TD 16 - Meteosat Data Collection and Distribution Service

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Document Change Record

Issue / Revision	*Date*	*DCN. No*	*Changed Pages / Paragraphs*
V1	20-06-09		Consolidation of TD 04 (Meteosat Data Collection and Retransmission Service for MTP) and TD 09 (same document for MSG
V1A	21-07-09		New Structure. Inclusion of HRDCP from TD 17
V1B	20-09-09		Further restructuring to include High Rate as an additional type.
V1C	04-11-09		Remove ‘Draft’ status of V1B
V1D	10-11-09		Include reference to TD 15
V1F	04-08-11		Include DCP Certification Process and Requirements
V1G	30-09-11		Edits to layout and content
V1H	11-10-12		Additional information on the DCP data via internet Section 2.5.3. Modification to the HRDCP header in section 3.2, sequence counter increase. Introduction of DCP frequency plan into section 7.
V1I	05-03-13		Clarification of DCP channel Frequencies in section 1.6.1. Additional details on pre modulation filter in sections 3.1.2.1 and 3.4.1.1. Minor edits to correct typing errors. Additional information about HRDCP in section 1.5.1.
V1J	18-07-13		Additional international frequencies in Table 11. EIRP power requirements relaxed. Now a min and max. Minor editorial changes.
V2	19-11-13		Changes to EIRP power requirements for HRDCP in section 3.4.4
V2A	27-09-18		Update to define HRDCP version to 1 Update table transmission time to +-0.25s in the section 5.5 HRDCP TEST MATRIX and included short term carrier freq value Changes to test matrix Change CMM1 to 2 s +-0.04 in all relevant sections Additional section 2.6 to include information on HRDCP EOT and CRC Remove section 2.5.3 Meteosat Direct

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			Dissemination Update definition of DCP Service header in section 2.5.4 Updated figure 2 Updated introduction
V2B	11-12-18		Minor editorial changes and update of broken web links

Table of Contents

1 INTRODUCTION

This document describes the collection of environmental data from Data Collection Platforms (DCP) and its subsequent distribution to users.
The collection and distribution of environmental data from Data Collection Platforms is one of the core services operated by EUMETSAT in support of Meteorology and Weather Prediction. It is achieved via the Data Collection and Distribution Service (DCS), which provides distribution mechanisms for data transmitted from sensors located on the surface of the earth and within its atmosphere. The DCS was initially established with the first generation of Meteosat satellites, and has been continued and expanded with Meteosat Second Generation (MSG). It will be expanded again with the introduction of Meteosat Third Generation (MTG).

The MSG satellites supporting the DCP mission are located at 0° longitude and over the Indian Ocean at 41.5°E. They acquire DCP data from DCP platforms located within their footprints. Similar systems are also operated by the US National Oceanic and Atmospheric Administration and the Japan Meteorological Agency, providing worldwide coverage. Some of the DCP bandwidth on board all these meteorological spacecraft is reserved for the International Data Collection System (IDCS). This system allows operators to receive messages from mobile platforms and on ships or aircraft travelling around the world

MSG satellites are compatible with the DCPs designed and built to operate with the first generation Meteosat satellites using the SRDCP (standard rate DCP messages). This document also covers the High Data Rate DCPs (HRDCP) which is the new standard of messages with a higher data rate, robustness to external interferences as well as a reliable indication of the message quality.

Due to the benefits of using HRDCPs, EUMETSAT will only consider new allocations for HRDCPs, although SRDCPs will still be supported for the foreseeable future. All users with dual transmitters (i.e. SRDCP and HRDCP) are recommended to request and use a HRDCP channel allocation.

The DCP bandwidth is divided into 1500Hz channels. The frequency assigned defines the centre frequency. A DCP allocation may span more than one of these channels; this is dependent on the type of DCP. See section 7 for details.

There are three methods of onward distribution:

- through the Global Telecommunications System (GTS) of the World Meteorological Organization (WMO) (used to transmit environmental data to meteorological services throughout the world)
- EUMETCast
- Internet.

1.1 Documentation

1.1.1 Applicable documents

[AD.1] TM Synchronisation and Channel Coding (CCSDS 131.0-B-1, Issue 1, September 2003) - Available at CCSDS webpage

[AD.2] The EUMETSAT Data Policy on the EUMETSAT website (www.eumetsat.int)

1.1.2 Reference documents

[RD.1] William H. Press, Saul A. Teukolsky, William T. Vetterling and Brian P. Flannery, "*Numerical Recipes in C++, The Art of Scientific Computing*", 2002.
Cambridge University Press ISBN 0-521-75033-4

[RD.2] MSG Ground Segment LRIT HRIT Mission Specific Implementation EUM/MSG/SPE/057

[RD.3] Operational Services Specification (OSS)
EUM/OPS/SPE/09/0810

[RD.4] IDCS Users' Guide - Issue 10, Version 1, October 2009

[RD.5] TD 15 EUMETCast EUMETSAT's Broadcast System for Environmental Data - EUM/OPS/DOC/06/0118

[RD.6] Registration form for DCP Certification EUM/OPS/DOC/09/4802

[RD.7] Registration form for DCP Admission EUM/OPS/FRM/11/2846

1.2 System overview

The Data Collection Service (DCS) currently supports the second generation of Meteosat satellites and will support the third generation in future years. DCS comprises the following main functions:

- The transmission of data from DCPs to the satellite
- The immediate relay of the data by the satellite to the Ground Station
- The subsequent basic processing and onward distribution of selected data to the user

The operational satellites are located at a longitude of 0°and 41.5°; hence the DCS can be used by all DCPs situated within their telecommunications field of view. A realistic limit of this view is about 75° great circle arc of the sub-satellite point and corresponding to a ground antenna elevation of 5° (see Figure 1 below). This field of view can extend to approximately 80° great circle arc, depending upon local topographical features.

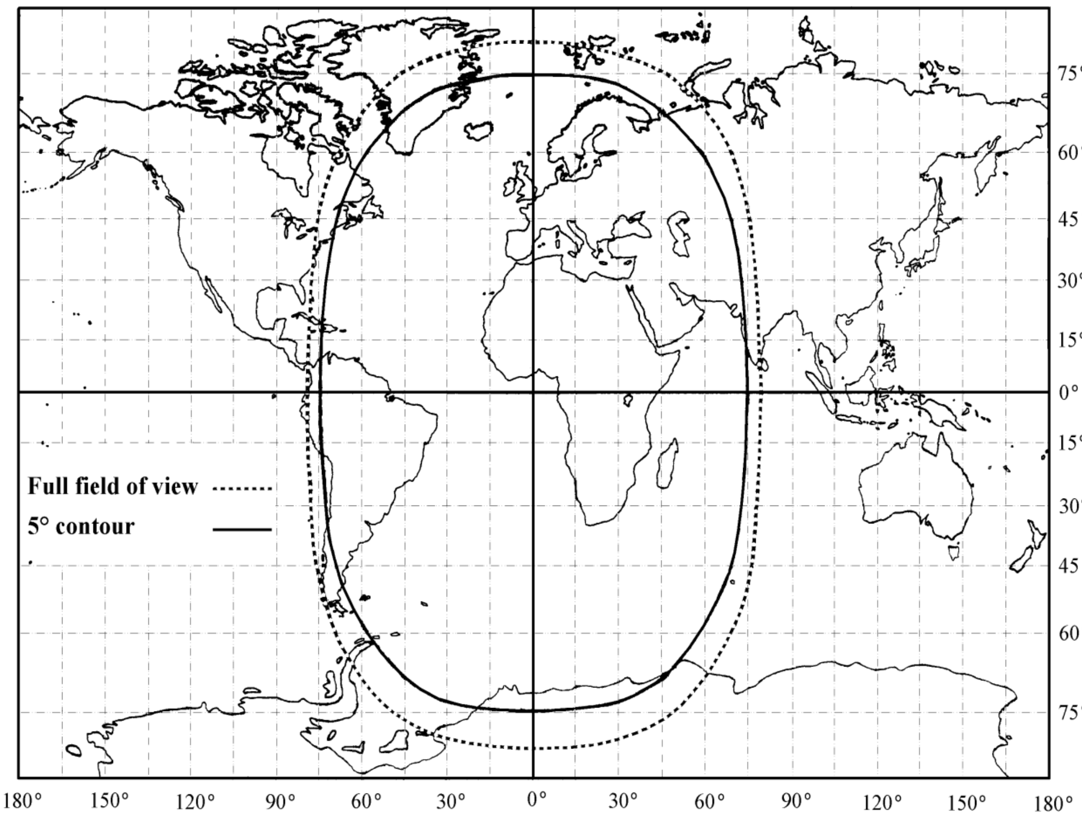

Figure 1: Meteosat 0° DCS Coverage Area

1.3 System diagram

DCP messages can be transponded by Meteosat spacecraft that are in the platforms field of view.They are received at the ground station and then routed immediately to the DCP Processing Facility (DCPF) at Main Control Centre (MCC) in Darmstadt. The messages are compared with the master list of expected DCPs, processed and distributed to end user (Figure 2).

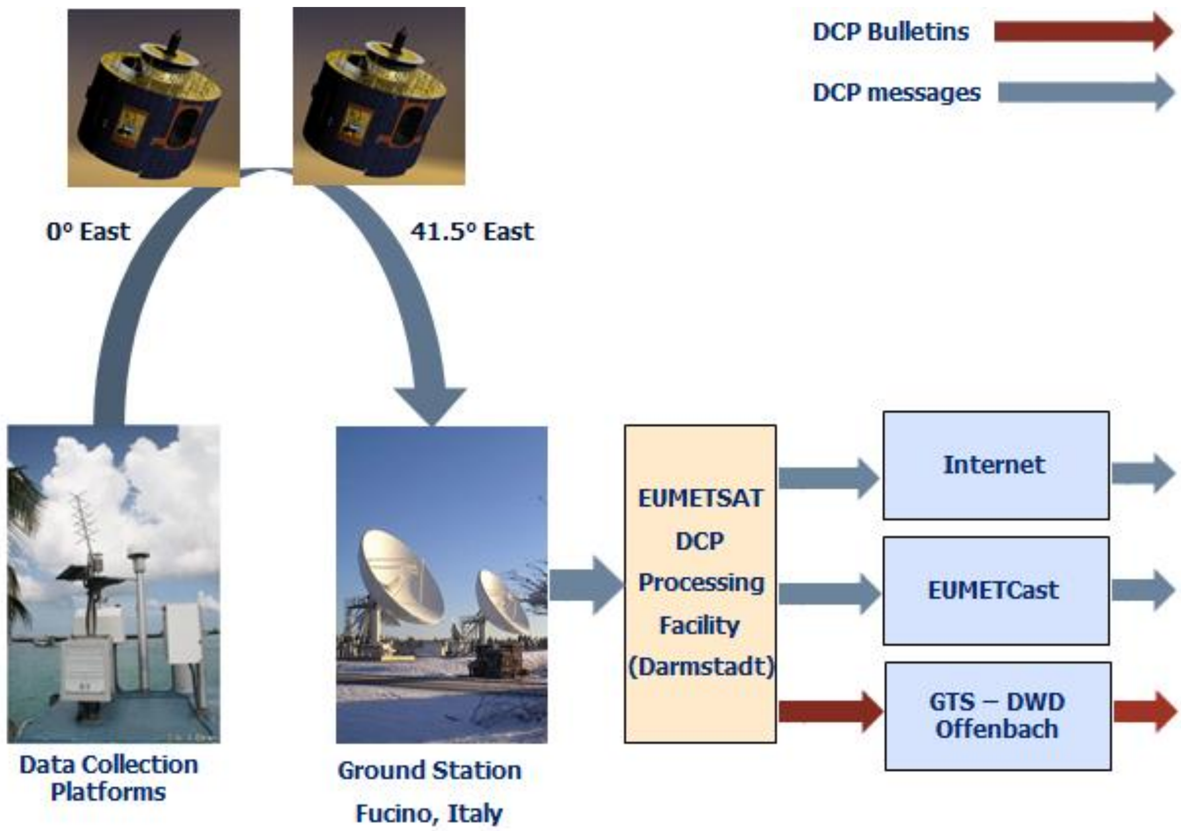

Figure 2: MSG Data Collection System

1.4 DCP Applications

The Meteosat DCS is particularly useful for the collection of environmental data from remote and inhospitable locations where it may provide the only possibility for data relay. Even so, the system has very many uses in regions with a highly developed infrastructure. The installations required for data transmission tend to be inexpensive, unobtrusive and normally blend easily into the local environment.

The following examples serve to demonstrate some of the possibilities offered by the system.

1.4.1 Meteorological Data Collection

The availability of meteorological observations from sparsely inhabited land areas are often poor. The use of automatically operated DCPs in such areas can provide information, which is essential for accurate weather prediction. Many such systems have been deployed across Africa under the sponsorship of the World Meteorological Organization (WMO).

1.4.2 Water Management

The management of water resources can be greatly assisted by making use of DCPs. The measurement of precipitation, river levels, river flow rates and water quality are just some of the parameters that can be easily relayed with a DCP. This type of DCP might also be operated in Alert Mode: for example, a special message might be transmitted once a particular parameter threshold has been exceeded, i.e. to warn of an impending flood danger resulting from the high-water level of a river.

1.4.3 Tsunami Warning Systems

The Meteosat satellites located at 0 degrees and also over the Indian Ocean acquire tide-level data from DCPs situated on moored buoys as part of the Tsunami Warning network. The data collected and transmitted by the platforms are received by the Tsunami Warning Centres in the form of bulletins disseminated using the Global Telecommunications System (GTS) of the WMO. These messages are used to confirm the absence or presence of a Tsunami, following a seismic event. If a Tsunami is detected, and when certain other criteria are met, warning messages are distributed to the affected national authorities to activate emergency measures.

1.5 DCP Types

There are two types of Data Collection Platforms (DCP):

1. Standard Rate DCP (SRDCP), transmits at 100 baud and can transmit 649 bytes of platform data in 60 seconds (including 5 seconds unmodulated carrier, preamble, sync code and address) with a timing accuracy better than +/- 15 seconds.

2. High Rate DCP (HRDCP), transmits at 1200 baud and can transmit 653 bytes of data in 10 seconds. The timing accuracy is also improved to +/- 0.5 seconds. The minimum transmission length will be 15 second slots.

1.5.1 Why Use HRDCP?

The introduction of High Rate Data Collection Platforms (HRDCPs) allows more frequent and robust reporting of data, thereby increasing the overall effectiveness of the DCS and its applications.

The maximum message size has increased, allowing messages of up to 7343 bytes (within a standard 60-second time-slot allocation, but up to 64 kbytes in theory) to be transmitted. A 'standard' DCP message of 653 bytes can now be transmitted within a 15-second slot.

HRDCPs have a much higher noise immunity due to the type of forward error correction used, and provide a very reliable level of message quality.

The large code block size of an HRDCP, along with the possibility for message compression, means that two or more 'standard' DCP messages can be sent per transmission (e.g. current and previous), thus greatly reducing the need for explicit re-transmission for reliability.

The HRDCP now supports binary data as standard, an improvement on the SRDCP.

1.6 Transmission Methods

DCPs can operate within one of the following defined transmission schedules:

Self-Timed: These DCPs transmit at regular intervals and are controlled by an internal clock, according to a schedule jointly agreed by the user and the satellite operator. The standard transmission intervals are hourly or three-hourly, but depending on the program and channel availability this repetition rate could be increased.

Alert: These DCPs transmit short messages, not exceeding 10 seconds in duration, when the value of one or more measured parameters exceeds a pre-set threshold. The platform will repeat the message two or three times every 10 to 15 minutes in order to reduce the risk of possible interference by other alert DCP messages on the same dedicated channel.

Hybrid: This is a DCP that combines the self-timed and alert modes of operation. The DCP will also be assigned to two different channels.

1.6.1 Frequency Bands

The DCS up-link bandwidth is divided into a number of channels, and depending upon its role, each DCP will be allocated to one or more of them, as shown in Figure 3:

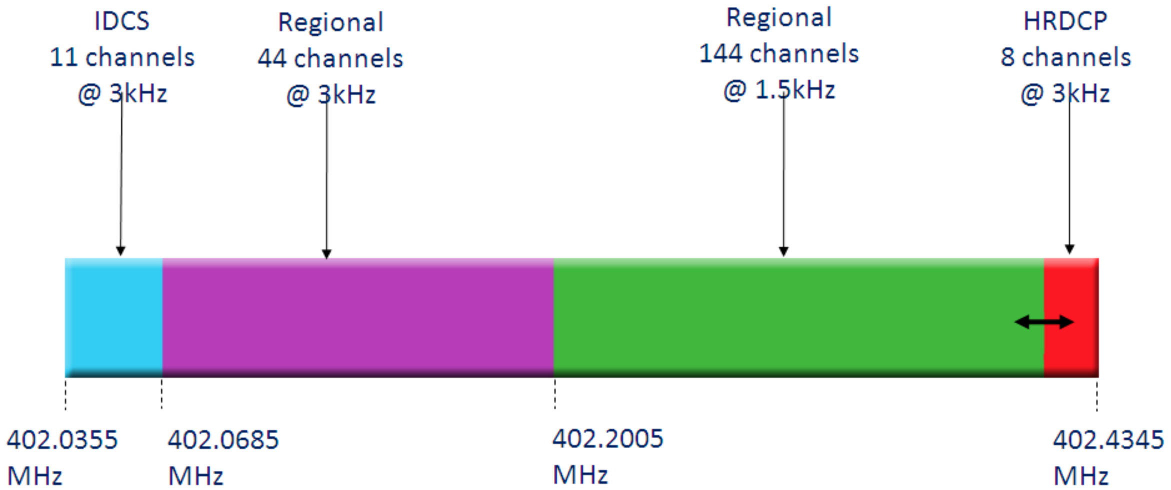

Figure 3 DCP Frequency Band Allocation

The DCS bandwidth is also grouped into two subsets.

1.6.1.1 International Frequency Band

The International Data Collection System (IDCS) is designed to support mobile DCPs, i.e. those DCPs on ships, ocean buoys, aircraft or balloons which move from the telecommunications field of view of one geostationary spacecraft to another.

Use of the IDCS allows coordinated DCP design and message formats, thus permitting the uninterrupted collection of messages from mobile DCPs to be received and processed by any of the CGMS geostationary meteorological satellite operators. By this means, almost continuous telecommunication coverage is possible in most regions of the globe, with the exception of the poles.

Note that only Standard Rate self-timed DCPs can use the IDCS channels.

There are 11 IDCS channels (with centre frequencies spaced 3 kHz apart), and they use the same frequencies (402.0355 - 402.0655 MHz) regardless of the spacecraft. [RD.4]

Additionally, but not shown in Figure 3, EUMETSAT has the permission to use the additional internationally assigned band from 402.0025MHz - 402.0340MHz. This appears in Table 11 from number 268 – 289. These will be assigned as appropriate.

1.6.1.2 Regional Frequency Band

Regional DCPs transmit within the footprint of one satellite and are generally in a fixed position. For compatibility with Meteosat First Generation DCP allocations, DCPs with 3 kHz channel spacing assignments are confined to 44 channels in the frequency range 402.0685 – 402.1975 MHz. The MSG satellites have an additional capacity of 157 regional channels when assigned to 1.5 kHz channel spacing within the frequency range 402.2005 – 402.4345 MHz.

High Rate DCPs will also use a separate area of the bandwidth within the 402.2005 – 402.4345 MHz range and will be assigned to avoid interference with Standard Rate DCPs. Use of the bandwidth for HRDCP will reduce the number of SRDCP channels without affecting established DCPs. These channel frequencies will be assigned as required. The HRDCPs will be assigned 3 kHz.

1.6.1.3 Reserved Frequency Band

The extended DCP frequency range from 402.43525MHz - 402.8500MHz is reserved for use with Meteosat Third Generation (MTG).

2 SECTION FOR DCP OPERATORS

2.1 Introduction

This section will describe how operators can access the DCS and receive their data. It also describes the responsibilities of both the DCP operator and EUMETSAT, and the operations guidelines for effective use of the system.

2.2 DCS Service Specification

The target availability of the DCS is specified as better than 98%. This means that users can expect that 98% or more of the messages transmitted by their DCP will be successfully received, processed and distributed in any given calendar month [RD.3].

2.3 Accessing the Meteosat DCS

The EUMETSAT Data Policy [AD.2] details the conditions to be fulfilled for access to the DCS.

2.4 Allocating a DCP

The allocation of time slots and channel frequencies for all types of DCP is the responsibility of EUMETSAT and a formal registration and allocation procedure must be followed for this purpose. The first step in allocating a DCP is to complete the DCP Admission Form [RD.7].

The main purpose of the DCP Application Form is to establish the DCP Type, its reporting frequency, the distribution method including the WMO GTS bulletin header, and the processing information.

The Meteosat Regional DCP bandwidth is divided into Self-Timed and Alert DCP channels. Self-timed and Alert DCPs use different strategies for the transmission of data

2.4.1 Self-Timed DCPs

For a self-timed DCP a system of timeslot allocation has been adopted, to maintain an effective use of available DCP channel frequencies.

Depending upon the application, the schedule of transmissions could range from several time slots per hour to one time slot per 24 hours. For Standard Rate DCPs each hour is divided into 40 equal time slots of one minute and 30 seconds and each message must be completed within the given time slot. Since the maximum duration of a DCP message is one minute, 30 seconds are available to serve as a guard band between successive messages, in order to allow some margin for long-term drift of the DCP internal clock. For High Rate DCPs the time slots are flexible. The smallest time slot allocation is 15 seconds including the guard band and a maximum of 60 seconds per channel. Channels will be configured as operationally required, to suit the user community needs.

It is imperative that a self-timed DCP transmits according to the agreed time slot, otherwise there will be conflict with transmissions from neighbouring DCPs and data from both the erroneous and the neighbouring DCP will be lost or severely corrupted.

2.4.2 Alert DCPs

In the case of an alert DCP, transmissions use a dedicated channel, which is never used for self-timed DCPs. Although the duration of the message is limited to a maximum of 10 seconds, it is possible that two or more alert messages could overlap. In this case, both messages would normally be lost. In order to reduce the risk of this occurrence, alert platforms repeat their messages several times at fixed intervals over a certain time period, e.g. 10 - 20 minutes. The strategy for the number of repeats and their intervals depends upon the number of alert DCPs and the channel loading.

2.4.3 DCP Data Processing

The following functions are performed for all DCP messages received and processed in Darmstadt:

1. Checking the completeness of data blocks.
2. DCP address recognition.
3. Logging of received and processed messages, including any anomalies;
4. Processing of DCP data and bulletin preparation for messages to be sent to the Regional Telecommunications Hub (RTH) in Offenbach as the entry point for distribution via the WMO GTS;
5. Local archiving of DCP data on a web-based archive, allowing DCP users to retrieve their data covering a minimum of 14 days;
6. Monitoring the operational performance of the DCS e.g. bit error rate, correctness of transmission time, inappropriate use of allocated time slots and channels, and evaluation of received message characteristics.

2.5 DCP Data Distribution

There are three methods of onward distribution: through the Global Telecommunications System (GTS) of the World Meteorological Organization (WMO), EUMETCastand Internet.

It should be noted that no software is provided for the accessing or decoding of DCP data, this responsibility lies with the user.

2.5.1 WMO GTS

DCP Bulletins

The Global Telecommunication System (GTS) is defined as: "The co-ordinated global system of telecommunication facilities and arrangements for the rapid collection, exchange and distribution of observations and processed information within the framework of the World Weather Watch." - WMO No 49 Technical Regulations.

DCP bulletins are forwarded to the GTS Regional Telecommunication Hub (RTH) interface in Offenbach, Germany. The availability of GTS is the responsibility of the WMO; EUMETSAT is only responsible for ensuring that bulletins reach the RTH within the specified timeliness.

Alert DCP messages and self-timed messages that are specified for immediate distribution are processed into bulletins and forwarded within a few minutes of reception.

Some DCP bulletins can contain more than one DCP message, if required by the operator. The availability of the bulletin on the GTS is a few minutes after the last contributing DCP message to that bulletin.

To enable the routing of DCP data via the GTS, the DCP messages must adhere to the formats, structures and procedures as defined by the WMO.

A GTS bulletin contains the following information:

> **Abbreviated Header** – This consists of the following parts:
>
> <u>Bulletin Header Code</u>
>
> The Bulletin Header Code specifies the type and form of the data along with geographical information (6 characters) e.g. SMIY64.
>
> <u>Originating Location Indicator</u>
>
> The Originating Location Indicator represents the station originating or compiling the GTS bulletin (4 characters) e.g. EUMS

Date-Time Group

The Date-Time Group specifies the day and time (UTC-based) of the observation using 6 characters e.g. 100600 DDHHMM where DD = day of month, HH = hour of day and MM = minutes of hour.

An example of a complete Abbreviated Header:

SMIY64 EUMS 100600

Code Identifier

The Code Identifier identifies the type of data contained within the message.

Meteorological Message

The Meteorological Message consists of the actual bulletin data, which can contain up to 15 Kilobytes for ASCII coded messages or 500 Kilobytes of binary coded data.

The specification for the timeliness for delivery of DCP bulletins to the GTS interface is within 10 minutes of arrival at the EUMETSAT Mission Control Centre.

2.5.2 EUMETCast

EUMETCast, EUMETSAT's Broadcast System for Environmental Data, is a multi-service dissemination system based on standard Digital Video Broadcast (DVB) technology. This is fully described in [RD.5]. It uses commercial telecommunication geostationary satellites to multicast files (data and products) to a wide user community. MSG DCP messages are disseminated to users as MSG LRIT files with the name as per the example in Figure 4.

```
1. L-000-MSG___-DCP_________-DCP______-000145___-200904200713-__
```

Figure 4: EUMETCast example filename

The specification for the timeliness for delivery of DCP messages on EUMETCast is within 10 minutes of arrival at the EUMETSAT Mission Control Centre.

2.5.3 Internet

DCP messages are accessible using the EUMETSAT Internet Web Service. This service is access-controlled and Operators can only access their own DCP data using this service.

It is accessed via the following address:
http://oiswww.eumetsat.org/SDDI/webapps/publicdcp/logon.jsp

The specification for the timeliness for delivery of DCP messages to the EUMETSAT website is within 10 minutes of arrival at the EUMETSAT Mission Control Centre.

The first 88 Bytes of the downloaded gzip DCP files will contain the DCP Service header. The following table, available on the EUMETSAT website, details the contents of this header.

https://www.eumetsat.int/website/home/Data/MeteosatDataCollectionServices/index.html

MSG DCPs downloaded from the EUMETSAT Internet Web Service include a DCP quality record.

The 31 Bytes that follow the first 88 Bytes contain the DCP Quality record (DCP_QUALITY), as described in appendix A.7 of [RD.2].

The DCP message (DCP_MESSAGE) follows the DCP Quality record. This is also described in appendix A.7 of [RD.2]. The size of the DCP_Message is variable.

The above sequence is repeated in subsequent messages throughout the gzip file.

There is a difference in formats between SRDCP and HRDCP which is described in Section 3.2

For further information, please contact our “User Service Helpdesk” (see section 2.11).

2.6 DCP Message Structure

The DCP message structure is described in Section 3 for both SRDCP and HRDCP.

For HRDCP there are some additional items that are not listed in section 3. These are:-

1. EOT - There is an EOT added to the end of the HRDCP message during reception in the ground station for processing compatibility with SRDCP. The EOT is described in section 3.1.1

2. CRC – The CRC at the end of an HRDCP message, see section 3.2, is calculated with the address spare bit set to the value 1. In the disseminated HRDCP message the spare

bit is set back to 0. Operators wishing to calculate the CRC need to take this into account.

2.7 LRIT File Structure

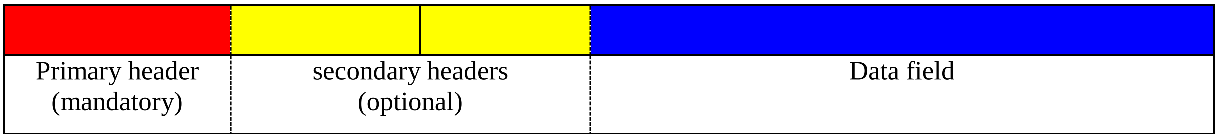

Figure 5: LRIT File Structure

An LRIT file consists of one or more header records and one data field, as illustrated in Table 1.

SIZE (OCTETS)	DATA TYPE	CONTENTS
1	integer, unsigned	header type, set to 0
2	integer, unsigned	header record length, set to 16
1	integer, unsigned	file type code, determining the top level structure of the file data field
4	integer, unsigned	total header length, specifying the total size of all header records (including this one) in octets
8	integer, unsigned	data field length, specifying the total size of the file data field in bits.

Table 1: LRIT header structure

The following file type is used to disseminate DCP data:-

File Type#130 – DCP Message, this is used for DCP messages.

DCP messages disseminated as LRIT files contain one or more DCP messages concatenated in to a single LRIT file.

Further information regarding the MSG LRIT dissemination and file format can be found in the Meteosat Second Generation LRIT/HRIT Service Technical Description. [RD.2]

2.8 EUMETSAT Responsibilities

EUMETSAT is responsible for assigning DCP addresses and managing the transmission schedules used by DCP operators.

EUMETSAT is responsible for monitoring DCP transmissions to ensure they are being made in accordance with agreed time slots and characteristics, and also that they are continuing to operate. In particular, EUMETSAT will notify operators:

- if a DCP is deviating from its allocated time slot (out-of-slot)
- if a DCP is exhibiting bad transmission characteristics
- if there are prolonged periods of non-reception of transmissions from a DCP. In this case, the user will be consulted with a view to de-allocating the DCP from the transmission schedule

EUMETSAT will monitor the performance of the whole DCS System for external interference. If necessary, affected DCPs will be re-allocated to another channel in coordination with the Operator.

EUMETSAT will monitor the performance of DCPs in terms of percentage of allocated slot usage.

EUMETSAT will inform Operators of DCPs found to be performing below specification, to help identify DCPs with possible transmission problems.

EUMETSAT will monitor the performance and quality parameters of all DCPs including:

- start time
- frequency offset
- modulation index
- carrier level
- message length
- number of detected bit errors

DCP performance parameters are included in the DCP messages [RD.2].

2.9 Operator Responsibilities

The success of the DCS is dependent upon operators running their DCPs in accordance with EUMETSAT procedures for the operation of the system. It is therefore important that operators rectify any problems with their DCPs as quickly as possible to minimise any impact on other users of the system.

Operators are strongly encouraged to contact EUMETSAT to clarify any issues relating to DCPs, especially those relating to equipment operation, the allocation of new DCPs and queries on the performance of their DCPs.

Operators should perform regular checks on their DCPs to ensure that they are transmitting in accordance with the agreed schedule.

Operators are requested to immediately respond to communications from EUMETSAT, such as notifications of out-of-slot transmissions or bad transmission characteristics.

Operators should inform EUMETSAT of any change in the status of their DCPs that might result in them not transmitting for an extended period of time (greater than three months). This is to ensure that disciplinary action is not taken by EUMETSAT to de-allocate the DCP.

Operators should inform EUMETSAT of any changes to the engineering or technical points of contact for their DCPs. This is to ensure that EUMETSAT can efficiently inform operators of any observed problems.

Operators should immediately inform EUMETSAT if DCP message slots are no longer required or if they no longer intend to operate their DCPs. The DCP slots can then be de-allocated and assigned to another user

2.10 DCS Operation Guidelines

2.10.1 Discipline

The DCS relies on the effective use of the system by Operators. DCPs should transmit on a regular basis. Any DCP that does not transmit for a three month period, unless by prior agreement with EUMETSAT, will be subject to de-allocation.

EUMETSAT will inform operators of DCPs that have not transmitted for three months. If no reply or suitable plan is received within a further month then the operator will be contacted again and the DCPs will be de-allocated shortly thereafter. The de-allocation of a DCP involves the removal of transmission schedules and all information relevant to that DCP. Any future transmission by the user from this DCP will no longer be recognised or processed by the system.

2.10.2 Out-of-Slot transmissions

EUMETSAT shall inform operators of any regular out-of-slot DCP transmissions as soon as they are detected.

An operator should confirm receipt of out-of-slot notifications issued by EUMETSAT within one week and provide information detailing the planned date for correction. This is particularly important if the DCP cannot be adjusted immediately and resulting in a situation where EUMETSAT has to take necessary action on behalf of other affected DCP operators.

If EUMETSAT has **not** received any confirmation of out-of-slot behaviour **after one week of notification by EUMETSAT**, the DCP will become subject to disciplinary actions. These actions include disabling the distribution of messages from the DCP.

2.11 Support to the Users & Manufacturers

The main point of contact for all User enquiries is the User Service Helpdesk. This includes enquiries from prospective Meteosat DCP operators, from DCP equipment manufacturers, and from any existing operators regarding DCP transmission or reception problems.

Contact details for the User Service Helpdesk:

EUMETSAT
User Service Helpdesk
Eumetsat-Allee 1
D-64295 Darmstadt
Germany

Tel: +49 6151 807 3770
Fax: +49 6151 807 3790
Email: ops@eumetsat.int

3 SECTION FOR MANUFACTURERS

3.1 DCP Data

3.1.1 SRDCP Message Characteristics

SRDCP transmissions are limited to a maximum duration of 60 seconds and each transmission is called a DCP message. In certain applications, data collected over a period of time between transmissions could be compiled and stored in a data buffer and released to the transmitter just prior to the time of transmission. Therefore, one DCP message could contain several sets of data or reports.

In the alert mode, a DCP message transmission is restricted to a maximum duration of 10 seconds, to reduce the risk of interference with other alert transmissions using the same frequency.

The message formats are shown in Table 2 below.

Self-timed DCP Message					
Carrier Preamble	**Bit Preamble**	**Sync Word**	**Address**	**Self-timed Data**	**EOT**
5 seconds	250 bits	15 bits	31 bits	up to 5192 bits	31 bits

Alert DCP Message					
Carrier Preamble	**Bit Preamble**	**Sync Word**	**Address**	**Alert Data**	**EOT**
5 seconds	250 bits	15 bits	31 bits	up to 184 bits	31 bits

Table 2: Message Characteristics of Self-timed and Alert and Standard DCP Messages

The elements of the DCP message are:

Carrier Preamble: Unmodulated, lasting 5 seconds. This period of time allows the appropriate Primary Ground Station DCS receiver to lock onto the carrier.

Bit Preamble: Containing 250 alternating 0 and 1 bits, the preamble permits the receiver bit conditioner and synchroniser to acquire the bit rate and lock onto it. All data transmission must be preceded by the following sequence:

– A minimum of 4.9 seconds of unmodulated carrier

– A minimum of 2.4 seconds of alternative “1” and “0” bits

Sync Word: A 15-bit (0.15 seconds) Maximal Linear Sequence (MLS) synchronisation word:

(FTB) 1000 1001 1010 111 (LTB)
FTB = First Transmitted Bit
LTB = Last Transmitted Bit

Address: A 31-bit Bose-Chaudhuri-Hocquenghem (BCH) coded word. This address word uniquely identifies the DCP, enabling error detection and correction. The first 21 bits are the address itself, the remaining 10 are derived from the first 21 bits and serve as an error check.

When applying for admission to the DCS, an address is uniquely assigned to the platform to identify the originator of the message. The address is generated in hexadecimal coding, in such a way that the user can easily identify several characteristics of the DCP, as shown in the following:

i) The first 4 bits denote the admitting authority for the platform. For example, EUMETSAT is allotted three codes:

EUMETSAT	0001	Hex code 1
EUMETSAT	0010	Hex code 2
EUMETSAT	0011	Hex code 3

The other geostationary meteorological satellite operators have been allotted different codes (see International Data Collection System User's Guide for details).

ii) The second set of 4 bits denotes the type of platform:

International DCS aircraft	0000	Hex code 0
International DCS ship	0001	Hex code 1
Regional self-timed land	0110	Hex code 6
Regional alert land	1110	Hex code E

Other address codes may be added to this list as required.

iii) The third to the fifth sets of 4 bits uniquely identify the platform.

iv) The 21st bit is always set to 0.

v) The remaining 10 bits are used for error checking.

Environmental Data: Maximum of 5192 bits (649 eight-bit words or bytes) in self-timed DCP messages and a maximum of 184 bits (23 eight-bit words or bytes) in alert DCP messages.

Transmissions may use full 8 bit coding (binary), or may be limited to a specific code subset such as ASCII, BCD (represents every decimal digit by four bits) etc. If the message data field contains other than ASCII data, it is the responsibility of the DCP operator to avoid the unique EOT sequence (e.g. by a bit-stuffing mechanism) within the data field to avoid interruptions in message reception. It should be noted that users can only access binary type transmissions either via EUMETCast or the EUMETSAT website.

All DCP messages will be distributed via the GTS. For this reason all DCP message must use International Alphabet No. 5 code (IA5). The recommended data format is the abridged version of IA5, coded using eight bits per character.

The bit numbering follows the convention:

b_1 is transmitted first and contains the LSB

b_8 is transmitted last and contains the MSB

For data field coded with IA5, b_8 will contain a parity bit used for error detection. The parity bit should be set to make the parity of the byte odd, i.e. $b_8 = 0$ if b_1 through b_7 contain an odd number of 'ones'.

EOT: End of Transmission sequence, comprising 31 bits. The first 8 bits are the End of Text (EOT) character of IA5:

(FTB) 0010 0000 1011 1011 0101 0011 1100 011 (LTB)

This code will be sent continuously at the end of the data (with no break) and the radio transmitter will then return to the standby condition.

3.1.2 SRDCP Message Modulation

The carrier is phase-modulated by the serial bit stream, the modulation index being 60°. The phase of the unmodulated carrier should correspond to 0°.

Since the data is "Manchester"-coded, the "0" consists of +60° carrier phase shift for 5 milliseconds followed by -60° carrier phase shift for 5 milliseconds, while the "1" consists of -60° carrier shift for 5 milliseconds followed by +60° carrier phase shift for 5 milliseconds (see Figure 6).

The data asymmetry shall not exceed ±1% of the bit period.

3.1.2.1 Pre Modulation Filter

It is recommended that a 300 Hz, 2-pole Bessel pre-modulation filter be included. In the absence of such a filter, the modulation index shall be 60° with a tolerance of +0% -10%. When the filter is included, the modulation index shall be such that a carrier reduction of between 6 dB and 4.6 dB is achieved."

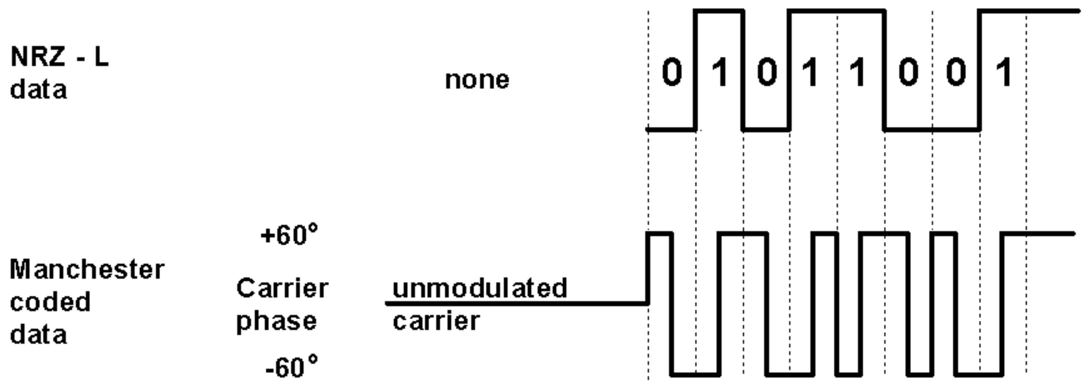

Figure 6: Definition of the Modulation

3.1.3 Radiated Power

The radiated power shall be such the power flux at the spacecraft is -145 dBW/m² ±5 dB.

Provision should be made to ensure that the maximum allowed power flux is not exceeded under any combination of operating conditions. The Effective Isotropic Radiated Power shall not exceed +52 dBm.

3.1.4 Antenna Polarisation

Polarisation shall be right-hand circular according to IEEE Standard 65.34.159, and have an axial ratio of equal to or less than 6 dB on axis.

3.1.5 Transmission Frequencies

The bandwidth assigned to the SRDCP service is divided in channels of either 1.5 kHz or 3 kHz of bandwidth. Refer to section 1.6.1.

3.2 HRDCP Message Format

The HRDCP transmitter is in charge of transmitting messages according to a given format and coding scheme to the MSG spacecraft. The HRDCP message format, as identified in Figure 8, is similar to the SRDCP and can be broken down in the following parts:

a) A header with the HRDCP address and engineering information
b) The platform data field
c) A trailer with an overall CRC.

Each message starts with a 12-bytes long header containing platform and engineering information. The transmitter is in charge of updating its contents, on a per message basis (i.e. length of the platform data field to be transmitted, sequence counter, health information …).

In the engineering section the HRDCP version should be set to 1.

Following the header, the platform data is appended formatted either in ASCII, pseudo binary or binary format without constraints regarding prohibited characters.

Although the HRDCP specification supports lossless compression of the platform data, EUMETSAT has decided not to implement this feature. This would result in a reduction of the total transmission time. Using a ‘gzip’ file compression utility this action is flagged accordingly in the message header. The unit can be configured in the following compression modes:

- Automatic, enabled when platform data size is greater than 653 bytes; and
- Disabled, never used.

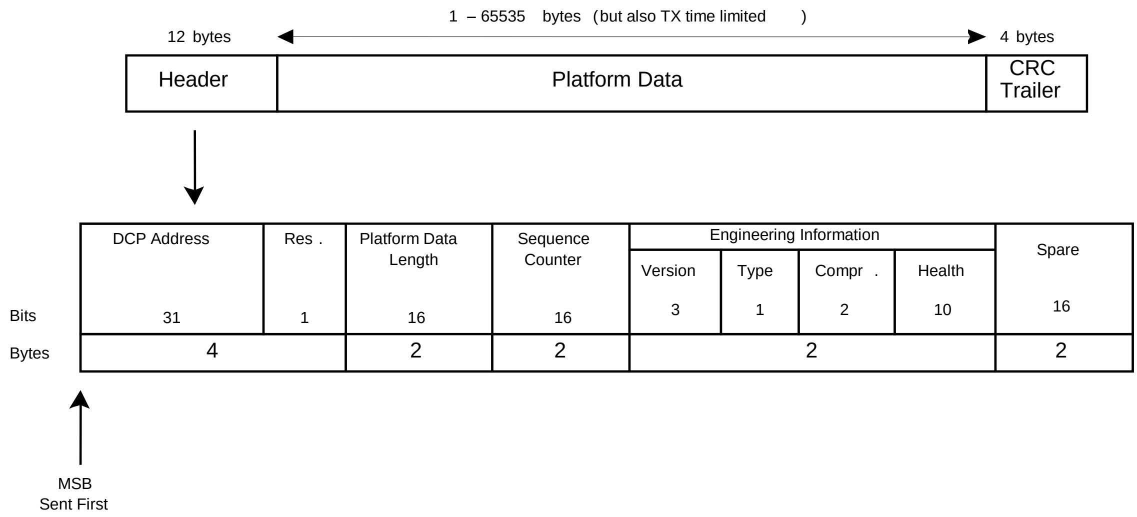

Figure 7: HRDCP Message format

Although the message header assigns two bytes for the platform data length, which would allow for up to 65535 bytes to be transmitted, the actual maximum size will depend on the time slot duration assigned to the transmitter that is limited to a maximum of 60 seconds. Table 4 displays the maximum size of platform data to be transmitted versus assigned time slot duration.

A CRC-32 trailer is appended, MSB-first, at the end of the platform data field to check the integrity of the received HRDCP messages. The CRC is computed according to 0x741B8CD7 polynomial over both the header and platform data. The CRC accumulator is initialised to zero and the data shifted in MSB-first. *(As a means of verifying the correct implementation for HRDCP use, the method of [RD.1] section 20.3 pages 898 to 903 may be used. The result from computing the CRC of the ASCII string "CatMouse987654321" should be 0x1FC0DFEC" and so the message would be appended with the bytes: 0x1F, 0xC0, 0xDF, 0xEC.)*

Parameter	Length in bits	Function
DCP Address	31	DCP address in a 31 bit long Bose Chaudhuri Hocquenghem (BCH) coded word. This address word uniquely identifies the DCP. The first (most significant) bits are the address itself. The remaining 10 bits are derived from the first 21 bits and serve as an error check.
Reserved	1	The LSB of the first 4 byte DCP address is set to 1.
Platform data length	16	The next 2 bytes contain the length in bytes of the platform data embedded in the transmitted message. This 16 bit long field allows for a total of 65535 bytes of platform data to be transmitted.
Sequence Counter	16	The following 2 bytes provide a counter increasing in a sequential manner for each transmitted message. This shall start at 0 following a hardware reset, and then on reaching 65535 shall cycle back to 1. This provides a method of checking the order at the receiving end of the system for reset or missing messages.
Engineering information	16	Information about the unit's status and settings used at the time of message transmission: • 3 bits: Version of HRDCP standard. Used only for changes that are not reverse compatible (Current version is 1). • 1 bit: Type. Used to indicate the type of transmission. (0= Self timed, 1=Alert) • 2 bits: Compression used (0=none, 1=gzip, 2&3 reserved for other methods). • 10 bits: Health. Used to indicate the unit's health status (i.e. time and frequency quality, batteries.....) This is to be defined by the manufacturer.
Spare	16	TBD for future use. Is set to zero.

Table 3: Header Bit Fields

Time Slot Duration [secs]	Max. Platform Data Length [bytes]
10	653
15	1322
20	1991
25	2660
30	3329
35	3998
40	4667
45	5336
50	6005
55	6674
60	7343

Table 4: Maximum transmitted platform data size as a function of assigned time slot.

3.3 HRDCP Message Scrambling and Coding

To improve the probability of successful message delivery, the HRDCP message is scrambled and encoded, using a convolutional concatenated encoder, prior to transmission, as depicted in Table 5 and Figure 8.

As inner code, the system uses the RS (255, 223) encoder, as defined in [AD.1], with an interleaving depth of $I = 3$. Filling, by insertion of zeroes to the right of the HRDCP message, is used when the message size is shorter than the required Reed-Solomon block.

In order to guarantee enough bit transitions, the output of the Reed-Solomon encoder is scrambled using the pseudo-randomizer defined in [AD.1].

A 1-byte tail sequence, value 0x80, is attached at the end of the HRDCP randomised frame to flush the K=7 convolutional encoder to end the trellis in the all zero state. This byte value is repeated as required during the power ramp down at the end of the message.

As outer code, a convolutional encoder (R=1/2, K = 7) is used to encode the HRDCP randomised frames, as defined in [AD.1], prior transmission to the modulator.

Parameter	Value R=1/2
Constraint Length	7
Rate	½
G1 Polynomial	171 Octal
G2 Polynomial	133 Octal
'Scrambling'	Inversion of G2
I Channel Symbol	G1 (171)
Q Channel Symbol	/G2 (133)

Table 5: Convolution Encoding Parameters

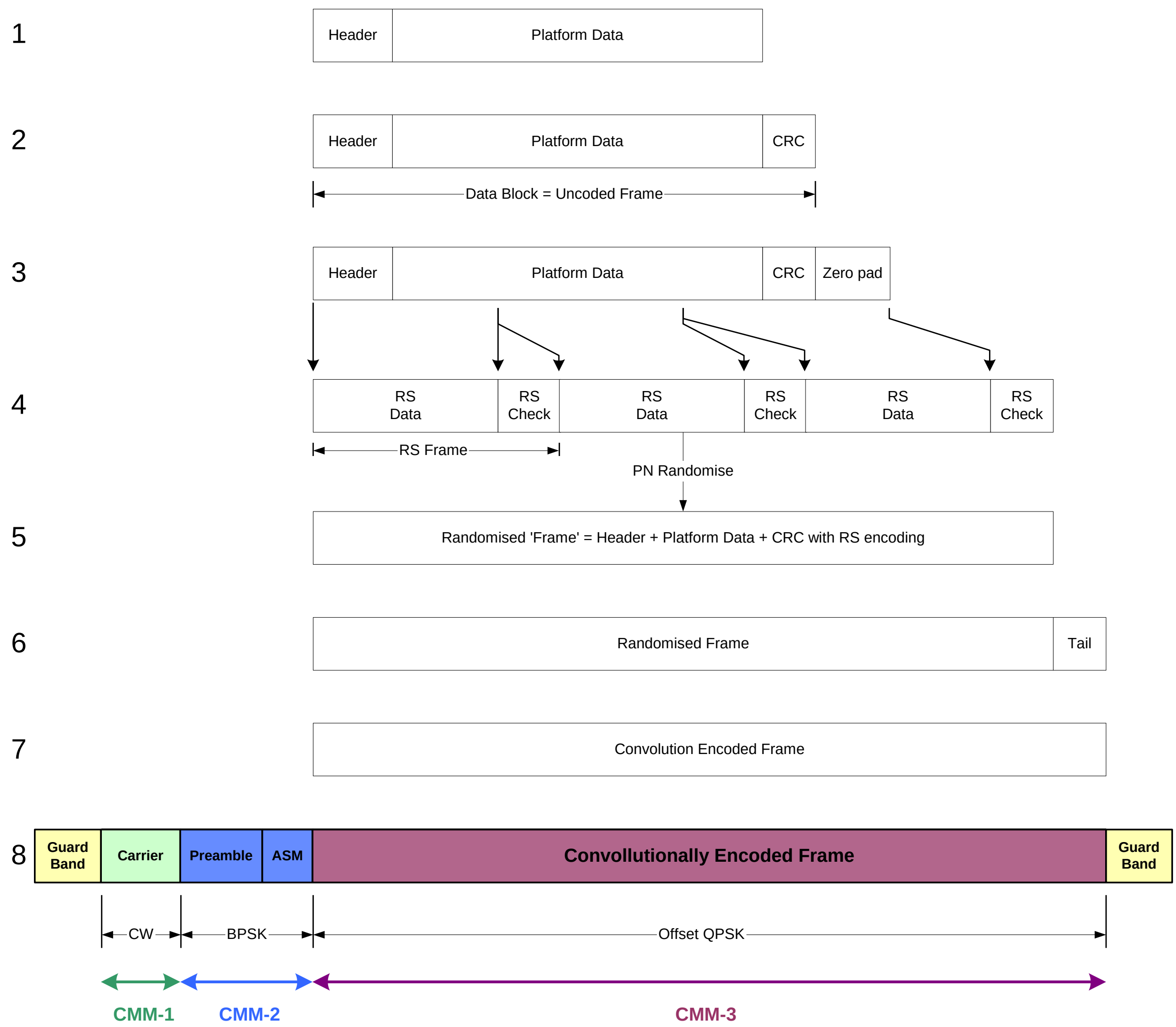

Figure 8: HRDCP message construction and transmission.

3.4 HRDCP Up-link Characteristics

3.4.1 HRDCP Message Modulation

Transmission of a HRDCP message goes through the following carrier modulation modes:

- CMM1: unmodulated carrier only,
- CMM2: BPSK modulation for preamble and ASM, and
- CMM3: OQPSK for HRDCP coded message frame.

In CMM-1 an unmodulated carrier, devised to facilitate carrier acquisition process on the HRDCP receiver side, of 2s ± 0.04s duration is transmitted at the beginning of every message *(During CW carrier transmission, the I/Q modulator is driven with a reference phase of 45º, I = Q = 0, to help the demodulator resolve phase ambiguity).*

In CMM-2, a preamble pattern (devised to facilitate bit synchronisation process on the HRDCP receiver side) and an Attached Synchronisation Marker (devised to counteract false detection) are transmitted after the unmodulated carrier. In this mode, the modulator produces a BPSK-like signal at 1200 bps ±50 ppm (measured at the input of the modulator) from a NRZ-L baseband waveform *(The phase values for the BPSK-like constellation are 45º for 0 and 225º for 1, instead of the traditional 0º and 180º).*

The preamble is a 128-bit long pattern generated by repeating four times the following sequence 0xA05050A0.

The ASM is a 64-bit long marker, 0x034776C7272895B0, attached to the left of the incoming data and it is to be sent once per message (described in [AD.1] for rate-1/2 turbo coded data).

In CMM-3, the convolutionally encoded frame is sent for transmission. The modulator automatically switches to OQPSK signal at 2400 bps ±50 ppm (measured at the input of the modulator) from an NRZ-L baseband waveform. The transmitted symbols have the following mapping (see Table 6):

IQ Symbols (logic values)	I	Q	Phase
00	+1	+1	45º
01	+1	-1	315º
10	-1	+1	135º
11	-1	-1	225º

Table 6: OQPSK Constellation Mapping

The OQPSK modulator has a static I/Q phase imbalance of less than 2° and an amplitude imbalance of less than 0.5dB and matches the ideal SRRC $\alpha = 0.5$ shape with less than 2.5° equivalent RMS phase error.

Transition between BPSK (CMM-2) and OQPSK (CMM-3) modulation is performed such that the output of the convolution encoder is synchronised to the end of the ASM so that the G1 symbol of byte-0 MSB is associated with the first output following the end of the ASM (I channel), followed by the /G2 symbol (for the Q channel). The Q signal initially maintains the last BPSK-like value to avoid any discontinuity.

3.4.1.1 Modulation Filter

The HRDCP transmitter should filter the data with the equivalent of a linear phase Square Root Raised Cosine (SRRC) filter with the parameter alpha=0.5 for both CMM2 and CMM3.

Both are 1200 symbols/second for the I & Q baseband so the same filter can be used. In addition, this filter applied to CMM1 may be sufficient to meet the carrier turn-on requirement (below).

3.4.2 Carrier Turn-On

The rise time of the CW section is kept between 0.5ms and 5ms as measured from the -30dB and -1dB points relative to the final (nominal) value, and shaped such that the overall spectral emission mask is met. Any possible overshoot is not included in the turn-on time.

3.4.3 Carrier Turn-Off

The fall time of the transmission starts following the final encoder ‘flush’ bit (8^{th} bit of the 1^{st} flush byte) sent and is in the range of 0.5ms to 5ms from -1dB to -30dB, and shaped such that the overall spectral emission mask is met. The RF is removed (-60dB or less) by 15ms. (see Figure 9 below).

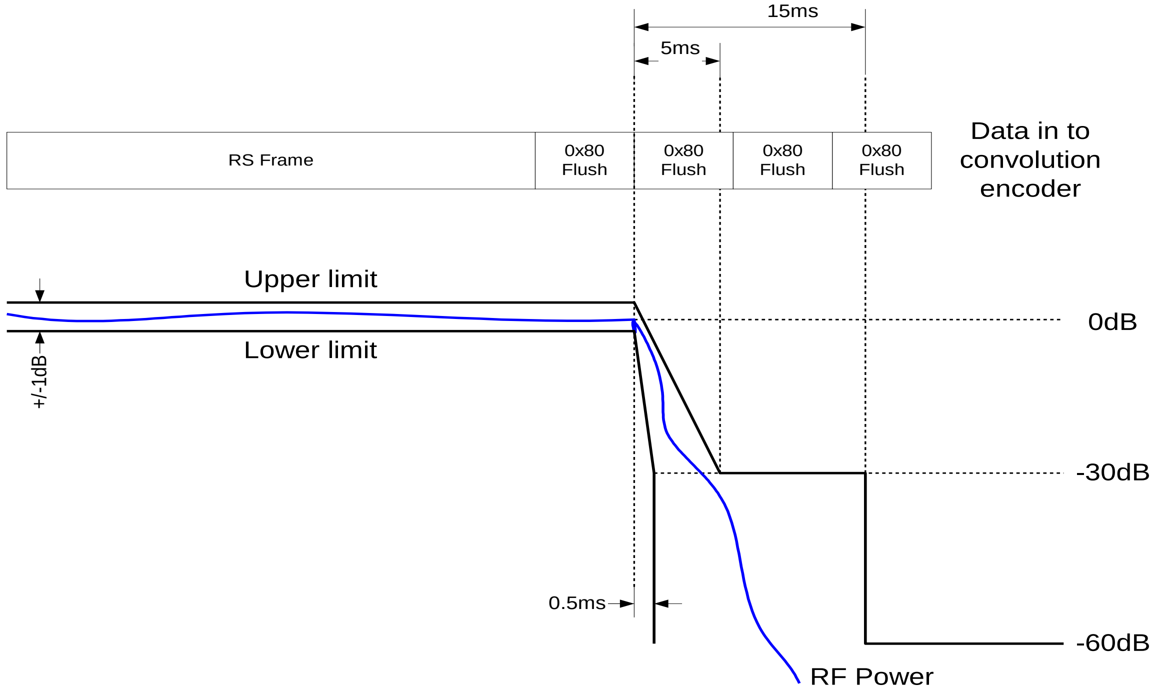

Figure 9: End of Transmission Power Down Mask

3.4.4 Radiated Power

The HRDCP system assumes two general classes of users:

- fixed-land based platforms, for which the recommended TX EIRP falls within the +10 to +18 dBW range, and
- ocean buoy platforms, for which the recommended TX EIRP falls within +14 to +20 dBW.

For both cases the overall successful message reception probability is > 99.5%.

Final operational EIRP is confirmed by EUMETSAT based on service parameters (as stated by the users in the application form). The measured EIRP during a live test will be recorded in the certification report.

The design of the HRDCP must ensure that the limits are not exceeded under any combination of operating conditions.

In both cases the design of the transmitter is such that the output TX power is kept within ±1dB over a message and the mean message output TX power within ±2 dB over the full operating temperature and aging range.

It is recommended that output power should be adjustable.

3.4.5 Antenna Polarisation

The antenna polarisation should be right-hand circular and have an axial ratio of equal to or less than 5 dB on axis.

The antenna gain is selected such that in combination with the HRDCP output power the maximum EIRP is not exceeded.

3.4.6 Transmission Frequencies

The nominal HRDCP bandwidth is 2.25 kHz, however the centre frequency will be assigned as per Table 11 in section 7 and will occupy two adjacent 1500Hz slots taking up 3kHz.

3.4.7 Transmit Frequency Stability

The long term transmit frequency stability is better than ±125 Hz over full operating conditions.

The short term transmit frequency stability is less than ±1 Hz/second rate of change in frequency from the start of the CW power ramp-up until the end of the message (defined by the -6 dB points for this requirement).

The integrated phase noise on the transmit carrier (at the UHF output) is lower than 2.0º RMS when measured with a type 2 PLL with 20 Hz double sideband noise bandwidth within 2 KHz.

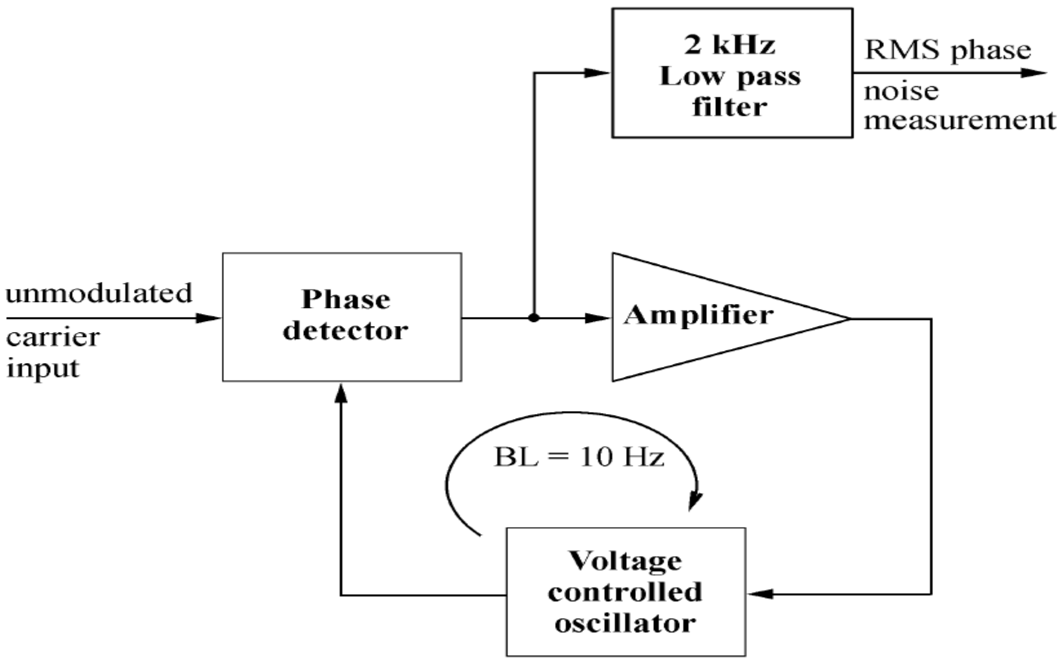

Figure 10: Phase Jitter Measurement Principle.

3.4.8 Transmission Mask

During transmission, the signal falls within the following spectral emission mask, measured at the HPA output at the worst operating point (in terms of bandwidth):

Frequency Relative to Carrier	**Relative Power Spectral Density wrt to Centre Frequency**
2250 Hz Channelisation	
±1125Hz	0 dB (constant limit)
-1125Hz to -2250Hz & 1125Hz to 2250Hz	-25 dB (constant limit)
-2250Hz to -6450Hz & 2250Hz to 6450Hz	-60 dB tapering to -25dB
Beyond ±6450Hz	-60 dB (constant limit)

Table 7: Modulated Signal Spectral Emission Mask.

Any out of band spurious HRDCP transmitter emission for any carrier modulation mode is required to be down from the unmodulated carrier level by 60.0 dB (referred to a measurement bandwidth of 500 Hz, corresponding to -62 dB at 300 Hz).

3.4.9 Timing Accuracy and Stability

The unit shall maintain time accuracy so the start of transmission is within ±0.25s of the assigned UTC start time over full operating conditions.

The unit can be programmed to start transmission with a 1s (or less) resolution.

3.4.10 Fail-Safe Design

The HRDCP design incorporates a "fail-safe" feature in order that a malfunction of the equipment does in no way cause continuous transmission. *(For test purposes only, the unit is able to generate a continuous unmodulated carrier).*

Furthermore, provision is made to ensure that any part of the transmission might occur outside the assigned reporting period ±0.25 seconds. Similarly, transmissions are inhibited if the unit no longer meets frequency accuracy requirements or power voltage drops below the minimum of the specified operating range.

3.5 HRDCP Dissemination and Distribution

HRDCP will be distributed as per the standard DCP methods.

4 DCPRS CERTIFICATION PROCESS

4.1 Introduction

With the implementation of the HRDCP standard, EUMETSAT has revised its Certification process and new Certifications (or any re-certifications) performed by EUMETSAT witnessing a series of tests at the manufacturer's premises, or at a third-party test facility selected by the manufacturer, and of review of the manufacturer's test report.

DCPRS Certification is achieved by demonstrating that a DCPRS (transmitter) fulfils each of the requirements set forth in the respective portions of this document. EUMETSAT certification is a "type certification", wherein a representative production unit is tested and found to fulfil all the stated requirements. The testing of further production units with the same model number is not required; however, where major design changes have been made, either to hardware or software, then either full or partial re-testing will be required. The extent of any re-testing will be agreed with EUMETSAT.

4.2 Certification Process

The certification process will consist of the following steps:

- Certification request to be made by the manufacturer using the EUMETSAT form [RD.6]: EUM/OPS/DOC/09/4802.

- Acknowledgement made by EUMETSAT and a test date agreed.

- At least six weeks prior to the scheduled test date the manufacturer shall submit to EUMETSAT the following documents for EUMETSAT's review and agreement:

  DCPRS Model Number with its specification data sheet(s)
  DCPRS electrical and electronic circuit schematics
  DCPRS software description/flow-charts that identify how the following DCPRS functions are fulfilled:
    - Reporting method(s) - random, self-timed;
    - Message formatting/generation;
    - Frequency and time stability functions; and
    - Fail-safe operation.

  DCPRS antenna gain, polarization, axial ratio, and VSWR data
  DCPRS oscillator aging analysis data to demonstrate that the specified aging requirements are met.

  Test Plan and Matrix
  Detailed Test Procedures

  The reference documents for the EUMETSAT requirements will be this document.

- Following a successful laboratory test, the manufacturer shall arrange a suitable location for performing a 24-hour test using one of the EUMETSAT spacecraft. EUMETSAT will assign the spacecraft and a test frequency, and collect and analyse the messages for this "live" test.

  The manufacturer will be responsible for arranging all of the national and local permissions for transmitting from their nominated location in the DCP frequency band(s).

- The manufacturer shall submit a complete test report to EUMETSAT within four weeks of the conclusion of the "live" test; this data will be reviewed by EUMETSAT and any discrepancies will be noted to the manufacturer and a suitable partial or complete re-test will be organised if required.

4.3 Test Documentation

4.3.1 Test Plan

As indicated above, six weeks prior to a scheduled certification test session, the manufacturer shall submit to EUMETSAT, for review, a detailed test plan showing how each of the EUMETSAT requirements will be demonstrated as met. It is expected that compliance with each requirement will be demonstrated by a test, however, in the case where a requirement is mutually deemed to be un-testable then the compliance with this requirement shall be demonstrated by Analysis or in exceptional circumstances by Design. The test plan document shall contain a matrix showing all the EUMETSAT requirements and how compliance will be demonstrated (Test, Analysis or Design).

4.3.2 Test Procedures and Analyses

As indicated above, six weeks prior to a scheduled certification test session, the manufacturer shall submit to EUMETSAT, for review, a set of detailed step-by-step test procedures describing how each test will be performed and the required test result and measurement error analysis. In addition any analyses required to demonstrate an un-testable requirement shall also be submitted at this time.

4.3.3 Test Facility

The manufacturer will arrange for a suitable test facility either at his premises or at a third party premises, where there is the required equipment (test equipment, ovens, variable power supply etc) necessary to perform the certification tests. All costs for the facility and personnel required to perform the tests will be the responsibility of the manufacturer or the entity submitting the certification request. EUMETSAT will be responsible for the costs associated with witnessing the tests and reviewing test plans, procedures and test results.

4.3.4 On-Satellite Test

The manufacturer will arrange for a suitable test facility either at his premises or at a third party premises, where there is the required visibility of a EUMETSAT spacecraft in order to perform a 24-hour test using the EUMETSAT spacecraft and the EUMETSAT DCP reception and processing facility. The purpose of this test is to demonstrate that the DCPRS under certification is fully compatible with the EUMETSAT system. EUMETSAT will assign a test frequency and schedule to be used for the test and will arrange to collect the test messages and statistics associated with each message. This data will be provided to the manufacturer for inclusion in the test report.

All costs for the facility and personnel required to perform the test will be the responsibility of the manufacturer or the entity submitting the certification request; in addition, the manufacturer will be responsible for obtaining any national or local permissions for transmitting in the DCP frequency band from the desired location(s).
EUMETSAT will be responsible for the costs associated with collecting the test data and statistics.

5 DCPRS CERTIFICATION SPECIFICATION REQUIREMENTS

5.1 General Requirements

The following requirements are applicable to both SRDCP and HRDCP radio sets (DCPRS).

5.1.1 Temperature

The DCPRS will be tested to demonstrate that it is capable of operating over the temperature range as defined by the manufacturer.
This range will be typically: - 40 °C to + 50 °C

5.1.2 Voltage

The DCPRS will be tested to demonstrate that it is capable of operating over the voltage range as defined by the manufacturer.
This range will be typically: nominal voltage – 12.5% to + 25%
Example for +12 volts battery operation: 10.5 volts to 15 volts

5.1.3 Voltage/Temperature Test Matrix Requirements

A matrix of temperature and voltage test requirements can be found in section 5.4 and 5.5 for SRDCP and HRDCP respectively.

5.1.4 EIRP

The DCPRS shall be capable of achieving a minimum EIRP of +40 dBm and must not exceed +52 dBm.

5.1.5 Antenna Polarisation

The antenna polarisation shall be Right Hand Circular (RHCP) according to the IEE standard 65.34.159 and shall have an on axis axial ratio of 5dB or less.

5.1.6 Transmission Frequencies

The table of transmission frequencies and channel allocations are shown in Section 7, Table 11.

5.1.7 DCPRS Test Functions

In order to perform some of the tests it will be necessary that the DCPRS is capable of operating in a non-normal mode. It will be the responsibility of the manufacturer to ensure that the DCPRS is capable of the required modes in order to demonstrate various requirements.
As an example of possible modes:

- CMM1 (Carrier only)
- Repetitive bit pattern 0 – 1
- CMM2 only
- Repetition of short message sequence
- Long message with pattern repetition

5.2 SRDCP REQUIREMENTS

5.2.1 Frequency Management

5.2.1.1 Temperature and long term stability

The transmitting carrier frequency stability shall be better than 0.75 parts per million against temperature variations and ageing together. The specification applies typically over the temperature range of -20°C to +50°C and over one year, unless specified differently by the DCP Operator and agreed by the admitting satellite operator.

5.2.1.2 Short Term

The phase jitter on the transmit carrier shall be less than 3 degrees RMS when measured through a phase lock loop two-sided noise bandwidth (2BL) of 20Hz and with 2 kHz Figure 11.

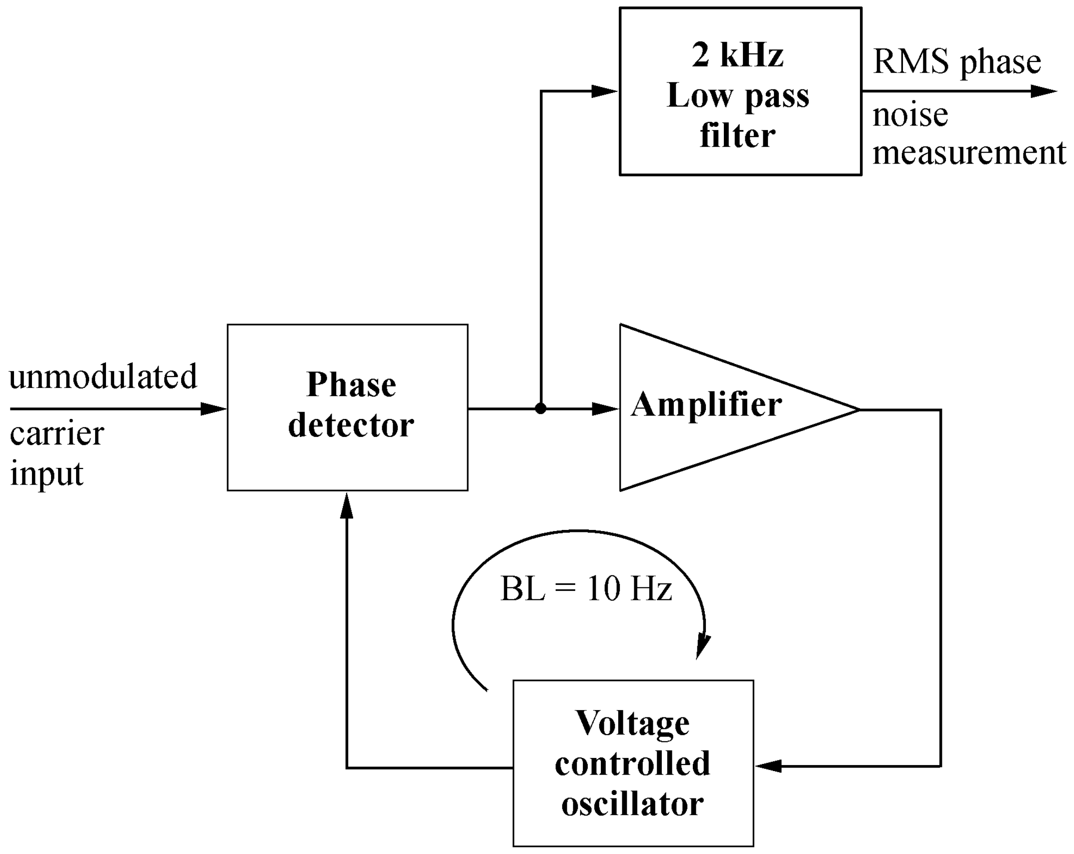

Figure 11: Phase Jitter Measurement Principle

5.2.2 Transmission Format

5.2.2.1 Preamble

All data transmissions shall be preceded by the following EUMETSAT defined sequence:
- a minimum of 4.9 seconds of unmodulated carrier,
- a minimum of 2.4 seconds of alternative "1" and "0" bits,
- the 15 bit (0.15 seconds) Maximal Length Sequence (MLS) synchronisation word:

  1 0 0 0 1 0 0 1 1 0 1 0 1 1 1

  ↑ first transmitted bit ... ↑ last transmitted bit
- the 31 bit (0.31 seconds) Bose-Chaudhuri-Hocquenghem (BCH) coded address word assigned by EUMETSAT:

  0 0 1 1 0 1 0 0 1 0 0 0 0 1 0 1 0 1 1 1 0 1 1 0 0 0 1 1 1 1 1

  ↑ first transmitted bit ... ↑ last transmitted bit

The maximum duration of the preamble shall be 8.0 seconds.

5.2.2.2 Data

All data must use approved characters from the International Alphabet no. 5 coded over 8 bits. The approved characters are shown in Table 8.

b1 is transmitted first
b8 is transmitted last
b8 is the parity bit odd
b8 = 0 if b1 through b7 contain an odd number of "ones".

The following control characters should not appear in the data message:
ACK, CAN, DLE, ENQ, EOT, ETB, ETX, GS, NAK, RS, SOH, STX and SYN.

All transmissions will have a data rate of 100 ±0.005 bps and will be Manchester encoded and shall not be greater than 5192 bits (Alert message 184 bits).

The carrier shall be modulated in the following manner (see Figure 6 Definition of the odulation):

(a) a data "0" shall consist of +60° carrier phase shift for 5 milliseconds followed by -60° carrier phase shift for 5 milliseconds,
(b) a data "1" shall consist of -60° carrier phase shift for 5 milliseconds followed by +60° carrier phase shift for 5 milliseconds,
(c) the phase of the 5 second unmodulated carrier shall correspond to the phase 0° of the modulated carrier.

				b_7	0	0	0	0	1	1	1	1
				b_6	0	0	1	1	0	0	1	1
				b_5	0	1	0	1	0	1	0	1
b_4	b_3	b_2	b_1		**0**	**1**	**2**	**3**	**4**	**5**	**6**	**7**
0	0	0	0	**0**			**SP**	**0**		**P**		
0	0	0	1	**1**				**1**	**A**	**Q**		
0	0	1	0	**2**				**2**	**B**	**R**		
0	0	1	1	**3**				**3**	**C**	**S**		
0	1	0	0	**4**				**4**	**D**	**T**		
0	1	0	1	**5**				**5**	**E**	**U**		
0	1	1	0	**6**				**6**	**F**	**V**		
0	1	1	1	**7**			**'**	**7**	**G**	**W**		
1	0	0	0	**8**			**(**	**8**	**H**	**X**		
1	0	0	1	**9**			**)**	**9**	**I**	**Y**		
1	0	1	0	**A**	**LF**			**:**	**J**	**Z**		
1	0	1	1	**B**			**+**		**K**			
1	1	0	0	**C**			**,**		**L**			
1	1	0	1	**D**	**CR**		**-**	**=**	**M**			
1	1	1	0	**E**			**.**		**N**			
1	1	1	1	**F**			**/**	**?**	**O**			

Table 8: Approved Characters of the International Alphabet No. 5 for SRDCP Transmitters

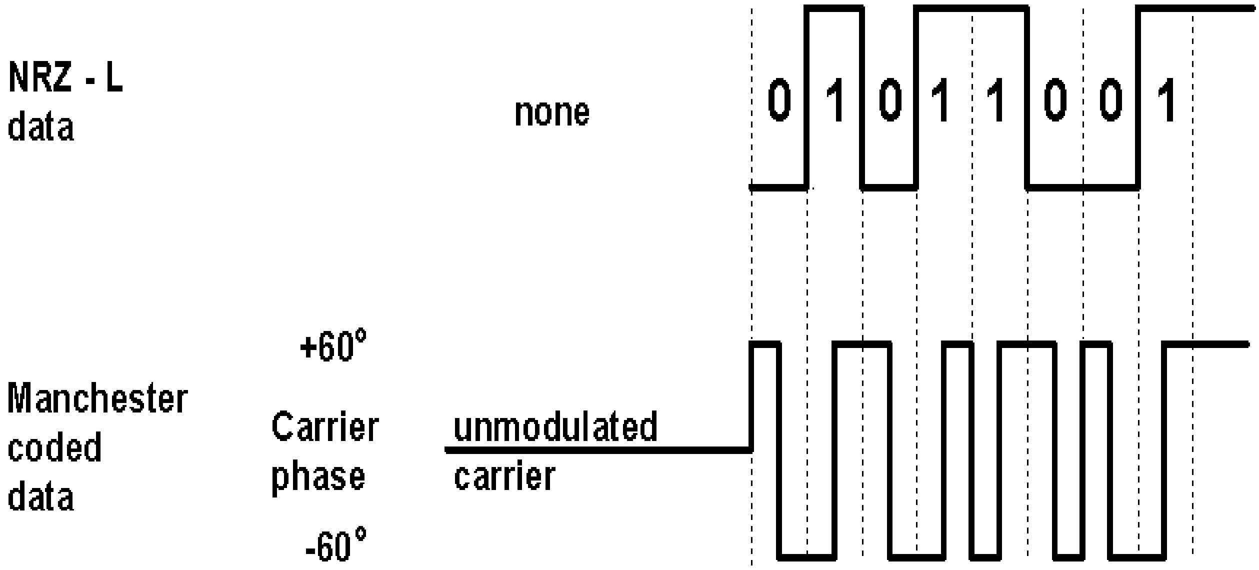

Figure 12: Table Definition of the Modulation

5.2.2.3 End of Transmission

Immediately after sending the sensor data, the 31 bit End of Transmission (EOT) code will be transmitted:

0 0 1 0 0 0 0 0 1 0 1 1 1 0 1 1 0 1 0 1 0 0 1 1 1 1 0 0 0 1 1
↑ first transmitted bit ↑ last transmitted bit

This code shall be sent continuously at the end of the sensor data (no break) and the radio set will then return to the standby condition.

5.2.3 Fail-Safe Design

The DCPRS shall incorporate a "fail-safe" design feature in order that a malfunction of the equipment shall in no way cause continuous transmission. Furthermore, provision shall be made to automatically terminate the transmission at a time not exceeding the platform's allocated message transmission slot plus 30 seconds.

5.2.4 Start Signal

The DCPRS shall provide a start signal at the required time of transmission. This start will initiate the read-out of data from the interface unit.

5.2.5 Timing Accuracy

The timer which determines the DCPRS reporting time shall be of sufficient accuracy to ensure that the DCPRS reporting time is maintained to within 15 seconds of its assigned reporting time. The timer shall provide a reporting interval of between 1 and 12 hours in 1-hour steps. Furthermore, the timer shall be capable of being set in steps of 30 seconds.

5.2.6 Clock Output

The DCPRS shall provide a 100 Hz clock frequency that shall be used to clock in the reply data. The 100 Hz clock frequency shall have a long-term and temperature stability better than 50 parts per million.

5.2.7 Data Input

The DCPRS shall accept, from an interface unit with environmental sensors or manual data input device, a serial bit flow NRZ-L, 100 bits/sec coded in International Alphabet no. 5.

5.3 HRDCP REQUIREMENTS

5.3.1 Transmit Carrier Frequency

The long term transmit frequency stability shall be better than ±125 Hz over full operating conditions.

The short term transmit frequency stability shall be less than ±1Hz/second rate of change in frequency from the start of the CW power ramp-up until the end of the message (defined by the -6dB points for this requirement).

5.3.2 Transmit Spectral Purity

During transmission, the signal falls within the following spectral emission mask, measured at the HPA output at the worst operating point (in terms of bandwidth):

Frequency Relative to Carrier	**Relative Power Spectral Density**
2250 Hz Channel Spacing	
±1125Hz	0 dBc (constant limit)
-1125Hz to -2250Hz &1125Hz to 2250Hz	-25 dBc (constant limit)
-2250Hz to -6450Hz &2250Hz to 6450Hz	-60 dBc tapering to -25dBc
Beyond ±6450Hz	-60 dBc (constant limit)

Table 9: Modulated Signal Spectral Emission Mask.

Any out of band spurious HRDCP transmitter emission, for any carrier modulation mode, is required to be lower than the unmodulated carrier level by 60.0 dB (referred to a measurement bandwidth of 500 Hz, corresponding to -62 dB at 300 Hz).

5.3.3 Transmit Carrier Phase Jitter

The integrated phase noise on the transmit carrier (at the UHF output) is lower than 2.0º RMS when measured with a type 2 PLL with 20Hz double sideband noise bandwidth within 2 KHz.

5.3.4 Transmit Carrier Modulation Modes

Transmission of a HRDCP message shall have the following carrier modulation modes:
- CMM1: unmodulated carrier only,
- CMM2: BPSK modulation for preamble and ASM
- CMM3: OQPSK for HRDCP coded message frame

5.3.5 Transmission Data Bit Rate

In CMM-2 the modulator shall produce a BPSK-like signal at 1200 bps ± 0.06 b/s (measured at the input of the modulator) from a NRZ-L baseband waveform.

In CMM-3, the convolutionally encoded frame shall be sent for transmission, and the modulator shall automatically switch to SRRC $\alpha = 0.5$ OQPSK signal at 2400 bps ± 0.12 b/s (measured at the input of the modulator) from an NRZ-L baseband waveform.

The transmitted symbols shall have the following mapping:

IQ Symbols (logic values)	I	Q	Phase
00	+1	+1	45º
01	+1	-1	315º
10	-1	+1	135º
11	-1	-1	225º

Table 10: OQPSK Constellation Mapping

5.3.6 Modulation Characteristics

5.3.6.1 CMM1:

In CMM-1 an unmodulated carrier shall be transmitted for a period of 2s ± 0.04s duration at the beginning of every message.

5.3.6.2 CMM2:

In CMM-2 a preamble pattern and an Attached Synchronisation Marker shall be transmitted after the unmodulated carrier. In this mode, the modulator produces a BPSK-like signal at 1200 bps ±50 ppm (measured at the input of the modulator) from a NRZ-L baseband waveform.

The preamble shall consist of a 128-bit long pattern generated by repeating four times the following sequence 0xA05050A0.

The ASM shall consist of a 64-bit long marker, 0x034776C7272895B0, attached to the left of the incoming data and it is to be sent once per message.

5.3.6.3 CMM3:

In CMM-3 the convolutionally encoded frame shall be sent for transmission. The modulator automatically switches to SRRC $\alpha = 0.5$ OQPSK signal at 2400 bps ±50 ppm (measured at the input of the modulator) from an NRZ-L baseband waveform.

5.3.6.4 Phase and Amplitude Imbalance

The OQPSK modulator shall have a static I/Q phase imbalance of less than 2°, an amplitude imbalance of less than 0.5dB and shall match the ideal SRRC $\alpha = 0.5$ shape with less than 2.5° equivalent RMS phase error.

5.3.6.5 CMM2 to CMM3 Transition

The transition between BPSK (CMM-2) and OQPSK (CMM-3) modulation shall be performed such that the output of the convolution encoder is synchronised to the end of the ASM, so that the G1 symbol of byte-0 MSB shall be associated with the first output following the end of the ASM (I channel), followed by the /G2 symbol (for the Q channel). The Q signal shall initially maintain the last BPSK-like value to avoid any discontinuity.

5.3.7 Message Scrambling and Coding

5.3.7.1 General

Prior to transmission the message shall be scrambled and encoded using a convolutional concatenated encoder.

5.3.7.2 RS Coding

As an inner code the system shall use the RS (255, 223) encoder, as defined in [AD.1], with an interleaving depth of I = 3. Filling, by insertion of zeroes to the right of the HRDCP message, shall be used when the message size is shorter than the required Reed-Solomon block.

5.3.7.3 Scrambling

In order to guarantee enough bit transitions, the output of the Reed-Solomon encoder shall be scrambled using the pseudo-randomizer as defined in [AD.1].

5.3.7.4 Convolutional Encoder Flushing

A 1-byte tail sequence, value 0x80, shall be attached at the end of the HRDCP randomised frame to flush the K=7 convolutional encoder to end the trellis in the all zero state. This byte value is repeated as required during the power ramp down at the end of the message.

5.3.7.5 Convolutional Code

As outer code, a convolutional encoder (R=1/2, K = 7) shall be used to encode the HRDCP randomised frames, as defined in [AD.1], prior to transmission to the modulator.

5.3.8 Carrier Control

5.3.8.1 Carrier Turn On

The rise time of the CW section shall be kept between 5ms and 0.5ms as measured from the -30dB and -1dB points relative to the final (nominal) value, and shaped such that the overall spectral emission mask is met.

5.3.8.2 Carrier Turn Off

The fall time of the transmission shall "start" following the final encoder 'flush' bit (8^{th} bit of the 1^{st} flush byte) sent and shall be in the range of 0.5ms to 5ms from -1dB to -30dB, and shaped such that the overall spectral emission mask is met. The RF carrier shall be removed (-60dB or less) within 15ms from the "start".

5.3.9 Message Format

5.3.9.1 Message Content

The HRDCP message format shall comprise of the following parts:

- A header with the HRDCP address and engineering information;
- Platform data field; and
- A trailer with an overall CRC.

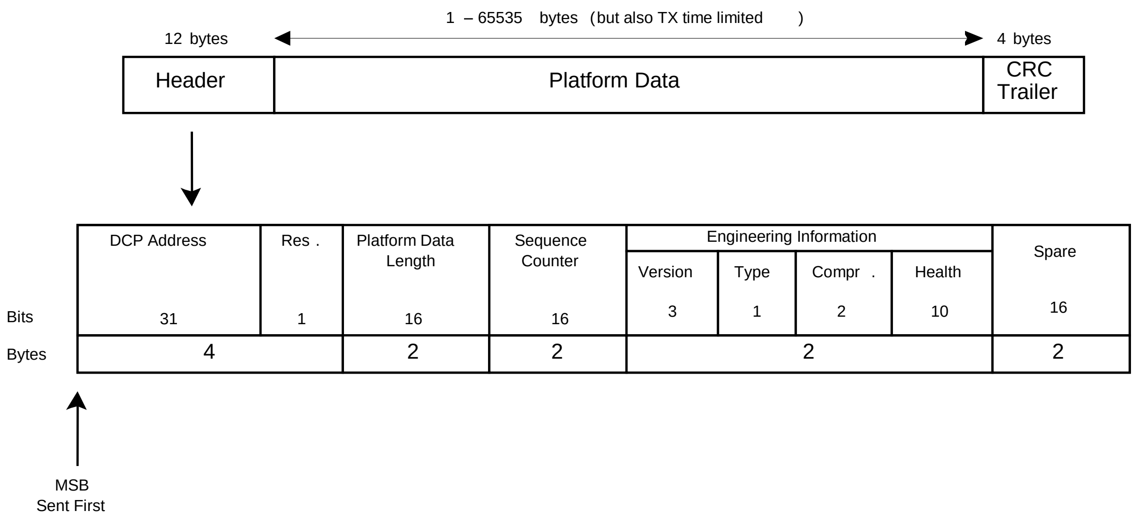

Figure 13: HRDCP Message Format

5.3.9.2 Header

The header shall consist of 12 bytes of information, as shown in Figure 13.

5.3.9.3 Platform Data

- The HRDCP shall be capable of accepting platform data formatted either in ASCII, pseudo binary, binary or BUFR (WMO) format without constraints regarding prohibited characters.

- The HRDCP system can support the lossless compression of the platform data where this results in a reduction of the total transmission time. EUMETSAT has decided **not** to implement this option.

- It would be implemented by the method of the ‘gzip’ file compression utility and this action is flagged accordingly in the message header.
  The unit could be capable of being configured in the following compression modes:

  - Automatic, enabled when platform data size is greater than 653 bytes; and

  - Disabled, never used.

5.3.9.4 Maximum Data and Transmission Length

- The maximum data transmission length shall be limited to 65535 bytes.

- The maximum time slot duration shall be limited to 60 seconds.

5.3.9.5 CRC Trailer

A CRC-32 trailer shall be added as described in Section 3.2.

5.3.10 Transmission Time Accuracy

The unit shall maintain a time accuracy such that the start of transmission shall be within ±0.25s of the assigned UTC start time over the full operating conditions.
The unit shall allow to program the start of transmission with 1s (or less) resolution.

5.3.11 Security Timer Functionality

The HRDCP design shall incorporate a "fail-safe" feature in order that a malfunction of the equipment shall not cause a continuous transmission.
Furthermore, provision shall be made to ensure that no part of the transmission shall occur outside the assigned reporting period ±0.25 secs.
In addition transmissions shall be inhibited if the unit no longer meets frequency accuracy requirements or the power supply voltage exceeds the specified operating range.

5.4 SRDCP TEST MATRIX

Test Description	Test Condition					EUMETSAT Requirement	Test Result	Test Reference
Voltage	L	L	N	H	H			Voltage/Temperature definitions depend on manufacturers design specifications.
Temperature	L	H	N	L	H			
Carrier Phase Jitter	X	X	X	X	X	3 degrees RMS		
Transmission Spectral Purity	X	X	X	X	X	-60 dBC/300 Hz within +/- 1 MHz		
Transmission Data Bit Rate	X	X	X	X	X	100 =/- 0.005 b/s		
SP-L (Manchester code) Symmetry			E			1% of bit period		
Modulation Index	X	X	X	X	X	+/- 60 degrees, + 0%, -10%		
Modulation Linearity			E			No specification		
Transmission Compatibility			X			Pre-amble, sync word, address, data and EOT bit lengths		
Security Timer Functionality			X			<10 seconds overrun		
Clock Signal Accuracy	X	X	X	X	X	100 +/- 0.005 B/S		
Transmission Time Reference	X	X	X	X	X	+/- 15 seconds from nominal		
Transmit EIRP	X	X	X	X	X	43.24 – 52 dBm		
Carrier Frequency	X	X	X	X	X	+/- 0.75 ppm		

X = Mandatory information required by EUMETSAT for certification. E = Additional information requested by EUMETSAT

5.5 HRDCP TEST MATRIX

Test Description	Test Condition					EUMETSAT Requirement	Test Result	Reference
Voltage	L	L	N	H	H			Voltage/Temperature definitions depend on manufacturers design specifications.
Temperature	L	H	N	L	H			
Carrier Phase Jitter	X	X	X	X	X	2 degrees RMS		TD16 3.4.7
Transmission Mask & Spectral Purity	X	X	X	X	X	• 0dB in +/- 1125Hz • -25dB in +/- 1125Hz to 2250 Hz • -60dB to -25dB in +/- 2250Hz to 6450Hz • -60 dB Outside +/- 6450Hz		TD16 3.4.8 Table 7 5.3.2 Table 9
Transmit EIRP	X	X	X	X	X	+40 to +52 dBm		TD16 3.4.4
Carrier Frequency	X	X	X	X	X	+/- 125 Hz (Long term) 1Hz/s (Short term)		TD16 5.1.6 & TD16 3.4.7
Transmission Data Bit Rate	X	X	X	X	X	1200 +/- 0.06 b/s 2400 +/- 0.12 b/s		TD16 3.4.1

Test Description	Test Condition					EUMETSAT Requirement	Test Result	Reference
Modulation	X	X	X	X	X	• CMM1 2 sec +/- 0.04secs • CMM2 1200 b/s +/- 0.06 b/s BPSK • CMM3 2400 b/s +/- 0.12 b/s OQPSK • OQPSK Symbol Mapping • OQPSK I/Q Phase Inbalance <2 degrees • OQPSK I/Q Amplitude Inbalance < 0.5 dB • SRRC Filter 2.5 degs RMS phase error		TD16 3.4.1 TD16 3.4.1 Table 6
Message Scrambling and Coding			X			• RS Code • Scrambling • Flushing • Convolutional Coding		TD16 3.3
Carrier Control	X	X	X	X	X	• Rise Time 0.5 mSecs to 5mSecs • Fall Time 0.5 mSecs to 5 mSecs • RF Off 15mSecs		TD16 3.4.2 TD16 3.4.3
Message Format			X			Carrier, Pre-amble, ASM, header, data and CRC bit lengths		TD16 3.2 and 3.3

Test Description	Test Condition					EUMETSAT Requirement	Test Result	Reference
Header Content			X			DCP Address, “Reserved”, Platform Data Length, Sequence Counter, Engineering Information, “Spare” bit lengths		TD16 3.2
Maximum Transmission Length			X			60 seconds		TD16 3.2
Security Timer Functionality			X			< 0.25 seconds overrun		TD16 3.4.10
Transmission Time: Reference Resolution	X	X	X	X	X	• +/- 0.25 s from nominal • 1 sec or less		TD16 3.4.9

X = Mandatory information required by EUMETSAT for certification
E = Additional information requested by EUMETSAT

6 DCP REFERENCE MESSAGES

The figure below (Figure 14) is an example of the reference message transmitted by EUMETSAT on an hourly basis on each operational DCP regional channel. The address and message contents are always as shown. The message contents are displayed here as both ASCII characters and in hexadecimal form. Note that each pair of hex characters represents eight bits (i.e. a byte), one of which is the parity bit, whereas the ASCII interpretation ignores the parity bit. Any byte that does not correspond to an ASCII character, or represents a character such as space or carriage return, is displayed as a dot. The reception of the DCP reference messages is monitored continuously. An alarm is raised if any DCP channel fails to receive a reference message in any hourly slot.

```
Address:                 162096C4
Channel:                 R04
Timestamp:               98.019.13.13.38
Processing Timestamp:         98.019.13.14.31

ASCII DUMP                    HEX DUMP
|.8|.|LW4I..D0YH.W5           FC 0F 38 FC 8E 7C CC D7 34 49 00 81 44 30 59 48 85 D7 B5
.0X.5.}.gm..Vq=i..b           0D 30 D8 0C B5 8E FD 88 E7 6D 01 85 56 F1 3D 69 90 89 62
;p8?a4.+yZ...4JMQ/h           3B F0 B8 3F 61 B4 0B AB 79 DA 04 91 0C 34 CA CD D1 AF E8
V0[Aee%..3.U>dbz..J           D6 30 5B C1 E5 65 25 07 9F B3 17 D5 3E E4 E2 FA 96 10 4A
.s7Drr0.c}I.Eti.MRb           8D F3 37 C4 72 F2 B0 1B E3 7D 49 81 C5 74 69 11 CD 52 62
8=hT9;suo.l.S'LTy.k           B8 3D E8 D4 B9 3B 73 75 6F 8A 6C 84 D3 A7 CC 54 F9 19 EB
YKH.^U? R#^..8~..~G           59 CB 48 87 5E D5 BF A0 D2 A3 DE 95 9D 38 FE 07 1C 7E 47
>fk.$.@".,$BkZ..1.Z           3E E6 6B 9A 24 80 40 22 98 2C A4 C2 EB DA 06 18 6C 86 5A
G~Ds6.B+x.4HDl.x\.0           C7 7E C4 F3 B6 80 42 AB F8 9E 34 C8 44 B1 1D 78 DC 9F 30
Z.U<m.H..efhWtk.-'r           DA 85 D5 3C 6D 82 48 06 1A E5 E6 E8 57 74 6B 98 AD E0 F2
2..OY.j.rq}K.%Fy.b9           B2 92 83 CF D9 8B 6A 1F 72 71 7D 4B 08 A5 C6 F9 1B 62 39
yX.q>$@b:4.f)1\.tj\           79 D8 8D F1 BE A4 C0 62 BA B4 88 66 29 31 DC 1E 74 EA DC
.9:7E6BiSf*|.u,e$C/           9D B9 BA 37 45 36 C2 E9 53 66 AA FC 8C F5 AC 65 A4 43 AF
j_PiQoJN....?#.s5M.           EA 5F 50 E9 51 EF CA 4E 1C FF 03 0E BF 23 1F F3 35 4D 12
@ .L.Raum..6C-c?by[           40 20 11 4C 16 52 E1 75 6D 03 0C 36 43 AD 63 3F E2 79 5B
@!U|O.d"X.<nO.mBj.6           40 A1 55 7C 4F 1A 64 A2 D8 0E 3C EE 4F 18 ED C2 6A 9E 36
A$..rst+:5LVpyYIAgl           41 24 03 8D 72 73 F4 2B BA 35 CC 56 70 79 59 C9 C1 E7 EC
E5.98>%.Rc|.1.<lFx_           45 B5 0F B9 B8 BE 25 84 52 E3 FC 0D B1 9C 3C EC C6 78 5F
R'1]ZD3..n.:unN\]."           52 60 31 5D 5A 44 B3 94 18 6E 0F 3A 75 EE CE 5C DD 9B 22
.at)3U~FzV2R!Wu/(t(           1B E1 F4 29 33 55 7E C6 7A D6 32 D2 A1 57 F5 2F A8 F4 A8
we'...._..y.&.  ..&.          77 65 27 8E FF 01 87 DF 91 8F F9 9A 26 09 20 90 08 26 0B
)p:6...!V1.q<- P*>'           A9 F0 BA B6 01 06 9B A1 D6 B1 1F F1 BC 2D A0 D0 2A BE 27
.2Ql..w'.va5O.  ..F9          0D 32 51 6C 07 1E F7 27 8C 76 61 35 4F 9B 20 92 81 46 B9
9z.].f+8<,d'sv"Z.\\           39 FA 15 DD 1A 66 2B B8 BC AC E4 E0 73 F6 A2 DA 87 5C 5C
_.B)q~.XN.vc</)0..-           DF 12 42 A9 71 FE 86 58 4E 1E 76 63 BC 2F 29 B0 98 2E 2D
"yJ 7..:wg.nM..pz..           A2 59 4A 0C B7 07 9D 3A 77 67 AE EE 4D 91 8D 70 FA 94 99
*?c=k.iP+z.TzT;2.G.           2A 3F 63 3D 6B 19 E9 D0 AB FA 17 54 7A D4 BB B2 13 C7 FF
.CoHG|M...H...Tx][.           80 C3 EF C8 C7 7C 4D 93 04 10 48 04 93 85 54 78 5D DB 00
.MPkX.x^.Ph._...(6.           83 CD 50 EB D8 8F 78 DE 16 50 68 15 DF 93 06 99 28 B6 03
.{.F;0.'M.I@#\.}.n.           8F FB 13 46 BB B0 9A A7 4D 10 C9 40 A3 DC 1C FD 8A 6E 0D
3.\^Vrp9{QmC..o.!T8           B3 15 5C 5E 56 72 F0 39 7B 51 ED 43 2E AE 6F 09 A1 D4 38
.C,'.;1^..XL..Q,%.[           7F 43 2C 27 0F BB 31 DE 97 14 58 4C 97 16 D1 2C 25 86 DB
.N.;3Ww&HF8}JL..1.5           83 4E 9D BB 33 57 F7 A6 C8 46 38 7D CA 4C 95 9F B1 9E B5
```

Figure 14: Reference DCP Message

7 DCP FREQUENCY ALLOCATION PLAN

The frequency plan, on the next page, is provided primarily for DCPRS manufacturers and will be used as the reference during DCP certification. This plan divides the DCP bandwidth up into 1500Hz channels and defines the centre frequency. DCP allocation may span more than one of these channels; this is dependent on the type of DCP.

Ch No.	Frequency	Bandwidth
1	402035500	1500
2	402037000	1500
3	402038500	1500
4	402040000	1500
5	402041500	1500
6	402043000	1500
7	402044500	1500
8	402046000	1500
9	402047500	1500
10	402049000	1500
11	402050500	1500
12	402052000	1500
13	402053500	1500
14	402055000	1500
15	402056500	1500
16	402058000	1500
17	402059500	1500
18	402061000	1500
19	402062500	1500
20	402064000	1500
21	402065500	1500
22	402067000	1500
23	402068500	1500
24	402070000	1500
25	402071500	1500
26	402073000	1500
27	402074500	1500
28	402076000	1500
29	402077500	1500
30	402079000	1500
31	402080500	1500
32	402082000	1500
33	402083500	1500
34	402085000	1500
35	402086500	1500
36	402088000	1500
37	402089500	1500
38	402091000	1500
39	402092500	1500
40	402094000	1500
41	402095500	1500
42	402097000	1500
43	402098500	1500
44	402100000	1500
45	402101500	1500
46	402103000	1500
47	402104500	1500
48	402106000	1500
49	402107500	1500
50	402109000	1500

Ch No.	Frequency	Bandwidth
51	402110500	1500
52	402112000	1500
53	402113500	1500
54	402115000	1500
55	402116500	1500
56	402118000	1500
57	402119500	1500
58	402121000	1500
59	402122500	1500
60	402124000	1500
61	402125500	1500
62	402127000	1500
63	402128500	1500
64	402130000	1500
65	402131500	1500
66	402133000	1500
67	402134500	1500
68	402136000	1500
69	402137500	1500
70	402139000	1500
71	402140500	1500
72	402142000	1500
73	402143500	1500
74	402145000	1500
75	402146500	1500
76	402148000	1500
77	402149500	1500
78	402151000	1500
79	402152500	1500
80	402154000	1500
81	402155500	1500
82	402157000	1500
83	402158500	1500
84	402160000	1500
85	402161500	1500
86	402163000	1500
87	402164500	1500
88	402166000	1500
89	402167500	1500
90	402169000	1500
91	402170500	1500
92	402172000	1500
93	402173500	1500
94	402175000	1500
95	402176500	1500
96	402178000	1500
97	402179500	1500
98	402181000	1500
99	402182500	1500
100	402184000	1500

Ch No.	Frequency	Bandwidth	Ch No.	Frequency	Bandwidth
101	402185500	1500	151	402260500	1500
102	402187000	1500	152	402262000	1500
103	402188500	1500	153	402263500	1500
104	402190000	1500	154	402265000	1500
105	402191500	1500	155	402266500	1500
106	402193000	1500	156	402268000	1500
107	402194500	1500	157	402269500	1500
108	402196000	1500	158	402271000	1500
109	402197500	1500	159	402272500	1500
110	402199000	1500	160	402274000	1500
111	402200500	1500	161	402275500	1500
112	402202000	1500	162	402277000	1500
113	402203500	1500	163	402278500	1500
114	402205000	1500	164	402280000	1500
115	402206500	1500	165	402281500	1500
116	402208000	1500	166	402283000	1500
117	402209500	1500	167	402284500	1500
118	402211000	1500	168	402286000	1500
119	402212500	1500	169	402287500	1500
120	402214000	1500	170	402289000	1500
121	402215500	1500	171	402290500	1500
122	402217000	1500	172	402292000	1500
123	402218500	1500	173	402293500	1500
124	402220000	1500	174	402295000	1500
125	402221500	1500	175	402296500	1500
126	402223000	1500	176	402298000	1500
127	402224500	1500	177	402299500	1500
128	402226000	1500	178	402301000	1500
129	402227500	1500	179	402302500	1500
130	402229000	1500	180	402304000	1500
131	402230500	1500	181	402305500	1500
132	402232000	1500	182	402307000	1500
133	402233500	1500	183	402308500	1500
134	402235000	1500	184	402310000	1500
135	402236500	1500	185	402311500	1500
136	402238000	1500	186	402313000	1500
137	402239500	1500	187	402314500	1500
138	402241000	1500	188	402316000	1500
139	402242500	1500	189	402317500	1500
140	402244000	1500	190	402319000	1500
141	402245500	1500	191	402320500	1500
142	402247000	1500	192	402322000	1500
143	402248500	1500	193	402323500	1500
144	402250000	1500	194	402325000	1500
145	402251500	1500	195	402326500	1500
146	402253000	1500	196	402328000	1500
147	402254500	1500	197	402329500	1500
148	402256000	1500	198	402331000	1500
149	402257500	1500	199	402332500	1500
150	402259000	1500	200	402334000	1500

Ch No.	Frequency	Bandwidth
201	402335500	1500
202	402337000	1500
203	402338500	1500
204	402340000	1500
205	402341500	1500
206	402343000	1500
207	402344500	1500
208	402346000	1500
209	402347500	1500
210	402349000	1500
211	402350500	1500
212	402352000	1500
213	402353500	1500
214	402355000	1500
215	402356500	1500
216	402358000	1500
217	402359500	1500
218	402361000	1500
219	402362500	1500
220	402364000	1500
221	402365500	1500
222	402367000	1500
223	402368500	1500
224	402370000	1500
225	402371500	1500
226	402373000	1500
227	402374500	1500
228	402376000	1500
229	402377500	1500
230	402379000	1500
231	402380500	1500
232	402382000	1500
233	402383500	1500
234	402385000	1500
235	402386500	1500
236	402388000	1500
237	402389500	1500
238	402391000	1500
239	402392500	1500
240	402394000	1500
241	402395500	1500
242	402397000	1500
243	402398500	1500
244	402400000	1500
245	402401500	1500
246	402403000	1500
247	402404500	1500
248	402406000	1500
249	402407500	1500
250	402409000	1500
251	402410500	1500
252	402412000	1500
253	402413500	1500
254	402415000	1500
255	402416500	1500
256	402418000	1500
257	402419500	1500
258	402421000	1500
259	402422500	1500
260	402424000	1500
261	402425500	1500
262	402427000	1500
263	402428500	1500
264	402430000	1500
265	402431500	1500
266	402433000	1500
267	402434500	1500
268	402002500	1500
269	402004000	1500
270	402005500	1500
271	402007000	1500
272	402008500	1500
273	402010000	1500
274	402011500	1500
275	402013000	1500
276	402014500	1500
277	402016000	1500
278	402017500	1500
279	402019000	1500
280	402020500	1500
281	402022000	1500
282	402023500	1500
283	402025000	1500
284	402026500	1500
285	402028000	1500
286	402029500	1500
287	402031000	1500
288	402032500	1500
289	402034000	1500

Table 11: DCP Frequency Plan

7.1 Table Construction

The table is constructed by splitting the frequency allocation into 1.5 kHz slices. This is true for channels 1 to 267. Channels 268 to 289 are the reassigned channels from the international bandwidth section from 402002500 to 402034000. A DCP operator will be assigned a frequency. This frequency will be clearly conveyed to the operator along with the channel number from Table 11.

8 GLOSSARY

ASCII	American Standard Code for Information Interchange, *also International Alphabet No. 5, standardised in ISO 646*
BCD	Binary Coded Decimal
BCH	Bose-Chaudhuri-Hocquenghem code for the generation of DCP addresses.
BUFR	Binary Universal Format for data Representation
CGMS	Coordination Group for Meteorological Satellites
Darmstadt	Location of EUMETSAT headquarters and Mission Control Centre
DCP	Data Collection Platform
DCPF	Data Collection Processing Facility
DCPRS	DCP Radio Set
DCS	Data Collection System
EOT	End of Text or Transmission
EUMETCast	EUMETSAT’s Broadcast System for Environmental Data
EUMETSAT	European Organisation for the Exploitation of Meteorological Satellites
FTB	First Transmitted Bit
FTP	File Transfer Protocol
GTS	Global Telecommunication System of the WMO
HRDCP	High Rate Data Collection Platform
IA5	International Alphabet No.5
IDCS	International Data Collection System
IODC	Indian Ocean data Coverage
LRIT	Low Rate Information Transmission
LSB	Least Significant Bit
LTB	Last Transmitted Bit
MCC	Mission Control Centre
Meteosat	EUMETSAT’s geostationary meteorological satellite programme
MLS	Maximal Linear Series
MSB	Most Significant Bit
MSG	Meteosat Second Generation
MTG	Meteosat Third Generation
NRZ	Non-Return Zero
RMS	Root Mean Square
RTH	Regional Telecommunications Hub
SP-L	Split Phase Level
SRDCP	Standard Rate Data Collection Platform
TD	Technical Document
UHF	Ultra High Frequency
WMO	World Meteorological Organization