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Technical Specification

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

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Contents

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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.

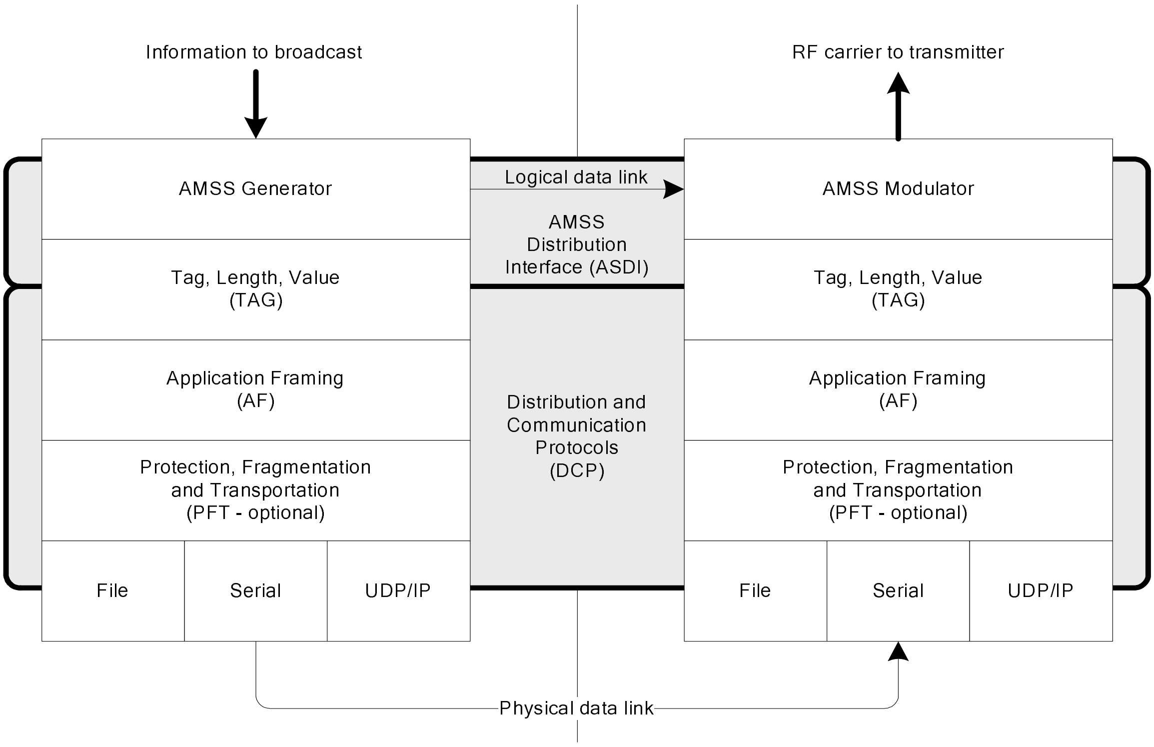

Figure 1: ASDI and DCP protocol stack

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.

5.1 Mandatory TAG Items

Every ASDI Implementation shall support the TAG Items detailed in table 1.

Table 1: Mandatory TAG Items

TAG Name (ASCII)	TAG Length (bits)	TAG Value
*ptr	64	Control TAG Item "Protocol Type and Revision"; see the DCP definition (TS 102 821 [5]) for format and interpretation details
assn	32	ASDI sequence number that identifies a single ASDI packet
ablk	0 or 48*n*	The data for each of *n* 47 bit AMSS blocks
arst	56	Asynchronous reset that returns the AMSS modulator to its "default" state

5.1.1 Protocol type and revision (*ptr)

This TAG Item shall be included in every ASDI Packet.

TAG Name				*TAG Length*				*TAG Value*							
ASCII "*ptr"				64 bits				Protocol				Major		Minor	
*	p	t	r	00_{16}	00_{16}	00_{16}	40_{16}	A	S	D	I	00_{16}	00_{16}	00_{16}	00_{16}
4 bytes				4 bytes				8 bytes							

Figure 2: Protocol type and revision

Protocol: ASCII string "ASDI" (AMSS Distribution Interface).

Major revision: currently 0 000_{16}.

Minor revision: currently 0 000_{16}.

For further information on the revision numbering, refer to clause 5.3.

5.1.2 ASDI Sequence Number (assn)

This TAG Item shall be included in every ASDI Packet.

TAG Name				*TAG Length*				*TAG Value*
ASCII "assn"				32 bits				ASDI Sequence Number
a	s	s	n	00_{16}	00_{16}	00_{16}	20_{16}	00000000_{16} … $FFFFFFFF_{16}$
4 bytes				4 bytes				4 bytes

Figure 3: ASDI sequence number

ASDI Sequence Number: This value shall be incremented by one by the device generating the ASDI packets for each ASDI TAG Packet sent from one ASDI Generator to one AMSS modulator. In the event that the maximum value (FF FFF FFF_{16}) is reached, the value shall reset to zero (00 000 000_{16}) afterwards.

An increase in the sequence number means that the contents of that TAG Packet shall be transmitted after the current data has been fully sent.

The sequence number can be used by the receiver to determine whether packets have been received out of order. It can also be used to detect lost ASDI packets. If a suitable link exists, re-transmission of the packet can be requested or the AMSS modulator can revert to local, default data to cover the gap if appropriate.

Identical ASDI TAG Packets can be re-sent with the same sequence number, in which case the AMSS modulator would just ignore the duplicate.

The sequence number may be initialized to a pseudo random number by the ASDI Generator.

5.1.3 AMSS block (ablk)

This TAG Item shall be included in every ASDI Packet.

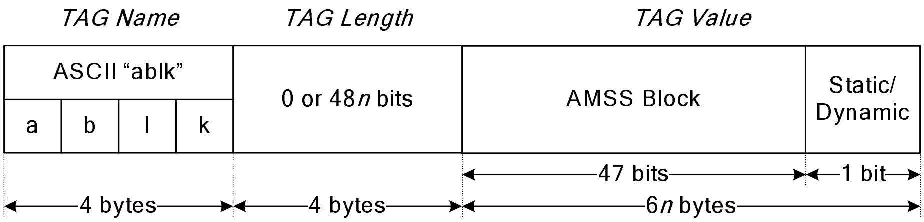

Figure 4: AMSS block

The following fields can be repeated multiple, *n*, times within the TAG Item's TAG Value section in order to send multiple AMSS blocks:

AMSS block: The 47 bits which make up the actual AMSS block (type 1 or type 2)

Static/Dynamic: Indicates whether the AMSS block specified by the previous 47 bits is static information or dynamic information. Values: 0 = Static; 1 = Dynamic.

NOTE 1: Complete AMSS groups (see annex A) are either static or dynamic, i.e. if the Block 1 of an AMSS group is signalled as dynamic, the Block 2 in the same group will also be signalled as dynamic. However, the two Blocks forming one AMSS group may be carried in successive ASDI Packets.

When it is required to mute the output of the AMSS modulator, empty "ablk" TAG Items should continue to be sent at the correct rate but the TAG should have no value (i.e. $n = 0$) and thus the TAG length should be set to "0".

NOTE 2: A modulator supporting ASDI profile A cannot tell from the signalling in the "ablk" TAG Item whether a given AMSS block is an AMSS Block 1 or an AMSS Block 2. Whilst this does not impact on the operation of the modulator (since it is simply required to transmit any incoming AMSS data verbatim), manufacturers might wish to indicate which AMSS block is currently being transmitted to give the user confidence that the modulator is operating correctly. Should this be required, the modulator can carry out the same steps as an AMSS receiver performs to distinguish between the two types of Block, namely by application of the standard AMSS offset word and testing of the AMSS block CRC as defined in the AMSS specification (ES 201 980 [2]).

5.1.4 ASDI asynchronous reset (arst)

This TAG Item is optional within an ASDI TAG Packet.

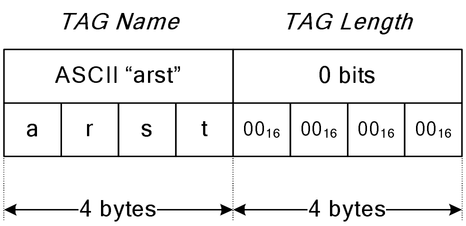

Figure 5: ASDI reset

On reception of this TAG, the AMSS modulator is reset to its default state; the input buffer shall be cleared and its output muted (no phase modulation). An "ablk" TAG Item carried in the same TAG Packet conveys the data to transmit immediately following the reset. An empty "ablk" TAG Item indicates that the modulator shall mute following the reset.

The TAG Item provides an asynchronous reset mechanism. Since AMSS modulator implementations are likely to include some form of circular ASDI input buffer, there is likely to be a delay between reception of a TAG Item and the decoding of its contents. AMSS modulators shall therefore check incoming ASDI TAG Packets immediately upon reception (i.e. before being placed into any circular buffer) for the presence of an "arst" TAG Item and reset immediately.

5.2 Optional TAG Items

Every ASDI implementation may choose to support the following optional TAG Items. Where one or more of the optional TAG Items are supported, they shall behave as described below. When not supported by an implementation, the presence of these TAG Items shall be ignored.

NOTE: Manufacturers should state clearly which optional TAG Items are supported by their implementation.

Table 2: Optional TAG Items

TAG Name (ASCII)	TAG Length (bits)	TAG Value
atst	64	Specifies the point in time at which the first bit of the first AMSS block within the "ablk" TAG Item should be emitted

5.2.1 ASDI timestamp (atst)

This TAG Item is optional within an ASDI TAG Packet. See Annex D for more information on the ASDI timestamp.

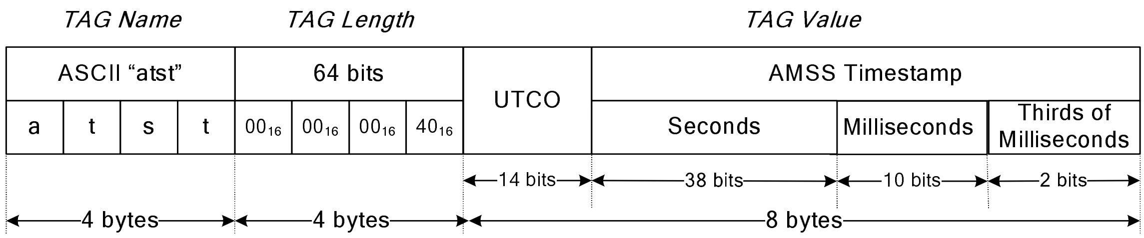

Figure 6: ASDI timestamp

UTCO: the offset (in seconds) between UTC and the Seconds value. The value is expressed as an unsigned 14-bit quantity. As of 2000-01-01 T 00:00:00 UTC, the value shall be zero and shall change accordingly as a result of each leap second introduced or removed from UTC. The value contained in this field shall have no effect on the time of emission from the modulator.

Seconds: the number of SI seconds since 2000-01-01 T 00:00:00 UTC as an unsigned 38-bit quantity.

Milliseconds: the number of milliseconds (1/1 000th of an SI second) since the time expressed in the Seconds field. The value is expressed as an unsigned 10-bit quantity. The values 1 000 to 1 023 inclusive are reserved for future use.

Thirds of Milliseconds: the number of thirds of milliseconds since the time expressed by the Seconds and Milliseconds field taken together. The value is expressed as a 2-bit quantity as shown in table 3. The value 3 is reserved for future use.

Table 3: Interpretation of thirds of milliseconds field

Thirds of Milliseconds field value	Meaning
0	Zero (no) thirds of milliseconds (0)
1	One third of a millisecond (⅓)
2	Two thirds of a millisecond (⅔)
3	Reserved for future use

ASDI Timestamp: taken together, the Seconds, Milliseconds and Thirds of Milliseconds values produce the ASDI Timestamp value that defines the time of emission of the first AMSS block of the "ablk" TAG Item within the same TAG Packet. It specifies the time of the first zero crossing of the first bi-phase bit of the Block. This is illustrated in figure 7. The chosen bit-widths allow the ASDI Timestamp to represent uniquely any date/time from 2 000 AD until approximately 8 700 AD with a resolution of ⅓ millisecond. Conversion between the ASDI Timestamp and other standard time references is outlined in annex B. The time period of a complete 47 bit AMSS block is 1 002 ⅔ ms.

NOTE: The binary value of the combined ASDI Timestamp field does not increase uniformly due to the modulo-1 000 milliseconds count.

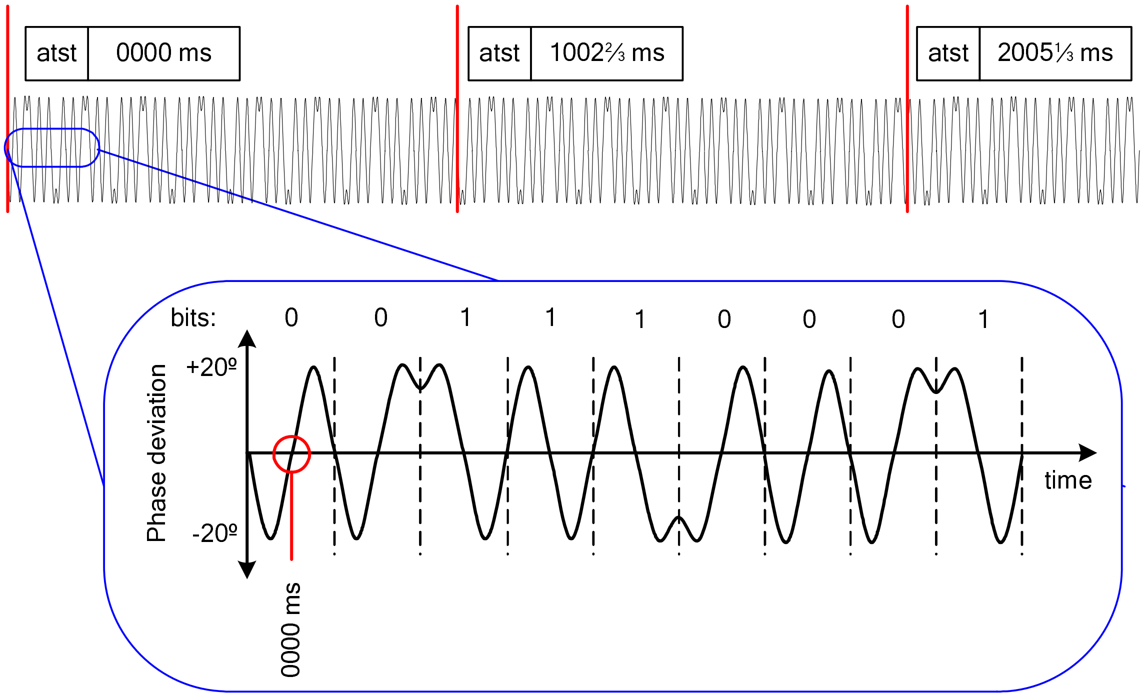

Figure 7: Time of emission specified by the ASDI Timestamp

It is the responsibility of the AMSS generator to allow sufficient time when encoding this value to enable the slowest transmission path to deliver the data before it is required by the AMSS modulator. All modulators supporting this TAG Item shall provide at least ten seconds of buffering of ASDI Packets.

AMSS modulators that support this TAG Item should also allow the user to input a fixed time offset so that the point at which the AMSS data from transmitters within a SFN is synchronized can be adjusted.

5.3 Revision history

Table 4 contains the history of the TAG Item changes of the ASDI Protocol for each new revision.

Table 4: Revision history

Major revision	Minor revision	Date	Changes from previous to new revision
0 000_{16}	0 000_{16}	2008-02-06	Initial revision

Changes to the protocol which will allow existing decoders to still function will be represented by an increment of the minor version number only. Any new features added by the change will obviously not need to be supported by older AMSS modulators. Existing TAG Items will not be altered except for the definition of bits previously declared rfu. New TAG Items may be added.

Changes to the protocol which will render previous implementations unable to correctly process the new format will be represented by an increment of the major version number. Older implementations should not attempt to decode such ASDI TAG Packets. Changes may include modification to or removal of existing TAG Item definitions.

Annex A (informative): AMSS data structure

AMSS is based on 94 bit Groups. A Group is made up of two types of block referred to as "Block 1" and "Block 2". Each individual block takes 1 002 ⅔ ms to be transmitted which equates to a bit rate of 46,875 bit/s. Block 2 carries 4-byte segments of DRM SDC entities [2] packaged into a Data Entity Group (DEG) [3]. Block 1 signals the service ID, the language, the type of carrier control and the number of Block 2 segments that make up the complete DEG. This is illustrated in figure A.1.

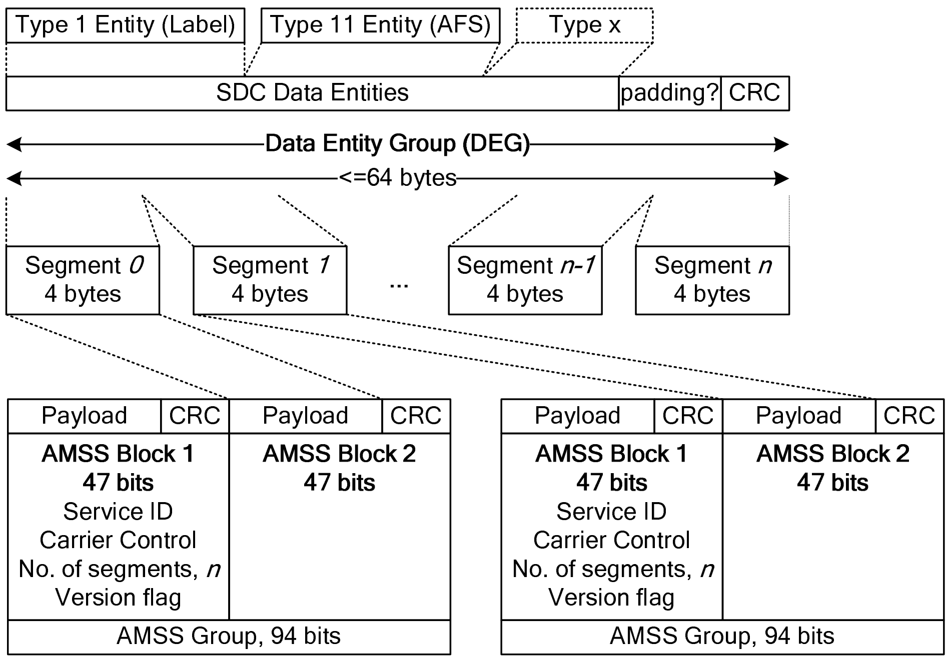

Figure A.1: The AMSS block and Data Entity Group structure

Annex B (normative): ASDI Profiles

The definition of ASDI Profiles is a convenient way to clearly indicate which functionality is provided by a specific ASDI implementation.

The available profiles are defined in table B.1.

Table B.1: ASDI Profiles

Profile	Supported TAG Items	Description	SFN Capability?
A	*ptr, ablk, assn, arst	AMSS blocks are carried and transmitted verbatim without any caching	Yes, when optional atst TAG tem supported

Manufacturers shall state which ASDI Profile their product supports and state whether it is capable of operating in a SFN by supporting the "atst" TAG Item.

Additional profiles with extended functionality may be defined in the future. For example AMSS data such as alternative frequencies and service labels will not change very often. Where this is the case it would be possible for the modulator to cache such information and to continue transmission of this AMSS data in the event that the ASDI link is lost.

Annex C (normative): Muting Mechanism

C.1 Muting

When it is required to mute the output of the AMSS modulator, "ablk" TAG Items should continue to be sent by the ASDI Generator at the same rate as before but their TAG value should be of zero length (a so-called "empty" TAG Item).

Since the AMSS modulator is likely to have an input buffer for the ASDI, there will be a delay between the sending of an empty "ablk" TAG Item and it being decoded and obeyed by an AMSS modulator. This will also be true when time stamps are in use controlling the precise time of emission of each AMSS block. To initiate an immediate (asynchronous) muting of the modulator a TAG Packet containing an "arst" TAG Item should be sent. This should be interpreted as soon as it is received by the ASDI modulator, ahead of any other TAG Packets in its ASDI input buffer.

If an AMSS modulator is currently muting and the ASDI data link is lost, the AMSS modulator shall continue to mute until explicitly instructed otherwise (by whatever means, e.g. by reception of non-empty ablk TAG Items).

Annex D (informative): ASDI Timestamps

The ASDI Timestamp follows the definition of the DRM Timestamp defined by the MDI [4].

D.1 Relationships

The relationships between UTC, TAI, GPS Time and ASDI Timestamp (as defined in clause 5.2.2) are, as of November 2007, as follows:

- GPS = TAI - 19 s (constant);
- UTC = TAI - 33 s (variable due to leap seconds);
- UTC = GPS - 14 s (variable due to leap seconds);
- UTC = ASDI - UTCO (constant due to varying value of UTCO);
- ASDI = TAI - 32 s (constant);
- ASDI = GPS - 13 s (constant);
- ASDI = UTC + UTCO (constant due to varying value of UTCO).

D.2 Rationale

Several other standard time/date encodings are in common use, including MJD, UTC, GPS and TAI. It was agreed that none of these adequately addressed the needs of an AMSS system and that it was desirable to define a time format specifically for the ASDI Timestamp. The following reasons were given for rejecting other common timebases:

- MJD is subject to leap seconds making the fractional portion very hard to represent in a fixed-point format;
- UTC is subject to leap seconds making the number of seconds in a day variable (86 399 / 86 400 / 86 401);
- GPS Time is subject to "week number wrapping" approximately every 19,7 years;
- UTC, TAI, MJD and GPS Time all have epochs (start dates) partway through the 400-year leap-year cycle.

The ASDI Timestamp is not subject to leap seconds but contains sufficient extra information (in the UTCO field) to trivially convert the value to UTC which does include leap-seconds. Conversion to GPS Time and/or TAI is also trivial, simply involving the subtraction of a constant value. The epoch for ASDI Time is synchronized with the start of a 400-year leap-year cycle, making leap-year calculations simpler and less error prone.

Annex E (normative): Physical presentation

The DCP (TS 102 821 [5]) allows almost any physical interface to be used.

All ASDI applications shall provide a UDP/IP interface using twisted-pair Ethernet (10Base-T or better). The parameters for the IP stack shall be manually configurable. Automatic configuration using DHCP, BOOTP or similar may also be provided.

Optionally RS232 interfaces may be provided.

Further optional interfaces may also be included in later revisions.

A detailed specification of the parameters and hardware of the interface types listed above is provided in TS 102 358 [6].

History

Document history		
V1.1.1	October 2008	Publication