**eLoran Data for Conversion to S-200 Series Format**

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# Introduction

This document describes the data that is required to be converted into S-200 series format. There are three sets of data required to be converted, thus:

1. ASF (Additional Secondary Factor) propagation data (S-245)
2. eLoran transmitter almanac data (S-246)
3. Differential-Loran Reference Station almanac data (S-247?)

The designators S-245 and S-246 have already been assigned to ASF data and eLoran transmitter almanac data respectively. We also request a third designation for differential-Loran reference station almanac data; we propose S-247, unless this has already been assigned.

We now present the fields and contents for each of these data sets, with examples. This data content and format has been developed under the auspices of the Radio Technical Commission for Maritime Services (RTCM) Special Committee (SC) 127 on eLoran Systems.

# ASF Data – S-245

ASF data will need to be provided to the mariner by the service provider. It is recommended that the ASF publishing authority provides ASF data in RTCM SC-127 format as outlined below. This data and any updates should then be submitted to the responsible body for conversion into S-245 format. In RTCM SC-127 format ASF data is presented in text files as data grids, with a number of lines of preamble and metadata. In general the data shall have the following characteristics:

* There shall be one file per coverage area (a ‘coverage area’ shall be a port approach, or other region specified by the service provider)
* An ASF map shall be associated with a single differential-Loran Reference Station, however there may be more than one ASF map associated with a single differential-Loran Reference Station. There may also be wide area ASF maps that are **not** associated with a differential-Loran Reference Station.
* The file shall be in ASCII format
* Data fields shall be Comma Separated Values (CSV)
* Geographical co-ordinates shall be specified as degrees and decimal fractions of degrees, e.g. 51.2°N; co-ordinates west of Greenwich or south of the Equator shall be specified as negative numbers. The co-ordinate reference system shall be WGS-84.
* Geographical co-ordinates shall be specified to a precision of up to 4 decimal places
* Leading or trailing zeros (0) shall be used where appropriate to allow uniform formatting
* For parity check purposes the last entry on a line shall contain a Cyclic Redundancy Check CRC-16 in four digit hexadecimal notation of the preceding data in the line, including the ‘,’ separator character. This CRC-16 value shall have ‘\*’ pre-pended to it
* The end of the data file shall be indicated using the string ‘#END’

The information provided for each coverage area shall include the following in order:

* RTCM SC identifier and reference to Minimum Performance Specification version conformance
* The name of the coverage area
* Name of issuing organisation, Issue number of the data, and date of issue in YYYY,MM,DD format
* The boundaries of the area covered by the enclosed grid of data (N/S/E/W)
* The number of cells in the grid (height, width)
* #REF, the name of the associated differential-Loran (DLoran) reference station; the ID number of the DLoran reference station and designation letter of this ASF map; the number of separate eLoran transmitter signals for which ASF data is provided (and for which DLoran corrections are transmitted)
* If the map is a Coastal Voyage Phase map, with no associated DLoran reference station, the word “COASTAL” will appear in the #REF sentence in place of the name of a reference station. In this case the ID and transmitter count fields will consist of zeros, thus ‘0’, ‘0’;
* #TRX, the name, GRI and designation letter (e.g. ‘M’, ‘W’, ‘X’, ‘Y’, ‘Z’) of the eLoran transmitter, and its sequence number (e.g. 0, 1,2, ..etc.) in the Loran Data Channel DLoran correction message sequence transmitted from the DLoran reference station
* The data type (#ASF or #ERR) of the following data
* ASF values (#ASF) shall then appear as comma separated variables in Lexicographic Format (W to E, N to S) in microseconds to three decimal places (1 ns resolution)
* Estimated ASF **measurement error** (#ERR) values shall then appear as CSV in Lexicographic Format (W to E, N to S) in units of meters, to two decimal places. Error values are given as standard-deviations of the ASF data statistics and are provided to allow the calculation of Horizontal Protection Level (HPL) within a receiver’s RAIM (Receiver Autonomous Integrity Monitoring) algorithm.

The above format shall be repeated, in order, for each DLoran Reference Station and eLoran transmitter combination in each coverage area.

Example (*Not to be used for navigation!*)

RTCM SC-127,V2.0\*0x8888

Dover\_Straits\_North\*0x1742

Issue,GLA,V1.2,2013,01,25\*0x6195

51.1000, 51.2080, 001.1000, 001.3580\*0x3640

24,36\*0x1A04

#REF,Dover,101A,6\*0xA1A5

#TRX,Anthorn,6731,Y,2\*0x78E0

#ASF\*0x9CC9

2.412, 2.456, 2.123, 2.431,…………………… 3.124\*0x4517

2.478, 2.788, 2.112, 2.346,…………………… 3.042\*0x6767

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3.478, 3.757, 3.141, 3.336,…………………… 3.192\*0x6767

#ERR\*0x2EA3

10.21, 04.41, 00.12, 00.12,…………………… 00.09\*0x4517

06.76, 01.01, 00.11, 00.04,…………………… 00.02\*0x6767

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.

00.32, 00.45, 00.44, 00.03,…………………… 50.00\*0x6767

#TRX,Lessay,6731,M,0\*0xE5C4

#ASF\*0x9CC9

2.412, 2.456, 2.123, 2.431,…………………… 3.124\*0x4517

2.478, 2.788, 2.112, 2.346,…………………… 3.042\*0x6767

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.

3.478, 3.757, 3.141, 3.336,…………………… 3.192\*0x6767

#ERR

…

#END

# eLoran Transmitter Almanac Data – S-246

eLoran transmitter almanac data will need to be provided to the mariner by the service provider. It is recommended that the publishing authority provides data in RTCM SC-127 format as outlined below. This data and any updates should then be submitted to the responsible body for conversion into S-246 format. In RTCM SC-127 format eLoran transmitter almanac data is presented in text files as data grids, with a number of lines of preamble and metadata.

Each data file shall contain the following information:

* RTCM SC identifier and reference to Minimum Performance Specification version conformance
* The name of the coverage region
* Name of issuing organisation, Issue number of the data, and date of issue in YYYY,MM,DD format
* Transmitter almanac information is presented as a series of data sentences prepended with the identifier “#TRX””

#TRX data sentence fields have the following format:

Transmitter ID designator; Emission Delay; Transmitter Name; power (ERP kW); Nominal ECD; latitude and longitude (WGS84, 8 decimal places, S of equator and West of Greenwich meridian represented by negative values); LDC Type: 0x00 = none, 0x01 = tri-state PPM, 0x02 = 9th Pulse, 0x04 = 10th Pulse (Logical OR flags for multiple LDCs); Pulse Type: 1 = eLoran, 2 = Chayka etc.; Dual rate flag (0=single rate, 1=dual rate); Blanking Priority flag (0=priority on this rate, 1=priority on dual-rate, 2=alternate blanking);UTC Synchronisation mode (0=SAM control, 1=TOE control); data line 16 bit CRC check code is included at the end of each line, in the example below these are faked for now.

* Each ‘#TRX’ sentence shall be separated by a new-line and a string of four ‘ \* ’ characters;

RTCM SC-127,V2.07\*0x7513 //SC-127 MoPS version number

NORTH\_WEST\_EUROPE\*Ox1452 //Region

Issue,GLA,V1.0,2015,03,30\*0x3354 //Data issued by, version and date

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#TRX,7499M,00000,Sylt,250,0.5,54.80813819,8.29357111,0x01,1,1,1,1\*0x4535

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#TRX,7499X,14100,Lessay,250,0.0,49.14867333,-1.50473028, 0x01,1,1,1,1\*0x9898

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#TRX,7499Y,29500,Vaerlandet,250,0.0,61.29706528,4.69628278,0x01,1,1,1,1\*0x4628

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#TRX,6731M,00000,Lessay,250,0.0,49.14867333,-1.50473028, 0x01,1,1,1,1\*0x6738

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#TRX,6731X,13000,Soustons,250,0.0,43.73974972,-1.38044000, 0x01,1,1,1,1\*0x02AD

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#TRX,6731Y,22000,Anthorn,220,0.5,54.91120833,-3.28728056, 0x01,1,1,1,1\*0xBC12

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#TRX,6731Z,42100,Sylt,250,0.5,54.80813819,8.29357111,0x01,1,1,1,1\*0x12EF

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#TRX,7001M,00000,Bo,400,0.0,68.63506000,14.46315278,0x01,1,1,1,1\*0x2347

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#TRX,7001X,14100,Janmayen,250,0.0,70.91429944,-8.73236806,0x01,1,1,1,1\*0x1637

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#TRX,7001Y,29100,Berlevag,250,0.0,70.84528167,29.20443889,0x01,1,1,1,1\*0x1642

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#TRX,9007M,00000,Ejde,400,0.0,62.29995472,7.07391083,0x01,1,1,1,1\*0x71DF

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#TRX,9007W,14200,Janmayen,250,0.0,70.91429944,-8.73236806,0x01,1,1,1,1\*0x1647

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#TRX,9007X,28000,Bo,400,0.0,68.63506000,14.46315278,0x01,1,1,1,1\*0xDF2B

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#TRX,9007Y,41100,Vaerlandet,250,0.0,61.29706528,4.69628278,0x01,1,1,1,1\*0xF21D

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#END

# DLoran Reference Station Almanac Data – S-247(or other?)

Differential-Loran Reference Station almanac data will need to be provided to the mariner by the service provider. It is recommended that the publishing authority provides data in RTCM SC-127 format as outlined below. This data and any updates should then be submitted to the responsible body for conversion into S-XXX format. In RTCM SC-127 format DLoran Reference Station almanac data is presented in text files as data grids, with a number of lines of preamble and metadata.

In general the data shall have the following characteristics:

* There shall be one file per region; a ‘region’ shall be defined as the entire coverage area of the eLoran service provided by a single service provider;
* The file shall be in ASCII format;
* Data fields shall be Comma Separated Values (CSV);
* Geographical co-ordinates shall be specified as degrees and decimal fractions of degrees, e.g. 51.2°N; co-ordinates west of Greenwich or south of the Equator shall be specified as negative numbers;
* Geographical co-ordinates shall be specified to a precision of up to 8 decimal places;
* Leading or trailing zeros (0) shall be used where appropriate to allow uniform formatting;
* For parity check purposes the last entry on a line shall contain a Cyclic Redundancy Check CRC-16 in four digit hexadecimal notation of the preceding data in the line, including the ‘,’ separator character. This CRC-16 value shall have ‘\*’ pre-pended to it;
* The end of the data file shall be indicated using the string ‘#END’;

The information provided for each coverage area shall include the following, in order:

* RTCM SC identifier and reference to Minimum Performance Specification version conformance;
* The name of the eLoran ‘region’;
* Name of issuing organisation, Issue number of the data, and date of issue in YYYY,MM,DD format;
* Sentence identifier ‘#REF’ will be used to demarcate reference station almanac entries;
* A ‘#REF’ sentence will contain the following in order:
  + The name of the associated differential-Loran (DLoran) reference station;
  + The numerical ID of the reference station;
  + A flag to indicate relative (0) or absolute (1) differential corrections. Absolute corrections are synchronized to UTC time;
  + The number of ASF maps served by the reference station;
  + The ID numbers of the ASF maps served by the reference station;
  + The latitude of the reference station to 8 decimal places;
  + The longitude of the reference station to 8 decimal places;
  + The number of transmitters served by the reference station;
  + Transmitter data is then expressed in groups of 3 values; each group contains the five character designator of the transmitter, the nominal ASF value of the transmitter in microseconds to 2 decimal places, and the nominal ECD value of the transmitter in microseconds to 1 decimal places;
  + The order of the transmitter information in each of the ‘#REF’ sentences is the order in which the transmitters’ differential corrections are broadcast from the reference station;
* Each ‘#REF’ sentence shall be separated by a new-line and a string of four ‘ \* ’ characters;

RTCM SC-127,V2.07\*0x7513  
UK\_Ireland\*0x3627  
Issue,GLA,V1.0,2014,12,02\*0x3354  
#REF,Harwich,101,0,1,101A, 51.94580316, 1.28563447,7,6731M,0.62,0.5,6731X,2.23,0.5,6731Y,1.24,1.0,6731Z,0.05,1.5,7499M,0.05,0.0,7499X,0.61,0.0,7499Y,0.26,0.0\*0x3412  
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#REF,Dover,102,0,3,102A,102B,102C, 51.12890169, 1.33519012,6,6731M,0.51,0.5,6731X,2.17,0.5,6731Y,1.12,0.5,6731Z,0.15,1.0,7499M,0.15,0.5,7499X,0.65,1.5,7499Y,0.27,-0.5\*0x1523  
\*\*\*\*  
#REF,Sheerness,103,0,1,103A, 51.44642991, 0.74740384,7,6731M,0.62,0.0,6731X,2.23,0.5,6731Y,1.24,1.0,6731Z,0.05,0.5,7499M,0.05,1.0,7499X,0.61,0.5,7499Y,0.26,0.0\*0x3412  
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#END