



Subject: Question ITU-R 210/10

**NOTE BY THE CHAIRMAN OF WORKING PARTY 6Q**

**IMPLEMENTATION OF RECOMMENDATION ITU-R BS.1387 (PEAQ)**

The attention of Working Party 6Q is drawn to the letter below submitted by Bell Labs – Lucent Technologies and Heinrich Hertz Institut concerning the implementation of Recommendation ITU-R BS.1387 (PEAQ). Working Party 6Q is invited to urgently consider this matter at the forthcoming March meeting.

Dear Mr. Evain and former TG 10/4 members,

In a long-term effort of implementing the algorithm described in the ITU-R Recommendation BS.1387 we met several severe problems, which makes, to our best knowledge, the realization of a standard-conform implementation impossible. This conclusion is drawn from two sites, Bell Labs - Lucent Technologies (Murray Hill, U.S.A.) and Heinrich Hertz Institut (Berlin, Germany), working independently on a software realization.

Although the results from the two independent implementations were the same, they were not in conformance to the data given in the Recommendation. Even with the kind support of some authors of the standard, we were not able to get results within the allowed tolerance range.

In general, the most obvious reason why conformance cannot be achieved is the lack of the conformance data files. Those files contain the original and processed audio signals that are needed to run the conformance test of an implementation and should be supplied by the ITU-R. Unfortunately, the former members of the standardization group (TG 10/4) cannot make those files available due to copyright considerations. We suggest avoiding this problem by using material to generate the conformance data, that is not copyright protected.

Despite this formal problem, the description of the algorithm in Annex 2 of the Recommendation is incomplete. Therefore, it cannot be implemented without additional help from a third party, e.g. the author(s). This statement is especially true for Section 4.8 (Harmonic Structure of Error). In addition, other sections contain several errors as well.

From our experience, we conclude that it is necessary to revise the Recommendation in order to achieve a broader acceptance and to see more applications. Furthermore, it would be very helpful, if more verification data would be provided, e.g. tables of model output variable values. As attachment to this letter we provide a list of potential errors in the algorithm description. After verification, it might be used for a future revision of the Recommendation.

We hope, that this letter is helpful for you to make this Recommendation more successful, and that it will contribute to simplify independent implementations in order to better establish this tool in research and industry.

Yours sincerely,

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**Attachment:** 1

## LIST OF POTENTIAL ERRORS IN RECOMMENDATION ITU-R BS.1387 (1998)

The following items describe the potential errors that created problems during our implementation. We also partly suggest how to correct those errors. Further information about each entry is available on request.

- Sect. 4.8: Error in described succession of averaging and windowing for the EHS measure
- Eq.(50): Initialization of variables missing. (We assumed initialization with zero if not given otherwise)
- A frame containing only zeros should be appended to the beginning and end of the input audio files. Otherwise, the beginning and end of an audio signal can be “muted” by the analysis window function, i.e. they have no effect.
- Sect. 2.1.5.1: Replace  $Pe[I] += F_{sp}[k] * (f_l[i] - f_u[i]) / F_{res}$  by  $Pe[I] += F_{sp}[k] * (f_u[i] - f_l[i]) / F_{res}$
- Sect. 2.2.7.1: Downward spreading should run from  $k=39$  to 0 (not from 0 to 39)
- Sect. 3.4 (text): Replace “power spectra” by “magnitude spectra”
- Sect. 4.3.2 (text): Replace “Excitation Patterns” by “Spectrally Adapted Excitation Patterns”
- Sect. 4.4.1: First *break* command in pseudo-code should be in the *if* section.
- Sect. 6.1: The model output values (MOV) should be truncated to the range between  $a_{min}$  and  $a_{max}$  used in the neural network. Otherwise, the ODG can substantially increase while the subjective audio quality decreases.
- Tables 19 and 20: Wrong content (mixed up, but draft version from Aug. 24, 1998 is correct)
- Sect. 5.2.4.4 (text): Replace “level is zero” with “level approaches minus infinity”
- Eq.(17) to (20): Replace  $Z$  by  $Z-1$
- Eq.(29): Replace  $N[n]$  by  $N[k]$
- Eq.(38): Replace  $\tau_0$  by  $\tau_{min}$
- Table 21: First row is wrong. Replace by  $w_y[0] \dots w_y[5]$
- Table 24: Conformance data for the Advanced Version of PEAQ in the latest Recommendation document from 1998 differ much more from our implementation results than the data in the Draft New Recommendation from Aug. 24, 1998.

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