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Technical Specification

Digital Radio Mondiale (DRM); AMSS Distribution Interface (ASDI)

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Foreword

This Technical Specification (TS) 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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Introduction

The frequency bands used for broadcasting below 30 MHz are:

- Low Frequency (LF) band - from 148,5 KHz to 283,5 KHz, in ITU Region 1 [1] only;
- Medium Frequency (MF) band - from 526,5 KHz to 1 606,5 KHz, in ITU Regions 1 [1] and 3 [1] and from 525 KHz to 1 705 KHz in ITU Region 2 [1];
- High Frequency (HF) bands - a set of individual broadcasting bands in the frequency range 2,3 MHz to 27 MHz, generally available on a Worldwide basis.

These bands offer unique propagation capabilities that permit the achievement of:

- large coverage areas, whose size and location may be dependent upon the time of day, season of the year or period in the (approximately) 11 year sunspot cycle;
- portable and mobile reception with relatively little impairment caused by the environment surrounding the receiver.

There is thus a desire to continue broadcasting in these bands, perhaps especially in the case of international broadcasting where the HF bands offer the only reception possibilities which do not also involve the use of local repeater stations.

However, broadcasting services in these bands:

- use analogue techniques;
- are subject to limited quality;
- are subject to considerable interference as a result of the long-distance propagation mechanisms which prevail in this part of the frequency spectrum and the large number of users.

As a direct result of the above considerations, there is a desire to effect a transfer to digital transmission and reception techniques in order to provide the increase in quality which is needed to retain listeners who, increasingly, have a wide variety of other programme reception media possibilities, usually already offering higher quality and reliability.

In order to meet the need for a digital transmission system suitable for use in all of the bands below 30 MHz, the Digital Radio Mondiale (DRM) [2] consortium was formed in early 1998. The DRM consortium is a non-profit making body which seeks to develop and promote the use of the DRM system worldwide. Its members include broadcasters, network providers, receiver and transmitter manufacturers and research institutes. More information is available from their website (http://www.drm.org/).

The AM Signalling System (AMSS) [3] adds a limited amount of service information to analogue broadcasts in the frequency bands below 30 MHz in a complementary way to the Digital Radio Mondiale (DRM) system. It is intended to be used by broadcasters in the transition to all digital transmission by providing labelling and frequency information for a better user experience.

1 Scope

The present document gives the specification of the link between an AMSS generator and an AMSS modulator.

2 References

References are either specific (identified by date of publication and/or edition number or version number) or non-specific.

- For a specific reference, subsequent revisions do not apply.
- Non-specific reference may be made only to a complete document or a part thereof and only in the following cases:
  - if it is accepted that it will be possible to use all future changes of the referenced document for the purposes of the referring document;
  - for informative references.

Referenced documents which are not found to be publicly available in the expected location might be found at http://docbox.etsi.org/Reference.

For online referenced documents, information sufficient to identify and locate the source shall be provided. Preferably, the primary source of the referenced document should be cited, in order to ensure traceability. Furthermore, the reference should, as far as possible, remain valid for the expected life of the document. The reference shall include the method of access to the referenced document and the full network address, with the same punctuation and use of upper case and lower case letters.

NOTE: While any hyperlinks included in this clause were valid at the time of publication ETSI cannot guarantee their long term validity.

2.1 Normative references

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

[1] ITU-R Radio Regulations.

[2] ETSI ES 201 980: "Digital Radio Mondiale (DRM); System Specification".

[3] ETSI TS 102 386: "Digital Radio Mondiale (DRM); AM Signalling System (AMSS)".

[4] ETSI TS 102 820: "Digital Radio Mondiale (DRM); Multiplex Distribution Interface (MDI)".

[5] ETSI TS 102 821: "Digital Radio Mondiale (DRM); Distribution and Communications Protocol (DCP)".

[6] ETSI TS 102 358: "Digital Radio Mondiale (DRM); Specific Restrictions for the use of the Distribution and Communication Protocol (DCP)".

2.2 Informative references

The following referenced documents are not essential to the use of the present document but they assist the user with regard to a particular subject area**.** For non-specific references, the latest version of the referenced document (including any amendments) applies.

Not applicable.

3 Definitions, symbols, abbreviations and conventions

3.1 Definitions

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

Alternative Frequency Signalling (AFS): feature of the DRM multiplex which allows receivers to automatically re-tune to a frequency offering more reliable reception without a break in the decoded audio

AMSS block: 47 bits containing AMSS data

AMSS group: 94 bits consisting of the two types of AMSS blocks, Block 1 and Block 2

byte: collection of 8 bits

Coordinated Universal Time (literally Universel Temps Coordonné) (UTC): time format counting in standard SI seconds with periodic adjustments made by the addition (or removal) of leap seconds to keep the difference between UTC and Astronomical Time less than ±0,9 s

NOTE: TAI and UTC were defined as having an initial offset of 10 s on January 1st 1972 (TAI prior to this date had a variable fractional offset to UTC as the two times did not use the same definition of the second). As at November 2007 there have been 23 leap seconds, all positive, making TAI = UTC + 33.

Data Entity Group: collection of DRM SDC data entities, protected by a 16-bit Cyclic Redundancy Check

Distribution and Communication Protocol (DCP): transport layer communications protocol providing fragmentation, addressing and/or reliable data transmission over errored channels using a Reed Solomon code to provide Forward Error Correction (FEC)

dynamic information: AMSS information that cannot be sensibly cached by an AMSS modulator for later transmission because it would be out of date, for example the time and date

Global Position System (GPS): constellation of satellites providing accurate time and position information to receivers

GPS Time: time signal broadcast by the GPS satellites using an epoch of January 6th 1980 with no leap seconds and a "week number" (actually a modulo-604 800 seconds number) that wraps every 1 024 weeks (approximately 19,7 years)

Greenwich Mean Time (GMT): historically the standard time for all international applications, now superseded by UTC

International Atomic Time (literally Temps Atomique International) (TAI): time format counting in standard SI seconds

NOTE: TAI and GPS Time have a constant offset of 19 s.

Modified Julian Date (MJD): date format based on the number of days since midnight GMT on 17th November 1858 AD

NOTE: Time can be represented as a fraction of a day, however as MJD is subject to leap seconds, the fractional part corresponding to an SI second is of variable size and hence complex to implement in a fixed width bit-field.

Multi-Frequency Network (MFN): network of transmitters serving a large geographic area using different radio frequencies to achieve improved reliability of reception

Offset Word: sequence of bits applied to a Cyclic Redundancy Check which breaks the cyclic property of the check and allows an AMSS receiver to perform Block synchronization

SDC Data Entity: part of the SDC which contains a specific type of information such as alternative frequency or region information

Service Description Channel (SDC): channel within the DRM multiplex that gives information necessary to decode the services included in the multiplex.

Single Frequency Network (SFN): network of transmitters sharing the same radio frequency to cover an area

static information: AMSS information that could be cached by an AMSS modulator for later transmission as it is generally static in nature such as the service label or the language

TAG Item: DCP elemental type combining in a single logical data the name, length and value of the data

TAG Name: name field within an individual TAG Item used to identify an individual piece of information

TAG Packet: collection of TAG Items with a header carrying a cohesive and self-contained block of data

TAG Value: payload of a TAG Item

3.2 Symbols

For the purposes of the present document, the following symbols apply:

n	An item that can be repeated multiple, *n*, times

3.3 Abbreviations

For the purposes of the present document, the following abbreviations apply:

AFS	Alternative Frequency Signalling
AM	Amplitude Modulation
AMSS	AM Signalling System
ASDI	AMSS Distribution Interface
BOOTP	BOOT Protocol
CRC	Cyclic Redundancy Check
DCP	Distribution and Communication Protocol
DEG	Data Entity Group
DHCP	Dynamic Host Configuration Protocol
DRM	Digital Radio Mondiale
FEC	Forward Error Correction
GMT	Greenwich Mean Time
GPS	Global Positioning System
HF	High Frequency
IP	Internet Protocol
LF	Low Frequency
LSb	Least Significant bit
MDI	Multiplex Distribution Interface
MF	Medium Frequency
MFN	Multi-Frequency Network
MJD	Modified Julian Date
MSb	Most Significant bit
RF	Radio Frequency
rfu	reserved for future use
SDC	Service Description Channel
SFN	Single Frequency Network
SMFN	Synchronized Multi-Frequency Network
TAG	Tag, Length, Value
TAI	International Atomic Time (Temps Atomique International)
UDP	User Datagram Protocol
UTC	Coordinated Universal Time (Universel Temps Coordonné)

3.4 Conventions

The order of bits and bytes within each description shall use the following notation unless otherwise stated:

- in figures, the bit or byte shown in the left hand position is considered to be first;
- in tables, the bit or byte shown in the left hand position is considered to be first;
- in byte fields, the Most Significant bit (MSb) is considered to be first and denoted by the higher number. For example, the MSb of a single byte is denoted "b7" and the Least Significant bit (LSb) is denoted "b0";
- in vectors (mathematical expressions), the bit with the lowest index is considered to be first.

4 General description

The AM Signalling System (AMSS) [3] adds a limited amount of service information to analogue broadcasts in the frequency bands below 30 MHz in a complementary way to the Digital Radio Mondiale (DRM) [2] system. It is intended to be used by broadcasters in the transition to all digital transmission by providing labelling and frequency information for a better user experience.

4.1 System overview

The AMSS Distribution Interface (ASDI) carries a complete description of the AMSS information to be broadcast from the equipment generating the data (the AMSS generator) to the equipment generating an analogue representation of the AMSS data as phase modulation of an AM carrier (the AMSS modulator). It does this in such a way that reliable networks of transmitters (MFN, SMFN and SFN) can be constructed. Typically the AMSS generator will be sited at the studio centre, although some systems may locate it at the transmitter. The AMSS modulator will almost invariably be located at the transmitter site, and in many networks, several such sites will combine to form a comprehensive network using one or more RF channels.

The ASDI supports Single Frequency Network operation through the provision of timing information that indicates the precise time of emission of each AMSS block.

4.2 System architecture

The protocol stack provided by the Distribution and Communication Protocols (TS 102 821 [5]) is described in figure 1. The AMSS Distribution Interface as described in the present document builds upon the DCP stack, defining the TAG Items to be used and the format of the data carried. The result is a collection of TAG Items which can be carried in a single TAG Packet and which together contain all the data necessary for the AMSS modulator to produce one or more AMSS blocks. When carrying TAG Items conforming to the present document, a TAG Packet is known as an ASDI Packet.

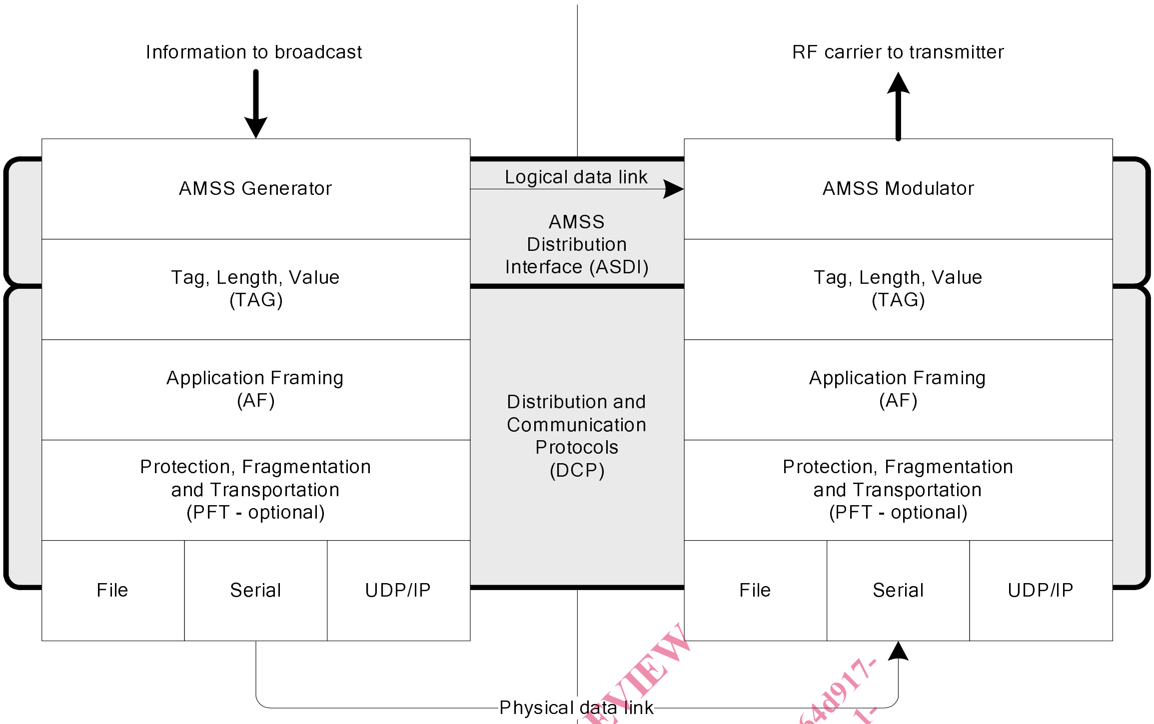

Figure 1: ASDI and DCP protocol stack

The basic structure of a TAG Packet and the TAG Items it contains is described in TS 102 821 [5].

5 TAG Items

Each ASDI Packet consists of a number of TAG Items where each TAG Item carries a single piece of information. When combined, the TAG Items describe one or more AMSS blocks to be transmitted and information about how the data may be cached.

Within a single ASDI Packet, each TAG Name shall be unique. No TAG Name may occur multiple times within a single ASDI Packet.

Mandatory TAG Items shall be supported by every ASDI implementation, although not every Mandatory TAG Item will appear in every ASDI Packet unless stated in the descriptions below.

The ASDI also defines additional TAG Items which may be supported by some implementations - these are known as optional TAG Items and extend the basic ASDI implementation. These TAG Items should be ignored without error by equipment not supporting the appropriate feature(s), in the same way as all TAG Items with unknown TAG Names.

Additional proprietary TAG Items may be supported by individual implementations but do not form part of the ASDI specification and should be ignored without error by equipment not recognizing the TAG Name. No ASDI conformant equipment shall produce or require any additional information other than as described in the present document in order to work according to the AMSS specification (ETSI TS 102 386 [3]).

All DRM-specific restrictions for the use of DCP (ETSI TS 102 358 [6]) shall also apply to the ASDI.