

MiniTiouner & MiniTiounerPro

Create your own DVB-S/S2
USB receiver

CAT16 24/09/2015

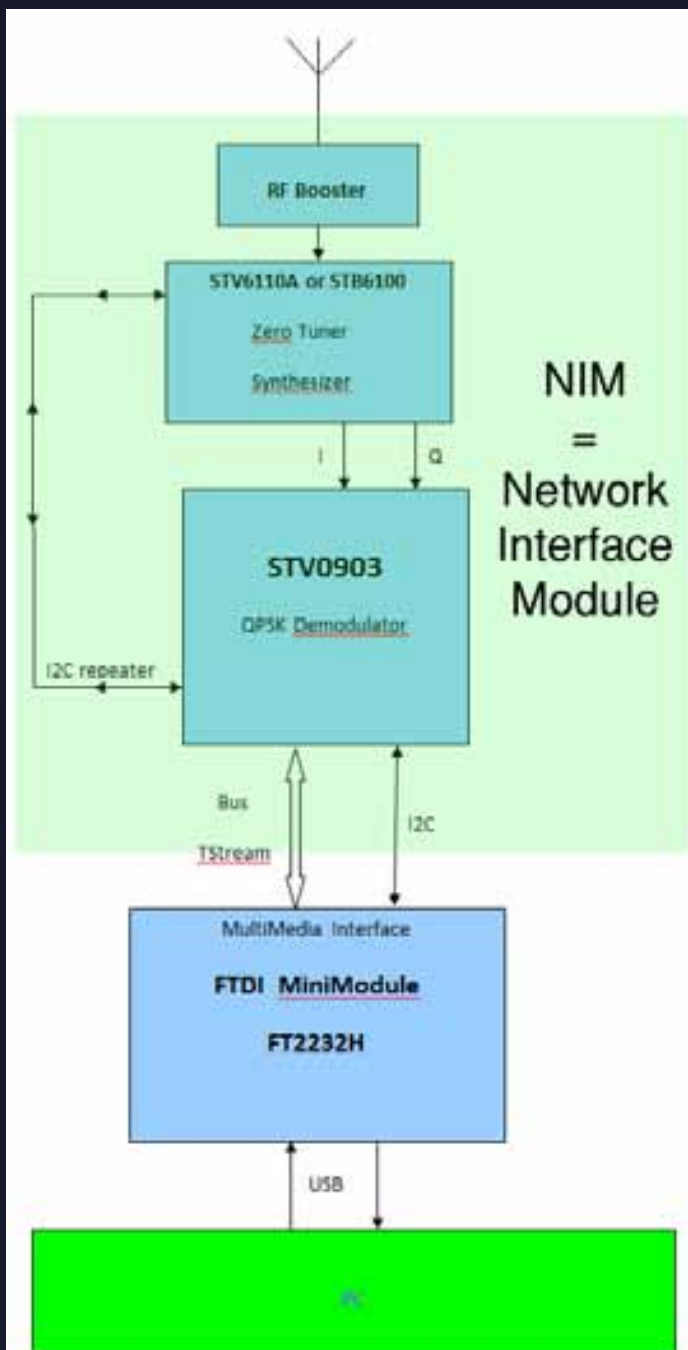
Jean Pierre Courjaud F6DZP





MiniTiouner Internals

- L-Band receiver
- Wide band or **Narrow band**, phase modulated signal
- STB6100 Or STV6110 processes RF signal
- Analogue differential I and Q signals
- QPSK demodulator, STV0903, Processes I and Q signals
- Transport Stream is transferred to the PC via the FTDI Mini-Module FT2232H, connected to the USB input of the PC.
- The software sends instructions to setup STV0903 via USB / I²C. The instructions are sent to the STB6100 or STV6110 synthesizer via an I²C repeater.

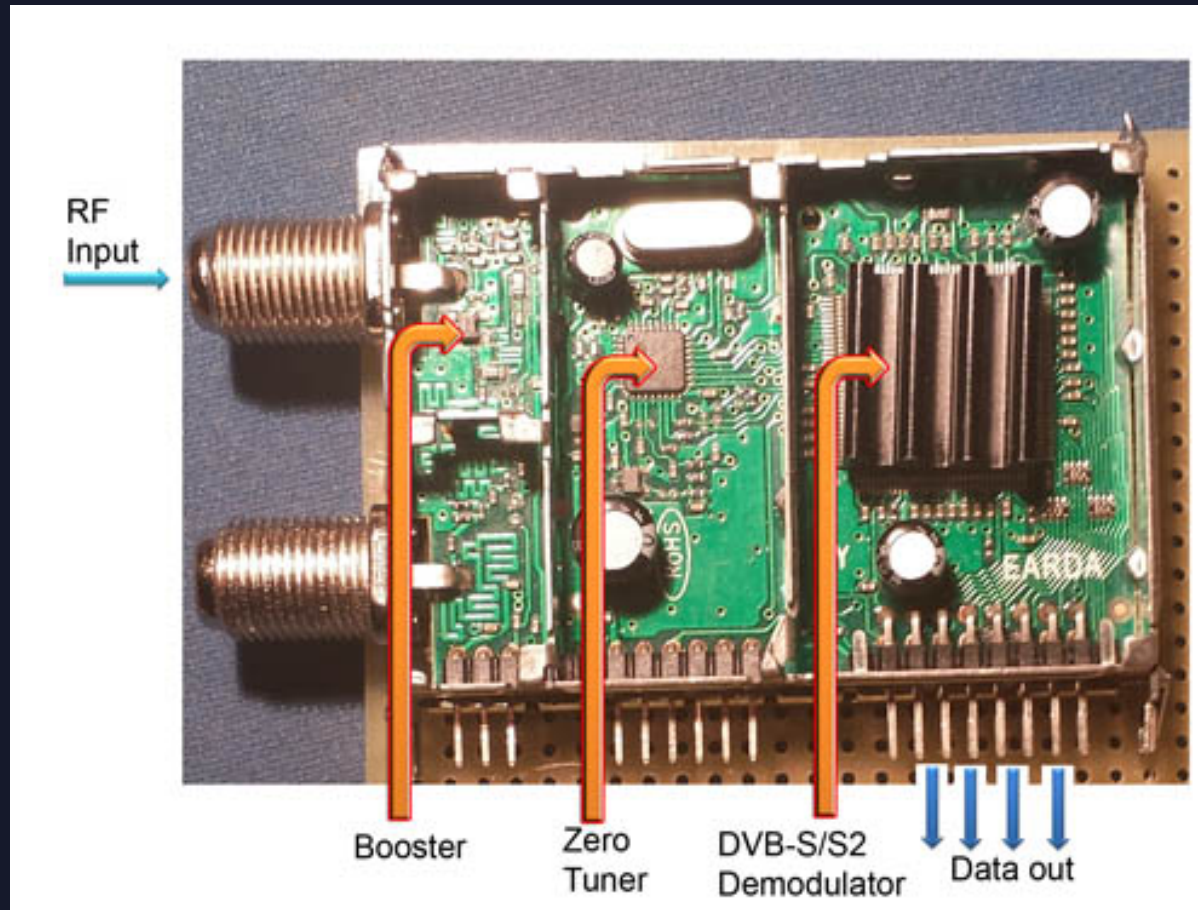


We use a NIM

Network Interface Module



Samsung



Eardatek

Which NIM must I use?



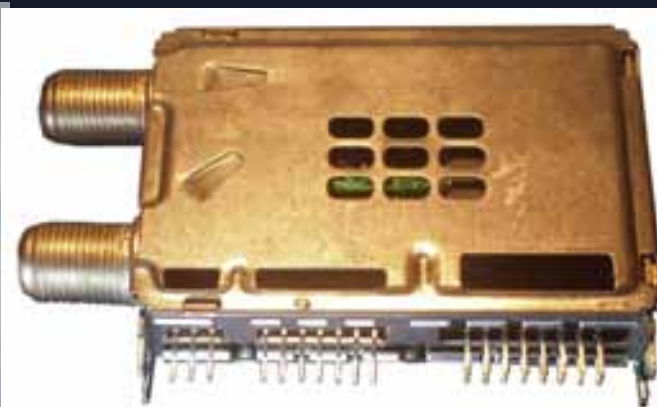
To be sure that it works well at low SR, we must chose a NIM using a STV0903 as the demodulator.

In 2015, I have selected 3 kinds of NIM.

Samsung

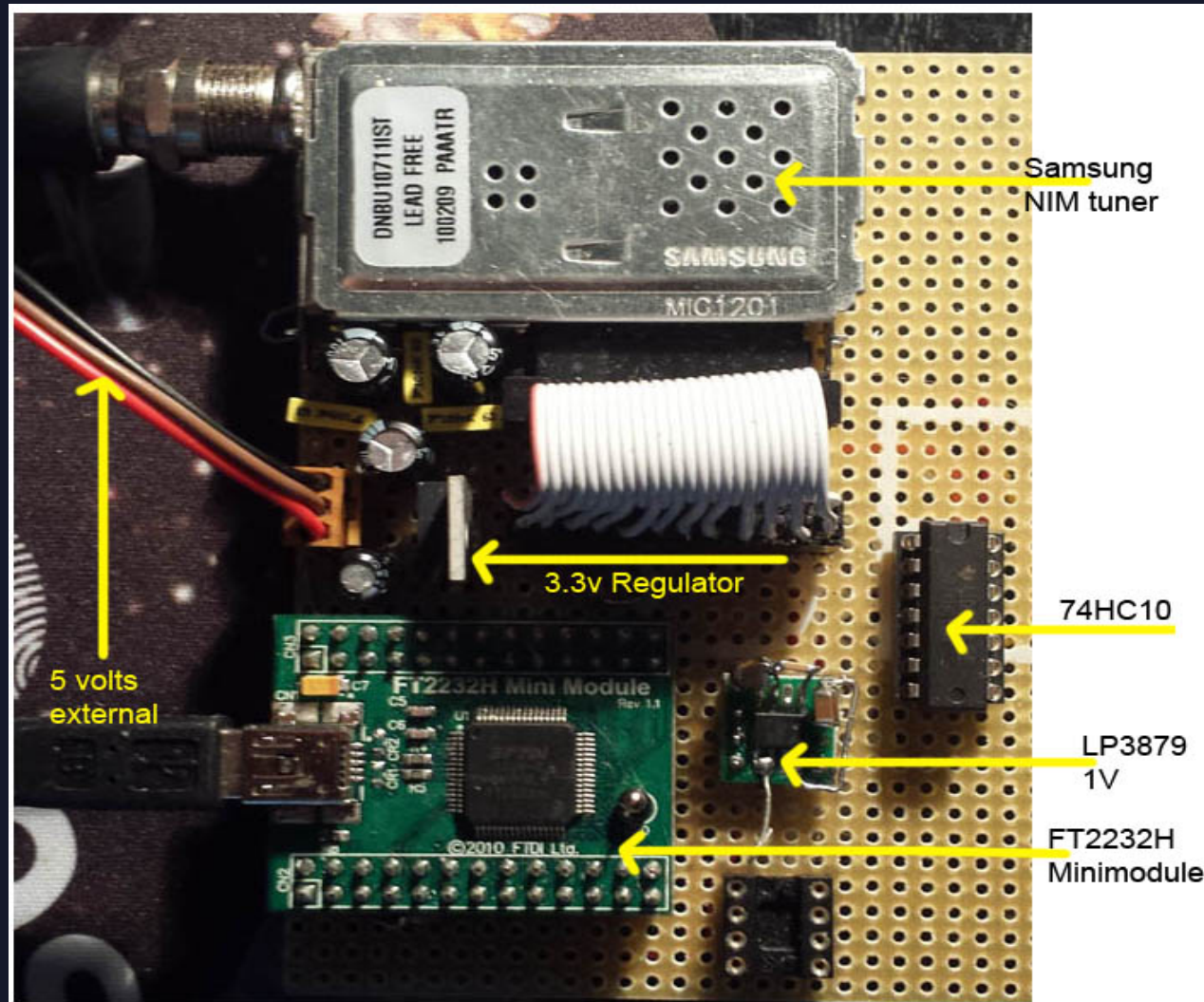
Sharp

Eardatek

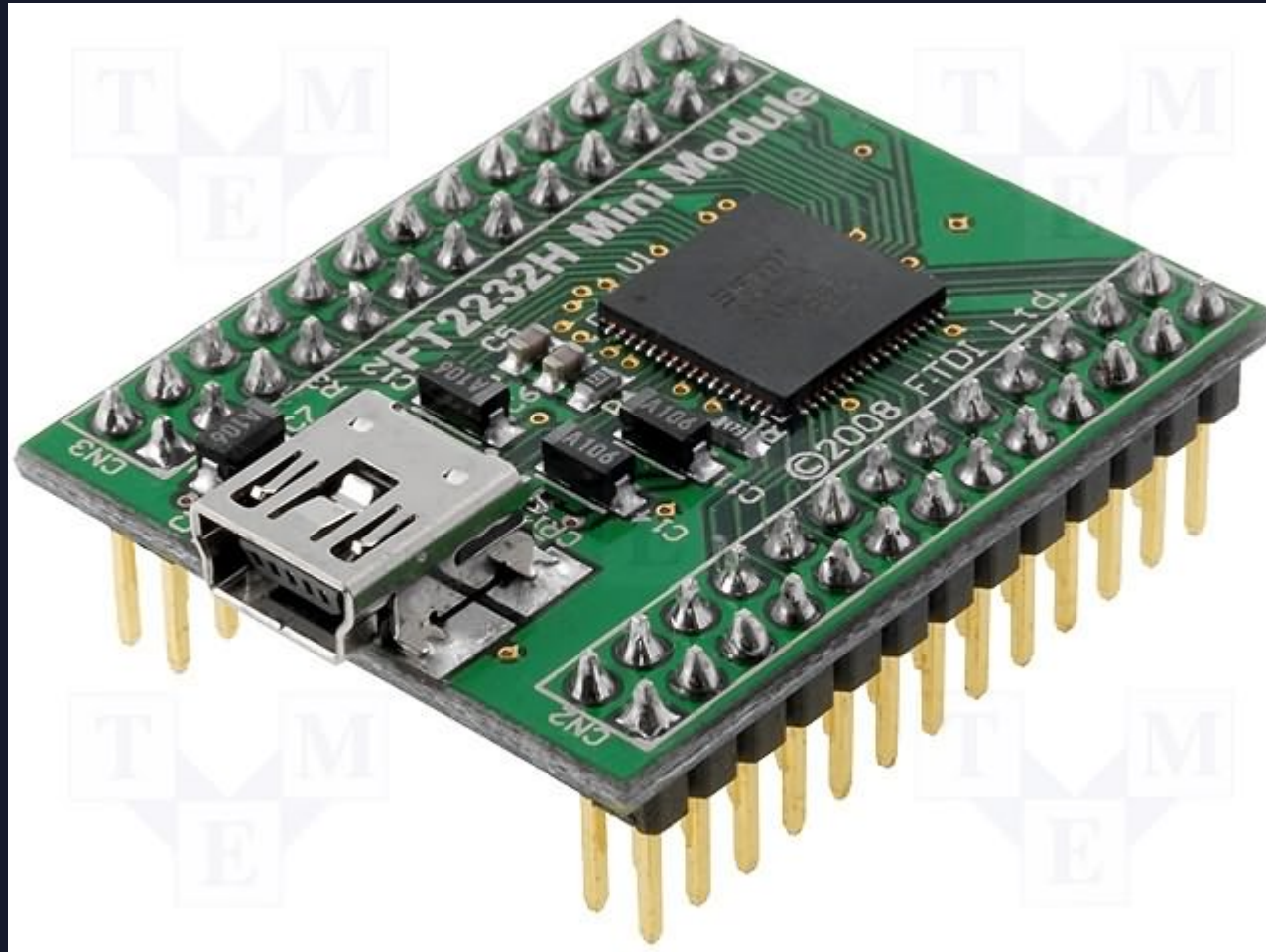


In 2016, I have added 2 new NIMs : **LG** and **Serit** with **STV0913**

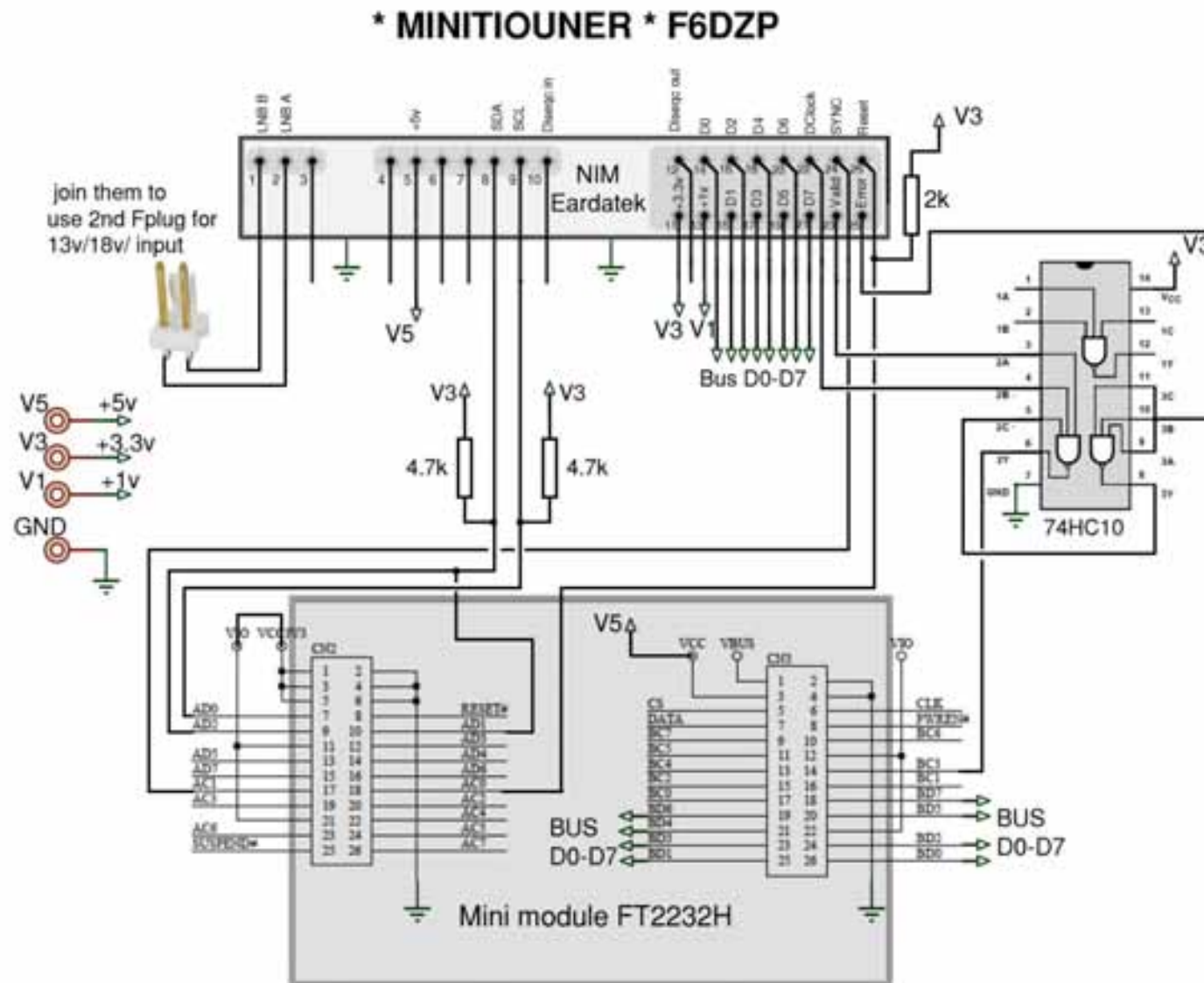
First prototype in March 2015



The USB mini module FT2232H



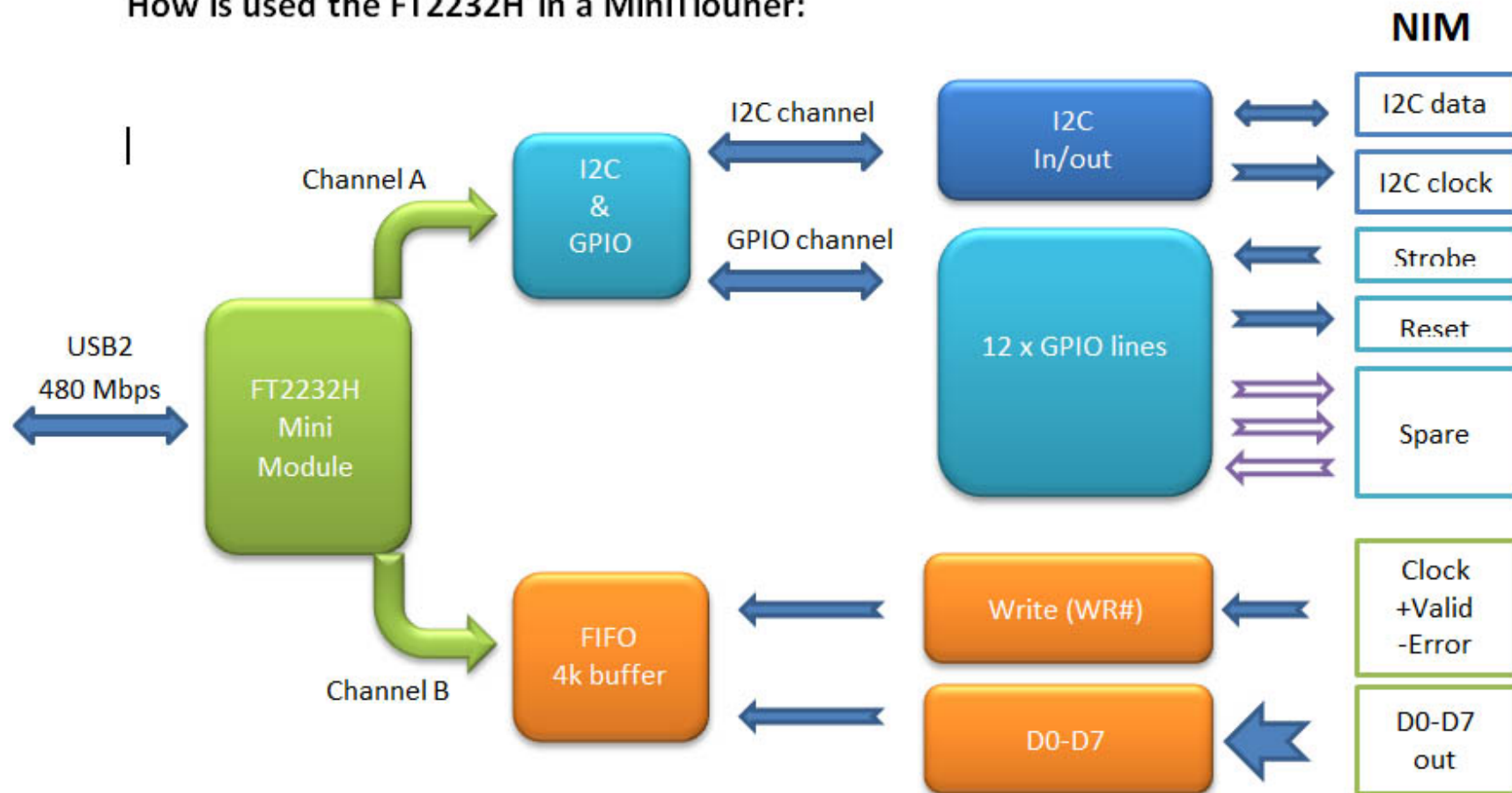
A decorative graphic in the bottom right corner consisting of a grid of colored dots in shades of blue, green, and purple, arranged in a pattern that tapers to the right.



FT2232H configuration



How is used the FT2232H in a MiniTiouner:



MiniTiouners...



Pipo can run MiniTioune

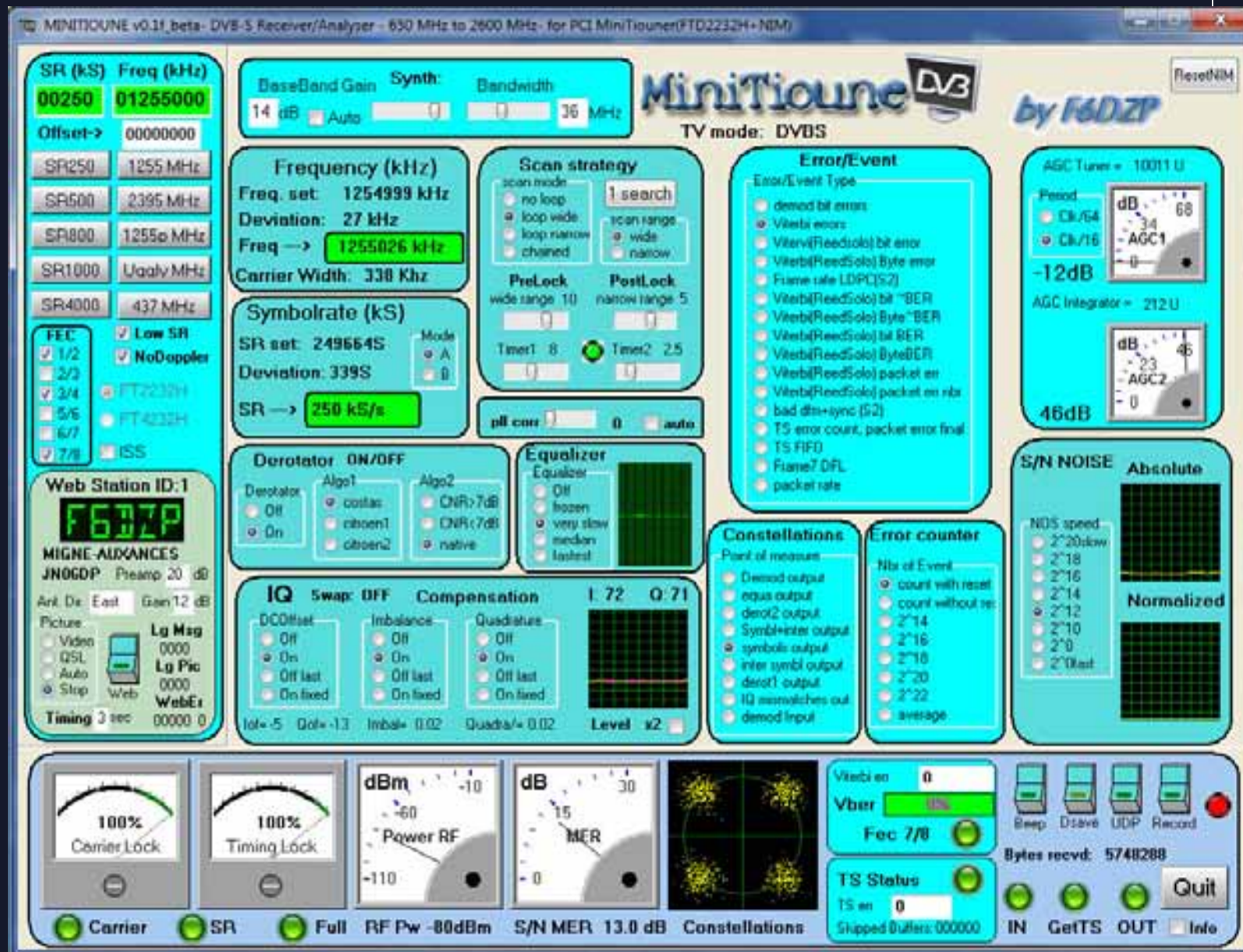


- A little PC running Win8.1
- Intel Atom Quad Core
- 4 USB + 1 micro USB
- HD touchscreen (1280x800)
- HDMI output
- Wi-Fi and Bluetooth
- 12v 480mA when receiving and rendering video
- Less than \$110

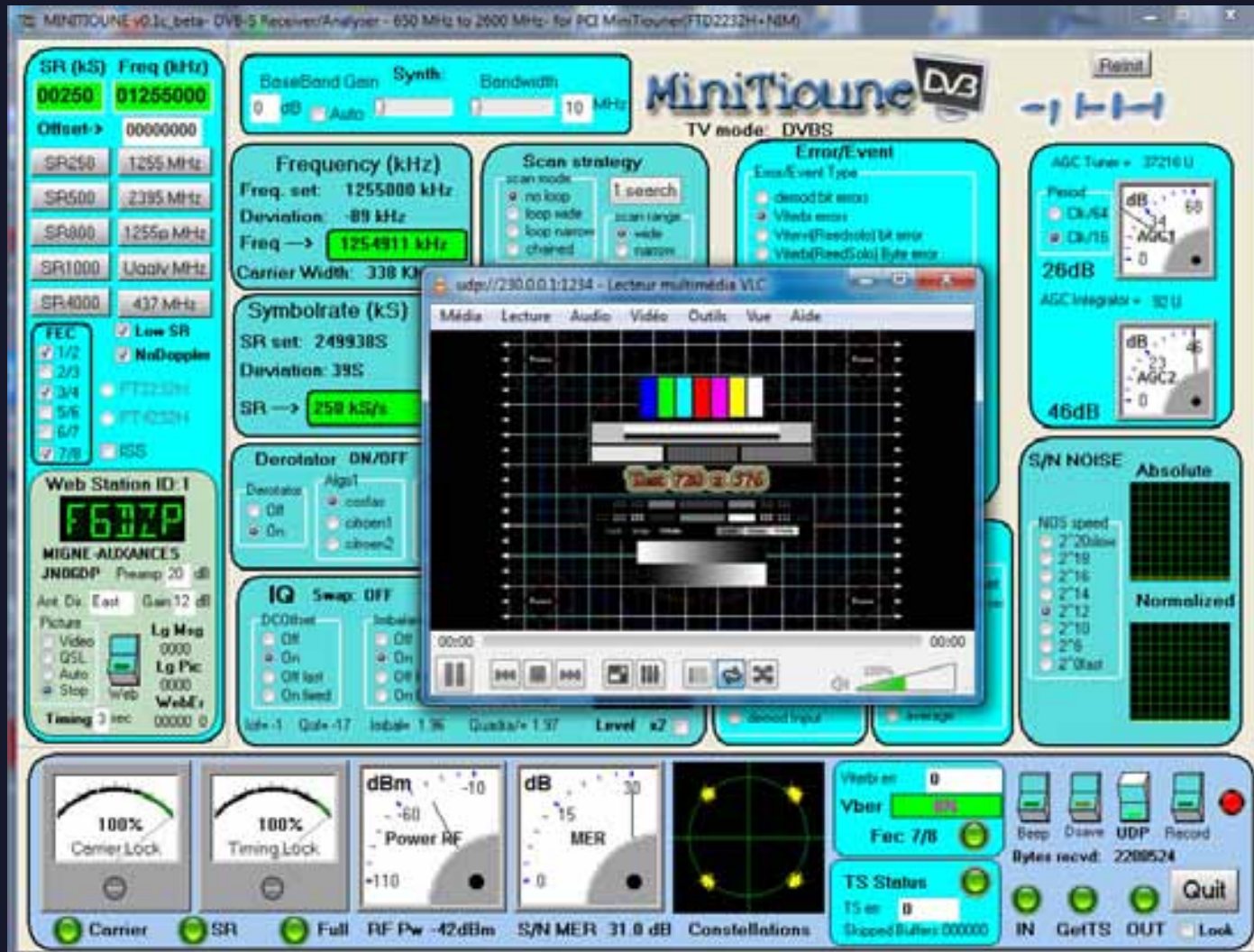
Using a Pipo X8



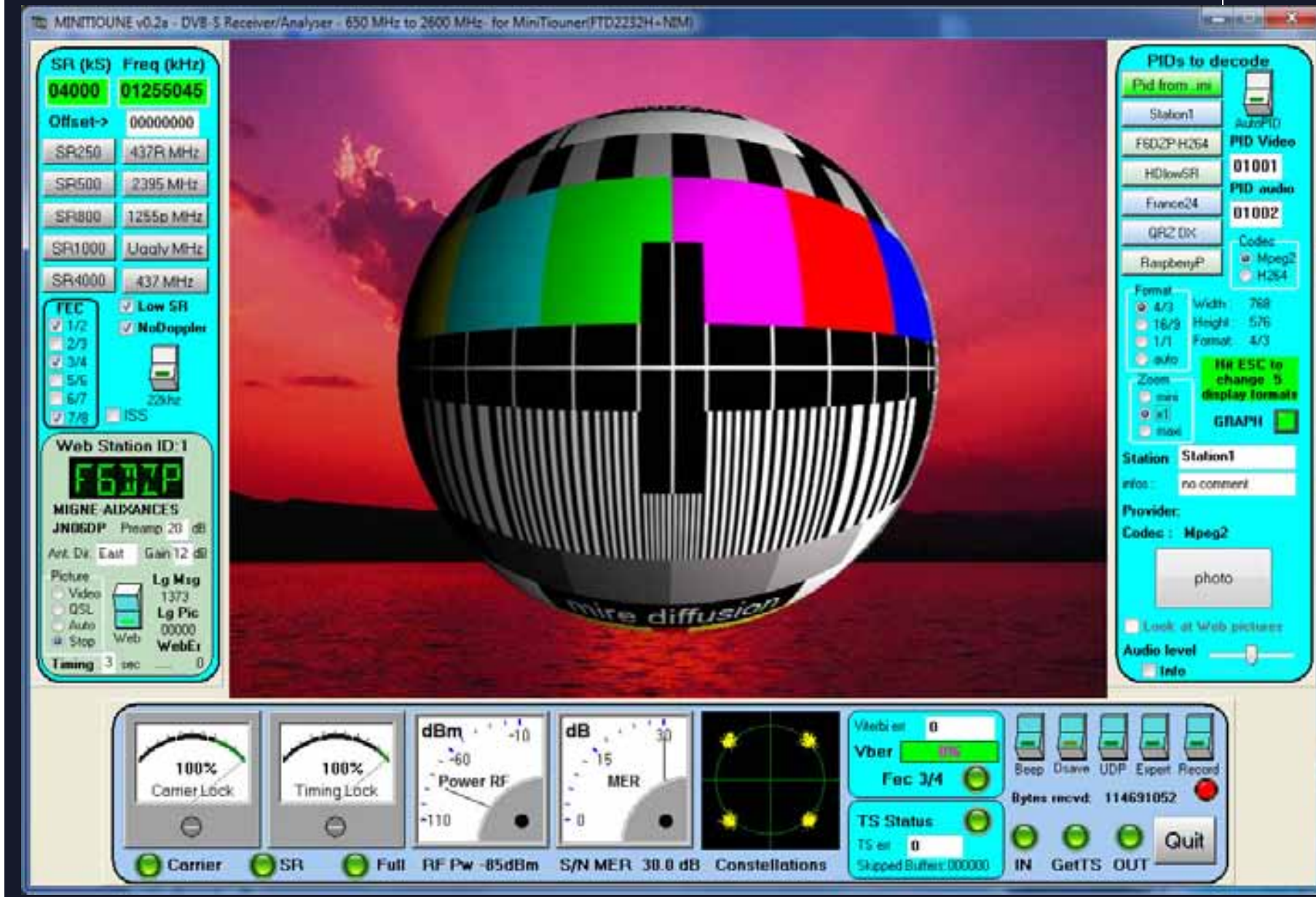
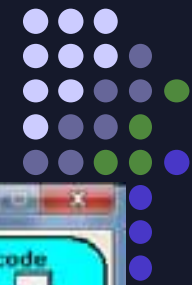
Software : Minitioune v0.1 April 2015



We use VLC to see the video



MiniTioune V0.2a Sept 2015



Minitioune v0.2 Expert mode



MINITIOUNE v0.2a - DVB-S Receiver/Analyser - 650 MHz to 2600 MHz- for MiniTouner(FTD232RL+NM)

BaseBand Gain Synth. Bandwidth
0 dB Auto 10 MHz

TV mode: DVBS

NIM : SHARP/Samsung

SR (KS) Freq (kHz)
00250 01256045

Offset-> 00000000

SR250 437R MHz
SR500 239S MHz
SR800 1255a MHz
SR1000 Uqaly MHz
SR4000 437 MHz

FEC
☒ 1/2
☒ 2/3
☒ 3/4
☒ 5/6
☒ 6/7
☒ 7/8

☒ Low SR
☒ NoDoppler

Web Station ID:1
F632P
MIGNE-AUXANCES
JN06DP Preamp 20 dB
Ant. Di. East Gain 12 dB
Picture
☐ Video
☐ QSL
☐ Auto
☐ Stop
Lg Mrg 0000
Lg Pic 0000
Web WebEx
Timing 3 sec 00000.0

Frequency (kHz)
Freq. set: 1255000 kHz
Deviation: -90 kHz
Freq-> 1254910 kHz
Carrier Width: 330 KHz

Symbolrate (KS)
SR set: 249938S
Deviation: 39S
SR-> 250 KS/s

Scan strategy
scan mode
☐ no loop
☐ loop wide
☐ loop narrow
☐ chained
scan range
☐ wide
☐ narrow

PreLock
wide range 10
Timer1 0
Timer2 2.5

PostLock
narrow range 5
Timer1 0
Timer2 2.5

Derotator ON/OFF
Derotator
☐ Off
☐ On
Algo1
☐ costas
☐ cfoen1
☐ cfoen2
Algo2
☐ ChR7dB
☐ ChR7dB
☐ native

Equalizer
Equalizer
☐ Off
☐ frozen
☐ very slow
☐ median
☐ fastest

IQ Swap: ON Compensation
DCOffset
☐ Off
☐ On
☐ Off last
☐ On fixed
Imbalance
☐ Off
☐ On
☐ Off last
☐ On fixed
Quadrature
☐ Off
☐ On
☐ Off last
☐ On fixed

Level x2

Error/Event
Error/Event Type
☐ demod bit errors
☐ Viterbi errors
☐ Viterbi(Feed5olo) bit error
☐ Viterbi(Feed5olo) byte error
☐ Frame rate LDPC(52)
☐ Viterbi(Feed5olo) bit BER
☐ Viterbi(Feed5olo) byte BER
☐ Viterbi(Feed5olo) bit BER
☐ Viterbi(Feed5olo) byte BER
☐ Viterbi(Feed5olo) packet error
☐ Viterbi(Feed5olo) packet error nbr
☐ bad dcm+sync (52)
☐ TS error count, packet error final
☐ TS FIFO
☐ packet rate

AGC Tuner = 40641 U
Feed
☐ Ch/54
☐ Ch/1E
56dB
AGC Integrator = 92 U
46dB

S/N NOISE
Absolute
NOS speed
☐ 2"20slow
☐ 2"18
☐ 2"16
☐ 2"14
☐ 2"12
☐ 2"10
☐ 2"8
☐ 2"0fast
Normalized

Constellations
Port of measure
☐ Demod output
☐ equo output
☐ deoc2 output
☐ Symbol+inter output
☐ inter symbol output
☐ deoc1 output
☐ IQ mismatches out
☐ demod input

Error counter
Nbr of Event
☐ count with reset
☐ count without reset
☐ 2"14
☐ 2"16
☐ 2"18
☐ 2"20
☐ 2"22
☐ average

PIDs to decode
Pid from .ini
Station1
F602P H264
HDlowSR
France24
QR2 DM
RaspberryP
AutolPID
PID Video
01001
PID audio
01002
Codec
☐ Mpeg2
☐ H264
Format
☐ 4/3
☐ 16/9
☐ 1/1
☐ auto
Width: 320
Height: 240
Format: 4/3
Zoom
☐ min
☐ x1
☐ max
GRAPH
Station Station1
Info: no comment
Provider:
Codec: H264
photo
☐ Look at Web pictures
Audio level
Info

Carrier Lock 100%
Timing Lock 100%

Power RF -60 dBm
MER 15 dB

Constellations

Viterbi 0
Vbar 0%
Fec 7/8

TS Status
TS in 0
Skipped Buffers: 000000

Deep Drive UDP Expert Record

Bytes recvd: 1019040

IN GeTS OUT

Quit

Minitioune v0.4c Expert mode



MINITIOUNE v0.4c - DVB-S Receiver/Analyser - 650 MHz to 2600 MHz - for MiniTuner(FTD232RL+NM)

SR (kS) Freq (kHz)
02000 01255000
Offset - 00000000
SR2000 12550 MHz
SR125 2395 MHz
SR250 43720 MHz
SR4000 43720 MHz
SR27500 43720 MHz

FEC
☒ 1/2
☒ 2/3
☒ 3/4
☒ 5/6
☒ 6/7
☒ 7/8
☒ Low SR
☒ 23kHz
☒ OFF
☒ ON
☒ TS_OK
☒ ISS

Web Station ID:1
F6DZP
MIGNE-AIDANCES
JN06DP Preamp 20 dB
Ant. Dir. East Gain 12 dB
Picture
☒ Video
☒ QSL
☒ Auto
☒ Stop
Lg Msg 0000
Lg Pic 0000
Web WebEr
Timing 2 sec 00000 0

Tuner BaseBand Gain
0 dB Auto
MiniTioune DVB
NIM : SHARP/Samsung
TV mode: searching

Frequency (kHz)
Freq. set: 1255000 kHz Target Freq: 1255000kHz
Freq -> 1255167 kHz
Target Dev 0 Deviation: 167 kHz

Scan strategy
scan mode
☒ no loop
☒ loop wide
☒ loop narrow
☒ channel
1 search
scan range
☒ wide
☒ narrow
PreLock wide range: 12 narrow range: 10
Timer1: 8 Timer2: 3.0
pll cor: 1 auto

PIDs to decode
Pid from 0000
F6DZP-Mpeg2 AutoPID
F6DZP-H264 PID Video 01001
HDlowSR PID audio 01002
France24
QRZ DX
RaspberryPi
Format
☒ 4/3 Width: 720
☒ 16/9 Height: 540
☒ 1/1 Format: ?
☒ auto
Zoom
☒ adapt
☒ x1
☒ max
GRAPHI ☒

Station F6DZP-Mpeg2
info: no comment
Provider:
Codec: Mpeg2
photo:
Audio level
Info

Symbolrate (kS) Mode
SR set: 1987812S
Deviation: -10353S
SR -> 1977 kS/s
Carrier Width: 2684 KHz

IQ
Swap: OFF
x2 ☒
I: 3 Q: 3 Equa Noise

Carrier Lock 29%
Timing Lock 0%
Power RF -110 dBm
MER 15 dB
Constellations

Web er
Vber 100%
Fec ?/?
TS Status
TS er
TS Buffer: 7036 bytes

Reep Dsave UDP Expert Record
Bytes recvd: ??????
IN OUT
Quit

Minitioune v0.4c Expert mode



MINITIOUNE v0.4c - DVB-S Receiver/Analyser - 650 MHz to 2600 MHz - for MiniTuner(FTD232RL+NM)

Tuner BaseBand Gain: 0 dB Auto

SR (kS) Freq (kHz)
04000 01255000
Offset: 00000000
SR2000 12550 MHz
SR125 2395 MHz
SR250 43720 MHz
SR4000 43700 MHz
SR27500 43700 MHz
FEC: 1/2, 2/3, 3/4, 5/6, 5/7, 7/8, Low SR, 23Hz, OFF, ON, TS_OK, ISS

Web Station ID:1
F6DZP
MIGNE-AUXANCES
JND6DP Preamp 20 dB
Ant. Dir: East Gain 12 dB
Picture: Video, QSL, Auto, Stop
Lg Msg: 0000, Lg Pic: 0000, WebEx: 0000000
Timing: 3 sec

Frequency (kHz)
Freq. set: 1255000 kHz Target Freq: 1254991 kHz
Freq → 1254993 kHz
Target Dev: -9kHz Deviation: -7 kHz

Scan strategy
scan mode: no loop, loop wide, loop narrow, chained
scan range: wide, narrow
PreLock: wide range 12, Times1: 8
PostLock: narrow range 10, Times2: 3.0
p11 cur: 1 auto

dBm
AGC1: 60, 2dB
AGC2: 46, 14dB

PIDs to decode
Pid from ini
Station1: F6DZP-H264, PID Video: 01001, PID audio: 01002
Codec: Mpeg2, H264
Format: 4/3, Width: 768, Height: 576, Format: 4/3
Zoom: adapt, v1, max
GRAPH: ☒
Station: Station1
info: no comment
Provider:
Codec: Mpeg2
photo
Audio level:
Info

Scan width
+/- 8000 kHz, +/- 4000 kHz, +/- 2000 kHz, +/- 1000 kHz, +/- 500 kHz, +/- 250 kHz, +/- 125 kHz

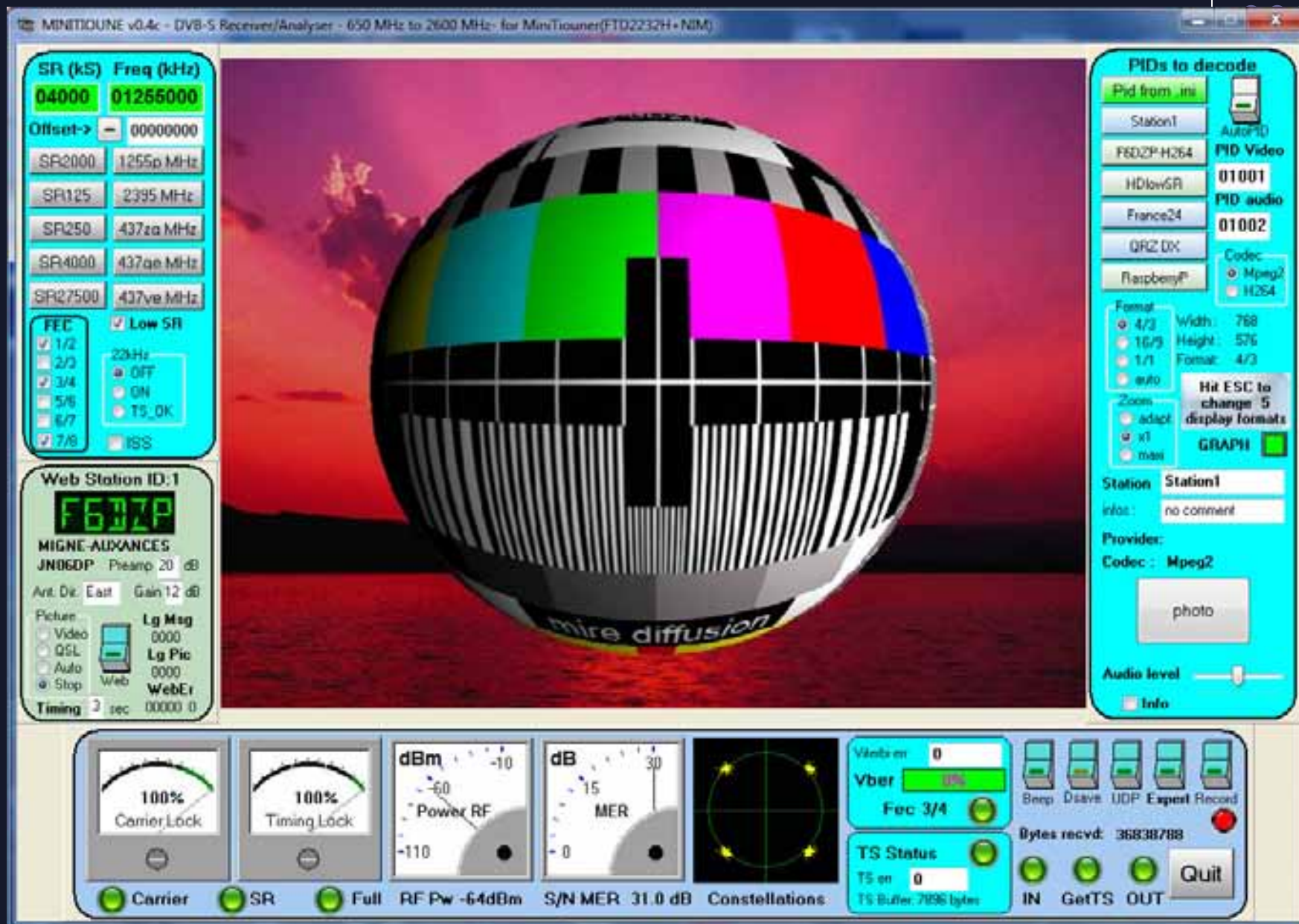
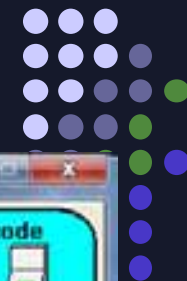
Symbolrate (kS)
SR set: 3976535S
Deviation: 24853S
SR → 4001 kS/s
Carrier Width: 5369 KHz
Mode: A, B

IQ
Swap: OFF, x2
E: 14 Q: 14
Equa: Noise

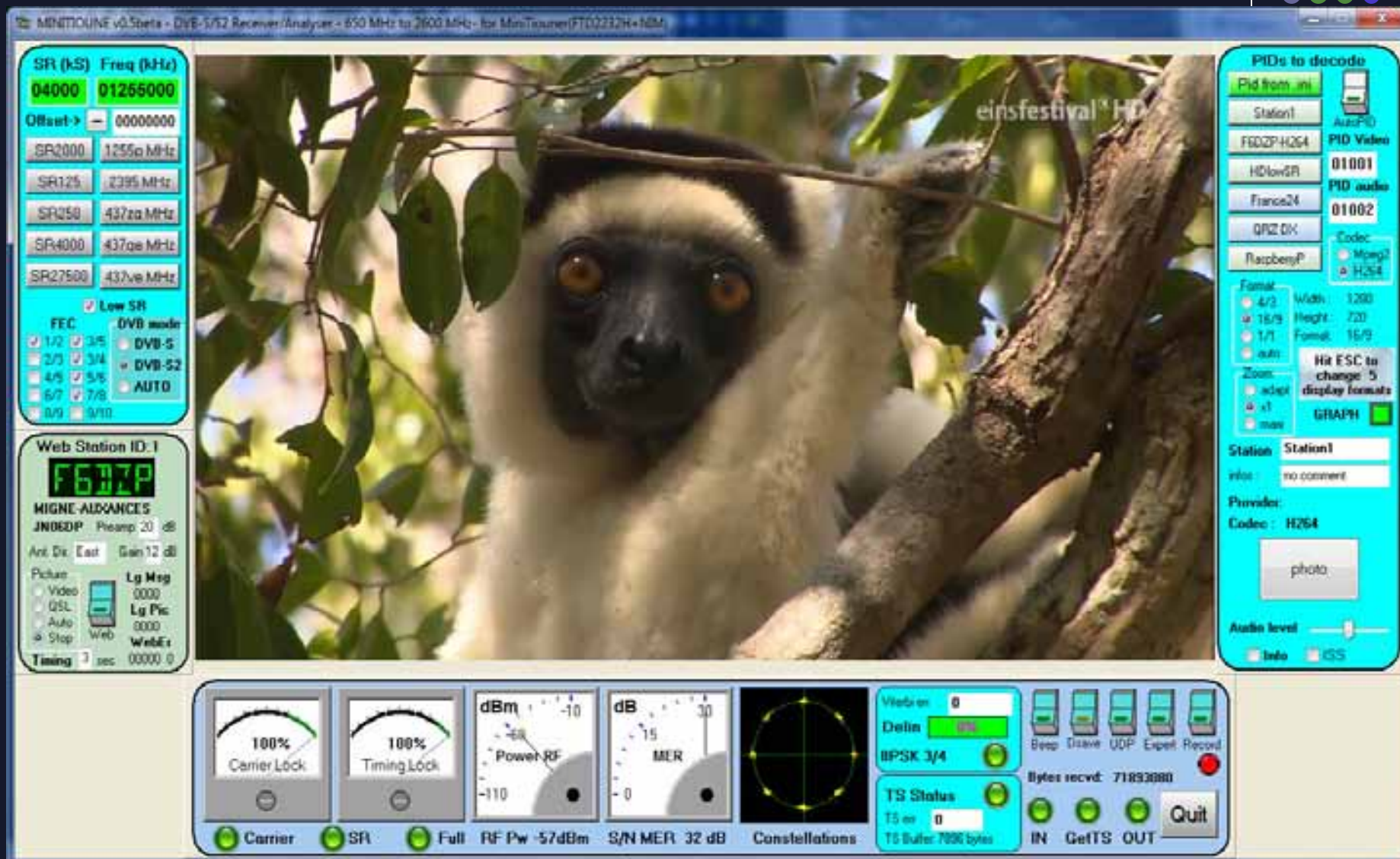
Carrier Lock 100%
Timing Lock 100%
Power RF dBm: -60 to -110
MER dB: 15 to 30
Constellations

Video Vbtr: 0, Fec 3/4
TS Status TS err: 0, TS Buffer: 7896 bytes
Beep, Drive, UDP, Expert, Record
Bytes recvd: 303481444
IN, GetTS, OUT, Quit

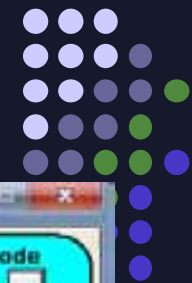
Minitioune v0.4c June 2016



Minitioune v0.5 Sept 2016



Minitioune v0.5 = DVB-S and S2



MINITIOUNE v0.5beta - DVB-S/S2 Receiver/Analyser - 650 MHz to 2600 MHz - for MiniTouner(FTD2232H+NIM)

Tuner BaseBand Gain: 0 dB Auto

MiniToune DV3 by F6DZP NIM : SHARP/Samsung TV mode: DVBS2

SR (kS) Freq (kHz)
04000 01255000
Offset -> 00000000
SR2000 12550 MHz
SR125 2395 MHz
SR250 43720 MHz
SR4000 43700 MHz
SR27500 43700 MHz

FEC **DVB mode**
1/2 3/5 DVB-S
2/3 3/4 DVB-S2
4/5 5/6 AUTO
6/7 7/8
8/9 9/10

Frequency (kHz)
Freq. set: 1255000 kHz Target Freq: 1254991 kHz
Freq -> 1254991 kHz
Target Dev -9kHz Deviation: -9 kHz

Scan strategy
scan mode: no loop 1 search
loop wide scan range: wide
loop narrow scan range: narrow
chained
PreLock wide range: 12 PostLock narrow range: 10
Timer1 0 Timer2 3.0
pll cor: 0 auto

PIDs to decode
Pid from .ini
Station1 AutoPID
F6DZP H264 PID Video 01001
HDlowSR PID audio 01002
France24
QR2 DX
RaspberryPi
Format: 4/3 Width: 768
16/9 Height: 576
1/1 Format: 4/3
auto
Zoom: edsp1
x1
maxi
GRAPH

Station Station1
info: no comment
Provider:
Codec: Mpeg2
photo
Audio level
Info ISS

Web Station ID: 1
F6DZP
MIGNE-AUXANCES
JN06DP Preamp 20 dB
Ant. Di: East Gain 12 dB
Picture: Video Lg Mrg 0000
QSL Lg Pic 0000
Auto Web WebEr
Timing 3 sec 00000 0

Scan width
+/- 9000 kHz
+/- 4000 kHz
+/- 2000 kHz
+/- 1000 kHz
+/- 500 kHz
+/- 250 kHz
+/- 125 kHz

Symbolrate (kS)
SR set: 3976535S Mode: A
Deviation: 24853S
SR -> 4001 kS/s
Carrier Width: 5369 KHz

IQ
Swap: ON
x2
I: 76 Q: 76
Equis Noise

dBm -10
-60
-110
Power RF

dB 15 30
MER

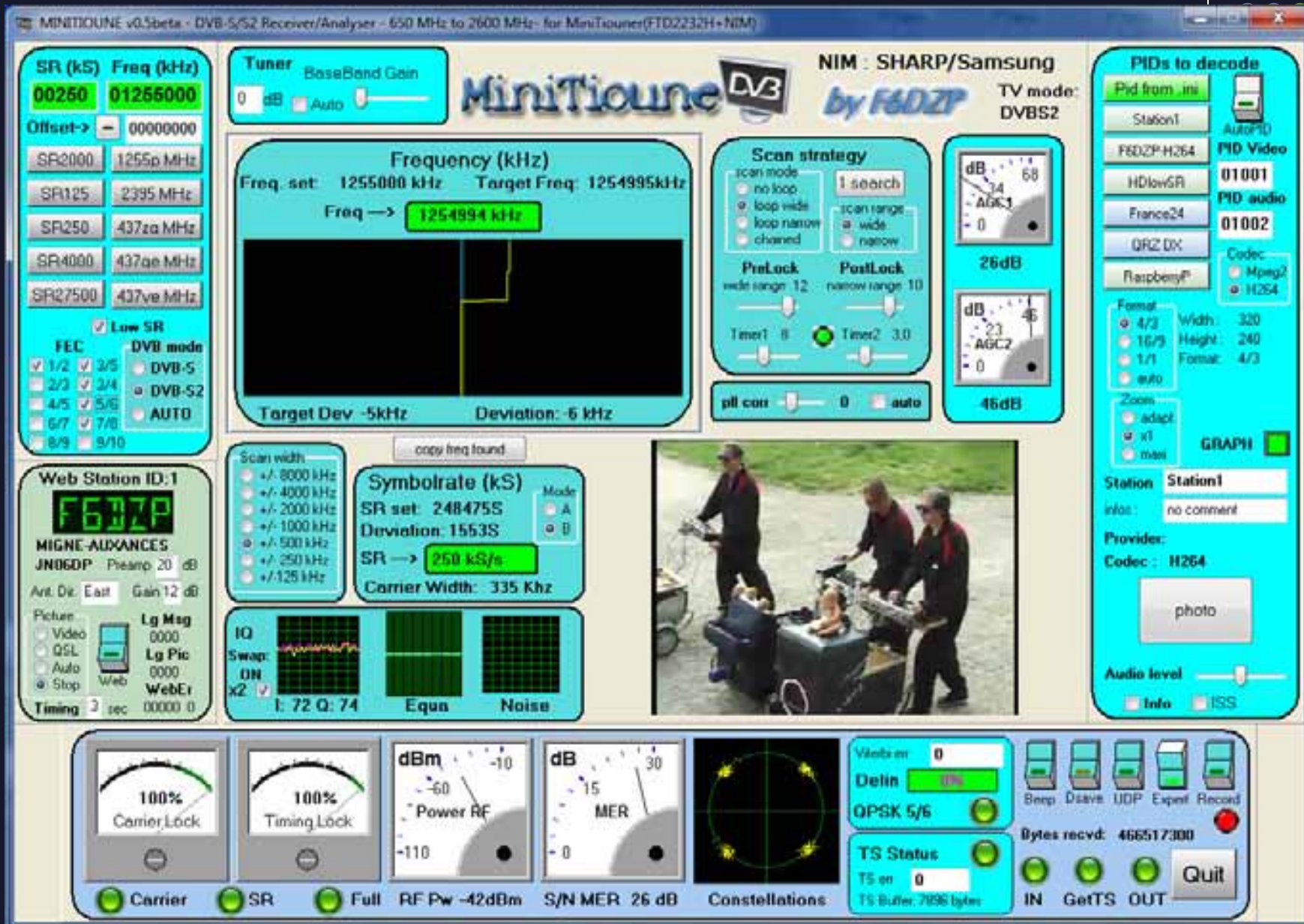
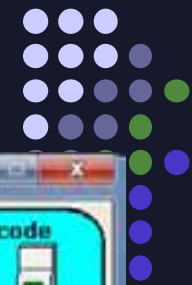
Constellations

Modem 0
Delin 100
8PSK 3/5
TS Status
TS in 0
TS Buffer: 7686 bytes

Bytes recvd: 12279596
IN GetTS OUT
Quit

Carrier **SR** **Full** **RF Pw** -57dBm **S/N MER** 34 dB

Minitioune v0.5 DVBS2-low SR



What new features does DVB-S2 offer?



Four modulation modes:

- **QPSK** and **8PSK** are proposed for broadcast applications, and can be used in non-linear transponders driven near to saturation.
- **16APSK** and **32APSK** are used mainly for professional, semi-linear applications, but can also be used for broadcasting though they require a higher level of available C/N and an adoption of advanced pre-distortion methods in the uplink station in order to minimize the effect of transponder linearity. (not offered with standard NIM)

What new features does DVB-S2 offer?



Improved coding

a modern large **LDPC code** is concatenated with an outer **BCH code** to achieve quasi-error free (QEF) reception conditions on an AWGN channel. The outer code is introduced to avoid error floors at low bit-error rates.

A single FEC frame may have either 64800 bits (normal) or 16200 bits (short) not offered with standard NIM.

Several code rates for flexible configuration

1/4, 1/3, 2/5, 1/2, 3/5, 2/3, 3/4, 4/5, 5/6, 8/9, and 9/10. Code rates 1/4, 1/3, and 2/5 have been introduced for exceptionally poor reception conditions in combination with QPSK modulation. (not offered with standard NIM)

What new features does DVB-S2 offer?



Improved rolloff:

0.20 and 0.25 in addition to the roll-off of DVB-S 0.35.

ACM/VCM : adaptive / variable coding modulation.

- Variable coding and modulation (VCM) to optimize bandwidth utilization based on the priority of the input data, e.g., SDTV could be delivered using a more robust setting than the corresponding HDTV service.
- Adaptive coding and modulation (ACM) to allow flexibly adapting transmission parameters to the reception conditions of terminals, e.g., switching to a lower code rate during fading. (not offered with standard NIM)

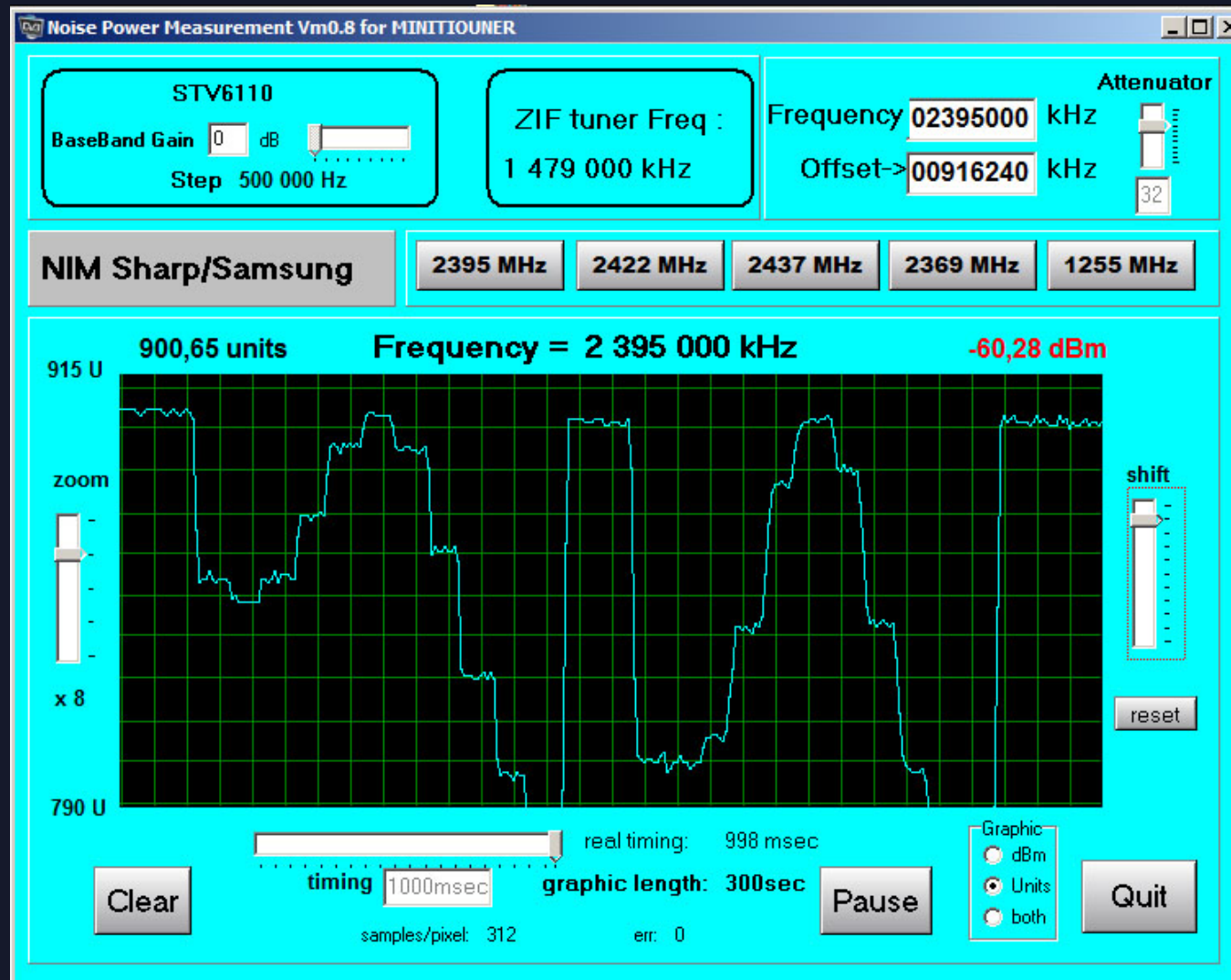


Should we use DVB-S2?

- At standard Symbol rate QPSK:
Better lock for lowest signal.
We could expect a gain of 2dB ???
- At low Symbol Rate QPSK:
Using a standard NIM, my first tests give me
a better result with DVBS
To be confirmed....
Using a NIM “pro”....I have not tested yet,
but I suppose a better result.

Noise Power Measurement

That helps for setting our tracking system, measuring the sun noise, using your MiniTioner





MiniTiouner Pro

MiniTiouner Pro - prototype



MiniTiouner Pro



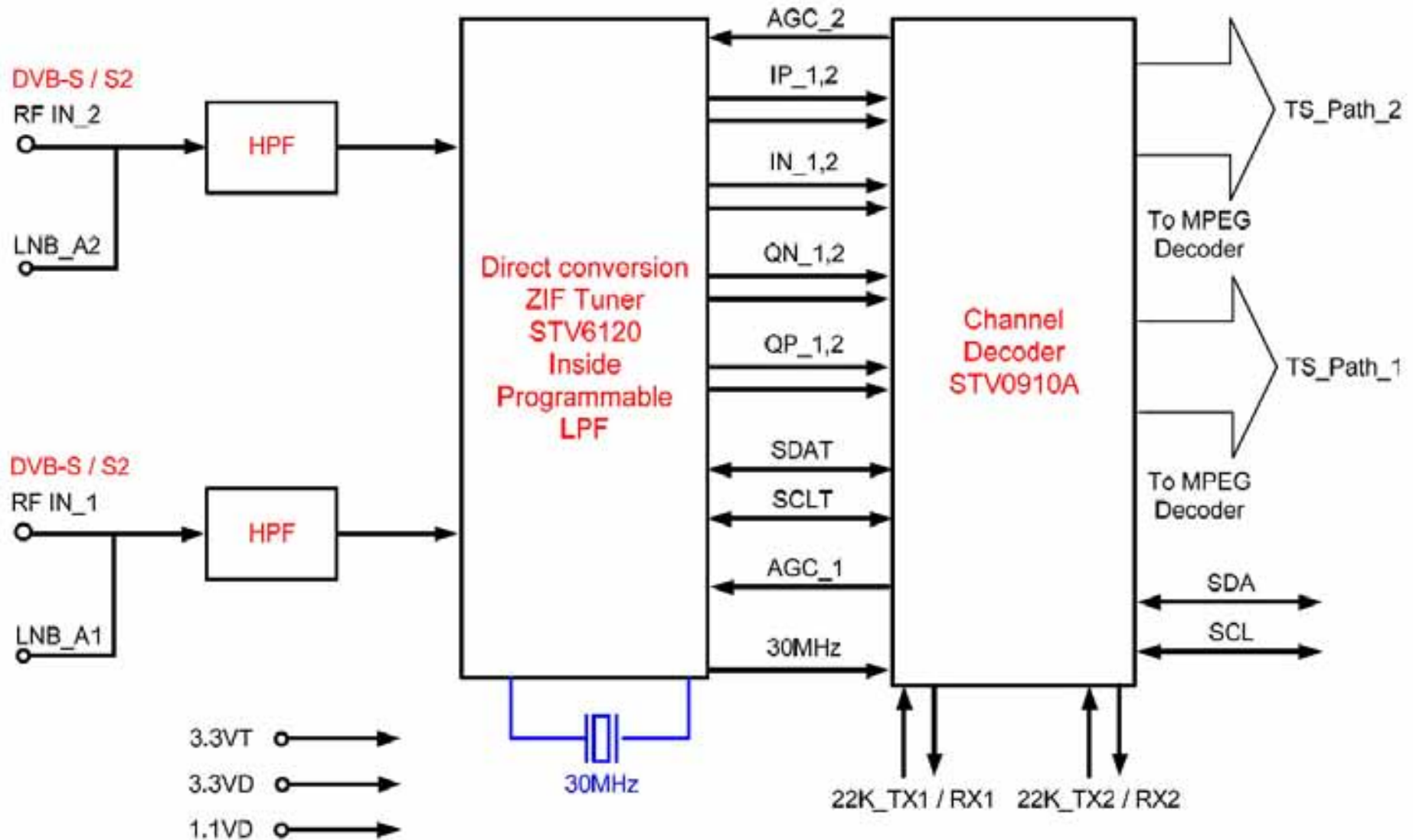
Using a NIM Pro : Serit FTS-4335

- 2 x RF inputs
- 2 x ZIF tuners **wide bandwidth**
- 2 x DVB-S/S2 demodulators **Advanced**
- 2 x TS parallel outputs



NIM FTS-4335

From Serit documentation



Why I call it « Pro » ?



Because there is an « A »!

The DVB S/S2 demodulator is the STV0910A

The « A » means « Advanced »

So we will have advanced features:

- Code rates 1/4, 1/3, and 2/5
- 16 APSK and 32 APSK
- Short frames
- ACM Adaptive coding and modulation
- Low Symbol Rate optimisation
- Data mode, Measuring mode ...

Dual tuner STV6120



Four VLNA inputs + On-chip 4:2 matrix

Input frequency range 250 MHz to 2150 MHz

→ tested working from 144MHz to 2450 MHz

Two independently programmable tuners

RF to baseband direct conversion

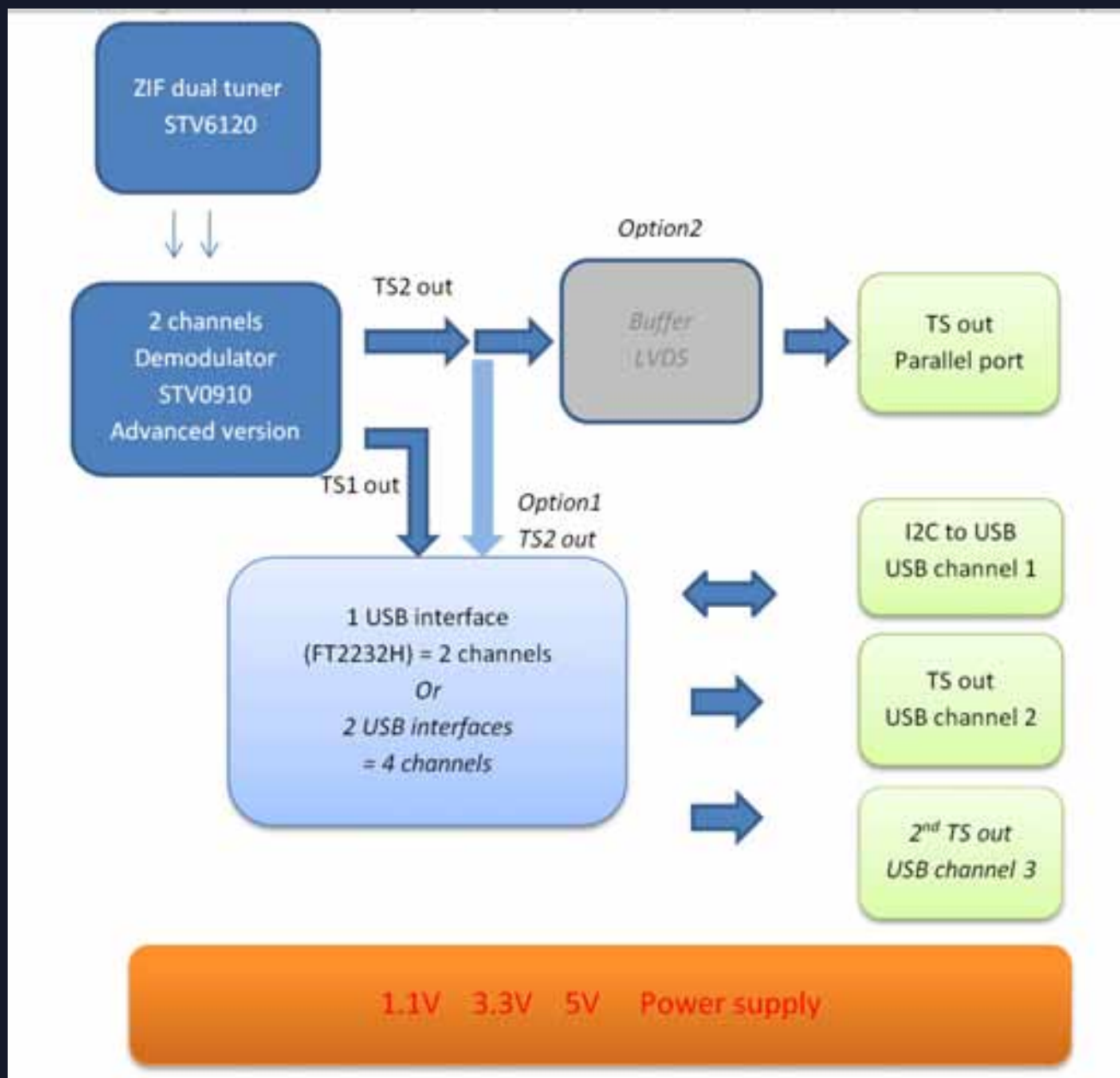
Extremely low phase noise

Continuously variable gain: 0 to 65 dB

Additional and programmable gain on baseband amplifier:
0 to 16 dB

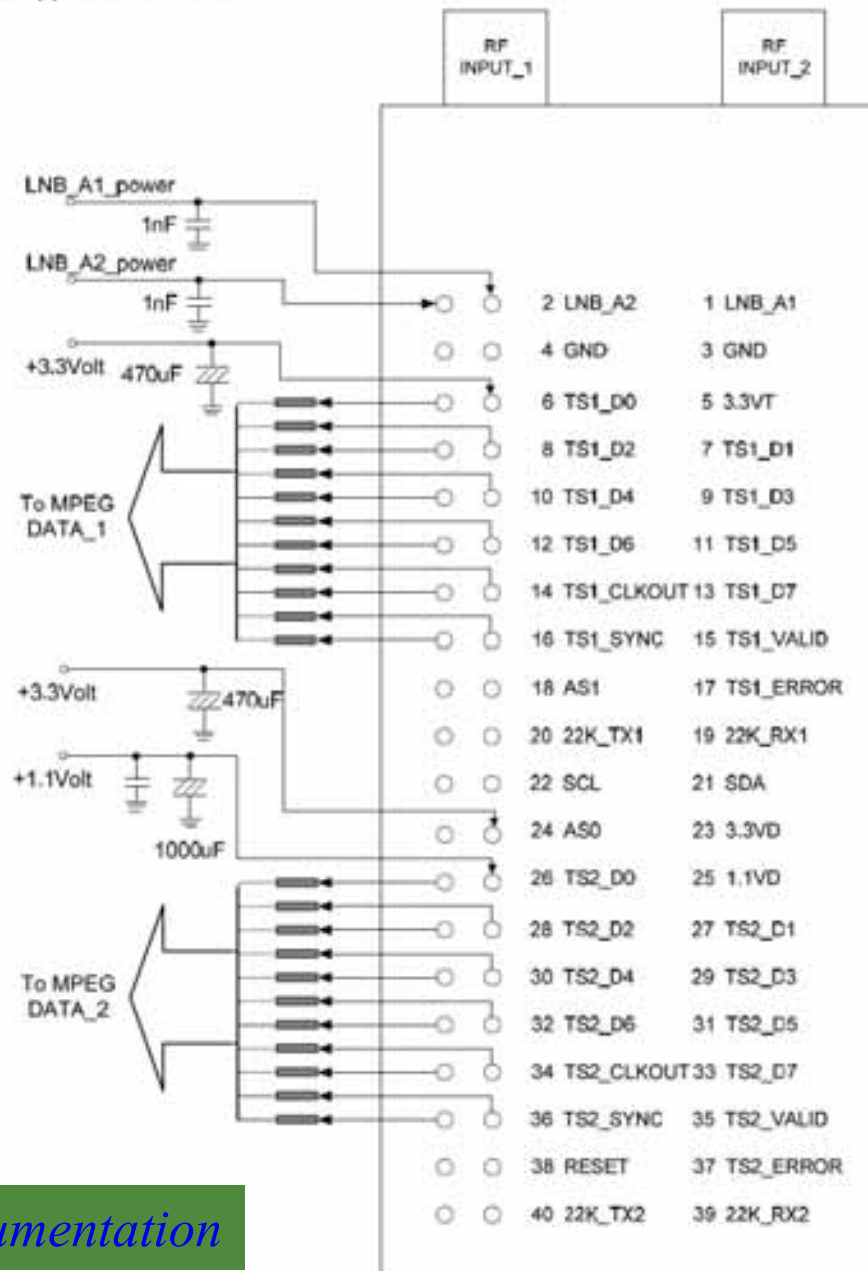
Programmable 5- to 36-MHz cut-off frequency (Butterworth
5th-order baseband filters)

MiniTiounerPro synoptic



FTS-4335

Pin Application Circuit



From Serit documentation

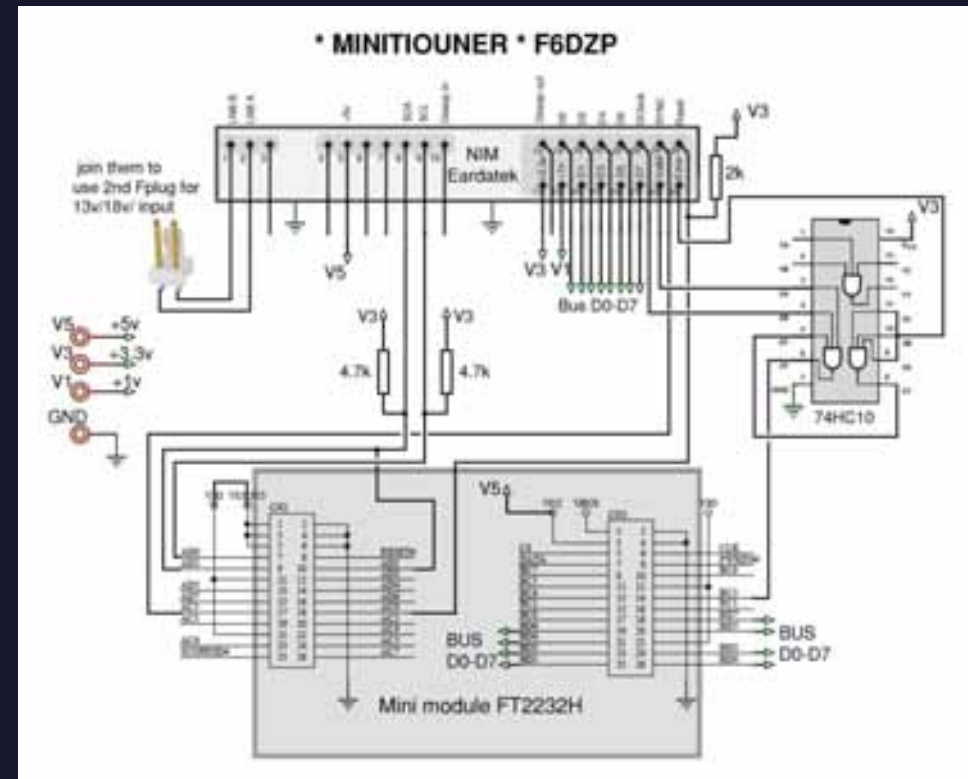
MiniTiounerPro schematic



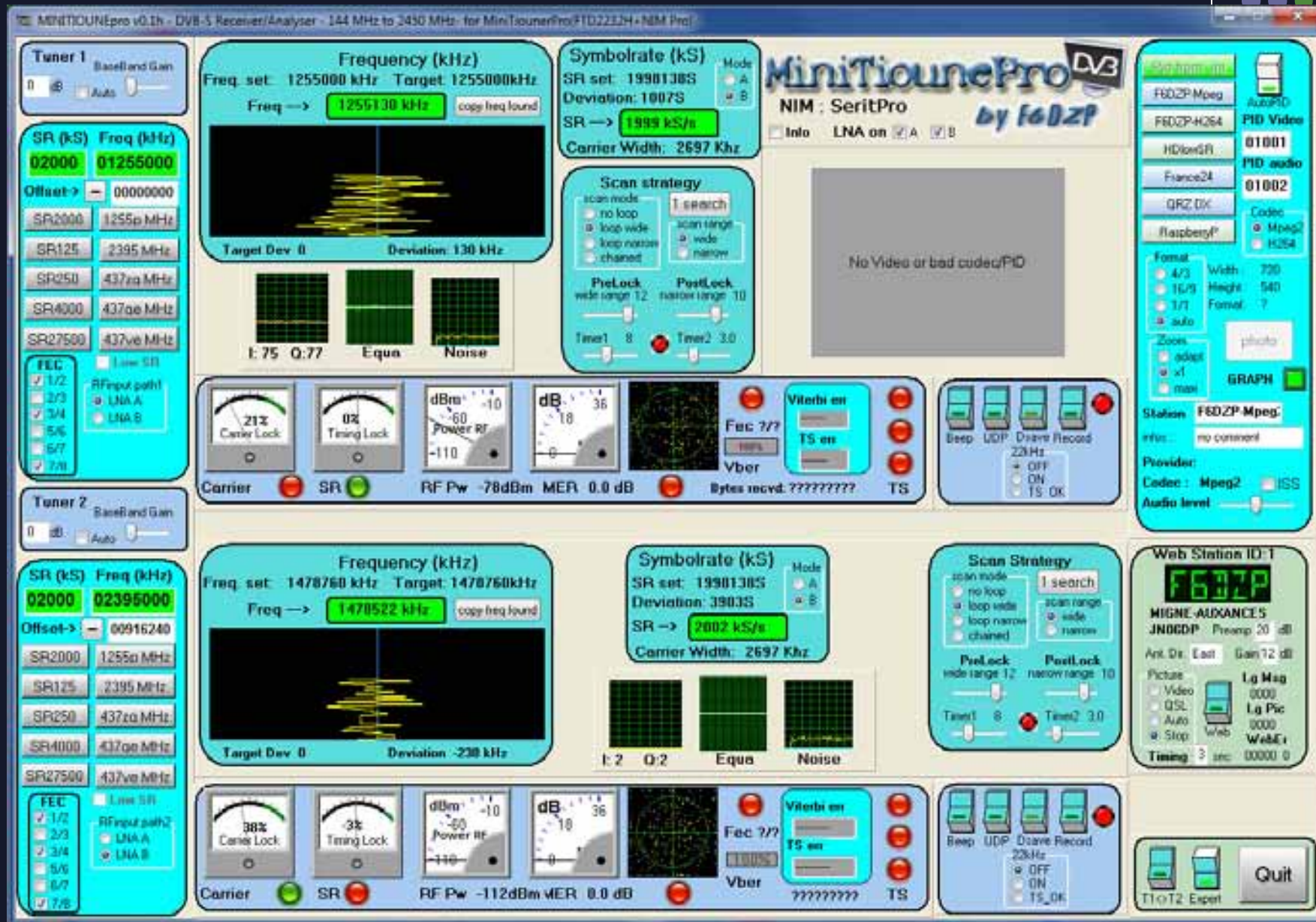
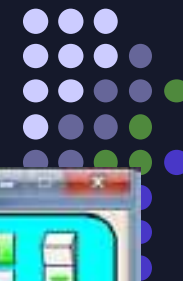
We can use the same schematic as we have used for the MiniTiouner.

We just need another FT2232H if we want to output the 2nd TS via USB

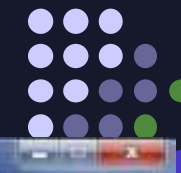
Another option is to output the second TS to a DVB parallel port



New software: Minitioune Pro



Minitioune Pro – 1 freq locked



MINITIOUNEpro v0.11h - DVB-S Receiver/Analyser - 144 MHz to 2450 MHz - for MiniTunerPro (FD2232H+ NIM Pro)

Tuner 1 BaseBand Gain: 0 dB Auto

Frequency (kHz)
Freq set: 1255000 kHz Target: 1255043 kHz
Freq → 1255044 kHz copy freq found

Symbolrate (kS)
SR set: 3998336S
Deviation: 1735S
SR → 4000 kS/s
Carrier Width: 5397 KHz

Scan strategy
scan mode: 1 search
scan range: wide narrow
PreLock: wide range 12 PostLock: narrow range 10
Time1: 0 Time2: 3.0

Station1 AutoPID
F6D2P-H264 PID Video: 01001
HDiceSR: 01002
France24 QM2 DX
RaspberyP Codec: MPEG2 H264
Format: 4/3 Width: 708 Height: 576
Zoom: adapt x1 max
photo GRAPH

Tuner 2 BaseBand Gain: 0 dB Auto

Frequency (kHz)
Freq set: 1478760 kHz Target: 1478760 kHz
Freq → 1478825 kHz copy freq found

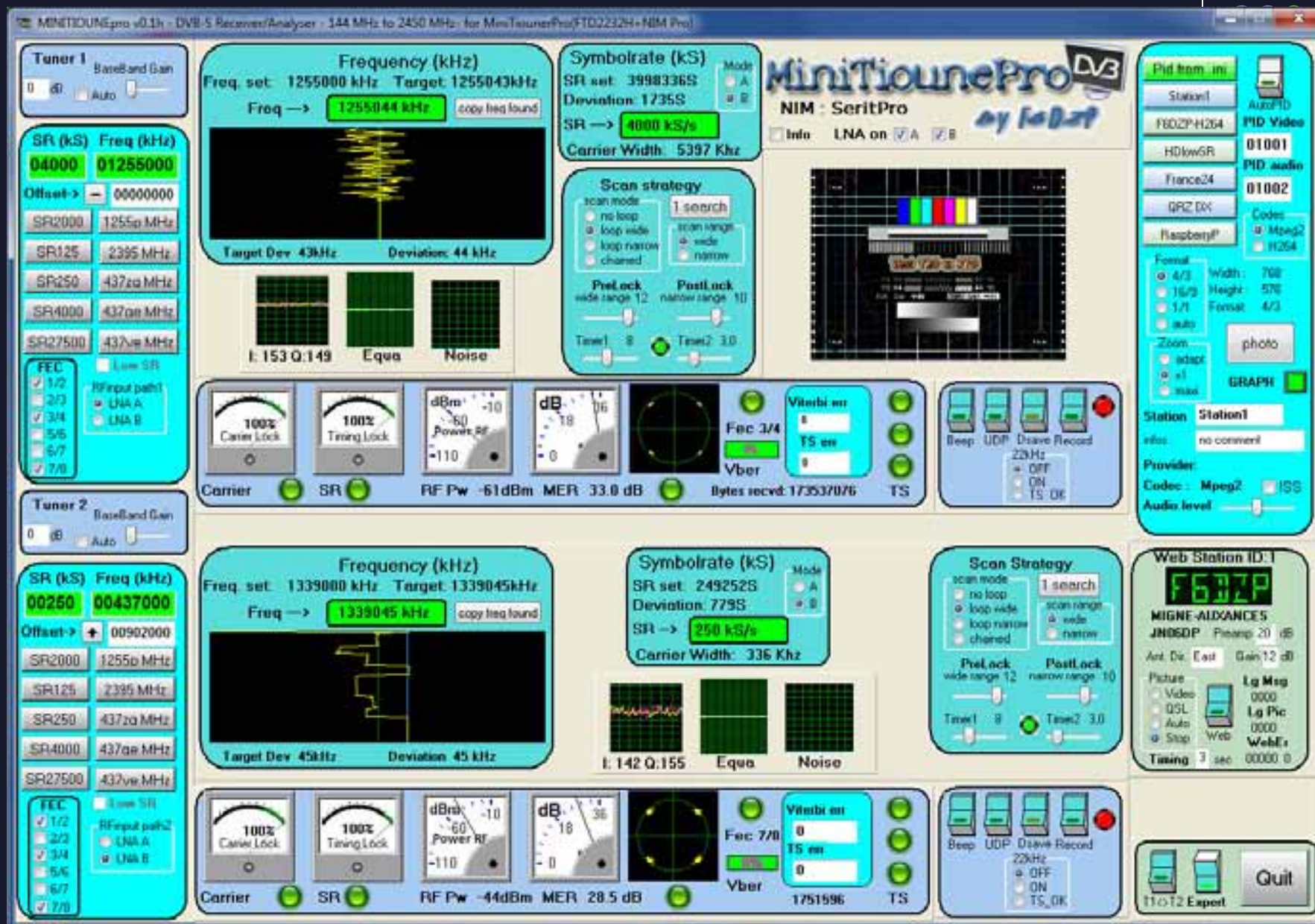
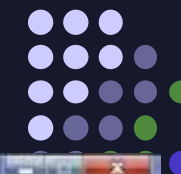
Symbolrate (kS)
SR set: 1998138S
Deviation: -15610S
SR → 1980 kS/s
Carrier Width: 2697 KHz

Scan strategy
scan mode: 1 search
scan range: wide narrow
PreLock: wide range 12 PostLock: narrow range 10
Time1: 0 Time2: 2.0

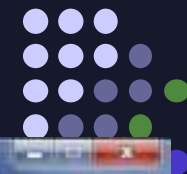
Web Station ID: 1
F6D2P
MIGNE-AUXANCES
JN06DP Preamp 20 dB
Ant. Dk: East Gain 12 dB
Picture: Video Lg Mig: 0000
QSL: Auto Lg Pic: 0000
Stop Web: WebEx
Timing: 3 sec 00000 0

Quit

Minitioune Pro – 2 freq locked



Minitioune Pro – 2 freq locked



The screenshot displays the Minitioune Pro software interface, which is designed for DVB-S Receiver/Analyser. The interface is divided into two main sections, Tuner 1 and Tuner 2, each showing a frequency lock.

Tuner 1:

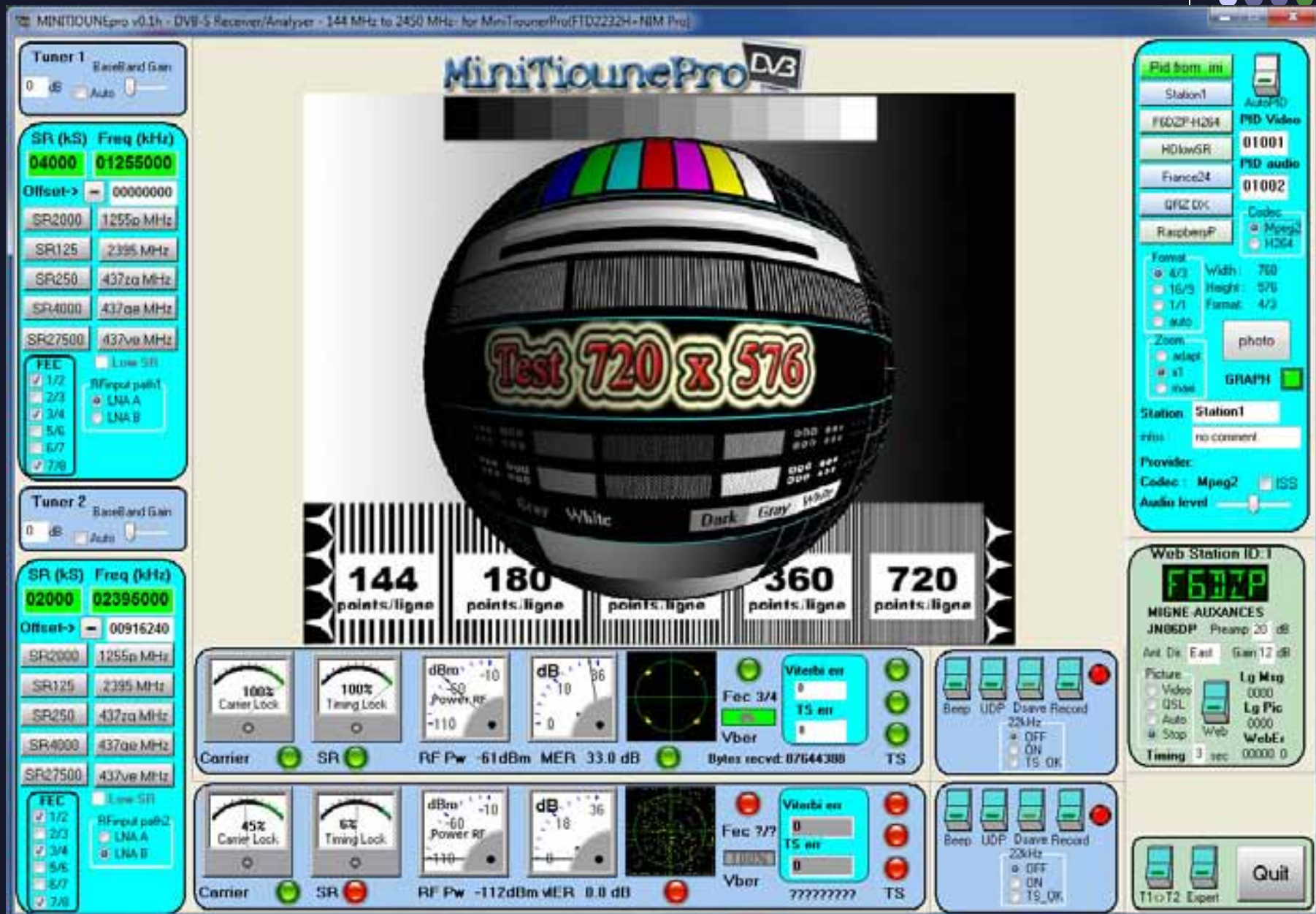
- Frequency (kHz): 1255000 kHz (Target: 1255043 kHz)
- Symbolrate (kS): 3998336S (Target: 1735S)
- Carrier Width: 5397 KHz
- Scan strategy: 1 search
- PreLock: wide range 12, narrow range 10
- PostLock: wide range 12, narrow range 10
- Carrier Lock: 100%
- Timing Lock: 100%
- RF Pw: -61dBm
- MER: 34.5 dB
- Bytes recvd: 9639700
- TS: 0

Tuner 2:

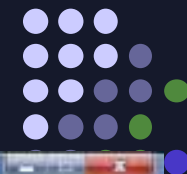
- Frequency (kHz): 1339000 kHz (Target: 1339045 kHz)
- Symbolrate (kS): 249252S (Target: 779S)
- Carrier Width: 336 KHz
- Scan strategy: 1 search
- PreLock: wide range 12, narrow range 10
- PostLock: wide range 12, narrow range 10
- Carrier Lock: 100%
- Timing Lock: 100%
- RF Pw: -44dBm
- MER: 28.5 dB
- Bytes recvd: 187560372
- TS: 0

The interface also includes various control panels on the right side, such as Station1, Station2, and Station3, each with its own set of parameters and controls. The bottom right corner features a 'Quit' button.

Minitioune Pro - TS1 display

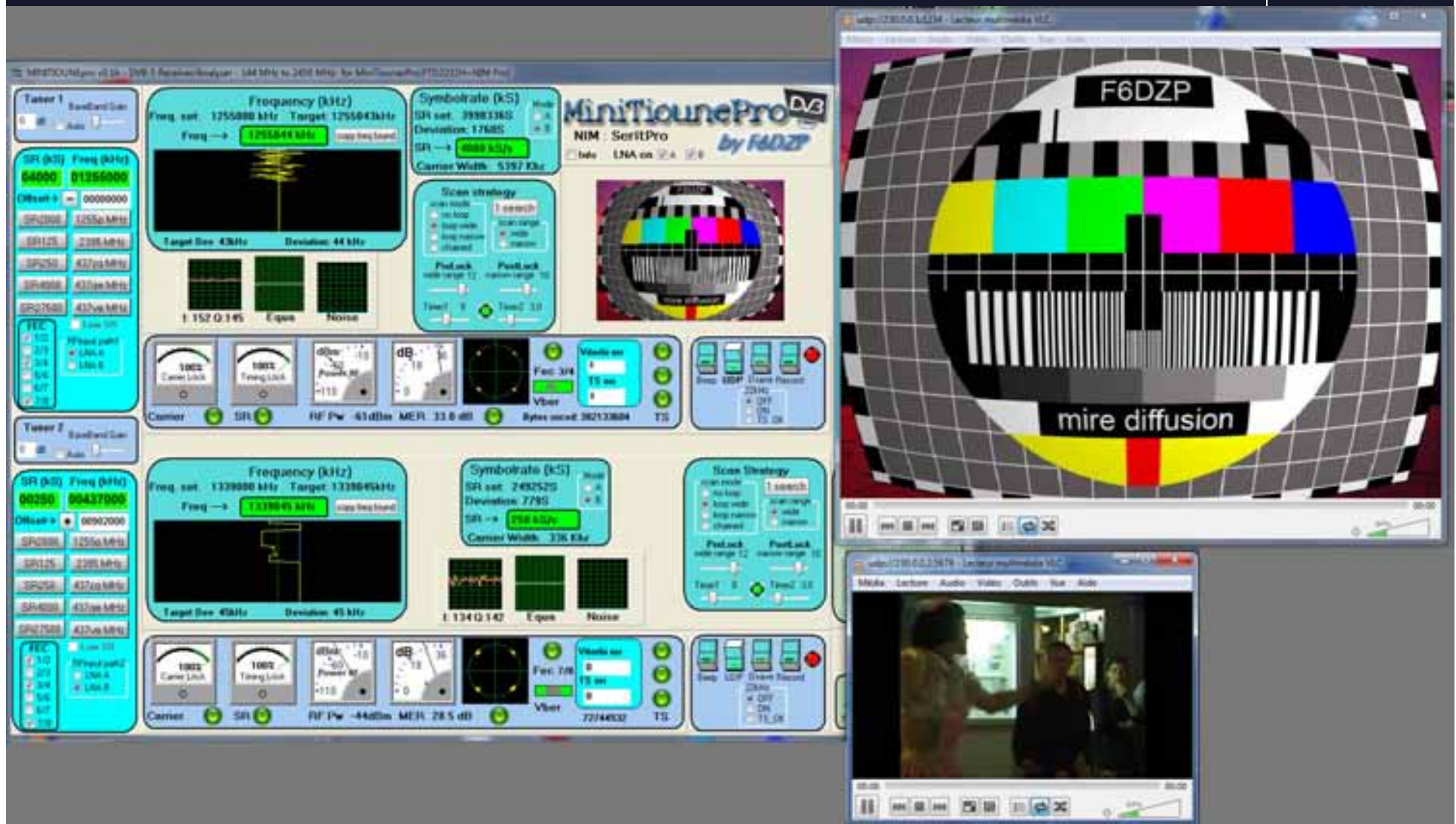


Minitioune Pro –TS2 display



Minitioune Pro

Using 2 VLC



MiniTiouner Pro / Minitioune

next steps



NIM FTS-4335 is easy to buy in lots of 100 units.
Before we create a PCB, we have now to decide which option to choose:

1. Same as MiniTiouner, same schematic : 1 x FT2232H → 1 TS output (demod1 **or** demod2).
2. Double USB TS output using 2 x FT2232H
3. 1 x USB TS output and 1 x TS parallel output
(remember that we have 2 multiplexers that allow us to do many things : receiving and showing a TS and sending the same to the parallel output ...or different TS at different output or ...)

In case we choose solution 3, it is easy to create a little external parallel to USB converter using a 2nd FT2232H

MiniTiouner-Pro - availability



MiniTiouner-Pro seems to be a good solution for the future
It can be used for many applications:

- DATV DVB-S
- Narrow band DATV
- DATV DVB-S2
- Receiving HamTV
- Receiving broadcast satellite DVB-S or DVB-S2

For a first solution, a kit or PCB could be offered.
A second solution could be a MiniTiouner-Pro fully assembled and tested, as proposed by Art Towslee WA8RMC.

Conclusion



- The Minitiouner /MiniTiouner-Pro project offer us to build our own USB DVB-S/**S2** tuner that can receive from SR 120 kS/s up to 45000 kS/s.
- NIM, pcb and others components are available at the BATC shop
- Pipo X8/X9 + Minitiouner = a mobile solution
- Narrow Bandwidth DATV is now possible for DX
- Useful also for receiving HamTV.

All information on www.vivadatv.org Forum

You can also look at the BATC forum :

<http://www.batc.org.uk/forum/>



Thank you for your attention