

# REGULATION

## Quality of Service and Regulation

### Quality of Service Regulation

A Regulation issued by the Telecommunications  
Regulatory Authority

11 September 2008

Regulation 5 of 2008

**Purpose:** To provide a framework for Quality of Service obligations applicable to all licensed operators including details of the reportable parameters and associated measures.



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### Preamble

This Regulation is issued by the Telecommunications Regulatory Authority (TRA) of the Kingdom of Bahrain under section 3(c)(1) and section 53 of Legislative Decree No. 48 of 2002 promulgating the Telecommunications Law. International standards, being introduced around the world and in particular those developed within the European Telecommunications Standards Institute (ETSI) and the Internet Engineering Task Force (IETF), have been taken into account in developing this Regulation.

### Definitions

Any word, phrase or expression used in this Regulation or in the Schedules annexed to this Regulation shall, unless the context requires otherwise or it is expressly defined in this Regulation, have the same meaning as it has in Legislative Decree No. 48 of 2002 promulgating the Telecommunications Law.

References to a specific gender encompass all other genders.

References to a word or phrase in the singular encompass references to words or phrases in the plural, and vice versa.

The terms listed below shall have the following meanings in this Regulation and in the Schedules annexed to this Regulation:

<b>“Broadband Internet Access Network Service”</b>	means any Internet Access Network Service that is not a Voiceband Internet Access Network Service.
<b>“Busy Time”</b>	means the collection of the same six (6) hours occurring on each of the same four (4) days in each of twelve (12) weeks of a Reporting Period during which the highest average traffic for a Service is measured or expected on the basis of observations conducted in the preceding Reporting Period.
<b>“Commercial Launch Date”</b>	means the date on which a Licensed Operator begins commercial provision of a Service.
<b>“End User”</b>	means a Subscriber that is not a Licensed Operator.
<b>“Fixed Telecommunication Access Network Service”</b>	means any Telecommunication Access Network Service that is not a Mobile Telecommunication Access Network Service.
<b>“General Reporting</b>	means each of the six (6) months periods, starting on

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<b>Periods</b>	1 January, and 1 July of Gregorian calendar years.
<b>“Internet Access Network Service”</b>	means any Service that is provided substantially for data communications directly to or from Network Termination Points that are associated with End Users and that have IP addresses assigned through delegation from the Internet Assigned Numbers Authority.
<b>“Internet Transit Network Service”</b>	means any Service that is provided for communications between networks of Licensed Operators that provide Internet Access Network Services, other Internet Transit Network Services, or international routes to or from the Kingdom of Bahrain, not for communications directly to or from Network Termination Points that are associated with End Users.
<b>“Internet Service”</b>	means any Internet Access Network Service or Internet Transit Network Service.
<b>“IP”</b>	means the Inter-network Protocol standardised by the Internet Engineering Task Force.
<b>“Mobile Telecommunication Access Network Service”</b>	means any Telecommunication Access Network Service that uses Mobile Radiocommunications to provide communications to or from Network Termination Points that are associated with End Users.
<b>“Measurement”</b>	means a numerical value obtained by measuring using a Measurement Method.
<b>“Measurement Method”</b>	means a method of measuring a Parameter in a way prescribed in Part A of the Schedule annexed to this Regulation.
<b>“Monitored Service”</b>	means a Service for which Measurements of a Parameter must be made as identified in Part B of Schedule 1 annexed to this Regulation.
<b>“Network Termination Point”</b>	means a point at which a Subscriber has physical access through terminals and customer premises equipment to a network of a Licensed Operator.
<b>“Parameter”</b>	means a characteristic of the quality of a Service derived from measurements.
<b>“Quality of Service”</b>	means quality of telecommunications services measured, using Parameters and Measurement Methods defined in this Regulation

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<b>“Published Measurement”</b>	means a Measurement intended for publication with the content and format prescribed in Part A of the Schedule 1 annexed to this Regulation.
<b>“Reporting Period”</b>	means the period of time over which Measurements are made when a Licensed Operator performs quality of service measurement and reporting tasks once.
<b>“Service”</b>	means any Telecommunications service provided by a Licensed Operator to Subscribers, who may be End Users or Licensed Operators.
<b>“Target” or “Published Measurement Target”</b>	means a numerical value of a Published Measurement that represents a satisfactory level for the quality of an aspect of a Monitored Service as identified in Part B of the Schedule annexed to this Regulation.
<b>“Telecommunications Law”</b>	means Legislative Decree No. 48 of 2002 promulgating the Telecommunications Law.
<b>“Telecommunication Access Network Service”</b>	means any Public Telecommunications Service that is provided directly to or from Network Termination Points that are associated with End Users and that have telephone numbers allocated according to the National Numbering Plan.
<b>“Telecommunication Transit Network Service”</b>	means any Service that is provided for communications between networks of Licensed Operators that provide Telecommunication Access Network Services, other Telecommunication Transit Network Services, or international routes to or from the Kingdom of Bahrain, not for communications directly to or from Network Termination Points that are associated with End Users.
<b>“Telecommunication Service”</b>	means any Telecommunication Access Network Service or Telecommunication Transit Network Service.
<b>“TRA”</b>	means the Telecommunications Regulatory Authority of the Kingdom of Bahrain.
<b>“Transport Service”</b>	means any Service that is provided for telecommunications, not just for applications of telecommunications, and that is not an Internet Service or a Telecommunication Service.
<b>“Voiceband Internet Access Network Service”</b>	means any Internet Access Network Service that uses a Telecommunication Access Network Service to provide communications to or from Network Termination Points that are associated with End

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Users.

### **Article 1 – Scope**

- 1.1 This Regulation places obligations on Licensed Operators for measuring and reporting Quality of Service and allows TRA to establish and amend, from time-to-time as required, performance targets that License Operators must comply with and introduces a reporting requirement for the regular collection of market data.

### **Article 2 – Objectives**

- 2.1 This Quality of Service Regulation has the following objectives:
- (a) to provide information to assist:
    - (i) End Users and Licensed Operators with their selection of services;
    - (ii) Licensed Operators with the design and operation of interconnected networks;
    - (iii) the development of the telecommunications industry in the Kingdom of Bahrain; and
  - (b) to, at a minimum, assist in the maintainance and the improvement of the Quality of Services provided by Licensed Operators.
- 2.2 The reporting requirements specified in this Regulation will facilitate TRA's monitoring of the telecommunications industry in the Kingdom of Bahrain as well as provide data to support the future development of the regulatory environment.

### **Article 3 – Principles of Quality of Service**

- 3.1 Quality of service standards in the Kingdom of Bahrain shall:
- (a) apply to all Monitored Services specified in Schedule 1 (Part B) of this Regulation;
  - (b) enable End Users to compare the performance of Licensed Operators;
  - (c) not constrain the Measurement Methods used by Licensed Operators;
  - (d) be described in such terms that provide flexibility in the provision of future services;

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- (e) enable TRA to establish appropriate targets as required to maintain levels of quality satisfactory to the needs of the telecommunications industry in the Kingdom of Bahrain;
- (f) support self regulation unless competitive forces fail to maintain the required levels of quality of service;
- (g) at an appropriate point in time, and as required, be subject to Targets as established by the TRA. As defined in Article 8 of this Regulation.

### **Article 4 – Structure**

- 4.1 This Regulation establishes the general duties imposed upon Licensed Operators to comply with the Quality of Service measurement requirements and meet Quality of Service targets as per Article 8.1 if imposed by TRA upon the Licensed Operator in the Schedules;
- 4.2 Schedule 1, annexed to this Regulation details Parameters imposed by TRA from time to time, characterising particular aspects of Quality of Service thus:
  - (a) Part A of the Schedule 1 prescribes for each Parameter the Measurement Method that is to be used for making Measurements of the Parameter and the Published Measurement that is to be published for the Parameter; and
  - (b) Part B of the Schedule 1 identifies for each Parameter every Monitored Service for which Measurements of the Parameter must be made and any associated Target to be achieved.

### **Article 5 –Review and amendment**

- 5.1 TRA may periodically conduct surveys to assess user perceptions of Services and Licensed Operators and to investigate which, if any, Quality of Service standards should be imposed.
- 5.2 TRA may periodically amend this Regulation in accordance with section 3(f) of the Telecommunications Law.
- 5.3 In the event of discrepancy between this Regulation and its associated Schedules this Regulation shall prevail.

### **Article 6 – Measurement and Reporting of Quality of Service (Schedule 1)**

- 6.1 The Reporting Periods, (for Quality of Service purposes) over which Measurements are made, shall be three (3) consecutive months, starting on: 1 January, 1 April, 1 July, and 1 October of the Gregorian calendar each year.

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- 6.2 Where Schedule 1 contains a Monitored Service for the Parameter that describes part or all of the Service then that Parameter shall be reportable for that Monitored Service of a Licensed Operator and the Licensed Operator shall have Quality of Service obligations related to the Parameter as per this Regulation.
- 6.3 No later than 30 days prior to the Commercial Launch Date for a Service the Licensed Operator shall inform TRA and shall include appropriate reporting in the next Reporting Period.
- 6.4 For each Reporting Period the Licensed Operator shall inform TRA the mean number of Subscribers to the Service during the Reporting Period no later than 30 days after the end of the Reporting Period. For the sake of this provision mean subscribers shall be calculated as the arithmetic average for the period calculated as follows: the average of the number of active subscribers at the time of 23:59:59 in the Kingdom of Bahrain on the last calendar day of each month during the Reporting period. For example, the sum of active subscribers as at 31<sup>st</sup> January and active subscribers as at 28<sup>th</sup> February and active subscribers as at 31<sup>st</sup> March) divided by 3.
- 6.5 Licensed Operators shall perform the following measurement and reporting tasks for each reportable Parameter for a Service of a Licensed Operator as specified in accordance with Schedule 1 for each Reporting Period:
- (a) make the Measurements by using the Measurement Method for the Parameter;
  - (b) no later than 30 days after the end of the Reporting Period, submit the Measurements to TRA in electronic format using the form contained in Schedule 1 as published by TRA from time to time pursuant to article 5.3 of this Regulation;
  - (c) no later than 30 days after the end of the Reporting Period or as otherwise directed by TRA, submit any information that is used in making the Measurements and any other information that is requested by TRA from time to time, including but not limited to details of the observations and calculations made for the Measurements; and
  - (d) keep the Measurements and any information that is used in making the Measurements for at least 12 months after the end of the Reporting Period or as otherwise directed by the TRA.

### **Article 7 – QoS Publication and Investigation**

- 7.1 TRA shall publish on its web site a Quality of Service Report, by using the Measurements submitted by Licensed Operators no later than 60 days after the end of the Reporting Period to which the Measurements apply.

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- 7.2 For each reportable Parameter for a Service of a Licensed Operator and for each Reporting Period, a Quality of Service report as published by the TRA under Article 7.1 shall contain:
- (a) at least one name of the Service that is known to Subscribers and that distinguishes the Service from other Services intended to be associated with different expectations about quality of service;
  - (b) the Published Measurement for the Parameter that is submitted by the Licensed Operator;
  - (c) an indication of any Target for the Parameter and the Service that the Licensed Operator should achieve;
  - (d) any explanatory remarks by the Licensed Operator that are previously accepted and approved by TRA; and
  - (e) any other remarks that are regarded as appropriate by TRA.
- 7.3 In approving explanatory remarks by a Licensed Operator under Article 7.2 TRA may take into account factors including but not limited to:
- (a) any service deficiencies that arise partly or wholly from the Services of another Licensed Operator, or another operator licenced to provide services in other countries that may contribute to the Reportable Service as per Schedule 1;
  - (b) any changes in environmental or operating conditions that could not have been reasonably foreseen by the Licensed Operator; and
  - (c) any expectations about quality of service that are appropriate to the tariffs for the Services of the Licensed Operator.
- 7.4 TRA may use numbers of Subscribers submitted by Licensed Operators under article 6.4 of this Regulation and Published Measurements that are submitted by Licensed Operators under article 6.5 of this Regulation, for publication pursuant to Section 54 of the Telecommunications Law.
- 7.5 TRA may investigate the quality of service measurement and reporting procedures of a Licensed Operator pursuant to Section 77 of the Telecommunications Law.

### **Article 8 – Target Setting**

- 8.1 If TRA perceive that operators are not achieving the required quality of service following analysis of QoS reports from operators, according to benchmarking or international standards, TRA will set targets to achieve within a specified period of time, either for all operators, or individual operators. Failure to achieve targets will be a contravention under Article 9.1 (d) of this regulation.



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### **Article 9 – Contravention and Enforcement**

- 9.1 For each reportable Parameter for a Service of a Licensed Operator, the Licensed Operator shall be deemed to be in breach of this Regulation if a Licensed Operator fails to:
- (a) inform the TRA the Commercial Launch Date for the Service as required under article 6.3;
  - (b) inform the TRA the mean number of Subscribers to the Service as required under article 6.4, for any Reporting Period that starts after the Commercial Launch Date for the Service;
  - (c) perform correctly and accurately the quality of service measurement and reporting tasks as described in Article 6.5 and the Schedules as they are published from time to time;
  - (d) reach a Target, as established by TRA in accordance with Article 8 of this Regulation; or
  - (e) provide, during a specified time period, information that is requested by the TRA pursuant to Article 7.3.
- 9.2 A breach of this Regulation will be deemed a breach of the Telecommunications Law and/or the relevant provisions of the Licenced Operator's relevant Licence and enforced pursuant to section 35 of the Telecommunications Law. TRA may, without prejudice to any other remedies or rights, apply one or more of the following measures under section 35 of the Telecommunications Law:
- (a) require the Licensed Operator to publish information about Quality of Service in ways and with contents approved by TRA;
  - (b) require the Licensed Operator to submit to TRA a plan to improve quality of the Service for TRA's approval and to subsequently implement the approved plan.
- 9.3 In considering the application of measures under article 9.2 TRA may take into account factors including but not limited to:
- (a) the factors set out in article 7.3;
  - (b) the number and nature of the Services, Parameters, Reporting Periods and Targets for which the Licensed Operator has committed quality of service contraventions;
  - (c) the effects of the quality of service contraventions on the Services of other Licensed Operators;
  - (d) any service credits, rebates or other remedial measures that have been provided by the Licensed Operator to End Users including

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other Licenced Operators, that may have been inconvenienced by the quality of service contraventions;

- (e) the number and nature of the measures that were applied on earlier occasions when the Licensed Operator or another Licensed Operator had committed quality of service contraventions; and
- (f) the financial circumstances of the Licensed Operator.

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### **Part A –Measurement Methods and Published Measurements**

<b>Parameter Name</b>	<b>Measurement Method</b>	<b>Published Measurement</b>
Account complaint rate	<p>An account is a statement of money owed or paid that is read or otherwise accessed by a Subscriber; the services provided to the Subscriber may be prepaid or postpaid.</p> <p>An account complaint is a complaint that an account is inaccurate. This occurs when, for instance, incorrect call data are used, calls are charged at an incorrect rate, services are billed incorrectly, call discounts, credits or debits are handled incorrectly, or the total charge including tax is calculated incorrectly. An account complaint should not be confused with a request for information about accounts or tariffs, or with a service fault report. An account complaint may be submitted by phone, by personal contact at a customer service centre or in written form.</p> <p>The number of account complaints received during the Reporting Period should be divided by the average number of Subscribers for the Licensed Operator during the same period. The result should be provided as a Measurement. Also, separate numbers of account complaints received during the Reporting Period should be provided as Measurements for at least the following classes of account complaint:</p> <ul style="list-style-type: none"> <li>• Charging for services with fixed recurring charges more than once.</li> <li>• Charging for calls more than once.</li> <li>• Charging for SMS messages more than once.</li> <li>• Charging for services with fixed recurring charges at incorrect rates.</li> <li>• Charging for SMS messages at incorrect rates.</li> <li>• Charging for calls at incorrect rates.</li> <li>• Charging for services with fixed recurring charges without successful supply.</li> <li>• Charging for calls without successful setup.</li> <li>• Charging for SMS messages without successful transmission.</li> </ul>	Percentage of service Subscribers making account complaints in the Reporting Period, rounded up to the nearest percentage point

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<b>Parameter Name</b>	<b>Measurement Method</b>	<b>Published Measurement</b>
	<ul style="list-style-type: none"> <li>• Charging for calls beyond their durations.</li> <li>• Not crediting recharge payments to the account.</li> <li>• Not crediting bill payments to the account.</li> <li>• Not accepting attempts to make recharge payments.</li> <li>• Not accepting attempts to make bill payments.</li> <li>• Not accepting attempts to determine the account balance.</li> <li>• Losing credited amounts from the account.</li> <li>• Incorrect customer account name as per either the name printed on the customers CPR card or a business' registered name.</li> <li>• Incorrect billing address</li> </ul> <p>The Measurements should include all account complaints received during the Reporting Period, regardless of the validity of the complaint, the extent to which the complaint repeats an earlier one, and the dates of calls or any other occurrences that are the subject of the complaint.</p>	
Account complaint resolution time	<p>The time to resolve an account complaint is the elapsed time (not the working time) from when the complaint is received by a Licensed Operator to when the cause for the complaint has been removed.</p> <p>The mean, standard deviation and 95th percentile of the distribution of times to resolve account complaints, and the number of account complaints resolved, should be provided as Measurements.</p> <p>The Measurements should include all account complaints resolved during the Reporting Period, regardless of the validity of the complaint the extent to which the complaint repeats an earlier one, and the dates of calls or any other occurrences that are the subject of the complaint.</p>	Mean time in days taken to correct inaccurate accounts for the service in the Reporting Period, rounded up to two numerically significant figures

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<b>Parameter Name</b>	<b>Measurement Method</b>	<b>Published Measurement</b>
Call statistics for Manual National Directory Enquiries (DQ)	Classes for Manual National Directory eQuery Services <ul style="list-style-type: none"> <li>• Total number of calls to DQ</li> <li>• Mean time to answer for the period</li> <li>• Mean holding time</li> <li>• Total number of telephone number look-ups performed</li> <li>• Number of unsuccessful look-ups</li> <li>• Failure rate for DQ look-ups</li> <li>• Average number of look-ups per DQ call</li> </ul>	The average answering time in seconds for the total calls to DQ during the reporting period rounded to complete seconds.
Call statistics for Manual International Operator Services	Classes for International Operator Services <ul style="list-style-type: none"> <li>• Total number of calls to Operator Services</li> <li>• Mean time to answer for the period</li> <li>• Mean holding time</li> </ul>	The average answering time in seconds for the total calls during the reporting period rounded to complete seconds.
Disconnection complaint rate	<p>A disconnection is any way of preventing a Subscriber from using a service; it may not require physical unplugging of connections.</p> <p>A disconnection complaint is a complaint that a disconnection is unjustified. This occurs when, for instance, calls to or from the telephone number of a Subscriber are made unsuccessful by deliberate acts of the Licensed Operator. A disconnection complaint should not be confused with a request for disconnection or transfer or with a fault report. A disconnection complaint may be submitted by phone, by personal contact at a customer service centre or in written form.</p> <p>The number of disconnection complaints received during the Reporting Period should be divided by the average number of Subscribers for the Licensed Operator during</p>	Percentage of service Subscribers making disconnection complaints in the Reporting Period, rounded up to the nearest percentage point

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<b>Parameter Name</b>	<b>Measurement Method</b>	<b>Published Measurement</b>
	<p>the same period. The result should be provided as a Measurement. Also, separate numbers of disconnection complaints received during the Reporting Period should be provided as Measurements for at least the following classes of disconnection complaint:</p> <ul style="list-style-type: none"> <li>• Blocking calls to or from certain numbers or networks.</li> <li>• Blocking SMS messages to or from certain numbers or networks.</li> <li>• Stopping services for alleged non-payment.</li> <li>• Stopping services after credit expiry.</li> </ul> <p>The Measurements should include all disconnection complaints received during the Reporting Period, regardless of the validity of the complaint, the extent to which the complaint repeats an earlier one, and the dates of disconnections or any other occurrences that are the subject of the complaint.</p>	
Disconnection complaint resolution time	<p>The time to resolve a disconnection complaint is the elapsed time (not the working time) from when the complaint is received by a Licensed Operator to when the cause for the complaint has been removed.</p> <p>The mean, standard deviation and 95th percentile of the distribution of times to resolve disconnection complaints, and the number of disconnection complaints resolved, should be provided as Measurements.</p> <p>The Measurements should include all disconnection complaints resolved during the Reporting Period, regardless of the validity of the complaint, the extent to which the complaint repeats an earlier one, and the dates of disconnections or any other occurrences that are the subject of the complaint.</p>	<p>Mean time in days taken to correct unjustified disconnections in the Reporting Period, rounded up to two numerically significant figures</p>

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Parameter Name	Measurement Method	Published Measurement
Network – Observation on International Outgoing Telephone Calls	Reference should be made to ITU-T Rec. E.422	As detailed in Table 4 of the Recommendation for each group of outgoing circuits from each international exchange or gateway
Network - Internal Automatic Observations	<p>Reference should be made to ITU-T Rec.E.425</p> <p><b>Answer Seizure Ratio (ASR)</b>            ASR gives the relationship between the number of seizures that result in an answer signal and the total number of seizures. This is usually expressed as a percentage as follows:</p> $\text{ASR} = \frac{\text{Seizures resulting in answer signal}}{\text{Total seizures}} \times 100$ <p>Measurement of ASR may be made on a route or on a destination code basis.</p> <p>The <i>destination</i> ASR is calculated on the total amount of traffic to the destination whichever the outgoing route used.</p> <p>A destination can be a mobile network, a country, a city, a service,</p>	Percentage per destination and per route.

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Parameter Name	Measurement Method	Published Measurement
	<p>etc.</p> <p>The most accurate view of the performance of the distant network is achieved by measuring direct ASR as indicated below.</p> <p>Considering the traffic to a country B (i.e. the destination), the ASR to this destination is:</p> <p>Country B ASR = <math>\frac{\text{Direct} + \text{Indirect Seizures for country B resulting in Answers}}{\text{Direct} + \text{Indirect Total Seizures for country B}}</math></p> <p>Direct Country B ASR = <math>\frac{\text{Direct Seizures for country B resulting in Answers}}{\text{Direct Total Seizures for country B}}</math></p> <p>Indirect Country B ASR = <math>\frac{\text{Indirect Seizures for country B resulting in Answers}}{\text{Indirect Total Seizures for country B}}</math></p> <p>The route ASR is calculated on the total amount of traffic on an outgoing route whichever the destination of this traffic. Considering traffic on a route c, the ASR on this route is:</p> <p>Route c ASR = <math>\frac{\text{Seizures on the route c resulting in Answers}}{\text{Total seizures on the route c}}</math></p> <p><b>Answer Bid Ratio (ABR)</b>            Gives the relationship between the number of bids that result in an answer signal and the total number of bids.</p>	



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Parameter Name	Measurement Method	Published Measurement
	<p style="text-align: center;"> <math display="block">\text{ABR} = \frac{\text{Bids resulting in answer signal} \times 100}{\text{Total bids}}</math> </p> <p>ABR is expressed as a percentage and is a direct measure of the effectiveness of traffic from the point of measurement. It is similar to ASR except that it includes bids that do not result in a seizure.</p> <p>NOTE – There is not always a direct relationship between ASR and ABR since:</p> <ul style="list-style-type: none"> <li>– some reattempts can be generated by the switch which can lead to a lower ASR than ABR;</li> <li>– some bids can be lost by the switch which can lead to a lower ABR than ASR.</li> </ul> <p><b>Network Effectiveness Ratio (NER)</b></p> <p>NER is designed to express the ability of networks to deliver calls to the far-end terminal. NER expresses the relationship between the number of seizures and the sum of the number of seizures resulting in either an answer message, or a user busy, or a ring no answer, or in the case of ISDN a terminal rejection/unavailability. Unlike ASR, NER excludes the effects of customer behaviour and terminal behaviour. Like ASR, measurement of NER may be made on a route or on a destination code basis.</p> <p style="text-align: center;"> <math display="block">\text{NER} = \frac{\text{Seizures resulting in Answer message or User Failure}}{\text{Total Seizures}}</math> </p>	

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<b>Parameter Name</b>	<b>Measurement Method</b>	<b>Published Measurement</b>
Network - IP based Network Measurements	<p>Reference should be made to ITU-T Rec. M.2301 which focuses attention on parameters related to international transmission systems, telephone circuits, telegraphy, facsimile and leased circuits that significantly affect the quality of service perceived by the customer, and the methods of measuring those parameters. These include those parameters that affect delay performance at the application layer. Performance limits for temporary dial-up access links, end-customer owned portions and MPLS networks are not covered by this Recommendation and are for further study. However, the performance of fixed access links, whose routing does not change, is covered.</p> <p>There are two basic approaches to performance measurement in IP based networks defined in the Recommendation. These are "intrusive" and "non-intrusive" which equate to the terms "active" and "passive" used by the IETF. Some performance parameters can be measured only intrusively, others only non-intrusively, and some both intrusively and non-intrusively as illustrated, for example using Management Information Base (MIB) monitoring, shown in Table 1 of the Recommendation.</p> <p>The parameters are:                      One way IP packet Transfer Delay (IPTD)                      One way IP packet Delay Variation (IPDV)                      IP packet Error Ratio (IPER)                      IP Packet Loss Ratio (IPLR)                      IP Packet Discard Ratio (IPDR)</p>	Refer to Table 2 and Table 3 of the Recommendation

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Parameter Name	Measurement Method	Published Measurement																		
	<p><b>Table 1/M.2301 – Intrusive and non-intrusive measurement of performance parameters</b></p> <table border="1" style="margin-left: auto; margin-right: auto; border-collapse: collapse;"> <thead> <tr> <th style="text-align: left;">Parameter</th> <th style="text-align: center;">Intrusive</th> <th style="text-align: center;">Non-intrusive</th> </tr> </thead> <tbody> <tr> <td>IPTD</td> <td style="text-align: center;">Y</td> <td></td> </tr> <tr> <td>IPDV</td> <td style="text-align: center;">Y</td> <td></td> </tr> <tr> <td>IPEP</td> <td style="text-align: center;">Y</td> <td style="text-align: center;">Y</td> </tr> <tr> <td>IPLR</td> <td style="text-align: center;">Y</td> <td style="text-align: center;">Y</td> </tr> <tr> <td>IPDR</td> <td></td> <td style="text-align: center;">Y</td> </tr> </tbody> </table> <p><b>Intrusive performance measurement (using test packets)</b>                      Intrusive performance measurements are made by inserting test packets interleaved with the normal traffic flows between two MPs. This kind of measurement allows more detailed investigation of specific performance parameters e.g. one-way delay using time stamped packets, effect of packet size and number of packets on performance. It should be noted that intrusive performance measurement causes additional traffic through the network so care must be taken to ensure that the use of this test does not cause congestion and the subsequent loss of customer's packets. It is also important that the test is not carried out when customer traffic is so low that the results of the test are invalid.</p> <p>The test packet stream and the measurement period should be appropriate to the application service to be supported.</p>	Parameter	Intrusive	Non-intrusive	IPTD	Y		IPDV	Y		IPEP	Y	Y	IPLR	Y	Y	IPDR		Y	
Parameter	Intrusive	Non-intrusive																		
IPTD	Y																			
IPDV	Y																			
IPEP	Y	Y																		
IPLR	Y	Y																		
IPDR		Y																		

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Parameter Name	Measurement Method	Published Measurement
	<p><b>Non-intrusive performance measurement (using MIB monitoring)</b></p> <p>The performance can be assessed by interrogating all the routers for performance statistics and thus obtaining a real time view of the effect of the network on the traffic passing through that network. The data available are listed in RFC 1213 [6] and RFC 2011 [8]. RFC 1213 [6] has been updated by RFCs 2011 [8], 2012 [9] and 2013 [10] but only RFC 2011 [8] is applicable to the M.2301 Recommendation. RFCs 1213 [6] and 2011 [8] include interface statistics, IP statistics, ICMP statistics, TCP statistics, EGP statistics and SNMP statistics. Only interface statistics and IP statistics should be used for performance measurement. This is because they will cover all traffic of all types and they will not be affected by the differences between the different protocols (e.g. the re-transmission of packets by TCP). This kind of measurement has the advantages of minimising impact on customer's traffic and testing every route through the network. Problems on links or routers can also be quickly identified. It should be noted, however, that non-intrusive measurements can realistically be done only within one IPOD since it may be difficult or undesirable for one operator to access the routers in another's IPOD. Results of non-intrusive measurements might be exchanged between connecting operators over a TMN X-interface. The application of MIB monitoring inside an IPOD is described in Appendix I of the M.2301 Recommendation. The measurements have to be made in pairs, which should be done 15 minutes apart except for those interfaces that are running at 1 Gbit/s or above. In the latter case, the readings should be</p>	

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### Quality of Service Regulation

Parameter Name	Measurement Method	Published Measurement
	separated by the time given in Table A.1 of the recommendation or less.	
Network – Performance and Availability for MPLS networks	<p>Reference should be made to ITU-T Rec. Y.1561 which defines parameters that may be used in specifying and assessing the performance of speed, accuracy, dependability, and availability of packet transfer over a Label Switched Path on a Multi-Protocol Label Switching (MPLS) network. The defined parameters apply to end-to-end, point-to-point and multipoint-to-point LSP and to any MPLS domain that provides, or contributes to the provision of, packet transfer services.</p> <p>Two categories of MPLS networks are considered:                      1) TE-LSP: Traffic Engineering Label Switched Path, or configured LSP. These are point-point paths.                      2) LDP-based LSP: This includes point-to-point and multipoint to point LSPs.</p>	The packet transfer performance parameters and availability parameters defined in the recommendation are to be applied.

# SCHEDULE 1

## Quality of Service Regulation

### Part B Monitored Services and Targets

**Operator Name:**

**QoS Report For the Period (Time/Month) to (Time/Month) 2008**

Parameter Name	Monitored Service (Product Name or Other Identifier)	Reporting requirement	Measurement	Explanatory Notes
<b>Account complaint Rate</b>	<b>Telecommunication Service; Mobile Telecommunication Access Service Internet Service; Transmission Service</b>	Charging for services with fixed recurring charges more than once.		
		Charging for calls more than once.		
		Charging for SMS messages more than once.		
		Charging for services with fixed recurring charges at incorrect rates.		
		Charging for SMS messages at incorrect rates.		
		Charging for calls at incorrect rates.		
		Charging for services with fixed recurring charges without successful supply.		
		Charging for calls without successful setup.		
		Charging for SMS messages without successful transmission.		
		Charging for calls beyond their durations.		
		Not crediting recharge payments to the account.		
		Not crediting bill payments to the account.		
Not accepting attempts to make recharge payments.				
Not accepting attempts to make bill payments.				
<b>Account complaint Resolution Time</b>	<b>Telecommunication Service; Mobile Telecommunication Access Service</b>	Charging for services with fixed recurring charges more than once.		
		Charging for calls more than once.		
		Charging for SMS messages more than once.		

Charging for services with fixed recurring charges at

# SCHEDULE 1

## Quality of Service Regulation

Parameter Name	Monitored Service (Product Name or Other Identifier)	Reporting requirement	Measurement	Explanatory Notes
	<b>Internet Service; Transmission Service</b>	incorrect rates.		
		Charging for SMS messages at incorrect rates.		
		Charging for calls at incorrect rates.		
		Charging for services with fixed recurring charges without successful supply.		
		Charging for calls without successful setup.		
		Charging for SMS messages without successful transmission.		
		Charging for calls beyond their durations.		
		Not crediting recharge payments to the account.		
		Not crediting bill payments to the account.		
		Not accepting attempts to make recharge payments.		
Not accepting attempts to make bill payments.				
<b>Call statistics for National Manual Directory Queries</b>	<b>Directory Enquiries</b>	Total number of calls to DQ (P)		
		Mean time to answer for the period (P)		
		Mean holding time (NP)		
		Total number of telephone number look-ups performed (NP)		
		Number of unsuccessful look-ups (NP)		
		Failure rate for DQ look-ups (NP)		
		Average number of look-ups per DQ call (NP)		
<b>Call statistics for International Manual Operator Services</b>	<b>Operator Services</b>	Total number of calls to Operator Services		
		Mean time to answer for the period		
		Mean holding time		
<b>Disconnection Complaint rate</b>	<b>Telecommunication Service; Mobile</b>	Blocking calls to or from certain numbers or networks.		
		Blocking SMS messages to or from certain numbers		

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## Quality of Service Regulation

Parameter Name	Monitored Service (Product Name or Other Identifier)	Reporting requirement	Measurement	Explanatory Notes
	<b>Telecommunication Access Service Internet Service; Transmission Service</b>	or networks.		
		Stopping services for alleged non-payment.		
		Stopping services after credit expiry		
<b>Disconnection complaints received</b>	<b>Telecommunication Service; Mobile Telecommunication Access Service Internet Service; Transmission Service</b>	Blocking calls to or from certain numbers or networks.		
		Blocking SMS messages to or from certain numbers or networks.		
		Stopping services for alleged non-payment.		
		Stopping services after credit expiry		
<b>Disconnection complaints resolution time (Mean)</b>	<b>Telecommunication Service; Mobile Telecommunication Access Service Internet Service; Transmission Service</b>	Blocking calls to or from certain numbers or networks.		
		Blocking SMS messages to or from certain numbers or networks.		
		Stopping services for alleged non-payment.		
		Stopping services after credit expiry		
<b>Disconnection complaints resolution time (Std Dev)</b>	<b>Telecommunication Service; Mobile Telecommunication Access Service Internet Service; Transmission Service</b>	Blocking calls to or from certain numbers or networks.		
		Blocking SMS messages to or from certain numbers or networks.		
		Stopping services for alleged non-payment.		
		Stopping services after credit expiry		
<b>Disconnection</b>	<b>Telecommunication</b>	Blocking calls to or from certain numbers or networks.		



# SCHEDULE 1

## Quality of Service Regulation

Parameter Name	Monitored Service (Product Name or Other Identifier)	Reporting requirement	Measurement	Explanatory Notes
<b>complaints resolution time (95<sup>th</sup> percentile)</b>	<b>Service; Mobile Telecommunication Access Service Internet Service; Transmission Service</b>	Blocking SMS messages to or from certain numbers or networks.		
		Stopping services for alleged non-payment.		
		Stopping services after credit expiry		
<b>Miscellaneous complaint</b>	<b>Telecommunication Service; Mobile Telecommunication Access Service Internet Service; Transmission Service</b>	Miscellaneous complaint rate		
		Miscellaneous complaint received		
		Miscellaneous complaint resolution time (mean)		
		Miscellaneous complaint resolution time (Std Dev)		
		Miscellaneous complaint resolution time (95th percentile)		
<b>Fault report rate</b>	<b>Telecommunication Service; Mobile Telecommunication Access Service Internet Service; Transmission Service</b>	Service affecting		
		Non service affecting		
<b>Number of Fault reported</b>	<b>Telecommunication Service; Mobile Telecommunication Access Service Internet Service; Transmission Service</b>	Service affecting		
		Non service affecting		

## SCHEDULE 1

### Quality of Service Regulation

Parameter Name	Monitored Service (Product Name or Other Identifier)	Reporting requirement	Measurement	Explanatory Notes
<b>Fault repair time (mean)</b>	<b>Telecommunication Service; Mobile Telecommunication Access Service Internet Service; Transmission Service</b>	Service affecting		
		Non service affecting		
<b>Fault repair time (Std Dev)</b>	<b>Telecommunication Service; Mobile Telecommunication Access Service Internet Service; Transmission Service</b>	Service affecting		
		Non service affecting		
<b>Fault repair time (95<sup>th</sup> percentile)</b>	<b>Telecommunication Service; Mobile Telecommunication Access Service Internet Service; Transmission Service</b>	Service affecting		
		Non service affecting		
<b>Service Supply Time (Number)</b>		Telephone line installations - Business		
		Telephone line installations - Residential		
		Interconnection Link Services		
		Local Leased Circuit for OLO		
		CATS		
		Wholesale ADSL		

# SCHEDULE 1

## Quality of Service Regulation

Parameter Name	Monitored Service (Product Name or Other Identifier)	Reporting requirement	Measurement	Explanatory Notes
		Bitstream		
		Leased Lines		
		ADSL		
		CPS		
<b>Service Supply Time (Mean)</b>		Telephone line installations - Business		
		Telephone line installations - Residential		
		Interconnection Link Services		
		Local Leased Circuit for OLO		
		CATS		
		Wholesale ADSL		
		Bitstream		
		Leased Lines		
		ADSL		
		CPS		
<b>Service Supply Time (Std Dev)</b>		Telephone line installations - Business		
		Telephone line installations - Residential		
		Interconnection Link Services		
		Local Leased Circuit for OLO		
		CATS		
		Wholesale ADSL		
		Bitstream		
		Leased Lines		
		ADSL		
		CPS		
<b>Service Supply</b>		Telephone line installations - Business		

# SCHEDULE 1

## Quality of Service Regulation

Parameter Name	Monitored Service (Product Name or Other Identifier)	Reporting requirement	Measurement	Explanatory Notes
<b>Time (95<sup>th</sup> percentile)</b>		Telephone line installations - Residential		
		Interconnection Link Services		
		Local Leased Circuit for OLO		
		CATS		
		Wholesale ADSL		
		Bitstream		
		Leased Lines		
		ADSL		
<b>Unsuccessful call centre access</b>		CPS		
		Public emergency		
		Operator assistance		
<b>Unsuccessful call set-up</b>		Directory information		
		Fixed - Fixed		
		Fixed - Mobile (Own Network)		
		Fixed - Mobile (Other Network)		
		Mobile - Fixed		
		Mobile - Mobile (Own Network)		
<b>Dropped Call Ratio</b>		Mobile - Mobile (Other Network)		
		Fixed - Fixed		
		Fixed - Mobile (Own Network)		
		Fixed - Mobile (Other Network)		
		Mobile - Fixed		
		Mobile - Mobile (Own Network)		

## SCHEDULE 1

### Quality of Service Regulation

Parameter Name	Monitored Service (Product Name or Other Identifier)	Reporting requirement	Measurement	Explanatory Notes
		Mobile - Mobile (Other Network)		
<b>Unsuccessful SMS transmission ratio</b>		Own Network		
		Other Network		
<b>Unsuccessful MMS transmission Ratio</b>		Own Network		
<b>Unsuccessful Internet Session Login ratio</b>				
<b>Dropped Internet Session ratio</b>				
<b>Unsuccessful Internet Data Transmission ratio</b>				
<b>Internet data transmission time</b>		Internet data transmission time (Mean)		
		Internet data transmission time (Std Dev)		
		Internet data transmission time (95th Percentile)		

# SCHEDULE 1

## Quality of Service Regulation

Parameter Name	Monitored Service (Product Name or Other Identifier)	Reporting requirement	From Fixed Line telephones	From Mobile Telephones	From Soft Diallers	Notes
<b>Network - Observation on International Outgoing Telephone Calls. Reference ITU-T E.425</b>	<b>International Telephone Calls</b>	Categories D.1 to D.13 for each group of outgoing circuits from each international exchange or gateway.				
<b>Network - Internal Automatic Observations. Reference ITU-T E.425</b>	<b>Telecommunication Service Mobile Telecommunication Access Service Internet Service; Transmission Service</b>	ASR for all international routes				
		ABR for all international routes				
		ASR for top 5 international destinations				
		ABR for top 5 international destinations				

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## Quality of Service Regulation

Parameter name	Monitored Service (Product Name or Other Identifier)	Reporting Requirement	Class 0	Class 1	Class 2	Class 3	Class 4	Class 5	Notes
<b>Network - IP based Network Measurements. Reference ITU-T M.2301</b>	All pair combinations of OBGRs within an IPOD.	Intrusive IPTD							
	All pair combinations of OBGRs within an IPOD using a similar test packet stream as for IPTD	Intrusive IPDV							
	All pair combinations of OBGRs within an IPOD.	Intrusive IPER							
	All pair combinations of OBGRs within an IPOD.	Intrusive IPLR							
	All pairs within the IPOD	Non Intrusive IPER							
	All pairs within the IPOD	Non Intrusive IPLR							

## SCHEDULE 1

### Quality of Service Regulation

Parameter name	Monitored Service (Product Name or Other Identifier)	Reporting Requirement	Class 0	Class 1	Class 2	Class 3	Class 4	Class 5	Notes
	All pairs within the IPOD	Non Intrusive IPDR							
<b>Network – Performance and Availability for MPLS networks. Reference ITU-T Y.1561</b>	<b>Telecommunication Service Mobile Telecommunication Access Service Internet Service Transmission Service</b>	The defined parameters apply to end-to-end, point-to-point and multipoint-to-point LSP and to any MPLS domain							

Issued by

**Alan Horne**

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in Manama

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