



Technology Comparison: MediaFLO™ and DVB-H

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INTRODUCTION

While Mobile TV is still in its infancy in terms of mass commercialization, it is only a matter of time before it becomes one of the significant factors driving mobile device and service demand. Consumers have demonstrated through studies and trials their desire for the service, and analysts have predicted tremendous growth. Now it is up to the marketplace to deliver.

Creating a positive business model for Mobile TV will be a key component for generating revenues. Also at the forefront is deciding which technology to use. Two contenders, MediaFLO and Digital Video Broadcast – Handheld (DVB-H), have garnered much attention, but some clarification must be made to differentiate between the two technologies. Outlining and highlighting the different features and characteristics of both technologies will help clarify what each technology has to offer.

TECHNOLOGY HIGHLIGHTS

MediaFLO

- A global air interface standard.
- An innovation of QUALCOMM.
- Supported by the FLO Forum and its industry members.
- Designed from the ground up specifically for the mobile environment to increase network capacity/coverage and reduce multimedia delivery costs.
- Broadcasts multimedia to an unlimited number of mobile handsets simultaneously.
- Statistical Multiplexing enables same video quality at 75% of bit rate, plus additional data services at no impact to allocated bit rate.
- Layered modulation extends coverage area and provides graceful degradation.
- Powerful coding scheme provides good coverage with fewer transmitters per market due to superior link margins.
- Provides 750 millisecond outer code time diversity for all bit rates.
- Supports wide and local area content within a single RF carrier.
- Signal structure enables fast channel switching time.
- Supports local and wide area services in a single RF channel.
- Features including fast channel change, large outer code time diversity, and statistical multiplexing supported concurrently with no adverse impact on power consumption.
- Utilizes IP protocol with support for lighter weight streaming media protocol.
- Available at no incremental licensing fee to any device with a standard multi-mode WCDMA or CDMA2000 license, under QUALCOMM's standard terms and conditions.

DVB-H

- A broadcast transmission system¹.
- Developed by the DVB-H Project
- Supported by the DVB organization²
- Developed based on the Digital Video Broadcast-Terrestrial (DVB-T) standard for fixed receivers³.
- Carries multimedia services over digital terrestrial broadcasting networks to handheld terminals⁴.
- Utilizes time-slicing technology, which sends bursts of data versus a continuous stream, to reduce power consumption on handhelds⁵.
- Each time slice is a nominally fixed bit rate.
- Considerable adjustability in the organization of time slice and outer code configuration.
- Acquisition time, outer code time diversity, and potential application of statistical multiplexing are interdependent. Some aspects are compromised in order to optimize others.
- Utilizes IP protocol exclusively.
- Undefined licensing terms and cost.

1. ETSI EN 302 304 V1.1.1 (2004-11)
European Standard (Telecommunications series)
Digital Video Broadcasting (DVB);
Transmission System for Handheld Terminals (DVB-H)

2. <http://www.dvb-h.org>

3. ETSI EN 302 304 V1.1.1

4. ETSI EN 302 304 V1.1.1

5. ETSI EN 302 304 V1.1.1

6 COMMON MISCONCEPTIONS ABOUT MEDIAFLO AND DVB-H

1. Standardization

DVB-H is often perceived as an established, fully standardized technology. The DVB-H physical and link layer standard was adopted by ETSI as standard EN 302 304 V1.1.1 in November 2004. Additionally, DVB-H has been standardized on the physical layer only, and due to ongoing debates in the industry the DVB-H service layer is yet to be standardized. There are no minimum performance specifications for DVB-H devices or transmitters. The application of conditional access control is fractured and conceptually dissimilar across the multiple proponents.

MediaFLO has achieved standardization in the areas of air interface TIA-1099, transmitter minimum performance spec TIA-1103, device minimum performance specification TIA-1102, and test instruments TIA-1104. The FLO Forum has a system information standard and several additional documents under development.

2. Openness

MediaFLO is a global open standard. Although DVB-H has been publicized for a longer period, there is no advantage in terms of openness. The FLO Forum, made up of global members representing the entire value chain, is driving the globalization and standardization of MediaFLO technology.

3. Domestic versus International Markets

Both MediaFLO and DVB-H are being trialed in various markets around the world, but no technology has achieved measured entrenchment in Europe or Asia, which points to an open playing field for technology adoption. MediaFLO holds a clear advantage in the USA, whereas DVB-H has one commercial deployment in Italy.

4. Handset Support

DVB-H proponents have claimed there is no handset support for MediaFLO. However, Verizon Wireless will be selling Samsung Electronics Co., Ltd. and LG Electronics handsets that provide full support for MediaFLO, and demonstrations of MediaFLO have been performed on other handsets including Amoi, Kyocera, Motorola, Pantech, and Sharp Corp. Handsets are a consequence of a commercial platform, not the cause. Successful commercial deployment in the largest TV market in the world – the US – will drive choice and scale of handsets worldwide, UMTS and CDMA.

5. Chipset Provision

MediaFLO is a global open standard and has a licensing agreement in place with mobile TV chip company Newport Media, and is negotiating with several others. Establishing chip relationships with semiconductor vendors such as Newport helps support the global deployment of MediaFLO by providing choice and differentiation.

6. Royalty Structures

QUALCOMM will license its essential MediaFLO patents for use in multi-mode WCDMA and CDMA2000 handsets with no increase to its standard royalty rate for WCDMA and CDMA2000-based handsets. Although often reported as “free” technology, all DVB formats charge royalties. These royalties are currently undefined and will be an additional expense in all 3G handsets⁶.

⁶. MGPEG-LA press release: <http://www.mpegla.com/news.cfm>

KEY TECHNOLOGY COMPARISONS

Design	
MediaFLO	DVB-H
<ul style="list-style-type: none"> • MediaFLO was designed from the ground up specifically for the delivery of multimedia to mobile handset devices. • MediaFLO was created to deliver optimal efficiency, mobility, capacity, and coverage. 	<ul style="list-style-type: none"> • DVB-H is a design based on the DVB-T terrestrial standard originally created for fixed receivers (in-home television) with different power consumption characteristics than handheld devices. • DVB-H requires trade-offs in viewing experience, channel switching time, quality, coverage, and deployment.

Standardization	
MediaFLO	DVB-H
<p>MediaFLO holds the following technical specifications:</p> <ul style="list-style-type: none"> • TR-47.1 Engineering Subcommittee publishes FLO Forum-sponsored FLO Air Interface Specification (AIS), Technical Standard TIA-1099 (7/06). • PN-3-0244 (published as TIA-1102) – Minimum Performance Specification for Terrestrial Mobile Multimedia Multicast Forward Link Only Devices (9/06) • PN-3-0245 (published as TIA-1103) - Minimum Performance Specification for Terrestrial Mobile Multimedia Multicast Forward Link Only Transmitters (9/06) • PN-3-0246 (published as TIA-1104) – Test Application Protocol for Terrestrial Mobile Multimedia Multicast Forward Link Only Transmitters and Devices (9/06) • PN-3-0270 – Forward Link Only Air Interface Specification Transport Protocols 	<p>DVB-H holds the following ETSI technical specifications:</p> <ul style="list-style-type: none"> • Transmission System for Handheld Terminals - EN 302 304 (10/04). • IP Datacast over DVB-H: Use Cases and Services – TR 102 473 • IP Datacast over DVB-H: Architecture -- TR 102 469 • Transmission to Handheld Terminals -- TR 102 401 • DVB-H Implementation Guidelines -- TR 102 377 • IP Datacast over DVB-H: Content Delivery Protocols -- TS 102 472 • IP Datacast over DVB-H: Electronic Service Guide (ESG) -- TS 102 471 • IP Datacast over DVB-H: Program Specific Information (PSI)/Service Information (SI) -- TS 102 470

Channel Switching Time & Power Consumption	
MediaFLO	DVB-H
This comparison considers channel switch time as when the user views the channel as having switched from one live service to another.	
<ul style="list-style-type: none"> • ~ 2 seconds with no compromise to battery power, splash screens, buffering, or progress bars • A typical 850 mAh battery will support roughly 3.9 hours of viewing time. 	<ul style="list-style-type: none"> • Typical implementation uses a 4 second time slice that results in a 4.5 – 5 second channel changing time. This implementation however has a very adverse affect on power consumption. Longer channel changing times (more than 5 seconds) can reduce the power consumption on the handset. • Reported DVB-H implementation for a 1550 mAh battery is roughly 3 hours.

Number of Stat Mux Channels	
MediaFLO	DVB-H
<ul style="list-style-type: none"> • MediaFLO can stat mux 25 channels with no impact on power consumption. 	<ul style="list-style-type: none"> • DVB-H stat mux of 5 channels increases physical layer power consumption by a factor of 4 to 5 times. • It is important to note that a 5-channel stat mux group provides very little in the way of capacity gains.

Layered Modulation	
MediaFLO	DVB-H
<ul style="list-style-type: none"> • Layered modulation is a baseline feature of MediaFLO Technology that supports transmission of base and enhancement layers with different levels of robustness. • Used in conjunction with layered source coding extends coverage area. • Layered modulation provides more graceful degradation of reception, as compared to a single grade of service. 	<ul style="list-style-type: none"> • At this time, the technology does not offer layered codec support.

Use of Bandwidth	
MediaFLO	DVB-H
MediaFLO Technology supports fine-grained multiplexing which allows efficient use of bandwidth through the implementation of variable bit rate encoding. Bandwidth can be allocated on a per second basis, and reducing allocated bit rate saves power.	DVB-H nominally allocates a fixed bandwidth per time slice. One time slice is the smallest unit of access to a DVB-H multiplex. The DVB-H receiver must decode the entire time slice no matter how small the data for the desired service contained therein.

Comparison with Equal Link Margins	
MediaFLO	DVB-H
<p>In a UHF band, MediaFLO can support:</p> <ul style="list-style-type: none"> • ~ 20 channels in 6 MHz • ~ 27 channels in 8 MHz • ~ 300 Kbps average allocated bandwidth per channel with statistical multiplexing applied <p><small>Note: The number number of real-time video channels may vary (typically within 10% to 20% range) depending on codec implementation capabilities, programming line-up and types of media deployed.</small></p>	<p>In a UHF band, MediaFLO can support:</p> <ul style="list-style-type: none"> • ~ 9 channels in 6 MHz • ~ 12 channels in 8 MHz • ~ 300 kpbs each fixed allocation

Physical Layer Performance	
MediaFLO	DVB-H
MediaFLO offers advantages in cost of operation and cost of network deployment versus DVB-H. MediaFLO at nominal similar bps/Hz capacity modes delivers on average about 3 dB better threshold for a typical pedestrian lab measurement with well known channel models such as TU-6. Actual MediaFLO implementations can out perform best in class DVB-H designs by 5-7 dB in actual field C/N performance.	The infrastructure costs for an equivalent footprint and service offering with DVB-H are approximately twice the cost as that for MediaFLO. The nominally doubled number of transmit sites required for DVB-H has a strong negative impact on network operational expense, as well.

Co-existence with DVB-T	
MediaFLO	DVB-H
<p>MediaFLO does not support this option. A separate network for Mobile TV is the significantly more cost effective approach. A separate network using MediaFLO as described above is substantially less expensive than DVB-H.</p>	<p>DVB-T and DVB-H may coexist within a single instance of a DVB-T multiplex. The link budget for the mobile device is such that the coverage areas are widely different. It is reasonable to expect a 40:1 ratio in coverage areas. Additional transmitters can be added to improve the DVB-H coverage, but it is considerably more cost effective on a per channel basis to run a dedicated DVB-H network.</p>

MediaFLO versus DVB-H – Trial Highlights

Trial: Cambridge Sky/MediaFLO Trial

MediaFLO and DVB-H were compared recently in a trial conducted in the UK by British Sky Broadcasting utilizing Arqiva's broadcast network infrastructure. Two Arqiva sites around Cambridge were identified as fitting the tight frequency constraints required for this technology comparison. Circuits carrying the MediaFLO services were provisioned and a new transmitter cabin installed at one of the sites, all within two months, allowing a rapid and thorough comparison of the technologies. The trial established several key results:

- MediaFLO in general either met or exceeded QUALCOMM's previous performance claims.
- Testing demonstrated that MediaFLO is capable of supporting 20 channels of QVGA video and stereo audio in a single 5MHz spectrum allocation. This performance represents a 20 percent increase in channels relative to prior performance claims of 20 video channels per 6 MHz channel.
- Testers of the 25 fps trial video services noted, "the picture quality is very good, small text is clear and movement is smooth," while operating at an average of 240 kb/sec throughput per video/audio channel.
- In tests measuring network acquisition, the MediaFLO device acquired the MediaFLO channel guide in an average of 2 seconds.
- Measurements of channel switching time yielded an average physical layer channel change time of <1.5 seconds and an average video to video channel change time of 2.1 seconds.
- The measured physical layer performance was better than previously published performance claims by 0.5 to 1.2 dB.
- The MediaFLO system allows the flexibility to trade off approximately half of the channel count for twice the coverage area per transmitter.

MediaFLO and DVB-H Performance Results

Format	Frequency Diversity	Time Diversity	Stat Mux Gains ^a	Time Domain Power Reduction ^b	Frequency or Code Domain Power Reduction ^b	Performance Relative to FLO at 1 bps/Hz
DVB-H	Good 5-8MHz	~0.25 sec	None	Yes	No	-3 to -4 dB
MediaFLO	Good 5-8MHz	~0.75 sec.	Good	Yes	Yes	0 dB

Table 1: Technical Parameters and Performance

- a. This refers to the gains realized by encoding real-time media under bit control of a statistical multiplexer that allocates bandwidth according to content need utilizing variable bit rate video and or audio codecs.
- b. Selective access to desired content (if the format is designed such that a device can access the desired data of interest and turns its receiver off) is critical to power efficiency and a key feature to a successful design. Selective access may be achieved in both time and frequency domains.

Additional User Experience Features

Format	Average Channel Switching Time	Video Watch Time With 850 mAhr Battery	Per Channel QOS ^a	File Download	Local- and Wide-Area in Single RF Channel
DVB-H	~5.0 sec.	Goal ~4 hours Demo ~2 hours with 1600 mAhr battery	No	Possibly	No
MediaFLO	~2 sec.	Goal ~3.8 hours (at 360kbps)	Yes	Yes + integrated ClipCasting™ solution with memory management, conditional access, and subscription model	Yes

Table 2: Service Experience and Features

- a. Quality of Service in a multicast context is the ability to adjust the Packet Error Rate (PER) on a per-application / service basis. This optimizes capacity for a service mix that includes multiple application types (e.g., media, games, and software downloads).

Format	Channels Per Transmitter	Infrastructure Costs for 20 Channels	Channels per MHz	Required Spectrum for 20 Channels
DVB-H	9 channels, 6 MHz ~ 300kbps each	~2X	1.5	12MHz
MediaFLO	20 channels, 6 MHz ~ 300kbps each	Reference (1X)	>3	6MHz

Table 3: Required Infrastructure for Comparable Service

This analysis shows that, due to the superior efficiency of the MediaFLO air interface in the areas of Packet Error Rate (PER) performance, protocol efficiency, and the application of layered service and modulation, MediaFLO technology can deliver equivalent or superior service with roughly half the spectrum and less than half the infrastructure. The implications for the user and operator are significant relative to the cost and breadth of services that can be delivered.

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MediaFLO vs DVBH
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