SPACE IMAGING

EOSAT FAST FORMAT DOCUMENT FOR EOSAT DIGITAL PRODUCTS VERSION C, EFFECTIVE APRIL 23, 1996 (REVISED JULY 29, 1996)

This document describes the format to be used on new EOSAT products. Version B will continue to be used for Landsat Thematic Mapper products produced by EOSAT. As new products are brought on line, clarification of various fields may be made by revisions of this document.

GENERAL FORMAT RULES:

1. All field definitions strictly follow American National Standards Institute (ANSI) and International Organization for Standardization (ISO) standards.
2. Only Band Sequential (BSQ) image structure is supported because data to be written to tape is made available a single band at a time. (Geometric corrections to the image are done one band at a time.)
3. Image files consist of a single band of data.
4. A digital product is referred to as a volume set. Individual media (tape, CD) are referred to as volumes. A volume set may have one or more volumes, depending on image size and output tape density. Multi-resolution data sets have a volume set for each resolution.

GENERAL FORMAT DESCRIPTION

The Fast Format (Version C) volume set contains a Header File and Image Files. The contents and format of the Header File in this version have been expanded to accommodate additional information pertinent to the data sets provided by EOSAT. The contents and format of the Image Files have not changed. Ingest software designed to accommodate Version C of the EOSAT Fast Format can read the Header and Image Files. For the proper procedure to ingest data in the EOSAT Fast Format Version C, please refer to the provider of your image viewing software or the software documentation. Information required for proper ingest of the image data is provided in the following sections.

HEADER FILE

The first file on each volume, a Read-Me-First file, contains header data. It is in American Standard Code for Information Interchange (ASCII), to ANSI and ISO standards.

Alphanumeric fields are left justified and numeric fields are right justified. Dates are given in ANSI full year, month, and day-of-month format. All processing options, radiometric calibration, geometric characteristics and map projection information for the product are contained in this file. Appendix D contains a table of the entries in the Header File. The table breaks the information into 80 byte units with

a carriage return as the eightieth character allowing convenient printing of the file. For this reason each 80 byte unit is referred to as a line. The table lists the field number in each record, the start and stop byte number, a FORTRAN format representation and a short text describing the field contents.

IMAGE FILES

All image files contain only one band of image pixels. There are no header records within the image file, nor are there prefix and/or suffix data in the individual image records. Image data may be blocked or unblocked. Blocking is performed to condense as much data onto the tape as possible; map-oriented full scenes otherwise would not fit onto four Computer Compatible Tapes (CCT).

BLOCKED RECORDS

In order to fit some products onto 6250 Bpi computer tapes, it was deemed necessary to block image records such that one record on the CCT contained several image lines. This blocking results in writing fewer End-of-Record gaps on the tape and allows more data to be written to the tape. Certain map oriented products on CCT must be blocked. Because of the relatively large data capacity of 8 mm tapes and CD_ROMs, it is not necessary to block data on these media.

DETAILED FORMAT DESCRIPTION

HEADER FILES

The Header File contains three 1536-byte ASCII records. The first record is the Administrative Record which contains information that identifies the product, the scene and the data specifically needed to ingest the imagery from the digital media. In order to import the image data, it is necessary to read entries in the Administrative Record.

The second record is the Radiometric Record which contains the coefficients needed to convert the scene digital values into at-satellite spectral radiance.

The third record is the Geometric Record which contains the scene geodetic location information. In order to align the imagery to other data sources, it will be necessary to read entries in the Geometric Record.

The accompanying tables in Appendix D describe the format of the three records, including the number of bytes, the FORTRAN format statement and a brief description of each field in the header file. All alphanumeric fields are left justified, and all numeric fields right justified. Fields of fixed (constant) values are represented with capital letters in quotes (e.g., "PRODUCT ="). Variable fields are represented with lower case letters. In both fixed and variable fields, blank spaces are indicated by the lower case "b" character.

All three records in the Header File have a carriage return every eightieth character. This allows convenient printing of the entire Header File. If you have difficulty reading and directly printing this file, it may be necessary to alert your software that a carriage return in these records implies a line feed.

Note that multi-volume data sets may be read in any order. Sufficient data is available on all volumes to

permit allocation of memory for the image files and to read the image data by complete files or by portions thereof. If software is not available to automatically read the Header File and then automatically read the Image Files, it is possible to read the pertinent fields by using any of various utilities to dump the Header File and print the ASCII file or view it on a computer screen. [See the previous comment regarding the carriage return every eightieth character.] Then, it is usually possible to use a general ingest program to read the correct files into the system hard drive. The following sections describe the critical fields that must be read.

ADMINISTRATIVE RECORD

The first fields in this record contain the Product ID, a unique identifier for the product as ordered by the customer.

The remainder of the initial two lines in this record describe the source of the image with pertinent sensor parameters. The next six lines are replicates of the first two without the Product ID. These are growth regions allowing for mosaic products containing up to four images and co-registered Panchromatic and multi-spectral imagery. These products are proposed and not yet implemented.

Line nine describes the type of product contained on the media; i.e. size and orientation. Line ten describes the characteristics of the processing; i.e. level of geometric correction and resampler used.

The remainder of the Administrative Record contains the critical data required to import the image data to computer memory.

For unblocked data (8 mm and CD-ROM), ingest of the imagery requires knowledge of the contents of fields 83 (Pixels per Line), 85 (Lines per Band on this volume) and 105 (Bands Present). 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 will have an ASCII character with the band label, usually a number. For IRS-1c the values are 2, 3 4, 5 and P. The later is for the panchromatic instrument. The sequence terminates in a blank.

For blocked data, fields 91 (Start Line), and either 93 (Blocking Factor) OR 95 (Record Length) and 87 (Number of lines in the output image) are also needed. Note that the (blocked) record length is equal to the blocking factor times the number of pixels per line. One may choose which parameter best fits their system software interface.

More sophisticated software will read fields 79 and 81 (Volume #/# in Set) relating to which volume is being read, and field 100 (Bits per Pixel) .

Field 73 (bytes 741-751) in Line 10 contains the level of processing that has been performed on the image.

RAW	No corrections applied
RADIOMETRIC	Radiometric corrections only
SYSTEMATIC	Radiometric and geometric corrections using spacecraft system data only.
PRECISION	Radiometric and geometric corrections using spacecraft system data and with control points used
TERRAIN	Radiometric and geometric corrections using spacecraft system data and with control points and digital elevation model (DEM) used

Field 75 (bytes 765-766) in Line 10 contains the resampling algorithm that has been applied to the image.

```
CC = Cubic convolution          NN = Nearest neighbor
```

Field 83 (bytes 843-847) in Line 11 contains the number of image pixels on each image line of each image band on the tape.

Field 85 (bytes 865-869) in Line 11 contains the number of image lines per band on this volume. This is the number of lines in each image file for tapes containing one or more complete image files. Field 86 (Bytes 872-876) contains the number of image lines for the entire band (The band may be split across multiple volumes). These are right-justified ASCII numeric fields.

Field 91 (bytes 895-899) in Line 12 identifies the first image line on the tape volume. This is "b1" unless the tape is the second or higher numbered volume of a multi-volume set (e.g. fields 79 & 81 are "b2/b2"). In this case it is the line number in the complete image of the first image line on the tape (nominally N/2 + 1 for two-tape sets, where N is the total number of lines in the image). This is a right-justified ASCII numeric field.

Field 93 (bytes 918-919) in Line 12 contains the blocking factor used to minimize the number of CCT tapes required to accommodate the image set. This field is always "1" for 8 mm tapes. (See Blocking Factor explanation under Image Files.)

Field 95 (bytes 936-940) in Line 12 contains the physical tape record length. The value is right justified in an ASCII numeric field. The number of pixels (samples) per image line can be determined by dividing this field by the value in Record 1, field 93 or by reading field 83 (bytes 843-847).

Field 100 (bytes 984-985) in Line 13 contains the integer number of bits per pixel that is used in the output media to represent the digital value of each individual pixel. (This value may be different from Field 102)

Field 102 (bytes 1010-1011) in Line 13 contains the integer number of bits per pixel that each individual pixel was quantized at onboard the satellite instrument. (This value may be different from field 100) IRS-1c panchromatic data is transmitted as six bit pixels, while the digital products are always produced with eight bit pixels.

Field 104 (bytes 1057-1088) in Line 13 contains the band identifiers for the image files on the tape volume. This field is composed of thirty-two one-byte sub-fields containing from one to thirty-two of

the band identifiers (i.e., "234b" for full IRS-1c LISS-3 data sets or "Pb" for IRS-1c panchromatic data sets). The band identifiers are listed in the order in which the image files appear on the tape and are single character fields, so the leftmost character (byte 1057) must be non-zero. The sequence ends with trailing blanks.

RADIOMETRIC RECORD

Fields 4-41 (bytes 81-689) contains the coefficients needed to convert scene digital values to at-satellite spectral radiances.

GEOMETRIC RECORD

Line 1 contains the map projection (field 3), Earth ellipsoid (field 5) and datum (field 7) used in producing the product. Appendix A contains the list of supported map projections and Appendix B contains the list of supported Earth ellipsoids and comments about the datum. Products are not always available in all projections and ellipsoids. You must verify your requirements with EOSAT Customer Services.

Fields 11-44 (bytes 110-504, lines two to six) contain the USGS projection parameters used to process the image in standard USGS order. The meaning of these values depends on the projection used. For information about the contents of each of the map projection fields see Appendix C.

Fields 47-88 (bytes 561-859, lines eight to eleven) contain the corresponding corner pixel locations (longitude, latitude, easting, northing) relative to the resampled pixel center for all bands on the current tape volume. Line twelve contains the same information about the scene center as well as the location of the scene center relative to the top right corner of the image on this medium. To calculate the Northing and Easting of any pixel within the image use the map coordinates of the image corner points and the following equations:

$$PE=((NP-P)(NL-L)ULE+(P-1)(NL-L)URE+(NP-P)(L-1)LLE+(P-1)(L-1)LRE)/((NP-1)(NL-1))$$

$$PN=((NP-P)(NL-L)ULN+(P-1)(NL-L)URN+(NP-P)(L-1)LLN+(P-1)(L-1)LRN)/((NP-1)(NL-1))$$

Where

PE = Desired pixel location Easting
PN = Desired pixel location Northing
ULE = Upper left corner point Easting (Field 53)
URE = Upper right corner point Easting (Field 64)
LLE = Lower left corner point Easting (Field 86)
LRE = Lower right corner point Easting (Field 75)
ULN = Upper left corner point Northing (Field 55)
URN = Upper right corner point Northing (Field 66)
LLN = Lower left corner point Northing (Field 88)
LRN = Lower right corner point Northing (Field 77)
P = Pixel number of desired location (counted from left)
L = Line number of desired location (counted from top)
NP = Number of pixels per image line (Record 1, Field 83)
NL = Total number of lines in the output image (Record 1, Field 87)

Field 107 (bytes 969-974) in Line thirteen contains the horizontal offset of the true scene center from the

nominal scene center in units of whole pixels. A negative value implies a westerly offset of the scene center from the nominal scene center in daytime scenes and an easterly offset of the scene center in nighttime scenes.

Field 109 (bytes 995-1000) in Line thirteen identifies the orientation angle of the scene. For non-polar scenes the orientation angle of the scene is relative to the scene alignment to map or grid north. For non-polar, map-oriented scenes this field should be zero. A negative angle implies a clockwise rotation of the scene to align with map north whereas a positive angle implies a counterclockwise rotation of the scene to align with map north. To calculate the orientation angle of any image use the following equation:

```
ANGLE = arctan ( NORTHDIFF / EASTDIFF )

Where

NORTHDIFF = URNORTH - ULNORTH
EASTDIFF = UREAST - ULEAST
URNORTH = Upper right corner point Northing ( field 66)
ULNORTH = Upper left corner point Northing ( field 55)
UREAST = Upper right corner point Easting ( field 64)
ULEAST = Upper left corner point Easting ( field 53)
```

Field 113 (bytes 1062-1065) in Line fourteen contains the sun elevation in degrees for the scene center location at the scene center acquisition time. This angle specifies the solar parallel of altitude on the celestial sphere as referenced from the celestial horizon of the scene center.

Field 115 (bytes 1086-1090) contains the sun azimuth (west) in degrees for the scene center location at the scene center acquisition time. This angle specifies the vertical circle (west) on which the sun's location is measured from the principal vertical circle of the scene center.

COPYRIGHT NOTICE

SOFTWARE

The cartographic software package used in processing the digital imagery is described in the following references:

General Cartographic Transformation Package (GCTP)
Software Reference
NOAA Technical Report NOS 124 CGS 9
General Cartographic Transformation Package GCTP, Version II
Atef A. Elassal - February 1987
U.S. Dept. of Commerce
National Geodetic Information Center, NOAA
Rockville, MD 20852

USGS Map Projection Reference
Map Projections - A Working Manual
U.S. Geological Survey Professional Paper 1395

(Supersedes USGS Bulletin 1532)
John P. Snyder - 1987
U.S.G.S. Map Sales
P.O. Box 25286
Denver, CO 80225

APPENDIX A

Map Projections

This appendix contains the map projections used in EOSAT's products. This list of map projections shows the name, and the identifier used in Record 3, Field 3 of the header file. Please note not all map projections are available for each instrument data set provided by EOSAT.

Projection Name	Mnemonic
Universal Transverse Mercator	UTM
State Plane Coordinate System	SPCS
Albers Conical Equal Area	ACEA
Lambert's Conformal Conic	LCC
Mercator	MER
Polar Stereographic	PS
Polyconic	PC
Equidistant Conic (Type A & B)	EC
Transverse Mercator (Gauss-Krueger)	TM
Stereographic	SG
Lamberts Azimuthal Equal Area	LAEA
Azimuthal Equidistant	AE
Gnomonic	GNO
Orthographic	OG
General Vertical Near-Side Perspective	GVNP
Sinusoidal	SIN
Equirectangular (Plate Carree)	ER
Miller Cylindrical	MC
Van Der Grinten I	VDG
Oblique Mercator (Type A & B)	OM
Space Oblique Mercator	SOM

APPENDIX B

Earth Ellipsoids

This appendix contains the earth ellipsoids used in EOSAT's products. This list of ellipsoids shows the

name, and the identifier used in Record 3, Field 3 of the header file. Please note not all earth ellipsoids are available for each instrument data set provided by EOSAT.

Ellipsoid Name	Semi-Major Axis (meters)	Semi-Minor Axis (meters)	Mnemonic
Clarke 1866	6378206.400000	6356583.800000	CLARKE_1866
Clarke 1880	6378249.145000	6356514.869550	CLARKE_1880
International 1967	6378157.500000	6356772.200000	INTERNATL_1967
International 1909	6378388.000000	6356911.946130	INTERNATL_1909
WGS 66	6378145.000000	6356759.769356	WGS_66
WGS 72	6378135.000000	6356750.519915	WGS_72
GRS 1980	6378137.000000	6356752.314140	GRS_80
Airy	6377563.396000	6356256.910000	AIRY
Modified Airy	6377340.189000	6356034.448000	MODIFIED_AIRY
Everest	6377276.345200	6356075.413300	EVEREST
Modified Everest	6377304.063000	6356103.039000	MODIFIED_EVEREST
Mercury 1960	6378166.000000	6356784.283666	MERCURY_1960
Modified Mercury 1968	6378150.000000	6356768.337303	MOD_MERC_1968
Bessel	6377397.155000	6356078.962840	BESSEL
Walbeck	6376896.000000	6355834.846700	WALBECK
Southeast Asia	6378155.000000	6356773.320500	SOUTHEAST_ASIA
Australian National	6378160.000000	6356774.719000	AUSTRALIAN_NATL
Krassovsky	6378245.000000	6356863.018800	KRASSOVSKY
Hough	6378270.000000	6356794.343479	HOUGH
6370997 Sphere	6370997.000000	6370997.000000	6370997_M_SPHERE

Datums

Standard products over North America use either NAD27 or NAD 83. Other datum are available for premium products. Please inquire with EOSAT Customer Services.

Datum	Name	Mnemonic
North American	1927	NAD27
North American	1983	NAD83

Appendix C

USGS/NOAA Projection Parameters

To Be Supplied at a later date

APPENDIX D

Fast Format Header File Record Format Tables

The following tables are a description of the three records in the Header File. Each record described below is separated by a blank typed line every eighty characters for ease of reading. A group of eighty characters can be thought of as a (printed) line. See the accompanying text for more explanation of critical entries.

Administrative Record

Line	Field	Start Byte	End Byte	Format	Description
1	1	1	12	A12	"PRODUCTbIDb="
2	13	23	A11	Product order number in yydddnnn-cc format	
3	24	34	A11	"bLOCATIONb="	
4	35	51	A17	First scene location path/row/fraction/subscene in ppp/rrrffss format	
5	52	70	A19	"bACQUISITIONbDATEb="	
6	71	78	A8	First scene acquisition date in yyyyddmm format	
7	79	79	1X	Blank fill	
8	80	80	A1	Carriage return	
2	9	81	91	A11	"SATELLITEb="
10	92	101	A10	First scene satellite Name: L4, L5, IRS 1B, IRS 1C	
11	102	110	A9	"bSENSORb="	
12	111	120	A10	First scene sensor Name: TM, LISS1, LISS2, LISS3, PAN, WiFS	
13	121	134	A14	"bSENSORbMODEb="	
14	135	140	A6	First scene sensor Mode	
15	141	153	A13	"bLOOKbANGLEb="	
16	154	159	F6.2	First scene off-nadir angle in degrees	
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/rrrffss format	
21	212	230	A19	"bACQUISITIONbDATEb="	
22	231	238	A8	Second scene acquisition date in yyyyddmm format	
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: L4, L5, IRS 1B, IRS 1C	
27	262	270	A9	"bSENSORb="	
28	271	280	A10	Second scene sensor Name: TM, LISS1, LISS2, LISS3, PAN, WiFS	
29	281	294	A14	"bSENSORbMODEb="	
30	295	300	A6	Second scene sensor Mode	
31	301	313	A13	"bLOOKbANGLEb="	
32	314	319	F6.2	Second scene off-nadir angle in degrees	
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/rrrffss format	
37	372	390	A19	"bACQUISITIONbDATEb="	
38	391	398	A8	Third scene acquisition date in yyyyddmm format	
39	399	399	1X	Blank fill	
40	400	400	A1	Carriage return	
6	41	401	411	A11	"SATELLITEb="
42	412	421	A10	Third scene satellite Name: L4, L5, IRS 1B,IRS 1C	
43	422	430	A9	"bSENSORb="	
44	431	440	A10	Third scene sensor Name: TM, LISS1, LISS2, LISS3, PAN, WiFS	
45	441	454	A14	"bSENSORbMODEb="	
46	455	460	A6	Third scene sensor Mode	
47	461	473	A13	"bLOOKbANGLEb="	
48	474	479	F6.2	Third scene off-nadir angle in degrees	

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/rrrffss format	
53	532	550	A19	"bACQUISITIONbDATEb="	
54	551	558	A8	Fourth scene acquisition date in yyyyddmm format	
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: L4, L5, IRS 1B,IRS 1C	
59	582	590	A9	"bSENSORb="	
60	591	600	A10	Fourth scene sensor Name: TM, LISS1, LISS2, LISS3, PAN, WiFS	
61	601	614	A14	"bSENSORbMODEb="	
62	615	620	A6	Fourth scene sensor Mode	
63	621	633	A13	"bLOOKbANGLEb="	
64	634	639	F6.2	Fourth scene off-nadir angle in degrees	
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' , 'MAPbSHEETb'	
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' , 'PRECISIONbb', 'TERRAINbbbb' , 'RADIOMETRIC' , 'RAWbbbbbbbb'	
74	752	764	A13	"bRESAMPLINGb="	
75	765	766	A2	Resampling algorithm used: 'CC' , 'NN'	

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 image).	
80	822	822	A1	"/"	
81	823	824	I2	Number of volumes in tape set (for multi-volume image).	
82	825	842	A18	"bPIXELSbPERbLINEb="	
83	843	847	I5	Number of pixels per image line	
84	848	864	A17	"bLINESbPERbBANDb="	
85	865	869	I5	Number of lines on this volume	
86	870	870	A1	"/"	
87	871	875	I5	Number of lines in the output image	
88	876	879	4X	blank fill	
89	880	880	A1	Carriage return	
12	90	881	894	A14	"STARTbLINEb#b="
91	895	899	I5	First image line number on this volume (for multi-volume image)	
92	900	917	A18	"bBLOCKINGbFACTORb="	
93	918	919	I2	Tape blocking factor	
94	920	935	A16	"bRECORDbLENGTHb="	
95	936	940	I5	Length of physical file record in bytes	
96	941	953	A13	"bPIXELbSIZEb="	
97	954	959	F6.2	Pixel size in meters	
98	960	960	A1	Carriage return	
13	99	961	983	A23	"OUTPUTbBITSbPERbPIXELb="
100	984	985	I2	Output bits per pixel	
101	986	1011	A26	"bACQUIREDbBITSbPERbPIXELb="	
102	1012	1013	I2	Acquired bits per pixel	
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 on this volume	
107	1088	1119	32X	blank fill	
108	1120	1120	A1	Carriage return	
15	109	1121	1199	79X	blank fill

110	1200	1200	A1	Carriage return	
16	111	1201	1279	79X	blank fill
112	1280	1280	A1	Carriage return	
17	113	1281	1359	79X	blank fill
114	1360	1360	A1	Carriage return	
18	115	1361	1439	79X	blank fill
116	1440	1440	A1	Carriage return	
19	117	1441	1519	79X	blank fill
118	1520	1520	A1	Carriage return	
20	119	1521	1535	15X	"REVbbbbbbbbbbb"
120	1536	1536	A1	Format version code (A-Z). This document describes version C.	

Radiometric Record

Line	Field	Start Byte	End Byte	Format	Description
1	1	1	50	A50	"BIASESbANDbGAINSbINbTHE bBANDbORDERbASbONbTHISbTAPE"
	2	51	79	29X	Blank fill
	3	80	80	A1	Carriage Return
2	4	81	104	D24.15	Bias for First Band on this tape
	5	105	105	1X	Blank fill
	6	106	129	D24.15	Gain for first Band on this tape
	7	130	159	30X	Blank fill
	8	160	160	A1	Carriage Return
3	9	161	184	D24.15	Bias for Second Band on this tape
	10	185	185	1X	Blank fill
	11	186	209	D24.15	Gain for Second Band on this tape
	12	210	239	30X	Blank fill
	13	240	240	A1	Carriage Return
4	14	241	264	D24.15	Bias for Third Band on this tape
15	265	265	1X	Blank fill	
16	266	289	D24.15	Gain for Third Band on this tape	
17	290	319	30X	Blank fill	
18	320	320	A1	Carriage Return	
5	19	321	344	D24.15	Bias for Fourth Band on this tape
20	345	345	1X	Blank fill	

21	346	369	D24.15	Gain for Fourth Band on this tape	
22	370	399	30X	Blank fill	
23	400	400	A1	Carriage Return	
6	24	401	424	D24.15	Bias for Fifth Band on this tape
25	425	425	1X	Blank fill	
26	426	449	D24.15	Gain for Fifth Band on this tape	
27	450	479	30X	Blank fill	
28	480	480	A1	Carriage Return	
7	29	481	504	D24.15	Bias for Sixth Band on this tape
30	505	505	1X	Blank fill	
31	506	529	D24.15	Gain for Sixth Band on this tape	
32	530	559	30X	Blank fill	
33	560	560	A1	Carriage Return	
8	34	561	584	D24.15	Bias for Seventh Band on this tape
35	585	585	1X	Blank fill	
36	586	609	D24.15	Gain for Seventh Band on this tape	
37	610	639	30X	Blank fill	
38	640	640	A1	Carriage Return	
9	39	641	664	D24.15	Bias for Eighth Band on this tape
40	665	665	1X	Blank fill	
41	666	689	D24.15	Gain for Eighth Band on this tape	
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
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

Geometric Record

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 (see Appendix B for list of mnemonics)	
6	66	73	A8	"bDATUMb="	
7	74	79	A6	Datum name (see Appendix B for list of mnemonics)	
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	559	55X	Blank fill	
46	560	560	A1	Carriage Return	
8	47	561	564	A4	"ULb="
48	565	565	1X	Blank fill	

49	566	578	A13	Geodetic Longitude of Upper Left corner of image. As per FIPS PUB 70, longitude will be expressed as degrees, minutes, seconds. Example: 5 degrees, 15 minutes, 13.2 seconds west of the prime meridian will be expressed as "0051513.2000W"	
50	579	579	1X	Blank fill	
51	580	591	A12	Geodetic Latitude of Upper Left corner of image. As per FIPS PUB 70, latitude will be expressed as degrees, minutes, seconds. Example: 9 degrees, 4 minutes, 24.2334 seconds north of the equator will be expressed as "090424.2334N"	
52	592	592	1X	Blank fill	
53	593	605	F13.3	Easting of Upper Left corner of image in projection units	
54	606	606	1X	Blank fill	
55	607	619	F13.3	Northing of Upper Left corner of image in projection units	
56	620	639	20X	Blank fill	
57	640	640	A1	Carriage Return	
9	58	641	644	A4	"URb="
59	645	645	1X	Blank fill	
60	646	658	A13	Geodetic Longitude of Upper Right corner of image.	
61	659	659	1X	Blank fill	
62	660	671	A12	Geodetic Latitude of Upper Right corner of image.	
63	672	672	1X	Blank fill	
64	673	685	F13.3	Easting of Upper Right corner of image in projection units	
65	686	686	1X	Blank fill	
66	687	699	F13.3	Northing of Upper Right corner of image in projection units	
67	700	719	20X	Blank fill	
68	720	720	A1	Carriage Return	

10	69	721	724	A4	"LRb="
70	725	725	1X	Blank fill	
71	726	738	A13	Geodetic Longitude of Lower Right corner of image.	
72	739	739	1X	Blank fill	
73	740	751	A12	Geodetic Latitude of Lower Right corner of image.	
74	752	752	1X	Blank fill	
75	753	765	F13.3	Easting of Lower Right corner of image in projection units	
76	766	766	1X	Blank fill	
77	767	779	F13.3	Northing of Lower Right corner of image in projection units	
78	780	799	20X	Blank fill	
79	800	800	A1	Carriage Return	
11	80	801	804	A4	"LLb="
81	805	805	1X	Blank fill	
82	806	818	A13	Geodetic Longitude of Lower Left corner of image.	
83	819	819	1X	Blank fill	
84	820	831	A12	Geodetic Latitude of Lower Left corner of image.	
85	832	832	1X	Blank fill	
86	833	845	F13.3	Easting of Lower Left corner of image in projection units	
87	846	846	1X	Blank fill	
88	847	859	F13.3	Northing of Lower Left corner of image in projection units	
89	860	879	20X	Blank fill	
90	880	880	A1	Carriage Return	
12	91	881	888	A8	"CENTERb="
92	889	889	1X	Blank fill	
93	890	902	A13	Scene center geodetic longitude expressed in degrees, minutes, seconds as above. This is the true center of the full scene from which the product image was made, and does not necessarily fall inside the product image.	
94	903	903	1X	Blank fill	

95	904	915	A12	Scene center geodetic latitude expressed in degrees, minutes, seconds as above. This is the true center of the full scene from which the product image was made, and does not necessarily fall inside the product image.	
96	916	916	1X	Blank fill	
97	917	929	F13.3	Scene center Easting in projection units	
98	930	930	1X	Blank fill	
99	931	943	F13.3	Scene center Northing in projection units	
100	944	944	1X	Blank fill	
101	945	949	I5	Scene center pixel number measured from the product upper left corner, rounded to nearest whole pixel (may be negative)	
102	950	950	1X	Blank fill	
103	951	955	I5	Scene center line number measured from the product upper left corner, rounded to nearest whole pixel (may be negative)	
104	956	959	4X	Blank fill	
105	960	960	A1	Carriage Return	
13	106	961	968	A8	"OFFSETb='
107	969	974	I6	Horizontal offset of the true scene from the nominal scene center in units of whole pixels. (May be negative)	
108	975	994	20A	"bORIENTATIONbANGLEb="	
109	995	1000	F6.2	Orientation angle in degrees (may be negative)	
110	1001	1039	39X	Blank fill	
111	1040	1040	A1	Carriage return	
14	112	1041	1061	21A	"SUNbELEVATIONbANGLEb="
113	1062	1065	F4.1	Sun elevation angle in degrees at scene center	
114	1066	1085	A20	"bSUNbAZIMUTHbANGLEb="	
115	1086	1090	F5.1	Sun azimuth in degrees at scene center	

116	1091	1119	29X	Blank fill	
117	1120	1120	A1	Carriage Return	
15	118	1121	1199	79X	Blank fill
	119	1200	1200	A1	
16	120	1201	1279	79X	
	121	1280	1280	A1	
17	122	1281	1359	79X	
	123	1360	1360	A1	
18	124	1361	1439	79X	
	125	1440	1440	A1	
19	126	1441	1519	79X	
	127	1520	1520	A1	
20	128	1521	1535	79X	
	129	1536	1536	A1	

Explanation of Allowable Fast Format Rev C Field Values for IRS-1c Products

The following tables either describe the field entry values format to be followed or the allowed values for the specific fields within the header file records.

Administrative Record

Field	Content	Format	Explanation or Allowable values
2	Product ID	yydddnnn-cc	yy = year ddd = julian date nnn = product sequence number cc = copy number
4,20,36,52	Location	ppp/rrrffss	ppp = path rrr = row ff = fractional shift applied = 00 for no shift ss = subscene designation pan full scenes = A, B, C, D pan 23km x 23 km scenes = A1-A9;B1-B9; C1-C9;D1-D9 Liss 2 scenes = A1, A2, B1, B2 All other products leave blank

6,22,38,54	Acquisition Date	yyyyddmm	YYYY = year dd = day mm = month
10,26,42,58	Satellite	A10	IRS 1B IRS 1C IRS P2 IRS P3
12,28,44,60	Sensor	A10	LISS1 = LISS 1 Sensor LISS2A = LISS 2 Sensor Camera A LISS2B = LISS 2 Sensor Camera B LISS3 = LISS 3 Sensor PAN = Panchromatic Sensor WiFS = Wide Field Sensor
67	Product Type	A18	MAP ORIENTED ORBIT ORIENTED
69	Product Size	A10	FULL SCENE - for Liss1, Liss2, Liss3, WiFS and full scene pan SUBSCENE - for 23km x 23km pan subscenes QUADRANT - for Liss3 quadrants MAP SHEET - for Liss1, Liss2, Liss3 and pan geocode product
72	Type of processing	A11	RAW = Raw data (Fully uncorrected product) RADIOMETRIC = Radiometrically only corrected SYSTEMATIC = Radiometrically and geometrically corr PRECISON = Radiometrically and geometrically corrected using ground control points TERRAIN = Radiometrically and geometrically corrected using ground control points and digital elevation model MERGE = Radiometrically and geometrically corrected with an IHS merge of panchromatic and Liss3 imagery
75	Resampling method	A2	CC = Cubic Convolution NN = Nearest Neighbor
98	Output bits per pixel	I2	8
100	Acquired bits per pixel	I2	7 for Liss 1, Liss2, and Liss 6 for Panchromatic

Geometric Record

Field	Content	Format	Explanation
3	Map projection	A4	UTM = Universal Transverse Mercator POL = Polyconic SPCS = State Plane Coordinate System ACEA = Albers Conical Equal Area LCC = Lambert Conformal Conic MER = Mercator PS = Polar Stereographic PC = Polyconic EC = Equidistant Conic (Type A & B) TM = Transverse Mercator (Gauss-Krueger) SG = Stereographic LAEA = Lamberts Azimuthal Equal Area AE = Azimuthal Equidistant GNO = Gnomonic OG = Orthographic GVNP = General Vertical Near-Side Perspective SIN = Sinusoidal ER = Equirectangular (Plate Carree) MC = Miller Cylindrical VDG = Van Der Grinten I OM = Oblique Mercator (Type A & B) SOM = Space Oblique Mercator
5	Ellipsoid	A13	CLARKE 1866 = Clarke 1866 CLARKE 1880 = Clarke 1880 WGS 66 = WGS 66 WGS 72 = WGS 72 GRS 1980 = GRS 1980 AIRY = Airy MODIFIED AIRY = Modified Airy EVEREST = Everest MOD EVEREST = Modified Everest MERCURY 1960 = Mercury 1968 MOD MER 1968 = Modified Mercury 1968 BESSEL = Bessel WALBECK = Walbeck SE ASIA = Southeast Asia AUSTRALIA NAT = Australian National KRASSOVSKY = Krassovsky HOUGH = Hough INT 1909 = International 1909 INT 1967 = International 1967
7	Datum	A5	NAD27 = North American Datum 1927 NAD83 = North American Datum 1983 NONE = No Datum used [Note: Others may be added from time to