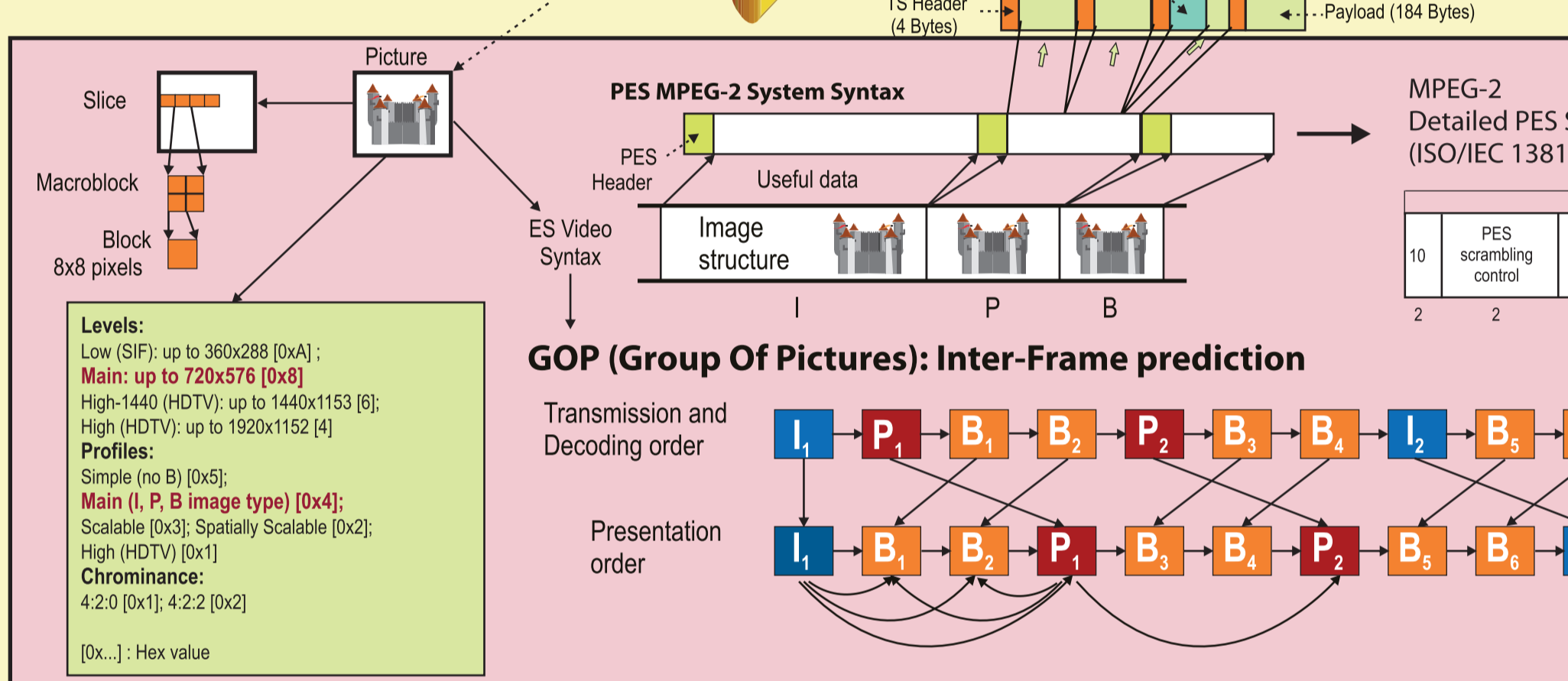
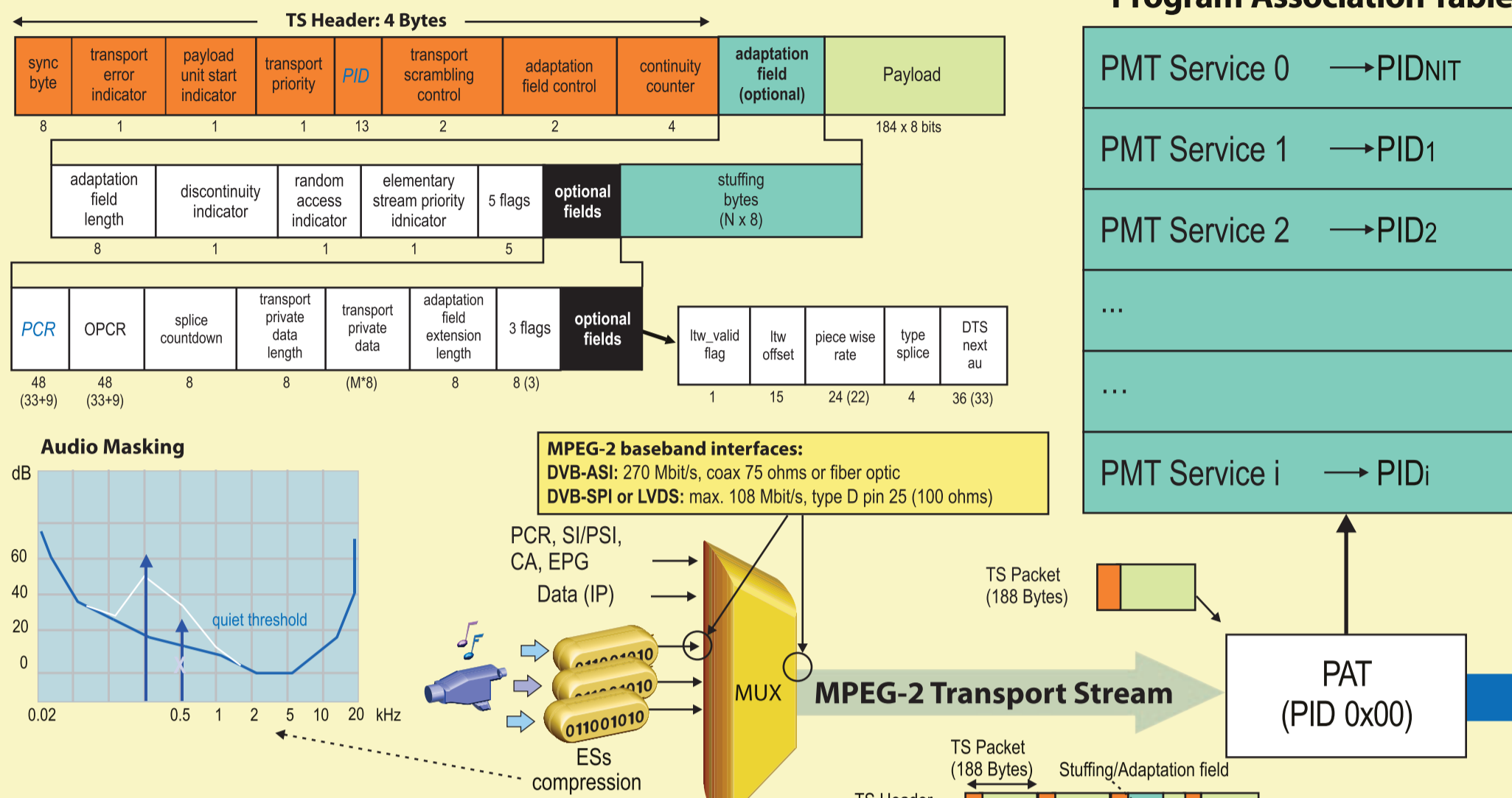


# JDSU MPEG-2 and DVB Digital Broadcasting

## Test & Measurement Solutions

### MPEG-2 detailed Transport Stream (TS) Syntax



### JDSU Digital Broadcast Test & Monitoring Solutions:

**MPEG-2 Transport Stream Generation, Simulation, Capture and Analysis**  
 Digital Broadcast Test Solutions for Labs and Field Applications

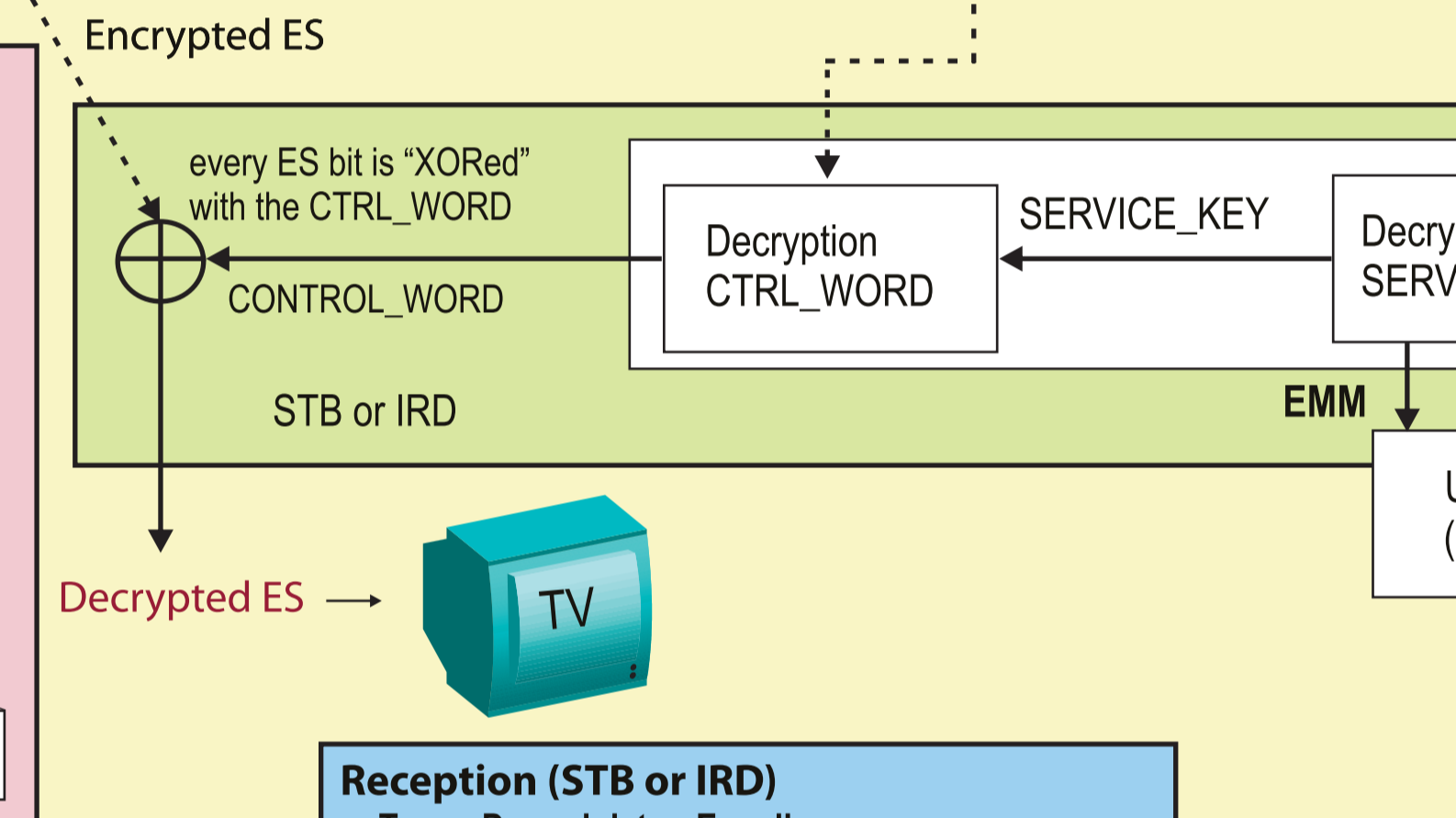
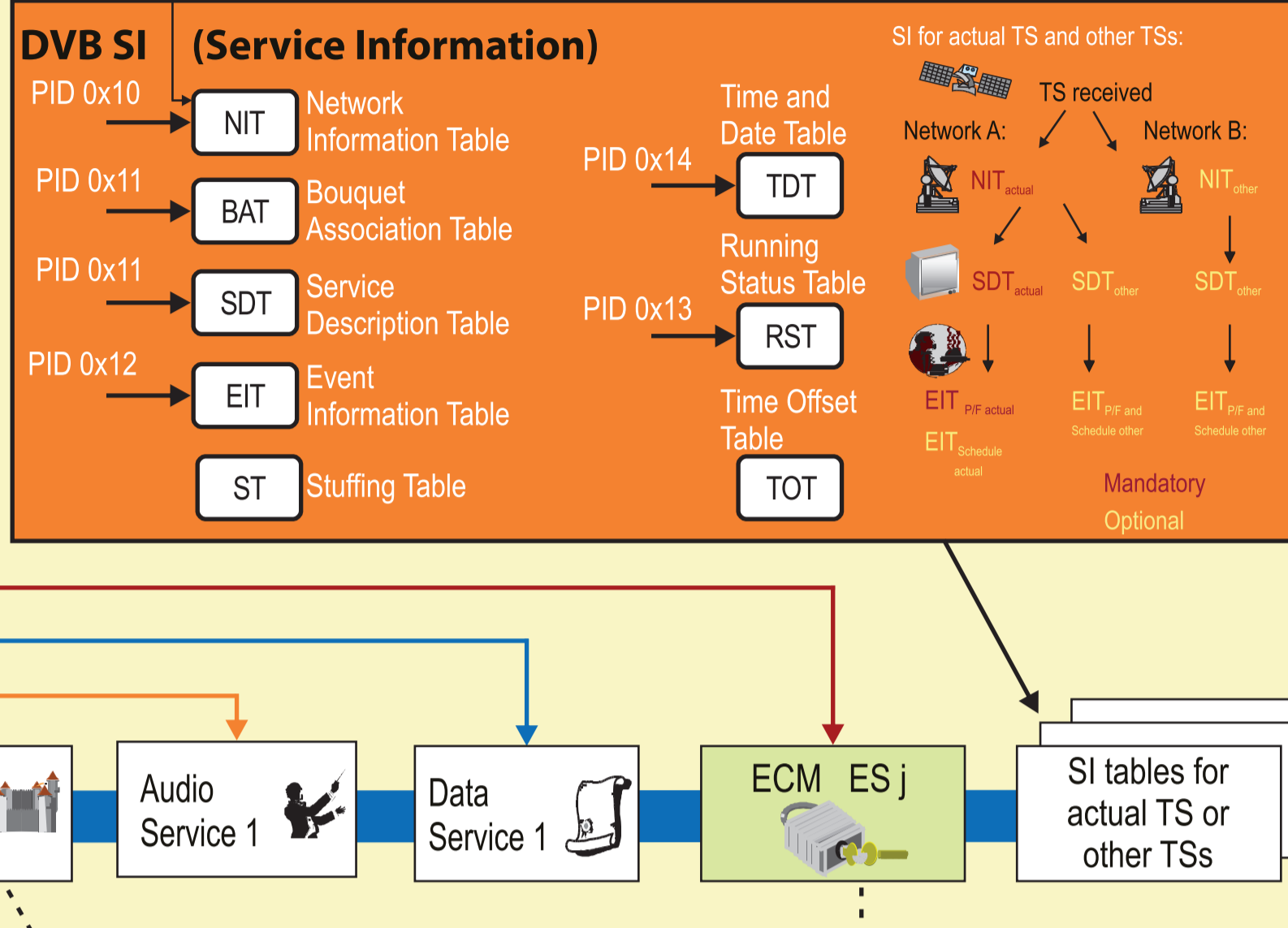
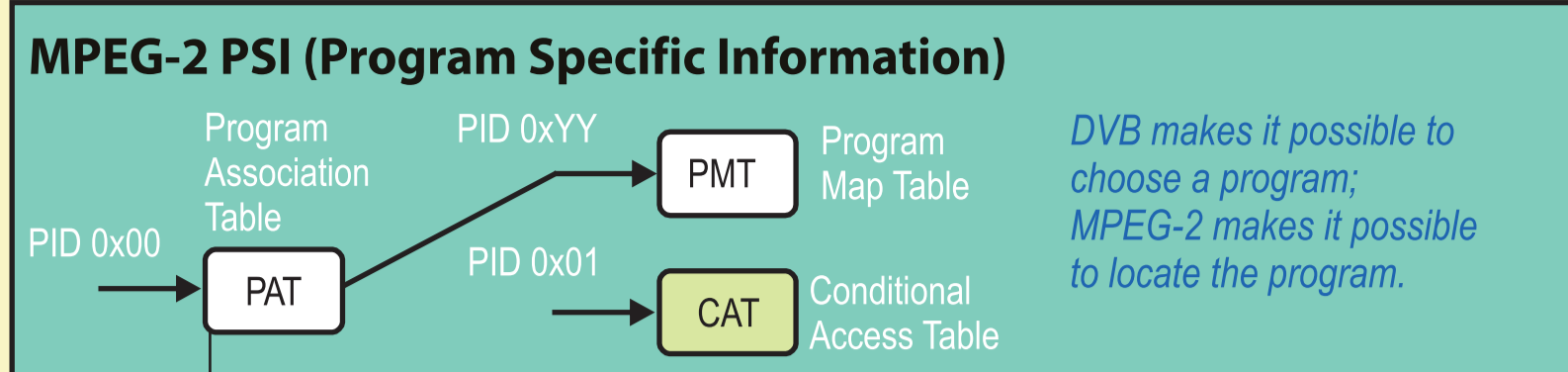
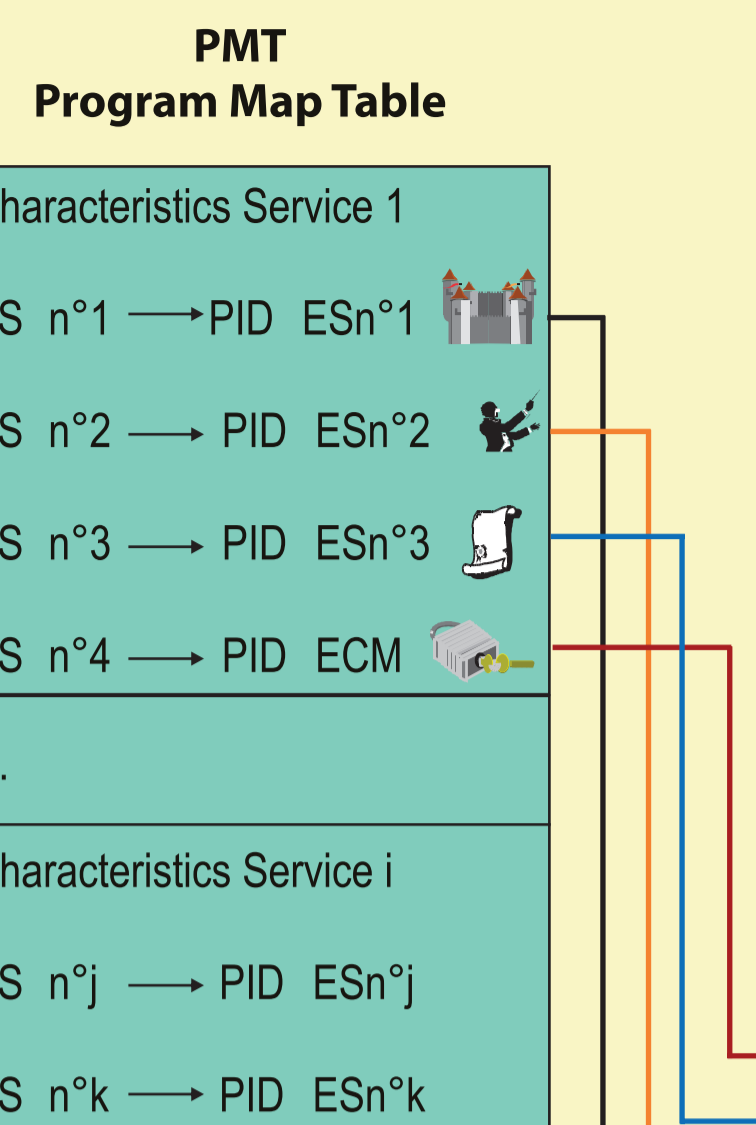
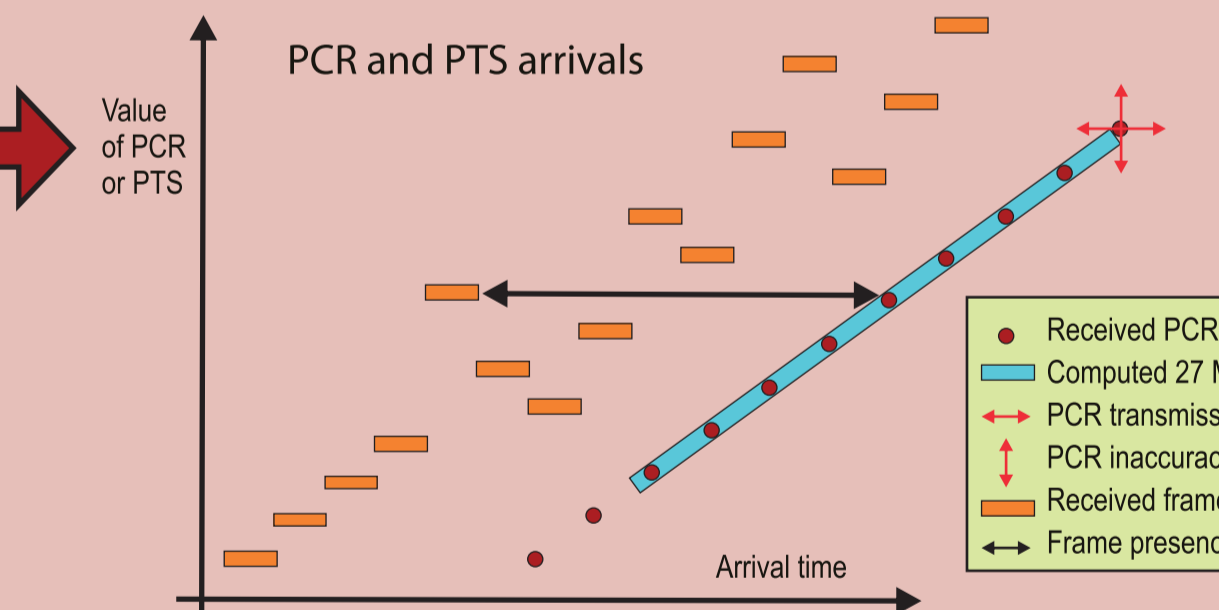
- Flexible and complete MPEG-2, DVB, and ATSC test solution
- Modular design provides flexibility to add interfaces and features
- Expert A/V Analysis
- DVB-RCS Analysis and Simulation

**QoS All Along the Broadcast Chain**  
 Digital Broadcast Monitoring System

- Network Operator's tool for detailed MPEG-2/DVB problem diagnosis
- Advanced Surveillance Platform for digital and analog TV
- DVB Service Assurance
- Real-time global EPG creation on a single transport stream

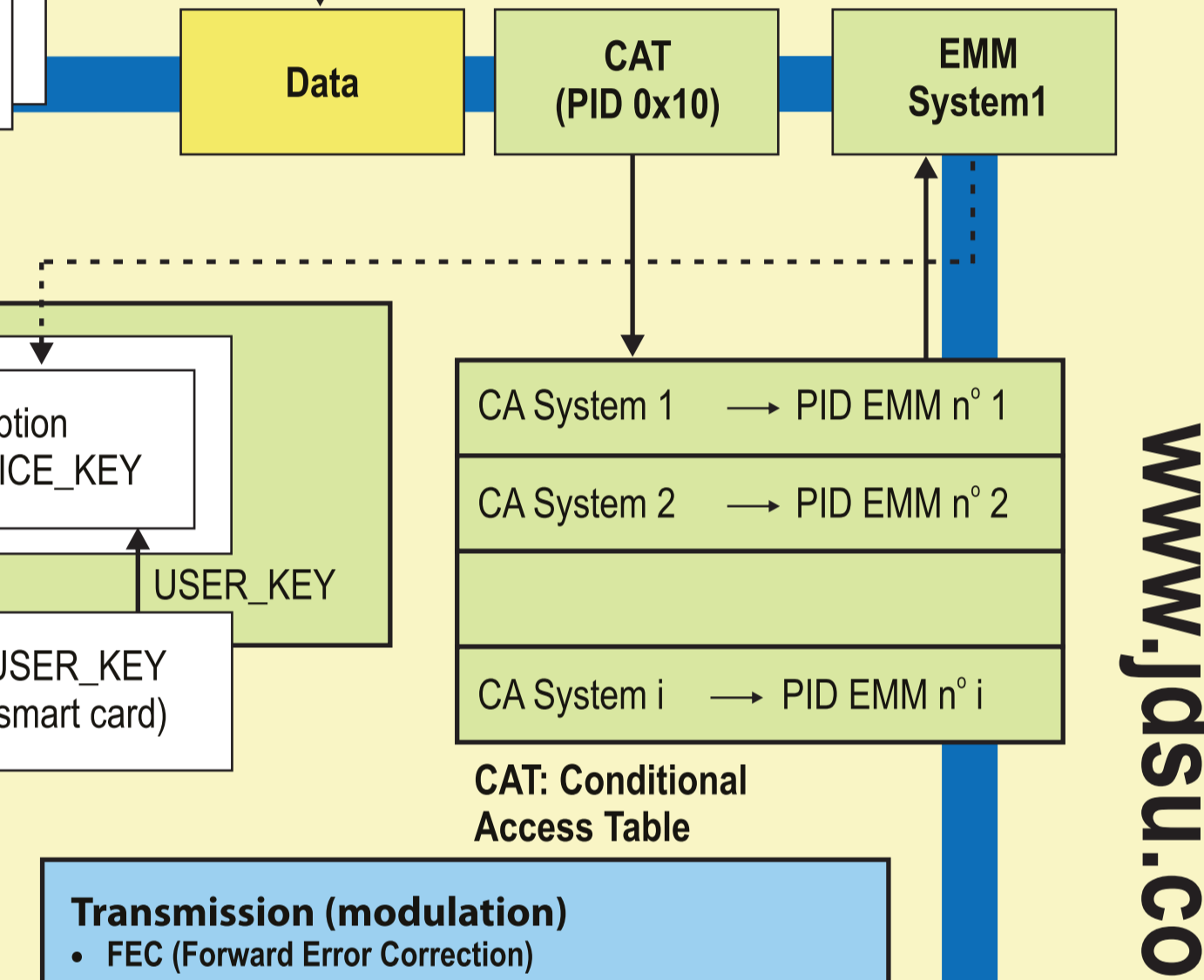
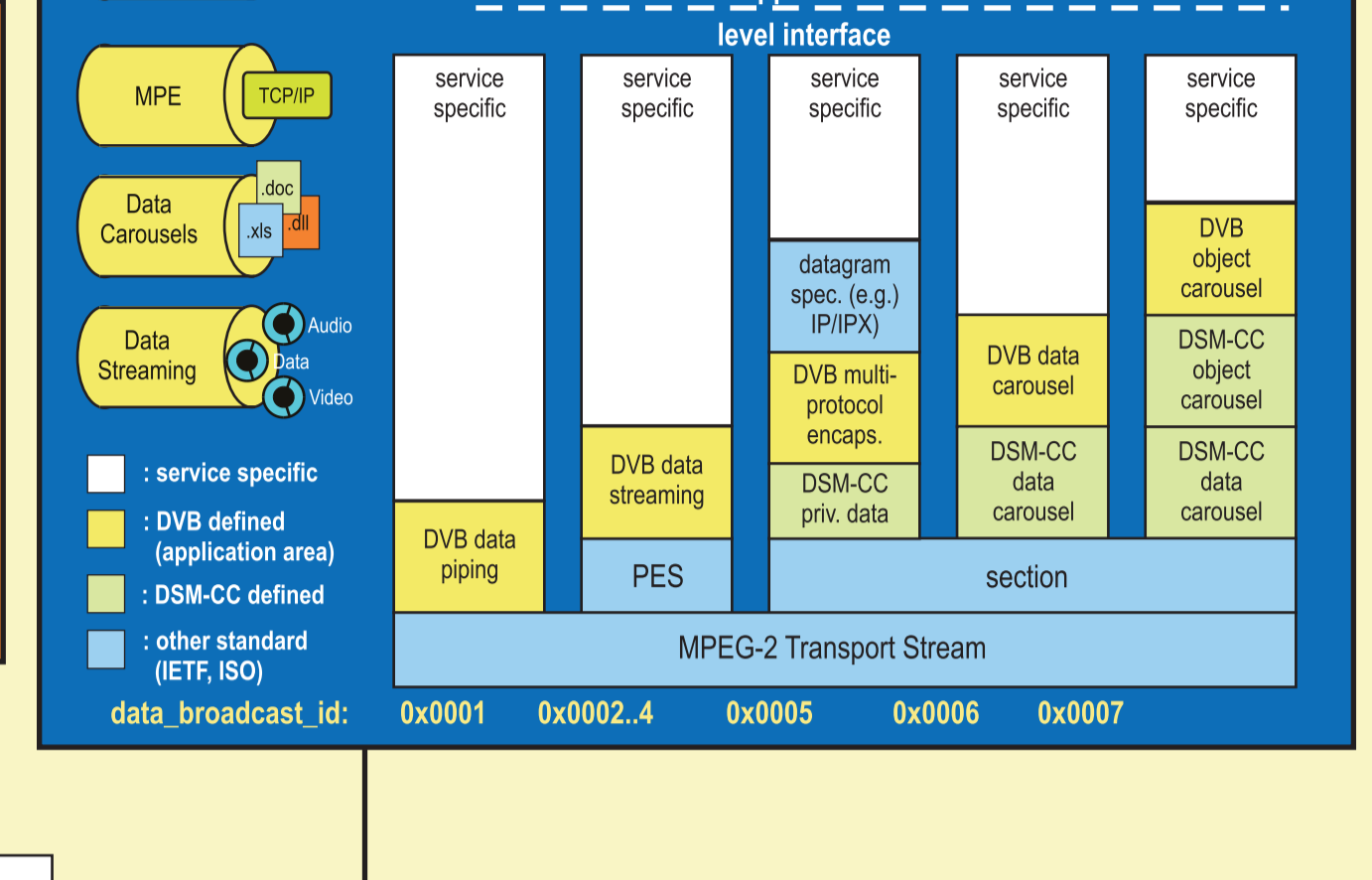
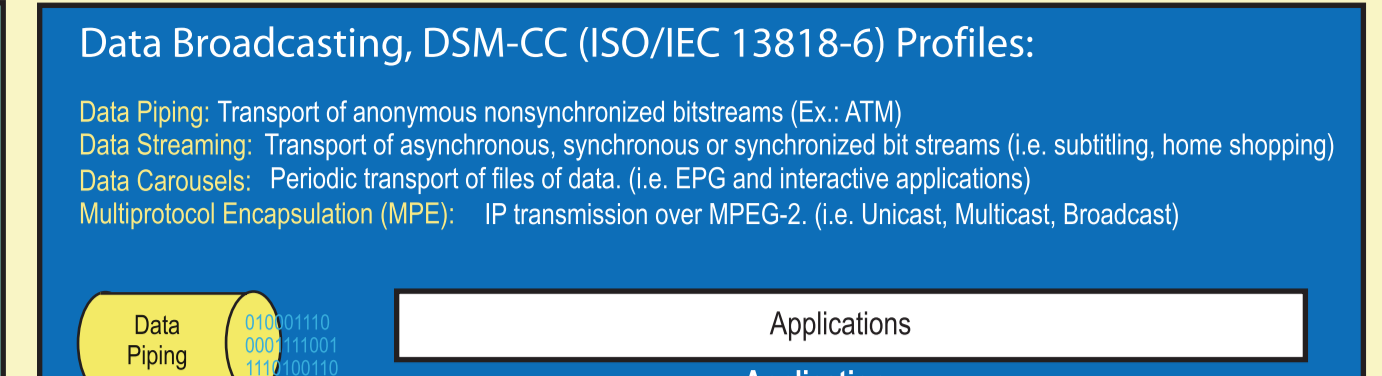
**ETR-290/TR101-290 tables and timing measurement guideline:**

Parameter	Value	Units
PCR spacing	2.3	40 ms
PCR discontinuity	2.3	100 ms
PCR jitter	2.4	± 500 ns
PTS spacing	2.5	700 ms
PCR Accuracy (13818-1)	± 500 ns	
PCR Offset (13818-1)	± 810 Hz	
PCR Drift (13818-1)	± 75 mHz	



- ### Reception (STB or IRD)
- Tuner, Demodulator, Equalizer
  - FEC (Common for Cable/Satellite/Terrestrial):
    - 1) Inner Decoding (Viterbi); Satellite only
    - 2) De-interleaving
    - 3) Outer Decoding RS (204, 188, 8)
    - 4) Descrambling
  - Demux → Transport Stream
  - MPEG Decoder → TV

- Aim of FEC: Not error-free channel (BER approx.  $10^{-4}$  -  $10^{-5}$ ) → QEF channel (BER approx.  $10^{-10}$  -  $10^{-12}$ )
- Energy dispersal: obtain an evenly distributed energy within the RF channel by means of PRBS (187 bytes randomized -Sync. not scrambled)
- RS (Reed Solomon): error correction coding (can correct up to 8 erroneous bytes)
- Forney convolution interleaving: increase the efficiency of RS (temporary spreading of burst errors)



- ### Transmission (modulation)
- FEC (Forward Error Correction) (Common for Cable/Satellite/Terrestrial):
    - 1) Energy dispersal
    - 2) Outer Coding RS (204, 188, 8)
    - 3) Forney Interleaving
    - 4) Inner Coding (Viterbi); Satellite only
  - Formatting, filtering, DAC (I, Q)
  - QAM/QPSK/OFDM Modulation; IF Up-conversion; Amplification; or GigE transport

**Glossary and Acronyms**

- 13/18 V: Vertical polarization switching (Sat)
- 22 kHz: High/Low Band switching (Sat)
- 64QAM: Quadrature Amplitude Modulation with 64 states
- ADC: Analog-Digital Converter
- ADPCM: Adaptive Differential Pulse Code Modulation
- ADR: Astra Digital Radio
- ADSL: Asymmetrical Digital Subscriber Line
- AES: Audio Engineering Society
- AF: Adaptation Field
- AIT: Application Information Table (used for MHP)
- AM: Amplitude Modulation
- API: Application Programming Interface
- ARD: Arbeitsgemeinschaft der öffentlich-rechtlichen Rundfunkanstalten in Deutschland
- ASCI: American Standard Code for Information Interchange
- ASX: Asynchronous Serial Interface
- Standard DVB Interface for Transport Stream
- ATM: Asynchronous Transfer Mode
- ATSC: Advanced Television Systems Committee
- ATV: Advanced Television
- North American standard for Digital Broadcasting
- BAT: Bouquet Association Table. Table describing a bouquet of programs offered by a broadcaster.
- BER: Bit Error Rate
- Block: Used for DCT 8x8 pixels (JPEG, MPEG)
- Bouquet: Set of services provided by the same operator on a network. The bouquet is controlled by one single authority and sold as one single entity.
- BTA: Broadcasting Technology Association
- CA: Conditional Access
- CA: Conditional Access Table (PAT=0x1)
- References to scrambled programs
- CATV: Community Antenna TV (sometimes thought to be Cable Television). The distribution of multiple TV channels to subscribers via a cable network.
- CCITT: Comité Consultatif International Téléphonique et Télégraphique (1989-TTU-1)
- CEIEEC: Conférence Européenne Internationale / International Electrotechnical Commission
- CELENEC: Comité Européen de Normalisation Electrotechnique
- CPT: European Conference of Postal and Telecommunications Administrations
- CI: Carrier-to-Interference Ratio (dB)
- CIF: Common Intermediate Format 360x288 @ 30 Hz
- CI or CNR: Carrier-to-Noise-Ratio (dB)
- CO: Common Core
- CM: Common Core
- CRC: Cyclic Redundancy Check
- CSA: Common Scrambling Algorithm
- D/A: Digital-to-Analog
- DAB: Digital Audio Broadcasting
- DAC: Digital-to-Analog Converter
- DAPS: Differential Amplitude Phase Shift Keying
- DAT: Digital Audio Tape
- DAVIC: Digital Audio Visual Council
- DBS: Direct Broadcasting Satellite
- DCT: Discrete Cosine Transformation
- EDTV: Enhanced Definition Television
- EIT: Event Information Table, TV guide or EPG.
- ETT: EIT for present and following events
- EMM: Entitlement Management Message
- This control message transports a personal key for Scrambling (Encryption).
- EPG: Electronic Program Guide
- Broadcasting data structure that contains all the information describing the programs and their events.
- ES: Elementary Stream. Data stream for video, audio or data. Preliminary stage to PES.
- ES: Elementary Stream. Data stream for video, audio or data. Preliminary stage to PES.
- ESCR: Elementary Stream Clock Reference
- Digital TV
- ETR: ETSI Technical Report
- ETR 290: ETSI recommendation regarding measurement of MPEG-2/DVB-TS
- ETSI: European Telecommunication Standard Institute
- FEC: Forward Error Correction
- Error control bits added to useful data in the QAM/QPSK modulator (errors may be detected and correct ed)
- GIF: Graphics Interchange Format
- GigE: Gigabit Ethernet
- GOIP: Group Of Pictures
- HDTV: High Definition Television
- HEX: Hexadecimal (0x)
- HFC: Hybrid Fiber-Coax
- Typical CATV network infrastructure
- HTML: Hypertext Markup Language
- IEC: International Electrotechnical Commission
- IEEE: Institute of Electrical and Electronics Engineers
- DVB-MG: DVB-Measurement Group
- IF: Intermediate Frequency. Generally 70 MHz for transmission. (950 to 1250 for the LNB)
- Terrestrial broadcasting of TV signals to digital standard via microwave (F=10 GHz)

**DVB-RCS Digital Video Broadcasting-Return Channel Satellite**

**DVB-S Digital Video Broadcasting-Satellite**  
 Broadcasting TV signals to digital standard via satellite.

**DVB-SMATV Satellite Master Antenna TV**

**DVB-T Digital Video Broadcasting-Terrestrial**  
 terrestrial broadcasting of TV signals to digital standard.

**IS: International Standard**

**ISDN: Integrated Services Digital Network**  
 ISO International Standardization Organization

**ITU: International Telecommunications Union**

**JPEG: Joint Photographic Experts Group**  
 An ISO video compression standard for storage and transmission of a variety of still graphics image formats.

**Ku-Band: 10.7-18 GHz (Satellite)**

**LDTV: Low Definition Television**

**LED: Light Emitting Diode**

**LMDS: Local Multipoint Distribution System**  
 16x16 pixels (JPEG, MPEG)

**MCPC: Multiple Channels Per Carrier**

**MFM: Multi-Frequency Network (DVB-T)**

**MPEG: Multimedia/Hypermedia information coding Expert Group.**  
 Provides standards for the coded representation of multimedia hypermedia information objects that are interchanged among applications and services using a variety of media

**MPEG-2/DVB-TS**  
 MPEG-2/DVB-TS

**ETSI: European Telecommunication Standard Institute**

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 Error control bits added to useful data in the QAM/QPSK modulator (errors may be detected and correct ed)

**GIF: Graphics Interchange Format**

**GigE: Gigabit Ethernet**

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**HDTV: High Definition Television**

**HEX: Hexadecimal (0x)**

**HFC: Hybrid Fiber-Coax**  
 Typical CATV network infrastructure

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Terrestrial broadcasting of TV signals to digital standard via microwave (F=10 GHz)

**I, Q In phase and Quadrature signals (carrier digital modulation - phase and amplitude)**

**IRD: Integrated Receiver Decoder. Receiver with MPEG-2 decoder (Set Top Box)**

**NAB: National Association of Broadcasters**

**NIT: Network Information Table**  
 Information about orbit, transponder etc.

**NTSC: National TV Standard Committee**  
 Color TV System (USA and 60 Hz countries)

**NVD: Near Video on Demand**  
 Same TV program broadcasted simultaneously with a few minutes of starting time difference

**OFDM: Orthogonal Frequency Division Multiplexing**

**ONID: Original Network ID**

**OPC: Original Program Clock Reference**  
 Assists in the reconstruction of a SPTS from another Transport Stream

**Color TV System (Europe and 50 Hz countries)**

**PAT: Program Association Table (PID=0)**  
 List of all the programs contained in TS Multiplex with reference to PID of PMT.

**PCR: Program Clock Reference**  
 Reference for the 27-MHz clock regeneration. Transmitted at least every 0.1 s.

**PES: Packetized Elementary Stream**  
 Video and audio data packets and ancillary data of undefined length.

**PH: PES Header**

**PID: Packet Identification**  
 Identification of programs/services in the transport stream

**PLL: Phase Lock Loop**

**PMT: Program Map Table**  
 Reference to packets with PCR. Name of programs, copyright, reference of the data streams with PIDs etc. Belonging to the relevant program.

**PRBS: Pseudo-Random Binary Sequence**

**PS: Program Stream**

**P-STD: Program System Target Decoder**

**SI: Service Information**. All the DVB data required by the receiver to demultiplex and decode the variety of programs in the TS.

**SIF: Source Intermediate Format**  
 360x288@25 Hz or 360x240@30 Hz (MPEG-1)

**S-MATV: Satellite Master Antenna TV**

**SMPTV: Society of Motion Picture and Television Engineers**

**SMS: Subscriber Management System**. In CA: storage for customer data

**SNG: Satellite News Gathering. Retransmission of events using mobile equipment and satellite transmission (e.g. sports).**

**SNR or S/N: Signal-to-Noise Ratio**

**SPI: Synchronous Parallel Interface. Standard DVB interface for TS.**

**SPTS: Single Program Transport Stream**  
 TS that contains one unique program.

**Statistical Multiplexer**: A device which combines a number of time-varying bit streams into a single bit stream for transmission.

**ST: Stuffing Table**

**STB Set Top Box. Digital TV receiver (IRD)**

**QAM: Quadrature Amplitude Modulation**  
 Type of modulation for digital signals used in CaTV transmission

**RGB: Red, Green, Blue**

**RLC: Run Length Coding**  
 Data compression method exploiting repetition

**RS: Reed-Solomon. Protection Code: 16-byte long error correction code added by the modulators to every 188 byte Transport Packets in a TS.**

**RST: Running Status Table**

**SAS: Subscriber Authorization System CA/SMS**

**SCPC: Single Channel Per Carrier**

**SDI: Serial Digital Interface**

**SDT: Service Description Table**

**SDF: Service Data File**

**SECAM: Séquentiel Couleur à Mémoire**  
 Color TV System (France, Eastern European countries)

**SER: Symbol Error Rate**

**SFN: Single Frequency Network (DVB-T)**

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**General Standard:**

**ISO/IEC 3818-1, 4 and 6:** Information Technology - Generic coding of moving pictures and associated audio information: Part 1: Systems (ITU-T H.222.0), Part 2: Video Rec. (ITU-T H.262), Part 3: Audio/Video for surround sound: Layer: L1, L2 (DVB, DAB, DVD), L3 (MPEG-2 AAC (Advanced Audio Codec): Surround Sound (Digital AM), Part 4: Conformance test. Part 6: Extension for DSM-CC

**MPEG-1 (ISO/IEC 11172-1-3):** Audio for mono and stereo sounds

**Dolby Digital AC3 (Audio Code N°3):** For stereo surround

**ISO 15398:** Multimedia content description interface (MPEG-7)

**ISO 15938:** Multimedia content description interface (MPEG-7)

**ISD 101 192:** DVB specification for data broadcasting

**TR 101 202:** Implementation Guidelines for Data Broadcasting

**TS 101 812:** DVB Multimedia Home Platform (MHP) Specification

**DVB A1010:** Interfacing (ASIS/SP) for CATV/SMATV Headends and Similar Professional Equipment

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**TR 101 202:** Implementation Guidelines for Data Broadcasting

**TS 101 812:** DVB Multimedia Home Platform (MHP) Specification

**DVB A1010:** Interfacing (ASIS/SP) for CATV/SMATV Headends and Similar Professional Equipment

**ISO/IEC 13818-9:** Information Technology - MPEG-4. Very low bit rate audio-visual coding

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