



# HPQI-2 QAM Pilot Generator Users Guide

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This document details how to setup and configure the Arcom Digital HPQI-2 Headend QAM Pilot Generator

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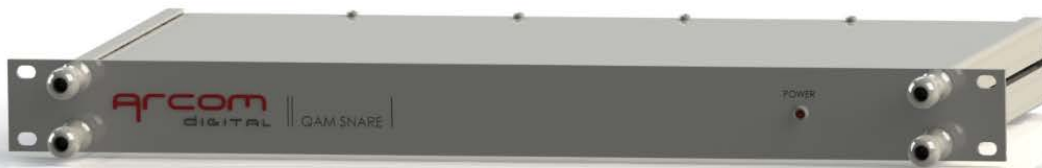
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## Overview

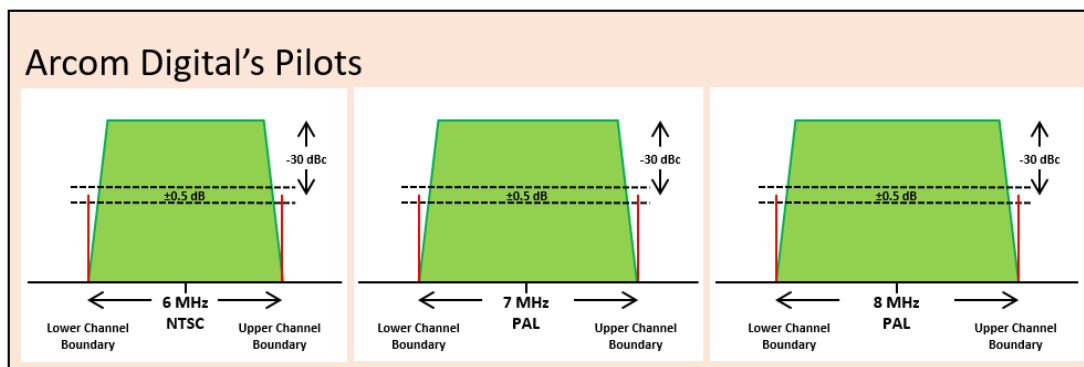
The rapid implementation of Remote-PHY Devices presents a challenge to the Arcom QAM Snare Leakage Detection when there are no QAM samples available for the detector to correlate. This can be easily overcome by programming the RPD to insert pilots in the guard bands surrounding a QAM channel. However, this presents new challenges to QAM Snare Server hub arrangements, that will require continuous boundary and global channel adjustments as new R-PHY Devices are activated.



The Arcom HPQI-2 QAM Pilot Generator is a headend device packaged in a 1 /U chassis that inserts QAM pilots in one or two bands. Installed in legacy hubs, the QAM Pilot Generator will allow for seamless leakage detection as RPD nodes begin to break up larger legacy hubs without a need to continuously update hub boundaries.

## The Arcom QAM Pilots

The Arcom Pilot/QAM detection feature is used to create a leakage test signal comprised of a pair of low-level CW carriers separated by 6 MHz, with one of the carriers injected at the channel boundary on the lower edge of a Single Carrier QAM (SC-QAM) signal, and the second CW carrier injected at the channel boundary on the upper edge of the same SC-QAM signal. The Pilot/QAM carriers, or “QAM Pilots”, are typically -30 dBc (QAM), and are precisely placed at the QAM band edge,  $\pm 5$  kHz for both NTSC and PAL standards.





Arcom Pilot/QAM “Tagging” is accomplished by the accuracy of the pilot carriers. Carrier frequency tolerance is  $\pm 5$  ppm, and separation tolerance is  $\pm 50$  Hz. Anything outside those limits will not be detected. This speaks for the accuracy of the HPQI-2 and protects against the confusion of overbuilds.

## Back Panel Illustrations

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110 - 240 VAC, 50/50 Hz

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-48 VDC

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## Installation

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Install the Arcom HPQI-2 QAM Pilot Generator in an equipment rack that is close to a system combiner input. Connect power, ground, and a coaxial connection between the HPQI-2 RF output port and a system combiner input.

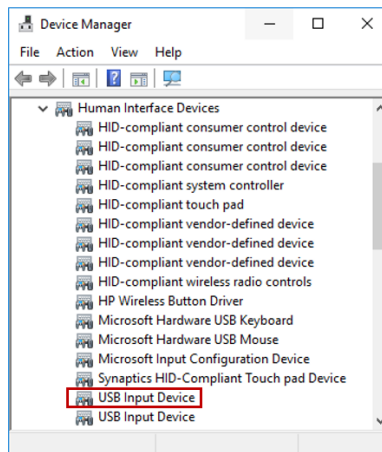
## PilotGenerator.exe

PilotGenerator.exe is a windows compatible app used for setting the Pilot Generator Operating Parameters. The latest revision can be found on the Arcom Digital Website Resources page at <https://www.arcomdigital.com/resources-info/>.

PilotGenerator.exe is an independent application that can be run in any authorized Windows folder.

## Connect a USB cable and Driver Installation.

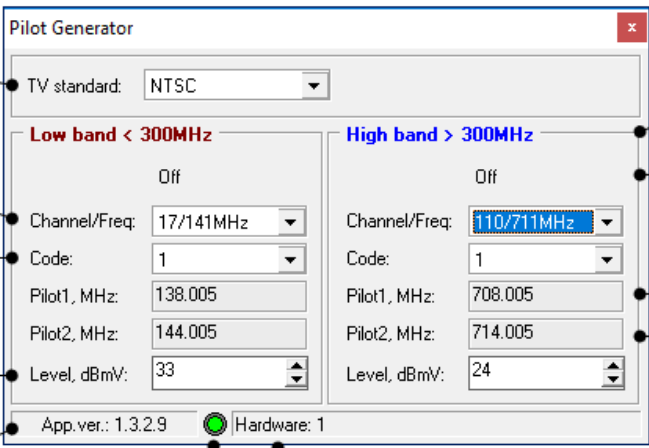
With power applied to your HPQI-2, connect a USB cable between the HPQI-2 and your PC and wait for the drivers to install. The Pilot Generator uses standard Human Interface Device (HID) drivers – no special drivers need to be installed. The Device Manager Entry should list as “USB Input Device”



## The PilotGenerator.exe Control Panel

Launch PilotGenerator.exe after the driver has installed. The Pilot Generator control panel will appear. The control panel shows the current state of the QAM Pilot Generator.

**If a pilot in either band is ON, then please turn them OFF at this time.**



**TV Standard:** Choose the desired TV Standard, NTSC, PAL-B/G, or PAL-D/K.

**Channel/Freq:** Pull-Down selection of the pilot channel.

**Detection Code:** Pull-Down selection of the pilot frequency detection code.

**Output Level:** Selects the RF Output Level in 0.5 dB steps.

**App ver.:** PilotGenerator.exe software revision number.

**LED:** Pilot Generator USB connection indicator, Green is connected. Red is not connected.

**Hardware Revision:** Displays the Pilot Generator Firmware Revision number.

**High and Low Bands:** One control Panel for each band.

**On/Off Button:** Turns the pilot carriers ON or OFF in each band.

**Pilot Frequencies:** Shows the actual pilot frequencies per the Channel/Freq and Detection Code selections.

## The Low and High Bands

Each Pilot Generator can output up to two sets of QAM Pilots. One set of pilots in the 120 MHz to 300 MHz (Low) band, and a second set of pilots in the 300 MHz to 1100 MHz (High) band.

## The On/Off Button

Each band has one On/Off button to enable or disable the RF output for that band.

## The Leakage Detection Code

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To simplify the setup of specific pilot frequencies, PilotGenerator.exe presents codes for the operator when selecting a desired pair of frequencies. To set the actual QAM Pilot detection frequency code, pull-down and select the code that represents the desired pilot frequency.

There are four possible channel codes used by Arcom, intended to provide flexibility in overbuild situations. The table below illustrates the frequencies associated with each code. F1 and F2 represent the QAM guard band frequencies.

**Code # vs Pilot Carrier Frequencies**

Code #	Pilot 1, MHz	Pilot 2, MHz
1	$F1^* + 0.005$	$F2^* + 0.005$
2	$F1^* - 0.005$	$F2^* - 0.005$
3	$F1^* + 0.005$	$F2^* - 0.005$
4	$F1^* - 0.005$	$F2^* + 0.005$
*F1 and F2 = SC-QAM band edge frequencies		

Actual frequencies are displayed in the PilotGenerator.exe “Pilot Frequencies” fields shown above.

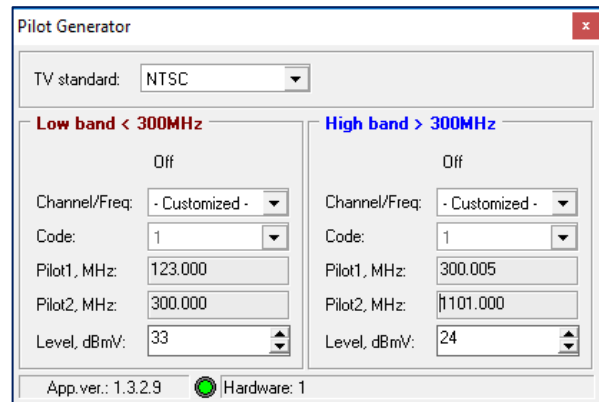
## Output Level

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RF Output levels are controlled in 0.5 dB steps using the up/down arrows for each band. Each output range is from +15 dBmV to +40 dBmV.

## Customized Output Frequencies

Although the Pilot Generator output frequencies are normally menu selected, the generator is also capable of producing specific operator selectable output frequencies in 1 KHz increments. Simply pull down “Channel/Freq” in the desired band and select “Customized” at the top of the list. Next, enter the desired frequencies within band ranges; Low Band = 123.000 MHz to 300.000 MHz, High Band = 300.005 MHz to 1101.000 MHz.



## 600 MHz Low Pass Filter

Any time a High Band frequency is 600 MHz or less is used, it is important to install the FLP-600 supplied with your Pilot Generator. The FLP-600 will eliminate any eliminate harmonics generated by the High Band Synthesizer. Be sure the FLP-600 is removed when output frequencies are above 600 MHz.

The FLP-600 is not required for Low Band operation.

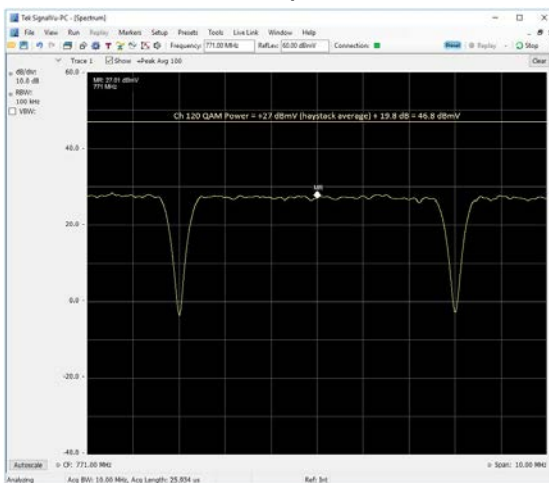




## Setting the Pilot Levels

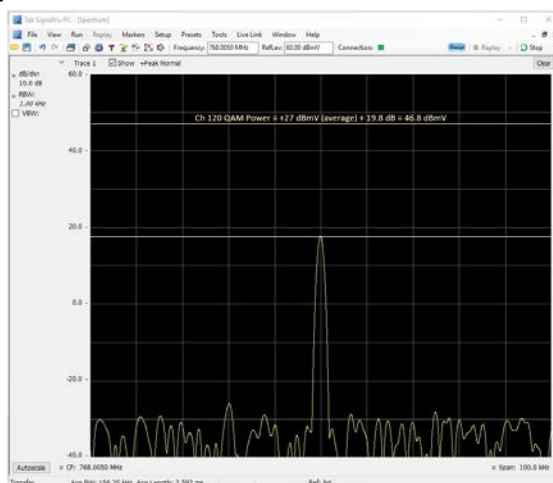
Now that the Pilot Generator Is installed, connected to the System Combiner, and PilotGenerator.exe is running, adjusting the pilot frequencies and levels is easy:

1. Connect a Spectrum Analyzer after the combiner and measure the QAM Power. For this example, we will use channel 120 with a center frequency of 771 MHz, and a QAM channel power of 46.8 dBmV.



$F_c = 771 \text{ MHz}$   
 Span = 10 MHz  
 ResBW = 100 KHz  
 Averaging = ON

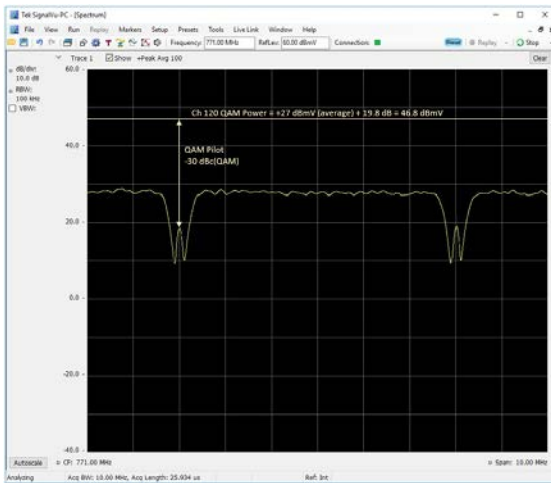
2. Determine the output level of your Pilot carriers. In this case the QAM power is +46.8 dBmV. We will place our carriers -30 dBc(QAM), or 16.8 dBmV.
3. Change your analyzer center frequency to the lower QAM Pilot frequency and using the additional settings below.
4. Now use PilotGenerator.exe to set the pilot carrier as close to 16.8 dBmV as possible.



$F_c = 768.005 \text{ MHz}$   
 Span = 100 KHz  
 ResBW = 1 KHz  
 Averaging = OFF

Note - the actual carrier level displayed on the Spectrum Analyzer will not be the same as the RF output level showing on PilotGenerator.exe because the analyzer is connected after the combiner.

- Finally, you can view the entire QAM channel to see both the QAM Pilots and Haystack. QAM Pilots may appear higher in this view because of noise and averaging.



$f_c = 771 \text{ MHz}$   
 Span = 10 MHz  
 ResBW = 100 KHz  
 Averaging = ON



## HPQI-2 QAM Pilot Generator Specifications

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### Model Numbers

Model HPQI-2 = 115 - 230 VAC, 50/60 Hz, 9 Watts @119 VAC. Typ.

Model HPQI-2-48VDC = (-)36 - (-)75 VDC, 4.5 Watts @-48 VDC. Typ.

### Physical

Dimensions = 19.000in X 1.750in X 9.000in (48.260cm x 4.445cm x 22.860cm).

Weight = 2.95 lb (1.34 kg).

### Environmental

Operating Temperature 0°C to +40C.

Operating Humidity 0 to 95 RH.

### Interfaces

Power:

110 - 240 VAC = IEC 60320-1 C14.

(-)48 VDC = 5.00mm Pitch Eurostyle Horizontal PCB Header, 2 Circuits.

RF Output = F-Type.

USB 2.0 type B.

### Operating Specifications

Frequency Standards:

NTSC

PAL B/G

PAL D/K

Other (Individual In-Band Custom Frequencies at 1Khz Increments)

RF Output:

Band 1 = Two (2) CW carriers 123-300 MHz,

Band 2 = Two (2) CW carriers 300.005 - 1104.00 MHz

RF Output Level

123 - 900 MHz = +15dBmV to +40 dBmV ( $\pm 3$  dB)

900 - 1000 MHz = +10dBmV to +35 dBmV ( $\pm 3$  dB)

1000 - 1104 MHz = +5 dBmV to +30 dBmV ( $\pm 3$  dB)

Custom Frequency Adjustment = 1KHz

Spurious <70 dBc max (<100 dBc QAM)