Technical Specification Group, RAN
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Source: **Simon Pike (Convenor of WG4 Ad Hoc 33)**

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Liaison Statement

To: **CEPT ERC TG1**

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From: **3GPP TSG RAN**

Subject: **Response to LS from ERC TG1**

1 Introduction

3GPP TSG RAN thanks ERC TG1 for its liaison statement on the progress of its work on UMTS. TSG RAN has identified the following areas in the LS where TG1 asks questions relevant to its work, and in particular within the responsibility of WG4.

2 Adjacent Channel performance

2.1 Definition of adjacent channel performance parameters

In the discussions held on adjacent channel performance in ETSI, ARIB, ITU, 3GPP, etc. there has been some confusion regarding the terms used. Especially the acronym “ACP” seems to have different meanings depending on the context.

WG4 has found it necessary to define three terms relating to adjacent channel performance, one to use for simulations, one for transmitter performance requirements and one for receiver performance requirements. Each term can be defined for any frequency offset. Thus “Adjacent Channel” may refer to not only the channel closest to the assigned channel, but also the 2nd Adjacent Channel, etc.

2.1.1 Adjacent channel performance in simulations

In a system performance simulation where it is assumed that the transmitter and receiver use RF carriers that are adjacent, an assumption has to be made of how much power is leaking from the transmitter to the receiver on the adjacent channel. This adjacent channel interference power occurs because of both transmitter imperfections (transmitter mask) and receiver imperfections (non-ideal receiver filter).

In a system simulation, the reason for the interference is irrelevant, it is the amount of interference that is interesting. This can be expressed as the ratio of the total transmitted power to the interference power affecting the receiver. This definition seems to be the one used in all system simulations presented to ETSI by different contributors, but it has been named differently (ACP, ACI, etc.). For simulation purposes, the following definition is proposed:

Adjacent Channel Interference power Ratio, ACIR = The ratio of the total power transmitted from a source (base station or UE) to the total interference power affecting a victim receiver, resulting from both transmitter and receiver imperfections.

2.1.2 Transmitter adjacent channel performance

Mainly because of transmitter non-linearities, the spectrum mask from transmitter will leak into adjacent channels. This is a very important system parameter, since it is essential for the co-existence performance of systems on adjacent channels. It is also one of the most important design parameters for transmitters, since a too strict requirement on adjacent channel leakage can restrict the implementation of efficient and low complexity transmitters (especially for UE). The used term in ETSI and ARIB has previously been ACP or ACPR, but with unclear definition as to what is intended.

The following definition is proposed. The term and intention is identical to the one propose in ITU IMT.RKEY.

Adjacent Channel Leakage power Ratio, ACLR = The ratio of the transmitted power to the power measured after a receiver filter in the adjacent RF channel. Both the transmitted power and the received power are measured within a filter response that is nominally rectangular, with a noise power bandwidth equal to the chip rate.

2.1.3 Receiver adjacent channel performance

The receiver will have additional interference from the adjacent channel, since the receiver filter cannot be ideal, i.e. not "nominally rectangular" as proposed in the definition of ACLR. The filter will have side lobes in the adjacent channel, causing the power from the main lobe of the transmitted interference source to affect receiver performance.

For simulations and receiver design purposes, it is the *receiver filter's suppression* of the main lobe of the transmitted signal in the adjacent channel that is of interest. This includes the RF filter suppression of the interference, but *not the receiver processing gain*. The following definition is proposed:

Adjacent Channel Selectivity, ACS: Adjacent Channel Selectivity is a measure of a receiver's ability to receive a signal at its assigned channel frequency in the presence of a modulated signal in the adjacent channel. ACS is the ratio of the receiver filter attenuation on the assigned channel frequency to the receiver filter attenuation on the adjacent channel frequency.

2.1.4 Relation between ACIR, ACLR and ACS

With the above definitions, it is clear that the ACIR (total interference between adjacent channels) will depend solely on the ACLR and ACS performance numbers. All three are power ratios and the relation between them is

$$ACIR \cong \frac{1}{\frac{1}{ACLR} + \frac{1}{ACS}}$$

In the uplink, the limiting design factor is the UE transmitter, which will dominate the uplink interference. The reason is that $ACLR_{UE} << ACS_{BS}$, which implies that uplink $ACIR \approx ACLR_{UE}$. Thus, in an uplink simulation, it is essentially the UE ACLR performance that is simulated.

In the downlink, the limiting design factor is the UE receiver, which will dominate the downlink interference. The reason is that $ACS_{UE} << ACLR_{BS}$, which implies that downlink $ACIR \approx ACS_{UE}$. A downlink simulation will thus essentially be a simulation of UE ACS performance.

2.2 Status of definition of ACLR and ACS requirements

WG4 has completed the definition of a methodology for simulation of ACIR requirements. It is hoped that results of simulations using this methodology will be presented to the next meeting of WG4 (Stockholm, 10 – 12 May). WG4 is also considering how this system requirement should be partitioned between ACLR and ACS. There may be other factors which should be considered in defining ACIR requirements.

3 UTRA Unwanted emissions mask

The spectrum mask which has been assumed in the ERC TG1 report came from the SMG2 Alpha Group UTRA proposal, and was used by the Alpha group for its own evaluation. However, the mask was not approved by SMG 2. This mask was based on measurements on a real amplifier, with the modulation parameters which were proposed by the Alpha Group.

The LS from TG1 also refers to some other spectrum masks which have been used by UKTAG in its work. These spectrum masks have also not been endorsed by SMG 2 or TSG RAN. The differences between them may reflect different trade-offs between conflicting requirements.

The spectrum mask from the transmitter antenna connector depends on a number of characteristics of the system, eg:

- Pulse shaping of the modulation
- Possibly, phase error of the modulation
- Adjacent channel leakage due to non-linearities in the transmitter (especially the PA).

All of these items are still under study in WG4, and the final spectrum mask will depend on the results of the on-going studies.

TSG RAN will inform TG1 of the outcome of these studies as soon as they are concluded.

4 Receiver Blocking

WG4 has made working assumptions for the in-band blocking requirement for the BS, and the in- and out-of-band requirements for the MS. WG4 would welcome information on the levels of signals which may be experienced from other systems, in order to determine appropriate blocking requirements.

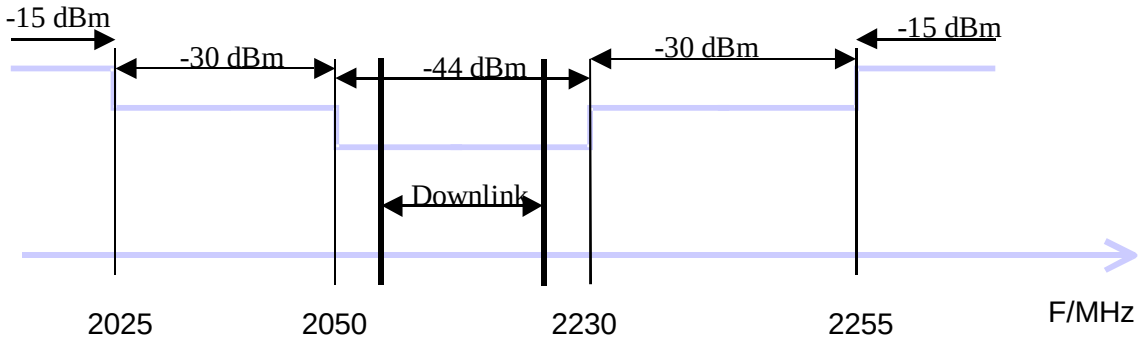
4.1 Base station receiver

A value of –42dBm has been accepted as a working assumption for the in-band blocking for the BS. This was based on simulations for macrocells, and further work is necessary for microcell scenarios.

Further work is also required on some aspects of the requirement related to the characteristics of the wanted and interfering signal.

4.2 MS receiver

The agreed working assumptions for the MS are –44dBm in-band and –30dBm and –15dBm out of band (depending on offset from the band edge); see the diagram below:



5 IMT.TERM

The part of IMT.TERM falling within the responsibility of TSG RAN is Section 3.2 of Annex 1 and Table 2.

TSG RAN wishes to inform TG1 that the parameters of UTRA submitted to ITU/R TG8/1 include options for chipsets of 8.192 and 16.384Mchip/s, as well as 4.096 Mchip/s. However, the spectrum mask defined in Table 2 is only consistent with a chip rate of 4.096Mchip/s. TSG RAN believes that it is essential for IMT.TERM to be compatible with all of the current options in ITU/R Document R.KEY, and not constrain future developments.

Secondly, TSG RAN WG4 has not defined a spectrum mask for MS emissions, and is therefore concerned that the content of table 2 may prove to be inconsistent with UTRA specifications, when these are finallised.

TSG RAN therefore recommends to ERC TG1 that IMT.TERM should not contain technical requirements related to the characteristics of the RTT. In particular, Table 2 should be removed from IMT.TERM. One possible solution is for IMT.TERM to reference requirements contained in R.KEY.