

PLC Communication

Diagnosis Specification - Addendum for B10 neo

v1.2

Confidential

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HISTORY

1.0	2015	First release
1.1	2017	Second release
1.2	2018-12-18	<ul style="list-style-type: none"> Remove unneeded interfaces for B10 Neo Check description of currently missing DiagOnCan elements: MAT_MATCHING_STATE.request and TRIGGER_HLC-PAUSE.request.

REFERENCED DOCUMENT

The following referenced documents are indispensable for the application of this document. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

[ISO-3]	ISO/IEC 15118-3:2015	Road vehicles - Vehicle to grid communication interface - Part 3: Physical and data link layer requirements, release 2015
[RN-PLC-HWS]	36-02-045	PLC Communication, ISO/IEC 15118 compliant, Hardware Specification
[RN-PLC-SWS]	36-02-046	PLC Communication, ISO/IEC 15118 compliant, Software Specification

1. Aim

This document lists and describes interfaces required to configure the PLC Modem and help the ECU integration into the EV. It is the intended input for the Diagnosis layer of the EV.

Each message description is following the same specific pattern:

<process>_XXX.{indication|request|response}

This pattern can be interpreted as described below:

- <process>: identifies the process (similar to process used in requirement ids)
 - CAL for the Calibration Profile management
 - AMP for the Amplitude Map exchange process
 - DEB for Debug purpose
 - MAT for the Matching process
- XXX: message identifier
- Direction:
 - request: coming from a higher layer
 - indication: to be sent to the higher layers
 - response: response to a request or an indication

Example: *EMC_ADD-PROFILE.request* identifies a request to “Add Profile” received by the PLC Modem (“*.request*”) about EMC requirements (“EMC”).

2. Calibration

2.1 Power Lines Calibration

2.1.1 Overview

The power lines calibration of the carriers is performed using a Calibration Profile. A Calibration Profile associates to each carrier number an attenuation power value related to a reference value of 50dBm/Hz.

On the PLC Modem, the attenuation of the 917 used carriers of HPGP can be configured, the other one are notched. A Calibration Profile is therefore composed of 917 bytes, one byte per carrier.

A carrier off (notched) is encoded as 0x00.

A carrier with an attenuation is encoded as X: $20 \times \log_{10}(X/256)$ dB.

The PLC Modem shall at least be able to modify the current Calibration Profile applicable. The possibility to store several Calibration Profiles and to select and apply one is useful for debug and industrialisation purposes. This feature can be required by the specialised specification and is not requested for B10 Neo.

[PLC-HWS-1a] The PLC Modem shall support EMC_SET-PROFILE.request configuration request to store and apply a new profile.

[PLC-HWS-2a] The PLC Modem may restart to finish the application of a new Calibration Profile.

[PLC-HWS-3a] The PLC Modem shall not reset the stored Calibration Profile when unpowered or between two communication session.

[PLC-HWS-4a] The PLC Modem shall accept power attenuation from 0dB to -50dB in a Calibration Profile.

Note 1: See [PLC-HWS-EMC-010a]

Note 2: If Calibration Profile is configured using DiagOnCan, this requirements allows to store 1500 values.

2.1.2 EMC_SET-CALIB-PROFILE.request

Primitive	EMC_SET-PROFILE.request	
Related Systems	Diagnosis / Configuration Tools → PLC Modem	
Description	Apply the given Calibration Profile	
Parameters	Parameter Description	
	NbOfTuples	Number of tuples in the given calibration profile
	Attenuation[0]	Power attenuation for the carrier number 1
	Attenuation[1]	Power attenuation for the carrier number 2

	Attenuation[N]	Power attenuation for the carrier number N

[PLC-HWS-5a] Once EMC_SET-PROFILE.request is received, the PLC Modem shall store and apply the given profile.

[PLC-HWS-6a] If an invalid Calibration Profile is provided in EMC_SET-PROFILE.request, no change is applied.

2.1.3 EMC_SET-AFE-GAIN.request

2.2 Amplitude Map Configuration

2.2.1 Overview

An Amplitude Map associates to each carrier number an attenuation power value related to a reference value of 50dBm/Hz. The resolution of the attenuation power value is -2dB.

E.g. [0, 0, 14, 14, 0, ...] is an example of the beginning of an Amplitude Map indicating a power attenuation of 28dB on carrier number 3 and 4, which means a limitation of the power to -78dBm/Hz on these carriers, and no attenuation on carriers 1, 2 and 5.

[PLC-HWS-7a] The PLC Modem shall support EMC_SET-AMP-MAP.request configuration request to store a new Amplitude Map and to select it as the Active Amplitude Map.

Note 1: The selected Amplitude Map is named "Active Amplitude Map".

Note 2: An Amplitude Map selected in mode "Computation only" is not sent to the EVSE during the Amplitude Map exchange, but is only used for the computation of the attenuation to be applied on power emission when an Amplitude Map is received from the EVSE.

Note 3: An Amplitude Map selected in mode "Computation and Exchange" is also used for sending a Map to the EVSE during the Amplitude Map exchange.

Note 4: If there is no stored or Active Amplitude Map, by default, the PLC Modem will consider having selected an Amplitude Map of -75dBm/Hz between 1.8 to 30 MHz, with [HPGP] notched carriers, in mode "Computation Only".

[PLC-HWS-8a] The PLC Modem shall not reset the stored Amplitude Map and the Active Amplitude Map (if any) when unpowered or between two communication sessions.

Note: If the PLC Modem has received an Amplitude Map from the EVSE, it shall only use it for the current Communication Session with this EVSE.

[PLC-HWS-9a] The PLC Modem shall accept power attenuation from 0dB to -50dB in Amplitude Map (0 to 25 with -2dB resolution).

Note 1: See [PLC-HWS-EMC-010a]

Note 2: If Amplitude Map is configured using DiagOnCan, this requirements allows to store 1500 values. Each value from 0 to 25 can be encoded with 5 bits.

2.2.2 EMC_SET-AMP-MAP.request

Primitive	EMC_SET-AMP-MAP.request
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Related Systems	Diagnosis / Configuration Tools → PLC Modem	
Description	Store the given Amplitude Map to be exchanged with the counterpart PLC Modem	
Parameters	Parameter Description	
	Mode	<ul style="list-style-type: none"> 0 = "Computation Only" 1 = "Computation and Exchange"
	NbOfTuples	Number of tuples in the given Amplitude Map
	Attenuation[0]	Power attenuation for the carrier number 1
	Attenuation[1]	Power attenuation for the carrier number 2

	Attenuation[N]	Power attenuation for the carrier number N

[PLC-HWS-10a] Once the PLC Modem receives an EMC_SET-AMP_MAP.request, it shall store the given map and select it as the Active Amplitude Map.

[PLC-HWS-11a] If an invalid Amplitude Map is provided in EMC_SET-AMP-MAP.request, no change is applied.

2.2.3 EMC_RESET-AMP-MAP.request

Primitive	EMC_RESET-AMP-MAP.request	
Related Systems	Diagnosis / Configuration Tools → PLC Modem	
Description	Remove existing Amplitude Map	
Parameters	Parameter Description	
	NbOfProfiles	Number of Amplitude Maps to be deleted, starting by the higher profile id

[PLC-HWS-12a] Any stored Amplitude Maps are removed using EMC_REMOVE-AMP-MAPS.request.

[PLC-HWS-13a] If a request EMC_REMOVE-AMP-MAPS.request is performed on the current Active Amplitude Map, this map is removed and there is no Active Amplitude Map anymore, the default one shall be applied.

2.3 Attenuation Profile Configuration

2.3.1 Overview

2.3.2 EMC_SET-ATTEN-PROFILE.request

58 bytes: [0x80..0x7F] = [-128dB..+127dB]

2.3.3 EMC_RESET-ATTEN-PROFILE.request

Reset 58bytes to 0dB.

3. Functional Mode

3.1 Debug Modes

3.1.1 Overview

The PLC Modem Debug Mode defines specific behaviour to be applied for debug purpose.

[PLC-DEB-1a] The default PLC Modem Debug Mode is “Nominal”, which means “0000”.

[PLC-DEB-2a] The PLC Modem shall reset the Debug Mode to the default value when unpowered.

3.1.2 DEBUG_MODE.indication

Primitive	DEBUG_MODE.indication	
Related Systems	PLC Modem → Diagnosis / Configuration Tools	
Description	The PLC Modem indicates its current mode	
Parameters	Parameter Description	
	Mode	<p>One byte, coding the PLC Mode in big endian:</p> <ul style="list-style-type: none"> • bit0: Nominal/Debug • bit1: Nominal/Mirroring • bit2: Nominal/By-pass validation • bit3: Nominal/Force validation <p>Therefore, the possible modes are:</p> <ul style="list-style-type: none"> • 0: Nominal • 1: Debug • 3: Debug + Mirroring • 5: Debug + By-pass validation • 7: Debug + Mirroring + By-pass validation • 9: Debug + Force validation • 11: Debug + Mirroring + Force validation

[PLC-DEB-3a] Once the PLC Modem updates its Debug Mode, it shall indicate its new mode with DEBUG_MODE.indication.

3.1.3 DEBUG_SET_MODE.request

Primitive	DEBUG_SET_MODE.request	
Related Systems	Diagnosis / Configuration Tools → PLC Modem	
Description	Change the functioning mode of the PLC Modem	
Parameters	Parameter Description	
	Mode	<p>One byte, coding the PLC Mode in big endian:</p> <ul style="list-style-type: none"> • bit0: Nominal/Debug • bit1: Nominal/Mirroring • bit2: Nominal/By-pass validation • bit3: Nominal/Force validation <p>Therefore, the possible modes are:</p> <ul style="list-style-type: none"> • 0: Nominal • 1: Debug • 3: Debug + Mirroring • 5: Debug + By-pass validation

		<ul style="list-style-type: none"> • 7: Debug + Mirroring + By-pass validation • 9: Debug + Force validation • 11: Debug + Mirroring + Force validation
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[PLC-DEB-4a]	The access to DEBUG_MODE.request shall be protected.
[PLC-DEB-5a]	“Mirroring”, “By-pass validation” and “Force validation” modes are only accessible in “Debug” mode.
[PLC-DEB-6a]	“By-pass validation” and “Force validation” modes are exclusive and cannot be applied at the same time.
[PLC-DEB-7a]	Once receiving a valid DEBUG_MODE.request, the PLC Modem shall update its Debug Mode.
[PLC-DEB-8a]	When receiving a DEBUG_MODE.request with invalid data, the request shall be ignored.
[PLC-DEB-9a]	In “Mirroring” mode, the EV PLC Modem shall send back, immediately and in the same order, all Ethernet PDU it is receiving. For more detail, see [RN-PLC-HWS] section 7.3.
[PLC-DEB-10a]	In “By-pass validation” mode, the EV PLC Modem shall interpret the Matching state “EVSE potentially found” as “EVSE found” to by-pass any Validation process.
[PLC-DEB-11a]	In “Force validation” mode, the EV PLC Modem shall interpret the Matching state “EVSE found” as “EVSE potentially found” to force the launch of the Validation process.

4. Action Triggers & Get Status

4.1 Matching process

4.1.1 MAT_TRIGGER-MATCHING.request

Primitive	MAT_TRIGGER-MATCHING.request
Related Systems	Diagnosis / Configuration Tools → PLC Modem
Description	Trigger the Matching process on the PLC Modem as if it was done by the Charge Service Manager

[PLC-SWS-12a] When the PLC Modem receives a MAT_TRIGGER-MATCHING.request, it shall Trigger the Matching process on the PLC Modem as if it was done by the Charge Service Manager (i.e. HEVC).

Note : As defined in [RN-PLC-HWS], this implies to internally trigger the MATCHING.request.

4.1.2 MAT_RESET-MATCHING.request

Primitive	MAT_RESET-MATCHING.request
Related Systems	Diagnosis / Configuration Tools → PLC Modem
Description	Trigger a Matching Reset on the PLC Modem as if it was done by the Charge Service Manager

[PLC-SWS-13a] When the PLC Modem receives a MAT_RESET-MATCHING.request as if it was done by the Charge Service Manager (i.e. HEVC).

Note : As defined in [RN-PLC-HWS], this implies to internally trigger the MATCHING_RESET.request.

4.1.3 MAT_MATCHING_STATE.request

The MAT_MATCHING_STATE.request provides details about the Matching state of the PLC Modem. It is particularly useful to know in which conditions the Matched state has been reached (with or without Validation).

Primitive	MAT_MATCHING_STATE.request	
Related Systems	PLC Modem → Charge System Manager	
Description	The PLC Modem indicates its current Matching state	
Response	Parameter Description	
	MatchingState	<ul style="list-style-type: none"> 0: Unmatched 1: Matching in progress 2: Matched without Validation 3: Matched with successful Validation 4: Matched with skipped Validation 5: Matched with failed Validation

4.2 Communication

4.2.1 HLC_TRIGGER-PAUSE.request

Primitive	HLC_TRIGGER-PAUSE.request
Related Systems	Diagnosis / Configuration Tools → EVCC
Description	Trigger a charging and communication pause in the EVCC.

[PLC-SWS-14a] When the EVCC receives a HLC_TRIGGER-PAUSE.request, it shall internally trigger the HLC_PAUSE.request defined in [RN-PLC-SWS]. The PLC Modem will therefore receive a D-LINK_PAUSE.request.

4.2.2 HLC_TRIGGER-STOP.request

Primitive	HLC_TRIGGER-STOP.request
Related Systems	Diagnosis / Configuration Tools → EVCC
Description	Trigger the end of the HLC in the EVCC.

[PLC-SWS-15a] When the EVCC receives a HLC_TRIGGER-STOP.request, it shall internally trigger the HLC_STOP.request defined in [RN-PLC-SWS]. The PLC Modem will therefore receive a D-LINK_TERMINATE.request.