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**Digital Video Broadcasting (DVB);
Next Generation broadcasting system to Handheld,
physical layer specification (DVB-NGH);
Part 3: Hybrid Profile**

EBU DVB

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Contents

Intellectual Property Rights 5
Foreword 5
Modal verbs terminology 6
1 Scope 7
2 References 7
2.1 Normative references 7
2.2 Informative references 7
3 Definition of terms, symbols and abbreviations 7
3.1 Terms 7
3.2 Symbols 7
3.3 Abbreviations 8
4 DVB-NGH hybrid system definition 8
4.1 System overview and architecture 8
4.1.1 Overview 8
4.1.2 Bit-interleaved coding and modulation, MISO precoding 10
4.1.3 Frame building, frequency interleaving 11
4.1.4 OFDM generation 11
4.1.5 SC-OFDM generation 12
5 Input processing 12
6 Bit interleaved coding and modulation 12
6.0 Overview 12
6.1 Constellation mapping 12
6.2 Time interleaver 12
6.3 Distributed and cross-polar MISO 14
7 Layer 1 signalling data specific for the Hybrid Profile 14
7.1 P1 and additional P1 signalling data 14
7.2 L1-PRE signalling data 15
7.3 L1-POST signalling data 15
7.3.1 L1-POST configurable signalling data 15
7.3.2 L1-POST dynamic signalling data 16
7.3.3 In-band signalling type A 16
8 Frame Builder 16
8.1 SC-OFDM 16
8.1.1 NGH hybrid SC-OFDM frames 16
8.1.1.1 Duration of the NGH hybrid SC-OFDM frame 16
8.1.1.2 Capacity and structure of the NGH hybrid SC-OFDM frame 17
8.1.2 Frequency interleaver 18
9 OFDM Generation 18
10 SC-OFDM generation 19
10.1 Overview 19
10.2 Spreading 19
10.3 Pilot insertion 20
10.3.1 Introduction 20
10.3.2 Definition of the reference NGH hybrid sequence 21
10.3.3 Scattered pilot insertion 21
10.3.3.0 Overview 21
10.3.3.1 Locations of the scattered pilots 21
10.3.3.2 Amplitudes of the scattered pilots 21
10.3.3.3 Modulation of the scattered pilots 22
10.4 IFFT - SC-OFDM modulation 22
10.5 Guard interval insertion 22

Annex A (informative): SC-OFDM pilot pattern 24

Annex B (normative): Receiver Buffer Model extension 25

Annex C (informative): Bibliography 26

History 27

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Foreword

This 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).

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 3 of a multi-part deliverable. Full details of the entire series can be found in part 1 [1].

National transposition dates	
Date of adoption of this EN:	24 March 2022
Date of latest announcement of this EN (doa):	30 June 2022
Date of latest publication of new National Standard or endorsement of this EN (dop/e):	31 December 2022
Date of withdrawal of any conflicting National Standard (dow):	31 December 2022

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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1 Scope

The present document describes the next generation transmission system for digital hybrid (combination of terrestrial with satellite transmissions) broadcasting to handheld terminals. It specifies the differences of the Hybrid Profile physical layer part to the physical layer part of the Base Profile ETSI EN 303 105-1 [1] from the input streams to the transmitted signals. This transmission system is intended for carrying Transport Streams or generic data streams feeding linear and non-linear applications like television, radio and data services. DVB-NGH terminals might also process DVB-T2-lite signals.

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 EN 303 105-1: "Digital Video Broadcasting (DVB); Next Generation broadcasting system to Handheld, physical layer specification (DVB-NGH); Part 1: Base Profile".

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.

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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

For the purposes of the present document, the terms given in ETSI EN 303 105-1 [1] apply.

3.2 Symbols

For the purposes of the present document, the symbols given in ETSI EN 303 105-1 [1] apply.

3.3 Abbreviations

For the purposes of the present document, the abbreviations given in ETSI EN 303 105-1 [1] apply.

4 DVB-NGH hybrid system definition

4.1 System overview and architecture

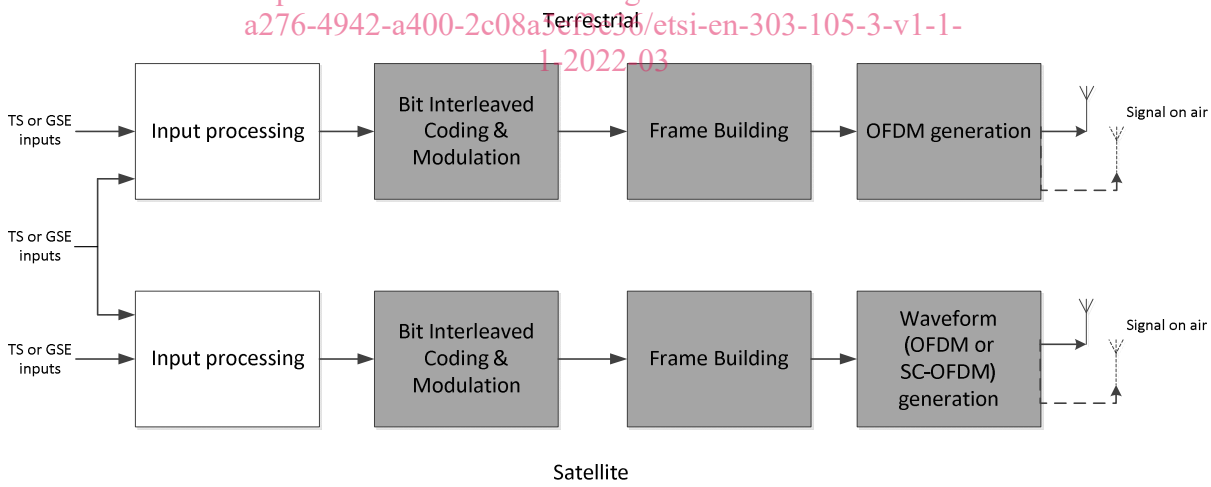
4.1.1 Overview

The Hybrid Profile - reflected by the present document - specifies the hybrid signal format, composed of a component coming from the terrestrial network, and an additional component, coming from the satellite. Hybrid signals according to the NGH profile reflected by the present document include an additional P1 symbol (aP1, see ETSI EN 303 105-1 [1], clause 11.8.3). The satellite component of the Hybrid Profile - reflected by the present document - is defined for channel bandwidths 1, 7, 2 and 5 MHz (these three bandwidths are also covered by the Base Profile [1]).

Hybrid NGH signals can also be Base Profile compliant, in which case they are covered by ETSI EN 303 105-1 [1].

Besides defining the hybrid signals, the Hybrid Profile - reflected by the present document - defines moreover the mechanisms to receive two signals simultaneously (one signal from a terrestrial transmitter and one from the satellite) and to combine their outputs to a single stream.

Figure 1 represents the high level NGH physical layer block diagram of the Hybrid Profile - reflected by the present document. Two chains are present, one for the terrestrial component and the other for the satellite component. Compared to the Base Profile, the terrestrial and satellite chains of the Hybrid Profile - reflected by the present document - present potential functional differences in the BICM, frame building and waveform generation. The system architecture of the satellite component is that of the terrestrial component, with the possibility of replacing the OFDM modulation block by the SC-OFDM modulation block, characterized additionally by the absence of particular functional blocks as explained in clause 4.1. Time frequency slicing can be applied to both, the terrestrial and the satellite components.



NOTE: Blocks differing from the Base Profile are shaded grey.

Figure 1: High level NGH physical layer block diagram of the Hybrid Profile - reflected by the present document

Both SFN and MFN configurations are possible for the Hybrid Profile - reflected by the present document. In the SFN case, when the satellite and terrestrial components share the same frequency, the signal transmitted in the two components shall be exactly the same. The system input(s) to the terrestrial and the satellite path may differ from each other in the MFN case. In the MFN case, the system architecture of the Hybrid Profile of DVB-NGH - reflected by the present document - is composed of two components: the terrestrial component, as specified in ETSI EN 303 105-1 [1], and the satellite component, as represented in figure 1.

MISO in the Hybrid Profile - reflected by the present document - is applicable to OFDM only, to both, the terrestrial and the satellite paths.

Table 1 indicates the allowed parameter settings for the Hybrid Profile - reflected by the present document. According to it, the following hybrid cases can be devised:

- SFN, OFDM: The terrestrial network and the satellite share the same frequency and the same signal is transmitted on the two components. The signal waveform is OFDM and the preambles of both components consist of a P1 plus an aP1 symbol. The OFDM parameter set is applicable to both components, terrestrial and satellite. Alternatively, the Base Profile could be adopted for both components. In that case the P1 part of the preamble of both components consists of a P1 symbol only.

- MFN, OFDM: The satellite signal is transmitted on a different frequency, OFDM is used on both components. The terrestrial component is transmitted according to the Base Profile, the satellite component according to the OFDM settings listed in table 1. The preamble of the terrestrial component consists of a P1 symbol and the preamble of the satellite component consists of a P1 plus an aP1 symbol.

- SFN, SC-OFDM: This case consists of the satellite coverage and of terrestrial gap fillers sharing the same frequency of the satellite signal. The SC-OFDM settings are applicable to both components, terrestrial and satellite. Preambles consist of P1 plus aP1 symbols for the satellite and the terrestrial component.

- MFN, SC-OFDM on the satellite component, OFDM on the terrestrial component: The terrestrial component is configured in line with the Base Profile, the satellite component using the permitted SC-OFDM settings outlined in table 1. The preamble of the terrestrial component consists of a P1 symbol and the one of the satellite component of a P1 plus an aP1 symbol.

Table 1: Allowed parameter settings for the Hybrid Profile - reflected by the present document

Parameters		Hybrid waveform	
Modulation		OFDM	SC-OFDM
Bandwidths	1,7 MHz	X	X
	2,5 MHz	X	X
	5,0 MHz	X	X
	6,0 MHz		
	7,0 MHz		
	8,0 MHz		
	10,0 MHz		
	15,0 MHz		
	20,0 MHz		
Constellations	QPSK	X	X
	16-QAM	X	X
	64-QAM		
	256-QAM		
FFT sizes	0,5k		X
	1k	X	X
	2k	X	X
	4k		
	8k		
	16k		

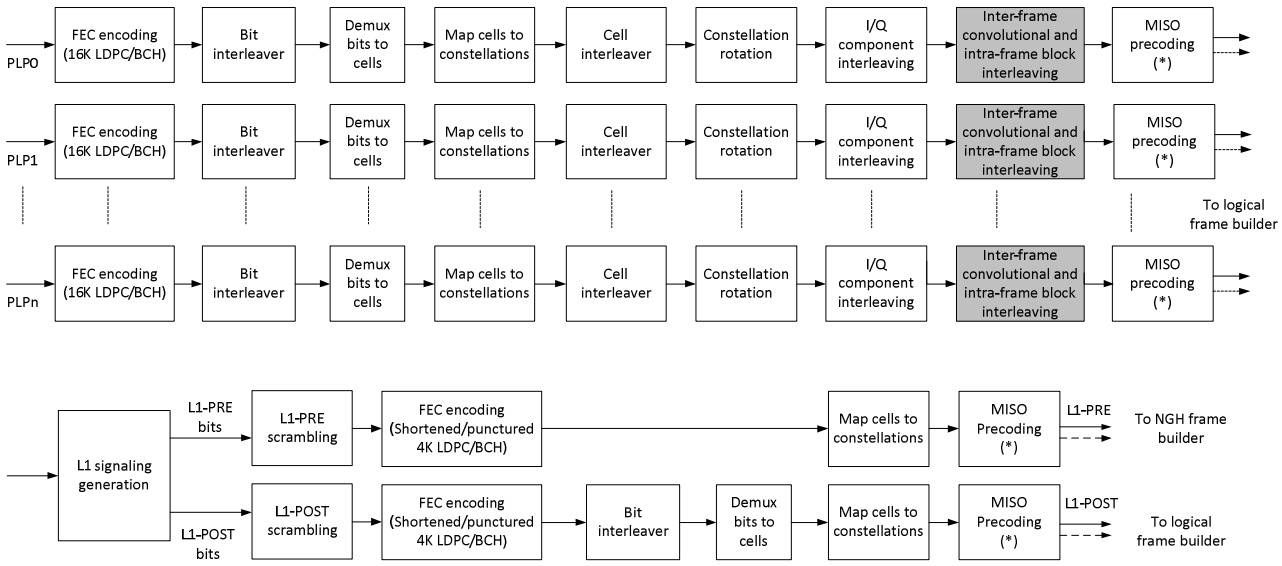
Parameters		Hybrid waveform	
Modulation		OFDM	SC-OFDM
Guard intervals	1/128		
	1/32	X	X
	1/16	X	X
	19/256		
	1/8	X	
	19/128		
	1/4	X	
Preambles	Single P1		
	P1 + aP1	X	X
Pilot patterns	Continuous pilot symbols	X	
	PP1	X	
	PP2	X	
	PP3	X	
	PP4	X	
	PP5	X	
	PP6		
	PP7		
	PP9		X
FEC code rates	1/5 (=3/15)	X	X
	4/15	X	X
	1/3 (=5/15)	X	X
	2/5 (=6/15)	X	X
	7/15	X	X
	8/15	X	X
	3/5 (=9/15)	X	X
	2/3 (=10/15)	X	X
	11/15	X	X
	3/4	X	X
MISO		X	
Time de-interleaver size	See note 2	According to clause 6.2	According to clause 6.2

NOTE 1: Not all parameter settings listed above can be combined with each other. The exceptions are described in the following clauses.

NOTE 2: In situations where a receiver needs to time de-interleave both, the terrestrial and the satellite signal, in parallel, limits for the time de-interleaver size outlined in clause 6.2 apply to the combination of both signals, i.e. they cannot simultaneously make use of the full specified time de-interleaver memory size.

4.1.2 Bit-interleaved coding and modulation, MISO precoding

The block diagram, illustrating the functional differences in the BICM stage, is shown in figure 2. Further to the time interleaving configurations of the Base Profile, the Hybrid Profile - reflected by the present document - allows a concentration of cells at the end of the logical frame sequence over which a FEC block is spread (uniform-late interleaving).



NOTE: (*): Applicable to OFDM waveform only.

Figure 2: BICM of the Hybrid Profile - reflected by the present document (applicable to the terrestrial and the satellite path)

4.1.3 Frame building, frequency interleaving

The block diagram, illustrating the functional differences in frame building stage, is shown in figure 3. This is the same architecture as the Base Profile except for the allocation of space for the aP1 symbol. As far as the physical and the logical framing is concerned, the same mechanisms are used for the terrestrial and satellite components. These mechanisms are described in ETSI EN 303 105-1 [1], clause 9. The frequency interleaver is applicable to OFDM only.

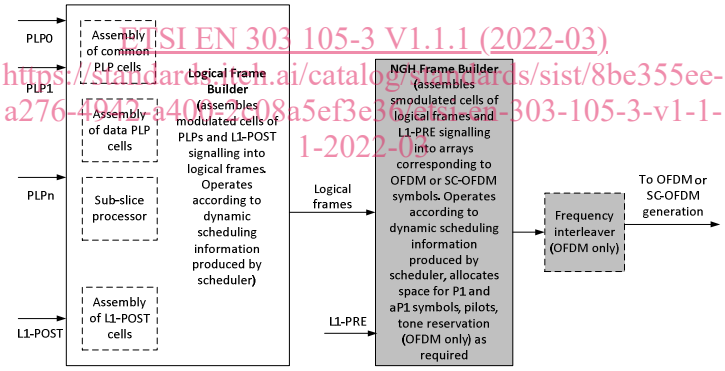


Figure 3: Frame builder of the Hybrid Profile - reflected by the present document (applicable to the terrestrial and the satellite path)

4.1.4 OFDM generation

The block diagram, illustrating the functional differences in the OFDM generation stage, is shown in figure 4. The only functional difference is the insertion of the additional preamble symbol aP1, following the preamble symbol P1, as specified in ETSI EN 303 105-1 [1], clause 11.8.3.

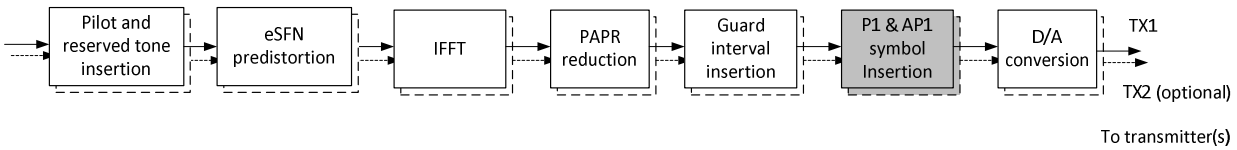


Figure 4: OFDM generation (applicable to the terrestrial and the satellite path)