

## Digital Video Broadcasting (DVB) User guidelines for the second generation system for Broadcasting, Interactive Services, News Gathering and other broadband satellite applications (DVB-S2)

European Broadcasting Union



Union Européenne de Radio-Télévision



---

Reference

DTR/JTC-DVB-166

---

Keywords

broadband, broadcasting, digital, satellite, TV,  
video

**ETSI**

650 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 - NAF 742 C  
Association à but non lucratif enregistrée à la  
Sous-Préfecture de Grasse (06) N° 7803/88

---

**Important notice**

Individual copies of the present document can be downloaded from:

<http://www.etsi.org>

The present document may be made available in more than one electronic version or in print. In any case of existing or perceived difference in contents between such versions, the reference version is the Portable Document Format (PDF). In case of dispute, the reference shall be the printing on ETSI printers of the PDF version kept on a specific network drive within ETSI Secretariat.

Users of the present document should be aware that the document may be subject to revision or change of status.

Information on the current status of this and other ETSI documents is available at

<http://portal.etsi.org/tb/status/status.asp>

If you find errors in the present document, please send your comment to one of the following services:

[http://portal.etsi.org/chaicor/ETSI\\_support.asp](http://portal.etsi.org/chaicor/ETSI_support.asp)

---

**Copyright Notification**

No part may be reproduced except as authorized by written permission.  
The copyright and the foregoing restriction extend to reproduction in all media.

© European Telecommunications Standards Institute 2005.

© European Broadcasting Union 2005.

All rights reserved.

DECT™, PLUGTESTS™ and UMTS™ are Trade Marks of ETSI registered for the benefit of its Members.  
TIPHON™ and the TIPHON logo are Trade Marks currently being registered by ETSI for the benefit of its Members.  
3GPP™ is a Trade Mark of ETSI registered for the benefit of its Members and of the 3GPP Organizational Partners.

# Contents

Intellectual Property Rights .....	5
Foreword.....	5
1 Scope .....	6
2 References .....	6
3 Symbols and abbreviations.....	8
3.1 Symbols.....	8
3.2 Abbreviations .....	9
4 General description of the technical characteristics of the DVB-S2 system.....	11
4.1 Commercial requirements .....	11
4.1.1 Commercial Requirements for Broadcast Services.....	12
4.1.2 Commercial Requirements for Non-Broadcast Services .....	13
4.1.3 Common Commercial Requirements.....	14
4.2 Application scenarios .....	14
4.3 System architecture .....	15
4.3.1 The system block diagram .....	18
4.3.2 Reference performance .....	19
4.3.2.1 Single carrier per transponder configuration.....	19
4.3.2.1.1 Sensitivity to satellite power amplifier characteristics .....	23
4.3.2.1.2 Sensitivity to roll-off .....	25
4.3.2.2 Multiple carrier per transponder configuration .....	25
4.4 The backwards compatible modes.....	26
4.4.1 Hierarchical modulations.....	27
4.5 Adaptive Coding and Modulation .....	29
4.5.1 ACM: the principles.....	29
4.5.2 Functional description of the DVB-S2 subsystem for ACM .....	32
4.5.2.1 Specific subsystems for supporting ACM with MPEG-TS.....	34
4.5.3 DVB-S2 performance in ACM mode .....	37
4.6 System configurations .....	38
5 Broadcast applications.....	38
5.1 SDTV broadcasting .....	39
5.2 SDTV and HDTV broadcasting with differentiated channel protection.....	39
5.3 Backwards Compatible services.....	39
5.3.1 Hierarchical modulations.....	40
6 Interactive applications.....	40
6.1 IP Unicast Services.....	41
6.1.1 Single Generic Stream and ACM command.....	41
6.1.2 Multiple (Generic or Transport) Streams.....	43
6.1.3 Encapsulation efficiency of ACM modes .....	45
6.1.4 Scheduling issues.....	48
6.2 Independent frames structure for Packetized streams with VCM/ACM .....	50
6.2.1 Independent framing issues (applicable to MPEG-TS).....	50
6.2.2 Example slicing process.....	51
6.2.3 Specific cases.....	51
7 Contribution services, data content distribution/trunking and other professional applications.....	52
7.1 Distribution of multiple MPEG multiplexes to Digital Terrestrial TV Transmitters.....	52
7.2 DSNG and other professional applications .....	52
7.2.1 DSNG bit rates and symbol rates.....	53
7.2.2 Phase noise recommendation.....	53
7.2.3 Receiver filter mask .....	53
7.2.4 DSNG carrier spacing.....	54
7.2.5 Link budget examples for DSNG .....	55
7.2.5.1 Generic Hypothesis .....	55

7.2.5.2	DSNG Examples .....	58
7.2.6	DSNG transmitting station identification .....	61
7.2.7	DSNG Services using ACM .....	61
<b>Annex A: Low Density Parity Check Codes .....</b>		<b>63</b>
A.1	Structure of Parity Check Matrices of Standardized LDPC Codes .....	64
A.2	Description of Standardized LDPC Codes .....	65
A.3	Performance Results .....	66
<b>Annex B: DVB-S2 Physical Layer Frame and pilot structure .....</b>		<b>69</b>
B.1	Structured PLS code for Frame Synchronization .....	69
B.2	Pilot Structure .....	71
<b>Annex C: Modem algorithms design and performance over typical satellite channels .....</b>		<b>73</b>
C.1	Modulator with Pre-Distortion .....	74
C.2	Clock Recovery .....	76
C.3	Physical Layer Frame Synchronization .....	76
C.3.1	An algorithm for Frame Synchronization .....	76
C.3.2	An Alternative Frame Synchronization Algorithm .....	77
C.3.2.1	Acquisition procedure description .....	77
C.3.2.2	Performance Analysis .....	78
C.3.2.3	Acquisition parameters optimization .....	79
C.4	Carrier Frequency Recovery .....	80
C.5	Automatic Gain Control .....	82
C.6	Carrier Phase Recovery .....	82
C.6.1	Pilot-Aided Linear Interpolation .....	82
C.6.2	Fine Phase Recovery for High Order Modulations .....	84
C.7	Performance Results .....	84
<b>Annex D: Capacity assessment in ACM modes .....</b>		<b>86</b>
D.1	System Sizing Issues .....	87
D.2	Methodology Description .....	87
D.3	Study Case Results .....	88
<b>Annex E: Physical layer adaptation in ACM systems .....</b>		<b>95</b>
E.1	Channel estimator .....	95
E.2	Physical Layer Selector .....	97
E.2.1	Shifted Threshold .....	98
E.2.2	Hysteresis .....	99
E.3	Performance results .....	99
<b>Annex F: ACM receiver implementation .....</b>		<b>101</b>
F.1	Type 1 receiver .....	101
F.2	Type 2 receiver .....	102
	History .....	104

---

## Intellectual Property Rights

IPRs essential or potentially essential to the present document may have been declared to ETSI. The information pertaining to these essential IPRs, if any, is publicly available for **ETSI members and non-members**, and can be found in ETSI SR 000 314: "*Intellectual Property Rights (IPRs); Essential, or potentially Essential, IPRs notified to ETSI in respect of ETSI standards*", which is available from the ETSI Secretariat. Latest updates are available on the ETSI Web server (<http://webapp.etsi.org/IPR/home.asp>).

Pursuant to the ETSI IPR Policy, no investigation, including IPR searches, has been carried out by ETSI. No guarantee can be given as to the existence of other IPRs not referenced in ETSI SR 000 314 (or the updates on the ETSI Web server) which are, or may be, or may become, essential to the present document.

---

## 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.

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

Founded in September 1993, the DVB Project is a market-led consortium of public and private sector organizations in the television industry. Its aim is to establish the framework for the introduction of MPEG-2 based digital television services. Now comprising over 200 organizations from more than 25 countries around the world, DVB fosters market-led systems, which meet the real needs, and economic circumstances, of the consumer electronics and the broadcast industry.

# Explore Litigation Insights

Docket Alarm provides insights to develop a more informed litigation strategy and the peace of mind of knowing you're on top of things.

## Real-Time Litigation Alerts



Keep your litigation team up-to-date with **real-time alerts** and advanced team management tools built for the enterprise, all while greatly reducing PACER spend.

Our comprehensive service means we can handle Federal, State, and Administrative courts across the country.

## Advanced Docket Research



With over 230 million records, Docket Alarm's cloud-native docket research platform finds what other services can't. Coverage includes Federal, State, plus PTAB, TTAB, ITC and NLRB decisions, all in one place.

Identify arguments that have been successful in the past with full text, pinpoint searching. Link to case law cited within any court document via Fastcase.

## Analytics At Your Fingertips



Learn what happened the last time a particular judge, opposing counsel or company faced cases similar to yours.

Advanced out-of-the-box PTAB and TTAB analytics are always at your fingertips.

## API

Docket Alarm offers a powerful API (application programming interface) to developers that want to integrate case filings into their apps.

## LAW FIRMS

Build custom dashboards for your attorneys and clients with live data direct from the court.

Automate many repetitive legal tasks like conflict checks, document management, and marketing.

## FINANCIAL INSTITUTIONS

Litigation and bankruptcy checks for companies and debtors.

## E-DISCOVERY AND LEGAL VENDORS

Sync your system to PACER to automate legal marketing.