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LANDSAT Specialisation for Level 0 products

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Approved by		date

ESRIN
Via Galileo Galilei - Casella Postale 64 - 00044 Frascati - Italy
Tel. (39) 06 94J80J - Fax (39) 06 94J80 280

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1. Introduction

1.1. Purpose and scope

This document is part of the Standard Archive Format for Europe specialisation for LANDSAT (SAFE Specialisation for LANDSAT). This specialisation consists of the following set of documents:

- the LANDSAT mission specialisation control book, which is the top-level document of the specialisation, containing all the information that is common to all SAFE LANDSAT products.
- one LANDSAT product specialisation control book for LANDSAT Level-0 products.

The current book is the specialisation control book for LANDSAT Level-0 products.

1.2. Book organisation

The specialisation control book for LANDSAT Level-0 products is organized as follows:

Chapter 1: Introduction	Introductory part of the document.
Chapter 2: Target of preservation	Description of the target of preservation for L0 products.
Chapter 3: Data Structures	Specification of the simple and complex types that are used to represent the structure of the products and auxiliary file types independently of the mission instrument to which they are associated.

1.3. Acronyms and abbreviations

DFDL	Data Format Description Language
GNU	GNU is Not Unix
PCM	Pulse Code Modulation
W3C	World Wide Web Consortium
XML	eXtensible Mark-up Language

2. Target of preservation

Some of the LANDSAT L0 products in native format are available in tar format (with ".TAR" extension). However, the targets of preservation considered in this SAFE specialisation are the contents of those compressed files, i.e. the files which are stored within the tar files.

Any product in native format must be unpackaged and decompressed before being converted into SAFE and the SAFE Packages will only contain the unpackaged and decompressed files. This is because the representation information schemas that are provided along with this specialisation describe the unpackaged and decompressed files, not the tar/gzip format (there would be limitations in doing this, as explained in the SAFE Core Specifications).

The following table summarises the list of product types in scope and points the reader to the sections in the document where the information about the main structure of the file can be found:

File Types	Structure specification
MSS_MSS_0P	See section 3.1.1
TM__TM__0P	See section 3.1.2
ETM_ETM_0P	See section 3.1.3

Table 1: File Types Specification Index

3. Data Structures

The information included in this chapter has been generated using the specifications defined by the DFDL schemas that represent the structure of the L0 products.

The representation information is described by means of complex structures that make use of simple types to represent the whole content of a given file type. The following sub-sections provide a detailed description of those complex/simple types.

The diagrams included in this document provide an overview of the structure of the products by depicting the schemas which provide their representation information.

3.1. LANDSAT L0 Products

The following subsections provide a description of the data structures for the LANDSAT products in scope.

All LANDSAT products are preserved in WILMA format containing a complete transcribed satellite imaging sequence (a passage), with all related information. This information is split in the following files:

Description	Filename
Block Address Descriptor	DTBlock.dat
Pass Identification Header	DTPassId.dat
Segment Descriptor	DTSegment.dat
Statistics File	DTStatisticFile.dat
User Header	DTUserHeader.dat
Sensor Acquired Data	DTVideoData.dat

3.1.1. MSS_MSS_0P

3.1.1.1. DTBlock

This file contains the description of all the blocks in which the pass has been divided and written. It is composed by a variable number of identical units. Each unit describes completely one satellite data block and contains all information to address any segment or any frame within the “Sensor Acquired Data” file. It contains block number of the video data block, the starting time of the first satellite format in the block and the number of swaths contained.

The structure is repeated as many times as the number of blocks recorded in the file. The number of items and the length are specified in the "DTUserHeader” file.

The next figure provides a high level overview of the complex structures used to represent the information of the DTBlock file:

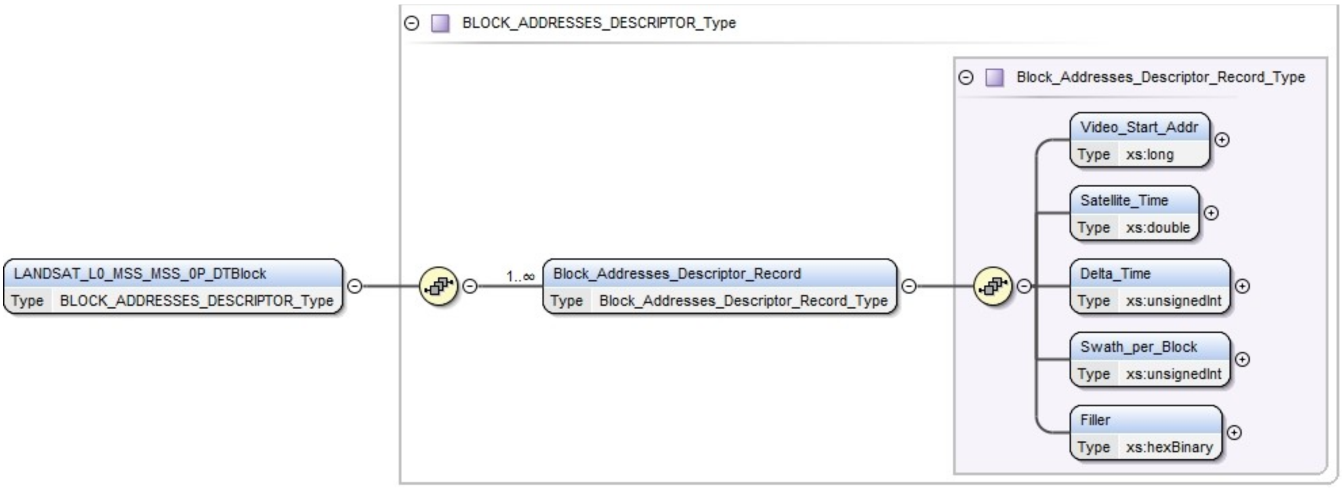
BLOCK_ADDRESSES_DESCRIPTOR_Type
Block_Addresses_Descriptor_Record_Type
Video_Start_Addr
Type xs:long
Satellite_Time
Type xs:double
LANDSAT_L0_MSS_MSS_0P_DTBlock
Type BLOCK_ADDRESSES_DESCRIPTOR_Type
1..∞
Block_Addresses_Descriptor_Record
Type Block_Addresses_Descriptor_Record_Type
Delta_Time
Type xs:unsignedInt
Swath_per_Block
Type xs:unsignedInt
Filler
Type xs:hexBinary

Figure 1: DFDL schema organisation DTBlock (MSS)

3.1.1.1.1. Root Element

#	Name/Description	Format
1	**LANDSAT_L0_MSS_MSS_0P_DTBlock** BLOCK ADDRESSES DESCRIPTOR file This file contains the description of all the blocks in which the pass has been divided and written on tape. It is composed by a variable number of identical units. Each unit describes completely one satellite data block and contains all information to address any segment or any frame within the "Sensor Acquired Data" file. It contains block number of the video data block, the starting time of the first satellite format in the block and the number of swaths contained. The structure is repeated as many times as the number of blocks recorded in the file. The number of items and the length are specified into the "User Header file - Pointer to Tape Data Structure Description Section" (Block Addresses section).	BLOCK_ADDRESSES_DESCRIPTOR_Type

Table 2: LANDSAT_L0_MSS_MSS_0P_DTBlock Specification

3.1.1.1.2. Complex Types

3.1.1.1.2.1.BLOCK_ADDRESSES_DESCRIPTOR_Type

#	Name/Description	Format
1	**Block_Addresses_Descriptor_Record**	Block_Addresses_Descriptor_Record_Type Min Occurs: 1 Max Occurs: unbounded

Table 3: BLOCK_ADDRESSES_DESCRIPTOR_Type Specification

3.1.1.1.2.2.Block_Addresses_Descriptor_Record_Type

#	Name/Description	Format
1	**Video_Start_Addr** Block number of the video data block	xs:long 4 bytes
2	**Satellite_Time** Time of current block. The time is expressed in Milliseconds from midnight of first block swath.	xs:double 8 bytes
3	**Delta_Time** Time distance between start of acquisition (first block of the file) and current block start The delta time is expressed in Milliseconds	xs:unsignedInt 4 bytes
4	**Swath_per_Block** Number of swaths per block	xs:unsignedInt 4 bytes
5	**Filler** Available fields	xs:hexBinary 12bytes

Table 4: Block_Addresses_Descriptor_Record_Type Specification

3.1.1.2. DTPassID

The DTPassID (Pass Identification Header) contains the information to unambiguously identify the imaging sequence contained in the product.

This record is divided into five logical sections:

- Mission and Instrument Identification
- Ground Stations and Transcription System Identification
- Transcription Identification
- Orbit and Acquisition Identification
- Pointers to Tape Data Structure

The next figure provides a high level overview of the complex structures used to represent the information of the DTPassID file:

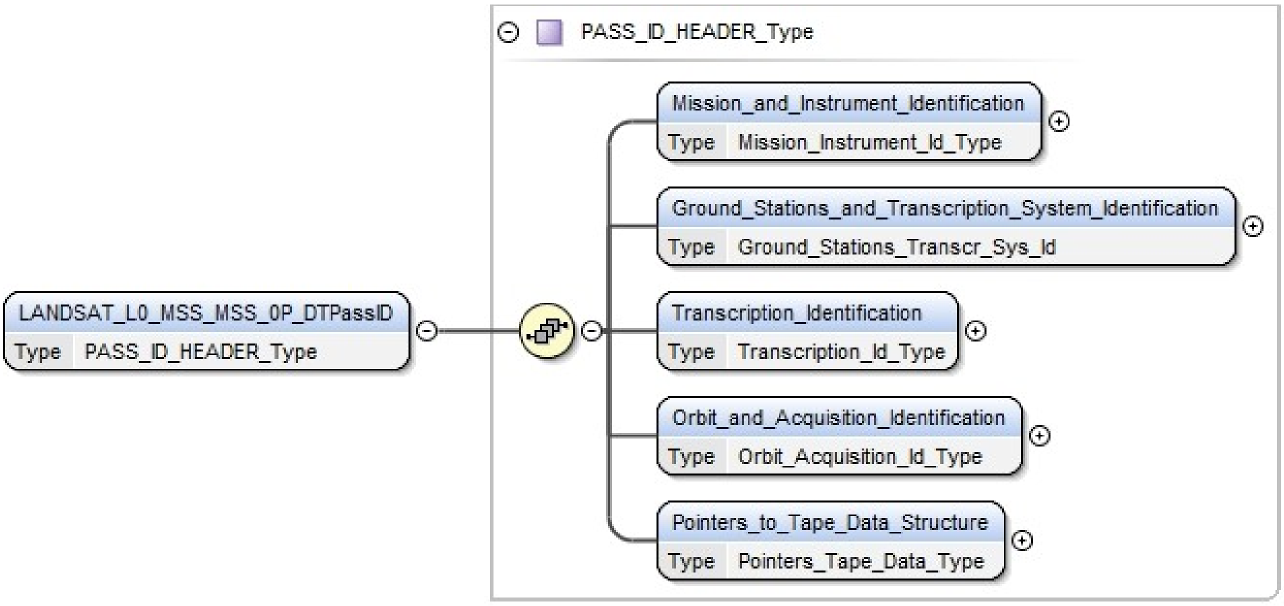
PASS_ID_HEADER_Type
LANDSAT_L0_MSS_MSS_0P_DTPassID
Type PASS_ID_HEADER_Type
Mission_and_Instrument_Identification
Type Mission_Instrument_Id_Type
Ground_Stations_and_Transcription_System_Identification
Type Ground_Stations_Transcr_Sys_Id
Transcription_Identification
Type Transcription_Id_Type
Orbit_and_Acquisition_Identification
Type Orbit_Acquisition_Id_Type
Pointers_to_Tape_Data_Structure
Type Pointers_Tape_Data_Type

Figure 2: DFDL schema organisation for DTPassID (MSS)

3.1.1.2.1. Root Element

#	Name/Description	Format
1	**LANDSAT_L0_MSS_MSS_0P_DTPassID** PASS IDENTIFICATION HEADER file The "Pass Identification Header" is the first file of the Transcription Area. It contains the information, available at the beginning of the transcription, to unambiguously identify the imaging sequence contained in the file. This record is divided into five logical sections: 1. Mission and Instrument Identification 2. Ground Stations and Transcription System Identification 3. Transcription Identification 4. Orbit and Acquisition Identification 5. Pointers to Tape Data Structure	PASS_ID_HEADER_Type

Table 5: LANDSAT_L0_MSS_MSS_0P_DTPassID Specification

3.1.1.2.2. Complex Types

3.1.1.2.2.1.PASS_ID_HEADER_Type

#	Name/Description	Format
1	**Mission_and_Instrument_Identification**	Mission_Instrument_Id_Type
2	**Ground_Stations_and_Transcription_System_Identification**	Ground_Stations_Transcr_Sys_Id
3	**Transcription_Identification**	Transcription_Id_Type
4	**Orbit_and_Acquisition_Identification**	Orbit_Acquisition_Id_Type

#	Name/Description	Format
5	**Pointers_to_Tape_Data_Structure**	Pointers_Tape_Data_Type

Table 6: PASS_ID_HEADER_Type Specification

3.1.1.2.2.2.Mission_Instrument_Id_Type

Mission and Instrument Identification

#	Name/Description	Format
1	**Reserved_1** Reserved	xs:hexBinary 76bytes
2	**Satellite_ID** Satellite Code: 1 - LANDSAT 2 - MOS 3 - J-ERS 4 - SPOT 5 - ERS 6 - IRS-C 7 - RADARSAT 8 - NOAA 9 - RESERVED 10 - RESERVED 11 - HELIOS 12 - SHUTTLE 13 - EOSAM 14 - EOSPM	xs:unsignedShort 2 bytes
3	**Mission_ID** Satellite Mission Number	xs:unsignedShort 2 bytes
4	**Instr_Type_ID** Satellite Mission Number: 1 - LANDSAT MSS 2 - LANDSAT TM 3 - LANDSAT ETM 4 - LANDSAT RBV 5 - MOS MESSR 6 - J-ERS VNIR 7 - J-ERS SWIR 8 - Not Used 9 - Not Used 10 - ERS AMI SAR 11 - ERS ATSR 12 - SPOT HRV 13 - J-ERS SAR 14 - NOAA AVHRR 15 - SPOT HRVIR 16 - SHUTTLE XSAR 17 - MODIS	xs:unsignedShort 2 bytes
5	**Reserved_2** Reserved	xs:unsignedShort Min Occurs: 2

#	Name/Description	Format
		Max Occurs: 2 2 bytes

Table 7: Mission_Instrument_Id_Type Specification

3.1.1.2.2.3. *Ground_Stations_Transcr_Sys_Id*

Ground Stations and Transcription System Identification

#	Name/Description	Format
1	**Station_ID** Acquisition Ground Station Code: 67 - Adelaide 97 - Agrhymet 10 - AliceSpring 68 - Aspendale 105 - Atlanta 20 - Aussaguel 6 - Bangkok 52 - BantonRouge 49 - Bedford 74 - Beijing 30 - Berlin 31 - Berne 112 - Bishkek 29 - Bremenhaven 28 - Budapest 96 - Cairo 92 - Casey 64 - Cashoiera 32 - Copenhagen 103 - Cordoba 8 - Cotopaxi 23 - Cuiaba 76 - Da-Xing 33 - DeBilt 75 - Dhaka 50 - Downsview 34 - Dundee 51 - Edmonton 7 - Fairbanks 24 - Farnborough 35 - Frascati 1 - Fucino 65 - Funceme 9 - Gatineau 54 - GilmoreCreek 36 - Hamburg 19 - HarteBeesHoek 16 - Hatoyama	xs:short 2 bytes

#	Name/Description	Format
	37 - Helsinki 22 - Hobart 69 - Honolulu 11 - Hyderabad 21 - Islamabad 115 - Itu 77 - Keelung 116 - KhantyMansiysk 2 - Kiruna 78 - Kiyose 113 - Kitab 111 - Kourou 38 - Krakow 91 - KualaLumpur 12 - Kumamoto 39 - Lannion 79 - Lapan 99 - LaReunion 40 - Lasham 106 - Libreville 41 - Madrid 109 - Malindi 80 - Manila 3 - Maspalomas 104 - Matera 93 - McMurdo 53 - Miami 110 - Moscow 98 - Nairobi 55 - NESDIS 108 - Neustrelitz 81 - NewDelhi 102 - Norman 42 - Norrkoping 27 - Oberpfaff 43 - Offenbach 15 - OHiggins 44 - Oslo 94 - Palmer 18 - PariPari 70 - Perth 45 - Prague 25 - Pretoria 13 - PrinceAlbert 57 - RedwoodCity 82 - Riyadh 46 - Rome 101 - RRSC_Nairobi 66 - Santiago 26 - Scanzano	

#	Name/Description	Format
	58 - Scipps Inst 84 - Selangor 87 - Sendai 85 - Seoul 86 - SeoulUniv 83 - Singapore 59 - SiouxFalls 47 - Spitzenbergen 60 - StennisSpace 71 - Sydney 17 - Syowa 90 - Taipei 5 - Tel_Aviv 95 - TerranovaBay 88 - TokaiUniv 89 - TokyoUniv 72 - Townsville 48 - Traben-Trar 4 - Tromso 100 - Tunis 114 - UlanBator 61 - UnivOfAlaska 63 - UnivOfRhodeIsl 62 - UnivOfTexas 56 - WallopsIsl 73 - Wellington 14 - WestFreugh	
2	**Station_DT_ID** Data Transcription Ground Station Code	xs:short 2 bytes
3	**Filler** Padding for stucture alignment	xs:hexBinary 2bytes

Table 8: Ground_Stations_Transcr_Sys_Id Specification

3.1.1.2.2.4.Transcription_Id_Type

Transcription Identification

#	Name/Description	Format
1	**Source_Type** Data Source Type: 1 - AMPEX 14 tracks 2 - Shlumberger 14 tracks 3 - Shlumberger 42 tracks 4 - Penny and Giles 5 - Honeywell HD-96 6 - AMPEX DCRSi 7 - CREO Optical Tape 8 - Direct Ingestion 9 - SONY DIR 1000 (R)	xs:unsignedInt 4 bytes

#	Name/Description	Format
2	**Format_SyncType** Format Synchroniser/Decommutator Code: 1 - MCS ERS FS 2 - SPACETEC ERS HR FS 3 - IAI ERS HR FS 4 - LABEN ERS HR FS 5 - SPACETEC/ACS ERS FS 6 - ENERTEC MSS FS 7 - ENERTEC TM FS 8 - ACS SW FORMAT SYNCH 14 - ACS XSAR FORMAT SW SYNCH	xs:unsignedInt 4 bytes
3	**Reserved** Reserved	xs:unsignedInt Min Occurs: 2 Max Occurs: 2 4 bytes

Table 9: Transcription_Id_Type Specification

3.1.1.2.2.5.Orbit_Acquisition_Id_Type

Orbit and Acquisition Identification

#	Name/Description	Format
1	**Track_Number** Track or Data Take Number (when applicable)	xs:integer 4 bytes
2	**Orbit** Orbit number (when applicable)	xs:integer 4 bytes
3	**Reserved_1** Reserved	xs:integer Min Occurs: 9 Max Occurs: 9 4 bytes
4	**Reserved_2** Reserved	xs:short Min Occurs: 3 Max Occurs: 3 2 bytes
5	**Reserved_3** Reserved	xs:hexBinary 18bytes
6	**Transcription_Date** Transcription Date in D M Y (WARNING: Year could be expressed in some tapes as years from 1900)	xs:short Min Occurs: 3 Max Occurs: 3 2 bytes
7	**Reserved_4** Reserved	xs:short Min Occurs: 6 Max Occurs: 6 2 bytes
8	**Filler** Padding for stucture alignment	xs:hexBinary 2bytes

Table 10: Orbit_Acquisition_Id_Type Specification

3.1.1.2.2.6.Pointers_Tape_Data_Type

Pointers to Tape Data Structure

#	Name/Description	Format
1	**Reserved_1** Reserved	xs:integer Min Occurs: 5 Max Occurs: 5 4 bytes
2	**Physical_Address_1** User Header Address. File Number of the User Header. It is the number of files, numbered from DLT start, preceding the User Header file in current Transcription Area.	xs:long 4 bytes
3	**Physical_Address_2** Pass Id. Header Address. File Number of the Pass Id. Header. It is the number of files, numbered from DLT start, preceding the Pass Id. Header file in current Transcription Area.	xs:long 4 bytes
4	**Reserved_2** Reserved	xs:hexBinary 652bytes

Table 11: Pointers_Tape_Data_Type Specification

3.1.1.3. DTSegment

This DTSegment file contains the descriptions of all the segments in which the satellite pass has been divided.

The next figure provides a high level overview of the complex structures used to represent the information of the DTSegment file:

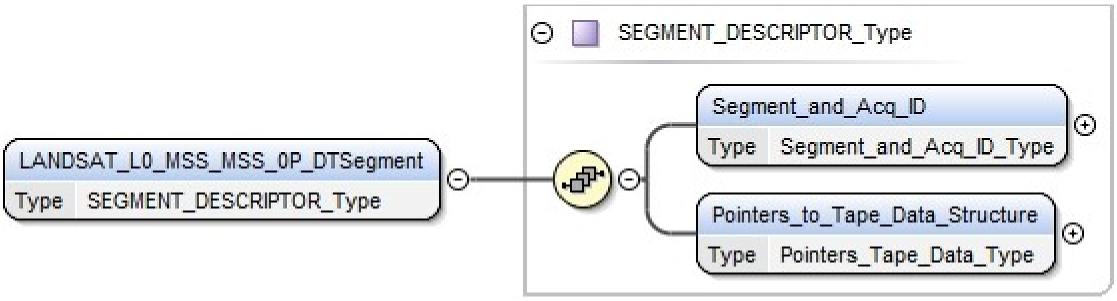
SEGMENT_DESCRIPTOR_Type
LANDSAT_L0_MSS_MSS_0P_DTSegment
Type SEGMENT_DESCRIPTOR_Type
Segment_and_Acq_ID
Type Segment_and_Acq_ID_Type
Pointers_to_Tape_Data_Structure
Type Pointers_Tape_Data_Type

Figure 3: DFDL schema organisation for DTSegment (MSS)

3.1.1.3.1. Root Element

#	Name/Description	Format
1	**LANDSAT_L0_MSS_MSS_0P_DTSegment** SEGMENT DESCRIPTOR file	SEGMENT_DESCRIPTOR_Type

#	Name/Description	Format
	This file contains the descriptions of all the segments in which the satellite pass has been divided. Each segment is described by one structure. The "Segment Descriptor Structure" is thus repeated as many times as the number of segments recorded in the "Sensor Acquired Data" file. Each segment is completely described by the following fields and contains all information to address it within the video data records. The number of items and the length are specified into the "User Header file - Pointer to Tape Data Structure Description Section" (described in previous paragraph).	

Table 12: LANDSAT_L0_MSS_MSS_0P_DTSegment Specification

3.1.1.3.2. Complex Types

3.1.1.3.2.1.SEGMENT_DESCRIPTOR_Type

#	Name/Description	Format
1	**Segment_and_Acq_ID**	Segment_and_Acq_ID_Type
2	**Pointers_to_Tape_Data_Structure**	Pointers_Tape_Data_Type

Table 13: SEGMENT_DESCRIPTOR_Type Specification

3.1.1.3.2.2.Segment_and_Acq_ID_Type

Segment and Acquisition Identification

#	Name/Description	Format
1	**Acquis_Date_Year** Acquisition Date of the Sat. Pass (Year)	xs:short 2 bytes
2	**Acquis_Date_Month** Acquisition Date of the Sat. Pass (Month)	xs:short 2 bytes
3	**Acquis_Date_Day** Acquisition Date of the Sat. Pass (Day)	xs:short 2 bytes
4	**Acquis_Day** Day in the year of the acquisition	xs:short 2 bytes
5	**Segment_Start_Hours** Start of Segment (Hours)	xs:short 2 bytes
6	**Segment_Start_Min** Start of Segment (Min)	xs:short 2 bytes
7	**Segment_Start_Sec** Start of Segment (Sec)	xs:short 2 bytes
8	**Segment_Start_Millisec** Start of Segment (Millisec)	xs:short 2 bytes
9	**Segment_End_Hours** End of Segment (Hours)	xs:short 2 bytes
10	**Segment_End_Min** End of Segment (Min)	xs:short 2 bytes

#	Name/Description	Format
11	**Segment_End_Sec** End of Segment (Sec)	xs:short 2 bytes
12	**Segment_End_Millisec** End of Segment (Millisec)	xs:short 2 bytes
13	**Loaded_Swath** Nr. of lines loaded on tape for this segment	xs:integer 4 bytes
14	**First_Swath** First swath of the segment	xs:integer 4 bytes
15	**Last_Swath** Last swath of the segment	xs:integer 4 bytes
16	**Lost_Swath** Lost swaths of the segment	xs:integer 4 bytes
17	**First_Frame** First frame of the segment (when applicable)	xs:integer 4 bytes
18	**Last_Frame** Last frame of the segment (when applicable)	xs:integer 4 bytes
19	**First_OBC** First On Board Counter or TSID (when applicable)	xs:integer 4 bytes
20	**Last_OBC** Last On Board Counter or TSID (when applicable)	xs:integer 4 bytes

Table 14: Segment_and_Acq_ID_Type Specification

3.1.1.3.2.3.Pointers_Tape_Data_Type

Pointers to Tape Data Structure

#	Name/Description	Format
1	**Starting_Address** Pass Id. Header file Address	xs:long 4 bytes
2	**Swath_Size** Swath length (in bytes) This field is filled only if its value changed between different Segments. If it does not change the valid value for this field must be read in the User Header (Pointers to Tape Data Structure)	xs:integer 4 bytes
3	**Swath_per_Block** Number of swaths per block This field is filled only if its value changed between different Segments. If it does not change the valid value for this field must be read in the User Header (Pointers to Tape Data Structure)	xs:integer 4 bytes
4	**Nr_of_Blocks** Number of blocks This field is filled only if its value changed between different Segments. If it does not change the valid value for this field must be read in the User Header (Pointers to Tape Data Structure)	xs:integer 4 bytes
5	**Formats_Per_Swath**	xs:integer

#	Name/Description	Format
	Number of formats per swath This field is filled only if its value changed between different Segments. If it does not change the valid value for this field must be read in the User Header (Pointers to Tape Data Structure)	4 bytes
6	**Filler** Filler	xs:hexBinary 52bytes

Table 15: Pointers_Tape_Data_Type Specification

3.1.1.4. DTStatisticFile

The Statistics file constitutes a sort of summary of all transcribed passes.

The next figure provides a high level overview of the complex structures used to represent the information of the DTStatisticFile:

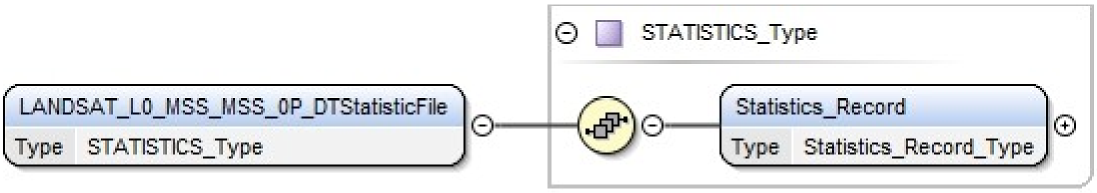
STATISTICS_Type
LANDSAT_L0_MSS_MSS_0P_DTStatisticFile
Type STATISTICS_Type
Statistics_Record
Type Statistics_Record_Type

Figure 4: DFDL schema organisation for DTStatisticFile (MSS)

3.1.1.4.1. Root Element

#	Name/Description	Format
1	**LANDSAT_L0_MSS_MSS_0P_DTStatisticFile** STATISTICS file The Statistics file always follows the Transcription Area in the DLT and constitutes a sort of summary of the passes contained in the DLT. The Statistics File following the last Transcription Area of the cassette constitutes a directory, with information on all the transcribed passes. This structure allows an easy positioning of the tape on the requested pass. To achieve this goal, when the tape inspection is performed, the end of tape is reached without reading any data. Then the control jumps one file back (at the beginning of the last Statistics file). Reading this file the content of the whole DLT can be known. The first record is empty. The successive records are structured according the table below; each of them points to the successive Transcription Area stored on the cassette.	STATISTICS_Type

Table 16: LANDSAT_L0_MSS_MSS_0P_DTStatisticFile Specification

3.1.1.4.2. Complex Types

3.1.1.4.2.1.STATISTICS_Type

#	Name/Description	Format
1	**Statistics_Record**	Statistics_Record_Type

Table 17: STATISTICS_Type Specification

3.1.1.4.2.2.Statistics_Record_Type

#	Name/Description	Format
1	**Reserved_1** Reserved	xs:hexBinary 4bytes
2	**Satellite_ID** Satellite Code	xs:unsignedShort 2 bytes
3	**Mission_ID** Mission. Number	xs:unsignedShort 2 bytes
4	**Instr_Type_ID** Instrument Type Code	xs:unsignedShort 2 bytes
5	**Reserved_2** Reserved	xs:unsignedShort Min Occurs: 2 Max Occurs: 2 2 bytes
6	**Station_ID** Acquisition Ground Station Code	xs:unsignedShort 2 bytes
7	**Reserved_3** Reserved	xs:short 2 bytes
8	**Filler** Padding for structure alignment	xs:hexBinary 2bytes
9	**Track_Number** Track Number (when applicable)	xs:integer 4 bytes
10	**Orbit_Number** Orbit number (when applicable)	xs:integer 4 bytes
11	**Reserved_4** Reserved	xs:integer 4 bytes
12	**Number_of_Frames** Number of standard frames (when applicable)	xs:integer 4 bytes
13	**First_Frame** Num of first standard frame (when applicable)	xs:integer 4 bytes
14	**Reserved_5** Reserved	xs:integer Min Occurs: 4 Max Occurs: 4 4 bytes
15	**Acquisition_Date_Year** Acquisition Date (Year)	xs:short 2 bytes
16	**Acquisition_Date_Month** Acquisition Date (Month)	xs:short 2 bytes
17	**Acquisition_Date_Day** Acquisition Date (Month)	xs:short 2 bytes
18	**Acquisition_Day** Acquisition Day of the year	xs:short 2 bytes

#	Name/Description	Format
19	**Acquisition_Start_Hours** Start of acquisition (Hours)	xs:short 2 bytes
20	**Acquisition_Start_Min** Start of acquisition (Min)	xs:short 2 bytes
21	**Acquisition_Start_Sec** Start of acquisition (Sec)	xs:short 2 bytes
22	**Acquisition_Start_Millisec** Start of acquisition (Millisec)	xs:short 2 bytes
23	**Acquisition_End_Hours** End of acquisition (Hours)	xs:short 2 bytes
24	**Acquisition_End_Min** End of acquisition (Min)	xs:short 2 bytes
25	**Acquisition_End_Sec** End of acquisition (Sec)	xs:short 2 bytes
26	**Acquisition_End_Millisec** End of acquisition (Millisec)	xs:short 2 bytes
27	**Transcription_Date_Day** Transcription Date (Day)	xs:short 2 bytes
28	**Transcription_Date_Month** Transcription Date (Month)	xs:short 2 bytes
29	**Transcription_Date_Year** Transcription Date (Year)(WARNING: Year could be expressed in some tapes as years from 1900)	xs:short 2 bytes
30	**Reserved_6** Reserved	xs:short Min Occurs: 6 Max Occurs: 6 2 bytes
31	**Filler** Padding for structure alignment	xs:hexBinary 2bytes
32	**Reserved_7** Reserved	xs:integer Min Occurs: 10 Max Occurs: 10 4 bytes
33	**Physical_Address_1** User Header file number	xs:long 4 bytes
34	**Physical_Address_2** Pass Id. Header file number	xs:long 4 bytes
35	**Reserved_8** Reserved	xs:hexBinary 697bytes
36	**Copy_Date_Day** Date when this record has been generated as a copy from another tape (Day)	xs:unsignedByte 1bytes
37	**Copy_Date_Month** Date when this record has been generated as a copy from another tape (Month)	xs:unsignedByte 1bytes
38	**Copy_Date_Year** Date when this record has been generated as a copy from another tape (Year)	xs:unsignedByte 1bytes
39	**Copy_Source_Tape_Number**	xs:long

#	Name/Description	Format
	Number of the source tape from where this record was generated	4 bytes
40	**Copy_Flag** 1 = this is a copied record 0 = this is the original transcribed record	xs:unsignedByte 1bytes
41	**Copy_Source_Media_Type** 4 = DLT 2 = SONY ID1	xs:unsignedByte 1bytes
42	**Reserved_9** Reserved	xs:unsignedByte 2bytes

Table 18: Statistics_Record_Type Specification

3.1.1.5. DTUserHeader

The DTUserHeader file contains the acquisition description as well as the logical and physical file structure. It contains all the parameters of the imaging sequence, the orbital parameters, the information about acquisition station, the description of the file structure and contents and all information necessary for further processing. It has the same structure for all satellites transcriptions.

The next figure provides a high level overview of the complex structures used to represent the information of the DTUserHeader file:

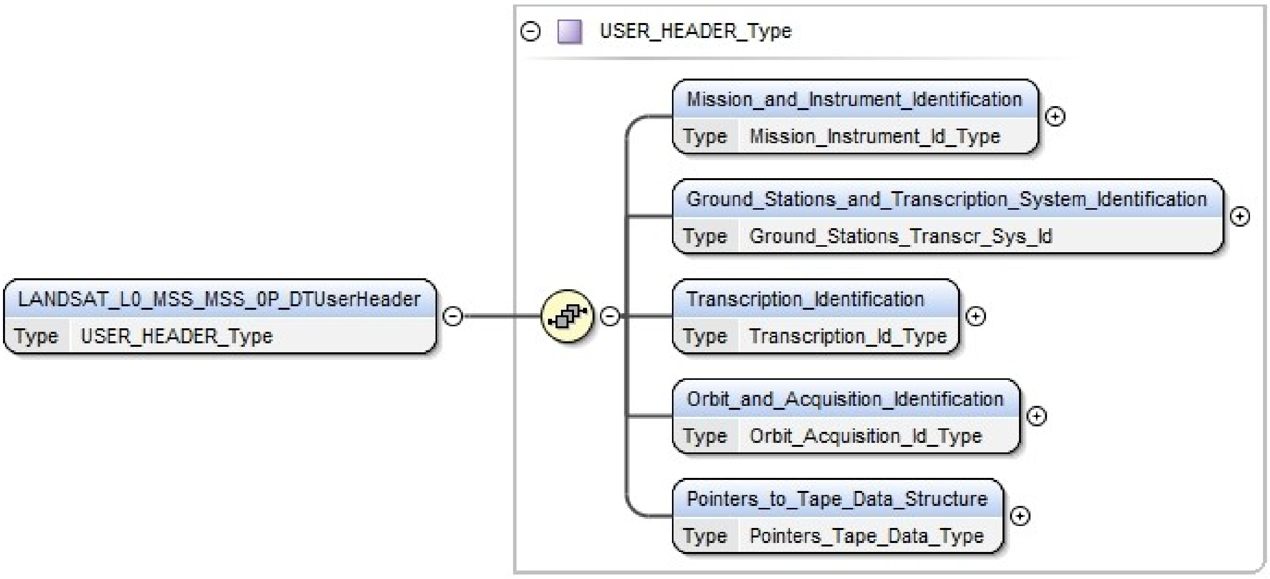
USER_HEADER_Type
LANDSAT_L0_MSS_MSS_0P_DTUserHeader
Type USER_HEADER_Type
Mission_and_Instrument_Identification
Type Mission_Instrument_Id_Type
Ground_Stations_and_Transcription_System_Identification
Type Ground_Stations_Transcr_Sys_Id
Transcription_Identification
Type Transcription_Id_Type
Orbit_and_Acquisition_Identification
Type Orbit_Acquisition_Id_Type
Pointers_to_Tape_Data_Structure
Type Pointers_Tape_Data_Type

Figure 5: DFDL schema organisation for DTUserHeader (MSS)

3.1.1.5.1. Root Element

#	Name/Description	Format
1	**LANDSAT_L0_MSS_MSS_0P_DTUserHeader** USER HEADER file The "User Header" file contains the acquisition description as well as the logical and physical file	USER_HEADER_Type

#	Name/Description	Format
	structure. It contains all the parameters of the imaging sequence, the orbital parameters, the information about acquisition station, the description of the file structure and contents and all information necessary for further processing. It has the same structure for all satellites transcriptions. The file is divided into five logical sections: 1. Mission and Instrument Identification 2. Ground Stations and Transcription System Identification 3. Transcription Identification 4. Orbit and Acquisition Identification 5. Pointers to Tape Data Structure	

Table 19: LANDSAT_L0_MSS_MSS_0P_DTUserHeader Specification

3.1.1.5.2. Complex Types

3.1.1.5.2.1.USER_HEADER_Type

#	Name/Description	Format
1	**Mission_and_Instrument_Identification**	Mission_Instrument_Id_Type
2	**Ground_Stations_and_Transcription_System_Identification**	Ground_Stations_Transcr_Sys_Id
3	**Transcription_Identification**	Transcription_Id_Type
4	**Orbit_and_Acquisition_Identification**	Orbit_Acquisition_Id_Type
5	**Pointers_to_Tape_Data_Structure**	Pointers_Tape_Data_Type

Table 20: USER_HEADER_Type Specification

3.1.1.5.2.2.Mission_Instrument_Id_Type

Mission and Instrument Identification

#	Name/Description	Format
1	**Reserved_1** Reserved	xs:hexBinary 76 bytes
2	**Satellite_ID** Satellite Code: 1 - LANDSAT 2 - MOS 3 - J-ERS 4 - SPOT 5 - ERS 6 - IRS-C 7 - RADARSAT 8 - NOAA 9 - RESERVED 10 - RESERVED	xs:short 2 bytes

#	Name/Description	Format
	11 - HELIOS 12 - SHUTTLE 13 - EOSAM 14 - EOSPM	
3	**Mission_ID** Satellite Mission Number	xs:short 2 bytes
4	**Instr_Type_ID** Satellite Mission Number: 1 - LANDSAT MSS 2 - LANDSAT TM 3 - LANDSAT ETM 4 - LANDSAT RBV 5 - MOS MESSR 6 - J-ERS VNIR 7 - J-ERS SWIR 8 - Not Used 9 - Not Used 10 - ERS AMI SAR 11 - ERS ATSR 12 - SPOT HRV 13 - J-ERS SAR 14 - NOAA AVHRR 15 - SPOT HRVIR 16 - SHUTTLE XSAR 17 - MODIS	xs:short 2 bytes
5	**Instr_Number** Instrument number (when applicable)	xs:short 2 bytes
6	**Transm_Channel** Instrument number (when applicable)	xs:short 2 bytes

Table 21: Mission_Instrument_Id_Type Specification

3.1.1.5.2.3.Ground_Stations_Transcr_Sys_Id

Ground Stations and Transcription System Identification

#	Name/Description	Format
1	**Station_ID** Acquisition Ground Station Code: 67 - Adelaide 97 - Agrhymet 10 - AliceSpring 68 - Aspendale 105 - Atlanta 20 - Aussaguel 6 - Bangkok 52 - BantonRouge 49 - Bedford 74 - Beijing	xs:short 2 bytes

#	Name/Description	Format
	30 - Berlin 31 - Berne 112 - Bishkek 29 - Bremenhaven 28 - Budapest 96 - Cairo 92 - Casey 64 - Cashoiera 32 - Copenhagen 103 - Cordoba 8 - Cotopaxi 23 - Cuiaba 76 - Da-Xing 33 - DeBilt 75 - Dhaka 50 - Downsview 34 - Dundee 51 - Edmonton 7 - Fairbanks 24 - Farnborough 35 - Frascati 1 - Fucino 65 - Funceme 9 - Gatineau 54 - GilmoreCreek 36 - Hamburg 19 - HarteBeesHoek 16 - Hatoyama 37 - Helsinki 22 - Hobart 69 - Honolulu 11 - Hyderabad 21 - Islamabad 115 - Itu 77 - Keelung 116 - KhantyMansiysk 2 - Kiruna 78 - Kiyose 113 - Kitab 111 - Kourou 38 - Krakow 91 - KualaLumpur 12 - Kumamoto 39 - Lannion 79 - Lapan 99 - LaReunion 40 - Lasham 106 - Libreville 41 - Madrid 109 - Malindi	

#	Name/Description	Format
	80 - Manila 3 - Maspalomas 104 - Matera 93 - McMurdo 53 - Miami 110 - Moscow 98 - Nairobi 55 - NESDIS 108 - Neustrelitz 81 - NewDelhi 102 - Norman 42 - Norrkoping 27 - Oberpfaff 43 - Offenbach 15 - OHiggins 44 - Oslo 94 - Palmer 18 - PariPari 70 - Perth 45 - Prague 25 - Pretoria 13 - PrinceAlbert 57 - RedwoodCity 82 - Riyadh 46 - Rome 101 - RRSC_Nairobi 66 - Santiago 26 - Scanzano 58 - Scipps Inst 84 - Selangor 87 - Sendai 85 - Seoul 86 - SeoulUniv 83 - Singapore 59 - SiouxFalls 47 - Spitzenbergen 60 - StennisSpace 71 - Sydney 17 - Syowa 90 - Taipei 5 - Tel_Aviv 95 - TerranovaBay 88 - TokaiUniv 89 - TokyoUniv 72 - Townsville 48 - Traben-Trar 4 - Tromso 100 - Tunis 114 - UlanBator 61 - UnivOfAlaska	

#	Name/Description	Format
	63 - UnivOfRhodeIsl 62 - UnivOfTexas 56 - WallopsIsl 73 - Wellington 14 - WestFreugh	
2	**Station_DT_ID** Data Transcription Ground Station Code	xs:short 2 bytes
3	**Filler** Padding for stucture alignment	xs:hexBinary 2 bytes

Table 22: Ground_Stations_Transcr_Sys_Id Specification

3.1.1.5.2.4.Transcription_Id_Type

Transcription Identification

#	Name/Description	Format
1	**Input_HddrType** HDDR Code	xs:unsignedInt 4 bytes
2	**Format_SyncType** Format Synchroniser/Decommutator Code: 1 - MCS ERS FS 2 - SPACETEC ERS HR FS 3 - IAI ERS HR FS 4 - LABEN ERS HR FS 5 - SPACETEC/ACS ERS FS 6 - ENERTEC MSS FS 7 - ENERTEC TM FS 8 - ACS SW FORMAT SYNCH 14 - ACS XSAR FORMAT SW SYNCH	xs:unsignedInt 4 bytes
3	**Reserved** Reserved	xs:unsignedInt Min Occurs: 2 Max Occurs: 2 4 bytes

Table 23: Transcription_Id_Type Specification

3.1.1.5.2.5.Orbit_Acquisition_Id_Type

Orbit and Acquisition Identification

#	Name/Description	Format
1	**Track_Number** Track or Data Take Number (when applicable)	xs:integer 4 bytes
2	**Orbit_Number** Orbit number (when applicable)	xs:integer 4 bytes
3	**Cycle_Number** Cycle number (when applicable)	xs:integer 4 bytes
4	**Numb_of_Frames** Number of standard frames (when applicable)	xs:integer 4 bytes

#	Name/Description	Format
5	**First_Frame** Num. of first standard frame (when applicable)	xs:integer 4 bytes
6	**Reserved** Reserved	xs:unsignedInt Min Occurs: 4 Max Occurs: 4 4 bytes
7	**First_OBC** 1st On Board Counter (when applicable)	xs:unsignedInt 4 bytes
8	**Last_OBC** Last On Board Counter (when applicable)	xs:unsignedInt 4 bytes
9	**Acquis_Date_Year** Acquisition Date (Year)	xs:unsignedShort 2 bytes
10	**Acquis_Date_Month** Acquisition Date (Month)	xs:unsignedShort 2 bytes
11	**Acquis_Date_Day** Acquisition Date (Day)	xs:unsignedShort 2 bytes
12	**Acquis_Day** Day in the year of the acquisition	xs:unsignedShort 2 bytes
13	**Acquis_start_Hour** Start of acquisition (Hour)	xs:unsignedShort 2 bytes
14	**Acquis_start_Min** Start of acquisition (Minutes)	xs:unsignedShort 2 bytes
15	**Acquis_start_Sec** Start of acquisition (Seconds)	xs:unsignedShort 2 bytes
16	**Acquis_start_Millisec** Start of acquisition (Milliseconds)	xs:unsignedShort 2 bytes
17	**Acquis_end_Hour** End of acquisition (Hours)	xs:unsignedShort 2 bytes
18	**Acquis_end_Min** End of acquisition (Minutes)	xs:unsignedShort 2 bytes
19	**Acquis_end_Sec** End of acquisition (Seconds)	xs:unsignedShort 2 bytes
20	**Acquis_end_Millisec** End of acquisition (Milliseconds)	xs:unsignedShort 2 bytes
21	**Transcription_Date_Day** Transcription Date in Days	xs:unsignedShort 2 bytes
22	**Transcription_Date_Month** Transcription Date in Months	xs:unsignedShort 2 bytes
23	**Transcription_Date_Year** Transcription Date in Years (WARNING: Year could be expressed in some tapes as years from 1900)	xs:unsignedShort 2 bytes
24	**Transcription_Start_Hour** Transcription start in Hours	xs:unsignedShort 2 bytes
25	**Transcription_Start_Min** Transcription start in Minutes	xs:unsignedShort 2 bytes
26	**Transcription_Start_Sec** Transcription start in Seconds	xs:unsignedShort 2 bytes
27	**Transcription_End_Hour**	xs:unsignedShort

#	Name/Description	Format
	Transcription end in Hours	2 bytes
28	**Transcription_End_Min** Transcription end in Minutes	xs:unsignedShort 2 bytes
29	**Transcription_End_Sec** Transcription end in Seconds	xs:unsignedShort 2 bytes
30	**Filler** Padding for stucture alignment	xs:hexBinary 2 bytes

Table 24: Orbit_Acquisition_Id_Type Specification

3.1.1.5.2.6.Pointers_Tape_Data_Type

This structure is meaningful only in the "User Header" file (it is empty in "Pass Id. Header"). The last field of the first area (Nr_of_Files) indicates how many files follow the "User Header" inside the same Transcription Area (same passage).
This number has been taken as a parameter to allow the maximum flexibility.
In the Transcription Systems presently designed and installed the parameter "Nr_of_Files" can be 2 for LANDSAT.

The 10 blocks which follow "Nr_of Files" describes the files following the "User Header" in current "Transcription Area". Each of these blocks describes one file. The number of blocks actually filled is thus equal to "Nr_of_Files"

In the LANDSAT case there are 2 blocks filled, which correspond respectively to:
1. the "Segment Descriptor" file
2. the "Block Addresses Descriptor" file.

#	Name/Description	Format
1	**Num_of_segments** Number of segments (when applicable)	xs:integer 4 bytes
2	**Loaded_Swath** Number of transcribed swaths	xs:integer 4 bytes
3	**Swath_Size** Swath length (in bytes)	xs:integer 4 bytes
4	**Swath_per_Block** Number of swaths per block	xs:integer 4 bytes
5	**Nr_of_Blocks** Number of blocks	xs:integer 4 bytes
6	**Physical_Address_1** User Header Address. File Number of the User Header. It is the number of files, numbered from DLT start, preceding the User Header file in current Transcription Area.	xs:long 4 bytes
7	**Physical_Address_2** Pass Id. Header Address. File Number of the Pass Id. Header. It is the number of files, numbered from DLT start, preceding the Pass Id. Header file in current Transcription Area.	xs:long 4 bytes
8	**Nr_of_Files**	xs:integer

#	Name/Description	Format
	Number of files following the present	4 bytes
9	**File**	Pointers_Tape_Data_File_Type Min Occurs: 10 Max Occurs: 10
10	**Reserved** Reserved	xs:hexBinary 8bytes

Table 25: Pointers_Tape_Data_Type Specification

3.1.1.5.2.7.Pointers_Tape_Data_File_Type

#	Name/Description	Format
1	**File_ID** File type identifier	xs:integer 4 bytes
2	**File_Num** Number of physical records	xs:integer 4 bytes
3	**Record_Length** Physical record length in bytes	xs:integer 4 bytes
4	**Elem_Num** Number of logical element per record	xs:integer 4 bytes
5	**Elem_Length** Logical element length in bytes	xs:integer 4 bytes
6	**Filler** Spare	xs:hexBinary 44 bytes

Table 26: Pointers_Tape_Data_File_Type Specification

3.1.1.6. DTVideoData

The LANDSAT MSS Sensor data of one imaging sequence are stored consecutively in the DTVideoData file. The data corresponding to one pass are subdivided in Blocks having the same length (about 4 Megabytes). Each block contains a fixed number of entire swaths (this number is stored in the “DTUserHeader” file).

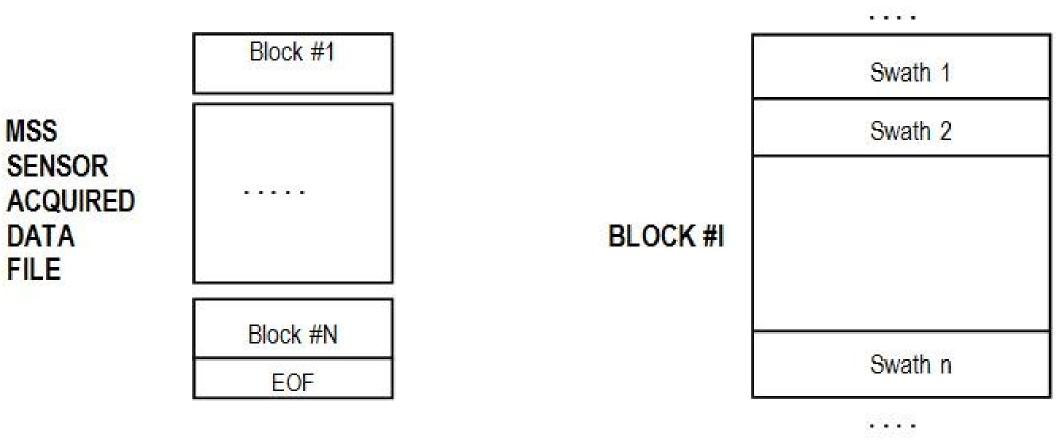

Figure 6: DTVideoData - MSS Sensor Acquired Data File organisation

Each swath consists of the following portions of data:

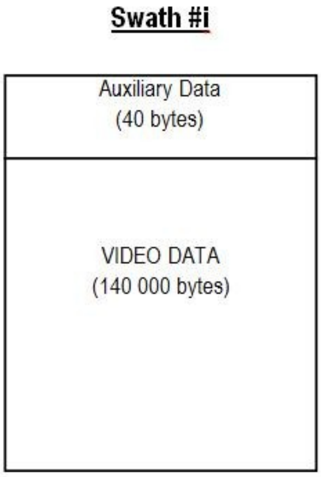

Figure 7: DTVideoData - MSS Swath organisation

The next figure provides a high level overview of the complex structures used to represent the information of the DTVideoData file:

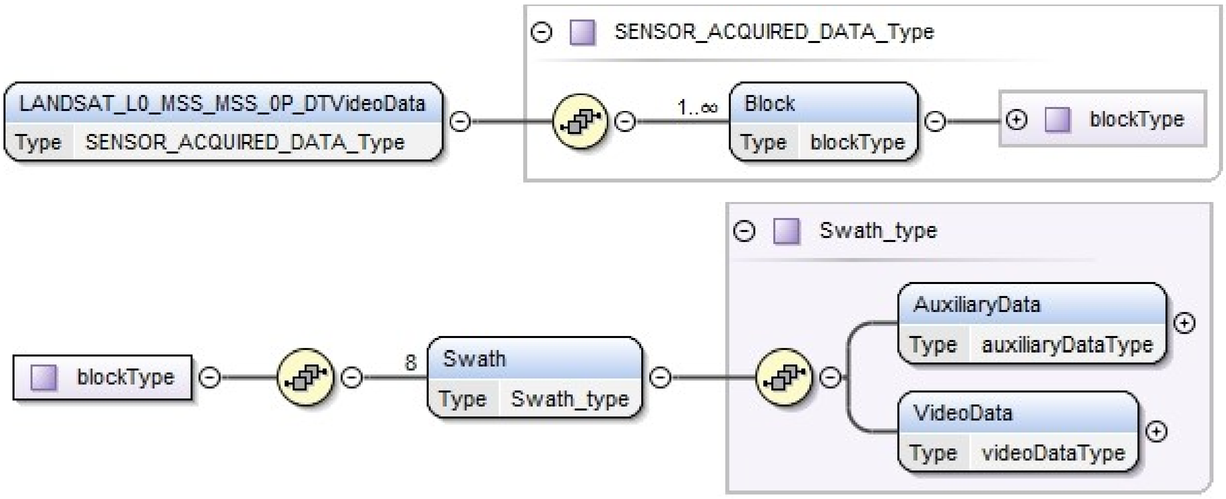

Figure 8: DFDL schema organisation for DTVideoData (MSS)

3.1.1.6.1. Root Element

#	Name/Description	Format
1	**LANDSAT_L0_MSS_MSS_0P_DTVideoData** SENSOR ACQUIRED DATA FILE The structure of the transcribed data depend on the Format Synchroniser used for data ingestion into the host computer before transcription. In the case of LANDSAT MSS data the system uses the format adopted by the ACS Software Format Synchronizer. The LANDSAT MSS Sensor Data corresponding to one pass are subdivided in Blocks having the same length (about 4 Megabytes) to allow the	SENSOR_ACQUIRED_DATA_Type

#	Name/Description	Format
	pointing mechanism described in previous sections. Each block contains a fixed number of entire swaths. This number has to be read from the "User Header".	

Table 27: LANDSAT_L0_MSS_MSS_0P_DTVideoData Specification

3.1.1.6.2. Complex Types

3.1.1.6.2.1.SENSOR_ACQUIRED_DATA_Type

The exact number of blocks is specified in the DTUserHeader file (at /Pointers_to_Tape_Data_Structure/Nr_of_Blocks)

#	Name/Description	Format
1	**Block**	blockType Min Occurs: 1 Max Occurs: unbounded

Table 28: SENSOR_ACQUIRED_DATA_Type Specification

3.1.1.6.2.2.blockType

The exact number of swaths is specified in the DTUserHeader file (at /Pointers_to_Tape_Data_Structure/Swath_per_Block)

#	Name/Description	Format
1	**Swath**	Swath_type Min Occurs: 8 Max Occurs: 8

Table 29: blockType Specification

3.1.1.6.2.3.Swath_type

Each swath is 140,040 bytes long and consists of the following portions of data.

#	Name/Description	Format
1	**AuxiliaryData**	auxiliaryDataType
2	**VideoData**	videoDataType

Table 30: Swath_type Specification

3.1.1.6.2.4.auxiliaryDataType

#	Name/Description	Format
1	**Day** # of days from the current year	xs:int 4 bytes
2	**Hours** # of hours from midnight	xs:int 4 bytes
3	**Minutes** # of minutes	xs:int 4 bytes
4	**Seconds** # of seconds	xs:int 4 bytes
5	**Milliseconds** # of milliseconds	xs:int 4 bytes

#	Name/Description	Format
6	**msec_fractionary** # of 1/16 of milliseconds	xs:unsignedShort 2 bytes
7	**Satellite_ID** LANDSAT mission number	xs:unsignedShort 2 bytes
8	**Line_length** Length of active scan in Minor Frames unity	xs:int 4 bytes
9	**Swath_length** Length in bytes of a swath (as transmitted from satellite. Note that the transcribed swath is a fixed part of this length).	xs:int 4 bytes
10	**Satellite_time** Swath time in milliseconds and 1/16 of milliseconds from beginning of year .	xs:double 8 bytes

Table 31: auxiliaryDataType Specification

3.1.1.6.2.5.videoDataType

#	Name/Description	Format
1	**TimeCode**	xs:hexBinary 50 bytes
2	**VideoData**	minorFrameType Min Occurs: 550 Max Occurs: 550
3	**EndOfScan**	xs:hexBinary 200 bytes
4	**DC_Restore_and_Calibration**	minorFrameType Min Occurs: 381 Max Occurs: 381
5	**Filler**	xs:hexBinary 100 bytes

Table 32: videoDataType Specification

3.1.1.6.2.6.minorFrameType

#	Name/Description	Format
1	**Row1**	minorFrameRowType
2	**Row2**	minorFrameRowType
3	**Row3**	minorFrameRowType
4	**Row4**	minorFrameRowType
5	**Row5**	minorFrameRowType
6	**Row6**	minorFrameRowType

Table 33: minorFrameType Specification

3.1.1.6.2.7.minorFrameRowType

#	Name/Description	Format
1	**Sync**	xs:hexBinary 1 bytes
2	**Sensors_VideoData**	xs:hexBinary 24 bytes

Table 34: minorFrameRowType Specification

3.1.2. TM__TM__0P

3.1.2.1. DTBlock

This file contains the description of all the blocks in which the pass has been divided and written. It is composed by a variable number of identical units. Each unit describes completely one satellite data block and contains all information to address any segment or any frame within the “Sensor Acquired Data” file. It contains block number of the video data block, the starting time of the first satellite format in the block and the number of swaths contained.

The structure is repeated as many times as the number of blocks recorded in the file. The number of items and the length are specified in the "DTUserHeader” file.

The next figure provides a high level overview of the complex structures used to represent the information of the DTBlock file:

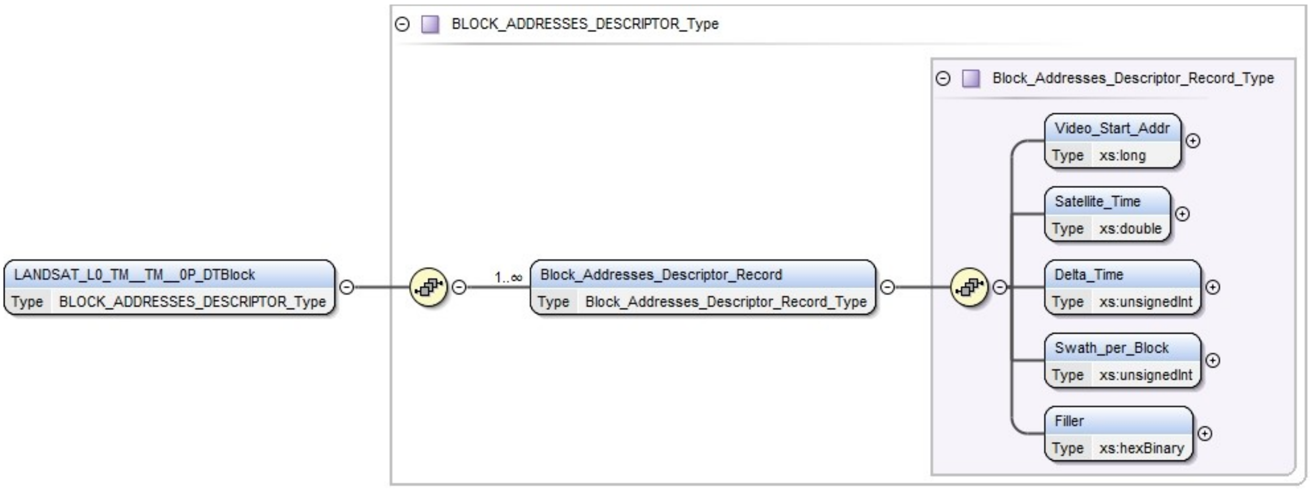
BLOCK_ADDRESSES_DESCRIPTOR_Type
Block_Addresses_Descriptor_Record_Type
LANDSAT_L0_TM__TM__0P_DTBlock
Type BLOCK_ADDRESSES_DESCRIPTOR_Type
1..∞
Block_Addresses_Descriptor_Record
Type Block_Addresses_Descriptor_Record_Type
Video_Start_Addr
Type xs:long
Satellite_Time
Type xs:double
Delta_Time
Type xs:unsignedInt
Swath_per_Block
Type xs:unsignedInt
Filler
Type xs:hexBinary

Figure 9: DFDL schema organisation DTBlock (TM)

3.1.2.1.1. Root Element

#	Name/Description	Format
1	**LANDSAT_L0_TM__TM__0P_DTBlock** BLOCK ADDRESSES DESCRIPTOR file This file contains the description of all the blocks in which the pass has been divided and written on tape. It is composed by a variable number of identical units. Each unit describes completely one satellite data block and contains all information to address any segment or any frame within the "Sensor Acquired Data" file. It contains block number of the video data block, the starting time of the first satellite format in the block and the number of swaths contained.	BLOCK_ADDRESSES_DESCRIPTOR_Type

#	Name/Description	Format
	The structure is repeated as many times as the number of blocks recorded in the file. The number of items and the length are specified into the "User Header file - Pointer to Tape Data Structure Description Section" (Block Addresses section).	

Table 35: LANDSAT_L0_TM__TM__0P_DTBlock Specification

3.1.2.1.2. Complex Types

3.1.2.1.2.1.BLOCK_ADDRESSES_DESCRIPTOR_Type

#	Name/Description	Format
1	**Block_Addresses_Descriptor_Record**	Block_Addresses_Descriptor_Record_Type Min Occurs: 1 Max Occurs: unbounded

Table 36: BLOCK_ADDRESSES_DESCRIPTOR_Type Specification

3.1.2.1.2.2.Block_Addresses_Descriptor_Record_Type

#	Name/Description	Format
1	**Video_Start_Addr** Block number of the video data block	xs:long 4 bytes
2	**Satellite_Time** Time of current block. The time is expressed in Milliseconds from midnight of first block swath.	xs:double 8 bytes
3	**Delta_Time** Time distance between start of acquisition (first block of the file) and current block start The delta time is expressed in Milliseconds	xs:unsignedInt 4 bytes
4	**Swath_per_Block** Number of swaths per block	xs:unsignedInt 4 bytes
5	**Filler** Available fields	xs:hexBinary 12bytes

Table 37: Block_Addresses_Descriptor_Record_Type Specification

3.1.2.2. DTPassID

The DTPassID (Pass Identification Header) contains the information to unambiguously identify the imaging sequence contained in the product.

This record is divided into five logical sections:

- Mission and Instrument Identification
- Ground Stations and Transcription System Identification
- Transcription Identification

- Orbit and Acquisition Identification
- Pointers to Tape Data Structure

The next figure provides a high level overview of the complex structures used to represent the information of the DTPassID file:

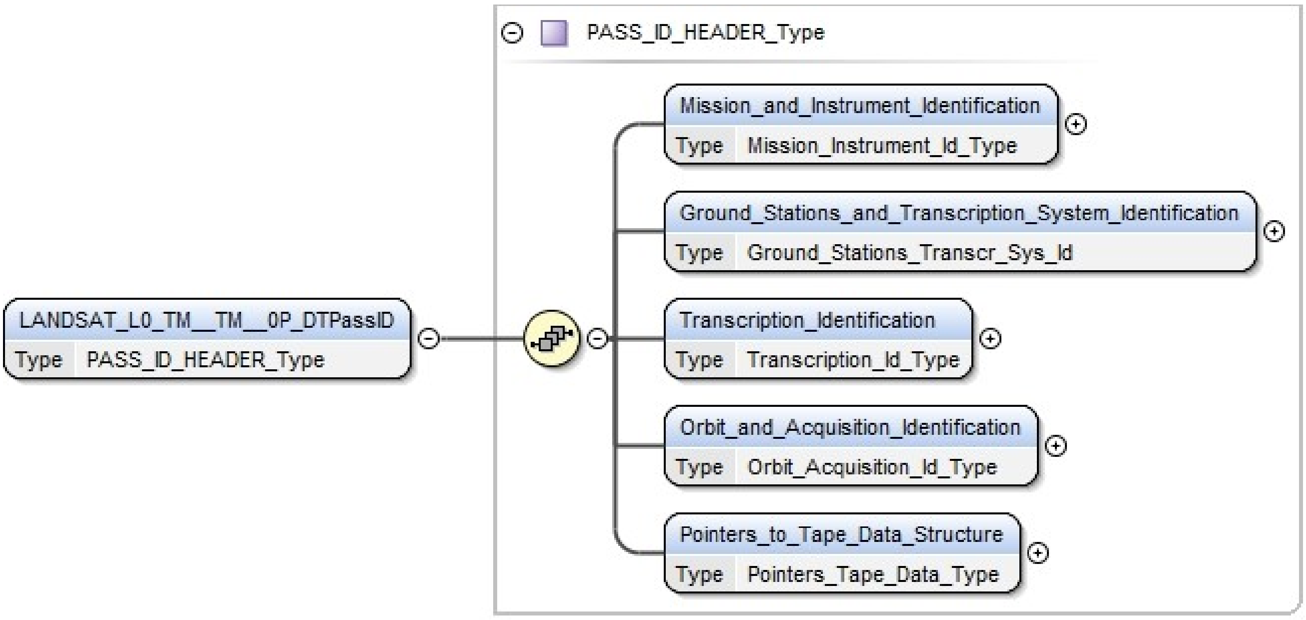
PASS_ID_HEADER_Type
LANDSAT_L0_TM__TM__0P_DTPassID
Type PASS_ID_HEADER_Type
Mission_and_Instrument_Identification
Type Mission_Instrument_Id_Type
Ground_Stations_and_Transcription_System_Identification
Type Ground_Stations_Transcr_Sys_Id
Transcription_Identification
Type Transcription_Id_Type
Orbit_and_Acquisition_Identification
Type Orbit_Acquisition_Id_Type
Pointers_to_Tape_Data_Structure
Type Pointers_Tape_Data_Type

Figure 10: DFDL schema organisation for DTPassID (TM)

3.1.2.2.1. Root Element

#	Name/Description	Format
1	**LANDSAT_L0_TM__TM__0P_DTPassID** PASS IDENTIFICATION HEADER file The "Pass Identification Header" is the first file of the Transcription Area. It contains the information, available at the beginning of the transcription, to unambiguously identify the imaging sequence contained in the file. This record is divided into five logical sections: 1. Mission and Instrument Identification 2. Ground Stations and Transcription System Identification 3. Transcription Identification 4. Orbit and Acquisition Identification 5. Pointers to Tape Data Structure	PASS_ID_HEADER_Type

Table 38: LANDSAT_L0_TM__TM__0P_DTPassID Specification

3.1.2.2.2. Complex Types

3.1.2.2.2.1.PASS_ID_HEADER_Type

#	Name/Description	Format
1	**Mission_and_Instrument_Identification**	Mission_Instrument_Id_Type
2	**Ground_Stations_and_Transcription_System_Identification**	Ground_Stations_Transcr_Sys_Id
3	**Transcription_Identification**	Transcription_Id_Type
4	**Orbit_and_Acquisition_Identification**	Orbit_Acquisition_Id_Type
5	**Pointers_to_Tape_Data_Structure**	Pointers_Tape_Data_Type

Table 39: PASS_ID_HEADER_Type Specification

3.1.2.2.2.2.Mission_Instrument_Id_Type

Mission and Instrument Identification

#	Name/Description	Format
1	**Reserved_1** Reserved	xs:hexBinary 76bytes
2	**Satellite_ID** Satellite Code: 1 - LANDSAT 2 - MOS 3 - J-ERS 4 - SPOT 5 - ERS 6 - IRS-C 7 - RADARSAT 8 - NOAA 9 - RESERVED 10 - RESERVED 11 - HELIOS 12 - SHUTTLE 13 - EOSAM 14 - EOSPM	xs:unsignedShort 2 bytes
3	**Mission_ID** Satellite Mission Number	xs:unsignedShort 2 bytes
4	**Instr_Type_ID** Satellite Mission Number: 1 - LANDSAT TM_ 2 - LANDSAT TM 3 - LANDSAT ETM 4 - LANDSAT RBV 5 - MOS MESSR 6 - J-ERS VNIR 7 - J-ERS SWIR 8 - Not Used 9 - Not Used 10 - ERS AMI SAR 11 - ERS ATSR	xs:unsignedShort 2 bytes

#	Name/Description	Format
	12 - SPOT HRV 13 - J-ERS SAR 14 - NOAA AVHRR 15 - SPOT HRVIR 16 - SHUTTLE XSAR 17 - MODIS	
5	**Reserved_2** Reserved	xs:unsignedShort Min Occurs: 2 Max Occurs: 2 2 bytes

Table 40: Mission_Instrument_Id_Type Specification

3.1.2.2.2.3.Ground_Stations_Transcr_Sys_Id

Ground Stations and Transcription System Identification

#	Name/Description	Format
1	**Station_ID** Acquisition Ground Station Code: 67 - Adelaide 97 - Agrhymet 10 - AliceSpring 68 - Aspendale 105 - Atlanta 20 - Aussaguel 6 - Bangkok 52 - BantonRouge 49 - Bedford 74 - Beijing 30 - Berlin 31 - Berne 112 - Bishkek 29 - Bremenhaven 28 - Budapest 96 - Cairo 92 - Casey 64 - Cashoiera 32 - Copenhagen 103 - Cordoba 8 - Cotopaxi 23 - Cuiaba 76 - Da-Xing 33 - DeBilt 75 - Dhaka 50 - Downsview 34 - Dundee 51 - Edmonton 7 - Fairbanks 24 - Farnborough	xs:short 2 bytes

#	Name/Description	Format
	35 - Frascati 1 - Fucino 65 - Funceme 9 - Gatineau 54 - GilmoreCreek 36 - Hamburg 19 - HarteBeesHoek 16 - Hatoyama 37 - Helsinki 22 - Hobart 69 - Honolulu 11 - Hyderabad 21 - Islamabad 115 - Itu 77 - Keelung 116 - KhantyMansiysk 2 - Kiruna 78 - Kiyose 113 - Kitab 111 - Kourou 38 - Krakow 91 - KualaLumpur 12 - Kumamoto 39 - Lannion 79 - Lapan 99 - LaReunion 40 - Lasham 106 - Libreville 41 - Madrid 109 - Malindi 80 - Manila 3 - Maspalomas 104 - Matera 93 - McMurdo 53 - Miami 110 - Moscow 98 - Nairobi 55 - NESDIS 108 - Neustrelitz 81 - NewDelhi 102 - Norman 42 - Norrkoping 27 - Oberpfaff 43 - Offenbach 15 - OHiggins 44 - Oslo 94 - Palmer 18 - PariPari 70 - Perth 45 - Prague	

#	Name/Description	Format
	25 - Pretoria 13 - PrinceAlbert 57 - RedwoodCity 82 - Riyadh 46 - Rome 101 - RRSC_Nairobi 66 - Santiago 26 - Scanzano 58 - Scipps Inst 84 - Selangor 87 - Sendai 85 - Seoul 86 - SeoulUniv 83 - Singapore 59 - SiouxFalls 47 - Spitzenbergen 60 - StennisSpace 71 - Sydney 17 - Syowa 90 - Taipei 5 - Tel_Aviv 95 - TerranovaBay 88 - TokaiUniv 89 - TokyoUniv 72 - Townsville 48 - Traben-Trar 4 - Tromso 100 - Tunis 114 - UlanBator 61 - UnivOfAlaska 63 - UnivOfRhodeIsl 62 - UnivOfTexas 56 - WallopsIsl 73 - Wellington 14 - WestFreugh	
2	**Station_DT_ID** Data Transcription Ground Station Code	xs:short 2 bytes
3	**Filler** Padding for stucture alignment	xs:hexBinary 2bytes

Table 41: Ground_Stations_Transcr_Sys_Id Specification

3.1.2.2.2.4.Transcription_Id_Type

Transcription Identification

#	Name/Description	Format
1	**Source_Type** Data Source Type: 1 - AMPEX 14 tracks	xs:unsignedInt 4 bytes

#	Name/Description	Format
	2 - Shlumberger 14 tracks 3 - Shlumberger 42 tracks 4 - Penny and Giles 5 - Honeywell HD-96 6 - AMPEX DCRSi 7 - CREO Optical Tape 8 - Direct Ingestion 9 - SONY DIR 1000 (R)	
2	**Format_SyncType** Format Synchroniser/Decommutator Code: 1 - MCS ERS FS 2 - SPACETEC ERS HR FS 3 - IAI ERS HR FS 4 - LABEN ERS HR FS 5 - SPACETEC/ACS ERS FS 6 - ENERTEC TM_ FS 7 - ENERTEC TM FS 8 - ACS SW FORMAT SYNCH 14 - ACS XSAR FORMAT SW SYNCH	xs:unsignedInt 4 bytes
3	**Reserved** Reserved	xs:unsignedInt Min Occurs: 2 Max Occurs: 2 4 bytes

Table 42: Transcription_Id_Type Specification

3.1.2.2.2.5.Orbit_Acquisition_Id_Type

Orbit and Acquisition Identification

#	Name/Description	Format
1	**Track_Number** Track or Data Take Number (when applicable)	xs:integer 4 bytes
2	**Orbit** Orbit number (when applicable)	xs:integer 4 bytes
3	**Reserved_1** Reserved	xs:integer Min Occurs: 9 Max Occurs: 9 4 bytes
4	**Reserved_2** Reserved	xs:short Min Occurs: 3 Max Occurs: 3 2 bytes
5	**Reserved_3** Reserved	xs:hexBinary 18bytes
6	**Transcription_Date** Transcription Date in D M Y (WARNING: Year could be expressed in some tapes as years from 1900)	xs:short Min Occurs: 3 Max Occurs: 3 2 bytes
7	**Reserved_4**	xs:short

#	Name/Description	Format
	Reserved	Min Occurs: 6 Max Occurs: 6 2 bytes
8	**Filler** Padding for stucture alignment	xs:hexBinary 2bytes

Table 43: Orbit_Acquisition_Id_Type Specification

3.1.2.2.2.6.Pointers_Tape_Data_Type

Pointers to Tape Data Structure

#	Name/Description	Format
1	**Reserved_1** Reserved	xs:integer Min Occurs: 5 Max Occurs: 5 4 bytes
2	**Physical_Address_1** User Header Address. File Number of the User Header. It is the number of files, numbered from DLT start, preceding the User Header file in current Transcription Area.	xs:long 4 bytes
3	**Physical_Address_2** Pass Id. Header Address. File Number of the Pass Id. Header. It is the number of files, numbered from DLT start, preceding the Pass Id. Header file in current Transcription Area.	xs:long 4 bytes
4	**Reserved_2** Reserved	xs:hexBinary 652bytes

Table 44: Pointers_Tape_Data_Type Specification

3.1.2.3. DTSegment

This DTSegment file contains the descriptions of all the segments in which the satellite pass has been divided.

The next figure provides a high level overview of the complex structures used to represent the information of the DTSegment file:

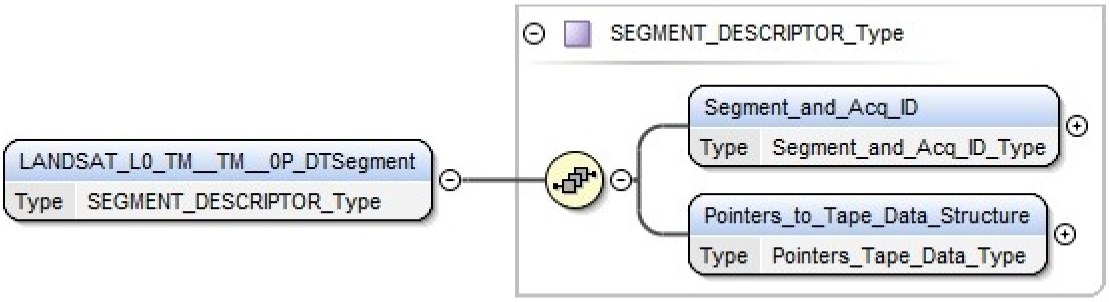
SEGMENT_DESCRIPTOR_Type
LANDSAT_L0_TM__TM__0P_DTSegment
Type SEGMENT_DESCRIPTOR_Type
Segment_and_Acq_ID
Type Segment_and_Acq_ID_Type
Pointers_to_Tape_Data_Structure
Type Pointers_Tape_Data_Type

Figure 11: DFDL schema organisation for DTSegment (TM)

3.1.2.3.1. Root Element

#	Name/Description	Format
1	**LANDSAT_L0_TM__TM__0P_DTSegment** SEGMENT DESCRIPTOR file This file contains the descriptions of all the segments in which the satellite pass has been divided. Each segment is described by one structure. The "Segment Descriptor Structure" is thus repeated as many times as the number of segments recorded in the "Sensor Acquired Data" file. Each segment is completely described by the following fields and contains all information to address it within the video data records. The number of items and the length are specified into the "User Header file - Pointer to Tape Data Structure Description Section" (described in previous paragraph).	SEGMENT_DESCRIPTOR_Type

Table 45: LANDSAT_L0_TM__TM__0P_DTSegment Specification

3.1.2.3.2. Complex Types

3.1.2.3.2.1.SEGMENT_DESCRIPTOR_Type

#	Name/Description	Format
1	**Segment_and_Acq_ID**	Segment_and_Acq_ID_Type
2	**Pointers_to_Tape_Data_Structure**	Pointers_Tape_Data_Type

Table 46: SEGMENT_DESCRIPTOR_Type Specification

3.1.2.3.2.2.Segment_and_Acq_ID_Type

Segment and Acquisition Identification

#	Name/Description	Format
1	**Acquis_Date_Year** Acquisition Date of the Sat. Pass (Year)	xs:short 2 bytes
2	**Acquis_Date_Month** Acquisition Date of the Sat. Pass (Month)	xs:short 2 bytes
3	**Acquis_Date_Day** Acquisition Date of the Sat. Pass (Day)	xs:short 2 bytes
4	**Acquis_Day** Day in the year of the acquisition	xs:short 2 bytes
5	**Segment_Start_Hours** Start of Segment (Hours)	xs:short 2 bytes
6	**Segment_Start_Min**	xs:short

#	Name/Description	Format
	Start of Segment (Min)	2 bytes
7	**Segment_Start_Sec** Start of Segment (Sec)	xs:short 2 bytes
8	**Segment_Start_Millisec** Start of Segment (Millisec)	xs:short 2 bytes
9	**Segment_End_Hours** End of Segment (Hours)	xs:short 2 bytes
10	**Segment_End_Min** End of Segment (Min)	xs:short 2 bytes
11	**Segment_End_Sec** End of Segment (Sec)	xs:short 2 bytes
12	**Segment_End_Millisec** End of Segment (Millisec)	xs:short 2 bytes
13	**Loaded_Swath** Nr. of lines loaded on tape for this segment	xs:integer 4 bytes
14	**First_Swath** First swath of the segment	xs:integer 4 bytes
15	**Last_Swath** Last swath of the segment	xs:integer 4 bytes
16	**Lost_Swath** Lost swaths of the segment	xs:integer 4 bytes
17	**First_Frame** First frame of the segment (when applicable)	xs:integer 4 bytes
18	**Last_Frame** Last frame of the segment (when applicable)	xs:integer 4 bytes
19	**First_OBC** First On Board Counter or TSID (when applicable)	xs:integer 4 bytes
20	**Last_OBC** Last On Board Counter or TSID (when applicable)	xs:integer 4 bytes

Table 47: Segment_and_Acq_ID_Type Specification

3.1.2.3.2.3.Pointers_Tape_Data_Type

Pointers to Tape Data Structure

#	Name/Description	Format
1	**Starting_Address** Pass Id. Header file Address	xs:long 4 bytes
2	**Swath_Size** Swath length (in bytes) This field is filled only if its value changed between different Segments. If it does not change the valid value for this field must be read in the User Header (Pointers to Tape Data Structure)	xs:integer 4 bytes
3	**Swath_per_Block** Number of swaths per block This field is filled only if its value changed between different Segments. If it does not change	xs:integer 4 bytes

#	Name/Description	Format
	the valid value for this field must be read in the User Header (Pointers to Tape Data Structure)	
4	**Nr_of_Blocks** Number of blocks This field is filled only if its value changed between different Segments. If it does not change the valid value for this field must be read in the User Header (Pointers to Tape Data Structure)	xs:integer 4 bytes
5	**Formats_Per_Swath** Number of formats per swath This field is filled only if its value changed between different Segments. If it does not change the valid value for this field must be read in the User Header (Pointers to Tape Data Structure)	xs:integer 4 bytes
6	**Filler** Filler	xs:hexBinary 52bytes

Table 48: Pointers_Tape_Data_Type Specification

3.1.2.4. DTStatisticFile

The Statistics file constitutes a sort of summary of all transcribed passes.

The next figure provides a high level overview of the complex structures used to represent the information of the DTStatisticFile:

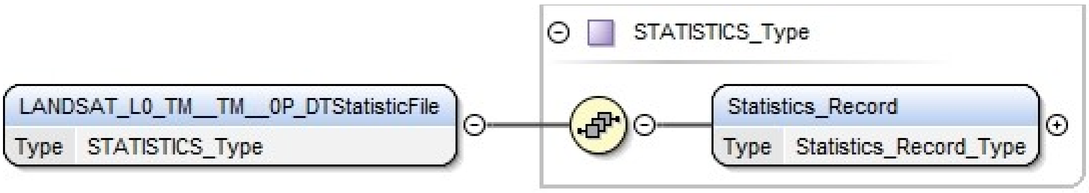
STATISTICS_Type
LANDSAT_L0_TM__TM__0P_DTStatisticFile
Type STATISTICS_Type
Statistics_Record
Type Statistics_Record_Type

Figure 12: DFDL schema organisation for DTStatisticFile (TM)

3.1.2.4.1. Root Element

#	Name/Description	Format
1	**LANDSAT_L0_TM__TM__0P_DTStatisticFile** STATISTICS file The Statistics file always follows the Transcription Area in the DLT and constitutes a sort of summary of the passes contained in the DLT. The Statistics File following the last Transcription Area of the cassette constitutes a directory, with information on all the transcribed passes. This structure allows an easy positioning of the tape on the requested pass. To achieve this goal, when the tape inspection is performed, the end of	STATISTICS_Type

#	Name/Description	Format
	tape is reached without reading any data. Then the control jumps one file back (at the beginning of the last Statistics file). Reading this file the content of the whole DLT can be known. The first record is empty. The successive records are structured according the table below; each of them points to the successive Transcription Area stored on the cassette.	

Table 49: LANDSAT_L0_TM__TM__0P_DTStatisticFile Specification

3.1.2.4.2. Complex Types

3.1.2.4.2.1.STATISTICS_Type

#	Name/Description	Format
1	**Statistics_Record**	Statistics_Record_Type

Table 50: STATISTICS_Type Specification

3.1.2.4.2.2.Statistics_Record_Type

#	Name/Description	Format
1	**Reserved_1** Reserved	xs:hexBinary 4bytes
2	**Satellite_ID** Satellite Code	xs:unsignedShort 2 bytes
3	**Mission_ID** Mission. Number	xs:unsignedShort 2 bytes
4	**Instr_Type_ID** Instrument Type Code	xs:unsignedShort 2 bytes
5	**Reserved_2** Reserved	xs:unsignedShort Min Occurs: 2 Max Occurs: 2 2 bytes
6	**Station_ID** Acquisition Ground Station Code	xs:unsignedShort 2 bytes
7	**Reserved_3** Reserved	xs:short 2 bytes
8	**Filler** Padding for structure alignment	xs:hexBinary 2bytes
9	**Track_Number** Track Number (when applicable)	xs:integer 4 bytes
10	**Orbit_Number** Orbit number (when applicable)	xs:integer 4 bytes
11	**Reserved_4** Reserved	xs:integer 4 bytes
12	**Number_of_Frames** Number of standard frames (when applicable)	xs:integer 4 bytes
13	**First_Frame**	xs:integer

#	Name/Description	Format
	Num of first standard frame (when applicable)	4 bytes
14	**Reserved_5** Reserved	xs:integer Min Occurs: 4 Max Occurs: 4 4 bytes
15	**Acquisition_Date_Year** Acquisition Date (Year)	xs:short 2 bytes
16	**Acquisition_Date_Month** Acquisition Date (Month)	xs:short 2 bytes
17	**Acquisition_Date_Day** Acquisition Date (Month)	xs:short 2 bytes
18	**Acquisition_Day** Acquisition Day of the year	xs:short 2 bytes
19	**Acquisition_Start_Hours** Start of acquisition (Hours)	xs:short 2 bytes
20	**Acquisition_Start_Min** Start of acquisition (Min)	xs:short 2 bytes
21	**Acquisition_Start_Sec** Start of acquisition (Sec)	xs:short 2 bytes
22	**Acquisition_Start_Millisec** Start of acquisition (Millisec)	xs:short 2 bytes
23	**Acquisition_End_Hours** End of acquisition (Hours)	xs:short 2 bytes
24	**Acquisition_End_Min** End of acquisition (Min)	xs:short 2 bytes
25	**Acquisition_End_Sec** End of acquisition (Sec)	xs:short 2 bytes
26	**Acquisition_End_Millisec** End of acquisition (Millisec)	xs:short 2 bytes
27	**Transcription_Date_Day** Transcription Date (Day)	xs:short 2 bytes
28	**Transcription_Date_Month** Transcription Date (Month)	xs:short 2 bytes
29	**Transcription_Date_Year** Transcription Date (Year)(WARNING: Year could be expressed in some tapes as years from 1900)	xs:short 2 bytes
30	**Reserved_6** Reserved	xs:short Min Occurs: 6 Max Occurs: 6 2 bytes
31	**Filler** Padding for structure alignment	xs:hexBinary 2bytes
32	**Reserved_7** Reserved	xs:integer Min Occurs: 10 Max Occurs: 10 4 bytes
33	**Physical_Address_1** User Header file number	xs:long 4 bytes
34	**Physical_Address_2**	xs:long

#	Name/Description	Format
	Pass Id. Header file number	4 bytes
35	**Reserved_8** Reserved	xs:hexBinary 697bytes
36	**Copy_Date_Day** Date when this record has been generated as a copy from another tape (Day)	xs:unsignedByte 1bytes
37	**Copy_Date_Month** Date when this record has been generated as a copy from another tape (Month)	xs:unsignedByte 1bytes
38	**Copy_Date_Year** Date when this record has been generated as a copy from another tape (Year)	xs:unsignedByte 1bytes
39	**Copy_Source_Tape_Number** Number of the source tape from where this record was generated	xs:long 4 bytes
40	**Copy_Flag** 1 = this is a copied record 0 = this is the original transcribed record	xs:unsignedByte 1bytes
41	**Copy_Source_Media_Type** 4 = DLT 2 = SONY ID1	xs:unsignedByte 1bytes
42	**Reserved_9** Reserved	xs:unsignedByte 2bytes

Table 51: Statistics_Record_Type Specification

3.1.2.5. DTUserHeader

The DTUserHeader file contains the acquisition description as well as the logical and physical file structure. It contains all the parameters of the imaging sequence, the orbital parameters, the information about acquisition station, the description of the file structure and contents and all information necessary for further processing. It has the same structure for all satellites transcriptions.

The next figure provides a high level overview of the complex structures used to represent the information of the DTUserHeader file:

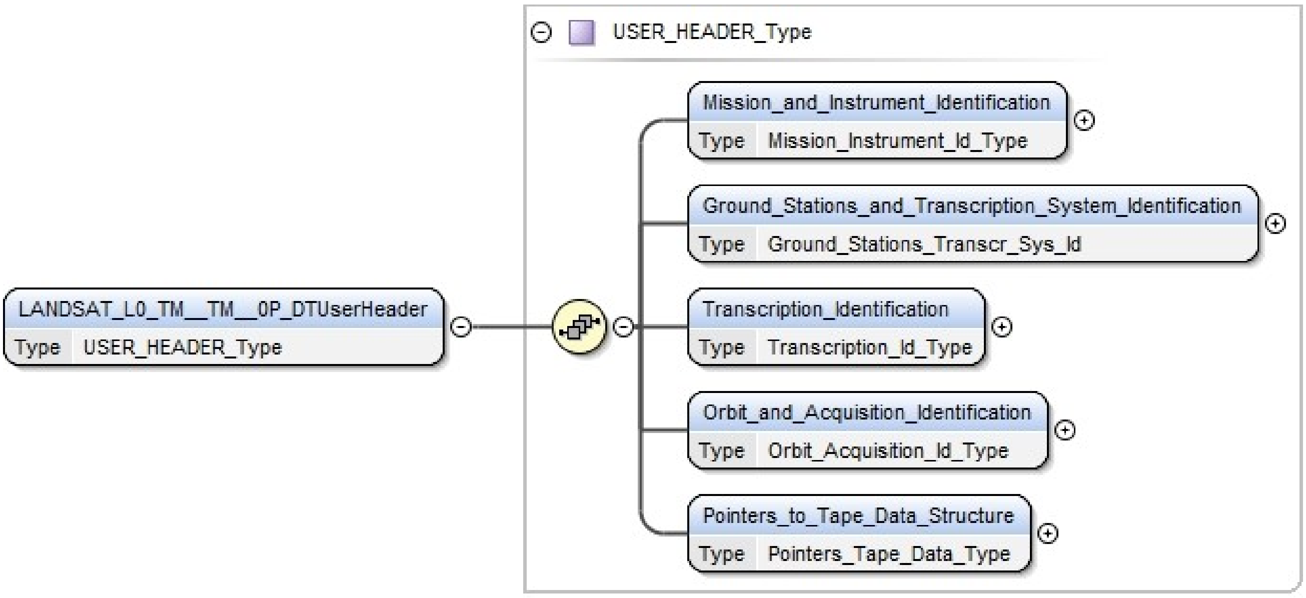
USER_HEADER_Type
LANDSAT_L0_TM__TM__0P_DTUserHeader
Type USER_HEADER_Type
Mission_and_Instrument_Identification
Type Mission_Instrument_Id_Type
Ground_Stations_and_Transcription_System_Identification
Type Ground_Stations_Transcr_Sys_Id
Transcription_Identification
Type Transcription_Id_Type
Orbit_and_Acquisition_Identification
Type Orbit_Acquisition_Id_Type
Pointers_to_Tape_Data_Structure
Type Pointers_Tape_Data_Type

Figure 13: DFDL schema organisation for DTUserHeader (TM)

3.1.2.5.1. Root Element

#	Name/Description	Format
1	**LANDSAT_L0_TM__TM__0P_DTUserHeader** USER HEADER file The "User Header" file contains the acquisition description as well as the logical and physical file structure. It contains all the parameters of the imaging sequence, the orbital parameters, the information about acquisition station, the description of the file structure and contents and all information necessary for further processing. It has the same structure for all satellites transcriptions. The file is divided into five logical sections: 1. Mission and Instrument Identification 2. Ground Stations and Transcription System Identification 3. Transcription Identification 4. Orbit and Acquisition Identification 5. Pointers to Tape Data Structure	USER_HEADER_Type

Table 52: LANDSAT_L0_TM__TM__0P_DTUserHeader Specification

3.1.2.5.2. Complex Types

3.1.2.5.2.1. USER_HEADER_Type

#	Name/Description	Format
1	**Mission_and_Instrument_Identification**	Mission_Instrument_Id_Type
2	**Ground_Stations_and_Transcription_System_Identification**	Ground_Stations_Transcr_Sys_Id
3	**Transcription_Identification**	Transcription_Id_Type
4	**Orbit_and_Acquisition_Identification**	Orbit_Acquisition_Id_Type
5	**Pointers_to_Tape_Data_Structure**	Pointers_Tape_Data_Type

Table 53: USER_HEADER_Type Specification

3.1.2.5.2.2. Mission_Instrument_Id_Type

Mission and Instrument Identification

#	Name/Description	Format
1	**Reserved_1** Reserved	xs:hexBinary 76 bytes
2	**Satellite_ID** Satellite Code: 1 - LANDSAT 2 - MOS 3 - J-ERS 4 - SPOT 5 - ERS 6 - IRS-C 7 - RADARSAT 8 - NOAA 9 - RESERVED 10 - RESERVED 11 - HELIOS 12 - SHUTTLE 13 - EOSAM 14 - EOSPM	xs:short 2 bytes
3	**Mission_ID** Satellite Mission Number	xs:short 2 bytes
4	**Instr_Type_ID** Satellite Mission Number: 1 - LANDSAT TM_ 2 - LANDSAT TM 3 - LANDSAT ETM 4 - LANDSAT RBV 5 - MOS MESSR 6 - J-ERS VNIR 7 - J-ERS SWIR 8 - Not Used 9 - Not Used 10 - ERS AMI SAR	xs:short 2 bytes

#	Name/Description	Format
	11 - ERS ATSR 12 - SPOT HRV 13 - J-ERS SAR 14 - NOAA AVHRR 15 - SPOT HRVIR 16 - SHUTTLE XSAR 17 - MODIS	
5	**Instr_Number** Instrument number (when applicable)	xs:short 2 bytes
6	**Transm_Channel** Instrument number (when applicable)	xs:short 2 bytes

Table 54: Mission_Instrument_Id_Type Specification

3.1.2.5.2.3.Ground_Stations_Transcr_Sys_Id

Ground Stations and Transcription System Identification

#	Name/Description	Format
1	**Station_ID** Acquisition Ground Station Code: 67 - Adelaide 97 - Agrhymet 10 - AliceSpring 68 - Aspendale 105 - Atlanta 20 - Aussaguel 6 - Bangkok 52 - BantonRouge 49 - Bedford 74 - Beijing 30 - Berlin 31 - Berne 112 - Bishkek 29 - Bremenhaven 28 - Budapest 96 - Cairo 92 - Casey 64 - Cashoiera 32 - Copenhagen 103 - Cordoba 8 - Cotopaxi 23 - Cuiaba 76 - Da-Xing 33 - DeBilt 75 - Dhaka 50 - Downsview 34 - Dundee 51 - Edmonton 7 - Fairbanks	xs:short 2 bytes

#	Name/Description	Format
	24 - Farnborough 35 - Frascati 1 - Fucino 65 - Funceme 9 - Gatineau 54 - GilmoreCreek 36 - Hamburg 19 - HarteBeesHoek 16 - Hatoyama 37 - Helsinki 22 - Hobart 69 - Honolulu 11 - Hyderabad 21 - Islamabad 115 - Itu 77 - Keelung 116 - KhantyMansiysk 2 - Kiruna 78 - Kiyose 113 - Kitab 111 - Kourou 38 - Krakow 91 - KualaLumpur 12 - Kumamoto 39 - Lannion 79 - Lapan 99 - LaReunion 40 - Lasham 106 - Libreville 41 - Madrid 109 - Malindi 80 - Manila 3 - Maspalomas 104 - Matera 93 - McMurdo 53 - Miami 110 - Moscow 98 - Nairobi 55 - NESDIS 108 - Neustrelitz 81 - NewDelhi 102 - Norman 42 - Norrkoping 27 - Oberpfaff 43 - Offenbach 15 - OHiggins 44 - Oslo 94 - Palmer 18 - PariPari 70 - Perth	

#	Name/Description	Format
	45 - Prague 25 - Pretoria 13 - PrinceAlbert 57 - RedwoodCity 82 - Riyadh 46 - Rome 101 - RRSC_Nairobi 66 - Santiago 26 - Scanzano 58 - Scipps Inst 84 - Selangor 87 - Sendai 85 - Seoul 86 - SeoulUniv 83 - Singapore 59 - SiouxFalls 47 - Spitzenbergen 60 - StennisSpace 71 - Sydney 17 - Syowa 90 - Taipei 5 - Tel_Aviv 95 - TerranovaBay 88 - TokaiUniv 89 - TokyoUniv 72 - Townsville 48 - Traben-Trar 4 - Tromso 100 - Tunis 114 - UlanBator 61 - UnivOfAlaska 63 - UnivOfRhodeIsl 62 - UnivOfTexas 56 - WallopsIsl 73 - Wellington 14 - WestFreugh	
2	**Station_DT_ID** Data Transcription Ground Station Code	xs:short 2 bytes
3	**Filler** Padding for stucture alignment	xs:hexBinary 2 bytes

Table 55: Ground_Stations_Transcr_Sys_Id Specification

3.1.2.5.2.4.Transcription_Id_Type

Transcription Identification

#	Name/Description	Format
1	**Input_HddrType** HDDR Code	xs:unsignedInt 4 bytes

#	Name/Description	Format
2	**Format_SyncType** Format Synchroniser/Decommutator Code: 1 - MCS ERS FS 2 - SPACETEC ERS HR FS 3 - IAI ERS HR FS 4 - LABEN ERS HR FS 5 - SPACETEC/ACS ERS FS 6 - ENERTEC TM_ FS 7 - ENERTEC TM FS 8 - ACS SW FORMAT SYNCH 14 - ACS XSAR FORMAT SW SYNCH	xs:unsignedInt 4 bytes
3	**Reserved** Reserved	xs:unsignedInt Min Occurs: 2 Max Occurs: 2 4 bytes

Table 56: Transcription_Id_Type Specification

3.1.2.5.2.5.Orbit_Acquisition_Id_Type

Orbit and Acquisition Identification

#	Name/Description	Format
1	**Track_Number** Track or Data Take Number (when applicable)	xs:integer 4 bytes
2	**Orbit_Number** Orbit number (when applicable)	xs:integer 4 bytes
3	**Cycle_Number** Cycle number (when applicable)	xs:integer 4 bytes
4	**Numb_of_Frames** Number of standard frames (when applicable)	xs:integer 4 bytes
5	**First_Frame** Num. of first standard frame (when applicable)	xs:integer 4 bytes
6	**Reserved** Reserved	xs:unsignedInt Min Occurs: 4 Max Occurs: 4 4 bytes
7	**First_OBC** 1st On Board Counter (when applicable)	xs:unsignedInt 4 bytes
8	**Last_OBC** Last On Board Counter (when applicable)	xs:unsignedInt 4 bytes
9	**Acquis_Date_Year** Acquisition Date (Year)	xs:unsignedShort 2 bytes
10	**Acquis_Date_Month** Acquisition Date (Month)	xs:unsignedShort 2 bytes
11	**Acquis_Date_Day** Acquisition Date (Day)	xs:unsignedShort 2 bytes
12	**Acquis_Day** Day in the year of the acquisition	xs:unsignedShort 2 bytes
13	**Acquis_start_Hour**	xs:unsignedShort

#	Name/Description	Format
	Start of acquisition (Hour)	2 bytes
14	**Acquis_start_Min** Start of acquisition (Minutes)	xs:unsignedShort 2 bytes
15	**Acquis_start_Sec** Start of acquisition (Seconds)	xs:unsignedShort 2 bytes
16	**Acquis_start_Millisec** Start of acquisition (Milliseconds)	xs:unsignedShort 2 bytes
17	**Acquis_end_Hour** End of acquisition (Hours)	xs:unsignedShort 2 bytes
18	**Acquis_end_Min** End of acquisition (Minutes)	xs:unsignedShort 2 bytes
19	**Acquis_end_Sec** End of acquisition (Seconds)	xs:unsignedShort 2 bytes
20	**Acquis_end_Millisec** End of acquisition (Milliseconds)	xs:unsignedShort 2 bytes
21	**Transcription_Date_Day** Transcription Date in Days	xs:unsignedShort 2 bytes
22	**Transcription_Date_Month** Transcription Date in Months	xs:unsignedShort 2 bytes
23	**Transcription_Date_Year** Transcription Date in Years (WARNING: Year could be expressed in some tapes as years from 1900)	xs:unsignedShort 2 bytes
24	**Transcription_Start_Hour** Transcription start in Hours	xs:unsignedShort 2 bytes
25	**Transcription_Start_Min** Transcription start in Minutes	xs:unsignedShort 2 bytes
26	**Transcription_Start_Sec** Transcription start in Seconds	xs:unsignedShort 2 bytes
27	**Transcription_End_Hour** Transcription end in Hours	xs:unsignedShort 2 bytes
28	**Transcription_End_Min** Transcription end in Minutes	xs:unsignedShort 2 bytes
29	**Transcription_End_Sec** Transcription end in Seconds	xs:unsignedShort 2 bytes
30	**Filler** Padding for stucture alignment	xs:hexBinary 2 bytes

Table 57: Orbit_Acquisition_Id_Type Specification

3.1.2.5.2.6.Pointers_Tape_Data_Type

This structure is meaningful only in the "User Header" file (it is empty in "Pass Id. Header"). The last field of the first area (Nr_of_Files) indicates how many files follow the "User Header" inside the same Transcription Area (same passage).
This number has been taken as a parameter to allow the maximum flexibility.
In the Transcription Systems presently designed and installed the parameter "Nr_of_Files" can be 2 for LANDSAT.

The 10 blocks which follow "Nr_of Files" describes the files following the "User Header" in current "Transcription Area". Each of these blocks describes one file. The number of blocks actually filled is thus equal to "Nr_of_Files"

In the LANDSAT case there are 2 blocks filled, which correspond respectively to:
1. the "Segment Descriptor" file
2. the "Block Addresses Descriptor" file.

#	Name/Description	Format
1	**Num_of_segments** Number of segments (when applicable)	xs:integer 4 bytes
2	**Loaded_Swath** Number of transcribed swaths	xs:integer 4 bytes
3	**Swath_Size** Swath length (in bytes)	xs:integer 4 bytes
4	**Swath_per_Block** Number of swaths per block	xs:integer 4 bytes
5	**Nr_of_Blocks** Number of blocks	xs:integer 4 bytes
6	**Physical_Address_1** User Header Address. File Number of the User Header. It is the number of files, numbered from DLT start, preceding the User Header file in current Transcription Area.	xs:long 4 bytes
7	**Physical_Address_2** Pass Id. Header Address. File Number of the Pass Id. Header. It is the number of files, numbered from DLT start, preceding the Pass Id. Header file in current Transcription Area.	xs:long 4 bytes
8	**Nr_of_Files** Number of files following the present	xs:integer 4 bytes
9	**File**	Pointers_Tape_Data_File_Type Min Occurs: 10 Max Occurs: 10
10	**Reserved** Reserved	xs:hexBinary 8bytes

Table 58: Pointers_Tape_Data_Type Specification

3.1.2.5.2.7.Pointers_Tape_Data_File_Type

#	Name/Description	Format
1	**File_ID** File type identifier	xs:integer 4 bytes
2	**File_Num** Number of physical records	xs:integer 4 bytes
3	**Record_Length** Physical record length in bytes	xs:integer 4 bytes
4	**Elem_Num** Number of logical element per record	xs:integer 4 bytes

#	Name/Description	Format
5	**Elem_Length** Logical element length in bytes	xs:integer 4 bytes
6	**Filler** Spare	xs:hexBinary 44 bytes

Table 59: Pointers_Tape_Data_File_Type Specification

3.1.2.6. DTVideoData

The LANDSAT TM Sensor data of one imaging sequence are stored consecutively in the DTVideoData file. The data corresponding to one pass are subdivided in Blocks having the same length (about 2 Megabytes).The total number of Major Frames per block is available in the “DTUserHeader” file.

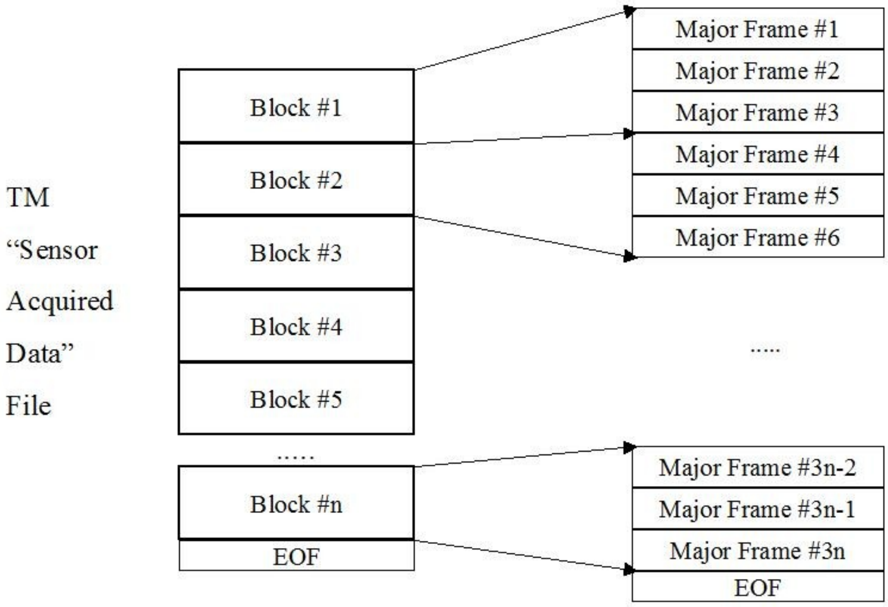

Figure 14: DTVideoData - TM Sensor Acquired Data File organisation

Each Major Frame is organised as follows:

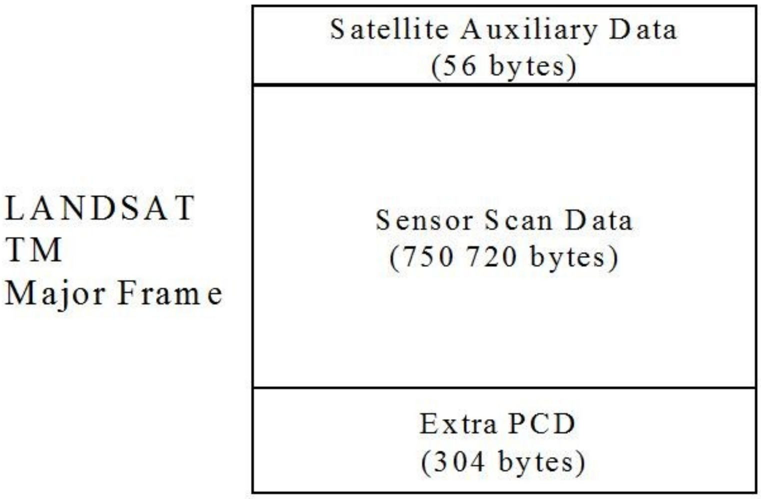

Figure 15: DTVideoData - TM Major Frame organisation

The next figure provides a high level overview of the complex structures used to represent the information of the DTVideoData file:

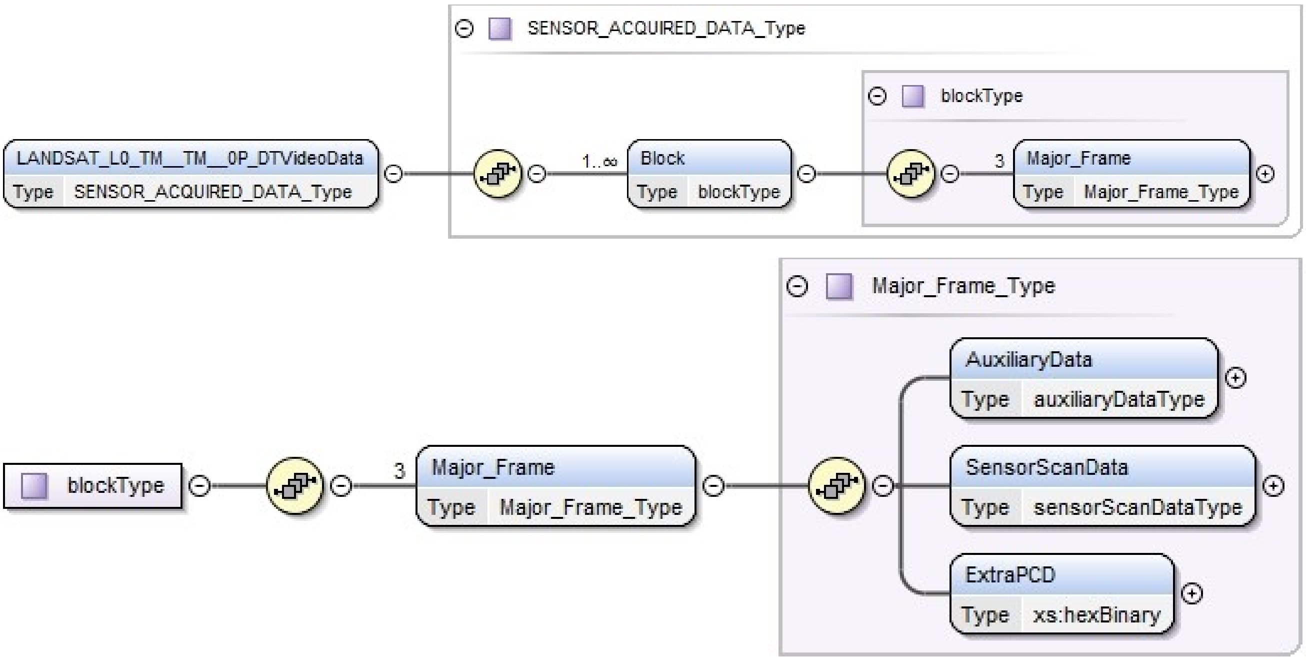

Figure 16: DFDL schema organisation for DTVideoData (TM)

3.1.2.6.1. Root Element

#	Name/Description	Format
1	**LANDSAT_L0_TM__TM__0P_DTVideoData** SENSOR ACQUIRED DATA FILE The structure of the transcribed data depend on the Format Synchroniser used for the data ingestion into the host computer before transcription. In the case of LANDSAT TM data the system uses the format adopted by the ACS Software Format Synchroniser. The LANDSAT TM Sensor Acquired Data corresponding to one pass are subdivided in Blocks having the same length (about 2 Megabytes). The real number of Major Frames per block must be read from the "User Header". As an example for LANDSAT TM each block contains usually 3 complete Major Frames.	SENSOR_ACQUIRED_DATA_Type

Table 60: LANDSAT_L0_TM__TM__0P_DTVideoData Specification

3.1.2.6.2. Complex Types

3.1.2.6.2.1.SENSOR_ACQUIRED_DATA_Type

The exact number of blocks is specified in the DTUserHeader file (at /Pointers_to_Tape_Data_Structure/Nr_of_Blocks)

#	Name/Description	Format
1	**Block**	blockType Min Occurs: 1 Max Occurs: unbounded

Table 61: SENSOR_ACQUIRED_DATA_Type Specification

3.1.2.6.2.2.blockType

The exact number of swaths is specified in the DTUserHeader file (at /Pointers_to_Tape_Data_Structure/Swath_per_Block)

#	Name/Description	Format
1	**Major_Frame**	Major_Frame_Type Min Occurs: 3 Max Occurs: 3

Table 62: blockType Specification

3.1.2.6.2.3.Major_Frame_Type

Each Major Frame has the length of 751080 bytes.

#	Name/Description	Format
1	**AuxiliaryData**	auxiliaryDataType
2	**SensorScanData**	sensorScanDataType
3	**ExtraPCD**	xs:hexBinary 304 bytes

Table 63: Major_Frame_Type Specification

3.1.2.6.2.4.auxiliaryDataType

#	Name/Description	Format
1	**Day** # of days from the current year	xs:unsignedInt 4 bytes
2	**Hours** # of hours from midnight	xs:unsignedInt 4 bytes
3	**Minutes** # of minutes	xs:unsignedInt 4 bytes
4	**Seconds** # of seconds	xs:unsignedInt 4 bytes
5	**Milliseconds** # of milliseconds	xs:unsignedInt 4 bytes
6	**msec_fractionary** # of 1/16 of milliseconds	xs:unsignedShort 2 bytes

#	Name/Description	Format
7	**Satellite_ID** LANDSAT mission number	xs:unsignedShort 2 bytes
8	**Fhserr** First half scan error	xs:unsignedInt 4 bytes
9	**Shserr** Second half scan error.	xs:unsignedInt 4 bytes
10	**Scan_direction** Direction of Scan: 0x00000000 Forward 0xFFFFFFFF Reverse	xs:unsignedInt 4 bytes
11	**Line_Length** Length of active scan in Minor Frames unity	xs:unsignedInt 4 bytes
12	**Swath_Length** Length in bytes of a swath (as transmitted from satellite. Note that the transcribed swath is a fixed part of this length).	xs:unsignedInt 4 bytes
13	**Filler** Padding for structure alignment	xs:unsignedInt 4 bytes
14	**Satellite_Time** Swath time in milliseconds and 1/16 of milliseconds from beginning of year.	xs:double 8 bytes

Table 64: auxiliaryDataType Specification

3.1.2.6.2.5.sensorScanDataType

#	Name/Description	Format

Table 65: sensorScanDataType Specification

3.1.2.6.2.6.TimeCodeType

#	Name/Description	Format
1	**TimeCode**	minorFrameType Min Occurs: 6 Max Occurs: 6

Table 66: TimeCodeType Specification

3.1.2.6.2.7.VideoDataType

#	Name/Description	Format
1	**VideoData**	minorFrameType Min Occurs: 1024 Max Occurs: 1024

#	Name/Description	Format
2	**VideoData**	minorFrameType Min Occurs: 1024 Max Occurs: 1024
3	**VideoData**	minorFrameType Min Occurs: 1024 Max Occurs: 1024
4	**VideoData**	minorFrameType Min Occurs: 1024 Max Occurs: 1024
5	**VideoData**	minorFrameType Min Occurs: 1024 Max Occurs: 1024
6	**VideoData**	minorFrameType Min Occurs: 1024 Max Occurs: 1024
7	**VideoData**	minorFrameType Min Occurs: 176 Max Occurs: 176

Table 67: VideoDataType Specification

3.1.2.6.2.8.LineLengthType

#	Name/Description	Format
1	**LineLength**	minorFrameType Min Occurs: 2 Max Occurs: 2

Table 68: LineLengthType Specification

3.1.2.6.2.9.EndOfScanType

#	Name/Description	Format
1	**EndOfScan**	minorFrameType Min Occurs: 2 Max Occurs: 2

Table 69: EndOfScanType Specification

3.1.2.6.2.10.DC_Restore_and_CalibrationType

#	Name/Description	Format
1	**DC_Restore_and_Calibration**	minorFrameType Min Occurs: 865 Max Occurs: 865

Table 70: DC_Restore_and_CalibrationType Specification

3.1.2.6.2.11.minorFrameType

#	Name/Description	Format
1	**Sync**	xs:hexBinary

#	Name/Description	Format
		4 bytes
2	**Band_6_VideoData**	xs:hexBinary 1 bytes
3	**PCD**	xs:hexBinary 1 bytes
4	**Sensors_VideData**	xs:hexBinary 96 bytes

Table 71: minorFrameType Specification

3.1.3. ETM_ETM_0P

3.1.3.1. DTBlock

This file contains the description of all the blocks in which the pass has been divided and written. It is composed by a variable number of identical units. Each unit describes completely one satellite data block and contains all information to address any segment or any frame within the “Sensor Acquired Data” file. It contains block number of the video data block, the starting time of the first satellite format in the block and the number of swaths contained.

The structure is repeated as many times as the number of blocks recorded in the file. The number of items and the length are specified in the "DTUserHeader” file.

The next figure provides a high level overview of the complex structures used to represent the information of the DTBlock file:

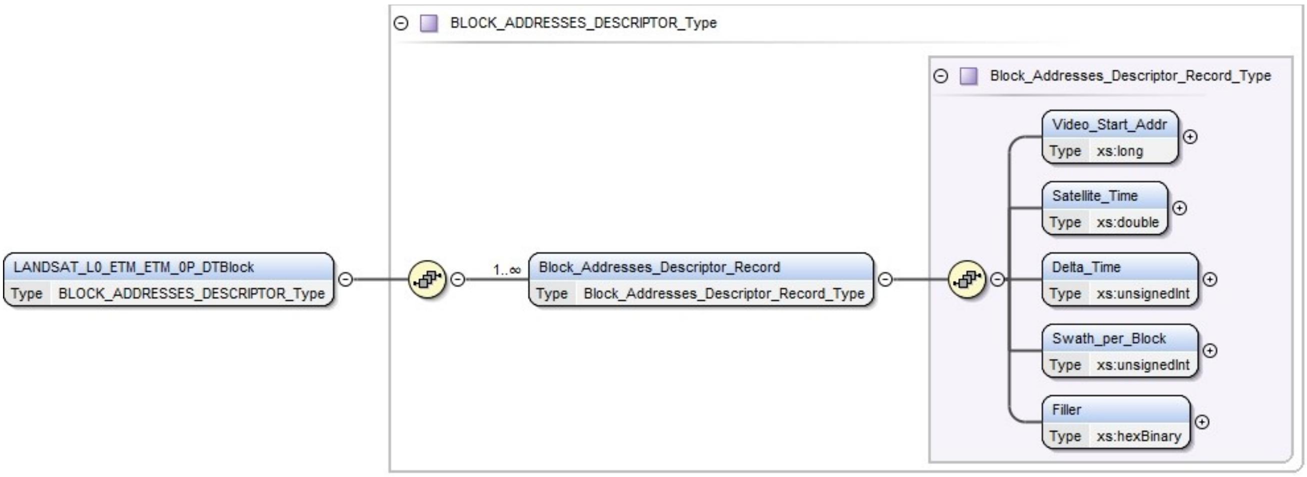
BLOCK_ADDRESSES_DESCRIPTOR_Type
Block_Addresses_Descriptor_Record_Type
LANDSAT_L0_ETM_ETM_0P_DTBlock
Type BLOCK_ADDRESSES_DESCRIPTOR_Type
1..∞
Block_Addresses_Descriptor_Record
Type Block_Addresses_Descriptor_Record_Type
Video_Start_Addr
Type xs:long
Satellite_Time
Type xs:double
Delta_Time
Type xs:unsignedInt
Swath_per_Block
Type xs:unsignedInt
Filler
Type xs:hexBinary

Figure 17: DFDL schema organisation for DTBlock (ETM)

3.1.3.1.1. Root Element

#	Name/Description	Format
1	**LANDSAT_L0_ETM_ETM_0P_DTBlock** BLOCK ADDRESSES DESCRIPTOR file This file contains the description of all the blocks in which the pass has been divided and written on tape. It is composed by a variable number of identical units. Each unit describes completely one satellite data block and contains all information to address any segment or any frame within the "Sensor Acquired Data" file. It contains block number of the video data block, the starting time of the first satellite format in the block and the number of swaths contained. The structure is repeated as many times as the	BLOCK_ADDRESSES_DESCRIPTOR_Type

#	Name/Description	Format
	number of blocks recorded in the file. The number of items and the length are specified into the "User Header file - Pointer to Tape Data Structure Description Section" (Block Addresses section).	

Table 72: LANDSAT_L0_ETM_ETM_0P_DTBlock Specification

3.1.3.1.2. Complex Types

3.1.3.1.2.1.BLOCK_ADDRESSES_DESCRIPTOR_Type

#	Name/Description	Format
1	**Block_Addresses_Descriptor_Record**	Block_Addresses_Descriptor_Record_Type Min Occurs: 1 Max Occurs: unbounded

Table 73: BLOCK_ADDRESSES_DESCRIPTOR_Type Specification

3.1.3.1.2.2.Block_Addresses_Descriptor_Record_Type

#	Name/Description	Format
1	**Video_Start_Addr** Block number of the video data block	xs:long 4 bytes
2	**Satellite_Time** Time of current block. The time is expressed in Milliseconds from midnight of first block swath.	xs:double 8 bytes
3	**Delta_Time** Time distance between start of acquisition (first block of the file) and current block start The delta time is expressed in Milliseconds	xs:unsignedInt 4 bytes
4	**Swath_per_Block** Number of swaths per block	xs:unsignedInt 4 bytes
5	**Filler** Available fields	xs:hexBinary 12bytes

Table 74: Block_Addresses_Descriptor_Record_Type Specification

3.1.3.2. DTPassID

The DTPassID (Pass Identification Header) contains the information to unambiguously identify the imaging sequence contained in the product.

This record is divided into five logical sections:

- Mission and Instrument Identification
- Ground Stations and Transcription System Identification
- Transcription Identification

- Orbit and Acquisition Identification
- Pointers to Tape Data Structure

The next figure provides a high level overview of the complex structures used to represent the information of the DTPassID file:

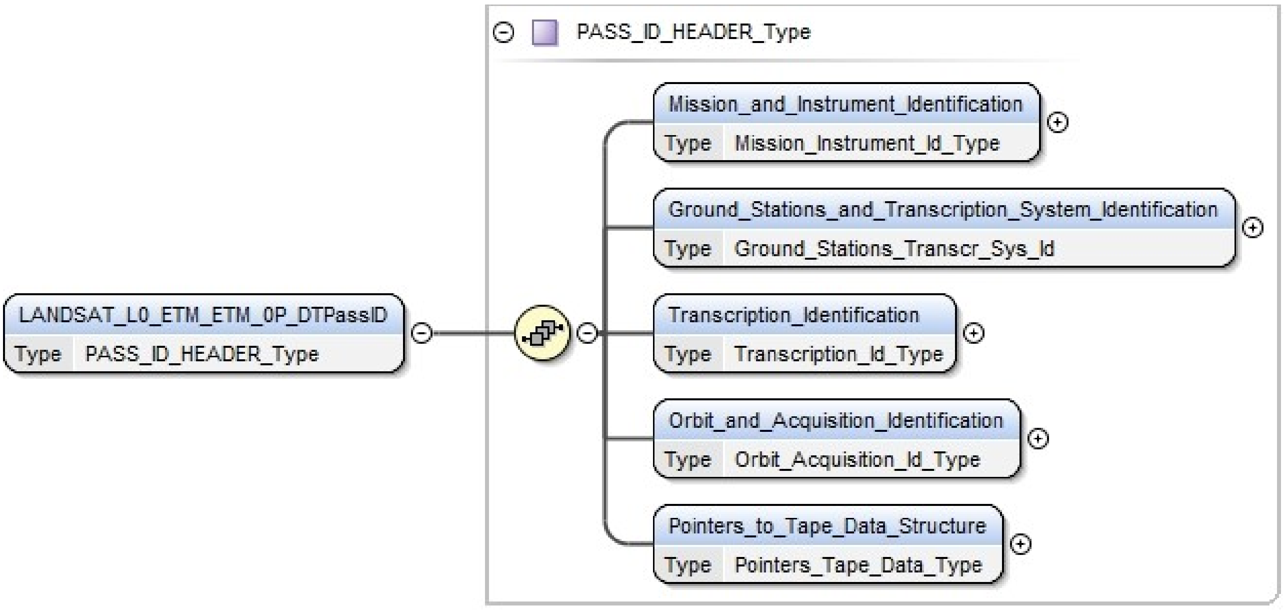
PASS_ID_HEADER_Type
LANDSAT_L0_ETM_ETM_0P_DTPassID
Type PASS_ID_HEADER_Type
Mission_and_Instrument_Identification
Type Mission_Instrument_Id_Type
Ground_Stations_and_Transcription_System_Identification
Type Ground_Stations_Transcr_Sys_Id
Transcription_Identification
Type Transcription_Id_Type
Orbit_and_Acquisition_Identification
Type Orbit_Acquisition_Id_Type
Pointers_to_Tape_Data_Structure
Type Pointers_Tape_Data_Type

Figure 18: DFDL schema organisation for DTPassID (ETM)

3.1.3.2.1. Root Element

#	Name/Description	Format
1	**LANDSAT_L0_ETM_ETM_0P_DTPassID** PASS IDENTIFICATION HEADER file The "Pass Identification Header" is the first file of the Transcription Area. It contains the information, available at the beginning of the transcription, to unambiguously identify the imaging sequence contained in the file. This record is divided into five logical sections: 1. Mission and Instrument Identification 2. Ground Stations and Transcription System Identification 3. Transcription Identification 4. Orbit and Acquisition Identification 5. Pointers to Tape Data Structure	PASS_ID_HEADER_Type

Table 75: LANDSAT_L0_ETM_ETM_0P_DTPassID Specification

3.1.3.2.2. Complex Types

3.1.3.2.2.1.PASS_ID_HEADER_Type

#	Name/Description	Format
1	**Mission_and_Instrument_Identification**	Mission_Instrument_Id_Type
2	**Ground_Stations_and_Transcription_System_Identification**	Ground_Stations_Transcr_Sys_Id
3	**Transcription_Identification**	Transcription_Id_Type
4	**Orbit_and_Acquisition_Identification**	Orbit_Acquisition_Id_Type
5	**Pointers_to_Tape_Data_Structure**	Pointers_Tape_Data_Type

Table 76: PASS_ID_HEADER_Type Specification

3.1.3.2.2.2.Mission_Instrument_Id_Type

Mission and Instrument Identification

#	Name/Description	Format
1	**Reserved_1** Reserved	xs:hexBinary 76bytes
2	**Satellite_ID** Satellite Code: 1 - LANDSAT 2 - MOS 3 - J-ERS 4 - SPOT 5 - ERS 6 - IRS-C 7 - RADARSAT 8 - NOAA 9 - RESERVED 10 - RESERVED 11 - HELIOS 12 - SHUTTLE 13 - EOSAM 14 - EOSPM	xs:unsignedShort 2 bytes
3	**Mission_ID** Satellite Mission Number	xs:unsignedShort 2 bytes
4	**Instr_Type_ID** Satellite Mission Number: 1 - LANDSAT ETM 2 - LANDSAT TM 3 - LANDSAT ETM 4 - LANDSAT RBV 5 - MOS MESSR 6 - J-ERS VNIR 7 - J-ERS SWIR 8 - Not Used 9 - Not Used 10 - ERS AMI SAR	xs:unsignedShort 2 bytes

#	Name/Description	Format
	11 - ERS ATSR 12 - SPOT HRV 13 - J-ERS SAR 14 - NOAA AVHRR 15 - SPOT HRVIR 16 - SHUTTLE XSAR 17 - MODIS	
5	**Reserved_2** Reserved	xs:unsignedShort Min Occurs: 2 Max Occurs: 2 2 bytes

Table 77: Mission_Instrument_Id_Type Specification

3.1.3.2.2.3.Ground_Stations_Transcr_Sys_Id

Ground Stations and Transcription System Identification

#	Name/Description	Format
1	**Station_ID** Acquisition Ground Station Code: 67 - Adelaide 97 - Agrhymet 10 - AliceSpring 68 - Aspendale 105 - Atlanta 20 - Aussaguel 6 - Bangkok 52 - BantonRouge 49 - Bedford 74 - Beijing 30 - Berlin 31 - Berne 112 - Bishkek 29 - Bremenhaven 28 - Budapest 96 - Cairo 92 - Casey 64 - Cashoiera 32 - Copenhagen 103 - Cordoba 8 - Cotopaxi 23 - Cuiaba 76 - Da-Xing 33 - DeBilt 75 - Dhaka 50 - Downsview 34 - Dundee 51 - Edmonton 7 - Fairbanks	xs:short 2 bytes

#	Name/Description	Format
	24 - Farnborough 35 - Frascati 1 - Fucino 65 - Funceme 9 - Gatineau 54 - GilmoreCreek 36 - Hamburg 19 - HarteBeesHoek 16 - Hatoyama 37 - Helsinki 22 - Hobart 69 - Honolulu 11 - Hyderabad 21 - Islamabad 115 - Itu 77 - Keelung 116 - KhantyMansiysk 2 - Kiruna 78 - Kiyose 113 - Kitab 111 - Kourou 38 - Krakow 91 - KualaLumpur 12 - Kumamoto 39 - Lannion 79 - Lapan 99 - LaReunion 40 - Lasham 106 - Libreville 41 - Madrid 109 - Malindi 80 - Manila 3 - Maspalomas 104 - Matera 93 - McMurdo 53 - Miami 110 - Moscow 98 - Nairobi 55 - NESDIS 108 - Neustrelitz 81 - NewDelhi 102 - Norman 42 - Norrkoping 27 - Oberpfaff 43 - Offenbach 15 - OHiggins 44 - Oslo 94 - Palmer 18 - PariPari 70 - Perth	

#	Name/Description	Format
	45 - Prague 25 - Pretoria 13 - PrinceAlbert 57 - RedwoodCity 82 - Riyadh 46 - Rome 101 - RRSC_Nairobi 66 - Santiago 26 - Scanzano 58 - Scipps Inst 84 - Selangor 87 - Sendai 85 - Seoul 86 - SeoulUniv 83 - Singapore 59 - SiouxFalls 47 - Spitzenbergen 60 - StennisSpace 71 - Sydney 17 - Syowa 90 - Taipei 5 - Tel_Aviv 95 - TerranovaBay 88 - TokaiUniv 89 - TokyoUniv 72 - Townsville 48 - Traben-Trar 4 - Tromso 100 - Tunis 114 - UlanBator 61 - UnivOfAlaska 63 - UnivOfRhodeIsl 62 - UnivOfTexas 56 - WallopsIsl 73 - Wellington 14 - WestFreugh	
2	**Station_DT_ID** Data Transcription Ground Station Code	xs:short 2 bytes
3	**Filler** Padding for stucture alignment	xs:hexBinary 2bytes

Table 78: Ground_Stations_Transcr_Sys_Id Specification

3.1.3.2.2.4.Transcription_Id_Type

Transcription Identification

#	Name/Description	Format
1	**Source_Type** Data Source Type:	xs:unsignedInt 4 bytes

#	Name/Description	Format
	1 - AMPEX 14 tracks 2 - Shlumberger 14 tracks 3 - Shlumberger 42 tracks 4 - Penny and Giles 5 - Honeywell HD-96 6 - AMPEX DCRSi 7 - CREO Optical Tape 8 - Direct Ingestion 9 - SONY DIR 1000 (R)	
2	**Format_SyncType** Format Synchroniser/Decommutator Code: 1 - MCS ERS FS 2 - SPACETEC ERS HR FS 3 - IAI ERS HR FS 4 - LABEN ERS HR FS 5 - SPACETEC/ACS ERS FS 6 - ENERTEC ETM FS 7 - ENERTEC TM FS 8 - ACS SW FORMAT SYNCH 14 - ACS XSAR FORMAT SW SYNCH	xs:unsignedInt 4 bytes
3	**Reserved** Reserved	xs:unsignedInt Min Occurs: 2 Max Occurs: 2 4 bytes

Table 79: Transcription_Id_Type Specification

3.1.3.2.2.5.Orbit_Acquisition_Id_Type

Orbit and Acquisition Identification

#	Name/Description	Format
1	**Track_Number** Track or Data Take Number (when applicable)	xs:integer 4 bytes
2	**Orbit** Orbit number (when applicable)	xs:integer 4 bytes
3	**Reserved_1** Reserved	xs:integer Min Occurs: 9 Max Occurs: 9 4 bytes
4	**Reserved_2** Reserved	xs:short Min Occurs: 3 Max Occurs: 3 2 bytes
5	**Reserved_3** Reserved	xs:hexBinary 18bytes
6	**Transcription_Date** Transcription Date in D M Y (WARNING: Year could be expressed in some tapes as years from 1900)	xs:short Min Occurs: 3 Max Occurs: 3 2 bytes

#	Name/Description	Format
7	**Reserved_4** Reserved	xs:short Min Occurs: 6 Max Occurs: 6 2 bytes
8	**Filler** Padding for stucture alignment	xs:hexBinary 2bytes

Table 80: Orbit_Acquisition_Id_Type Specification

3.1.3.2.2.6.Pointers_Tape_Data_Type

Pointers to Tape Data Structure

#	Name/Description	Format
1	**Reserved_1** Reserved	xs:integer Min Occurs: 5 Max Occurs: 5 4 bytes
2	**Physical_Address_1** User Header Address. File Number of the User Header. It is the number of files, numbered from DLT start, preceding the User Header file in current Transcription Area.	xs:long 4 bytes
3	**Physical_Address_2** Pass Id. Header Address. File Number of the Pass Id. Header. It is the number of files, numbered from DLT start, preceding the Pass Id. Header file in current Transcription Area.	xs:long 4 bytes
4	**Reserved_2** Reserved	xs:hexBinary 652bytes

Table 81: Pointers_Tape_Data_Type Specification

3.1.3.3. DTSegment

This DTSegment file contains the descriptions of all the segments in which the satellite pass has been divided.

The next figure provides a high level overview of the complex structures used to represent the information of the DTSegment file:

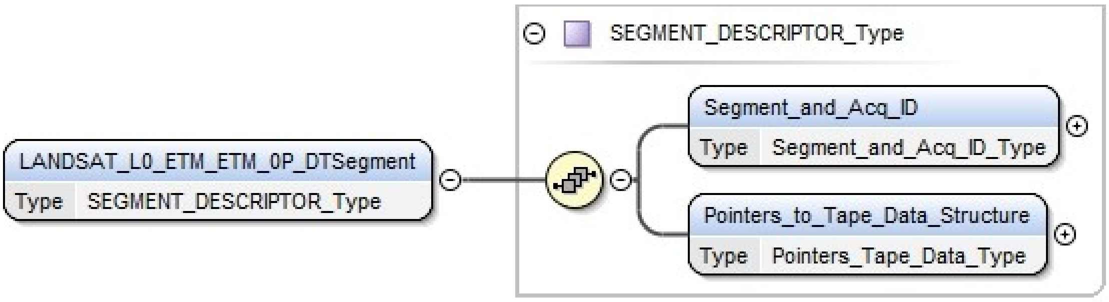
SEGMENT_DESCRIPTOR_Type
LANDSAT_L0_ETM_ETM_0P_DTSegment
Type SEGMENT_DESCRIPTOR_Type
Segment_and_Acq_ID
Type Segment_and_Acq_ID_Type
Pointers_to_Tape_Data_Structure
Type Pointers_Tape_Data_Type

Figure 19: DFDL schema organisation for DTSegment (ETM)

3.1.3.3.1. Root Element

#	Name/Description	Format
1	**LANDSAT_L0_ETM_ETM_0P_DTSegment** SEGMENT DESCRIPTOR file This file contains the descriptions of all the segments in which the satellite pass has been divided. Each segment is described by one structure. The "Segment Descriptor Structure" is thus repeated as many times as the number of segments recorded in the "Sensor Acquired Data" file. Each segment is completely described by the following fields and contains all information to address it within the video data records. The number of items and the length are specified into the "User Header file - Pointer to Tape Data Structure Description Section" (described in previous paragraph).	SEGMENT_DESCRIPTOR_Type

Table 82: LANDSAT_L0_ETM_ETM_0P_DTSegment Specification

3.1.3.3.2. Complex Types

3.1.3.3.2.1.SEGMENT_DESCRIPTOR_Type

#	Name/Description	Format
1	**Segment_and_Acq_ID**	Segment_and_Acq_ID_Type
2	**Pointers_to_Tape_Data_Structure**	Pointers_Tape_Data_Type

Table 83: SEGMENT_DESCRIPTOR_Type Specification

3.1.3.3.2.2.Segment_and_Acq_ID_Type

Segment and Acquisition Identification

#	Name/Description	Format
1	**Acquis_Date_Year** Acquisition Date of the Sat. Pass (Year)	xs:short 2 bytes
2	**Acquis_Date_Month** Acquisition Date of the Sat. Pass (Month)	xs:short 2 bytes
3	**Acquis_Date_Day** Acquisition Date of the Sat. Pass (Day)	xs:short 2 bytes
4	**Acquis_Day** Day in the year of the acquisition	xs:short 2 bytes
5	**Segment_Start_Hours** Start of Segment (Hours)	xs:short 2 bytes
6	**Segment_Start_Min** Start of Segment (Min)	xs:short 2 bytes
7	**Segment_Start_Sec** Start of Segment (Sec)	xs:short 2 bytes
8	**Segment_Start_Millisec** Start of Segment (Millisec)	xs:short 2 bytes
9	**Segment_End_Hours** End of Segment (Hours)	xs:short 2 bytes
10	**Segment_End_Min** End of Segment (Min)	xs:short 2 bytes
11	**Segment_End_Sec** End of Segment (Sec)	xs:short 2 bytes
12	**Segment_End_Millisec** End of Segment (Millisec)	xs:short 2 bytes
13	**Loaded_Swath** Nr. of lines loaded on tape for this segment	xs:integer 4 bytes
14	**First_Swath** First swath of the segment	xs:integer 4 bytes
15	**Last_Swath** Last swath of the segment	xs:integer 4 bytes
16	**Lost_Swath** Lost swaths of the segment	xs:integer 4 bytes
17	**First_Frame** First frame of the segment (when applicable)	xs:integer 4 bytes
18	**Last_Frame** Last frame of the segment (when applicable)	xs:integer 4 bytes
19	**First_OBC** First On Board Counter or TSID (when applicable)	xs:integer 4 bytes
20	**Last_OBC** Last On Board Counter or TSID (when applicable)	xs:integer 4 bytes

Table 84: Segment_and_Acq_ID_Type Specification

3.1.3.3.2.3.Pointers_Tape_Data_Type

Pointers to Tape Data Structure

#	Name/Description	Format
1	**Starting_Address** Pass Id. Header file Address	xs:long 4 bytes
2	**Swath_Size** Swath length (in bytes) This field is filled only if its value changed between different Segments. If it does not change the valid value for this field must be read in the User Header (Pointers to Tape Data Structure)	xs:integer 4 bytes
3	**Swath_per_Block** Number of swaths per block This field is filled only if its value changed between different Segments. If it does not change the valid value for this field must be read in the User Header (Pointers to Tape Data Structure)	xs:integer 4 bytes
4	**Nr_of_Blocks** Number of blocks This field is filled only if its value changed between different Segments. If it does not change the valid value for this field must be read in the User Header (Pointers to Tape Data Structure)	xs:integer 4 bytes
5	**Formats_Per_Swath** Number of formats per swath This field is filled only if its value changed between different Segments. If it does not change the valid value for this field must be read in the User Header (Pointers to Tape Data Structure)	xs:integer 4 bytes
6	**Filler** Filler	xs:hexBinary 52bytes

Table 85: Pointers_Tape_Data_Type Specification

3.1.3.4. DTStatisticFile

The Statistics file constitutes a sort of summary of all transcribed passes.

The next figure provides a high level overview of the complex structures used to represent the information of the DTStatisticFile:

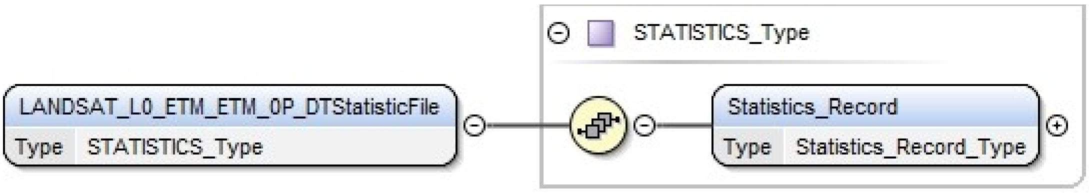
STATISTICS_Type
LANDSAT_L0_ETM_ETM_0P_DTStatisticFile
Type STATISTICS_Type
Statistics_Record
Type Statistics_Record_Type

Figure 20: DFDL schema organisation for DTStatistic (ETM)

3.1.3.4.1. Root Element

#	Name/Description	Format
1	**LANDSAT_L0_ETM_ETM_0P_DTStatisticFile** STATISTICS file The Statistics file always follows the Transcription Area in the DLT and constitutes a sort of summary of the passes contained in the DLT. The Statistics File following the last Transcription Area of the cassette constitutes a directory, with information on all the transcribed passes. This structure allows an easy positioning of the tape on the requested pass. To achieve this goal, when the tape inspection is performed, the end of tape is reached without reading any data. Then the control jumps one file back (at the beginning of the last Statistics file). Reading this file the content of the whole DLT can be known. The first record is empty. The successive records are structured according the table below; each of them points to the successive Transcription Area stored on the cassette.	STATISTICS_Type

Table 86: LANDSAT_L0_ETM_ETM_0P_DTStatisticFile Specification

3.1.3.4.2. Complex Types

3.1.3.4.2.1.STATISTICS_Type

#	Name/Description	Format
1	**Statistics_Record**	Statistics_Record_Type

Table 87: STATISTICS_Type Specification

3.1.3.4.2.2.Statistics_Record_Type

#	Name/Description	Format
1	**Reserved_1** Reserved	xs:hexBinary 4bytes
2	**Satellite_ID** Satellite Code	xs:unsignedShort 2 bytes
3	**Mission_ID** Mission. Number	xs:unsignedShort 2 bytes
4	**Instr_Type_ID** Instrument Type Code	xs:unsignedShort 2 bytes
5	**Reserved_2** Reserved	xs:unsignedShort Min Occurs: 2 Max Occurs: 2 2 bytes

#	Name/Description	Format
6	**Station_ID** Acquisition Ground Station Code	xs:unsignedShort 2 bytes
7	**Reserved_3** Reserved	xs:short 2 bytes
8	**Filler** Padding for structure alignment	xs:hexBinary 2bytes
9	**Track_Number** Track Number (when applicable)	xs:integer 4 bytes
10	**Orbit_Number** Orbit number (when applicable)	xs:integer 4 bytes
11	**Reserved_4** Reserved	xs:integer 4 bytes
12	**Number_of_Frames** Number of standard frames (when applicable)	xs:integer 4 bytes
13	**First_Frame** Num of first standard frame (when applicable)	xs:integer 4 bytes
14	**Reserved_5** Reserved	xs:integer Min Occurs: 4 Max Occurs: 4 4 bytes
15	**Acquisition_Date_Year** Acquisition Date (Year)	xs:short 2 bytes
16	**Acquisition_Date_Month** Acquisition Date (Month)	xs:short 2 bytes
17	**Acquisition_Date_Day** Acquisition Date (Month)	xs:short 2 bytes
18	**Acquisition_Day** Acquisition Day of the year	xs:short 2 bytes
19	**Acquisition_Start_Hours** Start of acquisition (Hours)	xs:short 2 bytes
20	**Acquisition_Start_Min** Start of acquisition (Min)	xs:short 2 bytes
21	**Acquisition_Start_Sec** Start of acquisition (Sec)	xs:short 2 bytes
22	**Acquisition_Start_Millisec** Start of acquisition (Millisec)	xs:short 2 bytes
23	**Acquisition_End_Hours** End of acquisition (Hours)	xs:short 2 bytes
24	**Acquisition_End_Min** End of acquisition (Min)	xs:short 2 bytes
25	**Acquisition_End_Sec** End of acquisition (Sec)	xs:short 2 bytes
26	**Acquisition_End_Millisec** End of acquisition (Millisec)	xs:short 2 bytes
27	**Transcription_Date_Day** Transcription Date (Day)	xs:short 2 bytes
28	**Transcription_Date_Month** Transcription Date (Month)	xs:short 2 bytes
29	**Transcription_Date_Year**	xs:short

#	Name/Description	Format
	Transcription Date (Year)(WARNING: Year could be expressed in some tapes as years from 1900)	2 bytes
30	**Reserved_6** Reserved	xs:short Min Occurs: 6 Max Occurs: 6 2 bytes
31	**Filler** Padding for structure alignment	xs:hexBinary 2bytes
32	**Reserved_7** Reserved	xs:integer Min Occurs: 10 Max Occurs: 10 4 bytes
33	**Physical_Address_1** User Header file number	xs:long 4 bytes
34	**Physical_Address_2** Pass Id. Header file number	xs:long 4 bytes
35	**Reserved_8** Reserved	xs:hexBinary 697bytes
36	**Copy_Date_Day** Date when this record has been generated as a copy from another tape (Day)	xs:unsignedByte 1bytes
37	**Copy_Date_Month** Date when this record has been generated as a copy from another tape (Month)	xs:unsignedByte 1bytes
38	**Copy_Date_Year** Date when this record has been generated as a copy from another tape (Year)	xs:unsignedByte 1bytes
39	**Copy_Source_Tape_Number** Number of the source tape from where this record was generated	xs:long 4 bytes
40	**Copy_Flag** 1 = this is a copied record 0 = this is the original transcribed record	xs:unsignedByte 1bytes
41	**Copy_Source_Media_Type** 4 = DLT 2 = SONY ID1	xs:unsignedByte 1bytes
42	**Reserved_9** Reserved	xs:unsignedByte 2bytes

Table 88: Statistics_Record_Type Specification

3.1.3.5. DTUserHeader

The DTUserHeader file contains the acquisition description as well as the logical and physical file structure. It contains all the parameters of the imaging sequence, the orbital parameters, the information about acquisition station, the description of the file structure and contents and all information necessary for further processing. It has the same structure for all satellites transcriptions.

The next figure provides a high level overview of the complex structures used to represent the information of the DTUserHeader file:

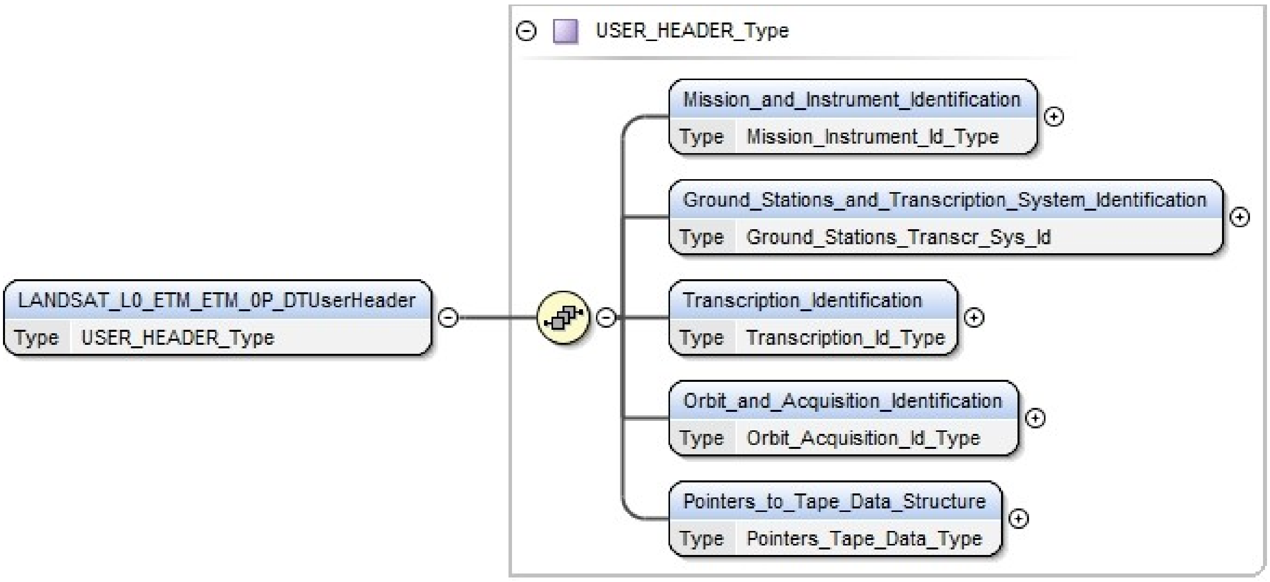
USER_HEADER_Type
LANDSAT_L0_ETM_ETM_0P_DTUserHeader
Type USER_HEADER_Type
Mission_and_Instrument_Identification
Type Mission_Instrument_Id_Type
Ground_Stations_and_Transcription_System_Identification
Type Ground_Stations_Transcr_Sys_Id
Transcription_Identification
Type Transcription_Id_Type
Orbit_and_Acquisition_Identification
Type Orbit_Acquisition_Id_Type
Pointers_to_Tape_Data_Structure
Type Pointers_Tape_Data_Type

Figure 21: DFDL schema organisation for DTUserHeader (ETM)

3.1.3.5.1. Root Element

#	Name/Description	Format
1	**LANDSAT_L0_ETM_ETM_0P_DTUserHeader** USER HEADER file The "User Header" file contains the acquisition description as well as the logical and physical file structure. It contains all the parameters of the imaging sequence, the orbital parameters, the information about acquisition station, the description of the file structure and contents and all information necessary for further processing. It has the same structure for all satellites transcriptions. The file is divided into five logical sections: 1. Mission and Instrument Identification 2. Ground Stations and Transcription System Identification 3. Transcription Identification 4. Orbit and Acquisition Identification 5. Pointers to Tape Data Structure	USER_HEADER_Type

Table 89: LANDSAT_L0_ETM_ETM_0P_DTUserHeader Specification

3.1.3.5.2. Complex Types

3.1.3.5.2.1. USER_HEADER_Type

#	Name/Description	Format
1	**Mission_and_Instrument_Identification**	Mission_Instrument_Id_Type
2	**Ground_Stations_and_Transcription_System_Identification**	Ground_Stations_Transcr_Sys_Id
3	**Transcription_Identification**	Transcription_Id_Type
4	**Orbit_and_Acquisition_Identification**	Orbit_Acquisition_Id_Type
5	**Pointers_to_Tape_Data_Structure**	Pointers_Tape_Data_Type

Table 90: USER_HEADER_Type Specification

3.1.3.5.2.2. Mission_Instrument_Id_Type

Mission and Instrument Identification

#	Name/Description	Format
1	**Reserved_1** Reserved	xs:hexBinary 76 bytes
2	**Satellite_ID** Satellite Code: 1 - LANDSAT 2 - MOS 3 - J-ERS 4 - SPOT 5 - ERS 6 - IRS-C 7 - RADARSAT 8 - NOAA 9 - RESERVED 10 - RESERVED 11 - HELIOS 12 - SHUTTLE 13 - EOSAM 14 - EOSPM	xs:short 2 bytes
3	**Mission_ID** Satellite Mission Number	xs:short 2 bytes
4	**Instr_Type_ID** Satellite Mission Number: 1 - LANDSAT ETM 2 - LANDSAT TM 3 - LANDSAT ETM 4 - LANDSAT RBV 5 - MOS MESSR 6 - J-ERS VNIR 7 - J-ERS SWIR 8 - Not Used 9 - Not Used 10 - ERS AMI SAR	xs:short 2 bytes

#	Name/Description	Format
	11 - ERS ATSR 12 - SPOT HRV 13 - J-ERS SAR 14 - NOAA AVHRR 15 - SPOT HRVIR 16 - SHUTTLE XSAR 17 - MODIS	
5	**Instr_Number** Instrument number (when applicable)	xs:short 2 bytes
6	**Transm_Channel** Instrument number (when applicable)	xs:short 2 bytes

Table 91: Mission_Instrument_Id_Type Specification

3.1.3.5.2.3.Ground_Stations_Transcr_Sys_Id

Ground Stations and Transcription System Identification

#	Name/Description	Format
1	**Station_ID** Acquisition Ground Station Code: 67 - Adelaide 97 - Agrhymet 10 - AliceSpring 68 - Aspendale 105 - Atlanta 20 - Aussaguel 6 - Bangkok 52 - BantonRouge 49 - Bedford 74 - Beijing 30 - Berlin 31 - Berne 112 - Bishkek 29 - Bremenhaven 28 - Budapest 96 - Cairo 92 - Casey 64 - Cashoiera 32 - Copenhagen 103 - Cordoba 8 - Cotopaxi 23 - Cuiaba 76 - Da-Xing 33 - DeBilt 75 - Dhaka 50 - Downsview 34 - Dundee 51 - Edmonton 7 - Fairbanks	xs:short 2 bytes

#	Name/Description	Format
	24 - Farnborough 35 - Frascati 1 - Fucino 65 - Funceme 9 - Gatineau 54 - GilmoreCreek 36 - Hamburg 19 - HarteBeesHoek 16 - Hatoyama 37 - Helsinki 22 - Hobart 69 - Honolulu 11 - Hyderabad 21 - Islamabad 115 - Itu 77 - Keelung 116 - KhantyMansiysk 2 - Kiruna 78 - Kiyose 113 - Kitab 111 - Kourou 38 - Krakow 91 - KualaLumpur 12 - Kumamoto 39 - Lannion 79 - Lapan 99 - LaReunion 40 - Lasham 106 - Libreville 41 - Madrid 109 - Malindi 80 - Manila 3 - Maspalomas 104 - Matera 93 - McMurdo 53 - Miami 110 - Moscow 98 - Nairobi 55 - NESDIS 108 - Neustrelitz 81 - NewDelhi 102 - Norman 42 - Norrkoping 27 - Oberpfaff 43 - Offenbach 15 - OHiggins 44 - Oslo 94 - Palmer 18 - PariPari 70 - Perth	

#	Name/Description	Format
	45 - Prague 25 - Pretoria 13 - PrinceAlbert 57 - RedwoodCity 82 - Riyadh 46 - Rome 101 - RRSC_Nairobi 66 - Santiago 26 - Scanzano 58 - Scipps Inst 84 - Selangor 87 - Sendai 85 - Seoul 86 - SeoulUniv 83 - Singapore 59 - SiouxFalls 47 - Spitzenbergen 60 - StennisSpace 71 - Sydney 17 - Syowa 90 - Taipei 5 - Tel_Aviv 95 - TerranovaBay 88 - TokaiUniv 89 - TokyoUniv 72 - Townsville 48 - Traben-Trar 4 - Tromso 100 - Tunis 114 - UlanBator 61 - UnivOfAlaska 63 - UnivOfRhodeIsl 62 - UnivOfTexas 56 - WallopsIsl 73 - Wellington 14 - WestFreugh	
2	**Station_DT_ID** Data Transcription Ground Station Code	xs:short 2 bytes
3	**Filler** Padding for stucture alignment	xs:hexBinary 2 bytes

Table 92: Ground_Stations_Transcr_Sys_Id Specification

3.1.3.5.2.4.Transcription_Id_Type

Transcription Identification

#	Name/Description	Format
1	**Input_HddrType** HDDR Code	xs:unsignedInt 4 bytes

#	Name/Description	Format
2	**Format_SyncType** Format Synchroniser/Decommutator Code: 1 - MCS ERS FS 2 - SPACETEC ERS HR FS 3 - IAI ERS HR FS 4 - LABEN ERS HR FS 5 - SPACETEC/ACS ERS FS 6 - ENERTEC ETM FS 7 - ENERTEC TM FS 8 - ACS SW FORMAT SYNCH 14 - ACS XSAR FORMAT SW SYNCH	xs:unsignedInt 4 bytes
3	**Reserved** Reserved	xs:unsignedInt Min Occurs: 2 Max Occurs: 2 4 bytes

Table 93: Transcription_Id_Type Specification

3.1.3.5.2.5.Orbit_Acquisition_Id_Type

Orbit and Acquisition Identification

#	Name/Description	Format
1	**Track_Number** Track or Data Take Number (when applicable)	xs:integer 4 bytes
2	**Orbit_Number** Orbit number (when applicable)	xs:integer 4 bytes
3	**Cycle_Number** Cycle number (when applicable)	xs:integer 4 bytes
4	**Numb_of_Frames** Number of standard frames (when applicable)	xs:integer 4 bytes
5	**First_Frame** Num. of first standard frame (when applicable)	xs:integer 4 bytes
6	**Reserved** Reserved	xs:unsignedInt Min Occurs: 4 Max Occurs: 4 4 bytes
7	**First_OBC** 1st On Board Counter (when applicable)	xs:unsignedInt 4 bytes
8	**Last_OBC** Last On Board Counter (when applicable)	xs:unsignedInt 4 bytes
9	**Acquis_Date_Year** Acquisition Date (Year)	xs:unsignedShort 2 bytes
10	**Acquis_Date_Month** Acquisition Date (Month)	xs:unsignedShort 2 bytes
11	**Acquis_Date_Day** Acquisition Date (Day)	xs:unsignedShort 2 bytes
12	**Acquis_Day** Day in the year of the acquisition	xs:unsignedShort 2 bytes
13	**Acquis_start_Hour**	xs:unsignedShort

#	Name/Description	Format
	Start of acquisition (Hour)	2 bytes
14	**Acquis_start_Min** Start of acquisition (Minutes)	xs:unsignedShort 2 bytes
15	**Acquis_start_Sec** Start of acquisition (Seconds)	xs:unsignedShort 2 bytes
16	**Acquis_start_Millisec** Start of acquisition (Milliseconds)	xs:unsignedShort 2 bytes
17	**Acquis_end_Hour** End of acquisition (Hours)	xs:unsignedShort 2 bytes
18	**Acquis_end_Min** End of acquisition (Minutes)	xs:unsignedShort 2 bytes
19	**Acquis_end_Sec** End of acquisition (Seconds)	xs:unsignedShort 2 bytes
20	**Acquis_end_Millisec** End of acquisition (Milliseconds)	xs:unsignedShort 2 bytes
21	**Transcription_Date_Day** Transcription Date in Days	xs:unsignedShort 2 bytes
22	**Transcription_Date_Month** Transcription Date in Months	xs:unsignedShort 2 bytes
23	**Transcription_Date_Year** Transcription Date in Years (WARNING: Year could be expressed in some tapes as years from 1900)	xs:unsignedShort 2 bytes
24	**Transcription_Start_Hour** Transcription start in Hours	xs:unsignedShort 2 bytes
25	**Transcription_Start_Min** Transcription start in Minutes	xs:unsignedShort 2 bytes
26	**Transcription_Start_Sec** Transcription start in Seconds	xs:unsignedShort 2 bytes
27	**Transcription_End_Hour** Transcription end in Hours	xs:unsignedShort 2 bytes
28	**Transcription_End_Min** Transcription end in Minutes	xs:unsignedShort 2 bytes
29	**Transcription_End_Sec** Transcription end in Seconds	xs:unsignedShort 2 bytes
30	**Filler** Padding for stucture alignment	xs:hexBinary 2 bytes

Table 94: Orbit_Acquisition_Id_Type Specification

3.1.3.5.2.6.Pointers_Tape_Data_Type

This structure is meaningful only in the "User Header" file (it is empty in "Pass Id. Header"). The last field of the first area (Nr_of_Files) indicates how many files follow the "User Header" inside the same Transcription Area (same passage).

This number has been taken as a parameter to allow the maximum flexibility.

In the Transcription Systems presently designed and installed the parameter "Nr_of_Files" can be 2 for LANDSAT.

The 10 blocks which follow "Nr_of Files" describes the files following the "User Header" in current "Transcription Area". Each of these blocks describes one file. The number of blocks actually filled is thus equal to "Nr_of_Files"

In the LANDSAT case there are 2 blocks filled, which correspond respectively to:
1. the "Segment Descriptor" file
2. the "Block Addresses Descriptor" file.

#	Name/Description	Format
1	**Num_of_segments** Number of segments (when applicable)	xs:integer 4 bytes
2	**Loaded_Swath** Number of transcribed swaths	xs:integer 4 bytes
3	**Swath_Size** Swath length (in bytes)	xs:integer 4 bytes
4	**Swath_per_Block** Number of swaths per block	xs:integer 4 bytes
5	**Nr_of_Blocks** Number of blocks	xs:integer 4 bytes
6	**Physical_Address_1** User Header Address. File Number of the User Header. It is the number of files, numbered from DLT start, preceding the User Header file in current Transcription Area.	xs:long 4 bytes
7	**Physical_Address_2** Pass Id. Header Address. File Number of the Pass Id. Header. It is the number of files, numbered from DLT start, preceding the Pass Id. Header file in current Transcription Area.	xs:long 4 bytes
8	**Nr_of_Files** Number of files following the present	xs:integer 4 bytes
9	**File**	Pointers_Tape_Data_File_Type Min Occurs: 10 Max Occurs: 10
10	**Reserved** Reserved	xs:hexBinary 8bytes

Table 95: Pointers_Tape_Data_Type Specification

3.1.3.5.2.7.Pointers_Tape_Data_File_Type

#	Name/Description	Format
1	**File_ID** File type identifier	xs:integer 4 bytes
2	**File_Num** Number of physical records	xs:integer 4 bytes
3	**Record_Length** Physical record length in bytes	xs:integer 4 bytes
4	**Elem_Num** Number of logical element per record	xs:integer 4 bytes

#	Name/Description	Format
5	**Elem_Length** Logical element length in bytes	xs:integer 4 bytes
6	**Filler** Spare	xs:hexBinary 44 bytes

Table 96: Pointers_Tape_Data_File_Type Specification

3.1.3.6. DTVideoData

The LANDSAT ETM+ Sensor data of one imaging sequence are stored consecutively in the DTVideoData file. The data corresponding to one pass are subdivided in Blocks having the same length (about 4 Megabytes). Each Block is formed by a fixed number (available in the "DTUserHeader" file) of Major Frames (MJF), format interleaved:

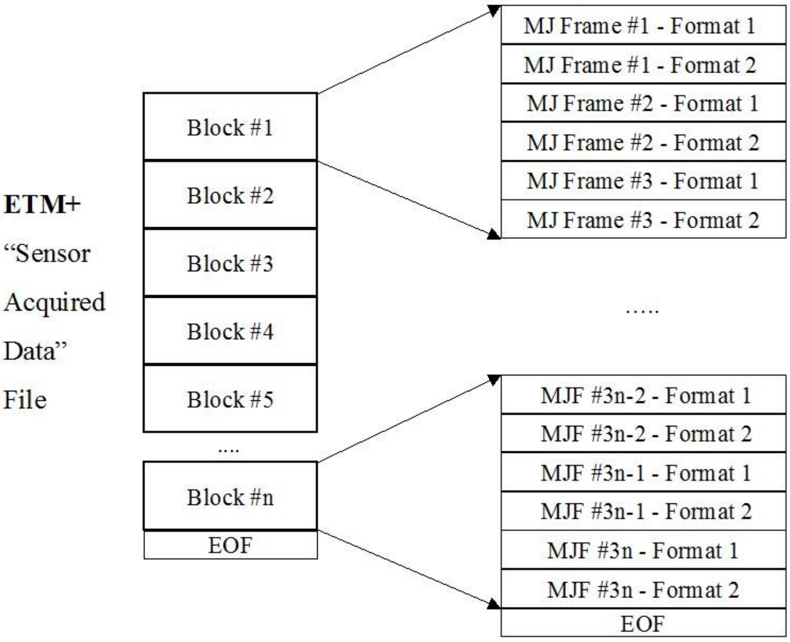

Figure 22: DTVideoData - ETM Sensor Acquired Data File organisation

Each MJF contains a complete sweep (Forward or Reverse) of ETM+ instrument (swath) and some other auxiliary information organised as follows:

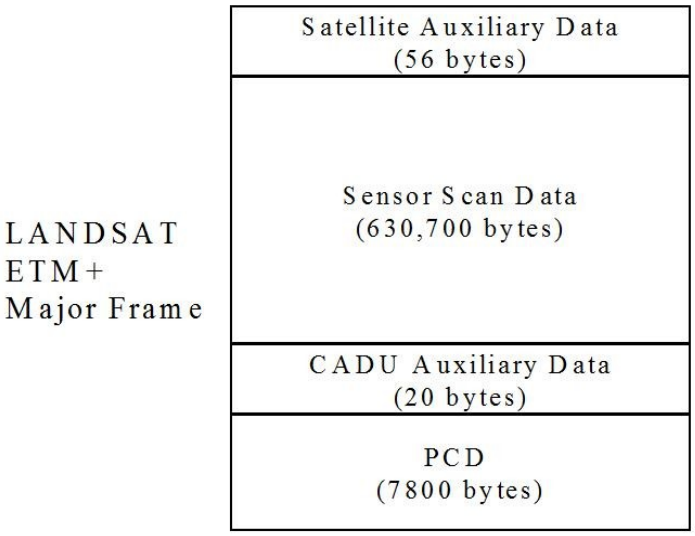

Figure 23: DTVideoData - ETM Major Frame organisation

The next figure provides a high level overview of the complex structures used to represent the information of the DTVideoData file:

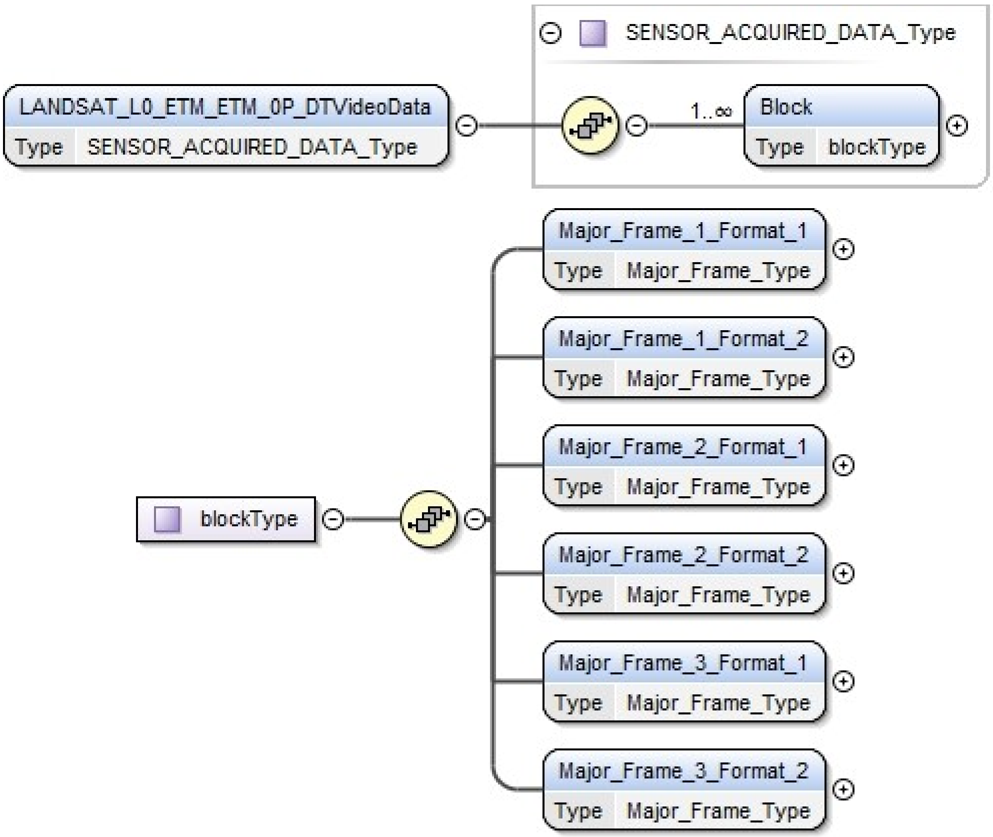

Figure 24: DFDL schema organisation for DTVideoData (ETM)

3.1.3.6.1. Root Element

#	Name/Description	Format
1	**LANDSAT_L0_ETM_ETM_0P_DTVideoData**	SENSOR_ACQUIRED_DATA_Type

#	Name/Description	Format
	SENSOR ACQUIRED DATA FILE In the case of LANDSAT 7 ETM+, data are transcribed using the format adopted by the ACS Software Format Synchroniser. The LANDSAT 7 ETM+ Sensor Data data corresponding to one pass are subdivided in Blocks having the same length.	

Table 97: LANDSAT_L0_ETM_ETM_0P_DTVideoData Specification

3.1.3.6.2. Complex Types

3.1.3.6.2.1.SENSOR_ACQUIRED_DATA_Type

#	Name/Description	Format
1	**Block**	blockType Min Occurs: 1 Max Occurs: unbounded

Table 98: SENSOR_ACQUIRED_DATA_Type Specification

3.1.3.6.2.2.blockType

Each Block is formed by a fixed number of Major Frames (MJF), format interleaved.
There should be 6 Major Frames per block although this number should be checked in the "User Header" file (/Pointers_to_Tape_Data_Structure/Swath_per_Block).

#	Name/Description	Format
1	**Major_Frame_1_Format_1**	Major_Frame_Type
2	**Major_Frame_1_Format_2**	Major_Frame_Type
3	**Major_Frame_2_Format_1**	Major_Frame_Type
4	**Major_Frame_2_Format_2**	Major_Frame_Type
5	**Major_Frame_3_Format_1**	Major_Frame_Type
6	**Major_Frame_3_Format_2**	Major_Frame_Type

Table 99: blockType Specification

3.1.3.6.2.3.Major_Frame_Type

Each Major Frame contains a complete sweep (Forward or Reverse) of ETM+ instrument (swath) and some other auxiliary information. It has the length of 638576 bytes

#	Name/Description	Format
1	**AuxiliaryData**	auxiliaryDataType
2	**SensorScanData**	Error: no se encontró el origen de la referencia

#	Name/Description	Format
3	**CADU**	CADUType
4	**PCD**	PCDType

Table 100: Major_Frame_Type Specification

3.1.3.6.2.4.auxiliaryDataType

#	Name/Description	Format
1	**Day** # of days from the current year	xs:int 4 bytes
2	**Hours** # of hours from midnight	xs:int 4 bytes
3	**Minutes** # of minutes	xs:int 4 bytes
4	**Seconds** # of seconds	xs:int 4 bytes
5	**Milliseconds** # of milliseconds	xs:int 4 bytes
6	**msec_fractionary** # of 1/16 of milliseconds	xs:unsignedShort 2 bytes
7	**Satellite_ID** LANDSAT mission number	xs:unsignedShort 2 bytes
8	**Format_ID** Format Identifier: 0x00 FMT 1 0xFF FMT 2	xs:unsignedByte 1 bytes
9	**Spare** Available fields	xs:hexBinary 3 bytes
10	**Fhserr** First half scan error	xs:int 4 bytes
11	**Shserr** Second half scan error.	xs:int 4 bytes
12	**Scan_direction** Direction of Scan: 0x00000000 Forward 0xFFFFFFFF Reverse	xs:int 4 bytes
13	**Line_Length** Length of active scan in Minor Frames unity	xs:int 4 bytes
14	**Swath_Length** Length in bytes of a swath (as transmitted from satellite. Note that the transcribed swath is a fixed part of this length).	xs:int 4 bytes
15	**Satellite_Time**	xs:double 8 bytes

#	Name/Description	Format
	Swath time in milliseconds and 1/16 of milliseconds from beginning of year.	

Table 101: auxiliaryDataType Specification

3.1.3.7. sensorScanDataType

The Sensor Scan Data portion reports information in swaths form, extracted and reconstructed from the "Mission Data Zone" of CADUs, with only few reformatting in order to suppress useless swath portions (Scan Line Start code and filler portion); the swath obtained in this way is formally equivalent to the TM one (not in size).
The data unit of a swath is the Minor Frame (hereafter indicated by MF) of 85 bytes, including 4 bytes of IR band 6, 1 spare and 80 of sensors video data. This structure is an exact copy of the original from satellite.
Format 1 or 2 differs in the 80 video bytes content and in band 6 gain. Format 1 represents bands from 1 to 5 with 16 sensors each, and IR band 6 with low gain. Format 2 represents band 7 (16 sensors), Panchromatic (32 sensors sampled twice) and IR band 6 with high gain.

#	Name/Description	Format
1	**TimeCode**	TimeCodeType
2	**VideoData**	VideoDataType
3	**EndOfScan**	EndOfScanType
4	**LineLength**	LineLengthType
5	**DC_Restore_and_Calibration**	DC_Restore_and_CalibrationType
6	**Filler**	xs:hexBinary 8840 bytes

Table 102: sensorScanDataType Specification

3.1.3.7.1.1. TimeCodeType

The time code data is collected from the spacecraft for transmission starting at the minor frame boundary immediately following each Line Sync Code. The time code data is received from the spacecraft and inserted into six (6) contiguous minor frames. Each of the 16 groups of 5 data words within a given minor frame will contain a single bit binary value (0 or 1) of information that is replicated for all of the bits in the group (40 bits per group).

The Time Code data is 480 data words and conforms to the Minor Frame structure, and pre-empts all minor frame video except Band 6 data.

The Time Code information is encoded in "8421" (natural) Binary-Coded Decimal (BCD) except for 0.0625 msec which is binary. Transmission order is left to right, top to bottom, odd numbered groups first, then even numbered groups last.

#	Name/Description	Format
1	**TimeCode**	minorFrameType Min Occurs: 6 Max Occurs: 6

Table 103: TimeCodeType Specification

3.1.3.7.1.2.VideoDataType

Scene data is provided in two specified Scene Data formats (Scene Data Format 1 and Scene Data Format 2). Scene data transmission starts at the minor frame boundary immediately following the Time Code and conforms to the Minor Frame Data Structure. Transmission of scene data continues until the start of the next End of Line Pattern code. For reference, 6313 Minor Frames of scene data are nominally transmitted during any given scan cycle. The digitized scene data from the analog video inputs can be organized into either of two minor frame scene data formats. A given multiplexer is capable of simultaneously providing both formats and has two high rate serial digital outputs that are each allocated to providing one of the two formats.

#	Name/Description	Format
1	**VideoData**	minorFrameType Min Occurs: 1024 Max Occurs: 1024
2	**VideoData**	minorFrameType Min Occurs: 1024 Max Occurs: 1024
3	**VideoData**	minorFrameType Min Occurs: 1024 Max Occurs: 1024
4	**VideoData**	minorFrameType Min Occurs: 1024 Max Occurs: 1024
5	**VideoData**	minorFrameType Min Occurs: 1024 Max Occurs: 1024
6	**VideoData**	minorFrameType Min Occurs: 1024 Max Occurs: 1024
7	**VideoData**	minorFrameType Min Occurs: 176 Max Occurs: 176

Table 104: VideoDataType Specification

3.1.3.7.1.3.EndOfScanType

The occurrence of the line stop pulse generated by the ETM+ scan mirror assembly is asynchronously detected by the L–7 AEM. Upon detection of the line stop pulse, an End of Line Pattern Code is generated and is synchronized to the Minor Frame boundary of the next minor frame.

The End of Line Pattern code conforms to the Minor Frame Data Structure and preempts all minor frame video except Band 6 data. The length of the End of Line Pattern Code included in 2 consecutive minor frames is 160 bytes.

The End of Line Pattern Code will be inserted into two contiguous minor frames. Each of the 16 groups of 5 data words within the minor frame will contain a single bit binary value (0 or 1) that is replicated for all of the bits in the group (40 bits per group).

#	Name/Description	Format
1	**EndOfScan**	minorFrameType Min Occurs: 2 Max Occurs: 2

Table 105: EndOfScanType Specification

3.1.3.7.1.4.LineLengthType

The Scan Mirror Assembly (SMA) may be operated in either of two modes:
(a) the primary mode,referred to as the Scan Angle Monitor (SAM) Mode
(b) the back-up, or Bumper Mode

#	Name/Description	Format
1	**LineLength**	minorFrameType Min Occurs: 2 Max Occurs: 2

Table 106: LineLengthType Specification

3.1.3.7.1.5.DC_Restore_and_CalibrationType

#	Name/Description	Format
1	**DC_Restore_and_Calibration**	minorFrameType Min Occurs: 986 Max Occurs: 986

Table 107: DC_Restore_and_CalibrationType Specification

3.1.3.7.1.6.minorFrameType

The Minor Frame Data Structure is a specific pattern for organizing groups of ETM+ data words. This pattern is based on the architecture of the L–7 Auxiliary Electronics Module (AEM) hardware that samples, digitizes, and groups analog video signals from the ETM+ scanner to form scene data.

The Minor Frame Data structure is 85 words (8 bits) in length consisting of:
- 16 separate groups of 5 words
- 4 data words from Band 6
- 1 spare data word.

Band 6 data shall alternate between the odd and even pixels for each successive minor frame and shall be resynchronized to odd pixel data for the first minor frame (line sync code) of each new scan. Each bit of the spare data word is set to zero.

Note that the odd numbered words are transmitted first followed by the even numbered words and then Band 6 data.
Format 1 contains Band 6 low gain and Format 2 Band 6 high gain when commanded to the appropriate gain setting to
acquire Band 6 data (BP6 = Lo Gain, BR6 = Hi Gain).

#	Name/Description	Format
1	**Sensors_Data**	Sensors_DataType
2	**Band_6_Data**	xs:hexBinary 4 bytes
3	**Spare**	xs:hexBinary 1 bytes

Table 108: minorFrameType Specification

3.1.3.7.1.7.Sensors_DataType

#	Name/Description	Format
1	**_01A_E**	xs:hexBinary 5 bytes
2	**_02A_E**	xs:hexBinary 5 bytes
3	**_03A_E**	xs:hexBinary 5 bytes
4	**_04A_E**	xs:hexBinary 5 bytes
5	**_05A_E**	xs:hexBinary 5 bytes
6	**_06A_E**	xs:hexBinary 5 bytes
7	**_07A_E**	xs:hexBinary 5 bytes
8	**_08A_E**	xs:hexBinary 5 bytes
9	**_09A_E**	xs:hexBinary 5 bytes
10	**_10A_E**	xs:hexBinary 5 bytes
11	**_11A_E**	xs:hexBinary 5 bytes
12	**_12A_E**	xs:hexBinary 5 bytes
13	**_13A_E**	xs:hexBinary 5 bytes
14	**_14A_E**	xs:hexBinary 5 bytes
15	**_15A_E**	xs:hexBinary 5 bytes
16	**_16A_E**	xs:hexBinary 5 bytes

Table 109: Sensors_DataType Specification

3.1.3.7.1.8.CADUType

CADU (Channel Access Data Unit) Auxiliary Data are some useful information about CADUs from which swaths are extracted

#	Name/Description	Format
1	**CADU_Start** CADU counter value when SLS occurs.	xs:unsignedInt 4 bytes
2	**CADU_Stop** CADU counter value when fill zone ends (at next SLS).	xs:unsignedInt 4 bytes
3	**CADU_offset** Bytes offset of SLS from start of Data Zone	xs:unsignedInt 4 bytes
4	**Data_Priority** Data priority flag: 0x00 Routine data 0xff Priority data	xs:unsignedByte 1 bytes
5	**Spare** Available field	xs:hexBinary 7 bytes

Table 110: CADUType Specification

3.1.3.7.1.9.PCDType

PCD data are extracted in 10 bytes block from each CADUs and transcribed sequentially.
Valid PCD bytes are also extracted from CADU when the abolished swath portion (filler portion) is transmitted, and are contiguous with the others.
The PCD field size in MJF is overestimated respect to the needed; the last portion of it will be filled with zeros.
In order to recover the right number of valid PCD, the two CADU counter values in previous structure have to be used.
The first one represent the CADU counter value when Scan Line Start is detected, the second is the counter value when next SLS is detected.

The valid PCD bytes are : (CADU Stop Num. – CADU Start Num.) * 10

#	Name/Description	Format
1	**PCD_Block**	PCDDataType Min Occurs: 780 Max Occurs: 780

Table 111: PCDType Specification

3.1.3.7.1.10.PCDDataType

#	**Name/Description**	**Format**
1	**PCD_data**	xs:hexBinary 10 bytes

Table 112: PCDDataType Specification