

## 1X Advanced

### Further enhancing voice communications performance

#### 1X Advanced Benefits

- More efficient use of limited spectrum
  - Up to a four-fold increase in voice capacity
  - Lower cost per call or more available minutes of use
  - Frees-up spectrum
  - Up to 70% greater 1X coverage (trade-off)
  - Peak data rate of 307 kbps
- Investment Protection
  - Cost-effective upgrade
  - More efficient use of existing resources
  - Backwards compatibility

**1X Advanced** includes enhancements that increase the voice capacity of CDMA2000® networks by up to a factor of four over legacy CDMA2000 1X networks.

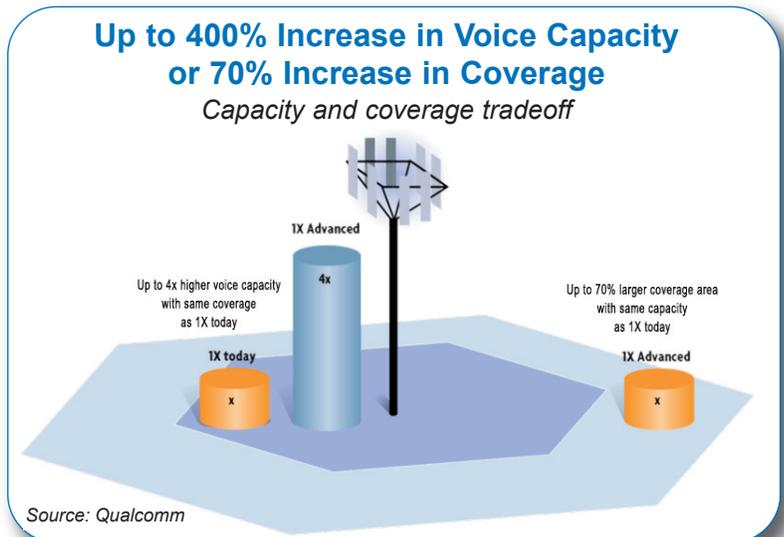
1X Advanced also allows an operator to tradeoff this capacity improvement to increase network coverage by up to **70 percent**.

The peak data rate is increased to **307 kbps** from 153 kbps or triple 1X data network capacity.

The 1X Advanced performance gains are realized through a combination of mobile device enhancements and new base station modems. Some of the enhancements are standards-based (e.g., CDMA2000 1X Release E), while others are not.

Operators have the flexibility to deploy 1X Advanced in phases. For example, an operator can pre-seed the market with fully-featured devices (new EVRC-B codec and multiple receive diversity antennas) to double their network capacity and then immediately double it again as soon as they deploy the new channel cards.

- **Enhanced Variable Rate Codec (EVRC-B):**  
An advanced codec that increases capacity without compromising voice quality.
- **Quasi-Linear Interference Cancellation (QLIC):**  
A device based feature that reduces interference in the forward link (base station to mobile device). Interference is due to other users within the cell or in adjacent cells, as well as the interference created by the pilot channel. By reducing the amount of interference at the mobile device, the base station can transmit at a lower power and still maintain the voice call. In turn, the power savings can be used to support additional voice calls.



- **Quasi-Orthogonal Functions (QOF):** Increase voice capacity by adding Walsh codes (beyond the existing 128 orthogonal Walsh codes) whenever the forward link is limited by Walsh codes.
- **Advanced QLIC:** Builds upon the capabilities of QLIC to further reduce forward link interference by canceling the additional interference from QOF and the interference from adjacent base stations.
- **Mobile Receive Diversity (MRD):** Leverages two mobile device antennas to boost the quality of the received base station signal. This enables the base station to reduce the amount of power required to support the connection, thus freeing up power to be used to support additional voice calls and data sessions. MRD also increases battery life since transmissions occur more quickly, enabling the transmitter to be disabled sooner.

• **Radio Link Enhancements:** Changes to the CDMA2000 1X radio configuration or Physical Layer are made by installing a new CDMA2000 1X Release E channel card that enables the following features.

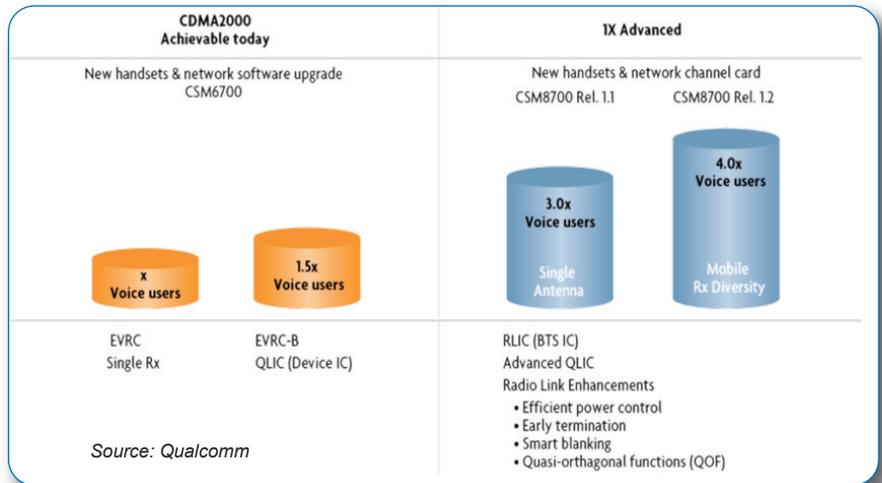
– **Reverse Link Interference**

**Cancellation (RLIC):** Also known as BTS Interference Cancellation, reduces reverse link interference to increase network capacity. RLIC also improves network coverage since the effective range of a cell site is typically limited by the reverse link. With RLIC the improved signal received at the cell site enables the device to remain connected from a greater distance or in a harder to reach location (e.g., indoors).

– **Smart Blanking:** Eliminates the transmission of background noise that typically consumes air interface resources. To the extent the background noise remains constant – a likely scenario in most voice calls – the amount of packets used during the voice call is reduced.

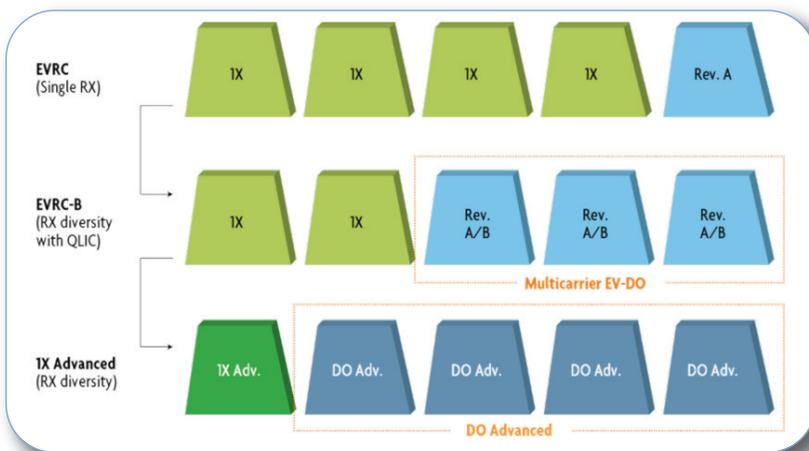
– **Efficient Power Control:** Reduces the overhead consumed by transmitting power control information that is shared between the network and the mobile devices. By reducing how often and how this information is exchanged, additional resources are made available to support more voice calls.

– **Frame Early Termination (FET):** Eliminates the need to transmit an entire frame if the mobile device (or base station) has already successfully decoded the information and sent an acknowledgement (ACK) receipt. FET reduces transmissions, thus increasing overall system capacity.



1X Advanced has meaningful implications for data traffic, coverage and 1X data network capacity.

• **More Data Channels:** By taking advantage of the capacity gain in voice traffic, an operator can free up spectrum for other uses such as additional mobile broadband data services.



• **70% More Coverage:** 1X Advanced can trade off voice capacity to increase 1X coverage by up to 70%.

• **Triple 1X Data Network Capacity:** If additional voice capacity is not needed, it can be traded off for additional 1X data network capacity. In effect, the 1X channel is used to transfer packets of data instead of packets of voice traffic increasing the data capacity of a CDMA2000 1X network by up to a factor of three.

• **307 kbps Peak Data Rate:** The peak data rate of 1X Advanced is double that of CDMA2000 1X, which makes it well-suited for most M2M services.

Since 1X Advanced is fully backwards compatible with CDMA2000 1X, an operator has the flexibility to only deploy some of the 1X Advanced features or introduce them all at one time.