DMG 3200

SYSTEM OF CHOICE FOR PROFESSIONAL OPERATORS

Sencore is dedicated to providing world class equipment that enable operators to deliver professional broadcast services at the highest possible quality. The DMG 3200 is built around a modular platform hosting a wide selection of interoperable modules that give unparalleled configuration possibilities. Through its clever and robust design, the integrated architecture offers superior reliability that can meet even the most demanding operator requirements.

A key feature of the DMG 3200 is the ability to accommodate customers preferred system architectures while reducing complexity. It is possible to build an entire broadcast system within a single chassis or distribute it between several discreet stages or distributed architectures. Sencore's deep understanding of the market and close co-operation with operators in the design of products ensures the ability to provide optimal solutions for a wide array of fixed or wireless networks. Our philosophy greatly reduces the cost of ownership and ensures that operators can simultaneously handle legacy challenges and evolve through the introduction of brand new services.

Sencore's DMG 3200 is our latest generation carrier grade platforms with 1RU and 4RU chassis options of unmatched power and versatility. There are no restrictions even for the most intensive processing requirement. Both units feature uprated dual-redundant and hot swappable power supplies, increased cooling, enhanced redundancy and a number of other features.

An advanced user friendly GUI offers an intuitive and comprehensive management of the many features of the system. The exhaustive multi-level alarm system, together with the easiness for integration to 3rd party management systems, enables full automatic control. The possibility of centralized monitoring simplifies deployment and streamlines maintenance.

Sencore classifies its modules into different categories depending on the functionality. These include switching, input for content aggregation, compression, processing, and output modules. All modules can be combined freely to provide the desired functionality. The latest innovations include the possibility to deliver and convert both analog and digital broadcast services, from point to point, or from point to multipoint and in any format to any screen.

All modules and functions are further described within the 'modules' section of this brochure.

Advanced architecture designed to save space, energy and resources
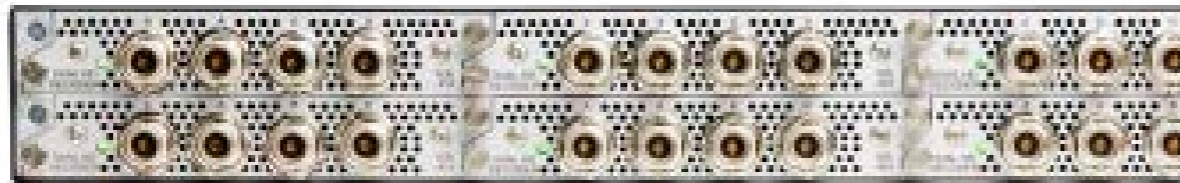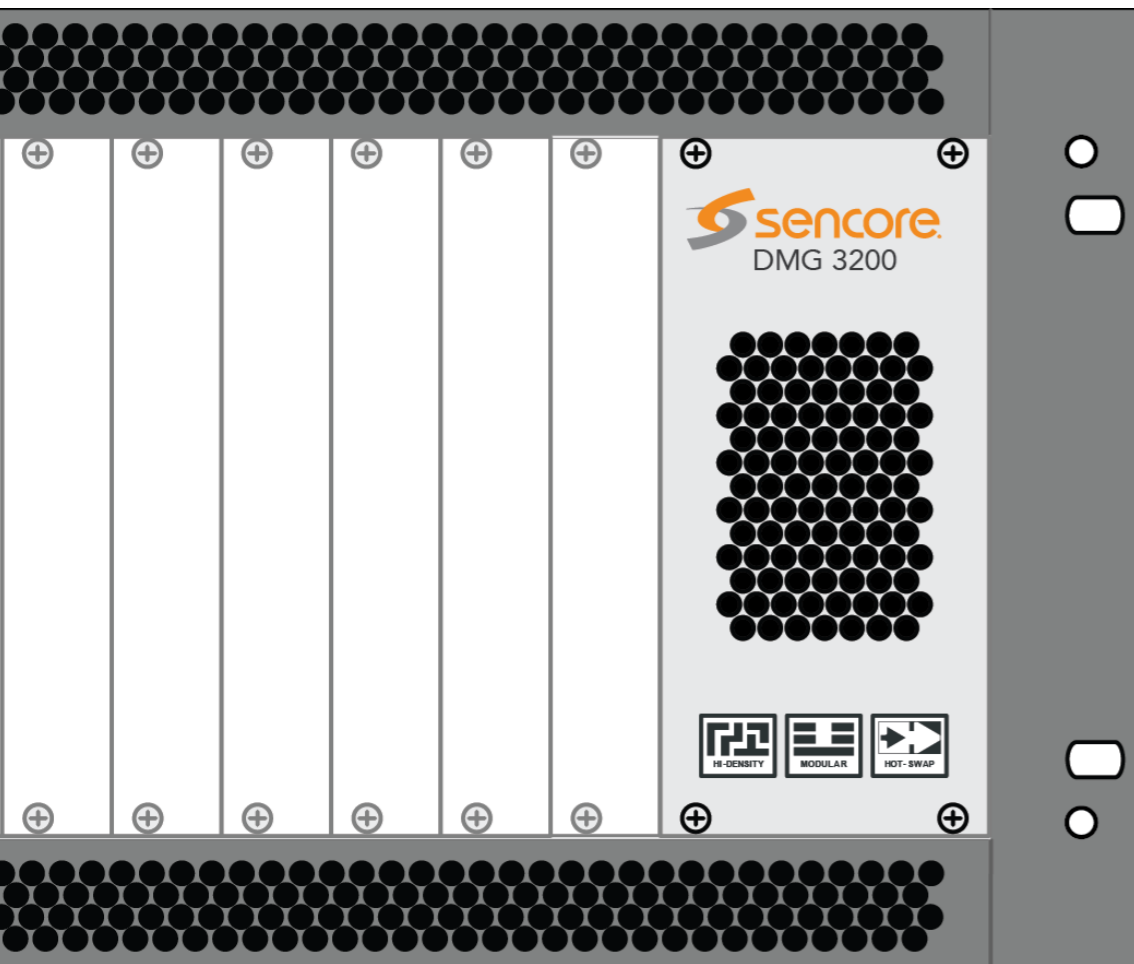
CHASSIS

Sencore offers two different chassis: the 4RU chassis which can hold 16 modules and the 1RU chassis which can hold 6 modules. In addition, each of the chassis houses a switch and management module that can be equipped with dual IP I/Os. Both chassis variants have dual-redundant and hot swappable power supplies. Each unit with its hot swappable modules allows for various redundancy scenarios.

Any of the modules listed under the Input, Encoding/Transcoding, Processing, and Output sections can be combined into the same chassis. Only chassis space or total throughput will limit the number of modules that can be fitted. The chassis has been designed for a throughput of 850 Mbit/s of MPEG TS data and 250 services. In selected configurations, capacity can be increased to 1700 Mbit/s and 500 services (please contact Sencore for more information).

The 4RU chassis has four independent fan modules that operate and are monitored independently. The four fan modules are identical and support hot-swap. The 1RU chassis has one preassembled fan module consisting of 6 fans. The fan module is hot-swappable as one complete module. The internal temperature is monitored and if a fan fails, the remaining fans will compensate by increasing the speed.

FEATURES

4RU
- Modular configuration with up to 16+2 board positions
- WEB based configuration, SNMP Alarms, SOAP/XML interface
- Forced air-cooling (front to back)
- Dual redundant hot-swappable power supply
- Remote reset of power
- 4 individually monitored hot-swappable fans
- Hot-swappable modules
- 100-240V AC power

1RU
- Modular configuration with up to 6+1 board positions
- WEB based configuration, SNMP Alarms, SOAP/XML interface
- Forced air-cooling (front to back)
- Dual redundant hot-swappable power supply
- Remote reset of power
- Swappable fan module
- Hot-swappable modules
- 100-240V AC or -48V DC power

DIMENSIONS

4RU
440 ×177 ×400 (w × h × d mm)

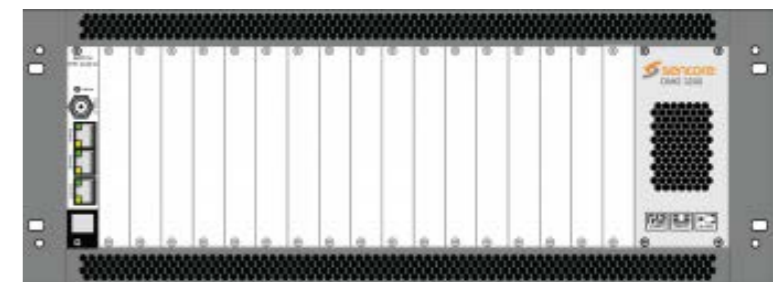**1RU**
440 ×44 ×480 (w × h × d mm)
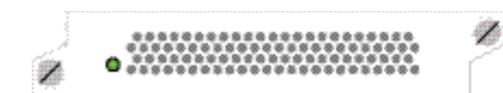

The 4RU and 1RU use the same set of modules and same SW, but the front plates are different.

The modules can therefore not be interchanged between 4RU and 1RU.

Module plate for 4RU

Module plate for 1RU

SWITCH MODULES

The switch module is used to enable MPEG traffic distribution within the chassis and provides the Man Machine Interface (MMI), enabling configuration and management of the chassis.

The 4RU chassis has dedicated positions for the switch module in slot 0 with an optional (for selected configurations) redundant switch module in slot 17. The switch module can be equipped with two independent IP IO ports as an option. The 1RU chassis provides an integrated switch module in the front with IP IO as standard. The switch module for 1RU is functionally identical to the switch module used in the larger 4RU chassis, but has a different hardware layout.

At least one switch module is required in all chassis. In addition to being the active part of the internal backplane, the switch module provides the central control and management interface. When equipped with two IP IO data ports, reception or streaming of MPEG compliant transport streams over UDP/RTP is supported by the module. Each port operates independently and can be configured as either IP in or IP out supporting full 850 Mbit/s TS data rate and up to 250 MPEG services. The switch module can be provided with either RJ45 connectors or SFP connectors on the two data ports. When equipped with two data ports, the module also has a Gen Lock input port. The switch module is hot-swappable for easy maintenance.

The Switch IP IO MMI module can also be ordered to include a GPS receiver for terrestrial SFN applications. For the 4RU, this is a separate module that must be placed in slot 1, while for 1RU, it is an add-on module for the switch module. One SMA connector for connecting either a GPS antenna or a 1 PPS reference is then available. It is also possible to order without the GPS radio module so that it just provides a high stability oscillator providing locking to a 1 PPS or 10MHz reference signal.

SWITCH MODULES FOR DMG 3200 4RU

Switch Module with Management

• Gbit/s routing between modules in a chassis
• Enables WEB management
• 10/100/1000BaseT management port (RJ45)
• 1 slot wide

Clock Reference Module

• GPS antenna input
• 1 pps input reference
• 10 MHz test output
• 1 pps test output
• 1 slot wide

Switch Module with Management and IPIO

• Gbit/s routing between modules in a chassis
• 2 × Gbit RJ45 or SFP input or output port for data
• Frame Synchronization input (genlock)
• Up to 850 Mbit/s TS rate per data port
• Supports UDP/RTP Multicast/Unicast
• Supports reception of MPTS and SPTS
• Supports streaming of MPTS and SPTS
• Supports seamless (hitless) input redundancy and cloned output
• Multiplexing on output with PSI/SI regeneration (license)
• Service filtering
• FEC encoding and decoding (license)
• Enables WEB management
• 10/100/1000 BaseT management port (RJ45)
• 1 slot wide
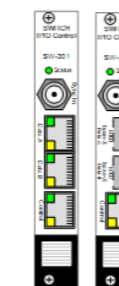
SWITCH MODULES FOR DMG 3200 1RU

Switch Module with Management

• Gbit/s routing between modules in a chassis
• Enables WEB management
• 10/100/1000 BaseT management port (RJ45)

Switch Module with Management and Dual IPIO

• Gbit/s routing between modules in a chassis
• 2 × Gbit RJ45 or SFP input or output port for data
• Frame Synchronization input (genlock)
• Up to 850 Mbit/s TS rate per data port
• Supports UDP/RTP Multicast/Unicast
• Supports reception of MPTS and SPTS
• Supports streaming of MPTS and SPTS
• Supports seamless (hitless) input redundancy and cloned output
• Multiplexing on output with PSI/SI regeneration (license)
• Service filtering
• FEC encoding and decoding (license)
• Enables WEB management
• 10/100/1000 BaseT management port (RJ45)
• Optional GPS Receiver
• PTP Support
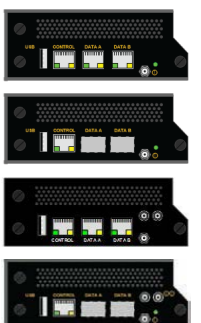
Hardware-managed redundancy for unbeatable speed and long-term reliability

MPEG INPUT MODULES

Sencore has a wide range of input modules making it the most effective content aggregation solution on the market. An input module analyzes incoming transport streams and extracts selected MPEG services from the desired physical input interface (eg. ASI, IP, DVB-S/S2/S2X, DVB-C, DVB-T/T2, ISDB-T and 8VSB). Each input module type is based on embedded hardware design offering high density and reliability. The ability to mix input types freely within a chassis enables multiple MPEG transport streams originating from a variety of sources to be received and processed in parallel. Received signals can be demodulated, de-multiplexed and distributed to other modules inside the chassis via the backplane.

A wide range of input modules are available including IP, ASI, DVB-S/S2/S2X, DVB-C, DVB-T/T2, ISDB-T and 8VSB. The chassis supports any combination of input modules limited only by available slot space. Each input module is designed to receive up to 850Mbit/s of MPEG TS rate or 250 services. In re-multiplexing mode, all services are de-multiplexed by the input module before passed onto the backplane. Unused services are blocked by the input module to avoid propagating them further, which increases efficiency. The full content of an input port can be mapped transparently to an output port with the option to perform PID filtering or service filtering.

FEATURES

- Modular
- Scalable
- Compact with multiple inputs per module
- Advanced input analysis and status information

- Easy to configure from one common web GUI interface
- Hot swappable
- Wide range of input types
- Mix and match card types freely, and add as many as you need

INPUT MODULES

Dual IP IO

- 2 × Gbit RJ45 or SFP input port for data (or 1×in and 1×out)
- Up to 850 Mbit/s TS rate per data port
- Supports UDP/RTP Multicast/Unicast
- Supports reception of MPTS and SPTS
- Supports seamless (hitless) input redundancy
- Service filtering
- Supports FEC (SMPTE 2022) (license)
- Input analysis
- 1 slot wide

ASI Input

- 4 × ASI inputs
- 4 × BNC connectors
- 213 Mbit/s Burst mode or 72 Mbit/s Spread mode per input
- Supports reception of MPTS and SPTS
- Service filtering
- Input analysis
- 1 slot wide
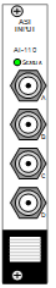
DVB-C Input

- 4 × QAM Annex A/C inputs
- 1 × F connector
- 0.87–6.9 Ms/s
- Supports reception of MPTS and SPTS
- Service filtering
- ASI monitoring port
- Input analysis
- 1 slot wide

ISDB-T Input module

- 4 x ISDB-T receivers per module
- 1 F-type, 75 ohm female input port (all 4 channels on one input cable)
- Frequency range 47-860MHz
- Supports reception of MPTS and SPTS
- Service filtering on input
- Input analysis
- 1 slot wide

DVB-S/S2X Input

- 4 × DVB-S/S2/S2X inputs, 1 F connector per input
- Satellite Standards:
    DVB-S EN 300 421
    DVB-S2 EN 302 307-1
    DVB-S2X EN 302 307-2, Broadcast Services
- Constellation: QPSK, 8PSK, 16APSK and 32APSK
- 950 – 2150 MHz Frequency Range
- Symbol rate:
    DVB-S/S2/S2X: 1-45 MSym/s for QPSK, 8PSK, 16APSK
    1-39.9 MSym/s for 32APSK
- FEC:
    According to EN300421 & EN302307
    part 1 & part 2 for Broadcast Services
- Supports reception of MPTS and SPTS
- Supports multistream reception
- Service filtering
- Input analysis
- 1 slot wide

8VSB/QAM Annex B Input

- 4 × 8VSB or QAM Annex B Inputs
- 4 × F connectors
- 50 to 860 MHz Frequency Range
- Supports reception of MPTS and SPTS
- ASI monitoring port
- Service Filtering
- 2 slots wide
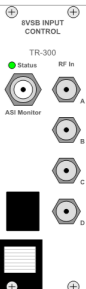
Enhanced DVB-S/S2 Input

- 4 × DVB-S/S2 inputs, 1 F connector per input
- 4 × F connectors
- DVB-S, DVB-S2 QPSK, 8PSK modes, 16APSK and 32APSK modes
- Frequency range 950 – 2150 MHz
- Symbol rate:
- DVB-S: 1-45 MSym/s
- DVB-S2: 1-45 MSym/s
- FEC:
- DVB-S: 1/2, 2/3, 3/4, 5/6, 7/8
- DVB-S2 QPSK: 1/2, 3/5, 2/3, 3/4, 4/5, 5/6, 8/9, 9/10
- DVB-S2 8PSK: 3/5, 2/3, 3/4, 5/6, 8/9, 10/9
- DVB-S2 16PSK: 2/3, 3/4, 4/5, 5/6, 8/9, 10/9
- DVB-S2 32PSK: 3/4, 4/5, 5/6, 8/9, 10/9
- Supports reception of MPTS and SPTS
- Supports multistream reception
- Service ltering
- ASI monitoring port
- Input analysis
- 2 slots wide

DVB-T/T2 Input

- 4 × DVB-T/T2 receivers per module.
- Input ports option:
    - 1 × F connector, signal is split and distributed internally
    - 4 × F connectors, one per demodulator
- Frequency range 47-862 MHz
- Carrier mode:
    - DVB-T: 2k, 8k
    - DVB-T2: 1k, 2k, 4k, 8k, 16k, 32k
- Modulation:
    - DVB-T: QPSK, 16QAM, 64QAM
    - DVB-T2: QPSK, 16QAM, 64QAM, 128QAM, 256QAM
- Supports reception of MPTS and SPTS
- Service filtering on input
- Input analysis
- 1 slot wide

UNIVERSAL ENCODER & TRANSCODER

Linear Broadcast

In order to optimize the performance of their networks, it is essential for professional broadcasters to deploy the latest advances in compression technology. Whether the aim is to add new channels to existing multiplexes or provide genuine video quality improvements, operators should always strive to utilize the best in class technology to offer superior viewing experience whilst improving bandwidth efficiency.

Sencore has developed an encoding/transcoding solution providing leading class performance for video quality and channel density on a specifically designed module targeting a wide range of applications. This allows users to maintain the best possible quality of service in combination with low power consumption and integrated multi-level redundancy.

The immense computational power of the platform runs all-new and highly evolved encoding algorithms, boosting performance to the limit for both AVC and MPEG2 video. The highly programmable and flexible audio encoder offers high density per channel and includes Dolby® codecs, making this one of the most powerful encoder platforms on the market.

A brand new architecture offers full flexibility for configuration, with adaptable application modes. The Universal Encoder and Universal Transcoder module can operate in either a High Video Quality mode, or alternatively in high density broadcast mode. Channel density is significantly increased with a small adjustment in performance whilst Multiscreen mode enables operators to increase content reach to multiple media devices in the fixed and mobile domain.

The new second generation statistical multiplexing provides ultra-fast refresh rate from a multi-pass look-ahead design minimizing inherent latency. Mixed encoder/ transcoder populations can be used within the platform supporting several single or mixed format SD/HD statistical multiplexing groups so that low-bitrate encoding can be applied to specific services within any given group.

All new Universal Encoder/Transcoder modules can be used in new or existing 4RU or 1RU Series platforms and can work in combination with any other modules from Sencores comprehensive range.

Multiscreen (OTT):

Increased internet access together with more powerful computers, integrated TVs, tablets and mobile phones makes it possible for consumers to receive video content from broadcasters anywhere, at any time and on any screen. This introduces new challenges for content and network infrastructure providers who need to offer a wide range of different distribution formats with the best possible live video experience regardless of the distribution networks and viewing devices that are being used.

The latest innovative Universal Encoder/Transcoder running in Multiscreen mode from Sencore enables broadcasters and IP network operators to provide high quality multiscreen services. The transcoder module supports MPEG-2/4 TS input and transcodes to multiformat MPEG-4 TS output with IDR alignment. The encoder module accepts SDI/HDSDI inputs directly, and encodes these into multiple profiles as a single pass, avoiding the need to concatenate compression stages which always causes inefficiencies and reduces VQ. The unique architecture delivers significant VQ and efficiency benefits for all real-time applications.

Sencore now offers a truly optimized OTT solution capable of accepting any input signal format. These benefits are magnified further by a modular architecture that lets you fit encoding or transcoding options freely according to actual need. The Sencore Multiscreen encoder/ transcoder simultaneously prepares multiple signals from any source in any format for distribution to high definition televisions, high resolution computers and low resolution web and mobile devices.

The highly programmable functions include input service replication, resolution change, interlaced to progressive conversion, rescaling and key frame alignment. The end result provides key-frame aligned outputs in transport stream format with the required metadata to support either IPTV distribution directly, or interface with the customers preferred packagers to perform segmentation.

The proven ability to interface with several leading segmenters/originserver is another major feature of the Sencore solution. It enables customers to freely create a best of breed solution, combining best in class compression with their choice of latest features such as targeted advertising and common encryption with MPEG DASH.

FEATURES

- Modular
- Exceptional video quality
- Compact HW based encoding/transcoding
- Supports MPEG-2 and MPEG-4 SD and HD
- Power and space efficient
- Scalable
- Segmentation agnostic: Can be used with customers having existing segmentation infrastructure
- Complete: Use with other modules to build a complete solution within a chassis
- Can be used to create hybrid broadcast / OTT capable platforms
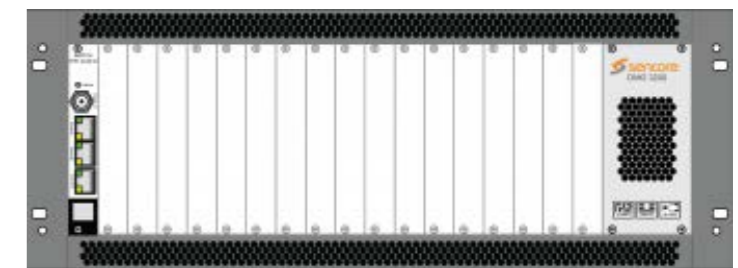
ENCODING/TRANSCODING MODULES

HD/SD SDI Encoder

- Encodes up to 2 HD or 4 SD channels
- 2 HD-SDI or up to 4 SD-SDI inputs, BNC connectors
- Available variants:
  - Dual HD Encoder with AES option
  - Quad SD upgradable to Dual HD
- Operates in three different Encoder Rate control modes:
  - Constant Bit Rate (CBR)
  - Capped Variable Bit Rate (CVBR)
  - Statistical Multiplexing
- MPEG-2/4 SD/HD encoding
- Picture in picture support
- Logo insertion
- 1 slot wide
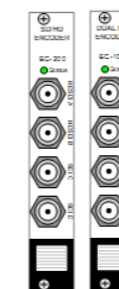
SD/HD Transcoder

- Transcodes up to 2 HD or 4 SD channels
- Full decode and re-encode
- MPEG-2/4 SD/HD transcoding
- Operates in three different Encoder Rate control modes:
  - Constant Bit Rate (CBR)
  - Capped Variable Bit Rate (CVBR)
  - Statistical Multiplexing
- 1 slot wide

Encoder -RF input

• Encodes up to 2 SD + PIP or 4 SD channels
• 4 F 75Ω input connectors, one per service
• Input frequency range 47-862MHz
• PAL B/G, PAL I and SECAM D/K input*
• MPEG-2 and MPEG 4 SD encoding
• Operates in two encoder rate control modes:
    - Constant bit-rate (CBR)
    - Capped variable bit-rate (CVBR)

*Other TV standards can be supported upon request

Analog Encoder

• Encodes up to 2 SD + PIP or 4 SD channels
• 4 HD BNC with composite video input
• 25 pin mini D-sub for audio:
    - 4 balanced analog audio
    - 2 AES/EBU audio
• MPEG-2 and MPEG 4 SD encoding
• Constant bit-rate (CBR)
• Capped variable bit-rate (CVBR)
• Logo insertion
• 1 slot wide

Universal Transcoder - Multiscreen (OTT)

• Transcodes up to four services into multiple profiles
• Transcodes single service into 4 HD or 28 sub SD profiles
• Profile range from 1920×1080p to 240×180p*
• Resolution conversion
• Frame rate reduction
• GOP alignment
• Audio transcoding
• 1 slot wide

*For complete list of available profiles, please contact Sencore

Universal Encoder - Multiscreen (OTT)

• Encodes up to four services into multiple profiles
• 4xSDI or 2xHDSDI input with embedded audio
• Supports an extensive range of resolutions and frame-rates
  from full 720p60/50 HD down to 144p15/12.5
• Resolution conversion
• Dynamic Encoder GOP Control Modes
• Key frame alignment
• Audio encoding
• 1 slot wide
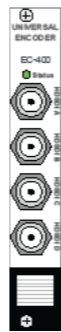
Universal Transcoder – High VQ Broadcast

• Transcodes up to:
    -1 HD with PIP
    -2 SD with PIP
• Full decode and re-encode
• Optional H.264 4:2:2 8bit/ 10bit decoding
• Resolution conversion
• MPEG-1, AAC and Dolby audio transcoding
• Component pass-through
• Operates in 3 different Encoder Rate Control modes:
Constant Bit Rate (CBR)
    -Statistical
    -Multiplexing
• 1 slot wide

Universal Encoder - High VQ Broadcast

• Encodes 1 HD or 2 SD into MPEG-2 or MPEG-4
• SDI/HDSDI input with embedded audio
• 2 BNC, 75 ohm female input ports (plus 2 unused BNC)
• Operates in three encoder rate control modes:
    - Constant Bit Rate (CBR)
    - Capped Variable Bit Rate (CVBR)
    - Statistical Multiplexing
• Resolution conversion
• Picture in Picture
• Logo insertion
• Advanced audio encoding with support for all common
  audio codecs
• 1 slot wide

Universal Transcoder - Dense Broadcast

• Transcodes up to:
    - 4 HD with PIP
    - 12 SD with PIP
    - 16 SD no PIP
• Full decode and re-encode
• Audio transcoding
• Component pass-through
• Operates in 3 different Encoder Rate Control modes:
    - Constant Bit Rate (CBR)
    - Capped Variable Bit Rate (CVBR)
    - Statistical Multiplexing (in future release)
• Mediaroom approved
• 1 slot wide

Universal Encoder - Dense Broadcast

• Encodes 2 HD or 4 SD into MPEG-2 or MPEG-4
• SDI/HDSDI input with embedded audio
• 4 BNC, 75 ohm female input ports
• Operates in three encoder rate control modes:
    - Constant Bit Rate (CBR)
    - Capped Variable Bit Rate (CVBR)
    - Statistical Multiplexing
    - Resolution conversion
    - Picture in Picture
    - Logo insertion
• Advanced audio encoding with support for all common audio
  codecs
• 1 slot wide

PROCESSING MODULES

Descrambling and Scrambling

Sencore provides two types of descramblers: CAM-based (DVB-Common Interface) and bulk descrambling. The CAM based descrambler module is integrated with professional CAM modules from vendors such as SMIT, SmarDTV, Aston etc. and supports descrambling of up to 10 services per CAM. The bulk descrambler is aimed at software-based CA systems or CA vendors open for an embedded integration. It is used for the descrambling of multiple services protected by one or more CA systems and offers very high descrambling density of up to 250 services per module, making it an efficient, space and energy saving solution. The scrambler module supports both DVB CSA and all common flavors of AES scrambling algorithms. The scrambler module is fully simulcrypt compliant and has been integrated with all major CA vendors.

EPG and audio leveling

The Electronic Program Guide (EPG) module allows a network operator to receive several channel bouquets from multiple sources and reuse the existing EPG information. The EPG will receive EIT tables from any available input automatically and filter out unused services and re-generate the EIT schedule to reflect the current channel lineup for the selected network. For channels without EPG information on air, the information can be imported via a dedicated IP interface using XMLTV format.

Sencore's audio leveling simplifies the process of changing the audio levels of hundreds of channels by eliminating the need to decode and re-encode these TV and radio channels prior to transmitting them. The solution lets operators tune the audio level of up to 250 audio tracks individually, within the MPEG domain. The audio leveling module supports MPEG-1 layer 1 or 2 audio with an adjustment range of ±30dB.

FEATURES

• Modular
• Customizable to specific operator demands
• High density

• Provides integrated functionality normally requiring separate chassis or servers
• Powerful MPEG processing with high throughput
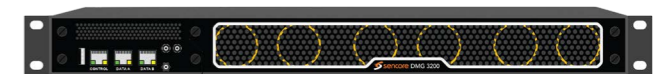
PROCESSING MODULES

Bulk Descrambler

- Descrambles up to 250 services (850 Mbit/s)
- Integrated with soft clients for ECM handling (no smart card required)
- Support for both DVB-CA and AES descrambling
- Integrated with Verimatrix and Latens
- BISS descrambling
- 1 slot wide

SIM Bulk Descrambler

- Descrambles up to 250 services (850 Mbit/s)
- Smart Card based descrambling (SIM)
- 16 SIM readers; 8 in front and 8 behind the front
- Support for both DVB-CA and AES descrambling
- Integrated with Conax
- BISS descrambling
- 2 slot wide

Scrambler

- DVB CA compliant scrambling (CSA) and AES compliant scrambling
- Scrambles up to 250 services, maximum 850 Mbit/s
- Supports scrambling of MPEG-2 and H264 in SD &HD
- DVB Simulcrypt compliant
- 10/100/1000BaseT IP interface towards CA system (RJ45)
- Handles up to 250 ECMs
- 1 slot wide

Descrambler

- 2 × DVB Common interface
- Descrambling of 10 services per CAM (depends on common interface)
- Support for all major CA systems and CAMs
- 1 slot wide

Digital Audio Leveling

- For equalisation of audio in TV and Radio services within a digital head-end
- Audio volume control in an MPEG domain
- Audio leveling of 250 channels
- Supports MPEG 1, layer 1 / 2 audio
- Adjustment range ± 30 dB
- 1 slot wide

Note: For Dynamic audio leveling (Interface options), please contact Sencore.

EPG

- Re-generation of EIT schedule on selected output ports
- Gathers EIT information from all input ports
- EPG data is filtered and regenerated to reflect new channelplan
- Supports multiple of networks
- Configurable play out rate with prioritization
- Configurable period to be played out
- EPG synchronization between multiple ATV units
- 1 slot wide

Audio Processor

- Encodes up to 32 stereo channels
- 4x SDI/HDSDI input with embedded audio
- 4x BNC, 75 Ohm female input ports
- 8 stereo audio tracks per SD/HDSDI feed
- Audio codec support
  - MPEG-1 - Layer 2
  - MPEG-1 - Layer 3 (MP3)
  - AAC-LC
  - HE-AAC v1
  - HE-AAC v2
- Audio channel modes:
  - Stereo
  - Mono
- Audio Level Adjustment , +6/-10dB
- 1 slot wide
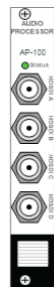
MPEG OUTPUT MODULES

Sencore offers a large number of different output modules that can be used in various applications. All output modules have powerful MPEG multiplexing and PSI/SI/PSIP capabilities to enable operators to maximize the potential of their network. Each output module has been designed to support 850 Mbit/s transport stream data-rate and 250 services.

IP and ASI output

The IP output module is a high capacity module with full multiplexing and PSI/SI regeneration targeted at linear broadcasting. The IP output modules support any combination of MPTS and SPTS as long as the total number of services is less than 250 and the total transport stream bit-rate is less than 850 Mbit/s. Each output port supports IPv4, IPv6, source specific multicast, generation of FEC according to SMPTE 2022 and Sencore's unique IP output redundancy solution.

For legacy systems an ASI output module with 4 independent ASI outputs is available. Each ASI output supports up to 213 Mbit/s in burst mode or 72 Mbit/s in spread (byte) mode.

Modulated output

All Sencore's modulated output modules are based on a full digital modulation and up-conversion architecture developed in house to provide the best possible output quality. Sencore's leading edge DVB-T/T2 modulator is fully frequency agile for terrestrial transmitters, MMDS systems or for DVB-T/T2 modulation into cable networks. This high density modulator is capable of producing up to 4 DVB-T or 2 DVB-T2 modulated channels, offering more throughput and improved error resiliency. For terrestrial operation, the modulator supports SFN with either MIP TS or T2MI as input .

Sencore's advanced DVB-S/S2 modulator is a fully frequency agile modulator aimed at modulating SD/HD services on to satellite. This high density modulator is capable of producing up to 2 DVB-S or DVB-S2 modulated channels. The solution offers broadcasters a higher rack density and lower power consumption, compared to alternative solutions and comes with advanced functionality like pre-compensation. The DVB-S/S2/S2X modulator is available in two different output configurations: IF or L-band.

Sencore's compact QAM solution generates 16 QAM frequencies for cable networks. The module support both full re-multiplexing and transparent mapping with optional NIT replacement and PID/Service blocking making it one of the most versatile QAM modulation solutions for linear broadcasting on the market. Sencore's QAM solution is ideal for regional cable head-ends where additional processing are required like service filtering, local re-multiplexing, local encoding, SI regeneration, EPG regeneration, etc.

Terrestrial GW solutions

The gateway module transforms an Sencore chassis into a complete solution for DVB-T and T2. It combines the MPEG multiplexing, PSI/SI generation and gateway roles into a single module. Combining this with modules to perform encoding, transcoding and scrambling enables a unique integrated head-end design eliminating the need for a traditional multiple box approach with the added complexity. The Sencore gateway module supports DVB-T with MIP timestamp insertion or DVB-T2 T2MI encapsulation with SFN timestamps together with multi PLP support. The terrestrial gateway module is available with ASI or IP outputs and can support up to 4 separate gateways per module (2 on ASI out). Integrated redundancy schemes are available to go beyond what is commonly available today and provide seamless protection of the distribution chain as well as the SFN network.

FEATURES

- Modular
- Integrated
- Scalable
- High density
- Flexible
- Seamless redundancy options

- Intelligent, automatic redundancy solutions
- Powerful multiplexing with high throughput
- Integrated multiplexing & PSI/SI re-generation

OUTPUT MODULES

Dual IP IO

• 2 × Gbit output port for data (or 1×in and 1×out)
• 10/100/1000BaseT (RJ45) or SFP output
• Up to 850 Mbit/s per data port TS
• Supports UDP/RTP Multicast/Unicast
• Supports streaming of MPTS and SPTS
• Supports cloned output
• Supports multiplexing and transparent pass-through
• PSI/SI/PSIP regeneration
• Supports FEC (SMPTE 2022) (license)
• 1 slot wide

ASI Output

• 4 × ASI outputs
• 4 × BNC connectors
• 213 Mbit/s Burst mode or 72 Mbit/s Spread mode per output
• 4 different multiplexed outputs
• Supports multiplexing and transparent pass-through
• PSI/SI/PSIP regeneration
• 1 slot wide

QAM Modulator

• 16 QAM modulators, 4 and 4 paired
• 2 × 75 Ω RF output (EN/IEC 60728-5) - F connector
• Full digital modulation and up-conversion
• DOCSIS 3.0 RF compliant
• 32 / 64 / 128 / 256 QAM modulation
• Frequency range of 47 – 862 MHz
• Supports multiplexing and transparent pass-through
• PSI/SI/PSIP regeneration
• ITU-TJ83. Annex A/B/C
• 1 slot wide

DVB-S/S2 Modulator

• 2 DVB-S/S2 modulated carriers per module
• Connectors:
  - IF › 1 × F connector + 1 × F for monitoring per output
  - L-band › 1 × SMA connector + 1 × F for monitoring per output
• Output options:
  - IF › 50-200 MHz
  - L-band › 950-2150 MHz
• Modulation:
  - DVB-S › QPSK
  - DVB-S2 › QPSK, 8-PSK, 16-APSK, 32-APSK
• Symbol rate: 0.5-45 Mbaud
• Linear static precorrection
• Supports multiplexing and transparent pass-through
• PSI/SI/PSIP regeneration
• 1 slot wide
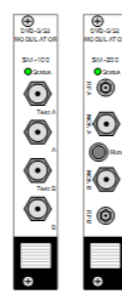
DVB-T/T2 Terrestrial Modulator

• 2 DVB-T2 or 2 DVB-T independent outputs
• 1 × BNC connector + 1 × BNC for monitoring per output
• Monitoring ports for each output
• VHF/UHF, 50 Ω BNC, 47-862 MHz
• Output levels: -15 to 0 dBm
• Supports multiplexing and transparent pass-through (mode A)
• Support for SFN (ETSI TS 102 733 T2-MI)
• Support for multiple PLPs
• Supports multiplexing and transparent
• PSI/SI regeneration
• 1 slot wide

DVB-T/T2 Cable Modulator

• 4 DVB-T modulators (TM-101)
• 2 DVB-T/T2 modulators (TM-200)
• Connectors:
  - COFDM › 1 × F connector + 1 × F for monitoring per module
  - DVB-T2 › 1 × BNC connector + 1 × BNC for monitoring per output
• Full digital modulation and up-conversion
• 5, 6, 7, 8 MHz bandwidth
• Frequency range 47-862 MHz, fully agile
• Output levels: -12 to 2.2 dBm
• PSI/SI regeneration
• 1 slot wide

ISDB-T Modulator

• 8 ISDB-T modulated carriers per module
• 2 × 75 RF output - F connector
• Full digital modulation and up-conversion
• DOCSIS 3.0 RF compliant
• QPSK, 16QAM, 64 QAM modulation
• Frequency range of 47 – 862 MHz
• Supports multiplexing and transparent pass-through
• PSI/SI/PSIP regeneration
• Relevant Standards:
  - ARIB STD-B31
  - ARIB STD-B10
• 1 slot wide
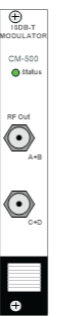
DVB-S/S2/S2X Modulator

• 2 DVB-S/S2/S2x modulated carriers per module
• Output connectors:
  -IF › 1 × 75 F connector + 1 × 50 SMA for monitoring per output
  -L-band › 1 × 50 SMA connector + 1 × 75 F for monitoring per output
• Satellite standards:
  -DVB-S EN 300 421
  -DVB-S2 EN 302 307 – 1
  -DVB-S2X EN 302 307 -2, Broadcast Services
• Output options:
  -IF › 50-200 MHz
  -L-band › 950-2150 MHz
• Modulation:
  -DVB-S › QPSK
  -DVB-S2X › QPSK, 8-PSK, 16/32/64/128/256-APSK
• Symbol rate: 0.1-68 Mbaud
• 24V DC and 10MHz reference output
• DVB Carrier ID, NIT Carrier ID
• Linear static precorrection
• Supports multiplexing and transparent pass-through
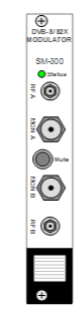
DVB-T/T2 GW

• IP or ASI out options:
-10/100/1000 BaseT (RJ45) or SFP output on IP
- 2 × (1+1) ASI out
• Supports DVB-T MIP insertion and DVB-T2 T2MI generation
• 4 independent gateways per module (2 for T2MI on ASI out)
• Supports up to 240 PLPs
• Regionalization options
• PAPR and MISO support
• Full (Re-)multiplexing support (per PLP)
• PSI/SI regeneration
• Supports SMPTE 2022 FEC (license)
• 1 slot wide
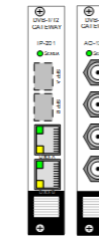
DAB/DAB+ Modulator

• Standards: DAB/DAB+
• EDI input
• 8 x DAB/DAB+ modulated carriers
• Frequency range 174-239 MHz
• Output level -4 dBm to -15 dBm
• 1 slot wide

END TO END TERRESTRIAL SOLUTIONS

Sencore offers the most integrated, powerful and flexible range of DVB-T2 solutions. The compact modular approach makes it possible to provide complete head-ends consisting of content acquisition, premium compression with statistical multiplexing, DVB-T2 gateways, and modulation in single or multiple units to provide an end to end solution.

Terrestrial signals for DVB-T2 can be distributed via satellite, ASI or IP to transmitter sites where regional processing is performed before being delivered to the transmitter. In addition Sencore can provide a complete low-power transmitter solution with all necessary components integrated into a compact 1RU chassis if applicable. All components are developed in house, giving customer's access to our design level expertise with the added benefit of being able to customize the solution to meet specific customer requirements.

The solution offers many highly distinctive features including a new option for providing regionalization using the 'common PLP' mechanism, an integrated seamless DVB-T2 gateway redundancy option and sophisticated seamless IP packet re-construction to dramatically increase signal distribution robustness over IP links. Because the entire solution is modular, Sencore offers the market an easy to manage, easy to upgrade, ultra-compact solution that provides the best possible standards of technical performance whilst consuming a fraction of the space and power of competing systems.

DVB-T2 Integrated Multiplexer and DVB-T2 Gateway Module

Sencore has improved upon typical DTT architectures that rely on multiple boxesand complex NMS to provide an integrated solution. In contrast, Sencore solutions are optimally integrated from the beginning. Sencore gateway module is an integrated MPEG multiplexer, PSI/SI generator and DVB-T2 gateway on a single slot.

The advanced Sencore DVB-T2 gateway module is representative of Sencore's modular approach enabling operators to combine reception, descrambling, encoding/transcoding, scrambling, multiplexing, PSI/SI generation,T2 gateway and modulation stages within a single chassis with integrated management.

Sencore modules offer high channel and carrier density. The gateway module supports multiplexing and T2MI generation of up to 4 independent complete T2MI streams on IP or 2 T2MI streams on ASI and provides up to 140 regional PLPs per module. The combination of integration and performance offered by the module is unique, making it the most powerful, yet easiest to use, DVB-T2 Gateway solution on the market. The modules are usually provided in 1+1 redundancy configuration using the Sencore seamless T2MI redundancy option.

The gateway's many features can be used to complement the requirements and distribution methods required by individual customers, and can support centralized (backhaul) and 'in region' (edge) content replacement models using any distribution mechanism including support for TS replacement or deterministic PLP replacement techniques as appropriate.

Architectures and Regionalization

Sencore network delivery enhancements include support for the DVB-S/S2 standard and are incorporated into the satellite modulator and demodulator modules. For IP distribution our 'seamless' packet re-construction technology provides superior protection against network packet loss and enables FEC levels to be reduced, re-claiming useful bandwidth

REDUNDANCY

Sencore's intelligent redundancy software provides seamless integration between broadcast equipment and IP networks. It protects every stage and provides automatic backup in case of service stream failure at input, protection from internal failures, and intermittent or permanent data losses within distribution networks without requiring complex control software.

Sencore's redundancy solution is unique in being the only solution in the IP television market to take a holistic view of operation and network management. Redundancy configuration is simplified and automated, and operational routines are significantly reduced. The integrated redundancy solutions offer operators compelling quality of service benefits and improved network reliability. The individual elements of this integrated solution are further described below. For more detailed information please contact Sencore.

Input redundancy
The Sencore system is equipped with an advanced input redundancy switching mechanism. Any output service can be configured to have a backup service from a different input TS regardless of input type. Input switching can also be performed on TS level using 'input port redundancy'.

Redundancy switching can be set to automatic or manual. In automatic mode it is possible to choose from the following switching modes: Once (switch and stop), Floating or Reverting.

Seamless IP input redundancy (License)
The Sencore Seamless IP Switch module makes it possible to achieve seamless IP input redundancy switching between two distribution networks. The Seamless IP Switch combines an innovative alignment technique with a fast acting data switch making it possible to reconstruct a perfect outgoing stream even from two imperfect network feeds.

The Seamless IP Switch can regenerate the traffic received via two networks, so that both networks are used 100% of the time to back each other up. Using the data provided by both networks simultaneously, rather than just one, enables dramatic improvements in QoS.

Internal Redundancy (4RU chassis feature)
By using Sencore's Internal Redundancy feature, all critical single points of failure in the 4RU chassis are eliminated. This clever mechanism facilitates configurations with redundant switch modules, redundant backplanes, redundant IP inputs, redundant MMI (i.e. management & control) as well as redundant power supplies. In case of input, switch or MMI failure, all output modules will switch backplane and log into the other MMI where it will receive the services from the backup inputs and switch.

By having 1+1 redundancy on inputs and switch modules, all components of the chassis are backed up, except for the output modules which normally handle a subset of the available channels. In case of failure of output modules, they can easily be hot-swapped, and the affected services will be up and running in seconds.

N+M redundancy (4RU chassis feature) (License)

The Sencore self-managed N+M redundancy for encoding and transcoding provides a powerful option for broadcasters needing the economies of N+M compression redundancy without the expense, complexity and long term reliability concerns of a conventional NMS. Rather than relying on external PC hardware, Sencore have integrated the redundancy control into the built in management system thus simplifying system configuration eliminating integration and operational issues between HW and management PC. It is the perfect method for creating the intelligent 'device islands' that are increasingly being favored by broadcasters when architecting new solutions.

The encoders and transcoders will be the only items within the chassis in N+M configuration. Everything else will be 1+1. This includes any input and output ports, all control and management functions, the backplane and the power supplies. Each 4RU chassis will be equipped with backup encoder or transcoder module(s) capable of providing module level replacement for any of the active encoders or transcoders within the chassis. Multiple redundancy groups can be combined in the chassis by automatically creating groups of encoders and transcoders. For encoding, the redundant control modules can drive a (HD)SDI video router directly

IP Output redundancy (License)
The IP output redundancy system presents a network with multiple sources from which it is possible to obtain the same service. Should the service from one source be corrupted, the network can receive the service from another source. The redundancy solution is service based (multicast based) where the same service will be available for two or more sources. As long as all sources with the same channel have the same IP source address, the network will route just a single copy of the multicast stream forward to the receiver based on routing cost. In the event of a service issue within, or prior to, the Sencore chassis, the IP output module exploits standard IP protocols to trigger external routers to switch to secondary sources. The "Monitor-in-out" functionality may be used for those networks not utilizing routing protocols.

Where full redundancy is not required, partial redundancy strategies can be implemented. Systems can be configured to provide full redundancy of only selected premium or 'must-carry' services. Operators can then choose not to replicate the input and descrambling functions of lower priority services, but still equip the chassis with

SWITCH MODULE SPECIFICATIONS

Switch Module	Bitrate	: Gbit/s routing between modules in a chassis
	Placement	: 1 slot wide (4RU switch module must be placed in slot 0; redundant module in slot 17)
	IP Input/Output	
	Interface	: 2 × 10/100/1000 Base-T Ethernet or SFP
		: Optical SFP (class 1 laser product)
	Maximum data rate per port	: Up to 850 MBit/s per port TS rate
	Maximum number of services per port	: 250
	Data format	: UDP/RTP Multicast/Unicast
	Transport stream	: SPTS and MPTS
	Service filtering	: Yes
	Video format	: Transport stream; MPEG-2, MPEG-4, HEVC
	IP Input	
	IP de-jittering	: PCR or CBR
	Forward Error Correction	: SMPTE 2022-1
		250 input streams per data port
	IP Output	
	Multiplexing	: Yes (licensed)
	Forward Error Correction	: SMPTE 2022-1
		250 output streams per data port
	Tables Supported	
	- PSI	: PAT, PMT, CAT
	- SI	: SDT, NIT, EIT pf , TOT, TDT, BAT, AIT
	- PSIP	: MGT, TVCT, CVCT
	Reference Clock	
	Frame Synchronization Input (Genlock)	: Accepts black burst and Tri-Level reference signal.*
	Internal Clock Reference	: 10 MHz
	MMI Clock Synchronization	: Yes
	Management	
	Interface	: 10/100/1000 Base-T Ethernet
	Built-in user interface	: Web
	External interface	: SNMP for alarms, SOAP for configuration and status
	* If SDI reference signal support is needed, contact your sales representative.	
	Licenced features	: 2xIP In, 1xIP In/1xIP Out, 2xIP Out, Seam. IP In, Cloned IP Out
		: FEC in, FEC out, FEC in/out
		: Multiplexing
		: IP Out Redundancy
Clock Reference	**GPS reference input**	
	Antenna connector	: SMA female
	Impedance	: 50 Ω
	1pps timing accuracy	: < 100 ns RMS
	Active Antenna Voltage output	: 0V, 3.3V(default) or 5V
	Internal reference hold-over	: ≤1us in 4 hrs @ΔT= 0˚C
	1pps reference input	
	Number of input ports	: 1
	Input connector type	: BNC female
	Impedance	: TTL or 50 Ω
	Input level 1pps (1Hz)	: TTL
	Internal reference hold-over	: ≤1us in 4 hrs @ΔT= 0˚C
	Licensed features	: GPS receiver, OCSO oscillator, OCXO oscillator (stability 0.2ppb/day)

COMMON INPUT SPECIFICATIONS

All Input Modules	Transport stream	: SPTS and MPTS
	Service filtering	: Yes
	Video format	: Transport stream, MPEG-2/4 (H264) and HEVC

INPUT INTERFACE SPECIFICATIONS

Dual IP IO	**IP Input/Output**	
	Interface	: 2×10/100/1000 Base-T Ethernet and SFP
	Operational mode	: The module can be configured to;
		- 1 input and 1 output
		- Seamless (Hitless) IP in
		- Cloned IP out
		- Dual IP in
		- Dual IP out
	Maximum data rate per port	: Up to 850 Mbit/s per port in Seamless (Hitless) in, cloned out or 1×IPIN + 1×IPOUT
		: Up to 850 Mbit/s sum of both ports in Dual IP in or Dual IP out mode
	Maximum number of services per port	: 250
	Data format	: UDP/RTP Multicast/Unicast
	IP Input	
	IP de-jittering	: Yes, based on PCR or CBR
	Forward Error Correction	: SMPTE 2022-1
		250 input streams per data port
	IP Output	
	Multiplexing	: Yes
	Forward Error Correction	: SMPTE 2022-1
		250 output streams per data port
	Licensed feature:	: Seamless input, Cloned IP Out
		: FEC in, FEC out, FEC in/out
		: Multiplexing
		: IP output redundancy
ASI Input	Key reference specification	: EN 50083-9
	Connector	: BNC female, 75Ω
	Number of inputs per module	: 4
	Maximum bit-rate per port	: Up to 213.7Mbit/s (burst)
Enhanced DVB-S/S2 Input	Key reference specifications	: EN 300 421, EN 302 307 p1&2
	Connector	: F female, 75Ω
	Number of inputs per module	: 4
	DVB-S Constellation	: QPSK
	DVB-S2/S2x Constellation	: QPSK, 8-PSK, 16-APSK, 32-APSK
	Symbol rate DVB-S	: 1–45 MSym/s
	Symbol rate DVB-S2	: 1–45 MSym/s
	Decoding DVB-S2	: LDPC and BCH
	FEC DVB-S	: 1/2, 2/3, 3/4, 5/6, 7/8
	FEC DVB-S2	: 1/4, 1/3, 2/5, 1/2, 3/5, 2/3, 3/4, 4/5, 5/6, 8/9, 9/10
	Roll off	: Auto, 0.15, 0.20, 0.25, 0.35
	Acquisition range	: Auto, 0.15MHz, 1MHz, 2MHz, 2.5MHz, 5MHz
	Spectrum inversion	: Auto, Normal, Inverted
	DVB-S2 FEC frames	: Short and Normal frames
	Input level	: -70 to -20 dBm (16 APSK, 9/10 code rate)
	Frequency range	: 950–2150 MHz
	LNB voltage	: 0/13/18 Volt
	Maximum LNB supply current	: 400 mA
	LNB signaling	: LNB voltage + 22kHz continuous tone
	Multiple streams	: Yes, 1 per input port
	T2MI De-encapsulation	: Yes, one PLP per port
	Licenced features:	: DVB-S2 Demodulation

DVB-S/S2X input	Key reference specification	: EN 300 421, EN 302 307 part 1 and 2
	SR-120 Connector	: F female, 75Ω
	Number of inputs per module	: 4
	Frequency range	: 950–2150 MHz
	Acquisition range	: Auto, 0.15MHz, 1MHz, 2MHz, 2.5MHz, 5MHz
	Input level	: -79 to -20 dBm (16-APSK, 9/10 code rate)
	DVB-S Constellation	: QPSK
	DVB-S2 Constellation	: QPSK, 8PSK, 16APSK, 32APSK
	DVB-S2X Constellation	: QPSK, 8PSK, 16APSK, 32APSK
	Symbol rate DVB-S/S2/S2X	: 1–45 MSym/s (1-39.9MSym/s for 32-APSK)
	Decoding DVB-S2/S2X	: LDPC and BCH
	FEC DVB-S	: 1/2, 2/3, 3/4, 5/6, 7/8
	FEC DVB-S2 QPSK	: 1/4, 13/45, 1/3, 2/5, 9/20, 1/2, 11/20, 3/5, 2/3, 3/4, 4/5, 5/6, 8/9, 9/10
	FEC DVB-S2 8PSK	: 3/5, 23/36, 2/3, 25/36, 13/18, 3/4, 5/6, 8/9, 9/10
	FEC DVB-S2 8APSK	: 5/9, 26/45
	FEC DVB-S2 16APSK	: 5/9, 8/15, 1/2, 26/45, 3/5, 28/45, 23/36, 2/3, 25/36, 13/18, 3/4, 7/9, 4/5, 5/6, 77/90, 8/9, 9/10
	FEC DVB-S2 32APSK	: 2/3, 32/45, 11/15, 3/4, 7/9, 4/5, 5/6, 8/9, 9/10
	Roll off DVB-S	: Auto, 0.35
	Roll off DVB-S2	: Auto, 0.20, 0.25, 0.35
	Roll off DVB-S2X	: Auto, 0.05, 0.10, 0.15, 0.20, 0.25, 0.35
	Spectrum inversion	: Auto, Normal, Inverted
	DVB-S2 FEC frames	: Normal frames
	LNB voltage	: 0/13/18 Volt
	Maximum LNB supply current	: 400 mA
	LNB signaling	: LNB voltage + 22kHz continuous tone
	Multiple streams	: 1 per input port
	T2MI De-encapsulation	: 1 PLP per port
	Licenced features	: DVB-S2 demodulation
		DVB-S2X demodulation
		T2MI de-encapsulation
DVB-T/T2 input	Number of DVB-T/T2 inputs per module	: 4
	Input connector	: F-female, 75 Ω
	Input connector configurations	: 1 F connector internally split or 4 F connectors
	Input frequency range	: 47–862 MHz
	Input level range	: - 80 to -10 dBm (at T2, 8MHz, 256 QAM, 3/5, gaussian channel)
	Minimum return loss	: 10 dB
	DVB-T	
	Key reference specification	: ETSI EN 300744, Nordig 2.0
	FFT Size	: 2k, 8k
	Guard Intervals	: 1/4, 1/8, 1/16, 1/32
	FEC code rate	: 1/2, 2/3, 3/4, 5/6, 7/8
	Constellation	: QPSK, 16-QAM, 64-QAM
	Channel bandwidth	: 6, 7, or 8 MHz
	Hierarchy stream	: High and Low priority
	Hierarchy mode	: All
	Spectral inversion	: Automatic
	DVB-T2	
	Key reference specification	: ETSI EN 302755, Nordig 2.1
	FFT Size	: 1k, 2k, 4k, 8k, 8k extended, 16k, 16k extended, 32k, 32k extended
	Guard Interval	: 1/4, 19/128, 1/8, 19/256, 1/16, 1/32, 1/128
	FEC frame	: Normal (64k), Short (16k)
	FEC code rate (PLP)	: 1/2, 3/5, 2/3, 3/4, 4/5, 5/6
	Constellation (PLP)	: QPSK, 16-QAM, 64-QAM, 256-QAM
	Channel bandwidth	: 5, 6, 7 or 8 MHz
	Pilot pattern	: P1–P8
	SISO and MISO transmission	: Yes
	Single and Multiple-PLPs	: Yes
	Spectral inversion	: Automatic
	Rotated constellation	: Automatic
	Licenced features:	: DVB-T2 demodulation

DVB-C Input	Key reference specification	: EN 300 429, ITU-T J83 annex A, and C
	Connector	: F female, 75Ω
	Number of inputs per module	: 4 independent tuner/demodulators
	Number of input ports	: 1 (internal splitter feeding the 4 tuners)
	Frequency range	: 47–862 MHz
	Channel bandwidth	: 6, 7 and 8 MHz
	QAM Mode	: 4, 16, 32, 64, 128, 256 QAM
	Symbol rate	: 1–7.2 Mbaud
	Spectrum inversion	: Automatic
	Input power level	: - 30 to -65 dBm (at 256 QAM, 6.9 Ms/s)
QAM Annex B input	Key reference specification	: ITU-T J83 annex B
	Connector	: F female, 75Ω
	Number of inputs per module	: 4
	Frequency range	: 54–860 MHz
	Channel bandwidth	: 6
	QAM Mode	: 64, 256 QAM
	Symbol rate	: 5.057 Mbaud (64 QAM), 5.360 MBaud (256 QAM)
8-VSB Input (ATSC)	Key reference specification	: ATSC A/53
	Connector	: F female, 75Ω
	Number of inputs per module	: 4
	Input level	: -34 to +40 dBmV
	Frequency range	: 50–860 MHz
	Modulation	: 8-VSB
	Band	: Broadcast
	Licenced features:	: 8-VSB, QAM Annex B
ISDB-T/SBTVD-T	Key reference specification	: ARIB STD-B31
	Channel bandwidth	: 6, 7 and 8 MHz
	RF Input specification	
	Number of inputs per module	: 4 independent tuner/demodulators
	Number of input ports	: 1 (internal splitter feeding the 4 tuners)
	Connector	: F female, 75Ω
	Frequency range	: 50–860 MHz
	Input power level	
	Maximum	: -10 dBm
	Minimum (QPSK, 2/3)	: -76 dBm
	Minimum (64 QAM, 7/8)	: -95dBm
	Return loss	: 10dB
	Demodulation	: DQPSK, QPSK, 16QAM, 64QAM
	FEC	: 1/2, 2/3, 3/4, 5/6, 7/8, Automatic
	Spectrum inversion	: Automatic

ENCODING/TRANSCODING SPECIFICATIONS

Universal Encoder - High VQ Broadcast

Density		
	Number of channels per module	: Up to 1 HD or 2 SD
Video Input		
	HD Res. / Frame rates (SMPTE 292M)	: 1080i – 29.97 fps or 25 fps
		: 720p – 59.94 fps or 50 fps
	SD Res. / Frame rates (SMPTE 259M)	: 480i – 29.97 fps
		: 576i – 25 fps
Audio Inputs		
	Embedded Audio	: SMPTE 272M (SD), SMPTE 299M (HD)
		: Sample rate 48kHz, synchronous to video
Video Encoder		
	Architecture	: Dual Pass with look ahead
	MPEG-2 profiles	: MP@HL (HD) up to 60Mbps
		: MP@ML (SD) up to 16Mbps

MPEG-4 AVC profiles	: MP@L4.2, HP@L4.2 (HD) up to 55Mbps
	: MP@L3.1, HP@L3.1 (SD) up to 16Mbps
Rate Control Modes	: Constant Bit Rate (CBR)
	: Capped VBR (CVBR) with QP target
	: Statistical Multiplexing
GOP structure	: Dynamic with Scene Change Detection and Adaptive GOP structure.
Clock Modes	: Locked to HDSDI/SDI input
Aspect Ratio Control	: Manual, WSS, Video Index or AFD codes
PCR PID	: PCR on Video PID or as separate PID
End-to-end Encoder Delay	: Typical 5000ms (4000ms reduced delay mode)
Audio Encoder	
Number of encoded stereo pairs per main video	: 6 (4 for Dolby® Digital / Dolby® Digital Plus)
Audio CODECS	: MPEG-1 Layer 2
	: AAC-LC (2.0, 5.1[1])
	: HE-AAC v1 (2.0, 5.1[1])
	: HE-AAC v2
	: Dolby® Digital[2]
	: Dolby® Digital Plus[3]
	: Dolby® Digital/Dolby® Digital Plus pass-through
Audio Channel Modes	: Stereo, Mono and Dual Mono, 5.1[1] and 7.1 (Dolby® Digital/Dolby® Digital Plus only)
AAC Data Encapsulation	: ADTS or LATM selectable per encoded channel
Audio Lipsync Adjustment	: +500ms / -200ms
Audio Level Adjustment	: +6/-10dB
Picture-in-Picture	
Density	: One PiP available for each main channel
Codec	: MPEG-4 AVC BP or MP
Bitrate	: Min 96kbps, Max 500kbps (CBR)
Resolutions	: 320x240, 192x192, 176x144, 128x96
GOP Size	: Configurable independent of main channel
Video Pre-processing	
Inverse Telecine Detection	: Detect if input is 3:2 pull down and omit repeated fields.
De-blocking Filter	: Adjustable
Motion Compensated Temporal Filter (MCTF)	: Adjustable
WSS Blanking	: Removal of line 23 WSS from active video
Video Re-scaling	
Horizontal Rescaling	: From 1920 to 1440, 1280 or 960
	: From 1280 to 960 or 640
	: From 720 to 704, 640, 544, 528, 480 or 352
Down Conversion HD to SD	: Including aspect ratio conversion, letter-/pillar boxing
Up Conversion SD to HD	: Including aspect ratio conversion, letter-/pillar boxing and de-interlacing.
Frame Rate Conversion	: From 59.94 fps to 59.94/29.97 fps
	: From 50 fps to 50/25 fps
	: From 29.97 fps to 59.94/29.97 fps
	: From 25 fps to 50/25 fps
	: Frame rate up conversion only for interlaced input (1080i/576i/480i) to 720p output.
Logo Insertion	
Maximum Size	: 192x128 (SD)
	: 360x180 (HD 720P)
	: 480x270 (HD 1080i)
Positioning	: User selectable (pixel accuracy)
File format	: PNG (8-bit ARGB) file per encoded channel
Ancillary Data and VBI	
Teletext processing	: Extracted from VANC OP47, SMPTE-2031 or VBI and transcoded to EN 301755.
Closed Captioning (EIA 608/EIA 708)	: Extracted from VANC and injected into video stream.
Digital Programme Insertion (DPI)	: SCTE104 triggers extracted from VANC and transcoded to SCTE35 TS triggers.

1) AAC-LC/HE-AAC v1 5.1 support in future release.
2) Dolby® Digital also known as AC-3
3) Dolby® Digital Plus also known as E-AC-3

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Active Format Description (AFD)	: Extracted from VANC SMPTE 2016 and injected into video stream.
Dolby® E metadata	: External Dolby® E metadata extracted from VANC SMPTE 2020 used for Dolby® Digital/Dolby® Digital Plus encoding configuration.
Wide Screen Signalling (WSS)	: Extracted from VBI line 23 or VANC SMPTE 2031 and transcoded to EN 301755
Video Programming System (VPS)	: Extracted from VBI line 23 or VANC SMPTE 2031 and transcoded to EN 301755
Video Inserted Time Code (VITC)	: Extracted from VANC SMPTE-RP188 and injected into video stream.

Auxillary Data Injection

EBU Subtitling, DVB Subtitling, PIDs can be added to service through an Sencore Input Interface (e.g. ASI, IP). PTS can be restamped for DVB subtitling.

Subtitling conversion	: Conversion from EBU Subtitling to DVB Subtitling

Statistical Multiplexing

Statmux Controller	: Local within chassis
Max. Number of Groups per chassis	: Maximum 16, one per encoder/transcoder module
Max. Number of Services within group	: 32

Licensed Features	: Video Mode HPBC (required)
	: Number of Encoder Channels HD
	: Number of Encoder Channels SD
	: Statistical Multiplexing - Number of Channels
	: Dolby® Digital/Dolby® Digital Plus Encode - Number of Stereo Pairs[4]
	: MPEG-1 Layer 2/AAC-LC/HE-AAC v1/HE-AAC v2 Encode - Number of Stereo Pairs
	: Subtitle transcoding from TTX to DVB

Universal Encoder - Dense

Number of channels per module	: Up to 2 HD or 4 SD
Video Input	
HD Resolutions/Frame rates (SMPTE 292M)	: 1080i – 29.97Hz or 25Hz
	: 720p – 59.97Hz or 50Hz
SD Resolutions/Frame rates (SMPTE 259M)	: 480i – 29.97Hz
	: 576i – 25Hz
Audio Inputs	
Embedded Audio	: SMPTE 272M (SD), SMPTE 299M (HD) Sample rate 48kHz, synchronous to video PCM or Dolby® Digital/Dolby® Digital Plus
Video Encoder	
Architecture	: Single Pass with look ahead
MPEG-2 profiles	: MP@HL (HD) up to 60Mbps
	: MP@ML (SD) up to 16Mbps
MPEG-4 AVC profiles	: MP@L4.2, HP@L4.2 (HD) up to 55Mbps
	: MP@L3.0, HP@L3.0 (SD) up to 16Mbps
Rate Control Modes	: Constant Bit Rate (CBR)
	: Capped VBR (CVBR) with QP target
	: Statistical Multiplexing
GOP structure	: Dynamic with Scene Change Detection and Adaptive GOP structure.
Clock Modes	: Locked to HDSDI/SDI input or to local clock
Aspect Ratio Control	: Manual, WSS, Video Index or AFD Codes
PCR PID	: PCR on Video PID or as separate PID
End-to-end Encoder Delay	: Video Quality optimized for 4500ms (3000ms reduced delay)
Audio Encoder	
Number of encoded stereo pairs per main video	: 8[1]

Audio CODECS	: MPEG-1 Layer 2
	: AAC-LC
	: HE-AAC v1
	: HE-AAC v2
	: Dolby® Digital2) 2.0 and 5.1
	: Dolby® Digital Plus3) 2.0, 5.1 and 7.1
	: Convert Dolby® Digital Plus to Dolby® Digital Dolby® Digital / Dolby® Digital Plus Pass-thru
Audio Channel Modes	: Multichannel, Stereo, Mono, Dual Mono
AAC Data Encapsulation	: ADTS or LATM selectable per encoded channel
Audio Lipsync Adjustment	: +500ms / -200ms
Audio Level Adjustment	: +6/-10dB
Video Pre-processing	
WSS Blanking	: Removal of line 23 WSS from active video
Picture-in-Picture	
Density	: One PiP available for each channel
Codec	: MPEG-4 AVC BP or MP
Bitrate	: Min 96kbps, Max 500kbps (CBR)
GOP Size	: Configurable independent of main channel
Resolutions	: 320x240, 192x192, 176x144, 128x96, 96x96
Video Re-scaling	
Horizontal Rescaling	: From 1920 to 1440, 1280 or 960
	: From 1280 to 960 or 640
	: From 720 to 704, 640, 544, 528
Down Conversion HD to SD	: Including aspect ratio conversion, letter-/pillar boxing
Up Conversion SD to HD	: Including aspect ratio conversion, letter-/pillar boxing and de-interlacing.
Frame Rate Conversion	: From 59.94 fps to 59.94/29.97 fps
	: From 50 fps to 50/25 fps
	: From 29.97 fps to 59.94/29.97
	: From 25 fps to 50/25 fps
	: Frame rate up conversion only for interlaced input (1080i/576i/480i) to 720p output.
Logo Insertion	
Maximum Size	: 192x128 (SD)
	: 360x180 (HD 720P)
	: 480x270 (HD 1080i)
Positioning	: User selectable (pixel accuracy)
File format	: PNG (8-bit ARGB) file per encoded channel
Ancillary Data and VBI	
Teletext processing	: Extracted from VANC OP47, SMPTE-2031 or VBI and transcoded to EN 301755.
Closed Captioning (EIA 608/EIA 708)	: Extracted from VANC and injected into video stream.
Digital Programme Insertion (DPI)	: SCTE104 triggers extracted from VANC and transcoded to SCTE35 TS triggers.
Active Format Desctription (AFD)	: Extracted from VANC SMPTE 2016 and injected into video stream.
Dolby® Metatdata	: SMPTE 2020 metadata extracted from VANC and injected into audio stream.
Wide Screen Signalling (WSS)	: Extracted from VBI line 23 or VANC SMPTE 2031 and transcoded to EN 301755
Video Programming System (VPS)	: Extracted from VANC SMPTE 2031 and transcoded to EN 301755
Video Inserted Time Code (VITC)	: Extracted from VANC SMPTE-RP188 and injected into video stream.
Auxillary Data Injection	
Subtitling insertion	: EBU Subtitling, DVB Subtitling. Teletext subtitling PIDs can be added to service through an Sencore Input interface (e.g. ASI, IP). PTS can be re-stamped.
Subtitling conversion	: Conversion from EBU Subtitling to DVB Subtitling
Statistical Multiplexing	
Statmux Controller	: Local on a Universal Encoder or Transcoder module
Maximum Number of Groups per chassis	: Maximum 16, one per encoder/transcoder module

	Maximum Number of Services within group	: 32
	Licensed Features	: Number of Encoder Channels HD
		: Number of Encoder Channels SD
		: Subtitle transcoding from TTX to DVB
		: Statistical Multiplexing - Number of Channels
		: Dolby® Digital Encode
		: Dolby® Digital Plus Encode
Universal Encoder - MS/OTT	Input Ports	: 2xHDSDI/4xSDI, 4 BNC 75 Ω
	Input Format	: SMPTE 292M (HD SDI), SMPTE 259M (SD SDI)

Video Pre-processing

WSS Blanking	: Removal of line 23 WSS from active video

Video Encode

MPEG-4 AVC Profiles	: High profile up to HP@L4.0
	: Main profile up to MP@L4.0
	: Base profile up to BP@L4.0
HD and sub HD resolutions[5]	: 1920 x 1080i @ 29.97, 25 fps
	: 1920 x 1080p @ 29.97, 25 fps
	: 1280 x 720p @ 59.94, 50 fps
	: 1280 x 720p @ 29.97, 25 fps
	: 960 x 540p @ 29.97, 25 fps
	: 852 x 480p @ 29.97, 25 fps
	: 640 x 360p @ 29.97, 25 fps
	: 480 x 270p @ 29.97, 25 fps
	: 416 x 240p @ 29.97 fps
SD and sub SD resolutions[5]	: 320 x 180p @ 29.97/14.985, 25/12.5 fps
	: 720 x 576i @ 25/12.5 fps
	: 720 x 480i @ 29.97/14.985 fps
	: 640 x 480p @ 29.97, 25 fps
	: 640 x 360p @ 29.97, 25 fps
	: 544 x 416p @ 29.97, 25 fps
	: 480 x 360p @ 29.97, 25 fps
	: 480 x 270p @ 29.97, 25 fps
	: 416 x 240p @ 29.97 fps
	: 400 x 224p @ 29.97, 25 fps
	: 400 x 300p @ 29.97, 25 fps
	: 384 x 216p @ 29.97, 25 fps
	: 352 x 288p @ 25 fps
	: 320 x 240p @ 29.97 /14.985, 25/12.5 fps
	: 320 x 180p @ 29.97, 25 fps
	: 240 x 180p @ 29.97/14.985, 25/12.5 fps
Frame rate conversion	: From 60/59.94/50 reduced to ½, ¼
	: From 50 reduced to ½ or ¼
	: From 30/29.97/50 reduced to ½
De-interlacing	: Interlaced to progressive conversion
Scene change detection	: Yes, insertion of P frame
GOP structure	: Dynamic
Number of output profiles	: Ranging from 4x HD to 28 sub SD per module, depending oncomplexity of profiles

Audio Encode

MPEG1 Layer II	: Modes: 2.0 (stereo), Bit rates: 64 – 384kbps
AAC-LC	: Modes: 2.0, Bit rates: 32 – 384kbps
HE-AAC v1	: Modes: 2.0, Bit rates: 32 - 192kbps
HE-AAC v2	: Modes: 2.0, Bit rates: 32 - 96kbps
Sample rates	: 32, 44.1, 48kHz
Number of channels per video source	: 2 (Audio resources can be combined.)

Reformatting/ Rescaling

Format conversion	: From HD to sub SD

Aspect Ratio Control

Aspect Ratio Modes	: Transparent Input to Output (Controlled by AFD), Manual 4:3 or 16:9

Ancillary Data and VBI

Closed Captioning (EIA 608/EIA 708)	: Extracted from VANC and injected into video stream.
Active Format Desctription (AFD)	: Extracted from VANC SMPTE 2016 and injected into video stream.

Encoder– CVBS input	Number of channels	: 4 SD or 2 SD+PIP
	Input Port	: 4 HD BNC 75 Ω, one per channel
		25 Pin Compact D-sub for audio:
		- 4 balanced analogue audio inputs
		- 2 AES/EBU inputs
	Video Input	: PAL B/G/I/D/K
		: SECAM D/K
		: PAL Nc
		: PAL M
		: NTSC M

Video Pre-processing

Inverse Telecine Detection	: Yes
De-blocking Filter	: Adjustable
Motion Compensated Temporal Filter (MCTF)	: Adjustable
Horizontal Rescaling	: From 720 to 704, 640, 544, 528, 480 or 352
WSS Blanking	: Removal of line 23 WSS from active video

Logo Insertion

File Format	: PNG (8-bit RGBA) file per encoded channel
Position	: User defined (pixel resolution)
Maximum Size	: 192 × 128 (SD)

Ancillary Data and VBI

VBI Extraction and processing	: Closed Captioning (EIA 708)
	: Teletext, WSS, VPS

Video Encoder

Number of channels per module	: 4 SD or 2 SD w/PiP (2SD mode gives improved VQ)
MPEG-2 profiles	: up to HP@ML
MPEG-4 AVC profiles	: up to HP@L3.0
Rate Control Modes	: Constant Bit Rate (CBR)
	: Capped VBR (CVBR) with QP target
Rate Range	: 4SD: From 250kbps to 10Mbps
	: 2SD: From 250kbps to 19Mbps
GOP control	: Fixed or Dynamic with Scene Change Detection and adaptive GOP structure
Picture-In-Picture	: 416×240, 352×288, 352×240, 192×192, 128×128, 128×96 or 96×96
Aspect Ratio Control	: Manual or WSS

Audio Encoder

Audio CODECs	: MPEG-1 Layer 2
	: AAC-LC
	: HE-AAC v1
	: HE-AAC v2
	: Dolby® Digital pass-through (from AES input)
AAC Data Encapsulation	: ADTS or LATM selectable per encoded channel
Channel Modes	: Stereo/Dual Mono/Mono
Encoded stereo pairs per video	: 2 pairs for 2SD+PIP configuration and 1 pair for 4 × SD configuration
Audio level adjustment	: +/-11dB
Injection of Private Data into service	: See Universal Encoder High VQ "Auxillary Data Injection"

Licensed Features   : Number of encoded channels, PIP

1) One 5.1 encode uses resources of 3x stereo pairs. One 7.1 encode uses resources of 4x stereo pairs.

2) Dolby® Digital also known as AC-3

3) Dolby® Digital Plus also known as E-AC-3

6) Other TV standards can be supported upon request

Encoder - RF Input	Number of channels per module	: 4 SD or 2 SD+PIP (2SD mode gives improved VQ)

RF Input
TV systems : PAL B/G, PAL I and SECAM D/K[6]
RF inputs : 4xF female, 75 Ω
Input frequency : 47 – 862 MHz
Frequency tuner step size : 1kHz
RF input level
– Max : 110 dBuV
– Min (for un-weighted video SNR=30dB) : 44 dBuV

Video Encoder
Please refer to "Encoder -CVBS input"

Picture-in-Picture
Please refer to "Encoder -CVBS input"

Video Pre-processing
Please refer to "Encoder -CVBS input"

Logo Insertion
Please refer to "Encoder -CVBS input"

Audio Encoder
Audio CODECS : MPEG-1 Layer 2 Stereo
: AAC-LC Stereo
: HE-AAC v1 Stereo
: HE-AAC v2 Stereo
AC Data Encapsulation : ADTS or LATM selectable per encoded channel
Channel Modes : Stereo/Mono/Dual Mono
Encoded stereo pairs per video : 1
Audio Level Adjustment : ± 11 dB

VBI
Please refer to "Encoder -CVBS input"
Auxillary Data Injection
Injection of Private Data into service : See Universal Encoder High VQ "Auxillary Data Injection"

Licensed Features : Number of Encoded channels, PIP

Universal Transcoder - High VQ Broadcast
Densitiy
Total Number of Video Transcodes : Up to 1x HD or 2x SD channels

Video Decoder
MPEG-2 profiles : MP@HL, 1Mbps – 80Mbps
: MP@ML, 600kbps – 15Mbps
H.264 profiles : MP@L4.2, 500kbps – 55Mbps
: HP@L4.2, 1Mbps – 55Mbps
: MP@L3.2, 300kbps – 16Mbps
: HP@L3.2, 300kbps – 16Mbps
: High 4:2:2@L4.2, 4.5Mbps - 80Mbps CABAC/100Mbps
SD 50Hz resolutions : 720/704/640/544/528/480/352 x 576i25
SD 60Hz resolutions : 720/704/640/544/528/480/352 x 480i30/29.97
HD 1080i resolutions : 1920/1440/1280/960 x 1080i30/29.97/25
HD 720p resolutions : 1280/960/640 x 720p60/59.94/50

Audio Decoder
Audio CODECS : MPEG-1 Layer 2 :AAC-LC
: HE-AAC v1
: HE-AAC v2
: Dolby® Digital / Dolby® Digital Plus
Audio Downmix : 5.1 to 2.0 for AAC and Dolby®

Video Encoder
MPEG-2 profiles : MP@HL, 1Mbps – 80Mbps
: MP@ML, 600kbps – 15Mbps

H.264 profiles : MP@L4.2, 500kbps – 55Mbps
: HP@L4.2, 1Mbps – 55Mbps
: MP@L3.2, 300kbps – 16Mbps
: HP@L3.2, 300kbps – 16Mbps
Rate Control Modes : Constant Bit Rate (CBR)
: Statistical Multiplexing
GOP structure : Dynamic with Scene Change Detection and Adaptive
GOP structure.
Aspect Ratio Control : Manual, Transparent input to output
PCR PID : PCR on Video PID or as separate PID
End-to-end Encoder Delay : Typically 5500ms (4500ms reduced delay mode)

Audio Encoder
Audio CODECS : MPEG-1 Layer 2
: AAC-LC
: HE-AAC v1
: HE-AAC v2
: Dolby® Digital
: Dolby® Digital Plus
: Pass though of all audio types
Audio Channel Modes : Stereo, Mono
AAC Data Encapsulation : ADTS or LATM selectable per encoded channel
Audio Lipsync Adjustment : +/- 300ms
Audio Level Adjustment : +6/-10dB

Picture-in-Picture
Codec : MPEG-4 AVC MP
Bitrate : Min 96kbps, Max 400kbps (CBR)
Resolutions : 192x192, 176x144, 128x96, 96x96

Video Re-scaling
Down Conversion HD to SD : Including aspect ratio conversion, letter-/pillar boxing
Up Conversion SD to HD : Including aspect ratio conversion, letter-/pillar-boxing
and de-interlacing.
Frame Rate Conversion : From 60 fps to 60/30 fps
: From 59.94 fps to 59.94/29.97 fps
: From 50 fps to 50/25 fps
: From 30 fps to 60/30 fps
: From 29.97 fps to 59.94/29.97
: From 25 fps to 50/25 fps
: Frame rate up conversion only for interlaced input
(1080i/576i/480i) to 720p output.

Audio Transcode Density
The table below describes maximum audio transcode density as a function of codec type.
One 5.1 audio use the same resources as 3x 2.0 audio. A combination of audio types are supported.

Logo Insertion
Maximum Size : 192x128 (SD)
: 360x180 (HD 720P)
: 480x270 (HD 1080i)
Positioning : User selectable (pixel accuracy)
File format : PNG (8-bit ARGB) file per encoded channel

Subtitling Burn In
DVB/EBU Subtitling : Burned into Transcoded Video

Auxillary Data
Pass Through : All auxillary data components (EBU Subtitling, DVB Sub
titling, Teletext etc.). Lipsync to video is maintained.
Generation : EBU Subtitling, DVB Subtitling, Teletext subtitling PIDs
from a generator can be added in the mux output

Video Processing
WSS Blanking : Line 23

Statistical Multiplexing
Statmux Controller : Local within chassis. (Management module.)
Maximum # Groups : Max 16, one group per encoder/transcoder module.
Maximum # Services within group : 32

Licensed Features

: Number of HD encoders
: Number of SD encoders
: Logo Insertion
: Statistical Multiplexing - Number of Channels
: MPEG/AAC Audio Transcode – Number of audio channels
: Dolby ® Decode – Number of channels
: Dolby® E Decode – Number of channels
: Dolby ® Encode– Number of channels
: 4:2:2 10bit decoding Density
: Subtitle transcoding from TTX to DVB

Universal Transcoder - Dense Broadcast Mode

Density

Total Number of Video Transcodes : Up to 4x HD or 16x SD channels per module

Video transcoder consists of four blocks each capable of
: 1x HD transcode with PiP OR
: 4x SD transcode without PiP OR
: 3x SD transcode with PiP OR
: 1x HD/SD transcode with PiP and up/downconv.
Each block can be configured independently.

Video Decoder

MPEG-2 profiles : MP@HL (HD)
: MP@ML (SD)
MPEG-4 AVC profiles : MP@L4.2, HP@L4.2 (HD)
: MP@L3.0, HP@L3.1 (SD)
SD resolutions : 720/704/640/544/528/480/352 x 576i25 fps
: 720/704/640/544/528/480/352 x 480i29.97 fps
HD 1080i resolutions : 1920/1440/1280/960 x 1080i30/29.97/25 fps
HD 720p resolutions : 1280/960/640 x 720p60/59.94/50 fps

Audio Decoder

Audio Codecs : MPEG1 Layer 2 (2.0)
: AAC-LC (2.0)
: HE-AACv1 (2.0)
: HE-AACv2 (2.0)
: Dolby® Digital (2.0/5.1)/Dolby® Digital Plus (2.0/5.1/7.1)
Audio Downmix : Multichannel audio (5.1 or 7.1) will be downmixed to 2.0
  as part of transcode process.

Video Encoder

MPEG-2 profiles : MP@HL (HD)
: MP@ML (SD)
MPEG-4 AVC profiles : MP@L4.1, HP@L4.1 (HD)
: MP@L3.1, HP@L3.1 (SD)
Rate Control Modes : Constant Bit Rate (CBR)
: Capped VBR (CVBR) with QP target
: Statistical Multiplexing (in future release)
GOP structure : Dynamic with Scene Change Detection and
Adaptive GOP structure
Aspect Ratio Control : Manual, Transparent input to output
PCR PID : PCR on Video PID or as separate PID
End-to-end Encoder Delay : Typically 5500ms (3500ms reduced delay mode)

Audio Encoder

Audio CODECS : MPEG1 Layer 2 (2.0)
: AAC-LC (2.0)
: HE-AACv1 (2.0)
: HE-AACv2 (2.0)
: Dolby® Digital pass-through
: Dolby® Digital Plus pass-through
Audio Channel Modes : Stereo, Mono
: 5.1 and 7.1 (TC-400)
AAC Data Encapsulation : ADTS or LATM selectable per encoded channel
Audio Lipsync Adjustment : +500ms / -200ms
Audio Level Adjustment : +6dB / -10dB

Audio Transcode Density : TC-400 - Max 6 stereo transcodes per video, limited
  to 24 stereo transcodes per module.
: TC-200 - Maximum 4 stereo transcodes per video,
  limited to 6 stereo transcodes per pair of video
  transcoder blocks.
: One 5.1 transcode consumes resources equivalent to
  three stereo (2.0) transcodes
Number of audio per channel : Max 6

Picture-in-Picture

Codec : MPEG-4 AVC MP
Bitrate : Min 96kbps, Max 400kbps (CBR)
Resolutions : 320x240,192x192, 176x144, 128x96, 96x96

Video Re-scaling

Down Conversion HD to SD : Including aspect ratio conversion, letter-/pillar boxing
Up Conversion SD to HD : Including aspect ratio conversion, letter-/pillar-boxing
and de-interlacing.
Frame Rate Conversion : From 60 fps to 60/30 fps
: From 59.94 fps to 59.94/29.97 fps
: From 50 fps to 50/25 fps
: From 30 fps to 60/30 fps
: From 29.97 fps to 59.94/29.97 fps
: From 25 fps to 50/25 fps
: Frame rate up conversion only for interlaced input
(1080i/576i/480i) to 720p output

Logo Insertion

Maximum Size : 192x128 (SD)
: 360x180 (HD 720P)
: 480x270 (HD 1080i)
Positioning : User selectable (pixel accuracy)
File format : PNG (8-bit ARGB) file per encoded channel

Subtitling

Subtitling Conversion : Conversion from EBU Subtitling to DVB Subtitling
DVB/EBU Subtitling : Burned into Transcoded Video. Restricted to 4 channels
per module

Auxillary Data

Auxillary data components (EBU Subtitling, DVB Subtitling, Teletext etc.) are passed through
Lipsync to video is maintained.

Video Processing

WSS (line 23) blanking : Yes

Statistical Multiplexing (Not supported in initial release)

Statmux Controller : Local within chassis.
Maximum # Groups : Maximum 16, one per encoder/transcoder module.
Maximum # Services within group : 32

Licensed Features : Video Transcode capacity in steps of blocks capable of
1xHD/4xSD
: Statistical Multiplexing - Number of Channels
: Dolby® Digital/Dolby® Digital Plus Decode
: High Density Mode (dense-sd for 4xSD per block)
: MPEG2/H264
: Subtitle transcoding from TTX to DVB
Mediaroom: : Approved

Universal Transcoder - MS/OTT

Number of input channels : Up to 4 HD channels[7]

Video Decoder

MPEG-2 profiles : Ranging from MP@ML (SD) to MP@HL (HD)
MPEG-4 AVC profiles : up to HP@L4.2
: up to MP@L4.2
: up to BP@L4.1

Audio Decoder

Input format : MPEG-1 Layer 2. Modes: 1.0 (mono), 2.0 (stereo)
: AAC-LC. Modes: 2.0, 5.1 (downmixed to 2.0)

7) Full HD (1080p) input restricts input density to 2 channels.
8) For complete table please contact Sencore.

Pass-through		: HE-AAC v1/2. Modes: 2.0, 5.1 (downmixed to 2.0)
		: Dolby® Digital (AC-3) : Modes: 2.0, 5.1 (downmixed to 2.0)
		: Dolby® Digital Plus (E-AC-3): Modes: 2.0, 5.1, 7.1 (down-mixed to 2.0)
		: MPEG1 Layer II
		: AAC-LC
		: HE-AACv1/2
		: Dolby® Digital (AC-3)
		: Dolby® Digital Plus (E-AC-3)

Video Encode

MPEG-4 AVC Profiles	: up to HP@4.0
	: up to MP@4.0
	: up to BP@4.0
Resolutions @ 59.94 fps or 50.00 fps[8]	: 720p › 1280, 960, 854
Resolutions @ 29.97 fps or 25.00 fps[8]	: 1080p › 1920, 1440, 1280, 960, 720, 640
	: 720p › 1280, 960, 854
	: 640p › 960
	: 576p › 1024, 768, 720, 352[9]
	: 540p › 960
	: 480p › 854, 720, 640, 352
	: 432p › 768
	: 360p › 640, 480
	: 320p › 480
	: 288p › 512
	: 270p › 480, 360
	: 256p › 144
	: 240p › 320
	: 216p › 384
	: 180p › 320, 240
Resolutions @ 14.99 fps or 12.50 fps[8]	: 640p › 960
	: 576p › 1024, 768, 720, 352
	: 480p › 854, 720, 640, 352
	: 432p › 768
	: 360p › 640, 480
	: 320p › 480
	: 288p › 512
	: 270p › 480, 360
	: 256p › 144
	: 240p › 320
	: 216p › 384
	: 180p › 320, 240
Frame rate conversion	: From 60/59.94/50 reduced to ½, ¼
	: From 50 reduced to ½ or ¼
	: From 30/29.97/50 reduced to ½
Number of profiles	: Ranging from 4 × HD to 28 × sub SD per module, depending on complexity of profiles
Key Frame Alignment	: Frame accurate key frame alignment across all profiles. Fixed IDR to IDR distance.
GOP control	: Dynamic GOP structure with Scene Change Detection.

Audio Encode

Capacity	: Up to 8 per module
Output format	: AAC-LC. Modes: 2.0, Bit rates: 32–384kbps
	: HE-AAC v1. Modes: 2.0, Bit rates: 32–192kbps
	: HE-AAC v2. Modes: 2.0, Bit rates: 32–96kbps
Sample rates	: 32, 48kHz

Reformatting/Rescaling

De-interlacing	: Interlaced to progressive conversion
Format conversion	: From HD to sub SD

Aspect Ratio Control

Aspect Ratio Modes	: Transparent Input to Output, Manual 4:3 or 16:9
AFD Modes	: Generated based on incoming AFD and format conversion.

8) For complete table please contact Sencore.
9) 352 only available for 25 fps

VBI

Pass-through	: Components such as EBU Teletext and DVB Subtitling can be passed through. Synchronization to video will be maintained.
Closed Captioning	: EIA-608n and EIA-708 passed through.

Graphics

Subtitling Insertion (burn-in)	: DVB Subtitling
Licensed Features	: Dolby® Digital/Dolby® Digital Plus Decode

PROCESSING MODULES SPECIFICATIONS

Audio leveling	Number of audio tracks	: 250 stereo
	Pass-Through	: All components signaled in service
	Audio format	: MPEG-1 layer 2
	Adjustable range	: ±30 dB
	Step	: 2 dB
	Adjustment mode	: Static
		Integrated with 3rd party SW solutions for automatic adjustment
	Licensed Features	: Number of audio channels
Bulk Descrambling	Interface	: SW based smart card
	CA system support	: Please contact Sencore*
	BISS support	: Mode 1, Mode E
	Maximum data rate	: Up to 850 MBit/s
	Number of services per module	: 250
	Scrambling algorithms	: DVB-CSA and AES
	Licensed Features	: Number of descrambled channels
		: Biss, Verimatrix, Latens
SIM Bulk Descrambling	Interface	: SIM based smart card
	Number of SIM card readers	: 8 in front and 8 behind front plate (Only 8 in front can be replaced while in operation)
	CA system support	: Conax
	BISS support	: Mode 1, Mode E
	Maximum data rate	: Up to 850 MBit/s
	Number of services per module	: 250
	Scrambling algorithms	: DVB-CSA and AES
	Licensed Features	: Number of descrambled channels
		: Conax
DVB Descrambling	Interface	: DVB Common Interface
	CA system support*	: BetaCrypt, Conax, Cryptoworks, Irdeto, Mediaguard, Viaccess, NDS Viasat, Nagra
	Number of services per CAM	: 10 (requires multi service CAM)
Scrambling	Scrambling algorithm	: DVB-CSA and AES
	Maximum data rate	: Up to 850 MBit/s
	Number of services per scrambler card	: 250 (depending on SW license)
	Video format	: Transport stream; MPEG-2, MPEG-4, HEVC
	Interface towards CA System	: Simulcrypt interface
	Number of CA systems	: 4 CA systems simultaneously
	EMM	: Yes
	Entropy reduction	: Yes for DVB
		No for AES
	Licensed Features	: Number of descrambled channels
		: PVR assist
EPG	Ingest	: EIT table from any port, XMLTV
	Output	: Re-generated EIT table

Audio Encoder

Number of stereo channels	: 32

Audio Inputs

Number of SDI/HSDI inputs	: 4
Number if stereo audio per SDI Input	: 8
Embedded Audio	: SMPTE 272M (SD), SMPTE 299M (HD)
	: Sample rate 48kHz, syncronous

Audio Encoder		Mono (kbps)	Stereo (kbps)
Audio Codecs	: MPEG-1 Layer 2	32 / 192	64 / 384
	: MPEG-1 Layer 3 (MP3)	32 / 320	32 / 320
	: AAC-LC	32 / 192	64 / 384
	: HE-AAC v1	32 / 96	48 / 192
	: HE-AAC v2	N/A	32 / 96

Audio Channel Modes	: Stereo and Mono
Audio Level Adjustments	: +6 / -10 dB
PCR	: On separate PID
Common PCR	: Yes, if input signals are Genlocked
Licensed Features	: Number of MPEG-1 Layer 2 and AAC stereo encoders
	: Number of MPEG-1 Layer 3 (MP3) stereo encoders

COMMON OUTPUT SPECIFICATIONS

All Output Modules

Key reference specification	: ETSI TR 101 211 V1.9.1, ISO IEC 13818-1

Multiplexing

Video format	: Transport stream, MPEG-2 SD/HD, MPEG-4 SD/HD, and HEVC
PCR regeneration	: Yes

PSI/SI

Function	: PSI/SI regeneration based on input and operations performed on the signal
Pass-through of scrambled services	: Yes, on TS level. For SPTS output only
PSI/SI handling	: Automatically regenerated
Tables Supported:	
PSI	: PAT, PMT, CAT
SI	: SDT, NIT, EITpf ,TOT, TDT, BAT, AIT

PSIP

Function	: PSIP input analysis
Tables Supported:	
PSI	: PAT, PMT, CAT
PSIP	: MGT, TVCT,CVCT

OUTPUT MODULE SPECIFICATIONS

Dual IP IO

IP Input/Output

Interface	: 2×10/100/1000 Base-T Ethernet and SFP
Operational mode	: The module can be configured to;
	- 1 input and 1 output
	- Seamless (Hitless) IP in
	- Cloned IP out
	- Dual IP in
	- Dual IP out
Maximum data rate per port	: Up to 850 Mbit/s per port in Seamless (Hitless) in, cloned out or 1×IPIN+1×IPOUT
	: Up to 850 Mbit/s sum of both ports in Dual IP in or Dual IP out mode
Maximum number of services per port	: 250
Data format	: UDP/RTP Multicast/Unicast
Transport stream	: SPTS and MPTS
Service filtering	: Yes
Video format	: Transport stream, MPEG-2/4 (H264) and HEVC

IP Input

IP de-jittering	: Yes, based on PCR or CBR
Forward Error Correction	: SMPTE 2022-1
	250 input streams per data port

IP Output

Forward Error Correction	: SMPTE 2022-1
	250 output streams per data port
Licensed Features	: Seamless IP In, Cloned IP Out
	: Multiplexing
	: FEC in, FEC out, FEC in/out
	: IP Out Redundancy

ASI Output

Key reference specification	: EN50083-9
Connectors	: 4 BNC female, 75Ω
Number of outputs per module	: 4 different Transport Streams
Maximum bit-rate per port	: burst mode: 213.7Mbit/s
	spread mode: 72Mbit/s
Transport stream output	: SPTS and MPTS
Number of services per card	: 250 (sum of all 4 ports)
Output format	: Constant bit-rate

QAM Output

Key reference specifications	: EN 300 429, ITU J.83.ABC
Interface	: 2 × F connector female, 75 Ω
Number of carriers	: 3 and 4 per group (adjacent channels)
Number of QAM frequencies per module	: up to 16 carriers in 4 groups, 8 per port
Modulation	: 16 / 32 / 64 / 128 / 256 - QAM
Symbol rate	: 4.48 to 7.00 Mbaud (Annex A and C)
Frequency range	: 47–862 MHz (CM-201, CM-301)
	: 47-1000 MHz (CM210, CM-310)
Spectrum inversion	: user selectable
Test mode	: CW
Channel spacing	: 5, 6, 7, 8 MHz (12 MHz available for 3 carrier groups)
Frequency step size	: 1 Hz
Frequency stability	: 2 ppm
Output level	: -12 to +2.2dBm per carrier
Output level stability	: ± 0.5 dB
Output level adjustment step size (GUI)	: 0.1 dB
MER	: > 42 dB
Return loss	: >16 dB
Spurious	: typ < -60 dBc

DVB-S/S2 Modulator, IF

Key reference specification	: EN 300 421 , EN 302 307
Number of DVB-S/S2 outputs per module	: 2
Monitoring ports	: 1 per output (30 dB attenuated)
Output connector	: F-type female, 75 Ω (RF Out and Test out)
Output frequency (center)	: 70–200 MHz
Output level	: -15 to 0 dBm
Output level stability	: ± 0.5 dB
Frequency stability	: 2 ppm
Return loss	: >16 dB
Spurious	: typ < -60 dBc
In-band flatness	: typ < ± 0.1 dB
Spectrum inversion	: user selectable
Precorrection	: Static linear pre-correction

DVB-S Coding and Modulation

Constellation	: QPSK
Modulation mode	: Constant
FEC outer	: RS (188, 204)
FEC inner	: Viterbi
Code rates	: 1/2, 2/3, 3/4, 5/6, 7/8
Symbol rate	: 0.5–45 Mbaud

DVB-S2 Coding and Modulation

Constellation	: QPSK, 8-PSK, 16-APSK, 32-APSK
Modulation mode	: CCM
FEC	: BCH/LDPC
Code rates	: 1/4, 1/3, 2/5, 1/2, 3/5, 2/3, 3/4, 4/5, 5/6, 8/9, 9/10

	Frame length	: 16200 bits (short), 64800 bits (long)
	Symbol rate	: 0.5–45 Mbaud
	Roll off	: 0.05, 0.10, 0.15, 0.20, 0.25, and 0.35
	Licensed Features	: DVB-S/S2
		: 1 or 2 outputs
DVB-S/S2 Modulator, L Band	Key reference specification	: EN 300 421 , EN 302 307
	Number of DVB-S/S2 outputs per module	: 2
	Monitoring ports	: 1 per output (30 dB attenuated)
	Output connector	: SMA female, 50Ω (RF out)
		: F-type female, 75Ω (Test out)
	Output frequency	: 950–2150 MHz
	Output level	: -20 to 5 dBm
	Output level stability	: ± 0.5 dB
	Frequency accuracy	: 2 ppm
	Return loss	: >14 dB
	Spectrum inversion	: user selectable
	Spurious	: < -65 dBc/4kHz (@ symbol rate ≥ 256 kb/s)
	In-band flatness	: typ < ± 0.1 dB
	Precorrection	: Static linear pre-correction
	DVB-S Coding and Modulation	
	Constellation	: QPSK
	Modulation mode	: Constant
	FEC outer	: RS (188, 204)
	FEC inner	: Viterbi
	Code rates	: 1/2, 2/3, 3/4, 5/6, 7/8
	Symbol rate	: 0.5–45 Mbaud
	DVB-S2 Coding and Modulation	
	Constellation	: QPSK, 8-PSK, 16-APSK, 32-APSK
	Modulation mode	: CCM
	FEC	: BCH/LDPC
	Code rates	: 1/4, 1/3, 2/5, 1/2, 3/5, 2/3, 3/4, 4/5, 5/6, 8/9, 9/10
	Frame length	: 16200 bits (short), 64800 bits (long)
	Symbol rate	: 0.5–45 Mbaud
	Roll off	: 0.05, 0.10, 0.15, 0.20, 0.25, and 0.35
	Licensed Features	: DVB-S/S2
		: 1 or 2 outputs
DVB-S/S2X Modulator	Key reference specification	: EN 300 421, EN 302 307 part 1 and 2
	Number of DVB-S/S2X carriers per module	: 2
	Spectrum inversion	: User selectable
	Precorrection	: Static linear pre-correction
	Carrier ID	: DVB,NIT
	DC output	: 24 Volt
	Maximum DC output current	: 500 mA
	10MHz reference output	: 0 dBm ± 2dB
	DVB-S Coding and Modulation	
	Constellation	: QPSK
	Modulation mode	: Constant
	FEC outer	: Reed-Solomon
	FEC inner	: Viterbi
	Code rates	: 1/2, 2/3, 3/4, 5/6, 7/8
	Symbol rate	: 0.1–68 MSym/s
	Roll off DVB-S	: 0.35
	DVB-S2X Coding and Modulation	
	Constellation	: QPSK, 8PSK, 16APSK, 32APSK
	Modulation mode	: CCM
	FEC	: BCH/LDPC
	Code rates DVB-S2X QPSK	: 1/4, 1/3, 2/5, 1/2, 3/5, 2/3, 3/4, 4/5, 5/6, 8/9, 9/10
	Code rates DVB-S2X 8PSK	: 3/5, 23/36, 2/3, 25/36, 13/18, 3/4, 5/6, 8/9, 9/10

	Code rates DVB-S2X 8APSK	: 5/9, 26/45
	Code rates DVB-S2X 16APSK	: 5/9, 8/15, 1/2, 26/45, 3/5, 28/45, 23/36, 2/3, 25/36, 13/18, 3/4, 7/9, 4/5, 5/6, 77/90, 8/9, 9/10
	Code rates DVB-S2X 32APSK	: 2/3, 32/45, 11/15, 3/4, 7/9, 4/5, 5/6, 8/9, 9/10
	Code rates DVB-S2X 64APSK	: 5/6, 4/5, 7/9, 11/15, 32/45-L
	Code rates DVB-S2X 128APSK	: 3/4, 7/9
	Code rates DVB-S2X 256APSK	: 3/4, 2/3-L, 11/15-L, 29/45-L, 31/45-L, 32/45
	Frame length	: Normal, Short
	Gold scrambling sequence	: 0-6
	Symbol rate	: 0.1–68 MSym/s
	Roll off	: 0.05, 0.10, 0.15, 0.20, 0.25, and 0.35
	Gold scrambling sequence	: 0—6
	IF	
	Frequency range	: 70-200 MHz
	Main output connector	: F-type female, 75 Ω
	Monitoring output connector	: SMA female, 50 Ω
	Output level	: -15 to 0 dBm
	Output level stability	: ± 0.5 dB
	Output level accuracy	: ± 0.5 dB
	Frequency stability	: 2 ppm
	Return loss	: >18 dB
	Spurious modulated signal	: < -65 dBc/4kHz (@ symbol rate ≥ 256 kbaud)
	Spurious carrier wave	: < -60 dBc/4kHz (typical)
	In-band flatness	: typ < ± 0.1 dB
	Monitoring ports level	: -40 dBm
	Monitoring ports return loss	: >20dB
	L-band	
	Frequency range	: 950-2150 MHz
	Main output connector	: SMA female, 50 Ω
	Monitoring output connector	: F-type female, 75 Ω
	Output level	: -40 to 7 dBm
	Output level stability	: ± 0.5 dB
	Frequency accuracy	: 2 ppm
	Return loss	: >14 dB
	Spurious modulated signal	: < -65 dBc/4kHz (@ symbol rate ≥ 256 kbaud)
	Spurious carrier wave	: < -60 dBc/4kHz
	In-band flatness	: typ < ± 0.2 dB
	Monitoring ports level	: -40 dBm
	Monitoring ports return loss	: >10dB
	Licensed Features	: Number of carriers
		: DVB-S2 modulation
		: VB-S2X modulation Broadcast
		: DVB-S2X modulation professional
		: 10MHz and 24V DC output
DVB-T Cable Modulator	Key reference specification	: ETSI EN 300744
	Number of carriers	: 4 independent carriers
	Number of output ports	: 2 (2 carriers per port)
	Output connector	: F-type
	Impedance	: 75 Ω
	Output frequency	: 47–862 MHz
	Frequency setting step size	: 1 Hz
	Output level	: -12 to 2.2 dBm
	Output level stability	: ± 0.5 dB
	Frequency accuracy	: 2 ppm
	Return loss	: >16 dB
	MER	: > 42 dB
	Test mode	: CW
	DVB-T Coding and Modulation	
	FFT size	: 2k, 8k
	Guard intervals	: 1/4, 1/8, 1/16, 1/32
	Code rates	: 1/2, 2/3, 3/4, 5/6, 7/8

DVB-T2 Cable Modulator

Constellation	: QPSK, 16-QAM, 64-QAM
Channel bandwidth	: 5, 6, 7, 8 MHz
Key reference specification	: ETSI EN 302755
Number of carriers	: 2 independent carriers
Number of output ports	: 2 (1 carrier per port)
Output connector	: F-type
Impedance	: 75 Ω
Output frequency	: 47-862 MHz
Frequency setting step size	: 1 Hz
Output level	: -10 to 2.2 dBm (TBD)
Output level stability	: ± 0.5 dB
Frequency accuracy	: 2 ppm
Return loss	: >16 dB
MER	: > 42 dB
Test mode	: CW

DVB-T2 Coding and Modulation

FFT size	: 1k, 2k, 4k, 8k, 8k extended, 16k, 16k extended, 32k, 32k extended
Guard intervals	: 1/4, 19/128, 1/8, 19/256, 1/16, 1/32, 1/128
FEC frame	: Normal (64k), Short (16k)
FEC code rate	: 1/2, 3/5, 2/3, 3/4, 4/5, 5/6
Constellation (PLP)	: QPSK, 16-QAM, 64-QAM, 256-QAM
Channel bandwidth	: 1.7, 5, 6, 7, 8, or 10 MHz
Pilot pattern	: P1–P8
Number of PLPs	: 1

DVB-T/T2 Modulator (Exciter)

Key reference specification	: ETSI EN 302755 , ETSI EN 300744
Number of carriers	: 2 independent carriers
Number of output ports	: 2 (1 carrier per port)
Output connector	: BNC
Impedance	: 50 Ω
Output frequency	: 47-862 MHz
Frequency setting step size	: 1 Hz
Output level	: -15 to 0 dBm
Output level stability	: ± 0.5 dB
Frequency accuracy	: 2 ppm
Return loss	: >16 dB
MER	: > 42 dB
Test mode	: CW

DVB-T Coding and Modulation

Input	: TS with MIP (SFN) or remultiplexed TS
FFT size	: 2k, 8k
Guard intervals	: 1/4, 1/8, 1/16, 1/32
Code rates	: 1/2, 2/3, 3/4, 5/6, 7/8
Constellation	: QPSK, 16-QAM, 64-QAM
Channel bandwidth	: 5, 6, 7, 8 MHz

DVB-T2 Coding and Modulation

Input	: T2MI (SFN) or remultiplexed TS
SFN	: Relative timestamps within 1000 ms
T2 versions	: 1.1.1 and 1.2.1
FFT size	: 1k, 2k, 4k, 8k, 8k extended, 16k, 16k extended, 32k, 32k extended
Guard intervals	: 1/4, 19/128, 1/8, 19/256, 1/16, 1/32, 1/128
FEC frame	: Normal (64k), Short (16k)
FEC code rate	: 1/2, 3/5, 2/3, 3/4, 4/5, 5/6
Constellation (PLP)	: QPSK, 16-QAM, 64-QAM, 256-QAM
Channel bandwidth	: 1.7, 5, 6, 7, 8, or 10 MHz
Pilot pattern	: P1–P8
Number of PLPs	: up to 128

ISDBT - Modulator

Key reference specification	: ARIB STD-B31, ARIB STD-B10
CM-500 Interface	: 2 × F connector female, 75 Ω
Number of ISDBT carriers per module	: 8, 2 per group (adjacent channels)
Carrier spacing	: 6-31 MHz
Frequency range	: 47–862 MHz
Spectrum inversion	: User selectable
Test mode	: CW
Frequency step size	: 1 Hz
Frequency stability	: 2 ppm
Output level	: -10 to +2.2dBm per carrier
Output level stability	: ± 0.5 dB
Output level adjustment step size (GUI)	: 0.1 dB
MER	: > 42 dB
Return loss	: >16 dB
Spurious	: typ < -60 dBc

ISDB-T Coding and Modulation*

Modulation	: QPSK, 16QAM, 64 QAM
Transmission mode	: Mode 3 (8K FFT)
Time interleaving	: 0
Hierarchical transmission	: no
Guard interval	: 1/4, 1/8, 1/16, 1/32
Code rate	: 1/2, 2/3, 3/4, 5/6, 7/8
Bandwidth	: 6, 7, 8 MHz

Multiplexing

Video format	: Transport stream, MPEG-2 SD/HD, MPEG-4 SD/HD, and HEVC
PCR regeneration	: Yes

PSI/SI

Function	: PSI/SI regeneration based on input and operations performed on the signal.

ARIB and ABNT compliant PSI/SI generation

PSI/SI handling	: Automatically regenerated

Tables Supported

PSI	: PAT, PMT, CAT
SI	: SDT, NIT, EITpf ,TOT, TDT, BAT, AIT
Pass-through of scrambled services	: Yes, on TS level. For SPTS output only

PSIP

Function	: PSIP input analysis

Tables Supported:

PSI	: PAT, PMT, CAT
PSIP	: MGT, TVCT,CVCT
Licensed Features	: Number of carriers

DVB-T/T2 Gateway ASI[10]

Connectors	: 4 x BNC 75Ω
Number of MPTS's with MIP	: 4
Number of T2MI streams	: 2
Maximum ASI bit-rate per port	: Spread Mode: 72Mbit/s Burst Mode: 213Mbit/s
Re-multiplexing	: See common output module specifications

DVB-T MIP inserter

Key specification	: ETSI EN 300 744, ETSI TS 101 191
Relative timestamps	: <1s

DVB-T2 T2MI

Key reference specifications	: EN50083-9, ETSI EN 302 755, ETSI TS 102 773
T2 version	: 1.1.1, 1.2.1 and 1.3.1
T2MI signaling	: T2MI is signaled in PSI/SI as a data service
Clock modes	: Relative Timestamps <1s (SFN) and Null timestamps (MFN)

10) DVB-T and DVB-T2 gateway run on different HW versions for ASI out.

PAPR		: TR and ACE (global on/off)
MISO/SISO		: Yes
Guard intervals		: 1/4, 19/128, 1/8, 19/256, 1/16, 1/32, 1/128
FFT sizes		: 1k, 2k, 4k, 8k, 8k extended, 16k,
		16k extended, 32k, 32k extended
Pilot Patterns		: P1 – P8
L1 Constellations		: QPSK, 16-QAM, 64-QAM, BPSK
Bandwidth		: 1.7, 5, 6, 7, 8, 10MHz

DVB-T2 PLP support

Number of PLPs	: 240 in total between all T2MI streams
PLP mode	: HEM, constant bit-rate
PLP types	: 1 and 2
TI types	: Within a T2 frame and across multiple T2 frames
Automatic calculation	: FEC blocks, TI blocks, TI frames and TI type
FEC frame	: Normal (64k), Short (16k)
FEC code rate	: 1/2, 3/5, 2/3, 3/4, 4/5, 5/6
Constellations	: QPSK, 16-QAM, 64-QAM, 256-QAM
Rotated constellations	: Yes
ISSY supported	: Yes

Licensed Features

	:DVB-T/T2
	:MIP, T2MI
	:1 or 2 outputs
	:Multi PLP, Regional PLP

DVB-T2 Gateway IP

Connectors	: 2 × 10/100/1000 Base-T Ethernet output or 2× Optical SFP (class 1 laser product)
Number of MPTS's with MIP	: 4
Number of T2MI streams	: 4
Maximum data rate	: Up to 850 MBit/s
Output mode	: CBR
Data format	: UDP/RTP Multicast/Unicast
Support for cloned output	: Yes
Forward Error Correction	: SMPTE 2022-1 (Licensed)
Re-multiplexing	: See common output module specifications

DVB-T MIP inserter

Key specification	: ETSI EN 300 744, ETSI TS 101 191
Relative timestamps	: <1s

DVB-T2 T2MI

Key reference specifications	: EN50083-9, ETSI EN 302 755, ETSI TS 102 773
T2 version	: 1.1.1, 1.2.1 and 1.3.1
System redundancy	: 1+1 protection on unit with T2MI frame (licensed) Output redundancy based on OSPF (licensed) Network level redundancy (licensed)
Regionalization	: Yes. Please contact Sencore for more information
T2MI signaling	: T2MI is signaled in PSI/SI as a data service
Clock modes	: Relative Timestamps <1s (SFN) and Null timestamps (MFN)
PAPR	: TR and ACE (global on/off)
MISO/SISO	: Yes
Guard intervals	: 1/4, 19/128, 1/8, 19/256, 1/16, 1/32, 1/128
FFT sizes	: 1k, 2k, 4k, 8k, 8k extended, 16k,16k extended, 32k, 32k extended
Pilot Patterns	: P1 – P8
L1 Constellations	: QPSK, 16-QAM, 64-QAM, BPSK
Bandwidth	: 1.7, 5, 6, 7, 8, 10MHz

DVB-T2 PLP support

Number of PLPs	: 240 in total between all T2MI streams
PLP mode	: HEM, constant bit-rate
PLP types	: 1 and 2
TI types	: Within a T2 frame and across multiple T2 frames

Automatic calculation		: FEC blocks, TI blocks, TI frames and TI type
FEC frame		: Normal (64k), Short (16k)
FEC code rate		: 1/2, 3/5, 2/3, 3/4, 4/5, 5/6
Constellations		: QPSK, 16-QAM, 64-QAM, 256-QAM
Rotated constellations		: Yes
ISSY supported		: Yes
Licensed Features		**:** IP Out Redundancy, T2MI sync+IP Redundancy
		: T2MI
		: Multi PLP, Regional PLP
		: FEC out

CHASSIS

4RU	Physical dimensions	: 19" × 4RU × 400mm (440 × 177 × 400 mm)
	Power supply	
	Power	: 800 Watt
	Input voltage	: 100-240 V AC, 50/60 Hz
	Redundancy	: Yes, dual hot swappable PS
	Monitoring	: Via WEB GUI and LED indicators on PS
	Cooling	
	Fans	: 4 fans
	Hot swap of fans	: Yes, fans are independently hot swappable
	Airflow direction	: Front to back
1RU	Physical dimensions	: 19" × 1RU × 400mm (440 × 44 × 480 mm)
	Power supply	
	Power	: 400 Watt
	Input voltage	: 100-240 V AC, 50/60 Hz
		: optional: -48V DC
	Redundancy	: Yes, dual hot swappable PS
	Monitoring	: Via WEB GUI and LED indicators on PS
	Cooling	
	Fans	: 6 fans
	Hot swap of fans	: Yes, common fan module with all 6 fans
	Airflow direction	: Front to back

ENVIRONMENTAL CONDITIONS

Operational conditions	Temperature	: 0 to +40 °C
	Humidity	: 5–95% (non-condensing)
Storage	Temperature	: -20 to +70 °C
	Humidity	: 5 to 95% (non-condensing)
Electrical safety	IEC 60950-1	
EMC	EN 55022, EN55013, EN50083-2, EN55024, EN61000-3-2, EN61000-3-3, FCC CFR 47 Part 15	
RoHS	Compliant	
WEEE	Compliant	

HI-DENSITY

MODULAR

HOT - SWAP

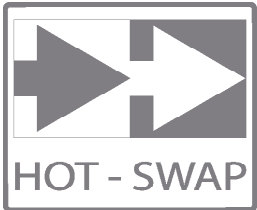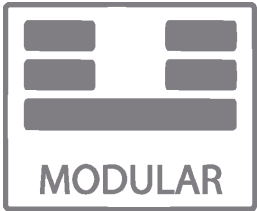# Sencore Inc

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