TSG-RAN Working Group 4 (Radio) meeting #5 **TSGW4#5(99)314**
Miami 14th – 16th June 1999

Agenda Item: 7.6

Source: Motorola

Title: BTS Receiver Blocking

Document for: Discussion

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1. Introduction

In a previous submission, Tdoc (99)108, simulation results for base station receiver blocking signal levels were shown for 2 km cells. The simulations have been redone for larger cells, and an error in the original simulation was corrected. The updated results follow. The allowed sensitivity degradation has also been changed.

2. Description of Simulations

Several simulations have been made to determine how often very large W-CDMA signals will occur at the input of a BS receiver. These are static Monte Carlo simulations using a methodology generally consistent with that described in [1]. The simulations are constructed using two uncoordinated networks that are on different frequencies. The frequencies are assumed to be separated by 10 MHz or more so that the BS receiver selectivity will not limit the simulation, and so that the UE's spurious and noise performance will dominate over its adjacent channel performance. These are factors that distinguish a blocking situation from an adjacent channel situation in which significant BS receiver degradation can be caused at very low levels due to the poor ACP from the UE.

The primary assumptions that are common to all simulations are: 1) the two networks have maximal geographic offset (a worst case condition), 2) cell radius is 5 km, 3) UE spurious and noise in a channel bandwidth is 46 dB, 4) BS selectivity is 100 dB (to remove its effect), 5) BS antenna gain is 11 dB, 6) UE antenna gain is 0 dB, and 7) minimum path loss is 70 dB including antenna gains. In addition, for the speech simulations, maximum UE power is 21 dBm and the C/I requirement is –21 dB. For the data simulations, maximum UE power is 33 dBm and the C/I requirement is –11.4 dB. Note that this is different from the basic assumption in [1], since its data power level is 21 dBm, just like the speech level.

During each trial of the simulations, uniform drops of the UE are made, power levels are adapted, and data is recorded. A thousand such trials are made for each condition. From these results, CDF's of the total signal appearing at the receivers' inputs have been constructed and are shown in the graphs at the end of this paper.

Simulations have been done for speech only systems and also for mixed speech and data systems. In the mixed systems, it was assumed that 90% of the total were speech users and 10% were data users. This led to about 45% of the total power being utilised by speech and 55% by data. This is also a deviation from [1], in that the 6 dB noise rise criterion was not used. In very large cells, it was found that 6 dB rise produced large outage values (>10%), so instead the number of users was adjusted to provide a 5% outage for the speech users (data user outage was lower).

3. Simulation Results

Figure 1 shows the overall CDF of the input signals to the receivers using speech only, and Figure 2 shows an expanded view of the occurrences having probability greater than .998. A sharp discontinuity can be seen at the –49 dBm input level in the expanded view. This occurs because in large cells there are a few occurrences of users operating at their maximum transmitted power level of 21 dBm while they are also close enough to another network's cell to produce a minimum coupling loss condition. Therefore, for this large of a cell, the received signal power level corresponding to 99.99% of the occurrences is very close to the level dictated by MCL and is about -49 dBm (= 21dBm – 70 dB).

The condition just described is for speech only systems with a maximum transmitted power level of 21 dBm. It is probably reasonable to assume that mixed speech and data systems would produce approximately the same result if the maximum power level for a data terminal were also 21 dBm. This is the case given in [1]. However, 33 dBm data terminals may exist, so it would be desirable to consider this higher power case also.

Figures 3 and 4 show the CDF of the input signals to the receivers in mixed speech and data systems. These indicate that 99.99% of occurrences of the input signals to the receivers are about –40 dBm or less. Of course, with this large of a cell, the absolute maximum signal is dictated by MCL also and is only a few dB higher (33 dBm – 70 dB = -37 dBm).

4. Other Issues

Recent proposals from other companies have indicated that it may be desirable to allow more than the 3 dB degradation in sensitivity that is typically used in the measurement of a blocking spec. This is probably reasonable since 1) the interfering UE's spurious and noise are going to dominate the noise in the victim cell in a real system, and 2) the measurement equipment is approaching the limit of its capability in the performance of this test. The first comment is evident by observing that the interfering UE's noise two channels from its assigned frequency is probably typically in the range of –90 dBm (= –40 dBm – 50dB), which is greatly larger than the typical noise floor of the receiver at –103 dBm. The second comment is evident by observing that the typical noise floor of most high quality signal generators is 65 to 70 dBc with a W-CDMA signal. This results in test equipment generated noise of –105 to –110 dBm, which can produce a significant error in the blocking measurement.

In view of these concerns, it is probably reasonable to allow more than a 3 dB increase in the specified sensitivity level under the blocking condition. Other proposals recommend up to a 13 dB sensitivity degradation in the blocking spec and a 6 dB degradation in similar specs (like receiver spurious and IM). Motorola would consider 6 dB preferable.

5. Conclusions

The in-band blocking specification for UTRA should be –40 dBm (assuming that 33 dBm terminals will exist), and the interfering (blocking) test signal should be an HPSK carrier. A 6 dB degradation in sensitivity under the blocking condition should be allowed. Recommended text is in the next section.

6. Recommended Text

7.6 Blocking characteristics

The blocking characteristic is a measure of the receiver's ability to receive a wanted signal at its assigned channel frequency in the presence of an unwanted interferer on frequencies other than those of the spurious response or the adjacent channels without this unwanted input signal causing a degradation of the performance of the receiver beyond a specified limit. The blocking performance shall apply at all frequencies except those at which a spurious response occurs.

The static reference performance as specified in clause 7.3.1 should be met when the following signals are applied to the receiver:

- A wanted signal at the assigned channel frequency, 6 dB above the specified reference sensitivity level.
- An interfering signal with a frequency offset of at least 10 MHz from the nominal assigned channel with a level and frequency range given below.

Frequency of Interfering Signal	Interfering Signal Level	Type of Interfering Signal
1920 – 1980 MHz	-40 dBm	HPSK modulated signal
1900 – 1920 MHz 1980 – 2000 MHz	TBD	HPSK modulated signal
<1900, > 2000 MHz	TBD	CW carrier

7. References

[1] AH 02 on ACIR simulation, Version: 0.3, 26/3/1999, editor: Omnitel

Figure 1: CDF of Total Signal for Speech Only System with 5km Cells and Worst Case Geographic Offset

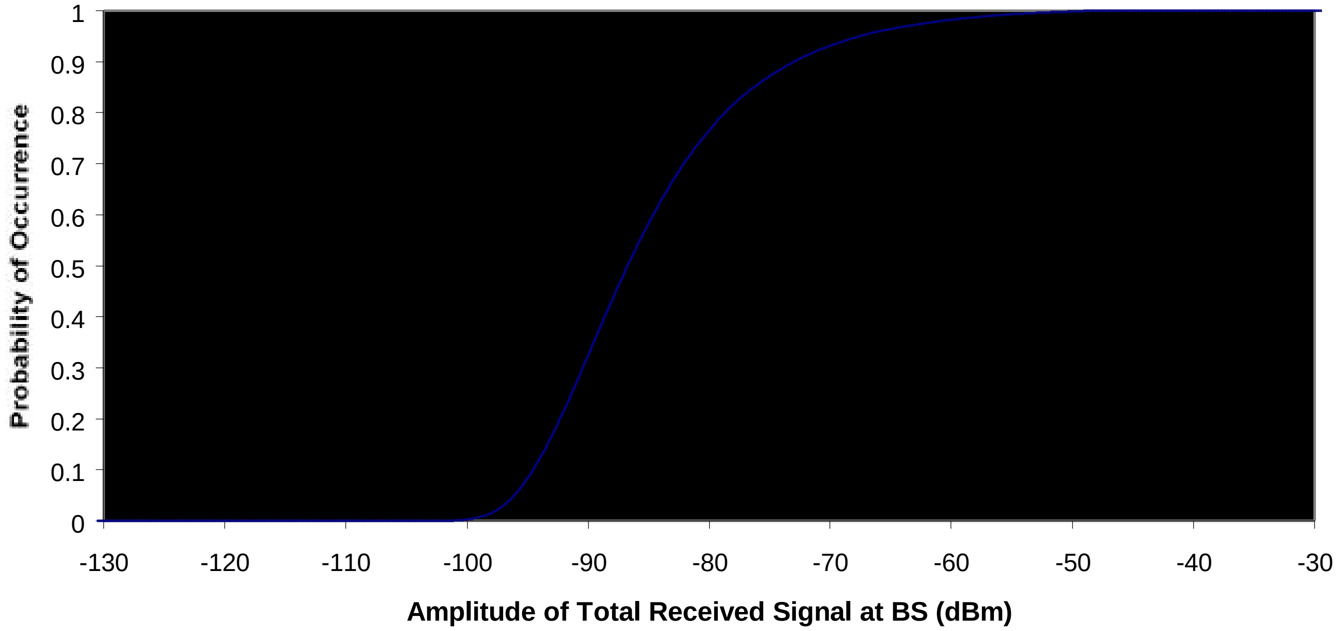

Figure 2: CDF of Total Signal for Speech Only System with 5km Cells and Worst Case Geographic Offset

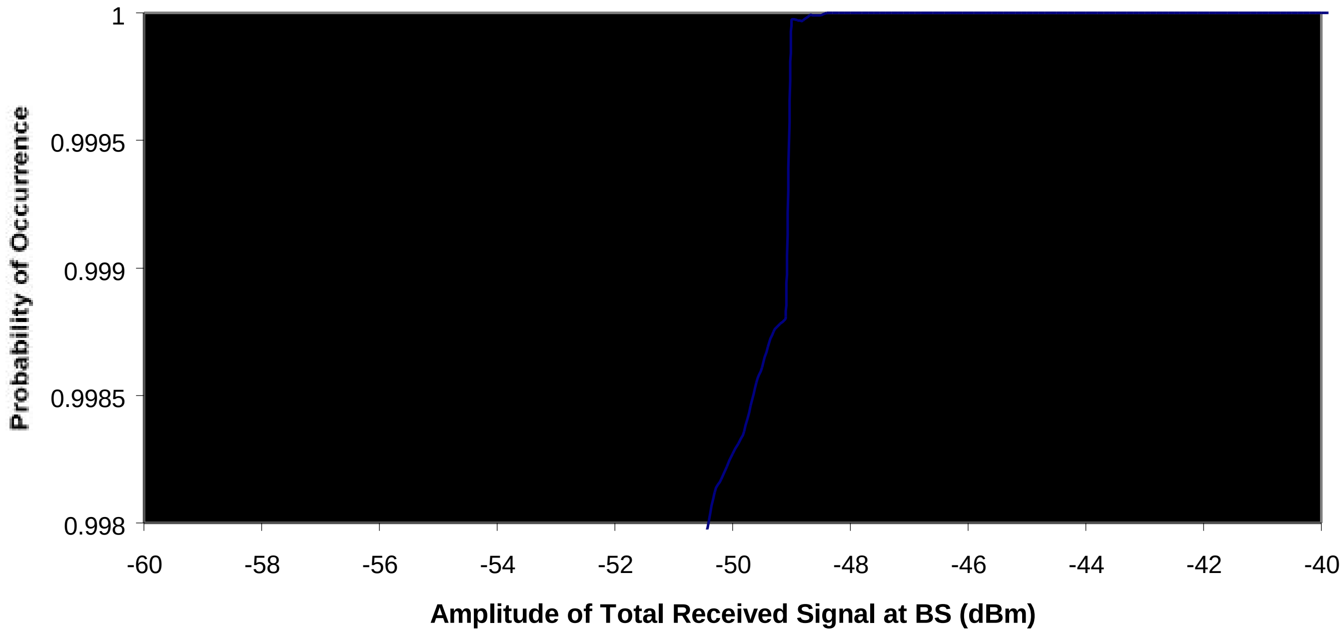

Figure 3: CDF of Total Signal for Mixed Speech and Data System with 5km Cells and Worst Case Geographic Offset

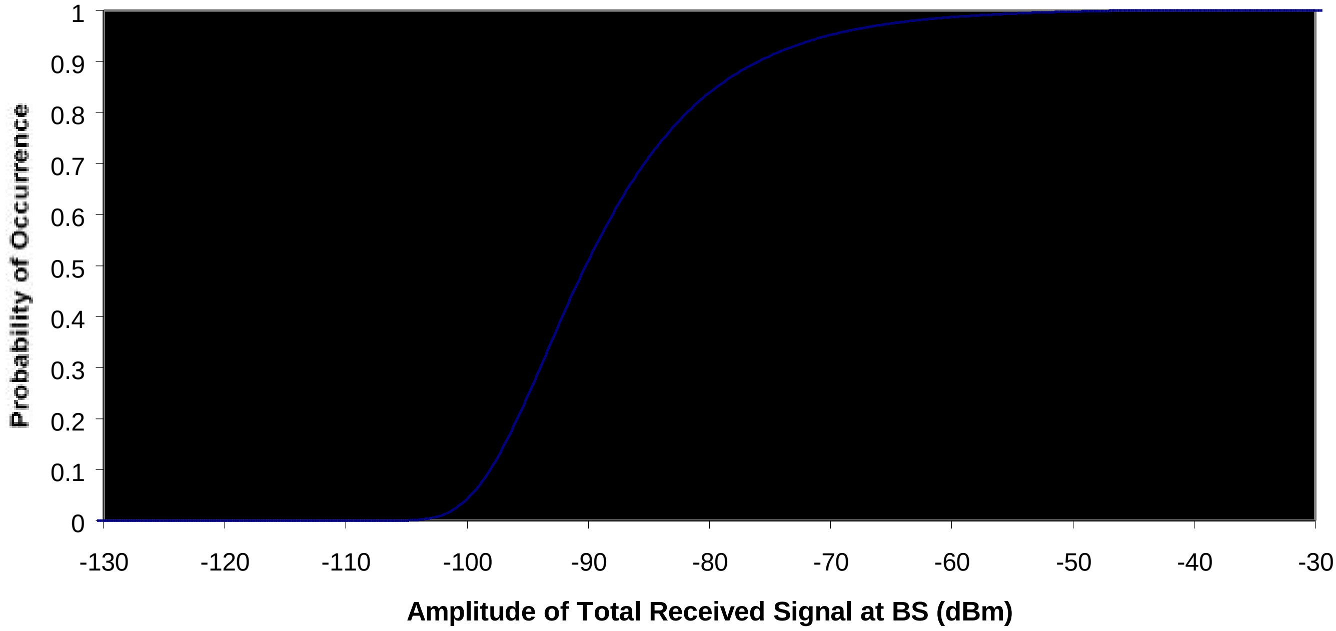

Figure 4: CDF of Total Signal for Mixed Speech and Data System with 5km Cells and Worst Case Geographic Offset