

CSS & MoCA® Combine to Deliver Competitive Advantages to DBS Operators

– Changing the way content is brought into and shared throughout the home

The battle for television subscribers is heating up as new entrants open up additional markets, the subscriber pool stagnates and the economy sputters. Eager to stay competitive in an environment where consumers have more choices than ever to get broadcast television programming, direct broadcast satellite (DBS) service providers are looking for ways to differentiate themselves by providing innovative services to attract new subscribers and retain current ones.

New technologies, such as the Multimedia over Coax Alliance or MoCA and Channel Stacking Switch (CSS) solutions are key tools for DBS operators to generate new lines of revenue while providing significant infrastructure savings. These technologies, whether used in a combined or stand-alone fashion, improve the customer experience, reduce churn and offer a conduit to deliver new services to drive average revenue per user (ARPU) – all of which can create a positive position in the highly competitive Pay-TV market.

According to Parks Associates in their recent report Home Networks for Consumer Electronics, home networking will reach 167 million households worldwide by the end of 2008 and

is forecasted to reach 250 million households by year-end 2013. The home entertainment networking segment is expected to grow even faster. Parks Associates forecasts home entertainment networking penetration to grow from 6.4 million at year-end 2008 to 52 million by year-end 2013 – a compound annual growth rate of over 50%.

Traditionally, DBS set-top boxes (STB) function as independent receivers with no need for connectivity between STBs within the home. However, with the introduction of digital video recording (DVR) capability integrated into DBS set-top boxes (STB), streaming content recorded on one DVR STB to another STB in another room becomes an attractive feature that consumers will soon come to demand. With multi-room DVR capabilities, family members are no longer forced to watch their favorite programs on the same television to which the DVR STB is attached. MoCA can provide this capability today. In fact, a MoCA home network allows DBS operators to not only gain the ability to provide multi-room DVR, but also to converge their DVR STBs with the subscriber's broadband access networks for HD video-on-demand downloads, remote DVR programming and other interactive services.

If a DBS Operator combined a MoCA home networking solution with CSS technology, they would gain the opportunity to offer new services while reducing the capital costs associated with new subscriber installations and current customer upgrades. Further, CSS provides a flexible way to allocate spectrum on the subscriber's coax wiring so that it is future proof against any potential bandwidth expansion required for the home network.

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MoCA® 101

The Multimedia over Coax Alliance (MoCA) has defined a network MAC/PHY standard that can establish a full-mesh communications network using existing coax cables found in typical residential dwellings. From its very beginnings, the targeted application for a MoCA home network was to provide access to and liberate multimedia content from the confines of a single room or device, providing the ability to stream multiple high-definition video, audio and data traffic throughout the home to provide access to entertainment content in any room with a coax outlet.

Coax cabling provides an ideal physical medium for a high-speed network since it offers wide bandwidth, a shielded and relatively low noise environment and is typically conveniently co-located next to televisions. Unlike other network technologies that focused primarily on transferring non-time critical data, MoCA focused on achieving the key performance specifications critical to support streaming multiple streams of HD video around the home.

- High reliability to assure operators MoCA works at virtually any coax outlet in any subscriber's home – without rewiring
- Throughput to support real-time streaming of multiple HD/SD video programs
- Low error rates and low latency to ensure a good subscriber viewing experience
- Frequency coexistence with established operator services to avoid contention

MoCA uses an adaptive orthogonal frequency division multiplexing (OFDM) modulation with forward error correction to achieve 175 Mbps of application layer throughput and high reliability with over 95% outlet coverage. 175 Mbps of application throughput is more than enough to

support multiple simultaneous high-definition video-on-demand programs and other services like multi-room DVR STB streaming and Internet data access for STBs, DVRs, and personal computers. The MoCA PHY adapts its transmission modulation profile to the conditions of the coax channel to ensure that communication between each MoCA node in the full-mesh network is always optimized for best possible throughput.

Low packet error rates (PER) and low latency are achieved through a fully-coordinated and collision-free MAC. When sending UDP video packets over a home network, the technology must provide low packet error rates at the PHY layer since retransmission of packets above the MAC layer is not supported. Since the MAC is fully coordinated with no retransmissions necessary to achieve low PER, latency remains low and is more deterministic than technologies that use multiple access protocols. These key attributes help ensure that video glitches due to dropped packets or starved data buffers are kept acceptably low to provide a high quality consumer experience.

Coax cabling within the home provides plenty of bandwidth, however for a home network technology to be accepted by operators, coexistence with existing coax services must be supported. MoCA already provides spectrum flexibility with channels available from 875 MHz to 1500 MHz. To provide even greater flexibility for DBS operators, Channel Stacking Switch technology can be used to re-allocate IF video to another portion of the coax cable to free-up channels for a MoCA home network. It is this frequency agility which allow the performance of a MoCA network to be combined with the cost and customer advantages provided by CSS technology to build competitive positions for DBS operators worldwide.

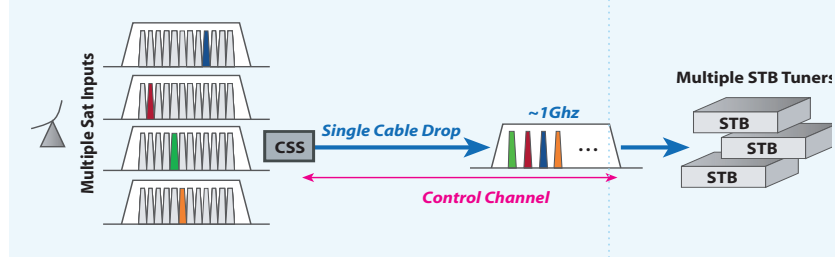
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CHANNEL STACKING SWITCH 101

Changes to the television viewing experience and the adoption of DVRs, sometimes multiple DVRs per household, have created an increasingly complex, difficult and expensive installation for DBS service providers. Traditional DBS installations consist of 1 or more dishes with an applicable low noise block (LNB) converter. The output(s) of the LNB is run directly to either each satellite set top box (STB) in the home or to a multi-switch with its outputs run to the STB. An individual cable run is required from either the LNB or multi-switch to each tuner in the STB. A typical DVR/PVR has at least two tuners to support watch and record functionality.

These cost and complexity issues are addressed through the use of channel stacking systems. CSS solutions create a channel-stacking architecture where multiple channels can be transmitted on a single cable based on the demands from multiple STBs and tuners connected to that cable. A single cable drop from the outdoor unit (ODU) provides each STB tuner with dedicated channels, eliminating the need for multiple cables. (See Figure 1)

Figure 1:



CSS technology enables a single cable drop to drive multiple STBs and tuners.

In-home receivers communicate with a CSS-enabled ODU to request specific channels. The CSS translates a particular satellite channel of interest and passes through a dedicated surface acoustic wave (SAW) filter. The

For a traditional DBS installation, this DVR would require two unique cable runs to the STB. A home with 3 DVR STBs requires 6 cable runs. One can see how this complex cabling architecture would be a significant cost driver for the DBS Operator and an area of concern for homeowner.

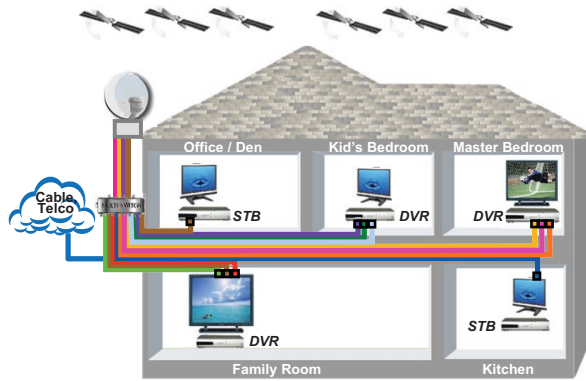
desired channels are then combined, or in other words, 'stacked', onto the single cable. The ODU tells each receiver where a requested channel is located.

These DBS systems typically transport programming from the ODU to STB using a frequency range of 950 to 2150 MHz, which provides a useable bandwidth of 1.2 GHz. Individual transponders are typically only 20 to 36 MHz wide, depending on satellite transmission symbol rates. For example, a CSS system can convert and pass desired channels with a typical SAW bandpass filter, allowing 12 individual channels to be stacked on a single cable. This translates into the ability to support 12 separate, active STBs or tuners on a single cable drop.

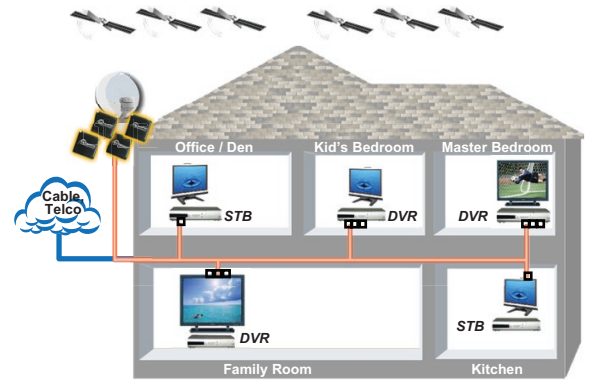
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CSS: SINGLE CABLE SOLUTION

CSS Single Cable Solutions Significantly Reduce the Deployment Cost for DBS Providers



Traditional DBS Deployment Model



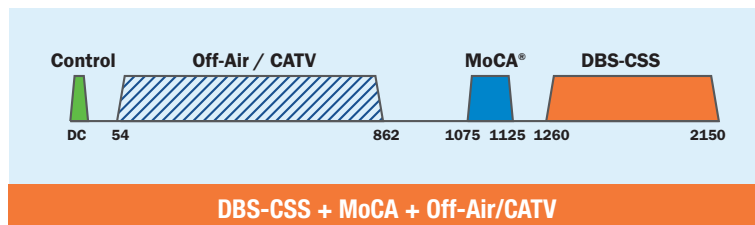
DBS Deployment With CSS

In most US homes, there is a cabling network already in place. This usually consists of a single point of entry at the curb or garage with splitters used as required to support multi-room outlets. This preexisting network goes largely unused during a traditional DBS installation, resulting in a lost opportunity to leverage the existing cabling and extra labor and material costs to the Operator.

A single cable network allows video-on-demand (VOD) and pay-per-view (PPV) support with only a central, conveniently located phone line or broadband connection versus a connection at each STB location. Additionally, with the CSS frequency agility, a DBS Operator is able to create large chunks of BW within the 950MHz -2150MHz band. This entire band is reserved for DBS service which provides the Operator means to incorporate a whole home entertainment network system like MoCA.

DBS CHANNEL STACKING SWITCH FREQUENCY PLAN

Ensures co-existence with other services on the same cable



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MoCA & CSS COEXISTENCE

For DBS operators, MoCA provides a network channel with a center frequency of 875 MHz that can coexist with the 950 MHz to 2150 MHz range of a typical DBS system. Currently, MoCA operates with channel bandwidth of 50 MHz. Operating a MoCA home network at 875 MHz provides 50 MHz of transition bandwidth between the home network and DBS video – easily meeting the filter requirements.

Looking into the future, it is foreseeable that the bandwidth needs of the home network and DBS operator will continue to grow as more HD broadcast channels and HD VOD programming becomes available. To support this growth, the home network's bandwidth requirement is expected to double. Under this scenario, if an operator were using the existing DBS MoCA channel, there would not be any room available for a transition band. However, by using CSS technology to shift the operating range of the video, the cost impact of filtering between the future home network and DBS video delivery can be kept in check.

As detailed above, the vast majority of DBS operators utilize the 950MHz to 2150MHz band for video broadcast use. With the CSS technology an Operator has the option of only using the amount of BW needed to support the specific numbers of tuners within the home. If a home has four DVRs (eight tuners) the Operator only needs ~800MHz to support this home from a broadcast video standpoint. This leaves ~400MHz free for other uses by the Operator.

Future-looking home networking needs to support multiple streams of HD Video and Data that are in the +100MHz BW range. While DBS operators can utilize BW outside of their traditional 950MHz to 2150MHz band, there can be interference issues, especially when attempting to coexist with Cable and Terrestrial TV signals. It is much simpler and in some instances technically necessary, for the DBS Operator to utilize the BW reserved for their use. The frequency agility of both MoCA and CSS technology enables simultaneous DBS video delivery and high data rate home networking solutions to coexist within the same home on the same coax cable.

For the first time, CSS technology enables DBS operators to support multiple viewing locations within the home via a single cable network. MoCA technology not only enables home networking capabilities between all DBS viewing locations, it also connects with any pre-existing PC network. Combining the two technologies allows a DBS Operator to provide industry leading HD content via Direct Broadcast Satellite and home networking services such as multi-room DVR, media centers, and server-based VOD/PPV. Additionally, with MoCA, the customer can access their personal content over this network and stream music, view a slideshow of family photos or watch stored or downloaded video from the NAS or PC to any viewing location in the network.

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SUMMARY

For service operators the benefits of a MoCA home network are clear. MoCA provides the most reliable, flexible and highest throughput network technology available with a true “no new wires” approach enabling operators to expand their service offerings. For subscribers, the benefits include a whole home entertainment network enabling any-room access to all of their multimedia content – all from a technology that already exists in their home and is completely transparent to them.

Channel Stacking Switch technology has revolutionized the way DBS operators run their businesses. Not only are installation and subscriber acquisition costs reduced, but so are the rates of service installation rejections and subscriber churn. CSS technology also enables plug and play upgrades and the opportunity to easily deploy new services without truck rolls to drive ARPU gains. The benefits of CSS taken collectively translate into higher customer satisfaction levels.

In conclusion, by combining MoCA and CSS, DBS operators can deliver programming from a single cable structure that also supports whole home entertainment networking to expand the service offerings to subscribers. Coexistence of CSS and MoCA technology enables competitive customer service advantages and monetization of revenue generating system technology solutions. Together MoCA and CSS offer DBS operators proven, ready-to-deploy technology solutions that are future proof, reliable, cost efficient and can help drive the operator’s bottom line.

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About Entropic Communications®

Entropic Communications, Inc. is a leading fabless semiconductor company that designs, develops and markets systems solutions to enable connected home entertainment. The company’s technologies significantly change the way high-definition television-quality video and other multimedia content such as movies, music, games and photos are brought into and delivered throughout the home.

