Kletskous V/U transponder

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Main Specifications

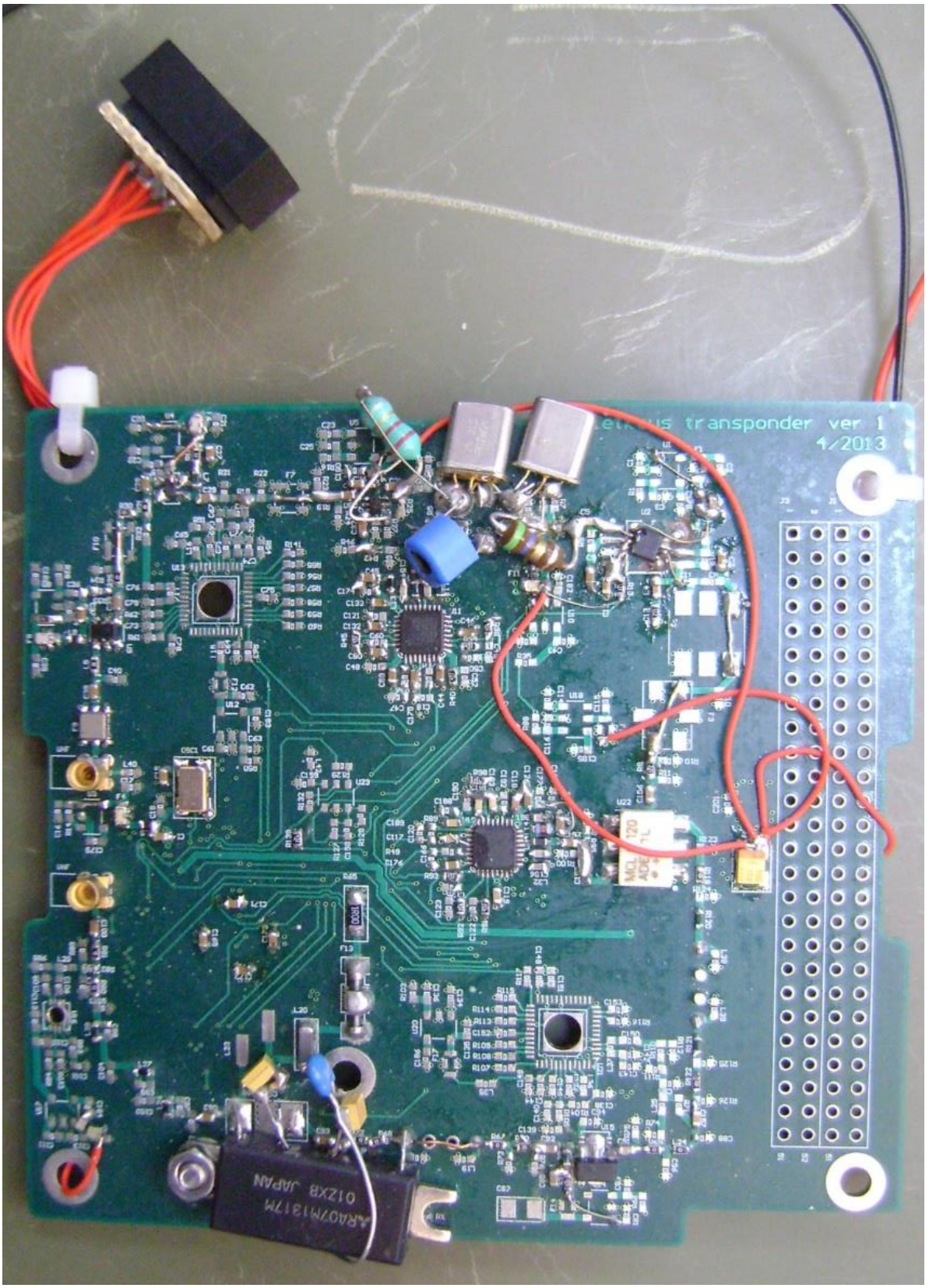
- UHF up to satellite and VHF downlink
- We need about 120dB gain (-100dBm signal will give 20dBm output)
- Output power >200mW or 23dBm
- DC power consumption <1W
- Automatic gain control
- Contain the tele command receiver and telemetry transmitter

Uplink Link budget

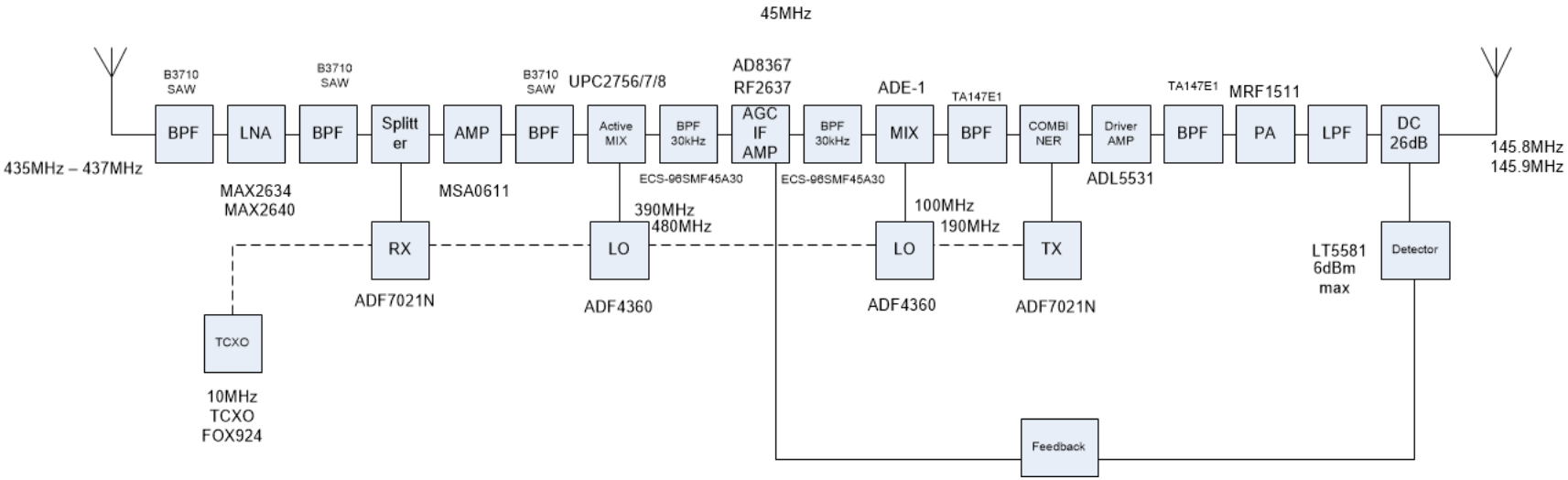
- 152dB loss at UHF on the horizon (2400km)
- 140dB at 600km (right above)
- 12dB improvement (6dB for doubling/halving the distance)
- For 5W (37dBm) + 10dBi gain antenna will give about -105dBm at satellite (0dBi antenna)
- This improves to –93dBm right above

VHF Downlink Link budget

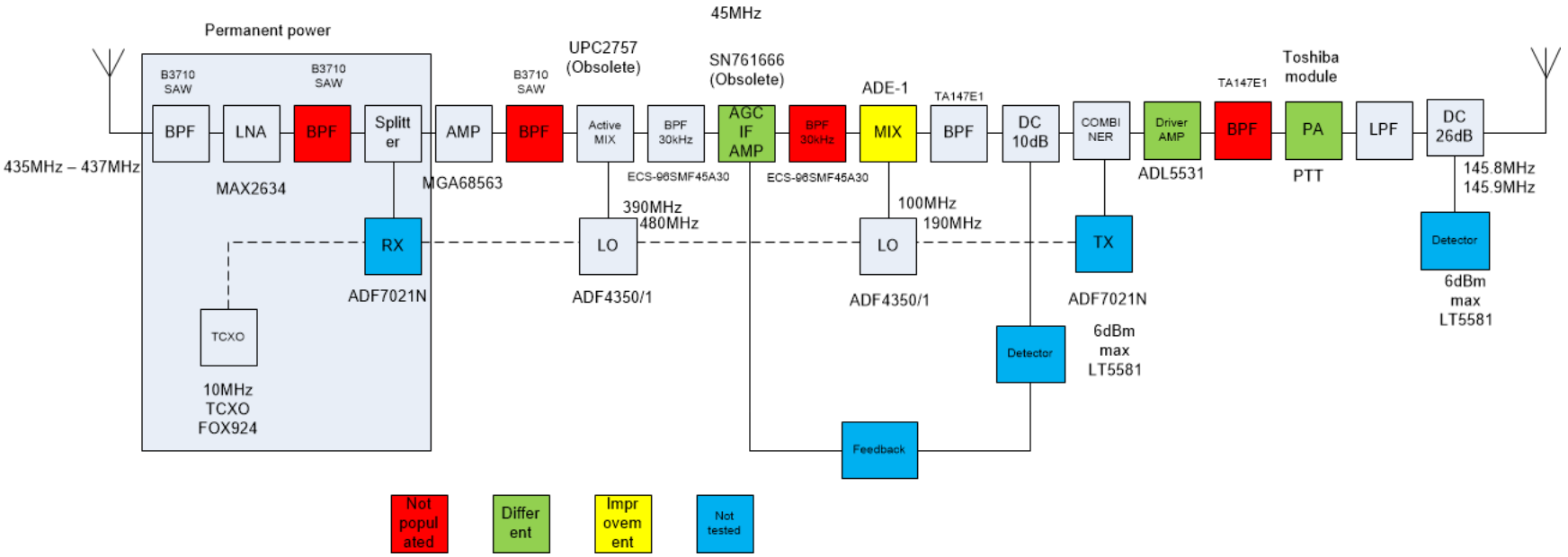
- Everything improves with 6dB
- For 23dBm TX at satellite (0dBi antenna) we will get -113dBm at ground after 10dBi TX antenna
- This improves to -101dBm right above
- Depending on power available we will be able to increase this to maybe up to 2W (another 10dB) as it will be configurable


transponder ver 1
1/2013

Old block diagram



New block diagram

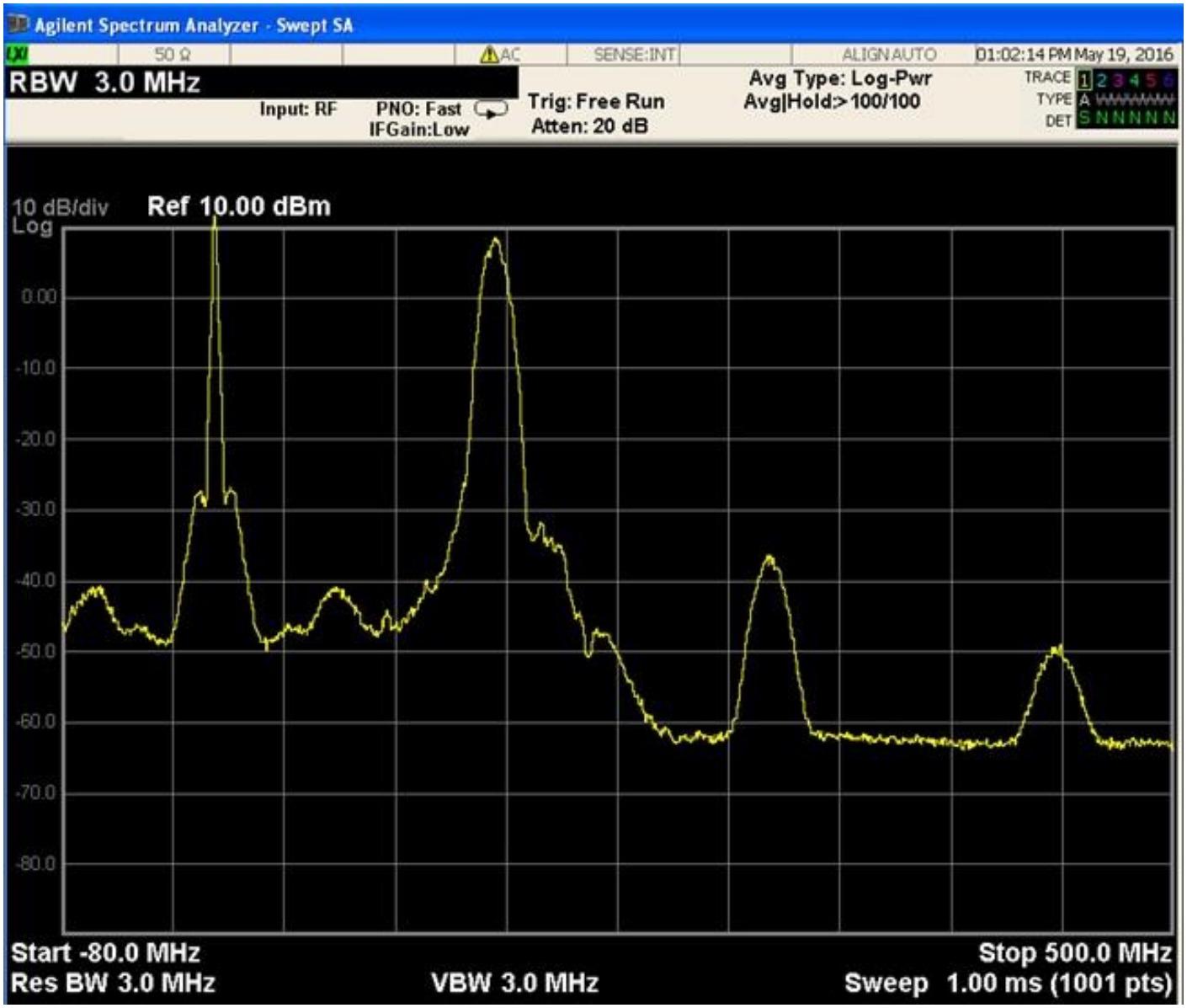


Current version 1 PCB status and updates

- Modular PA and new driver used due to availability and more gain needed
- Different AGC IC used again due to availability
- Less RF SAW filters – only one filter per UHF, IF and VHF stage
- Many regulators not populated and not needed for isolation, but needed for power control
- No PTT yet, but will be implemented using PA V_{gate} output power control and regulators ON/OFF control
- Using a 5V supply and one 3V3 linear regulator for 3V3 devices
- AGC not yet implemented and must change due to wrong place for power measure
- Most likely one antenna port will be used for VHF and UHF combined
- The RX will be powered on the whole time with LNA and TCXO and receiver having always power and uP in sleep mode for minimal DC power usage
- Transceivers not populated yet
- Transceiver interface is being finalized and will probably be directly interfaced with OBC via SPI
- These changes must be implemented on a new (hopefully FM) PCB

Conclusions

- Working 120dB gain system with too much DC power (>3W for 200mW out)
- Final frequencies must be determined for least amount of spurs
- Still considerable work left


Agilent Spectrum Analyzer - Swept SA
50 Ω
AC
SENSE:INT
ALIGN AUTO
01:02:14 PM May 19, 2016
RBW 3.0 MHz
Input: RF
PNO: Fast
IFGain:Low
Trig: Free Run
Atten: 20 dB
Avg Type: Log-Pwr
Avg|Hold:>100/100
TRACE 1 2 3 4 5 6
TYPE A WWWWW
DET S N N N N N
10 dB/div
Log
Ref 10.00 dBm
0.00
-10.0
-20.0
-30.0
-40.0
-50.0
-60.0
-70.0
-80.0
Start -80.0 MHz
Res BW 3.0 MHz
VBW 3.0 MHz
Stop 500.0 MHz
Sweep 1.00 ms (1001 pts)

- -174dBm/Hz
- 3MHz RBW > 63dB
- -111dBm noise power
- Measure just less than 10dBm
- Confirms the gain of 120dB
- Elliptical LPF not yet optimized after PA

Thank you