Project Galileo

Software Interface Specification

SSI Raw Experiment Data Record (REDR)

D-232-15

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National Aeronautics and Space Administration

Jet Propulsion Laboratory
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PROJECT GALILEO

SOFTWARE INTERFACE SPECIFICATION

COVER SHEET

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NUMBER: SIS 232-15
ORIGNAL
DATE: MAY 7, 1992

SIS NAME:

SSI Raw Experiment Data Record (REDR)

DOMAIN:

System	Subsystem	Program	Make/Use
MIPL	Realtime	SSIMERGE, GIMBUILD, GLLFILLIN, CDGEN, BADLABELS, ADESPIKE, GLLBLEMCOR, GREDRGEN, GREDRVAL	Make

PURPOSE OF INTERFACE (SUMMARY):

This interface describes the format and delivery specifications of the SSI REDR.

INTERFACE MEDIUM:

Disk File

CD-ROM

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Document Change Log

Change Order	Date	Affected Portions
Original	May 7, 1992	All

TBD Items

Page	Closure Date	Item Description
F-1		Update Appendix F to address REDRs.

ACRONYMS AND ABBREVIATIONS

ANSI	American National Standards Institute
APB	Asynchronous Playback
ASCII	American Standard Code for Information Interchange
bpi	Bits per inch
CD-ROM	Compact Disk - Read-Only Memory
CPU	Central Processing Unit
DN	Data Number
DSN ID	Deep Space Network Identification Number
EDR	Experiment Data Record
EOF	End of File
ERT	Earth Receive Time
GCF	Ground Control Facility
GLL	Galileo Project
GMT	Greenwich Mean Time
IDR	Intermediate Data Record
I/F	Radiance/Solar Flux
ISS	VGR Imaging Science Subsystem
JOI	Jupiter Orbital Insertion
JPL	Jet Propulsion Laboratory
LRS	Low Rate Science
LSB	Least Significant Bit
MIPL	Multimission Image Processing Laboratory
MIPS	Multimission Image Processing Subsystem
MOS	Mission Operations Subsystem
MSEC	Millisecond
N/A	Not Applicable
OPNAV	Optical Navigation
PDS	Planetary Data Subsystem
PTM	Proof Test Model (of SSI)
REDR	Raw Experiment Data Record
R/S	Reed/Solomon
S/C	Spacecraft
SCLK	Spacecraft Clock
SDR	System Data Record
SFDU	Standard Formatted Data Unit
SIS	Software Interface Specification
SNR	Signal-to-Noise Ratio
SSI	GLL Solid State Imaging Subsystem
TBD	To Be Determined
UDR	Unprocessed Data Record
UTC	Universal Time, Coordinated (same as GMT)
VICAR	Video Image Communication and Retrieval
WBDL	Wide Band Data Link

D-232-15
SSI Raw Experiment Data Record

1 INTRODUCTION

1.1 Content Overview

This Software Interface Specification describes the content, format, and method of transfer of the Solid State Imaging Subsystem (SSI) Raw Experiment Data Records (REDRs) supplied by the Multimission Image Processing Subsystem (MIPS) to the Galileo SSI team.

1.2 Scope

This specification is applicable to all SSI REDRs generated during the Cruise and Orbital Operations phases of the mission.

1.3 Applicable Documents

[1] GLL MOS FR GDS IPS *MOS-GLL-4-232* Revision 3, October 4, 1988

[2] Galileo SSI File Naming Conventions *IOM:384-91-HBM100* August 20, 1991

[3] GLL SSI CD-ROM Software Interface Specification, *D-232-16*

[4] Galileo SSI Picture Label *IOM:384:90:131* Revision 4, June 7, 1990

[5] Tracking GLL SSI Bad-Data Values *IOM:384:*91:3 Revision 2, May 14, 1991

[6] Project Galileo Software Interface Specification, SSI Image Catalog **D-3379**

1.4 Subsystem Siting

1.4.1 Interface Location, Medium

The REDR interface medium shall be a digital, with the distribution of REDR files on CD-ROM disks. Other media sources may be available with prior approval.

1.4.2 Data Source, Destinations, and Transfer Method

The SSI REDR shall be generated by MIPS procedures specifically developed or adapted for Galileo. The REDR generation and validation procedures shall input the disk file (UDR) generated by the realtime Galileo image build program (GIMBUILD). The REDR medium will reside at MIPS and shall be transferred to appropriate project personnel as requested.

1.4.3 Generation Method and Frequency

The REDR shall be generated on the MIPS computer system. Rate of production of the REDRs shall be as specified in reference [1].

1.4.4 Pertinent Relationships with Other Interfaces

The REDR format is identical to that of the EDR except that in the REDR several header fields are undetermined; also, the data format in the REDR is Byte and in the EDR it is Halfword (2-byte).

The REDR header and line record formats are similar to those used by the MIPS EDR interface to the Voyager Imaging Science Subsystem (ISS); they differ in Voyager and Galileo specific fields.

1.4.5 Labeling and Identification (Internal/External)

The internal file labeling shall be as defined in paragraph 4.2. The external filename will conform to the file naming conventions found in reference [2].

1.5 Assumptions and Constraints

The REDR is a new product designed to produce files which have not been radiometrically corrected. It is assumed that this product shall be used for inflight calibration images or for a limited number of non-calibration images.

2 INTERFACE CHARACTERISTICS

2.1 Hardware Characteristics and Limitations

N/A

2.1.1 Special Equipment and Device Interfaces

N/A

2.1.2 Special Setup Requirements

A premastered 8mm tape will be generated and sent to a vendor for REDR CD-ROM production.

2.2 Volume and Size

The REDR interface medium may hold more than one REDR file. Each REDR file contains at least a telemetry header record followed by zero or more bad-data value header records, followed by 800 line records.

The record lengths of REDR files are independent of the telemetry mode. Each REDR record is 1000 bytes for an 800 pixel line. For summation mode (telemetry AI8), the record is 1000 bytes and the image uses the first 400 samples and first 400 lines to store valid image data.

2.3 Interface Medium Characteristics

The REDR shall be written in VAX compatible (least significant byte first) format. The distributed interface medium will be CD-ROM, accessible from standard VAX/VMS or VICAR commands. REDR header and data records will be organized as 8-bit bytes. The bits in each byte will be numbered from 0 to 7, with bit 0 being the least significant bit. All 2 and 4 byte integers have their least significant bit in the first byte.

The image histogram, which trails the REDR telemetry header, will be organized as 32-bit words.

A PDS label file will accompany each REDR file. The format of this PDS label is found in reference [3].

2.4 Failure Protection, Detection, and Recovery Features

2.4.1 File Backup Requirements

The backup to the primary medium shall be disk REDR files residing on the MIPS system. Additional copies of the CD-ROM may be redistributed if required.

2.4.2 Security/Integrity Measures

N / A

3 ACCESS

3.1 Programs Affecting the SSI Data

Table 3-1 lists programs affecting SSI data from the Unprocessed Data Record (UDR), Raw Experiment Data Record (REDR), or Experiment Data Record (EDR).

Table 3-1. Programs Affecting SSI Data

Program	Input	Output	Description
ADESPIKE	UDR REDR EDR	REDR REDR EDR	Removes single-pixel spikes.
BADLABELS	UDR	REDR	Adds bad-data value headers and computer image entropy.
CDGEN	REDR EDR	REDR EDR	Writes PDS Label file and Index file on CD-ROMs.
GALSOS	UDR, REDR	EDR	Radiometrically corrects; removes blemishes and performs a unit conversion of the pixel data.
GEDREAD	EDR	EDR	Reads EDR tapes and copies EDRs to VICAR disk files; optionally updates the catalog with file location information.
GEDRGEN	EDR	EDR	Write EDR on tape.
GEDRVAL	EDR	----	Validates multiple copies of EDR tapes.
GIMBUILD	----	UDR	Generates UDR files.
GLLBLEMCOR	REDR	REDR	Removes camera blemishes.

Table 3-1. Programs Affecting SSI Data - Continued

Program	Input	Output	Description
GLLFILLIN	UDR REDR EDR	REDR REDR EDR	Fills in missing image lines due to data outage or R/S error.
GREDRGEN	REDR	REDR	Writes REDRs from disk to tape.
GREDRVAL	REDR	----	Validates REDR tapes.
SSIMERGE	UDR REDR	UDR REDR	Produces another image file; merge two images to produce third one with fewer missing lines.

3.2 Synchronization Considerations

N/A

3.3 Input/Output Protocols, Calling Sequences

N/A

3.4 Utility Programs

N/A

4 DETAILED INTERFACE SPECIFICATIONS

4.1 Structure and Organization Overview

Each REDR file will begin with a VICAR label, followed by the REDR telemetry header and a number of REDR bad-data value header records followed by REDR line records. Each line record will contain 200 bytes of line header information plus the pixel data (8 bits/pixel). See figure 4-1 for a diagram of the REDR file.

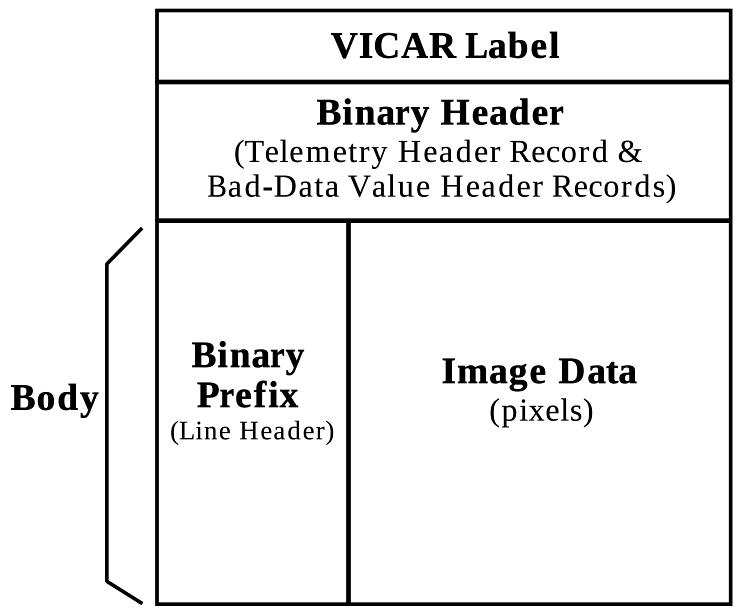

Figure 4-1. REDR File Diagram

All records have fixed length within each REDR file. All formats have 1000-byte records.

The telemetry header is split into two physical records. The first 1000 bytes are placed in the first physical record after the VICAR label, and the last 800 bytes are placed in the next physical record; the last 200 bytes are zero filled.

There will be a one-to-one correspondence between line records and image lines (excluding the header records, line record n will contain the data for image line n). Data not received will be zero-filled. Optionally, some missing data lines or lines with Reed-Solomon errors are artificially filled by GLLFILLIN program using interpolation. The fill-in process will occur based on parameters given by the SSI Team. Certain fields of each line header containing data sequencing information will be maintained even during data gaps.

4.2 Substructure Definition and Format

All fields are unsigned integers unless specified otherwise. All real numbers are represented in ASCII as noted for each field. The record identifier, byte 0, of every physical record identifies the type of that record, except for the telemetry header where each 1800-byte telemetry header record is split into two 1000-byte records. The last 200 bytes of the second record contains filler. Bad-data value header records will not cross physical record boundaries.

4.2.1 Label Description

The VICAR label is an ASCII record intended for use by MIPS and VICAR programs; others may ignore this record. This label always appears at the beginning of an REDR file. Since the length of this label may exceed one physical record, non-VICAR programs should ignore all records with a "Record ID", byte 0, of 32 or more.

The EDR VICAR label is defined in reference [4]. The REDR VICAR label is as described in this reference, with the exception that the following fields present in the EDR are missing in the REDR:

a. IOF

b. CNV

c. UBWC

d. DC

e. CAL

f. BLM

g. SO

h. EDRTAPE

i. EDRFILE

4.2.2 Telemetry Header Description

The REDR telemetry header record contains ancillary information specific to the image. It should not be confused with other binary header records, such as the bad-data value header records which are discussed later.

The REDR telemetry header record is described in Table 4-1.

Table 4-1. Telemetry Header

Byte	Bit	Item	Description	Valid For UDR	REDR	EDR
0		Record ID	ALWAYS = 0 for this header.	•	•	•
1		File Number	Binary count reset to zero for the first file on each physical product and incremented by one for each record written. Valid for tape interface only.		•	•
2 - 11		Project	Project name, 10 ASCII characters = "GALILEO".	•	•	•
12 - 17		Instrument	Instrument name, 6 ASCII characters = "SSI".	•	•	•
18 - 19		Phys. Seq.	Physical sequence, binary count reset to zero for first record written on the physical product and incremented by one for each subsequent write (includes VICAR label records). Valid for tape interface only.		•	•
20 - 21		Log. Seq.	Logical sequence, binary count reset to zero for the first record of a file (header record) and incremented by one for each record in the file. Always = 0 for this record. Note For UDRs, REDRs, and summation-mode EDRs, this header record spans two physical records.	•	•	•
		First ERT	Earth Received Time (UTC) of the first record containing valid data..	•	•	•
22 - 23		YEAR	Year			
24 - 25		DAY	Day of year			
26		HOUR	Hour of day			
27		MIN	Minute of hour			
28		SEC	Second of minute			
29 - 30		MSEC	Millisecond of second			
		Last ERT	Earth Received Time (UTC) of the last packet received for this image.	•	•	•
31 - 32		YEAR	Year			
33 - 34		DAY	Day of year			
35		HOUR	Hour of day			
36		MIN	Minute of hour			
37		SEC	Second of minute			
38 - 39		MSEC	Millisecond of second			

Table 4-1. Telemetry Header - Continued

Byte	Bit	Item	Description	Valid For UDR	REDR	EDR
		First SCLK	Spacecraft Clock of the first record in the file containing valid data.	•	•	•
40 - 43		RIM				
44		MOD91				
45		MOD10				
46		MOD8				
		Last SCLK	Spacecraft Clock of the last record in the file containing valid data.	•	•	•
47 - 50		RIM				
51		MOD91				
52		MOD10				
53		MOD8				
		SCET	Spacecraft Event Time (UTC) at the middle of shutter-open period.	•	•	•
54 - 55		YEAR	Year			
56 - 57		DAY	Day of year			
58		HOUR	Hour of day			
59		MIN	Minute of hour			
60		SEC	Second of minute			
61 - 62		MSEC	Millisecond of minute			
63 - 121		MIPS PRD	MIPS Physical Recording Data of the first record of the file (ASCII). See Appendix E.		•	•
122-123		Format ID	The correct format ID for this image as derived from line records by a voting algorithm.	•	•	•
124 - 127		Sync Errors	The sum of all bad bits in the sync code contained in all the line records in the file which contain valid data.	•	•	•
128		BOOM flag	Boom obscuration flag. 0: Boom present 1: Boom may be present 2: Boom not present	•	•	•
129 - 130		Missing Lines	Number of line records in the file with no valid pixels in the raw version of the image.	•	•	•
131 - 132		Partial Lines	Total number of line records in the file which contain some valid pixels.	•	•	•
133 - 134		Unreadables	Total number of records from the IDR and / or SDR which were unreadable and which fell within a time period for which data was required for this file. Note For SDR input this does not necessarily result in data loss.	•	•	•

Table 4-1. Telemetry Header - Continued

Byte	Bit	Item	Description	Valid For UDR	REDR	EDR
135 - 136		Seq. Breaks	Total number of IDR/SDR gaps (indicated by a discontinuity in the logical record numbers) which occurred during the time data was required for this file.	•	•	•
137 - 138		Source/Input	Logical sum (result of successive INCLUSIVE OR operations) of all source/input line records with valid data.	•	•	•
139 - 140		WBDLs	Total number of minor frames in this file which were derived from WBDL input.	•	•	•
141 - 142		SDRs	Total number of minor frames in this file which were derived from SDR input.	•	•	•
143 - 144		SFDUs	Total number of minor frames in this file which were derived from SFDU input.	•	•	•
145 - 151		Pic. No.	Picture number. Seven-ASCII-character "XXYZZZZ" (See Appendix C).	•	•	•
152 - 163		SSI LRS	First SSI LRS packet during this image.	•	•	•
164 - 165		Flags		•	•	•
	0	Compression	Compression 0=data not compressed 1=data compressed			
	1	Comp Mode	Compression Mode (Valid only if compression flag is set) 0= rate control 1= info preserv			
	2	Exposure	Exposure Mode 0= normal 1= extended			
	3	Flood	Light Flood Status 0= off 1= on			
	4	Blemish	Blemish Protection 0= off 1= on			
	5	Clock	Parallel Clock State 0= normal 1= inverted			
	6-15	Reserved				

Table 4-1. Telemetry Header - Continued

Byte	Bit	Item	Description	Valid For UDR	REDR	EDR
166 - 171		Mean DN	Mean DN level of all valid pixels. Real number represented as ASCII string in the form "123.12".	•	•	•
172 - 177		Truncated bits	Mean number of truncated bits/pixel. Real number represented as ASCII string in the form "12.345".	•	•	•
178 - 183		Truncated pixel	Mean number of truncated pixels/line. Real number represented as ASCII string in the form "123.12".	•	•	•
184 - 195		I/F	Mean I/F level. Real number represented as ASCII string in the from "123.12".			•
196 - 202		Entropy Average	Entropy level for the whole picture (bits/pixel). Real number represented as ASCII string in the form "12.1234".		•	•
203 - 307		Entropies	Entropy level for 15 lines. First line is 50, and incremented by 50 to line 750. 15 real numbers represented as ASCII strings in the form "12.1234".		•	•
308 - 331		Pointing	Scan platform coordinates at direction middle of shutter-open period in J2000. Three numbers for right ascension, declination and twist angles. Three real numbers represented as ASCII strings in the form of "1234.123".		•	•
332 - 347		Scale Factors	Radiometric calibration scale factors. Two real numbers in the form of "123.1234". First number is reflectance/(10,000xDN), the second is the radiance (nanowatts/cm^2/sr/nm)/DN scale factor.			•
348 - 379		Slope-File	Radiometric file used for systematic processing. 32 ASCII characters.			•
380 - 411		Offset-File	Radiometric file (dark current) used for systematic processing. 32 ASCII characters.			•

Table 4-1. Telemetry Header - Continued

Byte	Bit	Item	Description	Valid For UDR	REDR	EDR
412 - 431		Activity	20 ASCII characters of the form: "NNTIOOOOOOMM#SSSXXXX" (See Appendix D).	•	•	•
432		Filler		•	•	•
433		Filter	Filter position (See Appendix A).	•	•	•
435		Imaging Mode	0: 60-2/3 sec.(Low) 1: 8-2/3 sec.(High) 2: 30-1/3 sec.(Medium) 3: 2-1/3 sec.(Radiation)	•	•	•
436		Camera gain state	0: Gain 1 400K 1: Gain 2 100K 2: Gain 3 40K 3: Gain 4 10K	•	•	•
437- 440		Range	Target's range to sun in kilometers.		•	•
441		Format	Telemetry format number (See Appendix B).	•	•	•
442 - 443		Version	MIPS catalog version number, reserved for MIPS use.	•	•	•
 444 - 447 448 449 450		Starting SCLK RIM MOD91 MOD10 MOD8	Spacecraft Clock of the start of image. This clock refers to the start of the SSI frame cycle.	•	•	•
 451 - 454 455 456 457		Ending SCLK RIM MOD91 MOD10 MOD8	Spacecraft Clock at the end of image. This clock refers to the end of the SSI frame cycle.	•	•	•
458 - 775		Reserved		•	•	•
776 -1799		Histogram	256 32-bit binary valued histogram of the pixels for this file, including fill data.	•	•	•

NOTE

Table 4-1 above defines the logical telemetry header structure. The physical structure is dependent upon the file structure, which is described in paragraph 4.1.

4.2.3 Bad-Data Value Header Records

These records describe several types of bad data values. Each record describes only one type and depending on the number of bad pixels, they may span over several physical records. Each record is identified by the "Record Id" field which is located at byte 0. The definition of these records is provided in reference [5] and Appendix F.

4.2.4 Body Description

The REDR body or image line record is described in the Table 4-2.

Table 4-2. Image Line Record

Byte	Bit	Item	Description	Valid For UDR	REDR	EDR
0		Record ID	Always = 2 for line records.	•	•	•
1		File Number	Binary count reset to zero for the first file on physical product and incremented by one for each header record written. Always zero on disk.		•	•
2 - 3		Phys. Seq.	Physical sequence, binary count reset to zero for the first record written on a given physical product and incremented by one for each subsequent write.		•	•
4 - 5		Log. Seq.	Logical sequence, binary count reset to zero for the first record of a file (header record) and incremented by one for each record in the file.	•	•	•
		ERT	Earth Received Time (UTC) of the first bit of the telemetry frame which contained the first pixel of this line as interpolated from the ERT in the GCF block containing this bit. (The first bit of the frame is the first bit of the sync code).	•	•	•
6 - 7		YEAR	Year			
8 - 9		DAY	Day of year			
10		HOUR	Hour of day			
11		MIN	Minute of hour			
12		SEC	Second of minute			
13 - 14		MSEC	Millisecond of second			

Table 4-2. Image Line Record - Continued

Byte	Bit	Item	Description	Valid For UDR	REDR	EDR
 15 - 18 19 20 21		SCLK RIM MOD91 MOD10 MOD8	SCLK readout of the 1st minor frame of this line.	•	•	•
22 - 80		MIPS Physical Recording Words	59 ASCII characters which define the recording and validation devices, software version and CPU used to write this record and the data on which it was recorded.			•
81 - 82		Format ID	16-bit corrected telemetry format ID from the minor frame of this line.	•	•	•
83		Input Type	Decimal value: 0: S/C Flight Data MOS 1: PTM Data 2: Ext. Simulation 3: S/C Flight Data Test 4: Internal Simulation 5-255: Not used	•	•	•
84	 0 1 2 3 4 5 6 7	Input Source SFDU data WBDL data SDR tape IDR tape EDR Realtime APB Not used	=1 if present in record.	•	•	•
85		Allowed Sync Code Errors	The number of sync code errors allowed in frame synching.	•	•	•
86		Sync Code Err	The total number of bits in the sync code of the minor frame for this line which deviate from the standard sync code.	•	•	•
87 - 98		SSI LRS	SSI LRS packet. Present only for the first line of each MOD91 count. Otherwise zero.	•	•	•

Table 4-2. Image Line Record - Continued

Byte	Bit	Item	Description	Valid For UDR	Valid For REDR	Valid For EDR
99 - 100		Last Pixel ID	Element position (1-800) of the last pixel in this line not artificially set to zeros or interpolated by MIPS processing. Set to zero for missing lines.	•	•	•
101 - 102	0 - 13	Sync error Sync Status	Total number of bits in the 64-bit frame id which deviate from the "corrected" bits for that frame. Sync status for each minor frame: 00= fully synched (leading and trailing frame ID) 01= partial sync (leading but no trailing frame ID) 11= unsynched	•	•	•
103 -106	 0 - 1 2 - 3 4 - 5 .... 24 -25 26 -31	Truncation BLOCK 0 BLOCK 1 BLOCK 2 .... BLOCK 12 Filler	Number of truncated bits per block due to data compression. 2 bits/block, 13 blocks/line. Each contains 64 pixels except last one which contain 32 pixels.	•	•	•
107 -108		Truncated	Total number of pixels truncated at end of line due to data compression.	•	•	•
109 - 110		Version	Catalog version for identical images.		•	•
111 - 112		SNR	GCF symbol signal to noise ratio	•	•	•
113		DSN ID	As defined in GLL-820-13/OPS-6-8.	•	•	•
114 - 115		Line Number	Image line number, 1-800.	•	•	•
116		R/S Overflow	Reed/Solomon overflow error flag 1=Overflow occurred	•	•	•
117 - 199			Reserved	•	•	•
200 - 599 600 - 999 or 200 - 999		Pixel Data Filler Pixel Data	400 8-bit unsigned pixel values (summation mode only). Set to zero (summation mode only). 800 8-bit unsigned pixel values.	 • •	 • •	

Table 4-2. Image Line Record - Continued

Byte	Bit	Item	Description	Valid For		
				UDR	REDR	EDR
200 - 999		Pixel Data	400 16-bit signed pixel values, radiometrically corrected (summation mode only).			•
or						
200 - 1799		Pixel Data	800 16-bit signed pixel values, radiometrically corrected.			•

Appendix A

CAMERA PARAMETERS

Table A-1 below describes SSI filters and Table A-2 gives exposure values. These values were obtained from reference [6].

Table A-1. SSI Filters

Filter No.	Filter name
0	Clear
1	Green
2	Red
3	Violet
4	IR-7560
5	IR-9680
6	IR-7270
7	IR-8890

Table A-2. SSI Exposure Intervals in Milliseconds

Exposure No.	Exposure Time	Exposure No.	Exposure Time
0	0	10	100
1	4-1/6	11	133-1/3
2	6-1/4	12	200
3	8-1/3	13	266-2/3
4	12-1/2	14	400
5	16-2/3	15	533-1/3
6	25	16	800
7	33-1/3	17	1066-2/3
8	50	18	1600
9	66-2/3	19	2133-1/3

Table A-2. SSI Exposure Intervals in Milliseconds - Continued

Exposure No.	Exposure Time	Exposure No.	Exposure Time
20	3200	26	25600
21	4266-2/3	27	34133-1/3
22	6400	28	51200
23	8533-1/3	29	0-Dark Current
24	12800	30	0
25	17066-2/3	31	0

Appendix B

TELEMETRY FORMATS

Table B-1 below lists the telemetry formats and their downlink data rates. Entries in boldface type indicate SSI data telemetry formats.

Table B-1. Telemetry Formats

Telemetry Format Number	Mnemonic	Downlink Data Rate	Telemetry Format Number	Mnemonic	Downlink Data Rate
0	LPB	7.68 Kbps	16	HPW	115.2 Kbps
1	EHR	1.2 K bps	17	**HIM**	115.2 Kbps
2	BPB	16.8 Kbps	18	**HCM**	115.2 Kbps
3	MPB	28.8 Kbps	19	LRS	7.68 Kbps
4	XPW	67.2 Kbps	20	MPW	28.8 Kbps
5	**XCM**	67.2 Kbps	21	PW8	806.4 Kbps
6	**XED**	67.2 Kbps	22	**IM8**	806.4 Kbps
7	XPB	80.64 Kbps	23	**AI8**	806.4 Kbps
8	XPN	80.64 Kbps	24	PW4	403.2 Kbps
9	XRW	115.2 Kbps	25	**IM4**	403.2 Kbps
10	HPB	134.4 Kbps	26	---	---
11	HPJ	134.4 Kbps	27	---	---
12	HPW	134.4 Kbps	28	---	---
13	**HCJ**	134.4 Kbps	29	ESS	40 bps
14	MPP	28.8 Kbps	30	ELS	10 bps
15	MPR	28.8 Kbps			

Appendix C

PICTURE NUMBER

The structure of the picture number field in the EDR header is a seven ASCII character string, of the form "XXYZZZZ"

where:

XX = Orbit. 00 is from 5 days before JOI to the periapse following JOI. Subsequent orbits increment normally. Approach images are separated into logical phases and designated A1, A2, A3 or similar. Cruise images are separated into calendar periods of 3, 6, or 12 months and designated C1, C2,

Y = Target Body.

where:

J	**Jupiter**
A	**Amalthea**
I	**Io**
E	**Europa**
G	**Ganymede**
C	**Callisto**
S	**Minor satellites**
R	**Ring**
H	**Star**
L	**Moon**
W	**Earth**
V	**Venus**
U	**Ida**
P	**Gaspra**
etc.	**etc.**

ZZZZ = Picture Count. This count will be generated in the sequence generation process and will be incremented separately for each target body in each orbit. It will jump a few counts for each profile activity initialization to simplify subsequent sequence changes.

Appendix D

ACTIVITY

Structure of the ACTIVITY field in the EDR header is a 20 ASCII character string of the form "NNTIOOOOOOMM#SSSXXXX" obtained from the operative SSI Profile Activity.

where:

NN	Orbit Number
T	Scan platform target body initial (if applicable).
I	Instrument
OOOOOO	Orbit planning guide objective mnemonic.
MM	Sequential OAPEL number for each value of NNTIOOOOOO.
#	Multiple observation flag symbol (- or +).
SSS	PA set number
XXXX	MIPL processing code

Appendix E

MIPS PHYSICAL RECORDING WORDS

Table E-1 below describes the structure of the MIPS physical recording words. All fields are in ASCII.

Table E-1. MIPS Physical Recording Words

Bytes	Item	Description
8	OS	Operating system version number "Vxxx.yyy". Eight ASCII characters
6	G_TYPE	Generating device "_MTAO:", etc.
2	G_ID	Generating device "AO", "A1", etc.
8	G_VOL	Tape Label, ASCII
8		Reserved
2	V_ID	Validation ID, "A0", "A1", etc.
8	CPU	CPU name, "MIPL1", "MIPL2", etc.
11	DATE	Generation date "DD-MMM-YYYY"

Appendix F

BAD-DATA VALUE HEADER

INTEROFFICE MEMORANDUM

384-91-3:	GMY		May 14, 1992
TO:	Distribution	FROM:	Gary Yagi

Subject: Tracking GLL SSI Bad-Data Values, Binary Label Design, Revision 2

Revision summary:

Reed-Solomon overflow records are defined as a new bad data type. These are encoded as line segments (CODE=2) with RECORD-ID=7.

References:

1) Tracking GLL SSI Bad-Data Values, a Preliminary Design, G.Yagi, April 3, 1989.

2) SSI Experiment Data Record, Galileo SIS 232-07.

3) Galileo SSI UDR file format, Payam Zamani, 10 April 89.

4) VICAR Run-Time Library Reference Manual, D. Stanfill, June 10, 88.

This memo defines the format and contents of the binary labels used to store SSI bad-data values, as proposed in Reference 1.

There are two parts to the binary label: the binary header, and the binary prefix (see Ref. 4, Sec. 2.1.2). The binary header precedes the image data (as do the ASCII labels) and contains information which pertain to the entire image. The binary prefix precedes each image line and contains information specific to each line. Binary labels are created by adding the U_NLB and U_NBB keywords to the XVOPEN call. Binary labels are accessed from a file already containing them by adding the CONDITION, BINARY keywords to the XVOPEN call. Note that since VICAR programs do not normally include these keywords in their XVOPEN calls, binary labels are usually ignored and disappear when new versions of an image are created. Binary labels were originally designed to support the generation of Voyager EDRs.

The binary header consists of an arbitrary number of records. The first record contains ancillary telemetry information and the image histogram (Ref.2). The remaining binary header records contain bad-data information, stored as a sequence of "objects" in 16-bit integer format. The following types of objects have been defined:

Object Type	Code	Format
Single Pixels	1	Line, sample
Line segments	2	line, starting-sample, number-of-samples
Column segments	3	sample, starting-line, number-of-lines

These objects are used to encode the following bad-data types:

Bad Data Type	Record ID	Created By
Data dropout	3	GALSOS
Saturated pixels	4	GALSOS
Low-full-well pixels	5	GALSOS
Single-pixel spikes	6	ADESPIKE
Reed-Solomon overflow	7	GALSOS

Single-pixel spikes are stored as single pixels, data drop-outs, saturated pixels, and Reed-Solomon overflow records are stored as line segments, and low-full-well pixels as column segments.

Note: If a Reed-Solomon overflow occurs on a given line, it will cause the line to pass through the R-S decoder uncorrected. For compressed image data, all pixels to the right of the first bit error will be corrupted. Since it is not possible to determine where this bit error occurs, the entire line is flagged as bad.

Each record will be in 16-bit integer data format and will contain only one type of object. The first three integers of each record contain the record ID, object code (CODE), and the number of objects in the record (N), respectively. The remainder of the record will contain a sequence of N objects. The maximum number of objects which can be stored on a record is a function of the EDR record length and object code. Full-frame and summation-mode EDRs have record lengths of 1800 bytes and 1000 bytes, respectively:

Code	Full-Frame Max. Objects	Summation-Mode Max. Objects
1	448	248
2	299	165
3	299	165

If more objects of a certain type exist, they are written on subsequent records. The records are not necessarily written in any particular order, although they must all precede the image line records.

Example 1: Let a binary header record contain the sequence of integers 6,1,3,211,104,322,111,401,233. The record contains single-pixel spikes (6) encoded as single-pixels (1). There are three objects encoded as line-sample coordinates: (211,104), (322,111), and (401,233).

Example 2: Let a binary header record contain the sequence of integers 4,2,2,110,216,105,789,420,381. The record contains saturated pixels (4) encoded as line segments (2). There are two objects. The first line segment is on line 110 and from sample 216 to 320. The second line segment is on line 789 and from sample 420 to 800.

Example 3: Let a binary header record contain the sequence of integers 5,3,2,299,710,91,521,72,729. The record contains low-full-well pixels (5) encoded as column segments (3). There are two objects. The first column segment is on sample 299 and from lines 710 to 800. The second column segment is on sample 521 and from lines 72 to 800.

The following is an example of a program which reads an image containing bad-data information, does something with this information, and outputs an image which does not contain any binary labels (all subroutines other than XV routines are fictitious):

```
COMMON / HDRREC / RECORDID,CODE,NOBJECTS,SPIX(2,448)!Binary header record
INTEGER*2 RECORDID,CODE,NOBJECTS,SPIX
INTEGER*2 BUF(900),LSEG(3,299),CSEG(3,299)
EQUIVALENCE (BUF,RECORDID),(SPIX,LSEG,CSEG)

COMMON / IMGREC / LHDR(100),PIXELS(800) !Image line record
INTEGER*2 LHDR,PIXELS,LBUF(900)
EQUIVALENCE (LBUF,LHDR)

CALL XVUNIT(IUNIT,'INP',1,IND)
CALL XVOPEN(IUNIT,IND,'COND','BINARY')
CALL XVGET(IUNIT,IND,'NL',NL,'NS',NS,'NLB',NLB)

DO L=2,NLB !Loop through the binary header records
CALL XVREAD(IUNIT,BUF,IND,'LINE',L)
IF (CODE.EQ.1) CALL SINGLE_PIXEL(SPIX,RECORDID,NOBJECTS)
IF (CODE.EQ.2) CALL LINE_SEGMENT(LSEG,RECORDID,NOBJECTS)
IF (CODE.EQ.3) CALL COLUMN_SEGMENT(CSEG,RECORDID,NOBJECTS)
ENDDO

CALL XVUNIT(OUNIT,'OUT',1,IND)
CALL XVOPEN(OUNIT,IND,'OP','WRITE')

DO L=1,NL!Loop through each image line record
CALL XVREAD(IUNIT,LBUF,IND)!Read a line record
CALL PROCESS_LINE(PIXELS,NS)!Process the image line
CALL XVWRIT(OUNIT,PIXELS,IND)  !Write the image line
ENDDO
```