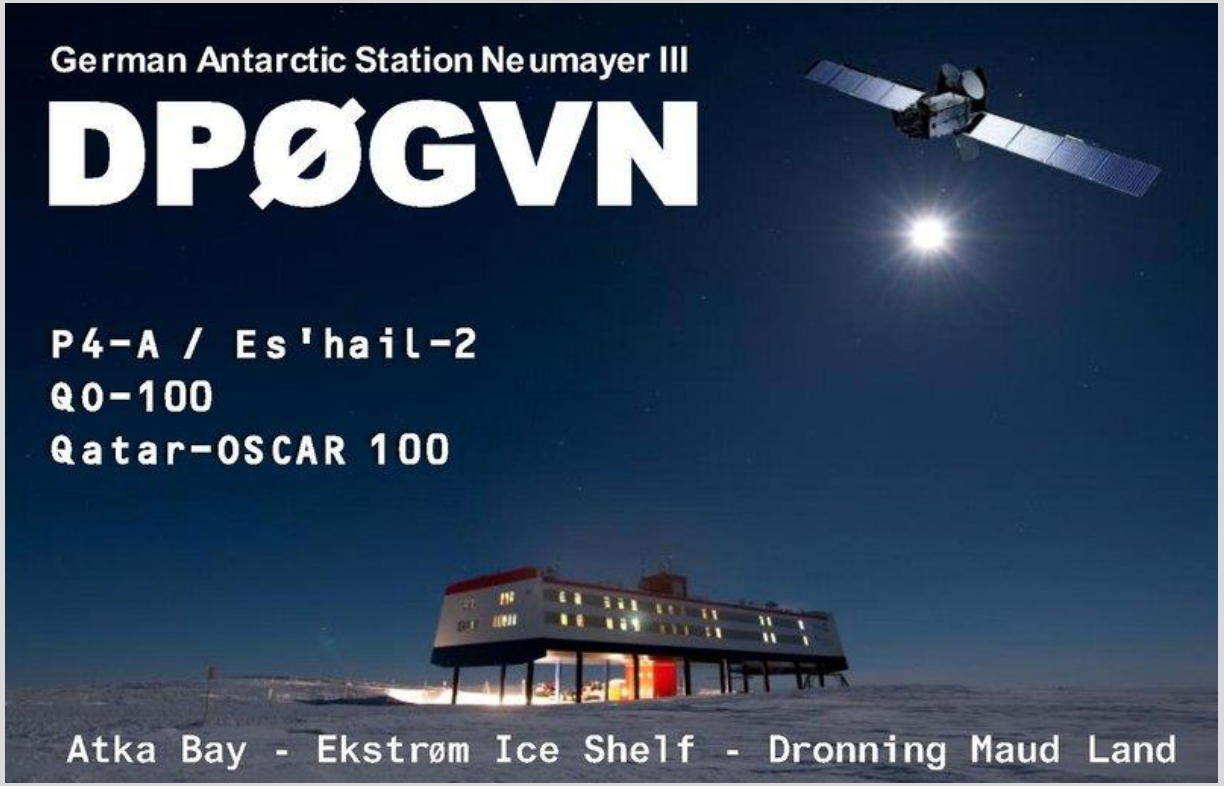
Amateur Radio Activities via QO-100 from DP0GVN at the German Research Station Neumayer-III in Antarctica



Source: DB2OS

Matthias Bopp DD1US
June 10th 2022
VII Microwave & EME Symposium
Radkow / Poland

Deutscher Amateur-Radio-Club e.V.
Bundesverband für Amateurfunk in Deutschland

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Satellites for Communication, Science and Education

Agenda

- **QO-100**
- Neumayer-Station III
- Amateur Radio Station DP0GVN
- School Contacts
- Digital Amateur Television DATV

Qatar-OSCAR 100 (QO-100)

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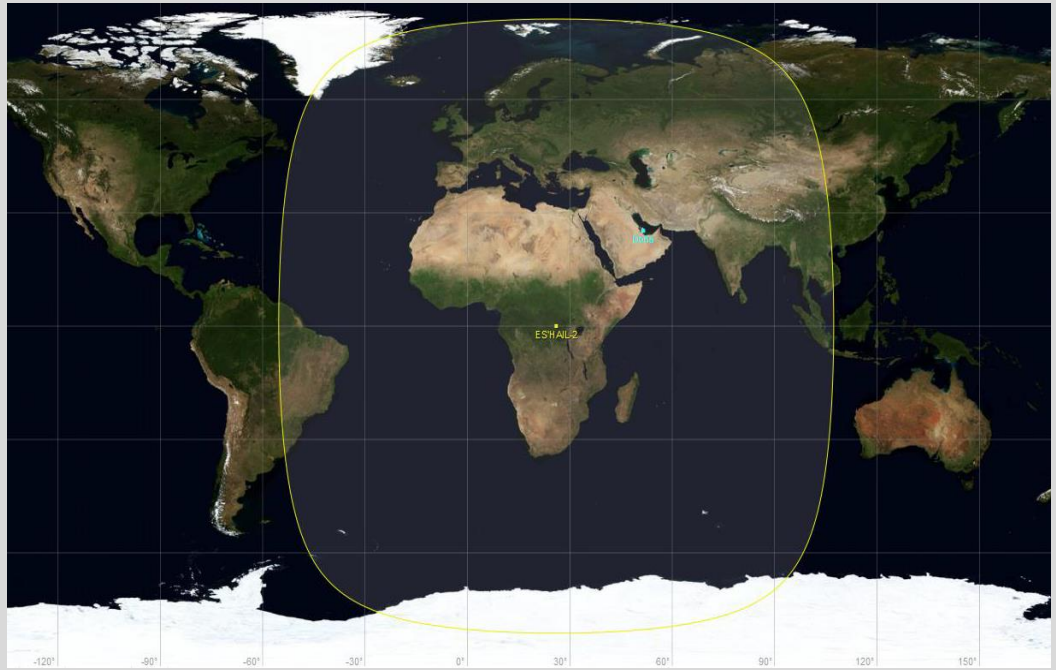
On November 15th 2018, SpaceX launched the Es'Hail-2 geostationary communications satellite for Qatar on a Falcon 9 rocket. It also has an amateur radio payload called Qatar-OSCAR 100 with two amateur radio transponders (↑13cm uplink / ↓3cm downlink).
QO-100 is positioned at 26° East, covering Brazil, Europe, Africa and much of Asia simultaneously.



QO-100 features a 500 kHz wide linear transponder for narrowband modes (voice, data, images) and a 9 MHz wide transponder for experimental digital modulation modes such as digital amateur radio television.
The technical expertise was provided mainly by German radio amateurs of AMSAT-DL.

Source: DD1US

QO-100 Orbit

Quelle: AMSAT-DL

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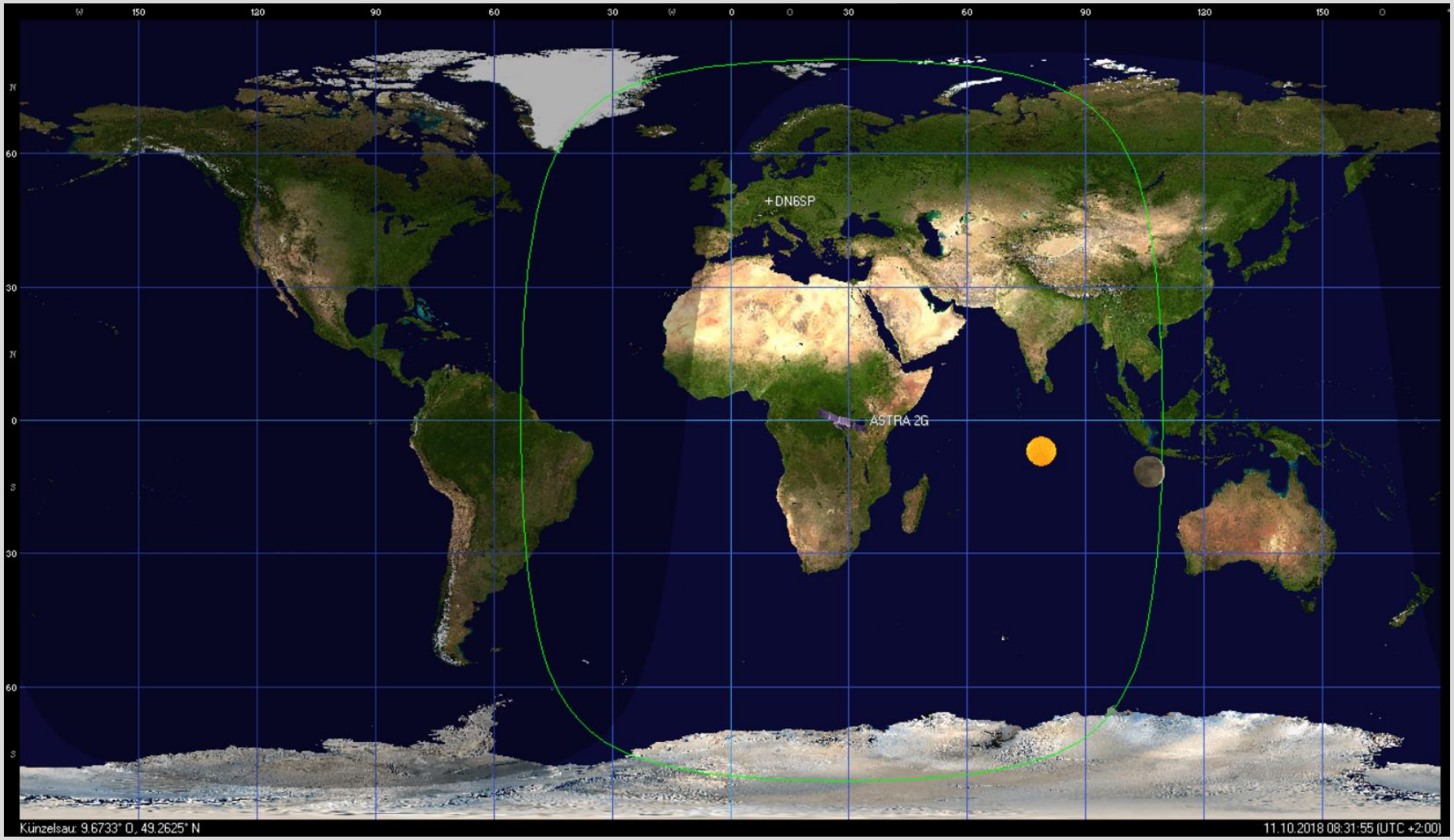
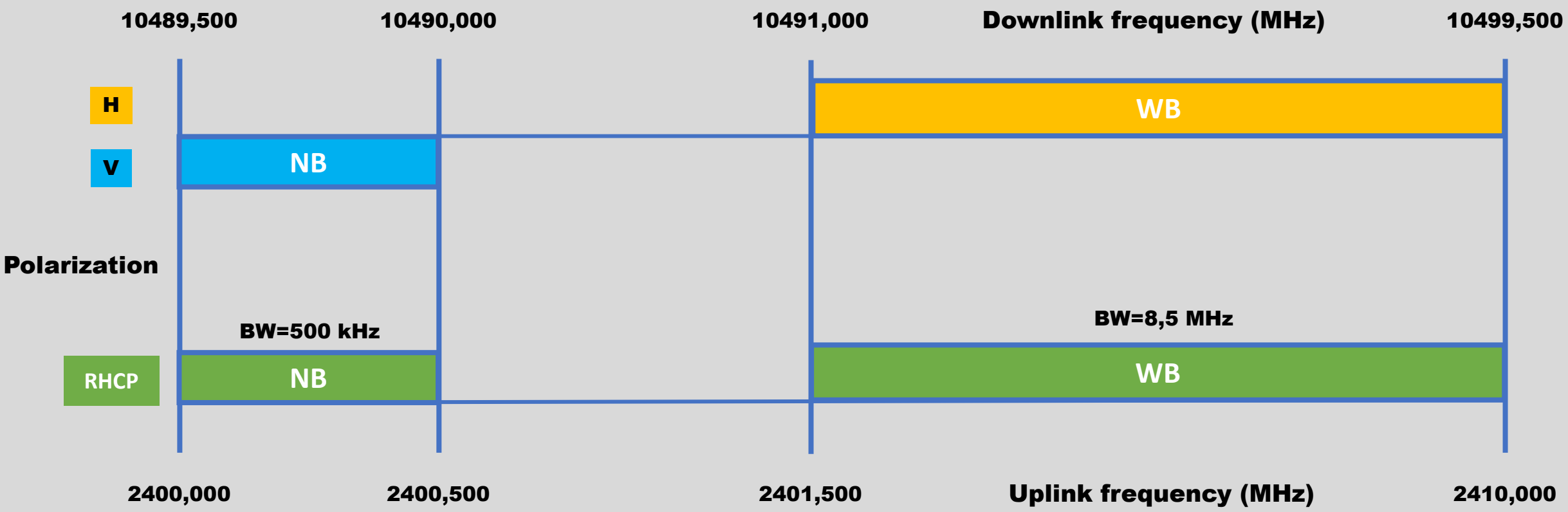


Qatar-OSCAR 100 is in a GEO (Geostationary Orbit): large constant visibility range, fixed antennas on the ground are sufficient

Source: DD1US

QO-100 Narrowband (NB) & Wideband (WB) Transponders



Source: DD1US

QO-100 NB Transponder

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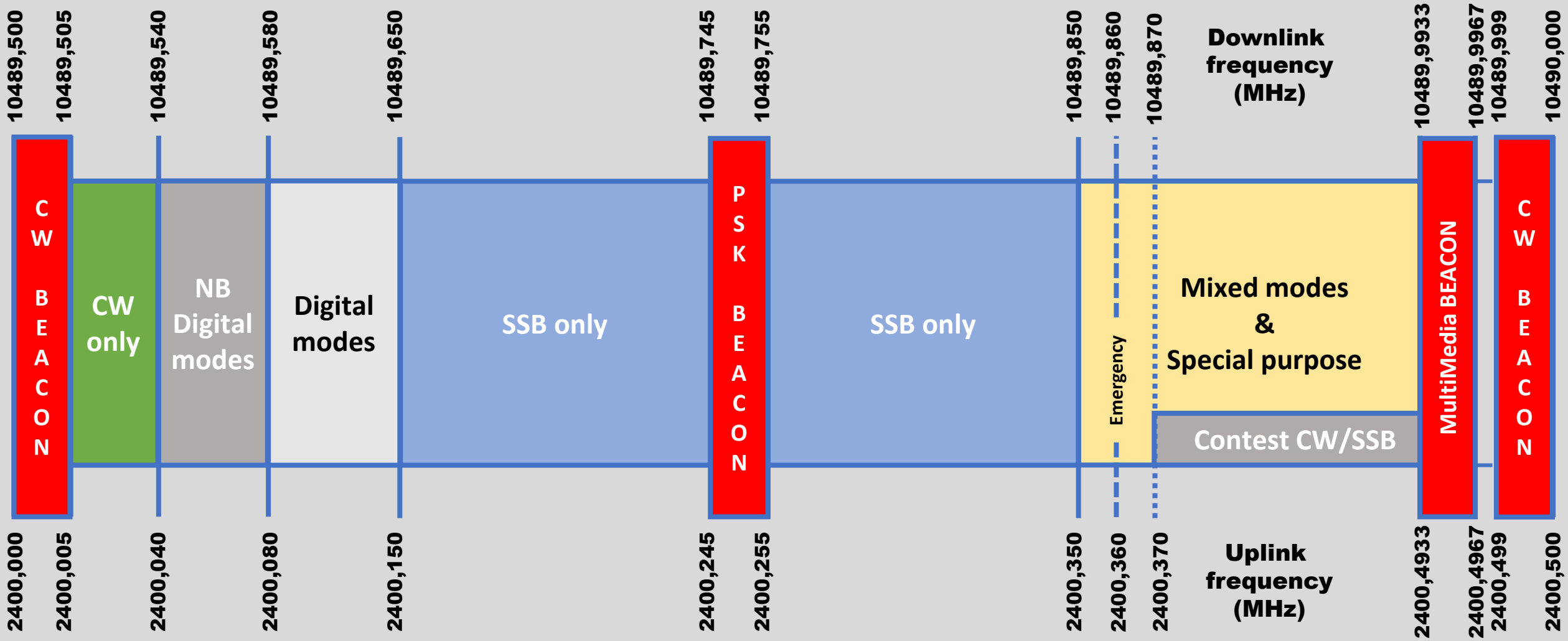
New band plan since April 3rd 2021:



Source: DD1US

QO-100 Narrowband Transponder

Uplink		Downlink			
Start [MHz]	End [MHz]	Start [MHz]	End [MHz]	Available [MHz]	Comment
		10489,500	10489,505	0,005	Lower Beacon 10489,500 MHz, CW F1A 400Hz shift, + guard band
2400,005	2400,040	10489,505	10489,540	0,035	CW only
2400,040	2400,080	10489,540	10489,580	0,040	digimodes (500 Hz max. BW)
2400,080	2400,150	10489,580	10489,650	0,070	digimodes (2700 Hz max. BW)
2400,150	2400,245	10489,650	10489,745	0,095	SSB only (2700 Hz max. BW)
		10489,745	10489,755	0,010	Middle Beacon 10489,750 MHz, 400 Bit/sec BPSK, + guard bands
2400,255	2400,350	10489,755	10489,850	0,095	SSB only (2700 Hz max. BW)
2400,350	2400,495	10489,850	10489,995	0,145	mixed modes (2700 Hz max. BW) & special purpose
		10489,993	10489,997	0,004	Multimedia Beacon 10489,995 MHz, 7200 Bitsec 8APSK
		10489,995	10490,000	0,005	Upper Beacon 10490,000 MHz, CW F1A 400 shift, + guard band

Source: DD1US

<u>Special frequency:</u>
International emergency frequency

Uplink
2400,360 MHz

Downlink
10489,860 MHz

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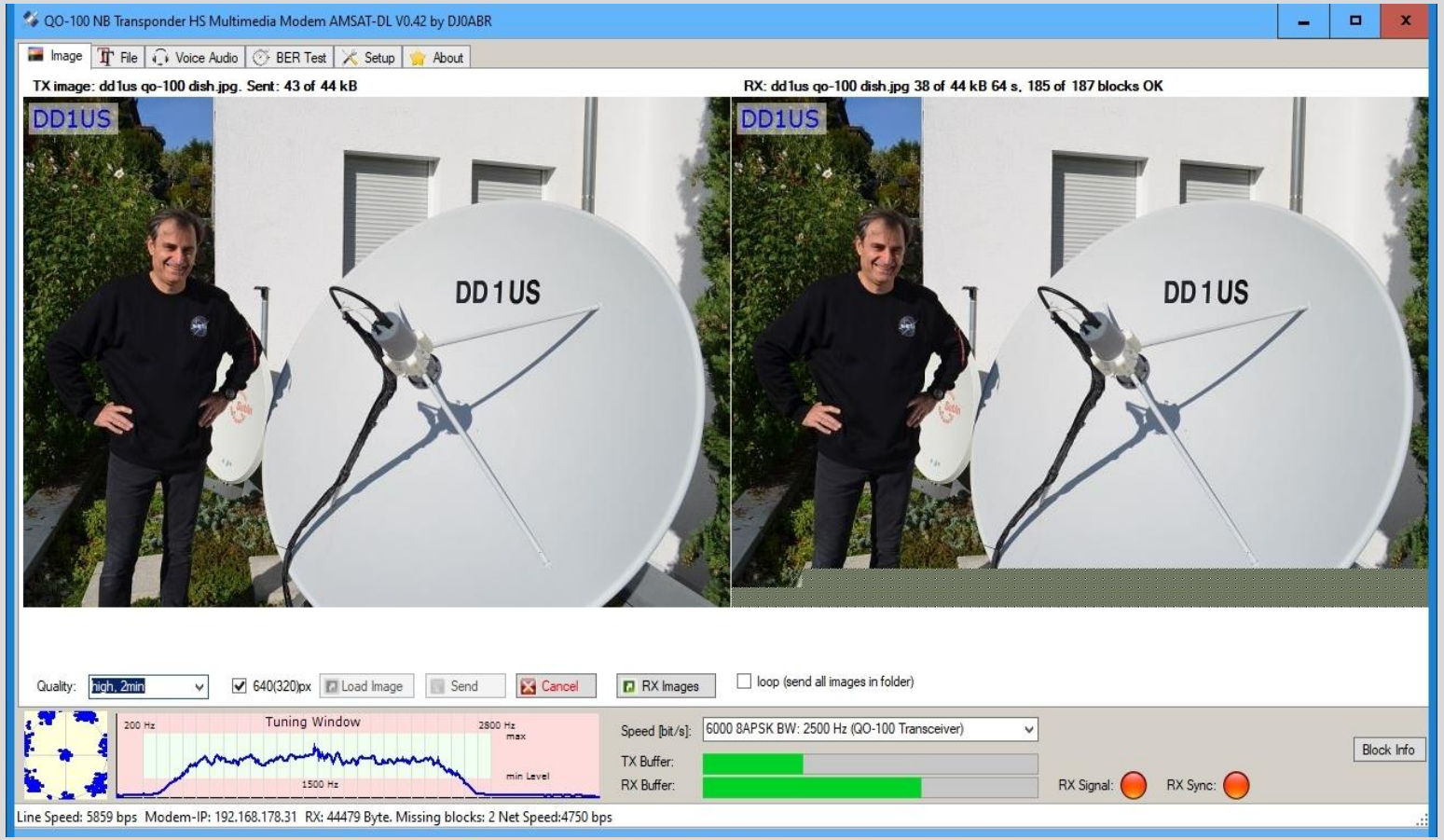
AMSAT-DL High Speed Multimedia Modem

developed by Kurt DJ0ABR

- Sound card modem
- Open Source
- Supports fullduplex
- Optimized modes for QO-100
- Maximum BW 2.7kHz
- Datarates up to 7200bps
- Different modulation schemes
- Transfer of Images
- File Transfer
- Website transfer
- Digital Voice
- RTTY



Source: DD1US

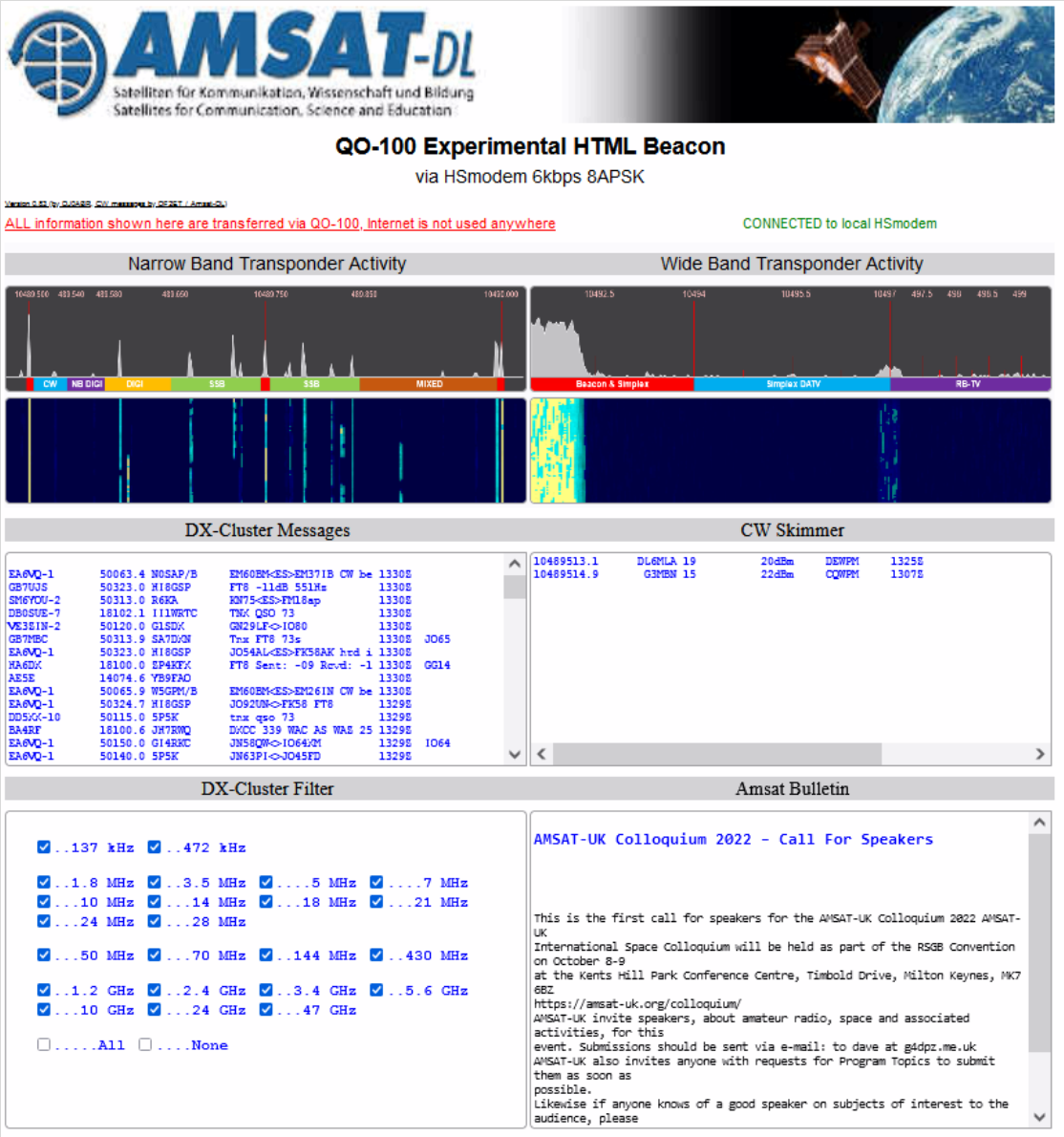
AMSAT-DL Multimedia Beacon

The multimedia beacon is transmitted from the ground station in Bochum on 10489.995 MHz at 7200 bit/s in 8APSK.

Like the High Speed Multimedia Modem, it was developed by Kurt DJ0ABR.

The MM beacon is presently transmitting:

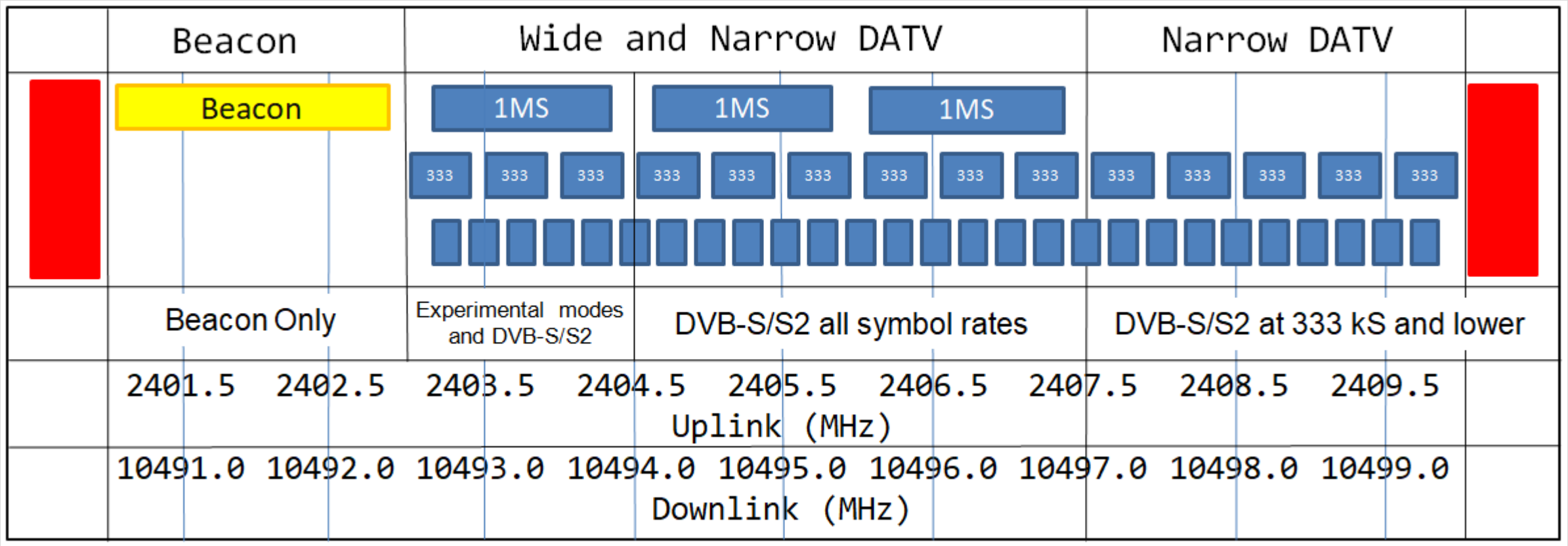
- Realtime spectrum & waterfall of the NB TPX
- Realtime spectrum & waterfall of the WB TPX
- DX-Cluster messages (configurable)
- CW-Skimmer of the QO-100 NB TPX
- AMSAT satellite bulletins



Source: DD1US

QO-100 Wideband Transponder

New band plan since February 2021:



Source: AMSAT-DL

Agenda

- QO-100
- **Neumayer-Station III**
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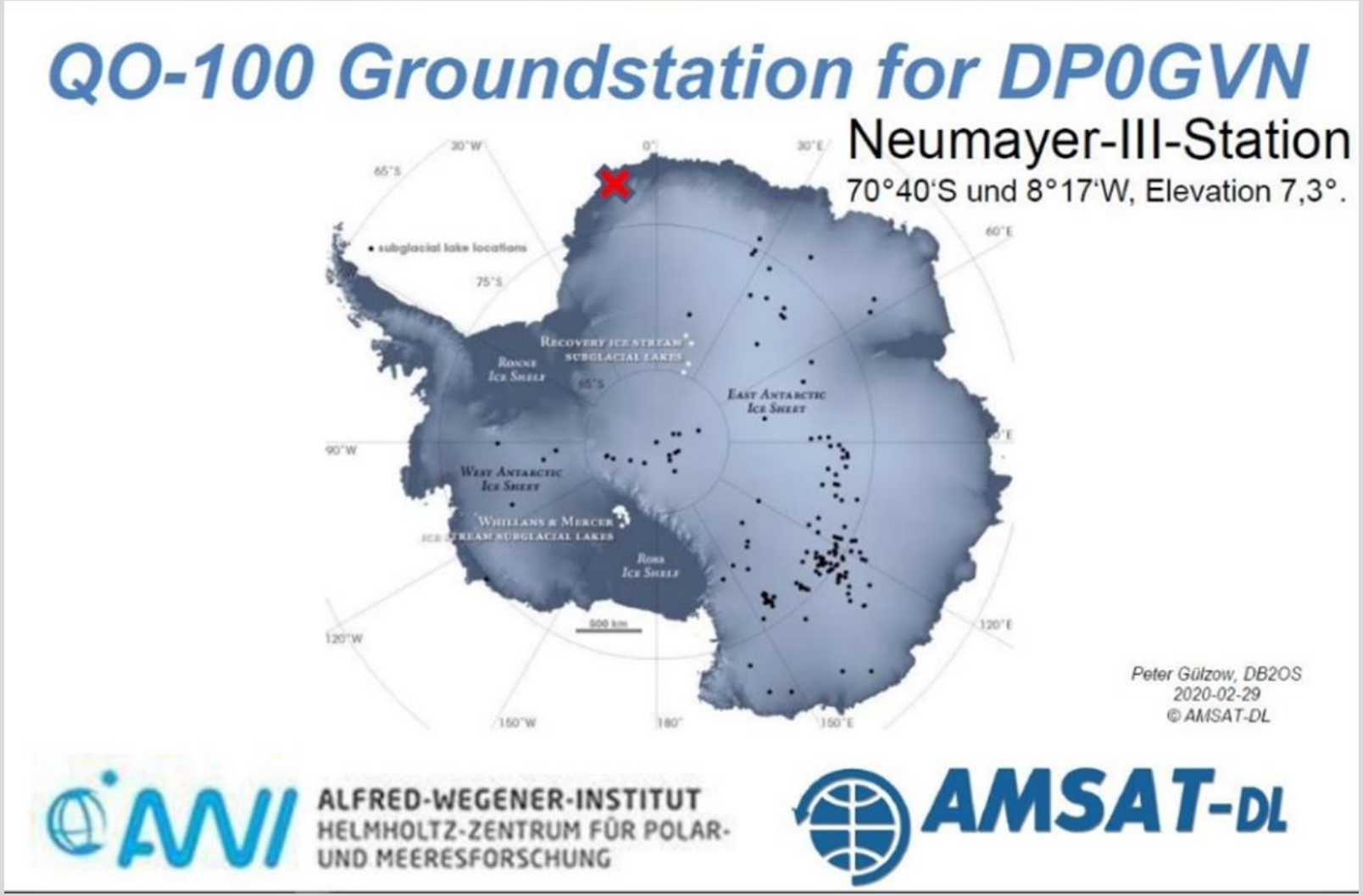
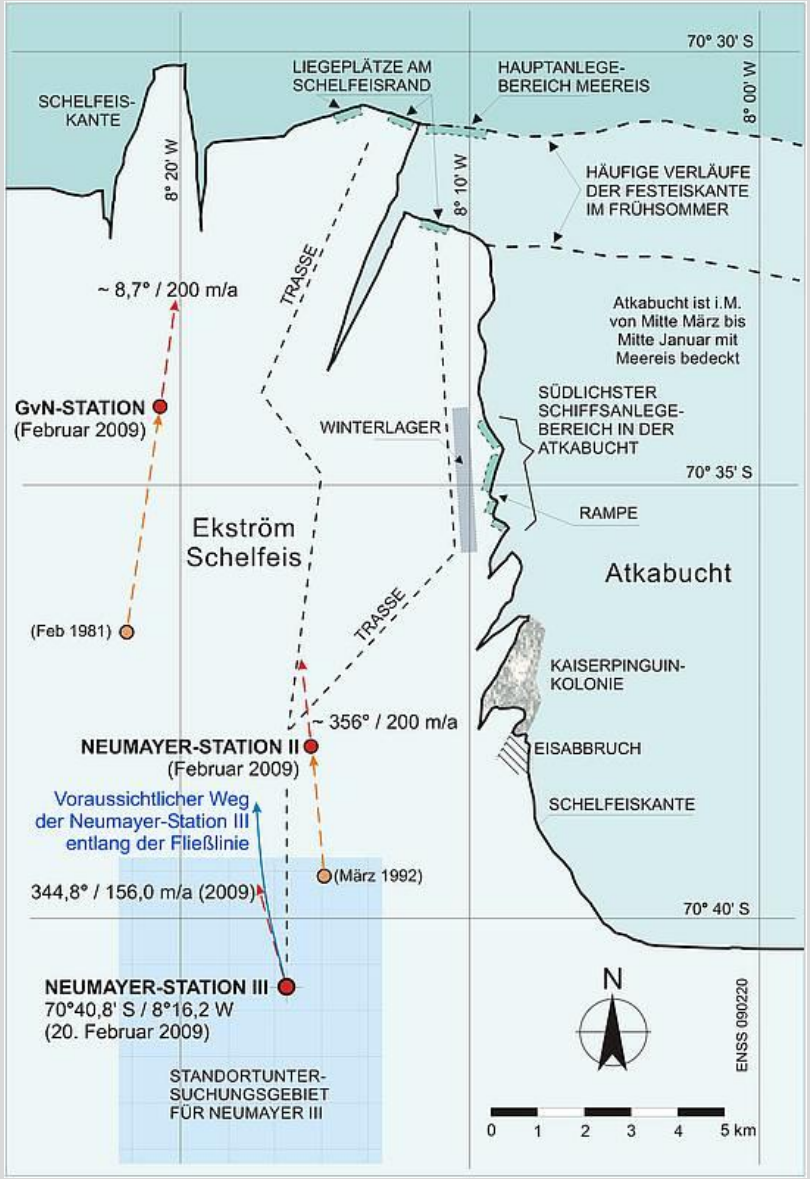
Neumayer-Station III

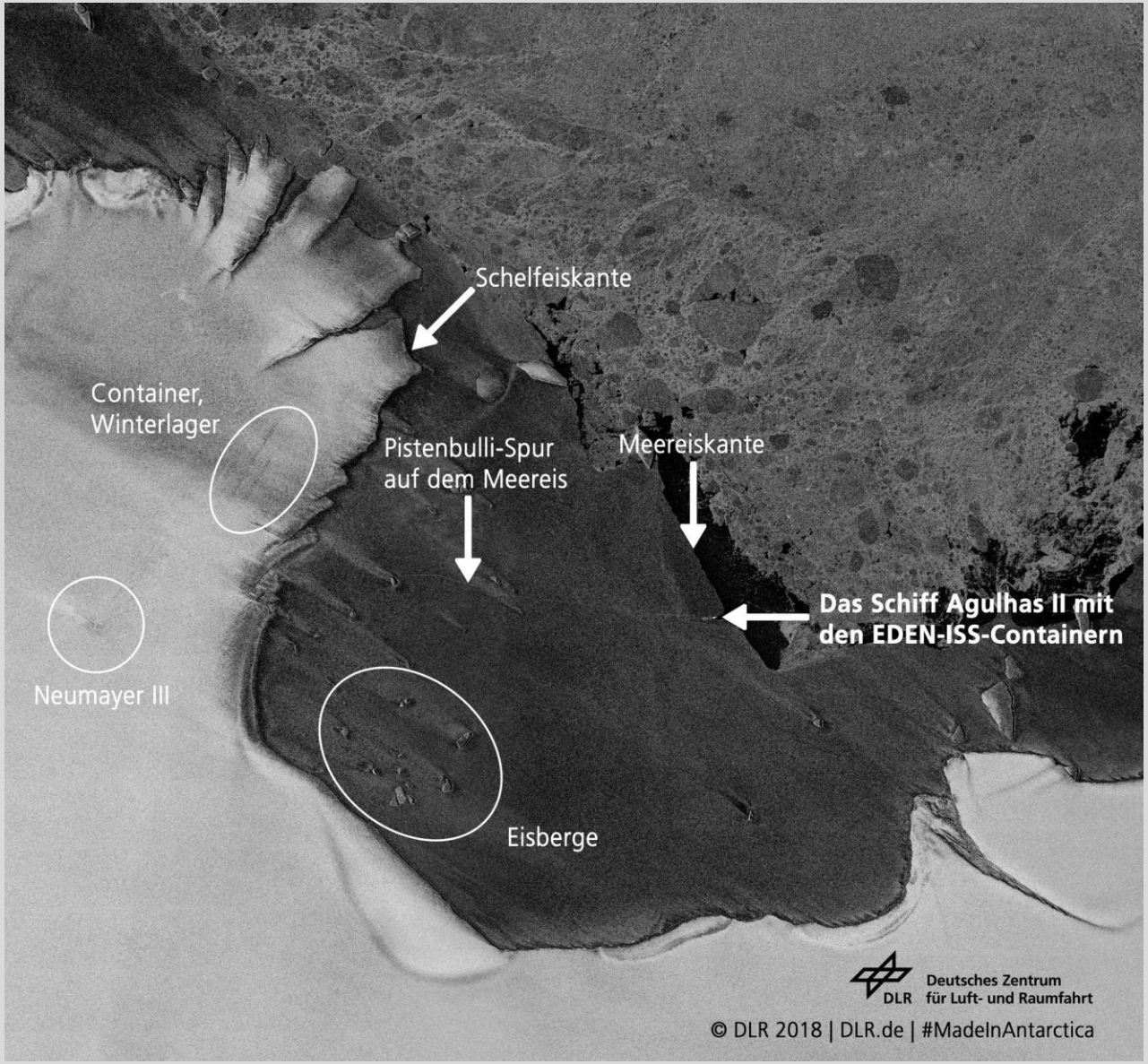


Source: DB2OS

Location of Neumayer-Station III

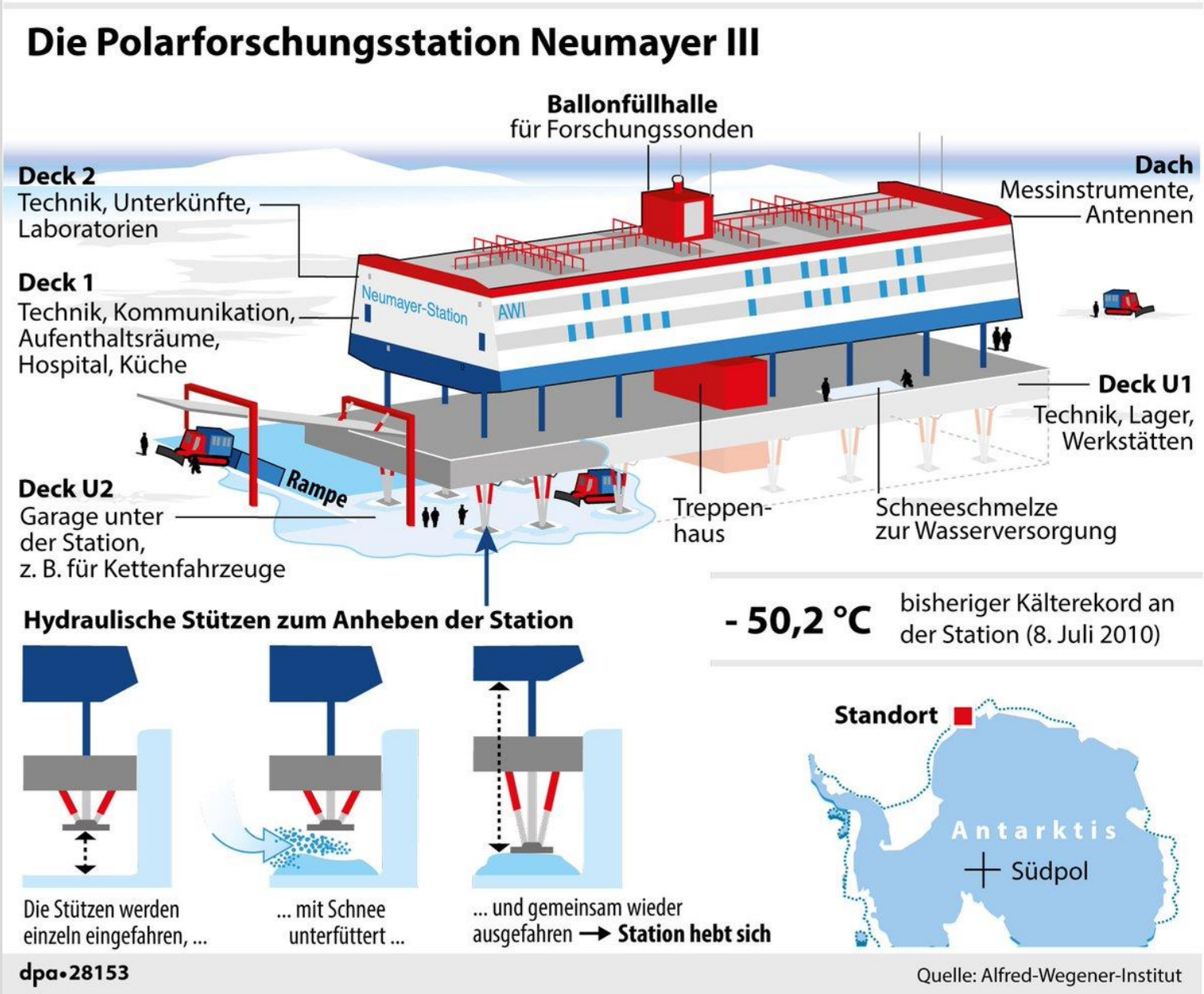


Source: Alfred-Wegener Institut Bremerhaven



Source: DLR

Neumayer-Station III

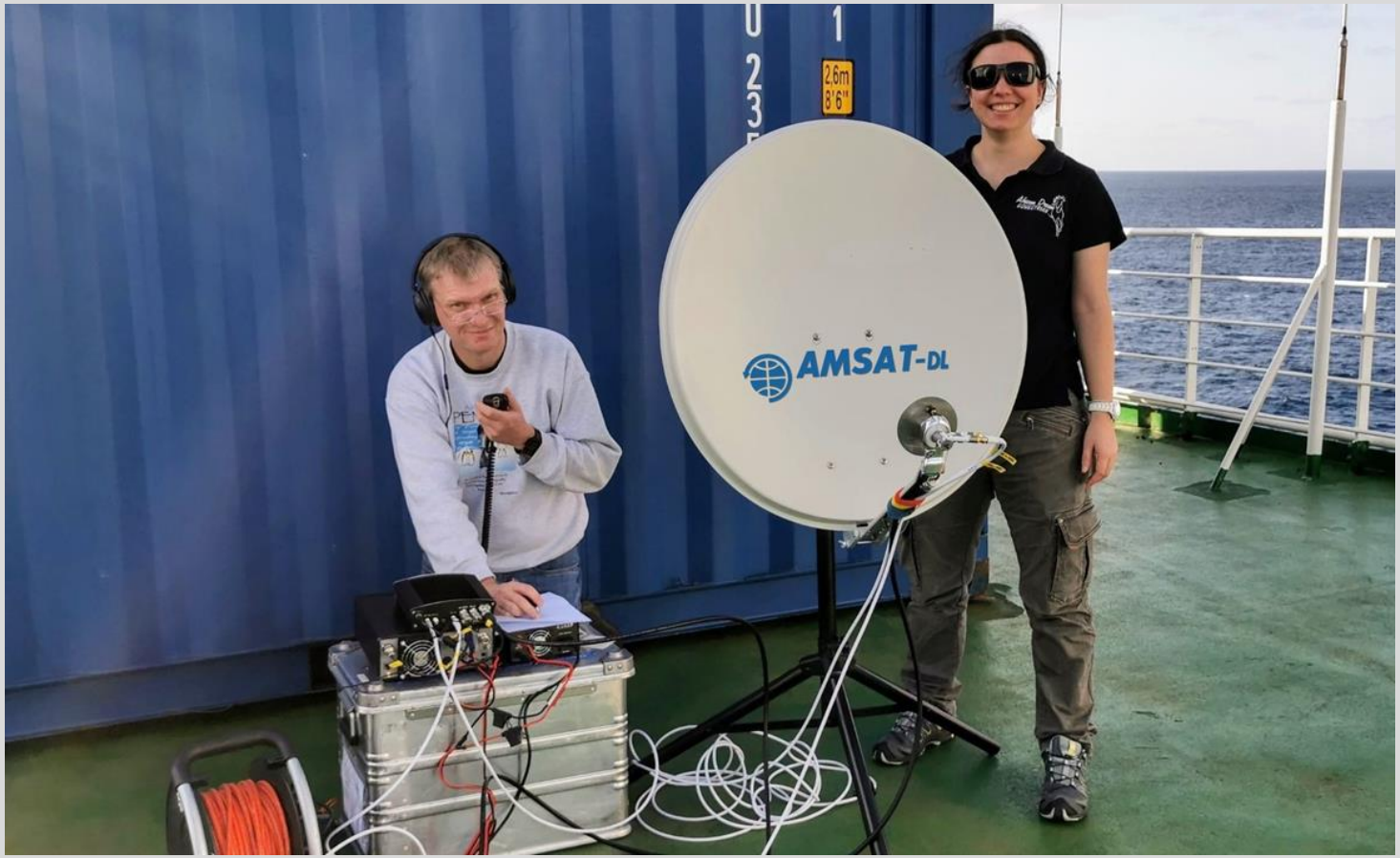


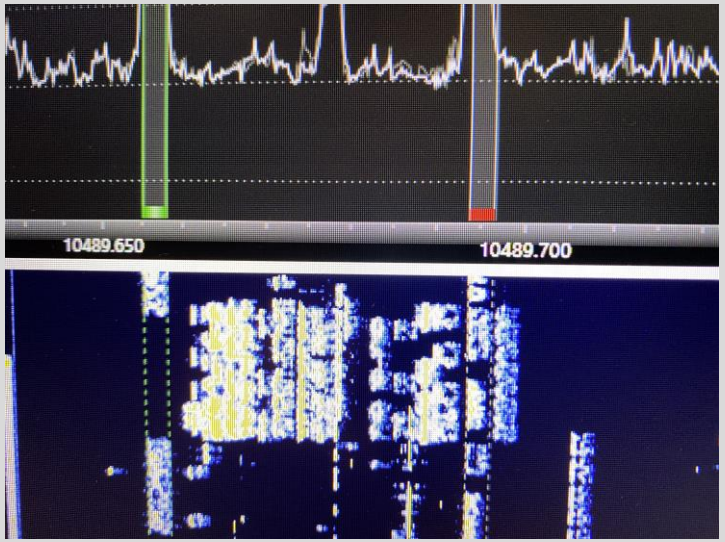
Lifting of the complete station

Source: Alfred-Wegener Institut Bremerhaven

Arrival with the ship Polarstern DP0POL/mm

Last year, because of Corona, the new crew could not travel by plane via South Africa as usual, but by icebreaker “Polarstern”.





Thus Felix DL5XL and Theresa DC1TH had a lot of time to distribute "wet grid-squares" with a portable system of AMSAT-DL and Theresa learned to deal with pile-ups.

Source: DL5XL, DC1TH

Source: Hinnerek Heuck, Alfred-Wegener Institut

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QO-100 Amateur Radio Station DP0GVN

The station, which was built and sponsored by AMSAT-DL consists of 3 parts:

1.) the antenna on the roof,
2.) a unit directly under the roof,
3.) the units in the shack.

Between the shack and the unit under the roof, 3 times 60m of Ecoflex-15 have been installed.

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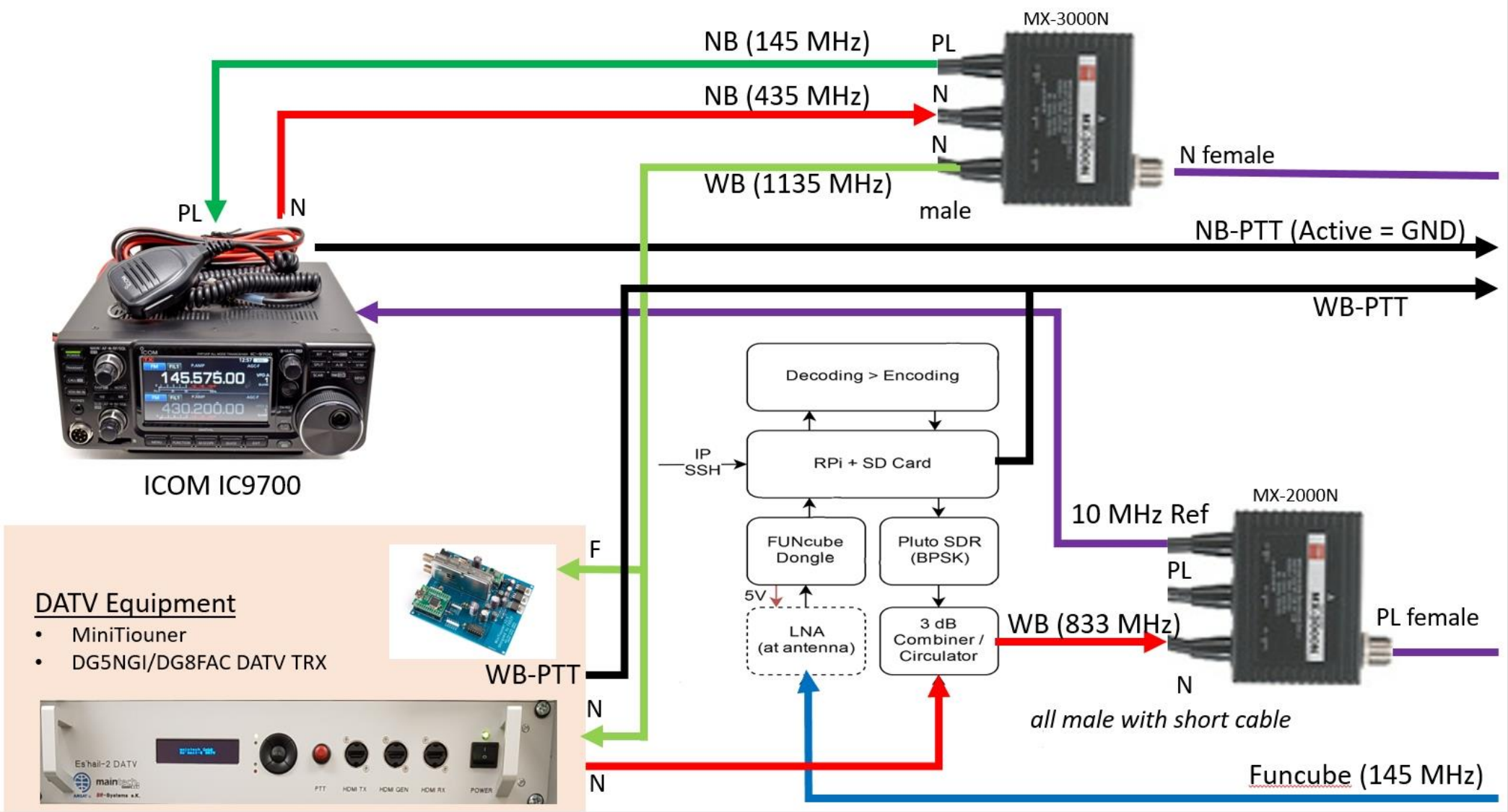
Source: DL5XL, HB9HCF

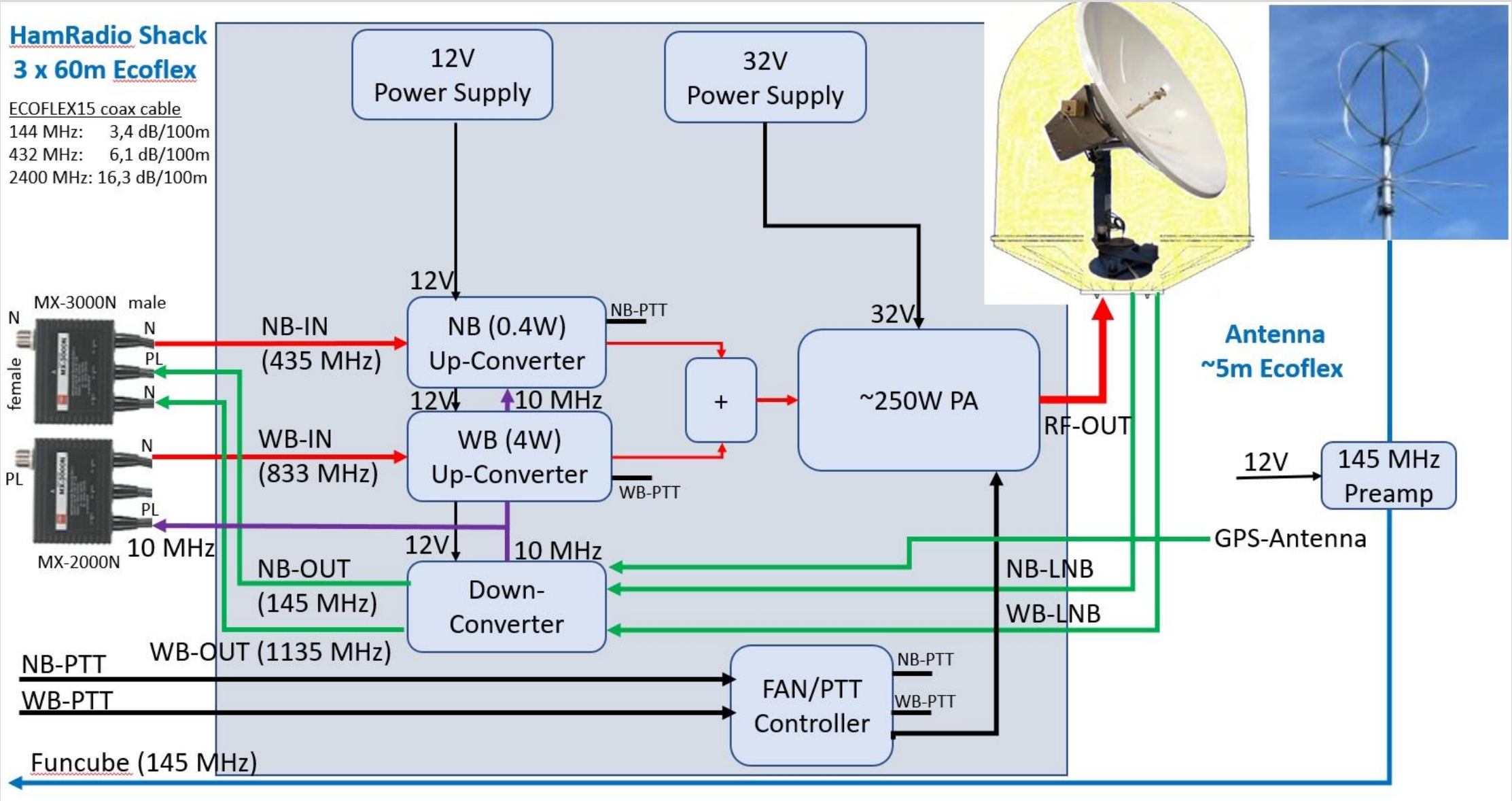
QO-100 amateur radio station in the shack

In the shack are the radios for Narrowband=NB (SSB) and Wideband=WB (DATV) operations.



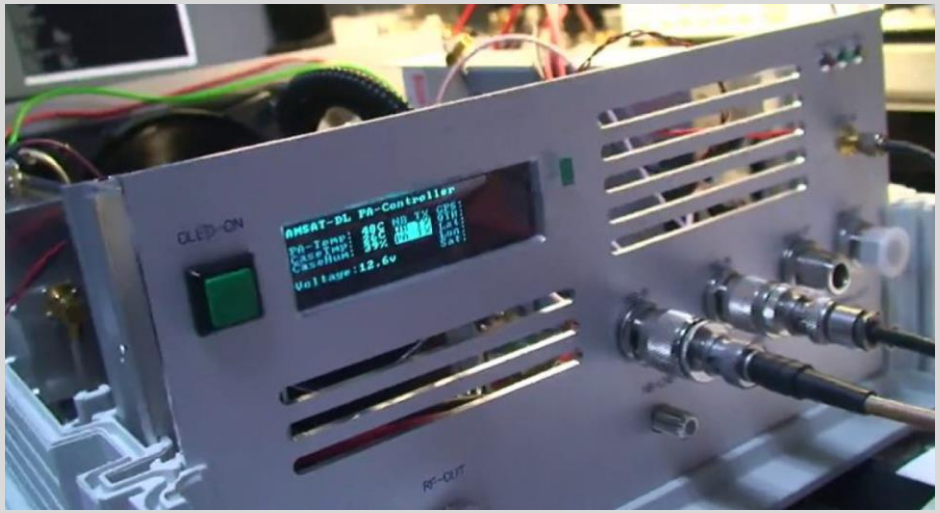
Source: DB2OS

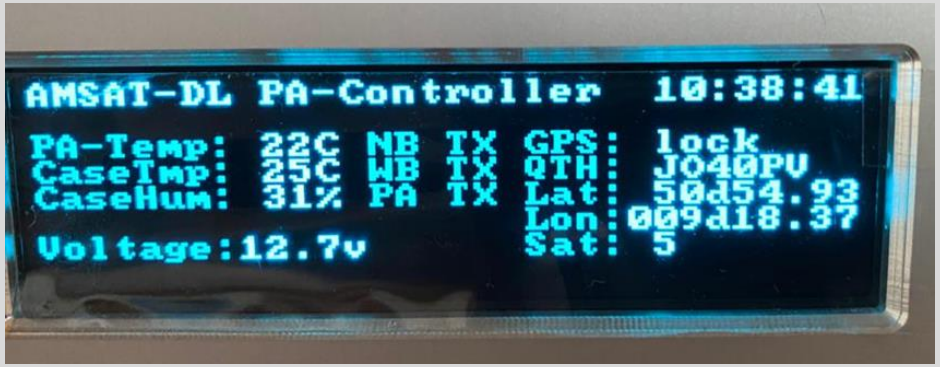
QO-100 unit under and antenna on top of the roof

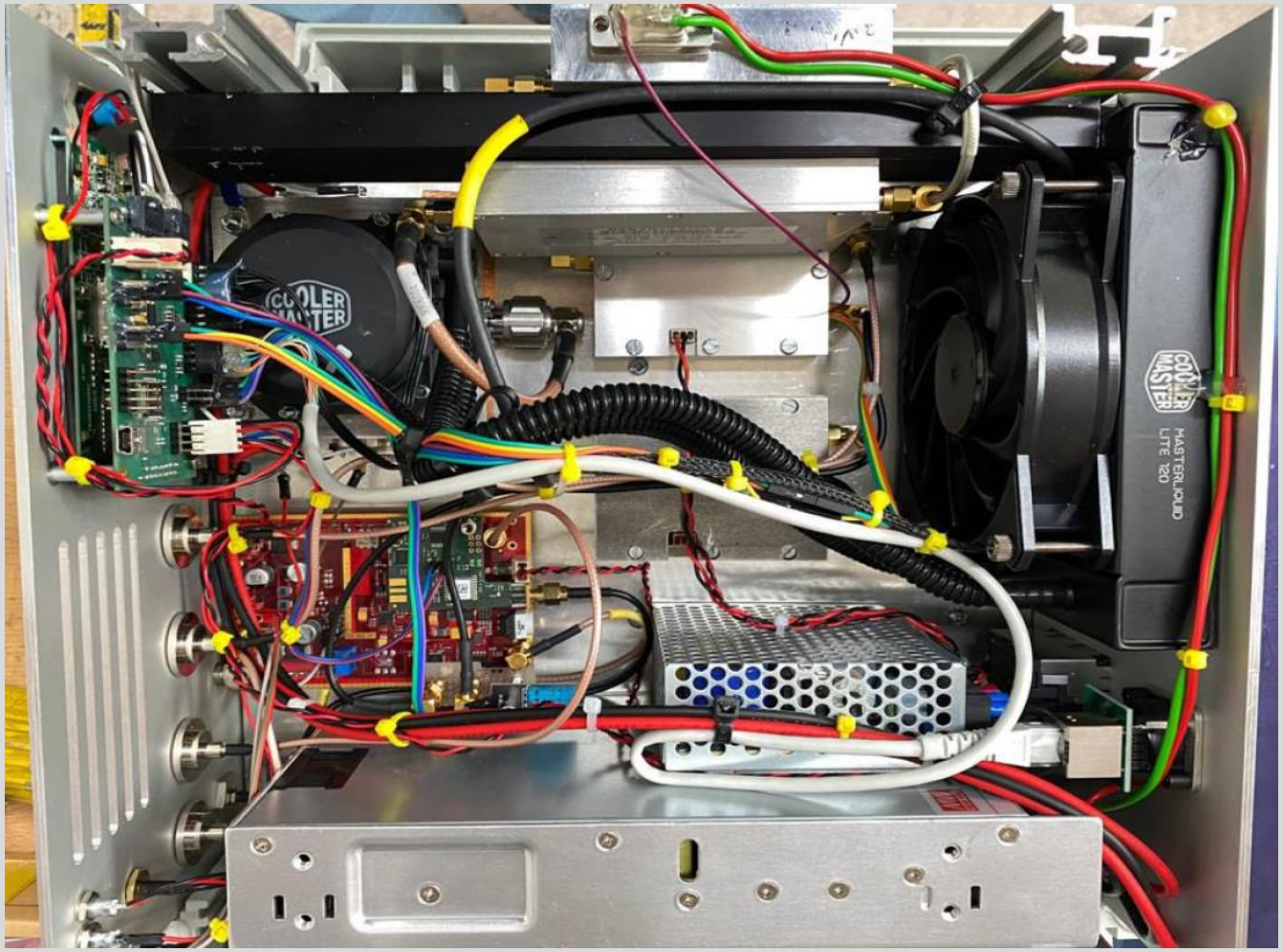


Source: DB2OS

QO-100 unit under the roof



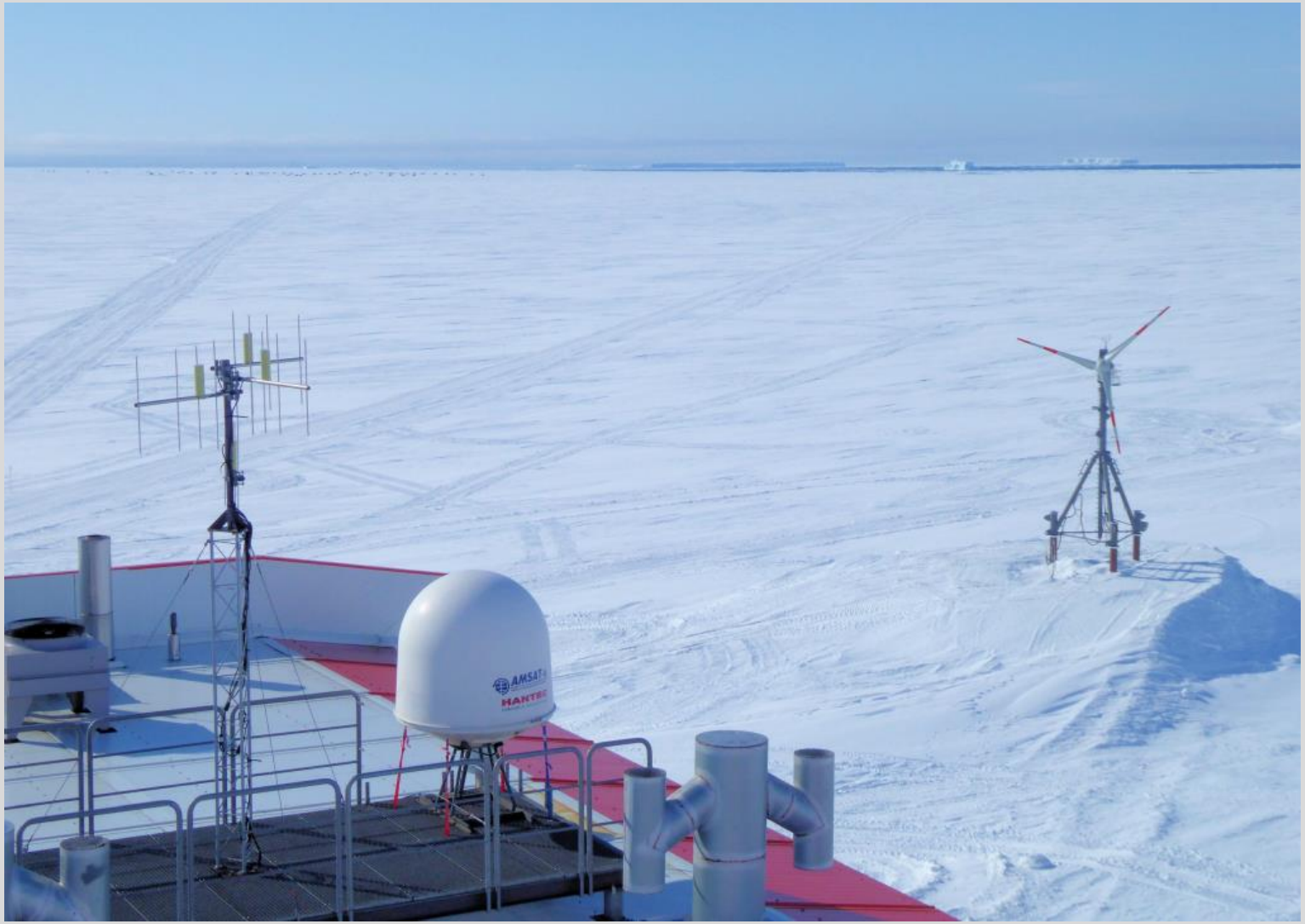




The unit under the roof includes a water-cooled 250W power amplifier. It is located directly under the roof to minimize cable losses to the antenna.

Source: AMSAT-DL

First QO-100 antenna



Source: DL5XL

In January 2020 an antenna for QO-100 was installed on top of Neumayer-Station III

Heavy storm at Neumayer-Station III

Source: ZDF - TerraX

On the night of August 13th to 14th 2021, a particularly strong storm swept across Atka Bay in Antarctica and wind speeds of up to 207km/h were also measured at Neumayer Station III, 20km away.
The radome and antenna for QO-100 were completely destroyed.

New antenna for QO-100

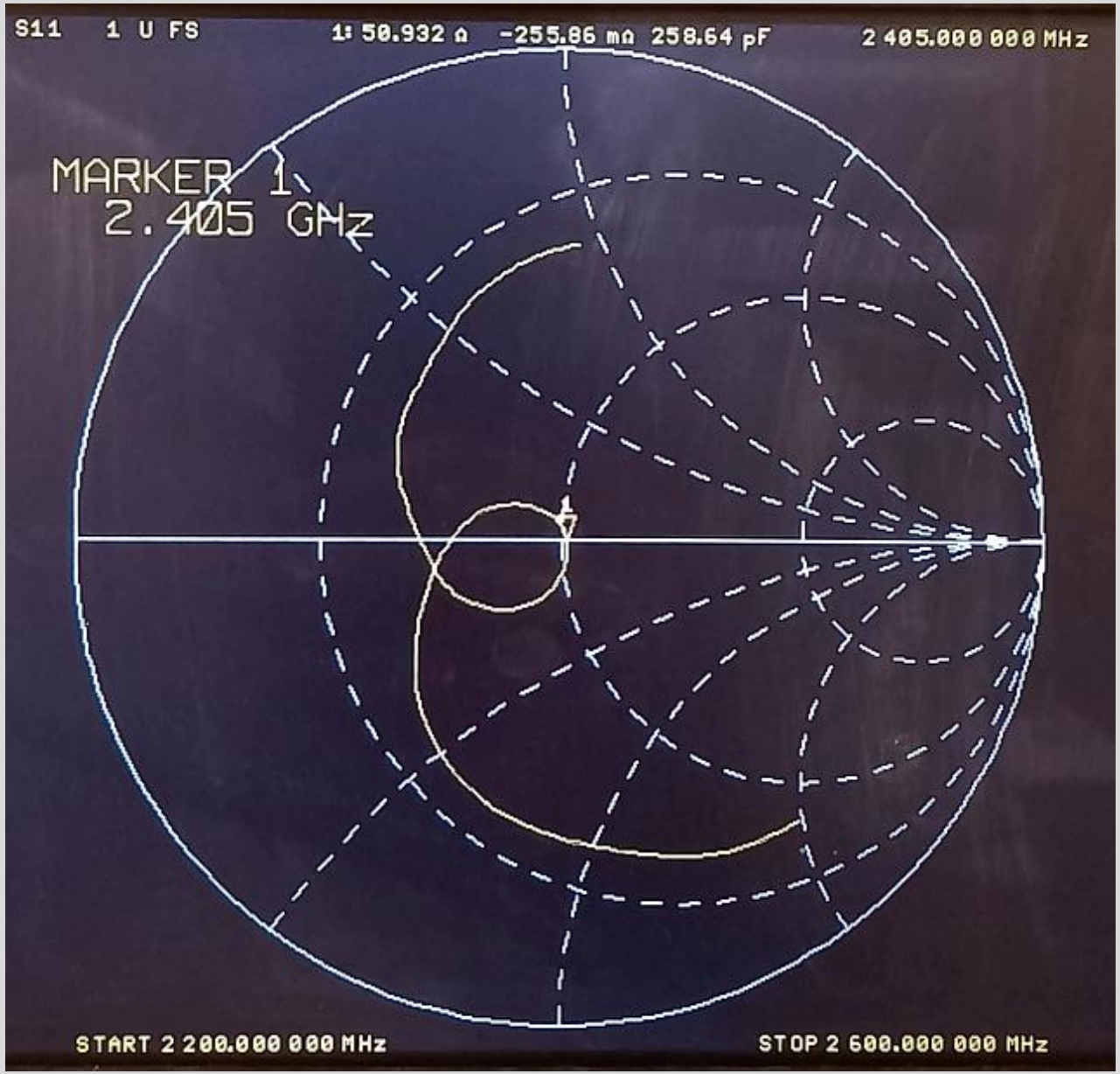
Kathrein 120cm prime-focus-dish (PFD) with POTY-feed

Built by Heinz DJ5JN and Matthias DD1US

Source: DD1US

New antenna for QO-100

Source: DD1US



Source: DD1US

POTY-feed and its impedance after careful alignment

New antenna for QO-100

We tested several LNBs for best SNR performance and used the best 2 for DP0GVN

Source: DD1US

New antenna for QO-100

After shipping the antenna to Bochum it was assembled into the radome

Source: AMSAT-DL

New antenna for QO-100

Next the antenna in the radome was shipped by Florian DF2ET to Rostock

Source: AMSAT-DL

New antenna for QO-100

Source: Alfred-Wegener Institut Bremerhaven

After a long journey on the German research ship “Polarstern” it finally arrived in Antarctica.

Source: Alfred-Wegener Institut Bremerhaven

New antenna for QO-100

Transport from the ice shelf edge to the station

In front of Neumayer Station III

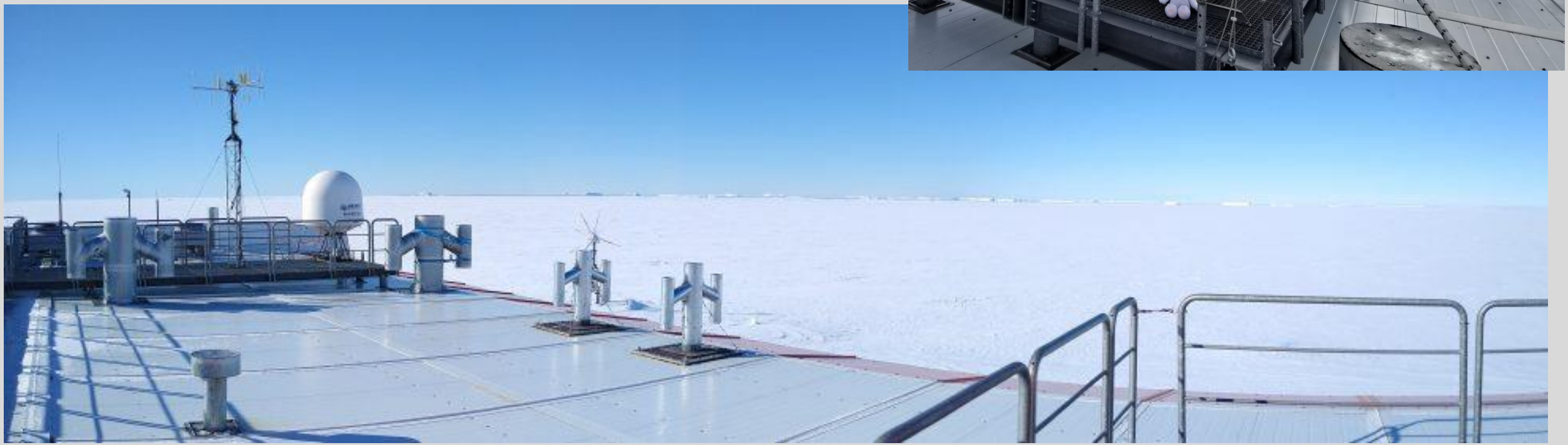
On Jan. 5th 2022 the antenna was placed on the station

Almost there …

Source: DL5XL, DC1TH

New antenna for QO-100

Since January 1st 2022 DP0GVN is QRV again.
RX and TX signals are is improved compared
to the old antenna.



Source: DL5XL

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School Contacts with DP0GVN

In the meantime, numerous contacts by DP0GVN with international schools in the footprint of QO-100 have been successfully carried out.

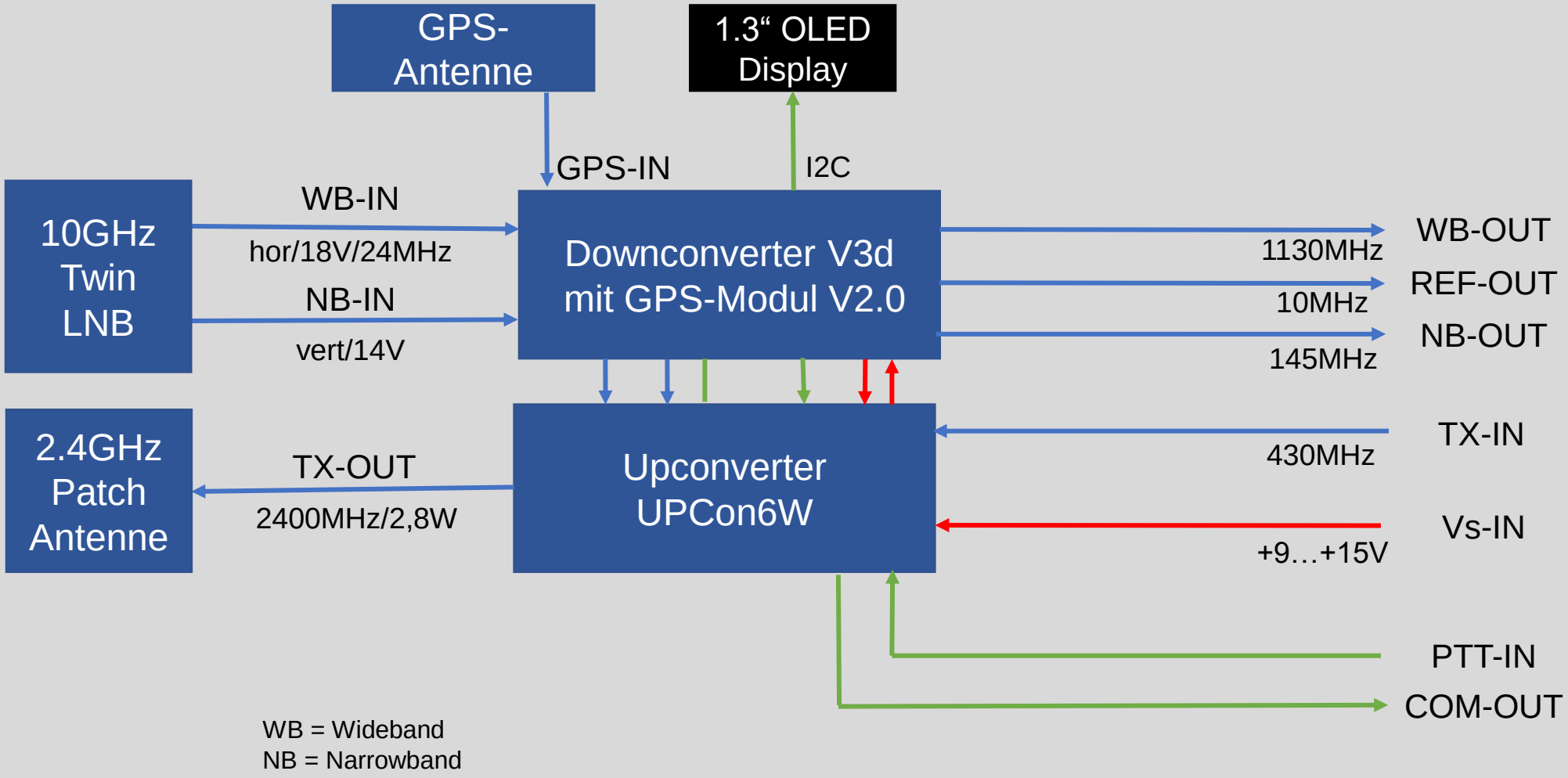
Such a contact usually lasts 30 to 45 minutes and the crew of Neumayer-Station III is happy to answer the wide-ranging questions of the young people (and teachers).

The coordination is done by Charly DK3ZL, board member of AMSAT-DL. If you are interested to arrange a contact with DP0GVN, just send an email to him: dp0gvn@amsat-dl.org

As part of the preparation for an ARISS contact in Q1'2022 with Matthias Maurer on the ISS, Heinrich DK8GL and Matthias DD1US gave presentations and practiced radio communication at both participating schools.

The highlight was an SSB contact with the Neumayer-Station III in Antarctica via QO-100.
The portable equipment of DD1US consisting of a 60cm parabolic dish, a transverter based on the AMSAT-DL modules and an ICOM IC-9700 transceiver was used.

QO-100 portable station

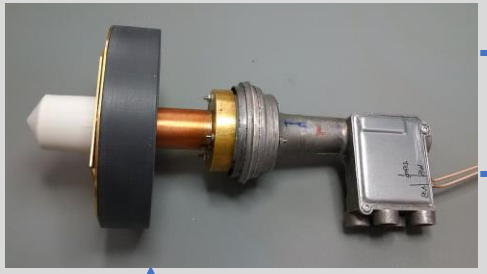


WB = Wideband
NB = Narrowband

Source: DD1US

QO-100 portable station

GPS-IN



WB-IN

hor/18V/24MHz

NB-IN

vert/14V

TX-OUT

2400MHz/2,8W

1130MHz WB-OUT

10MHz REF-OUT

145MHz NB-OUT

+9…+15V Vs-IN

430MHz TX-IN

PTT-IN

COM-OUT

Source: DD1US

QO-100 portable station

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60cm Kathrein offset dish with feed mounted upside down
=> Feed protected against rain

GPS-Antenna on small bracket attached to feed

=> also during TX no interference of GPS-RX

Transverter attached to feed

=> weight well balanced

Source: DD1US

School Contact Denzlingen

ERASMUS-GYMNASIUM
DENZLINGEN

Source: DK3GL

School Contact Freiburg

GOETHE-GYMNASIUM FREIBURG

Source: DK3GL

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Digital Amateur Television via QO-100

It was planned from the beginning that DP0GVN should also become QRV in DATV.

Unfortunately, the first setup installed at the beginning of 2020, had problems to reach the necessary transmit power.

Thus, in addition to full operation on the narrowband transponder (SSB), initially only DATV reception was possible with DP0GVN.

With the replacement of the antenna and the power amplifier at the beginning of 2022, DATV transmission at DP0GVN is now also possible.

Karsten DM2KX, the current operator of the station, is regularly QRV in SSB and DATV.

DATV via QO-100

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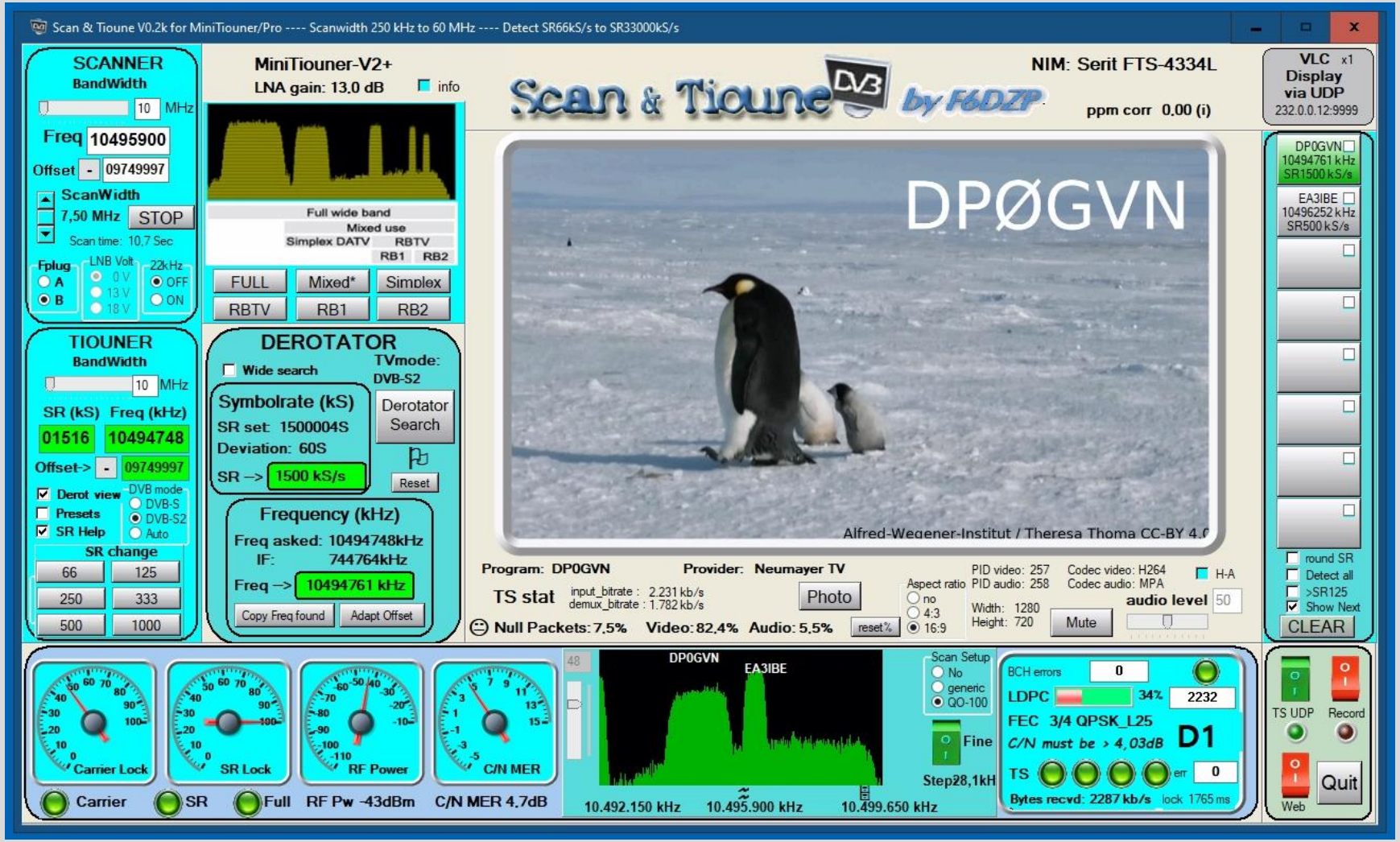

Source: DD1US

DATV via QO-100

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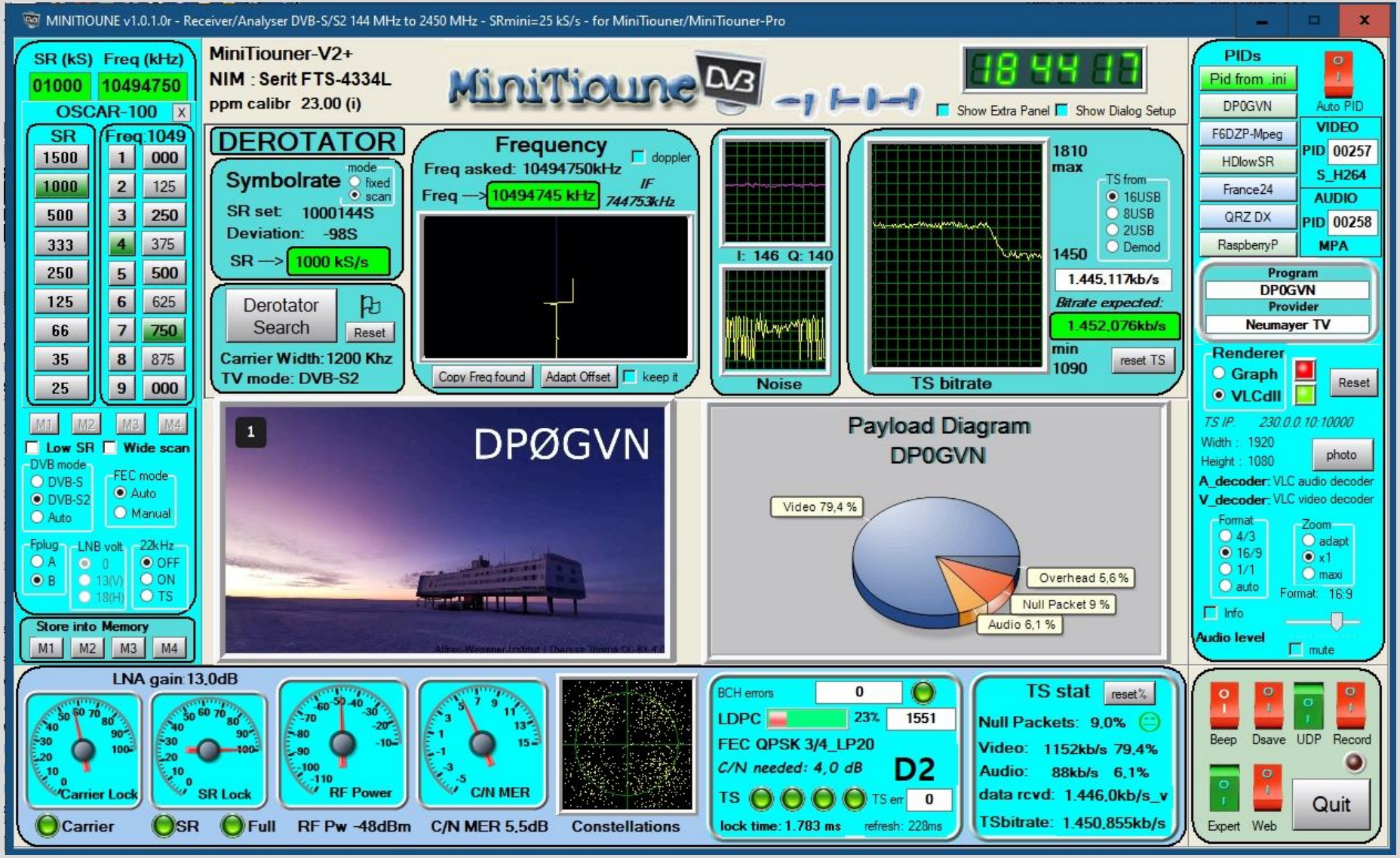

Source: DD1US

DATV via QO-100

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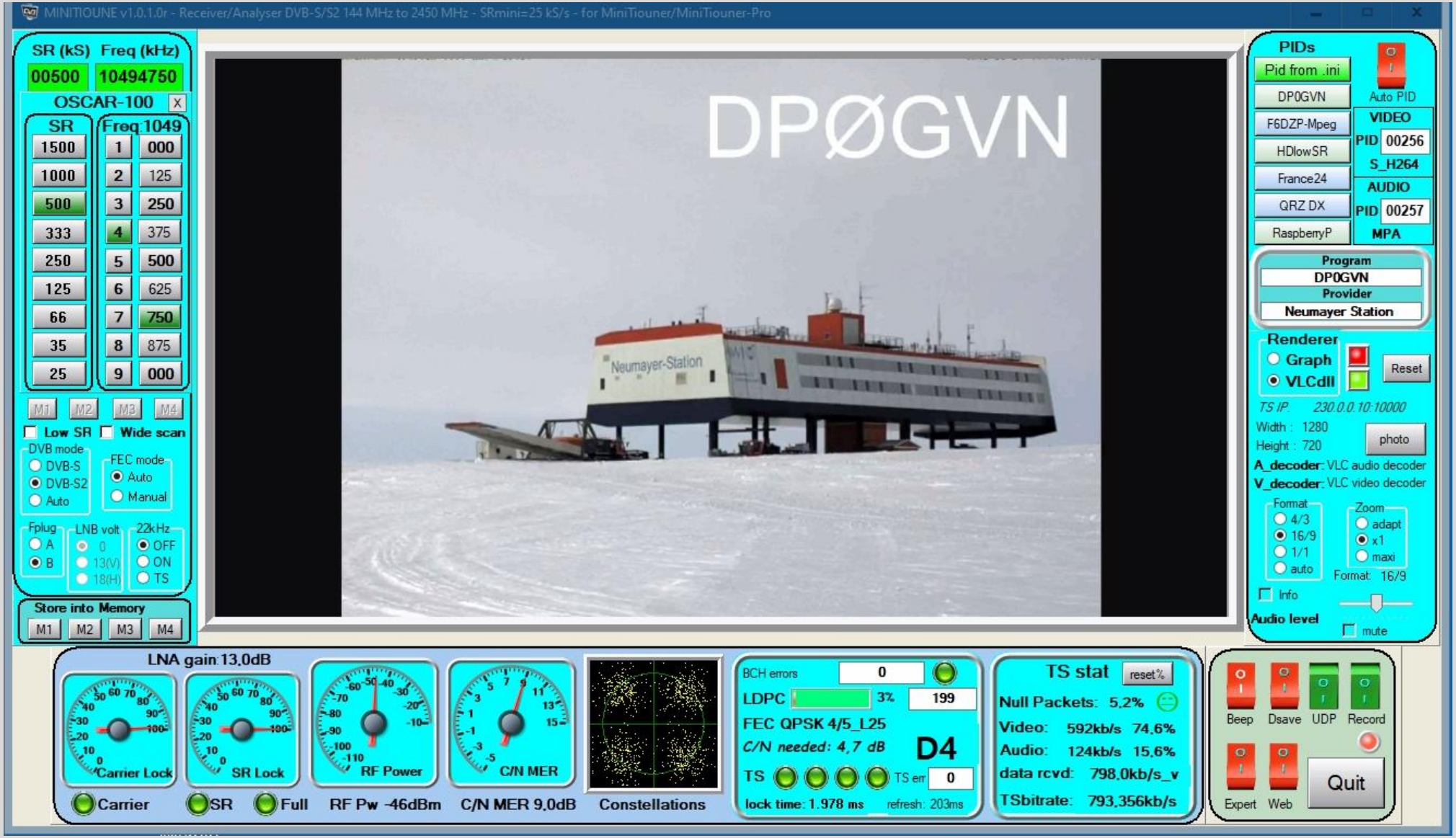

Source: DD1US

DATV via QO-100

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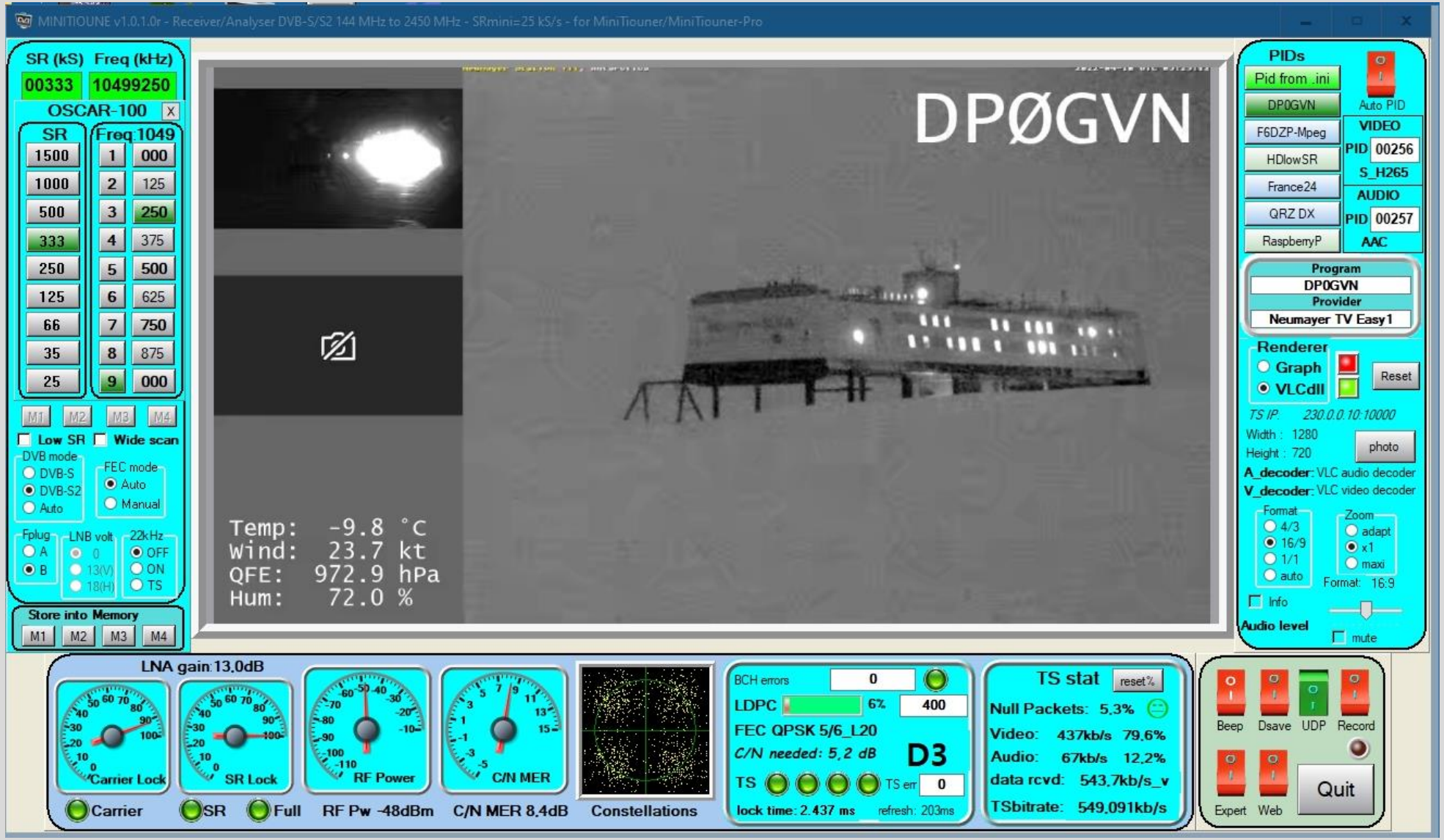

Source: DD1US

Special thanks to Charly DK3ZL who provided much of the information in this presentation!

Source: Marcus Heger, Alfred-Wegener Institut Bremerhaven

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DARC
Deutscher Amateur-Radio-Club e.V.
Bundesverband für Amateurfunk in Deutschland