



**Digital Video Broadcasting (DVB);
Second generation framing structure, channel coding and
modulation systems for Broadcasting,
Interactive Services, News Gathering and
other broadband satellite applications;
Part 2: DVB-S2 Extensions (DVB-S2X)**

EBU DVB[®]

ReferenceREN/JTC-DVB-395-2

KeywordsBSS, digital, DVB, modulation, satellite, TV

ETSI650 Route des Lucioles
F-06921 Sophia Antipolis Cedex - FRANCE

Tel.: +33 4 92 94 42 00 Fax: +33 4 93 65 47 16

Siret N° 348 623 562 00017 - APE 7112B
Association à but non lucratif enregistrée à la
Sous-Préfecture de Grasse (06) N° w061004871

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Foreword

ETSI EN 302 307-2 V1.3.1 (2021-04)

This draft European Standard (EN) 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), and is now submitted for the combined Public Enquiry and Vote phase of the ETSI standards EN Approval Procedure.

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.

European Broadcasting Union
CH-1218 GRAND SACONNEX (Geneva)
Switzerland
Tel: +41 22 717 21 11
Fax: +41 22 717 24 81

The Digital Video Broadcasting Project (DVB) is an industry-led consortium of broadcasters, manufacturers, network operators, software developers, regulatory bodies, content owners and others committed to designing global standards for the delivery of digital television and data services. DVB fosters market driven solutions that meet the needs and economic circumstances of broadcast industry stakeholders and consumers. DVB standards 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 to provide global standardisation, interoperability and future proof specifications.

The present document is part 2 of a multi-part deliverable covering the optional extensions of the DVB-S2 system, denoted "DVB-S2X", as identified below:

Part 1: "DVB-S2";

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

| Proposed national transposition dates | |
|--|---------------------------------|
| Date of latest announcement of this EN (doa): | 3 months after ETSI publication |
| Date of latest publication of new National Standard or endorsement of this EN (dop/e): | 6 months after doa |
| Date of withdrawal of any conflicting National Standard (dow): | 6 months after doa |

Modal verbs terminology

In the present document "shall", "shall not", "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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Introduction

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The optional extensions of the S2 system have been approved in 2014 and are identified by the S2X denomination. Such extensions are non-backwards-compatible with ETSI EN 302 307-1 [4], are optional for the implementation of new receivers under ETSI EN 302 307-1 [3], but are normative for the implementation of receivers under the present document: mapping of specific S2X building blocks to application areas is specified in Table 1. For every S2X application area, as defined in Table 1, the configurations for the corresponding S2 application area, as defined in ETSI EN 302 307-1 [3], Table 1, will be implemented. In case of conflicts the definition of the S2X application area applies.

The present document targets the core application areas of S2 (Digital Video Broadcasting, forward link for interactive services using ACM, Digital Satellite News Gathering and professional digital links such as video point-to-point or Internet trunking links), and new application areas requiring very-low carrier-to-noise and carrier-to-interference operation (VL-SNR).

In particular for DTH, a possible use case is the launch of UHDTV-1 (e.g. 4k) television services in Ku-/Ka-band that will adopt HEVC encoding. In this context it may be desirable to eventually use fragments of smaller blocks of capacity on two or three DTH transponders and bond them into one logical stream. This permits to maximize capacity exploitation by avoiding the presence of spare capacity in individual transponders and/or to take maximum advantage of statistical multiplexing.

The S2X system offers the ability to operate with very-low carrier-to-noise and carrier-to-interference ratios (SNR down to -10 dB), to serve markets such as airborne (business jets), maritime, civil aviation internet access, VSAT terminals at higher frequency ranges or in tropical zones, small portable terminals for journalists and other professionals. Furthermore, the S2X system provides transmission modes offering significantly higher capacity and efficiency to serve professional links characterized by very-high carrier-to-noise and carrier-to-interference ratios conditions.

The present document reuses the S2 system architecture, while adding finer MODCOD steps, sharper roll-off filtering, technical means for bonding of multiple transponders and additional signalling capacity by means of an optional periodic super-frame structure, extended PLHEADER signalling schemes and the support of GSE-Lite signals.

The present document maintains the same clause numbering as ETSI EN 302 307-1 [3], in order to facilitate cross-reference.

1 Scope

The present document specifies the optional extensions of the S2 system, identified by the S2X denomination. The present document also includes amendments to the standard to enable beam hopping operation.

2 References

2.1 Normative 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.

Referenced documents which are not found to be publicly available in the expected location might be found at <https://docbox.etsi.org/Reference/>.

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 necessary for the application of the present document.

- [1] ETSI TS 101 545-1 (V1.1.1): "Digital Video Broadcasting (DVB); Second Generation DVB Interactive Satellite System (DVB-RCS2); Part 1: Overview and System Level specification".
- [2] ETSI TS 102 606-1 (V1.2.1): "Digital Video Broadcasting (DVB); Generic Stream Encapsulation (GSE); Part 1: Protocol".
- [3] ETSI EN 302 307-1: "Digital Video Broadcasting (DVB); Second generation framing structure, channel coding and modulation systems for Broadcasting, Interactive Services, News Gathering and other broadband satellite applications; Part 1: DVB-S2".
- [4] ETSI EN 302 307 (V1.1.1): "Digital Video Broadcasting (DVB); Second generation framing structure, channel coding and modulation systems for Broadcasting, Interactive Services, News Gathering and other broadband satellite applications".
- [5] ETSI EN 300 468: "Digital Video Broadcasting (DVB); Specification for Service Information (SI) in DVB systems".
- [6] ETSI TS 102 606-2: "Digital Video Broadcasting (DVB); Generic Stream Encapsulation (GSE); Part 2: Logical Link Control (LLC)".
- [7] ETSI ETS 300 801: "Digital Video Broadcasting (DVB); Interaction channel through Public Switched Telecommunications Network (PSTN)/Integrated Services Digital Networks (ISDN)".
- [8] ETSI EN 301 195: "Digital Video Broadcasting (DVB); Interaction channel through the Global System for Mobile communications (GSM)".
- [9] ETSI ES 200 800: "Digital Video Broadcasting (DVB); DVB interaction channel for Cable TV distribution systems (CATV)".
- [10] ETSI ETS 300 802: "Digital Video Broadcasting (DVB); Network-independent protocols for DVB interactive services".
- [11] ETSI EN 301 790: "Digital Video Broadcasting (DVB); Interaction channel for satellite distribution systems".

2.2 Informative references

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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.

Not applicable.

3 Definition of terms, symbols and abbreviations

3.1 Terms

Void.

3.2 Symbols

For the purposes of the present document, the symbols given in ETSI EN 302 307-1 [3] and the following apply:

| | |
|------------|--|
| d_{SF} | SF-pilot distances |
| P_{SF} | SF-pilot field length |
| H_{ST} | SFH-Trailer (ST) Matrix |
| H_{SOSF} | Start Of SuperFrame Matrix |
| R_S | Symbol rate corresponding to the bilateral Nyquist bandwidth of the modulated signal |

3.3 Abbreviations

For the purposes of the present document, the abbreviations given in ETSI EN 302 307-1 [3] and the following apply:

| | |
|---------|---|
| 128APSK | 128-ary Amplitude and Phase Shift Keying |
| 256APSK | 256-ary Amplitude and Phase Shift Keying |
| 64APSK | 64-ary Amplitude and Phase Shift Keying |
| BH | Beam Hopping |
| BHTC | Beam Hopping Transmission Channel |
| BHTP | Beam Hopping Time Plan |
| BPSK | Binary Phase Shift Keying |
| CU | Capacity Unit |
| DT | Dwell Time |
| GSE | Generic Stream Encapsulation |
| GSE-HEM | Generic Stream Encapsulation - High Efficiency Mode |
| HEVC | High Efficiency Video Coding |
| RFU | Reserved for Future Use |
| SF | Super-Frame |
| SFFI | Super-Frame Format Indicator |
| SFH | Super-Frame Header |
| SFL | Super Frame Length |
| SOSF | Start Of Super-Frame |
| ST | Super-Frame header Trailer |
| UHDTV | Ultra High Definition TeleVision |
| VL-SNR | Very Low - Signal to Noise Ratio |

4 Transmission system description

4.0 General aspects

See ETSI EN 302 307-1 [3], clause 4.

4.1 System definition

See ETSI EN 302 307-1 [3], clause 4.1.

4.2 System architecture

See ETSI EN 302 307-1 [3], clause 4.2.

The present document reuses the S2 system architecture as described in ETSI EN 302 307-1 [3], Figure 1, while adding finer MODCOD steps, sharper roll-off filtering, technical means allowing time-slicing of wide-band signals (for a reduced processing speed in the receiver), technical means for bonding of multiple transponders, among other technologies.

Additional signalling capacity is provided:

- an optional periodic super-frame structure with signalling of the format of the super-frame content and further benefits like simplifying synch recovery at VL-SNR and allowing periodic pilot structures and PL-Scramblers;
- an extended PLHEADER signalling scheme to support the additional MODCODs;
- an extended PLHEADER signalling scheme to support Mobile Frames (VL-SNR);
- a high-efficiency BBFRAME mode (GSE-HEM), similar to the T2 and C2 systems, to transport GSE/GSE-Lite packets;
- signalling of streams which are GSE-Lite compliant.

Annex E includes optional additional formats to enable operation of beam -hopping. The specified waveforms provide additional signalling and framing options that support both periodic, pre-scheduled beam hopping operation, as well as random, traffic driven illumination policy, at signal to noise ratios ranging from -10 dB and above.

4.3 System configurations

See ETSI EN 302 307-1 [3], clause 4.3.

Table 1 associates the S2X system elements to the applications areas. All elements in Table 1 are optional in transmitting and receiving equipment complying with the S2 specification. At least "Normative" subsystems and functionalities shall be implemented in the transmitting and receiving equipment to comply with the present document for a specific application area.

Table 1: S2X System configurations and application areas

| System configurations | | Broadcast services | Interactive services | DSNG | Professional services | VL-SNR |
|--|--|--------------------|----------------------|------|-----------------------|--------|
| FECFRAME (normal) (see MODCODs below) | 64 800 (bits) | | | | | |
| QPSK | 1/4, 1/3, 2/5 (S2-MODCODs) | N | N | N | N | N |
| | 1/2, 3/5, 2/3, 3/4, 4/5, 5/6, 8/9, 9/10 (S2-MODCODs) | N | N | N | N | N |
| | 13/45 | N | N | N | N | N |
| | 9/20; 11/20 | N | N | N | N | N |
| 8PSK | 3/5, 2/3, 3/4, 5/6, 8/9, 9/10 (S2-MODCODs) | N | N | N | N | N |
| | 23/36; 25/36; 13/18 | N | N | N | N | N |
| 8APSK-L (note 7) | 5/9; 26/45 | N | N | N | N | N |
| 16APSK | 2/3, 3/4, 4/5, 5/6, 8/9, 9/10 (S2-MODCODs) | N | N | N | N | N |
| | 26/45; 3/5; 28/45; 23/36; 25/36; 13/18; 7/9; 77/90 | N | N | N | N | N |
| 16APSK-L (note 7) | 5/9; 8/15; 1/2; 3/5; 2/3 | N | N | N | N | N |
| 32APSK | 3/4, 4/5, 5/6, 8/9, 9/10 (S2-MODCODs) | N | N | N | N | N |
| | 32/45; 11/15; 7/9 | N | N | N | N | N |
| 32APSK-L (note 7) | 2/3 | N | N | N | N | N |
| 64APSK | 11/15; 7/9; 4/5; 5/6 | O | N | N | N | O |
| 64APSK-L (note 7) | 32/45 | O | N | N | N | O |
| 128APSK | 3/4; 7/9 | NA | O | O | N | NA |
| 256APSK | 32/45; 3/4 | NA | O | O | N | NA |
| 256APSK-L (note 7) | 29/45; 2/3; 31/45; 11/15 | NA | O | O | N | NA |
| | | | | | | |
| FECFRAME (short) (see MODCODs below) | 16 200 (bits) | | | | | |
| QPSK | 1/4, 1/3, 2/5 (S2-MODCODs) | NA | N | O | N | N |
| | 1/2, 3/5, 2/3, 3/4, 4/5, 5/6, 8/9 (S2-MODCODs) | NA | N | O | N | N |
| | 11/45; 4/15; 14/45; 7/15 8/15; 32/45 | NA | N | O | N | N |
| 8PSK | 3/5, 2/3, 3/4, 5/6, 8/9 (S2-MODCODs) | NA | N | O | N | N |
| | 7/15; 8/15; 26/45; 32/45 | NA | N | O | N | N |
| 16APSK | 2/3, 3/4, 4/5, 5/6, 8/9 (S2-MODCODs) | NA | N | O | N | N |
| | 7/15; 8/15; 26/45; 3/5; 32/45 | NA | N | O | N | N |

| System configurations | | Broadcast services | Interactive services | DSNG | Professional services | VL-SNR |
|--|--|--------------------|----------------------|------|-----------------------|---------------|
| 32APSK | 3/4, 4/5, 5/6, 8/9 (S2-MODCODs) | NA | N | O | N | N |
| | 2/3; 32/45 | NA | N | O | N | N |
| | | | | | | |
| VL-SNR Header (see MODCODs below) (note 1) | | O | O | O | NA | N |
| QPSK | 2/9 (normal) | NA | O | O | NA | N |
| BPSK | 1/5; 4/15; 1/3 (short) 1/5; 11/45; 1/3 (medium) | NA | O | O | NA | N |
| BPSK-S Spreading Factor 2 | 1/5; 11/45 (short) | NA | O | O | NA | N |
| | | | | | | |
| Fixed Size Super-frame (notes 8 and 11) | | NA | O | O | O | O/NA (note 9) |
| Part 2 PLHEADER (note 5) | 8-bits | N | N | N | N | N |
| Extended PLHEADER For Wide-band mode (note 5) | 8+8 bits (time slicing) | O | O | NA | O | O |
| GSE-High Efficiency Mode | For GSE/GSE-Lite (note 6) | N | N | N | N | N |
| Roll-off 0,15; 0,10 and 0,05 | | N | N | N | N | N |
| Channel bonding (note 2) | | N (note 3) | NA | NA | O | NA |
| VCM (note 4) | | N | N | N | N | N |
| ACM | | NA | N | O | O | N |
| Beam Hopping Periodic BH, VLSNR (note 8) (Superframe Format 5) (note 10) | | O | O | O | O | O |
| Traffic driven BH VLSNR (note 8) (Superframe Format 6) | | O | O | O | O | O |

| System configurations | | Broadcast services | Interactive services | DSNG | Professional services | VL-SNR |
|---|--|--------------------|----------------------|------|-----------------------|--------|
| Traffic driven BH, no VL-SNR (note 8) (Superframe Format 7) | | O | O | O | O | NA |
| N = normative, O = optional, NA = not applicable. | | | | | | |
| NOTE 1: Ability to skip VL-SNR frames: Normative. | | | | | | |
| NOTE 2: Requires Input Stream Synchronizer, Null-Packet Deletion and Dummy Frame insertion. | | | | | | |
| NOTE 3: Normative for broadcast services in case of optional multiple tuner receivers. | | | | | | |
| NOTE 4: Any S2X receiver shall be able to recognize the whole set of MODCODS within the PLHeader and skip the XFECFrame if the MODCOD is not supported. | | | | | | |
| NOTE 5: The present document, PLHEADER and Extended PLHEADER for wideband transponders (ETSI EN 302 307-1 [3] or ETSI EN 302 307-2 (the present document), Annex M) cannot coexist in the same carrier but either can coexist with the VL-SNR header. | | | | | | |
| NOTE 6: GSE is optional while support for GSE-Lite in GSE-HEM is normative across all the services. | | | | | | |
| NOTE 7: xxx-L= MODCODs optimized for quasi-linear channels. | | | | | | |
| NOTE 8: Each of the Annex E formats are individually optional. | | | | | | |
| NOTE 9: Not all Annex E Super-Frame Formats support VL-SNR. They are different from the VL-SNR XFECFRAMEs in clause 5.5.2. | | | | | | |
| NOTE 10: Format 5 can also be used for continuous transmission scenarios. | | | | | | |
| NOTE 11: Fixed size Superframes refer to Annex E Formats 0, 1, 2, 3 and 4. | | | | | | |

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