Analyze of ITU-T Recommendations on conformance testing.
Анализ рекомендаций МСЭ-Т по тестированию соответствия

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Рекомендации МСЭ-Т по тестированию

1. Полный перечень в приложении (168).
2. Классификация:

- тестирование соответствия (86)
- тестирование совместимости и взаимодействия,
- тестирование услуг,
- тестирование качества, включая методы субъективного тестирования,

- рейтинговое тестирование,
- тестовые последовательности (вызовы, сигналы и т.д.),
- тестирование воздействий (перенапряжения, избыточные токи и т.д.),
- тестирование отдельных физических элементов сети (кабели, оптические усилители и т.д.),
- тестовое оборудование.

Тестирование соответствия:

- методологические рекомендации (8),
- рекомендации по автоматизации тестирования (10),
- рекомендации по тестированию протоколов (48),
- рекомендации по тестированию услуг (3),
- рекомендации по тестированию качества (1).

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Методологические рекомендации по тестированию соответствия

X.290 – OSI conformance testing methodology and framework for protocol recommendations for ITU-T applications – General concept.

X.291 – Abstract Test Suite (ATS) Specification

X.292*– The Tree and Tubular Combined Notation (TTCN)

X.293 – Test realization

X.294 – Requirements on test laboratories and clients for the conformance assessments process

X.295 – Protocol profile test specification

X.296 – Implementation conformance statements

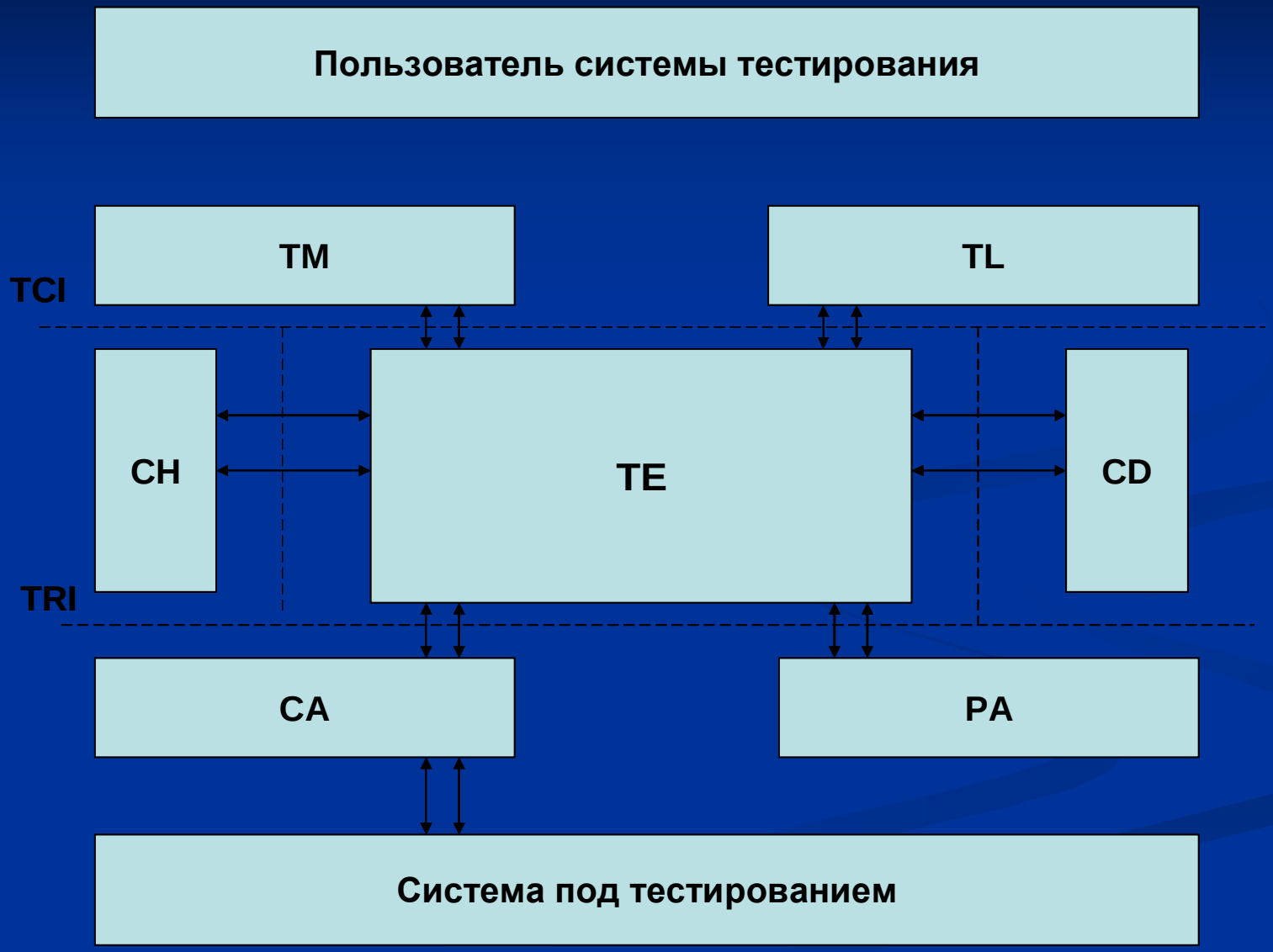
X.29x – Апрель 1995

* - май, 2002

- PICS – Protocol Implementation Conformance Statement. Протокол PICS определяет процедуру тестирования для базовой спецификации.
- PIXIT - Protocol Implementation eXtra Information for Testing. Протокол PIXIT определяет процедуру тестирования для дополнительных (опциональных) спецификаций. Оба протокола – PICS и PIXIT – представляются в формализованном виде с помощью ATS (Abstract Test Suite), что должно обеспечивать возможность применения языка TTCN для тестирования спецификаций.
- TSS & TP – Test Suite Structure & Test Purposes.

Рекомендации по автоматизации тестирования (TTCN-3)

Архитектура программно-аппаратных средств TTCN-3



TRI – TTCN-3 Runtime Interface (интерфейс функционирования),
TCI – TTCN-3 Control Interface (интерфейс управления),
TE – TTCN-3 Executable (ядро TTCN-3),
CD – Coding/Decoding (система кодирования/декодирования),
CH – Component Handling (система компонентов),
SA – System Adaptor (системный адаптер),
PA – Platform Adaptor (адаптер платформы).
TM – Test Management
TM – Test Logging
} (блоки управления)

Язык TTCN-3 представляет собой набор тестов, которые в целом независимы от методов тестирования, протоколов, уровней модели взаимодействия открытых систем (за исключением физического). Различные сценарии тестирования для TTCN-3 определяются либо в табличной (Z.162, ES 201 873-2), либо в графической форме (Z.163, ES 201 873-3).

- Стандарты TTCN-3 включают в себя:
- базовый язык (Z.161, ES 201 873-1),
- табличный формат представления (Z.162, ES 201 873-2),
- графический формат представления (Z.163, ES 201 873-3),
- семантику языка (Z.164, ES 201 873-4),

- интерфейс функционирования TTCN-3 TRI (TTCN-3 Runtime Interface), (Z.165, ES 201 873-5),
- интерфейс управления TTCN-3 (Z.166, ES 201873-6),
- спецификации использования ASN.1 в TTCN-3 (Z.167, ES 201 873-7),
- спецификации использования IDL в TTCN-3 Z.168 (ES 201 873-8),
- спецификации использования XML в TTCN-3 Z.169 (ES 201 873-9),
- спецификации документами TTCN-3 Z.170 (ES 201 873-10).
- Z.16x – ноябрь 2007
- Z.167, Z.169 – ноябрь 2008

Тестирование протоколов

1. ОКС№7, 1997, 1999.

Q.784.2. ATS (Abstract Test Suite) для ISUP'92, базовый вызов.

Q.784.3. TSS&TP (Test Suite Structure and Test Purposes) для ISUP'92, базовый вызов.

Q.785.2. TSS&TP для ISUP'92, дополнительные услуги.

Q.787.Тестовые спецификации (функциональные) для подсистемы транзакций ТС (Transaction capabilities).

2. Цифровой широкополосный доступ (B-ISDN), абонентская система сигнализации DSS2.

   Q.2931, Q.2961, Q.2962, Q.2963, Q.2965, Q,2971 – TSS&TP, ATS, PICS, PIXIT.

- Q.1912.5B. Interworking between Session Initiation Protocol (SIP) and bearer independent call control protocol (BICC) or ISDN user part (ISUP): Protocol implementation conformance statement (PICS). October, 2008.
- Q. 1912.5C. Interworking between Session Initiation Protocol (SIP) and bearer independent call control protocol (BICC) or ISDN user part (ISUP). Test suite structure and rest purposes (TSS&TP) for profile A and B. October, 2008.
- Q.1912.5D. Interworking between Session Initiation Protocol (SIP) and bearer independent call control protocol (BICC) or ISDN user part (ISUP). Test suite structure and rest purposes (TSS&TP) for profile C. October, 2008.
- Q.1912.5E. Interworking between Session Initiation Protocol (SIP) and bearer independent call control protocol (BICC) or ISDN user part (ISUP). Abstract Test Suite (ATS) and partial Protocol Implementation eXtra Information for Testing (PIXIT) for profiles A and B October, 2008.

Рекомендации по тестированию услуг

1. ОКС№7: Q.785.2. ISUP'92 supplementary services: TSS&TP. March, 1999.
2. Q.Conf-TIP-TIR B: Terminating Identification Presentation (TIP) and Terminating Identification Restriction (TIR) - Part 1: Protocol Implementation Conformance Statement (PICS).

   Q. Conf-TIP-TIR C: Terminating Identification Presentation (TIP) and Terminating Identification Restriction (TIR) - Part 2: Test Suite Structure and Test Purposes (TSS&TP).

   Q. Conf-TIP-TIR D: Terminating Identification Presentation (TIP) and Terminating Identification Restriction (TIR) - Part 4: ATS & PIXIT.

   Q. Conf-OIP-OIR B: Originating Identification Presentation (OIP) and Originating Identification Restriction (OIR) - Part 1: Protocol Implementation Conformance Statement (PICS).

   Q. Conf-OIP-OIR C: Originating Identification Presentation (OIP) and Originating Identification Restriction (OIR) - Part 2: Test Suite Structure and Test Purposes (TSS&TP).

   Q. Conf-OIP-OIR D: Originating Identification Presentation (OIP) and Originating Identification Restriction (OIR) - Part 3: ATS &PIXIT.

   Q. Conf-Hold B. Communication HOLD (CH) - Part 1: Protocol Implementation Conformance Statement (PICS).

   Q. Conf-Hold C. Communication HOLD (CH) - Part 2: Test Suite Structure and Test Purposes (TSS&TP)

Рекомендации по тестированию качества

P.564 “Conformance testing for voice over IP transmission quality assessment models”. November, 2007.

Специфическая методология, основанная на использовании набора тестовых векторов.

Речевой файл формируется четырьмя говорящими (два мужчины и две женщины) в качестве четырех восьмисекундных интервалов.

Выводы

1. МСЭ-Т уделяет большое внимание проблемам тестирования и в настоящее время действует 168 рекомендаций МСЭ-Т в этой области.
2. Около половины рекомендаций в настоящее время посвящено тестированию соответствия, большинство из них – тестированию соответствия для протоколов.
3. В разработке находится значимое число рекомендаций по тестированию соответствия услуг как нового направления в развитии тестирования. Проблемы тестирования соответствия классов и параметров качества обслуживания еще требуют своего решения.

Приложение

1. 1. E.424. Test calls. October, 1992.
2. 2. E.439. Test call measurements to access N-ISDN 64 kbit/s circuit-switched bearer service UDI in operation. March, 2000.
3. 3. E.456. Test transaction for facsimile transmission performance. March, 1998.
4. 4. E.300 serSup5. Modeling of an experimental test design for the determination of inexperienced user difficulties in setting up international calls using nationally available instructions, or to compare different sets of instructions. October, 1984.

5. 5. G.650.1. Definition and test methods for linear, deterministic attributes of single-mode fibre and cable. June, 2004.
6. 6. G.650.2. Definition and test methods for statistical and non-linear related attribute of single mode fibre and cable. July, 2007.
7. 7. G.650.3. Test methods for installed single mode optical fibre and cable. March, 2008.
8. 8. G.661. Definition and test methods for the relevant generic parameters of optical amplifier devices and subsystem. July, 2007.

9. G.967.3. V – interfaces at the Service Node (SN): Protocol implementation conformance statements for interfaces at VB5 reference points. March, 2000.
10. G.976. Test methods applicable to optical fibre submarine cable systems. July, 2007.
11. G.996.1. Test procedures for digital subscriber line (DSL) transiviers. February, 2001.
12. G.Sup.44. Test plan to verify B-PON interoperability. June, 2007.
13. G.Sup.46. G-PON interoperability test plan between optical line termination and optical network units. May, 2009

14. H.248.17. Line test packages. November, 2002.
15. H.264.1. Conformance specification for H.264 advanced video coding. June, 2008.

16. J.19. A conventional test signal simulating soung-programme signals for measuring interference in other channels. CMTT 571-2. November, 1988.
17. J.26. Test signals to be used on international sound-programme connection. CMTT 645-1. June, 1990.
18. J.63. Insertion of test signals in the field-blanking interval of monochrome and colour television signals. CMTT 473-5. June, 1990.
19. J.64. Definitions of parameters for simplified automatic measurement of television insertion test signals. CMTT 569-2. February, 1986.

20. J.65. Standard test signal for conventional loading of a television channel. CMTT 570. February, 1978.
21. J.67. Test signals and measurement techniques for transmission circuits carring MAC/packet signals. CMTT 772-1. March, 2001.
22. J.101. Measurement methods and test procedures for teletext signals. CMTT 720. June, 1990.
23. J.147. Objective picture quality measurement methods by use of in-service test signals. July, 2002.

24. K.38. Radiated emission test procedure for physically large system. October, 1996.
25. K.44. Resistibility tests for telecommunication equipment exposed to overvoltages and overcurrents – Basic Recommendation. April, 2008.
26. K.49. Test requirements and performance criteria for voice terminal telephones subject to disturbance from digital mobile telecommunications systems. December, 2005.
27. .K.54. Conducted immunity test methods and level at fundamental power frequences. December, 2004.
28. K.60. Emission levels and test method for wireline telecommunication networks to minimize electromagnetic disturbance of radio services. February, 2008.
29. K.65. Overvoltage and overcurrent requirements for termination modules with contacts for test ports or SPD's (Surge Protective Devices). December, 2004.

30. L.66. Optical fibre cable maintenance criteria for in-service fibre testing in access networks. May, 2007.
31. L.68. Optical fibre cable maintenance support, monitoring and testing system for optical fibre cable networks carrying high total optical power. October, 2007.
32. L.75. Test, acceptance and maintenance methods of cooper subscriber pairs. May, 2008.

33. M. 110. Circuit testing. November, 1988.
34. M. 556. Setting up and initial testing of digital channels on an international digital path or block. November, 1988.
35. M.665. Testing of echo cancellers. November, 1988.
36. M.717. Testing point (transmission). November, 1988.
37. M.718. Testing point (line signaling). November, 1988.
38. M.719. Testing point (switching and interregister signaling). November, 1988.
39. M.732. Signaling and switching routine maintenance tests and measurements. November, 1988.

40. M.734. Exchange of information on incoming test facilities at international switching centers. November, 1988.
41. M.820. Periodicity of routine tests on international voice-frequency telegraph links. November, 1988.
42. M.1235. Use of automatically generated test calls for assessment of network performance. November, 1988.
43. M.3031. Guide lines for implementation Conformance Statement proformas for tML schemes. July, 2004.
44. M.3611. Test management of the B-ISDN ATM layer using the TMN. April, 1997.
45. M.3620. Principles for the use of ISDN test calls, systems and responders. October, 1992.

46. N.62. Tests to be made during the line-up period that precedes a television transmission. March, 1993.
47. N.63. Test signals to be used by the broadcasting organizations during the preparatory period. November, 1988.

48. O.3. Climatic conditions and relevant tests for measuring equipment. October, 1992.
49. O.6. 1020 Hz reference test frequency. November, 1988.
50. O.22. CCITT automatic transmission measuring and signaling testing equipment ATME N2. October, 1992.
51. O.201. Q – factor test equipment to estimate the transmission performance of optical channels. July, 2003.
52. O.211. Test and measurement equipment to perform tests at the IP layer. January, 2006.

53. P.78. Subject testing method for determination of loudness ratings in accordance with Recommendation P.76. February, 1996.
54. P.501. Test signals for use in telephonometry. June, 2007.
55. P.502. Objective test methods for speech communication system using complex test signals. May, 2000.
56. P.564. Conformance testing for voice over IP transmission quality assessment models. November, 2007.

57. P.833. Methodology for derivation of equipment impairment factors from subjective listing – only tests. February, 2001.
58. P.833.1. Methodology for derivation of equipment impairment factors from subjective listing – only tests for wideband speech codes. April, 2009.
59. P.835. Subjective test methodology for evaluating speech communication systems that include noise suppression algorithm. November, 2003.
60. P.840. Subjective listening method for evaluating circuit multiplaction equipment. November, 2003.
61. P. 920. Interactive test methods for audiovisual communications. May, 2000.

62. Q. 707. Testing and maintenance (SS N7). November, 1988.
63. Q.755. Signaling System N7 protocol tests. March, 1993.
64. Q.755.1. MTP Protocol Tester. May, 1998.
65. Q. 755.2. Transaction capabilities test responder. September, 1997.
66. Q.765 bis. Signaling System N7. Application transport mechanism. Test suite structure and test purpose (TSS&TP). December, 1998.
67. Q.765.1 bis. Abstract test suite for the APM support of VPN applications. December, 1999.
68. Q.783. TUP test specification. November, 1988.
69. Q.784. ISUP basic call test specification. February, 1991.

70. Q.784.1. ISUP basic call test specification. Validation and compatibility for ISUP'92 and Q.767 protocols. July, 1996.
71. Q.784.2. ISUP basic call test specification. Abstract test suite for ISUP'92 basic call control procedure. June, 1997.
72. Q.784.3. ISUP basic call test specification. Test suite structure and test purposes (TSS&TP). December, 1999.
73. Q.785. ISUP protocol test specification for supplementary services. September, 1991.
74. Q.785.2. ISUP'92 supplementary services: Test suite structure and test purposes (TSS&TP). March, 1999.
75. Q.786. SCCP test specification. March, 1993.
76. Q.787. Transaction capabilities (TC) test specification. September, 1997.
77. Q.835. Line and line circuit test management of ISDN and analogue customer accesses. March, 1999.
78. Q.921 bis. Abstract test suite for LAPD conformance testing. March, 1993.
79. Q.933 bis. Abstract test suite signaling specification for frame mode basic call control conformance testing for permanent virtual connections (PVC). October, 1995.

80. Q.1600 bis. Signaling system N7. Interaction between ISDN user part ISUP'97 and INAP CS-1: Test suite structure and test purposes (TSS&TP). December, 1999.
81. Q.1912.5B. Interworking between Session Initiation Protocol (SIP) and bearer independent call control protocol (BICC) or ISDN user part (ISUP): Protocol implementation conformance statement (PICS). October, 2008.
82. Q. 1912.5C. Interworking between Session Initiation Protocol (SIP) and bearer independent call control protocol (BICC) or ISDN user part (ISUP). Test suite structure and test purposes (TSS&TP) for profile A and B. October, 2008.
83. Q.1912.5D. Interworking between Session Initiation Protocol (SIP) and bearer independent call control protocol (BICC) or ISDN user part (ISUP). Test suite structure and test purposes (TSS&TP) for profile C. October, 2008.
84. Q.1912.5E. Interworking between Session Initiation Protocol (SIP) and bearer independent call control protocol (BICC) or ISDN user part (ISUP). Abstract Test Suite (ATS) and partial Protocol Implementation eXtra Information for Testing (PTXIT) for profiles A and B October, 2008.
85. Q.2931 B. Broadband integrated services digital network (B-ISDN). Digital subscriber signaling system N2(DSS2). User network interface (UNI) layer 3 specification for basic call/connection control: Protocol implementation conformance statement (PICS) proforma. December, 2000.

86. Q.2931.C. Broadband integrated services digital network (B-ISDN). Digital subscriber signaling system N2(DSS2). User network interface (UNI) layer 3 specification for basic call/connection control. Test suite structure and test purposes (TSS&TP) for the user. December, 2000.

87. Q.2931.D. Broadband integrated services digital network (B-ISDN). Digital subscriber signaling system N2(DSS2). User network interface (UNI) layer 3 specification for basic call/connection control. Abstract Test Suite (ATS) and partial Protocol Implementation eXtra Information for Testing (PTXIT) proforma for user. December, 2000.

88. Q.2931.E. Broadband integrated services digital network (B-ISDN). Digital subscriber signaling system N2(DSS2). User network interface (UNI) layer 3 specification for basic call/connection control: Test suite structure and test purposes (TSS&TP) for the network. December, 2000.

89. Q.2931 F. D. Broadband integrated services digital network (B-ISDN). Digital subscriber signaling system N2(DSS2). User network interface (UNI) layer 3 specification for basic call/connection control. Abstract Test Suite (ATS) and partial Protocol Implementation eXtra Information for Testing (PTXIT) proforma for the network. December, 2000.

90. Q. 2961B. Digital subscriber signaling system N2 (DSS2). Additional traffic parameters. Protocol Implementation Conformance Statement (PICS). December, 2000.
91. Q.2961C. Digital subscriber signaling system N2 (DSS2). Additional traffic parameters. Test suite structure and test purposes (TSS&TP) for the user. December, 2000.
92. Q.2961D. Digital subscriber signaling system N2 (DSS2). Additional traffic parameters. Abstract Test Suite (ATS) and partial Protocol Implementation eXtra Information for Testing (PTXIT) proforma for the user. December, 2000.
93. Q.2961E. Digital subscriber signaling system N2 (DSS2). Additional traffic parameters. Test suite structure and test purposes (TSS&TP) for the network. December, 2000.
94. Q.2961F. Digital subscriber signaling system N2 (DSS2). Additional traffic parameters. Abstract Test Suite (ATS) and partial Protocol Implementation eXtra Information for Testing (PTXIT) proforma for the network. December, 2000.
95. Q.2962B. Digital subscriber signaling system N2 – Connection characteristics negotiation during call/connection establishment phase: Protocol Implementation Conformance Statement (PICS) proforma. December, 2000.

96. Q.2962C. Digital subscriber signaling system N2 – Connection characteristics negotiation during call/connection establishment phase. Test suite structure and test purposes (TSS&TP) for the user. December, 2000.
97. Q.2962D. Digital subscriber signaling system N2 – Connection characteristics negotiation during call/connection establishment phase. Abstract Test Suite (ATS) and partial protocol implementation extra information for testing ((PTXIT) proforma for user. December, 2000.
98. Q.2962E. Digital subscriber signaling system N2 – Connection characteristics negotiation during call/connection establishment phase. Test suite structure and test purposes (TSS&TP) for the network. December, 2000.
99. Q.2962F. Digital subscriber signaling system N2 – Connection characteristics negotiation during call/connection establishment phase. Abstract Test Suite (ATS) and partial protocol implementation extra information for testing ((PTXIT) proforma for network. December, 2000.

100. Q.2963.1B. Digital subscriber signaling system N2 – Connection modification: Peak call rate modification by the connection owner: Protocol Implementation Conformance Statement (PICS) proforma. December, 2000.
101. Q.2963.1C. Digital subscriber signaling system N2 – Connection modification: Peak call rate modification by the connection owner. Test suite structure and test purposes (TSS&TP) for the user. December, 2000.
102. Q.2963.1D. Digital subscriber signaling system N2 – Connection modification: Peak call rate modification by the connection owner Abstract Test Suite (ATS) and partial protocol implementation extra information for testing ((PTXIT) proforma for the user. December, 2000.
103. Q.2963.1E. Digital subscriber signaling system N2 – Connection modification: Peak call rate modification by the connection owner. Test suite structure and test purposes (TSS&TP) for the network. December, 2000.

104. Q.2963.1F. Digital subscriber signaling system N2 – Connection modification: Peak call rate modification by the connection owner Abstract Test Suite (ATS) and partial Protocol Implementation eXtra Information for Testing (PTXIT) proforma for the network. December, 2000.
105. Q. 2965.1B. Digital subscriber signaling system N2 – Support of Quality of Service classes: Protocol Implementation Conformance Statement (PICS) proforma. December, 2000.
106. Q. 2965.2B. Digital subscriber signaling system N2 – Signaling of individual Quality of Service Parameters: Protocol Implementation Conformance Statement (PICS) proforma. December, 2000.
107. Q. 2971C. Digital subscriber signaling system N2 – User-network interface layer 3 specification for point-to-multipoint call/connection control: Test Suite Structure and Test Purposes (TSS&TP) for the user. December, 1999.

108. Q. 2971D. Digital subscriber signaling system N2 – User-network interface layer 3 specification for point-to-multipoint call/connection control. Abstract Test Suite (ATS) and partial Protocol Implementation eXtra Information for Testing (PTXIT) proforma for the user. December, 1999.

109. Q. 2971E. Digital subscriber signaling system N2 – User-network interface layer 3 specification for point-to-multipoint call/connection control. Test Suite Structure and Test Purposes (TSS&TP) and partial Protocol Implementation eXtra Information for Testing (PTXIT) proforma for the network. December, 1999.

110. Q. 2971F. Digital subscriber signaling system N2 – User-network interface layer 3 specification for point-to-multipoint call/connection control. Abstract Test Suite (ATS) and partial Protocol Implementation eXtra Information for Testing (PTXIT) proforma for the network. December, 1999.

111. Q.2991.1. Abstract Test Suite (ATS) for the network integration testing for B-ISDN and B-ISDN/N-ISDN: TSS&TP. December, 1999.
112. Q.2991.2. Abstract Test Suite (ATS) for the network integration testing for B-ISDN and B-ISDN/N-ISDN. ICS&IIT and ATS. December, 1999.
113. Q.3900. Methods of testing and model network architecture for NGN technical means testing as applied to public telecommunication networks. September, 2006.
114. Q.3901. Distribution of tests and services for NGN technical means testing in the model and operator networks. January, 2008.
115. Q.3903. Formalized presentation of testing results. October, 2008.
116. Q.Sup.1. Signaling System N7 testing and planning tools. October, 1995.

117. T.5. Test methodology for Group 3 Facsimile terminal for document transmission. February, 1998.
118. T.22. Standardized test chart for document facsimile transmissions. March, 1993.
119. T.23. Standardized colour test chart for document facsimile transmissions. April, 1994.
120. T.83. Information technology – Digital compression and coding of continous-tone still images: Compliance testing. November, 1994.
121. T.803. Information technology – JPEG 2000 image coding system: Conformance testing. November, 2002.
122. T.Sup 1. Compliance testing requirements for Recommendations of the T.170-series. November, 2004.

123. V.54. Loop test devices for modems. November, 1988.
124. V.56. Comparative tests of modems for use over telephone-type circuits. November, 1988.
125. V.56. Test procedure for evaluation of 2-wire 4 kHz voiceband duplex modems. August, 1996.

126. X.150. Principles of maintenence testing for public data networks using Data Terminal Equipment (DTE) and Data Circuit-terminating Equipment (DCE) test loops. November, 1988.
127. X.245. Connection-oriented Session protocol: Protocol Implementation Conformance Statement (PICS) proforma. April, 1995.
128. X.246. Connection-oriented Presentation Protocol. Protocol Implementation Conformance Statement (PICS) proforma. April, 1995.
129. X.247. Protocol Specification for the Association Control Service Element. Protocol Implementation Conformance Statement (PICS) proforma. April, 1995.

130. X.248. Reliable Transfer. Protocol Implementation Conformance Statement (PICS) proforma. April, 1995.
131. X.249. Remote operations. Protocol Implementation Conformance Statement (PICS) proforma. April, 1995.
132. X.255. Connectionless Session Protocol. Protocol Implementation Conformance Statement (PICS) proforma. April, 1995.
133. X.256. Connectionless Presentation Protocol. Protocol Implementation Conformance Statement (PICS) proforma. April, 1995.
134. X.257. Connectionless Presentation Protocol for the Association Control Service Element. Protocol Implementation Conformance Statement (PICS) proforma. April, 1995.
135. X.290. OSI conformance testing methodology and framework for ITU-T applications. General concepts. April, 1995.

136. X.291. OSI conformance testing methodology and framework for ITU-T applications. Abstract test suite specification. April, 1995.
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