Quatar-OSCAR 100 -
den första geostationära amatörsatelliten

Gudmund Wannberg SM3BYA 2020-10-27

Lite historisk bakgrund

- Den allra första OSCAR-satelliten, OSCAR1, sändes upp den 12 december 1961 (59 år sedan !) med en Thor-Agena bärraket från Vandenberg AFB
- Världens första privatbyggda satellit !
- 30 x 25 x 12 cm, 10 kg, ostabiliserad
- Inklination 81,2 grader, omloppstid 91,1 minuter
- Perigeum 245 km, apogeum 474 km
- 140 mW sändare på 144,983 MHz
- Ingen transponder, bara telemetri och ”HI”
- Slutade sända 3/1 1962, återinträdde 31/1 1962

QST nr 2 / 1962 hade
OSCAR1 - uppskjutningen
på första sidan...

och flera artiklar inne i tidningen;
här en bild av huvudnyttolasten...

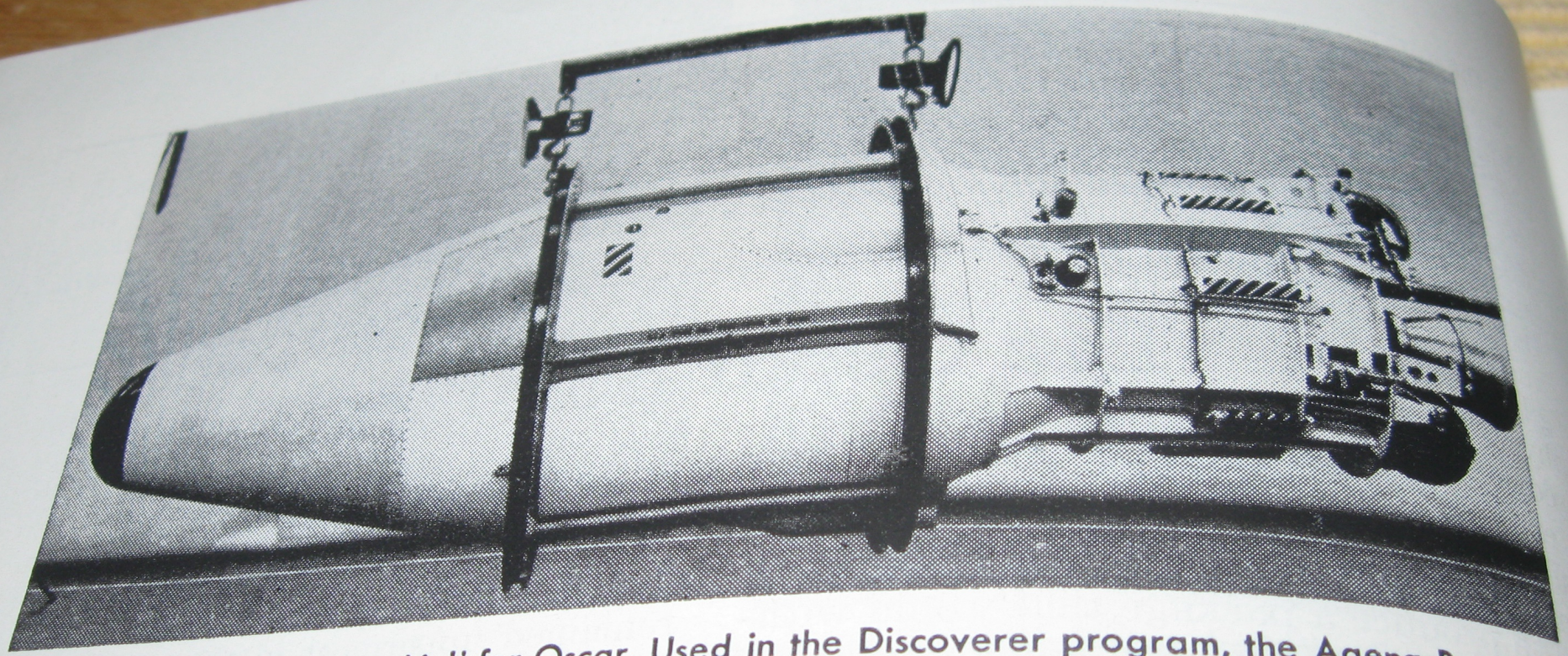


Fig. 2—The Agena-B satellite, "mother ship" for Oscar. Used in the Discoverer program, the Agena-B tips the scales ore than 8500 pounds when it is boosted space-ward by the Thor IRBM vehicle. In orbit, Agena weighs about 17 unds after the liquid propellant has been exhausted. The Oscar satellite was placed in the aft equipment rack (ne right in photograph). Once in orbit, the "piggy-back" Oscar beacon was ejected from the Agena, to go int own orbit about the earth. Nose cone of Discoverer XXXVI was recovered in Pacific area after four days of orbiting about the earth, while Oscar continued on his journey alone!

passed for naught. It was imperative, container with gold to reflect most of

output and primary battery life. Too much output meant that battery life would be unreasonably short. In the final unit, the over-all transmitter efficiency is better than 30 per cent at a power output level of 140 milliwatts. This balance permits good battery life, yet allows a good signal to be radiated.

The Keyer Section

A unique, recognizable identification was required for the Oscar satellite. A waiver was

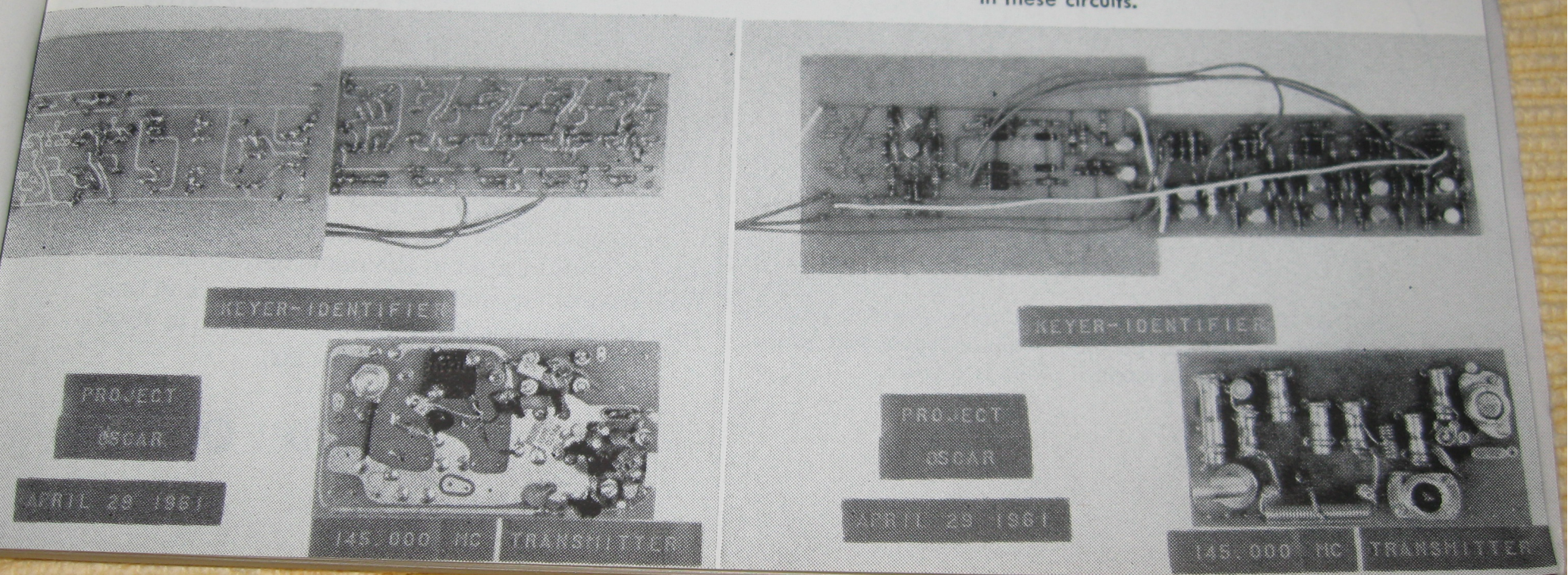
(after a fashion) serves as the other half of the dipole. The resulting pattern, Fig. 6, is similar to that of a half-wave dipole in space. Here is one situation where the free-space pattern of an antenna is utilized in practice!

It would have been desirable if the deep nulls of the pattern could have been eliminated; however, they should have little detrimental effect upon signal reception. In fact, the roll rate of the package may be determined from the ampli-

[1] U.S. Government Printing Office, Washington, 25, D.C. BuShips NObsr 73231, NAVships 93484, price $2.25.

Fig. 3—Bottom view of Oscar printed-circuit boards. The electrical connections between circuit components are made by means of thin copper plated to the insulating board.

Fig. 4—The Oscar unit is built upon two printed-circuit boards. At top is the keyer and pulse-generator unit. The 145-Mc. transmitter is below. Sixteen transistors, a number of diodes and a "Varicap" semiconductor are used in these circuits.



och ett foto av kretskorten; sändaren nederst till höger och ”HI”-generatorn ovanför. Nästan rörande att se...

OSCAR-projektet fortsatte -

- OSCAR 3 var den första satelliten med transponder ombord -
  - Uppskjuten 9/3 1965, transpondern höll i 18 dagar
  - 146 MHz upp / 144 MHz ner, 1W, 50 kHz BW, linjär
  - > 1000 amatörer i 22 länder hann få QSO via transpondern

- OSCAR 4
  - Uppskjuten 12/12 1965, planerad som geostationär
  - men pga ett fel vid uppskjutningen hamnade den i en starkt elliptisk bana, 162 - 33561 km och 587 min omloppstid
  - 3 W, 10 kHz BW transponder, 144 MHz upp, 432 MHz ner
  - Transpondern aktiv i 85 dygn. Endast 12 tvåvägs QSO,
  - men 22/12 1965 den första USA/USSR satellitförbindelsen !

AMSAT- NA och OSCAR-6

- 1969 tog AMSAT-NA över där Project OSCAR slutat. Man började planera fyra nya satellitgenerationer (”Phases”) med transpondrar ombord:
  - Phase 2 : långlivade lågbanesatelliter med solceller
  - Phase 3 : långlivade satelliter i Molniya-banor,
  - Phase 4 : geostationära satelliter,
  - Phase 5 : transpondrar för placering på/runt månen, Mars
- Man började med OSCAR-6 -
  - Uppsänd15/10 1972, nästan cirkulär bana, tyst 21/6 1977
  - r = 1450 km, i = 101,7 grader
  - 145 MHz upp, 29 MHz ner, 1,3 W ut, halvvågsdipol

OSCAR-7

- OSCAR-7 är en seglivad krabat:
  - Uppsänd 15/11 1974
  - I full drift till 1981, då ett batterifel fick den att tystna
  - Återuppstånden omkring 21/6 2002 - 27 år efter launch!
  - Två transpondrar, 144/28 (Mode A) och 432/144 (Mode B). Båda någorlunda brukbara när satelliten är solbelyst (solcellerna enda strömkällan) men kan slå ifrån

- SM3BYA körde en del via O-7 under sjuttiotalet:
  - Mode A första QSO 7412 01, totalt 22 QSO
  - Mode B, första QSO 770804, totalt 194 QSO
  - JA8, W/K 0,1, 2, 3, 4, 8, VE 2, 5, 6, JW m.fl. 99% CW

Phase 3 - OSCAR 10, 13 och 40

- OSCAR 10
  - 16/6 1983 t.o.m. december 1986 (datorfel), Mode B
- OSCAR 13
  - 15/6 1988 - 5/12 1996, Modes B och S
- OSCAR 40
  - Uppsänd 16/11 2000. 13/12 explosion ombord (kickmotorn)
  - Trots detta QRV i Mode B till 25/1 2004, då dog batterierna

En annorlunda väg till Phase 4...

- Emiratet Quatar, känt för det ena och det andra, hyser även en amatörradioförening, A71A, med goda kontakter i landets telekom-satellitindustri - och man hade planer för satelliten Es'hail-2:
  - ”The first geostationary amateur radio transponder (P4-A) on Es’hail-2 is a joint project by the Qatar Satellite Company (Es’hailSat), the Qatar Amateur Radio Society (QARS) and AMSAT Deutschland (AMSAT-DL).

Scheduled for launch in 2018, this high-powered, advanced satellite will further boost broadband delivery, broadcasting and global connectivity in Qatar, the entire region and beyond. Es’hail-2 is being manufactured in Japan by MELCO (Mitsubishi Electric Corporation). Es’hail-2 will have Ku-band and Ka-band capabilities and support TV distribution, telecoms and government services to strategic stakeholders and commercial customers who value broadcasting independence, interference resilience, quality of service and wide geographical coverage. The satellite will also provide greater capability for anti-jamming protection and redundancy and back-up for Es’hail-1.

Es’hail-2 is a joint project by the Qatar Satellite Company (Es’hailSat), the Qatar Amateur Radio Society (QARS) and AMSAT Deutschland (AMSAT-DL).”

About Es'hailSat

Es'hailSat, The Qatar Satellite Company was established in 2010. Based in Doha, Qatar, the company owns and operates satellites to serve broadcasters, businesses and governments. Es'hail 1, which shares a spacecraft platform with the European satellite operator Eutelsat, was successfully launched on 29th August 2013. The satellite provides television, voice, Internet, corporate and government communications services across the Middle East and North Africa region and beyond. Es'hail 2 is currently under development and will be located at the 26 degrees East TV broadcasting hotspot. www.eshailsat.qa

The Qatar Amateur Radio Society (QARS) is a national non-profit organization for amateur radio enthusiasts in Qatar.

In order to promote and foster space technology development in Qatar, Es'hailSat has initiated the development of new technology for the Qatar Amateur Radio Society.

With the provision of two transponders on the Es'hail-2 satellite for an Amateur Satellite Radio payload, this ground-breaking project is expected to provide an exciting new phase of activity for radio amateurs in the 21st century.

Es'hail-2 will provide the first Radio Amateur Satellite Corporation (AMSAT) geostationary communication capability that connects users across the visible globe in one single hop and in real-time. It will allow also the AMSAT community to validate and demonstrate their DVB standard.

AMSAT-DL's involvement on behalf of QARS started in in December 2012, when AMSAT-DL president Peter Gülzow, DB2OS was invited to the International Amateur Radio Festival in Doha for a presentation about Amateur Radio Satellites.

The conference was chaired by A71AU H.E. Abdullah bin Hamad Al Attiyah, Chairman of the Qatar Amateur Radio Society (QARS), former deputy Prime Minister of The State of Qatar, Minister of Energy Industry, Chairman of the Administrative Control and Transparency Authority. In his opening ceremony HE Abdullah bin Hamad Al Attiyah stressed the significant role amateur radio plays in the society during the opening of the Qatar international amateur radio festival at the Al Rayyan Theatre in Souq Waqif.

"For developing countries amateur radio societies can promote technical expertise to help out in the local communities," he said, adding amateur radio as a hobby has provided platform for training in electronics, broadcasting theories, and telecommunication techniques. Al Attiyah also underscored the importance of amateur radio for special needs persons, giving them a good chance to keep in touch with the world. "Amateur radio also responds very quickly in times of crisis and emergencies and provide support for telecom when ordinary channels of communications are not functional," he said. It is not surprising, he said, in an era of advanced technology that more people are joining amateur radio societies around the world with an increasing number of people seeking licences. "That is why we as concerned bodies are giving support to further promote this hobby under the International Telecommunication Union," he said.

“While users of electronic social media discuss issues on individual-to-individual basis, members of amateur radio put subject before large audiences across the world. Even though it has some limitations as regards discussion of some subjects like religion, politics and business openly, amateur radio continues as a creative hobby for large numbers of people.” Lauding Qatar government for its support to the group, Attiyah said, “Qatar’s government has been very supportive of QARS since its beginning in the early 80’s. Now, the society has over 100 members in Qatar.

Och på den vägen gick det vidare...

AMSAT-DLs sammanfattning av projektet:

infoga AMSAT-DL här...

AMSAT-DL

Satellites for Communication and Science
Satelliten für Kommunikation und Wissenschaft

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

AMSAT-DL

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

P4-A / Es'hail-2

QO-100

Qatar-OSCAR 100

Peter Gülzow, DB2OS
2020-06-05

AMSAT-DL

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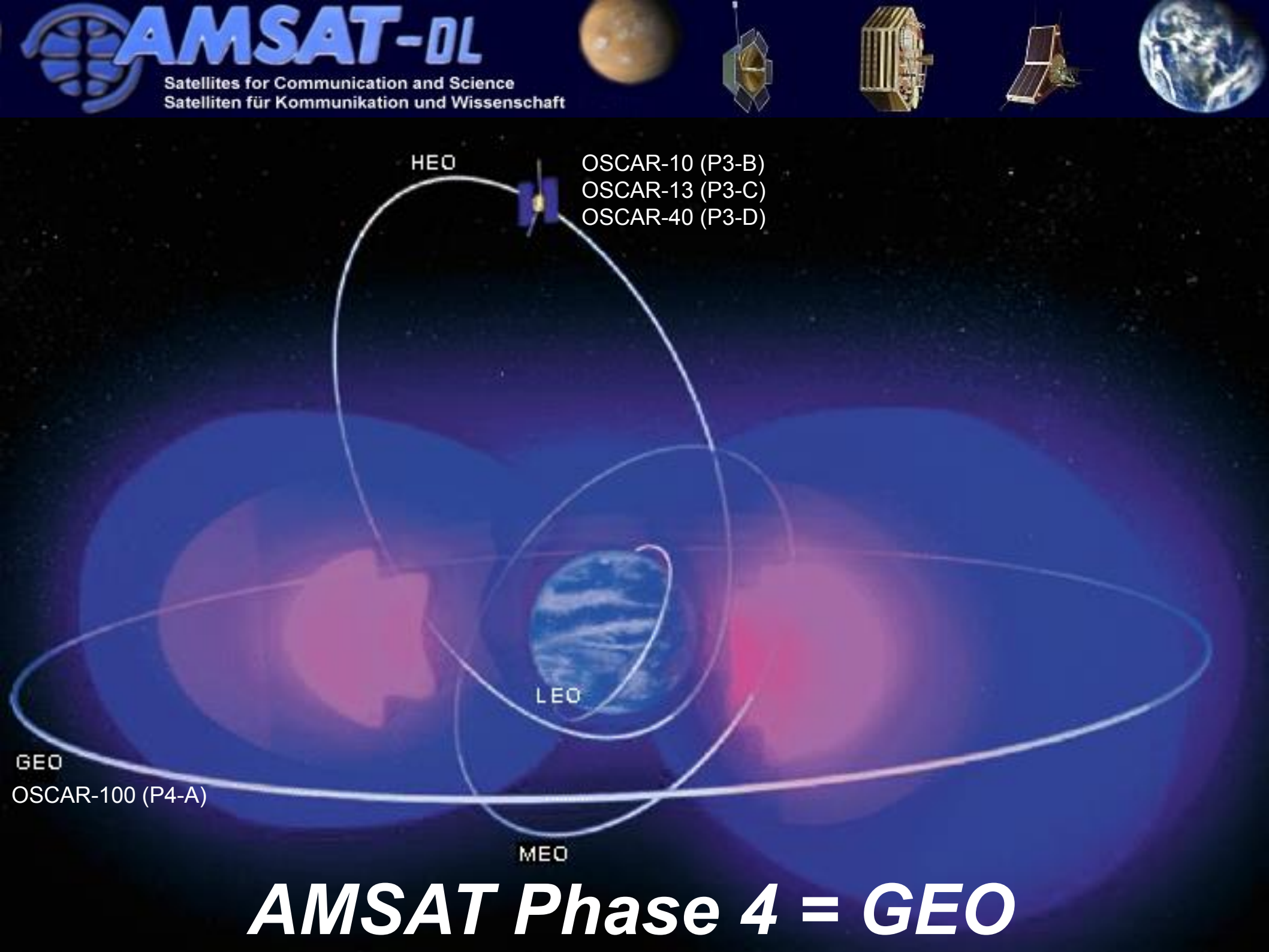
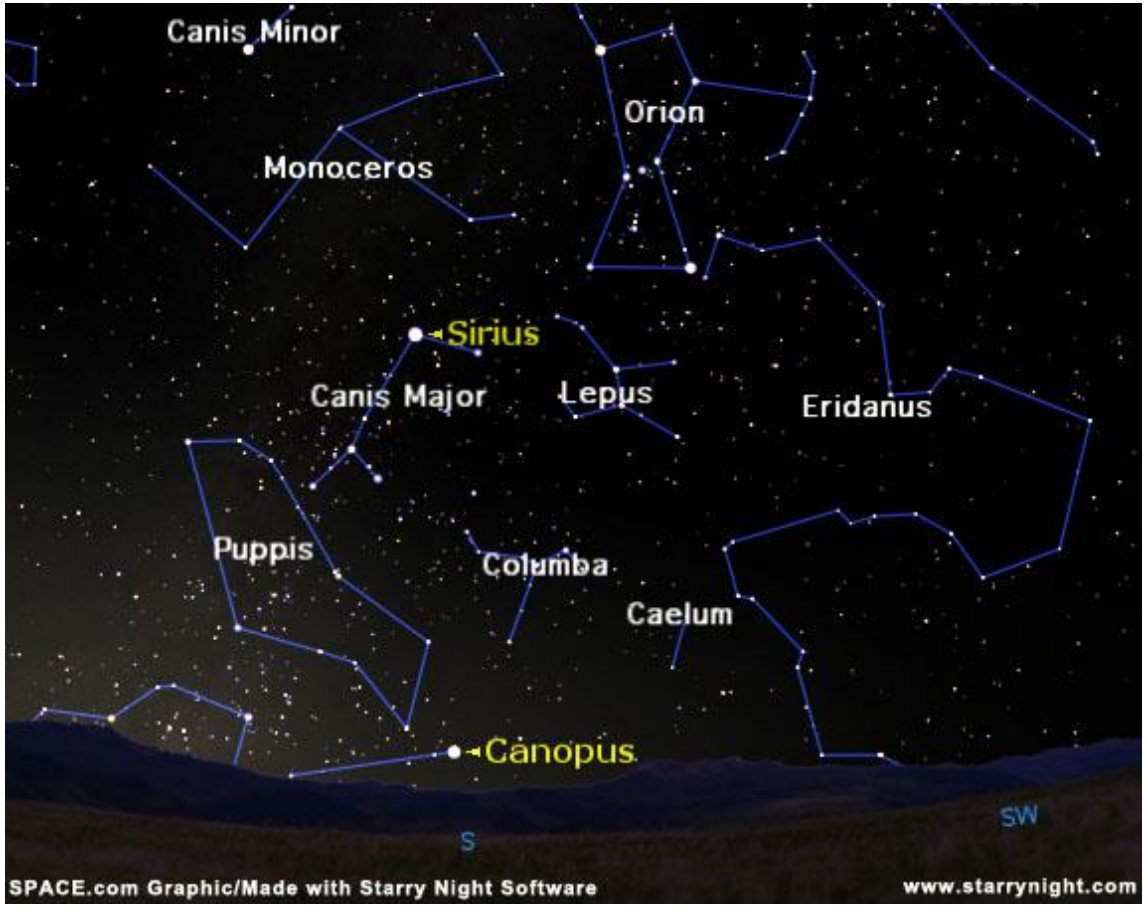


AMSAT Phase 4 = GEO

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*)

Canopus /kəˈnoʊpəs is the brightest star in the southern constellation of Carina, and is located near the western edge of the constellation around 310 light-years from the Sun. Its proper name is generally considered to originate from the mythological Canopus, who was a navigator for Menelaus, king of Sparta.

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

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2012 Qatar Ham Radio Festival

visiting Qatar TV yesterday.

HH the Emir Sheikh Hamad bin Khalifa al-Thani, HH the Heir Apparent Sheikh Tamim bin Hamad al-Thani and HE the Prime Minister and Foreign Minister

bor al-Thani have sent ... congratulations to the president of Kazakhstan on his country's National Day.

Qatar to create platform for regional HAM broadcasters

By Zia Khan
Staff Reporter

Qatar will push for creating a common platform for amateur radio broadcasters from all over the Arab world to 'institutionalise' what currently is a hobby for individuals, HE the Chairman of Administrative Control and Transparency Authority, Abdullah bin Hamad al-Attiyah, said yesterday.

"We are looking into it and hope will be able to do that sometime next year," said al-Attiyah, at a news conference in Doha.

Al-Attiyah, who is also the chairman of Qatar Amateur Radio Society (QARS), hoped that the country would be hosting early next year such broadcasters at least from the Gulf Co-operation Council (GCC) member states.

"We are going to have a very strong Arab union and this initiative can help us achieve that goal," al-Attiyah added. He was talking to media after delivering a keynote speech at an international festival organised by the QARS.

Al-Attiyah said at least five mobile amateur radio stations would be set up on Qatar's National Day (tomorrow) to amuse people on the Corniche.


HE Abdullah bin Hamad al-Attiyyah speaking to media at a news conference.

These portable radio stations, he explained, would be moving up and down along the Corniche to reach out to as many people as they could.

Al-Attiyah said he was himself an amateur broadcaster in the 70s and used to cultivate friendships across the globe through his hobby.

He said that there were several hundred members associated with the QARS and they undergo extensive training and orientation sessions before getting a licence.

Al-Attiyah said the concept of amateur radio is different from the social media network because an individual can do 'whatever is on one's mind' on networking sites like the Facebook and Twitter.

One the other hand, he explained, the amateur radio stations in Qatar were not allowed to discuss politics, religion and business on the waves to avoid the 'negative' use of the facility and liberty available to them.

He added that there was no monitoring mechanism to check whether amateur broadcasters were stepping out of their mandated territory but a deep sense of the social responsibility kept them away from forbidden topics.

He said the amateur broadcasting has very strong social implications as those running such ventures in Qatar were on the forefront of relief efforts after earthquakes in Iran and Turkey in recent years by motivating people to donate for rehabilitation.

In some instances, he revealed, these broadcasters were helpful in establishing a link between victims in home countries and their relatives in Qatar when all other means of communication did not work properly.


bles Tahir al-Masri, n, secretary general of nber of the board of eral in Libya Dr Tarek , currently under way

Qatar

00 square metres and 23 permarkets, and 11 con- ience stores.
"Over the last three years, have grown rapidly with new branches coming in Qatar and outside. e have doubled our retail ace from 28,000 square etres in 2009 to more an 60,000 square metres the end of this year," said r al-Qahtani.
The deputy CEO added at his company's intenon is to operate at least 0,000 square metres of tail space by 2017.

ts to be Qatar

04 The Peninsula MONDAY 17 DECEMBER 2012
www.thepeninsulaqatar.com

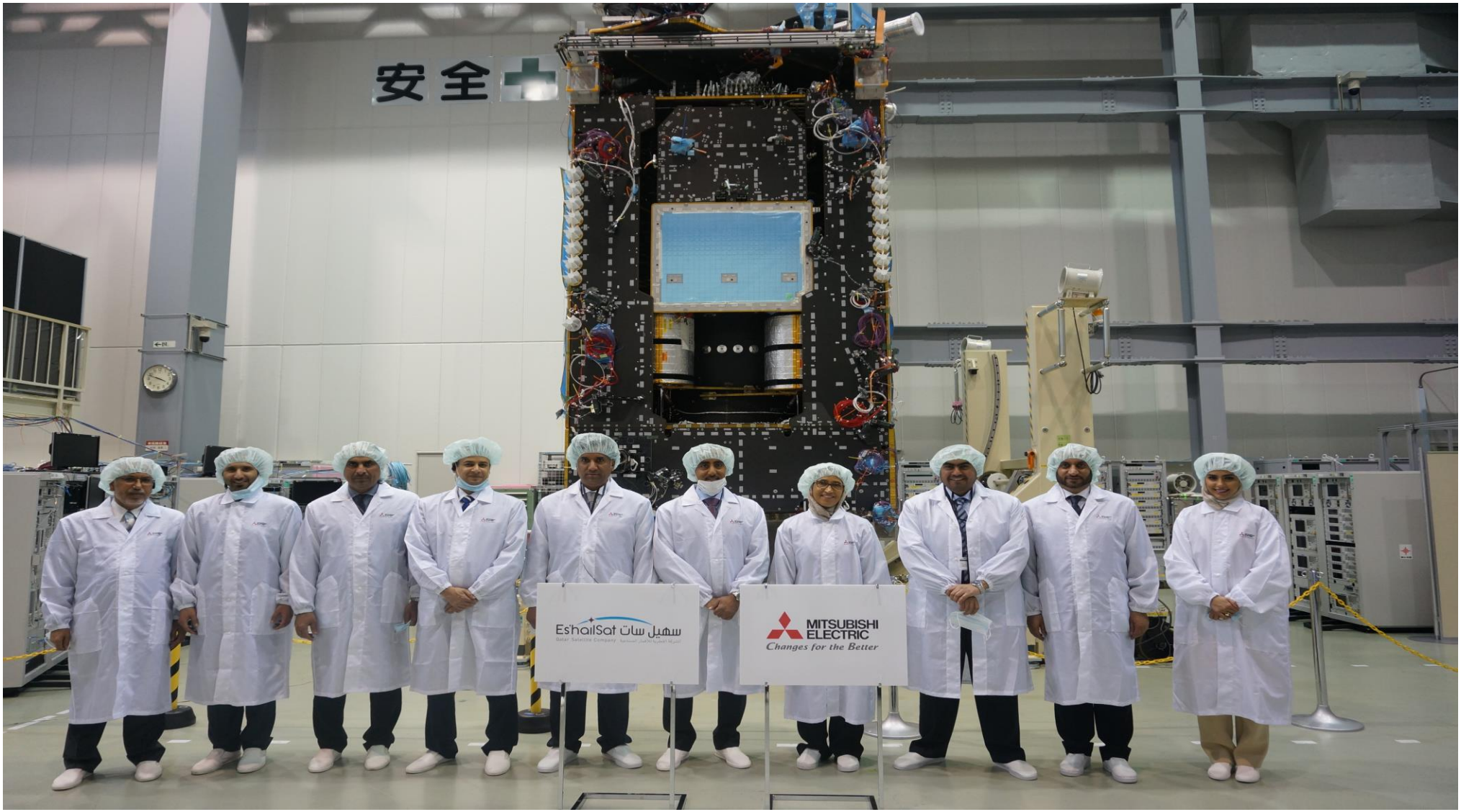
Global amateur radio fest begins

BY RAYNALD C RIVERA

DOHA: H E Abdullah bin Hamad Al Attiyah, Chairman of the Administrative Control and Transparency Authority, stressed the significant role amateur radio plays in the society during the opening of the Qatar international amateur radio festival yesterday at the Al Rayyan Theatre in Souq Waqif.

Al Attiyah, who is also the Chairman of the Qatar Amateur Radio Society (QARS), who are hosting the event for the first time in the Middle East addressed hundreds in the audience comprising officials of various amateur radio societies around the world and secondary students and


H E Abdullah bin Hamad Al Attiyah receiving a sword from Dr Ahmed Al Muhannadi, Vice-President of Qatar Amateur Radio Society (QARS), at Al



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.

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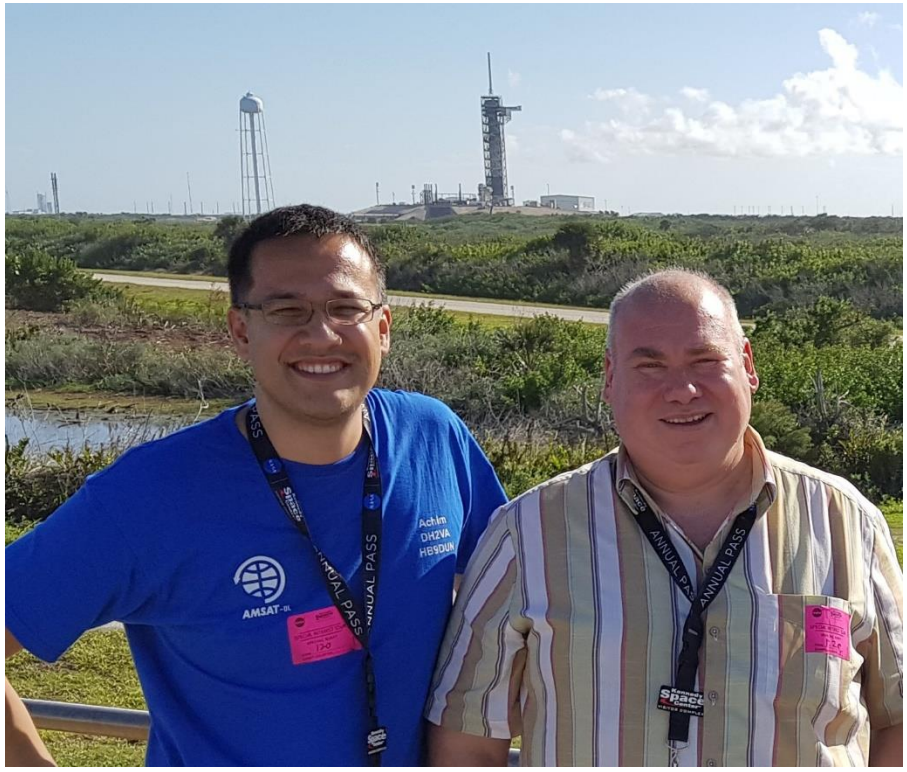
Launch on November 15th 2018

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
Qatar Satellite Company الشركة القطرية للأقمار الصناعية

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Q.A.R.S.
QATAR AMATEUR RADIO SOCIETY
الجمعية القطرية لهواة الراديو

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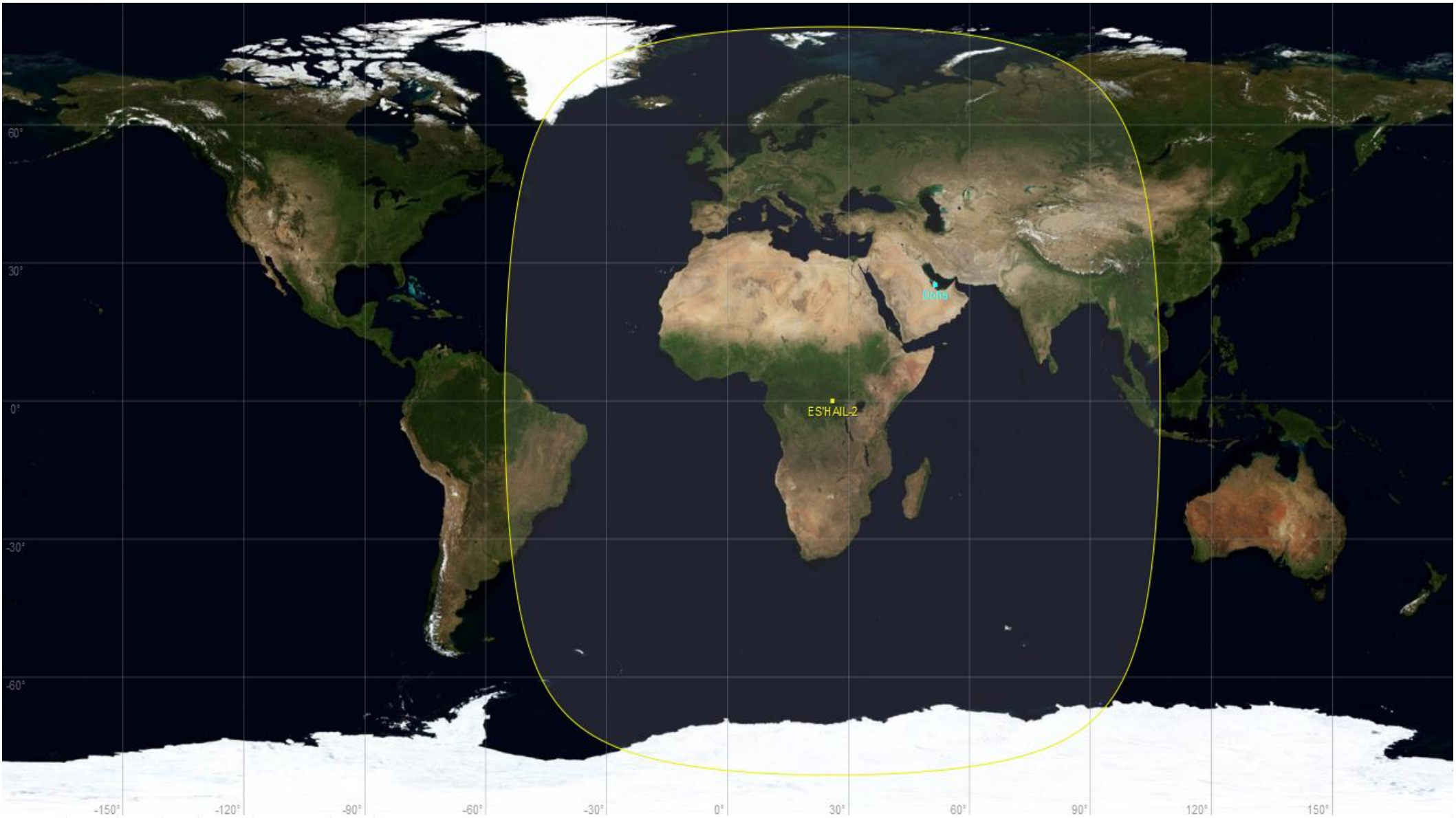
Earth Coverage Es'hail-2



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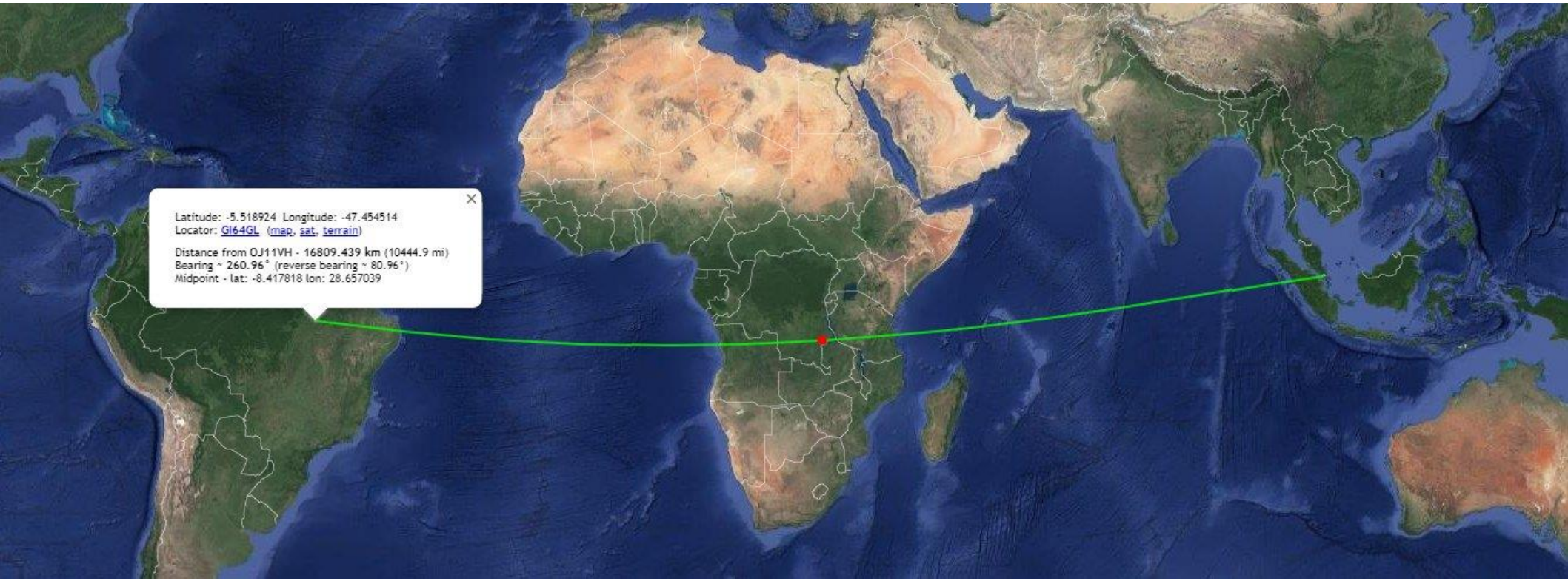
QO-100 Satellite Distance Record



QO-100 (NB) on 08-Feb-2020 at 11:47 UTC
Distance: 16,809 km.
9V1HY in Singapore (OJ11vh) ←→ PR8ZX in Brazil (GI64gl)

If you wish to claim a new record, see: https://www.amsat.org/satellite-distance-records/

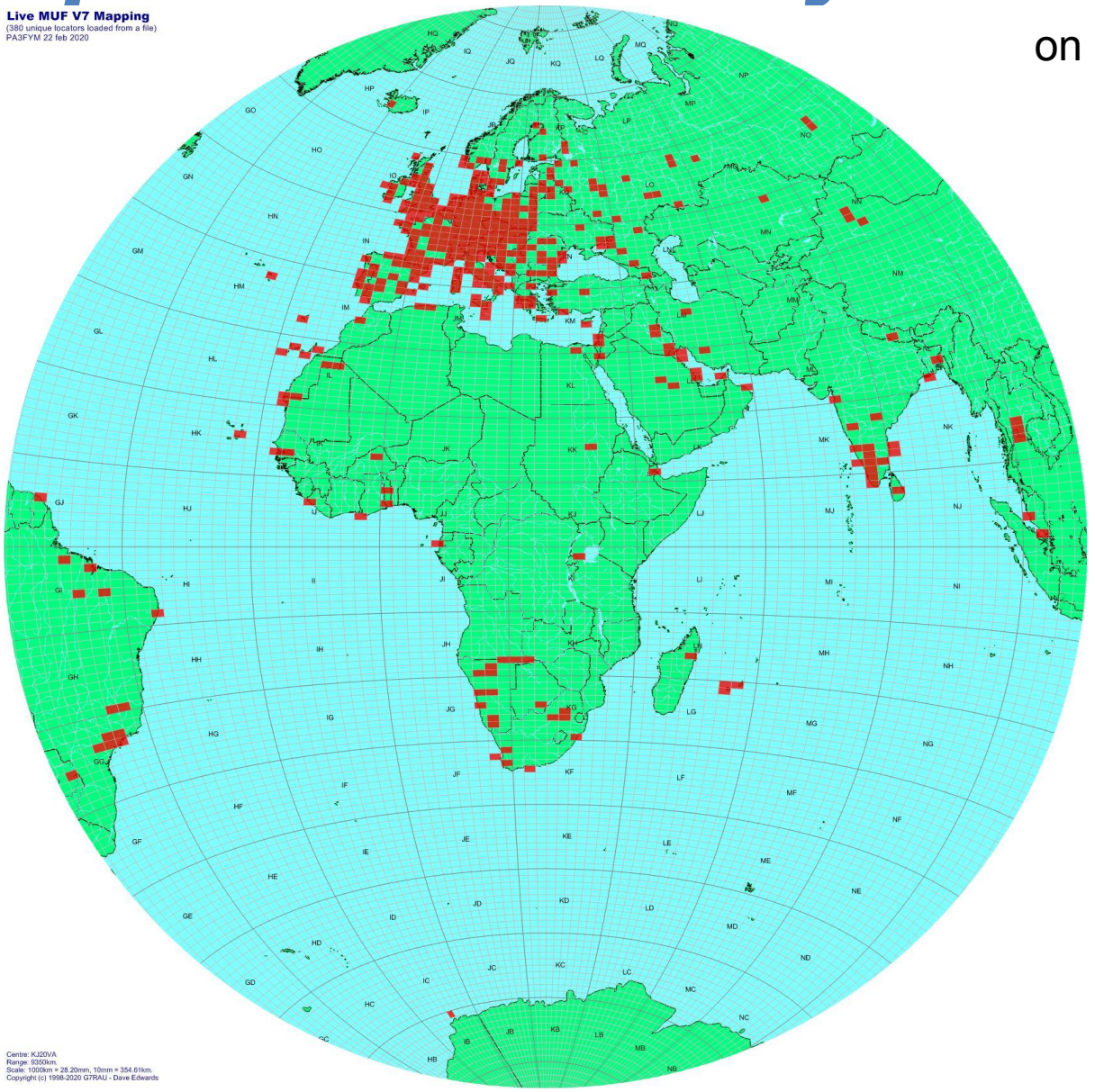
103 DXCC countries on QO-100

3A, 3B8, 4L, 4O, 4S, 4U, 4X, 5B, 5R, 5V7, 7X, 8Q, 9A, 9G, 9H, 9J, 9K, 9M2, 9N, 9V, 9X, A2, A4, A6, A7, A9, BY, C31, C5, CE9, CN, CT, CT3, CU, D4, DL, E7, EA, EA6, EA8, EI, EL, EP, ES, EU, F, FR, FY, G, GD, GI, GJ, GM, GU, GW, HA, HB, HB0, HS, HZ, I, IS0, J2, LA, LX, LY, LZ, OE, OH, OK, OM, ON, OZ, PA, PY, S0, S2, S5, SM, SP, ST, SU, SV, SV9, TA, TF, TK, TR, UA, UA0, UN, UR, V5, VU, XT, YI, YL, YO, YT, ZA, ZC4, ZS

MONACO, MAURITIUS ISLAND, GEORGIA, MONTENEGRO, SRI LANKA, ITU HQ, ISRAEL, CYPRUS, MADAGASCAR, TOGO, ALGERIA, MALDIVES, CROATIA, GHANA, MALTA, ZAMBIA, KUWAIT, WEST MALAYSIA, NEPAL, SINGAPORE, RWANDA, BOTSWANA, OMAN, UNITED ARAB EMIRATES, QATAR, BAHRAIN, CHINA, ANDORRA, THE, GAMBIA, ANTARCTICA, MOROCCO, PORTUGAL, MADEIRA ISLANDS, AZORES, CAPE VERDE, FEDERAL REPUBLIC OF GERMANY, BOSNIA-HERZEGOVINA, SPAIN, BALEARIC ISLANDS, CANARY ISLANDS, IRELAND, LIBERIA, IRAN, ESTONIA, BELARUS, FRANCE, REUNION ISLAND, FRENCH GUIANA, ENGLAND, ISLE OF MAN, NORTHERN IRELAND, JERSEY, SCOTLAND, GUERNSEY, WALES, HUNGARY, SWITZERLAND, LIECHTENSTEIN, THAILAND, SAUDI ARABIA, ITALY, SARDINIA, DJIBOUTI, NORWAY, LUXEMBOURG, LITHUANIA, BULGARIA, AUSTRIA, FINLAND, CZECH REPUBLIC, SLOVAK REPUBLIC, BELGIUM, DENMARK, NETHERLANDS, BRAZIL, WESTERN SAHARA, BANGLADESH, SLOVENIA, SWEDEN, POLAND, SUDAN, EGYPT, GREECE, CRETE, TURKEY, ICELAND, CORSICA, GABON, EUROPE, N RUSSIA, ASIATIC RUSSIA, KAZAKHSTAN, UKRAINE, NAMIBIA, INDIA, BURKINA FASO, IRAQ, LATVIA, ROMANIA, SERBIA, ALBANIA, UK BASES ON CYPRUS, REPUBLIC OF SOUTH AFRICA

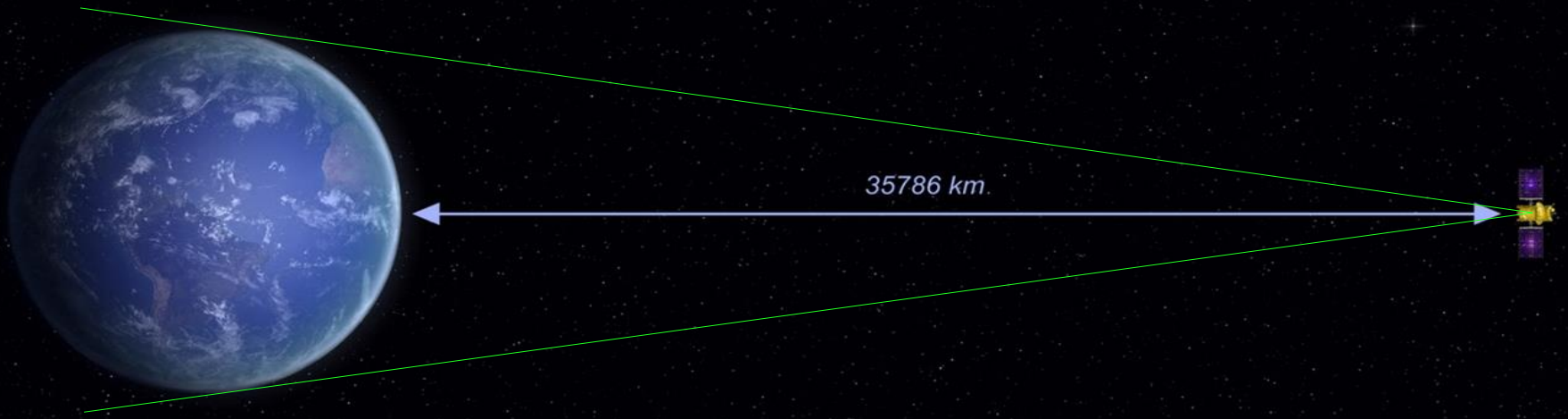
380 unique locations by PA3FYM

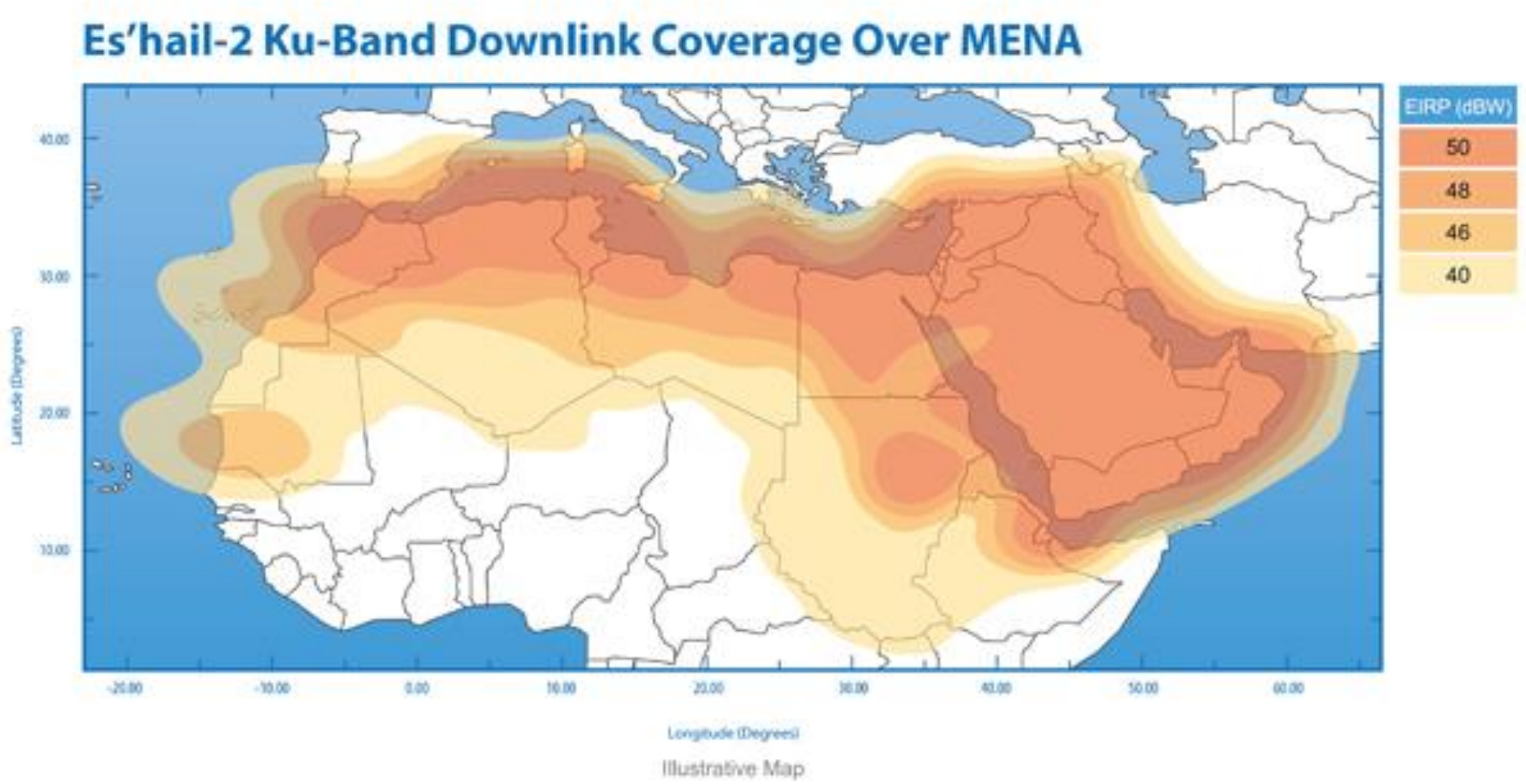
on 22 Feb 2020



QO-100 Downlink Wide Beam

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





commercial SAT-TV Spot Beam!

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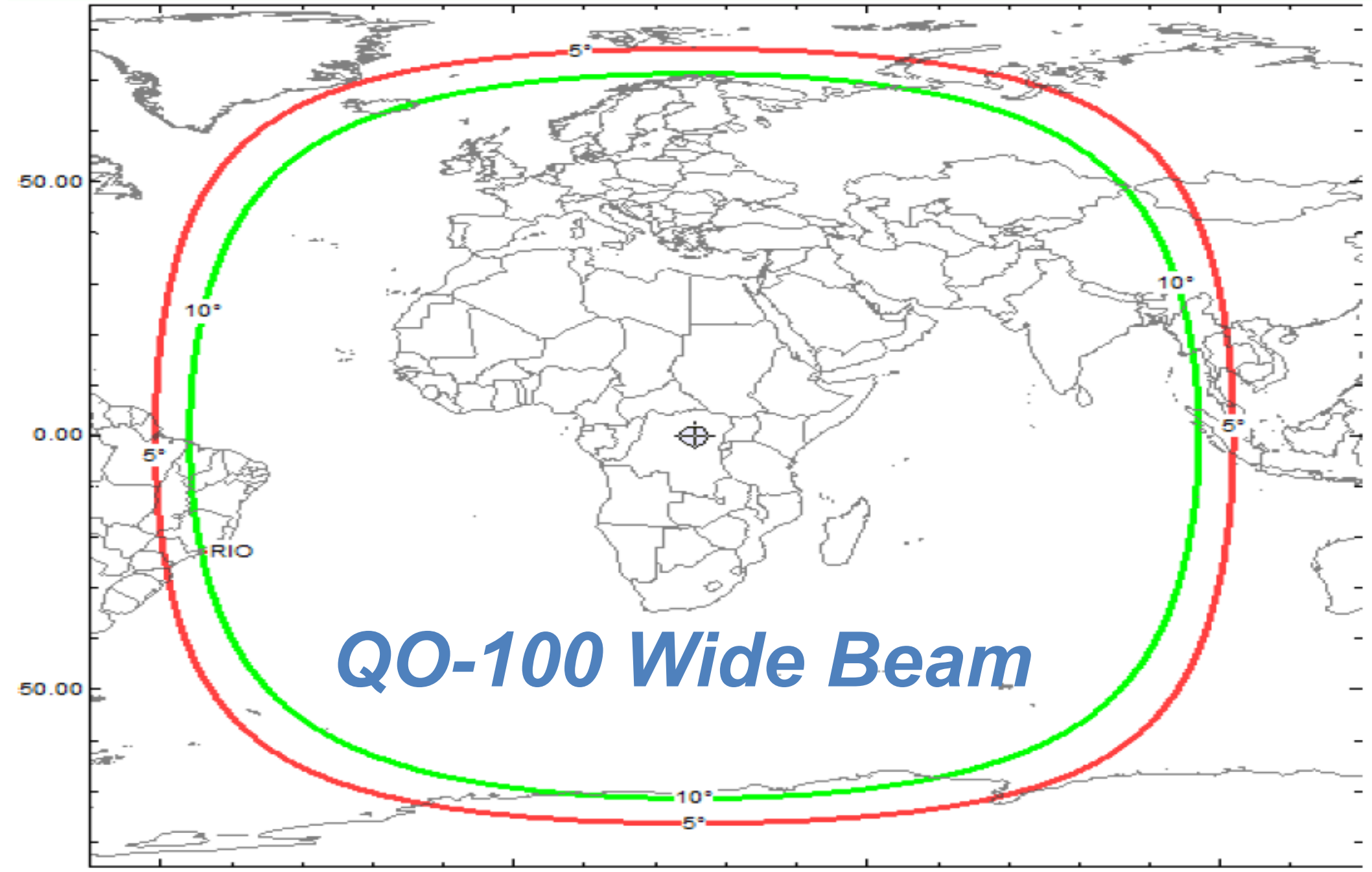

QO-100 Wide Beam

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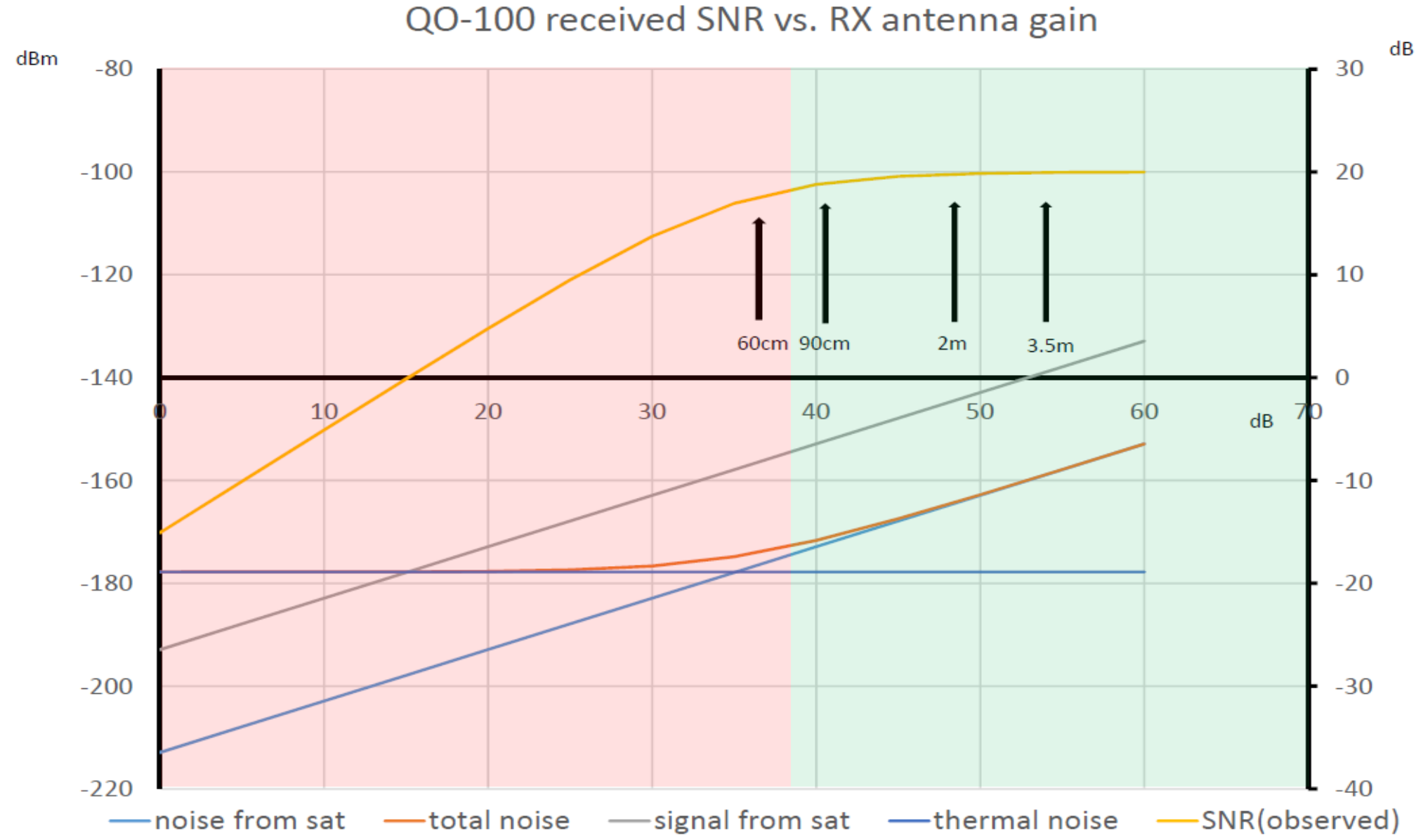
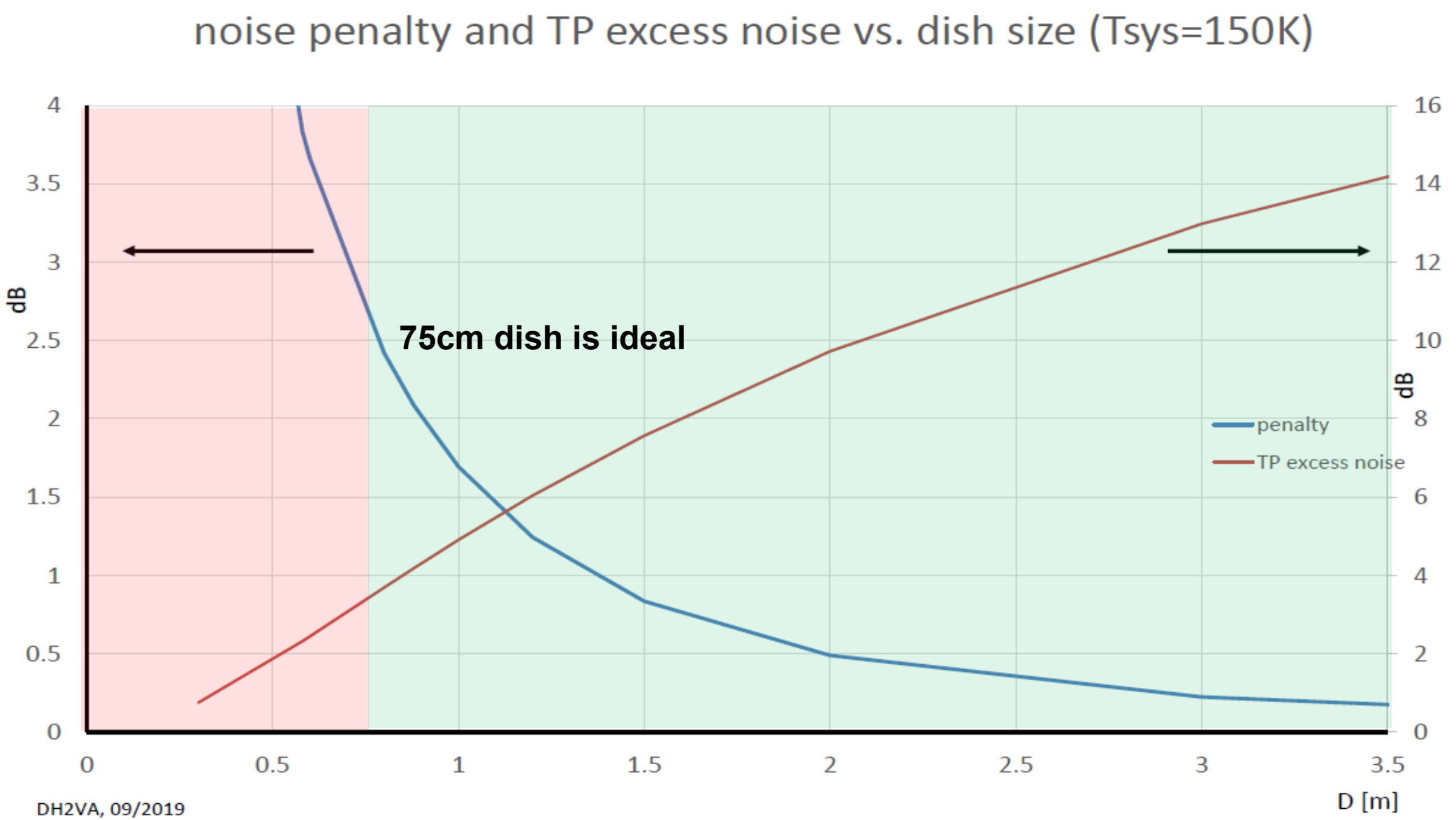
Is your dish big enough?



DH2VA, 09/2019

As good as necessary?



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

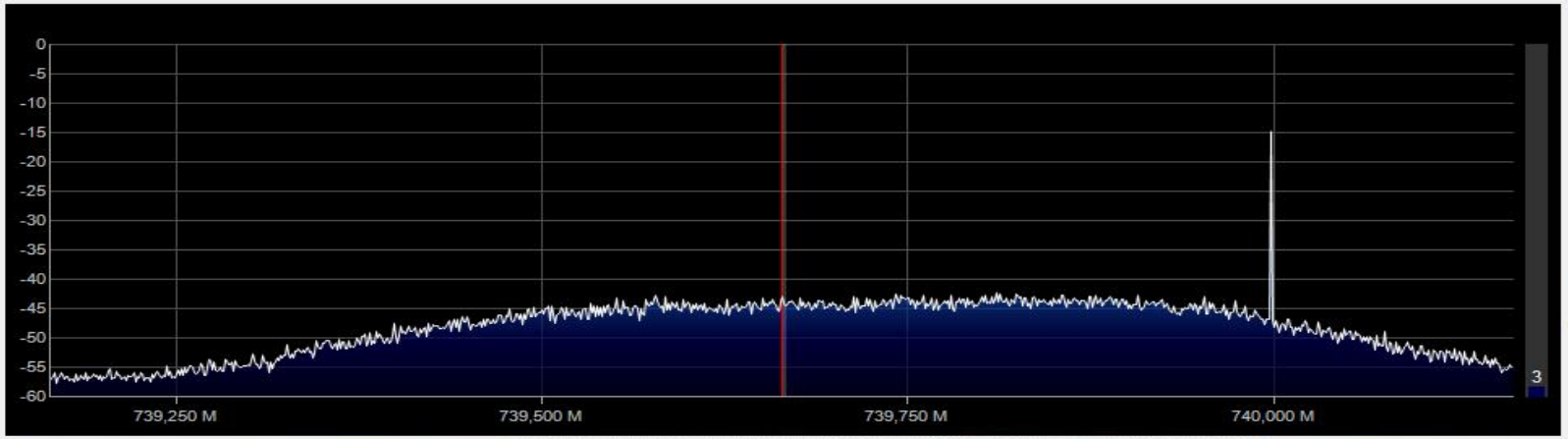
Resolution 131072

Spectrum Style Static Gradient

Time Markers Gradient ...

Mark Peaks

Smoothing

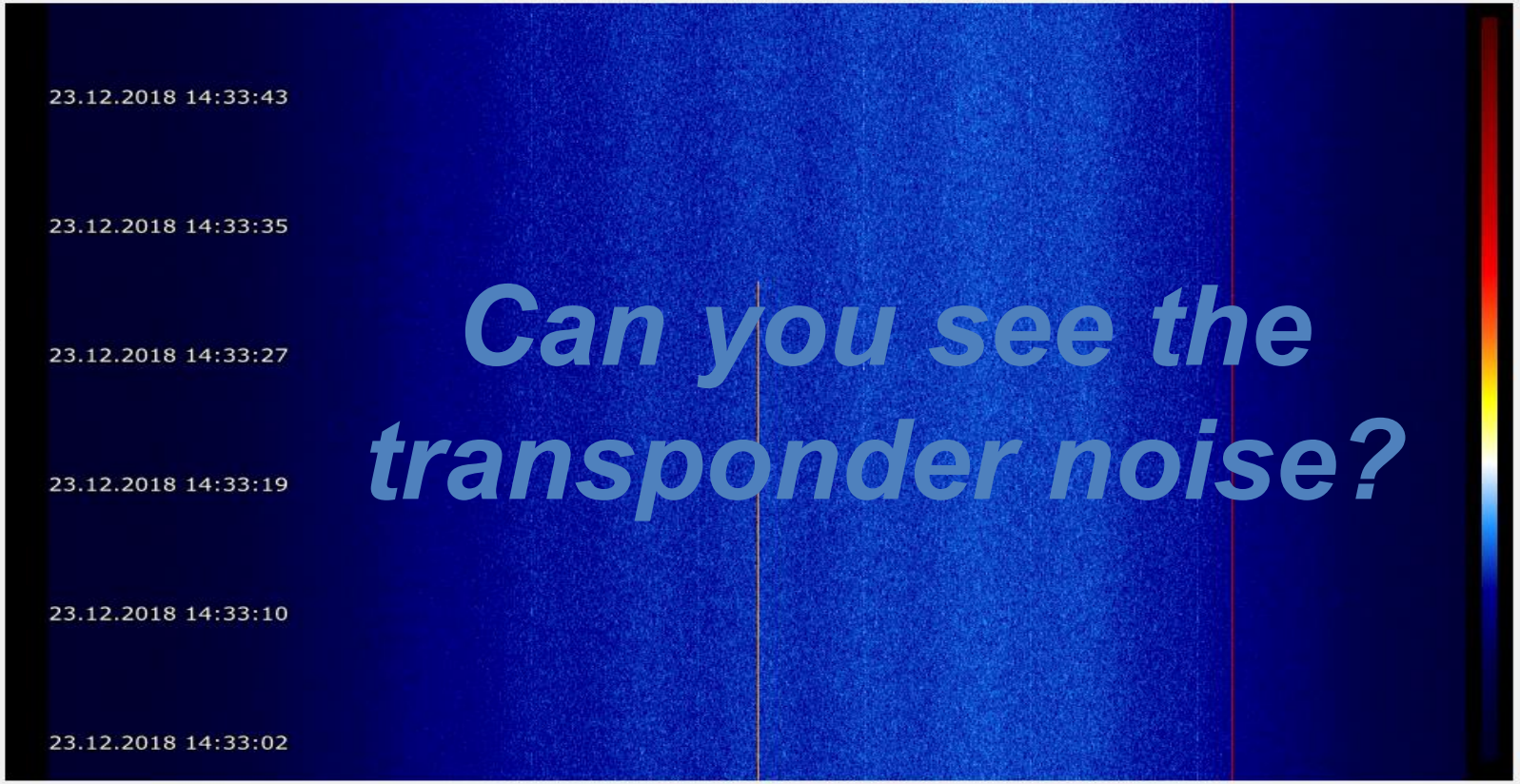


Zoom

Contrast

Range

Offset



Bochum

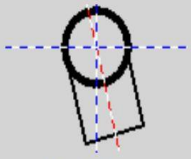
Your location:

Latitude:
51.48° N (51° 28' 47")

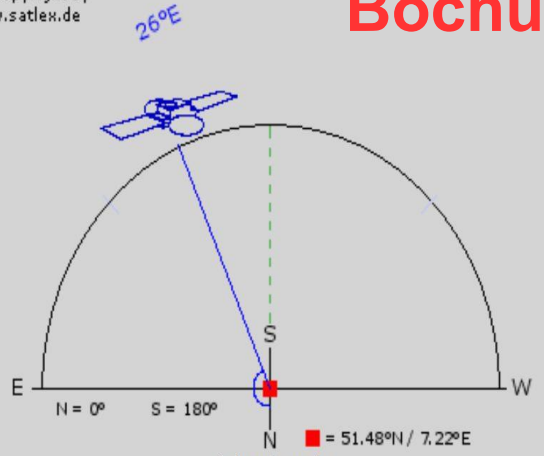
Longitude:
7.22° E (7° 13' 11")

City:
Bochum

Country:
Germany



LNB tilt (Skew)



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)*

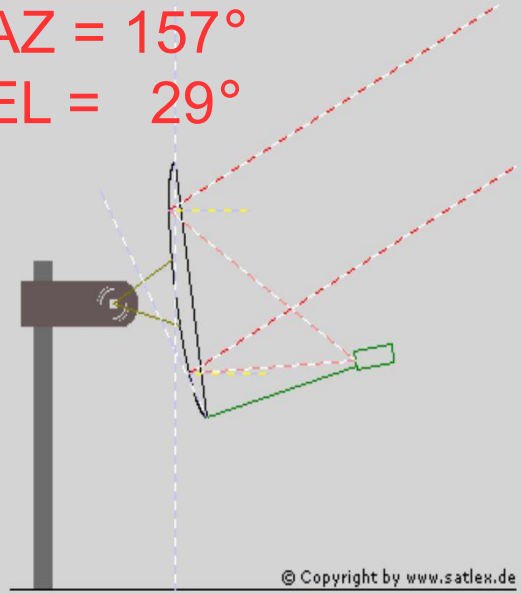
Declination angle:
-7.34°

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°



Elevation angle

Doha

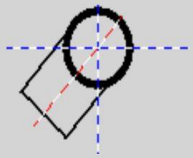
Your location:

Latitude:
25.25° N (25° 15' 0")

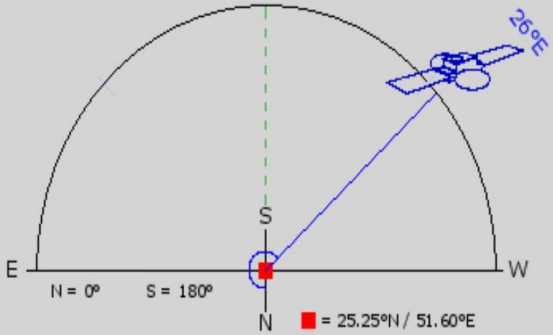
Longitude:
51.60° E (51° 36' 0")

City:
Doha

Country:
Qatar



LNB tilt (Skew)



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)*

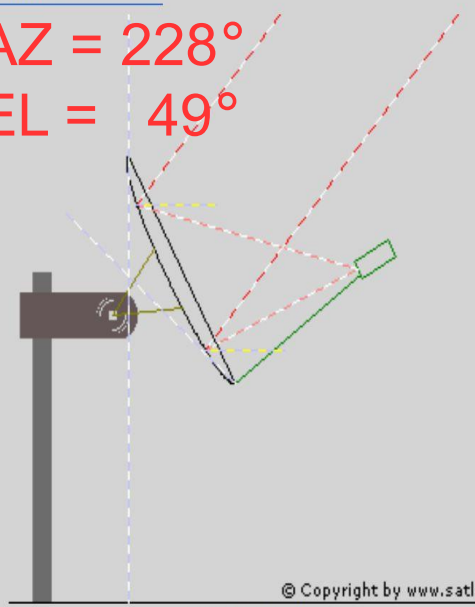
Declination angle:
-4.18°

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°



Elevation angle

Rio de Janeiro

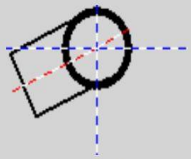
Your location:

Latitude:
-22.90° N (22° 53' 59")

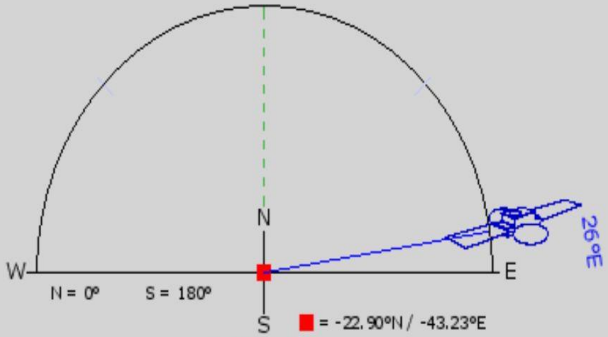
Longitude:
-43.23° E (43° 13' 47")

City:
Rio De Janeiro

Country:
Brazil



LNB tilt (Skew)



Azimuth angle

Following values have been calculated for your location:

Azimuth angle:
81.60° *(True North)*

AZ = 82°

Elevation angle:
10.61°

EL = 11°

LNB tilt (Skew):
65.69°

Offset angle:
20.36°

Distance to satellite:
40531.41 Km

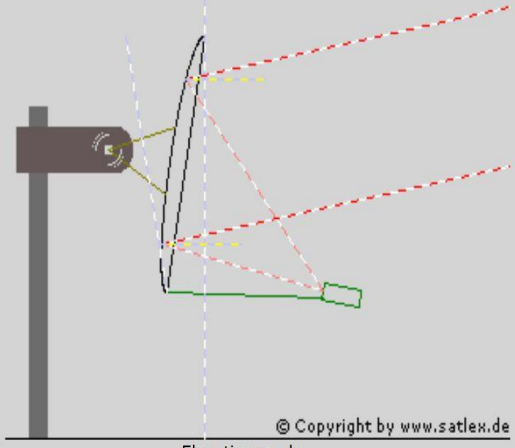
Signal delay:
270.21 ms *(Uplink + Downlink)*

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)



Elevation angle

Penang

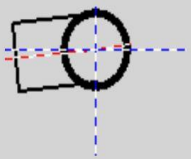
Your location:

Latitude:
5.50° N (5° 30' 0")

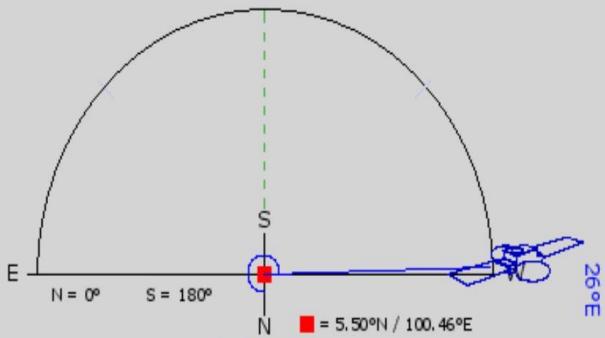
Longitude:
100.46° E (100° 27' 35")

City:
Pinang

Country:
Malaysia



LNB tilt (Skew)



Azimuth angle

Following values have been calculated for your location:

Azimuth angle:
268.47° *(True North)*

AZ = 268°

Elevation angle:
6.95°

EL = 7°

LNB tilt (Skew):
84.29°

Offset angle:
20.36°

Distance to satellite:
40927.52 Km

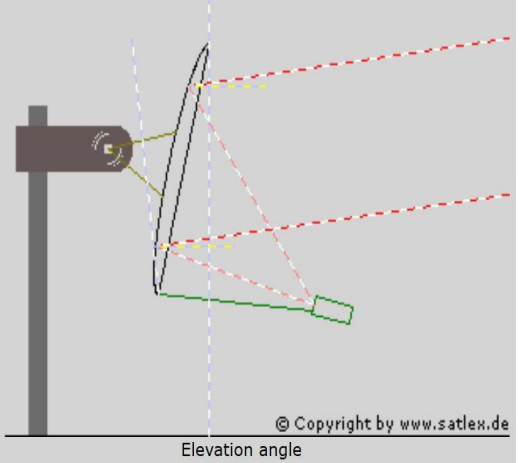
Signal delay:
272.85 ms *(Uplink + Downlink)*

Declination angle:
-0.85°

Polarmount hour angle:
262.93°

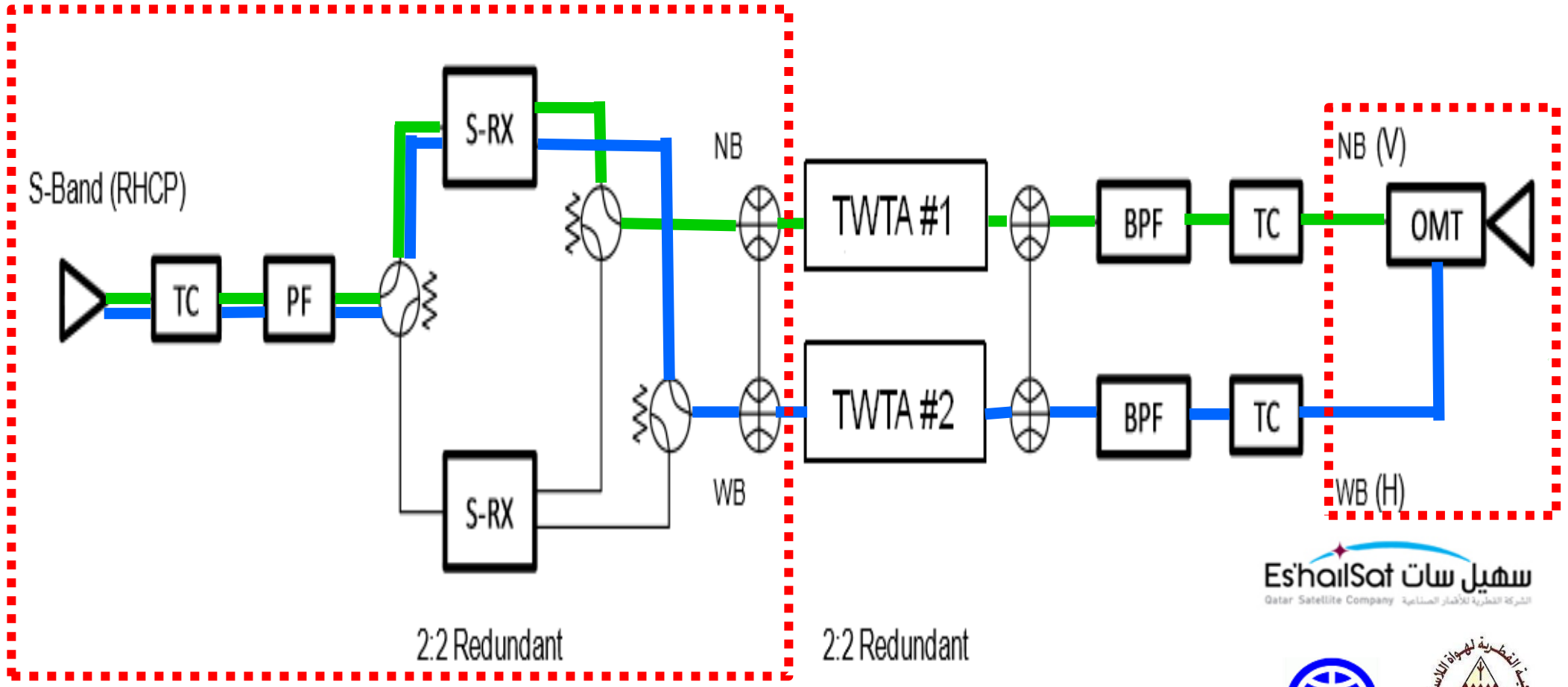
Angle setting on motor:
82.93° West

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



Elevation angle

AMSAT Payload Block Diagram

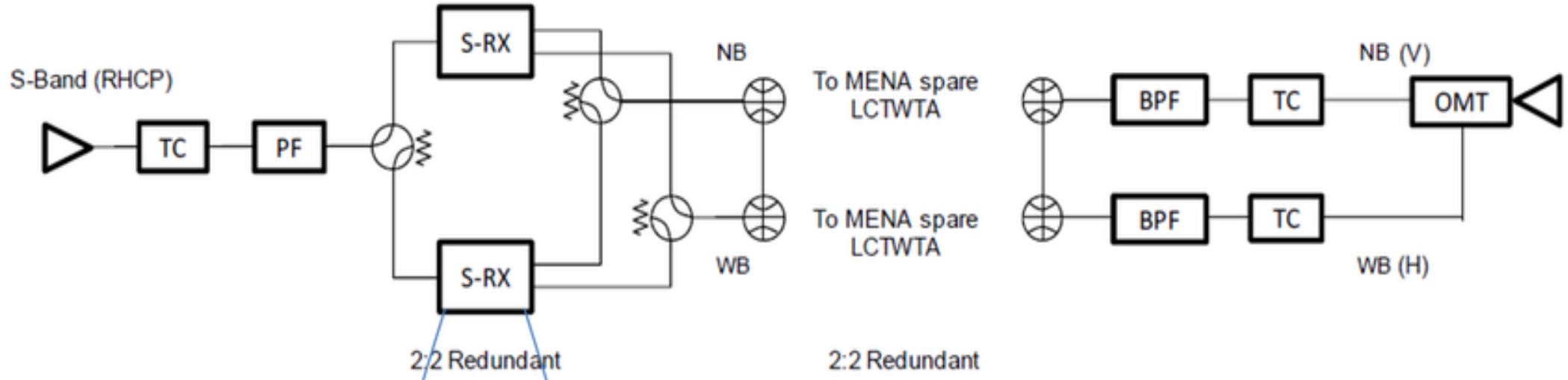


Custom design for AMSAT

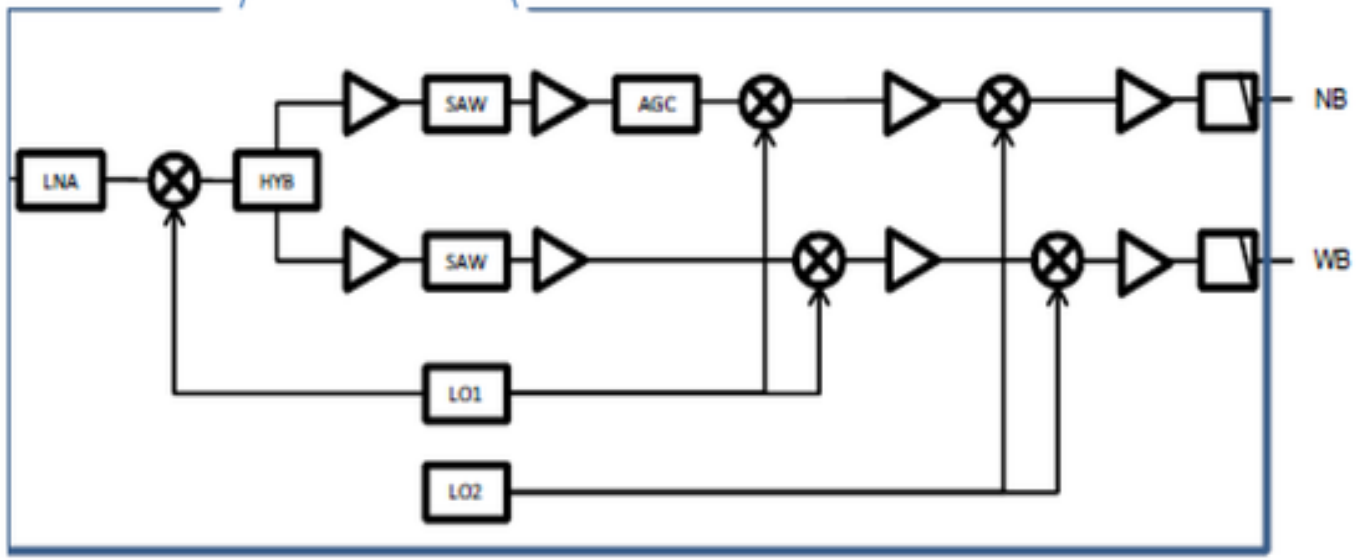
EshailSat سهيل سات
Qatar Satellite Company الشركة القطرية للأقمار الصناعية

AMSAT-DL

QATAR AMATEUR RADIO SOCIETY Q.A.R.S. الجمعية القطرية للهواة اللاسلكي



AMSAT Payload Block Diagram

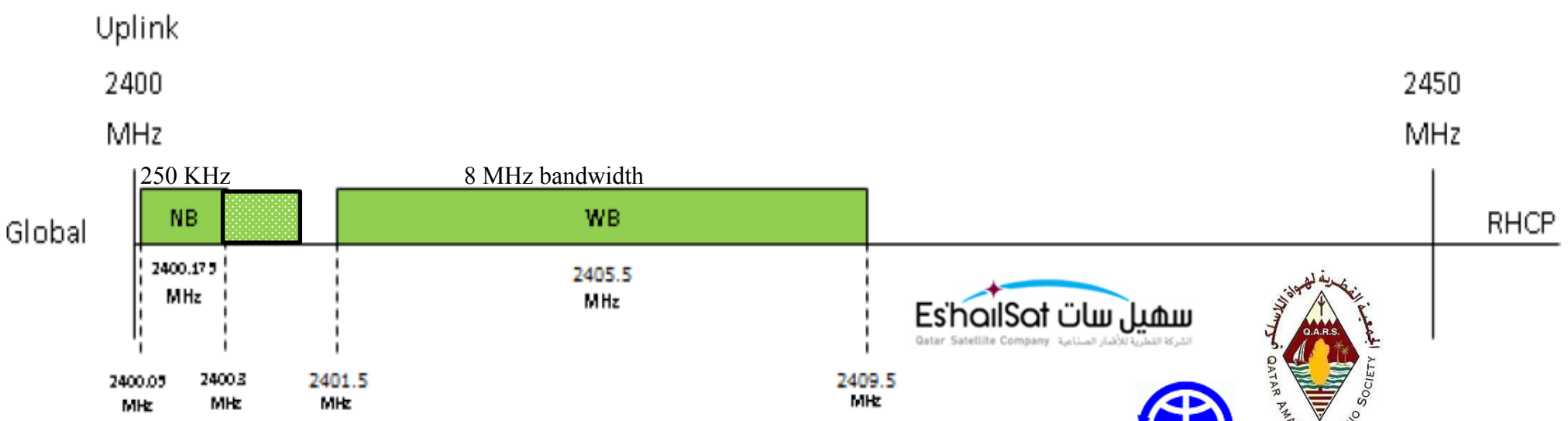


S-band Receiver/X-band Upconverter Assembly

EsʻhailSat سهيل سات
Qatar Satellite Company الشركة القطرية للأقمار الصناعية

AMSAT-DL

QATAR AMATEUR RADIO SOCIETY
Q.A.R.S.
الجمعية القطرية لهواة الإرسال



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
  - → everything with less than 2.7 kHz Bandwidth!
  - → no FM (DSTAR, etc.)

- 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)

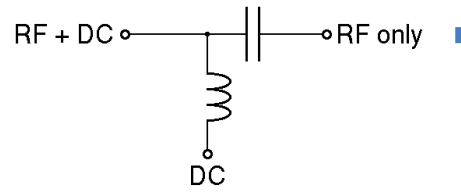
2-5W

Easy Sat !
Ultra Cheap

20€

12€

There are two different kinds of LNB's:
- with DRO → bad
- with PLL → good



Bias-T (DC Power combiner)
NB → (V)ertical: 11…14 V
WB → (H)orizontal: 16…20 V

35€

Display Spectrum and listen with SDR# or similiar…

Dongles for NB Downlink:
- RTL-SDR or Funcube dongle
- free SDR software available

SDR Console with Beacon stabilisation

Airspy :: SDR Console v3.0.10

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

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

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

10489.780 10489.785 10489.790 10489.795 10489.800 10489.805 10489.810 10489.815 10489.820

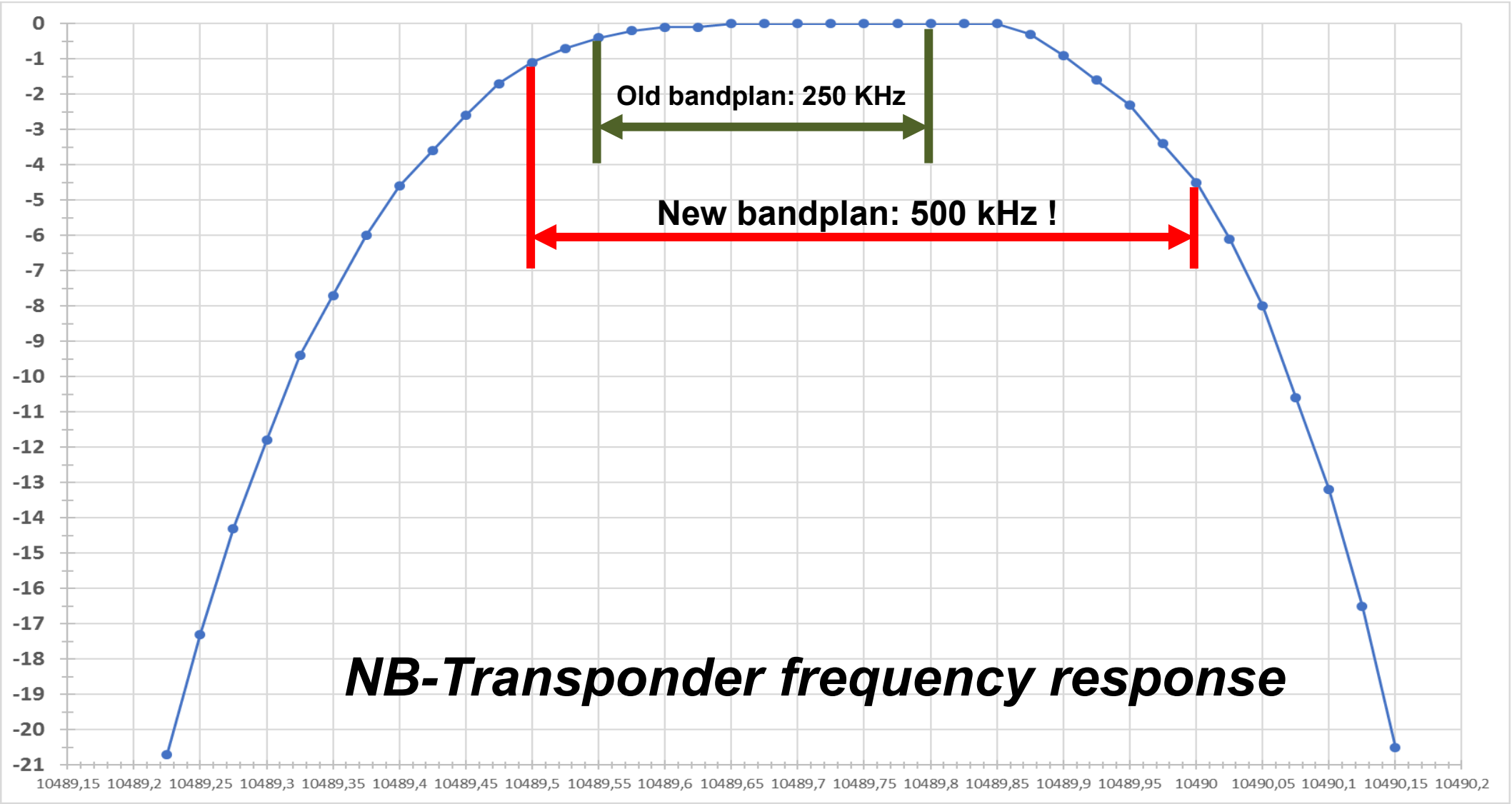
Δ +18,196Hz

Beacon: 10.489.818.191

Airspy, BW = 625 kHz

CPU: 5.5% Audio: 53ms

Going to the "Edge



NB-Transponder frequency response

AMSAT QO-100 / P4A
NB Transponder Bandplan

AMSAT-DL
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Satellites for Communication, Science and Education

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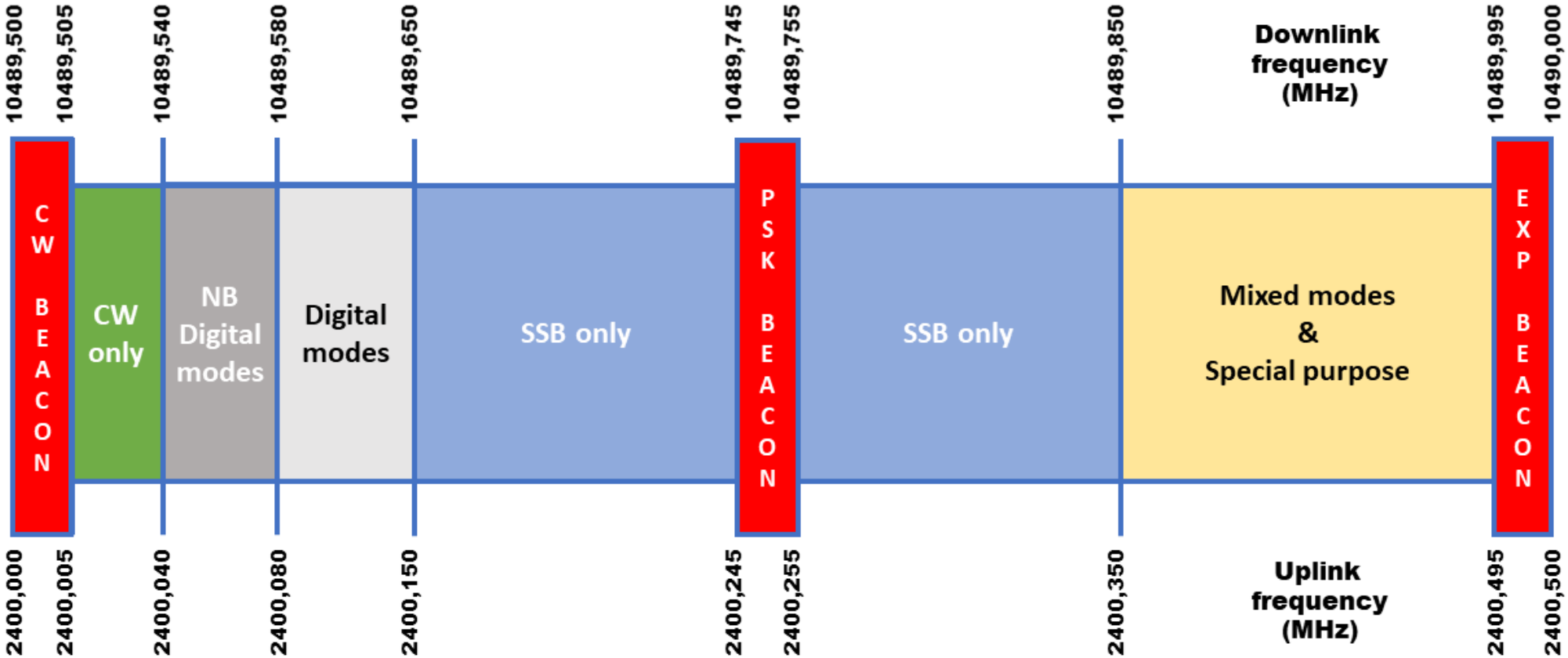
Qatar Satellite Company الشركة القطرية للأقمار الصناعية

QARS QATAR AMATEUR RADIO SOCIETY



AMSAT QO-100 / P4A
NB Transponder Bandplan

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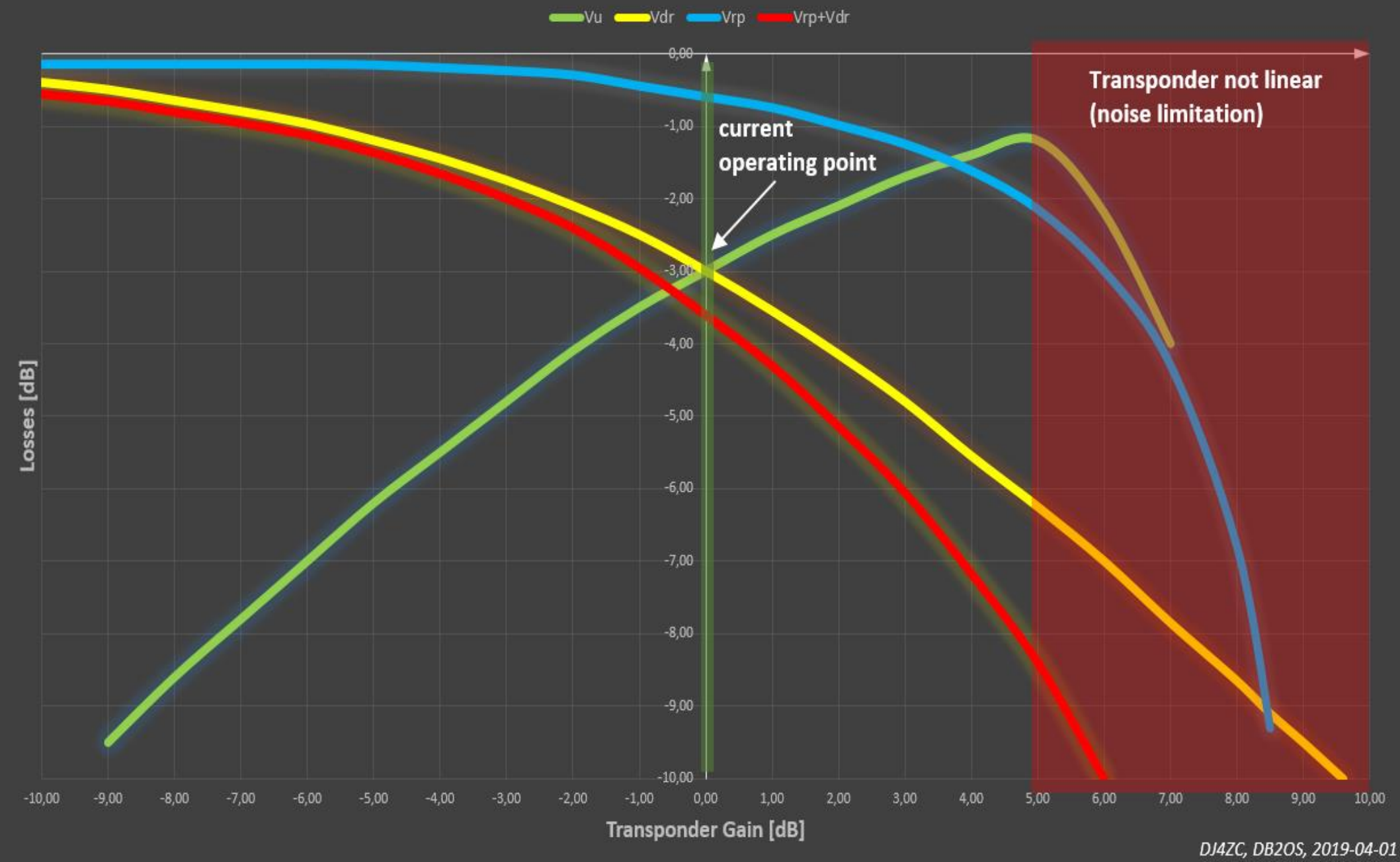
Uplink		Downlink			
Start [MHz]	End [MHz]	Start [MHz]	End [MHz]	Available [MHz]	Comment
		10489,500	10489,505	0,005	Lower Beacon 10489,500 MHz, CW F1A, + guard band
2400,005	2400,040	10489,505	10489,540	0,035	CW only
2400,040	2400,080	10489,540	10489,580	0,040	digimodes (500 Hz max. BW)
2400,080	2400,150	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/s BPSK + guard band
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
		10489,995	10490,000	0,005	Experimental Beacon 10490,000 MHz, CW and other modulations + guard Band

AMSAT-DL

Satellites for Communication and Science
Satelliten für Kommunikation und Wissenschaft

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.

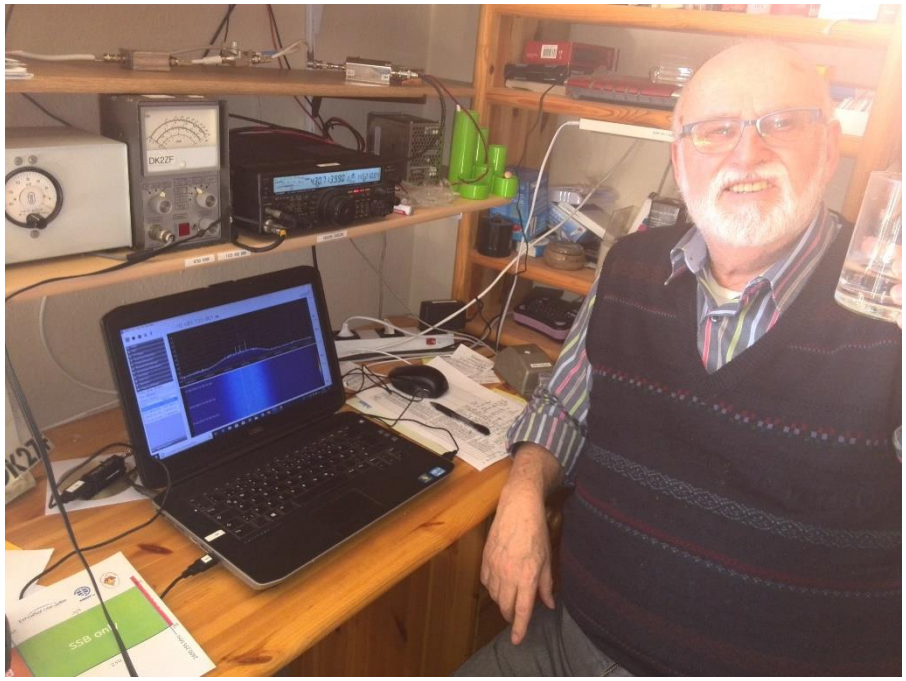
Die Downlinkverluste 1.) und 2.) zusammen ergeben die rote **Kurve Vdr+Vrp**.

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.“*

"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!**
- **Respect the Guard-band around the CW/PSK beacons**

- 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!)**

- 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..

QO-100 SDR-mottagare på nätet

- Ett bra sätt att bekanta sig med trafiken på QO-100 innan man börjar bygga/köpa egen utrustning

- BATC kör flera SDR som alla är fritt tillgängliga:
  - ”Narrowband segment” SDR för stationär dator / laptop
  - https://eshail.batc.org.uk/nb/
  - ”Narrowband segment” SDR för smartphone / läsplatta
  - https://eshail.batc.org.uk/nb/m.html
  - ”Wideband spectrum monitor” för stationär dator
  - https://eshail.batc.org.uk/wb//

Iakttagelser

- Jag har lyssnat ganska flitigt med BATC-SDR (Goonhilly-mottagaren) och noterat några genomgående trender -
  - Naturligtvis helt QRM-fritt (utom när det blir pileup...)
  - Trafiken är till > 90% SSB, många av dessa QSO sker på tyska mellan tysktalande land (DL, OE, HB9...)
  - Engelskan kommer fram när t.ex. PY, ZS, VU, ST, 5O, OK, OM, OZ eller G-stationer dyker upp
  - Några få stationer kör både CW och SSB. Även SSTV, FT8
  - CW-trafiken ofta i låg takt och lite stel (få riktiga ragchews)
  - 599 / 59 - rapporter delas ut ganska slentrianmässigt (är signalrapporter ens relevanta över en transponder ?)

Vad behövs för att komma igång på QO100?

- **30 dBW EIRP (2 - 3 W och en 80 cm parabol) => S9**
- **Här i SM får vi ju bara köra 100 mW på 2400 MHz ?**
- Men det går att söka tillstånd för lite mer, och PTS har en rutin för hur man hanterar såna ansökningar:
  - Tillstånd delas ut för frekvensintervallet 2400,005 - 2400,500
  - Man skriver till amatorradio@pts.se och säger att man vill söka tillstånd för högre effekt för trafik över QO-100
  - Då får man som svar ett formulär att fylla i, där man ska uppge bl.a. stationsplats, avstånd till närmaste hus i pekriktningen, antennstorlek och sändareffekt
  - PTS kollar sedan om den utstrålade effekten överskrider de gränser som man satt efter konsultationer med SSA och RSGB; om OK så får man tillstånd 6 månader i taget

Så följande grejor kan räcka:

- Uppblandare från något lägre band (144, 432) till 2400 MHz
  - flera alternativ på marknaden till överkomliga priser
  - kompletteras eventuellt med 2 - 4 W PA (wifi-booster)
- Frekvensstabil (TCXO-styrd) 10 GHz LNB + SDR på 739 MHz
  - alternativt frekvensstabilisering mha SDR Console
- 60 - 90 cm parabolantenn
  - eller upp till 150 cm om man måste köra QRP (100mW)
- Matarantenn för 2400 MHz, LHC
  - t.ex. 4-5 varvs helix eller POTY
  - alternativt lång RHC helix, 10-15 varv, riktad mot satelliten

Två populära sändarblandare

Prisklass 160 - 180 EUR

Transverter for 13 cm band

SG Labs, uteffekt 2 W, kan räcka barfota...

New DX-Patrol QO-100 Up converter MK3

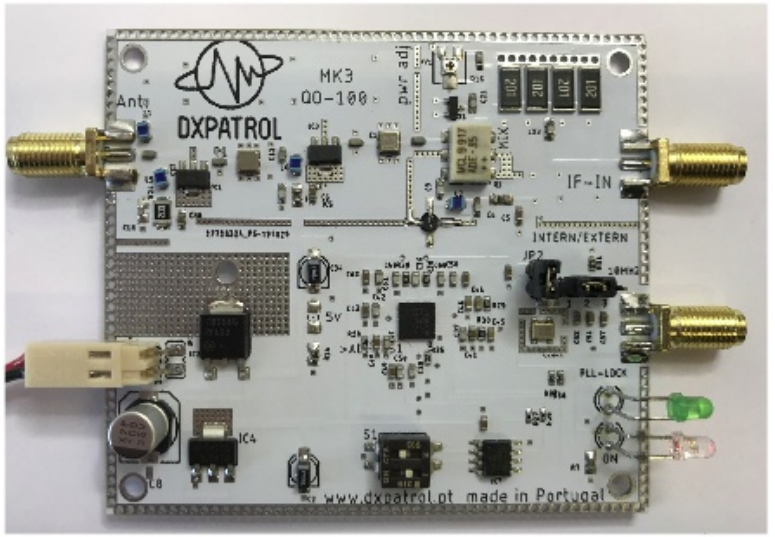
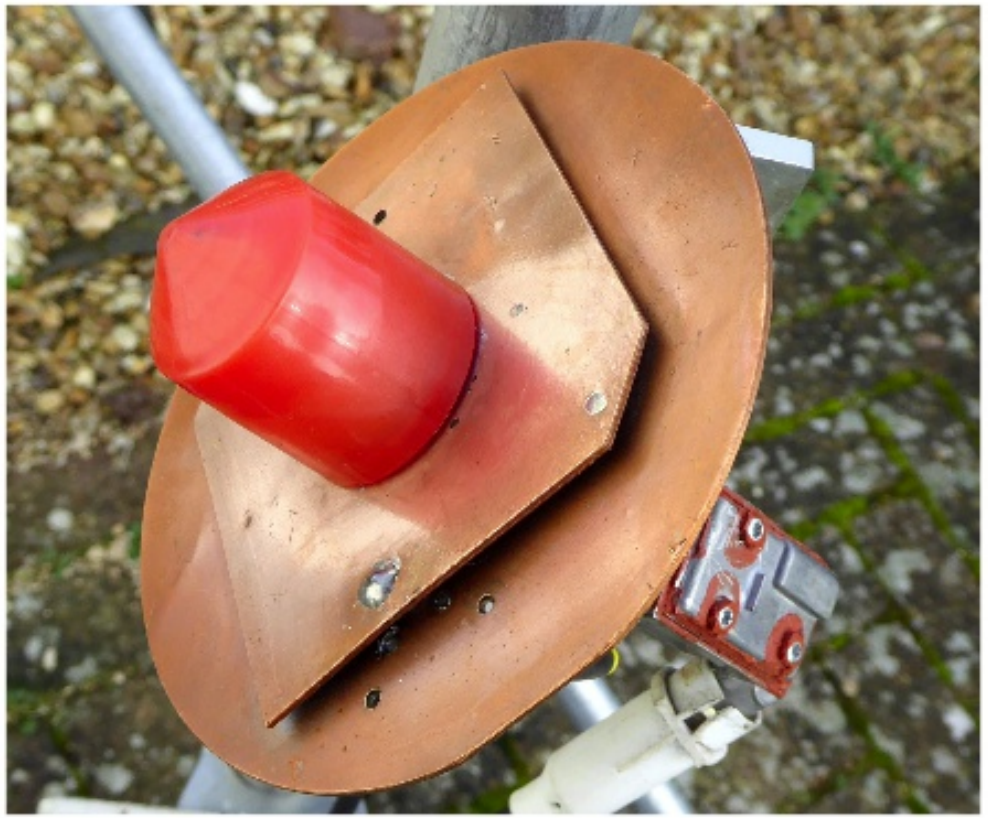


fig 1, Upconverter full assembled PCB

DX Patrol, uteffekt 100 mW, kräver PA om man har liten antenn

POTY (”Patch Of The Year”)



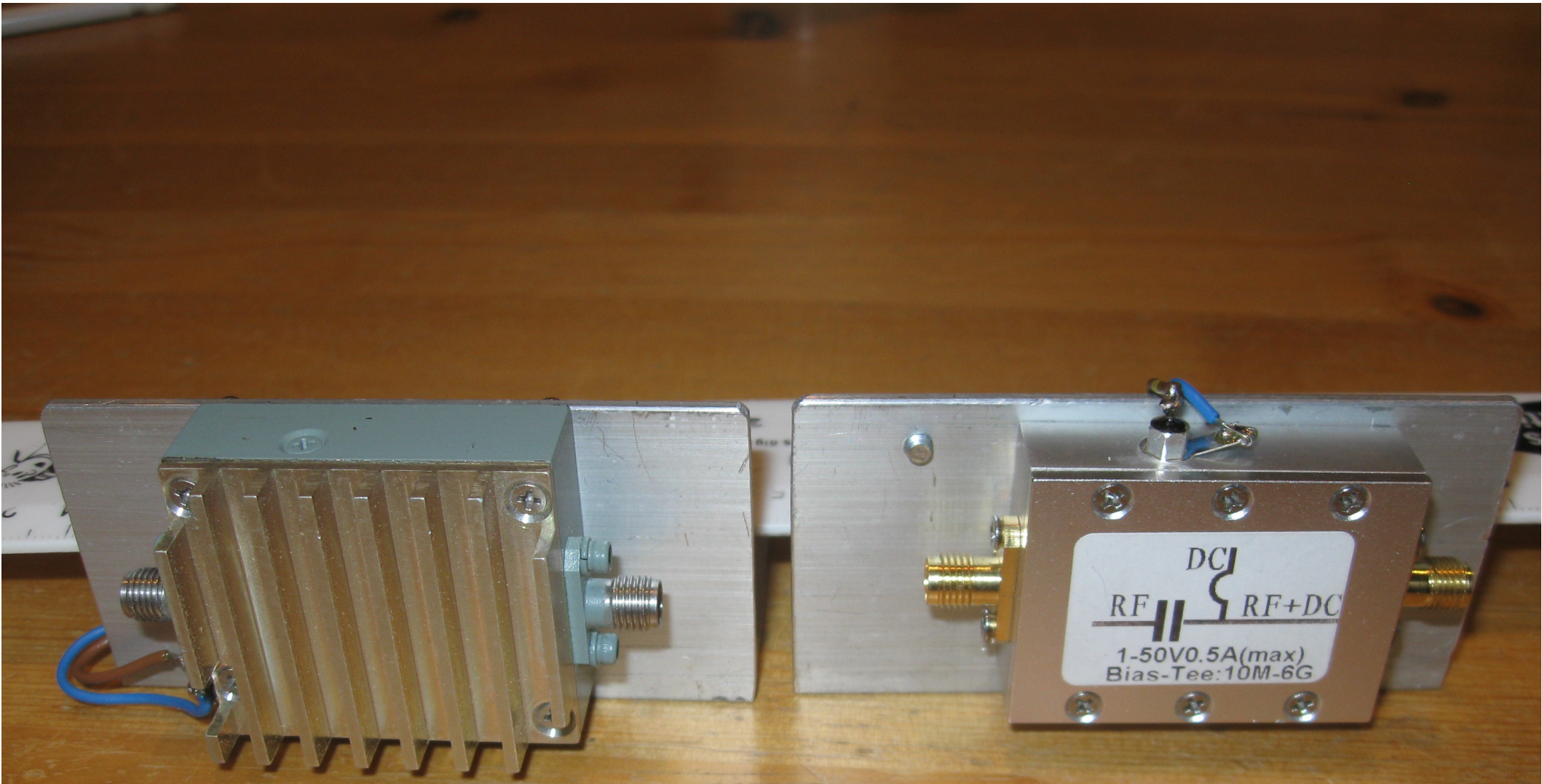
Listig konstruktion som gör det möjligt att använda samma offsetparabol både för sändning på 2,3 och mottagning på 10,4 GHz - LNB tittar ut genom ett hål i mitten av 2,4 G patch-antennen.

Kräver dock noggrannhet och precision vid tillverkningen och är tydligen inte trivial att stämma av utan tillgång till instrumentering.

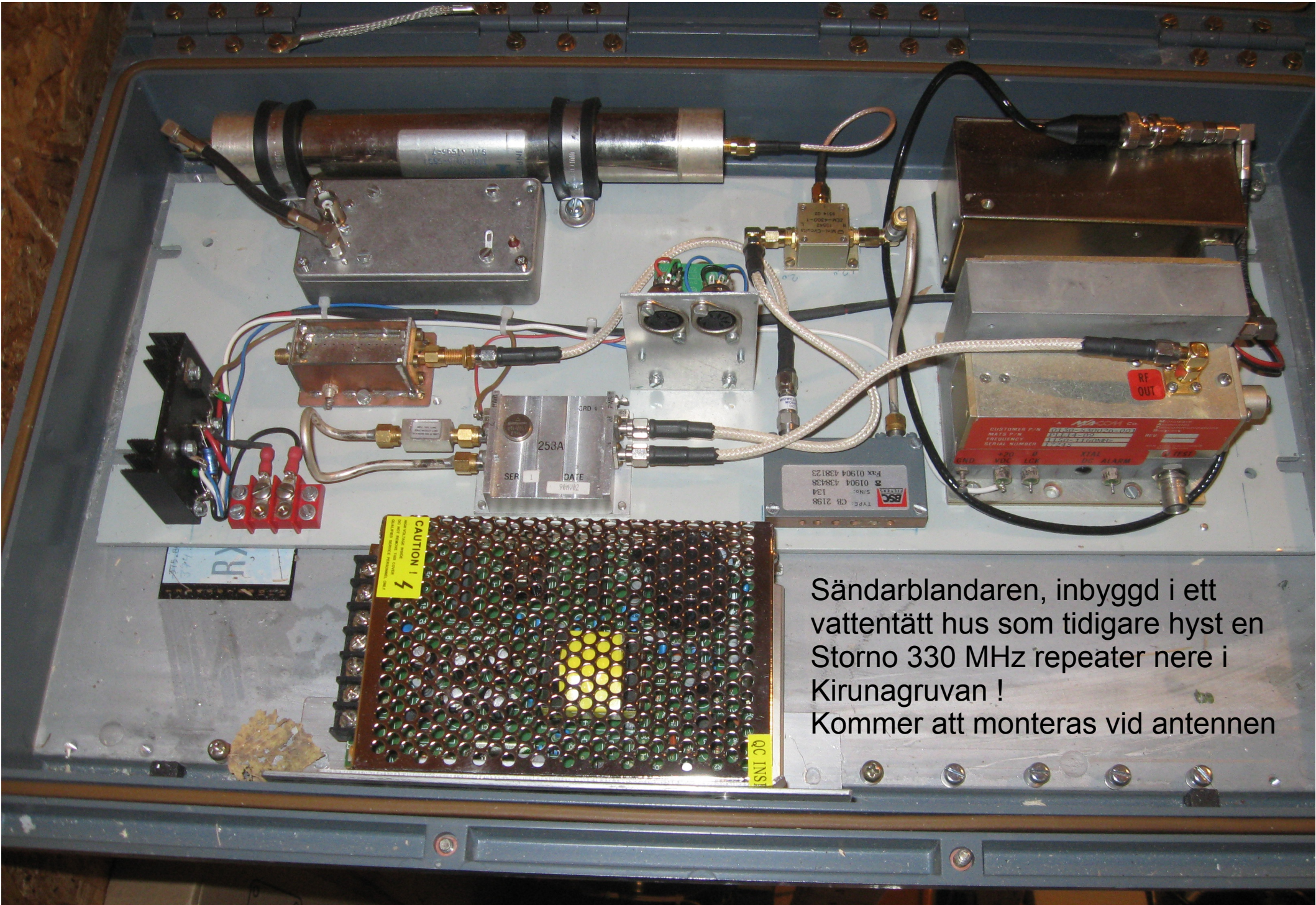
Finns dock ibland att köpa som byggsats och även färdig.
Prisklass 50 - 100 EUR

SM3BYA OSCAR-100 station

- Sändarkedja
  - FT817 på 145,5 MHz
  - Hembyggd 145 => 2400 upconverter med 1 mW (0 dBm) ut
  - 26 dB mellanförstärkare
  - Kinesisk ”8W” WIFI-booster, uppmätt till 3 W ut
  - 60 cm offsetdish med 4 varvs LHC helix som matare
- Mottagarkedja
  - 90 cm offsetdish med Bullseye TCXO-stabiliserat LNB
  - RTL-SDR på 739,5 MHz
  - GQRX, MacMini, OSX 10.11.6



Mellanförstärkare för TX och bias-tee för LNB



Sändarblandaren, inbyggd i ett vattentätt hus som tidigare hyst en Storno 330 MHz repeater nere i Kirunagruvan !
Kommer att monteras vid antennen

Antennerna på stadigt rör nedgjutet 90 cm i marken

Pekning i Bergsjö:

Az 169 grader
El 19,5 grader

Az grovriktad mha solen
El grovriktad mha skala på parabolfästet

Öppningsvinkel sändar-antenn c:a 12 grader

Sändarsidans helix, trimmad till -20 dB

Reference: QO100-LNB-BULLSEYE-978

Online only

Othernet Bullseye LNB TCXO ultra stable for Oscar 100 & KU band satellite

Aucun avis pour le moment

The Othernet Bullseye LNB is a down-converter for reception of the Oscar 100 amateur radio and those in the Ku band. The Bullseye is one of the most stable and precise LNB to date. It does not need to be modified to receive the narrow or wide QO-100 transponder.

Each Bullseye is calibrated at the factory at 1kHz with a spectrum analyzer locked by GPS.

In normal outdoor use (25°C), the **frequency offset is less than 10 kHz** thanks to its integrated 2ppm TCXO and a 25 Mhz reference.

A second output F (red) is available to benefit from the 25 Mhz reference signal output in order to control another device or to check the stability.

Supplied with: 1 Othernet Bullseye LNB TCXO.

28,00 € tax incl.

In stock

Order it before 10:00 on lundi and receive it between **Tuesday 27th October** and **Wednesday 28th October** with **Chronopost EXPRESS**

Quantity 1

Add to cart

MORE INFO

Reference: QO100-LNB-BULLSEYE-978

Supplied with: 1 Othernet Bullseye LNB TCXO.

28,00 € tax incl.

In stock

Order it before 10:00 on lundi and receive it between **Tuesday 27th October** and **Wednesday 28th October** with **Chronopost EXPRESS**

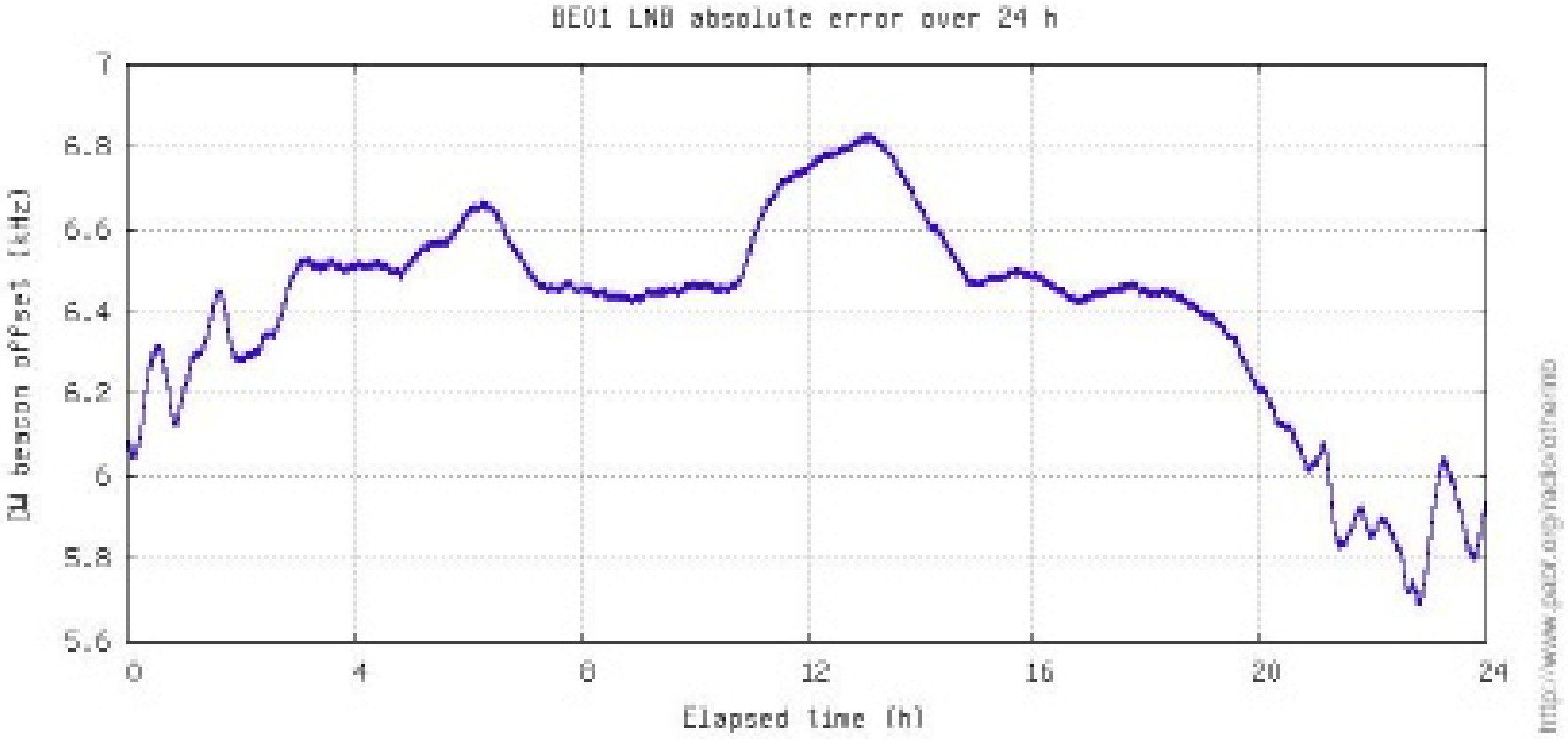
Quantity 1 Add to cart

MORE INFO

Specification Bullseye LNB PLL TCXO

Reference: Bullseye 10 kHz BE01
LNB type: PLL
PLL: 2 PPM TCXO 25Mhz
Output 1 (green): 739Mhz for QO-100 use on the primary female F connector (green)
Output 2 (red): 25 MHz on the secondary female F connector (red)
Input frequency: 10489 - 12750 MHz
LO frequency 9750/10600 MHz
LO frequency stability at 23°C: +/- 10 kHz / or +/- 30 kHz
LNB gain: 50 - 66 dB
Output frequency: 739 - 1950 MHz (low band) and 1100 - 2150 (high band)
Return loss: 8dB (739 - 1950 MHz) and 10dB (1100 - 2150 MHz)
Noise factor: 0.5dB
Vertical polarization voltage: 11.5 to 14V
Horizontal polarization voltage: 16 to 19V
CE standards
2 years warranty

Frekvensdrift över 24 timmar i typisk miljö totalt c:a 1.2 kHz



- Bör duga för SSB och CW om man inte är kinkig...

Ett bias-tee behövs för att spänningsmata LNB. Kör på 12V för V pol

View larger



RF Amplifier EDUP EP-AB003 2400 MHz (8W) for QO100

Aucun avis pour le moment

EDUP EP-AB003 amplifier for the amateur radio band 2400Mhz (13cm), this 2.4Ghz amp of 8W theoretical, is able to deliver an **effective power of 3-4W max.** with an input of 100mW maximum.

This equipment can be used with the following SDR hardware: LimeSDR mini, HackRF One, Adalm-Pluto.

It is compatible for use in 2.4Ghz transmission on the QO-100 amateur radio satellite.

Comes with: 1 EDUP EP-AB003 2.4Ghz RF Amplifier, 1 power charger 220V, 1 cable RP-SMA Male (reverse SMA) - SMA Male, 1 WIFI antenna 6dBi in RP-SMA.

Material only reserved for amateur radio use only and on amateur satellite band from 2400 to 2450Mhz.

58,00 € tax incl.

In stock

Order it before 10:00 on lundi and receive it between **Tuesday 27th October** and **Wednesday 28th October** with **Chronopost EXPRESS**

Quantity 1 Add to cart

Reference: QO100-EDUP-AB003-8W-797

MORE INFO

Specifications EDUP EP-AB003 2400Mhz amplifier

Material only reserved for amateur radio use only and on amateur satellite band from 2400 to 2450Mhz.

58,00 € tax incl.

In stock

Order it before 10:00 on lundi and receive it between **Tuesday 27th October** and **Wednesday 28th October** with **Chronopost EXPRESS**

Reference: QO100-EDUP-AB003-8W-797

Quantity 1 Add to cart

MORE INFO

Specifications EDUP EP-AB003 2400Mhz amplifier

Frequency range: 2400 - 2500 MHz
Max. Input power : 100mW
Max. Output power : Theoretical 8W - 4W maximum according to use
Impedance: 50 Ohms
Connector: SMA Female (TX side) and RP-SMA (RX side antenna)
Operating mode: bidirectional, half duplex, automatic switching via carrier detection
Frequency response: ± 1dB
Input power: 5 to 20 dBm
Optimum input power recommended: 15-16dBm
Gain transmission: 17 dBm nominal
Gain reception: 11dBm
Operating temperature: -40 to 70 degrees
Operating humidity: Relative humidity up to 95%
Aluminum case
Weight: 650g
Size: 8x8x2.5cm
2 years warranty*

Den automatiska RX-TX-switchningen kan behöva sättas ur funktion om man ska köra SSB. Info på nätet.

Nu kan vi gå in på BATC Narrowband SDR:

- https://eshail.batc.org.uk/nb/

Ur SSA inlaga till PTS 2019-06-09
PTS valde i stället att gå fram med max 30 dBW ERP

2400 MHz Till skillnad från övervägande delen av europeiska länder har svenska radioamatörer tillgång med mycket begränsad effekt (100mW) i bandet 2400 - 2450 MHz. Nyligen har den första geostationära amatörradiosatelliten placerats ut och SSA föreslår att även svenska radioamatörer skall kunna kommunicera med denna satellit inom dagens allokering. Satelliten beräknas ha en livslängd på 15 år.

SSA föreslår två varianter av förändringen, dels för smalbandig och dels för bredbandig kommunikation. SSA har studerat de tekniska förutsättningarna som gäller vid kommunikation med en geostationär satellit och de risker med störningar som skulle kunna uppkomma, vilket presenteras i bifogade presentation. Vi är givetvis måna om att en förändring enligt förslagen inte skall försämra annan användning i närområdet, vilket även skulle ställa radioamatören i dålig dager. SSA:s slutsats är dock att med de förslag som presenteras är risken för störningar ytterst minimal och att förändringen är möjlig att genomföra.

För det smalbandiga segmentet: En generell lösning där svenska radioamatörer får sända med 1W mot den geostationära satelliten i bandet 2400-2401 MHz.