I. Summary

Handset measurements using HATS require a different positioning of the handset to the head than LRGP. This is required especially in combination with the new proposed Type 3.4 simplified pinna-simulator. The document describes a proposal for a new position and shows in addition measurement results in comparison to LRGP.

1. Definition of the new HATS position

During the Round Robin Tests a handset position was used which was adapted as much as possible to LRGP. The problem with that position is that the handset relative to the mouth is tilted too much downwards. The angle $\alpha$ which is 24° for the HATS is set to 39° in LRGP-position. This results in a much lower sending sensitivity for the handsets due to the distance between mouth and handset microphone. So a new position was defined in order to get a) the typical leakage effect which is shown in the results of the Round Robin experiment and to have b) a more closer sending sensitivity to LRGP-position.

The new position is defined as follows:

The handset position has been defined according to the procedure described in Annex C to P.64. The orientation of the handset is defined by vectors normal to the plane of the ear cap and the plane of symmetry of the handset.

Unit vector normal to the plane of the ear cap:

$$n_{EC} = \pm (0.1771, -0.9842, +0.0086)$$

Unit vector normal to plane of the symmetry of the handset:

$$n_{HS} = \pm (0.4083, 0.0655, 0.9105)$$
The relative position between EEP and plain of lips are defined in ITU-T P.58. The center of the earcap is shifted from the EEP by +11.5 mm in x-direction and +0.8 mm in z-direction.

2. Measurement results

2.1 Loudness ratings

For 5 handsets from the Round Robin test the sending sensitivity frequency responses were measured in the proposed position. The sending loudness ratings were calculated according to ITU-T P. 79 (The other sets from the Round Robin test were either not equipped with a microphone or no appropriate feeding for the microphone was available). All measurements were carried out with a pressure force of 13 N for the handset. The measured sensitivity in receiving direction for this position is comparable to the measurements with the type 3.2 ear simulator, low leak version (see COM 12-59).

For this new position the loudness ratings listed in table 1 were measured. In comparison the results measured in the LRGP-position using the artificial mouth according to ITU-T P.51 are shown.

<table>
<thead>
<tr>
<th></th>
<th>SLR P.79, LRGP-Position</th>
<th>SLR P.79, new HATS-Position</th>
<th>Δ</th>
</tr>
</thead>
<tbody>
<tr>
<td>SIEM 1</td>
<td>4.3 dB</td>
<td>4.1 dB</td>
<td>-0.2 dB</td>
</tr>
<tr>
<td>DBP-T</td>
<td>4.7 dB</td>
<td>3.8 dB</td>
<td>-0.9 dB</td>
</tr>
<tr>
<td>BT 1</td>
<td>0.7 dB</td>
<td>-0.1 dB</td>
<td>-0.8 dB</td>
</tr>
<tr>
<td>BT 2</td>
<td>1.9 dB</td>
<td>2.4 dB</td>
<td>0.5 dB</td>
</tr>
<tr>
<td>BT 3</td>
<td>2.3 dB</td>
<td>2.1 dB</td>
<td>-0.2 dB</td>
</tr>
</tbody>
</table>

Table 1: Comparison of SLR

2.2 Frequency responses in sending direction

The sending sensitivity frequency response for the new HATS position compared to LRGP-position is shown in the Figs. 1 - 5.

In general it can be seen that the frequency responses for the different handsets are in principle quite similar for the HATS position in comparison to the LRGP position. However, there are some remarkable differences due to reflections between head and handset which are not present when using only the artificial mouth according to P.51. Especially for the handset BT2 (see Fig. 4) it can be
seen that in a frequency range of 3 kHz the measured frequency response is no longer flat. Obviously a reflection between the very flat handset shape and the HATS leads to this narrow-band attenuation.

### 2.3 Frequency responses in receiving direction

The receiving sensitivity frequency responses for the new proposed HATS position in comparison to the results of the Round Robin Test and the Type 3.2 ear are shown in Figs. 6 to 14.

The sensitivity frequency responses are shown for 2 N and 13 N pressure force. In general it can be seen that the results between the Round Robin Test measurements and the new proposed HATS position are very similar. However, there is a tendency to a closer sealing of the handset in comparison to the Round Robin Test. Nevertheless it can be seen that the results, achieved by the Round Robin Test again are very similar to the Type 3.2 ear for 13 N pressure force (except handset BT2, which can not be pressed to the heads in such a way that the handset seriously sealed. The handset touches the skin of the HATS already at 4 N pressure force.).

### 3. Summary

The new proposed HATS position allows a very realistic measurement of handsets in dependence of pressure forces. In general the results for the sealed condition are comparable to the results achieved with the Type 3.2 ear (low leak version) and the artificial mouth according to P.51 in LRGP position. Remarkable differences can be found for the sending direction where the shape of the handset interferes with the shape of the HATS. Those results are certainly more realistic than the measurements using only the simplified mouth according to P.51. For the receiving direction a very realistic pressure force dependent frequency response and loudness rating measurement can be achieved.