Digital Transition

Solutions & Applications Guide

Issue 4- 100223

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Introduction

What is the "Digital TV Transition" ?

It is the switch from analog to digital broadcast television mandated by the US Congress which will take effect on June 12, 2009.

To allow consumers to make necessary arrangements for converting their television sets to be able to view programs (or channels) broadcast in digital format, broadcasters in the US have been permitted to simultaneously broadcast both in analog and in digital formats in a "transition period" that started in 1997. That transition period however will end at midnight on June 12, 2009, after which all full-power television stations in the US will broadcast in digital format only.

Why the US Congress mandated the Transition ?

Primarily, for two reasons.

Firstly, it will free up parts of the broadcast spectrum for public safety communications (such as police, fire departments, and rescue squads). Also, some of the spectrum will be auctioned by FCC to companies that will be able to provide consumers with more advanced wireless services (such as wireless broadband).

Secondly, digital broadcasting allows stations to offer, in addition to improved picture and sound quality, more channels through a process called "multicasting." Multicasting allows broadcast stations to offer several digital channels using the same amount of spectrum required for one analog channel. So, for example, while today a station broadcasting on channel 7 in analog format is only able to offer viewers one program, a station broadcasting on channel 7 in digital format can offer viewers one digital program on the main channel 7-1, and several other digital programs on sub-channels 7-2, 7-3, ... This means more programming choices for viewers.

How can I upgrade my CATV Headend to provide both Analog & Digital services?

Depending on how you intend to receive or distribute CATV services to your customers, there are several ways to prepare for the transition. We will discuss in this **Digital Transition Guide** the building blocks of the digital technology, and will present design and product solutions for upgrading your CATV Headend to provide both Analog and Digital services, or to migrate entirely to an all-digital platform.

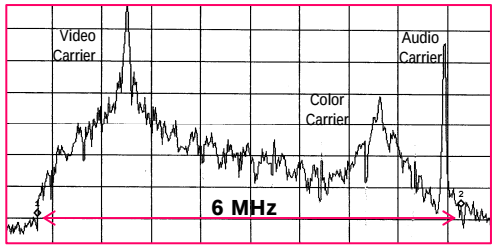
1. Terminology - Analog Standards

1.1 Analog Off-Air or Broadcast NTSC

Standard: Vestigial Sideband (VSB)

Off-Air transmission is defined as the broadcast by a television station of a TV program that is transmitted from a terrestrial transmitter and which traverses through the air.

In North America, the analog off-air programs are typically broadcast on channels 2-13 (54-216 MHz; VHF) and channels 14-68 (470-806 MHz; UHF) using the Vestigial SideBand (VSB) technique developed by the NTSC (National Television System Committee). First introduced in 1941, the original standard required 525 lines of picture information in each frame, 30 interlaced frames per second with an aspect ratio of 4:3, and frequency modulation (FM) for the sound signal. The frame rate was slightly adjusted in 1953 to accommodate for color TVs.



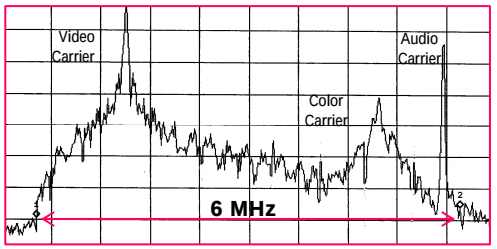
Mandated by the US Congress, analog off-air programs currently provided by full-power broadcasters in the US will not be available after midnight on June 12, 2009.

1.2 Analog CATV or RF Modulated NTSC

Standard: NTSC System M (NTSC)

CATV transmission is defined as the transmission by a CATV service provider of a few hundred TV programs which are originated from a CATV Headend, and are distributed over a coaxial network.

In North America, the analog CATV programs are distributed using the NTSC System M modulation standard, usually referred to as RF MOdulated NTSC, whereby each TV channel has a 6 MHz-wide bandwidth. The CATV programs are typically transmitted in the 47 to 1000 MHz spectrum of the coaxial network.



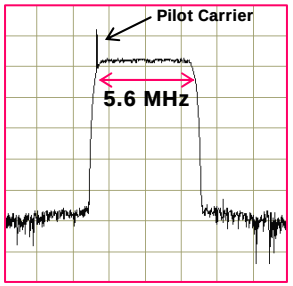
2. Terminology - Digital Standards

2.1 Digital Off-Air

Standard: 8-level Vestigial SideBand (8VSB)

In North America, the digital off-air programs are typically broadcast on channels 2-13 (54-216 MHz; VHF) and channels 14-51 (470-698 MHz; UHF)using the 8VSB (8-level Vestigial SideBand) modulation standard developed by the ATSC (Advanced Television Systems Committee).

The 8VSB standard allocates a net bit rate of 19.39 Mbits/sec of usable data which enables TV stations to broadcast their programs in high-definition (HD) utilizing a wide-screen (16:9) format with up to 1920×1080 pixels in size. Since 8VSB supports many different image sizes, broadcasters can also transmit, simultaneously with their “main” HD program, several “sub-channels” in standard-definition (SD) - all within the same bandwidth used previously to broadcast only one analog channel. Typical data-rate for one HD program is 10-15 Mbits/sec, and 2-4 Mbits/sec for a SD program. TV programs broadcast in 8VSB can also carry “theater quality" audio by utilizing the Dolby Digital AC-3 format which provides 5.1-channel surround sound. Numerous auxiliary data-casting services can also be provided by broadcasters.

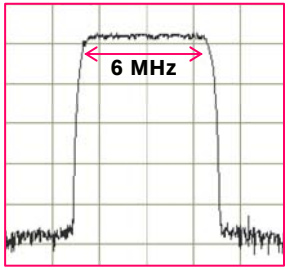


2.2 Digital CATV

Standard: Quadrature Amplitude Modulation (QAM)

In North America, the digital CATV programs are distributed usign the QAM (Quadrature Amplitude Modulation) modulation standard.

There are various QAM modulation modes, but the most commonly used modes in North America are the QAM 64 and QAM 256, also known as Annex B of the ITU-T J.83 standard. Similar to an Analog CATV channel, both QAM 64, and QAM 256 each has a 6 MHz-wide bandwidth. However, while analog CATV standard allows for transmission of only one cahnnel in a 6 MHz-wide bandwidth, QAM 256 allows for transmission of 2-3 HD programs or 10-12 SD programs in that same bandwidth.

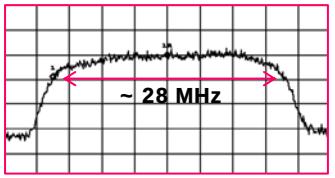


2.3 Satellite

Standard: QPSK & 8PSK

Satellite transmission is defined as the transmission by a satellite service provider of several hundred TV programs which are transmitted from a series of satellites travelling in a geo-stationary orbit about 22,300 miles above the equator.

In North America, the satellite programs are transmited primarily in digital fomrat using the QPSK(Quadrature Phase Shift Keying) and the 8PSK (8th-order Phase Shift Keying) standards. The QPSK programs are typically transmitted in the C-band (3.7 to 4.2 GHz) and the Ku-band (11.7 to 12.2 GHz). The 8PSK programs are typically transmitted in DBS (12.2 to 12.7 GHz). DBS (Direct Broadcast Satellite), also known more broadly as direct-to-home, is a term used to refer to satellite television broadcasts intended for home reception.

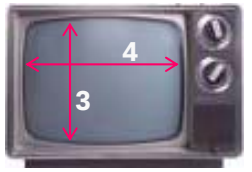


3. Terminology - Television Standards

Commercially-made television sets, or TVs, have been available since 1928. And although TVs today use various display technologies such as CRT (Cathode Ray Tube), LCD (Liquid Crystal Display), or PDP (Plasma Display Panel, or Plasma), they all can be classified into two basic types, namely Analog TV and Digital TV.

3.1 Analog TV

An analog TV is equipped with an anlog tuner and is capable of displaying video and sound information received in an analog format only. In North America, that analog format must adhere to the NTSC standard discussed previoulsy. Analog TVs typically ulitize a CRT display with a screen width-to-height ratio of 4:3. Per FCC mandate, televisions sold in the US after May 25, 2007 should contain a digital tuner (also known as ATSC tuner) compatible with the 8VSB standard (Digital Off-Air), or should be identified at the point-of-sale as not having one.



3.2 Digital-Ready TV

Not exactly a Digital TV, nor exactly an Analog TV, Digital-Ready TVs are typically an Analog TV equipped with an internal digital tuner (ATSC tuner). A digital-ready TV can receive and display analog and digital off-air programs without the need for an external 8VSB-to-analog converter box. To ensure that a TV set is equipped with digital/ATSC tuner you should consult its user manual or manufacturer's documentation. However, most digital-ready TVs are marketed with labels such as "Integrated Digital Tuner" or "Digital Tuner Built-In." In some cases, the word "Receiver" may be substituted for "Tuner". In other cases, the words "DTV", ATSC", or "HDTV" may be substituted for "Digital." Most digital-ready TVs have a display aspect ratio of 4:3.

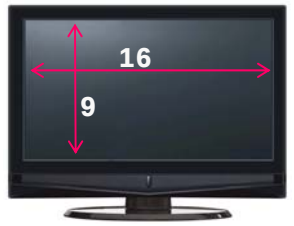
3.3 Digital TV

A digital TV is equipped with an analog tuner, a digital/ATSC tuner, and a QAM (Digital Cable) tuner. Digital TV sets typically ulitize an LCD or Plasma display and are classified, based on their display resolution, as an SDTV (Standard-Defintion Television) or HDTV (High-Definition Television).

SDTV: A digital TV capable of displaying 480 actively-interlaced vertical lines of resolution is usually considered an SDTV. As such, an SDTV is also known as a "480i" set. A typical SDTV has a display aspect ratio of 4:3, and a resolution of 720x480 (345,600 pixels).

HDTV: A digital TV set capable of displaying at least 720 vertical lines of resolution is usually considered a HDTV. A typical HDTV has a display aspect ratio of 16:9 and is available in the following video formats and display resolutions:

Video	Display Resolution	Displayed Pixels
720p	1280 x 720 Progressively-Scanned Lines	921,600
1080i	1280 x 1080 Actively-Interlaced Lines	1,382,400
1080p	1920 x 1080 Progressively-Scanned Lines	2,073,600

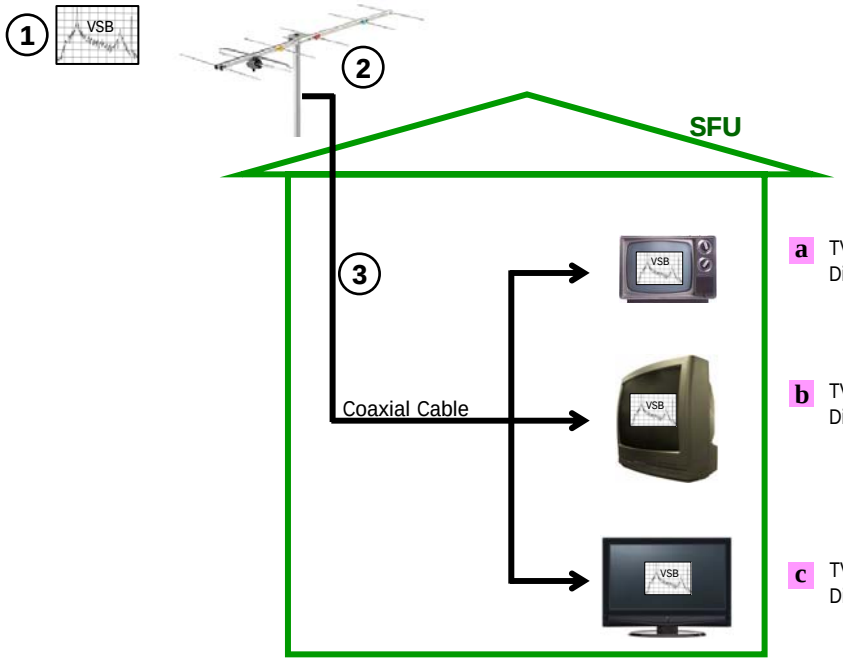


4. Off-Air Solutions (Receive & Distribute)

4.1 Receiving Analog Off-Air, and Distributing at a Single-Family Unit

Mandated by the US Congress, Analog Off-Air programs currently provided by full-power broadcasters in the US will not be available after June 12, 2009.

In addition to cable operators in the US, those in Canada and Mexico that rely on off-air programs from the US will be affected.



a TV: Analog (Analog Tuner Only)
Display: Analog off-air programs

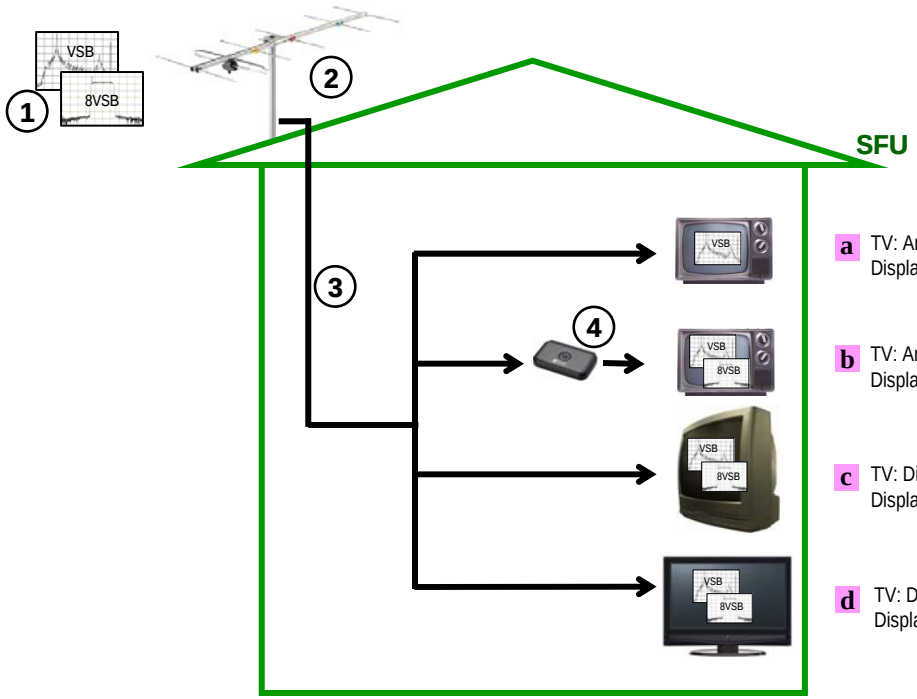
b TV: Digital-Ready (Analog + ATSC Tuners)
Display: Analog off-air programs

c TV: Digital (Analog + ATSC + QAM Tuners)
Display: Analog off-air programs.

1. Program broadcast in Analog (Broadcast NTSC standard)
2. Roof-top Antenna **(Blonder Tongue: BTY Series)**
3. Analog off-air program(s) are distributed over cable to TV sets

4. Off-Air Solutions (Receive & Distribute)

4.2 Receiving Analog & Digital Off-Air, and Distributing at a Single-Family Unit



Mandated by the US Congress, Analog Off-Air programs currently provided by full-power broadcasters in the US will not be available after June 12, 2009.

In addition to cable operators in the US, those in Canada and Mexico that rely on off-air programs from the US will be affected.

a TV: Analog (Analog Tuner Only)
Display: ONLY Analog off-air programs

b TV: Analog (Analog Tuner Only)
Display: BOTH the Analog & the Digital off-air programs

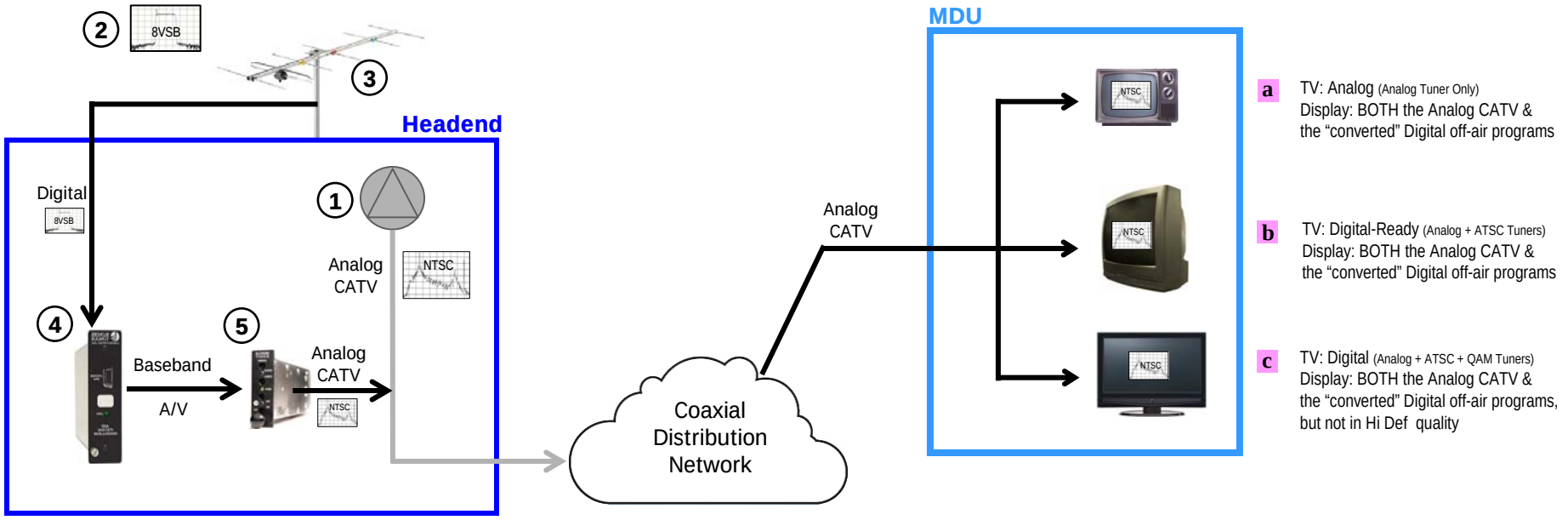
c TV: Digital-Ready (Analog + ATSC Tuners)
Display: BOTH the Analog & the Digital off-air programs

d TV: Digital (Analog + ATSC + QAM Tuners)
Display: BOTH the Analog & the Digital off-air programs

1. Program multicast in Analog & in Digital (8VSB Standard)
2. Roof-top Antenna **(Blonder Tongue: BTY Series)**
3. Digital off-air program(s) are distributed over cable to TV sets
4. 8VSB-to-Analog Converter is required to view the program on an Analog TV **(Blonder Tongue: Conductor Series; stock 2151)**
   Every household can receive up to two $40-Dollar coupons, under a program sponsored by the US Department of Commerce - visit www.dtv2009.gov or call 1-888-388-2009.

4. Off-Air Solutions (Receive, Convert, & Distribute)

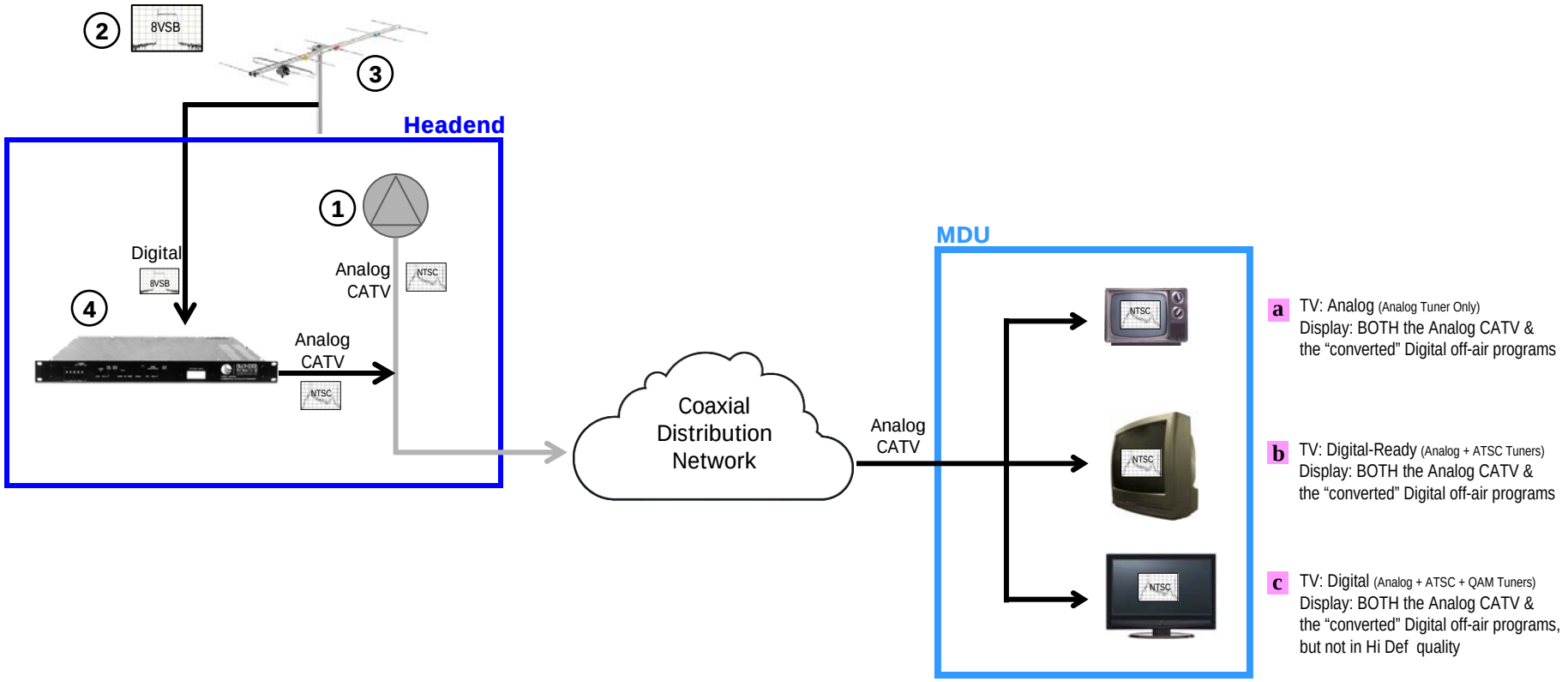
4.3 Receiving Digital Off-Air, and Converting to Analog CATV (Option I: OK)



1. An existing Analog HeadEnd & Distribution Network
2. Program broadcast in Digital (8VSB Standard)
3. Roof-top Antenna **(Blonder Tongue: BTY Series)**
4. 8VSB-to-Baseband Demodulator **(Blonder Tongue: AQD; stock 6245)**
5. Analog Modulator **(Blonder Tongue: Agile AM & AMCM Series; Fixed-channel MAVM & MICM Series)**

4. Off-Air Solutions (Receive, Convert, & Distribute)

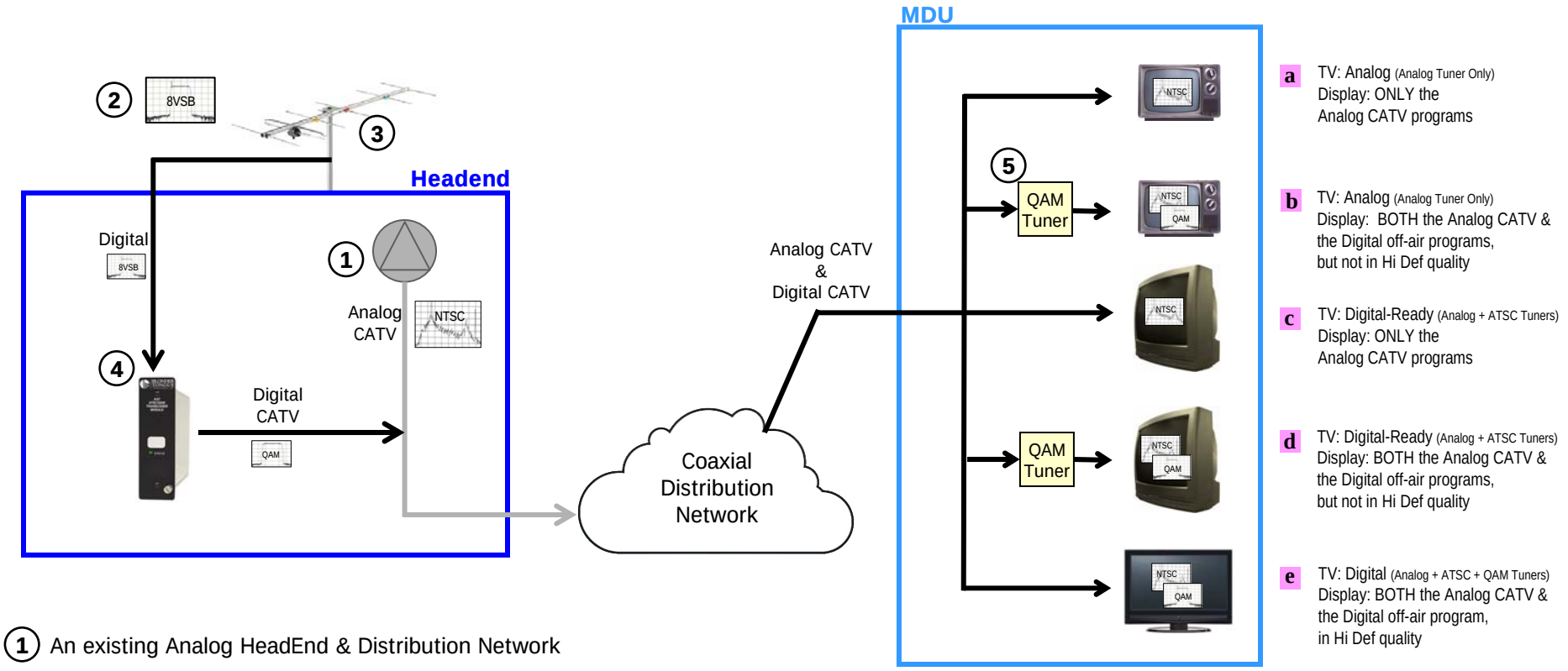
4.4 Receiving Digital Off-Air, and Converting to Analog CATV (Option II: GOOD)



1. An existing Analog HeadEnd & Distribution Network
2. Program broadcast in Digital (8VSB Standard)
3. Roof-top Antenna **(Blonder Tongue: BTY Series)**
4. Digital-to-Analog Processor **(Blonder Tongue: DAP; stock 6290)**

4. Off-Air Solutions (Receive, Convert, & Distribute)

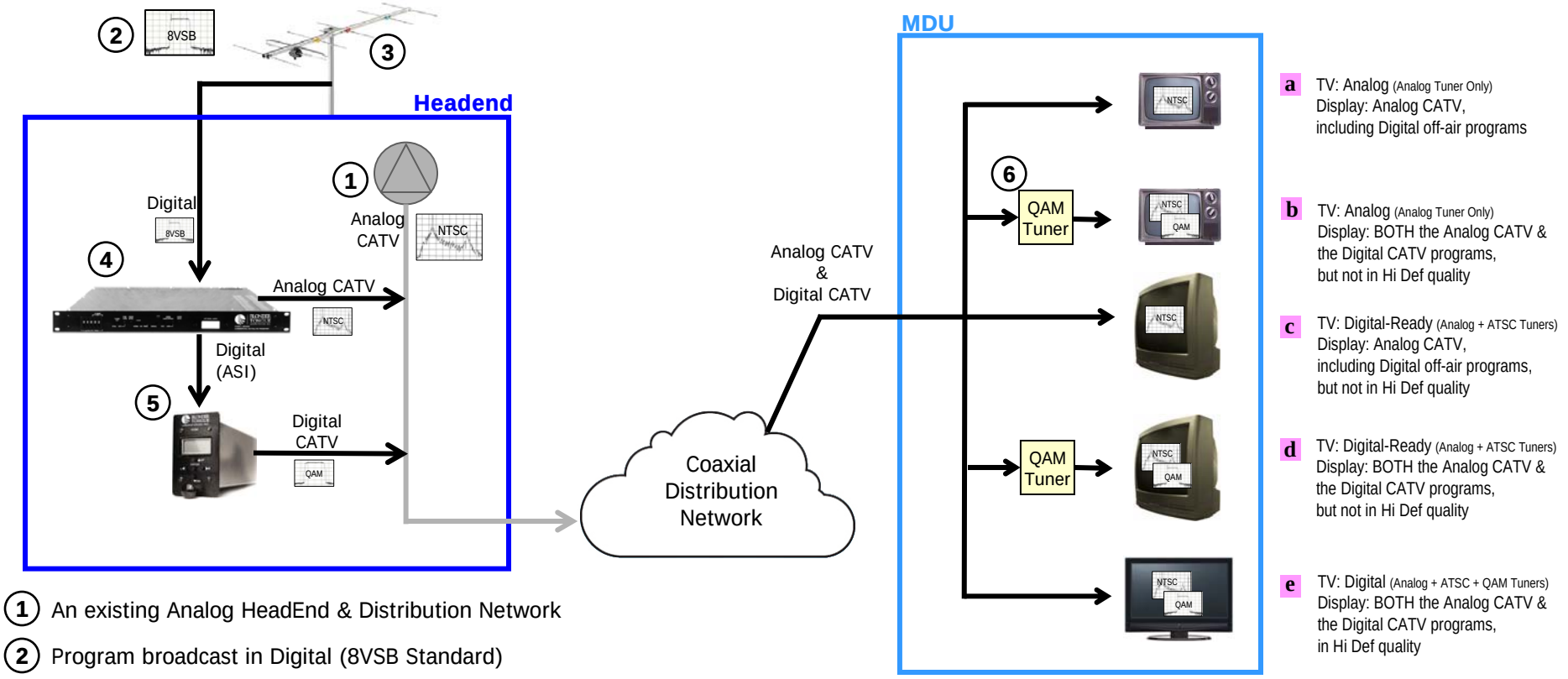
4.5 Receiving Digital Off-Air, and Converting to Digital CATV (Option III: BETTER)



1. An existing Analog HeadEnd & Distribution Network
2. Program broadcast in Digital (8VSB Standard)
3. Roof-top Antenna **(Blonder Tongue: BTY Series)**
4. 8VSB-to-QAM Transcoder **(Blonder Tongue: AQT; stock 6275)**
5. QAM-to-Analog tuner (SetTop Box) by others

4. Off-Air Solutions (Receive, Convert, & Distribute)

4.6 Receiving Digital Off-Air, and Converting to Analog & Digital CATV (Option IV: BEST)

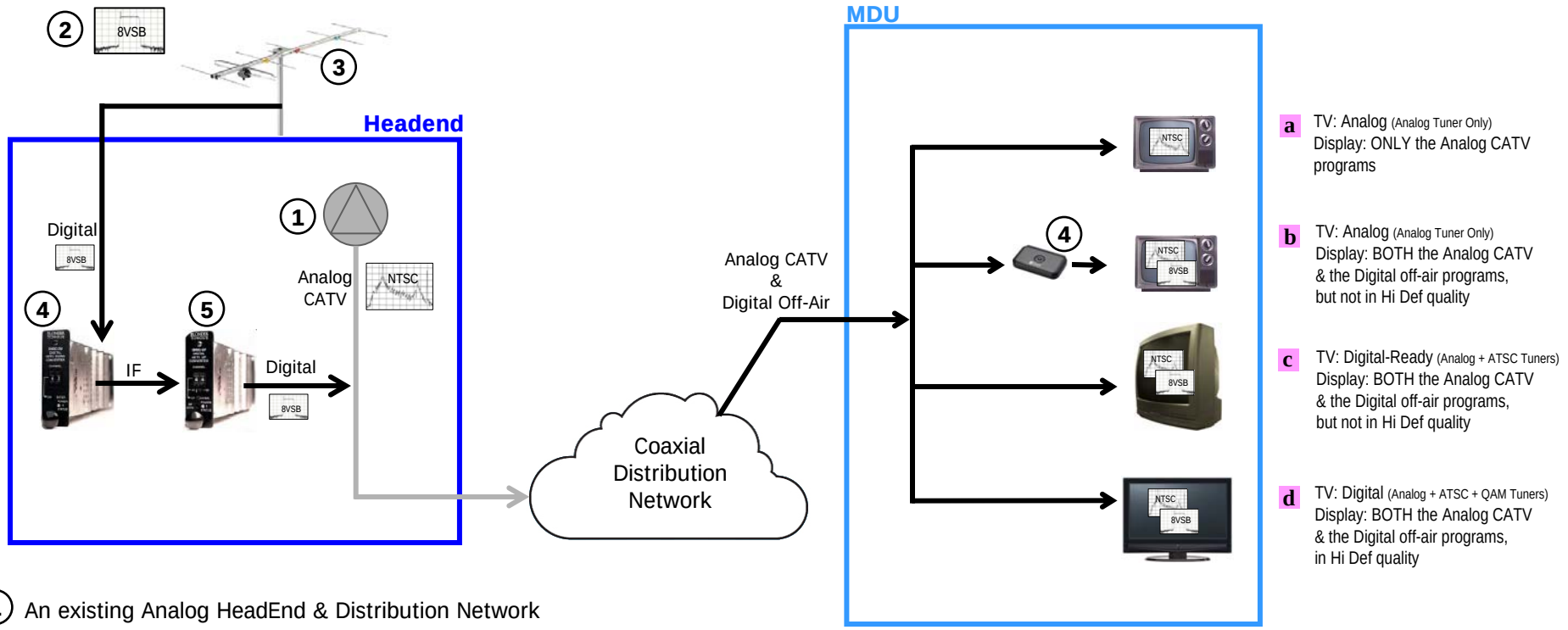


1. An existing Analog HeadEnd & Distribution Network
2. Program broadcast in Digital (8VSB Standard)
3. Roof-top Antenna **(Blonder Tongue: BTY Series)**
4. Digital-to-Analog Processor with ASI output **(Blonder Tongue: DAP PLUS ASI; stock 6295 10)**
5. ASI-to-QAM Modulator **(Blonder Tongue: AQM; stock 6271A)**
6. QAM-to-Analog tuner (SetTop Box) by others

ASI = Asynchronous Serial Interface. A streaming data format at 270 Mbits/sec which often carries an MPEG Transport Stream

4. Off-Air Solutions (Receive, Add, & Distribute)

4.7 Receiving Digital Off-Air, and Adding to Analog Headend



a TV: Analog (Analog Tuner Only)
Display: ONLY the Analog CATV programs

b TV: Analog (Analog Tuner Only)
Display: BOTH the Analog CATV & the Digital off-air programs, but not in Hi Def quality

c TV: Digital-Ready (Analog + ATSC Tuners)
Display: BOTH the Analog CATV & the Digital off-air programs, but not in Hi Def quality

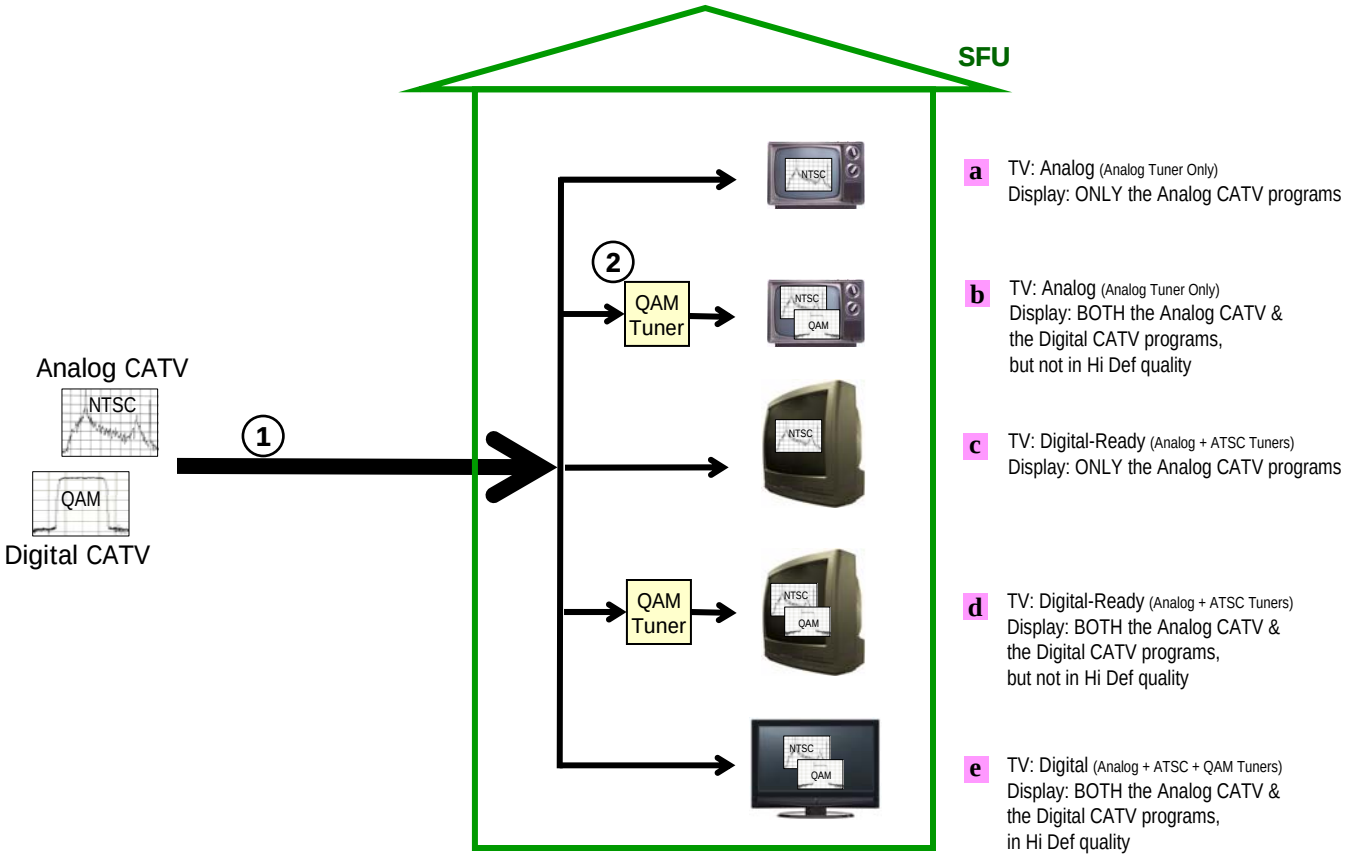
d TV: Digital (Analog + ATSC + QAM Tuners)
Display: BOTH the Analog CATV & the Digital off-air programs, in Hi Def quality

1. An existing Analog HeadEnd & Distribution Network
2. Program broadcast in Digital (8VSB Standard)
3. Roof-top Antenna **(Blonder Tongue: BTY Series)**
4. Digital High-Definition Down-Converter **(Blonder Tongue: DHDC-DV; stock 6264)**
5. Digital High-Definition Up-Converter[1] **(Blonder Tongue: DHDC-UV; stock 6265A)**
6. 8VSB-to-Analog Converter **(Blonder Tongue: Conductor Series; stock 2151)**

[1] The output of the up-converter must be within the North America off-air UHF frequency allocation (Channel 14 to 60)
IF = Intermediate Frequency

5. Cable Solutions (Receive & Distribute)

5.1 Receiving Analog & Digital CATV, and Distributing at a Single-Family Unit



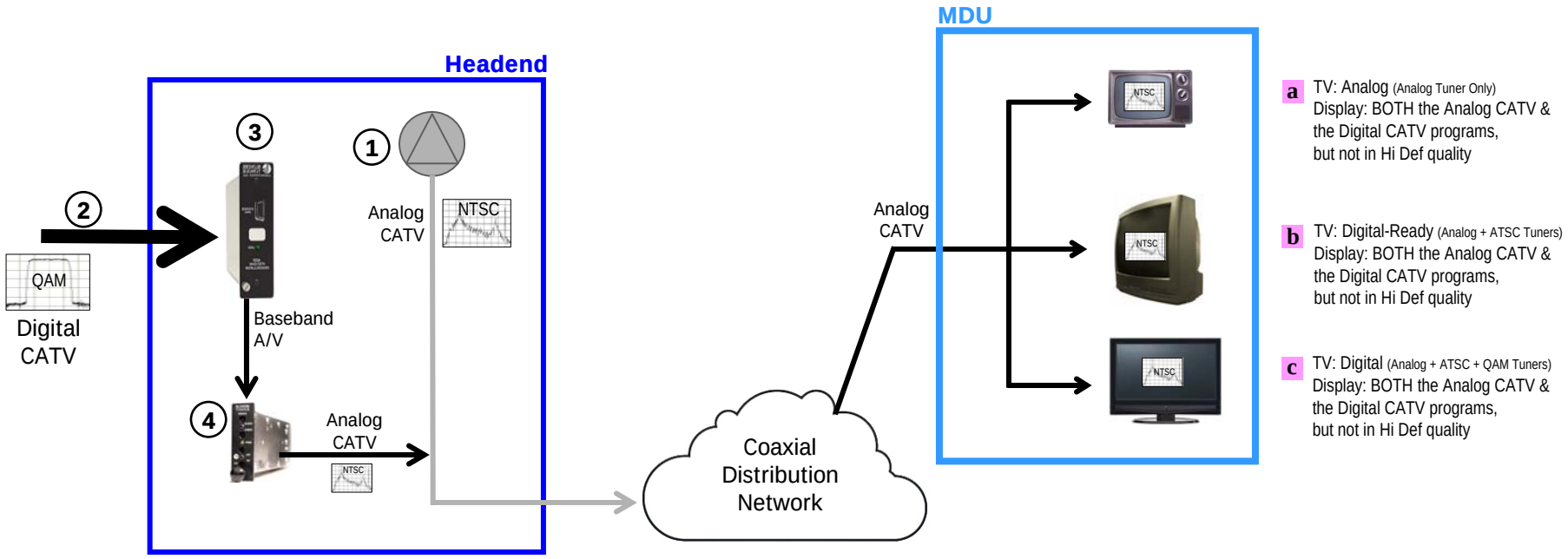
(1) CATV feed from cable company containing Analog CATV (NTSC) & CLEAR[1] Digital CATV (QAM) programs

(2) QAM-to-Analog tuner (SetTop Box) by others

[1] CLEAR means that the program is NOT encrypted by the cable company. If the program in encrypted, then additional de-coding settop boxes must be installed at the TV set.

5. Cable Solutions (Receive, Convert, & Distribute)

5.2 Receiving Digital CATV, and Converting to Analog CATV

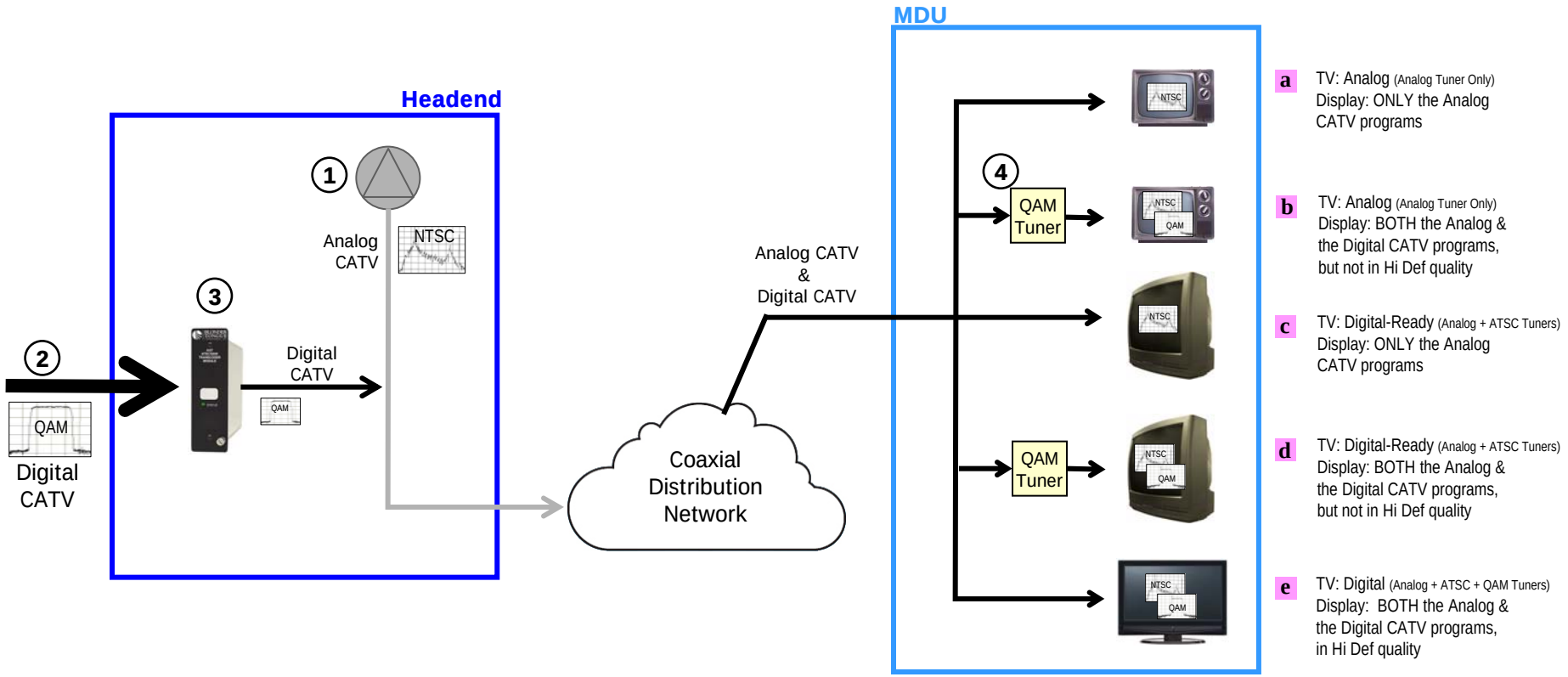


1. An existing Analog HeadEnd & Distribution Network
2. CATV feed from cable company containing CLEAR[1] Digital CATV (QAM) programs
3. QAM-to-Baseband Demodulator **(Blonder Tongue: AQD; stock 6245)**
4. Analog Modulator **(Blonder Tongue: AM & AMCM (Agile); MAVM & MICM (Fixed-Channel))**

[1] CLEAR means that the program is NOT encrypted by the cable company. If the program in encrypted, then additional de-coding settop boxes must be installed at the TV set.

5. Cable Solutions (Receive, Select, & Distribute)

5.3 Receiving Digital CATV, and Selecting from Digital CATV

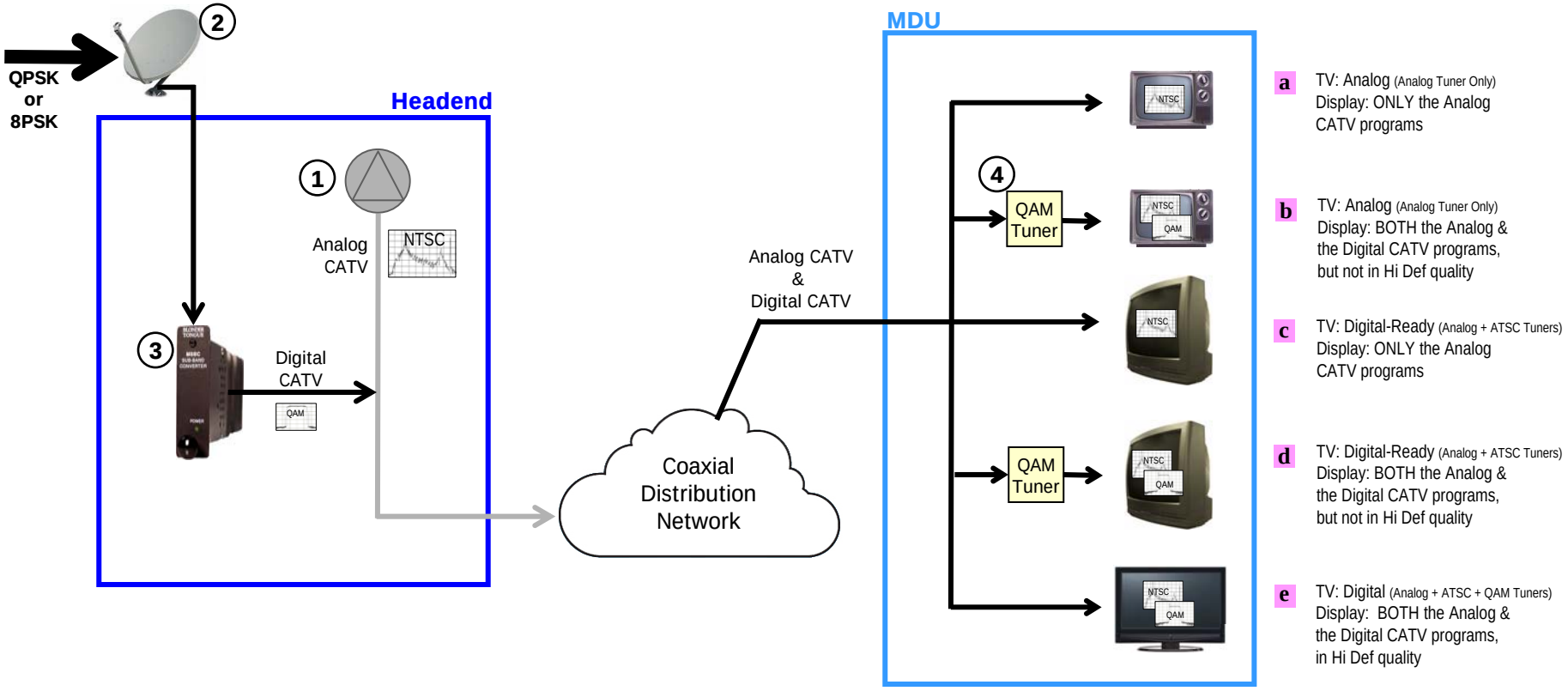


1. An existing Analog HeadEnd & Distribution Network
2. CATV feed from cable company containing CLEAR[1] Digital CATV (QAM) programs
3. QAM-to-QAM Transcoder **(Blonder Tongue: AQT; stock 6275)**
4. QAM-to-Analog tuner (SetTop Box) by others

[1] CLEAR means that the program is NOT encrypted by the cable company. If the program in encrypted, then additional de-coding settop boxes must be installed at the TV set.

6. Satellite Solutions (Receive, Transcode, & Distribute)

6.1 Receiving "clear" satellite programs, and Transcoding into Digital CATV

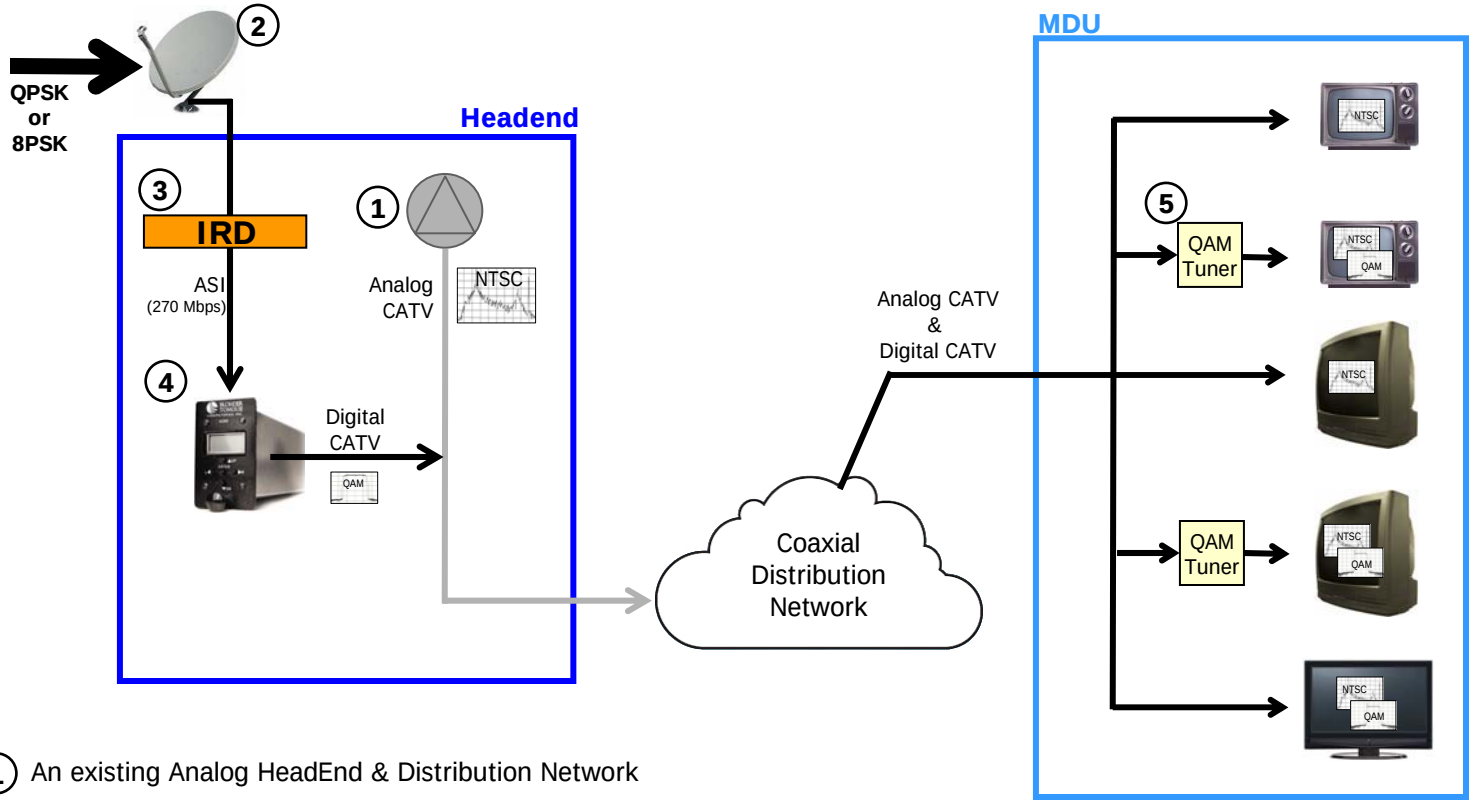


1. An existing Analog HeadEnd & Distribution Network
2. CLEAR[1] feed from satellite provider in QPSk or 8PSK formats
3. QPSK/8PSK-to-QAM Transcoder **(Blonder Tongue: QTM; stock 6231A)**
4. QAM-to-Analog tuner (SetTop Box) by others

[1] CLEAR means that the program is NOT encrypted by the satellite provider. If the program in encrypted, then additional de-coding settop boxes must be installed at the TV set.

6. Satellite Solutions (Receive, Decode, Modulate, & Distribute)

6.2 Receiving "encrypted" satellite programs, and Modulating into Digital CATV



a TV: Analog (Analog Tuner Only)
Display: ONLY the Analog CATV programs

b TV: Analog (Analog Tuner Only)
Display: BOTH the Analog & the Digital CATV programs, but not in Hi Def quality

c TV: Digital-Ready (Analog + ATSC Tuners)
Display: ONLY the Analog CATV programs

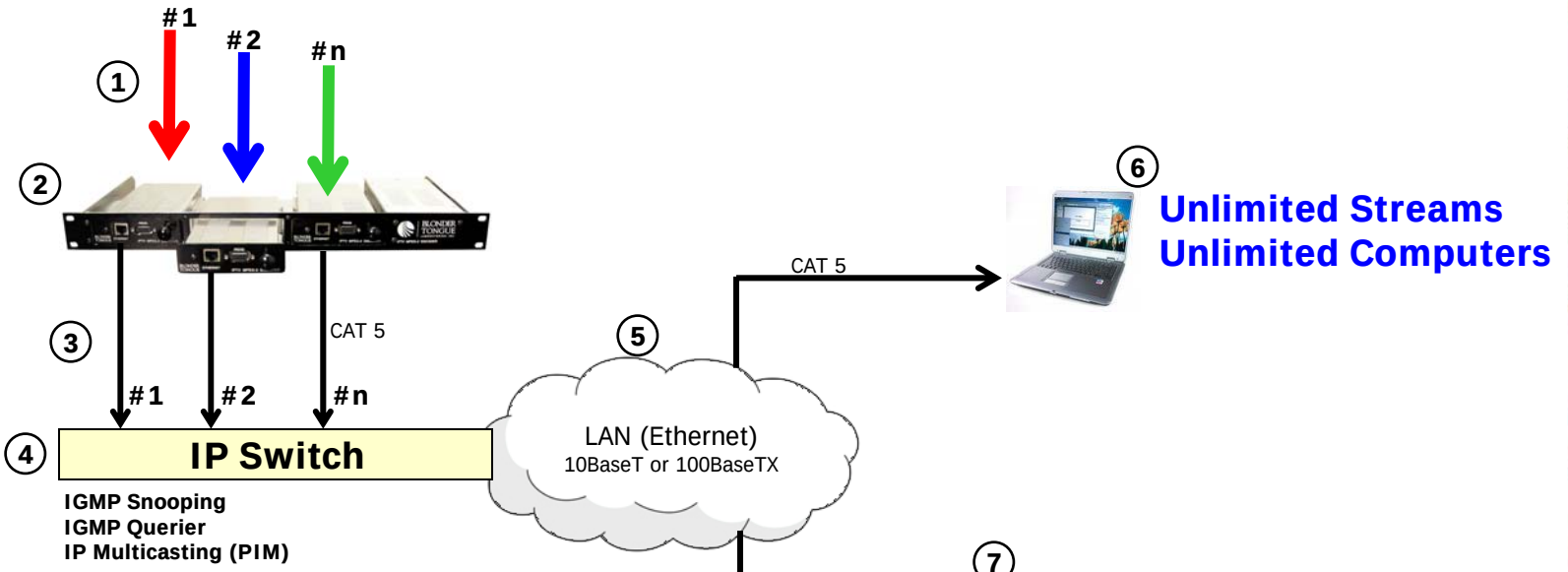
d TV: Digital-Ready (Analog + ATSC Tuners)
Display: BOTH the Analog & the Digital CATV programs, but not in Hi Def quality

e TV: Digital (Analog + ATSC + QAM Tuners)
Display: BOTH the Analog & the Digital CATV programs, in Hi Def quality

1. An existing Analog HeadEnd & Distribution Network
2. Encrypted[1] feed from satellite provider in QPSk or 8PSK formats
3. Integrated Receiver Decoder (IRD) with ASI output by others/satellite provider
4. ASI-to-QAM Modulator **(Blonder Tongue: AQM; stock 6271A)**
5. QAM-to-Analog tuner (SetTop Box) by others

[1] ENCRYPTED means that the program is encrypted by the satellite provider. The IRD performs the de-coding, therefore, no additional settop boxes are necessary at the TV set.

7.1 Encoding Application (IPTV: Baseband-to-IP)



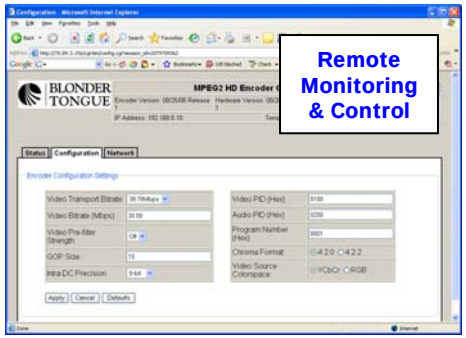
1. Unlimited programs in baseband Audio/Video format
2. Baseband-to-IP encoder **(Blonder Tongue: IPME-2; stock 2420;** three modules shown**)**
3. MPEG-2 encoded IP-encapsulated video streams (user-selectable 1.5 to 7.5 Mbps per stream)
4. IP Switch by others (Cisco model 3650 or equivalent)
5. Typical Ethernet network (configured for IGMP Snooping, IGMP Querier, and PIM)
6. All the video streams can be viewed on unlimited number of computers
7. IP-to-Baseband/RF converter **(Blonder Tongue: IPME-STB; stock 2431)**
8. All the streams can be viewed on unlimited Analog or Digital TVs (one converter (7) is needed for each TV set)

7.2 Encoding Application (HDMI-to-QAM)

The HDE-QAM Encoder accepts one input in HDMI format, and delivers one HD MPEG-2 encoded output in QAM format in the 54-864 MHz range. Remote monitoring and control is accomplished using any standard Web browser.

HDMI

HD MPEG-2 Encoding



QAM

Agile 54-864 MHz
+60dBmV (120 dBμV)

7.3 Encoding & Muxing (HD/SD/NTSC-to-ASI)

HDE-ASI Encoder & Multiplexer accepts & auto-detects input streams in HD-SDI, SD-SDI, and analog NTSC formats, and delivers one HD/SD MPEG-2 encoded output in ASI format. Additionally, a multi-channel output in DVI format is available for preview and testing purposes.The audio program of the digital inputs is encoded in Dolby AC-3 format. Remote monitoring and control is accomplished using any standard Web browser.

HD , SD , NTSC

HD/SD MPEG-2 Encoding
Dolby AC-3 Audio Encoding

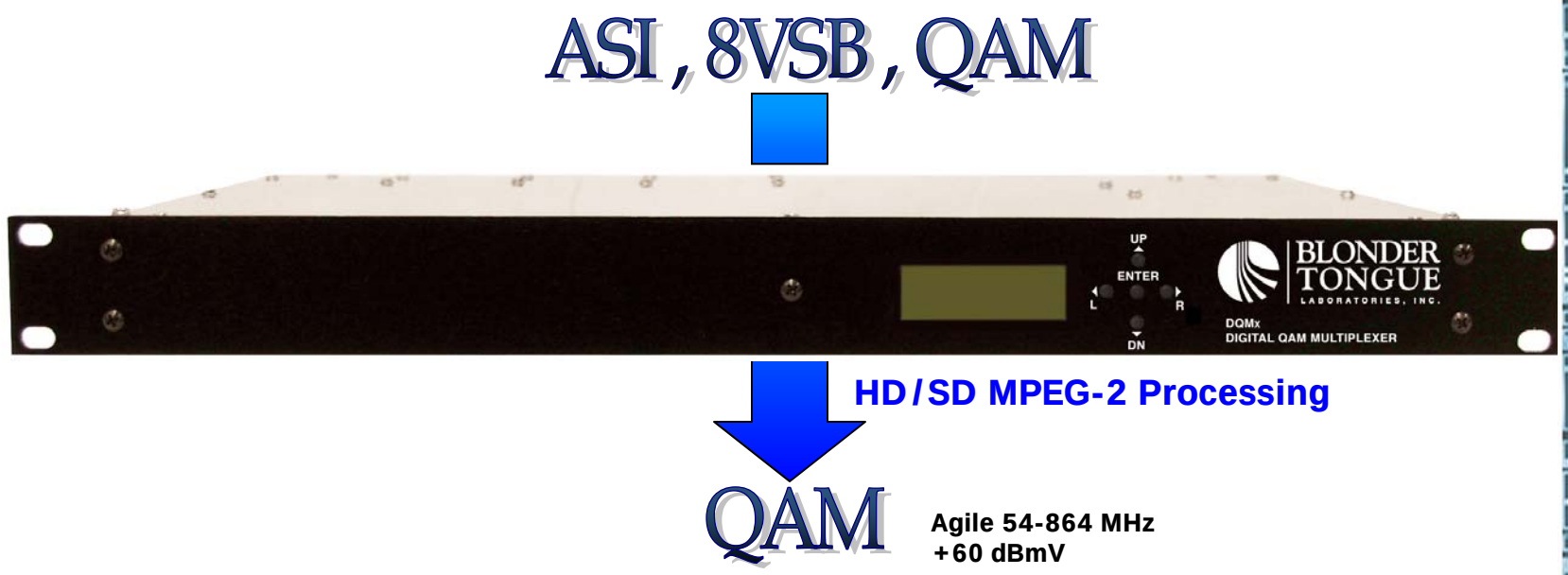
ASI

HD-SDI: High-Definition Serial Digital Interface; SMPTE 292M; 1.485Gbps; 720p/1080i
SD-SDI: Standard-Definition Serial Digital Interface; SMPTE 259M; 270 Mbps; 480i
NTSC: The analog television system developed by National Television System Committee and used in North America; 525 lines per frame
ASI: Asynchronous Serial Interface; 270 Mbps

7.4 Muxing Application (ASI/8VSB/QAM-to-QAM)

DQMx Multiplexer can be configured with up to 4 input modules in ASI, 8VSB, and QAM formats, and delivers one output in QAM format in the 54-864 MHz range.

Each ASI Input Module can process up to 12 channels, not to exceed 270 Mbps. Each 8VSB/QAM Input Module can process up to 12 channels, not to exceed 19.4 Mbps for 8VSb or 38.8 Mbps for QAM 256. Any mix of input modules are allowed - for example DQMx can be configured with 2 ASI input modules and 2 8VSB input modules. The QAM-modulated output can contain up to 12 channels, not to exceed 38.8 Mbps when operating in QAM 256 mode.



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