GSFC 424-28-28-02
REVISION B

UNIQUE INSTRUMENT INTERFACE DOCUMENT (UIID)
FOR THE
OZONE MONITORING INSTRUMENT (OMI)
SYSTEM

EOS AURA PROJECT

JULY 2002

GODDARD SPACE FLIGHT CENTER
GREENBELT, MARYLAND

GSFC 424-28-28-02

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NASA Goddard Space Flight Center
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EOS AURA PROJECT

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CHANGE RECORD PAGE

DOCUMENT TITLE: Unique Instrument Interface Document (UIID) for the EOS Ozone Monitoring Instrument (OMI) System, EOS Aura Project

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ISSUE	DATE	PAGES AFFECTED	DESCRIPTION
Original	09/98	All	This Release (Doc. Number 424-28-28-02) is the baselined version.
CH-01	12/10/98	Pages iii, iv and 5-5	CCR 424-12-28-002.
CH-02	9/99	All pages excluding 3-2, 3-3, 3-4, 3-5, and A-2	Approved CCR 424-12-28-004 incorporates Change 2 (CH-02) to this document. All modifications related to CH-02 are indicated by unlabeled change bars in the CH-02 version of the document and establish the formal change record.
Revision A	9/99	All	CCR 424-12-28-004 also simultaneously approves Revision A to this document. Revision A incorporates all CH-01 and CH-02 modifications and removes all change bars.
CH-01	11/28/00	iii, iv, 5-5	Approved by CCR 424-12-28-005 and CCR 424-12-28-006
CH-02	01/29/01	iii, iv, v, 5-5, 5-6	Approved by CCR 424-12-28-007 and CCR 424-12-28-008
CH-03	03/02/01	iii, iv, 5-6	Approved by CCR 424-12-28-012

CHANGE RECORD PAGE

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ISSUE	DATE	PAGES AFFECTED	DESCRIPTION
CH-04	08/02/01	Pages iv, v, vi, vii, 5-6 through 5-10	Approved by CCR 424-12-28-014.
CH-05	08/10/01	Pages iv, v, 5-9, 5-10	Approved by CCR 424-12-28-013 and CCR 424-12-28-015.
CH-06	12/14/01	Pages iv, v, 5-10, 5-11	Approved by CCR 424-12-28-018.
CH-07	02/13/02	Pages iv, v, vi, 5-10, 5-11	Approved by CCR 424-12-28-017 and CCR 424-12-28-020.
CH-08	July 2002	All	Approved by CCR 424-12-28-019
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CH-01	08/05/02	Pages iv, v, 5-10	Approved by CCR 424-12-28-021
CH-02	01/05/03	Pages iv, v, 4-1, 5-11, 5-12	Approved by CCRs 424-12-28-022, 424-12-28-023, and 424-12-28-024
CH-03	04/15/04	Page, iv, v, 5-11	Approved by CCR 424-13-11-019

EOS 420-CM-05 (4/92)

DOCUMENT TITLE: Unique Instrument Interface Document (UIID) for the EOS Ozone Monitoring Instrument System, EOS Aura Project

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1.0 SCOPE

The purpose of the Unique Instrument Interface Document (UIID) is to define the special interface requirements that are unique to the instrument system. Interface elements not addressed in this UIID are assumed to be compatible with the interface requirements of the EOS General Interface Requirements Document (GIRD).

The information contained herein establishes the constraints that must be adhered to by both the instrument developers and the spacecraft developer. The UIID data aids the proper planning and smooth flow of project development.

The interface documentation, referenced in Section 2 of this document, establishes the electrical, mechanical, thermal, and ground support equipment interfaces between the Ozone Monitoring Instrument (OMI), the Interface Adapter Module (IAM), and the EOS Aura Spacecraft. Section 3 of this document allocates resources for critical elements, such as weight, power, fields of view, pointing, thermal dissipation, and command and data handling. Constraints on the handling and operation of the instrument in shipment and integration and test are described in Section 4. Approved deviations/waivers to applicable documents are listed in Section 5.

The UIID for the EOS OMI System (OMIS), in conjunction with the EOS GIRD, establishes the OMIS/EOS Spacecraft interface. The OMI and the IAM comprise the OMIS. The reference documents in Section 2.1, establish details of the mechanical, thermal, electrical, and command and data handling interfaces between the OMIS and the EOS Aura spacecraft and between the OMI instrument and the IAM. The order of precedence for these documents is UIID, GIRD, OMI System ICD, OMI to IAM ICD.

Any changes to the UIID or GIRD must be approved by the EOS Aura Project Configuration Control Board.

2.0 APPLICABLE DOCUMENTS

The requirements stated in the most current released version of the documents listed in this section of the UIID apply to the OMI System. Section 5.0 of this UIID contains deviations and waivers to the applicable documents that have been approved for the OMI System.

DOCUMENT NO.	TITLE
422-11-12-01	General Interface Requirements Document (GIRD) for EOS Common Spacecraft/Instruments
424-11-13-05	Mission Assurance Requirements (MAR) for the Ozone Monitoring Instrument (OMI) /Interface Adapter Module (IAM)
C326377	Mechanical Interface Drawing, EOS-CHEM - OMI

2.1 REFERENCE DOCUMENTS

REFERENCE NO.	TITLE
D26478	Interface Control Document for the Ozone Monitoring Instrument System, EOS Common Spacecraft Project
990639	EOS Ozone Monitoring Instrument (OMI) to Interface Adapter Module (IAM) Interface Control Document (ICD)
424-11-13-03	Mission Assurance Requirements (MAR) for the Ozone Monitoring Instrument (OMI)

3.0 ALLOCATIONS

This section defines the EOS Aura Project resources that are specifically allocated to the EOS OMI System.

3.1 MECHANICAL ALLOCATIONS

3.1.1 Instrument Mechanical Envelope Allocation

The OMI Optical Assembly (OA) overall mechanical envelope allocation for launch and on-orbit conditions shall be as defined on sheet 4 of the OMI Mechanical Interface Drawing (MID). The OMI Electronics Assembly (EA) mechanical envelope allocation for launch and on-orbit conditions shall be as defined on sheet 15 of the OMI MID. The OMI IAM mechanical envelope allocation for launch and on-orbit conditions shall be as defined on sheet 22 of the OMI MID.

Dimensions, which include external instrument MLI and instrument provided connectors, shall not exceed the mechanical envelope allocation. The envelope for all OMI System inter-module cables shall be documented in the OMI System to spacecraft MID.

3.1.2 Field of View Allocation

The OMI Nadir Science Field-of-View allocation, inclusive of all stay-out-zones, and the OMI Solar Calibration Field-of-View allocation shall be as defined on sheet 7 of the OMI MID.

3.1.3 Mass Allocation

Optical Assembly	35 kg
Electronics Assembly	15 kg
EA to OA Inter-Module Cables	2 kg
Interface Adapter Module	14 kg
IAM to EA Inter-Module Cables	5 kg
Total Instrument	71 kg

Note: Total instrument system allocation includes contingency.

3.1.4 Pointing Allocation

Unless otherwise specified, accuracy and knowledge pointing allocation values represent the summation of individually root-sum-squared bias, drift, and jitter terms and are expressed in arcsec measured zero to peak (3σ). Additionally, unless otherwise specified, stability pointing allocations are expressed in arcsec measured peak to peak (3σ) over defined time intervals. Finally, all pointing allocations are applicable to the OMI Optical Assembly only.

3.1.4.1 Mission Requirements

Mission pointing requirements are based on instrument science requirements and represent total mission pointing requirements from the instrument boresight to the Spacecraft Reference Coordinate Frame (SRCF) (as defined in the GIRD).

Mission Requirements	Roll (X)	Pitch (Y)	Yaw (Z)	Note
Pointing Accuracy (arcsec 3σ)	866	866	866	-
Pointing Knowledge (arcsec 3σ)	87	87	87	-
Pointing Stability (arcsec 3σ) (Time Interval) 6 sec	87	87	87	-

The following sections allocate portions of the mission requirements to the spacecraft and the instrument. These allocations represent the maximum allowable instrument and spacecraft contributions to mission pointing accuracy, knowledge, and stability error. Unless otherwise specified, spacecraft and instrument allocations, when root-sum-squared, equal the mission requirement.

3.1.4.2 Spacecraft Allocation

Spacecraft pointing allocations are the spacecraft portion of the mission pointing requirements and represent pointing requirements placed on the spacecraft. Spacecraft pointing knowledge shall be measured from the instrument Interface Alignment Cube (IAC) to the SRCF. Spacecraft pointing accuracy and stability shall be measured from the spacecraft/instrument mounting interface (OMI OA mechanical datum) to the SRCF.

For the purpose of enhancing accountability and verification of compliance with individual requirements, in the category of pointing stability, the pointing stability allocations are separately specified as Observatory Level allocations and Spacecraft Bus Level allocations.

The Observatory Level pointing stability allocations (see below) represent the maximum errors that can be tolerated by the OMI optical assembly at the spacecraft/instrument interface in order to prevent unacceptable deterioration of gathered science data. Such errors depend on the combination of all environmental disturbances, including those produced by the OMIS OA, the other payload instruments, and the spacecraft.

The Spacecraft Bus Level pointing stability allocations represent the maximum contribution by the spacecraft bus to the pointing stability errors at the same interface, in the absence of disturbances generated by all of the instruments. Thus the Spacecraft Bus Level allocations represent performance requirement limits placed on the spacecraft bus.

Spacecraft Allocation	Roll (X)	Pitch (Y)	Yaw (Z)	Note
Pointing Accuracy (arcsec 3σ)	800	800	800	-
Pointing Knowledge (arcsec 3σ)	80	80	80	-
Observatory Level Pointing Stability (arcsec 3σ) (Time Interval) 6 sec	80	80	80	-
Spacecraft Bus Level Pointing Stability (arcsec 3σ) (Time Interval) 6 sec	(TBR)	(TBR)	(TBR)	-

3.1.4.3 Instrument Allocation

Instrument pointing allocations are the instrument portion of the mission pointing requirements and represent pointing requirements placed on the OMI OA. Instrument pointing knowledge shall be measured from the instrument boresight to the IAC. Instrument pointing accuracy and stability shall be measured from the instrument boresight to the spacecraft/instrument mounting interface (OMI OA mechanical datum).

Instrument Allocation	Roll (X)	Pitch (Y)	Yaw (Z)	Note
Pointing Accuracy (arcsec 3σ)	332	332	332	-
Pointing Knowledge (arcsec 3σ)	34	34	34	-
Pointing Stability (arcsec 3σ) (Time Interval) 6 sec	34	34	34	-

3.1.4.4 Co-Alignment Allocation

OMI imposes no instrument co-alignment requirements on the spacecraft.

3.1.4.5 Calibration Maneuvers

OMI imposes no calibration maneuver requirements on the spacecraft.

3.1.5 Instrument Mounting

The mounting plane (mounting points) of OMI OA shall be parallel to the XY plane relative to the spacecraft body frame. The spacecraft body frame is centered at the center of mass of the observatory with the +Z axis nominally normal to the nadir-facing instrument mounting surface, +X forward in the general direction of flight in normal operation, and Y normal to X and Z. Through the definition of a Master Reference Cube, this is the frame to which instrument bases are mechanically aligned. The spacecraft mounting configuration shall accommodate three kinematic mounts and orient the OMI Optical Assembly aperture view in the +Z direction (nadir) and the OMI Optical Assembly radiator in the +Y direction.

The mounting plane (mounting points) of OMI Electronics Assembly shall be parallel to the XY plane relative to the spacecraft body frame. The spacecraft mounting configuration shall accommodate hard mounts and orient OMI Electronics Assembly radiator in the +Y direction. The mounting plane (mounting points) of the IAM shall be parallel to the XY plane relative to the spacecraft body frame. The spacecraft mounting configuration shall accommodate hard mounts and orient the IAM radiators in the +Y and -Y directions.

3.2 THERMAL CONTROL ALLOCATION

3.2.1 Thermal Control Methods/Dissipations

The thermal control methods/dissipations allocations are given below.

Thermal Control Allocation	LOCAL RADIATOR (WATTS)	COLD PLATE (WATTS)
Optical Assembly	40	N/A
Electronics Assembly	42	N/A
EA to OA Inter-Module Cables	4	N/A
Interface Adapter Module	18	N/A
IAM to EA Inter-Module Cables	2	N/A
OMI System Total	86	N/A

Note: The dissipation data given represents only heat generated by the instrument system when it is drawing its full power allocation; it does not include absorbed spacecraft and environmental radiation.

3.2.2 Thermal Field of View Allocation

The OMI Optical Assembly and Electronics Assembly thermal Field-of-View allocations are illustrated on sheets 11-13 of the OMI MID. The Interface Adapter Module thermal Field-of-View allocation is illustrated on sheet 25 of the OMI MID.

Thermal field-of-view allocations are to be considered as an OMIS accommodation goal for the spacecraft. Intrusions into thermal fields-of-view may be allowed to properly integrate the entire OMIS complement on the spacecraft and will be evaluated on a case by case basis through thermal analysis. Approved intrusions will be documented in the OMI MID.

3.3 ELECTRICAL ALLOCATIONS

3.3.1 Power Allocations

Power Allocation	OMI (Watts)	IAM (Watts)
Launch Mode	0	0
Survival Mode	40	13
Operational Mode (2 Orbit Average)	66	20
Decontamination Mode (2 Orbit Average)	81	20
Operational Mode (Peak)	85	25
Decontamination Mode (Peak)	93	25

Note: Peak power is the maximum power averaged over any 10 msec period.

3.4 COMMAND AND DATA HANDLING ALLOCATION

3.4.1 Science Data Rate Allocation

The science data rate allocation below represents the OMIS (OMI and IAM) combined data rate allocation to the spacecraft.

	Average Data Rate	Peak Data Rate
Total	0.76 Mbps	1.08 Mbps

As a risk mitigation option for on-board spacecraft storage of OMIS generated data, the IAM shall provide the capability for loss-less data compression of OMI science data. Although the capability to decompress the OMI science data should not be precluded upon ground receipt, implementation of this option should not be exercised. Average/Peak data rates specified above are uncompressed rates and should be used when determining total OMIS data volume.

3.4.2 Remote Terminal Allocations

The number of functionally distinct MIL-STD-1553 Remote Terminals (addresses) allocated shall be limited to one (1) for the EOS OMIS. The RT address assignment shall be documented in the OMIS to spacecraft ICD (see section 5.1.4).

3.4.3 Spacecraft Ancillary Data Allocation

3.4.3.1 Spacecraft Data to Instrument (on-orbit)

On-orbit spacecraft ancillary data will be added to the OMI science data by the IAM (see section 3.4.4). The OMIS on-orbit spacecraft ancillary data requirements are listed in Table 3-1.

3.4.3.2 Spacecraft Data to Ground (post-processed)

The OMI System imposes no unique requirements on the spacecraft for telemetered spacecraft ancillary data.

3.4.4 OMI EA to IAM Command and Data Handling Interface

The OMI EA to IAM C&DH interface, shown in Figure 3-1, shall comprise two RS422 synchronous data lines and associated clock lines (1 Mbps maximum data rate/1 MHz clock each) for science (digital video) data transfer to the IAM, two RS422 asynchronous data lines (9.6 kbps) for commands/data from and telemetry to the IAM, a master clock signal from the instrument to the IAM, a command enable signal from the instrument to the IAM, a reset pulse from the IAM to the instrument for reset of the OMI electronics unit, and a sync signal (time mark pulse, once per second) from the IAM to the instrument for time synchronization.

Upon receipt, the IAM will format instrument science data into CCSDS Version 1 Source Packets (synchronized to the master clock signal) for transmission to the spacecraft. In addition, the IAM will similarly generate engineering packets upon receipt of instrument telemetry and insert them into the OMI science stream. A subset of this engineering telemetry as well as the IAM housekeeping telemetry will be supplied to the spacecraft in a housekeeping telemetry packet over the MIL-

STD-1553 bus. Finally, the IAM shall transfer its diagnostic data and ancillary data packets received over the MIL-STD-1553 bus to the OMI science stream. For ancillary data packets, the IAM shall replace the spacecraft APIDs in the CCSDS header with the appropriate OMI APIDs prior to transfer. All packets of OMI data created by the IAM will have an additional timestamp associated with the current master clock period.

For uplinked commands, the IAM will de-packetize and format commands for transfer to the instrument. The individual OMI instructions extracted from the command will be transferred to the EA when the "command enable" signal from the instrument is present. All commands sent to the EA during each master clock period will be echoed back in the OMI science/diagnostic stream.

The two orbit average data rate for the transfer of science and telemetry data to the IAM from the instrument shall not exceed 0.75 Mbps (a two orbit data volume of 8.90 Gbits).

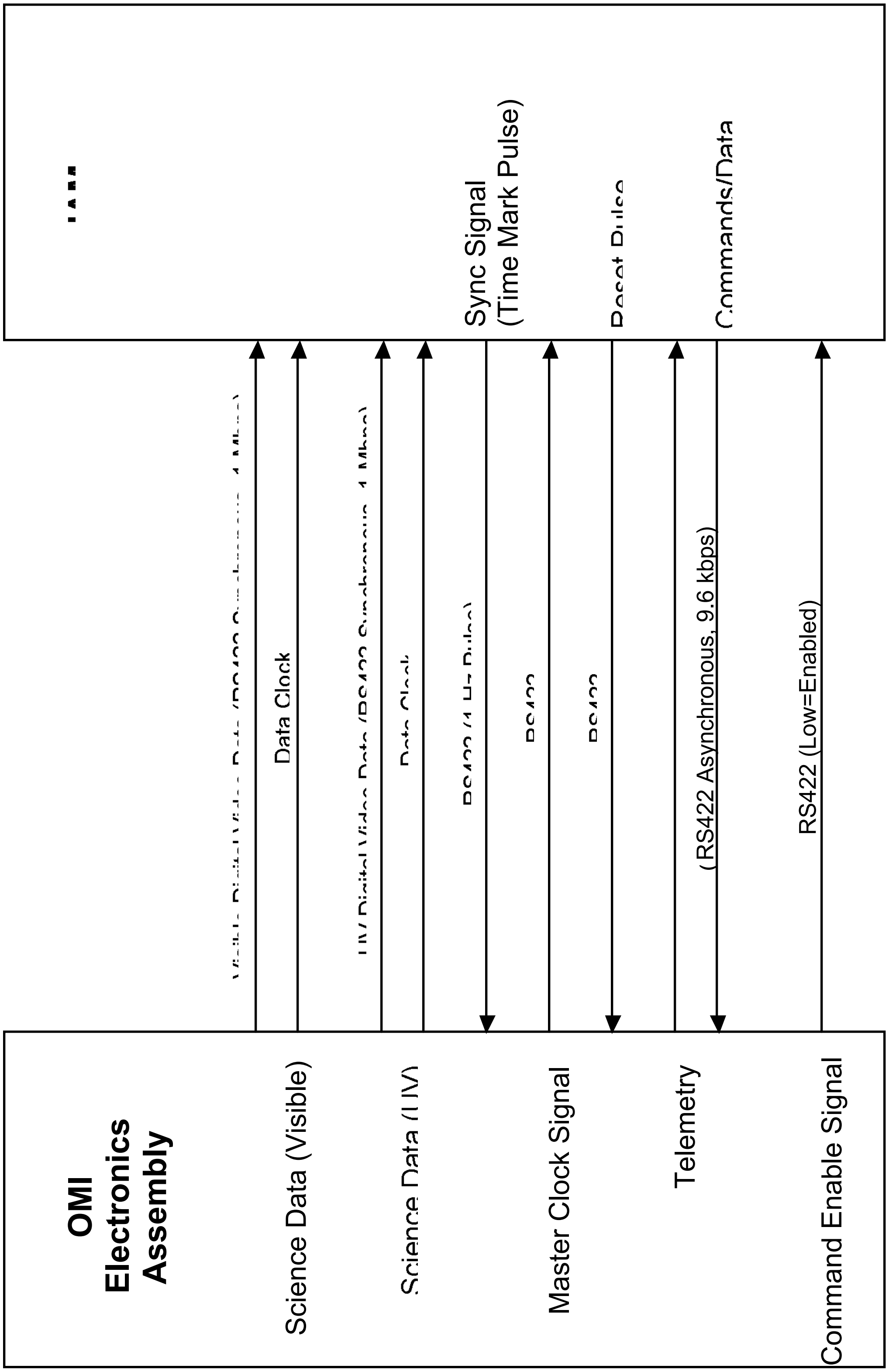

Figure 3-1. OMI EA to IAM Command and Data Handling Interface

Table 3-1

OMIS On-Orbit Spacecraft Ancillary Data Requirements

Spacecraft Parameter	Description	Knowledge; Resolution	Time Tag Accuracy; Latency	Frequency
Position	ECI XYZ	500 meters; 1 meter	50 msec; <0.5 sec	1 Hz
Velocity	ECI XYZ rates	0.1 meter/sec; 1mm/sec	50 msec; <0.5 sec	1 Hz
Attitude Rate (roll/pitch/yaw)	Euler angle rates	0.1 arcsec/sec; 0.01 arcsec/sec	50 msec; <0.5 sec	1 Hz
Sun Vector	Spacecraft to Sun XYZ	0.075 degrees; 0.01 degrees	50 msec; <0.5 sec	1 Hz
Time	Time signal for onboard data	10 msec; <15.2 µsec	1 msec; <0.5 sec	1 Hz

4.0 CONSTRAINTS

The information contained in this section defines any constraints in the operation or handling of the instrument that must be observed in order to prevent possible damage or degradation.

4.1 PURGE

A protective purge shall be provided for the OMI OA during ambient operation, storage, and transportation of the instrument until launch as defined in the OMIS to Spacecraft ICD.

4.2 ORBIT

In addition to the GIRD paragraph 9.1, the optical and thermal design of the OMI System shall be based on the following orbital design requirements levied on the Common Spacecraft for EOS Aura:

Nominal Orbit Altitude:	705 km
Ascending Node:	1:45 pm +/-15 min
Ground Track Repeatability:	+/-20 km, all latitudes, cross-track
Repeat Cycle:	233 revolution, 16 days

4.3 TELEMETRY MONITOR (TMON) REQUIREMENTS

In addition to TMONs required for on-orbit operations, OMI requires the use of a White Light Source (WLS) TMON for I&T. The WLS TMON will protect the WLS (a limited life item) against inadvertently being left on. The WLS TMON must trigger an action (of turning off the WLS) after detecting that the WLS has been "on" for 14 cycles of 64 seconds (896 seconds). (Ref. CCR 424-12-28-024) CH-02

5.0 DEVIATIONS/WAIVERS

The information contained in this section identifies all the deviations/waivers agreed upon by the EOS OMI Program Manager and the GSFC EOS Aura Project Manager.

5.1 GIRD DEVIATIONS/WAIVERS

5.1.1 Revised Instrument Input Voltage Requirements

For the OMI System, a deviation to the GIRD (Revision A, Change 4 R1) has been approved which modifies instrument input voltage requirements.

In lieu of the Primary Instrument Voltage requirement for spacecraft provided switched instrument power at +28 +7/-4 Vdc (GIRD paragraph 5.2.5.1.1), the spacecraft shall supply switched instrument power at the instrument's external electrical interface connector(s) at +29 ±2 Vdc. Additionally, during instrument power transient conditions, as specified in GIRD paragraph 5.2.5.2.3, the spacecraft supply voltage shall not deviate by more than ±2.9 volts about the supplied voltage.

In lieu of the Abnormal Operation Steady-State Voltage Limits requirement for instrument survival following steady-state voltages in the range of 0-50 Vdc (GIRD paragraph 5.2.5.1.4), under failure mode conditions the instrument shall survive, without permanent degradation, spacecraft steady state supply voltages in the range of 0 to 36 Vdc. In addition the instrument shall survive, without permanent degradation, a maximum spacecraft supply voltage of 42 Vdc for durations less than 10 ms.

(Ref. CCR 424-12-28-001)

5.1.2 Instrument Disturbance Torque

A deviation to GIRD (Revision A, Change 4 R1) section 3.10 has been approved for all instruments that potentially allows non-compliance with the constant, periodic, or linear force (assumes moment arm) disturbance torque limits governed by the GIRD under the following conditions.

Known and estimated instrument and Common spacecraft disturbances will be used as inputs to an appropriate model of the spacecraft dynamics to analytically determine the expected on-orbit pointing stability and jitter performance at each instrument interface. Calculated responses produced by the Aura Observatory pointing stability and jitter model will be used to assess whether instrument imposed pointing stability and jitter requirements on the observatory are being met.

The Aura Observatory pointing stability and jitter model will be updated throughout the program to reflect substantial changes to spacecraft/instrument models or disturbances. Approved disturbance profiles, which reflect the need for instrument disturbances to fall below the maximum levels specified in the GIRD in some frequency bands in order to accommodate exceedances in others, will be documented in the ICD between the Common spacecraft and each instrument.

If the calculated responses from the jitter and stability capability analysis indicate that any instrument pointing stability requirement is not being met with sufficient margin, the source(s) responsible for pointing stability degradation may be required to take measures to reduce or modify the profile(s) of their generated disturbances. Pointing stability non-compliance will be evaluated on a case by case basis by the Aura Project to determine the most effective solution toward compliance.

(Ref. CCR 424-12-28-001)

5.1.3 OMI Survival Heater Power

For OMI, a deviation to the GIRD (Revision A, Change 4 R1) has been approved which modifies allowable instrument survival heater bus power.

In lieu of the requirement for instrument survival heater power to be no more than 30% of the average instrument power (GIRD paragraph 4.6.1.3), OMI will be allocated 40 watts (average) for survival heater power during survival mode.

In addition, during transition from survival mode to operational mode, OMI shall be allowed to temporarily exceed their average power allocation for up to three orbits, in order to accommodate simultaneous use of the survival and operational power buses. Total OMI average power during this transition shall not exceed 81 watts.

(Ref. CCR 424-12-28-004)

5.1.4 Remote Terminal Address Assignment

For the OMI System, a deviation to the GIRD (Revision B), paragraph 6.5.5.4, Instrument RT Address Assignment, has been approved. The deviation removes the requirement for the RT address to be externally selectable. The RT address assignment shall be documented in the OMI System to spacecraft ICD.

(Ref. CCR 424-12-28-004)

5.1.5 Thermal Model Software

For OMI, a deviation to the GIRD (Revision A, Change 4 R1) has been approved which modifies thermal math model submittal requirements.

In lieu of the requirement to submit instrument thermal surface models in Thermal Radiation Analyzer System (TRASYS) format (GIRD paragraph 11.2.2) and instrument reduced node thermal models in Systems Improved Numerical Differencing Analyzer (SINDA) format (GIRD paragraph 11.2.3), OMI will submit instrument thermal surface models in Thermica and instrument reduced node thermal models in European Space Agency Thermal Analysis Network (ESATAN) to GSFC. GSFC will be responsible for model conversion to TRASYS and SINDA prior to delivery to the spacecraft.

(Ref. CCR 424-12-28-001)

5.1.6 Quiet Bus Ripple Current

For OMI, a deviation to the GIRD (Revision B) has been approved which modifies the allowable instrument reflected ripple current on the quiet bus.

In lieu of the requirement for peak-to-peak load current ripple generated by the instrument not to exceed 5% of the average current on the quiet bus (GIRD paragraph 5.2.5.2.4), OMI shall be allowed to generate a peak-to-peak load current ripple of up to 1.25 amps provided the electromagnetic interference requirements are being met.

(Ref. CCR 424-12-28-004)

5.1.7 IAM Survival Heater Power

For IAM, a deviation to the GIRD (Revision B, Change 2) has been approved which modifies allowable instrument survival heater bus power.

In lieu of the requirement for instrument survival heater power to be no more than 30% of the average instrument power (GIRD paragraph 4.6.1.3), IAM will be allocated 13 watts (average) for survival heater power during survival mode.

(Ref. CCR 424-12-28-019)

5.1.8 IAM Software Programming Language

For the IAM, a deviation to the GIRD (Revision B) has been approved which modifies allowable instrument software programming languages.

In lieu of the requirement to implement all instrument software using standard Ada, Fortran, or C (GIRD paragraph 8.2), the IAM shall also be allowed to implement software using C++.

(Ref. CCR 424-12-28-004)

5.1.9 Active Analog Telemetry

For OMI, a deviation to the GIRD (Revision B) Paragraphs 5.1.1 and 5.2.6.1 has been approved which allows the addition of an active analog telemetry interface between the OMI System and the spacecraft. The active analog telemetry interface will monitor the status of the +5 volt IAM power supply(s) and be used for troubleshooting potential command/telemetry problems between the IAM and OMI EA. Detailed definition of the active analog telemetry interface shall be documented in the OMI System to Spacecraft ICD.

(Ref. CCR 424-12-28-004)

5.1.10 Connector Clearance

A deviation to the GIRD (Revision B) paragraph 5.4.5.1 has been approved which allows the OMI System to deviate from the 50 mm minimum clearance around the outside of mated connectors.

Because of the large number of connectors required over a limited area on small modules, OMI System connector clearance shall be maintained to the best extent possible and remain consistent with the best practices of the spacecraft and instrument developers.

(Ref. CCR 424-12-28-004)

5.1.11 Digital Data Convention

For the OMI System, a deviation to the GIRD (Revision B) has been approved which modifies allowable digital data conventions.

In lieu of the requirement that all digital C&DH data use the 2's complement with 1 being true convention (GIRD paragraph 6.4), the OMI System shall also be allowed to use straight binary encoding.

(Ref. CCR 424-12-28-004)

5.1.12 EMI/EMC and Magnetic Requirements

For the OMI Instrument, a deviation to the GIRD (Revision B) Paragraphs 10.11.1, 10.11.6.2 and 10.11.5.1 has been approved which allows for the following:

1. Deleting the requirement for broadband conducted emissions limit measurements on power and power return leads.

2. Deleting the requirement for broadband radiated electric field emissions limit measurements.

3. Modifying the radiated AC magnetic field emissions limit for frequencies between 20 Hz and 250 HZ. The new limit is: 94 dB above 1 pico-Tesla (dBpT) between 20 Hz and 30 Hz, decreasing linearly to 60 dBpT at 250 Hz and remaining flat at 60 dBpT to 50 KHz.

(Ref. CCR 424-12-28-005)

5.1.13 Narrowband Radiated Electric Field Emissions

For the OMI Instrument, a deviation to the GIRD (Revision B) Paragraph 10.11.6.1 has been approved which allows for relaxation of the RE02 Narrowband Radiated Emission Limit requirement. Specifically, it increases the limit (dBuV/m Peak) by 10dB in the frequency range 10MHz to 120MHz.

(Ref. CCR 424-12-28-006)

5.1.14 OMI Test Equipment Measurement Bandwidths

For OMI, a deviation to the GIRD (Revision B) Paragraphs 10.11.1 and
10.11.6.1 has been approved which alters the required test bandwidths.

Per the GIRD, measurement bandwidths of 5Hz, 500Hz, 5KHz, 50KHz, and 100KHz are required for conducted emissions (10.11.1) and radiated emissions (10.11.6.1) measurements. EMC measuring equipment has standard bandwidths that differ from the required ones (e.g. 10Hz, 30Hz, 100Hz, 300Hz, 1KHz, 3KHz, etc.).

In lieu of the required test bandwidths, the following test procedure using standard EMC test equipment shall be implemented. Test level frequency settings shall be made to the closest greater than or equal bandwidth with respect to the original required bandwidth. If the emission requirement is met, compliance is implicit. If the measured emission values exceed the limit, the measurement bandwidth shall be decreased to the next standard available bandwidth for retest of emission requirement compliance. Reducing the test bandwidths tends to significantly increase the test durations, but helps to eliminate the noise contribution at higher bandwidths for a more accurate determination of emission requirement compliance.

(Ref. CCR 424-12-28-007)

5.1.15 OMI Number of Nodes in Thermal Math Model

For OMI, a deviation to the GIRD (Revision B) Paragraph 11.2.3c has been approved which increases the number of allowable nodes in the Reduced Node Thermal Model.

In lieu of the requirement that the Reduced Node Thermal Math Model not exceed 100 nodes, the OMI ESATAN Thermal Math Model delivered to GSFC shall not exceed 145 nodes.

(Ref. CCR 424-12-28-008)

5.1.16 Sine Vibration

For OMI, a deviation to the GIRD (Revision B, paragraph 10.2) has been approved which modifies the required Sinusoidal Protoflight/Qualification Test Levels for the protoflight instrument.

In lieu of the Sinusoidal Protoflight/Qualification Test Levels specified in Table 10-3 and Figure 10-1 in each of three orthogonal axes, the OMI Instrument modules shall be subjected to the test levels documented in Table 5-1 and Figures 5-1 thru 5-2.

Table 5-1 OMIS (OA, EA, IAM)
Sinusoidal Protoflight/Qualification Test Levels

AXIS	FREQUENCY (HZ)	LEVEL (G)	SWEEP RATE
X	5 – 5.6	.5″ D.A.	4 oct/min
	5.6 - 25	± 0.8	4 oct/min
	25 - 35	± 0.8	1.5 oct/min
	35 - 50	± 0.5	4 oct/min
Y & Z	5 - 25	± 0.5	4 oct/min
	25 - 35	± 1.4	1.5 oct/min
	35 - 50	± 0.5	4 oct/min

Note:

1 Protoflight levels shown are 1.25 times maximum expected flight levels.
2 Test axes are in spacecraft coordinate axes.
3 For similarity to flight responses, the above levels shall be notched at critical frequencies (if required) to limit structural loads to 1.25 x flight limit loads.

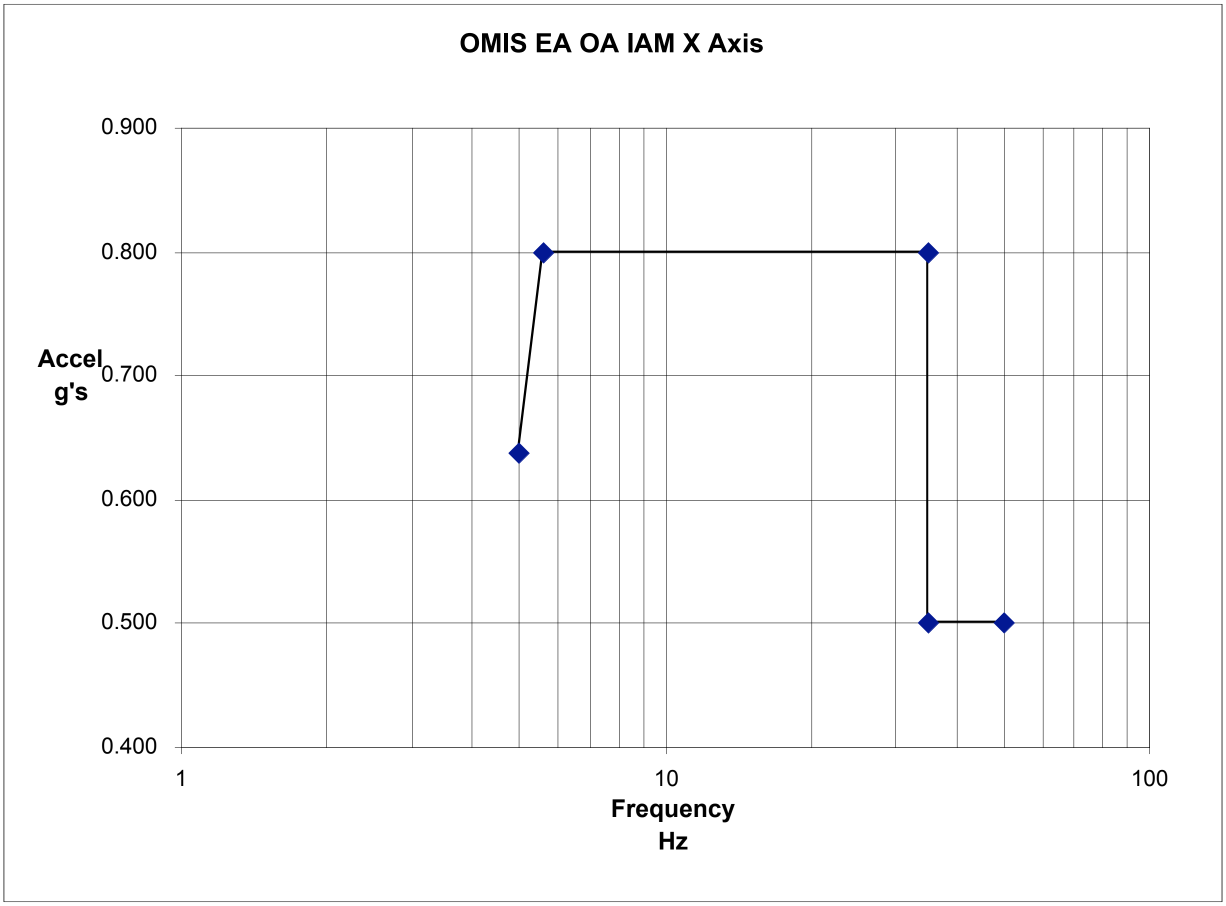

Figure 5-1 Sinusoidal Protoflight/Qualification Test Levels: OMIS EA OA IAM X Axis

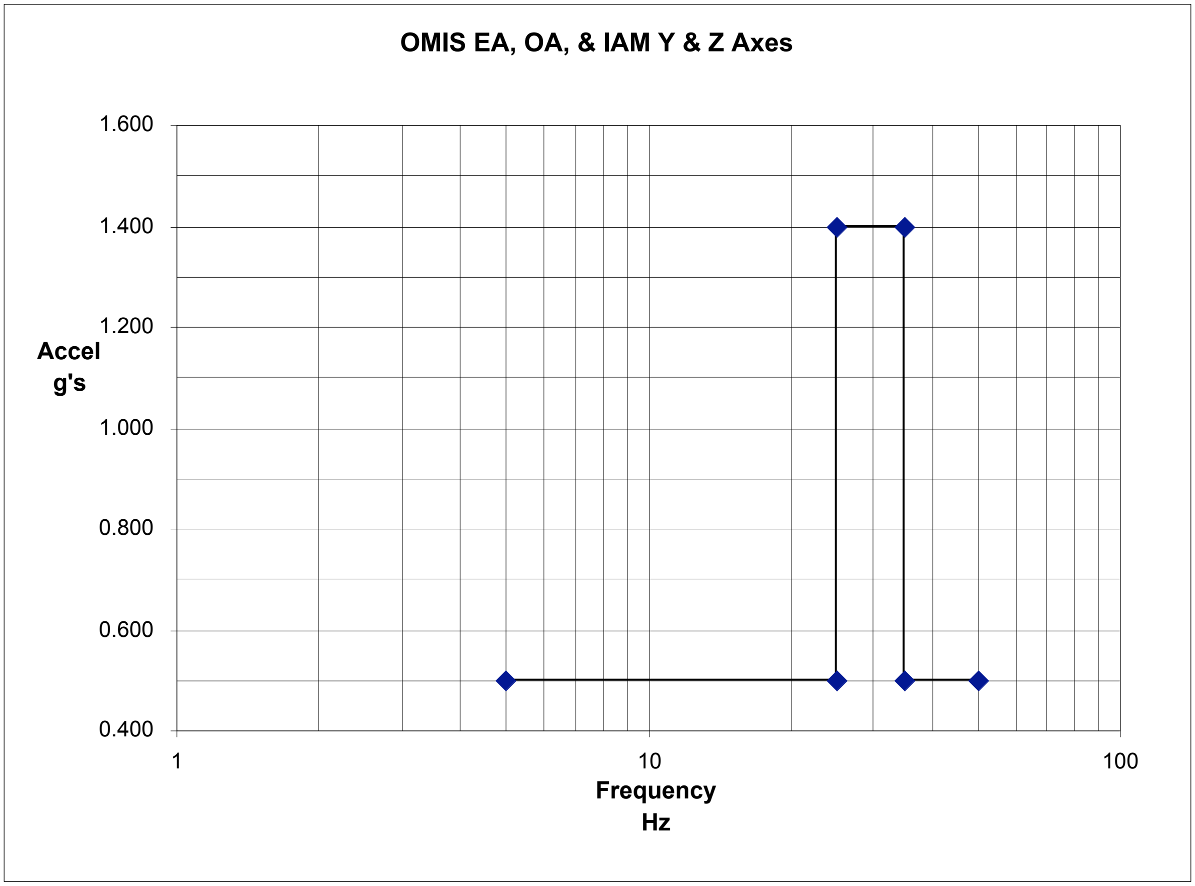

Figure 5-2 Sinusoidal Protoflight/Qualification Test Levels: OMIS EA, OA, & IAM Y & Z Axes

(Ref. CCR 424-12-28-014)

5.1.17 OMI EA Conducted Emissions (CE-01)/Conducted Susceptibility on Quiet Bus Power Lines

5.1.17.1 Conducted Emissions (CE-01)

A deviation to the GIRD (Revision B), paragraph 10.11.1, has been approved which allows a relaxation of the conducted emission limit in the 3-10 kHz frequency range.

In lieu of the GIRD requirement, the OMI EA emissions shall be relaxed by10 dB, i.e., 90 dBuA at 3 kHz and 70 dBuA at 10 kHz.

(Ref. CCR 424-12-28-015)

5.1.18 Time Code Data Spare Octets

For OMI, a waiver to the GIRD (Revision B) paragraph 6.5.7.2.1 Time Code Data and Format has been approved which modifies the format of time code data transmitted to the instrument.

Rather than receiving 16 octets of time code data from the spacecraft, OMI shall only receive eight octets. The trailing eight spare octets have been deleted.
(Ref. CCR 424-12-28-018)

5.1.19 OMI OA Survival Heater Power Bus

For the OMI Optical Assembly (OA), the following deviations from the GIRD requirement regarding the use of the Survival Heater Power Bus (Paragraph 5.1.2.4) have been approved:
(1) Survival power of 20 watts maximum will be used in addition to operational power to maintain the proper decontamination temperature during flight. During this Decontamination Mode, OMI power dissipation will increase to 81 watts average and 93 watts peak.
(2) The survival/decontamination power bus will be connected to the OA survival heaters on one side only (currently the OA Side A), via a commandable switch located in the spacecraft secondary converter electronics assembly (SCE-4). Temperature will be controlled by appropriate OA thermostats.
(3) Only one survival bus will be continuously powered during flight (currently Side B). Both survival buses will be connected when operational power to the OMI is interrupted.
(Ref. CCR 424-12-28-017)

5.1.20 Narrowband Conducted Emissions - Power Leads

For the Ozone Monitoring Instrument (OMI), a relaxation of the narrowband conducted emission limits on power and power return leads has been approved. With respect to GIRD Figure 10.8 (CE01/CE03 Narrowband Conducted Emission Limit), the emission limit between 2 MHz and 11 MHz is increased by 3 db to 23 dBuA.
(Ref. CCR 424-12-28-020)

5.1.21 OMI Survival Heater Connector Identification Approach & Types

For OMI, a deviation to the GIRD (Rev B), Paragraph 5.4.5.3 has been approved which allows OMI to use their identification approach for the survival heater connectors on the EA bracket. In leiu of the GIRD requirement that connectors be different sizes, different types, or uniquely keyed, the markings for these CH-01 connectors, as specified in the OMI MID, shall be used along with the I&T procedures to assure proper mating.

(Ref. CCR 424-12-28-021)

5.1.22 Data Buffering

For the OMI Interface Adapter Module (IAM), a deviation from the GIRD requirement for data buffering (Paragraph 6.5.5.8) has been approved, allowing for passing all science and engineering data directly to the Aura observatory without buffering.

(Ref. CCR 424-12-28-022)

5.1.23 IAM Narrowband Conducted Emissions - Power Leads

For the OMI Interface Adapter Module (IAM), a relaxation of the narrowband conducted emission limits on power and power return leads, for both primary and redundant sides, has been approved. With respect to GIRD Figure 10.8 (CE01/CE03 Narrowband Conducted Emission Limit), the emission limit between 8.55 MHz and 12.05 MHz is increased by 9.4 dBuA to 29.4 dBuA. In addition, the emission limit between 29.4 MHz and 30.6 MHz is increased by 4.2 dBuA to 24.2 dBuA and the limit at 2.013MHz is increased by 7.2 dBuA to 27.2dBuA. CH-02

(Ref. CCR 424-12-28-023)

5.1.24 IAM Narrowband Radiated Emission, Electric Field (RE02)

For the OMI Interface Adapter Module (IAM), a relaxation of the narrowband radiated emission limit has been approved. With respect to GIRD Figure 10-12 (RE02 Narrowband Radiated Emission Limit), the emission limit between 2.0 GHz and 2.2 GHz is increased by 1.2 dBuV/m to 14.2 dBuV/m.

(Ref. CCR 424-12-28-023)

5.1.25

For the OMI instrument, approval has been granted to waive the GIRD requirement 6.2.3, "The instrument and spacecraft shall be tolerant of a single fault occurring in a single interface circuit on either side of the same interface." and use the "Harness Assembly Panel 1 -W41", as is, with out rewiring the redundant telemetry to a separate telemetry MUX. CH-03

(Ref. CCR 424-13-11-019, NGST Waiver ES-W013, and TDR 27408.)

5.2 MAR DEVIATIONS/WAIVERS

5.2.1 OMI Component/Assembly Outgassing

A deviation to the MAR (Original Issue) paragraph 5.2, Materials and Lubrication, has been approved that modifies the outgassing limits for the following materials used in the development of the OMI Instrument.

In lieu of the requirement for a Total Mass Loss (TML) of less than 1.00% and a Collected Volatile Condensable Mass (CVCM) of less than 0.10%, the OMI component/assembly materials identified below shall meet the following requirements:

Thermofit RT876:	TML ≤ 1.33 %	CVCM≤ 0.12%
Glue EC-2216 A/B:	TML ≤ 1.25 %	CVCM≤ 0.10%
Chemglaze Z306:	TML ≤ 1.70 %	CVCM≤ 0.10%
3M-Scotchweld 2216 B/A gray	TML ≤ 1.42 %	CVCM≤ 0.10%
Araldit AV136/HY991	TML ≤ 1.88 %	CVCM≤ 0.10%
Vespel-SP1	TML ≤ 1.09 %	CVCM≤ 0.10%
Kapton	TML ≤ 1.10 %	CVCM≤ 0.10%

The OMI shall allow only limited amounts of these materials and the sum of all materials shall meet the overall contamination control requirements, as specified in the MAR (424-11-13-03), Sections 5.2 and 7.0, and detailed in the ICD for the OMI System (D26478), Section 7.0.

(Refs. CCR-424-12-28-004 and CCR-424-12-28-012)

5.2.2 OMI OA EEE Part Derating Requirement

A deviation to the MAR (October 1999 Issue) paragraph 5.1, Parts, has been approved that waives the derating guideline as specified in ESA PSS-01-301, paragraph 14.1, for the LED of the Optocoupler in the OMI OA. In the worst case, $I_{forward}$ is 0.013A versus the derated value of 0.010A.

The Optocoupler, used to monitor the position of the OA mechanism stepmotors, is not used as part of the active control of the motor position. In addition, the optical switch will only be switched on and used during motor operations. The ratio of the worst case $I_{forward}$/nominal $I_{forward}$ rating is 26% (0.013A/0.05A) versus the desired 20%. Finally, failure of this part has no impact on the science or spacecraft performance.

(Ref. CCR 424-12-28-013)

APPENDIX A

ACRONYM LIST

ACRONYM LIST

APID	Application Process Identifier
C&DH	Command and Data Handling
CVCM	Collected Volatile Condensable Mass
EA	Electronics Assembly
ECI	Earth Centered Inertial
EOS	Earth Observing System
ESATAN	European Space Agency Thermal Analysis Network
FOV	Field of View
GIRD	General Interface Requirements Document
GSFC	Goddard Space Flight Center
IAC	Interface Alignment Cube
IAM	Interface Adapter Module
ICD	Interface Control Document
kg	Kilograms
Kbps	Kilobits per second
MAR	Mission Assurance Requirements
Mbps	Megabits per second
MID	Mechanical Interface Drawing
mm	Millimeter
msec	Millisecond
NASA	National Aeronautics and Space Administration
OA	Optical Assembly
OMI	Ozone Monitoring Instrument
OMIS	OMI System
PDD	EOS Common Payload Definition Document
RFD	Request for Deviation
RT	Remote Terminal
SINDA	Systems Improved Numerical Differencing Analyzer
SRCF	Spacecraft Reference Coordinate Frame
SRTS	System Technical Requirements Specification
TBD	To Be Determined
TBR	To Be Resolved
TML	Total Mass Loss
TRASYS	Thermal Radiation Analyzer System
UIID	Unique Instrument Interface Document