

**Level 1 Product Output Files
Data Format Control Book**

Volume 5, Book 2

Revision 4

January 2000

Level 1 Product Output Files Data Format Control Book Volume 5, Book 2

Revision 4

January 2000

Prepared Under Contract USGS 1434-CR-97-CN-40274
Task Order 9012-678-40
By Raytheon ITSS

Prepared by:

K. Lowell Date
Software Lead, L1 Systems
Raytheon ITSS

Concurred by:

D. Duval Date
TAL, AAPS, User Services
Raytheon ITSS

Reviewed by:

T. Gardner Date
Software Lead, IAS
Raytheon ITSS

J. Christopherson Date
Lead, IAS
Raytheon ITSS

Approved by:

Process Reviewed by:

C. Damme Date
SEPG Lead
Raytheon ITSS

T. Zeiler Date
L7 Mission Management Officer
U.S. Geological Survey

EROS Data Center
Sioux Falls, South Dakota

Preface

This Data Format Control Book (DFCB) is maintained and controlled by the Landsat 7 Configuration Control Board (CCB) and may be updated or revised only on approval by the CCB. Comments and questions regarding this DFCB should be directed to

Landsat 7 Mission Management Officer
USGS/EROS Data Center
Sioux Falls, SD 57198

Revision 4 of this DFCB is the result of approved Landsat 7 configuration change requests (CCRs), which are listed below, along with minor editorial changes.

CCR Number	Change Pages
1201	Appendix A, Table 4.3-1
1206	Appendix A, Table 4.3-1
1124	Appendix A, Table 4.3-1
1153	Appendix A, Table 4.3-1

Abstract

This Data Format Control Book (DFCB) presents detailed data formats of the output files generated by the Level 1 Product Generation System (LPGS). The LPGS produces Level 1 output files from Level 0R images based on user requests. The LPGS produces images in the following formats: Hierarchical Data Format (HDF), FAST-Landsat 7 (FAST-L7A), or Geographic Tagged Image File Format (GeoTIFF).

This document is based on the requirements contained in the *Level 1 Product Generation System (LPGS) System Requirements Document*.

Keywords: *Data Format Control Book (DFCB), Earth Resources Observation System (EROS), EOSDIS Core System (ECS), FAST format, Geographic Tagged Image File Format (GeoTIFF), Hierarchical Data Format (HDF), Landsat 7, Level 1 Product, Level 1 Product Generation System (LPGS), Level 1 Product Distribution System (LPDS)*

Change Information Page

List of Effective Pages			
Page Number		Issue	
All		Original	
Document History			
Document Number	Status/Issue	Publication Date	CCR Number
L1-409	Original	January 2000	N/A

Contents

PREFACE.....	III
ABSTRACT.....	V
CHANGE INFORMATION PAGE.....	IX
CONTENTS.....	X
SECTION 1 - INTRODUCTION	1-1
1.1 PURPOSE.....	1-1
1.2 SCOPE.....	1-1
1.3 INTENDED USERS	1-1
1.4 DEFINITIONS	1-2
1.5 LOR PRE-ARCHIVE PROCESSING	1-3
SECTION 2 - APPLICABLE DOCUMENTS.....	2-1
SECTION 3 - OVERVIEW OF LPGS OUTPUT FILES	3-1
3.1 FAST-L7A.....	3-2
3.1.1 Header File.....	3-2
3.1.2 Image File.....	3-2
3.2 GEOTIFF.....	3-3
3.3 HDF.....	3-3
3.3.1 Image File.....	3-5
3.3.2 Ancillary Data	3-5
SECTION 4 - LPGS OUTPUT FILE FORMATS.....	4-1
4.1 FAST-L7A FILE FORMATS.....	4-1
4.1.1 Header File.....	4-1
4.2 GEOTIFF FILE FORMATS.....	4-27
4.2.1 GeoTIFF Tags.....	4-27
4.2.2 GeoTIFF Keys.....	4-28
4.3 HDF FILE FORMATS	4-32
4.3.1 Image Files	4-32
4.3.2 Internal Calibrator Data Files.....	4-32
4.3.3 Mirror Scan Correction Data File.....	4-32
4.3.4 Payload Correction Data File	4-32
4.3.5 Scan Line Offsets	4-33
4.3.6 Calibration Parameter File.....	4-33
4.3.7 Geolocation Table File.....	4-33
4.3.8 LPS Metadata File.....	4-33
4.3.9 LPGS Metadata File	4-34
4.3.10 HDF Directory File	4-34
4.3.11 Vgroup Definitions.....	4-34
SECTION 5 - PRODUCT PACKAGING.....	5-1
5.1 8-MM TAPE.....	5-1
5.2 CD-ROM	5-1

5.3 ELECTRONIC TRANSFER	5-1
SECTION 6 - SOFTWARE TOOLS	6-1
6.1 NCSA HDF LIBRARIES	6-1
6.2 HDF LIBRARIES	6-1
6.3 ODL PARSER	6-2
APPENDIX A - PROJECTION PARAMETERS.....	A-1
APPENDIX B - SAMPLE READ-ME FILE.....	B-1
ABBREVIATIONS AND ACRONYMS.....	AB-1

Section 1 - Introduction

1.1 Purpose

This Data Format Control Book (DFCB) provides the user with a high-level description of the Landsat 7 Level 1 (L1) distribution product, product packaging, and viewing tools.

1.2 Scope

This DFCB describes the formats and data contents of the L1 output files. The formats discussed are Hierarchical Data Format (HDF), FAST-Landsat 7 (FAST-L7A), and Geographic Tagged Image File Format (GeoTIFF). These output file formats are based on the requirements contained in the *Level 1 Product Generation System (LPGS) System Requirements Document (SRD)* (Applicable Document 1).

The HDF L1 product formats are heavily derived from the formats of the Level 0R (L0R) products so as to cause less impact on the user community and to provide general consistency in output. The L0R product formats are described in the *Landsat 7 System Zero-R Distribution Product Data Format Control Book, Volume 5, Book 1* (Applicable Document 4). [Note: L1 customers are advised to obtain a copy of Book 1 because related tables are referenced in Book 2 to describe L1R output files.] In addition, the output files defined in this DFCB are based on the already established FAST and GeoTIFF standards. Current Space Imaging Corporation Earth Observation Satellite (EOSAT) Landsat products are in FAST-B format, and new EOSAT products will be in FAST-C format. The Landsat 7 L1 products will be in FAST-L7A format. This is the FAST-C format modified to accommodate the features of the Enhanced Thematic Mapper Plus (ETM+) instrument.

The functional, performance, operational, and interface design details for the transfer of these files from the Level 1 Product Generation System (LPGS) to the Level 1 Product Distribution System (LPDS) are contained in the *Interface Control Document (ICD) Between the Level 1 Product Generation System (LPGS) and the Level 1 Product Distribution System (LPDS)* (Applicable Document 3).

The file formats contained in this DFCB are applicable to the interface between the LPDS and the LPGS.

1.3 Intended Users

This document is intended as a guide to recipients of L1 products. This document contains detailed information on the L1 output data file formats to allow users on both sides to proceed with independent development of L1 processing capability. It also provides detailed information on the packaging of the L1 product.

1.4 Definitions

Level 0R (L0R) digital image—Spatially reformatted, demultiplexed, and, unrectified subinterval data

Level 0R (L0R) product—L0R digital image plus radiometric, calibration, attitude, and ephemeris data, consisting of the following files in HDF:

- L0R digital image (one file per band)
- Internal calibrator (IC) data—Calibration data file containing all the calibration data received on a major frame basis subset to the product size ordered
- Mirror scan correction data (MSCD)—Scan direction and error information subset to the product size ordered
- Payload correction data (PCD)—Information on spacecraft attitude and ephemeris, including quality indicators for the entire subinterval from which the product is derived
- Metadata—Descriptive information about the L0R image and names of appended files associated with the image
- Calibration parameter file (CPF)—Formatted file containing radiometric and geometric correction parameters
- Scan line offsets—Information on actual starting and ending pixel positions for valid image data on a line-by-line basis
- Geolocation table—File containing scene corner coordinates and product-specific scene line numbers for bands
- HDF directory—File containing all the pointers, file size information, and data objects required to process the L0R product

Level 1R (L1R) digital image—Radiometrically corrected but not geometrically resampled

Level 1R (L1R) product—L1 product packaged by the LPGS, distributed by the LPDS to the customer, and consisting of the following in HDF:

- L1R digital image (one image file per band)
- IC data—Calibration data file containing all the calibration data received on a major frame basis subset to the product size ordered
- Consensus MSCD—Scan direction and error information subset to the product size ordered
- Consensus PCD—Information on spacecraft attitude and ephemeris, including quality indicators for the entire subinterval from which the product is derived
- Metadata—Descriptive information about the L0 and L1 digital images and names of appended files associated with the images

- CPF—Formatted file containing radiometric and geometric correction parameters
- Scan line offsets—Information on actual starting and ending pixel positions for valid image data on a line-by-line basis
- Geolocation table—File containing scene corner coordinates and product-specific scene line numbers for bands
- HDF directory— The directory file contains all the pointers, file size information, and data objects required to open and process the L1 product using the HDF library and interface routines

Consensus File—A single file created from the two original files included with the L0R product and with errors corrected

Level 1G (L1G) digital image—Radiometrically corrected and resampled for geometric correction and registration to a geographic map projection

Level 1G (L1G) product—L1 product packaged by the LPGS and distributed by the LPDS to the customer; includes, for all requested bands, FAST-L7A or GeoTIFF format L1G image and associated data accommodated by the format; or HDF L1G image and metadata

Interval—Time duration between the start and stop of an imaging operation (observation) of the Landsat 7 ETM+ instrument

Subinterval—Segment of time corresponding to a portion of an observation within a single Landsat 7 contact period

Worldwide Reference System (WRS) scene—Digital image that covers an area equivalent to one of the 57,784 scene centers (233 paths by 248 rows areas) defined by the WRS structure

1.5 L0R Pre-Archive Processing

A basic knowledge of the pre-archive ground processing will enable the user to better understand the L1 product.

The Landsat Ground Station (LGS) acquires ETM+ wideband data directly from the Landsat 7 spacecraft by way of two 150-megabits-per-second (Mbps) X-band return links, separates each X-band data into two 75-Mbps channels (I and Q), and transmits the acquired wideband data over four 75-Mbps LGS output channels to the Landsat Processing System (LPS). The LPS records all wideband data, at real-time rates, into its wideband data stores. An I-Q channel pair represents a complete data set. One channel holds bands 1 through 6 low gain, and the second holds bands 7 and 8 and a high-gain form of band 6.

The LPS retrieves and processes each channel of raw wideband data, at lower than real-time rates, into separate accumulations of Earth image data, calibration data, MSCD, and PCD. Channel accumulations represented by bands 1 through 6-low and 6-high through 8 become formats 1 and 2, respectively. PCD and MSCD are generated twice, once for each format. Their contents should be identical but are not guaranteed to be identical.

The LPS spatially reformats Earth imagery and calibration data into LOR data. This involves shifting pixels by integer amounts to account for the alternating forward-reverse scanning pattern of the ETM+ sensor, the odd-even detector arrangement within each band, and the detector offsets inherent to the focal plane array engineering design. All LPS OR corrections are reversible; the pixel shift parameters used are documented in the Image Assessment System (IAS) CPF.

During LPS processing, format 1 bands are duplicated, aligned, and used to assess cloud cover content and to generate scene-based browse data. Cloud cover scores are generated on a scene-by-scene and quadrant-by-quadrant basis. Metadata are generated for the entire subinterval and on a scene-by-scene basis. The image data, PCD, MSCD, calibration data, and metadata are structured into HDF for each format and sent to the Earth Resources Observation System (EROS) Data Center Distributed Active Archive Center (EDC DAAC) for archiving in subinterval form. The two formats of data are united when a Landsat 7 OR product is ordered. The browse is sent to the EDC DAAC separately for use as an online aid to ordering.

Section 2 - Applicable Documents

The following documents provide additional detail and reference information regarding the format of the Level 1 output files.

1. U.S. Geological Survey (USGS)/EROS Data Center (EDC), LPGS-600, *Level 1 Product Generation System (LPGS) System Requirements Document (SRD)*, September 1999
2. —, LPS-112-1, *Landsat 7 System Zero-R Distribution Product Data Format Control Book, Volume 5, Book 1, Revision 6*, October 1999
3. National Aeronautics and Space Administration (NASA)/Goddard Space Flight Center (GSFC), 586-1ICD/0198 (CSC 10041004), *Interface Control Document (ICD) Between the Level 1 Product Generation System (LPGS) and the Level 1 Product Distribution System (LPDS), Revision 1*, February 1999
5. —, 430-15-01-002-2, *Landsat-7 Calibration Parameter File Definition, Revision 3 (Review)*, May 1999 (available at <http://ltpwww.gsfc.nasa.gov/IAS/htmls/review.html>)
6. —, 505-10-36, *Earth Science Data and Information System (ESDIS) Project Mission Specific Requirements for the Landsat 7 Mission Level 1 Processing*, November 1998
7. GeoTIFF Specification, Revision 1.0 (available at <http://home.earthlink.net/~ritter/geotiff/spec/geotiffhome.html>)
8. Jet Propulsion Laboratory, California Institute of Technology, “Object Description Language Specification and Usage,” Chapter 12 of *Planetary Data System Standards Reference*, Version 3.2, July 24, 1995 (available at <http://pds.jpl.nasa.gov/stdref/chap12.htm>)

Section 3 - Overview of LPGS Output Files

The L1R digital image is very similar to the L0R digital image, except that the L1R image data are radiometrically corrected. In addition, the format 1 and format 2 PCD files are combined into one consensus file, as are the format 1 and format 2 MSCD files. The consensus file is a single file created from the two original files included with the L0R product and with errors corrected. The L1R product is available in HDF only. The L1G digital image is radiometrically and geometrically corrected and is available in three format options: FAST-L7A, GeoTIFF, and HDF. The product size can be as large as 3 full WRS scene equivalents or as small as a 182-scan half WRS scene.

Tables 3-1 through 3-3 detail the L1 product components for each format. The number of bands ordered by the user determines the number of components in a specific product.

Appendix A - Table 3-1. FAST-L7A Product Components

Component	L1G
Header file (for each requested band group)	X
L1 digital image (for each requested band)	X

Appendix B - Table 3-2. GeoTIFF Product Components

Component	L1G
File (for each requested band, contains both image data and metadata)	X

Appendix C - Table 3-3. HDF Product Components

Component	L1R	L1G
L1 digital image (for each requested band)	X	X
IC data—format 1 (for bands 1 through 6 low)	X	
IC data—format 2 (for bands 6 high through 8)	X	
Scan line offsets—format 1 (for bands 1 through 6 low)	X	
Scan line offsets—format 2 (for bands 6 high through 8)	X	
MSCD (consensus)	X	
PCD (consensus)	X	
CPF	X	
Metadata (LPS)—format 1	X	
Metadata (LPS)—format 2	X	
Metadata (LPGS)	X	X
Geolocation table	X	
HDF directory file	X	X

3.1 FAST-L7A

The file naming convention for the FAST-L7A product files is

L7fpprrr_rrrYYYYMMDD_AAA.FST

where

L7 = Landsat 7 mission

f = ETM+ format (1 or 2) (data not pertaining to a specific format defaults to 1)

ppp = starting path of the product

rrr_rrr = starting and ending rows of the product

YYYYMMDD = acquisition date of the image

AAA = file type:

HPN= panchromatic band header file

HRF = VNIR/ SWIR bands header file

HTM = thermal bands header file

B10 = band 1

B20 = band 2

B30 = band 3

B40 = band 4

B50 = band 5

B61 = band 6L

B62 = band 6H

B70 = band 7

B80 = band 8

FST = FAST file extension

3.1.1 Header File

The first file that should be read is a read-me-first file that contains header data in American Standard Code for Information Interchange (ASCII). Each band group [panchromatic, visible near infrared/shortwave infrared (VNIR/SWIR), and thermal] has a specific header file. Alphanumeric fields are left justified and numeric fields are right justified. All processing options and map projection information for the product are also contained in this file.

3.1.2 Image File

Each image file contains only one ETM+ band of image pixels. There are no header records within the image file, nor are there prefix or suffix data in the individual image records. Image data are unblocked. The image files are 8-bit unsigned integers.

3.2 GeoTIFF

GeoTIFF defines a set of public domain TIFF tags that describe all cartographic and geodetic information associated with geographic TIFF imagery. GeoTIFF is a means for tying a raster image to a known model space or map projection and for describing those projections. A metadata format provides geographic information to associate with the image data, but the TIFF file structure allows both the metadata and the image data to be encoded into the same file. The GeoTIFF file is grayscale, scanline, uncompressed, and 8-bit unsigned integers. The file naming convention for the GeoTIFF product is

L7fpprrr_rrrYYYYMMDD_AAA.TIF

where

L7 = Landsat 7 mission

f = ETM+ format (1 or 2)

ppp = starting path of the product

rrr_rrr = starting and ending rows of the product

YYYYMMDD = acquisition date of the image

AAA = file type:

B10 = band 1

B20 = band 2

B30 = band 3

B40 = band 4

B50 = band 5

B61 = band 6L

B62 = band 6H

B70 = band 7

B80 = band 8

TIF = GeoTIFF file extension

3.3 HDF

The L1R and L1G HDF products are packaged and distributed as a collection of external elements with an HDF directory. External elements are distinguished by the fact that they exist as separate files and contain only data. Information about their HDF structure and interrelationships can be found in the HDF directory. The file naming convention for the HDF product files (except the CPF) is

L7fpprrr_rrrYYYYMMDD_AAA.XXX

where

L7 = Landsat 7 mission

f = ETM+ format (1 or 2) (data not pertaining to a specific format defaults to 1)

ppp = starting path of the product
 rrr_rrr = starting and ending rows of the product
 YYYYMMDD = acquisition date of the image
 AAA = file type:
 B10 = band 1
 B20 = band 2
 B30 = band 3
 B40 = band 4
 B50 = band 5
 B61 = band 6L
 B62 = band 6H
 B70 = band 7
 B80 = band 8
 CAL = internal calibrator
 GEO = geolocation
 HDF = HDF directory
 MSD = consensus MSCD
 MTA = LPS metadata
 MTL = LPGS metadata
 PCD = consensus PCD
 SLO = scan line offset
 XXX = product type (L1R or L1G)

The CPF file naming convention is

L7CPFYYYYMMDD_YYYYMMDD_nn

where L7 = Landsat 7 mission
 CPF = calibration parameter file
 YYYY = starting year of the CPF
 MM = starting month of the CPF
 DD = starting day of the CPF
 _ = separator
 YYYY = ending year of the CPF
 MM = ending month of the CPF
 DD = ending day of the CPF
 _ = separator
 nn = 01-99

3.3.1 Image File

Each requested image band is self-contained in a single file. The L1R image files are in absolute units scaled to 16 bits. The L1G images are 8-bit unsigned integers that exploit the full 0-255 numeric range. Note that the L1R image files are constructed on a Silicon Graphics, Inc. (SGI), Origin 2000 platform, which is a big-endian byte order machine.

3.3.2 Ancillary Data

The remaining files included with the HDF product include the IC data, scan line offsets, MSCD, PCD, CPF, metadata, geolocation table, and HDF directory file. See Table 3-3 for a complete listing of which files are included with each product. These files are described in detail in Section 4.3

Section 4 - LPGS Output File Formats

4.1 FAST-L7A File Formats

4.1.1 Header File

There is one header file for each band group in the product. The three possible band groups are panchromatic, VNIR/SWIR, and thermal. The header file for each band group contains three 1536-byte ASCII records: administrative, radiometric, and geometric. The administrative record, the first record in each header file, contains information that identifies the product, the image, and the data specifically needed to ingest the imagery for each particular band. To import the image data, it is necessary to read the entries in the administrative record.

The second record is the radiometric record that contains the coefficients needed to convert the image digital values into at-satellite spectral radiance for each particular band.

The third record is the geometric record that contains the image geodetic location information. To align the imagery to other data sources, it is necessary to read the entries in the geometric record for each particular band.

Tables 4.1-1 through 4.1-9 describe the formats of the three records for each of the three band groups (panchromatic, VNIR/SWIR, and thermal). The tables include the start and end bytes, the Fortran format statement, and a brief description of each field. In the Fortran format statements

A = character data

D = double precision data

F = floating data

all N/A fields are blank filled and are maintained in the records for historical consistency with the FAST-C format. The “b” in the descriptions indicates a space.

Fields 79, 81, 91, and 93 of the administrative record refer to products that span multiple tapes and are, therefore, not applicable to the L1 products produced by the LPGS.

Field 106 of the administrative record is the Bands Present field for each particular band group. It is necessary to count the number of non-blank entries in the Bands Present field to get the count of the number of bands. Each character (byte) in this field has an ASCII character with the band label, usually a number. For ETM+, the values are 8 for the panchromatic band; 1, 2, 3, 4, 5, and 7 for the VNIR/SWIR bands, and L and H for the thermal bands. The sequence terminates with blanks.

Appendix A - Table 4.1-1. Administrative Record for Panchromatic Band (1 of 3)

Line	Field	Start Byte	End Byte	Format	Description
1	1	1	8	A8	"REQbIDb="
	2	9	28	A20	Request Number in "NNNYMMDDSSSSUUUbbb" format >where: > NNNYYMMDDSSSS = 13-digit DORRAN order number > NNN = Node indicator > YY = Year > MM = Month > DD = Day > SSSS = Sequence number for the day > UUUU = 4-digit DORRAN unit number
	3	29	34	A6	"bLOCb="
	4	35	51	A17	First product starting location in "ppp/rrrrfssbbbbbb" format. path/row/fraction/subscene
	5	52	70	A19	"bACQUISITIONbDATEb="
	6	71	78	A8	First product acquisition date in yyymmdd format
	7	79	79	1X	Blank fill
	8	80	80	A1	Carriage return
2	9	81	91	A11	"SATELLITEb="
	10	92	101	A10	First product satellite name: LANDSAT7
	11	102	110	A9	"bSENSORb="
	12	111	120	A10	First product sensor name: ETM+
	13	121	134	A14	"bSENSORbMODEb="
	14	135	140	A6	First product sensor mode: NORMAL
	15	141	153	A13	"bLOOKbANGLEb="
	16	154	159	F6.2	First product off-nadir angle in degrees: 0.0
	17	160	160	A1	Carriage return
3	18	161	183	23X	Blank fill
	19	184	194	A11	"bLOCATIONb="
	20	195	211	A17	Second scene location path/row/fraction/subscene in "ppp/rrrrfssbbbbbb" format: N/A
	21	212	230	A19	"bACQUISITIONbDATEb="
	22	231	238	A8	Second scene acquisition date in yyymmdd format: N/A
	23	239	239	1X	Blank fill
	24	240	240	A1	Carriage return
4	25	241	251	A11	"SATELLITEb="
	26	252	261	A10	Second scene satellite name: N/A
	27	262	270	A9	"bSENSORb="
	28	271	280	A10	Second scene sensor name: N/A
	29	281	294	A14	"bSENSORbMODEb="
	30	295	300	A6	Second scene sensor mode: N/A
	31	301	313	A13	"bLOOKbANGLEb="
	32	314	319	F6.2	Second scene off-nadir angle in degrees: N/A
	33	320	320	A1	Carriage return
5	34	321	343	23X	Blank fill
	35	344	354	A11	"bLOCATIONb="
	36	355	371	A17	Third scene location path/row/fraction/subscene in ppp/rrrrfssbbbbbb format: N/A
	37	372	390	A19	"bACQUISITIONbDATEb="
	38	391	398	A8	Third scene acquisition date in yyymmdd format: N/A
	39	399	399	1X	Blank fill
	40	400	400	A1	Carriage return

Table 4.1-1. Administrative Record for Panchromatic Band (2 of 3)

Line	Field	Start Byte	End Byte	Format	Description	
6	41	401	411	A11	"SATELLITEb="	
	42	412	421	A10	Third scene satellite name: N/A	
	43	422	430	A9	"bSENSORb="	
	44	431	440	A10	Third scene sensor name: N/A	
	45	441	454	A14	"bSENSORbMODEb="	
	46	455	460	A6	Third scene sensor mode: N/A	
	47	461	473	A13	"bLOOKbANGLEb=v	
	48	474	479	F6.2	Third scene off-nadir angle in degrees: N/A	
	49	480	480	A1	Carriage return	
7	50	481	503	23X	Blank fill	
	51	504	514	A11	"bLOCATIONb="	
	52	515	531	A17	Fourth scene location path/row/fraction/subscene in "ppp/rrrrfssbbbbbb" format: N/A	
	53	532	550	A19	"bACQUISITIONbDATEb="	
	54	551	558	A8	Fourth scene acquisition date in yyyyymmdd format: N/A	
	55	559	559	1X	Blank fill	
	56	560	560	A1	Carriage return	
	8	57	561	571	A11	"SATELLITEb="
		58	572	581	A10	Fourth scene satellite name: N/A
59		582	590	A9	"bSENSORb="	
60		591	600	A10	Fourth scene sensor name: N/A	
61		601	614	A14	"bSENSORbMODEb="	
62		615	620	A6	Fourth scene sensor mode: N/A	
63		621	633	A13	"bLOOKbANGLEb="	
64		634	639	F6.2	Fourth scene off-nadir angle in degrees: N/A	
65		640	640	A1	Carriage return	
9	66	641	654	A14	"PRODUCTbTYPEb="	
	67	655	672	A18	Product type: 'MAPbORIENTEDbbbbbb', 'ORBITbORIENTEDbbbb'	
	68	673	687	A15	"bPRODUCTbSIZEb="	
	69	688	697	A10	Product size: 'FULLbSCENE', 'SUBSCENEbb', 'MULTISCENE'	
	70	698	719	22X	Blank fill	
	71	720	720	A1	Carriage return	
10	72	721	740	A20	"TYPEbOFbPROCESSINGb="	
	73	741	751	A11	Type of processing used: 'SYSTEMATICb',	
	74	752	764	A13	"bRESAMPLINGb="	
	75	765	766	A2	Resampling algorithm used: 'CC', 'NN', 'MF'	
	76	767	799	33X	Blank fill	
	77	800	800	A1	Carriage return	
11	78	801	819	A19	"VOLUMEb##bINbSETb="	
	79	820	821	I2	Tape volume number in tape set (for multi-volume product): N/A	
	80	822	822	A1	"/'	
	81	823	824	I2	Number of volumes in tape set (for multi-volume product): N/A	
	82	825	842	A18	"bPIXELbPERbLINEb="	
	83	843	847	I5	Number of pixels per product line for pan band	
	84	848	864	A17	"bLINESbPERbBANDb="	
	85	865	869	I5	Number of lines per pan band	
	86	870	870	A1	"/'	
	87	871	875	I5	Number of lines in output product	

Table 4.1-1. Administrative Record for Panchromatic Band (3 of 3)

Line	Field	Start Byte	End Byte	Format	Description
	88	876	879	4X	Blank fill
	89	880	880	A1	Carriage return
12	90	881	894	A14	"STARTbLINE#b="
	91	895	899	I5	First product line number on this volume (for multivolume product): N/A
	92	900	917	A18	"bBLOCKINGbFACTORb="
	93	918	919	I2	Tape blocking factor: N/A
	94	920	931	A12	"bRECbSIZEbb="
	95	932	940	I9	Length of physical file record in bytes per pan band
	96	941	953	A13	"bPIXELbSIZEb="
	97	954	959	F6.2	Pixel size in meters for pan band
	98	960	960	A1	Carriage return
13	99	961	983	A23	"OUTPUTbBITSbPERbPIXELb="
	100	984	985	I2	Output bits per pixel: 8
	101	986	1011	A26	"bACQUIREDbBITSbPERbPIXELb="
	102	1012	1013	I2	Acquired bits per pixel: 8
	103	1014	1039	26X	Blank fill
	104	1040	1040	A1	Carriage return
14	105	1041	1055	A15	"BANDSbPRESENTb="
	106	1056	1087	A32	Image bands present for the pan band group: 8
	107	1088	1119	32X	Blank fill
	108	1120	1120	A1	Carriage return
15	109	1121	1130	A10	"FILENAMEb="
	110	1131	1159	A29	Filename for first band
	111	1160	1169	A10	"FILENAMEb="
	112	1170	1198	A29	Filename for second band (N/A)
	113	1199	1199	1X	Blank fill
	114	1200	1200	A1	Carriage return
16	115	1201	1210	A10	"FILENAMEb="
	116	1211	1239	A29	Filename for third band (N/A)
	117	1240	1249	A10	"FILENAMEb="
	117	1250	1278	A29	Filename for fourth band (N/A)
	119	1279	1279	1X	Blank fill
	120	1280	1280	A1	Carriage return
17	121	1281	1290	A10	"FILENAMEb="
	122	1291	1319	A29	Filename for fifth band (N/A)
	123	1320	1329	A10	"FILENAMEb="
	124	1330	1358	A29	Filename for sixth band (N/A)
	125	1359	1359	1X	Blank fill
	126	1360	1360	A1	Carriage return
18	127	1361	1439	79X	Blank fill
	128	1440	1440	A1	Carriage return
19	129	1441	1519	79X	Blank fill
	130	1520	1520	A1	Carriage return
20	131	1521	1532	12X	"REVbbbbbbbbb"
	132	1533	1535	A3	Format version code: L7A
	133	1536	1536	A1	Carriage return

Table 4.1-2. Radiometric Record for Panchromatic Band (1 of 2)

Line	Field	Start Byte	End Byte	Format	Description
1	1	1	50	A50	"GAINSbANDbBIASESbINbASCENDINGbBANDbNUMBERbORDER bbb"
	2	51	79	29X	Blank fill
	3	80	80	A1	Carriage return
2	4	81	104	D24.15	Bias for first band
	5	105	105	1X	Blank fill
	6	106	129	D24.15	Gain for first band
	7	130	159	30X	Blank fill
	8	160	160	A1	Carriage return
3	9	161	184	D24.15	Bias for second band
	10	185	185	1X	Blank fill
	11	186	209	D24.15	Gain for second band
	12	210	239	30X	Blank fill
	13	240	240	A1	Carriage return
4	14	241	264	D24.15	Bias for third band)
	15	265	265	1X	Blank fill
	16	266	289	D24.15	Gain for third band)
	17	290	319	30X	Blank fill
	18	320	320	A1	Carriage return
5	19	321	344	D24.15	Bias for fourth band
	20	345	345	1X	Blank fill
	21	346	369	D24.15	Gain for fourth band
	22	370	399	30X	Blank fill
	23	400	400	A1	Carriage return
6	24	401	424	D24.15	Bias for fifth band
	25	425	425	1X	Blank fill
	26	426	449	D24.15	Gain for fifth band
	27	450	479	30X	Blank fill
	28	480	480	A1	Carriage return
7	29	481	504	D24.15	Bias for sixth band
	30	505	505	1X	Blank fill
	31	506	529	D24.15	Gain for sixth band
	32	530	559	30X	Blank fill
	33	560	560	A1	Carriage return
8	34	561	584	D24.15	Bias for seventh band
	35	585	585	1X	Blank fill
	36	586	609	D24.15	Gain for seventh band
	37	610	639	30X	Blank fill
	38	640	640	A1	Carriage return
9	39	641	664	D24.15	Bias for eighth band
	40	665	665	1X	Blank fill
	41	666	689	D24.15	Gain for eighth band
	42	690	719	30X	Blank fill
	43	720	720	A1	Carriage return
10	44	721	799	79X	Blank fill
	45	800	800	A1	Carriage return
11	46	801	879	79X	Blank fill

Table 4.1-2. Radiometric Record for Panchromatic Band (2 of 2)

Line	Field	Start Byte	End Byte	Format	Description
	47	880	880	A1	Carriage return
12	48	881	959	79X	Blank fill
	49	960	960	A1	Carriage return
13	50	961	1039	79X	Blank fill
	51	1040	1040	A1	Carriage return
14	52	1041	1119	79X	Blank fill
	53	1120	1120	A1	Carriage return
15	54	1121	1199	79X	Blank fill
	55	1200	1200	A1	Carriage return
16	56	1201	1279	79X	Blank fill
	57	1280	1280	A1	Carriage return
17	58	1281	1359	79X	Blank fill
	59	1360	1360	A1	Carriage return
18	60	1361	1439	79X	Blank fill
	61	1440	1440	A1	Carriage return
19	62	1441	1519	79X	Blank fill
	63	1520	1520	A1	Carriage return
20	64	1521	1535	15X	Blank fill
	65	1536	1536	A1	Carriage return

Appendix B - Table 4.1-3. Geometric Record for Panchromatic Band (1 of 3)

Line	Field	Start Byte	End Byte	Format	Description
1	1	1	14	A14	"GEOMETRICbDATA"
	2	15	31	A17	"bMAPbPROJECTIONb="
	3	32	35	A4	Map projection name (see Appendix A for list of mnemonics)
	4	36	47	A12	"bELLIPSOIDb="
	5	48	65	A18	Earth ellipsoid used: WGS84
	6	66	73	A8	"bDATUMB="
	7	74	79	A6	Datum name: WGS84
	8	80	80	A1	Carriage return
2	9	81	108	A28	"USGSbPROJECTIONbPARAMETERSb="
	10	109	109	1X	Blank fill
	11	110	133	D24.15	USGS projection parameter #1: Semi-major axis
	12	134	134	1X	Blank fill
	13	135	158	D24.15	USGS projection parameter #2: Semi-minor axis
	14	159	159	1X	Blank fill
	15	160	160	A1	Carriage return
3	16	161	184	D24.15	USGS projection parameter #3
	17	185	185	1X	Blank fill
	18	186	209	D24.15	USGS projection parameter #4
	19	210	210	1X	Blank fill
	20	211	234	D24.15	USGS projection parameter #5
	21	235	239	5X	Blank fill
	22	240	240	A1	Carriage return
4	23	241	264	D24.15	USGS projection parameter #6
	24	265	265	1X	Blank fill
	25	266	289	D24.15	USGS projection parameter #7
	26	290	290	1X	Blank fill
	27	291	314	D24.15	USGS projection parameter #8
	28	315	319	5X	Blank fill
	29	320	320	A1	Carriage return
5	30	321	344	D24.15	USGS projection parameter #9
	31	345	345	1X	Blank fill
	32	346	369	D24.15	USGS projection parameter #10
	33	370	370	1X	Blank fill
	34	371	394	D24.15	USGS projection parameter #11
	35	395	399	5X	Blank fill
	36	400	400	A1	Carriage return
6	37	401	424	D24.15	USGS projection parameter #12
	38	425	425	1X	Blank fill
	39	426	449	D24.15	USGS projection parameter #13
	40	450	450	1X	Blank fill
	41	451	474	D24.15	USGS projection parameter #14
	42	475	479	5X	Blank fill
	43	480	480	A1	Carriage return
7	44	481	504	D24.15	USGS projection parameter #15
	45	505	505	A1	Blank fill
	46	506	520	A15	"USGSbMAPbZONEb="
	47	521	526	I6	Zone Number
	48	527	559	33X	Blank fill

Appendix C - Table 4.1-3. Geometric Record for Panchromatic Band (2 of 3)

Line	Field	Start Byte	End Byte	Format	Description
	49	560	560	A1	Carriage return
8	50	561	564	A4	"ULb="
	51	565	565	1X	Blank fill
	52	566	578	A13	Geodetic longitude of upper left corner of product. Longitude is expressed as degrees, minutes, seconds. For example, 5 degrees, 15 minutes, 13.2 seconds west of the prime meridian is expressed as "0051513.2000W"
	53	579	579	1X	Blank fill
	54	580	591	A12	Geodetic latitude of upper left corner of product. Latitude is expressed as degrees, minutes, seconds. For example, 9 degrees, 4 minutes, 24.2334 seconds north of the equator is expressed as "090424.2334N"
	55	592	592	1X	Blank fill
	56	593	605	F13.3	Easting of upper left corner of product in projection units (meters only)
	57	606	606	1X	Blank fill
	58	607	619	F13.3	Northing of upper left corner of product in projection units (meters only)
	59	620	639	20X	Blank fill
	60	640	640	A1	Carriage return
9	61	641	644	A4	"URb="
	62	645	645	1X	Blank fill
	63	646	658	A13	Geodetic longitude of upper right corner of product
	64	659	659	1X	Blank fill
	65	660	671	A12	Geodetic latitude of upper right corner of product
	66	672	672	1X	Blank fill
	67	673	685	F13.3	Easting of upper right corner of product in projection units (meters only)
	68	686	686	1X	Blank fill
	69	687	699	F13.3	Northing of upper right corner of product in projection units (meters only)
	70	700	719	20X	Blank fill
	71	720	720	A1	Carriage return
10	72	721	724	A4	"LRb="
	73	725	725	1X	Blank fill
	74	726	738	A13	Geodetic longitude of lower right corner of product
	75	739	739	1X	Blank fill
	76	740	751	A12	Geodetic latitude of lower right corner of product
	77	752	752	1X	Blank fill
	78	753	765	F13.3	Easting of lower right corner of product in projection units (meters only)
	79	766	766	1X	Blank fill
	80	767	779	F13.3	Northing of lower right corner of product in projection units (meters only)
	81	780	799	20X	Blank fill
	82	800	800	A1	Carriage return
11	83	801	804	A4	"LLb="
	84	805	805	1X	Blank fill
	85	806	818	A13	Geodetic longitude of lower left corner of product
	86	819	819	1X	Blank fill
	87	820	831	A12	Geodetic latitude of lower left corner of product
	88	832	832	1X	Blank fill
	89	833	845	F13.3	Easting of lower left corner of product in projection units (meters only)
	90	846	846	1X	Blank fill
	91	847	859	F13.3	Northing of lower left corner of product in projection units (meters only)

Table 4.1-3. Geometric Record for Panchromatic Band (3 of 3)

Line	Field	Start Byte	End Byte	Format	Description
	92	860	879	20X	Blank fill
	93	880	880	A1	Carriage return
12	94	881	888	A8	"CENTERb="
	95	889	889	1X	Blank fill
	96	890	902	A13	Product center geodetic longitude expressed in degrees, minutes, seconds, as above. This is the true center of the input imagery from which the product was made, and does not necessarily fall inside the product
	97	903	903	1X	Blank fill
	98	904	915	A12	Product center geodetic latitude expressed in degrees, minutes, seconds, as above. This is the true center of the input imagery from which the product was made, and does not necessarily fall inside the product
	99	916	916	1X	Blank fill
	100	917	929	F13.3	Product center Easting in projection units (meters only)
	101	930	930	1X	Blank fill
	102	931	943	F13.3	Product center Northing in projection units (meters only)
	103	944	944	1X	Blank fill
	104	945	949	I5	Product center pixel number measured from the product upper left corner, rounded to nearest whole pixel
	105	950	950	1X	Blank fill
	106	951	955	I5	Product center line number measured from the product upper left corner, rounded to nearest whole pixel
	107	956	959	4X	Blank fill
	108	960	960	A1	Carriage return
13	109	961	968	A8	"OFFSETb="
	110	969	974	I6	Horizontal offset of the true product from the nominal product center calculated in meters. Calculated as an average (may be negative).
	111	975	994	20A	"bORIENTATIONbANGLEb="
	112	995	1000	F6.2	Orientation angle in degrees (may be negative)
	113	1001	1039	39X	Blank fill
	114	1040	1040	A1	Carriage return
14	115	1041	1061	21A	"SUNbELEVATIONbANGLEb="
	116	1062	1065	F4.1	Sun elevation angle in degrees at product center
	117	1066	1085	A20	"bSUNbAZIMUTHbANGLEb="
	118	1086	1090	F5.1	Sun azimuth in degrees at product center
	119	1091	1119	29X	Blank fill
	120	1120	1120	A1	Carriage return
15	121	1121	1199	79X	Blank fill
	122	1200	1200	A1	Carriage return
16	123	1201	1279	79X	Blank fill
	124	1280	1280	A1	Carriage return
17	125	1281	1359	79X	Blank fill
	126	1360	1360	A1	Carriage return
18	127	1361	1439	79X	Blank fill
	128	1440	1440	A1	Carriage return
19	129	1441	1519	79X	Blank fill
	130	1520	1520	A1	Carriage return
20	131	1521	1535	15X	Blank fill
	132	1536	1536	A1	Carriage return

Appendix D - Table 4.1-4. Administrative Record for VNIR and SWIR Bands (1 of 3)

Line	Field	Start Byte	End Byte	Format	Description
1	1	1	8	A8	"REQbIDb="
	2	9	28	A20	Request number in "NNNYMMDDSSSSUUUbb"format where: > NNNYMMDDSSSS = 13-digit DORRAN order number > NNN = Node indicator > YY = Year > MM = Month > DD = Day > SSSS = Sequence number for the day > UUUU = 4-digit DORRAN unit number
	3	29	34	A6	"bLOCb="
	4	35	51	A17	First product location path/row in "ppp/rrrrfssbbbbb" format path/row/fraction/subscene
	5	52	70	A19	"bACQUISITIONbDATEb="
	6	71	78	A8	First product acquisition date in yyymmdd format
	7	79	79	1X	Blank fill
	8	80	80	A1	Carriage return
2	9	81	91	A11	"SATELLITEb="
	10	92	101	A10	First product satellite Name: LANDSAT7
	11	102	110	A9	"bSENSORb="
	12	111	120	A10	First product sensor Name: ETM+
	13	121	134	A14	"bSENSORbMODEb="
	14	135	140	A6	First product sensor Mode: NORMAL
	15	141	153	A13	"bLOOKbANGLEb="
	16	154	159	F6.2	First product off-nadir angle in degrees: 0.0
	17	160	160	A1	Carriage return
3	18	161	183	23X	Blank fill
	19	184	194	A11	"bLOCATIONb="
	20	195	211	A17	Second scene location path/row/fraction/subscene in "ppp/rrrrfssbbbbb" format: N/A
	21	212	230	A19	"bACQUISITIONbDATEb="
	22	231	238	A8	Second scene acquisition date in yyymmdd format: N/A
	23	239	239	1X	Blank fill
	24	240	240	A1	Carriage return
4	25	241	251	A11	"SATELLITEb="
	26	252	261	A10	Second scene satellite Name: N/A
	27	262	270	A9	"bSENSORb="
	28	271	280	A10	Second scene sensor Name: N/A
	29	281	294	A14	"bSENSORbMODEb="
	30	295	300	A6	Second scene sensor Mode: N/A
	31	301	313	A13	"bLOOKbANGLEb="
	32	314	319	F6.2	Second scene off-nadir angle in degrees: N/A
	33	320	320	A1	Carriage return
5	34	321	343	23X	Blank fill
	35	344	354	A11	"bLOCATIONb="
	36	355	371	A17	Third scene location path/row/fraction/subscene in "ppp/rrrrfssbbbbb" format: N/A
	37	372	390	A19	"bACQUISITIONbDATEb="
	38	391	398	A8	Third scene acquisition date in yyymmdd format: N/A
	39	399	399	1X	Blank fill

	40	400	400	A1	Carriage return
--	----	-----	-----	----	-----------------

Table 4.1-4. Administrative Record for VNIR and SWIR Bands (2 of 3)

Line	Field	Start Byte	End Byte	Format	Description
6	41	401	411	A11	"SATELLITEb="
	42	412	421	A10	Third scene satellite Name: N/A
	43	422	430	A9	"bSENSORb="
	44	431	440	A10	Third scene sensor Name: N/A
	45	441	454	A14	"bSENSORbMODEb="
	46	455	460	A6	Third scene sensor Mode: N/A
	47	461	473	A13	"bLOOKbANGLEb="
	48	474	479	F6.2	Third scene off-nadir angle in degrees: N/A
	49	480	480	A1	Carriage return
7	50	481	503	23X	Blank fill
	51	504	514	A11	"bLOCATIONb="
	52	515	531	A17	Fourth scene location path/row/fraction/subscene in ppp/rrrrfssbbbbbb format: N/A
	53	532	550	A19	"bACQUISITIONbDATEb="
	54	551	558	A8	Fourth scene acquisition date in yyyyymmdd format: N/A
	55	559	559	1X	Blank fill
	56	560	560	A1	Carriage return
8	57	561	571	A11	"SATELLITEb="
	58	572	581	A10	Fourth scene satellite name: N/A
	59	582	590	A9	"bSENSORb="
	60	591	600	A10	Fourth scene sensor name: N/A
	61	601	614	A14	"bSENSORbMODEb="
	62	615	620	A6	Fourth scene sensor mode: N/A
	63	621	633	A13	"bLOOKbANGLEb="
	64	634	639	F6.2	Fourth scene off-nadir angle in degrees: N/A
	65	640	640	A1	Carriage return
9	66	641	654	A14	"PRODUCTbTYPEb="
	67	655	672	A18	Product type: 'MAPbORIENTEDbbbbbb', 'ORBITbORIENTEDbbbb'
	68	673	687	A15	"bPRODUCTbSIZEb="
	69	688	697	A10	Product size: 'FULLbSCENE', 'SUBSCENEbb', 'MULTISCENE'
	70	698	719	22X	Blank fill
	71	720	720	A1	Carriage return
10	72	721	740	A20	"TYPEbOFbPROCESSINGb="
	73	741	751	A11	Type of processing used: 'SYSTEMATICb'
	74	752	764	A13	"bRESAMPLINGb="
	75	765	766	A2	Resampling algorithm used: 'CC', 'NN', 'MF'
	76	767	799	33X	Blank fill
	77	800	800	A1	Carriage return
11	78	801	819	A19	"VOLUMEb##/bINbSETb="
	79	820	821	I2	Tape volume number in tape set (for multivolume product): N/A
	80	822	822	A1	"/
	81	823	824	I2	Number of volumes in tape set (for multivolume product): N/A
	82	825	842	A18	"bPIXELbSPERbLINEb="
	83	843	847	I5	Number of pixels per product line for VNIR and SWIR bands
	84	848	864	A17	"bLINEbSPERbBANDb="
	85	865	869	I5	Number of lines per VNIR and SWIR bands
86	870	870	A1	"/	
87	871	875	I5	Number of lines in output product	

Table 4.1-4. Administrative Record for VNIR and SWIR Bands (3 of 3)

Line	Field	Start Byte	End Byte	Format	Description
	88	876	879	4X	Blank fill
	89	880	880	A1	Carriage return
12	90	881	894	A14	"STARTbLINEb#b="
	91	895	899	I5	First product line number on this volume (for multivolume product): N/A
	92	900	917	A18	"bBLOCKINGbFACTORb="
	93	918	919	I2	Tape blocking factor: N/A
	94	920	931	A12	"bRECbSIZEbb="
	95	932	940	I9	Length of physical file record in bytes per VNIR and SWIR bands
	96	941	953	A13	"bPIXELbSIZEb="
	97	954	959	F6.2	Pixel size in meters for VNIR and SWIR bands
	98	960	960	A1	Carriage return
13	99	961	983	A23	"OUTPUTbBITSbPERbPIXELb="
	100	984	985	I2	Output bits per pixel: 8
	101	986	1011	A26	"bACQUIREDbBITSbPERbPIXELb="
	102	1012	1013	I2	Acquired bits per pixel: 8
	103	1014	1039	26X	Blank fill
	104	1040	1040	A1	Carriage return
14	105	1041	1055	A15	"BANDSbPRESENTb="
	106	1056	1087	A32	Image bands present for the VNIR and SWIR bands group:123457 (or subset)
	107	1088	1119	32X	Blank fill
	108	1120	1120	A1	Carriage return
15	109	1121	1130	A10	"FILENAMEb="
	110	1131	1159	A29	Filename for first band
	111	1160	1169	A10	"FILENAMEb="
	112	1170	1198	A29	Filename for second band
	113	1199	1199	1X	Blank fill
	114	1200	1200	A1	Carriage return
16	115	1201	1210	A10	"FILENAMEb="
	116	1211	1239	A29	Filename for third band
	117	1240	1249	A10	"FILENAMEb="
	117	1250	1278	A29	Filename for fourth band
	119	1279	1279	1X	Blank fill
	120	1280	1280	A1	Carriage return
17	121	1281	1290	A10	"FILENAMEb="
	122	1291	1319	A29	Filename for fifth band
	123	1320	1329	A10	"FILENAMEb="
	124	1330	1358	A29	Filename for sixth band
	125	1359	1359	1X	Blank fill
	126	1360	1360	A1	Carriage return
18	127	1361	1439	79X	Blank fill
	128	1440	1440	A1	Carriage return
19	129	1441	1519	79X	Blank fill
	130	1520	1520	A1	Carriage return
20	131	1521	1532	12X	"REVbbbbbbbbb"
	132	1533	1535	A3	Format version code: L7A
	133	1536	1536	A1	Carriage return

Appendix E - Table 4.1-5. Radiometric Record for VNIR and SWIR Bands (1 of 2)

Line	Field	Start Byte	End Byte	Format	Description
1	1	1	50	A50	"GAINSbANDbBIASESbINbASCENDINGbBANDbNUMBERbORDER bbb
	2	51	79	29X	Blank fill
	3	80	80	A1	Carriage return
2	4	81	104	D24.15	Bias for first band
	5	105	105	1X	Blank fill
	6	106	129	D24.15	Gain for first band
	7	130	159	30X	Blank fill
	8	160	160	A1	Carriage return
3	9	161	184	D24.15	Bias for second band
	10	185	185	1X	Blank fill
	11	186	209	D24.15	Gain for second band
	12	210	239	30X	Blank fill
	13	240	240	A1	Carriage return
4	14	241	264	D24.15	Bias for third band
	15	265	265	1X	Blank fill
	16	266	289	D24.15	Gain for third band
	17	290	319	30X	Blank fill
	18	320	320	A1	Carriage return
5	19	321	344	D24.15	Bias for fourth band
	20	345	345	1X	Blank fill
	21	346	369	D24.15	Gain for fourth band
	22	370	399	30X	Blank fill
	23	400	400	A1	Carriage return
6	24	401	424	D24.15	Bias for fifth band
	25	425	425	1X	Blank fill
	26	426	449	D24.15	Gain for fifth band
	27	450	479	30X	Blank fill
	28	480	480	A1	Carriage return
7	29	481	504	D24.15	Bias for sixth band
	30	505	505	1X	Blank fill
	31	506	529	D24.15	Gain for sixth band
	32	530	559	30X	Blank fill
	33	560	560	A1	Carriage return
8	34	561	584	D24.15	Bias for seventh band
	35	585	585	1X	Blank fill
	36	586	609	D24.15	Gain for seventh band
	37	610	639	30X	Blank fill
	38	640	640	A1	Carriage return
9	39	641	664	D24.15	Bias for eighth band
	40	665	665	1X	Blank fill
	41	666	689	D24.15	Gain for eighth band
	42	690	719	30X	Blank fill
	43	720	720	A1	Carriage return
10	44	721	799	79X	Blank fill
	45	800	800	A1	Carriage return
11	46	801	879	79X	Blank fill
	47	880	880	A1	Carriage return

Table 4.1-5. Radiometric Record for VNIR and SWIR Bands (2 of 2)

Line	Field	Start Byte	End Byte	Format	Description
12	48	881	959	79X	Blank fill
	49	960	960	A1	Carriage return
13	50	961	1039	79X	Blank fill
	51	1040	1040	A1	Carriage return
14	52	1041	1119	79X	Blank fill
	53	1120	1120	A1	Carriage return
15	54	1121	1199	79X	Blank fill
	55	1200	1200	A1	Carriage return
16	56	1201	1279	79X	Blank fill
	57	1280	1280	A1	Carriage return
17	58	1281	1359	79X	Blank fill
	59	1360	1360	A1	Carriage return
18	60	1361	1439	79X	Blank fill
	61	1440	1440	A1	Carriage return
19	62	1441	1519	79X	Blank fill
	63	1520	1520	A1	Carriage return
20	64	1521	1535	15X	Blank fill
	65	1536	1536	A1	Carriage return

Appendix F - Table 4.1-6. Geometric Record for VNIR and SWIR Bands (1 of 3)

Line	Field	Start Byte	End Byte	Format	Description
1	1	1	14	A14	"GEOMETRICbDATA"
	2	15	31	A17	"bMAPbPROJECTIONb="
	3	32	35	A4	Map projection name (see Appendix A for list of mnemonics)
	4	36	47	A12	"bELLIPSOIDb="
	5	48	65	A18	Earth ellipsoid used: WGS84
	6	66	73	A8	"bDATUMB="
	7	74	79	A6	Datum name: WGS84
	8	80	80	A1	Carriage return
2	9	81	108	A28	"USGSbPROJECTIONbPARAMETERSb="
	10	109	109	1X	Blank fill
	11	110	133	D24.15	USGS projection parameter #1: Semi-major axis
	12	134	134	1X	Blank fill
	13	135	158	D24.15	USGS projection parameter #2: Semi-minor axis
	14	159	159	1X	Blank fill
	15	160	160	A1	Carriage return
3	16	161	184	D24.15	USGS projection parameter #3
	17	185	185	1X	Blank fill
	18	186	209	D24.15	USGS projection parameter #4
	19	210	210	1X	Blank fill
	20	211	234	D24.15	USGS projection parameter #5
	21	235	239	5X	Blank fill
	22	240	240	A1	Carriage return
4	23	241	264	D24.15	USGS projection parameter #6
	24	265	265	1X	Blank fill
	25	266	289	D24.15	USGS projection parameter #7
	26	290	290	1X	Blank fill
	27	291	314	D24.15	USGS projection parameter #8
	28	315	319	5X	Blank fill
	29	320	320	A1	Carriage return
5	30	321	344	D24.15	USGS projection parameter #9
	31	345	345	1X	Blank fill
	32	346	369	D24.15	USGS projection parameter #10
	33	370	370	1X	Blank fill
	34	371	394	D24.15	USGS projection parameter #11
	35	395	399	5X	Blank fill
	36	400	400	A1	Carriage return
6	37	401	424	D24.15	USGS projection parameter #12
	38	425	425	1X	Blank fill
	39	426	449	D24.15	USGS projection parameter #13
	40	450	450	1X	Blank fill
	41	451	474	D24.15	USGS projection parameter #14
	42	475	479	5X	Blank fill
	43	480	480	A1	Carriage return
7	44	481	504	D24.15	USGS projection parameter #15
	45	505	505	A1	Blank fill
	46	506	520	A15	"USGSbMAPbZONEb="
	47	521	526	I6	Zone Number
	48	527	559	33X	Blank fill

Table 4.1-6. Geometric Record for VNIR and SWIR Bands (2 of 3)

Line	Field	Start Byte	End Byte	Format	Description
	49	560	560	A1	Carriage return
8	50	561	564	A4	"ULb="
	51	565	565	1X	Blank fill
	52	566	578	A13	Geodetic longitude of upper left corner expressed as degrees, minutes, seconds. For example, 5 degrees, 15 minutes, 13.2 seconds west of the prime meridian is expressed as "0051513.2000W"
	53	579	579	1X	Blank fill
	54	580	591	A12	Geodetic latitude of upper left corner expressed as degrees, minutes, seconds. For example, 9 degrees, 4 minutes, 24.2334 seconds north of the equator is expressed as "090424.2334N"
	55	592	592	1X	Blank fill
	56	593	605	F13.3	Easting of upper left corner of product in projection units (meters only)
	57	606	606	1X	Blank fill
	58	607	619	F13.3	Northing of upper left corner of product in projection units (meters only)
	59	620	639	20X	Blank fill
	60	640	640	A1	Carriage return
9	61	641	644	A4	"URb="
	62	645	645	1X	Blank fill
	63	646	658	A13	Geodetic longitude of upper right corner of product
	64	659	659	1X	Blank fill
	65	660	671	A12	Geodetic Latitude of upper right corner of product
	66	672	672	1X	Blank fill
	67	673	685	F13.3	Easting of upper right corner of product in projection units (meters only)
	68	686	686	1X	Blank fill
	69	687	699	F13.3	Northing of upper right corner of product in projection units (meters only)
	70	700	719	20X	Blank fill
	71	720	720	A1	Carriage return
10	72	721	724	A4	"LRb="
	73	725	725	1X	Blank fill
	74	726	738	A13	Geodetic longitude of lower right corner of product
	75	739	739	1X	Blank fill
	76	740	751	A12	Geodetic latitude of lower right corner of product
	77	752	752	1X	Blank fill
	78	753	765	F13.3	Easting of lower right corner of product in projection units (meters only)
	79	766	766	1X	Blank fill
	80	767	779	F13.3	Northing of lower right corner of product in projection units (meters only)
	81	780	799	20X	Blank fill
	82	800	800	A1	Carriage return
11	83	801	804	A4	"LLb="
	84	805	805	1X	Blank fill
	85	806	818	A13	Geodetic longitude of lower left corner of product
	86	819	819	1X	Blank fill
	87	820	831	A12	Geodetic latitude of lower left corner of product
	88	832	832	1X	Blank fill
	89	833	845	F13.3	Easting of lower left corner of product in projection units (meters only)
	90	846	846	1X	Blank fill
	91	847	859	F13.3	Northing of lower left corner of product in projection units (meters only)
	92	860	879	20X	Blank fill

Table 4.1-6. Geometric Record for VNIR and SWIR Bands (3 of 3)

Line	Field	Start Byte	End Byte	Format	Description
	93	880	880	A1	Carriage return
12	94	881	888	A8	"CENTERb="
	95	889	889	1X	Blank fill
	96	890	902	A13	Product center geodetic longitude expressed in degrees, minutes, seconds. This is the true center of the input imagery from which the product was made, and does not necessarily fall inside the product
	97	903	903	1X	Blank fill
	98	904	915	A12	Product center geodetic latitude expressed in degrees, minutes, seconds. This is the true center of the input imagery from which the product was made, and does not necessarily fall inside the product
	99	916	916	1X	Blank fill
	100	917	929	F13.3	Product center Easting in projection units (meters only)
	101	930	930	1X	Blank fill
	102	931	943	F13.3	Product center Northing in projection units (meters only)
	103	944	944	1X	Blank fill
	104	945	949	I5	Product center pixel number measured from the product upper left corner, rounded to nearest whole pixel
	105	950	950	1X	Blank fill
	106	951	955	I5	Product center line number measured from the product upper left corner, rounded to nearest whole pixel
	107	956	959	4X	Blank fill
	108	960	960	A1	Carriage return
13	109	961	968	A8	"OFFSETb="
	110	969	974	I6	Horizontal offset of the true product from the nominal product center calculated in meters. Calculated as an average (may be negative).
	111	975	994	20A	"bORIENTATIONbANGLEb="
	112	995	1000	F6.2	Orientation angle in degrees (may be negative)
	113	1001	1039	39X	Blank fill
	114	1040	1040	A1	Carriage return
14	115	1041	1061	21A	"SUNbELEVATIONbANGLEb="
	116	1062	1065	F4.1	Sun elevation angle in degrees at product center
	117	1066	1085	A20	"bSUNbAZIMUTHbANGLEb="
	118	1086	1090	F5.1	Sun azimuth in degrees at product center
	119	1091	1119	29X	Blank fill
	120	1120	1120	A1	Carriage return
15	121	1121	1199	79X	Blank fill
	122	1200	1200	A1	Carriage return
16	123	1201	1279	79X	Blank fill
	124	1280	1280	A1	Carriage return
17	125	1281	1359	79X	Blank fill
	126	1360	1360	A1	Carriage return
18	127	1361	1439	79X	Blank fill
	128	1440	1440	A1	Carriage return
19	129	1441	1519	79X	Blank fill
	130	1520	1520	A1	Carriage return
20	131	1521	1535	15X	Blank fill
	132	1536	1536	A1	Carriage return

Appendix G - Table 4.1-7. Administrative Record for Thermal Bands (1 of 3)

Line	Field	Start Byte	End Byte	Format	Description
1	1	1	8	A8	"REQbIDb="
	2	9	28	A20	Request number in "NNNYMMDDSSSSUUUbb" format >where: > NNNYMMDDSSSS = 13-digit DORRAN order number > NNN = Node indicator > YY = Year > MM = Month > DD = Day > SSSS = Sequence number for the day > UUUU = 4-digit DORRAN unit number
	3	29	34	A6	"bLOCb="
	4	35	51	A17	First product location path/row in "ppp/rrrrfssbbbbb" format path/row/fraction/subscene
	5	52	70	A19	"bACQUISITIONbDATEb="
	6	71	78	A8	First product acquisition date in yyymmdd format
	7	79	79	1X	Blank fill
	8	80	80	A1	Carriage return
2	9	81	91	A11	"SATELLITEb="
	10	92	101	A10	First product satellite Name: LANDSAT7
	11	102	110	A9	"bSENSORb="
	12	111	120	A10	First product sensor Name: ETM+
	13	121	134	A14	"bSENSORbMODEb="
	14	135	140	A6	First product sensor Mode: NORMAL
	15	141	153	A13	"bLOOKbANGLEb="
	16	154	159	F6.2	First product off-nadir angle in degrees: 0.0
	17	160	160	A1	Carriage return
3	18	161	183	23X	Blank fill
	19	184	194	A11	"bLOCATIONb="
	20	195	211	A17	Second scene location path/row/fraction/subscene in "ppp/rrrrfssbbbbb" format: N/A
	21	212	230	A19	"bACQUISITIONbDATEb="
	22	231	238	A8	Second scene acquisition date in yyymmdd format: N/A
	23	239	239	1X	Blank fill
	24	240	240	A1	Carriage return
4	25	241	251	A11	"SATELLITEb="
	26	252	261	A10	Second scene satellite Name: N/A
	27	262	270	A9	"bSENSORb="
	28	271	280	A10	Second scene sensor Name: N/A
	29	281	294	A14	"bSENSORbMODEb="
	30	295	300	A6	Second scene sensor Mode: N/A
	31	301	313	A13	"bLOOKbANGLEb="
	32	314	319	F6.2	Second scene off-nadir angle in degrees: N/A
	33	320	320	A1	Carriage return
5	34	321	343	23X	Blank fill
	35	344	354	A11	"bLOCATIONb="
	36	355	371	A17	Third scene location path/row/fraction/subscene N/A
	37	372	390	A19	"bACQUISITIONbDATEb="
	38	391	398	A8	Third scene acquisition date in yyymmdd format: N/A
	39	399	399	1X	Blank fill
	40	400	400	A1	Carriage return

Table 4.1-7. Administrative Record for Thermal Bands (2 of 3)

Line	Field	Start Byte	End Byte	Format	Description
6	41	401	411	A11	"SATELLITEb="
	42	412	421	A10	Third scene satellite Name: N/A
	43	422	430	A9	"bSENSORb="
	44	431	440	A10	Third scene sensor Name: N/A
	45	441	454	A14	"bSENSORbMODEb="
	46	455	460	A6	Third scene sensor Mode: N/A
	47	461	473	A13	"bLOOKbANGLEb="
	48	474	479	F6.2	Third scene off-nadir angle in degrees: N/A
	49	480	480	A1	Carriage return
7	50	481	503	23X	Blank fill
	51	504	514	A11	"bLOCATIONb="
	52	515	531	A17	Fourth scene location path/row/fraction/subscene in "ppp/rrrrfssbbbb" format: N/A
	53	532	550	A19	"bACQUISITIONbDATEb="
	54	551	558	A8	Fourth scene acquisition date in yyyyymmdd format: N/A
	55	559	559	1X	Blank fill
	56	560	560	A1	Carriage return
8	57	561	571	A11	"SATELLITEb="
	58	572	581	A10	Fourth scene satellite Name: N/A
	59	582	590	A9	"bSENSORb="
	60	591	600	A10	Fourth scene sensor Name: N/A
	61	601	614	A14	"bSENSORbMODEb="
	62	615	620	A6	Fourth scene sensor Mode: N/A
	63	621	633	A13	"bLOOKbANGLEb="
	64	634	639	F6.2	Fourth scene off-nadir angle in degrees: N/A
	65	640	640	A1	Carriage return
9	66	641	654	A14	"PRODUCTbTYPEb="
	67	655	672	A18	Product type: 'MAPbORIENTEDbbbbbb', 'ORBITbORIENTEDbbbb'
	68	673	687	A15	"bPRODUCTbSIZEb="
	69	688	697	A10	Product size: 'FULLbSCENE', 'SUBSCENEbb', 'MULTISCENE'
	70	698	719	22X	Blank fill
	71	720	720	A1	Carriage return
10	72	721	740	A20	"TYPEbOFbPROCESSINGb="
	73	741	751	A11	Type of processing used: 'SYSTEMATICb'
	74	752	764	A13	"bRESAMPLINGb="
	75	765	766	A2	Resampling algorithm used: 'CC', 'NN', 'MF'
	76	767	799	33X	Blank fill
	77	800	800	A1	Carriage return
11	78	801	819	A19	"VOLUMEb##/bINbSETb="
	79	820	821	I2	Tape volume number in tape set (for multivolume product): N/A
	80	822	822	A1	"/"
	81	823	824	I2	Number of volumes in tape set (for multivolume product): N/A
	82	825	842	A18	"bPIXELSbPERbLINEb="
	83	843	847	I5	Number of pixels per product line for thermal band
	84	848	864	A17	"bLINEsbPERbBANDb="
	85	865	869	I5	Number of lines per thermal band
	86	870	870	A1	"/"
87	871	875	I5	Number of lines in output product	

Table 4.1-7. Administrative Record for Thermal Bands (3 of 3)

Line	Field	Start Byte	End Byte	Format	Description
	88	876	879	4X	Blank fill
	89	880	880	A1	Carriage return
12	90	881	894	A14	"STARTbLINEb#b="
	91	895	899	I5	First product line number on this volume (for multivolume product): N/A
	92	900	917	A18	"bBLOCKINGbFACTORb="
	93	918	919	I2	Tape blocking factor: N/A
	94	920	931	A12	"bRECbSIZEbb="
	95	932	940	I9	Length of physical file record in bytes per thermal band
	96	941	953	A13	"bPIXELbSIZEb="
	97	954	959	F6.2	Pixel size in meters for thermal band
	98	960	960	A1	Carriage return
13	99	961	983	A23	"OUTPUTbBITSbPERbPIXELb="
	100	984	985	I2	Output bits per pixel: 8
	101	986	1011	A26	"bACQUIREDbBITSbPERbPIXELb="
	102	1012	1013	I2	Acquired bits per pixel: 8
	103	1014	1039	26X	Blank fill
	104	1040	1040	A1	Carriage return
14	105	1041	1055	A15	"BANDSbPRESENTb="
	106	1056	1087	A32	Image bands present for the thermal band group: LH (or subset)
	107	1088	1119	32X	Blank fill
	108	1120	1120	A1	Carriage return
15	109	1121	1130	A10	"FILENAMEb="
	110	1131	1159	A29	Filename for first band
	111	1160	1169	A10	"FILENAMEb="
	112	1170	1198	A29	Filename for second band
	113	1199	1199	1X	Blank fill
	114	1200	1200	A1	Carriage return
16	115	1201	1210	A10	"FILENAMEb="
	116	1211	1239	A29	Filename for third band
	117	1240	1249	A10	"FILENAMEb="
	117	1250	1278	A29	Filename for fourth band
	119	1279	1279	1X	Blank fill
	120	1280	1280	A1	Carriage return
17	121	1281	1290	A10	"FILENAMEb="
	122	1291	1319	A29	Filename for fifth band
	123	1320	1329	A10	"FILENAMEb="
	124	1330	1358	A29	Filename for sixth band
	125	1359	1359	1X	Blank fill
	126	1360	1360	A1	Carriage return
18	127	1361	1439	79X	Blank fill
	128	1440	1440	A1	Carriage return
19	129	1441	1519	79X	Blank fill
	130	1520	1520	A1	Carriage return
20	131	1521	1532	12X	"REVbbbbbbbbb"
	132	1533	1535	A3	Format version code: L7A
	133	1536	1536	A1	Carriage return

Appendix H - Table 4.1-8. Radiometric Record for Thermal Bands (1 of 2)

Line	Field	Start Byte	End Byte	Format	Description
1	1	1	50	A50	"GAINSbANDbBIASESbINbASCENDINGbBANDbNUMBERbORDER bbb
	2	51	79	29X	Blank fill
	3	80	80	A1	Carriage return
2	4	81	104	D24.15	Bias for first band
	5	105	105	1X	Blank fill
	6	106	129	D24.15	Gain for first band
	7	130	159	30X	Blank fill
	8	160	160	A1	Carriage return
3	9	161	184	D24.15	Bias for second band)
	10	185	185	1X	Blank fill
	11	186	209	D24.15	Gain for second band
	12	210	239	30X	Blank fill
	13	240	240	A1	Carriage return
4	14	241	264	D24.15	Bias for third band
	15	265	265	1X	Blank fill
	16	266	289	D24.15	Gain for third band
	17	290	319	30X	Blank fill
	18	320	320	A1	Carriage return
5	19	321	344	D24.15	Bias for fourth band
	20	345	345	1X	Blank fill
	21	346	369	D24.15	Gain for fourth band
	22	370	399	30X	Blank fill
	23	400	400	A1	Carriage return
6	24	401	424	D24.15	Bias for fifth band
	25	425	425	1X	Blank fill
	26	426	449	D24.15	Gain for fifth band
	27	450	479	30X	Blank fill
	28	480	480	A1	Carriage return
7	29	481	504	D24.15	Bias for sixth band
	30	505	505	1X	Blank fill
	31	506	529	D24.15	Gain for sixth band
	32	530	559	30X	Blank fill
	33	560	560	A1	Carriage return
8	34	561	584	D24.15	Bias for seventh band
	35	585	585	1X	Blank fill
	36	586	609	D24.15	Gain for seventh band
	37	610	639	30X	Blank fill
	38	640	640	A1	Carriage return
9	39	641	664	D24.15	Bias for eighth band
	40	665	665	1X	Blank fill
	41	666	689	D24.15	Gain for eighth band
	42	690	719	30X	Blank fill
	43	720	720	A1	Carriage return
10	44	721	799	79X	Blank fill
	45	800	800	A1	Carriage return
11	46	801	879	79X	Blank fill
	47	880	880	A1	Carriage return

Table 4.1-8. Radiometric Record for Thermal Bands (2 of 2)

Line	Field	Start Byte	End Byte	Format	Description
12	48	881	959	79X	Blank fill
	49	960	960	A1	Carriage return
13	50	961	1039	79X	Blank fill
	51	1040	1040	A1	Carriage return
14	52	1041	1119	79X	Blank fill
	53	1120	1120	A1	Carriage return
15	54	1121	1199	79X	Blank fill
	55	1200	1200	A1	Carriage return
16	56	1201	1279	79X	Blank fill
	57	1280	1280	A1	Carriage return
17	58	1281	1359	79X	Blank fill
	59	1360	1360	A1	Carriage return
18	60	1361	1439	79X	Blank fill
	61	1440	1440	A1	Carriage return
19	62	1441	1519	79X	Blank fill
	63	1520	1520	A1	Carriage return
20	64	1521	1535	15X	Blank fill
	65	1536	1536	A1	Carriage return

Appendix I - Table 4.1-9. Geometric Record for Thermal Bands (1 of 3)

Line	Field	Start Byte	End Byte	Format	Description
1	1	1	14	A14	"GEOMETRICbDATA"
	2	15	31	A17	"bMAPbPROJECTIONb="
	3	32	35	A4	Map projection name (see Appendix A for list of mnemonics)
	4	36	47	A12	"bELLIPSOIDb="
	5	48	65	A18	Earth ellipsoid used: WGS84
	6	66	73	A8	"bDATUMB="
	7	74	79	A6	Datum name: WGS84
	8	80	80	A1	Carriage return
2	9	81	108	A28	"USGSbPROJECTIONbPARAMETERSb="
	10	109	109	1X	Blank fill
	11	110	133	D24.15	USGS projection parameter #1: Semi-major axis
	12	134	134	1X	Blank fill
	13	135	158	D24.15	USGS projection parameter #2: Semi-minor axis
	14	159	159	1X	Blank fill
	15	160	160	A1	Carriage return
3	16	161	184	D24.15	USGS projection parameter #3
	17	185	185	1X	Blank fill
	18	186	209	D24.15	USGS projection parameter #4
	19	210	210	1X	Blank fill
	20	211	234	D24.15	USGS projection parameter #5
	21	235	239	5X	Blank fill
	22	240	240	A1	Carriage return
4	23	241	264	D24.15	USGS projection parameter #6
	24	265	265	1X	Blank fill
	25	266	289	D24.15	USGS projection parameter #7
	26	290	290	1X	Blank fill
	27	291	314	D24.15	USGS projection parameter #8
	28	315	319	5X	Blank fill
	29	320	320	A1	Carriage return
5	30	321	344	D24.15	USGS projection parameter #9
	31	345	345	1X	Blank fill
	32	346	369	D24.15	USGS projection parameter #10
	33	370	370	1X	Blank fill
	34	371	394	D24.15	USGS projection parameter #11
	35	395	399	5X	Blank fill
	36	400	400	A1	Carriage return
6	37	401	424	D24.15	USGS projection parameter #12
	38	425	425	1X	Blank fill
	39	426	449	D24.15	USGS projection parameter #13
	40	450	450	1X	Blank fill
	41	451	474	D24.15	USGS projection parameter #14
	42	475	479	5X	Blank fill
	43	480	480	A1	Carriage return
7	44	481	504	D24.15	USGS projection parameter #15
	45	505	505	A1	Blank fill
	46	506	520	A15	"USGSbMAPbZONEb="
	47	521	526	I6	" ZONE Number
	48	527	559	33X	Blank fill

Table 4.1-9. Geometric Record for Thermal Bands (2 of 3)

Line	Field	Start Byte	End Byte	Format	Description
	49	560	560	A1	Carriage return
8	50	561	564	A4	"ULb="
	51	565	565	1X	Blank fill
	52	566	578	A13	Geodetic longitude of upper left corner expressed as degrees, minutes, seconds. For example, 5 degrees, 15 minutes, 13.2 seconds west of the prime meridian is expressed as "0051513.2000W"
	53	579	579	1X	Blank fill
	54	580	591	A12	Geodetic latitude of upper left corner expressed as degrees, minutes, seconds. For example, 9 degrees, 4 minutes, 24.2334 seconds north of the equator is expressed as "090424.2334N"
	55	592	592	1X	Blank fill
	56	593	605	F13.3	Easting of upper left corner of product in projection units (meters only)
	57	606	606	1X	Blank fill
	58	607	619	F13.3	Northing of upper left corner of product in projection units (meters only)
	59	620	639	20X	Blank fill
	60	640	640	A1	Carriage return
9	61	641	644	A4	"URb="
	62	645	645	1X	Blank fill
	63	646	658	A13	Geodetic longitude of upper right corner of product
	64	659	659	1X	Blank fill
	65	660	671	A12	Geodetic latitude of upper right corner of product
	66	672	672	1X	Blank fill
	67	673	685	F13.3	Easting of upper right corner of product in projection units (meters only)
	68	686	686	1X	Blank fill
	69	687	699	F13.3	Northing of upper right corner of product in projection units (meters only)
	70	700	719	20X	Blank fill
	71	720	720	A1	Carriage return
10	72	721	724	A4	"LRb="
	73	725	725	1X	Blank fill
	74	726	738	A13	Geodetic longitude of lower right corner of product
	75	739	739	1X	Blank fill
	76	740	751	A12	Geodetic latitude of lower right corner of product
	77	752	752	1X	Blank fill
	78	753	765	F13.3	Easting of lower right corner of product in projection units (meters only)
	79	766	766	1X	Blank fill
	80	767	779	F13.3	Northing of lower right corner of product in projection units (meters only)
	81	780	799	20X	Blank fill
	82	800	800	A1	Carriage return
11	83	801	804	A4	"LLb="
	84	805	805	1X	Blank fill
	85	806	818	A13	Geodetic longitude of lower left corner of product
	86	819	819	1X	Blank fill
	87	820	831	A12	Geodetic latitude of lower left corner of product
	88	832	832	1X	Blank fill
	89	833	845	F13.3	Easting of lower left corner of product in projection units (meters only)
	90	846	846	1X	Blank fill
	91	847	859	F13.3	Northing of lower left corner of product in projection units (meters only)
	92	860	879	20X	Blank fill

Table 4.1-9. Geometric Record for Thermal Bands (3 of 3)

Line	Field	Start Byte	End Byte	Format	Description
	93	880	880	A1	Carriage return
12	94	881	888	A8	"CENTERb="
	95	889	889	1X	Blank fill
	96	890	902	A13	Product center geodetic longitude expressed in degrees, minutes, seconds. This is the true center of the input imagery from which the product was made, and does not necessarily fall inside the product
	97	903	903	1X	Blank fill
	98	904	915	A12	Product center geodetic latitude expressed in degrees, minutes, seconds. This is the true center of the input imagery from which the product was made, and does not necessarily fall inside the product
	99	916	916	1X	Blank fill
	100	917	929	F13.3	Product center easting in projection units (meters only)
	101	930	930	1X	Blank fill
	102	931	943	F13.3	Product center northing in projection units (meters only)
	103	944	944	1X	Blank fill
	104	945	949	I5	Product center pixel number measured from the product upper left corner, rounded to nearest whole pixel
	105	950	950	1X	Blank fill
	106	951	955	I5	Product center line number measured from the product upper left corner, rounded to nearest whole pixel
	107	956	959	4X	Blank fill
	108	960	960	A1	Carriage return
13	109	961	968	A8	"OFFSETb="
	110	969	974	I6	Horizontal offset of the true product from the nominal product center calculated in meters Calculated as an average (may be negative) .
	111	975	994	20A	"bORIENTATIONbANGLEb="
	112	995	1000	F6.2	Orientation angle in degrees (may be negative)
	113	1001	1039	39X	Blank fill
	114	1040	1040	A1	Carriage return
14	115	1041	1061	21A	"SUNbELEVATIONbANGLEb="
	116	1062	1065	F4.1	Sun elevation angle in degrees at product center
	117	1066	1085	A20	"bSUNbAZIMUTHbANGLEb="
	118	1086	1090	F5.1	Sun azimuth in degrees at product center
	119	1091	1119	29X	Blank fill
	120	1120	1120	A1	Carriage return
15	121	1121	1199	79X	Blank fill
	122	1200	1200	A1	Carriage return
16	123	1201	1279	79X	Blank fill
	124	1280	1280	A1	Carriage return
17	125	1281	1359	79X	Blank fill
	126	1360	1360	A1	Carriage return
18	127	1361	1439	79X	Blank fill
	128	1440	1440	A1	Carriage return
19	129	1441	1519	79X	Blank fill
	130	1520	1520	A1	Carriage return
20	131	1521	1535	15X	Blank fill
	132	1536	1536	A1	Carriage return

4.2 GeoTIFF File Formats

The description of an image in GeoTIFF requires tags and keys as described in Applicable Document 7. These tags and keys will be included in the image files and are automatically detected and read by TIFF readers. They are described in the following subsections.

4.2.1 GeoTIFF Tags

TIFF tags convey information about the image and are TIFF's version of metadata. The tags describe the image with information the TIFF reader needs to control the appearance of the image on the user's screen. The TIFF tags are in the same file as the TIFF image.

A complete description of the raster data requires georeferencing of the data, which is accomplished through the use of tags. LPGS uses the transformation raster and model space tiepoints and scaling parameters. ModelTiepointTag and ModelPixelScaleTag are used for this purpose.

ModelTiepointTag

Tag = 33922

Type = DOUBLE

$N = 6 * K$, K = number of tiepoints

Alias: GeoreferenceTag

Owner: Intergraph

This tag stores the raster-to-model tiepoint pairs in the order

ModelTiepointTag = (... , I, J, K, X, Y, Z...),

where (I, J, K) is the point at location (I, J) in raster space with pixel-value K, and (X, Y, Z) is a vector in model space.

The raster image is georeferenced by specifying its location, size, and orientation in the model coordinate space. Because the relationship between the raster space and the model space often will be an exact, affine transformation, the relationship can be defined using one set of tiepoints and the ModelPixelScaleTag, which gives the vertical and horizontal raster grid cell size.

ModelPixelScaleTag:

Tag = 33550

Type = DOUBLE

N = 3

Owner: SoftDesk

This tag is used to specify the size of raster pixel spacing in the model space units, when the raster space can be embedded in the model space coordinate system without rotation, and consists of the following three values:

$$\text{ModelPixelScaleTag} = (\text{ScaleX}, \text{ScaleY}, \text{ScaleZ})$$

where ScaleX and ScaleY give the horizontal and vertical spacing of raster pixels and ScaleZ is used to map the pixel value of a digital elevation model into the correct Z-scale. Scale Z will not be used for LPGS data since it is only systematically corrected and not corrected for elevation.

A single tiepoint in the ModelTiepointTag, together with the ModelPixelScaleTag, completely determines the relationship between raster and model space.

4.2.2 GeoTIFF Keys

In addition to tags, the description of a projection in GeoTIFF requires the use of keys. The keys necessary to define the projections supported by the LPGS, and their possible values, are listed below.

Valid Keys	Possible Values	Meaning
Transverse Mercator (TM)		
GTMModelTypeGeoKey	1	ModelTypeProjected (Projection Coordinate System)
GTRasterTypeGeoKey	1	RasterPixellsArea
	2	RasterPixellsPoint
GTCitationGeoKey	(ASCII, 17)	ASCII reference to public documentation
GeographicTypeGeoKey	4326	GCS_WGS_84
GeogLinearUnitsGeoKey	9001	Linear_Meter
	9002	Linear_Foot
GeogAngularUnitsGeoKey	9102	Angular_Degree
ProjectedCSTypeGeoKey	20000 - 32760	EPSG Projection System Codes (see Applicable Document 7 for values)
	32767	User defined
ProjectionGeoKey	10000 - 19999	EPSG/POSC Projection Codes (see Applicable Document 7 for values)
	32767	User defined
ProjNatOriginLatGeoKey		Value in units of GeogAngularUnits
ProjScaleAtNatOriginGeoKey		Value entered as a ratio
ProjCenterLongGeoKey		Value entered in units of GeogAngularUnits
ProjLinearUnitsGeoKey	9001	Linear_Meter
	9002	Linear_Foot
ProjFalseNorthingGeoKey		Value entered in units of ProjLinearUnits
ProjFalseEastingGeoKey		Value entered in units of ProjLinearUnits

Valid Keys	Possible Values	Meaning
Universal Transverse Mercator (UTM)		
GTMModelTypeGeoKey	1	ModelTypeProjected (Projection Coordinate System)
GTRasterTypeGeoKey	1	RasterPixellsArea
	2	RasterPixellsPoint
GTCitationGeoKey	(ASCII, 17)	ASCII reference to public documentation
GeogLinearUnitsGeoKey	9001	Linear_Meter
	9002	Linear_Foot
GeogAngularUnitsGeoKey	9102	Angular_Degree
ProjectedCSTypeGeoKey	20000 - 32760	EPSG Projection System Codes (see Applicable Document 7 for values)
	32767	User defined
Oblique Mercator, Type B (OMB)		
ProjCoordTransGeoKey	3	CT_ObliqueMercator
GTMModelTypeGeoKey	1	ModelTypeProjected (Projection Coordinate System)
GTRasterTypeGeoKey	1	RasterPixellsArea
	2	RasterPixellsPoint
GTCitationGeoKey	(ASCII, 17)	ASCII reference to public documentation
GeographicTypeGeoKey	4326	GCS_WGS_84
GeogLinearUnitsGeoKey	9001	Linear_Meter
	9002	Linear_Foot
GeogAngularUnitsGeoKey	9102	Angular_Degree
GeogAzimuthUnitsGeoKey	9102	Angular_Degree
ProjectedCSTypeGeoKey	20000 - 32760	EPSG Projection System Codes (see Applicable Document 7 for values)
	32767	User defined
ProjectionGeoKey	10000 - 19999	EPSG/POSC Projection Codes (see Applicable Document 7 for values)
	32767	User defined
ProjLinearUnitsGeoKey	9001	Linear_Meter
	9002	Linear_Foot
ProjAzimuthAngleGeoKey		Value in units of GeogAngularUnits
ProjScaleAtNatOriginGeoKey		Value entered as a ratio
ProjCenterLatGeoKey		Value in units of GeogAngularUnits
ProjCenterLongGeoKey		Value in units of GeogAngularUnits
ProjFalseNorthingGeoKey		Value entered in units of ProjLinearUnits
ProjFalseEastingGeoKey		Value entered in units of ProjLinearUnits
Lambert Conformal Conic (LCC)		
ProjCoordTransGeoKey	8	CT_LambertConfConic_2SP
GTMModelTypeGeoKey	1	ModelTypeProjected (Projection Coordinate System)

Valid Keys	Possible Values	Meaning
GTRasterTypeGeoKey	1	RasterPixellsArea
	2	RasterPixellsPoint
GTCitationGeoKey	(ASCII, 17)	ASCII reference to public documentation
GeographicTypeGeoKey	4326	GCS_WGS_84
GeogLinearUnitsGeoKey	9001	Linear_Meter
	9002	Linear_Foot
GeogAngularUnitsGeoKey	9102	Angular_Degree
ProjectedCSTypeGeoKey	20000 - 32760	EPSG Projection System Codes (see Applicable Document 7 for values)
	32767	User defined
ProjectionGeoKey	10000 - 19999	EPSG/POSC Projection Codes (see Applicable Document 7 for values)
	32767	User defined
ProjLinearUnitsGeoKey	9001	Linear_Meter
	9002	Linear_Foot
ProjStdParallel1GeoKey		Value in units of GeogAngularUnits
ProjStdParallel2GeoKey		Value in units of GeogAngularUnits
ProjFalseOriginLongGeoKey		Value in units of GeogAngularUnits (default to 0)
ProjFalseOriginLatGeoKey		Value in units of GeogAngularUnits (default to 0)
ProjNatOriginLatGeoKey		Value in units of GeogAngularUnits
ProjFalseNorthingGeoKey		Value entered in units of ProjLinearUnits
ProjFalseEastingGeoKey		Value entered in units of ProjLinearUnits
Polar Stereographic (PS)		
ProjCoordTransGeoKey	15	CT_PolarStereographic
GTMModelTypeGeoKey	1	ModelTypeProjected (Projection Coordinate System)
GTRasterTypeGeoKey	1	RasterPixellsArea
	2	RasterPixellsPoint
GTCitationGeoKey	(ASCII, 17)	ASCII reference to public documentation
GeographicTypeGeoKey	4326	GCS_WGS_84
GeogLinearUnitsGeoKey	9001	Linear_Meter
	9002	Linear_Foot
GeogAngularUnitsGeoKey	9102	Angular_Degree
ProjectedCSTypeGeoKey	20000 - 32760	EPSG Projection System Codes (see Applicable Document 7 for values)
	32767	User defined
ProjectionGeoKey	10000 - 19999	EPSG/POSC Projection Codes (see Applicable Document 7 for values)
	32767	User defined
ProjLinearUnitsGeoKey	9001	Linear_Meter
	9002	Linear_Foot

Valid Keys	Possible Values	Meaning
ProjStraightVertPoleLongGeoKey		Value in units of GeogAngularUnits
ProjNatOriginLatGeoKey		Value in units of GeogAngularUnits
ProjFalseNorthingGeoKey		Value entered in units of ProjLinearUnits
ProjFalseEastingGeoKey		Value entered in units of ProjLinearUnits
Polyconic (PC)		
ProjCoordTransGeoKey	22	CT_Polyconic
GTRasterTypeGeoKey	1	ModelTypeProjected (Projection Coordinate System)
GTRasterTypeGeoKey	1	RasterPixellsArea
	2	RasterPixellsPoint
GTCitationGeoKey	(ASCII, 17)	ASCII reference to public documentation
GeographicTypeGeoKey	4326	GCS_WGS_84
GeogLinearUnitsGeoKey	9001	Linear_Meter
	9002	Linear_Foot
GeogAngularUnitsGeoKey	9102	Angular_Degree
ProjectedCSTypeGeoKey	20000 - 32760	EPSG Projection System Codes (see Applicable Document 7 for values)
	32767	User defined
ProjectionGeoKey	10000 - 19999	EPSG/POSC Projection Codes (see Applicable Document 7 for values)
	32767	User defined
ProjCenterLatGeoKey		Value in units of GeogAngularUnits
ProjCenterLongGeoKey		Value in units of GeogAngularUnits
ProjFalseNorthingGeoKey		Value entered in units of ProjLinearUnits
ProjFalseEastingGeoKey		Value entered in units of ProjLinearUnits
ProjLinearUnitsGeokey	9001	Linear_Meter
	9002	Linear_Foot

4.3 HDF File Formats

4.3.1 Image Files

Each Earth image band in the requested product is contained in a separate file. The data are laid out in a scan line sequential format in descending detector order (i.e., detector 16 followed by detector 15 and so forth for the 30-m bands). The L1R image is radiometrically corrected but not geometrically resampled. The L1G image is radiometrically corrected and resampled for geometric correction and registration to geographic map projections.

4.3.2 Internal Calibrator Data Files

The IC data files are included only with the L1R output product. The IC data for format 1 consist of scan-line-ordered internal lamp and shutter data for bands 1 through 5 and blackbody radiance and shutter data for band 6L. IC data for format 2 consist of scan-line-ordered internal lamp and shutter data for bands 7 and 8 and black body radiance and shutter data for band 6H. The data are collected once per scan and structured in a band sequential format in detector descending order. The IC data format 1 file is provided with products that include bands 1 through 6 low image data; the format 2 file is provided with products that include bands 6 high through 8. These data are subsetted to correspond to the user-requested product (i.e., by band and product size).

4.3.3 Mirror Scan Correction Data File

The consensus MSCD data file is included only with the L1R output product. Each logical record consists of three data values—the first half scan error, the second half scan error, and the scan line direction, along with scan quality information. This information, which usually applies to the previous scan, is used to compute deviations from nominal scan mirror profiles as measured on the ground and reported in the CPF. One consensus MSCD file is provided. A consensus MSCD file is a single MSCD file, created from the two original files included with the LOR product, with errors corrected according to LPGS processing algorithms. These data are subsetted to correspond to the user-requested product size. The file structure for the consensus MSCD is described in Applicable Document 4 with the exception of the LPGS-assigned Vdata Name and Vdata class, which are described below.

Vdata Name: "L71ppprrr_rrrYYYYMMDD.MSD"
Vdata Class: LPGS_MSCD

4.3.4 Payload Correction Data File

The consensus PCD data file is included only with the L1R output product. This file consists of attitude and ephemeris profiles as well as high-frequency jitter measurements. One consensus PCD file is provided. A consensus PCD file is a single PCD file created from the two original files included with the LOR product and with errors corrected according to LPGS processing algorithms. This consensus PCD file will not be subsetted. The file structure for the consensus

PCD is described in Applicable Document 4 with the exception of the LPGS-assigned Vdata Name and Vdata class, which are described below.

Vdata Name: "L71ppprrr_rrrYYYYMMDD.PCD"

Vdata Class: LPGS_PCD

4.3.5 Scan Line Offsets

The scan line offsets are included only with the L1R output product. The scan line offsets represent the actual starting and ending pixel positions for valid (nonzero fill) Earth image data on a data-line-by-data-line basis. The scan line offset format 1 file is provided with products that include bands 1 through 6 low image data; the format 2 file is provided with products that include bands 6 high through 8. These data are subsetted to correspond to the user-requested product (i.e., by band and product size). The file structure for the scan line offset is described in Applicable Document 4 with the exception of the LPGS-assigned Vdata Name and Vdata class, which are described below.

Vdata Name: "L7fppprrr_rrrYYYYMMDD.ONN"

Vdata Class: LPGS_SLO

4.3.6 Calibration Parameter File

The CPF is a formatted file containing radiometric and geometric processing parameters required for L1 processing. It is provided only with the L1R product, without modification from what was provided with the L0R product. A complete description of this file currently exists in the *Landsat 7 Calibration Parameter File Definition* (Applicable Document 5).

4.3.7 Geolocation Table File

The geolocation table file contains scene corner coordinates and their product-specific scan line numbers and is included only with the L1R product. The file structure for the geolocation table is described in Applicable Document 4 with the exception of the LPGS-assigned Vdata Name and Vdata class, which are described below.

Vdata Name: "L71ppprrr_rrrYYYYMMDD.GEO"

Vdata Class: Index

4.3.8 LPS Metadata File

The LPS metadata files are included with the L1R output product without modification from what was provided with the L0R product. The metadata format 1 and format 2 files are provided with all L1R products.

Some information in the LPS metadata file pertains to parent subintervals of the LPGS product and may not be applicable to L1 products produced by the LPGS. The file structure for the LPS metadata is described in Applicable Document 4 with the exception of the LPGS-assigned Vdata Name, which is described below.

Vdata Name: "L7fppprrr_rrrYYYYMMDD.MTA"

4.3.9 LPGS Metadata File

The LPGS metadata file is created during product generation and contains information specific to the product ordered. Table 4.3-1 lists the full contents of the LPGS metadata file. This file contains all applicable image description information from the Earth Observing System (EOS) Data and Information System (EOSDIS) Core System (ECS) metadata provided with the LOR product.

4.3.10 HDF Directory File

The directory file contains all the pointers, file size information, and data objects required to open and process the L1 product using the HDF library and interface routines.

4.3.11 Vgroup Definitions

The Vgroup structure was designed to associate related HDF data objects. Any HDF data object [e.g., Vdata, scientific data sets (SDSs), and attributes] can be included in an HDF Vgroup definition. Vgroups employ Vgroup names and Vgroup classes for characterizing a collection of data objects and for searching activities. Three classes are recognized for the L1 HDF product: image data, correction data, and metadata.

The HDF Vgroup interface consists of routines for accessing and getting information about the L1 product Vgroups. This information is stored in the HDF data directory.

The Vgroups used to relate the different data objects that make up a complete L1 product are presented in Tables 4.3-2 and 4.3-3.

Appendix A - Table 4.3-1. LPGS Metadata File (1 of 9)

Vdata Name: "L71ppprrr_rrrYYYYMMDD.MTL"			
Vdata Class: LPGS_Metadata			
Interlace Type: FULL_INTERLACE			
Bytes Per Logical Record: 65536			
Number of Records: One record.			
Parameter Name	Size*	Value, Format, Range, and Units	Parameter Description/Remarks
GROUP	18	= LPGS_METADATA_FILE	Beginning of first level ODL group. It indicates start of LPGS metadata file level group
GROUP	18	= METADATA_FILE_INFO	Beginning of metadata file information group
REQUEST_ID	20	ASCII string indicating the request number in the format "NNNYMMDDSSSSUUUbbb" where NNNYMMDDSSSS = 13-digit DORRAN order number NNN = Node indicator YY = Year MM = Month DD = Day SSSS = Sequence number for the day UUUU = 4-digit DORRAN unit number	Unique product generation request ID generated by DORRAN
PRODUCT_CREATION_TIME	20	= YYYY-MM-DDThh:mm:ssZ where YYYY = 4-digit Julian year MM = month number of Julian year (01-12) DD = day of Julian month (01-31) T indicates start of time information in ODL ASCII time code format hh = hours (00-23) mm = minutes (00-59) ss = seconds (00-59) Z indicates "Zulu" time (same as GMT)	LPGS system date and time when metadata file for L1 product set was created. For ease of human readability, this date and time are presented in ODL ASCII format. Time is expressed as UTC (also known as GMT). Insertion of additional characters "T" and "Z" is required to meet ODL ASCII format
STATION_ID	3	= "EDC"	Unique 3-letter code identifying originating ground station
LANDSAT7_XBAND	1	= "1", "2", or "3"	Landsat 7 X-band used to downlink data to LGS
GROUND_STATION	3	= "NNN"	Ground station that received data
LPS_PROCESSOR_NUMBER	1	= 1-9	LPS processor number
DATEHOUR_CONTACT_PERIOD	7	= "YYDOYHH"	Date and hour of contact period
SUBINTERVAL_NUMBER	2	= "00-99"	Subinterval number within contact period
END_GROUP	18	= METADATA_FILE_INFO	End of metadata information group
GROUP	16	= PRODUCT_METADATA	Beginning of product metadata group
PRODUCT_TYPE	3	= "L1G" or "L1R"	Identifier to inform user of product type

EPHEMERIS_TYPE	10	= "DEFINITIVE" or "PREDICTIVE"	Identifier to inform user of orbital ephemeris type used. If field is not present then the user should assume "PREDICTIVE" in all cases (1G product only)
SPACECRAFT_ID	8	= "Landsat7"	Name of satellite platform

Table 4.3-1. LPGS Metadata File (2 of 9)

Parameter Name	Size*	Value, Format, Range, and Units	Parameter Description/Remarks
SENSOR_ID	4	= "ETM+"	Name of imaging sensor
ACQUISITION_DATE	20	= YYYY-MM-DD	Date image was acquired
WRS_PATH	3	= NNN, where NNN = path number (001-233)	WRS path value for product
STARTING_ROW	3	= NNN, where NNN = row of first full or partial scene in product (001-248)	Starting WRS row
ENDING_ROW	3	= NNN, where NNN = row of last full or partial scene in product (001-248)	Ending WRS row
BAND_COMBINATION	9	= "NNNNNNNNN", where NNNNNNNNN = e.g., 123456678 for all bands present, 123----8 for bands 1, 2, 3, 8. A '-' is a position holder for absent bands	LPGS-generated indicator of bands present for product ordered. First 6 is format 1, band 6. Second 6 is format 2, band 6
PRODUCT_UL_CORNER_LAT	11	= -90.0000000 through +90.0000000 degrees (with 7-digit precision) Positive (+) value indicates North latitude; negative (-) value indicates South latitude	Latitude value for upper left corner of product (LPGS recalculates for 1G product)
PRODUCT_UL_CORNER_LON	12	= -180.0000000 through +180.0000000 degrees (with 7-digit precision) Positive (+) value indicates East longitude; negative (-) value indicates West longitude	Longitude value for upper left corner of product (LPGS recalculates for 1G product)
PRODUCT_UR_CORNER_LAT	11	= -90.0000000 through +90.0000000 degrees (with 7-digit precision)	Latitude value for upper right corner of product (LPGS recalculates for 1G product)
PRODUCT_UR_CORNER_LON	12	= -180.0000000 through +180.0000000 degrees (with 7-digit precision)	Longitude value for upper right corner of product (LPGS recalculates for 1G product)
PRODUCT_LL_CORNER_LAT	11	= -90.0000000 through +90.0000000 degrees (with 7-digit precision)	Latitude value for lower left corner of product (LPGS recalculates for 1G product)
PRODUCT_LL_CORNER_LON	12	= -180.0000000 through +180.0000000 degrees (with 7-digit precision)	Longitude value for lower left corner of product (LPGS recalculates for 1G product)
PRODUCT_LR_CORNER_LAT	11	= -90.0000000 through +90.0000000 degrees (with 7-digit precision)	Latitude value for lower right corner of product (LPGS recalculates for 1G product)
PRODUCT_LR_CORNER_LON	12	= -180.0000000 through +180.0000000 degrees (with 7-digit precision)	Longitude value for lower right corner of product (LPGS recalculates for 1G product)
PRODUCT_UL_CORNER_MAPX	14	= -132000000.000 through 132000000.000 Units are feet or meters	Projection X coordinate for upper left corner of product (LPGS calculated, 1G only)
PRODUCT_UL_CORNER_MAPY	14	= -132000000.000 through 132000000.000 Units are feet or meters	Projection Y coordinate for upper left corner of product (LPGS calculated, 1G only)
PRODUCT_UR_CORNER_MAPX	14	= -132000000.000 through 132000000.000 Units are feet or meters	Projection X coordinate for upper right corner of product (LPGS calculated, 1G only)
PRODUCT_UR_CORNER_MAPY	14	= -132000000.000 through 132000000.000 Units are feet or meters	Projection Y coordinate for upper right corner of product (LPGS calculated, 1G only)

Table 4.3-1. LPGS Metadata File (3 of 9)

Parameter Name	Size*	Value, Format, Range, and Units	Parameter Description/Remarks
PRODUCT_LL_CORNER_MAPX	14	= -132000000.000 through 132000000.000 Units are feet or meters	Projection X coordinate for lower left corner of product (LPGS calculated, 1G only)
PRODUCT_LL_CORNER_MAPY	14	= -132000000.000 through 132000000.000 Units are feet or meters	Projection Y coordinate for lower left corner of product (LPGS calculated, 1G only)
PRODUCT_LR_CORNER_MAPX	14	= -132000000.000 through 132000000.000 Units are feet or meters	Projection X coordinate for lower right corner of product (LPGS calculated, 1G only)
PRODUCT_LR_CORNER_MAPY	14	= -132000000.000 through 132000000.000 Units are feet or meters	Projection Y coordinate for lower right corner of product (LPGS calculated, 1G only)
PRODUCT_SAMPLES_PAN	6	= 13200 through 20000	Product samples for the panchromatic band
PRODUCT_LINES_PAN	6	= 5984 through 40000	Product lines for the panchromatic band
PRODUCT_SAMPLES_REF	6	= 6600 through 10000	Product samples for the reflective bands
PRODUCT_LINES_REF	6	= 2992 through 20000	Product lines for the reflective bands
PRODUCT_SAMPLES_THM	6	= 3300 through 5000	Product samples for the thermal bands
PRODUCT_LINES_THM	6	= 1496 through 10000	Product lines for the thermal bands
BAND1_FILE_NAME	29	"L71pprrrr_rrrYYYYMMDD_B10.XXX"	LPGS-generated external element file name for band 1 if part of product
BAND2_FILE_NAME	29	"L71pprrrr_rrrYYYYMMDD_B20.XXX"	LPGS-generated external element file name for band 2 if part of product
BAND3_FILE_NAME	29	"L71pprrrr_rrrYYYYMMDD_B30.XXX"	LPGS-generated external element file name for band 3 if part of product
BAND4_FILE_NAME	29	"L71pprrrr_rrrYYYYMMDD_B40.XXX"	LPGS-generated external element file name for band 4 if part of product
BAND5_FILE_NAME	29	"L71pprrrr_rrrYYYYMMDD_B50.XXX"	LPGS-generated external element file name for band 5 if part of product
BAND61_FILE_NAME	29	"L71pprrrr_rrrYYYYMMDD_B61.XXX"	LPGS-generated external element file name for band 6, format 1 if part of product
BAND62_FILE_NAME	29	"L72pprrrr_rrrYYYYMMDD_B62.XXX"	LPGS-generated external element file name for band 6, format 2 if part of product
BAND7_FILE_NAME	29	"L72pprrrr_rrrYYYYMMDD_B70.XXX"	LPGS-generated external element file name for band 7 if part of product
BAND8_FILE_NAME	29	"L72pprrrr_rrrYYYYMMDD_B80.XXX"	LPGS-generated external element file name for band 8 if part of product
IC_DATA_F1_FILE_NAME	29	"L71pprrrr_rrrYYYYMMDD_CAL.XXX"	LPGS-generated external element file name for format 1 internal calibrator data (1R product only) if part of product
IC_DATA_F2_FILE_NAME	29	"L72pprrrr_rrrYYYYMMDD_CAL.XXX"	LPGS-generated external element file name for format 2 internal calibrator data (1R product only) if part of product
SCAN_SHIFTS_F1_FILE_NAME	29	"L71pprrrr_rrrYYYYMMDD_SLO.XXX"	LPGS-generated external element file name for format 1 scan line shifts (1R product only) if part of product
SCAN_SHIFTS_F2_FILE_NAME	29	"L72pprrrr_rrrYYYYMMDD_SLO.XXX"	LPGS-generated external element file name for format 2 scan line shifts (1R product only) if part of product

Table 4.3-1. LPGS Metadata File (4 of 9)

Parameter Name	Size*	Value, Format, Range, and Units	Parameter Description/Remarks
MSCD_FILE_NAME	29	"L71ppprrr_rrrYYYYMMDD_MSD.XXX"	LPGS-generated external element file name for consensus MSCD (1R product only)
PCD_FILE_NAME	29	"L71ppprrr_rrrYYYYMMDD_PCD.XXX"	LPGS-generated external element file name for consensus PCD (1R product only)
METADATA_LPS1_FILE_NAME	29	"L71ppprrr_rrrYYYYMMDD_MTA.XXX"	LPGS-generated external element file name for LPS format 1 metadata (1R product only)
METADATA_LPS2_FILE_NAME	29	"L72ppprrr_rrrYYYYMMDD_MTA.XXX"	LPGS-generated external element file name for LPS format 2 metadata (1R product only)
METADATA_LPGS_FILE_NAME	29	"L71ppprrr_rrrYYYYMMDD_MTL.XXX"	LPGS-generated external element file name for LPGS metadata
CPF_FILE_NAME	25	"L7CPFYYYYMMDD_YYYYMMDD_nn" where YYYYMMDD = effective start date and effective end date, respectively nn = incrementing version number within a 90-day period (00-99)	ECS-generated external element file name for IAS CPF (1R product only)
GEOLOCATION_FILE_NAME	29	"L71ppprrr_rrrYYYYMMDD_GEO.XXX"	LPGS-generated external element file name for geolocation table (1R product only)
HDF_DIR_FILE_NAME	29	"L71ppprrr_rrrYYYYMMDD_HDF.XXX"	LPGS-generated file name for HDF directory file
END_GROUP	16	= PRODUCT_METADATA	End of product metadata group
GROUP	16	= MIN_MAX_RADIANCE	Beginning of the min/max radiance group (1G product only)
MAX_DETECTED_RADIANCE_LEVEL_BAND1	7	= NNN.NNN	Maximum detectable radiance value for band 1 if part of product
MIN_DETECTED_RADIANCE_LEVEL_BAND1	7	= NNN.NNN	Minimum detectable radiance value for band 1 if part of product
MAX_DETECTED_RADIANCE_LEVEL_BAND2	7	= NNN.NNN	Maximum detectable radiance value for band 2 if part of product
MIN_DETECTED_RADIANCE_LEVEL_BAND2	7	= NNN.NNN	Minimum detectable radiance value for band 2 if part of product
MAX_DETECTED_RADIANCE_LEVEL_BAND3	7	= NNN.NNN	Maximum detectable radiance value for band 3 if part of product
MIN_DETECTED_RADIANCE_LEVEL_BAND3	7	= NNN.NNN	Minimum detectable radiance value for band 3 if part of product
MAX_DETECTED_RADIANCE_LEVEL_BAND4	7	= NNN.NNN	Maximum detectable radiance value for band 4 if part of product
MIN_DETECTED_RADIANCE_LEVEL_BAND4	7	= NNN.NNN	Minimum detectable radiance value for band 4 if part of product
MAX_DETECTED_RADIANCE_LEVEL_BAND5	7	= NNN.NNN	Maximum detectable radiance value for band 5 if part of product
MIN_DETECTED_RADIANCE_LEVEL_BAND5	7	= NNN.NNN	Minimum detectable radiance value for band 5 if part of product
MAX_DETECTED_RADIANCE_LEVEL_BAND61	7	= NNN.NNN	Maximum detectable radiance value for band 6 format 1 if part of product
MIN_DETECTED_RADIANCE_LEVEL_BAND61	7	= NNN.NNN	Minimum detectable radiance value for band 6 format 1 if part of product
MAX_DETECTED_RADIANCE_LEVEL_BAND62	7	= NNN.NNN	Maximum detectable radiance value for band 6 format 2 if part of product
MIN_DETECTED_RADIANCE_LEVEL_BAND62	7	= NNN.NNN	Minimum detectable radiance value for band 6 format 2 if part of product

Table 4.3-1. LPGS Metadata File (5 of 9)

Parameter Name	Size*	Value, Format, Range, and Units	Parameter Description/Remarks
MAX_DETECTED_RADIANCE_LEVEL_BAND7	7	= NNN.NNN	Maximum detectable radiance value for band 7 if part of product
MIN_DETECTED_RADIANCE_LEVEL_BAND7	7	= NNN.NNN	Minimum detectable radiance value for band 7 if part of product
MAX_DETECTED_RADIANCE_LEVEL_BAND8	7	= NNN.NNN	Maximum detectable radiance value for band 8 if part of product
MIN_DETECTED_RADIANCE_LEVEL_BAND8	7	= NNN.NNN	Minimum detectable radiance value for band 8 if part of product
END_GROUP	16	= MIN_MAX_RADIANCE	End of the min/max radiance group
GROUP	19	= MIN_MAX_PIXEL_VALUE	Beginning of the min/max pixel value group (1G product only)
MAX_PIXEL_VALUE_BAND1	5	= NNN.N	Maximum detectable pixel value for band 1 if part of product
MIN_PIXEL_VALUE_BAND1	5	= NNN.N	Minimum detectable pixel value for band 1 if part of product
MAX_PIXEL_VALUE_BAND2	5	= NNN.N	Maximum detectable pixel value for band 2 if part of product
MIN_PIXEL_VALUE_BAND2	5	= NNN.N	Minimum detectable pixel value for band 2 if part of product
MAX_PIXEL_VALUE_BAND3	5	= NNN.N	Maximum detectable pixel value for band 3 if part of product
MIN_PIXEL_VALUE_BAND3	5	= NNN.N	Minimum detectable pixel value for band 3 if part of product
MAX_PIXEL_VALUE_BAND4	5	= NNN.N	Maximum detectable pixel value for band 4 if part of product
MIN_PIXEL_VALUE_BAND4	5	= NNN.N	Minimum detectable pixel value for band 4 if part of product
MAX_PIXEL_VALUE_BAND5	5	= NNN.N	Maximum detectable pixel value for band 5 if part of product
MIN_PIXEL_VALUE_BAND5	5	= NNN.N	Minimum detectable pixel value for band 5 if part of product
MAX_PIXEL_VALUE_BAND61	5	= NNN.N	Maximum detectable pixel value for band 6 format 1 if part of product
MIN_PIXEL_VALUE_BAND61	5	= NNN.N	Minimum detectable pixel value for band 6 format 1 if part of product
MAX_PIXEL_VALUE_BAND62	5	= NNN.N	Maximum detectable pixel value for band 6 format 2 if part of product
MIN_PIXEL_VALUE_BAND62	5	= NNN.N	Minimum detectable pixel value for band 6 format 2 if part of product
MAX_PIXEL_VALUE_BAND7	5	= NNN.N	Maximum detectable pixel value for band 7 if part of product
MIN_PIXEL_VALUE_BAND7	5	= NNN.N	Minimum detectable pixel value for band 7 if part of product
MAX_PIXEL_VALUE_BAND8	5	= NNN.N	Maximum detectable pixel value for band 8 if part of product
MIN_PIXEL_VALUE_BAND8	5	= NNN.N	Minimum detectable pixel value for band 8 if part of product
END_GROUP	19	= MIN_MAX_PIXEL_VALUE	End of the min/max pixel value group
GROUP	18	= PRODUCT_PARAMETERS	Beginning of product parameters group (both 1R and 1G products)
CORRECTION_METHOD_GAIN_BAND1	3	= "CPF" for CPF gains = "IC" for IC gains	Correction method used by LPGS in creating image for band 1 if part of product

Parameter Name	Size*	Value, Format, Range, and Units	Parameter Description/Remarks
CORRECTION_METHOD_GAIN_BAND2	3	= "CPF" for CPF gains = "IC" for IC gains	Correction method used by LPGS in creating image for band 2 if part of product
CORRECTION_METHOD_GAIN_BAND3	3	= "CPF" for CPF gains = "IC" for IC gains	Correction method used by LPGS in creating image for band 3 if part of product
CORRECTION_METHOD_GAIN_BAND4	3	= "CPF" for CPF gains = "IC" for IC gains	Correction method used by LPGS in creating image for band 4 if part of product
CORRECTION_METHOD_GAIN_BAND5	3	= "CPF" for CPF gains = "IC" for IC gains	Correction method used by LPGS in creating image for band 5 if part of product
CORRECTION_METHOD_GAIN_BAND61	3	= "CPF" for CPF gains = "IC" for IC gains	Correction method used by LPGS in creating image for band 6 format 1 if part of product
CORRECTION_METHOD_GAIN_BAND62	3	= "CPF" for CPF gains = "IC" for IC gains	Correction method used by LPGS in creating image for band 6 format 2 if part of product
CORRECTION_METHOD_GAIN_BAND7	3	= "CPF" for CPF gains = "IC" for IC gains	Correction method used by LPGS in creating image for band 7 if part of product
CORRECTION_METHOD_GAIN_BAND8	3	= "CPF" for CPF gains = "IC" for IC gains	Correction method used by LPGS in creating image for band 8 if part of product
CORRECTION_METHOD_BIAS	3	= "CPF" for CPF gains = "IC" for IC gains	Correction method used by LPGS in creating image

Table 4.3-1. LPGS Metadata File (6 of 9)

Parameter Name	Size*	Value, Format, Range, and Units	Parameter Description/Remarks
BAND1_GAIN	1	= "L" for low or "H" for high	Gain state for band 1's first data line if part of product
BAND2_GAIN	1	= "L" for low or "H" for high	Gain state for band 2's first data line if part of product
BAND3_GAIN	1	= "L" for low or "H" for high	Gain state for band 3's first data line if part of product
BAND4_GAIN	1	= "L" for low or "H" for high	Gain state for band 4's first data line if part of product
BAND5_GAIN	1	= "L" for low or "H" for high	Gain state for band 5's first data line if part of product
BAND6_GAIN1	1	= "L" for low or "H" for high	Gain state for band 6's first data line if part of product-format 1
BAND6_GAIN2	1	= "L" for low or "H" for high	Gain state for band 6's first data line if part of product-format 2
BAND7_GAIN	1	= "L" for low or "H" for high	Gain state for band 7's first data line if part of product
BAND8_GAIN	1	= "L" for low or "H" for high	Gain state for band 8's first data line if part of product
SUN_AZIMUTH	12	= -180.0000000 through 180.0000000 degrees (with 7-digit precision) A positive value indicates angles to the east or clockwise from north. A negative value (-) indicates angles to the west or counterclockwise from north. Leading zeros are not required.	Sun azimuth angle in degrees for image center location at image center acquisition time
SUN_ELEVATION	11	= -90.0000000 through 90.0000000 degrees (with 7-digit precision) A positive value indicates a daytime scene. A negative value (-) indicates a nighttime scene. Leading zeros are not required.	Sun elevation angle in degrees for image center location at image center acquisition time
OUTPUT_FORMAT	3	= "HDF"	Output format of image
END_GROUP	18	= PRODUCT_PARAMETERS	End of product parameters group
GROUP	19	= CORRECTIONS_APPLIED	Beginning of corrections applied group
STRIPING_BAND1	1	= "Y" or "N"	Indicator of whether the band 1 image was corrected for striping if part of product
STRIPING_BAND2	1	= "Y" or "N"	Indicator of whether the band 2 image was corrected for striping if part of product
STRIPING_BAND3	1	= "Y" or "N"	Indicator of whether the band 3 image was corrected for striping if part of product
STRIPING_BAND4	1	= "Y" or "N"	Indicator of whether the band 4 image was corrected for striping if part of product
STRIPING_BAND5	1	= "Y" or "N"	Indicator of whether the band 5 image was corrected for striping if part of product
STRIPING_BAND61	1	= "Y" or "N"	Indicator of whether the band 6 format 1 image was corrected for striping if part of product

Parameter Name	Size*	Value, Format, Range, and Units	Parameter Description/Remarks
STRIPING_BAND62	1	= "Y" or "N"	Indicator of whether the band 6 format 2 image was corrected for striping if part of product
STRIPING_BAND7	1	= "Y" or "N"	Indicator of whether the band 7 image was corrected for striping if part of product
STRIPING_BAND8	1	= "Y" or "N"	Indicator of whether the band 8 image was corrected for striping if part of product
BANDING	1	= "Y" or "N"	Indicator of whether image was corrected for banding
COHERENT_NOISE	1	= "Y" or "N"	Indicator of whether image was corrected for coherent noise (band 8 only)
MEMORY_EFFECT	1	= "Y" or "N"	Indicator of whether image was corrected for memory effect
SCAN_CORRELATED_SHIFT	1	= "Y" or "N"	Indicator of whether image was corrected for scan correlated shift
INOPERABLE_DETECTORS	1	= "Y" or "N"	Indicator of whether image was corrected for inoperable detectors
DROPPED_LINES	1	= "Y" or "N"	Indicator of whether image was corrected for dropped lines
END_GROUP	19	= CORRECTIONS_APPLIED	End of corrections applied group

Table 4.3-1. LPGS Metadata File (7 of 9)

Parameter Name	Size*	Value, Format, Range, and Units	Parameter Description/Remarks
GROUP	21	= PROJECTION_PARAMETERS	Beginning of projection parameters group (1G product only)
REFERENCE_DATUM	5	= "WGS84"	Datum used by LPGS in creating image
REFERENCE_ELLIPSOID	5	= "WGS84"	Ellipsoid used by LPGS in creating image
GRID_CELL_SIZE_PAN	6	= 14.250 through 60.000 meters, in increments of .001 meters	Size of grid cell used by LPGS in creating image for pan band if part of product
GRID_CELL_SIZE_THM	6	= 14.250 through 60.000 meters, in increments of .001 meters	Size of grid cell used by LPGS in creating image for thermal bands if part of product
GRID_CELL_SIZE_REF	6	= 14.250 through 60.000 meters, in increments of .001 meters	Size of grid cell used by LPGS in creating image for VNIR/SWIR bands if part of product
ORIENTATION	3	= "NOM" for nominal path = "NUP" for North up	Orientation used by LPGS in creating image
RESAMPLING_OPTION	3	= "NN" for nearest neighbor = "CC" for cubic convolution = "MTF" for modulation transfer function	Resampling option used by LPGS in creating image
MAP_PROJECTION	3	= "SOM" for space oblique mercator = "UTM" for universal transverse mercator = "LCC" for Lambert conformal conic = "TM" for transverse mercator = "OM" for oblique mercator = "PC" for polyconic = "PS" for polar stereographic	Map projection used by LPGS in creating image
END_GROUP	21	= PROJECTION_PARAMETERS	End of projection parameters group
Projection parameters data (not an LPGS metadata parameter)			The following parameters are included only with products that select a map projection of LCC
GROUP	14	LCC_PARAMETERS	Beginning of LCC parameters group
LATITUDE_OF_FIRST_STANDARD_PARALLEL	11	= -90.0 to +90.0	Latitude of first standard parallel
LATITUDE_OF_SECOND_STANDARD_PARALLEL	11	= -90.0 to +90.0	Latitude of second standard parallel
LONGITUDE_OF_CENTRAL_MERIDIAN	12	= -180.0 to +180.0	Longitude of central meridian
LATITUDE_OF_PROJECTION_ORIGIN	11	= -90.0 to +90.0	Latitude of projection origin
FALSE_EASTING	18	= -1.0x10 ⁸ to +1.0x10 ⁸	False easting
FALSE_NORTHING	18	= -1.0x10 ⁸ to +1.0x10 ⁸	False northing
FALSE_EASTING_NORTHING_UNITS	6	= "meters" or "feet"	Units for false easting and northing for LCC projection
END_GROUP	14	LCC_PARAMETERS	End of LCC parameters group
Projection parameters data (not an LPGS metadata parameter)			The following parameters are included only with products that select a map projection of TM
GROUP	13	TM_PARAMETERS	Beginning of TM parameters group
SCALE_FACTOR_AT_CENTRAL_MERIDIAN	11	= 0.0 to 2.0	Scale factor at central meridian
LONGITUDE_OF_CENTRAL_MERIDIAN	12	= -180.0 to +180.0	Longitude of central meridian

Appendix B - Table 4.3-1. LPGS Metadata File (8 of 9)

Parameter Name	Size*	Value, Format, Range, and Units	Parameter Description/Remarks
LATITUDE_OF_PROJECTION_ORIGIN	11	= -90.0 to +90.0	Latitude of projection origin
FALSE_EASTING	18	= -1.0x10 ⁸ to +1.0x10 ⁸	False easting
FALSE_NORTHING	18	= -1.0x10 ⁸ to +1.0x10 ⁸	False northing
FALSE_EASTING_NORTHING_UNITS	6	= "meters" or "feet"	Units for false easting and northing for TM projection
END_GROUP	13	TM_PARAMETERS	End of TM parameters group
Projection parameters data (not an LPGS metadata parameter)			The following parameters are included only with products that select a map projection of PC
GROUP	13	PC_PARAMETERS	Beginning of PC parameters group
LONGITUDE_OF_CENTRAL_MERIDIAN	12	= -180.0 to +180.0	Longitude of central meridian
LATITUDE_OF_PROJECTION_ORIGIN	11	= -90.0 to +90.0	Latitude of projection origin
FALSE_EASTING	18	= -1.0x10 ⁸ to +1.0x10 ⁸	False easting
FALSE_NORTHING	18	= -1.0x10 ⁸ to +1.0x10 ⁸	False northing
FALSE_EASTING_NORTHING_UNITS	6	= "meters" or "feet"	Units for false easting and northing for PC projection
END_GROUP	13	P C_PARAMETERS	End of PC parameters group
Projection parameters data (not an LPGS metadata parameter)			The following parameters are included only with products that select a map projection of PS
GROUP	13	PS_PARAMETERS	Beginning of PS parameters group
VERTICAL_LONGITUDE_FROM_POLE	12	= -180.0 to +180.0	Vertical longitude from pole
LATITUDE_OF_TRUE_SCALE	11	= -90.0 to +90.0	Latitude of true scale
FALSE_EASTING	18	= -1.0x10 ⁸ to +1.0x10 ⁸	False easting
FALSE_NORTHING	18	= -1.0x10 ⁸ to +1.0x10 ⁸	False northing
FALSE_EASTING_NORTHING_UNITS	6	= "meters" or "feet"	Units for false easting and northing for PS projection
END_GROUP	13	PS_PARAMETERS	End of PS parameters group
Projection parameters data (not an LPGS metadata parameter)			The following parameters are included only with products that select a map projection of OM
GROUP	13	OM_PARAMETERS	Beginning of OM parameters group
SCALE_FACTOR_AT_CENTER_OF_PROJECTION	9	= 0.0 to 2.0	Scale factor at center of projection
LATITUDE_OF_PROJECTION_ORIGIN	11	= -90.0 to +90.0	Latitude of projection origin
FALSE_EASTING	18	= -1.0x10 ⁸ to +1.0x10 ⁸	False easting
FALSE_NORTHING	18	= -1.0x10 ⁸ to +1.0x10 ⁸	False northing
FALSE_EASTING_NORTHING_UNITS	6	= "meters" or "feet"	Units for false easting and northing for OM projection
OM_TYPE	1	= "A" or "B"	Value used to indicate type of OM projection
END_GROUP	13	OM_PARAMETERS	End of OM parameters group
Projection parameters data (not an LPGS metadata parameter)			The following parameters are included only with products that select a map projection of OMA
GROUP	14	OMA_PARAMETERS	Beginning of OMA parameters group
LONGITUDE_FIRST_POINT_GEODETTIC	12	= -180.0 to +180.0	Longitude of first point defining central geodetic line of projection

Table 4.3-1. LPGS Metadata File (9 of 9)

Parameter Name	Size*	Value, Format, Range, and Units	Parameter Description/Remarks
LATITUDE_FIRST_POINT_GEODETTIC	11	= -90.0 to +90.0	Latitude of first point defining central geodetic line of projection
LONGITUDE_SECOND_POINT_GEODETTIC	12	= -180.0 to +180.0	Longitude of second point defining central geodetic line of projection
LATITUDE_SECOND_POINT_GEODETTIC	11	= -90.0 to +90.0	Latitude of second point defining central geodetic line of projection
END_GROUP	14	OMA_PARAMETERS	End of OMA parameters group
Projection parameters data (not an LPGS metadata parameter)			The following parameters are included only with products that select a map projection of OMB
GROUP	14	OMB_PARAMETERS	Beginning of OMB parameters group
ANGLE_OF_AZIMUTH	12	= -180.0 to +180.0	Angle of azimuth east of north for central line of projection
LONGITUDE_ALONG_PROJECTION	12	= -180.0 to +180.0	Longitude of point along central line of projection at which angle of azimuth is measured
END_GROUP	14	OMB_PARAMETERS	End of OMB parameters group
Projection parameters data (not an LPGS metadata parameter)			The following parameters are included only with products that select a map projection of UTM
GROUP	14	UTM_PARAMETERS	Beginning of UTM parameters group
ZONE_NUMBER	3	= 1 to 60 or -1 to -60	Value used to indicate zone number
END_GROUP	13	UTM_PARAMETERS	End of UTM parameters group
END_GROUP	148	LPGS_METADATA_FILE	End of LPGS metadata file level group
END			Required standalone parameter signifying file end

*ASCII bytes

Appendix C - Table 4.3-2. Vgroup Definitions—Level 1R Product (1 of 2)

Vgroup Name	Vgroup Class	Object Name	Type	Description
Scene_Data_Ref	Image_Data	L71ppprrr_rrrYYYYMMDD.B10	SDS	ETM+ band 1 data
		L71ppprrr_rrrYYYYMMDD.B20	SDS	ETM+ band 2 data
		L71ppprrr_rrrYYYYMMDD.B30	SDS	ETM+ band 3 data
		L71ppprrr_rrrYYYYMMDD.B40	SDS	ETM+ band 4 data
		L71ppprrr_rrrYYYYMMDD.B50	SDS	ETM+ band 5 data
		L72ppprrr_rrrYYYYMMDD.B70	SDS	ETM+ band 7 data
Scene_Data_Thm	Image_Data	L71ppprrr_rrrYYYYMMDD.B60	SDS	ETM+ band 6 low gain data
		L72ppprrr_rrrYYYYMMDD.B60	SDS	ETM+ band 6 high gain data
		L71ppprrr_rrrYYYYMMDD.GEO	Vdata	Geolocation table
Scene_Data_Pan	Image_Data	L72ppprrr_rrrYYYYMMDD.B80	SDS	ETM+ band 8 data
		L71ppprrr_rrrYYYYMMDD.GEO	Vdata	Geolocation table
IC_Data_Ref	Correction_Data	L71ppprrr_rrrYYYYMMDD.C10	SDS	IC data band 1
		L71ppprrr_rrrYYYYMMDD.C20	SDS	IC data band 2
		L71ppprrr_rrrYYYYMMDD.C30	SDS	IC data band 3
		L71ppprrr_rrrYYYYMMDD.C40	SDS	IC data band 4
		L71ppprrr_rrrYYYYMMDD.C50	SDS	IC data band 5
		L72ppprrr_rrrYYYYMMDD.C70	SDS	IC data band 7
		L71ppprrr_rrrYYYYMMDD.GEO	Vdata	Geolocation table
IC_Data_Thm	Correction_Data	L71ppprrr_rrrYYYYMMDD.C60	SDS	IC data band 6 low gain
		L72ppprrr_rrrYYYYMMDD.C60	SDS	IC data band 6 high gain
		L71ppprrr_rrrYYYYMMDD.GEO	Vdata	Geolocation table
IC_Data_Pan	Correction_Data	L72ppprrr_rrrYYYYMMDD.C80	SDS	IC data band 8
		L71ppprrr_rrrYYYYMMDD.GEO	Vdata	Geolocation table
Scan_Line_Offsets_Ref	Correction_Data	L71ppprrr_rrrYYYYMMDD.O10	Vdata	Scan line offsets band 1
		L71ppprrr_rrrYYYYMMDD.O20	Vdata	Scan line offsets band 2
		L71ppprrr_rrrYYYYMMDD.O30	Vdata	Scan line offsets band 3
		L71ppprrr_rrrYYYYMMDD.O40	Vdata	Scan line offsets band 4
		L71ppprrr_rrrYYYYMMDD.O50	Vdata	Scan line offsets band 5
		L72ppprrr_rrrYYYYMMDD.O70	Vdata	Scan line offsets band 7
Scan_Line_Offsets_Thm	Correction_Data	L71ppprrr_rrrYYYYMMDD.O60	Vdata	Scan line offsets band 6 low gain
		L72ppprrr_rrrYYYYMMDD.O60	Vdata	Scan line offsets band 6 high gain
		L71ppprrr_rrrYYYYMMDD.GEO	Vdata	Geolocation table
Scan_Line_Offsets_Pan	Correction_Data	L72ppprrr_rrrYYYYMMDD.O80	Vdata	Scan line offsets band 8
		L71ppprrr_rrrYYYYMMDD.GEO	Vdata	Geolocation table
PCD	Correction_Data	L71ppprrr_rrrYYYYMMDD.PCD	Vdata	Consensus PCD
MSCD	Correction_Data	L71ppprrr_rrrYYYYMMDD.MSD	Vdata	Consensus MSCD

Table 4.3-2. Vgroup Definitions—Level 1R Product (2 of 2)

Vgroup Name	Vgroup Class	Object Name	Type	Description
Product_ Metadata	Metadata	L71ppprrr_rrrYYYYMMDD.MTA	Vdata	LPS metadata format 1
		L72ppprrr_rrrYYYYMMDD.MTA	Vdata	LPS metadata format 2
		L71ppprrr_rrrYYYYMMDD.MTL	Vdata	LPGS-product-specific metadata
CPF	Correction_Data	L7CPFYYYYMMDD_YYYYMMDD_nn	Vdata	IAS CPF

Appendix D - Table 4.3-3. Vgroup Definitions—Level 1G Product

Vgroup Name	Vgroup Class	Object Name	Type	Description
Scene_Data_ Ref	Image_Data	L71ppprrr_rrrYYYYMMDD.B10	SDS	ETM+ band 1 data
		L71ppprrr_rrrYYYYMMDD.B20	SDS	ETM+ band 2 data
		L71ppprrr_rrrYYYYMMDD.B30	SDS	ETM+ band 3 data
		L71ppprrr_rrrYYYYMMDD.B40	SDS	ETM+ band 4 data
		L71ppprrr_rrrYYYYMMDD.B50	SDS	ETM+ band 5 data
		L72ppprrr_rrrYYYYMMDD.B70	SDS	ETM+ band 7 data
Scene_Data_ Thm	Image_Data	L71ppprrr_rrrYYYYMMDD.B60	SDS	ETM+ band 6 low gain data
		L72ppprrr_rrrYYYYMMDD.B60	SDS	ETM+ band 6 high gain data
Scene_Data_ Pan	Image_Data	L72ppprrr_rrrYYYYMMDD.B80	SDS	ETM+ band 8 data
Product_ Metadata	Metadata	L71ppprrr_rrrYYYYMMDD.MTL	Vdata	LPGS-product-specific metadata

Section 5 - Product Packaging

L1R and L1G products are available on 8-millimeter (mm) tape and Compact Disc Read-Only Memory (CD-ROM). L1G products are available on 8-mm tape, CD-ROM, and via electronic transfer. The following sections provide information on each of the distribution methods for the available L1 product formats.

5.1 8-mm Tape

Tapes are available only in high-density mode. They will be created with the UNIX utility tar. The first file on 8-mm tape is the L1 volume descriptor (read-me file). The filenames for the read-me files for each of the L1 product formats is README.HDF, README.GTF, and README.FF7. See Appendix B for the HDF sample of the read-me file. The no-swap device and a blocking factor of 20 512-byte blocks are used to maximize portability between platforms.

The 8-mm tape labels will include at least the following information: mission indicator (i.e., Landsat 7), start path, start row, end row, acquisition date, and product type (e.g., HDF, GeoTIFF, or FAST). The path, row, and acquisition date information is supplied in the format of the naming convention of the base part of filenames as defined in Section 3.

5.2 CD-ROM

The CD-ROM format also contains the L1 volume descriptor (read-me file) with the same file names as listed in the section above. Only single scene (or less) products will be written to CD-ROM due to the size of the Band 8 file. If an HDF L1 product must be written to more than one CD, there will be an HDF directory written to each CD. If a FAST L1 product must be written to more than one CD, relevant header records will be replicated.

At least the following information will be labeled directly onto the CD-ROM: product type (e.g., HDF, GeoTIFF, or FAST), Distributed Ordering Research and Accounting Network (DORRAN) order number, DORRAN unit number, CD-ROM volume number, start path, start row, end row, acquisition date, and the United States Geological Survey (USGS) logo. The path, row, and acquisition date information is supplied in the format of the naming convention of the base part of filenames as defined in Section 3.

5.3 Electronic Transfer

Products available via electronic transfer will also include the L1 volume descriptor (read-me file) with the same filenames as listed above.

Section 6 - Software Tools

A variety of public domain software tools are available for processing the L1 distribution product in either an HDF or independent computing environment.

6.1 NCSA HDF Libraries

HDF is a library- and platform-independent data format for the storage and exchange of scientific data. It includes Fortran and C calling interfaces and utilities for analyzing and converting HDF data files. HDF is developed and supported by National Center for Supercomputing Applications (NCSA) and is available in the public domain.

The HDF library contains two parts: the base library and the multi-file library. The base library contains a general purpose interface and application-level interfaces, one for each data structure type. Each application-level interface is specifically designed to read, write, and manipulate one type. The general purpose interface contains functions, such as file input/output (I/O), error handling, memory management, and physical storage. HDF library functions can be called from C or Fortran user application programs.

HDF source code for UNIX, Virtual Memory Storage (VMS), Windows NT/95, and Macintosh is available via anonymous file transfer protocol (ftp) from <http://hdf.ncsa.uiuc.edu/obtain.html>. HDF reference manuals, user guides, release notes, and newsletters are web accessible at <http://hdf.ncsa.uiuc.edu>.

6.2 HDF Libraries

HDF-EOS is standard HDF with ECS conventions and metadata added. The principal distinction is the specification of three geolocation data types: point, grid, and swath, which allow the file contents to be queried by Earth coordinates and time using the HDF application programming interface (API). The Landsat 7 OR distribution product does not employ either of these data structures. However, any application that makes use of the HDF-EOS API will, as a consequence of linking to the API, have access to the NCSA native base libraries that can be used to access the distribution OR product.

EOSView is a file-viewing tool developed for the ECS Project to examine and verify HDF data files. This tool enables users of EOS data products to view the contents of HDF files and individual objects via straightforward product access and display tools. Supported record types for viewing and display capability include images, multidimensional arrays, text, Vdatas, and Vgroups. EOSView users see the underlying HDF structures and are prompted for which parts of the structure they wish to view.

Users of the Landsat 7 OR product may also find the Science Data Production (SDP) Toolkit useful for follow-on processing. The SDP Toolkit consists of a set of fully tested and reliable C and Fortran language functions, customized for application to ECS product generation software. Of particular interest to Landsat 7 data users is the object description language (ODL) parser,

which allows for reading, writing, and manipulating product metadata and the digital elevation model software tools.

The SDP Toolkit and HDF libraries are available via anonymous ftp from [edhs1.gsfc.nasa.gov](ftp://edhs1.gsfc.nasa.gov). Because this software was developed under a NASA contract and is intended for the use of EOS instrument teams and science investigators, access to download it is password protected. The password may be obtained by E-mail to pgstlkit@eos.hitc.com.

6.3 ODL Parser

The ODL parser (Version 1.0) incorporated into the SDP Toolkit was originally implemented by the University of Colorado's Laboratory for Atmospheric and Space Physics (LASP). The Jet Propulsion Laboratory (JPL) enhanced the ODL parser in building their Planetary Data System. This enhanced version, available via anonymous ftp from [miranda.colorado.edu](ftp://miranda.colorado.edu) (IP address: 128.128.137.33), was modified by IAS. It is this IAS-modified version that LPGS uses.

The IAS-modified version should be particularly useful to those operating in a non-HDF-EOS environment. The software stands alone and can be used to read the LOR or L1 metadata external elements and the CPF.

Appendix A - Projection Parameters

This appendix contains the map projection parameters used in the LPGS FAST-L7A L1G products (Table A-1) and the USGS Projection Parameters (Table A-2).

Table A-1. LPGS FAST-L7A Projection Parameters

Project Name	Mnemonic
Universal Transverse Mercator	UTM
Lambert Conformal Conic	LCC
Polar Stereographic	PS
Polyconic	PC
Transverse Mercator (Gauss-Krueger)	TM
Oblique Mercator (Type A & B)	OM
Space Oblique Mercator	SOM

Appendix A - Table A-2. USGS Projection Parameters

(A) Projection Transformation Package Projection Parameters Elements 1-8

Code and Projection ID	Array Element							
	1	2	3	4	5	6	7	8
UTM	Lon/Z	Lat/Z						
Lambert Conformal C	SMajor	SMinor	STDPR1	STDPR2	CentMer	OriginLat	FE	FN
Polar Stereographic	SMajor	SMinor			LongPol	TrueScale	FE	FN
Polyconic	SMajor	SMinor			CentMer	OriginLat	FE	FN
Transverse Mercator	SMajor	SMinor	Factor		CentMer	OriginLat	FE	FN
Hotine Oblique Merc A	SMajor	SMinor	Factor			OriginLat	FE	FN
Hotine Oblique Merc B	SMajor	SMinor	Factor	AziAng	AzmthPt	OriginLat	FE	FN
Space Oblique Merc B	SMajor	SMinor	Satnum	Path			FE	FN

(B) Projection Transformation Package Projection Parameters Elements 9-15

Code and Projection ID	Array Element				
	9	10	11	12	13
UTM					
Lambert Conformal C					
Polar Stereographic					
Polyconic					
Transverse Mercator					
Hotine Oblique Merc A	Long1	Lat1	Long2	Lat2	zero
Hotine Oblique Merc B					one
Space Oblique Merc B					one

where

- Lon/Z = longitude of any point in the UTM zone or zero
- Lat/Z = latitude of any point in the UTM zone or zero.
- SMajor = semi-major axis of ellipsoid. If zero, Clarke 1866 in meters is assumed
- SMinor = eccentricity squared of the ellipsoid if less than zero. If zero, a spherical form is assumed, or if greater than zero, the semi-major axis of ellipsoid
- STDPR1 = latitude of the first standard parallel
- STDPR2 = latitude of the second standard parallel
- CentMer = longitude of the central meridian
- OriginLat = latitude of the projection origin
 - FE = false easting in the same units as the semi-major axis
 - FN = false northing in the same units as the semi-major axis
- LongPol = longitude down below pole of map
- TrueScale = latitude of true scale
 - Factor = scale factor at central meridian (Transverse Mercator) or center of projection (Hotine Oblique Mercator)
 - Long1 = longitude of first point on center line (Hotine Oblique Mercator, format A)
 - Long2 = longitude of second point on center line (Hotine Oblique Mercator, format A)
 - Lat1 = latitude of first point on center line (Hotine Oblique Mercator, format A)
 - Lat2 = latitude of second point on center line (Hotine Oblique Mercator, format A)
 - AziAng = azimuth angle east of north of center line (Hotine Oblique Mercator, format B)
- AzmthPt = longitude of point on central meridian where azimuth occurs (Hotine Oblique Mercator, format B)
- Satnum = Landsat satellite number (SOM, format B)
 - Path = Landsat path number (use WRS-1 for Landsat 1, 2, and 3 and WRS-2 for Landsat 4, 5, 6, or 7) (SOM, format B)

NOTES: Array elements 14 and 15 are set to zero. All array elements with blank fields are set to zero. All angles (latitudes, longitudes, azimuths, etc.) are entered in packed degrees/minutes/seconds (DDMMSS.SS) format.

Appendix B - Sample Read-Me File

EROS DATA CENTER LEVEL-1 PRODUCT GENERATION SYSTEM PRODUCT README:
HDF FORMAT

TABLE OF CONTENTS

BACKGROUND
FORMAT
ORGANIZATION
NAMING CONVENTION
READING DATA

- o DELIVERED ON TAPE
- o DELIVERED ON CD-ROM
- o DELIVERED VIA FILE TRANSFER PROTOCOL

EDC CONTACT
REFERENCES
APPENDIX

- o ACRONYM LIST

BACKGROUND

The launch of the Landsat-7 satellite on April 15, 1999, marks the addition of the latest satellite to the National Aeronautics and Space Administration's Landsat satellite series. The Landsat-7 satellite carries the enhanced thematic mapper plus (ETM+) sensor and is part of an ongoing mission to provide quality remote sensing data in support of research and applications activities. Information on the Landsat-7 Program, including information about the Landsat-7 satellite, the ETM+ sensor, and Landsat-7 data collection, is available in the "Landsat 7 Science Data Users Handbook." The Hierarchical Data Format (HDF) files are described in detail in the "Earth Science Data and Information System (ESDIS) Level 1 Product Output Files Data Format Control Book, Volume 5, Book 2." See References.

FORMAT

The Landsat-7 data are provided in standard HDF for radiometrically corrected (level-1R) products and for radiometrically and geometrically corrected (level-1G) products. Data may be represented in both binary and American Standard Code for Information Interchange (ASCII) formats. Bit and byte ordering follow conventions set by the Institute of Electrical and Electronics Engineers (IEEE) with the term "byte" being synonymous with octet as used by the International Organization for Standardization. For more information on HDF structures, visit the following Web sites:

HDFinfo at: <http://www.hdfinfo.com/>
The NCSA HDF Home Page at: <http://hdf.ncsa.uiuc.edu/>

ORGANIZATION

The Landsat-7 data files are stored separately from the HDF directory file, which contains the file names and pointers for the data files. The level-1R

and level-1G image files are in absolute radiance units scaled to 16 bits and 8 bits, respectively.

NAMING CONVENTION

Except for the calibration parameter file, the file naming convention for HDF is as follows:

```
L7fppprrr_rrrYYYYMMDD_AAA.XXX
```

where

L7 indicates the Landsat-7 mission.

f indicates the ETM+ data format.

ppp indicates the starting path of the product.

rrr_rrr indicates the starting and ending rows of the product.

YYYYMMDD indicates the acquisition date of an image.

AAA indicates the file type:

- B10 = band 1
- B20 = band 2
- B30 = band 3
- B40 = band 4
- B50 = band 5
- B61 = band 6L (low gain)
- B62 = band 6H (high gain)
- B70 = band 7
- B80 = band 8
- CAL = internal calibrator (1R only)
- GEO = geolocation (1R only)
- HDF = HDF directory file
- MSD = consensus MSCD (1R only)
- MTA = LPS metadata (1R only)
- MTL = LPGS metadata
- PCD = consensus PCD (1R only)
- SLO = scan line offset (1R only)

XXX indicates product type (L1R or L1G).

Calibration parameters are stored as ASCII text using an object data language syntax developed by the Jet Propulsion Laboratory. The naming convention for the calibration parameter file is derived from the file name assigned by the Image Assessment System and is annotated as follows:

```
L7CPFYYYYMMDD_YYYYMMDD_nn
```

where

L7 indicates the Landsat-7 mission.

CPF indicates that it is a calibration parameter file.

YYYYMMDD_YYYYMMDD indicates the starting and stopping year, month, and day of the CPF.

nn indicates the incrementing number within a 90-day period (01-99).

READING DATA

o Delivered On Tape

Data on 8-mm, high-density (Exabyte) tapes are tarred per IEEE POSIX standard 1003.1, preserving file names. To read a tar tape on a computer with a UNIX operating system, type:

```
tar -xvf /<device name>
```

Command key arguments include:

x indicates that the data are to be read from tape.
v requests verbose output (that is, processed file names will be listed).
f indicates that the archive name is specified.

The device name is system specific and may specify a device such as a tape drive or a file path. Specific parameters depend upon local workstation configurations.

o Delivered On CD-ROM

Data files are not packed. ISO 9660 Level 2.

o Delivered Via File Transfer Protocol

Data files are not packed or compressed.

EDC CONTACT

EDC User Services
U.S. Geological Survey
EROS Data Center
47914 252nd Street
Sioux Falls, SD 57198-0001
USA
Voice: 605-594-6116
Fax: 605-594-6963
E-Mail: edc@eos.nasa.gov

REFERENCES

Irish, Richard, 1998, Landsat 7 science data users handbook: Greenbelt, Maryland, Goddard Space Flight Center, electronic version, http://ltpwww.gsfc.nasa.gov/IAS/handbook/handbook_toc.html

National Aeronautics and Space Administration, 1998, Earth Science Data and Information System (ESDIS) level 1 product output files data format control book, volume 5, book 2, revision 3: Greenbelt, Maryland, Goddard Space Flight Center, electronic version,

[http://lpgs-server.gsfc.nasa.gov/!LPGS_Baseline/
LPGS_DFCB_Rev3\(5.99\).pdf](http://lpgs-server.gsfc.nasa.gov/!LPGS_Baseline/LPGS_DFCB_Rev3(5.99).pdf)
[Updated May 1999, 510-3DFC/0197, CSC 10036361]

Data Format Control Books may be revised periodically. Visit the following document server:

Earth Science Data and Information System (ESDIS) Level 1 Product Generation System (LPGS) Document Server at:

http://lpgs-server.gsfc.nasa.gov/!LPGS_Baseline/baseline.html

Disclaimer: Any use of trade, product, or firm names is for descriptive purposes only and does not imply endorsement by the U.S. Government.

APPENDIX

o ACRONYM LIST

ASCII -- American Standard Code for Information Interchange
CD-ROM -- Compact Disc-Read Only Memory
CPF -- Calibration Parameter File
EDC -- EROS Data Center
EROS -- Earth Resources Observation Systems
ESDIS -- Earth Science Data and Information System
ETM+ -- Enhanced Thematic Mapper Plus
HDF -- Hierarchical Data Format
IEEE -- Institute of Electrical and Electronics Engineers
LPGS -- Level-1 Product Generation System
LPS -- Landsat Processing System
MSCD -- Mirror Scan Correction Data
NCSA -- National Center for Supercomputing Applications
PCD -- Payload Correction Data

Abbreviations and Acronyms

API	application programming interface
ASCII	American Standard Code for Information Interchange
CCB	Configuration Control Board
CCR	configuration change request
CD-ROM	compact disc read-only memory
CPF	calibration parameter file
DAAC	Distributed Active Archive Center
DFCB	data format control book
DORRAN	Distributed Ordering Research and Accounting Network
ECS	EOSDIS Core System
EDC	EROS Data Center
EOS	Earth Observing System
EOSAT	Earth Observation Satellite
EOSDIS	EOS Data and Information System
EPSG	European Petroleum Survey Group
EROS	Earth Resources Observation System
ESDIS	Earth Science Data and Information System
ETM+	Enhanced Thematic Mapper Plus
FAST-L7A	FAST-Landsat 7 format
ftp	file transfer protocol
F&PRS	Functional and Performance Requirements Specification
GeoTIFF	Geographic Tagged Image File Format
GMT	Greenwich mean time
GSFC	Goddard Space Flight Center
HDF	Hierarchical Data Format
IAS	Image Assessment System
IC	internal calibrator

ICD	interface control document
I/O	input/output
JPL	Jet Propulsion Laboratory
L0R	Level 0 reformatted
L1	Level 1
L1G	Level 1 geometrically corrected
L1R	Level 1 radiometrically corrected
LASP	Laboratory for Atmospheric and Space Physics
LCC	Lambert Conformal Conic
LGS	Landsat Ground System
LPDS	Level 1 Product Distribution System
LPGS	Level 1 Product Generation System
LPS	Landsat Processing System
m	meter
mm	millimeter
Mbps	megabits per second
MSCD	mirror scan correction data
N/A	not applicable
NASA	National Aeronautics and Space Administration
NCSA	National Center for Supercomputing Applications
ODL	object description language
OMA	Oblique Mercator, Type A
OMB	Oblique Mercator, Type B
PC	Polyconic
PCD	payload correction data
POSC	Petrotechnical Open Software Corporation
PS	Polar Stereographic
SDP	Science Data Production
SDS	scientific data set

SGI	Silicon Graphics, Inc.
SLO	scan line offset
SOM	Space Oblique Mercator
SWIR	short-wave infrared
TIFF	Tagged Image File Format
TM	Traverse Mercator
USGS	United States Geologic Survey
UTC	universal time coordinated
UTM	Universal Transverse Mercator
VMS	Virtual Memory Storage
VNIR	visible and near infrared
WRS	Worldwide Reference System
0R	zero reformatted data
Zulu	Greenwich mean time