Geostationary Operational Environmental Satellite (GOES)

GOES-R Series

Instrument Mission Assurance Requirements (IMAR)

February 12, 2007

National Aeronautics and Space Administration

Goddard Space Flight Center
Greenbelt, Maryland

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Geostationary Operational Environmental Satellite (GOES)
GOES-R Series
Instrument Mission Assurance Requirements (IMAR)

Prepared By:

Michael P. Kelly, NASA GSFC
GOES-R Series Systems Assurance Manager

Date 1/4/06

Reviewed By:

Alexander Krimchansky, NASA GSFC
GOES-R Series Systems Manager

Date 1/4/06

Fred G. Cunningham, NASA GSFC
GOES-R Series Instrument Systems Manager

Date 1/04/06

Concurred By:

for Abigail D. Harper, NASA GSFC
Acting Director
Office of System Safety and Mission Assurance

Date 01/04/2006

Approved By:

Michael L. Donnelly, NASA GSFC
GOES-R Series Project Manager

Date 1/5/06

To verify the correct version of this document, please contact the GOES-R Series Configuration Management Office.

/Mission Assurance

IMAR

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IMAR1	1	**# 1 Overall Requirements**
IMAR3	1.1	**## 1.1 Description of Overall Requirements**
IMAR4	1.1.0-1	The Contractor **shall** plan and implement an organized Mission Assurance program that encompasses (1) all flight hardware, whether designed/built by the Contractor or sub-tier contractors, from project initiation through launch operations, (2) ground support equipment that interfaces to flight hardware to assure the integrity and safety of flight items, and (3) all software critical for mission success.
IMAR1093	1.1.0-2	Any deviations/waivers from this IMAR **shall** be submitted to the GOES-R Project for approval. These deviations/waviers will be controlled and maintained by the GOES-R Project Office.
IMAR1094	1.1.0-3	Contractor personnel responsible for assurance activities **shall** have direct access to Contractor management, independent of project management, with the functional freedom and authority to interact with all other elements of the project.
IMAR8	1.2	**## 1.2 Use of Multi-Mission or Previously Designed, Fabricated, or Flown Hardware**
IMAR9	1.2.0-1	When hardware that was designed, fabricated, or flown on a previous project is considered to have demonstrated compliance with some or all of the requirements of this document such that certain tasks need not be repeated, the Contractor **shall** demonstrate how the hardware complies with requirements.
IMAR10	1.2.0-2	The Contractor **shall** submit the substantiating documentation in accordance with the Contract Data Requirements List (CDRL).
IMAR11	1.3	**## 1.3 Surveillance of the Contractor**
IMAR12	1.3.0-1	The work activities, operations, and documentation performed by the Contractor and sub-tier contractors or suppliers **shall** be subject to evaluation, review, audit, and inspection by government-designated representatives from GSFC, the Government Inspection Agency (GIA), or an Independent Assurance Contractor (IAC). GSFC will delegate in-plant responsibilities and authority to those agencies via a letter of delegation and task assignment. *(CCR 00053)*
IMAR13	1.3.0-2	The contractor and/or suppliers **shall** grant access for NASA and/or NASA representatives to conduct assessments/surveys upon notice.
IMAR14	1.3.0-3	Resources **shall** be provided to assist with the assessments/surveys with minimal disruption to work activities.
IMAR15	1.3.0-4	The contractor, upon request, **shall** provide government assurance representatives with documents, records, and equipment required to perform their assurance and safety activities.
IMAR16	1.3.0-5	The contractor **shall** also provide the government assurance representative(s) with an acceptable work area within contractor facilities.
IMAR17	1.4	**## 1.4 Applicable and Reference Documents**
IMAR18	1.4.0-1	The effective version of all documents referenced in Section 12 are the versions noted. They form a part of this specification to the extent specified in Section 12. In the event of conflict between documents specified in Section 12 and other detailed content of the IMAR, the IMAR **shall** be the superseding requirement. *(CCR 00112)*
IMAR19	1.4.0-2	Deliverables referenced in this document **shal**l be delivered in accordance with the instrument CDRL. *(CCR 00112)*

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IMAR20	2	**2** Quality Management System
IMAR21	2.0-1	The Contractor **shall** have a Quality Management System (QMS) that is compliant with the minimum requirements of ANSI/ISO/ASQC Q9001 Rev 2000, Quality Management Systems - Requirements.
IMAR23	2.1	**2.1 QA Management System Requirements Augmentation**
IMAR24	2.1.0-1	The following requirements augment identified portions of the ISO requirements.
IMAR25	2.1.1	**2.1.1 Nonconformance Reporting**
IMAR26	2.1.1.0-1	The Contractor **shall** have a system for identifying and reporting hardware and software nonconformances through a closed loop reporting system; ensuring that positive corrective action is implemented to preclude recurrence and verification of the adequacy of implemented corrective action.
IMAR27	2.1.1.0-2	Nonconformances **shall** be reported in accordance with the CDRL.
IMAR28	2.1.1.1	**2.1.1.1 Preliminary Review**
IMAR29	2.1.1.1.0-1	The material review process **shall** be initiated with the identification and documentation of a nonconformance.
IMAR30	2.1.1.1.0-2	A preliminary review **shall** be the initial step performed by Contractor-appointed personnel to determine if the nonconformance is minor and can readily be processed using the following disposition actions: a) Scrap, because the product is unusable for the intended purposes and cannot be economically reworked or repaired. b) Rework (or retest), to result in a characteristic that completely conforms to the standards, procedures, or drawing requirements. c) Return to supplier, for rework or replacement. d) Refer to Material Review Board when the above actions do not apply to the nonconformance. Note that Preliminary Review does not negate the requirement to identify, segregate, document, report and disposition nonconformances.
IMAR31	2.1.1.2	**2.1.1.2 Material Review Board (MRB)**
IMAR32	2.1.1.2.0-1	Nonconformances not dispositioned by Preliminary Review **shall** be referred to the MRB for disposition.
IMAR33	2.1.1.2.0-2	MRB dispositions **shall** include: scrap, rework, return to supplier, repair by standard or non-standard repair procedures, use-as-is, or request for major waiver.
IMAR34	2.1.1.2.0-3	The Contractor **shall** establish a Material Review Board.
IMAR35	2.1.1.2.0-4	The MRB **shall** contain a core team with other disciplines brought in as necessary.
IMAR36	2.1.1.2.0-5	The MRB **shall** be chaired by a Contractor representative responsible for ensuring that the MRB actions are performed in compliance with this standard as implemented by Contractor procedures.
IMAR37	2.1.1.2.0-6	The MRB **shall** consist of the appropriate functional and project representatives that are needed to ensure timely determination, implementation and close out of the recommended MRB disposition.

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IMAR38	2.1.1.2.0-7	A GOES-R SAM representative will participate as voting members in MRB activities. Completed MRBs will be approved by the SAM or his designee.
IMAR39	2.1.1.2.0-8	The MRB process **shall** investigate, in a timely manner, each nonconforming item in sufficient depth to determine proper disposition.
IMAR40	2.1.1.2.0-9	For each reported nonconformance, there **shall** be an investigation and engineering analysis sufficient to determine cause and corrective actions for the nonconformance.
IMAR41	2.1.1.2.0-10	Written authorization **shall** be documented to disposition the nonconforming product.
IMAR42	2.1.1.3	**2.1.1.3 Failure Review Board (FRB)**
IMAR43	2.1.1.3.0-1	Nonconformance's not dispositioned by Preliminary Review or Material Review Board **shall** be referred to the Failure Review Board for disposition.
IMAR44	2.1.1.3.0-2	FRB dispositions **shall** include: those items that fail; show performance at limits of tolerance and out of family type operation. Scrap, rework, return to supplier, repair by standard or non-standard repair procedures, use-as-is, or request for waiver are also FRB type dispositions.
IMAR45	2.1.1.3.0-3	The Contractor **shall** establish a Failure Review Board.
IMAR46	2.1.1.3.0-4	The FRB **shall** contain a core team with other disciplines brought in as necessary.
IMAR47	2.1.1.3.0-5	The FRB **shall** be chaired by a Contractor representative responsible for ensuring that the FRB actions are performed in compliance with this standard as implemented by Contractor procedures.
IMAR48	2.1.1.3.0-6	The FRB **shall** consist of the appropriate functional and project representatives that are needed to ensure timely determination, implementation and close out of the recommended FRB disposition.
IMAR49	2.1.1.3.0-7	A GOES-R SAM representative will participate as voting members in FRB activities. Completed FRB's will be approved by the SAM or his designee.
IMAR50	2.1.1.3.0-8	The FRB process **shall** investigate, in a timely manner, each nonconforming item in sufficient depth to determine proper disposition.
IMAR51	2.1.1.3.0-9	For each reported nonconformance, there **shall** be an investigation and engineering analysis sufficient to determine cause and corrective actions for the nonconformance.
IMAR52	2.1.1.3.0-10	Written authorization **shall** be documented to disposition the nonconforming product.
IMAR53	2.1.1.4	**2.1.1.4 Reporting of Nonconformances**
IMAR54	2.1.1.4.0-1	Reporting of all nonconformances **shall** begin with the first power application or the first operation of a mechanical item.
IMAR55	2.1.1.4.0-2	Non-conformance reporting **shall** continue through on orbit checkout.
IMAR56	2.1.2	**2.1.2 Calibration**
IMAR57	2.1.2.0-1	Testing and Calibration Laboratories **shall** be compliant with the requirements of ISO/IEC-17025 General Requirements for the Competence of Testing and Calibration Laboratories.
IMAR58	2.1.3	**2.1.3 Lessons Learned**
IMAR59	2.1.3.0-1	The Contractor **shall** collect lessons learned and submit them to the GOES-R Project for input into a Government Lessons Learned Database.
IMAR61	2.1.4	**2.1.4 Flow-Down**

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IMAR62	2.1.4.0-1	The Contractor's QA program **shall** ensure the flow-down of technical and product assurance requirements to all suppliers.
IMAR63	2.1.4.0-2	The Contractor's QA program **shall** document and implement a process to verify compliance.
IMAR64	2.1.4.0-3	Specifically, the Contractor's Contract Review and Purchasing processes **shall** establish the process for documenting, communicating, and reviewing requirements with sub-tier suppliers to ensure requirements are met.

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IMAR65	3	**3** System Safety Requirements
IMAR67	3.1	**3.1 System Safety Requirements**
IMAR68	3.1.0-1	The Contractor **shall** plan and implement a system safety program to include their facility, the spacecraft integrator's facility and the launch facilities.
IMAR69	3.1.0-2	The system safety program **shall** provide for early identification and control of hazards during design, fabrication, test, transportation and ground activities.
IMAR70	3.1.0-3	The safety program **shall** satisfy the applicable guidelines, constraints, and requirements stated in Air Force Space Command Manual 91-710 (AFSPCMAN 91-710), Range Safety Requirements. Specific safety requirements include the following: a) If a system failure may lead to a **catastrophic hazard**, the system shall have three inhibits (dual fault tolerant). A Catastrophic hazard is defined as a condition that may cause death or permanently disabling injury, major system or facility destruction on the ground, or vehicle during the mission. b) If a system failure may lead to a **critical hazard**, the system shall have two inhibits (single fault tolerant). A Critical hazard is defined as a condition that may cause severe injury or occupational illness, or major property damage to facilities, systems, or flight hardware c) Hazards which cannot be controlled by failure tolerance (e.g., structures, pressure vessels, etc.) are called "Design for Minimum Risk" areas of design and have separate, detailed safety requirements that they must meet. Hazard controls related to these areas are extremely critical and warrant careful attention to the details of verification of compliance on the part of the developer. *(CCR 00050B)*
IMAR71	3.1.0-4	Safety Requirements documents for GOES-R: AFSPCMAN 91-710 which defines the Range Safety Program responsibilities and authorities and which delineates policies, processes, and approvals for all activities from the design concept through test, check-out, assembly, and the launch of launch vehicles and payloads to orbital insertion or impact from or onto the Eastern Range (ER) or the Western Range (WR). It also establishes minimum design, test, inspection, and data requirements for hazardous and safety critical launch vehicles, payloads, and ground support equipment, systems, and materials for ER/WR users. *(CCR 00050B)*
IMAR73	3.2	**3.2 System Safety Program Plan**
IMAR74	3.2.0-1	The System Safety Program Plan (SSPP) **shall** describe the system safety implementation process which includes analysis, reduction, and/or elimination of hazards. *(CCR 00050B)*
IMAR76	3.2.0-2	The SSPP **shall** define the required safety documentation, applicable documents, associated schedules for completion, roles and responsibilities on the project, methodologies for the conduct of any required safety analyses, reviews, and safety data package.
IMAR77	3.2.0-3	The Contractor **shall** deliver the SSPP in accordance with the CDRL.
IMAR78	3.3	**3.3 Safety Assessment Report** *(CCR 00050B)*
IMAR79	3.3.0-1	The instrument or subsystem developer shall perform and document a comprehensive evaluation of the mishap risk of their instrument or subsystem. This report is used to assist the spacecraft developer/integrator in preparing the Missile System Prelaunch Safety Package (MSPSP) for submittal to the launch range. This safety assessment **shall** identify all safety features of the hardware, software, and system design, as well as operational hazards present in the system. *(CCR 00050B)*

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IMAR80	3.3.0-2	The Contractor **shall** deliver the SAR in accordance with the CDRL. *(CCR 00050B)*
IMAR81	3.3.0-3	The SAR **shall** begin at Contract Award and continue throughout all phases of the mission lifecycle.
IMAR85	3.4	**3.4 Verification Tracking Log (VTL)** *(CCR 00050B)*
IMAR88	3.4.0-1	All verifications that are listed on the hazard reports **shall** reference the test, analyses, and/or inspections that were performed to verify the hazard is controlled or eliminated.
IMAR89	3.4.0-2	The VTL **shall** be delivered with the final SAR and updated regularly until all items are closed.
IMAR1183	3.4.0-3	Individual VTL items **shall** be closed with appropriate documentation verifying the stated hazard control has been implemented, and individual closures shall be complete prior to first operational use/restraint. *(CCR 00050B)*
IMAR96	3.5	**3.5 Ground Operations Procedures**
IMAR97	3.5.0-1	All ground operations procedures to be used at the launch site **shall** be submitted to the GOES-R Project Safety Manager (PSM) for review and approval. The GOES-R Project reserves the right to review, on request, contractor site operations procedures to ensure compliance. *(CCR 00050B)*
IMAR102	3.6	**3.6 Safety Noncompliance/Waiver Requests**
IMAR103	3.6.0-1	When a specific safety requirement cannot be met the contractor **shall** submit an associated safety noncompliance/waiver request which identifies the hazard and shows rationale for approval of the waiver, as defined by AFSPCMAN 91-710. *(CCR 00050B)*
IMAR104	3.6.0-2	The noncompliance request **shall** include the following information: a) A statement of the specific safety requirement and its associated source document name and paragraph number for which the waiver or deviation is being requested. b) A detailed technical justification for the exception. c) Analyses to show that the mishap potential of the proposed alternate requirement, method or process, as compared to the specified requirement. d) A narrative assessment of the risk involved in accepting the waiver or deviation. e) A narrative on possible ways of reducing hazard severity and probability, and existing compliance activities. f) Starting and expiration date for the waiver/deviation.
IMAR105	3.6.0-3	Safety Noncompliance/Waiver Requests **shal**l be delivered in accordance with the CDRL.
IMAR110	3.7	**3.7 Support for Safety Working Group Meetings**
IMAR111	3.7.0-1	Contractor safety personnel **shall** support Safety Working Group (SWG) meetings, Technical Interface Meetings (TIM), and technical reviews, as required. The SWG will meet as necessary to review procedures and analyses that contain or examine safety critical functions or as convened by the GOES-R Project Safety Manager (PSM) to discuss any situations that may arise with respect to overall project safety. Meetings are normally held as a sidebar to other reviews and meetings to minimize extra travel. There is no required number of meetings. *(CCR 00050B)*
IMAR116	3.8	**3.8 Hazard Analyses**

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IMAR117	3.8.1	**3.8.1 Preliminary Hazard Analyses**
IMAR118	3.8.1.0-1	The contractor **shall** perform and document a preliminary hazard analysis (PHA) in accordance with AFSPCMAN 91-710 to obtain an initial risk assessment of the instrument system. *(CCR 00050B)*
IMAR119	3.8.1.0-2	Based on the best available data, including mishap data from similar systems and other lessons learned, hazards associated with the proposed instrument design **shall** be evaluated for hazard severity, hazard probability, and operational constraints.
IMAR120	3.8.1.0-3	The PHA **shall** consider the following for identification and evaluation of hazards as a minimum: a) Hazardous components b) Safety related interface considerations among various elements of the system, including consideration of the potential contribution by software to system and subsystem mishaps. c) Environmental constraints including the operating environments. d) Operating, test, maintenance, built-in-tests, diagnostics, and emergency procedures. e) Facilities. f) Safety related equipment, safe guards, and possible alternate approaches. g) Malfunctions to the system, subsystems, or software. This list is not all-inclusive; there are other areas that should be considered when conducting a PHA.
IMAR121	3.8.1.0-4	The contractor **shall** develop analyses for identifying the hazards associated with the hardware, support equipment, software, instrument ground operations and ground support equipment, and their interfaces. *(CCR 00050B)*
IMAR122	3.8.1.0-5	The contractor **shall** take measures to minimize each identified hazard.
IMAR123	3.8.1.0-6	The analysis **shall** be updated as all hardware and software progresses through the stages of design, fabrication, test, transportation, and launch.
IMAR124	3.8.1.0-7	Hazard reports **shall** be generated for all identified system hazards.
IMAR125	3.8.1.0-8	The hazard reports **shall** document the causes, controls, verification methods and status of verification for each hazard.
IMAR126	3.8.1.0-9	Instrument hazard reports **shall** be supplied to GSFC as part of the SAR for forwarding to the S/C contractor and inclusion in the S/C MSPSP. *(CCR 00050B)*
IMAR128	3.8.2	**3.8.2 Operations Hazard Analysis**
IMAR129	3.8.2.0-1	An Operations Hazard Analysis (OHA) will be performed to identify the hazards to payload or personnel when a facility is being used or an activity is being performed.
IMAR130	3.8.2.0-2	The OHA **shall** document all controls and methods of verifications for each hazard listed. The OHA process considers the timing and sequence of tasks with respect to the equipment/hardware/software design, human engineering provisions, assembly, test, and operating procedures, and the facility environments for each specific operation being performed. *(CCR 00050B)*
IMAR131	3.8.2.0-3	The Operations Hazard Analysis **shall** be delivered in accordance with the CDRL.
IMAR132	3.9	**3.9 Reviews**

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IMAR133	3.9.0-1	The contractor's system safety program **shall** be presented at GSFC assurance reviews and payload safety reviews.
IMAR134	3.9.0-2	At each review the contractor **shall** describe the actions being taken to reduce and control hazards.
IMAR135	3.10	**3.10 Mishap Reporting**
IMAR136	3.10.0-1	All mishaps and close calls that affect the GOES-R Program **shall** be reported within 24 hours of occurrence to GSFC.
IMAR137	3.10.0-2	A follow-up report **shall** be documented in accordance with NPR 8621.1, NASA Procedures and Requirements for Mishap Reporting. NPR 8621.1 defines a Close Call as an occurrence or a condition of employee concern in which there is no injury or only minor injury requiring first aid and no significant equipment/property damage (less than $1000), but which possesses a potential to cause a mishap. *(CCR 00050B)*
IMAR138	3.10.0-3	Reports **shall** be delivered in accordance with the CDRL.
IMAR139	3.11	**3.11 Software Safety**
IMAR140	3.11.0-1	Section 5.1.2 describes desired software safety activities to meet NASA HQ guidelines. Hazards caused by software will be identified as a part of the nominal hazard analysis process, and their controls will be verified prior to acceptance. *(CCR 00051B)*
IMAR152	3.12	**3.12 Test Safety Responsibilities**
IMAR158	3.12.1	**3.12.1 Treatment of Hazards**
IMAR159	3.12.1.0-1	As hazards are discovered, every attempt **shall** be made to eliminate them. This may be accomplished by redesign, controlling energy sources, revising the test, or by some other method.
IMAR160	3.12.1.0-2	If the hazard cannot be eliminated, automatic safety controls **shall** be applied, for example: pressure relief devices, electrical circuit protection devices, or mechanical interlocks.
IMAR161	3.12.1.0-3	If that is not possible or is too costly, warning devices **shall** be considered.
IMAR162	3.12.1.0-4	If none of the foregoing methods are practicable, control procedures must be developed and applied. In practice, a combination of all four methods may be the best solution to the hazards posed by a complex system.
IMAR163	3.12.1.0-5	Before any test begins, the Contractor project manager and test facility management **shall** agree on the hazard control method(s) that are to be used. *(CCR 00231)*
IMAR164	3.12.2	**3.12.2 Facility Safety**
IMAR165	3.12.2.0-1	The contractor **shall** verify that the test facility and normal operations present no unacceptable hazard to the test item, test and support equipment, or personnel.
IMAR166	3.12.2.0-2	The contractor **shall** ensure that facility personnel abide by all applicable regulations, (ie., OSHA and NASA) observe all appropriate industrial safety measures, and follow all requirements for personal protective equipment. *(CCR 00050B)*
IMAR167	3.12.2.0-3	The contractor **shall** ensure that all facility personnel are trained and qualified for their positions. Training should include the handling of emergencies by the simulation of emergency conditions.
IMAR168	3.12.2.0-4	Analysis, tests and inspections **shall** be performed to verify that the safety requirements are satisfied.

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IMAR175	4	**4** Reliability Requirements
IMAR176	4.0-1	This section addresses the Reliability Requirements for the Instrument.
IMAR178	4.1	**4.1 General**
IMAR179	4.1.0-1	The contractor **shall** plan and implement a reliability program that interacts effectively with other project disciplines, including systems engineering, hardware design, and product assurance.
IMAR180	4.1.0-2	The program **shall** be tailored to: a) Assure the specified reliability probability of success is achieved. b) Demonstrate that redundant functions, including alternative paths and work-arounds, are independent to the extent practicable c) Demonstrate that the stress applied to parts meet applicable derating criteria. d) Identify single failure items/points, their effect on the attainment of mission objectives, and possible safety degradation. e) Identify limited-life items and ensure that special precautions are taken to conserve their useful life for on-orbit operations.
IMAR1096	4.1.0-3	The Government will perform a Probabilistic Risk Assessment (PRA) for the mission. Instrument data required under the CDRL is used for this analysis. The Contractor **shall** attend meetings and answer questions related to CDRL items to support the development of the PRA.
IMAR1097	4.1.0-4	The Contractor **shall** develop and deliver a Reliability Program Plan (RPP) in accordance with the CDRL.
IMAR189	4.2	**4.2 Reliability Analyses**
IMAR190	4.2.0-1	Reliability analyses **shall** be performed concurrently with design.
IMAR191	4.2.1	**4.2.1 Failure Modes Effects and Criticality Analysis and Critical Items List**
IMAR192	4.2.1.0-1	A Failure Modes Effects and Criticality Analysis (FMECA) **shall** be performed and delivered, in accordance with the CDRL. As additional design information becomes available the FMECA will be refined and updated.
IMAR193	4.2.1.0-2	Failure modes **shall** be assessed at a level sufficient to identify all single point failure modes at the piece part (e.g transistor, Integrated Circuit) level.
IMAR194	4.2.1.0-3	The failure mode **shall** be assigned a severity category based on the most severe effect caused by a failure.
IMAR195	4.2.1.0-4	All mission phases (e.g., ground handling, launch, deployment, on orbit storage, on-orbit operation) **shall** be addressed in the analysis.
IMAR196	4.2.1.0-5	Severity categories will be determined in accordance with the table below.

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IMAR196 4.2.1.0-5 **TABLE SEVERITY CATEGORIES**

Category	Severity	Description
1	Catastrophic	Failure modes that could result in serious injury, loss of life (flight or ground personnel), or loss of launch vehicle.
1 R		Failures modes of identical or equivalent redundant hardware items that, if all failed could result in category 1 effects.
1S		Failure in a safety or hazard monitoring system that could cause the system to fail to detect a hazardous condition or fail to operate during such condition and lead to Severity Category 1 consequences.
2	Critical	Failure modes that could result in loss of one or more mission objectives as defined by the GOES-R Project Office.
2R		Failure modes of identical or equivalent redundant hardware items that could result in Category 2 effects if all failed.
3	Significant	Failure modes that could cause degradation to mission objectives.
4	Minor	Failure modes that could result in insignificant or no loss to mission objectives.

(CCR 00142)

IMAR213 4.2.1.0-6 FMECA analysis procedures and documentation **shall** be performed in accordance with documented procedures.

IMAR214 4.2.1.0-7 Failure modes resulting in Severity Categories 1or 2 **shall** be analyzed at a greater depth, to the single parts if necessary, to identify the cause of failure.

IMAR215 4.2.1.0-8 Results of the FMECA **shall** be used to evaluate the design relative to requirements (e.g., no single instrument failure will prevent removal of power from the instrument).

IMAR216 4.2.1.0-9 Identified discrepancies **shall** be evaluated by management and design groups for assessment of the need for corrective action.

IMAR217 4.2.1.0-10 The FMECA **shall** analyze redundancies to ensure that redundant paths are isolated or protected such that any single failure that causes the loss of a functional path will not affect the other functional path(s) or the capability to switch operation to that redundant path.

IMAR218 4.2.1.0-11 All failure modes that are assigned to Severity Categories 1 and 2, **shall** be itemized on a Critical Items List (CIL) and maintained with the FMECA report.

IMAR219 4.2.1.0-12 Rationale for retaining the items **shall** be included on the CIL.

IMAR220 4.2.1.0-13 Results of the FMECA, as well as the CIL, **shall** be presented at all design reviews starting with the PDR.

IMAR221 4.2.1.0-14 The presentations **shall** include comments on how the analysis was used to perform design trade-offs or how the results were taken into consideration when making design or risk management decisions.

IMAR222 4.2.2

4.2.2 Worst Case Analyses

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IMAR223	4.2.2.0-1	Worst Case Analyses **shall** be performed on all circuits where failure results in a severity category of 1or 2 or where de-rating guidelines are violated.
IMAR224	4.2.2.0-2	Worst case analyses **shall** be documented and delivered in accordance with the CDRL.
IMAR225	4.2.2.0-3	The most sensitive design parameters, including those that are subject to variations that could degrade performance, **shall** be subjected to the analysis.
IMAR226	4.2.2.0-4	The analyses **shall** consider all parameters set at worst case limits and worst case environmental stresses for the parameter or operation being evaluated. Depending on mission parameters and parts selection methods, part parameter values for the analysis will typically include: manufacturing variability, variability due to temperature, aging effects of environment, and variability due to cumulative radiation.
IMAR227	4.2.2.0-5	The analyses **shall** be updated in keeping with design changes.
IMAR228	4.2.2.0-6	The results of any analyses will be presented at all design reviews starting with peer reviews.
IMAR229	4.2.3	**4.2.3 Reliability Predictions**
IMAR230	4.2.3.0-1	The contractor **shall** perform numerical reliability prediction to validate that the design meets the requirements of the specification and to assist: a) Evaluation of alternative design concepts, redundancy and cross-strapping approaches. b) Identification of the elements of the design, which are the greatest detractors of system reliability. c) Identification of those potential mission limiting elements and components that will require special attention in part selection, testing, environmental isolation, and/or special operations. d) Evaluation of the impact of proposed engineering change and waiver requests on reliability.
IMAR231	4.2.3.0-2	MIL-HDBK-217, Reliability Prediction of Electronic Equipment , with updated failure rates from the Reliability Analysis Center or equivalent, **shall** be used as the source of failure rates unless otherwise approved by GSFC.
IMAR232	4.2.3.0-3	The assessments and updates will be submitted to GSFC in accordance with the CDRL. The results of reliability assessments **shall** be reported at PDR and CDR.
IMAR233	4.2.3.0-4	As part of the reliability prediction the contractor **shall** provide and update a Reliability Block Diagram.
IMAR234	4.2.4	**4.2.4 Trend Analysis**
IMAR235	4.2.4.0-1	As part of the routine system assessment, the contractor **shall** assess all subassemblies and units to determine measurable parameters that relate to performance stability.
IMAR239	4.2.4.0-2	A list of subassemblies and units to be assessed and the parameters to be monitored and the trend analysis reports **shall** be maintained and submitted in accordance with the CDRL.
IMAR236	4.2.4.0-3	Selected parameters **shall** be monitored for trends starting at the 1st functional test of a subassembly or unit and continue during all system integration and test phases.
IMAR237	4.2.4.0-4	The monitoring will be accomplished within the normal test framework; i.e., during functional tests, environmental tests, etc.

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IMAR238	4.2.4.0-5	The contractor **shall** establish a system for recording and analyzing the parameters as well as any changes from the nominal (out of family) even if the levels are within specified limits.
IMAR242	4.2.5	**4.2.5 Limited-Life Items**
IMAR243	4.2.5.0-1	Limited-life items **shall** be identified, and managed as described in the RPP.
IMAR244	4.2.5.0-2	A list of limited life items **shall** be presented in the PDR and CDR and delivered in accordance with the CDRL.
IMAR245	4.2.5.0-3	The list of limited-life items **shall** include electromechanical mechanisms.
IMAR246	4.2.5.0-4	Atomic oxygen, solar radiation, shelf-life, extreme temperatures, thermal cycling, wear and fatigue **shall** be used to identify limited-life thermal control surfaces and structure items.
IMAR247	4.2.5.0-5	Mechanisms such as compressors, seals, bearings, valves, actuators, and scan devices **shall** be included when aging, wear, fatigue and lubricant degradation limit their life.
IMAR248	4.2.5.0-6	Records **shall** be maintained that allows evaluation of the cumulative stress (time and/or cycles) for limited-life items starting when useful life is initiated and indicating the project activity that will stress the items.
IMAR249	4.2.5.0-7	The use of an item whose expected life is less than its mission design life must be approved by GSFC.
IMAR251	4.3	**4.3 Fault Tree Analysis**
IMAR252	4.3.0-1	A fault tree analyses (FTA) **shall** be performed and delivered in accordance with the CDRL that addresses instrument failures and degraded modes of operation.
IMAR253	4.3.0-2	Beginning with each undesired state (instrument failure or degraded mode of operation), the fault tree **shall** be expanded to include all credible combinations of events/faults and environments that could lead to the undesired state.
IMAR254	4.3.0-3	Subassembly hardware/software failures, external hardware/software failures and human factors **shall** be considered in the analysis.
IMAR256	4.4	**4.4 Parts Stress Analyses**
IMAR257	4.4.0-1	Each application of electrical, electronic, and electromechanical (EEE) parts **shall** be subjected to stress analyses for conformance with the applicable derating guidelines.
IMAR258	4.4.0-2	The analyses **shall** be performed at the most stressful values that result from specified performance and environmental requirements (e.g., temperature and voltage) on the assembly or part.
IMAR259	4.4.0-3	The results of the analyses **shall** be presented at all design reviews starting with the PDR.
IMAR260	4.4.0-4	The analyses with summary sheets and updates **shall** be submitted as part of the Reliability Predictions.
IMAR261	4.4.0-5	Presentations **shall** include comments on how the analysis was used to perform design trade-offs and how the results were taken into consideration when making design or risk management decisions.

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IMAR262	5	**5** Software Assurance Requirements
IMAR263	5.0-1	The contractor's QMS **shall** address software assurance functions for all software and firmware developed under this contract.
IMAR264	5.0-2	The contractor **shall** plan and document software development processes and procedures, software tools, reviews, resources, schedules and deliverables.
IMAR265	5.0-3	A Software Management Plan **shall** be prepared and delivered in accordance with the CDRL.
IMAR267	5.1	**5.1 Software Assurance**
IMAR268	5.1.0-1	Software assurance is the planned and systematic set of activities and disciplines that ensures that software lifecycle processes and products conform to requirements, standards, and procedures. These disciplines include Software Quality Assurance (SQA), Software Safety, Verification and Validation (V&V), and Independent Verification and Validation (IV&V).
IMAR269	5.1.1	**5.1.1 Software Quality**
IMAR270	5.1.1.0-1	The contractor **shall** implement a Software Quality program to assure the quality of all software products.
IMAR272	5.1.1.0-2	This program **shall** assure that the standards, processes and procedures are appropriate for the project, correctly implemented, and that all efforts adhere to the requirements, plans, procedures and standards.
IMAR273	5.1.1.0-3	The contractor **shall** prepare and document a Software Assurance Plan delivered in accordance with the CDRL.
IMAR275	5.1.2	**5.1.2 Software Safety**
IMAR278	5.1.2.0-1	Software safety is the aspects of software engineering and software assurance that provide a systematic approach to identifying, analyzing, and tracking software mitigation and control of hazards and hazardous functions (e.g. data and commands) to ensure safer software operation within a system. *(CCR 00051B)*
IMAR1115	5.1.2.0-2	The contractor **shall** conduct a software safety program that is integrated with the overall software assurance and systems safety program, as described in Section 4.2 of NASA-STD-8719.13B. *(CCR 00051B)*
IMAR1116	5.1.2.0-3	The contractor **shall** document their approach to the software safety program in the Software Management Plan. *(CCR 00051B)*
IMAR1117	5.1.2.0-4	The contractor **shall** determine and identify software that is safety critical, based upon the determination process listed in Section 4.1 of NASA-STD-8719.13B, using any hazards identified in the PHA and Safety Assessment Report (SAR). *(CCR 00051B)*
IMAR1118	5.1.2.0-5	The contractor **shall** document all software safety analyses used to determine software safety critical software. *(CCR 00051B)*
IMAR1119	5.1.2.0-6	For software classified as safety critical, the contractor **shall** identify and document the risk posed by each item in terms of criticality, severity, and likelihood of occurrence. *(CCR 00051B)*
IMAR1120	5.1.2.0-7	The contractor **shall** ensure that software safety requirements development and analysis is performed as described in Section 6.1 of NASA-STD-8719.13B. *(CCR 00051B)*
IMAR1121	5.1.2.0-8	Software safety requirements, both generic and specific, **shall** be clearly identified as such in the Software Requirements Specification. *(CCR 00051B)*

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IMAR1122	5.1.2.0-9	In cases where the contractor cannot meet a software safety requirement and/or feels that it is not in the best interest of the project to implement, the contractor **shall** document these items in a waiver request, detailing the justification to support the waiver. *(CCR 00051B)*
IMAR1123	5.1.2.0-10	The contractor **shall** iteratively perform system and software safety analyses over the life of the system as the system is better defined or changes are made. *(CCR 00051B)*
IMAR279	5.1.3	**5.1.3 Verification and Validation**
IMAR280	5.1.3.0-1	The contractor **shall** implement a Verification and Validation (V&V) program to ensure that software being developed or maintained satisfies functional and other requirements at each stage of the development process and that the final product meets customer requirements.
IMAR281	5.1.3.0-2	To assist in the V&V of software requirements, the contractor **shall** develop and maintain under configuration control a Software Requirements Verification Matrix.
IMAR282	5.1.3.0-3	This matrix **shall** document the flow-down of each requirement to the test case and test method used to verify compliance and the test results.
IMAR284	5.1.3.0-4	The Matrix **shall** be incorporated in the overall System Performance Verification Plan and the System Performance Verification Matrix.
IMAR283	5.1.3.0-5	The contractor **shall** install and operate identical flight software on flight and test hardware.
IMAR285	5.1.4	**5.1.4 Independent Verification and Validation**
IMAR286	5.1.4.0-1	NASA will perform an Independent Verification and Validation (IV&V) effort.
IMAR287	5.1.4.0-2	This will require, but is not limited to, access to all software reviews and reports, contractor plans and procedures, software code, software design documentation, and software problem reporting data.
IMAR288	5.1.4.0-3	Wherever possible, the contractor **shall** permit electronic access to the required information or furnish soft copies of requested information to NASA IV&V personnel.
IMAR289	5.1.4.0-4	The contractor **shall** review and assess all NASA IV&V findings and recommendations.
IMAR290	5.1.4.0-5	The contractor **shall** take necessary corrective action based upon their assessment and notify NASA of this corrective action.
IMAR291	5.1.4.0-6	The contractor **shall** also notify NASA of those instances where they decided not to take corrective action on specific IV&V findings and recommendations.
IMAR292	5.1.4.0-7	Detailed justification **shall** be provided if no corrective action is proposed for software critical items.
IMAR293	5.2	**5.2 Peer Reviews**
IMAR294	5.2.0-1	Software peer reviews (e.g., design walkthroughs or code inspections) **shall** be implemented in accordance with the Project Review Requirements section of the SOW.
IMAR295	5.3	**5.3 Software Configuration Management**
IMAR296	5.3.0-1	The contractor **shall** develop and implement a Software Configuration Management (SCM) system that provides baseline management and control of software requirements, design, source code, data, and documentation.
IMAR297	5.3.0-2	As part of the SCM, the contractor **shall** employ a source code version control tool to check in/check out current or previous versions of a source file.

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IMAR298	5.3.0-3	As part of the SCM system, the contractor **shall** document, create and maintain a Software Configuration Control Board (SCCB) to classify, manage, assess and control all changes.
IMAR299	5.3.0-4	Class 1 changes **shall** be forwarded to GSFC for approval. Class 1 changes are defined to include those which impact System requirements, System safety, System reliability, Software requirements, Software safety, and external interfaces.
IMAR300	5.3.0-5	Class 2 changes **shall** be dispositioned by the contractor, but made available to GSFC for review and concurrence of classification in accordance with the SOW.
IMAR301	5.3.0-6	SCCB class 1 and class 2 changes **shall** be delivered in accordance with the CDRL.
IMAR302	5.4	**5.4 Software Problem Reporting and Corrective Action**
IMAR303	5.4.0-1	The contractor **shall** implement a process for Software Problem Reporting and Corrective Action that addresses reporting, analyzing and correcting software nonconformances throughout the development lifecycle.
IMAR304	5.4.0-2	The contractor's QMS **shall** provide for a corrective action process that tracks every software nonconformance to its final disposition.

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IMAR305	6	**6** Workmanship Standards
IMAR306	6.0-1	The contractor **shall** plan and implement a Workmanship Program to assure that all electronic packaging technologies, processes, and workmanship activities selected and applied meet mission objectives for quality and reliability.
IMAR316	6.0-2	The following standards in their entirety (or alternates submitted as described in IMAR308) apply to all flight hardware and **shall** be flowed down to subcontractors as appropriate to the scope of efforts being performed by those subcontractors. a) Conformal Coating and Staking: NASA-STD-8739.1, Workmanship Standard for Staking and Conformal Coating of Printed Wiring Boards and Electronic Assemblies b) Soldering - Flight: NASA-STD-8739.3, Soldered Electrrical Connections. c) Surface mount: NASA-STD-8739.2, NASA Workmanship Standard for Surface Mount Technology. d) Crimping, Wiring, and Harnessing: NASA-STD-8739.4, Crimping, Interconnecting Cables, Harnesses, and Wiring e) Fiber Optics: NASA-STD-8739.5, Fiber Optic Terminations, Cable Assemblies, and Installation Printed Wiring Board (PWB) Design: f) IPC-2221, Generic Standard on Printed Board Design g) IPC-2222, Sectional Design Standard for Rigid Organic Printed Boards h) IPC-2223, Sectional Design Standard for Flexible Printed Boards Printed Wiring Board Manufacture: i) IPC-6011, Generic Performance Specification for Printed Boards j) IPC-6012B Qualification and Performance Specification for Rigid Printed Boards - all flight boards shall be in compliance with the Performance Specification Sheet for Space and Military Avionics (SMA specification sheet). In the event of a conflict between the Design and Manufacture Specifications, the SMA specification shall take precedence. *(CCR 00075)* k) IPC-6013, Qualification and Performance Specification for Flexible Printed Boards
IMAR307	6.0-3	It is recognized that contractors may wish to use similar but not identical workmanship standards, procedures and training. *(CCR 00142)*
IMAR309	6.0-4	Any such alternatives **shall** be accompanied by a comparison to the standards in IMAR316 and a discussion of significant differences and rationale for use.
IMAR308	6.0-5	Where differences are proposed, alternate standards **shall** be submitted to the GOES-R Project office at least 120 days prior to use. *(CCR 00142)*
IMAR317	6.0-6	Prior to the start of manufacturing, the Contractor **shall** assure that all workmanship requirements and associated procedures and training are in place or that changes or waivers have been approved by the Government.

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IMAR319	6.1	**6.1 Ground Systems That Interface With Space Flight Hardware**
IMAR320	6.1.0-1	Any portion of ground system assemblies that mate with the flight hardware, or that will reside with the space flight hardware in environmental chambers or other test facilities that simulate a space flight environment (e.g., connectors, test cables, etc.), **shall** be designed and fabricated using space flight materials and processes. *(CCR 00142)*
IMAR321	6.1.0-2	Connector savers **shall** be used for testing all flight connectors.
IMAR322	6.1.0-3	Mate/Demate logs **shall** be maintained for all flight connectors and connector savers. *(CCR 00142)*
IMAR323	6.2	**6.2 Training and Certification**
IMAR324	6.2.0-1	All personnel working on GOES hardware **shall** be certified as having completed the required training, appropriate to their involvement, as defined in the above standards or in the contractor's quality manual.
IMAR325	6.2.0-2	At a minimum, certification **shall** include successful completion of formal training and demonstrated performance in the appropriate discipline.
IMAR326	6.3	**6.3 Printed Wiring Boards**
IMAR327	6.3.0-1	PWBs **shall** be manufactured in accordance with the Class 3 Requirements in the applicable (Section 6.0)PWB manufacturing standards. *(CCR 00142)*
IMAR328	6.3.0-2	The contractor **shall** provide PWB coupons to GSFC Systems Assurance Manager (SAM) or a GSFC approved laboratory for evaluation.
IMAR329	6.3.0-3	Approval **shall** be obtained prior to population of flight PWBs.
IMAR330	6.3.0-4	Coupons and test reports are not required for delivery to GSFC/Materials Engineering Branch (MEB) if the contractor has the coupons evaluated by a laboratory that has been approved by the GSFC/MEB, however, they **shall** be retained and included as part of the Project's documentation/data deliverables package.
IMAR1114	6.3.0-5	Planar magnetic devices, where the coils are an integral part of the design of a printed circuit board, are not subject to the assembly and screening requirements of MIL-STD-981 (refer to MAR444). The testing of any such devices **shall** be defined in the requirements for the printed circuit board or the next higher level assembly. *(CCR 00079)*
IMAR333	6.4	**6.4 Handling**
IMAR334	6.4.0-1	Handling (including storage) procedures **shall** be instituted to prevent part and material degradation.
IMAR335	6.4.0-2	The handling procedures **shall** be retained through inspection, kitting, and assembly and **shall** be identified on "build to" documentation.
IMAR336	6.4.0-3	The following criteria **shall** be used as a minimum for establishing handling and storage procedures for parts and materials: a) Control of environment, such as temperature, humidity, contamination, and pressure. b) Measures and facilities to segregate and protect parts and materials routed to different locations such as, to the materials review crib, or to a laboratory for inspection, or returned to the manufacturer from unaccepted shipments. c) Easily identifiable containers to identify space quality parts.

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IMAR336	6.4.0-3	d) Control measures to limit personnel access to parts and materials during receiving inspection and storage. e) Facilities for interim storage of parts and materials. f) Provisions for protective cushioning, as required, on storage area shelves, and in storage and transportation containers. g) Protective features of transportation equipment design to prevent packages from being dropped or dislodged in transit h) Protective bench surfaces on which parts and materials are handled during operations such as test, assembly, inspection, and organizing kits. i) Required use of gloves, finger cots, tweezers, or other means when handling parts to protect the parts from contact by bare hands. j) Provisions for protection of parts susceptible to damage by electrostatic discharge. k) Unique parts and materials criteria.
IMAR1132	6.4.0-4	All materials contacting the flight hardware **shall** meet the requirements for contamination control. *(CCR 00075)*
IMAR337	6.5	**6.5 Preservation and Packaging**
IMAR338	6.5.0-1	Preservation and packaging **shall** be in accordance with the item packaging requirements and NPR 6000.1. *(CCR 000064).*
IMAR339	6.5.0-2	All parts that are subject to degradation by electrostatic discharge **shall** be packaged in accordance with the approved ESD procedures.

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IMAR340	7	**7** Parts Requirements
IMAR342	7.1	**7.1 General**
IMAR343	7.1.0-1	The Contractor **shall** plan and implement an Electrical, Electronic, and Electromechanical (EEE) Parts Control Program to assure that all parts selected for use in flight hardware meet mission objectives for quality and reliability.
IMAR344	7.1.0-2	The program **shall** be in place in time to effectively support the design and selection processes.
IMAR345	7.1.0-3	All parts **shall** be selected, processed, and derated in accordance with GSFC EEE-INST-002, Instructions for EEE Parts Selection, Screening, Qualification, and Derating.
IMAR1136	7.1.0-4	Parts for primary instruments **shall** be to the requirements for part quality level 1.
IMAR1137	7.1.0-5	Parts for non-primary instruments **shall** be to the requirements for part quality level 2.
IMAR346	7.1.0-6	For those parts not readily available as part quality level 1 but are available at part quality level 2, parts require appropriate additional testing to bring parts into level 1 compliance.
IMAR347	7.1.0-7	The Contractor **shall** control the selection, application, evaluation, and acceptance of all parts through a Parts Control Board (PMCB), or another documented system of parts control that is approved by the GOES-R project.
IMAR348	7.1.0-8	The Contractor **shall** prepare a Parts and Materials Control Plan (PMCP) describing the approach and methodology for implementing the Parts and Materials Control Program.
IMAR349	7.1.0-9	PMCP **shall** also define the Contractor's criteria for parts selection and approval based on the guidelines of this section.
IMAR350	7.1.0-10	The PMCP **shall** be delivered in accordance with the CDRL.
IMAR351	7.2	**7.2 Single Point of Contact**
IMAR353	7.2.0-1	The Contractor and each Subcontractor **shall** designate a key individual to be their Project Parts Engineer (PPE).
IMAR354	7.2.0-2	The PPE **shall** have the prime responsibility for management of their EEE parts control program.
IMAR355	7.2.0-3	This individual **shall** have direct, independent and unimpeded access to the GOES-R Project PPE and Parts Control Board.

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IMAR356	7.2.0-4	Tasks typically performed by the prime contractor PPE and each subcontractor PPE **shall** include but are not limited to the following: a) Work with GOES-R PPE to perform parts control. b) Provide PMCB agenda, prepare Parts Identification Lists and provide supporting part information for part evaluation and approval by the PMCB. c) Coordinate Parts Control Board meetings, maintain minutes, develop and maintain the Project Approved Parts List (PAPL), develop and maintain As-Designed and As-Built Parts Lists (ADPL, ABPL). d) Perform Customer Source Inspections (CSI) and audits at supplier's facilities as necessary or as directed by the PMCB. e) Prepare part procurement, screening, qualification, and modification specifications, as required. f) Disposition / track part nonconformance's and part failure investigations g) Track and report impact of ALERTS and advisories on flight hardware.
IMAR357	7.3	**7.3 Parts and Materials Control Board (PMCB)**
IMAR358	7.3.0-1	The Contractor **shall** establish a Parts and Materials Control Board (PMCB) or a similar documented system to facilitate the management, selection, standardization, and control of parts, materials and associated documentation for the duration of the contract.
IMAR359	7.3.0-2	The PMCB **shall** be responsible for the review and approval of all EEE parts, for conformance to established criteria of section 7.4 (including radiation effects), and for developing and maintaining a PAPL. The PMCB is responsible for all parts activities such as failure investigations, disposition of non-conformances, and problem resolutions.
IMAR360	7.3.0-3	In addition the PMCB **shall** review and approve materials for use on the instrument in accordance with materials section of the IMAR.
IMAR361	7.3.0-4	PMCB operating procedures **shall** be included as part of the PMCP.
IMAR362	7.3.1	**7.3.1 PMCB Responsibilities**
IMAR364	7.3.1.0-1	The PMCB **shall** be responsible for: a) Evaluation of EEE parts for conformance to established criteria and inclusion in the PAPL, b) Review and approve EEE part derating as necessary for unique applications, c) Define testing requirements, d) Review non-preferred applications (including radiation effects), e) Track part failure investigations and nonconformances.
IMAR365	7.3.1.0-2	If there are any parts issues that cannot be resolved at the PMCB level, the issues **shall** be elevated to the GOES Program at NASA for resolution.
IMAR366	7.3.2	**7.3.2 PMCB Meetings and Notification**
IMAR368	7.3.2.0-1	The GOES-R Project Parts Engineer will participate in all PMCB meetings and **shall** be notified in advance of all upcoming meetings.

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IMAR369	7.3.2.0-2	Meeting minutes or records **shall** be maintained by the Contractor to document all decisions made and a copy provided to GSFC within five (5) working days of convening the meeting.
IMAR370	7.3.2.0-3	The GOES-R Project will retain the right to overturn decisions involving nonconformances within five working days after receipt of meeting minutes.
IMAR371	7.3.2.0-4	The Contractor PPE **shall** notify attendees at least five (5) days in advance of upcoming meetings as a goal.
IMAR372	7.3.2.0-5	Notification **shall** as a minimum, include a proposed agenda and Parts Identification List (PIL) of candidate parts.
IMAR373	7.3.3	**7.3.3 PMCB Membership**
IMAR374	7.3.3.0-1	As a minimum, the PMCB voting membership **shall** consist of the Instrument Contractor, Subcontractors, GOES-R Project Parts Engineer (PPE) and GOES-R Project Radiation Engineer (RE) and the GOES-R Materials Engineer (ME).
IMAR375	7.3.3.0-2	The Contractor PPE and GSFC GOES-R Project Parts Engineer will participate in all PMCB meetings.
IMAR378	7.3.3.0-3	The Contractor, and Subcontractors PPE **shall** assure that the appropriate individuals with engineering knowledge and skills are represented as necessary at meetings, such as part commodity specialists, Radiation Engineers or the appropriate subsystem design engineer.
IMAR380	7.4	**7.4 Part Selection And Processing**
IMAR381	7.4.1	**7.4.1 General**
IMAR382	7.4.1.0-1	All part commodities identified in the NASA Part Selection List (NPSL) are considered EEE parts and **shall** be subjected to the requirements set forth in this section.
IMAR383	7.4.1.0-2	Custom or advanced technology devices such as custom hybrid microcircuits, detectors, Application Specific Integrated Circuits (ASICs), and Multi-Chip Module (MCM) **shall** also be subject to parts control appropriate for the individual technology.
IMAR384	7.4.2	**7.4.2 Selection**
IMAR385	7.4.2.0-1	For primary instruments, parts selected from the NASA Parts Selection List (NPSL) for quality level 1 are preferred. For non-primary instruments, parts listed as quality level 2 are acceptable.
IMAR386	7.4.2.0-2	All other EEE parts **shall** be selected, manufactured, processed, screened, and qualified, as a minimum, to the requirements of EEE-INST-002, Instructions for EEE Parts Selection, Screening Qualification and Derating. *(CCR 00103)*
IMAR387	7.4.3	**7.4.3 Radiation Requirements for Part Selection**
IMAR388	7.4.3.0-1	All parts **shall** be selected to perform their function in their intended application for a 2X mission radiation dose based on 417-R-RPT-0027, The Radiation Environment for Electronic Devices on the GOES-R Series Satellites, and any associated analyses.
IMAR389	7.4.3.0-2	The radiation environment poses three main risks to active parts that must be considered during part selection:
IMAR390	7.4.3.1	**7.4.3.1 Total Ionizing Dose (TID)**
IMAR391	7.4.3.1.0-1	Total Ionizing Dose including Enhanced Low Dose Rate (ELDR) effects. Parts **shall** be selected to ensure their adequate performance in the application up to a dose of 2x the expected mission dose.

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IMAR392	7.4.3.1.0-2	Linear bipolar parts **shall** be assumed to be ELDR susceptible unless the parts have been successfully tested and shown to be insensitive.
IMAR393	7.4.3.2	**7.4.3.2 Displacement Damage**
IMAR394	7.4.3.2.0-1	Parts **shall** be selected to ensure their adequate performance in the application up to a dose of 2x the expected mission displacement damage dose. As an example, for silicon devices, and assuming shielding equivalent to 100 mils aluminum, parts must be able to withstand a minimum fluence equivalent to 2.68 x 10^{12} Protons/cm^2 (Si) at an equivalent energy level of 50 MeV without system-level degradation. Again, because of the dominance of electrons in geostationary orbit, displacement damage decreases rapidly with added shielding up to at least the first 300 mils Al equivalent.
IMAR395	7.4.3.3	**7.4.3.3 Single-Event Effects (SEE)**
IMAR396	7.4.3.3.0-1	The contractor **shall** carry out an analysis documenting the consequences of single-event induced error modes to the part, circuit, subsystem, and instrument system.
IMAR397	7.4.3.3.0-2	In particular, the analysis **shall** consider the consequences of Single Event Upset (SEU) or Single Event Transient (SET) in each application of the part.
IMAR398	7.4.3.3.0-3	Parts susceptible to Single Event Latch up (SEL) should be avoided.
IMAR399	7.4.3.3.0-4	NOTE: If performance demands the use of an SEL susceptible part, measures **shall** be implemented to ensure that SEL induced damage (both prompt and latent) are mitigated and that the mission success is not compromised. These measures must be approved by the contractor RE and PPE and the project RE and PPE before the part can be added to the PAPL. *(CCR 00062)*
IMAR401	7.4.3.3.0-5	Applied voltages for power MOSFETs, FETs and bipolar junction transistors **shall** be in the safe operating ranges for these devices.
IMAR402	7.4.4	**7.4.4 Custom or Advanced Technology Devices**
IMAR403	7.4.4.0-1	Devices such as custom hybrid microcircuits, detectors, ASICs, and MCMs **shall** be subject to parts control and include a design review appropriate for the individual technology.
IMAR404	7.4.4.0-2	The design review **shall** address items such as element analysis and, when necessary - packaging, qualification, and screening requirements. *(CCR 00038)*
IMAR1098	7.4.4.0-3	The GSFC Materials Branch **shall** be consulted to evaluate differences in coefficients of thermal expansion between materials.
IMAR405	7.4.4.0-4	A Customer Source Inspection may be required.
IMAR406	7.4.4.0-5	A procurement specification may be required for parts in this category based on the recommendation of the PPE.
IMAR407	7.4.4.0-6	If a procurement specification is generated it **shall** fully identify the item being procured. *(CCR 00080)*
IMAR1099	7.4.4.0-7	A specification **shall** include physical, mechanical, electrical, and environmental test requirements and quality assurance provisions necessary to control manufacture and acceptance. *(CCR 00080)*
IMAR408	7.4.4.0-8	If screening requirements are included in the procurement specification, these requirements **shall** include test conditions, burn-in circuits, failure criteria, and lot rejection criteria. *(CCR 00080)*
IMAR409	7.4.4.0-9	For lot acceptance or rejection, the Percentage of Defectives Allowable (PDA) in a screened lot **shall** be in accordance with EEE-INST-002.

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IMAR1133	7.4.4.0-10	If the screening requirements are not included in the procurement specification, a separate screening specification **shall** be prepared for the part, which includes test conditions, burn-in circuits, failure criteria, and lot rejection criteria. *(CCR 00080)*
IMAR410	7.4.5	**7.4.5 Plastic Encapsulated Microcircuits (PEMs)**
IMAR411	7.4.5.0-1	The use of Plastic Encapsulated Microcircuits and plastic semi-conductors is discouraged. However, when use is necessary to achieve unique requirements that can not be found in hermetic high reliability microcircuits, plastic encapsulated parts **shall** meet the requirements of NASA GSFC Supplement to GFSC EEE-INST-002, *INSTRUCTIONS FOR* PLASTIC ENCAPSULATED MICROCIRCUITS (PEMs) SELECTION, SCREENING AND QUALIFICATION.
IMAR412	7.4.5.0-2	The PMCB **shall** review the procurement specification for appropriate testing, and also review application, procurement and storage processes for the plastic encapsulated part(s) to assure that all aspects of the GSFC policy have been met. The PMCB may grant Preliminary Approval when the GSFC requirements have been met.
IMAR1082	7.4.5.0-3	Final approval for the use of the PEM(s) **shall** be obtained from the GOES-R Project Office.
IMAR413	7.4.6	**7.4.6 Verification Testing**
IMAR414	7.4.6.0-1	Re-performance of screening tests, which were performed by the manufacturer or authorized test house as required by military or procurement specification, is not required unless deemed necessary as indicated by failure history, GIDEP Alerts, age or other reliability concerns.
IMAR415	7.4.6.0-2	If required, testing **shall** be performed in accordance with EEE-INST-002 or as determined by the PMCB.
IMAR417	7.4.7	**7.4.7 Parts Approved on Prior Programs**
IMAR418	7.4.7.0-1	"Grandfather approval" of parts previously approved by GSFC via a Nonstandard Parts Approval Request (NSPAR) or prior PMCB activity **shall** not be permitted. However, existing approvals may be presented to the PMCB as an aid to review candidate parts for approval.
IMAR419	7.4.7.0-2	Such candidate parts **shall** be evaluated by the PMCB for compliance to current Program requirements by determining that: a) No changes have been made to the previously approved NSPAR, Source Control Drawing (SCD) or vendor list. b) All stipulations cited in the previous NSPAR approval have been implemented on the current flight lot, including performance of any additional testing. c) The previous program's parts quality level is identical to the current program. d) No new information has become available which would preclude the use of the previously approved part in a high reliability space flight application.
IMAR420	7.4.8	**7.4.8 Parts Used in Off-the-Shelf Assemblies**
IMAR421	7.4.8.0-1	Units or assemblies that are purchased as "off-the-shelf" hardware items **shall** be subjected to an evaluation of the parts used within them.
IMAR422	7.4.8.0-2	The parts **shall** be evaluated for screening compliance to EEE-INST-002, established reliability level, and include a radiation analysis.
IMAR423	7.4.8.0-3	Units may be required to undergo modification for use of higher reliability parts or Radiation hardened parts.

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IMAR424	7.4.8.0-4	All parts **shall** be subject to PMCB approval.
IMAR425	7.4.8.0-5	Modifications such as additional shielding for radiation effectiveness or replacing radiation soft parts for radiation hardened parts may be required and **shall** be subject to RE approval.
IMAR427	7.5	**7.5 Value Added Testing**
IMAR428	7.5.0-1	The following value - added tests provide for enhanced reliability of parts and all additional testing **shall** be noted in the PAPL (Section 7.8).
IMAR429	7.5.0-2	Unless otherwise specified, testing **shall** be in accordance with the test methods referenced in EEE-INST-002.
IMAR430	7.5.1	**7.5.1 Particle Impact Noise Detection (PIND)**
IMAR431	7.5.1.0-1	All EEE devices with internal cavities (transistors, microcircuits, hybrids, relays and switches) **shall** be subjected to Particle Impact Noise Detection (PIND) screening, in accordance with the applicable specification. The PMCB may waive this requirement for part types where the testing will be destructive or the presence of a particle will not impair the operation of the part. *(CCR 00034)*
IMAR432	7.5.1.0-2	Any device failing this screen **shall** not be used in any flight application.
IMAR433	7.5.2	**7.5.2 Capacitors**
IMAR434	7.5.2.1	**7.5.2.1 Surge Current Screening for Tantalum Capacitors**
IMAR435	7.5.2.1.0-1	All solid tantalum capacitors used in filtering applications **shall** be subjected to surge current screening.
IMAR436	7.5.2.1.0-2	Chip devices **shall** receive surge current testing in accordance with the requirements of MIL-PRF-55365, Capacitor, Fixed, Electrolytic (Tantalum), Chip, Non-established Reliability, Established Reliability, General Specification For, as imposed by surge current Option B of the specification. *(CCR 00060)*
IMAR1138	7.5.2.1.0-3	For a primary instrument, chip devices **shall** be tested in accordance with Option B of the specification.
IMAR1139	7.5.2.1.0-4	For a non-primary instrument, chip devices **shall** be tested in accordance with Option A of the specification. Parts may be ordered from the manufacturers with this testing by adding the appropriate symbol ("A" or "B") as the last character of the military part number.
IMAR437	7.5.2.1.0-5	For a primary instrument, leaded devices **shall** receive surge current testing in accordance with MIL-PRF-39003/10, Capacitors, Fixed, Electrolytic (Solid Electrolyte) Tantalum, (Polarized sintered slug), Established Reliability Styles CSS13 and CSS33 (High Reliability Applications). *(CCR 00060)*
IMAR1140	7.5.2.1.0-6	For a non-primary instrument, leaded devices **shall** receive surge current testing in accordance with MIL-PRF-39003/9, Capacitor, Fixed, Electrolytic (Solid Electrolyte) Tantalum, (Polarized Sintered Slug), High Frequency, Established Reliability Styles CSR21.
IMAR438	7.5.2.2	**7.5.2.2 Dielectric Screening for Ceramic Capacitors**
IMAR439	7.5.2.2.0-1	Ceramic capacitors used in circuits at or below 10V **shall** be rated at 100V or greater except as follows.

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IMAR440	7.5.2.2.0-2	Each lot of capacitors rated below 100V, **shall** have samples subjected to Humidity Steady State Low Voltage testing (85°C and 85% relative humidity) in accordance with MIL-PRF-123, Capacitors, Fixed, Ceramic Dielectric (Temperature Stable and General Purpose), High Reliability, General Specification for (12 piece sample for each lot/date code).
IMAR1141	7.5.2.2.0-3	For a primary instrument, the sample size **shall** be 12 pieces with zero failures (12 (0)) for each lot/date code.
IMAR1142	7.5.2.2.0-4	For a non-primary instrument, the sample size **shall** be 5 pieces with zero failures (5/(0)) for each lot/date code.
IMAR441	7.5.2.2.0-5	Following humidity exposure, a Destructive Physical Analysis (DPA) **shall** be performed in accordance with MIL-PRF-123 (sample size of 5 pieces for each lot/date code) prior to acceptance. *(CCR 00061)*
IMAR442	7.5.3	**7.5.3 Screening for Magnetic Components**
IMAR444	7.5.3.0-1	Custom magnetic devices (transformers and inductors) **shall** be assembled and screened to the requirements of MIL-STD-981, Design, Manufacturing and Quality Standards for Custom Electromagnetic Devices for Space Applications. *(CCR 00079)*
IMAR1143	7.5.3.0-2	For use in a primary instrument, the parts **shall** meet the requirements for Class S.
IMAR1144	7.5.3.0-3	For use in a non-primary instrument, the parts **shall** meet the requirements for Class B. Planar magnetic devices, where the coils are an integral part of the design of a printed circuit board, are not subject to the assembly and screening requirements of MIL-STD-981. The testing of any such devices **shall** be defined in the requirements for the printed circuit board or the next higher level assembly.
IMAR445	7.5.3.0-4	Burn-in screening **shall** be considered based on vendor history, performance stability requirements, device complexity, and application criticality.
IMAR446	7.5.3.0-5	Simple toroidal coils with one layer of windings may be exempted from burn in unless required by the core manufacturer to stabilize its properties, and such decisions require PMCB documentation and approval.
IMAR447	7.6	**7.6 Part Analysis**
IMAR449	7.6.1	**7.6.1 Destructive Physical Analysis**
IMAR450	7.6.1.0-1	A sample of each lot date code of microcircuits, hybrid microcircuits, EMI filters, relays, capacitors, oscillators, and semiconductor devices **shall** be subjected to a Destructive Physical Analysis (DPA) based on PMCB recommendation.
IMAR451	7.6.1.0-2	All other parts may require a sample DPA if it is deemed necessary as indicated by failure history, GIDEP Alerts, or other reliability concerns.
IMAR452	7.6.1.0-3	DPA tests, procedures, sample size and criteria **shall** be as specified in GSFC specification S-311-M-70.
IMAR453	7.6.1.0-4	Contractor's procedures for DPA may be used in place of S-311-M-70 and **shall** be submitted to the PMCP for concurrence prior to use.
IMAR454	7.6.1.0-5	The PMCB on a case-by-case basis **shall** consider variation to the DPA sample size requirements, due to part complexity, availability or cost.
IMAR455	7.6.2	**7.6.2 Failure Analysis**

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IMAR456	7.6.2.0-1	The Contractor **shall** perform part Failure Analysis essential to achieve a timely resolution and closeout of each failure incident.
IMAR457	7.6.2.0-2	The Contractor PPE **shall** submit the completed EEE part failure report with all supporting data, analyses, and photographs to the PMCB for review and approval within 10 working days of initiating corrective action.
IMAR458	7.6.2.0-3	The failure report form **shall** as a minimum, provide the following information: a) The failed part's identity (part name, part number, reference designator, manufacturer, manufacturing lot / date code, and part serial number if applicable), and symptoms by which the failure was identified (the conditions observed as opposed to those expected). b) The name of the unit or subsystem on which the failure occurred, the contract number, date of failure, the test phase, and the environment in which the test was being conducted. c) The results of the failure analyses conducted and the nature of the rework / retest / corrective action taken in response. d) An indication of whether the failure of the part or item in question constitutes a primary or a secondary (collateral) failure.
IMAR459	7.6.2.0-4	The completed failure report **shall** include copies of any supporting photographs, X-rays, metallurgical data, microprobe or spectrographic data, scanning electronic microscope photographs, pertinent variables (electrical and radiation) data, etc.
IMAR460	7.6.2.0-5	Radiation data **shall** be submitted where it is deemed pertinent to the failure mechanism.
IMAR461	7.7	**7.7 Additional Requirements**
IMAR462	7.7.1	**7.7.1 Parts Age and Storage Control**
IMAR463	7.7.1.0-1	All parts procured with date codes indicating that more than five (5) years have elapsed from the date of manufacture to date of procurement **shall** be subjected to a re-screen and sample DPA per PMCB recommendation.
IMAR464	7.7.1.0-2	Alternate test plans may be used as approved by the PMCB on a case-by case basis.
IMAR465	7.7.1.0-3	Parts taken from user inventory older than 5 years do not require re screen, provided they have been properly stored.
IMAR466	7.7.1.0-4	Parts over 10 years old from the date of manufacture to date of procurement **shall** not be procured. *(CCR 00059)*
IMAR467	7.7.2	**7.7.2 Derating**
IMAR468	7.7.2.0-1	All EEE parts **shall** be used in accordance with the derating guidelines of EEE-INST-002.
IMAR469	7.7.2.0-2	The Contractor's derating policy may be used in place of the EEE-INST-002 guidelines and **shall** be defined in the Contractor's PMCP. *(CCR 00058)*
IMAR470	7.7.2.0-3	The Contractor **shall** maintain documentation on parts derating analysis and make it available for GSFC review.
IMAR471	7.7.3	**7.7.3 Traceability**
IMAR473	7.7.3.0-1	The Contractor **shall** utilize traceability database(s) that provide the capability to retrieve historical records of EEE parts from initial procurement and receipt through, storage, kitting, assembly, test, and final acceptance of the deliverable product.

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IMAR475	7.7.3.0-2	Also, the database **shall** permit the traceability to the procurement document and provide for: a) Cross-referencing and traceability of part manufacturer and date code to the assembly traveler or production plan. b) The storage of the accumulated data records.
IMAR477	7.7.3.0-3	All flight EEE parts **shall** be traceable to the lot date code or the manufacturer's inspection lot code. *(CCR 00032)*
IMAR478	7.7.3.0-4	Traceability **shall** be maintained throughout manufacturing for each deliverable item.
IMAR1113	7.7.3.0-5	When necessary for radiation hardness or other requirements, the parts **shall** be traceable to the wafer lot, as determined by the PMCB. *(CCR 00032)*
IMAR483	7.7.4	**7.7.4 Prohibited Metals**
IMAR484	7.7.4.0-1	Pure tin plating **shall** not be used in the construction and surface finish of EEE parts proposed for space hardware.
IMAR485	7.7.4.0-2	Only alloys containing less than 97% tin are acceptable.
IMAR486	7.7.4.0-3	The use of cadmium or zinc is prohibited in the construction and surface finish of space hardware.
IMAR487	7.7.4.0-4	All cadmium alloys or zinc alloys (e.g. brass) **shall** be completely over plated with an approved metal.
IMAR489	7.7.5	**7.7.5 Supplier and Manufacturer Surveillance (Monitoring)**
IMAR490	7.7.5.0-1	The PMCB **shall** establish a policy and procedures for the periodic surveillance and auditing of suppliers, vendors, laboratories and manufacturers to ensure compliance to procurement, quality, reliability and survivability requirements.
IMAR491	7.7.5.0-2	Contractor's surveillance is not required for laboratories, suppliers, vendors, and manufacturers that have been approved as a part of Qualified Parts List (QPL) or Qualified Manufacturer's List (QML) program for products listed in the space quality baseline.
IMAR492	7.7.5.0-3	When surveillance/audit data is available from other sources (e.g. other contractor programs, other contractor sub-contractors, independent audits reports, etc.), the contractor may utilize the results of the data contingent on the review and approval by the PMCB. Acceptability of the data **shall** be based on technical considerations, as well as timeliness and confidence in the source of the data.
IMAR493	7.7.6	**7.7.6 Re-use of Parts and Materials**
IMAR494	7.7.6.0-1	Parts and materials which have been installed in an assembly, and are then removed from the assembly for any reason, **shall** not be used again in any item of flight or spare hardware without prior approval of the PMCB based on the submission of evidence that this practice does not degrade the system performance.
IMAR495	7.8	**7.8 Parts Lists**
IMAR496	7.8.0-1	The Contractor **shall** create and maintain a Program Approved Parts List (PAPL) and Parts Identification List (PIL) for the duration of the program.
IMAR498	7.8.0-2	Clear distinctions **shall** be made as to parts approval status and whether parts are planned for use in flight hardware.

ID	Object Number	417-R-IMAR-0039, RM Version, Instrument Mission Assurance Requirements (IMAR) Document
IMAR499	7.8.0-3	Parts **shall** be approved for listing on the PAPL or PIL before initiation of procurement activity. *(CCR 00057)*
IMAR500	7.8.1	**7.8.1 Program Approved Parts List (PAPL)**
IMAR501	7.8.1.0-1	The PAPL **shall** be the only listing of approved parts for flight hardware, and as such may contain parts not actually in flight design.
IMAR502	7.8.1.0-2	Only parts that have been evaluated and approved by the PMCB **shall** be listed in the PAPL.
IMAR503	7.8.1.0-3	The PMCB **shall** assure standardization and the maximum use of parts listed in the PAPL. (See Parts List Required Fields Table IMAR513)
IMAR504	7.8.2	**7.8.2 Parts Identification List (PIL)**
IMAR505	7.8.2.0-1	The PIL **shall** list all parts proposed for use in flight hardware. The PIL is prepared from design team inputs or subcontractor inputs, to be used for presenting candidate parts to the PMCB.
IMAR506	7.8.2.0-2	The PIL **shall** include as a minimum the following information: part number, part name or description, manufacturer, manufacturer's generic part number, drawing number, specifications, comments as necessary to indicate problems, long lead times, additional testing imposed, application unique notes, etc.
IMAR507	7.8.3	**7.8.3 As-Designed Parts List (ADPL)**
IMAR508	7.8.3.0-1	The Contractor PPE **shall** establish an As-Designed Parts List (ADPL) as soon as practical after the preliminary release of designs for CDR.
IMAR509	7.8.3.0-2	The ADPL **shall** follow the Parts Lists Required Fields Table (IMAR513). *(CCR 00031)*
IMAR1083	7.8.3.0-3	The Contractor **shall** submit the final version of the ADPL in accordance with the CDRL.
IMAR510	7.8.4	**7.8.4 As-Built Parts List (ABPL)**
IMAR511	7.8.4.0-1	An As-Built Parts List (ABPL) **shall** also be prepared and submitted in accordance with the CDRL.
IMAR512	7.8.4.0-2	The ABPL is generally a final compilation of all parts as installed in flight equipment, with additional "as-installed" part information such as manufacturer name, CAGE code, Lot-Date Code, part serial number (if applicable), quantity used and box or board location. The manufacturer's plant specific CAGE code is preferred, but if unknown, the supplier's general cage code is sufficient (See Parts List Required Fields Table IMAR513).
IMAR513	7.8.4.0-3	Parts Lists Required Fields Table.

ID	Object Number	417-R-IMAR-0039, RM Version, Instrument Mission Assurance Requirements (IMAR) Document

IMAR513 7.8.4.0-3

FIELD	Required Field for Parts List Type		
	ADPL	PAPL	ABPL
Item Number	X	X	X
Spacecraft Name	X	X	X
Instrument Name	X	X	X
Generic Part Number	X	X	X
Procurement Part Number	X	X	X
Flight Part Number		X	X
Description	X	X	X
Package: Case Style and Number of Pins	X	X	X
Lot Date Code			X
Manufacturer	X	X	X
Cage Code	X	X	X
Distributor	X		
Additional Testing Required	X	X	
Quantity needed	X		X
Quantity Procured	X		
Radiation Hardness Evaluation: TID, Krads	X	X	X
Radiation Hardness Evaluation: SEL, MeV	X	X	X
Radiation Hardness Evaluation: SEU, MeV	X	X	X
Radiation Hardness Evaluation: Displacement Damage	X	X	X
Radiation Data Source: TID	X		
Radiation Data Source: SEE	X		
Notes	X		
PMCB Comments	X	X	
Approval Date	X	X	X
Box Identification	X	X	X
Part Location (Circuit Identifier)			X

IMAR514 7.9

7.9 Data Requirements

ID	Object Number	417-R-IMAR-0039, RM Version, Instrument Mission Assurance Requirements (IMAR) Document
IMAR515	7.9.1	**7.9.1 General**
IMAR516	7.9.1.0-1	Attributes (parametric test) summary data **shall** be available to GSFC for all testing performed.
IMAR517	7.9.1.0-2	Variable data (read and record) **shall** be recorded for initial, interim and final electrical test points.
IMAR518	7.9.1.0-3	Test data **shall** be available to GSFC.
IMAR519	7.9.1.0-4	For those parts potentially susceptible to radiation effects in the GOES-R environment, a summary radiation report that identifies parameter degradation behavior **shall** be provided to the PMCB.
IMAR520	7.9.1.0-5	Variables data acquired during radiation testing **shall** be available to GSFC.
IMAR521	7.9.2	**7.9.2 Retention of Data and Test Samples**
IMAR522	7.9.2.0-1	All builders of flight hardware **shall** have a method in place for retention of data generated for parts tested and used in flight hardware.
IMAR523	7.9.2.0-2	The data **shall** be kept on file in order to facilitate future risk assessment and technical evaluation, as needed.
IMAR524	7.9.2.0-3	In addition, the prime contractor and subcontractors **shall** retain all part functional failures, all destructive and non-flight non-destructive test samples, which could be used for future validation of parts for performance under certain conditions not previously accounted for.
IMAR525	7.9.2.0-4	PIND test failures may be submitted for DPA, radiation testing or used in engineering models.
IMAR526	7.9.2.0-5	Parts and data **shall** be retained for the useful life of the instrument unless otherwise permitted by the PMCB.
IMAR527	7.9.2.0-6	All historical quality records and those data required to support these records **shall** be retained until contract completion.
IMAR528	7.9.3	**7.9.3 End Item Acceptance Data Package**
IMAR529	7.9.3.0-1	The Instrument Contractor PPE **shall** establish and maintain an EEE parts data package for each instrument produced under the contract. *(CCR 00056)*
IMAR530	7.9.3.0-2	The data package **shall** identify and include all parts in the instrument. *(CCR 00056)*
IMAR531	7.9.3.0-3	Each instrument EEE parts data package **shall** contain, as a minimum: a) "As- designed'' to ''As- Built" parts list configuration comparison. b) Part nonconformance documentation, including part failure reports, and waiver/deviation reports. c) Dispositions for installed parts impacted by GIDEP ALERTS Problem Advisories, NASA Advisories, or contractor purges. d) PMCB defined data relevant to the use of the part in that instrument. *(CCR 00056)*

ID	Object Number	417-R-IMAR-0039, RM Version, Instrument Mission Assurance Requirements (IMAR) Document
IMAR543	8	**8** Materials, Processes, and Lubrication Requirements
IMAR545	8.1	**8.1 General**
IMAR546	8.1.0-1	The Contractor **shall** prepare a Materials and Processes Plan and integrate that plan with the Parts and Materials Control Plan described above.
IMAR547	8.1.0-2	Materials and lubrication approval by the PMCB is required for each usage or application in space-flight hardware.
IMAR1100	8.1.0-3	The contractor **shall** submit the as-designed Materials and Lubrication List in accordance with the CDRL.
IMAR1084	8.1.0-4	The Contractor **shall** submit the as-built Materials and Lubrication List in accordance with the CDRL.
IMAR548	8.2	**8.2 Materials Selection Requirements**
IMAR549	8.2.0-1	In order to anticipate and minimize materials problems during space hardware development and operation, the Contractor **shall**, when selecting materials and lubricants, consider potential problem areas such as radiation effects, thermal cycling, stress corrosion cracking, galvanic corrosion, hydrogen embrittlement, lubrication, contamination of surfaces, particulate contaminates, composite materials, useful life, vacuum outgassing, toxic offgassing, flammability and fracture toughness as well as the properties required by each material usage or application.
IMAR550	8.2.0-2	The suitability and durability of materials used for parts **shall** be established on the basis of flight experience or tests.
IMAR551	8.2.0-3	The materials used **shall** conform to NASA approved specifications to ensure that the materials have the strength, modulus, coefficient of thermal expansion, thermal conductivity and other properties assumed in the design data.
IMAR552	8.2.0-4	Furthermore, material selection **shall** take into account the effects of environmental conditions expected during the life of the instrument.
IMAR1085	8.2.0-5	Materials **shall** be corrosion resistant or be suitably treated to resist corrosion when subjected to the specified environments.
IMAR553	8.2.0-6	Where practicable, fungus inert materials **shall** be used.
IMAR554	8.2.1	**8.2.1 Compliant Materials**
IMAR555	8.2.1.0-1	The Contractor **shall** use compliant materials in the fabrication of hardware to the extent practicable.
IMAR556	8.2.1.0-2	In order to be compliant, a material **shall** be used in a conventional application and meet the applicable selection criteria identified in Air Force Space Command Manual 91-710 (AFSPCMAN 91-710), Range Safety Requirements volume 3. *(CCR 00074A)*
IMAR557	8.2.1.0-3	The proposed use of a non-compliant material requires that a Materials Usage Agreement (MUA) and/or a Stress Corrosion Evaluation Form or Contractor's equivalent forms (Material Usage Agreement Form IMAR600, Stress Corrosion Evaluation Form IMAR601 and Polymeric Materials and Composites Usage Lists IMAR 615), be submitted to GSFC for approval in accordance with the CDRL.

ID	Object Number	417-R-IMAR-0039, RM Version, Instrument Mission Assurance Requirements (IMAR) Document
IMAR558	8.2.1.0-4	The instrument structural parts **shall** consist of only the materials approved by the Parts and Materials Control Board (PMCB). Table 1 of MSFC-STD-3029 MultiProgram/Project Common-Use Document Guidelines for the Selection of Metallic Materials for Stress Corrosion Cracking Resistance in Sodium Chloride Environments Materials, Processes, and Manufacturing Department Metallic Materials and Processes Group are examples of materials that can be considered for use. *(CCR 00066)*
IMAR559	8.2.1.1	**8.2.1.1 Materials Used in "Off-the-Shelf-Hardware"**
IMAR560	8.2.1.1.0-1	"Off-the-shelf hardware" for which a detailed materials list is not available and where the included materials cannot be easily identified and/or changed **shall** be treated as non-compliant.
IMAR561	8.2.1.1.0-2	The Contractor shall define on a MUA, what measures **shall** be used to ensure that all materials in the hardware are acceptable for use. Such measures might include any one or a combination of the following: hermetic sealing, vacuum bake-out, material changes for known non-compliant materials, etc
IMAR562	8.2.2	**8.2.2 Conventional Applications**
IMAR563	8.2.2.0-1	Conventional applications or usage of materials is the use of compliant materials in a manner for which there is extensive satisfactory aerospace heritage.
IMAR564	8.2.3	**8.2.3 Non-conventional Applications**
IMAR565	8.2.3.0-1	The proposed use of a compliant material for an application for which there is limited satisfactory aerospace usage **shall** be considered a non-conventional application. Under these circumstances, the PMCB will review any/all the information required in a Non-conventional Material and Lubrication Report so that it may fully understand and approve the application.
IMAR566	8.2.4	**8.2.4 Polymeric Materials**
IMAR567	8.2.4.0-1	The Contractor **shall** prepare and submit a polymeric materials and composites usage list or the Contractor's equivalent. Refer to Polymeric Materials and Composites Usage List IMAR615.
IMAR568	8.2.4.1	**8.2.4.1 Flammability and Toxic Offgassing**
IMAR569	8.2.4.1.0-1	Hazardous material requirements, including flammability, toxic offgassing and compatibility **shall** be in accordance with Air Force Space Command Manual 91-710 (AFSPCMAN 91-710), Range Safety Requirements. *(CCR 00074A)*
IMAR570	8.2.4.2	**8.2.4.2 Vacuum Outgassing**
IMAR571	8.2.4.2.0-1	Material vacuum outgassing **shall** be determined in accordance with ASTM E595 Standard Test Method for Total Mass Loss and Collected Volatile Condensable Materials from Outgassing in a Vacuum Environment. In general, a material is qualified on a product-by-product basis. However, the PMCB may require lot testing of any material for which lot variation is suspected. In such cases, material approval is contingent upon lot testing.
IMAR572	8.2.4.2.0-2	Only materials that have a total mass loss (TML) less than 1.00% and a collected volatile condensable material (CVCM) less than 0.10% **shall** be considered approved for use in a vacuum environment unless application considerations listed on a MUA dictate otherwise. *(CCR 00074A)*
IMAR573	8.2.4.3	**8.2.4.3 Shelf-Life-Controlled Materials**
IMAR574	8.2.4.3.0-1	Polymeric materials that have a limited shelf life **shall** be controlled by a process that identifies the start date (manufacturer's processing, shipment date, or date of receipt, etc.), the storage conditions associated with a specified shelf life, and expiration date.

ID	Object Number	417-R-IMAR-0039, RM Version, Instrument Mission Assurance Requirements (IMAR) Document
IMAR575	8.2.4.3.0-2	Materials such as o-rings, rubber seals, tape, uncured polymers, lubricated bearings and paints **shall** be included.
IMAR576	8.2.4.3.0-3	The use of materials whose date code has expired **shall** be approved by the PMCB. *(CCR 00067)*
IMAR577	8.2.4.3.0-4	The Contractor **shall** demonstrate, by means of appropriate tests, that the properties of the materials have not been compromised for their intended use. *(CCR 00067)*
IMAR578	8.2.4.3.0-5	When a limited-life piece part is installed in a subassembly, its usage **shall** be approved by the PMCB and included in the CDRL. *(CCR 00067)*
IMAR579	8.2.5	**8.2.5 Inorganic Materials**
IMAR580	8.2.5.0-1	The Contractor **shall** prepare and document an inorganic materials and composites usage list (Inorganic Materials and Composites Usage List IMAR616) or the Contractor's equivalent.
IMAR581	8.2.5.0-2	The list **shall** be submitted to the PMCB for review and approval. In addition, the Contractor may be requested to submit supporting applications data.
IMAR582	8.2.5.0-3	The criteria specified in MSFC-STD-3029 **shall** be used as a guide to determine that metallic materials meet the stress corrosion cracking criteria. Materials selected require approval by the PMCB. *(CCR 00074A)*
IMAR583	8.2.5.0-4	An MUA **shall** be submitted for each material usage from table 2 or table 3 of the MSFC STD-3029 requirements. *(CCR 00074A)*
IMAR584	8.2.5.0-5	Additionally, for GSFC to approve usage of individual materials, a stress corrosion evaluation form, as discussed in IMAR601 or an equivalent Contractor form or any/all of the information contained in the stress corrosion evaluation form **shall** be prepared and made available to GSFC upon request.
IMAR585	8.2.5.1	**8.2.5.1 Fasteners**
IMAR586	8.2.5.1.0-1	The Contractor **shall** prepare a Fastener Control Plan.
IMAR587	8.2.5.1.0-2	The plan **shall** be included in the PMCP.
IMAR588	8.2.5.1.0-3	The PMCB will approve all flight fasteners as part of the parts and materials list approval process.
IMAR589	8.2.5.1.0-4	The Contractor **shall** comply with the procurement documentation and test requirements for flight hardware and critical ground support equipment fasteners contained in 541-PG-8072.1.2, Goddard Space Flight Center Fastener Integrity Requirements. *(CCR 00074A)*
IMAR590	8.2.5.1.0-5	Material test reports for fastener lots **shall** be retained and made available for government inspection.
IMAR591	8.2.5.1.0-6	Fasteners made of plain carbon or low alloy steel **shall** be protected from corrosion.
IMAR592	8.2.5.1.0-7	When plating is specified, it **shall** be compatible with the space environment.
IMAR593	8.2.5.1.0-8	On steels harder than RC 33, the fastener **shall** be plated by a process that does not cause embrittlement.
IMAR594	8.2.5.2	**8.2.5.2 Locking Features**
IMAR595	8.2.5.2.0-1	Each removable bolt, screw, nut, pin or other removable fastener **shall** use a locking feature.
IMAR596	8.2.5.3	**8.2.5.3 Dissimilar Metals**

ID	Object Number	417-R-IMAR-0039, RM Version, Instrument Mission Assurance Requirements (IMAR) Document
IMAR597	8.2.5.3.0-1	Use of dissimilar metals in contact, as defined by MIL-STD-889, Dissimilar Metals, **shall** be limited to applications where similar metals cannot be used due to design requirements.
IMAR598	8.2.5.3.0-2	When use is unavoidable, metals **shall** be protected against galvanic corrosion by a method listed in MIL-STD-889.
IMAR599	8.2.5.3.0-3	Composite materials containing graphite fibers **shall** be treated as graphite in MIL-STD-889.
IMAR600	8.2.5.3.0-4	Material Usage Agreement Form

MATERIAL USAGE AGREEMENT			USAGE AGREEMENT NO.:		PAGE OF	
PROJECT:	SUBSYSTEM:		ORIGINATOR:		ORGANIZATION:	
DETAIL DRAWING	NOMENCLATURE		USING ASSEMBLY		NOMENCLATURE	
MATERIAL & SPECIFICATION			MANUFACTURER & TRADE NAME			
USAGE	THICKNESS	WEIGHT	EXPOSED AREA	ENVIRONMENT		
				PRESSURE	TEMPERATURE	MEDIA
APPLICATION:						
RATIONALE:						
ORIGINATOR:			PROJECT MANAGER:		DATE:	

IMAR601	8.2.5.3.0-5	

ID	Object Number	417-R-IMAR-0039, RM Version, Instrument Mission Assurance Requirements (IMAR) Document

IMAR601 8.2.5.3.0-5 Stress Corrosion Evaluation Form

1. Part Number _____
2. Part Name _____
3. Next Assembly Number _____
4. Manufacturer _____
5. Material _____
6. Heat Treatment _____
7. Size and Form _____
8. Sustained Tensile Stresses-Magnitude and Direction
   a. Process Residual _____
   b. Assembly _____
   c. Design, Static _____
9. Special Processing _____
10. Weldments
    a. Alloy Form, Temper of Parent Metal _____
    b. Filler Alloy, if none, indicate _____
    c. Welding Process _____
    d. Weld Bead Removed - Yes ( ), No ( ) _____
    e. Post-Weld Thermal Treatment _____
    f. Post-Weld Stress Relief _____
11. Environment _____
12. Protective Finish _____
13. Function of Part _____
    _____
14. Effect of Failure _____
    _____
15. Evaluation of Stress Corrosion Susceptibility _____
    _____
16. Remarks: _____

IMAR603 8.2.6

8.2.6 Lubrication

IMAR604 8.2.6-1 The Contractor **shall** prepare and document a lubrication usage list (Lubrication Usage List IMAR617) or the Contractor's equivalent. *(CCR 00074A)*

IMAR605 8.2.6-2 The list **shall** be submitted to the PMCB for approval. The Contractor may be requested to submit supporting applications data. *(CCR 00074A)*

ID	Object Number	417-R-IMAR-0039, RM Version, Instrument Mission Assurance Requirements (IMAR) Document
IMAR606	8.2.6-3	Lubricants **shall** be selected for use with materials on the basis of valid test results that confirm the suitability of the composition and the performance characteristics for each specific application, including compatibility with the anticipated environment and contamination effects. *(CCR 00074A)*
IMAR607	8.2.6-4	All lubricated mechanisms **shall** be qualified by life testing in accordance with the life test plan or heritage of an identical mechanism used in identical applications. *(CCR 00074A)*
IMAR608	8.3	**8.3 Process Selection Requirements**
IMAR609	8.3.0-1	The Contractor **shall** prepare and document a material process utilization list or the Contractor's equivalent (Materials Process Utilization List IMAR618).
IMAR610	8.3.0-1.0-1	A copy of any process **shall** be submitted for review upon request.
IMAR611	8.3.0-1.0-1.0-1	Manufacturing processes (e.g., lubrication, heat treatment, welding, and chemical or metallic coatings) **shall** be carefully selected to prevent any unacceptable material property changes that could cause adverse effects of materials applications.
IMAR612	8.4	**8.4 Procurement Requirements**
IMAR613	8.4.1	**8.4.1 Purchased Raw Materials**
IMAR614	8.4.1.0-1	Raw materials purchased by the Contractor and his suppliers **shall** be accompanied by the results of nondestructive, chemical and physical tests, or a Certificate of Compliance. This information need only be provided to PMCB when there is a direct question concerning the material's flightworthiness.
IMAR615	8.4.1.0-2	Polymeric Materials and Composites Usage List

ID Object Number

IMAR615 8.4.1.0-2

417-R-IMAR-0039, RM Version, Instrument Mission Assurance Requirements (IMAR) Document

POLYMERIC MATERIALS AND COMPOSITES USAGE LIST

SPACECRAFT _____ SYSTEM/EXPERIMENT _____ GSFC T/O _____

CONTRACTOR/CONTRACTOR _____ ADDRESS _____

PREPARED BY _____ PHONE _____ DATE PREPARED _____

GSFC MATERIALS EVALUATOR _____ PHONE _____ DATE RECEIVED _____ DATE EVALUATED _____

ITEM NO.	MATERIAL IDENTIFICATION[1]	MIX FORMULA[2]	CURE[3]	AMOUNT CODE Estimated mass in gm	EXPECTED ENVIRONMENT[5]	REASON FOR SELECTION[6]	OUTGASSING VALUES TML	OUTGASSING VALUES CVCM

NOTES

1. List all polymeric materials and composites applications utilized in the system except lubricants which should be listed on polymeric and composite materials usage list.
2. Give the name of the material, identifying number and manufacturer. Example: Epoxy, Epon 828, E. V. Roberts and Associates
3. Provide proportions and name of resin, hardener (catalyst), filler, etc. Example: 828/V140/Silflake 135 as 5/5/38 by weight
4. Provide cure cycle details. Example: 8 hrs. at room temperature + 2 hrs. at 150C
5. Provide the details of the environment that the material will experience as a finished S/C component, both in ground test and in space. List all materials with the same environment in a group. Example: T/V : -20C/+60C, 2 weeks, 10E-5 torr, ultraviolet radiation (UV)
   Storage: up to 1 year at room temperature
   Space: -100C/+20C, 2 years, 150 mile altitude, UV, electron, proton, atomic oxygen
6. Provide any special reason why the materials was selected. If for a particular property, please give the property. Example: Cost, availability, room temperature curing or low thermal expansion.

IMAR616 8.4.1.0-3 Inorganic Materials and Composites Usage List (*CCR 00086*)

ID Object Number

IMAR616 8.4.1.0-3

417-R-IMAR-0039, RM Version, Instrument Mission Assurance Requirements (IMAR) Document

INORGANIC MATERIALS AND COMPOSITES USAGE LIST

SPACECRAFT _____ SYSTEM/EXPERIMENT _____ GSFC T/O _____

CONTRACTOR/CONTRACTOR _____ ADDRESS _____

PREPARED BY _____ PHONE _____ DATE PREPARED _____

GSFC MATERIALS EVALUATOR _____ PHONE _____ DATE RECEIVED _____ DATE EVALUATED _____

ITEM NO	MATERIAL IDENTIFICATION[2]	CONDITION[3]	APPLICATION[4] OR OTHER SPEC. NO	EXPECTED ENVIRONMENT[5]	S.C.C. TABLE NO	MUA NO	NCE METHOD

NOTES:

1. List all inorganic materials (metals, ceramics, glasses, liquids, and metal/ceramic composites) except bearing and lubrication materials that should be listed on Form 18-59C.
2. Give materials name, identifying number manufacturer.
   Example: a. Aluminum 6061-T6
   b. Electroless nickel plate, Enplate Ni 410, Enthone, Inc.
   c. Fused silica, Corning 7940, Corning Class Works
3. Give details of the finished condition of the material, heat treat designation (hardness or strength), surface finish and coating, cold worked state, welding, brazing, etc.
   Example: a. Heat treated to Rockwell C 60 hardness, gold electroplated, brazed.
   B. Surface coated with vapor deposited aluminum and magnesium fluoride
   c. Cold worked to full hard condition. TIG welded and electroless nickel plated.
4. Give details of where on the spacecraft the material will be used (component) and its function
   Example: Electronics box structure in attitude control system, not hermetically sealed.
5. Give the details of the environment that the material will experience as a finished S/C component, both in ground test and in space. Exclude vibration environment. List all materials with the same environment in a group.
   Example. T/V. -20C/+60C, 2 weeks, 10E-5 torr, Ultraviolet radiation (UV)
   Storage: up to 1 year at room temperature
   Space: -10C/+20C, 2 years, 150 miles altitude, UV, electron, proton, Atomic Oxygen

IMAR617 8.4.1.0-4 Lubrication Usage List *(CCR 00086)*

ID **Object Number**

IMAR617 8.4.1.0-4

417-R-IMAR-0039, RM Version, Instrument Mission Assurance Requirements (IMAR) Document

LUBRICATION USAGE LIST

SPACECRAFT _____ SYSTEM/EXPERIMENT _____ GSFC T/O _____

DEVELOPER/CONTRACTOR _____ ADDRESS _____

PREPARED BY _____ PHONE _____ DATE PREPARED _____

GSFC MATERIALS EVALUATOR _____ PHONE _____ DATE RECEIVED _____ DATE EVALUATED _____

ITEM NO.	COMPONENT TYPE, SIZE MATERIAL(1)	COMPONENT MANUFACTURER & MFR. IDENTIFICATION	PROPOSED LUBRICATION SYSTEM & AMT. OF LUBRICANT	TYPE & NO. OF WEAR CYCLES(1)	SPEED, TEMP., & M. OF OPERATION(3)	TYPE OF LOADS & AMT.	OTHER DETAILS(1)

NOTES

(1) BB = ball bearing, SB = sleeve bearing, G = gear, SS = sliding surfaces, SEC = sliding electrical contacts. Give generic identification of materials used for the component e.g., 440C steel, PTFE.

(2) C,IR = continuous unidirectional rotation, CO = continuous oscillation, IR = intermittent rotation, IO = intermittent oscillation, SO = small oscillation, (<30°), LO = large oscillation (>30°), CS = continuous sliding, IS = intermittent sliding.
No. of wear cycles: A($1-10^2$), B(10^2-10^5), C(10^5-10^8), D(>10^8)

(3) Speed: RPM = revs./min., OPM = oscillations/min., VS = variable speed
CPM = cm/min. (sliding applications)
Temp. of operation, max. & min., °C
Atmosphere: vacuum, air, gas, sealed or unsealed & pressure

(4) Type of loads: A = axial, R = radial, T = tangential (gear load). Give amount of load.

(5) If BB, give type and material of ball cage and number of shields and specified ball groove and ball finishes. If G, give surface treatment and hardness. If SB, give dia. of bore and width. If torque available is limited, give approx. value.

IMAR618 8.4.1.0-5 Materials Process Utilization List (*CCR 00086*)

ID	Object Number	417-R-IMAR-0039, RM Version, Instrument Mission Assurance Requirements (IMAR) Document
IMAR618	8.4.1.0-5	

MATERIALS PROCESS UTILIZATION LIST

SPACECRAFT _____ SYSTEM/EXPERIMENT _____ CSFC T/O _____

CONTRACTOR/CONTRACTOR _____ ADDRESS _____

PREPARED BY _____ PHONE _____ DATE PREPARED _____

CSFC MATERIALS EVALUATOR _____ PHONE _____ DATE RECEIVED _____ DATE EVALUATED _____

ITEM NO	PROCESS TYPE[1]	CONTRACTOR SPEC. NO.[2]	MIL., ASTM., FED. OR OTHER SPEC. NO.	DESCRIPTION OF MAT'L PROCESSED[3]	SPACECRAFT/EXP. APPLICATION[4]

NOTES

(1) Give generic name of process, e.g., anodizing (sulfuric acid).

(2) If process if proprietary, please state so.

(3) Identify the type and condition of the material subjected to the process. E.g., 6061-T6

(4) Identify the component or structure of which the materials are being processed. E.g., Antenna dish

ID	Object Number	417-R-IMAR-0039, RM Version, Instrument Mission Assurance Requirements (IMAR) Document
IMAR619	9	# 9 Design Verification Requirements
IMAR620	9.1	## 9.1 General
IMAR621	9.1.0-1	The following requirements represents only a portion of the overall system verification (i.e., contractor derived requirements are not described) that must be integrated into the total system program which verifies that the system will meet the mission requirements. A system performance verification program documenting the overall verification plan, implementation, and results is required which will provide traceability from mission specification requirements to launch and initial on-orbit capability. This will also provide the baseline for tracking on-orbit performance versus pre-launch capability.
IMAR622	9.2	## 9.2 System Performance Verification Plan and Matrix
IMAR623	9.2.0-1	A System Performance Verification Plan and Matrix, **shall** be prepared and delivered in accordance with the CDRL.
IMAR639	9.3	## 9.3 Criteria for Unsatisfactory Performance
IMAR640	9.3.1	### 9.3.1 General
IMAR641	9.3.1.0-1	Failure (see definitions) or significant change, in performance of any test item **shall** be documented and processed in accordance with the following.
IMAR1101	9.3.1.0-2	Deterioration or change in performance of any test item that does or could in any manner prevent the item from meeting its functional, operational, or design requirements throughout its mission **shall** be reason to consider the test item as having failed. Other factors concerning failure are considered in the following paragraphs.
IMAR642	9.3.1.1	#### 9.3.1.1 Failure
IMAR643	9.3.1.1.0-1	When a failure occurs, a determination **shall** be made as to the feasibility and value of continuing the test to it specified conclusion.
IMAR644	9.3.1.1.0-2	If corrective action is taken, the test **shall** be repeated to the extent necessary to demonstrate that the test item's performance is satisfactory.
IMAR645	9.3.1.2	#### 9.3.1.2 Failure with Retroactive Effect
IMAR646	9.3.1.2.0-1	If corrective action taken as a result of failure, e.g., redesign of a component, affects the validity of previously completed tests, prior tests **shall** be repeated to the extent necessary to demonstrate satisfactory performance.
IMAR647	9.3.1.3	#### 9.3.1.3 Failure Reporting
IMAR648	9.3.1.3.0-1	Every failure **shall** be recorded and reported in accordance with the failure reporting provisions of Section 2.
IMAR649	9.3.1.4	#### 9.3.1.4 Wear Out
IMAR650	9.3.1.4.0-1	A spare may be substituted if during a test sequence a test item is: A) operated in excess of design life and wears out or B) becomes unsuitable for further testing from causes other than deficiencies. If the substitution affects the significance of test results, the test during which the item was replaced and any previously completed tests that are affected **shall** be repeated to the extent necessary to demonstrate satisfactory performance.
IMAR665	9.4	## 9.4 Environmental Verification Specification

ID	Object Number	417-R-IMAR-0039, RM Version, Instrument Mission Assurance Requirements (IMAR) Document
IMAR666	9.4.0-1	An Environmental Verification Specification **shall** be prepared that defines the specific environmental parameters that each hardware element is subjected to either by test or analysis in order to demonstrate its ability to meet the mission performance requirements.
IMAR667	9.4.0-2	The Environmental Verification Specification **shall** be delivered in accordance with the CDRL.
IMAR668	9.5	**9.5 Performance Verification Procedures**
IMAR669	9.5.0-1	For each verification test activity conducted at the unit, subsystem or instrument level (or other appropriate levels) of assembly, a Performance Verification Procedure **shall** be prepared that describes the configuration of the device under test, and how each test activity contained in the verification plan and specification will be implemented.
IMAR670	9.5.0-2	Performance Verification Procedures **shall** be delivered in accordance with the CDRL.
IMAR671	9.5.0-3	Performance Verification procedures **shall** contain details such as instrumentation monitoring, facility control sequences, and device under test functions, test parameters, pass/fail criteria, quality control checkpoints, data collection and reporting requirements.
IMAR672	9.5.0-4	The procedures also **shall** address safety and contamination control provisions.
IMAR673	9.6	**9.6 Verification Reports**
IMAR674	9.6.0-1	After each unit or instrument environmental test activity has been completed, a report **shall** be submitted to GSFC.
IMAR675	9.6.0-2	For each analysis activity, the report **shall** describe the degree to which the objectives were accomplished, how well the mathematical model was validated by related test data, and other such significant results.
IMAR676	9.6.0-3	In addition, as-run verification procedures and all test and analysis data **shall** be retained for review.
IMAR677	9.6.0-4	Verification Reports **shall** be delivered in accordance with the CDRL.
IMAR678	9.7	**9.7 System Performance Verification Report**
IMAR679	9.7.0-1	At the conclusion of the performance verification program, a final System Performance Verification Report **shall** be delivered that compares the hardware/software specifications with the final verified values (whether measured or computed).
IMAR680	9.7.0-2	The System Performance Verification Report **shall** be maintained “real-time” throughout the program summarizing the successful completion of verification activities, and showing that the applicable system performance specifications have been acceptably complied with prior to integration of hardware/software into the next higher level of assembly.
IMAR681	9.7.0-3	The System Performance Verification Report **shall** be delivered in accordance with the CDRL.
IMAR682	9.8	**9.8 Electrical Functional and Performance Test Requirements**
IMAR683	9.8.1	**9.8.1 General**
IMAR684	9.8.1.0-1	The following paragraphs describe the required electrical functional and performance tests that verify the instrument operation before, during, and after performance and environmental testing. These tests along with all other calibrations, functional/performance tests, measurements/alignments (and alignment verifications), etc., that are part of the overall verification program **shall** be described in the System Performance Environmental Verification Plan.

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IMAR685	9.8.2	**9.8.2 Electrical Interface Tests**
IMAR686	9.8.2.0-1	Before the integration of an assembly, unit or subsystem into the next higher hardware assembly, electrical interface tests **shall** be performed to verify that all interface signals are within acceptable limits of applicable performance specifications.
IMAR687	9.8.2.0-2	Prior to mating with other hardware, electrical harnessing **shall** be tested to verify proper characteristics; such as routing of electrical signals, impedance, isolation, and overall workmanship.
IMAR688	9.8.3	**9.8.3 Comprehensive Performance Tests**
IMAR689	9.8.3.0-1	The comprehensive performance test (CPT) **shall** be a detailed demonstration that the hardware and software meet their performance requirements within allowable tolerances.
IMAR690	9.8.3.0-2	The test **shall** demonstrate operation of all redundant and cross-strapped circuitry and satisfactory performance in all operational modes.
IMAR691	9.8.3.0-3	The initial CPT at ambient temperature prior to the start of the environmental test program **shall** serve as a baseline against which the results of all later CPTs can be readily compared.
IMAR693	9.8.3.0-4	CPT's **shall** be repeated at the conclusion of major environmental tests of each level of assembly.
IMAR694	9.8.3.0-5	At the instrument system level, the CPT **shall** demonstrate that, with the application of known stimuli, the instrument will produce the expected response.
IMAR695	9.8.3.0-6	At lower levels of assembly, the test **shall** demonstrate that, when provided with appropriate inputs, internal performance is satisfactory and outputs are within acceptable limits.
IMAR697	9.8.4	**9.8.4 Limited Performance Tests**
IMAR698	9.8.4.0-1	A Limited Performance Test (LPT) is a subset of the CPT. It demonstrates the aliveness, addressability, and response of all units including primary and redundant sides. The instrument response during LPT **shall** be recorded for comparison and tracking of critical parameters and for insight and characterizing instrument health.
IMAR701	9.8.5	**9.8.5 Performance Operating Time and Trouble-Free Performance Testing**
IMAR702	9.8.5.0-1	A minimum of one-thousand (1000) hours of operating/powered-on time **shall** be accumulated on all flight electronic hardware prior to shipping the instrument.
IMAR1086	9.8.5.0-2	Powered on time **shall** be divided between primary and redundant electronics.
IMAR703	9.8.5.0-3	At the conclusion of the performance verification program, instruments **shall** have demonstrated trouble-free performance testing for at least the last 350 hours of operation prior to instrument shipment.
IMAR1102	9.8.5.0-4	Trouble-free performance testing time **shall** be divided between primary and redundant electronics.
IMAR704	9.8.5.0-5	Trouble-free operation **shall** include 200 hours during the thermal-vacuum test with 100 hours being logged at the hot-dwell temperature and 100 hours being logged at the cold-dwell temperature.
IMAR1087	9.8.5.0-6	Trouble-free operation during thermal vacuum test **shall** be divided between primary and redundant electronics.

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IMAR706	9.8.6	**9.8.6 Limited-Life Electrical Parts**
IMAR707	9.8.6.0-1	A life test program **shall** be conducted for electrical parts that have limited lifetimes.
IMAR708	9.8.6.0-2	The Life Test Plan **shall** address the life test program, identifying the electrical and electromechanical parts that require such testing, describing the test hardware that will be used, and the test methods that will be employed.
IMAR709	9.9	**9.9 Structural and Mechanical Verification Requirements**
IMAR710	9.9.1	**9.9.1 General Requirements**
IMAR711	9.9.1.0-1	The contractor **shall** demonstrate compliance with structural and mechanical requirements with a series of interdependent tests and analysis activities.
IMAR712	9.9.1.0-2	The demonstrations **shall** qualify the design and demonstrate margins using specified factors of safety, ensure interface compatibility, acceptable workmanship, and compliance with both Atlas V and Delta IV interface and safety requirements.
IMAR1152	9.9.2	**9.9.2 Mechanical Test Factors and Duration**
IMAR1153	9.9.2.0-1	The project **shall** employ the mechanical test factors and durations in accordance with Section 2.2.4 of GSFC-STD-7000. For pressurized glass elements, the qualification test factor is 2.0, and the acceptance test factor is 1.25.
IMAR1155	9.9.3	**9.9.3 Minimum Workmanship**
IMAR1156	9.9.3.0-1	All electrical, electronic, and electro-mechanical components **shall** be subjected to minimum workmanship test levels as specified in GSFC-STD-7000 Section 2.4.2.6.
IMAR1157	9.9.4	**9.9.4 Testing in Flight Configuration**
IMAR1158	9.9.4.0-1	Mechanical environmental testing of flight hardware **shall** be performed with the test article in its appropriate configuration.
IMAR1159	9.9.4.0-2	Hardware powered on for launch **shall** be powered on for testing.
IMAR1160	9.9.5	**9.9.5 Structural Proof Testing**
IMAR1161	9.9.5.0-1	Primary and secondary structures fabricated from nonmetallic composites, beryllium, or containing bonded joints or bonded inserts **shall** be proof tested in accordance with GSFC-STD-7000 Section 2.4.1.4.1.
IMAR1162	9.9.6	**9.9.6 Model Survey Characterization**
IMAR1163	9.9.6.0-1	Modes up to 75 Hz and with more than 5% predicted modal mass participation **shall** have frequencies verified by test. *(CCR 00218)*
IMAR1187	9.9.6.0-2	Predicted frequencies of these modes **shall** correlate to test frequencies within 5%. *(CCR 00218)*
IMAR1188	9.9.6.0-3	Modes below 50 Hz and with more than 5% predicted modal mass participation **shall** be verified by modal survey. *(CCR 00218)*
IMAR1189	9.9.6.0-4	Cross-orthogonality checks of these test and analytical mode shapes, with respect to the analytical mass matrix, **shall** be performed with the requirement of obtaining at least 0.9 on diagonal terms and no greater than 0.1 off-diagonal. *(CCR 00218)*

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IMAR1164	9.9.6.0-5	The instrument contractor **shall** determine by loads and jitter analysis the critical modal parameters.
IMAR1165	9.9.6.0-6	The instrument contractor **shall** measure by test the critical modal parameters of the structure.
IMAR1166	9.9.6.0-7	The measured modal parameters **shall** be used to verify and update the loads and jitter performance.
IMAR1167	9.9.7	**9.9.7 Structural Qualification**
IMAR1168	9.9.7.0-1	Structural tests that demonstrate that flight hardware is compatible with expected mission environments **shall** be conducted in compliance with GSFC-STD-7000 Section 2.4.
IMAR1169	9.9.7.0-2	Any glass elements with bonds **shall** be qualified with a non-flight prototype.
IMAR1170	9.9.7.0-3	The number of qualification tests on a non-flight prototype **shall** be greater than or equal to the planned number of acceptance tests performed on any flight unit.
IMAR1171	9.9.7.0-4	The test durations **shall** have a tolerance of plus 5 seconds and minus zero.
IMAR1172	9.9.7.0-5	The qualification tests **shall** reduce the input levels as necessary to prevent the unit interface forces from exceeding the yield limits defined in the instrument ICD.
IMAR1173	9.9.7.0-6	The acceptance tests **shall** reduce the input levels as necessary to prevent the interface forces from exceeding the flight limits defined in the instrument ICD.
IMAR1174	9.9.7.0-7	Vibration tests **shall** be performed to provide test data sufficient to update structural models, to compute responses to launch loads using updated models, and to verify margins against yield and ultimate strength requirements in the 50.1 to 100 Hz frequency range. *(CCR 00082A)*
IMAR1175	9.9.7.0-8	For shock isolated units, the lower frequency limit of the input shock spectrum **shall** be less than 0.7 times the frequency of the first natural mode of the isolated unit.
IMAR1176	9.9.8	**9.9.8 Deployment and Articulation Verification**
IMAR1177	9.9.8.0-1	All flight deployables, movable appendages, and mechanisms **shall** demonstrate full range of motion and articulation under worst-case conditions prior to flight.
IMAR1178	9.9.9	**9.9.9 Life Test**
IMAR1179	9.9.9.0-1	Except for active cryogenic cooling systems, a life test **shall** be conducted, within representative operational environments, to at least 2x expected life for all repetitive motion devices with a goal of completing 1x expected life by CDR.
IMAR1180	9.9.9.0-2	For active cryogenic cooling systems, the total operating time or number of operational cycles without failure **shall** be at least 1.0 times mission life with 0.5 times mission life completed prior to the scheduled launch date of the first flight model.
IMAR1181	9.9.10	**9.9.10 Mechanical Clearance Verification**
IMAR1182	9.9.10.0-1	Verification of mechanical clearances and margins including potential reduced clearances after blanket expansion **shall** be performed on the final as-built hardware.
IMAR795	9.10	**9.10 Electromagnetic Compatibility Requirements**
IMAR796	9.10.1	**9.10.1 General**

ID	Object Number	417-R-IMAR-0039, RM Version, Instrument Mission Assurance Requirements (IMAR) Document
IMAR797	9.10.1.0-1	The instrument and its units **shall** not generate electromagnetic interference that could adversely affect its own performance or the performance and operation of other units on the spacecraft, or the launch vehicle and launch site.
IMAR798	9.10.1.0-2	An EMC/EMI Compatibility Plan **shall** be prepared and delivered in accordance with the CDRL.
IMAR799	9.10.1.0-3	The instrument **shall** not be susceptible to emissions that could adversely affect its performance and safety. This applies whether the emissions are intentional or non-intentional.
IMAR800	9.10.1.0-4	The qualification and flight acceptance tests for the EMC program are the same. The EMC test program is intended to uncover workmanship defects and unit-to-unit variation in electromagnetic characteristics, as well as design flaws. Performance of the qualification and acceptance test programs will provide a margin of hardware reliability. The EMC requirements described below also apply to all previously qualified hardware.
IMAR801	9.10.2	**9.10.2 Safety and Controls**
IMAR802	9.10.2.0-1	Spurious signals that lie above specified testing limits **shall** be eliminated.
IMAR803	9.10.2.0-2	Spurious signals (i.e. Any unintentional out of band signals that are a direct or indirect product of one or more oscillators) that are below specified limits **shall** be analyzed to determine if a subsequent change in frequency or amplitude is possible; if it is possible, the spurious signals should be eliminated to protect the spacecraft and instruments from the possibility of interference. *(CCR 00232)*
IMAR804	9.10.2.0-3	Retest **shall** be performed to verify that intended solutions are effective.
IMAR805	9.10.3	**9.10.3 Conducted Emission Requirements**
IMAR806	9.10.3.0-1	Conducted emission limits on power leads **shall** be applied to instrument hardware as defined below.
IMAR807	9.10.3.1	**9.10.3.1 Power Leads Conducted Emissions *(CCR 00078A) (CCR 00146B)***
IMAR808	9.10.3.1.0-1	Narrowband conducted emission on power and power-return leads **shall** be limited to the levels specified in the Conducted Emissions on Instrument Power Leads Figures (IMAR1128 /IMAR811). *(CCR 00078A)*
IMAR1125	9.10.3.1.1	**9.10.3.1.1 Conducted Emissions (30Hz to 9.999kHz) *(CCR 00078A) (CCR 00146B)***
IMAR1126	9.10.3.1.1.0-1	Testing for the control of electromagnetic interference characteristics of subsystems and equipment in the 30Hz to 9.999kHz frequency range **shall** be in accordance with MIL-STD-461E, section 5.4.3 (CE101 test procedure). *(CCR 00078A) (CCR 00146B)*
IMAR1127	9.10.3.1.1.0-2	The test bandwidth **shall** be as indicated in MIL-STD-461E, Table II. *(CCR 00078A) (CCR 00146B)*
IMAR1128	9.10.3.1.1.0-3	

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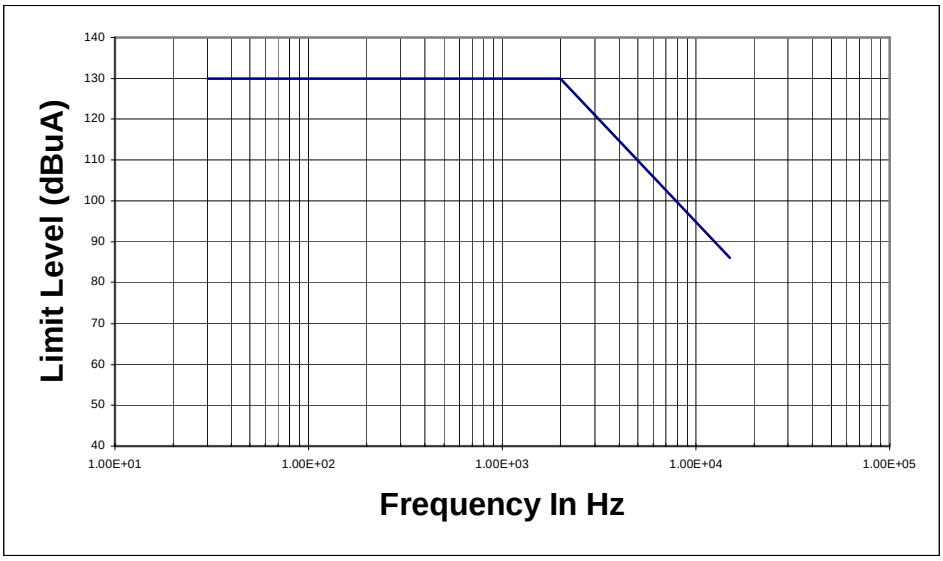
IMAR1128 9.10.3.1.1.0-3 **Conducted Emissions on Instrument Power Leads Figure (30Hz to 9.999kHz)** ***(CCR 00078A) (CCR 00146B)***

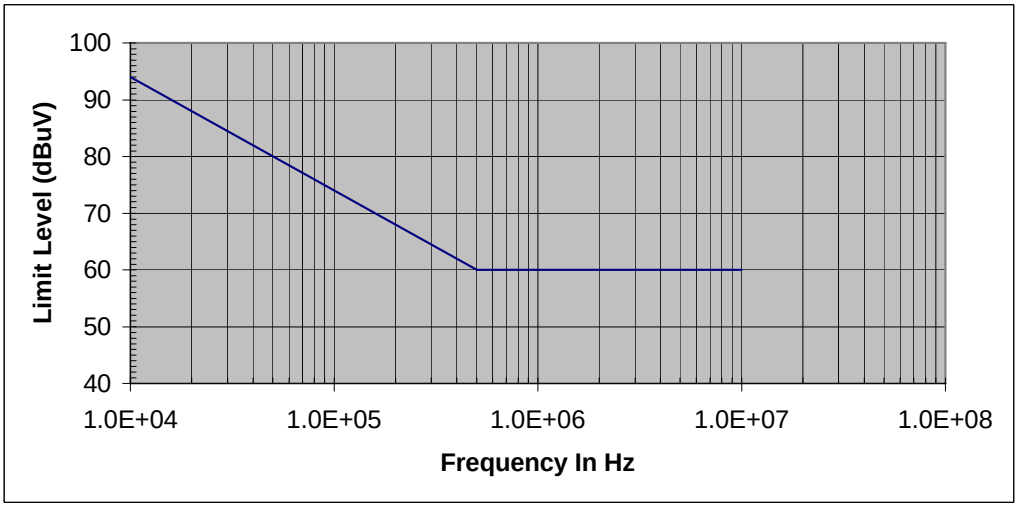


IMAR1130 9.10.3.1.2 **9.10.3.1.2 Conducted Emissions (CE102)** *(CCR 00078A)*

IMAR809 9.10.3.1.2.0-1 Testing **shall** be in accordance with MIL-STD-461E, Requirements for the control of electromagnetic Interference Characteristics of Subsystems and Equipment, test number CE102 (10 KHz to 50 MHz). *(CCR 00078A)*

IMAR810 9.10.3.1.2.0-2 The measurement bandwidth **shall** be as indicated in Table II in MIL-STD-461E. *(CCR 0078A)*

IMAR811 9.10.3.1.2.0-3 Conducted Emissions on Instrument Power Leads Figure (CE102) *(CCR 00006) (CCR 00078A)*



IMAR812 9.10.4 **9.10.4 Common Mode Noise**

IMAR816 9.10.4.1 **9.10.4.1 Common Mode Noise (Frequency Domain)**

IMAR817 9.10.4.1.0-1 Conducted emission common mode noise in the frequency domain **shall** be limited to the levels specified in the Power Lead Common Mode Noise Figure (IMAR820).

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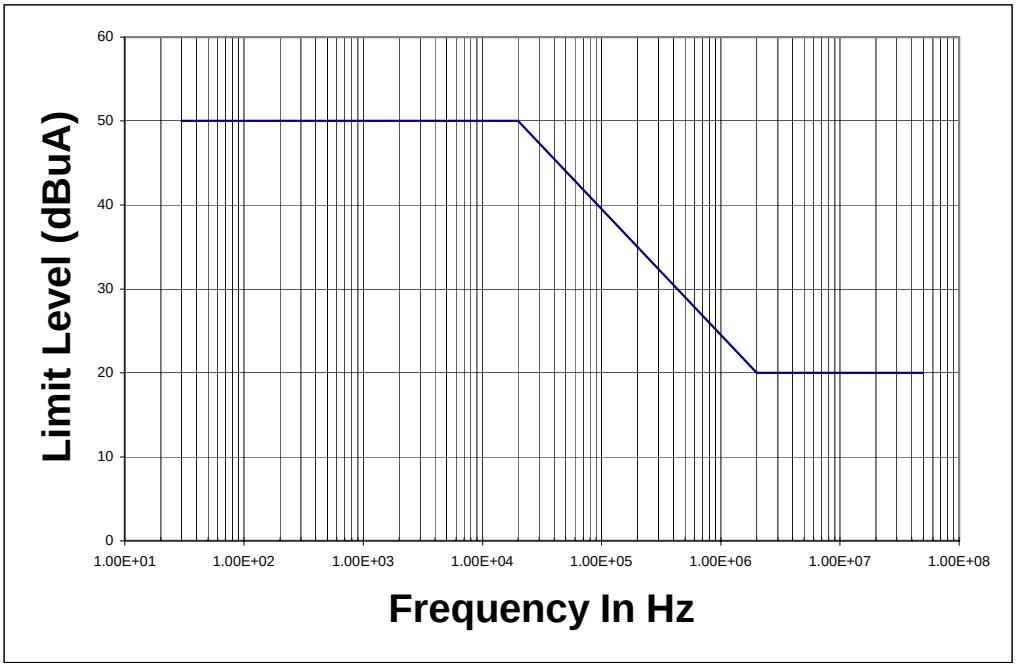
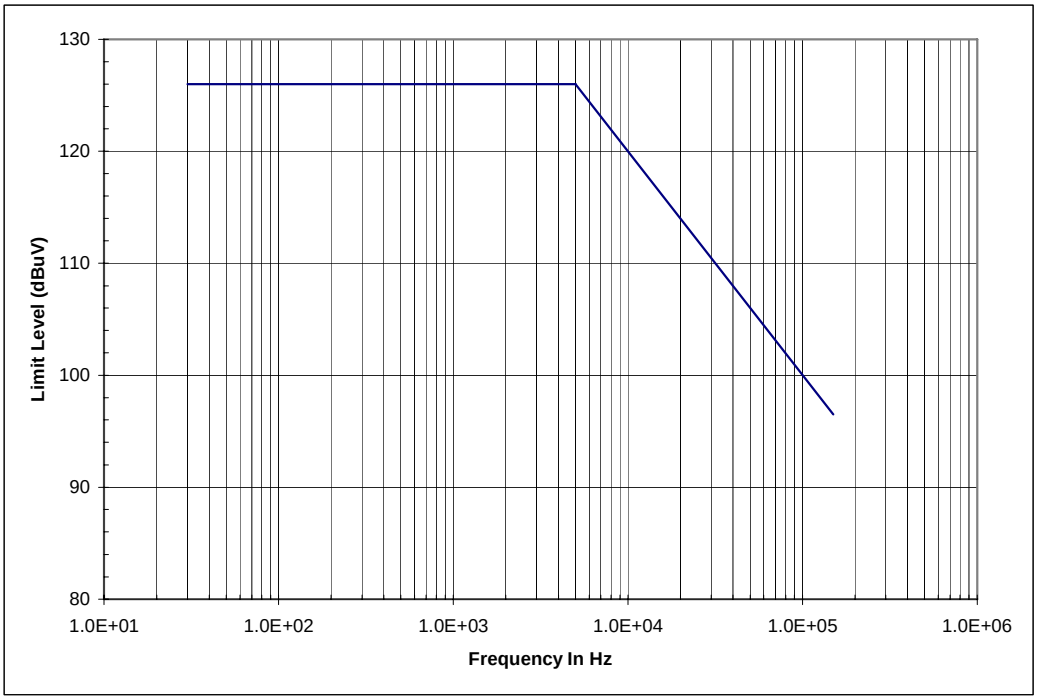
IMAR818	9.10.4.1.0-2	The test procedure used for this test **shall** be in accordance with MIL-STD-461 test number CE101.
IMAR819	9.10.4.1.0-3	In the test required by IMAR818, the probe **shall** be placed around both the positive and return leads.
IMAR820	9.10.4.1.0-4	Power Lead Common Mode Noise Figure



IMAR821 9.10.5

9.10.5 Conducted Susceptibility, Power Leads (CS101 30 Hz to 150 KHz)

IMAR822	9.10.5.0-1	The instrument **shall** not exhibit any malfunction, degradation of performance, or deviations from instrument specifications beyond the allowable tolerances, when subjected to an injection probe drive level which has been pre-calibrated to the appropriate current limit shown in the Conducted Susceptibility for Power Leads Figure (IMAR824).
IMAR823	9.10.5.0-2	The test procedure used for this test **shall** be in accordance with MIL-STD-461, CS101.
IMAR824	9.10.5.0-3	Conducted Susceptibility for Power Leads Figure

ID	Object Number	417-R-IMAR-0039, RM Version, Instrument Mission Assurance Requirements (IMAR) Document
IMAR824	9.10.5.0-3	

IMAR825 9.10.6

9.10.6 Conducted Susceptibility, Bulk Cable Injection (CS114 10 KHz to 200 MHz)

IMAR826 9.10.6.0-1 The instrument **shall** not exhibit any malfunction, degradation of performance, or deviation from instrument specifications beyond allowable tolerances, when subjected to an injection probe drive level onto the power leads which has been pre-calibrated to the appropriate current limit shown in the Conducted Susceptibility for Power Leads, Bulk Current Injection Figure (IMAR831).

IMAR828 9.10.6.0-2 The test procedures used for these tests **shall** be accordance with MIL-STD-461 Rev E, CS114. *(CCR 00004)*

IMAR831 9.10.6.0-3 Conducted Susceptibility for Power Leads, Bulk Current Injection Figure

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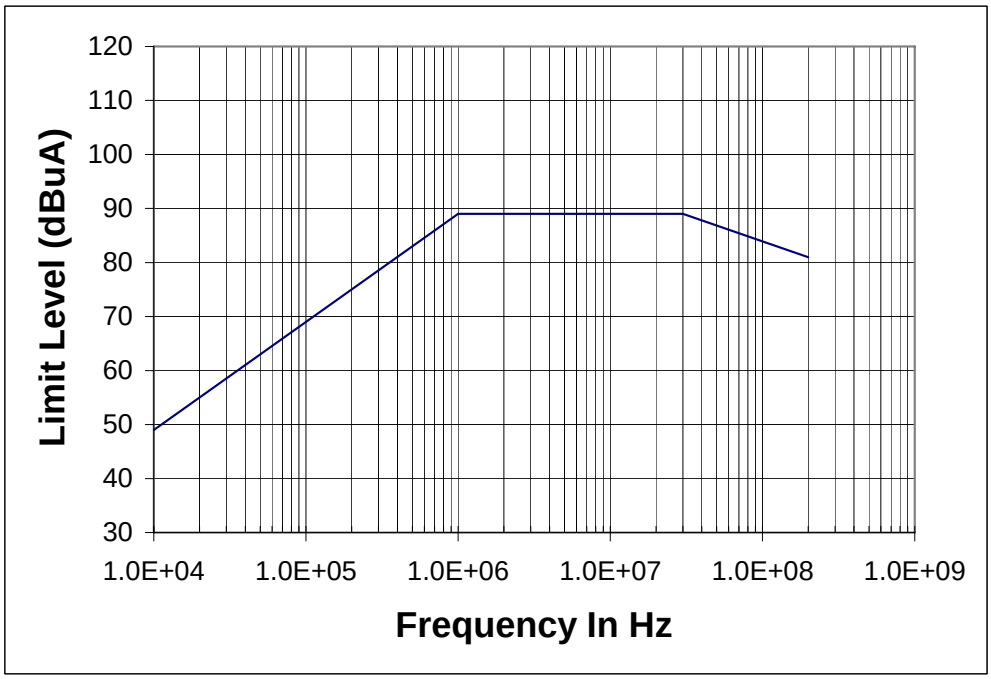
IMAR831 9.10.6.0-3



IMAR830 9.10.7

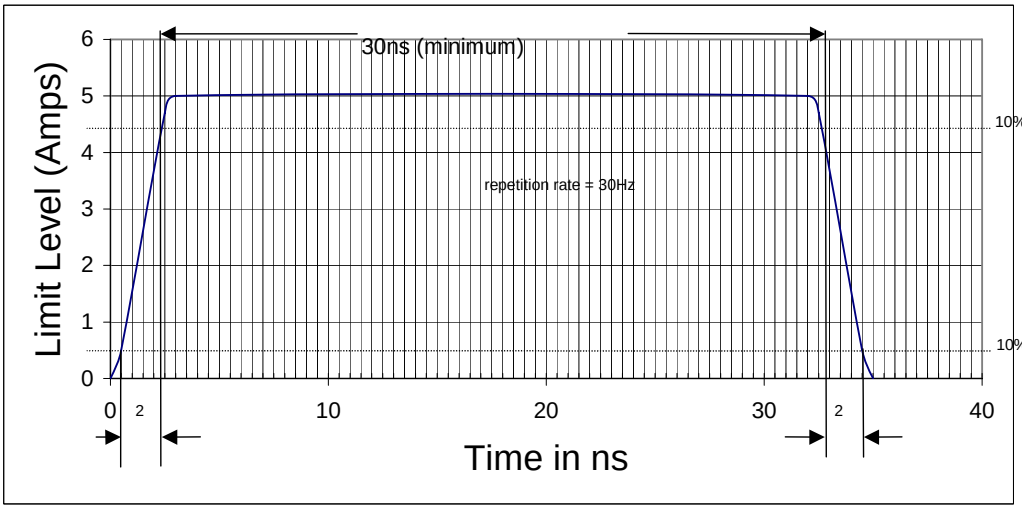
9.10.7 Conducted Susceptibility, Bulk Injection, Impulse Excitation (CS 115)

IMAR832 9.10.7.0-1 The instrument **shall** not exhibit any malfunction, degradation of performance, or deviation from instrument specifications beyond allowable tolerances, when subjected to a pre-calibrated signal having rise and fall times, pulse width, and amplitude as specified in the Conducted Susceptibility, Current Test, Impulse Excitation Figure (IMAR836) at a 30 Hz rate for one minute.

IMAR833 9.10.7.0-2 This test signal **shall** be injected onto the power leads of the instrument.

IMAR835 9.10.7.0-3 The test procedure used for this test **shall** be in accordance with MIL-STD-461 Rev E, CS 115. *(CCR 00004)*

IMAR836 9.10.7.0-4 Conducted Susceptibility, Current Test, Impulse Excitation Figure



ID	Object Number	417-R-IMAR-0039, RM Version, Instrument Mission Assurance Requirements (IMAR) Document
IMAR837	9.10.8	**9.10.8 Conducted Susceptibility, Damped Sinusoidal Transients, Cable and Power Leads (CS116 10 KHz to 100 MHz)**
IMAR838	9.10.8.0-1	The instrument **shall** not exhibit any malfunction, degradation of performance, or deviation from instrument specifications beyond allowable tolerances, when subjected to a signal having the waveform shown in the Power Lead Conducted Susceptibility, Damped Sinusoidal Transient Figure and having a maximum current as specified in the Maximum Current for the Damped Sinusoidal Transient Figure. The criteria for this test is described below: a) The test signal will be injected onto the power leads of the instrument. b) The indicated test limit is applicable across the entire specified frequency range. c) As a minimum, compliance will be demonstrated at the following frequencies: 0.01, 0.1, 1.0, 10.0, 30.0 and 100 MHz. d) The test procedure used for this test will be accordance with MIL-STD-461 Rev E, CS116 *(CCR 00004)*

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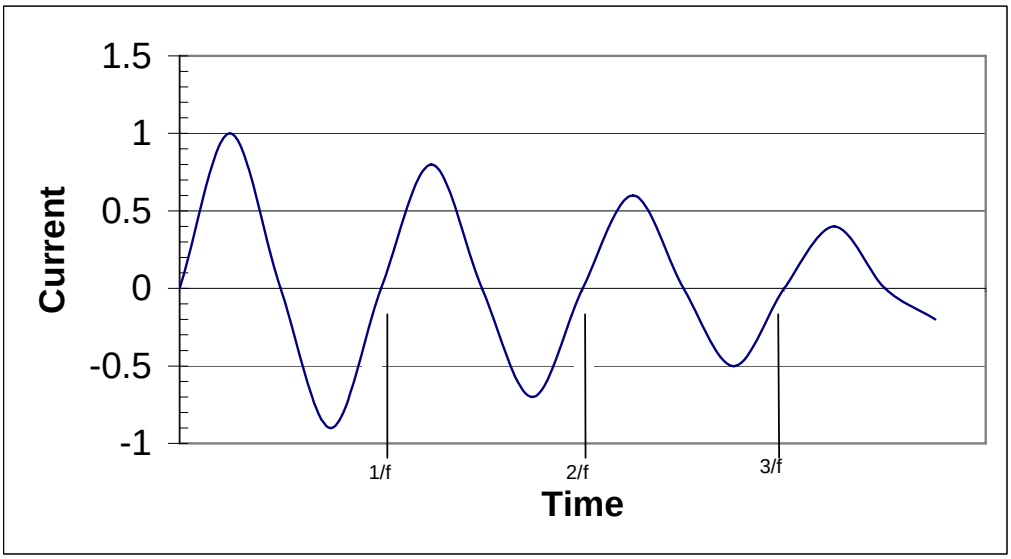
IMAR846	9.10.8.0-2	Power Lead Conducted Susceptibility, Damped Sinusoidal Transient Figure



Notes for the Power Lead Conducted Susceptibility, Damped Sinusoidal Transient Figure.

a) Normalized waveform: $e^{-(\pi ft)/Q}\text{Sin}(2\pi ft)$

Where: f= Frequency (Hz)
t= Time (sec)
Q= Damping factor, 15 ± 5

b) Damping factor (Q) will be determined as follows: $Q= \pi (N-1)/\ln (IP/IN)$

Where: Q= Damping factor
N= Cycle number (i.e., N= 2,3,4,5,….)
IP= Peak, current at the first cycle
IN=Peak current at cycle closest to 50 % decay
ln= Natural log

c) IP is as specified in the Maximum Current for the Damped Sinusoidal Transient Figure (IMAR847).

IMAR847	9.10.8.0-3	Maximum Current for the Damped Sinusoidal Transient Figure

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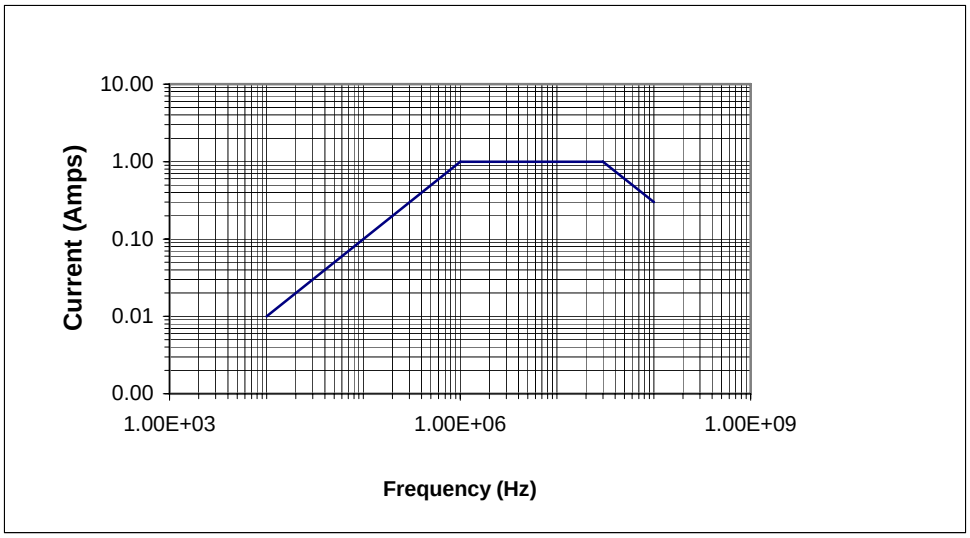
IMAR847 9.10.8.0-3



IMAR848 9.10.9

9.10.9 Radiated Emissions

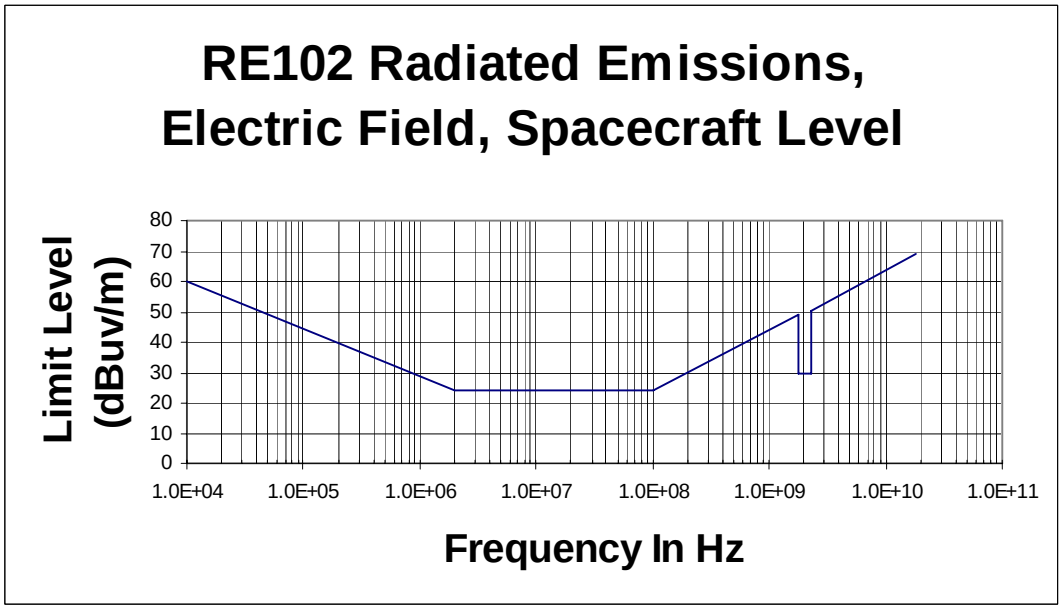
IMAR850 9.10.9.1

9.10.9.1 Radiated Emissions, Electric Field (RE 102)

IMAR851 9.10.9.1.0-1

Radiated narrow band electric field levels generated by the instrument **shall** not exceed the levels specified in the Radiated Emissions, Electric Field Figure below except for the SAR and DCS Receiver bands specified in IMAR860. *(CCR 00337)*

Radiated Emission, Electric Field Figure



(CCR 00337)

IMAR852 9.10.9.1.0-2

The test procedure used for this test **shall** be in accordance with MIL-STD-461, RE102.

IMAR854 9.10.10

9.10.10 Radiated Emissions in SAR and DCS Receiver Bands

ID	Object Number	417-R-IMAR-0039, RM Version, Instrument Mission Assurance Requirements (IMAR) Document
IMAR855	9.10.10.0-1	Radiated emission measurements in the SAR and DCS receiver bands **shall** be made in accordance with MIL-STD-461, RE102 with the EMI meter replaced by a spectrum analyzer preceded by a low noise pre-amplifier such that the test system noise figure is equal to or less than 3 dB, e.g., an HP-8566 spectrum analyzer preceded by a MITEQ AU-2A-0550 pre-amplifier or equivalent. *(CCR 00337)*
IMAR856	9.10.10.0-2	The spectrum analyzer levels and the difference in the levels **shall** be recorded for both white noise and spurious signals before and after power is applied to the instrument clock and control signals.
IMAR857	9.10.10.0-3	The test antenna **shall** be tuned to the center of each of the two frequency bands specified in the SAR and DCS EMC Test Parameters Table (IMAR862).
IMAR858	9.10.10.0-4	Prior to making the actual measurements, the test antenna **shall** be de-mated and the cable terminated with 50 ohms.
IMAR859	9.10.10.0-5	The noise floor of the measuring equipment **shall** be verified to be lower than the specified maximum signal level in a 100 Hz resolution bandwidth.

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IMAR860 9.10.10.0-6 Radiated emission levels generated by the instrument **shall** not exceed the maximum signal levels specified in the SAR and DCS EMC Test Parameters Table below.

SAR (406.000 to 406.100 MHz) and DCS (401.700 to 402.400 -140 MHz) EMC Test Parameters Table

Unit Name	Designated Frequency Band	Measurement Bandwidth (Hz)	Dwell Time (Seconds)	Minimum Measurement Time Analog Measurement Receiver (sec/kHz)	Max. Field Intensity (dBuV/m)
Instrument Electronics Boxes	SAR/DCS	100	.015	0.15	10 (each box)
Magnetosphere Particle Sensor (MPS)	SAR/DCS	100	.015	0.15	-24 (+Z) (per sensor) 10 (-Z)
Geostationary Lightning Mapper (GLM)	SAR/DCS	100	.015	0.15	-24
Solar Galatic Particle Sensor (SGPS)	SAR/DCS	100	.015	0.15	-12.8 (per sensor)
Energetic Heavy Ion Sensor (EHIS)	SAR/DCS	100	.015	0.15	-24 (+Z) 10 (-Z)
Solar Ultraviolet Imager (SUVI)	SAR/DCS	100	.015	0.15	-12.8
EUVS XRS Irradiance Sensors (EXIS)	SAR/DCS	100	.015	0.15	-12.8

(CCR 00337)

IMAR861 9.10.10.0-7 The results of this test **shall** be provided with sufficient sensitivity and resolution to demonstrate that these requirements are met.

IMAR863 9.10.11

9.10.11 Radiated Susceptibility

IMAR864 9.10.11.1

9.10.11.1 Reserved *(CCR 00156)*

IMAR865 9.10.11.1-1 Reserved *(CCR 00156)*

IMAR866 9.10.11.2

9.10.11.2 Radiated Susceptibility, Launch Environment

IMAR867 9.10.11.2.0-1 The instrument **shall** be exposed to external electromagnetic field strengths in accordance with MIL-STD-461.

IMAR868 9.10.11.2.0-2 The test **shall** simulate launch environment levels as stated in Table VII of MIL-STD-461.

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IMAR869 9.10.12

9.10.12 Electrostatic Arc-Discharge Susceptibility

IMAR870 9.10.12.0-1 The instrument **shall** be designed to preclude or minimize the impact of ESD events.

IMAR871 9.10.12.0-2 The instrument **shall** be designed to withstand both a radiated and direct arc as shown in the ESD Characteristics Table (IMAR879) without sustaining permanent damage.

IMAR872 9.10.12.1

9.10.12.1 External Surface-to-Surface direct discharge

IMAR873 9.10.12.1.0-1 The direct arc-discharge can occur on any of the exposed surfaces of the instrument. The instrument **shall** not be impaired by differential charging between it's external surfaces.

IMAR875 9.10.12.2

9.10.12.2 Deep Dielectric Charging

IMAR876 9.10.12.2.0-1 The instrument **shall** withstand all direct discharges caused by deep dielectric charging (Internal Electrostatic Discharge, IESD). Terminating all unused wires within a harness and terminating all unused pins within connectors will minimize the magnitude of charge build up.

IMAR877 9.10.12.3

9.10.12.3 ESD Characteristics

IMAR878 9.10.12.3.0-1 Test or analysis **shall** be used to show that the instrument operation will not be impaired after an arc discharge with the characteristics listed in the ESD Characteristics Table (IMAR879).

IMAR879 9.10.12.3.0-2 ESD Characteristics Table

Item	Description	Characteristics
1	Discharge Voltage	10 kv
2	Discharge Energy	3 millijoules, maximum
3	Peak Current	1 amp
4	Time Constant	600 nsec
5	Repetition Rate	1 sec
6	Quantity of Discharges per Surface	≥ 30
7	Distance of Radiated Discharge from Instrument Surface	30 cm

IMAR880 9.11

9.11 Radiation Environment

IMAR881 9.11.1

9.11.1 General

IMAR882 9.11.1.0-1 The radiation environment requirements **shall** be as described in 417-R-RPT-0027.

IMAR1090 9.11.1.0-2 The contractor **shall** prepare a Radiation Shielding and Dose Analysis Report in accordance with the CDRL.

IMAR883 9.11.2

9.11.2 Single Event Effects

IMAR884 9.11.2.0-1 A Single Event Effects Control Plan **shall** be prepared and delivered in accordance with the CDRL.

IMAR885 9.11.3

9.11.3 In-Orbit Electro-Static Discharge Control Plan

ID	Object Number	417-R-IMAR-0039, RM Version, Instrument Mission Assurance Requirements (IMAR) Document
IMAR886	9.11.3.0-1	An In-Orbit Electro-Static Discharge Control Plan **shall** be prepared and delivered in accordance with the CDRL.
IMAR887	9.12	**9.12 Magnetic Properties**
IMAR888	9.12.1	**9.12.1 General**
IMAR889	9.12.1.0-1	The magnetic field test **shall** measure the peak-to-peak change in magnetic field produced by each unit for all instrument operating modes. *(CCR 00042B)*
IMAR892	9.12.1.0-2	Measurements **shall** be made in the X, Y and Z-axis of all units for both primary and redundant configurations. *(CCR 00042B)*
IMAR894	9.12.1.0-3	The measured change in the magnetic field strength will be the difference between the ambient background level of the instrument and the maximum magnetic field induced by the change in the instrument's state.
IMAR895	9.12.1.0-4	A reference probe **shall** be used to exclude anomalous data caused by external events such as opening and closing of doors.
IMAR896	9.12.1.0-5	A Magnetic Control Plan **shall** be prepared and delivered in accordance with the CDRL.
IMAR1190	9.12.1.0-6	The magnetic field test **shall** measure the permanent magnetic field produced by each unit. *(CCR 00330)*
IMAR897	9.13	**9.13 Thermal Requirements**
IMAR898	9.13.1	**9.13.1 General Requirements**
IMAR899	9.13.1.0-1	The thermal vacuum, thermal balance, and humidity requirements herein apply to GOES-R instruments.
IMAR900	9.13.1.0-2	An appropriate set of tests and analyses **shall** be performed to demonstrate IMAR901, IMAR902, IMAR903, IMAR904, IMAR906.
IMAR901	9.13.1.0-3	The instrument **shall** meet performance requirements while operating under vacuum and within test temperature limits including during hot and cold plateaus and transitions
IMAR902	9.13.1.0-4	Instrument thermal design and thermal control system **shall** maintain the affected hardware within the established survival temperatures during non-operating mission phases including launch and ascent.
IMAR903	9.13.1.0-5	Instrument thermal design and thermal control system **shall** maintain the affected hardware within the established Mission Allowable Temperature (MAT) during planned operating mission phases.
IMAR904	9.13.1.0-6	The flight hardware **shall** withstand, the temperature and humidity conditions of integration, transportation, storage, and pre-launch activities as well as launch and flight.
IMAR906	9.13.1.0-7	The quality of workmanship and materials of the hardware **shall** be sufficient to pass thermal cycle test screening in vacuum.
IMAR908	9.13.1.1	**9.13.1.1 Summary of Requirements**
IMAR909	9.13.1.1.0-1	The Thermal Test Verification Methodology Table (IMAR910) summarizes the tests and analyses that collectively will fulfill the General Requirements. Tests noted in the table may require supporting analyses.

ID	Object Number	417-R-IMAR-0039, RM Version, Instrument Mission Assurance Requirements (IMAR) Document

IMAR910 9.13.1.1.0-2 Thermal Test Verification Methodology Table

Requirement	Instrument	Unit
Thermal Vacuum	T	T
Thermal Balance	T and A	T and A
Leakage	L	L
Venting	V	V

T = Test required
A = Analysis, correlate model to TB test
L = Leakage measured during vacuum testing
V = Venting test at performed during chamber pump-down

IMAR911 9.13.1.2

9.13.1.2 Applicability

IMAR912 9.13.1.2.0-1 All instrument flight hardware **shall** be subjected to thermal-vacuum testing in order to demonstrate satisfactory operation in modes representative of mission functions at temperatures in excess of the extremes predicted for the mission.

IMAR913 9.13.1.2.0-2 The tests **shall** exercise flight hardware to produce the maximum and minimum dissipation in components including operation over the range of possible applied voltages.

IMAR914 9.13.1.2.0-3 These tests **shall** demonstrate survival mode and survival heater margin, as well as operational heaters and their margin.

IMAR915 9.13.1.3

9.13.1.3 Test Chronology

IMAR916 9.13.1.3.0-1 For the testing program to emulate the chronology of mission stresses, the order of tests will generally follow the chronology of mission event stresses.

IMAR917 9.13.1.3.0-2 Instrument-level thermal testing **shall** follow instrument-level mechanical testing.

IMAR918 9.13.1.4

9.13.1.4 Thermal Test Chronology

IMAR919 9.13.1.4.0-1 Thermal Balance (TB) and Thermal Vacuum (TV) testing may occur as individual or combined tests. Combined tests must, however, satisfy the requirements of both tests.

IMAR920 9.13.1.4.0-2 Regardless of whether TB is a combined or separate test, TB **shall** precede TV, thereby allowing the TB results to refine the TV plateau temperatures if appropriate. The permissible exception to this is that the first hot plateau may be combined with bake-out prior to TB.

IMAR921 9.13.1.5

9.13.1.5 Pressure

IMAR922 9.13.1.5.0-1 The chamber pressure during TB and TV **shall** be maintained at less than 1.33 X 10-3 Pa. (1 X 10-5 torr).

IMAR923 9.13.1.6

9.13.1.6 Temperature Monitoring and Alarms

IMAR924 9.13.1.6.0-1 Test article and test equipment temperatures **shall** be monitored throughout the test and have “temperature alarms”.

IMAR925 9.13.1.7

9.13.1.7 Contamination Control

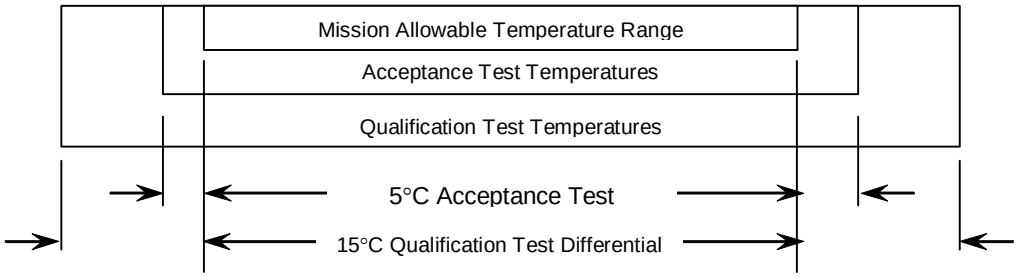
IMAR926 9.13.1.7.0-1 The test(s) **shall** be configured and conducted to be compliant with the contamination control

ID	Object Number	417-R-IMAR-0039, RM Version, Instrument Mission Assurance Requirements (IMAR) Document
IMAR927	9.13.1.8	**9.13.1.8 Unrealistic Failure Modes**
IMAR928	9.13.1.8.0-1	The test program **shall** avoid unrealistically overstressing environmental conditions that could induce test failure modes such as exceeding acceptable rates of temperature change.
IMAR929	9.13.2	**9.13.2 Thermal Vacuum**
IMAR930	9.13.2.1	**9.13.2.1 Transition Rates**
IMAR932	9.13.2.1.0-1	The temperature rate of changes **shall** be at least at the expected orbital temperature transition rate.
IMAR933	9.13.2.2	**9.13.2.2 Corona Operation**
IMAR934	9.13.2.2.0-1	Any unit that is electrically powered during launch **shall** be operated through chamber pump down to demonstrate that they will not sustain damage though the corona voltage breakdown regime. This applies at unit, instrument and spacecraft testing levels.
IMAR937	9.13.2.3	**9.13.2.3 Hot and Cold Start Demonstrations**
IMAR938	9.13.2.3.0-1	Start-up capability **shall** be demonstrated to verify that the unit under test will turn on after exposure to the extreme temperatures that may occur in orbit.
IMAR939	9.13.2.3.0-2	Cold start **shall** be demonstrated from non-operational temperatures (unit level or lower) or from temperatures maintained by survival heaters (unit level or higher).
IMAR940	9.13.2.3.0-3	Cold start **shall** be demonstrated during the cold plateau and minimum input voltage.
IMAR941	9.13.2.3.0-4	Hot restart **shall** be demonstrated during hot plateau and maximum input voltage.
IMAR942	9.13.2.4	**9.13.2.4 Heater Verification**
IMAR943	9.13.2.4.0-1	TV testing **shall** demonstrate the ability of survival heaters to maintain units within Non-Operating Temperature Limits during worst cold environments, minimum voltage and while the instrument is off.
IMAR944	9.13.2.4.0-2	Cold plateau testing **shall** demonstrate that operational heaters maintain applicable components within the MAT.
IMAR945	9.13.2.4.0-3	Both operational and survival heater set points and heater control (including primary and redundant circuits) **shall** be independently verified.
IMAR946	9.13.2.5	**9.13.2.5 Flight Temperature Sensor Verification**
IMAR947	9.13.2.5.0-1	Instrument level TV testing **shall** corroborate flight temperature sensors against test temperature sensors in at least the hot and cold bounding operating conditions.
IMAR948	9.13.3	**9.13.3 Thermal Cycling**
IMAR949	9.13.3.0-1	Thermal Cycling consists of cycling between temperature extremes for the purpose of checking operability over broad temperature ranges while inducing stress to uncover workmanship defects and other flaws.
IMAR950	9.13.3.1	**9.13.3.1 Spacecraft Level TV Test**
IMAR951	9.13.3.1.0-1	Four TV cycles are planned during spacecraft thermal testing. The instrument **shall** be operating during spacecraft level thermal vacuum testing.
IMAR952	9.13.3.2	**9.13.3.2 Cumulative Cycles**

ID	Object Number	417-R-IMAR-0039, RM Version, Instrument Mission Assurance Requirements (IMAR) Document
IMAR953	9.13.3.2.0-1	Every unit **shall** undergo 12 TV cycles prior to launch, this applies to flight spares as well as to repaired units.
IMAR955	9.13.3.3	**9.13.3.3 Instrument Level TVCycling**
IMAR957	9.13.3.3.0-1	There **shall** be a minimum of (4) four thermal-vacuum cycles at the instrument level of testing.
IMAR958	9.13.3.3.0-2	The thermal plateaus **shall** be of sufficient duration to conduct functional testing.
IMAR960	9.13.3.3.0-3	Operational time **shall** be divided between primary and redundant sides.
IMAR961	9.13.3.3.0-4	The instrument **shall** be operated and its performance **shall** be monitored, during hot and cold plateaus as well as during hot and cold transitions.
IMAR963	9.13.3.3.0-5	At least two cold starts **shall** be demonstrated.
IMAR964	9.13.3.3.0-6	In redundant units as well as internally redundant single units, each unit or side **shall** demonstrate at least one cold start.
IMAR965	9.13.3.4	**9.13.3.4 Unit Level TV Cycling**
IMAR966	9.13.3.4.0-1	Unit level level plateaus **shall** be of sufficient duration to conduct functional testing.
IMAR967	9.13.3.4.0-2	During the unit level plateaus and temperature transitions, the unit **shall** be operating and performance **shall** be monitored.
IMAR969	9.13.3.4.0-3	Operational time **shall** be divided between primary and redundant sides.
IMAR970	9.13.3.4.0-4	Two cold starts **shall** be demonstrated.
IMAR971	9.13.3.4.0-5	In internally redundant and cross-strapped units, each side **shall** demonstrate cold start.
IMAR972	9.13.3.5	**9.13.3.5 Ambient Pressure Thermal Cycling Substitution**
IMAR973	9.13.3.5.0-1	Substituting ambient pressure thermal cycling for thermal vacuum testing is not permitted at the unit level of assembly, or the instrument level of assembly.
IMAR1150	9.13.3.5.0-2	The chamber pressure **shall** be monitored and provide a "pressure alarm" for loss of vacuum.
IMAR1151	9.13.3.5.0-3	In the event of a pressure alarm, appropriate action **shall** be taken automatically to safe the instruments.
IMAR974	9.13.3.6	**9.13.3.6 Test Temperatures**

ID	Object Number	417-R-IMAR-0039, RM Version, Instrument Mission Assurance Requirements (IMAR) Document
IMAR975	9.13.3.6.0-1	The test temperature description is provided below in the Test Temperature Description Figure.

Test Temperature Description Figure



IMAR976	9.13.3.6.1	**9.13.3.6.1 Mission Allowable Temperatures**
IMAR977	9.13.3.6.1.0-1	Mission Allowable Temperatures (MAT) are the established range of temperatures that units are permitted to experience while operating in orbit. Mission allowable temperatures are established based upon analytical temperature predictions and upon the temperature range over which the hardware can operate. MAT encompasses worst case operating temperature predictions, uncertainty, and any contractor desired temperature margin.
IMAR979	9.13.3.6.2	**9.13.3.6.2 Qualification, Protoflight and Acceptance Temperatures**
IMAR980	9.13.3.6.2.0-1	Qualification, proto-flight and acceptance verification tests are the same except for adjustments in test temperature differentials.
IMAR981	9.13.3.6.2.0-2	The qualification temperature is 15°C warmer than the maximum MAT and 15°C colder than the minimum MAT.
IMAR1091	9.13.3.6.2.0-3	Proto-flight temperature is 10°C warmer than the maximum MAT and 10°C colder than the minimum MAT.
IMAR1092	9.13.3.6.2.0-4	Acceptance temperature is 5°C warmer than the maximum MAT and 5°C colder than the minimum MAT.
IMAR984	9.13.3.6.3	**9.13.3.6.3 Non-operational Temperatures**
IMAR985	9.13.3.6.3.0-1	Non-operational Temperatures (NOT) are the established range of temperatures that components are permitted to experience while dormant, not operating and not powered. NOT temperatures represent the permissible range while the hardware is off. During flight, survival heaters maintain hardware at or above the cold NOT limit and passive design maintains hardware below the upper NOT limit.
IMAR988	9.13.3.7	**9.13.3.7 Temperature test tolerances**
IMAR989	9.13.3.7.0-1	In lieu of more specific instructions or requirements, TV test tolerances **shall** be ±2° C.
IMAR990	9.13.3.8	**9.13.3.8 Plateau Criteria**
IMAR991	9.13.3.8.0-1	Thermal vacuum soak **shall** be based upon representative temperature sensor(s) or an average of such sensors.
IMAR992	9.13.3.8.0-2	These **shall** be representative of unit or critical parts of the payload.

ID	Object Number	417-R-IMAR-0039, RM Version, Instrument Mission Assurance Requirements (IMAR) Document
IMAR993	9.13.3.8.0-3	Temperature soaks **shall** begin when the "control" temperature is: within ±2° C of the proposed test temperature and the temperature rate of change is less than 1° C/hour per hour.
IMAR994	9.13.4	**9.13.4 Thermal Balance (TB)**
IMAR995	9.13.4.0-1	The Thermal Balance (TB) test directly validates the adequacy of the thermal design and as built thermal hardware. TB testing demonstrates the thermal control system performance by operating in (simulated) worst hot and cold case thermal environment.
IMAR996	9.13.4.1	**9.13.4.1 TB Applicability**
IMAR997	9.13.4.1.0-1	All of the GOES-R instruments **shall** be subject to TB testing.
IMAR998	9.13.4.2	**9.13.4.2 Balance Points**
IMAR999	9.13.4.2.0-1	The two compulsory balance points **shall** directly simulate operation during the hot environment and cold environment.
IMAR1000	9.13.4.2.0-2	A third compulsory balance point **shall** directly verify survival heater margins at worst cold environment with the instrument non-operational.
IMAR1001	9.13.4.2.0-3	Additional balance point(s) **shall** be required for case(s) that challenge the thermal control system in ways not demonstrated during the compulsory balance points.
IMAR1002	9.13.4.3	**9.13.4.3 TB-Instrument Configuration**
IMAR1003	9.13.4.3.0-1	For TB, the test units **shall** be in flight-like configuration including: a) Coatings and finishes b) MLI c) Mounting hardware and isolators
IMAR1004	9.13.4.4	**9.13.4.4 TB Accuracy and Knowledge**
IMAR1005	9.13.4.4.0-1	For TB simulations, the simulated environment **shal**l replicate at least 95% of the overall instrument heat transfer.
IMAR1006	9.13.4.4.0-2	The hot and cold simulated environment **shall** be measured, characterized and understood to ±2%.
IMAR1007	9.13.4.4.0-3	During or prior to TB testing, unit dissipation (in all relevant modes) **shall** be measured and characterized to 1% accuracy.
IMAR1008	9.13.4.4.0-4	Prior to TB testing, the test harness losses (voltage drops) **shall** be measured and characterized.
IMAR1009	9.13.4.4.0-5	Conductive heat losses due to test harnesses **shall** be less than 5% of the instrument heat balance, and the conductive loss knowledge uncertainty **shall** be less than 2% of the instrument heat balance.
IMAR1011	9.13.4.5	**9.13.4.5 TB Steady State Criteria**
IMAR1012	9.13.4.5.0-1	TB conditions are stable when each control temperature sensor's variation is less than 0.10° C/hour for 6 hours and to a rate representing energy balance to within 3%.
IMAR1015	9.13.4.6	**9.13.4.6 Thermal Analytical Model Correlation**
IMAR1016	9.13.4.6.0-1	In the course of the instrument development program, analytical thermal models **shall** be developed of the instrument in orbit.

ID	Object Number	417-R-IMAR-0039, RM Version, Instrument Mission Assurance Requirements (IMAR) Document
IMAR1017	9.13.4.6.0-2	The instrument orbital thermal model **shall** be modified to reflect the test chamber configuration, boundary conditions and Beginning of Life (BOL) surface properties to predict instrument thermal performance under test conditions, this model is the thermal balance model.
IMAR1018	9.13.4.6.0-3	The TB model **shall** be correlated against the TB results.
IMAR1019	9.13.4.6.0-4	Correlation modifications to the TB model **shall** be tracked and propagated into updated flight predictions.
IMAR1020	9.13.4.7	**9.13.4.7 Correlation Accuracy**
IMAR1021	9.13.4.7.0-1	The post TB correlation **shall** meet the following accuracy requirements: a) 95.4% of the measured nodes will be within ±3° C. b) 99.7% of the measured nodes will be within ±5° C for the bounding TB cases. c) Standard deviation of correlated model nodal temperatures against balance temperatures less than 3° d) Model energy balance agreement within 3 %.
IMAR1027	9.14	**9.14 Testing of Spare Hardware**
IMAR1028	9.14.1	**9.14.1 General**
IMAR1029	9.14.1.0-1	As a minimum, spares **shall** undergo a verification program equal to that required for follow-on hardware. Therefore, special consideration must be given to spares as indicated below.
IMAR1030	9.14.1.1	**9.14.1.1 Extent of Testing**
IMAR1031	9.14.1.1.0-1	The extent and type of testing **shall** be determined as part of the flight hardware test program.
IMAR1032	9.14.1.1.0-2	A spare unit may be used for qualification of the hardware by subjecting it to protoflight testing, and testing flight hardware to acceptance levels.
IMAR1033	9.14.1.2	**9.14.1.2 Spares Testing**
IMAR1034	9.14.1.2.0-1	If a flight item is replaced for reasons of failure and is then repaired and re-designated as a spare, appropriate re-testing **shall** be conducted.
IMAR1035	9.14.1.3	**9.14.1.3 Caution on the Use of Spares**
IMAR1036	9.14.1.3.0-1	When the need for a spare arises, immediate analysis and review of the failed hardware **shall** be made. If failure occurs in a hardware item of which there are others of identical design, the fault may prove to be generic and may thus affect all hardware of that design. Hardware modifications and/or additional testing of the replacement spare hardware should be carefully considered, as well as for any redundant hardware in the instrument.
IMAR1037	9.14.1.4	**9.14.1.4 “One-Shot” Items**
IMAR1038	9.14.1.4.0-1	Some items may be degraded or expended during the integration and test period and replaced by spares.
IMAR1039	9.14.1.4.0-2	The spare that is used **shall** have met the required quality control standards or auxiliary tests.
IMAR1040	9.14.1.4.0-3	Units **shall** be of qualified design.
IMAR1041	9.14.1.4.0-4	Examples are pyrotechnic devices, and elements that absorb impact energy by plastic yielding.

ID	Object Number	417-R-IMAR-0039, RM Version, Instrument Mission Assurance Requirements (IMAR) Document
IMAR1042	9.14.1.4.0-5	When the replacement entails procedures that could jeopardize mission success, the replacement procedure **shall** be successfully demonstrated with the hardware in the same configuration that it will be in when final replacement is to be accomplished.
IMAR1043	9.15	**9.15 Test Facilities**
IMAR1044	9.15.1	**9.15.1 General**
IMAR1045	9.15.1.0-1	The facilities and fixtures used in conducting tests **shall** be capable of producing and maintaining the test conditions prescribed with the test specimen installed and operating or not operating, as required.
IMAR1046	9.15.1.0-2	In any major test, facility performance **shall** be verified prior to the test either by a review of its performance during a test that occurred a short time earlier or by conducting a test with a substitute test item.
IMAR1047	9.15.2	**9.15.2 Test Facilities Calibration**
IMAR1112	9.15.2.0-1	All equipment used for tests **shall** be in current calibration and so noted by tags and stickers. *(CCR*
IMAR1049	9.16	**9.16 Test Condition Tolerances**
IMAR1050	9.16.1	**9.16.1 General**
IMAR1103	9.16.1.0-1	In the absence of a rationale for other test condition tolerances, the following **shall** be used; the values include measurement uncertainties.

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IMAR1103	9.16.1.0-1	

Acoustics		
	≤ 1 dB	
Overall Level:	Frequency (Hz)	Tolerance (dB)
	f £ 40	+3, -6
l/3 Octave Band Tolerance:	40< F < 3150	± 3
	f ≥ 3150	+3, -6
Antenna Pattern Determination	± 2 dB	
Electromagnetic Compatibility		
Voltage Magnitude:	± 5% of the peak value	
Current Magnitude:	± 5% of the peak value	
RF Amplitudes:	± 2 dB	
Frequency:	± 2%	
Distance:	± 5% of specified distance or ± 5 cm, whichever is greater	
Humidity	± 5% RH	
Loads		
Steady-State (Acceleration):	± 5%	
Static:	± 5%	

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IMAR1103	9.16.1.0-1	

Magnetic Properties	
Mapping Distance Measurement:	± 1 cm
Displacement of assembly center of gravity (cg) from rotation axis:	± 5 cm
Vertical displacement of single probe centerline from cg of assembly:	± 5 cm
Mapping turntable angular displacement:	± 3 degrees
Magnetic Field Strength:	± 1 nT
Repeatability of magnetic measurements (short term):	± 5% or ± 2 nT, whichever is greater
Demagnetizing and Magnetizing Field Level:	± 5% of nominal
Mass Properties	
Weight:	± 0.2%
Center of Gravity:	± 0.15cm (± 0.06 in.)
Moments of Inertia:	± 1.5%
Mechanical Shock	
Response Spectrum:	+25%, -10%
Time History:	± 10%

ID	Object Number	417-R-IMAR-0039, RM Version, Instrument Mission Assurance Requirements (IMAR) Document
IMAR1103	9.16.1.0-1	

Pressure		
	Greater than 1.3 X 10^4 Pa (Greater than 100 mm Hg):	± 5%
	1.3 X $l0^4$ to 1.3 X $l0^2$ Pa (l00 mm Hg to 1 mm Hg):	± 10%
	1.3 X $l0^2$ to 1.3 X 10^1 Pa (1 mm Hg to 1 micron):	± 25%
	Less than 1.3 X 10^1 Pa (less than 1 micron):	± 80%
Temperature		± 2°C
Vibration		
	Sinusoidal:	
	Amplitude	± 10%
	Frequency	± 2%
	Random:	
	RMS level	± 10%
	Accel. Spectral Density	± 3 dB

ID	Object Number	417-R-IMAR-0039, RM Version, Instrument Mission Assurance Requirements (IMAR) Document
IMAR1052	10	**10** Electrostatic Discharge (ESD) Control
IMAR1055	10.0-1	The contractor **shall** document and implement an ESD Control Program to assure that all manufacturing, inspection, testing, and other processes will not compromise mission objectives for quality and reliability due to ESD events.
IMAR1056	10.1	**10.1 Electrostatic Discharge Control Requirements**
IMAR1057	10.1.0-1	The contractor **shall** document and implement an ESD Control Program in accordance with ANSI/ESDS20.20, ESD Association Standard for the Development of an ESD Control Program for Protection of Electrical and Electronic Parts, Assemblies and Equipment (Excluding Electrically Initiated Explosive Devices) suitable to protect the most sensitive component involved.
IMAR1058	10.1.0-2	At a minimum, the ESD Control Program **shall** address training, protected work area procedures and verification schedules, packaging, facility maintenance, storage, and shipping.
IMAR1059	10.1.0-3	The ESD Control Plan **shall** be submitted and approved in accordance with the CDRL.
IMAR1060	10.1.0-4	All personnel who manufacture, inspect, test, otherwise process electronic hardware, or require unescorted access into ESD protected areas **shall** be certified as having completed the required training, appropriate to their involvement, as defined in the contractor's quality manual prior to handling any electronic hardware.
IMAR1061	10.1.0-5	Electronic hardware **shall** be manufactured, inspected, tested, or otherwise processed only at designated ESD protective work areas.
IMAR1062	10.1.0-6	These work areas **shall** be verified on a regular schedule as identified in the contractor's ESD Control Program.
IMAR1063	10.1.0-7	Electronic hardware **shall** be properly packaged in ESD protective packaging at all times when not actively being manufactured, inspected, tested, or otherwise processed.

ID	Object Number	417-R-IMAR-0039, RM Version, Instrument Mission Assurance Requirements (IMAR) Document
IMAR1064	11	**11** GIDEP Alerts and Problem Advisories
IMAR1065	11.1	**11.1 GIDEP Participation**
IMAR1066	11.1.0-1	The contractor and all subcontractors unless prohibited by export control regulations **shall** participate in the Government-Industry Data Exchange Program (GIDEP) in accordance with the requirements of the S0300-BT-PRO-010, GIDEP Operations Manual and S0300-BU-GYD-01 Government Industry Data Exchange Program Requirements Guide, available from the GIDEP Operations Center, PO Box 8000, Corona, California 91718-8000. *(CCR 00039)*
IMAR1067	11.1.0-2	The contractor **shall** review all GIDEP ALERTS, GIDEP SAFE-ALERTS, GIDEP Problem Advisories, GIDEP Agency Action Notices, and NASA Advisories to determine if they affect the contractors products produced for NASA.
IMAR1068	11.1.0-3	If a subcontractor is not a GIDEP participant, the contractor will solicit the necessary information from the subcontractor or may elect to determine any impact by its own review of subcontractor-supplied documentation, such as an As-Design or As-Built Parts List. *(CCR 00039)*
IMAR1069	11.1.0-4	The contractor **shall** review, document and submit results of GIDEP reports and NASA advisories in accordance with the CDRL. *(CCR 00037A)*
IMAR1070	11.1.0-5	For GIDEP ALERTS, GIDEP SAFE-ALERTS, GIDEP Problem Advisories, GIDEP Agency Action Notices, and NASA Advisories that are determined to affect the program, the contractor **shall** take action to eliminate or mitigate any negative effect to an acceptable level.
IMAR1071	11.1.0-6	The contractor **shall** generate the appropriate failure experience data report(s) (GIDEP ALERT, GIDEP S AFE-ALERT, GIDEP Problem Advisory) in accordance with the requirements of S0300-BT-PRO-010 and S0300-BU-GYD-01 whenever failed or nonconforming items, available to other buyers, are discovered during the course of the contract.
IMAR1131	11.1.0-7	NASA/GSFC will inform the contractor of all GIDEP reports and NASA Advisories that it deems to be of interest. The contractor **shall** distribute this information to its subcontractors and solicit their responses as to the impact of the document. *(CCR 00037A)*

ID	Object Number	417-R-IMAR-0039, RM Version, Instrument Mission Assurance Requirements (IMAR) Document
IMAR1072	12	**12** Applicable Documents List
IMAR1105	12.1	**12.1 Applicable Documents**
IMAR1106	12.1.0-1	

Section 2

ANSI/ISO/ASQ-Q9001 Rev. 2000, Quality Management Systems-Requirements

ISO/IEC-17025 Rev. 1999, General Requirements for the Competence of Testing and Calibration Laboratories

Section 3

AFSPCMAN 91-710, Air Force Space Command Manual 91-710 (AFSPCMAN 91-710), Range Safety Requirements, July 2004. *(CCR 00112)*

(CCR 00112)

NPR 8621.1A, NASA Procedural Requirements for Mishap Reporting, Investigating, and Recordkeeping, February 11, 2004. *(CCR 00112)*

Section 4

MIL-HDBK-217 Rev. F, Change Notice 2, Reliability Prediction of Electronic Equipment, February, 1995. *(CCR 00112)*

Section 5

NASA-STD-8719.13B w/Change 1, Software Safety Standard, July 8, 2004. *(CCR 00051B)*

Section 6

NASA-STD-8739.1, Workmanship Standard for Staking and Conformal Coating of Printed Wiring Boards and Electronic Assemblies, August 6, 1999. *(CCR 00112)*

NASA-STD-8739.2, NASA Workmanship Standard for Surface Mount Technology, August 31, 1999. *(CCR 00112)*

NASA-STD-8739.3, w/Change 2, Soldered Electrical Connections, January 18, 2001. *(CCR 00112)*

NASA-STD-8739.4, Crimping, Interconnecting Cables, Harnesses, and Wiring, February 9, 1998. *(CCR 00112)*

NASA-STD-8739.5, Fiber Optic Terminations, Cable Assemblies, and Installation, February 9, 1998.*(CCR 00112)*

NPR 6000.1G, Requirements for Packaging, Handling, and Transportation for Aeronautical and Space Systems, Equipment and Associated Components, March 28, 2005. *(CCR 00064) (CCR 00112)*

IPC-2221 Rev A, Generic Standard on Printed Board Design, May 2003. *(CCR 00112)*

IPC-2222, Sectional Design Standard for Rigid Organic Printed Boards, February 1998, *(CCR 00112)*

IPC-2223, Sectional Design Standard for Flexible Printed Boards, November 1998. *(CCR 00112)*

IPC-6011, Generic Performance Specification for Printed Boards, July 1996. *(CCR 00112)*

IPC-6012B, Qualification and Performance Specification for Rigid Printed Boards, August 1, 2004. *(CCR 00112)*

IPC-6013 Rev A, Qualification and Performance Specification for Flexible Printed Boards, November 2003. *(CCR 00112)*

MIL-STD-981 Rev B(4), Design, Manufacturing and Quality Standards for Custom Electromagnetic Devices for Space Applications *(CCR 00112)*

ID	Object Number	417-R-IMAR-0039, RM Version, Instrument Mission Assurance Requirements (IMAR) Document
IMAR1106	12.1.0-1	**Section 7** GSFC EEE-INST-002, Instructions for EEE Parts Selecting Screening, Qualification, and Derating, May 2003. *(CCR 00112)* MIL-PRF-55365 Rev F., Capacitors, Chip, Fixed, Tantalum, Established Reliability, Style CWR11 (Metric) MIL-PRF-39003/10 Rev B (Am1), Capacitors, Fixed, Electrolytic (Solid Electrolyte) Tantalum, (Polarized, sintered slug), Established Reliability, Styles, CSS13 and CSS33 (High Reliability Applications) MIL-PRF 123 Rev C (sup. 1), Capacitors, Fixed, Ceramic Dielectric (Temperature Stable and General Purpose), High Reliability, General Specification for GSFC S-311-M70 Rev A, Specification for Destructive Physical Analysis. January 7, 1991. *(CCR 00112)* MIL-STD-981 Rev B(4), Design, Manufacturing and Quality Standards for Custom Electromagnetic Devices for Space Applications 417-R-RPT-0027, The Radiation Environment for Electronic Devices on the GOES-R Series Satellites **Section 8** MSFC-STD-3029, Multiprogram/Project Common-Use Document Guidelines for the Selection of Metallic Materials for Stress Corrosion Cracking Resistance in Sodium Chloride Environments Materials, Processes, and Manufacturing Department Metallic Materials and Processes Group, May 22, 2000. *(CCR 00112)* ASTM E-595 Rev 1993, Standard Test Method for Total Mass Loss and Collected Volatile Condensable Materials from Outgassing in a Vacuum Environment *(CCR 00112)* MIL-STD-889 Rev. B (VN2), Dissimilar Metals 541-PG-8072.1.2, Goddard Space Flight Center Fastener Integrity Requirements, March 5, 2001. *(CCR 00074A) (CCR 00112)* Air Force Space Command Manual 91-710 (AFSPCMAN 91-710), Range Safety Requirements, July 1, 2004. *(CCR 00074A) (CCR 00112)* **Section 9** MIL-STD-461 Rev E, Requirements for the Control of Electromagnetic Interference Characteristics of Subsystems and Equipment GSFC-STD-7000, General Environmental Verification Standard (GEVS) For GSFC Flight Programs and Projects **Section 10** ANSI/ESD-S20.20 Rev 1999, ESD Association Standard for the Development of an ESD Control Program for Protection of Electrical and Electronic Parts, Assemblies and Equipment (Excluding Electrically Initiated Explosive Devices) **Section 11** S0300-BT-PRO-010, GIDEP Operations Manual S0300-BU-GYD-01, Government-Industry Data Exchange Program Requirements Guide, November 1994. *(CCR 00112)*
IMAR1107	12.2	**12.2 Reference Documents**

ID	Object Number	417-R-IMAR-0039, RM Version, Instrument Mission Assurance Requirements (IMAR) Document
IMAR1108	12.2.0-1	The following documents can be used as reference documents for the development of the performance verification test program. NASA-STD-7001, Payload Vibroacoustic Test Criteria NASA-STD-7002, Payload Test Requirements NASA-HDBK-4002, Avoiding Problems Caused by Spacecraft On-Orbit Internal Charging Effects MIL-HDBK-340 Rev. A, Test Requirements for Launch, Upper Stage, and Space Vehicles Vol. I: Baselines, Vol. II: Application Guidelines MIL-STD-1540 Rev. D, Product Verification Requirements for Launch, Upper stage, and Space Vehicles MIL-A-83577B, Assemblies, Moving Mechanical, for Space and Launch Vehicles, General Specification for DOD-HDBK-343, Design, Construction, and Testing Requirements for One of a Kind Space Equipment NPSL, NASA Part Selection List : <http://nepp.nasa.gov/npsl> GSFC-STD-7000, General Environmental Verification Standard (GEVS) for GSFC Flight Programs and Projects GSFC-STD-1000, Goddard Space Flight Center Rules for the Design, Development, Verification, and Operation of Flight Systems *(CCR 00099A)*

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IMAR1075	13	**13** Acronyms and Glossary
IMAR1077	13.1	**13.1 Acronyms** *(CCR 00112)*
IMAR1110	13.1.0-1	

ABPL	As-Built Parts List
ADPL	As-Designed Parts List
AFSPCMAN	Air Force Space Command Manual
ANSI	American National Standards Institute
ASD	Acceleration Spectral Density
ASIC	Application Specific Integrated Circuits
ASQC	American Society for Quality Control
ASTM	American Society for Testing and Materials
BOL	Beginning of Life
CDR	Critical Design Review
CDRL	Contract Data Requirements List
CIL	Critical Items List
CPT	Comprehensive Performance Test
CS	Conducted Susceptibility
CSI	Customer Source Inspections
CVCM	Collected Volatile Condensable Material
DCS	Data Collection System
DID	Data Item Description
DoD	Department of Defense
DPA	Destructive Physical Analysis
EEE	Electrical, Electronic, and Electromechanical
ELDR	Enhanced Low Dose Rate
EMC	Electromagnetic Compatibility
EMI	Electromagnetic Interference
ER/WR	Eastern Range/Western Range
ESD	Electrostatic Discharge
FET	Field Effect Transistor
FRB	Failure Review Board
FMECA	Failure Modes Effect and Criticality Analysis
FMEA	Failure Modes and Effects Analysis
FTA	Fault Tree Analysis
GEVS-SE	General Environmental Verification Specification for STS & ELV Payloads, Subsystems, and Components
GIA	Government Inspection Agency
GIDEP	Government Industry Data Exchange Program
GOES	Geostationary Operational Environmental Satellite
GSFC	Goddard Space Flight Center
HDBK	Handbook
HP	Hewlett Packard
ICD	Interface Control Document
IEC	International Electrotechnical Commission
IESD	Internal Electrostatic Discharge
INST	Instruction
IPC	Association Connecting Electronics Industries
ISO	International Standards Organization
IV&V	Independent Verification and Validation
LPT	Limited Performance Test
MAR	Mission Assurance Requirements
MAT	Mission Allowable Temperatures
MCM	Multi-Chip Module
MEB	Materials Engineering Branch
MIL	Military
MITEQ	Microwave Information Transmission Equipment

ID	Object Number	417-R-IMAR-0039, RM Version, Instrument Mission Assurance Requirements (IMAR) Document	
IMAR1110	13.1.0-1	MLI	multilayered insulation
		MOSFET	Metal Oxide-Silicon Field Effect Transistor
		MRB	Material Review Board
		MSFC	Marshall Space Flight Center
		MSPSP	Missile Systems Pre-Launch Safety Package
		MUA	Materials Usage Agreement
		NASA	National Aeronautics and Space Administration
		NOT	Non-operational Temperatures
		NPD	NASA Policy Directive
		NPG	NASA Procedures and Guidelines
		NPR	NASA Procedural Requirements
		NPSL	NASA Parts Selection List
		NSPAR	Nonstandard Parts Approval Request
		ODA	Orbital Debris Assessment
		OHA	Operations Hazard Analysis
		OSHA	Occupational Safety & Health Administration
		PAPL	Project Approved Parts List
		PDA	Percentage of Defectives Allowable
		PDR	Preliminary Design Review
		PEM	Plastic Encapsulated Microcircuit
		PG	Procedures and Guidelines
		PHA	Preliminary Hazard Analysis
		PIL	Parts Identification List
		PIND	Particle Impact Noise Detection
		PMCB	Parts and Materials Control Board
		PMCP	Parts and Materials Control Plan
		PORD	Performance and Operational Requirements Document
		PPE	Project Parts Engineer
		PRA	Probabilistic Risk Assessment
		PRF	Performance Requirements For
		PSM	Project Safety Manager
		PWB	Printed Wiring Board
		QMS	Quality Management System
		QML	Qualified Manufacturers List
		QPL	Qualified Parts List
		RE	Radiation Engineer
		RPP	Reliability Program Plan
		RPT	Report
		SAM	Systems Assurance Manager
		SAR	Search and Rescue, Safety Assessment Report
		S/C	Spacecraft
		SCCB	Software Configuration Control Board
		SCD	Source Control Drawing
		SCM	Software Configuration Management
		SDP	Safety Data Package
		SEE	Single Event Effect
		SEL	Single Event Latch-up
		SET	Single Event Transient
		SMA	Space & Military Avionics
		SOW	Statement of Work
		SQA	Software Quality Assurance
		SSPP	System Safety Program Plan
		STD	Standard
		TB	Thermal Balance
		TBS	To be supplied
		TID	Total Ionizing Dose
		TIM	Technical Interface Meeting
		TML	Total Mass Loss

ID	Object Number	417-R-IMAR-0039, RM Version, Instrument Mission Assurance Requirements (IMAR) Document
IMAR1110	13.1.0-1	TV Thermal Vacuum VTL Verification Tracking Log V&V Verification and Validation
IMAR1078	13.2	**13.2 Definitions**
IMAR1079	13.2.0-1	The following definitions apply within the context of this document: **Acceptance Tests:** The validation process that demonstrates that hardware is acceptable for flight. It also serves as a quality control screen to detect deficiencies and, normally, to provide the basis for delivery of an item under terms of a contract. **Audit:** A review of the Contractor's, contractor's or subcontractor's documentation or hardware to verify that it complies with project requirements. **Close Call:** An event. An occurrence or a condition of employee concern in which there is no injury or only minor injury requiring first aid and no significant equipment/property damage/mission failure (less than $1000), but which possesses a potential to cause a mishap. **Collected Volatile Condensable Material (CVCM):** The quantity of outgassed matter from a test specimen that condenses on a collector maintained at a specific constant temperature for a specified time. **Configuration:** The functional and physical characteristics of the payload and all its integral parts, assemblies and systems that are capable of fulfilling the fit, form and functional requirements defined by performance specifications and engineering drawings. **Configuration Control:** The systematic evaluation, coordination, and formal approval/disapproval of proposed changes and implementation of all approved changes to the design and production of an item the configuration of which has been formally approved by the contractor or by the purchaser, or both. **Configuration Management:** The systematic control and evaluation of all changes to baseline documentation and subsequent changes to that documentation which define the original scope of effort to be accomplished (contract and reference documentation) and the systematic control, identification, status accounting and verification of all configuration items. **Contamination:** The presence of materials of molecular or particulate nature, which degrade the performance of hardware. **Component:** See Level of Assembly **Derating:** The reduction of the applied load (or rating) of a device to improve reliability or to permit operation at high ambient temperatures. **Designated Representative:** An individual (such as a NASA plant representative), firm (such as assessment contractor), Department of Defense (DOD) plant representative, or other government representative designated and authorized by NASA to perform a specific function for NASA. As related to the contractor's effort, this may include evaluation, assessment, design review, participation, and review/approval of certain documents or actions. **Destructive Physical Analysis (DPA):** An internal destructive examination of a finished part or device to assess design, workmanship, assembly, and any other processing associated with fabrication of the part. **Deviation:** A written authorization accepting a known departure from requirements prior to any manufacturing taking place.

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IMAR1079	13.2.0-1	

Discrepancy: See Nonconformance.

Design Qualification Tests: Tests intended to demonstrate that the test item will function within performance specifications under simulated conditions more severe than those expected from ground handling, launch, and orbital operations. Their purpose is to uncover deficiencies in design and method of manufacture. They are not intended to exceed design safety margins or to introduce unrealistic modes of failure. The design qualification tests may be to either "prototype" or "protoflight" test levels.

Discrepancy: See Nonconformance

Electromagnetic Compatibility (EMC): The condition that prevails when various electronic devices are performing their functions according to design in a common electromagnetic environment.

Electromagnetic Interference (EMI): Electromagnetic energy which interrupts, obstructs, or otherwise degrades or limits the effective performance of electrical equipment.

Electromagnetic Susceptibility: Undesired response by a component, subsystem, or system to conducted or radiated electromagnetic emissions.

Failure: A departure from specification that is discovered in the functioning or operation of the hardware or software. See nonconformance. Loss or degradation of designed-in redundant components shall be counted as failures.

Failure Modes and Effects Analysis (FMEA): A procedure by which each credible failure mode of each item from a low indenture level to the highest is analyzed to determine the effects on the system and to classify each potential failure mode in accordance with the severity of its effect.

Flight Acceptance: See Acceptance Tests.

Functional Tests: The operation of a unit in accordance with a defined operational procedure to determine whether performance is within the specified requirements.

Hardware: As used in this document, there are two major categories of hardware as follows:

a) **Prototype Hardware:** Hardware of a new design; it is subject to a design qualification test program; it is not intended for flight.

b) **Flight Hardware:** Hardware to be used operationally in space. It includes the following subsets:

   1) **Protoflight Hardware:** Flight hardware of a new design; it is subject to a qualification test program that combines elements of prototype and flight acceptance validation; that is, the application of design qualification test levels and duration of flight acceptance tests.

   2) **Follow-On Hardware:** Flight hardware built in accordance with a design that has been qualified either as prototype or as protoflight hardware; follow-on hardware is subject to a flight acceptance test program.

   3) **Spare Hardware:** Hardware the design of which has been proven in a design qualification test program; it is subject to a flight acceptance test program and is used to replace flight hardware that is no longer acceptable for flight.

Inspection: The process of measuring, examining, gauging, or otherwise comparing an article or service with specified requirements.

ID	Object Number	417-R-IMAR-0039, RM Version, Instrument Mission Assurance Requirements (IMAR) Document
IMAR1079	13.2.0-1	**Level of Assembly:** The environmental test requirements of GEVS generally start at the component or unit-level assembly and continue hardware/software build through the system level (referred to in GEVS as the payload or spacecraft level). The assurance program includes the part level. Validation testing may also include testing at the assembly and subassembly levels of assembly; for test record keeping these levels are combined into a "subassembly" level. The validation program continues through launch, and on-orbit performance. The following levels of assembly are used for describing test and analysis configurations: a) **Part:** A hardware element that is not normally subject to further subdivision or disassembly without destruction of design use. Examples include resistor, integrated circuit, relay, connector, bolt, and gaskets. b) **Subassembly:** A subdivision of an assembly. Examples are wire harness and loaded printed circuit boards. c) **Assembly:** A functional subdivision of a component consisting of parts or subassemblies that perform functions necessary for the operation of the component as a whole. Examples are a power amplifier and gyroscope. d) **Component or unit:** A functional subdivision of a subsystem and generally a self-contained combination of items performing a function necessary for the subsystem's operation. Examples are electronic box, transmitter, gyro package, actuator, motor, battery. For the purposes of this document, "component" and "unit" are used interchangeably. e) **Subsystem:** A functional subdivision of a payload consisting of two or more components. Examples are structural, attitude control, electrical power, and communication subsystems. Also included as subsystems of the payload are the science instruments or experiments. f) **Instrument:** A spacecraft subsystem consisting of sensors and associated hardware for making measurements or observations in space. For the purposes of this document, an instrument is considered a subsystem (of the spacecraft). **Limited Life Items:** Spaceflight hardware (1) that has an expected failure-free life that is less than the projected mission life, when considering cumulative ground operation, storage and on-orbit operation, (2) limited shelf life material used to fabricate flight hardware. **Margin:** The amount by which hardware capability exceeds mission requirements **Material Review Board (MRB):** The formal Contractor board established for the purpose of reviewing, evaluating, and disposing of specific nonconforming materials, supplies or services, and for ensuring the implementation and accomplishment of corrective action to preclude recurrence. **Monitor:** To keep track of the progress of a performance assurance activity; the monitor need not be present at the scene during the entire course of the activity, but he will review resulting data or other associated documentation (see Witness). **Nonconformance:** A condition of any hardware, software, material, or service in which one or more characteristics do not conform to requirements. As applied in quality assurance, nonconformances fall into two categories--discrepancies and failures. A discrepancy is a departure from specification that is detected during inspection or process control testing, etc., while the hardware or software is not functioning or operating. A failure is a departure from specification that is discovered in the functioning or operation of the hardware or software. **Nonconformance, minor:** A nonconformance that is not likely to materially reduce the usability of the supplies or services for their intended purpose, or is a departure from established standards having little bearing on the effective use or operation of the supplies or services.

ID	Object Number	417-R-IMAR-0039, RM Version, Instrument Mission Assurance Requirements (IMAR) Document
IMAR1079	13.2.0-1	**Offgassing:** The emanation of volatile matter of any kind from materials into a manned pressurized volume. **Outgassing:** The emanation of volatile materials resulting in a mass loss and/or material condensation on nearby surfaces. **Protoflight Testing:** See Hardware. **Prototype Testing:** See Hardware. **Qualification:** See Design Qualification Tests. **Redundancy** (of design)**:** The use of more than one independent means of accomplishing a given function. **Repair:** A corrective maintenance action performed as a result of a failure so as to restore an item to operate within specified limits. **Rework:** Return for completion of operations (complete to drawing). The article shall be reprocessed to conform to the original specifications or drawings. **Single Point Failure:** A single element of hardware the failure of which would result in loss of mission objectives, hardware, or crew, as defined for the specific application or project for which a single point failure analysis is performed. **Temperature Cycle:** A transition from some initial temperature condition to temperature stabilization at one extreme and then to temperature stabilization at the opposite extreme and returning to the initial temperature condition. **Thermal Balance Test:** A test conducted to verify the adequacy of the thermal model, the adequacy of the thermal design, and the capability of the thermal control system to maintain thermal conditions within established mission limits. **Thermal-Vacuum Test:** A test conducted to demonstrate the capability of the test item to operate satisfactorily in vacuum at temperatures based on those expected for the mission. The test, including the gradient shifts induced by cycling between temperature extremes, can also uncover latent defects in design, parts, and workmanship. **Total Mass Loss (TML):** Total mass of material outgassed from a specimen that is maintained at a specified constant temperature and operating pressure for a specified time. **Validation:** Proof that Operations Concept, Requirements, and Architecture and Design will meet Mission Objectives, that they are consistent, and that the "right system" has been designed. *(CCR 00215)* **Verification:** Proof of compliance with requirements and that the system has been "designed and built right." May be determined by a combination of test, analysis, and inspection. *(CCR 00215)* **Waiver:** A written authorization to accept an item that is found to depart from specific requirements, either during the manufacturing process or after having been submitted for Government inspection or acceptance but nevertheless is considered “acceptable as is”, or after repair by an approved method. **Witness:** A personal, on-the-scene observation of a performance assurance activity with the purpose of verifying compliance with project requirements (see Monitor).

417-R-IMAR-0039 DCR

CCR #: 00001 Rev
CCB Status: **Approved**
CCB Date: 12/7/2004

Doc Change Date:
12/7/2004

Title: Combining of System and Environmental Verification Plans
GOES S/C: R Effectivity: Instruments
Contract # NNG0 - 4HZ07C, Info 4HZ48C, 4HZ49C, 4HZ50C, 4HZ65C, 5HY06C, 5HY07C
Doc #: 417-R-ABICDRL-0018, 417-R-ABIMAR-0012, 417-R-ABISOW-0016
Doc Section #: CDRL: Table 2-1, DID 65, DID 66; MAR: 9.2, 9.4, 9.8; SOW:
DOORS Version: ABICDRL N/A,
DOORS ID #: CDRL: N/A; MAR: ABIMAR624, 625, 626, 627, 628, 629, 630, 631, 632, 633, 634, 636, 637, 638, 652, 653, 654, 655, 656, 658, 659, 660, 661, 662, 663, 664, 696, 700; SOW:

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CCB Date: 2/18/2005

Doc Change Date:
3/15/2005

Title: Cleanup of MAR Section 9.10 EMC - Conducted Susceptibility Levels
GOES S/C: R Effectivity: Instruments
Contract # NNG0 - 4HZ07C, Info 4HZ48C, 4HZ49C, 4HZ50C, 4HZ65C, 5HY06C, 5HY07C
Doc #: 417-R-ABIMAR-0012
Doc Section #: MAR: 9.10.6, 9.10.7, 9.10.8
DOORS Version: ABIMAR 1.0
DOORS ID #: ABIMAR827, 828, 834, 835, 844, 845

CCR #: 00006 Rev
CCB Status: **Approved**
CCB Date: 2/18/2005

Doc Change Date:
3/15/2005

Title: Cleanup of MAR Section 9.10 EMC - Conducted Emissions on Instrument Power Leads
GOES S/C: R Effectivity: Instruments
Contract # NNG0 - 4HZ07C, Info 4HZ48C, 4HZ49C, 4HZ50C, 4HZ65C, 5HY06C, 5HY07C
Doc #: 417-R-ABIMAR-0012
Doc Section #: MAR: 9.10.3.1 Figure
DOORS Version: ABIMAR 1.0
DOORS ID #: ABIMAR811 (9.10.3.1-4)

CCR #: 00007 Rev
CCB Status: **Approved**
CCB Date: 2/18/2005

Doc Change Date:
3/15/2005

Title: Cleanup of MAR Section 9.10 EMC - Common Mode Noise
GOES S/C: R Effectivity: Instruments
Contract # NNG0 - 4HZ07C, Info 4HZ48C, 4HZ49C, 4HZ50C, 4HZ65C, 5HY06C, 5HY07C
Doc #: 417-R-ABIMAR-0012
Doc Section #: MAR 9.10.4.1
DOORS Version: ABIMAR 1.0
DOORS ID #: ABIMAR814 (9.10.4.1-1), 815 (9.10.4.1-2)

CCR #: 00031 Rev
CCB Status: **Approved**
CCB Date: 2/18/2005

Doc Change Date:
3/15/2005

Title: ABI MAR (MAID 118) Delete NASA Electronic Parts Database Rqmt & Define ADPL Format
GOES S/C: R Effectivity: Instruments
Contract # NNG0 - 4HZ07C, Info 4HZ48C, 4HZ49C, 4HZ50C, 4HZ65C, 5HY06C, 5HY07C
Doc #: 417-R-ABIMAR-0012
Doc Section #: MAR 7.8.3
DOORS Version: ABIMAR 1.0
DOORS ID #: ABIMAR509 (7.8.3-2)

CCR #: 00032 Rev
CCB Status: **Approved**
CCB Date: 2/18/2005

Doc Change Date:
3/15/2005

Title: ABI MAR (MAID 119) Clarify EEE Parts Traceability Requirements
GOES S/C: R Effectivity: Instruments
Contract # NNG0 - 4HZ07C, Info 4HZ48C, 4HZ49C, 4HZ50C, 4HZ65C, 5HY06C, 5HY07C
Doc #: 417-R-ABIMAR-0012
Doc Section #: MAR 7.7.3
DOORS Version: ABIMAR 1.0
DOORS ID #: ABIMAR477 (7.7.3-3), ABI MAR(TBD) (7.7.3-5)

CCR #: 00034 Rev

CCB Status: **Approved**
CCB Date: 2/18/2005

Doc Change Date:
3/15/2005

Title: ABI MAR (MAID 121) PIND Screening Requirement Clarification
GOES S/C: R Effectivity: Instruments
Contract # NNG0 - 4HZ07C, Info 4HZ48C, 4HZ49C, 4HZ50C, 4HZ65C, 5HY06C, 5HY07C
Doc #: 417-R-ABIMAR-0012
Doc Section #: MAR 7.5.1
DOORS Version: ABIMAR 1.0
DOORS ID #: ABIMAR431 (7.5.1-1)

CCR #: 00035 Rev

CCB Status: **Approved**
CCB Date: 2/18/2005

Doc Change Date:
3/15/2005

Title: ABI MAR (MAID 122) Deletion of Duplicate Parts Derating
GOES S/C: R Effectivity: Instruments
Contract # NNG0 - 4HZ07C, Info 4HZ48C, 4HZ49C, 4HZ50C, 4HZ65C, 5HY06C, 5HY07C
Doc #: 417-R-ABIMAR-0012
Doc Section #: MAR 7.4.6
DOORS Version: ABIMAR 1.0
DOORS ID #: ABIMAR416 (7.4.6-3)

CCR #: 00037 Rev **A**

CCB Status: **Approved**
CCB Date: 7/8/2005

Doc Change Date:
7/8/2005

Title: ABI MAR (MAID 126) Clarification of GIDEP and NASA Advisories Handling by Contractors
GOES S/C: R Effectivity: Instruments
Contract # NNG0 - 4HZ07C, Info 4HZ48C, 4HZ49C, 4HZ50C, 4HZ65C, 5HY06C, 5HY07C
Doc #: 417-R-ABIMAR-0012
Doc Section #: MAR 11.1
DOORS Version: ABIMAR 1.0
DOORS ID #: ABIMAR1067 (11.1-2), ABIMAR1069 (11.1-4), ABIMAR(TBD)

CCR #: 00038 Rev

CCB Status: **Approved**
CCB Date: 2/18/2005

Doc Change Date:
3/15/2005

Title: ABI MAR (MAID 124) Clarify "Custom or Advanced Technology Devices" Design Review Requirements
GOES S/C: R Effectivity: Instruments
Contract # NNG0 - 4HZ07C, Info 4HZ48C, 4HZ49C, 4HZ50C, 4HZ65C, 5HY06C, 5HY07C
Doc #: 417-R-ABIMAR-0012
Doc Section #: MAR 7.4.4
DOORS Version: ABIMAR 1.0
DOORS ID #: ABIMAR404 (7.4.4-2)

CCR #: 00039 Rev

CCB Status: **Approved**
CCB Date: 2/18/2005

Doc Change Date:
3/15/2005

Title: ABI MAR (MAID 127) GIDEP Requirements Clarification.
GOES S/C: R Effectivity: Instruments
Contract # NNG0 - 4HZ07C, Info 4HZ48C, 4HZ49C, 4HZ50C, 4HZ65C, 5HY06C, 5HY07C
Doc #: 417-R-ABIMAR-0012
Doc Section #: MAR 11.1
DOORS Version: ABIMAR 1.0
DOORS ID #: ABIMAR1066 (11.1-1), ABIMAR1068 (11.1-3)

CCR #: 00042 Rev **B**

CCB Status: **Approved**
CCB Date: 8/12/2005

Doc Change Date:
8/12/2005

Title: Modification of Magnetic Field Testing Requirements for Magnetometer Goal Requirements.
GOES S/C: R Effectivity: S/C & Instruments
Contract # NNG0 - 4HZ07, Info 4HZ48, 4HZ49, 4HZ50, 4HZ65
Doc #: 417-R-ABIMAR-0012
Doc Section #: MAR 9.12
DOORS Version: ABIMAR 1.0
DOORS ID #: ABIMAR889 (9.12.1-1), ABIMAR891 (9.12.1-2) (was -3), ABIMAR892 (9.12.1-3), ABIMAR893 (9.12.1-4)

CCR #: 00050 Rev **B**
CCB Status: **Approved**
CCB Date: 5/12/2005

Doc Change Date:
6/13/2005

Title: ABI MAR (MAID 96) System Safety Requirements Update
GOES S/C: R Effectivity: Instruments
Contract # NNG0 - 4HZ07C, Info 4HZ48C, 4HZ49C, 4HZ50C, 4HZ65C, 5HY06C, 5HY07C
Doc #: 417-R-ABIMAR-0012
Doc Section #: ABIMAR TOC, ABIMAR 3
DOORS Version: ABIMAR 1.0
DOORS ID #: ABIMAR70 (3.1-3), ABIMAR71 (3.1-4), ABIMAR72 (3.1-5), ABIMAR74 (3.2-1), ABIMAR78 (3.3), ABIMAR79 (3.3-1), ABIMAR80 (3.3-2), ABIMAR81 (3.3-3), ABIMAR85 (3.4), ABIMAR87 (3.4-1), ABIMAR88 (3.4-2), ABIMAR89 (3.4-3), ABIMAR90 (3.4-4), ABIMAR91 (3.5), ABIMAR92 (3.1), ABIMAR93 (3.5-2), ABIMAR94 (3.5-3), ABIMAR95 (3.5-4), ABIMAR97 (3.6-1), ABIMAR99 (3.6-2), ABIMAR100 (3.6-3), ABIMAR103 (3.7-1), ABIMAR107 (3.8), ABIMAR108 (3.8-1), ABIMAR109 (3.8-2), ABIMAR111 (3.9-1), ABIMAR112 (3.10), ABIMAR113 (3.10-1), ABIMAR114 (3.10-2), ABIMAR115 (3.10-3), ABIMAR118 (3.11-1), ABIMAR121 (3.11-4), ABIMAR126 (3.11-1-9), ABIMAR127 (3.11-10), ABIMAR130 (3.11-12), ABIMAR137 (3.13-2), ABIMAR153 (3.15.1), ABIMAR154 (3.15.1-1), ABIMAR155 (3.15.1-2), ABIMAR156 (3.15.1-3), ABIMAR157 (3.15.1-4), ABIMAR156 (3.15.3-2), ABIMAR169 (3.15.4), ABIMAR170 (3.15.4-1), ABIMAR171 (3.15.4-2), ABIMAR172 (3.15.4-3), ABIMAR173 (3.15.4-5), ABIMAR174

CCR #: 00051 Rev **B**
CCB Status: **Approved**
CCB Date: 5/24/2005
Doc Change Date:
6/13/2005

Title: ABI MAR (MAID 96) Section change for Software Safety
GOES S/C: R Effectivity: Instruments
Contract # NNG0 - NNG04HZ07C
Doc #: 417-R-ABIMAR-0012, 417-R-IMAR-0039
Doc Section #: MAR 3.14, 5.1.2, 12.1
DOORS Version: ABIMAR 1.0
DOORS ID #: ABIMAR140 (3.14-1), 141 (3.14-2),142 (3.14-3),143 (3.14-4),144 (3.14-5),145 (3.14-6),146 (3.14-7),147 (3.14-8),148 (3.14-9),149 (3.14-10),150 (3.14-11), 151 (3.14-12), ABIMAR278 (5.1.2-1), ABIMAR(TBD) (5.1.2-2), ABIMAR(TBD) (5.1.2-3), ABIMAR(TBD) (5.1.2-4), ABIMAR(TBD) (5.1.2-5), ABIMAR(TBD) (5.1.2-6), ABIMAR(TBD) (5.1.2-7), ABIMAR(TBD) (5.1.2-7), ABIMAR(TBD) (5.1.2-8), ABIMAR(TBD) (5.1.2-9), ABIMAR(TBD)

CCR #: 00053 Rev
CCB Status: **Approved**
CCB Date: 4/1/2005

Doc Change Date:
4/1/2005

Title: ABI MAR (MAID 115) Change Surveillance of the Contractor to a Shall Requirement
GOES S/C: R Effectivity: Instruments
Contract # NNG0 - 4HZ07C, Info 4HZ48C, 4HZ49C, 4HZ50C, 4HZ65C, 5HY06C, 5HY07C
Doc #: 417-R-ABIMAR-0012
Doc Section #: MAR 1.3
DOORS Version: ABIMAR 1.0
DOORS ID #: ABIMAR12 (1.3.1)

CCR #: 00055 Rev **A**
CCB Status: **Approved**
CCB Date: 4/1/2005

Doc Change Date:
4/1/2005

Title: ABI MAR (MAID 129 and 131) Delete Duplicate Record Retention Requirement
GOES S/C: R Effectivity: Instruments
Contract # NNG0 - 4HZ07C, Info 4HZ48C, 4HZ49C, 4HZ50C, 4HZ65C, 5HY06C, 5HY07C
Doc #: 417-R-ABIMAR-0012
Doc Section #: MAR 7.9.3
DOORS Version: ABIMAR 1.0
DOORS ID #: ABIMAR532 (7.9.3-4)

CCR #: 00056 Rev

CCB Status: **Approved**
CCB Date: 4/1/2005

Doc Change Date:
4/1/2005

Title: ABI MAR (MAID 130) Change Unit/Subsystem to Instrument & Clarify End Item Acceptance Data Package Rqmts

GOES S/C: R Effectivity: Instruments
Contract # NNG0 - 4HZ07C, Info 4HZ48C, 4HZ49C, 4HZ50C, 4HZ65C, 5HY06C, 5HY07C

Doc #: 417-R-ABIMAR-0012
Doc Section #: MAR 7.9.3
DOORS Version: ABIMAR 1.0

DOORS ID #: ABIMAR529 (7.9.3-1), 530 (7.9.3-2), 531 (7.9.3-3)

CCR #: 00057 Rev

CCB Status: **Approved**
CCB Date: 2/18/2005

Doc Change Date:
3/15/2005

Title: ABI MAR (MAID 132) Correct Typo in Parts List Rqmts

GOES S/C: R Effectivity: Instruments
Contract # NNG0 - 4HZ07C, Info 4HZ48C, 4HZ49C, 4HZ50C, 4HZ65C, 5HY06C, 5HY07C

Doc #: 417-R-ABIMAR-0012
Doc Section #: MAR 7.8
DOORS Version: ABIMAR 1.0

DOORS ID #: ABIMAR499 (7.8-3)

CCR #: 00058 Rev

CCB Status: **Approved**
CCB Date: 4/1/2005

Doc Change Date:
4/1/2005

Title: ABI MAR (MAID 134) Correct Derating Policy Guidelines Reference

GOES S/C: R Effectivity: Instruments
Contract # NNG0 - 4HZ07C, Info 4HZ48C, 4HZ49C, 4HZ50C, 4HZ65C, 5HY06C, 5HY07C

Doc #: 417-R-ABIMAR-0012
Doc Section #: MAR 7.7.2
DOORS Version: ABIMAR 1.0

DOORS ID #: ABIMAR469 (7.7.2-2)

CCR #: 00059 Rev

CCB Status: **Approved**
CCB Date: 4/26/2005

Doc Change Date:
4/26/2005

Title: ABI MAR (MAID 135) Delete Redundant Parts Age and Storage Control Rqmt

GOES S/C: R Effectivity: Instruments
Contract # NNG0 - 4HZ07C, Info 4HZ48C, 4HZ49C, 4HZ50C, 4HZ65C, 5HY06C, 5HY07C

Doc #: 417-R-ABIMAR-0012
Doc Section #: MAR 7.7.1
DOORS Version: ABIMAR 1.0

DOORS ID #: ABIMAR466 (7.7.1-4)

CCR #: 00060 Rev

CCB Status: **Approved**
CCB Date: 2/18/2005

Doc Change Date:
3/15/2005

Title: ABI MAR (MAID 136 and 138) Capacitor Surge Current Screening Requirement Correction

GOES S/C: R Effectivity: Instruments
Contract # NNG0 - 4HZ07C, Info 4HZ48C, 4HZ49C, 4HZ50C, 4HZ65C, 5HY06C, 5HY07C

Doc #: 417-R-ABIMAR-0012
Doc Section #: MAR 7.5.2.1
DOORS Version: ABIMAR 1.0

DOORS ID #: ABIMAR436 (7.5.2.1-2), 437 (7.5.2.1-3)

CCR #: 00061 Rev

CCB Status: **Approved**
CCB Date: 4/26/2005

Doc Change Date:
4/26/2005

Title: ABI MAR (MAID 137) Addition of Sample Size to DPA Requirement

GOES S/C: R Effectivity: Instruments
Contract # NNG0 - 4HZ07C, Info 4HZ48C, 4HZ49C, 4HZ50C, 4HZ65C, 5HY06C, 5HY07C

Doc #: 417-R-ABIMAR-0012
Doc Section #: MAR 7.5.2.2
DOORS Version: ABIMAR 1.0

DOORS ID #: ABIMAR441 (7.5.2.2-3)

CCR #: 00062 Rev

Title: ABI MAR (MAID 140) Add Contractor RE & PPE Approvals to SEL Susceptible Parts Usage

CCB Status: **Approved**
CCB Date: 4/1/2005

Doc Change Date:
4/1/2005

GOES S/C: R Effectivity: Instruments
Contract # NNG0 - 4HZ07C, Info 4HZ48C, 4HZ49C, 4HZ50C, 4HZ65C, 5HY06C, 5HY07C
Doc #: 417-R-ABIMAR-0012
Doc Section #: MAR 7.4.3.3
DOORS Version: ABIMAR 1.0
DOORS ID #: ABIMAR399 (7.4.3.3-4)

CCR #: 00063 Rev **A**

Title: ABI MAR (MAID 142) Deletes an Unnecessary Contractor PMCB Membership Rqmt

CCB Status: **Approved**
CCB Date: 7/8/2005

Doc Change Date:
7/8/2005

GOES S/C: R Effectivity: Instruments
Contract # NNG0 - 4HZ07C, Info 4HZ48C, 4HZ49C, 4HZ50C, 4HZ65C, 5HY06C, 5HY07C
Doc #: 417-R-ABIMAR-0012
Doc Section #: MAR 7.3.3
DOORS Version: ABIMAR 1.0
DOORS ID #: ABIMAR379 (7.3.3-6)

CCR #: 00064 Rev

Title: ABI MAR (MAID 117) Clarify Packaging Requirements in Workmanship Standards Section

CCB Status: **Approved**
CCB Date: 4/1/2005

Doc Change Date:
4/1/2005

GOES S/C: R Effectivity: Instruments
Contract # NNG0 - 4HZ07C, Info 4HZ48C, 4HZ49C, 4HZ50C, 4HZ65C, 5HY06C, 5HY07C
Doc #: 417-R-ABIMAR-0012
Doc Section #: MAR 6.7
DOORS Version: ABIMAR 1.0
DOORS ID #: ABIMAR338 (6.7-1)

CCR #: 00066 Rev

Title: ABI MAR (MAID 157) Corrects Materials Selection Reference Document and Document Use

CCB Status: **Approved**
CCB Date: 4/1/2005

Doc Change Date:
4/1/2005

GOES S/C: R Effectivity: Instruments
Contract # NNG0 - 4HZ07C, Info 4HZ48C, 4HZ49C, 4HZ50C, 4HZ65C, 5HY06C, 5HY07C
Doc #: 417-R-ABIMAR-0012
Doc Section #: MAR 8.2.1
DOORS Version: ABIMAR 1.0
DOORS ID #: ABIMAR558 (8.2.1-4)

CCR #: 00067 Rev

Title: ABI MAR (MAID 159) Clarification of Shelf-Life-Controlled Materials

CCB Status: **Approved**
CCB Date: 2/18/2005

Doc Change Date:
3/15/2005

GOES S/C: R Effectivity: Instruments
Contract # NNG0 - 4HZ07C, Info 4HZ48C, 4HZ49C, 4HZ50C, 4HZ65C, 5HY06C, 5HY07C
Doc #: 417-R-ABIMAR-0012
Doc Section #: MAR 8.2.4.3
DOORS Version: ABIMAR 1.0
DOORS ID #: ABIMAR576 (8.2.4.3-3), 577 (8.2.4.3-4), 578 (8.2.4.3-5)

CCR #: 00069 Rev **A**

Title: ABI MAR Conversion to Instrument MAR (IMAR)

CCB Status: **Approved**
CCB Date: 7/8/2005
Doc Change Date:
1/5/2006

GOES S/C: R Effectivity: Instruments
Contract # NNG0 - NNG04HZ07C
Doc #: 417-R-ABIMAR-0012, 417-R-IMAR-0039
Doc Section #: ALL
DOORS Version: ABIMAR 1.0,
DOORS ID #: ALL

CCR #: 00074 Rev **A**

Title: Clarification of Materials Requirements

CCB Status: **Approved**
GOES S/C: R Effectivity: Instruments

CCB Date: 4/26/2005
Doc Change Date: 4/26/2005

Contract # NNG0 - NNG04HZ07C
Doc #: 417-R-ABIMAR-0012
Doc Section #: ABIMAR 8.2
DOORS Version: ABIMAR 1.0
DOORS ID #: ABIMAR556 (8.2.1-2), 568 (8.2.4.1-1), 572 (8.2.4.2-2), 582 (8.2.5-3), 583 (8.2.5-4), 589 (8.2.5.1-4), 604 (8.2.6-1), 605 (8.2.6-2), 606 (8.2.6-3), 607 (8.2.6-4), 1106 (12.1-1)

CCR #: 00075 Rev

Title: Clarification of Workmanship Requirements

CCB Status: **Approved**
CCB Date: 7/25/2005
Doc Change Date: 7/25/2005

GOES S/C: R Effectivity: Instruments
Contract # NNG0 - 4HZ07C, Info 4HZ48C, 4HZ49C, 4HZ50C, 4HZ65C, 5HY06C, 5HY07C
Doc #: 417-R-ABIMAR-0012
Doc Section #: ABIMAR 6.1, 6.6
DOORS Version: ABIMAR 1.0
DOORS ID #: ABIMAR318 (6.1-3), 336 (6.6-3)

CCR #: 00078 Rev **A**

Title: Addition of Test Number CE01

CCB Status: **Approved**
CCB Date: 6/8/2005
Doc Change Date: 6/13/2005

GOES S/C: R Effectivity: Instruments
Contract # NNG0 - 4HZ07C, Info 4HZ48C, 4HZ49C, 4HZ50C, 4HZ65C, 5HY06C, 5HY07C
Doc #: 417-R-ABIMAR-0012
Doc Section #: ABIMAR 9.10.3.1, 9.10.3.1.1(add), 9.10.3.1.2(add)
DOORS Version: ABIMAR 1.0
DOORS ID #: ABIMAR808 (9.10.3.1-1), ABIMAR(TBD) (9.10.3.1.1-1), ABIMAR(TBD) (9.10.3.1.1-2), ABIMAR(TBD) (9.10.3.1.1-3), ABIMAR809 (9.10.3.1-2), ABIMAR809 (9.10.3.1-3), ABIMAR809 (9.10.3.1-4)

CCR #: 00079 Rev

Title: ABI MAR (MAID 120) Change Screening requirements for Magnetic Components to Exempt Planar Devices

CCB Status: **Approved**
CCB Date: 4/26/2005
Doc Change Date: 4/26/2005

GOES S/C: R Effectivity: Instruments
Contract # NNG0 - 4HZ07C, Info 4HZ48C, 4HZ49C, 4HZ50C, 4HZ65C, 5HY06C, 5HY07C
Doc #: 417-R-ABIMAR-0012
Doc Section #: ABIMAR 6.4-5(add), 7.5.3-1
DOORS Version: ABIMAR 1.0
DOORS ID #: ABIMAR(TBD) (6.4-5), ABIMAR444 (7.5.3-1)

CCR #: 00080 Rev

Title: ABI MAR (MAID 123) Clarification of Procurement Specification Requirements for Custom or Advanced Technology Devices

CCB Status: **Approved**
CCB Date: 7/25/2005
Doc Change Date: 7/25/2005

GOES S/C: R Effectivity: Instruments
Contract # NNG0 - 4HZ07C, Info 4HZ48C, 4HZ49C, 4HZ50C, 4HZ65C, 5HY06C, 5HY07C
Doc #: 417-R-ABIMAR-0012
Doc Section #: ABIMAR 7.4.4
DOORS Version: ABIMAR 1.0
DOORS ID #: ABIMAR407 (7.4.4-6), ABIMAR1099 (7.4.4-7), ABIMAR408 (7.4.4-8), ABIMAR409 (7.4.4-9), ABIMAR(TBD) (7.4.4-10)

CCR #: 00082 Rev **A**

Title: Sinusoidal Testing Frequency Limit (MAID 38)

CCB Status: **Approved**
CCB Date: 5/24/2005
Doc Change Date: 6/13/2005

GOES S/C: R Effectivity: Instruments
Contract # NNG0 - NNG04HZ07C
Doc #: 417-R-ABIMAR-0012
Doc Section #: ABIMAR 9.9.5
DOORS Version: ABIMAR 1.0
DOORS ID #: ABIMAR742 (9.9.5-1), ABIMAR747 (9.9.5-6), ABIMAR(TBD) (9.9.5-12)

CCR #: 00093 Rev
CCB Status: **Approved**
CCB Date: 4/26/2005

Doc Change Date:
4/26/2005

Title: Simplification of MAR Section 9 Re-Test Requirements (MAID 49, 160)
GOES S/C: R Effectivity: Instruments
Contract # NNG0 - 4HZ07C, Info 4HZ48C, 4HZ49C, 4HZ50C, 4HZ65C, 5HY06C, 5HY07C
Doc #: 417-R-ABIMAR-0012, 417-R-ABICDRL-0018
Doc Section #: ABIMAR :9.8.5, 9.9.4, 9.9.5, 9.9.6, 9.13.3.2; ABI CDRL DID 94
DOORS Version: ABIMAR 1.0,
DOORS ID #: ABIMAR705 (9.8.5-8), ABIMAR729 (9.9.4-3), ABIMAR744 (9.9.5-3), ABIMAR759 (9.9.6-6), ABIMAR954 (9.13.3.2-2); CDRL

CCR #: 00094 Rev
CCB Status: **Approved**
CCB Date: 4/26/2005

Doc Change Date:
4/26/2005

Title: Deletion of Heater Cycling Requirements for Thermal Balance (MAID
GOES S/C: R Effectivity: Instruments
Contract # NNG0 - 4HZ07C, Info 4HZ48C, 4HZ49C, 4HZ50C, 4HZ65C, 5HY06C, 5HY07C
Doc #: 417-R-ABIMAR-0012
Doc Section #: ABIMAR 9.13.4.5
DOORS Version: ABIMAR 1.0
DOORS ID #: ABIMAR1013 (9.13.4.5-2) and ABIMAR1014 (9.13.4.5-3).

CCR #: 00099 Rev **A**
CCB Status: **Approved**
CCB Date: 7/25/2005

Doc Change Date:
7/25/2005

Title: Add GSFC-STD-1000 to MAR Reference Document List and Change the GEVS-SE Reference to the Current GSFC Document
GOES S/C: R Effectivity: Instruments
Contract # NNG0 - 4HZ07C, Info 4HZ48C, 4HZ49C, 4HZ50C, 4HZ65C, 5HY06C, 5HY07C
Doc #: 417-R-ABIMAR-0012
Doc Section #: ABIMAR 12.2
DOORS Version: ABIMAR 1.0
DOORS ID #: ABIMAR1108

CCR #: 00103 Rev
CCB Status: **Approved**
CCB Date: 7/25/2005

Doc Change Date:
7/25/2005

Title: MAR Section 7.4.2 Cleanup (MAID 141)
GOES S/C: R Effectivity: Instruments
Contract # NNG0 - 4HZ07C, Info 4HZ48C, 4HZ49C, 4HZ50C, 4HZ65C, 5HY06C, 5HY07C
Doc #: 417-R-ABIMAR-0012
Doc Section #: ABIMAR 7.4.2
DOORS Version: ABIMAR 1.0
DOORS ID #: ABIMAR386

CCR #: 00104 Rev
CCB Status: **Approved**
CCB Date: 7/25/2005

Doc Change Date:
7/25/2005

Title: MAR Section 9.15.2 Cleanup (MAID 150)
GOES S/C: R Effectivity: Instruments
Contract # NNG0 - 4HZ07C, Info 4HZ48C, 4HZ49C, 4HZ50C, 4HZ65C, 5HY06C, 5HY07C
Doc #: 417-R-ABIMAR-0012
Doc Section #: ABIMAR 9.15.2
DOORS Version: ABIMAR 1.0
DOORS ID #: ABIMAR1048 (9.15.2-1), (9.15.2-2), (9.15.2-3)

CCR #: 00112 Rev
CCB Status: **Approved**
CCB Date: 10/11/200

Doc Change Date:
11/16/2005

Title: MAR Applicable Documents List Update
GOES S/C: R Effectivity: Instruments
Contract # NNG0 - 4HZ07C, Info 4HZ48C, 4HZ49C, 4HZ50C, 4HZ65C, 5HY06C, 5HY07C
Doc #: 417-R-ABIMAR-0012
Doc Section #: ABIMAR 1.4, 12, 13
DOORS Version: ABIMAR 1.0
DOORS ID #: ABIMAR18 (1.4-1), ABIMAR19 (1.4-2), ABIMAR1106 (12.1-1), ABIMAR1110 (13.1-1)

CCR #: 00142 Rev
CCB Status: **Approved**
CCB Date: 11/16/200

Doc Change Date:
11/16/2005

Title: ABIMAR Reliability and Workmanship Updates
GOES S/C: R Effectivity: Instruments
Contract # NNG0 - 4HZ07C, Info 4HZ48C, 4HZ49C, 4HZ50C, 4HZ65C, GLM RFP. SEISS RFP
Doc #: 417-R-ABIMAR-0012
Doc Section #: 4.3.1, 6.0, 6.2, 6.4
DOORS Version: ABIMAR 1.0
DOORS ID #: ABIMAR196 (4.3.1-5), 307 (6.0-2), 308 (6.0-3), 311 (6.0-5), 312 (6.0-6), 320 (6.2-1), 327 (6.4-1)

CCR #: 00134 Rev
CCB Status: **Approved**
CCB Date: 6/2/2006

Doc Change Date:
6/14/2006

Title: Revised RE102 Radiated Emissions, Electric Field, Spacecraft Level Figure
GOES S/C: R Effectivity: Instruments
Contract # NNG0 - 4HZ07C, Info 4HZ48C, 4HZ49C, 4HZ50C, 4HZ65C, 5HY06C, 5HY07C
Doc #: 417-R-ABIMAR-0012
Doc Section #: 9.10.9
DOORS Version: ABIMAR 1.0
DOORS ID #: ABIMAR853

CCR #: 00156 Rev
CCB Status: **Approved**
CCB Date: 4/13/2006

Doc Change Date:
6/14/2006

Title: Delete the Magnetic Field Radiated Susceptibility RS101 Testing Requirement
GOES S/C: R Effectivity: Instruments
Contract # NNG0 - 4HZ07C, Info 4HZ48C, 4HZ49C, 4HZ50C, 4HZ65C, 6HX11C, 6HX12C, 6HX13C, SEISS #tbd
Doc #: 417-R-ABIMAR-0012, 417-R-IMAR-0039
Doc Section #: 9.10.11.1
DOORS Version: ABIMAR 1.0,
DOORS ID #: ABIMAR864, IMAR864, ABIMAR865, IMAR865

CCR #: 00217 Rev
CCB Status: **Approved**
CCB Date: 6/2/2006

Doc Change Date:
6/14/2006

Title: IMAR Test Tolerances
GOES S/C: R Effectivity: Instruments (- ABI)
Contract # NNG0 - Info 4HZ48C, 4HZ49C, 4HZ50C, 4HZ65C, 6HX11C, 6HX12C, 6HX13C, SEISS #tbd
Doc #: 417-R-IMAR-0039
Doc Section #: 9.9.2
DOORS Version: IMAR 2.0
DOORS ID #: IMAR1154 (9.9.2.0-2)

CCR #: 00218 Rev
CCB Status: **Approved**
CCB Date: 6/2/2006

Doc Change Date:
6/14/2006

Title: IMAR Modal Survey
GOES S/C: R Effectivity: Instruments (- ABI)
Contract # NNG0 - Info 4HZ48C, 4HZ49C, 4HZ50C, 4HZ65C, 6HX11C, 6HX12C, 6HX13C, SEISS #tbd
Doc #: 417-R-IMAR-0039
Doc Section #: 9.9.6
DOORS Version: IMAR 2.0
DOORS ID #: IMAR1163 (9.9.6.0-1)

CCR #: 00231 Rev
CCB Status: **Approved**
CCB Date: 6/14/2006

Doc Change Date:
6/14/2006

Title: IMAR Clarification
GOES S/C: R Effectivity: Instruments (- ABI)
Contract # NNG0 - Info 4HZ48C, 4HZ49C, 4HZ50C, 4HZ65C, 6HX11C, 6HX12C, 6HX13C, SEISS #tbd
Doc #: 417-R-IMAR-0039
Doc Section #: 3.12.1
DOORS Version: IMAR 2.0
DOORS ID #: IMAR163 (3.12.1.0-5)

CCR #: 00232 Rev

CCB Status: **Approved**
CCB Date: 6/14/2006

Doc Change Date:
6/14/2006

Title: IMAR Spurious Signals Definition Clarification
GOES S/C: R Effectivity: Instruments (- ABI)
Contract # NNG0 - Info 4HZ48C, 4HZ49C, 4HZ50C, 4HZ65C, 6HX11C, 6HX12C, 6HX13C, SEISS #tbd
Doc #: 417-R-IMAR-0039
Doc Section #: 9.10.2
DOORS Version: IMAR 2.0
DOORS ID #: IMAR803 (9.10.2.0-2)

CCR #: 00215 Rev

CCB Status: **Approved**
CCB Date: 8/1/2006

Doc Change Date:
8/1/2006

Title: Change and Addition of Definitions to ABIMAR and IMAR
GOES S/C: R Effectivity: Instruments
Contract # NNG0 - 4HZ07C, Info 4HZ48C, 4HZ49C, 4HZ50C, 4HZ65C, 6HX11C, 6HX12C, 6HX13C, SEISS #tbd
Doc #: 417-R-IMAR-0039, 417-R-ABIMAR-0012
Doc Section #: 13.2
DOORS Version: IMAR 2.0,
DOORS ID #: IMAR1079 (13.2.0-1), ABIMAR1079 (13.2)

CCR #: 00146 Rev **B**

CCB Status: **Approved**
CCB Date: 6/2/2006

Doc Change Date:
8/2/2006

Title: Clarification of Requirements for Control of Electromagnetic Interference Characteristics
GOES S/C: R Effectivity: Instruments
Contract # NNG0 - 4HZ07C, Info 4HZ48C, 4HZ49C, 4HZ50C, 4HZ65C, 6HX11C, 6HX12C, 6HX13C, SEISS #tbd
Doc #: 417-R-IMAR-0039, 417-R-ABIMAR-0012
Doc Section #: 9.10.3.1
DOORS Version: IMAR 2.0,
DOORS ID #: IMAR807 (9.10.3.1), IMAR1125 (9.10.3.1.1), IMAR1126 (9.10.3.1.1.0-1), IMAR1127 (9.10.3.1.1.0-2), IMAR1128 (9.10.3.1.1.0-3), ABIMAR807 (9.10.3.1), ABIMAR1125 (9.10.3.1.1), ABIMAR1126 (9.10.3.1.1-1), ABIMAR1127 (9.10.3.1.1-2), ABIMAR1128 (9.10.3.1.1-3)

CCR #: 00330 Rev

CCB Status: **Approved**
CCB Date: 11/27/200

Doc Change Date:
11/27/2006

Title: Permanent Magnetic Field Test Requirement Addition
GOES S/C: R Effectivity: Instruments
Contract # NNG0 - 4HZ07C, 6HX01C, Info 4HZ48C, 4HZ49C, 4HZ50C, 4HZ65C, 6HX11C, 6HX12C, 6HX13C, SUVI/EXIS TBD
Doc #: 417-R-IMAR-0039
Doc Section #: 9.12
DOORS Version: IMAR 2.1
DOORS ID #: IMARTBD (9.12.1.0-6)

CCR #: 00337 Rev

CCB Status: **Approved**
CCB Date: 2/12/2007

Doc Change Date:
2/12/2007

Title: IMAR Radiated Emissions Levels and Measurement Requirements Update
GOES S/C: R Effectivity: Instruments - ABI
Contract # NNG0 - 6HX01C, Info 4HZ48C, 4HZ49C, 4HZ50C, 4HZ65C, 6HX11C, 6HX12C, 6HX13C, SUVI/EXIS TBD
Doc #: 417-R-IMAR-0039
Doc Section #: 9.10.9, 9.10.10
DOORS Version: IMAR 2.2
DOORS ID #: IMAR851 (9.10.9.1.-1), IMAR853 (9.10.9.1.-3), 855 (9.10.10.1.0.-1), 860 (9.10.10.0-6), 862 (9.10.10.0-8)