

# Data Sheet

## cdma2000 Design Conformance Lab U-2003.09

### Physical Layer Models for cdma2000

The Synopsys cdma2000 Design Conformance Lab provides the systems engineer with 3GPP2 standard compliant reference designs and conformance test suites. It includes digital baseband designs for forward and reverse link of EV-DV and EV-DO. Simulation models allow for a dynamic change of the data rate during the simulation.

3GPP2 reference documents are:  
for EV-DV: C.S0002-C  
for EV-DO: C.S0024 V4.0

### Physical Channels EV-DV (1X only):

- Forward link channels:
  - Forward Packet Data Channel (F-PDCH)
  - Forward Packet Data Control Channel (F-PDCCH)
- Reverse link channels:
  - Traffic Channels for Radio Configurations 3-4
  - Access Channel (ACH)
  - Enhanced Access Channel (EACH)
  - Reverse Common Control Channel (RCCCCH)
  - Reverse Acknowledgment Channel (R-ACKCH)
  - Reverse Channel Quality Indicator (R-CQICH)

### Physical Channels EV-DO:

- Reverse link channels:
- Access Channel (ACH)
  - Reverse Traffic Channel (RTCH)
    - Reverse Rate Indicator (RRI) Channel
    - Data Rate Control (DRC) Channel
    - Acknowledgement (ACK) Channel
    - Data Channel

### Channel Coding

- Frame quality indicator attachment
- Convolution encoding
- Turbo encoding
- Puncturing and repetition
- Block-interleaving
- Reverse Rate Indicator (RRI) encoding
- Data Rate Control (DRC) encoding
- Packet repetition
- Subpacket symbol selection
- ARQ buffering
- MAC to PHY interface

### Spreading, Modulation and Filtering

- Orthogonal spreading
- Quadrature spreading
- BPSK, QPSK, 8-PSK, 16-QAM modulation
- Baseband filtering

### Propagation Channels and Noise Modeling

- Additive White Gaussian Noise (AWGN)
- Multipath fading channel fully compliant to 3GPP2 C.S0010 and C.S0011 for EV-DV and C.S0032 and C.S0033 for EV-DO

### The Reference Receiver Model

The reference receiver design included in the cdma2000 Design Conformance Lab includes an algorithmic-level implementation of the inner and outer receiver. It also comes with pre-configured link-level designs for performance simulations.

### Receiver Front-End Design

- Baseband filtering

### Inner Receiver

- Non-coherent receiver for EV-DV ACH
- Rake receiver with maximum ratio combining on pilot channel
- Channel estimation based on pilot channel
- Quadrature despreading
- Orthogonal despreading
- Data demodulation
- EV-DO ACH preamble detector by means of correlation with coherent and non-coherent averaging
- EV-DO ACH controller for dual antenna processing

### Outer Receiver

- Soft quantization
- Deinterleaving
- Depuncturing
- Derepetition
- Soft output Viterbi decoder
- Soft output Turbo decoder
- CQI and ACK demodulation
- Frame quality indicator check
- Reverse Rate Indicator decoder
- Packet derepetition

### Reverse Link Power Control

- Estimation of signal-to-interference ratio (SIR)
- Derivation of transmit power control commands
- Modeling of transmission errors of power control bits

### Receiver Performance Analysis

- Frame error rate (FER)
- Bit error ratio (BER)
- Packet Error Rate (PER)
- EV-DO preamble access probe failure rate

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1x EV-DV	Measurement	Reference
Reverse Link: Fundamental Channel for Radio Configurations 3-4 with single and dual branch antenna under AWGN conditions without power control	FER	3GPP2 C.S0010-A V1.0
Reverse Link: Fundamental Channel for Radio Configurations 3-4 with dual branch antenna under fading channel conditions with power control	FER	3GPP2 C.S0010-A V1.0
Reverse Link: Supplemental Channel for Radio Configurations 3-4 with single and dual branch antenna under AWGN conditions without power control	FER	3GPP2 C.S0010-A V1.0
Reverse Link: Supplemental Channel for Radio Configurations 3-4 with dual branch antenna under fading channel conditions with power control	FER	3GPP2 C.S0010-A V1.0
Reverse Link: Common control channel under AWGN and fading conditions	FER	3GPP2 C.S0010-A V1.0
Reverse Link: Access channel under AWGN and fading channel conditions	FER	N/A
Reverse Link: Enhanced access channel under AWGN and fading channel conditions	FER	N/A

**Table 1. EV-DV link level receiver performance test benches for base station**

1x EV-DO	Measurement	Reference
Reverse Traffic Channel under AWGN conditions without power control	PER	3GPP2 C.S0032
Reverse Traffic Channel under fading conditions with power control	PER	3GPP2 C.S0032
Access channel under AWGN and static and fading channel conditions	PER Preamble Access Probe Failure Rate	3GPP2 C.S0032

**Table 2. EV-DO link level receiver performance test benches for base station**

FER = Frame Error Rate  
 PER = Packet Error Rate