
Analog-to-Digital

Simplifying the terrestrial broadcast network conversion



As broadcasters around the world convert their terrestrial broadcast plan to digital, a pre-engineered solution can reduce time-to-market, complexity and risk.

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Introduction

Advances in television technology and the demand for new multimedia services found in other forms of television delivery has resulted in most countries around the world developing and specifying new standards for their terrestrial television distribution. These new standards allow the transformation of their terrestrial distribution from single channel analog broadcasts to multi-channel digital broadcasts along with the ability to provide new services, such as mobile TV, electronic program guides, widgets, push video on demand, and other interactive features that end users are looking for today. All of these new services provide an opportunity for the broadcast to develop and generate additional revenue streams.

In that light, Globecomm has developed a universal Digital Terrestrial Television (DTT) solution that is modular, compact, lightweight, and very cost effective. The Globecomm pre-engineered DTT solution is capable, through software download, to address all of the differing major standards in place today. In addition, because of its modularity and flexibility new services can easily be added and configured by the broadcaster. The following paragraphs provide some background and a detailed look at the Globecomm DTT solution.

Digital Television Standards

The various worldwide digital television standards that exist today differ in video and audio formatting as well as in the conversion from transport stream to broadcast signal. For example, one standard may require MPEG-2 compression whereby another specifies MPEG-4. One system requires Vestigial Sideband (VSB) modulation while another requires Coded Orthogonal Frequency Division Multiplexing (COFDM). In addition, the implementation of mobile TV and other multimedia services may also differ with the different standards. Figure 1 shows the four (4) most prevalent standards; DVB-T/T2, ATSC, ISDB-T, and DTMB and the countries that are either using or committed to using them. All of these standards support mobile television and are individually described below:

ATSC is a standard that was developed by the Advanced Television Standards Committee and has been adopted by the United States, Canada, Mexico, South Korea, and Honduras. The ATSC standards were developed in the early 1990s by the "Grand Alliance, which was a consortium of electronics and telecommunications companies that were brought together to develop a specification for what is now known as High Definition Television (HDTV). The terrestrial ATSC System utilizes 8-VSB modulation and is an eight (8) level amplitude modulation format. It is argued that ATSC is not as robust as COFDM especially when it comes to multipath interference, however it is superior for impulse noise, which is present on Very High Frequency (VHF) bands. ATSC signals are designed to use the same six (6) MHz bandwidth as analog NTSC television channels. Once the digital video and audio signals have been compressed and multiplexed, the transport stream can be modulated in different ways depending on the method of transmission. ATSC has completed their mobile television standard, which is ATSC-M/H (Mobile/Handheld) and it has started operation in some localities. ATSC fixed terrestrial operation is basically fully implemented in the United States.



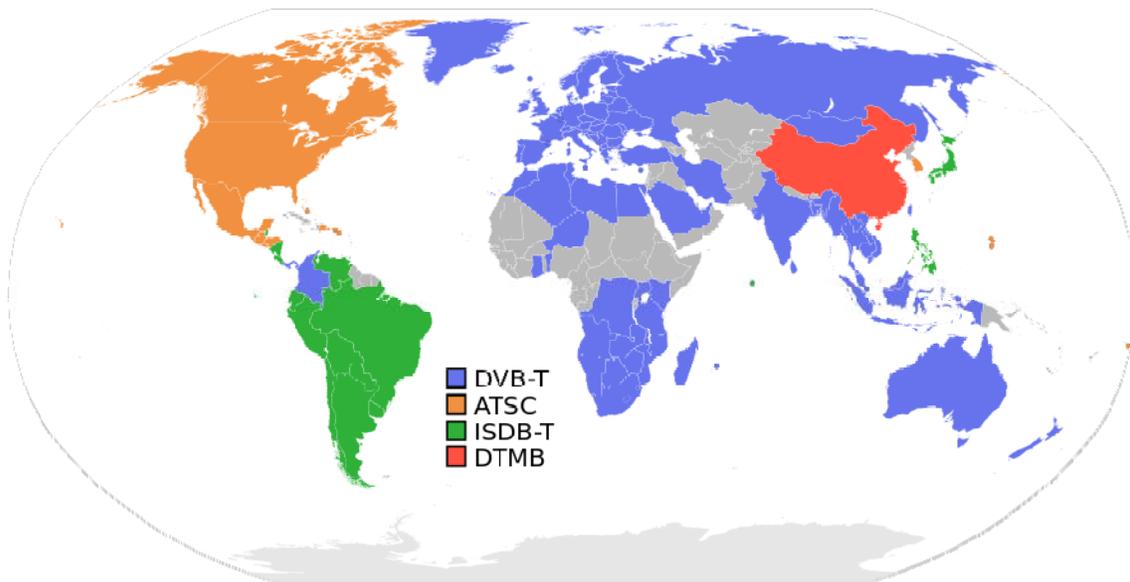


Figure 1 – Worldwide Digital Terrestrial Television Standards

DVB-T and DVB-T2 are standards that were developed by the Digital Video Broadcasting Project (DVB), which is an industry-led consortium of over 200 broadcasters, manufacturers, network operators, software developers, regulatory bodies and others in over 35 countries committed to designing open technical standards for the global delivery of digital television and data services. DVB-T is the most widely deployed DTT system worldwide, with over 60 countries that have adapted or deployed the standard. DVB-T uses coded orthogonal frequency division multiplexing, which uses as many as 8000 independent carriers, each transmitting data at a comparatively low rate. DVB-T2 offers an increased efficiency of 30 to 50 percent in its spectrum usage as compared to DVB-T. The original mobile version was designated DVB-H (Handheld) however, it has not developed as envisioned and there is a new version that is being discussed DVB-NGH (Next Generation Handheld). Also, there is a less complex version of DVB-T2 that was designed for smaller mobile devices called DVB-T2 Lite

ISDB-T (Integrated Services Digital Broadcasting) is a Japanese standard that was developed by the Association of Radio Industries and Businesses (ARIB). Brazil has adopted a modified version and most of the other Latin and South American countries are transitioning to the Brazilian standard. ISDB-T operates in both VHF and UHF and uses COFDM modulation. One of the differences is that Japan uses MPEG-2 compression while Brazil uses the more efficient MPEG-4 compression standard. While ISDB-T is similar to DVB it was designed with 13 sub-channels of which twelve are used for fixed television and thirteenth channel is used either as a guard band or for ISDB-H mobile terrestrial digital audio/video and data broadcasting service.

DTMB (Digital Terrestrial Multimedia Broadcast) is a standard developed and adapted in China, as well as, Hong Kong. DTMB is a merger of the following standards: ADTB-T (developed by the Shanghai Jiao Tong University, Shanghai), and DMB-T/H (developed by Tsinghua University, Beijing) and TiMi



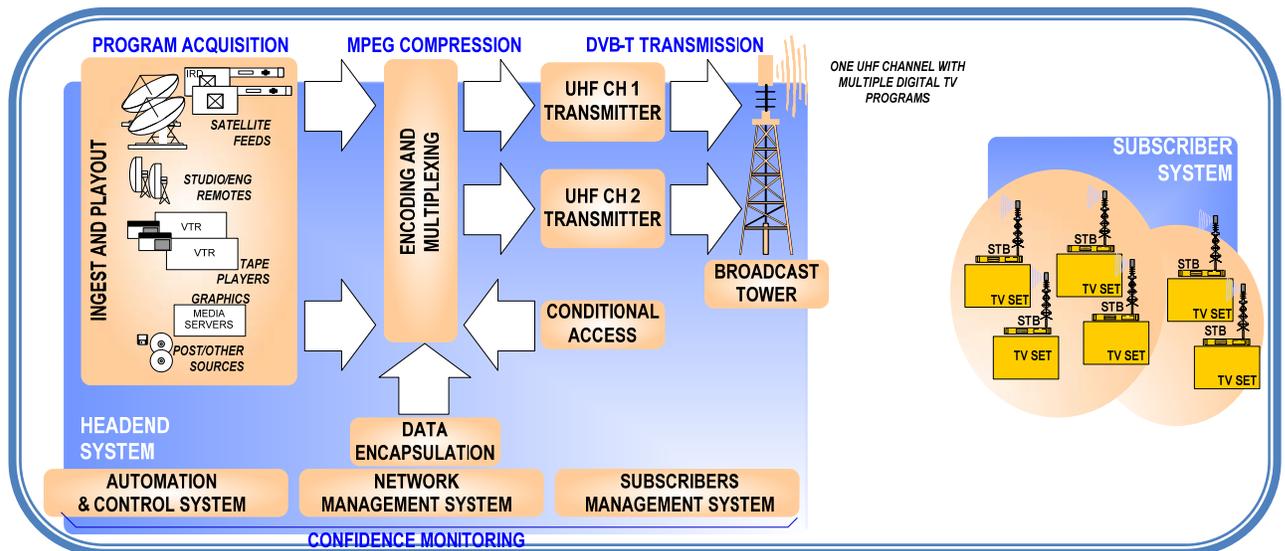
(Terrestrial Interactive Multiservice Infrastructure), which is the standard proposed by the Academy of Broadcasting Science in 2002. Neither Shanghai Jiao Tong University nor Tsinghua had enough political strength to make their own technology become the unique standard, so the final decision was to opt for a double standard, merged along with the TIMI 3 standard, responding to a need of backward compatibility. DTMB was created in 2004 and became an official DTT standard in 2006. Two multiplex schemes coexist in the DTMB standard, vestigial sideband and time-domain OFDM. The standard does not restrict implementation to a specific codec (such as ATSC) and was developed to support both fixed and mobile television.

Globecomm's Digital Terrestrial Television Initiative

Television bandwidth is a precious commodity. Analog TV systems require programs to occupy the entire licensed frequency band, which sharply limits the broadcaster's ability to meet viewer demand.

Converting analog terrestrial television systems to digital brings many benefits. With h.264 encoding technology and transport stream multiplexing, broadcasters can place multiple services on a single band. At the same time, digital terrestrial television (DTT) systems offer simplified operation, lower operational expenses and reduced maintenance costs.

Globecomm offers broadcasters a pre-engineered, fully-tested, configurable system for analog-to-digital conversion of terrestrial TV. The Globecomm DTT Solution makes it possible to upgrade analog terrestrial TV systems without disrupting program operation. As a leading technology integration company, Globecomm takes end-to-end responsibility from design and configuration to installation, testing and lifecycle support.



The Globecomm DTT Solution includes:

■ **Program Acquisition Subsystem**

Satellite TVRO antennas and fiber receivers may be provided with distribution modules. Modular processing units are available to condition signal levels at entry point for contribution programs and other content acquisition.

■ **Compression Subsystem**

Innovative MPEG 4 h.264 encoders and transport multiplexers with an associated Network Management System form part of the encoding and service provisioning. Data multiplexing for multimedia application such as Closed Captioning, Teletext, Internet and/or Mobile TV ensembles can be incorporated if desired. Additionally, insertion of Conditional Access is available for TV programs requiring encryption.

■ **DVB-T2 Transmission Subsystem**

Prior to emission, modulator/exciter feed VHF or UHF power amplifiers and associated antennas for over-the-air transmission. The modulator/exciter are capable of providing the necessary waveforms for ASTC, DVB-T2, ISDB-T and other systems regardless of the transmission media. Globecomm can also provide the necessary engineering to design Multiple Frequency and Single Frequency Networks.

■ **Confidence Monitoring**

Broadcasters can monitor and control the entire system chain from acquisition to emission using Globecomm's premier AxxSys Orion SNMP management platform. Globecomm can implement multi-point monitoring presentation with automatic notification of alarms and logging 24x7, including a Presentation Video Wall and QC Stations with IP proactive test tools and MPEG measurement units. In addition, Audio Loudness Control (ALC), logging, and compliance reporting can be implemented as needed.

■ **Life Cycle Support**

All Globecomm solutions are backed by our 24x NOC and technical support staff for the first two years of operation. During this time, Globecomm NOC will monitor your TV stations and provides remote support plus mandatory site maintenance visits twice a year.

The Globecomm Pre-Engineered DTT Solution

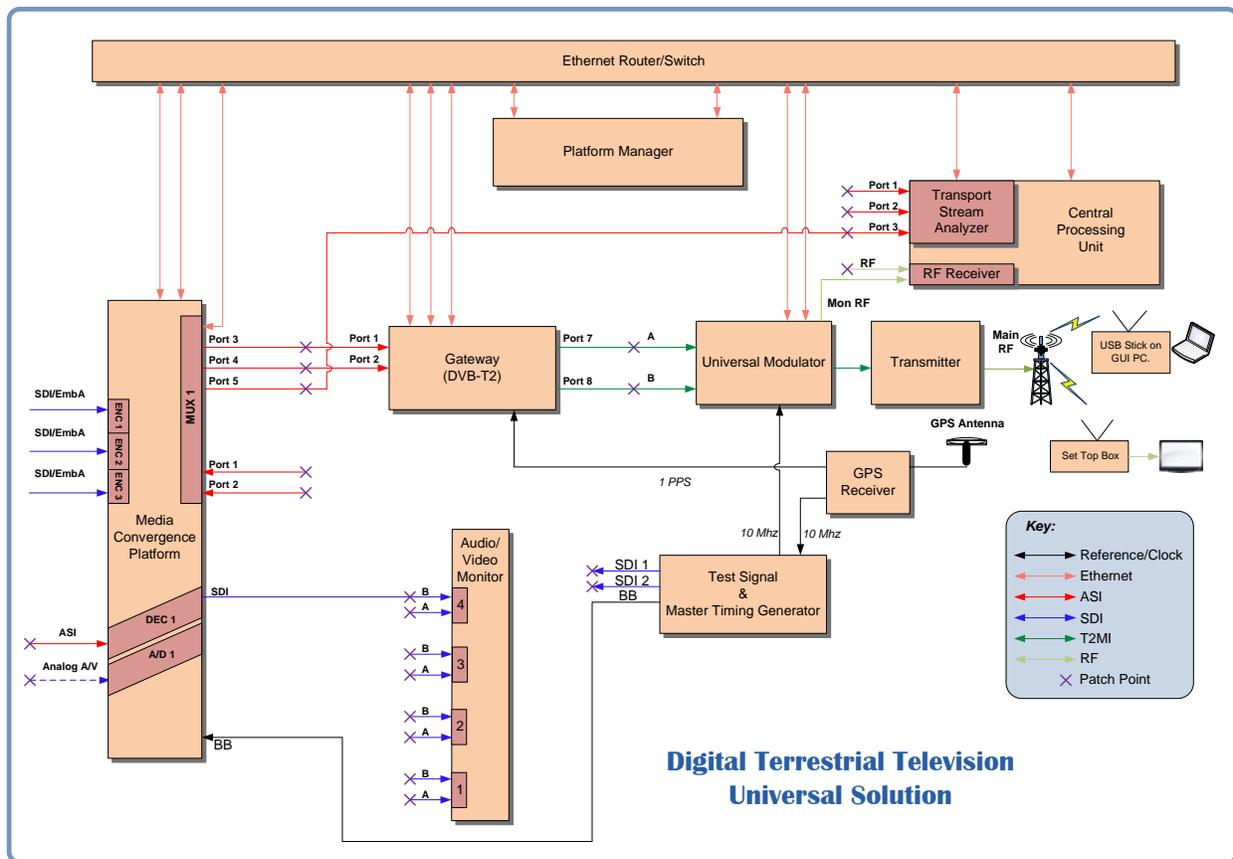
The Globecomm Pre-Engineered DTT System provides a very modular and flexible solution that gives analog based terrestrial broadcast operators the opportunity to migrate to a digital broadcast transmission platform in a cost effective and simple manner. The Globecomm solution is a scalable system that adheres to published television standards with much of the integration work completed prior to site installation, thereby aiding in the rapid conversion and deployment of a new digital terrestrial television system.



The key system components; analog to digital signal conversion, digital signal compression and multiplexing, insertion of external data streams, formatting to transmission standards, monitoring of signal quality and standards compliance have been addressed.

As discussed previously, there are multiple transmission/modulation standards that are currently in use around the world. Based on the geographical location of an operator; ATSC, ISDB-T, DVB-T/T2, or DTMB may need to be deployed. Additionally, these fixed transmission standards may have a mobile component that can be based on yet a different standard. The Globecomm solution has the adaptability to conform and deploy these differing standards as well as any new standards that are developed. Examples of these new mobile standards are, DVB-T2 Lite and/or DVB-T2 NGH (Next Generation Handheld).

A key component of the Globecomm solution is the ability to upload different software packages in order to reconfigure or change modulation and transport stream formatting.



The following paragraphs discuss the specific components that make up the Globecomm DTT Universal Solution:



■ **Media Convergence Platform**

The Media Convergence Platform (MCP) is a next generation modular solution, which provides a whole new approach to networking and signal processing in this new convergent world. It combines traditional baseband video and audio processing, compression, multiplexing and IP networking all in a three (3) rack unit platform. The MCP combines IP and baseband sub-networks in a single flexible chassis along with intuitive graphical management tools. It supports up to fourteen independent, single slot modules with internal connectivity and includes, as a minimum, 3 Gb/s baseband connections to and from each module, 1 Gb/s data connection to and from each module and one (1) independent control network to and from each module. There are a plethora of other features, which makes this one of the most versatile media platforms available today. Up to ten (10) MPEG-2 or MPEG-4 encoders can be aggregated in one (1) MCP chassis and with five (5) or more encoders statistical multiplexing can be effectively implemented. More chassis units can be integrated into the system, thereby allowing additional encoders or other network components, such as analog to digital converters, to merge into the overall network.

■ **DVB-T2 Gateway**

The DVB-T2 Gateway provides a central point of control for DVB-T2 networks enabling the operator to take advantage of more efficient spectrum utilization in a Next Generation Network (NGN). The DVB-T2 Gateway rearranges the transport streams into DVB-T2 Modulator Interface (MI) format, which in turn controls the modulator parameters and provides accurate timing and rate control for Single Frequency Network (SFN) operation. The DVB-T2 Gateway can encapsulate one or several MPEG transport streams into a single Physical Layer Pipe (PLP) or multiple PLPs. The Gateway provides for SFN time stamp insertion, encapsulation of the transport stream into DVB-T2 baseband frames, mapping of input transport streams into individual PLPs and centralized control and signaling of DVB-T2 modulators.

■ **Universal Modulator**

The Universal Modulator utilizes an innovative universal waveform engine that supports all of the world standards for digital terrestrial television broadcasting. Using the latest technologies, the modulator uses a direct conversion process that allows the modulator to provide an RF output from 47 MHz to 946 MHz. The modulator can be configured to support one, two or all of the DTT waveforms and the operator can easily switch from one waveform to another through software selection.

■ **Transmitter**

The Transmitter is a separate system unit that is not a part of the Globecom DTT Universal Solution; however it is an integral component in the overall system and on a system basis can be provided by Globecom. The transmitter is typically a solid state, broadband, power amplifier that is designed to operate in the VHF or UHF frequency band.



■ **Central Processing Unit**

The Central Processing Unit (CPU) is an industrial grade computer with several added boards; one of which is a RF Receiver and the other a Transport Stream Analyzer, which analyses PIDs, tables, and timing for compliance monitoring. The CPU provides for browser based monitor and control of the system, as well as, measurement and analysis of the transport stream(s) described above.

■ **Test Signal and Master Timing Generator**

The Test Signal/Master Timing Generator is used both as a test signal generator and a master time generator. As a test signal generator it can produce analog, digital, and audio test signals required in a broadcast facility. As a master time generator, it inputs time information from the GPS receiver reference source and provides a digital audio reference signal, vertical interval time code and absolute time reference support for black burst video outputs.

■ **Platform Manager**

The Platform Manager is a server that provides for the processing and transport of Service Information (SI) as defined in the ATSC, DVB, and ISDB-T specifications for SI. In addition, it provides additional value added services such as an Electronic Program Guide, as well as, other interactive enhancements, which are discussed in Section V. The server hardware has the capacity to run multiple simultaneous applications.

■ **Audio/Video Monitor**

The Audio/Video Monitor is a quad set of 4.3" LCD screens with two (2) SDI inputs on each screen used for quality control viewing of any baseband signal. All inputs are available through the patch bay. Each monitor is auto sensing on the input format and can display waveform measurement and vector scope data, as well as, eight (8) channels of audio metering. UDM data can be programmed.

■ **Ethernet Router Switch**

The Ethernet Router Switch provides the Local Area Network interconnection between all of the elements of the network.

Interactive Enhancements

The Platform Manager is a unique value added data file transport solution that is compliant with all standards. As such, one of its highly strategic applications is its service guide solution. It is the mainspring for promoting content and services to end users and for them to view, order, and consume content that is relevant to them. The Service Guide has been designed to promote abundant consumer usage and enhance the attractiveness of the service it offers. There are a growing number of value added services available, which include:

- ❖ Interactivity services such as advertisements, voting, polling, and etc.
- ❖ Automatically downloaded content



- ❖ On demand video clips (push VOD)
- ❖ Ringtones
- ❖ Images
- ❖ Games

The Push VOD solution is based on an open multicast protocol coupled with an error correction protocol. The technology guarantees the delivery of the whole file, not only its packets. The delivery is done with a single transmission and can save at least 50% in bandwidth as rebroadcast is not required. The solution works with any kind of files whether they are video, audio, games, magazines, electronic program guides or any other.

Conclusion

The Globecomm Digital Terrestrial Television Universal Solution has been designed to operate with all of the world standards for digital terrestrial television broadcasting. It is very compact and for up to ten (10) channels can be integrated in less than one half of a standard cabinet.

Globecomm's DVB-T2 demonstration unit is shown in the picture to the left.

Globecomm has designed our DTT system with several discriminators that we feel is unique to the industry and sets our solution apart from others such as:

- ❖ A Media Convergence Platform that is highly configurable, compact, and easily expanded.
- ❖ A DVB-T2 Gateway that provides a central point of control for DVB-T2 networks.
- ❖ A Universal Modulator that supports all of the world standards for digital terrestrial television broadcasting.

- ❖ A Platform Manager that provides DVB-SI, as well as, many other interactive enhancements.



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