

BS EN 62002-2:2008



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Mobile and portable DVB-T/H radio access —

Part 2: Interface conformance testing

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National foreword

This British Standard is the UK implementation of EN 62002-2:2008. It is identical to IEC 62002-2:2008. It supersedes BS EN 62002-2:2006 which is withdrawn.

The UK participation in its preparation was entrusted to Technical Committee EPL/100, Audio, video and multimedia systems and equipment.

A list of organizations represented on this committee can be obtained on request to its secretary.

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English version

Mobile and portable DVB-T/H radio access - Part 2: Interface conformance testing (IEC 62002-2:2008)

Accès radio DVB-T/H
vers les mobiles et les portables -
Partie 2: Contrôles de conformité
de l'interface
(CEI 62002-2:2008)

Mobiler und tragbarer Funkzugang
zu DVB-T/H -
Teil 2: Konformitätsprüfung
der Schnittstelle
(IEC 62002-2:2008)

This European Standard was approved by CENELEC on 2008-06-01. CENELEC members are bound to comply with the CEN/CENELEC Internal Regulations which stipulate the conditions for giving this European Standard the status of a national standard without any alteration.

Up-to-date lists and bibliographical references concerning such national standards may be obtained on application to the Central Secretariat or to any CENELEC member.

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CENELEC

European Committee for Electrotechnical Standardization
Comité Européen de Normalisation Electrotechnique
Europäisches Komitee für Elektrotechnische Normung

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Foreword

The text of document 100/1290/CDV, future edition 2 of IEC 62002-2, prepared by IEC TC 100, Audio, video and multimedia systems and equipment, was submitted to the IEC-CENELEC parallel vote and was approved by CENELEC as EN 62002-2 on 2008-06-01.

This European Standard supersedes EN 62002-2:2006.

The main changes with respect to EN 62002-2:2006 are listed below:

- DVB-H has been included as a part of the main specification;
- all the performance figures have been revised as new simulation results have been made available as well as new reference receivers for DVB-H have been developed;
- DVB-H now includes all the different MPE-FEC code rates;
- new portable indoor and portable outdoor channel models have been included as well as performance figures for those;
- a new 2x TU-6 mobile SFN test channel has been included;
- a new L4 linearity pattern has been added;
- dedicated performance figures for DVB-H for S1, S2, L1 to L4 interference patterns have been included;
- new GSM-interference measurement method has been added.

The following dates were fixed:

- | | | |
|--|-------|------------|
| – latest date by which the EN has to be implemented at national level by publication of an identical national standard or by endorsement | (dop) | 2009-03-01 |
| – latest date by which the national standards conflicting with the EN have to be withdrawn | (dow) | 2011-06-01 |

Annex ZA has been added by CENELEC.

Endorsement notice

The text of the International Standard IEC 62002-2:2008 was approved by CENELEC as a European Standard without any modification.

Annex ZA
(normative)**Normative references to international publications
with their corresponding European publications**

The following referenced documents are indispensable for the application of this document. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

NOTE When an international publication has been modified by common modifications, indicated by (mod), the relevant EN/HD applies.

<u>Publication</u>	<u>Year</u>	<u>Title</u>	<u>EN/HD</u>	<u>Year</u>
-	-	Digital Video Broadcasting (DVB): Framing structure, channel coding and modulation for digital terrestrial television	ETSI EN 300 744	2007
IEC 62002-1	- ¹⁾	Mobile and portable DVB-T/H radio access - Part 1: Interface specification	EN 62002-1	2008 ²⁾
ITU-R BT.1701-1	- ¹⁾	Characteristics of radiated signals of conventional analogue television systems	-	-

¹⁾ Undated reference.

²⁾ Valid edition at date of issue.

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MOBILE AND PORTABLE DVB-T/H RADIO ACCESS ±

Part 2: Interface conformance testing

1 Scope

This part of IEC 62002 provides the conformance testing rules and guidelines for equipment built to meet the Mobile and portable DVB-T/H radio access interface specification (IEC 62002-1).

One aim is to limit the number of tests to a practical level. Nevertheless, the manufacturer is responsible of guaranteeing that the terminal fulfils all aspects of the mobile and portable DVB-T/H radio access interface specification (see IEC 62002-1).

2 Normative references

The following references are indispensable for the application of this document. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

IEC 62002-1, *Mobile and portable DVB-T/H radio access ± Part 1: Interface specification*

ETSI EN 300 744:2007, *Digital Video Broadcasting (DVB) ± Framing structure, channel coding and modulation for digital terrestrial television, V1.5.2*

ITU-R BT.1701-1, *Characteristics of radiated signals of conventional analogue television systems*

3 Abbreviations

For the purposes of part of IEC 62002, the following abbreviations apply.

λ	Lambda, wavelength ($\lambda = c/f$)
A2	German analogue TV-stereo system
A_A	Coupling between antennas
AGC	Automatic Gain Control
A_{GSM}	Stop band attenuation of the GSM reject filter
B	Bandwidth
BER	Bit Error Ratio
C	Carrier power (In band carrier power including any echoes)
c	Speed of light $c = 3,0 \times 10^8$ m/s
C_i	Power contribution from the i -th signal
C_t	Total useful carrier power
C/N	Carrier to Noise ratio
C/N_{min}	Minimum C/N
CPE	Common Phase Error
CR	Code rate
dB	Decibel

<i>dBc</i>	dB compared to carrier power <i>C</i>
<i>dBd</i>	Antenna gain in dB compared to reference dipole (0 dBd = –2,14 dBi)
<i>dBi</i>	Antenna gain in dB compared to isotropic antenna (0 dBi = 2,14 dBd)
<i>dB(mW)</i>	Power in dB compared to 1 mW
<i>DUT</i>	Device Under Test
<i>DVB, DVB-T</i>	Digital Video Broadcasting, Terrestrial Digital Video Broadcasting
<i>DVB-H</i>	Digital Video Broadcasting to hand-held terminals
<i>DVB-RCT</i>	DVB Terrestrial Return Channel
<i>E</i>	Field strength V/m
<i>E(dBµV/m)</i>	Field strength in dB compared to 1 µV
<i>EDGE</i>	Enhanced Data rates for GSM/Global Evolution
<i>EMC</i>	Electromagnetic Compatibility
<i>END</i>	Equivalent Noise Degradation
<i>ENF</i>	Equivalent Noise Floor
<i>ESR</i>	Erroneous Second Ratio
<i>f</i>	Frequency in Hz
<i>f (MHz)</i>	Frequency in MHz
<i>f_c</i>	Centre frequency
<i>F</i>	Noise factor
<i>f_d, F_d</i>	Doppler Frequency
<i>F_{d3dB}</i>	Doppler Frequency with minimum <i>C/N</i> requirement raised by 3 dB
<i>FER</i>	Frame Error Rate
<i>G</i>	Gain
<i>G_a</i>	Antenna gain
<i>GI</i>	Guard Interval
<i>GPRS</i>	General Packet Radio Service
<i>GSM</i>	Global System for Mobile communications
<i>I</i>	Interfering power
<i>ICI</i>	Intercarrier Interference
<i>J</i>	joule
<i>k</i>	Boltzmann's constant $k = 1,38 \times 10^{-26}$ J/K
<i>K</i>	kelvin
<i>L1, L2, L3, L4</i>	Linearity patterns
<i>L_{GSM}</i>	Insertion loss of the GSM reject filter
<i>LNA</i>	Low Noise Amplifier
<i>MER</i>	Modulation Error Ratio
<i>MFER</i>	MPE-FEC Frame Error Rate
<i>MHz</i>	Megahertz
<i>MPE-FEC</i>	Multi Protocol Encapsulation Forward Error Correction
<i>MPEG-2</i>	Motion Pictures Expert Group, Video compression standard
<i>n, m, N</i>	Channel indexes
<i>NF</i>	Noise figure in dB
<i>NICAM</i>	Additional sound carrier for analogue TV, modulated with a Near Instantaneous Companded Audio Multiplex.
<i>PA</i>	Power Amplifier
<i>PAL, PAL B, PAL G, PAL I, PAL I1</i>	Phase Alternation Line, TV-systems using PAL

PER	Packet Error Ratio
PFP	Picture Failure Point
P_{in}	Input power W
P_{in} (dB(mW))	Input power dB compared to 1 mW
P_{max}	Maximum power
ppm	Parts per million
PSI/SI	Program Specific Information, Service Information
P_{TX}	Transmission power
P_x	Excess noise Power dBc
QAM16, QAM64	Quadrature Amplitude Modulation, 16-level and 64-level versions
QEF	Quasi Error Free
QoS	Quality of Service
QPSK	Quaternary Phase Shift Keying
RF	Radio Frequency
RS	Reed Solomon
Rx	Receiver
S1,S2	Selectivity Patterns
SECAM, SECAM L	Sequential á mémoire, TV-system using SECAM
SFN	Single Frequency Network
SFP	Subjective Failure Point
T	Temperature in kelvin
T_c	Corner point
T_e	Total duration of the gating pulses
t_i	Time of arrival for the i -th signal
TS	Transport Stream
T_g	Guard Interval duration
T_u	Active symbol duration
Tx	Transmitter
UHF	Ultra High Frequency
UMTS	Universal Mobile Telecommunications System
VHF	Very High Frequency
W	watt
WCDMA	Wide-band Code Division Multiple Access
W_i	Weighting coefficient for the i -th component

4 Test conditions

4.1 General test conditions

4.1.1 General

The general test conditions are set out below. Manufacturers should note that the actual conditions of use could be more stringent.

4.1.2 Temperature

The terminal shall be tested in the normal laboratory conditions defined below:

+15 °C to + 35 °C For normal conditions (with relative humidity of 25 % to 75 %)

4.1.3 Voltage

All tests are performed under nominal operating voltage as defined by the manufacturer.

4.2 Terminal categories and summarized measurement conditions

Table 1 shows which conformance measurements are performed with different terminal categories and provides a summary of the measurement conditions.

Table 1 ± Valid conformance measurements for different terminal categories

Clause	Conditions	Terminal category a car terminals	Terminal category b1 portable TVs	Terminal category b2 pocketable TVs	Terminal Category c hand-held convergence terminals
5 C/N performance		Ch 45			
	Gaussian	All modulations, 2k/4k/8k			
	Portable	All modulations, 2k/4k/8k			
	PI / PO	16-QAM 2/3, 3/4, 64-QAM 2/3, <i>GI</i> 1/4, 8k			QPSK 1/2, 2/3, 16-QAM 1/2, 2/3, MPE-FEC 3/4, <i>GI</i> 1/4, 8k
	Mobile	QPSK 1/2, 2/3, 16-QAM 1/2, 2/3, 64-QAM 2/3 <i>GI</i> 1/4, 8k	-	-	QPSK 1/2, 2/3 16-QAM 1/2, 2/3, MPE-FEC 3/4, <i>GI</i> 1/4, 8k
6 Receiver minimum and maximum input signal levels	Minimum and maximum input levels	Ch 21, 45, 64 (UHF), Ch 8, 12 (VHF)			
		QPSK 1/2			
7 Immunity to analogue and/or digital signals in other channels	S1	$N \pm 1$: Ch 45 (UHF), Ch 8 (VHF) with 64-QAM 2/3 additionally Ch 21, 64 (UHF), Ch 5, 12 (VHF). $N \pm 2$: Ch 45 (UHF), Ch 8 (VHF)			
		16-QAM 3/4, 16-QAM 2/3, 16-QAM 1/2, 64-QAM 3/4, 64-QAM 2/3 <i>GI</i> 1/8			
	S2	Ch 45 (UHF), Ch 8 (VHF)			
		QPSK 1/2, 2/3, 16-QAM 1/2, 2/3, 3/4, 64-QAM 2/3, 3/4, <i>GI</i> 1/8			
	L1-L3	Ch 21,45,64 (UHF) Ch 8 (VHF)			
		16-QAM 1/2, 2/3, 3/4, 64-QAM 2/3, <i>GI</i> 1/8, 8k	16-QAM 1/2, 2/3, 3/4, 64-QAM 2/3, <i>GI</i> 1/8, 8k	16-QAM 1/2, 2/3, 3/4, 64-QAM 2/3, <i>GI</i> 1/8, 8k	QPSK 1/2, 2/3, 16-QAM 1/2, 2/3, <i>GI</i> 1/8, 8k
	L4	Ch 43			
		QPSK 1/2, 2/3, 16-QAM 1/2, 2/3, <i>GI</i> 1/8, 8k	QPSK 1/2, 2/3, 16-QAM 1/2, 2/3, <i>GI</i> 1/8, 8k	QPSK 1/2, 2/3, 16-QAM 1/2, 2/3, <i>GI</i> 1/8, 8k	QPSK 1/2, 2/3, 16-QAM 1/2, 2/3, <i>GI</i> 1/8, 8k
8 Immunity to co-channel interference from analogue TV signals		Ch 45 (UHF)			
		16-QAM 1/2, 2/3, 3/4, 64-QAM 2/3, 3/4, <i>GI</i> 1/8			QPSK 1/2, 2/3, 16-QAM 1/2, 2/3, MPE-FEC 3/4, <i>GI</i> 1/4, 8k
9 Guard interval utilization: echoes within guard interval		Ch 45 (UHF)			
		8k, 64-QAM 2/3, <i>GI</i> 1/8 8k, 16-QAM 1/2, <i>GI</i> 1/8			

Clause	Conditions	Terminal category a car terminals	Terminal category b1 portable TVs	Terminal category b2 pocketable TVs	Terminal Category c hand-held convergence terminals
10 Guard interval utilization: echoes outside the guard interval		Ch 45 (UHF)			
		8k, 64-QAM 2/3, <i>GI</i> 1/8 8k, 16-QAM 1/2, <i>GI</i> 1/8 8k, 16-QAM 2/3, <i>GI</i> 1/8			
11 Tolerance to impulse interference		Ch 45 (UHF)			
		8k, 64-QAM 2/3, <i>GI</i> 1/8, 8k 8k, 16-QAM 1/2, <i>GI</i> 1/8, 8k 8k, 16-QAM 2/3, <i>GI</i> 1/8, 8k			
12 GSM900 TX signal blocking test					8k, <i>GI</i> 1/4, QPSK 1/2CR MPE-FEC 3/4, C55
13 Mobile SFN channel test					8k, <i>GI</i> 1/4, 16-QAM 1/2 MPE-FEC 3/4, C45

4.3 Required equipment

The following list gives an overview of the measurement equipment required for the entire set of conformance testing. Capabilities and features of the actual equipment may vary and there could be alternative ways of performing the measurements. Therefore no detailed instructions for various measurements are given and the list of the required equipment is an example.

- 3 DVB-T/H signal sources;
- Wideband noise source;
- 2 PAL/SECAM analogue TV-signal sources;
- Spectrum analyser;
- Channel simulator;
- RF-power meter;
- Impulse noise source;
- MPEG-2 source;
- MPEG-2 decoder;
- DVB-H IP encapsulator;
- MPEG-2 TS player;
- Step attenuators, power dividers, cables and other standard RF-measurement accessories.

4.4 Reference model and test point

The receiver performance is defined according to the reference model shown in Figure 1.

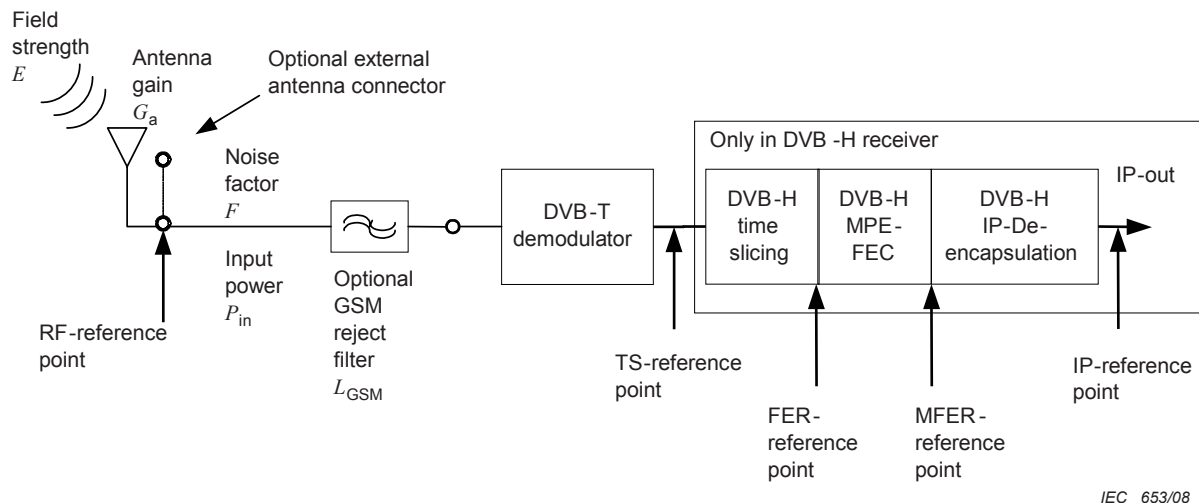


Figure 1 ± Reference model

The receiver performance figures are all specified at the reference point, which is the input of the receiver. All conformance testing is performed at the same point.

In the case where the GSM rejection filter is included (terminal category c), the measurements will be carried out in the front of the GSM rejection filter.

In the case of a DVB-H receiver, the manufacturer shall provide the specified test mode in which the following parameters can be monitored:

- TS-BER after Viterbi decoder,
- TS-PER,
- MPE FER (FER) (Frame Error Rate before MPE-FEC),
- MPE-FEC FER (MFER) (Frame Error rate after MPE-FEC).

4.5 Degradation criteria and resynchronization

Four different degradation criteria are used. The criteria a and b are used in the non-mobile cases for DVB-T. Criterion c is for mobile reception in DVB-T and criterion d for DVB-H reception. A receiver must be able to acquire a degraded signal and a resynchronization test must be done to ensure the C/N or C/I value is valid. Once the degradation criterion is achieved, all receiver input signals are removed for a period of 5 seconds and then re-applied. The same degradation criterion must be achieved within a further 5 seconds. If that is not the case, then the only degradation criterion that can be used for receiver measurement has to be based upon successful signal acquisition.

- a) Reference BER, defined as $BER = 2 \times 10^{-4}$ after Viterbi decoding.

This corresponds to the quasi error free (QEF) criterion in the DVB-T standard, which states: "less than one uncorrected error event per hour". In the stationary reception cases, QEF is equivalent to the reference BER after Viterbi decoding.

- b) Picture failure point (PFP).

The picture failure point is defined as the C/N or C/I value when picture errors become visible. This is preferred if BER measurements are unstable or unavailable. A more objective definition can be made using the ESR₅ (5 % erroneous second ratio) criterion, which allows one erroneous second within the 20 s observation period in the transport stream. Note that the reception quality is poor at picture failure point as one possible error

in each 20 s interval is too much for fixed TV-reception. The criterion is nevertheless suitable for measurements, and a 1 dB to 2 dB carrier power increase will improve the reception quality to QEF level. A useful method to reduce the uncertainty of visual picture failure point is to use the two out of three method. Here 2 out of 3 consecutive 10 s periods must be good (no artefacts), i.e. 1 out of 3 can contain artefacts. More complex M out of N periods can lead to more accurate results but will increase the measurement time. Table 2 shows the correlation between the picture failure point and the reference BER error criterion for various measurements. When the picture failure point is used in the measurement, the measured value can be converted to corresponding reference BER value by using Table 2.

Table 2 ± Delta values between picture failure point and reference BER

Measurement	Delta dB
C/N in Gaussian channel	1,3
Minimum input level	1,3
Immunity to other channels	2,0
Immunity to co-channel	2,0
C/N in portable channels	1,3

c) Subjective failure point in mobile reception SFP

The reference BER , meaning perfect “quality of transmission”, is unfortunately not suitable in the mobile environment due to the fast channel variations. In mobile cases, the reference BER criterion may give unstable values which could result in an underestimation of DVB-T mobile capabilities. Within the motivate project, a subjective quality has been defined, referred to as the subjective failure point (SFP). SFP corresponds to: “on average, one visible error in the video, during an observation period of 20 s”. This corresponds to the ESR_5 (5 % erroneous second ratio, 5 % ESR) criterion, which allows one erroneous second within the 20 s observation period. Thus, the ESR_5 method can be used to measure the SFP.

d) DVB-H error criterion

In DVB-H a suitable degradation criterion is the MPE-FEC frame error rate ($MFER$), referring to the error rate of the time sliced burst protected with the MPE-FEC. As an erroneous frame will destroy the service reception for the whole interval between the bursts, it is appropriate to fix the degradation point to the frequency of lost frames. Obviously the used burst and IP-parameters will affect the final service quality obtained with certain fixed $MFER$, but experience has shown that the behaviour is very steep and a very small change in C/N will result a large change in $MFER$.

$MFER$ is the ratio of the number of erroneous frames (i.e. not recoverable) and total number of received frames. To provide sufficient accuracy, at least 100 frames shall be analysed.

$$MFER = \frac{\text{Number of erroneous frames} \times 100}{\text{Total number of frames}} \text{ in } \%$$

It has been agreed that 5 % $MFER$ is used to mark the degradation point of the DVB-H service. Note that the service reception quality at the 5 % $MFER$ degradation point may not meet the QoS requirement in all cases. The criterion is nevertheless suitable for measurements, and a small 0,5 to 1dB carrier power increase will improve the reception quality to less than 1 % $MFER$.

It is also possible to estimate the $MFER$ with good accuracy without performing the actual MPE-FEC calculation by just observing row by row the number of erroneous bytes and comparing this with the error correction capability of the RS-code used and marking the row erroneous or non-erroneous. If all rows are non-erroneous the frame is non-erroneous.

With this method, it is possible to decode all services (i.e. the whole transport stream) in parallel and shorten the observation time for the 100 frames needed.

In DVB-H receivers with no MPE-FEC, the frame error rate criterion can be used in a slightly different way. A frame is marked as erroneous if any TS-packet within the frame is erroneous. This criterion is called *FER* and degradation point is set to 5 % value. Note that 5 % *FER* may lead to better actual QoS than 5 % *MFER* as in *FER* it is possible that only a few TS-packets within the frame are erroneous, but in *MFER* a non recoverable frame is probably highly corrupted. The actual performance figures with 5 % *FER* are very similar what would be achieved using *ESR₅* criterion to the transport stream directly.

4.6 Definition of *C/N*

C/N is the ratio in dB, of the DVB-T/H signal level to the noise level present in the relevant bandwidth (5,71 MHz, 6,67 MHz or 7,61 MHz).

Example: Measured noise level in 7,61 MHz bandwidth is -70 dB(mW). Measured DVB-T/H signal level is -50 dB(mW). Resulting *C/N* is 20 dB.

4.7 Definition of measurement signals

4.7.1 Wanted DVB-T/H signal and interfering DVB-T signal definition

The DVB-T signal is according to the ETSI EN 300 744.

For DVB-H measurements a set of recorded TS-streams has been generated. There is a separate TS-stream for each of the pre-selected modes of DVB-H. In the streams IPV4 packets are used as payload in the burst. The IP packet length is always fixed 512 bytes. MPE-FEC number of rows is always 512. The TS streams contain several services, but only the first one should be used for physical layer measurements. The other services simulate more practical configuration with higher power saving. The burst cycle time for the measurement service is 1 s.

An example of DVB-H measurement stream is depicted in Figure 2 below.

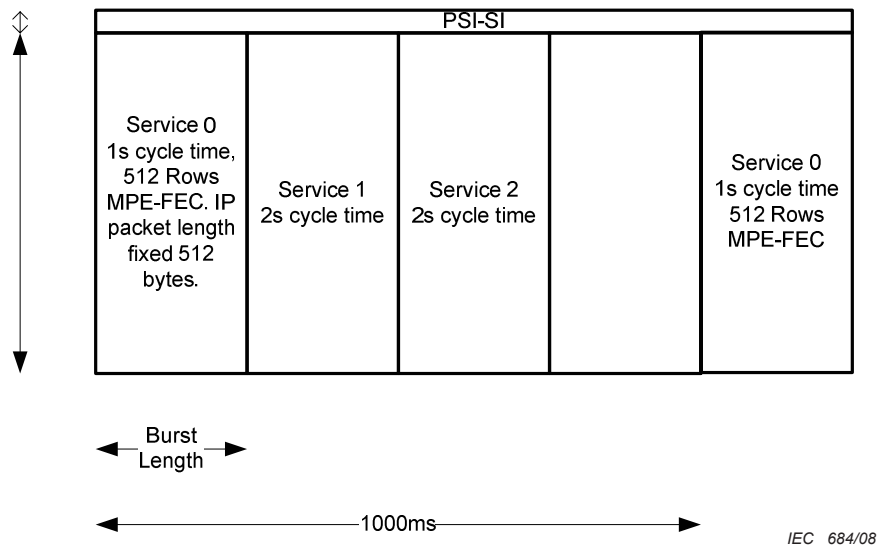


Figure 2 ± DVB-H measurement stream

The measurement streams for the different modes are explained in the Table 3.