



SLOVENSKI STANDARD
SIST EN 303 105-4 V1.1.1:2022

01-maj-2022

Digitalna videoradiodifuzija (DVB) - Radiodifuzijski sistem naslednje generacije za dlančnike, specifikacija fizične plasti (DVB-NGH) - 4. del: Hibridni profil MIMO

Digital Video Broadcasting (DVB) - Next Generation broadcasting system to Handheld, physical layer specification (DVB-NGH) - Part 4: Hybrid MIMO Profile

iTeh STANDARD
PREVIEW
(standards.iteh.ai)

Ta slovenski standard je istoveten z: ETSI EN 303 105-4 V1.1.1 (2022-03)

[SIST EN 303 105-4 V1.1.1:2022](https://standards.iteh.ai/catalog/standards/sist/0cf6a4cc-4433-460c-b068-f79dbd8dffec/sist-en-303-105-4-v1-1-1-2022)

<https://standards.iteh.ai/catalog/standards/sist/0cf6a4cc-4433-460c-b068-f79dbd8dffec/sist-en-303-105-4-v1-1-1-2022>

ICS:

33.170	Televizijska in radijska difuzija	Television and radio broadcasting
35.100.10	Fizični sloj	Physical layer

SIST EN 303 105-4 V1.1.1:2022 **en**

**iTeh STANDARD
PREVIEW
(standards.iteh.ai)**

SIST EN 303 105-4 V1.1.1:2022

<https://standards.iteh.ai/catalog/standards/sist/0cf6a4ec-4433-460c-b068-f79dbd8dffec/sist-en-303-105-4-v1-1-1-2022>

ETSI EN 303 105-4 V1.1.1 (2022-03)



**Digital Video Broadcasting (DVB);
Next Generation broadcasting system to Handheld,
physical layer specification (DVB-NGH);
Part 4: Hybrid MIMO Profile**

[SIST EN 303 105-4 V1.1.1:2022](https://standards.iteh.ai/catalog/standards/sist/0cf6a4ec-4433-460c-b068-f79dbd8dffec/sist-en-303-105-4-v1-1-1-2022)

<https://standards.iteh.ai/catalog/standards/sist/0cf6a4ec-4433-460c-b068-f79dbd8dffec/sist-en-303-105-4-v1-1-1-2022>

EBU DVB[®]

Reference

DEN/JTC-DVB-373-4

Keywords

audio, broadcasting, data, digital, DVB, hybrid, MIMO, MPEG, radio, satellite, terrestrial, TV, video

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

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 prevailing version of an ETSI deliverable is the one made publicly available in PDF format at www.etsi.org/deliver.

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

<https://portal.etsi.org/TB/ETSIDeliverableStatus.aspx>

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

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

If you find a security vulnerability in the present document, please report it through our

Coordinated Vulnerability Disclosure Program:

<https://www.etsi.org/standards/coordinated-vulnerability-disclosure>

Notice of disclaimer & limitation of liability

The information provided in the present deliverable is directed solely to professionals who have the appropriate degree of experience to understand and interpret its content in accordance with generally accepted engineering or other professional standard and applicable regulations.

No recommendation as to products and services or vendors is made or should be implied.

In no event shall ETSI be held liable for loss of profits or any other incidental or consequential damages.

Any software contained in this deliverable is provided "AS IS" with no warranties, express or implied, including but not limited to, the warranties of merchantability, fitness for a particular purpose and non-infringement of intellectual property rights and ETSI shall not be held liable in any event for any damages whatsoever (including, without limitation, damages for loss of profits, business interruption, loss of information, or any other pecuniary loss) arising out of or related to the use of or inability to use the software.

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.

© ETSI 2022.

© European Broadcasting Union 2022.

All rights reserved.

Contents

Intellectual Property Rights	4
Foreword.....	4
Modal verbs terminology.....	5
1 Scope	6
2 References	6
2.1 Normative references	6
2.2 Informative references.....	6
3 Definition of terms, symbols and abbreviations.....	6
3.1 Terms.....	6
3.2 Symbols.....	7
3.3 Abbreviations	7
4 DVB-NGH hybrid MIMO system definition	7
4.1 System overview and architecture.....	7
4.1.1 Overview	7
4.1.2 Hybrid MIMO SFN	7
4.1.3 Hybrid MIMO MFN	7
4.1.4 Time interleaving.....	8
5 Hybrid MIMO SFN.....	8
5.1 Transmit/receive system compatibility.....	8
5.2 Operational SFN modes	9
5.3 Power imbalance cases	9
6 Hybrid MIMO MFN.....	10
6.1 Transmit/receive system compatibility.....	10
6.2 Operational MFN modes	10
6.3 Spatial Multiplexing encoding for SC-OFDM waveform for rate 2 satellite MIMO	11
7 Layer 1 signalling data for the hybrid MIMO profile	11
7.1 P1 and additional P1 signalling data.....	11
7.2 L1-PRE signalling data	12
7.3 L1-POST signalling data	13
7.3.1 L1-POST configurable signalling data	13
7.3.2 L1-POST dynamic signalling data.....	14
7.3.3 In-band signalling type A	14
Annex A (informative): SC-OFDM pilot pattern	15
Annex B (informative): Rate-2 transmission with one transmit antenna	16
B.1 VMIMO.....	16
B.1.1 Overview	16
B.1.2 Block diagram	16
B.1.3 VMIMO processing.....	16
B.1.4 Parameter setting	16
B.1.5 Phase Hopping.....	17
B.1.6 Miscellaneous.....	17
Annex C (informative): Bibliography.....	18
History	19

Intellectual Property Rights

Essential patents

IPRs essential or potentially essential to normative deliverables may have been declared to ETSI. The declarations pertaining to these essential IPRs, if any, are 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 (<https://ipr.etsi.org/>).

Pursuant to the ETSI Directives including the ETSI IPR Policy, no investigation regarding the essentiality of IPRs, 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.

Trademarks

The present document may include trademarks and/or tradenames which are asserted and/or registered by their owners. ETSI claims no ownership of these except for any which are indicated as being the property of ETSI, and conveys no right to use or reproduce any trademark and/or tradename. Mention of those trademarks in the present document does not constitute an endorsement by ETSI of products, services or organizations associated with those trademarks.

DECT™, **PLUGTESTS™**, **UMTS™** and the ETSI logo are trademarks of ETSI registered for the benefit of its Members. **3GPP™** and **LTE™** are trademarks of ETSI registered for the benefit of its Members and of the 3GPP Organizational Partners. **oneM2M™** logo is a trademark of ETSI registered for the benefit of its Members and of the oneM2M Partners. **GSM®** and the GSM logo are trademarks registered and owned by the GSM Association.

Foreword

(standards.iteh.ai)

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.

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

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 4 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).

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

iTeh STANDARD PREVIEW (standards.iteh.ai)

[SIST EN 303 105-4 V1.1.1:2022](https://standards.iteh.ai/catalog/standards/sist/0cf6a4ec-4433-460c-b068-f79dbd8dffec/sist-en-303-105-4-v1-1-1-2022)
<https://standards.iteh.ai/catalog/standards/sist/0cf6a4ec-4433-460c-b068-f79dbd8dffec/sist-en-303-105-4-v1-1-1-2022>

1 Scope

The present document describes the next generation transmission system for digital hybrid (combination of terrestrial with satellite transmissions) MIMO broadcasting to handheld terminals making use of multi-aerial structures at the transmitting and receiving ends. It specifies the relationship of the hybrid MIMO profile physical layer part to the physical layer part of the other three profiles, namely the base profile ETSI EN 303 105-1 [1], the MIMO profile ETSI EN 303 105-2 [2] and the hybrid profile ETSI EN 303 105-3 [3], from the input streams to the transmitted signal. 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] ETSI EN 303 105-2: "Digital Video Broadcasting (DVB); Next Generation broadcasting system to Handheld, physical layer specification (DVB-NGH); Part 2: MIMO Profile".
- [3] ETSI EN 303 105-3: "Digital Video Broadcasting (DVB); Next Generation broadcasting system to Handheld, physical layer specification (DVB-NGH); Part 3: Hybrid 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.

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.

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 MIMO system definition

4.1 System overview and architecture

4.1.1 Overview

The hybrid MIMO profile - reflected by the present document - is an optional profile facilitating the use of MIMO on the terrestrial and/or satellite elements within a hybrid transmission scenario.

The ACE PAPR technique cannot be applied to frames of preamble format "NGH-MIMO".

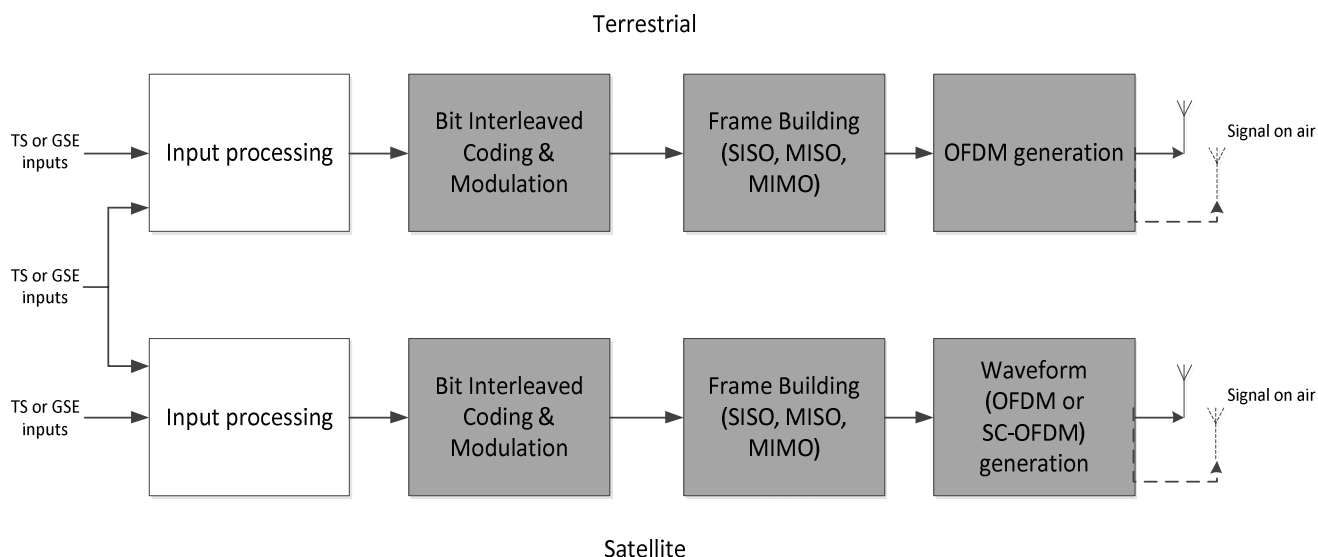
Two modes within this profile are available.

4.1.2 Hybrid MIMO SFN

The hybrid MIMO SFN describes the case where the satellite and terrestrial parts of the transmission utilize the same carrier frequency and radiate synchronized signals intended to create an effective SFN. In the case of a SISO SFN, covered in the hybrid profile, the signals are nominally identical (except for the possible application of eSFN) but in the case of a hybrid MIMO SFN MIMO pre-coding may exist in conjunction with eSFN pre-processing. The cases defined in the hybrid MIMO SFN mode are those where MIXO pre-coding is applied within or across the satellite and terrestrial transmission elements. In the case of mixed SISO/MIXO transmission the MIXO pre-coding is applicable solely during MIXO frames; during the hybrid SISO frames eSFN may be applied.

4.1.3 Hybrid MIMO MFN

The hybrid MIMO MFN describes the case where the satellite and terrestrial parts of the transmission are on different carrier frequencies, and do not necessarily share any common frame or symbol timing at the physical layer. They may however share content in terms of data payload. At least one of the transmission elements (i.e. terrestrial or satellite) shall be configured using multiple antennas, otherwise the form of transmission belongs to the Hybrid Profile ETSI EN 303 105-3 [3], not the Hybrid MIMO Profile reflected by the present document.



NOTE: Blocks differing from the Base Profile ETSI EN 303 105-1 [1] are shaded to grey.

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

NOTE 1: This block diagram is common to both hybrid MIMO MFN and hybrid MIMO SFN.

NOTE 2: One of the two paths is using two transmission antennas.

4.1.4 Time interleaving

For rate 2 schemes of the Hybrid MIMO Profile reflected by the present document, both MIMO branches, i.e. the signal generation for both transmit antennas, shall use the same time interleaver configuration. The required time de-interleaver memory sizes $N_{\text{MUS,PLP}}$ and $N_{\text{MUS,PLP,1 frame}}$ per MIMO branch can be calculated in the same way as described for the SISO scheme of the Hybrid Profile in ETSI EN 303 105-3 [3], clause 6.2, when setting 1 MU corresponding always to 1 cell. The total required de-interleaver memory for both MIMO branches is twice this size. The applicable limits for the hybrid MIMO profile are still $\sum 2N_{\text{MUS,PLP}} \leq 2^{21}$ and $\sum 2N_{\text{MUS,PLP,1 frame}} \leq 2^{18}$, where the sum is taken over all PLPs in a given PLP cluster and the factor 2 comes from the fact, that the size for both MIMO branches is double that per single MIMO branch.

When two signals are transmitted that shall be (hybridly) combined in the receiver, the same rules apply as laid down in ETSI EN 303 105-3 [3], clause 6.2, i.e. the sum of the required time de-interleaver sizes (in MUs) for both signals shall not exceed the aforementioned limits.

The Receiver Buffer Model (RBM) to use for the hybrid MIMO profile is the one of the Hybrid Profile in ETSI EN 303 105-3 [3], annex B.

5 Hybrid MIMO SFN

5.1 Transmit/receive system compatibility

To make use of the hybrid MIMO SFN, the proposed transmission hardware shall include individually-fed terrestrial and satellite transmitters with suitable antennas as outlined below, delivering an OFDM waveform on both the terrestrial and satellite sides. Cases included are one or two (cross-polar, linear polarization) terrestrial antennas in combination with one or two (cross-polar, counter-rotating circular polarization) satellite antennas. In the case of rate 2 MIMO transmission (e.g. eSM) from either the satellite or terrestrial equipments the receiver shall be equipped with a dual-polarized (linear polarization or counter-rotating circular) pair of antennas. For rate 1 transmission, (e.g. Alamouti, eSFN) a cross-polar receive antenna is recommended but a single antenna is sufficient.

In all SFN cases the satellite transmission appears as 'transparent' to the receiver which sees an equivalent terrestrial transmission via an enhanced channel partly delivered by the satellite transmission. The pilot patterns for SISO/MIXO are retained on both the terrestrial and satellite transmission.

SC-OFDM is not an option for the hybrid SFN profile.

5.2 Operational SFN modes

In each of the operational mode combinations shown in tables 1 and 2, the technical descriptions of the signals specified as forming the terrestrial and satellite components can be found in one or more of the Base Profile ETSI EN 303 105-1 [1], MIMO Profile ETSI EN 303 105-2 [2] or Hybrid Profile ETSI EN 303 105-3 [3].

NOTE 1: Where a modulation is described as A+B, 'A' refers to the terrestrial part, 'B' to the satellite part.

NOTE 2: eSFN may optionally be applied to any transmission component not already having it present.

NOTE 3: The TX identifier mentioned in table 1 below is described in ETSI EN 303 105-1 [1], clause 11.5.2.

Table 1: Rate 1 transmission schemes for hybrid SFN

Terrestrial transmission	Satellite transmission	MIXO scheme(s)
Single polarization (VP or HP)	Single polarization (RHCP or LHCP)	eSFN: Terr and Sat with 2 different TX identifiers (during SISO frames) Alamouti code (during MIXO frames)
Dual polarization (VP and HP)	Single polarization (RHCP or LHCP)	eSFN: 2 x Terr + Sat with 3 different TX identifiers (during SISO frames) Alamouti+ QAM (during MIXO frames)
Single polarization (VP or HP)	Dual polarization (RHCP and LHCP)	eSFN: Terr + 2 x Sat with 3 different TX identifiers (during SISO frames) Alamouti+ QAM (during MIXO frames)
Dual polarization (VP and HP)	Dual polarization (RHCP and LHCP)	eSFN: 2 x Terr + 2 x Sat with 4 different TX identifiers (during SISO frames)
Dual polarization (VP and HP)	Dual polarization (RHCP and LHCP)	Alamouti + Alamouti (during MIXO frames)

Table 2: Rate 2 transmission schemes for hybrid SFN

Terrestrial transmission	Satellite transmission	MIXO scheme(s)
Dual polarization (VP and HP)	Dual polarization (RHCP and LHCP)	eSM+PH Terr + eSM+PH+eSFN Sat (during MIMO frames)

5.3 Power imbalance cases

In the case of terrestrial power imbalance, the satellite transmission maintains a fixed 0 dB imbalance, but adopts the same values of parameters θ and α as the terrestrial transmission for the chosen imbalance. Table 3 shows the corresponding set of parameters.