

RECOMMENDATION ITU-R F.1566-1

Performance limits for maintenance of digital fixed wireless systems operating in plesiochronous and synchronous digital hierarchy-based international paths and sections

(Question ITU-R 161/9)

(2002-2007)

Scope

This Recommendation provides performance limits for international plesiochronous digital hierarchy (PDH) and synchronous digital hierarchy (SDH) paths and sections implemented using fixed wireless systems (FWSs). The approach is aligned with the maintenance approach taken by ITU-T, but some media-specific aspects for digital fixed wireless systems are incorporated. The Annex details the application of the performance limits for bringing into service (BIS).

The ITU Radiocommunication Assembly,

considering

- a) that digital fixed wireless systems (FWSs) for use in constant bit-rate digital paths at or above the primary rate in the international portion of a 27 500 km hypothetical reference path (HRP) are being designed, operated and maintained;
- b) that performance objectives for planning of FWSs are specified in practice for real digital paths;
- c) that there is a need to specify maintenance performance limits for digital FWSs;
- d) that ITU-T has prepared performance limits for maintenance and bringing into service (BIS) of international multi-operator plesiochronous digital hierarchy (PDH) paths and connections in ITU-T Recommendation M.2100 and for international multi-operator synchronous digital hierarchy (SDH) paths and international SDH multiplex sections in ITU-T Recommendation M.2101, being based on ITU-T Recommendations G.826 and G.828, respectively;
- e) that ITU-T Recommendation M.2120 provides procedures for fault detection and localization, with and without in-service monitoring, for international multi-operator digital paths, sections and transmission systems;
- f) that ITU-R has prepared Recommendation ITU-R F.1668 for the error performance objectives for real FWS links used in 27 500 km hypothetical reference paths and connections;
- g) that the influence of propagation conditions on the fault detection and localization procedures for determining maintenance intervention for digital FWSs is currently under study in ITU-R;
- h) that performance limits for maintenance and procedures for their measurement for PDH and SDH digital FWSs transporting PDH and/or SDH signals should be defined;
- j) that in defining the performance limits for maintenance of PDH and SDH digital FWSs and for the purposes of identifying possible maintenance interventions, levels of performance limits should be considered. ITU-T Recommendations M.2100 and M.2101 identify and define levels of performance limits as degraded performance, unacceptable performance, and in addition, performance after intervention (repair);

k) that the performance limits for maintenance may be different from the BIS limits, as defined in Recommendation ITU-R F.1330;

l) that due consideration should be taken of periods of severe fading when undertaking measurements that relate to performance limits for maintenance,

recognizing

a) that for the purpose of allocating the performance objectives for the international portion of a constant bit-rate path at or above the primary rate, an international digital path has been partitioned in geographical terms; these portions have been titled path core elements (PCEs). Two types of international PCE are used:

- an international PCE (IPCE) between an international gateway and a frontier station in a terminating country, or between frontier stations in a transit country¹;
- an inter-country PCE (ICPCE) between the adjacent frontier stations of the two countries involved. The ICPCE corresponds to the highest order digital path carried on a digital transmission system linking the two countries;

recommends

1 that the limits for maintenance should be based on end-to-end reference performance objectives (RPOs), applicable to each direction of any real digital FWS link of length d , and derived by using the values in Tables 1a and 1b as well as allocations shown in Table 2;

TABLE 1a (see Note 1)

RPO for end-to-end international digital paths

PDH	Primary (see Note 3)	Secondary	Tertiary	Quaternary	
SDH (Mbit/s)	1.5 to 5	> 5 to 15	> 15 to 55	> 55 to 160	> 160 to 3 500
Parameter	End-to-end RPO				
ESR for paths designed according to G.826	0.02	0.025	0.0375	0.08	N/A
ESR for paths designed according to G.828	0.005	0.005	0.01	0.02	N/A
BBER for SDH paths designed according to G.828	2.5×10^{-5}	2.5×10^{-5}	2.5×10^{-5}	5×10^{-5}	5×10^{-5}
SESR	0.001	0.001	0.001	0.001	0.001

ESR: errored second ratio

N/A: not applicable

BBER: background block error ratio

SESR: severely errored second ratio.

¹ The definition of an international gateway and a frontier station can be found in ITU-T Recommendation M.2101.

TABLE 1b (see Note 1)

RPO for end-to-end international SDH multiplex sections

Rate	STM-0	STM-1	STM-4
Blocks	64 000	192 000	768 000
ESR (according to G.826)	0.0375	0.08	N/A
ESR (according to G.828)	0.01	0.02	N/A
SESR	0.001	0.001	0.001
BBER (according to G.826)	N/A	N/A	N/A
BBER (according to G.828)	2.5×10^{-5}	5×10^{-5}	5×10^{-5}

TABLE 2

Allocation (a_n)

PCE classification (km)	Allocation (% of end-to-end RPO)
IPCE	
Terminating/transit national network:	
$d \leq 100$	1.2
$100 < d \leq 200$	1.4
$200 < d \leq 300$	1.6
$300 < d \leq 400$	1.8
$400 < d \leq 500$	2
$500 < d \leq 1000$	3
$1000 < d \leq 2500$	4
$2500 < d \leq 5000$	6
$5000 < d \leq 7500$	8
$d > 7500$	10
ICPCE⁽¹⁾	
$d < 300$	0.3
International multiplex section	0.2

⁽¹⁾ ICPCE allocations must be met regardless of how many multiplex sections comprise the ICPCE.

2 that the allocated performance objective (APO) and the relevant maintenance performance limit (MPL) for the maintenance of a path or multiplex section should be calculated as follows:

for a path:

$$APO_{es} = A\% \times RPO_{es} \times TP \div 100 \text{ (convert } A\% \text{ to ratio)}$$

$$APO_{ses} = A\% \times RPO_{ses} \times TP \div 100 \text{ (convert } A\% \text{ to ratio)}$$

$$APO_{bbe} = A\% \times RPO_{bbe} \times TP \times 2\,000 \div 100 \text{ (convert } A\% \text{ to ratio – VC-1 and 2)}$$