Test Report

No E-14-I-019-PJ

PRIME Certification Tests Cases for Service Nodes

EQUIPMENT UNDER TEST

MODEL:
SGM1100

MANUFACTURER:
General Electric

APPLICANT:
David Morera

DATE OF RECEPTION:
February 4th, 2014

PRIME PROTOCOL/ TEST CASE VERSION:
01.03.06.09i

DATE OF EXECUTION:
5 February 2014

DATE OF ISSUE OF REPORT
February 7th, 2014 Brussels,

Responsible of tests	Head of Laboratory	PRIME Alliance Secretary
		

Pablo Jiménez	Elena Henríquez	Andrew Rosenstein

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1.- EQUIPMENT UNDER TEST IDENTIFICATION

Unit:	Single-phase meter
Model:	SGM1100
Trade Mark:	General Electric
Serial Number:	000000750
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	FF:FF:FF:FF:FF:FF
Firmware version	01.03.06.09i
Applicable Optional tests	No
Recertification	No

2.- SUMMARY OF TEST RESULTS

The scope of this certification is just PHY layer test cases. DUT uses firmware file 01.03.06.09i, that has been used during the complete certification (PHY layer, MAC layer and Convergence sub-layer) of General Electric SGM1112 meter. See report no. E-13-I-193-FL.

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	PASS
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	PASS
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	PASS
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	PASS
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	PASS
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	PASS
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	PASS
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	PASS
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	PASS
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.	PASS
2.4.2	Verify that the EVM of the transmitted signal output level is above 17dB.	PASS
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).	NA
3.2.2	Service node start-up (No PNPDUs are transmit when DUT receives BPDUs).	NA

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

For more detailed information about the test results see Annex I

3.- APPLICANT

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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:	SGM1100
Trade Mark:	General Electric
Serial Number:	000000750
Manufacturer:	General Electric

- ✓ **COMPLIES** with the tests cases of PHY layer defined by PRIME Alliance in its PRIME Certification. Test Cases version 1.2 based on PRIME-Specification v.1.3E.
- ✓ **NB:** Firmware file 01.03.06.09i has been used during the complete certification (PHY layer, MAC layer and Convergence sub-layer) of General Electric SGM1112 meter. See report no. E-13-I-193-FL.

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	2000	1996-2000	PASS	1, 2
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	2000	1996-2000	PASS	1, 2
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	2000	1996-2000	PASS	1, 2
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	2000	1996-2000	PASS	1, 2
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	2000	1996-2000	PASS	1, 2
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	2000	1996-2000	PASS	1, 2

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	2000	1996-2000	PASS	1, 2
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	2000	1996-2000	PASS	1, 2
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	2000	1996-2000	PASS	1, 2
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.	18,05 dB	>17 dB	PASS	1, 2, 3
2.4.2	Verify that the EVM of the transmitted signal output level of 120 dBuV is above 17dB.	18,00 dB	>17dB	PASS	1, 2, 3, 4

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

GE SGM1100 Meter version 01030201000000 (previous PRIME firmware version that was certified) is conformant to EN 50065-1, EN 50065-2-3 + A1 and EN 50065-7 in the band 9-148.5 kHz according attestation of conformity no. 2152605.0501-EMC issued by DEKRA (04/05/2012). In addition, GE SGM1100 Meter version 01.03.06.02 (previous PRIME firmware version that was certified) is conformant to EN 50065-1, EN 50065-2-3 + A1 and EN 50065-7 in the band 9-148.5 kHz according verification tests no. 2158957.0501-EMC issued by DEKRA (30/11/2012).

Based on a document issued by General Electric, in which a set of PRIME PLC Firmware changes from version 01.03.06.02 to 01.03.06.04 were declared, all involved parts are agreed that a new EN50065 retesting is not needed

For new release 01.03.06.09i GENERAL ELECTRIC SGM1100 Meter is conformant to EN 50065-1 according attestation of conformity no. 140033/01 issued by LACECAL (07/02/2014).

- DUT identification

Model Tested SGM1100 IEC Smart Energy Meter with Serial Number 000000748

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).			NA	
3.2.2	Service node start-up (No PNPDUs are transmit when DUT receives BPDUs).			NA	
3.2.3	Service node start-up (Tx rate of PNPDUs reduced by factor of received PNPDUs).			NA	
3.2.4	Service node start-up (PNPDU generation latency and transmission parameters).			NA	
3.2.5	Service Node start-up (RANDOMness in the transmission of PNPDUs)			NA	
3.2.6	Service Node start-up (seeking promotion of DUT).			NA	
	3.3 MAC Test Cases: Channel Access				
3.3.1	Channel access- Shared Contention Period. Channel is idle			NA	
3.3.2	Channel access- Shared Contention Period. Channel is occupied.			NA	
3.3.3	Channel access- Contention Free Period.			NA	
3.3.4	Channel access-Adaptation to frame structure change (FRA)			NA	
	3.4 MAC Test Cases: Service Node MAC specific procedures				
3.4.1	Registration accepted (Base Node available when DUT powers up).			NA	
3.4.2	Registration accepted (Base Node not available when DUT powers up).			NA	

3.4.3	Registration accepted (DUT connected to a Switch node and the Switch node is connected to the Base Node).	NA
3.4.4	Unregistering process initiated by a terminal node.	NA
3.4.5	Unregistering process initiated by the Base node.	NA
3.4.6	Promotion process initiated by the base node.	NA
3.4.7	Promotion process initiated by the service node DUT.	NA
3.4.8	Switching process: 2 levels of switching (DUT1 as a level 1 switch).	NA
3.4.9	Switching process: 2 levels of switching (DUT as a level 2 switch).	NA
3.4.10	Switching functions: BPDU transmisión	NA
3.4.11	Switching functions: BPDU updates from FRA control packet	NA
3.4.12	Promotion rejected by the base node.	NA
3.4.13	Demotion process initiated by the base node.	NA
3.4.14	Keep-Alive process (response from DUT).	NA
3.4.15	Keep-Alive process (timeout and disconnect).	NA
3.4.16	Keep-Alive process (changes in Keep Alive timeout).	NA
3.4.17	Connection establishment initiated by the Base node.	NA

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

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			NA	
	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.			NA	

COMMENTS ON TEST RESULTS

1. All Physical tests where done with AUX1 as transmitting (or, in case of test 2.4.2 as receiving) device. Also, the extended power range capability required for test case 2.2.9 is only available in this hardware module.

The bit-to-bit check on the content of the bursts was checked by starting the sniffer from the command prompt and by visual inspection that only burst with the content "PRIME IS A WONDERFUL TECHNOLOGY" were sniffed.

2. Test cases with comment-2 are those which were performed via manually with test tool console, and they were checked by reading PIB attributes of the DUT with Atmel PRIME Service Node Vendor Tool.exe (ATMEL tool).

3. When the DUT is in 'silent mode', resulting from the 'phy start rx' or 'phy start tx' console command in each case, the EVM is calculated according to the new arithmetic average method.

4. Test cases with comment-4 are those which were performed via manually with test tool console, and they were checked by reading PIB attributes of the DUT with test tool console.