



**Digital Video Broadcasting (DVB);  
Implementation guidelines for the second generation system  
for Broadcasting, Interactive Services, News Gathering and  
other broadband satellite applications;  
Part 2: S2 Extensions (DVB-S2X)**

**EBU DVB®**

## Reference

RTR/JTC-DVB-393

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# Foreword

This Technical Report (TR) has been produced by Joint Technical Committee (JTC) Broadcast of the European Broadcasting Union (EBU), Comité Européen de Normalisation Electrotechnique (CENELEC) and the European Telecommunications Standards Institute (ETSI).

The work of the JTC was based on the studies carried out by the European DVB Project under the auspices of the Ad Hoc Group on DVB-S2 of the DVB Technical Module. This joint group of industry, operators and broadcasters provided the necessary information on all relevant technical matters (see clause 2).

**NOTE:** The EBU/ETSI JTC Broadcast was established in 1990 to co-ordinate the drafting of standards in the specific field of broadcasting and related fields. Since 1995 the JTC Broadcast became a tripartite body by including in the Memorandum of Understanding also CENELEC, which is responsible for the standardization of radio and television receivers. The EBU is a professional association of broadcasting organizations whose work includes the co-ordination of its members' activities in the technical, legal, programme-making and programme-exchange domains. The EBU has active members in about 60 countries in the European broadcasting area; its headquarters is in Geneva.

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The DVB Project is an industry-led consortium of broadcasters, manufacturers, network operators, software developers, regulators and others from around the world committed to designing open, interoperable technical specifications for the global delivery of digital media and broadcast services. DVB specifications cover all aspects of digital television from transmission through interfacing, conditional access and interactivity for digital video, audio and data. The consortium came together in 1993.

The present document is part 2 of a multi-part deliverable covering the implementation guidelines for the second generation system for Broadcasting, Interactive Services, News Gathering and other broadband satellite applications, as identified below:

**Part 1:** "DVB-S2";

**Part 2:** "S2 Extensions (DVB-S2X)".



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## Modal verbs terminology

In the present document "**should**", "**should not**", "**may**", "**need not**", "**will**", "**will not**", "**can**" and "**cannot**" are to be interpreted as described in clause 3.2 of the [ETSI Drafting Rules](#) (Verbal forms for the expression of provisions).

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# 1 Scope

The present document gives an overview of the technical and operational issues relevant to the system specified in ETSI EN 302 307-2 [i.2], and is intended to provide guidance to broadcasters and operators considering the adoption of DVB-S2X. It is assumed a reasonable familiarity with the original DVB-S2 standard ETSI EN 302 307-1 [i.1], whose technical and operational issues are described in details in ETSI TR 102 376-1 [i.3]. It can also be considered as a useful guideline for implementation of DVB-S2, when enhanced DVB-S2 receivers and channel models are applicable. The present document also includes guidelines for the implementations of the amendments to the standard to enable beam hopping operation.

# 2 References

## 2.1 Normative references

Normative references are not applicable in the present document.

## 2.2 Informative references

References are either specific (identified by date of publication and/or edition number or version number) or non-specific. For specific references, only the cited version applies. For non-specific references, the latest version of the referenced document (including any amendments) applies.

NOTE: While any hyperlinks included in this clause were valid at the time of publication, ETSI cannot guarantee their long term validity.

The following referenced documents are not necessary for the application of the present document but they assist the user with regard to a particular subject area.

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## 3 Definition of terms, symbols and abbreviations

### 3.1 Terms

Void.

### 3.2 Symbols

For the purposes of the present document, the following symbols apply:

|          |                                                         |
|----------|---------------------------------------------------------|
| $\alpha$ | Roll-off factor                                         |
| $A_{AS}$ | Amplitude of the interfering signal                     |
| $A_{PU}$ | Factor to take into account uncompensated fading events |
| $B_S$    | Bandwidth of the frequency Slot allocated to a service  |
| $B_{LT}$ | Loop Bandwidth                                          |

|                                            |                                                                                                                 |
|--------------------------------------------|-----------------------------------------------------------------------------------------------------------------|
| BUFS                                       | Maximum size of the requested receiver buffer to compensate delay variations                                    |
| c                                          | codeword                                                                                                        |
| C/N                                        | Carrier-to-noise power ratio (N measured in a bandwidth equal to symbol rate)                                   |
| C/(N+I)                                    | Carrier-to-(Noise + Interference) ratio                                                                         |
| DFL                                        | Data Field Length                                                                                               |
| $E_b/N_0$                                  | Ratio between the energy per information bit and single sided noise power spectral density                      |
| $E_s/N_0$                                  | Ratio between the energy per transmitted symbol and single sided noise power spectral density                   |
| $E_s/(N_0 + I_0)$                          | Ratio between the energy per transmitted symbol and single sided noise plus interference power spectral density |
| $\Phi$                                     | Antenna diameter                                                                                                |
| i                                          | LDPC code information block                                                                                     |
| $i_0, i_1, \dots, i_{k_{ldpc}-1}$          | LDPC code information bits                                                                                      |
| $H_{(N-K) \times N}$                       | LDPC code parity check matrix                                                                                   |
| I, Q                                       | In-phase, Quadrature phase components of the modulated signal                                                   |
| $I_{ADJ}$                                  | Adjacent carrier interference                                                                                   |
| $I_{TOT}$                                  | Total interference                                                                                              |
| $K_{BCH}$                                  | number of bits of BCH uncoded Block                                                                             |
| $N_{BCH}$                                  | number of bits of BCH coded Block                                                                               |
| $k_{ldpc}$                                 | number of bits of LDPC uncoded Block                                                                            |
| $n_{ldpc}$                                 | number of bits of LDPC coded Block                                                                              |
| $\eta$                                     | Spectral efficiency                                                                                             |
| $\eta_c$                                   | code efficiency                                                                                                 |
| $\eta_{MOD}$                               | number of transmitted bits per constellation symbol                                                             |
| L                                          | IP packet length                                                                                                |
| m                                          | BCH code information word                                                                                       |
| m(x)                                       | BCH code message polynomial                                                                                     |
| $p_0, p_1, \dots, p_{n_{ldpc}-k_{ldpc}-1}$ | LDPC code parity bits                                                                                           |
| $P_D$                                      | Detection Probability                                                                                           |
| $P_{SF}$                                   | Transmitted Pilots in a SuperFrame                                                                              |
| q                                          | code rate dependant constant for LDPC codes                                                                     |
| $r_m$                                      | In-band ripple (dB)                                                                                             |
| $R_s$                                      | Symbol rate corresponding to the bilateral Nyquist bandwidth of the modulated signal                            |
| $R_u$                                      | Useful bit rate at the DVB-S2 system input                                                                      |
| S                                          | Number of Slots in a XFECFRAME                                                                                  |
| $T_s$                                      | Symbol period                                                                                                   |
| $T_{loop}$                                 | loop delay                                                                                                      |
| $T_{prop}$                                 | propagation time                                                                                                |
| $T_q$                                      | waiting time                                                                                                    |
| UPL                                        | User Packet Length                                                                                              |
| $T_{ST}$                                   | Threshold on SOF in Tentative state                                                                             |
| $T_{PT}$                                   | Threshold on PLSCODE in Tentative state                                                                         |
| $T_{SL}$                                   | Threshold on SOF in Locked state                                                                                |
| $XPI_{TX}$                                 | Transmitter cross-polar isolation                                                                               |
| $XPI_{RX}$                                 | Receiver cross-polar isolation                                                                                  |

### 3.3 Abbreviations

For the purposes of the present document, the following abbreviations apply:

|         |                                          |
|---------|------------------------------------------|
| 128APSK | 128-ary Amplitude and Phase Shift Keying |
| 16APSK  | 16-ary Amplitude and Phase Shift Keying  |

|                  |                                                                        |
|------------------|------------------------------------------------------------------------|
| 256APSK          | 256-ary Amplitude and Phase Shift Keying                               |
| 32APSK           | 32-ary Amplitude and Phase Shift Keying                                |
| 64APSK           | 64-ary Amplitude and Phase Shift Keying                                |
| 8APSK            | 8-ary Amplitude and Phase Shift Keying                                 |
| 8PSK             | 8-ary Phase Shift Keying                                               |
| ACM              | Adaptive Coding and Modulation                                         |
| ADSL             | Asymmetric Digital Subscriber Line                                     |
| ALC              | Automatic Level Control                                                |
| AM/AM            | Amplitude Modulation/Amplitude Modulation                              |
| AM/PM            | Amplitude Modulation/Phase Modulation                                  |
| APSK             | Amplitude Phase Shift Keying                                           |
| ASI              | Adjacent Satellite Interference                                        |
| AVC              | Advanced Video Coding                                                  |
| AWGN             | Additive White Gaussian Noise                                          |
| BB               | Base-Band                                                              |
| BBH              | BaseBand Header                                                        |
| BBP              | Block-Based Processing                                                 |
| BCH              | Bose-Chaudhuri-Hocquenghem multiple error correction binary block code |
| BH               | Beam Hopping                                                           |
| BHC              | Beam Hopping Cycle                                                     |
| BHC <sup>3</sup> | Beam Hopping Common Control Channel                                    |
| BHCT             | Beam Hopping Cycle Time                                                |
| BHTC             | Beam Hopping Transmission Channel                                      |
| BHTP             | Beam Hopping Time Plan                                                 |
| BPSK             | Binary Phase Shift Keying                                              |
| BPSK-S           | Binary Phase Shift Keying-Spread                                       |
| BSS              | Broadcast Satellite Systems                                            |
| BW               | Bandwidth (at -3 dB) of the transponder                                |
| CAPEX            | Capital expenditure                                                    |
| CBR              | Constant Bit Rate                                                      |
| CCDF             | Complementary Cumulative Distribution Function                         |
| CCI              | Co-Channel Interference                                                |
| CCM              | Constant Coding and Modulation                                         |
| CDF              | Cumulative Distribution Function                                       |
| CER              | Code-word Error Rate                                                   |
| CF               | Carrier Frequency                                                      |
| CFAR             | Constant False Alarm Rate                                              |
| CH               | Transmission Channel                                                   |
| CM               | Commercial Module                                                      |
| CM-BSS           | Commercial Module - Broadcast Satellite Systems group                  |
| CRC              | Cyclic Redundancy Check                                                |
| CRLB             | Cramer- Rao Lower Bound                                                |
| CSI              | Channel State Information                                              |
| CU               | Capacity Unit                                                          |
| D                | Decimal notation                                                       |
| DC               | Direct Current                                                         |
| DDSO             | Digital Data Service Obligation                                        |
| DEMUX            | DEMUltipleXer                                                          |
| DMD              | Demodulation                                                           |
| DNP              | Deleted Null Packets                                                   |
| DPC              | Dirty Paper Coding                                                     |
| DSF              | Dummy Synchronization Frame                                            |
| DSNG             | Digital Satellite News Gathering                                       |
| DT               | Dwell Time                                                             |
| DTH              | Direct To Home                                                         |
| DTT              | Digital Terrestrial Television                                         |
| DVB              | Digital Video Broadcasting project                                     |
| DVB-C            | Digital Video Broadcasting - Cable                                     |
| DVB-CM           | Digital Video Broadcasting - Commercial Module                         |
| DVB-S            | DVB System for satellite broadcasting                                  |

NOTE: As specified in ETSI EN 300 421 [i.32].



## DVB-S2 DVB-S2 System

NOTE: As specified in ETSI EN 302 307-1 [i.1].

|         |                                                     |
|---------|-----------------------------------------------------|
| EBU     | European Broadcasting Union                         |
| EHF     | Extended Header Field                               |
| EIRP    | Effective Isotropic Radiated Power                  |
| EN      | European Norm                                       |
| EPG     | Electronic Program Guide                            |
| FA      | False Alarm                                         |
| FCC     | Federal Communications Commission                   |
| FEC     | Forward Error Correction                            |
| FER     | Frame Error Rate                                    |
| FFP     | Feed Forward Processing                             |
| FFR     | Fractional Frequency Re-use                         |
| FFT     | Fast Fourier Transform                              |
| FSS     | Fixed Satellite Service                             |
| FWD     | Forward                                             |
| GEO     | Geostationary Satellite                             |
| GS      | Generic Stream                                      |
| GSE     | Generic Stream Encapsulation                        |
| GW      | GateWay                                             |
| HD      | High Definition                                     |
| HDTV    | High Definition Television                          |
| HEVC    | High Efficiency Video Coding                        |
| HPA     | High Power Amplifier                                |
| HQ      | High Quality                                        |
| HTS     | High Throughput Satellite                           |
| IBO     | Input Back Off                                      |
| IFFT    | Inverse Fast Fourier Transform                      |
| IM      | InterModulation                                     |
| IMUX    | Input MUltipleXer - Filter                          |
| IP      | Internet Protocol                                   |
| ISCR    | Input Stream Clock Reference                        |
| ISI     | Input Stream Identifier                             |
| ISSY    | Input Stream SYNchronizer                           |
| ITU     | International Telecommunications Union              |
| ITU-R   | Telecommunication Union - Radiocommunication sector |
| LDPC    | Low Density Parity Check (codes)                    |
| LEO     | Low Earth Orbit satellite                           |
| LMS     | Least Mean Square                                   |
| LNB     | Low Noise Block                                     |
| LO      | Local Oscillator                                    |
| LOS     | Line Of Sight                                       |
| LQ      | Low Quality                                         |
| LTE     | Long Term Evolution                                 |
| MF      | Matched Filtering                                   |
| ML      | Maximum Likelihood                                  |
| MMSE    | Minimum Mean Square Error                           |
| MOD     | Modulation                                          |
| MODCOD  | Modulation & Coding                                 |
| MP      | Missed Peak                                         |
| MPEG    | Moving Pictures Experts Group                       |
| MU-MIMO | Multi User Multiple Input Multiple Output           |
| MUX     | MUltipleX                                           |
| NA      | Not Applicable                                      |
| NCR     | Network Clock Reference                             |
| NDA     | Non Data Aided                                      |
| NF      | Noise Figure                                        |
| NP      | Null Packets                                        |
| NPD     | Null-Packet Deletion                                |
| NPI     | Null Packet Insertion                               |