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14. Abstract/Notes <i>This document defines the format of the computer compatible tapes (CCT) which contain Thematic Mapper (TM) imagery data acquired from the Landsat series of satellites by the INSTITUTO DE PESQUISAS ESPACIAIS (MCT-INPE/BRAZIL)</i>			
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**INPE LANDSAT THEMATIC MAPPER
COMPUTER COMPATIBLE TAPE
FORMAT SPECIFICATION
(Revision C)**

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BRAZIL**

This Revision C of the INPE LANDSAT THEMATIC MAPPER COMPUTER COMPATIBLE TAPE FORMAT SPECIFICATION updates the Revision B document, not published. The main modification introduced in the present Revision was the exclusion of products recorded in 800 bpi tapes and the inclusion of those recorded in 6250 bpi.

This Revision B of the INPE LANDSAT THEMATIC MAPPER COMPUTER COMPATIBLE TAPE FORMAT SPECIFICATION updates the Revision A document published in August 1985, and corresponds to Production Software Release number 3. The major change introduced by Revision B is the presence of geometrically corrected imagery, which gives rise to two product types: the "raw" data product (CCT-AT) and the corrected one (CCT-PT). This new product requires some modifications on the parameters - as described below - and is available only in the quadrant mode.

The major modification of Revision A was the inclusion of the Supplemental Volume. This volume is present in the CCTs generated after August 1985, which carry the number "2" in the SOFTWARE RELEASE NUMBER field of the superstructure records, and another change made refers to the coding and number of Quadrants, which - since August 1985 - are being represented by letters instead of numbers, utilizing the well-known A/B/C/D nomenclature, plus N/S/W/E/X for the newly included quadrants.

Except for the points mentioned above, this Revision applies also to CCTs generated before August, 1985.

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CHAPTER 1

INTRODUCTION

1.1 DOCUMENT PURPOSE

This document defines the format of the computer compatible tapes (CCT) which contain Thematic Mapper (TM) imagery data acquired from the Landsat 4 and 5 satellites by the INSTITUTO DE PESQUISAS ESPACIAIS (INPE/BRAZIL).

The INPE Landsat TM CCT product format is based on the "LGSOWG CCT format CCB document : The standard CCT family of tape formats". This standard was developed by the Canada Centre for Remote Sensing (CCRS) and is being used as a reference by the Landsat Technical Working Group (LTIWG) of the Landsat Ground Stations Operators Working Group (LGSOWG). The main objective of this standard is to allow the easy interchange of data from various remote sensing sources, and in particular, the international interchange of LANDSAT imagery data.

1.2 DOCUMENT ORGANIZATION

Chapter 2 describes the physical and logical organization of the INPE Landsat TM CCT-AT product, accordingly to processing options like interleaving format, number of spectral bands, tape density etc.

Chapter 3 describes the physical and logical organization of the INPE Landsat TM CCT-PT product, giving information similar as above.

Chapter 4 presents an overview of the superstructure concepts used in the definition of the CCT format. In addition it presents the CCT files and describes all record types that compose the products.

Appendix A presents the detailed description of the record types, field by field, necessary for the complete understanding of the format.

CHAPTER 2

INPE LANDSAT TM CCT-AT PRODUCT DESCRIPTION

2.1 PRODUCT DEFINITION

The standard Landsat TM CCT-AT product consists in a full TM scene or a single quadrant recorded in 1600 or 6250 bpi tapes. Up to seven TM spectral bands may be requested. Consult the Landsat Products Price List to find the available options.

2.1.1 DESCRIPTION OF STANDARD PRODUCT

A full scene is composed by 386 sweeps of video data such that the 194th sweep is the one which scans the WRS frame center.

Radiometric corrections are applied to calibrate the video data. Under user request, special radiometric corrections may be performed.

The video data are shifted along-line by an integer number of pixels to perform the alignment among video lines. Reverse scans are inverted to nominally register the forward scans. Thermal band data are replicated four times within the line and the lines are also replicated four times such that all bands will have the same number of pixels and lines.

Normally, the video is resampled in the along scan direction by a nearest neighbour method, in order to compensate the effects of mirror profile, line length variation and sensor offsets, ensuring the video continuity between adjacent sweeps. Optionally, this resampling can be made by a cubic convolution method (at additional cost).

2.1.2 SCENE DEFINITION BY QUADRANTS

A CCT-AT may contain a full TM scene or a quadrant. There are nine possible quadrants:

- Quadrant A contains the upper left quarter of the scene.
- Quadrant B contains the upper right quarter of the scene.
- Quadrant C contains the lower left quarter of the scene.

Quadrant D contains the lower right quarter of the scene.
Quadrant N is between quadrants A and B.
Quadrant S is between quadrants C and D.
Quadrant W is between quadrants A and C.
Quadrant E is between quadrants B and D.
Quadrant X is the center quadrant.

Assuming that :

- pixel number 1 is band 1 first pixel;
- each full line contains 6304 image pixels; and
- band offsets, in pixels, are

Band 1 - 0 pixels
Band 2 - 25 pixels
Band 3 - 50 pixels
Band 4 - 75 pixels
Band 5 - 146 pixels
Band 6 - 183 pixels
Band 7 - 120 pixels ,

if the alignment of the bands is performed, a full line shall contain the 6304 image pixels plus the maximum band offset which is 183 pixels. So, an aligned video line is defined as having 6487 pixels and the first useful pixel of band 1 is pixel 1, the first useful pixel of band 2 is pixel 26 and so on.

As the scene has 386 sweeps and each sweep has 16 lines, the scene center is placed in pixel 3245, line 3089. There is no overlap between quadrants A, B, C and D.

Table 2.1 presents the complete definition of quadrants.

Quadrant	First pixel	Last pixel	First line	Last line
A	1	3244	1	3088
B	3245	6487	1	3088
C	1	3244	3089	6176
D	3245	6487	3089	6176
N	1623	4866	1	3088
S	1623	4866	3089	6176
W	1	3244	1537	4624
E	3245	6487	1537	4624
X	1623	4866	1537	4624

Table 2.1
Quadrant Definition

2.1.3 FULL FRAME DEFINITION

Due to space limitation in magnetic tapes, when generating full frame scenes all the pixels which are not sampled by all detectors will be discarded. This means that every original video line, containing 6304 pixels, will be shortened by 183 pixels. So, each recorded line will contain 6121 pixels aligned across all bands. The number of discarded pixels at the beginning of a line is given by the value 183 minus the respective band offset; and the number of discarded pixels at the end of the line is given by the respective band offset. Nevertheless, the pixel numbering is kept with respect to the full aligned video line (1 to 6487), i.e., the first recorded pixel is pixel 184 for all bands.

Furthermore, also due to space limitations, the last 16 sweeps of video nominally belonging to a full scene are not recorded, therefore leaving out about 7.7 km of video across the bottom of the nominal frame. This corresponds to 4% of the full image and lies totally within the overlap region between consecutive frames.

2.2 PRODUCT ORGANIZATION

INPE Landsat TM CCT-AT products are organized into two logical volumes, which can be split over one or more physical volumes (tapes). The number of physical volumes depends on the number of requested spectral bands, the tape density and the size of the scene (full frame or quadrant). The first logical volume is the IMAGERY VOLUME, which contains header, ancillary, image data and trailer information for a scene. The second logical volume is the SUPPLEMENTAL VOLUME, which contains the geometric modeling data records. All these data are organized in the following files, defined by the superstructure concepts:

- Imagery volume directory file
- Leader file
- Imagery file
- Trailer file
- Supplemental volume directory file
- Supplemental file
- Null volume directory file

The video organization may be Band Sequential (BSQ) or Band Interleaved by Lines (BIL). In the BSQ format the video data of one spectral band are sequentially written in one imagery file such that there are as many imagery files as spectral bands in the product. In the BIL format the video data for all requested spectral bands of one scan line are recorded sequentially before starting the next scan line. All the scene is recorded as just one imagery file.

The imagery volume directory file contains information about the distribution of the other files among the physical volumes that compose the first logical volume.

The leader file provides auxiliary data related to the recorded scene.

The supplemental volume directory file describes the distribution of the files which compose the supplemental volume.

The supplemental file contains the geometric modeling data records, which contain the data necessary to geometrically correct the video data.

The null volume directory file is a subset of the volume directory file and appears at the end of the logical volume set.

Figures 2.1 through 2.8 present the logical volume organization depending on tape density and scene size. Although the number of spectral bands is always 7 in these examples, fewer bands may be present in the logical volume, according to the user request and the options offered in the Price List, where the number of physical volumes is also listed for each option.

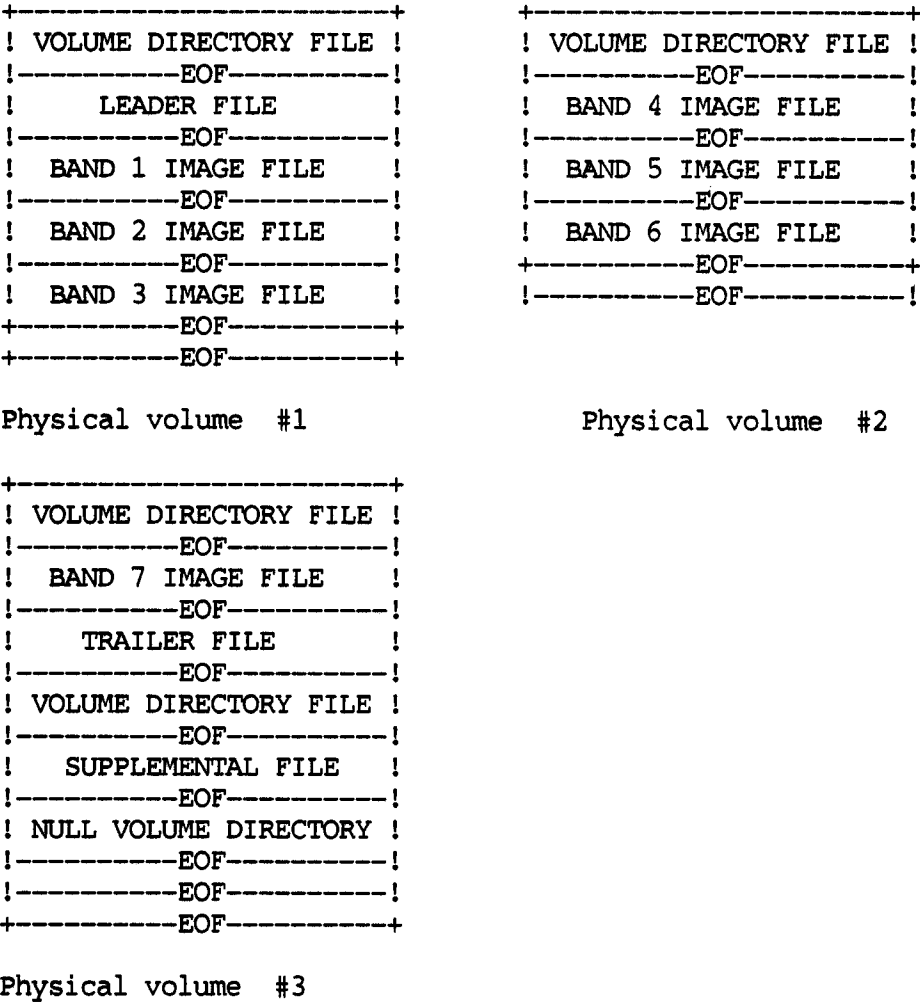
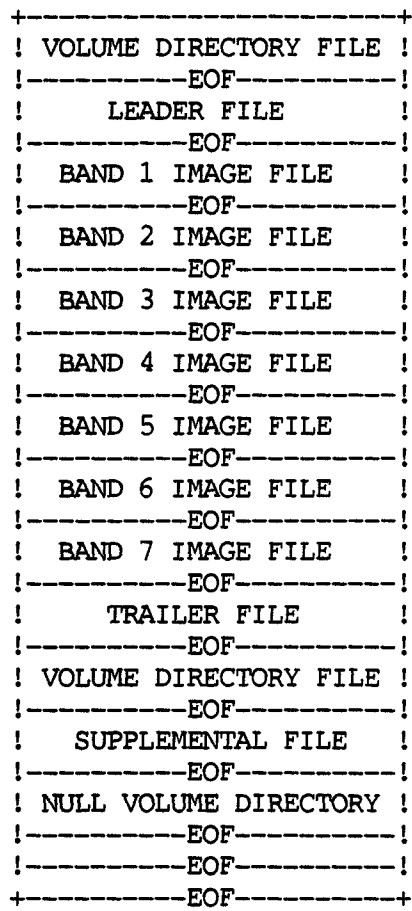


Figure 2.1
BSQ/1600 bpi/quadrant CCT-AT layout



Physical volume #1

Figure 2.2
BSQ/6250 bpi/quadrant CCT-AT layout

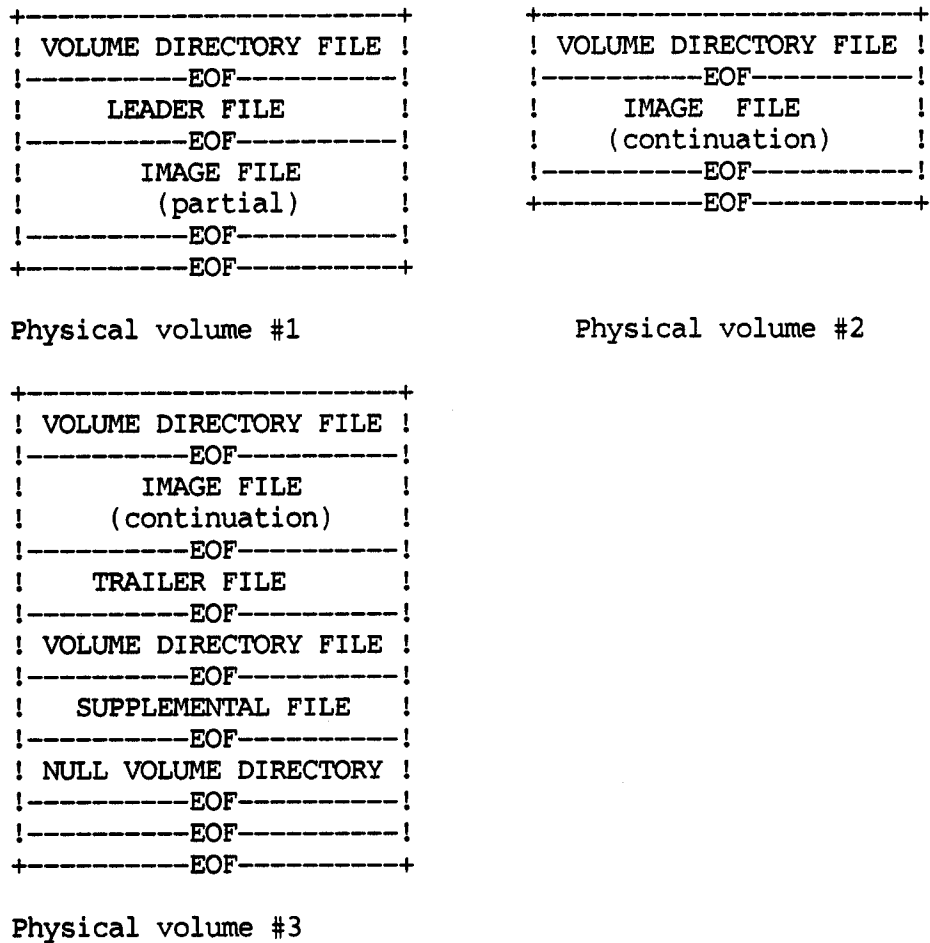
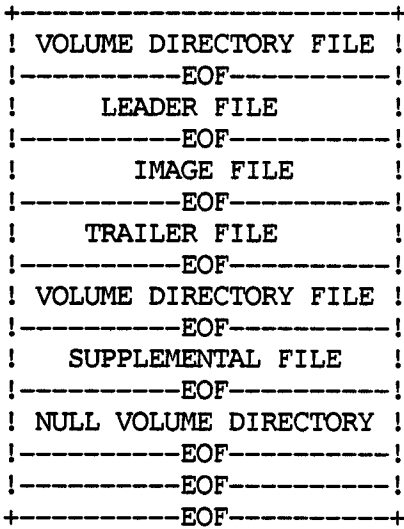


Figure 2.3
BIL/1600 bpi/quadrant CCT-AT layout



Physical volume #1

Figure 2.4
BIL/6250 bpi/quadrant CCT-AT layout

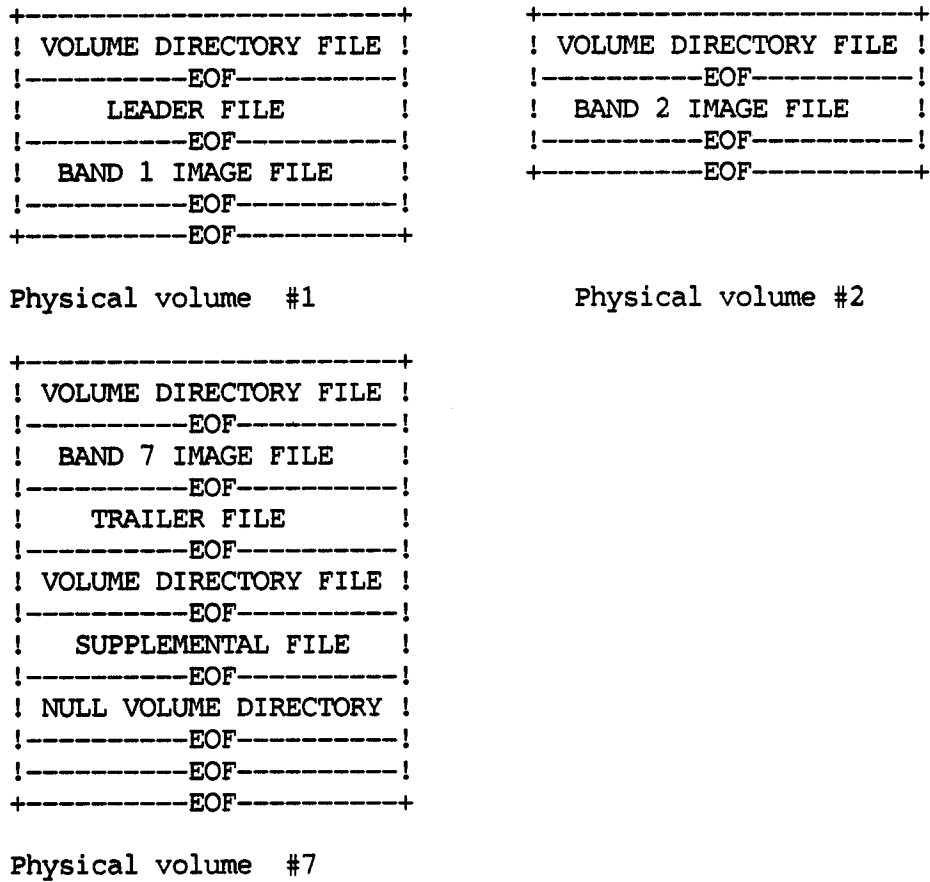


Figure 2.5
BSQ/1600 bpi/full frame CCT-AT layout

```
+-----+
! VOLUME DIRECTORY FILE !
!-----EOF-----!
!      LEADER FILE      !
!-----EOF-----!
!   BAND 1 IMAGE FILE   !
!-----EOF-----!
!   BAND 2 IMAGE FILE   !
!-----EOF-----!
!   BAND 3 IMAGE FILE   !
!-----EOF-----!
!   BAND 4 IMAGE FILE   !
!-----EOF-----!
!-----EOF-----!
```

Physical volume #1

```
+-----+
! VOLUME DIRECTORY FILE !
!-----EOF-----!
!   BAND 5 IMAGE FILE   !
!-----EOF-----!
!   BAND 6 IMAGE FILE   !
!-----EOF-----!
!   BAND 7 IMAGE FILE   !
!-----EOF-----!
!   TRAILER FILE        !
!-----EOF-----!
! VOLUME DIRECTORY FILE !
!-----EOF-----!
!   SUPPLEMENTAL FILE   !
!-----EOF-----!
! NULL VOLUME DIRECTORY !
!-----EOF-----!
!-----EOF-----!
```

Physical volume #2

Figure 2.6
BSQ/6250 bpi/full frame CCT-AT layout

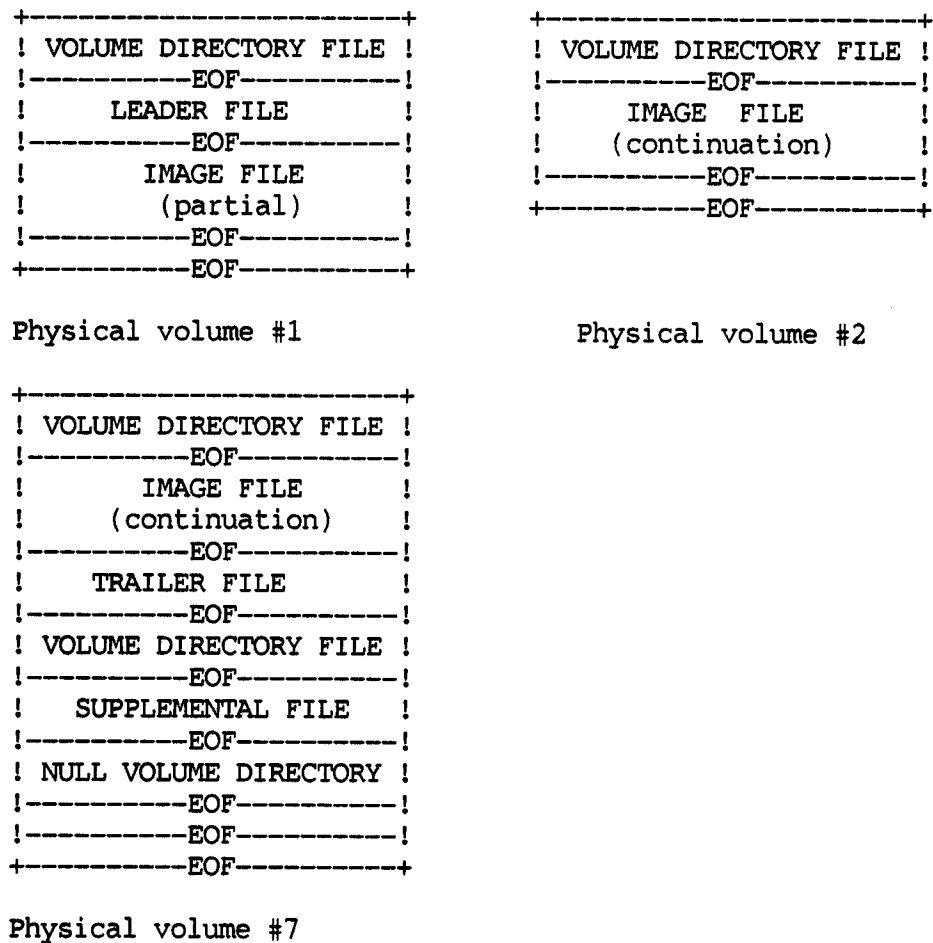


Figure 2.7
BIL/1600 bpi/full frame CCT-AT layout

```
+-----+
! VOLUME DIRECTORY FILE !
!-----EOF-----!
!      LEADER FILE      !
!-----EOF-----!
!      IMAGE FILE       !
!      (partial)        !
!-----EOF-----!
+-----EOF-----+
```

Physical volume #1

```
+-----+
! VOLUME DIRECTORY FILE !
!-----EOF-----!
!      IMAGE FILE       !
!      (continuation)   !
!-----EOF-----!
!      TRAILER FILE     !
!-----EOF-----!
! VOLUME DIRECTORY FILE !
!-----EOF-----!
!      SUPPLEMENTAL FILE !
!-----EOF-----!
! NULL VOLUME DIRECTORY !
!-----EOF-----!
!-----EOF-----!
+-----EOF-----+
```

Physical volume #2

Figure 2.8
BIL/6250 bpi/full frame CCT-AT layout

CHAPTER 3

INPE LANDSAT TM CCT-PT PRODUCT DESCRIPTION

3.1 PRODUCT DEFINITION

The geometrically corrected Landsat TM CCT consists in a quadrant TM scene recorded in one or more 1600 bpi tapes or in one 6250 bpi tape. Consult the Landsat Products Price List to find the available options.

3.1.1 DESCRIPTION OF GEOMETRICALLY CORRECTED PRODUCT

A geometrically corrected product is defined as an image on which a direct relationship may be obtained between image coordinates and projection coordinates. The basis for this relation is that, given the orientation between the image and the projection coordinate system (ALPHA), and the coordinates (X0,Y0) of a reference pixel (i0,j0), the projection coordinates (X,Y) for a pixel (i,j) are computed by:

$$\begin{array}{rcl} \begin{array}{c} \overline{X} \\ \overline{Y} \end{array} & = & \begin{array}{c} \overline{\cos(\text{ALPHA})} \quad \overline{\sin(\text{ALPHA})} \\ \overline{-\sin(\text{ALPHA})} \quad \overline{\cos(\text{ALPHA})} \end{array} \begin{array}{c} \overline{(j-j_0).pix_siz_h} \\ \overline{(i-i_0).pix_siz_v} \end{array} + \begin{array}{c} \overline{X_0} \\ \overline{Y_0} \end{array} \end{array}$$

where $\overline{pix_siz_h}$ and $\overline{pix_siz_v}$ are the pixel sizes in the horizontal and vertical directions.

The projection is given in item 41 of the SCENE HEADER record of LEADER FILE, with codes:

- 1 = no proj.
- 2 = UTM
- 3 = SOM
- 4 = geocoded imagery.

The other elements are furnished in the MAP PROJECTION DATA RECORD, as follows:

UTM projection

- X0 (Easting of full scene center) : item 16
- Y0 (Northing of full scene center) : item 15
- ALPHA (orientation angle) : item 19
- i0 (line number at scene center) : item 32
- j0 (pixel number at scene center) : item 33

SOM projection

- X0 (Coordinate of full scene center) : item 22
- Y0 (Coordinate of full scene center) : item 23
- ALPHA (orientation angle) : item 26
- i0 (line number at scene center) : item 32
- j0 (pixel number of scene center) : item 33

The CCT-PT is a digital equivalent of INPE's quadrant "bulk" photographic imagery. Therefore, the geometric model is the same as the one used to obtain those products; this model is based only in the spacecraft attitude and ephemeris data and uses no control points. It is recommended that the user determines a couple of control points in order to correct positional errors.

It should be noted that the CCT-PT is available only in the quadrant mode. It follows that the scene is not North-oriented and that the user will need to apply a rotation to this data in order to superimpose it to a map.

The geometric characteristics of the CCT-PT are:

- projections : SOM and UTM
- image size : 3200 lines by 3500 pixels, covering an area of 96 x 105 km², filled with additional "black" pixels
- pixel size : 30 x 30 meters
- scene center location and orientation : given in the MAP PROJECTION DATA RECORD

As for the radiometric properties, the CCT-PT may be resampled using either nearest neighbor or cubic convolution algorithms, as chosen by the user.

3.1.2 SCENE DEFINITION BY QUADRANTS

A CCT-PT contains a quadrant. There are nine possible quadrants:

- Quadrant A contains the upper left quarter of the scene.
- Quadrant B contains the upper right quarter of the scene.
- Quadrant C contains the lower left quarter of the scene.
- Quadrant D contains the lower right quarter of the scene.
- Quadrant N is between quadrants A and B.
- Quadrant S is between quadrants C and D.
- Quadrant W is between quadrants A and C.

Quadrant E is between quadrants B and D.
Quadrant X is the center quadrant.

In order to mosaic two or more quadrants of a same scene to produce a larger area image, the full scene center location (furnished as indicated above) may be used as a reference, since it corresponds to the same ground location in all of the quadrants. It should also be noted that the orientation angle for all quadrants on a scene has a common value.

3.2 PRODUCT ORGANIZATION

INPE Landsat TM CCT-PT products are organized into one logical volume, which can be split over one or more physical volumes (tapes). The number of physical volumes depends on the number of requested spectral bands.

Note that the imagery file uses a blocking factor of two(2) records per tape block, as explained in section 4.2.4 "Blocking Factor".

The logical volume is the IMAGERY VOLUME, which contains header, ancillary, image data and trailer information for a scene. The SUPPLEMENTAL VOLUME, which contains the geometric modeling data records, in the case of a CCT-AT, is not present in a CCT-PT because the geometric modelling has already been applied to the data. All these data are organized in the following files, defined by the superstructure concepts:

- Imagery volume directory file
- Leader file
- Imagery file
- Trailer file
- Null volume directory file

The video organization may be Band Sequential (BSQ) or Band Interleaved by Lines (BIL). In the BSQ format the video data of one spectral band are sequentially written in one imagery file such that there are as many imagery files as spectral bands in the product. In the BIL format the video data for all requested spectral bands of one scan line are recorded sequentially before starting the next scan line. All the scene is recorded as just one imagery file.

The imagery volume directory file contains information about the distribution of the other files among the physical volumes that compose the first logical volume.

The leader file provides auxiliary data related to the recorded scene.

The null volume directory file is a subset of the volume directory file and appears at the end of the logical volume set.

Figures 3.1 through 3.4 present the logical volume organization depending on video organization. Although the number of spectral bands is always 7 in these examples, fewer bands may be present in the logical volume, according to the user request and the options offered in the Price List, where the number of physical volumes is also listed for each option.

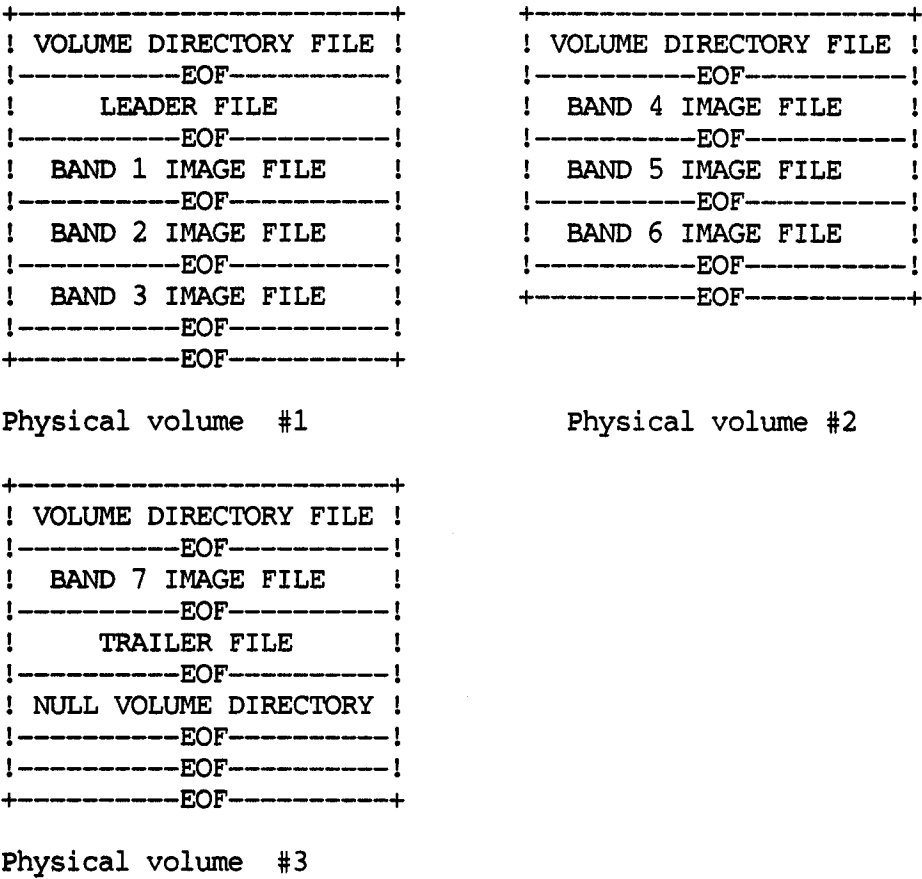


Figure 3.1
BSQ/1600 bpi/quadrant CCT-PT layout

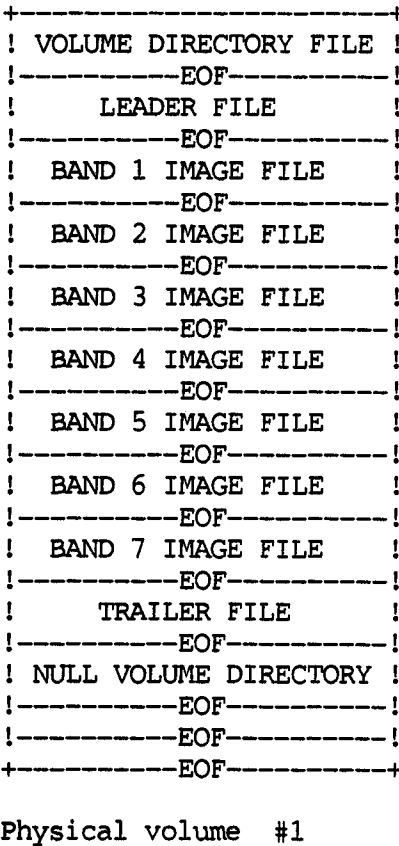


Figure 3.2
BSQ/6250 bpi/quadrant CCT-PT layout

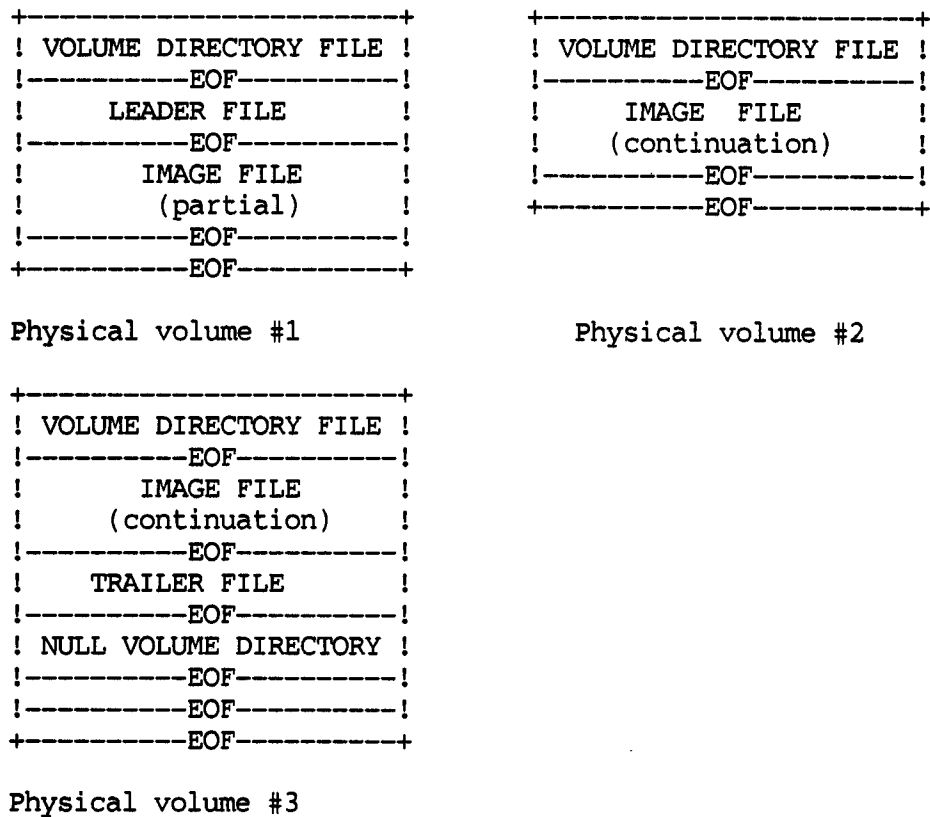


Figure 3.3
BIL/1600 bpi/quadrant/CCT-PT layout

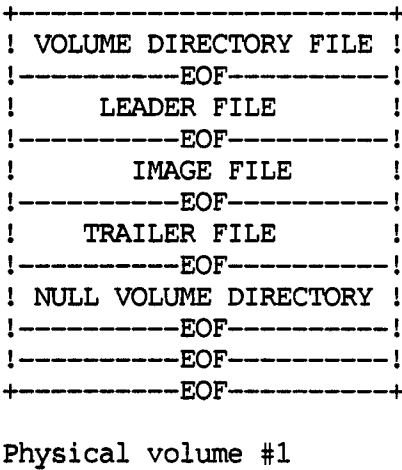


Figure 3.4
BIL/6250 bpi/quadrant/CCT-PT layout

CHAPTER 4

INPE LANDSAT TM CCT FORMAT DEFINITION

4.1 SUPERSTRUCTURE CONCEPTS OVERVIEW

The standard format family is based on superstructure concepts which comprises four distinct hierarchical levels of data organization : volume, file, record and data field level. A group of files compose a logical volume which may be stored in several physical volumes (tapes) and a physical volume may store several logical volumes.

The two basic components of the superstructure are the volume directory file and the file descriptor record.

At the highest level, a logical volume is introduced by the volume directory file which identifies and defines the logical volume. It is the first file recorded on a volume and is composed of a volume descriptor record, file pointer records (one for each subsequent data file) and optionally a text record. The end of a set of logical volumes is marked by a null volume directory file. This file is composed by an updated volume descriptor record.

Besides these superstructure files, there are four data file classes :

CLASS NAME	CLASS CODE	FILE CONTENT
LEADER FILE	LEAD	scene related information
IMAGERY FILE	IMGY	image data
TRAILER FILE	TRAI	trailer data
SUPPLEMENTAL FILE	SUPP	ancillary data

The file descriptor record is the first record within each data file and it defines the internal structure of the file providing parameters to interpret its content. It is separated into two segments, a fixed segment and a variable segment. The fixed segment format is predefined by the superstructure and contains the file number, class and name, and specifies the location and format of the introductory information (sequence number, type codes and record length) within the data records. The variable segment format is unique for each file class, and contains information concerning the content of the file. When a file is split

between tapes, the file descriptor record appears only once at the beginning of the file.

Within each record, the first six fields are generally used to specify the record sequence number, the record type code and sub-type codes (3 sub-types) and the record length. These fields are always stored in binary and constitute what is called the record identification segment.

4.2 INPE LANDSAT TM CCT FILES

4.2.1 IMAGERY LOGICAL VOLUME

4.2.1.1 IMAGERY VOLUME DIRECTORY FILE

The imagery volume directory is the first file of every INPE LANDSAT TM physical volume. It consists of a text record, volume descriptor record and file pointer records.

4.2.1.1.1 **TEXT RECORD** - This record appears only in the first volume directory file of the imagery logical volume. It contains general information about the product, under an easily readable format. Tape and scene identification, time and date of creation, are for instance part of the information.

4.2.1.1.2 **VOLUME DESCRIPTOR RECORD** - The volume descriptor record is separated into five segments, which are the record identification, superstructure documentation identification, volume identification, a spare segment and a local use segment. It contains all information about the identification and organization of the logical volume, such as the number of physical volumes in this logical volume, identification of the current physical volume and the product identification. In addition, it specifies the number of data files in the logical volume.

Some fields of this record are updated whenever a new physical volume is initiated in order to reflect the actual state of the logical volume. When there is no text record in the volume, the volume descriptor is the first record of the volume.

4.2.1.1.3 **FILE POINTER RECORD** - This record points to a specific file in the logical volume. For each file within the logical volume there is one file pointer record. It is separated into four segments : the record identification, file identification, a spare segment and a local use segment.

The file identification consists of the file number, name and class, file data type and type code, number of records within the file, record length and length type, and file location within the logical volume.

4.2.1.2 LEADER FILE

This file is the second one in a logical volume, it comes just after the imagery volume directory file. It supplies useful information associated with the scene, like map projection data, radiometric data and detailed scene identification.

4.2.1.2.1 LEADER FILE DESCRIPTOR RECORD - This is the first record in the leader file and its variable segment gives the number and length of all types of records contained within the file. In addition, it supplies locators to important fields which permit their precise localization within the file.

Locators for the leader file are sixteen bytes long with the following format :

BYTES	CONTENT
1-6	sequence number of the record containing the field
7-12	byte number of first byte of field
13-15	length of the field in bytes
16	type of data in the field : A - alphanumeric (ASCII or EBCDIC) B - binary N - numeric (ASCII or EBCDIC)

4.2.1.2.2 SCENE HEADER RECORD - The scene header record contains the product identification, the input scene identification, the processed scene identification and the processing options.

4.2.1.2.3 MAP PROJECTION DATA RECORD - This record contains geometric characteristics of the scene and includes the basic parameters for the UTM and SOM map projections. In the case of a CCT-PT, the information necessary to relate image and projection coordinates is given here.

4.2.1.2.4 RADIOMETRIC CALIBRATION DATA RECORD - This record contains the look-up tables (LUTs) assigned to a particular spectral band. There will be as many records as spectral bands requested. If the imagery data is raw video data, the LUTs must be applied to calibrate the video. If the imagery data is calibrated video, the LUTs are those used to calibrate the video. If the imagery data is a radiometrically processed special product, the LUTs are those used to "special" process the calibrated video. In addition, an offset and a gain coefficients are supplied to allow transformation of the calibrated video gray levels into radiance values.

4.2.1.3 IMAGERY FILE

The imagery file contains the video data of one spectral band in BSQ format or the video of all requested bands in BIL format. Each record within the file comprises the video data and some support data such as scan time, scan line number and quality codes. The support data may appear at the beginning of the record, where it is called prefix data, or at the end, where it is called suffix data.

The first record of this file is the file descriptor record, which contains information about the image data records.

4.2.1.3.1 IMAGERY FILE DESCRIPTOR RECORD - This is the first record in the imagery file and its variable segment gives the number and length of the records contained within the file, the organization of the pixels within a group of bytes, the organization of multispectral lines within the records and other important information about the data organization. In addition, it supplies locators to important fields which permit their precise localization within the record.

Locators for the imagery file are eight bytes long with the following format:

BYTES	CONTENT
1-4	first byte number of the field, within prefix or suffix.
5-6	length of the field in bytes
7	indicator to field location : P - field is in prefix S - field is in suffix
8	type of data in the field : A - alphanumeric (ASCII or EBCDIC) B - binary N - numeric (ASCII or EBCDIC)

4.2.1.3.2 **IMAGE DATA RECORD** - This record contains one scan line of image data from one spectral band, prefix and suffix data and the standard introductory data. The record length depends on the size of the image, if it is a full frame image or a quadrant image.

4.2.1.4 **TRAILER FILE**

The trailer file is present on the logical volume, but until the moment it contains no useful data.

4.2.2 **SUPPLEMENTAL VOLUME**

4.2.2.1 **SUPPLEMENTAL VOLUME DIRECTORY FILE**

The supplemental volume directory is the first file of the supplemental volume, and comes immediately after the Trailer file of the Imagery Logical Volume. Note that the supplemental volume is not present in a CCT-PT.

It consists of a volume descriptor record and a file pointer record.

4.2.2.1.1 **VOLUME DESCRIPTOR RECORD** - The volume descriptor record contains all information about the identification and organization of the logical volume, such as identification of the current physical volume and the product identification. In addition, it specifies the number of data files in the logical volume.

4.2.2.1.2 **FILE POINTER RECORD** - This record points to a specific file in the logical volume. In the Supplemental volume there is one file pointer record, since there is only one file in this volume.

4.2.2.2 **SUPPLEMENTAL FILE**

This is the only file in the supplemental volume. It contains the data necessary to geometrically correct the image. These data is in the form of geodetic coordinates (latitude and longitude) for a grid indexed by line and pixel numbers in the image. This file is composed of a file descriptor record and a certain number of geometric modeling data records, depending on the required geometric level. This number of records is usually 50, for geometric levels 1 to 3, or 386 for geometric level 4.

Note that the geometric modeling data cover always the full frame, even if the product is a quadrant.

4.2.2.2.1 VOLUME DESCRIPTOR RECORD - The first record of the supplemental file is the volume descriptor record, which describes the organization of the supplemental file. This file contains the number of data records in the file.

4.2.2.2.2 GEOMETRIC MODELING DATA RECORDS - These records contain the latitude and longitude for the predefined grid of lines and pixels. These coordinates apply to the center line of the sweep, midway between lines 8 and 9. The pixel numbering refers to the aligned video line, which comprises 6487 pixels. In this numbering scheme, the first recorded pixel in the CCT is pixel number:

- 184, for the full scene CCTs,
- 1 for the left side (A, C, W) quadrant CCTs,
- 3245 for the right side (B, D, E) quadrant CCTs, and
- 1623 for the middle (N, S, X) quadrant CCTs.

Each record contains the sweep number and 18 pairs (pixel number, geodetic coordinates).

4.2.3 NULL VOLUME

4.2.3.1 NULL VOLUME DIRECTORY FILE

The null volume directory file is the end of set of volumes marker. It comes after the last file of the last logical volume. It comprises an updated volume descriptor record.

4.2.3.1.1 VOLUME DESCRIPTOR RECORD - This record is basically the volume descriptor record that appears in the preceeding volume directory files, but several fields are now blank filled.

4.2.3 SUMMARY OF FILES AND RECORDS

IMAGERY VOLUME

IMAGERY VOLUME DIRECTORY FILE

! Record	! Record	Record Type				!
! Name	! Length	T	S1	S2	S3	!
! Text record	! 360	! 077	! 022	! 022	! 022	!
! Volume descriptor	! 360	! 300	! 300	! 022	! 022	!
! File pointer	! 360	! 300	! 333	! 022	! 022	!

LEADER FILE

! Record	! Record	Record Type (octal)				!
! Name	! Length	T	S1	S2	S3	!
! File descriptor	! 4320	! 300	! 077	! 022	! 022	!
! Scene header	! 4320	! 022	! 022	! 022	! 011	!
! Map projection data	! 4320	! 044	! 044	! 022	! 011	!
! Radiometric calibration	! 4320	! 044	! 077	! 022	! 022	!

IMAGERY FILE (full frame)

! Record	! Record	Record Type (octal)				!
! Name	! Length	T	S1	S2	S3	!
! File descriptor	! 6300	! 300	! 077	! 022	! 022	!
! Image data	! 6300	! 355	! 355	! 333	! 011	!

IMAGERY FILE (quadrant)

! Record	! Record	Record Type (octal)				!
! Name	! Length	T	S1	S2	S3	!
! File descriptor	! 3600	! 300	! 077	! 022	! 022	!
! Image data	! 3600	! 355	! 355	! 333	! 011	!

TRAILER FILE

! Record	! Record	Record Type (octal)				!
! Name	! Length	T	S1	S2	S3	!
! File descriptor	! 4320	! 300	! 077	! 022	! 022	!
! Trailer record	! 4320	! 366	! 022	! 022	! 022	!

SUPPLEMENTAL VOLUME (only CCT-AT)

SUPPLEMENTAL VOLUME DIRECTORY FILE

! Record	! Record	Record Type				!
! Name	! Length	T	S1	S2	S3	!
! Volume descriptor	! 360	! 300	! 300	! 022	! 022	!
! File pointer	! 360	! 300	! 333	! 022	! 022	!

SUPPLEMENTAL FILE

! Record	! Record	Record Type				!
! Name	! Length	T	S1	S2	S3	!
! File descriptor	! 360	! 300	! 077	! 022	! 022	!
! Geometric modeling	! 360	! 044	! 044	! 022	! 022	!

NULL VOLUME

NULL VOLUME DIRECTORY FILE

! Record	! Record	Record Type				!
! Name	! Length	T	S1	S2	S3	!
! Volume descriptor	! 360	! 300	! 300	! 077	! 022	!

4.2.4 BLOCKING FACTOR

In order to make a 3-band corrected scene (CCT-PT) fit on a single tape reel, it was necessary to use a blocking factor of two(2) records per tape block. The block size for the imagery file on a CCT-PT is, therefore, 7200, and the file descriptor for the imagery file is placed on a single block, without video data. Therefore, the first line of video data is located in block 2, record 1, that is the third record of the imagery file.

APPENDIX A

INPE LANDSAT TM CCT FILES FORMAT LAYOUT

This appendix presents the layout of all records defined in the preceding chapters.

The data specified in the layouts have the following data types :

- A - alphanumeric coded in ASCII
- N - numeric coded in ASCII
- B - binary

A string of alphanumeric data represented in ASCII is always left justified and blank filled on the right and a string of numeric data is right justified and blank filled at left. An ASCII character occupies the low order seven bits of a byte and the eighth bit is zero.

The binary data is represented in the following formats, compatible with DEC VAX 11/780 data representation :

- Byte - One byte unsigned integer (8 bits)
- Integer*2 - Single precision integer (16 bits)
- Integer*4 - Double precision integer (32 bits)
- Real*4 - Single precision floating point (32 bits)
- Real*8 - Double precision floating point (64 bits)

In the layouts, each field may be located within the record by the columns POS and SIZE. POS indicates the number of the first byte of the field within the record (first byte is byte 1), and SIZE indicates the field size in bytes.

By default, binary data with no format specification in the layouts are INTEGER*n data, where n is the size of the field (INTEGER*1 = BYTE).

For better illustration, blanks in the layouts are sometimes represented as dollar signs.

IMAGERY VOLUME DIRECTORY FILE
TEXT RECORD

A.1 IMAGERY VOLUME DIRECTORY FILE

A.1.1 TEXT RECORD

Seq	Field description	Type	Pos	Size	Unit	Format or value
1	Record sequence number	B	1	4		
2	Sub type code #1	B	5	1		022(8)
3	Type code	B	6	1		077(8)
4	Sub type code #2	B	7	1		022(8)
5	Sub type code #3	B	8	1		022(8)
6	Length of this record	B	9	4		360
7	ASCII/EBCDIC flag	A	13	2		A\$
8	Blanks					\$
9	Product type	A	15	2		\$
		A	17	48		PRODUCT\$:
						\$LANDSAT\$TM\$ffff\$RAW
						\$LANDSAT\$TM\$fffn\$
						SYSTEM\$CORRECTED
						s = Mission number (4 or 5)
						fff = BIL or BSQ
						n = number of bands
						<LF><CR>
10	Carriage return / line feed	A	65	2		
11	Location and date/time of creation	A	67	64		PROCESSED\$:
						\$BRASIL\$INPE\$
						ON\$:\$DD-MMM-YYYY\$
						AT\$:\$HH-MM-SS.MM\$
						<LF><CR>
						IMAGED\$ON\$:\$DD-MMM-YYYY
						<LF><CR>
						SCENE\$IDENTIFICATION\$:
						\$TMSYYDDHHMMSS.T
						s = Mission number (4 or 5)
						<LF><CR>
16	Carriage return / line feed	A	207	2		
17	Quadrant	A	209	16		QUADRANT:\$X
18	Carriage return / line feed	A	225	2		<LF><CR>
19	Bands processed	A	227	16		BANDS\$:\$1234567
20	Carriage return / line feed	A	243	2		<LF><CR>
21	WRS location	A	245	40		WRS\$:\$PPP-RRR
						\$ASCENDING\$OUT\$OF\$GRID
						PPP = Path number
						RRR = Row number
						<LF><CR>
22	Carriage return / line feed	A	285	2		
23	Center coordinates	A	287	32		LAT/LONG\$:
						\$SDD:MM:SS/WDD:MM:SS
24	Carriage return / line feed	A	319	2		
25	Blanks	A	321	40		<LF><CR>

IMAGERY VOLUME DIRECTORY FILE
IMAGERY VOLUME DESCRIPTOR RECORD

A.1.1.2 IMAGERY VOLUME DESCRIPTOR RECORD

Seq	Field description	Type	Pos	Size	Unit	Format or value
1	Record sequence number	B	1	4	I	
2	Sub type code #1	B	5	1	I	300(8)
3	Type code	B	6	1	I	300(8)
4	Sub type code #2	B	7	1	I	022(8)
5	Sub type code #3	B	8	1	I	022(8)
6	Length of this record	B	9	4	I	360
7	ASCII/EBCDIC flag	A	13	2	I	A\$
8	2 Blanks	A	15	2	I	\$
9	Superstructure control document ID	A	17	12	I	CCB-CCT-0002
10	Superstructure control document revision number	A	29	2	I	\$D
11	Superstructure record format revision letter number	A	31	2	I	\$A
12	Software Release Number	A	33	12	I	3\$\$\$\$\$
13	Tape ID of current physical volume	A	45	16	I	YDDHH-rrrr/nn rrrr = request number nn = physical volume (01)
14	Logical Volume ID	A	61	16	I	YDDHHMSS.T
15	Volume Set ID	A	77	16	I	LANDSAT\$TM\$
16	Number of tapes on logical volume	N	93	2	I	FORTRAN I2 format
17	First physical volume of logical volume	N	95	2	I	\$1
18	Last physical volume of logical volume	N	97	2	I	FORTRAN I2 format
19	Current Physical Volume number	N	99	2	I	FORTRAN I2 format
20	First file number in this physical volume	N	101	4	I	FORTRAN I4 format
21	Logical volume number within volume set	N	105	4	I	FORTRAN I4 format
22	Logical volume number within physical volume	A	109	4	I	FORTRAN I4 format
23	Logical volume creation date	A	113	8	I	\$\$\$1 YYYYMMDD
24	Logical volume creation time	A	121	8	I	HMMSSXX
25	Logical volume generation country	A	129	12	I	BRASIL\$\$\$\$\$
26	Logical volume generation agency	A	141	8	I	INPE\$\$\$\$\$
27	Logical volume generation facility	A	149	12	I	DGI\$\$\$\$\$
28	Number of file pointers in volume directory	N	161	4	I	FORTRAN I4 format
29	Number of records in volume directory	N	165	4	I	FORTRAN I4 format
30	Volume spare segment	A	169	92	I	BLANKS
	Local Use Segment					
	Scene identification					
31	Instrument	A	261	2	I	TM
32	Satellite	A	263	1	I	4 or 5
33	Separator	A	264	1	I	-
34	Revolution	N	265	5	I	FORTRAN I5.5 format
35	Separator	A	270	1	I	-
36	Row	N	271	3	I	FORTRAN I3.3 format
37	Separator	A	274	1	I	-

IMAGERY VOLUME DIRECTORY FILE
IMAGERY VOLUME DESCRIPTOR RECORD

! Seq !	Field description	!Type!	Pos !	Size !	Unit !	Format or value	!
! 38 !	Type of run	! A !	275 !	1 !	!	C	!
! 39 !	Number of the run	! N !	276 !	3 !	!	FORTRAN I3 format	!
! 40 !	Separator	! A !	279 !	1 !	!	-	!
! 41 !	Quadrant code	! A !	280 !	1 !	!	A, B, C, D, N, S, W, E or X	!
! 42 !	Separator	! A !	281 !	1 !	!	-	!
! 43 !	Interleaving indicator	! A !	282 !	3 !	!	BIL or BSQ	!
! 44 !	Separator	! A !	285 !	1 !	!	-	!
! 45 !	Processed bands	! A !	286 !	7 !	!	one character per band	!
! 46 !	Blank	!	!	!	!	!	!
! 47 !	Instrument	! A !	293 !	1 !	!	!	!
! 48 !	Satellite	! A !	294 !	2 !	!	TM	!
! 49 !	Scene center time	! A !	296 !	1 !	!	4 or 5	!
! 50 !	WRS designator	! A !	297 !	16 !	!	YDDDDHHMMSSMMFF	!
! 51 !	Path number	!	!	!	!	!	!
! 51 !	Orbital direction	! N !	313 !	3 !	!	FORTRAN I3 format	!
! 52 !	Row number	! A !	316 !	1 !	!	A or D	!
! 53 !	Out of WRS grid indicator	! N !	317 !	3 !	!	FORTRAN I3 format	!
! 54 !	Acquisition date	! A !	320 !	1 !	!	+ if out of grid, else blank	!
! 55 !	GMT acquisition time	! A !	321 !	8 !	!	YYYYMMDD	!
! 56 !	Blank	! A !	329 !	8 !	!	HMMSSXX	!
! 57 !	INPE processing type	! A !	337 !	1 !	!	!	!
! 58 !	Scene center latitude	! A !	338 !	3 !	!	HIC,HDC,CDC ...	!
! 59 !	Scene center longitude	! A !	341 !	10 !	!	NDDD:MM:SS or SDDD:MM:SS	!
		! A !	351 !	10 !	!	EDDD:MM:SS or WDDD:MM:SS	!

IMAGERY VOLUME DIRECTORY FILE
FILE POINTER RECORD

A.1.1.3 FILE POINTER RECORD

Seq	Field description	Type	Pos	Size	Unit	Format or value
1	Record sequence number	B	1	4		
2	Sub type code #1	B	5	1		333(8)
3	Type code	B	6	1		300(8)
4	Sub type code #2	B	7	1		022(8)
5	Sub type code #3	B	8	1		022(8)
6	Length of this record	B	9	4		360
7	ASCII/EBCDIC flag	A	13	2		A\$
8	2 Blanks	A	15	2		\$
9	Referenced file number (position after volume directory)	N	17	4		FORTRAN I4 format
10	Referenced file name	A	21	16		LSnT\$RFFFFXX\$
						R - 'A' for AT, 'p' for PT
						FFFF - LEAD, IMGY or TRAI
						XXX - BSQ or BIL
11	Referenced file class	A	37	28		LEADER
						IMAGERY
						TRAILER
12	Referenced file class Code	A	65	4		LEAD
						IMGY
						TRAI
13	Referenced file data type	A	69	28		BINARY\$ONLY
						MIXED\$BINARY\$AND\$ASCII
						8\$BIT\$ASCII\$ONLY
14	Referenced file data type class	A	97	4		BINO
						MBAA
						ASCO
15	Number of records in file	N	101	8		FORTRAN I8 format
16	Referenced file descriptor record length	N	109	8		FORTRAN I8 format
17	Referenced file maximum record length	N	117	8		FORTRAN I8 format
18	Referenced file record length type	A	125	12		FIXED\$LENGTH
						VARIABLE\$LEN
19	Referenced file record length type code	A	137	4		FIXD
						VARE
20	Physical volume containing first referenced file record	N	141	2		FORTRAN I2 format
21	Physical volume containing last referenced file record	N	143	2		FORTRAN I2 format
22	Referenced file first record in this physical volume	N	145	8		FORTRAN I8 format
23	File pointer spare segment	A	153	108		
24	Local use segment	A	261	100		

LEADER FILE
LEADER FILE DESCRIPTOR RECORD

A.2 LEADER FILE

A.2.1 LEADER FILE DESCRIPTOR RECORD

Seq	Field description	Type	Pos	Size	Unit	Format or value
1	FILE DESCRIPTOR FIXED SEGMENT					
1	Record sequence number	B	1	4		077(8)
2	Sub type code #1	B	5	1		300(8)
3	Type code	B	6	1		022(8)
4	Sub type code #2	B	7	1		022(8)
5	Sub type code #3	B	8	1		4320
6	Length of this record	B	9	4		A\$
7	ASCII/EBCDIC Flag	A	13	2		\$
8	Blanks	A	15	2		CCB-CCT-0002
9	Superstructure control document	A	17	12		\$D
10	Revision number of above document	A	29	2		\$A
11	Revision number of file format	A	31	2		3\$\$\$\$\$\$\$\$\$
12	Software release number	A	33	12		FORTRAN I4 format
13	File number within logical volume	N	45	4		LSSTM\$RLEADBSQ\$
14	Referenced file name	A	49	16		LSSTM\$RLEADBIL\$
15	Record sequence and location type flag	A	65	4		s = Mission number (4 or 5)
16	Sequence number location	A	69	8		FSEQ
17	Sequence number field length	A	77	4		\$\$\$\$\$1
18	Record code and location type flag	A	81	4		\$\$\$4
19	Record code location	A	85	8		FTYP
20	Record code field length	A	93	4		\$\$\$\$\$\$\$5
21	Record length and location type flag	A	97	4		\$\$\$4
22	Record length location	A	101	8		FLGT
23	Record length field length	A	109	4		\$\$\$\$\$\$\$9
24	Flag indicating whether data interpretation information is included in the file descriptor record	A	113	1		\$\$\$4
25	Flag indicating whether data interpretation information is included in records other than file descriptor	A	114	1		N
26	Flag indicating whether data display information is included in the file descriptor record	A	115	1		N
27	Flag indicating whether data display information is included in records other than file descriptor	A	116	1		N
28	Reserved segment	A	117	64		
29	Number of scene header records	N	181	6		FORTRAN I6 format
30	Scene header record length	N	187	6		FORTRAN I6 format
31	Number of map projection records	N	193	6		FORTRAN I6 format

LEADER FILE
LEADER FILE DESCRIPTOR RECORD

! Seq !	! Field description !	! Type !	! Pos !	! Size !	! Unit !	! Format or value !
! 32 !	! Map projection record length !	! N !	! 199 !	! 6 !	! !	! FORTRAN I6 format !
! 33 !	! Number of radiometric calibration records !	! N !	! 205 !	! 6 !	! !	! FORTRAN I6 format !
! 34 !	! Radiometric calibration record length !	! N !	! 211 !	! 6 !	! !	! FORTRAN I6 format !
! 35 !	! Locator format : !	! !	! !	! !	! !	! !
! 36 !	! hhhhhhhhhhhhhhhhhhh !	! !	! !	! !	! !	! !
! 37 !	! where : !	! !	! !	! !	! !	! !
! 38 !	! hhhhhh - record number containing the field !	! !	! !	! !	! !	! !
! 39 !	! bbbbb - number of first byte in field !	! !	! !	! !	! !	! !
! 40 !	! lll - field length in bytes !	! !	! !	! !	! !	! !
! 41 !	! t - type of data : A, B or N !	! !	! !	! !	! !	! !
! 42 !	! Scene identification field locator !	! A !	! 217 !	! 16 !	! !	! 000002000037016A !
! 43 !	! WRS identification field locator !	! A !	! 233 !	! 16 !	! !	! 000002000165016A !
! 44 !	! Mission identification field locator !	! A !	! 249 !	! 16 !	! !	! 000002000309016A !
! 45 !	! Sensor identification field locator !	! A !	! 265 !	! 16 !	! !	! 000002000325016A !
! 46 !	! Scene center date-time field locator !	! A !	! 281 !	! 16 !	! !	! 000002000117032A !
! 47 !	! Geographic reference field locator !	! A !	! 297 !	! 16 !	! !	! 000002000213032N !
! 48 !	! Image processing parameters field locator !	! A !	! 313 !	! 16 !	! !	! 000002001477096A !
! 49 !	! Imagery interleaving format field locator !	! A !	! 329 !	! 16 !	! !	! 000002001717016A !
! 50 !	! Processed bands field locator !	! A !	! 345 !	! 16 !	! !	! 000002001653064A !
! 51 !	! Blanks !	! A !	! 361 !	! 16 !	! !	! !
! 52 !	! Pixel size field locator !	! A !	! 377 !	! 16 !	! !	! 000003000365032N !
! 53 !	! Number of interquadrant overlap lines !	! A !	! 393 !	! 16 !	! !	! 000002000277016N !
! 54 !	! indicator field locator !	! !	! !	! !	! !	! !
! 55 !	! Number of interquadrant overlap pixels !	! A !	! 409 !	! 16 !	! !	! 000002000293016N !
! 56 !	! indicator field locator !	! !	! !	! !	! !	! !
! 57 !	! Blanks !	! A !	! 425 !	! 3896 !	! !	! !

LEADER FILE
SCENE HEADER RECORD

A.2.2 SCENE HEADER RECORD

Seq	Field description	Type	Pos	Size	Unit	Format or value
1	Record sequence number	B	1	4		
2	Sub type code #1	B	5	1		022(8)
3	Type code	B	6	1		022(8)
4	Sub type code #2	B	7	1		022(8)
5	Sub type code #3	B	8	1		011(8)
6	Length of this record	B	9	4		4320
7	Header record sequence number	A	13	4		\$\$\$1
8	Blanks	A	17	4		\$\$\$
	Input scene parameters					
	Product identification					
9	Product identification	A	21	16		INPE\$LSTM\$RAW
	Input scene identification					
10	Input scene identification	A	37	16		INPE\$LSTM\$SYSCOR
	Input scene center latitude					
11	Input scene center latitude	N	53	16	degrees	s = Mission number (4 or 5)
12	Input scene center longitude	N	69	16	degrees	TMSYYDDDDHHMMSS.T
13	Line number at input scene center	N	85	16		s = Mission number (4 or 5)
14	Pixel number at input scene center	N	101	16		FORTTRAN F16.7
15	Input scene center time	A	117	32		FORTTRAN F16.7
16	Time offset from WRS	N	149	16	millisecon	FORTTRAN F16.7 format
17	WRS designator	A	165	16		YYDDDDHHMMSSMMFF
	M = mission					FORTTRAN I16 format
	PPP = path					MPPPPRR
	RRR = row					
18	WRS cycle	N	181	16		FORTTRAN I16 format
	Processed scene parameters (quadrant x)					
	Processed scene identification					
19	Processed scene identification	A	197	16		TMSYYDDDDHHMMSS/x
	Processed scene center latitude					s = Mission number (4 or 5)
20	Processed scene center longitude	N	213	16	degrees	x = Quadrant code
21	Line number at processed scene center	N	229	16	degrees	FORTTRAN F16.7
22	Pixel number at processed scene center	N	245	16		FORTTRAN F16.7
23	Vertical quadrant overlap	N	261	16		FORTTRAN F16.7 format
24	Horizontal quadrant overlap	N	277	16		FORTTRAN F16.7 format
25	Mission ID	A	293	16		FORTTRAN I16 format
26	Sensor ID	A	309	16		LANDSAT\$s
27	Orbit number	N	325	16		TM
28	Orbital direction	A	341	16		FORTTRAN I16 format
29		A	357	16		ASCENDING

LEADER FILE
SCENE HEADER RECORD

Seq	Field description	Type	Pos	Size	Unit	Format or value
30	Blanks	A	373	16		DESCENDING
31	Blanks for local use	A	389	1024		
32	Number of active bands in processed scene	N	1413	16		FORTTRAN I16 format
33	Number of scene pixels per line	N	1429	16		FORTTRAN I16 format
34	Number of lines in processed scene	N	1445	16		FORTTRAN I16 format
35	First recorded pixel referred to aligned video line	N	1461	16		FORTTRAN I16 format
	Processing parameters					
	Each processing option designator may be considered as a					
	string of 16 1-byte codes, each specifying whether the					
	identified correction has been applied (value='Y') or					
	has not been applied (value='N').					
36	Radiometric calibration designator	A	1477	16		
	The first seven bytes represent the following options:					
	BYTE					
	OPTION					
	1 Internal calibration source					
	2 Pre-flight data					
	3 Histogram equalization					
	4 Sun elevation correction					
	5 Film gamma correction					
	6 Scenic correction					
	7 Histogram mean and standard deviation					
	Bytes 10 through 16 take the value 'N'.					
37	Blanks	A	1493	16		
38	Radiometric correction designator	A	1509	16		
	The first eight bytes represent the following options					
	BYTE					
	OPTION					
	1 Completely raw data					
	2 Linear representation					
	3 Logarithmic representation					
	4 Other non-linear representation					
	5 Reserved (set to 'N')					
	6 Sun illumination angle correction					
	7 Haze correction					
	8 Sun illumination and haze correction					
	Bytes 9 through 16 take the value 'N'.					
39	Geometric correction designator	A	1525	16		
	The first 13 bytes represent corrections using the following					
	options					
	BYTE					
	OPTION					
	1 Forward/reverse alignment					
	2 Detector placement and delay					

LEADER FILE
SCENE HEADER RECORD

Seq	Field description	Type	Pos	Size	Unit	Format or value
1	3 Mirror scan profile	!	!	!	!	!
1	4 Line length information	!	!	!	!	!
1	5 Gyro data	!	!	!	!	!
1	6 Angular displacement sensor (ADS) data	!	!	!	!	!
1	7 Attitude correction system (ACS) data	!	!	!	!	!
1	8 Ephemeris data	!	!	!	!	!
1	9 Scan gap	!	!	!	!	!
1	10 Groun control points	!	!	!	!	!
1	11 Earth rotation	!	!	!	!	!
1	12 Sensor altitude and panoramic distortion	!	!	!	!	!
1	13 Digital terrain model (DTM)	!	!	!	!	!
1	Bytes 14 through 16 contain 'N'.	!	!	!	!	!
40	Resampling designator	!	!	!	!	!
1	The first 3 bytes represent the following options	A	1541	16	!	!
1	BYTE	!	!	!	!	!
1	1 No resampling	!	!	!	!	!
1	2 Resampling along-line only	!	!	!	!	!
1	3 Two-dimensional resampling	!	!	!	!	!
1	Bytes 4 through 12 take the value 'N'.	!	!	!	!	!
1	The last 4 bytes take one of the following codes:	!	!	!	!	!
1	NONE - None	!	!	!	!	!
1	NN\$\$ - Nearest neighbour	!	!	!	!	!
1	CC\$\$ - Cubic convolution	!	!	!	!	!
41	Map projection identifier	!	!	!	!	!
1	The first 4 bytes represent the following options:	A	1557	16	!	!
1	BYTE	!	!	!	!	!
1	1 No projection	!	!	!	!	!
1	2 UTM (Universal Transverse Mercator)	!	!	!	!	!
1	projection	!	!	!	!	!
1	3 SOM (Space Oblique Mercator) projection	!	!	!	!	!
1	4 Geocoded product	!	!	!	!	!
1	Bytes 5 through 16 take the value 'N'.	!	!	!	!	!
42	Product class	!	!	!	!	!
1	The product class is represented by two numeric characters	!	!	!	!	!
1	representing the overall level of corrections applied.	!	!	!	!	!
1	The normal values for this field are:	!	!	!	!	!
1	02 - for the geometrically uncorrected products	!	!	!	!	!
1	04 - for the products which have been geometrically	!	!	!	!	!
1	corrected only in the along-scan direction for	!	!	!	!	!
1	the effects of detector placement and delays,	!	!	!	!	!
1	mirror scan profile and line length variation,	!	!	!	!	!
1	to ensure the video continuity between conse-	!	!	!	!	!
1	cutive sweeps.	!	!	!	!	!
1	05 - for the products that have been geometrically	!	!	!	!	!

LEADER FILE
SCENE HEADER RECORD

! Seq !	Field description	!Type!	Pos !	Size !	Unit	! Format or value
! !	! ! corrected in both directions, using attitude	! !	! !	! !	! !	! !
! !	! ! and ephemeris data, without GCPs.	! !	! !	! !	! !	! !
! 43 !	! ! Number of map projection records	! N !	! 1589 !	! 16 !	! !	! FORTRAN 116 format
! 44 !	! ! Blanks	! A !	! 1605 !	! 16 !	! !	! !
! 45 !	! ! Blanks	! A !	! 1621 !	! 16 !	! !	! !
! 46 !	! ! Number of radiometric records	! N !	! 1637 !	! 16 !	! !	! FORTRAN 116 format
! 47 !	! ! Bands present	! A !	! 1653 !	! 64 !	! !	! 1111111...
! !	! !	! !	! !	! !	! !	! 0 - absent
! !	! !	! !	! !	! !	! !	! 1 - present
! 48 !	! ! Interleaving indicator	! A !	! 1717 !	! 16 !	! !	! BIL or BSQ
! 49 !	! ! Detector substitution array	! N !	! 1733 !	! 400 !	! !	! FORTRAN 100I4 format
! 50 !	! ! Detector smoothing array	! N !	! 2133 !	! 100 !	! !	! FORTRAN 100A1 format
! 51 !	! ! Blanks	! A !	! 2233 !	! 548 !	! !	! !
! 52 !	! ! Spare	! A !	! 2781 !	! 1540 !	! !	! !

LEADER FILE
MAP PROJECTION DATA RECORD

A.2.3 MAP PROJECTION DATA RECORD

Seq	Field description	Type	Pos	Size	Unit	Format or value
1	Record sequence number	B	1	4		
2	Sub type code #1	B	5	1		044(8)
3	Type code	B	6	1		044(8)
4	Sub type code #2	B	7	1		022(8)
5	Sub type code #3	B	8	1		011(8)
6	Length of this record	B	9	4		4320
	Input scene - full frame					
	Processed scene - quadrant					
	Input scene related data					
7	Nominal pixels per line	N	13	16		FORTTRAN I16 format
8	Nominal lines per scene number	N	29	16		FORTTRAN I16 format
9	Nominal inter-pixel distance at nadir	N	45	16	meter	FORTTRAN F16.7 format
10	Nominal inter-line distance at nadir	N	61	16	meter	FORTTRAN F16.7 format
11	Image skew at scene center	N	77	16	degree	*** NOT IMPLEMENTED ***
	UTM related data					
12	UTM datum and zone number	A	93	16		SAD\$69,I10
13	Nominal WRS northing of center	N	109	16	meter	FORTTRAN F16.7 format
14	Nominal WRS easting of center	N	125	16	meter	FORTTRAN F16.7 format
15	Northing of scene center	N	141	16	meter	FORTTRAN F16.7 format
16	Easting of scene center	N	157	16	meter	FORTTRAN F16.7 format
17	Vertical offset of scene center to WRS nominal center	N	173	16	meter	FORTTRAN F16.7 format
18	Horizontal offset of scene center to WRS nominal center	N	189	16	meter	FORTTRAN F16.7 format
19	Orientation of center	N	205	16	degree	FORTTRAN F16.7 format
	SOM related data					
20	Nominal WRS X coordinate of center	N	221	16	meter	FORTTRAN F16.7 format
21	Nominal WRS Y coordinate of center	N	237	16	meter	FORTTRAN F16.7 format
22	X coordinate of scene center	N	253	16	meter	FORTTRAN F16.7 format
23	Y coordinate of scene center	N	269	16	meter	FORTTRAN F16.7 format
24	Vertical offset of scene center to WRS nominal center	N	285	16	meter	FORTTRAN F16.7 format
25	Horizontal offset of scene center to WRS nominal center	N	301	16	meter	FORTTRAN F16.7 format
26	Orientation of center	N	317	16	degree	FORTTRAN F16.7 format
	Processed scene related data					
27	Pixels per line	N	333	16		FORTTRAN F16.7 format
28	Lines per scene	N	349	16		FORTTRAN F16.7 format
29	Nominal inter-pixel distance at nadir	N	365	16	meter	FORTTRAN F16.7 format
30	Nominal inter-line distance at nadir	N	381	16	meter	FORTTRAN F16.7 format
31	UTM zone number	N	397	16		FORTTRAN F16.7 format
32	Line number at WRS center	N	413	16		FORTTRAN F16.7 format
33	Pixel number at WRS center	N	429	16		FORTTRAN F16.7 format

LEADER FILE
MAP PROJECTION DATA RECORD

Seq	Field description	Type	Pos	Size	Unit	Format or value
34	Orientation of center	N	445	16	degree	FORTTRAN F16.7 format
35	Nominal satellite inclination	N	461	16	degree	FORTTRAN F16.7 format
36	Nominal ascending node longitude at equator	N	477	16	degree	FORTTRAN F16.7 format
37	Nominal satellite altitude	N	493	16	Km	FORTTRAN F16.7 format
38	Nominal ground speed	N	509	16	meter/sec	FORTTRAN F16.7 format
39	Satellite heading including earth rotation	N	525	16	degree	*** NOT IMPLEMENTED ***
40	Blank	A	541	16		
41	Cross-track field of view	N	557	16	degree	FORTTRAN F16.7 format
42	Sensor scan rate	N	573	16	scan/sec	FORTTRAN F16.4 format
43	Sensor active sampling rate	N	589	16	sample/sec	FORTTRAN F16.4 format
44	Sun elevation	N	605	16	degree	FORTTRAN F16.7 format
45	Sun azimuth	N	621	16	degree	FORTTRAN F16.7 format
46	Blanks	A	637	3684		

LEADER FILE
RADIOMETRIC CALIBRATION DATA RECORD

A.2.4 RADIOMETRIC CALIBRATION DATA RECORD

Seq	Field description	Type	Pos	Size	Unit	Format or value
1	Record sequence number	B	1	4		
2	Sub type code #1	B	5	1		077(8)
3	Type code	B	6	1		044(8)
4	Sub type code #2	B	7	1		022(8)
5	Sub type code #3	B	8	1		022(8)
6	Length of this record	B	9	4		4320
7	Band number	N	13	4		FORTRAN I4 format
8	Lower reflectance limit used in contrast stretch	N	17	4		*** NOT IMPLEMENTED ***
9	Upper reflectance limit used in contrast stretch	N	21	4		*** NOT IMPLEMENTED ***
10	Equalizing reference detector	N	25	4		FORTRAN I4 format
11	Radiance = Gray level * A1 + A0					
12	Offset coefficient (A0)	N	29	20	mW/cm2/sr/	FORTRAN E20.10 format
13	Gain coefficient (A1)	N	49	20	mW/cm2/sr/	FORTRAN E20.10 format
14	Det 1 look up table data	B	69	256		Byte
15	Det 2 look up table data	B	325	256		Byte
16	Det 3 look up table data	B	581	256		Byte
17	Det 4 look up table data	B	837	256		Byte
18	Det 5 look up table data	B	1093	256		Byte
19	Det 6 look up table data	B	1349	256		Byte
20	Det 7 look up table data	B	1605	256		Byte
21	Det 8 look up table data	B	1861	256		Byte
22	Det 9 look up table data	B	2117	256		Byte
23	Det 10 look up table data	B	2373	256		Byte
24	Det 11 look up table data	B	2629	256		Byte
25	Det 12 look up table data	B	2885	256		Byte
26	Det 13 look up table data	B	3141	256		Byte
27	Det 14 look up table data	B	3397	256		Byte
28	Det 15 look up table data	B	3653	256		Byte
29	Det 16 look up table data	B	3909	256		Byte
30	BLANKS	A	4165	156		

Seq	Field description	Type	Pos	Size	Unit	Format or value
1	FILE DESCRIPTOR FIXED SEGMENT					
2	Record Sequence Number	B	1	4		077(8)
3	Sub Type Code #1	B	5	1		300(8)
4	Type Code	B	6	1		022(8)
5	Sub Type Code #2	B	7	1		022(8)
6	Sub Type Code #3	B	8	1		3600 or 6300
7	Length of this Record	B	9	4		A\$
8	ASCI/EBDIC Flag	A	13	2		\$
9	Blanks	A	15	2		CCB-CCT-0002
10	Superstructure Control Document	A	17	12		\$D
11	Revision Number	A	29	2		\$A
12	Revision Letter Number	A	31	2		3\$\$\$\$\$\$\$\$\$
13	Software Release Number	A	33	12		FORTAN I4 format
14	File Number within Logical Volume	N	45	4		LSS\$TMSRIMGYBSQn
15	File name	A	49	16		(where n = Band number), or LSS\$TMSRIMGYBIL\$ S = Mission number (4 or 5) R = 'A' for AT, 'P' for PT
16	Record sequence and location type flag	A	65	4		FSEQ
17	Sequence Number Location	A	69	8		\$\$\$\$\$\$\$1
18	Sequence Number Field Len	A	77	4		\$\$\$4
19	Record code and location type flag	A	81	4		FTYP
20	Record code location	A	85	8		\$\$\$\$\$\$\$5
21	Record code field length	A	93	4		\$\$\$4
22	Record length and location type flag	A	97	4		FLGT
23	Record length location	A	101	8		\$\$\$\$\$\$\$9
24	Record length field length	A	109	4		\$\$\$4
25	Flag indicating whether data interpretation information is included in the file descriptor record	A	113	1		N
26	Flag indicating whether data interpretation information is included in records other than file descriptor	A	114	1		N
27	Flag indicating whether data display information is included in the file descriptor record	A	115	1		N
28	Flag indicating whether data display information is included in records other than file descriptor	A	116	1		N
29	Blanks	A	117	64		
30	FILE DESCRIPTOR VARIABLE SEGMENT					
31	Number of image records	N	181	6		FORTAN I6 format
32	Image record length	N	187	6		FORTAN I6 format

IMAGERY FILE
IMAGERY FILE DESCRIPTOR RECORD

Seq	Field description	Type	Pos	Size	Unit	Format or value
31	Blanks	A	193	24		
	Pixel Group Data					
32	Number of bits per pixel	A	217	4		\$\$\$8
33	Number of pixels per group	A	221	4		\$\$\$1
34	Number of bytes per group	A	225	4		\$\$\$1
35	Justification and order of pixels within data group	A	229	4		RJLR
	Image Data					
36	Number of spectral bands in this imagery file	N	233	4		FORTAN I4 format
37	Number of lines per band	N	237	8		FORTAN I8 format
38	Number of left border pixels	A	245	4		\$\$\$0
39	Number of image pixels per line	N	249	8		FORTAN I8 format
40	Number of right border pixels	A	257	4		\$\$\$0
41	Number of top border lines	A	261	4		\$\$\$0
42	Number of bottom border lines	A	265	4		\$\$\$0
43	Interleaving indicator	A	269	4		BSQ\$ or BIL\$
	Record Data					
44	Number of physical records per line	A	273	4		\$\$\$1 (\$\$0 for CCT-PT)
45	Number of physical records per multispectral line	N	277	4		FORTAN I4 format
46	Number of prefix bytes per record	A	281	4		\$\$\$20
47	Number of image bytes/record	A	285	8		\$\$\$3500 for quadrant
						\$\$\$6200 for full frame
48	Number of suffix bytes/record	A	293	4		
49	Prefix/suffix repeat flag	A	297	4		\$\$\$
	Prefix/Suffix Data Locators					
	Locator format :					
	bbbbllst					
	where :					
	bbbb - field first byte,					
	within prefix or suffix					
	ll - field length in bytes					
	s - field is in (P)refix					
	or (S)uffix					
	t - type of data : A - alphanumeric					
	B - binary					

IMAGERY FILE
IMAGERY FILE DESCRIPTOR RECORD

Seq	Field description	Type	Pos	Size	Unit	Format or value
	N - numeric					
50	Scan Line Number Locator	A	301	8		000104PB
51	Band Number Locator	A	309	8		000504PB
52	Time of Scan Line Locator	A	317	8		000904PB
53	Left-Fill Count Locator	A	325	8		001304PB
54	Rigth-Fill Count Locator	A	333	8		001704PB
55	Blanks	A	341	32		
56	Scan Line Quality Locator	A	373	8		000108SB for AT
57	Blanks	A	381	56		
58	Number of Left Fill Bits within Pixel	A	437	4		\$\$\$0
59	Number of Right Fill Bits within Pixel	A	441	4		\$\$\$0
60	Maximum Pixel Data Range	A	445	4		\$255
61	Blanks	A	449	3152		

IMAGERY FILE
QUADRANT IMAGE DATA RECORD

A.3.2 QUADRANT IMAGE DATA RECORD

Seq	Field description	Type	Pos	Size	Unit	Format or value
1	Record sequence number	B	1	4		
2	Sub type code #1	B	5	1		355(8)
3	Type code	B	6	1		355(8)
4	Sub type code #2	B	7	1		333(8)
5	Sub type code #3	B	8	1		11(8)
6	Length of this record	B	9	4		3600
	Prefix Data					
7	Scan Line Number	B	13	4		Integer*4
8	Image Band Number	B	17	4		Integer*4
9	Time in GMT at SLS for AT	B	21	4	milliseconds	Integer*4
10	Count of Left Fill Pixels	B	25	4		Integer*4
11	Count of Right Fill Pixels	B	29	4		Integer*4
	Image Data					
12	Image Pixels	B	33	3500		Byte
	Suffix Data (not present for PT)					
13	Scan Line Quality	B	3533	1		Byte
14	Sync Loss indicator (1-sync loss 0-no)	B	3534	1		Byte
15	Local use quality code	B	3535	1		Byte
16	Detector substitution indicator (1=yes 0-no)	A	3536	5		
17	Counted full-scan line length	B	3541	4		Integer*4
18	Embedded line length	B	3545	4		Integer*4
19	Time Error from line start to mid scan	B	3549	2	clock coun	Integer*2
20	Time Error from mid scan to line end	B	3551	2	clock coun	Integer*2
21	Scan line direction	B	3553	4	1=>forward 0=>reverse	Integer*4
22	Current line length	B	3557	4		Integer*4
	Satellite time code at SLS					
	Time is coded in a BCD format, using four bits per unit in the sequence :					
23	Zero, 100s of days	B	3561	1		Byte
24	10s of days, Units of days	B	3562	1		Byte
25	10s of hours, Units of hours	B	3563	1		Byte
26	10s of minutes, Units of minutes	B	3564	1		Byte
27	10s of seconds, Units of seconds	B	3565	1		Byte
28	100s of milliseconds, Tens of milliseconds	B	3566	1		Byte
29	Units of milliseconds, 1/16 of milliseconds	B	3567	1		Byte

IMAGERY FILE
QUADRANT IMAGE DATA RECORD

Seq	Field description	Type	Pos	Size	Unit	Format or value
30	Zero	B	3568	1		Byte
31	Zero fill	A	3569	32		

IMAGERY FILE
FULL FRAME IMAGE DATA RECORD

A.3.3 FULL FRAME IMAGE DATA RECORD

Seq	Field description	Type	Pos	Size	Unit	Format or value
1	Record sequence number	B	1	4		
2	Sub type code #1	B	5	1		355(8)
3	Type code	B	6	1		355(8)
4	Sub type code #2	B	7	1		333(8)
5	Sub type code #3	B	8	1		11(8)
6	Length of this record	B	9	4		6300
	Prefix Data					
7	Scan Line Number	B	13	4		Integer*4
8	Image Band Number	B	17	4		Integer*4
9	Time in GMT at SLS	B	21	4	milliseconds	Integer*4
10	Count of Left Fill Pixels	B	25	4		Integer*4
11	Count of Right Fill Pixels	B	29	4		Integer*4
	Image Data					
12	Image Pixels	B	33	6200		Byte
	Suffix Data					
13	Scan Line Quality	B	6233	1		Byte
14	Sync Loss indicator (1-sync loss 0-no)	B	6234	1		Byte
15	Local use quality code	B	6235	1		Byte
16	Detector substitution indicator (1=yes 0-no)	A	6236	5		
17	Local use quality code	B	6241	4		Integer*4
18	Counted full-scan line length	B	6245	4		Integer*4
19	Embedded line length	B	6249	2	clock coun	Integer*2
20	Time Error from line start to mid scan	B	6251	2	clock coun	Integer*2
21	Time Error from mid scan to line end	B	6253	4	1=>forward	Integer*4
22	Scan line direction	B	6257	4	0=>reverse	Integer*4
23	Current line length	B	6261	1		Byte
24	Satellite time code at SLS	B	6262	1		Byte
25	Time is coded in a BCD format, using four bits per unit in the sequence :	B	6263	1		Byte
26	Zero, 100s of days	B	6264	1		Byte
27	10s of days, Units of hours	B	6265	1		Byte
28	10s of hours, Units of minutes	B	6266	1		Byte
29	10s of minutes, Units of seconds	B	6267	1		Byte
	100s of seconds, Units of milliseconds					
	100s of milliseconds, Tens of milliseconds					
	Units of milliseconds, 1/16 of milliseconds					

IMAGERY FILE
FULL FRAME IMAGE DATA RECORD

! Seq !	Field description	!Type!	Pos !	Size !	Unit !	Format or value	!
! 30 !	Zero	! B !	6268 !	1 !	!	Byte	!
! 31 !	Zero fill	! A !	6269 !	32 !	!		!

TRAILER FILE
TRAILER FILE DESCRIPTOR RECORD

A.4 TRAILER FILE

A.4.1 TRAILER FILE DESCRIPTOR RECORD

Seq	Field description	Type	Pos	Size	Unit	Format or value
1	FILE DESCRIPTOR FIXED SEGMENT					
1	Record sequence number	B	1	4		077(8)
2	Sub type code #1	B	5	1		300(8)
3	Type code	B	6	1		022(8)
4	Sub type code #2	B	7	1		022(8)
5	Sub type code #3	B	8	1		4320
6	Length of this record	B	9	4		A\$
7	ASCII/EBCDIC Flag	A	13	2		\$
8	Blanks	A	15	2		\$
9	Superstructure control document	A	17	12		CCB-CCT-0002
10	Revision number of above document	A	29	2		\$D
11	Revision number of file format	A	31	2		\$A
12	Software release number	A	33	12		3\$\$\$\$\$\$\$\$\$
13	File number within logical volume	N	45	4		FORTRAN I4 format
14	Referenced file name	A	49	16		LSS\$TRTRAIXXX\$
						S = Mission number (4 or 5)
						R = 'A' for AT, 'P' for PT
						XXX = BIL or BSQ
15	Record sequence and location type flag	A	65	4		FSEQ
16	Sequence number location	A	69	8		\$\$\$\$\$\$1
17	Sequence number field length	A	77	4		\$\$\$4
18	Record code and location type flag	A	81	4		FTYP
19	Record code location	A	85	8		\$\$\$\$\$\$5
20	Record code field length	A	93	4		\$\$\$4
21	Record length and location type flag	A	97	4		FLGT
22	Record length location	A	101	8		\$\$\$\$\$\$9
23	Record length field length	A	109	4		\$\$\$4
24	Flag indicating whether data interpretation information is included in the file descriptor record	A	113	1		N
25	Flag indicating whether data interpretation information is included in records other than file descriptor	A	114	1		N
26	Flag indicating whether data display information is included in the file descriptor record	A	115	1		N
27	Flag indicating whether data display information is included in records other than file descriptor	A	116	1		N
28	Blanks	A	117	64		
	FILE DESCRIPTOR VARIABLE SEGMENT					
29	Number of trailer records	N	181	6		FORTRAN I6 format
30	Trailer record length	N	187	6		FORTRAN I6 format

TRAILER FILE
TRAILER FILE DESCRIPTOR RECORD

Seq	Field description	Type	Pos	Size	Unit	Format or value
1	Locator format :					
2	hhhhhhbbbblllt					
3	where :					
4	hhhhh - record number containing the field					
5	bbbbbb - number of first byte in field					
6	lll - field length in bytes					
7	t - type of data : A, B or N					
31	Quality indicator summary counts locator	A	193	16		\$\$\$\$\$\$\$\$\$\$\$\$\$\$\$\$
32	Quality summary map field locator	A	209	16		\$\$\$\$\$\$\$\$\$\$\$\$\$\$\$\$
33	Blanks	A	225	4096		

TRAILER FILE
TRAILER RECORD

A.4.2 TRAILER RECORD

! Seq !	Field description	!Type!	Pos !	Size !	Unit	! Format or value
1 !	Record sequence number	B !	1 !	4 !		
2 !	Sub type code #1	B !	5 !	1 !		022(8)
3 !	Type code	B !	6 !	1 !		366(8)
4 !	Sub type code #2	B !	7 !	1 !		022(8)
5 !	Sub type code #3	B !	8 !	1 !		022(8)
6 !	Length of this record	B !	9 !	4 !		4320
7 !	Trailer record sequence number	A !	13 !	4 !		\$\$\$1
8 !	Blanks	A !	17 !	4 !		\$\$\$
9 !	Blanks	A !	21 !	4300 !		

SUPPLEMENTAL VOLUME DIRECTORY FILE
SUPPLEMENTAL VOLUME DESCRIPTOR RECORD

A.5 SUPPLEMENTAL VOLUME DIRECTORY FILE

A.5.1 SUPPLEMENTAL VOLUME DESCRIPTOR RECORD

Seq	Field description	Type	Pos	Size	Unit	Format or value
1	FILE DESCRIPTOR FIXED SEGMENT					
1	Record sequence number	B	1	4		300(8)
2	Sub type code #1	B	5	1		300(8)
3	Type code	B	6	1		022(8)
4	Sub type code #2	B	7	1		022(8)
5	Sub type code #3	B	8	1		360
6	Length of this record	B	9	4		A\$
7	ASCII/EBCDIC Flag	A	13	2		\$
8	2 blanks	A	15	2		CCB-CCT-0002
9	Superstructure control document	A	17	12		\$D
10	Revision number	A	29	2		\$A
11	Revision letter number	A	31	2		2\$
12	Software release number	A	33	12		YYDDHH-rrrr/nn
13	Tape ID of current physical volume	A	45	16		rrrr = request number
14	Logical Volume ID	A	61	16		nn = physical volume (01)
15	Volume Set ID	A	77	16		YYDDHHMMSS.T
16	Number of tapes on logical volume	N	93	2		LANDSAT\$TM\$
17	First physical volume of logical volume	N	95	2		s = Mission number (4 or 5)
18	Last physical volume of logical volume	N	97	2		FORTRAN I2 format
19	Current Physical Volume number	N	99	2		FORTRAN I2 format
20	First file number in this physical volume	N	101	4		FORTRAN I4 format
21	Logical volume number within volume set	N	105	4		FORTRAN I4 format
22	Logical volume number within physical volume	A	109	4		\$
23	Logical volume creation date	A	113	8		YYMMDD
24	Logical volume creation time	A	121	8		HHMMSSXX
25	Logical volume generation country	A	129	12		BRASIL\$
26	Logical volume generation agency	A	141	8		INPE\$
27	Logical volume generation facility	A	149	12		DGI\$
28	Number of file pointers in volume directory	N	161	4		FORTRAN I4 format
29	Number of records in volume directory	N	165	4		FORTRAN I4 format
30	Volume spare segment	A	169	92		BLANKS
31	Local Use Segment					
32	Scene identification					
33	Instrument	A	261	2		TM
34	Satellite	A	263	1		4 or 5
35	Separator	A	264	1		-

SUPPLEMENTAL VOLUME DIRECTORY FILE
SUPPLEMENTAL VOLUME DESCRIPTOR RECORD

Seq	Field description	Type	Pos	Size	Unit	Format or value
34	Revolution	N	265	5		FORTRAM I5.5 format
35	Separator	A	270	1		-
36	Row	N	271	3		FORTRAM I3.3 format
37	Separator	A	274	1		-
38	Type of run	A	275	1		C
39	Number of the run	N	276	3		FORTRAM I3 format
40	Separator	A	279	1		-
41	Quadrant code	A	280	1		A, B, C, D, N, S, W, E OR X
42	Separator	A	281	1		-
43	Interleaving indicator	A	282	3		BIL or BSQ
44	Separator	A	285	1		-
45	Processed bands	A	286	7		one character per band
46	Blank	A	293	1		
47	Instrument	A	294	2		TM
48	Satellite	A	296	1		4 or 5
49	Scene center time	A	297	16		YYDDHHMMSSMMFF
50	WRS designator	N	313	3		FORTRAM I3 format
51	Path number	A	316	1		A or D
52	Orbital direction	N	317	3		FORTRAM I3 format
53	Row number	N	320	1		+ if out of grid, blank oth
54	Out of WRS grid indicator	A	321	8		YYYYMMDD
55	Acquisition date	A	321	8		HHMMSSXX
56	GMT acquisition time	A	329	1		
57	Blank	A	337	1		
58	INPE processing type	A	338	3		HIC,HDC,CDC ...
59	Scene center latitude	A	341	10		NDDD:MM:SS or SDDD:MM:SS
59	Scene center longitude	A	351	10		EDDD:MM:SS or WDDD:MM:SS

SUPPLEMENTAL VOLUME DIRECTORY FILE
FILE POINTER RECORD

A.5.2 FILE POINTER RECORD

Seq	Field description	Type	Pos	Size	Unit	Format or value
1	Record sequence number	B	1	4		
2	Sub type code #1	B	5	1		333(8)
3	Type code	B	6	1		300(8)
4	Sub type code #2	B	7	1		022(8)
5	Sub type code #3	B	8	1		022(8)
6	Length of this record	B	9	4		360
7	ASCII/EBCDIC flag	A	13	2		A\$
8	2 Blanks	A	15	2		\$
9	Referenced file number (position after volume directory)	N	17	4		FORTTRAN I4 format
10	Referenced file name	A	21	16		LSNTM\$RSUPPXXX\$
11	Referenced file class	A	37	28		XXX - BSQ or BIL
12	Referenced file class Code	A	65	4		SUPP
13	Referenced file data type	A	69	28		SUPP
14	Referenced file data type class	A	97	4		BINARY\$ONLY
15	Number of records in file	N	101	8		BINO
16	Referenced file descriptor record length	N	109	8		FORTTRAN I8 format
17	Referenced file maximum record length	N	117	8		FORTTRAN I8 format
18	Referenced file record length type	A	125	12		FIXED\$LENGTH
19	Referenced file record length type code	A	137	4		FIXD
20	Physical volume containing first referenced file record	N	141	2		FORTTRAN I2 format
21	Physical volume containing last referenced file record	N	143	2		FORTTRAN I2 format
22	Referenced file first record in this physical volume	N	145	8		FORTTRAN I8 format
23	File pointer spare segment	A	153	108		
24	Local use segment	A	261	100		

SUPPLEMENTAL FILE
SUPPLEMENTAL FILE DESCRIPTOR RECORD

A.6 SUPPLEMENTAL FILE

A.6.1 SUPPLEMENTAL FILE DESCRIPTOR RECORD

! Seq !	Field description	!Type!	Pos !	Size !	Unit	Format or value
!	!	!	!	!	!	!
!	!	!	!	!	!	!
!	FILE DESCRIPTOR FIXED SEGMENT	!	!	!	!	!
1 !	Record sequence number	B !	1 !	4 !	!	!
2 !	Sub type code #1	B !	5 !	1 !	!	!
3 !	Type code	B !	6 !	1 !	!	077(8)
4 !	Sub type code #2	B !	7 !	1 !	!	300(8)
5 !	Sub type code #3	B !	8 !	1 !	!	022(8)
6 !	Length of this record	B !	9 !	4 !	!	360
7 !	ASCII/EBCDIC Flag	A !	13 !	2 !	!	A\$
8 !	2 blanks	A !	15 !	2 !	!	\$
9 !	Superstructure control document	A !	17 !	12 !	!	CCB-CCT-0002
10 !	Revision number	A !	29 !	2 !	!	\$D
11 !	Revision letter number	A !	31 !	2 !	!	\$A
12 !	Software release number	A !	33 !	12 !	!	2\$\$\$\$\$\$\$\$\$
13 !	Data file number within logical volume	N !	45 !	4 !	!	FORTRAN I4 format
14 !	File name	A !	49 !	16 !	!	LSNTM\$RSUPPXXX\$
!	!	!	!	!	!	XXX - BSQ or BIL
15 !	Record sequence and location type flag	A !	65 !	4 !	!	FSEQ
16 !	Sequence number location	A !	69 !	8 !	!	\$\$\$\$\$\$\$1
17 !	Sequence number field length	A !	77 !	4 !	!	\$\$\$4
18 !	Record code and location type flag	A !	81 !	4 !	!	FTYP
19 !	Record code location	A !	85 !	4 !	!	\$\$\$5
20 !	Record code field length	A !	89 !	4 !	!	\$\$\$4
21 !	Record length and location type flag	A !	93 !	4 !	!	FLGT
22 !	Record length location	A !	97 !	8 !	!	\$\$\$\$\$\$\$9
23 !	Record length field length	A !	105 !	8 !	!	\$\$\$\$\$\$\$4
24 !	Flag indicating whether data interpretation information is included in the file descriptor record	A !	113 !	1 !	!	N
25 !	Flag indicating whether data interpretation information is included in records other than file descriptor	A !	114 !	1 !	!	N
26 !	Flag indicating whether data display information is included in the file descriptor record	A !	115 !	1 !	!	N
27 !	Flag indicating whether data display information is included in records other than file descriptor	A !	116 !	1 !	!	N
28 !	Reserved segment	A !	117 !	64 !	!	!
!	!	!	!	!	!	!
!	FILE DESCRIPTOR VARIABLE SEGMENT	!	!	!	!	!
!	!	!	!	!	!	!
29 !	Number of geometric MODELING data records	N !	181 !	6 !	!	FORTRAN I6 format
30 !	Geometric MODELING data record length	N !	187 !	6 !	!	FORTRAN I6 format
!	!	!	!	!	!	!
31 !	Blanks	A !	193 !	168 !	!	!

SUPPLEMENTAL FILE
GEOMETRIC MODELING DATA RECORD

A.6.2 GEOMETRIC MODELING DATA RECORD

Seq	Field description	Type	Pos	Size	Unit	Format or value
1	Record sequence number	B	1	4		
2	Sub type code #1	B	5	1		044(8)
3	Type code	B	6	1		044(8)
4	Sub type code #2	B	7	1		222(8)
5	Sub type code #3	B	8	1		022(8)
6	Length of this record	B	9	4		360
7	Sweep number within full scene (1 to 386)	B	13	4		Integer*4
8	Sweep direction (1 ->forward, 0 ->reverse)	B	17	4		Integer*4
	The pixel number is related to the aligned video line, and the number of the first pixel present on the video line can be read from field 35 of SCENE HEADER RECORD in the LEADER FILE.					
	Breakpoint 1 related data					
9	Pixel number within full sweep (1 to 6487)	B	21	4		Integer*4
10	Latitude	B	25	4	10**-8 rad	Integer*4
11	Longitude	B	29	4	10**-8 rad	Integer*4
	Breakpoint 2 related data					
12	Pixel number within full sweep (1 to 6487)	B	33	4		Integer*4
13	Latitude	B	37	4	10**-8 rad	Integer*4
14	Longitude	B	41	4	10**-8 rad	Integer*4
	Breakpoint 3 related data					
15	Pixel number within full sweep (1 to 6487)	B	45	4		Integer*4
16	Latitude	B	49	4	10**-8 rad	Integer*4
17	Longitude	B	53	4	10**-8 rad	Integer*4
	Breakpoint 4 related data					
18	Pixel number within full sweep (1 to 6487)	B	57	4		Integer*4
19	Latitude	B	61	4	10**-8 rad	Integer*4
20	Longitude	B	65	4	10**-8 rad	Integer*4
	Breakpoint 5 related data					
21	Pixel number within full sweep (1 to 6487)	B	69	4		Integer*4
22	Latitude	B	73	4	10**-8 rad	Integer*4
23	Longitude	B	77	4	10**-8 rad	Integer*4
	Breakpoint 6 related data					
24	Pixel number within full sweep (1 to 6487)	B	81	4		Integer*4
25	Latitude	B	85	4	10**-8 rad	Integer*4
26	Longitude	B	89	4	10**-8 rad	Integer*4

SUPPLEMENTAL FILE
GEOMETRIC MODELING DATA RECORD

Seq	Field description	Type	Pos	Size	Unit	Format or value
27	Breakpoint 7 related data					
28	Pixel number within full sweep (1 to 6487)	B	93	4		Integer*4
29	Latitude	B	97	4	10**-8 rad	Integer*4
29	Longitude	B	101	4	10**-8 rad	Integer*4
30	Breakpoint 8 related data					
31	Pixel number within full sweep (1 to 6487)	B	105	4		Integer*4
31	Latitude	B	109	4	10**-8 rad	Integer*4
32	Longitude	B	113	4	10**-8 rad	Integer*4
33	Breakpoint 9 related data					
34	Pixel number within full sweep (1 to 6487)	B	117	4		Integer*4
34	Latitude	B	121	4	10**-8 rad	Integer*4
35	Longitude	B	125	4	10**-8 rad	Integer*4
36	Breakpoint 10 related data					
37	Pixel number within full sweep (1 to 6487)	B	129	4		Integer*4
37	Latitude	B	133	4	10**-8 rad	Integer*4
38	Longitude	B	137	4	10**-8 rad	Integer*4
39	Breakpoint 11 related data					
40	Pixel number within full sweep (1 to 6487)	B	141	4		Integer*4
40	Latitude	B	145	4	10**-8 rad	Integer*4
41	Longitude	B	149	4	10**-8 rad	Integer*4
42	Breakpoint 12 related data					
43	Pixel number within full sweep (1 to 6487)	B	153	4		Integer*4
43	Latitude	B	157	4	10**-8 rad	Integer*4
44	Longitude	B	161	4	10**-8 rad	Integer*4
45	Breakpoint 13 related data					
46	Pixel number within full sweep (1 to 6487)	B	165	4		Integer*4
46	Latitude	B	169	4	10**-8 rad	Integer*4
47	Longitude	B	173	4	10**-8 rad	Integer*4
48	Breakpoint 14 related data					
49	Pixel number within full sweep (1 to 6487)	B	177	4		Integer*4
49	Latitude	B	181	4	10**-8 rad	Integer*4
50	Longitude	B	185	4	10**-8 rad	Integer*4
51	Breakpoint 15 related data					
51	Pixel number within full sweep (1 to 6487)	B	189	4		Integer*4
52	Latitude	B	193	4	10**-8 rad	Integer*4

SUPPLEMENTAL FILE
GEOMETRIC MODELING DATA RECORD

Seq	Field description	Type	Pos	Size	Unit	Format or value
53	Longitude	B	197	4	10**-8 rad	Integer*4
	Breakpoint 16 related data					
54	Pixel number within full sweep (1 to 6487)	B	201	4		Integer*4
55	Latitude	B	205	4	10**-8 rad	Integer*4
56	Longitude	B	209	4	10**-8 rad	Integer*4
	Breakpoint 17 related data					
57	Pixel number within full sweep (1 to 6487)	B	213	4		Integer*4
58	Latitude	B	217	4	10**-8 rad	Integer*4
59	Longitude	B	221	4	10**-8 rad	Integer*4
	Breakpoint 18 related data					
60	Pixel number within full sweep (1 to 6487)	B	225	4		Integer*4
61	Latitude	B	229	4	10**-8 rad	Integer*4
62	Longitude	B	233	4	10**-8 rad	Integer*4
63	ZERO FILL	A	237	124		

NULL VOLUME DIRECTORY FILE
VOLUME DESCRIPTOR RECORD

A.7 NULL VOLUME DIRECTORY FILE

A.7.1 VOLUME DESCRIPTOR RECORD

Seq	Field description	Type	Pos	Size	Unit	Format or value
1	Record sequence number	B	1	4		
2	Sub type code #1	B	5	1		300(8)
3	Type code	B	6	1		300(8)
4	Sub type code #2	B	7	1		77(8)
5	Sub type code #3	B	8	1		22(8)
6	Length of this record	B	9	4		360
7	ASCII/EBCDIC flag	A	13	2		A\$
8	2 Blanks	A	15	2		\$
9	Superstructure control document ID	A	17	12		CCB-CCT-0002
10	Superstructure control document revision number	A	29	2		\$D
11	Superstructure record format revision letter number	A	31	2		\$A
12	Software Release Number	A	33	12		2\$\$\$\$\$\$\$\$\$\$\$
13	Tape ID of current physical volume	A	45	16		YDDDDHH-RRRRR/NN
14	Logical Volume ID	A	61	16		Blanks
15	Volume Set ID	A	77	16		Blanks
16	Number of tapes on logical volume	N	93	2		FORTRAN I2 format
17	First physical volume of logical volume	N	95	2		\$1
18	Last physical volume of logical volume	N	97	2		FORTRAN I2 format
19	Current Physical Volume number	N	99	2		FORTRAN I2 format
20	First file number in this physical volume	N	101	4		FORTRAN I4 format
21	Logical volume number within volume set	N	105	4		FORTRAN I4 format
22	Logical volume number within physical volume	A	109	4		\$\$\$1
23	Logical volume creation date	A	113	8		Blanks
24	Logical volume creation time	A	121	8		Blanks
25	Logical volume generation country	A	129	12		Blanks
26	Logical volume generation agency	A	141	8		Blanks
27	Logical volume generation facility	A	149	12		Blanks
28	Number of file pointers in volume directory	A	161	4		Blanks
29	Number of records in volume directory	A	165	4		Blanks
30	Volume spare segment	A	169	92		Blanks
	Local Use Segment					
	Scene identification					
31	Instrument	A	261	2		TM
32	Satellite	A	263	1		4 or 5
33	Separator	A	264	1		-
34	Revolution	N	265	5		FORTRAN I5.5 format
35	Separator	A	270	1		-
36	Row	N	271	3		FORTRAN I3.3 format
37	Separator	A	274	1		-
38	Type of run	A	275	1		C
39	Number of the run	N	276	3		FORTRAN I3 format

NULL VOLUME DIRECTORY FILE
VOLUME DESCRIPTOR RECORD

Seq	Field description	Type	Pos	Size	Unit	Format or value
40	Separator	A	279	1		-
41	Quadrant code	A	280	1		A, B, C, D, N, S, W, E or X
42	Separator	A	281	1		-
43	Interleaving indicator	A	282	3		BIL or BSQ
44	Separator	A	285	1		-
45	Processed bands	A	286	7		one character per band
46	Blank					
47	Instrument	A	293	1		TM
48	Satellite	A	294	2		4 or 5
49	Scene center time	A	296	1		YDDDDHHMMSSMMFF
	WRS designator	A	297	16		
50	Path number	N	313	3		FORTTRAN I3 format
51	Orbital direction	A	316	1		A or D
52	Row number	N	317	3		FORTTRAN I3 format
53	Out of WRS grid indicator	A	320	1		+ if out of grid, blank oth
54	Acquisition date	A	321	8		YYYYMMDD
55	GMT acquisition time	A	329	8		HHMMSSXX
56	Blank					
57	INPE processing type	A	337	1		HDC,CDC ...
58	Scene center latitude	A	338	3		NDDD:MM:SS or SDDD:MM:SS
59	Scene center longitude	A	341	10		EDDD:MM:SS or WDDD:MM:SS
		A	351	10		



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RESUMO - NOTAS / ABSTRACT - NOTES

This document defines the format of the computer compatible tapes (CCT) which contain Thematic Mapper (TM) imagery data acquired from the LANDSAT series of satellites by the Instituto Nacional de Pesquisas Espaciais (SCT - INPE/BRAZIL).

OBSERVAÇÕES / REMARKS