



ON COHERENCY REQUIREMENT

GP-160280
GERAN#70
23rd – 26th May, 2016
Nanjing, P.R.China
Source: Ericsson LM

OVERVIEW



- › This slide set provides input on the ongoing discussion regarding coherency requirement to be adopted for EC-GSM-IoT.
- › The information is basically the same as submitted to the 6th telco on EC-GSM-IoT

COHERENCY REQUIREMENT



- › At GERAN telco#6 on EC-GSM-IoT a new coherency requirement was adopted for the MS
 - The proposal is based on achieving good enough amplitude and phase consistency between any two bursts of the set of blind physical layer transmissions within a TDMA frame.

COHERENCY REQUIREMENT



› Cont.

- Considering that overlaid CDMA rely on both amplitude *and* phase being the same between repeated bursts, the new proposal takes this into account by requiring the error vector between any two bursts to be lower than a specified RMS value
- It has also been added in 3GPP TS 45.005 that the coherency requirement shall be fulfilled when being assigned different Overlaid CDMA codes, and that the requirement apply at the reference sensitivity of the EC-SCH (i.e. any frequency offset from cell synchronization should be included in the measurement)
- See next slide for an outline of the proposal

COHERENCY REQUIREMENT



- › The proposal is outlined to the right

A_x = I/Q representation of burst x

$$A_{x,rms} = \sqrt{\frac{1}{N} \sum_n |A_x(n)|^2}$$

$$\Delta_{x,y}(n) = A_y(n) - A_x(n)$$

$$\bar{A}_{rms} = \frac{1}{M} \sum_{m=0}^{M-1} A_{m,rms}$$

$$\Delta_{x,y,rms} = \sqrt{\frac{1}{N} \sum_n |\Delta_{x,y}(n)|^2}$$

$$\Delta_{rms} = \frac{\max(\Delta_{x,y,rms})}{\bar{A}_{rms}}$$

where

- \sum_n is the sum over the N samples of the useful part of the burst at the symbol rate
- x and y are indices to any given burst pair out of the blind physical layer transmissions
- M is the number of blind physical layer transmissions per TDMA frame

Before taking the logarithm, the average of $\bar{\Delta}_{rms}$ over the number of TDMA frames measured shall be computed. Then this average shall be transferred to dB scale according to:

$$\bar{\Delta}_{rms}[dB] = 20 \log_{10}(\bar{\Delta}_{rms})$$

COHERENCY REQUIREMENT



- › For simplicity and spec. consistency it is proposed to adopt the same procedure for the MS also for the base station, although the resulting requirement can be different.

COHERENCY REQUIREMENT

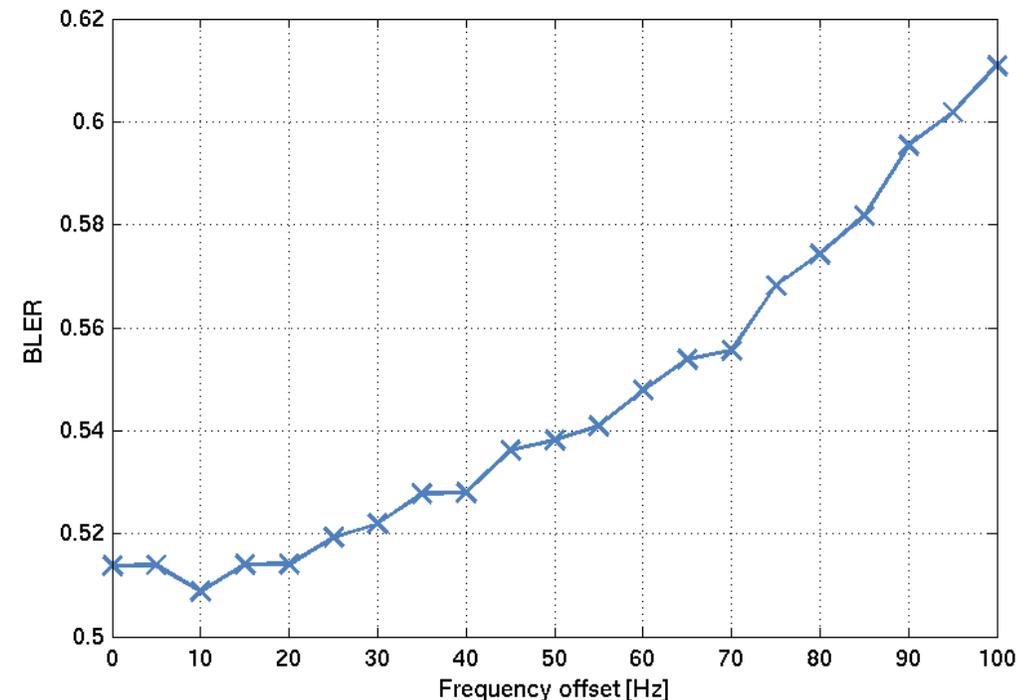


- › The proposed requirement has been investigated by simulations together with the earlier proposed requirements. The different methods are shortly described below:
 - Proposal 1: Measure RMS and peak **phase** deviation between any two consecutive bursts
 - Proposal 2: Blindly accumulate blind physical layer transmissions and measure **accumulated energy** and compare against a single transmission (in dB)
 - Proposal 3 (new): Measure RMS of **error vector magnitude** between any two bursts.

COHERENCY REQUIREMENT



- › The impairment added to the signal is here modeled as a frequency error
- › The simulator is first put to an SNR target where 50% BLER is achieved without a frequency error injected
- › The impact on BLER is then investigated when increasing the added, fixed frequency error
- › As can be seen, to achieve a reasonably low impact on BLER, the frequency error is advisable to stay at 30-40 Hz
- › Simulation assumptions include:
 - No Overlaid CDMA
 - Rx diversity
 - Sensitivity
 - Typical impairments in addition to a fixed frequency offset



COHERENCY REQUIREMENT

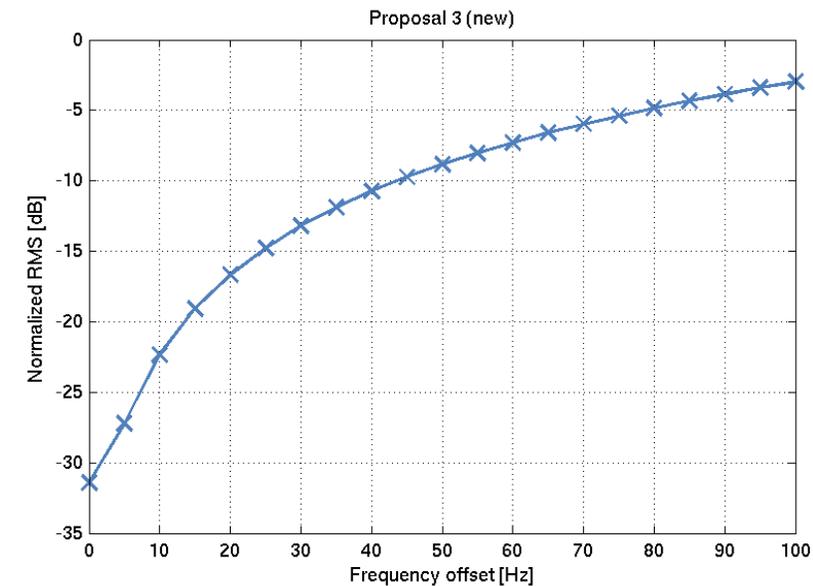
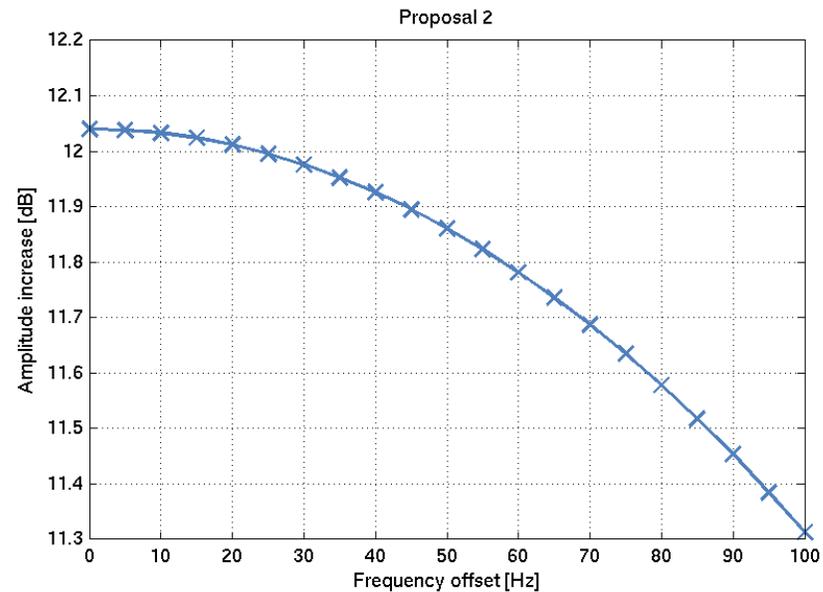
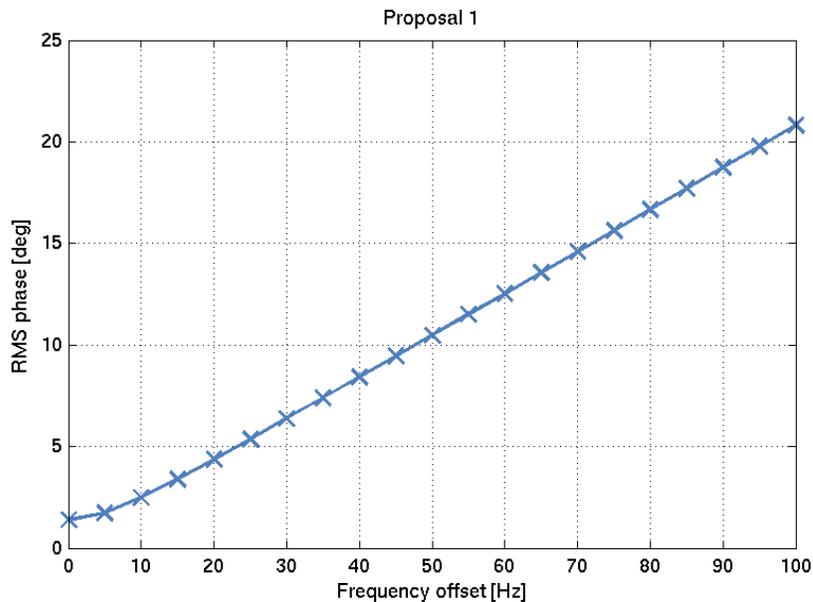


- › As a second step, the three different proposals are evaluated at different frequency offsets
- › A simulation with 200 frames have been simulated. 200 frames is commonly used to show compliance with requirements in 3GPP TS 45.005 and seems to be enough for this requirement as well.

COHERENCY REQUIREMENT



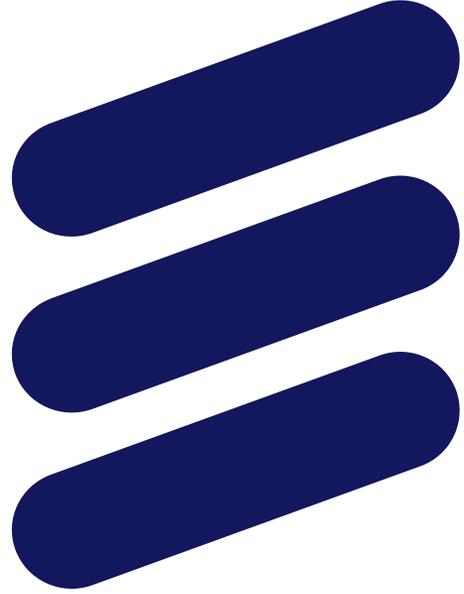
- › As can be seen, both proposal 1 and 3 provides clear performance targets that would result in a clear pass/fail criterion at 200 frames around the targeted frequency offset of around 30-40 Hz.
- › For proposal 2, the metric measured is not impacted much comparing the ideal case (around 0.1 dB), and the applied frequency offset at the acceptable degradation. Hence, it would be more difficult to perform measurements of this requirement and classify it as pass/fail.



COHERENCY REQUIREMENT



- › The acceptable uncertainty of the measurement equipment in 3GPP TS 51.021 should also be considered. The applicable requirement is shown below for the three proposals:
 - Proposal 1: 1.5 degrees (phase, modulation accuracy)
 - Proposal 2: ± 0.7 dB (relative RF power)
 - Proposal 3: ± 1.5 dB (origin offset suppression, modulation accuracy)
- › Comparing accuracy to the simulations provided in the previous slide it is also clear that the current uncertainty of the measurement equipment would be a problem with proposal 2 but not with proposal 1 and proposal 3.
- › Considering the benefit of proposal 3 compared to proposal 1 in that it measures not only deviations in phase but also in amplitude, it is considered a more suitable requirement.



ERICSSON