**_TSGR1-(00)0064_**

TSG-RAN Working Group 1 meeting #10
Beijing, China, 18th - 21st , Jan., 2000

**Agenda Item :**

**Source : Samsung**

**Title : Enhanced performance using the adaptive SSDT ID code**

**Document for : Approval**

# 1. Introduction

SSDT (Site selection diversity transmit) ID code is used for the UE to transmit the result of selection for the primary cell to each cell in the active set [1]. It is therefore desirable that the SSDT ID code is designed as an error correcting code having good performance.

In the last Ad Hoc 9 meeting in Dresden, two contributions [2, 3] about SSDT ID code were proposed by Samsung and LGIC respectively. The contributions differed in terms of the criterion used to select the ID code. LGIC proposed an ID code with a performance gain in terms only of its error correcting ability. Samsung proposed an ID code adapted for the real situation, and requiring a limited amount of signalling, to reallocate cell IDs and inform each cell of the size of the active set.

Following discussions on the capability of the UTRAN to reallocate cell IDs, a liaison statement was sent to WG3 [4]. Even though the WG3 procedures do not support dynamic allocation of SSDT cell ID during operation of SSDT, we know that such reallocation may take place, from the sentence "However, SSDT ID cell may be reallocated by deactivating and reactivating SSDT with the Radio link reconfiguration procedure"[5]. Without loss of generality, it is possible to improve the overall performance of SSDT operation by sending additional information to Node B such as cell ID reallocation and the number of Node Bs in an active set. In a real situation, the active set update is not able to happen frequently, as it takes more than 1 second, so the additional signalling burden is negligible.

Technical report[6], TR25.942, Nokia shows simulation results relating to the active set size. In that report, it is clearly shown that the dominant case is for an active set of 2. (i.e., 55.79-78.2% of the time). Since the UTRAN knows the size of the active set, Samsung's proposal shows a 3dB performance gain with respect to LGIC's, at the expense of a small signalling overhead. Such a coding gain is not insignificant, so it is desirable to design a code according Samsung's criterion.

Comparing our proposed code to the current one, we can find two points. One is that the current one is not a linear block code, the other is that Samsung's code has the better performance in most practical cases.

Therefore, we propose a linear block code well-suited to the real situation, i.e., when the size of the active set is 2, it (actually, the repetition code) has the best performance and when the size of the active set is 4, as a code including the above the repetition code, it has the best performance, and so on. Hence, we can get the best performance with only minor additional signalling: the reallocation of ID in the active set update and the size of the active set.

In a view of the overall performance with just a few signalling, which the UTRAN may support, the LGIC's code degrades the performance of the SSDT operation when compared to the current code when the active set is small.

In this contribution, we highlight advantages in terms of the performance of our proposed ID code compared with LGIC's and the current one.

# 2. Active set size

In this section, the distribution of the active set size is described. This section is referred from the technical report[6].

Before describing the distribution of the active set size, for the reliability, the simulation assumption for the distribution of the active set size is describe.

## 2.1. Simulation assumptions  (25.942, Chapter 11.2)

The used planning tool prototype can perform snapshot simulations and/or pixel by pixel calculations. For this study the pixel by pixel calculations were sufficient.

The SHO criterion was to include to the active set of a map pixel 1) the best cell, meaning the largest measured received CPICH Ec/No, and 2) all the cells within WINDOW_ADD from the best cell. Furthermore the size of the active set in a pixel is the number of the cells in the active set of that pixel.

In most simulations the WINDOW_ADD parameter was 5dB. The basis for this choice was to have approximately 40% soft handover probability that was considered as the worst case, but still a realistic case.

The pixels from which the UE is not able to maintain a connection due to uplink power limitation are doomed to outage and at these pixels the size of the active set is set to zero. In all but the last simulation case the uplink outage was calculated for 144kbit data. In the last case the uplink outage was calculated for 8kbit/s speech. The radio network planning was targeted to better than 95% coverage probability.

The simulations were done on the following cell layouts:

Case 1. Three sectored, 65 deg. antenna

Case 2. Three sectored, 90 deg. antenna

Case 3 Three sectored, 65 deg. antenna, bad radio network planning

Cases 4. Standard omni scenario used in the ACIR coexistence analysis

Case 4a. WINDOW_ADD = 5 dB

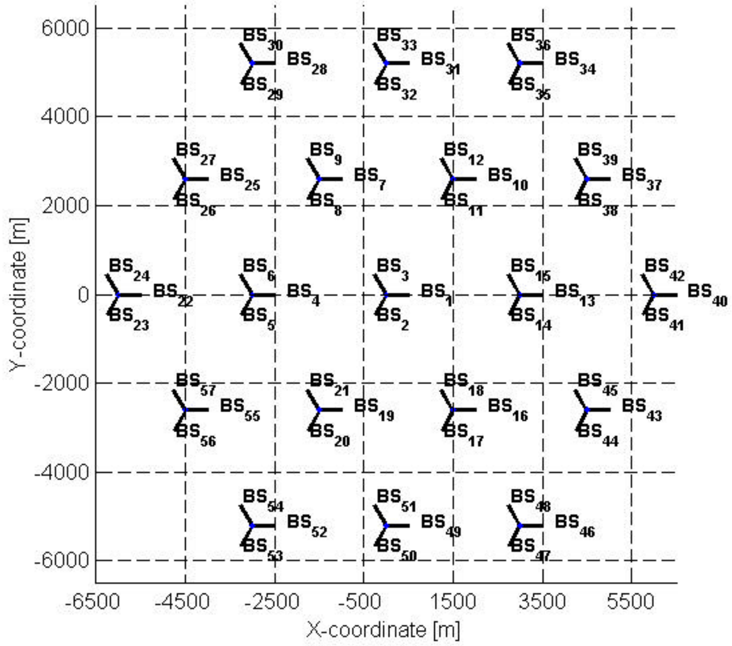
Case 4b. WINDOW_ADD = 3 dB

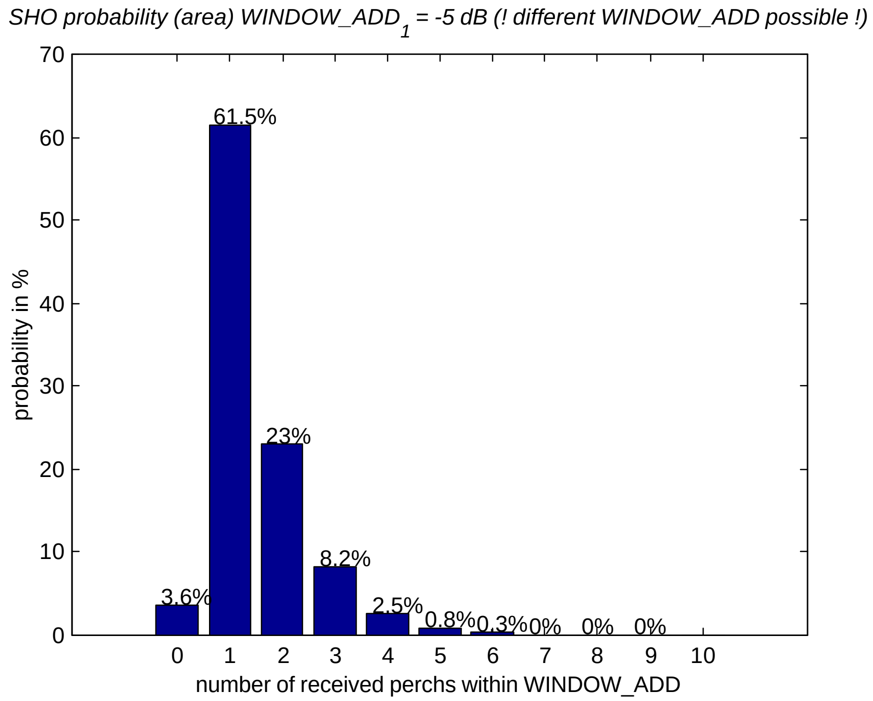
Case 4c. WINDOW_ADD = 7 dB

Case 5. Realistic map

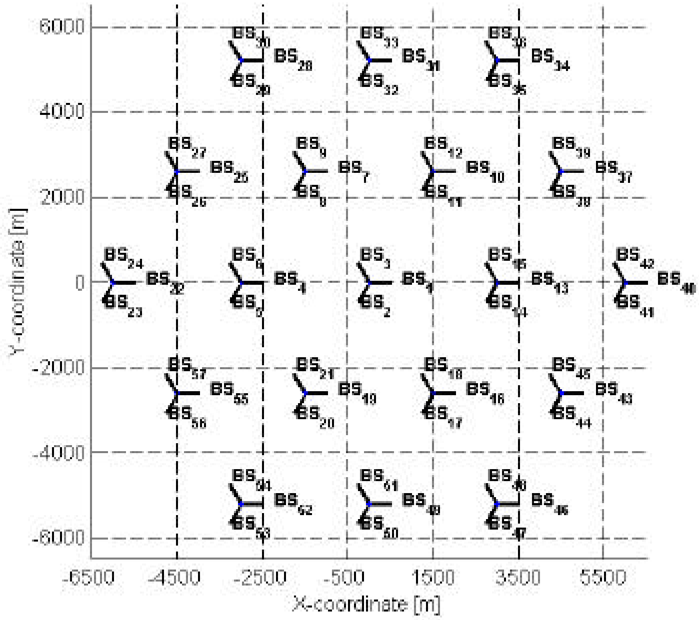
In all but the last case the distance loss was calculated as 128.1+37.6*lg(R), as used in the ACIR coexistence analysis, on top of which a log-normally distributed shadow fading term was added, with standard deviation of 10 dB. The log normal fading was generated so that the correlation between the fading terms from any pair of cells was 0.5. In the last case the distance loss was calculated by an extended Okumura-Hata model with area type correction factors fit to measured data.

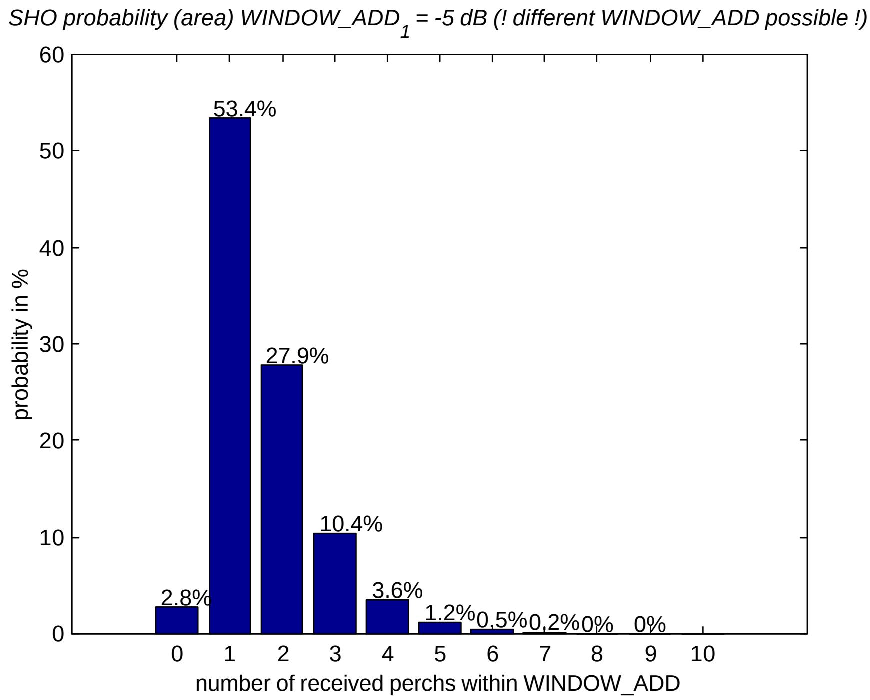
Case 1. Three sectored, 65 deg. antenna



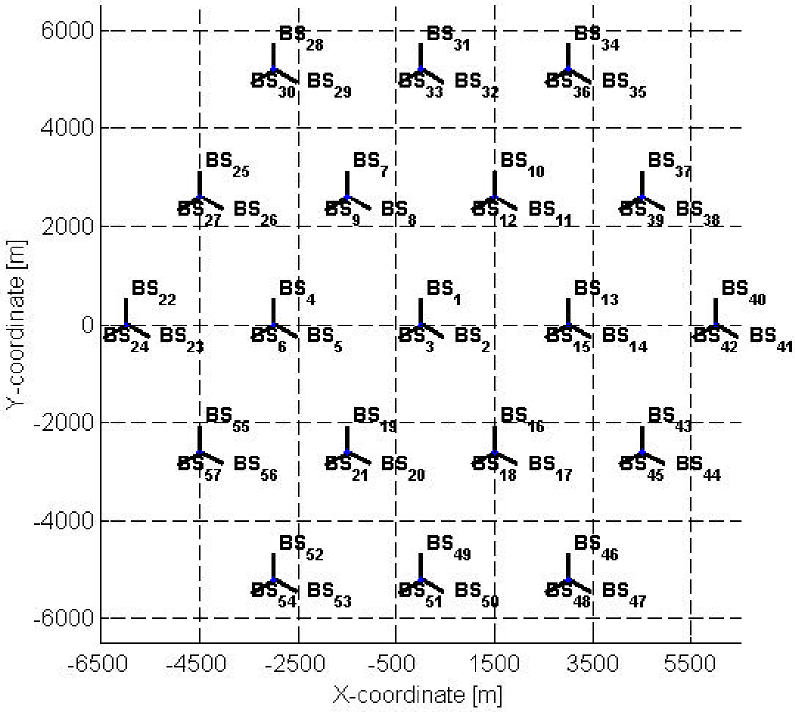



Case 2. Three sectored, 90 deg. antenna

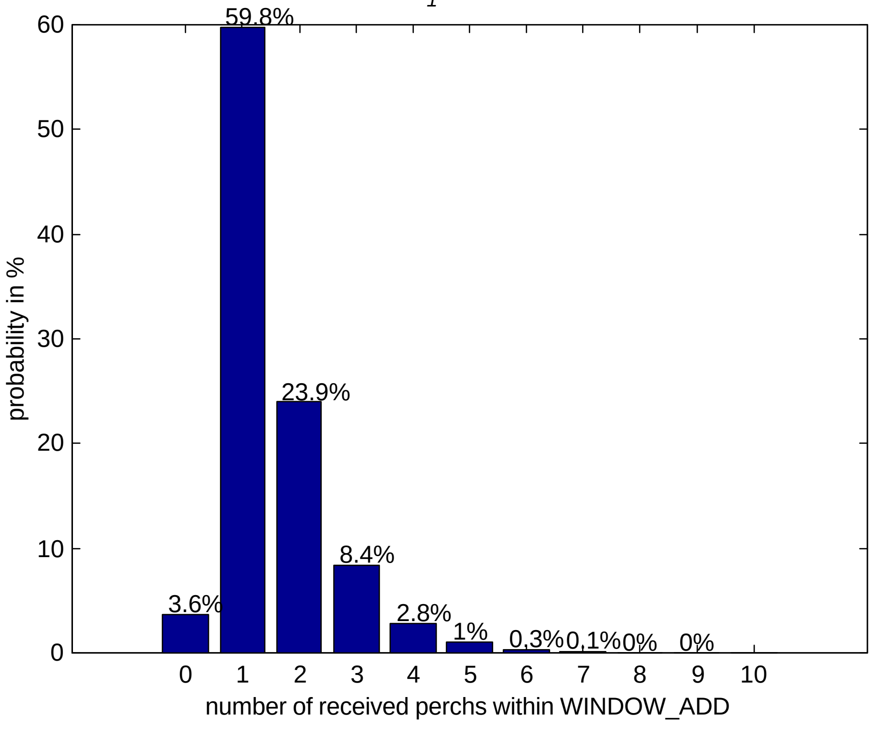


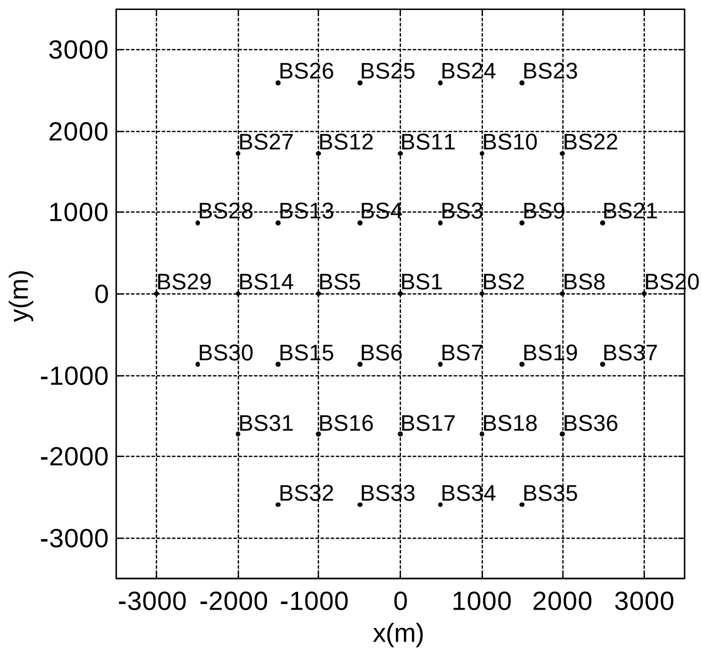
Case 3. Three sectored, 65 deg. antenna, stupid planning



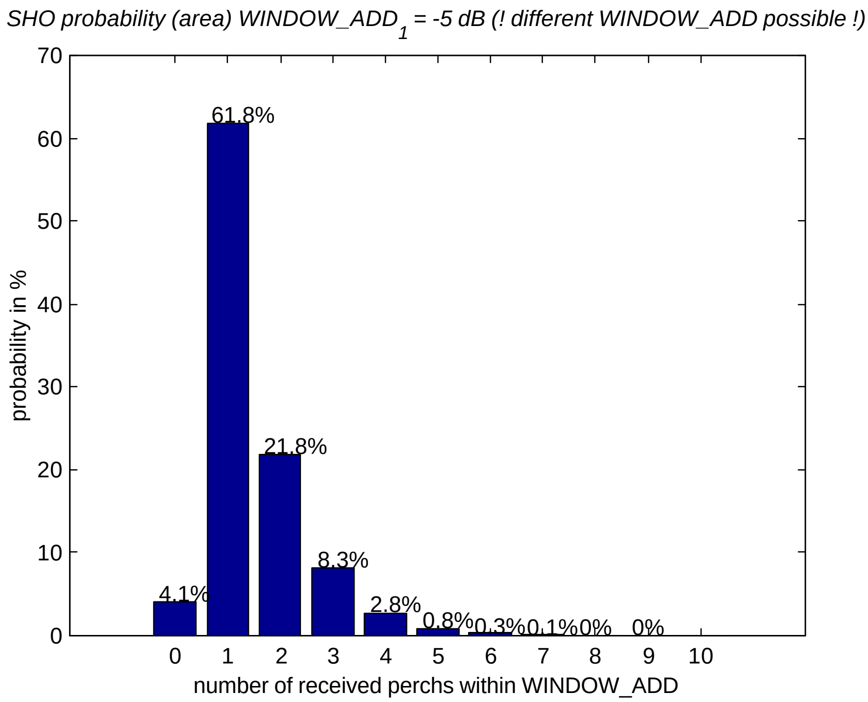

SHO probability (area) WINDOW_ADD$_1$ = -5 dB (! different WINDOW_ADD possible !)



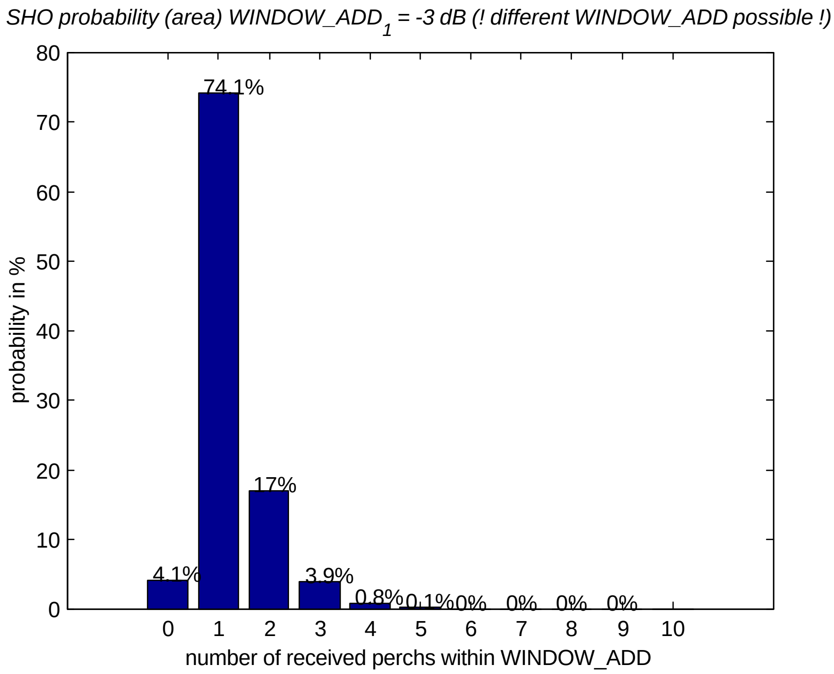
Cases 4. Standard omni scenario according to *TS RAN 25.942 RF System Scenarios*



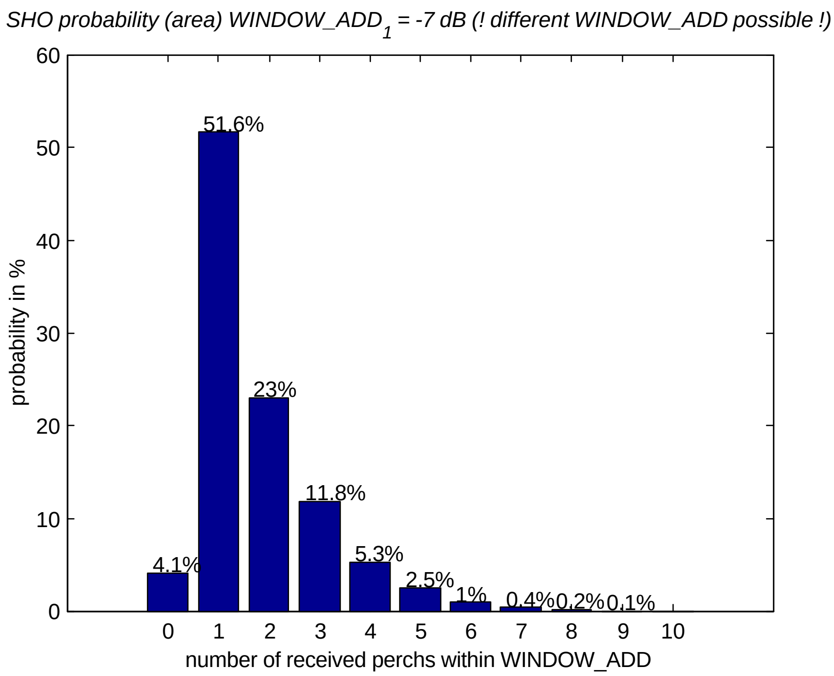

Case 4a. WINDOW_ADD = 5dB



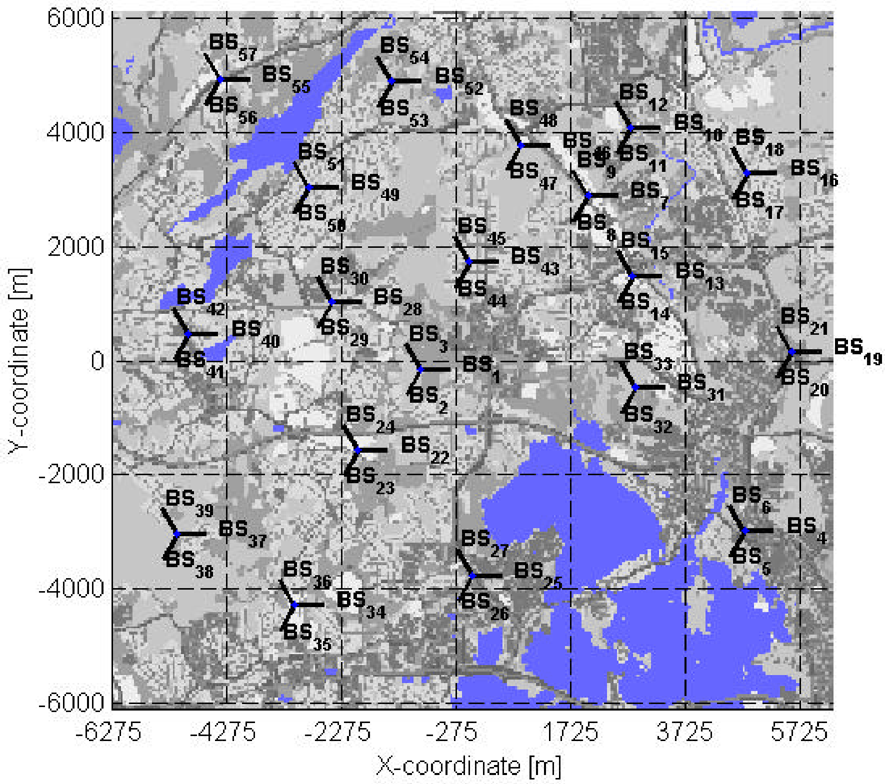

Case 4b. WINDOW_ADD = 3dB

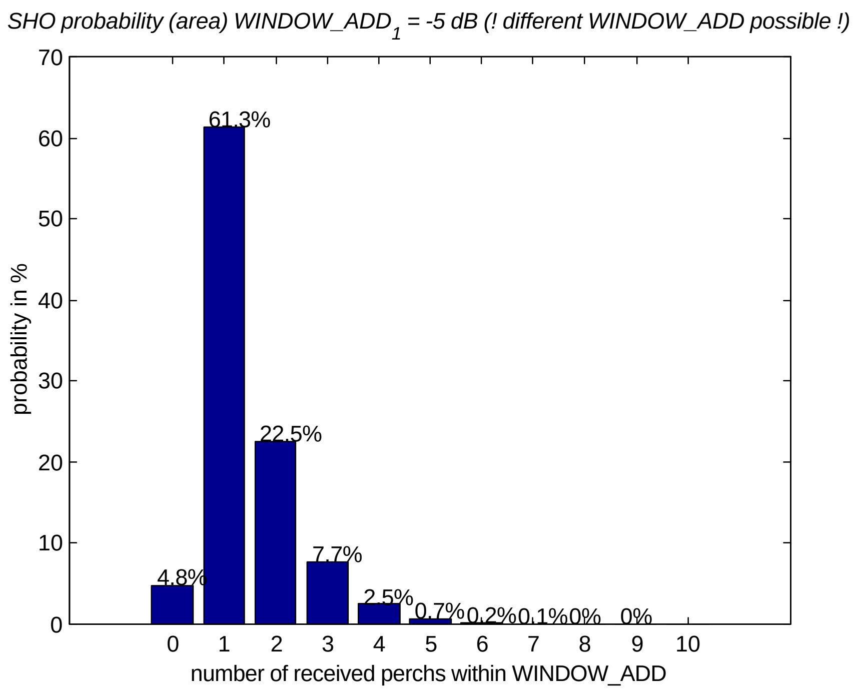



## Case 4c. WINDOW_ADD = 7dB



## Case 5. Realistic map



## 2.2. Distribution of the active set size

The table 1 is the summary of the distribution of the active set size for the 7 cell layouts in [6]. As we can see, the case of less than 2 active set size is dominant (i.e., 55.79-78.2% from that report).

| Cell Layout | Frequency for the size of Active Set | | |
|---|---|---|---|
| | **0-2** | **3-4** | **5-8** |
| **Three sectored, 65 deg. Antenna** | **65.1%** | 31.2% | 3.6 % |
| **Three sectored, 90 deg. Antenna** | **56.2%** | 38.3% | 5.5% |
| **Three sectored, 65 deg. Antenna, stupid planning** | **63.4%** | 32.3% | 4.2% |
| **Standard omni scenario according to TS RAN 25.942 RF System Scenarios (WINDOW_ADD = 5dB)** | **65.9%** | 30.1% | 4% |
| **Standard omni scenario according to TS RAN 25.942 RF System Scenarios (WINDOW_ADD = 3dB)** | **78.2%** | 20.9% | 0.9% |
| **Standard omni scenario according to TS RAN 25.942 RF System Scenarios (WINDOW_ADD = 7dB)** | **55.7%** | 34.8% | 9.2% |
| **Realistic map** | **66.1%** | 30.2% | 3.5% |

**Table 1. The distribution of the size of Active Set**

# 3. SSDT ID Code

In this section, the current SSDT ID code set, Samsung's, LGIC's one are described.

**Table 2: CURRENT SSDT ID codes**

| | ID label | ID code "long" | ID code "medium" | ID code "short" |
|---|---|---|---|---|
| 1 bit FBI | A | 000000000000000 | 0000000(0) | 00000 |
| | B | 111111111111111 | 1111111(1) | 11111 |
| | C | 000000001111111 | 0000111(1) | 00011 |
| | D | 111111110000000 | 1111000(0) | 11100 |
| | E | 000011111111000 | 0011110(0) | 00110 |
| | F | 111100000000111 | 1100001(1) | 11001 |
| | G | 001111000011110 | 0110011(0) | 01010 |
| | H | 110000111100001 | 1001100(1) | 10101 |
| 2 bit FBI | A | 0000000(0)<br>0000000(0) | 000(0)<br>000(0) | 000<br>000 |
| | B | 1111111(1)<br>1111111(1) | 111(1)<br>111(1) | 111<br>111 |
| | C | 0000000(0)<br>1111111(1) | 000(0)<br>111(1) | 000<br>111 |
| | D | 1111111(1)<br>0000000(0) | 111(1)<br>000(0) | 111<br>000 |
| | E | 0000111(1)<br>1111000(0) | 001(1)<br>110(0) | 001<br>100 |
| | F | 1111000(0)<br>0000111(1) | 110(0)<br>001(1) | 110<br>011 |
| | G | 0011110(0)<br>0011110(0) | 011(0)<br>011(0) | 010<br>010 |
| | H | 1100001(1)<br>1100001(1) | 100(1)<br>100(1) | 101<br>101 |

**Table 3: LGIC's proposed SSDT ID codes**

| | ID label | ID code "long" | "medium" | "short" |
|---|---|---|---|---|
| 1 bit FBI | A | 000000000000000 | (0)0000000 | 00000 |
| | B | 101010101010101 | (0)1010101 | 10111 |
| | C | 011001100110011 | (0)0110011 | 01101 |
| | D | 110011001100110 | (0)1100110 | 11010 |
| | E | 000111100001111 | (0)0001111 | 00011 |
| | F | 101101001011010 | (0)1011010 | 10100 |
| | G | 011110000111100 | (0)0111100 | 01110 |
| | H | 110100101101001 | (0)1101001 | 11001 |
| 2 bit FBI | A | (0)0000000<br>(0)0000000 | (0)000<br>(0)000 | 000<br>000 |
| | B | (0)0000000<br>(1)1111111 | (0)000<br>(1)111 | 000<br>111 |
| | C | (0)1010101<br>(0)1010101 | (0)101<br>(0)101 | 101<br>101 |
| | D | (0)1010101<br>(1)0101010 | (0)101<br>(1)010 | 101<br>010 |
| | E | (0)0110011<br>(0)0110011 | (0)011<br>(0)011 | 011<br>011 |
| | F | (0)0110011<br>(1)1001100 | (0)011<br>(1)100 | 011<br>100 |
| | G | (0)1100110<br>(0)1100110 | (0)110<br>(0)110 | 110<br>110 |
| | H | (0)1100110<br>(1)0011001 | (0)110<br>(1)001 | 110<br>001 |

**Table 4: Samsung's proposed SSDT ID codes**

| | ID label | ID code | | |
|---|---|---|---|---|
| | | "long" | "medium" | "short" |
| 1 bit FBI | A | 000000000000000 | 0000000(0) | 00000 |
| | B | 111111111111111 | 1111111(1) | 11111 |
| | C | 010101010101010 | 0101010(1) | 01010 |
| | D | 101010101010101 | 1010101(0) | 10101 |
| | E | 001100110011001 | 0011001(1) | 00110 |
| | F | 110011001100110 | 1100110(0) | 11001 |
| | G | 011001100110011 | 0110011(0) | 01100 |
| | H | 100110011001100 | 1001100(1) | 10011 |
| 2 bit FBI | A | 0000000(0)<br>0000000(0) | 000(0)<br>000(0) | 000<br>000 |
| | B | 1111111(1)<br>1111111(1) | 111(1)<br>111(1) | 111<br>111 |
| | C | 0000000(0)<br>1111111(1) | 000(0)<br>111(1) | 000<br>111 |
| | D | 1111111(1)<br>0000000(0) | 111(1)<br>000(0) | 111<br>000 |
| | E | 0101010(1)<br>0101010(1) | 010(1)<br>010(1) | 010<br>010 |
| | F | 1010101(0)<br>1010101(0) | 101(0)<br>101(0) | 101<br>101 |
| | G | 0101010(1)<br>1010101(0) | 010(1)<br>101(0) | 010<br>101 |
| | H | 1010101(0)<br>0101010(1) | 101(0)<br>010(1) | 101<br>010 |

Table 4 is the proposed SSDT ID code set. As we can see, in terms of the weight distribution as well as the minimum distance, sub-code set a, b are repetition codes, and sub-code set a,b,c,d are optimal among the code set including the repetition code. And whole code sets are optimal among the code set including sub-code set a,b,c,d.

So, we can classify ID code in the code set into three categories, i.e. category 1 is the active set with less than 2 size, category 2 is the active set with the size 3~4 , and category 3 is the active set with the size 5~8. Then, the preferred ID code set for category 1 is {A,B}, the preferred ID code set for category 2 is {A,B,C,D}, the preferred ID code set for category 3 is {A,B,C,D,E,F,G,H}. "Category" can be used for the development of the decoding performance, instead of the size of size of the Active set size. Actually, in terms of the decoding performance, the only 2,4,8 codes are meaningful. So, we need only 2bit signalling message about the set size of the active set. Then, we need a reallocation, only when the category of the active set is changed. For example, assume that SSDT ID's A, B, C are used in the current active set. Then, the current active set is in the category 2. When the cell with SSDT ID B is out of the current active set, cells with SSDT ID A,C are remained. But, since the preferred ID code set of category is {A,B}, for the performance of, the ID code of the cell with SSDT ID C is changed into SSDT ID code B, and this reallocation message is transmitted from Network into the only the cell with SSDT ID C in the previous active set.

In the view of using this signalling, LGIC's code degrade the performance when the active set is in the category 1, because LGIC's code have a minimum distance 8, while the current and Samsung's code have a minimum distance 15 (repetition code with length). Furthermore, the probability of the active set with less than 2 size is 55.79-78.2%.

# 4. Simulation results

In this section, we show some simulation result. Each result describes a comparing of performance in each size of the active set. In results, each graph describes the word error rate for the size of the active set. For each size of the active set, the word error rate is estimated in the same Eb/No.

- Simulation Conditions
  - No power control
  - 1-path fading channel with 3, 30, 100km/h mobile speed
  - Same SNR cases are compared near the Word Error Rate is 0.1%.
  - All simulation results are considered for the puncturing cases.

➢ **<u>Mobile Speed : 3km/h</u>**

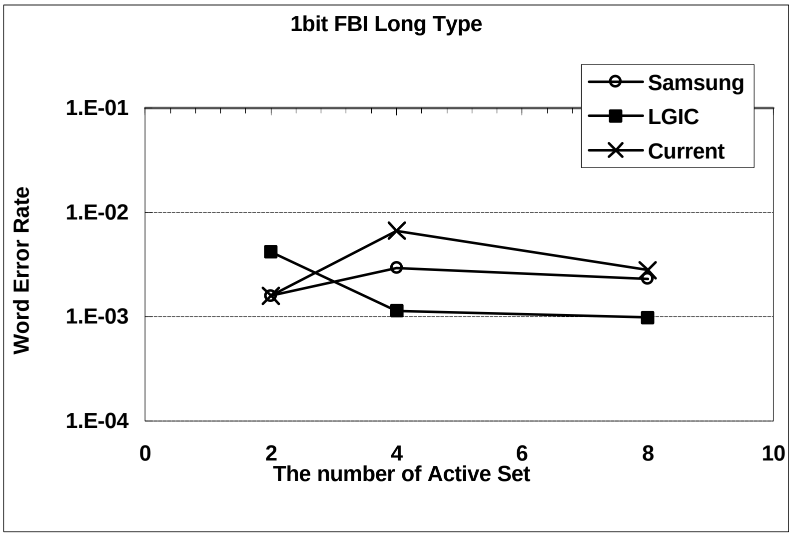



**Figure 1. Performance in 1bit FBI Long Type**

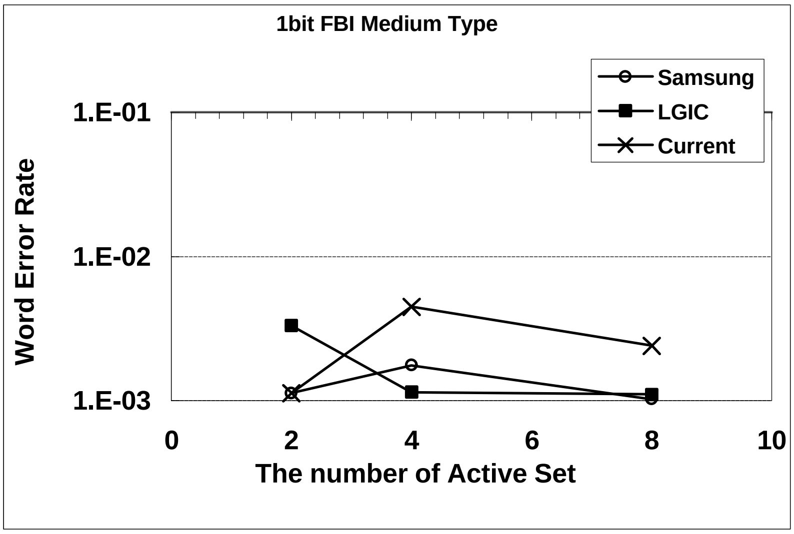



**Figure 2. Performance in 1bit FBI Medium Type**

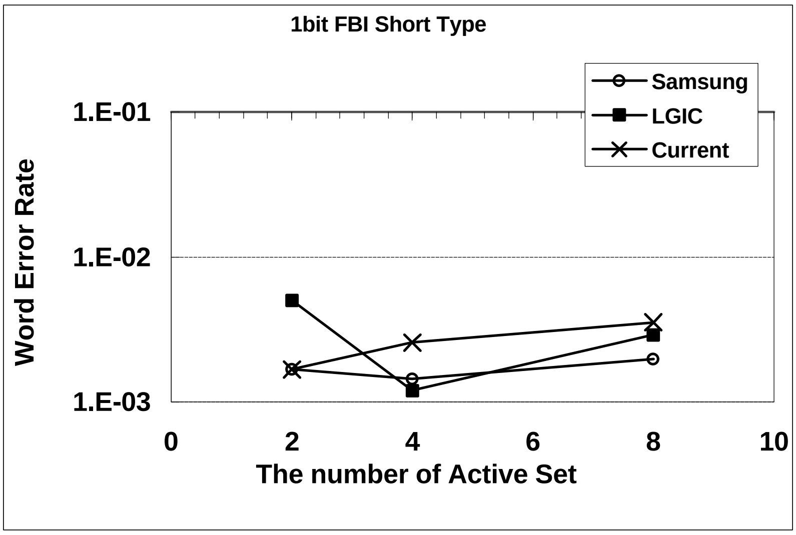



**Figure 3. Performance in 1bit FBI Short Type**

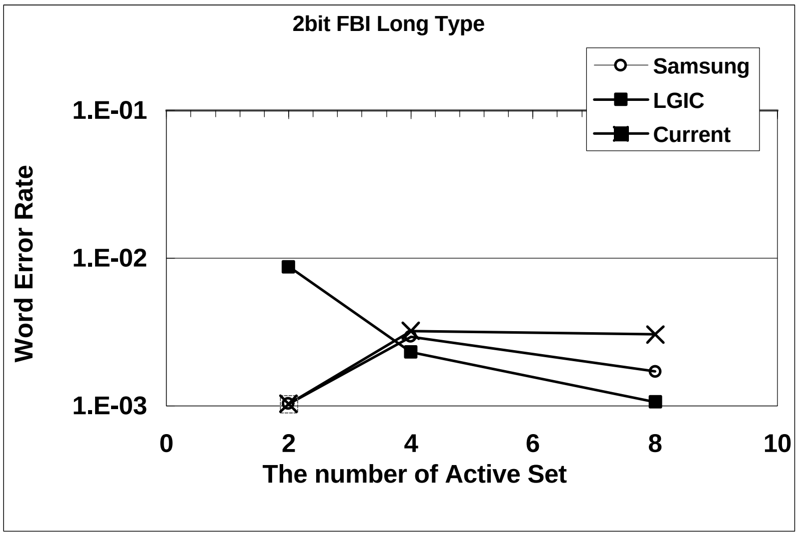



**Figure 4. Performance in 2bit FBI Long Type**

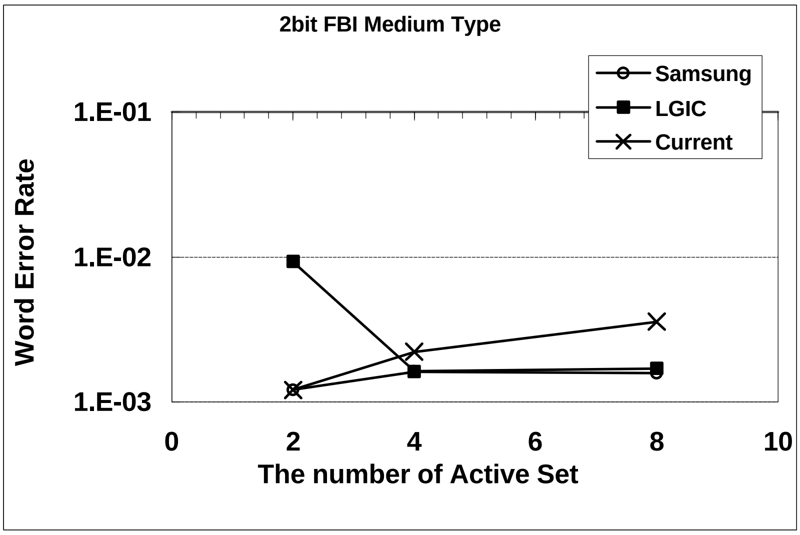



**Figure 5. Performance in 2bit FBI Medium Type**

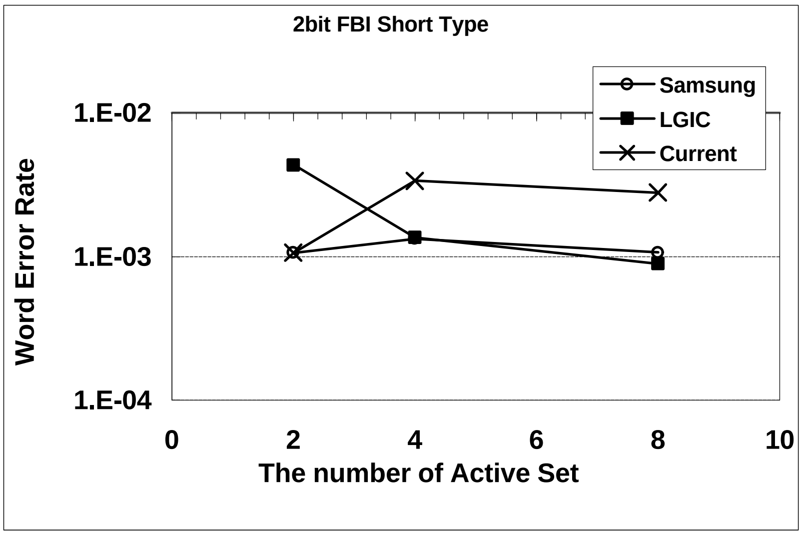



**Figure 6. Performance in 2bit FBI Short Type**

➢ <u>**Mobile Speed : 30km/h**</u>

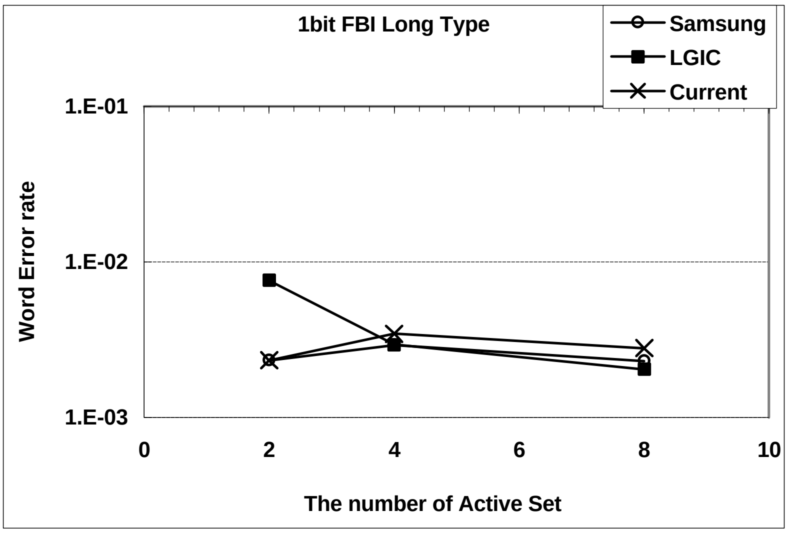



**Figure 7. Performance in 1bit FBI Long Type**

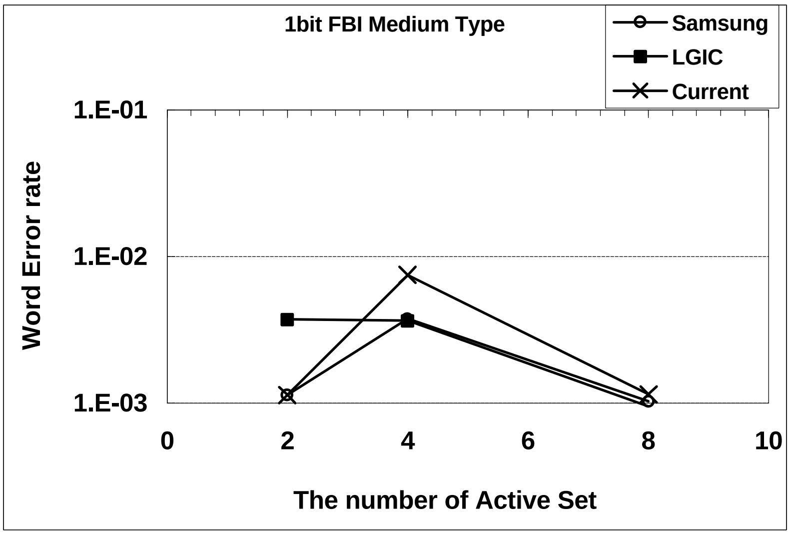



**Figure 8. Performance in 1bit FBI Medium Type**

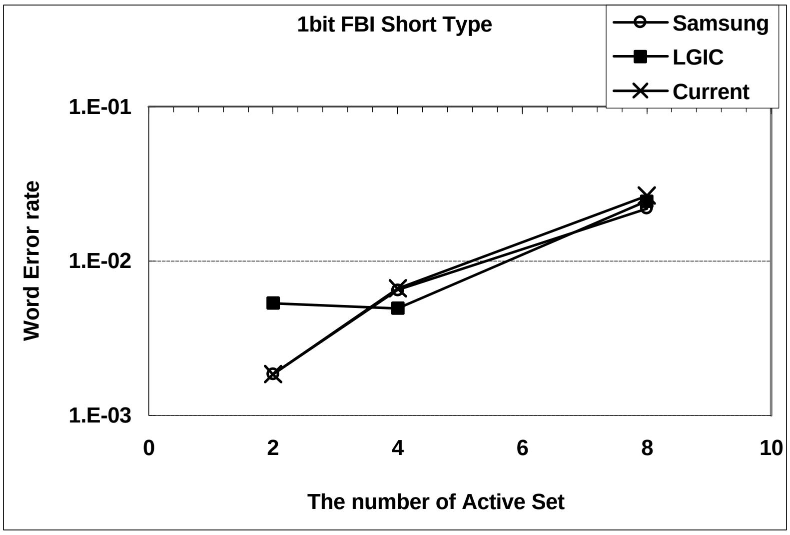



**Figure 9. Performance in 1bit FBI Short Type**

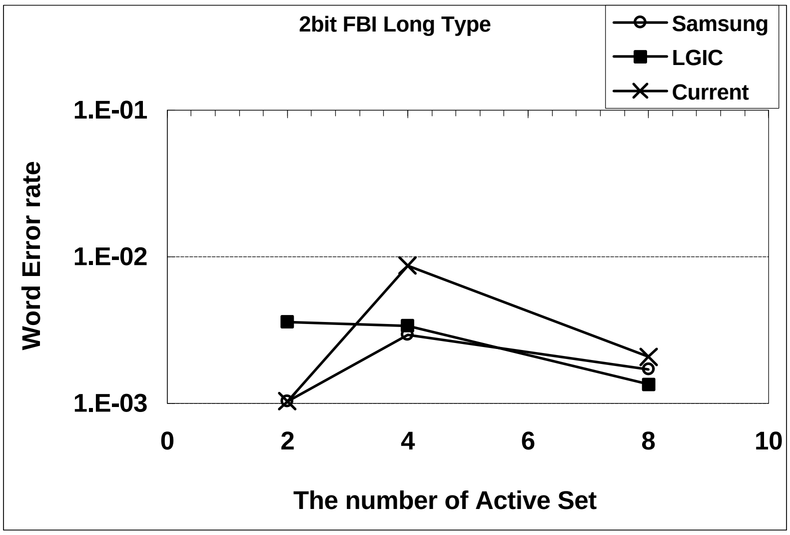



**Figure 10. Performance in 2bit FBI Long Type**

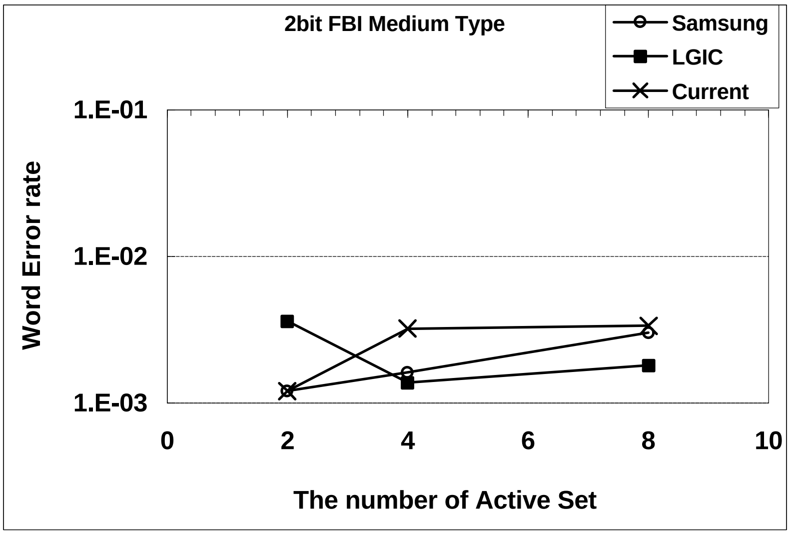



**Figure 11. Performance in 2bit FBI Medium Type**

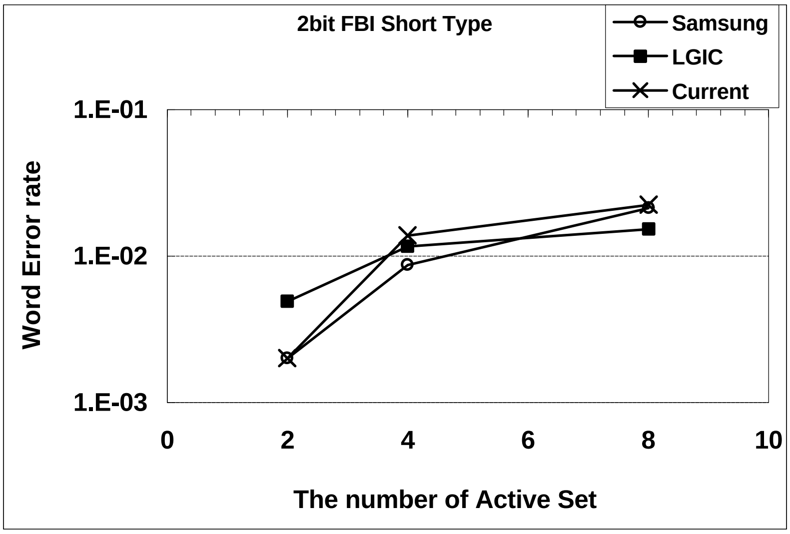



**Figure 12. Performance in 2bit FBI Short Type**

- **Mobile Speed : 100km/h**

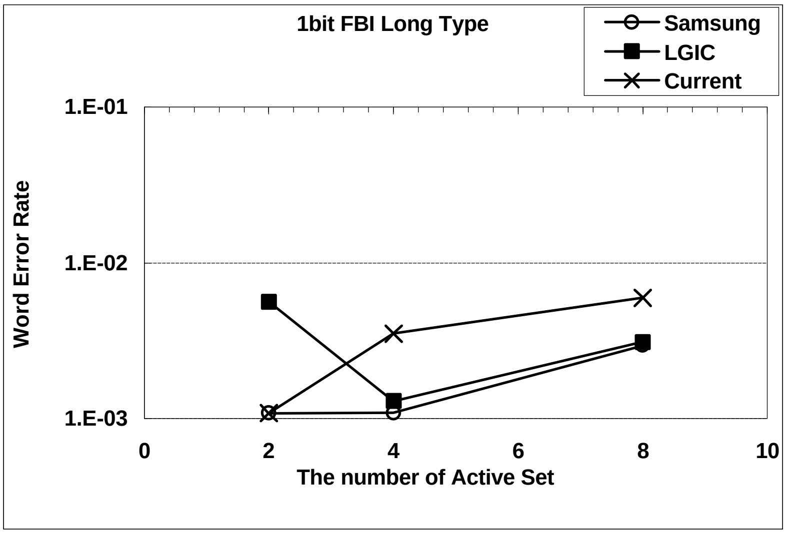



**Figure 13. Performance in 1bit FBI Long Type**

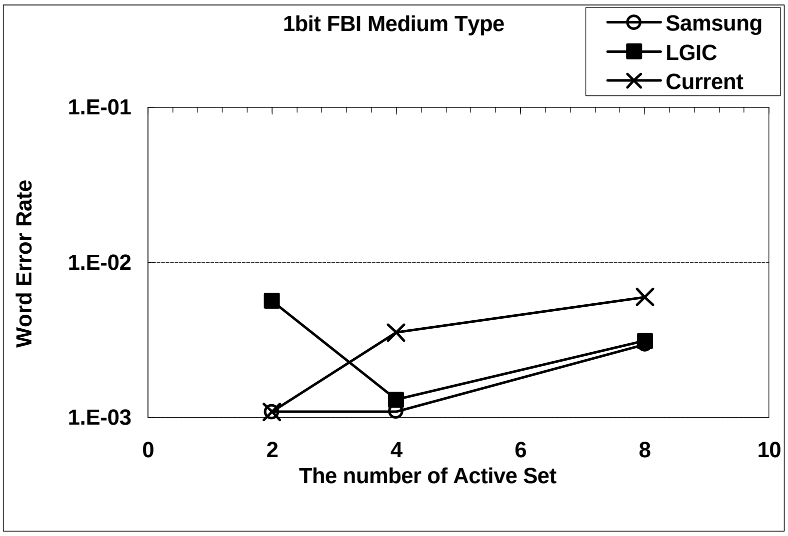



**Figure 14. Performance in 1bit FBI Medium Type**

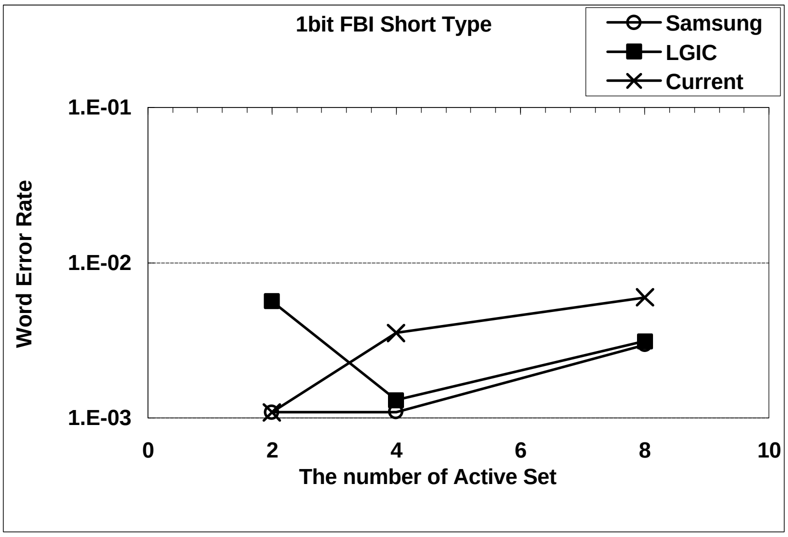



**Figure 15. Performance in 1bit FBI Short Type**

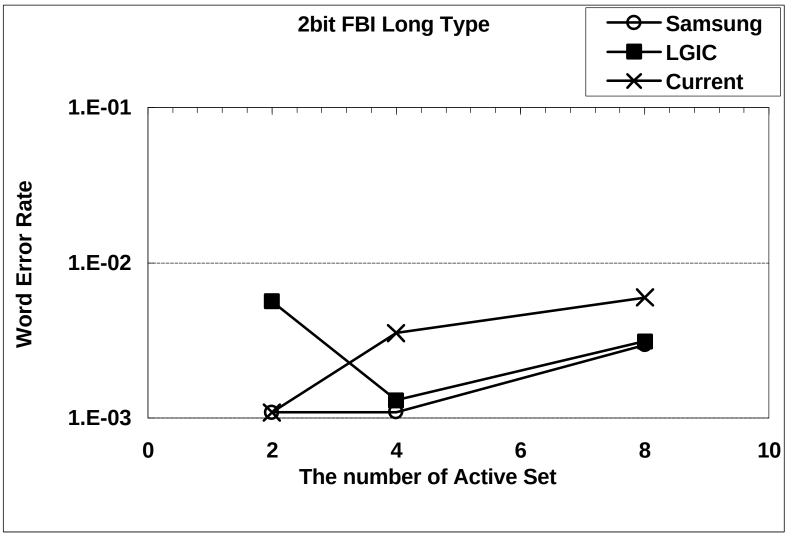



**Figure 16. Performance in 2bit FBI Long Type**

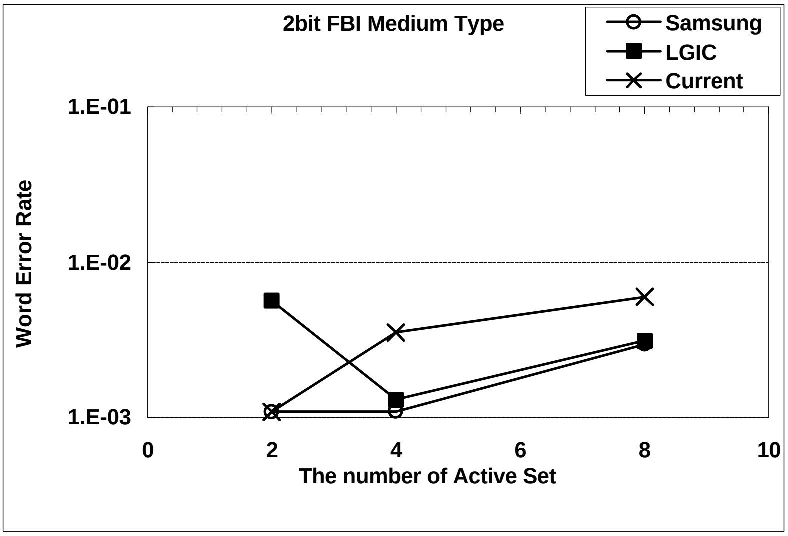



**Figure 17. Performance in 2bit FBI Medium Type**

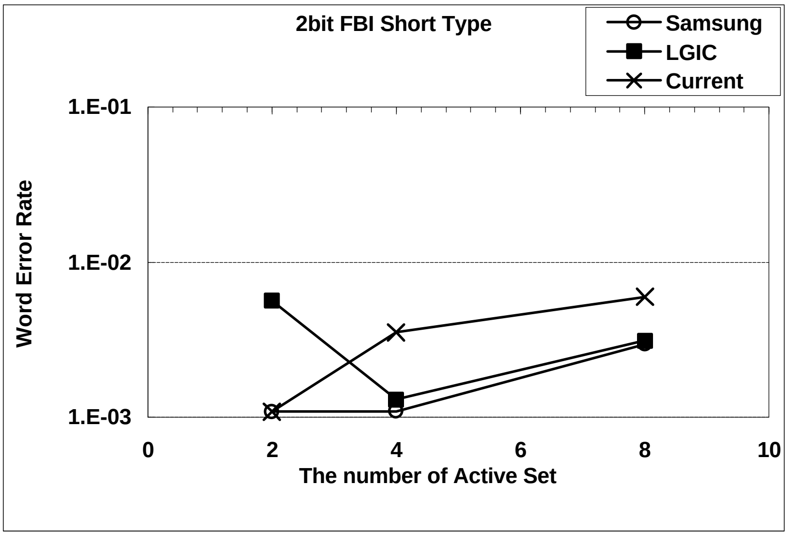



**Figure 18. Performance in 2bit FBI Short Type**

The following figures show the performance in word error rate vs. Eb/No. Simulation parameter is as follows. This simulation results are referred from [2]. Actually, in case of the active set size 2, the proposed code and the current code use the same code, i.e. the repetition code. But, LGIC uses the orthogonal code. The following figures show the difference of performance in that case. As we can see, the difference is about 3dB in the 1% error rate.

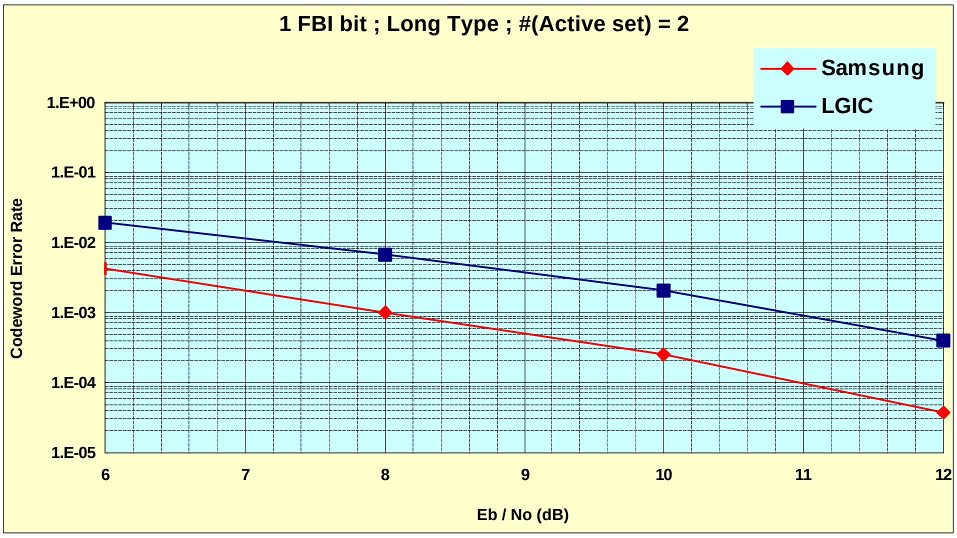



**Figure 19. The Identification error rate versus Eb / No: 1 bit FBI, long ID type, the size of active set = 2, mobile velocity is 100 km/h, 1 path, no power control.**

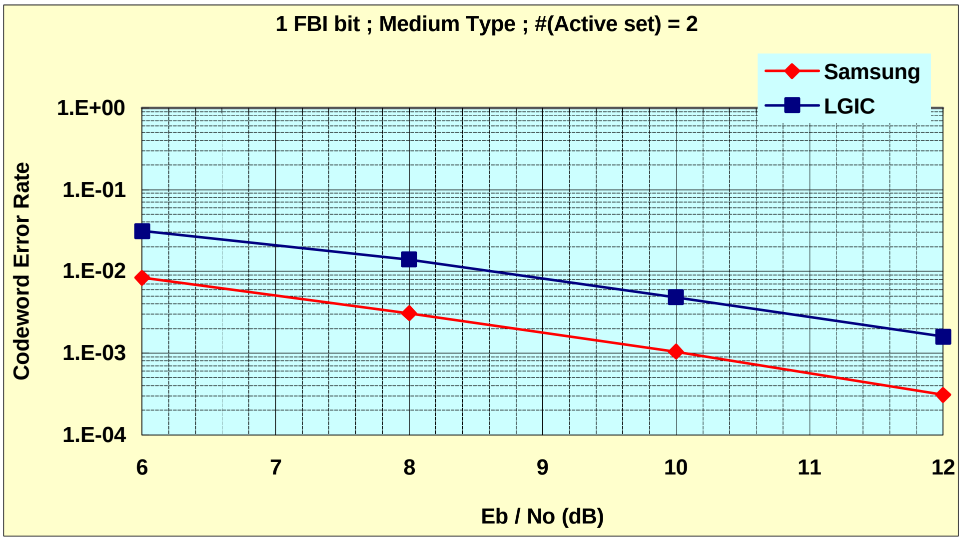



**Figure 20. The Identification error rate versus Eb / No: 1 bit FBI, Medium ID type, the size of active set = 2, mobile velocity is 100 km/h, 1 path, no power control.**

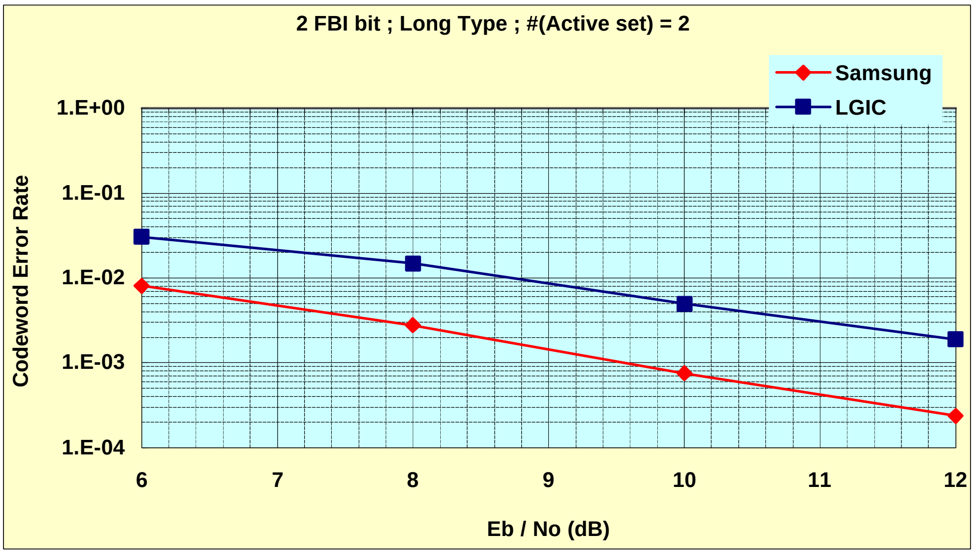



**Figure 21. The Identification error rate versus Eb / No: 2 bit FBI, long ID type, the size of active set = 2, mobile velocity is 100 km/h, 1 path, no power control.**

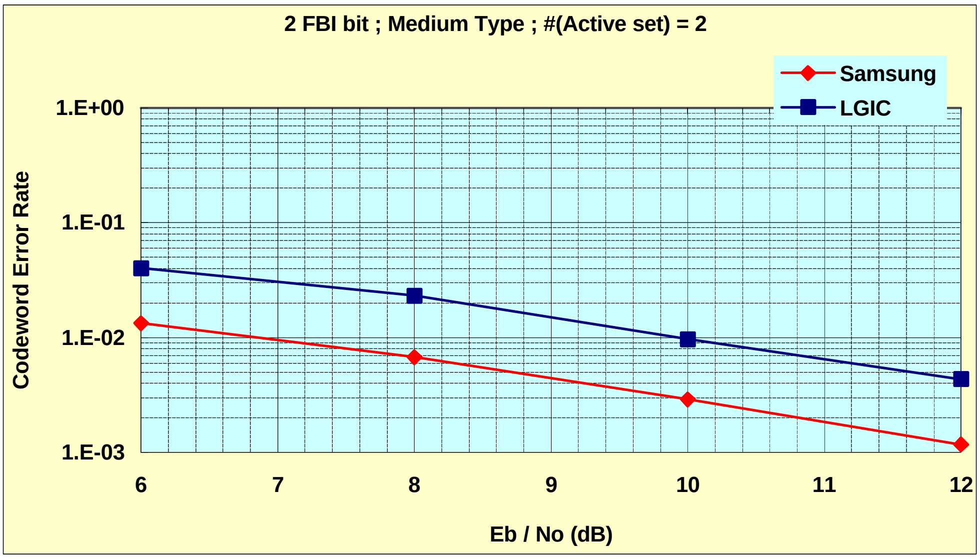



**Figure 22. The Identification error rate versus Eb / No: 2 bit FBI, Medium ID type, the size of active set = 2, mobile velocity is 100 km/h, 1 path, no power control.**

# 5. Conclusion

In this contribution, we describe the performance using a SSDT ID code adapted for a real situation, requiring only a minor amount of additional signalling, (i.e. a re-allocation message of each cell ID and information on the size of the active set from the network to each cell). As we can see, the use of such additional signalling produces a significant performance advantage. It is therefore practical to use a code adapted for the real situation, because the signalling burden is negligible

# 6. Reference

[1] "UTRA FDD; Physical layer procedures", 3GPP TS25.214, v3.1.0 (1999-12).
[2] Samsung, "SSDT ID code (rev.1)", TSGR1#9(99)K91
[3] LGIC, "Optimum ID Codes for SSDT", TSGR1#9(99)K76
[4] WG1, "Proposed LS on Higher Layer Signalling for Site Selection Diversity Transmission Power Control", TSGR1#9(99)L74.
[5] WG3, "Response to LS on Higher Layer Signalling for Site Selection Diversity Transmission Power Control", TSGR1-00-0008.
[6] TR 25.942 v 2.0.0 (chapter 11)

## Contact Person

Jaeyoel. KIM : kimjy@telecom.samsung.co.kr
Seong I. PARK : sipark@telecom.samsung.co.kr

Hyeonwoo LEE : woojaa@samsung.co.kr

| | | |
|---|---|---|
| **3GPP TSG RAN WG1 Meeting #10**<br>**Beijing, China, Jan 18 – 21, 2000** | ***Document*** | ***R1-00-0054***<br>*e.g. for 3GPP use the format TP-99xxx*<br>*or for SMG, use the format P-99-xxx* |

# CHANGE REQUEST

*Please see embedded help file at the bottom of this page for instructions on how to fill in this form correctly.*

| | | | | |
|---|---|---|---|---|
| | **25.214** | **CR** | **054** | Current Version: 3.1.0 |

*GSM (AA.BB) or 3G (AA.BBB) specification number* ↑ ↑ *CR number as allocated by MCC support team*

| | | | | | |
|---|---|---|---|---|---|
| For submission to: | TSG-RAN #7 | for approval | **X** | strategic | *(for SMG* |
| *List expected approval meeting # here* ↑ | | for information | | Non-strategic | *Use only)* |

*Form: CR cover sheet, version 2 for 3GPP and SMG* *The latest version of this form is available from:* ftp://ftp.3gpp.org/Information/CR-Form-v2.doc

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **Proposed change affects:**<br>*(at least one should be marked with an X)* | (U)SIM | | ME | **X** | UTRAN / Radio | **X** | Core Network | |

| | | | |
|---|---|---|---|
| **Source:** | Samsung | **Date:** | 2000-1-12 |
| **Subject:** | **Enhanced performance using the adaptive SSDT ID code** | | |
| **Work item:** | | | |

| | | | | | | |
|---|---|---|---|---|---|---|
| **Category:** | F | Correction | **X** | **Release:** | Phase 2 | |
| | A | Corresponds to a correction in an earlier release | | | Release 96 | |
| *(only one category* | B | Addition of feature | | | Release 97 | |
| *Shall be marked* | C | Functional modification of feature | | | Release 98 | |
| *With an X)* | D | Editorial modification | | | Release 99 | **X** |
| | | | | | Release 00 | |

| | |
|---|---|
| **Reason for change:** | The current ID codes for SSDT have worse performance than the proposed codes. This CR corrects the codes. |
| **Clauses affected:** | 5.2.1.4 |

| | | | | |
|---|---|---|---|---|
| **Other specs Affected:** | Other 3G core specifications | | → List of CRs: | |
| | Other GSM core specifications | | → List of CRs: | |
| | MS test specifications | | → List of CRs: | |
| | BSS test specifications | | → List of CRs: | |
| | O&M specifications | | → List of CRs: | |

| | |
|---|---|
| **Other comments:** | |

## 5.2.1.4 Site selection diversity transmit power control

### 5.2.1.4.1 General

Site selection diversity transmit power control (SSDT) is an optional macro diversity method in soft handover mode.

Operation is summarised as follows. The UE selects one of the cells from its active set to be ‘primary’, all The main objective is to transmit on the downlink from the primary cell, thus reducing the interference caused by multiple transmissions in a soft handover mode. A second objective is to achieve fast site selection without network intervention, thus maintaining the advantage of the soft handover. In order to select a primary cell, each cell is assigned a temporary identification (ID) and UE periodically informs a primary cell ID to the connecting cells. The non-primary cells selected by UE switch off the transmission power. The primary cell ID is delivered by UE to the active cells via uplink FBI field. SSDT activation, SSDT termination and ID assignment are all carried out by higher layer signalling.

#### 5.2.1.4.1.1 Definition of temporary cell identification

Each cell is given a temporary ID during SSDT and the ID is utilised as site selection signal. The ID is given a binary bit sequence. There are three different lengths of coded ID available denoted as "long", "medium" and "short". The network decides which length of coded ID is used. Settings of ID codes for 1-bit and 2-bit FBI are exhibited in table 3 and table 4, respectively.

**Table 3: Settings of ID codes for 1 bit FBI**

| ID label | ID code "long" | "medium" | "short" |
|---|---|---|---|
| a | 000000000000000 | 0000000(0) | 00000 |
| b | 111111111111111 | 1111111(1) | 11111 |
| c | 010101010101010<br>~~000000001111111~~ | 0101010(1)<br>~~0000111(1)~~ | 01010<br>~~00011~~ |
| d | 101010101010101<br>~~111111110000000~~ | 1010101(0)<br>~~1111000(0)~~ | 10101<br>~~11100~~ |
| e | 001100110011001<br>~~000011111111000~~ | 0011001(1)<br>~~0011110(0)~~ | 00110<br>~~00110~~ |
| f | 110011001100110<br>~~111100000000111~~ | 1100110(0)<br>~~1100001(1)~~ | 11001<br>~~11001~~ |
| g | 011001100110011<br>~~001111000011110~~ | 0110011(0)<br>~~0110011(0)~~ | 01100<br>~~01010~~ |
| h | 100110011001100<br>~~110000111100001~~ | 1001100(1)<br>~~1001100(1)~~ | 10011<br>~~10101~~ |

**Table 4: Settings of ID codes for 2 bit FBI**

| ID label | ID code<br>(Column and Row denote slot position and FBI-bit position.)<br>"long" | "medium" | "short" |
|---|---|---|---|
| a | 0000000(0)<br>0000000(0) | 000(0)<br>000(0) | 000<br>000 |
| b | 1111111(1)<br>1111111(1) | 111(1)<br>111(1) | 111<br>111 |
| c | 0000000(0)<br>1111111(1) | 000(0)<br>111(1) | 000<br>111 |
| d | 1111111(1)<br>0000000(0) | 111(1)<br>000(0) | 111<br>000 |
| e | 0101010(1)<br>0101010(1)<br>~~0000111(1)~~<br>~~1111000(0)~~ | 010(1)<br>010(1)<br>~~001(1)~~<br>~~110(0)~~ | 010<br>010<br>~~001~~<br>~~100~~ |
| f | 1010101(0)<br>1010101(0)<br>~~1111000(0)~~<br>~~0000111(1)~~ | 101(0)<br>101(0)<br>~~110(0)~~<br>~~001(1)~~ | 101<br>101<br>~~110~~<br>~~011~~ |
| g | 0101010(1)<br>1010101(0)<br>~~0011110(0)~~<br>~~0011110(0)~~ | 010(1)<br>101(0)<br>~~011(0)~~<br>~~011(0)~~ | 010<br>101<br>~~010~~<br>~~010~~ |
| h | 1010101(0)<br>0101010(1)<br>~~1100001(1)~~<br>~~1100001(1)~~ | 101(0)<br>010(1)<br>~~100(1)~~<br>~~100(1)~~ | 101<br>010<br>~~101~~<br>~~101~~ |

ID must be terminated within a frame. If FBI space for sending a given ID cannot be obtained within a frame, hence if the entire ID is not transmitted within a frame but must be split over two frames, the last bit(s) of the ID is(are) punctured. The relating bit(s) to be punctured are shown with brackets in table 3 and table 4. From the high layer, the category is informed. There are three categories. For the category 1, the codeword a and b are used. And for the category 2, the codeword a, b, c, and d are used for the SSDT. Finally, all eight codewords are used for the category 3.

#### 5.2.1.4.2 TPC procedure in UE

The TPC procedure of the UE in SSDT is identical to that described in subclause5.2.1.2 or 5.2.1.3 in compressed mode.

#### 5.2.1.4.3 Selection of primary cell

The UE selects a primary cell periodically by measuring the RSCP of  CPICHs transmitted by the active cells. The cell with the highest CPICH RSCP is detected as a primary cell.

#### 5.2.1.4.4 Delivery of primary cell ID

The UE periodically sends the ID code of the primary cell via portion of the uplink FBI field assigned for SSDT use (FBI S field). A cell recognises its state as non-primary if the following conditions are fulfilled simultaneously:

- the received primary ID code does not match with the own ID code,
- the received uplink signal quality satisfies a quality threshold, Qth, a parameter defined by the network.

and, when the uplink link compressed mode, does not results in excessive levels of puncturing on the coded ID. The acceptable level of puncturing on the coded ID is less than (int)$N_{ID}$/3 symbols in the coded ID (where $N_{ID}$ is the length of the coded ID).

Otherwise the cell recognises its state as primary.
The state of the cells (primary or non-primary) in the active set with update synchronous. If a cell receives the last portion of the coded ID in uplink slot #j, the state of cell is updated in downlink slot#{(j+1+$T_{os}$) mod 15}. Where $T_{os}$ is defined as a constant of 2 time slots. The updating of cell state is unchanged by the operation of downlink compressed mode.

At the UE, the primary ID code to be sent to the cells is segmented into a number of portions. These portions are distributed in the uplink FBI S-field. The cell in SSDT collects the distributed portions of the primary ID code and then detects the transmitted ID. Period of primary cell update depends on the settings of code length and the number of FBI bits assigned for SSDT use as shown in table 5

**Table 5: Period of primary cell update**

| | **The number of FBI bits per slot assigned for SSDT** | |
|---|---|---|
| **code length** | **1** | **2** |
| "long" | 1 update per frame | 2 updates per frame |
| "medium" | 2 updates per frame | 4 updates per frame |
| "short" | 3 updates per frame | 5 updates per frame |