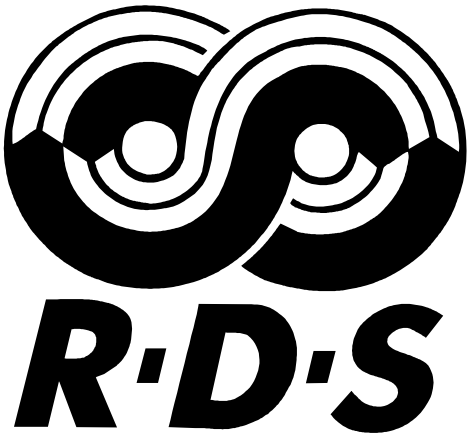
SPB 490 (5th Revision)

22.08.97

RDS Universal Encoder Communication Protocol

UECP Version 5.1



european broadcasting union / rds forum - the association of rds users

Geneva **August 1997**

FOREWORD

The EBU has a requirement that the various RDS encoder communication protocols should be harmonized. Such harmonization would enable broadcasters to purchase RDS system components (encoders, update generators etc.) from a variety of sources. RDS component manufacturers would then be able to integrate their products with those from other manufacturers, enabling more complex systems to be produced than otherwise possible.

Most protocols have similar functional elements. However, they differ significantly in their environmental models. The structure, functionality, and addressing of their intended networks, and the data structures within each encoder are often quite different. Therefore this specification is based on harmonized environmental and encoder models.

This document describes these harmonized models and a universal layered protocol, based on the ISO/OSI recommendation, which encompasses all current RDS features, and can also accommodate new developments.

The model and protocol provide a template specification upon which new products may be based. An encoder does not need to implement all the features described, but any feature implemented must be made in accordance with this standard.

The EBU thanks the following organizations and manufacturers who have contributed significantly to the elaboration of this specification: Aztec, Auditem, BBC, Deutsche Telekom AG, Ericsson, RE Technology, Rohde & Schwarz, TDF, Telefunken Sendertechnik, Teleray and Velec.

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1. Environmental model

1.1 Addressing method

Communication to RDS encoders needs to be capable of many levels of addressing: to all encoders, to specific sets of encoders or to a particular device. This may be accomplished by unique physical connections or by a suitable logical addressing method.

In defining an environmental model for the universal protocol, the following assumptions are made:

> The data stream will feed one or more transmitter sites. Each site will have a unique address, known as the **site address** (a number in the range 1-1023). All encoders at a particular transmitter site share the same site address.
>
> An encoder will possess one or more site addresses. One of these must be unique to the particular physical site location. Additional site addresses are permitted for a particular area, region, or country.

To clarify this concept, an example is given. All encoders at the NEWTOWN site have the unique site address "123". Other encoders in the system are not permitted to use this address. Encoders at the NEWTOWN site also have the site address "267", which is allocated to all encoders in the LAKEVALLEY area. Messages arriving at the NEWTOWN site with either of these two site addresses will be accepted. Messages arriving at the LITTLEVILLAGE site (address "452"), also in the LAKEVALLEY area, will not be accepted if they carry the NEWTOWN site address, but will be accepted if they carry either the LITTLEVILLAGE or the LAKEVALLEY site address.

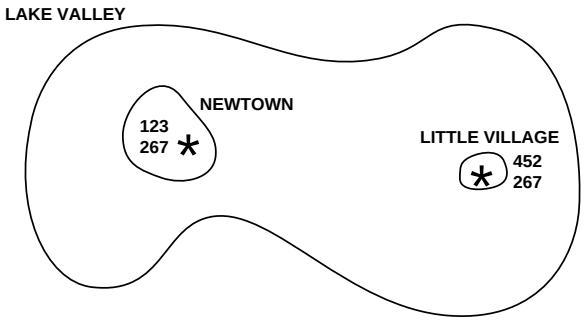


Fig. 1: Fictitious example of site addressing

Several RDS encoders are installed at each transmitter site, serving a number of programme services. Backup equipment is sometimes provided, sometimes not. A single backup encoder may even be provided for several programme services. Whatever the situation may be, each encoder at the site needs to be individually addressable. A second level of addressing is therefore introduced, the **encoder address** (a number in a range 1-63).

An encoder will possess one or more encoder addresses. One must be unique to the encoder at that site. Additional encoder addresses may be assigned according the encoder's usage or manufacture. However, the site and encoder addresses are not intended to specify a particular radio service. The specification of a particular radio service, a third level of addressing, is accomplished by using a **programme service number**, defined in Section 1.2.1. The site and encoder addresses should be thought of being entirely physical, and are used only to address a certain "box" at a certain location, the functionality of the "box" is irrelevant in this context.

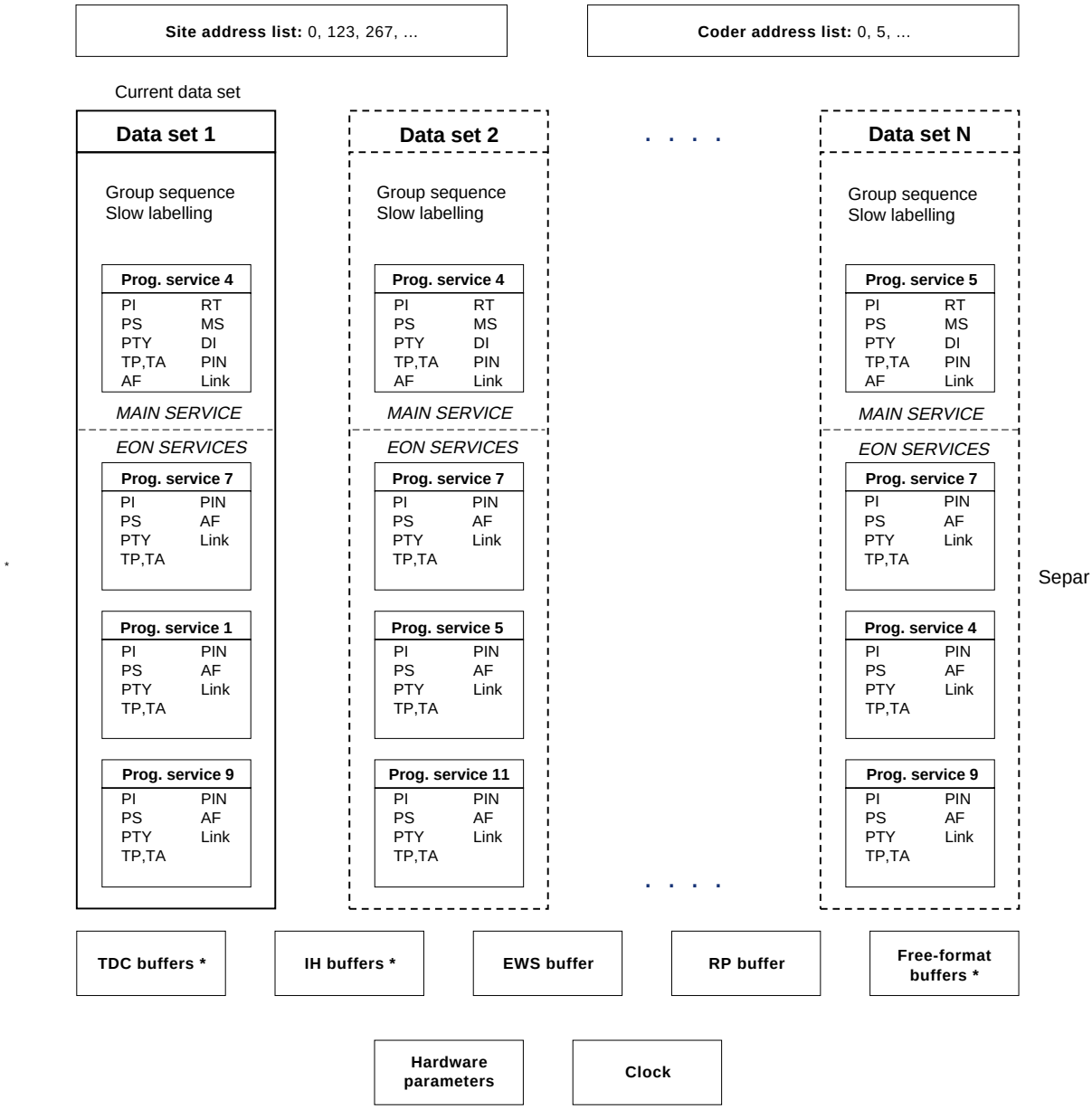
It is expected that many messages will be sent to all encoders. Thus, the **global** number of "0" is defined for both the site and encoder addresses. Messages bearing the global site address are deemed to be acceptable at all sites in the system. Messages bearing the global encoder address are deemed to be acceptable at all encoders at sites specified by the accompanying site address.

An encoder will have two address lists, one of acceptable site addresses and the other of acceptable encoder addresses. The site address list includes "0" (the global site address), the unique site address and any additional site group addresses. The encoder address list includes "0" (the global encoder address), the unique encoder address and any additional encoder group addresses.

A message is acceptable to a particular encoder only if the site address is contained within its site address list and the encoder address is contained within its encoder address list.

1.2 Encoder model

1.2.1 Software model



* Separate buffers for type A and B groups should be used

Fig. 2: RDS Encoder Software Model

Messages are accepted by the encoder in accordance with the addressing method described in Section 1.1. Applicability is further determined by optional fields within the message itself. This permits addressing of the following structures within an encoder:

Data sets: An encoder will have one or more **data sets**, each of which results in a particular RDS output. Each data set may refer to many programme services using the RDS EON feature. Only one data set is responsible at any one time for the encoder's output and is known as the current data set. Data sets are addressed by the protocol as described in Section 2.3.2.

Programme services: All programme services are identified by a unique programme service number which is used to label data within RDS networks. In a network providing the EON feature, data for several programme services will be sent to an encoder which may then identify that the data refers to one or more of the data sets and elements within the data sets used by that encoder. Programme services are addressed by the protocol as described in Section 2.3.3. There is a specific memory area in each data set for each programme service.

Buffers: Some information is buffered, for example EWS, IH, TDC, TMC and Free Format Groups. This means that the received information is placed in a queue awaiting transmission. It is possible to configure a buffer for cyclic transmission.

1.2.2 Hardware model

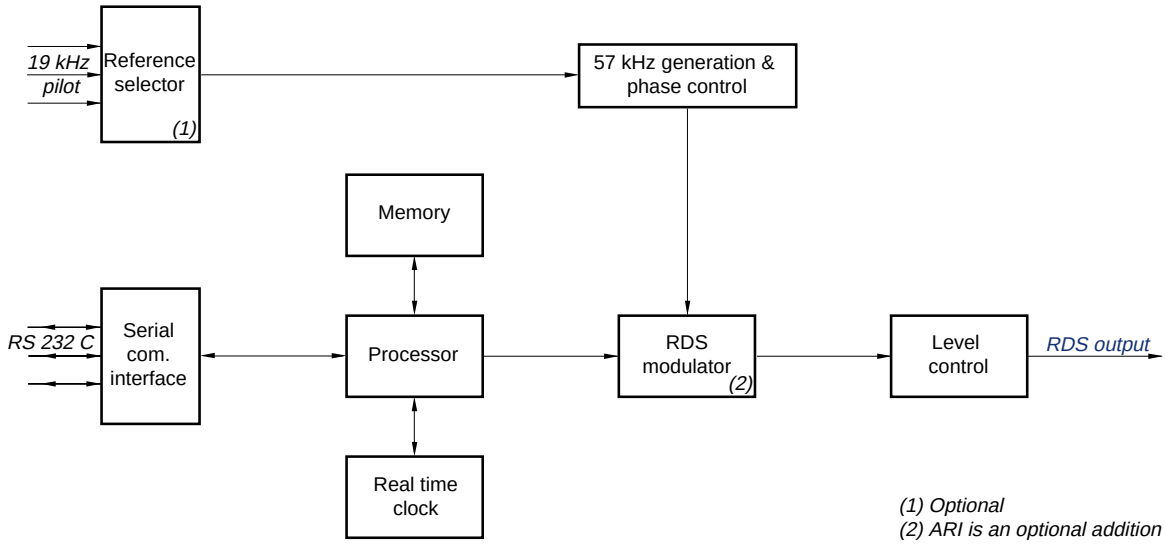


Fig. 3: RDS Encoder Hardware Model

A simplified model of an RDS encoder has been used in the development of this universal protocol and is shown in Figure 3. The model does not include such obvious or necessary components as a power supplier or control panel, but includes only the blocks necessary to understand and develop the protocol itself. These are:

Processor: The central processing unit of the encoder, usually a micro-processor, with access to input and output devices, the real-time clock, and memory.

Memory: Comprises ROM and RAM necessary for the operating software of the encoder, and appropriate RAM, NVRAM, and ROM for stored data.

Real time clock: Maintains the current time of day and calendar date. Used to generate type 4A groups (CT).

Serial communication interface: Data, according to this protocol, is received and transmitted using the serial communications interface.

RDS modulator: Produces the RDS bi-phase signal, and optionally ARI in accordance with CENELEC prEN 50067: 1997.

57 kHz oscillator: Frequency and phase locked to the third harmonic of the selected reference source.

Reference selector (optional): Selects one source of 19 kHz reference signal, out of a maximum of six, to lock to the internal 57 kHz oscillator. Each 19 kHz reference source corresponds to a specific level and phase adjustment of the produced output signal. When a specific reference source is selected via the Reference selector, the corresponding level and phase values are taken from a "reference entry table". This table comprises the following parameters:

- RDS output level
- RDS phase
- ARI level (if implemented)

Level and phase control: The level and phase of the RDS signal (optionally ARI) may be adjusted by the processor under the appropriate commands (see pp. 47 and 48). The Output level may be set in the range 0 to 8191 mV, and the phase in the range between 0 and 360 degrees to lock to the internal 57 kHz oscillator. Level and phase of the RDS signal may depend of the 19 kHz reference signal. As up to six reference inputs may be used, level and phase are set on the "reference table entry", as mentioned under Reference selector.

1.3 Transmission modes

The universal protocol is designed to operate in various communication modes as follows:

1.3.1 Uni-directional mode

This mode is used on one way communication links. Data is transmitted to one, a group or all encoders. Answer back is not required.

1.3.2 Bi-directional mode, requested response

This mode uses a two-way communication link to transmit data to one, a group or all encoders. It enables the server to request data, status, and error report from encoders.

1.3.3 Bi-directional mode, spontaneous response

A two-way communication link enables a server to transmit data to encoders, and request data from encoders. Encoders are also able to spontaneously generate status and error messages. Such messages, their content and application are described in Section 3.

2. Protocol description

2.1 Physical layer

Specification at this level is necessary to ensure electrical and mechanical compatibility of equipment. Interfacing to the encoder is accomplished with a serial interface based on the well-known standard EIA RS 232C (compatible with V24/V28). This is a full-duplex interface with hardware handshaking, able to operate with modems.

2.1.1 Mechanical specification

The encoder should be equipped with either the 25-pin SUB-D or the 9-pin SUB-D connectors. The 9-pin SUB-D connector would be preferred. Converting between the two types of connectors is easily done via commonly available adapters. The interface is designed as a DTE (Data Terminating Equipment) and therefore the connectors should be of a male type.

Signals on the 9-pin connector for DTE (IBM-compatible) are given in Table 1.

Table 1

Pin	*Signal*	*I/O*	*Signal description*
1	DCD	I	Data Carrier Detect (optional)
2	RxD	I	Received Data
3	TxD	O	Transmitted Data
4	DTR	O	Data Terminal Ready
5	GND	-	Signal Ground
6	DSR	I	Data Set Ready
7	RTS	O	Request to Send
8	CTS	I	Clear to Send
9	RI/+5...+15V	I/O	Ring Indicator (optional) or auxiliary supply voltage (optional)

Signals on the 25 pin connector for DTE are given in Table 2.

Table 2

Pin	*Signal*	*I/O*	*Signal description*
1	PE	-	Protection Earth
2	TxD	O	Transmitted Data
3	RxD	I	Received Data
4	RTS	O	Request to Send
5	CTS	I	Clear to Send
6	DSR	I	Data Set Ready
7	GND	-	Signal Ground
8	DCD	I	Data Carrier Detect (optional)
18	+5...+15V	O	Auxiliary Supply Voltage
20	DTR	O	Data Terminal Ready

2.1.2 Signal description

The specified interface is an electrical unbalanced circuit with signal levels according the EIA RS 232C.

The signals have the following functionality:

PE (Protection Earth):	Is available only on the 25-pin connector and should be tied to the encoder case internally
TxD (Transmitted Data):	Data from the encoder to an external device
RxD (Received Data):	Data from an external device to the encoder
RTS (Request to Send):	The OFF-State on this line is used to indicate to an external device to pause with data transmission on RxD until RTS is switched to the ON-State again (also called dynamic handshake)
CTS (Clear to Send):	The OFF-State on this line is used to indicate to the encoder to pause with data transmission on TxD until CTS is switched to the ON-State again (also called dynamic handshake)
DSR (Data Set Ready):	The ON-State on this line is used to indicate to the encoder that an external device is connected and is ready for operation (also called static handshake)
DTR (Data Terminal Ready):	The ON-State on this line is used to indicate to an external device that the encoder is ready for operation (also called static handshake)
GND (Signal Ground):	Analog Ground for the circuitry (not shield)
DCD (Data Carrier Detect):	This signal can be (optional) evaluated to detect an active modem
RI (Ring Indicator):	This optional signal can be evaluated to detect an incoming call from modem.
+5..+15V:	This (optional) signal is an auxiliary supply voltage for external low power devices, such as level converters or fiber optic devices, and should be current limited.

Remarks:

- If DTR/DSR signals are OFF, the corresponding RTS/CTS signals must also be in OFF-state.
- If hardware handshake is used, then it should work in this way. If it is not used, the system should be operated at a suitable data rates which guarantees that no characters are dropped.

2.1.3 Data format

The data is transmitted character by character in asynchronous mode.

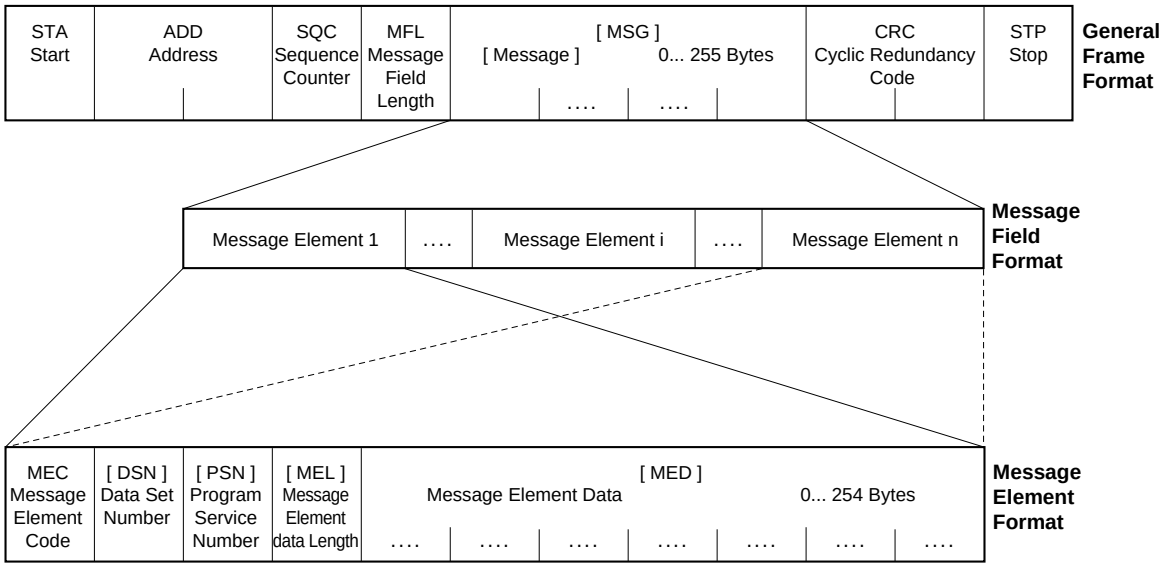
Characters of 8 bits are transferred, preceded by 1 start bit and followed by 1 stop bit. No parity bit is included. Transmission speeds will be any of the following standard values 75, 150, 300, 600, 1200, 2400, 4800, 9600 and 19200, 38400, 57600, 115200 bps.

2.2 Data Link Layer

Update data comprises a stream of data frames. A frame comprises a series of bytes, delimited by two reserved bytes, which mark the beginning and end of the frame. Each frame contains a destination address, defining the set of encoders to which the record is being sent. A sequence counter labels each separate record. The message itself is preceded by a byte defining the message length, and followed by a CRC check.

The start and stop bytes are uniquely defined, and may not occur in any other fields of a frame. In order to prevent this, a frame is byte-stuffed prior to transmission. Byte-stuffing transforms an illegal occurrence of a reserved byte into two legal bytes. The reverse process is applied at reception, byte-stuffed frames are converted prior to frame processing. Thus, although the start and stop bytes are reserved, messages may freely use bytes with any value. In cases where reserved byte values are present in the message, the transmitted message length will be increased. However, the length of a message is always defined in its unstuffed, shortest, state.

2.2.1 General Frame Format



[ ] Fields in brackets are optional. Inclusion is inherently defined by the Message Element Code

Fig. 4: Data protocol format

Each data frame has the following format:

Field Description	Descriptor	Field Length
Start	STA	1 byte
Address	ADD	2 bytes
Sequence Counter	SQC	1 byte
Message field length	MFL	1 byte
[Message] [1])	[MSG]	0...255 bytes
Cyclic Redundancy Check	CRC	2 bytes
Stop	STP	1 byte

Frames are built according to this structure, and then byte-stuffed prior to transmission. Byte-stuffing removes any occurrences of reserved bytes (FE and FF) within the fields "Address" to "Cyclic Redundancy Check" inclusively.

The complete frame is represented in Figure 4.

2.2.2 Start (STA)

A data record starts with the start byte (FE hex). This byte will not occur at any other point in a transmitted sequence (after byte-stuffing).

2.2.3 Address (ADD)

The address field comprises two elements, these are:

Site address	10 bits (most significant)
Encoder address	6 bits (least significant)

For a message to be acceptable to a particular encoder both the site address and the encoder address must be contained within the respective address lists of the encoder.

2.2.3.1 Site address

The site address defines the site, or group of sites to which this record is being sent.

0	=	All sites
1-3FF hex	=	Specific site or group of sites, as selected by encoder operator.

Each encoder will acknowledge a series of site address codes. One must be unique, i.e. common to all encoders at a particular location. Another may be common to all encoders in a certain area and so on.

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[1]) The symbols [ ] indicate that this field is optional. When not included the message field length will be set to zero. Such a record may be used to indicate an idle line.

2.2.3.2 Encoder address

The encoder address defines to which encoder(s) at a particular site this record is being sent.

0	= All encoders at the site
1-3F hex	= Specific encoder or group of encoders, as selected by the encoder operator.

Each encoder will acknowledge one or more encoder address codes. One must be unique (i.e. at that site), another may be common to all encoders providing a certain RDS facility and so on.

2.2.4 Sequence Counter (SQC)

Each frame transmitted may be assigned a sequential number in the range 01-FF hex. Repetitions of any given frame, transmitted to increase data reliability in a simplex system or by request in a duplex system, can be assigned the original sequence number. Such repetitions must be completed before the current sequence counter, i.e. that used for new frames, is 100 decimal steps in advance, in order to avoid confusion between a repeat and a new record from a subsequent sequence. In the duplex mode the absence of a number in a received sequence may be used to request repetition of the particular record. If the sequence counter is not used, this field should be set to 00 hex.

2.2.5 Message field length (MFL)

This single byte informs the encoder of the number of bytes in the message field. This length is defined as that prior to byte-stuffing.

2.2.6 Message (MSG)

The message comprises 0 to 255 bytes of data. These bytes may freely take any value in the range 00-FF hex. Byte stuffing is applied afterwards (see 3.2.9.). The message field format is defined in Section 2.3.

2.2.7 Cyclic Redundancy Check (CRC)

The check field consists of two bytes (prior to byte-stuffing) which represent the result of a 16-bit cyclic redundancy check (CRC) calculation.

The divisor polynomial used to generate the CRC is the CCITT polynomial, $x^{16} + x^{12} + x^5 + 1$. The CRC calculation starts with the most significant bit of the first byte of the address field, and ends with the least significant bit of the last byte of the message field. The CRC is initialized to a value of FFFF hex, and the two check bytes are formed from the inverse of the result. The eight most significant bits are represented by the first check field byte, and the eight least significant bits are represented by the second check field byte (see also Appendix 1).

2.2.8 Stop (STP)

A data record ends with the stop byte (FF hex). This byte will not occur at any other point in a transmitted sequence (after byte-stuffing).

2.2.9 Byte-stuffing method

The technique of byte-stuffing allows a byte oriented protocol such as this to preserve certain unique values for framing purposes, and yet allow conveyed messages to utilize the full byte range (00-FF hex). This is achieved by trapping reserved bytes in illegal fields, and transforming them into legal byte pairs.

Byte values FD hex, FE hex, and FF hex are trapped in the fields "Address" to "Cyclic Redundancy Check" and transformed into a pair of bytes as shown in Table 3.

Table 3

Byte		*Resultant byte pair*
FD	transformed into	FD 00
FE	transformed into	FD 01
FF	transformed into	FD 02

Thus, the reserved bytes (FE and FF) will never occur within these fields in a transmitted record, and will only occur within the start and stop fields.

When a message is received, the reverse technique is used to transform two-byte sequences (always starting with FD hex), into single bytes prior to the record being processed.

2.3 Message field format

2.3.1 Message structure

The message field, if non-zero in length, consists of one or more message elements. Each message element has the structure as shown in Table 4.

Table 4

Field description	*Descriptor*	*Field length*
Message Element Code	MEC	1 byte
[Data Set Number][2])	[DSN][2])	0...1 byte
[Programme Service Number][2])	[PSN][2])	0...1 byte
[Message Element data Length][2])	[MEL][2])	0...1 byte
[Message Element Data][2])	[MED][2])	0...254 bytes

Several message elements may be packed together into one message field, subject to a maximum message field length of 255 bytes, as defined in Section 2.2.1. An individual message element must not be split between different message fields.

The complete message field may be represented as follows:

MEC,[DSN],[PSN],[MEL],[MED],[[MEC,[DSN],[PSN],[MEL],[MED]], ...

Fields and whole message elements shown in square brackets are optional. Message elements may be concatenated freely, subject to a maximum message field length of 255 bytes.

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[2]) The symbls [ ] indicate that this field is optional. They are used, as required by the specific command. See Section 3.

The maximum available length for a message element is 255 bytes. This inherently limits the message data to 254 bytes. If the optional fields "Data Set Number", "Programme Service Number", and/or "Message element data length" are utilized, further reduction to the maximum data length will occur. For example, if all optional fields are employed, the maximum data length will be 251 bytes.

2.3.2 Data Set Number (DSN)

The Data Set Number (DSN) permits a message to be targeted to the following within an encoder:

- a specific data set,
- the current data set,
- all data sets.

The DSN within a message element is chosen as shown in Table 5.

Table 5

Data Set Number (DSN)	*Target*
0	Current data set
1-253	Specific data set
254	All data sets except the current data set
255	All data sets

2.3.3 Programme Service Number (PSN)

The Programme Service Number (PSN) permits a message element to operate a number of services within one or more data sets and the corresponding addressing is shown in Table 6.

Table 6

Programme Service Number (PSN)	*Target*
0	Special PSN for main service of specified data set(s)
1-255	Specific service within data set(s)

2.4 Message codes

Message codes are described in Section 3. Different classes of message are thus identified.

2.4.1 Remote and configuration commands

These commands permit to control the various functionality options of encoders or permit to request messages from the encoders in a case of bi-directional transmission mode.

2.4.2 RDS messages

These messages are related to all the RDS features which have to be processed by an encoder.

2.4.3 Status messages

These messages are used in bi-directional transmission mode to transmit information from an encoder to another device.

2.4.4 Specific messages

These types of messages are not allocated in this specification and concern specific and internal functionality which can be needed by encoder manufacturers. Specific code are reserved for these types of message and should not be used for other features.

2.5 Description of data handling

The data is transmitted to the encoder using the specified commands described in Section 3, and stored in memory according to the encoder software model (see Section 1.2.1).

2.5.1 Group sequence

The encoder must be told about the types of groups to be transmitted and about the appropriate transmission rate for every transmitted group type.

This is achieved with the "Group sequence" command, which is treated by the encoder like a group enable command. When a specific group is encountered in the sequence, data relating to that type is transmitted if available. The "extended group sequence" command enables alternative groups to be transmitted if the specific group type is not available. If no alternative group is specified then the group type is not generated and the next group type in the sequence is used instead.

With this method also the desired repetition rate for every group type is implicitly defined in a very flexible way for the broadcaster. There are, however, special transmission conditions which are described in the following sub-sections.

2.5.1.1 Insertion of type 4A group (CT)

The type 4A group is not allowed in the group sequence. If the CT function is set to On-State (see CT-On/Off command) a type 4A group is inserted automatically by the encoder at the edge of the minute.

During the insertion of a type 4A group, the given group sequence is suspended for this one group. This action has highest priority over any other event (e.g. inserting a type 14B group due to the change of TA flag).

If the CT function is set to the Off-State and the encoder is in the paging mode, type 4A groups with zero-bits for the time information will be transmitted every minute. If the encoder is not in paging mode, no type 4A groups will be transmitted.

2.5.1.2 Handling of type 1A group

If the encoder is in the non-paging mode, the type 1A group is processed as given in the group sequence and is treated like any other group type.

2.5.1.3 Insertion of type 14B group

The type 14B group is not allowed in the group sequence. In order to turn "on" the TA flag for EON services, type 14B groups are inserted automatically by the encoder as controlled with the EON TA control command, interrupting the given group sequence as a consequence.

If the encoder is in the paging mode, type 1A and 4A groups, for marking the intervals, have the highest priority. In the worst case, the inserted type 14B groups are delayed.

2.5.1.4 Insertion of type 15B group

Similar to the insertion of type 14B groups, type 15B groups are inserted automatically by the encoder as controlled with the TA control command when the TA flag for the main service changes.

If the encoder is in the paging mode, type 1A and 4A groups, for marking the intervals, have the highest priority. In the worst case, the inserted type 15B groups are delayed.

2.5.2 Handling of data in paging mode

If the group sequence contains a type 7A group, and 7A is not declared for ODA (see 3.3.14), the encoder is in the paging mode.

If the encoder is in the paging mode, a type 1A group is transmitted every second and is also marking every paging interval. This is done by the encoder automatically when in paging mode. In order not to influence this structure, the given type 1A groups in the group enable sequence are ignored. The transmission of a type 1A group every second (in conjunction with a type 4A group at the edge of the minute) has priority over all other events.

Each paging interval contains a maximum of 48 type 7A groups. When EPP is used, one or two 7A groups at the beginning of the interval are replaced by 13A groups. These are transmitted immediately after the first 1A group at the beginning of the interval (4A group for interval 0).

2.5.3 Handling of ODA data

The introduction of open data applications to the RDS standard prEN50067:1997offers a very flexible way of setting up new (and maybe unknown) applications using RDS. This in turn however requires a very flexible means of allocating resources to ODA and dealing with possible conflicts of priority for different applications.

RDS resource allocation: The transmission of data according to the group sequence and extended group sequence does not offer the timing constraints necessary for certain OD Applications and so two additional mechanisms have been included to increase the flexibility of the RDS resource allocation: "Burst Mode" transmission and "Spinning wheel" mode transmission.

"Burst mode" transmission: This mode enables ODA free-format groups to be transmitted like 14B and 15B groups with a predetermined number of repetions and inter-group spacing.

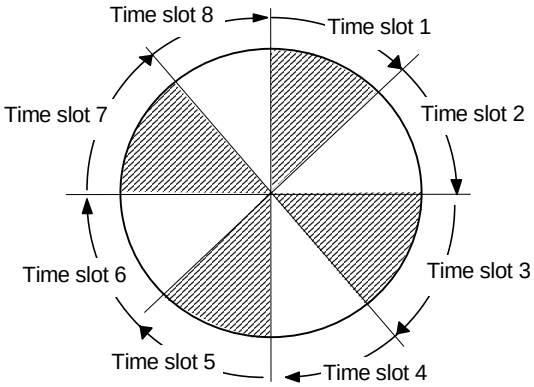
"Spinning wheel" mode transmission: The so called “spinning wheel” technique is based on the following ideas:

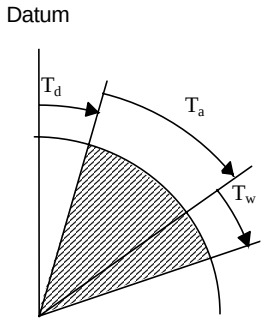
Divide the minute into an integer number of time slots.

Split each of these time slots into a first part (activity time, T_a), during which ODA groups may be inserted into the data stream and a second part (window time, T_w), during which no ODA groups shall be inserted into the data stream.

Between the start of the minute (as indicated in the RDS-data stream by the presence of the type 4A group, which must be transmitted for this technique) and the start of the first time slot, a delay is possible (delay time, T_d).

The meaning of the parameters T_a, T_d and T_w is illustrated below:





Structure of a time slot

The insertion of ODA-groups is governed by the following rules:

No ODA groups should start outside the activity window.
An ODA group may be completed outside the activity time.
T_a, T_w, T_d have to be multiples of a second, with 60 s/(T_a + T_w) = n (where n: integer > 0).

The actual values of these parameters should be assumed to be either default values or be coded into the system information.

Priority setting: In order to offer flexible priority setting for different OD applications the ODA free-format group is sent to the encoder with one of the following priorities: normal, "extremely urgent" or "immediate" transmission.

A group sent with normal priority will be added to the specified free-format group buffer for transmission according to the group sequence and resource allocation configuration. A group sent with "extremely urgent" priority will bypass the free-format buffer and will be sent as soon as possible according to the group sequence and resource allocation configuration. A group sent for "immediate" transmission is immediately transmitted irrespective of the group sequence, but respecting the higher priority of 1A and 4A groups.

The relative priority setting for different groups can also be configured in order to explicitly define the relative priority for groups competing to be transmitted outside of the group sequence: e.g. 14B, 15B and repetitions of ODA "Burst mode" groups.

3. Message description

3.1 List of all defined commands

RDS adjustment and control		
RDS On/Off	1E	73
RDS phase	22	74
RDS level	0E	75
ARI adjustment and control		
ARI On/Off	21	76
ARI area (BK)	0F	77
ARI level	1F	78
Control and set up commands		
Site address	23	79
Encoder address	27	80
Make PSN list	28	81
PSN enable/disable	0B	82
Communication mode	2C	83
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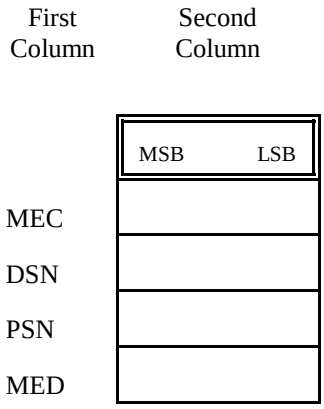
[3]) The Astra ADR specification is published by Société Européene des Satellites, Luxembourg

3.2 Command format (see the following pages)



Conventions:

The message description is made according to the above diagram. The first column indicates the descriptor of the message which is detailed in the table (Second column).

Each element in the table represents one byte where the bits are numbered from 7..0 (from left to right). For transmission of a respective message each byte is represented by two hex symbols of which the permitted range is indicated in the respective element. The message structure used is explained in Section 2.3.1. Symbol 00..XX or 0..X, 0..X specifies the range of the hex value that may be used.

The third column gives information of the context of the table. Symbol hex means that any hex value may be used. Any other information describes the nature of the data which is put in the table.

The coding of all RDS features is in the same format as used in CENELEC prEN 50067: 1997, unless otherwise specified.

3.3 Command repertoire (see the following pages)

The following pages detail each command, in the order listed in Section 3.1. This is not in any particular order but has been subdivided into groups of common interest. Where there are associated request messages these are also shown.

3.3.1 Message Name: PI

Message Element Code: 01

Function: To set the PI code of the specified programme service(s) of the specified data set(s).

Format:

	MSB LSB	
MEC	01	
DSN	00..FF	
PSN	00..FF	
MED	00..FF	PI (MSB)
MED	00..FF	PI (LSB)

Conventions: Coding of PI is according to CENELEC prEN 50067: 1997.

Example: <01><00><01><C2><01>

Set PI code in current data set for programme service 1 to C201.

3.3.2 Message Name: PS

Message Element Code: 02

Function: To set the PS name of the specified programme service(s) of the specified data set(s).

Format:

	MSB LSB	
MEC	02	
DSN	00..FF	
PSN	00..FF	
MED	20..FE	PS Character 1
MED	20..FE	PS Character 2
MED	20..FE	PS Character 3
MED	20..FE	PS Character 4
MED	20..FE	PS Character 5
MED	20..FE	PS Character 6
MED	20..FE	PS Character 7
MED	20..FE	PS Character 8

Conventions: Coding of PS is according to CENELEC prEN 50067: 1997.

Example: <02><00><02><52><41><44><49><4F><20><31><20>

Set PS in current data set for programme service 2 to >RADIO␣1␣<.

3.3.3 Message Name: PIN

Message Element Code: 06

Function: To set the PIN Code of the specified programme service on the specified data set(s).

Format:

	MSB LSB	
MEC	06	
DSN	00..FF	
PSN	00..FF	
MED	00..FD	PIN (MSB)
MED	00..FB	PIN (LSB)

Conventions: Coding of PIN is according to CENELEC prEN 50067: 1997.

Example: <06><00><06><71><5E>

Set PIN for day = 14, hour = 5, minute = 30 in current data set, for programme service 6.

3.3.4 Message Name: DI

Message Element Code: 04

Function: To set the Decoder Information bits of the specified programme service(s) on the specified data set(s).

Format:

	MSB LSB	
MEC	04	
DSN	00..FF	
PSN	00..FF	
MED	00..0F	DI

Conventions: Coding of DI is according to CENELEC prEN 50067:1997.

Example: <04><00><03><01>

Set DI to stereophonic transmission (=1) in current data set, for programme service 3.

3.3.5 Message Name: TA/TP

Message Element Code: 03

Function: To set the Traffic Announcement and Traffic Programme bits.

Format:

	MSB LSB	
MEC	03	
DSN	00..FF	
PSN	00..FF	
MED	00..03	Bit 0: TA Bit 1: TP

Conventions: Coding of TA and TP is according to CENELEC prEN 50067: 1997.

Example: <03><00><05><02>

Set on current data set TP = 1 and TA = 0, for programme service 5.

3.3.6 Message Name: MS

Message Element Code: 05

Function: To set the MS flag of the specified programme service on the specified data set(s).

Format:

	MSB LSB	
MEC	05	
DSN	00..FF	
PSN	00..FF	
MED	00..01	Bit 0: MS

Conventions: Coding of MS is according to CENELEC prEN 50067: 1997.

Example: <05><00><01><01>

Set MS to 1 on current data set, for programme service 1.

3.3.7 Message Name: PTY

Message Element Code: 07

Function: To set the Programme Type information of the specified programme service on the specified data set(s).

Format:

	MSB LSB	
MEC	07	
DSN	00..FF	
PSN	00..FF	
MED	00..1F	PTY

Conventions: Coding of PTY is according to CENELEC prEN 50067: 1997.

Example: <07><00><05><08>

Set PTY to 8 in current data set, programme service 5.

3.3.8 Message Name: PTYN

Message Element Code: 3E

Function: To set the Programme Type Name of the specified service(s) of the specified data set(s).

Format:

	MSB LSB	
MEC	3E	
DSN	00..FF	
PSN	00..FF	
MED	20..FE	PTYN Character 1
MED	20..FE	PTYN Character 2
MED	20..FE	PTYN Character 3
MED	20..FE	PTYN Character 4
MED	20..FE	PTYN Character 5
MED	20..FE	PTYN Character 6
MED	20..FE	PTYN Character 7
MED	20..FE	PTYN Character 8

Conventions: Coding of PTYN is according to CENELEC prEN 50067:1997.

Example: <3E><00><02><46><6F><6F><74><62><61><6C><6C>

Set PTYN in current data set for programme service 2 to >Football<.

3.3.9 Message Name: RT

Message Element Code: 0A

Function: To edit Radiotext.

Format:

	MSB LSB	
MEC	0A	
DSN	00..FF	
PSN	00..FF	
MEL	00..41	
MED	00..FF	Bit 7: Reserved Bits 6..5: Buffer configuration Bits 4..1: Number of transmissions Bit 0: A/B flag status control: 0=do not toggle A/B flag 1=toggle A/B flag
MED	00..FE	Text character 1
MED	00..FE	Text character 2
	:	
	:	
MED	00..FE	Last Text Character (Maximum 64)

Conventions: Coding of Radiotext data is according to CENELEC prEN 50067: 1997.

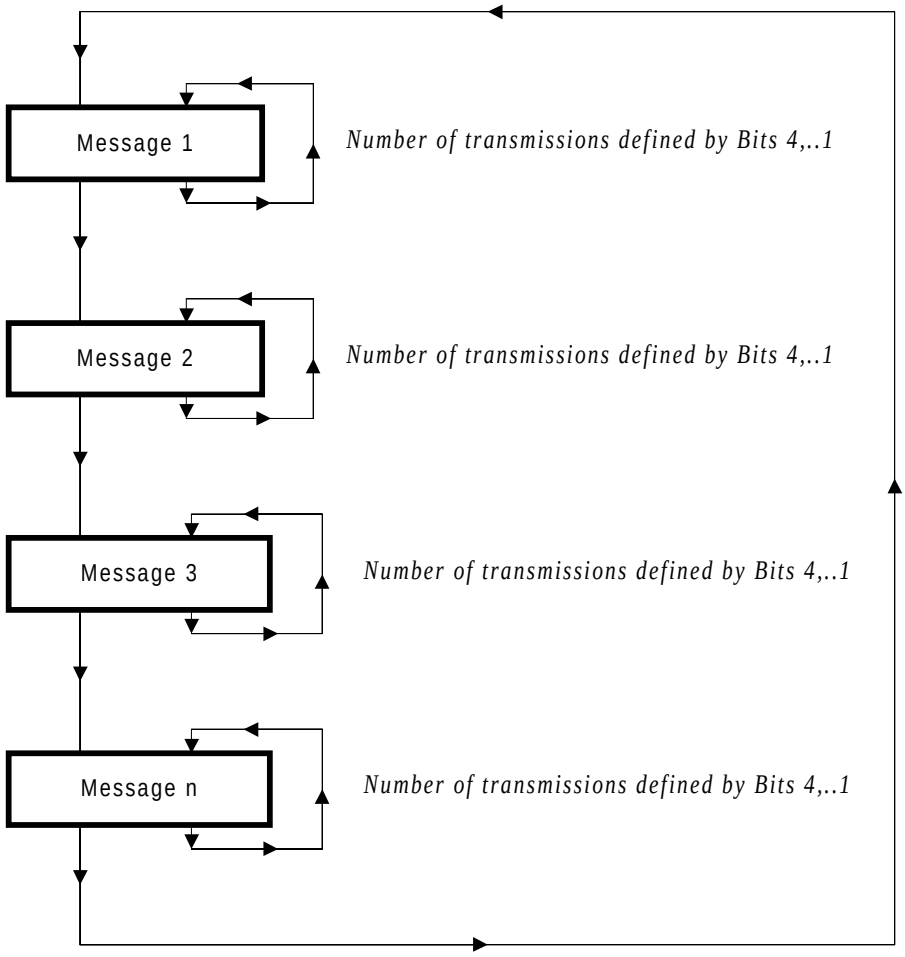
If the PSN is not the main PSN the command is ignored.

If the buffer is empty then no Radiotext is transmitted.

If a message is received with MEL=0, then the buffer is emptied and therefore transmission ceases. This may also be achieved with MEL=1 with bits 5 and 6 of the MED=0.

If the buffer contains only one message, then transmission is repeated indefinitely, despite the defined number of transmissions. If further messages are added, then each message (including the first) is transmitted as defined by its number of transmissions field, within an overall indefinite cycle as shown below.

Cycle Diagram:



Bits 4..1:	0	Indefinite transmissions
	1 - F	Hex value of the number of transmissions of each individual message

Bit 6	Bit 5	Buffer Configuration
0	0	The Radiotext buffer is completely flushed then, if MEL is greater than 1, the specified Radiotext message is placed in the buffer.
0	1	Reserved
1	0	Add specified Radiotext message to the Radiotext buffer. The Radiotext messages within the buffer are transmitted cyclically. Each message is repeated individually, within the cycle, a number of times as specified in Bits 4..1.
1	1	Reserved

RDS message commands

Example: <0A><00><01><04><0B><52><44><53>

Send to current data set, programme service 1. This message causes the buffer to be flushed, the A/B flag to be toggled and the text >RDS< is transmitted indefinitely.

<0A><00><01><05><51><74><65><78><74>

Send to current data set, programme service 1. This, message adds another Radiotext message >text< to the buffer to be repeated 8 times. The previous message and this message are cycled. >RDS< is sent five times, then >text< 8 times and so on.

Request Message Command Format:

To request the Radiotext, the following format is required:

	MSB LSB	
MEC	17	
MEL	04	
MED	0A	Code of requested message
MED	00..FF	DSN
MED	00..FF	PSN
MED	00..FF	Radiotext Buffer number

If the requested Radiotext buffer is empty, the MEL is set to zero in the reply and no data follows.

3.3.10 Message Name: AF

Message Element Code: 13

Function: To edit AF data in the specified data set(s) of the specified programme service(s).

Format:

	MSB LSB	
MEC	13	
DSN	00..FF	
PSN	00..FF	
MEL	03..FB	
MED	00..FF	Start Location (High)
MED	00..FF	Start Location (Low)
MED	01..FF	AF Data
MED	01..FF	AF Data
	:	
	:	
MED	01..FF	AF Data
MED	0	Terminator, if necessary

Conventions: The PSN must be a main service in the addressed data set(s). An AF value of 00 indicates the end of the AF list(s) loaded into memory. The AF list terminator 00 indicates that the transmission of AF data has to restart from location 00 00 in the specified AF memory. The start location defines the offset in AF codes from the beginning of the AF memory used for the respective programme service, at which the new data is to be stored. If the start location is set to FF FF, then the AF data are appended at the location of the first terminator 00, of the specified AF memory. In this case the terminator is required in the supplied message.

In loading the AF codes into memory, no distinction is made between the different Methods A or B. The AF list(s) have to be structured in pairs as in CENELEC prEN 50067: 1997.

Example: <13><00><01><07><00><00><E2><15><27><CD><00>

AFs for current data set, programme service 1, offset by 0 AF codes, are set to frequency codes E2 15 27 CD (2 frequencies follow, 89.6 MHz, 91.4 MHz and the filler code).

Request Message Command Format:

To request the AF data, the following format is required:

	MSB LSB	
MEC	17	
MEL	05	
MED	13	Code of requested message
MED	00..FF	DSN
MED	00..FF	PSN
MED	00..FF	Start location (high)
MED	00..FF	Start location (low)

3.3.11 Message Name: EON - AF

Message Element Code: 14

Function: To edit EON AF data on the specified data set(s) of the specified programme service(s).

Format:

	MSB LSB	
MEC	14	
DSN	00..FF	
PSN	00..FF	
MEL	04..FB	
MED	00..FF	Start Location (High)
MED	00..FF	Start Location (Low)
MED	04..09	AF Data (Variant code of Group Type 14A)
MED	01..FF	AF Data
MED	01..FF	AF Data
	:	
	:	
MED	00	Terminator, if necessary

Conventions: AF data are prepared in three byte units for direct coding in type 14A groups. The first byte of each three designates the variant code in the range 4..9. An AF value of 00 terminates the AF list(s). The start location defines the offset in bytes (including the variant codes) from the beginning of the AF memory used for the respective programme service, at which the new data is to be stored. The EON AF list terminator 00 indicates that the transmission of AF data has to restart from location 00 00 in the specified EON AF memory. If the start location is set to FF FF, then the EON AF data are appended at the location of the first EON AF list terminator of the specified EON AF memory. In this case the terminator is required in the supplied message.

The specified programme service must be an EON service in all addressed data set(s). The EON AF lists have to conform to CENELEC prEN 50067: 1997.

Example: <14><00><01><09><00><00><05><15><19><05><18><10><00>

In the current data set, programme service number 1, AF memory location offset by 0 AF codes, set two mapped frequencies with variant code 5, main frequency 89.6 MHz, mapped frequency 90.0 MHz, variant code 5, main frequency 89.9 MHz, mapped frequency 89.1 MHz

Request Message Command Format:

To request the EON - AF data, the following format is required:

	MSB LSB	
MEC	17	
MEL	05	
MED	14	Code of requested message
MED	00..FF	DSN
MED	00..FF	PSN
MED	00..FF	Start location (high)
MED	00..FF	Start location (low)

3.3.12 Message Name: Slow labeling codes

Message Element Code: 1A

Function: To edit data for type 1A group, block 3.

Format:

	MSB LSB	
MEC	1A	
DSN	00..FF	
MED	0..7 0..F	Bit 7: Reserved Bits 6..4: Variant code Bits 3..0: Data MSB
MED	00..FF	Data LSB

Conventions: For each Variant code 0..7, data can be set in the range 000..FFF.

Example: <1A><04><00><E2>

In data set number 4, set the data transmitted with Variant code 0 to 0E2 hex.

Request Message Command Format:

To request Slow Labelling Variant codes, the following format is required:

	MSB LSB	
MEC	17	
MEL	03	
MED	1A	Code of requested message
MED	00..FF	DSN
MED	00..07	Variant Code

3.3.13 Message Name: Linkage information

Message Element Code: 2E

Function: To edit Linkage information, variant 12 of block 3 of type 14A groups. The Linkage activator LA (MSB) is also in type 1A group, block 3.

Format:

	MSB LSB	
MEC	2E	
DSN	00..FF	
PSN	00..FF	
MED	00..FF	Link information MSB
MED	00..FF	Link information LSB

Conventions: The Linkage information is mapped as applied in type 14A groups.

If the PSN specified is the main PSN, the most significant bit (the Linkage Actuator LA) is sent in type 1A groups and the Linkage Set Number LSN is transmitted using a type 14A group in which the PI ON= PI TN.

Example: <2E><02><03><81><23>

Set Linkage information in data set 2, programme service 3, to 8123 hex. The Linkage Actuator is set to 1. If programme service 3 is the main PSN, the Linkage Actuator will be transmitted in type 1A and 14A groups with value 1.

3.3.14 Message Name: ODA Configuration and Short Message Command

Message Element Code: 40

Function: To set the ODA Application Group Type Code and AID, in type 3A groups. The command also edits the Type 3A group message bits in Block 3.

Format:

	MSB LSB	
MEC	40	
MED	00..1B	Application Group Type code (see prEN 50067:1997, page 19 for valid codes)
MED	00..FF	AID (MSB)
MED	00..FF	AID (LSB)
MED	00..03	Bits 1..0 Buffer configuration
MED	00..FF	Message (MSB)
MED	00..FF	Message (LSB)
MED	00..FF	ODA data input timeout, where: 0 = off and 1 - 255 minutes can be signaled

Conventions: The available Application Group Type codes are defined in Table 6 of prEN 50067:1997, page 19. When configured for cyclic transmission, loss of application data input (to the encoder) for longer than the data input timeout, will be signaled by Type 3A groups of this AID with Application Group Type code set to 1F. An Application Group type code 00 is used to indicate that there is no associated group.

Bits 1 and 0 of the fourth MED are coded as follows:

Bit 1	Bit 0	Buffer Configuration
0	0	Information transmitted once only and removed after transmission
0	1	Reserved
1	0	For cyclic transmission, type 3A groups are added to the specified buffer
1	1	Remove all type 3A groups from the specified Application Group type buffer

Example: <40><16><12><34><02><AB><CD><0A>

Assign Group Type code 11A to AID >1234< hex. The message >ABCD< hex is added to the buffer for cyclic transmission. The ODA data input timeout is set to 10 minutes.

Request Message Command Format:

To request the Application Group type code used for ODA configuration.

	MSB LSB	
MEC	17	
MEL	01,02	
MED	40	Code of requested message
MED	00..0B	[Application Group type code]. If none specified, data for all Application Group type codes will be packed into separate message elements inside the same frame. But if this is too long for a single frame, then the Error message 09: “not acceptable” will be generated.

3.3.15 Message Name: ODA Identification Group usage sequence

Message Element Code: 41

Function: To set the ODA Identification Group usage sequence for type 3A groups, in the specified data set(s).

Format:

	MSB LSB	
MEC	41	
DSN	00..FF	
MEL	00..FC	
MED	00..1B	First Application Group Type code Bits 7..5: Set to 0 Bits 4..1: Group type Bit 0: Group version, 0=A,1=B
	:	
MED	00..1B	n^{th} Application Group Type code

Conventions: The available Application Group Type codes are defined in Table 6 of prEN 50067:1997, page 19.

An Application Group Type code 00 is used to indicate Type 3A groups with no associated group.

Type 3A groups are transmitted according to the group sequence. Within the group sequence the Application Group Type code to be transmitted is determined by the usage sequence.

If no usage sequence is used, each programmed Application Group Type code is transmitted once.

Example: <41><00><04><16><16><16><12>

Set a new ODA Identification Group usage sequence in the current data set as: > 11A, 11A, 11A, 9A <. Therefore type 3A groups will be transmitted in the ratio 75% conveying type 11A group information and 25% conveying type 9A group information.

Request Message Command Format:

To request the ODA Identification Group usage sequence, the following format is required:

	MSB LSB	
MEC	17	
MEL	02	
MED	41	Code of requested message
MED	00..FF	DSN

3.3.16 Message Name: ODA Free-format group (Message bits)

Message Element Code: 42

Function: To add a group to the free-format buffer for that Application Group Type Code.

Format:

	MSB LSB	
MEC	42	
MED	07..1B	Application Group Type code (see prEN 50067:1997, page 19 for valid codes)
MED	00..7F	Configuration: Bits 7..6: Set to 0 Bits 5 to 4: Priority setting (see 2.5.3) Bits 3..2: Mode selection Bits 1..0: Buffer configuration
MED	00..1F	Block 2, 5 bits
MED	00..FF	Block 3 MSB
MED	00..FF	Block 3 LSB
MED	00..FF	Block 4 MSB
MED	00..FF	Block 4 LSB

Conventions: Bits 1 and 0 of the second MED are coded as follows:

Bit 1	Bit 0	Buffer configuration
0	0	Information transmitted once only and removed after transmission
0	1	Reserved
1	0	For cyclic transmission, free-format information sets are added to the specified buffer
1	1	Remove all free-format information sets from the specified free-format buffer

Bits 3 and 2 of the second MED are coded as follows:

Bit 3	Bit 2	Mode selection
0	0	Normal mode
0	1	“Burst mode” (See MEC 44)
1	0	“Spinning wheel mode” (See MEC 45)
1	1	Reserved

Bits 5 and 4 of the second MED are coded as follows:

Bit 5	Bit4	Priority setting (see 2.5.3)	
0	0	Normal	
0	1	"Extremely urgent"	Valid only if the buffer configuration is 00.
1	0	Immediate	
1	1	Reserved	

Bits 6 - 7 of the second MED are set to zero.

A group sent with "Extremely urgent" priority will be inserted as soon as possible according to the group sequence.

A group with "immediate" priority will be transmitted immediately, irrespective of group sequence, but respecting the priorities defined in the RDS standard prEN 500067:1997, unless the ODA priority group sequence has been configured (see 2.5.3 and 3.3.17).

Example: <42><16><14><12><34><56><78><90>

Data for ODA Application Group Type code 11A, Block 2 data is 12hex, Block 3 data is 3456hex and Block 4 data is 7890hex. The data is transmitted once only in burst mode (defined by the ODA Control command MEC 44), with high priority.

3.3.17 Message Name: ODA Relative Priority Group Sequence

Message Element Code: 43

Function: To set the relative priority level for groups transmitted using the ODA free-format command with “immediate” priority (see 2.5.3).

Format:

	MSB LSB	
MEC	43	
MEL	00..FD	
MED	00..1F	Highest relative priority group Bits 7..5: Set to 0 Bits 4..1: Group Type Bit: 0 Group version, 0=A, 1=B
	:	
	:	
MED	00..1F	Lowest relative priority group

Conventions: If no ODA Relative Priority Group Sequence is specified, the priority of groups sent with the ODA free-format command and “immediate” priority is below the priorities specified in prEN 50067:1997.

Setting the ODA Relative Priority Group Sequence enables the relative priority of groups to be altered.

Example: <43><03><16><1F><1D>

Type 11A groups sent, using the ODA free-format command, will be given a higher priority for transmission than type 15B and type 14B groups generated by the encoder. Other high priority groups, such as type 4A groups or, in Paging mode, type 1A and type 13A groups will still have higher priority.

3.3.18 Message Name: ODA "Burst Mode" Control

Message Element Code: 44

Function: To control the generation of ODA free-format groups, configured for "Burst mode" transmission (see 2.5.3).

Format:

	MSB LSB	
MEC	44	
MED	07..1B	Bits 4..0: Application Group type code
MED	00..FF	Bits 7..4: Number of repetitions Bits 3..0: Spacing

Conventions: The number of repetitions are indicated in the range 0 to F times (according to relative priority). Spacing is indicated by the minimum number of other groups between two ODA free-format groups with this Application Group Type code.

Example: <44><16><10>

Transmit two ODA free-format Application Group type codes 11A, with no groups in between (depending on the priority - see MEC 42 and 43).

Request Message Command Format:

To request the Application Group type code used for ODA "Burst Mode".

	MSB LSB	
MEC	17	
MEL	01,02	
MED	44	Code of requested message
MED	07..0B	[Application Group type code]. If none specified, data for all Application Group type codes will be packed into separate message elements inside the same frame. But if this is too long for a single frame, then the Error message: 09 "not acceptable" will be generated.

3.3.19 Message Name: ODA "Spinning Wheel" timing Control

Message Element Code: 45

Function: To set the timing parameters for ODA Application Group Type codes, configured for "Spinning Wheel" transmission (see 2.5.3).

Format:

	MSB LSB	
MEC	45	
MED	07..1B	Application Group Type code (see prEN 50067:1997, page 19 for valid codes)
MED	01..3C	Number of time slots
MED	00..3C	Window time (in seconds)
MED	00..3B	Delay time, relative to beginning of the minute (in seconds).

Conventions: The number of time slots should be chosen to give an integer number of seconds.

The time from the beginning of the time slot until the beginning of the window time, is the "active time" during which the ODA Application Group Type codes may be transmitted.

Example: <45><16><0A><03><00>

Sets 10 time slots of 3 seconds "active time" and 3 seconds "window time", for the ODA Application Group Type 11A, synchronized to the beginning of the minute.

Request Message Command Format:

To request the Application Group type code used for ODA “Spinning Wheel Mode”.

	MSB LSB	
MEC	17	
MEL	01,02	
MED	45	Code of requested message
MED	07..0B	[Application Group type code]. If none specified, data for all Application Group type codes will be packed into separate message elements inside the same frame. But if this is too long for a single frame, then the Error message: 09 “not acceptable” will be generated.

3.3.20 Message Name: TDC

Message Element Code: 26

Function: To edit the data for the Transparent Data Channel.

Format:

	MSB LSB	
MEC	26	
MEL	02..FD	
MED	00..01	00 = Group Version A 01 = Group Version B
MED	00..7F	Bit 7: Set to 0 (Reserved) Bits 6..5: Buffer Configuration Bits 4..0: Channel number as in CENELEC prEN 50067
MED	00..FF	Data
MED	00..FF	Data
	:	
	:	
MED	00..FF	Data

Conventions: The data in the command are sent together with the given binary coded channel number.

The data must be provided in multiples of 4 bytes for A groups and 2 bytes for B groups

Bits 6 and 5 of the second Message Element Data are coded as follows:

Bit 6	Bit 5	Buffer Configuration
0	0	Information transmitted once only and removed after transmission
0	1	Remove the TDC information sets from the specified TDC channel of the TDC buffer
1	0	For cyclic transmission, TDC information sets are added to the specified TDC buffer
1	1	Remove all TDC information sets from the specified TDC buffer

Example: <26><06><00><01><45><42><55><20>

Send the data >EBU␣< on TDC channel 1, once only.

3.3.21 Message Name: EWS

Message Element Code: 2B

Function: Edit the Emergency Warning System data (37 bits) in type 9A group.

Format:

	MSB LSB	
MEC	2B	
MED	00..7F	Bit 7: Set to 0 (Reserved) Bits 6..5: Buffer Configuration Bits 4..0: Block 2, 5 Bits
MED	00..FF	Block 3 MSB
MED	00..FF	Block 3 LSB
MED	00..FF	Block 4 MSB
MED	00..FF	Block 4 LSB

Conventions: 37 bits of EWS data are to be sent to the encoder EWS buffer.

Bits 6 and 5 of the first Message Element Data are coded as follows:

Bit 6	Bit 5	Buffer Configuration
0	0	Information transmitted once only and removed after transmission
0	1	Reserved
1	0	For cyclic transmission, EWS information sets (37 bits) are added to the buffer
1	1	Remove all EWS information sets (37 bits) from the EWS buffer

Example: <2B><41><23><45><67><89>

Add the EWS data >01 2345 6789< hex for type 9A group to the EWS buffer. Transmit the contents of the buffer including this new information cyclically.

3.3.22 Message Name: IH

Message Element Code: 25

Function: To edit the In-house applications and specify the group version.

Format:

	MSB LSB	
MEC	25	
MED	00..01	00 = Group Version A 01 = Group Version B
MED	00..7F	Bit 7: Set to 0 Bits 6..5: Buffer Configuration Bits 4..0: Block 2, 5 Bits
MED	00..FF	Block 3 MSB
MED	00..FF	Block 3 LSB
MED	00..FF	Block 4 MSB
MED	00..FF	Block 4 LSB

Conventions: The data in type 6A or 6B groups block 2, 3, and 4 are sent as 10 hex numbers.

In the case of type B groups, the information for block 3 will be overridden by the information of the PI code.

Bits 6 and 5 of the second Message Element Data are coded as follows:

Bit 6	Bit 5	Buffer Configuration
0	0	Information transmitted once only and removed after transmission
0	1	Reserved
1	0	For cyclic transmission, IH information sets are added to the specified buffer
1	1	Remove all IH information sets from the specified IH buffer

Example: <25><01><60><00><00><00><00>

Remove all IH information from the specified IH buffer B.

3.3.23 Message Name: TMC[4])

Message Element Code: 30

Function: Edit the TMC data in type 8A group.

Format:

	MSB LSB	
MEC	30	
MEL	01..FB	
MED	00..FF	Bit 7: 0= Normal, 1= "Extremely Urgent" Bits 6..5: Buffer Configuration Bits 4..1: Number of transmissions 1-15 Bit 0: Set to zero
MED	00..1F	Block 2 5 bits of first TMC message
MED	00..FF	Block 3 MSB of first TMC message
MED	00..FF	Block 3 LSB of first TMC message
MED	00..FF	Block 4 MSB of first TMC message
MED	00..FF	Block 4 LSB of first TMC message
	:	
	:	
MED	00..FF	Block 4 LSB of nth TMC message

Conventions: Multiples of 37 bits of TMC data are to be sent to the encoder's internal TMC buffer. Bits 6 and 5 of the first Message Element Data are coded as follows:

Bit 6	Bit 5	Buffer Configuration
0	0	Information transmitted with the number of transmissions specified and removed after completion
0	1	Reserved
1	0	For cyclic transmission, TMC information sets (37 bits) are added to the TMC buffer
1	1	Remove all TMC information sets from the TMC buffer

Example: <30><0B><04><01><23><65><B0><E3><11><23><45><67><89>

Add the TMC data, >01 2365 B0E3< and >11 2345 6789< hex, with normal priority to the TMC buffer. Transmit each information set twice.

---

[4]) It is recommended in CEN ENV/12313-1 that TMC be transmitted in ODA using type 8A/3A groups. Therefore ODA commands should be used (see MECs 40 to 45).

3.3.24 Message Name: Free-format group

Message Element Code: 24

Function: To add a group to the free-format buffer for that group type.

Format:

	MSB LSB	
MEC	24	
MED	00..1F	Bits 4..1: Group Type number Bits 0: Group Version A or B
MED	00..7F	Bit 7: Set to 0 Bits 6..5: Buffer Configuration Bits 4..0: Block 2, 5 Bits
MED	00..FF	Block 3 (MSB)
MED	00..FF	Block 3 (LSB)
MED	00..FF	Block 4 (MSB)
MED	00..FF	Block 4 (LSB)

Conventions: If free-format data is present in the buffer for the scheduled group, it will be transmitted instead of the "internally generated RDS data". An encoder schedules group transmission according to its group sequence or higher priority event. If free-format data is present in the buffer for a group type which is not scheduled for transmission the free-format data will not be transmitted. Therefore the necessary group for free-format data has to be inserted into the group sequence in addition to the "normal RDS groups".

Bits 6 and 5 of the second MED are coded as follows:

Bit 6	Bit 5	Buffer Configuration
0	0	Information transmitted once only and removed after transmission
0	1	Reserved
1	0	For cyclic transmission, free-format information sets are added to the specified buffer
1	1	Remove all free-format information sets from the specified free-format buffer

Example: <24><07><0C><00><00><AB><DE>

Data for type 3B group, Block 2 data is 0C hex, Block 3 data will be overwritten by PI code because type B group is selected, Block 4 data is AB DE hex. The data is transmitted only once.

3.3.25 Message Name: Paging call without message

Message Element Code: 0C

Function: To send a paging call with no message and specify the number of repetitions.

Format:

	MSB LSB	
MEC	0C	
MED	0..F 0..F	Bits 7..4: Number of repetitions (max 15) Bits 3..0: Pager address (MSB)
MED	00..FF	Pager address
MED	00..FF	Pager address (LSB)

Conventions: The first hex number (bits 7..4) of the first byte of the Message Element Data (MED) is used to define the number of repetitions of a paging call. If this number equals 0, the default repetition number shall be used. The second hex number (bits 3..0) of the first byte of the MED and the next two bytes of the MED, represent 20 bits for hex coding of the pager address number (a number of 6 digits) as in CENELEC prEN 50067:1997.

Example: <0C><20><25><34>

Send a call, twice, to pager address "009524" (02534 hex).

3.3.26 Message Name: Paging call with numeric message (10 digits)

Message Element Code: 08

Function: To send a paging call with a 10 digit numeric message and specify the number of repetitions.

Format:

	MSB LSB	
MEC	08	
MED	0..F 0..F	Bits 7..4: Number of repetitions (max 15) Bits 3..0: Pager address (MSB)
MED	00..FF	Bits 7..0: Pager address
MED	00..FF	Bits 7..0: Pager address (LSB)
MED	0..A 0..A	Message (first 2 digits)
MED	0..A 0..A	Message (second 2 digits)
MED	0..A 0..A	Message (third 2 digits)
MED	0..A 0..A	Message (fourth 2 digits)
MED	0..A 0..A	Message (fifth 2 digits)

Conventions: The first hex number (bits 7..4) of the first byte of the Message Element Data (MED) is used to define the number of repetitions of a paging call. If this number equals 0, the default repetition number shall be used. The second hex number (bits 3..0) of the first byte of the MED and the next two bytes of the MED, represent 20 bits for hex coding of the pager address (6 digits). The remainder of the MED contains the 10 digit message, in conformity with CENELEC prEN 50067:1997.

Example: <08><31><84><86><72><10><01><1A><AA>

Send the message >7210011␣ ␣ ␣<, three times, to pager address "099462" (18486 hex).

3.3.27 Message Name: Paging call with numeric message (18 digits)

Message Element Code: 20

Function: To send a paging call with an 18 digit numeric message and specify the number of repetitions.

Format:

	MSB LSB	
MEC	20	
MED	0..F 0..F	Bits 7..4: Number of repetitions Bits 3..0: Pager address (MSB)
MED	00..FF	Bits 7..0: Pager address
MED	00..FF	Bits 7..0: Pager address (LSB)
MED	0..A 0..A	Message (first 2 digits)
MED	0..A 0..A	Message (second 2 digits)
MED	0..A 0..A	Message (third 2 digits)
	:	
	:	
MED	0..A 0..A	Message (eighth 2 digits)
MED	0..A 0..A	Message (last 2 digits)

Conventions: The first hex number (bits 7..4) of the first byte of the Message Element Data (MED) is used to define the number of repetitions of a paging call. If this number equals 0, the default repetition number shall be used. The second hex number (bits 3..0) of the first byte of the MED and the next two bytes of the MED, represent 20 bits for hex coding of the pager address (6 digits). The remainder of the MED contains the 18 digit message, in conformity with CENELEC prEN 50067: 1997.

Example: <20><F1><84><80><72><10><01><10><03><31><83><95><72>

Send the message >721001100331839572<, 15 times, to pager address "099456" (18480 hex).

3.3.28 Message Name: Paging call with alphanumeric message (80 characters)

Message Element Code: 1B

Function: To send a paging call with up to an 80 character alphanumeric message and specify the number of repetitions.

Format:

	MSB LSB	
MEC	1B	
MEL	4..53	Message element length
MED	0..F 0..F	Bits 7..4: Number of repetitions Bits 3..0: Pager address (MSB)
MED	00..FF	Bits 7..0: Pager address
MED	00..FF	Bits 7..0: Pager address (LSB)
MED	00..FE	Message (first character)
MED	00..FE	Message (second character)
MED	00..FE	Message (third character)
	:	
	:	
MED	00..FE	Message (last character) Maximum of 80 characters

Conventions: The first hex number (bits 7..4) of the first byte of the Message Element Data (MED) is used to define the number of repetitions of a paging call. If this number equals 0, the default repetition number shall be used. The second hex number (bits 3..0) of the first byte of the MED and the next two bytes of the MED, represent 20 bits for hex coding of the pager address (6 digits). The remainder of the MED contains the alphanumeric message, in conformity with CENELEC prEN 50067: 1997.

Example: <1B><08><41><E2><40><48><65><6C><6C><6F>

Send the message >Hello< (1E240 hex), 4 times, to pager address "123456".

3.3.29 Message Name: International paging call with numeric message (15 digits)

Message Element Code: 11

Function: To send an International paging call with a 15 digit numeric message and specify the number of repetitions.

Format:

	MSB LSB	
MEC	11	
MED	0..F 0..F	Bits 7..4: Number of repetitions (max 15) Bits 3..0: Pager address (MSB)
MED	00..FF	Bits 7..0: Pager address
MED	00..FF	Bits 7..0: Pager address (LSB)
MED	0..9 0..9	Country Code (2 digits)
MED	0..9 0..A	Bits 7..4: Country code (1 digit) Bits 3..0: Message (first 2 digits)
MED	0..A 0..A	Message (next 2 digits)
	:	
	:	
MED	0..A 0..A	Message (last 2 digits)

Conventions: The first hex number (bits 7..4) of the first byte of the Message Element Data (MED) is used to define the number of repetitions of a paging call. If this number equals 0, the default repetition number shall be used. The second hex number (bits 3..0) of the first byte of the MED and the next two bytes of the MED, represent 20 bits for hex coding of the pager address (6 digits). The remainder of the MED contains the 15 digit coded in conformity with CENELEC prEN 50067: 1997.

Example: <11><31><E2><40><22><00><03><8A><61><A3><01><92><6A>

Send the message >0038 61 301926<, 3 times, to pager address "123456" (1E240 hex) in country >220<.

3.3.30 Message Name: International paging with functions message

Message Element Code: 10

Function: To send a paging call with a international function message.

Format:

	MSB LSB	
MEC	10	
MED	0..F 0..F	Bits 7..4: Number of repetitions (max 15) Bits 3..0: Pager address (MSB)
MED	00..FF	Bits 7..0: Pager address
MED	00..FF	Bits 7..0: Pager address (LSB)
MED	0..9 0..9	Country code (2 digits)
MED	0..9 0..F	Bits 7..4: Country code (1 digit) Bits 3..0: Message (first character)
MED	0..F 0..F	Message (second and third characters)
MED	0..F 0..F	Message (fourth and fifth characters)
MED	0..F 0..F	Message (sixth and seventh characters)

Conventions: The first hex number (bits 7..4) of the first byte of the Message Element Data (MED) is used to define the number of repetitions of a paging call. If this number equals 0, the default repetition number shall be used. The second hex number (bits 3..0) of the first byte of the MED and the next two bytes of the MED, represent 20 bits for hex coding of the pager address (6 digits). The remainder of the MED contains the seven hex character message, in conformity with CENELEC prEN 50067: 1997.

Example: <10><31><E2><40><78><9A><BC><DE><F0>

Send the function message >ABCDEF0<, three times, to pager "123456" (1E240 hex) in country >789<.

3.3.31 Message Name: Transmitter network group designation

Message Element Code: 12

Function: To set the transmitter network group designation.

Format:

	MSB LSB
MEC	12
DSN	00..FF
MED	00..07

Conventions: Transmitter network group designation coding is in conformity with CENELEC EN 50067: 1997. (Section 3.2.6.2.2)

All information sets in the paging buffer are removed.

Example: <12><02><03>

Set the transmitter network group designation to >3< (Group code 40-99) in data set 2.

3.3.32 Message Name: EPP transmitter information

Message Element Code: 31

Function: To set paging area code, operator code, extended country code and notification method.

Format:

	MSB LSB	
MEC	31	
DSN	00..FF	
MED	00..FF	Extended Country Code (ECC)
MED	00..3F	Paging Area Code (PAC)
MED	00..0F	Operator Code (OPC)
MED	00..FF	Current Carrier Frequency (CCF)
MED	00..07	Bit 0 : address notification bits, 0=25, 1=50 Bit 1: cycle structure, 0=60 s only, 1= mixed 60 s and 120 s Bit 2: 0=unsorted, 1= sorted

Conventions: The ECC is as defined in CENELEC prEN 50067: 1997. The PAC, OPC and CCF are as defined in prEN 50067 : 1997, Annex M. Bits 0,1 and 2 of the last MED refer respectively to the fields STY, CS and S1 S2, also defined in prEN 50067 : 1997, Annex M.

When the messages are sorted (Bit 2=1) it is recommended that ascending and descending sorting order be alternated.

Example: <31><00><E1><01><03><15><06>

Sets the ECC to E1, PAC to 01, OPC to 03 in the current data set, indicates a current carrier frequency 89.6 MHz, enables one type 13A group at the start of each paging interval; the paging cycle is mixed 60 seconds and 120 seconds and the paging messages are sorted.

3.3.33 Message Name: EPP call without additional message

Message Element Code: 32

Function: To send a paging call without additional message using EPP.

Format:

	MSB LSB	
MEC	32	
MED	00..1F	Bit 6: priority, 0=normal, 1=high Bit 5: cycle structure, 0=60 s, 1=120 s Bit 4: 0=original call, 1=repetition Bits 3..0: paging call counter
MED	00..FF	Bits 7..0: pager address (group code)
MED	00..FF	Bits 7..0: pager address (individual code MSB)
MED	00..F9	Bits 7..0: pager address (individual code LSB)

Conventions: The first byte of the MED indicates to the encoder that the message should be sent with high priority where the encoder structure allows this (Bit 6=1) or with normal priority (Bit 6=0), that the message is addressed to a paging receiver which runs on a 60 or 120 seconds cycle (Bit 5), that the message is the original call or a repetition generated by the paging server (Bit 4).

The paging call counter (Bits 3 to 0) and the repetition flag (Bit 4) are as defined in prEN 50067 : 1997, Annex M. The next three bytes of the MED represent the six digits of the pager address number coded in hexadecimal, but the sixth digit may not exceed 9 to respect the number of paging intervals.

Example: <32><61><AB><CD><E6>

Sends a first paging call without additional message with high priority to the paging receiver address "ABCDE6" which follows a 120 seconds cycle. The paging call counter is 1.

3.3.34 Message Name: EPP national and international call with alphanumeric message

Message Element Code: 33

Function: To send an alphanumeric message paging call using EPP. Recommended maximum length is 80 characters.

Format:

	MSB LSB	
MEC	33	
MEL	05..FD	
MED	00..FF	Bit 7: 0= national call, 1= international call Bit 6: call priority, 0=normal, 1=high Bit 5: cycle structure, 0=60 s, 1= 120 s Bit 4: 0=original call, 1=repetition Bits 3..0: paging call counter
MED	00..FF	Bits 7..0: country code (MSB), international call only
MED	00..FF	Bits 7..4: country code (LSB) , international call only Bits 3..0: original operator code, international call only
MED	00..FF	Bits 7..0: pager address (group code)
MED	00..FF	Bits 7..0: pager address (individual code MSB)
MED	00..F9	Bits 7..0: pager address (individual code LSB)
MED	00..FE	message (first character)
	:	
	:	
MED	00..FE	message (last character)

Conventions: The first byte of the MED indicates that the message is a national or international call (Bit 7), indicates to the encoder that the message should be sent with high priority where the encoder structure allows this (Bit 6=1) or with normal priority (Bit 6=0), that the message is addressed to a paging receiver which runs on a 60 or 120 seconds cycle (Bit 5), that the message is the original call or a repetition generated by the paging server (Bit 4).

The paging call counter (Bits 3 to 0) and the repetition flag (Bit 4) are as defined in prEN 50067 : 1997, Annex M.

The next two bytes of the MED are present only in the case of an international call and contain a country code (according to CCITT Rec. 212) and the original operator code according to RDS Paging WG Doc. 1 and 2. The next three bytes of the MED represent the six digits of a pager address number coded in hexadecimal but the sixth digit may not exceed 9 to respect the number of paging intervals. The following bytes contain the characters of the message.

Example: <33><09><31><01><23><45><48><65><6C><6C><6F>

Sends a repeat of a national variable length alphanumeric message "hello" with normal priority to the paging receiver address "012345" which follows a 120 s cycle. The paging call counter is 1.

3.3.35 Message Name: EPP national and international call with variable length numeric message

Message Element Code: 34

Function: To send a numeric message paging call using EPP. Recommended maximum length is 160 digits.

Format:

	MSB LSB	
MEC	34	
MEL	05..FD	
MED	00..FF	Bit 7: 0= national call, 1= international call Bit 6: call priority, 0=normal, 1=high Bit 5: cycle structure, 0=60 s, 1= 120 s Bit 4: 0=original call, 1=repetition Bits 3..0: paging call counter
MED	00..FF	Bits 7..0: country code (MSB), international call only
MED	00..FF	Bits 7..4: country code (LSB), international call only Bits 3..0: original operator code, international call only
MED	00..FF	Bits 7..0: pager address (group code)
MED	00..FF	Bits 7..0: pager address (individual code MSB)
MED	00..F9	Bits 7..0: pager address (individual code LSB)
MED	00..FF	message (first 2 digits)
	:	
	:	
MED	00..FF	message (last 2 digits)

Conventions: The first byte of the MED indicates that the message is a national or international call (Bit 7), indicates to the encoder that the message should be sent with high priority where the encoder structure allows this (Bit 6=1) or with normal priority (Bit 6=0), that the message is addressed to a paging receiver which runs on a 60 or 120 seconds cycle (Bit 5), that the message is the original call or a repetition generated by the paging server (Bit 4).

The paging call counter (Bits 3 to 0) and the repetition flag (Bit 4) are as defined in prEN 50067 : 1997, Annex M.

The next two bytes of the MED are present only in the case of an international call and contain a country code (according to CCITT Rec. 212) and the original operator code according to RDS Paging WG Doc. 1 and 2. The next three bytes of the MED represent the six digits of a pager address number coded in hexadecimal but the sixth digit may not exceed 9 to respect the number of pagng intervals. The following bytes contain the digits of the message.

Example: <34><05><26><EF><09><52><67>

Sends the first occurrence of a two digit long national variable length numeric message "67" with normal priority to the paging receiver address "EF0952" which follows a 120 second cycle. The value of the paging call counter is 6.

3.3.36 Message Name: EPP national and international call with variable length functions message

Message Element Code: 35

Function: To send a functions message paging call using EPP. Recommended maximum length is 160 digits.

Format:

	MSB LSB	
MEC	35	
MEL	05..FF	
MED	00..FF	Bit 7: 0= national call, 1= international call Bit 6: call priority, 0=normal, 1=high Bit 5: cycle structure, 0=60 s, 1= 120 s Bit 4: 0=original call, 1=repetition Bits 3..0: paging call counter
MED	00..FF	Bits 7..0: country code (MSB), international call only
MED	00..FF	Bits 7..4: country code (LSB), international call only Bits 3..0: original operator code, international call only
MED	00..FF	Bits 7..0: pager address (group code)
MED	00..FF	Bits 7..0: pager address (individual code MSB)
MED	00..F9	Bits 7..0: pager address (individual code LSB)
MED	00..FF	message (first 2 digits)
	:	
	:	
MED	00..FF	message (last 2 digits)

Conventions: The first byte of the MED indicates that the message is a national or international call (Bit 7), indicates to the encoder that the message should be sent with high priority where the encoder structure allows this (Bit 6=1) or with normal priority (Bit 6=0), that the message is addressed to a paging receiver which runs on a 60 or 120 seconds cycle (Bit 5), that the message is the original call or a repetition generated by the paging server (Bit 4).

The paging call counter (Bits 3 to 0) and the repetition flag (Bit 4) are as defined in pr EN 500067 : 1997, Annex M.

The next two bytes of the MED are present only in the case of an international call and contain a country code (according to CCITT Rec. 212) and the original operator code according to RDS Paging WG doc. 1 and 2. The next three bytes of the MED represent the six digits of a pager address number coded in hexadecimal but the sixth digit may not exceed 9 to respect the number of pagng intervals. The following bytes contain the digits of the message.

Example: <35><08><D3><20><83><C4><8F><91><12><34>

Sends a repetition of a four digit long international variable length functions message "1234" with high priority to the paging receiver address "C48F91" which follows a 60 s cycle. The value of the paging call counter is 3. The CCITT code is 208, and the original OPC is 3.

3.3.37 Message Name: Real time clock

Message Element Code: 0D

Function: To set the date and time.

Format:

	MSB LSB	
MEC	0D	
MED	00..63	Last two decimal digits of Year expressed as hex
MED	00..0C	Month
MED	00..1F	Date
MED	00..17	Hours
MED	00..3B	Minutes
MED	00..3B	Seconds
MED	00..63	Centiseconds
MED	00..3F	Local Time offset

Conventions: Time of day is expressed in terms of Co-ordinated Universal Time (UTC). The local Time Offset byte should be coded in conformity with CENELEC prEN 50067: 1997, as follows:

MSB							LSB
1	2	3	4	5	6	7	8
Not Used	Not Used	Sign of Local Time Offset 0 = + 1 = -	Magnitude of Local Time Offset in multiples of half hours				

Date, hours, minutes, seconds and centiseconds are coded as binary numbers and then expressed as a two digit hex number. If all fields are set to zero, the type 4A groups are transmitted with all zeros.

Example: <0D><5C><09><0C><0A><12><21><0F><02>

The following is to be set: Year is 1992, Month is September, Date is 12, Hour is 10, Minute is 18, Second is 33, Centisecond is 15 and Local Time offset is 1 hour.

3.3.38 Message Name: Real time clock correction

Message Element Code: 09

Function: To set real time clock correction (RTCC) in order to compensate a delay caused by the signal distribution. The adjustment range is between -32768 ms and +32767 ms.

Format:

	MSB LSB	
MEC	09	
MED	00..FF	RTCC higher byte hex
MED	00..FF	RTCC lower byte hex

Conventions: The RTCC is coded as a 16 Bit two's complement number.

Example: <09><FF><C6>

Set Real Time Clock Correction to -58ms.

3.3.39 Message Name: CT On/Off

Message Element Code: 19

Function: To enable/disable the transmission of type 4A group.

Format:

	MSB LSB	
MEC	19	
MED	00..01	Enable/Disable

Conventions: "01" enables the transmission of type 4A groups and "00" disables it. The time is set with the Real Time Clock Command.

Example: <19><01>

Enable transmission of type 4A group.

3.3.40 Message Name: RDS On/Off

Message Element Code: 1E

Function: To switch RDS output signal "On" or "Off".

Format:

	MSB LSB	
MEC	1E	
MED	00..01	RDS Off/On

Conventions: "00" switches RDS "Off", "01" switches "On"

Example: <1E><00>

Switch the RDS output signal "Off".

3.3.41 Message Name: RDS phase

Message Element Code: 22

Function: To set RDS subcarrier phase shift relative to the phase of the 3rd harmonic of the 19 kHz reference signal for a specified Reference Table entry.

Format:

	MSB LSB	
MEC	22	
MED	0..7 0..E	Bits 7..5: Reference Table entry Bit 4: Set to 0 Bits 3..0: RDS phase MSB
MED	00..FF	RDS phase LSB

Conventions: Reference '0' means that the phase is related to all table entries, '1' to '6' identify a specific table entry, '7' is the currently selected table entry.
The RDS phase is expressed in the range from 0 to 359.9 degrees, in steps of 0.1 degrees and converted to a hex number.

Example: <22><45><4C>

Set phase to 135.6 degrees for Reference Table entry: Input 4.

Request Message Command Format:

To request the RDS phase, the following format is required:

	MSB LSB	
MEC	17	
MEL	02	
MED	22	Code of requested message
MED	00..07	Reference table entry

On a request, with reference table entry set to 0, the data of all reference table entries is returned in separate message elements.

3.3.42 Message Name: RDS level

Message Element Code: 0E

Function: To adjust the level of the RDS subcarrier in mV_{p-p} for a specified Reference Table entry.

Format:

	MSB LSB	
MEC	0E	
MED	0..7 0..1F	Bits 7..5: Reference Table entry Bits 4..0: RDS level MSB
MED	00..FF	RDS level LSB

Conventions: Reference "0" means that the level is related to all table entries, "1" to "6" identify a specific table entry, "7" is the currently selected table entry. The RDS level is expressed in the range from 0 to 8191 mV_{p-p}, and converted to a 13 Bit number.

Example: <0E><A3><11>

Set RDS level to 785 mV_{p-p} for Reference Table entry: input 5.

Request Message Command Format:

To request the RDS level, the following format is required:

	MSB LSB	
MEC	17	
MEL	02	
MED	0E	Code of requested message
MED	00..07	Reference table entry

On a request, with reference table entry set to 0, the data of all reference table entries is returned in separate message elements.

3.3.43 Message Name: ARI On/Off

Message Element Code: 21

Function: To switch ARI output signal "On" or "Off".

Format:

	MSB LSB	
MEC	21	
MED	00..01	ARI Off/On

Conventions: "00" switches ARI "Off", "01" switches ARI "On".

Example: <21><00>

Switch the ARI output signal "Off".

3.3.44 Message Name: ARI area (BK)

Message Element Code: 0F

Function: To set the ARI area code.

Format:

	MSB LSB	
MEC	0F	
MED	00,0A..0F	ARI Area code A..F

Conventions: "00" switches the ARI Area modulation "Off".

Example: <0F><0A>

Switch ARI Area code to A.

3.3.45 Message Name: ARI level

Message Element Code: 1F

Function: To adjust the output level of the ARI subcarrier in mV_{p-p} for a specified Reference Table entry.

Format:

	MSB LSB	
MEC	1F	
MED	0..7 0..1F	Bits 7..5: Reference Table entry Bits 4..0: ARI level MSB
MED	00..FF	ARI level LSB

Conventions: Reference "00" means that the level is related to all table entries, "1" to "6" identify a specific table entry, "7" is the currently selected table entry. The ARI level is expressed in the range from 0..8191 mV_{p-p}, and converted to a 13 Bit number.

Example: <1F><F4><07>

Set ARI level to 5127 mV_{p-p} on all Reference Table entries.

Request Message Command Format:

To request the ARI level, the following format is required:

	MSB LSB	
MEC	17	
MEL	02	
MED	1F	Code of requested message
MED	00..07	Reference table entry

On a request, with reference table entry set to 0, the data of all reference table entries is returned in separate message elements.

3.3.46 Message Name: Site address

Message Element Code: 23

Function: To load or remove a site address in the encoder.

Format:

	MSB LSB	
MEC	23	
MED	00..03	Control Bits
MED	00..03	Site address high
MED	00..FF	Site address low

Conventions: The range of permitted site addresses is 001..3FF hex (10 Bits).
The global site address "0" is always defined for the encoder. This address does not need to be included in a downloaded address list, and may not be cleared.

Manufacturers may choose to implement a special (individual) site address that cannot be changed or cleared with this command, to prevent lock-out

Significance of the two control bits:

Bit 1	Bit 0	
0	0	remove the specified site address from the list
0	1	add the specified site address to the list
1	0	remove all site addresses
1	1	not used

On a request all stored site addresses are returned in separate message elements with control bits set to Bit 1=0 and Bit 0=1.

Example: <23><01><00><48>

Add the site address 0048 hex to the list of site addresses.

3.3.47 Message Name: Encoder address

Message Element Code: 27

Function: To load or remove an encoder address in the encoder.

Format:

	MSB LSB	
MEC	27	
MED	00..03	Control Bits
MED	01..3F	Encoder address

Conventions: The range of permitted encoder addresses is 01..3F hex (6 Bits).

The global encoder address "0" is always defined for the encoder. This address does not need to be included in a downloaded address list, and may not be cleared.

Manufacturers may choose to implement a special (individual) encoder address that cannot be changed or cleared with this command.

Significance of the two control bits:

Bit 1	Bit 0	
0	0	remove the specified encoder address from the list
0	1	add the specified encoder address to the list
1	0	remove all encoder addresses
1	1	not used

On a request all stored encoder addresses are returned in separate message elements with control bits set to Bit 1=0 and Bit 0=1.

Example: <27><01><13>

Add the encoder address 13 (hex) to the list of encoder addresses.

3.3.48 Message Name: Make PSN list

Message Element Code: 28

Function: To assign one PSN as the main network service in the specified data set(s) and assign the other PSNs as other networks (EON).

Format:

	MSB LSB	
MEC	28	
DSN	00..FF	
MEL	01..FC	
MED	01..FF	PSN Main service
MED	01..FF	PSN EON service
	:	
	:	
MED	01 FF	PSN EON service

Conventions: This command establishes the Main service and the EON services which will be utilized in a given data set within the encoder. When issued, the command deletes all data in the specified data set and establishes the program services from this command. These services will need to be loaded using appropriate commands and then be enabled using the PSN enable command before the output is transmitted. The command is not permitted for the current data set.

Example: <28><02><05><03><01><04><09><2F>

In data set 2, assign PSN = 3 as the main service and the PSN's 1, 4, 9 and 47 as EON services.

3.3.49 Message Name: PSN enable/disable

Message Element Code: 0B

Function: To enable or disable a specified PSN.

Format:

	MSB LSB	
MEC	0B	
DSN	00..FF	
MEL	02..FC	
MED	00..01	Bit 0: 0 disable PSN; 1 enable PSN
MED	01..FF	Index of PSN to be enabled/disabled
MED	00..01	
	:	
	:	
MED	00..01	
MED	01..FF	

Conventions: The main PSN may not be affected, addressing the main PSN will cause an error code.

Example: <0B><03><04><00><06><01><07>

Disable PSN 6 and enable PSN 7 in Data set 3.

3.3.50 Message Name: Communication mode

Message Element Code: 2C

Function: To set the communication mode of the encoder.

Format:

	MSB LSB	
MEC	2C	
MED	00..02	Control Bits

Conventions: 0 means unidirectional mode (see Section 1.3.1).
1 means bi-directional mode with requested response (see Section 1.3.2).
2 means bi-directional mode with spontaneous response (see Section 1.3.3); the sequence counter is set to 0.

Whenever this command is received, by an encoder, it must reset the sequence counter to a value of 1.

When changing from mode 2 to any other mode it will not be acknowledged.

Example: <2C><01>

The encoder is set to bi-directional mode with requested response.

3.3.51 Message Name: TA control

Message Element Code: 2A

Function: To control the generation of type 15B groups in the "On" and "Off" transition.

Format:

	MSB LSB	
MEC	2A	
MED	00..08	Minimum number of other groups between two type 15B groups (0..8)
MED	0..F 0..F	Bits 7..4: Number of type 15B groups at TA "On" transition Bits 3..0: Number of type 15B groups at TA "Off" transition

Conventions: In the second MED, 0 specifies that no type 15B group is to be transmitted at the given transition. 1..E specifies the number of type 15B groups to be transmitted at the given transition. F means the type 15B groups should be transmitted continuously while the respective state is maintained.

Example: <2A><01><02>

Transmit two 15B groups, with a gap of >1< between two 15B groups, at the TA "Off" transition.

3.3.52 Message Name: EON - TA control

Message Element Code: 15

Function: To control the generation of type 14B groups in the "On" and "Off" transition.

Format:

	MSB LSB	
MEC	15	
MED	00..08	Minimum number of other groups between successive 14B groups (0..8)
MED	0..F 0..F	Bits 7..4: Number of 14B groups at TA "On" transition Bits 3..0: Number of 14B groups at TA "Off" transition

Conventions: In the second MED, 0 specifies that no type 14B group is to transmitted at the given transition. 1..E specify the number of type 14B groups to be transmitted at the given transition. F means the type 14B group should be transmitted continuously while the respective state is maintained.

Example: <15><01><02>

Transmit two type 14B groups, with a gap of >1< between two type 14B groups, at the TA "Off" transition.

3.3.53 Message Name: Reference input select

Message Element Code: 1D

Function: To select the 19 kHz reference input in the encoder and apply levels and phase from corresponding Reference Table entry.

Format:

	MSB LSB
MEC	1D
MED	01..06

Conventions: The Reference Table contains one entry corresponding to each reference input. Each table entry contains RDS level, RDS phase, ARI level (optional) and ARI phase (optional).

Example: <1D><01>

Reference input number >1< is selected, as well as level and phase parameters for Reference Table entry number 1.

3.3.54 Message Name: Data set select

Message Element Code: 1C

Function: To select desired data set to be active ("on air").

Format:

	MSB LSB	
MEC	1C	
MED	01..FD	Data set

Example: <1C><17>

Select data set >23< to be active.

3.3.55 Message Name: Group sequence

Message Element Code: 16

Function: To set the group sequence in the specified data set(s).

Format:

	MSB LSB	
MEC	16	
DSN	00..FF	
MEL	01..FC	
MED	00..1F	Bits 7..5: Set to 0 Bits 4..1: group type Bit 0: group version, 0=A,1=B
	:	
	:	
MED	00..1F	n'th group type and version

Example: <16><00><06><00><04><0E><1C><0D><00>

Set a new group sequence in the current data set as type 0A, 2A, 7A, 14A, 6B, 0A groups.

3.3.56 Message Name: Extended Group Sequence

Message Element Code: 38

Function: To set alternative group sequences for use when dynamic buffers are empty of data for particular groups.

Format:

	MSB LSB	
MEC	38	
DSN	00..FF	
MEL	02..FC	
MED	02..1F	Group type in the group sequence (see 3.3.48, MEC 16) for possible replacement; Bits 4..1: group type Bit 0: group version, 0=A, 1=B
MED	00..1F	Number of alternatives
MED	00..1F	Alternative 1
	:	
MED	00..1F	Alternative n
	:	
MED	02..1F	n'th group type in the group sequence (see 3.3.48, MEC 16) for possible replacement; Bits 4..1: group type Bit 0: group version, 0=A, 1=B
MED	00..1F	Number of alternatives
MED	00..1F	Alternative 1
	:	
MED	00..1F	Alternative n

Convention: More than one alternative sequence is allowed for the same group type, the list of these alternative sequences being cycled through when there is no data for the replaced group. In the case where there are several alternative sequences for the same group type, the position in the list is not advanced if data is available for the particular group type.

Example: <38><01><09><0E><03><10><0C><1C><0E><02><0C><00>

In data set 1, transmission of the first type 7A group should be replaced, if there is no data, by transmission of a type 8A group, or if the type 8A group buffer is empty by a type 6A group, or if the type 6A group buffer is empty by a type 14A group. The next transmission of a type 7A group for which there is no data should be replaced by transmission of a type 6A group or, if the type 6A buffer is empty, by a type 0A group. The following transmission of a type 7A group for which there is no data should be replaced by the alternatives sequence: type 8A, 6A, 14A groups.

0A,	2A,	7A,	14A,	7A,	0A,	6A,	2A,	7A,	group sequence
		|		|				|	
		8A		6A				8A	first alternate
		|		|				|	
		6A		0A				6A	second alternate
		|						|	
		14A						14A	final alternate

3.3.57 Message Name: Group variant code sequence

Message Element Code: 29

Function: To set the variant code sequence for a specified group type in the specified data set(s).

Format:

	MSB LSB	
MEC	29	
DSN	00..FF	
MEL	02..FC	
MED	02,1C	Bits 4..1: group type Bit 0: group version, 0=A, 1=B
MED	00..0F	First Variant code
	:	
	:	
MED	00..0F	nth Variant code

Convention: Type 1A and 14A groups may be used. Other groups which do not utilize Variant codes will be ignored.

Example: <29><00><04><02><00><01><06>

Set a new variant code sequence for type 1A groups in the current data set as: >00, 01, 06<.

Request Message Command Format:

To request the group variant code sequence, the following format is required:

	MSB LSB	
MEC	17	
MEL	03	
MED	29	Code of requested message
MED	00..FF	DSN
MED	02,1C	Bits 4..1: group type Bit 0: group version

3.3.58 Message Name: PS Character code table selection

Message Element Code: 2F

Function: To select the code table number used by the encoder for PS transmission.

Format:

	MSB LSB	
MEC	2F	
MED	00..03	Code Table number

Conventions: The encoder has to use the code table as specified in CENELEC prEN 50067: 1997 Annex E, Fig. E.1 is default.

Setting the MED to 00 indicates to the encoder that no control characters for code table selection will be transmitted.

Example: <2F><02>

Use code table of Figure E.2 in annex E of CENELEC prEN 50067: 1997.

3.3.59 Message Name: Encoder access right

Message Element Code: 3A

Function: To enable or disable access to any message on any port.

Format:

	MSB LSB	
MEC	3A	
MED	00..FF	MEC of the command to be accessed
MED	00..FF	0 = Current port 1 to 253 = Specific port 254 = All ports except current port 255 = All ports
MED	00..01	Bits 7..1: set to zero Bit 0: enable bit 0 = disabled 1 = enabled

Conventions: If a wrong or non-existent port number is specified, the encoder should respond with the Error message 06: "parameter out of range".

If a command is sent that attempts to lock-out the currently used port, the encoder must generate the Error message 09:"message not acceptable".

Example: <3A><3A><FE><00>

Coder access right (MEC 3A) is disabled on all other ports.

<3A><01><08><00>

PI change is disabled on port 8.

Request Message Command Format:

To request the access setting, the following format is required:

	MSB LSB	
MEC	17	
MEL	03	
MED	3A	Code of requested message
MED	00..FF	MEC of the requested access right. If 254 or 255 specified, then data for all implemented MECs will be packed into separate message elements inside the same frame. But if this is too long for a single frame then the Error message 09: "not acceptable" will be generated.
MED	01..FF	Port number. If 0 is specified, then the Error message 06: "parameter out of range" will be generated.

3.3.60 Message Name: Communications port configuration - Mode

Message Element Code: 3B

Function: To set the mode of specified communications ports.

Format:

	MSB LSB	
MEC	3B	
MED	00..FF	0 = Current port 1 to 253 = Specific port 254 = All ports except current port 255 = All ports
MED	00..02	00 Unidirectional mode 01 Bidirectional mode with requested response 02 Bidirectional mode with spontaneous response

Conventions: Communications modes are described in Section 2.3. Changing from Mode 2 to Modes 0 or 1 will not give a spontaneous response.

If a wrong or non-existent port number is specified, the encoder should respond with the Error message 06: "parameter out of range".

Example: <3B><00><01>

Set bidirectional mode with requested response to all ports

<3B><FF><02>

Set bidirectional mode with spontaneous response to currently used port

Request Message Command Format:

To request the mode setting, the following format is required:

	MSB LSB	
MEC	17	
MEL	01,02	
MED	3B	Code of requested message
MED	00..FF	[Port number]. If 0 or none specified, then data for all installed ports will be packed into separate message elements inside the same frame. But if this is too long for a single frame then the Error message 09: "not acceptable" will be generated.

3.3.61 Message Name: Communications port configuration - Speed

Message Element Code: 3C

Function: To change speed of communications ports.

Format:

	MSB LSB	
MEC	3C	
MED	00..FF	0 = Current port 1 to 253 = Specific port 254 = All ports except current port 255 = All ports
MED	00..0C	00 No action 01 75 bps 02 150 bps 03 300 bps 04 600 bps 05 1200 bps 06 2400 bps 07 4800 bps 08 9600 bps 09 19200 bps 0A 38400 bps 0B 57600 bps 0C 115200 bps

Conventions: This command must not be used with any other messages in the same frame to ensure the full response of the encoder is completed.

If a wrong or non-existent port number is specified, the encoder should respond with the Error message 06: "parameter out of range").

If Port 255 is selected then all ports will be affected by the command. Reply to this message, when bi-directional links are used, should use the original speed. All subsequent responses must be at the new speed.

Notes: *Extreme care must be taken when changing speed of the "current" port. Setting the wrong speed may lock out all future communication. Therefore it is required that this command is sent twice to ensure reliability in making speed changes.*

Firstly the command is sent at the "original" speed and then it is sent at the "new" speed; if the second command is not recognized by the encoder, within 60 seconds, it will revert to the "original" speed.

Example: <3C><02><08>

Change speed of port 2 to 9600 bps

<3C><FF><05>

Set speed of currently used port to 1200 bps

Request Message Command Format:

To request the speed setting, the following format is required:

	MSB LSB	
MEC	17	
MEL	01,02	
MED	3C	Code of requested message
MED	00..FF	[Port number]. If 0 or none specified, then data for all installed ports will be packed into separate message elements inside the same frame. But if this is too long for a single frame then the Error message 09: "not acceptable" will be generated.

3.3.62 Message Name: Communications Port Configuration - Timeout

Message Element Code: 3D

Function: To set a timer to indicate loss of data at a communications port of an encoder.

Format:

	MSB LSB	
MEC	3D	
MED	00..FF	0 = Current port 1 to 253 = Specific port 254 = All ports except current port 255 = All ports
MED	00..FF	00 No action 01 1 minute 02 2 minutes : FE 254 minutes FF Timeout inactive

Conventions: This command is provided to allow the encoder to take specific action on loss of the data link.

If a wrong or non-existent port number is specified, the encoder should respond with the Error message 06: "parameter out of range".

Example: <3D><01><FF>

Disable timer associated with port 1

<3D><FF><01>

Set timer for currently used port to 1 minute

Manufacturer specific response: for example an encoder may change Group Designation to zero, so that pagers scan for a new channel.

Request Message Command Format:

To request the timeout setting, the following format is required:

	MSB LSB	
MEC	17	
MEL	01,02	
MED	3D	Code of requested message
MED	00..FF	[Port number]. If 0 or none specified, then data for all installed ports will be packed into separate message elements inside the same frame. But if this is too long for a single frame then the Error message 09: "not acceptable" will be generated.

3.3.63 Message Name: Message acknowledgment

Message Element Code: 18

Function: Messages used to report acknowledgment of received messages.

Format:

	MSB LSB	
MEC	18	
MED	00..FF	Response Code
MED	00..FF	Sequence counter number

Conventions: The response code is as follows:

0 = Message received OK
1 = CRC error has occurred: Message is wrong
2 = Message was not received (derived from the sequence counter)
3 = Message unknown
4 = DSN error
5 = PSN error
6 = Parameter out of range
7 = Message element length error
8 = Message field length error
9 = Message not acceptable
10 = End message (FF hex) missing
11 = Buffer overflow
12 = Bad stuffing, after FD hex a number outside the range 00 to 02 has been received
13 = Unexpected end of message (FF hex) received
14 - 255 = Undefined

The Sequence counter number is a copy of the sequence counter of the received message reflected by the response. This field is sent only if an error occurred, otherwise, if transmission is OK, this field is not transmitted. In this case, response reflects to last message (bi-directional communication mode 2) or to all messages after last response (bi-directional communication mode 1). If the sequence counter number cannot be determined due to errors, then 00 hex is used.

When multiple commands are sent in one message frame the encoder may either return a frame containing one message acknowledgement for each command in the received frame, or a single acknowledgement if all commands in the frame were correctly received or the error is a global error related to the whole message frame.

This MEC can only be requested in bi-directional mode, requested response.

Example: <18><00><25>

In the bi-directional mode 1: All messages after the last response were correctly received. In the bi-directional mode 2: the last message was correctly received.

<18><02><42> means that sequence number 42 hex is wrong.

3.3.64 Message Name: Request message

Message Element Code: 17

Function: To request specific message to be replied by the encoder.

Format:

	MSB LSB	
MEC	17	
MEL	01..FD	
MED	00..FF	Code of requested message
MED	00..FF	[DSN] if required
MED	00..FF	[PSN] if required
MED	00..FF	Further information if required
	:	
	:	
MED	00..FF	Further information if required

Conventions: The Request Message code is the code of a message to be answered, i.e. most Message Element Codes can be requested, in the same format and length as defined.

The encoder may either respond with the requested message immediately, or may respond with a message acknowledgement and then send the requested message for which the server may send a message acknowledgement.

The presence of DSN and PSN is dependent on the Request Message code and [DSN] and [PSN] are included in conformity with the code that is requested.

Request of the following MEC's needs additional information:

MEC 13 (AF) requires start location,
MEC 14 (EON-AF) requires start location,
MEC 29 (Group variant code sequence) requires group type and version,
MEC 22 (RDS phase) requires reference table entry,
MEC 0E (RDS level) requires reference table entry,
MEC 1F (ARI level) requires reference table entry,
MEC 0A (RT) requires the index of the Radiotext in the Radiotext buffers,
MEC 3A (Access right) requires port number and the MEC concerned,
MEC 3B (Port communication mode) requires port number,
MEC 3C (Port baud rate configuration) requires port number,
MEC 3D (Port timeout) requires port number.
MEC 1A (Slow labeling codes) requires variant code

Details for the request message replies for each of these cases are given on the pages referring to the MEC's.

The following MEC's cannot be requested: MEC 17 (Request message), MEC 2D (Manufacturer's specific command) and all the paging call commands.

Transparent data commands (TDC, EWS, IH, TMC, Free-format group) will return only the contents of cyclic buffers.

Example: <17><02><1A><01>

Means that the Request message code is 1A for DSN 01 hex.

3.3.65 Message Name: Manufacturer's specific command

Message Element Code: 2D

Function: The content and meaning of this command is manufacturer dependant.

Format:

	MSB LSB	
MEC	2D	
MEL	02..FD	
MED	00..FF	Manufacturer designation
MED	00..FF	Manufacturer designation
MED	00..FF	Command (Byte 1)
MED	00..FF	Command (Byte 2)
	:	
	:	
MED	00..FF	Command (Last Byte)

Conventions: This command can be used by the manufacturer to implement any manufacturer's dependent special feature. The manufacturer's designation consists of two bytes. The meaning of the command must be specified by the manufacturer.

Example: <2D><06><4D><41><12><34><56><78>

The >MA< manufacturer's specific command having a length of 4 bytes.

3.3.66 Message Name: Astra ADR special commands

In 1995, the new ASTRA Digital Radio service will start its operation. The Institut für Rundfunktechnik IRT in München has recently studied its potential for its use to provide programme and data links to FM transmitters. This study led to adopting the UECP for inclusion into the ADR transmission standard, and it will thus be possible to feed RDS encoders directly via the satellite. This will not only facilitate but also permit to significantly reduce cost for the implementation of dynamic RDS features within large FM networks. To achieve the objective from an operational point of view, it was thus found necessary and justified to ***reserve a limited set of 17 commands (MEC EC to FC) for the further independent development of the ASTRA ADR specification***, thus maintaining compatibility with this UECP to the highest degree possible.

When these commands are defined, they will be added to this specification.

Appendix 1

CCITT Polynomial

1. Introduction

The CRC is a cyclic redundancy check carried out on data to allow error checking to take place.

The field consists of four hexadecimal characters representing a 16 bit calculation. The divisor polynomial used to generate the CRC is:

$x^{16} + x^{12} + x^5 + 1$

The CRC calculation starts with the most significant bit of the field immediately following the start character and ends with the least significant bit of the character immediately preceding the first CRC character.

The CRC is initialized to a value of FFFF(hex) and the four CRC characters are formed from the INVERSE of the result of the CRC calculation. The four most significant bits are represented by the first CRC field character.

2. PASCAL listing of CCITT CRC calculation routine

Type STRING is a PACKED ARRAY of CHAR with zero'th element holding the length of the string:

SWAP is a library function which swaps the high- and low-order bytes of the argument e.g.

```
VAR X:  WORD;

BEGIN
        X:= SWAP ($1234)        [$3412]
END;
```

LO is a library function which returns the low-order byte of the argument e.g.

```
VAR W:  WORD;

BEGIN
        W:= LO ($1234)          [$34]
END;
```

```
FUNCTION CRCVALUE (STRINGTOEVAL :  STRING):  INTEGER;

VAR

COUNT:  BYTE;
TEMPCRC: WORD;

BEGIN

        TEMPCRC:= $FFFF;

        FOR COUNT:= 1 TO LENGTH (STRINGTOEVAL) DO

        BEGIN

           TEMPCRC:= SWAP (TEMPCRC) XOR ORD (STRINGTOEVAL [COUNT]);
           TEMPCRC:= TEMPCRC XOR (LO (TEMPCRC) SHR 4);
           TEMPCRC:= TEMPCRC XOR (SWAP (LO (TEMPCRC)) SHL 4) XOR
                     (LO (TEMPCRC) SHL 5)
        END;

        CRCVALUE:= TEMPCRC XOR $FFFF

END;  [OF FUNCTION CRCVALUE]
```

3. Example

When applied to the string:

2D111234010105ABCD123F0XXXX11069212491000320066

The range of each of these 47 characters is 00..FF and the CRC generated and then appended will be:

97 23 hex.

Appendix 2

Glossary

Alternative Frequencies (AF)

The list(s) of alternative frequencies give information on the various transmitters broadcasting the same programme in the same or adjacent reception areas, and enable receivers equipped with a memory to store the list(s), to reduce the time for switching to another transmitter. This facility is particularly useful in the case of car and portable radios. One of two Methods, A or B, can be used. Their protocols are explained in 3.2.1.6 of CENELEC prEN 50067: 1997.

Clock-time and date (CT)

In application of the relevant CCIR Recommendations, broadcast time and date codes should use Coordinated Universal Time (UTC) and Modified Julian Day (MJD). Details of using these codes are given in 3.2.3 and annex G of CENELEC prEN 50067: 1997. The listener, however, will not use this information directly and the conversion to local time and date will be made in the receiver's circuitry.

Decoder identification (DI)

This is a switching signal indicating which of 16 possible operating modes (or combinations thereof) is appropriate for use with the broadcast signals.

Enhanced other networks information (EON)

This feature can be used to update the information stored in a receiver about programme services other than the one received. Alternative frequencies, the PS name, Traffic-programme and announcement identification as well as Programme-type and Programme-item-number information can be transmitted for each other service. The relation to the corresponding programme is established by means of the relevant programme identification (see 3.2.1.8 of CENELEC prEN 50067: 1997). Linkage information (see 3.2.1.8.3 of CENELEC prEN 50067: 1997), consisting of four data elements, provides the means by which several programme services may be treated by the receiver as a single service during times a common programme is carried.

Emergency warning systems (EWS)

The EWS feature is intended to provide for the coding of warning messages that for reasons of secrecy cannot be fully detailed. These messages will be broadcast only in cases of extreme emergency and will only be evaluated by special receivers that will automatically tune to the channel carrying the corresponding identification (see 3.2.7 of CENELEC prEN 50067: 1997).

In-house application (IH)

This refers to data to be decoded only within the broadcasting organization. Some examples noted are identification of transmission origin, remote switching of networks and paging of staff. The applications of coding may be decided by each broadcasting organization itself.

Music/speech switch (M/S)

This is a two-state signal to provide information on whether music or speech is being broadcast. The signal would permit receivers to be equipped with two separate volume controls, one for music and one for speech, so that the listener could adjust the balance between them to suit his individual listening habits.

ODA - Open Data Applications

The Open Data Applications feature allows data applications, not previously specified in EN 50067, to be conveyed in a number of allocated groups in an RDS transmission. The groups allocated are indicated by the use of type 3A group which is used to identify to a receiver the data application in use in accordance with the registration details in the EBU/RDS Forum - Open Data Applications Directory.

Programme identification (PI)

This information consists of a code enabling the receiver to distinguish between countries, areas in which the same programme is transmitted, and the identification of the programme itself. The code is not intended for direct display and is assigned to each individual radio programme, to enable it to be distinguished from all other programmes. One important application of this information would be to enable the receiver to search automatically for an alternative frequency in case of bad reception of the programme to which the receiver is tuned; the criteria for the change-over to the new frequency would be the presence of a better signal having the same programme identification code.

Programme-item number (PIN)

The code should enable receivers and recorders designed to make use of this feature to respond to the particular programme item(s) that the user has preselected. Use is made of the scheduled programme time, to which is added the day of the month in order to avoid ambiguity (see 3.2.1.7 of CENELEC prEN 50067: 1997).

Programme service (PS) name

This is a text consisting of not more than eight alphanumeric characters coded in accordance with annex E of CENELEC prEN 50067: 1997, which is displayed by RDS receivers in order to inform the listener what programme service is being broadcast by the station to which the receiver is tuned. An example for a name is "Radio 21". In the case of a local programme, the broadcaster may use any designation (up to 8 characters).

Programme type (PTY)

This is an identification number to be transmitted with each programme and which is intended to specify the programme type within 31 possibilities (see annex F of CENELEC prEN 50067: 1997). This code could also be used for search tuning. The code will, moreover, enable suitable receivers and recorders to be pre-set to respond only to programme items of the desired type. The last number, i.e. 31, is reserved for an alarm identification which is intended to switch on the audio signal when a receiver is operated in a waiting reception mode.

Programme TYpe Name (PTYN)

The PTYN feature is used to further describe current PTY. PTYN permits the display of a more specific PTY description that the broadcaster can freely decide (eg PTY=4: Sport and PTYN: Football). The PTYN is not intended to change the default eight characters of PTY which will be used during search or wait modes, but only to show in detail the programme type once tuned to a programme. If the broadcaster is satisfied with a default PTY

name, it is not necessary to use additional data capacity for PTYN. The Programme Type Name is not intended to be used for automatic PTY selection and must not be used for giving sequential information.

Radio paging (RP)

The RP Feature is intended to provide radio paging using the existing VHF/FM broadcasts as a transport mechanism, thereby avoiding the need for a dedicated network of transmitters. Subscribers to a paging service will require a special pocket paging receiver in which the subscriber address code is stored. Two kinds of Radio paging exist:

- The basic Radio paging
- The Enhanced Paging Protocol (EPP)

In the basic Radio paging, four types of call messages are possible:

- a simple call (bleeper) without message,
- a 10 or 18 digit numeric message, restricted to 15 digits in international paging,
- an alphanumeric message of up to 80 characters,
- a functions message in international paging.

In the Enhanced Paging Protocol, a complete set of variable length messages is added to the four types listed above. These variable length messages are:

- national or international numeric,
- national or international alphanumeric,
- national or international functions.

Radiotext (RT)

This refers to text transmissions coded in accordance with annex E, primarily addressed to home receivers, equipped with suitable display facilities. In car receivers where a text display is undesirable for safety reasons, the Radiotext transmission could be used to control a speech synthesizer; details of operation in this mode require further study.

Traffic-announcement identification (TA)

This is an on/off switching signal to indicate whether an announcement for motorists is on the air. The signal could be used in receivers to:

a) switch automatically from any audio mode to the traffic announcement;

b) switch on the traffic announcement automatically when the receiver is in a waiting reception mode and the audio signal is muted;

c) switch from a programme carrying no traffic information to one carrying a traffic announcement, according to those possibilities which are given in 3.2.1.3 or 3.2.1.8.2 of CENELEC prEN 50067: 1997.

After the end of the traffic announcement the initial operating mode will be restored.

Transparent data channel (TDC)

As well as for the application described above, Radiotext could also be sent in a form suitable for presenting a display on a television receiver similar to that obtained with teletext. These channels may be used to send alphanumeric characters, or other text (including mosaic graphics), or for transmission of computer programs and similar data not for display.

Traffic Message Channel (TMC)

This feature is intended to be used for the coded transmission of traffic information. Type 8A/3A or 8A/1A groups may be used for this purpose and details are descibed in the TMC specific standards issued by CEN (see the ENV/12313-... family of standards).

Traffic-programme identification (TP)

This is an on/off switching signal to indicate, by means of a special lamp (or a similar device) on the receiver, that this is a programme on which announcements are usually made for motorists. The signal could be taken into account during automatic search tuning.

Index of abbreviations

The abbreviations which are commonly used in context with the Radio Data System are listed below in alphabetical order. Most of these terms are explained in the preceding glossary.

1. RDS features:

AF List of alternative frequencies

CT Clock time and date

DI Decoder identification

EON Enhanced information on other networks

EWS Emergency warning systems

IH In-house application

M/S Music/speech switch

ODA Open data application

PI Programme identification

PIN Programme-item number

PS Programme service name

PTY Programme type

PTYN Programme type name

RDS Radio Data System

RP Radio paging

RT Radiotext

TA Traffic-announcement identification

TDC Transparent data channel

TMC Traffic message channel (Application under discussion)

TP Traffic-programme identification

2. Other abbreviations:

ADI Application identification for Open data (see 3.1.5.4 of CENELEC prEN 50067: 1997)

ARI Identification system for broadcasts to motorists (CCIR Report 463 and annex H of CENELEC prEN 50067: 1997)

CI Country identifier (see 3.2.1.8.3 of CENELEC prEN 50067: 1997)

ECC Extended country code (see annex D of CENELEC prEN 50067: 1997)

EG Extended Generic indicator (see 3.2.1.8.3 of CENELEC prEN 50067: 1997)

ILS International Linkage Set indicator (see 3.2.1.8.3 of CENELEC prEN 50067: 1997)

LA Linkage Actuator (see 3.2.1.8.3 of CENELEC prEN 50067: 1997)

LI Linkage Identifier (see 3.2.1.8.3 of CENELEC prEN 50067: 1997)

LSN Linkage Set Number (see 3.2.1.8.3 of CENELEC prEN 50067: 1997)

UECP Universal Encoder Communications Protocol

3. RDS Paging abbreviations:

CCF Current Carrier Frequency (see Figure 8 b of RDS Paging WG Doc. 2, Sept. 1994)

CS Cycle Selection (see 3.2.8.4.1.3 of RDS Paging WG Doc. 2, Sept. 1994)

EPP Enhanced Paging Protocol (see 3.2.8. of RDS Paging WG Doc. 2, Sept. 1994)

IT Paging interval (see 3.8.4.1.3 of RDS Paging WG Doc. 2, Sept. 1994)

OPC Operator Code (see 3.2.8.2 of RDS Paging WG Doc. 2, Sept. 1994)

PAC Paging Area Code (see 3.2.8.2 of RDS Paging WG Doc. 2, Sept. 1994)

SI System Information (see 3.2.8.2 of RDS Paging WG Doc. 2, Sept. 1994)

STY Sub-type of type 13A group (see 3.2.8.4.1.3 of RDS Paging WG Doc. 2, Sept. 1994)

Appendix 3

Identification of manufacturers for the Manufacturer's specific command

Manufacturer	Assigned id.	hex code
Acorn, Slovenia	AC	<41><43>
AEV, Italy	AE	<41><45>
Auditem, France	AU	<41><55>
Aztec, France	AZ	<41><5A>
Cambridge Systems Technology, UK	CA	<43><41>
Cepar, Italy	CE	<43><45>
CRL Inc., USA	CR	<43><52>
Ericsson, Sweden	TE	<54><45>
Gian Technologies, USA	GI	<47 ><49>
Inovonics Inc., USA	IN	<49><4E>
Itelco SpA, Italy	IT	<49><54>
Link Comunicaciones, Spain	LI	<4C><49>
Munter, Italy	MU	<4D><55>
Modulation Sciences., USA	MS	<4D><53>
Profline, Netherlands	PR	<50><52>
RE Technology AS, Denmark	RE	<52><45>
Rohde & Schwarz, Germany	RS	<52><53>
Siel, Italy	SI	<53><49>
Suono Telecom, Italy	SU	<53><55>
Telefunken, Germany	TF	<54><46>
Teleray, Slovenia	TR	<54><52>
Tiesseci, Italy	TI	<54><49>
Velec, France	VE	<56><45>
VG Broadcast, UK	VG	<56><47>

Note: Manufacturers of encoders, worldwide, not included in the list, may apply for a code assignment to the EBU **(contact Mr. Dietmar Kopitz, Tel. +41 22 717 2711, Fax. +41 22 717 2481, E-mail: kopitz@ebu.ch).** Information on RDS and the RDS Forum is available on **http://www.rds.org.uk/**

RDS Universal Encoder Communication Protocol

UECP Version 5.1

Document history

Date	Doc Title	Paper type/Details	Location	disk
February 94	SPB 490 (revised)	Green - double sided	Geneva	
April 94	SPB 490 (2nd Revision)	White - single sided	Geneva	SPB490E2.wpd
September 94	Working Party notes	Not printed	Kingswood Warren	spb490e3.wpd
October 94	SPB 490 (3rd Revision)	Blue - double sided	Kingswood Warren	spb490e4.wpd
May '95	SPB 490 (4th Revision)	Used at meeting	Berlin	spb490e5.wpd
May '95	SPB 490 (4th Revision)	Updated after meeting 26.05.95 for review by drafting group	Berlin	spb490e6.wpd
June ´95	SPB 490 (4th Revision)	Updated after Working Group comments - for issue to RDS Forum	Geneva	spb490e7.wpd
May ‘97	SPB 490 (5th Revision) Version 5.0	Updated after Working Group 5 meeting - for issue to 9th RDS Forum, Metz ‘97	Geneva	s490e50.wpd
August ‘97	SPB 490 (5th Revision) Version 5.1	Revised after review by members of RDS Forum Working Group 5	Geneva	s490e51.wpd

Dietmar Kopitz / Bev Marks
Issue: 2
Date: 26.08.97

DK>D:\My Documents\Text\Rds\S490e51.wpd