

## MINIMUM QUALITY INDICATORS FOR ALL TYPES OF LEASED LINES

### Definition:

*Leased lines* – telecommunications facilities provided to a public telecommunications network, offered within the context of establishing, developing and operating the telecommunication public network, allowing the transparency between network terminal points and excluding switching functions under user's control (e.g. switching upon request). Leased lines can be provided by a single operator or by several, by means of agreement concluded among them.

### **1. Service availability for leased lines**

#### Definition:

*Service availability* is the average time of availability for the real or potential use of the service under specified performance conditions, expressed as a percentage of the observation period. The service availability shall be assessed during a long observation period (three months) and cannot be measured by using only one test.

*The non-availability periods* to be assessed in case of leased lines are generally due to one of the following causes:

1. Fault reports by users, confirmed by tests and investigations carried out by the service provider;
2. Impaired service reports by users, while they continue to use the low performance service;
3. Deliberate interruptions of the service, as for example in order to perform repairs or verification and maintenance activities.

Columns 1 and 2 in the table below show the classification and duration of the service non-availability periods under above category of reports no. 1.

The classification of the above impaired service reports no. 2, where the leased line performance is impaired, but the user decides the leased line can still be used, is shown in column 3 in the table below.

**TABLE 1. Non-availability periods following users' claims**

| <b>REPORTS ON<br/>MALFUNCTIONS AND<br/>IMPAIRED SERVICE</b> | <b>NON-AVAILABILITY PERIODS</b> |  |
|---|---------------------------------|--|
|   | <b>Beginning</b>                | <b>End</b>   |
| 1. <i>Confirmed</i> reports on malfunctions                 |                                 |  |
| Malfunctions previously ascertained by the operator         |                                 | When the service is again at user's disposal (on the first |

|  |   |  |
|--|---|--|
| Malfunction is unascertained by the operator, but investigations confirm the existence of a faulty circuit for a longer time | According to user's statement   | attempt of that kind)  |
| Malfunctions remedied when found   |   |  |
| Malfunctions caused by deliberate service interruptions exceeding the period announced by the operator                       | The moment declared by the operator as the end of the deliberate interruption   |  |
| Malfunctions caused by deliberate service interruptions upon which the user has not been informed                            | The moment declared by the operator as the beginning of the deliberate interruption (If the beginning moment of the deliberate interruption is not known at the claim registration point, the moment declared by the user will be taken into consideration) | The moment declared by the operator as the end of the deliberate interruption (If the beginning moment of the deliberate interruption is not known at the claim registration point, the moment when the service is available again or the first attempt of that kind will be considered. |
| <i>2. Unconfirmed fault reports</i>  |   |  |
| Problems caused by user's equipment or errors committed by the user  | Are not taken into consideration  |  |
| Malfunctions unconfirmed by the leased line provider   | Are not taken into consideration  |  |
| <i>3. Impaired service reports</i>   |   |  |
| Confirmed by tests or investigations   | Non-availability duration=total time when the leased line is not available to the user for testing or repairs purposes  |  |
| Not confirmed by the leased line provider and unrevealed by tests or investigations  | Are not taken into consideration  |  |

Deliberate interruptions refer to the interruption of the leased line service, deliberate and operated by the service provider in order to conduct repairs, maintenance tests etc. The manner of assessing the non-availability intervals depends on the position of the user against the decision of deliberate interruption of the service, as shown in Table 2 below.

**TABLE 2. Non-availability periods following deliberate interruptions**

| <b>DELIBERATE SERVICE INTERRUPTIONS</b>                 |  | <b>NON-AVAILABILITY PERIOD</b>   |
|---|--|----------------------------------|
| Interruptions notified to the user and accepted by this |  | Are not taken into consideration |

|  |  |   |
|--|--|---|
| one  |  |   |
| Interruption notified to, and unaccepted by, the user (the user requires the service to be diverted to another line) | The operator diverts the service to an acceptable quality for the user       | Are not taken into consideration  |
|  | The operator diverts the service with quality level unacceptable by the user | The non-availability period = the period announced as a deliberate interruption of the service, if noticed (in case of claims as a result of the declared period being exceeded, the considerations in Table 1 shall apply) |
|  | There are no possibilities to divert the service                             |   |

If a circuit is unavailable at the beginning of an observation period, the malfunctions or deliberate interruptions resulting in the unavailability of the service, occurring within this period, shall not be considered individually. The non-availability of the service is considered as started at the beginning of the observation period.

If the circuit is unavailable at the end of the observation period, the malfunctions or deliberate interruptions resulting in the unavailability of the service, occurring within this period, shall be considered individually. The non-availability of the service is considered as completed at the end of the observation period.

No standard form has been drafted for service availability, due to the potential problems related to testing the availability of a leased line over a too long period (three months) to be relevant from statistical standpoint.

The values in Table 3 shall only be considered broadly and they are obtained by extrapolating the measurement results of certain 2048 Kbps digital lines for 64 Kbps digital lines with terrestrial links between the clients' headquarters of up to 5500 km and satellite connections with access lines of up to 1375 km; the real values are expected to be considerably higher.

**TABLE 3. Values of service availability indicators**

| Type of link      | Service availability |               |
|-------------------|----------------------|---------------|
|                   | Average value        | Minimum value |
| Terrestrial links | 97.3%                | 94.7%         |
| Satellite links   | -                    | 97%           |

*The average value* refers to an average over all leased lines of the operator.

*The minimum value* refers to the most unfavorable situation and no line should go below this parameter. The clients requesting a better availability performance shall carry out separate negotiations with the service provider.

The measurement and presentation of the indicator, upon request of bodies competent to carry out checking and control, shall be done in accordance with Recommendations M.1016, M.1025 and M.1040 – ITU – T, and within the limits provided by ETR 281 – ETSI.

#### The technical quality of the service

The provided service shall meet the essential operational, electric, acoustic, environmental, electro-security and electromagnetic compatibility requirements imposed by technical specifications and standards regarding both terminals and the lines used to provide the service (DE89/336/EEC, EG 201 769-1, EN 50082 AND EN 300 386 – 2 ETSI).

#### Definition:

***Analogical leased lines*** are leased lines that cannot transmit signals in the vocal band (300 +/- 3400Hz) without any restriction on frequency use. The requirements imposed by standards [DE 92/44/EEC, ETS 300 448 and ETS 300 449 ETSI respectively] divide the transmission environments for leased lines into two classes:

- normal quality lines (A2O, A4O) with 2 or 4 wires;
- special quality lines (A2S, A4S) with 2 or 4 wires.

The analogical leased lines are defined as bi-directional, configured point-to-point, entirely covering the vocal band. The connections are generally symmetrical, in the sense that each transmission direction has the same nominal characteristics (although the real values are independent).

*By definition*, establishing and finalizing the communication on the leased line do not imply a switching protocol or any other intervention at the terminal point.

All point-to-point connections for data transmission and for voice are achieved using 2 wires. When the connection implies a signaling system using 4 wires, the 4-wire line will be chosen. When stability and echo are important, a 4-wire line or a 2-wire line of special quality can be chosen.

The performances of the leased line depend on the technical averages by which the service provider ensures this link. The main parameters affected by the way of implementing the link are:

1. ***Global attenuation*** – a leased line derivates directly from the national transmission plan, comprising two basic elements:

##### 1.1 *Attenuation in the local loop*

For the copper analogical lines, under extreme conditions, attenuations of down to 10dB can be recorded for 10-15 km lines. Although such case falls outside the standards (e.g. maximum 8 km, for Romania), such lines are still under operation.

##### 1.2 *Attenuation between the local stations*

According to the equipment involved in transmission, the attenuation between stations can range between 0 dB (the case of two leased lines connected to the same exchange) and 4-8 dB (according to the number of transits from 2 to 4 wires

and back), the case of international link included). The total losses are very significant in determining the availability of the leased line for a certain application and depend on the variety of installations used, on various factors such as the distance from the local station to the terminal access points or the practical working methods specific to each network operator.

2. The level of transmitted signals:

2.1. *The average power level admitted at the input* – measured during one minute, the line being closed at both ends on 600-ohm charge.

2.2. *The relative power level admitted at the input/output* – measured during 0.1s, on 600 ohm charge at both ends, using a test-signal with 1020 Hz frequency.

The maximum limits for the total losses related to analogical leased lines are included on Table 4.

**TABLE 4. Transmission parameters for analogical leased lines**

| Type of leased line | Maximum level of the average input power | Minimum output level | Maximum level of global attenuation | Minimum relative input level | Minimum relative output level |
|---------------------|--|----------------------|-------------------------------------|------------------------------|-------------------------------|
| A20                 | - 9dBm                                   | - 34dBm              | 25dB                                | + 4dBr                       | - 21dBr                       |
| A40                 | - 13dBm                                  | - 34dBm              | 21dB                                | 0dBr                         | - 21dBr                       |
| A2S                 | - 9dBm                                   | - 26dBm              | 17dB                                | + 4dBr                       | - 13dBr                       |
| A4S                 | - 13dBm                                  | - 26dBm              | 13dB                                | 0dB                          | - 13dB                        |

3. Output noise level

| Nature of noise    | Measure  | Value     |
|--------------------|--|-----------|
| Psophometric noise | Level of the psophometric noise power at the output of the leased line | < 41dBm0p |

|   |  |  |
|---|--|--|
|   | The relative output level  | <p>1. Shall be the value resulting from the network planning, according to the statement of the leased line service provider.</p> <p>2. If the relative output level is not given or cannot be declared by the provider, the psophometric noise power level shall be by at least 28 dB below the reception level of a test signal of:</p> <ul style="list-style-type: none"> <li>- 9dBm/1020Hz/2 wires,</li> <li>- 13 dBm/1020Hz/4 wires respectively, applied at the remote input of the line.</li> </ul>               |
| <p><b><u>Inter-modulation components</u></b></p> <p>There are no restrictions in case of A20; A40 lines</p> | <p>For A2S; A4S lines</p> <p>The level of any unitonal component in the domain 300-3400 Hz measured at the output of the line, in a 30 Hz band</p> | <p>&lt; - 44dBm0</p> <p>The line will be closed at both ends on 600 ohm charge</p>   |
|   | The relative output level  | <p>1. Shall be the value resulting from the network planning, according to the statement of the leased line service provider.</p> <p>2. If the relative output level is not given or cannot be declared by the provider, the level of any unitonal component at the output shall be by at least 31 dB below the reception level of a test signal of:</p> <ul style="list-style-type: none"> <li>- 9dBm/1020Hz/2 wires,</li> <li>- 13 dBm/1020Hz/4 wires respectively, applied at the remote input of the line</li> </ul> |

|   |   |  |
|---|---|--|
| <p><b><u>Noise in impulses</u></b></p> <p>There are no restrictions in the case of A20; A40 lines</p> | <p>For A2S; A4S lines</p> <p>The number of output impulses, when at the line input is applied a test signal of:</p> <ul style="list-style-type: none"> <li>- 9dBm/1020Hz/2 wires,</li> <li>- 13 dBm/1020Hz/4 wires</li> </ul> | <p>≤18 impulses exceeding a ceiling level of -21dBm0 within a 15 minutes interval.</p>   |
|   | <p>The relative output level</p>  | <ol style="list-style-type: none"> <li>1. Shall be the value resulting from the network planning, according to the statement of the leased line service provider.</li> <li>2. If the relative output level is not given or cannot be declared by the provider, the ceiling level considered will be 31 dB below the reception level of a test signal of: <ul style="list-style-type: none"> <li>- 9dBm/1020Hz/2 wires,</li> <li>- 13 dBm/1020Hz/4 wires respectively, applied at the remote input of the line</li> </ul> </li> </ol> |

#### *4. Transmission delay*

|                          |   |                         |
|--------------------------|---|-------------------------|
| Terrestrial transmission | <(15+0,01 G) ms<br>(G= geographic distance in km) | ITU-T G.114; EN 300 289 |
| Satellite transmission   | < 350 ms  | ITU-T G.114; EN 300 289 |

#### *5. Output distortions*

|  |   |  |
|--|---|--|
| <p><b><u>Quantifying distortions</u></b></p> <p>They represent a direct expression of the number of A/D or D/A conversions occurred in the transmission chain, expressed as quantifying distortion units (qdu)</p> | <p><u>A2O; A4O lines</u> (no more than one ADPCM system shall be used in the transmission)</p> <p><u>A2S; A4S lines</u> (no ADPCM system shall be used in the transmission)</p>   | <p><math>\leq 7,5</math> qdu</p> <p><math>\leq 3</math> qdu<br/>Under special conditions, a 4 qdu value is however admitted.</p> |
| <p><b><u>Total distortions</u></b></p> <p>There are no restrictions for A2O; A4O lines</p>   | <p><u>For A2O; A4O lines</u></p> <p>The signal/total distortion ratio (when at the line input a test signal of:<br/>-9dBm/1020Hz/2 wires<br/>-13dBm/1020Hz/4 wires is applied)</p>                                      | <p><math>\geq 28</math> dB</p>   |
| <p><b><u>Harmonic distortions</u></b></p> <p>There are no restrictions for A2S; A4S lines</p>  | <p><u>For A2S; A4S lines</u></p> <p>The level of each individual component of the harmonics at line output (when at the line input a test signal of:<br/>-9dBm/1020Hz/2 wires<br/>-13dBm/1020Hz/4 wires is applied)</p> | <p><math>\geq 25</math>dB<br/>under the level of the fundamental signal</p>  |

## 6. Echo

In order to facilitate data transmission, echo control devices shall be used.

### 6.1. Speaker's echo

The level of each echo component received at line input shall be inferior to  $-19$ dBm (e.g. over 10 db below the level of the fundamental signal applied at the input), when a test signal is applied to it as follows:

- in 500 ÷ 2500Hz band (- 9 dBm/600 ohm for A2O lines, - 13dBm/600 ohm for A4O lines, respectively)
- in 300 ÷ 3600Hz band (- 9dBm/600 ohm for A2S lines, - 13dBm/600 ohm for A4S lines, respectively)

The condition shall be verified based upon the network planning information provided by the operator.



## 6.2. Listener's echo

The level of any echo components received at the line input shall be by more than 20 dB below the level at which the fundamental signal is received at the output, when a test signal is applied as follows:

- in 500 ÷ 2500Hz band (- 9 dBm/600 ohm for A2O lines, - 13dBm/600 ohm for A4O lines, respectively)
- in 300 ÷ 3600Hz band (- 9dBm/600 ohm for A2S lines, - 13dBm/600 ohm for A4S lines, respectively).

The condition shall be verified based upon the network planning information supplied by the operator.

## 6.3. Stability

The leased line is considered stable between 0 and 4000 Hz for any kind of terminations at both ends, including null, short-circuit or high impedance. The line is considered stable if, as a result of oscillatory phenomena, the output signal level is not more than 22 dB below the level at which is received a test signal of - 9 dBm/1020 Hz/2 wires and - 13dBm/1020 Hz/4 wires, respectively, applied at the input.

\*

These requirements are considered as met by the exclusive use of "type approved" terminal equipment and lines that comply with the conditions under the following documents, respectively:

### 1. Analogical leased lines

| <b>Technical and/or service parameters</b>                                    | <b>Reference</b>                | <b>Note</b>  |
|---|---------------------------------|--|
| <b><u>A2O</u></b><br>Line on 2 wires with usual vocal band width              | ETSI EN 300 448<br>ETSI TBR 015 | Connection characteristics<br>Interface presentation |
| <b><u>A2S</u></b><br>Line on 2 wires with vocal band width of special quality | ETSI EN 300 449<br>ETSI TBR 015 |  |
| <b><u>A4O</u></b><br>Line on 4 wires with usual vocal band width              | ETSI EN 300 451<br>ETSI TBR 017 |  |
| <b><u>A4S</u></b><br>Line on 4 wires with vocal width band of special quality | ETSI EN 300 452<br>ETSI TBR 017 |  |

## 2. Digital leased lines.

| Technical and/or service parameters   | Reference  | Note   |
|---|--|--|
| <p><b><u>64 Kbps - D64U</u></b></p> <p>Digital leased line without restrictions, with binary 64 Kbps rate with octet integrity.</p> | <p>ETSI EN 300 288<br/>ETSI EN 300 288/A1<br/>ETSI EN 300 289<br/>ETSI TBR 014</p> | <p>Connection characteristics<br/>Interface presentation</p> |
| <p><b><u>2048 Kbps - E1 (unstructured) - D2048U</u></b></p> <p>Unstructured digital leased line with 2048 Kbps rate.</p>            | <p>ETSI EN 300 247<br/>ETSI EN 300 247/A1<br/>ETSI EN 300 418<br/>ETSI TBR 012</p> |  |
| <p><b><u>2048 Kbps - E1 (structured) - D2048S</u></b></p> <p>Structured digital leased line with 2048 Kbps rate.</p>                | <p>ETSI EN 300 418<br/>ETSI EN 300 419<br/>ETSI TBR 013</p>                        |  |

## 3. Digital leased lines with 34 Mbps and 140/155 Mbps rates

The minimum conditions are imposed in accordance with the Open Network Provision (ONP), standards and technical specifications: ETR 087 and ETS 300 686 - ETSI.

| Technical and/or service parameters  | Reference                                  | Note   |
|--|--|--|
| <p><b><u>34368 Kbps - E3 unstructured and/or structured D34U; D34S</u></b></p> <p>Unstructured or structured high order leased line with 34 Mbps rate</p>      | <p>ETSI EN 300 686<br/>ETSI EN 300 687</p> | <p>Connection characteristics<br/>Interface presentation</p> |
| <p><b><u>139264 Kbps - E4 unstructured and/or structured D140U; D140S</u></b></p> <p>Unstructured or structured high order leased line with 140 Mbps rate.</p> | <p>ETSI EN 300 686<br/>ETSI EN 300 687</p> |  |

|   |                                    |  |
|---|------------------------------------|--|
| <b><u>N x 15520 Kbps</u></b><br>SDH (Synchronous Digital Hierarchy) lines with 155 Mbps rate. | ETSI EN 301 164<br>ETSI EN 301 165 |  |
|---|------------------------------------|--|

Provisions herein referring to the minimum service quality indicators for leased lines can be revised and/or completed according to the adopted technical regulations, under compliance with the procedure provided by the law.

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