PSNN-2014-1202

Safety-Related

Project Document No.	Rev.	-	5

Commercial Dedication Instruction

Customer Name	N/A (As per each Job Order)
Project Name	N/A (As per each Job Order)
Item Name	N/A (As per each Job Order)
Item Number	N/A (As per each Job Order)
Job Number	N/A (As per each Job Order)

Product Name	TRN module
Model Number	HNS0531

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1. Product Identification

a. Part Number: See following table

b. Model Number: HNS0531

c. Drawing Number: 5Q8K0016 Rev.5

d. Manufacturer's Name: TOSHIBA Corporation, Power Systems Company, Power Platform Development Department (PPDD)

Sub supplier: Toshiba Design and Manufacturing Service Corporation (TDMS)

e. Manufacturer's Model Number: See following table

f. Manufacturer's Catalog Number: N/A

g. Name plate data: N/A

h. Applicable Material/Part Specification Number: N/A

i. Identification of Parent Component: See Section 2.3

j. Software Version: N/A

k. Firmware Version: N/A

FPGA Code Name	FPGA Identification*	Applicable Module (Part Number)
[redacted]^{a,c}	100100	P001, P002
[redacted]^{a,c}	100200	P002, P002
[redacted]^{a,c}	107001	P001
[redacted]^{a,c}	111300	P002

* The first 6-digit numeric strings in registration number of FPGA fuse-map

Table 1 Part Number List

Part Number: (Procurement/Purchase Specification Number/ Part Number)	Manufacturer's Model Number	Description
5Q8K0016/P001	HNS0531B00000	-
5Q8K0016/P002	HNS0531B00001	P001 with Cyclic Redundancy Check (CRC) function

2. Product Description

2.1 Definitions

a. General Name of Product: TRN module

b. Product Name of Manufacturer: TRN module

c. Description of Terms

- APRM: Average Power Range Monitor, a safety-related subsystem of Neutron Monitoring System (NMS).
- APRM unit: A parent component of the APRM, FLOW, GAF/ST, TRN, RCV, DIO, and LVPS modules. An APRM unit measures Core Flow Level (safety function) and APRM Level (safety function) using the LPRM Levels.
- CAL/ST module: The CAL/ST module mounted on LPRM unit receives LPRM Levels from LPRM modules, and transmits LPRM Multiple Data (safety function) to TRN module mounted in LPRM unit.

- DAT/ST module: The DAT/ST module mounted on OPRM unit receives serial data from modules mounted on OPRM unit, and transmits the OPRM Multiple Data (safety function) to TRN module mounted in the OPRM unit.
- GAF: Gain Adjustment Factor (GAF) is used to adjust the LPRM Icals. The Icals are the LPRM detector currents at 100% power. GAF is a factor to compensate a previous Ical value. For example, when the previous Ical is 1,000μA and GAF is 1.1, then the new Ical becomes 1,100μA.
- GAF/ST module: The GAF/ST module mounted on APRM unit receives APRM Multiple Data and FLOW Multiple Data from APRM module and FLOW module, and transmits APRM Unit Data (safety function) to TRN module mounted in the APRM unit. The GAF/ST module receives APRM Trip, APRM Alarm, FLOW Trip and FLOW Alarm signals from APRM module and FLOW module, and transmits APRM Unit Trip and APRM Unit Alarm signals (safety function) to DIO module mounted in the APRM unit.
- LPRM: Local Power Range Monitor, a safety-related subsystem of Neutron Monitoring System (NMS).
- LPRM unit: A parent component of the LPRM, CAL/ST, TRN, RCV, and LVPS modules.
- NMS: Neutron Monitoring System, NMS consists of three safety-related subsystems: Startup Range Neutron Monitor (SRNM), Local Power Range Monitor (LPRM), and Average Power Range Monitor (APRM) which includes Oscillation Power Range Monitor (OPRM). The LPRM, OPRM, and APRM are collectively called the Power Range Neutron Monitor (PRNM).
- OPRM: Oscillation Power Range Monitor, a safety-related subsystem of Neutron Monitoring System (NMS). OPRM is functional sub-system of APRM.
- OPRM unit: A parent component of the CELL, AGRD, PBD, DAT/ST, TRN, RCV, DIO, and LVPS modules.
- PRNM: Power Range Neutron Monitor, the parent system of the LPRM unit, the APRM unit and the OPRM unit. For Advanced Boiling Water Reactor (ABWR) application, four divisions of the PRNM are installed to plant. Each of those four PRNM divisions contains four LPRM units, an APRM unit and an OPRM unit.
- SRNM: Startup Range Neutron Monitor, a safety-related subsystem of Neutron Monitoring System (NMS).
- TRN module: The TRN module is used to transmit optical signal between units in PRNM, and also used to transmit optical signal to external system.

d. Abbreviation

ABWR	Advanced Boiling Water Reactor
AQ	Augmented Quality
CC	Critical Characteristics
CCD	Critical Characteristics for Design
CCA	Critical Characteristics for Acceptance
CDI	Commercial Dedication Instruction
CFI	Counterfeit and Fraudulent Item
CG	Commercial Grade
CRC	Cyclic Redundancy Check
C of C	Certificate of Conformance
DDS	Detailed Design Specification
DR	Design Review

ELCS	Engineered Safety Features Logic & Control System
EMC	Electromagnetic Compatibility
EQ	Equipment Qualification
FD	Flat Display
FPGA	Field Programmable Gate Array
FMEA	Failure Mode and Effect Analysis
IF	Interface
IV&V	Independent Verification and Validation
MDS	Module Design Specification
NICSD	Nuclear Instrumentation and Control Systems Department
NICS-QA	Quality Assurance Group for Nuclear Instrumentation & Control Systems
NICS-QC	Quality Control Group for Nuclear Instrumentation & Control Systems
NISD	Nuclear Instrumentation Systems Development & Designing Group
NSR	Non-Safety-Related
PCB	Printed Circuit Board
PPDD	Power Platform Development Department
QA	Quality Assurance
QC	Quality Control
SOE	Sequence of Event
SR	Safety-Related
TDMS	Toshiba Design and Manufacturing Service Corporation
TDR	Transient Data Recorder
WDT	Watch Dog Timer

2.2 Function of Product

P001: A TRN module (P001) is used mounted on units that are parent components specified in Section 2.3. The TRN module has four optical outputs. The TRN module receives signals of three-wire electrical communication link from other modules in the same unit via middle plane, and provides them to external systems as an optical signal. The TRN module adds frame signal to the received signals of three-wire electrical communication link and convert them into Manchester code to make an optical signal. The TRN module attaches a set of "Unit Type" and "Unit ID", which are used to distinguish parent component and divisional information where the TRN module is mounted on, to the received signals of three-wire electrical communication link.

P002: A TRN module (P002) has the function of the TRN module (P001) with CRC function. The TRN module adds the 32bits CRC data to the end of the multiplexed data.

2.3 Function of Parent Component

Table 2 Function of Parent Component

Part No.	Model No.	Parent Component	Function of Parent Component (Safety Function)	Functional Classification of Parent Component
P001, P002	HNS0531	LPRM unit	LPRM Level, which represents a local neutron flux	Safety Related
		APRM unit	APRM Level, which represents an average neutron flux Simulated Thermal Power Core Flow Level APRM Upscale Flux Trip Simulated Thermal Power Upscale Trip APRM Inoperative Core Flow Rapid Coastdown APRM ATWS Permissive signals	Safety Related

Part No.	Model No.	Parent Component	Function of Parent Component (Safety Function)	Functional Classification of Parent Component
			Providing the data signals, bypass state, trip state, annunciator, and operation state to the Engineered Safety Features Logic & Control System (ELCS) Flat Display (FD).	
		OPRM unit	Neutron flux oscillation Growth Rate-Based Trip Amplitude-Based Maximum Trip Period-Based Trip OPRM Inoperative Providing the data signals, bypass state, trip state, annunciator, and operation state to the Engineered Safety Features Logic & Control System (ELCS) Flat Display (FD).	Safety Related

3. Safety Related Function

The TRN module is required to perform before, during, and after abnormal environmental conditions (seismic, environmental and Electromagnetic Compatibility (EMC) conditions). The TRN module shall perform the safety related functions described in the following table. The environmental and EMC qualification of the TRN module are not performed as a standalone item. The verification of environmental and EMC qualification will take place at a higher level as part of system equipment qualification effort (Refer to Section 6.2.1).

Table 3 Safety Related Function

Part No.	Model No.	Safety Related Function	Functional Classification
P001, P002	HNS0531	<LPRM application> One TRN module is mounted on and electrically connected to LPRM unit which has safety-related functions. <Application 1> The TRN module receives LPRM Multiple Data (safety function) from CAL/ST module mounted on LPRM unit, and transmits those to APRM unit and OPRM unit. LPRM Multiple Data are necessary to transmits LPRM levels (safety function).	Safety Related (Having a safety function)
		<APRM application> Three TRN modules are mounted on and electrically connected to APRM unit which has safety-related functions. <Application 1> Two TRN modules receive APRM unit data (safety function) from GAF/ST module mounted on APRM unit. TRN modules transmit APRM unit data to OPRM unit, and transmit APRM unit data to ELCS-FD via [a,c].	Safety Related (Having a safety function)
		<Application 2> One TRN module receives GAF data, which are needed to calculate LPRM level (safety function) in LPRM unit, from GAF/ST module mounted on APRM unit, and transmits those to 4 LPRM units.	Safety Related (Having an effect on performance of the system safety function)
		<OPRM application> Two TRN modules are mounted on and electrically connected to OPRM unit which has safety-related functions. <Application 1> One TRN module receives OPRM Multiple Data (safety function) which are needed to calculate Neutron flux oscillation (safety function) in OPRM unit, from DAT/ST module mounted on OPRM unit, and transmits those to ELCS -FD via [a,c].	Safety Related (Having a safety function)

Part No.	Model No.	Safety Related Function	Functional Classification
		<Application 2> The other TRN module receives OPRM Record Data from DAT/ST module mounted on OPRM unit, and transmits those to TDR.	Safety Related (Having an effect on performance of the system safety function)

The TRN module is required to operate during and after the defined design basis events.

■ Seismic Sensitive Part/Assembly

□ Not Seismic Sensitive

□ Application Does Not Require Seismic Adequacy

The TRN module is attached to a parent system, and the seismic integrity of the TRN module is verified by qualification testing (Refer to Section 6.2.1).

3.1 Functional Classification

The functional mode and functional classification were evaluated and identified as follows.

a. Functional Mode : □ Active Functional Mode

■ Passive Functional Mode

b. Functional Classification : ■ Safety-Related (SR)

□ Non-Safety-Related (NSR)

□ Augmented Quality (AQ)

4. Critical Characteristics for Design

Table 4-1 shows the Critical Characteristics for Design (CCD) and technical evaluations. Table 4-2-1 and Table 4-2-2 show the result of Failure Mode and Effect Analysis (FMEA). This evaluation is performed base on technical requirements for the TRN modules of OPRM application.

Nuclear Instrumentation Systems Development & Designing Group (NISD) evaluated following supplier's module design:

Manufacturer's Model Number : HNS0531A10000 (Commercial use)

Module Design Specification : 5G8HA760 Rev.5 (Reference (2))

This module was developed under the ISO-9001 Quality Assurance (QA) process but not verified with the Independent Verification and Validation (IV&V) process under the Nuclear Instrumentation and Control Systems Department (NICSD) Appendix-B QA program. For dedication of this module, NICSD requires PPDD to apply additional QA and documentation requirements specified in Purchase Specification (Reference (1)). By applying additional requirements based on the Purchase Specification (Reference (1)), manufacturer's model number is changed to the following to distinguish the commercial use and US safety-related use. NISD also evaluated following supplier's module design:

Manufacturer's Model Number : P001: HNS0531B00000 (US safety-related use)

Module Design Specification : P001: 5G8HC108 Rev.3 (Reference (7))

The TRN module (P001) was developed under the ISO-9001 Quality Assurance (QA) process, and this module was verified with the Independent Verification and Validation (IV&V) process under the Nuclear Instrumentation and Control Systems Department (NICSD) Appendix-B QA program as a commercial grade item. The TRN module (P002) has the function of the TRN module (P001) with CRC function to add the 32bits CRC data to the

end of the multiplexed data. Through technical evaluation NISD has classified the CRC function of the TRN module (P002) as a function of performance characteristics (data transmission function), which is a CCD. During the technical evaluation it was confirmed that the scope of design change to add the CRC function would only cover the change of FPGA logics for respective processes; no change would be made to hardware of the module at all. As the result of this technical evaluation NISD concluded that CCA of the TRN module (P002) would have the same result as that of the TRN module (P001). For dedication of the TRN module (P002), NICSD requires PPDD to apply QA and documentation requirements specified in the Purchase Specification (Reference (1)) which are equivalent to the QA and documentation requirements applied to the TRN module (P001). By design change from the TRN module (P001), manufacturer's model number was newly assigned to distinguish from the TRN module (P002) from the TRN module (P001). NISD also evaluated following supplier's module design:

Manufacturer's Model Number : P002: HNS0531B00001 (US safety-related use)

Module Design Specification : P002: 5G8HC108 Rev.3 (Reference (7))

Table 4-1 CCD and Technical Evaluation

Part No.	No	CCD	Manufacturer's specification	Technical Evaluation
P001	1	Physical Characteristics -Dimension Section 6 of purchase specification*1 (30.1 W × 128.4 H × 172.4D mm) Permissible deviations for dimensions are specified in receiving inspection specification (Reference (5)). -Mass Section 6 of purchase specification*1 (300g or less)	Dimension is specified in Section 4.1.1 of MDS*2 (30.1 W × 128.4 H × 172.4D mm) Mass is specified in Section 4.1.2 of MDS*2 (300g or less)	Manufacturer's item meets the purchaser requirement. This characteristic does not directly contribute to safety function. However, this characteristic related to item compatibility, form or fit is important when considering replacement and Counterfeit and Fraudulent Items (CFI) issues. Mass is a factor which may affect seismic capability of parent component.
	2	Physical Characteristics -General configuration and shape Module configuration and shape is described in Section 6 of purchase specification*1	Module configuration is described in Section 4.1 of MDS*2	Manufacturer's item meets the purchaser requirement. This characteristic does not directly contribute to safety function. However, this characteristic related to item compatibility, form or fit is important when considering replacement and CFI issues. These characteristics contribute to Equipment Qualification (EQ) and EMC capability.
	3	Performance Characteristics -Data transmission function Sections 5.2.5-1, and -2 of Unit DDS*3 specifies data transmission functions.	Data transmission function is specified in Sections 5.1, 5.2, and 6.1 of MDS*2	Manufacturer's item meets the purchaser requirement. This characteristic contributes to safety function of parent component.
	4	Performance Characteristics -Fault Management and Diagnostics Sections 9 of Unit DDS*3 specifies function of FPGA operation monitor (Watch Dog Timer (WDT)). Section 8 of Unit DDS*3 specifies initializing processes.	WDT function is specified in Section 6.2.1 of MDS*2. Power on reset function is specified in Section 9 of MDS*2.	Manufacturer's item meets the purchaser requirement. This characteristic does not directly contribute to safety function. However, the failure of fault management and diagnostic function may lead to failure to detect malfunctions of item's safety functions.
	5	Dependability	-	FPGA modules that include FPGA logic need special attention when indentifying CCDs. Dependability becomes significantly more important when dedicating digital equipment. If there is a problem in the FPGA logic that degrades the dependability of a FPGA-based module, it reflects a design error that was built into the FPGA-based module, or a mismatch between the functional requirements and the FPGA-based module design. The

Part No.	No	CCD	Manufacturer's specification	Technical Evaluation
				"Dependability" is a CCD of FPGA-based module.
P002	1	Physical Characteristics -Dimension Section 6 of purchase specification*1 (30.1 W × 128.4 H × 172.4D mm) Permissible deviations for dimensions are specified in receiving inspection specification (Reference (5)). -Mass Section 6 of purchase specification*1 (300g or less)	Dimension is specified in Section 4.1.1 of MDS*2 (30.1 W × 128.4 H × 172.4D mm) Mass is specified in Section 4.1.2 of MDS*2 (300g or less)	Manufacturer's item meets the purchaser requirement. This characteristic does not directly contribute to safety function. However, this characteristic related to item compatibility, form or fit is important when considering replacement and Counterfeit and Fraudulent Items (CFI) issues. Mass is a factor which may affect seismic capability of parent component.
	2	Physical Characteristics -General configuration and shape Module configuration and shape is described in Section 6 of purchase specification*1	Module configuration is described in Section 4.1 of MDS*2	Manufacturer's item meets the purchaser requirement. This characteristic does not directly contribute to safety function. However, this characteristic related to item compatibility, form or fit is important when considering replacement and CFI issues. These characteristics contribute to Equipment Qualification (EQ) and EMC capability.
	3	Performance Characteristics -Data transmission function Sections 5.2.5-1, and -2 of Unit DDS*3 specifies data transmission functions.	Data transmission function is specified in Sections 5.1, 5.2, and 6.1 of MDS*2	Manufacturer's item meets the purchaser requirement. This characteristic contributes to safety function of parent component.
	4	Performance Characteristics -Fault Management and Diagnostics Sections 9 of Unit DDS*3 specifies function of FPGA operation monitor (Watch Dog Timer (WDT)). Section 8 of Unit DDS*3 specifies initializing processes.	WDT function is specified in Section 6.2.1 of MDS*2. Power on reset function is specified in Section 9 of MDS*2.	Manufacturer's item meets the purchaser requirement. This characteristic does not directly contribute to safety function. However, the failure of fault management and diagnostic function may lead to failure to detect malfunctions of item's safety functions.
	5	Dependability	-	FPGA modules that include FPGA logic need special attention when indentifying CCDs. Dependability becomes significantly more important when dedicating digital equipment. If there is a problem in the FPGA logic that degrades the dependability of a FPGA-based module, it reflects a design error that was built into the FPGA-based module, or a mismatch between the functional requirements and the FPGA-based module design. The "Dependability" is a CCD of FPGA-based module.

*1 Purchase Specification, 5Q8K0016 Rev.5 (Reference (1))

*2 MDS: Module Design Specification, 5G8HC108 Rev.3 (Reference (7))

*3 Unit DDS: Unit Detailed Design Specification, 5B8K0041 Rev.3 (Reference (3))

Table 4-2-1 Failure Mode and Effect Analysis (P001)

No	Function	Failure Mode	Failure Mechanism	Effect on System	Method of Detection	Effect on Plant Operation	Remarks
1	Power on reset function	Fail on during module operating	Device failure	All FPGAs in the TRN module will halt.	This failure can be detected by LEDs on the TRN module. The interface of the [redacted]a,c detects "Input timeout," "Parity error" and "Unit type and ID error."	The display in main control room indicates 'NMS' alarm.	*1
					This failure can be detected by LEDs on the TRN module. The interface of the TDR&SOE detects "Input timeout," "Parity error" and "Unit type and ID error."	The display of TDR indicates these errors.	*2
		Fail off when initializing	Device failure	All FPGAs in the module will not restart (initialize) once it shuts down.	This failure will be detected with a surveillance test during periodic inspection.	None	
2	DC/DC converter (+2.5V power supply to FPGA)	Fail low	Circuit failure	All FPGAs in the TRN module will halt.	This failure can be detected by LEDs on the TRN module. The interface of the [redacted]a,c detects "Input timeout," "Parity error" and "Unit type and ID error."	The display in main control room indicates 'NMS' alarm.	*1
					This failure can be detected by LEDs on the TRN module. The interface of the TDR&SOE detects "Input timeout," "Parity error" and "Unit type and ID error."	The display of TDR indicates these errors.	*2
		Fail high	Circuit failure	This failure may cause damage to FPGA device.	The interface of the [redacted]a,c detects "Input timeout," "Parity error" and "Unit type and ID error."	The display in main control room indicates 'NMS' alarm.	*1
					The interface of the TDR&SOE detects "Input timeout," "Parity error" and "Unit type and ID error."	The display of TDR indicates these errors.	*2
3	Input data receiving and processing function (From DAT/ST module)	Incorrect data input	Circuit failure Contact failure of middle-plane connector	None	The interface of the [redacted]a,c detects "Input timeout," "Parity error" and "Unit type and ID error."	The display in main control room indicates 'NMS' alarm.	*1
					The interface of the TDR&SOE detects "Input timeout," "Parity error" and "Unit type and ID error."	The display of TDR indicates these errors.	*2
		Incorrect data output	Circuit failure FPGA([redacted]a,c) failure	None	The interface of the [redacted]a,c detects "Input timeout," "Parity error" and "Unit type and ID error."	The display in main control room indicates 'NMS' alarm.	*1
					The interface of the TDR&SOE detects "Input timeout," "Parity error" and "Unit type and ID error."	The display of TDR indicates these errors.	*2
4	Optical output data transmission function (Output to external systems)	Incorrect data output	FPGA([redacted]a,c) failure Contact failure between main and sub PCB Contact failure of optical connector Device failure	None	The interface of the [redacted]a,c detects "Input timeout," "Parity error" and "Unit type and ID error."	The display in main control room indicates 'NMS' alarm.	*1
					The interface of the TDR&SOE detects "Input timeout," "Parity error" and "Unit type and ID error."	The display of TDR indicates these errors.	*2
5	HMI -Front Panel display LED	Fail Off	Device failure Circuit failure	None	This failure will be detected with a surveillance test during periodic inspection.	None	
		Fail On	Device failure Circuit failure	None	This failure will be detected with a surveillance test during periodic inspection.	None	

*1 Application 1 of OPRM unit (Refer to Table 3)
*2 Application 2 of OPRM unit (Refer to Table 3)

Table 4-2-2 Failure Mode and Effect Analysis (P002)

No	Function	Failure Mode	Failure Mechanism	Effect on System	Method of Detection	Effect on Plant Operation	Remarks
1	Power on reset function	Fail on during module operating	Device failure	All FPGAs in the TRN module will halt.	This failure can be detected by LEDs on the TRN module. The interface of the [a,c] detects "Input timeout," "CRC error," "Parity error" and "Unit type and ID error."	The display in main control room indicates 'NMS' alarm.	*1
					This failure can be detected by LEDs on the TRN module. The interface of the TDR&SOE detects "Input timeout," "CRC error," "Parity error" and "Unit type and ID error."	The display of TDR indicates these errors.	*2
		Fail off when initializing	Device failure	All FPGAs in the module will not restart (initialize) once it shuts down.	This failure will be detected with a surveillance test during periodic inspection.	None	
2	DC/DC converter (+2.5V power supply to FPGA)	Fail low	Circuit failure	All FPGAs in the TRN module will halt.	This failure can be detected by LEDs on the TRN module. The interface of the [a,c] detects "Input timeout," "CRC error," "Parity error" and "Unit type and ID error."	The display in main control room indicates 'NMS' alarm.	*1
					This failure can be detected by LEDs on the TRN module. The interface of the TDR&SOE detects "Input timeout," "CRC error," "Parity error" and "Unit type and ID error."	The display of TDR indicates these errors.	*2
		Fail high	Circuit failure	This failure may cause damage to FPGA device.	The interface of the [a,c] detects "Input timeout," "CRC error," "Parity error" and "Unit type and ID error."	The display in main control room indicates 'NMS' alarm.	*1
					The interface of the TDR&SOE detects "Input timeout," "CRC error," "Parity error" and "Unit type and ID error."	The display of TDR indicates these errors.	*2
3	Input data receiving and processing function (From DAT/ST module)	Incorrect data input	Circuit failure Contact failure of middle-plane connector	None	The interface of the [a,c] detects "Input timeout," "CRC error," "Parity error" and "Unit type and ID error."	The display in main control room indicates 'NMS' alarm.	*1
					The interface of the TDR&SOE detects "Input timeout," "CRC error," "Parity error" and "Unit type and ID error."	The display of TDR indicates these errors.	*2
		Incorrect data output	Circuit failure FPGA [a,c] failure	None	The interface of the [a,c] detects "Input timeout," "CRC error," "Parity error" and "Unit type and ID error."	The display in main control room indicates 'NMS' alarm.	*1
					The interface of the TDR&SOE detects "Input timeout," "CRC error," "Parity error" and "Unit type and ID error."	The display of TDR indicates these errors.	*2
4	Optical output data transmission function (Output to external systems)	Incorrect data output	FPGA [a,c] failure Contact failure between main and sub PCB Contact failure of optical connector Device failure	None	The interface of the [a,c] detects "Input timeout," "CRC error," "Parity error" and "Unit type and ID error."	The display in main control room indicates 'NMS' alarm.	*1
					The interface of the TDR&SOE detects "Input timeout," "CRC error," "Parity error" and "Unit type and ID error."	The display of TDR indicates these errors.	*2
5	HMI -Front Panel display LED	Fail Off	Device failure Circuit failure	None	This failure will be detected with a surveillance test during periodic inspection.	None	
		Fail On	Device failure Circuit failure	None	This failure will be detected with a surveillance test during periodic inspection.	None	

*1 Application 1 of OPRM unit (Refer to Table 3)
*2 Application 2 of OPRM unit (Refer to Table 3)

5. Critical Characteristics for Acceptance, Verification Methods and Responsibilities

5.1 Verification of Physical and Performance Characteristics Depending on Supplier Testing

The physical characteristics and performance characteristics are able to be measured as CCAs by the supplier testing and Nuclear Instrumentation and Control Systems Department (NICSD) intends to receive Certificate of Conformance (C of C) and the supplier's test record during the receiving inspection, the following supplier's process to control CC shall be verified as CCAs, as a minimum, through Commercial Grade (CG) survey of PPDD and receiving inspection.

- Design Control (Document Control)
- Inspection and Test Control
- Measuring and Test Equipment Control

To supplement verification of the general configuration and shape, supplier's control capability regarding "Configuration Control and Traceability of Hardware" shall be verified through CG Survey of PPDD, evaluation of sub-suppliers, and receiving inspection. Refer to Table 5-1.

5.2 Verification of "Dependability" of Module

To verify the dependability of modules, the following CCAs related to supplier's control capability of CC shall be verified through CG survey of PPDD, evaluation of sub-suppliers, receiving inspection, oversight of design review meeting, review of supplier documents, oversight of supplier testing, and witness of FPGA implementation.

- Built-in Quality
- Configuration Control and Traceability of Software and Hardware

Refer to Table 5-1.

Table 5-1 CCA and Verification Method (Common to P001 and P002)

Item No	Critical Characteristics for Acceptance	Verification Method for Qualification	Responsibility	Verification Method for Production	Responsibility
1	Physical Characteristics -Dimension -Mass -General Configuration and Shape	-	-	Receiving Inspection (Receiving C of C and supplier's test record, Section 6.1.1)	NICS-QC
2	Performance Characteristics -Data Transmission Function -Fault Management and Diagnostics	-	-	Receiving Inspection (Receiving C of C and supplier's test record, Section 6.1.1)	NICS-QC
3	Design Control (Document Control)	CG Survey of PPDD (Section 6.2.2)	NICS-QA	Receiving Inspection (Receiving C of C, Section 6.1.1)	NICS-QC
4	Inspection and Test Control	CG Survey of PPDD (Section 6.2.2)	NICS-QA	Receiving Inspection (Receiving C of C, Section 6.1.1)	NICS-QC
5	Measuring and Test Equipment Control	CG Survey of PPDD (Section 6.2.2)	NICS-QA	Receiving Inspection (Receiving C of C, Section 6.1.1)	NICS-QC
6	Build in Quality	CG Survey of PPDD (Section 6.2.2)	NICS-QA	Oversight of design review meeting (Section 6.1.2)	NICS-QC
				Review of supplier documents (Section 6.1.3)	NICSD IV&V Team
				Oversight of supplier testing (Section 6.1.4)	NICSD IV&V Team

Item No	Critical Characteristics for Acceptance	Verification Method for Qualification	Responsibility	Verification Method for Production	Responsibility
7	Configuration Control and Traceability of Software and Hardware	CG Survey of PPDD, Evaluation of sub-suppliers (Section 6.2.2)	NICS-QA	Witness of FPGA implementation (Section 6.1.5)	NICS-QC

NICSD Nuclear Instrumentation and Control Systems Department
NICS-QA Quality Assurance Group for Nuclear Instrumentation & Control Systems
NICS-QC Quality Control Group for Nuclear Instrumentation & Control Systems
IV&V Independent Verification and Validation

6. Verification Instruction

6.1 Recurring Activities

6.1.1 Receiving Inspection

Receiving inspectors or QC inspectors from NICS-QC shall implement the receiving inspection in accordance with the "Receiving Inspection Procedure (Section 9-(1))" and the "Standard Receiving Inspection Specification (Section 9-(2))." The verification results are recorded in the form of "Receiving Inspection Check List/Report (Section 7-(1))."

6.1.2 Oversight of Design Review Meeting

NICSD shall perform oversight of Design Review (DR) meetings conducted by PPDD in accordance with Section 9.1.1 of the Commercial Dedication Instruction (Reference (6)).

6.1.3 Review of Supplier Documents

NICSD shall perform review of supplier documents in accordance with Section 9.1.2 of the Commercial Dedication Instruction (Reference (6)).

6.1.4 Oversight of Supplier Testing

NICSD shall perform oversight on FPGA Testing and Module Validation Testing conducted by PPDD supplier documents in accordance with Section 9.1.3 of the Commercial Dedication Instruction (Reference (6)).

6.1.5 Witness of FPGA Implementation

NICSD shall perform witness of the FPGA implementation work by TDMS in accordance with Section 9.1.4 of the Commercial Dedication Instruction (Reference (6)).

6.2 Periodic Activities

6.2.1 Environmental Conditions Qualification

Equipment qualification testing and EMC qualification testing are performed in a type test using test specimen. Successful completion and continued application of qualification testing verifies that the item is capable of performing its intended safety function. Any time a design change is made to the item or item is used in another application, impact on all previous qualification programs shall be evaluated to determine if re-qualification is required.

The responsible design engineers from NISD shall identify a test report in Section 7 of this Commercial Dedication Instruction (CDI) after qualification test, which shows successful compliance with qualification test requirements. If any changes are made to a configuration as the result of qualification test, the responsible design engineers shall identify a baseline after change in the CDI. The responsible design engineers evaluates any changes to an item that are made after baseline establishment, determines the need for an additional qualification test, and documents the evaluation result in the CDI. In order to continuously purchase items with same configuration, the "Configuration Control and Traceability of Hardware" of supplier shall be verified through CG Surveys as described in Section 6.2.2.

6.2.2 Vendor Evaluation

NICSD shall perform CG Survey of PPDD and evaluation of sub-suppliers in accordance with Section 9.2 of the Commercial Dedication Instruction (Reference (6)).

7. Acceptance Documentation

(1) Receiving Inspection Check List/Report (Attachment to NQ-3024 (Reference (4))
(2) Certificate of Conformance (Attachment to Reference (1))
(3) Test record by supplier (As per supplier's form)
(4) Nuclear Instrumentation & Control Systems Department
Environmental Qualification Report for Safety-Related Oscillation Power Range Monitor (OPRM)
FC51-7513-1000 Rev.0 (5B8K0077 Rev.0)
(5) Nuclear Instrumentation & Control Systems Department
Dynamic Qualification Report for Safety-Related Oscillation Power Range Monitor (OPRM)
FC51-7513-1003 Rev.0 (5B8K0094 Rev.0)
(6) Nuclear Instrumentation & Control Systems Department
EMC Qualification Report for Safety-Related Oscillation Power Range Monitor (OPRM)
FC51-7513-1001 Rev.0 (5B8K0078 Rev.0)

8. References

(1) PURCHASE SPECIFICATON for in-house (5Q8K0016 Rev.5)
(2) TRN MODULE HNS530/HNS0531 Equipment Design Specification (5G8HA760 Rev.5) *1
(3) OPRM Unit Detailed Design Specification for Power Range Neutron Monitor (5B8K0041 Rev.3)
(4) Receiving Inspection Procedure, NQ-3024
(5) Standard Receiving Inspection Specification for Modules from Power Platform Development Department (5T8K0001 Rev.1)
(6) Commercial Dedication Instruction for Dedication of Modules from Commercial Supplier (Common Requirements) (9B8K0057 Rev.1)
(7) TRN Module HNS0531 Series Module Design Specification (5G8HC108 Rev.3)

*1 TRN MODULE HNS530/HNS0531 Equipment Design Specification listed in the baseline document (5B8H7200 Rev.11) is revision 4. This document has been revised to revision 5 due to correction of character corruptions in figure 1.1 without any engineering changes. Thus the revision 5 of this document is referred in this CDI.

9. Inspection and Test Procedure

(1) Receiving Inspection Procedure (Reference (4))

(2) Standard Receiving Inspection Specification (Reference (5))

10. Supplements

N/A

変 更 記 録 REVISIONS						
変更記号 REV. MARK 変更発行日 REV. ISSUED	ページ PAGE	変更箇所・変更内容 CHANGED PLACE AND CONTENTS	承認 APPROVED BY	調査 REVIEWED BY	担当 PREPARED BY	保管 REGISTERED
① Jul.17, 2012	3, 7, 8, 12	For detailed changed contents and impact evaluation, refer to DECN-9B8K0054-01 Rev.0.	K. Wakita Jul. 17, 2012	T. Tarumi Jul. 17, 2012	T. Furusawa Jul. 17, 2012	H. Ito Jul. 17, 2012
② Aug.22, 2012	-	For detailed changed contents and impact evaluation, refer to DECN-9B8K0054-02 Rev.0.	K. Wakita Aug.22, 2012	T. Tarumi Aug.22, 2012	T. Furusawa Aug.20, 2012	H. Ito Aug.22,2012
③ Dec.27, 2012	-	For detailed changed contents and impact evaluation, refer to DECN-9B8K0054-03 Rev.1.	K. Wakita Dec.27, 2012	T. Tarumi Dec.26, 2012	H. Ito Dec.25,2012	H. Ito Dec.27,2012
④ Feb.18, 2013	-	For detailed changed contents and impact evaluation, refer to DECN-9B8K0054-04 Rev.0.	K. Wakita Feb.18, 2013	T. Furusawa Feb.14, 2013	H. Ito Feb.14, 2013	H. Ito Feb.18, 2013
⑤ Jan.16.2014	-	For detailed changed contents and impact evaluation, refer to DECN-9B8K0054-05 Rev.0.	K. Wakita Jan 16.2014	T. Tarumi Jan.16.2014	T. Furusawa Jan.16, 2014	H. Ito Jan.16.2014