

PLC PHY Tester

PLC PHY Tester User Guide

Introduction

The Power Line Communication (PLC) Physical Layer (PHY) Tester has been developed to allow the user to test basic characteristics of physical layers of Microchip PLC products. This tool is able to configure the different physical layers of each product with basic parameters such as modulation schemes, transmission power, baudrate, etc. in order to make the interchange of basic PLC messages possible.

The tool has been structured similar to a wizard, where each step allows the user to configure some parameters related to one aspect of the test. This structure allows the user to configure the test to be performed, and at the end of the wizard the test will start with the proper configuration chosen by the user.

It should be kept in mind that in order to obtain repeatable results, a physical test must be done under controlled condition; it is recommended to carry out the test in an isolated path free of other PLC messages or interferences that can introduce uncontrolled signals in the channel to be evaluated.

Features

- Supported Platforms: ATPL230, SAM4CP16B, ATPL250A, SAM4CP16C and PL360
- Basic PHY Configuration for Transmission and Reception of Messages
- Signal Quality Measurement

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1. Initial Steps

1.1 Software Installation

To install the software, execute the installation wizard provided. The first window allows selecting between multi-user support and current user:

Figure 1-1. First Wizard Window



Next window is the welcome window and contains some advice about tool installation:

Figure 1-2. Welcome Window



The next window shows you the License Agreement:

Figure 1-3. License Agreement Window

PLC PHY Tester Tool Setup	
License Agreement Please review the license terms before installing PLC PHY Tester Tool.	
Press Page Down to see the rest of the agreement.	
EVALUATION LICENSE AGREEMENT	-
IT IS IMPORTANT THAT YOU READ THIS AGREEMENT CAREFULLY AND CON This Evaluation License Agreement ('Agreement') is a legally binding agreen your employer ('Licensee') and Amel Corporation ('Athen!'). By clicking the button or by downloading, installing or using any of the software available ('Licensed' Software', you are indicating that you are binding Licensee to the this Agreement, and that you are duly authorized by Licensee to do so. If y authorized to bind Licensee to the terms of this Agreement, do not click the 'I agree to be bound by al of the terms of this Agreement, do not click the 'I	APLETELY. nent between "I Accept" 'or download he terms of oou are not oes not Accept" ←
If you accept the terms of the agreement, click I Agree to continue. You mu agreement to install PLC PHY Tester Tool.	st accept the
Nulsoft Install System v3.0	Cancel

Next, select the components to install:

Figure 1-4. Select Components

Choose which features of Pl	LC PHY Tester Tool you want to insta	all.
Check the components you install. Click Next to continue	want to install and uncheck the comp e.	oonents you don't want to
Select components to install	Microdhip PLC PHY Tester	Description Position your mouse over a component to see its description.
Space required: 30.4MB	4	

And finally, select the install location:

Figure 1-5. Select Folder

PLC PHY Tester Tool Setup	
Choose Install Location Choose the folder in which to install PLC PHY Tester Tool.	
Setup will install PLC PHY Tester Tool in the following folder. To install in a d click Browse and select another folder. Click Install to start the installation.	ifferent folder,
Destination Folder 5:19trogram Files (v:80)94crochip19LC PHY Tester Tool_3.0.0	Browse
Space required: 30.4MB Space available: 43.4GB Mullsoft Install System v3.0	
< <u>B</u> ack Install	Cancel

The wizard must complete without any other configuration:

Figure 1-6. Installation Completed

🕞 PLC PHY Tester Tool Setup	
	Completing PLC PHY Tester Tool Setup
	PLC PHY Tester Tool has been installed on your computer.
R	Click Finish to dose Setup.
	< Back Finish Cancel

The installation procedure generates a desktop link and start menu entry. Use either to start the tool.¹

1.2 Hardware Device

The different firmware releases include PHY layer project examples. Use the right software to have all the features enabled. Follow the instructions supplied with the kit to program the firmware correctly.

1.3 Starting the Tool

The first step is to plug the hardware device to the power line. Then, connect the USB cable to the host computer. Now we are ready to start the PLC PHY Tester software using, for example, the link created on your desktop during the install process. In order to work with PLC PHY Tester, the hardware must be flashed with the PHY Tester tool embedded application. See *"Kit User Manual"* in order to flash the appropriate firmware.

Upon start, the main window will appear:

Figure 1-7. Starting Window

p				
Velcome				
	6 mm			
	Summary Welcome to Microchip PLC PHY Tester Tool, this application allow you to test basic fi Please select the serial port in wich your Microchip board is connected to your PC.	unctionality of Microchi	p PLC products.	
	Remember that the PHY Tester Tool embedded app must be flashed in the hardware See Kit User Manual in order to flash the appropriate firmware.	e.		
		Connection		
	and the second second			
1.	100010111000			
	111101010101010101010	Serial Port:	COM1	•
.e	111010100101111110	BaudRate:	115200	*
ø	110100010101010		FindPorts	Connect
	1111			
3	MICROCHIP			Next >>
AA '				

If the COM port to choose is not known, it can be located at the Windows Device Manager in the Port (COM & LPT) section.² In this example, the COM55 is used:

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¹ In order to be able to connect to the Microchip PLC boards, USB drivers are provided with this software. Please be sure that these drivers are installed before using this tool.

Figure 1-8. Windows Device Manager



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² Some Microchip PLC evaluation kits use a USB to UART bridge from Silicon Labs. This device creates two COM ports (one standard and one enhanced) when you connect the evaluation kit to the PC. In order to work with this application the enhanced one must be selected.

2. General Operation

The PLC PHY Tester has been designed to work as a wizard commonly used by many desktop applications. The wizard is structured in tabs that are shown and enabled as the user sets configurations specific for each tab, and goes to the next tab by means of the proper button. The next sections show the general layout of the tabs that compose the wizard.

2.1 Welcome Tab

The main window that appears as soon as the application is started (Figure 1-7) shows a welcome message and asks the user to select the serial port where Microchip PLC Development Board has been connected.

The user must select the proper port and baudrate to connect and then press the "Connect" button. As soon as the button is pressed the button text changes to "connecting" triggering a process of board identification; after few seconds the button text changes to "Disconnect" which means that the identification process has finished. A new tab (Product Information) appears on the wizard and the "Next" button is enabled allowing the user to advance to the following step of the configuration. In case of error, please check the FW of the board and configuration of the serial connection.

2.2 Product Information Tab

As soon as the user presses the Next button in the Welcome tab, a new tab is shown:

Description This tab shows information re At the bottom of the tab it's	Reception Parameters Rx Test Parameters Configuration Sum lated with product identification, model of the PCB and information ab necessary to select a choice between Transmision and Reception test	mary TestExecution
Product Info Test Selection	Product Id: SAM4CM616C G3 CENELEC-A Model Id: 0x0001 Firmware Id: 0x06010101	Protocol Specific Content
Verify Coupling Warning! Ti Check the coup one for binary the coupling bo	he coupling board plugged in the main board must b ling identifies that you can find in the coupling board. If current coupli alreads, joase rance and concert that proce one. Also verify tha and selected. Otherwise the board could be seriously damaged.	e the proper one. 1

Figure 2-1. Product Information Tab

The Product Information tab shows basic board information and also asks the user to configure the board as transmitter or receiver.

The information shown is related to the physical layer implemented in the firmware of the board:

- **Product ID:** Shows a text string identifying the Microchip PLC product (platform)
- Model ID: Is a 16-bits unsigned integer that identifies the model of the board
- **Firmware ID:** Is a 32-bits unsigned integer that identifies the physical layer firmware version running on the board

The next tab depends on transmission or reception test selection. For reception tests "Reception Parameters" and "Rx Test Parameters" tabs are added; for transmission tests "Transmission Parameters" and "Tx Test Parameters" tabs are added. Finally, independently of the kind of test selected, two more tabs are added: "Configuration Summary" and "Test Execution". All of these tabs are disabled at this point; as the user navigates through the wizard with the Next and Prev. buttons, the tabs become enabled.

2.3 Reception Parameters Tab

This tab allows configuration of the reception parameters of the board. These parameters depend on the PHY layer (Protocol). Section Protocol Specific Tabs shows the content of this tab for each PLC protocol supported. The following figure shows the general aspect of this tab:

Figure 2-2. Reception Parameters Tab (G3-PLC Example)

elcome Product Information Reception	Parameters Rx Test Parameters Configuration Summary TestExecution
Description	
This tab allow to configure the channel layer in order to receive messages.	in which board is going to receive the messages. This is the only configuration needed by the PHY
Tonal Noise Adaptation	Protocol Specific Conter
Automatic Configuration	Manual Configuration
Interval (ms): 1	Set Search and Adapt to Noise Disable Noise Filtering
	Adapt to Target Frequency Target Frequency (Hz):
Perform EVM and	d SNR Test:
ToneMask	
None	
Default	
Custom:	[Lower frequency Higher Frequency]

2.4 Rx Test Parameters Tab

This tab allows configuration of the reception test parameters. These parameters are the amount of expected messages to be received and the time interval from message to message (receiver instance will wait for this time prior to consider message is missed). These parameters are used just for test statistic results. Unlike the previous one, this tab is common for all the Microchip PLC protocols. The following figure shows the tab layout:

Figure 2-3. Rx Test Parameters Tab

р							
/elcome	Product Information	Reception Parameters	Rx Test Paramete	rs Configuratio	in Summary T	estExecution	
1 1 1	escription his tab allow to configure arameters are: -Time Interval : -Number of Fran	all necessary parameters i expected interval betweer nes : number of frames to	elated with a recepti n frame transmmition be received	on test.			
	-Message : asci Test Parameters	message expected	iterval (ms): 10	D			
		Numbe	r of Frames: 10	D			
	MICROCHIF	1				<< Prev	Next >>

2.5 Transmission Parameters Tab

This tab allows the user to configure transmission parameters such as modulation, gain, etc. This tab is protocol-dependent, thus its content varies depending on which PHY layer runs on the board connected to the tool. Section Protocol Specific Tabs shows the content of this tab depending on the PHY layer. The following figure shows the tab layout in case of G3-PLC PHY layer:

Figure 2-4. Transmission Parameters Tab (G3-PLC example)

Welcome	Product Inform		TA TESC Parameter		residicted out
1	Description				
1	This tab allow to co	nfigure all necessary par	ameters in order to make a trans	mission	
Tr	ansmission Parame	ters			
		Modulation Scheme:	Differential 💌	Tx Power: Full_Gain	•
		Modulation Scheme	BPSK		
		Tone Map:	0x3f		
		Transmission Mode:	Auto 💌		
			Perform EVM and SNR Test:		
То	ne Mask				
	None				
	Default				
	Custom:			[Lower frequency High	er Frequency]
			P	rotocol Spe	cific Conter

2.6 Tx Test Parameters Tab

This tab is very similar to the Rx Test Parameters tab. The "Message" parameter allows configuration of the content of the message to be transmitted in ASCII characters. the "Time Interval" parameter defines the interval of time, measured in milliseconds, between the transmissions of two messages.³Finally, the "Number of Frames" parameter allows configuration of the number of messages to be transmitted. As in the Rx Test Parameter Tab, this tab is independent of PHY layer.

³ This time interval indicates the time between the beginnings of two frames.

IMPORTANT: 10ms drifts in the transmission and reception times may appear due to the application running on a non-real time operating system.

IMPORTANT: A "Time Interval" shorter than 70 milliseconds may not work properly due to PC OS and USB connection. Please use the PHY TX console firmware example to transmit messages with shorter time interval.

Welcome	Product Information Transm	ssion Parameters	Tx Test Parameters	Configuration Summary	TestExecution
ſ	Description				
1	This tab allow to configure all necess	ary parameters rela	ated with a tranmission	test.	
,	 arameters are: -Time Interval : interval b -Number of Frames : num 	etween frame trans per of frames to be	smmition transmitted		
	-Message : asci message	to be tranmitted			
	Test Parameters				
	Time Interval (ms):	100			
	Number of Frames:	100			
	Message:	Microchip Techno	ology Inc. The Embedde	ed Control Solutions Company	
	Місвоснів				< < Prev Nevt

Figure 2-5. Tx Test Parameters Tab

2.7 Configuration Summary Tab

This is the last tab in the wizard before starting the execution of the test. This tab shows a table where all the configuration parameters are listed that have been configured along the wizard. The "Next" button has been substituted with a "Start Test" button that allows starting the message transmission or reception.

Figure 2-6. Configuration Summary Tab of a Transmission Test

	Deaduct To Group Han	Transmission Decembers	To Task Deventers	Configuration Summary	TeelTusevilles					
conte	Produce priormation	n anomission Parameters	TA TESCE di ameters	comparation Summary	resulvecubbri					
D	escription									
т	his tab shows a brief of t	he configuration fixed in previ	ous steps, at the tab the	ere is a little explanation of h	ow to proceed with th	e test				
	Configuration Summary									
		Parameter		Value		*				
	Social Dort		COM76 Enha	ncod						
	Seliar Forc		COM/O Enha	nceu		E				
	Test Type		TX							
	Frame Interval (ms)		100	100						
	Number of Frames		100	100 Differential						
	Modulation Scheme		Differential							
	Modulation Type		RPSK	RDSK						
	Attention									
					~ · ·					
	In order to obtain	correct result for the	test, please start	Defore KX board tha	n Ix board					
ΔM	MICROCHIF				<< Prev	Start Te				

2.8 Test Execution Tab

This is the tab shown while the test is being executed; it shows the transmission or reception of each message in form of a table. The following figures show examples of this tab for transmission and a reception tests:

Microch	ip PLC PHY 1	ester v	3.0.1					- C -X-	Micro	ochip P	LC PHY Tester v3.0.:	1				
Help									Help							
Welcome	Product I	nformat	ion Tr	ansmission Paramet	ers Tx Test Parameters Cont	figuration Su	mmary TestExecution		Welco	me	Product Information	Reception Parameters F	x Test Param	eters Config	uration Summary Test	Execution
							Co	opy Table								Copy Table
Fram	e# Tx Re	sult F	MS_Calc	Modulation Typ	e Modulation Scheme	Tone Map		Dati ^	F	ame #	Modulation Type	Modulation Scheme	Tone Ma	RSSI (dBuV)	Link Quality (LQI in dB)
97	Tx Succ	esful 3	75092336	BPSK	MOD_SCHEME_DIFFERENTIAL	0x3f	Microchip Technology Inc. Th	ne Embe	97		BPSK	MOD_SCHEME_DIFFERENTIA	AL 0x3f	52.81	19.00	Microchip Technology
98	Tx Succ	esful 3	73982190	BPSK	MOD_SCHEME_DIFFERENTIAL	0x3f	Microchip Technology Inc. Th	ne Embe	98		BPSK	MOD_SCHEME_DIFFERENTIA	AL 0x3f	52.71	19.00	Microchip Technology
99	Tx Succ	esful 3	74829669	BPSK	MOD_SCHEME_DIFFERENTIAL	0x3f	Microchip Technology Inc. Th	ne Embe	99		BPSK	MOD_SCHEME_DIFFERENTIA	AL 0x3f	52.77	19.25	Microchip Technology
100	Tx Succ	esful 3	73889290	BPSK	MOD_SCHEME_DIFFERENTIAL	0x3f	Microchip Technology Inc. Th	ne Embr 🖕	10)	BPSK	MOD_SCHEME_DIFFERENTIA	AL 0x3f	52.75	19.25	Microchip Technology 👻
٠ 📃			n	п				F.	•			m				E.
Mess Fram Tx M Effect Effect Raw I Raw I Chan	age: Microc e Symbols: e Duration: an Interval tive Baudrat Baudrate (P Baudrate (R nel Usage :	hip Teo 53 42.915 : 108.7 e (Peal e (Real e (Real eak): 4 eal): 1 39.45%	thnology ms '8 ms (): 11931): 4707 4460 bp: 7540 bps %	Inc. The Embed L bps bps s	ded Control Solutions Company	Spe	cific Conter	nt 🌷	To To To To To	ital Fra ital Byt ital RS ital Exc ames F ital Fra ital Fra	ame Error Info imes Received: 1 es Received: 730 Error Frames: 0 exeptions Errors: 0 Received with Bad imes Bad Payload imes Received OK	00)0 FCH CRC: 0 : 0 : 100	Pro	otocol	Specific	Content
<u> </u>	MICR	OCł	١P				<< Prev	Restart		Ň	Ліскоснії	P				<< Prev Restart

Figure 2-7. Execution Tab for Transmission and Reception

Both views (Tx and Rx) show tables representing different information depending on test type (transmission/reception). When the test is finished or is cancelled, a final report is shown at the bottom of the tab.

This tab will provide additional information about signal quality in case of selecting "Performing EVM and SNR Test" check-box in the "Reception Parameters" tab. More information about this feature can be found in Section Protocol Specific Tabs.

The user can copy the information included in the corresponding table to the clipboard by clicking on the "Copy Table" button. Then users can paste this information in a spreadsheet for later data processing. This tab is only able to hold the information of the last 10000 frames; the user can choose a bigger number of frames to be transmitted/received but only the last 10000 frames will be available.

3. Test Execution Example

Boards must be connected to a computer by means of USB connections. The PLC PHY Tester must be installed in the PC and the user has to initiate one instance of the tool for each board. The next example shows a G3-PLC PHY layer test using PL360, but it is general enough to be valid for other platforms.

3.1 Connection Step

Once each tool instance is opened, it is necessary to select the proper port in each instance.

Figure 3-1. Example First Step: Connection

Microchip PLC PHY Tester Tool v3.0.0		Microchip PLC PHY Tester Tool v3.0.0	
the Waters Summary Messessels for each of the CPH Tester Tool, the application allow you be test basic functionality of Microschip R.C. products. Presentee that the NHT Tester Tool methodold age must be faulted in the hardware. See 161 user Markal models that the approximate fitmane. See 161 user Markal models that the approximate fitmane.		Help Welcome Summary Welcome before the Mark and the approximation allow your be test back functionality of Mocodity R.C. products Remember that the hif Tester Tool, this application allow your be test back functionality of Mocodity R.C. products Remember that the hift Tester Tool, this application allow your be test back functionality of Mocodity R.C. products Remember that the appropriate finance. See In User Markal moder to that the appropriate finance. See In User Markal moder to that the appropriate finance. Connection Connectio	anced •
	Next >>	Місвосні р	Next >

3.2 Test Type Selection Step

After selecting each port and performing the connection and pressing the "Next" button, the tool shows the Product Information tab. In this tab the user has to configure one board in Reception mode and the other in Transmission mode. In case of a connection error, please check the FW of the board and configuration of the serial connection.





3.3 Transmission/Reception Parameters Configuration Step

At this step parameters for transmission and reception can be configured. Specific PHY layer documentation must be checked in order to perform a proper configuration.

Figure 3-3. Example Third Step: Tx/Rx Parameter Configuration

Microchip PLC PHY Tester Tool v3.0.0	Microchip PLC PHY Tester Tool v3.0.0
lp	Help
Velcome Product Information Transmission Parameters Tx:Test Parameters Configuration Summary TestExecution	Welcome Product Information Reception Parameters Rx Test Parameters Configuration Summary TestExecution
Description This tab allow to configure all necessary parameters in order to make a transmission	Description This tab allow to configure the channel in which board is going to receive the messages. This is the only configuration needed by the PMI layer in order to receive messages.
Transmission Parameters Modulation Scheme: Differential Tx Power: Full_Cain Modulation Scheme:	Tonal Noise Adaptation
Tone Map: 0x3f	Automatic Configuration Manual Configuration
Transmission Mode: Auto Perform EM and SHR Test:	Interval (mg): 1 Set Carch and Adapt to Hoise Disable Hoise Filtering Adapt to Target Frequency Target Frequency (Hz):
Tone Mask	Perfore EVM and SNR Test:
None	ToneMask
Default Deven frammen	None
[With insubsky]	Default Outom: [Lower frequency Higher Frequency]

3.4 Tx/Rx Test Parameters Configuration Step

At this point it is recommended to configure both boards with the same configuration (Message, Time Interval and Number of Frames), otherwise the test results may not be as expected.

Figure 3-4. Example Fourth Step: Tx/Rx Parameter Configuration

Microchip PLC PHY Tester Tool v3.0.0		Microchip PLC PHY Tester Tool v3.0.0
Help Welcome Product Information Transmission Parameters Tx Test Parameters Configuration Summary TestBuenden Description The tab allow to configure all necessary parameters related with a transission test. Parameters ze: Parameters ze: Parameters ze: Parameters to be transmitted -Number of Frames: number of frames to be transmitted -Number of Frames: Number of frames to be transmitted -Number of Frames: Number of frames to be transmitted -Number of Frames: Number of frames to be transmitted -Number of Frames: Number of frames to be transmitted -Number of Frames: Number of frames to be transmitted -Number of Frames: Number of Frames to be transmitted -Number of Frames: Number of Frames to be transmitted -Number of Frames: Number of Frames to be transmitted -Number of Frames: Number of Frames to be transmitted -Number of Frames: Number of Frames to be transmitted -Number of Frames: Number of Frames to be transmitted -Number of Frames: Number of Frames to be transmitted -Number of Frames: Number of Frames: Number of Frames to be transmitted -Number of Frames: Number of		Help Welcame Product Information Reception Parameters Rx Test Parameters Configuration Summary TestSecution Description Test balow to configure all necessary parameters related with a reception test. Parameters are: TestSecution This tab allow to configure all necessary parameters related with a reception test. Parameters are: Parameters are: Aucebord Frames: number of frames to be received
Test Paramèters Time Enterval (ms): 100 Number of Frames: 100 Message: Microchip Technology Inc. The Embedded Control Solutions Company		Test Parameters Time Interval (ms): 100 Number of Frames: 100
	iext >>	

3.5 Summary Check Step

This tab shows a short summary of the configuration fixed in previous steps and allows the user to start the test by pressing the corresponding "Start test" button. The test should start first with the reception, and in less than 10 seconds start with the transmission.

PLC PHY Tester Test Execution Example

Figure 3-5. Example Fifth Step: Tx/Rx Parameter Configuration

Microchip PLC PHY Tester Tool v3.0.0 Help Welcome Product Information Transmission Param Description	neters Tx Test Parameters Configuration Summary TestSuecut		Microchip PLC PHY Tester Tool v3.0.0 Help Welcome Product Information Reception Paral Description	eters Ru Test Parameters Configuration Summary TestSusculos	
This tab shows a brief of the configuration fixed	I in previous steps, at the tab there is a little explanation of how to proceed	d with the test	This tab shows a brief of the configuration fit	ed in previous steps, at the tab there is a little explanation of how to proceed	I with the test
Parameter	Value	^	Parameter	Value	
lest lype	IX	=	Serial Port	CUMbb Enhanced	_
Frame Interval (ms)	100		Test Type	RX	
Number of Frames	100		Frame Interval (ms)	100	
Modulation Scheme	Differential		Number of Frames	100	
Modulation Type	BPSK		Perform EVM and SNR Analysis	False	
Perform FVM and SNR Analysis	False	-			
Attention In order to obtain correct result f	for the test, please start before Rx board than Tx board		Attention In order to obtain correct resul	t for the test, please start before Rx board than Tx board	
Міскосні Р	~~~	Prev Start Test	Міскоснір		Prev Start Test

3.6 Test Execution Step

This tab is shown while the test execution is being performed. The information in this tab is presented in table format, filled with information about the messages transmitted or received. At the end of the test a short summary of the information is shown.

Figure 3-6.	Example	Sixth	Step:	Execution
-------------	---------	-------	-------	-----------

Þ	Microchip F	LC PHY Tester	v3.0.1					- 0 X	To Micro	ochip Pl	C PHY Tester v3.0.	1				- • ×
F	lelp								Help							
[Welcome	Product Inform	ation Tri	ansmission Parameter	s Tx Test Parameters Cor	figuration Su	mmary TestExecution		Welco	me	Product Information	Reception Parameters Rx	Test Paramet	ers Configu	ration Summary TestEx	ecution
								Convertable								Convertable
		T D b	D145 C 1			T 14		Copy Table					7 14	DOCT (ID 10	1.1.0 1. 4.01. 10	Copy Table
	Frame #	TX Kesult	KIVIS_Calc	Modulation Type	Modulation Scheme	Tone Map		Dati -	FI	ame #	Modulation Type	Modulation Scheme	Tone Map	K221 (GBUV)	Link Quality (LQL in dB)	
	9	Tx Succesful	374161869	BPSK	MOD_SCHEME_DIFFERENTIAL	0x3f	Microchip Technology Inc. T	The Embe	9		BPSK	MOD_SCHEME_DIFFERENTIAL	0x3f	52.77	19.00	Microchip Technology
	10	Tx Succesful	374180867	BPSK	MOD_SCHEME_DIFFERENTIAL	0x3f	Microchip Technology Inc. T	The Embe	10		BPSK	MOD_SCHEME_DIFFERENTIAL	0x3f	52.71	19.00	Microchip Technology
	11	Tx Succesful	374215092	BPSK	MOD_SCHEME_DIFFERENTIAL	0x3f	Microchip Technology Inc. T	The Embe	11		BPSK	MOD_SCHEME_DIFFERENTIAL	0x3f	52.65	19.25	Microchip Technology
	12	Tx Succesful	374287175	BPSK	MOD_SCHEME_DIFFERENTIAL	0x3f	Microchip Technology Inc. T	The Embe	12		BPSK	MOD_SCHEME_DIFFERENTIAL	0x3f	52.70	19.00	Microchip Technology
	13	Tx Succesful	374347329	BPSK	MOD_SCHEME_DIFFERENTIAL	0x3f	Microchip Technology Inc. T	The Embe	13		BPSK	MOD_SCHEME_DIFFERENTIAL	0x3f	52.73	19.00	Microchip Technology
	14	Tx Succesful	372677337	BPSK	MOD_SCHEME_DIFFERENTIAL	0x3f	Microchip Technology Inc. T	The Embe	14		BPSK	MOD_SCHEME_DIFFERENTIAL	0x3f	52.71	19.00	Microchip Technology
	15	Tx Succesful	371660810	BPSK	MOD_SCHEME_DIFFERENTIAL	0x3f	Microchip Technology Inc. T	The Embe _E	15		BPSK	MOD_SCHEME_DIFFERENTIAL	0x3f	52.75	19.25	Microchip Technology E
	16	Tx Succesful	372761037	BPSK	MOD_SCHEME_DIFFERENTIAL	0x3f	Microchip Technology Inc. T	The Embe	16		BPSK	MOD_SCHEME_DIFFERENTIAL	0x3f	52.75	19.25	Microchip Technology
	17	Tx Succesful	370867013	BPSK	MOD_SCHEME_DIFFERENTIAL	0x3f	Microchip Technology Inc. T	The Embe	17		BPSK	MOD_SCHEME_DIFFERENTIAL	0x3f	52.68	19.25	Microchip Technology
	18	Tx Succesful	370872529	BPSK	MOD_SCHEME_DIFFERENTIAL	0x3f	Microchip Technology Inc. T	The Embe 🖕	18		BPSK	MOD_SCHEME_DIFFERENTIAL	0x3f	52.76	19.00	Microchip Technology 🛫
	•			"				E.	4			m				E.
								Cancel								Cancel
	<u> </u>	AICROC	HIP				<< Prev	Restart		Ň	ICROCHI	P			(<< Prev Restart
								.ii								II

PLC PHY Tester Test Execution Example

Figure 3-7. Example Sixth Step: Execution Finished

Microchip P	LC PHY Tester	v3.0.1					se 🖉 🚾 M	Nicrochip P	LC PHY Tester v3.0.	1				
Help							Help	р						
Welcome	Product Inform	ation Tra	ansmission Parameter	rs Tx Test Parameters Con	figuration Su	mmary TestExecution	w	/elcome	Product Information	Reception Parameters R	(Test Parame	ters Config	uration Summary TestE	xecution
						Copy Table								Copy Table
Frame #	Tx Result	RMS_Calc	Modulation Type	Modulation Scheme	Tone Map	Dat, ^		Frame #	Modulation Type	Modulation Scheme	Tone Map	RSSI (dBuV)	Link Quality (LQI in dB)
97	Tx Succesful	375092336	BPSK	MOD_SCHEME_DIFFERENTIAL	0x3f	Microchip Technology Inc. The Embe		97	BPSK	MOD_SCHEME_DIFFERENTIA	L 0x3f	52.81	19.00	Microchip Technology
98	Tx Succesful	373982190	BPSK	MOD_SCHEME_DIFFERENTIAL	0x3f	Microchip Technology Inc. The Embe		98	BPSK	MOD_SCHEME_DIFFERENTIA	L 0x3f	52.71	19.00	Microchip Technology
99	Tx Succesful	374829669	BPSK	MOD_SCHEME_DIFFERENTIAL	0x3f	Microchip Technology Inc. The Embe		99	BPSK	MOD_SCHEME_DIFFERENTIA	L 0x3f	52.77	19.25	Microchip Technology
100	Tx Succesful	373889290	BPSK	MOD_SCHEME_DIFFERENTIAL	0x3f	Microchip Technology Inc. The Embe		100	BPSK	MOD_SCHEME_DIFFERENTIA	L 0x3f	52.75	19.25	Microchip Technology
٠ .		11	п			•		٠ .		m				F
Message Frame S Frame D Tx Mean Effective Raw Bau Raw Bau Channel	si: Microchip T ymbols: 53 uration: 42.9: Interval: 108 Baudrate (Pe Baudrate (Real): Usage : 39.4:	echnology 15 ms .78 ms ak): 11931 ak): 4707 b 44460 bps 17540 bps 5%	Inc. The Embedde L bps bps s	ed Control Solutions Company	/	e Canol		Total Fra Total Byt Total RS Total Exc Frames I Total Fra Total Fra	ame Error Info mes Received: 1 es Received: 730 Error Frames: 0 Received with Bad mes Bad Payload mes Received OK	00)0)FCH CRC: 0 : 0 : 100				E Cancel
<u> </u>	AICROC	HIP				<< Prev Restart		<u> </u>	Ліскосні	P				<< Prev Restart

4. **Protocol Specific Tabs**

PLC PHY Tester is a multi-platform tool designed to work with any device from the Microchip PLC family of products. The way of working with the tool is similar for all the platforms supported, but some of the tabs of the wizard may contain specific PLC protocol content. This section describes the content of these tabs.

4.1 Tx/Rx Parameters for PRIME PHY Layer

4.1.1 Transmission Parameters for PRIME PHY Layer

Figure 4-1. Transmission Parameters Tab for PRIME PHY Layer

p			
Velcome Product Information Tran	nsmission Parameters Tx Te	ot Parameters Configuration Summary T	estExecution
This tab allow to configure all nee	essary parameters in order to	nake a transmission	
Couppling Selection			
	Select Coupling:	ATPLCOUP001_v1 •	
Transmission Parameters			
	Channel:	Ch. 1	
	Frame Type:	Type A / PRIME v1.3.6 V	
	Modulation Scheme:	DBPSK	
	Attenuation Level:	0 dB	
	Transmission Mode:	Auto	
	renom ever rest		
			Neut >>
			<< Prev Next >>

This tab is shown when transmission test is selected after connecting the application to a board which is running a serialized PRIME PHY Layer. It allows configuration of the coupling that is connected to the chip, as well as some parameters related with the transmission.

First of all, users must select the coupling. PRIME PHY Layer defines several coupling circuits to be selected and plugged in the Evaluation Kit boards. Each coupling board is identified as: ATPLCOUPXXX, where XXX identifies each coupling. In the "Select Coupling" list, the user must select the same coupling that has been plugged in the board.⁴

The transmission specific parameters are:

- Channel: Allows selection of which channel the frames are going to be transmitted on; depending on the coupling plugged to the board, different channels can be available
- Frame Type: Configures the board to transmit different types of frames (Type A/B/BC) following PRIME 1.4 specification

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⁴ Warning! If current coupling is not the proper one for the channel you want to transmit, please remove it and plug the proper one. Also verify that V_{DD} has the correct value for the coupling board selected. Otherwise the board could be seriously damaged.

- Modulation Scheme: Configures the modulation scheme of the frames⁵
- Attenuation Level: Allows to attenuate the transmitted signal in 1dB steps
- Transmission Mode: Configures the output stage depending on the line impedance seen by the board
- Perform EVM Test: Selecting this option changes the message and interval of transmission in order to make a test that evaluates the PHY layer performance. For more information check application note "Guidelines for PLC Performance Verification".

4.1.2 Reception Parameters for PRIME PHY Layer Figure 4-2. Reception Parameters Tab for PRIME PHY Layer

Product Information	Reception Parameters	Rx Test Para	ameters Co	nfiguration Summary	TestExecution	
)						
This tab allow to configure ayer in order to receive m	the channel in which board essages.	is going to rec	eive the messa	ges. This is the only c	onfiguration needed by	y the PHY
Coupling Selection						
	Select	Coupling		w1 💌		
	3660	Cooping.				
Reception Parameters						
	Chann	el:	Ch. 1			
	Perfor	m EVM Test:		V		
Міскоснір)				<< Prev	Next >>
	Product Information Description This tab allow to configure syster in order to receive m Coupling Selection Reception Parameters	Product Information Reception Parameters Description This tab allow to configure the channel in which board syrr in order to receive messages. Coupling Selection Select Reception Parameters Chann Perfor MICROCHIP	Product Information Reception Parameters Rx Test Parameters Description	Product Information Reception Parameters Rx Test Parameters Co Description This tab allow to configure the channel in which board is going to receive the messager in order to receive messages. Coupling Selection Coupling Selection Select Coupling: ATPLCOUPO01_ Reception Parameters Channel: Ch. 1 Perform EVM Test: Image: Coupling Selection	Product Information Reception Parameters Rx Test Parameters Configuration Summary Description	Product Information Reception Parameters Rx Test Parameters Configuration Summary TestExecution Description This tab allow to configure the channel in which board is going to receive the messages. This is the only configuration needed by sympler in order to receive messages. Coupling Selection Coupling Selection Select Coupling: ATPLCOUP001_v1 • Reception Parameters Channel: Ch. 1 Perform EVM Test:

This tab is shown when reception test is selected after connecting the application to a board that is running a serialized PRIME PHY Layer. It allows selection of the coupling as well as the PRIME channel where test will be performed.

First of all, users must configure the coupling board. PRIME PHY Layer defines several coupling circuits to be selected and plugged in the Evaluation Kit boards. Each of the coupling boards is identified as: ATPLCOUPXXX, where XXX identifies each coupling. In the "Select Coupling" list, the user must select the coupling that has been plugged in the board.⁶

The "Perform EVM Test" option changes the message and time interval of consecutive receptions in order to make a test that evaluates the PHY layer performance. In test execution tab some extra columns are added in order to obtain more information about performance of the PHY layer. For more information check application note *"Guidelines for PLC Performance Verification"*.

- ⁵ Robust modulation schemes are only supported in Type B Frames.
- ⁶ Warning! If current coupling is not the proper one for the channel you want to receive, please remove it and connect the proper one. Also verify that V_{DD} has the correct value for the coupling board selected. Otherwise the board could be seriously damaged.

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4.2 Execution Tab for PRIME PHY Layer

This tab shows information about the frames received/transmitted while the test is being executed, and when the test finished it shows some summary information.

4.2.1 Transmission Test

Figure 4-3. Execution Tab for PRIME PHY Layer in Tx Test

elcome	Product Inform	ation Tr	ansmission Parameters	Tx Test Parameters	Configuration Summary	TestExecution	
							Copy Table
Frame #	Tx Result	RMS_Calc		Data		Tx Interval	^
89	Tx Succesful	3101	Microchip Technolog	yy Inc. The Embedded	Control Solutions Company	109	
90	Tx Succesful	3118	Microchip Technolog	y Inc. The Embedded	Control Solutions Company	109	
91	Tx Succesful	3098	Microchip Technolog	y Inc. The Embedded	Control Solutions Company	109	
92	Tx Succesful	3104	Microchip Technolog	y Inc. The Embedded	Control Solutions Company	110	
93	Tx Succesful	3125	Microchip Technolog	y Inc. The Embedded	Control Solutions Company	109	
94	Tx Succesful	3108	Microchip Technolog	yy Inc. The Embedded	Control Solutions Company	109	
95	Tx Succesful	3124	Microchip Technolog	yy Inc. The Embedded	Control Solutions Company	109	
96	Tx Succesful	3121	Microchip Technolog	y Inc. The Embedded	Control Solutions Company	109	
97	Tx Succesful	3103	Microchip Technolog	y Inc. The Embedded	Control Solutions Company	125	
98	Tx Succesful	3115	Microchip Technolog	y Inc. The Embedded	Control Solutions Company	94	
99	Tx Succesful	3108	Microchip Technolog	yy Inc. The Embedded	Control Solutions Company	109	-
100	Tx Succesful	3123	Microchip Technolog	jy Inc. The Embedded	Control Solutions Company	109	-
Total Phy Frames N Frames N Frames N Frames N Frames N Tx Frame N Modulatio Message Message Frame S Frame D Tx Mean Effective Effective Raw Bau	Layer Error lot Transmitt lot Transmitt lot Transmitt lot Transmitt lot Transmitt lot Transmitt lot Transmitt lot Transmitt lot Transmitt Pre: Type A / pre:	Frames: ed due to ed due to ed due to ed due to due to due to ced due to / PRIME v1 D8PSK echnology ytes 28 ms .04 ms ak): 2888 cal): 4696 36552 bp 5943 bps	0 Busy Tx: 0 Busy Channel: 0 Bad Len: 0 Bad Format: 0 Timeout: 0 	Control Solutions Co	npany		E
Channel	Usage : 16.20	6%					Cancel

While the test is executing, a row is added to the top of the table for every transmitted frame. The table contains four columns showing the following information:

- Frame #: Indicates the number of frame transmitted. It is useful to track the test progress
- Tx Result: Indicates the result of transmission. If an error occurs, a descriptive text will appear
- RMS_Calc: This number is related with the impedance detected in the Power Line; it is used by the PHY layer to determine the Transmission mode
- Data: Shows the message received in ASCII format
- Tx Interval: Represents measured time between the current frame and the previous one

After all frames have been transmitted, a text box with information about the test will appear at the bottom of the tab. First of all, information about starting and ending time is shown. This information is measured by the PC application.

After that, there is a section called Frame Error information that shows information about transmitted frames and possible errors. Finally, another section shows a summary of the transmission test - this contains information such as modulation scheme, message length, and other fields with the following meaning:

• Frame Duration: Is the duration of the frame in milliseconds calculated as:

(Frame Symbols x2.21) + chirp duration(ms)

- Tx mean Interval: Is the average interval between transmissions calculated from top table data
- Effective Baudrate (Peak): Is the effective baudrate if frames were transmitted consecutively, calculated as following:

Message length in Bytes x8 Frame Duration

• Effective Baudrate (Real): Is the effective baudrate, calculated as following:

Message length in Bytes x8 Tx mean interval

• Raw Baudrate (Peak): Is the baudrate taking into account all headers that previous baudrates have not considered if frames were transmitted consecutively, calculated as following:

All bits transmitted Frame Duration

• Raw Baudrate (Real): Is the baudrate taking into account all headers that previous baudrates have not considered, calculated as following:

All bits transmitted Tx mean interval

• Channel Usage : Is the percentage of channel that has been used, calculated as this:

Frame Duration Tx mean interval

4.2.2 Reception Test

Figure 4-4. Signal Quality Information for Reception Test for PRIME PHY Layer

Alcome Deduct Information Decombing Decombing Dy Test Decompany Configuration Summary TestFixed tion							
auone rioouculanonnauon keepuon varantieteis kui iest varantieteis Connigurauon sunniary restexecuuon							
						Copy Table	
Frame #	Frame Type	Mod. Scheme	RSSI (dBuV)	SNR (dB)	EVM (db)	Data	
89	TYPE A	DBPSK	113	21.00	-18.00	Microchip Technology Inc. The Embedded Control Solutions Co	
90	TYPE A	DBPSK	113	21.25	-18.25	Microchip Technology Inc. The Embedded Control Solutions Co	
91	TYPE A	DBPSK	113	21.00	-18.00	Microchip Technology Inc. The Embedded Control Solutions Co	
92	TYPE A	DBPSK	113	21.00	-18.00	Microchip Technology Inc. The Embedded Control Solutions Co	
93	TYPE A	DBPSK	113	21.25	-18.25	Microchip Technology Inc. The Embedded Control Solutions Co	
94	TYPE A	DBPSK	113	21.00	-18.00	Microchip Technology Inc. The Embedded Control Solutions Co	
95	TYPE A	DBPSK	113	20.75	-17.75	Microchip Technology Inc. The Embedded Control Solutions Co	
96	TYPE A	DBPSK	113	21.00	-18.00	Microchip Technology Inc. The Embedded Control Solutions Co	
97	TYPE A	DBPSK	113	20.75	-17.75	Microchip Technology Inc. The Embedded Control Solutions Cc	
98	TYPE A	DBPSK	113	20.75	-17.75	Microchip Technology Inc. The Embedded Control Solutions Co	
99	TYPE A	DBPSK	113	21.25	-18.25	Microchip Technology Inc. The Embedded Control Solutions Co	
Initial Time : 21.02.2018 10:55:01.469 Final Time : 21.02.2018 10:55:01.469 Total Frames Received : 99 Total Frames Bad Header CRC : 0 Total Frames Bad Header LEN : 0 Total Frames Bad Payload : 99 Total Frames Received OK : 0							
Cancel							

While the test is running, a row is added to the top of the table with information about the frame currently received. The columns contain the following information:

- Frame #: Indicates the number of frame transmitted. It is useful to track the test progress
- Frame Type: Indicates the format of the frame received
- Mod. Scheme: Indicates the modulation scheme of the frame
- RSSI (dBuV): Indicates the strength of the signal received in dBuV
- SNR (dB): Signal-to-Noise Ratio calculated as PRIME 1.4 Spec
- EVM (dB): Error Vector Magnitude calculated as PRIME 1.4 Spec
- Data: Received message in ASCII format
- Rx Interval: Interval of time between the reception of the current frame and the previous one
- · Payload Integrity: Shows if the content of the frame is correct or not

After all frames have been received, or the test has been cancelled, a text box with information about the test will appear at the bottom of the tab. First of all, information about starting and ending time is shown. This information is measured by the PC application. After that, there is a section called Frame Error

information that shows information about received frames and possible errors. Fields shown in this section are:

- Total Frames Received: Shows the number of frames detected, not taking into account if the frame has errors
- Total Frames Bad Header CRC: Shows the number of frames in which the header CRC8 is not valid. These frames are discarded by the hardware and are not reported in the application
- Total Frames Bad Header LEN: Shows the number of frames in which the header LEN field is not correct. These frames are discarded by the hardware and are not reported in the application
- Total Frames Bad Payload: Shows the number of frames where the content of the payload is not what it is supposed to be
- Total Frames Received OK: Shows the number of frames received with the correct content

4.3 Tx/Rx Parameters for G3-PLC PHY Layer

4.3.1 Transmission Parameters for G3-PLC PHY Layer

Figure 4-5. Transmission Parameters Tab for G3-PLC PHY Layer

Micro	ochip PLC PHY T	ester Tool v3.0.0				
Welco	me Product I	nformation Transmiss	ion Parameters Tx Test Para	ameters Confi	guration Summary TestExecution	
	Description This tab allow	v to configure all necessar	y parameters in order to make a	a transmission		
	Transmission Pa	arameters				
		Modulation Scheme:	Differential 🔻	Tx Power:	Full_Gain	
		Modulation Scheme	BPSK 👻		SubBand Idx SubBand Power	
		Tone Map:	0x3f	Preemphasis:	0 テ Full_Gain 🔻	
		Transmission Mode:	Perform EVM and SNR Test:			
	Tone Mask					
	Nor	ne Fault				
	 Cus 	stom:		[Lov	ver frequency Higher Frequency]	
	-					
	MICR	OCHIP			<< Prev	Next >>

This tab allows the user to configure all parameters related with the transmission of G3-PLC PHY frames. Configurable parameters are the following:

- Modulation Scheme: Allows configuration of differential or coherent modulation scheme
- Modulation Type: Allows selection between BPSK, QPSK, 8PSK and robust BPSK
- Tone Map: Allows disabling sub-bands (groups of tones), and the format depends on the selected bandplan. Each band is activated or deactivated setting to '1' or '0' the corresponding bit in the hex array. The different sub-bands are ordered in the hex array from least significant bit (lower frequency sub-band) to most significant bit (higher frequency sub-band). For example, in CENELEC-A bandplan (6 sub-bands) 0x01 represent a tone map where only the lower sub-band is active, as well as 0x20 is the tone map corresponding to a tone map where only higher sub-band is active

- Reed Solomon 2nd Block: Only available for FCC bandplan, it allows to introduce a second RS block as defined in the G3-PLC specification
- Tx Power: Allows to decrease the transmission power in 3dB steps
- Pre-emphasis: Allows to decrease the transmission power in steps of 3 dB to each sub-band
- Transmission Mode: Configures the output stage depending on the line impedance seen by the board
- Tone-Mask: it allows to suppress the energy of carriers as defined in the G3-PLC specification. An array of booleans is used to define the tone mask. The array length depends on the bandplan: (CENELEC-A = 36; FCC = 72; ARIB = 54), 1 means carrier disabled and 0 means carrier enabled.
- Perform EVM and SNR Test: Selecting this option changes the message and interval of transmission in order to make a test that evaluates the PHY layer performance. For more information check application note *"Guidelines for PLC Performance Verification"*

4.3.2 Reception Parameters for G3-PLC PHY Layer

Figure 4-6. Reception Parameters Tab for G3-PLC PHY Layer

lcome	Product Information	Reception Parameters	Rx Test Parameters	Configuration Summary	TestExecution		
_D	escription						
Ţ	his tab allow to configure	the channel in which board	l is going to receive the m	essages. This is the only cor	figuration needed by t	he PHY	
la	iyer in order to receive m	essages.					
Tonal No	pise Adaptation						
A	utomatic Configuration		Manual Configuration	n			
Interv	val (ms): 60000	Set	Search and Adapt to	Noise Disable N	oise Filtering		
Delay Noise capture after correct reception							
	Perf	orm EVM and SNR Test:					
ToneMa	sk						
	None						
	Default						
	Custom:			[Lower frequency H	igher Frequency]		
	MICROCHIE)			<< Prev	Next >>	

This tab allows the user to configure all parameters related with the reception of frames. Configurable parameters are as follows:

- Tone-Mask: it allows to suppress the energy of carriers as G3-PLC specification defines. An array of booleans is used to define the tone mask. The length of array depends on bandplan: (CENELEC-A = 36; FCC = 72; ARIB = 54), 1 means carrier disabled and 0 means carrier enabled. It is important to configure the same value for Tone-Mask both in transmission board as well as in reception board, otherwise communication will fail
- Tonal Noise Adaptation: The PHY layer is able to detect tonal noise and configure some input filters in order to cancel this noise. The user can select:
 - Automatic Configuration: Hardware is performing noise captures every fixed interval (configurable, see "G3-PLC FW Manual"). After each capture the hardware selects the proper filtering for the detected noise (if any). User can configure to only perform the noise captures

when hardware is not receiving (only available for ATPL250A/SAM4CP16C platforms). This option is activated by means of the "Delay Noise capture after correct reception" check box.

- Manual Configuration: In this mode the hardware only performs noise analysis when the user presses "Search and Adapt to Noise". The user can also configure the hardware to configure notch filter to certain frequency by means of the "Adapt to Target Frequency". Finally the user can disable noise adaptation using the "Disable Noise Filtering" option
- The "Perform EVM and SNR Test" option changes message and interval of reception in order to make a test that evaluates the PHY layer performance. In test execution tab some extra columns are added in order to obtain more information about performance of the PHY layer. For more information check application note *"Guidelines for PLC Performance Verification"*

4.4 Execution Tab for G3-PLC PHY Layer

4.4.1 Transmission Test

Figure 4-7. Execution Tab for G3-PLC PHY Layer in Tx Test

						Сору Т	able
Frame #	Tx Result	RMS_Calc	Modulation Type	Modulation Scheme	Tone Map	Data	-
90	Tx Succesful	119881823	BPSK	MOD_SCHEME_DIFFERENTIAL	0x3f	Microchip Technology Inc. The Embed	dei
91	Tx Succesful	119269438	BPSK	MOD_SCHEME_DIFFERENTIAL	0x3f	Microchip Technology Inc. The Embed	dei
92	Tx Succesful	119468475	BPSK	MOD_SCHEME_DIFFERENTIAL	0x3f	Microchip Technology Inc. The Embed	dei
93	Tx Succesful	118995604	BPSK	MOD_SCHEME_DIFFERENTIAL	0x3f	Microchip Technology Inc. The Embed	dei
94	Tx Succesful	119727984	BPSK	MOD_SCHEME_DIFFERENTIAL	0x3f	Microchip Technology Inc. The Embed	dei
95	Tx Succesful	119111225	BPSK	MOD_SCHEME_DIFFERENTIAL	0x3f	Microchip Technology Inc. The Embed	dei
96	Tx Succesful	119609059	BPSK	MOD_SCHEME_DIFFERENTIAL	0x3f	Microchip Technology Inc. The Embed	dei
97	Tx Succesful	119460867	BPSK	MOD_SCHEME_DIFFERENTIAL	0x3f	Microchip Technology Inc. The Embed	dei
98	Tx Succesful	118865049	BPSK	MOD_SCHEME_DIFFERENTIAL	0x3f	Microchip Technology Inc. The Embed	dei
99	Tx Succesful	118972720	BPSK	MOD_SCHEME_DIFFERENTIAL	0x3f	Microchip Technology Inc. The Embed	dei
100	Tx Succesful	120022524	BPSK	MOD_SCHEME_DIFFERENTIAL	0x3f	Microchip Technology Inc. The Embed	de
Total Bytes Transmitted: 7300 Phy Layer Error Frames: 0 Frames Not Transmitted due to Busy Tx: 0 Frames Not Transmitted due to Busy Channel : 0 Frames Not Transmitted due to Busy Channel : 0 Frames Not Transmitted due to Basy Channel : 0 Frames Not Transmitted due to Basy Channel : 0 Frames Not Transmitted due to Basy Channel : 0 Frames Not Transmitted due to Basy Channel : 0 Frames Not Transmitted due to Basy Channel : 0 Frames Not Transmitted due to Basy Channel : 0 Frames Not Transmitted due to Basy Channel : 0 Frames Not Transmitted due to Basy Channel : 0 Frame Not Transmitted due to Basy Channel : 0 Frame Symbols: 53 Frame Duration: 42.915 ms Tx Mean Interval: 108.16 ms Effective Baudrate (Peak): 11931 bps Effective Baudrate (Peak): 4734 bps							
Raw Baudrate (Peak): 44460 bps Raw Baudrate (Real): 17640 bps Channel Usage : 39.68%							

There are eight columns that show the following information:

- Frame #: Indicates the number of frames transmitted. It is useful to track the test progress
- Tx Result: Indicates the result of the transmission. If an error occurs, a descriptive text will appear
- RMS_Calc: This number is related with the impedance detected in the power line; it is used by the PHY layer to determine the transmission mode.
- Modulation Scheme: Indicates if modulation scheme is differential or coherent
- Modulation Type: Indicates the type of modulation: BPSK, QPSK, 8PSK or BPSK_ROBO
- Tone Map: Indicates active sub-bands in the frame
- Data: Shows the message received in ASCII format
- Tx Interval: Represents the time interval between the current frame and the previous one

After all frames have been transmitted, a text box with information about the test will appear at the bottom of the tab.

Test timestamps are provided; this information is measured by the PC application. After that, there is a section of information called Frame Error information that shows information about transmitted frames and possible errors. Finally, another section shows a summary of the transmission test; apart from known transmission parameters other parameters are shown:

- Frame Duration: Is the duration in millisecond of the frame
- Tx Mean Interval: Is the average interval between transmissions calculated from top table data
- Effective Baudrate (Peak): Is the effective baudrate if frames were transmitted consecutively, calculated as follows:

Message length in Bytes x8 Frame Duration

• Effective Baudrate (Real): Is the effective baudrate, calculated as follows:

Message length in Bytes x8 Tx mean interval

• Raw Baudrate (Peak): Is the baudrate taking into account all headers and redundancies:

Num Symbols FCH*Carriers FCH*Bits per carrier FCH + Num Symbols Payload*Carriers Payload*Bits per carrier Payload Frame Duration

• Raw Baudrate (Real): Is the baudrate taking into account all headers and redundancies, calculated as follows:

Num Symbols FCH*Carriers FCH*Bits per carrier FCH + Num Symbols Payload*Carriers Payload*Bits per carrier Payload Tx mean interval

• Channel Usage : Is the percentage of channel that has been used, calculated as follows:

Frame Duration Tx mean interval

4.4.2 Reception Test

Figure 4-8. Execution Tab for G3-PLC PHY Layer Rx Test

elcome	Product Information	Reception Parameters Rx	Test Paramet	ters Configu	uration Summary TestEx	ecution		
						Copy Tab		
Frame #	Modulation Type	Modulation Scheme	Tone Map	RSSI (dBuV)	Link Quality (LQI in dB)			
90	BPSK	MOD_SCHEME_DIFFERENTIAL	0x3f	42.20	10.75	Microchip Technology Inc.		
91	BPSK	MOD_SCHEME_DIFFERENTIAL	0x3f	41.84	11.00	Microchip Technology Inc.		
92	BPSK	MOD_SCHEME_DIFFERENTIAL	0x3f	42.01	11.00	Microchip Technology Inc.		
93	BPSK	MOD_SCHEME_DIFFERENTIAL	0x3f	42.10	10.50	Microchip Technology Inc.		
94	BPSK	MOD_SCHEME_DIFFERENTIAL	0x3f	41.84	10.75	Microchip Technology Inc.		
95	BPSK	MOD_SCHEME_DIFFERENTIAL	0x3f	41.92	11.00	Microchip Technology Inc.		
96	BPSK	MOD_SCHEME_DIFFERENTIAL	0x3f	42.06	11.00	Microchip Technology Inc.		
97	BPSK	MOD_SCHEME_DIFFERENTIAL	0x3f	42.17	11.00	Microchip Technology Inc.		
98	BPSK	MOD_SCHEME_DIFFERENTIAL	0x3f	42.06	11.00	Microchip Technology Inc.		
99	BPSK	MOD_SCHEME_DIFFERENTIAL	0x3f	41.94	10.75	Microchip Technology Inc.		
100	BPSK	MOD_SCHEME_DIFFERENTIAL	0x3f	41.84	10.75	Microchip Technology Inc.		
Total Frames Received with Bad FCH CRC: 0 Total Frames Received OK : 100								
Cancel								

Information included in the table is as follows:

- Frame #: Indicates the received frame number
- Modulation Type: Indicates the type of modulation: BPSK, QPSK, 8PSK or BPSK_ROBO
- · Modulation Scheme: Indicates if modulation scheme is differential or coherent
- Tone Map: Indicates active sub-bands in the frame
- RSSI (dBuV): Indicates the strength of the received signal in dBuV
- LQI (dB): Link Quality Indicator (See G3-PLC specification for more information)
- Data: Is the received info in ASCII format
- Rx Interval: Is the interval of time between the reception of the current frame and the previous one
- Payload Integrity: Shows if the content of the frame is correct or not

After all frames have been received, or the test has been cancelled, a text box with information about the test will be shown at the bottom of the tab. First of all, test timestamps are shown; this information is measured by the PC application. After that, there is a section called Frame Error information that shows information about received frames and possible errors. Fields shown in this section are:

- Total Frames Received: Shows the number of frames detected, not taking into account if the frame has errors
- Total Frames Bad FCH CRC: Shows the number of frames in which the header CRC is not valid. These frames are discarded by the firmware and are not reported in the application
- Total Frames Bad RS LEN: Frames that RS block is not able to correct are discarded by the firmware
- Total Exception Errors: Other kinds of errors in the reception chain
- Total Frames Bad Payload: Shows the number of frames where the content of the payload is not what it is supposed to be
- Total Frames Received OK: Shows the number of frames received with the correct content

5. Revision History

5.1 Atmel Rev A - 04/2014

Note: Rev A-F (2014-2015) reference Atmel document number 43057. This document was updated to the Microchip format, with document number DS50002734 in March 2018 starting with Microchip Rev A.

Document	Initial document release of Atmel document
	number 43057.

5.2 Rev B - 10/2014

Document Added support for ATPL250A

5.3 Rev C - 12/2014

Document	Added support for EVM test in PRIME and Tonal
	Noise Adaptation for G3

5.4 Rev D - 02/2015

Document	Improved Tonal Noise for ATPL250/SAM4CP16C
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5.5 Rev E - 02/2015

Document	Improved file format
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5.6 Rev F - 10/2015

Added support for 65 EVM and SNR test	Document	Added support for G3 EVM and SNR test
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5.7 Microchip Rev A - 03/2018

Document	Updated to Microchip format with new document
	number DS50002734 and added references to
	PL360 (G3)

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