RTCA Special Committee 186, Working Group 5
ADS-B UAT MOPS
Meeting #10

Update on MER Modeling Discrepancy in DME Interference

Prepared by

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SUMMARY

The discrepancy between measured and predicted MER for DME interference (reported in WP-8-04) has been resolved, based on new MER measurements and modifications to the model.

Update on MER Modeling Discrepancy In DME Interference

28 January 2002

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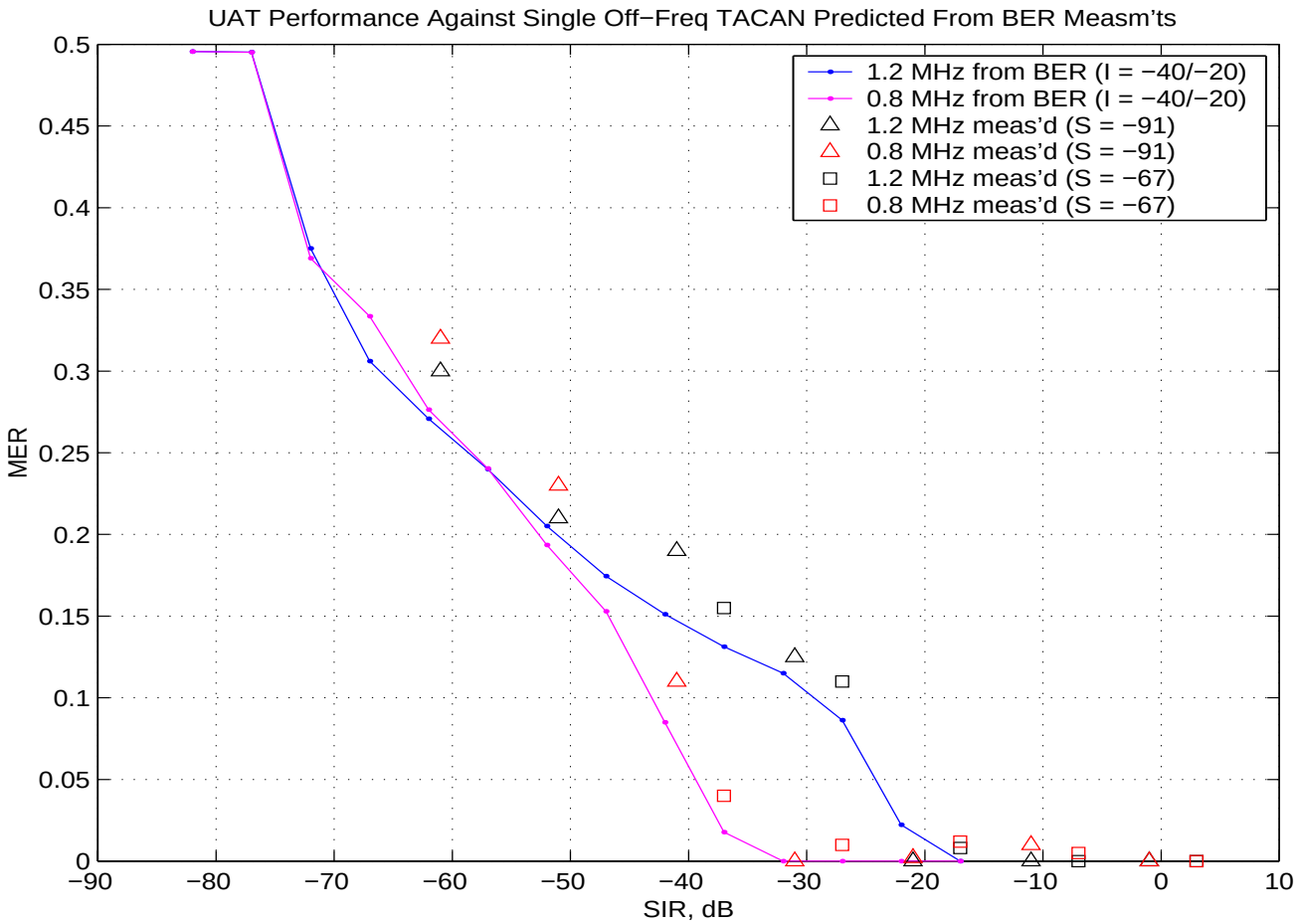
"4 dB" Discrepancy Between Predicted & Measured MER For Single, Adjacent-Channel DME (from WP-8-04)

1-Sample Sync Bits, Sync Threshold = 84, No Receiver Noise Modeled



New Measured Data

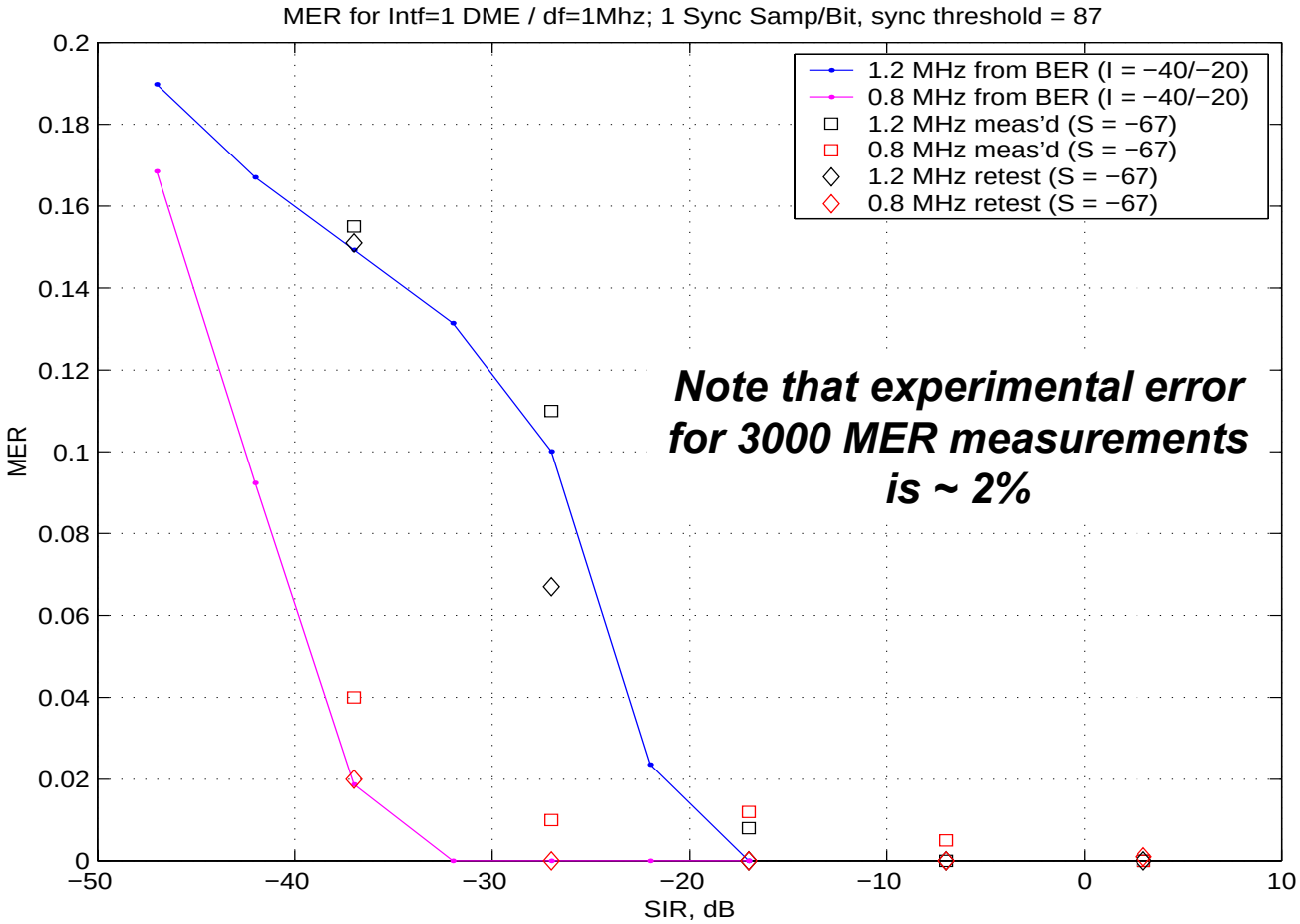
- (Jan 8 2002) Repeated the MER measurements
  - Same Signal & Interference levels
    - Single 3000-message sample vice three 1000-message samples
  - Additional data collected at same time
    - Sync Error Rates
    - Bit Errors for all messages (not yet analyzed)
- New data ~ 3 dB better than old
  - Much closer to model predictions

Better Modeling

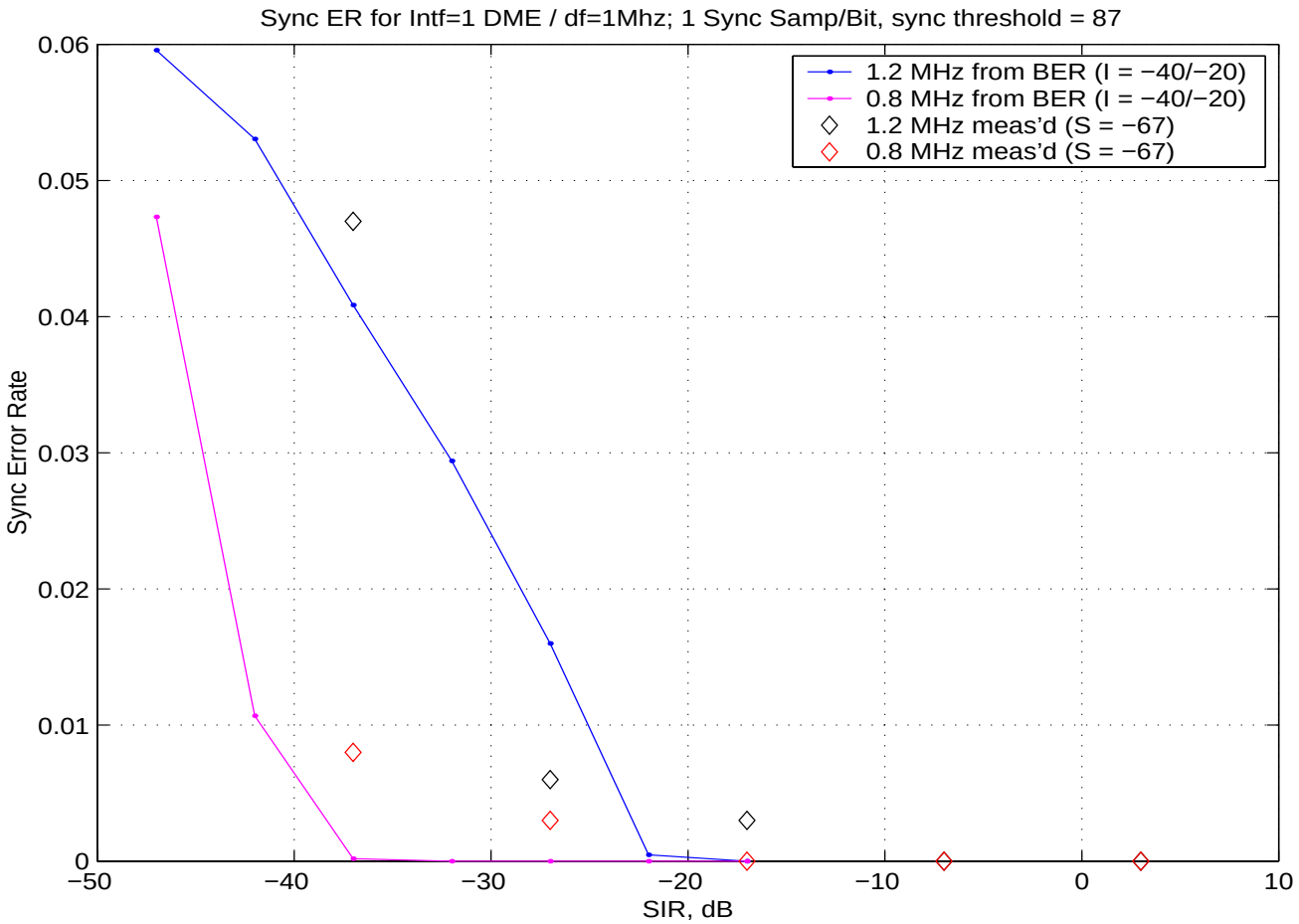
- Sync threshold = 87 samples vice 84 (old, wrong value)
  - Makes performance ~ 2 dB worse
- Modeled receiver noise at SNR = 18 dB for S = -91 dBm case
  - Makes performance 0.5-1 dB worse

Current Receiver Model, S = -67 dBm

(1-Sample Sync Bits,Sync Threshold = 87, No Receiver Noise Modeled)

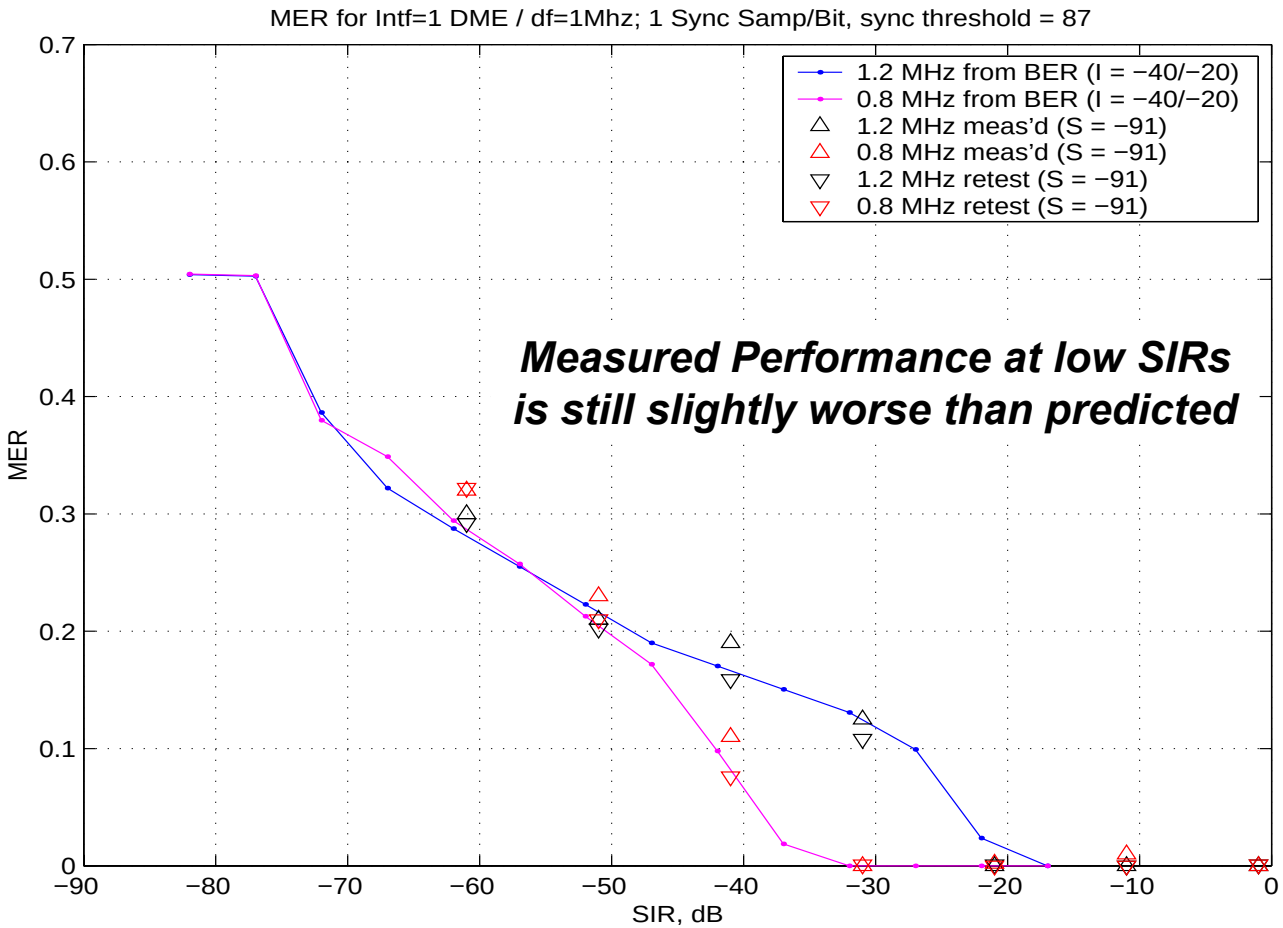


Sync Error Rate for Current Receiver Model, S = -67 dBm

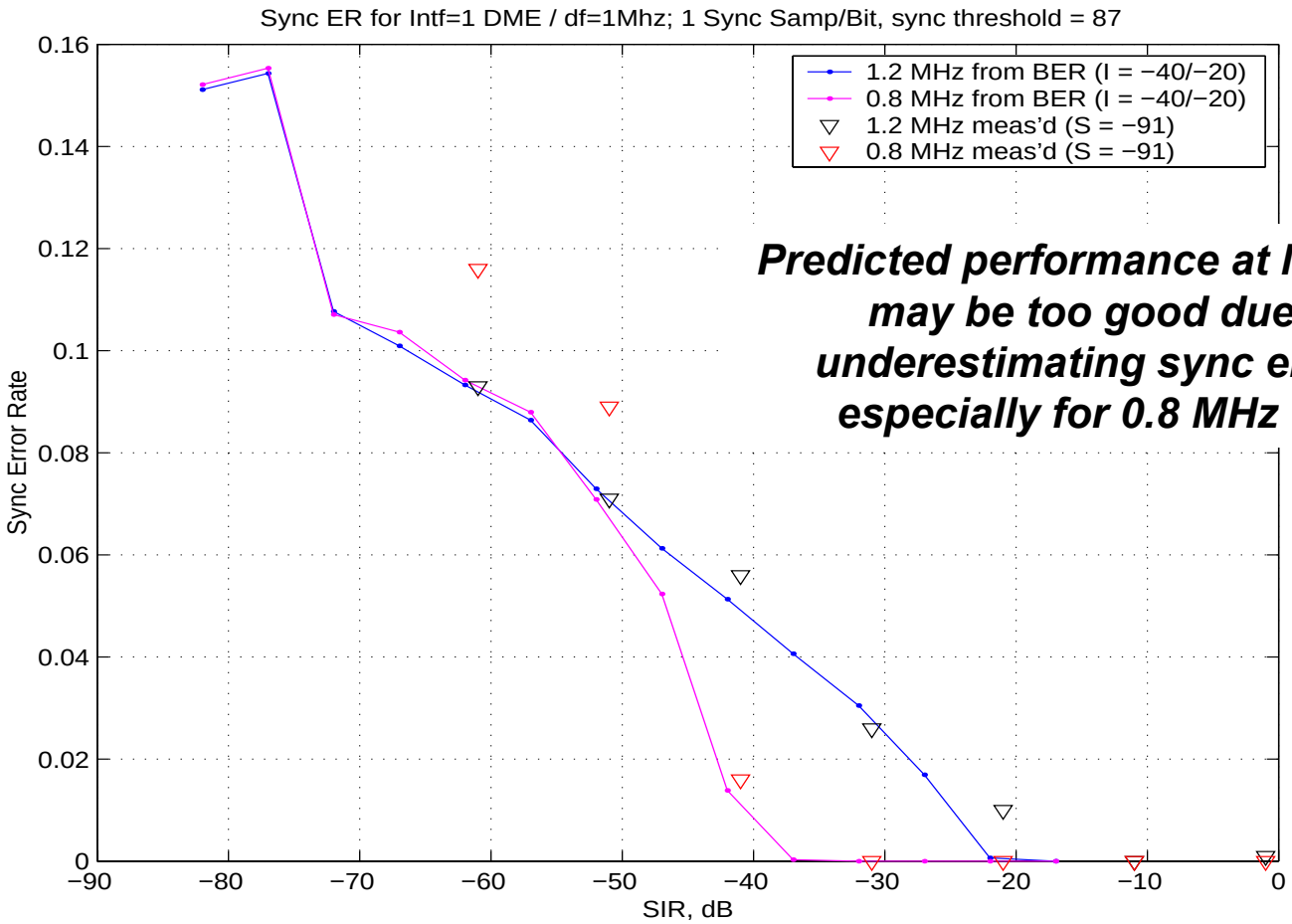


Current Receiver Model, S = -91 dBm

(1-Sample Sync Bits,Sync Threshold = 87, Modeled SNR ~ 18 dB)



Sync Error Rate for Current Receiver Model, S = -91 dBm



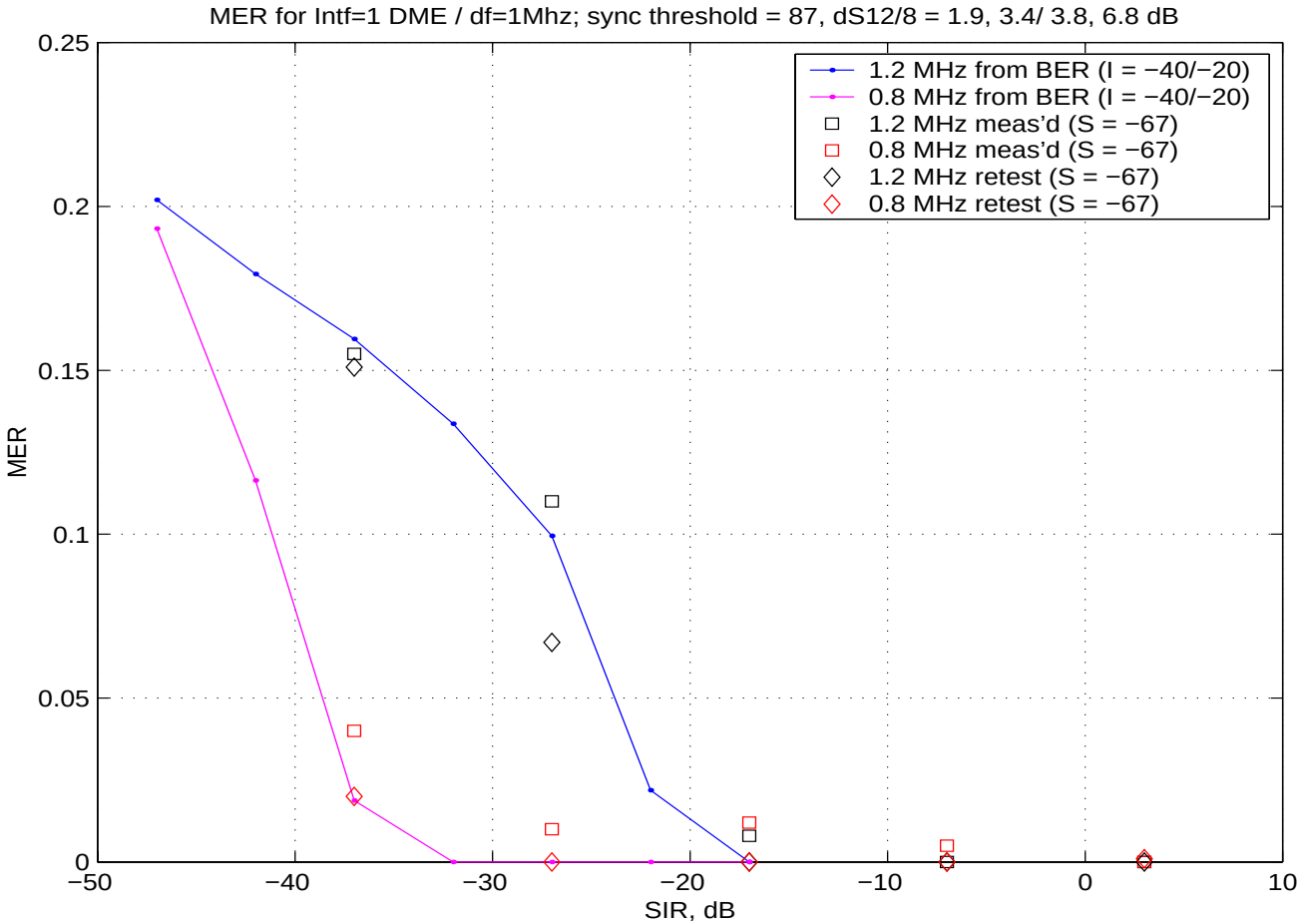
Predicted performance at low SIRs may be too good due to underestimating sync errors, especially for 0.8 MHz UAT

Impact of Simplified Sync Modeling

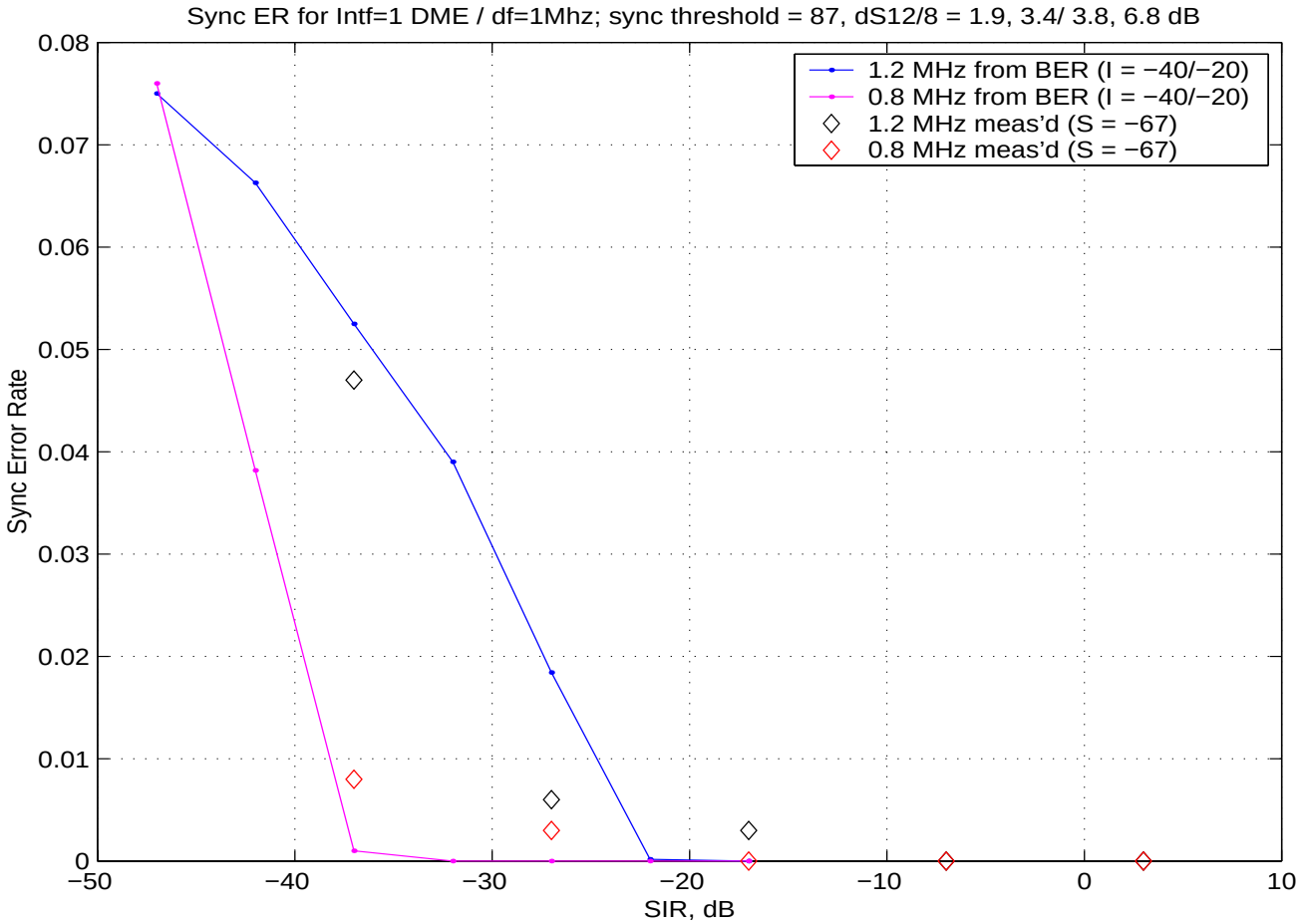
- Model used by Multi-Aircraft UAT Simulation assumes 1 sample per sync bit
  - Sample assumed in center of bit (best SNR point)
  - Simplified approach was selected to reduce simulation time
- Actual UAT uses 3 samples per bit for Sync
  - Reduced effective signal level, dS, on early and late samples. Modeled as:
    - 1.9 and 3.8 dB for 1.2 MHz UAT (measured for 1.5 MHz transmission)
    - 3.8 and 6.8 dB for 0.8 MHz UAT (double measured values—guessed)
  - Makes performance worse:
    - ~ 1 dB worse for 1.2 MHz UAT
    - ~ 1.5 dB worse for 0.8 MHz UAT

3-Sample per Sync Bit Model, S = -67 dBm

(dS = 1.9,3.4/3.8,6.8 dB, Sync Threshold = 87, No Receiver Noise Modeled)

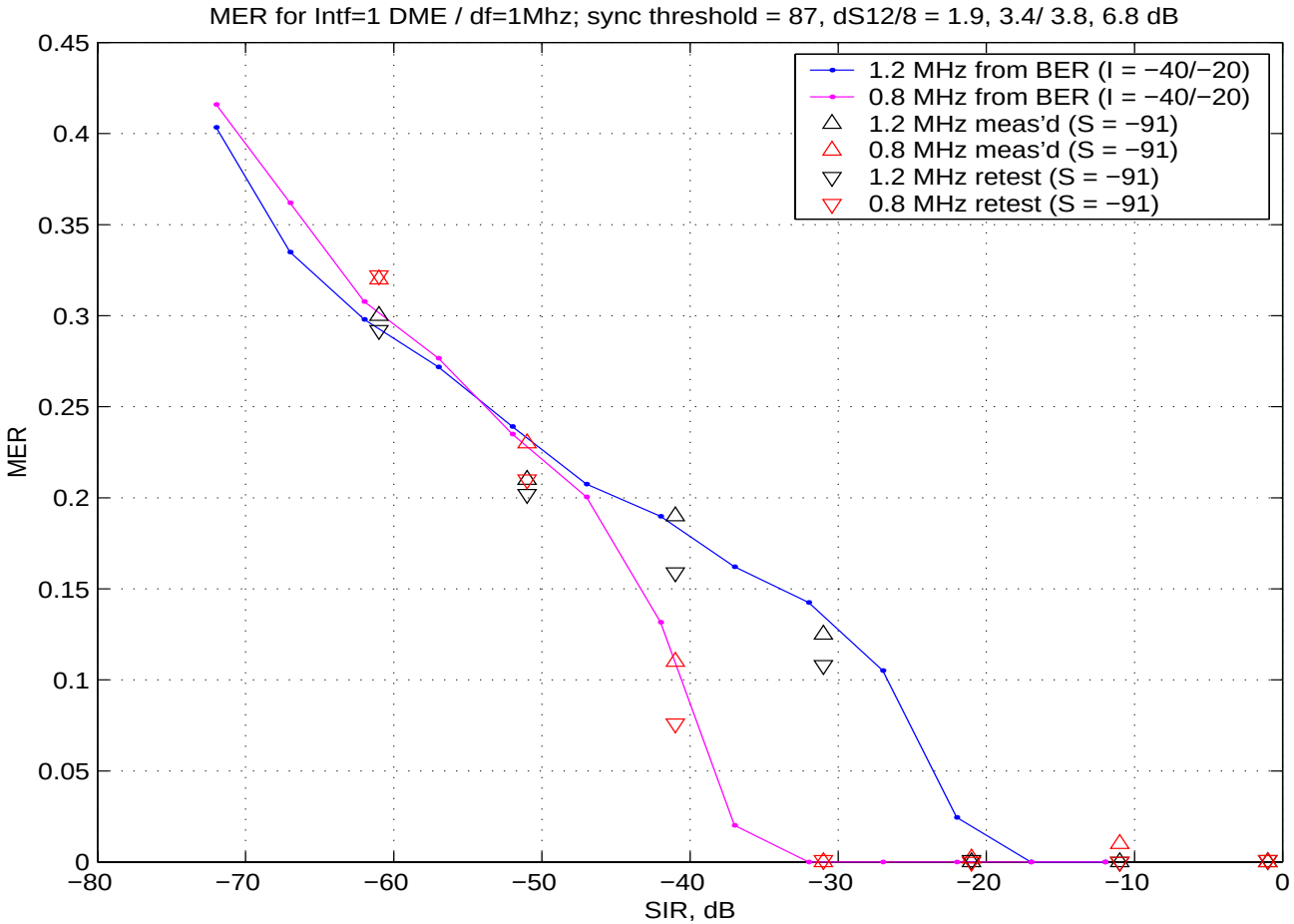


Sync Error Rate for 3-sample/bit Sync Model, S = -67 dBm

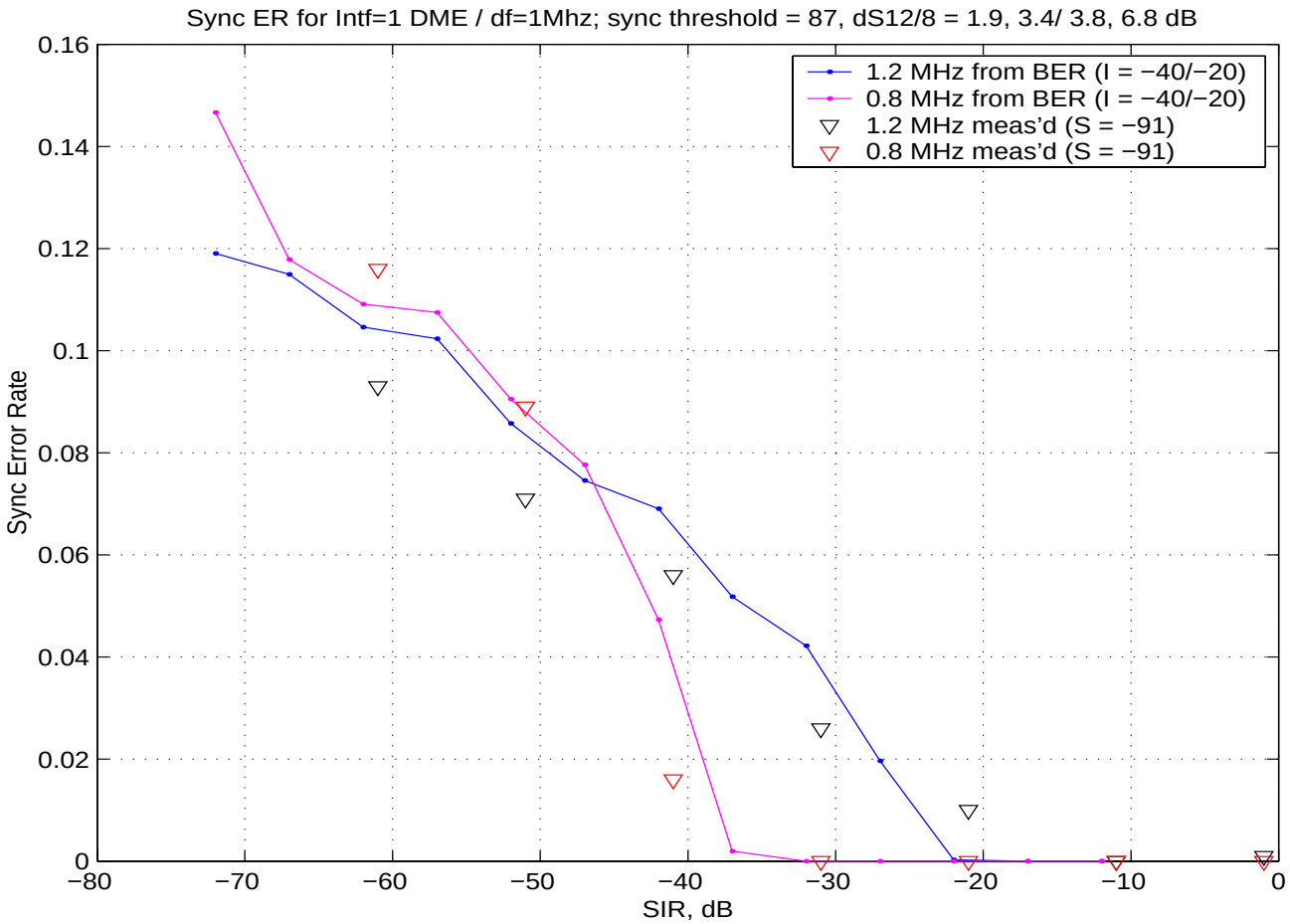


3-Sample per Sync Bit Model, S = -91 dBm

(dS = 1.9,3.4/3.8,6.8 dB, Sync Threshold = 87, Modeled SNR ~ 18 dB)



Sync Error Rate for 3-sample/bit Sync Model, S = -91 dBm



Conclusion

- "4 dB" discrepancy for modeling performance in DME interference has been eliminated
  - Agreement between model and measurements is within experimental error
- However, simulations suggest that model may be optimistic for DME interference
  - Caused by 1-sample per bit sync modeling
- Propose to include expected impact of simplified sync modeling in Multi-Aircraft UAT Simulation by raising DME levels
  - 1 for 1.2 MHz UAT
  - 1.5 dB for 0.8 MHz UAT