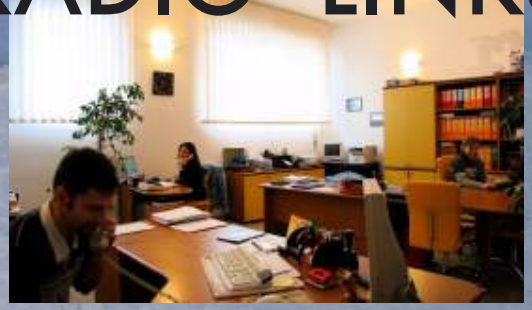
ELBER

MICROWAVE RADIO LINKS



Company profile

- ✓ Founded in 1978 in Genoa
- ✓ Focused on broadcasting microwave radio link
- ✓ High technology solutions
- ✓ High-flexibility to meet customers' requests
- ✓ More than 5000 radio links in operation
- ✓ High-reliability
- ✓ 5-Years Warranty

ISO 9001 certified

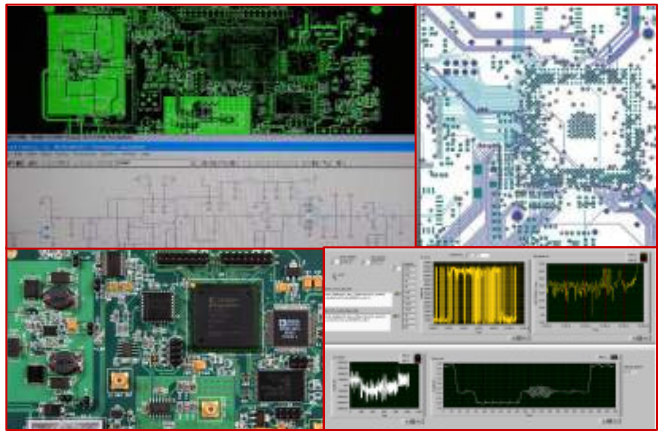
Mission Statement

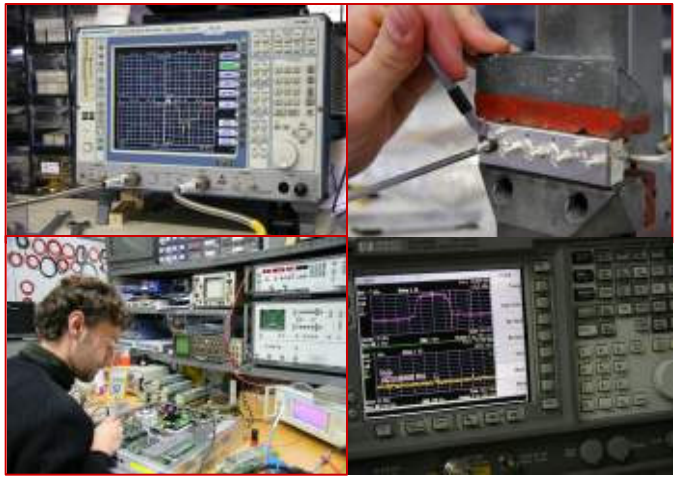
- ✓ The improvement of its image and reputation on the worldwide market and hence the growth of the number of clients, the increase of the turnover, the territorial expansion and the entry in new areas of the market
- ✓ The satisfaction of all concerned parties (clients, staff, providers) and hence:
  - The achievement of budgetary goals
  - The maintenance of the occupational level
  - The control of the number of complaints
  - The elevated level of the client satisfaction
  - The supply contracts of our providers
- ✓ The respect of implicit and explicit contractual commitments
- ✓ The attention to client communication
- ✓ The client assistance

Company profile

Research & Development

Systems, PCB and RF Circuits Design,
FPGA and DSP based Signal Processing,
Custom Solutions..





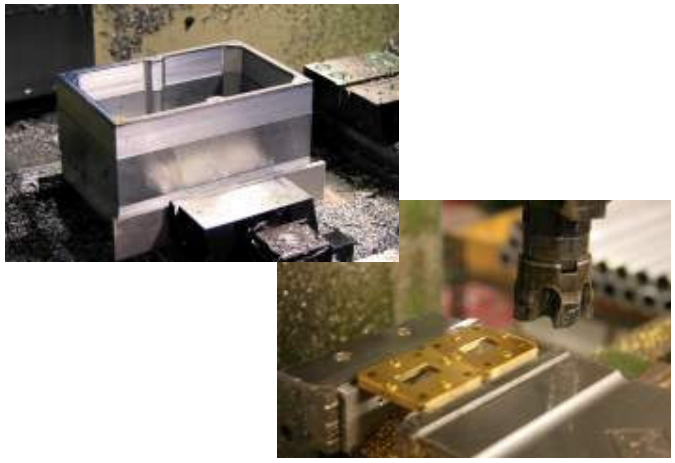
Laboratory

Test of all parts of the equipment, Filters,
Oscillators, Mixers, Amplifiers Calibrations,
Climatic tests...

Company profile

Mechanical workshop

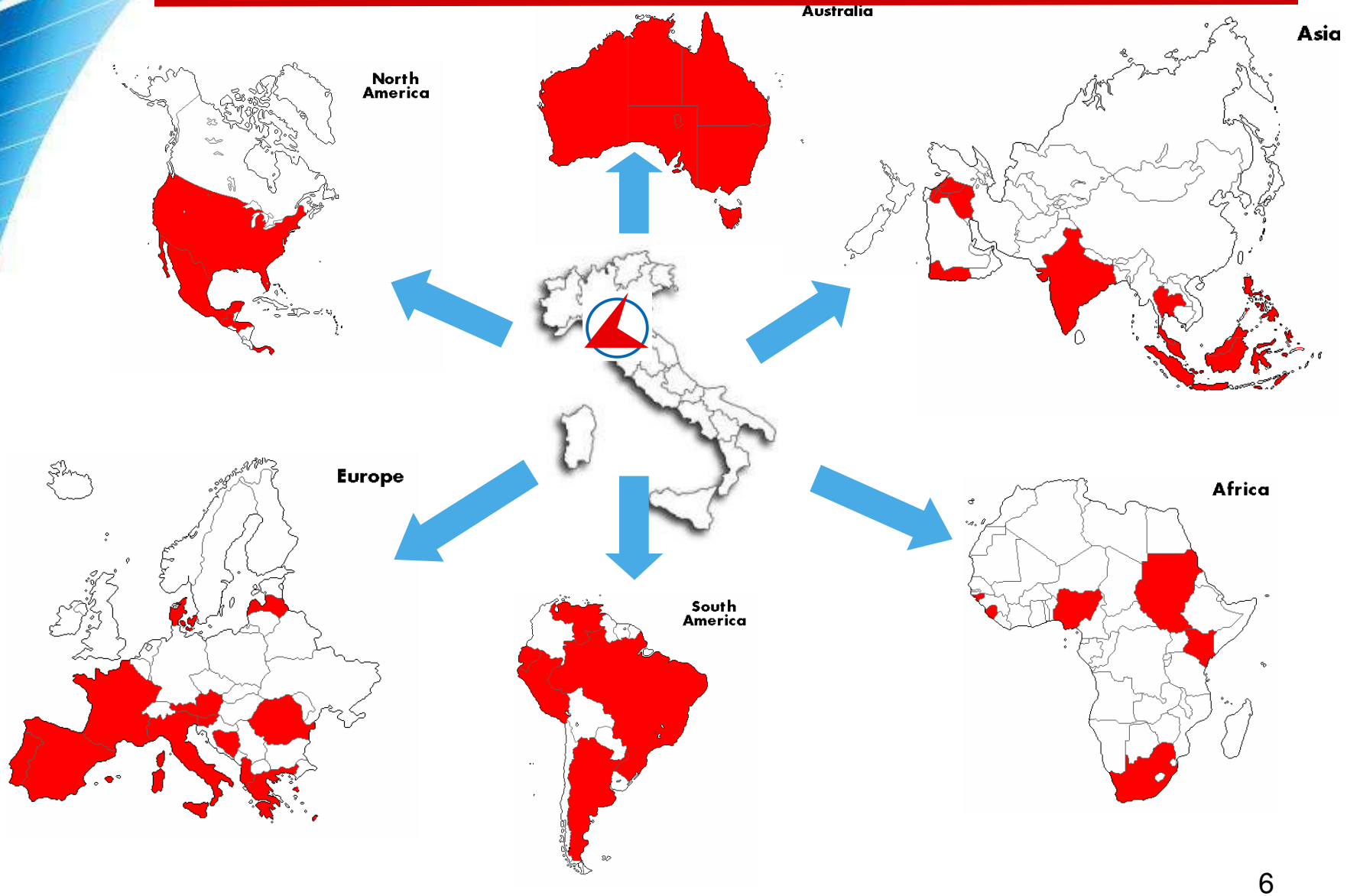
Chassis, RF Heads, Cavities, Rack, Filters, Circulators, Diplexers, Waveguides, Tripods..



Assembly Department

PCB, Mechanical Parts, RF Circuits Assembling, Cables and Connectors Production, Power Supply Testing..

Elber in the World



Exhibitions

ELBER is present at the most important broadcasting exhibitions to present its new products, meet clients and discuss their needs.

NABSHOW - Las Vegas

IBC - Amsterdam

CABSAT - Dubai

Broadcast Asia - Singapore

ELBERS' PRODUCT RANGE

January 2008

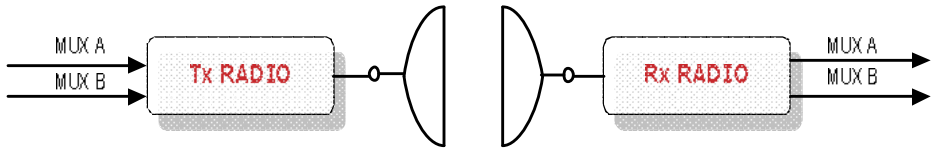
Introduction

Analogue and Digital transport systems over Microwave links

- High performance
- Reliability
- Flexible solutions

Why DVB-ASI?

Flexible → **Variable Bit Rate** → **HD Ready**



ASI
(Asynchronous Serial Interface)

Efficient Use of Bandwidth

Modulation Scheme	STM-1	ASI
Net Bit Rate	48.4 Mbit/s	48.4 Mbit/s
Payload	155.52 Mbit/s	54 Mbit/s
Modulation	128 QAM	16 QAM
Trsehold	-70 dBm	-80 dBm
Bandwidth	28 MHz	20 MHz
Output Power*	+30 dBm	+33 dBm
System gain	100 dB	113 dB
Notch tolerance (mp, nmp)	17 dB	40 dB

**With booster 8W*

DVB-T standard ***(EN 50083-9:1998)*** → **Cutting-edge Technology** → **Optimised for Broadcasting**

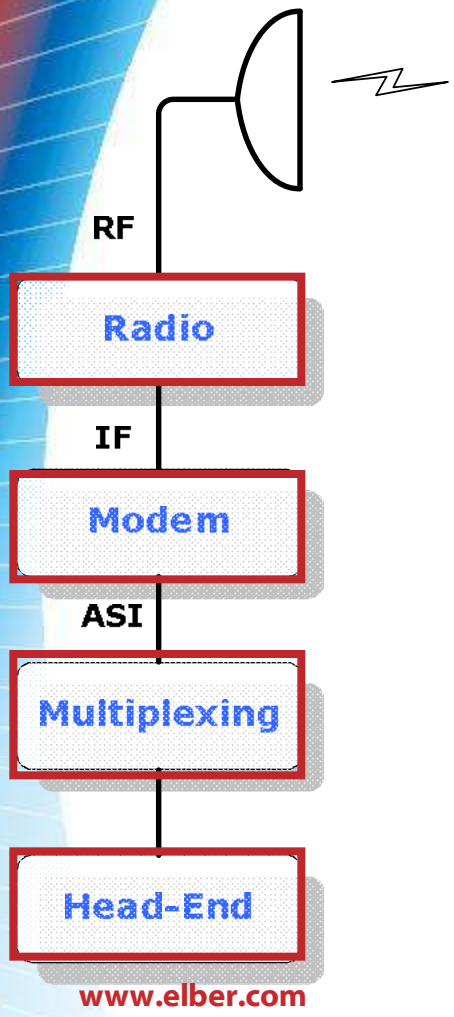
System Description [1]

Equipment Realised With Standard Features:

- Compact Design *(1U rack 19")*
- Power Supply:
  - *AC 230 V ± 10%*
  - *DC 22 to 65 V*
- Local Management through keypad and LCD display.
- Remote Control through:
  - *Ethernet (SNMP)*
  - *RS485*
  - *RS232*

System Description [2]

System can be subdivided in four sections:



- *Parabolas*
- *Flange*
- *Feeders*
- *Branching*
- *Transmitters*
- *Boosters*
- *Receivers*

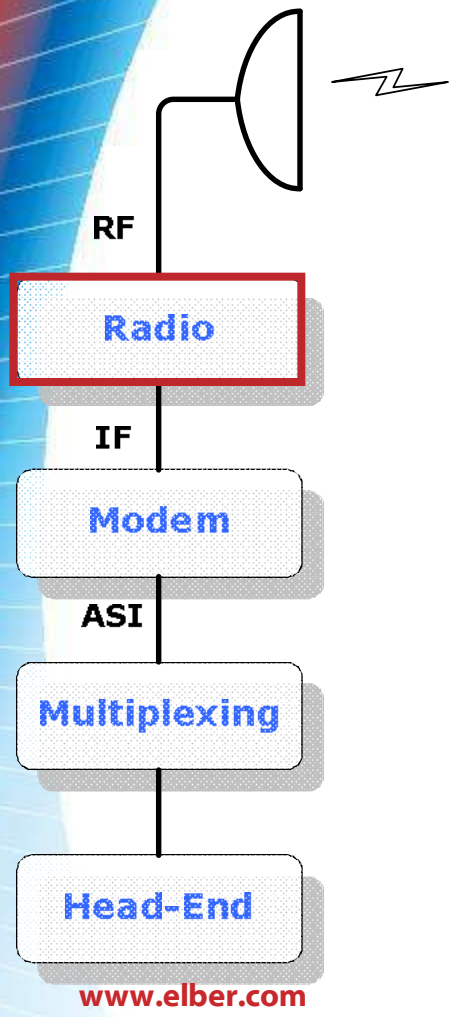
- *Mod/dem FM*
- *Modem QPSK/QAM*
- *Mod/dem COFDM*

- *Encoders/Decoders*
- *PDH Mux/Demux*
- *Analogue Video/audio*
- *Ethernet*
- *Monitoring Channels*

- *Network Adapters*
- *ASI Mux/Demux*
- *ASI Distributors*
- *Hitless Switch*

Radio Section

Fixed and Mobile Links:



- Transmitters and Receivers available in **indoor** or in **split version configuration.**

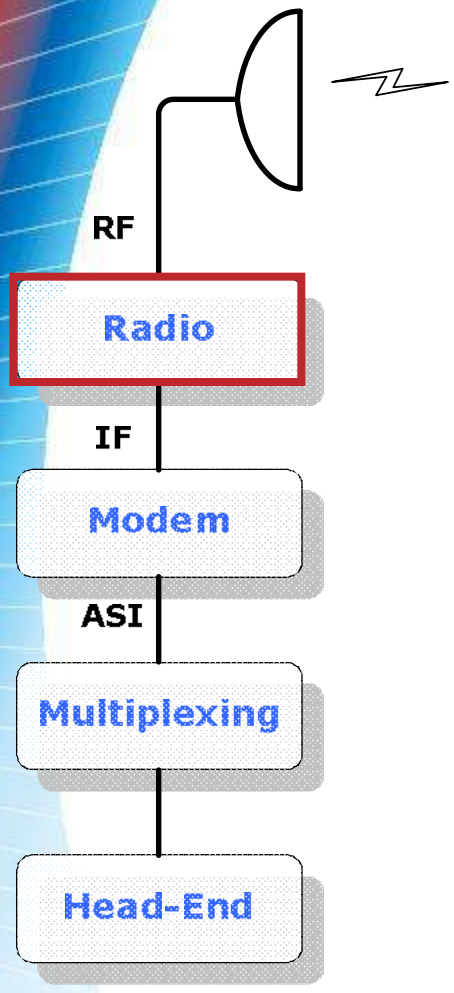
T_SL

- The new range permits optimised performance in both analogue and digital transmission.
  - Phase noise oscillators
  - Filters' Selectivity
  - Output Power Control
  - Frequency Agile

MT

Indoor Radio Links

SL Line



- *Slim Line* Indoor Units
- Analogue and Digital
- Double conversion system
- 4 GHz ÷ 15 GHz
- Maximum power up to +30 dBm (after *branching*)
- *Frequency Agile*
- Frequency span up to 500 MHz
- Channel Bandwidth 3 ÷ 28 MHz
- 70 MHz Generation
- High spurious suppression
- Low noise receiver
- Path link equaliser

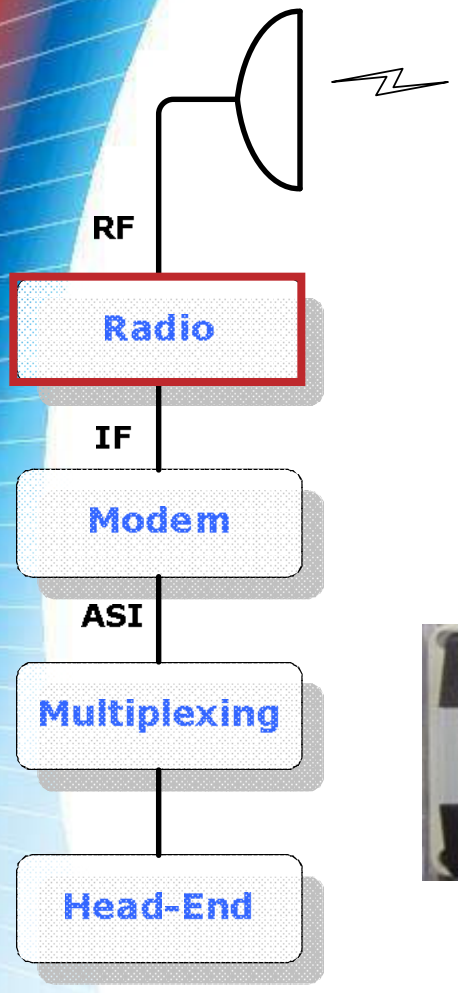

T_SL


R_SL

Boosters

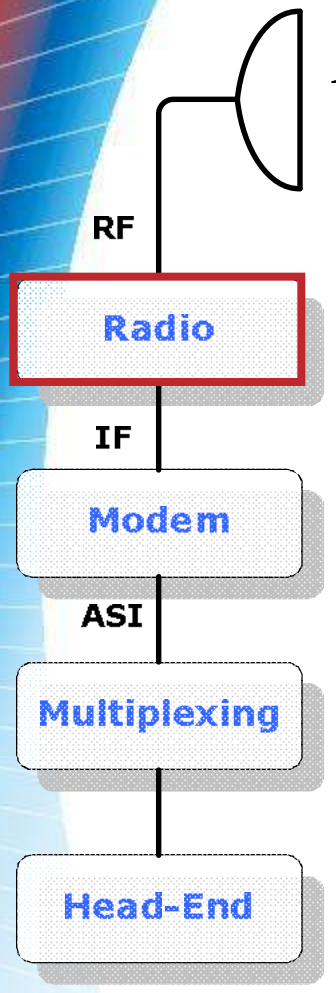
Amp Line

A new line of power amplifiers (*2U rack 19"*) is shown.



Frequency [GHz]	Power [W]	Gain	Consumption [W]
2	20	10 - 12	60
5	8	8	40
5	15	8	65
6	40	9	120
10 – 12	8	13	50
10 – 12	15	13	65
14	8	10	65

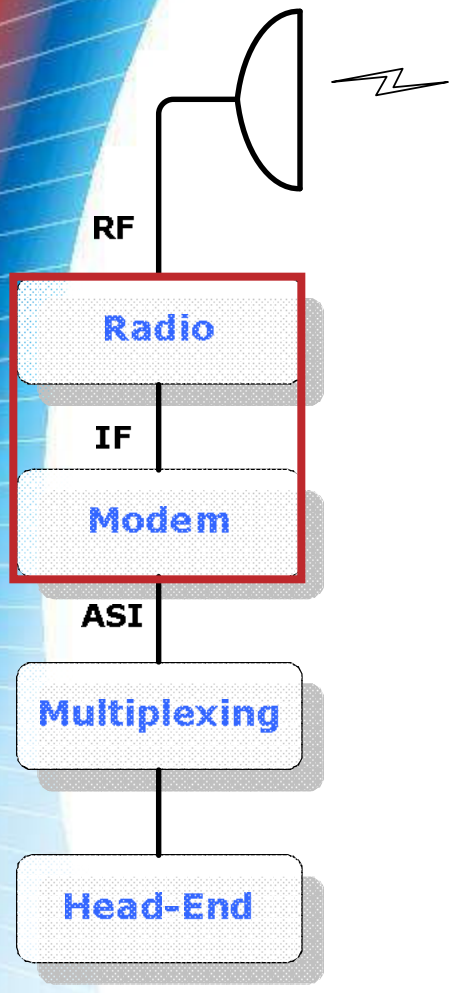
Split type radio links



- Weather Proof Outdoor Units
- Double Frequency Conversion (70 -1100 MHz)
- Analogue and /or Digital
- 5 GHz ÷ 22 GHz
- Frequency Agile
- Frequency Span up to 300 MHz
- Up to +30 dBm power output (after *branching*)
- Optional internal *Booster* (8 W)
- Local monitoring for antennas alignment

Control Unit for Split-type system

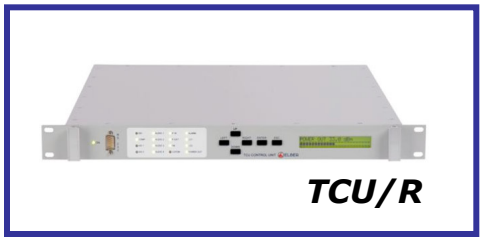
TCU Series



The control units for the external equipment are available according to the modulation scheme.

The standard version characteristics are:

- IF 70 MHz
- External RF Head 48 V_{DC}
- RF Head Monitoring and configuration



Three other versions are available

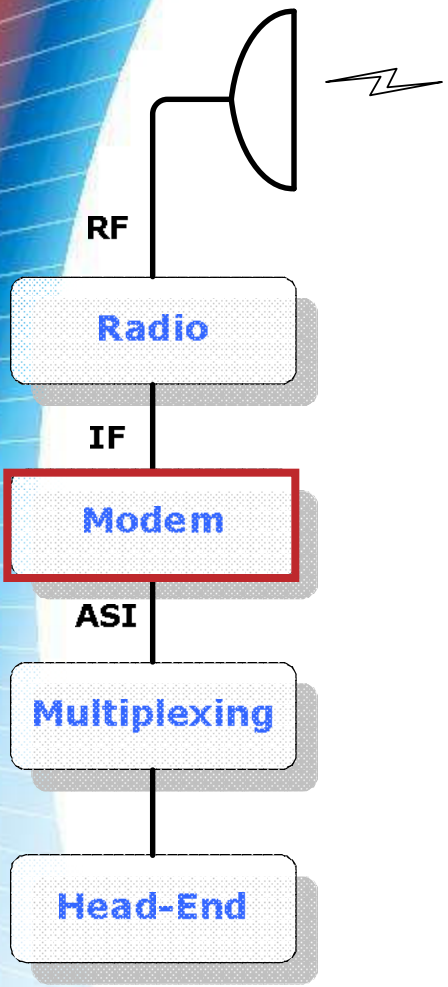
1. Modulator/Demodulator 70 MHz FM
2. Modulator/Demodulator COFDM
3. Encoder/Decoder MPEG-2 4:2:0/4:2:2
4. Combination of FM and COFDM

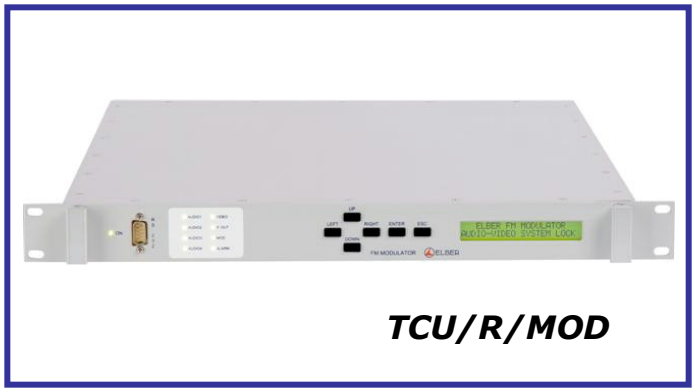
Analogue Mod/Dem

TCU Series

Analogue mod/dem line has been improved with the use of digital techniques based on fast FPGA processing.

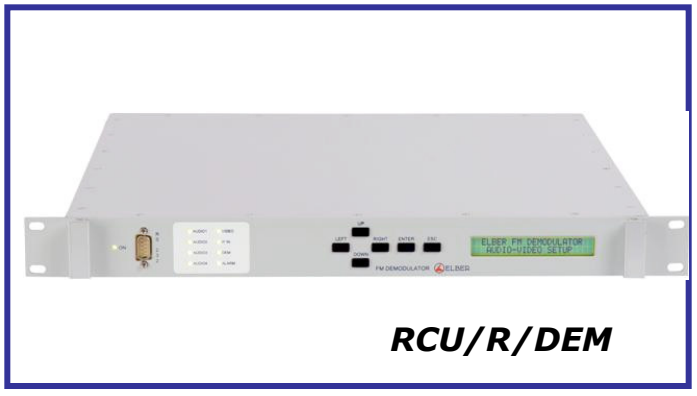
- 1 Video
- 4 Audio Mono
- IF 70 MHz
- Digital IF Processing





TCU/R/MOD

Board DEM FM

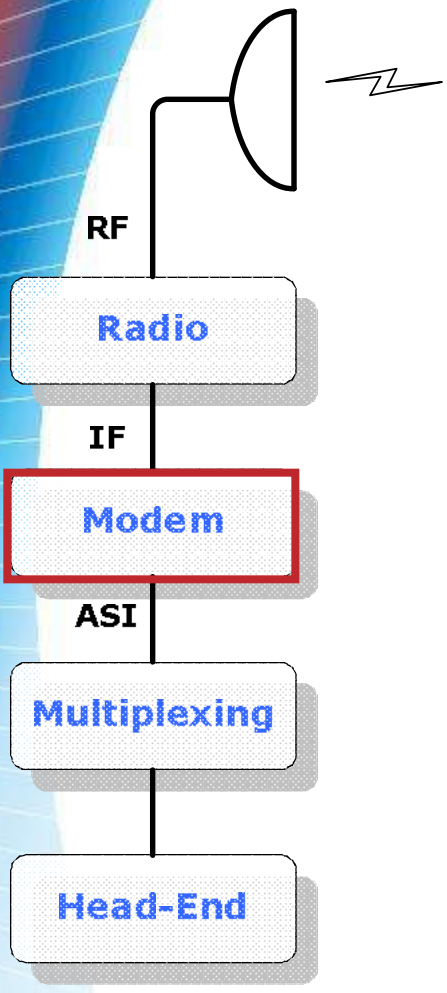


RCU/R/DEM

Digital Modem

DDM310

High performace, reliability and flexibility are the main features of the digital modem DDM310.



- Modulator/Demodulator/Modem
- Data interface:

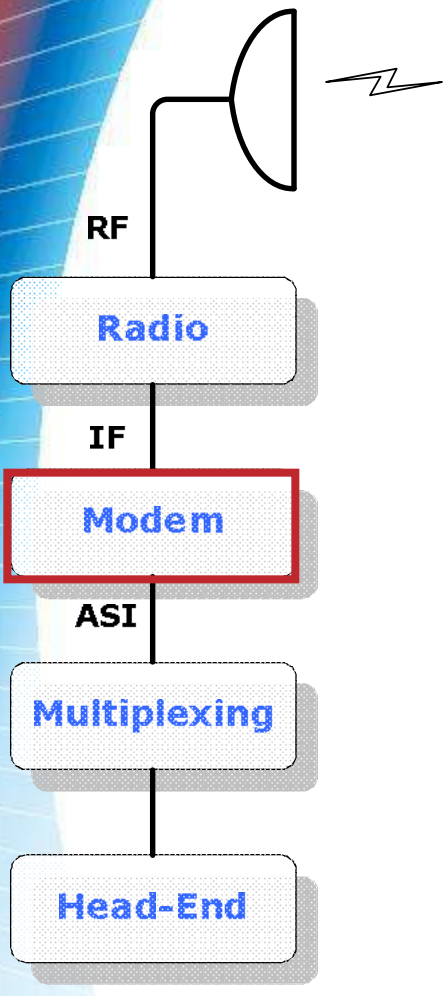
  DVB-ASI, DS3, E3, STM-1,

  STS-1, E1
- QPSK, 16, 32, 64, 128, 256 QAM
- Bandwidth from 3,5 MHz to 28 MHz
- External FEC **Reed-Solomon**
- Internal FEC convolutional/PTCM
- 6 pre-set configurations
- 24 taps powerful adaptive equalizer
- Digital Pre-correction

DDM310

Digital Modem

Payload



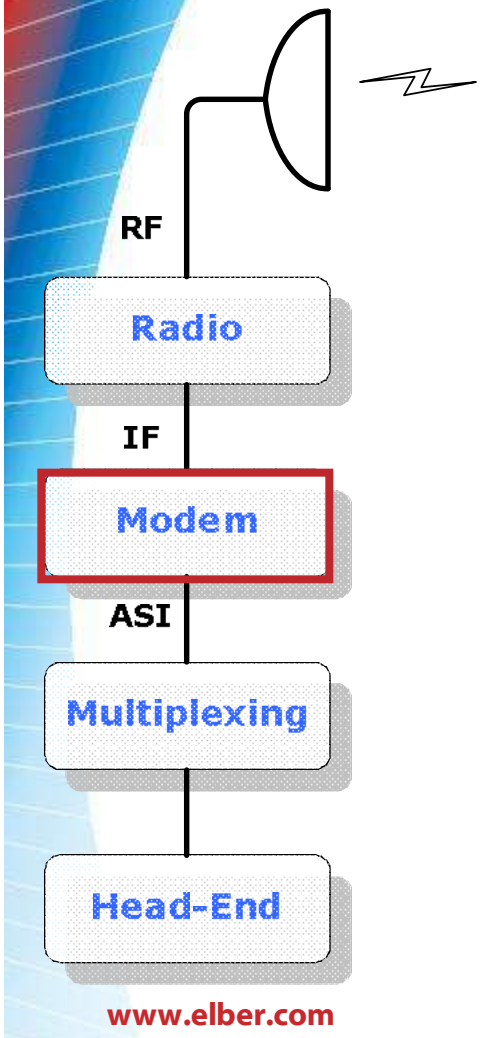
Consideration for each modulation scheme:

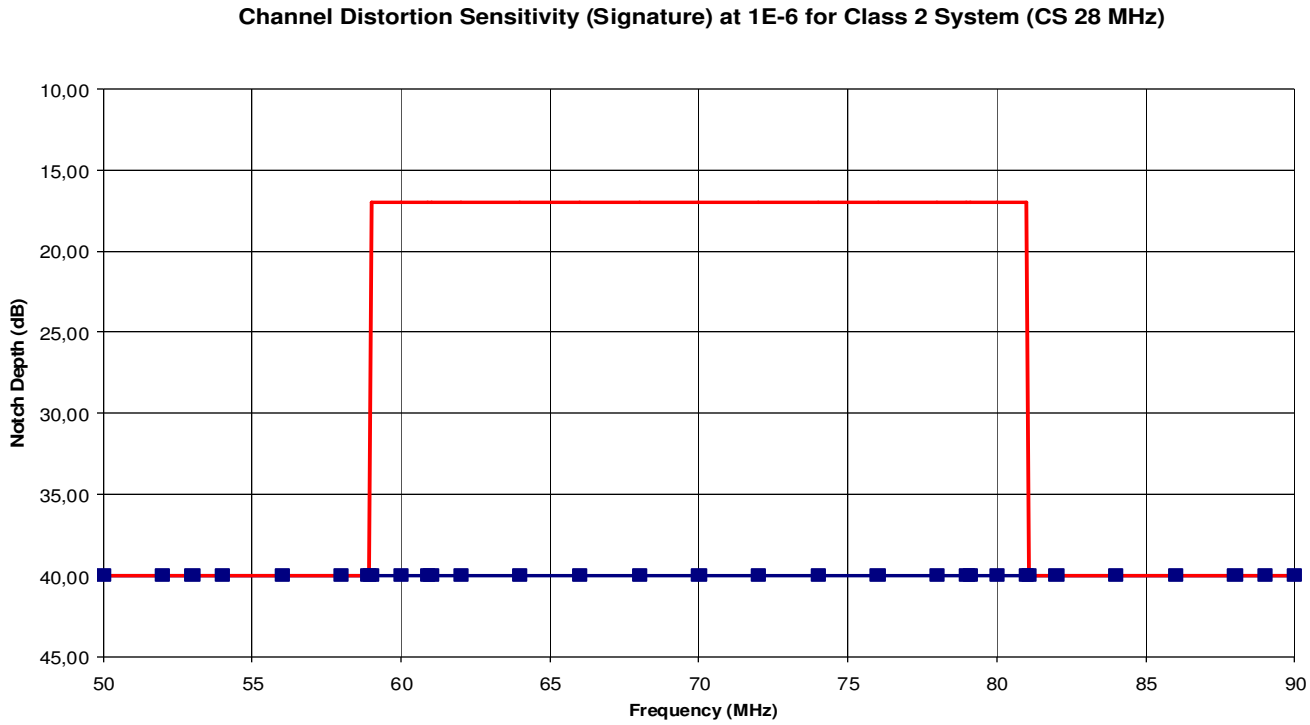
- 20 or 28 MHz bandwidth
- Reed-Solomon coding able to correct 10 bytes on a 250 bytes frame at least
- convolutional coding

Modulation	Bandwidth 20 MHz	Bandwidth 28 MHz
QPSK	25 Mbit/s	35 Mbit/s
16QAM	54 Mbit/s	72 Mbit/s
32QAM	66 Mbit/s	92 Mbit/s
64QAM	82 Mbit/s	108 Mbit/s
128QAM	104 Mbit/s	138 Mbit/s
256QAM	115 Mbit/s	160 Mbit/s

Notch Tolerance – [1]

The digital modem distinguishes itself from other modems due to high tolerance it can withstand caused by multi-path fading, thus applicable to difficult environments.

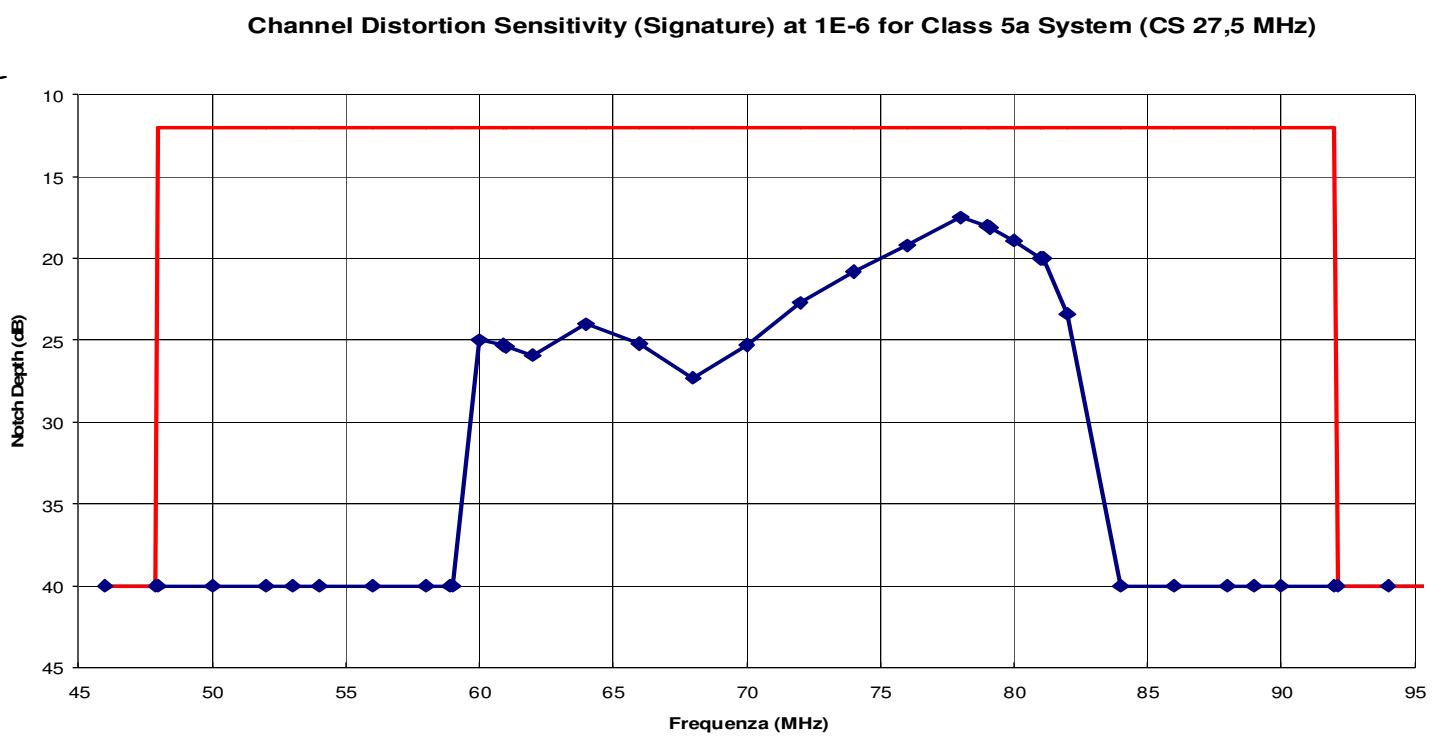




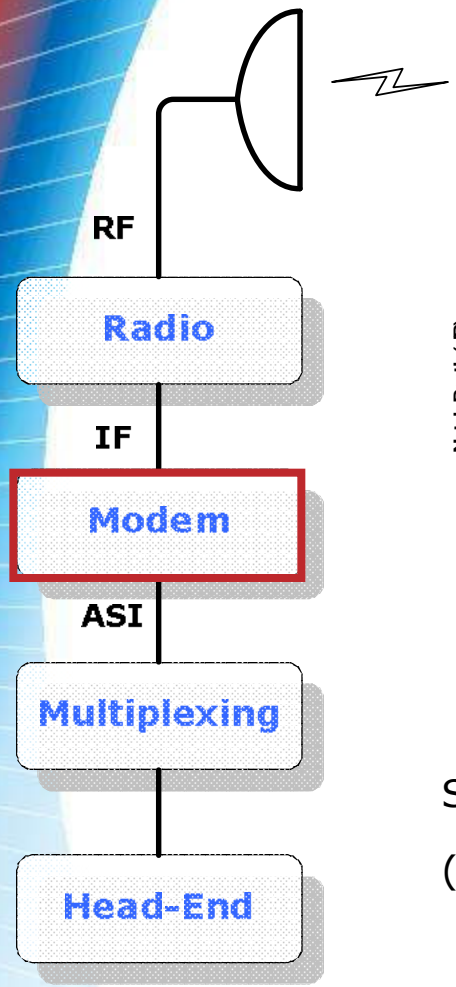
Signature at BER = 1e-6 with 16 QAM modulation and 45 Mbit/s bitrate (blue) compared with ETSI EN 301 216 (red)

Notch Tolerance– [2]

Notch Tolerance up to 17 dB in high modulation schemes (eg. 128 QAM), higher at lower modulating schemes

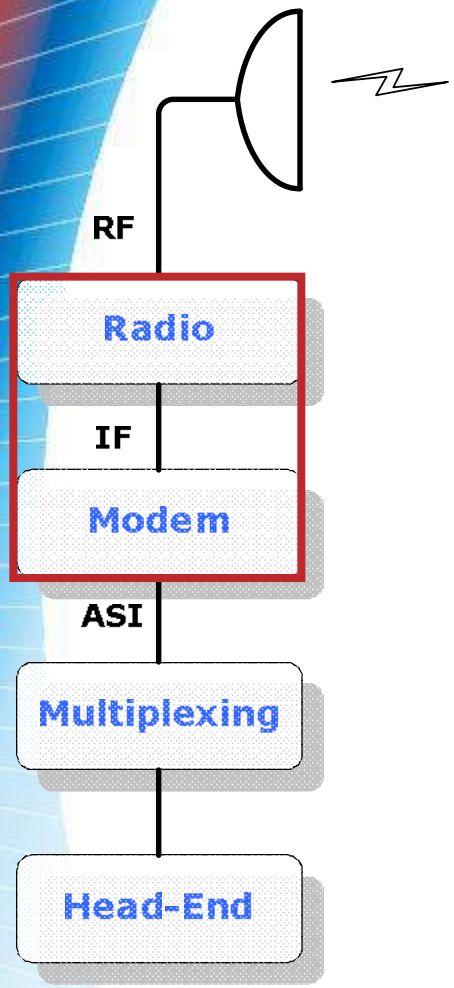


Signature at BER = 1e-6 with 128 QAM modulation and 140 Mbit/s bitrate (blu) compared with ETSI EN 300 430 (red)



Receiving Signal Threshold

Low Threshold due to High performance of SL microwave link and DDM310 digital modem.

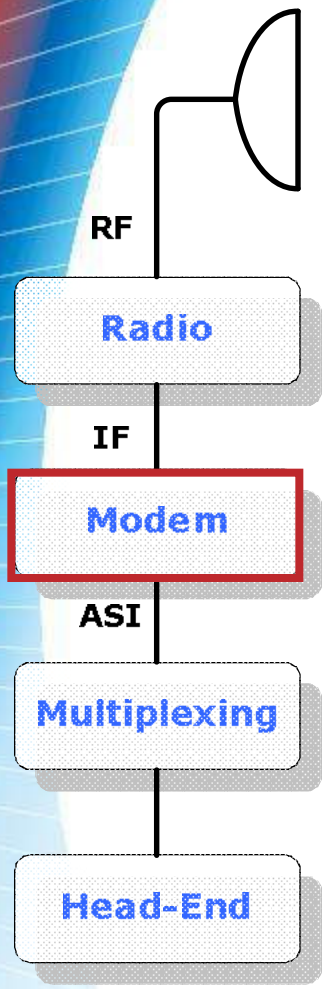


Modulation scheme Parameters:

- 28 MHz bandwidth
- Reed-Solomon coding able to correct 10 wrong bytes
- Convolutional coding

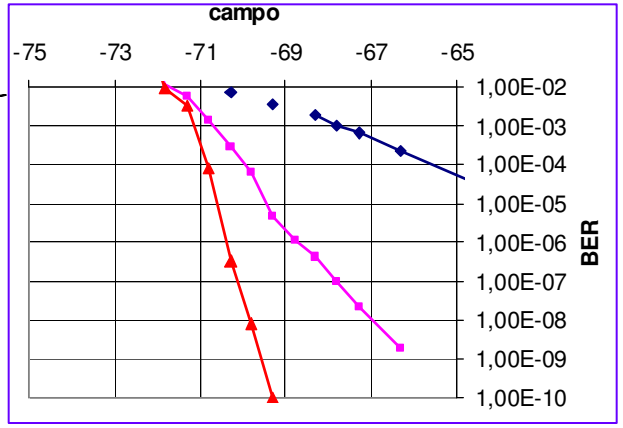
Modulation	Thres.
QPSK	-86 dBm
16QAM	-80 dBm
32QAM	-76 dBm
64QAM	-73 dBm
128QAM	-70 dBm
256QAM	-67 dBm

B.E.R. vs RF Field



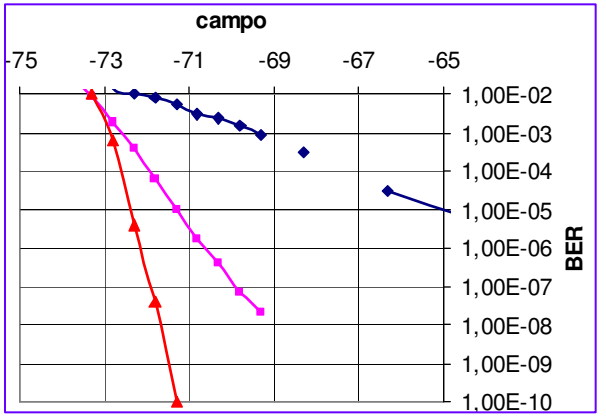
28 MHz Channel

128 QAM 138 Mbit/s



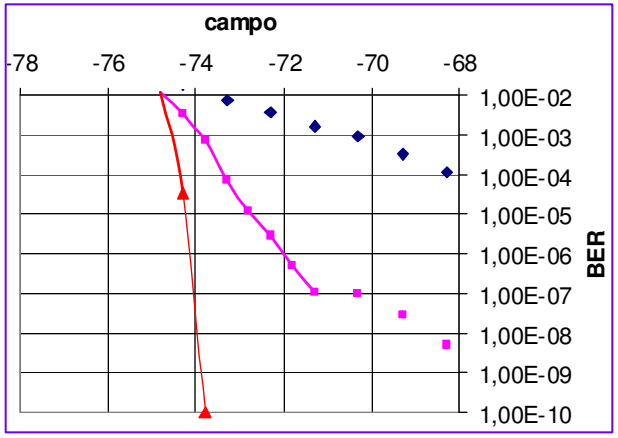
20 MHz Channel

128 QAM 104 Mbit/s

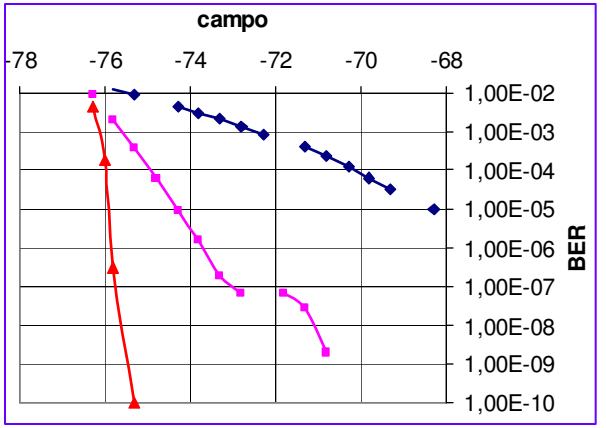


uncoded
ptcm 13/14 no RS
ptcm 13/14 con RS

64 QAM 108 Mbit/s



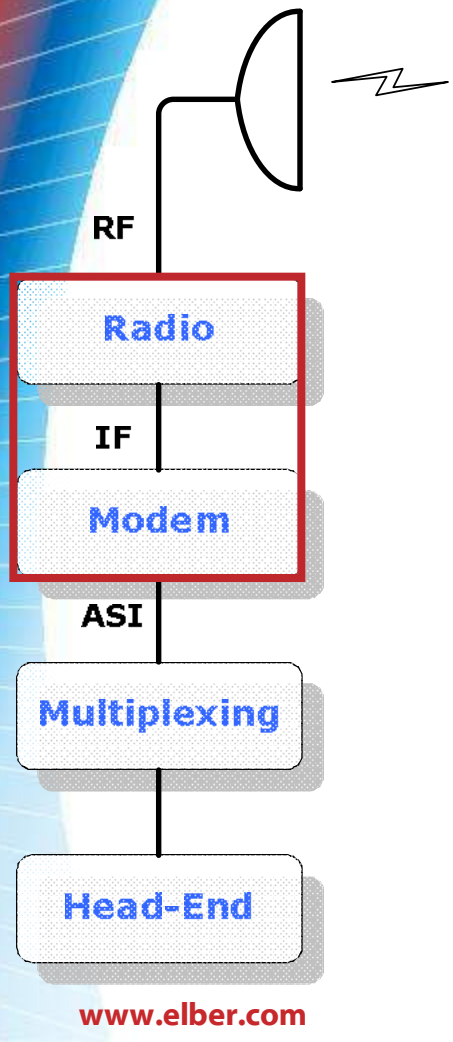
64 QAM 82 Mbit/s

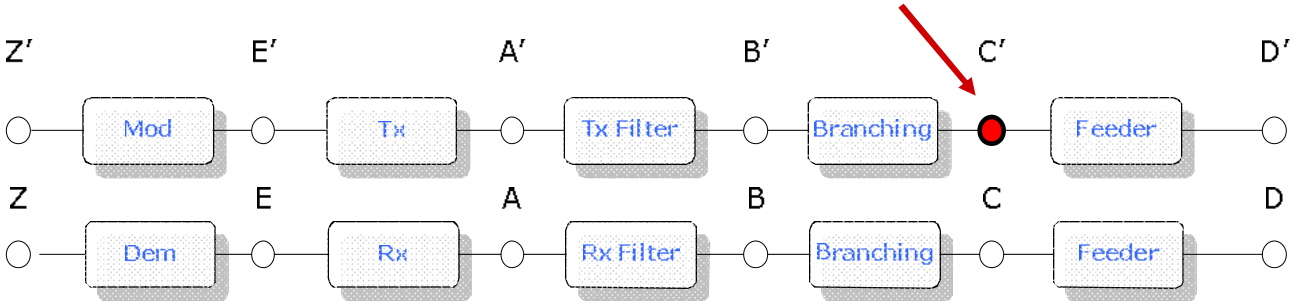


uncoded
ptcm 11/12 no RS
ptcm 11/12 con RS

Power

Digital predistortion, in a 128 QAM configuration with booster permits a 33 dBm at C’ point.

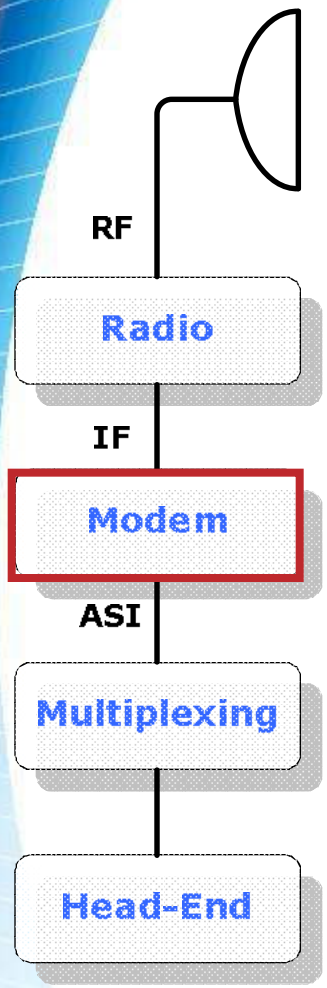


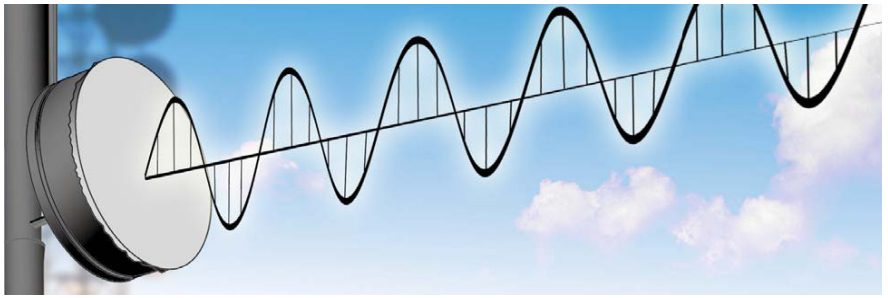


Modulation	Back-off	Power
QPSK	4 dB	+29 dBm
16QAM	6 dB	+27 dBm
32QAM	7 dB	+26 dBm
64QAM	8 dB	+25 dBm
128QAM	10 dB	+23 dBm
256QAM	11 dB	+22 dBm

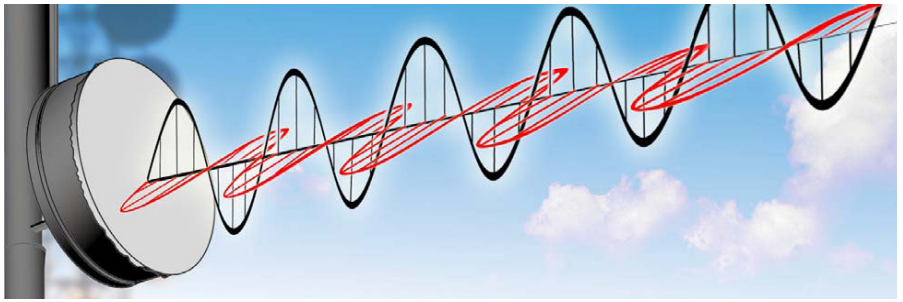
XPIC

XPIC (Cross Polarisation Interference Cancellation) technology doubles the capacity of the link utilising two polarisation and a single frequency.





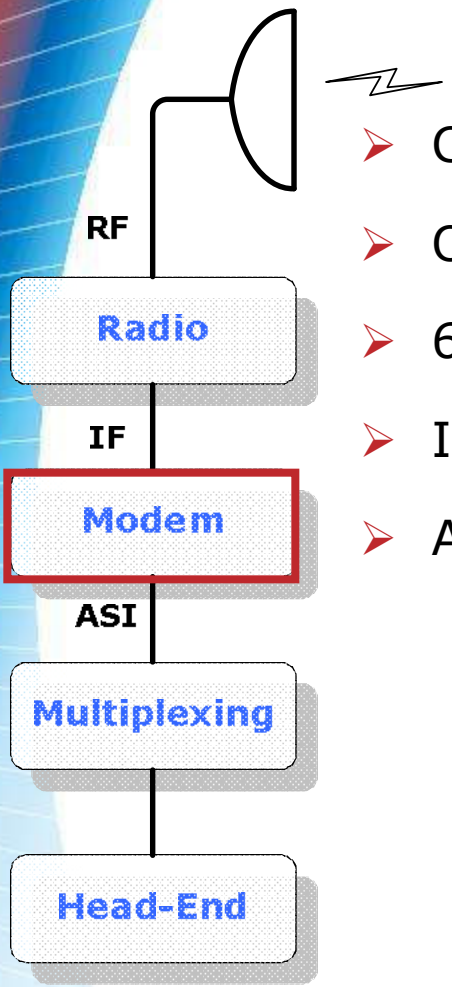
Single polarisation transmission



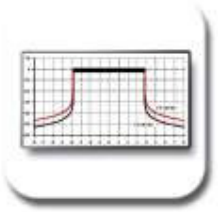
Double polarisation transmission

COFDM Modulator

For semi-fixed and mobile applications, a multi-carrier COFDM digital modulator has been realised.



- COFDM 2K/8K *DVB-T compliant*
- QPSK, 16, 64 QAM Modulation
- 6/7/8 MHz Bandwidth
- IF 36 MHz
- ASI Input



COFDM Spectrum

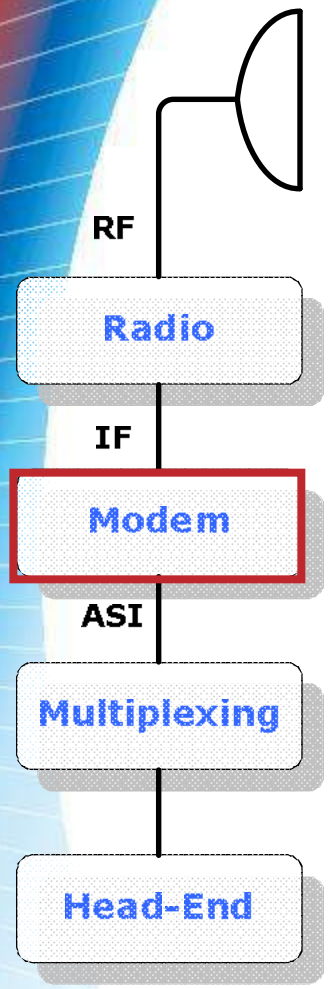
COFDM Modulator Board

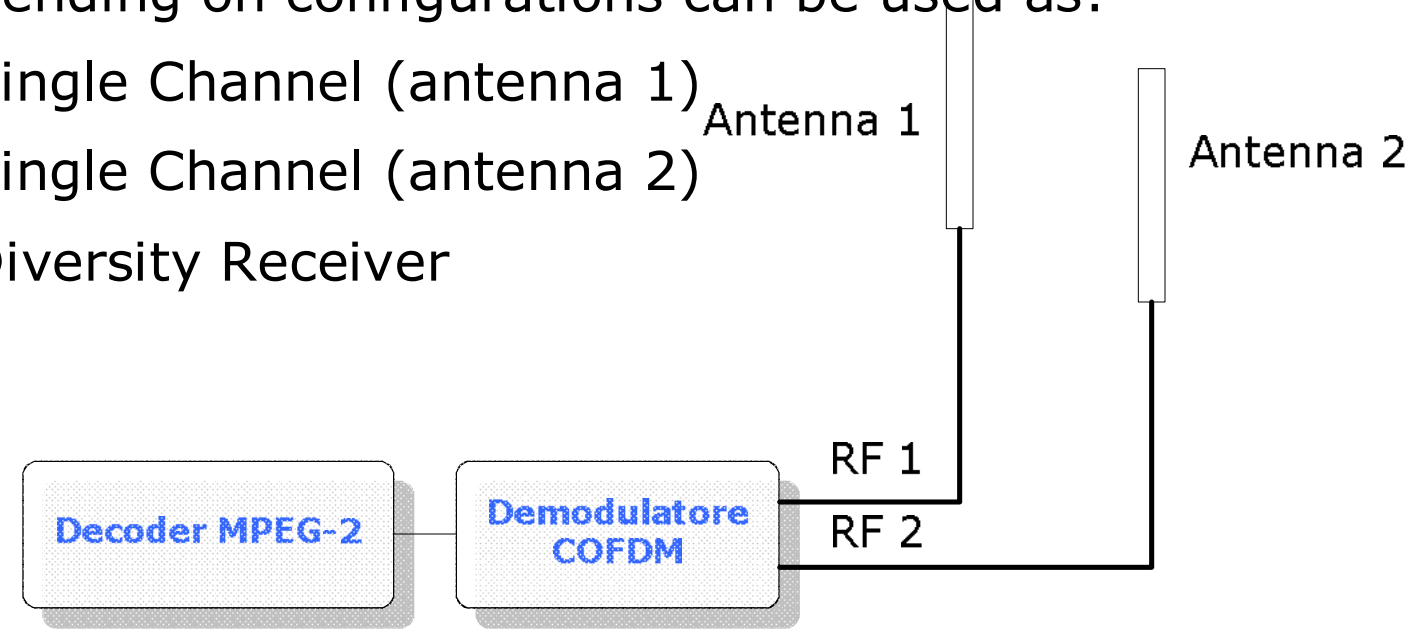
- Integrated Encoder MPEG-II 4:2:0/4:2:2
- 1 video + 4 audio mono
- Low latency (100 ms)
- 2-way Diversity Receiver

COFDM Demodulator

The COFDM demodulator accepts two RF input signals; depending on configurations can be used as:

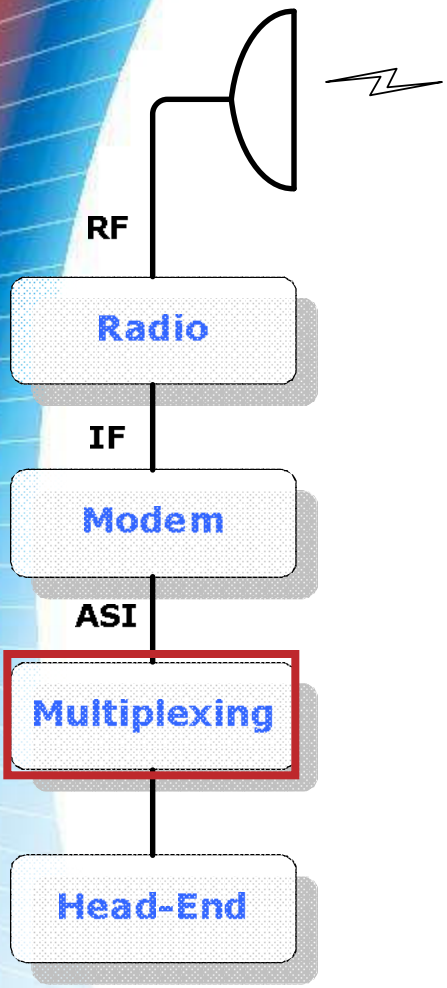
- Single Channel (antenna 1)
- Single Channel (antenna 2)
- Diversity Receiver





Multiplexing Section

RK210 Line

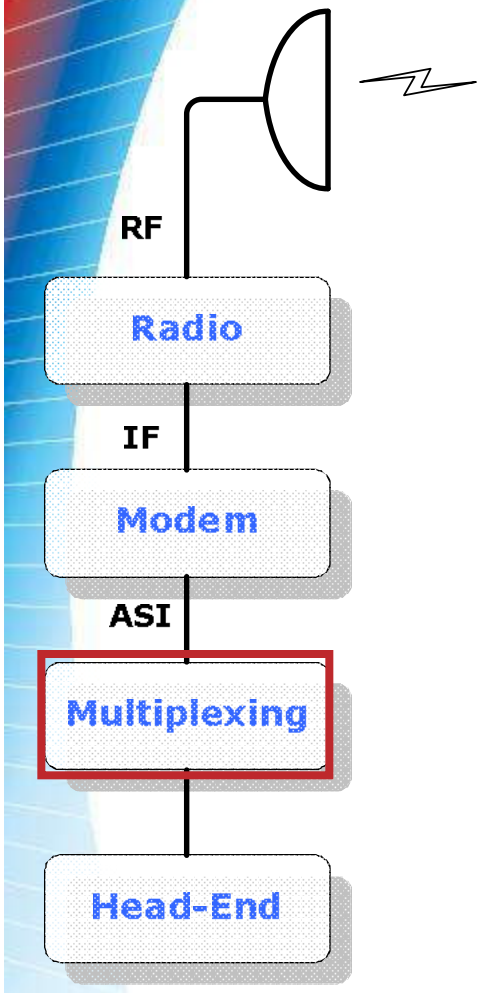


Accessory used in digital systems, permit to:

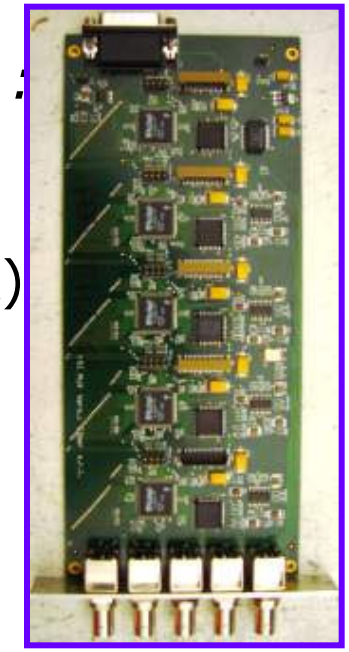
- multiplex heterogeneous streams in a single **composite ASI** *stream* (proprietary protocol);
- get the original streams from the composite ASI ;
- used together with DDM310 will efficiently exploit the available bandwidth.

Multiplexing Section

RK210 Line



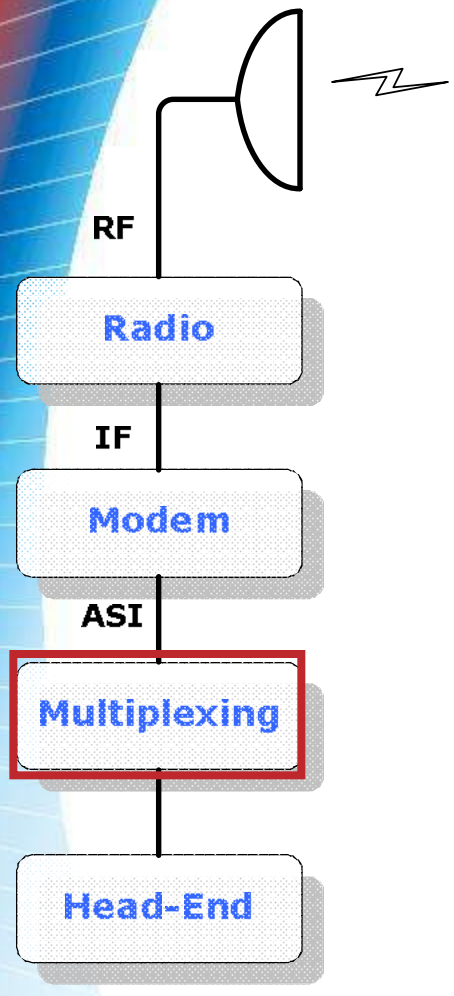
- ✓ Modular equipment
- ✓ Can lodge up to 4 plug-in modules :
  - DVB-ASI Multiplexer (RMX4)
  - DVB-ASI Remultiplexer (RMX4R)
  - DVB-ASI Demultiplexer (DMX4)
  - ASI Distributor (ASID4)
  - Hitless Switch (HS210)
  - E3 / ASI (DS3_T)
  - ASI / E3 (DS3_F)
  - 4xE1 / ASI
  - ASI / 4xE1



RMX4 Plug-in board

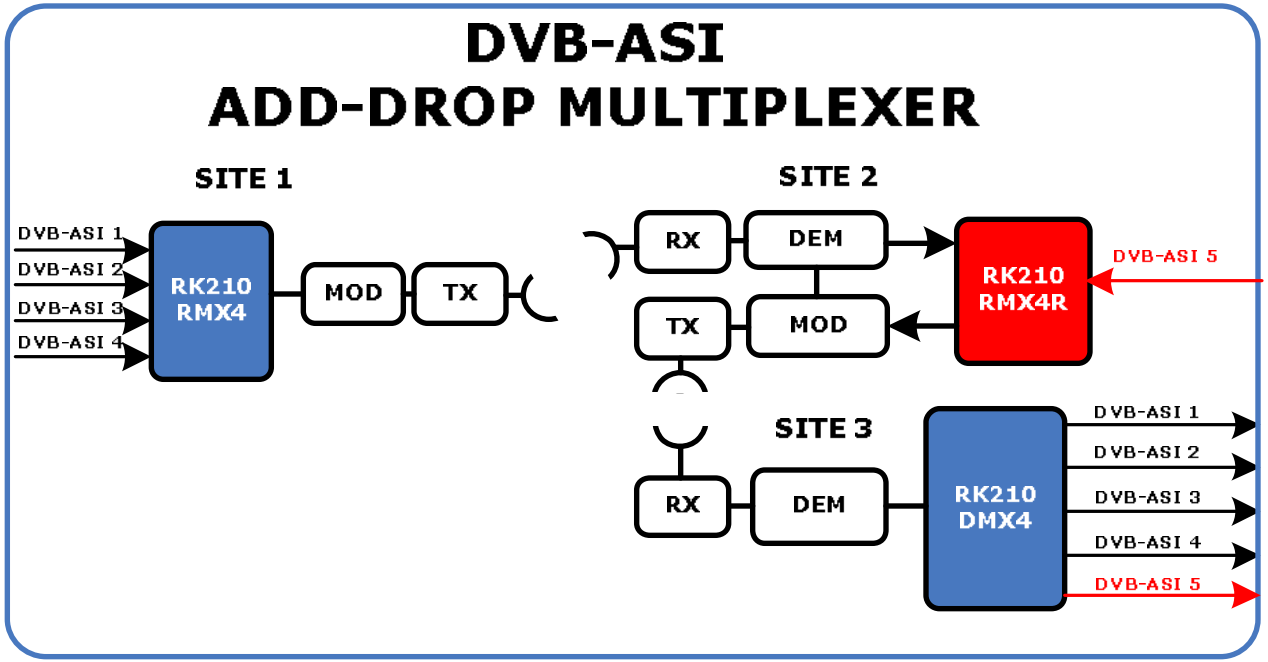
RK210

In order to transport streams over the same microwave link more than one *DVB-T/H bouquet,* transparent multiplexers are used.



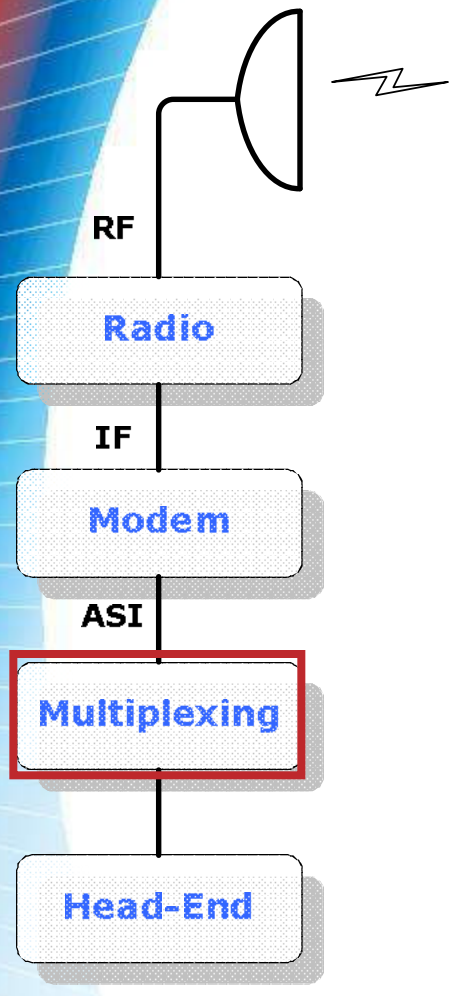
➡ **No original data is changed**

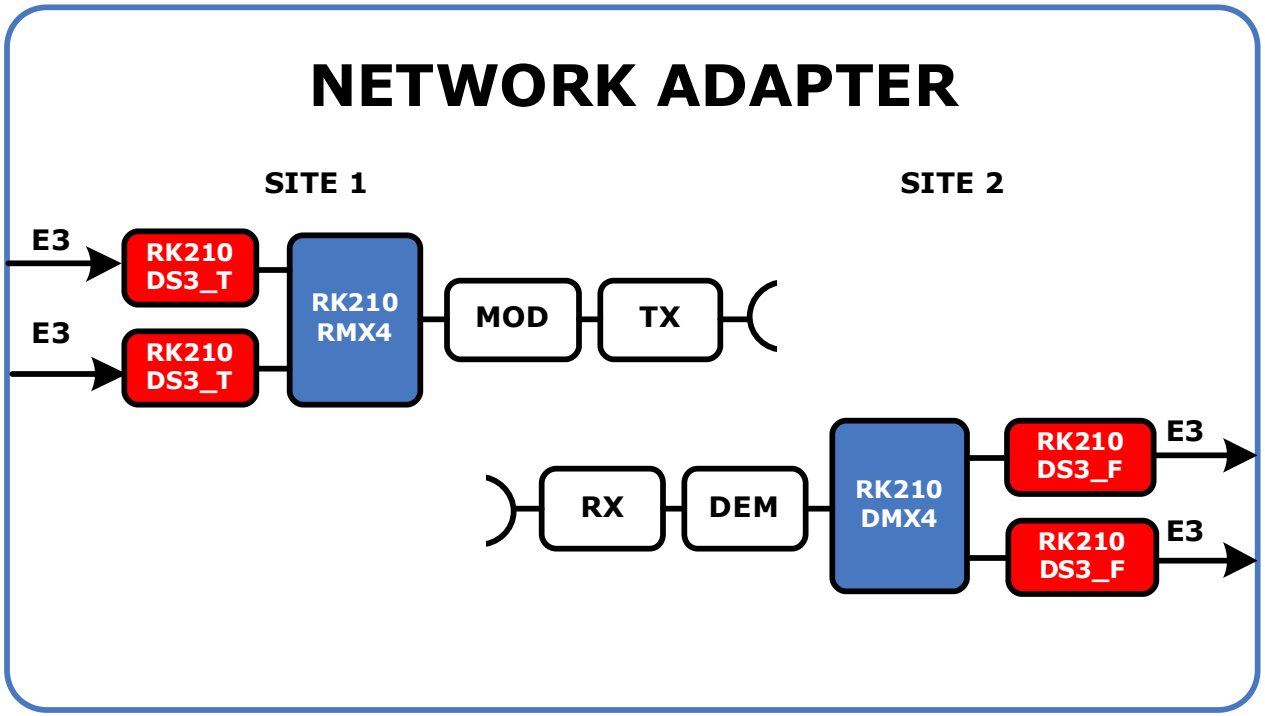
➡ **SFN compatible**



RK210

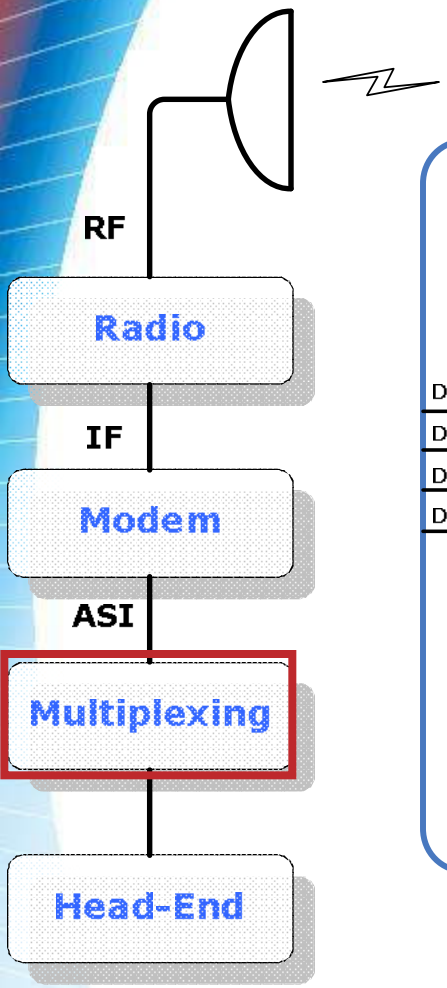
To integrate telephone network with a TV microwave link, a series of interfaces has been realised.

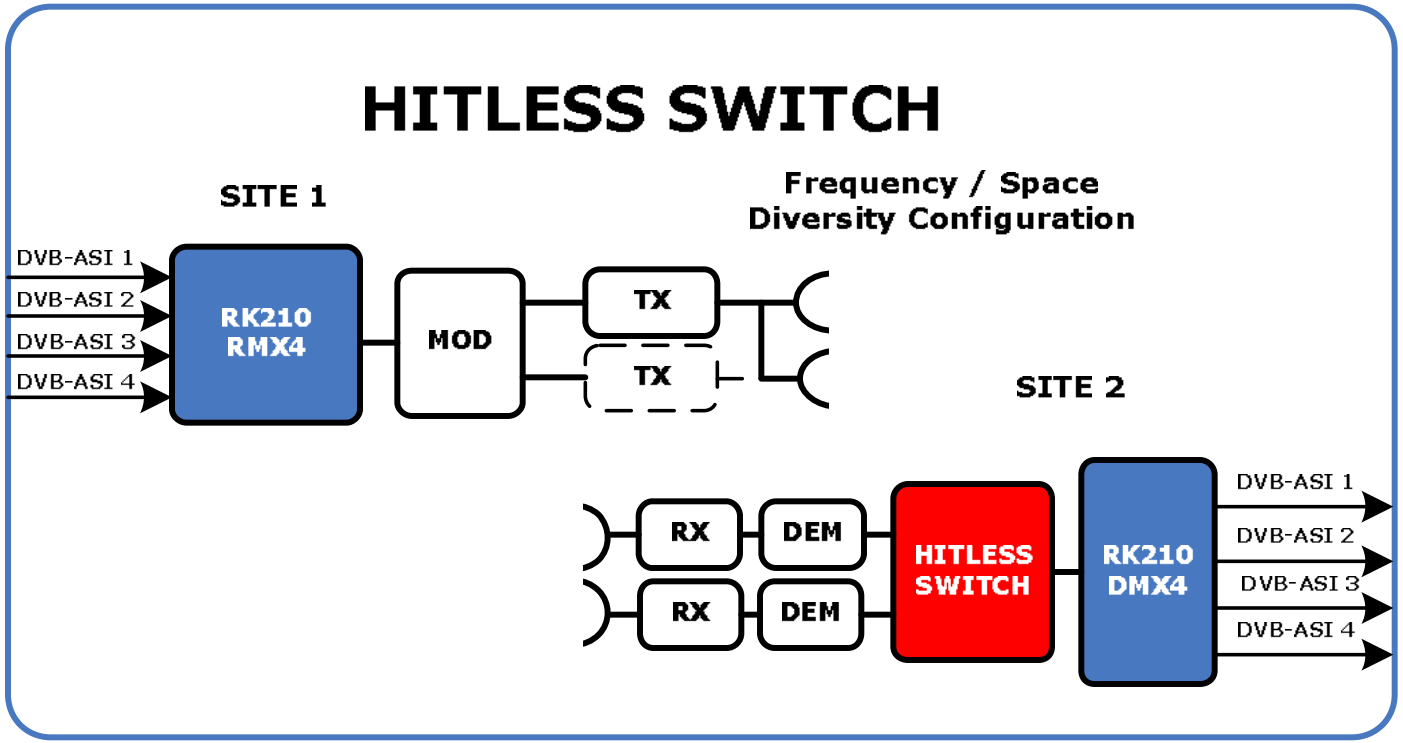




RK210

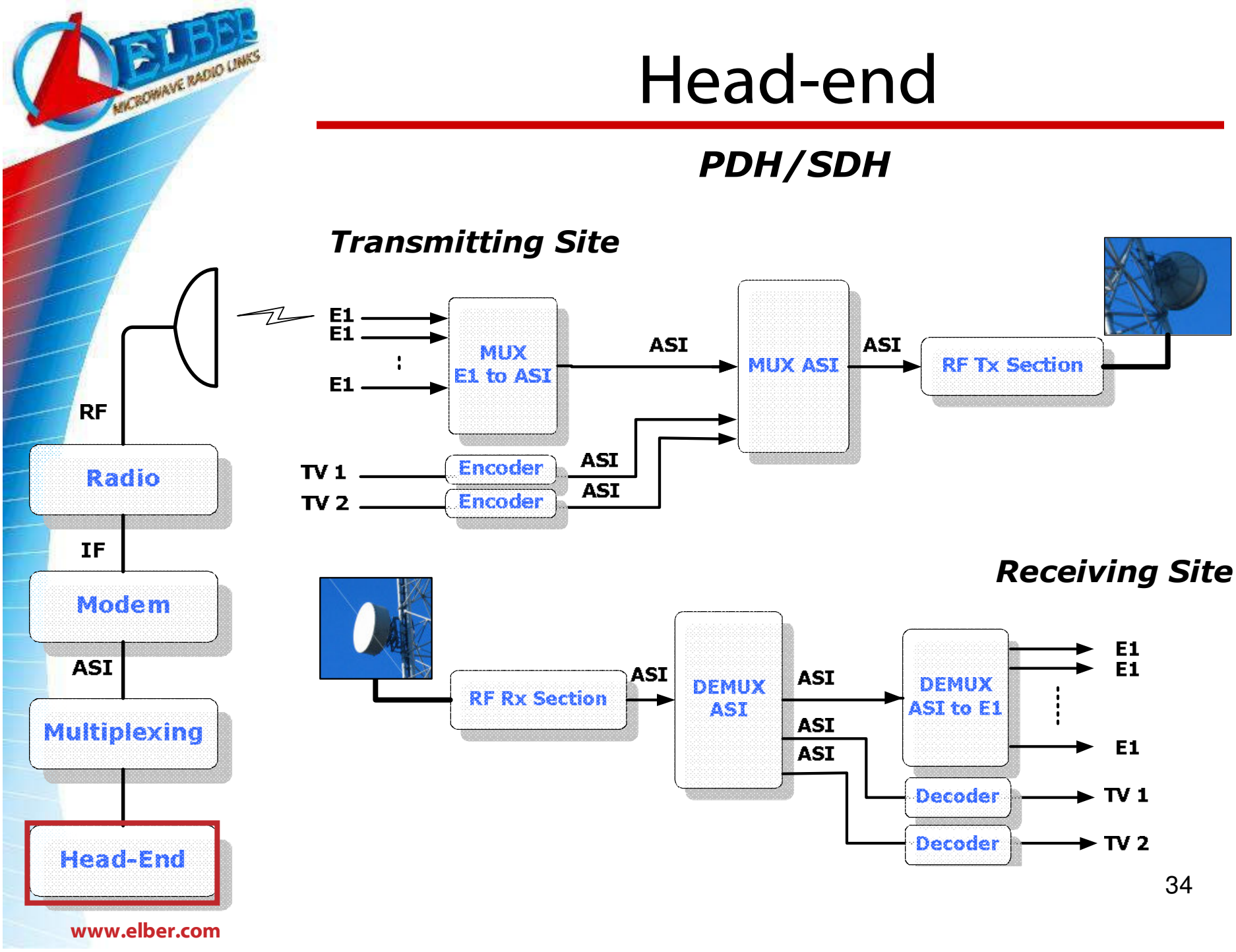
To have redundant configuration (*frequency* and *space-diversity*) an hitless switch is available.





Head-end

PDH/SDH



Portable Links

CPM Line

Mobile microwave link CPM line allows fast connection in difficult places, thanks to the simple yet robust mechanical structure and due to the excellent performance of electronic part.

- Simplex, Double Simplex o Duplex
- Analogue and/or Digital
  - COFDM 2k/8k
  - FM
  - External IF input (eg: DDM310)
- Frequency: 6 ÷ 15 GHz
- Frequency agile up to 500 MHz
- Integrated Encoder SD-MPEG-II 4:2:0/4:2:2
- Video Inputs:
  - YUV , Y/C
  - SDI
  - DVB-ASI
- Audio Inputs: 4 mono channels, DVB-ASI, SDI audio embedded
- Weatherproof RF Heads

CPM

Mobile Links

SPM Line

SPM Mobile Links Line has a robust mechanical structure, useful in external semi-fixed applications.

- *Simplex, Double Simplex o Duplex*
- Analogue or Digital
- Frequency: 6 ÷ 15 GHz
- Frequency agile up to 500 MHz
- Max Power Output:
  - MT/07 +33 dBm ±1 dB
  - MT/10 +30 dBm ±1 dB
  - MT/14 +30 dBm ±1 dB
- Weatherproof RF Heads
- Carrying case

SPM

PVT Line

This range of products allows the fast setting up of temporary / permanent radio link systems for video signal transmission in either analogue or digital transmission

- Analogue or Digital
- Frequency: 6 ÷ 22 GHz
- Frequency agile up to 500 MHz
- Max Power Output:
  - 6 GHz +31.5 dBm ±1 dB
  - 10 GHz +30 dBm ±1 dB
  - 18 ÷ 22 GHz +26 dBm ±1 dB
- Weatherproof RF Heads

RF HEAD

CONTROL UNIT

Wireless Camera

Digital wireless camera offers fast reliable links for news and studio applications.

- COFDM 2K
- QPSK, 16QAM, 64 QAM
- Frequency 2.3÷2.7 GHz
- Power out:
  - 0 dBm
  - 600 mW with antenna active
- Composite and Component Video Input
- Diversity Receiver
- 8 pre-settable configurations

WLCT-02 ("Studio")

- Encoder 4:2:2/4:2:0
- SDI video (audio embedded)
- 4 audio channel
- Latency < 64 ms