DE KUNSTMAAN

In dit nummer o.a.
Voeden van de HRPT/QPSK -ontvanger / decoder
(A)HRPT-decoder: meetpunten en testbeelden
ADSB-ontvanger
en nog veel meer

Dear member,

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

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

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

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

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Content

Photo front page: Patch antenna.

Preface

When writing the foreword of the last issue of the year I always look back in old Kunstmanen. If you read those old articles then you think they are recent stories, but no they are years old. It seems that time is going faster and faster , it will have to do with age. In any case, the frequency does increase, which we have to receive.

22 parts packages have now been delivered from the QPSK receiver. These are not all working receivers yet, but still. Time to look higher up. 1700 MHz seems to be direct current when you look at the 8 GHz that we now have to receive. The first experiments are there and there are amateurs who can already receive the weather satellites at the 8 GHz.

Many things were offered and sold at the meeting on 11 November. Our treasurer is very happy with this because we are loss-making as an association. I myself now and then have the urge to "organize" my parts stock. Probably natural. But I saw on a website someone who uses coin envelopes. Small and very useful to put components in order. Why I could only buy these envelopes in the United States, because we only pin here?

*Coin envelopes for storing non-ESD sensitive parts.*

The Metop-C has recently been launched. In this Kunstmaan one of the first pictures received by Harrie. It is a mystery why the Metop-A , B and C are so close behind

each other. Why do not they spread this about the day ? Maybe we should ask Eumetsat about this.

Patch antennas

The patch antenna is back again. Both Peters have built one and the results on the spectrum analyzer look good. The design is from Oleg. Still waiting for the final test: mounted in a dish and received.
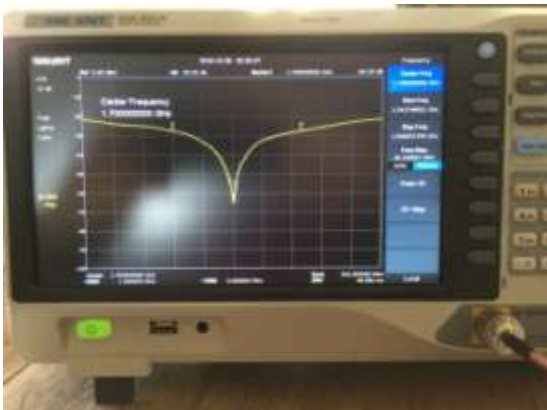
The result on the spectrum analyzer. A neat dip on the 1700 MHz

To Eumetsat in 2019?

A visit to Eumetsat will take place on July 4, 2019 . We are invited to go to Darmstadt together with the members of GEO. The last visit in 2015, it seems to be a four-year tradition. The program is not yet final. Thursday will be at Eumetsat and maybe Friday to the antennepark in Usingen or to Esoc , who knows. Let us know if you are

interested in coming along. The costs are minimal, travel and accommodation costs are for your own account. Keep an eye on the GEO website: www.geo-web.org.uk .

The antenna park in Usingen . Maybe we can visit this again in 2019. Eumetsat in any case on July 4, 2019

We were back on Radio Amateur Day, this time in Zwolle. We had a spacious stand, with a lot of visitors. Because the location was in Zwolle, there were now also other visitors, for whom Apeldoorn was too far away.

And we were on the open day of ESTEC! I was allowed to stand as a stand crew for the Dutch Association for Space, thanks for this. You can become a member for 35 Euro and receive their magazine four times a year.

The Kunstmanen Working Group on the open day of Estec

The Kunstmaan

Fred still managed to write a report from Vietnam, despite 25 cm of rain that fell on one day! If everything goes according to plan, we may welcome him again at the New Year's reception. Rob has written a nice article about feeding the QPSK receiver and decoder. In general, the subject of nutrition is a neglected child with electronic circuits. Completely unjustified, it can make the difference between something that works and does not work, examples too. The mood sometimes rises high on this subject. We will stay here or read more going on in the future. Rob has expanded his decoder with the possibility to check the correct sample moment and the generator for FengYun and MetOp give a picture. Paul has nice recollections from the library that put us in the mood for the holidays.

In the basements downstairs at the Nimeto is also a lot of old reception equipment. How wonderful it would be if we could restore it back to its original state. The characteristic sound of the APT signal (lady on high heels ??) may not be lost. Thanks to Harm to call for making a very simple SDR receiver installation to get the youth excited beeps and images from space. I myself have written something about ADS-B. I dared this because Arne had done this before. It is a nice introduction to an RTL dongle and the Raspberry Pi.

With the editorship , it does not want to run a storm. Fred has indicated to have to stop because of the condition of his eyes and as an association we must respect this. In this holiday month I do not want to hang up a doom and gloom story or sketch dark vistas. We do that in the new year.

That is why I want to wish everyone, on behalf of the entire board, happy holidays. I hope to meet you on January 5th during our meeting with New Year's drinks.

Lecture January 5

At the time of this writing it is not yet known where the lecture will take place on January 5th. Maybe we just have a nice drink.

Sincerely,

Ben Schellekens

PS: We remind you to pay your contribution for 2019. We hold the contribution of 25 Euro per year for members in the Netherlands and 30 euro for members abroad. For members outside the Netherlands and Belgium we have the possibility of a pdf membership for 10 Euro.

Links

[1] Patch antenna Oleg for the 1700 MHz

http://www.sat.cc.ua/page3.html

[2] JR Miller design for the 2.4 GHz

http://www.jrmiller.demon.co.uk/products/patch.html

Weather satellites in Vietnam (30)   **Fred van den Bosch**

Summary
My experiences with weather satellites etc. in Vietnam.

Well, sorry, but this is a shorter version than normal. The title could therefore better be called something like "Life in Vietnam". There are a few reasons for this.

We were in the rainy season. E.g. Sunday 25/11 we had, thanks to a tropical storm, 254 mm. rain, according to my weather station. Given the non-full-wet-proofing of the rotors, I still find it smarter not to turn them on when it rains. And when it was finally dry, so much had to be done outdoors at home and in the garden that the satellites were ignored.

Furthermore, we had guests from the Netherlands. And you should also keep them busy.

Add to this that everything regularly breaks down and you are often busy for a long time trying to get something working again: many things, especially those I brought from the Netherlands, are not or barely for sale here.

Yes, you will not get bored.

APT
No, still no new PC. So no news from this eastern front either.

HRPT / QPSK
And well, it's getting monotonous but also here ...

There is now a new 3-core cable for the rotors ready. Only solder the plugs. The old cable had been gnawed by the rats on several occasions and soldered together again in several places. Soon, if it is a little longer dry, the old cables will be replaced.

Miscellaneous
First man on the moon
At the Astroforum is in [1] a review of the cinema film and some additional information :.
• *"I have seen the film First Man in the meantime. A fascinating film for space travel, but difficult for occasional visitors to follow. Many people are not well introduced in terms of role and function in the space program. Essential matters are skipped, sometimes the film is painfully slow.*
  Tip: read the Gemini and Apollo events on Wikipedia before going to the bios film. I thought Apollo 13 was a better movie. "
• *"Sometimes you see the best things on YouTube [2]. This documentary certainly belongs to that. The life of Neil Armstrong after the moon landing. Very worthwhile "*
• *"The documentary 'Moonshot' [3] is almost the same story as the movie "The Right Stuff" but tells the story from the perspective of the astronauts. Is also highly recommended and worth watching for anyone who is interested in the subject."*

Space utopia
Perhaps some have already seen this https://wepresent.wetransfer.com/story/vincent-fournier/ while using WeTransfer. See also the link to the book, somewhere on the page.

Apollo

In [4] to [6] there are a number of links that relate to the Apollo project, resp. photographs taken, restoration of the computers and the Apollo missions.

Radio astronomy

For those who want to receive something different: see [7].

References
[1] Astrophorum, see website
[2] The life of Neil Armstrong, see website
[3] Moonshot, see website
[4] Apollo a, see website
[5] Apollo b, see website
[6] Apollo c, see website
[7] Radio astronomy, see website

Powering the HRPT / QPSK receiver and decoder

The power supply for the (A) HRPT / QPSK equipment (receiver and decoder) has not yet been discussed. Possibly because this seems rather trivial. Yet there are a number of points to take into account:
- interference caused by the digital decoder
- interference caused by switching stabilizers
- protection against overvoltage / polarity

This story is aimed at the (A) HRPT / QPSK receiver and decoder, but also applies to other devices, especially with both an analogue and digital part.
There are tuners, used in the receiver, using either 5V or 12 V.

Instead of making a power supply yourself it is now easier to buy a plug-in power supply. It costs almost nothing, saves space in the case and there are no high voltages in the receiver box.
The disadvantage of a plug-in power supply is that a connection error is easy to make; accidentally using a 12V instead of a 5V adapter or a wrong polarity can result in a one-time smoke signal from the receiver. In particular, power supplies which are adjustable nowadays have plug-in plugs so that they are generally applicable. Handy, but if that plug comes loose and you plug it wrong then the polarity is reversed. It is indicated, black-relief on black, not very clear ...

5V receiver
With a 5V receiver it is obvious to supply both receiver and decoder directly from the same 5V. However, this is generally not a good idea. The problem is that the current consumption of the digital decoder varies quite a bit, and that can affect the receiver via the power supply. The big culprit here is the LED display. This worked with a repetition frequency of only 40 Hz, which is difficult to filter out without large capacitors / coils in the power supply. In the latest FPGA load, I increased that frequency to 10 kHz, which makes filtering a bit easier. The power filter already on the UV1316 print (100 uH, 1000 uF) is sufficient; with an extra C of 220 uF at the decoder (which then has no stabilizer) there are no further problems.

12V receiver
With a 12V receiver one could think of a 12V plug-in power supply, from which a 5V stabilizer is made for the decoder. A traditional stabilizer, however, will have to be cooled properly (there is about 2W burned). A switching power supply is obvious. In the decoder this is already provided in the form of a stabilizer of the Tracopower brand. However, switching power supplies are rather disturbing the incoming voltage. I measured 500 kHz here with a top-top ripple of 200 mV! That is on the 12V that goes directly to the receiver, and that is not going well. Also in this case there will have to be properly filtered. On the tracopower site [1] a filter is recommended to comply with the " EN55032 Class A limits". See fig. 1.
In addition to this hf interference, the discussed lf noise of the decoder also plays a role here. In older receivers, where the UV916 is used, the used coil in the power supply is smaller; in the published article in KM No. 3, 2009, only 10 uH is used.
A larger value may solve problems.
(Note: If filters, with large C and L, can work badly for higher frequencies, large Cs will exhibit coil tendencies, and large L's capacitor tendencies, so it may be necessary to use both lf and hf filters to suppress both interference components sufficiently.)
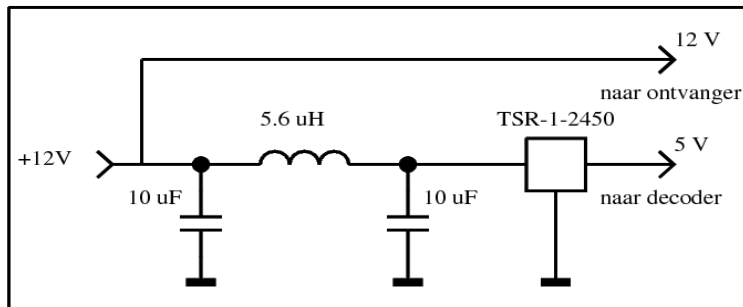
FIG. 1. Circuit to filter out the hf noise of the Traco stabilizer.

Separate feedings

I have used a slightly different approach myself; see fig. 2. My 5V receiver and decoder both have their own 5V Traco stabilizer; I supply the whole via a 12V plug-in power supply, via a diode. In addition to interference problems, some safety devices are built in: the receiver and decoder are effectively isolated from each other by the two stabilizers, the input voltage can be between 9V and 30V and the diode protects against the wrong polarity.

If a 12V tuner is used then simply use a 12V version of a Traco for the receiver; feed the whole with 15V and that problem is solved.

As an extra, I have included a small 12V / 100 mA stabilizer to supply the LNB. That power supply, which runs via the coax, can be short-circuited rather easily, so that the voltage of receiver and decoder would also fall out. With the stabilizer (which then works more as a current limiter) this is captured.

Because receiver and decoder have their own stabilizer, there is no need for suppression filters (the already existing filter on the receiver board may not be necessary anymore, I did not test this).

NB Decoupling C's are already present in the TSR-1, not in the 78L12.

The 78L12 has a very low "drop" voltage of less than 1V. An input voltage of 12V is actually too low, but this type will work as a "resistance zener" in that case. So no strange effects occur. The output voltage is somewhat lower than 12V, but that does not seem to be a problem for my LNB. Optionally, the input voltage can be increased to 15V.
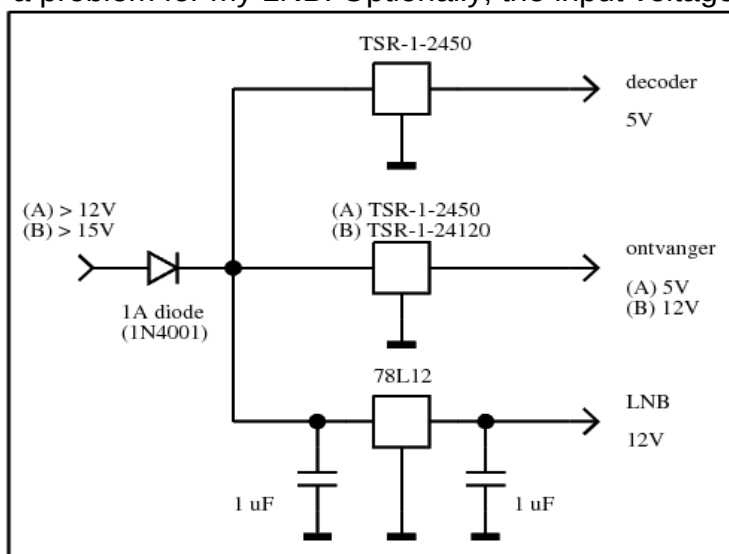

FIG. 2. Separate stabilizers for decoder and receiver: (A) for 5V, (B) for 12V receiver

[1] www.tracopower.com

(A) HRPT decoder: measuring points and test images

In the latest version of the (A) HRPT decoder, a number of items have been added: a number of measuring points and a better generator for the QPSK satellites.

Sample moments.

2 pins have been added making it possible to view the position of input signal change with respect to the sample moment.

These are the pins:

- GODIL: B14, connector: pin 14, for NOAA / Meteor, and METOP / Fengyun, input I
- GODIL: B16, connector: pin 16, for METOP / Fengyun, input Q

Together with:

- GODIL: B22, connector: pin 22

the signals can then be judged whether the sample moment is right, and does not vary too much (due to a weak input signal). A scope picture for METOP, input I, looks like in fig. 1.
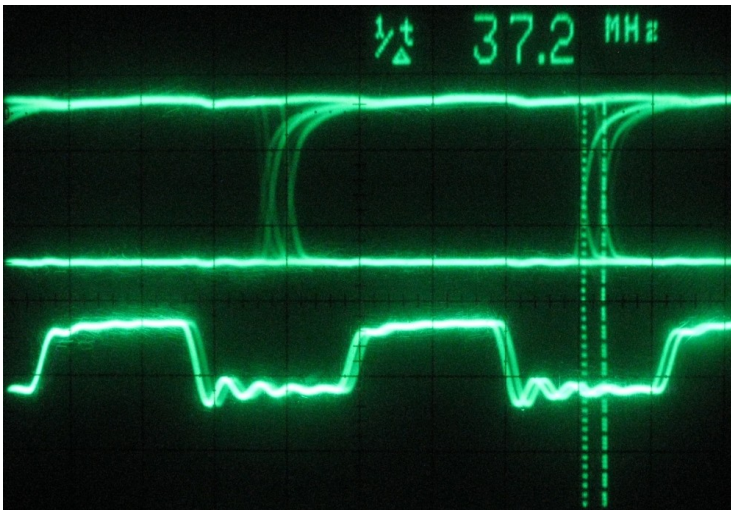

FIG. 1. Signals on outputs B14 and B22 at METOP. B16 (Q) is like B14.

Here you can see the VCO clock on the bottom (pin 22); 2,333 MHz. Above you can see what is on pin 14; the incoming bit stream. Those bits can stay 0, stay 1 or change between 0 and 1. In the picture this is drawn over each other. In fact, this is the digital eye pattern.

To be able to judge this properly, it is necessary to know how the data is sampled. The divided VCO clock is locked on the incoming data stream and thus runs 90 degrees shifted in phase; that is the classic operation of a PLL with an EXOR as a phase detector.

If a single sample is taken per bit, it must be halfway through the moments that the incoming bit can change, ie halfway through the positive half of the VCO clock. See fig. 1. This is how it is built up internally.

In the most ideal case, therefore, the inbound bit should change to a new value (or remain constant) half way through the 0-period of the VCO, and there should be no change around the middle of the 1-level.

If the bit integrator is switched on, multiple samples are taken per bit (see [1]). The sampling of a sample set then starts halfway through the negative period half of the VCO clock, and ends midway through the next negative period half. Then a majority decision is taken: are most samples '1' or '0'? The picture as fig. 1 remains the same.

This picture is taken with the METOP-generator connected, hence it looks very "clean". Yet there is a variation in the bit change. Because it is synchronized on the VCO clock it still looks tight, but more to the right you can still see some variations in the flanks.

This is easier to see in the bit stream at the top. These variations are due to the 'fractional dividers' that have been used, see [2]. The bitstream shows a variation of approx. 27 ns, which corresponds to a period of approx. 37 MHz, and that is exactly the frequency that comes from the fractional divider for METOP. Occasionally there will be an additional period of 37 MHz, hence. With a "real" input signal these variations are much larger (because of noise).

When using a VCXO (see article mentioned in [2]) the sample moment will always be right; if using a VCO, that position may be shifted if the central frequency of the VCO is not right. The 2 signals in Fig. 1 will then show a offset with respect to each other.

Tthe signal of B16 (Q bit stream) looks much like the bit stream on B14 (I-bit stream). The PLL only uses 'I' to lock. If the incoming bit stream of 'Q' is shifted with respect to 'I' then this is clearly visible on the scope.

Conclusion: With the pins B14 and B16 one can check the correct operation of the sample process.

Generator METOP / Fengyun

The HRPT and METEOR generators, also present in the same FPGA, cretae a test image. The generators for METOP and Fengyun generated a (more or less) valid bit stream, but without a real image. If the generator was connected to the decoder, data was collected on the hard disk, but there was no image to be seen.

This has now been changed; both generators now give data in which there is also an AVHRR "picture". Channel 1 gives black and white bars; the higher channels give dark gray / light gray bars, the shade of gray depends on the channel. See fig. 2.

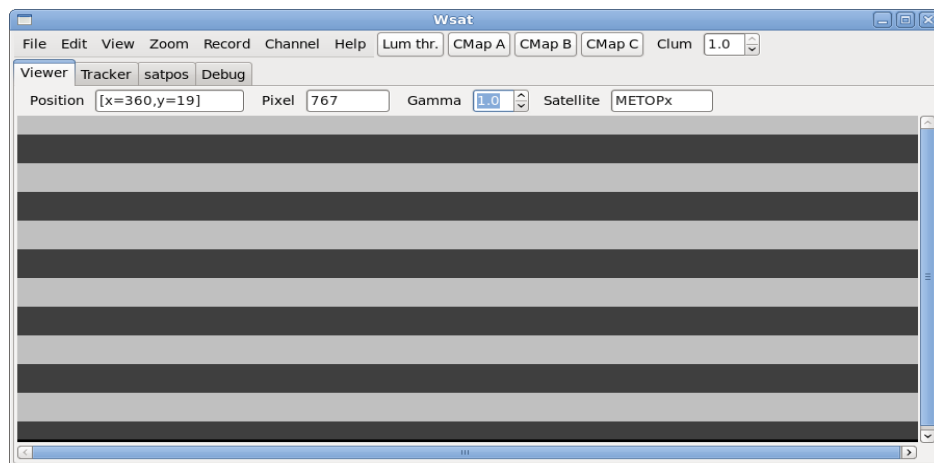This can be useful for testing hardware / software without receiving reception.

FIG. 2. Test image METOP, channel 2.

The new FPGA load, version 2018.8, can be downloaded from my web-site.

(for links see see web-site http://www.kunstmanen.net/, weblinks, 2018)

[1] Direct reception METOP, page 9: Bit integration. De Kunstmaan 2016, nr. 4

[2] The VCO of the decoder. FIG. 2, p. 11. de Kunstmaan 2018, no. 3

[3] FPGA loads; website Rob Alblas

ADS-B receiver

Summary
This article describes an ADS-B receiver built with a groundplane or
a colinary antenna, RTL-dongle and a Raspberry Pi. Virtual Radar Server is used for
presenting the tracks of the planes.

Preface
My article is not so much about the reception of satellites, but the techniques and
ideas used are interesting enough for members not to mention.
The idea about this article arose when I was at Split airport and had a delay of more
than three hours. One of the travelers could see via his mobile phone where the
plane I was in at that moment was. Then I thought that Arne had written an article
about an ADSB receiver in the Kunstmaan in the past [1]. Time to delve into this
once.

Disclaimer
This article does not attempt to describe a professional / commercial ADS-B
receiver. The goal is to demonstrate only some techniques and concepts.

What is ADS-B
ADS-B is for Automatic Dependent Surveillance-Broadcast. ADS-B equipped aircraft
periodically transmit their position and other information such as geographic location,
registration number, flight number, speed, altitude, heading and intentions.
In contrast to radar, where the location of the aircraft is determined by radio waves ,
everyone who receives the ADS-B signal knows where the plane is and not only the
control tower. Another major advantage over radar is the extra information that is also
broadcast.
For more information, I refer to the article by Arne [1] in the December 2011
Kunstmaan.

Reception of the ADS-B signal
First we need an antenna. In Arne 's article a colinary antenna is described. I
myself also made a much smaller groundplane antenna from the next drawing. The
length of the radians is 68 mm.
The length does not have to be accurate to a fraction of a millimeter. More important
is that the antenna requires clear vision. With a receiving frequency of 1090 MHz you
have visual connections. So preferably outside and as high as possible.
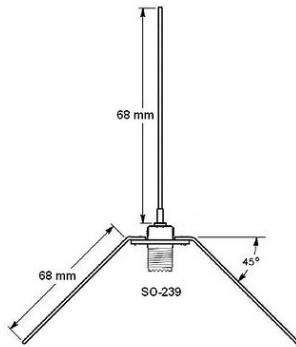
Fig 1 Drawing of the groundplane
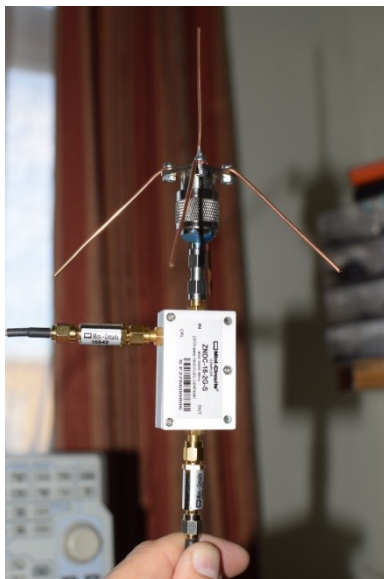
Fig 2 The built copy made of electricity wire on an N-female connector with a directional coupler

More information about this antenna can of course be found on the internet [2].

Optimizing antenna
With the above antenna you already receive many planes. If necessary, you could check whether the antenna can be further improved. In the case of the groundplane , in particular the upper radial frequency is decisive.

Adjusting the antenna
Initially make the radians a little longer, for example 72 mm. The frequency of the antenna is now too low. We will increase the frequency by shortening the radians.
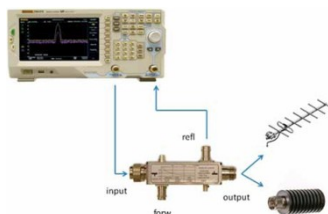

Fig 3 Directional coupler of Mini Circuits
We do the measuring with a directional coupler and a spectrum analyzer (SA), see also figure 1.

Measurement setup
The tracking generator (TG) output goes to the output of the directional coupler . The input of the SA goes to the linked port (CPL port , see figure 3) .

Fig 4 The measuring setup with spectrum analyzer and directional coupler
At first we do not connect an antenna . We turn on the TG. The signal will be on the unconnected "output" of the directional coupler 100% reflected and then comes to the CPL port of the directional coupler / at the entrance of the SA . We will normalize the SA on this signal, this is the reference.
Now we connect the antenna to the entrance, the TG is still on. Near 1090 MHz will result in a dip because here emits the antenna to resonate and signal (which is no longer comes to the CPL-port). By shortening the radial slightly, we can set the antenna exactly on frequency.
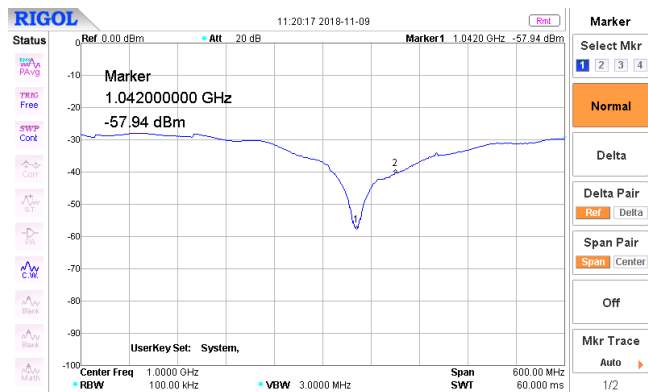
Fig 5 Measurement of the ground plane antenna

Colinary antenna
On the internet you see that the colinary antenna is often recommended for the reception of ADS-B signals [13]. This is somewhat more difficult to make, but the performance seems to be slightly better.


Fig 6 Schematic representation of a colinary antenna

Construction of the colinary antenna
The construction is fairly simple. They are pieces of coaxial cable that are pushed together (see image).
The length of the pieces of cable depends on the frequency and the shortening factor. It does not matter if you use 50 Ohm or 75 Ohm cable. I used 75 Ohm cable, the Koka 799, I still had it. Here you can easily mount an F-connector.
Each piece of cable is half a wavelength long x the shortening factor (this is 0.85):
0.5 x (300,000 / 1090) x 0.85 = 117 mm
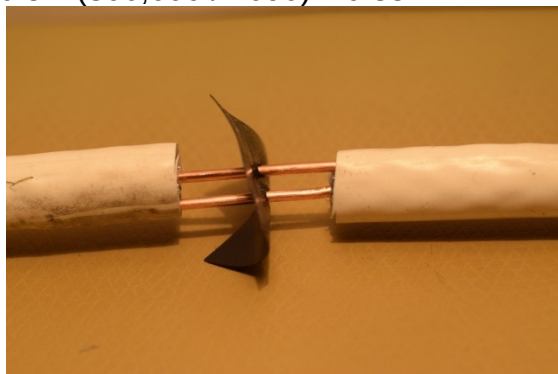
FIG 7 The core of the cable is inserted between the insulating material and the outer sheath, in the screen. There is insulation tape between the cable
pieces to prevent accidental short-circuiting. The pieces of cable are tight together.
I compared the groundplane and the colines (the sa picture looks worse) by looking at the number of correct ADS-B messages in 1 minute:
Grounplane   324 ADS-B messages
Colinary   399 ADS-B messages

If you look at the SWR on the spectrum analyzer, then the story is very different:
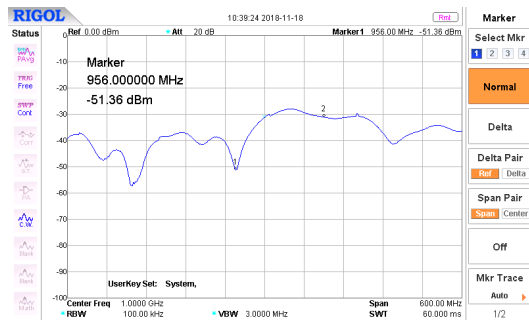
FIG 8 Measurement of the colary antenna

The peak here is 956 MHz, a lot lower. Perhaps the cause is that the antenna of 75 Ohm cable is made and this is connected to a 50 Ohm system. The easiest way is to make an adjustment with resistances or an L / C. The question is whether it matters so much.

Remember that with this type of measurement you are looking at the adaptation of antenna at a certain frequency. It does not say much about the sensitivity over a certain frequency range.

Antenna cable
In the first setup I had the antenna placed against the window and I could with a short cable to the receiver (an RTL dongle). Notice , the dongle has an MCX-CONNECTION. On eBay you can buy an adapter cable from N to MCX, search for " pigtail MCX N male".

RTL dongle
The type I used comes from eBay , but only on "R820T2". Now I read on the internet that this chip would be discontinued . Only manufacturers that purchase large numbers can still get this chip. How this will develop in the future is unclear.

FIG 9 USB dongle from eBay . The included An antenna is not really usable for us .

If you do not want the eBay adventure, you can buy the tuner (and even a complete ADS-B package) from van Dijken [3] .

USB extension cable
Have you mounted the antenna at the window and close the USB dongle then you will need a USB extension cable. These are available up to a length of 5 meters.

Software
Because I only use Windows I can only tell a bit about this. Undoubtedly there are also Linux or Mac programs.
The following programs are needed:
- Zadig drivers . This is a Windows application that generic USB drivers are installed to control the RTL dongle [4].
- Dump1090. With this program the RTL dongle is controlled and decodes the ADS-B signal and offers the data to the network. This program was first available only under Linux and Mac, but now also under Windows.
- Virtual Radar Server [5] . With this free, open source, .NET program, the planes are shown on a map. This program is available under Windows and Lin u x (Via Mono , a software dispute that allows you to run .NET Framework applications on other

operating systems) . As the name says it is a web server that runs locally on your PC, e n you access using a web browser.

Raspberry pi as a receiver
With this simple setup you can already put a lot of planes on your PC, but it can always be better. Especially the location of the antenna is important: as high as possible and clear view. With the 5 meter USB extension cable you will not get far enough.
A solution could be to take a long antenna cable, we also do this on the 1700 MHz. The solution I have chosen is the following: the USB dongle is close to the antenna via an adapter cable and is in a Raspberry Pi. The Raspberry Pi decodes the ADS-B signal and sends it to the PC via a long network cable . The power of the whole also goes via the network cable.

What is needed?
Raspberry Pi
What is this? It is a pocket-sized computer. There are USB and network connections and an HDMI output. More information can be found on the internet [6]. The latest versions have wifi and a 1.4 GHz quadcore processor
For 30 Euro this small pcb is already in your possession. Look at [7] for points of sale.

FIG 10 The Raspberry Pi 3. On the right you see 4 USB and the network connections . At the bottom of the print is a micro sd card reader.

You will also find alternatives to the Raspberry Pi, Banana Pi, Orange Pi. Do not buy these alternatives unless you know what you are doing. The most important thing with a Pi is the Operating System, because it is still a computer. At the Raspberry Pi this is very well organized, with the other suppliers you end up in an indescribable hell of drivers, updates etc. And that for a few Euro that you might save. The Raspberry Pi organization has light years of origin in the field of software , but that is my personal opinion.

Installation Raspberry Pi
Maybe there will be a separate article about this in the future. Installing the OS is done with Etcher [8]. Make sure that you do "Run as administrator" under Windows , this can also pop up as a pop-up window.

Network cable

The network cable goes outside and I also use power for the Raspberry Pi. Because of the weather conditions, not all cables are suitable for outdoor use. Search for "UTP outer cable".

Power over Ethernet

A network cable has four wire pairs of which only two are used for network traffic. So the other two can be used to feed the Raspberry Pi. You do not have a separate power cable needed but a so-called PoE injector and splitter . For a few Euro you can buy it here [9] or at Reichelt .
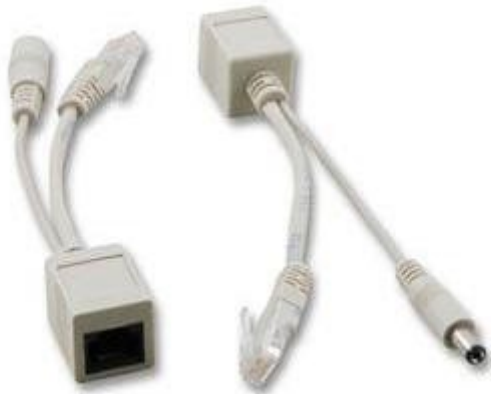
FIG 11 Power over Ethernet injector and splitter
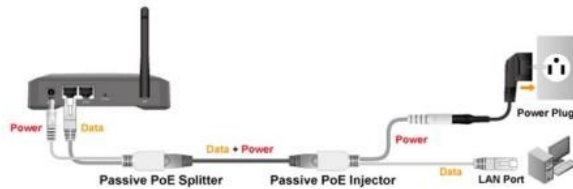
FIG 12 Power Over E t structure

Power supply

The Raspberry Pi needs a 5V power supply. According to specifications, this should go to 2A. We do not need much for our application , around 500 mA is sufficient. Because due to the resistance of the network cable, there is still a voltage drop, I decided to offer "down" 12V and above with a switched regulator (the R-78E5.0-1.0 from Recom) to the 5V. You still need a cable with a micro USB connection for the Raspberry Pi.
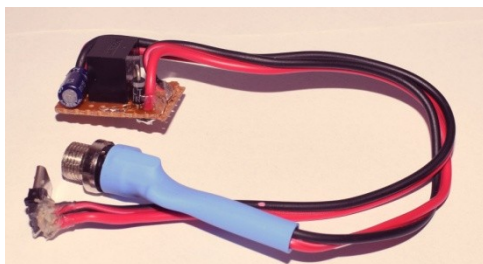
FIG 13 5V regulator with connection cables

Installation of the Raspberry Pi

I do not want to discuss the entire installation of the Raspberry Pi because there are many descriptions of this, but there are some points of interest.

- I have done a so-called " headless " installation. This is without a connected keyboard and monitor. All communication is via the network cable.
- When you install the Operating System, in my case "RASPBIAN STRETCH LITE" you have to create a file " ssh ". It may be empty and does not need to have an extension. This starts the Raspberry Pi op with the possibility to log in via a terminal program.
- If you want to be able to log in then you need to know the IP number . The easiest thing to find out under Windows is with the free program nmap [10]. Do the scan with the following command: nmap - sn192.168.1.0/24
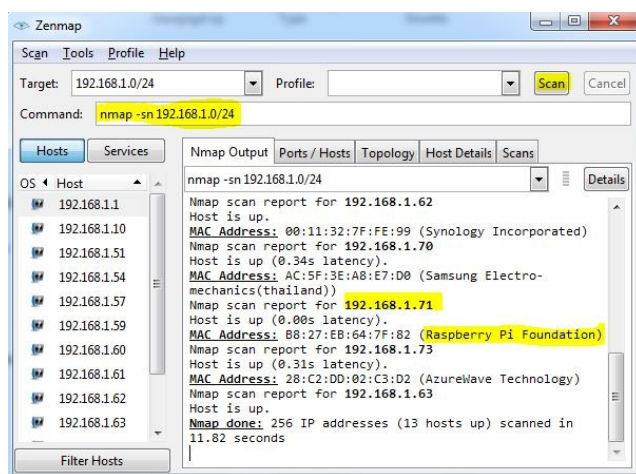

FIG 14 The program nmap with which you can see the IP number of the Raspberry Pi

- You can then log in with the program PuTTY [11]. The username is pi and the password raspberry
- Finally, we have to install Dump1090. David Taylor has written an extensive page here [12]. See in particular the part under the heading "Preparing the Raspberry Pi" that you have to follow.

Construction

The whole must of course be placed on the roof in a watertight manner. I chose to use a piece of drain pipe of 80mm diameter. As a cap I use a part of PET soft drink bottle of 1.5 liters, it fits exactly over it. The radians from the groundplane they stick out a very small piece but that does not matter.

Fig 15 The groundplane is under a pet bottle

The Raspberry Pi fits in just when you solder a cable on the USB plug. A standard USB power cable makes the whole too wide.

Virtual Radar Server
In Virtual Radar Server, all you have to do is enter the IP number of the Raspberry Pi and, if all goes well, the information flows inside.
Note that in Virtual Radar Server under Tools / Options you indicate that the format " Mode-S Beast binary format ".
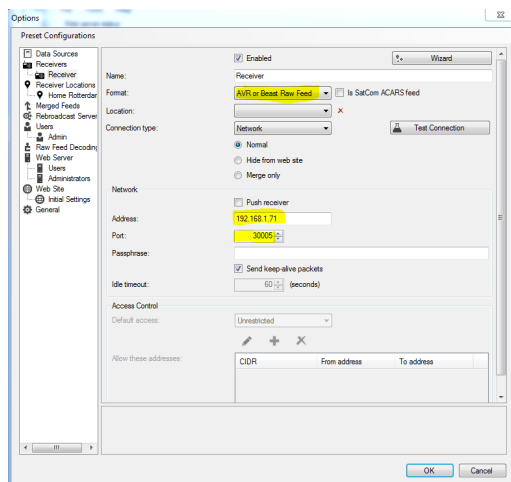
Fig 16 Virtual Radar settings

Then you can use the URL / web browser http://127.0.0.1/VirtualRadar
see the planes .
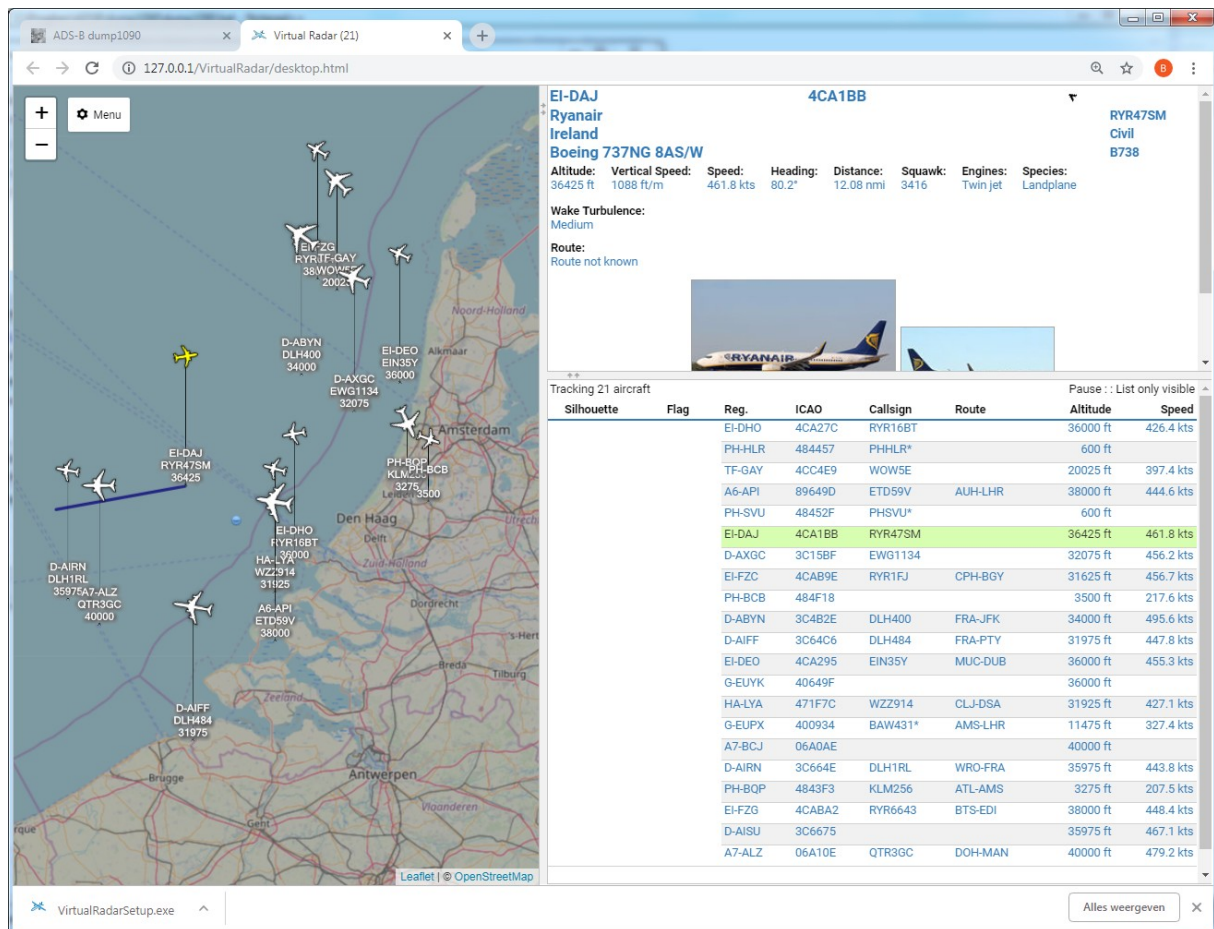
Figure 17 As in your web - browser is displayed.

Conclusion

An article about ADS-B reception in the Kunstmaan. For me, there were plenty of leads to this to justify:

- Adjusting the antenna with a spectrum analyzer and a directional coupler .
- The use of a Raspberry Pi, we can also use this for other

things. So I have seen that xtrack can also run on this. Something for a next article.

- Power over Ethernet, with which you can easily feed devices remotely.

As a sequel, I want to see if an interdigital filter and a pre-amplifier can improve reception.

Links

[1] ADS-B reception, page 158. Kunstmaan December 2011
http://kunstmanen.net/images/documenten/kunstmaan/KM201104.pdf

[2] Information about groundplane antennas for the 1090 MHz
https://blog.webernetz.net/bessere-antennen-fur-den-ads-b-flugzeugempfang/

[3] van Dijken, supplier of RTL dongles among others
https://www.vandijkenelektronica.eu/nl/

[4] Zadig driver for Windows
https://zadig.akeo.ie/
https://github.com/pbatard/libwdi/wiki/Zadig
https://www.rtl-sdr.com/tag/zadig/

[5] Virtual Radar software
http://www.virtualradarserver.co.uk/

[6] Raspberry Pi
https://www.raspberrypi.org/
Free download magazine:
https://www.raspberrypi.org/magpi/

[7] Some distributors of Raspberry Pi
https://www.sossolutions.nl/
https://www.kiwi-electronics.nl/
https://www.conrad.nl
https://www.reichelt.de

[8] Etcher
https://www.balena.io/etcher/

[9] UTP outer cable and PoE
https://www.allekabels.nl/power-over-ethernet/7394/1169868/poe-injector-en-splitter-set.html

[10] nmap
https://nmap.org/

[11] PuTTY
https://www.putty.org/

[12] Dump1090 on the Raspberry Pi
http://www.satsignal.eu/raspberry-pi/dump1090.html

[13] Colinary antenna
https://www.balarad.net/
https://www.rtl-sdr.com/homemade-ads-b-collinear-antenna/

OLED display for the Arduino

Ben Schellekens

Summary

This article describes the use of OLED display with the Arduino. The library of Adafruit and Greiman is discussed .

Introduction

For various projects I use an ATmega328 / Arduino with an LCD display , also in the Receiver 2008 and the QPSK receiver. Do you want to build the 2x16 LCD display in a small cabinet then it turns out to be very large. Time to look for something else.

If you search on eBay with the terms "Arduino display" you will be flooded with displays. You can also search for driver IC: SSD1306, SSD1331, SSD1351. The 0.96 "display seems very attractive with a price of around 2.50 Euro.

OLED vs LCD

OLED displays are made of organic material that give light when electricity is being applied. An LCD display is always backlit (backlight) is required.

The advantage of OLED:

- Better image quality due to higher contrast and greater light intensity .
- Larger viewing angle. I think this is important, you are not always directly in front of the measuring instrument .

The disadvantage is the shorter lifespan (5,000 hours). It still seems to me for a long time. See also [1] .

Properties of the display

The PCB measures 28 x 27 mm and is fed with 3 - 5V. Note: some displays can only have 3V3. Also pay attention to the connections of the pin headers, which may differ per provider. The interface is I2C or SPI.

The resolution is 128 x 64 pixels. My display has two colors. The upper rows of pixels are yellow, the rest is blue. You can not control these colors separately.

Another very important feature is the driver IC used. In this case the SSD1306. This also starts the search on the Internet for libraries for the Arduino.

Library for the SSD1306

One of the first library 's where you're going to find is Adafruit [2], probably they are the creators of this display.

Fig 1 The Adafruit logo. The display is small, see the four pins at the top with a total width of 1 cm.

Fig 2 Graphic The Adafruit library is very strong

When you load the sample ѕketch (for some reason the I2C 128 x 32 -pixels sketch) you immediately see what the problem is. The microcontroller is 96 percent full. So I went looking for a text-only library and found it at Greiman [3]. Because I only want to show text, I started working on this.

Library of William Greiman

You can easily download the library from Github [4]. The purpose of this library is to only display text and use as little RAM and flash memory as possible.

There are more than 40 fonts , both proportionally and with a fixed width . Optionally you can also enlarge it twice. Only the fonts you use are loaded into the flash memory.

The library has many examples. A nice thing to start with is FontSamplesWire.ino . This allows every 10 seconds n see a new font.

Fig 3 Example of the Calibri-15 font of the Greiman library

Fig 4 And another example of a small font

In the March 2018 Kunstmaan I described the control of the Weinschel attenuator . It still lacked a decent case with a rotary knob (rotary encoder) to control the attenuator. As a readout I am going to use this display.

Fig 5 You can also show text twice as big .

Arduino sketch

Below are the relevant rules for the control of the text as shown in figure 5.

```
#include "SSD1306Ascii.h" //https://github.com/greiman/SSD1306Ascii
#include "SSD1306AsciiWire.h"

#define I2C_ADDRESS 0x3C // 0X3C + SA0 - 0x3C or 0x3D
#define RST_PIN -1 // Define clean RST_PIN if required
```

```
void setup ()
{
// Initialize oled display
  oled.begin (& Adafruit128x64, I2C_ADDRESS);
  oled.setFont (fixed_bold10x15);
  oled.clear ();
  oled.println ("Attenuator");
oled.set2X ();
}

void loop () {

            // Show value before decimal point
            oled.setCursor (20.3);
            oled.clearToEOL ();
            attdisplay = String (steps / 100);
            oled.print ( attdisplay );

            // Show value after decimal point
            oled.print ('.');
            attdisplay = String (steps% 100);
            if ( attdisplay == "0")
               oled.print ("0");
            oled.print ( attdisplay );
  }
}
```

The value to be shown on the display is in the variable " attdisplay ", this is attenuation multiplied by 100. In the loop () I first determine the text for the decimal point (by dividing 100) , then the decimal point and finally the text after the decimal point (the remainder after division by 100) . If the attenuation is an integer, then I paste an extra zero. In a next article I will describe this further, together with the usedrotary encoder .

Conclusion

They are very attractive displays due to their low price and small size . Readability is also good , I do not need reading glasses yet ......

Links

[1] OLED vs LCD

https://www.makerfabs.com/Display:OLED_vs_LCD

[2] Adafruit

https://github.com/adafruit/Adafruit_SSD1306

Adafruit GFX library

https://github.com/adafruit/Adafruit-GFX-Library

[3] Greiman

https://github.com/greiman/SSD1306Ascii

UKW-BERICHTE

Paul Baak / Ben Schellekens

Summary
In this article a small review of articles published in the German magazine UKW-Berichte. We have a subscription on this magazine.

As noted by our librarian we have a subscription to UKW-Berichte. It is a quarterly magazine and at meetings it is to be read from the libarry table.

We would like to receive comments as to wether to keep the subscription or not. Here is a list of subjects from the first of 3 issues of this year.

1st issue 2018

Heiko Leutbecher describes MMIC-circuits for 70cm. Including many MMIC's cascaded or in contra fase. Also by Alexander Meier a home made power-meter. Gunthard Kraus describes the freely available antenna simulation program 4NEC2, created by Arie Voors (a dutchman). The artikel focusses on antennas for 2300 MHz.

2nd issue 2018
Aristoteles Tsiamitros describes Delta-Sigma-A/D-converters and Gunthard Kraus describes the programwelle.io which enables an RTL-dongle to receive DAB-radio. Michael Margraf explains QucsStudio, developped by himself. QucsStudio (freely available) is a very expanded simulator with more than hundred components.
Transmissiion line calculations and simulations with stripline, microstrip, etc. are possible as well.

3rd issue 2018
Thomas Rapp describes the possibility for an amateur to receive a pulsar (1420 MHz). In addition a continuation of the subject about the 4NEC2-software and the MMIC-circuits.

Perhaps unnecessary to say: UKW-Berichte is written in the german language, without an english translation (as with the magazine Dubus). The money can not be a problem; the magazine will cost 32 Euro a year, including shipment from Germany.

DE-5000 LCR meter
Ben Schellekens

Summary
This is a small review from the DE-5000 LCR meter

preface
Before I solder parts I want to check the value, especially if the source is dubious (China / eBay). This is particularly the case with SMD components where there is no component imprint on capacitors and coils.

Fig 1 The eBay offer

So it was time again to look for a measuring device. Now there are very nice SMD tweezers with built - in LCR meter . So Ideal-tek has beautiful starting at 275 Euros. The cheapest of KeySight with SMD tweezers costs 444 Euro. This is all too good and I went looking for a cheap alternative. Job had experience with the DE-5000 and I had read good reviews about it so I ordered this meter on eBay .

The meter was produced in Taiwan and is probably a clone of an LCR meter designed by IET Labs. The meter is offered in Japan and costs around US $ 110/100. The package I could pick up at Primera because the government claims its rightful part concerning the VAT, I had to pay 22 Euro. Shipping went via Japan Post, slow but the package arrived.

Fig 2 Content package

Power is with a 9V battery (included) or with a 9V adapter (not included). The supplied manual is in Chinese. The English-language manual can be found on the internet [1].

Fig 3 Everything unpacked

Calibration

Especially when you want to measure small values, it is important to calibrate the DE-5000 . Do this with the attachment where you are going to measure. The alibreren k is performed in two steps: first, a test with the probes open and short-circuited to the second test.

The measurements

The problem with testing is that I do not have any reference parts . So we have to do it with the factory specifications of the parts. It does give an indication of what the DE-5000 can do.

Inductors

All measurements are done with a frequency of 100 kHz and with 5 to 10 parts .

Mouser partno	Nominal value	Tolerance	Measured value
609-L-14C8N2JV4T	8.2 nH	5%	25 -26 nH
652-CE201210-22NJ	22 nH	5%	51 - 60 nH
652-CS321613-R 10 K	100 nH	10%	105 - 114 nH
652-CS321613-R33K	330 nH	10%	336 - 353 nH
652-CS321613-R68K	680 nH	10%	707-775 nH
542-78F4R7-RC	4.7 uH	5%	4.6 - 4.8 µH
542-78F100-RC	10 uH	5%	9.0 - 9.2 uH
871-B78108S1683J	68 uH	5%	64.4 - 66.9 uH
542-78F10 1 -RC	100 uH	5%	88.1 - 92.0 uH

You can see the abnormalities become big at small values. I would not trust it under 100 nH .

Capacitors

Note that when measuring the capacitors, no voltage may be applied. The DE-5000 is not protected against this.

Mouser partno	Nominal value	Tolerance	Measured value
77-VJ0603A1R2BXQCBC	1.2 pF	0.1 pF	1.5 - 1.6 pF
77- VJ0603A2R2BXJPBC	2.2 pF	0.1 pF	2.5 - 2.6 pF
77-VJ0603A4R7BXACBC	4.7 pF	0.1 pF	4.9 - 5.0 pF
77-VJ0603A120JXACBC	12 pF	5%	12.3 - 12.6 pF

In addition, I still had three "precision" capacitors (1%) of 1000 pF . These had values between 993 and 1002 pF .

Fig 4 Meter in action with a 1000 pF "precision" capacitor

Resistors

Origin	Nominal value	Tolerance	Measured value
Unknown	1 R	1%	0.994 - 0.997 R
Unknown	2 R	1%	1,937 - 1,946 R
Unknown	10 M	5%	10.4 - 10.9 M
Unknown	22 M	5%	21.7 - 22.2 M

Conclusion

The DE-5000 is a nice meter. The automatic mode works well, you do not have to indicate whether it is a coil, resistance or capacitor.

I have not discussed (and tried) all options, such as measuring the ESR of capacitors or the Q-factor of coils. You can also sort parts. On the DE-5000 you enter the tolerance and the meter then indicates whether the component falls within the range.

The DE-5000 satisfies my goal that I have purchased for: being able to quickly measure values to know that you have taken the right part. For the capacitors and inuctors with small values, I rely more on the manufacturers.

Links

https://www.ietlabs.com/pdf/Manuals/DE_5000_im.pdf

HP test equipment up to 26 GHz
Job de Haas

Summary
This article describes some test equipment from Job for repairing the Advantest R3361A

Introduction
Recently my Advantest R3361A spectrum analyzer started to break-down and I wanted to be able to fix this myself. This led me on a path of progressively more complicated challenges of measuring and adjusting the device.

Therefor I decided to start and look for the right equipment for such a task, such that I would be able to get my spectrum analyzer within spec again. I searched for: a signal generator (a 'sweeper' in this case), a frequency counter, a power meter and a digital voltmeter.

With a second hand radio equipment dealer I found the following:

Fig 1 HP8341B Synthesized Sweeper up to 20GHz (including attenuator to -110dB), with above that a HP5351B Microwave Frequency Counter up to 26.5GHz (with OCXO)

Fig 2 HP436A Power Meter with HP8484A power sensor and above that a HP3556A Digital Voltmeter, 6.5 digits

Fig 3 Power Sensor -20dBm tot -70dBm DC-18GHz

With this a significant need of tools is fulfilled and at same time more than enough for 8GHz. The next challenge is: how accurate are these tools still? Because they mostly date from (before) my days at university.

That's why I'm already working on a GPSDO (10MHz locked with GPS) and the results are not bad at all.

While all this equipment had been ordered, I tinkered some more with the RF section of my Advantest SA that mysteriously started working again as if never had been wrong at all.

In case this is a temporary revival of the machine, at least I'm now prepared to readjust it!

Note from the editor: The configuration of this measurement setup is similar to what I showed in my presentation on 11 November and is ideal for 8 GHz. It can be used to perform VSWR measurements (using a directional coupler) for antennas and feeds or to sweep filters or test LNA's. De big advantage of such HP equipment is its professional nature and higher accuracy and that it covers 8GHz easily. Before you run of to get some yourself, remember it is big and quite heavy.

Ben Schellekens

FINE ADJUSTMENT FROM THE DISH

Hendrik Jalving

This is a fine tuning for TV satellite dishes. The goal is to quickly do an accurate alignment of a dish, for example for an exhibition. The bigger the dish the more accurate it needs to be aligned.

When aligning, first do a rough alignment based on info at internet / Google earth. Then you use the rotary controls to increase the elevation and then adjust the azimuth to maximum signal.
Building is not extremely difficult but you need to be able to do welding. There is not much needed for material: one pair of bolts, nuts and some sheet steel.
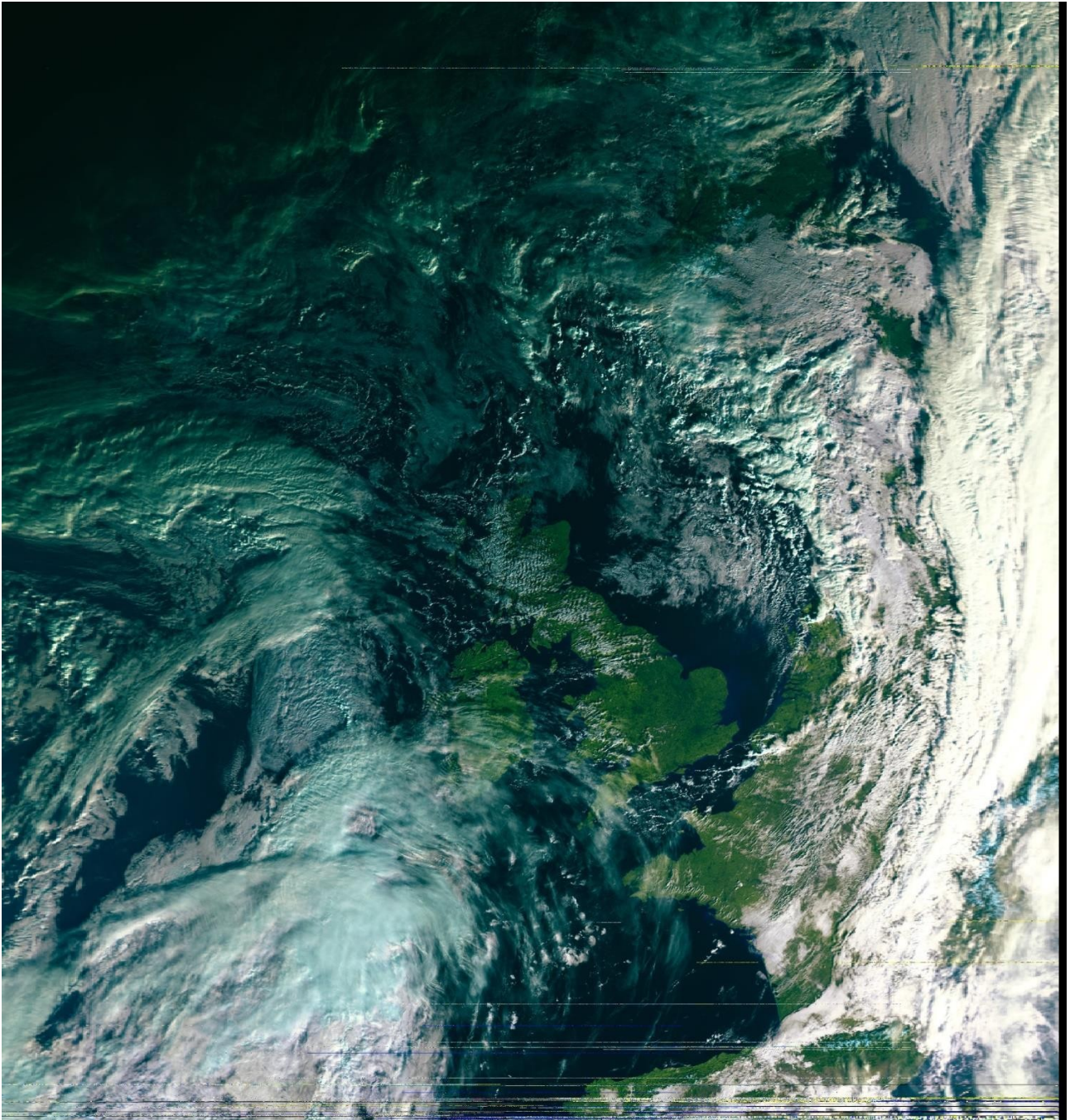
FIRST IMAGE: METOP-C

Harrie van Deursen

This is my first recording of Metop-C, received at 1701.3 MHz. As far as the RF level is concerned it's the same as with Metop A and B.
The Fenyun's really put a stronger signal down, here 71 versus 67 from Metop on my level meter.
Unfortunately, there are regular lines of error at FY.

Metop-C 20181311_1134 (Harrie van Deursen)

From the Library

Paul Baak

Summary
Some thoughts from our Librarian

ISS, the international space station now exists for 20 years. Congratulations. I sometimes have a look at it, especially in spring when he can pass several times an eveing. I wonder: why do not they turn ISS into a real weather satellite? That thing has a great orbit for it and already weighs more than 400 tons, if I'm right. A few cameras and a transmitter on one of those long wings do not matter anymore. With some searching, I can not find photos now other than the obligatory pictures of the ISS next to the earth or the moon, or some eyes of hurricanes, or astronauts playing with balls of water. No real weather photos. This can be done so much better!

Soldering irons have a hard life in my house. On off, on off, cold warm, cold warm. When one expires, and replacement is needed I buy a new one of 30 watts, in stock in the neighborhood at Radio Twenthe shop. With 15 euros it is done. I was surprised to read in Elektuur that there is now an entry model at offer of .. 150 euro. Can someone tell me the added value of that thing (except for the price I mean)? Heat is not better when it is more expensive? Or is it?

It has been a year ago that PC Active magazine made a broad report on the front page of the coming death of Arduino. I was shocked by that. I did get a cardiac arrest for less! It turned out that someone thought that a device without included Wi-Fi does not have a chance of survival. In the meantime, we are one year further and we know what has become of this: nothing. When I recently read somewhere on the internet that we have to use the Arduino IDE (with which we control our important motors) because there would be a better silly language to program, I took it lightly. Progress continues, but continuation is not always progress. "Time to Say Goodbye to Arduino and Go On to Micropython"? What is it about: someone thinks the Python language is better and there must also be another architecture because Python is an interpreter language. On the Arduino a whole development environment has to be set up complete with folders and the PC becomes a expensive glorified keyboard. My advice: stay with Arduino and his IDE. It is good as it is. Python gobbles up memory and speed. It does sound like a boa constrictor for a reason.

I prefer analog meters. It tells me more when I see a needle coming up, even with static measurements. Small misery this week: one of my analogue universal meters has died. He had a strange mistake: the needle only occasionally comes up. Misery in the needle bearing I think. You can not live with that of course: Say you will have a good 5 volts on your TTLs and the meter indicates 3 volts. You

turn the pot on the bottom leg of the 317 in good faith and you wave goodbye to your TTL's. I once read that all the meters under hundred euros are toys. So I should have known. In case you need a meter at our meetings: the club has a digital Metex M-4650 in the library.

The last meeting I got a plane suitcase with magazines that I carried down the stairs with difficulty. A caring lady asked if I needed help. You notice that you get older, or paper heavier. The library must be reorganized. We have 4 cabinets in the basement at Nimeto and they are now full, very full. At one moment we do not escape making choices about the collection. First I will make an up-to-date inventory. Many gifts from recent times and doubles play a big role.

According to a recent publication ftom the Ministry of Health, almost the entire population suffers from depression. Understandable. No, do not blame autumn again. The cause is simpler: our club year and your membership in 2018 comes to an end after December and you no longer know what to do with January. And the solution is so simple! You prolong your membership for 2019. Instructions are on the colored sheet in the Kunstmaan. It costs an amount of almost nothing. Then you will receive a magazine full of exciting adventures from your friends four times a year. You are also welcome every two months at the meetings: full of joy through inspiring discussions and lectures! You can face and resist the whole world for a year. This advice for mental health care is offered to you free of charge and free of personal gain by

your librarian

Report members meeting 10 November 2018.

Opening by the chairman.
Ben has taken some electronics "from the attic" again. This includes items from the estate of deceased members. Among other receivers, downconverters. The revenues go to our workgroup.

For an open day at Estec, the NVR asked its members for stand crew. Because we as working group are member of the NVR, Ben has registered. He stood there one morning with workgroup affairs. The only stand that showed actual equipment which attracted interested people.

From Francis Bell of GEO comes the news that on 4 July 2019 an excursion will be organized at Eumetsat in Darmstadt. We are going to try to profile ourselves there in one way or another. On July 5 there may be a visit to ESOC (also in Damstadt) or antenna park.
You have to take care of transport and accommodation yourself; a small contribution may be required if bus transport is needed on the spot.

We are still working on making a new decoder-print (with VCXO and new USB-interface) and a set-up print to use the VCXO on the old decoder-print.

Furthermore, METOP-C has been successfully launched. No signals have yet been received. (Last message: Harrie v. Deursen has received the first images.)

Setting the agenda
No comments.

Administrative affairs, editorship
Fred vd Bosch is a temporary editor. In the last Kunstmaan there was a call for an editor; unfortunately little response ... Robert Langenhuysen reports that Wim de Vries (still (?) no member) may be interested.

Cash control committee:
For this we are looking for a new member. Peter Kuipers has done it twice and leaves the committee; Job de Haas will stay for another year. Herman ten Grotenhuis indicates that he wants to do this.

Satellite status
Given by Arne, see elsewhere in this "Kunstmaan".

Any other business
Robert Langenhuysen reports that the VERON organizes RF seminars again, with different topics.
Harrie v. Deursen is moving and has brought with him things he wants to get rid of. Among others Jesu rotors, 50 euros each, and 1700 MHz measuring transmitters.

Wim Bravenboer has bought an 8 GHz LNA on the DvdRA. The 8 GHz band is important to us because all new weather satellites use this band.

Harm de Wit asks if anyone has experience with SDR and receiving NOAAs. This is because he wants to do demonstrations. Unfortunately, there was no one at the meeting

with experience, but there are certainly people who have experience with this. See GEO mailing list.

Dirk de Schutter has 1700 MHz bandfilters with him. Very suitable for HRPT, to filter out unwanted signals just outside the band. They are 60 euros each.

Peter Smits has made a 1.7 meter dish with mesh. Furthermore he has made a patch antenna for 1.7 GHz (recipe Oleg, to be mounted in the focal point of a dish). This is narrow-band; possibly no interdigital filter is needed. Such a patch antenna is probably better than a helical one.

Paul Baak of the library has the magazine "UKW-berichte" for inspection. There are also a number of "new" books, obtained from inheritance.

Arne van Belle has bought a directional coupler 800-2600 MHz for 11 euros, via Ebay.

Closing

Presentation Ben: Measuring = knowing.
Because we have to gain more experience with 8 GHz, Ben has been busy with measurements on that frequency. On the basis of a document from Miniciruits:
ww2.minicircuits.com/app/COUP7-2.pdf
he has done some SWR measurements. The ADF5355 has been used as a signal generator.

Rob Alblas
(secretary AI)

satellietstatus

Arne van Belle, 3 december 2018

POLAIR	APT (MHz)	HRPT (MHz)	Overkomst
NOAA 15	137.620	1702.5	morning/evening, HRPT signal weak
NOAA 18	137.9125	1707.0	early morning/afternoon
NOAA 19	137.100	1698.0	noon/night
FengYun 3A	geen	1704.5	AHRPT 2.80 Msym/s
FengYun 3B	geen	1704.5	AHRPT 2.80 Msym/s
FengYun 3C	geen	1701.3	AHRPT 2.60 Msym/s
FengYun 3D	geen	7820.0 X-band	noon MPT 60 Mbps
Metop-A	uit(137.100)	1701.3	LRPT/AHRPT 2.33 Msym/s
Metop-B	geen	1701.3	Only AHRPT 2.33 Msym/s
Metop-C	geen	1701.3	Only AHRPT 2.33 Msym/s testphase
METEOR M N1	uit(137.100 LRPT)		1700.0 Black image
METEOR M N2	137.100 LRPT	1700.0	LRPT on/MHRPT on
NPP	geen	7812.0 X-band	HRD 15 Mbps
JPSS-1/NOAA 20	geen	7812.0 X-band	HRD 15 or 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. Recommend is 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 and broadcast on X-band with
LHCP. Rob Alblas has expanded his GODIL decoder and can now demodulate HRPT,
Meteor HRPT, METOP and FY3A / B and FY3C in the 1700 MHz band!

FY-3D transmits just like the NPP and JPSS-1 only on the X-band!

Harrie van Deursen has already received Metop-C on November 13, same frequency
and strength as A and B.
The Fenyun's give a little more signal but unfortunately there are lines missing
more often.

GEOSTATIONAIR	APT (MHz)	(SDUS)/PDUS (MHz)	Baanpositie
MET-11 (MSG-4)	1691 LRIT	1695.15 HRIT	0 degree, operational
MET-10	1691 LRIT	1695.15 HRIT	9.5 degree E, RSS
MET-9	1691 LRIT	1695.15 HRIT	3.5 degree E, RSS parallel operation
MET-8	geen LRIT	1695.15 HRIT	41.5° degree E, IODC
GOES-E (no. 16)	1686.6 GRB	1694.1 HRIT	75.2 degree W via Eumetcast
GOES-W (no. 15)	1691 LRIT	1685,7 GVAR	128 degree W via Eumetcast
GOES 14	1691 LRIT	1685,7 GVAR	105 degree W, Backup
GOES 13	1691 LRIT	1685,7 GVAR	60 degree W, Backup
GOES-17			137.2 degree W, in testphase until 20 december
Elektro-L2	1691 LRIT	1693 HRIT	78 Degree E, via Eumetcast
MTSAT-1R	1691 LRIT	1691 HRIT	140 degree E, Backup for MTSAT2

MTSAT-2	1691 LRIT	1687.1 HRIT	145 degree E, via Eumetcast
Himawari-8	geen LRIT	geen HRIT	140 degree E, via HimawariCast
Himawari-9			no LRIT, no HRIT, Backup for 8
Feng Yun 2E	-	-	86.5 degree E
Feng Yun 2F	-	-	112.5 degree E, Backup
Feng Yun 2G	-	-	99.5 degree E
Feng Yun 2H	-	-	79 degree E, test phase
Feng Yun 4A	1697 LRIT	1681HRIT	99.5 degree E, Operational

Lanceringen

Meteor M N2-2   Launch delayed, probably March 2019

Elektro-L no 3   Launch moved to 2020, possible it will be active again at 1691 MHz!

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

The 2nd EUMETCast transponder TP2 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.

Users can receive GOES 16 data live on TP1 / HVS-1 after requesting.
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 a GOES ABI Manager for Goes 16 and 17 NetCDF data:
http://www.satsignal.eu/software/GOES-ABI-Manager.html

Due to "congestion" in the TV satellite world, we see that more and more transponders are being used on Eutelsat 10A. For optimum signal quality (SNR) you have to rotate the LNB (Skew) so that vertical transmitters are attenuated as much as possible. A LNB of moderate or poor quality can 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.
Dishes smaller than 120 cm have a larger opening angle and may experience more interference from neighboring satellites.

Eumetsat recommends that you repeat the fine-tuning of your dish every year and pay attention to correct rotation (Skew) of the 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

With a splitter you can connect a second receiver to the same dish / LNB and at the same time receive Transponder 2. On the same PC, 3x Tellicast, for BAS, for HVS-1 and for HVS-2 will run. If you also want to save all data, you have to use a ramdisk and multiple harddisks or a fast SSD.
The TBS dual or quad tuner cards are suitable to receive both transponders simultaneously.

Eumetsat has adjusted the distribution of the data on Transponder TP1 and TP2. GOES 16 and NOAA20 data are now on TP1 (HVS-1) and Sentinel 3A data has been moved to TP2 (HVS-2). Sentinel 3B data will also be on HVS-2 in the future. Unfortunately, the GOES-East images on Basic Service have stopped as a result! For adaptation of the recv-channels file (s) see https://www.eumetsat.int/website/home/News/DAT_3942692.html

Himawari-8 images are now being broadcast via EUMETCast every 10 minutes. Since these are all 16 spectral channels with a resolution of 2 km, they are transmitted via HVS-1 under channel E1H-TPG-2. Unfortunately, the half-hour Himawari-8 images on the Basic Service were stopped on 10 October.

So we see that with an increasing datastreams they are diverted to HVS-1 and 2, the images of Eumetsat remain available on Basic Service.