

Draft **ETSI EN 302 755** V1.4.1 (2015-02)



**Digital Video Broadcasting (DVB);
Frame structure channel coding and modulation
for a second generation digital terrestrial
television broadcasting system (DVB-T2)**

EBU
OPERATING EUROVISION

DVB[®]
Digital Video
Broadcasting

Reference

REN/JTC-DVB-349

Keywordsaudio, broadcasting, data, digital, DVB, MPEG,
terrestrial, 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

The present document can be downloaded from:

<http://www.etsi.org/standards-search>

The present document may be made available in electronic versions and/or in print. The content of any electronic and/or print versions of the present document shall not be modified without the prior written authorization of ETSI. In case of any existing or perceived difference in contents between such versions and/or in print, the only prevailing document is the print of the Portable Document Format (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:

<https://portal.etsi.org/People/CommiteeSupportStaff.aspx>

Copyright Notification

No part may be reproduced or utilized in any form or by any means, electronic or mechanical, including photocopying and microfilm except as authorized by written permission of ETSI.

The content of the PDF version shall not be modified without the written authorization of ETSI.

The copyright and the foregoing restriction extend to reproduction in all media.

© European Telecommunications Standards Institute 2015.

© European Broadcasting Union 2015.

All rights reserved.

DECT™, PLUGTESTS™, UMTS™ and the ETSI logo are Trade Marks of ETSI registered for the benefit of its Members.

3GPP™ and LTE™ are Trade Marks of ETSI registered for the benefit of its Members and of the 3GPP Organizational Partners.

GSM® and the GSM logo are Trade Marks registered and owned by the GSM Association.

Contents

Intellectual Property Rights	8
Foreword.....	8
Modal verbs terminology.....	9
1 Scope	10
2 References	10
2.1 Normative references	10
2.2 Informative references.....	11
3 Definitions, symbols and abbreviations	11
3.1 Definitions.....	11
3.2 Symbols.....	14
3.3 Abbreviations	18
4 DVB-T2 System architecture	20
4.1 System overview	20
4.2 System architecture	22
4.3 Target performance	24
5 Input processing	25
5.1 Mode adaptation.....	25
5.1.0 Overview	25
5.1.1 Input Formats.....	25
5.1.2 Input Interface.....	26
5.1.3 Input Stream Synchronization.....	26
5.1.4 Compensating Delay for Transport Streams.....	27
5.1.5 Null Packet Deletion (optional, for TS only, NM and HEM).....	27
5.1.6 CRC-8 encoding (for GFPS and TS, NM only).....	28
5.1.7 Baseband Header (BBHEADER) insertion.....	28
5.1.8 Mode adaptation sub-system output stream formats.....	29
5.2 Stream adaptation.....	32
5.2.0 Overview	32
5.2.1 Scheduler	33
5.2.2 Padding	33
5.2.3 Use of the padding field for in-band signalling	33
5.2.3.0 Types and format	33
5.2.3.1 In-band type A	34
5.2.3.2 In-band type B.....	36
5.2.4 BB scrambling	37
6 Bit-interleaved coding and modulation	38
6.1 FEC encoding.....	38
6.1.0 Overview	38
6.1.1 Outer encoding (BCH).....	39
6.1.2 Inner encoding (LDPC)	41
6.1.2.0 Overview	41
6.1.2.1 Inner coding for normal FECFRAME.....	41
6.1.2.2 Inner coding for short FECFRAME.....	42
6.1.3 Bit Interleaver (for 16-QAM, 64-QAM and 256-QAM).....	43
6.2 Mapping bits onto constellations.....	44
6.2.0 Overview	44
6.2.1 Bit to cell word de-multiplexer.....	45
6.2.2 Cell word mapping into I/Q constellations	48
6.3 Constellation Rotation and Cyclic Q Delay	53
6.4 Cell Interleaver	53
6.5 Time Interleaver	55
6.5.0 Overview	55

6.5.1	Mapping of Interleaving Frames onto one or more T2-frames	57
6.5.2	Division of Interleaving frames into Time Interleaving Blocks.....	57
6.5.3	Interleaving of each TI-block.....	58
6.5.4	Using the three Time Interleaving options with sub-slicing	60
6.5.5	PLPs for which Time Interleaving is not used.....	62
7	Generation, coding and modulation of Layer 1 signalling	62
7.1	Introduction	62
7.2	L1 signalling data	63
7.2.0	Overview	63
7.2.1	P1 Signalling data	63
7.2.2	L1-Pre Signalling data	65
7.2.3	L1-post signalling data.....	69
7.2.3.0	Overview	69
7.2.3.1	Configurable L1-post signalling.....	70
7.2.3.2	Dynamic L1-post signalling.....	75
7.2.3.3	Repetition of L1-post dynamic data	77
7.2.3.4	L1-post extension field.....	77
7.2.3.4.0	Overview	77
7.2.3.4.1	Padding L1-post extension blocks	78
7.2.3.5	CRC for the L1-post signalling	78
7.2.3.6	L1 padding	78
7.2.3.7	L1 bias balancing bits.....	78
7.3	Modulation and error correction coding of the L1 data	79
7.3.1	Overview	79
7.3.1.1	Error correction coding and modulation of the L1-pre signalling	79
7.3.1.2	Error correction coding and modulation of the L1-post signalling	79
7.3.2	Scrambling and FEC Encoding.....	81
7.3.2.1	Scrambling of L1-post information bits	81
7.3.2.2	Zero padding of BCH information bits	82
7.3.2.3	BCH encoding.....	83
7.3.2.4	LDPC encoding.....	84
7.3.2.5	Puncturing of LDPC parity bits.....	84
7.3.2.6	Removal of zero padding bits.....	85
7.3.2.7	Bit interleaving for L1-post signalling	85
7.3.3	Mapping bits onto constellations	86
7.3.3.0	Overview	86
7.3.3.1	Demultiplexing of L1-post signalling	86
7.3.3.2	Mapping into I/Q constellations.....	86
7.3.3.3	Modification of L1 signalling constellations by L1-ACE algorithm.....	86
8	Frame Builder.....	88
8.0	Overview	88
8.1	Frame structure.....	88
8.2	Super-frame	89
8.3	T2-Frame	90
8.3.0	Overview	90
8.3.1	Duration of the T2-Frame	90
8.3.2	Capacity and structure of the T2-frame	91
8.3.3	Signalling of the T2-frame structure and PLPs.....	94
8.3.4	Overview of the T2-frame mapping	94
8.3.5	Mapping of L1 signalling information to P2 symbol(s).....	95
8.3.6	Mapping the PLPs.....	97
8.3.6.0	Overview	97
8.3.6.1	Allocating the cells of the Interleaving Frames to the T2-Frames	97
8.3.6.2	Addressing of OFDM cells	98
8.3.6.3	Mapping the PLPs to the data cell addresses.....	99
8.3.6.3.0	Overview	99
8.3.6.3.1	Insertion of bias balancing cells	99
8.3.6.3.2	Mapping the Common and Type 1 PLPs.....	101
8.3.6.3.3	Mapping the Type 2 PLPs	101
8.3.7	Auxiliary stream insertion	102

8.3.8	Dummy cell insertion.....	103
8.3.9	Insertion of unmodulated cells in the Frame Closing Symbol.....	103
8.4	Future Extension Frames (FEF)	103
8.5	Frequency interleaver	104
9	OFDM Generation.....	109
9.0	Overview	109
9.1	MISO Processing.....	109
9.2	Pilot insertion	110
9.2.1	Introduction.....	110
9.2.2	Definition of the reference sequence	110
9.2.2.0	Overview	110
9.2.2.1	Symbol level	111
9.2.2.2	Frame level.....	112
9.2.3	Scattered pilot insertion	112
9.2.3.0	Overview.....	112
9.2.3.1	Locations of the scattered pilots.....	112
9.2.3.2	Amplitudes of the scattered pilots	114
9.2.3.3	Modulation of the scattered pilots	114
9.2.4	Continual pilot insertion	114
9.2.4.0	Overview	114
9.2.4.1	Locations of the continual pilots	114
9.2.4.2	Locations of additional continual pilots in extended carrier mode.....	115
9.2.4.3	Amplitudes of the Continual Pilots	115
9.2.4.4	Modulation of the Continual Pilots	115
9.2.5	Edge pilot insertion.....	115
9.2.6	P2 pilot insertion.....	116
9.2.6.1	Locations of the P2 pilots.....	116
9.2.6.2	Amplitudes of the P2 pilots.....	116
9.2.6.3	Modulation of the P2 pilots.....	116
9.2.7	Insertion of frame closing pilots	116
9.2.7.0	Overview	116
9.2.7.1	Locations of the frame closing pilots	117
9.2.7.2	Amplitudes of the frame closing pilots	117
9.2.7.3	Modulation of the frame closing pilots	117
9.2.8	Modification of the pilots for MISO.....	117
9.3	Dummy tone reservation	119
9.4	Mapping of data cells to OFDM carriers.....	119
9.5	IFFT - OFDM Modulation	119
9.6	PAPR Reduction	121
9.6.0	Overview	121
9.6.1	Active Constellation Extension.....	121
9.6.2	PAPR reduction using tone reservation	123
9.6.2.0	Overview	123
9.6.2.1	Algorithm of PAPR reduction using tone reservation.....	124
9.7	Guard interval insertion.....	126
9.8	P1 Symbol insertion	126
9.8.1	P1 Symbol overview	126
9.8.2	P1 Symbol description	126
9.8.2.0	Overview.....	126
9.8.2.1	Carrier Distribution in P1 symbol	128
9.8.2.2	Modulation of the Active Carriers in P1	128
9.8.2.3	Boosting of the Active Carriers.....	130
9.8.2.4	Generation of the time domain P1 signal	131
9.8.2.4.1	Generation of the main part of the P1 signal	131
9.8.2.4.2	Frequency Shifted repetition in Guard Intervals.....	131
10	Spectrum characteristics.....	131
Annex A (normative):	Addresses of parity bit accumulators for $N_{ldpc} = 64\ 800$	134
Annex B (normative):	Addresses of parity bit accumulators for $N_{ldpc} = 16\ 200$	141

Annex C (normative):	Additional Mode Adaptation tools	144
C.1	Input stream synchronizer	144
C.1.0	ISSY definition and signalling	144
C.1.1	Receiver Buffer Model	146
C.1.2	Requirements of input signal	149
Annex D (normative):	Splitting of input MPEG-2 TSs into the data PLPs and common PLP of a group of PLPs	151
D.1	Overview	151
D.2	Splitting of input TS into a TSPS stream and a TSPSC stream	152
D.2.1	General	152
D.2.2	Co-timed TS packets that are identical on all input TSs of the group before the split	152
D.2.3	Co-timed TS packets carrying Service Description Table (SDT) and not having the characteristic of category (1)	153
D.2.4	Co-timed TS packets carrying Event Information Table (EIT) and not having the characteristic of category (1)	155
D.2.4.0	Overview	155
D.2.4.1	Required operations	155
D.2.4.2	Conditions	155
D.3	Receiver Implementation Considerations	157
Annex E (informative):	T2-frame structure for Time-Frequency Slicing	158
E.1	General	158
E.2	T2-frame structure	159
E.2.1	Duration and capacity of the T2-frame	159
E.2.2	Overall structure of the T2-frame	159
E.2.3	Structure of the Type-2 part of the T2-frame	160
E.2.4	Restrictions on frame structure to allow tuner switching time	161
E.2.5	Signalling of the dynamic parameters in a TFS configuration	162
E.2.6	Indexing of RF channels	162
E.2.7	Mapping the PLPs	163
E.2.7.0	Overview	163
E.2.7.1	Mapping the Common and Type 1 PLPs	163
E.2.7.2	Mapping the Type 2 PLPs	163
E.2.7.2.0	Overview	163
E.2.7.2.1	Allocating the cells of the Interleaving Frame to the T2-Frames	164
E.2.7.2.2	Size of the sub-slices	165
E.2.7.2.3	Allocation of cell addresses to the sub-slices on RF _{start}	165
E.2.7.2.4	Allocation of cell addresses to the sub-slices on the other RF channels	166
E.2.7.2.5	Mapping the PLP cells to the allocated cell addresses	167
E.2.8	Auxiliary streams and dummy cells	167
Annex F (normative):	Calculation of the CRC word	168
Annex G (normative):	Locations of the continual pilots	169
Annex H (normative):	Reserved carrier indices for PAPR reduction	173
Annex I (normative):	T2-Lite	175
I.1	Overview	175
I.2	In-band signalling	175
I.3	FEC encoding for T2-Lite	175
I.4	Bit to cell word de-multiplexer	176
I.5	Modulation limitations for T2-Lite	177

I.6	T2-Lite L1-signalling	177
I.7	T2-Lite mode limitations	178
I.7.0	Overview	178
I.7.1	FFT size limitations	178
I.7.2	Pilot pattern limitations	178
I.7.3	Limitations on mode combinations	178
I.8	T2-Lite time interleaver memory	179
I.9	T2-Lite signal structure	179
I.10	T2-Lite PLP data rate limitations	179
I.11	T2-Lite receiver buffer model limitations	180
Annex J (informative):	Transport Stream regeneration and clock recovery using ISCR	181
Annex K (informative):	Pilot patterns	182
Annex L (informative):	Allowable sub-slicing values	190
Annex M (informative):	Bibliography	192
History		193

iTeh STANDARD PREVIEW
 (standards.iteh.ai)

Full standard:
<https://standards.iteh.ai/catalog/standards/sist/339e595f-373e-40e1-bf56-18c024707286/etsi-en-302-755-v1.4.1-2015-07>

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://ipr.etsi.org>).

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 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 standardization, interoperability and future proof specifications.

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", "may not", "need", "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).

"must" and "must not" are **NOT** allowed in ETSI deliverables except when used in direct citation.

iTeh STANDARD PREVIEW
(standards.iteh.ai)

Full standard:
<https://standards.iteh.ai/catalog/standards/sist/339e595f-373e-40e1-bf56-18c024707286/etsi-en-302-755-v1.4.1-2015-07>

1 Scope

The present document describes a second generation baseline transmission system for digital terrestrial television broadcasting. It specifies the channel coding/modulation system intended for digital television services and generic data streams.

The scope is as follows:

- it gives a general description of the Baseline System for digital terrestrial TV;
- it specifies the digitally modulated signal in order to allow compatibility between pieces of equipment developed by different manufacturers. This is achieved by describing in detail the signal processing at the modulator side, while the processing at the receiver side is left open to different implementation solutions. However, it is necessary in this text to refer to certain aspects of reception.

Versions 1.1.1 and 1.2.1 of the present document [i.7] and [i.8] defined a single profile which incorporates time-slicing but not time-frequency-slicing (TFS). Features which would allow a possible future implementation of TFS (for receivers with two tuners/front-ends) can be found in annex E. It is not intended that a receiver with a single tuner should support TFS.

Version 1.3.1 of the present document [i.9] added a T2-Lite profile. This profile is intended to allow simpler receiver implementations for very low capacity applications such as mobile broadcasting, although it may also be received by conventional stationary receivers. The details of this T2-Lite profile are described in annex I. Version 1.3.1 of the present document [i.9] also introduces a name, which is 'T2-base profile', for the previous single profile.

Version 1.4.1 (the present document) made a number of changes, but all of these are clarifications of particular points, changes in non-normative recommendations, and corrections to the wording; no new technical features have been added and no changes have been made to existing features.

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 reference document (including any amendments) applies.

Referenced documents which are not found to be publicly available in the expected location might be found at <http://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 101 162: "Digital Video Broadcasting (DVB); Allocation of identifiers and codes for Digital Video Broadcasting (DVB) systems".
- [2] ETSI TS 102 992: "Digital Video Broadcasting (DVB); Structure and modulation of optional transmitter signatures (T2-TX-SIG) for use with the DVB-T2 second generation digital terrestrial television broadcasting system".

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 reference 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.

- [i.1] ISO/IEC 13818-1: "Information technology - Generic coding of moving pictures and associated audio information: Systems".
- [i.2] ETSI TS 102 606: "Digital Video Broadcasting (DVB); Generic Stream Encapsulation (GSE) Protocol".
- [i.3] ETSI EN 302 307: "Digital Video Broadcasting (DVB); Second generation framing structure, channel coding and modulation systems for Broadcasting, Interactive Services, News Gathering and other broadband satellite applications (DVB-S2)".
- [i.4] ETSI EN 300 468: "Digital Video Broadcasting (DVB); Specification for Service Information (SI) in DVB systems".
- [i.5] ETSI EN 300 744: "Digital Video Broadcasting (DVB); Framing structure, channel coding and modulation for digital terrestrial television".
- [i.6] ETSI TS 102 831: "Digital Video Broadcasting (DVB); Implementation guidelines for a second generation digital terrestrial television broadcasting system (DVB-T2)".
- [i.7] ETSI EN 302 755 (V1.1.1): "Digital Video Broadcasting (DVB); Frame structure channel coding and modulation for a second generation digital terrestrial television broadcasting system (DVB-T2)".
- [i.8] ETSI EN 302 755 (V1.2.1): "Digital Video Broadcasting (DVB); Frame structure channel coding and modulation for a second generation digital terrestrial television broadcasting system (DVB-T2)".
- [i.9] ETSI EN 302 755 (V1.3.1): "Digital Video Broadcasting (DVB); Frame structure channel coding and modulation for a second generation digital terrestrial television broadcasting system (DVB-T2)".

3 Definitions, symbols and abbreviations

3.1 Definitions

For the purposes of the present document, the following terms and definitions apply:

0xkk: digits 'kk' should be interpreted as a hexadecimal number

active cell: OFDM cell which is not a pilot, tone reservation cell or unmodulated cell in the frame closing symbol

auxiliary stream: sequence of cells carrying data of as yet undefined modulation and coding, which may be used for future extensions or as required by broadcasters or network operators

BBFRAME: set of K_{bch} bits which form the input to one FEC encoding process (BCH and LDPC encoding)

bias balancing cells: special cells inserted into the P2 symbols to reduce the effect of the bias in the L1 signalling

common PLP: PLP having one slice per T2-frame, transmitted after the L1 signalling and any bias balancing cells, which may contain data shared by multiple PLPs

configurable L1-signalling: L1 signalling consisting of parameters which remain the same for the duration of one super-frame

data cell: OFDM cell which is not a pilot or tone reservation cell (may be an unmodulated cell in the Frame Closing Symbol)

data PLP: PLP of Type 1 or Type 2

data symbol: OFDM symbol in a T2-frame which is not a P1 or P2 symbol

div: integer division operator, defined as:

$$x \text{ div } y = \left\lfloor \frac{x}{y} \right\rfloor$$

dummy cell: OFDM cell carrying a pseudo-random value used to fill the remaining capacity not used for L1 signalling, PLPs or Auxiliary Streams

dynamic L1-signalling: L1 signalling consisting of parameters which may change from one T2-frame to the next

elementary period: time period which depends on the system bandwidth and is used to define the other time periods in the T2 system

FEC Block: set of N_{cells} OFDM cells carrying all the bits of one LDPC FECFRAME

FECFRAME: set of N_{ldpc} (16 200 or 64 800) bits from one LDPC encoding operation

FEF part: part of the super-frame between two T2-frames which contains FEFs

NOTE: A FEF part always starts with a P1 symbol. The remaining contents of the FEF part should be ignored by a DVB-T2 receiver and may contain further P1 symbols.

FFT size: nominal FFT size used for a particular mode, equal to the active symbol period T_s expressed in cycles of the elementary period T

for i=0..xxx-1: the corresponding signalling loop is repeated as many times as there are elements of the loop

NOTE: If there are no elements, the whole loop is omitted.

frame closing symbol: OFDM symbol with higher pilot density used at the end of a T2-frame in certain combinations of FFT size, guard interval and scattered pilot pattern

Im(x): imaginary part of x

interleaving frame: unit over which dynamic capacity allocation for a particular PLP is carried out, made up of an integer, dynamically varying number of FEC blocks and having a fixed relationship to the T2-frames

NOTE: The Interleaving Frame may be mapped directly to one T2-frame or may be mapped to multiple T2-frames. It may contain one or more TI-blocks.

L1 bias balancing bits: unused bits within the L1 signalling fields which are nominated to be set so as to reduce the overall bias in the L1 signalling

L1-post signalling: signalling carried in the P2 symbol carrying more detailed L1 information about the T2 system and the PLPs

L1-pre signalling: signalling carried in the P2 symbols having a fixed size, coding and modulation, including basic information about the T2 system as well as information needed to decode the L1-post signalling

NOTE: L1-pre signalling remains the same for the duration of a super-frame.

MISO group: group (1 or 2) to which a particular transmitter in a MISO network belongs, determining the type of processing which is performed to the data cells and the pilots

NOTE: Signals from transmitters in different groups will combine in an optimal manner at the receiver.

mod: modulo operator, defined as:

$$x \bmod y = x - y \left\lfloor \frac{x}{y} \right\rfloor$$

nn_D: digits 'nn' should be interpreted as a decimal number

normal symbol: OFDM symbol in a T2-frame which is not a P1, P2 or Frame Closing symbol

OFDM cell: modulation value for one OFDM carrier during one OFDM symbol, e.g. a single constellation point

OFDM symbol: waveform Ts in duration comprising all the active carriers modulated with their corresponding modulation values and including the guard interval

P1 signalling: signalling carried by the P1 symbol and used to identify the basic mode of the DVB-T2 symbol

P1 symbol: fixed pilot symbol that carries S1 and S2 signalling fields and is located in the beginning of the frame within each RF-channel

NOTE: The P1 symbol is mainly used for fast initial band scan to detect the T2 signal, its timing, frequency offset, and FFT-size.

P2 symbol: pilot symbol located right after P1 with the same FFT-size and guard interval as the data symbols

NOTE: The number of P2 symbols depends on the FFT-size. The P2 symbols are used for fine frequency and timing synchronization as well as for initial channel estimate. P2 symbols carry L1 and L2 signalling information and may also carry data.

physical layer pipe: physical layer TDM channel that is carried by the specified sub-slices

NOTE: A PLP may carry one or multiple services

PLP_ID: this 8-bit field identifies uniquely a PLP within the T2-system, identified with the T2_system_id

NOTE: The same PLP_ID may occur in one or more frames of the super-frame.

Re(x): real part of x

reserved for future use: not defined by the present document but may be defined in future revisions of the present document

NOTE: Further requirements concerning the use of fields indicated as "reserved for future use" are given in clause 7.1.

slice: set of all cells of a PLP which are mapped to a particular T2-frame

NOTE: A slice may be divided into sub-slices.

sub-slice: group of cells from a single PLP, which before frequency interleaving, are transmitted on active OFDM cells with consecutive addresses over a single RF channel

T2-base signal: T2 signal using the T2-base profile

T2-frame: fixed physical layer TDM frame that is further divided into variable size sub-slices. T2-frame starts with one P1 and one or multiple P2 symbols

T2-Lite signal: T2 signal using the T2-Lite profile

T2 profile: subset of all configurations allowed by the present document

NOTE: The present document defines a T2-base profile and a T2-Lite profile.

T2 signal: signal consisting of the waveform using a particular profile of the present document (T2-base profile or T2-Lite profile), including any FEF parts

NOTE: A composite RF signal may be formed comprising two or more T2 signals, where each T2 signal has the others in its FEF parts.