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Title : **IDEAS - RA2/MWR/DORIS instruments events during ENVISAT mission**

Abstract :

This document describes all major events occurred during the whole ENVISAT mission for RA2, MWR and DORIS instruments

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TABLE OF CONTENTS

AMENDMENT POLICY

This document shall be amended by releasing a new edition of the document in its entirety. The Amendment Record Sheet below records the history and issue status of this document.

AMENDMENT RECORD SHEET

ISSUE	DATE	DCI No	REASON
1.0	21/08/2012		First issue
1.5	20/09/2012		Update following comments from ESA (PF)
1.6	08/01/2013		Updated after IDEAS internal revision: updated unavailabilities tables with more information to be aligned with same document for other ENVISAT instrument, added new chapter " Overview of mission events"
1.7	09/05/2013		Update following comments from ESA (PF) adding reference to instrument unavailabilities

REFERENCE DOCUMENTS

[R - 1] "Envisat Switch-On and Data Acquisition Phase (SODAP) Performance Reports" – Published daily during the first 17 days of mission.

[R – 2] "ENVISAT_Unavailabilities_EOM.xlsx" – file received by email from ESOC on 31 July 2012.

[R – 3] Final Technical Note IF Masks Tests - OSME-DPQC-SEDA-TN-08-0576.

[R – 4] Envisat RA-2 and MWR Quality Working Group Meeting #4 Presentation – November 2004.

[R – 5] Envisat Manoeuvre and Mass History Web Page -

http://nng.esoc.esa.de/envisat/calmanhist.env

[R – 6] IDEAS – ERS and Envisat Orbit Manoeuvres - IDEAS-BAE-SOM-REP-1249

[R -7] IDEAS – Report on the ENVISAT 2010+ Mini-commissioning and Cal/Val Phase for RA2 System

[R – 8] ENVISAT ALTIMETRY - Level 2 User Manual v. 1.4 – October 2011. Available at web site: https://earth.esa.int/pub/ESA_DOC/ENVISAT/RA2-MWR/PH_light_1rev4_ESA.pdf

1. INTRODUCTION

This document describes all major events occurred during the full ENVISAT mission for RA2 and MWR instruments. The period starts on 12/03/2002 with the availability of the first acquired ENVISAT RA2 data product [R - 1], and ends with the last available RA2 data at 12:28 on the 8th April 2012 when the Envisat mission ended. These events include: instrument unavailabilities, ARTEMIS/ESRIN station unavailabilities and DORIS/MWR ICU unavailabilities. All these events can be of help in addressing issues to define a "clean" Level 0 dataset for future reprocessing.

Moreover, this document also describes the altimeter calibration strategy for IF masks and USO, altimeter S-Band failure, altimeter B-side operations, ENVISAT maneuvers strategy, ENVISAT orbit change

2. OVERIVIEW OF MISSION EVENTS FOR RA2

RA2 instrument has been operational during the whole mission. The instrument has been switched on the 12th March 2002 for the commissioning phase, which ended on 25th September 2002 [R -7].

The RA2 instrument was always operational. The planning did not foresee any acquisition interruption.

Major instrument anomalies during the first 4 years of operations were:

- a Single Event Upset (SEU) which caused Interface Control Unit (ICU) switch down;
- RA2 Interface Control Unit (ICU) in Reset/Wait mode due to an uncontrolled software action;
- RA2 Interface Control Unit (ICU) in Reset mode following the detection of two consecutive Format Header errors; and
- RA2 in Standby/Refuse mode due to Macro Command (MCMD) timeout.

The first two anomalies were analyzed and corrected uploading patches developed by instrument maintainer (Alenia – Italy) in November 2006 and January 2007. The other two did not occurred anymore starting from mid 2003.

A brief list of RA2 events is summarized in the following bullets (more details can be found in following sections):

- **12th March 2002**: Instrument switch-on
- **13th March 2002:** S-Band anomaly occurrence: first evidence of echo accumulation
- **25th September 2002:** end of commissioning phase. Start of Official data release.
- **27th September 2004:** start of 1st *USO anomaly period*
- **29th September 2004:** stop of 1st *USO anomaly period*

- **4th October 2004**: *IF calibration modified*: two calibrations, instead of one only, over Himalaya's zone with 1 ascending and 1 descending pass per day

- **1st February 2006:** start of 2nd *USO anomaly period*

- **11 February 2006:** stop of 2nd *USO anomaly period*

- **13th March 2006:** start of 3rd *USO anomaly period*

- **2nd April 2006:** stop of 3th *USO anomaly period*

- **8th April 2006**: **:** start of 4th *USO anomaly period*

- **12-13th May 2006:** special operations to limit Chirp Bandwidth

- **15th May 2006:** RA2 instrument switch from Side-A to Side-B and associated stop of 4th *USO anomaly period*

- **20th May 2006:** RA2 S-Band Radio Frequency sub system (RFSS) side-B failure

- **21st June 2006:** RA2 instrument switched back from Side-B to Side-A and associated start of the 5th *USO anomaly period*

- **16th January 2007**: patch uploaded to correct the S-Band anomaly at the instrument level

- **26th February 2007:** *IF calibration modified:* only 1 ascending pass over Himalaya's zone and two passes over Rocky Mountains (1 ascending and 1 descending)

- **1st March 2007:** stop of 5th *USO anomaly period*

- **9th April 2007**: patch for S-Band anomaly correction dismissed because it was causing the Instrument to switch down to Heater 0/Refuse Mode

- **27th September 2007:** start of 6th *USO anomaly period*

- **3rd December 2007:** stop of 6th *USO anomaly period*

- **4th December 2007**: start of 7th *USO anomaly period*

- **7th January 2008:** *IF calibration:* over Himalaya's zone 1 descending pass per day

- **17th January 2008:** RA2 S-Band Radio Frequency Sub System (RFSS) Side-A failure

- **23rd January 2008:** end of *7th USO anomaly period*

- **11th February 2008**: *IF calibration final procedure*: over Himalaya's zone 1 descending pass per day

- **21st October 2010:** end of ENVISAT Phase 2 operations

- **24th October 2010:** start of ENVISAT Phase 3 operation with new orbit

- **8th April 2012**: loss of communication with platform

3. RA2 INSTRUMENT EVENTS

In this section major instrument events are listed and briefly explained.

3.1 IF Calibration strategy

One of the components of the Envisat RA-2 sensor is an Intermediate Frequency (IF) Pass Band Filter. In theory the spectrum of the impulse response of such a filter should be a rectangle, but in reality this is not the case.

In order to compensate for the distortion on the RA-2 waveforms due to this component, the measurement of the filter impulse response is needed.

To retrieve the shape of the IF Filter impulse response spectrum, the RA-2 is commanded to operate in the so-called IF Calibration mode. This consists of the measurement of noise power spectra by setting the instrument in listen-only mode (no power transmitted) and putting the receiving window delay to a value such that no echo from the surface could be received (in figure 1 the two calibration sites used during ENVISAT mission).

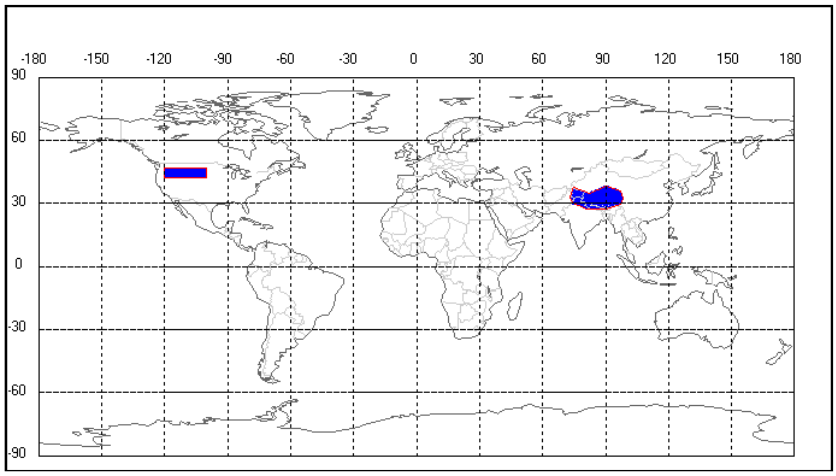

Figure 1. IF masks calibration sites.

The different IF Calibration strategies applied during the whole ENVISAT mission are summarized in Table 1. In this table when two "x"'s present in the location of IF masks acquisition means that both ascending and descending

overpasses are used to generate an IF mask. In Figure 1 the calibration sites masks are presented.

The impact of the new calibration procedure on science data, in place from cycle 66 up to end of mission, has been analyzed and, compared to the nominal procedure used since the beginning of the mission, it results in the loss of ~72 seconds of measurement data per day before and after the calibration [R – 3].

Cycle	Date	Planning	Himalaya	Rockies	Comments
From beginning of mission to cycle 30	Up to 04 Oct 04	IF cal over Himalaya zone for the entire cycle, 1 ascending pass per day	x		
From cycle 31 to 52	From 4 Oct 04 to 13 Nov 06	IF cal over Himalaya zone for the entire cycle, 1 ascending pass and 1 descending pass per day	x x		
53	13 Nov 06	Same as previous cycle plus The CTI_IFC table has been disseminated by IECF with the updated Rx Distance = 90 microsecond; start orb #24604 at ANX=0.	x x		I In-Flight Tests for IF Anomaly
54	18 Dec 2006	Same as previous cycle plus The CTI_IFC table has been disseminated by IECF with the updated Rx Distance = 100 microsecond; start orb #25105 at ANX=0.	x x		I In-Flight Tests for IF Anomaly
55	22 Jan 2007	Same as previous cycle plus The CTI_IFC table has been disseminated by IECF with the updated Rx Distance = 81 microsecond; start orb #25606 at ANX=0.	x x		I In-Flight Tests for IF Anomaly
From cycle 56 to 61	From 26 Feb 07 to 24 Sep 07	IF cal over Himalayas for the entire cycle, 1 ascending pass per day IF calibration over Rocky Mountains for the entire cycle, each ascending and descending pass	x	x x	Inclusion of Rockies site for IF Cal
From cycle 62 to 64	24 Sep 2007	Same as previous cycle plus New procedure for IF calibration (through Digital BITE Mode command) over Rocky Mountains for the entire cycle, each ascending and descending pass	x	x x	II In-Flight Tests for IF Anomaly
65	07 Jan 2008	IF calibration over Himalaya's zone for the entire cycle, (1 ascending pass per day) New procedure for IF calibration (through Digital BITE Mode command) over Himalaya for the entire cycle, 1 **descending** pass per day	x		II In-Flight Tests for IF Anomaly
From cycle 66 to end of mission	11-feb-08	New procedure for IF calibration (through Digital BITE Mode command) over Himalaya for the entire cycle, 1 **ascending** pass per day No IF calibration over the Rocky Mountains	x		Start Operational Implementation of new procedure only on Himalaya site

Table 1. IF calibration procedure history during the whole ENVISAT mission. Two "x"in the Himalaya/Rockies column means that both, ascending and descending overpasses are used to generate an IF mask.

3.2 USO Anomalies

In February 2006, after an instrument anomaly, a jump on the Ku and S band altimetric range (through the Sea Level Anomaly) was detected. This was thought to be connected to the behavior of USO (Ultra Stable Oscillator) as the USO provides the clock for the altimeter data and the jumps in range were generally seen to occur after an RA2 instrument anomaly.

Since 2006, the USO correction was monitored and several periods of USO anomaly have been identified (see Table 2). In particular the first period of USO anomaly (during cycle 30) was identified only during the first RA2 "full mission" reprocessing in 2011. Previously it was erroneously identified as a problem in the OBDH (On-Board Data Handling) datation [R – 4].

Table 2. USO clock period anomalies identified during RA2 full mission reprocessing in 2011.

	USO Clock Period Anomaly				
Anomaly	Cycle	USO Anomaly Start	Time	USO Anomaly Stop	Time
1	30	27/09/2004	16:00:00	29/09/2004	12:00:00
2	44/45	01/02/2006	12:04:30	11/02/2006	00:54:49
3	45/46	13/03/2006	17:40:00	02/04/2006	18:00:00
4	46/47	08/04/2006	12:31:00	15/05/2006	14:21:50
5	48/56	21/06/2006	13:20:15	01/03/2007	09:19:00
6	62/63	27/09/2007	11:13:30	03/12/2007	03:00:00
7	64/65	04/12/2007	13:50:00	23/01/2008	14:10:30

In the "full mission" RA2 reprocessed data set v2.1, the USO clock anomaly has been corrected within the processing, and there is no need for users to apply an additional correction.

3.3 RA2 B-Side Operation and Fixed Chirp bandwidth

In response to the USO anomaly (as described in previous Section) it was decided to switch the RA2 instrument to its B-Side between the 15th May 2006 and 21st June 2006 and to operate using fixed Chirp bandwidth on 12-13th May 2006.

Before the switch to the B-side operation, on 12th-13th May, a special operation was executed to limit RA-2 Chirp Bandwidth to:

- 80MHz, starting from 12 May 2006 at.15:51:37,
- 20 MHz, starting from 13 May 2006 at.03:57:57,
- 320MHz, starting from 13 May 2006 at.15:10:17.

During cycle 47 the instrument sub-system Radio Frequency Module (RFM) was switched to its B-side on 15 May 2006 at 14:21:50, Orbit = 21994. After a few days of promising operations with the RFM B-side, the S-band transmission power dropped on 20th May 2006 at 13:24:57, Orbit=22065, making all the S Band related parameters invalid.

Due to the loss of the S-Band side-B, the Envisat RA-2 instrument was then successfully reconfigured to its nominal side (Radio Frequency Sub System A-side) and commanded back into Measurement Mode on June 21, 2006 at 13:20:15.000 UTC time, Orbit = 22523. Subsequent analysis of the RA-2 data showed expected behaviour of the RA-2 parameters but also confirmed the persistence of the abnormal RA-2 Ultra-Stable Oscillator (USO) behaviour affecting the Altimetric Range by a few meters

3.4 S-Band failure

Failure of the S-Band occurred as follows:

- S-band RA-2 RFSS (Radio Frequency Sub System) side-B occurred on 20 May 2006 at 13:24:57, Orbit=22065.
- S-band RA-2 RFSS side-A occurred on 17th January 2008 at 23:23:40 (Cycle 65 pass 289, absolute orbit 30759).

It is recommended that starting from that date the ionospheric correction from the Bent model (in FGDR data products), and the GIM ionospheric correction (for IGDR and GDR products) should be used.

Also, from that date, the rain flag is not recommended for use, as it is derived from S-Band data and therefore no longer valid.

4. ENVISAT MANOEUVRE STRATEGY AND SATELLITE ORBIT CHANGE

The Envisat orbit is varying over time due to various perturbation forces. If uncorrected this will lead to a degradation of scientific data. Therefore it is necessary periodically to perform orbit maintenance manoeuvres.

The orbit corrections commanded by ground are mainly performed to control the semi major axis, eccentricity and inclination of the spacecraft.

The manoeuvres to control the semi major axis (referred to as Stellar Fine Control Manoeuvre-**SFCM** or Fine Control Manoeuvre-**FCM**) are performed every 30-40 days. This is defined as an "in-plane" manoeuvres, which are used for altitude adjustment to compensate for the effects of air-drag.

The evolution of the inclination is somewhat slower and the correction manoeuvres (referred to as Orbit Control Manoeuvre-**OCM**) are performed approximately three times per year. This is defined as an "out-of-plane" manoeuvre. They are performed to increase the inclination of the orbit plane and to rectify the steady drift of inclination mainly caused by solar and lunar gravity perturbations.

OCM manoeuvres could have impact on the altimeter mispointing. In APPENDIX A all the OCM and SFCM manoeuvres of the whole ENVISAT mission are reported [R - 5] and [R – 6].

During cycle 94 the ENVISAT satellite orbit was lowered by ~17.4 km to ensure the continuation of the mission for an additional 3 years (manoeuvres were carried out between 22nd October 2010 and 2nd November 2010). Since then, the cycle length was 30 days and number of orbits per cycle are 431. More details on the orbit change can be found on the web site:

http://earth.esa.int/object/index.cfm?fobjectid=7267.

Starting from cycle 95 the satellite phase is #3.

During the first two months of this new satellite phase, a mini-commissioning validation phase has been performed to check the data quality and the eventual impact of the new orbit on altimeter data [R-6].

All data between 22nd October and 2nd November 2010 should be discarded as they were intended only for the ESA internal verification.

5. INSTRUMENT UNAVAILABILITIES

Source of RA2, MWR and DORIS instruments unavailabilities are [R-1] and [R-2].

5.1 RA2

The RA2 instrument has been put in tracking mode, i.e. acquiring the first scientific data, on 12nd March 2002 [R - 1], and ends with the last available RA2 data at 12:28 on the 8th April 2012 when the Envisat mission has been declared completed. In this section events affecting RA-2 instrument are reported in Table 3.

Table 3: List of events affecting RA2 mission

RA2 Instrument							
Year	**Start time**	**Stop time**	**Start orbit**	**Stop orbit**	**Description**	**Duration (Hours)**	**Total hours lost in year/ %**
2002	01/03/2002	-	1	-	ENVISAT Launch from Kourou, French Guiana	-	2002: 884.13 hours / 0.1027 %
2002	11/03/2002	11/03/2002	153	155	SODAP (Switch-On and Data Acquisition Plan): RA2 in IF mode	-	
2002	12/03/2002	-	167	-	SODAP: RA2 in measurement mode (Tracking or Open Loop Acquisition mode)	-	
2002	13/03/2002	-	176	-	SODAP: First S-Band anomaly: Evidence of echo accumulation		
2002	01/04/2002 12:16	08/04/2002 18:38	450	554	RA2 out of measurement mode: RA2 Instrument Control Unit (ICU) in Suspended mode	174.37	
2002	11/05/2002 12:54	14/05/2002 18:32	1022	1069	RA2 out of measurement mode: Payload switch off	82.14	
2002	17/05/2002 08:45	24/05/2002 14:58	1106	1210	RA2 out of measurement mode: RA-2 switched to Heater0/Refuse mode due to an attempt to clear Configuration Table Interfaces (CTI)	172.49	
2002	27/05/2002 01:38	30/05/2002 10:13	1245	1293	RA2 out of measurement mode: Payload switch off	91.91	
2002	05/06/2002 21:18	11/06/2002 10:32	1385	1465	RA2 out of measurement mode: Payload switch off	134.40	

RA2 Instrument							
Year	**Start time**	**Stop time**	**Start orbit**	**Stop orbit**	**Description**	**Duration (Hours)**	**Total hours lost in year/ %**
2002	24/06/2002 16:18	26/06/2002 16:03	1654	1683	RA2 out of measurement mode: RA2 in Standby mode following execution of commands sent to the instrument aiming at resolving the problem of S-Band anomaly	47.75	
2002	27/06/2002 14:24	28/06/2002 13:19	1696	1710	RA2 out of measurement mode: RA2 Instrument Control Unit (ICU) in Suspended mode	22.92	
2002	01/07/2002 21:36	02/07/2002 17:55	1758	1770	RA2 out of measurement mode: RA-2 to Reset/Wait mode as a result of the ICU software problem	20.32	
2002	08/07/2002 14:37	08/07/2002 16:17	1854	1855	RA2 out of measurement mode : RA-2 down for Signal Processor Subassembly (SPSA) patches upload	1.67	
2002	18/07/2002 11:05	18/07/2002 11:16	1995	1995	RA2 out of measurement mode : RA-2 down for upload of patches to Signal Processor Subassembly (SPSA)	0.18	
2002	22/07/2002 12:19	22/07/2002 12:30	2053	2053	RA2 out of measurement mode: RA-2 down for upload of patches to Signal Processor Subassembly (SPSA)	0.18	
2002	04/08/2002 18:56	05/08/2002 16:44	2243	2256	RA2 out of measurement mode: RA2 in Heater0/Refuse mode	21.8	
2002	08/08/2002 00:00	09/08/2002 17:48	2289	2314	RA2 out of measurement mode: RA-2 in Reset/Wait mode. Interface Control Unit (ICU) locked.	41.8	
2002	23/08/2002 10:38	23/08/2002 10:53	2510	2510	RA2 out of measurement mode: Validated Equipment Switch-On using the latest Configuration Table Interface (CTI)	0.25	
2002	08/09/2002 07:10	10/09/2002 19:07	2737	2773	RA2 out of measurement mode: RA2 in Standby/Refuse mode due to Individual Echo Macro Command (MCMD) timeout	59.95	
2002	25/09/2002	-	-	-	ENVISAT Phase 2 - Exploitation Phase start: RA2 Full Resolution Mission	-	

RA2 Instrument							
Year	**Start time**	**Stop time**	**Start orbit**	**Stop orbit**	**Description**	**Duration (Hours)**	**Total hours lost in year/ %**
2002	09/10/2002 13:34	10/10/2002 08:56	3184	3196	RA2 out of measurement mode: RA2 in Standby/Refuse mode due to Individual Echo Macro Command (MCMD) timeout	19.37	
2002	18/11/2002 04:38	19/11/2002 19:18	3752	3775	RA2 out of measurement mode: Planned Service Module (SM) switch off due to Leonid shower preparation	38.67	
2002	21/12/2002 04:31	21/12/2002 12:52	4224	4229	RA2 out of measurement mode: RA2 in Heater0/Refuse mode	8.35	
2003	16/01/2003 01:52	17/01/2003 17:00	4594	4618	RA2 out of measurement mode: Multiple Single Event Upset (SEU) caused Interface Control Unit (ICU) switch down.	39.13	2003: 661.91 hours / 0.0773 %
2003	25/01/2003 23:56	27/01/2003 19:54	4736	4763	RA2 out of measurement mode: Multiple Single Event Upset (SEU) caused Interface Control Unit (ICU) switch down.	43.97	
2003	20/02/2003 07:27	22/02/2003 14:20	5099	5132	RA2 out of measurement mode: unplanned Payload switch off	54.88	
2003	02/03/2003 12:46	03/03/2003 16:46	5245	5262	RA2 out of measurement mode: Multiple Single Event Upset (SEU) caused Interface Control Unit (ICU) switch down.	28	
2003	15/03/2003 04:21	17/03/2003 19:00	5426	5464	RA2 out of measurement mode: unplanned Payload switch off	62.65	
2003	17/03/2003 21:09	18/03/2003 18:50	5465	5478	RA2 out of measurement mode: RA2 in Heater0/Refuse mode	21.68	
2003	08/04/2003 15:08	09/04/2003 17:12	5776	5792	RA2 out of measurement mode: RA2 Interface Control Unit (ICU) in Reset mode following the detection of two consecutive Format Header errors	26.07	

RA2 Instrument							
Year	**Start time**	**Stop time**	**Start orbit**	**Stop orbit**	**Description**	**Duration (Hours)**	**Total hours lost in year/ %**
2003	15/04/2003 06:23	15/04/2003 17:29	5871	5878	RA2 out of measurement mode: RA2 Interface Control Unit (ICU) in Reset mode following the detection of two consecutive Format Header errors	11.1	
2003	24/04/2003 13:20	25/04/2003 09:15	6004	6016	RA2 out of measurement mode: Multiple Single Event Upset (SEU) caused Interface Control Unit (ICU) switch down.	19.92	
2003	05/05/2003 12:30	06/05/2003 10:01	6161	6174	RA2 out of measurement mode: RA2 Interface Control Unit (ICU) in Reset mode following the detection of two consecutive Format Header errors	21.52	
2003	11/05/2003 11:06	12/05/2003 10:14	6246	6260	RA2 out of measurement mode: RA2 Interface Control Unit (ICU) in Reset mode following the detection of two consecutive Format Header errors	23.13	
2003	18/05/2003 06:25	19/05/2003 15:59	6343	6364	RA2 out of measurement mode: Switch-down for Service Module Command software upgrade and Orbit Control Manouvre (OCM)	33.57	
2003	01/06/2003 14:36	02/06/2003 09:20	6549	6560	RA2 out of measurement mode: RA2 Interface Control Unit (ICU) in Reset mode following the detection of two consecutive Format Header errors	18.73	
2003	26/07/2003 15:28	26/07/2003 17:25	7337	7338	RA2 out of measurement mode: RA2 in Standby/Refuse mode due to Individual Echo Macro Command (MCMD) timeout	1.95	
2003	31/07/2003 16:11	31/07/2003 18:06	7409	7410	RA2 out of measurement mode: RA2 in Standby/Refuse mode due to Individual Echo Macro Command (MCMD) timeout	1.92	

RA2 Instrument							
Year	**Start time**	**Stop time**	**Start orbit**	**Stop orbit**	**Description**	**Duration (Hours)**	**Total hours lost in year/ %**
2003	15/08/2003 16:40	15/08/2003 18:35	7624	7625	RA2 out of measurement mode: RA2 in Standby/Refuse mode due to Individual Echo Macro Command (MCMD) timeout	1.92	
2003	30/08/2003 15:28	30/08/2003 20:47	7838	7841	RA2 out of measurement mode: RA2 in Standby/Refuse mode due to Individual Echo Macro Command (MCMD) timeout	5.32	
2003	04/09/2003 22:52	06/09/2003 16:41	7914	7939	RA2 out of measurement mode: Payload switch off	41.82	
2003	12/09/2003 15:19	12/09/2003 15:47	8024	8024	RA2 out of measurement mode: RA2 in Standby/Refuse mode due to Macro Command (MCMD) timeout	0.47	
2003	21/09/2003 15:36	21/09/2003 17:33	8153	8154	RA2 out of measurement mode: RA2 in Standby/Refuse mode due to Macro Command (MCMD) timeout	1.95	
2003	27/09/2003 00:28	27/09/2003 12:52	8229	8237	RA2 out of measurement mode: Multiple Single Event Upset (SEU) caused Interface Control Unit (ICU) switch down.	12.4	
2003	29/10/2003 06:47	29/10/2003 12:58	8691	8695	RA2 out of measurement mode: Multiple Single Event Upset (SEU) caused Interface Control Unit (ICU) switch down.	6.18	
2003	02/11/2003 15:16	03/11/2003 12:08	8754	8766	RA2 out of measurement mode: RA2 Interface Control Unit (ICU) in Reset/Wait mode due to repeated telemetry anomalies	20.87	
2003	26/11/2003 13:31	26/11/2003 19:39	9096	9100	RA2 out of measurement mode: Multiple Single Event Upset (SEU) caused Interface Control Unit (ICU) switch down.	6.13	
2003	03/12/2003 07:18	05/12/2003 16:35	9193	9227	RA2 out of measurement mode: unplanned Payload switch off	57.28	

RA2 Instrument							
Year	**Start time**	**Stop time**	**Start orbit**	**Stop orbit**	**Description**	**Duration (Hours)**	**Total hours lost in year/ %**
2003	06/12/2003 15:55	10/12/2003 19:16	9241	9300	RA2 out of measurement mode: RA2 Interface Control Unit (ICU) in Reset/Wait mode due to an uncontrolled software action	99.35	
2004	22/04/2004 15:15	22/04/2004 17:07	11216	11217	RA2 out of measurement mode: RA2 in Standby/Refuse mode due to Macro Command (MCMD) failure (EN-UNA-2004/0120)	1.87	2004: 118.97 hours / 0.0136 %
2004	10/05/2004 02:06	10/05/2004 11:27	11465	11471	RA2 out of measurement mode: RA2 Interface Control Unit (ICU) in Reset/Wait mode following a multiple Single Event Upset (SEU) anomaly (EN-UNA-2004/0133)	9.35	
2004	31/05/2004 02:45	31/05/2004 12:01	11766	11772	RA2 out of measurement mode: RA2 Interface Control Unit (ICU) in Reset/Wait mode following a multiple Single Event Upset (SEU) anomaly (EN-UNA-2004/0144)	9.27	
2004	21/06/2004 07:56	22/06/2004 11:50 *	12070	12087	Transition to Yaw Steering Mode satellite pointing due to Star Sensor anomaly	3.90	
2004	21/06/2004 14:47	21/06/2004 19:24	12074	12077	RA2 out of measurement mode: RA2 Interface Control Unit (ICU) in Reset/Wait mode following a multiple Single Event Upset (SEU) anomaly (EN-UNA-2004/0164)	4.62	
2004	18/07/2004 13:47	18/07/2004 19:59	12460	12464	RA2 out of measurement mode: RA2 Interface Control Unit (ICU) in Reset/Wait mode following a multiple Single Event Upset (SEU) anomaly (EN-UNA-2004/0181)	6.2	
2004	10/08/2004 15:00	11/08/2004 10:59	12790	12802	RA2 out of measurement mode: RA2 Interface Control Unit (ICU) in Reset/Wait mode following a multiple Single Event Upset (SEU) anomaly (EN-UNA-2004/0197)	19.98	

RA2 Instrument							
Year	**Start time**	**Stop time**	**Start orbit**	**Stop orbit**	**Description**	**Duration (Hours)**	**Total hours lost in year/ %**
2004	26/09/2004 13:39	27/09/2004 16:23	13462	13478	RA2 out of measurement mode: RA2 Interface Control Unit (ICU) in Reset/Wait mode following a multiple Single Event Upset (SEU) anomaly (EN-UNA-2004/0250). Start of first USO anomaly period when the instrument restarted	26.73	
2004	27/09/2004 16:00	29/09/2004 12:00	13478	13504	First USO anomaly period	-	
2004	23/11/2004 13:25	24/11/2004 14:10	14292	14307	RA2 out of measurement mode: RA2 Interface Control Unit (ICU) in Reset/Wait mode following a multiple Single Event Upset (SEU) anomaly (EN-UNA-2004/0296)	24.75	
2004	01/12/2004 10:22	01/12/2004 15:34	14405	14408	RA2 out of measurement mode: RA2 Interface Control Unit (ICU) in Reset/Wait mode due to repeated telemetry anomalies (EN-UNA-2004/0302)	5.2	
2004	27/12/2004 02:49	27/12/2004 13:49	14772	14779	RA2 out of measurement mode: RA2 Interface Control Unit (ICU) in Reset/Wait mode following a Single Event Upset (SEU) anomaly (EN-UNA-2004/0316)	11	
2005	26/01/2005 15:50	26/01/2005 21:07	15210	15213	RA2 out of measurement mode: RA2 Interface Control Unit (ICU) in Reset/Wait mode due to repeated telemetry anomalies (EN-UNA-2005/0027)	5.28	2005: 114.55 hours / 0.0131 %
2005	18/03/2005 04:35	18/03/2005 12:58	15933	15938	RA2 out of measurement mode: RA2 Interface Control Unit (ICU) in Reset/Wait mode after an uncontrolled Software action (EN-UNA-2005/0081)	8.38	
2005	18/04/2005 05:01	18/04/2005 13:22	16377	16382	RA2 out of measurement mode: RA2 Interface Control Unit (ICU) in Reset/Wait mode after an uncontrolled Software action (EN-UNA-2005/0117)	8.35	

RA2 Instrument							
Year	**Start time**	**Stop time**	**Start orbit**	**Stop orbit**	**Description**	**Duration (Hours)**	**Total hours lost in year/ %**
2005	23/04/2005 18:37	24/04/2005 11:42	16457	16467	RA2 out of measurement mode: RA2 Interface Control Unit (ICU) in Reset/Wait mode due to repeated telemetry anomalies (EN-UNA-2005/0126)	17.08	
2005	14/05/2005 23:56	15/05/2005 10:53	16760	16767	RA2 out of measurement mode: RA2 Interface Control Unit (ICU) in Reset/Wait mode following a Single Event Upset (SEU) anomaly (EN-UNA-2005/0151)	10.95	
2005	21/05/2005 00:10	21/05/2005 10:55	16846	16853	RA2 out of measurement mode: RA2 Interface Control Unit (ICU) in Reset/Wait mode following a Single Event Upset (SEU) anomaly (EN-UNA-2005/0166)	10.75	
2005	04/07/2005 04:41	04/07/2005 11:19	17479	17483	RA2 out of measurement mode: RA2 Interface Control Unit (ICU) in Reset/Wait mode after an uncontrolled Software action (EN-UNA-2005/0217)	6.63	
2005	16/07/2005 13:32	16/07/2005 19:58	17656	17660	RA2 out of measurement mode: RA2 Interface Control Unit (ICU) in Reset/Wait mode following a Single Event Upset (SEU) anomaly (EN-UNA-2005/0237)	6.43	
2005	17/07/2005 14:43	17/07/2005 19:20	17671	17674	RA2 out of measurement mode: RA2 Interface Control Unit (ICU) in Reset/Wait mode following a multiple Single Event Upset (SEU) anomaly (EN-UNA-2005/0240)	4.62	
2005	29/07/2005 00:41	29/07/2005 09:58	17834	17840	RA2 out of measurement mode: RA2 Interface Control Unit (ICU) in Reset/Wait mode following a multiple Single Event Upset (SEU) anomaly (EN-UNA-2005/0260)	9.28	
2005	16/08/2005 16:41	16/08/2005 20:22	18102	18104	RA2 out of measurement mode: RA2 Interface Control Unit (ICU) in Reset/Wait mode after an uncontrolled Software action (EN-UNA-2005/0294)	3.68	

RA2 Instrument							
Year	**Start time**	**Stop time**	**Start orbit**	**Stop orbit**	**Description**	**Duration (Hours)**	**Total hours lost in year/ %**
2005	30/08/2005 16:01	30/08/2005 19:43	18302	18304	RA2 out of measurement mode: RA2 Interface Control Unit (ICU) in Reset/Wait mode after an uncontrolled Software action (EN-UNA-2005/0348)	3.7	
2005	12/09/2005 15:53	12/09/2005 19:47	18488	18490	RA2 out of measurement mode: RA2 Interface Control Unit (ICU) in Reset/Wait mode after an uncontrolled Software action (EN-UNA-2005/0360)	3.9	
2005	20/09/2005 12:19	20/09/2005 18:56	18600	18604	RA2 out of measurement mode: RA2 Interface Control Unit (ICU) in Reset/Wait mode following a multiple Single Event Upset (SEU) anomaly (EN-UNA-2005/0375)	6.62	
2005	04/10/2005 12:47	04/10/2005 16:35	18801	18803	RA2 out of measurement mode: RA2 Interface Control Unit (ICU) in Reset/Wait mode following a multiple Single Event Upset (SEU) anomaly (EN-UNA-2005/0408)	3.8	
2005	28/10/2005 05:34	28/10/2005 10:39	19140	19143	RA2 out of measurement mode: RA2 Interface Control Unit (ICU) in Reset/Wait mode after an uncontrolled Software action (EN-UNA-2005/0445)	5.08	
2006	02/01/2006 12:56	02/01/2006 18:09	20089	20092	RA2 out of measurement mode: RA2 Interface Control Unit (ICU) in Reset/Wait mode after an uncontrolled Software action (EN-UNA-2006/0001)	5.22	2006: 402.15 hours / 0.0459 %
2006	12/01/2006 14:20	12/01/2006 19:12	20233	20236	RA2 out of measurement mode: RA2 Interface Control Unit (ICU) in Reset/Wait mode following a multiple Single Event Upset (SEU) anomaly (EN-UNA-2006/0015)	4.87	
2006	30/01/2006 02:07	30/01/2006 11:29	20483	20489	RA2 out of measurement mode: RA2 Interface Control Unit (ICU) in Reset/Wait mode following a Single Event Upset (SEU) anomaly (EN-UNA-2006/0023)	9.37	

RA2 Instrument							
Year	**Start time**	**Stop time**	**Start orbit**	**Stop orbit**	**Description**	**Duration (Hours)**	**Total hours lost in year/ %**
2006	01/02/2006 05:17	01/02/2006 12:04	20514	20518	RA2 out of measurement mode: RA2 Interface Control Unit (ICU) in Reset/Wait mode after an uncontrolled Software action (EN-UNA-2006/0028). Start of second USO anomaly period when the instrument restarted	6.78	
2006	01/02/2006 16:30	01/02/2006 18:36	20521	20522	RA2 out of measurement mode: RA2 Interface Control Unit (ICU) in Reset/Wait mode after an uncontrolled Software action (EN-UNA-2006/0030)	2.1	
2006	01/02/2006 12:04	11/02/2006 00:54	20518	20654	Second USO anomaly period		
2006	13/03/2006 09:36	13/03/2006 17:40	21089	21094	RA2 out of measurement mode: RA2 Interface Control Unit (ICU) in Reset/Wait mode due to repeated telemetry anomalies (EN-UNA-2006/0094). Start of third USO anomaly period when the instrument restarted	8.07	
2006	13/03/2006 17:40	02/04/2006 18:00	21094	21380	Third USO anomaly period		
2006	17/03/2006 12:04	17/03/2006 13:26	21148	21149	RA2 out of measurement mode: RA2 Interface Control Unit (ICU) in planned Suspended mode to try to solve the problem of USO anomaly (EN-UNA-2006/0099)	1.37	
2006	06/04/2006 02:29	08/04/2006 12:31	21428	21453	RA2 out of measurement mode: Service Module (SM) On-Board Data Handling (OBDH) anomaly (EN-UNA-2006/0116)	58.03	
2006	08/04/2006 12:31	15/05/2006 14:21	21453	21992	Fourth USO anomaly period		
2006	15/05/2006 11:00	15/05/2006 14:21	21992	21994	RA-2 Radio Frequency Sub System (RFSS) configured to Side-B redundancy. Stop of fourth USO anomaly period when the instrument restarted (EN-UNA-2006/0163)	3.35	

RA2 Instrument							
Year	**Start time**	**Stop time**	**Start orbit**	**Stop orbit**	**Description**	**Duration (Hours)**	**Total hours lost in year/ %**
2006	19/05/2006 09:24	19/05/2006 19:13	22048	22054	RA2 out of measurement mode: RA2 Interface Control Unit (ICU) in Reset/Wait mode following a Single Event Upset (SEU) anomaly (EN-UNA-2006/0165)	9.82	
2006	20/05/2006 13:24	-	22065		RA2 S-Band Radio Frequency sub system (RFSS) side-B failure		
2006	23/05/2006 15:06	23/05/2006 15:23	22109	22109	RA2 out of measurement mode: RA2 Interface Control Unit (ICU) in Standby mode (EN-UNA-2006/0173)	0.28	
2006	26/05/2006 13:37	29/05/2006 10:43	22151	22192	RA2 out of measurement mode: RA2 commanded in Heater-1 (EN-UNA-2006/0174)	69.1	
2006	03/06/2006 13:14	03/06/2006 18:03	22265	22268	RA2 out of measurement mode: RA2 Interface Control Unit (ICU) in Reset/Wait mode following a Single Event Upset (SEU) anomaly (EN-UNA-2006/0182)	4.82	
2006	15/06/2006 00:50	15/06/2006 10:11	22429	22435	RA2 out of measurement mode: RA2 Interface Control Unit (ICU) in Reset/Wait mode following a Single Event Upset (SEU) anomaly (EN-UNA-2006/0192)	9.35	
2006	21/06/2006 11:37	21/06/2006 13:20	22522	22523	RA-2 Radio Frequency Sub System (RFSS) redundancy configured from Side-B to Side-A (EN-UNA-2006/0197)	1.72	
2006	21/06/2006 13:20	01/03/2007 09:19	22523	26142	Fifth USO anomaly period		
2006	25/06/2006 15:01	25/06/2006 19:46	22581	22584	RA2 out of measurement mode: RA2 Interface Control Unit (ICU) in Reset/Wait mode after an uncontrolled Software action (EN-UNA-2006/0205)	4.75	
2006	01/08/2006 01:14	01/08/2006 08:54	23102	23107	RA2 out of measurement mode: RA2 Interface Control Unit (ICU) in Reset/Wait mode following multiple Single Event Upset (SEU) anomaly (EN-UNA-2006/0233)	7.67	

RA2 Instrument							
Year	**Start time**	**Stop time**	**Start orbit**	**Stop orbit**	**Description**	**Duration (Hours)**	**Total hours lost in year/ %**
2006	07/09/2006 16:40	10/09/2006 15:47	23641	23684	RA2 out of measurement mode: Payload off due to Service Module Anomaly (EN-UNA-2006/0270)	71.12	
2006	26/10/2006 04:02	26/10/2006 10:32	24335	24339	RA2 out of measurement mode: RA2 Interface Control Unit (ICU) in Reset/Wait mode following multiple Single Event Upset (SEU) anomaly (EN-UNA-2006/0324)	6.5	
2006	02/11/2006 15:20	02/11/2006 20:07	24442	24445	RA2 out of measurement mode: RA2 Interface Control Unit (ICU) in Reset/Wait mode following multiple Single Event Upset (SEU) anomaly (EN-UNA-2006/0332)	4.78	
2006	26/11/2006 08:01	26/11/2006 17:32	24781	24787	RA2 out of measurement mode: RA2 Interface Control Unit (ICU) in Reset/Wait mode following multiple Single Event Upset (SEU) anomaly (EN-UNA-2006/0352)	9.52	
2006	28/11/2006 07:40	29/11/2006 17:23	24810	24829	RA2 out of measurement mode: Correction - Service Module Memory Maintenance (EN-UNA-2006/0354)	33.72	
2006	12/12/2006 18:02	15/12/2006 15:54	25016	25058	RA2 out of measurement mode: unplanned Payload switch off (EN-UNA-2006/0370)	69.87	
2007	16/01/2007 08:50	16/01/2007 09:11	25512	25512	RA2 out of measurement mode: RA-2 down for Signal Processor Subassembly (SPSA) patches upload (EN-UNA-2007/0009)	0.35	2007: 352.27 hours / 0.0402 %
2007	01/02/2007 15:15	01/02/2007 17:11	25745	25746	RA2 out of measurement mode: RA2 in Standby/Refuse mode due to Individual Echo Macro Command (MCMD) timeout (EN-UNA-2007/0022)	1.93	
2007	16/02/2007 00:47	16/02/2007 11:07	25951	25957	RA2 out of measurement mode: RA2 in Reset/Wait mode due to Macro Command (MCMD) transfer error (EN-UNA-2007/0043)	10.33	

RA2 Instrument							
Year	**Start time**	**Stop time**	**Start orbit**	**Stop orbit**	**Description**	**Duration (Hours)**	**Total hours lost in year/ %**
2007	17/02/2007 00:45	19/02/2007 11:11	25965	26000	RA2 out of measurement mode: RA2 in Heater0/Refuse mode (EN-UNA-2007/0045)	58.43	
2007	28/02/2007 18:14	01/03/2007 09:19	26133	26142	RA2 out of measurement mode: RA2 in Standby/Refuse mode due to Measure Individual Echo (IE) commanding conflict (EN-UNA-2007/0051). Stop of fifth USO anomaly period when the instrument restarted	15.08	
2007	09/03/2007 19:32	12/03/2007 10:13	26262	26300	RA2 out of measurement mode: RA2 in Heater0/Refuse mode (EN-UNA-2007/0062)	62.68	
2007	16/03/2007 12:01	16/03/2007 14:42	26358	26360	RA2 out of measurement mode: RA2 in Heater0/Refuse mode (EN-UNA-2007/0067)	2.68	
2007	20/03/2007 02:32	20/03/2007 09:20	26410	26414	RA2 out of measurement mode: RA2 in Heater0/Refuse mode (EN-UNA-2007/0072)	6.8	
2007	29/03/2007 00:59	29/03/2007 09:54	26538	26543	RA2 out of measurement mode: RA2 in Heater0/Refuse mode due to an out of limit of the High Power Amplifier bus current. New ICU Flight Patch uploaded (EN-UNA-2007/0081)	8.92	
2007	03/04/2007 12:37	03/04/2007 13:48	26616	26617	RA2 out of measurement mode: RA2 in Heater0/Refuse mode due to an out of limit of the High Power Amplifier bus current (EN-UNA-2007/0093)	1.18	
2007	04/04/2007 09:49	04/04/2007 11:30	26629	26630	RA2 out of measurement mode: RA2 in Heater0/Refuse mode due to an out of limit of the High Power Amplifier bus current (EN-UNA-2007/0094)	1.68	

RA2 Instrument							
Year	**Start time**	**Stop time**	**Start orbit**	**Stop orbit**	**Description**	**Duration (Hours)**	**Total hours lost in year/ %**
2007	09/04/2007 05:01	09/04/2007 10:36	26698	26701	RA2 out of measurement mode: RA2 in Standby/Refuse following Heater0/Refuse mode due to an out of limit of the High Power Amplifier bus current. During recovery, the Signal Processor Subassembly (SPSA) patch (loaded on 16/01/2007) was disabled (EN-UNA-2007/0097)	5.47	
2007	27/06/2007 07:23	27/06/2007 07:35	27830	27830	RA2 out of measurement mode : RA-2 down for S-Band Waveform Anomaly, Signal Processor Subassembly (SPSA) patches upload (EN-UNA-2007/0164)	0.2	
2007	30/06/2007 00:37	02/07/2007 09:51	27869	27903	RA2 out of measurement mode: RA2 in Heater1/Refuse mode (EN-UNA-2007/0167)	57.23	
2007	19/07/2007 01:08	19/07/2007 07:38	28141	28145	RA2 out of measurement mode: RA2 in Heater1/Refuse mode (EN-UNA-2007/0181)	6.5	
2007	24/09/2007 12:27	27/09/2007 11:13	29107	29149	RA2 out of measurement mode: Payload switch-off due to Service Module Anomaly (EN-UNA-2007/0220). Start of sixth USO anomaly period when the instrument restarted	70.77	
2007	27/09/2007 11:13	03/12/2007 03:00	29149	30103	Sixth USO anomaly period	-	
2007	02/10/2007 16:15	02/10/2007 20:09	29224	29226	RA2 out of measurement mode: RA2 in Reset/Wait mode due to Macro Command (MCMD) transfer error (EN-UNA-2007/0233)	3.9	
2007	08/11/2007 13:31	08/11/2007 17:24	29752	29754	RA2 out of measurement mode: RA2 Interface Control Unit (ICU) in Reset/Wait mode due to repeated telemetry anomalies (EN-UNA-2007/0244)	3.88	

RA2 Instrument							
Year	**Start time**	**Stop time**	**Start orbit**	**Stop orbit**	**Description**	**Duration (Hours)**	**Total hours lost in year/ %**
2007	03/12/2007 22:00	04/12/2007 13:50	30115	30124	RA2 out of measurement mode: Orbit Control Manoeuvre (OCM) and Maintenance. Start of seventh USO anomaly period when the instrument restarted (EN-UNA-2007/0258)	15.83	
2007	04/12/2007 13:50	23/01/2008 14:10	30124	30840	Seventh USO anomaly period	-	
2007	09/12/2007 20:45	10/12/2007 09:14	30200	30207	RA2 out of measurement mode: RA2 in Reset/Wait mode following Telemetry format anomaly (EN-UNA-2007/0271)	12.48	
2007	13/12/2007 06:44	13/12/2007 12:39	30249	30252	RA2 out of measurement mode: Service Module memory maintenance (EN-UNA-2007/0273)	5.92	
2008	16/01/2008 16:11	17/01/2008 12:05	30741	30752	RA2 out of measurement mode: RA2 in Heater 2 mode due to High Speed Multiplexer (HSM) anomaly (EN-UNA-2008/0008)	19.9	2008: 20.82 hours / 0.0024 %
2008	17/01/2008 23:23	-	30759	-	RA2 S-Band Radio Frequency Sub System (RFSS) Side-A failure	-	
2008	23/01/2008 13:55	23/01/2008 14:10	30840	30840	RA2 out of measurement mode: RA-2 switched to Standby & Back to Operations for S-Band Anomaly Investigation (EN-UNA-2008/0019)	0.25	
2008	01/02/2008 12:00	01/02/2008 12:40	30967	30968	RA2 out of measurement mode: RA2 planned to Heater2 mode to provide stable temperature data after the S-Band failure (EN-UNA-2008/0025)	0.67	
2008	13/03/2008 09:33	13/03/2008 19:28 *	31553	31559	Switch down to Yaw Steering Mode satellite pointing due to bright object in Field of View (FOV)	9.92	

RA2 Instrument							
Year	**Start time**	**Stop time**	**Start orbit**	**Stop orbit**	**Description**	**Duration (Hours)**	**Total hours lost in year/ %**
2009	05/01/2009 14:59	05/01/2009 15:04	35822	35822	RA2 out of measurement mode: RA2 switched down to Heater1 mode to clear persistent Signal Processor Subassembly (SPSA) anomaly (EN-UNA-2009/0005)	0.08	2009: 45.27 hours / 0.0052 %
2009	15/02/2009 03:38	16/02/2009 13:09 *	36402	36422	Switch down to Yaw Steering Mode satellite pointing due to bright object in Field of View (FOV)	33.52	
2009	05/03/2009 19:18	06/03/2009 15:10 *	36669	36681	Switch down to Yaw Steering Mode satellite pointing due to bright object in Field of View (FOV)	19.87	
2009	28/04/2009 13:03	29/04/2009 11:56	37451	37451	RA2 out of measurement mode: full High Speed Multiplexer (HSM) reset (EN-UNA-2009/0078)	22.88	
2009	11/05/2009 17:58	12/05/2009 10:39	37627	37637	RA2 out of measurement mode: RA2 Interface Control Unit (ICU) in Reset/Wait mode due to telemetry format anomaly (EN-UNA-2009/0089)	16.68	
2009	23/07/2009 15:30	23/07/2009 21:07	38671	38674	RA2 out of measurement mode: RA2 in Reset/Wait mode due to Macro Command (MCMD) transfer error (EN-UNA-2009/0116)	5.62	
2010	11/01/2010 11:34	11/01/2010 19:05 *	41130	41135	Switch down to Yaw Steering Mode satellite pointing due to bright object in FOV	7.52	2010: 0.07 hours / 0.0000007 %
2010	26/05/2010 12:12	26/05/2010 16:45 *	43063	43066	Switch to Yaw Steering Mode satellite pointing due to Star Sensor anomaly	4.55	
2010	15/07/2010 15:25	15/07/2010 15:27	43781	43781	RA2 out of measurement mode: RA switched down to Heater1 mode to clear persistent Signal Processor Subassembly (SPSA) anomaly (EN-UNA-2010/0113)	0.03	
2010	01/09/2010 16:30	01/09/2010 16:32	44468	44468	RA2 out of measurement mode: On-Board Time (OBT) full wrap around (EN-UNA-2010/0133)	0.03	
2010	24/10/2010 07:05	-	45222	-	Start of ENVISAT Phase 3 - with orbit change	N/A	

RA2 Instrument							
Year	**Start time**	**Stop time**	**Start orbit**	**Stop orbit**	**Description**	**Duration (Hours)**	**Total hours lost in year/ %**
2011	21/02/2011 16:29	21/02/2011 21:14	46951	46954	RA2 out of measurement mode: RA2 Interface Control Unit (ICU) in Reset/Wait mode due to telemetry format anomaly (EN-UNA-2011/0026)	4.75	2011: 50.32 hours / 0.0057 %
2011	01/04/2011 00:19	01/04/2011 10:53	47502	47508	RA2 out of measurement mode: RA2 Interface Control Unit (ICU) in Reset/Wait mode due to telemetry format anomaly (EN-UNA-2011/0050)	10.57	
2011	03/04/2011 15:51	04/04/2011 15:38	47540	47554	RA2 out of measurement mode: Payload switch-off due to Service Module Anomaly (EN-UNA-2011/0053)	23.78	
2011	27/04/2011 03:25	27/04/2011 10:02	47877	47881	RA2 out of measurement mode: RA2 Interface Control Unit (ICU) in Reset/Wait mode due to telemetry format anomaly (EN-UNA-2011/0068)	6.62	
2011	22/12/2011 05:46	22/12/2011 10:22	51312	51315	RA2 out of measurement mode: RA2 Interface Control Unit (ICU) in Reset/Wait mode due to telemetry format anomaly (EN-UNA-2011/0244)	4.6	
2012	23/01/2012 06:45	23/01/2012 11:36	51772	51775	RA2 out of measurement mode: Service Module Memory Fault (EN-UNA-2012/0016)	4.85	2012: 4.85 hours/0.00020% **
2012	08/04/2012 12:28	No further data	52866	-	Communication loss (EN-UNA-2012/0060)	NA	

* Does not correspond to a RA2 instrument unavailability, but the Service Module has been switched down to YSM (Yaw Steering Mode) instead of nominal SYSM (Stellar Yaw Steering Mode). This could cause degradation in the geolocation. The corresponding time duration is not included in the total hours lost.

**As a percentage up to mission end

5.2 MWR

MWR instrument has been switched on 13th March 2002, and put in measurement mode on 15th March 2002.

List of events affecting the MWR instrument mission are reported in Table 4.

Table 4. : List of events affecting MWR data

MWR Instrument							
Year	**Start time**	**Stop time**	**Start orbit**	**Stop orbit**	**Description**	**Duration (Hours)**	**Total hours lost in year/ %**
2002	01/03/2002	-	1	-	ENVISAT Launch from Kourou, French Guiana	-	1052.80 hours / 0.1022 %
	13/03/2002	-	-	-	SODAP (Switch-On and Data Acquisition Plan): DORIS/MWR Instrument Control Unit (ICU) on, to Standby mode	-	
	15/03/2002	-	-	-	SODAP: MWR instrument in Measurement mode	-	
	29/03/2002 13:00	10/04/2002 16:17			SODAP -MWR out of measurement mode: First DORIS/MWR Instrument Control Unit (ICU) spurious Wait state	291.28	
	18/04/2002 12:42	19/04/2002 18:15	693	711	MWR out of measurement mode: DORIS/MWR Instrument Control Unit (ICU) in Suspend Mode	29.55	
	01/05/2002 09:09	03/05/2002 14:14	877	909	MWR out of measurement mode: DORIS/MWR Instrument Control Unit (ICU) in Reset/Wait Mode	53.08	
	06/05/2002 16:01	07/05/2002 15:27	953	967	MWR out of measurement mode: DORIS/MWR Instrument Control Unit (ICU) in Suspend Mode	23.43	
	08/05/2002 11:39	08/05/2002 13:22	979	979	MWR out of measurement mode: MWR switched off to solve datation problem	1.72	
	11/05/2002 12:54	16/05/2002 07:29			MWR out of measurement mode: Payload switch off	114.58	
	16/05/2002 12:22	16/05/2002 15:13				2.85	
	27/05/2002 01:38	29/05/2002 22:16	1245		MWR out of measurement mode: Payload switch off	68.63	
	05/06/2002 21:18	11/06/2002 14:58	1385	1467	MWR out of measurement mode: Payload switch off	137.67	

MWR Instrument							
Year	**Start time**	**Stop time**	**Start orbit**	**Stop orbit**	**Description**	**Duration (Hours)**	**Total hours lost in year/ %**
	06/07/2002 08:04	09/07/2002 14:15	1821	1868	MWR out of measurement mode: DORIS/MWR ICU switched down	78.18	
	02/08/2002 11:34	02/08/2002 11:44	2210	2210	MWR out of measurement mode: Warm reset of the ICU software	0.17	
	23/08/2002 10:34	23/08/2002 10:45	2510	2510	MWR out of measurement mode: DORIS/MWR ICU manually cold reset & restarted	0.18	
	08/09/2002 07:10	11/09/2002 10:41	2737	2781	MWR out of measurement mode: Planned Service Module (SM) switch off	75.52	
	15/09/2002 02:53	17/09/2002 10:56	2834	2868	MWR out of measurement mode: DORIS/MWR ICU restarted	56.05	
	14/11/2002 08:47	14/11/2002 08:57	3697	3697	MWR out of measurement mode: MWR reset	0.17	
	18/11/2002 04:38	20/11/2002 12:20	3752	3784	MWR out of measurement mode: Planned SM switch off due to Leonid shower preparation	55.7	
2003	20/02/2003 07:27	24/02/2003 13:41	5099	5159	MWR out of measurement mode: unplanned Payload switch off	102.23	312.17 hours / 0.0356 %
	15/03/2003 04:21	17/03/2003 15:57	5426	5461	MWR out of measurement mode: Autonomous payload switch-off	59.6	
	18/05/2003 06:25	19/05/2003 14:45	6344	6362	MWR out of measurement mode: Switch-down for Module Command software upgrade and Orbit Control Manouvre (OCM)	32.33	
	04/09/2003 22:52	08/09/2003 09:25	7914	7963	MWR out of measurement mode: Payload switch off	82.55	
	03/12/2003 07:18	04/12/2003 18:45	9193	9213	MWR out of measurement mode: Payload switch off	35.45	
2004	21/06/2004 07:56	22/06/2004 11:50	12070	12087	Transition to Yaw Steering Mode satellite pointing due to Star Sensor anomaly	27.9	27.9 hours / 0.0034 %
2005	06/01/2005 06:29	17/01/2005 12:00	14918	15079	MWR out of measurement mode: Housekeeping data products can't be generated (EN-UNA-2005/0012)	269.51	269.51 hours / 0.0312 %

MWR Instrument							
Year	**Start time**	**Stop time**	**Start orbit**	**Stop orbit**	**Description**	**Duration (Hours)**	**Total hours lost in year/ %**
2006	06/04/2006 02:09	08/04/2006 12:27	21428	21463	MWR out of measurement mode: Service Module (SM) On-Board Data Handling (OBDH) anomaly (EN-UNA-2006/0116)	58.3	283.15 hours / 0.0323 %
	14/04/2006 08:55	14/04/2006 14:01	21547	21550	MWR out of measurement mode: Commanded to Standby and Reset mode (EN-UNA-2006/0127)	5.1	
	07/09/2006 16:40	11/09/2006 08:41	23641	23694	MWR out of measurement mode: Payload off due to Service Module Anomaly (EN-UNA-2006/0270)	88.02	
	28/11/2006 07:58	30/11/2006 11:51	24810	24841	MWR out of measurement mode: Correction – Service Module Memory Maintenance (EN-UNA-2006/0354)	51.88	
	12/12/2006 18:02	15/12/2006 18:51	25016	25060	MWR out of measurement mode: High Speed Multiplexer (HSM) protocol error and interrupt (EN-UNA-2006/0370)	72.82	
	24/12/2006 08:30	24/12/2006 12:07	25182	25185	MWR out of measurement mode: High Speed Multiplexer (HSM) failure (EN-UNA-2006/0379)	3.63	
	27/12/2006 14:15	27/12/2006 17:40	25229	25231	MWR out of measurement mode: High Speed Multiplexer (HSM) input reset (EN-UNA-2006/0383)	3.42	
2007	26/05/2007 13:20	30/05/2007 13:41	27375	27433	MWR in Standby and Refuse Mode (EN-UNA-2007/0132)	96.35	264.58 hours / 0.0302 %
	28/07/2007 09:53	31/07/2007 09:34	28275	28318	MWR out of measurement mode: DORIS/MWR in Reset Mode (EN-UNA-2007/0192)	71.68	
	24/09/2007 12:27	27/09/2007 14:11	29107	29151	MWR out of measurement mode: Payload switch-off due to Service Module Anomaly (EN-UNA-2007/0220)	73.73	
	03/12/2007 22:00	04/12/2007 15:08	30115	30125	MWR out of measurement mode: Orbit Control Manoeuvre (OCM) and Maintenance (EN-UNA-2007/0258)	17.13	
	13/12/2007 06:44	13/12/2007 12:25	30249	30252	MWR out of measurement mode: Memory maintenance (EN-UNA-2007/0273)	5.68	

MWR Instrument							
Year	**Start time**	**Stop time**	**Start orbit**	**Stop orbit**	**Description**	**Duration (Hours)**	**Total hours lost in year/ %**
2008	16/01/2008 16:11	17/01/2008 18:40	30741	30757	MWR out of measurement mode: High Speed Multiplexer (HSM) anomaly (EN-UNA-2008/0008)	26.48	36.40 hours / 0.0041 %
	13/03/2008 09:33	13/03/2008 19:28	31553	31559	Switch down to Yaw Steering Mode satellite pointing due to bright object in Field of View (FOV)	9.91	
2009	15/02/2009 03:38	16/02/2009 13:09	36402	36422	Switch down to Yaw Steering Mode satellite pointing due to bright object in FOV	33.51	23.68 hours / 0.0032 %
	05/03/2009 19:18	06/03/2009 15:10	36669	36681	Switch down to Yaw Steering Mode satellite pointing due to bright object in FOV	19,87	
	28/04/2009 13:03	29/04/2009 12:44	37438	37452	MWR out of measurement mode: full High Speed Multiplexer (HSM) reset (EN-UNA-2009/0083)	23.68	
2010	11/01/2010 11:34	11/01/2010 19:05	41130	41135	Switch down to Yaw Steering Mode satellite pointing due to bright object in FOV	7.51	17.21 hours / 0.0020 %
	26/05/2010 12:12	26/05/2010 16:45	43063	43066	Switch to Yaw Steering Mode satellite pointing due to Star Sensor anomaly	4.55	
	25/10/2010 10:07	25/10/2010 15:16	45238	45241	MWR out of measurement mode MWR commanded to Standby to reset High Speed Multiplexer (HSM) Input Module (EN-UNA-2010/0163)	5.15	
2011	03/04/2011 15:51	05/04/2011 06:24	47540	47563	MWR out of measurement mode: Payload switch-off due to Service Module Anomaly (EN-UNA-2011/0053)	38.55	104.42 hours / 0.0119 %
	21/05/2011 00:58	23/05/2011 13:43	48220	48257	MWR out of measurement mode due to Remote Bus Interface (RBI) status check error (EN-UNA-2011/0076)	60.75	
	22/12/2011 10:12	22/12/2011 11:55	51315	51316	MWR out of measurement mode: MWR Restart due to High Speed Multiplexer (HSM) error (EN-UNA-2011/0246)	1.72	
	27/12/2011 13:45	27/12/2011 17:09	51389	51391	MWR out of measurement mode: High Speed Multiplexer (HSM) Input Module reset (EN-UNA-2011/0249)	3.4	

MWR Instrument							
Year	**Start time**	**Stop time**	**Start orbit**	**Stop orbit**	**Description**	**Duration (Hours)**	**Total hours lost in year/ %**
2012	23/01/2012 06:45	23/01/2012 14:03	51772	51777	MWR out of measurement mode: Service Module Memory Fault (EN-UNA-2012/0010)	7.3	7.30 hours / 0.0031* %
	08/04/2012 12:28	No further data	52866	--	Communication loss	NA	

*As a percentage up to mission end on 8th April 2012

5.3 DORIS

DORIS instrument has been switched on 13th March 2002, and put in measurement mode on 15th March 2002.

List of events affecting the DORIS instrument mission are reported in Table 5.

Table 5. List of events affecting DORIS data

DORIS Instrument							
Year	**Start time**	**Stop time**	**Start orbit**	**Stop orbit**	**Description**	**Duration (Hours)**	**Total hours lost in year/ %**
2002	01/03/2002	-	1	-	ENVISAT Launch from Kourou, French Guiana	-	2002: 875.45 hours / 0.0850
	13/03/2002	-	-	-	SODAP: DORIS/MWR Instrument Control Unit (ICU) on, to Standby mode	-	
	15/03/2002	-	-	-	SODAP (Switch-On and Data Acquisition Plan): DORIS instrument in Measurement mode	-	
	19/03/2002 21:00	-	-	-	SODAP: DORIS navigator, called DIODE, started	-	
	20/03/2002		-	-	SODAP: First DORIS navigator data produced	-	
	04/04/2002 17:37	05/04/2002 17:20	496	510	DORIS out of measurement mode	23.72	
	07/04/2002 01:01	08/04/2002 17:20	529	553	DORIS out of measurement mode	40.32	
	18/04/2002 12:42	19/04/2002 18:15	693	711	DORIS out of measurement mode: DORIS/MWR Instrument Control Unit (ICU) in Suspend Mode	29.55	
	01/05/2002 09:09	03/05/2002 14:14	877	909	DORIS out of measurement mode: DORIS/MWR ICU) in Reset/Wait Mode	53.08	
	06/05/2002 16:01	07/05/2002 15:27	953	967	DORIS out of measurement mode: DORIS/MWR Instrument Control Unit (ICU) in Suspend Mode	23.43	
	08/05/2002 11:39	08/05/2002 13:22	979	979	DORIS out of measurement mode: DORIS switched off to solve datation problem	1.72	
	11/05/2002 12:54	16/05/2002 14:09	1022	1095	DORIS out of measurement mode: Payload switch off	121.25	
	27/05/2002 01:38	03/06/2002 13:11	1245	1352	DORIS out of measurement mode: Payload switch off	179.55	

DORIS Instrument							
Year	**Start time**	**Stop time**	**Start orbit**	**Stop orbit**	**Description**	**Duration (Hours)**	**Total hours lost in year/ %**
	05/06/2002 21:18	11/06/2002 14:00	1385	1467	DORIS out of measurement mode: Payload switch off	136.7	
	06/07/2002 08:04	09/07/2002 14:15	1821	1868	DORIS out of measurement mode: DORIS/MWR ICU switched down	78.18	
	02/08/2002 11:34	02/08/2002 11:44	2210	2210	DORIS out of measurement mode: Warm reset of the ICU software	0.17	
	23/08/2002 10:34	23/08/2002 10:45	2510	2510	DORIS out of measurement mode: DORIS/MWR ICU manually cold reset & restarted	0.18	
	08/09/2002 07:10	11/09/2002 09:12	2737	2781	DORIS out of measurement mode: Planned Service Module (SM) switch off	74.03	
	15/09/2002 02:53	17/09/2002 10:56	2834	2868	DORIS out of measurement mode: DORIS/MWR ICU restarted	56.05	
	18/11/2002 04:38	20/11/2002 11:08	3752	3784	DORIS out of measurement mode: Planned SM switch off due to Leonid shower preparation	54.7	
2003	20/02/2003 07:27	24/02/2003 12:18	5099	5159	DORIS out of measurement mode: Payload switch off	100.85	2003: 306.38 hours / 0.0350
	15/03/2003 04:21	17/03/2003 14:24	5426	5461	DORIS out of measurement mode: Autonomous payload switch-off	58.05	
	18/05/2003 06:25	19/05/2003 13:21	6344	6362	DORIS out of measurement mode: Switch-down for Module Command software upgrade	30.93	
	04/09/2003 22:52	08/09/2003 09:25	7914	7963	DORIS out of measurement mode: Payload switch off	82.55	
	03/12/2003 07:18	04/12/2003 17:18	9193	9213	DORIS out of measurement mode: Payload switch off	34	
2004	06/06/2004 13:00	14/06/2004 14:52	11858	11974	DORIS out of measurement mode: Interruption of the OUS 10 MHz frequency	193.87	2004: 279.43 hours / 0.0318
	21/06/2004 07:56	22/06/2004 11:50	12070	12087	Transition to Yaw Steering Mode satellite pointing	27,90	
	17/07/2004 16:55	17/07/2004 19:53	12448	12449	DORIS out of measurement mode: High Speed Multiplexer (HSM) input modules-anomalies	2.97	
	12/10/2004 08:00	14/10/2004 14:42	13688	13720	DORIS out of measurement mode: Operations suspended to upload new software image	54.7	

DORIS Instrument							
Year	**Start time**	**Stop time**	**Start orbit**	**Stop orbit**	**Description**	**Duration (Hours)**	**Total hours lost in year/ %**
2005	06/01/2005 06:29	17/01/2005 12:00	14918	15079	DORIS out of measurement mode: Housekeeping data products can't be generated (EN-UNA-2005/0012)	269.52	2005: 606.23 hours / 0.0692
	06/05/2005 11:30	20/05/2005 12:11	16638	16839	DORIS out of measurement mode: High Speed Multiplexer (HSM) Input Module reset	336.68	
	20/05/2005 12:10	20/05/2005 12:12	16839	16839	DORIS out of measurement mode: High Speed Multiplexer (HSM) Input Module reset (EN-UNA-2005/0169)	0.03	
2006	06/04/2006 02:09	08/04/2006 12:09	21428	21463	DORIS out of measurement mode: Service Module (SM) On-Board Data Handling (OBDH) anomaly (EN-UNA-2006/0116)	58	2006: 404.80 hours / 0.0462
	13/04/2006 02:00	19/04/2006 08:17	21528	21618	DORIS out of measurement mode: DORIS/MWR ICU and High Speed Multiplexer (HSM) input Module reset(EN-UNA-2006/0127 and EN-UNA-2006/0137)	150.28	
	07/09/2006 16:40	11/09/2006 08:45	23641	23694	DORIS out of measurement mode: Payload off due to Service Module Anomaly (EN-UNA-2006/0270)	88.08	
	28/11/2006 07:58	29/11/2006 17:34	24810	24830	DORIS out of measurement mode: Correction – Service Module Memory Maintenance (EN-UNA-2006/0354)	33.6	
	12/12/2006 18:02	15/12/2006 13:58	25016	25057	DORIS out of measurement mode: High Speed Multiplexer (HSM) protocol error and interrupt (EN-UNA-2006/0370)	67.83	
	24/12/2006 08:30	24/12/2006 12:07	25182	25185	DORIS out of measurement mode: High Speed Multiplexer (HSM) failure (EN-UNA-2006/0379)	3.62	
	27/12/2006 14:15	27/12/2006 17:32	25229	25231	DORIS out of measurement mode: High Speed Multiplexer (HSM) input reset (EN-UNA-2006/0383)	3.28	
2007	30/05/2007 10:26	30/05/2007 13:41	27431	27433	DORIS out of measurement mode: DORIS switched in Stabilization mode during a Cold Reset of DORIS/MWR ICU (EN-UNA-2007/0140)	3.25	2007: 140.87 hours / 0.0161

DORIS Instrument							
Year	**Start time**	**Stop time**	**Start orbit**	**Stop orbit**	**Description**	**Duration (Hours)**	**Total hours lost in year/ %**
	28/07/2007 09:53	30/07/2007 16:38	28275	28308	DORIS out of measurement mode: DORIS/MWR in Reset Mode (EN-UNA-2007/0192)	54.75	
	24/09/2007 12:27	27/09/2007 11:03	29107	29149	DORIS out of measurement mode: Payload switch-off due to Service Module Anomaly (EN-UNA-2007/0220)	70.6	
	03/12/2007 22:00	04/12/2007 10:16	30115	30122	DORIS out of measurement mode: Orbit Control Manouvre (OCM) and Maintenance (EN-UNA-2007/0258)	12.27	
2008	16/01/2008 16:11	17/01/2008 18:41	30741	30757	DORIS out of measurement mode: High Speed Multiplexer (HSM) anomaly (EN-UNA-2008/0008)	26.5	2008: 36.41 hours / 0.0041
	13/03/2008 09:33	13/03/2008 19:28	31553	31559	Switch down to Yaw Steering Mode satellite pointing due to bright object in Field of View (FOV)	9,91	
2009	15/02/2009 03:38	16/02/2009 13:09	36402	36422	Switch down to Yaw Steering Mode satellite pointing due to bright object in FOV	33,51	2009: 75.42 hours / 0.0086
	05/03/2009 19:18	06/03/2009 15:10	36669	36681	Switch down to Yaw Steering Mode satellite pointing due to bright object in FOV	19,87	
	28/04/2009 13:03	29/04/2009 11:06	37438	37451	DORIS out of measurement mode: Full High Speed Multiplexer (HSM) reset (EN-UNA-2009/0083)	22.05	
2010	11/01/2010 11:34	11/01/2010 19:05	41130	41135	Switch down to Yaw Steering Mode satellite pointing due to bright object in FOV	7,51	2010: 12.06 hours / 0.0014
	26/05/2010 12:12	26/05/2010 16:45	43063	43066	Switch to Yaw Steering Mode satellite pointing due to Star Sensor anomaly	4,55	
2011	03/04/2011 15:51	04/04/2011 16:48	47540	47555	DORIS out of measurement mode: Payload switch-off due to Service Module Anomaly (EN-UNA-2011/0053)	24.95	2011: 24.95 hours / 0.0096
	21/05/2011 00:58	23/05/2011 10:23	48220	48255	DORIS out of measurement mode due to Remote Bus Interface (RBI) status check error (EN-UNA-2011/0076)	57.42	

DORIS Instrument							
Year	**Start time**	**Stop time**	**Start orbit**	**Stop orbit**	**Description**	**Duration (Hours)**	**Total hours lost in year/ %**
	27/12/2011 13:49	27/12/2011 15:29	51389	51390	DORIS out of measurement mode: High Speed Multiplexer (HSM) Input Module reset (EN-UNA-2011/0249)	1.67	
2012	08/04/2012 12:28	No further data	52866	--	Communication loss	NA	NA

6. KA-BAND AND ARTEMIS UNAVAILABILITIES

In this section the ground stations and the ARTEMIS data-rely spacecraft unavailalbilities are reported in Tables 6 and 7 respectively. Unavailability periods are derived from [R - 2].

During daytime time ARTEMIS/Esrin unavailabilities have no impact on RA2, MWR or DORIS data availability, as these data are nominally not acquired by the Esrin station between 6:00 and 18:00 UTC.

Table 6. List of Ka-Band unavailability periods

Ka-BAND UNAVAILABILITIES		
Year	**Start time**	**Stop time**
2007	03/04/2007 02:27	03/04/2007 06:53
	17/07/2007 02:29	17/07/2007 06:50
	24/09/2007 12:27	26/09/2007 13:10
2008	12/02/2008 03:38	12/02/2008 08:51
	22/04/2008 02:14	22/04/2008 07:25
	01/07/2008 02:19	01/07/2008 07:09
	23/08/2008 09:10	23/08/2008 09:28
	09/09/2008 02:29	09/09/2008 06:52
	18/11/2008 02:38	18/11/2008 06:44
2009	27/01/2009 02:09	27/01/2009 06:50
	07/04/2009 02:11	07/04/2009 07:30
	21/07/2009 02:32	21/07/2009 08:25
	28/09/2009 02:32	29/09/2009 06:57
	29/09/2009 02:32	29/09/2009 06:57
2010	16/02/2010 01:34	16/02/2010 08:27
	27/04/2010 01:38	27/04/2010 07:37
	06/07/2010 01:30	06/07/2010 06:38
	21/10/2010 01:38	21/10/2010 23:58
	21/10/2010 23:59	26/10/2010 22:00
2011	14/10/2011 01:15	14/10/2011 06:26
2012	23/01/2012 06:45	23/01/2012 15:13
	01/03/2012 00:37	01/03/2012 05:37

Table 7. List of Artemis/ESRIN unavailabilities

ARTEMIS/ESRIN UNAVAILABILITIES		
Year	**Start time**	**Stop time**
2003	20/04/2003 16:20:29	23/04/2003 11:15:00
	30/04/2003 00:41:22	14/05/2003 11:00:00
	15/05/2003 07:49:16	21/05/2003 08:50:00
	29/05/2003 07:34:51	29/05/2003 08:04:00
	07/06/2003 10:35:00	07/06/2003 11:15:00
	16/06/2003 07:01:23	16/06/2003 07:12:37
	14/07/2003 10:28:34	14/07/2003 14:13:00
	18/07/2003 03:49:39	18/07/2003 04:14:17

ARTEMIS/ESRIN UNAVAILABILITIES		
Year	**Start time**	**Stop time**
	29/07/2003 18:25:55	30/07/2003 14:45:00
	04/08/2003 06:32:59	05/08/2003 11:39:00
	06/08/2003 04:56:08	05/08/2003 05:17:45
	27/08/2003 23:11:00	28/08/2003 12:20:00
	06/09/2003 04:17:00	07/09/2003 19:27:00
	29/09/2003 03:20:00	29/09/2003 16:15:00
	13/10/2003 09:22:41	13/10/2003 09:44:37
	18/10/2003 11:02:04	18/10/2003 11:55:00
	15/07/2003 06:27:38	15/07/2003 07:04:33
	19/07/2003 06:04:42	19/07/2003 06:34:22
	31/07/2003 03:08:49	31/07/2003 03:29:36
	01/08/2003 05:53:14	01/08/2003 06:25:35
	06/08/2003 06:36:15	06/08/2003 07:13:15
	29/08/2003 06:15:41	29/08/2003 06:45:49
	08/09/2003 04:18:51	08/09/2003 04:41:57
	30/09/2003 06:13:04	30/09/2003 06:39:45
	10/10/2003 10:59:24	10/10/2003 11:16:40
	11/10/2003 10:27:10	11/10/2003 10:47:03
	17/10/2003 10:35:19	17/10/2003 10:57:55
	18/10/2003 08:32:01	18/10/2003 08:44:06
	18/10/2003 10:03:04	18/10/2003 10:28:10
	19/10/2003 02:55:37	19/10/2003 03:16:59
	19/10/2003 07:51:05	19/10/2003 08:18:13
	19/10/2003 09:36:14	19/10/2003 09:55:18
	22/10/2003 09:36:24	22/10/2003 10:01:09
	23/10/2003 10:52:16	23/10/2003 11:08:44
	27/10/2003 10:25:20	27/10/2003 10:44:00
	28/10/2003 06:33:22	28/10/2003 06:57:29
	28/10/2003 08:11:18	28/10/2003 08:27:48
	28/10/2003 09:52:40	28/10/2003 10:13:34
	15/11/2003 10:24:28	15/11/2003 10:41:00
	16/11/2003 01:50:29	16/11/2003 01:58:00
	02/12/2003 01:47:34	02/12/2003 01:58:31
	01/12/2003 22:35:00	01/12/2003 23:43:00
	08/12/2003 10:24:56	08/12/2003 10:41:18
	09/12/2003 02:19:00	09/12/2003 02:23:23
2004	17/01/2004 02:34:11	17/01/2004 02:47:55
	16/01/2004 12:51:03	16/01/2004 13:12:00
	01/02/2004 10:06:34	01/02/2004 10:22:00
	07/02/2004 13:38:22	07/02/2004 13:58:00
	08/02/2004 02:39:39	08/02/2004 02:51:44
	08/02/2004 04:16:25	08/02/2004 04:24:11
	08/02/2004 05:51:05	08/02/2004 06:05:27
	08/02/2004 07:31:06	08/02/2004 08:04:37
	09/02/2004 08:46:12	09/02/2004 09:09:37
	12/03/2004 07:28:38	12/03/2004 11:38:00
	13/03/2004 01:48:33	13/03/2004 01:54:05
	13/03/2004 13:22:00	13/03/2004 14:45:00
	14/03/2004 02:40:16	14/03/2004 02:53:39
	18/03/2004 10:27:19	18/03/2004 11:12:14
	29/03/2004 16:32:00	29/03/2004 16:54:00
	30/03/2004 02:36:47	30/03/2004 02:55:02
	07/04/2004 18:23:52	07/07/2004 20:54:00
	19/04/2004 08:39:36	19/04/2004 09:08:16

ARTEMIS/ESRIN UNAVAILABILITIES		
Year	**Start time**	**Stop time**
	04/06/2004 11:37:10	04/06/2004 12:35:00
	05/06/2004 02:36:59	05/06/2004 02:48:15
	17/06/2004 12:21:31	17/06/2004 20:49:12
	19/06/2004 21:17:44	19/06/2004 21:25:00
	19/06/2004 22:32:16	19/06/2004 23:11:48
	20/06/2004 00:08:44	20/06/2004 00:42:49
	29/06/2004 16:09:41	29/06/2004 19:45:00
	04/07/2004 23:43:44	04/07/2004 23:54:00
	09/07/2004 23:11:50	10/07/2004 00:03:00
	18/07/2004 06:10:00	18/07/2004 06:38:07
	18/07/2004 06:10:00	18/07/2004 06:38:07
	18/07/2004 11:25:17	18/07/2004 16:08:19
	18/07/2004 11:25:17	18/07/2004 16:08:19
2006	24/01/2006 23:16:52	24/01/2006 23:48:12
	29/01/2006 07:08:36	29/01/2006 07:20:50
	31/01/2006 15:06:54	31/01/2006 15:11:32
	08/02/2006 20:27:23	08/02/2006 20:55:45
	18/02/2006 09:16:00	18/02/2006 09:27:00
	23/03/2006 18:09:17	23/03/2006 19:55:06
	27/03/2006 06:08:22	27/03/2006 10:52:11
	12/04/2006 20:48:14	12/04/2006 21:05:37
	12/04/2006 22:27:10	12/04/2006 22:35:44
	16/04/2006 11:05:53	16/04/2006 12:01:32
	16/04/2006 20:23:57	16/04/2006 20:47:58
	13/05/2006 11:19:42	13/05/2006 11:28:17
	22/05/2006 15:08:39	22/05/2006 16:22:00
	10/06/2006 11:00:19	10/06/2006 12:36:14
	21/06/2006 13:25:29	21/06/2006 13:29:32
	23/06/2006 16:10:00	24/06/2006 11:36:00
	04/07/2006 17:18:48	04/07/2006 17:56:49
	06/07/2006 06:20:16	06/07/2006 07:25:48
	06/07/2006 12:28:51	06/07/2006 12:38:00
	07/07/2006 00:29:53	07/07/2006 00:38:20
	07/07/2006 01:58:31	07/07/2006 02:10:10
	11/08/2006 10:33:53	11/08/2006 10:46:29
	12/08/2006 00:34:11	12/08/2006 02:14:47
	12/08/2006 02:46:56	12/08/2006 02:49:13
	26/08/2006 20:19:51	26/08/2006 20:45:00
	20/09/2006 16:32:14	20/09/2006 17:00:30
	22/09/2006 09:41:42	22/09/2006 09:58:37
	22/09/2006 10:07:28	22/09/2006 10:26:47
	11/10/2006 07:57:08	11/10/2006 08:13:18
	11/10/2006 07:57:08	11/10/2006 08:13:18
	26/09/2006 22:12:11	26/09/2006 23:52:47
	26/09/2006 23:52:47	27/09/2006 01:33:23
	27/09/2006 01:33:23	27/09/2006 03:13:58
	27/09/2006 03:13:58	27/09/2006 04:54:34
	27/09/2006 04:54:34	27/09/2006 06:35:10
	27/09/2006 21:40:34	27/09/2006 23:21:10
	27/09/2006 23:21:10	28/09/2006 01:01:46
	28/09/2006 01:01:46	28/09/2006 02:42:21
	28/09/2006 02:42:21	28/09/2006 04:22:57
	28/09/2006 04:22:57	28/09/2006 06:03:33
	28/09/2006 21:08:57	28/09/2006 22:49:33

ARTEMIS/ESRIN UNAVAILABILITIES		
Year	**Start time**	**Stop time**
	28/09/2006 22:49:33	29/09/2006 00:30:09
	29/09/2006 00:30:09	29/09/2006 02:10:44
	29/09/2006 02:10:44	29/09/2006 03:51:20
	29/09/2006 03:51:20	29/09/2006 05:31:56
	29/09/2006 22:17:56	29/09/2006 23:58:32
	29/09/2006 23:58:32	30/09/2006 01:39:07
	30/09/2006 01:39:07	30/09/2006 03:19:43
	30/09/2006 03:19:43	30/09/2006 05:00:19
	30/09/2006 21:46:19	30/09/2006 23:26:55
	30/09/2006 23:26:55	01/10/2006 01:07:30
	01/10/2006 01:07:30	01/10/2006 02:48:06
	01/10/2006 02:48:06	01/10/2006 04:28:42
	20/10/2006 05:08:24	20/10/2006 05:34:59
	26/10/2006 16:29:17	26/10/2006 16:50:36
	19/11/2006 09:31:47	19/11/2006 10:03:33
	24/11/2006 11:28:16	24/11/2006 11:38:02
	28/11/2006 14:47:54	28/11/2006 14:53:50
	29/11/2006 21:37:50	30/11/2006 08:16:16
	08/06/2007 16:24:22	08/06/2007 16:41:27
	12/06/2007 15:54:44	12/06/2007 16:26:38
	04/07/2007 12:21:05	04/07/2007 12:40:03
	14/07/2007 17:16:42	14/07/2007 21:00:52
	23/07/2007 17:42:26	23/07/2007 23:04:54
2007	17/09/2007 19:04:05	17/09/2007 19:22:00
	29/10/2007 11:23:24	29/10/2007 12:16:08
	15/11/2007 10:48:57	15/11/2007 10:56:19
	15/11/2007 11:39:53	15/11/2007 11:43:59
	16/11/2007 15:20:00	16/11/2007 22:00:00
	28/12/2007 04:21:15	28/12/2007 06:02:26
	08/01/2008 10:18:48	08/01/2008 10:55:43
	16/01/2008 16:48:03	16/01/2008 16:57:44
	16/01/2008 17:19:07	16/01/2008 17:29:30
	03/02/2008 18:13:22	03/02/2008 18:18:41
	07/02/2008 02:36:33	07/02/2008 03:30:25
	07/02/2008 12:23:53	07/02/2008 14:29:28
	08/02/2008 15:26:28	08/02/2008 15:45:27
	24/02/2008 15:46:26	24/02/2008 16:24:40
	25/02/2008 13:10:37	25/02/2008 13:15:52
	01/03/2008 21:36:13	01/03/2008 21:46:19
	02/03/2008 10:47:33	02/03/2008 10:58:49
	05/03/2008 00:52:36	05/03/2008 01:22:38
2008	29/03/2008 02:56:23	29/03/2008 03:22:55
	07/04/2008 07:57:09	07/04/2008 08:08:33
	07/04/2008 07:57:09	07/04/2008 08:23:21
	09/04/2008 01:23:34	09/04/2008 05:23:07
	17/04/2008 00:04:06	17/04/2008 00:31:55
	26/04/2008 10:50:29	26/04/2008 12:11:49
	29/04/2008 06:27:26	29/04/2008 08:11:40
	24/05/2008 11:37:13	24/05/2008 11:56:29
	24/05/2008 18:22:06	24/05/2008 18:28:11
	24/05/2008 19:15:45	24/05/2008 19:28:20
	24/05/2008 20:58:59	24/05/2008 21:19:09
	31/05/2008 17:45:14	31/05/2008 17:49:05
	16/06/2008 09:46:03	16/06/2008 10:04:59

ARTEMIS/ESRIN UNAVAILABILITIES		
Year	**Start time**	**Stop time**
	18/06/2008 08:42:49	18/06/2008 09:04:00
	29/06/2008 19:17:07	29/06/2008 19:26:07
	29/06/2008 20:34:19	29/06/2008 20:42:19
	12/08/2008 08:56:07	12/08/2008 09:02:40
	11/09/2008 21:37:34	11/09/2008 21:58:27
	11/09/2008 23:16:59	11/09/2008 23:40:16
	12/09/2008 00:49:13	12/09/2008 01:19:11
	17/09/2008 22:32:53	17/09/2008 23:35:26
	17/09/2008 22:32:53	17/09/2008 23:35:26
	29/09/2008 09:46:03	29/09/2008 10:11:41
	29/09/2008 11:14:46	29/09/2008 12:08:10
	03/10/2008 11:56:56	03/10/2008 14:32:14
	31/10/2008 09:27:26	31/10/2008 09:46:33
	13/11/2008 16:07:15	13/11/2008 16:21:23
	13/11/2008 16:57:11	13/11/2008 17:03:00
	30/11/2008 21:54:56	30/11/2008 23:35:32
2009	07/02/2009 22:54:19	08/02/2009 06:11:09
	17/02/2009 15:39:06	17/02/2009 15:44:00
	17/02/2009 16:39:58	17/02/2009 16:52:12
	16/03/2009 06:46:59	16/03/2009 07:20:52
	28/04/2009 13:49:11	28/04/2009 15:29:47
	28/04/2009 15:29:47	28/04/2009 17:10:23
	28/04/2009 17:10:23	28/04/2009 18:50:59
	28/04/2009 18:50:59	28/04/2009 20:31:35
	28/04/2009 20:31:35	28/04/2009 22:12:11
	28/04/2009 22:12:11	28/04/2009 23:52:47
	28/04/2009 23:52:47	29/04/2009 01:33:23
	29/04/2009 01:33:23	29/04/2009 03:13:58
	29/04/2009 03:13:58	29/04/2009 04:54:34
	29/04/2009 04:54:34	29/04/2009 06:35:10
	29/04/2009 06:35:10	29/04/2009 08:15:46
	29/04/2009 08:15:46	29/04/2009 09:56:22
	29/04/2009 09:56:22	29/04/2009 11:36:58
	22/06/2009 21:11:11	22/06/2009 21:32:10
	22/06/2009 22:49:56	22/06/2009 23:04:59
	20/08/2009 01:35:29	20/08/2009 02:08:50
	24/08/2009 05:37:21	24/08/2009 06:24:34
	30/09/2009 04:49:03	30/09/2009 05:21:38
	27/10/2009 20:02:47	28/10/2009 12:24:09
	16/12/2009 18:28:42	16/12/2009 18:50:16
2010	31/01/2010 11:19:12	31/01/2010 11:56:03
	02/02/2010 02:34:22	02/02/2010 06:33:11
	06/02/2010 22:33:17	07/02/2010 23:05:07
	06/02/2010 23:27:57	07/02/2010 12:17:55
	09/04/2010 14:12:42	09/04/2010 14:16:19
	09/04/2010 15:38:39	09/04/2010 16:13:32
	12/05/2010 05:34:59	12/05/2010 05:57:10
	05/07/2010 15:32:04	05/07/2010 15:39:57
	12/08/2010 23:42:19	13/08/2010 00:01:40
	30/08/2010 17:28:00	30/08/2010 17:50:08
	02/09/2010 15:37:38	02/09/2010 15:56:39
	25/10/2010 11:10:18	25/10/2010 11:24:46
	02/12/2010 22:59:37	02/12/2010 23:35:18
	03/12/2010 00:25:21	03/12/2010 00:34:52

ARTEMIS/ESRIN UNAVAILABILITIES		
Year	**Start time**	**Stop time**
	02/12/2010 22:59:37	03/12/2010 00:34:52
	26/12/2010 22:08:51	26/12/2010 22:21:02
2011	03/01/2011 15:42:43	03/01/2011 15:45:03
	09/01/2011 07:45:36	09/01/2011 12:09:35
	12/01/2011 17:03:40	12/01/2011 23:21:56
	13/01/2011 22:11:48	13/01/2011 22:58:00
	06/02/2011 11:08:38	06/02/2011 11:53:10
	16/02/2011 23:04:25	16/02/2011 23:50:00
	18/02/2011 15:44:08	18/02/2011 15:57:30
	21/02/2011 04:12:52	21/02/2011 04:59:08
	20/02/2011 23:18:50	21/02/2011 11:42:22
	21/02/2011 15:39:24	21/02/2011 15:52:38
	16/03/2011 11:22:15	16/03/2011 11:58:14
	23/03/2011 10:50:43	23/03/2011 11:21:59
	25/03/2011 01:48:20	25/03/2011 02:21:12
	27/03/2011 00:46:51	27/03/2011 01:18:05
	17/04/2011 08:58:21	17/04/2011 11:10:47
	22/04/2011 07:35:43	22/04/2011 11:09:16
	23/05/2011 21:09:19	24/05/2011 00:31:45
	02/06/2011 06:16:40	02/06/2011 12:17:46
	02/06/2011 15:40:35	02/06/2011 15:51:36
	02/06/2011 15:53:30	02/06/2011 20:59:30
	02/06/2011 21:41:10	03/06/2011 07:22:47
	08/06/2011 04:20:41	08/06/2011 04:37:51
	08/06/2011 05:31:29	08/06/2011 06:17:46
	16/06/2011 02:19:02	16/06/2011 02:46:55
	16/06/2011 02:50:45	16/06/2011 04:18:44
	01/07/2011 09:49:20	01/07/2011 10:19:46
	01/07/2011 11:24:51	01/07/2011 11:47:28
	08/07/2011 08:53:00	08/07/2011 09:07:00
	24/07/2011 21:38:27	24/07/2011 22:24:58
	30/07/2011 09:45:18	30/07/2011 16:24:09
	29/09/2011 16:22:14	29/09/2011 17:38:19
2012	10/03/2012 17:49:03	10/03/2012 18:04:11
	22/03/2012 09:54:38	22/03/2012 11:27:37

APPENDIX 1. ENVISAT manoeuvres table

	Date	Start	End	Type
2002	02/03/2002	02:17:32.460	02:27:00.710	OCM, 1-burn
	02/03/2002	14:42:11.969	14:51:02.031	OCM, 1-burn
	05/03/2002	02:26:22.159	02:34:58.221	OCM, 1-burn
	03/04/2002	19:46:31.031	19:54:28.969	OCM, 1-burn
	04/04/2002	18:38:56.352	18:40:30.477	OCM, 1-burn
	05/04/2002	00:31:40.624	00:31:56.624	FCM, 1-burn
	19/04/2002	05:48:18.067	05:48:25.067	SFCM, 2-burn
	19/04/2002	06:38:33.554	06:38:42.554	SFCM, 2-burn
	09/05/2002	06:19:49.021	06:19:57.021	SFCM, 2-burn
	09/05/2002	07:10:11.710	07:10:17.710	SFCM, 2-burn
	01/06/2002	11:26:42.887	11:26:49.887	SFCM, 2-burn
	01/06/2002	12:17:03.666	12:17:08.666	SFCM, 2-burn
	06/07/2002	04:47:26.211	04:47:32.211	SFCM, 2-burn
	06/07/2002	05:37:46.757	05:37:49.757	SFCM, 2-burn
	06/08/2002	04:15:01.075	04:15:03.075	SFCM, 2-burn
	06/08/2002	05:05:13.558	05:05:20.558	SFCM, 2-burn
	26/08/2002	18:06:54.803	18:07:01.803	SFCM, 2-burn
	26/08/2002	18:57:16.497	18:57:19.497	SFCM, 2-burn
	10/09/2002	00:35:02.969	00:45:27.031	OCM, 1-burn
	11/09/2002	02:55:00.186	02:55:06.186	FCM, 1-burn
	25/09/2002	23:21:32.447	23:21:36.447	SFCM, 2-burn
	26/09/2002	00:11:49.088	00:11:55.088	SFCM, 2-burn
	17/10/2002	20:18:25.598	20:18:31.598	SFCM, 2-burn
	17/10/2002	21:08:44.295	21:08:53.295	SFCM, 2-burn
	07/11/2002	19:15:19.095	19:15:25.095	SFCM, 2-burn
	07/11/2002	20:05:37.636	20:05:45.636	SFCM, 2-burn
	29/11/2002	04:34:58.000	04:35:02.000	SFCM, 2-burn
	29/11/2002	05:25:19.869	05:25:24.869	SFCM, 2-burn
	18/12/2002	05:27:45.781	05:36:14.219	OCM, 1-burn
	18/12/2002	23:16:50.427	23:17:02.427	SFCM, 1-burn
2003	14/01/2003	01:54:45.150	01:54:48.150	SFCM, 2-burn
	14/01/2003	02:45:03.813	02:45:09.813	SFCM, 2-burn
	12/02/2003	00:04:16.532	00:04:24.532	SFCM, 1-burn
	21/02/2003	04:42:25.000	04:52:52.000	OCM, 1-burn
	04/03/2003	00:50:42.147	00:50:50.147	SFCM, 1-burn
	04/04/2003	01:40:39.318	01:40:49.318	SFCM, 1-burn
	14/05/2003	23:39:41.000	23:39:47.000	SFCM, 1-burn
	20/05/2003	05:11:20.812	05:22:59.187	OCM, 1-burn
	07/06/2003	02:07:43.640	02:07:50.640	SFCM, 1-burn

	Date	Start	End	Type
	11/07/2003	01:58:12.691	01:58:15.691	SFCM, 2-burn
	11/07/2003	02:48:31.793	02:48:35.793	SFCM, 2-burn
	15/08/2003	02:30:57.000	02:31:03.000	SFCM, 1-burn
	30/09/2003	01:40:20.730	01:40:27.730	SFCM, 1-burn
	28/10/2003	05:55:46.362	06:09:12.050	OCM, 1-burn
	31/10/2003	02:12:37.633	02:12:52.633	SFCM, 1-burn
	19/11/2003	00:01:58.500	00:02:01.500	SFCM, 2-burn
	19/11/2003	00:52:16.985	00:52:22.985	SFCM, 2-burn
	15/12/2003	22:01:55.500	22:02:04.500	SFCM, 1-burn
	26/12/2003	22:02:58.500	22:03:01.500	SFCM, 1-burn
2004	22/01/2004	00:53:55.000	00:54:05.000	SFCM, 1-burn
	26/01/2004	23:25:35.000	23:25:39.000	SFCM, 1-burn
	04/02/2004	05:46:06.531	05:57:33.469	OCM, 1-burn
	05/02/2004	12:16:49.016	12:16:51.016	SFCM, 1-burn
	24/02/2004	12:48:07.090	12:48:13.090	SFCM, 1-burn
	07/04/2004	21:04:58.000	21:05:02.000	SFCM, 1-burn
	14/04/2004	05:42:29.812	05:54:28.187	OCM, 1-burn
	07/05/2004	02:08:24.500	02:08:31.500	SFCM, 1-burn
	30/06/2004	09:07:57.000	09:08:03.000	SFCM, 1-burn
	17/08/2004	03:03:48.500	03:03:53.500	SFCM, 1-burn
	01/09/2004	23:51:55.500	23:52:04.500	SFCM, 1-burn
	03/09/2004	00:43:55.000	00:44:05.000	SFCM, 1-burn
	21/09/2004	05:14:05.031	05:28:46.969	OCM, 1-burn
	24/09/2004	04:53:05.817	04:53:13.817	SFCM, 1-burn
	22/10/2004	04:19:50.500	04:20:09.500	SFCM, 2-burn
	22/10/2004	05:59:51.000	06:00:09.000	SFCM, 2-burn
	12/11/2004	02:07:25.140	02:07:34.140	SFCM, 1-burn
	17/12/2004	02:03:15.500	02:03:20.500	SFCM, 1-burn
2005	06/01/2005	00:09:56.500	00:10:03.500	SFCM, 1-burn
	07/01/2005	05:24:45.375	05:38:20.625	OCM, 1-burn
	18/02/2005	02:22:52.500	02:22:56.500	SFCM, 1-burn
	17/03/2005	05:50:53.656	06:05:59.344	OCM, 1-burn
	30/03/2005	23:45:22.723	23:45:28.723	SFCM, 1-burn
	01/04/2005	23:36:59.500	23:37:00.500	SFCM, 1-burn
	20/05/2005	01:09:30.000	01:09:34.000	SFCM, 1-burn
	08/06/2005	20:06:08.420	20:06:14.420	SFCM, 1-burn
	09/08/2005	23:45:12.500	23:45:17.500	SFCM, 1-burn
	07/09/2005	06:19:20.969	06:35:59.031	OCM, 1-burn
	06/10/2005	02:18:38.000	02:18:42.000	SFCM, 1-burn
	02/12/2005	00:09:52.100	00:09:57.100	SFCM, 1-burn
2006	04/01/2006	05:00:32.000	05:00:36.000	SFCM, 1-burn

	Date	Start	End	Type
	10/01/2006	05:53:51.450	06:10:50.950	OCM, 1-burn
	19/01/2006	23:46:42.914	23:46:45.914	SFCM, 1-burn
	28/03/2006	05:32:47.825	05:51:37.513	OCM, 1-burn
	31/03/2006	05:48:06.822	05:48:12.822	SFCM, 1-burn
	01/06/2006	00:53:15.200	00:53:21.200	SFCM, 1-burn
	20/06/2006	01:17:54.500	01:18:15.500	SFCM, 2-burn
	20/06/2006	02:57:54.500	02:58:15.500	SFCM, 2-burn
	07/09/2006	16:40:00.000	17:20:00.000	OCM, 1-burn
	12/09/2006	03:18:49.678	03:18:56.678	SFCM, 1-burn
	13/09/2006	05:21:44.439	05:39:55.377	OCM, 1-burn
	15/11/2006	03:07:21.281	03:07:26.281	SFCM, 1-burn
	20/12/2006	23:38:27.000	23:38:29.000	OCM, 1-burn
2007	23/01/2007	04:32:33.157	04:51:16.469	OCM, 1-burn
	24/01/2007	02:02:47.000	02:02:53.000	SFCM, 1-burn
	22/02/2007	03:05:44.321	03:05:45.321	OCM, 1-burn
	03/04/2007	04:34:09.342	04:49:40.217	OCM, 1-burn
	05/04/2007	03:04:35.500	03:04:38.500	SFCM, 1-burn
	16/05/2007	03:36:18.500	03:36:21.500	SFCM, 1-burn
	15/06/2007	01:36:14.400	01:36:16.400	SFCM, 1-burn
	10/07/2007	02:59:59.000	03:00:01.000	SFCM, 1-burn
	17/07/2007	04:40:53.716	04:43:08.986	OCM, 1-burn
	18/07/2007	03:07:24.085	03:07:28.085	SFCM, 1-burn
	09/08/2007	02:59:03.968	02:59:04.968	SFCM, 1-burn
	24/09/2007	12:33:00.000	13:04:01.000	OCM, 1-burn
	25/09/2007	10:10:00.000	10:10:01.000	OCM, 1-burn
	27/09/2007	05:15:52.597	05:30:41.403	OCM, 1-burn
	28/09/2007	03:15:31.268	03:15:34.268	SFCM, 1-burn
	25/10/2007	02:59:41.413	02:59:43.413	SFCM, 1-burn
	29/11/2007	03:18:53.296	03:18:57.296	SFCM, 1-burn
	04/12/2007	04:34:21.887	04:49:21.885	OCM, 1-burn
	07/12/2007	02:46:52.064	02:46:56.064	SFCM, 1-burn
2008	02/01/2008	20:29:00.103	20:29:01.103	SFCM, 1-burn
	10/01/2008	20:44:59.500	20:45:00.500	SFCM, 1-burn
	12/02/2008	04:34:50.940	04:48:54.640	OCM, 1-burn
	07/03/2008	03:16:36.618	03:16:37.618	SFCM, 1-burn
	18/04/2008	03:20:44.550	03:20:46.550	SFCM, 1-burn
	22/04/2008	04:36:31.774	04:47:14.218	OCM, 1-burn
	24/04/2008	14:11:02.500	14:11:07.500	SFCM, 1-burn
	30/05/2008	03:04:37.009	03:04:40.009	SFCM, 1-burn
	01/07/2008	04:40:44.750	04:43:05.916	OCM, 1-burn
	03/07/2008	03:14:28.918	03:14:30.918	SFCM, 2-burn

	Date	Start	End	Type
	03/07/2008	04:55:04.957	04:55:06.957	SFCM, 2-burn
	29/08/2008	01:36:08.500	01:36:09.500	SFCM, 1-burn
	09/09/2008	04:33:48.847	04:49:52.877	OCM, 1-burn
	10/09/2008	02:41:10.650	02:41:15.650	SFCM, 1-burn
	19/09/2008	02:53:50.500	02:53:51.500	SFCM, 1-burn
	07/11/2008	01:36:49.500	01:36:52.500	SFCM, 1-burn
	18/11/2008	04:35:00.694	04:48:39.376	OCM, 1-burn
	19/12/2008	03:11:59.000	03:12:01.000	SFCM, 1-burn
2009	27/01/2009	04:34:44.279	04:48:55.147	OCM, 1-burn
	28/01/2009	02:25:57.000	02:26:03.000	SFCM, 1-burn
	17/02/2009	03:27:17.889	03:27:19.889	SFCM, 1-burn
	13/03/2009	03:05:55.500	03:05:56.500	SFCM, 1-burn
	07/04/2009	04:33:52.716	04:49:46.186	OCM, 1-burn
	15/04/2009	22:16:02.500	22:16:11.500	SFCM, 2-burn
	15/04/2009	23:56:04.000	23:56:10.000	SFCM, 2-burn
	21/04/2009	02:49:59.000	02:50:01.000	SFCM, 1-burn
	20/05/2009	01:31:59.000	01:32:01.000	SFCM, 2-burn
	20/05/2009	03:12:34.985	03:12:36.985	SFCM, 2-burn
	09/07/2009	03:00:38.500	03:00:41.500	SFCM, 1-burn
	21/07/2009	04:39:47.045	04:44:00.147	OCM, 1-burn
	23/07/2009	01:59:58.500	02:00:01.500	SFCM, 2-burn
	23/07/2009	02:50:12.039	02:50:15.039	SFCM, 2-burn
	29/09/2009	04:33:08.721	04:50:25.907	OCM, 1-burn
	15/10/2009	01:56:08.000	01:56:10.000	SFCM, 1-burn
	04/11/2009	07:51:02.223	07:51:18.223	FCM, 2-burn
	04/11/2009	09:31:37.014	09:31:55.014	SFCM, 2-burn
	06/11/2009	02:34:34.000	02:34:36.000	SFCM, 1-burn
	03/12/2009	03:03:29.000	03:03:32.000	SFCM, 1-burn
	08/12/2009	04:34:06.800	04:49:22.496	OCM, 1-burn
	09/12/2009	22:18:13.000	22:18:19.000	SFCM, 1-burn
	18/12/2009	02:23:29.069	02:23:30.069	SFCM, 1-burn
2010	21/01/2010	02:02:55.000	02:03:23.000	FCM, 2-burn
	21/01/2010	03:43:32.492	03:43:57.492	SFCM, 2-burn
	22/01/2010	01:51:59.516	01:52:03.516	FCM, 1-burn
	16/02/2010	04:33:24.997	04:50:04.969	OCM, 1-burn
	22/02/2010	21:13:20.648	21:13:22.648	FCM, 2-burn
	22/02/2010	22:03:38.874	22:03:40.874	SFCM, 2-burn
	17/03/2010	17:23:55.500	17:24:04.500	FCM, 2-burn
	17/03/2010	19:04:30.945	19:04:40.945	SFCM, 2-burn
	17/04/2010	03:02:53.000	03:02:55.000	SFCM, 2-burn
	17/04/2010	04:43:29.024	04:43:31.024	SFCM, 2-burn

	Date	Start	End	Type
	27/04/2010	04:36:31.877	04:46:55.669	OCM, 1-burn
	28/05/2010	02:34:41.000	02:34:43.000	SFCM, 2-burn
	28/05/2010	04:15:16.937	04:15:18.937	SFCM, 2-burn
	25/06/2010	03:22:23.881	03:22:26.881	SFCM, 1-burn
	06/07/2010	04:36:55.329	04:46:31.861	OCM, 1-burn
	07/07/2010	02:03:01.000	02:03:03.000	SFCM, 1-burn
	30/07/2010	05:19:40.530	05:19:42.530	SFCM, 1-burn
	23/08/2010	21:40:59.890	21:41:01.890	SFCM, 1-burn
	24/09/2010	03:38:59.000	03:39:01.000	OCM, 1-burn
	15/10/2010	04:02:51.758	04:02:53.758	OCM, 1-burn
	22/10/2010	06:35:56.430	07:04:03.570	OCM, 1-burn
	22/10/2010	09:06:07.481	09:35:20.423	OCM, 1-burn
	26/10/2010	13:48:39.128	14:11:20.872	OCM, 1-burn
	26/10/2010	16:18:43.161	16:42:08.335	OCM, 1-burn
	04/11/2010	20:40:19.500	20:40:34.500	OCM, 1-burn
	04/11/2010	21:30:24.076	21:30:39.076	OCM, 1-burn
	22/11/2010	07:01:38.500	07:01:41.500	SFCM, 2-burn
	22/11/2010	08:41:52.517	08:41:55.517	SFCM, 2-burn
	25/11/2010	03:15:29.000	03:15:31.000	SFCM, 2-burn
	25/11/2010	04:55:43.054	04:55:45.054	SFCM, 2-burn
	01/12/2010	20:50:54.500	20:51:05.500	SFCM, 2-burn
	02/12/2010	00:11:22.375	00:11:33.375	SFCM, 2-burn
	17/12/2010	06:11:41.500	06:11:44.500	SFCM, 1-burn
2011	14/01/2011	01:57:44.500	01:57:47.500	SFCM, 1-burn
	18/02/2011	05:09:42.500	05:09:45.500	SFCM, 1-burn
	17/03/2011	00:50:58.500	00:51:01.500	SFCM, 2-burn
	17/03/2011	02:31:12.455	02:31:15.455	SFCM, 2-burn
	08/04/2011	09:42:46.500	09:42:53.500	SFCM, 1-burn
	16/04/2011	14:16:33.500	14:16:36.500	SFCM, 1-burn
	05/05/2011	01:02:19.000	01:02:27.000	SFCM, 1-burn
	01/06/2011	02:41:22.000	02:41:24.000	SFCM, 2-burn
	01/06/2011	03:31:24.644	03:31:26.644	SFCM, 2-burn
	16/06/2011	03:59:36.500	03:59:39.500	SFCM, 2-burn
	16/06/2011	05:39:50.525	05:39:53.525	SFCM, 2-burn
	13/07/2011	02:07:43.740	02:07:45.740	SFCM, 2-burn
	13/07/2011	03:47:57.722	03:47:59.722	SFCM, 2-burn
	11/08/2011	00:54:42.000	00:54:44.000	SFCM, 2-burn
	11/08/2011	02:34:55.940	02:34:57.940	SFCM, 2-burn
	17/08/2011	22:45:48.000	22:46:12.000	SFCM, 2-burn
	18/08/2011	00:26:02.989	00:26:24.989	SFCM, 2-burn
	23/08/2011	00:37:59.000	00:38:01.000	SFCM, 1-burn

	Date	Start	End	Type
	09/09/2011	02:30:46.500	02:30:49.500	SFCM, 2-burn
	09/09/2011	04:11:00.484	04:11:03.484	SFCM, 2-burn
	23/09/2011	01:18:32.527	01:18:35.527	SFCM, 2-burn
	23/09/2011	02:58:46.469	02:58:49.469	SFCM, 2-burn
	30/09/2011	03:36:59.000	03:37:01.000	SFCM, 2-burn
	30/09/2011	04:27:02.618	04:27:04.618	SFCM, 2-burn
	14/10/2011	03:10:44.053	03:10:51.947	SFCM, 1-burn
	28/10/2011	02:45:29.500	02:45:40.500	SFCM, 1-burn
	06/11/2011	14:57:51.000	14:58:09.000	SFCM, 2-burn
	06/11/2011	18:18:19.685	18:18:36.685	SFCM, 2-burn
	11/11/2011	03:07:33.500	03:07:36.500	SFCM, 2-burn
	11/11/2011	03:57:36.133	03:57:39.133	SFCM, 2-burn
	17/11/2011	02:44:25.816	02:44:35.816	SFCM, 1-burn
	25/11/2011	02:45:03.500	02:45:12.500	SFCM, 1-burn
	08/12/2011	02:57:30.000	02:57:42.000	SFCM, 1-burn
	25/12/2011	02:20:00.500	02:20:09.500	SFCM, 1-burn
2012	13/01/2012	03:43:05.000	03:43:11.000	SFCM, 1-burn
	01/02/2012	01:53:10.197	01:53:17.197	SFCM, 1-burn
	24/02/2012	04:16:52.066	04:17:04.066	SFCM, 1-burn
	01/03/2012	03:28:37.187	03:48:43.167	SFCM, 1-burn
	06/03/2012	03:47:03.000	03:47:07.000	SFCM, 1-burn
	15/03/2012	03:11:25.500	03:11:34.500	SFCM, 1-burn
	05/04/2012	04:17:42.309	04:17:49.309	SFCM, 1-burn