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Satellites for Communication and Science
Satelliten für Kommunikation und Wissenschaft

Es'hailSat سهيل سات
Qatar Satellite Company الشركة القطرية للأقمار الصناعية

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Q.A.R.S.
QATAR AMATEUR RADIO SOCIETY

P4-A / Es'hail-2

QO-100

Qatar-OSCAR 100

Peter Gülzow, DB2OS
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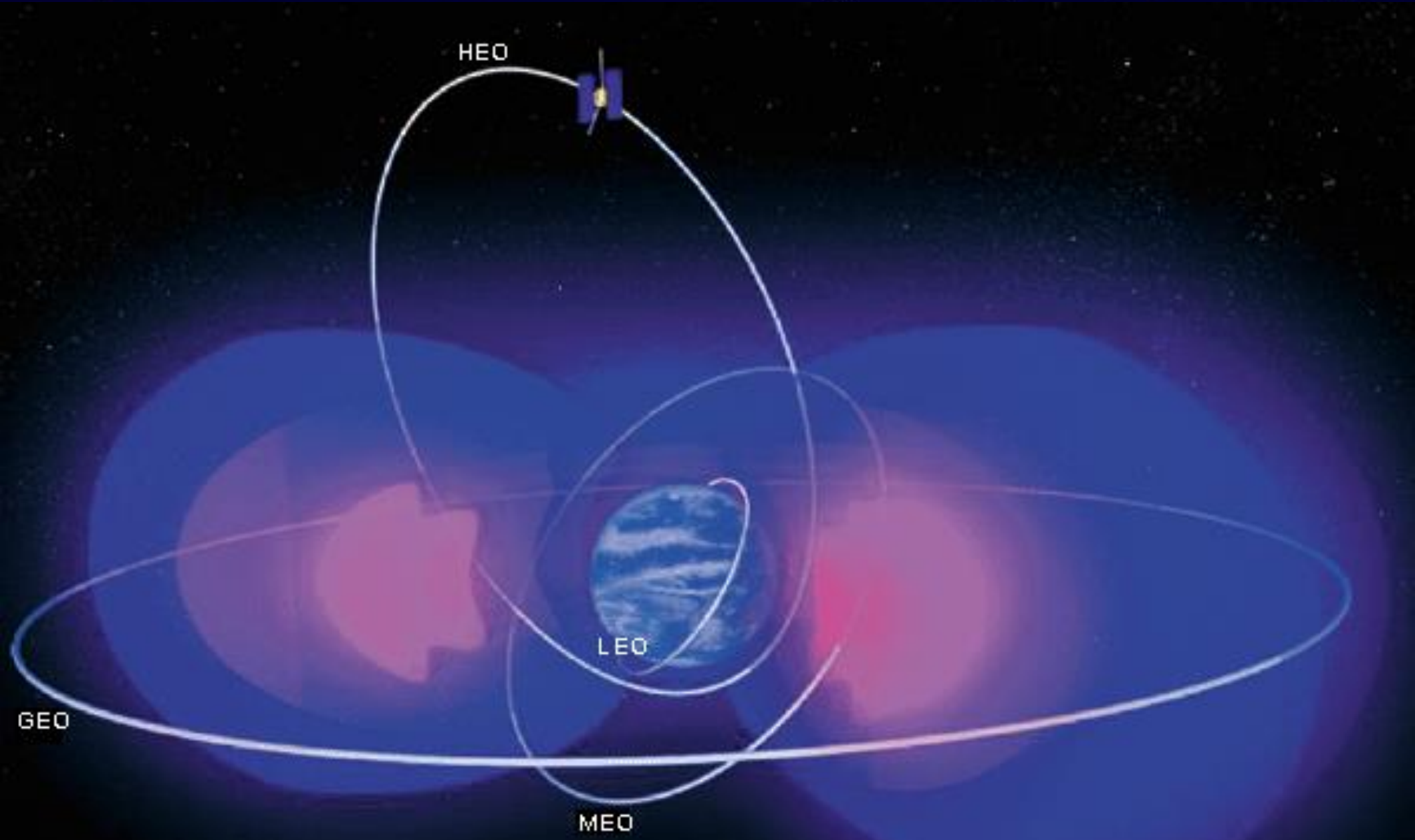
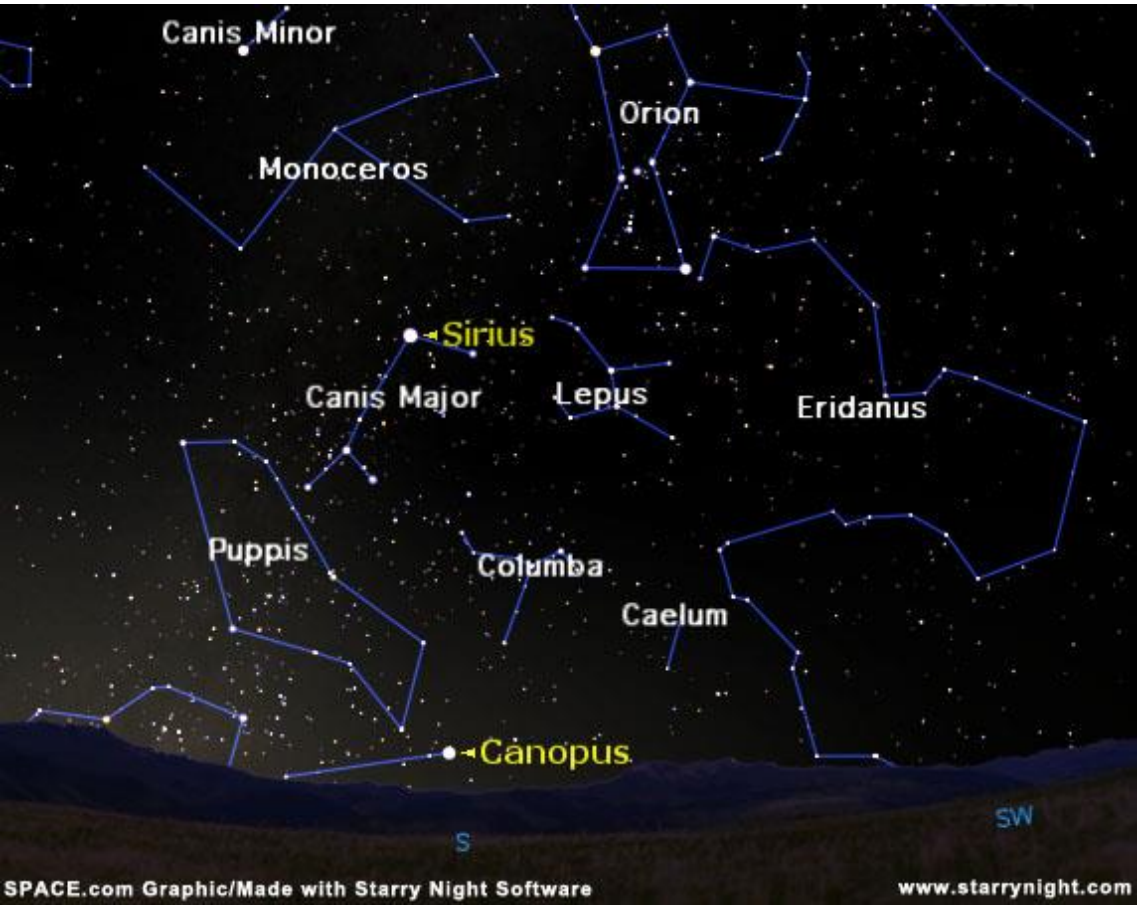


AMSAT Phase 4

The meaning of Es'hail



"The story behind the name Es'hail (Canopus) is the name of a star which becomes visible in the night sky of the Middle East as summer turns to autumn. Traditionally, the sighting of Es'hail brings happiness as it means that winter is coming and that good weather will soon be with us. We hope that the arrival of Es'hailSat will equally be beneficial for the satellite community."
(from Es'hailSat: *Follow the star*)

Time line

1001+ arabian nights…

H E Abdullah bin Hamad Al Attiyah, A71AU, Chairman of the Administrative Control and Transparency Authority, who is also the Chairman of the Qatar Amateur Radio Society (QARS) during the Qatar international amateur radio festival in December 2012.

2012 AMSAT-DL meets QARS

(DB2OS @ International Amateur Radio Festival in Qatar)

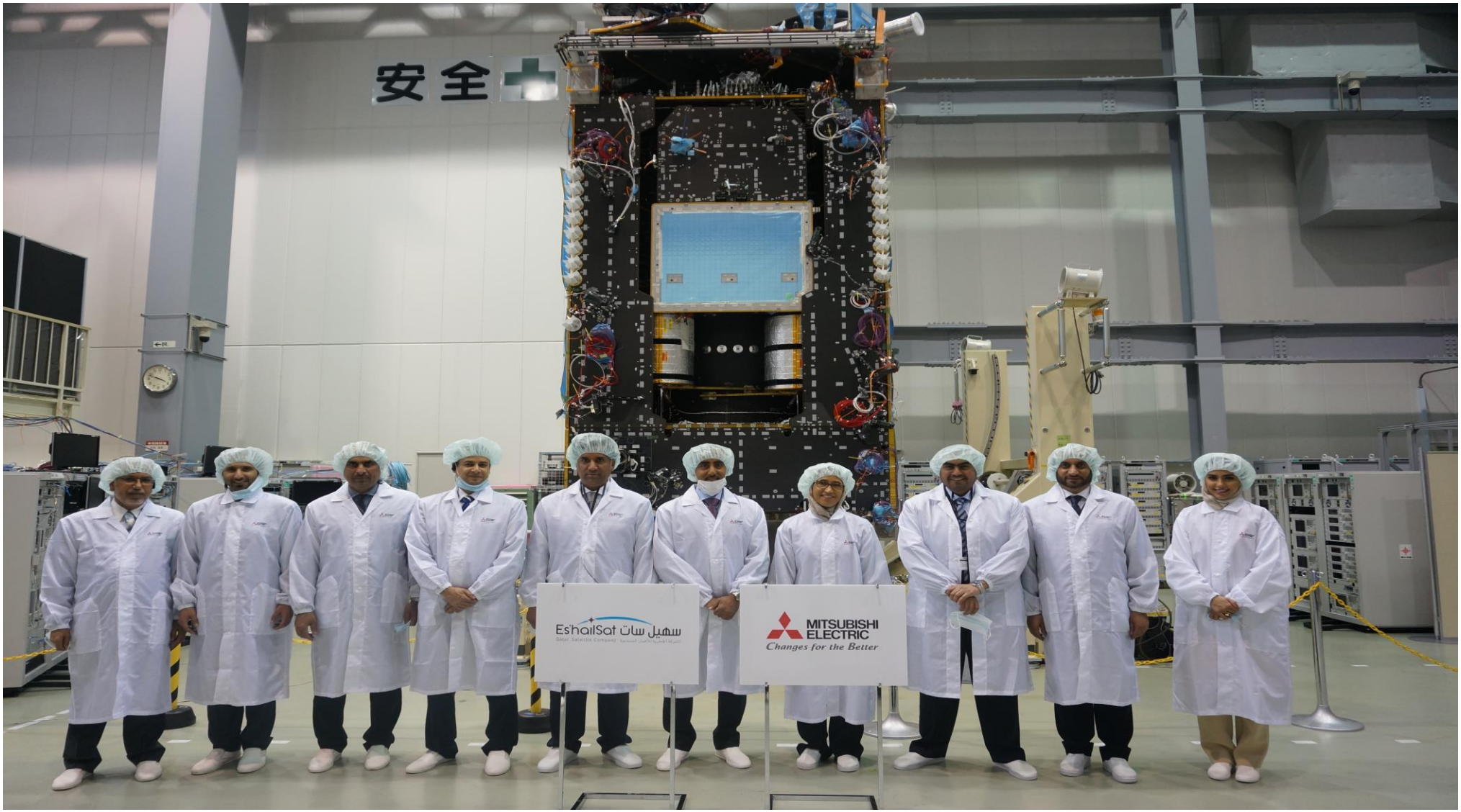
2013 Es'hailSat - Qatar Satellite Company

(idea, concept, design requirements, RFI, meetings with potential suppliers, RFP, finalisiation of requirements)

2016 Kick-Off at MELCO Japan

(Technical presentations, Requirements review, Critical Design Review, Design Validation)

2018 November 15th launch with SpaceX Falcon 9



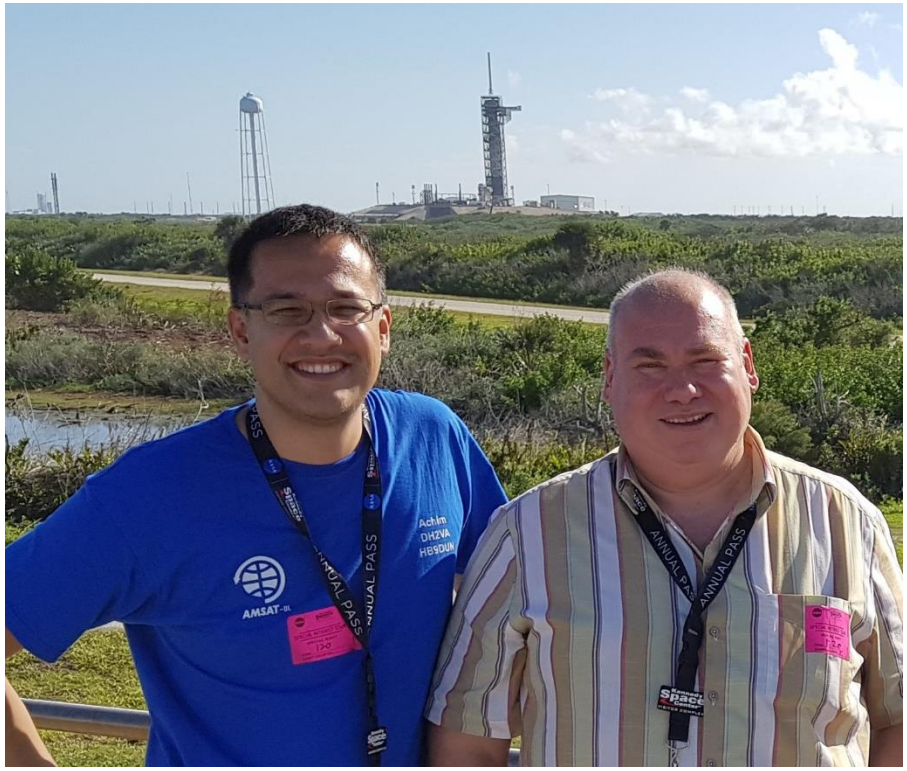
Executives from Qatar's Es'hailSat and Japan's Mitsubishi Electric Space Systems (MELCO) in Kamakura, outside of Tokyo, Japan, to observe the vacuum chamber test of Es'hail-2. Photograph courtesy of Es'hailSat, June 2016.

Melco DS-2000 Platform

- **Life:** 15+ yrs
- **Maximum Launch mass:** ~3,000 kg (3 – 5 tons class)
- **Launch Vehicle Compatibility:** Ariane-5, Proton Breeze M, Atlas, Falcon 9, H-IIA
- **Payload Heritage:** L, S, C, X, Ku and Ka frequency bands, 72 transponders (nominal)
- **EPS:** Electric Power Subsystem
  100v regulated bus, 12kW in sunlit and eclipse in maximum, automatic battery operation, 100-175Ah Li-Ion battery
- **SCS:** Satellite Control Subsystem
  Data handling of command/telemetry, satellite House-Keeping (battery, heater). MIL-STD-1553B processor and 64bit MPU (or HR5000) applied.
- **SPS:** Solar Power Subsystem
  12-13 kW total power generation (GaAs cells).
- **TC&R**: Telemetry Command and Ranging
  Maximum 4 command telemetry units. Standard bit rate 7.68 kbps for TLM, 500 bps for CMD. TLM, CMD and RNG operated simultaneously.
- **BPS:** Bi-Propellant Subsystem
  Fuel (MMH) and Oxygen (MON-3) Bipropellant, 1 Apogee Kick Motor + 12 Thrusters, Ion engine available on request.
- **AOCS:** Attitude and Orbit Control Subsystem
  Uses 4-skewed reaction wheel; standard highly accurate attitude control by with 0.03deg for three axis.

Launch on November 15th 2018

the launch took place at 20:46 UTC from the legendary launch pad 39A, from which Apollo 11 to the moon and the maiden flights of the first Space Shuttle Columbia and the SpaceX Falcon Heavy were launched. About half an hour after the launch, the satellite was placed by the launch vehicle into a geostationary transfer orbit. Only a few days later the Es'hail-2 was injected into a circular semi-geostationary orbit with its own propulsion system. Later parked at temporarily at 24°E for the In-Orbit-Testing (IOT) phase before it was shifted to its final position of 26 degrees East over Central Africa.



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Launch on November 15th 2018

Official SpaceX Es'hail-2 Mission Patch

QARS Vice President: Dr Ahmed Hamad Al-Muhannadi, AMSAT-DL President & P4-A Project Leader: Peter Gülzow DB2OS, QARS General Secretary: Sabaan Musmar Al-Jassim A71BP, AMSAT-DL P4-A Project Manager: Dr. Achim Vollhardt DH2VA

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The earth as seen by Es'hail-2

Es'hailSat سهيل سات
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QATAR AMATEUR RADIO SOCIETY
الجمعية القطرية لهواة الراديو

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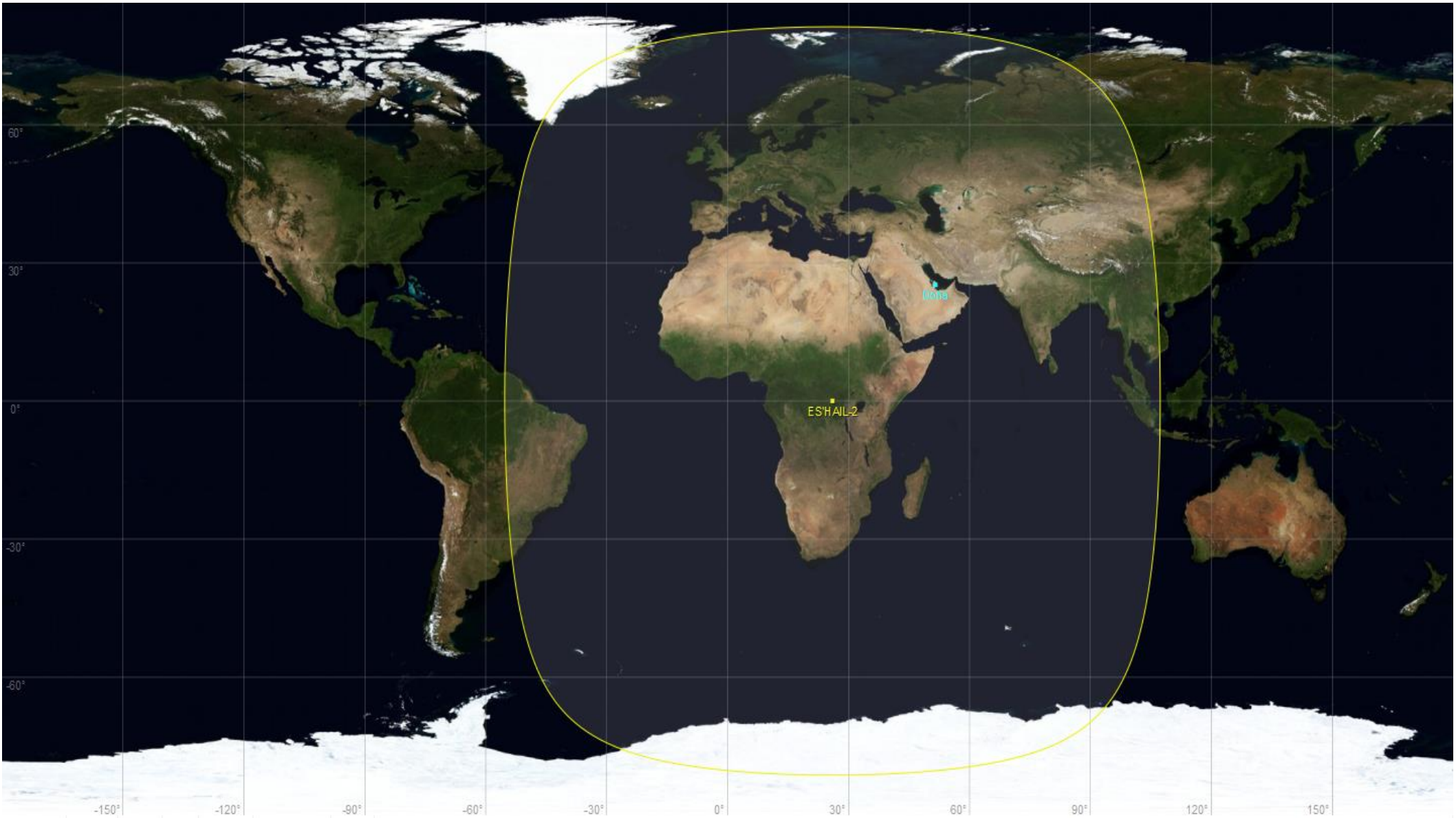
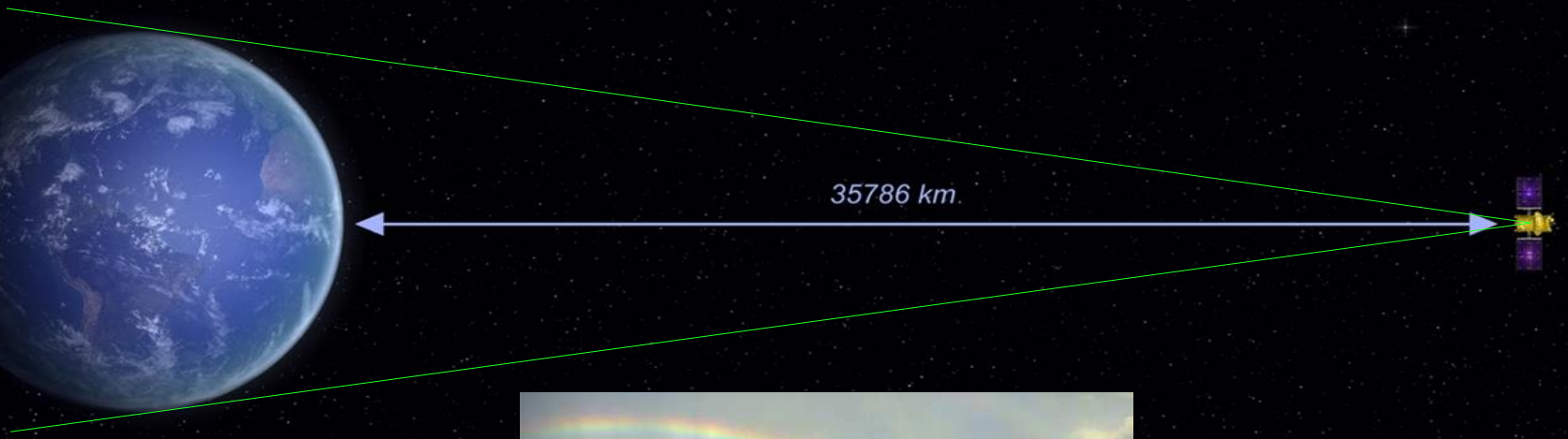
Earth Coverage Es'hail-2



-3dB Beamwidth = 17.4° → ~20dB Antenna Gain !!



Bochum

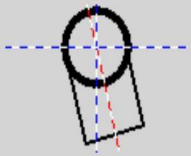
Your location:

Latitude:
51.48° N (51° 28' 47")

Longitude:
7.22° E (7° 13' 11")

City:
Bochum

Country:
Germany



LNB tilt (Skew)

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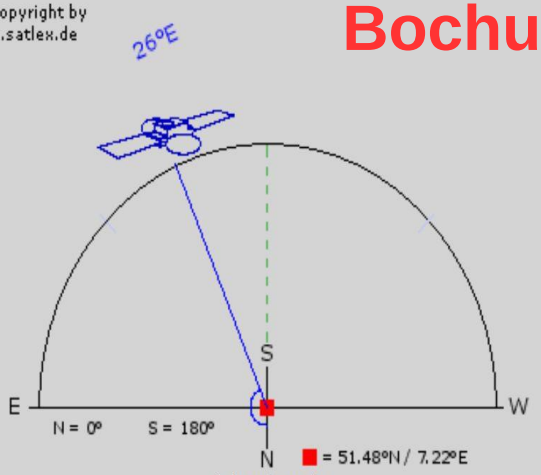


Azimuth angle

Following values have been calculated for your location:

Azimuth angle:
156.51° *(True North)*

Elevation angle:
28.55°

LNB tilt (Skew):
-14.37°

Offset angle:
20.36°

Distance to satellite:
38747.37 Km

Signal delay:
258.32 ms *(Uplink + Downlink)*

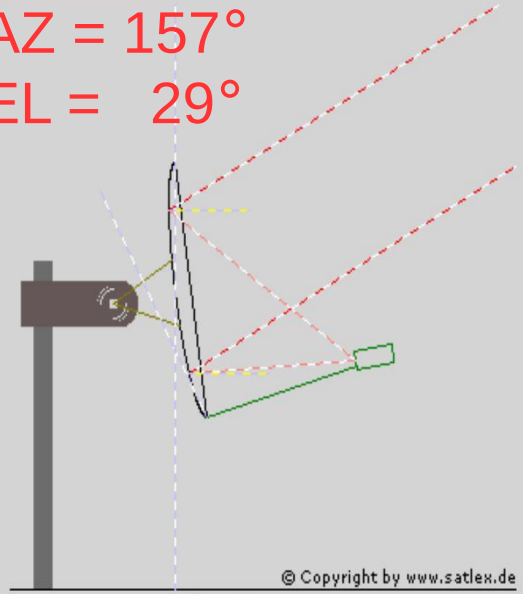
Declination angle:
-7.34°

Polarmount hour angle:
159.33°

Angle setting on motor:
20.67° East

Satellite:
Badr 4/5/6 (26° E = 334° W)

AZ = 157°
EL = 29°



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Elevation angle

Doha

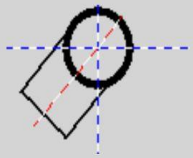
Your location:

Latitude:
25.25° N (25° 15' 0")

Longitude:
51.60° E (51° 36' 0")

City:
Doha

Country:
Qatar



LNB tilt (Skew)

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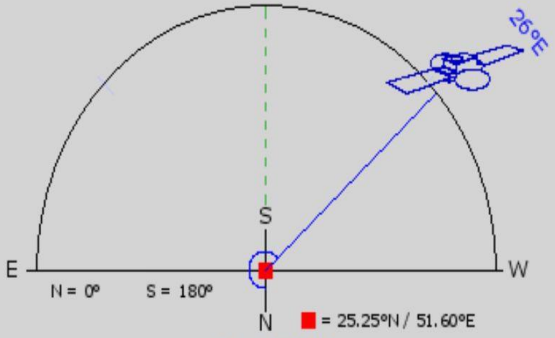


Azimuth angle

Following values have been calculated for your location:

Azimuth angle:
228.32° *(True North)*

Elevation angle:
48.98°

LNB tilt (Skew):
42.49°

Offset angle:
20.36°

Distance to satellite:
37145.43 Km

Signal delay:
247.64 ms *(Uplink + Downlink)*

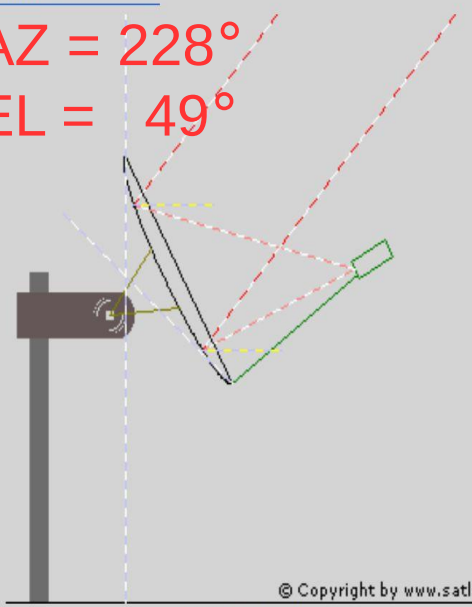
Declination angle:
-4.18°

Polarmount hour angle:
209.44°

Angle setting on motor:
29.44° West

Satellite:
Badr 4/5/6 (26° E = 334° W)

AZ = 228°
EL = 49°



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Elevation angle

Rio de Janeiro

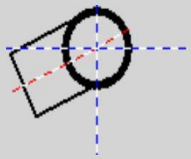
Your location:

Latitude:
-22.90° N (22° 53' 59")

Longitude:
-43.23° E (43° 13' 47")

City:
Rio De Janeiro

Country:
Brazil



LNB tilt (Skew)

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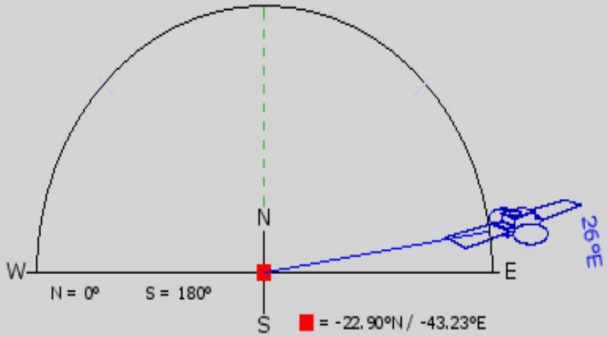


Azimuth angle

Following values have been calculated for your location:

Azimuth angle:
81.60° *(True North)*

Elevation angle:
10.61°

LNB tilt (Skew):
65.69°

Offset angle:
20.36°

Distance to satellite:
40531.41 Km

Signal delay:
270.21 ms *(Uplink + Downlink)*

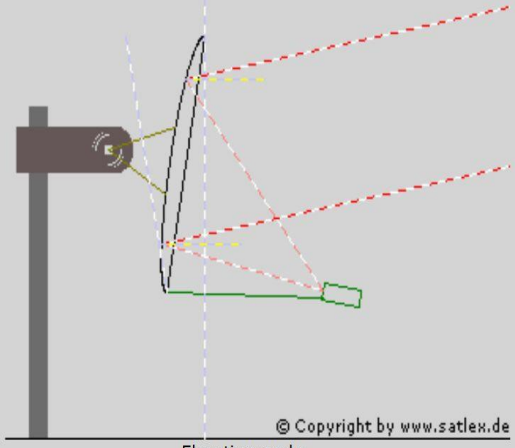
Declination angle:
3.48°

Polarmount hour angle:
76.94°

Angle setting on motor:
103.06° East

Satellite:
Badr 4/5/6 (26° E = 334° W)

AZ = 82°
EL = 11°



Elevation angle

Penang

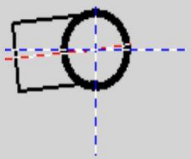
Your location:

Latitude:
5.50° N (5° 30' 0")

Longitude:
100.46° E (100° 27' 35")

City:
Pinang

Country:
Malaysia



LNB tilt (Skew)

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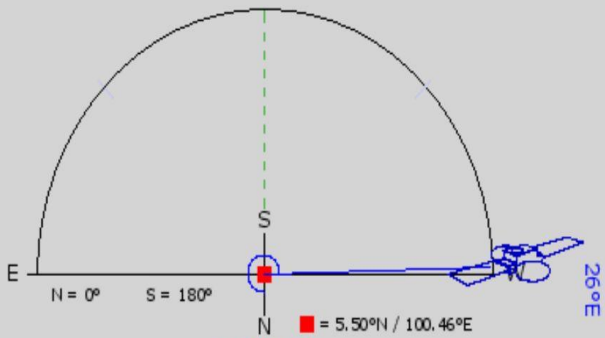


Azimuth angle

Following values have been calculated for your location:

Azimuth angle:
268.47° *(True North)*

Elevation angle:
6.95°

LNB tilt (Skew):
84.29°

Offset angle:
20.36°

Distance to satellite:
40927.52 Km

Signal delay:
272.85 ms *(Uplink + Downlink)*

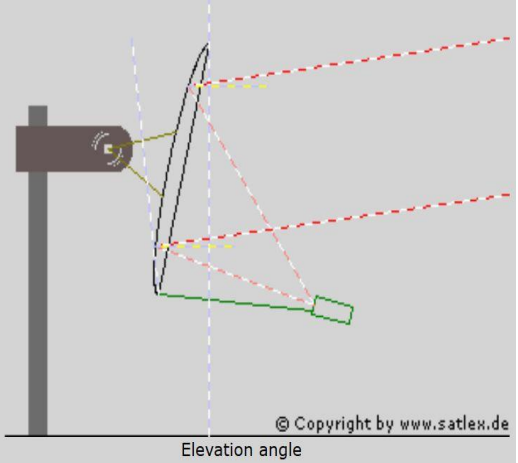
Declination angle:
-0.85°

Polarmount hour angle:
262.93°

Angle setting on motor:
82.93° West

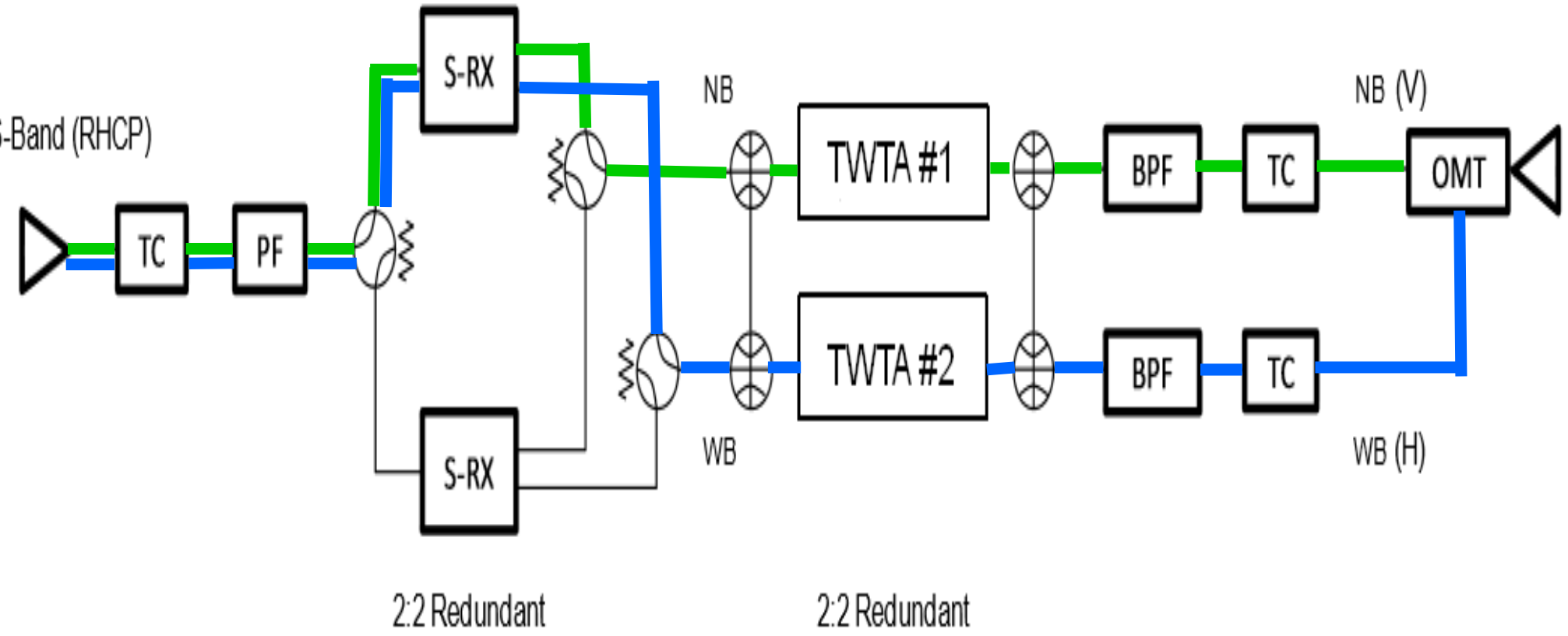
Satellite:
Badr 4/5/6 (26° E = 334° W)

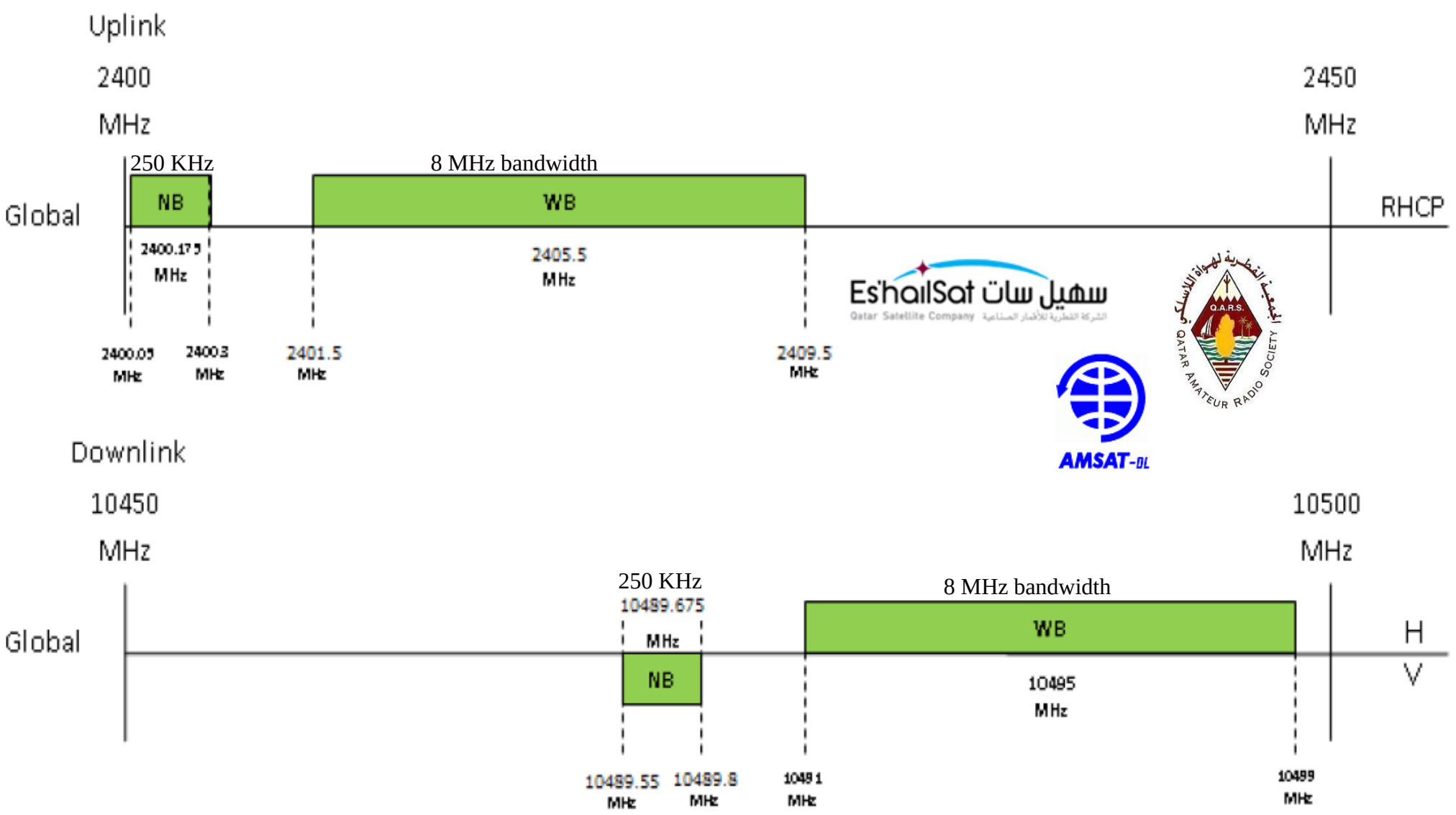
AZ = 268°
EL = 7°



Elevation angle

AMSAT Payload Block Diagram





Xpdr	U/L FREQUENCY (MHz)				D/L FREQUENCY (MHz)				LO	BW
No	Pol	Begin	Center	End	Pol	Begin	Center	End	(MHz)	(MHz)
NB	RHCP	2400.05	2400.175	2400.3	V	10489.55	10489.675	10489.8	8089.5	0.25
WB	RHCP	2401.5	2405.5	2409.5	H	10491	10495	10499	8089.5	8

“NB” Transponder (narrow band)

Linear Transponder for low power narrow bandwidth voice, morse and digital communication

- preferred modes: narrow band modes like SSB and CW, PSK

- 250 kHz allocated bandwidth + a little reserve

- non-inverting bent-pipe transponder

- Assumes 50 simultaneous 2-way carriers to serve 100 Users

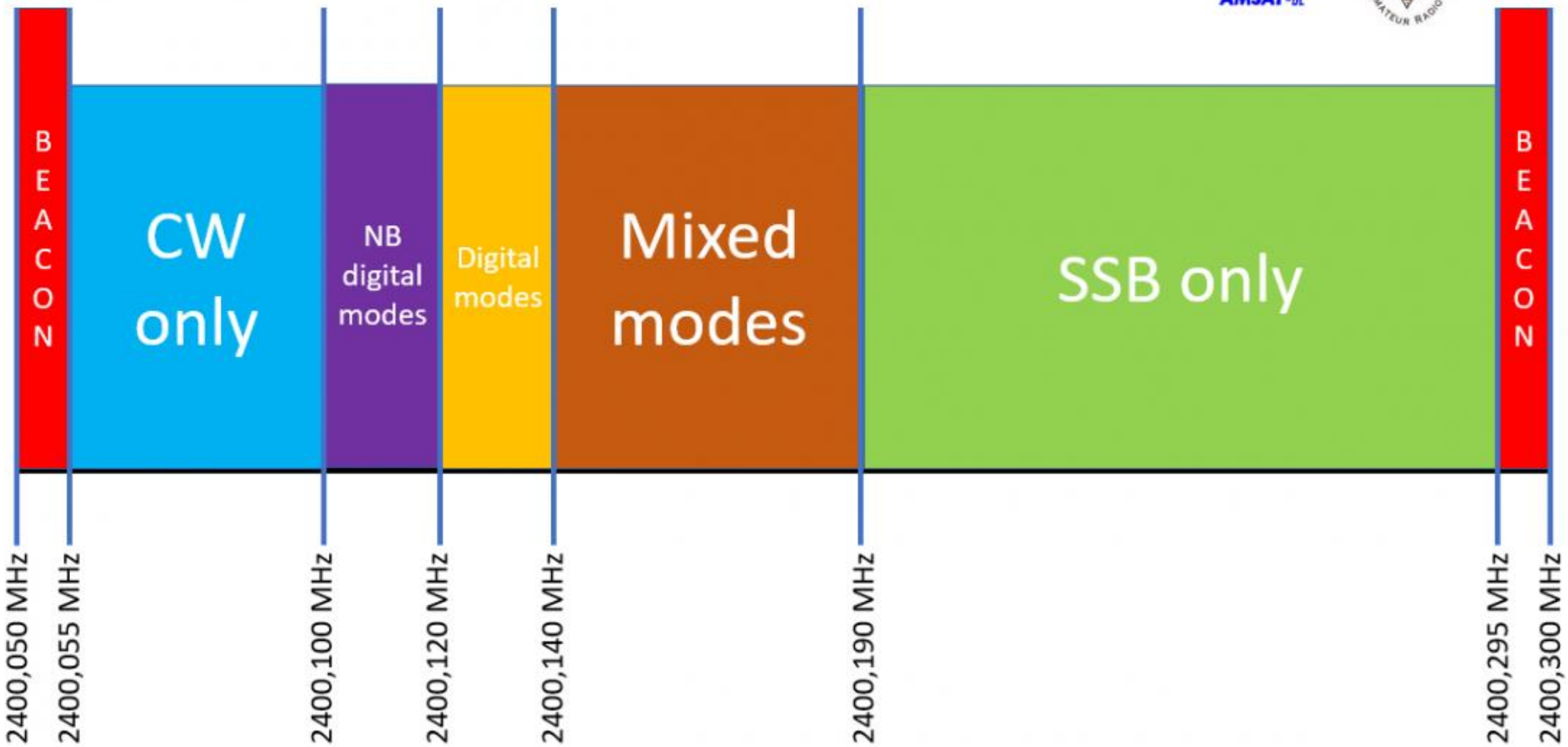
- X-Band Downlink (SAT-TV dish)

90 cm dishes in rainy areas at EOC like Brazil or Thailand
60 cm around around coverage peak
75 cm dishes at peak -2dB

- Downlink Polarisation on X-Band is Vertical !

- Uplink Polarisation on S-Band is RHCP
- Uplink transmitter 5-10W PEP (22.5 dBi antenna gain, 75cm dish)

“NB” Transponder Bandplan



“NB” Transponder Bandplan

Uplink [MHz]	Downlink [MHz]	available Bandwith [kHz]	Notes
	10489,550 – 10489,555	do not transmit	Lower Beacon, 400 Bit/s BPSK or CW
2400,055 – 2400,100	10489,555 – 10489,600	45	CW Only
2400,100 – 2400,120	10489,600 – 10489,620	20	narrowband digimodes (500 Hz max. BW)
2400,120 – 2400,140	10489,620 – 10489,640	20	digimodes (2700 Hz max. BW)
2400,140 – 2400,190	10489,640 – 10489,690	50	mixed modes (2700 Hz max. BW)
2400,190 – 2400,295	10489,690 – 10489,795	105	SSB only
	10489,795 – 10489,800	do not transmit	Upper Beacon, 400 Bit/s BPSK or CW

"NB" Operating Guidelines

- **No FM mode** or any other modulation exceeding 2700 Hz bandwidth.
- **No transmission below the lower CW beacon**:
  - the Amateur Satellites Service operate exclusively on a secondary basis in the band 2400-2450 MHz. **You are responsibly for you own transmissions!**
- **No transmission above the PSK beacon**: might change in future…

- Uplink polarisation is RHCP (right-hand circular polarization, the Feed must be LHCP!)
- Downlink polarisation for the **NB transponder is V** (vertical linear polarisation).
- You loose 3dB (half of your uplink power) with cheap WiFi-Antennas.

- AMSAT recommends to keep your own signal **in the same range as the CW beacon**
- Excessive signals might trigger LEILA warnings to remind you to reduce uplink power.

- **Full-Duplex operation is mandatory (you must be able to monitor your own downlink while transmitting!) → WebSDR via Internet is be OK, but….**
- The Upper Beacon is modulated in 400 bit/s BPSK (similar to the P3-satellites).

- If you hear the transponder noise more than ~5dB above the LNB noise, everything is fine and a larger antenna will not subjectively increase the S/N.. Theoretical 3dB (S/N+N) improvement possible, but you need an EME style antenna to notice the difference..

SDR# v1.0.0.1667 - AIRSPY

000.739.663.680

AIRSPY

AIRSPY

Sensitivity Linearity Free

Gain 17

Sample rate 10 MSPS

Decimation 8

Display 1 MHz

Bias-Tee Tracking Filter

SpyVerter Enable HDR

PPM 0,00

Radio

NFM AM LSB USB

WFM DSB CW RAW

Shift 0

Filter Blackman-Harris 4

Bandwidth 2.780

Order 1.000

Squelch

CW Shift

50

1.000

FM Stereo

Step Size

Snap to Grid 10 Hz

Lock Carrier

Correct IQ

Anti-Fading

Swap I & Q

Audio

AGC

FFT Display

View Both

Window Blackman-Harris 4

Resolution 131072

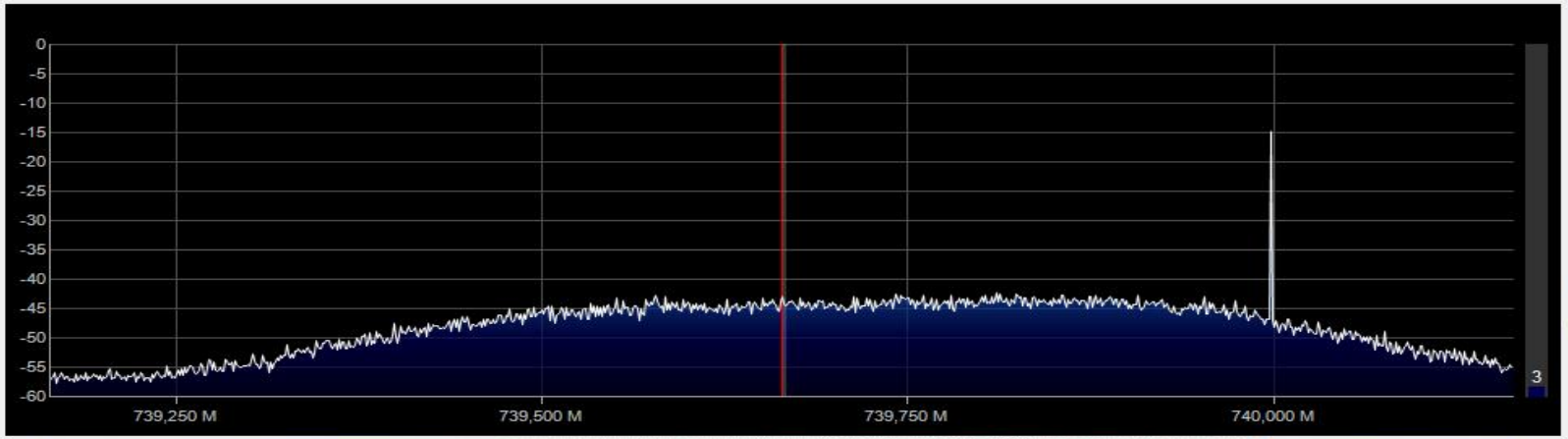
Spectrum Style Static Gradient

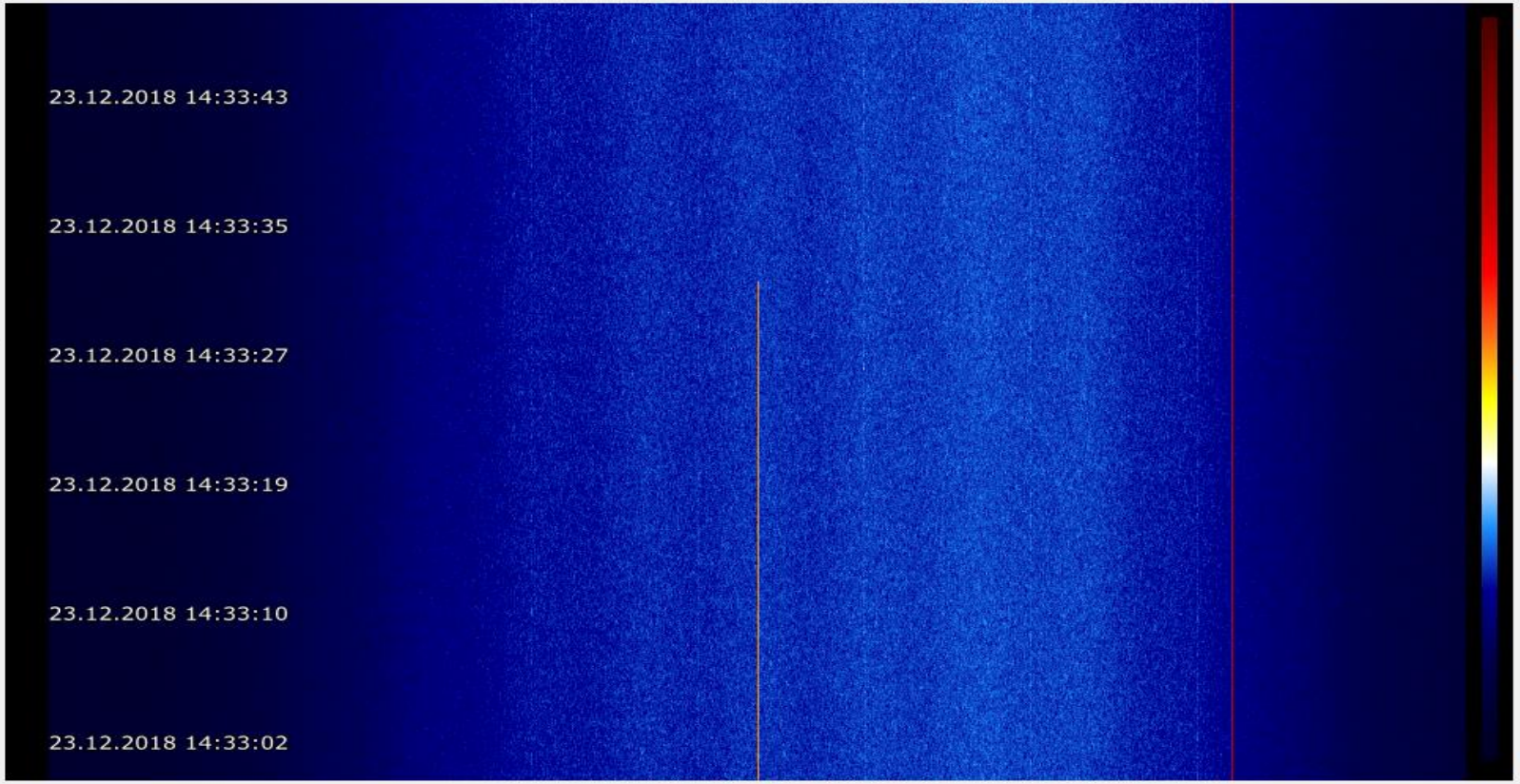
Time Markers

Gradient ...

Mark Peaks

Smoothing





Zoom

Contrast

Range

Offset

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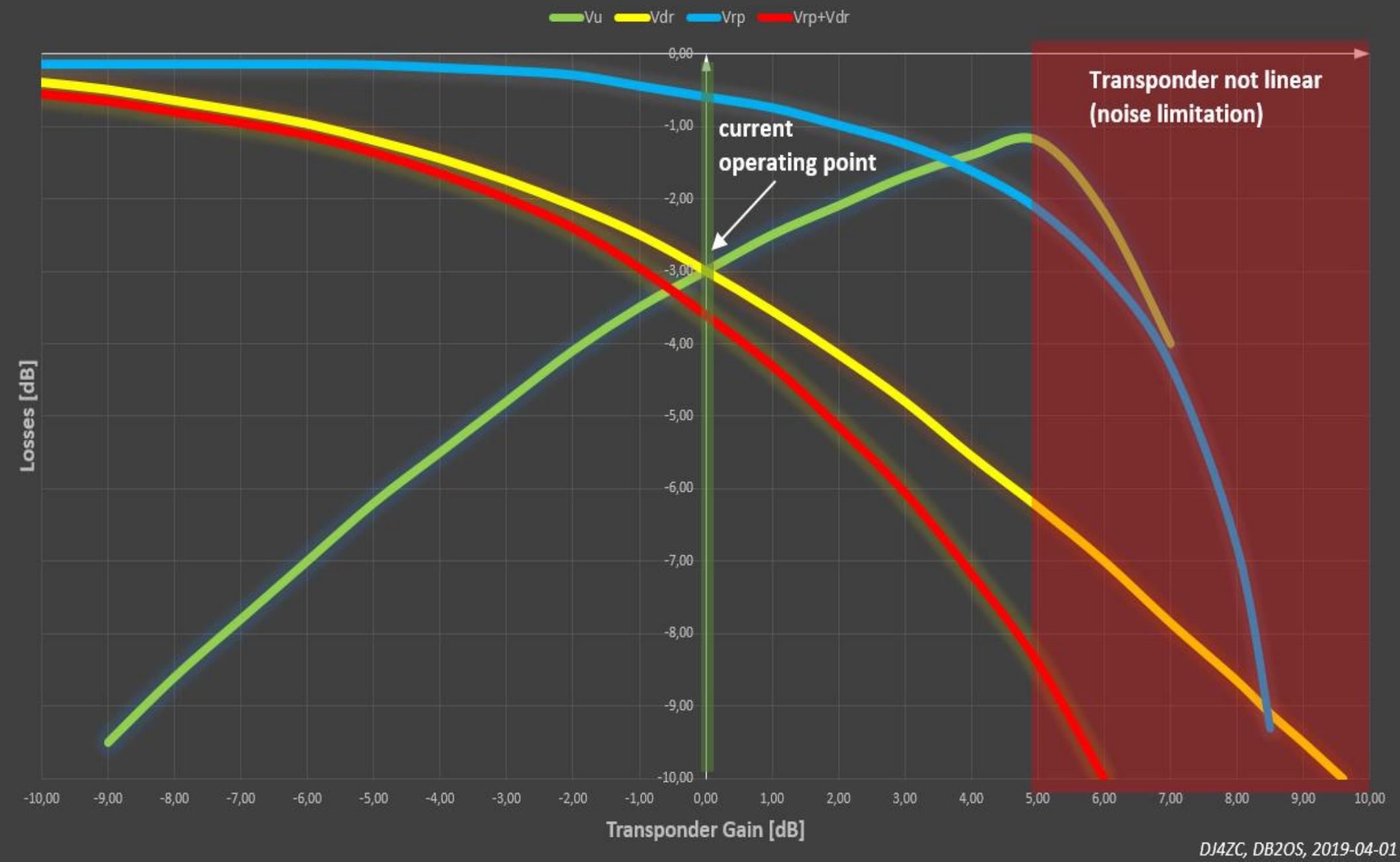
QO-100 Transponder Tradeoff



DJ4ZC, DB2OS, 2019-04-01

Es gibt im drei unvermeidliche Verlustquellen:

1.) Da die PEP-Leistung des Transponders fest gegeben ist, ist damit auch der höchstmögliche Pegel im Empfang gegeben. Die verfügbare Dynamik ergibt sich daraus, wie hoch der Rauschpegel ist. Wenn nur Bodenrauschen vorhanden ist, ist sie am höchsten; durch das Uplink-Rauschen wird der Rauschpegel im Rx am Boden erhöht und damit die Dynamik reduziert. Das ist die **Kurve Vdr**.

2.) Bei genügend großer Verstärkung im Transponder wird immer mehr Leistung als Rauschen abgestrahlt. Diese Leistung steht den Benutzern nicht mehr zur Verfügung. Dieser Verlust ist mit **Vrp** bezeichnet.

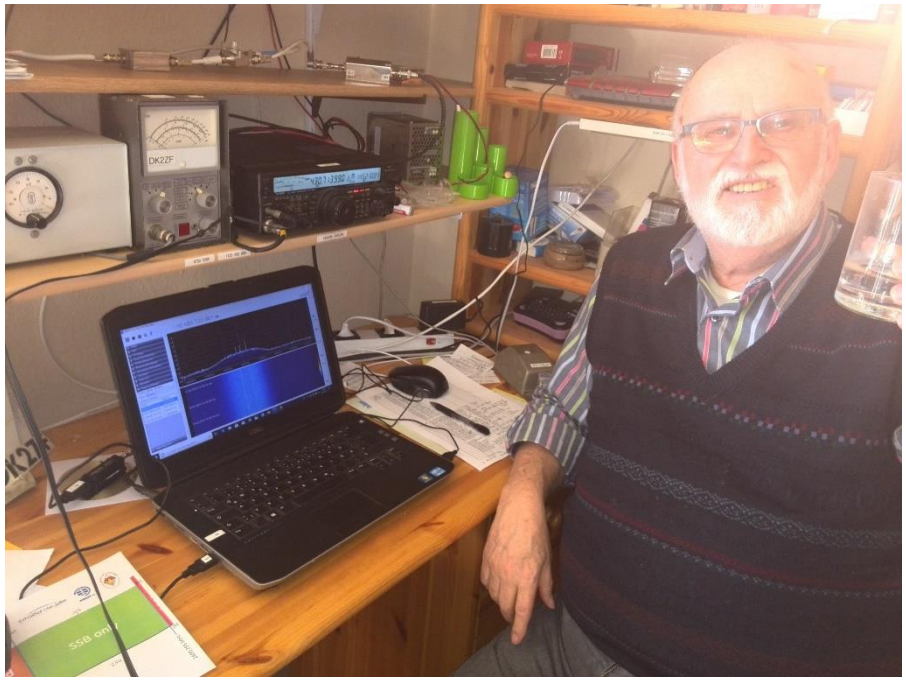
Die Downlinkverluste 1.) und 2.) zusammen ergeben die rote **Kurve Vdr+Vrp**.

3.) Die geringste Uplink-Leistung für einen gegebenen Rauschabstand wird benötigt, wenn nur das Uplink-Rauschen am Boden hörbar ist. Durch das hinzukommende Downlink-Rauschen erhöht sich die erforderliche Uplink-Leistung. Das ist in der grünen **Kurve Vu** dargestellt. Rechts der gestrichelten roten vertikalen Linie wird das Rauschen im Transponder begrenzt. Dadurch werden schwache Signale gegenüber dem Rauschen unterdrückt und daher kommt das scharfe Abknicken der grünen Linie im nichtlinearen Bereich.

Im Prinzip sind Fehler in der Verstärkung des Transponders zu kleineren Verstärkungen hin weniger schädlich, weil sie durch etwas mehr Uplink-Leistung ausgeglichen werden können. Für die Downlink-Verluste ist das nicht oder nur teilweise möglich (wenn man außerhalb des offiziellen Passbands arbeitet).

Wie man der Abbildung entnehmen kann, dürften wir sehr nahe am Optimum sein. Wenn man davon ausgeht, dass QRP-Stationen gleichzeitig eine kleinere Sende- und Empfangsantenne haben, verschieben sich die rote und die grüne Line entgegengesetzt auf der Abszisse. D.h. die Lage des Optimums für die Verstärkung des Transponders ändert sich dadurch nicht.

73s Karl, DJ4ZC



Rolf, DK2ZF: First QSO with A71A via QO-100 (OP: Sabaan A71BP and Peter DB2OS)

„Nachdem wir gleich zu Beginn feststellen mussten: ***5W HF am Spiegel sind schon zu viel****. So wurde in den ersten Tagen viel darüber gesprochen wie man die überschüssige HF wegbekommt...“*

„Meine Erfahrung ***2W HF an einem 60er Spiegel für SSB voll ausreichend****. Für CW reichen 1W HF für ein 579 Signal.“*

“WB” Transponder (wide band)

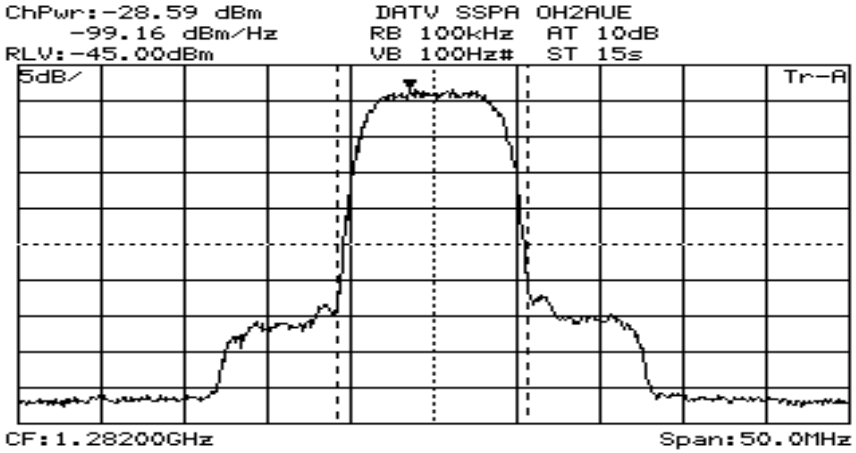
Linear Transponder for Digital Amateur Television (DATV) and other highspeed data transmissions.

First DATV transponder in space!!

- 8 MHz bandwidth
- one or two DVB-S2 carrier in HD quality or more channels with SD or lower quality

- assumes S-Band Uplink peak EIRP of 53 dBW (100W PEP into 2.4m dish)

- **X-Band Downlink (SAT-TV dish):**
  - 90 cm dishes in rainy areas at EOC like Brazil or Thailand
  - 60 cm around around coverage peak
  - **75 cm dishes at peak -2dB**



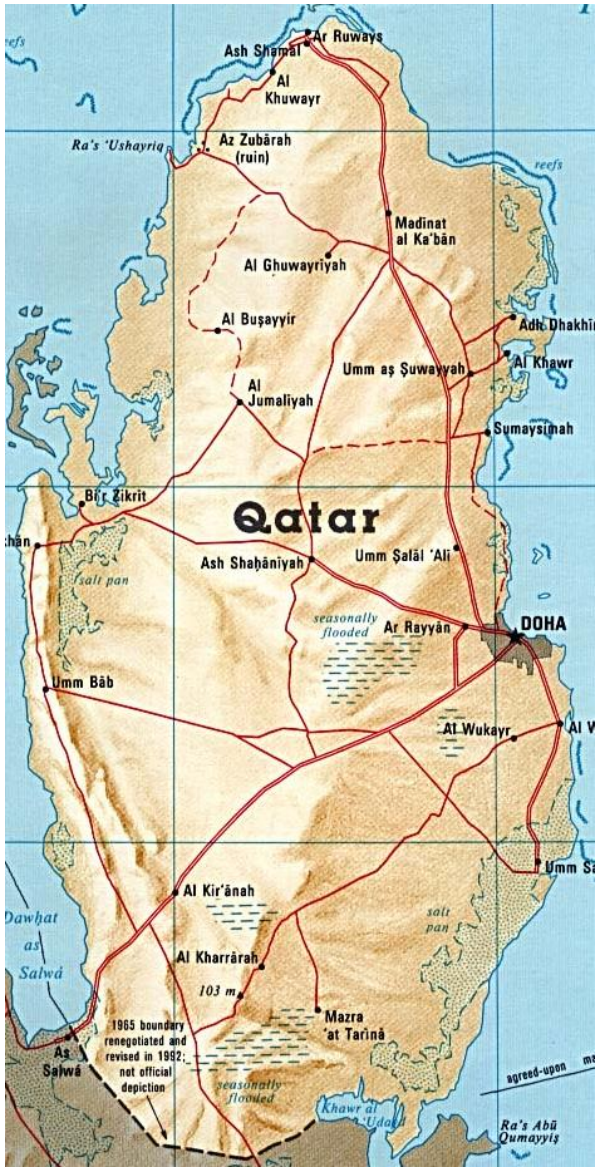
- Uplink Polarisation on S-Band is RHCP

- Downlink Polarisation on X-Band is Horizontal !

- DVB-S2 “beacon” from Qatar with promotional video.

- RF Bandwidth = 1.33 x Symbol-Rate = 1.33 x 2.5 MSymbols/sec = 3.33 MHz signal

Es'hailSat Satellite Control Center



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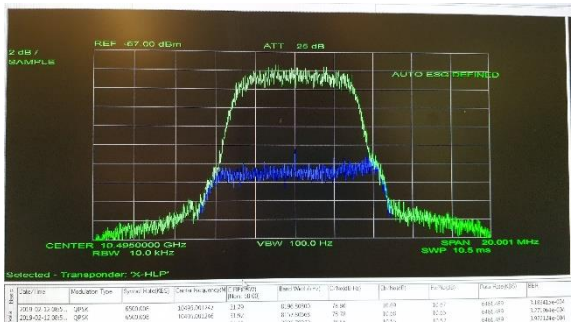
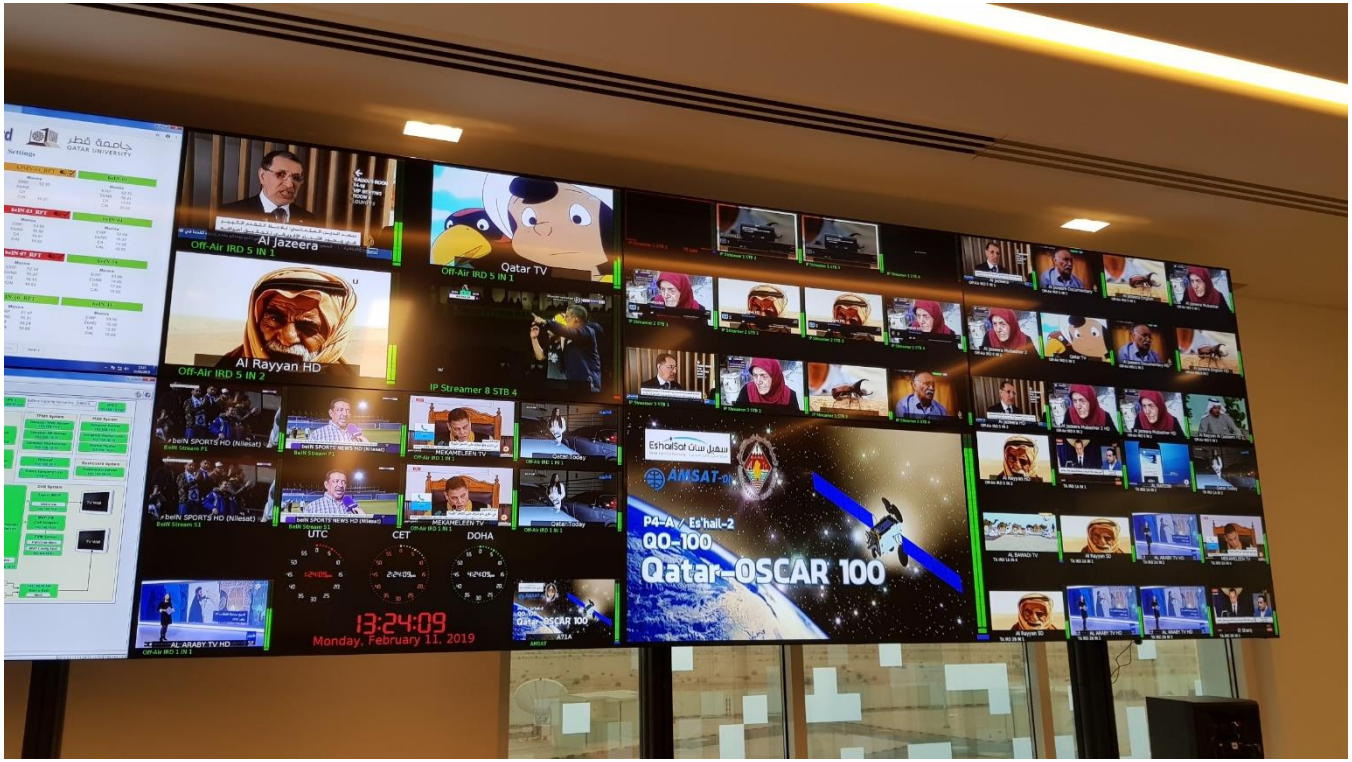
Es'hailSat Satellite Control Center





Es'hailSat Groundstation in the Shelter

(developed and constructed by AMSAT-DL team)

QARS HQ, Doha


الجمعية القطرية لهواة الاسلكي
QATAR AMATEUR RADIO SOCIETY
A71A


Q.A.R.S.
الجمعية القطرية لهواة الاسلكي
Qatar Amateur Radio Society
A71A
www.qars.org.qa


www.qars.org.qa

AMSAT-DL HQ Bochum

- 3m antenna for 2.4 GHz Uplink with VE4MA septum feed
- 2.5m antenna for 10 GHz Downlink
- 20m dish available for emergency operations ☺

Inauguration Day, 2019-02-14

PM inaugurates Es'hailSat teleport

HE the Prime Minister and Interior Minister Sheikh Abdullah bin Nasser bin Khalifa al-Thani yesterday inaugurated the Teleport Control Station of Qatar Satellite Company (Es'hailSat) in Al Ghuwairiya area, north of Doha.

The ceremony, attended by HE the Minister of Transport and Communications Jassim Seif Ahmed al-Sulaiti, Es'hailSat chairperson Dr Hessa Sultan al-Jaber and a number of other dignitaries began with the screening of a documentary film about the company,

HE the Prime Minister and Interior Minister Sheikh Abdullah bin Nasser bin Khalifa al-Thani inaugurates the Teleport Control Station of Es'hailSat as HE the Minister of Transport and Communications Jassim Seif Ahmed al-Sulaiti, Es'hailSat chairperson Dr Hessa Sultan al-Jaber and CEO Ali bin Ahmed al-Kuwari look on

Teleport promotes Qatar's economic position

gency broadcasting centre.

Al-Kuwari said the company is currently evaluating various investment opportunities in order to support the sustainability of its economic plan in terms of diversifying the sources of income and achieving its strategic objectives. It is also in the process of submitting the Es'hail-3 project proposal which will guarantee coverage of the country's needs in broadband communications to support complete independence during the FIFA 2022 World Cup, he said.

The state-of-the-art control station, in the Al Ghuwairiya area, north of Doha, is designed to provide back-up studios for television channels as well as an emergency broadcasting centre where it will connect with the most important media in Qatar through fibre optics to the station.

Es'hailSat currently broadcasts a variety of best television channels such as Al Jazeera News, beIN channels and Qatar Media Corporation channels as Es'hail-1 and Es'hail-2 are designed with the latest anti-jamming technology.

Qatar Satellite Company was established in 2010 with the aim of owning satellites and operating rights, providing various services to the public and private sectors in the Mena region and achieving self-sufficiency through the development and acquisition of technologies related to satellite development, all whilst providing means, materials and infrastructure to achieve these objectives.

The Communications Regulatory Authority (CRA) president Mohamed Ali al-Mannai said the satellite control station is a major step forward after the launch of the Qatari satellites Es'hail-1 and Es'hail-2, which will be controlled by the station, in addition to its work on securing terrestrial communications, the internet and other tasks.

In a statement to the press, he said Qatar currently has a large capacity of communication channels through submarine cables, which is sufficient to meet the current and future demand beyond 2022.

Dignitaries at the opening of the satellite control station yesterday.

A facility in the satellite control station.

AMSAT Ground Segment

Located at the Es'hailSat Satellite Control Center (SCC) near Doha in 'shelter' close to main Es'Hail 2 SCC uplink/downlink antennas

- unattended operations, but remote access to tweak LEILA-2 parameters.

- 2.4 Meter dedicated Uplink antenna for AMSAT on S-Band

- In-Orbit-Verification and Monitoring of the AMSAT transponder with FFT passband (NB+WB) displays for quick assessment of situation.

- LEILA-2 (LEIstungs Limit Anzeige) analyses passband of NB transponder and send Marker tones on all stations which use too much uplink power.

- LEILA-2 generates pseudobeacon(s) and add them to the uplink signal (400 Bit/s PSK Telemetry with FEC).

- Hamradio shack equipped with SSB equipment for Voice and with DVB-S2 equipment for DATV transmissions directly from Doha.

- Backup station for LEILA will be located at QARS HQ and in Bochum at AMSAT-DL HQ

Pseudobeacon

* A beacon signal to enable users a signal reference (frequency and level) to orient themself → SDR Console

* A beacon generated on ground, not inside spacecraft

* Same flight-proven Phase 3 format, 400 bit/s BPSK telemetry with FEC

* Pseudobeacons at both ends of the Passband (transmissions outside are not permitted)

LEILA

LEILA is an german acronym for *"**LEIstungs Limit Anzeige**"*, which means: Power Limit Indicator.

The original concept of an hybrid analog/digital LEILA on AO-40 was developed by Dr. Karl Meinzer DJ4ZC and Dr. Matjaz Vidmar S53MV. It was the first time that such a system was used as part of an transponder with ***uncoordinated multiple access***.

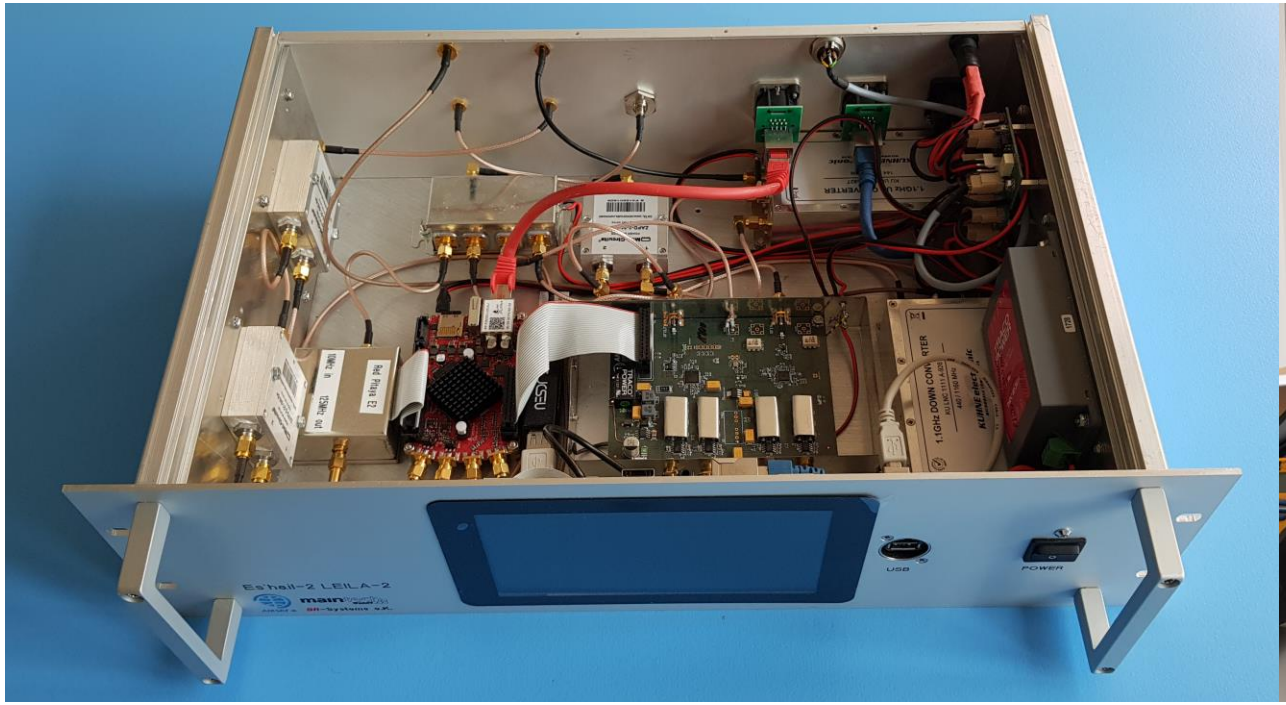
LEILA-2 on P4-A is ***ground-based !!***

- Siren marker (sufficient if operators work full duplex)
- Notch filter not possible because of delay

LEILA-2

redpitaya

- Analyzing the NB transponder passband (FFT) and generating individual siren markers.
- Encoding (FEC) and generation of pseudobeacons at upper and lower passband limit,
- Up-/downconversion boards developed by AMSAT-DL/UK (G6LVB, DH2VA).
- LEILA software by Mario DL5MLO
- installed at Es‘hailSat SCC, QARS backup and in Bochum at AMSAT-DL (currently active).



DATV transponder (WB)

DVB-S2

DVB-S2

HD Video + Audio QSO
(maybe even Full Duplex)

Data Broadcast

DATV Beacon
„Promo Video“

HW: DG8FAC (SR-Systems), DG0VE
SW: DG5NGI, DG2NDK, Matthias Kleffel,
Bastian Euler and more (maintech)

Bochum

Doha

Advantech Wireless

What is DVB-S2 ?

- **New DVB standard for digitial satellite communications**
- **Meant to replace DVB-S & DVB-DSNG**
- **Much better spectral efficiency**
  - –Up to 30% bandwidth saving
  - –Up to 2.5 dB margin gain
- New features such as
  - –Variable and Adaptive Coding and Modulation
  - –Generic Mode (no transport stream overhead)
  - –Support of multiple streams on a single carrier
- So close to the Shannon limit that it could be the last DVB-S standard!

DATV - Groundstation

RF OUT
ETH BRIDGE
SERVICE BRIDGE
SERVICE WEB
ETH WEB
RF IN
POWER

Rear Panel

N-Buchse
NE8FDP
LEMO
LEMO
NE8FDP
N-Buchse
NL2MP

Power Amplifier

DVB MiniMod 4
DVB-S/S2 Modulator

WEB-IF
User Interface Controller

POWER SPLITTER

DVB-S/S2 DUAL NIM

PWR DIST

i.MX6 Stream Processor
Linux based Ethernet Bridge

H.264 Encoder
HDMI HD video encoder

H.264 MPEG2 Decoder
HDMI HD video decoder

Front Panel

DISPLAY / KEYPAD

NAHDMI-W
HDMI IN

NAHDMI-W
HDMI OUT

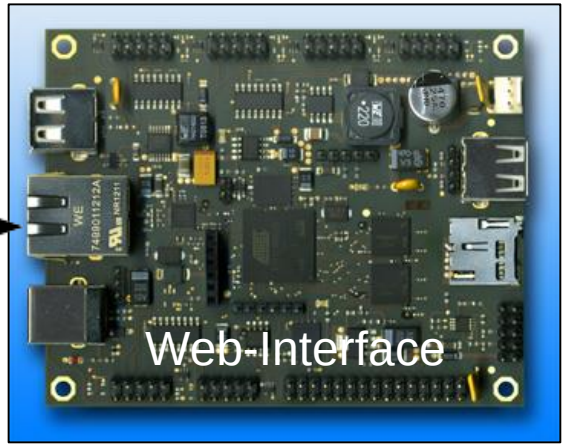
DATV - Groundstation

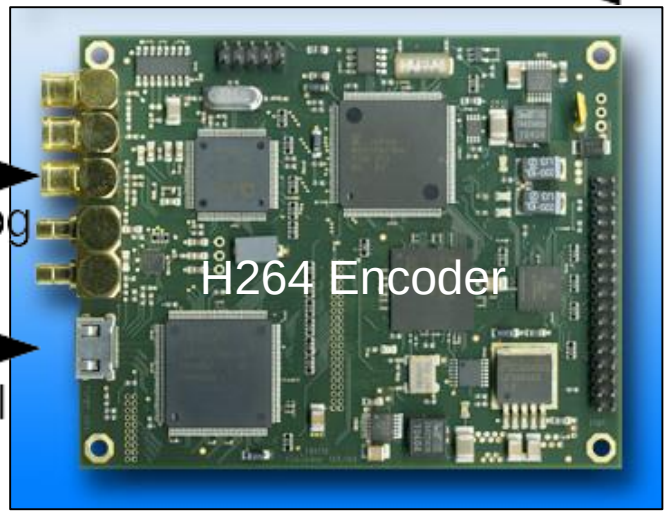
Analog

HDMI

RF-out: -35 … 0 dBm

Ethernet



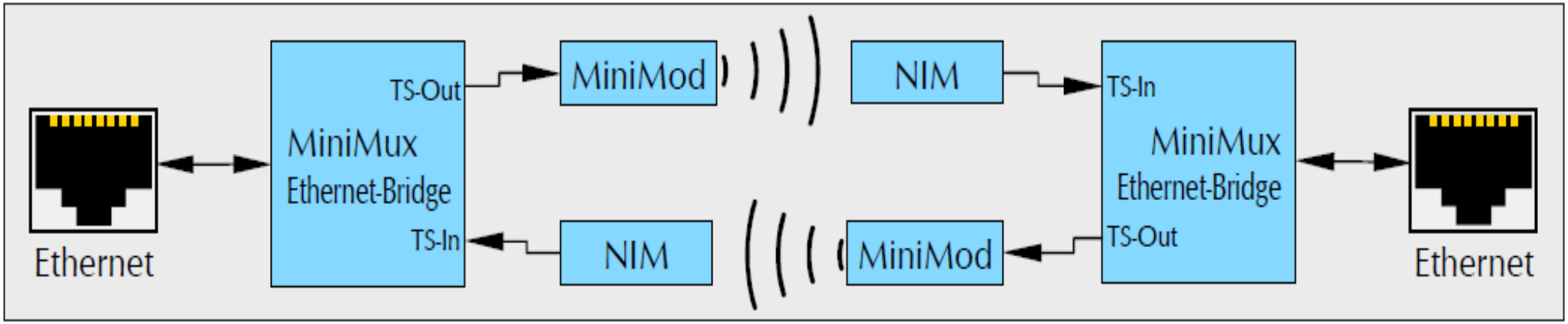


Analog

HDMI

RF-in: 950…2150 MHz

Ethernet-Bridge (Ethernet over DVB)

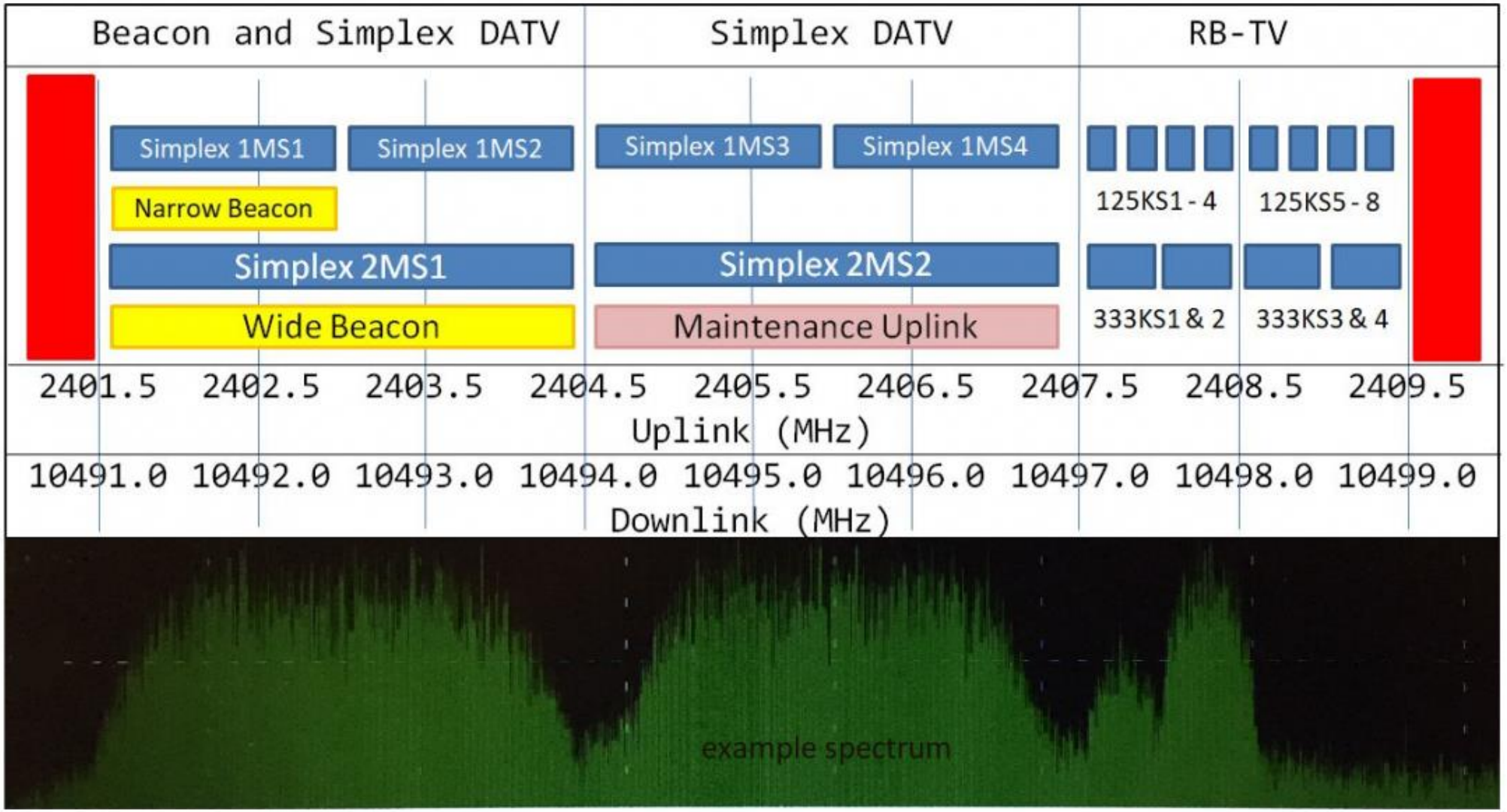


Unless only broadcast packets are sent, Ethernet bridging requires a full bidirectional link.

* Ethernet-Link
* Multiplexing with Video/Audio is possible
* Broadcast UDP
* full bidirectional link possible
* up to 30 Mbit/s

* 4 Uplinks possible when using Mux4 ??

WB Bandplan (DATV)



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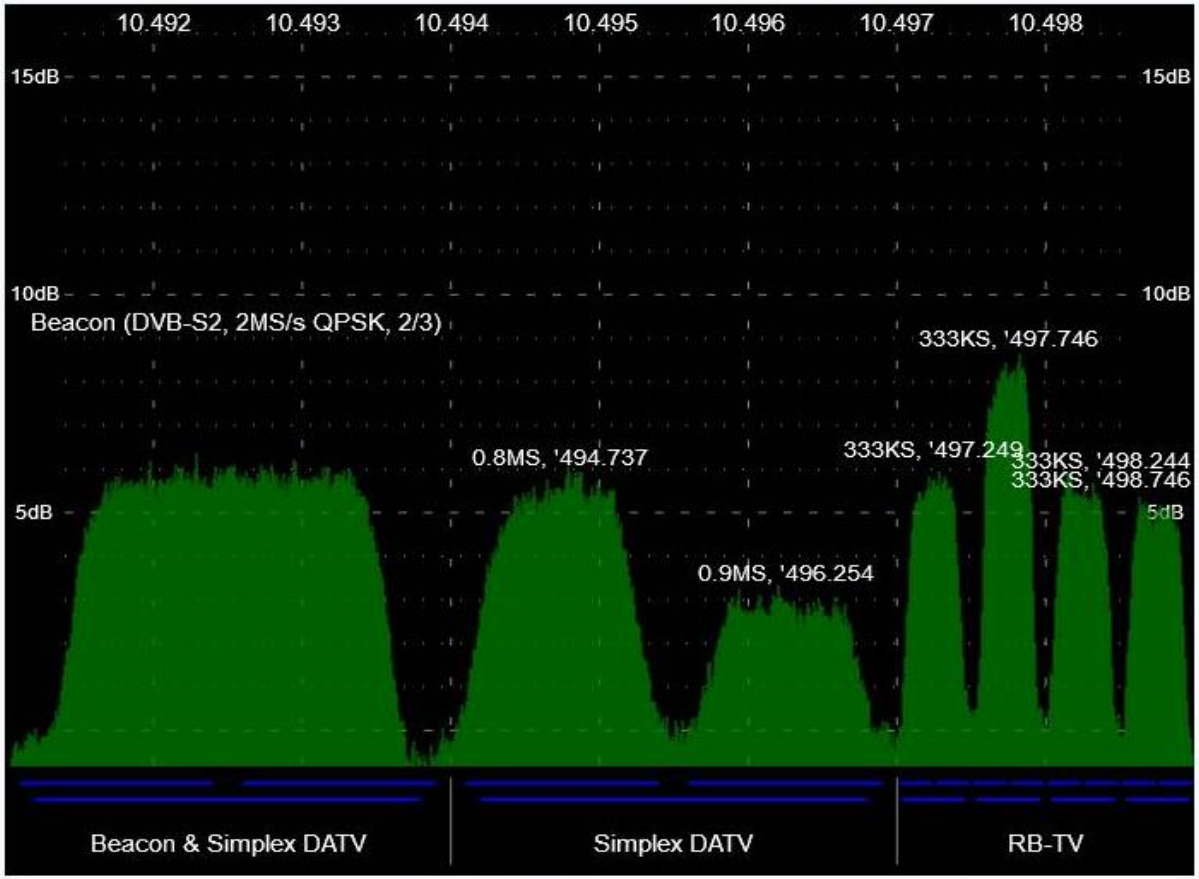
Qatar OSCAR-100 Wideband Spectrum Monitor

This spectrum monitor, hosted at Goonhilly Earth Station in Cornwall, shows the Qatar OSCAR-100 wideband transponder onboard the Es'hail-2 satellite.

You can read more about the WebSDR & Spectrum Viewer station at wiki.batc.org.uk/Es'hail-2 Ground Station

- For more details on Qatar OSCAR-100 see amsat-dl.org/eshail-2-amsat-phase-4-a
- The QO-100 narrowband websdr can be found here eshail.batc.org.uk/nb/



power at that symbol rate
22:00 **G7NTG_JIM** good pic though
22:00 **G0MJW** Me
22:00 **f5oeo_evariste** OK...too weak for lock at this FEC
22:00 **G0MJW** MER 6 here
22:01 **G3NWR** Txing 6.25 S2 1000 1/4
22:01 **f5oeo_evariste** MER 1.5 here..Mike
22:01 **G3NWR** Getting myself at 2dB.
22:01 **G0MJW** Fine Colin.
22:02 **f5oeo_evariste** MER 2.5, Mike now..locked, thx
22:02 **G0MJW** Added 2 on LIME power
22:03 **G0MJW** 2.5 V == 12 W
22:03 **G0MJW** I am on 82
22:03 **G0MJW** I was on 80
22:03 **f5oeo_evariste** Now unlocked as soon as 1Ms arrived, so was at limit
22:03 **G7NTG_JIM** g0mjw very good mer 5
22:04 **G0MJW** Get a bigger dish?
22:04 **G0MJW** Thanks Jim - Relaying Colin
22:04 **f5oeo_evariste** Think about Mike, sure !
22:04 **G0MJW** Colin is 3/4 rather than 2/3
22:04 **f5oeo_evariste** My dish maybe drift also

markro92
F4VSG Robert
g4bao
DH5DAX-Michael
OE3GBB
PE1BR-Marco
M1CDQ
G0MJW
G6OUA_Bob
F6GWE
PA0BOJ-Jack
G2DD_Lauren
dc6pd
Charles_G4GU
f6ciu
G7III
G8NOP-Pip
Keith G0KTD
Simon_G0FCU
F1FCO
Steve

Type '/nick your_name' and press enter to register.

Users: 165

DATV Bandplan Link

Open fullscreen

Uplink Power Budget

- Starting point is that an 8 MHz of DVB-S2 transmission will require 100W into a 2.4m dish

Power Budget (Watts)					
	8 MHz	4 MHz	2 MHz	1 MHz	0.5MHz
2.4m	100	50	25	12.5	6.25
1.7m	200	100	50	25	12.5
1.2m	400	200	100	50	25
0.85m	800	400	200	100	50

Credit M0DTS

Cheap Equipment

DATV DVB-S2 Equipment for Downlink:

- Most consumer DVB-S2 set top boxes shall “work out of the box”

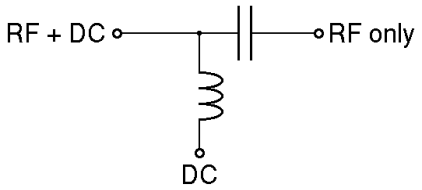
Dongles for NB Downlink:

- RTL-SDR or Funcube dongle
- free SDR software available

Easy Sat !
Ultra Cheap

20€

12€



35€

Display Spectrum and listen with SDR# or similiar…

NB → (V)ertical: 11…14 V
WB → (H)orizontal: 16…20 V

SDR Console V3.x

Airspy :: SDR Console v3.0.10

Home | View | Receive | Transmit | Rec/Playback | Favourites | Memories | Tools | Help

Style

Select Radio | Start | Stop | Bandwidth | Calibration | Frequency | Previous | History | Screenshot | Auto-mute: Enable Options | Noise Blanker: Enable Options

Radio | RX Frequency | Extras | Wideband DSP

Receive

RX 1 ▼9750 MHz 100 - 2700 Hz

10.489.699.200

Default

IF Display

10489.700

Mode

CW-U | NFM | LSB | USB

Filter

1.6kHz | 2.2kHz | 2.4kHz | 2.6kHz | 2.8kHz | 3.0kHz | 3.2kHz | 3.4kHz | 3.6kHz

Radio

Help | Options

Bias-T

Data packing

Gain: Linear Sensitive

S9

10489.540 10489.560 10489.580 10489.600 10489.620 10489.640 10489.660 10489.680 10489.700 10489.720 10489.740 10489.760 10489.780 10489.800

PW4DBZ

10489.400 10489.450 10489.500 10489.550 10489.600 10489.650 10489.700 10489.750 10489.800 10489.850 10489.900 10489.950

x2

Geostationary Satellite Beacon

Δ +18,196Hz

10489.780 10489.785 10489.790 10489.795 10489.800 10489.805 10489.810 10489.815 10489.820

Beacon: 10.489.818.191

Airspy, BW = 625 kHz

CPU: 5.5% Audio: 53ms

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Easy Sat !

20€

12€

NB → (V)ertical: 11…14 V
WB → (H)orizontal: 16…20 V

H

V

175€

145 MHz

0€

Existing 2m/VHF Transceiver

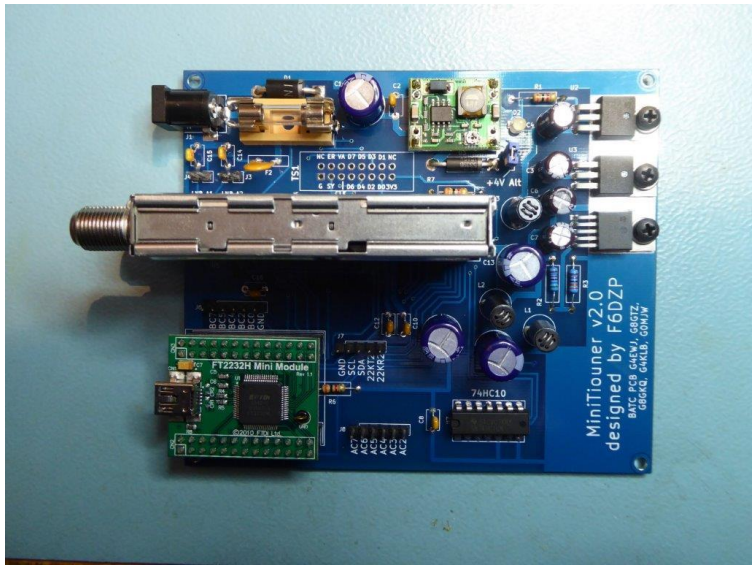
1339 MHz

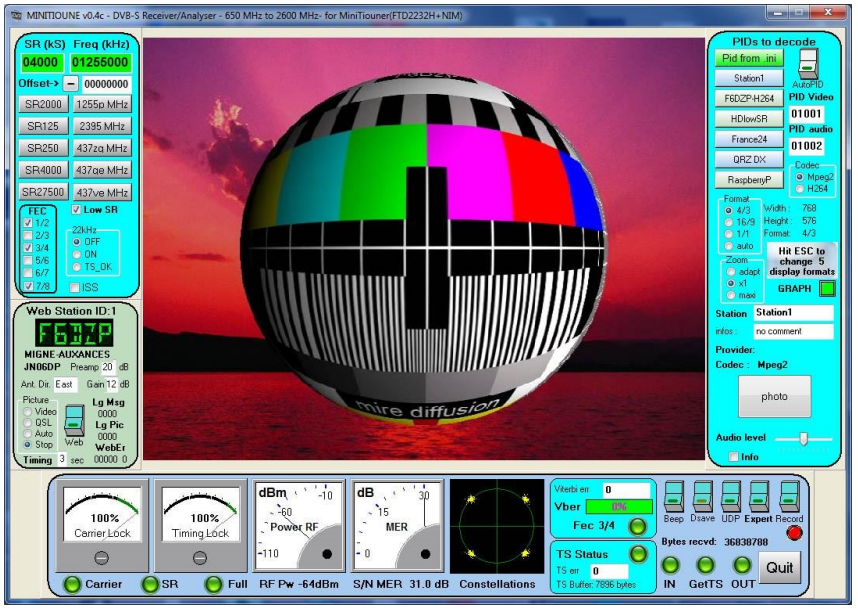
40€

Universal Down-Converter for P4-A

Achim Vollhardt, DH2VA

MiniTioune





The MiniTioune receiver project, developed by Jean-Pierre F6DZP, interfaces via a standard USB 2.0 to a Windows PC running the MiniTioune software.

It will receive DVB-S QPSK and DVB-S2 QPSK, 8PSK, 16APSK, 32 APSK from broadcast and amateur TV transmissions with symbol rates (SR) from 30 Msymbols down to 120 Ksymbols per second. It is also capable of receiving Reduced Bandwidth (RB-TV) transmissions.

For more details: https://wiki.batc.org.uk/MiniTioune

unmodified LNB with PLL

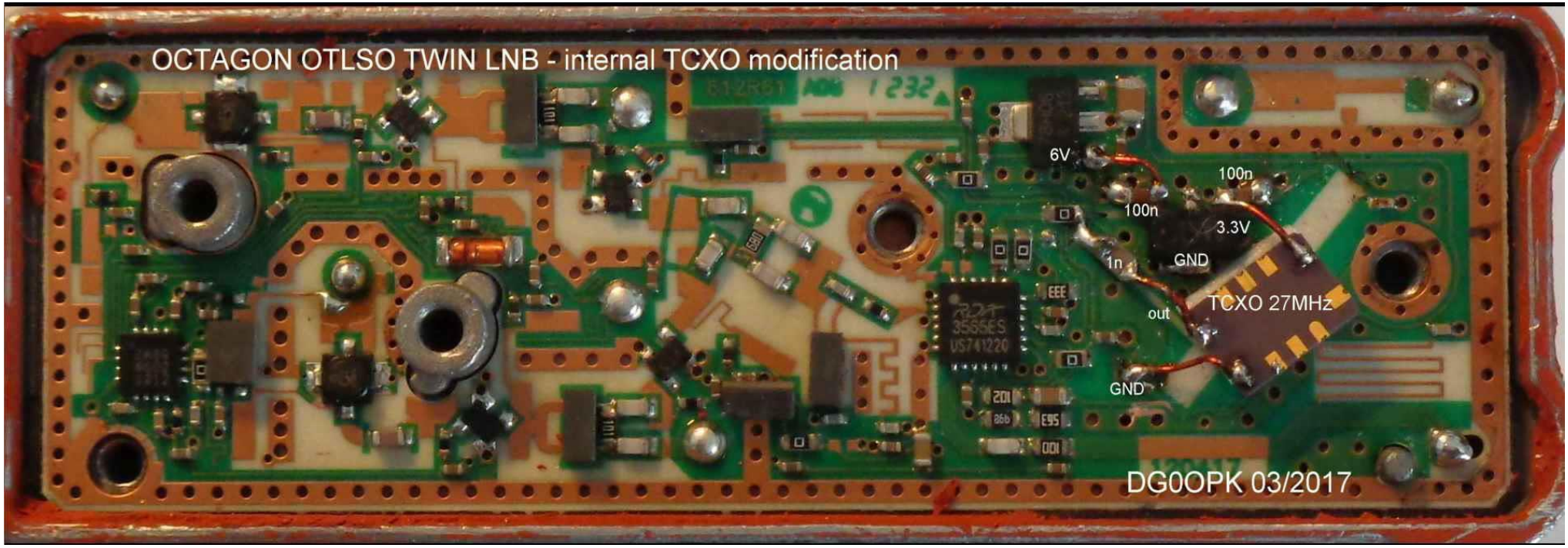
Frequency stability

Test Results from ZS6BTE
http://www.qsl.net/zs6bte/LNB%20Test%20Results.htm

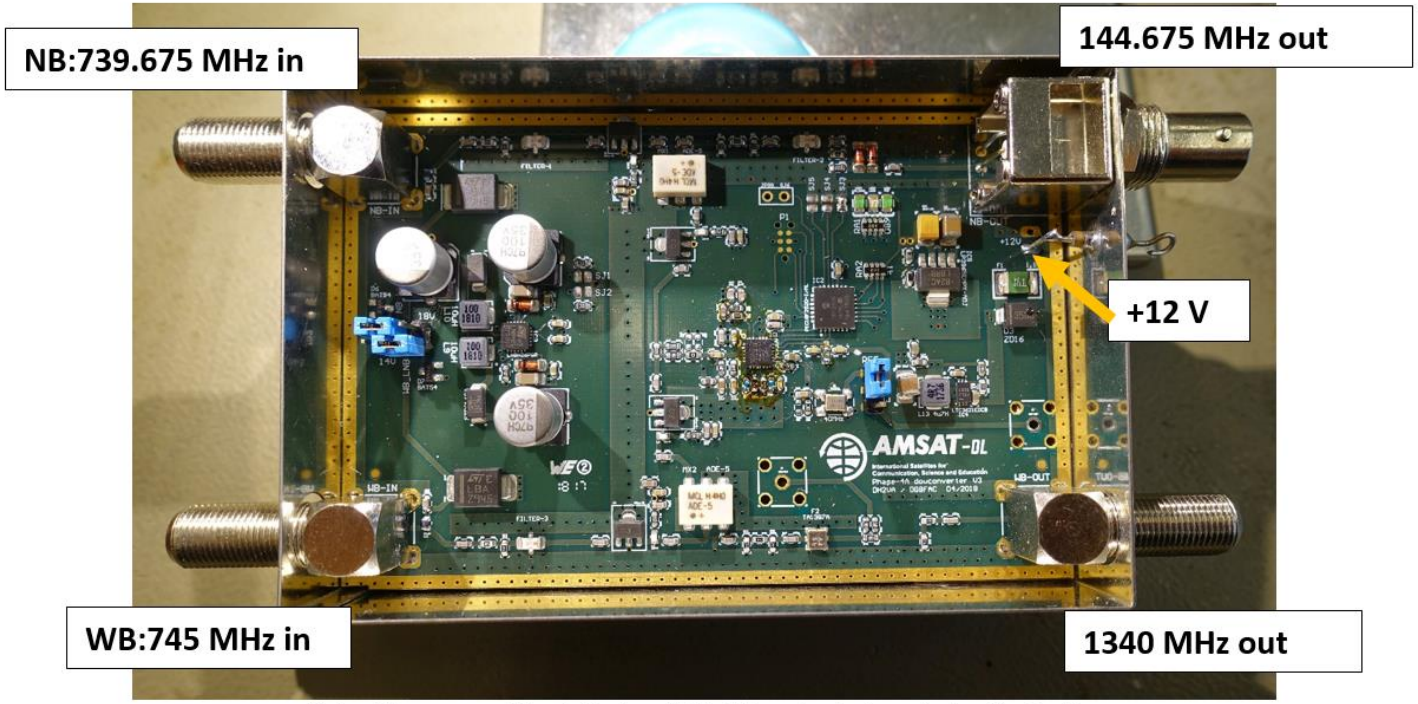
- Standard 27 MHz LO crystal is cheaply and drifts heavily during warm-up.
- **For the first 20 minutes the LNB is quite useless for narrow band working.**
- After 40-45 minutes (tested indoors), the LO frequency stabilizes to 1 Hz at 27 MHz per 5 minutes or 360 Hz per 5 minutes at RF (9750 MHz).
- The LO at 9750 MHz ended up 36 kHz low, and reset to this same value subsequently (again indoors) when restarted.
- **Once warmed up after 45 minutes it is thus very suitable for narrow-band working, provided time periods are not more than a minute or two.**

Modified LNB with TCXO

- D75F analog controlled TCXO from Conner Winfield
- with RDA356SES PLL chip
- 1 ppm stability over temperature range 0-70 degrees
- http://www.dg0opk.darc.de/Octagon_LNB_mod_March2017.html
- Suggested for SSB and other narrow band modes
- works with 27 MHz Quartz/TCXO



AMSAT QO-100 Down-Converter

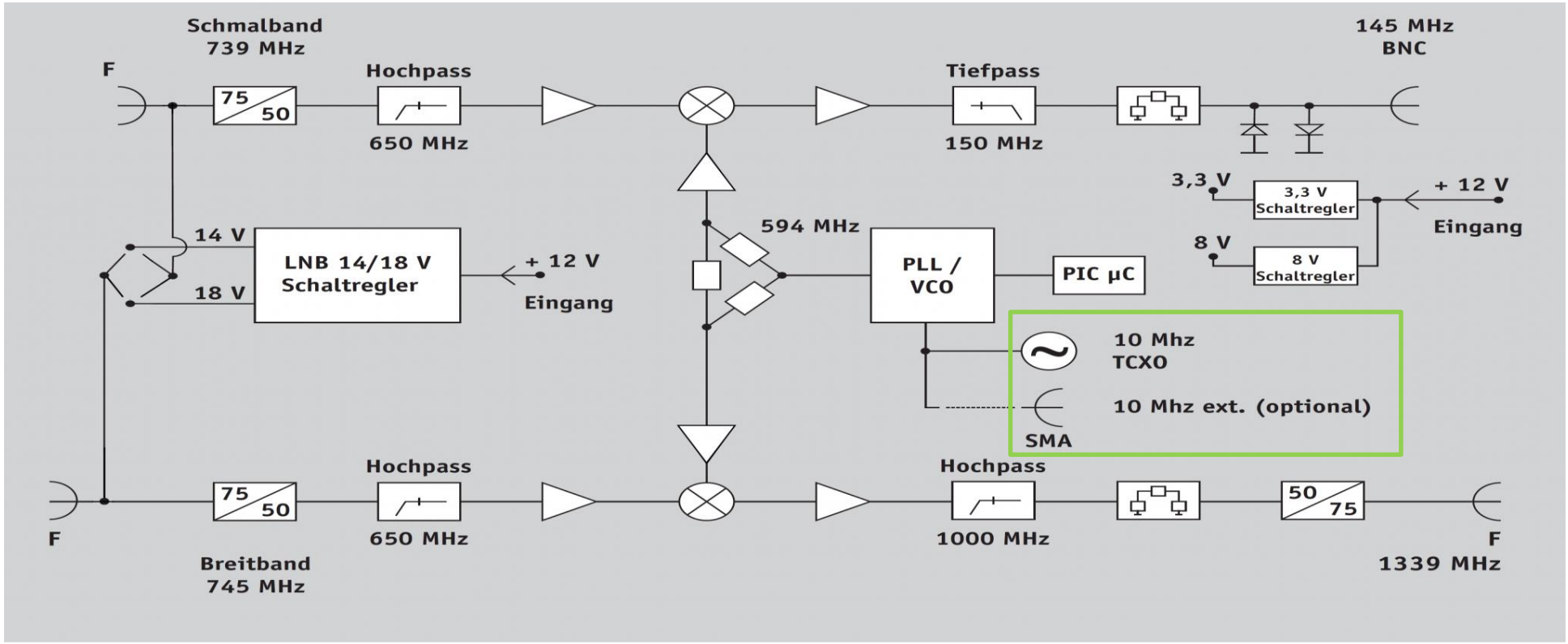


Note: kit comes without tin box (111x74mm), photo only for illustration

- Published in AMSAT-DL Journal No. 3, September 2017 and on our Webpage.
- Kit is available at http://shop.amsat-dl.org

AMSAT QO-100 Down-Converter

- **LO** at 594/595 MHz to shift **NB Downlink to 144/145 MHz**
- **Same LO** signal to **shift WB Downlink to ~1340 MHz** (inside Sat-Receiver IF band)
- Optional: external 10 MHz reference clock
- Includes amplifier for following Receivers
- F connector for LNB (with 14/18V supply) and Sat-Receiver
- BNC for VHF Receiver



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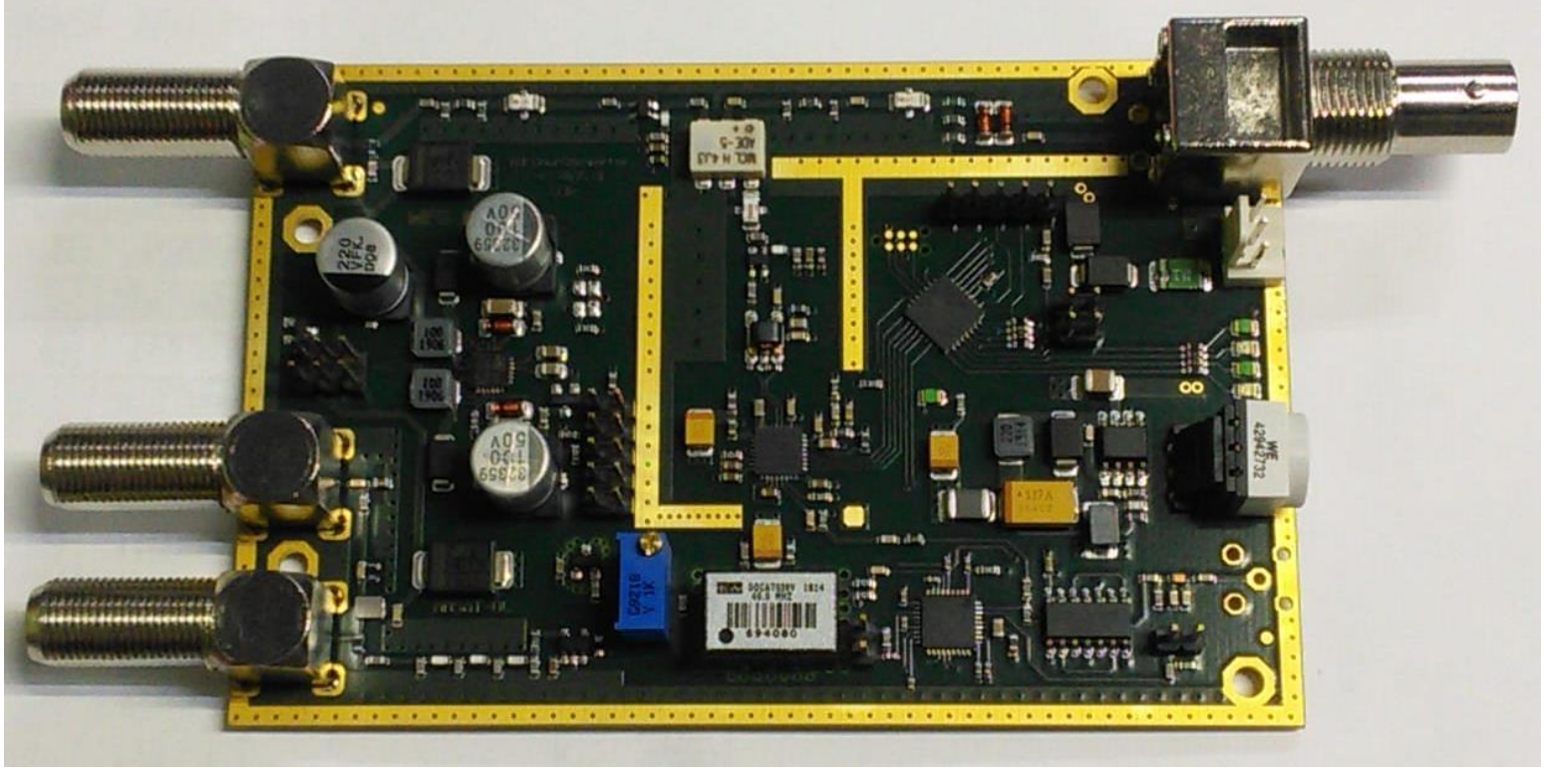
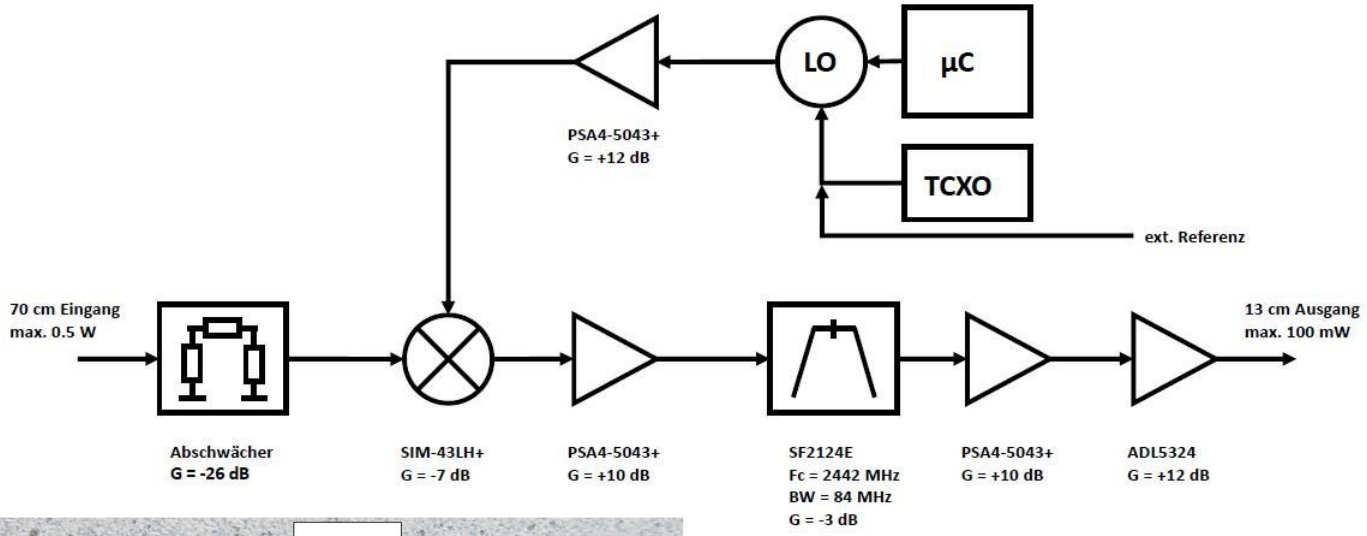
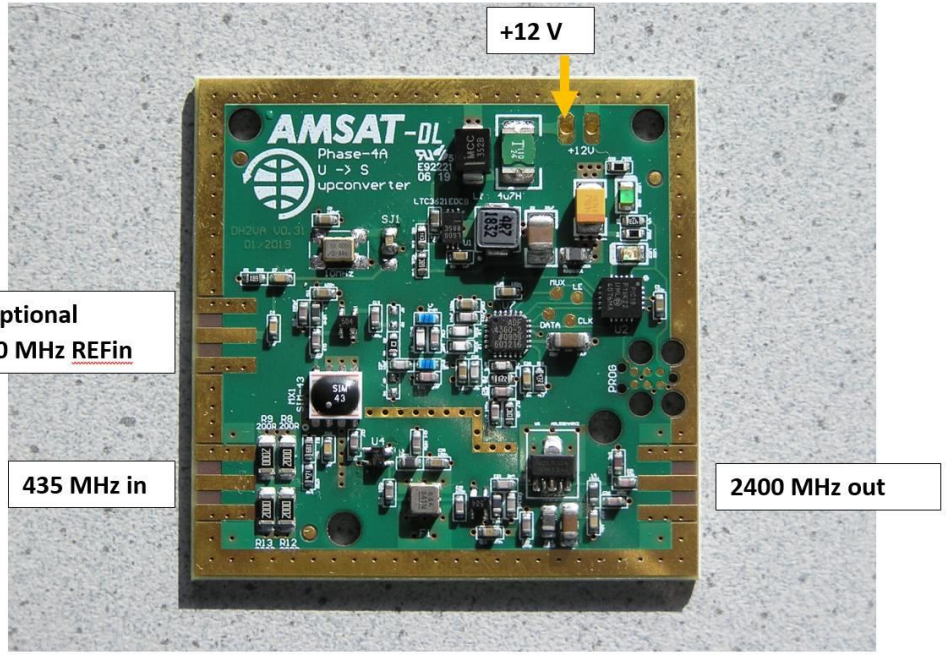
New AMSAT QO-100 Down-Converter

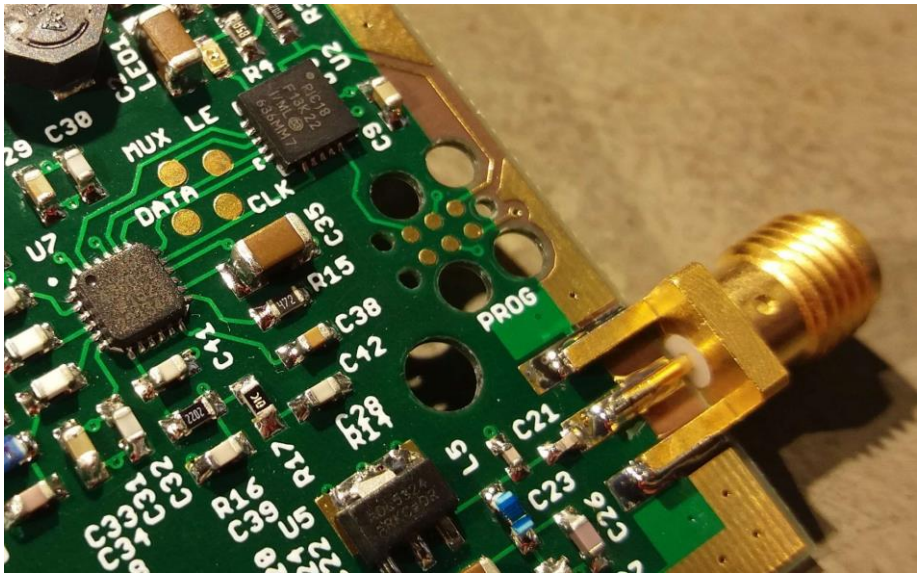
- Available soon!
- two versions: VCOCXO (20ppb) or VCTCXO (500ppb)
- GPSDO with external GPS unit (1pps pulse)
- IF frequency for RX: 28 MHz, 50 MHz, 70 MHz, 144 MHz or 145 MHz
- 10 MHz Reference Output for Up-Converter
- programable LNB external Ref clock: 24/25/26/27 MHz



AMSAT QO-100 Up-Converter

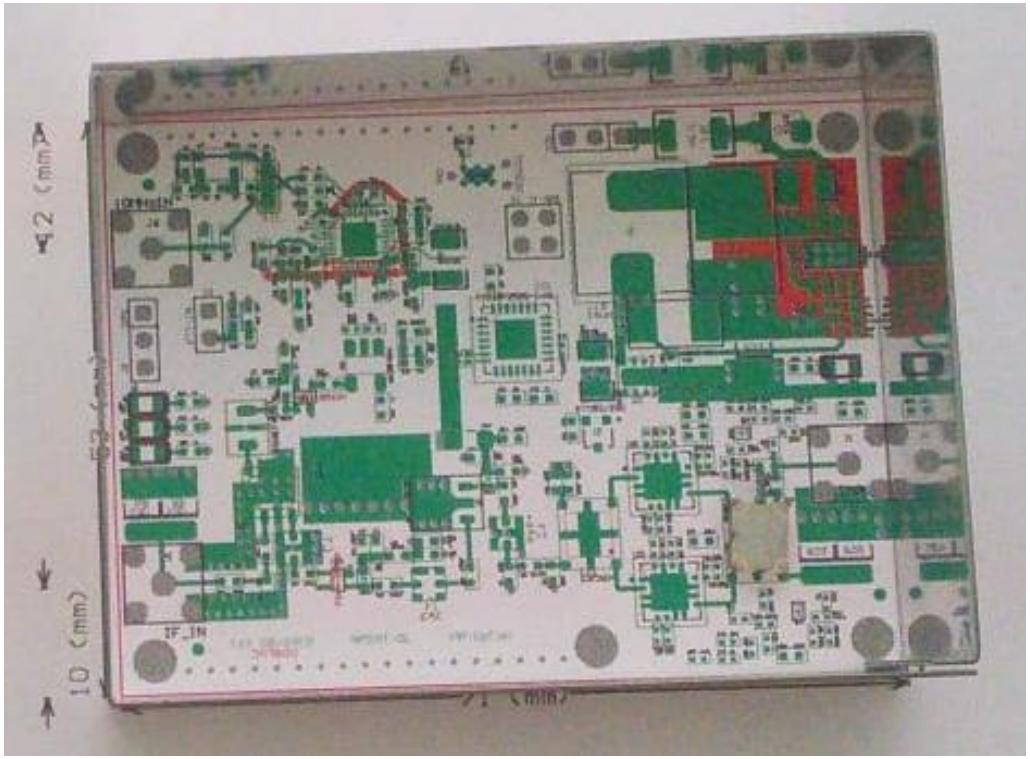






New AMSAT QO-100 Up-Converter

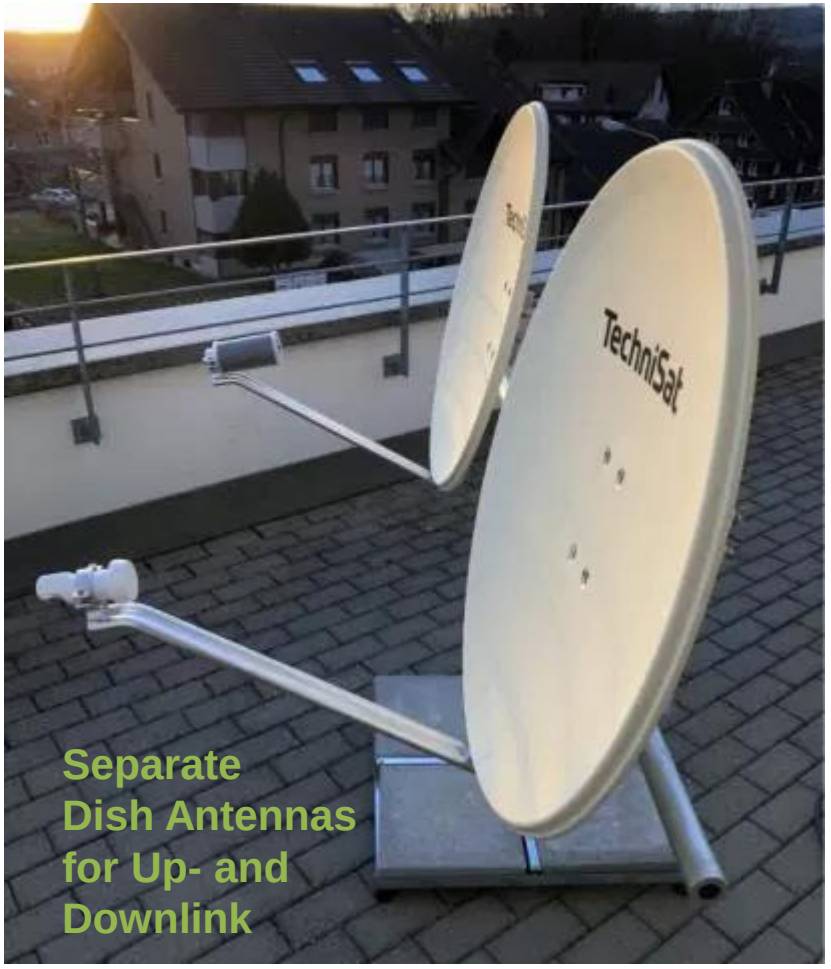
- Available soon!
- 10 MHz Reference Input from Down-Converter
- VCOCXO (20ppb) or VCTCXO (500ppb)
- programable IF for TX: 433 MHz / 435 MHz / 833 MHz / 1293 MHz
- Build-in PA with **8 Watt RF Output!!** (6W with FR4 material)



Antennas for QO-100

WIFI Grid linear

Helix RHCP



Separate Dish Antennas for Up- and Downlink

Patch Array

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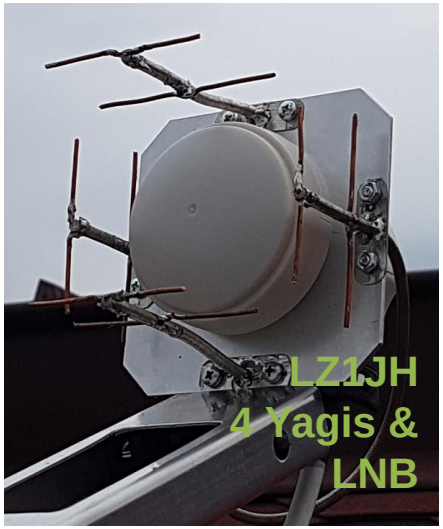
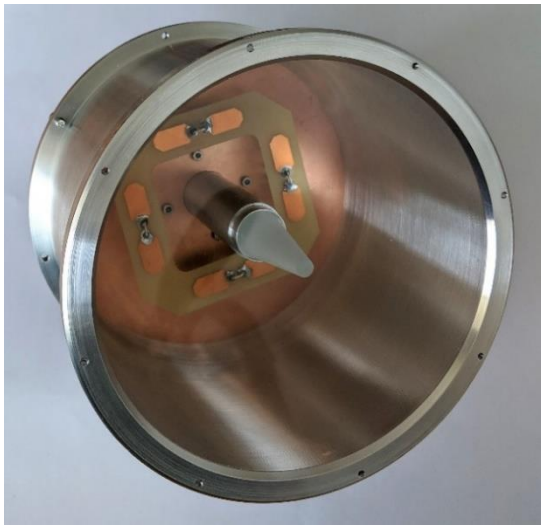
Antennas for QO-100

Dualband Feeds for QO-100



DJ7GP
Dual-band
Feed



HB9PZK
Dipole Array
&
Waveguide

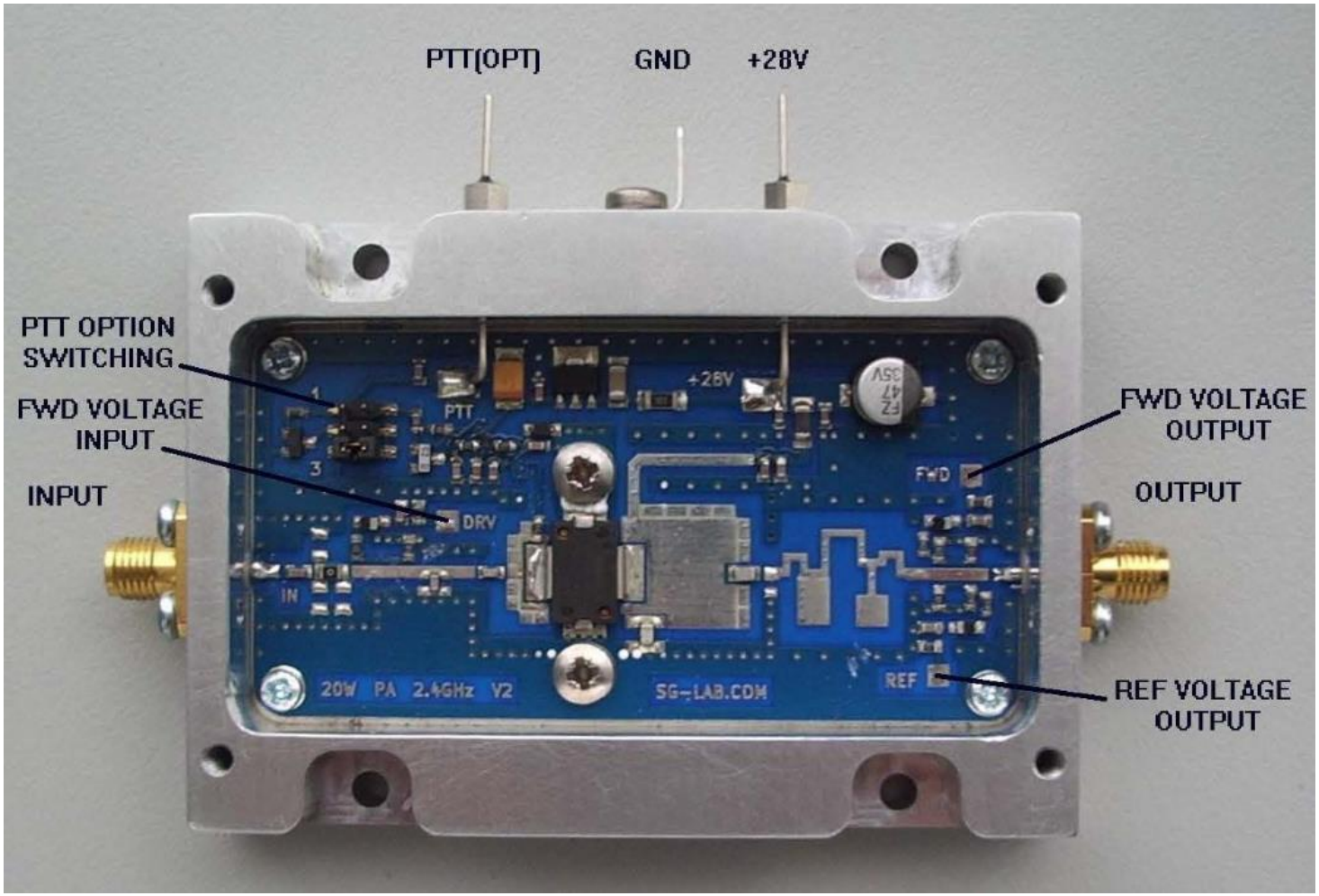
WiFi Booster for 2.4 GHz

2.4 GHz 20W Wifi Booster from AliExpress (190€)

- Good for SSB
- 33dB gain, up to 15W
- 12V input, 5A max.
- see article from Achim DH2VA in AMSAT-DL Journal

SG Laboratory 2.4 GHz Amplifier

- Output Power: 20W
- Gain: 16 dB
- 24..28V, 1.5A
- Price: ~126€



All-in-one solution (DB6NT)

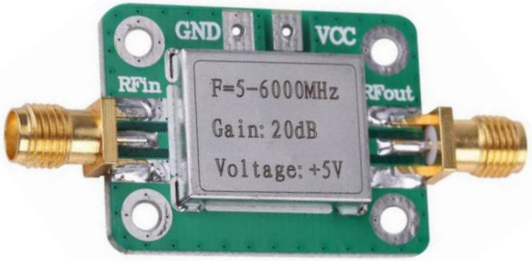
MKU UP 2424 A, Oscar Phase 4 Up-Converter

2400 ... 2402 MHz

Stand-alone up converter for the OSCAR PHASE 4 geostationary satellite
144 MHz IF
Fully remote controllable

Frequency range (IF)	144 ... 146 MHz
Input power (IF)	0.5 ... 5 W (adjustable)
Frequency range (RF)	2400 ... 2402 MHz
LO accuracy @ 18 °C	typ. +/-2 ppm, max. +/-3 ppm
LO frequency stability	typ. +/-2 ppm, max. +/-3 ppm
Output power (Psat)	min. 20 W

ADALM-PLUTO

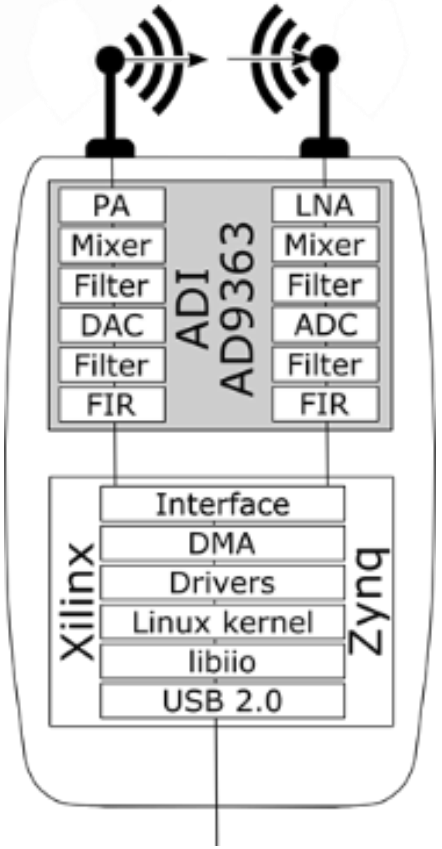


Software-Defined Radio Active Learning Module

- RF coverage from 325 MHz to 3.8 GHz
- (extended range: 70 MHz to 6 GHz)
- Up to 20 MHz of instantaneous bandwidth

- Supports SSB (SDR-Radio)… DVB-S (TX)

- Price: ~120 € (Digi-Key, Mouser)

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THANK YOU!

The first AMSAT **P4-A** transponder in **geostationary orbit** on Es'hail-2 was brought to you by Es'hailSat, QARS and AMSAT-DL

P4-A / Es'hail-2 is now called Qatar-OSCAR 100 (QO-100)

Please suppport AMSAT-DL

Visit our Website at: http://amsat-dl.org

Visit the QO-100 (Es'hail-2) Forum at: http://forum.amsat-dl.org

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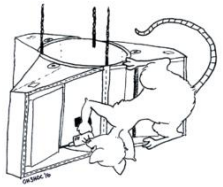

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