TSG-RAN Working Group 4 (Radio) meeting #1 ***TSGR4#1(99)001***

Espoo 21st - 22nd January 1999

Agenda Item: 7

Source: **Ericsson**

Title: **Measurement of MS Adjacent Channel Selectivity**

Document for:

---

1. INTRODUCTION

This document is Ericsson's proposal on how to measure Adjacent channel selectivity of the receiver of a mobile station in a WCDMA system.

Adjacent channel selectivity (ACS) is a measure of the receivers ability to receive CDMA signals in presence of an interfering adjacent CDMA signal.

2. REQUIREMENT

From an implementation point of view 30dB receiver filter selectivity is the limit of what is possible to implement. A higher requirement would seriously affect the complexity (size and current consumption) of the MS. In ref 1 the impact of 30 dB selectivity is studied and the loss in capacity due to finite selectivity is considered acceptable.

3. PROPOSED TEST CASE

The Adjacent Channel selectivity is only tested for one data rate. This rate should be one that is available (mandatory) for all MS:s. Since the purpose of the test is to verify the selectivity of the receiver, it makes no sense to test more than one channel. The assumed measurement channel is according the structure and mapping of the 12.2 kbps voice channel.

The test is performed in the following way: Apply a wanted signal (DPCH) at a level well above reference sensitivity. This is done to separate the receiver selectivity test from the sensitivity test. Apply an interfering CDMA signal of a certain power level centred at certain frequency offsets from the wanted signal. The interfering signal should be generated by an PRBS QPSK signal (PRBS rate: 4.096Msps, modulation filter: Root raised cosine 0.22)

P_{DPCH}	Power of wanted CDMA signal
P_{ac}	Power of interfering adjacent channel CDMA signal
Fuw	Frequency offset of adjacent channel interfering signal.
PG_{usr}	User data Processing Gain, 10log(chiprate/user data bit rate)
$(Eb/No)_{usr}$	Minimum Eb/No required for reference performance (BER). Note that Eb is the user data bit energy.
margin	Implementation margin for digital baseband

The level of the interfering signal (P_{ac}) can be calculated using the following equation:

$$P_{ac} = P_{DPCH} + ACS + PG_{usr} - (\frac{Eb}{No})_{usr} - \text{margin}$$

The levels of the signals are illustrated below:

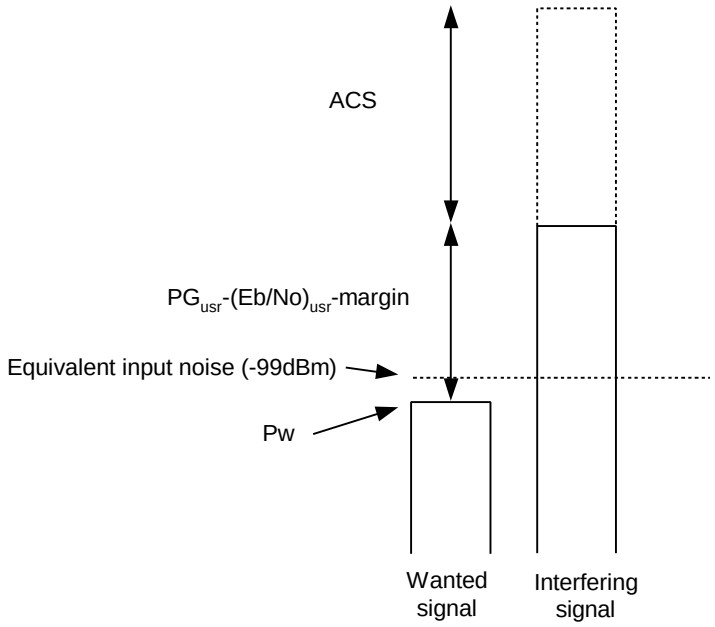

Figure 1: Illustration of the signal levels in the ACS testcase

The following test parameters can be calculated, assuming an implementation margin of 2dB for digital baseband, and min required Eb/No=5.2 dB for the channel tested (12.2kbps) :

Parameter	**Level**	**Unit**
User bit rate	12.2	kbps
Reference performance, BER	10^{-3}	
Channel symbol rate	32	ksps
$\frac{Perch\_Ec}{I_{or}}$	-1	dB
$\frac{DPCH\_Ec}{I_{or}}$	-7 (*)	dB
$\hat{I}_{or}$	-93	dBm/4.096MHz
I_{oac}	-52	dBm/4.096MHz
Fuw	5	MHz

Table 1: Test parameters for adjacent channel selectivity test

(*): Approx. 18dB above reference sensitivity

where:

DPCH	Dedicated Physical Channel
$\frac{DPCH\_E_c}{I_{or}}$	The ratio of the average transmit energy per PN chip for the Dedicated physical channel to the total transmit power spectral density.
I_o	The total received power spectral density, including signal and interference, as measured at the mobile station antenna connector.
I_{oac}	The power spectral density of a adjacent channel interfering signal, as measured at the mobile station antenna connector.
I_{or}	The total transmit power spectral density of the Forward link at the base station antenna connector.
$\hat{I}_{or}$	The received power spectral density of the Forward link as measured at the mobile station antenna connector.
$\frac{Perch\_E_c}{I_{or}}$	The ratio of the average transmit energy per PN chip for the Perch Channel to the total transmit power spectral density.

4. MEASUREMENT CONFIGURATION

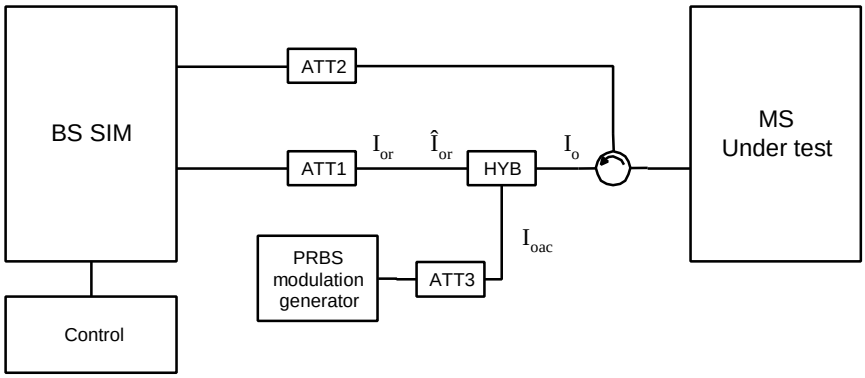

Figure 2: Measurement configuration for adjacent selectivity test. It is assumed that BER test is performed by loop back of the received bits. All control of the MS is done from the BS SIM.

5. COMMENTS

A Study on capacity vs. selectivity is presented in Tdoc SMG2 UMTS-L1 382/98. The conclusion is that for 30dB selectivity in the receiver (ACS) the capacity loss will be 5% in a worse case (4000m cell radius). This is considered acceptable.

It has been discussed whether to use AWGN or PRBS as interfering signal Our opinion is that it does not matter since the interfering signal is on another frequency. For the simplicity of generation of the signal it is suggested that PRBS is used.

6. CONCLUSIONS

30dB receiver filter selectivity for the MS is the acceptable specification from system and implementation point of view. Based on this, a test-case is proposed that measures the ACS performance at a level well above reference sensitivity.

The Adjacent Channel Selectivity should be measured only for one data rate and is defined based on 12.2 kbps voice channel. The requirement for Adjacent Channel Selectivity is 48 dB.

7. REFERENCES

- Tdoc SMG2 UMTS-L1 382/98: "Downlink Adjacent Channel Interference in UTRA system"