Hvězdárna Ďáblice

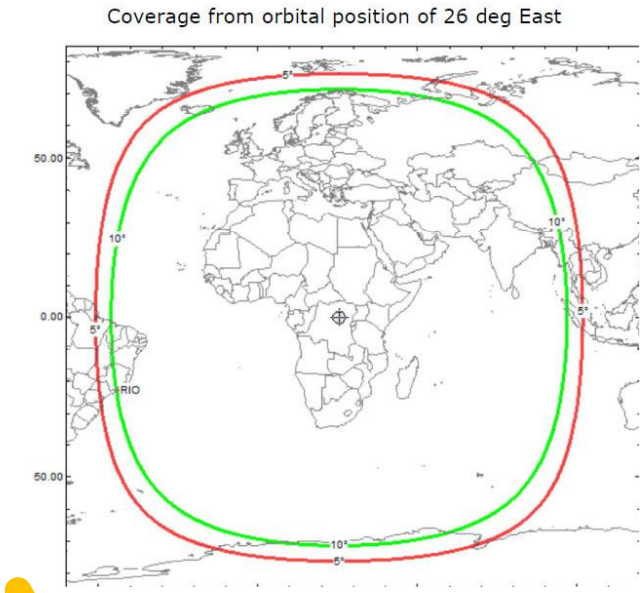
Vysíláme přes družici QO-100

Přehled základních provozních sestav pro komunikaci a provoz

Agenda

- Základní informace o QO-100
- Základní typy sestav pozemních stanic
- Výběr jednotlivých komponent, čemu se vyhnout
- Dostupné SW vybavení pro SDR
- Používané provozy na QO-100
- Q & A

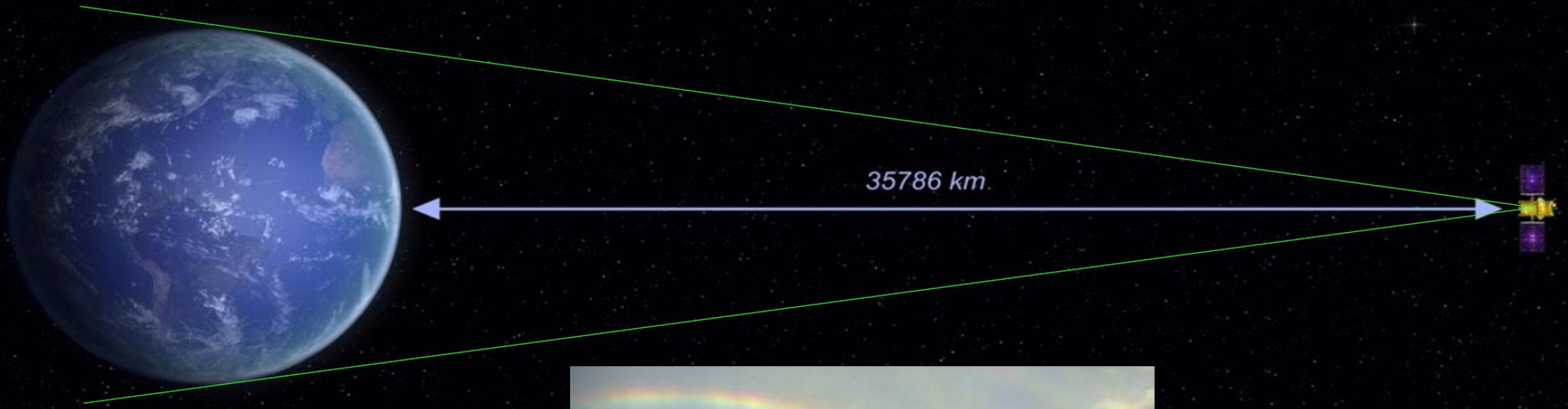
Základní informace QO-100

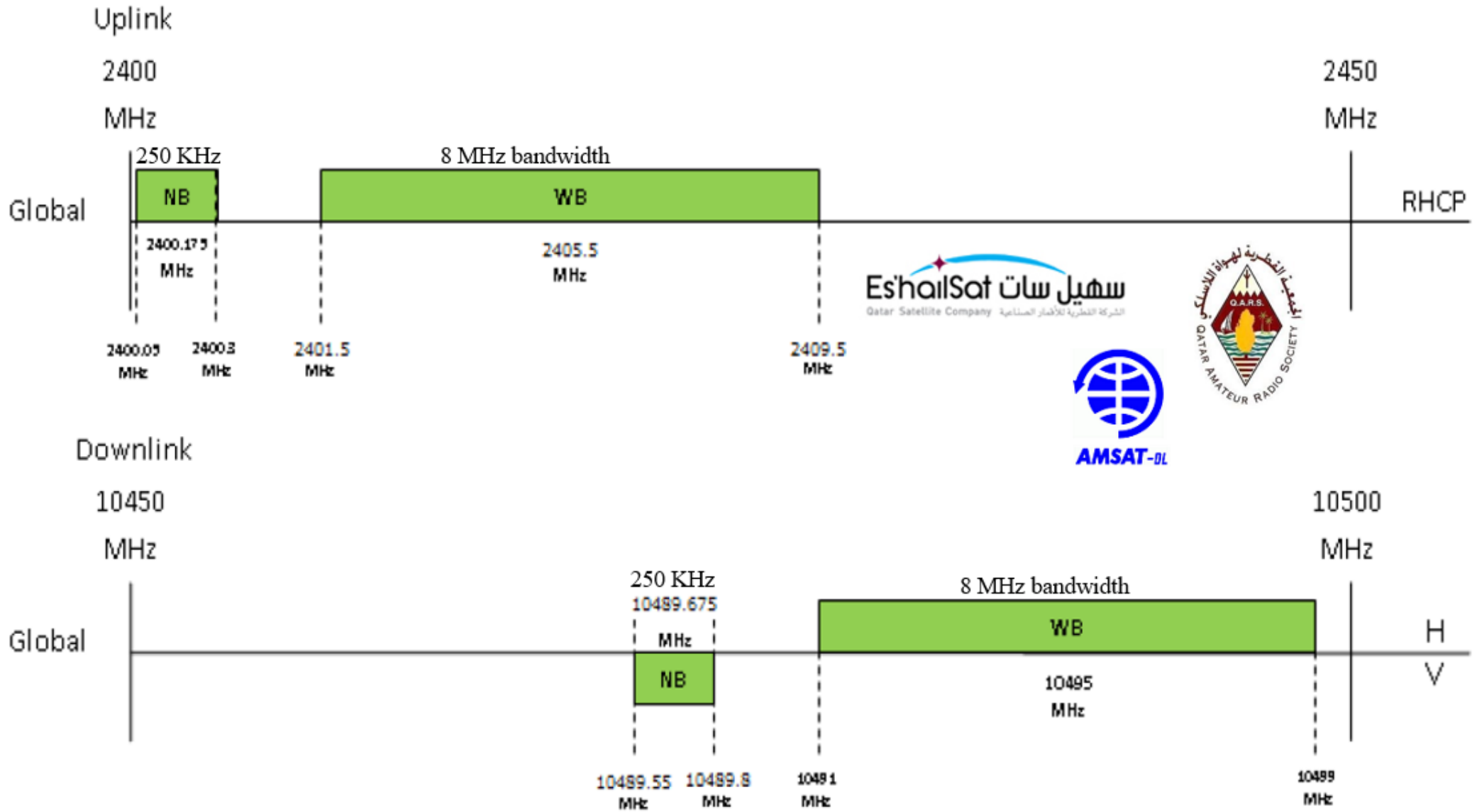


- 15. listopadu 2018 v 20:46 UTC vypuštěn z Kennedyho střediska (rampa LC-39A)
- Od 12.2.2019 je plně aktivní a dostupný uživatelům

- **Pozice 25.5° E**
  - Elevace: 31.6°
  - Azimut: 165.6°
  - LNB Skew: -9.2° (úhel stočení polarizace)

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





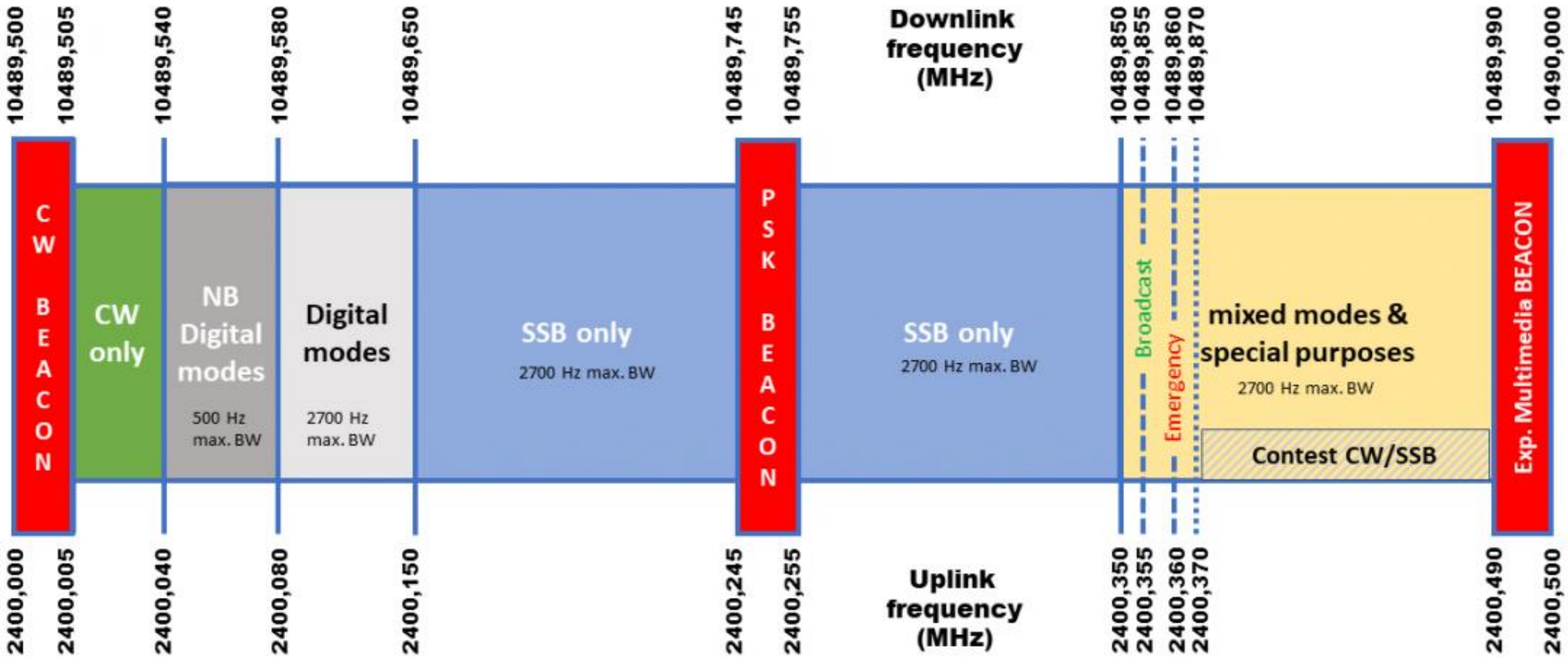
Xpdr	U/L FREQUENCY (MHz)				D/L FREQUENCY (MHz)				LO	BW
No	Pol	Begin	Center	End	Pol	Begin	Center	End	(MHz)	(MHz)
NB	RHCP	2400.05	2400.175	2400.3	V	10489.55	10489.675	10489.8	8089.5	0.25
WB	RHCP	2401.5	2405.5	2409.5	H	10491	10495	10499	8089.5	8

AMSAT QO-100 / P4A
NB Transponder Bandplan

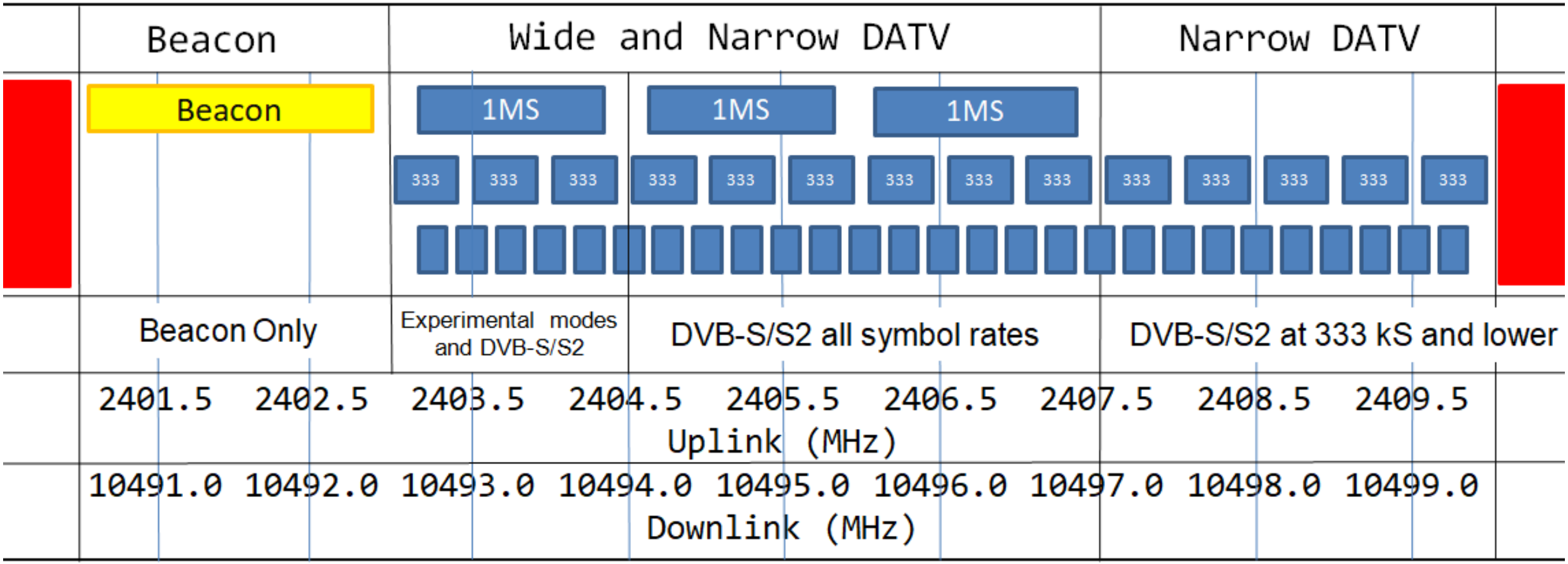
AMSAT-DL
Satelliten für Kommunikation, Wissenschaft und Bildung
Satellites for Communication, Science and Education

Es'hailSat سهيل سات
Qatar Satellite Company

QATAR AMATEUR RADIO SOCIETY



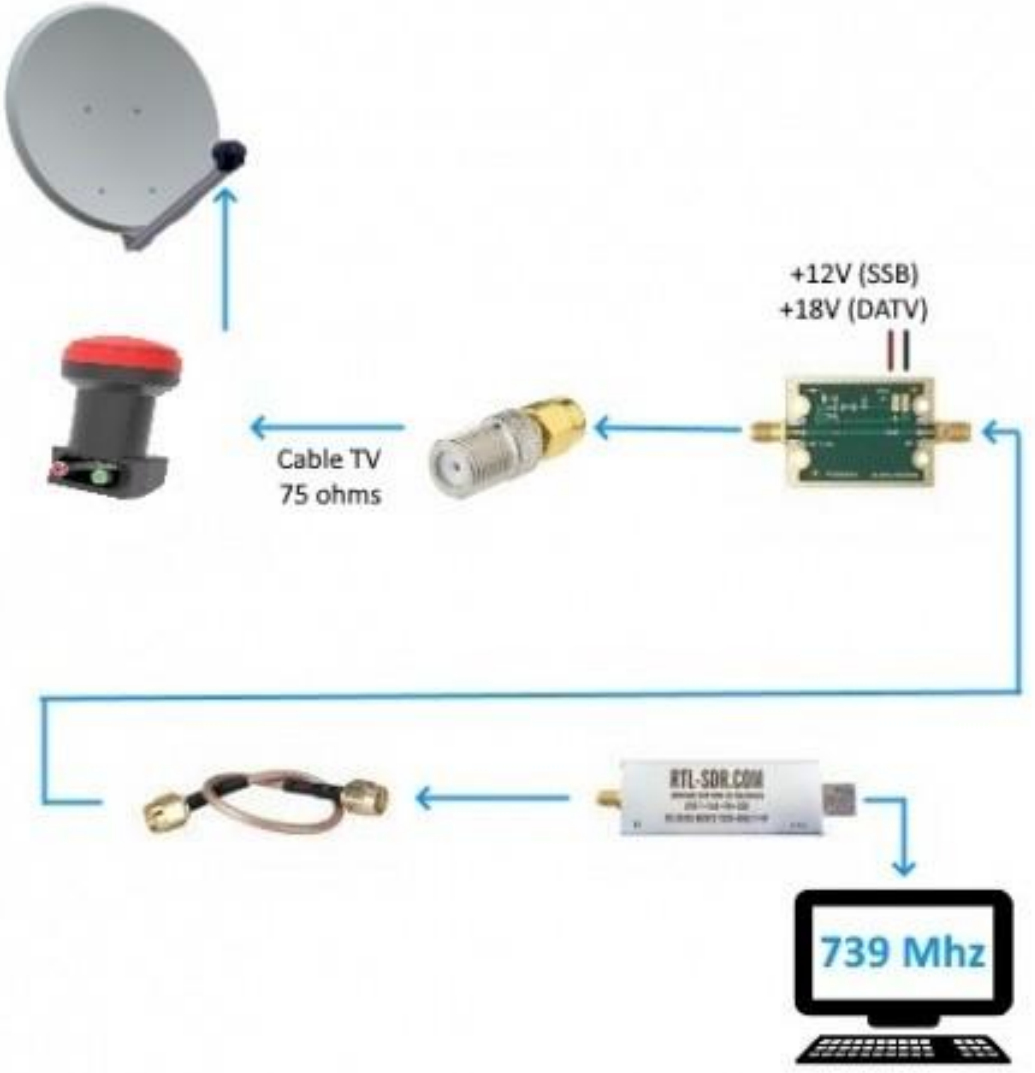
Oct 8th 2022


Beacon
Wide and Narrow DATV
Narrow DATV
Beacon
1MS
1MS
1MS
333
Beacon Only
Experimental modes and DVB-S/S2
DVB-S/S2 all symbol rates
DVB-S/S2 at 333 kS and lower
2401.5 2402.5 2403.5 2404.5 2405.5 2406.5 2407.5 2408.5 2409.5
Uplink (MHz)
10491.0 10492.0 10493.0 10494.0 10495.0 10496.0 10497.0 10498.0 10499.0
Downlink (MHz)

Základní typy sestav pozemních stanic

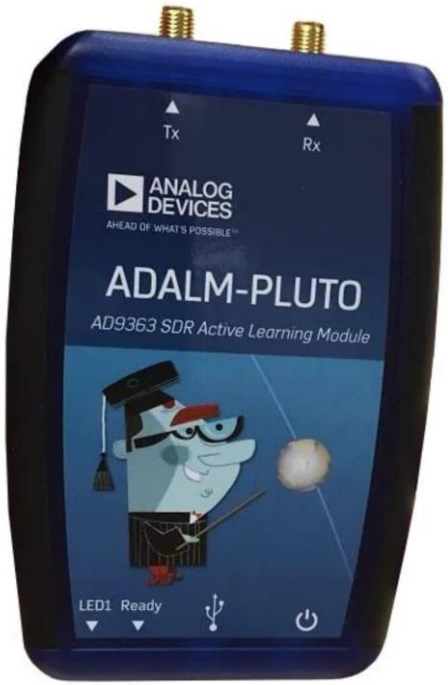
NB RX only - (400,- ~ 1000,-kč)

- LNB
- Min. 65cm offset parabola
- SDR + PC



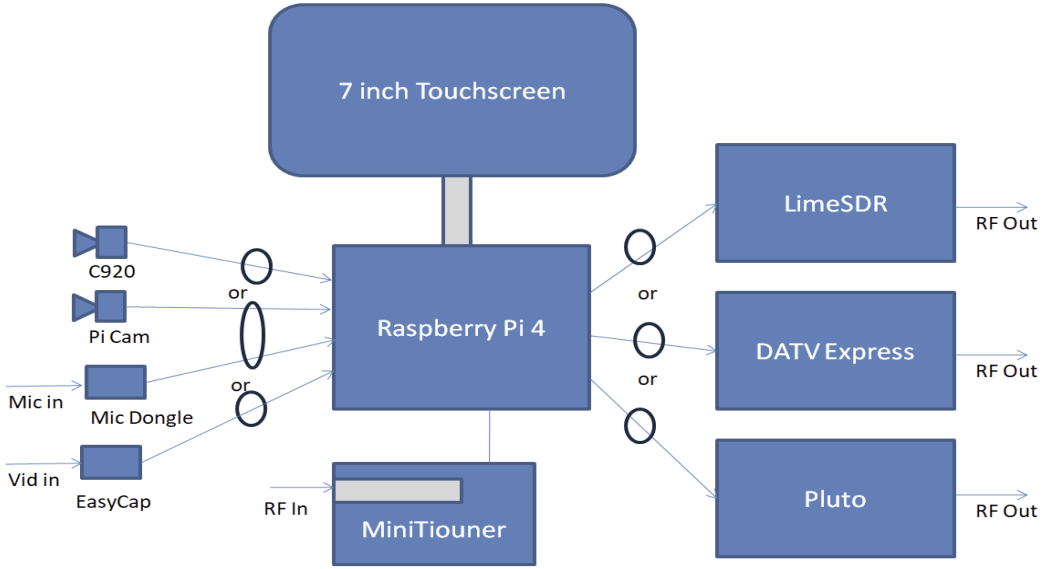
Sestava pro NB provoz

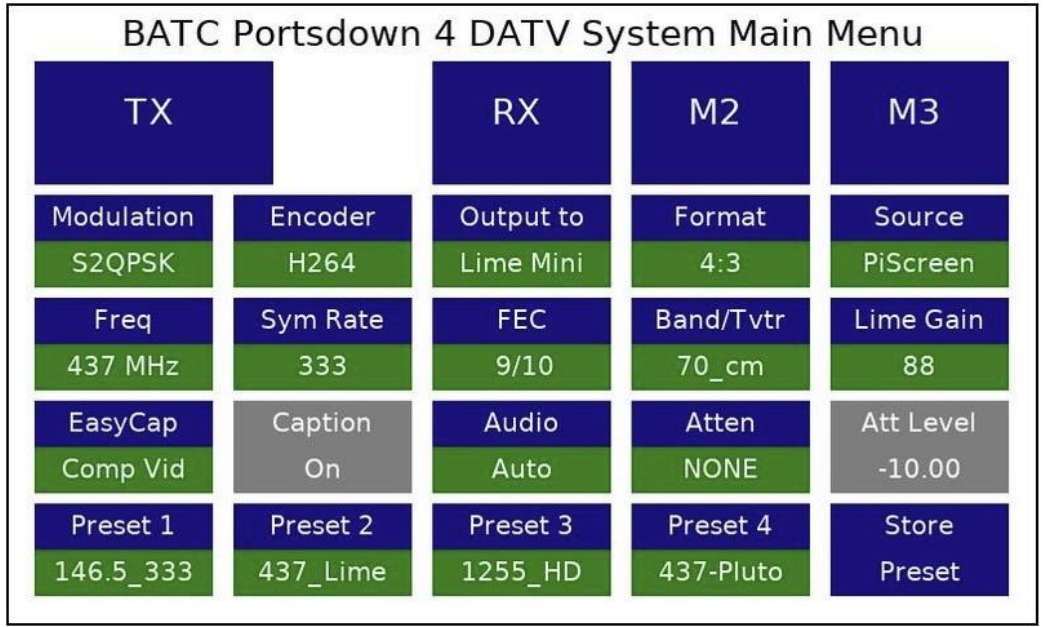
- **Minimální sestava ~ 7800,-Kč**
  - PC / Notebook
  - LNB with PLL - (150,-)
  - Homemade ozařovač helix
  - ADALM Pluto - (6500,-)
  - China PA 4W - (1000,-)
  - 65cm offset parabola
- Optional
  - GPSDO
    - Leo Bodnar + cca 130,-Eur
    - GPSDO China



Sestava pro WB / DATV provoz (Portsdown 4)

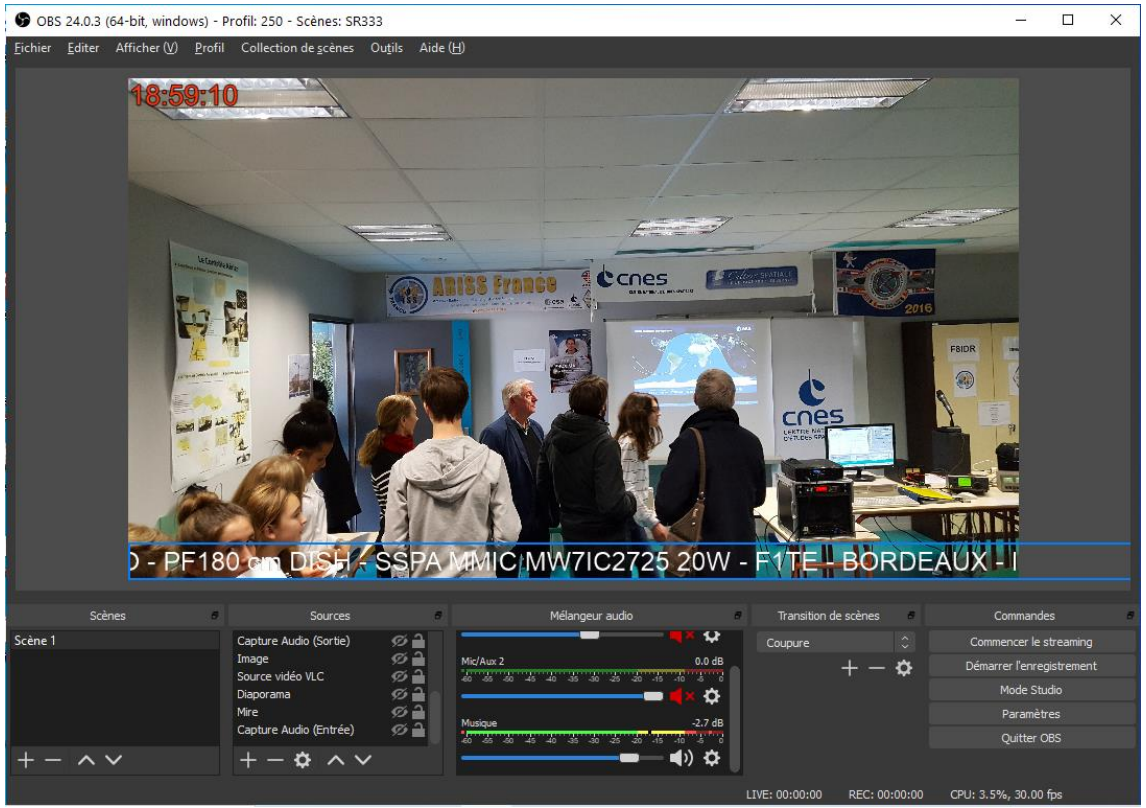
- **Minimální sestava 9500,- ~ 16000,-Kč**
  - PC / Notebook / Portsdown 4 (4000,-)
    - H264
  - LNB with PLL (250,-)
  - ADALM Pluto / Lime SDR (6500,-)
  - WCDMA PA 50W min. (1500,-)
  - 85cm offset parabola 120cm optimal (4000,-)
- Optional
  - GPSDO
    - Leo Bodnar ~ 130,-Eur
    - GPSDO China





Sestava pro WB / DATV provoz OBS etc

- **Minimální sestava 9500,- ~ 16000,-Kč**
  - PC / Notebook with straming SW
  - H265 encoder
  - LNB with PLL (250,-)
  - ADALM Pluto / Lime SDR (6500,-)
  - WCDMA PA 50W min. (1500,-)
  - 85cm offset parabola 120cm optimal (4000,-)
- Optional
  - GPSDO
    - Leo Bodnar ~ 130,-Eur
    - GPSDO China



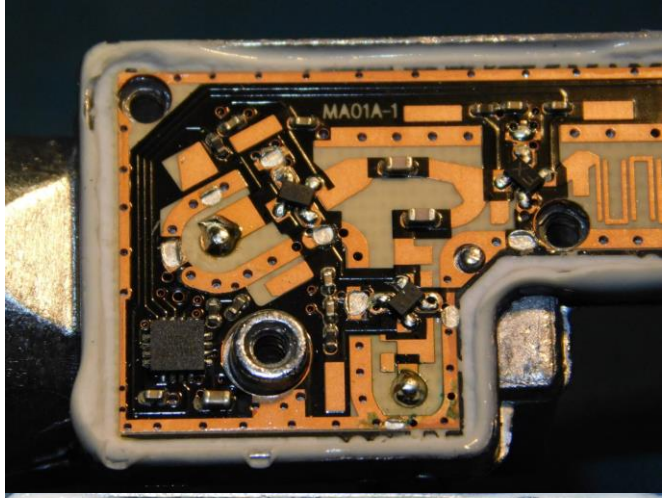
Výběr jednotlivých komponent, čemu se vyhnout

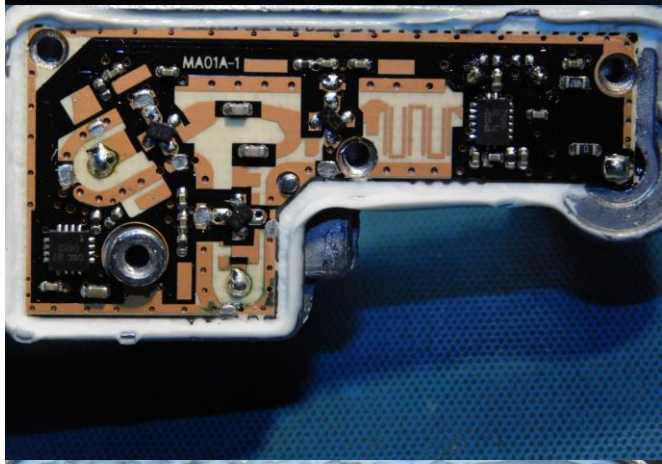
LNB – Low Noise Block

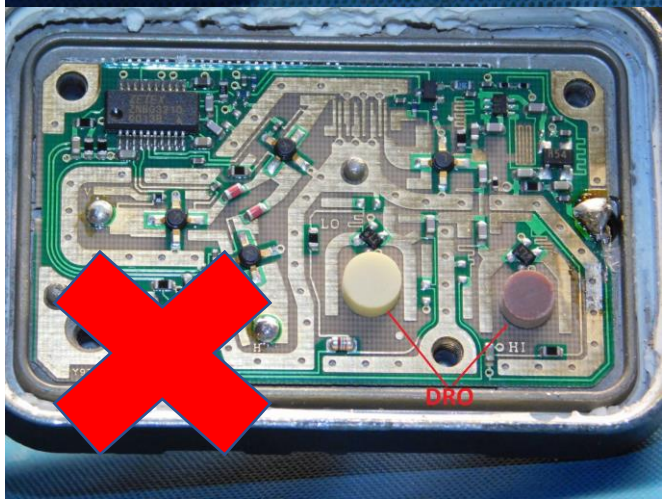
- LNB – alespoň s PLL **ne dielektrický rezonátor**
  - **4K Ultra HD**

- XO 25MHz x 390 = LO 9750MHz
- **IF ~ 740MHz**
- Změnou na **24MHz** => **IF 1129MHz** (LO 9360MHz)
  - Značné zlepšení parametrů LNB

- Vyzkoušené LNB (s XO 20PPM)
  - Amiko L-107
  - Mascom MCT01, MCS02HD
  - Tesla **TL-200**, TL-100
  - **Bullseye**
    - **TCXO 2PPM**
    - ~ 30,-Eur

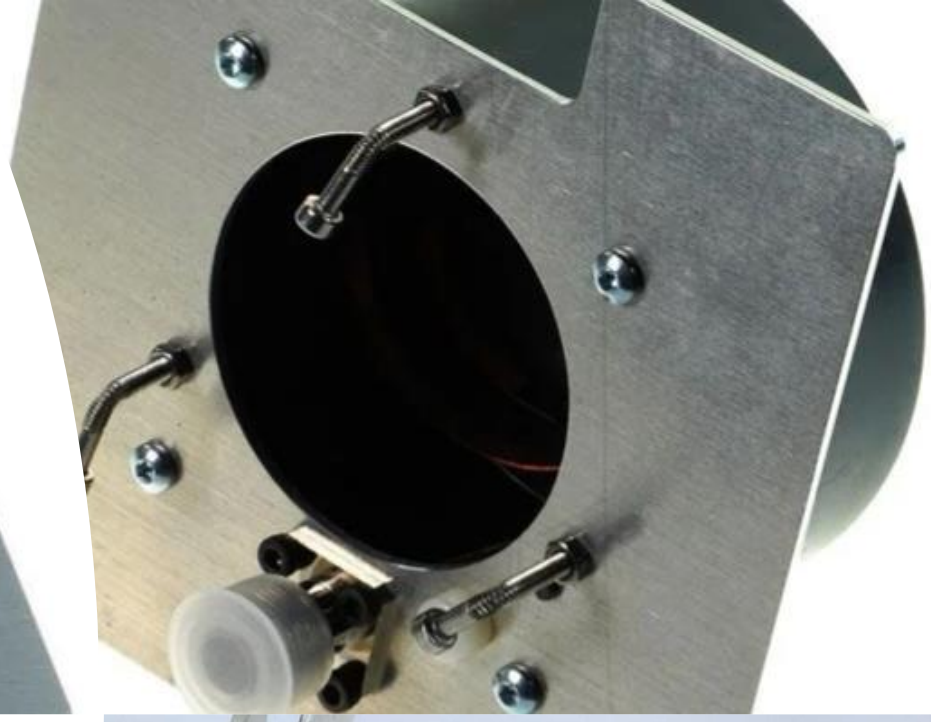


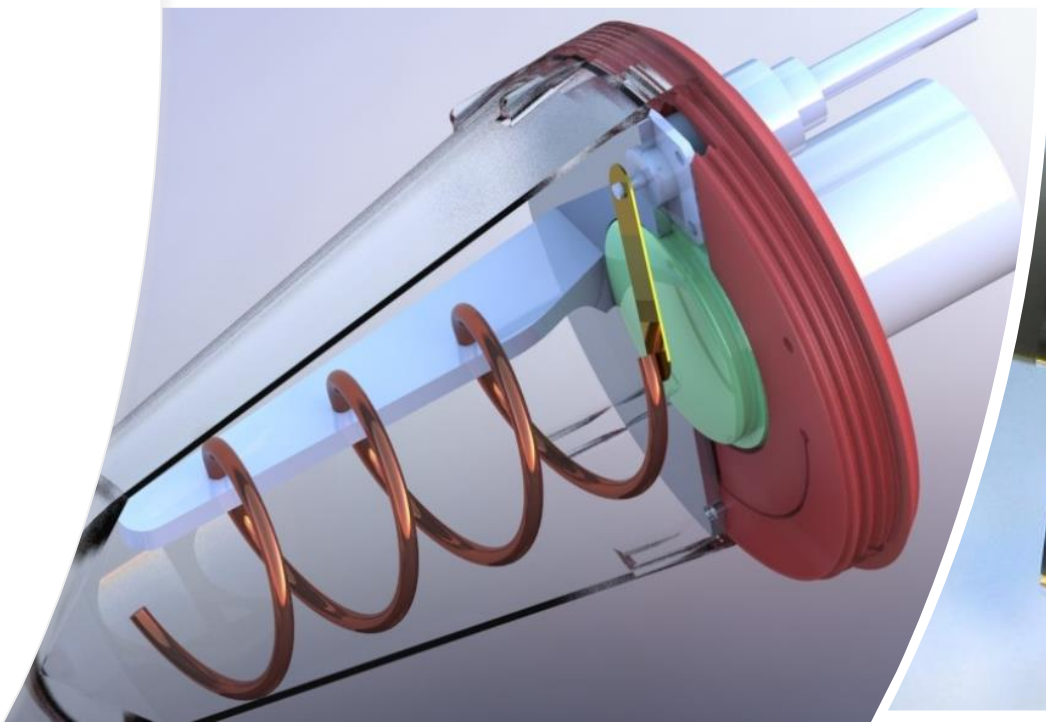




Ozařovače

- Dxpatrol Helix Antenne
  - **~ 89,-Eur**
- DG7GP – bamatech.net
  - **~ 92,-Eur**
- IceCone
  - **~ 10,-Eur**

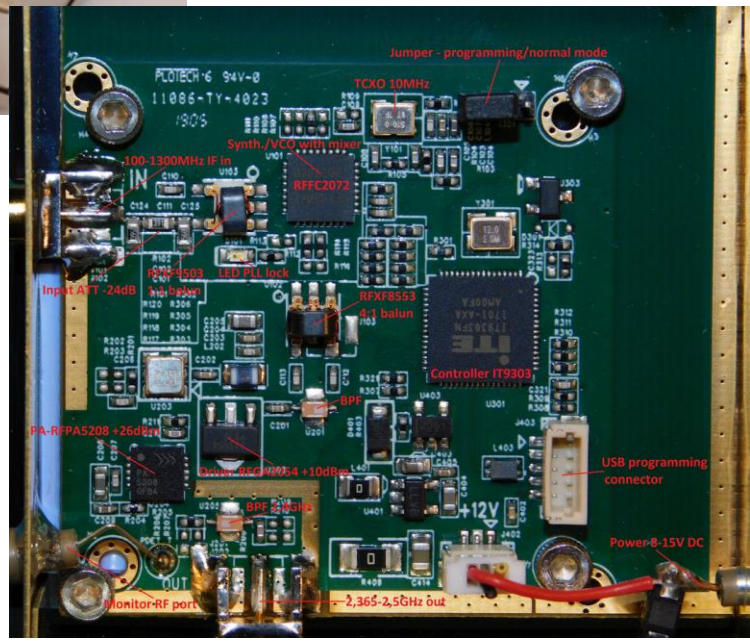




Antény

- Offset / Gregorian parabola 65~150cm
  - **20,-Eur ~ 400,- Eur**
  - **NB min 65cm**
  - **WB min. 85cm (125cm optimal)**
- Wi-Fi „síto“
  - Lineární polarizace vs. RHCP -3dB

Transvertory

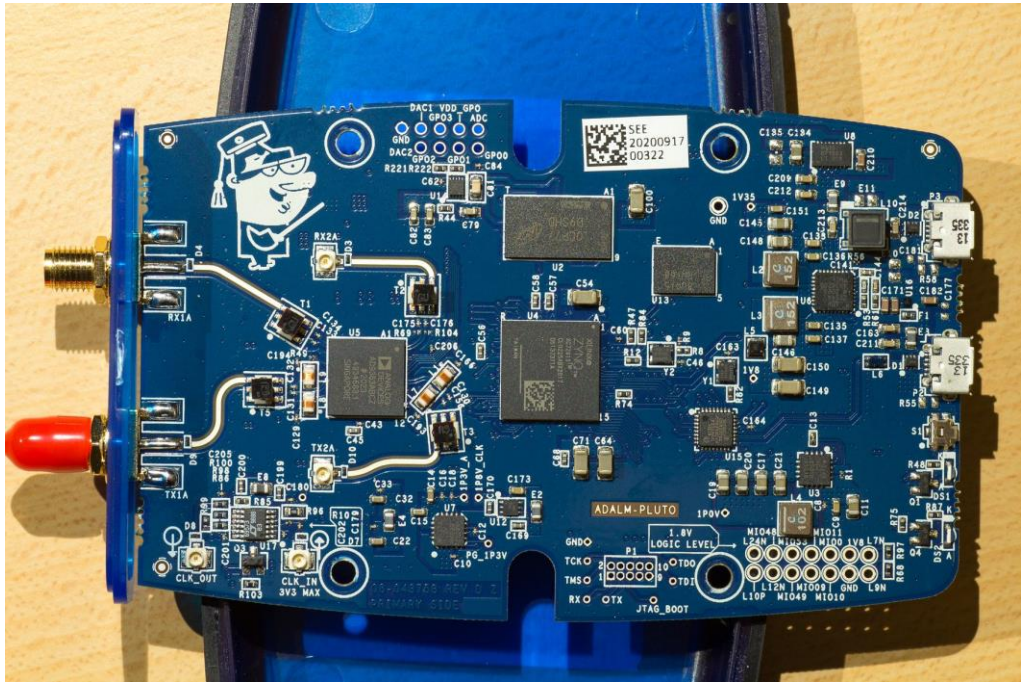


- BU-500 de OE7DBH
  - IF 100 ~ 1300MHz
  - RF 0,5W out
  - 2 PPM
  - ~ 135,- Eur

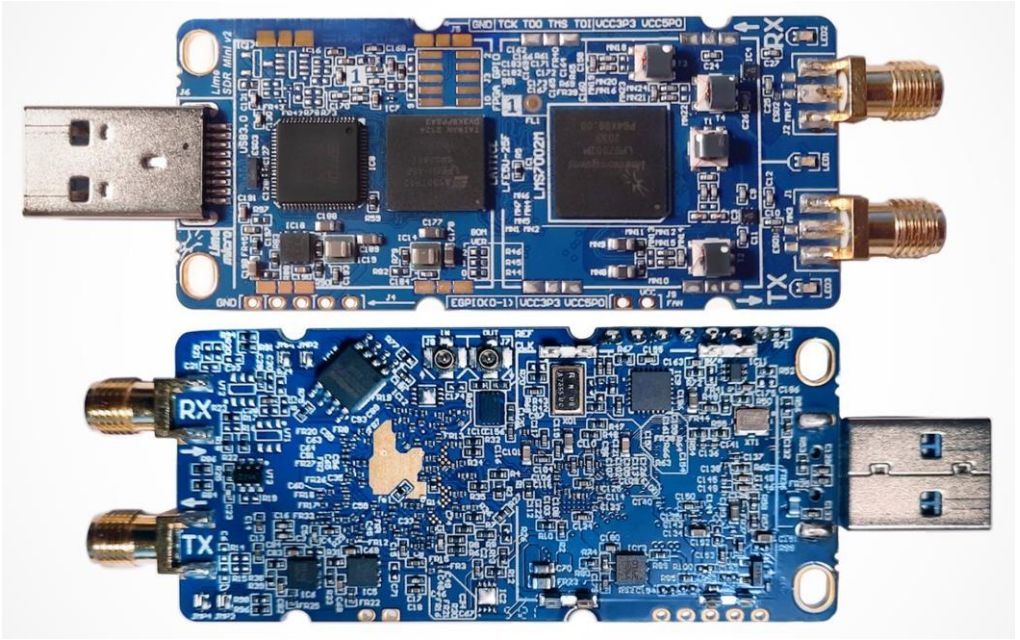
- SG Labotarory
  - IF 432MHz
  - RF 2W out
  - ~ 210,-Eur

- DX Patrol
  - IF 28 / 50 / 70 / 144 / 432 / 1296MHz
  - GPS reference
  - RF 10W out
  - ~ 1000,- Eur

SDR



- ADALM Pluto
  - Nestabilní LO lokální oscilátor (20PPM) - který je třeba vyměnit.
  - USB 2.0 (Přenášené hodnoty jsou 2x Float32)
  - „20MHz“ šířka pásma (6MSps)
  - Podporuje přímé ovládání ze “studiových” programů pro zpracování videa a lze jej ovládat přímo z PC jako streamovací zařízení.
  - S upraveným FW lze Pluto používat jako SNA analyzátor
  - Výkon cca 0dBm / 2400MHz
  - Cena ~ 225,-Eur
- LimeSDR Mini
  - Stabilní TCXO Rakon RTX5032A @40.00MHz / 1ppm
  - USB 3.0
  - 30,72MHz šířka pásma
  - Možnost dalších experimentů (FakeGPS, NMT, LTE vysílače)
  - Výkon cca +8dBm / 2400MHz
  - Pouze ve verzi 2.0 za ~400,-Eur



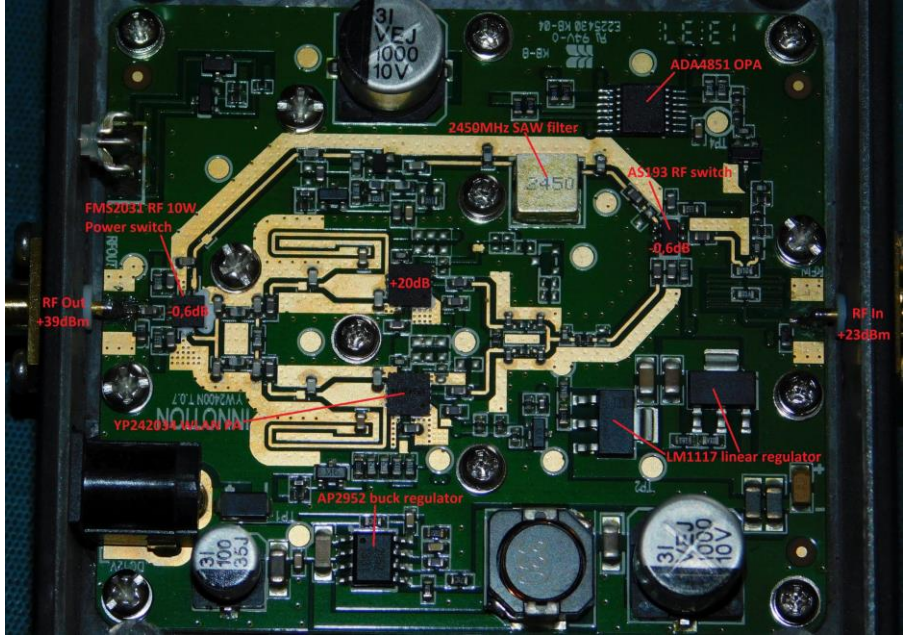
SDR – High end

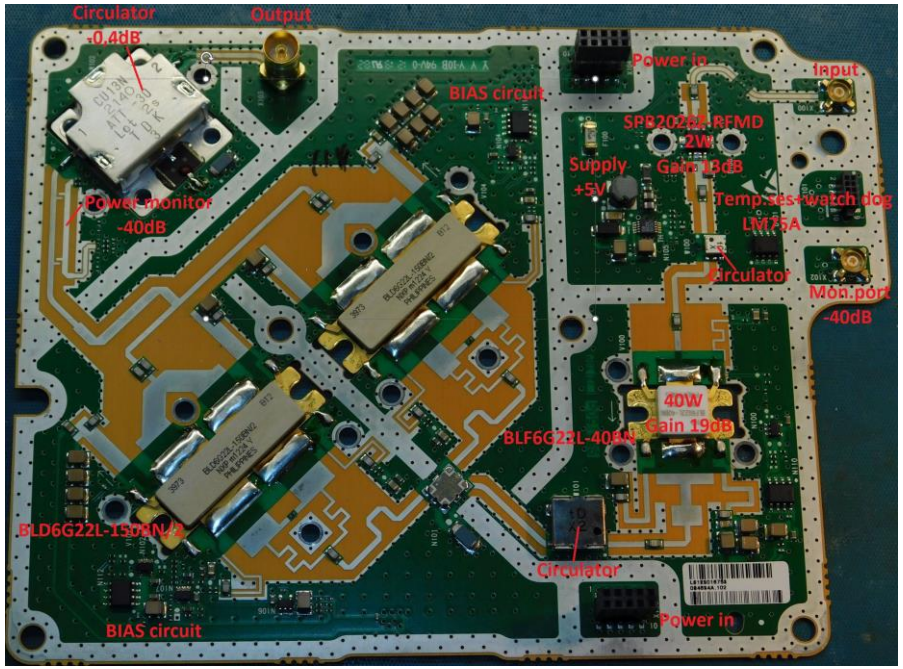
- USRP B-200
  - 25.000,-kč
- USRP B-310
  - 350.000,-kč

PA

- Wi-Fi booster china s YP242034
  - **RF 2/4W out**
  - 800,- / 1600,-kč

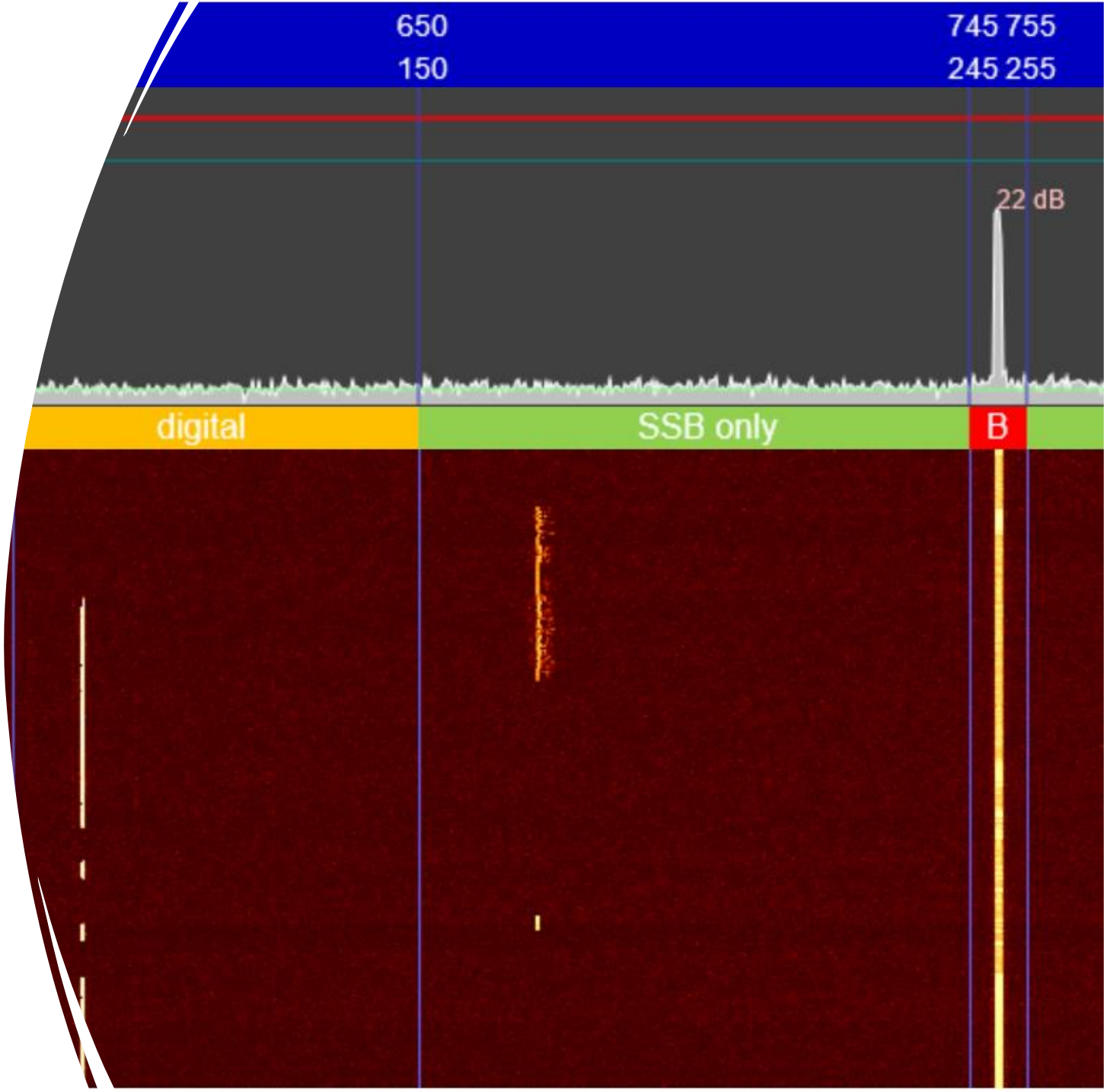
- WCDMA PA s vyzařených sítí
  - Ruzné typy
  - **RF 60W -200W out**
  - 1500,- ~ 3000,-kč





Web SDR

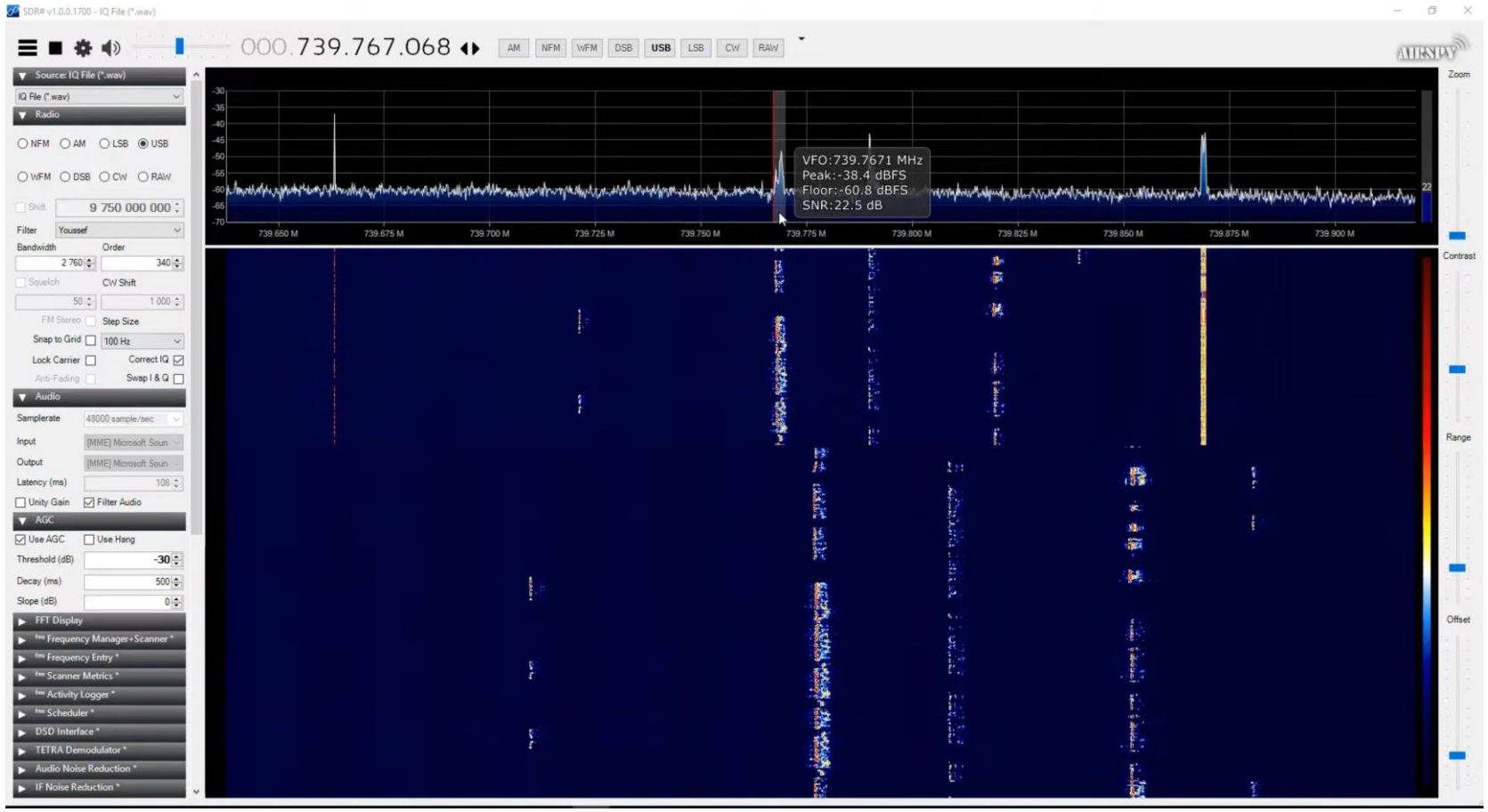
- http://db0hal.dyndns.org
- https://eshail.batc.org.uk/nb/
- https://www.twitch.tv/pa3fbx



Dostupná SW vybavení

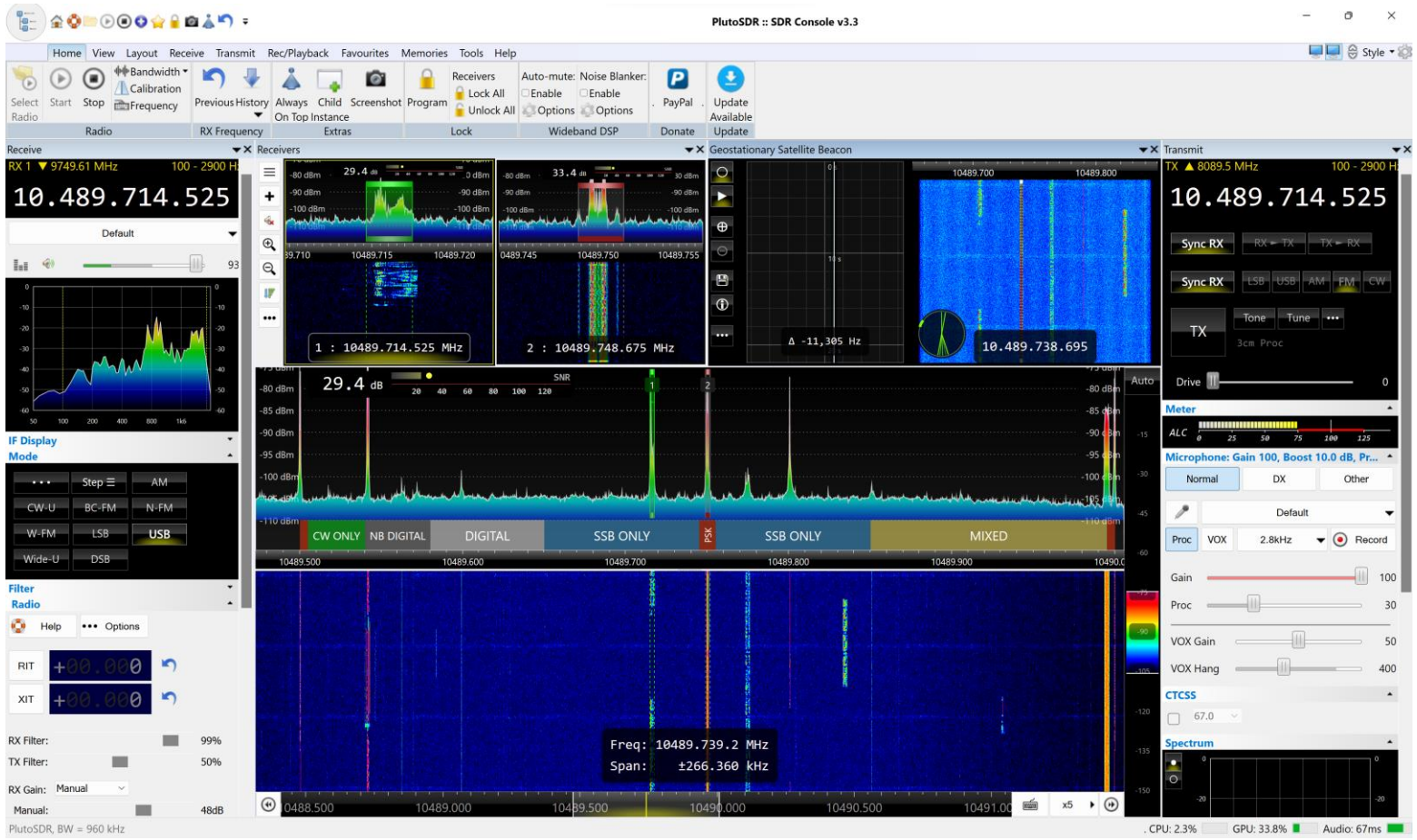
SDR Sharp

- Pouze RX
- Jednoduchý
- Zásuvné moduly pro dekódování dig. provozů



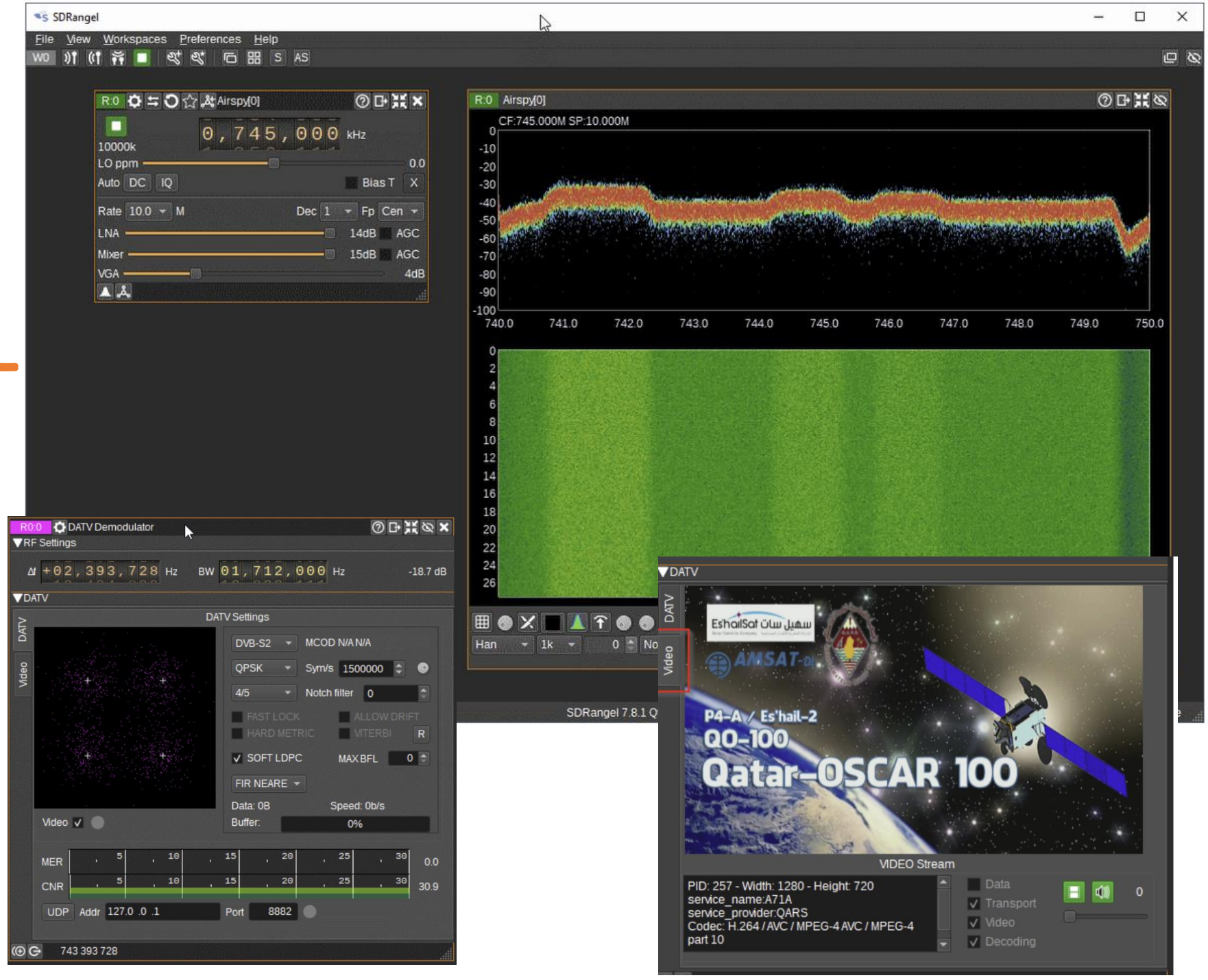
SDR console

- Full transceiver
  - Nejen na QO-100
- Široká podpora HW
  - LimeSDR, ADALM pluto, AirSpy, USRP
- Synchronizace na datový maják



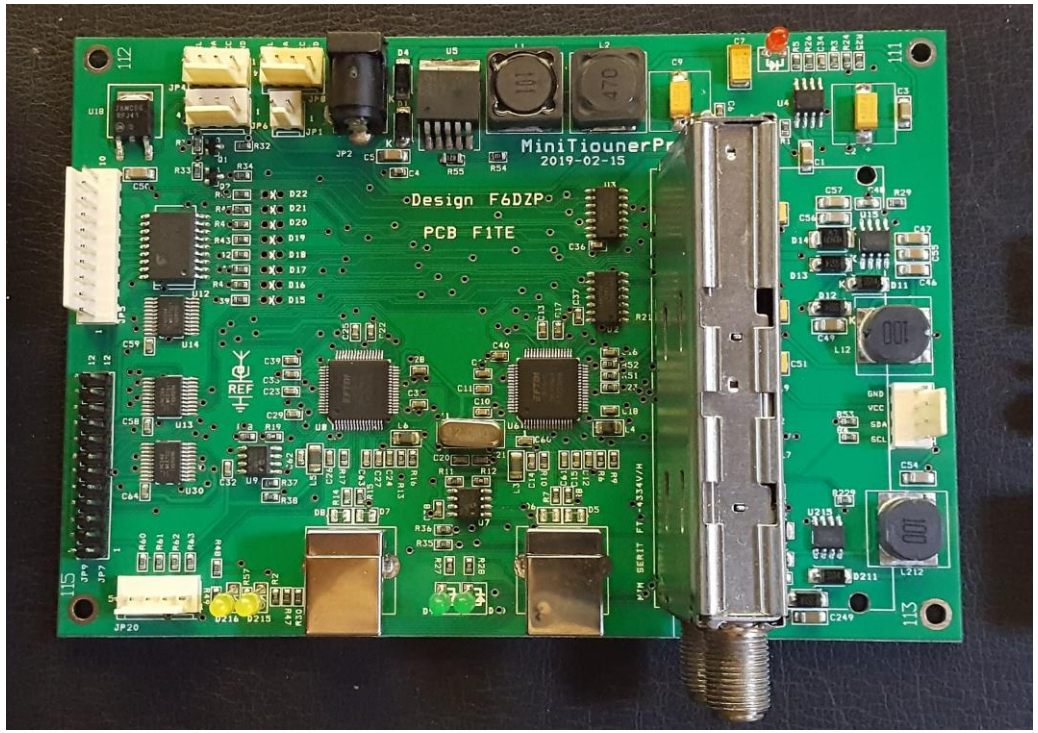
SDR Angel

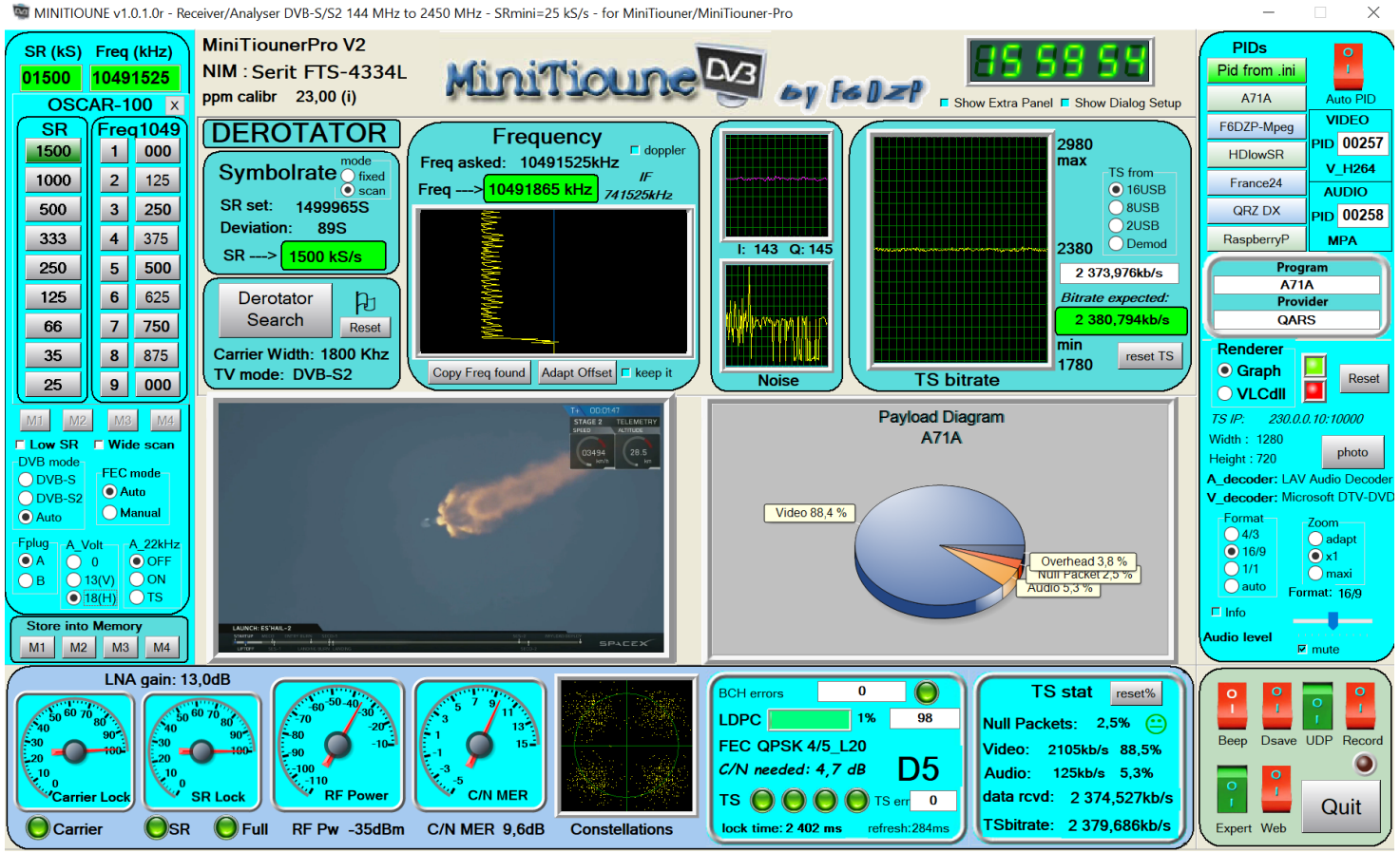
- Linux SW
- Podpora DATV



MiniTiouner

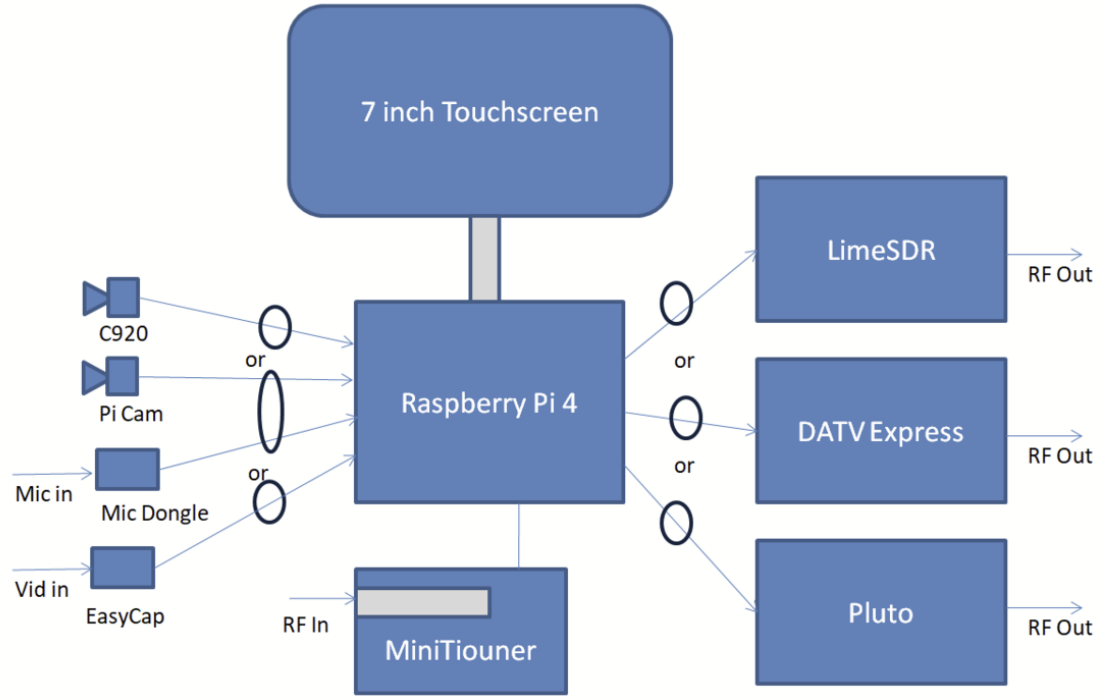
- Single RX
- Detailnější rozbor signálu
- Dedikovaný HW

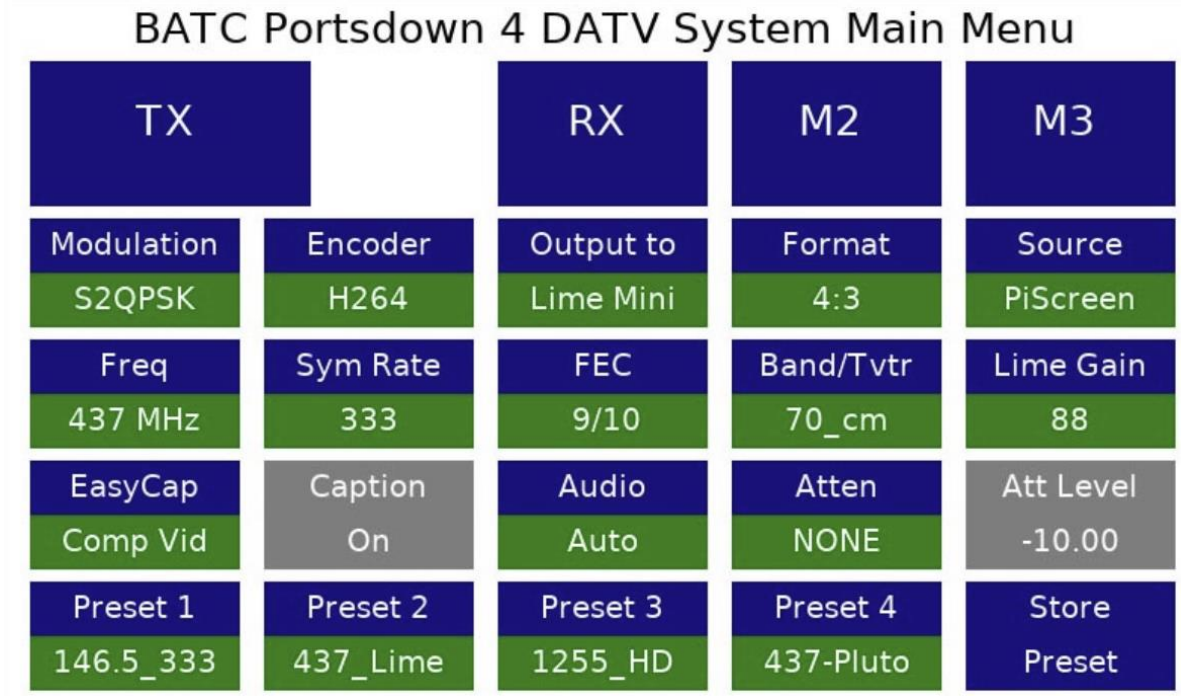




Portsdown 4

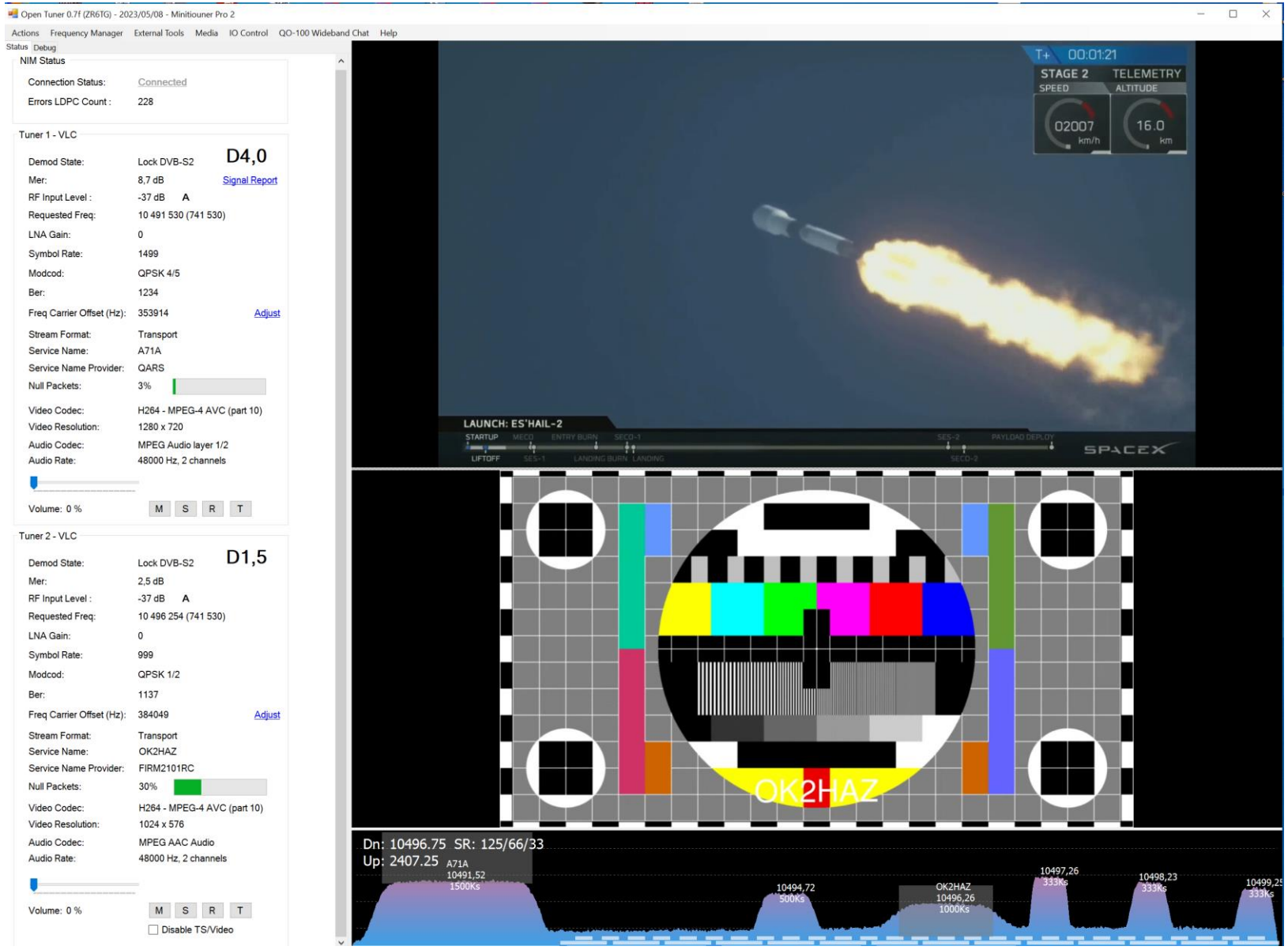
- Standalone řešení DATV
  - Běží na RPi 3/4
- Podpora LimeSDR + ADALM Pluto
  - DVB-T, DVB-S, DVB-S2
  - QPSK, 8PSK, 16APSK
  - 66kS ~ 4MS
- Sada podpůrných tools
  - BandViewer, Noise meter, Power meter
  - Signal generator, Meteor viewer (need SDR Play)
  - Langstone TRVCR





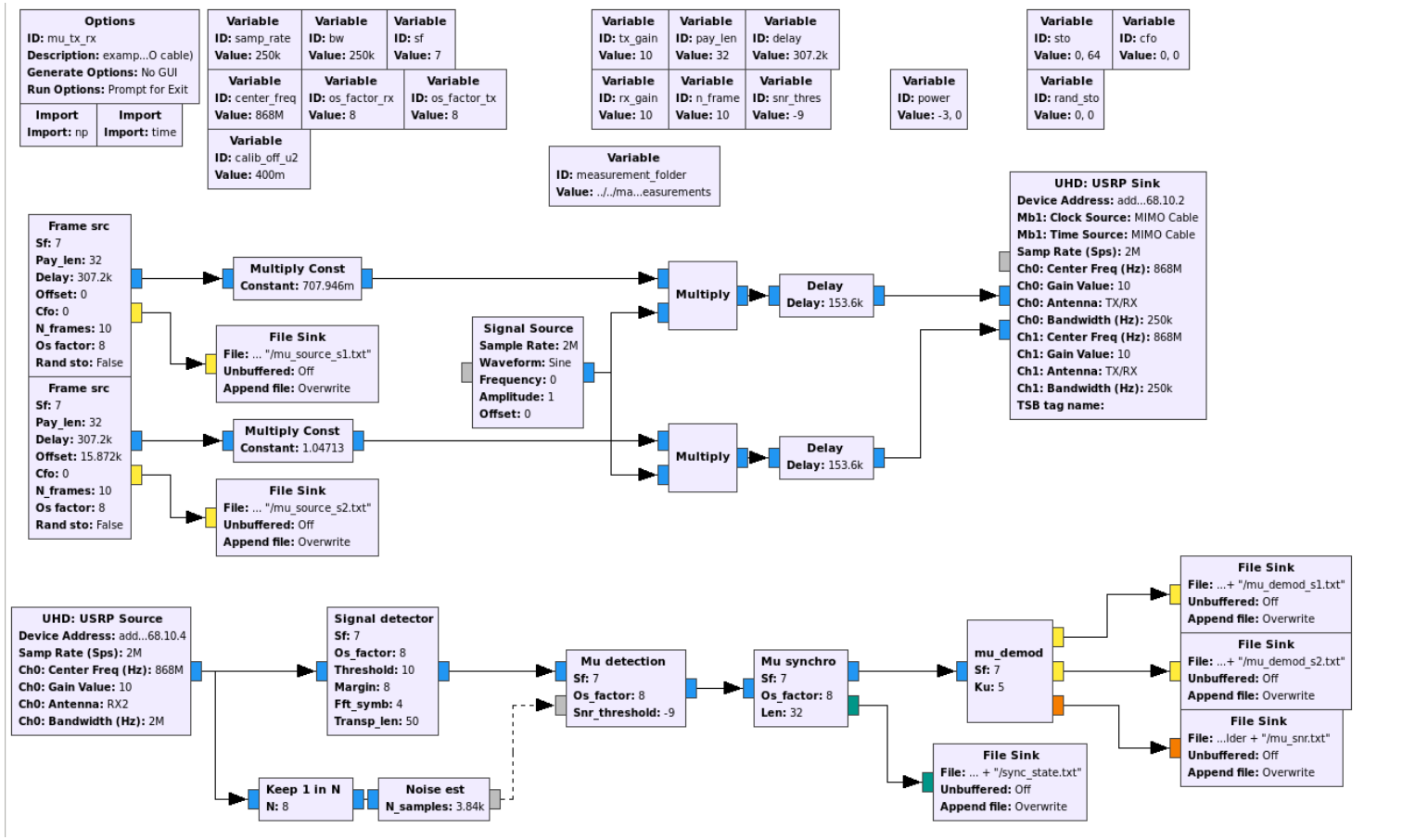
Open Tuner
by ZR6TG

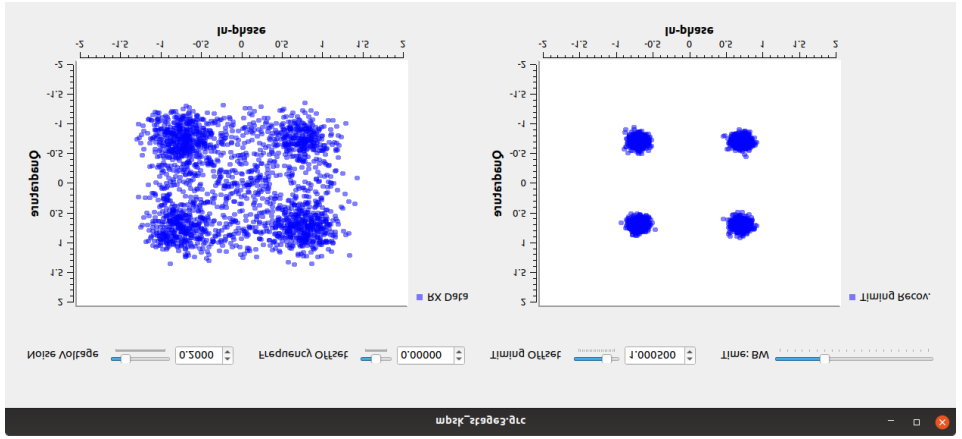
- Dual RX
- Spektrogram
- Wideband chat
- Potřeba Minitiouner HW

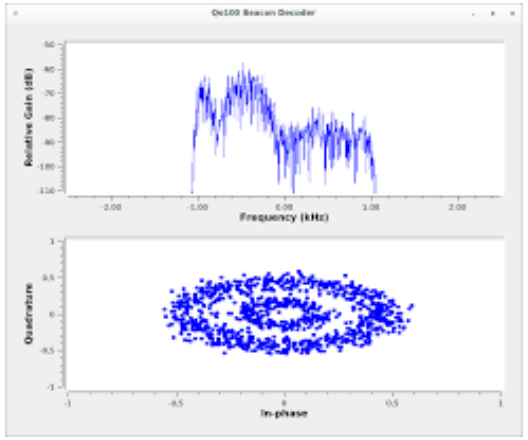


GNU Radio

- Extrémí škálovatelnost
- Lze implementovat prakticky jakýkoliv provoz
- Složitější na ovládání







Používané provozy na QO-100

- CW
- SSB (FM je zakázána)
- SSTV (analog + digital DRM)
- FSK (telemetrický + multimediální maják)
- Digital voice (FreeDV)
- FT8 

- DATV
  - DVB-S, DVB-S2
    - H.265 / H.265 / H.266

Q & A

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