COVERING NOTE

RADIOCOMMUNICATION BUREAU - INTERNATIONAL TELECOMMUNICATION UNION

Subject: **Corrigendum**

Geneva, 10 December 2021

Handbook on Digital Terrestrial Television Broadcasting networks and systems implementation

Please replace pages 29, 70, 71, 73 and 104 by the new ones provided here.

ATSC. ATSC standards are a set of standards developed by the Advanced Television Systems Committee for digital television transmission over terrestrial, cable, and satellite networks. ATSC Mobile DTV is an enhancement of the ATSC system to provide multimedia services including video, audio, and interactive data service delivery to small (power efficient) receivers, for fixed, handheld and vehicular environments. The most current ATSC standard, ATSC 3.0, uses COFDM for improved robustness and flexibility, and the multiplex is IP-based rather than using the MPEG Transport Stream. ATSC standards that have been finalised and approved by ATSC can be found on the ATSC website, www.atsc.org.

DTMB. DTMB (Digital Terrestrial Multimedia Broadcast) is a TV standard for mobile and fixed terminals. DTMB system is compatible with fixed reception (indoor and outdoor) and mobile digital terrestrial television. Mobile reception is compatible with standard definition digital TV broadcasting, digital audio broadcasting, multimedia broadcasting and data broadcasting service. Fixed reception in addition to the previous services also supports high definition digital TV broadcasting.

DVB-T. DVB-T is the standard for the broadcast transmission of digital terrestrial television. The system transmits compressed digital audio, digital video and other data in an MPEG-2 transport stream, using COFDM modulation.

DVB-H and **DVB-SH**. These systems are end-to-end broadcast systems for delivery of any types of digital content and services using IP-based mechanisms optimized for devices with limitations on computational resources and battery. They consist of a unidirectional broadcast path that may be combined with a bidirectional mobile cellular (2G/3G) interactivity path. The broadcast path of DVB-SH system uses combined or integrated satellite and terrestrial networks.

DVB-T2. DVB-T2 is a 2nd generation terrestrial broadcast transmission system. The main purpose was to increase capacity, ruggedness and flexibility to the DVB-T system. DVB-T2 Lite is the DVB-T2 profile designed to efficiently deliver TV and radio for and mobile devices such as phones and tablets.

ISDB-T. The ISDB-T family (ISDB-T, ISDB-TSB, ISDB-T multimedia systems) was designed based on the OFDM band-segmented transmission scheme. One OFDM segment corresponds to 1/13 of the bandwidth of a television channel. The number of segments can be chosen in accordance with the available bandwidth and application.

4.4 Broadcast network planning

4.4.1 Basic principles of frequency planning

In a general sense, planning and coordination of DTTB system in MFN or SFN mode follows the same lines and rules as are well known from the procedures of coordination for analogue broadcasting services. However, some of the new features of DTTB system have also an impact on the way the new digital services are to be coordinated.

The allotment approach is often felt as the more appropriate way to describe SFN service areas in coordination procedures, since for an SFN the coverage area is a unique and undividable object, which corresponds in the allotment approach with the envisaged service area.

4.4.2 Planning approaches

4.4.2.1 Assignment planning

In the past, terrestrial television planning (and most other broadcasting) in Europe has been implemented by way of assignment conferences. In assignment planning, a significant amount of individual station planning is needed to prepare for a planning conference.

A4.2.3.5 Scenario 3a: Rooftop reception for limited area MFN, high data rate

The selection of the guard interval in this scenario would be 1/9(55.6 μs), using 3780 sub carriers and code rate 0.6, the constellation is 64-QAM.

Due to the use of multicarrier, this mode is intended to be used in big city or where the channel multipath effect changes quickly depend on the time.

TABLE A4.2.16

DTMB MFN rooftop reception (64-QAM)

Bandwidth:	8 MHz
Sub carriers	3780
PN identification	ON
Pilots	OFF
Time interleaving	720
Guard interval:	1/9 (55.6 μs)
Modulation:	64-QAM
Code rate:	0.6
C/*N* (Rice):	16.6 dB
Resulting data rate:	**24.365 Mbit/s**

A4.2.3.6 Scenario 3b: Rooftop reception for limited area MFN, high data rate

The selection of the guard interval in this scenario would be 1/6(78.7 μs), using single carrier modulation and code rate 0.8, the constellation is 32-QAM.

Due to the use of single, this mode is intended to be used in wide open area or where the channel multipath effect changes slowly depend on the time.

TABLE A4.2.17

DTMB MFN rooftop reception (32-QAM)

Bandwidth:	8 MHz
Sub carriers	1
PN identification	OFF
Pilots	OFF
Time interleaving	720
Guard interval:	1/6(78.7 μs)
Modulation:	32-QAM
Code rate:	0.8
C/*N* (Rice):	16.6 dB
Resulting data rate:	**25.989 Mbit/s**

A4.2.3.7 Scenario 4: MFN/SFN rooftop reception, moderate data rate, high robust

Due to results from DTMB field trials, for moderate coverage and high robust rooftop reception, there are two operation parameters choices. The parameters for these two modes are quite difference, from the sub carriers, code rate, constellation and guard interval. These two modes have similar payload bit rate.

A4.2.3.8 Scenario 4a: Rooftop reception for limited area MFN/SFN

The selection of the guard interval in this scenario would be 1/9(55.6 µs), using 3780 sub carriers and code rate 0.8, the constellation is 16-QAM.

Due to the use of multicarrier, this mode is intended to be used in big city or where the channel multipath effect changes quickly depend on the time.

TABLE A4.2.18

DTMB MFN/SFN rooftop reception (*GI* 55.6 µs)

Bandwidth:	8 MHz
Sub carriers	3780
PN identification	ON
Pilots	OFF
Time interleaving	720
Guard interval:	1/9 (55.6 µs)
Modulation:	16-QAM
Code rate:	0.8
C/*N* (Rice):	14.0 dB
Resulting data rate:	**21.658 Mbit/s**

A4.2.3.9 Scenario 4b: Rooftop reception for limited area MFN/SFN

The selection of the guard interval in this scenario would be 1/6(78.7 µs), using single carrier modulation and code rate 0.8, the constellation is 16-QAM.

Due to the use of single, this mode is intended to be used in wide open area or where the channel multipath effect changes slowly depend on the time.

TABLE A4.2.19

DTMB MFN/SFN rooftop reception (*GI* 78.7 µs)

Bandwidth:	8 MHz
Sub carriers	1
PN identification	OFF
Pilots	OFF
Time interleaving	720
Guard interval:	1/6(78.7 µs)
Modulation:	16-QAM
Code rate:	0.8
C/*N* (Rice):	13.3 dB
Resulting data rate:	**20.791 Mbit/s**

A4.2.3.12 Scenario 7: mobile reception (moderate coverage area, high robust)

The selection of the guard interval in this scenario would be 1/6(78.7 µs), using single carrier modulation and code rate 0.8, the constellation is 4-QAM. Due to the use of 4-QAM constellation, this mode can also support mobile reception.

TABLE A4.2.22

DTMB mobile reception (moderate coverage, high robust)

Bandwidth:	8 MHz
Sub carriers	1
PN identification	OFF
Pilots	OFF
Time interleaving	720
Guard interval:	1/6(78.7 µs)
Modulation:	4-QAM
Code rate:	0.8
C/*N* (Rice):	6.5 dB
Resulting data rate:	**10.396 Mbit/s**

A4.2.4 ATSC implementation scenarios

ATSC utilizes the 8-VSB transmission technology (an 8-level single-carrier high-data-rate amplitude-modulated suppressed-carrier vestigial sideband signal). The terrestrial broadcast mode supports one DTV signal in a single 6 MHz channel. The parameters for the 8-VSB terrestrial transmission mode are shown in Table A4.2.23.

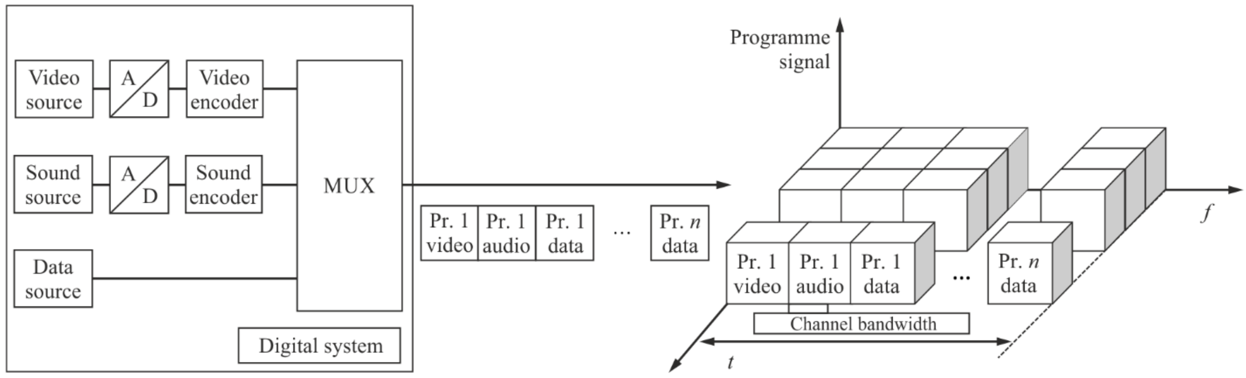
TABLE A4.2.23

Parameters for the 8-VSB Terrestrial Transmission Mode

Parameter	Terrestrial Mode
Channel bandwidth	6 MHz
Guard bandwidth	11.5 percent
Symbol rate	10.76… Msymbols/s
Bits per symbol	3
Trellis FEC	2/3 rate
Reed-Solomon FEC	T = 10 (207,187)
Segment length	832 symbols
Segment sync	4 symbols per segment
Frame sync	1 per 313 segments
Analogue co-channel rejection	Analogue rejection filter in receiver
Pilot power contribution	0.3 dB
C/*N* threshold	~ 14.9 dB
Payload data rate	**19.39 Mbit/s**

FIGURE 9.2

Principle of multi-programme transmission in digital broadcasting systems



DTTB-09-02

It became possible to provide simultaneous transmission of multiple programmes' components by the use of digital signal processing techniques, digital telecommunication technologies and, particularly, data reduction methods based on redundancy specific for certain type of media (e.g. visual redundancy, psychoacoustic redundancy and statistical redundancy). Combined use of all these technologies made possible the increasingly efficient use of the radio spectrum and thus a significant reduction of the channel capacity required for information transmission.

9.1.1.2 Service multiplex methods

In DTTB, one or more digital multiplexes may carry a number of television services, each comprised of one or more video components, one or more audio components, and optionally other components such as ancillary data. It is also necessary to transmit additional data that enables the user equipment to locate the service of interest (and the components of interest within that service), and to enable the user equipment to create a suitable navigation environment for user-friendly access to the available digital services.

Service multiplexing can be implemented using structured transmission (fixed assigned method), packet transferring (variable assigned method), or a combination of both. Such approaches have significant advantages for various service implementations.

Fixed and variable length packet multiplexing. The overall system multiplexing approach can be thought of as a combination of multiplexing at two different layers. In the first layer (programme layer), single programme bit streams are formed by multiplexing packets from one or more elementary bit streams (Figure 9.3), and in the second layer (transport layer), a number of single programme bit streams are combined to form one or more transport stream(s).

At the source encoder output (video and audio encoders) information is organized as series of a separated streams, called Elementary Streams (ES) (Figure 9.3).