BLANKOM®

Professional Headend Solutions

Instruction manual

SAT-TV-Transmodulator

DVB-S/S2 (QPSK/8PSK)   DVB-C (QAM)

Contents

⟫ STB 016
Art.Nr.: 9710.02

...Setting Signals

STB 016
Art.Nr.: 9710.02

SAT - TV TRANSMODULATOR
DVB-S/S2   DVB-C

B LINE CE

1. Frontal view

SAT - IF input

Operating voltage / Control bus

LED "STANDBY" (red)

LED "READY" (green)

LED "ADDR." (yellow)

Address selection switch

RF output

agile   DCS   managed by SNMP

2. Device variants

STB 016   9710.02   QPSK / 8PSK   QAM(RF)

Minimum software required for HCB 100:
9650.03:   Version 2.34*
9650.04/.05: Version 3.18*

*) Updates: www.blankom.de

3. General

The SAT - TV - transmodulator STB 016 is a module of the headend system B - LINE which is conceived as a complete system for middle-sized networks.
The module converts QPSK - or 8PSK - signals into QAM - signals. All modules will be programmed via a central control unit (HCB100) and are working fully independent afterwards.

The status of the module is displayed via LED's:

· Red:	- STANDBY	Standby mode
· Green	- READY	Operating mode
· Yellow	- ADDR.	Remote control access

4. Function description

The digital tuner picks up the input signal matching the SAT-IF (intermediate frequency range for satellite signals) which has been set. The I/Q demodulator which comes after the tuner generates a transport stream of MPEG data. Then follows the signal processing. Here the SI (Service Information) and PSI (Program Specific Information) information is evaluated and processed to meet the DVB standard. The headend controller serves to generate an NIT (Network Information Table) into the Transport Stream. This is required to enable the receiver (such as Set-Top-Box) to tune in automatically. The NIT is fed into the Transport Stream; this is an element of the processing of the SI and PSI; it goes in as a PSI table.

There is a filter which can be used to select programmes which are to be excluded from the Transport Stream. The procedure involves a PID filter which removes the data associated with the banned programmes. The SI and PSI tables affected (i.e. the PAT, PMT, SDT, EIT) are automatically corrected. The MPEG Transport Stream is then fed into the QAM modulator and an IF signal is generated at the output.
Then the IF filtering takes place, and after that the production in the desired output channel. There is a free choice of frequency in the output channel from 45 to 862 MHz. On the output side, the modulator does not leak to adjacent channels. So that errors in level can be signalled if the load fluctuates (the red LED will flash and a trap message will be sent), a reference level is generated. Every time the level or frequency figures are programmed, automatic measurement of the reference level takes place; this function will, however, not start until 100 seconds have elapsed after start-up of the system.

5. Adjustment

5.1 Adjustment with the Headend Controller
· Adjustment of the addresses at the Bus Extender BEB 100 and at the modules
· Activation of the programming mode of each module by selecting the line (BEB 100) and the module position (01... 15) at the Headend Controller(HCB 100)
    yellow LED will be lit up til the beginning of the parameter adjustment
· Adjustment of the STB 016 parameter (see chapter 10)
    green LED is lit up
· After the programming the STB 016 will be automatically switched into the operating status
    yellow LED lights up briefly / green LED is lit up

5.2 Adjustment with the PC / Laptop
· Condition for the remote programming is an "online - connection" after IP - standard and an ethernet connection at the PC / Laptop
· Adjustment of the line / position addresses at the Bus Extender BEB 100 as well as at the modules
· At the Headend Controller HCB 100 IP - address input (e.g. 192.168.001.001)
· For "direct connection" between a PC and HCB 100 use a crossed patch cable (RJ 45)
· For connection over a deviation use an uncrossed patch cable
· HTML - browser start-up and put in IP - address as target address
· If connected correctly the HTML - control surface at the PC will open up and a blue LED (LINK) at the HCB 100 will be lit up
· All adjustment of the modules are specified at the control surface

The manual instructions of the Headend Controller HCB 100 and the Bus Extender BEB 100 have to be considered!

6. Display function of the led front panels

Colour	Status	Displayed function
red	permanently shining	Module in stand-by
	flashing	Module defect (hardware)
green	Permanently shining	Module works faultless
	flashing	Dysfunction depending on the signal: tuner not sync (e.g. in case of missing input signal) no input signal on the QAM-Modulator buffer overflows in the QAM-Modulator QAM overflow (input data rate on the QAM modulator too large) Level faults in the Up Converter
yellow	shining/flashing	Remote control access/Data transmission

7. Technical datas

SAT IF Input

Frequency range	950...2150 MHz
Tuning grid	1 MHz
AFC-Range	± 5 MHz
AGC-level range	42 ... 82 dBµV
Connector	F socket
Impedance	75

DVB-S Demodulator / Decoder

Modulation	QPSK
Symbol rate	2…45 MSps
Code rate (Viterbi)	1/2, 2/3, 3/4, 5/6, 7/8
Roll off	35 %
Signal processing	ETS 300 421 (DVB-S) [1]

DVB-S2 Demodulator / Decoder

Modulation		QPSK, 8PSK
Symbol rate	QPSK	1…34 MSps
	8PSK	1…28.9 MSps
Code rate (LDPC)	QPSK	1/4, 1/3, 2/5, 1/2, 3/5, 2/3, 3/4, 4/5, 5/6, 8/9, 9/10
	8PSK	3/5, 2/3, 3/4, 5/6, 8/9, 9/10
Roll off		20, 25, 35 %
Signal processing		ETS 302 307 (DVB-S2) [2]

QAM-Modulator

Constellation	16; 32; 64; 128; 256
Symbol rate	1.0...7.0 MSps
Roll off	15 %
Modulation error rate (MER)	45 dB
Shoulder attenuation	58 dB
Test- /measuring signals	PRBS
Zero stuffing	continuously
PSI-/SI processing	disconnectable
Signal processing	EN 300 429 [3]

RF-Output

Output frequency range	45 ... 862 MHz
Tuning grid	125 kHz
Max. output level	116 dBµV
Level adjustment range	0 ... 31.5 dB (0.5 dB steps)
Channel allocation	adjacent channel ability
Connector	F socket

Impedance	75
Return loss	18 dB 45 MHz
	- 1.5 dB / Octave
Signal quality	
Intermodulation channel	66 dB
Noise level 3'rd order	60 dB
Spurious 45...862 MHz	60 dB
C/N within analogue adjacent channels	
(fo ± 25 MHz; BW = 4.8 MHz)	typ. 80 dB
Phase noise	1 kHz; typ. -92 dBc/Hz
	10 kHz; typ. -101 dBc/Hz
	100 kHz; typ. -108 dBc/Hz
Frequency stability	± 30 kHz
Output level stability	± 0.5 dB
Amplitude frequency response	
Channel (8 MHz)	max. 1 dB$_{PP}$

Operating parameter

Voltage/ current	12 V (± 0.2 V) max. 900 mA
Residual ripple of the supply voltage	10 mV$_{PP}$

Enviromental conditions

Temperature range	-10 ... +55 °C
Temperature range (for data keeping)	5 ... 45 °C
Relative humidity	80 % (non condensing)
Mounting method	vertical
Mounting location	squirting and dripping water protected

Physical information

Dimensions (l x w x h)	
without 19" - adapter	50 x 276 x 148 mm
with 19" - Adapter	50 x 301 x 148 mm
Weight	1,190 g

Delivery content

1 x BUS connector

8. Security and operating instructions

🛑 When assembling, starting-up and adjusting the modules, it is necessary to consider the system specific references in the manual instruction!

⚠ The modules may only be installed and started up by authorized technical personnel!

⚠ When assembling the modules into the receiving points, the adherence of the EMC regulations is to be secured!

⚠ The assembly and wiring have to be done without voltage!

⚠ All active modules may only be operated with the Headend Controller HCB 100 or Bus Extender BEB 100!

⚠ The supply voltage and operating voltage for all modules operated with direct current has to be in accordance to the technical specifications of the respective module (see respective device manual)!

⚠ With all work the defaults of the DIN EN 50083 have to be considered! Especially the safety relevant execution of the DIN EN 50083/1 [4] is necessary!

9. Programming by Web servers *
9.1 Main menu

SAT-TV TRANSMODULATOR, STB 016
(9710.02 / 00), Address 00 / 01

Description	xxxx

Input
SAT-ZF	1236	MHz
Symbolrate	27500	kSps
Status	SYNC	DVB-S

Output
Channel	S21 (306,00 MHz)	
Frequency	306000	kHz
Attenuation	0	dB
QAM-Symbolrate	6900	kSps
QAM modulation mode	64	QAM
RF signal	On	

Status
Operating mode QAM modulator	Transcoder
NIT processing	Off
CAT processing	Off
Change TS-ID's	Off
Program filter	Off
Operating status	On [On]
SNMP trap message	On

Extended settings | NIT table | Program filter
Data rate overview | Softwareversion | Status
Save reference level | Factory settings
Reload | Transmit
<<<< | Back | >>>>

appliance designation, article number, HE address

description	program name (max. 30 characters)

Input
SAT - IF	adjustment range 950 ... 2150 MHz
QPSK Symbol rate	adjustment range 2000 ... 45000 MSps
Status	display whether **SYNC**hronization or **noSYNC**hronization at the input

Output
Channel	channel selection (2 ... 69, standard B/G)
Frequency	dedicated output frequency
Attenuation	adjustment range 0 ... 31.5 dB
QAM Symbol rate	selection: 6900, 6875, 6111 kSps
modulation mode	selection: 16, 32, 64, 128, 256 QAM
RF signal	selection: On/Off

Status
Operating mode	
NIT processing	On/Off according adjustment menu 1
CAT processing	On/Off according adjustment menu 1
Change TS-ID's	On/Off according adjustment menu 1
Program filter	On/Off according adjustment menu 1
Operating status	On/Off
SNMP trap message	On/Off

routing to the appropriate adjustment menu
Extended settings	see menu 1
NIT - table	see menu 2
Program filter	see menu 3
Data rate overview	see menu 4
Softwareversion	see menu 5
Status	see menu 6
Save reference level	manual measurements for the reference level
Factory settings	adjustment of Default-values

9.2 Advanced settings (menu 1)

SAT-TV TRANSMODULATOR, STB 016
(9710.02 / 00), Address 00 / 01

Output
Frequency	306000	kHz
QAM-Symbolrate	6900	kSps
Spectrum inversion	normal	
Operating mode QAM modulator	Transcoder	

Table processing
NIT
NIT processing	Off	
Network name	none	
Network ID	0	dez

CAT
CAT processing	Off	
CA system ID	0	dez
Operator ID	0	dez

Transportstream
Change TS-ID's	Off	
Transportstream ID	0	dez
Network ID	0	dez

Reload | Back | Transmit

appliance designation, article number, HE address

Output
Frequency	adjustment range 45000 ... 862000 kHz
QAM - Symbol rate	adjustment range 1000 ... 7000 kSps
Spectrum inversion	selectable between normal/inverse
Operating mode	selectable between Transcoder, test level, test signal

Table processing
NIT
NIT processing	activation or deactivation
Network name	freely selectable (max. 30 characters)
Network ID	freely selectable (0...65535)

CAT
CAT processing	activation or deactivation
CA system ID	freely selectable (0...65535)
Operator ID	freely selectable (0...65535)

Transportstream
Change TS-ID's	activation or deactivation
Transportstream - ID	freely selectable (0...65535)
Network - ID	freely selectable (0...65535)

* Continuative information are located in the HCB manual instruction

9.3 NIT table (menu 2)

SAT-TV TRANSMODULATOR, STB 016
(9710.02 / 00), Address 00 / 01

Entry	Original TS-ID	Original Network ID	Frequency (kHz)	QAM Symbolrate (kSps)	Modulation (QAM)
1	1101	1	306000	6900	64

NIT distribution: dynamically
Network name: none
Network ID: 0

[Reload] [Back]

appliance designation, article number, HE address

NIT - table with all additionally registered information

9.4 Program filters (menu 3)

SAT-TV TRANSMODULATOR, STB 016
(9710.02 / 00), Address 00 / 01

Program filter configuration

Operating status	Off ▾
Other transponder table	Pass ▾

Program selection

Operating mode		Drop ▾

Service ID	Program name	Selection
0x6DCA	Das Erste	☑
0x6DCB	Bayerisches FS Süd	☑
0x6DCC	hr-fernsehen	☐
0x6DCE	Bayerisches FS Nord	☐
0x6DCF	WDR Köln	☐
0x6DD0	BR-alpha*	☑
0x6DD1	SWR Fernsehen BW	☑

[Reverse selection] [Select all] [Clear all]
[Data rate overview]

[Reload] [Back] [Transmit]

appliance designation, article number, HE address

Program filter configuration
Operating status — activation or deactivation
Other transporder table — Pass or Drop
Program selection
Operating mode — Pass or Drop of the marked programs

Reserve selection — all not marked programs are choosen or vice versa
Select all — all programs of the list are marked
Clear all — no program of the list is marked
Data rate overview — routing to menu 4

9.5 Data rate overview (menu 4)

SAT-TV TRANSMODULATOR, STB 016
(9710.02 / 00), Address 00 / 01

Input data rate	38.015	MBit/s
Data rate by filter	36.772	MBit/s
max. QAM data rate	38.152	MBit/s
Reserve	*1.379*	MBit/s

[Reload] [Back]

appliance designation, article number, HE address

Input data rate — net data rate at the input
Data rate by filter — net data rate by program filters
max. QAM data rate — max. possible net data rate
Reserve — max. QAM data rate minus data rate by filter

9.6 Softwareversions (menu 5)

SAT-TV TRANSMODULATOR, STB 016 (9710.02 / 00), Address 00 / 01		
Version		
AP Controller	9710.02-81.01 Steuercontroller Anschluss-LP V1.03 21.07.2008 JR	
FPGA Boot Controller	9710.02-88.01 FPGA Boot Controller(1) V1.02 24.04.08 JR	
FPGA	9710.02-87.01 TS-Mux;QAM-Modulator V1.00 Beta 06.05.2008 WE,JR	
Nios	9710.02-86.01 TS-Manager V1.00 Beta 06.05.2008 JR	
S2-NIM Controller	9619.05-88.02 S2-NIM-Controller H2V1.02 07.06.2006 PK	
Up Converter	9199.01-88.02 internal Controller V2.00 26.06.2008 JH	
		Back

appliance designation, article number, HE address

Software version

Controller of the front circuit board

FPGA-Boot-Controller

QAM Modulator, TS Mux (FPGA)

TS manager

NIM controller

Up Converter controller

9.7 Device status (menu 6)

SAT-TV TRANSMODULATOR, STB 016 (9710.02 / 00), Address 00 / 01		
Tuner		
Status	*SYNC*	
Mode	DVB-S	
Set values	Sat ZF:1236 Symbolrate:27505	
BER	<1.192E-07	
Input data rate	38.015	MBit/s
FPGA Status	Transportstream OK	
FPGA error memory	empty	
Up Converter error memory	empty	
Oirginal TS-ID's	TS-ID: 1101 Network-ID: 1	
Information		
Temperature	41 °C	
Device number	0200939	
Device index	00	
	Reload	Back

appliance designation, article number, HE address

Tuner
Status — synchronization status
Mode — transfer format
Set values — display SAT IF/ Symbol rate
BER — display o the bit error rate
Input data rate — display of the net data rate
QAM-Modulator
FPGA Status — status, transportstream input
FPGA error memory — error memory TS Mux, QAM Mod.
Up Converter error memory..error memory Up Converter

Original TS-ID's — display transportstream ID and Network ID

Information
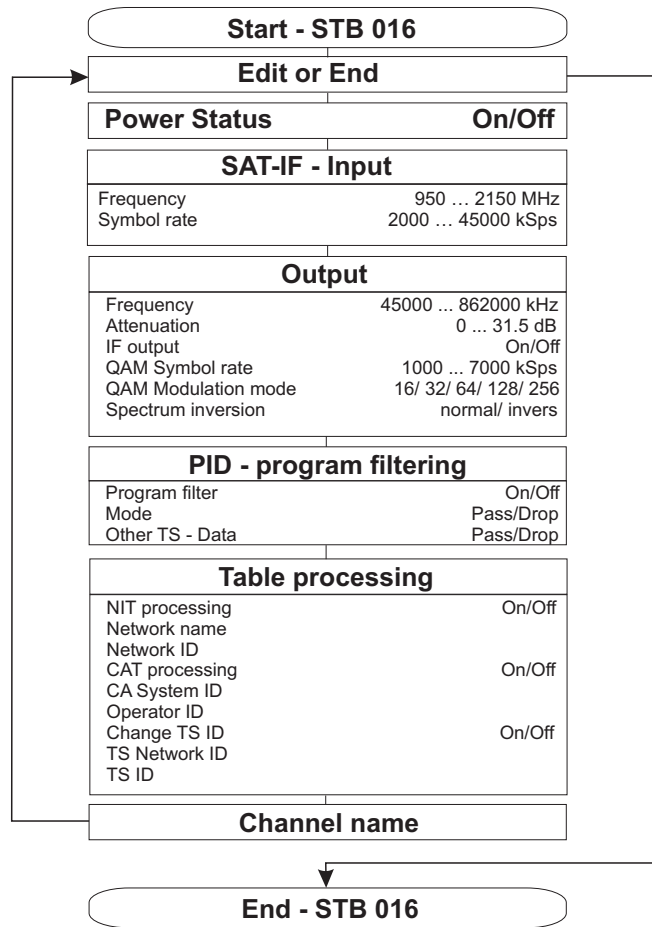Temperature — temperature of the front circuit board
Device number — display of the device number
Device index — display of the device index

10. Menu control with Headend Controller (HCB 100)

```
┌─────────────────────────────────────┐
│           Start - STB 016            │
└─────────────────────────────────────┘
┌─────────────────────────────────────┐
│            Edit or End               │
├─────────────────────────────────────┤
│ Power Status              On/Off     │
│  ┌──────────────────────────────────┐│
│  │         SAT-IF - Input           ││
│  ├──────────────────────────────────┤│
│  │ Frequency        950 … 2150 MHz  ││
│  │ Symbol rate    2000 … 45000 kSps ││
│  │  ┌───────────────────────────────┐│
│  │  │           Output              ││
│  │  ├───────────────────────────────┤│
│  │  │ Frequency    45000 ... 862000 kHz││
│  │  │ Attenuation       0 ... 31.5 dB ││
│  │  │ IF output              On/Off ││
│  │  │ QAM Symbol rate  1000 ... 7000 kSps││
│  │  │ QAM Modulation mode  16/32/64/128/256││
│  │  │ Spectrum inversion  normal/ invers││
│  │  │  ┌─────────────────────────────┐│
│  │  │  │     PID - program filtering ││
│  │  │  ├─────────────────────────────┤│
│  │  │  │ Program filter      On/Off  ││
│  │  │  │ Mode             Pass/Drop  ││
│  │  │  │ Other TS - Data  Pass/Drop  ││
│  │  │  │  ┌──────────────────────────┐│
│  │  │  │  │     Table processing     ││
│  │  │  │  ├──────────────────────────┤│
│  │  │  │  │ NIT processing    On/Off ││
│  │  │  │  │ Network name             ││
│  │  │  │  │ Network ID               ││
│  │  │  │  │ CAT processing    On/Off ││
│  │  │  │  │ CA System ID             ││
│  │  │  │  │ Operator ID              ││
│  │  │  │  │ Change TS ID      On/Off ││
│  │  │  │  │ TS Network ID            ││
│  │  │  │  │ TS ID                    ││
└─────────────────────────────────────┘
┌─────────────────────────────────────┐
│            Channel name              │
└─────────────────────────────────────┘
┌─────────────────────────────────────┐
│            End - STB 016             │
└─────────────────────────────────────┘
```

11. Trap-dispatches

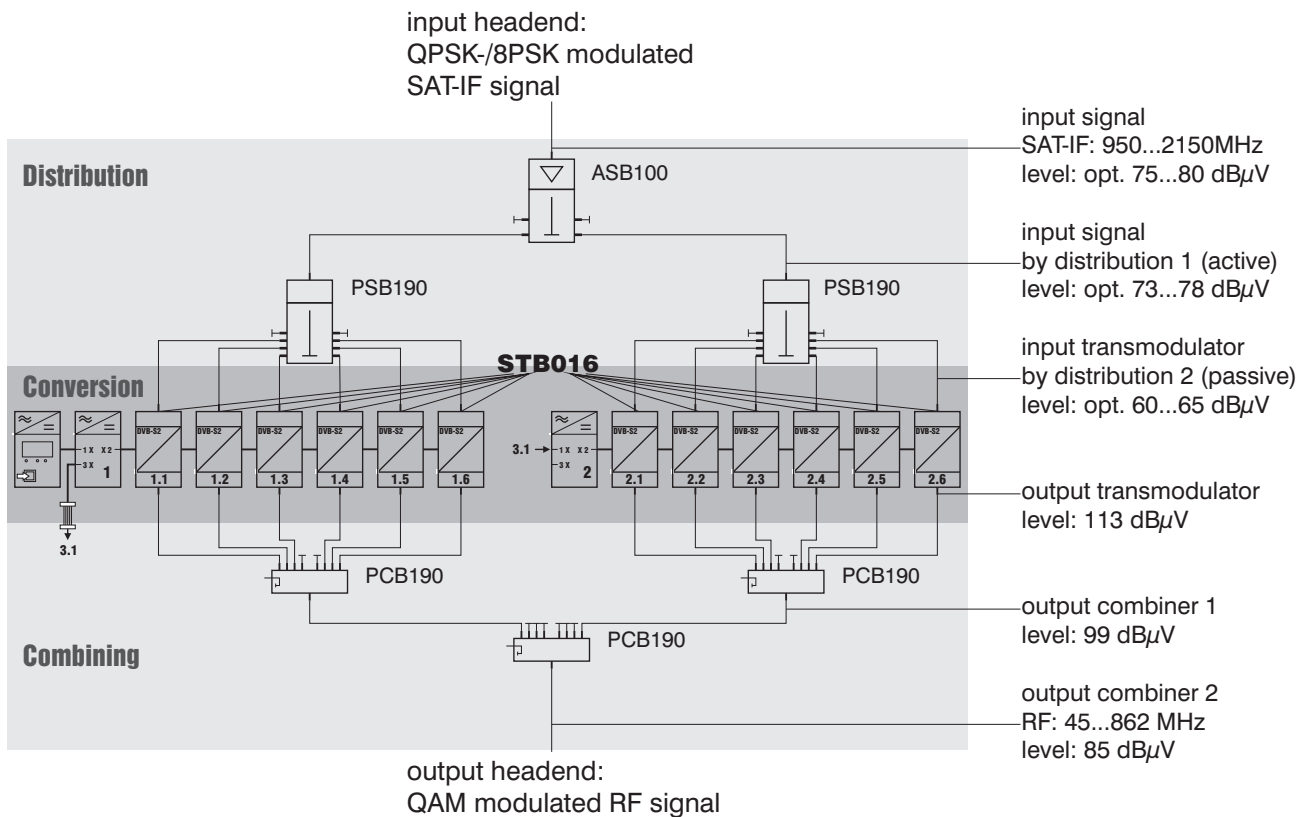| Lfd. Nr.	Note	Typ	Reference
01	Power fail	CRITICAL	short circuit
02	System Reset	WARNING	reset by internal error
03	Signal OK	INFORMATION	module works correctly
04	Tuner not sync	WARNING	no input signal at the tuner
05	IIC error	CRITICAL	IIC-Bus-error
06	TS-MUX not sync	WARNING	no transport stream at the FPGA
07	Internal controller reset	WARNING	error when accessing internal controller
08	FPGA: Program memory full	WARNING	overflow of program memory in the FPGA
09	FPGA: PID memory full	WARNING	overflow of PID memory in the FPGA
10	FPGA: Directory full	WARNING	overflow of Directory in the FPGA
11	FPGA: FAT memory full	WARNING	overflow of FAT memory in the FPGA
12	FPGA: TS-Packed buffer overflow	WARNING	overflow of TS-Packet buffer
13	QAM overflow	CRITICAL	overflow of QAM
14	Sync error data FIFO	CRITICAL	data FIFO doesn't work correctly
15	No response to OPEN command	CRITICAL	error internal port
16	Up Converter: PLL1 not locked	CRITICAL	no funktion at the PLL 1 converter
17	Up Converter: PLL2 not locked	CRITICAL	no funktion at the PLL 2 converter
18	Up Converter: IF input too small	WARNING	IF input too small at the Up converter
19	Up Converter: IF input too large	WARNING	IF input too large at the Up converter
20	Up Converter: RF output too small	WARNING	RF output too small at the Up converter
21	Up Converter: RF output too large	WARNING	RF output too large at the Up converter

12. Block diagram
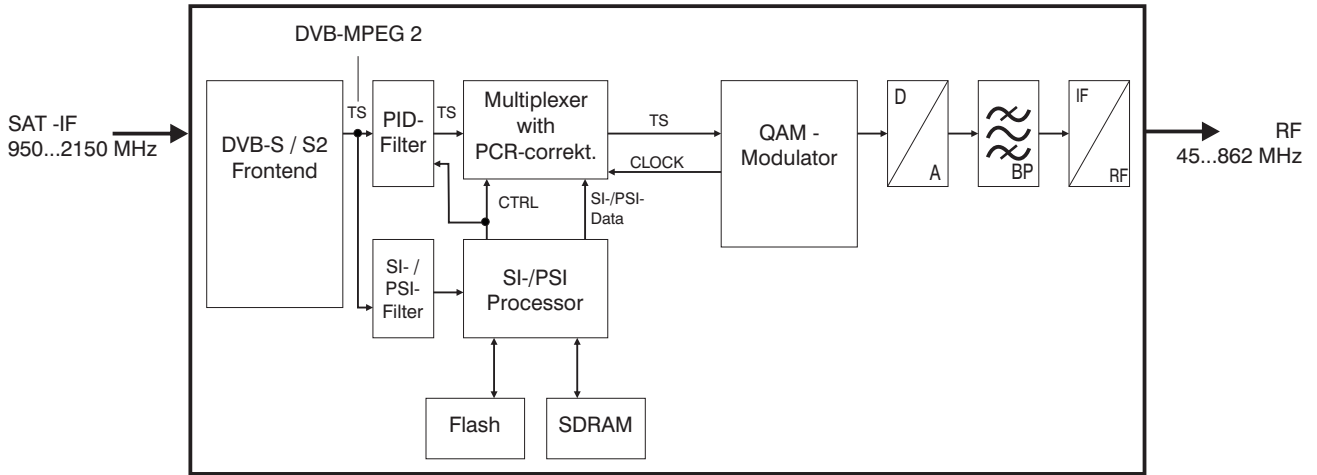
13. Headend BUS structure
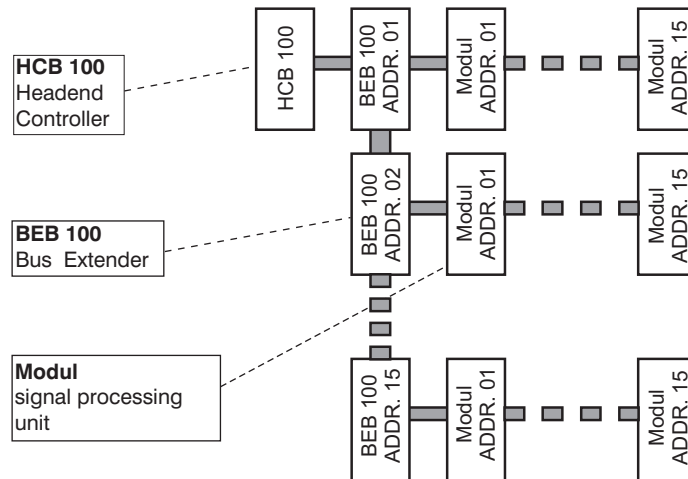
The number of the possible module connections (00 ... 15) to a BEB 100 depends on the total power consumption of this line!

14. Example of application

input headend:
QPSK-/8PSK modulated
SAT-IF signal

input signal
SAT-IF: 950...2150MHz
level: opt. 75...80 dBμV

Distribution

ASB100

input signal
by distribution 1 (active)
level: opt. 73...78 dBμV

PSB190   PSB190

input transmodulator
by distribution 2 (passive)
level: opt. 60...65 dBμV

STB016

Conversion

1X X2
3X 1   3.1 → 1X X2
                   3X 2

DVB-S2 1.1 DVB-S2 1.2 DVB-S2 1.3 DVB-S2 1.4 DVB-S2 1.5 DVB-S2 1.6   DVB-S2 2.1 DVB-S2 2.2 DVB-S2 2.3 DVB-S2 2.4 DVB-S2 2.5 DVB-S2 2.6

3.1

output transmodulator
level: 113 dBμV

PCB190   PCB190

output combiner 1
level: 99 dBμV

Combining

PCB190

output combiner 2
RF: 45...862 MHz
level: 85 dBμV

output headend:
QAM modulated RF signal

15. Bibliography

[1] EN 300 421: Digital Video Broadcasting (DVB): Framing structure, channel coding and modulation for 11/12 GHz satellite services

[2] ETSI EN 302 307: Digital Video Broadcasting (DVB): Second generation framing structure, channel coding and modulation systems for Broadcasting Interactive Services, News Gathering and other broadband satellite applications

[3] EN 300 429: Digital Video Broadcasting (DVB): Framing structure, channel coding and modulation for cable systems

[4] EN 50083-1: Kabelverteilsysteme für Fernseh-, Ton- und interaktive Multimediasysteme, Sicherheitsanforderungen

16. Glossary

8PSK	**8 P**hase **S**hift **K**eying
AFC	**A**utomatic **F**requency **C**ontrol
AGC	**A**utomatic **G**ain **C**ontrol
APL	Front circuit board
BER	**B**it **E**rror **R**ate
BW	**B**and**w**idth
CA	**C**onditional **A**ccess
CAT	**C**onditional **A**ccess **T**able
DVB	**D**igital **V**ideo **B**roadcasting (-C **C**able, -S **S**atellit, -S2 **S**atellite **2**)
EIT	**E**vent **I**nformation **T**able
ETSI	**E**uropean **T**elecommunications **S**tandards **I**nstitute
FAT	**F**ile **A**llocation **T**able
FEC	**F**orward **E**rror **C**orrection
FPGA	**F**ield **P**rogrammable **G**ate **A**rray
HE	**H**ead**e**nd
http	**h**yper**t**ext **t**ransfer **p**rotocol
I/Q	**I**n-phase/**Q**uadrature
ID	**Id**entifier
IF	**I**ntermediate **F**requency
IIC	**I**nter-**I**ntegrated **C**ircuit (internal data bus of the module)
IP	**I**nternet **P**rotocol
LDPC	**L**ow **D**ensity **P**arity Check **C**ode
LED	**L**ight **E**mitting **D**iode
MAC	**M**edia **A**ccess **C**ontrol
MER	**M**odulation **E**rror **R**ate
MIB	**M**anagement **I**nformation **B**ase
MPEG	**M**oving **P**icture **E**xperts **G**roup
MPTS	**M**ulti **P**rogram **T**ransport Stream
NIM	**N**etwork **I**nterface **M**odule
Nios	Product name of a processor
NIT	**N**etwork **I**nformation **T**able
PAT	**P**rogram **A**ssociation **T**able
PCR	**P**rogram **C**lock **R**eference
PID	**P**rogram **Id**entifier
PMT	**P**rogram **M**ap **T**able
PSI	**P**rogram **S**ervice **I**nformation
QAM	**Q**uadrature **A**mplitude **M**odulation
QPSK	**Q**uadrature **P**hase **S**hift **K**eying
RF	**R**adio **F**requency
SDT	**S**ervice **D**escription **T**able
SI	**S**ervice **I**nformation
SNMP	**S**ingle **N**etwork **M**anagement **P**rotocol
SPTS	**S**ingle **P**rogram **T**ransport **S**tream
TS	**T**ransport **S**tream

17. History

version	date	modification	editor
1.00	18.07.2008	basic document	Poch

Options and other TV standards available upon request! Changes due to technical progress possible!