
Fixed Set FIR Transfer Functions for 10GBASE-T Tomlinson-Harashima Precoder

Albert Vareljian
KeyEye Communications

IEEE P802.3an Task Force
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Supporters

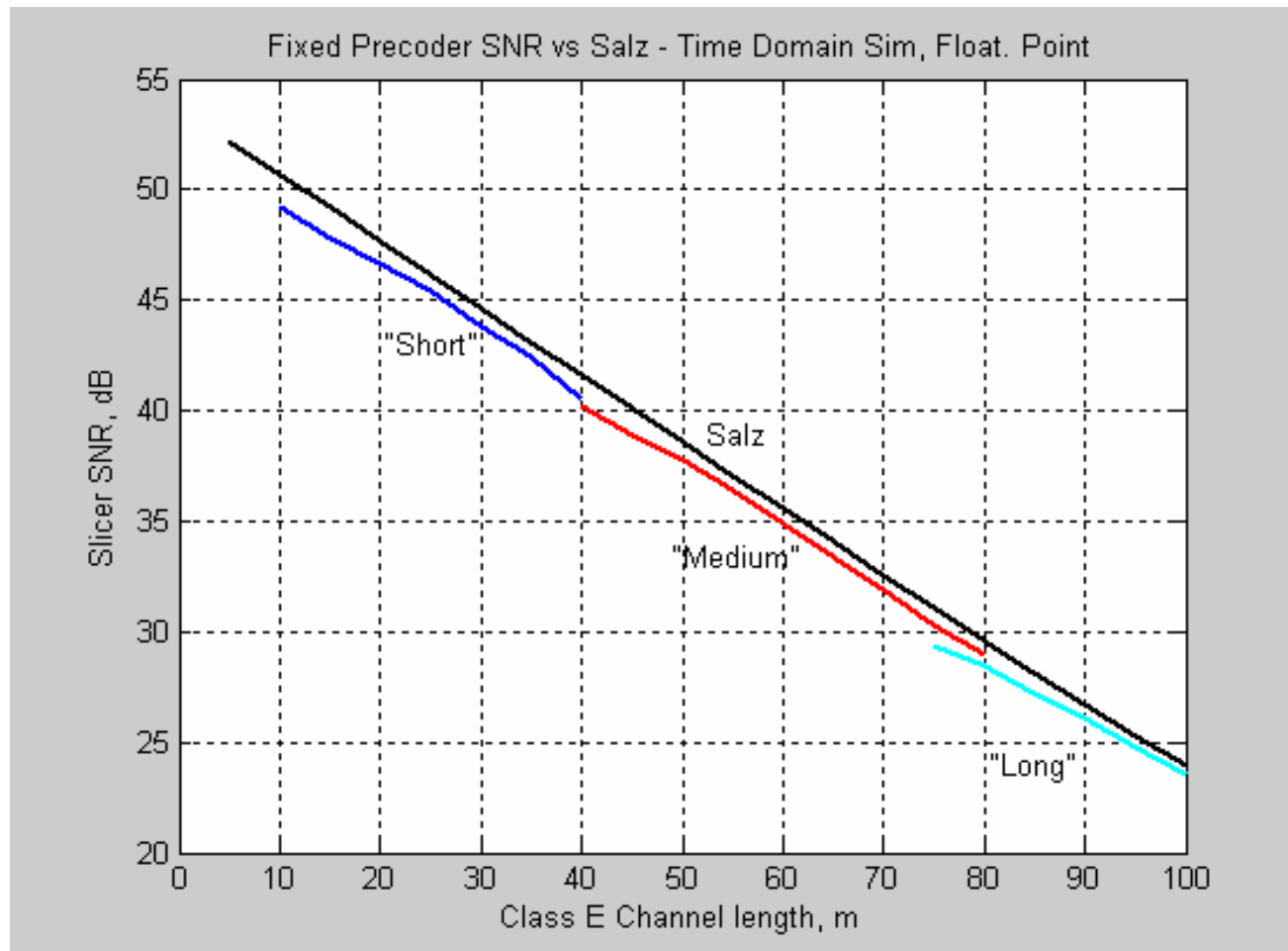
- Katsutoshi Seki, NEC Electronics
- Jose Tellado, Teranetics

H(D) - 1 Fixed 3-Set Coefficients

| “LONG” (80-100m) | | “MEDIUM” (45-80m) | | “SHORT” (< 45 m) | |
|---------------------|----------|----------------------|----------|---------------------|----------|
| FLOAT | 7-BIT | FLOAT | 7-BIT | FLOAT | 7-BIT |
| 1.7882 | 1.78125 | 1.262 | 1.25 | 0.59037 | 0.59375 |
| 1.3886 | 1.375 | 0.36757 | 0.375 | -0.36938 | -0.375 |
| 0.51683 | 0.53125 | -0.4370 | -0.4375 | -0.61887 | -0.625 |
| -0.20361 | -0.21875 | -0.777 | -0.78125 | -0.52253 | -0.53125 |
| -0.65657 | -0.65625 | -0.76492 | -0.75 | -0.24784 | -0.25 |
| -0.87095 | -0.875 | -0.49457 | -0.5 | 0.091094 | 0.09375 |
| -0.90013 | -0.90625 | -0.13909 | -0.125 | 0.079077 | 0.09375 |
| -0.79667 | -0.78125 | | | | |
| -0.60553 | -0.59375 | | | | |
| -0.365 | -0.375 | | | | |
| -0.14265 | -0.15625 | | | | |
| -0.031834 | -0.03125 | | | | |

Column Coefficients in Top-Down Order Correspond to Ascending Delay FIR Form, (Denominator = 1)

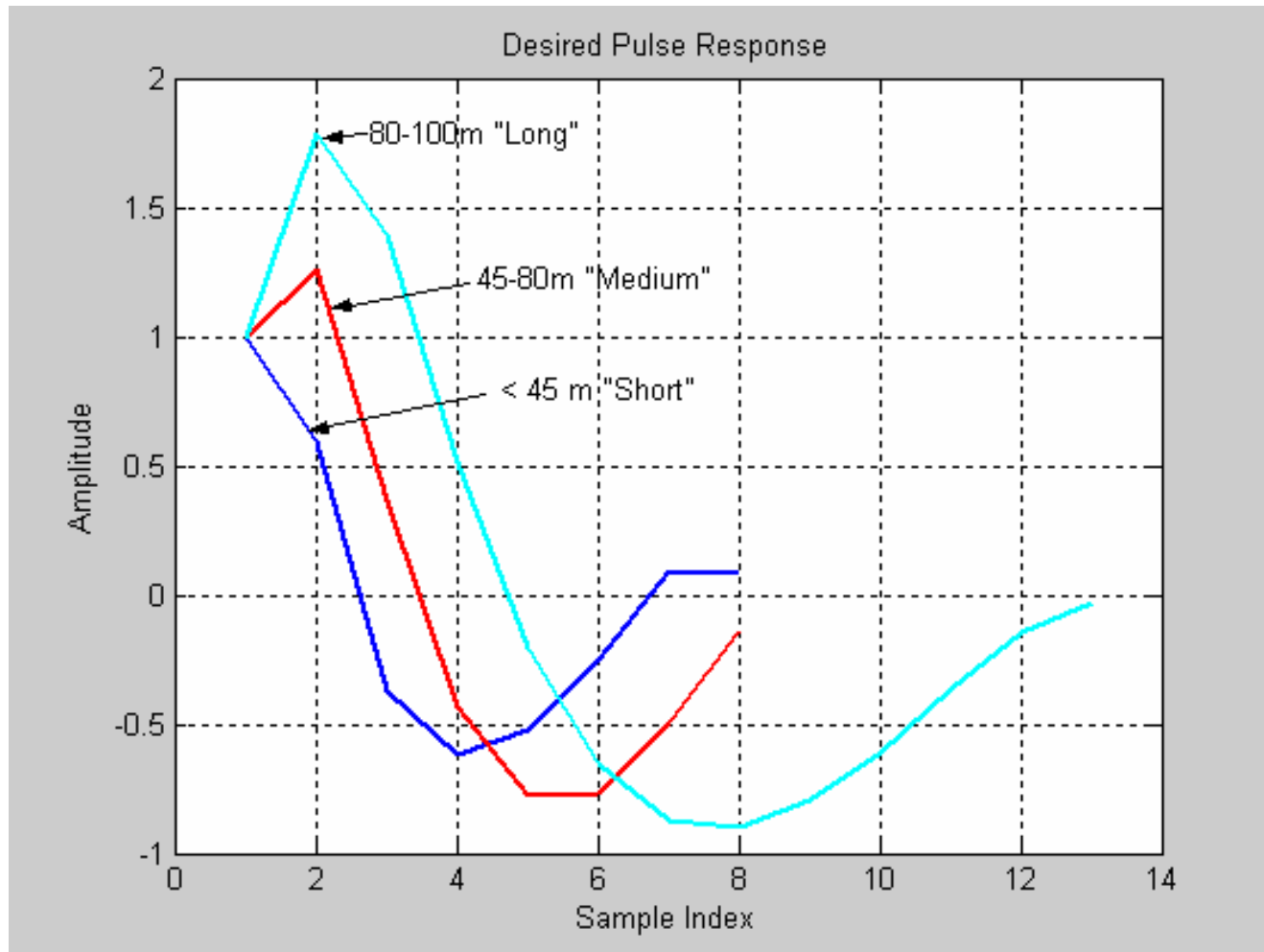
Fixed Set SNR Performance vs. Salz Opt. Time Domain Analysis, FFE 24-Tap or Less



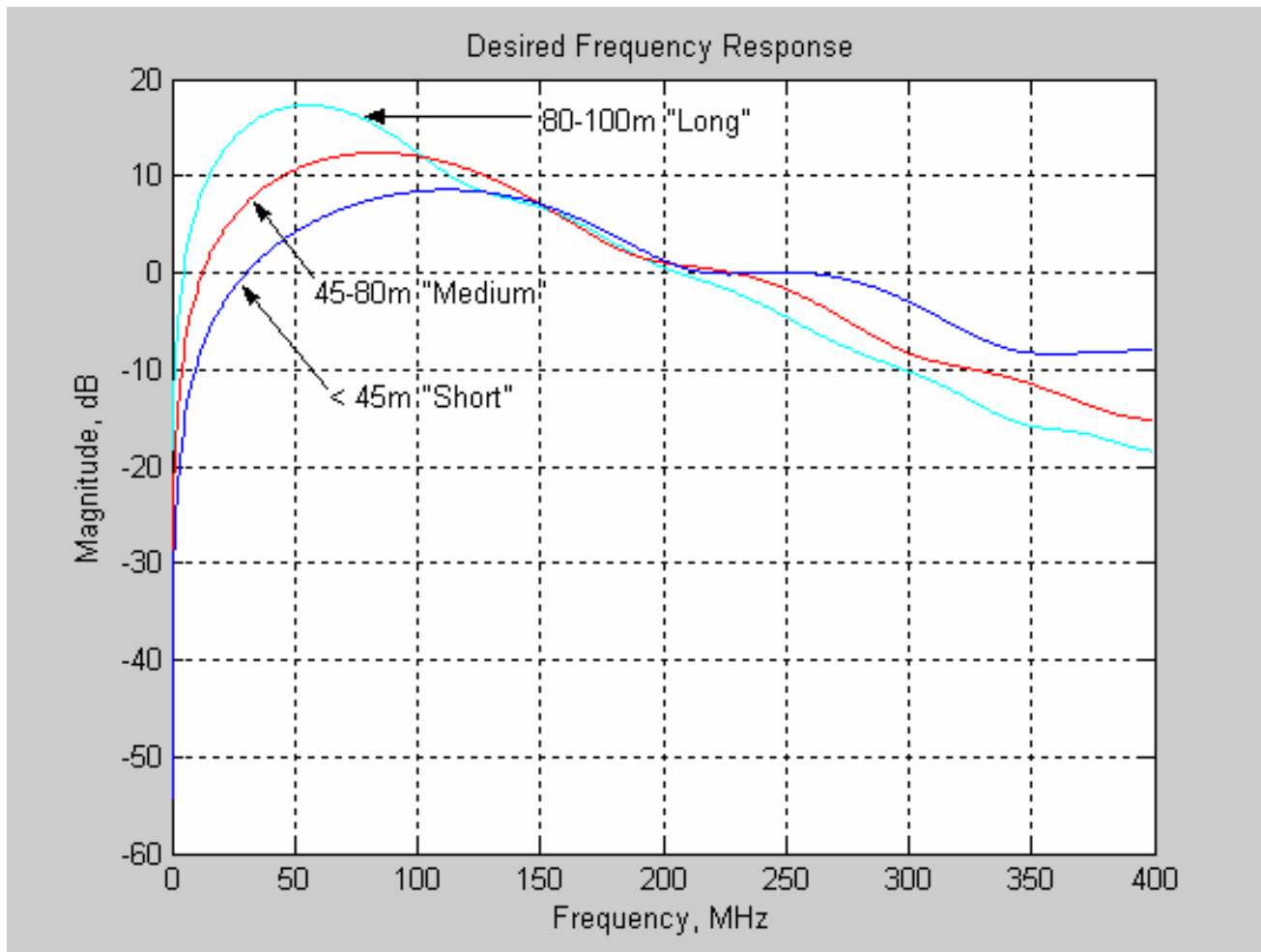
Time Domain Simulation Setup as per “vareljian_1_1104.pdf”, p. 4, $P_{TX} \sim 3.7$ dBm

Similar Performance is Attained with 2nd Order Tx LPF @ 200 MHz as per “ungerboeck_1_1104.pdf” p. 15

Constrained Opt. H(D) Pulse Response



Constrained Opt. H(D) Frequency Response



Conclusions

- **12-Tap FIR Pre-coder Showed Good Performance in the $F_s/2$ Tx-Rx Filtering Scheme with Moderate Size FFE**
- **Achieved Comparable Performance with $F_s/4$ Tx Filtering**
- **Small Performance Degradation with Coefficient Values Quantized to 7-8 bits**
- **Propose 12-Tap Direct Form FIR Representation with Corresponding 7-8 bit Pre-optimized Coefficient Sets as a Baseline for Fixed THP Configuration in 10GBASE-T**
- **Proposal Does Not Preclude Co-existence with IIR Form Coefficient Formulation**
- **Format Does Not Preclude FIR or IIR Implementation of THP Function**
- **As an Option for Added System Flexibility and Performance a 12-Tap Format THP (as per Above) May Be Configured at Startup with Coefficient Values Supplied by a Link Partner PHY**