CHRIS DATA FORMAT

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CHANGES RECORD

Issue	Rev	Date	Pages	Description of changes
1		3 Oct 02		First issue
2		18 Oct 02	8	Mode 1 diagram changed
3				Issue not release to arrange a match between this document number and issue 4 of the HDF data files
4		17 Nov 04	2	Change record included
4		17 Nov 04	4	Introduction changed
4		17 Nov 04	4	Section 2 mentions the use of Mode 3A
4		17 Nov 04	4	Section 2 emphasises the difference between “nominal” and “actual” wavelengths.
4		17 Nov 04	4	Section 3 updated
4		17 Nov 04	7	Annotation table, section 4.3.1, updated to include image centre time, observation azimuth and zenith angles.
4		17 Nov 04	8	Line formats have been modified in section 4.3.2.1
4		17 Nov 04	8	Permitted range for Target Latitude updated
4		17 Nov 04	13	Updated section 4.3.2.2
4		17 Nov 04	13	Table 4-3 VData Definition updated
4		17 Nov 04	14	Table 4-4 VData Example updated
4		17 Nov 04	17	Mode 3A added to cover San Rossore requirements
4		17 Nov 04	20	Target codes updated
4	1	13 Dec 04	11	Mask key information added in section 4.3.1
4	1	13 Dec 04	12	Comment added re- reset pixel errors being set to zero.
4	1	13 Dec 04	14	Section 4.3.3 added describing the additional saturation and reset mask
4	2	29 Mar 05	7	Chapter 3 has been subdivided into three separated subsections, with a new sub-section added (3.3) explaining the requirements for target longitude details when using the half swath mode (Mode 5).

CONTENTS

1. INTRODUCTION

This document describes the CHRIS HDF file format for HDF version 4.

2. CHRIS MODES

There are five formal CHRIS imaging modes, classified as modes 1 to 5. (NB. Mode 3 exits with one variation: Mode 3A. Mode 3A addresses the requirements of PIs using the San Rossore site.)

The "nominal" wavelength allocations for each band within each mode are specified in Annex 1, as well as the nominal ground sampling distance (GSD). The "actual" wavelengths for the operating temperature are detailed within the HDF file, see section 4.3.4.

3. OBSERVATION ASPECTS

3.1 OBSERVATION ANGLES

CHRIS acquires a set of up to five images of each target during each acquisition sequence.

Each imaged target will have an associated "fly-by" position. This is the position on the *ground track* when the platform zenith angle, as seen from the target, is a minimum (i.e. Minimum Zenith Angle (MZA)). Negative values correspond to target locations east of the ground track.

The platform acquires the images at times when the zenith angle of the platform with *respect to the fly-by position* is equal to a set of Fly-by Zenith Angles (FZA).

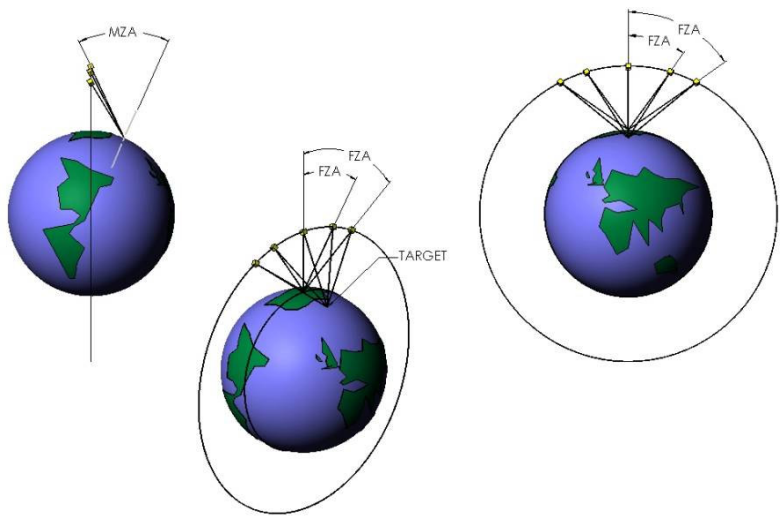


Figure 3.1 Illustration of the FZA and MZA

The 5 angular CHRIS acquisitions are assumed take place within a 55º cone, as defined by a vector connecting the centre of the Earth to the spacecraft. This is illustrated in the diagram below. Two important points need to be made:

- The 55º cone assumes a circular orbit with the distance to spacecraft equal to the semi-major axis of the orbit, i.e. constant distance. For orbits higher or lower than the semi-major axis the cone traced by the satellite during acquisition will be slightly different.
- The first acquisition is initiated at the leading edge of the cone and the final acquisition finishes at the finishing edge of the cone. The centre time of the image acquisition therefore does not correspond to the edge of the cone.

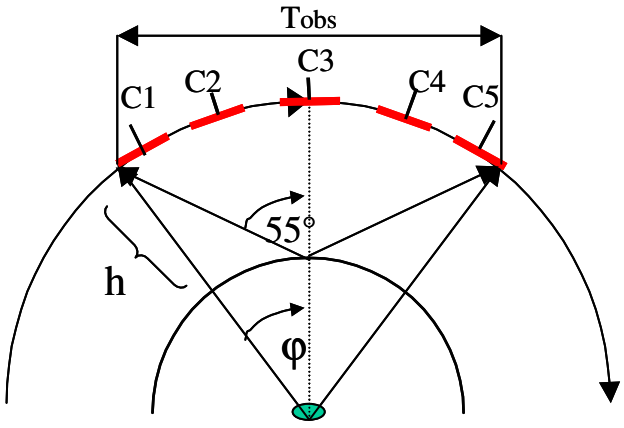


Figure 3.2: Illustration of acquisition geometry. The red lines indicate image acquisitions and C1 to C5 the image centre times.

The timing of the acquisition is based on the total observation time Tobs, which is given by

$$Tobs = \phi/\omega$$

where ϕ is constant and is calculated assuming constant distance to the satellite based on the semi-major orbit axis and ω, the angular rate varies with orbital height. Tobs is defined from the beginning of the 1st scan to the end of the 5th scan. The time within Tobs is divided into

i) scan time (Tsc) during which the imaging is performed

ii) slew period (Tsl) equal to 12.5s between each scan

iii) margin periods (Tmar) added to both sides of the scan to damp transients occurring between slew period and the scan period.

The total observation period is made up of 5 scans, 4 slew periods and 8 margin periods (the margin periods before the 1st scan and after the 5th scan are considered outside Tobs) as illustrated in Table 3.1. As Tobs is calculated based on the actual angular rate of the orbit ω, the centre times C1 to C5 vary slightly over time as function of orbit height and corresponding changes in ω.

Tobs =

Tsc + Tmar +	→	1st acquisition
Tsl + Tmar + Tsc + Tmar +	→	2nd acquisition
Tsl + Tmar + Tsc + Tmar +	→	3nd acquisition
Tsl + Tmar + Tsc + Tmar +	→	4th acquisition
Tsl + Tmar + Tsc +	→	5th acquisition

Table 3.1 Illustration of the image acquisition sequences including scan time (Tsc), slew period (Tsl) and margin periods (Tmar).

The acquisition angles are nominally +/-55°**,** +/-36°, 0° but not precisely. The FZA can be calculated from the image centre times.

For example, using a simple spherical Earth geometry and the image centre times, one can calculate the FZA angles shown in table 3.2

	Max altitude	Min. altitude
FZA angles (°) for "nominal 55° condition"	49.52	56.18
FZA angles (°) for "nominal 36° condition"	29.27	32.02
Inclination (°)	97.81	97.81
Period (min)	98.33	95.60
Altitude (m)	678800	547400

Table 3.2 FZA examples for maximum and minimum altitude conditions.

Rather than provide the FZA for each acquisition it has been decided to include the azimuth and zenith angles of the observations.

3.2 IMAGING SEQUENCE

Each image, within a set of five images, will be assigned a different but consecutive tag number (four digit hex format). The direction of the scan is indicated in Table 3.3.

Chronological Imaging Order	Tag No. order	Scan Direction	Nominal FZA
First	3	N-S	+55°
Second	1	S-N	+36°
Third	0	N-S	0°
Fourth	2	S-N	-36°
Last	4	N-S	-55°

Table 3.3 Imaging Sequence

3.3 HALF SWATH MODE (MODE 5)

The half swath mode (Mode 5) images only one half of the nominal imaging area, which is the side on the west of the full image. The platform attitude system has only one pointing reference frame, which is coincident with the optical axis of the imaging system. Thus it is necessary to define a shifted longitude coordinate pointing to the eastern edge of the area to be imaged. This is approximately ¼ of the full swath width in normal imaging modes. The precise eastward shift depends on platform altitude and is given by:

Shift = altitude*(0.0225*748)/(746*4) km

In March 2005 the altitude varied between 552 and 685km, resulting in eastward imaging shifts of between 3.1 and 3.9km.

4. HDF FILES

4.1 FILE COMPATIBILITY

CHRIS data is supplied in HDF data files compatible to HDF version 4.1r3.

4.2 FILE NAME DEFINITION

Files will use the following naming convention:

<Instrument>_<TargetCode>_<YYMMDD>_<ImageID>_<Version>.<FileType>

Name	Attribute	Value
Instrument	**Meaning**	Instrument name
	Type	ASCII
	Formation	<ccccc>
	Permitted Values	CHRIS
TargetCode	**Meaning**	Target identification code
	Type	ASCII
	Formation	<cc>
	Permitted Values	See annex 2
YYMMDD	**Meaning**	Image acquisition date
	Type	ASCII
	Formation	<cccccc>
	Permitted Values	
ImageID	**Meaning**	Image identification code
	Type	ASCII
	Formation	<cccc>
	Permitted Values	ASCII equivalent hex code
Version	**Meaning**	Image file version number
	Type	ASCII
	Formation	<cc>
	Permitted Values	Positive numbers
File Type	**Meaning**	File type
	Type	ASCII
	Formation	<ccc>
	Permitted Values	hdf

4.3 FILE CONTENTS

The HDF file contains:

- Annotations – see section 4.3.1
- Response corrected image (RCI) – see section 4.3.2
- V Data – Gain Settings – see section 4.3.3
- V Data – Mode Information – see section 4.3.4

The HDF File contents and format are described below.

4.3.1 Annotations

The HDF annotations will contain the image information in ascii characters listed in the following table. (Note that some programmes will identify each value as Vdata.)

Name	Attribute	Value
Sensor Type	**Meaning**	Instrument name
	Formation	<ccccc>
	Permitted Values	CHRIS
Data rights	**Meaning**	Data rights & requirements re-publications
	Formation	<400 ascii characters maximum>
	Permitted Values	
Target Name	**Meaning**	Name of the image target
	Formation	<40 ascii characters>
	Permitted Values	
Image Date	**Meaning**	Date image was taken
	Formation	<YYYY-MM-DD>
	Permitted Values	
Image Number	**Meaning**	Image order from the set requested
	Formation	<cccccc>
	Permitted Values	1 of 5, 2 of 5 etc
Image Tag	**Meaning**	Image identification number
	Formation	<cccc>
	Permitted Values	ASCII equivalent hex codes, e.g. 2EF0
Target Longitude	**Meaning**	Nominal longitude of the requested target (WGS-84). *Units are degrees decimal.* *Negative values are east of zero longitude.*
	Formation	<cccc.cc>
	Permitted Values	180.00 < 000.00 < -179.99
Target Latitude	**Meaning**	Nominal latitude (degrees decimal) of the requested target (WGS-84). *Negative values are south of the equator*
	Formation	<ccc.cc>
	Permitted Values	90.00 < 00.00 < -89.99
Target Altitude	**Meaning**	Requested target altitude (m), (WGS-84)
	Formation	<ccccc>
	Permitted Values	Negative and positive values

Name	Attribute	Value
Nominal Fly-by Zenith Angle	**Meaning**	See section 3 for a definition. *Units are degrees decimal.* *Negative values are for images acquired after over-flying the fly-by ground point.*
	Formation	<ccc>
	Permitted Values	55, 36, 0, -36, -55
Minimum Zenith Angle	**Meaning**	This is calculated from NORAD TLEs. *See section 3 for a definition. Negative values correspond to locations east of the PROBA ground track. Units are degrees decimal.*
	Formation	<ccc>
	Permitted Values	25 > 0 >-25
Solar Zenith Angle	**Meaning**	Calculated solar zenith angle from target. *Units are degrees decimal.*
	Formation	<ccc.cc>
	Permitted Values	0 to 90.00
Fly-by Time	**Meaning**	Estimated UTC time of the platform's closest approach to the target (fly-by position) using NORAD TLEs.
	Formation	<hh:mm>
	Permitted Values	00:00 to 24:00
Image Centre Time	**Meaning**	*Calculated by the on-board Attitude Control & Navigation System.* *The information is available in HDF files ver. 3.1 and later. The on-board GPS occasionally gives rise to up to 6 sec. shift in acquisitions compared to the requested time. A single image acquisition period is approximately 9.5sec and the nominal period between the five images is 49.3 seconds.*
	Formation	<hh:mm:ss>
	Permitted Values	00:00:00 to 23:59:59

Name	Attribute	Value
Observation Zenith Angle	**Meaning**	The angle between the line-of-sight of the satellite from the target and the local zenith. *Units are degrees decimal.* *The zenith angle is calculated from the platform GPS data and the Image Centre Time. As indicated above the on-board GPS occasionally gives rise to up to 6 sec. shift in acquisitions compared to the requested time. A single image acquisition period is approximately 9.5sec. While the observation angle algorithm will smooth out errors in the GPS position data it will not reduce the errors in the timing information. However, the nominal time differences between the five sets of images is 49.3 sec, if this is substantially different then timing errors could have occurred resulting in erroneous observation angles. Note that this will be the case where split images have occurred – mainly a problem before August 2004.* *The zenith angle is available in HDF files ver. 4 and later.*
	Formation	<cc.c>
	Permitted Values	90.0 to 0.0
Observation Azimuth Angle	**Meaning**	The angle between the plane of observation and the local line of longitude measured clockwise when looking down towards the Earth. The plane of observation is the plane containing the target, PROBA satellite and the satellite nadir point on the Earth. *Units are degrees decimal.* *The azimuth angle is calculated from the platform GPS data and the Image Centre Time. As indicated above the on-board GPS occasionally gives rise to up to 6 sec. shift in acquisitions compared to the requested time. A single image acquisition period is approximately 9.5sec. While the observation angle algorithm will smooth out errors in the GPS position data it will not reduce the errors in the timing information. However, the nominal time differences between the five sets of images is 49.3 sec, if this is substantially different then timing errors could have occurred resulting in erroneous observation angles. Note that this will be the case where split images have occurred – mainly a problem before August 2004.* The azimuth angle is available in HDF files ver. 4 and later.
	Formation	<cc.c>
	Permitted Values	259.9 to 0.0
CHRIS Mode	**Meaning**	CHRIS mode used to acquire the image.
	Formation	<c>
	Permitted Values	1, 2, 3, 4, 5 (additional modes may be added)

Name	Attribute	Value
Number of Samples	**Meaning**	The number of data samples in the image.
	Formation	<ccc>
	Permitted Values	766
Number of Ground Lines	**Meaning**	Number of image lines.
	Formation	<cccc>
	Permitted Values	1 to 1024
Number of Bands	**Meaning**	Number of bands contained within the image data set.
	Formation	<ccc>
	Permitted Values	18, 37, 62
Platform Altitude	**Meaning**	PROBA altitude (km) at fly-by, (WGS-84)
	Formation	<cccc>
	Permitted Values	Positive numbers
Response File Creation Time	**Meaning**	The time that the response file used in the image processing was created.
	Formation	<YY-MM-DD hh:mm>
	Permitted Values	
Dark File Creation Time	**Meaning**	The time that the dark file used in the image processing was created.
	Formation	<YY-MM-DD hh:mm>
	Permitted Values	
Calibration Data Units	**Meaning**	Image radiance data units
	Formation	<ccccccccccccccccccc>
	Permitted Values	microW/nm/m^2/str
CHRIS Temperature	**Meaning**	CHRIS temperature (°C).
	Formation	<ccc.cc>
	Permitted Values	Negative and positive numbers
Mask Key Information	**Meaning**	The key to understanding the values contained within the mask dataset included as part of the version 4.1 hdf data release.
	Formation	<64 characters>
	Permitted Values	

4.3.2 RCI Image

4.3.2.1 Data Format

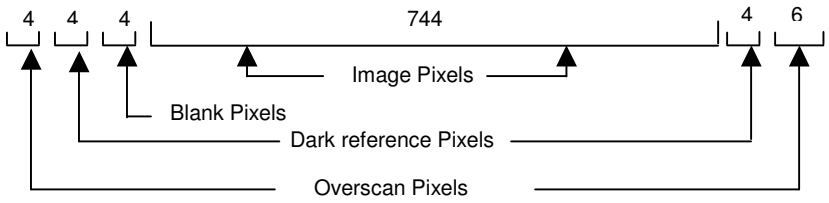
The image data is tabulated within the HDF file in the section called “RCI Image”.

The RCI Image is three-dimensional and ordered in band sequential format (BSQ). The three dimensions are: along-track image lines, across-track pixels and spectral bands. Data values are stored as long integers .

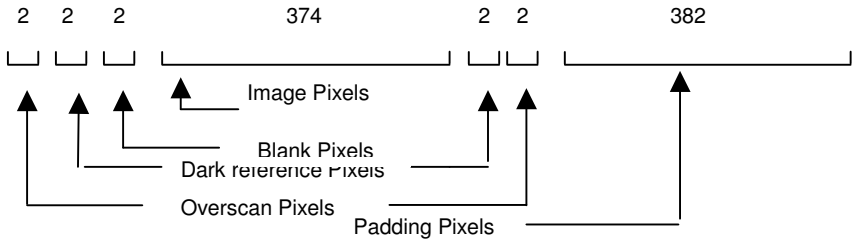
PPU reset errors have been set to zero (originally resulted in negative values in previous releases of the data.)

In the across-track direction an image will consist of 766 pixels, these consist of overscan, dark reference, blank and padding pixels. The line formats are illustrated below for the four possible swath width and binning options available.

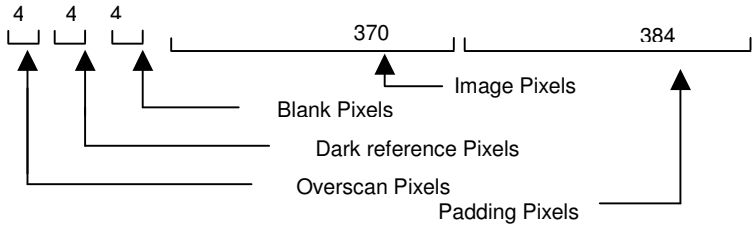
- **Full Width Un-binned (Modes 2, 3, 4)**



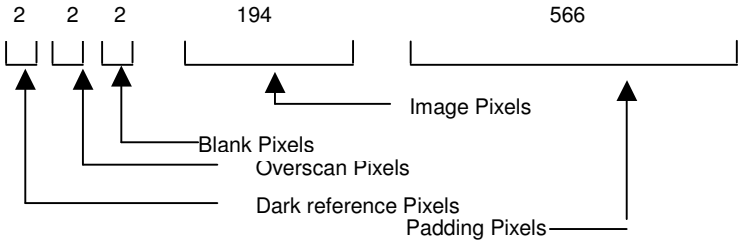
- **Full Width Binned (Mode 1)**



- **Half Width Un-binned (Mode 5)**



- **Half Width Binned**



The overscan and dark reference pixels are situated under a masked area of the CCD. They are used for image correction purposes only and do not form a part of the imaging area. The blank pixels replace noisy image pixels at the start of the line that were present in the HDF file prior to version 3.1.

4.3.2.2 RCI Image Data Units

The image data is presented in units of $\mu W/nm/m^2/str$ and represents the radiance at top of the atmosphere. The radiance values are based on pre-launch sensor calibration. Reduction of radiance values will be expected through in-orbit life and thus the values presented will be on the high side.

4.3.2.3 Image Orientation

The first image data value within the image data set is on the west of the image for all modes and pitch angles. The scan direction is as indicated in Table 3.3.

4.3.3 Mask Key Data

The mask is a new addition to the version 4.1 data release and has the same dimensions in terms of number of pixels as the rci image dataset, it is essentially an image quality map. It is of byte type and contains one value for each pixel in the rci image dataset. Each pixel will have one of three values, with their meanings given in the following key.

Mask Pixel Value	Meaning
0	This pixel in the rci image is a useful image pixel
1	This pixel in the rci image is a channel 2 reset pixel and holds no valuable data
2	This pixel in the rci image has saturated and holds no valuable data. It should also be noted that the data from surrounding pixels may have been affected and should be considered with care.

This information is also given briefly in the hdf header included with the data release as a simple line of text:

0 = useful pixels; 1 = Ch2 reset pixels; 2 = Saturated data pixels

4.3.4 V Data – Gain Information

The relative analogue gain utilised within the CHRIS electronics can be set to one of four values. These values are defined in the “Gain Information” and recorded as ascii characters. The definition of the gain information table is presented in Table 4-1.

Term	Definition	Formation
Gain setting	**Digital number from 0 to 3**	**<c>**
Gain value	**Relative analogue gain**	**<c.ccc>**

Table 4-1 V Data Gain Information Definition

An example V Data table is presented Table 4-2.

Record	Gain setting	Gain value
1	**0**	**1.000**
2	**1**	**2.000**
3	**2**	**4.033**
4	**3**	**8.583**

Table 4-2 V Data Gain Information

The heading “Record” does not appear in all HDF Viewers.

4.3.5 V data – Mode Information

The CHRIS "Mode Information" is recorded as a V Data table with ascii characters. The definition of the Mode Information is described in Table 4-3. It consists of a table of values that describe the actual band configuration at the measured operating temperature. An example table of V Data is presented in Table 4-4.

Term	Definition	Formation
WlLow	**Cut-on wavelength (nm)**	**<cccc.c>**
WlHigh	**Cut-off wavelength (nm)**	**<cccc.c>**
WlMid	**Mid-wavelength (nm)**	**<cccc.c>**
BWidth	**Cut-off minus cut-on wavelength (nm)**	**<cccc.c>**
Gain	**CHRIS analogue electronics gain setting**	**<c>**
RowLow	**CCD row number for the WlLow**	**<ccc>**
RowHigh	**CCD row number for the WlHigh**	**<ccc>**

Table 4-3 *V Data Definition*

Record	WlLow	WlHigh	WlMid	Bwidth	gain	RowLow	RowHigh
1	438.0	448.5	443.1	10.5	3	87	92
2	485.4	497.1	491.2	11.6	3	111	115
3	525.5	537.1	531.2	11.6	3	127	130
4	546.2	559.2	552.6	13.0	2	134	137
5	566.1	576.9	571.4	10.7	3	140	142
6	626.3	640.5	633.3	14.2	2	155	157
7	655.5	671.3	663.3	15.8	2	161	163
8	671.3	682.4	676.8	11.1	2	164	165
9	693.9	705.9	699.8	11.9	2	168	169
10	705.9	712.0	708.9	6.2	3	170	170
11	712.0	718.3	715.1	6.2	3	171	171
12	737.8	751.4	744.5	13.6	2	175	176
13	751.4	758.4	754.9	7.0	3	177	177
14	772.9	795.5	784.0	22.7	1	180	182
15	862.4	889.9	876.0	27.4	1	191	193
16	889.9	909.0	899.4	19.2	2	194	195
17	909.0	918.8	913.9	9.8	3	196	196
18	1001.7	1045.7	1023.7	44.1	2	205	208

Table 4-4 VData Example

NB. The heading "Record" does not appear in all HDF Viewers. In addition some HDF viewers will present this data with apparently higher precision but this should be ignored.

ANNEX 1

CHRIS FORMAL MODES

MODE 1

Swath Width: Full
Nadir GSD: 34m @ 556km altitude

Band	Min λ (nm)	Max λ (nm)	Mid λ (nm)	Width (nm)	Corresponding to:
A1	406	415	411	10	W1
A2	438	447	442	9	W2,L1
A3	447	456	452	9	
A4	456	466	461	10	
A5	466	477	471	11	
A6	477	486	481	9	
A7	486	495	490	9	W3,L2
A8	495	505	500	10	
A9	505	515	510	10	W4
A10	515	526	520	11	
A11	526	534	530	9	W5,L3
A12	534	546	540	12	
A13	546	556	551	10	L4
A14	556	566	561	10	W6
A15	566	577	572	11	L5
A16	577	585	581	8	W7
A17	585	596	590	12	W8
A18	596	609	603	12	
A19	609	618	613	9	
A20	618	627	622	9	W9
A21	627	636	631	9	L6
A22	636	646	641	10	
A23	646	656	651	10	W10
A24	656	666	661	11	L7
A25	666	677	672	11	W11,L8
A26	677	683	680	6	W12
A27	683	689	686	6	W13
A28	689	694	691	6	
A29	694	700	697	6	L9
A30	700	706	703	6	W14(part),L10
A31	706	712	709	6	W14(part),L11
A32	712	719	716	6	
A33	719	725	722	6	
A34	725	732	728	7	
A35	732	738	735	7	
A36	738	745	742	7	L12
A37	745	752	748	7	L13
A38	752	759	755	7	W15
A39	759	766	762	7	
A40	766	773	770	7	
A41	773	781	777	7	W16,L14(part)
A42	781	788	785	8	W16,L14(part)

MODE 1

Swath Width: Full
Nadir GSD: 34m @ 556km altitude

Band	Min λ (nm)	Max λ (nm)	Mid λ (nm)	Width (nm)	Corresponding to:
A43	788	796	792	8	
A44	796	804	800	8	
A45	804	812	808	8	
A46	828	837	833	9	
A47	837	845	841	9	
A48	845	854	850	9	
A49	854	863	859	9	
A50	863	872	868	9	W17,L15(part)
A51	872	881	877	9	W17,L15(part)
A52	881	891	886	9	
A53	891	900	895	10	L16
A54	900	910	905	10	L17
A55	910	920	915	10	
A56	920	930	925	20	
A57	930	950	940	20	
A58	950	960	955	10	
A59	960	971	965	11	
A60	971	981	976	11	
A61	981	992	987	11	
A62	992	1003	997	11	

MODE 2 WATER BANDS

Swath Width: Full
Nadir GSD: 17m @ 556km altitude

Band	Min λ (nm)	Max λ (nm)	Mid λ (nm)	Width (nm)	Corresponding to:
W1	406	415	411	10	
W2	438	447	442	9	
W3	486	495	490	9	
W4	505	515	510	10	
W5	526	534	530	9	
W6	556	566	561	10	
W7	566	577	570	8	
W8	585	596	590	12	
W9	618	627	622	9	
W10	646	656	651	10	
W11	666	677	672	11	
W12	677	683	680	6	
W13	683	689	686	6	
W14	700	712	706	12	
W15	752	759	755	7	
W16	773	788	781	15	
W17	863	881	872	18	
W18	1003	1036	1019	33	

MODE 3 BANDS – LAND CHANNELS

Swath Width: Full
Nadir GSD: 17m @ 556km altitude

Band	Min λ (nm)	Max λ (nm)	Mid λ (nm)	Width (nm)	Corresponding to:
L1	438	447	442	9	
L2	486	495	490	9	
L3	526	534	530	9	
L4	546	556	551	10	
L5	566	573	570	8	
L6	627	636	631	9	
L7	656	666	661	11	
L8	666	677	672	11	
L9	694	700	697	6	
L10	700	706	703	6	
L11	706	712	709	6	
L12	738	745	742	7	
L13	745	752	748	7	
L14	773	788	781	15	
L15	863	881	872	18	
L16	891	900	895	10	
L17	900	910	905	10	
L18	1002	1035	1019	33	

MODE 3A BANDS – LAND CHANNELS
(Special band for San Rossore)
Swath Width: Full
Nadir GSD: 17m @ 556km altitude

Band	Min λ (nm)	Max λ (nm)	Mid λ (nm)	Width (nm)	Corresponding to:
L1	420	421	421	1	
L2	438	447	442	9	
L3	486	495	490	9	
L4	526	534	530	9	
L5	546	556	551	10	
L6	566	573	570	8	
L7	627	636	631	9	
L8	656	666	661	11	
L9	666	677	672	11	
L10	694	700	697	6	
L11	700	706	703	6	
L12	706	712	709	6	
L13	738	745	742	7	
L14	745	752	748	7	
L15	773	788	781	15	
L16	863	881	872	18	
L17	891	900	895	10	
L18	900	910	905	10	

MODE 4 CHLOROPHYLL BAND SET

Swath Width: Full

Nadir GSD: 17m @ 556km altitude

Band	Min λ (nm)	Max λ (nm)	Mid λ (nm)	Width (nm)	Corresponding to:
C1	486	495	489	9	
C2	546	556	551	10	
C3	627	636	631	9	
C4	666	677	672	11	
C5	677	683	680	6	
C6	683	689	686	6	
C7	689	694	691	6	
C8	694	700	697	6	
C9	700	706	703	6	
C10	706	712	709	6	
C11	712	719	716	6	
C12	732	738	735	7	
C13	738	745	742	7	
C14	745	752	748	7	
C15	752	759	755	7	
C16	773	781	777	7	
C17	781	788	785	8	
C18	788	796	792	8	

MODE 5 – LAND CHANNELS

Swath Width: Half
Nadir GSD: 17m @ 556km altitude

Band	Min λ (nm)	Max λ (nm)	Mid λ (nm)	Width (nm)	Corresponding to:
H1	438	447	442	9	L1,W2
H2	486	495	489	9	L2,W3
H3	526	534	530	9	L3,W5
H4	546	556	551	10	L4
H5	566	573	570	8	L5
H6	627	636	631	9	L6
H7	656	666	661	11	L7
H8	666	677	672	11	L8,W11
H9	677	689	683	11	W12+13
H10	694	700	697	6	L9
H11	700	706	703	6	L10
H12	706	712	709	6	L11
H13	712	719	716	6	
H14	719	725	722	6	
H15	725	732	728	7	
H16	732	738	735	7	
H17	738	745	742	7	L12
H18	745	752	748	7	L13
H19	752	759	755	7	W15
H20	759	766	762	7	
H21	766	773	770	7	
H22	773	788	777	15	L14,W16
H23	788	796	792	8	
H24	796	804	800	8	
H25	863	881	872	18	L15,W17
H26	881	891	886	10	
H27	891	900	895	10	L16
H28	900	910	905	10	L17
H29	910	920	915	10	
H30	920	930	925	10	
H31	930	950	940	20	
H32	950	960	955	10	
H33	960	971	965	11	
H34	971	981	976	11	
H35	981	992	987	11	
H36	992	1003	997	11	
H37	1003	1036	1019	33	L18,W18

ANNEX 2

TARGET CODES

Ordered by Site Name

SITE NAME (ordered by site name)	TARGET CODE
Angara A	A1
Angara B	A2
Angara C	A3
Angara D	A4
Angara E	A5
Amburla	AB
AusCott	AC
Averto	AE
Algoma	AG
Albufeira	AL
Antelope Creek	AT
Audobon	AU
AusBushFires (1st year)	AU
Avignon	AV
Borneo A	B1
Borneo B	B2
Borneo C	B3
Barton Bendish	BB
Beauraing	BE
Bartlett	BL
Boreas North	BN
Botswana	BO
Babina Polder	BP
Barrax	BR
Boreas South	BS
Cyprus Eddy	CE
Chichester Harbour	CH
Central Portugal	CP
Clayoquot Sound	CS
Cat Tien Vietnam	CT
Daimiel	DA
Demmin	DM
Danube Red	DR
Fairbanks	FA
Fontainebleau	FT
Flevoland	FV
Gilching	GC
Goldbro	GD
Giles Point	GI
Great Plains	GP
Greater Vic Watershed	GV
Hubbard Brook	HB
Harvard Forest	HF
Howland	HL
Harwood Forest	HW
Indian Head	IH
Jabiru	JB

SITE NAME (ordered by site name)	TARGET CODE
Jornada	JN
Jasper Ridge	JR
Keonsuo	KE
KamKotia	KK
L'Acadie	LC
Libyan Desert	LD
Lake Argyle (1st year)	LE
Lake Constance	LE
Lake Argyle	LG
Lake Isaac	LI
Liminganlahti	LL
Limoncocha	LM
Lanai Hawaii	LN
Lanier	LR
La Segua	LS
Lake Wannsee	LW
Longyearbyen	LY
Mexico City	MC
Mongu	MG
Milford Haven	MH
Mikolajki	MK
Makhtesh Ramon	MR
Mueritz	MU
Mundaka-Guernica	MN
Mragowo	MW
Mazury	MZ
New Forest	NF
Nanisivik	NN
Norunda	NR
Oberammergau	OB
Oostende	OT
Prudhoe Bay Alaska	PB
Penobscot	PE
Pollino	PL
South Portugal	PO
Pijnven	PV
Rheinsberg	RB
Reynolds Creek	RC
Rame Head	RH
Red Lake	RL
Rosarito Reservoir	RO
Roraima	RR
Railroad Valley	RV
Santa Rita	SA
Shingles Bank	SB
SERC	SC
St Andre	SD
Sevilleta	SE
Shunyi	SH
Sabodia	SI

SITE NAME (ordered by site name)	TARGET CODE
Siikalahti	SK
Sodankyla	SO
Swiss National Park	SP
San Rossore	SR
SE Australia	SS
Sudbury	SU
Solar Village	SV
Thetford Forest	TF
Thangoo	TG
The Hague	TH
Torre Guaceto	TO
Tinga Tingana	TT
Uardry	UD
Upper Rhine	UR
Uyuni	UY
Uzlina	UZ
Venice1	V1
Venice2	V2
Venice3	V3
Villafafila	VF
Vanhan	VH
Venice (previous)	VN
Chesapeake (WaterCalVal)	WC
Dorset Wytch Farm	WF
Wangqing	WQ
Washington	WS
Yakutsk	YK
Zwalm	ZW

Sites in red indicate duplication of the codes between the 1st and 2nd year, therefore it is important to check dates or details in the HDF files.

Ordered by Target Code

SITE NAME (ordered by target code)	TARGET CODE
Angara A	A1
Angara B	A2
Angara C	A3
Angara D	A4
Angara E	A5
Amburla	AB
AusCott	AC
Averto	AE
Algoma	AG
Albufeira	AL
Antelope Creek	AT
Audobon	AU
AusBushFires (1st year)	AU
Avignon	AV
Borneo A	B1
Borneo B	B2
Borneo C	B3
Barton Bendish	BB
Beauraing	BE
Bartlett	BL
Boreas North	BN
Botswana	BO
Babina Polder	BP
Barrax	BR
Boreas South	BS
Cyprus Eddy	CE
Chichester Harbour	CH
Central Portugal	CP
Clayoquot Sound	CS
Cat Tien Vietnam	CT
Daimiel	DA
Demmin	DM
Danube Red	DR
Fairbanks	FA
Fontainebleau	FT
Flevoland	FV
Gilching	GC
Goldbro	GD
Giles Point	GI
Great Plains	GP
Greater Vic Watershed	GV
Hubbard Brook	HB
Harvard Forest	HF
Howland	HL
Harwood Forest	HW
Indian Head	IH
Jabiru	JB

SITE NAME (ordered by target code)	TARGET CODE
Jornada	JN
Jasper Ridge	JR
Keonsuo	KE
KamKotia	KK
L Acadie	LC
Libyan Desert	LD
Lake Argyle (1st year)	LE
Lake Constance	LE
Lake Argyle	LG
Lake Isaac	LI
Liminganlahti	LL
Limoncocha	LM
Lanai Hawaii	LN
Lanier	LR
La Segua	LS
Lake Wannsee	LW
Longyearbyen	LY
Mexico City	MC
Mongu	MG
Milford Haven	MH
Mikolajki	MK
Makhtesh Ramon	MR
Mueritz	MU
Mundaka-Guernica	MN
Mragowo	MW
Mazury	MZ
New Forest	NF
Nanisivik	NN
Norunda	NR
Oberammergau	OB
Oostende	OT
Prudhoe Bay Alaska	PB
Penobscot	PE
Pollino	PL
South Portugal	PO
Pijnven	PV
Rheinsberg	RB
Reynolds Creek	RC
Rame Head	RH
Red Lake	RL
Rosarito Reservoir	RO
Roraima	RR
Railroad Valley	RV
Santa Rita	SA
Shingles Bank	SB
SERC	SC
St Andre	SD
Sevilleta	SE
Shunyi	SH
Sabodia	SI

SITE NAME (ordered by target code)	TARGET CODE
Siikalahti	SK
Sodankyla	SO
Swiss National Park	SP
San Rossore	SR
SE Australia	SS
Sudbury	SU
Solar Village	SV
Thetford Forest	TF
Thangoo	TG
The Hague	TH
Torre Guaceto	TO
Tinga Tingana	TT
Uardry	UD
Upper Rhine	UR
Uyuni	UY
Uzlina	UZ
Venice1	V1
Venice2	V2
Venice3	V3
Villafafila	VF
Vanhan	VH
Venice prev	VN
Chesapeake WaterCalVal	WC
Dorset Wytch Farm	WF
Wangqing	WQ
Washington	WS
Yakutsk	YK
Zwalm	ZW

Sites in red indicate duplication of the codes between the 1st and 2nd year, therefore it is important to check dates or details in the HDF files.