A simple linear transponder

AMSAT Italy proposal
for ARISS meeting
Washington, december 2002

Overview

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- Satellite communications today

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- Digital

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  - Low speed/high use

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  - FM voice single user repeater style

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- Digital
  - Low speed/high use
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- Analog
  - FM voice single user repeater style
  - Long distance,SSB specialized (AO40)

Overview

- Satellite communications today
- Best results between schools and astronauts

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- Great impact on general public, little return of interest for radioamateurs

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- Few occasions, short time, too people
- Schedule vs random contacts

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- We are loosing other communication systems?

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- Simple duplex QSO (CW or SSB)
- New digital mode (PSK, BPSK, PSK31)

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- Best results between schools and astronauts
- We are loosing other communication systems?

- Simple duplex QSO (CW or SSB)
- New digital mode (PSK, BPSK, PSK31)
- SSTV and others ...

After that?

After that?

- We have few operational satellites

After that?

- We have few operational satellites
- No new satellites at horizon

After that?

- We have few operational satellites
- No new satellites at horizon
- No new projects for large use of space-band segment as demonstrated in the past years

After that?

- We have few operational satellites
- We haven't economical resources for other satellites

After that?

- We have few operational satellites
- We haven't economical resources for other satellites

- why not use technologies and resources available?

AMSAT Italy considerations

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- ISS is the outpost to be used for restart

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  - Interest in communications

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  - Interest in communications
  - Interest in technology

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  - Interest in general for radio activity

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ARISS goals are the same

AMSAT Italy proposal

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- To install on ISS a simple linear transponder (bandwidth 50 KHz)

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- as for Vusat (AMSAT India) project

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  - w/o internal control/intelligence

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- as for Vusat (AMSAT India) project
  - mode B operation (70cm up, 2m down)
  - w/o internal control/intelligence
  - low output power (1W average)

Why ...

Why ...

- Linear transponder

Why ...

- Linear transponder
- For multiple and simultaneous communications

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- Linear transponder
- For multiple and simultaneous communications
- For any type of transmissions (narrowband) actual and future

Why ...

Why ...

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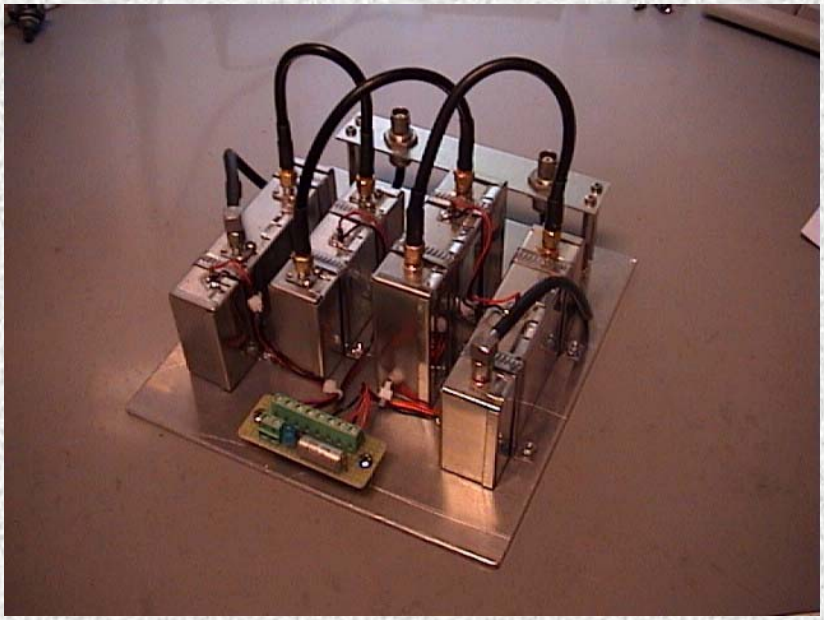

- We have designed and built a full functional breadboard prototype

Why ...

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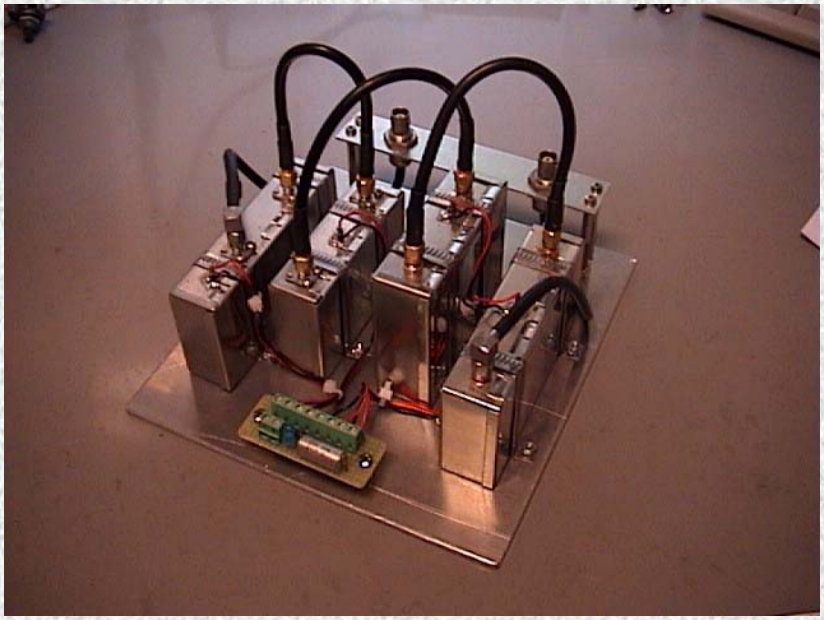

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- using economical COTS (components off the shelf)

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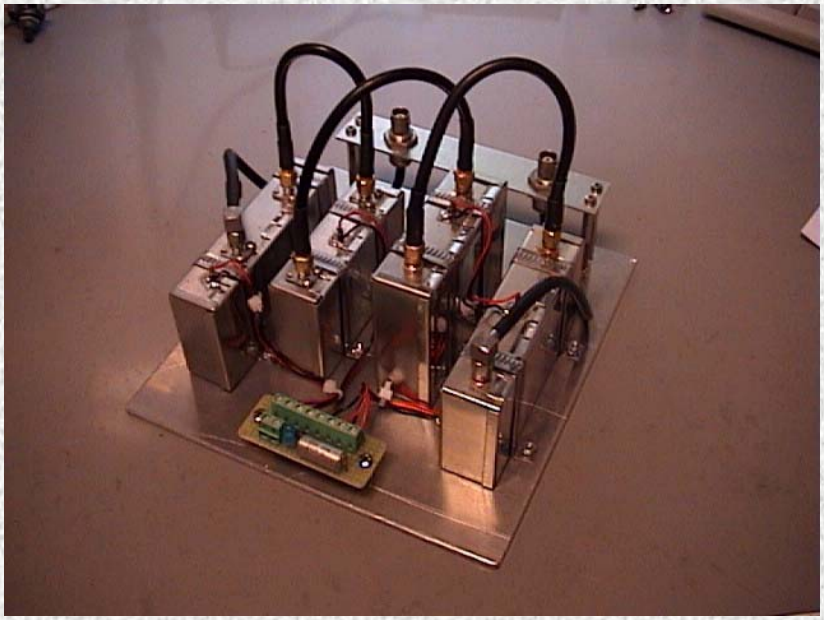

- We have designed and built a full functional breadboard prototype
- using economical COTS (components off the shelf)
- the system is proof and modular

Why ...

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- mode B operation
  (70cm up, 2m down)

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- To obtain maximum use from small and inexpensive stations around the world

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- To obtain maximum use from small and inexpensive stations around the world
- to re-gain the use of V-UHF satellite band
- using antennas already installed on ISS

Why ...

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- w/o internal control/intelligence

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- We have one or more amateurs on ISS

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- We have one or more amateurs on ISS
- the system is controllable as “ in house” ON/OFF
- as for a simple transceiver or TNC

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- Path loss small regarding orbital height
  - A= ~142dB (0° el.)

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- low output power (1W average)
- Path loss small regarding orbital height
  - A= ~142dB (0° el.)
- optimum antenna positions on ISS

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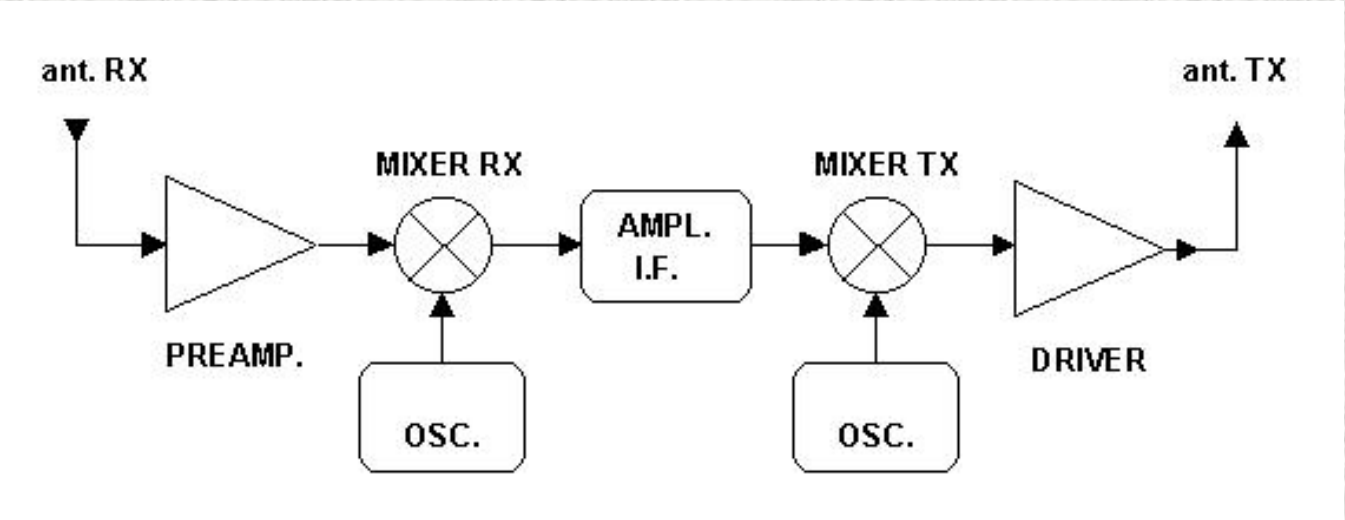
transponder block diagram



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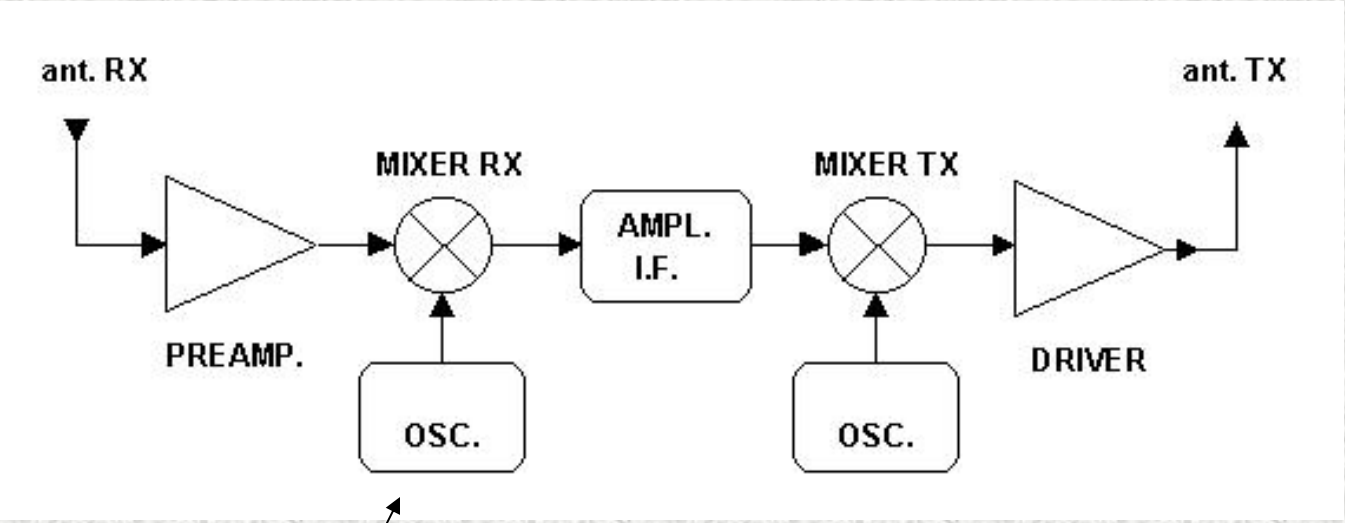
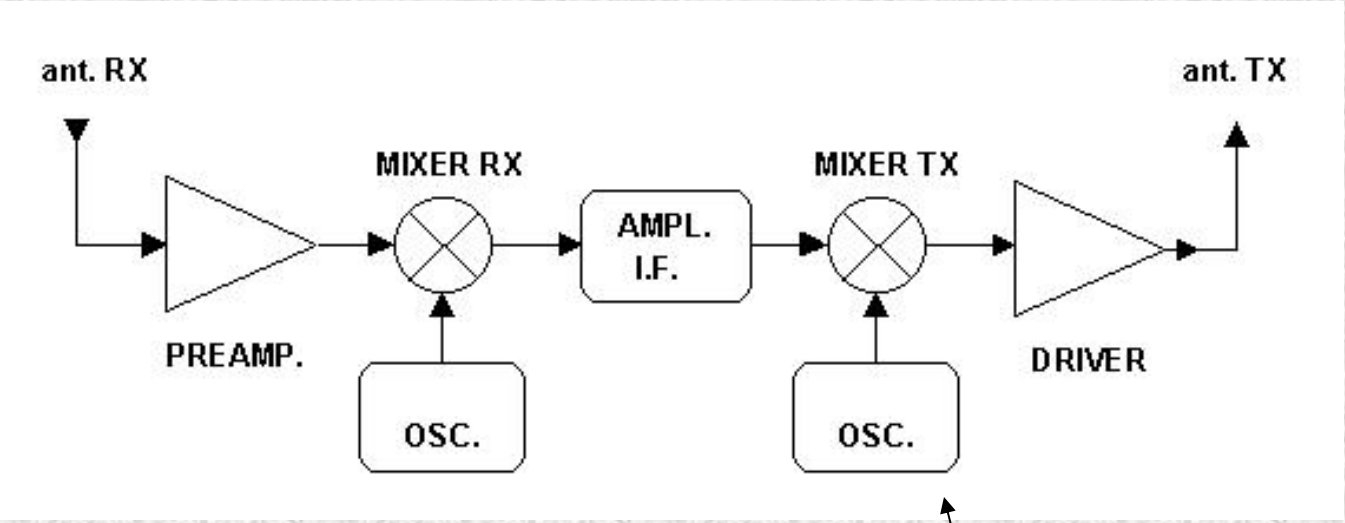


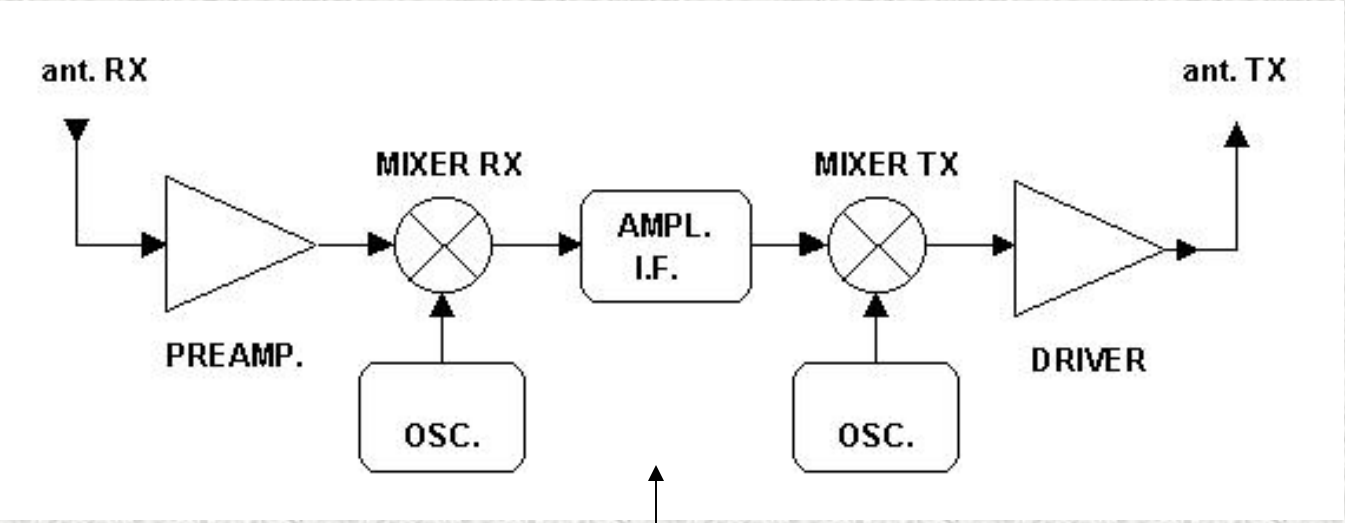
Down
Conversion
Block

transponder block diagram



Up
Conversion
Block

transponder block diagram



Intermediate
Frequency
Block

Technical highlights

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- Modular design approach

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  - as proposed at Surrey meeting (july, 1998)

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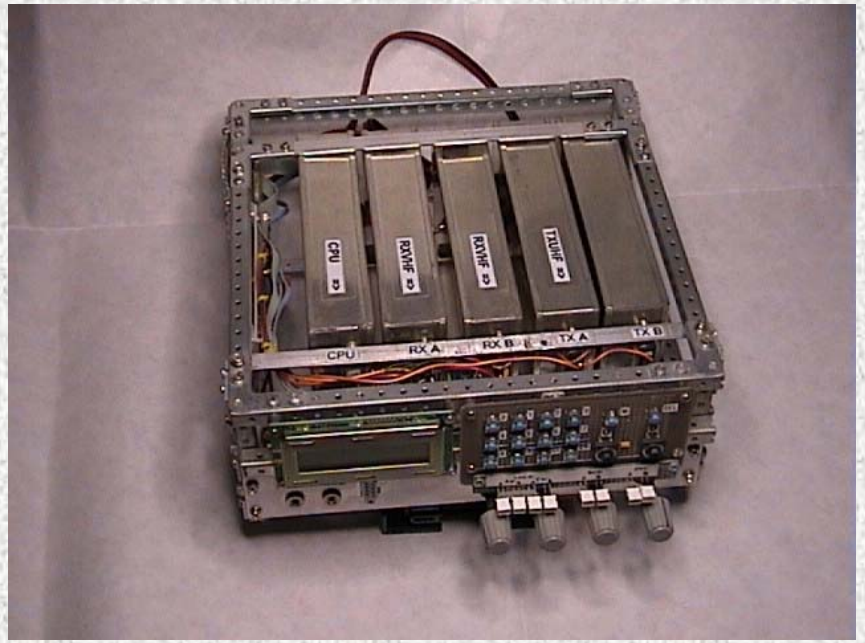

Technical highlights

- Modular design approach
  - as proposed at Surrey meeting (july, 1998)
- Single, small box

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- Modular design approach
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- Single, small box
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- Easy reconfiguration
  - change module -> change operational band

Technical details

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- Down Conversion Block (DCB)

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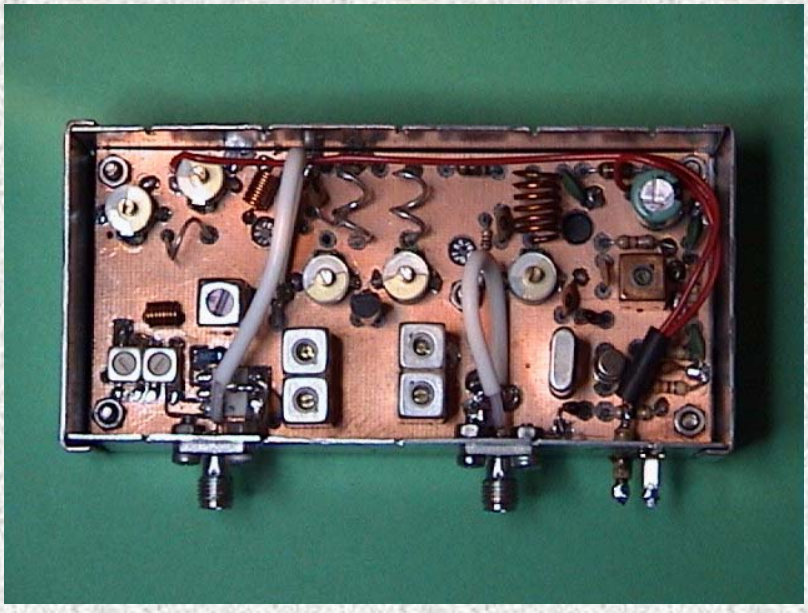

- Convert the uplink signals into IF value

Technical details

- UP Conversion Block (UCB)

Technical details

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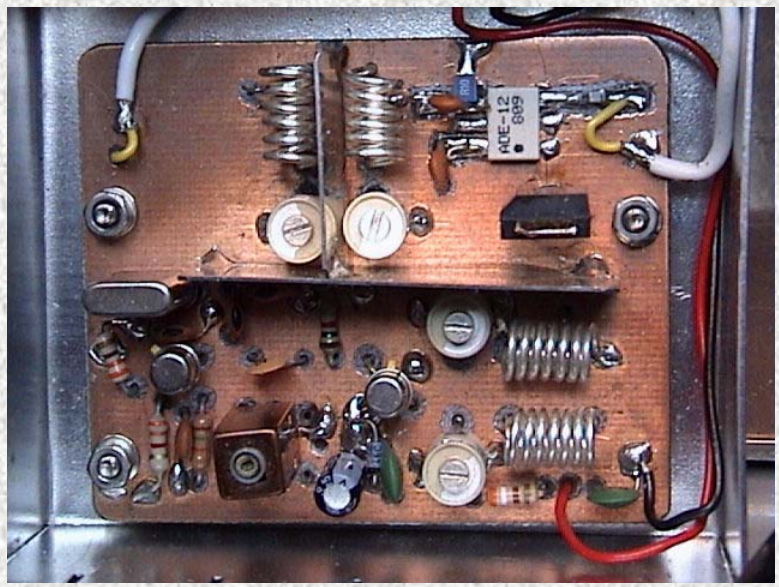


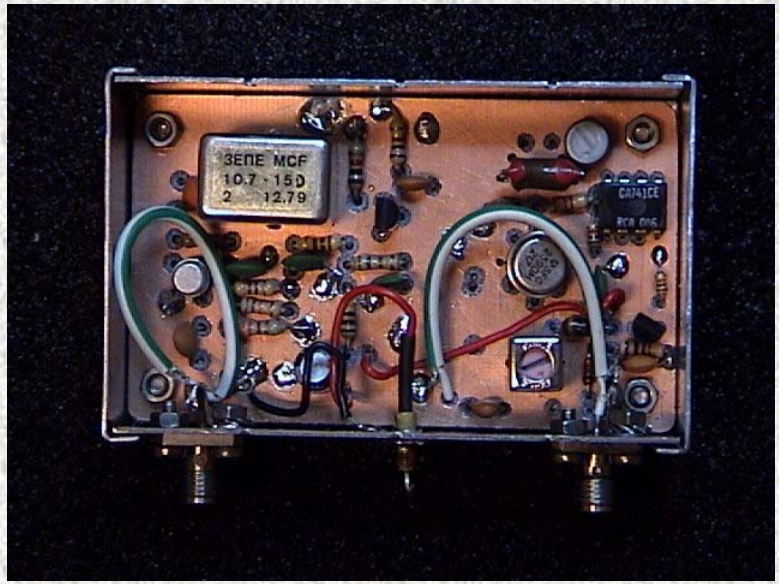
- Convert the IF signals to downlink value

Technical details

- Intermediate Frequency Block (IFB)

Technical details

- Intermediate Frequency Block (IFB)



- Amplifier and gain control of in-band signals

Operational details

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unattended operations

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  - for easy access for crewmembers in a QSO
  - and using full duplex capacity of two band ops (more powerful during school contacts)
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  - for easy access for crewmembers in a QSO
  - and using full duplex capacity of two band ops (more powerful during school contacts)
- Change operational-mode
  - using a 10 meters downlink (similar to RS sats)
  - using S-band downlink (similar to AO40) (we have 4 antennas available on ISS)

Possible locations

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- Actual

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- Zvezda module

Possible locations

- Actual
- Zvezda module

- Future

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- Future
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- Future
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- JEM ?

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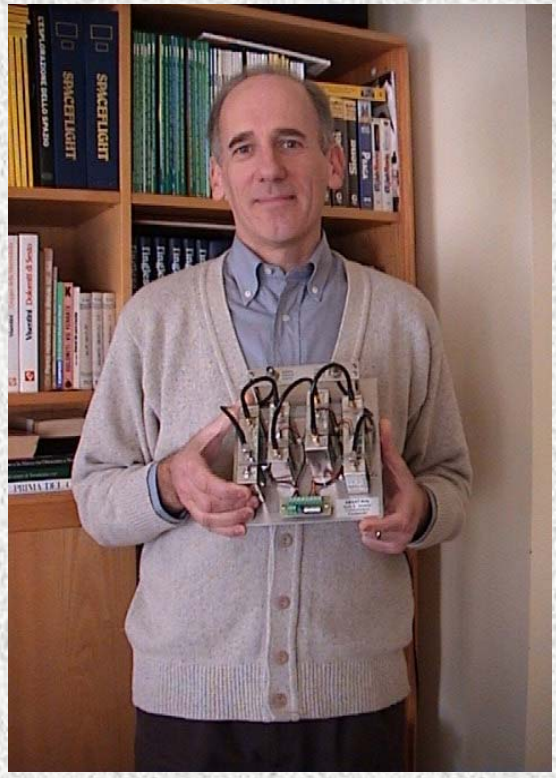
- Future ARISS operations:
  - only with schools ?
- our proposal is to revert this trend

Best 73,

Paolo Pitacco, IW3QBN



Conclusions

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  - smaller with radioamateurs
- Future ARISS operations:
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