CARTOSAT-1 (IRS – P5)
DATA PRODUCTS SYSTEM

IRS-1C/1D/RESOURCESAT-1 (P6)/CARTOSAT-1(P5)
DIGITAL DATA PRODUCT
FORMAT SPECIFICATIONSFOR REVISION C
FAST FORMAT PRODUCTS(Version – 2)

March 2005

Signal and Image Processing Group
Remote Sensing Applications and Image Processing Area
Space Applications Centre
Indian Space Research Organization
Ahmedabad – 380 015

Government of India
Space Applications Centre (ISRO)
Ahmedabad-380015.

.

DOCUMENT CONTROL AND DATA SHEET

1. **Report No. and date** : IRS-P5/DP/SAC/RESIPA/SIPG/TN-15/March-2005

2. **Title and sub-title** : **IRS-1C/1D/RESOURCESAT-1(P6)/CARTOSAT-1(P5) DIGITAL DATA PRODUCT FORMAT SPECIFICATIONS FOR REVISION C FAST FORMAT PRODUCTS (Version-2)**

3. **Type of Report** : Technical

4. **No. of pages** : 29
5.
5. **Authors** : Cartosat-1(IRS-P5) Data Products Team

6. **Originating Unit** : Signal & Image Processing Group
    Remote Sensing Applications and Image Processing Area, SAC.

7. **Abstract** : This document contains the format specifications for IRS-1C/1D/ Resourcesat-1 (P6)/Cartosat-1 (P5) Fast Format Digital Data Products

8. **Key words** : Fast Format, Header File, Image File, Blocked Record, Administrative Record, Radiometric Record, Geometric Record, Map Projections, Format Layouts

9. **Security Classification** : Unrestricted

10. **Distribution** : To identified individuals within ISRO/DOS and IRS Data Users

IRS-1C/1D/RESOURCESAT-1 (P6) / CARTOSAT-1 (P5)

DIGITAL DATA PRODUCT FORMAT SPECIFICATIONS
FOR REVISION C FAST FORMAT PRODUCTS

**IRS-1C/1D/RESOURCESAT-1 (P6) / CARTOSAT-1 (P5)
DIGITAL DATA PRODUCT FORMAT SPECIFICATIONS
FOR REVISION C FAST FORMAT PRODUCTS**

1.0 INTRODUCTION

This document describes the format specifications for IRS-1C/1D/Resourcesat-1(IRS-P6)/Cartosat-1(IRS-P5) fast format digital data products. This format has been adopted from EOSAT Fast Format Revision C, 1995 and has undergone changes w.r.t. addition of new fields without modifying original field specifications for IRS-1C, IRS-1D, Resourcesat-1(IRS-P6) and Cartosat-1(IRS-P5). The current format differs from the original EOSAT Fast Format Revision C in the following ways:

1. Path number field has been enhanced to four characters for Cartosat-1.
2. Scene centre coordinates are referenced w.r.t. Top Left Corner of the image product rather than the full scene reference.
3. Some of the fields such as Horizontal Offset have been made dummy for Cartosat-1.

1.1 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 (a single band in a single file).
3. A digital product is referred to as a volume set. Individual media (8mm DAT, CD) are referred to as volumes. A volume set may have one or more volumes, depending on image size and output media capacity.
4. Sequential media like 8mm DAT are not supported for AOI (Area of Interest) and ORTHOKIT products of IRS-P5

1.2 GENERAL FORMAT DESCRIPTION

The Fast Format (Version C) volume set contains a Header File and one or more Image Files

1.2.1 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) format, confirming to ANSI and ISO standards so as to enable easy human reading using any standard text reader/ editor software packages.

Alphanumeric fields are left-justified and numeric fields are right-justified. Dates are given in yyyyddmm format (full year, day-of-month and month format). Identification of the scene data, 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.

1.2.2 IMAGE FILES

Each image file contains one band of image data. There are no header records within the image file, nor are there prefix and/or suffix data in the individual image records.

1.2.3 IMAGE DATA RECORDS

For IRS image data products, the image data records contain one scanline per each record. Provision to block multiple image data records into a single physical record for optimizing the

access from tape media is not used in any of the IRS data products. However to maintain the format compatibility, the blocking factor is chosen always as one.

2.0 DETAILED FORMAT DESCRIPTION

2.1 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 read the image file(s) 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 <u>Appendix D</u> 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 at every eightieth character.

2.1.1 ADMINISTRATIVE RECORD

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

The remainder of the initial two lines in this record describes 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.

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 critical fields required to read the image data into computer memory.

For unblocked data (*applicable for all IRS data products*) ingest of the image files requires knowledge of the contents of fields 83 (pixels per line), 85 (Lines per Band on this volume), 87 (No. of lines in output image), 95 (image data record length in bytes), 100 (Output bits per pixel) 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/1D/P6 the values are 2, 3, 4, 5 for LISS-3, 2,3,4 for LISS-4, 3,4 for WiFS and 2,3,4,5 for AWiFS and P for PAN. For IRS-P5 this field will contain P for both FORE and AFT Sensor. 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 the parameter that best fits their system software interface.

Fields 79 and 81 (Volume #/# in Set) relate to which volume number in a set and field 100 indicates 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 along with control points.
TERRAIN	Radiometric and geometric corrections using spacecraft system data, along with control points and digital elevation model (DEM)

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

CC = Cubic convolution   NN = Nearest neighbour SI=Sinc16 KI=KaiserField 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 87 (Bytes 871-875) contains the number of image lines for the entire band (The band may be split across multiple volumes). These are right-justified numeric fields.

Field 91 (bytes 895-899) in Line 12 identifies the first image line on this 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 8mm 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 in the value in Field 93 or by directly reading field 83 (bytes 843-847).For two byte data like AwiFS (IRS-P6), FORE/AFT (IRS-P5) Pixels = RecordLength/(BlockingFactor * BytesPerPixel). 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 1012-1013) in Line 13 contains the integer number of bits per pixel that each individual pixel was quantized by 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 106 (bytes 1056-1087) in Line 14 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 identifies (i.e., "234b" for only band 2,3,4 IRS-1C LISS-3 data sets or "Pb" for IRS-1C/1D panchromatic data sets and FORE AFT sensor of IRS-P5, "2345" for LISS-3/AWiFS,). 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 1056) must be non-zero. The sequence ends with trailing blanks.

2.1.2 RADIOMETRIC RECORD

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

2.1.3 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.

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 volume. Line twelve contains the same information about the scene center as well as the location of the scene center relative to the top left 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. This field is dummy for Cartosat-1 (IRS-P5).

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 (NORTHDIFE/EASTDIFF)
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 (east) in degrees for the scene center location at the scene center acquisition time. This angle specifies the vertical circle (east) on which the sun's location is measured from the principal vertical circle of the scene center.

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.

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	POL
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 Career)	ER
Miller Cylindrical	MC
Van Der Grintern I	VDG
Oblique Mercator (Type A & B)	OM
Space Oblique Mercator	SOM

APPENDIX- B-1 : Earth Ellipsoids

This appendix contains the earth ellipsoids used in products.
This list of ellipsoids shows the name and the identifier used in Record 3 Field 3 of the header file.

Ellipsoid Name	Semi-Major Axis (meters)	Semi-Minor Axis (meters)	Mnemonics
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	6356911.646130	INTERNATL_1909
WGS 66	6378145.000000	6356759.769356	WGS_66
WGS 72	6378135.000000	6356750.519915	WGS_72
WGS 84	6378137.000000	6356752.314000	WGS_84
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	6356075.41330	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 Natl.	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

APPENDIX- B-2: Ellipsoid and Datum Mnemonics

Ellipsoid Name	Ellipsoid Mnemonic	Possible Datum Name	Datum Mnemonics
Clarke 1866	CLARKE_1866	Datum_North_American _Datum_1927	NAS-E
Clarke 1880	CLARKE_1880	Datum_Adindan	ADI-M
International 1967	INTERNATL_1967	Datum_New_Zealand_Geodetic_Datum_1949	GEO
International 1909/1924	INTERNATL_1909	Datum_European_Datum_1950	EUR-M
WGS 66	WGS_66	WGS_66	WGS_66
WGS 72	WGS_72	WGS_72	WGS_72
WGS 84	WGS_84	WGS_84	WGS_84
GRS 1980	GRS_80	Datum_North_American _Datum_1983	NAR-B
Airy	AIRY	Datum_OSGB_1936	OGB_M
Modified Airy	MODIFIED_AIRY	Datum_TM65	IRL
Everest	EVEREST	Datum_Indian_1975	IND-I
Modified Everest	MODIFIED_EVEREST	Datum_Indian_1975	IND-I
Mercury 1960	MERCURY_1960	NOT DEFINED	
Modified Mercury 1968	MOD_MERC_1968	NOT DEFINED	
Bessel	BESSEL	Datum_Tokyo	TOY-M
Walbeck	WALBECK	Datum_European_Datum_1950	EUR-M
Southeast Asia	SOUTHEAST_ASIA	Datum_Southasia	SOA
Australian Natl.	AUSTRALIAN_NATL	Datum_Australian_Geodetic_datum_1984	AUG
Krassovsky	KRASSOVSKY	Datum_Pulkovo_1942	PUK
Hough	HOUGH	Datum_Wake-Eniwetok_1960	ENW
6370997 Sphere	6370997_M_SPHERE	NOT DEFINED	

APPENDIX – C: USGS   Projection Parameters

Fast Format Revision C Supports 17 USGS projections. For all projections except State Plane, USGS parameters 1 and 2 are semi major and minor axes of the requested earth ellipsoid.

* Not every parameter will be used by the designated projection.

* If a parameter is not used the field for the parameter will be initialized to Zero.

* All latitude and longitude fields will be specified in Decimal Degree (floating point)

* All other fields will be specified as double precision floating point values.

Please note that all co-ordinates for State Plane System contained in the Fast
Format is in map meters (not in feet).

The single character codes given in bracket in the following list represents the third character of the Product Code corresponding to IRS data products (Eg., U represents UTM).

C1(U) Universal Transverse Mercator (UTM)

Parameter 3*   UTM Zone number (Optional)

C2(A) Albers Conical Equal Area (ACEA)

Parameter 3   Latitude of first Standard Parallel
Parameter 4   Latitude of second Standard Parallel
Parameter 5   Longitude of central meridian
Parameter 6   Latitude of projection's Origin
Parameter 7   False Easting (in meters)
Parameter 8   False Northing (in meters)

C3(L) Lamberts Conformal Conic (LCC)

Parameter 3   Latitude of first Standard Parallel
Parameter 4   Latitude of second Standard Parallel
Parameter 5   Longitude of central meridian
Parameter 6   Latitude of projection's Origin
Parameter 7   False Easting (in meters)
Parameter 8   False Northing (in meters)

C4(M) Mercator (Mer)Parameter 5   Longitude of central meridian Parameter 7
        False Easting (in meters)
Parameter 8   False Northing (in meters)

C5(D) Polar Stereographic (PS)

Parameter 5   Longitude directed straight down below pole of map
Parameter 6   Latitude of true scale
Parameter 7   False Easting (in meters)

Parameter 8   False Northing (in meters)

C6(P) Polyconic (POL)

Parameter 5   Longitude of central meridian
Parameter 6   Latitude of projection's Origin
Parameter 7   False Easting (in meters)
Parameter 8   False Northing (in meters)

C7(T) Tranverse Mercator (TM)

Parameter 3   Scale Factor at central meridian
Parameter 5   Longitude of central meridian
Parameter 6   Latitude of projections's origin
Parameter 7   False Easting (in meters)
Parameter 8   False Northing (in meters)

C8(H) Stereographic (SG)

Parameter 5   Longitude of central meridian
Parameter 6   Latitude of centre of projection
Parameter 7   False Easting (in meters)
Parameter 8   False Northing (in meters)

C9(Z) Lamberts Azimuthal Equal Area (LAEA)

Parameter 5   Longitude of central meridian
Parameter 6   Latitude of centre of projection
Parameter 7   False Easting (in meters)
Parameter 8   False Northing (in meters)

C10(E) Azimuthal Equidistant (AE)

Parameter 5   Longitude of central meridian
Parameter 6   Latitude of centre of projection
Parameter 7   False Easting (in meters)
Parameter 8   False Northing (in meters)

C11(G) Gnomonic (GNO)

Parameter 5   Longitude of central meridian
Parameter 6   Latitude of centre of projection
Parameter 7   False Easting (in meters)
Parameter 8   False Northing (in meters)

C12(R) Orthographic (OG)

Parameter 5	Longitude of central meridian
Parameter 6	Latitude of centre of projection
Parameter 7	False Easting (in meters)
Parameter 8	False Northing (in meters)

C13(N) General Vertical Near-Side Perspective (GVNP)

Parameter 3	Height of perspective point above sphere
Parameter 5	Longitude of centre of projection
Parameter 6	Latitude of centre of projection
Parameter 7	False Easting (in meters)
Parameter 8	False Northing (in meters)

C14(I) Sinusoidal (SIN)

Parameter 5	Longitude of central meridian
Parameter 7	False Easting (in meters)
Parameter 8	False Northing (in meters)

C15(C) Miller Cylinderical (MC)

Parameter 5	Longitude of central meridian
Parameter 7	False Easting (in meters)
Parameter 8	False Northing (in meters)

C16(V) Van Der Grinten (VDG)

Parameter 5	Longitude of central meridian
Parameter 7	False Easting (in meters)
Parameter 8	False Northing (in meters)

C17(S) Space Oblique Mercator (SOM)Parameter 4   Angle of azimuth east of north
for central line

	of projection
Parameter 9	Longitude of the ascending Node
Parameter 11	Longitude of descending Node

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 case for reading. A group of eighty characters can be thought of as a (printed) line. See the accompanying text (Section 2.1.1,2.1.2 and 2.1.3) 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
					yyddnnnn-cc format
					yyddd=First 1 to 5 Char
					nnn=8-10th char of Unique Work Order
					Product Identification string.
					cc=Scene Number.
	3	24	34	A11	"bLOCATIONb="
	4	35	51	A17	First scene location path/
					row/fraction (shift %)/subscene(or
					quadrant) in
					ppp/rrrffss format(for IRS-1C/1D/P6)
					pppp/rrrffss format(for IRS-P5)
					In case of LISS4 Multi Spectral Mode
					Path=Strip Number,Row=Scene Number.
	5	52	70	A19	"bACQUISITIONbDATEb="First scene
	6	71	78	A8	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:IRS 1C,1D,P6 and CARTOSAT-1
	11	102	110	A9	"bSENSORb="First scene sensor Name:
	12	111	120	A10	LISS3, PAN, WIFS, LISS4,
					AWIFS,FORE,AFT
					"bSENSORbMODEb="First scene sensor
	13	121	134	A14	Mode
	14	135	140	A6	This field is not valid for IRS-P5.
					"bLOOKbANGLEb="
	15	141	1453	A13	First scene off-nadir
	16	154	159	F6.2	angle in degrees
					This field is not valid for IRS-P5.
					Carriage return
	17	160	160	A1	
3	18	161	183	23X	Blank fill
	19	184	194	A11	"bLOCATIONb="
	20	195	211	A17	Second scene location path/
					row/fractions/subscene in
					ppp/rrrffss format(for IRS-1C/1D/P6)
	21	212	230	A19	pppp/rrrffss format(for IRS-P5)
	22	231	238	A8	"bACQUISITIONbDATEb="
					Second scene acquisition
	23	239	239	1X	date in yyyyddmm format
	24	240	240	A1	Blank fill
					Carriage return

4	25	241	251	A11	"SATELLITEb="
	26	252	261	A10	Second scene satellite Name:IRS
					1C,1D,P6 and CARTOSAT-1
	27	262	270	A9	"bSENSORb="Second scene sensor Name:
	28	271	280	A10	PAN, WIFS,LISS4,AWIFS,FORE,AFT
					"bSENSORbMODEb=" Second scene sensor
	29	281	294	A14	Mode
	30	295	30	A6	"bLOOKbANGLEb="
	31	301	313	A13	Second scene off-nadir angle
	32	314	319	F6.2	in deg.
					Carriage return
	33	320	320	A1	
5	34	321	343	23X	Blankfill
	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:
					IRS 1C,1D,P6 and CARTOSAT-1
	43	422	430	A9	"bSENSORb="
	44	431	440	A10	Third scene sensor Name:
					LISS3, PAN,
					WIFS,LISS4,AWIFS,FORE,AFT"bSENSORbMO
	45	441	454	A14	DEb="Third scene sensor Mode
	46	455	460	A6	"bLOOKbANGLEb="
	47	461	473	A13	Third scene off-nadir angle
	48	474	479	F6.2	in degree
					Carriage return
	49	480	480	A1	
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="Fourth scene
	54	551	558	A8	acquisition
					date in yyyyddmm format
	55	559	559	1X	Blank fill
	56	560	560	A1	Carriage return
8	57	561	571	A11	"SATELLITEb="Fourth scene satellite
	58	572	581	A10	Name:
					IRS 1C,1D,P6 and CARTOSAT-1
	59	582	590	A9	"bSENSORb="
	60	591	600	A10	Fourth scene sensor Name: LISS3,PAN,
					WIFS,
					LISS4,AWIFS,FORE,AFT"bSENSORbMODEb="
	61	601	614	A14	Fourth scene sensor mode
	62	615	620	A6	"bLOOKbANGLEb="
	63	621	633	A13	Fourth scene off-nadir angle
	64	634	639	F6.2	In deg.
					Carriage return
	65	640	640	A1	
9	66	641	654	A14	"PRODUCTbTYPEb=" Product type:

	67	655	672	A18	'MAPbORIENTEDbbbbbb'.'ORBITbORIENTED bbbb'"bPRODUCTbSIZEb="
	68	673	687	A15	Product size:'FULLbSCENE', 'SUBSCENEbb' and 'QUADRANTbb'(Only
	69	688	697	A10	for 1C/1D/P6); 'FULLbSCENE', 'MAPbSHEETb',& 'MOSAIC'(for IRS-P5)blank fill carriage return
	70	698	719	22X	
	71	720	720	A1	
10	72	721	740	A20	"TYPEbOFbPROCESSINGb="
	73	741	751	A11	Type of processing used: 'SYSTEMATICb','PRECISIONbb', 'TERRAINbbbb','RADIOMETRIC', 'RAWbbbbbbbb' "bRESAMPLINGb="Resampling algorithm
	74	752	764	A13	used:
	75	765	766	A2	'CC','NN','SI','KI' Blank fill
	76	767	799	33X	Carriage return
	77	800	800	A1	
11	78	801	819	A19	'VOLUMEb#/#bINbSETb="
	79	820	821	I2	Media number in volume set (for multi-volume
	80	822	822	A1	image)"/"Number of volumes in volume
	81	823	824	I2	set (for multi-volume image) "bPIXELSbPERLINEb="
	82	825	842	A18	Number of pixels per image
	83	843	847	I5	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	15	First image line number on this volume (for multi-volume image)
	92	900	917	A18	"bBLOCKINGbFACTORb="
	93	918	919	I2	Media blocking Factor
	94	920	935	A16	"bRECORDbLENGTHb="Length of physical
	95	936	940	I5	file record in bytes
	96	941	953	A13	"bPIXELbSIZEb="
	97	954	959	F6.2	Pixel size in meters(X Direction)
	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
	103a	1014	1029	A16	"bPIXELbSIZE(Y)b="
	103b	1030	1035	F6.2	Pixel size in meters(Y Direction)
	103c	1036	1039	4X	Blank fills
	104	1040	1040	A1	Carriage return

14	105	1041	1055	A15	"BANDSbPRESENTb=
	106	1056	1087	A32	Image bands present on this volume. Refer Section 2.1.1 for text description.
	107	1088	1102	A14	"PRODUCTbCODEb="
	108	1103	1111	A9	product code e.g. STPCD02AI
					ST : Two Char Product Type (e.g ST for STANDARD pathbased)
					P : 1 Char Projection Code (e.g. Polyconic)
					C : 1 Char Resampling Option (e.g. Cubic Convolution)
					D : 1 char Ellipsdoid Code (e.g. D for Everest) This field is used in IGS only. For Indian Ground Stations, this is always '0'.
					0 : Enhancement Code(Zero Always)
					2 : Processing level. '1' for only radiometrically corrected products. '2' for System corrected
					A : Fast Format Code 'A' is used for IGS 'B' is used for NRSA.
					I : Media Code(e.g. I for DAT, J for CDROM, V for DVD, Z (for IGS DISK products)/D (for Indian Ground Station DISK products)
	109	1112	1119	8X	Blank Fill
	110	1120	1120	A1	Carriage return
15	111	1121	1132	A12	"VERSION NO ="
	112	1133	1144	A12	DPS software version
	113	1145	1152	8X	Blank fill
	114	1153	1170	A18	"ACQUISITIONbTIME ="
	115	1171	1182	A12	Scene Start time in HH:MM:SS:mmm
	116	1183	1199	17X	Blank fill
	117	1200	1200	A1	Carriage return
16	118	1201	1220	A20	"GENERATINGbCOUNTRYb="
	119	1221	1232	A12	Generating Country Name
	120	1233	1235	3X	Blank fill
	121	1236	1254	A19	"GENERATINGbAGENCYb="
	122	1255	1264	A10	Generating Agency Name
	123	1265	1279	15X	Blank Fill
	124	1280	1280	A1	Carriage Return
17	125	1281	1301	A21	"GENERATINGbFACILITYb="
	126	1302	1309	A8	facility Name
	127	1310	1325	A16	"PRODUCTbENDIANb="
	128	1326	1332	A7	Endian in which product has been generated. e.g. **BIG** : For product generated with MOTOROLA Architecture(MSB First) **LITTLE** : For product generated with INTEL Architecture(LSB First)

	129	1333	1359	27X	Blank fill
	130	1360	1360	A1	Carriage return
18	131A	1361	1380	A20	"SOURCEbCOMPRESSIONb="
	131B	1381	1383	A3	Whether source data was compressed or not: e.g. 'YES' or 'NOb'
	131C	1384	1403	A20	"bCOMPRESSIONbTABLEb="
	131D	1404	1410	A7	Compression table Used.Possible values are 'QnnbHnn' Where Qnn=Q01 to Q10 represents Quantization table number. And Hnn=H01 to H10 represents Huffman table number.
	131E	1411	1428	A18	"bATTITUDEbSOURCEb="
	131F	1429	1431	A3	Source of attitude. For example SS1= Q's from Star Sensor 1 SS2= Q's from Star Sensor 2 S12= Q's from Star Sensor 1 and 2 ESQ= Q's from Earth Sensor AOC= Q's from Onboard Attitude Orbit Control OS1= Q's from Onboard Star Sensor 1 OS2= Q's from Onboard Star Sensor 2
	131G	1432	1439	8X	Blank fill
	132	1440	1440	A1	Carriage return
19	133	1441	1519	79X	Blank fill
	134	1520	1520	A1	Carriage return
20	135	1521	1535	15X	"REVbbbbbbbbbbbb"
	136	1536	1536	A	Format version code (A-Z). Current Version is 'C' This field describes Fast Format document version

Radiometric Record

Line	Field	Start Byte	End Byte	Format	Description
1	1	1	50	A50	"BIASESbANDbGAINSbINbTHE bBANDbORDERbASbONbTHISbTAPE" Blank fill
	2	51	79	29X	Carriage return
	3	80	80	A1	
2	4	81	104	D24.15	Bias for first Band on this tape
	5	105	105	1X	Blank fill
	6	106	129	D25.15	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 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	D25.15	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	819	A19	"SENSOR GAIN STATE="
	47	520	851	8*I4	bbbnbbbnbbbnbbbnbbbnbbbnbbbnbbbn
					This field is not valid for IRS-P5
	48	852	879	28X	Blank fill
	49	880	880	A1	Carriage return
12	50	881	894	14A	"SENSORbSTATEb="
	51A	895	902	A8	Correction Alogrithm Used
					1:ORIG or 2:CORLTN or 3:1DCC for
					LISS-3
					GOOD or DEGRADED for PAN
					Default is GOOD.
	51B	903	959	57X	Blank fill
	51C	960	960	A1	Carriage return
13	50	961	1038	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

* NOTE: - In IRS series only four bands are present so information related to fifth to eighth band are filled with blank.
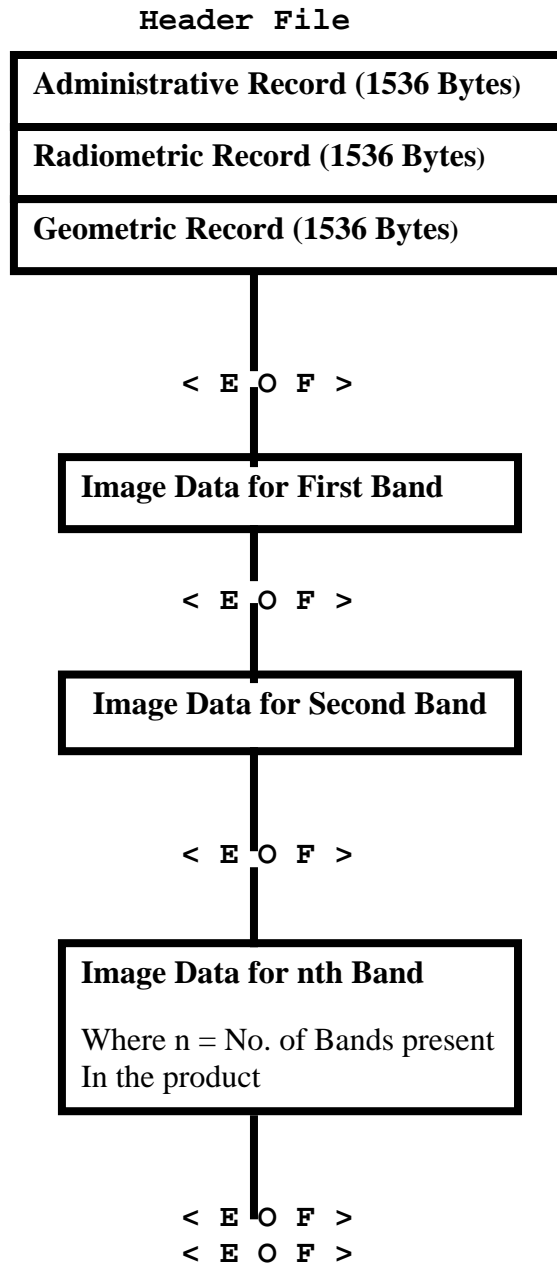
Geometric Record

Line	Field	Start Byte	End Byte	Format	Description
1	1	1	14	A14	"GEOMETRICbDATA""bMAPbPROJECTIONb
	2	15	31	A17	="
	3	32	35	A4	Map projection name (see Appendix A for list of mnemonics)
	4	36	47	A12	"bELLIPSOIDb="Earth Ellipsoid
	5	48	65	A18	used (see Appendix B for list of mnemonics)
	6	66	73	A8	"bDATUMb="Datum name (see
	7	74	79	A6	Appendix B for list of mnemonics) Carriage return
	8	80	80	A1	
2	9	81	108	A28	"USGSbPROJECTIONbPARAMETERSb="
	10	109	109	1X	Blank fill
	11	110	133	D24.15	USGS projection parameter #1:Semimajor axis
	12	134	134	1X	Blank fill
	13	135	158	D24.15	USGS projection parameter #2:Semiminor 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 FIBSPUB degrees, minutes, seconds. Example:5 degrees, 15 minutes, 13.2 seconds west of the prime meridian will be "0051513.2000W" Blank fill
	50	579	579	1x	Geodetic latitude of Upper
	51	580	591	A12	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 expressed as PUB 70 Seconds north of the Equator will be "090424.2334N" Blank fill
	52	592	592	1x	Easting of Upper left corner of
	53	593	605	F13.3	image in meters Blank fill
	54	606	606	1x	Northing of Upper left corner of
	55	607	619	F13.3	image in meters Blank fill
	56	620	639	20x	Carriage return
	57	640	640	A1	
9	58	641	644	A4	"URb="Blank fill
	59	645	645	1x	Geodetic Longitude of Upper
	60	646	658	A13	Right corner of image Blank fill
	61	659	659	1x	Geodetic Latitude of Upper
	62	660	671	A12	Right corner of image Blank fill
	63	672	672	1x	Easting of Upper Right corner
	64	673	685	F13.3	Of image in meters Blank fill
	65	686	686	1x	Northing of Upper Right corner
	66	687	699	F13.3	Of image in meters Blank fill
	67	700	719	20X	Carriage return
	68	720	720	A1	

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	750	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 meters
	76	766	766	1x	Blank fill
	77	767	779	F13.3	Northing of Lower Right corner Of image in meters
	78	780	799	20X	Blank fill
	79	800	800	A1	Carriage return
11	80	801	804	A4	"LLb"Blank fill
	81	805	805	1x	Geodetic Longitude of Lower Left
	82	806	818	A13	Corner of image
					Blank fill
	83	819	819	1x	Geodetic Latitude of Lower Left
	84	820	831	A12	Corner of image
					Blank fill
	85	832	832	1x	Easting of Lower Left corner
	86	833	845	F13.3	Of image in meters
					Blank fill
	87	846	846	1x	Northing of Lower Left corner of
	88	847	859	F13.3	image in meters
					Blank fill
	89	860	879	20X	Carriage return
	90	880	880	A1	
12	91	881	888	A8	"CENTERb=" Blank fill
	92	889	889	1x	Scene centre geodetic
	93	890	902	A13	longitude expressed in degrees, minutes, seconds as above. Blank fill
	94	903	903	1x	Scene center geodetic
	95	904	915	A12	latitude expressed in degrees, minutes seconds as above. Blank fill
	96	916	916	1x	Scene center Easting in
	97	917	929	F13.3	Meters Blank fill
	98	930	930	1x	Scene center Northing in
	99	931	943	F13.3	Meters Blank fill
	100	944	944	1x	Scene center pixel number
	101	945	949	15	measured from the product upper left corner rounded to nearest whole pixel Blank fill
	102	950	950	1x	Scene center line number
	103	951	955	15	measured from the product upper left corner rounded to nearest whole pixel Blank fill
	104	956	959	4x	Carriage return
	105	960	960	A1	

13	106	961	968	A8	"OFFSETb="Horizontal offset of the
	107	969	974	16	
					true scene center in units
					of whole pixels. (may be
					negative)
					This field is dummy for IRS-P5.
	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	1101	A11	"bALTITUDEb="
	117	1102	1113	F12.5	Satellite Altitude in Meters at
					Scene Centre.
	118	1114	1119	6X	
	119	1120	1120	A1	Blank fill
					Carriage return
15	120	1121	1135	A15	"HEADINGbANGLEb=
	121	1136	1149	F14.6	Satellite Heading Angle in
					degrees at Scene centre.
	122a	1150	1167	A18	"bINCIDENCEbANGLEb="
	122b	1168	1181	F14.6	Incidence angle of scan centre at
					Scene Centre in degrees.
					This field is specific to IRS-P5.
	122c	1182	1199	18X	Blank fill
	122d	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	79X	Blank fill
	132	1536	1536	A1	Carriage Return

APPENDIX-E: Fast Format Layout

`Header File`

Administrative Record (1536 Bytes)
Radiometric Record (1536 Bytes)
Geometric Record (1536 Bytes)

`< E O F >`

Image Data for First Band

`< E O F >`

Image Data for Second Band

`< E O F >`

Image Data for nth Band

Where n = No. of Bands present
In the product

`< E O F >`
`< E O F >`

APPENDIX-F: PRODUCT FILE NAMING CONVENTION AND LAYOUT

Following are the file naming convention and directory structure for CDROM /DVD and DISK products. The 8mm DAT products layout is given in APPENDIX-E.

LEGEND:
   SATID=P5/P6
       n=Band Number
         ='F' or 'A' for IRS-P5 FORE and AFT sensor.
    JobID= Twelve character Unique Product Identification String
     SEN= Three Char Sensor Code (L-3, L-4,AWF in IRS-P6)
        Similarly SEN=PAF for Fore and PAA for Aft camera for IRS-P5.

1) Single Scene Case
(a) CDROM/DVD Products

Every CDROM/DVD product contains a file named CDINFO along with a directory PRODUCT1. The directory structure for normal single scene product in CDROM is as follows:

CDINFO
PRODUCT1/HEADER.SEN
PRODUCT1/BANDn.SEN
PRODUCT1/SATIDFast.doc
PRODUCT1/PRODUCT_MET.TXT

(b) DISK Products

The file naming convention in case of DISK products are as follows.
JobID.hdr
JobID_n.geo
JobID_MET.TXT

2) Contents of a typical CDINFO File(for IRS-P5)

```
PRODUCT 1:
Product number             :G4PC006BJ001
Satellite ID               :P5
Sensor                     :PAF (PAF for FORE sensor, similarly PAA for AFT)
Path-Row                   :0041-051
Date, Time and  Scene Id. :12AUG04004105100:36:19F 1G4600
Product Code               :G4PC006BJ
Orbit Number               :21002
Image Layout               :BSQ
Number Of Bands            :1
Bands Present in Product   :P
Bands in this volume       :P
File Header                :0
Line Header (Prefix Bytes):0
Line Trailer(Suffix Bytes):0
Scan Lines                 :5568
Pixels                     :4992
Bytes Per Pixel            :2
Image Record Length(Bytes):9984
No of Volume               :1/1(Current Volume No./Total Volumes constituting
                                 this particular Scene)
```

APPENDIX-G: Scene Identification Definition of IRS-P5

This Scene ID definition is also given as "Date, Time and Scene Id." for CDINFO File of CDROM/DVD products for all Digital Products (Super structure, Fast Format, GeoTIFF).

1. 1:7   DDMMMYY (Date of Pass)
2. 8:11   Path
3. 12:14   Row
4. 15:22   HH:MM:SS (Time of acquisition in UT of Scene center)
5. 23:24   Sensor – ID (F for FORE, A for AFT, FA for FORE and AFT)
6. 25:25   No. of sensors
7. 26:27   Product type code (ST/SR)*
8. 28:28   Processing level (0 – RAW, 1 – RAD)*
9. 29:30   Shift percentage
10. 31:32   Blank Char

* In CDINFO File of CDROM/DVD products these fields will vary based on Product Type and Processing level for other digital products format (fast Format and Super Structure).