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GENERIC CALIBRATION PLAN

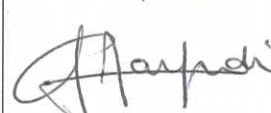
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Accepted by :

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Project concerned	DJ2	DCY2	DOA	D3S	DHY2	DJ3	DJCS	DSW			DOR	SMM
											X	

DORIS project internal management :

As DESIGNED :	NO	Managed by : CCM DORIS	Until : 02/2016
As BUILT :	NO		



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CONTROL ELEMENT

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DOCUMENT CHANGE RECORD

The modifications are listed in the Change Record section of the document and identified by change bars in affected sections.

Issue	Date	Modifications
0.0	01/02/05	Document creation
1.0	24/05/05	As per comments readback (DM CO-DM-D0-411-CN rév.1)
2.0	28/06/05	As per comments readback of latest issue (DM CO-DM-D0-411-CN rév.2)
2.1	28/06/07	As per DM CO-DM-D0-465-CN Rév 1 : New parameters added in Generic Calibration Plan.
2.2	17/04/08	DM CO-DM-D0-501-CN (REX Generic Calibration Plan).
2.3	06/04/09	Issue 4_01 of DIODE (CO-DM-D1122-534-CN) introducing new parameters : § 4.1 : transition matrix from platform Reference to TRL0 Reference (Antenna direction is already specific)
2.4	25/02/11	DGXX-S Generation of DORIS OBSW (DM FT-2544-CN) Identical on-board Transit Time for UT1-7 Modification of DIODE ZQS Parameters Lists in Appendix
2.5	11/06/2013	As per DM CO-DM-D0-2891-CN : orbital angular position type added,
2.6	12/11/2013	DM CO-DM-D0-2924-CN : explicitly mention the geoid model used, add informations about USO sensitivity to acceleration
2.7	14/01/2014	DM CO-DM-D0-2945-CN : explicitly mention the solar array rotation axis components if solar array is mobile
2.8	10/03/2015	DM CO-DM-D0-3020-CN : UT measurement mode policy; Auxiliary Data Management
2.9	08/04/2016	Report de la DM DORIS/SWOT 3094 panneaux solaires

APPLICABLE AND REFERENCE DOCUMENTS

The contents of applicable documents, in their common edition, have to be applied as a supplement to the text of the present document. If an applicable document, listed in the table below, is not called in the text of the present document with detailed application condition, he can be considered to be a reference document for supplementary benefit of information and, because of that, not mandatorily applicable.

Reference	Document title
CO-MU-D011-OP-13700-COF	AD 1 LOGICIEL DE SIMULATION DE MESURES DORIS : MANUEL D'UTILISATION
A.D.	AD 2 DORIS DGXX DATA USER MANUAL
CO-SP-D1-EA-15704-CN	AD 3 SPECIFICATION TECHNIQUE DE BESOIN DE L'INSTRUMENT DORIS DGXX-S
CO-SP-D13-EA-13050-CN	AD 4 EXIGENCES SYSTEME POUR L'ANTENNE BORD DORIS
DXS-ID-1000-0001-TSA	DR1. INTERFACE CONTROL DOCUMENT FOR DORIS DGXX-S
CO-SP-D0-OP-2460-CN	DR2. MODELLING OF DORIS INSTRUMENTS
CO-MU-D1122-OP-14994-CN	DR3. MANUEL ALGO DIODE

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TBC AND TBD LIST

(in case of no TBC or TBD mention "none" is mandatory in the table here after)

TBC/TBD	Section	Brief description
TBC	none	
TBD	none	

ABBREVIATIONS

Sigle	Definition
AD	Applicable Document
CNES	Centre National d'Etudes Spatiales (French Space Agency)
DORIS	Détermination d'Orbite par Doppler et Radiopositionnement Intégrés par Satellite (Doppler Orbitography and Radio Positioning Integrated by Satellite)
MVR	Mesure de Vitesse Radiale" (DORIS Receiver Unit)
N/A	Not Applicable
RD	Reference Document
TBC	To be confirmed
TBD	To be defined
BDR	Boîtier DORIS redondé
LSD	Logiciel de Simulation DORIS

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1 PURPOSE OF THE DOCUMENT

This generic document describes the information required, for each project whose satellite will carry a DORIS receiver, in order to :

- ◆ tune the DORIS receiver and software, before and during their flight on-board a satellite. The values of different parameters are necessary to ensure optimal parametrisation of on-board software, and ground processing software.
- ◆ define a test orbit as much representative of the flight as possible. This test orbit will in particular be used for DORIS receivers acceptance tests.

For each project, information and parameter values shall be provided in a dedicated document. Accuracy of these information may vary from one project to another, depending on the mission requirements. Some points may even be not applicable at all (e.g. no use of the geodetic bulletin, or no satellite mobile parts).

Some of the requirements below may be difficult to fulfill in the early phases of a project (e.g. 1 kg accuracy on the mass). The Lowest Significant Bit (LSB) values are those necessary for an ultimate accuracy of the orbit restitutions and/or for DIODE navigation function. Preliminary approximate values are sometimes possible, and will be specifically discussed and analysed with the project.

RANGE values precise the lowest and largest values fit for DIODE. Out of this range, an evolution of the software will be necessary.

2 APPLICABILITY

This document applies internally in the DORIS team to the redaction of the dedicated document for different projects.

Information required in chapters 3, 4 and 6 shall be provided by the project team.

Information required in chapter 5 shall be provided by the supplier of the DORIS receiver.

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3 OVERALL MISSION DESCRIPTION

A complete description of the mission is necessary, in order to check its compatibility with the DORIS receiver environment.

The requirements of the mission w.r.t. DORIS availability shall be precisely described. In particular, the following points should be specifically detailed :

3.1 BEGINNING OF LIFE

The satellite status at DORIS switch-on shall be precised :

Pointing	Motion
Sun pointed	3-axes stabilized
Earth pointed	Spinned :
Other : ...	spin axe : ...
	rotation speed : ...

3.2 PLANNED CHANGES OF THE ORBIT (IF ANY)

Planned changes in the orbit during the satellite lifetime (if the satellites has different missions to fulfill) shall be described. For each Mission Orbit, the characteristics mentioned in the following paragraph shall be detailed.

3.3 MISSION ORBIT CHARACTERISTICS

3.3.1 ORBIT ACQUISITION MANOEUVERS

The characteristics of each orbit acquisition manoeuvre shall be precised : will DORIS be ON, will DIODE be operating, detail of the dates, durations, directions and amplitudes of the thrusts.

FOR EACH ORBIT ACQUITION MANOEUVRE :

DORIS is : ON // OFF**DIODE is OPERATING // INACTIVE****Estimated beginning date**

UNIT = 2000 julian day, second LSB.= 10 seconds RANGE= ± 32767 days

Delta V on 3 axes Radial, Along-Track, Across-Track

UNIT = meter/second LSB.= 0.00001 RANGE= ± 21474.8

Duration

UNIT = second LSB.= 10 RANGE= 0 .. 655350

Accelerations on 3 axes Radial, Along-Track, Across-Track

UNIT = meter/second**2 LSB.= 0.000001 RANGE= ± 2147.48

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3.3.2 NOMINAL ORBIT

Orbital parameters of the nominal orbit will be used for the beacon programming :

- semi-major axis (km)
- eccentricity
- inclination (°)
- right ascension of ascending node (°)
- argument of perigee (°)

The value of the orbit altitude is also necessary to calculate the power of the signal received by the on-board antenna.

3.3.3 ORBIT CONTROL MANOEUVRES

Orbit control manoeuvres : directions, typical duration and acceleration of thrusts, frequency of the manoeuvres.

3.3.4 ATTITUDE MODE

Is the attitude controlled by thrusts, inertial wheels, ... ?

The nominal attitude of the satellite shall be described : Earth-pointed, Yaw-Steering, Attitude_TC, ...

Will Attitude TC be generated by the AOCS towards DIODE ? In this case its format must be agreed in the TM/TC definition document.

For each mode, the following parameters shall be detailed :

If DIODE Yaw_Steering model is used :

Environ -15 deg

UNIT = degree LSB.= 0.01 RANGE = ± 327.67

Environ +15 deg

UNIT = degree LSB.= 0.01 RANGE = ± 327.67

Solar Panel Angular Offset (if any)

UNIT = degree LSB.= 0.01 RANGE = ± 327.67

Environ -80 deg

UNIT = degree LSB.= 0.01 RANGE = ± 327.67

Environ +80 deg

UNIT = degree LSB.= 0.01 RANGE = ± 327.67

If the Attitude_TC is used :

Restitution Threshold 1 for Attitude

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UNIT = seconds LSB.= 0.01 RANGE = 0 .. 655.35

Restitution Threshold 2 for Attitude

UNIT = seconds LSB.= 0.01 RANGE = 0 .. 655.35

Programmation Threshold 1 for Attitude

UNIT = seconds LSB.= 0.01 RANGE = 0 .. 655.35

Programmation Threshold 2 for Attitude

UNIT = seconds LSB.= 0.01 RANGE = 0 .. 655.35

These two sets of Thresholds will impact the reaction of the on-board software :

- If an attitude quaternion is received with a delay shorter than **Threshold 1** , everything is normal.
- If the delay is comprised between **Threshold 1 and Threshold 2**, the software will ignore the quaternion, doing as if the attitude was geocentric, and signal it to the ground Control (by emitting an Anomaly report).
- If the delay is larger than **Threshold 2**, the software will also ignore the quaternion, doing as if the attitude was geocentric, but it will not emit an Anomaly Report anymore. This to avoid permanent emission of reports over extremely long periods.

Two sets of Thresholds will allow different values, and thus different behaviours of the software, depending on the fact that attitude quaternion is used both for Restitution (for which accuracy is required) and programming (for which accuracy is less critical, and thus geocentric attitude can be supposed during longer periods).

3.3.5 SATELLITE SAFEHOLD MODES (IF ANY)

Satellite SAFEHOLD MODE (if any) : is DORIS going to be turned OFF ?

If DORIS is turned OFF, when is it switched back ON (in SHM, in nominal pointing) ?

3.4 BULLETINS IN TELEMETRY

Authorisations must be set for each type of telemetry :

GESTION_TM_ITRF,

GESTION_TM_J2000,

GESTION_TM_GEOD,

GESTION_TM_ITRF_J2000,

GESTION_TM_DOPPLER,

GESTION_TM_ATTITUDE,

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GESTION_TM_AUXILIARY_DATA

TM generation either permanent or upon TC and enabling TC format, if any, must be agreed in the TM/TC definition document.

3.5 SPECIFIC USE OF THE GEODETIC BULLETINS

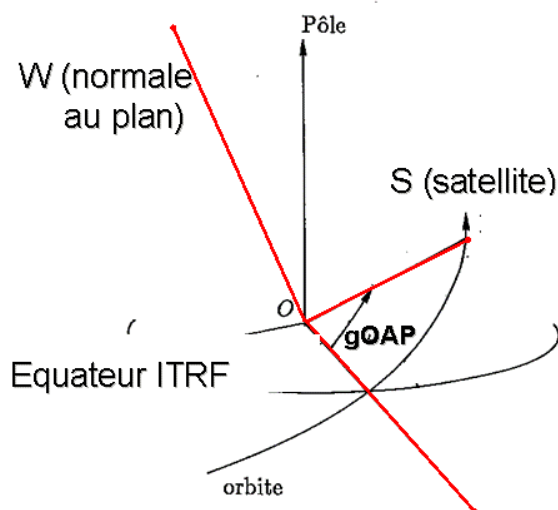
If DIODE geodetic bulletins are to be used, the following values are required :

- ◆ Number of orbits in the cycle
- ◆ Longitude of the first ascending node of the cycle (UNIT = degree, LSB. = 0.01)
- ◆ Orbital angular position type :

INERTIAL_OAP = Angle, measured in the orbital plane, between the ascending node position of the orbit and the satellite position.

Or :

GEODETIC_OAP = Angle between the intersection of the true Terrestrial Equator plan (ITRF) and the orbital plane, and the current satellite position,



- ◆ Type of reference surface : the altitude may be computed w.r.t. GEOID or ELLIPSOID

In each case, more information is required : precise definition of the geoid used (DIODE uses EIGEN 6S model interpolated on 2013/Jan/1st by using long term drift only (periodic terms not take into account) and truncated at order/degree 78)

, or ellipsoid parameters :

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Semi major axis of the reference ellipsoid (in m)

Flattening coefficient of the reference ellipsoid

3.6 UT MEASUREMENT MODE POLICY

Depending on the altitude of the satellite, and/or mission choices, the modes of different UTs must be defined :

MODE_DE_L_UT_1_EN_ROUTINE (VEILLE_UT, DESIGNATION_DIODE, TEST_UT, DASN, DASF, DAST)

MODE_DE_L_UT_2_EN_ROUTINE

MODE_DE_L_UT_3_EN_ROUTINE

MODE_DE_L_UT_4_EN_ROUTINE

MODE_DE_L_UT_5_EN_ROUTINE

MODE_DE_L_UT_6_EN_ROUTINE

MODE_DE_L_UT_7_EN_ROUTINE

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4 SATELLITE DESCRIPTION

The following parameters shall be used both for the test orbit, and for the flight. They shall be representative of the satellite characteristics, in order to make the test representative of the mission.

The values may need to be reactualized prior to launch in order to provide the most accurate information available at that time. In that case, the new parameters shall be provided **NOT LATER THAN FOUR MONTHS BEFORE THE LAUNCH AND ONE MONTH BEFORE THE LAST POSSIBILITY OF THE ON-BOARD SOFTWARE UPLOAD BEFORE THE LAUNCH.**

The values may need to be reactualized during the satellite lifetime, if any major change occurs.

4.1 SATELLITE VIEW AND REFERENCE FRAME

A drawing or views of the satellite shall be provided, indicating the satellite reference frame (X, Y and Z directions). The directions of the nadir, as well as Pitch, Roll, and Yaw axis, and the satellite speed shall be displayed.

The DORIS antenna shall be signalled on the graph, as well as other RF reflecting or transmitting equipment.

The transition matrix between the satellite reference frame and the orbital frame (Pitch, Roll and Yaw) shall be given. This matrix should be normalized, and the Diode convention will be carefully verified (to avoid any sign error).

Nine components of the transition matrix between the satellite Reference frame and the Orbital frame

UNIT = none LSB.= 0.000001 RANGE = ± 1.0

4.2 SATELLITE MOBILE PARTS (IF ANY)

Mass, Center of Mass, size and motion of each moving part shall be precised (particularly the solar array if it is mobile).

Solar array rotation axis (normalized vector given by its three components in the satellite reference frame) :

Solar array rotation axis direction X component

UNIT = none LSB.= 0.000001 RANGE = ± 1.000000

Solar array rotation axis direction Y component

UNIT = none LSB.= 0.000001 RANGE = ± 1.000000

Solar array rotation axis direction Z component

UNIT = none LSB.= 0.000001 RANGE = ± 1.000000

Rotation sign for the solar panels around the solar array rotation vector

+1 = angles are positive when the rotation is done in the trigonometric way,

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-1 = angles are positive when the rotation is done in the opposite trigonometric way (clockwise).

Angle between the reference direction and the position 0 of the angular coder for the rotation of the panel

UNIT = degrees LSB = 0.01 RANGE = ± 180.00

If solar panels are mobile, will a "solar panel position" TC be generated by AOCS or by ground segment towards DIODE. In this case, its format must be agreed in the TM/TC definition document. Also its maximum unavailability duration shall be specified (after this duration, the software switches into a predefined solar array pointing model).

Currently in DIODE :

0 = no solar array TC

1 = Jason-3 G2 TC

2 = SWOT SAP TC

Is there an offset angle (array not exactly directed towards the Sun) ?

4.3 MASS PROPERTIES

The values of :

- ◆ Beginning of Life Satellite mass (before orbit acquisition manoeuvre),
- ◆ Nominal Satellite total mass (beginning of mission, including moving parts if any),
- ◆ End of Life Satellite Mass

shall be given (UNIT = kilograms, LSB.= 1.0, DYN = 0 .. 65535).

The Centre of Mass coordinates shall be given in the Satellite Reference Frame :

X Coordinate of the satellite Center of Mass

UNIT = meter LSB.= 0.001 RANGE = ± 32.767

Y Coordinate of the satellite Center of Mass

UNIT = meter LSB.= 0.001 RANGE = ± 32.767

Z Coordinate of the satellite Center of Mass

UNIT = meter LSB.= 0.001 RANGE = ± 32.767

The Centre of Mass coordinates uncertainties and their evolution during the satellite lifetime shall be precised.

4.4 SATELLITE SURFACES

The satellite projected surfaces shall be given :

+X area

UNIT = m**2 LSB. = 0.001 RANGE = 0 .. 65.535

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-X area

UNIT = m**2 LSB.= 0.001 RANGE = 0 .. 65.535

+Y area

UNIT = m**2 LSB.= 0.001 RANGE = 0 .. 65.535

-Y area

UNIT = m**2 LSB.= 0.001 RANGE = 0 .. 65.535

+Z area

UNIT = m**2 LSB.= 0.001 RANGE = 0 .. 65.535

-Z area

UNIT = m**2 LSB.= 0.001 RANGE = 0 .. 65.535

Solar panel area (if independant of the satellite body)

UNIT = m**2 LSB.= 0.001 RANGE = 0 .. 65.535

The satellite surface properties (+X, -X, +Y, -Y, +Z, -Z and both faces of the solar panel : front size with solar cells and rear size) for the solar spectrum and the albedo / infrared spectrum, shall be given :

Specular reflectivity coefficient

UNIT = none LSB.= 0.001 RANGE = 0 .. 65.535

Diffuse reflectivity coefficient

UNIT = none LSB.= 0.001 RANGE = 0 .. 65.535

Emissivity coefficient (s.u)

UNIT = none LSB.= 0.001 RANGE = 0 .. 65.535

These values are very important for the solar pressure model, and shall be established as global values for each surface, taking into account the different properties of the different materials, and their respective contributions to the global coefficient.

4.5 DORIS ANTENNA REFERENCE POINTS

The DORIS Antenna Reference Point is described in DA2. The DORIS Reference point coordinates shall be given in the satellite reference frame :

X Coordinate of the DORIS Antenna reference point

UNIT = meter LSB.= 0.001 RANGE = ± 32.767

Y Coordinate of the DORIS Antenna reference point

UNIT = meter LSB.= 0.001 RANGE = ± 32.767

Z Coordinate of the DORIS Antenna reference point

UNIT = meter LSB.= 0.001 RANGE = ± 32.767

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DORIS antenna RF axis (normalized vector given by its three components in the satellite reference frame) :

DORIS axis direction X component

UNIT = none LSB.= 0.0001 RANGE = ± 3.2767

DORIS axis direction Y component

UNIT = none LSB.= 0.0001 RANGE = ± 3.2767

DORIS axis direction Z component

UNIT = none LSB.= 0.0001 RANGE = ± 3.2767

NB : DORIS antenna RF axis shall be nominally pointed towards geocenter.

4.6 DORIS ANTENNA ENVIRONMENT

Masks shall be nominally avoided in the field of view of the antenna. However, if any limited mask remains it shall be carefully described : size, distance from the antenna, RF characteristics.

Masks, emitting/reflecting surfaces will lead to an accommodation feasibility study.

4.7 CABLE LOSSES

Losses due to onboard cables, in dB, for each channel, from the antenna bracket to the BDR bracket, including intermediate connector brackets if any

Losses for each channel : LSB. = 0.1 dB

Cable length : UNIT = meter LSB.=0.1

These values are required to compute link budget and define level thresholds.

4.8 ATTITUDE AND USO FREQUENCY

The distance between the satellite Center of mass and the DORIS USO shall be known,.

In this purpose, the following characteristics will be of interest :

X, Y and Z coordinates of the DORIS Receiver reference point in the satellite Reference frame
(Unit = meters, required accuracy a few centimeters)

In order to identify the USO position, transition matrix between the satellite reference frame and the DORIS receiver Reference frame shall be given.

Nine components of the transition matrix between the satellite Reference frame and the DORIS receiver Reference frame (Unit=none -normalized coefficients-, required accuracy 10^{-3}).

The receiver Reference point and Reference frame are described in the DORIS Interface Control Document, for instance RD1 for DGXX-S series.

With these information, a few-centimeters accuracy may be achieved for the distance between the satellite center of mass and the DORIS USO. This should be sufficient to have a rough value of the distance between the satellite center of mass and the DORIS USO.

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Together with maximum values for angular speed and angular acceleration, and with the measured sensitivity of the USO(see next chapter), the impact of acceleration on the USO frequency will be estimated.

Maximum value of angular speed

(Unit = degrees/second)

Maximum value of angular acceleration

(Unit = degrees/second²)

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5 DORIS RECEIVER DESCRIPTION

5.1 DORIS RECEIVER PARAMETERS

Receiver clock frequency value (12 MHz or 36 MHz)

temps transit bord IT3 400 MHZ UT1 to 7

UNIT = second LSB.= 1.0^{-7} (obj. 1.0^{-8}) RANGE = 0 .. 65535 e-7

(An only value may be given for the seven UT)

Sensibility of the 400 MHz IT3 transit time wrt Doppler frequency

UNIT = second LSB.= 1.0^{-3} RANGE = 0 .. 65.535

The relevant formula is $TT(f) = TT(f_0) + coef*(f-f_0)/f_0$, see DR2 Modelling of DORIS instruments

temps transit bord IT3 2 GHZ UT1 to 7

UNIT = second LSB.= 1.0^{-7} (obj. 1.0^{-8}) RANGE = 0 .. 65535 e-7

(An only value may be given for the seven UT)

Sensibility of the 2 GHZ IT3 transit time wrt Doppler frequency

UNIT = second LSB.= 1.0^{-3} RANGE = 0 .. 65.535

(note that an only parameter is possible at present in DIODE to deal with both 400 MHz and 2 GHz sensitivity of IT3 transit time wrt Doppler frequency)

The relevant formula is $TT(f) = TT(f_0) + coef*(f-f_0)/f_0$, see DR2 Modelling of DORIS instruments

temps de transit doppler 400 MHZ UT1 to 7

UNIT = second LSB.= 1.0^{-7} (obj. 1.0^{-8}) RANGE = 0 .. 65535 e-7

(An only value may be given for the seven UT)

temps de transit doppler 2 GHZ UT1 to 7

UNIT = second LSB.= 1.0^{-7} (obj. 1.0^{-8}) RANGE = 0 .. 65535 e-7

(An only value may be given for the seven UT)

borne sup plage Doppler invalidant IT3

(two values, 2 GHz and 400 MHz channels)

UNIT = Hertz LSB.= 1.0 RANGE = 0 .. 65535

borne sup plage Doppler invalidant mesure chaînée (mesures à fréquence centrale)

UNIT = meter/second LSB.= 1.0 RANGE = 0 .. 65535

borne sup plage Doppler invalidant mesure non chaînée (mesures à fréquence centrale)

UNIT = meter/second LSB.= 1.0 RANGE = 0 .. 65535

Delay between the TDI_400_MHz pulse and the TDI_2_GHz pulse.

UNIT = second LSB.= 1/12 microsecond RANGE = ± 2.73 millisecond

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This delay has a positive value when the TDI_400_MHz pulse signal occurs after the TDI_2_GHz pulse signal.

Delay between reception of the Restart TC, and the first TDI UC pulse

UNIT = second LSB.= 100 nanoseconds RANGE = ± 3.2767 millisecond

This is related with FONC_BDT_080 requirement in SPECIFICATION TECHNIQUE DE BESOIN DE L'INSTRUMENT DORIS DGXX (DA3).

5.2 ANTENNA GAINS

Antenna gains tabulations :

θ_{onboard} value (angle between the onboard geocentric centripetal axis, and the propagation direction)	Values of gains (dBi) on the 400 MHz channel LSB = 1 dB	Values of gains (dBi) on the 2 GHz channel LSB = 1 dB
$\theta_{\text{onboard}} = 0^\circ$		
$\theta_{\text{onboard}} = 10^\circ$		
$\theta_{\text{onboard}} = 20^\circ$		
$\theta_{\text{onboard}} = 30^\circ$		
$\theta_{\text{onboard}} = 40^\circ$		
$\theta_{\text{onboard}} = 50^\circ$		
$\theta_{\text{onboard}} = 60^\circ$		
$\theta_{\text{onboard}} = 70^\circ$		

These values are required to compute the link budget and define level thresholds.

5.3 ON-BOARD USO FREQUENCY MODEL

On-board frequency model :

Fb (thermal, magnetic, ageing, radiations, ...) model of the on-board USO frequency.

This model is required for the measurement processings.

Measured sensitivity of the USO to acceleration

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(Unit = second²/meter or 10e-10/g)

5.4 ANTENNA PHASE CENTER

The antenna phase centers for both 400 MHz and 2 GHz channels shall be defined in the antenna reference frame, with an accuracy of :

± 5 mm required for both 400 MHz and 2 GHz channel (see DA4).

± 2 mm objective both 400 MHz and 2 GHz channel.

5.5 ANTENNA PHASE LAWS

Azimuth and Elevation Antenna phase laws shall be described according to the phase center defined here above.

LSB. = ± 2.0 deg.

These values are required for the ground software, users of the DA2 (parag. "Phase laws").

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6 TEST ORBIT CONTEXT

This test orbit shall use the values of all the parameters given in chapters 3, 4 and 5 (in order to be fully representative of the actual satellite mission).

Furthermore, the following parameters have to be specified :

6.1 ORBITAL PARAMETERS

Definition of the Reference orbit used for the satellite simulations : one set of parameters, that will be extrapolated by DIODE

Whole test Duration

UNIT = seconds LSB. = 10 RANGE = 0 .. 43200

(a duration shorter than ½ day is an operational request)

Initial TAI date

UNIT = (2000 julian days, seconds) LSB. = 10 seconds RANGE = ± 32767 days

(for TAI-UTC and UT1-UTC values, see below chapter TIME REFERENCE)

Initial X position in the ITRF reference frame

UNIT = meter LSB. = 0.001 RANGE = ± 32.767

Initial Y position in the ITRF reference frame

UNIT = meter LSB. = 0.001 RANGE = ± 32.767

Initial Z position in the ITRF reference frame

UNIT = meter LSB. = 0.001 RANGE = ± 32.767

Initial Xdot relative velocity wrt ITRF reference frame

UNIT = meter/second LSB. = 0.000001 RANGE = ± 0.032767

Initial Ydot relative velocity wrt ITRF reference frame

UNIT = meter/second LSB. = 0.000001 RANGE = ± 0.032767

Initial Zdot relative velocity wrt ITRF reference frame

UNIT = meter/second LSB. = 0.000001 RANGE = ± 0.032767

Presence or not of an orbit maintenance manoeuvre , and if so :

Manoeuvre beginning date

UNIT = (2000 julian days, seconds) LSB.= 10 seconds RANGE = ± 32767 days

Delta V on 3 axes Radial, Along-Track, Across-Track

UNIT = meter/second LSB.= 0.00001 RANGE = ± 21474.8

Manoeuvre duration

UNIT = seconds LSB.= 10 RANGE = ± 655350

accelerations on 3 axes Radial, Along-Track, Across-Track

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UNIT = meter/second**2

LSB.= 0.00001

RANGE = ± 2147.48

The gravity, airdrag and radiation pressure used to extrapolate the orbit, are those of DIODE software.

6.2 ATTITUDE PARAMETERS

Definition of the Reference attitude used for the satellite simulations : a file giving for each date (every 10 seconds) one set of quaternion parameters between J2000 and the satellite Reference Frame.

These quaternions will be used as an input in the L.S.D., which will simulate DORIS measurements along the chosen test orbit, taking into account the attitude information.

The reference format is specified in DA1, with comments in Annex 2.

6.3 ASSUMED ENVIRONMENTAL CONDITIONS

For the orbit simulation a reference set of environmental and earth parameters need to be defined. These are intended to be representative of the conditions at the time of the reference orbit.

6.3.1 POLE POSITION

The values for the test shall be precised :

U_pole

UNIT = arcseconds

LSB.= $1.0 \cdot 10^{-6}$

V_pole

UNIT = arcseconds

LSB.= $1.0 \cdot 10^{-6}$

6.3.2 TIME REFERENCE

UT1-UTC

UNIT = seconds

LSB.= $1.0 \cdot 10^{-6}$

TAI-UTC

UNIT = seconds

LSB.= 1.0

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ANNEXE 1 : DIODE INVOLVED PARAMETERS LIST

(intentionnally suppressed)

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ANNEXE 2 : ATTITUDE QUATERNIONS

The format of this information is specified in DA1. It is composed of two files :

An ASCII file precising the type of information, here :

```
QUATERNION_AVEC_VITESSE
DE_J2000_A_PLATE_FORME
```

And an ASCII file giving in each line :

jour julien (entier signe 16 bits)

secondes dans le jour julien (reel)

q1 (real part)	UNIT = none	REQ ACC = $1/(2^{15}-1)$	RANGE = ± 1.0
q2	UNIT = none	REQ ACC = $1/(2^{15}-1)$	RANGE = ± 1.0
q3	UNIT = none	REQ ACC = $1/(2^{15}-1)$	RANGE = ± 1.0
q4	UNIT = none	REQ ACC = $1/(2^{15}-1)$	RANGE = ± 1.0
petit_omega_1 ± 5.0	UNIT = degre/seconde	REQ ACC = $2.5 \cdot 10^{-9}$	RANGE =
petit_omega_2 ± 5.0	UNIT = degre/seconde	REQ ACC = $2.5 \cdot 10^{-9}$	RANGE =
petit_omega_3 ± 5.0	UNIT = degre/seconde	REQ ACC = $2.5 \cdot 10^{-9}$	RANGE =

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DIFFUSION**Diffusion Interne**

A. AURIOL	CNES - DCT/PO/AL	BP 2002
C. JAYLES	CNES - DCT/PO/AL	BP 2002
C. MANFREDI	CNES - DCT/PO/AL	BP 2002
O. DUMOND	CNES - DCT/PO/AL	BP 2002
P. BUZON	CNES - DCT/PO/AL	BP 2002
J.F. DUTREY	CNES - DCT/PO/AL	BP 2002
J.M. BENEZETH	LOGIQUAL – DCT/AQ/QP	
T.BONOMO	AKKA - DCT/PO/AL	BP 2002

Diffusion Externe

J.P CHAUVEAU	AKKA	
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