RADIO TEST REPORT

Test Report No.: 30JE0035-SH-C-R2

Applicant	:	**Yokogawa Electric Corporation**
Type of Equipment	:	**VN210 Module**
Model No.	:	**VN210**
FCC ID	:	**SGJ-WFC001**
Test regulation	:	**FCC Part15 Subpart C: 2010**
Test result	:	**Complied**

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6. The opinions and the interpretations to the result of the description in this report are outside scopes where UL Japan has been accredited.
7. This report is a revised version of 30JE0035-SH-C-R1. 30JE0035-SH-C-R1 is replaced with this report.

Date of test: April 8 to June 7, 2010

Tested by:

Akio Hayashi
Engineer of EMC Services

Kenichi Adachi
Engineer of EMC Services

Approved by :

Ichiro Isozaki
Leader of Shonan EMC Lab.

☐ The testing in which "Non-accreditation" is displayed is outside the accreditation scopes in UL Japan.
☒ There is no testing item of "Non-accreditation".

JAB Testing RTL02610

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SECTION 1: Customer information

Company Name	:	Yokogawa Electric Corporation
Address	:	2-9-32 Nakacho Musashino-shi Tokyo, 180-8750 Japan
Telephone Number	:	+81-422-52-5558
Facsimile Number	:	+81-422-55-3536
Contact Person	:	Hirofumi Suda

SECTION 2: Equipment under test (E.U.T.)

2.1 Identification of E.U.T.

Type of Equipment	:	VN210 Module
Model Number	:	VN210
Serial Number	:	0022-FF00-0002-046E (for conducted emission tests), 0022-FF00-0002-0264 (for antenna terminal tests), 0022-FF00-0002-049B (for radiated emission tests (transmitting mode) only), 0022-FF00-0002-021E (for radiated emission tests (receiving mode) only)
Rating	:	DC 3.3V
Condition of EUT	:	Production model
Country of Mass-production	:	USA
Receipt Date of Sample	:	April 5, 2010 (for conducted emission tests) May 12, 2010 (for antenna terminal tests) June 7, 2010 (for radiated emission tests)
Modification of EUT	:	The test lab did not make the modification to the EUT supplied from the customer to have it pass the tests.

2.2 Product description

Model: VN210 (referred to as the EUT in this report) is a VN210 Module.

The clock frequency used in EUT:
Timer Clock: 32.768kHz, RF Clock: 24MHz

<Radio part>

Equipment type	:	Transceiver
Frequency of operation	:	2405MHz to 2475MHz
Radio part clock frequency	:	24MHz
Bandwidth / Channel spacing	:	2.65MHz / 5MHz
Type of modulation	:	ISA100.11a (O-QPSK)
Antenna type	:	sleeve antenna
Antenna connector type	:	MMCX type
Antenna gain	:	2.14 dBi (for built into EJX series and YTA series) , 2.00 dBi (for built into YFGW series)
ITU code	:	G1D
Operating Voltage	:	DC 3.3V
Operation temperature range	:	-40 ~ +85 deg.C.

FCC 15.31 (e)/212
The RF Module do not have voltage regulator. However, this application limited the host equipment, and EUT's voltage is supplied from voltage regulator of the limited host. Therefore, the test voltage was only the voltage of EUT specification. Therefore, this EUT complies with the requirement.

FCC Part 15.203/212
The EUT has a unique coupling/antenna connector (MMCX).
And the installation and replacement of antenna are done by professionals as directed in the user's manual.
Therefore the equipment complies with the requirement of 15.203 and 15.212.

SECTION 3: Test specification, procedures & results

3.1 Test specification

Test specification : FCC Part 15 Subpart C: 2010, final revised on January 22, 2010 and effective March 1, 2010

Title : FCC 47CFR Part15 Radio Frequency Device Subpart C Intentional Radiators
Section 15.207 Conducted limits
Section 15.209 Radiated emission limits, general requirements
Section 15.247 Operation within the bands 902-928MHz, 2400-2483.5MHz, and 5725-5850MHz

3.2 Procedures & Results

Item	Test Procedure	Specification	Remarks	Deviation	Worst Margin	Results
Conducted Emission	ANSI C63.4:2003 7. AC powerline conducted emission measurements	FCC 15.207	-	N/A	<YFGW series> [AV] **6.5dB** (23.12970MHz, N) [QP] **10.3dB** (0.56304MHz, N, 0.57080MHz, L)	Complied
6dB Bandwidth	ANSI C63.4:2003 13. Measurement of intentional radiators	FCC 15.247 (a)(2) & 15.209	Conducted	N/A	-	Complied
Maximum Peak Output Power	ANSI C63.4:2003 13. Measurement of intentional radiators	FCC 15.247 (b)(3) & 15.209	Conducted	N/A		Complied
Out of Band Emission & Restricted Band Edges	ANSI C63.4:2003 13. Measurement of intentional radiators	FCC 15.109, 15.247 (d) & 15.209	Conducted / Radiated	N/A	<2.14dBi antenna> Tx: **5.4dB** (7215.000MHz, Horizontal, PK) Rx: **21.9dB** (887.985 MHz, Horizontal/Vertical, QP)	Complied
Power Density	ANSI C63.4:2003 13. Measurement of intentional radiators	FCC 15.247 (e) & 15.209	Conducted	N/A	-	Complied

Note: UL Japan's EMI Work Procedures No.QPM05 and QPM15.
These tests were also referred to "Guidance on Measurement for Digital Transmission Systems Section15.247".

3.3 Addition to standard

Item	Test Procedure	Specification	Remarks	Worst Margin	Results
Occupied Bandwidth (99%)	ANSI C63.4:2003 13. Measurement of intentional radiators, RSS-Gen 4.6.1	RSS-Gen 4.6.1	Conducted	-	Complied

* Other than above, no addition, exclusion nor deviation has been made from the standard.

3.4 Uncertainty

The following uncertainties have been calculated to provide a confidence level of 95% using a coverage factor k=2.

Item	Frequency range	No.1 SAC*1/SR*2 (±)	No.2 SAC/SR (±)	No.3 SAC/SR (±)
Conducted emission (AC Mains) AMN/LISN	9kHz-150kHz	3.7 dB	3.1 dB	3.5 dB
	150kHz-30MHz	3.0 dB	2.6 dB	3.1 dB
Radiated emission (Measurement distance: 3m)	9kHz-30MHz	3.4 dB	2.7 dB	3.4 dB
	30MHz-300MHz	4.6 dB	4.5 dB	4.9 dB
	300MHz-1GHz	4.5 dB	4.6 dB	5.1 dB
	1GHz-13GHz	3.9 dB	3.9 dB	4.0 dB
Radiated emission (Measurement distance: 1m)	13GHz-18GHz	4.8 dB	4.8 dB	4.8 dB
	18GHz-40GHz	4.2 dB	4.2 dB	4.2 dB

*1: SAC=Semi-Anechoic Chamber
*2: SR= Shielded Room is applied besides radiated emission

Conducted emission test

The data listed in this test report has enough margin, more than site margin.

Radiated emission test

The data listed in this test report has enough margin, more than site margin.

Power Measurement uncertainty above 1GHz for this test was: (±) 0.8dB

Conducted emissions Measurement (below 1GHz) uncertainty for this test was: (±) 1.1dB
Conducted emissions, Power Density Measurement (1G-3GHz) uncertainty for this test was: (±) 1.2dB
Conducted emissions Measurement (3G-18GHz) uncertainty for this test was: (±) 2.9dB
Conducted emissions Measurement (18G-26.5GHz) uncertainty for this test was: (±) 3.4dB

Frequency Measurement uncertainty for this test was: (±) 2.1%

Bandwidth Measurement uncertainty for this test was: (±) 5.4%

3.5 Test location

UL Japan, Inc. Shonan EMC Lab.
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Telephone number : +81 463 50 6400
Facsimile number : +81 463 50 6401
JAB Accreditation No. : RTL02610

No.1/ No.2/ No.3 anechoic chamber has been fully described in a report submitted to FCC office, and accepted on April 17, 2009 (Registration No.: 697847).
IC Registration No. : 2973D-1 (No1 Semi-Anechoic Chamber)
2973D-2 (No2 Semi-Anechoic Chamber)
2973D-3 (No3 Semi-Anechoic Chamber)

Test room	Width x Depth x Height (m)	Test room	Width x Depth x Height (m)
No.1 Semi-Anechoic Chamber	20.6 x 11.3 x 7.65 Maximum measurement distance: 10m	No.1 Shielded room	6.8 x 4.1 x 2.7
No.2 Semi-Anechoic Chamber	20.6 x 11.3 x 7.65 Maximum measurement distance: 10m	No.2 Shielded room	6.8 x 4.1 x 2.7
No.3 Semi-Anechoic Chamber	12.7 x 7.7 x 5.35 Maximum measurement distance: 5m	No.3 Shielded room	6.3 x 4.7 x 2.7
No.4 Semi-Anechoic Chamber	8.1 x 5.1 x 3.55	No.4 Shielded room	4.4 x 4.7 x 2.7
		No.5 Shielded room	7.8 x 6.4 x 2.7
		No.6 Shielded room	7.8 x 6.4 x 2.7

3.6 Test setup, Data of EMI & Test instruments

Refer to Appendix 1 to 3.

SECTION 4: Operation of E.U.T. during testing

4.1 Operating mode

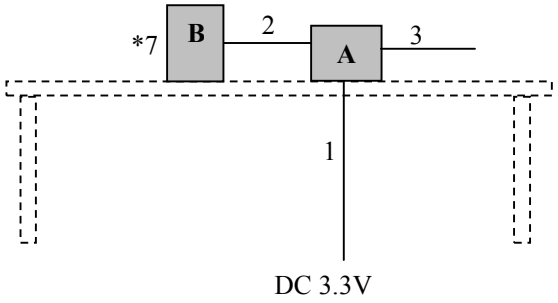
The EUT exercise program used during testing was designed to exercise the various system components in a manner similar to typical use.

Test sequence is used : Communication mode (for Conducted emission (Only built into YFGW series) only) *1
Transmitting (Tx) 2405MHz (with normal modulation, Continuous Transmittting)
Transmitting (Tx) 2440MHz (with normal modulation, Continuous Transmittting)
Transmitting (Tx) 2475MHz (with normal modulation, Continuous Transmittting)
Receiving (Rx) 2440MHz (Continuous Receiving)

*1. The Conducted emission test was previously tested at Communication mode, Transmitting mode and Receiving mode. The test result on Communication mode is selected on this report.
Other result of measurement was equal or less. (YFGW710-A1G-S00NA /AC3A was only selected for Conducted emission test because it seemed that the test result was equivalent.)

4.2 Configuration and peripherals

4.2.1 module + antenna setup for All tests



*2. Cabling and setup were taken into consideration and test data was taken under worse case conditions.
*7. Because a short stub that described at antenna specification was not influence the test result, it didn't use it. Also we selected the antenna that has larger gain.

Description of EUT and support equipment

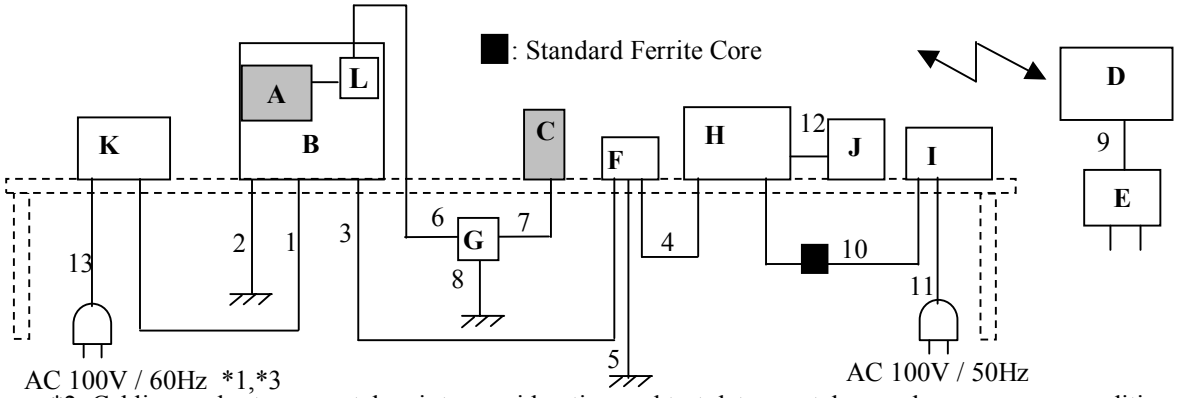
No.	Item	Model number	Serial number	Manufacturer	Remarks	FCC ID
A	VN210 Module	VN210	0022-FF00-0002-0264 *4 0022-FF00-0002-049B *5 0022-FF00-0002-021E *6	YOKOGAWA	EUT	SGJ-WFC001
B	Sleeve Antenna	ASSL-STP-00200	1	HOKO DENSHI	EUT	

*4 used for antenna terminal tests.
*5 used for radiated emission tests (transmitting mode).
*6 used for radiated emission tests (receiving mode).

List of cables used

No.	Name	Length (m)	Shield	
			Cable	Connector
1	DC cable	2.0	Unshielded	Unshielded
2	Antenna cable	0.1	Shielded	Shielded
3	Signal cable	0.1	Unshielded	Unshielded

4.2.2 Built into YFGW710-A1G-S00NA /AC3A for Conducted emission test



*2. Cabling and setup were taken into consideration and test data was taken under worse case conditions.
*3. Tested with AC100V from power supply, because DC power supply can use only with AC100V.

Description of EUT and support equipment

No.	Item	Model number	Serial number	Manufacturer	Remarks	FCC ID
A	VN210 Module	VN210	0022-FF00-0002-046E	YOKOGAWA	EUT	SGJ-WFC001
B	Field Wireless Integated Gateway	YFGW710-A1G-S00NA /AC3A	#3	YOKOGAWA	-	-
C	Antenna	AT1089	1	HOKO DENSHI	EUT	SGJ-WFC001
D	Field Wireless Sensor	VS210	#2	Nivis, LCC	-	SQB-NIVISMOD0003
E	AC adapter	92P1156	-	LENOVO	-	-
F	Arrester	A1299EZ	-	YOKOGAWA	-	-
G	Arrester	A1299EZ	-	YOKOGAWA	-	-
H	Personal Computer	TYPE 2764-RQ2	R8-FBAHC	LENOVO	-	-
I	AC adapter	42T4426	11S42T4426Z1ZF3F9B94VX	LENOVO	-	-
J	Mouse	M-M1URBK/RS	9A000948A	ELECOM	-	-
K	DC power supply	PAN35-10A	NA000955	Kikusui	-	-
L	Short Stub	-	-	-	-	-

List of cables used

No.	Name	Length (m)	Shield	
			Cable	Connector
1	DC cable	1.5	Unshielded	Unshielded
2	FG cable	2.0	Unshielded	Unshielded
3	Ethernet cable	3.0	Unshielded	Unshielded
4	Ethernet cable	40.0	Unshielded	Unshielded
5	FG cable	2.0	Unshielded	Unshielded
6	Antenna cable	3.0	Shielded	Shielded
7	Antenna cable	10.0	Shielded	Shielded
8	FG cable	3.0	Unshielded	Unshielded
9	DC cable	1.5	Unshielded	Unshielded
10	DC cable	1.0	Unshielded	Unshielded
11	AC cable	1.0	Unshielded	Unshielded
12	USB mouse cable	1.5	Shielded	Shielded
13	AC cable	2.0	Unshielded	Unshielded

SECTION 5: Conducted emission

5.1 Operating environment

The test was carried out in No.1 Shielded room.

Temperature : See test data (APPENDIX 2)
Humidity : See test data (APPENDIX 2)

5.2 Test configuration

EUT was placed on a platform of nominal size, 1m by 1.5m, raised 80cm above the conducting ground plane.
The table is made of Styrofoam and covered with polyvinyl chloride. That has very low permittivity.
The rear of tabletop was located 40cm to the vertical conducting plane. The rear of EUT, including peripherals was aligned and was flushed with rear of tabletop. All other surfaces of tabletop were at least 80cm from any other grounded conducting surface. EUT was located 80cm from LISN and excess AC cable was bundled in center. I/O cables that were connected to the peripherals were bundled in center. They were folded back and for the forming a bundle 30cm to 40cm long and were hanged at a 40cm height to the ground plane.
Each EUT current-carrying power lead, except the ground (safety) lead, was individually connected through a LISN to the input power source. All unused 50ohm connectors of the LISN were resistively terminated in 50ohm when not connected to the measuring equipment.
Photographs of the set up are shown in Appendix 1.

5.3 Test conditions

Frequency range : 0.15 - 30MHz
EUT position : Table top
EUT operation mode : Refer to Clause 4.1

5.4 Test procedure

The AC Mains Terminal Continuous disturbance Voltage had been measured with the EUT within a Shielded room.
The EUT was connected to a Line Impedance Stabilization Network (LISN).
An overview sweep with peak detection has been performed.
The measurements had been performed with a quasi-peak detector and if required, an average detector.
The conducted emission measurements were made with the following detection of the test receiver.

Detection Type : Quasi-Peak/ Average
IF Bandwidth : 9kHz

5.5 Results

Summary of the test results : Pass

Date : April 8, 2010 Tested by : Akio Hayashi

SECTION 6: Radiated emission

6.1 Operating environment

The test was carried out in No.3 Semi-Anechoic Chamber.

Temperature : See test data (APPENDIX 2)
Humidity : See test data (APPENDIX 2)

6.2 Test configuration

EUT was placed on a platform of nominal size, 1m by 2.0m, raised 80cm above the conducting ground plane.
The table is made of Styrofoam and covered with polyvinyl chloride. That has very low permittivity.
The rear of EUT, including its peripherals was aligned and flushed with rear of tabletop. I/O cables that were connected to the peripherals were bundled in center. They were folded back and for the forming a bundle 30cm to 40cm long and were hanged at a 40cm height to the ground plane.
Test was made with the antenna positioned in both the horizontal and vertical planes of polarization. The measurement antenna was varied in height above the conducting ground plane to obtain the maximum signal strength.
Photographs of the set up are shown in Appendix 1.

6.3 Test conditions

Frequency range : 30M - 26GHz
Test distance : 3m(below 13GHz) / 1m(above13GHz)
EUT position : Table top
EUT operation mode : Refer to Clause 4.1

6.4 Test procedure

The Radiated Electric Field Strength intensity has been measured on a semi-anechoic chamber with a ground plane and at a distance of 3m(below 13GHz) / 1m(above 13GHz) (Refer to Figure 1). Measurements were performed with quasi-peak, peak and average detector. The measuring antenna height was varied between 1 and 4m and EUT was rotated a full revolution in order to obtain the maximum value of the electric field intensity. The measurements were performed for both vertical and horizontal antenna polarization.
The radiated emission measurements were made with the following detection of the test receiver.

Frequency	:	30M-1GHz	1G-26GHz	
Detection Type	:	Quasi-Peak	Peak	Average
IF Bandwidth	:	120kHz	RBW:1MHz/VBW:3MHz	RBW:1MHz/VBW:3MHz - duty factor *

* We deemed the worst case was with duty 100%. So we performed the test with 100% duty. But we could not detect the worst duty cycle at the real operation (Refer the chart in APPENDIX 4). However, we applied the following values of the customer declaration were adopted as worst case.

duty factor = 20 x log (((worst on times = 4.096 [ms]) / (worst 1 slot times = 136.5333[ms]))^(-1)) =30.46dB

The equipment (module and antenna) was previously checked at each position of three axes X, Y and Z. The position in which the maximum noise occurred was chosen to put into measurement. See the photographs in appendix.

Combinations of the worst case

	Worst position	
	Below 1GHz	Above 1GHz
Antenna position axis	Horizontal: Y, Vertical: Y	Horizontal: Y, Vertical: Z
Module position axis	Horizontal: Y, Vertical: Z	Horizontal: Y, Vertical: Z

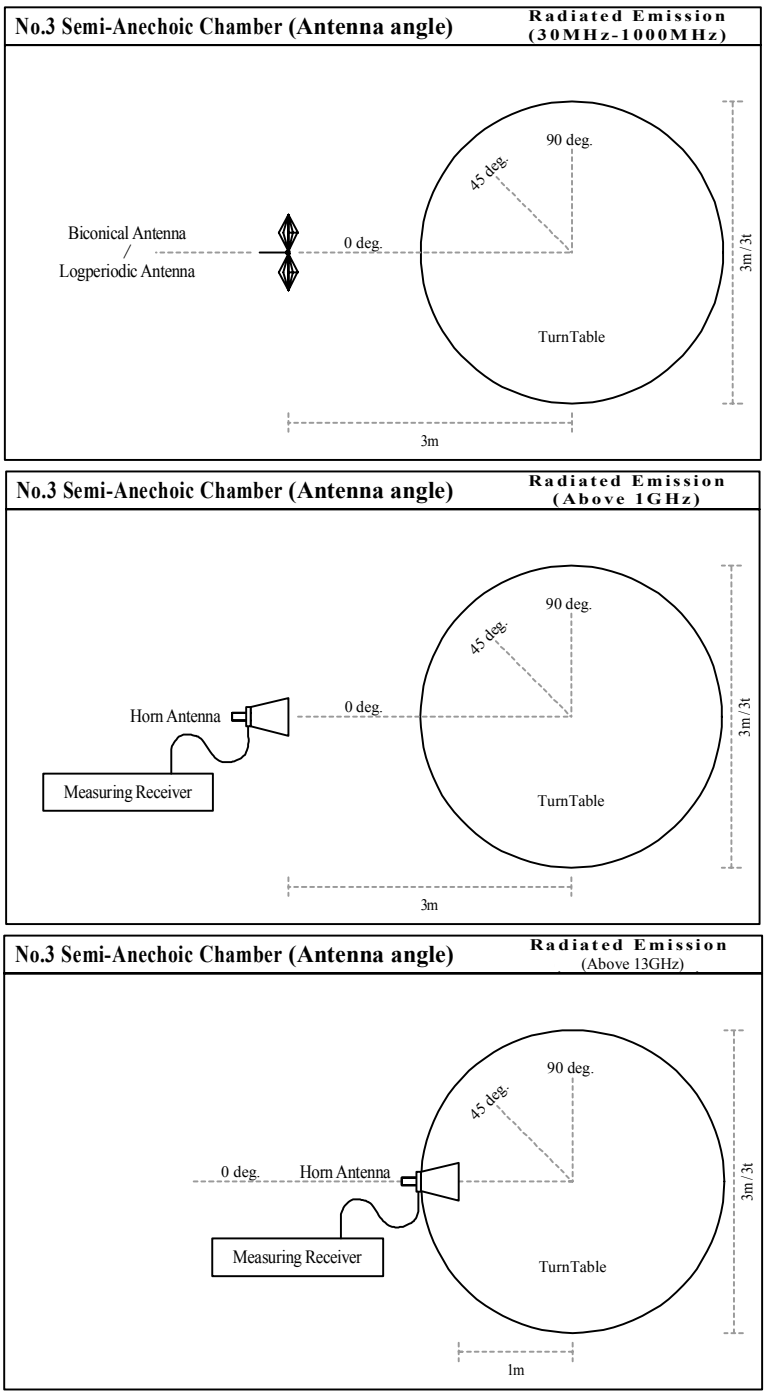


Figure 1. Antenna angle

6.5 Results

Summary of the test results : Pass

Date : June 7, 2010 Tested by : Kenichi Adachi

SECTION 7: Spurious emissions (Conducted)(include Band Edge compliance)

Test procedure
The Out of Band Emissions was measured with a spectrum analyzer connected to the antenna port.
In any 100kHz bandwidth outside the frequency band in which the spread spectrum intentional radiator is operating, the radio frequency power that is produced by the intentional radiator confirmed 20dB below that in the 100kHz bandwidth within the band that contains the highest level of the desired power, based on a radiated measurement.

Summary of the test results: Pass
Refer to APPENDIX 2

SECTION 8: 6dB bandwidth & 99% Occupied bandwidth

Test procedure
The bandwidth was measured with a spectrum analyzer connected to the antenna port.

Summary of the test results: Pass
Refer to APPENDIX 2

SECTION 9: Maximum peak output power

Test procedure
The Maximum Peak Output Power was measured with a peak power meter connected to the antenna port.

Summary of the test results: Pass
Refer to APPENDIX 2

SECTION 10: Peak power density

Test procedure
The peak power density was measured with a spectrum analyzer connected to the antenna port.

Summary of the test results: Pass
Refer to APPENDIX 2

Contents of appendixes

APPENDIX 1: Photographs of test setup

APPENDIX 2: Data of EMI test

APPENDIX 3: Test instruments

APPENDIX 4: Worst Duty Specification