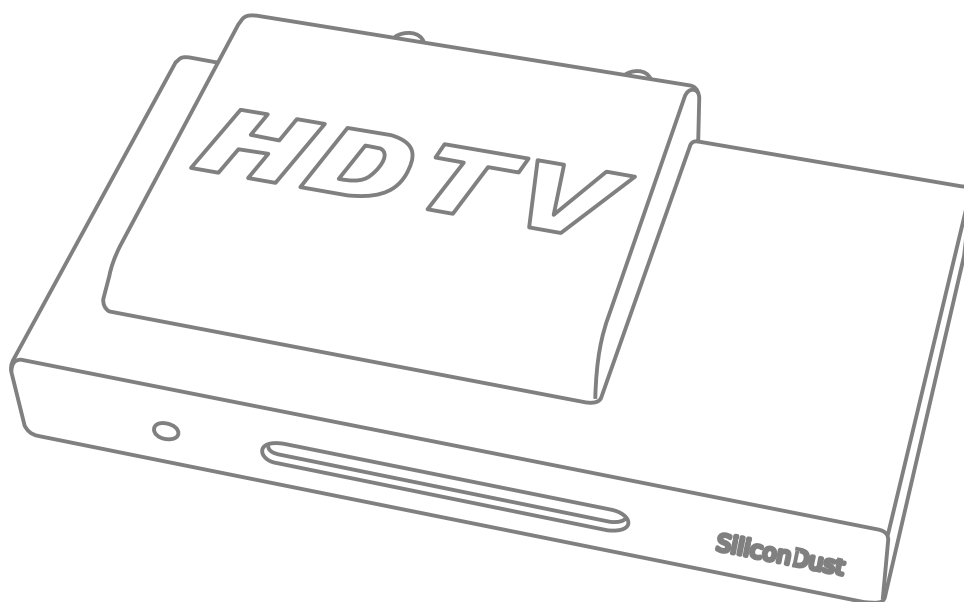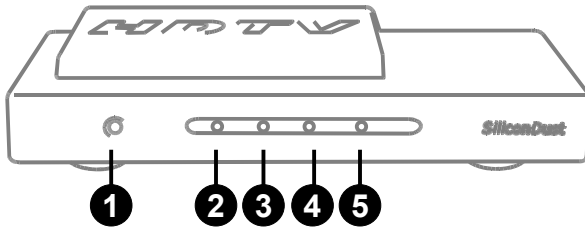# HDHomeRun TECH Usage Guide (20090223)

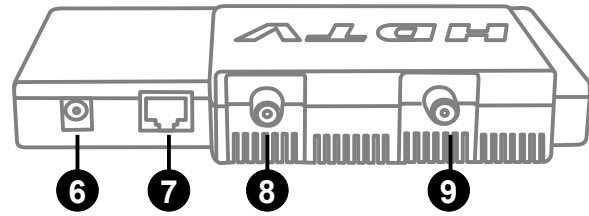# I. Hardware:

Front

1. Power LED
2. Network LED
3. Tuner0 LED
4. Tuner1 LED

Back

6. Power connector
7. Network connector
8. Tuner1
9. Tuner0

Power:

The HDHomeRun TECH should be used with the supplied 5V 1A power adapter.

Ethernet:

The HDHomeRun TECH can be connected to a network switch (100baseT or Gigabit), or can be connected directly to a computer/laptop Ethernet port.

Direct-connect: The Ethernet port on the HDHomeRun TECH is Auto-MDX (auto-crossover) and does not require a cross-over cable when connected directly to a computer/laptop.

Tuners/RF:

Each tuner on the HDHR-TECH-US supports 8VSB, QAM265 (ITU Annex B), and QAM64 (ITU Annex B) with an RF range of 55-861MHz (cable channels 1 to 135).

The signal level for digital cable must be in the range of -12dBmV to +40dBmV. Lower signal levels can be measured.

II. Software Installation

The latest HDHomeRun drivers, code, and firmware can be found on the Silicondust website:

http://www.silicondust.com/downloads

The HDHomeRun TECH requires the HDHomeRun Software release 20090215 or newer.

Windows:

Download and install the latest Windows release of the HDHomeRun software.

The installation process will automatically detect and upgrade the firmware in any HDHomeRun TECH units detected on the local subnet.

Location: The location setting is not used by the TECH hardware and can be left blank.

Signal source: The signal source should be set to "Digital Antenna" or "Digital Cable" as appropriate for the intended use of each tuner.

Application: The application setting is only required if a DVR application is used. When the TECH is used for non-DVR use this setting has no effect and can be left at the default.

Channels: Untick "Connect to the Silicondust Lineup server" to disable channel name correction information. A channel scan may be run to verify correct operation.

When the installation process is complete it is recommended that the HDHomeRun program directory be added to the PATH so that the hdhomerun_config utility can be run from a cmd prompt. The default program directory is "C:\Program Files\Silicondust\HDHomeRun\"

Linux/*BSD/Solaris:

Download and extract the libhdhomerun archive.

Run "make" to compile hdhomerun_config.

Copy hdhomerun_config to /usr/local/bin

VideoLAN VLC:

VideoLAN VLC is a third party video player that works with the HDHomeRun TECH:

http://www.videolan.org/vlc/

TSReader:

TSReader is a third party Transport Stream analyzer for Windows that works with the HDHomeRun TECH:

http://www.coolstf.com/tsreader/

III.Initial Configuration

Computer IP address configuration:

If the HDHomeRun TECH is connected directly to a computer (no DHCP server) the computer will need to be configured such that it has a 169.254.x.x IP address (subnet 255.255.0.0). This can be achieved by statically configuring a 169.254.x.x IP address, or by the computer assigning itself an AutoIP address.

Windows: Windows will pick an AutoIP address after a period of time if configured to "obtain an IP address automatically". This takes 3 minutes on XP and 30 seconds on Vista. Setting a static 169.254.x.x IP address will avoid this delay.

The HDHomeRun will take 20 seconds from link-up until it can be addressed using an AutoIP address.

Default IP Address:

By default the HDHomeRun TECH will attempt to acquire an IP address using DHCP, as well as choosing an AutoIP address in the 169.254.x.x range.

If The HDHomeRun TECH is on the same DHCP-managed subnet as the computer or is connected directly to the computer then the unit can be addresses by Device ID. It is not necessary to know the IP address.

Methods to determine the IP address of the HDHomeRun TECH:

- If using DHCP and the computer is on the same subnet as the HDHomeRun TECH, run "hdhomerun_config discover" from a shell.

- If using DHCP and the computer is on a different subnet then check the DHCP server logs. The HDHomeRun TECH reports a hostname of "HDHR-XXXXXXXX" where XXXXXXXX is the Device ID printed on the bottom of the unit.

- If the HDHomeRun TECH is directly connected to the computer the computer will need to be configured such that it has a 169.254.x.x IP address (subnet 255.255.0.0). This can be achieved by statically configuring a 169.254.x.x IP address, or by the computer assigning itself an AutoIP address. Run "hdhomerun_config discover" from a shell.

- If the HDHomeRun TECH has been previously configured with a static IP address and that IP address is no longer valid for the network then connect the HDHomeRun TECH directly to a computer and use the direct-connect technique to communicate with the unit.

Setting the IP address:

DHCP local subet:

The HDHomeRun TECH can be addressed by device ID if it is on the same DHCP-managed subnet as the computers that will be controlling it. It is not necessary to set an IP address.

DHCP Fixed assignment:

Most DHCP servers can be configured to assign a set IP address to a specific device. The HDHomeRun TECH can be identified by the DHCP server by MAC address or by hostname. The hostname will be reported as "HDHR-XXXXXXXX" where XXXXXXXX is the Device ID printed on the bottom of the unit. The MAC address is printed on the bottom of the unit.

Static IP assignment:

A static IP address can be configured using the following command (the quotes are required as shown):

```
Format:  hdhomerun_config <old ip> set /sys/ipaddr "<new ip> <subnet> <gateway>"
Example: hdhomerun_config 169.254.34.98 set /sys/ipaddr "10.10.20.43 255.255.255.0 10.10.20.1"
```

Reverting to DHCP:

The HDHomeRun TECH can be configured for DHCP operation (default) using the following command:

```
Format:  hdhomerun_config <old ip> set /sys/ipaddr dhcp
Example: hdhomerun_config 169.254.34.98 set /sys/ipaddr dhcp
```

Setting the channel map:

The channel map is a non-volatile configuration option that is used to set the channel to frequency table, to configure the channel scan table, and to optimize the auto-modulation detection.

GUI: The channel map can be set for each tuner by running HDHomeRun Config (GUI).

Command line: The channel map can be set for each tuner using the following command:

```
Format:  hdhomerun_config <ip|id> set /tuner<n>/channelmap <channelmap>
Example: hdhomerun_config 10001000 set /tuner0/channelmap us-cable
Example: hdhomerun_config 10001000 set /tuner1/channelmap us-cable
```

Channel maps supported by HDHR-TECH-US hardware:

Name	Description	Location
us-bcast	Digital Antenna (ATSC).	US, Canada
us-cable	Digital Cable - Normal frequency layout.	US, Canada
us-hrc	Digital Cable - HRC frequency layout.	US, Canada
us-irc	Digital Cable - IRC frequency layout.	US, Canada

Channel maps supported by HDHR-TECH-EU hardware:

Name	Description	Location
au-bcast	Digital Antenna (Australia).	Australia
au-cable	Digital Cable (Australia).	Australia
eu-bcast	Digital Antenna (Europe).	Europe, New Zealand
eu-cable	Digital Cable (Europe).	Europe, New Zealand
tw-bcast	Digital Antenna (Taiwan).	Taiwan
tw-cable	Digital Cable (Taiwan).	Taiwan

IV.HDHomeRun Config (GUI)

HDHomeRun Config (GUI) is a GUI utility for checking signal level and/or previewing channels using VLC. VideoLAN VLC should be installed prior to running HDHomeRun Config (GUI).

Step 1: Select a HDHomeRun TECH tuner.

Step 2: Select the desired channel map.

Step 3: Select the desired channel. The scan up/down buttons will automatically stop on the next digital channel found.
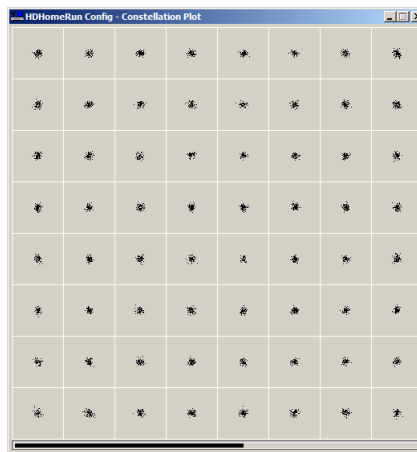
The HDHomeRun TECH should auto-detect all programs (sub-channels) present on the selected channel.

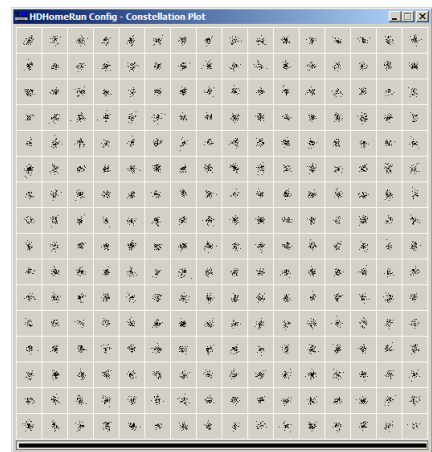To view a program select the desired program and click View.

To view the constellation plot for the channel click Plot (Windows only).
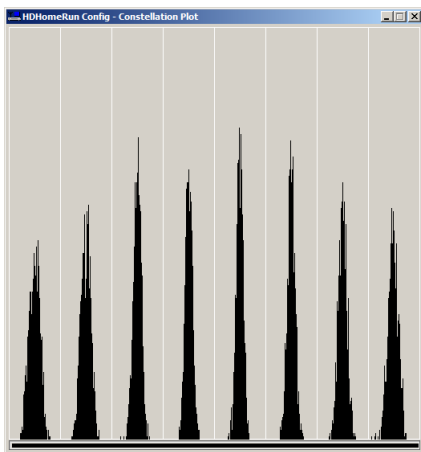
8VSB Constellation plot

QAM64 Constellation plot

QAM256 Constellation plot

V.Scripting

The HDHomeRun can be scripted using the hdhomerun_config command line utility.

This utility is cross-platform:

- Windows, Linux, Mac, *BSD, Solaris.
- 32-bit or 64-bit operating systems.
- Big-endian and little-endian CPUs.
- PC or embedded platforms.

Using hdhomerun_config

The list of supported commands can be obtained by running hdhomerun_config without any parameters:

```
hdhomerun_config discover
hdhomerun_config <id> get help
hdhomerun_config <id> get <item>
hdhomerun_config <id> set <item> <value>
hdhomerun_config <id> scan <tuner> [<filename>]
hdhomerun_config <id> save <tuner> <filename>
hdhomerun_config <id> upgrade <filename>
```

Discover the HDHomeRun devices on the network:

The discover command will find HDHomeRun devices that are on the same subnet as the host:

```
hdhomerun_config discover
```

Sending commands to a specific HDHomeRun:

The "<id>" shown above represents a unique identifier for a HDHomeRun device, this can be either Device ID, or IP address:

```
hdhomerun_config <device id> get help
hdhomerun_config <ip address> get help
```

To address by Device ID the HDHomeRun must be on the same subnet as the host.

A Device ID of FFFFFFFF can be used as a wild card for the first HDHomeRun device found on the network. Do not use this syntax if there are multiple HDHomeRun devices on the network, as the device used will be random based on discovery order, which may change between commands.

Query the list of options supported by a HDHomeRun device:

The get/set options supported by a specific HDHomeRun device can be queried using the get help command:

```
hdhomerun_config <id> get help
```

Example output:

```
Supported configuration options:
  /tuner<n>/channel <modulation>:<freq|ch>    Get/set modulation and frequency
  /tuner<n>/channelmap <channel map>          Get/set channel to frequency map
  /tuner<n>/filter 0x<nnnn>-0x<nnnn> [...]     Get/set PID filter
  /tuner<n>/program <program number>          Get/set MPEG program filter
  /tuner<n>/target <ip>:<port>                Get/set target IP for tuner
  /tuner<n>/status                            Display status of tuner
  /tuner<n>/streaminfo                        Display stream info
  /tuner<n>/debug                             Display debug info for tuner
  /tuner<n>/lockkey                           Set/clear tuner lock
  /sys/model                                  Display model name
  /sys/features                               Display supported features
  /sys/version                                Display firmware version
  /sys/copyright                              Display firmware copyright
  /sys/debug                                  Display debug info
```

Channel scan:

To run a channel scan:

```
Format:  hdhomerun_config <id> scan /tuner<n> [<log filename>]
Example: hdhomerun_config FFFFFFFF scan /tuner0 scan0.log
```

This command will scan all channels on the selected channel map plus any additional channel maps associated with the selected channel map. All standard modulation types for the selected channel map are tested.

When a digital channel is found it will identify the programs on the channel.

The log filename is optional; if included it will log to the given filename.

Tuning a physical channel:

To set a channel use the set channel command:

```
Format:  hdhomerun_config <id> set /tuner<n>/channel <modulation>:<frequency>
Format:  hdhomerun_config <id> set /tuner<n>/channel <modulation>:<channel>
Example: hdhomerun_config FFFFFFFF set /tuner0/channel auto:651000000
Example: hdhomerun_config FFFFFFFF set /tuner0/channel auto:60
```

To auto-detect the modulation type use "auto" for the modulation.

Supported modulation types can be queried with the get sys-features command:

```
hdhomerun_config <id> get /sys/features
```

To stop the tuner set the channel to none:

```
Format:  hdhomerun_config <id> set /tuner<n>/channel none
Example: hdhomerun_config FFFFFFFF set /tuner0/channel none
```

Checking the signal strength:

The basic signal information can be obtained by using the get status command:

```
Format:  hdhomerun_config <id> get /tuner<n>/status
Example: hdhomerun_config FFFFFFFF get /tuner0/status
```

Example output:

```
ch=qam:33 lock=qam256 ss=83(-10dBmV) snq=90(29dB) seq=100 bps=38807712 pps=0
```

- ch = channel requested
- lock = actual modulation detected
- ss = signal strength.
- snq = signal to noise quality (MER).
- seq = symbol error quality (based on the number of uncorrectable digital errors detected).
- bps = raw channel bits per second.
- pps = packets per second sent through the network.

More advanced information can be obtained by using the get debug command:

```
Format:  hdhomerun_config <device id> get /tuner<n>/debug
Example: hdhomerun_config FFFFFFFF get /tuner0/debug
```

Example output:

```
tun: ch=qam:33 lock=qam256 ss=84 snq=88 seq=100 dbg=22081-6930
dev: resync=0 overflow=0
ts:  bps=38809216 ut=94 te=0 miss=0 crc=0
flt: bps=38809216
net: pps=0 err=0 stop=0
```

Each line contains a prefix to indicate the type of data, followed by the values.

- tun = tuner status
  - see above section
- dev = device status
- ts = transport stream
  - bps = bits per second
  - ut = utilization percentage (100% is filled to capacity)
  - te = transport error counter (uncorrectable reception error)
  - miss = missed packet counter (jump in sequence numbers)
  - crc = crc error counter
- flt = results after pid filtering
  - bps = bits per second
- net = network status
  - pps = packets per second
  - err = packets or TS frames dropped before transmission.
  - stop = reason for stopping the stream

The counters are reset to zero upon a channel change, but may indicate a small number of errors caused before the tuner locks on the channel. As a result, diagnostics should be based on the change in values over time, and not the initial values.

Detecting the programs on a physical channel:

The HDHomeRun will detect the programs (sub-channels). Use the get streaminfo command to query the detected programs:

```
Format:  hdhomerun_config <id> get /tuner<n>/streaminfo
Example: hdhomerun_config FFFFFFFF get /tuner0/channel streaminfo
```

The output format is:

```
    <program number>: <virtual major>.<virtual minor> [<name>] [(<flags>)]
```

Example output:

```
    3: 20.1 KBWB-HD
    4: 20.4 AZTECA
```

Digital cable does not always provide the channel name or virtual channel number:

```
    1: 0.0
    2: 0.0 (encrypted)
    3: 0.0 (control)
```

It may take several seconds after setting the channel for the stream information to be fully populated (depending on how long the channel takes to lock and how often the stream information is sent by the broadcaster/cable provider).

Filtering by program (sub-channel):

The HDHomeRun supports automatic PID filtering by program number or virtual channel number:

```
Format:  hdhomerun_config <id> set /tuner<n>/program <program number>
         hdhomerun_config <id> set /tuner<n>/program <virtual channel number>

Example: hdhomerun_config FFFFFFFF set /tuner0/program 3
         hdhomerun_config FFFFFFFF set /tuner0/program 11.2
```

When filtering by program the MPEG TS tables are generated by the HDHomeRun. The result is a valid single-program transport stream.

The program filter is cleared when a set channel or a set filter command is received.

Advanced: By default the PAT and PMT are generated. To also generate a ATSC-style TVCT use:

```
hdhomerun_config <id> set /tuner<n>/program "<program number> tvct_from_pmt=<virtual major>.<virtual
minor>(<name>)"

Example: hdhomerun_config <id> set /tuner0/program "3 tvct_from_pmt=11.2(TEST)"
```

Advanced: On cable systems the video elementary stream may be flagged as DC-II. To change this indication to MPEG2 add the pmt_dc2_to_mpeg2 flag:

```
hdhomerun_config <id> set /tuner<n>/program "<program number> pmt_dc2_to_mpeg2 tvct_from_pmt=<virtual
major>.<virtual minor>(<name>)"

Example: hdhomerun_config <id> set /tuner0/program "3 pmt_dc2_to_mpeg2 tvct_from_pmt=11.2(TEST)"
```

Filtering by PID:

The HDHomeRun supports arbitrary hardware PID filtering:

```
Format:  hdhomerun_config <id> set /tuner<n>/filter <filter>
Example: hdhomerun_config FFFFFFFF set /tuner0/filter "0x0000-0x1FFF"
         hdhomerun_config FFFFFFFF set /tuner0/filter "0x0000 0x0030-0x0033 0x1FFB"
```

When filtering by PID the stream is filtered but otherwise unmodified.

The filter is cleared to pass-all (0x0000-0x1FFF) when a set channel command is received.

Saving a stream:

The hdhomerun_config command can be used to automate the process of saving to the local filesystem:

```
Format:  hdhomerun_config <id> save /tuner<n> <filename>
Example: hdhomerun_config FFFFFFFF save /tuner0 capture.ts
```

While saving the stream, a single period "." will be displayed every second. Errors will be indicated by a letter.

Example output:

```
............n.................................n..........ts..........
-- Video statistics --
23323 packets recieved, 2 network errors, 1 transport errors, 1 sequence errors
```

Advanced: A filename of "null" indicates no file should be created, allowing the use of the save command as a diagnostic tool.

Advanced: "-" may be used as a filename to indicate standard output, allowing the save command to be used as a pipe on supported platforms.

```
Example: hdhomerun_config FFFFFFFF save /tuner0 - | vlc -
```

Streaming to a target machine:

Set the target IP address and port number using the set target command:

```
Format:  hdhomerun_config <id> set /tuner<n>/target udp://<ip>:<port>
Format:  hdhomerun_config <id> set /tuner<n>/target rtp://<ip>:<port>
Example: hdhomerun_config FFFFFFFF set /tuner0/target udp://192.168.1.100:5000
Example: hdhomerun_config FFFFFFFF set /tuner0/target rtp://192.168.1.100:5000
```

The target machine must be listening on the given UDP port. The HDHomeRun will automatically clear the target if a ICMP port unreachable message is received.

A global broadcast (255.255.255.255), subnet broadcast, or multicast target can be specified however care must be taken to ensure that the traffic will not cause problems with other devices on the network. If the local network is bridged to a wireless network then the AP will typically transmit at a low broadcast speed saturating the wireless network.

The time-to-live (TTL) defaults to 64. To configure a lower TTL use the following format (quotes required):

```
Format:  hdhomerun_config <id> set /tuner<n>/target "udp://<ip>:<port> ttl=<n>"
Format:  hdhomerun_config <id> set /tuner<n>/target "rtp://<ip>:<port> ttl=<n>"
Example: hdhomerun_config FFFFFFFF set /tuner0/target "udp://192.168.1.100:5000 ttl=8"
Example: hdhomerun_config FFFFFFFF set /tuner0/target "rtp://192.168.1.100:5000 ttl=8"
```

Example: Streaming to VLC:

Run VLC: File, Open Network Stream. Select UDP/RTP. Specify port 5000.

Discover the HDHomeRun:

```
hdhomerun_config discover
```

Run a channel scan:

```
hdhomerun_config FFFFFFFF scan /tuner0 scan0.log
```

Set the physical channel:

```
hdhomerun_config FFFFFFFF set /tuner0/channel auto:651000000
```

Check sub-programs:

```
hdhomerun_config FFFFFFFF get /tuner0/streaminfo
```

Select a sub-program:

```
hdhomerun_config FFFFFFFF set /tuner0/program 3
```

Set the target:

```
hdhomerun_config FFFFFFFF set /tuner0/target <ip address of pc>:5000
```

Using /sys/boot

The /sys/boot variable allows the HDHomeRun Tech unit to automatically set variables at startup, allowing you to preserve settings across power outages or simply set the power on defaults.

The syntax for the /sys/boot consists of multiple lines of text; a variable name followed by a single space and then the value: (there should not be any space before the variable name)

```
<variable1> <value of variable1>
<variable2> <value of variable2>
...
<variableN> <value of variableN>
```

Example (save as boot.txt):

```
/tuner0/chanelmap us-cable
/tuner0/channel 103
/tuner0/program 4
```

To store the configuration to the HDHomeRun:

```
Format:  hdhomerun_config <id> set /sys/boot - < filename
Example: hdhomerun_config FFFFFFFF set /sys/boot - < boot.txt
```

Changes will be applied the next boot; to execute the new /sys/boot immediately:

```
Format:  hdhomerun_config <id> execute
Example: hdhomerun_config FFFFFFFF execute
```