Test Report

No E-13-I-193-FL

PRIME Certification Tests Cases for Service Nodes

EQUIPMENT UNDER TEST

MODEL:
SGM1112

MANUFACTURER:
General Electric

APPLICANT:
David Morera

DATE OF RECEPTION:
December 17th, 2013

PRIME PROTOCOL/ TEST CASE VERSION:
01.03.06.09i

DATE OF EXECUTION:
From 18 till 23 December 2013

DATE OF ISSUE OF REPORT
February 24th, 2014 Brussels,

Responsible of tests	Head of Laboratory	PRIME Alliance Secretary
		
Fernando Lobo	Elena Henríquez	Andrew Rosenstein

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1.- EQUIPMENT UNDER TEST IDENTIFICATION

Unit:	Single-phase meter
Model:	SGM1112
Trade Mark:	General Electric
Serial Number:	000011490
Manufacturer:	General Electric

The samples were selected and delivered by the applicant.

Equipment characteristics declared by the applicant:

Device type	Single-phase PRIME Meter
BaudRate	57600
MAC	C4:B5:12:20:41:09
Firmware version	01.03.06.09i
Applicable Optional tests	3.4.23
Recertification	No

2.- SUMMARY OF TEST RESULTS

The scope of this certification is MAC and Convergence layer test cases.

PHY LAYER		
2.2 PHY Test Cases: Functional Category		
2.2.1	Verify error free communication (0.2% FER) checking the complete frame payload when communicating directly over the LISN stated in the PRIME PHY Spec and output level 120 dBuV, PPDU length 256 bytes. D8PSK	NA
2.2.2	Verify error free communication (0.2% FER) checking the complete frame payload when communicating directly over the LISN stated in the PRIME PHY Spec and output level 120 dBuV,PPDU length 256 bytes. D8PSK+CC	NA
2.2.3	Verify error free communication (0.2% FER) checking the complete frame payload when communicating directly over the LISN stated in the PRIME PHY Spec and output level 120 dBuV, PPDU length 256 bytes. DBPSK	NA
2.2.4	Verify error free communication (0.2% FER) checking the complete frame payload when communicating directly over the LISN stated in the PRIME PHY Spec and output level 120dBuV, PPDU length 256 bytes. DBPSK+CC	NA
2.2.5	Verify error free communication (0.2% FER) checking the complete frame payload when communicating directly over the LISN stated in the PRIME PHY Spec and output level 120 dBuV, PPDU length 256 bytes. Modulation type: DQPSK	NA
2.2.6	Verify error free communication (0.2% FER) checking the complete frame payload when communicating directly over the LISN stated in the PRIME PHY Spec and output level 120 dBuV, PPDU length 256 bytes. QPSK+CC	NA
2.2.7	Verify error free communication (0.2% FER) checking the complete frame payload when communicating directly over the LISN stated in the PRIME PHY Spec (2Ohm) and output level 120 dBuV, PPDU length 256 bytes.DBPSK	NA
2.2.8	Verify error free communication (0.2% FER) checking the complete frame payload when communicating directly over the LISN stated in the PRIME PHY Spec (2Ohm) and output level 120 dBuV, PPDU length 256 bytes. D8PSK+CC	NA
2.2.9	Verify error free communication (0.2% FER) (checking the complete frame payload) when receiving input signal of 122 dBuV. (DUT is in reception state). Modulation type: D8PSK	NA
2.4 PHY Test Cases: Signal Quality category		
2.4.1	Verify that the EVM of the received signal at output level is above 17dB.	NA
2.4.2	Verify that the EVM of the transmitted signal output level is above 17dB.	NA
2.5 PHY Test Cases: Regulatory category		
2.5.1	PHY Test Cases: Regulatory category	PASS
MAC LAYER		
3.2 MAC Test Cases: Service Node Start-up		
3.2.1	Service node start-up (forcing the reception of beacons).	PASS
3.2.2	Service node start-up (No PNPDUs are transmit when DUT receives BPDUs).	PASS
3.2.3	Service node start-up (Tx rate of PNPDUs reduced by factor of received	PASS

	PNPDUs).	
3.2.4	Service node start-up (PNPDU generation latency and transmission parameters).	PASS
3.2.5	Service Node start-up (RANDOMness in the transmission of PNPDUs)	PASS
3.2.6	Service Node start-up (seeking promotion of DUT).	PASS
	3.3 MAC Test Cases: Channel Access	
3.3.1	Channel access- Shared Contention Period. Channel is idle	PASS
3.3.2	Channel access- Shared Contention Period. Channel is occupied.	PASS
3.3.3	Channel access- Contention Free Period.	PASS
3.3.4	Channel access-Adaptation to frame structure change (FRA)	PASS
	3.4 MAC Test Cases: Service Node MAC specific procedures	
3.4.1	Registration accepted (Base Node available when DUT powers up).	PASS
3.4.2	Registration accepted (Base Node not available when DUT powers up).	PASS
3.4.3	Registration accepted (DUT connected to a Switch node and the Switch node is connected to the Base Node).	PASS
3.4.4	Unregistering process initiated by a terminal node.	PASS
3.4.5	Unregistering process initiated by the Base node.	PASS
3.4.6	Promotion process initiated by the base node.	PASS
3.4.7	Promotion process initiated by the service node DUT.	PASS
3.4.8	Switching process: 2 levels of switching (DUT1 as a level 1 switch).	PASS
3.4.9	Switching process: 2 levels of switching (DUT as a level 2 switch).	PASS
3.4.10	Switching functions: BPDU transmisión	PASS
3.4.11	Switching functions: BPDU updates from FRA control packet	PASS
3.4.12	Promotion rejected by the base node.	PASS
3.4.13	Demotion process initiated by the base node.	PASS
3.4.14	Keep-Alive process (response from DUT).	PASS
3.4.15	Keep-Alive process (timeout and disconnect).	PASS
3.4.16	Keep-Alive process (changes in Keep Alive timeout).	PASS
3.4.17	Connection establishment initiated by the Base node.	PASS
3.4.18	Connection establishment initiated by the Service node.	PASS
3.4.19	Connection establishment rejected by the Base node.	PASS
3.4.20	Connection closing initiated by the Base node.	PASS
3.4.21	Connection closing initiated by the Service node.	PASS
3.4.22	File transfer process (unicast).	PASS
3.4.23	File transfer process (multicast).	PASS
3.4.24	Error in the firmware upgrade process.	PASS
	CONVERGENCE LAYER	
	4.2 CL Test Cases: 4-32 Connection establishment	
4.2.1	Correct establishment and disconnection of 4-32 link	PASS
	4.3 CL Test Cases: DLMS traffic over 4-32 connection	
4.3.1	CS4-32 is able to pass valid DLMS payload between the meter and the test system.	PASS

For more detailed information about the test results see Annex I

3.- APPLICANT

Name: David Morera

Company Name: General Electric

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4.- PLACE OF RECEPTION AND EXECUTION OF THE TESTS

Laboratory Name: DNV GL

Address: C. Almansa 105, Planta 2ª, Oficina 1, C.P. 28040 - Madrid - Spain

5.- STANDARDS AND TEST PROCEDURES EMPLOYED

Standards:

- Draft Specification for PoweRline Intelligent Metering Evolution. PRIME-Specification v.1.3E.
- EN 50065-1 (2001): “Signalling on low-voltage electrical installations in the frequency range 3 kHz to 148.5 kHz. Part 1: General requirements, frequency bands and electromagnetic disturbances”.
- EN 50065-2-3 (2003) + A1 (2005): “Signalling on low-voltage electrical installations in the frequency range 3 kHz to 148.5 kHz. Part 2-3: Immunity requirements for mains communications equipment and systems operating in the range of frequencies of 3 kHz to 95 kHz and intended for use by electricity suppliers and distributors”.
- EN 50065-7 (2001): “Signalling on low-voltage electrical installations in the frequency range 3 kHz to 148.5 kHz. Part 7: Equipment impedance”.

Testing procedures:

- PRIME Certification. Test Cases version 1.2

6.- CONCLUSIONS

In view of the results and in the test conditions expressed in the present report, the tested sample of:

Unit:	Single-phase meter
Model:	SGM1112
Trade Mark:	General Electric
Serial Number:	000011490
Manufacturer:	General Electric

✓ **COMPLIES** with the tests cases of MAC and Convergence layer defined by PRIME Alliance in its PRIME Certification. Test Cases version 1.2 based on PRIME-Specification v.1.3E.

ANNEX I. TEST RESULTS

Place:

Climatic conditions:

Responsible:

Used instruments:

Measurement instruments	
X	*SW*
	✓ *SW CURRENT CURRENT PRIME audition v1.2.3ct*
X	*HW*
	✓ *HW CURRET Base Node*
	✓ *HW CURRET Service Node 1*
	✓ *HW CURRET Service Node 2*
	✓ *HW CURRET Sniffer*
Data registers storage place	
PSNCTT1 laptop	

Results:

4.1. PHY layer

4.1.1. Test setup

4.1.2. Test results

CODE	DESCRIPTION	RESULT	EXPECTED	STAT.	COMMENTS
	2.2 PHY Test Cases: Functional Category				
2.2.1	Verify error free communication (0.2% FER) checking the complete frame payload when communicating directly over the LISN stated in the PRIME PHY Spec and output level 120 dBuV, PPDU length 256 bytes. D8PSK			NA	
2.2.2	Verify error free communication (0.2% FER) checking the complete frame payload when communicating directly over the LISN stated in the PRIME PHY Spec and output level 120 dBuV,PPDU length 256 bytes. D8PSK+CC			NA	
2.2.3	Verify error free communication (0.2% FER) checking the complete frame payload when communicating directly over the LISN stated in the PRIME PHY Spec and output level 120 dBuV, PPDU length 256 bytes. DBPSK			NA	
2.2.4	Verify error free communication (0.2% FER) checking the complete frame payload when communicating directly over the LISN stated in the PRIME PHY Spec and output level 120dBuV, PPDU length 256 bytes. DBPSK+CC			NA	
2.2.5	Verify error free communication (0.2% FER) checking the complete frame payload when communicating directly over the LISN stated in the PRIME PHY Spec and output level 120 dBuV, PPDU length 256 bytes. Modulation type: DQPSK			NA	
2.2.6	Verify error free communication (0.2% FER) checking the complete frame payload when communicating directly over the LISN stated in the PRIME PHY Spec and output level 120 dBuV, PPDU length 256 bytes. DQPSK+CC			NA	

2.2.7	Verify error free communication (0.2% FER) checking the complete frame payload when communicating directly over the LISN stated in the PRIME PHY Spec (2Ohm) and output level 120 dBuV, PPDU length 256 bytes.DBPSK	NA
2.2.8	Verify error free communication (0.2% FER) checking the complete frame payload when communicating directly over the LISN stated in the PRIME PHY Spec (2Ohm) and output level 120 dBuV, PPDU length 256 bytes. D8PSK+CC	NA
2.2.9	Verify error free communication (0.2% FER) (checking the complete frame payload) when receiving input signal of 122 dBuV. (DUT is in reception state). Modulation type: D8PSK	NA
	2.4 PHY Test Cases: Signal Quality category	
2.4.1	Verify that the EVM of the received signal at output level of 120 dBuV is above 17dB.	NA
2.4.2	Verify that the EVM of the transmitted signal output level of 120 dBuV is above 17dB.	NA

PHY Test Cases: Regulatory category

DUT is EN50065-1, EN50065-2-3 and EN50065-7 compliant in order to be PRIME compliant.

- Test report identification

  For release 01.03.06.09i GENERAL ELECTRIC SGM1112 Meter is conformant to is conformant to EN 50065-1, EN 50065-2-3 and EN 50065-7 according verification tests no.140002/01 issued by LACECAL (14/02/2014).

- DUT identification

  Model Tested SGM1112 IEC Smart Energy Meter with Serial Number 000011151.

4.2. MAC layer

4.2.1. Test setup

4.2.2. Test results

CODE	DESCRIPTION	RESULT	EXPECTED	STAT.	COMMENTS
	3.2 MAC Test cases: Service Node Start-up				
3.2.1	Service node start-up (forcing the reception of beacons).			PASS	1
3.2.2	Service node start-up (No PNPDUs are transmit when DUT receives BPDUs).			PASS	1
3.2.3	Service node start-up (Tx rate of PNPDUs reduced by factor of received PNPDUs).			PASS	1
3.2.4	Service node start-up (PNPDU generation latency and transmission parameters).			PASS	1
3.2.5	Service Node start-up (RANDOMness in the transmission of PNPDUs)			PASS	1
3.2.6	Service Node start-up (seeking promotion of DUT).			PASS	1, 2
	3.3 MAC Test Cases: Channel Access				
3.3.1	Channel access- Shared Contention Period. Channel is idle			PASS	1
3.3.2	Channel access- Shared Contention Period. Channel is occupied.	MacCSMAChBusyCount = 1 MacCSMAFailCount = 23	MacCSMAFailCount > MacCSMAChBusyCount	PASS	1, 3
3.3.3	Channel access- Contention Free Period.			PASS	1
3.3.4	Channel access-Adaptation to frame structure change (FRA)			PASS	1
	3.4 MAC Test Cases: Service Node MAC specific procedures				
3.4.1	Registration accepted (Base Node available when DUT powers up).			PASS	1

3.4.2	Registration accepted (Base Node not available when DUT powers up).	PASS	1
3.4.3	Registration accepted (DUT connected to a Switch node and the Switch node is connected to the Base Node).	PASS	1
3.4.4	Unregistering process initiated by a terminal node.	PASS	1,4
3.4.5	Unregistering process initiated by the Base node.	PASS	1
3.4.6	Promotion process initiated by the base node.	PASS	1
3.4.7	Promotion process initiated by the service node DUT.	PASS	1
3.4.8	Switching process: 2 levels of switching (DUT1 as a level 1 switch).	PASS	1, 5
3.4.9	Switching process: 2 levels of switching (DUT as a level 2 switch).	PASS	1, 5
3.4.10	Switching functions: BPDU transmisión	PASS	1
3.4.11	Switching functions: BPDU updates from FRA control packet	PASS	1
3.4.12	Promotion rejected by the base node.	PASS	1
3.4.13	Demotion process initiated by the base node.	PASS	1
3.4.14	Keep-Alive process (response from DUT).	PASS	1
3.4.15	Keep-Alive process (timeout and disconnect).	PASS	1
3.4.16	Keep-Alive process (changes in Keep Alive timeout).	PASS	1

3.4.17	Connection establishment initiated by the Base node.	PASS	1
3.4.18	Connection establishment initiated by the Service node.	PASS	1
3.4.19	Connection establishment rejected by the Base node.	PASS	1
3.4.20	Connection closing initiated by the Base node.	PASS	1
3.4.21	Connection closing initiated by the Service node.	PASS	1, 4
3.4.22	File transfer process (unicast).	PASS	6
3.4.23	File transfer process (multicast).	PASS	6
3.4.24	Error in the firmware upgrade process.	PASS	6

4.3. CL layer

4.3.1. Test setup

4.3.2. Test results

CODE	DESCRIPTION	RESULT	EXPECTED	STAT.	COMMENTS
	4.2 CS Test Cases: 4-32 Connection establishment				
4.2.1	Correct establishment and disconnection of 4-32 link			PASS	6
	4.3 CS Test Cases: DLMS traffic over 4-32 connection				
4.3.1	CS4-32 is able to pass valid DLMS payload between the meter and the test system.			PASS	6, 7

COMMENTS ON TEST RESULTS

1. Test cases were performed with a special firmware file (version 01.03.06.09i with AppEmu activated) loaded on the DUT for MAC Layer test cases.

2. This test cases was performed with PRIME Audition Conformance Test Tool, but it was necessary to increase timeout to 500 seconds, initially 300 seconds, so that the meter has time to start a promotion process in the sixth step of these test cases.

3. MacCSMAFailCount and MacCSMAChBusyCount were checked through Atmel PRIME Service Node Vendor Tool.exe (ATMEL tool).

4. Test cases were performed manually by sending the appropriate commands to the DUT through BitBoy.exe tool.

5. These test cases were performed omitting the first 2 bullets points of step 8 as indicated in the e-mail received from PRIME Alliance. According to Conformance tester implementation after confirming step 6, it is check that no PRIME frames of AUX2 are seen at AUX1 in 3.4.8 and that no PRIME frames of AUX1 are seen at AUX2 in 3.4.9.

6. Test cases with comment-6 are those which were performed with normal state of the meter (DLMS is activated).

7. This test case was performed with DNV GL DLMS Simulator and a test case was run in which ensure that objects to set up data exchanged using PRIME PLC can be read.