Dolphin PCI Express PXH812

Adapter card user's guide

Version 1.19

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Table of Contents

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LIFE SUPPORT POLICY

DOLPHIN INTERCONNECT SOLUTIONS' PRODUCTS ARE NOT AUTHORIZED FOR USE AS CRITICAL COMPONENTS IN LIFE SUPPORT DEVICES.

ENVIRONMENTAL POLICY

Dolphin is minimizing the amount of printed documentation and software CDs in its shipments; please download additional documentation and software from www.dolphinics.com/px.

Quick Install Guide

The PXH812 card is shipped in an anti-static bag to prevent static electricity damage. The card should only be removed from the bag after ensuring that anti-static precautions are taken.
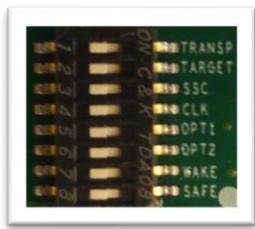
The PXH812 card can be installed in any PCI Express compliant x8 or x16, Gen1, Gen2 or Gen3 slot. Electrically, the PXH812 supports PCIe Gen1, Gen2 and Gen3 speeds and x1, x2, x4 and x8 link-widths.

The card will operate at the highest common speed shared between the slot and the card (Gen3) and the widest common link-width (x8).

For best performance, we recommend a PCI Express Gen3 x8 or Gen3 x16 slot.

PXH812 Operating Modes

The Dolphin PCI Express PXH812 card is a transparent PCI Express Gen3 cable adapter card. The card supports both upstream host and downstream target operation. The operation is controlled by the TRANSP and TARGET DIP switches that can be found close to the upper edge of the board. The main configuration options are found in the table below. The shipping default is Transparent Host mode. To enable Transparent Target mode, DIP switch TARGET needs to be set. In Transparetn Target mode, the NTB-LED will be orange. For both modes, OPT2 can also be set to tune the card for long cables – this is typically required for 3-5m (10-16ft) copper cables.

DIP Switches

Configuration PXH812	DIP switch view	NTB LED Color
Transparent Host mode (shipping default)		Not lit
Transparent Target mode		Orange
Transparent Host mode (long-cable tuning)		Not lit
Transparent Target mode (long-cable tuning)		Orange

Table 1: PXH812 SW2 configuration settings
Actual settings depend on the functionality of the target device.

All other DIP switches should normally be left in the shipping default setting. More details on DIP switch settings can be found on page 11 in this document.

Cable Connections

The PXH812 requires an x8 iPass™ or PCI Express standard cable. A single x8 cable is used to connect to a PXH812 card in target mode, other compliant transparent I/O devices, or an IXS600 8 port switch in transparent mode.

To install the cable, match the x8 cable with the connector on the PXH812 board. Use even pressure to insert the connector until it is secure. Adhere to ESD guidelines when installing the cable to prevent damage to the board. The PXH812 supports both copper and active fiber cables. Copper cables up to 5 meters long and active fiber cables up to 100 meters long are supported at full Gen3 speed between PXH812 cards. Connectivity to other PCIe devices may require special tuning for copper cables longer than 2 meters.

Connecting to a x4 Device
An x8 to x4 transition cable can be used to connect the card to PCI Express equipment having an x4 iPass connector. Please contact Dolphin for more information.

Using the PXH812 with Optical Fibers
The PXH812 card is compliant with active fiber optic cables from Samtec. The fiber iPass houses are marked with Host or Target. The Host side should be connected to the card configured to be the upstream transparent host. The iPass house marked with Target should be connected to the downstream target adapter card.

Dolphin Software
Transparent mode (Host or Target operation) does not require any special software.

Overview

This document describes the Dolphin PCI Express PXH812 PCI Express Gen3 adapter cards.

The Dolphin Express IX and PX product family consists of the following compliant products:

- PXH810   PCI Express Gen3 x8 NTB iPass cable adapter card
- PXH812   PCI Express Gen3 x8 Host and Target Transparent iPass cable adapter card
- IXH610   PCI Express Gen2 x8 NTB Host iPass cable adapter card
- IXH611   PCI Express Gen2 x8 Host and Target iPass cable adapter card
- IXH620   XMC PCI Express Gen2 NTB Host and Target XMC iPass cable adapter card
- IXS600   PCI Express Gen3 iPass 8 port rack mount iPass cable switch
- IXC1M   1 meter PCIe Gen3 x8 iPass copper cable
- IXC2M   2 meter PCIe Gen3 x8 iPass copper cable
- IXC5M   5 meter PCIe Gen3 x8 iPass copper cable
- IXC7M   7 meter PCIe Gen2 x8 iPass copper cable
- IXC448-2M   2 meter x8 to x4 transition PCIe Gen3 iPass copper cable

The PXH812 adapter can be used to connect to any existing PCI Express compliant target device having a standard PCI Express x8 connector (PCI Express Gen 1 through Gen3, auto detect). The PXH812 can connect to the IXH620 XMC card for transparent operation.

Please note that the PXH812 adapter does not supports the Dolphin NTB Software. To utilize the Dolphin software, you need an NTB adapter like the PXH810, PXH830 or any of the IXH6xx adapters.

More information about the Dolphin PCI Express software can be found on the Dolphin website at.
http://www.dolphinics.com/software
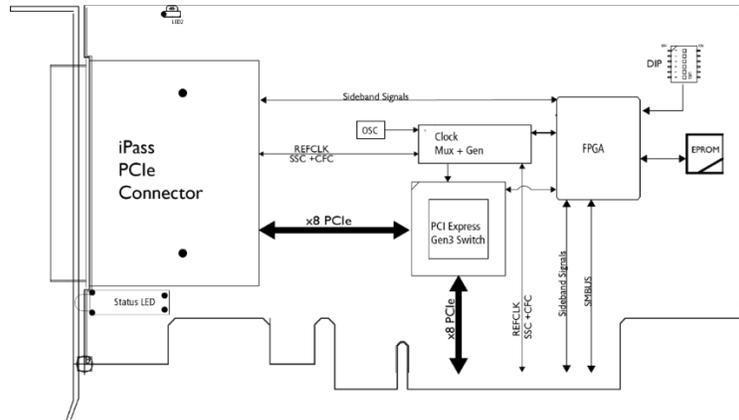
Dolphin Express Adapter Card - PXH812

Figure 1: PXH812 schematics

The PXH812 is a PCI Express Gen3 x8 adapter card available from Dolphin that provides a reliable transparent connection.

PXH812 High Level Specification

- PCI Express Gen3 8.0 GT/s per lane signaling – 64 GT/s total signaling.
- PCI Express Gen3 x8 edge connector. The card installs in any PCI Express slot that has a physical x8 or x16 connector.
- Compliant with PCI Express Gen1 through Gen3 computers and IO systems, auto detection.
- The PXH812 supports transparent connections to IO systems (host and target operation).
- PCI Express Base Specification Rev. 3.0.
- PCI Express External Cabling Specification, Rev. 1.0.
- One PCI Express Gen3 x8 iPass cable connection.
- PEX8717 PCI Express Gen3 chipset.
- 138 nanosecond cut-through latency port to port.
- Support for copper cables up to 5 meters (between PXH812 cards).
- Support for active optical fibers, up to 100 meters.
- Low Profile - PCI Express Electromechanical Specification, Rev. 2.0.
- Comes with both low profile and standard profile PCI Express bracket.
- Host clock isolation. Automatic support for host running CFC or SSC mode.
- Generates high quality, low jitter CFC CREFCLK.
- Quad 64 KB EEPROM for boot up configuration data.
- EEPROM recovery option.
- Optional software utility for reprogramming of EEPROM content.
- No PCI Express power domain isolation.
- Power Consumption: 12 Volt: Max 12 Watt, Typical 8 Watt.
- Operating temperature 0°C to 55°C.
- Relative Humidity 5% - 95% non-condensing.
- RoHS compliant.
- Compliant to EN-55022 (2010), EN 55024 (2010), EN 61000-6-2 (2005).
- CE
- FCC Class B

MTBF by Temperature and Environment

The MTBF (in hours) for the PXH812 can be found in the table below. The numbers are calculated using the Telcordia SR-332 issue 2 (2006) standard.

Ambient Temp [°C]	Environment		
	Ground fixed, controlled	Ground fixed, uncontrolled	Ground mobile
0	6.083.909	3.041.955	1.013.985
5	5.058.271	2.529.136	843.045
10	4.161.465	2.080.732	693.577
15	3.388.624	1.694.312	564.771
20	2.732.576	1.366.288	455.429
25	2.183.983	1.091.992	363.997
30	1.731.842	865.921	288.640
35	1.364.152	682.076	227.359
40	1.068.703	534.351	178.117
45	833.753	416.876	138.959
50	648.530	324.265	108.088
55	503.529	251.764	83.921
60	390.625	195.313	65.104

Table 1: MTBF vs. Temperature and Environment

LEDs

The card has two bi-color LEDs visible through the PCI Express front bracket.

| Name	Dark	Yellow	Green	Blinking
Link	Power off or failure	Power on, Link down	Power on, Link up in Gen3	Fast green/yellow: Link is at Gen2 Slow green/yellow: Link is at Gen1
NTB	Transparent mode	Transparent Target	NA	NA

Table 2: LED overview

The NTB link LED is controlled by software. An incorrect EEPROM can cause dark LEDs. DIP switch SAFE in position ON will cause all LEDs to be dark.

Use Cases

The PXH812 card may be used in the following use cases. The use cases are summarized in Table 3: Adapter Use Cases on page 12.
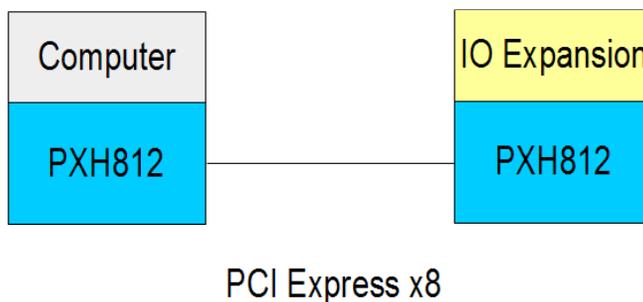
Use Case A: Transparent IO

The Dolphin PXH812 connects to any standardized PCI Express x8 target device. No special device driver is required for the PXH812 card. Any device in the PCI Express IO system will operate using its standard device driver. The PXH812 is configured in Target Host transparent mode.
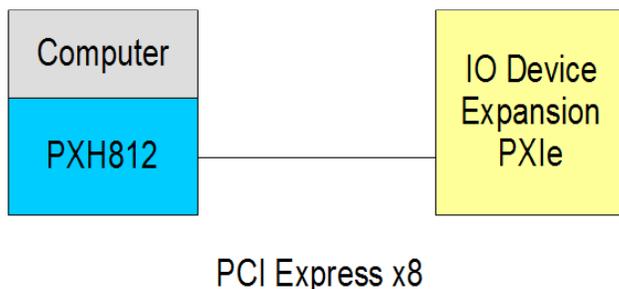
Use Case B – Transparent Downstream Target

The PXH812 adapter can be used as a downstream target adapter. The PXH812 in the expansion chassis operates in Transparent Target mode. The PXH812 in the computer operates in Transparent Host mode (Use Case A). The PXH812 card is compliant to the PCIe Target card specification and has been tested with several expansion boxes from Magma Inc. Please contact Dolphin for details.

Use Case C – Expansion Scale Out

Up to 7 IO devices or expansion chassis can be connected to a single host using a combination of the PXH812 and the IXS600 switch. The PXH812 in the PC operates in Transparent Host mode. The other PXH812 cards operate in Transparent Target mode.
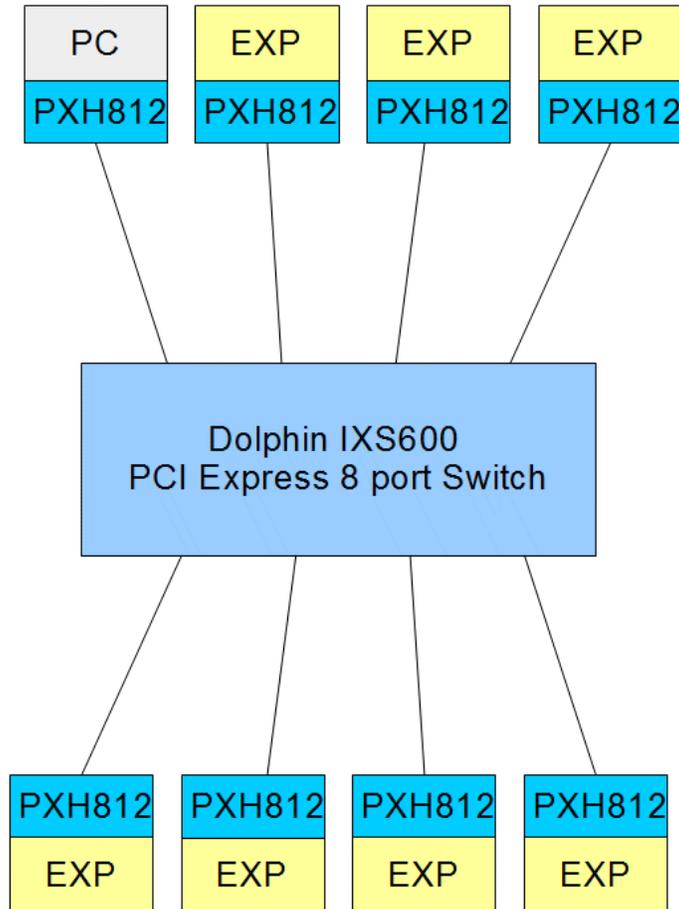
Configuration and DIP Switches

The PXH812 has one bank of 8 DIP switches. The default factory setting for the PXH812 is Transparent Host mode.
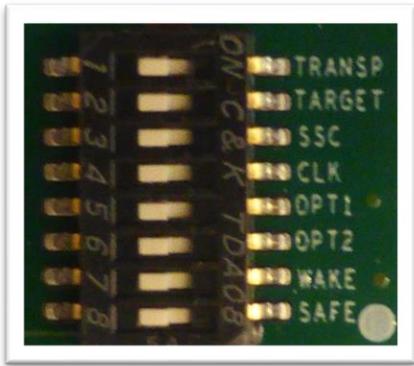
The PXH812 has DIP switches for setting special modes or operations. Please carefully read the documentation before modifying any DIP switch settings. Please pay careful attention to ON and OFF positions written on the DIP switch.

DIP Switch Bank – Configuration

The DIP switch on the PXH812 is used to configure the adapter card. Please leave all undocumented DIP switches in the default position.

Picture 1: DIP Switch

DIP no	Name	Description	ON	OFF	Default
1	TRANSP	PXH812: Should always be ON	PXH812 will operate in TRANSPARENT mode	PXH812: Reserved for future use	ON
2	TARGET	Enable Target or Host operation	Card operates in Target mode	Card operates in Host mode	OFF
3	SSC	TBD			OFF
4	CLK	TBD			OFF
5	OPT1	TBD			OFF
6	OPT2	Cable tuning	Recommended for 3-5 meter copper cables or fiber optics	Recommended for 0.5-2 meter copper cables or fiber optics	OFF
7	WAKE	TBD			OFF
8	SAFE	Enables the card to boot with a corrupted EEPROM			OFF

Note: Some DIP switch configuration options may be removed in the future versions. Please always consult the user guide for details.

Use Cases Summary and Settings

The table below gives an overview of the various use cases, settings, and limitations.

Use case	Description	NTB	DIP switch setting	Clock source	Cable pull	Power sequence requirements	Software/Driver
A	PXH812 in transparent Host mode connects to downstream IO	no	TRANSP ON TARGET OFF	Adapter card drives CREFCLK	Not supported by legacy device drivers	IO system must power on first	No driver required for PXH812 card. Legacy drivers for IO Devices
B	PXH812 in transparent Target mode	no	TRANSP ON TARGET ON	Adapter card receives clock from PCI Express cable. PXH812 will provide REFCLK on edge connector	Not supported by legacy device drivers	IO system must power on first	No driver required for PXH812 card. Legacy drivers for IO Devices
C	IXS600 switch used to create a scale out expansion network. Up to 7 systems connected to one Host	no	Set as specified for use case A and B	IXS600 receives clock from upstream PXH812 and generates clock to downstream PXH812	Not supported by legacy device drivers	IO system must power on first	No driver required for PXH812 card. Legacy drivers for IO Devices

Table 3: Adapter Use Cases

Installation

Static electricity from your clothes or work environment can damage your PCI Express adapter card or your PC. Always wear a grounded anti-static wrist strap while opening the PC and when the PXH812 is removed from the anti-static bag.

Changing the PCI Express Bracket

The PXH812 package includes both a standard and a low-profile PCI Express bracket. By default, the standard height bracket is installed on the board. If you need to replace the mounted bracket with a low-profile bracket, carefully unscrew the two mounting screws to remove the full height bracket. Save the two mounting screws and replace the bracket with the low-profile bracket. Use the two mounting screws to install the low-profile bracket. The screws should be carefully tightened but be careful not to over-tighten. Make sure you are properly grounded to avoid static discharges while performing this procedure.

Installing the Adapter Card

Before installing the adapter card, make sure you are properly grounded to avoid static discharges that may destroy your computer or the adapter card. Ensure you are properly grounded before opening your computer or the anti-static bag containing the PXH812. Please follow your computer's manual on how to install a PCI Express card.

The PXH812 Adapter card can be installed into any PCI Express x8 or x16 slot. The PXH812 supports PCI Express Gen1, Gen2 and Gen3 signaling. *NOTE: A Gen3 slot is recommended as it typically doubles the performance compared to a Gen2 slot.* The PXH812 is a x8 card, so no additional performance can be obtained using a x16 slot.

The PXH812 supports hosts using either spread spectrum or constant frequency clocking. The card implements clock isolation and will provide a high-quality CFC CREFCLK signal on the cable.

Installing and Removing the Cable

The PXH812 supports PCI Express x8 Gen3 cables. Installing and removing cables should be done with both upstream and downstream devices powered off. Standard PCI Express cables are not designed for a high number of installations and removals. Please contact your Dolphin representative if you intend to continuously connect and disconnect the PCI Express cables.

Connecting the Cable

Please carefully install the PCI Express cable connector into the connector housing on the PXH812 adapter card or IXS600 Switch box. Computer cables should always use strain relief to protect the connected equipment from excessive force on the cable. This is especially important for cables between racks.

Disconnecting the Cable

Please carefully pull back the thumb tab to release the cable from the connector house, and then pull back the cable.

EEPROM Programming

Dolphin may, from time to time, publish updated firmware. Current firmware is normally included in the Dolphin software distribution and published on www.dolphinics.com/px. Please consult the software documentation for information on firmware upgrades or contact Dolphin support if assistance is required.

Identifying the Card

The card has a label-sticker with the serial number in the format 'PXH812-YY-ZZZZZZ', where, YY denotes the card revision (*e.g. CC*) and ZZZZZZ denotes the serialized production number (*e.g. 012345*).

You can get this information from the card, using lspci in Linux:

First run lspci, and identify the card. It will show up like this:

```
01:00.0 PCI bridge: PLX Technology, Inc. PEX 8717 16-lane, 8-Port PCI Express Gen 3
(8.0 GT/s) Switch with DMA (rev ca)
01:00.1 System peripheral: PLX Technology, Inc. Device 87d0 (rev ca)
01:00.2 System peripheral: PLX Technology, Inc. Device 87d0 (rev ca)
02:00.0 PCI bridge: PLX Technology, Inc. PEX 8717 16-lane, 8-Port PCI Express Gen 3
(8.0 GT/s) Switch with DMA (rev ca)
03:00.0 Bridge: PLX Technology, Inc. PEX 8732 32-lane, 8-Port PCI Express Gen 3
(8.0 GT/s) Switch (rev ca)
```

Second, do an lspci –vvvv –s <device>, and look for the 'Serial' –string
```
# lspci -s 01:00.0 -vvv | grep Serial
        Capabilities: [180 v1] Device Serial Number 00-00-44-45-00-00-05-48
```

This shows the card as revision 0x4445 (*hexadecimal values of the 'DE' letters in the ASCII table*), with the production number 0x00000548 (*001352 in decimal*).

In Windows, we export the serial number through the event-log where the transparent-mode driver is loaded (v 1.0.1 or later required). This driver is available through the download section at http://www.dolphinics.com/px

PS C:\> Get-EventLog System -Source PXH_T -Newest 1

```
  Index Time          EntryType   Source InstanceID Message
  ----- ----          ---------   ------ ---------- -------
  34206 Oct 25 23:02  Information PXH_T 1074069505 Serial number is PXH812-CC-000101.
```

Support
More information about the product, support and software download can be found at http://www.dolphinics.com/px.

For general support questions, please contact Dolphin via the Jira Service Management portal: https://www.dolphinics.com/csp.

Technical information

PCI-Express 8x Finger Connector Pin-Out

The PXH812 Edge connector follows PCI Express CEM Specification, Rev. 3.0 section 6 – Card Connector Specification. In host mode, the PXH812 is PCIe SIG compliant. In target mode, the following signals are configured as outputs from the edge connector:

- REFCLK+/REFCLK-, 100 MHz HCSL constant clock
- PERST#, open drain, pulled high to +3.3V through 1kOhm

PCIe iPass Cable Connector Pin-Out

The PXH812 Edge connector follows PCI Express External Cabling Specification, Rev. 2.0

Cable Sideband signals

The PXH812 will generate a high precision CFC 100 MHz reference clock on the cable if the device on the other side of the cable signals CPRESNT#

The PXH812 will signal CPRESNT# if the TARGET DIP is set. For normal NTB use, the TARGET DIP only needs to be set if fiber cables are used.

Compliance and Regulatory Testing

EMC Compliance

The Dolphin PCI Express PXH812 adapter has been tested to the following relevant test standards for PCI Express cards, telecommunication and industry equipment installed in a standard PC:

EN 55022 (2010), Class B
EN 55024 (2010), Class A
EN 61000-6-2 (2005)

This does not ensure that it will comply with these standards in any random PC. It is the responsibility of the integrator to ensure that their products are compliant with all regulations where their product will be used.

RoHS Compliance

The Dolphin PXH812 is RoHS compliant. A Compliance certificate issued by the manufacturer is available upon request.

FCC Class B

This equipment has been tested and found to comply with the limits for a Class B digital device, pursuant to part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference in a residential installation. This equipment generates, uses and can radiate radio frequency energy and, if not installed and used in accordance with the instructions, may cause harmful interference to radio communications. However, there is no guarantee that interference will not occur in a particular installation. If this equipment does cause harmful interference to radio or television reception, which can be determined by turning the equipment off and on, the user is encouraged to try to correct the interference by one or more of the following measures:
- Reorient or relocate the receiving antenna.
- Increase the separation between the equipment and receiver.
- Connect the equipment into an outlet on a circuit different from that to which the receiver is connected.
- Consult the dealer or an experienced radio/TV technician for help.

Limited Warranty

Dolphin Interconnect Solutions warrants this product to be free from manufacturing defects under the following terms:

Warranty Period

The warranty applies for one (1) year from the date of purchase. Extended warranty is available.

Coverage

To the extent permitted by applicable law, this warranty does not apply to:

- Damage caused by operator error or non-compliance with instructions available for the product.
- Use or attempt to use or program firmware not approved by Dolphin.
- Damage due to accidents, abuse, misuse, improper handling or installation, moisture, corrosive environments, high voltage surges, shipping, or abnormal working conditions.
- Damage caused by acts of nature, e.g. floods, storms, fire, or earthquakes.
- Damage caused by any power source out of range or not provided with the product.
- Normal wear and tear.
- Attempts to repair, modify, open, or upgrade the product by personnel or agents not authorized by Dolphin.
- Products for which the serial number label has been tampered with or removed.
- Damage to the product caused by products not supplied by Dolphin.

Service Procedure

In the event that the product proves defective during the Warranty Period, you should contact the seller that supplied you with the product, or if you purchased it directly from Dolphin, visit https://www.dolphinics.com/csp to obtain a valid RMA number and instructions. Products returned to Dolphin without a proper RMA number will not be serviced under this warranty.

Limitations

TO THE FULLEST EXTENT PERMITTED BY LAW, DOLPHIN WILL NOT BE LIABLE FOR ANY INDIRECT, INCIDENTAL, SPECIAL OR CONSEQUENTIAL DAMAGES (INCLUDING LOST PROFITS, LOST DATA, OR LOSS OF USE) ARISING OUT OF ANY USE OF DOLPHIN'S PRODUCTS, SOFTWARE OR SERVICE PROVIDED. DOLPHIN'S MAXIMUM LIABILITY WILL NOT EXCEED THE TOTAL AMOUNT PAID FOR THE PRODUCT BY THE PURCHASER.