BRIEFING PAPER

CDMA 2000 EV-DO Revision B

MOTOROLA

EXECUTIVE SUMMARY

CDMA2000 is a 3G technology consisting of voice and data traffic. Voice traffic is often referred to as CDMA 2000 1X and data as CDMA EV-DO. The CDMA 2000 delivers the highest voice efficiency in the wireless industry, and EV-DO is clearly the market leader for high speed wireless mobile broadband. EV-DO provides service provider's with an efficient and orderly network evolution (upgrades consisting primarily of software and channel cards). The migration through EV-DO Revisions 0, A, B, and C provides the service provider with a cost effective means to upgrade the network capability. Multi-carrier EV-DO Revision B (EV-DOrB) delivers the means to compete aggressively with other services in the rapidly expanding market for wireless mobile broadband.

Multi-carrier EV-DO Revision B advances the industry by delivering higher data rates. Consumers will appreciate the enhanced user experience made possible by the higher data rates of EV-DO Revision B (EV-DOrB). In its fullest manifestation, EV-DOrB improves both forward and reverse link air interface capability by several means, including, but not limited to:

- Higher data rates with aggregating multiple carriers to deliver traffic faster
- Dynamic load balancing to increase overall throughput
- Increased performance with a flexible frequency reuse approach
- Support for existing EV-DO subscriber devices

EV-DOrB can be implemented with a software upgrade when multiple EV-DOrA carriers are deployed. A service provider can then grow into the higher performance of EV-DOrB as the market gains momentum. Multi-carrier EV-DOrB can be implemented with two or three carriers, leveraging the scalability of the technology.

MOTOROLA CDMA NETWORKS MIGRATION TO EV-DO REVISION B

Motorola's CDMA Value Proposition

EV-DO presents both service providers and consumers with a smooth, orderly, and economical evolution of the world's most advanced and capable wireless networks into the age of ubiquitous 4G. Motorola enables this smooth and seemingly effortless evolution by providing the means for an incremental build as you grow network evolution strategy throughout the entire network, including BTS, IP-BSC-DO, and IMS Core Network. Motorola's EV-DO customers are well positioned to provide the world's most compelling wireless broadband service.

Incremental upgrade and build out

CDMA service providers are faced with the need to upgrade their broadband wireless experience in the face of new applications and services that will require higher data rates. EV-DOrB provides the means to incrementally upgrade the network by leveraging existing investment in the EV-DOrA network. With the addition of a second EV-DOrA carrier, a typical user will notice an improvement in throughput and responsiveness. With the addition of EV-DOrB capability, subscribers with EV-DOrB mobiles will benefit from the higher peak data rates as well as additional improvements in system performance, due to load balancing and scheduling efficiencies.

A service provider may choose to deploy EV-DOrB for selected geographical areas to serve high capacity hot spots. For example, a high traffic urban core with EV-DOrA may be upgraded by adding additional carriers as desired and upgrading to EV-DOrB with software. The surrounding lower density areas of suburban or rural areas may remain as a single carrier EV-DOrA deployment. Mobiles will seamlessly transition through the zones in the network.

An increase in data subscriptions will result in an increase in high value traffic loading. While EV-DOrB successfully addresses performance needs of the last mile, service providers may incrementally expand their backhaul capacity to match the needs of their subscriber base.

Backward Compatibility

DOrB continues the heritage of providing graceful network evolution by continuing support for legacy mobiles. This enables immediate revenue generation and utilization of assets as the demand for new high speed services of EV-DOrB are rolled out. All EV-DOr0 and EV-DOrA mobiles will be readily supported in the EV-DOrB network, with performance limited by the capability of the mobile.

EV-DOrA infrastructure assets may be converted to EV-DOrB with a software upgrade, addressing time to market concerns, while maximizing the economic productivity of the EV-DOrA investment. This rapid deployment strategy will deliver the benefits of EV-DOrB with the use of EV-DOrA hardware.

Radio Access and Core Network Upgrade

Motorola's all IP Base Station Control (IP-BSC-DO) provides the optimal upgrade path for the all IP network, including EV-DOrB and beyond. This encourages an incremental upgrade and build out capability that enables a build as you grow strategy for network evolution. With IP-BSC-DO, a service provider has everything in place for evolving the all IP network. New network elements are simply software upgrades to existing network elements and are needed to implement the EV-DOrB protocols. Additional hardware for added capacity can be deployed as demand for EV-DOrB service grows.

Service Provider Benefits

Multi-Carrier Operation

The main feature of EV-DOrB is the scalable aggregation of discrete 1.25 MHz carriers for higher data rates, allowing enhanced content delivery for even the most demanding applications. A deployment of two or three EV-DOrB carriers will basically increase the peak and average data rates by up to two or three times that of a single EV-DOrA carrier. The relative performance improvements can be represented in comparisons below.

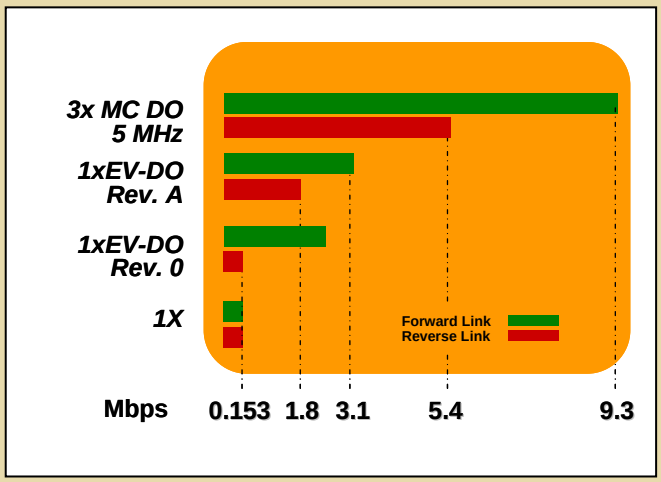

Figure 1. Forward Link Performance Improvement

	Mbps	200 KB Picture	3.5 MB MP3	10 MB Powerpoint
3x MC DO 5 MHz	9.3	0.2	3	8.7
1xEV-DO Rev. A	3.1	0.5	9	26
1xEV-DO Rev. 0	2.4	0.7	12	33
1X	0.153	10	183	523

Figure 2. Comparative Downloads (sec.)

Hybrid Frequency Reuse

Hybrid Frequency Reuse allows a service provider to trade spectrum utilization for overall performance improvement. By using a different frequency assignment for each sector in a cell, download throughput can increase quite substantially. The EV-DOrB approach is a hybrid; as the first frequency assignment is applied to all three sectors in a cell, subsequent sectors receive a different frequency assignment. This approach allows an overall throughput of three to four times that of a single EV-DOrA carrier with what amounts to two carriers of hardware.

Flexible Duplexing

EV-DOrB introduces added flexibility by not requiring paired spectrum for forward and reverse links. This allows deployment of fewer reverse link carriers than forward link carriers, and reduces power demand on the mobiles for applications that are forward link dominated.

Dynamic Carrier Allocation, Scheduling, and Load Balancing

With multiple carriers available, the IP-BSC-DO and EV-DOrB network has great flexibility in determining the best means to assign resources for various differentiated services. Optimizations are made in real time with all the information needed to provide the best performance and greatest capacity possible. These features contribute to the overall efficiency and increased utilization of the multiple carriers above and beyond that which is otherwise possible, with the discrete carriers without the aggregation of EV-DOrB.

Mobile Devices

DOrB mobiles can move freely between zones that support DOr0/A/B, adapting to changing conditions dictated by resource availability. Power management is always a critical function for the mobile devices, and for a three carrier EV-DOrB implementation, the handset complexity is equivalent to a WCDMA handset. Initial EV-DOrB handsets will likely support up to three carriers at a time.

On the reverse link, the multiple carriers will allow either higher data rates at the same transmit power, or alternatively, maintain the same data rate, but at a lower power. Initial mobile devices are likely to be datacards (including embedded) for laptop PC and PDA deployments.

Evolution

Motorola's EV-DOrB enabled BTS, IP-BSC-DO and Core Network are fundamental to the successful deployment of EV-DOrB, and also for the evolution to both the all-IP network and future 4G technologies. EV-DOrC is the 4G wireless broadband technology being addressed by 3GPP2. Baseline text for this new standard is expected to be complete in 2007, and commercial realization as early as 2010. With this in mind, EV-DOrB is a key milestone along the path to 4G.

It is difficult to predict the final composition of the EV-DOrC standard, but it appears reasonable that several common themes are likely to be included, and will serve the CDMA 2000 community well into the next decade. Some of the more likely aspects include:

Backward Compatibility with EV-DO 0/A/B Mobiles

Historically, CDMA 2000 has had an orderly technology evolution with continuous support for current subscribers. CDMA 2000 has avoided the need for a broad ecosystem turnover and the obsolescence of legacy mobiles. Accommodation of EV-DOr0/A/B devices will likely be addressed by the standard. The 3GPP2 standards body is addressing how legacy EV-DO devices operate in a DOrC network without new spectrum.

Scalable Bandwidth

One of the key differentiators for CDMA 2000 is the relatively narrowband CDMA bandwidth of 1.25 MHz. This allows a service provider to incrementally evolve the capacity of their network within the constraints of limited spectrum availability. The continued evolution through EV-DOr0/A/B also continues this heritage, allowing a service provider to add radio capacity as traffic demand grows. Also, this leverage allows the reuse of infrastructure components where feasible. The standard is likely to incorporate scalable bandwidths ranging from 1.25 MHz up to 20 MHz and support applications that will benefit with this truly wireless broadband technology.

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