



Mobile Communications Systems

GSM / UMTS

Quality of Service Assessment

Assessment of the QoS of the Short Message Service (SMS) and
Multimedia Messaging Service (MMS)

December 2011

ANACOM

ABBREVIATIONS AND ACRONYMS

CoDec	Codifier/De-codifier
CPICH RSCP	Common Pilot Channel, Received Signal Code Power – Level of the signal received by a mobile terminal (WCDMA).
ETSI	European Telecommunications Standards Institute.
GSM	Global System for Mobile communications – Second generation (2G) Mobile Communications System.
ITU	International Telecommunications Union.
MMS	Multimedia Messaging Service.
MMSC	Multimedia Messaging Service Centre.
MOS	Mean Opinion Score – Quality index quantifying the effort to understand an end-to-end type conversation. Its limits are 0 (zero) when there is no communication and 5 (five) when the communication is perfect. The value “zero” never shows in the results since only connections that were established and maintained for a given period are considered. “Five” never shows in the results either, because the CoDec used by mobile networks renders such high voice or video quality values impossible (the voice or video quality reached with the CoDec usually used gives MOS values lower than 4.5).
PESQ	Perceptual Evaluation of Speech Quality – Algorithm used in the analysis of the audio quality of a voice communication (Recommended by ITU: ITU-T Recommendation P.862 (02/2001); ITU-T Recommendation P.862.1 (11/2003)).
ISDN	Integrated Services Digital Network – Technology used on the fixed access network.
RF	Radio Frequency.
RxLev	Received signal level, at a mobile terminal (GSM).
s	Second – time unit.
Scanner	Scanner measurement equipment that collects radio signal levels for each channel of a frequency band.
SMS	Short Message Service.
SMSC	Short Message Service Centre.
SQuad-LQ	SwissQual’s speech quality algorithm for Listening Quality – Algorithm developed by SwissQual to analyse the listening quality of a communication.
UMTS	Universal Mobile Telecommunications System – Third generation (3G) Mobile Communications System.
VQuad	Objective Model for Video Quality Assessment – Algorithm used in the analysis of the video quality of a communication (developed by SwissQual).
WCDMA	Wideband Code Division Multiple Access – Technology used in the radio component of the UMTS communications systems.

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I EXECUTIVE SUMMARY

I.I GENERAL FRAMEWORK

In December 2011 the Autoridade Nacional de Comunicações (ANACOM) carried out an assessment of the quality of the short message service (SMS) and multimedia messaging service (MMS) provided by operators OPTIMUS, TMN and VODAFONE, by analysing the technical parameters which reflect the perception of quality from the consumer standpoint.

The method used in this study relied on field tests performed from the user's standpoint, by using an automatic measurement system that reflects the several features affecting the quality of the services (end-to-end measurements). Measurements were carried out on equal terms for the three operators, i.e. at the same time, in the same locations and with the same parameters, thus making it possible to perform a comparative analysis of the observed performances.

The main quality indicators were analysed, considering the user's perspective and the services under study:

1. **Service Accessibility** – probability of a user having access to the services, i.e. probability of success when sending messages;
2. **Message Delivery Rate** – probability of a message being successfully delivered to the receiver, i.e. the relationship between the number of messages successfully received by the receiving terminal equipment and the number of messages sent by originating terminal equipment.
3. **Message Delivery Time** – time taken from the beginning of the sending of a message to the Message Centre and the end of the reception of that message by the receiving terminal equipment.
4. **Variation of these indicators throughout the day.**

Field measurements took place from the installations of ANACOM in Porto and Barcarena, on 17, 18, 19, 20, 27, and 28 December 2011. 15,592 test messages were sent, amounting to approximately 72 hours of tests.

The sample used provided global results for each operator, with a maximum error below 1.2% for the *Service Accessibility* and *Message Delivery Rate* indicators, and below 1.6 seconds for the *Message Delivery Time* indicator, for a 95% confidence level.

In view of these services' penetration rate and the diversity of the terminal equipment that is used, and given each user's subjective view, it is impossible to rigorously reproduce each consumer's conditions of interaction with the networks. In this context, the results of this study must be understood as an indicator of the overall behaviour of the mobile communications systems, since it does not intend to assess the mobile operators' compliance with licences. The transposition/extrapolation of these results to specific situations requires some prudence, at the risk that biased conclusions might be drawn.

The technical and methodological options of this study directly influenced its results and must be taken into account when analysing the results, as follows:

- Tests were exclusively based on a technical solution (hardware + software) and performed totally automatically, thereby setting a level playing field for the monitoring of the three operators and eliminating the subjectivity inherent to the human user;
- It used NOKIA N95 terminal equipment configured for the automatic selection of the GSM or UMTS infrastructure. These terminals were kept motionless in locations with adequate (good) radio coverage and with minimum interference, each of them performing a single function, i.e., message originator or receiver;
- Test message sizes were 120 characters, for SMS, and 95kB for MMS, the latter being composed of text and image.
- The minimum wait between the consecutive sending of messages was 70 seconds, for SMS, and 120 seconds for MMS;
- Messages with delivery times over 175 seconds for SMS or 818 seconds for MMS, or which had content errors were considered failed messages.
- The results of the study only reflect the behaviour of the networks in the locations and at the time the measurements were taken; any technical interventions in the networks by operators

may alter the quality levels of the services provided.

I.II MAIN RESULTS AND CONCLUSIONS

Mobile communications systems present a very good SMS messaging performance. Operators provide full accessibility to the service and deliver all messages sent, with average times below seven seconds, both on business days and at weekends.

Operators have a very good performance for MMS messaging at weekends, with delivery rates above 98.7% and average delivery times below 38.6 seconds. On business days, TMN and VODAFONE maintain their performance levels while OPTIMUS suffers a decline to levels that are still acceptable, particularly with regard to the message delivery rate.

SMS – Short Message Service

The mobile communications services of the studied operators register very good performance levels in the SMS service. In the tests carried out, all messages were sent and delivered successfully, both on business days and at weekends (*Figure 1 – SMS Message Accessibility, Delivery Rate and Delivery Time indicators*).

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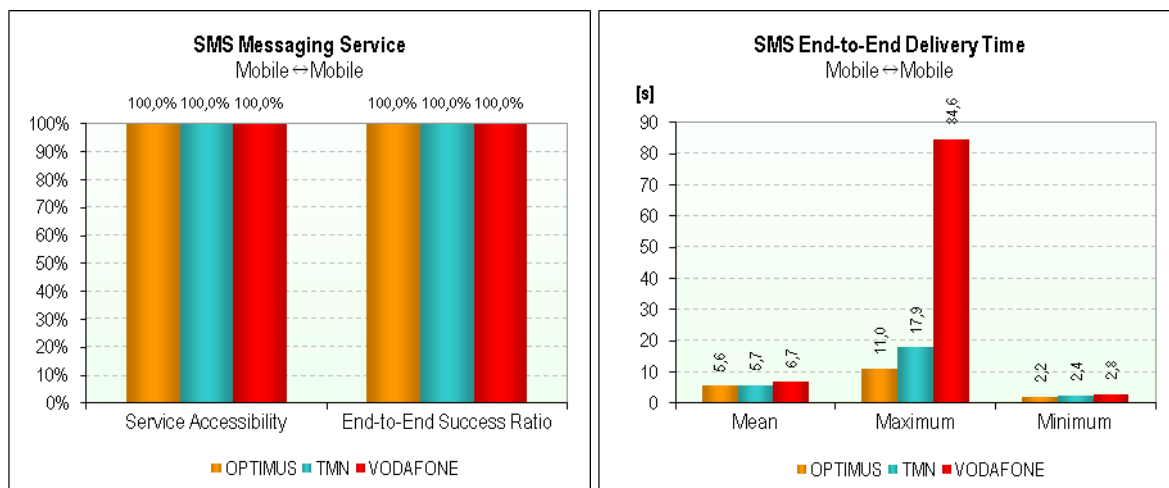


Figure 1 – SMS Message Accessibility, Delivery Rate and Delivery Time indicators.

The average message delivery times recorded were also very good. OPTIMUS and TMN record the best performances, with average times of 5.6 and 5.7 seconds, respectively, while VODAFONE records 6.7 seconds (*Figure 1 – SMS Message Accessibility, Delivery Rate and Delivery Time indicators*).

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Mobile operators registered no major variations in the performance of their SMS messaging throughout the day, bearing in mind consumers' expectations (*Figure 2 – Time variation of Average SMS Send Time indicator*).

and *Figure 3 – Time variation of Average SMS Delivery Time indicator*.

). The greatest variation was recorded in the *Average SMS Delivery Time* indicator, by VODAFONE; however the difference between the best and worst level recorded is no more than 1.9 seconds (*Figure 3 – Time variation of Average SMS Delivery Time indicator*).

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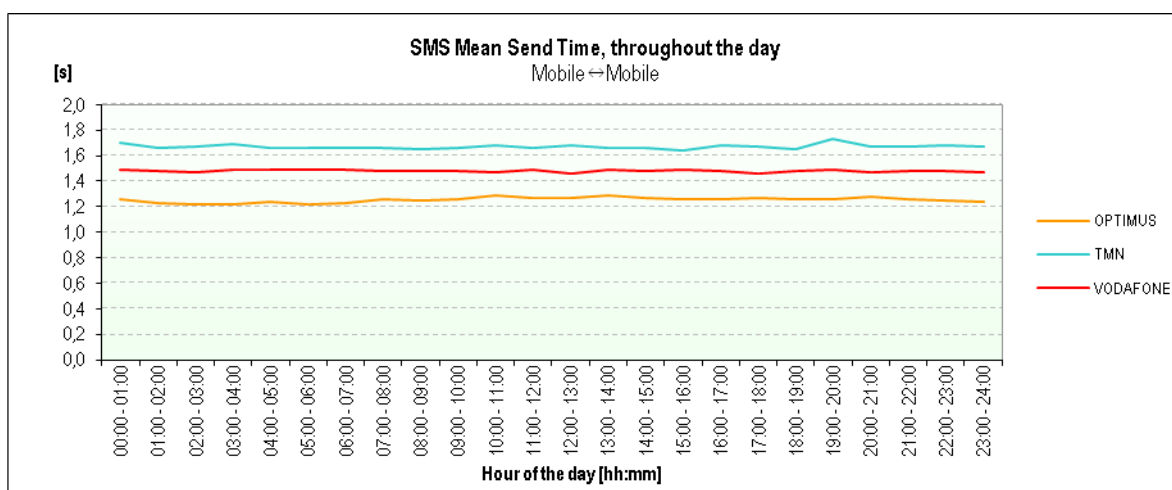


Figure 2 – Time variation of Average SMS Send Time indicator.

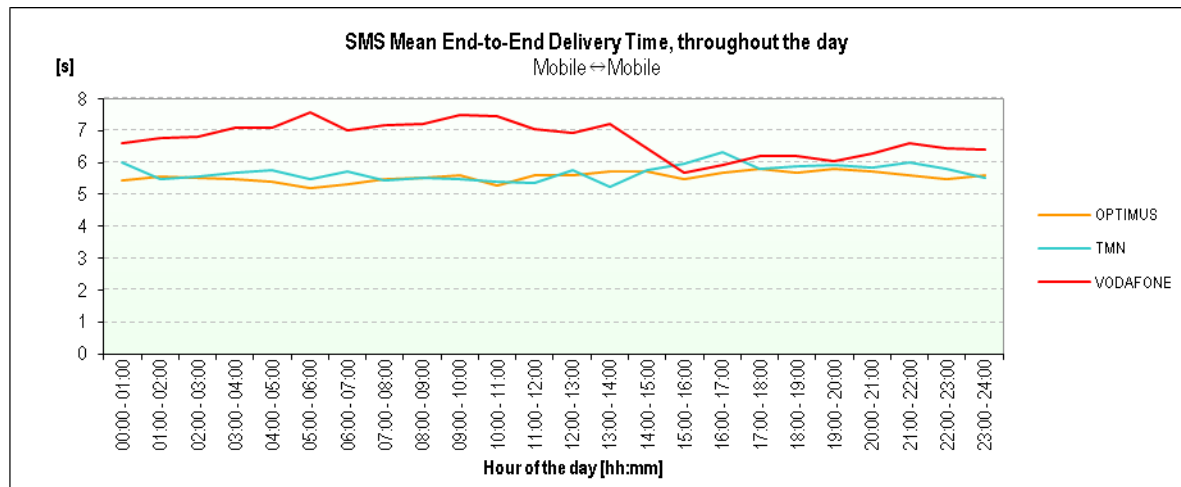


Figure 3 – Time variation of Average SMS Delivery Time indicator.

MMS – Multimedia Messaging Service

The MMS messaging service exhibits different performances between operators and between business days and weekends.

TMN presents the best performance, since all messages were sent and delivered without any flaws, and it presents the best average message delivery time, both on business days and at weekends (*Figure 4 – MMS Messaging Send Rate, Notification Rate, Reception Rate, Delivery Rate and Delivery Time indicators, on business days.*

and *Figure 5 – MMS Messaging Send Rate, Notification Rate, Reception Rate, Delivery Rate and Delivery Time indicators, at weekends.*

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VODAFONE also has a very good performance, which is slightly better at weekends than on business days. The message send and delivery rates recorded by this operator are above 98.8%, and the average delivery times are 40.3 seconds on business days and 38.6 seconds at weekends (*Figure 4 – MMS Messaging Send Rate, Notification Rate, Reception Rate, Delivery Rate and Delivery Time indicators, on business days.*

and Figure 5 – MMS Messaging Send Rate, Notification Rate, Reception Rate, Delivery Rate and Delivery Time indicators, at weekends.

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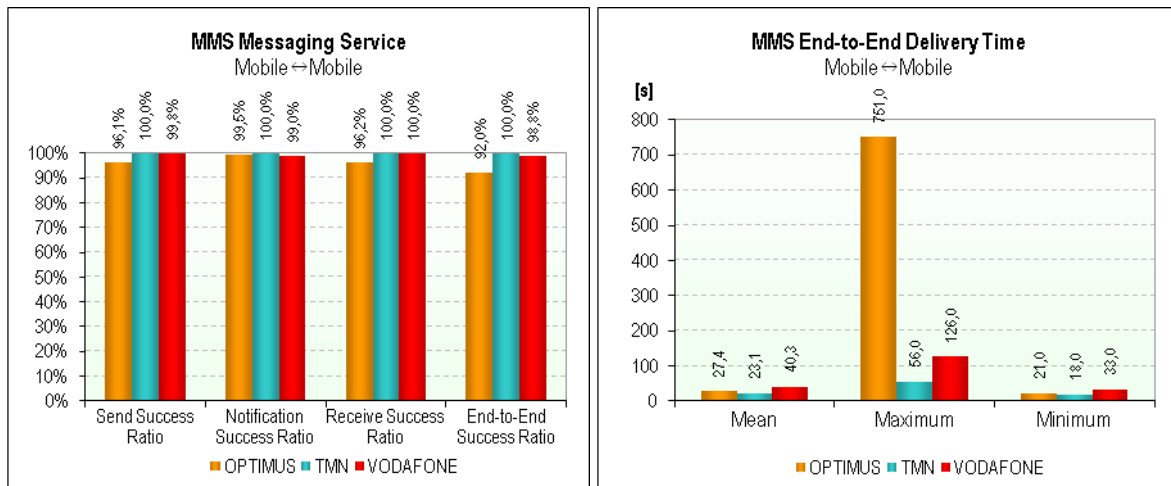


Figure 4 – MMS Messaging Send Rate, Notification Rate, Reception Rate, Delivery Rate and Delivery Time indicators, on business days.

Meanwhile, OPTIMUS exhibits different performances between business days and weekends, particularly in relation to the message send and delivery rates. At the weekend this operator has a very good performance, with message send and delivery rates above 98.7%, and an average MMS delivery time of 27.9 seconds (Figure 5 – MMS Messaging Send Rate, Notification Rate, Reception Rate, Delivery Rate and Delivery Time indicators, at weekends.

). On business days there is a decline to acceptable levels in the performance of the service, in both the sending and delivery of messages. Only 96.1% of MMS messages were sent successfully and only 92% were delivered. The average message delivery time remained good, at 27.4 seconds (Figure 4 – MMS Messaging Send Rate, Notification Rate, Reception Rate, Delivery Rate and Delivery Time indicators, on business days.

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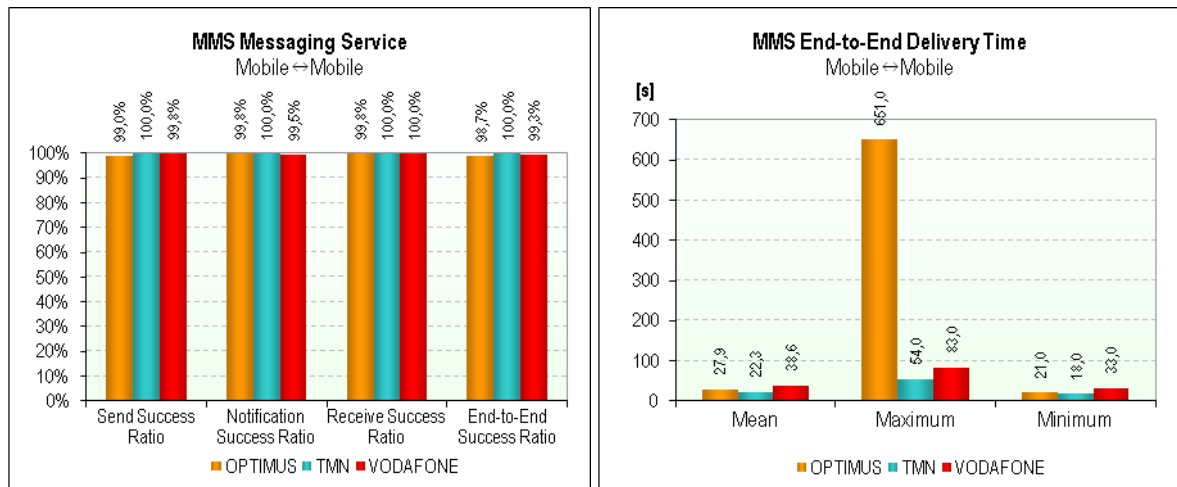


Figure 5 – MMS Messaging Send Rate, Notification Rate, Reception Rate, Delivery Rate and Delivery Time indicators, at weekends.

MMS messaging has different performances during the course of the day, for each operator (Figure 6 – Time variation of the MMS Message Send Rate indicator, on business days.

, Figure 7 – Time variation of the MMS Message Send Rate indicator, at weekends.

, Figure 8 – Time variation of the MMS Message Delivery Rate indicator, on business days.

, Figure 9 – Time variation of the MMS Message Delivery Rate indicator, at weekends.

, Figure 10 – Time variation of the Average MMS Message Delivery Time indicator, on business days.

and Figure 11 – Time variation of the Average MMS Message Delivery Time indicator, at weekends.

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TMN registers no variation in the sending and delivery rates, since all MMS messages were sent and delivered without failures (Figure 6 – Time variation of the MMS Message Send Rate indicator, on business days.

, Figure 7 – Time variation of the MMS Message Send Rate indicator, at weekends.

, *Figure 8* – Time variation of the *MMS Message Delivery Rate* indicator, on business days.

and *Figure 9* – Time variation of the *MMS Message Delivery Rate* indicator, at weekends.

). Nor does the average message delivery time recorded by this operator exhibit major variations over the day, either on business days or at weekends (*Figure 10* – Time variation of the *Average MMS Message Delivery Time* indicator, on business days.

and *Figure 11* – Time variation of the *Average MMS Message Delivery Time* indicator, at weekends.

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VODAFONE presents no major variations in the MMS messaging send rate during the course of the day, either on business days or at weekends (*Figure 6* – Time variation of the *MMS Message Send Rate* indicator, on business days.

and *Figure 7* – Time variation of the *MMS Message Send Rate* indicator, at weekends.

). However, there are small variations in the delivery rate and the average message delivery time; the most relevant recorded in the 12:00-24:00 period, on business days (*Figure 8* – Time variation of the *MMS Message Delivery Rate* indicator, on business days.

, *Figure 9* – Time variation of the *MMS Message Delivery Rate* indicator, at weekends.

, *Figure 10* – Time variation of the *Average MMS Message Delivery Time* indicator, on business days.

and *Figure 11* – Time variation of the *Average MMS Message Delivery Time* indicator, at weekends.

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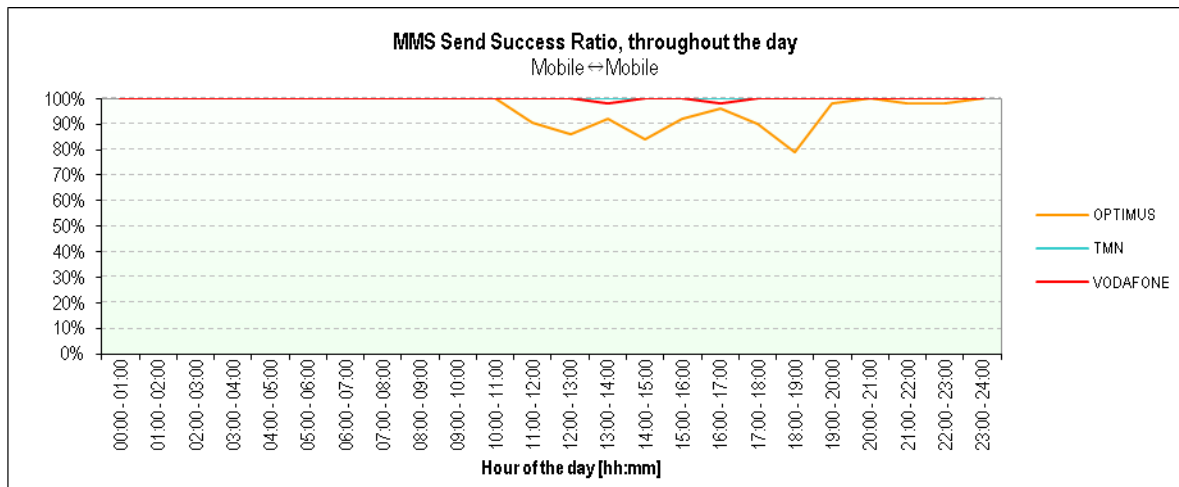


Figure 6 – Time variation of the MMS Message Send Rate indicator, on business days.

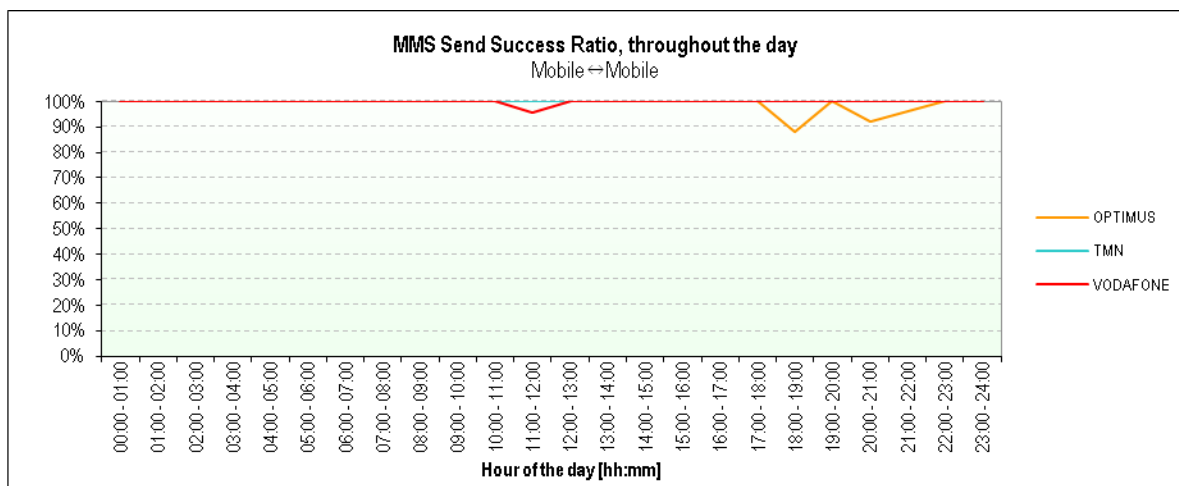


Figure 7 – Time variation of the MMS Message Send Rate indicator, at weekends.

Operator OPTIMUS has significant performance variations, particularly in the MMS message send rate and delivery rate. The lowest performances for these indicators occur in the 11:00-20:00 period, on business days, and in the 18:00-22:00 period, at weekends (Figure 6 – Time variation of the MMS Message Send Rate indicator, on business days.

, Figure 7 – Time variation of the MMS Message Send Rate indicator, at weekends.

, Figure 8 – Time variation of the MMS Message Delivery Rate indicator, on business days.

and Figure 9 – Time variation of the MMS Message Delivery Rate indicator, at weekends.

) There are no major variations in the average message delivery time indicator for most of the day. However, poor performances were recorded over some short periods: 1:00-2:00, 3:00-4:00 and 7:00-8:00, on business days; 1:00-2:00 and 3:00-4:00, at weekends (*Figure 10 – Time variation of the Average MMS Message Delivery Time indicator, on business days.*

and *Figure 11 – Time variation of the Average MMS Message Delivery Time indicator, at weekends.*

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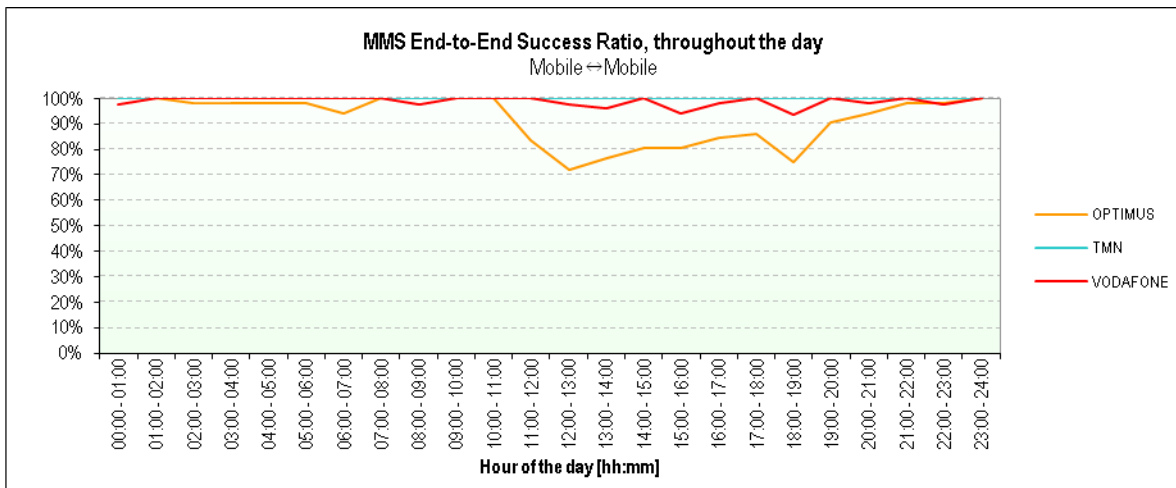


Figure 8 – Time variation of the MMS Message Delivery Rate indicator, on business days.

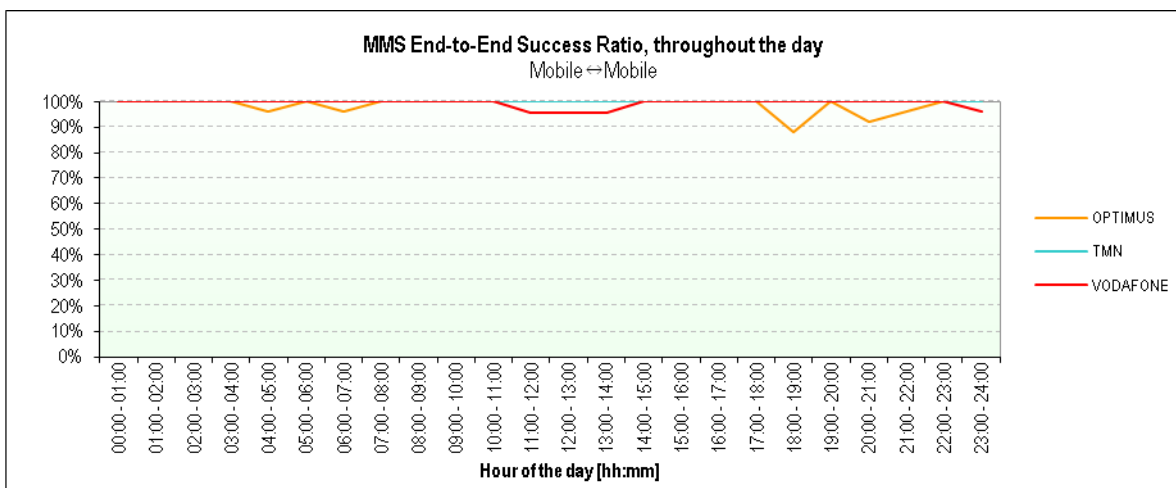


Figure 9 – Time variation of the MMS Message Delivery Rate indicator, at weekends.

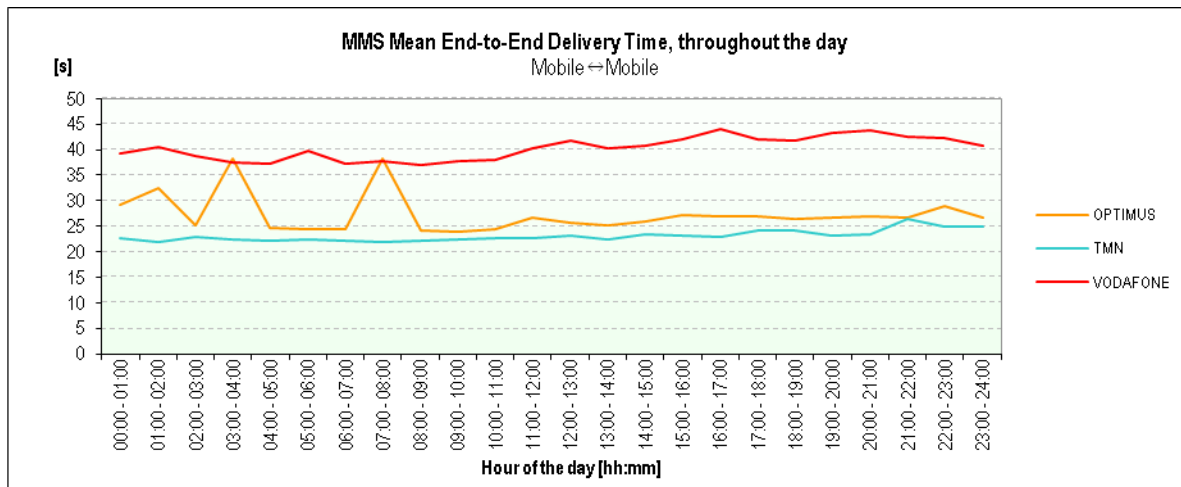


Figure 10 – Time variation of the Average MMS Message Delivery Time indicator, on business days.

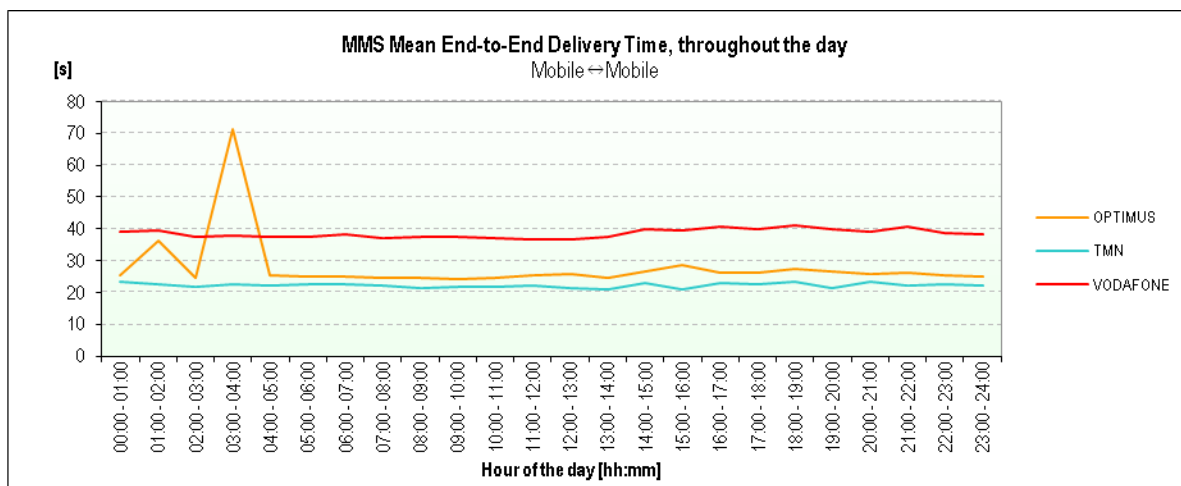


Figure 11 – Time variation of the Average MMS Message Delivery Time indicator, at weekends.