RECOMMENDATION ITU-R BS.706-2*

Data system in monophonic AM sound broadcasting (AMDS)

(l990-1992-1998)

The ITU Radiocommunication Assembly,

considering

a) the growing interest for a data transmission system for AM broadcasting and its applications;

b) that it is desirable to have one system applicable to all AM broadcasting bands and that the future introduction of SSB in HF and of synchronous detection should be taken into account;

c) that existing systems cannot be implemented on single-sideband (SSB) transmission in band 7 (HF);

d) that certain applications of an AM data transmission system could correspond to similar features in the FM radio data system (RDS), as defined in Recommendation ITU-R BS.643, taking account of the lower bit rate available;

e) that the design of such a system should take into account the mass production of receivers;

f) that data signals can be added to existing AM broadcast transmissions in such a way that they are inaudible, thus achieving good compatibility with reception of the normal monophonic sound programme signals,

recommends

1 that a system for data transmission in AM broadcasting (AMDS) should fulfil the requirements listed in Annex 1;

2 that since a system is not available for SSB in band 7 (HF) and for AM-Stereo in band 6 (MF) a system for data transmission in AM-DSB broadcasting bands 5 (LF), 6 (MF) and 7 (HF) shall fulfil the requirements listed in Annex 1 and shall comply with the minimum specification listed in Annex 2.

NOTE 1 – Information regarding operational or projected systems is given in Annex 3.

---

* Radiocommunication Study Group 6 made editorial amendments to this Recommendation in 2002 in accordance with Resolution ITU-R 44.

ANNEX 1

Requirements for an AM radio-data transmission system

1 Compatibility aspects

1.1 Compatibility with the main programme

The supplementary data system must be compatible with the main audio programme under all operational conditions including:

– transmitters operated with energy-saving carrier-control techniques;

– synchronized networks of transmitters;

– SSB transmissions (if the introduction of an AM data system in HF broadcasting is feasible);

– transmitters which are used as a high stability frequency reference;

– mobile reception and, where necessary, reception with a stereophonic AM receiver in band 6 (MF).

1.2 Compatibility with other programmes in co- or adjacent channels

The protection ratios used in planning should not be affected, i.e. no additional interference should be caused to the audio programme signal by the data signals.

2 Reliability of data reception

The area in which the data signal can be reliably received, should be at least as large as that where the main programme service for ground- and sky-wave propagation conditions is provided.

3 Applications

Because of the low data-rate which is expected to be available in an AM radio-data system, it may not be feasible to support simultaneously more than a few of the applications listed below.

It is expected that a large part of the data-transmission capacity will usually be used for features related to automatic or assisted tuning functions. These features are therefore labelled “primary”. Other applications are labelled “secondary” and may be introduced to meet the needs of individual broadcasters. Note that although similar terms are used, these features may not correspond exactly with those used in RDS (see Recommendation ITU-R BS.643).

Primary

– Programme Identification (PI) code including:
  – unique country code for each ITU country;
  – unique language code.
– List of Alternative Frequencies (AFs).
– Programme Service (PS) name: this comprises at least four alpha-numeric characters and is intended for display.
– Scheduling information (SI).
– Traffic Programme (TP) identification and Traffic Announcement (TA) identification.

Secondary (examples)

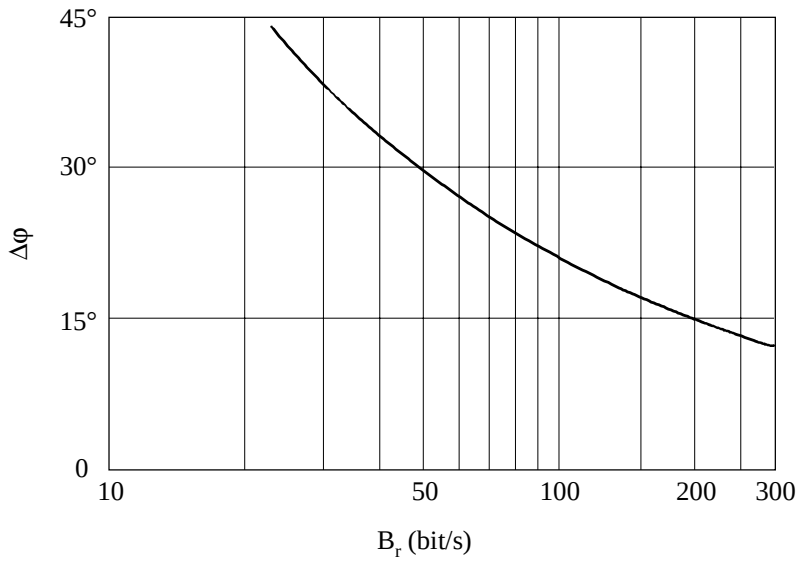
– Differential GPS data (dGPS)
– Clock-Time (CT) and date (UTC and MJD)
– Programme Item Number (PIN)
– Decoder Identification code (DI) (e.g. stereo)
– Programme Type code (PTY)
– Transparent Data Channel (TDC)
– In-House (IH) applications
– Traffic Message Channel (TMC)
– Radio Paging (RP).

ANNEX 2

Specification of a data system for use in monophonic AM sound-broadcasting

Frequency bands:	LF, MF and HF
Method of modulation:	phase modulation of the main carrier
Maximum phase deviation:	depending on bit rate according to Fig. 1
Data format for bit rates below 100 bit/s:	depending on application
Data format for bit rates ≥ 100 bit/s:	according to Annex 4

FIGURE 1
Dependence of the permitted phase deviation value Δφ on the transmission bit rate (B_r)



Δφ: maximum peak phase deviation

$$\Delta\varphi = \frac{210}{\sqrt{B_r(\text{bit/s})}} \quad \text{(degrees)}$$

0706-01

ANNEX 3

Information on operational and projected AM data systems (AMDS)

Table 1 gives information on AMDS systems as applied in different countries.

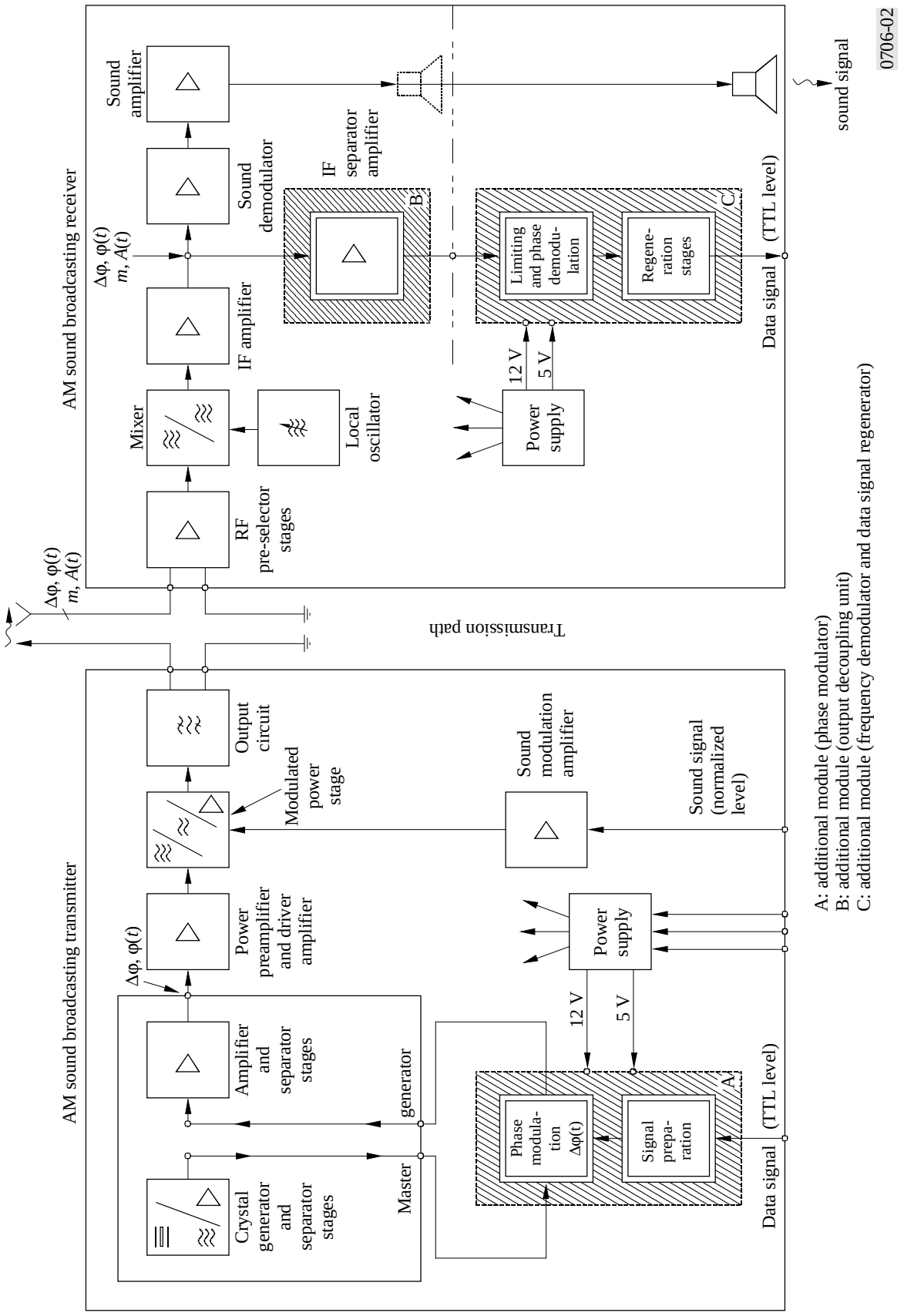
TABLE 1

Application of AMDS systems

Characteristics	United Kingdom	France	Germany
– Operating frequency band	LF	LF	LF, MF, HF
– Possible frequency bands	LF, MF	LF, MF, HF	LF, MF, HF
– Phase deviation	±22.5º	±28.5º	±15º
– Bit rate	25 bit/s	40 bit/s	200 bit/s
– Data coding	Bi-phase	NRZ	NRZ
– Data structure	Blocks of 50 bits with 32 useful	Blocks of 50 bits with 32 useful	Blocks of 47 bits with 36 useful
– Achieved bit error ratio (normal conditions)			$< 10^{-3}$ for LF and MF (50% time)
– Application	Coded weather information	Time information	Automatic or assisted tuning
	Electricity supply switching		Traffic information
In operation since	1985	1986	Field tests since 1988
Reference		French national standard NFC 90-002	

FIGURE 2

Basic circuit diagram of a monophonic AM sound broadcasting system (AMDS) for supplementary data transmission



ANNEX 4

1 Baseband coding

1.1 Structure of baseband coding

Figure 3 shows the structure of the baseband coding. The largest element within the structure is called a **Group**. One Group consists of 2 **Blocks** with 47 bits each. Each Block contains one **information word** (36 bits) and one **check word** (11 bits). To distinguish the Blocks of a Group and to improve the Block synchronization, each Block is superimposed by an **offset word** (11 bits, modulo-2 addition).

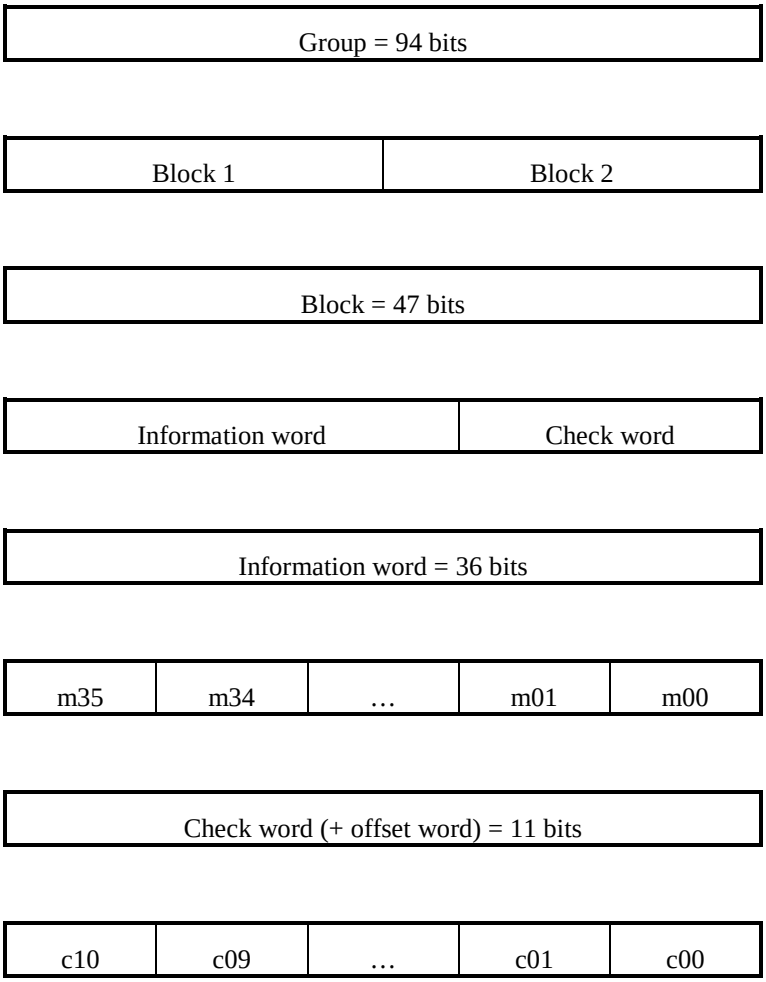


FIGURE 3

Baseband coding structure

1.2 Features of data transmission

For all information words, check words, binary numbers or addresses, the most significant bit will be transmitted first (Fig. 4). The order assigned to the binary number or address bit transmitted last is 2^0.

The transmission of data is fully synchronized, i.e. there are no gaps between Groups and Blocks.

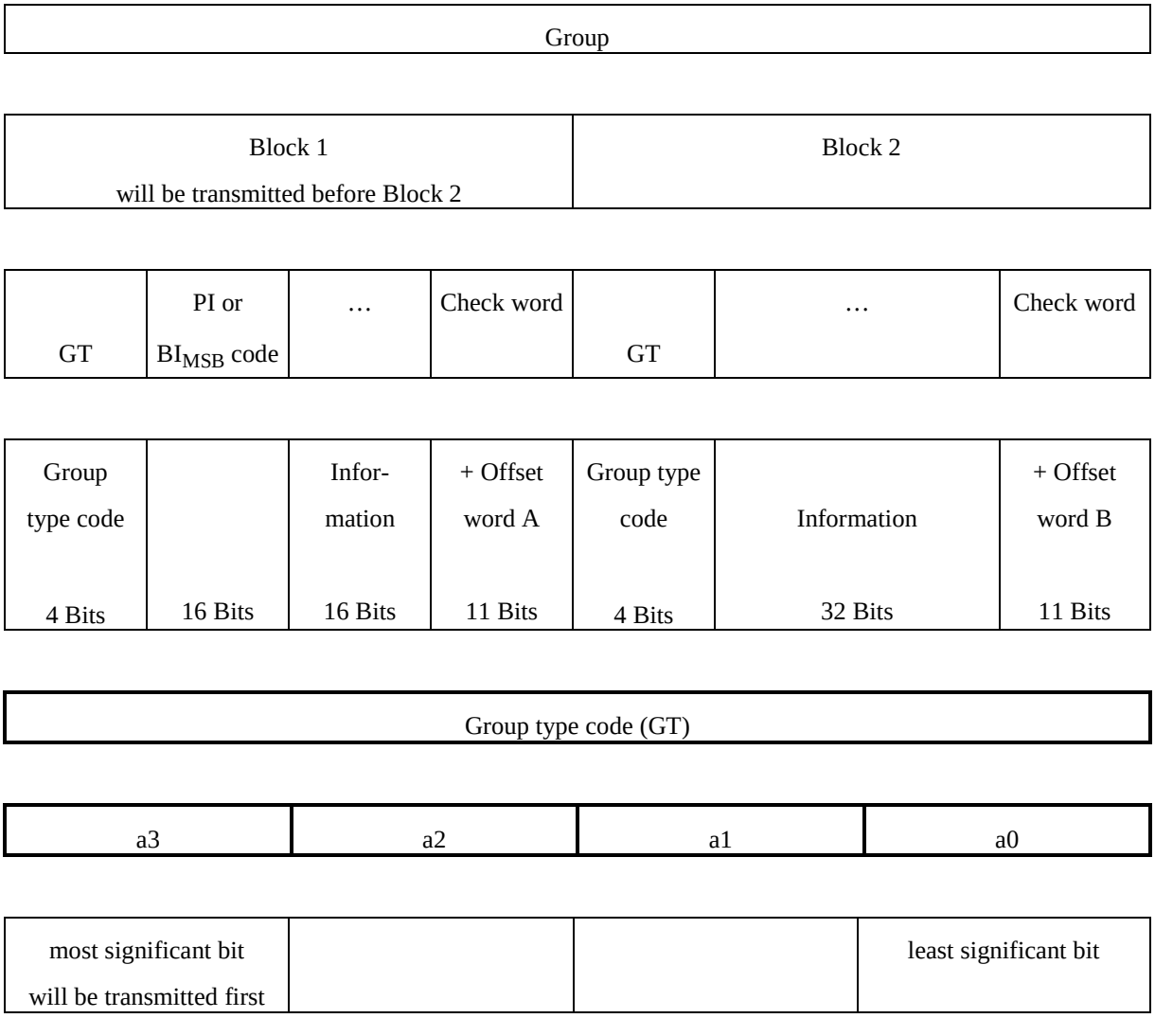


FIGURE 4

Data format and addressing

TABLE 2

Data elements

Data element	Note	Chapter
Check word	Error detection, error correction, Block and Group synchronization	2.1 - 2.4
PI code	Programme identification code	3.2.1
BI code	Broadcast identification code	3.2.2
GT	Group type	4
Information	is defined by the Group type code	5.1 - 5.11
X	unused capacity	5.1 - 5.11

1.3 Error protection

In order to enable the receiver/decoder to detect and correct transmission errors, each Block is assigned a check word (11 bits). This check word

c(x) (c10, c09, ... , c00 shown in Fig. 3) is the sum total (modulo 2) of:

– the remainder obtained after multiplication of the 36-bit information word m(x) by x^{11} and a following division (modulo 2) by the generator polynomial g(x), and

– an 11-bit binary sequence d(x), called offset word such that:

$$c(x) = d(x) + \frac{m(x) \cdot x^{11}}{g(x)} \quad \left| \text{mod } g(x) \right. \tag{1}$$

whereby the generator polynomial (degree 11) may be described by the following formula:

$$g(x) = x^{11} + x^8 + x^6 + 1 \tag{2}$$

Different offset words A and B are used for each Block of a Group.

The 11-bit binary sequence for the offset words A and B are shown in the Table below:

TABLE 3

Offset words

Offset	Offset word d(x)										
	d10	d9	d8	d7	d6	d5	d4	d3	d2	d1	d0
A	0	1	0	1	1	0	1	0	1	0	1
B	1	0	1	1	0	1	0	1	0	1	1

The error protection code offers the following features:

– detects all single and double errors in a Block;

– detects any single burst spanning 10 bits or less;

– detects about 99.90% of bursts spanning 11 bits; and

– about 99.95% of all longer bursts.

The code is an optimal burst error correcting code and is capable of correcting any single burst of span 5 bits or less. Depending on the number of errors within a Block or within the content of a Block the receiver/decoder may utilize either the error detection mode or the error correction mode or both of them.

The probability of unrecognized errors depends on the number of errors which are corrected. Field trials have shown that no more than 2 errors in a Block should be corrected.

1.4 Block and Group synchronization

The beginning and end of a data Block as well as the beginning and end of a Group may be detected in the receiver/decoder by using the two offset words A and B. These offset words destroy the cyclic property of the basic code so that in the modified code, cyclic shifts of code words do not give rise to other code words. By means of this method the Block synchronization becomes reliable.

2 Data format

2.1 Definitions relating to the data transmission

There is no specific repetition cycle fixed for the various types of Groups (see § 4), i.e. a large degree of flexibility is provided. This allows the user to create combinations of different types of information, which comply with his requirements.

The selected data format comprises 5 Group types which are still unused and therefore provides a sufficient degree of adaptability for future applications.

In order to ensure efficient utilization of the AM data channel, the number of different types of information is minimized within a given Group. Thereby the user will not be forced to waste data capacity by the transmission of unused information.

The first 4 bits of each Block are assigned to the Group type code (Fig. 5) specifying the application of the Group. By this process each Block of a Group can be decoded within the receiver/decoder without reference to the other Block. Thus the access time for data which are transmitted in several Blocks is reduced during interference.

2.2 Programme identification

The programme identification is a code which enables the receiver to distinguish between country of origin, programme area, language and the identification of the programme itself.

The code is not intended for direct display. It is assigned to each individual broadcast programme to identify transmitters radiating the same sound programme. By this code the mobile receiver/decoder is enabled to search automatically for an alternative frequency in case of bad reception of the just received frequency. In cases of stationary reception and especially in the HF bands the listener may start search tuning for transmissions originated in a specific country with a desired language.

Except for Group type 5 (Transparent Data Channel) the programme identification is always included in the first Block of each Group (see Fig. 5). Depending on the service two different codes for the programme identification are available. These are the BI code and the PI code.

2.2.1 PI code

The usage of the PI code is equivalent to RDS. For reasons of compatibility with RDS, transmissions that are implemented on LF and/or MF and also on VHF/FM Band II, have to be identified with the PI code. This is necessary for automatic search tuning on all bands and moreover to support cross-border functions especially for the TMC service (Traffic Message Channel).

TABLE 4

PI structure

Bits	Identification
1 to 4	Country identification
5 to 8	Programme type in terms of area coverage
9 to 16	Programme reference number

Extended country codes (ECC) may optionally be transmitted to render the country identification in bits 1 to 4 of the PI code unique. The extended country code consists of eight bits and is coded according to RDS-Standards.

2.2.2 BI code

The BI code (Broadcast identification) should be used to facilitate maximum flexibility with respect to tuning and searching for a particular HF transmission. An eight-bit extension (bits 17 to 24) allows identification of up to 32 broadcasters (organization number has to be agreed nationally) and up to 8 different simultaneous programmes from a single broadcaster (programme marker).

TABLE 5

BI structure

Bits	Identification
	BI_{MSB}
1 to 8	Country identification (255 countries can be coded)(1)
9 to 16	Language code (255 languages can be coded)
	BI_{LSB}
17 to 21	Organization number (32 organizations within a country)
22 to 24	Programme marker (8 programmes)

(1) These country codes are given in Appendix A.

NOTES: Use of PI vs. BI code:

a) For reasons of compatibility with RDS, those programmes that are implemented on LF and/or MF and VHF/FM Band II, have to be identified with **PI-code**. The use of the ECC code will be optional.

b) All other applications can use **BI code** instead of the **PI code**.

c) For HF, the **BI code** should be used to facilitate maximum flexibility with respect to tuning and searching for a particular transmission.

d) The usage of BI or PI code is signalled by the codeflag CF.

e) A short designation of the respective country could be derived from the Country identification or ECC to be shown on the receiver display. 2-Letter ISO 3166 codes are recommended.

3 Group types

The application of a Group is determined by the Group type code, i.e. the first 4 bits in each Block (Fig. 5). The assigned Group types for the different applications are listed in Table 6.

TABLE 6

Group types

Group type					Application	Type of information
Dec	Binary Code					
	A3	A2	A1	A0		(1)
0	0	0	0	0	Basic tuning and switching information **BTI**	interactive
1	0	0	0	1	Radiotext **RT**	interactive
2	0	0	1	0	Alternative frequencies **AF**	interactive
3	0	0	1	1	Traffic message channel **TMC**	interactive
4	0	1	0	0	In-House applications **IH**	various
5	0	1	0	1	Transparent data channel **TDC**	various
6	0	1	1	0	Scheduling information **SI**	off-line
7	0	1	1	1	Supplementary scheduling information **SIS**	off-line
8	1	0	0	0	Additional tuning information **ATI**	interactive
9	1	0	0	1	Differential Global Positioning System data **dGPS**	interactive
10	1	0	1	0	Time information **UTC**	interactive
11	1	0	1	1	Undefined	
12	1	1	0	0	Undefined	
13	1	1	0	1	Undefined	
14	1	1	1	0	Undefined	
15	1	1	1	1	Undefined	

(1) The reception of a Group can have different effects on the actions subsequently taken:

interactive = The information is treated directly by the receiving system and results in either tuning or change of settings, display or storage.

Off-line = The information is stored for further reference and will be basically used to update a database in the receiving system.

Various = The actual effect on or at the receiving system depends on the application and the type of data transmitted.

3.1 Usage of Groups

TABLE 7

Usage of Groups for different applications

Application	Primary Groups	Secondary Groups
LF-MF station identification	0,2	1,4,8,10
HF station identification	8,2	1,4,10
LF-MF TMC	0,3,2	1,4,8,10
LF-MF-dGPS	0,9,2,5	1,4,8,10
LF-MF-scheduling	0,2,6,7	1,4,8,10
HF-scheduling	8,2,6,7	1,4,10

3.2 Group sequences

Unlike RDS applications, a fixed Group sequence cannot be given for AMDS. The sequence depends on the amount of data that is to be transmitted and the envisaged reaction time at the receivers.

If for example, it is necessary to have a PS-name to appear on the receivers display within 3 seconds, Group 0 is transmitted at least every 6th Group (error-free conditions). In a heavily distorted environment as in HF, it is advisable to send every 3rd Group in the sequence a Group 8.

Basis for the calculation of Group sequences is the Group duration of **T_G = 0.47 second (s)** under error-free conditions. The Group sequence can then be derived from the formula:

$$N_{oc} = \frac{T_R}{T_G} \tag{3}$$

where:

N_{OC} is the repetition rate of the particular Group within a sequence

T_R is the wanted reaction time at the receiving terminal in (s)

T_G is the Group duration in (s)

In HF-applications it has been found that a dynamic Group sequence is appropriate, for example:

Transmission is due to start at 1200 UTC.

TABLE 8

Dynamic Group sequences

Time (UTC)	Group sequence	Task
1159-1200	8,2,8,2	Station name and alternative frequencies
1200-1201	8,2,1,8,2,1	Station name, alternative frequencies and radiotext
1201-1204	8,2,6,7,8,6,7	Station name and scheduling information
1204-1205	8,2,8,2	Station name and alternative frequencies

4 Description of Groups

4.1 Group type 0/Basic tuning and switching information BTI

Usage interactive

The Group type 0 contains the programme service name (PS), identification signals for traffic transmitters (TMC, TP, TA) and an identification for the audio bandwidth of the sound programme signal (BW). With two flags (PIX and PSX) an extended PI and/or extended PS service can be marked.

Group 0/Block 1

GT	PI	PIX	PSX	PS Character 1	PS Character 2
4	16	1	1	7	7

Group 0/Block 2

GT	TA	TP	TMCF	BW	PS Character 3	PS Character 4	PS Character 5	PS Character 6
4	1	1	1	1	7	7	7	7

FIGURE 5

Group 0

TABLE 9

Data in Group 0

Data	Binary value	Meaning
PI	0000 0001 ... 1111 1111	PI code
TMCF	0 1	Programme with coded traffic messages
TP	0 1	Programme with spoken traffic messages
TA	0 1	There is no voiced traffic message (off) There is a voiced traffic message (on)
BW	0 1	AF bandwidth of the sound programme signal: 4.5 kHz Ext. AF bandwidth of the sound programme signal: 7 kHz
PIX	0 1	No ECC will be transmitted ECC is transmitted in Group 8
PSX	0 1	PS using 6 characters PS using 8 characters (see also Group 8)
PS		Programme service name characters 1 ... 6

PS

According to the code tables of ISO 646, the programme service name is transmitted in 7-bit characters to be indicated on the receiver display. For each name basically 6 characters including spaces are allowed. The position of the individual characters in the name corresponds to the assigned number. The transmission of the name starts with character 1. The bit transmitted first is the most significant bit of a character.

PSX

Two additional PS characters can be transmitted in Group 8. The number of characters of PS is marked by the PS extension flag (PSX). Characters 1 to 6 are transmitted in Group 0 and the characters 7 and 8 in Group 8.

PIX

With the PIX flag the transmission of the extended country code for PI is marked.

TMCF

Traffic Message Channel identification represents a switching signal to identify channels, which at certain times, transmit coded traffic messages. This identification could be used for an automatic TMC transmitter search tuning.

TP

Traffic Programme identification represents a switching signal to identify channels which, at certain times, transmit spoken traffic messages. An indicator lamp or similar device could be used in the receiver to inform the motorist that the channel received, at certain times, will transmit traffic messages. This identification could be used for an automatic search tuning of a traffic channel.

TA

The Traffic Announcement identification represents a switching signal to identify traffic announcements currently being transmitted. The signal could be used in the receiver as follows:

– automatic activation in the case of traffic announcements, when the receiver is in ready-to-receive mode and has been muted;

– automatic switch-over from tape to traffic announcement.

BW

Bandwidth identification represents a switching signal to identify the audio bandwidth of the sound programme signal. This signal identifies LF and MF transmitters which operate with an extended bandwidth during the day. This identification could be used for adapting the IF selection filter to the actual audio bandwidth of the sound programme signal.

4.2 Group type 1/Radiotext RT

Usage interactive

Group type 1 is used to transmit radiotext (RT).

Group 1/Block 1						
GT	PI/ BI_{MSB}	TE	TN	TF	TSA a3..a0	RT character 1
4	16	1	2	1	4	8

Group 1/Block 2				
GT	RT character 2	RT character 3	RT character 4	RT character 5
4	8	8	8	8

FIGURE 6

Group 1

TABLE 10

Data in Group 1

Data	Binary value	Meaning
PI/ BI_{MSB}	0000 0001 ... 1111 1111	PI code or BI_{MSB} code
TE	0 1	Last text-segment of the text signalled by TN is being transmitted
TN	00 .. 11	Number of text being transmitted
TF	0 1	Text signalled by TN has changed
TSA	0000 1111	Text segment address of the text signalled by TN
RT		Radio text characters 1 ... 5 of segment TSA

According to the code tables of ISO 646, radio text is transmitted using 8-bit characters. The transmission starts with the most significant bit of a character.

TSA

The text segment address in Block 1 is used to position the text segment consisting of the characters in Blocks 1 and 2 (characters 1 to 5) in the display or in the memory. Determined by the range of the segment addresses (0-15) and the number of characters (5) contained in a Group, it is possible to transmit radio texts up to a maximum length of 80 characters.

If the display comprises less than 80 characters the receiver/decoder should be equipped with a memory in order to display parts of the RT successively.

TN

Addresses a text 0 ... 3 that will be affected by the data transmitted.

TF

Changing the text flag (TF) in Block 1 will identify a new radio text for the signalled TN. The text flag is used by the receiver/decoder to clear the display memory.

TE

Indicates that the last segment of a text addressed by TN is being transmitted.

RT is considered to be especially useful for home receivers equipped with an appropriate display and for car receivers equipped with a speech generator.

4.3 Group type 2/Alternative frequencies AF

Usage interactive

Group type 2 is used to transmit alternative frequencies (AF).

Group 2/Block 1			
GT	PI/ BI_{MSB}	AF Code 1	AF Code 2
4	16	8	8

Group 2/Block 2				
GT	AF Code 3	AF Code 4	AF Code 5	AF Code 6
4	8	8	8	8

FIGURE 7

Group 2

TABLE 11

Data in Group 2

Data	Binary value	Meaning
PI/ BI_{MSB}	0000 0001 ... 1111 1111	PI code or BI_{MSB} code
AF	0000 0001 ... 1111 1111	Alternative frequency code 1 ... 6

Codes for alternative frequencies

Six AF codes or up to 6 alternative frequencies can be transmitted within a Group. All specified AF codes and all currently specified frequency codes are indicated in Table 8.

LF band

LF frequencies (153-279 kHz) are represented by an 8-bit code with a channel spacing of 9 kHz (ITU Regions 1 and 3).

$$Code_{LF} = 1 + (f_{LF} - 153)/9 \quad (4)$$

$$f_{LF} = 153 + (Code_{LF} - 1) \cdot 9 \quad (5)$$

MF band

MF frequencies (531-1 602 kHz) are represented by an 8-bit code with a channel spacing of 9 kHz (ITU Regions 1 and 3).

$$Code_{MF} = 16 + (f_{MF} - 531)/9 \quad (6)$$

$$f_{MF} = 531 + (Code_{MF} - 16) \cdot 9 \quad (7)$$

HF band

HF frequencies (2 300-26 100 kHz) are represented by two 8-bit codes with a channel spacing of 5 kHz. They are characterized by the fact that the first 8-bit code is within the range of 141-159. In this case, the first code must be evaluated together with the subsequent code. Block-exceeding pairings are not permitted.

$$\text{Code}_{HF} = 35\,674 + f_{HF}/5$$

$$\text{1st Code}_{HF} = \text{INT}(\text{Code}_{HF}/256) \quad (8)$$

$$\text{2nd Code}_{HF} = \text{Code}_{HF} \text{ MOD } 256$$

$$f_{HF} = ((\text{1st Code}_{HF} - 139) \cdot 256 + \text{2nd Code}_{HF} - 90)) \cdot 5 \quad (9)$$

NOTE – f_{LF}, f_{MF} and f_{HF} are given in kHz.

0-2 295 kHz band with a channel spacing of 5 kHz

This frequency band is an extension of the HF band down to lower frequencies. It provides for the transmission of alternative frequencies up to 2 295 kHz for radio services or MF transmitters in ITU Region 2 with 10 kHz channel spacing.

Code and frequency equations are as for HF.

VHF band

The VHF channels (87.5-107.9 MHz) are represented by two 8-bit codes with a channel spacing of 100 kHz. They are characterized by the fact that the first 8-bit code is 160. In this case, the first code and the subsequent code identify an VHF channel. Block-exceeding pairings are not permitted.

$$\text{1st Code}_{VHF} = 160$$

$$\text{2nd Code} = (f_{VHF} - 87.5) \cdot 10 \quad (10)$$

$$f_{VHF} = 87.5 + \text{2nd Code}_{VHF}/10 \quad (11)$$

Filler code

The filler code (code = 136) is used to substitute AF codes not being used within the Group.

Number code

The number code indicates how many frequencies, except for filler codes, are included in the AF list. AF lists may include up to 31 frequencies. The number code is transmitted at the beginning of the AF list.

$$\text{Code} = \text{Number} + 224 \quad (12)$$

$$\text{Number} = \text{Code} - 224 \quad (13)$$

AF list

The AF list identifies transmitters which broadcast an identical sound programme in the same or in an adjacent receiving area. Receiver/decoder equipped with a memory for AF can reduce the time for switching over to another transmitter.

NOTE – f_{VHF} is given in MHz.

TABLE 12

Coding of alternative frequencies

Frequencies Remarks	1st Code Binary	2nd Code Binary	Decimal equivalent
free	0000 0000		0
LF band			
153 kHz	0000 0001		1
…	…		
279 kHz	0000 1111		15
MF band			
531 kHz	0001 0000		16
…	…		
1 602 kHz	1000 0111		135
Filler code	1000 1000		136
free	1000 1001 1000 1010		137 138
0-2 295 kHz	**5 kHz spacing**		
0 kHz	1000 1011	0101 1010	35674
…	…	…	…
2 295 kHz	1000 1101	0010 0101	36133
HF band			
2 300 kHz	1000 1101	0010 0110	36134
…	…	…	…
26 100 kHz	1001 1111	1011 1110	40894
VHF band			
87.5 MHz	1010 0000	0000 0000	40960
…		…	…
107.9 MHz	1010 0000	1100 1100	41164
free	1010 0001 … 1101 1111		205 . 223
Number Codes			
No AF exists	1110 0000		224
1 AF	1110 0001		225
…	…		
31 AF	1111 1111		255

4.4 Group type 3/Traffic message channel TMC

Usage interactive

Group type 3 is used to transmit coded traffic messages (TMC).

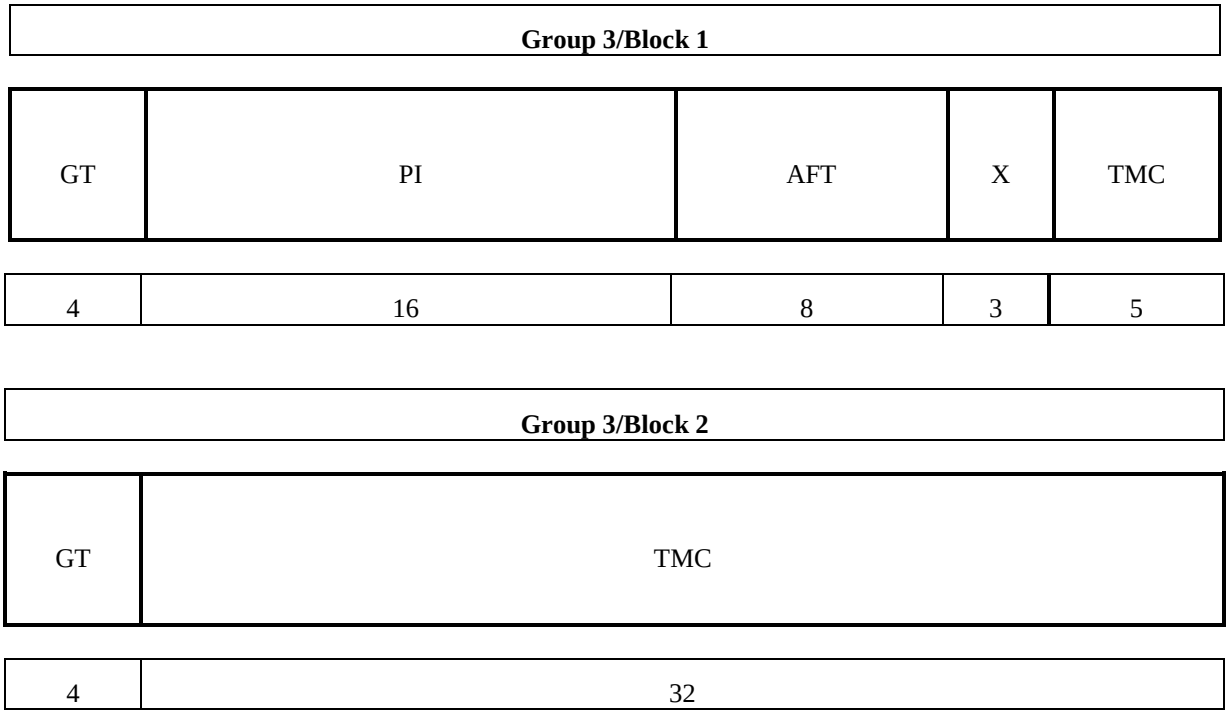


FIGURE 8

Group 3

The data format of AMDS TMC is identical with RDS TMC (information length = 37 bits).

TABLE 13

Data in Group 3

Data	Binary value	Meaning
PI	0000 0001 ... 1111 1111	PI code
AFT	0000 0001 ... 1000 0111	Alternative frequency coded as Group 2, limited to LF-MF
TMC	...	TMC data
X		Unused capacity

The alternative frequencies for TMC (AFT) only refer to channels transmitting identical traffic messages. These channels do not necessarily transmit the same sound programme. The AFT are based on the same coding as used for alternative frequencies AF. The use of AFT is restricted to LF and MF bands.

4.5 Group type 4/In-house applications IH

Usage various

Group type 4 is used to transmit coded in-house applications (IH).

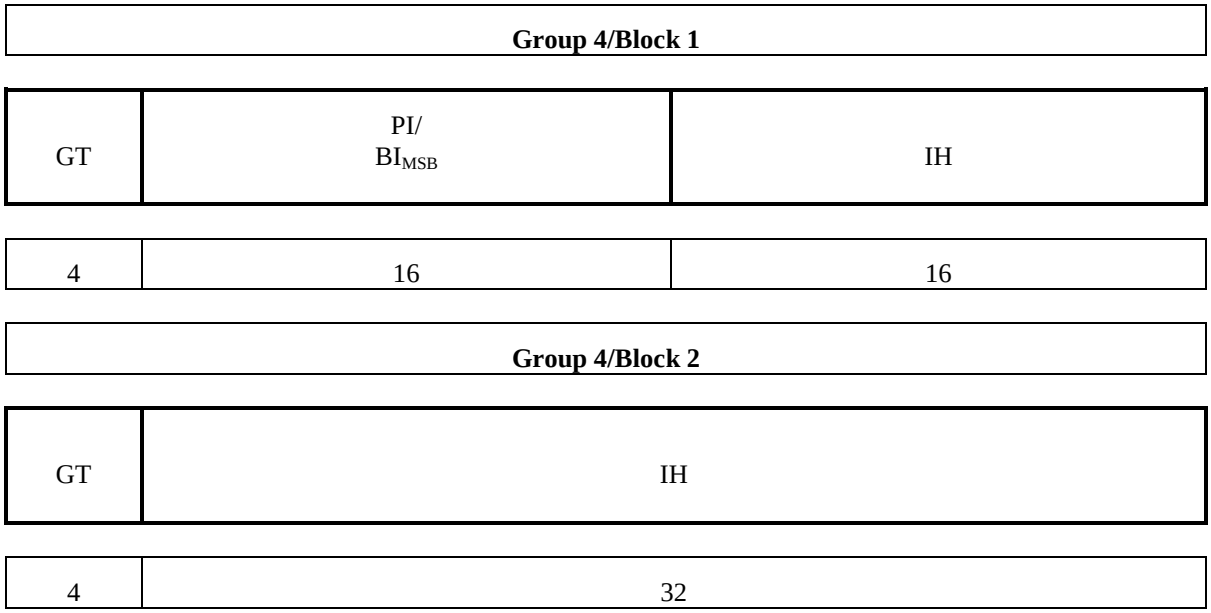


FIGURE 9

Group 4

There are 48 bits available for IH: 16 bits in Block 1 and 32 bits in Block 2. The contents of the bits for IH can be determined by the broadcaster.

TABLE 14

Data in Group 4

Data	Binary value	Meaning
PI/ BI_{MSB}	0000 0001 ... 1111 1111	PI Code or BI_{MSB} code
IH	...	In-house data

Application examples for IH

– Identification of the sound programme.
– Remote operation of transmitter networks.
– Paging for the operational staff.

4.6 Group type 5/Transparent Data Channel TDC

Usage various

Group type 5 is used to transmit any kind of transparent data which can utilize the maximum capacity of the channel.

Group 5/Block 1	
GT	transparent DATA
4	32

Group 5/Block 2	
GT	transparent DATA
4	32

FIGURE 10

Group 5

NOTE 1 – This Group carries no PI or BI code to allow maximum capacity for transparent data.

NOTE 2 – Identification of the transmission has to be provided by transmission of Group 0 or Group 8 in the Group sequence.

4.7 Group type 6/Scheduling Information SI

Usage off-line

Group type 6 is used to transmit broadcast schedule information, to allow receivers to set up a database for easy access and selection of the wanted transmission.

Group 6/Block 1					
GT	PI/ BI_{MSB} (ON)	CF	DF	ECC/ BI_{LSB} (ON)	START MSB
4	16	1	1	8	6

Group 6/Block 2					
GT	START LSB	END	FMSB	FLSB	DOW1
4	3	9	8	8	4

FIGURE 11

Group 6

TABLE 15

Coding in Group 6

Data	Binary value	Meaning
PI/ BI_{MSB} (ON)	0000 0001 ... 1111 1111	PI code or BI_{MSB} code of other network
ECC BI_{LSB} (ON)	0000 0001 ... 1111 1111	ECC or BI_{LSB} code of other network
CF	0 1	PI-code environment BI-code environment
DF	0 1	Entry is not limited by a date Entry will have start- or end-date (transmitted in Group 7)
START	0 0000 0000 ... 1 0010 0000	0000 UTC ... Start time of transmission in 5-minute interval 2355 UTC (see Formula (14))
END	0 0000 0000 ... 1 0010 0000	0000 UTC ... End time of transmission in 5-minute interval 2355 UTC (see Formula (14))
FMSB	0000 0000 ... 1111 1111	Frequency code MSB coded according to Table 12
FLSB	0000 0000 ... 1111 1111	Frequency code LSB coded according to Table 12

TABLE 16

Coding DOW1 in Group 6

Data	Binary value	Meaning
DOW1 (day of week)	0000	Daily service
	0001	Monday
	0010	Tuesday
	0011	Wednesday
	0100	Thursday
	0101	Friday
	0110	Saturday
	0111	Sunday
	1000	Saturday and Sunday
	1001	Weekdays only (Monday through Friday)
	1010	Friday, Saturday and Sunday
	1011	Monday and Tuesday
	1100	Tuesday and Wednesday
	1101	Wednesday and Thursday
	1110	Thursday and Friday
	1111	Friday and Saturday
		Other combinations of operations have to be transmitted in separate Groups of type 6 using this coding or via Group 7 (see example).

Example coding DOW1

Given a transmission on Monday, Wednesday, Thursday and Friday this will result in 3 separate Groups of type 6, coded as:

First	Group 6	0001 (Monday)
Second	Group 6	0011 (Wednesday)
Third	Group 6	1110 (Thursday and Friday)

4.7.1 Coding of START and END

The coding of START and END time of a transmission is based on 5-minute interval.

$$\text{START/END} = \text{INT}\left(\frac{(\text{HOUR}_{\text{UTC}} \cdot 60 + \text{MINUTE}_{\text{UTC}})}{5}\right) \quad (14)$$

4.8 Group type 7/Scheduling information supplementary SIS

Usage off-line

Group type 7 is used to transmit supplementary broadcaster schedule information, to allow receivers to set up a database for easy access and selection of the wanted transmission. The contents includes the target **CIRAF**-zones and the transmitter location. Using this information, the receiver could select the transmitter serving the area he is situated in and – or being closest to his location. The start time of the transmission has to be transmitted in order to provide a reference to the **SI –** entry, in Group 6.

Group 7/Block 1

GT	PI/ BI_{MSB} (ON)	CF	DF	ECC/ BI_{LSB} (ON)	START MSB
4	16	1	1	8	6

Group 7/Block 2

GT	START LSB	UC1	Applications are defined by usage code UC1
4	3	4	25

FIGURE 12

Group 7

TABLE 17

Data in Group 7

Data	Binary value	Meaning
PI/ BI_{MSB} (ON)	0000 0001 ... 1111 1111	PI Code or BI_{MSB} code of other network
ECC BI_{LSB} (ON)	0000 0001 ... 1111 1111	ECC or BI_{LSB} code of other network
CF	0 1	PI-code environment BI-code environment
DF	0 1	Entry is not limited by a date Entry is limited by a start/end date (transmitted in Group 7)
START	0 0000 0000 ... 1 0010 0000	0000 UTC ... start time of transmission 2355 UTC (see Formula (14))
UC1	0000 ... 1111	Usage code

4.8.1 Information addressed by the usage code UC1

The information transmitted in Block 2 is determined by the usage code 1 (UC1, 4 bits) and is independent from the identification code. Sixteen applications can be addressed by the usage code.

TABLE 18

Coding of UC1 in Group 7

UC1																								
0	0	0	0	CIRAF 1							CIRAF 2							CIRAF 3							P	S	C	X
4				7							7							7							1	1	1	1
0	0	0	1	CIRAF 4							CIRAF 5							CIRAF 6							P	S	X	X
4				7							7							7							1	1	1	1
0	0	1	0	DSTART																	DOW1							S
4				17																	7							1
0	0	1	1	DEND																	DOW1							S
4				17																	7							1
0	1	0	0	CIRAFTX							LAT										LON							X
4				7							8										9							1
0	1	0	1	not defined yet																								
...																												
1	1	1	0	not defined yet																								
1	1	1	1	Reserved for broadcasters use																								
4				25																								

UC1 = 0

Three CIRAF zones of the intended Target area can be transmitted.

UC1 = 1

Three additional CIRAF zones of the intended Target area can be transmitted.

UC1 = 2

The START date and comprehensive days of week can be transmitted.

UC1 = 3

The END date and comprehensive days of week can be transmitted.

START and END date are coded with 17 bits as Julian date according to RDS specifications.

UC1 = 4

The CIRAF zone and the latitude, longitude of the transmitter location can be transmitted. (See Formulae (15) and (16)).

UC1 = 5 to 14

Not defined yet.

UC1 = 15

Information can be transmitted which are only related to the broadcaster.

TABLE 19

Data of UC1 in Group 7

Data	Binary value	Meaning
P	0 1	Permanent entry Entry is limited by start and/or end date
S	0 1	 Special transmission
C	0 1	Only CIRAF 1 to 3 will be transmitted CIRAF 4 .. 6 will be transmitted in Group 7 UC1 = 1
DOW2	1000000 ... 1111111 1000000 0100000 0010000 0001000 0000100 0000010 0000001 0000000 1111111	Each bit representing one day of the week MSB = Monday (see example) 7 days a week Monday Tuesday Wednesday Thursday Friday Saturday Sunday Undefined Every day
LAT	0101 1010 ... 1110 1010	Latitude of transmitter 90 degrees NORTH ... Step 1 degree (see Formula (15)) Latitude of transmitter 90 degrees SOUTH
LON	0 1011 0100 ... 1 1011 0100	Longitude of transmitter 180 degrees EAST ... Step 1 degree (see Formula (16)) Longitude of transmitter 180 degrees WEST
DSTART		Date of the begin of the transmission (see RDS specification for coding Julian date)
DEND		Date of the end of the transmission (see RDS specification for coding Julian date)
CIRAF	000 0001 ... 101 0101	Target areas of the transmission Decimal values between 1 and 85 CIRAF1 ... 6
CIRAFTX	000 0001 ... 101 0101	Geographical area of the transmitter location Decimal values between 1 and 85

Example for the treatment of DOW2 in a receiver

Given a transmission on Tuesday, Wednesday and Friday

code for Tuesday	0100000
code for Wednesday	0010000
code for Friday	0000100
	———————
resultant code	0110100 derived by a logical OR of all codes

4.8.2 Coding of latitude and longitude

Latitude (decimal) must be in the range of 90 South (-90) to 90 North (+90).

$$\begin{aligned} LAT(north) &= INT(latitude+0.5) \\ LAT(south) &= -INT(latitude+0.5) \end{aligned} \quad (15)$$

Longitude (decimal) must be in the range of 180 West (-180) to 180 East (+180).

$$\begin{aligned} LON(east) &= INT(longitude+0.5) \\ LON(west) &= -INT(longitude+0.5) \end{aligned} \quad (16)$$

4.9 Group type 8/Additional tuning information ATI

Usage interactive

Group type 8 is used to transmit additional tuning information. To support fast tuning applications the identification code (PI or BI), marked by the code flag (CF) is also transmitted.

Depending on the identification code different information will be transmitted in Block 1. In case of PI (CF = 0) the extended country code (ECC) can be transmitted and in case of BI (CF = 1) the BI_{LSB}.

In both identification modes the programme type (PTY) is transmitted. The applied coding of PTY corresponds to RDS.

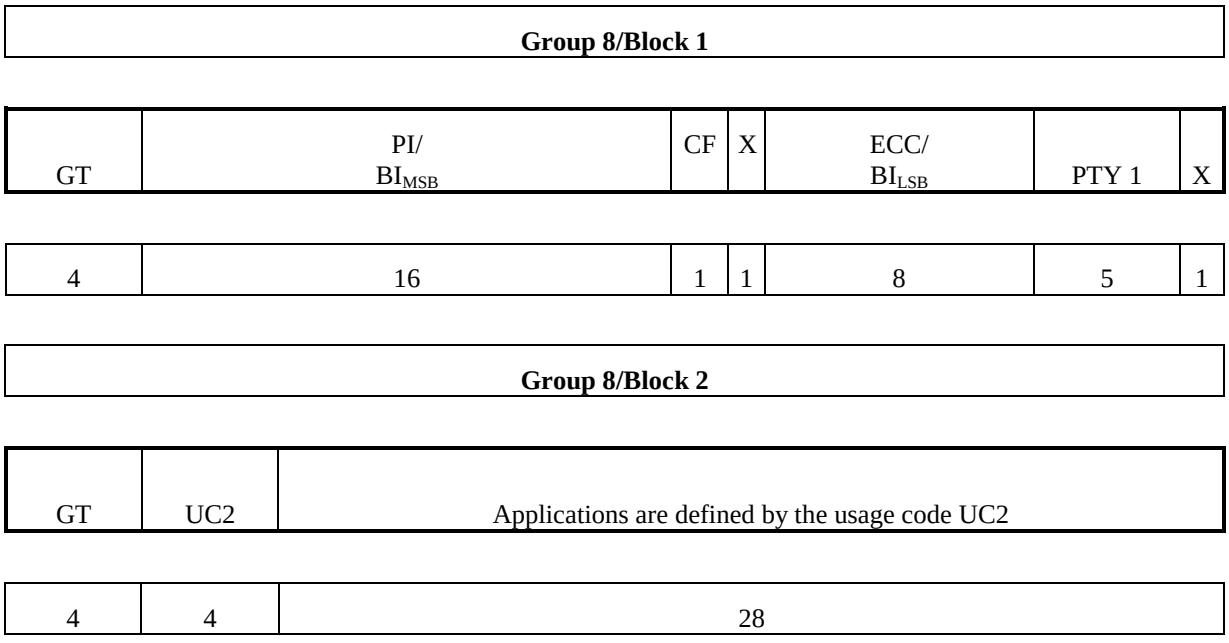


FIGURE 13

Group 8

TABLE 20

Data in Group 8

Data	Binary value	Meaning
PI/ BI_{MSB}	0000 0001 ... 1111 1111	PI code or BI_{MSB} code
ECC BI_{LSB}	0000 0001 ... 1111 1111	ECC or BI_{LSB} code
CF	0 1	PI-code environment BI-code environment
PTY1	00000 ... 11111	Programme type information (see RDS specifications)
UC2	0000 ... 1111	Usage code

4.9.1 Information addressed by the usage code UC2

The information transmitted in Block 2 is determined by the usage code 2 (UC2, 4 bits) and is independent from the identification code. Sixteen applications can be addressed by the usage code.

TABLE 21

Coding of UC2 in Group 8

UC2																															
0	0	0	0	PS char.7							PS char.8							(PTY 2)						X							
4				7							7							5						9							
0	0	0	1	PTYN.1							PTYN.2							PTYN.3							PTYN.4						
4				7							7							7							7						
0	0	1	0	PTYN.5							PTYN.6							PTYN.7							PTYN.8						
4				7							7							7							7						
0	0	1	1	CIRAF 1							CIRAF 2							CIRAF 3							CIRAF 4						
4				7							7							7							7						
0	1	0	0	CIRAF 5							CIRAF 6							CIRAF 7							CIRAF 8						
4				7							7							7							7						
0	1	0	1	PS 1							PS 2							PS 3							PS 4						
4				7							7							7							7						
0	1	1	0	PS 5							PS 6							PS 7							PS 8						
4				7							7							7							7						
0	1	1	1	START									END									CIRAF 1						X			
4				9									9									7						3			
1	0	0	0	FMSB									FLSB									STARTN								X	
4				8									8									9								3	
1	0	0	1	not defined yet																											
...																															
1	1	1	0	not defined yet																											
1	1	1	1	Reserved for broadcasters use																											
4				28																											

UC2 = 0

Two additional PS characters (characters 7 and 8) and PTY 2 can be transmitted. PTY 2 is used to characterize the programme in detail, e.g. Pop and News. PTY 2 should not be used until the RDS specification is finalized.

This usage code is restricted to PI usage only.

UC2 = 1 and UC2 = 2

The PTY name (2×4 characters) can be transmitted. The PTY name can be used additionally to define more clearly the programme type. Unused characters must be transmitted as space ASCII character (hex. 20).

UC2 = 3

The broadcast target area can be transmitted (CIRAF-zone: zone 1 = primary, zones 2-4 = additional). Using this information, the receiver could select transmissions aimed at a specific target area carrying a specific type of programme.

UC2 = 4

Additional target areas (CIRAF-zones 5-8) can be transmitted in conjunction with UC2 = 3. Using this information, the receiver could select transmissions aimed at a specific target area carrying a specific type of programme.

UC2 = 5

The first 4 characters of the programme service name are transmitted.

UC2 = 6

Characters 5 through 8 of the programme service name are transmitted.

UC2 = 7

Start and stop time as well as the primary CIRAF-zone of the broadcast target area as defined in UC2 = 3 CIRAF1 is transmitted. This will allow these information to be stored in the receiver in order to create a self-learning system.

UC2 = 8

The frequency of the next scheduled transmission carrying the same programme is transmitted. This allows to give an information on how to continue the reception when a frequency change is due. The STARTN time of this next scheduled transmission provides an indication, when this entry becomes valid.

UC2 = 9 to 14

Not defined yet.

UC2 = 15

Information can be transmitted which are only related to the broadcaster.

TABLE 22

Data of UC2 in Group 8

Data	Binary value	Meaning
PTY 2	00000 ... 11111	(see RDS specifications)
PTYN.1 ... PTYN.8	...	Programme type information in text coded according to ISO 646
CIRAF 1 ... CIRAF 8	000 0001 ... 101 0101	Target area of transmission (1 to 85)
PS	..	Programme service name (see 5.1 Group 0)
START	0 0000 0000 ... 1 0001 1111	0000 UTC ... (coding see Formula (14)) 2355 UTC
END	0 0000 0000 ... 1 0001 1111	0000 UTC ... (coding see Formula (14)) 2355 UTC
FMSB	0000 0000 ... 1111 1111	Frequency code MSB of the following programme coded according to Table 12
FLSB	0000 0000 ... 1111 1111	Frequency code LSB of the following programme coded according to Table 12
STARTN	0 0000 0000 ... 1 0001 1111	Start time (UTC) of the next scheduled transmission (coding see Formula (14))

4.10 Group type 9/differential GPS-data dGPS

Usage interactive

Group type 9 is used to transmit differential GPS-Data.

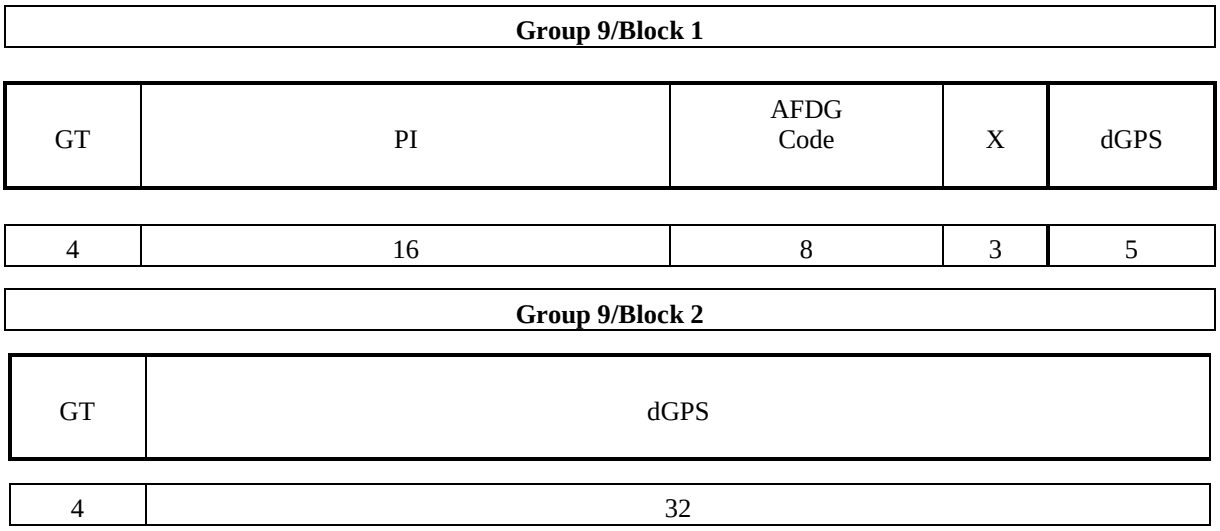


FIGURE 14

Group 9

AFDG

Alternative frequency carrying dGPS-Data are coded according to Table 12, Group 2.

The coding of dGPS-Data has to be finalized after the RDS applications are defined.

TABLE 23

Data in Group 9

Data	Binary value	Meaning
PI	0000 0001 ... 1111 1111	PI code
AFDG	0000 0000 ... 1111 1111	Alternative frequency carrying dGPS coded according to Table 12 The frequency range is limited to LF and MF
dGPS	...	Differential GPS data The coding is to be finalized after RDS applications are defined
X		Unused capacity

4.11 Group type 10/TIME information UTC

Usage interactive

Group 10 can be used to transmit Time (UTC), Local time offset and Date to the receiver in order to set the internal clock.

Group 10/Block 1

GT	PI/ BI_{MSB}	CF	X	ECC/ BI_{LSB}	OS	LOS
4	16	1	1	8	1	5

Group 10/Block 2

GT	HOUR	MINUTE	JULIAN	X
4	5	6	17	4

FIGURE 15

Group 10

TABLE 24

Data in Group 10

Data	Binary value	Meaning
PI/ BI_{MSB}	0000 0001 ... 1111 1111	PI code or BI_{MSB} code
ECC BI_{LSB}	0 0000 0000 ... 1 0010 0000	ECC or BI_{LSB} code
CF	0 1	PI-code environment BI-code environment
OS	0 1	Time offset to UTC positive (+) Time offset to UTC negative (-)(1)
LOS	00000 ... 11000	Offset in number of half hours Local time to UTC(1)
HOUR	00000 ... 10111	0000 UTC ... Hour (UTC) 2300 UTC
MINUTE	00 0000 ... 11 1011	00 ... Minute (UTC) 59
JULIAN	17 bits	Julian date (see RDS specification)

(1) For services crossing time zones LOS and OS should be set to 0 (zero).

5 Glossary of terms

AF alternative frequency

AFDG alternative frequency for dGPS

AFT alternative frequency carrying TMC

AM amplitude modulation

AMDS AM-data system

AM-DSB amplitude double sideband

ATI additional tuning information

BI_{LSB}	broadcast identification code LSB
BI_{MSB}	broadcast identification code MSB
BTI	basic tuning and switching information
BW	flag indicating a particular bandwidth
CF	flag indicating the use of PI or BI
CIRAF	reception zone for broadcasts ranging from 1 to 85
CIRAFTX	geographical zone in which the transmitter is located
DEND	end date of an entry
DF	flag indicating a date-limited entry
dGPS	differential Global Positioning System
DOW1	day of week (limited coding)
DOW2	day of week (full coding)
DSTART	start date of an entry
ECC	extended country code
END	end of a transmission (UTC)
FLSB	frequency code (LSB)
FMSB	frequency code (MSB)
GT	Group type
HOUR	hour in UTC
IF	intermediate frequency
IH	in house
JULIAN	Julian date
LAT	geographical latitude 90N ... 90S (decimal)
LON	geographical longitude 180E ... 180W (decimal)
LOS	local time offset
LSB	least significant bits
MINUTE	minute in UTC
MSB	most significant bits

ON	other network or transmission of the broadcaster
OS	time offset sign
P	flag indicating a permanent scheduling entry
PI	programme identification code
PIX	flag indicating the use of extended country code ECC
PS	programme service name
PSX	flag indicating the use of extended PS
PTY1	programme type
PTY2	second programme type
PTYN	programme type name
RT	radio text
S	flag indicating a special transmission
SI	scheduling information
SIS	supplementary scheduling information
SSB	single sideband
START	start time of a transmission (UTC)
STARTN	start time of next scheduled transmission
TA	flag identifying traffic announcement
TDC	transparent data channel
TE	flag indicating end of radiotext
TMC	traffic message channel
TMCF	flag identifying traffic message transmissions
TN	number of radiotext
TP	flag identifying traffic programme
TSA	text segment address
UC1	usage code 1
UC2	usage code 2
UTC	time information
X	not defined

6 Index of Tables

7 Index of Figures

8 Index of formulas

APPENDIX A

TABLE 25

Index of ALPHA-2 country codes (ISO 3166:1993)

This index does not constitute the official list of names of entities

Country Code decimal	Country Code Hex.	2-Letter Code	Country English name	Country French name
0	0	..	not used	
1	1	AD	Andorra	Andorre
2	2	AE	United Arab Emirates	Emirats arabes unis
3	3	AF	Afghanistan	Afghanistan
4	4	AG	Antigua and Barbuda	Antigua-et-Barbuda
5	5	Al	Anguilla	Anguilla
6	6	AL	Albania	Albanie
7	7	AM	Armenia	Arménie
8	8	AN	Netherlands Antilles	Antilles néerlandaises
9	9	AO	Angola	Angola
10	0A	AQ	Antarctica	Antarctique
11	0B	AR	Argentina	Argentine
12	0C	AS	American Samoa	Samoa américaines
13	0D	AT	Austria	Autriche
14	0E	AU	Australia	Australie
15	0F	AW	Aruba	Aruba
16	10	AZ	Azerbaijan	Azerbaïdjan
17	11	BA	Bosnia and Herzegovina	Bosnie-Herzégovine
18	12	BB	Barbados	Barbade
19	13	BD	Bangladesh	Bangladesh
20	14	BE	Belgium	Belgique
21	15	BF	Burkina Faso	Burkina Faso
22	16	BG	Bulgaria	Bulgarie
23	17	BH	Bahrain	Bahreïn
24	18	BI	Burundi	Burundi
25	19	BJ	Benin	Bénin
26	1A	BM	Bermuda	Bermudes
27	1B	BN	Brunei Darussalam	Brunéi Darussalam
28	1C	BO	Bolivia	Bolivie
29	1D	BR	Brazil	Brésil
30	1E	BS	Bahamas	Bahamas
31	1F	BT	Bhutan	Bhoutan
32	20	BV	Bouvet Island	Bouvet Ile
33	21	BW	Botswana	Botswana
34	22	BY	Belarus	Bélarus
35	23	BZ	Belize	Belize

TABLE 25 (*continued*)

Country Code decimal	Country Code Hex.	2-Letter Code	Country English name	Country French name
36	24	CA	Canada	Canada
37	25	CC	Cocos (Keeling) Islands	Cocos (Keeling) Iles des
38	26	CF	Central African Republic	Centrafricaine République
39	27	CG	Congo	Congo
40	28	CH	Switzerland	Suisse
41	29	CI	Côte d'Ivoire	Côte d'Ivoire
42	2A	CK	Cook Islands	Iles Cook
43	2B	CL	Chile	Chili
44	2C	CM	Cameroon	Cameroun
45	2D	CN	China	Chine
46	2E	CO	Colombia	Colombie
47	2F	CR	Costa Rica	Costa Rica
48	30	CU	Cuba	Cuba
49	31	CV	Cape Verde	Cap-Vert
50	32	CX	Christmas Island	Ile Christmas
51	33	CY	Cyprus	Chypre
52	34	CZ	Czech Republic	République tchèque
53	35	DE	Germany	Allemagne
54	36	DJ	Djibouti	Djibouti
55	37	DK	Denmark	Danemark
56	38	DM	Dominica	Dominique
57	39	DO	Dominican Republic	République Dominicaine
58	3A	DZ	Algeria	Algérie
59	3B	EC	Ecuador	Equateur
60	3C	EE	Estonia	Estonie
61	3D	EG	Egypt	Egypte
62	3E	EH	Western Sahara	Sahara occidental
63	3F	ER	Eritrea	Erythrée
64	40	ES	Spain	Espagne
65	41	ET	Ethiopia	Ethiopie
66	42	FI	Finland	Finlande
67	43	FJ	Fiji	Fidji
68	44	FK	Falkland Islands (Malvinas)	Iles Falkland (Malvinas)
69	45	FM	Micronesia (Federated States of)	Micronésie (Etats fédérés de)
70	46	FO	Faroe Islands	Iles Féroé
71	47	FR	France	France
72	48	FX	France Metropolitan	France métropolitaine
73	49	GA	Gabon	Gabon
74	4A	GB	United Kingdom	Royaume-Uni
75	4B	GD	Grenada	Grenade
76	4C	GE	Georgia	Géorgie
77	4D	GF	French Guyana	Guyane française
78	4E	GH	Ghana	Ghana
79	4F	GI	Gibraltar	Gibraltar
80	50	GL	Greenland	Groenland

TABLE 25 (*continued*)

Country Code decimal	Country Code Hex.	2-Letter Code	Country English name	Country French name
81	51	GM	Gambia	Gambie
82	52	GN	Guinea	Guinée
83	53	GP	Guadeloupe	Guadeloupe
84	54	GQ	Equatorial Guinea	Guinée équatoriale
85	55	GR	Greece	Grèce
86	56	GS	South Georgia and the South Sandwich Islands	Géorgie du Sud et les îles Sandwich du Sud
87	57	GT	Guatemala	Guatemala
88	58	GU	Guam	Guam
89	59	GW	Guinea-Bissau	Guinée-Bissau
90	5A	GY	Guyana	Guyana
91	5B	HK	Hong Kong	Hong Kong
92	5C	HM	Heard Island and McDonald Islands	Ile Heard et Iles McDonald
93	5D	HN	Honduras	Honduras
94	5E	HR	Croatia	Croatie
95	5F	HT	Haiti	Haïti
96	60	HU	Hungary	Hongrie
97	61	ID	Indonesia	Indonésie
98	62	IE	Ireland	Irlande
99	63	IL	Israel	Israël
100	64	IN	India	Inde
101	65	IO	British Indian Ocean Territory	Territoire britannique de l'Océan Indien
102	66	IQ	Iraq	Iraq
103	67	IR	Iran (Islamic Republic of)	Iran (République islamique d')
104	68	IS	Iceland	Islande
105	69	IT	Italy	Italie
106	6A	JM	Jamaica	Jamaïque
107	6B	JO	Jordan	Jordanie
108	6C	JP	Japan	Japon
109	6D	KE	Kenya	Kenya
110	6E	KG	Kyrgyz Republic	République Kirghiz
111	6F	KH	Cambodia	Cambodge
112	70	KI	Kiribati	Kiribati
113	71	KM	Comoros	Comores
114	72	KN	Saint Kitts and Nevis	Saint-Kitts-et-Nevis
115	73	KP	Korea (Democratic People's of)	Corée (République populaire démocratique de)
116	74	KR	Korea (Republic of)	Corée (République de)
117	75	KW	Kuwait	Koweït
118	76	KY	Cayman Islands	Iles Caïmans
119	77	KZ	Kazakstan	Kazakstan
120	78	LA	Lao (People's Democratic Republic)	Lao (République démocratique populaire)
121	79	LB	Lebanon	Liban
122	7A	LC	Saint Lucia	Sainte-Lucie
123	7B	LI	Liechtenstein	Liechtenstein

TABLE 25 (*continued*)

Country Code decimal	Country Code Hex.	2-Letter Code	Country English name	Country French name
124	7C	LK	Sri Lanka	Sri Lanka
125	7D	LR	Liberia	Libéria
126	7E	LS	Lesotho	Lesotho
127	7F	LT	Lithuania	Lituanie
128	80	LU	Luxembourg	Luxembourg
129	81	LV	Latvia	Lettonie
130	82	LY	Libyan Arab Jamahiriya	Jamahiriya arabe libyenne
131	83	MA	Morocco	Maroc
132	84	MC	Monaco	Monaco
133	85	MD	Moldova (Republic of)	Moldova (République de)
134	86	MG	Madagascar	Madagascar
135	87	MH	Marshall Islands	Iles Marshall
136	88	ML	Mali	Mali
137	89	MM	Myanmar	Myanmar
138	8A	MN	Mongolia	Mongolie
139	8B	MO	Macau	Macao
140	8C	MP	Northern Mariana Islands	Iles Mariannes du Nord
141	8D	MQ	Martinique	Martinique
142	8E	MR	Mauritania	Mauritanie
143	8F	MS	Montserrat	Montserrat
144	90	MT	Malta	Malte
145	91	MU	Mauritius	Maurice
146	92	MV	Maldives	Maldives
147	93	MW	Malawi	Malawi
148	94	MX	Mexico	Mexique
149	95	MY	Malaysia	Malaisie
150	96	MZ	Mozambique	Mozambique
151	97	NA	Namibia	Namibie
152	98	NC	New Caledonia	Nouvelle-Calédonie
153	99	NE	Niger	Niger
154	9A	NF	Norfolk Island	Ile Norfolk
155	9B	NG	Nigeria	Nigéria
156	9C	NI	Nicaragua	Nicaragua
157	9D	NL	Netherlands	Pays-Bas
158	9E	NO	Norway	Norvège
159	9F	NP	Nepal	Népal
160	A0	NR	Nauru	Nauru
161	A1	NU	Niue	Nioué
162	A2	NZ	New Zealand	Nouvelle-Zélande
163	A3	OM	Oman	Oman
164	A4	PA	Panama	Panama
165	A5	PE	Peru	Pérou
166	A6	PF	French Polynesia	Polynésie française
167	A7	PG	Papua New Guinea	Papouasie-Nouvelle-Guinée
168	A8	PH	Philippines	Philippines

TABLE 25 (*continued*)

Country Code decimal	Country Code Hex.	2-Letter Code	Country English name	Country French name
169	A9	PK	Pakistan	Pakistan
170	AA	PL	Poland	Pologne
171	AB	PM	Saint Pierre and Miquelon	Saint-Pierre-et-Miquelon
172	AC	PN	Pitcairn	Pitcairn
173	AD	PR	Puerto Rico	Porto Rico
174	AE	PT	Portugal	Portugal
175	AF	PW	Palau	Palau
176	B0	PY	Paraguay	Paraguay
177	B1	QA	Qatar	Qatar
178	B2	RE	Réunion	Réunion
179	B3	RO	Romania	Roumanie
180	B4	RU	Russian Federation	Russie (Fédération de)
181	B5	RW	Rwanda	Rwanda
182	B6	SA	Saudi Arabia	Arabie saoudite
183	B7	SB	Solomon Islands	Iles Salomon
184	B8	SC	Seychelles	Seychelles
185	B9	SD	Sudan	Soudan
186	BA	SE	Sweden	Suède
187	BB	SG	Singapore	Singapour
188	BC	SH	Saint Helena	Sainte-Hélène
189	BD	SI	Slovenia	Slovénie
190	BE	SJ	Swalbard and Jan Mayen	Svalbard et île Jan Mayen
191	BF	SK	Slovakia	Slovaquie
192	C0	SL	Sierra Leone	Sierra Leone
193	C1	SM	San Marino	Saint-Marin
194	C2	SN	Senegal	Sénégal
195	C3	SO	Somalia	Somalie
196	C4	SR	Suriname	Suriname
197	C5	ST	Sao Tome and Principe	Sao-Tomé-et-Principe
198	C6	SV	El Salvador	El Salvador
199	C7	SY	Syrian Arab Republic	Syrienne (République arabe)
200	C8	SZ	Swaziland	Swaziland
201	C9	TC	Turks and Caicos Islands	Turks et Caiques Iles
202	CA	TD	Chad	Tchad
203	CB	TF	French Southern Territories	Terres australes françaises
204	CC	TG	Togo	Togo
205	CD	TH	Thailand	Thaïlande
206	CE	TJ	Tajikistan	Tadjikistan
207	CF	TK	Tokelau	Tokélaou
208	D0	TM	Turkmenistan	Turkménistan
209	D1	TN	Tunisia	Tunisie
210	D2	TO	Tonga	Tonga
211	D3	TP	East Timor	Timor oriental
212	D4	TR	Turkey	Turquie

TABLE 25 (*end*)

Country Code decimal	Country Code Hex.	2-Letter Code	Country English name	Country French name
213	D5	TT	Trinidad and Tobago	Trinité-et-Tobago
214	D6	TV	Tuvalu	Tuvalu
215	D7	TW	Taiwan (Province of China)	Taiwan (Province de Chine)
216	D8	TZ	Tanzania (United Republic of)	Tanzanie (République-Unie de)
217	D9	UA	Ukraine	Ukraine
218	DA	UG	Uganda	Ouganda
219	DB	UM	United States Minor Outlying Islands	Iles mineures éloignées des Etats-Unis
220	DC	US	United States	Etats-Unis
221	DD	UY	Uruguay	Uruguay
222	DE	UZ	Uzbekistan	Ouzbékistan
223	DF	VA	Vatican City State (Holy See)	Vatican (Etat de la Cité du) (Saint-Siège)
224	E0	VC	Saint Vincent and the Grenadines	Saint-Vincent-et-Grenadines
225	E1	VE	Venezuela	Venezuela
226	E2	VG	Virgin Islands (British)	Iles Vierges (britanniques)
227	E3	VI	Virgin Islands (US)	Iles Vierges (Etats-Unis)
228	E4	VN	Viet Nam	Viet Nam
229	E5	VU	Vanuatu	Vanuatu
230	E6	WF	Wallis and Futuna Islands	Iles Wallis et Futuna
231	E7	WS	Samoa	Samoa
232	E8	YE	Yemen	Yémen
233	E9	YT	Mayotte	Mayotte
234	EA	YU	Yugoslavia	Yougoslavie
235	EB	ZA	South Africa	Afrique du Sud
236	EC	ZM	Zambia	Zambie
237	ED	ZR	Zaire	Zaïre
238	EE	ZW	Zimbabwe	Zimbabwe
239	EF		Not assigned	
240	F0		Not assigned	
241	F1		Not assigned	
242	F2		Not assigned	
243	F3		Not assigned	
244	F4		Not assigned	
245	F5		Not assigned	
246	F6		Not assigned	
247	F7		Not assigned	
248	F8		Not assigned	
249	F9		Not assigned	
250	FA		Not assigned	
251	FB		Not assigned	
252	FC		Not assigned	
253	FD		Not assigned	
254	FE		Not assigned	
255	FF		Not used	