

Performance Evaluation and Comparison for Primary Fast Feedback Channels

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Performance Evaluation and Comparison for Primary Fast Feedback Channels

March, 2009

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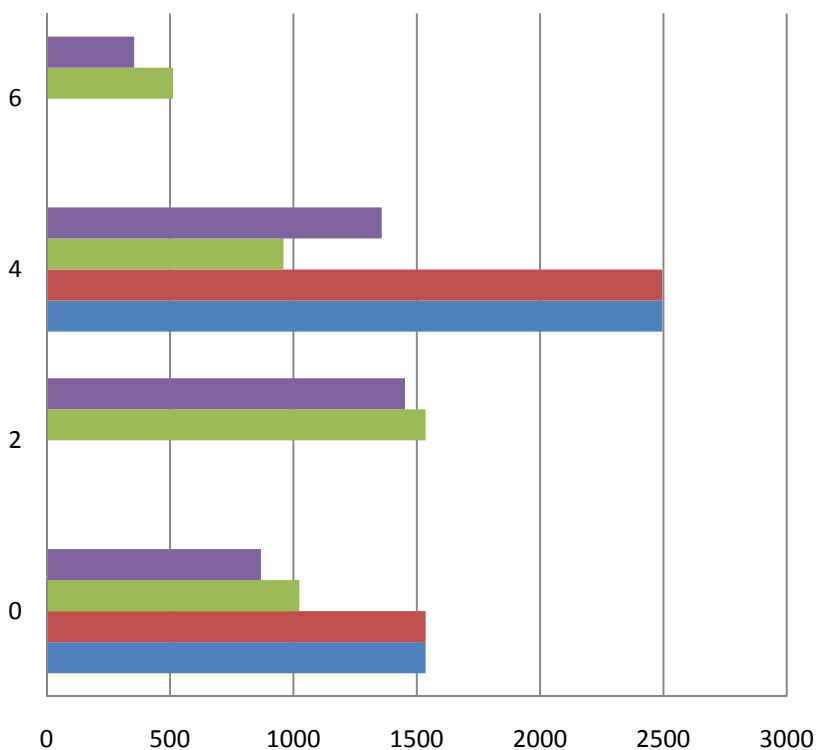
Samsung Electronics Co., Ltd

Introduction

- **Sequence Evaluation**
 - Several sequences are proposed for modulating Primary Fast Feedback Channel
 - Refer to UL Control DG Non-harmonized text (C80216m-09_0387r1)
- **Performance Comparison**
 - Sequence correlation property
 - Simulation results in various channel conditions

Sequence Characteristics

Cross-correlation Test (6bits)



| | 0 | 2 | 4 | 6 |
|---------|------|------|------|-----|
| ITRI | 868 | 1452 | 1358 | 354 |
| LGE | 1024 | 1536 | 960 | 512 |
| Intel | 1536 | 0 | 2496 | 0 |
| Samsung | 1536 | 0 | 2496 | 0 |

- **Correlation Property**

- Distribution of correlator outputs

$$\rho_{p,q} = \left| \sum_{k=0}^{11} C_p[k] C_q^*[k] \right|$$

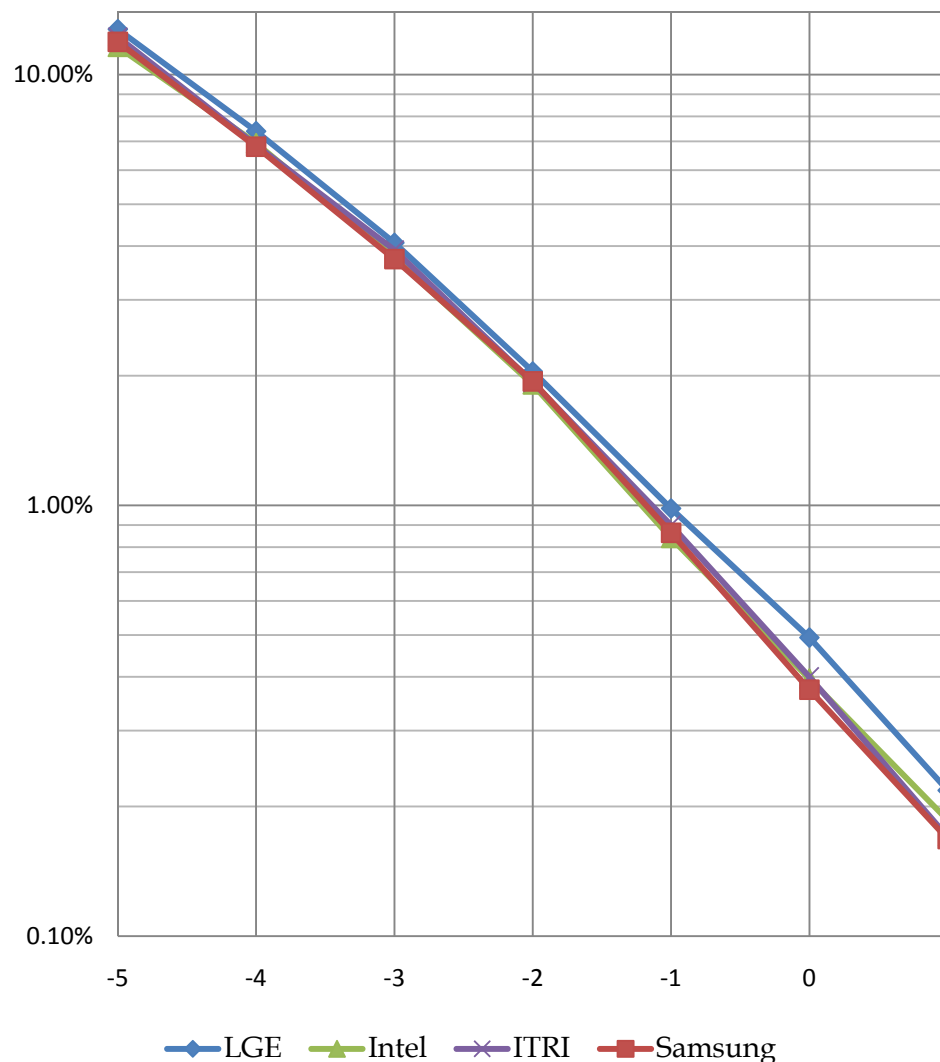
- Ideal condition is when all correlations are same,

- **Correlation Comparison**

- Correlation of Samsung's and Intel's are 0 or 4,
- Correlation of ITRI's and LGE's have the values of 0, 2, 4, 6

Detection Performance in Ped. B 3km/h

Ped. B 3km/h (6bits)

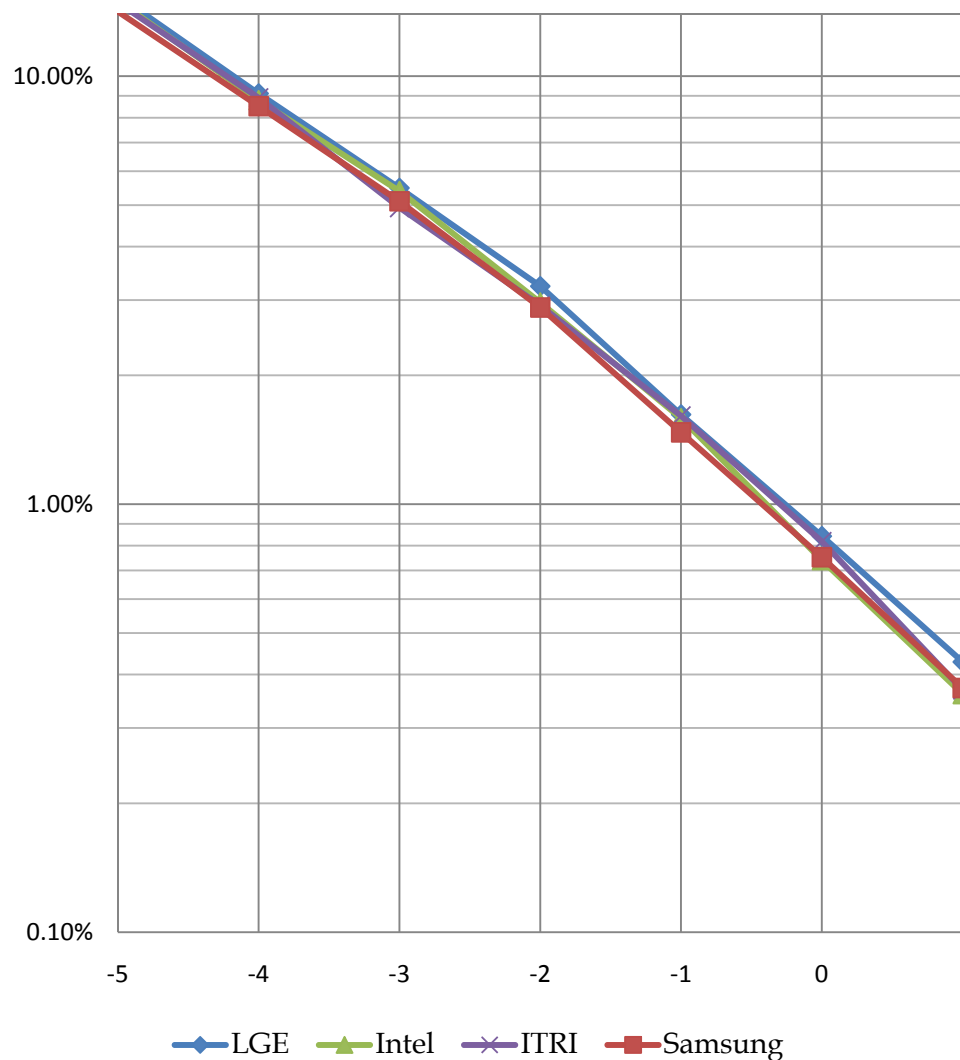


Analytic Remarks

- LGE's sequence is slightly worse than others
- Intel, ITRI, Samsung's have almost same performance
- Performance gap is about 0.2dB @ 1% PER

Detection Performance in Veh. A 120km/h

Veh. A 120km/h (6bits)

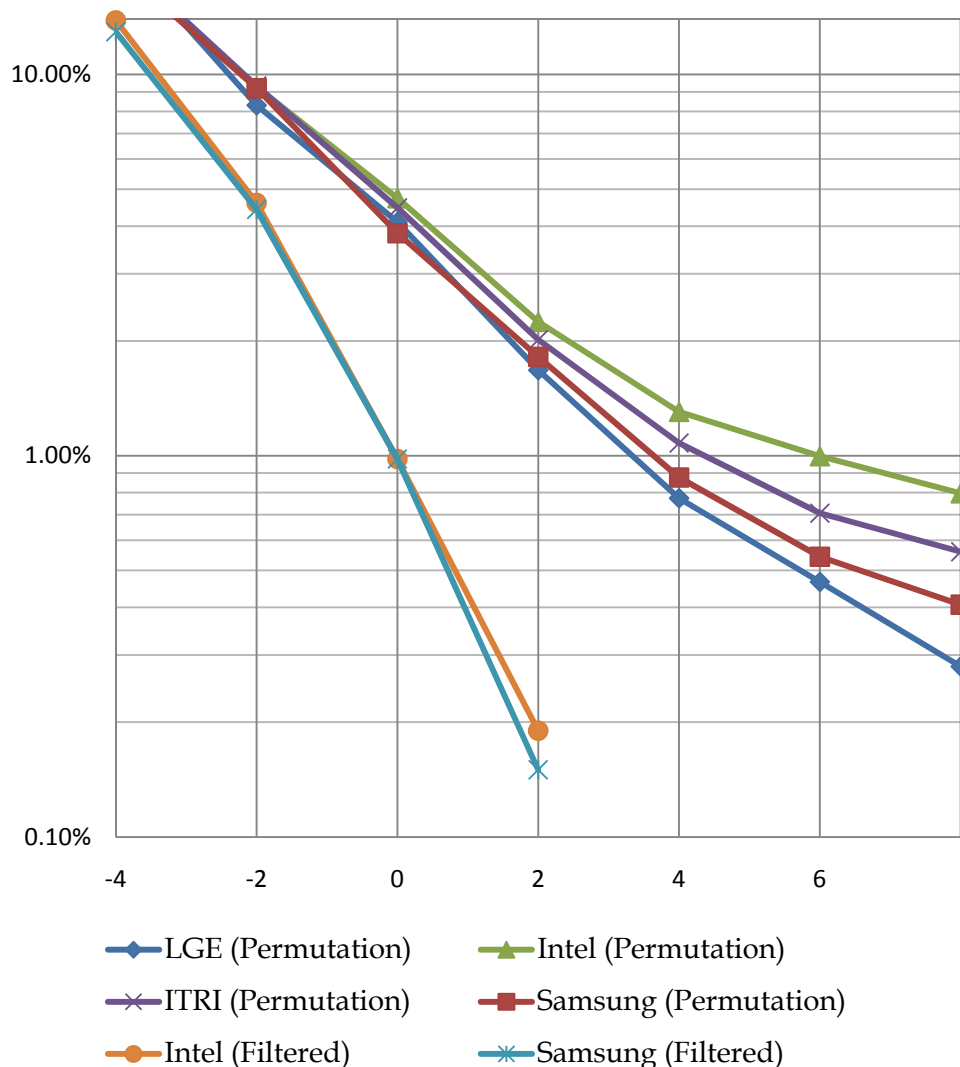


Analytic Remarks

- LGE's and ITRI's sequences are slightly worse than others
- Intel's and Samsung's have almost same performance
- Performance gap is about 0.1~0.2dB @ 1% PER

Detection Performance in Veh. A 350km/h

Veh. A 350km/h (6bits)



Analytic Remarks

- With correlator receivers, the better performance is obtained by (LGE > Samsung > ITRI > Intel)
- Performance gap is about 0.3dB ~ 1.6dB @ 1% PER
- Some advanced receivers can significantly improve high speed detection performance

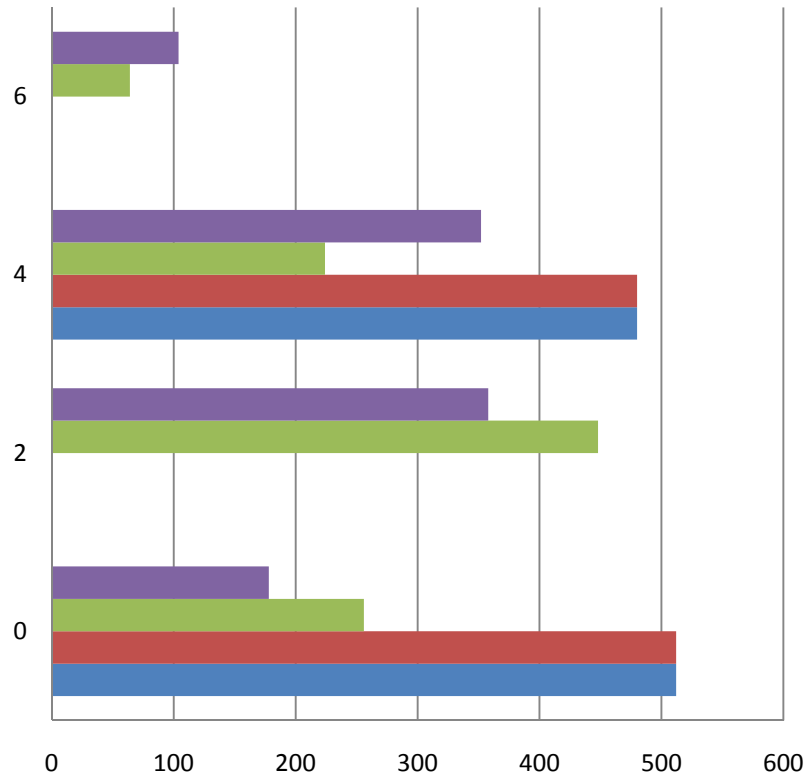
Summary

- **Correlation Property**
 - Samsung's and Intel's sequence have better correlation property than others (Maximum correlation is limited by 4)
- **In relatively slow fading conditions,**
 - Samsung's = Intel's > ITRI's > LGE's
 - Performance SHALL be optimized in these conditions,
- **In an extremely fast fading condition,**
 - Samsung's is the best among ones having the same performance in slow fading
- **Suggestion : to Adopt Samsung's Sequence as Primary FBCH sequence**
 - Proposed text is provided in C80216m-09/0724 or latest version

Appendix#1

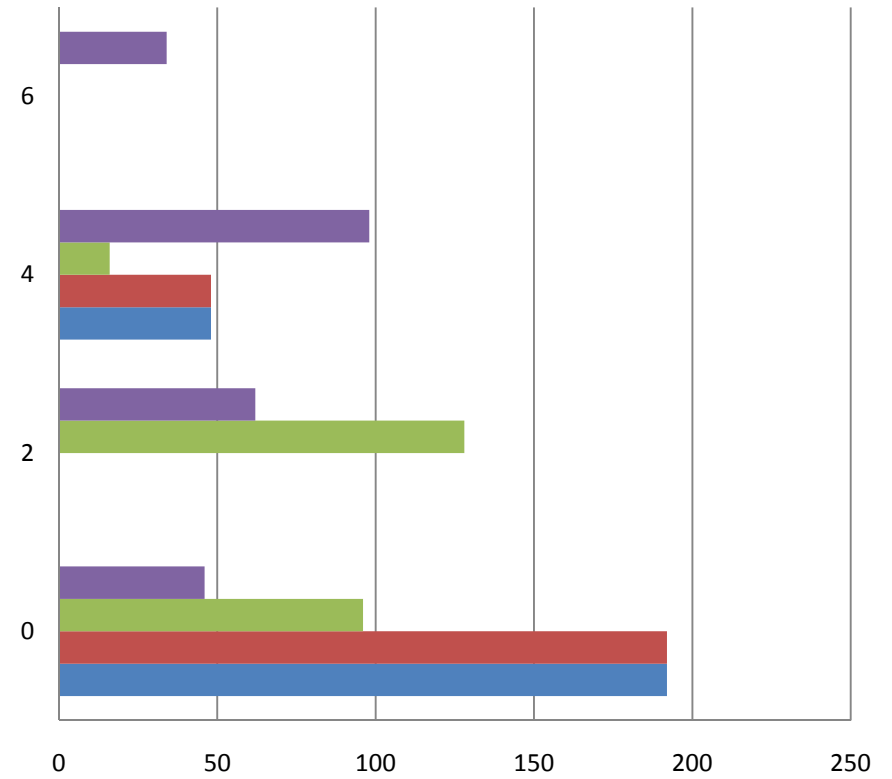
Sequence Characteristics

Cross-correlation Test (5bits)



| | 0 | 2 | 4 | 6 |
|---------|-----|-----|-----|-----|
| ITRI | 178 | 358 | 352 | 104 |
| LGE | 256 | 448 | 224 | 64 |
| Intel | 512 | 0 | 480 | 0 |
| Samsung | 512 | 0 | 480 | 0 |

Cross-correlation Test (4bits)



| | 0 | 2 | 4 | 6 |
|---------|-----|-----|----|----|
| ITRI | 46 | 62 | 98 | 34 |
| LGE | 96 | 128 | 16 | 0 |
| Intel | 192 | 0 | 48 | 0 |
| Samsung | 192 | 0 | 48 | 0 |

Appendix#2

Simulation Environments

| Parameters | Values |
|-------------------------|---|
| Sampling rate | 11.2MHz |
| Carrier frequency | 2.3GHz |
| Feedback tile structure | (2 by 6) |
| Antenna configuration | 1Tx + 2Rx |
| Detector | Correlator-based MLD (MLD with Wiener filtering are optionally used for Veh. A 350km/h) |
| Sequence mapping | Permutation in C80216m-09_0387r1 Tile#1 {0, 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11} Tile#2 {9, 10, 11, 3, 4, 5, 0, 1, 2, 6, 7, 8} Tile#3 {3, 4, 5, 6, 7, 8, 9, 10, 11, 0, 1, 2} |