|  |  |  |
| --- | --- | --- |
| World Telecommunication Standardization Assembly (WTSA-20) Geneva, 1-9 March 2022 |  | |
|  |  | |
|  |  | |
| PLENARY MEETING | Document | 11-E |
|  | December 2021 | |
|  | Original: English | |
|  | | |
| ITU‑T Study Group 12 | | |
| Performance, QoS and QoE | | |
| Report of ITU-T SG12 to the World Telecommunication Standardization Assembly (WTSA-20), Part I: GENERAL | | |

|  |  |  |
| --- | --- | --- |
| **Abstract:** | This contribution contains the report of ITU-T Study Group 12 to WTSA-20 concerning its activities during the 2017-2021 study period. | |
| **Contact:** | Mr Kwame Baah-Acheamfuor Chairman ITU-T SG12 Ghana | Tel: +233 24 6375700 Email: [kwame.baah-acheamfuor@moc.gov.gh](mailto:kwame.baah-acheamfuor@moc.gov.gh) |

Note by the TSB:

The report of Study Group 12 to the WTSA-20 is presented in the following documents:

Part I: **Document 11** – General

Part II: **Document 12** – Questions proposed for study during the study period 2022-2024

**CONTENTS**

| Page |
| --- |
| [1 Introduction 3](#_Toc90995787)  [2 Organization of work 10](#_Toc90995788)  [3 Results of the work accomplished during the 2017-2020 study period 14](#_Toc90995789)  [4 Observations concerning future work 18](#_Toc90995790)  [5 Updates to the WTSA Resolution 2 for the 2022-2024 study period 18](#_Toc90995791)  [ANNEX 1 - List of Recommendations, Supplements and other materials produced or deleted during the study period 19](#_Toc90995792)  [ANNEX 2 - Proposed updates to the Study Group 12 mandate and Lead Study Group roles 28](#_Toc90995793) |

# 1 Introduction

## 1.1 Responsibilities of Study Group 12

Study Group 12 was entrusted by the World Telecommunications Standardization Assembly (Dubai, 2012) with the study of 19 Questions in the area of performance, quality of service (QoS) and quality of experience (QoE).

## 1.2 Management team and meetings held by Study Group 12

Study Group 12 met 11 times in Plenary and 2 times in Working Partiesin the course of the study period (see Table 1) under the chairmanship of Mr Kwame BAAH-ACHEAMFUOR (Ghana) assisted by Vice-Chairmen Mr Zeid ALKADI (Jordan), Mr Sergio Daniel D'UVA (Argentina), Mr Seyni Malan FATY (Senegal), Ms Rachel HUANG (China), Mr Seong-Ho JEONG (Korea (Rep. of)), Mr Hassan Mukhtar Hassan MOHAMED (Sudan), Mr Al MORTON (United States), Mr Edoyemi OGOH (Nigeria), Mr Mehmet ÖZDEM (Turkey), Mr Tiago Sousa PRADO (Brazil), Mr Aymen SALAH (Tunisia), and Ms Yvonne UMUTONI (Rwanda).

In addition, many Rapporteurs’ meetings (including e-meetings) took place during the study period in different locations, see Table 1-bis. (NOTE: this table does not list weekly Q14/12 calls)

TABLE 1  
Meetings of Study Group 12 and its Working Parties

| **Meetings** | **Place, date** | **Reports** |
| --- | --- | --- |
| SG/WP 12 | E-Meeting, 12-21 October 2021 | SG12–R42 to R45 |
| SG/WP 12 | E-Meeting, 4-13 May 2021 | SG12–R38 to R41 |
| SG/WP 12 | E-Meeting, 6-7 January 2021 | SG12–R37 |
| SG/WP 12 | E-Meeting, 7-11 September 2020 | SG12–R32 to R35 |
| SG/WP 12 | E-Meeting, 15-24 April 2020 | SG12–R28 to R31 |
| SG/WP 12 | Geneva, 26 November - 5 December 2019 | SG12–R24 to R27 |
| WP3/12 | Stockholm, 4 September 2019 | SG12–R23 |
| SG/WP 12 | Geneva, 7-16 May 2019 | SG12–R18 to R21 |
| SG/WP 12 | Geneva, 27 November - 6 December 2018 | SG12–R14 to R17 |
| SG/WP 12 | Geneva, 1-10 May 2018 | SG12–R10 to R13 |
| WP2/12 | Geneva, 15 February 2018 | SG12–R9 |
| SG/WP 12 | Geneva, 19-28 September 2017 | SG12–R5 to R8 |
| SG/WP 12 | Geneva, 10-19 January 2017 | SG12–R1 to R4 |

TABLE 1-bis  
Rapporteur meetings organized under Study Group 12 during the study period

| **Dates** | **Place/Host** | **Question(s)** | **Event name** |
| --- | --- | --- | --- |
| 2016-11-29 | France [Paris] | Q9/12 | Rapporteur meeting for Q9/12 |
| 2017-03-22 to 2017-03-24 | Germany [Berlin] | Q13/12, Q14/12, Q17/12 | Rapporteur group meeting for Q13, Q14, Q17/12 |
| 2017-05-10 to 2017-05-12 | United States | Q14/12 | Rapporteur group meeting for Q14/12 |
| 2017-05-29 to 2017-05-30 | Switzerland [Bern] | Q5/12 | Rapporteur group meeting for Q5/12 |
| 2017-08-02 | Switzerland [Geneva] | Q4/12 | Rapporteur group meeting for Q4/12 |
| 2017-11-27 to 2017-11-29 | Poland [Krakow] | Q14/12 | Rapporteur Group meeting Q14/12 (P.NATS-ph2) |
| 2017-11-28 to 2017-11-29 | Poland [Krakow] | Q13/12 | Rapporteur Group meeting Q13/12 (G.QoE-VR, G.NCP, P.QUITS) |
| 2018-01-23 to 2018-01-24 | United States | Q4/12 | Rapporteur Group meeting Q4/12 (P.ICC) |
| 2018-02-02 | E-Meeting | Q12/12 | Q12/12: E.MTSM editing call |
| 2018-02-14 to 2018-02-15 | Switzerland [Geneva] | Q9/12 | Rapporteur Group meeting Q9/12 (P.863, P.AMD, P.ONRA) |
| 2018-02-27 to 2018-02-28 | Switzerland [Geneva] | Q13/12 | Rapporteur Group meeting Q13/12 (G.QoE-VR, G.NCP, P.QUIT, P.QUITS, rev. G.1070) |
| 2018-03-21 to 2018-03-22 | Senegal [Dakar] | Q12/12 | Rapporteur Group meeting Q12/12 (E.RQUAL, E.QSIMBox, E.QoSMgtMod, G.CSFB) |
| 2018-04-13 | E-Meeting | Q12/12 | Q12/12: E.MTSM editing call |
| 2018-04-23 | E-Meeting | Q17/12 | Q17/12 (Y.1540) |
| 2018-06-19 to 2018-06-21 | E-Meeting | Q14/12 | Rapporteur Group meeting Q14/12 (P.NATS ph2) |
| 2018-06-28 | E-Meeting | Q5/12 | Q5/12: P.Loudness editing call |
| 2018-07-26 | E-Meeting | Q4/12 | Q4/12: P.ICC editing call |
| 2018-09-06 to 2018-09-07 | Turkey [Istanbul] | Q12/12 | Rapporteur Group meeting Q12/12 (E.RQUAL, E.RQST, other work items) |
| 2018-09-19 to 2018-09-21 | Switzerland [Geneva] | Q13/12 | Rapporteur Group meeting Q13/12 (G.NCP, G.QoE-VR, P.360-VR, P.QUITS) |
| 2018-09-27 to 2018-09-28 | Germany [Herzogenrath] | Q4/12 | Rapporteur Group meeting Q4/12 (P.ICC, P.1100 series) |
| 2018-10-16 to 2018-10-17 | Germany [Darmstadt] | Q17/12 | Rapporteur Group meeting Q17/12 (Y.1540) |
| 2018-11-07 | E-Meeting | Q13/12 | Q13/12: G.QoE-VR and P.360-VR |
| 2019-01-29 | E-Meeting | Q17/12 | Q17/12: bimonthly call |
| 2019-02-12 | E-Meeting | Q6/12, Q7/12, Q10/12, Q19/12 | Q7 and Q10/12: monthly call |
| 2019-03-05 to 2019-03-07 | Germany [Berlin] | Q13/12, Q14/12, Q17/12 | Rapporteur Group meeting 'Q44': Qs 13, 14, 17/12, co-located with VQEG |
| 2019-03-06 to 2019-03-07 | Rwanda [Kigali] | Q12/12 | Q12/12 (E.MTSM, E.CrowdESFB, G.CSFB, E.RQUAL) |
| 2019-03-13 to 2019-03-14 | Denmark [Copenhagen] | Q4/12 | Q4/12 (P.ICC) |
| 2019-03-25 | E-Meeting | Q6/12, Q7/12, Q10/12, Q19/12 | Q7 and Q10/12: monthly call |
| 2019-04-10 | E-Meeting | Q17/12 | Q17/12: bimonthly call |
| 2019-04-11 | E-Meeting | Q12/12 | Q12/12: E.MTSM editing call |
| 2019-04-18 | E-Meeting | Q12/12 | Q12/12: E.MTSM editing call |
| 2019-04-29 | E-Meeting | Q12/12 | Q12/12: E.MTSM editing call |
| 2019-06-12 | E-Meeting | Q15/12 | Q15/12: P.VSQMTF editing call |
| 2019-06-19 | E-Meeting | Q12/12 | Q12/12: E.crowdESFB editing call |
| 2019-07-02 | E-Meeting | Q13/12 | Q13/12: G.QUIT editing call |
| 2019-07-08 | E-Meeting | Q15/12 | Q15/12: P.VSQMTF editing call |
| 2019-07-15 | E-Meeting | Q12/12 | Q12/12: E.crowdESFB editing call |
| 2019-07-17 | E-Meeting | Q4/12 | Q4/12: P.ICC editing call |
| 2019-07-31 | E-Meeting | Q17/12 | Q17/12: bimonthly call |
| 2019-08-20 | E-Meeting | Q6/12, Q7/12, Q10/12, Q19/12 | Q7 and Q10/12: monthly call |
| 2019-09-02 to 2019-09-04 | Sweden [Stockholm] | Q13/12, Q14/12, Q17/12 | 'Q44': Qs 13, 14, 17/12 |
| 2019-09-11 | E-Meeting | Q15/12 | Q15/12: G.CMVTQS project call |
| 2019-09-16 | E-Meeting | Q7/12, Q10/12 | Q7 and Q10/12: monthly call |
| 2019-09-18 | E-Meeting | Q3/12 | Q3/12: P.381, P.382 and P.DHIP |
| 2019-10-04 | E-Meeting | Q15/12 | Q15/12: P.VSQMTF editing call |
| 2019-10-08 to 2019-10-09 | Germany [Herzogenrath] | Q4/12 | Rapporteur Group meeting Q4/12 (P.ICC) |
| 2019-10-22 to 2019-10-23 | Germany [Darmstadt] | Q17/12 | Rapporteur Group meeting Q17/12 (Y.1540 Annex B) |
| 2019-11-07 | E-Meeting | Q12/12 | Q12/12: E.crowdESFB editing call |
| 2020-01-07 | E-Meeting | Q5/12 | Q5/12: HATS measurement campaign |
| 2020-01-20 | E-Meeting | Q12/12 | Q12/12: E.QoSMgtMod editing call |
| 2020-01-28 | E-Meeting | Q12/12 | Q12/12: E.crowdESFB editing call |
| 2020-01-30 | E-Meeting | Q12/12 | Q12/12: E.RQST editing call |
| 2020-02-19 | E-Meeting | Q12/12 | Q12/12: E.QoSMgtMod editing call |
| 2020-02-21 | E-Meeting | Q12/12 | Q12/12: E.crowdESFB editing call |
| 2020-02-25 to 2020-02-27 | Sweden [Lulea] | Q13/12, Q14/12, Q17/12 | Rapporteur Group meetings Q13, Q14, Q17/12 |
| 2020-02-26 | E-Meeting | Q3/12 | Q3/12: P.381, P.382 and P.DHIP |
| 2020-02-27 | E-Meeting | Q12/12 | Q12/12: E.RQST editing call |
| 2020-03-12 to 2020-03-13 | E-Meeting | Q19/12 | Rapporteur Group meeting Q19/12 |
| 2020-03-13 | E-Meeting | Q12/12 | Q12/12: E.RQST editing call |
| 2020-03-19 | E-Meeting | Q15/12 | Q15/12: G.CMVTQS project call |
| 2020-03-19 | E-Meeting | Q12/12 | Q12/12: E.QoSMgtMod editing call |
| 2020-03-25 | E-Meeting | Q12/12 | Q12/12: E.QoSMgtMod editing call |
| 2020-03-26 | E-Meeting | Q12/12 | Q12/12: E.crowdESFB editing call |
| 2020-03-27 | E-Meeting | Q12/12 | Q12/12: E.QoSMgtMod editing call |
| 2020-03-30 | E-Meeting | Q12/12 | Q12/12: E.crowdESFB editing call |
| 2020-03-31 | E-Meeting | Q12/12 | Q12/12: E.RQST editing call |
| 2020-04-01 | E-Meeting | Q12/12 | Q12/12: E.QoSMgtMod editing call |
| 2020-04-02 | E-Meeting | Q15/12 | Q15/12: G.CMVTQS project call |
| 2020-04-02 | E-Meeting | Q12/12 | Q12/12: E.crowdESFB editing call |
| 2020-04-06 | E-Meeting | Q12/12 | Q12/12: E.RQST editing call |
| 2020-04-09 | E-Meeting | Q15/12 | Q15/12: G.CMVTQS project call |
| 2020-04-09 | E-Meeting | Q17/12 | Q17/12: Pre-meeting discussions |
| 2020-05-07 | E-Meeting | Q15/12 | Q15/12: G.CMVTQS project call |
| 2020-05-13 | E-Meeting | Q1/12 | Q1/12: Suppl.CDR editing call |
| 2020-05-19 | E-Meeting | Q7/12, Q10/12 | Q7 and Q10/12: monthly call |
| 2020-05-20 | E-Meeting | Q2/12 | Q2/12: Technical Report coordination |
| 2020-05-25 | E-Meeting | Q12/12 | Q12/12: E.804.1 editing call |
| 2020-05-28 | E-Meeting | Q15/12 | Q15/12: G.CMVTQS project call |
| 2020-06-09 | E-Meeting | Q12/12 | Q12/12: E.804.1 editing call |
| 2020-06-11 | E-Meeting | Q12/12 | Q12/12: E.CrowdESFB-app editing call |
| 2020-06-16 | E-Meeting | Q7/12, Q10/12 | Q7 and Q10/12: monthly call |
| 2020-06-18 | E-Meeting | Q1/12 | Q1/12: Suppl.CDR editing call |
| 2020-06-22 | E-Meeting | Q1/12 | Q1/12: Suppl.CDR editing call |
| 2020-06-23 | E-Meeting | Q12/12 | Q12/12: E.804.1 editing call |
| 2020-06-24 to 2020-06-26 | E-Meeting | Q14/12 | Rapporteur Group meeting Q14/12: P.NATS ph2 and ph3 |
| 2020-06-25 | E-Meeting | Q12/12 | Q12/12: E.CrowdESFB-app editing call |
| 2020-07-02 | E-Meeting | Q15/12 | Q15/12: G.CMVTQS project call |
| 2020-07-02 | E-Meeting | Q14/12 | Q14/12: P.BBQCG project call |
| 2020-07-06 | E-Meeting | Q5/12 | Rapporteur Group meeting Q5/12: HATS measurement campaign |
| 2020-07-07 | E-Meeting | Q3/12 | Rapporteur Group meeting Q3/12: P.381, P.382 and P.DHIP |
| 2020-07-10 | E-Meeting | Q12/12 | Q12/12: E.QoSMgtMod editing call |
| 2020-07-16 | E-Meeting | Q15/12 | Q15/12: G.CMVTQS project call |
| 2020-07-21 | E-Meeting | Q12/12 | Q12/12: E.CrowdESFB-app editing call |
| 2020-07-23 | E-Meeting | Q14/12 | Q14/12: P.BBQCG project call |
| 2020-07-24 | E-Meeting | Q12/12 | Q12/12: E.QoSMgtMod editing call |
| 2020-07-30 | E-Meeting | Q15/12 | Q15/12: G.CMVTQS project call |
| 2020-08-11 | E-Meeting | Q12/12 | Q12/12: E.CrowdESFB-app editing call |
| 2020-08-13 | E-Meeting | Q3/12 | Q3/12: P.381, P.382 and P.DHIP |
| 2020-08-13 | E-Meeting | Q15/12 | Q15/12: G.CMVTQS project call |
| 2020-08-13 | E-Meeting | Q5/12 | Q5/12: HATS measurement campaign |
| 2020-08-13 | E-Meeting | Q14/12 | Q14/12: P.BBQCG project call |
| 2020-08-18 | E-Meeting | Q12/12 | Q12/12: E.QoSMgtMod editing call |
| 2020-08-25 | E-Meeting | Q7/12, Q10/12 | Q7 and Q10/12: monthly call |
| 2020-08-27 | E-Meeting | Q15/12 | Q15/12: G.CMVTQS project call |
| 2020-09-03 | E-Meeting | Q14/12 | Q14/12: P.BBQCG project call |
| 2020-09-17 | E-Meeting | Q15/12 | Q15/12: G.CMVTQS project call |
| 2020-10-01 | E-Meeting | Q14/12 | Q14/12: P.BBQCG project call |
| 2020-10-15 | E-Meeting | Q15/12 | Q15/12: G.CMVTQS project call |
| 2020-10-22 | E-Meeting | Q14/12 | Q14/12: P.BBQCG project call |
| 2020-10-28 | E-Meeting | Q12/12 | Q12/12: E.800Sup9-rev editing call |
| 2020-10-29 | E-Meeting | Q15/12 | Q15/12: G.CMVTQS project call |
| 2020-11-12 | E-Meeting | Q15/12 | Q15/12: G.CMVTQS project call |
| 2020-11-12 | E-Meeting | Q14/12 | Q14/12: P.BBQCG project call |
| 2020-11-16 | E-Meeting | Q12/12 | Q12/12: E.800Sup9-rev editing call |
| 2020-11-17 | E-Meeting | Q5/12 | Rapporteur Group Meeting Q5/12: HATS measurement campaign, P.57, P.58 |
| 2020-11-18 | E-Meeting | Q3/12 | Rapporteur Group Meeting Q3/12: P.DHIP |
| 2020-11-26 | E-Meeting | Q15/12 | Q15/12: G.CMVTQS project call |
| 2020-11-30 | E-Meeting | Q12/12 | Q12/12: E.800Sup9-rev editing call |
| 2020-12-02 to 2020-12-04 | E-Meeting | Q14/12 | Rapporteur Group Meeting Q14/12 |
| 2020-12-03 | E-Meeting | Q14/12 | Q14/12: P.BBQCG project call |
| 2020-12-08 | E-Meeting | Q9/12 | Rapporteur Group Meeting Q9/12: P.AMD, P.SAMD |
| 2020-12-10 | E-Meeting | Q15/12 | Q15/12: G.CMVTQS project call |
| 2020-12-14 | E-Meeting | Q12/12 | Q12/12: E.800Sup9-rev editing call |
| 2020-12-15 | E-Meeting | Q19/12 | Rapporteur Group Meeting Q19/12: P.910 and P.913 |
| 2020-12-16 | E-Meeting | Q5/12 | Rapporteur Group Meeting Q5/12: HATS measurement campaign, P.57, P.58 |
| 2020-12-17 | E-Meeting | Q12/12 | Q12/12: E.803 editing call |
| 2021-01-14 | E-Meeting | Q15/12 | Q15/12: G.CMVTQS project call |
| 2021-01-14 | E-Meeting | Q14/12 | Q14/12: P.BBQCG project call |
| 2021-01-19 | E-Meeting | Q12/12 | Q12/12: E.803 editing call |
| 2021-01-27 | E-Meeting | Q12/12 | Q12/12: E.800Sup9-rev editing call |
| 2021-01-28 | E-Meeting | Q15/12 | Q15/12: G.CMVTQS project call |
| 2021-02-04 | E-Meeting | Q14/12 | Q14/12: P.BBQCG project call |
| 2021-02-16 | E-Meeting | Q12/12 | Q12/12: E.800Sup9-rev editing call |
| 2021-02-18 | E-Meeting | Q12/12 | Q12/12: E.803 editing call |
| 2021-02-23 | E-Meeting | Q12/12 | Q12/12: E.800Sup9-rev editing call |
| 2021-02-25 | E-Meeting | Q15/12 | Q15/12: G.CMVTQS project call |
| 2021-02-25 | E-Meeting | Q14/12 | Q14/12: P.BBQCG project call |
| 2021-03-04 | E-Meeting | Q12/12 | Q12/12: E.803 editing call |
| 2021-03-11 | E-Meeting | Q15/12 | Q15/12: G.CMVTQS project call |
| 2021-03-16 | E-Meeting | Q5/12 | Rapporteur Group Meeting Q5/12: HATS measurement campaign, P.57, P.58 |
| 2021-03-17 | E-Meeting | Q6/12 | Rapporteur Group Meeting Q6/12: P.DHIP |
| 2021-03-18 | E-Meeting | Q14/12 | Q14/12: P.BBQCG project call |
| 2021-03-25 | E-Meeting | Q15/12 | Q15/12: G.CMVTQS project call |
| 2021-03-31 | E-Meeting | Q17/12 | Rapporteur Group Meeting Q17/12 |
| 2021-04-08 | E-Meeting | Q15/12 | Q15/12: G.CMVTQS project call |
| 2021-04-08 | E-Meeting | Q12/12 | Q12/12: E.803 editing call |
| 2021-04-08 | E-Meeting | Q14/12 | Q14/12: P.BBQCG project call |
| 2021-04-14 | E-Meeting | Q5/12 | Rapporteur Group Meeting Q5/12: HATS measurement campaign, P.57, P.58 |
| 2021-04-21 | E-Meeting | Q6/12 | Rapporteur Group Meeting Q6/12: P.DHIP |
| 2021-04-22 | E-Meeting | Q15/12 | Q15/12: G.CMVTQS project call |
| 2021-04-22 | E-Meeting | Q14/12 | Q14/12: P.BBQCG project call |
| 2021-05-27 | E-Meeting | Q15/12 | Q15/12: G.CMVTQS project call |
| 2021-05-27 | E-Meeting | Q14/12 | Q14/12: P.BBQCG project call |
| 2021-06-08 | E-Meeting | Q7/12, Q10/12 | Q7 and Q10/12: monthly call |
| 2021-06-10 | E-Meeting | Q15/12 | Q15/12: G.CMVTQS project call |
| 2021-06-15 | E-Meeting | Q7/12, Q10/12 | Q7 and Q10/12: monthly call (continuation of 8 June) |
| 2021-06-21 to 2021-06-22 | E-Meeting | Q15/12 | Q15/12: Rapporteur Group Meeting |
| 2021-06-24 | E-Meeting | Q15/12 | Q15/12: P.565 editing call |
| 2021-06-24 | E-Meeting | Q15/12 | Q15/12: G.CMVTQS project call |
| 2021-06-24 | E-Meeting | Q14/12 | Q14/12: P.BBQCG project call |
| 2021-07-06 | E-Meeting | Q7/12, Q10/12 | Q7 and Q10/12: monthly call |
| 2021-07-08 | E-Meeting | Q15/12 | Q15/12: G.CMVTQS project call |
| 2021-07-08 | E-Meeting | Q14/12 | Q14/12: P.BBQCG project call |
| 2021-07-22 | E-Meeting | Q15/12 | Q15/12: G.CMVTQS project call |
| 2021-07-28 | E-Meeting | Q12/12 | Q12/12: E.800Sup9-rev editing call |
| 2021-08-05 | E-Meeting | Q15/12 | Q15/12: G.CMVTQS project call |
| 2021-08-12 | E-Meeting | Q12/12 | Q12/12: E.800Sup9-rev editing call |
| 2021-08-19 | E-Meeting | Q14/12 | Q14/12: Rapporteur Group Meeting (Session 1) |
| 2021-08-19 | E-Meeting | Q15/12 | Q15/12: G.CMVTQS project call |
| 2021-08-19 | E-Meeting | Q14/12 | Q14/12: P.BBQCG project call |
| 2021-08-26 | E-Meeting | Q14/12 | Q14/12: Rapporteur Group Meeting (Session 2) |
| 2021-08-26 | E-Meeting | Q12/12 | Q12/12: E.800Sup9-rev editing call |
| 2021-09-02 | E-Meeting | Q15/12 | Q15/12: G.CMVTQS project call |
| 2021-09-07 | E-Meeting | Q7/12, Q10/12 | Q7 and Q10/12: monthly call |
| 2021-09-08 | E-Meeting | Q15/12 | Q15/12: P.VSQMTF-1 editing call |
| 2021-09-09 | E-Meeting | Q14/12 | Q14/12: Rapporteur Group Meeting (Session 3) |
| 2021-09-16 | E-Meeting | Q2/12 | Q2/12: TR-Recs editing call |
| 2021-09-16 | E-Meeting | Q15/12 | Q15/12: G.CMVTQS project call |
| 2021-09-16 | E-Meeting | Q12/12 | Q12/12: E.800Sup9-rev editing call |
| 2021-09-20 | E-Meeting | Q9/12 | Q9/12: Rapporteur Group Meeting |
| 2021-09-21 | E-Meeting | Q7/12, Q10/12 | Q7 and Q10/12: monthly call |
| 2021-09-29 | E-Meeting | Q15/12 | Q15/12: G.CMVTQS project call |
| 2021-09-30 | E-Meeting | Q14/12 | Q14/12: P.BBQCG project call |
| 2021-10-04 | E-Meeting | Q14/12 | Q14/12: P.BBQCG Interactive Test Discussion |
| 2021-11-03 | E-Meeting | Q12/12 | Q12/12: E.RQST editing call |
| 2021-11-04 | E-Meeting | Q15/12 | Q15/12: G.CMVTQS project call |
| 2021-11-08 | E-Meeting | Q14/12 | Q14/12: P.BBQCG Interactive Test Discussion |
| 2021-11-10 | E-Meeting | Q12/12 | Q12/12: E.RQST editing call |
| 2021-11-11 | E-Meeting | Q14/12 | Q14/12: P.BBQCG project call |
| 2021-11-18 | E-Meeting | Q15/12 | Q15/12: G.CMVTQS project call |
| 2021-11-18 | E-Meeting | Q12/12 | Q12/12: E.RQST editing call |
| 2021-11-22 | E-Meeting | Q14/12 | Q14/12: P.BBQCG Interactive Test Discussion |
| 2021-11-24 | E-Meeting | Q12/12 | Q12/12: E.RQST editing call |
| 2021-12-02 | E-Meeting | Q15/12 | Q15/12: G.CMVTQS project call |
| 2021-12-06 | E-Meeting | Q14/12 | Q14/12: P.BBQCG Interactive Test Discussion |
| 2021-12-08 | E-Meeting | Q7/12, Q10/12 | Q7 and Q10/12: monthly call |
| 2021-12-08 | E-Meeting | Q12/12 | Q12/12: E.RQST editing call |
| 2021-12-09 to 2021-12-10 | E-Meeting | Q14/12 | Q14/12: Rapporteur Group Meeting |
| 2021-12-16 | E-Meeting | Q15/12 | Q15/12: G.CMVTQS project call |
| 2022-01-27 | E-Meeting | Q15/12 | Q15/12: G.CMVTQS project call |

# 2 Organization of work

## 2.1 Organization of studies and allocation of work

**2.1.1** At its first meeting of the study period, Study Group 12 decided to establish 3 Working Parties.

**2.1.2** Table 2 shows the number and title of each Working Party, together with the number of Questions assigned to it and the name of its Chairman.

**2.1.3** Table 3 lists other groups under responsibility of Study Group 12 during the study period.

– ITU-T SG12 Regional Group on QoS for the Africa Region (SG12RG-AFR)

– Quality of Service Development Group (QSDG)

TABLE 2  
Organization of Study Group 12

| **Designation** | **Questions to be studied** | **Title of the Working Party** | **Chairman and Vice-Chairmen** |
| --- | --- | --- | --- |
| PLEN | Q1/12; Q2/12; | Plenary |  |
| WP1/12 | Q3/12 (deleted); Q4/12; Q5/12; Q6/12; Q7/12; Q10/12; | Terminals and multimedia subjective assessment | Mr Nielsen Lars Birger (Chairman) Mrs Berndtsson Gunilla (Vice-chairman) |
| WP2/12 | Q9/12; Q14/12; Q15/12; Q16/12; Q19/12; | Objective models and tools for multimedia quality | Mr Barriac Vincent (Chairman) Mr Malfait Ludovic (Vice-chairman) |
| WP3/12 | Q8/12; Q11/12; Q12/12; Q13/12; Q17/12; Q18/12 (deleted); Q20/12; | Multimedia QoS and QoE | Mr Morton Al  (Chairman (01/2021-))  Mr Coverdale Paul  (Chairman (-01/2021))  Ms Umutoni Yvonne  (Vice-chairman (01/2021-))  Mr Yamagishi Kazuhisa  (Vice-chairman (01/2021-))  Mr Morton Al  (Vice-chairman (-01/2021))  Mr Prado Tiago Sousa  (Vice-chairman (-01/2021)) |

TABLE 3  
Other groups (if any)

| **Title of the Group** | **Chairman** | **Vice-Chairmen** |
| --- | --- | --- |
| Study Group 12 Regional Group for Africa | Mr Faty Seyni Malan | Mr Agyekum Samuel Mr Mbulo Collins Mr Mohamed Hassan Mukhtar Hassan Mr Salah Aymen |
| Quality of Service Development Group | Ms Umutoni Yvonne |  |

## 2.2 Questions and Rapporteurs

**2.2.1** WTSA-16 assigned to Study Group 12 the 19 Questions listed in Table 4.

**2.2.2** The Questions listed in Table 5 have been adopted during this period.

**2.2.3** The Questions listed in Table 6 have been deleted during this period.

TABLE 4  
Study Group 12 – Questions assigned by WTSA-16 and Rapporteurs

| **Questions** | **Title of the Questions** | **WP** | **Rapporteur** |
| --- | --- | --- | --- |
| Q1/12 | SG12 work programme and quality of service/quality of experience (QoS/QoE) coordination in ITU-T | PLEN | Mr Baah-Acheamfuor Kwame (Rapporteur) Mr Jeong Seong-Ho (Rapporteur) Mr Pomy Joachim (Rapporteur) |
| Q2/12 | Definitions, guides and frameworks related to quality of service/quality of experience (QoS/QoE) | PLEN | Mr Pomy Joachim (Rapporteur) Mr Mbulo Collins (Associate rapporteur (05/2019-)) |
| Q4/12 | Objective methods for speech and audio evaluation in vehicles | WP1/12 | Mr Gierlich Hans Wilhelm (Rapporteur) |
| Q5/12 | Telephonometric methodologies for handset and headset terminals | WP1/12 | Mr Nielsen Lars Birger (Rapporteur) |
| Q6/12 | Analysis methods for speech and audio using complex measurement signals | WP1/12 | Mr Gierlich Hans Wilhelm (Rapporteur) |
| Q7/12 | Methodologies, tools and test plans for the subjective assessment of speech, audio and audiovisual quality interactions | WP1/12 | Mr Malfait Ludovic (Rapporteur) Mr Usai Paolino (Rapporteur (-04/2020)) |
| Q8/12 | Virtualized deployment of recommended methods for network performance, quality of service (QoS) and quality of experience (QoE) assessment | WP3/12 | Mr Morton Al (Rapporteur) |
| Q9/12 | Perceptual-based objective methods and corresponding evaluation guidelines for voice and audio quality measurements in telecommunication services | WP2/12 | Mr Berger Jens (Rapporteur) |
| Q10/12 | Conferencing and telemeeting assessment | WP1/12 | Mrs Berndtsson Gunilla (Rapporteur) Mr Skowronek Janto (Rapporteur) |
| Q11/12 | End-to-end performance considerations | WP3/12 | Mr Pomy Joachim (Rapporteur) |
| Q12/12 | Operational aspects of telecommunication network service quality | WP3/12 | Ms Umutoni Yvonne (Rapporteur) Mr Prado Tiago Sousa (Associate rapporteur (-01/2021)) |
| Q13/12 | Quality of experience (QoE), quality of service (QoS) and performance requirements and assessment methods for multimedia applications | WP3/12 | Ms Huang Rachel (Rapporteur) Mr Yamagishi Kazuhisa (Rapporteur) |
| Q14/12 | Development of models and tools for multimedia quality assessment of packet-based video services | WP2/12 | Mr Gustafsson Jörgen (Rapporteur) Mr Raake Alexander (Rapporteur) |
| Q15/12 | Parametric and E-model-based planning, prediction and monitoring of conversational speech and audio-visual quality | WP2/12 | Mr Barriac Vincent (Rapporteur) Mr Möller Sebastian (Rapporteur) Mr Pomy Joachim (Rapporteur) |
| Q16/12 | Intelligent diagnostic functions framework for networks and services | WP2/12 | Mr Malfait Ludovic (Rapporteur) Mr Wu Qin (Rapporteur) |
| Q17/12 | Performance of packet-based networks and other networking technologies | WP3/12 | Mr Morton Al (Rapporteur) |
| Q19/12 | Objective and subjective methods for evaluating perceptual audiovisual quality in multimedia and television services | WP2/12 | Mr Lee Chulhee (Rapporteur) Mr Huynh-Thu Quan (Associate rapporteur) |

TABLE 5  
Study Group 12 – New Questions adopted and Rapporteurs

| Questions | Title of the Questions | WP | Rapporteur | Note |
| --- | --- | --- | --- | --- |
| Q20/12 | Perceptual and field assessment principles for quality of service (QoS) and quality of experience (QoE) of digital financial services (DFS) | WP3/12 | Mr Balzer Wolfgang (Rapporteur) Ms Beyaraaza Fiona Kamikazi (Rapporteur) Mr Pomy Joachim (Rapporteur) | New Question (endorsed by TSAG on 18 January 2021) |

TABLE 6  
Study Group 12 – Questions deleted

| **Questions** | **Title of the Questions** | **Rapporteur** | **Results** |
| --- | --- | --- | --- |
| Q3/12 (deleted) | Speech transmission and audio characteristics of communication terminals for fixed circuit-switched, mobile and packet-switched Internet protocol (IP) networks | Mr Yi Gaoxiong (Rapporteur (-09/2017))  Mr Nielsen Lars Birger (Acting rapporteur (09/2017-05/2018))  Mr Woo Allen (Rapporteur (05/2018-11/2019))  Mr Nielsen Lars Birger (Acting rapporteur (11/2019-)) | Question 3/12 was discontinued on 18 January 2021, following endorsement by TSAG. The studies of this Question continued under Questions 5/12 and 6/12. |
| Q18/12 (deleted) | Measurement and control of the end-to-end quality of service (QoS) for advanced television technologies, from image acquisition to rendering, in contribution, primary distribution and secondary distribution networks | Mr Huynh-Thu Quan (Rapporteur) Mr Lee Chulhee (Associate rapporteur) | Question 18/12 was discontinued in May 2019. The studies of this Question continued under Question 19/12. |

# 3 Results of the work accomplished during the 2017-2020 study period

## 3.1 General

During the study period, Study Group 12 examined 605 contributions and generated a large number of TDs and liaison statements.

It also:

– drew up 44 new ITU-T Recommendations;

– amended/revised 56 existing Recommendations, and issued 10 Corrigenda;

– developed 10 Supplements and 2 Implementers’ Guides;

– produced 1 Technical Paper and 2 Technical Reports;

## 3.2 Highlights of achievements

The main results achieved on the various Questions assigned to Study Group 12 are briefly summarized below. Formal replies to the Questions are given in a synoptic table in Annex 1 of this report.

Study Group 12 is looking back at a long, busy and successful study period. It held 11 plenary meetings, 5 of which were held exclusively online, attended by more than 1050 participants.

During the study period, 94 countries were represented in Study Group 12 meetings (including delegates from 28 least developed countries). On average, delegates from 45 countries were represented in the study group meetings. The wide geographical representation was in part due to activities aimed at meeting the mandate of WTSA-16 Resolution 95 on “ITU-T initiatives to raise awareness on best practices and policies related to service quality”, described below in more detail.

Typically, Member States and industry were represented in similar numbers, roughly 10 per cent of delegates represented universities and academic institutions.

Study Group 12 started the study period with 9 Associates, and, following extensive outreach and engagement and despite the negative economic impact of the COVID-19 crisis, ends it with 21 Associates (more than double) representing organizations across the performance measurement, QoS and QoE assessment ecosystem, including several SMEs.

Study Group 12 made extensive use of the remote meeting facilities in more than 200 interim activities including rapporteur group meetings, editing and project calls to advance the work in-between plenary meetings.

**a) WTSA-16 Resolution 95 - best practices and policies related to service quality**

In response to WTSA-16 Resolution 95 on “ITU-T initiatives to raise awareness on best practices and policies related to service quality”, Study Group 12 carried out various activities across the study period to implement the Resolution. The Resolution calls for further studies related to quality regulatory approaches to be conducted, as well as for capacity building initiatives to be undertaken by ITU-T in close collaboration with ITU-D.

In addressing this Resolution, Study Group 12 issued a questionnaire to ITU Member States with an objective of obtaining a better understanding of the maturity level of service quality regulatory frameworks in ITU Member States and assist countries in deploying their quality regulatory framework. Findings obtained from the analysis of the questionnaire’s responses informed work in Study Group 12 on service quality regulatory frameworks during the study period and serves as a benchmark for countries interested in establishing or reviewing their QoS and QoE regulatory framework.

The activities of the Quality of Service Development Group (QSDG) also contributed to meeting the objectives of WTSA Resolution 95 by serving as a global platform stimulating discussions on the technical and regulatory aspects related to the improvement of performance. In the study period, it held 3 meetings (South Africa, Turkey and Singapore) preceded by thematic workshops and a series of thematic webinars/virtual workshops – three weekly webinars, late August to early September 2020, virtual workshop geared towards the interests of national regulatory authorities in Spanish-speaking countries in Latin America from 2 to 4 June 2021 and a virtual workshop from 8 to 9 September 2021.

There was enhanced participation of regulators, operators and suppliers in the international debate on service quality throughout the study period, facilitated by the various outreach activities (including the 13 workshops and webinars/virtual workshops) and regular publication of Study Group 12’s standardization work and activities in the study period.

The enhanced participation of regulators in Study Group 12 led to the development of new standards offering guidance to regulators in their QoS activities, including:

– Recommendation ITU-T E.805 “Strategies to establish quality regulatory frameworks” which provides a reference for regulators on service quality regulatory frameworks suitable for assessing, comparing and giving transparency to the quality achieved by a delivered service, quality as perceived by the end-user and the end-user's degree of satisfaction.

– Recommendation ITU-T E.806 “Measurement campaigns, monitoring systems, and sampling methodologies to monitor the quality of service in mobile networks” which provides a baseline framework of best practices for measuring quality of service (QoS) in mobile networks.

– Recommendation ITU-T E.811 “Quality measurement in major events” which provides a reference for regulators and operators on the quality assessment of mobile broadband and voice services during major events.

– Recommendation ITU-T E.812 “Crowdsourcing approach for the assessment of end-to-end quality of service in fixed and mobile broadband networks” outlines different crowdsourcing approaches used to assess end-to-end QoS on both fixed and mobile broadband networks with a detailed view on some crowdsourcing use cases.

Study Group 12’s outputs have also informed training material on service quality aspects in ITU Academy courses and is widely referenced in various publications related to service quality including the ITU Regulation Handbook, ITU QoS Regulation Manual, QoS guidelines of regional organizations and in national quality regulatory frameworks globally.

**b) Digital financial services**

Responding to WTSA-16 Resolution 89 “Promoting the use of information and communication technologies to bridge the financial inclusion gap”, Study Group 12 adopted two new Recommendations ITU-T G.1033 “QoS and QoE aspects of digital financial services” and ITU-T P.1502 “Methodology for QoE testing of digital financial services”.

The work on perceptual and field assessment principles for QoS and QoE of digital financial services found a new home in a standalone Question (Q20/12) established during the study period.

**c) IP packet transfer and availability performance parameters**

Following over 20 years as an in-force Recommendation, the 2019 Edition of Recommendation ITU-T Y.1540 “Internet protocol data communication service – IP packet transfer and availability performance parameters” recognizes many changes in the design of IP services and in the protocols employed by end-users.

It introduces the new Annex A that defines IP-layer Capacity parameters in ways that cater toward assessment, and provides requirements for methods of measurement of IP-layer Capacity.

This new Annex is the result of years of study, and application of Study Group 12 principles of accurately evaluating performance parameters and methods of measurement against a “ground truth” reference in laboratory and field measurements.

Flow-related throughput parameters and methods of measurement (reliable delivery transport), remain for further study, and the text makes a clear distinction between these IP-layer capacity parameters. In the same way, parameters describing performance of a specific reliable transport layer protocol (TCP) remain for further study, and recognize that reliable transport protocols for the Internet are constantly changing and the subject of on-going research.

SG12 completed the work at a time in which TCP transport is rapidly being replaced by UDP transport, payloads with open and encrypted portions, and application-layer retransmission and congestion-control.

The introduction of the Google QUIC and IETF QUIC protocols has rapidly changed the transport landscape of the Internet, and consumers using popular browsers are among the earliest adopters – trends acknowledged by the CTO Meetings and the Study Group Leadership Assembly held during the study period.

The new edition of Y.1540 is coordinated and aligned with related relevant work in ETSI, BBF, IETF, among others.

The reference implementation of the method chosen for standardization in Y.1540 and the subsequent development of BBF TR-471 have been released in open-source form, as part of the Open Broadband series of projects.

Supplement 60 to the ITU-T Y-series Recommendations provides information on interpreting Y.1540 maximum IP-layer capacity measurements and provides useful information for those who measure various technologies.

**d) Video quality assessment**

Two major sets of video quality assessment standards were adopted by Study Group 12 during the study period.

Approved right at the beginning of the study period, the ITU-T P.1203 series of Recommendations defines parametric bitstream-based quality assessment of progressive download and adaptive audiovisual streaming services over reliable transport. The standard is primarily targeted towards prediction of the integral quality of longer video streaming sessions between 1 min and 5 min duration, more in line with the idea of an overall session QoE rather than sheer video quality.

Approved in 2020, the ITU-T P.1204 series of Recommendations describes model algorithms for monitoring the video quality for streaming using reliable transport (e.g., adaptive streaming based on the hypertext transfer protocol (HTTP) over the transmission control protocol (TCP), quick user datagram protocol internet connections (QUIC)). The ITU-T P.1204 series of Recommendations comprises different variants of models for sequence-related (between 5 and 10 s) and per-1-second video-quality estimation. The variants differ in the type of input information they use: bitstream based, pixel based, and hybrid (using both bitstream and pixel information). P.1204 models are able to handle various video codecs (i.e., H.264, H.265 high-efficiency video coding (HEVC), video payload type 9 (VP9), resolutions up to 4K or ultra-high definition-1 (UHD1) and frame rates of up to 60 frames/s. Open-source reference implementations are available for the P.1203 and some of the P.1204 models.

Moreover, Study Group 12 adopted foundational work in the area of virtual reality, including on QoE influencing factors for virtual reality services (ITU-T G.1035) and subjective test methodologies for 360º video on head-mounted displays (ITU-T P.919).

Another area of great interest was the work on video gaming quality. Achievements included the adoption of Recommendations on subjective evaluation methods for gaming quality (ITU-T P.809), QoE influencing factors for gaming (ITU-T G.1032), and an opinion model predicting gaming quality of experience for cloud gaming services (ITU-T G.1072). An open-source reference implementation is available for G.1072.

**e) Speech and listening quality and performance**

Study Group 12 developed a framework for creation and performance testing of machine learning based models for the assessment of transmission network impact on speech quality for mobile packet-switched voice services (e.g., Voice over LTE (VoLTE), Voice over New Radio (VoNR), OTT voice) (ITU-T P.565) and based on the framework, standardized such model in ITU-T P.565.1.

The study group developed guidance on subjective evaluation of speech quality with a crowdsourcing approach (ITU-T P.808). An open-source reference implementation is available for this Recommendation.

A new Edition of ITU-T P.863 “Perceptual objective listening quality prediction” was adopted.

Study Group 12 concluded major revisions to Recommendations ITU-T P.381, P.382, and P.383 (new) related to technical requirements and test methods for headsets and headphones.

**f) In-car communications**

Study Group 12 completed work in the P.1100 series of Recommendations, including on super-wideband and fullband stereo hands-free communication in motor vehicles (P.1120), and on communication requirements for in-car communication systems (P.1150) that utilize microphones and speakers integrated in a motor vehicle cabin to amplify conversation to provide for an improved communication between all vehicle occupants.

The above text only describes a small selection of achievements. For more details, please refer to the recordings of the meeting highlights webinars and the executive summaries covering the outcomes of Study Group 12 meetings. Both can be found on the Study Group 12 webpage.

## 3.3 Report of lead study group activities, JCAs and regional groups

### 3.3.1 Lead study group activities

SG12 assumed lead study group responsibilities in the following areas of work:

– quality of service and quality of experience;

– driver distraction and voice aspects of car communications;

– quality assessment of video communications and applications.

For more information, please refer to TSAG TDs 35, 152, 305, 482, 668, 802, 945 and 1044.

### 3.3.2 JCAs

None.

### 3.3.3 Regional Group on QoS for the Africa Region (SG12 RG-AFR)

In line with WTSA-16 Resolution 54, the Regional Group on QoS for the Africa Region (SG12 RG-AFR), launched by Study Group 12 in May 2008, continued to operate during the study period 2017-2020. It held meetings during the Study Group 12 plenary meetings in Geneva and virtually, four physical meetings in Africa (South Africa, Senegal, Rwanda, and Chad) and one virtual meeting in September 2021.

The continual progressive increase in number and intent of African participants in Study Group 12 reflects the level of the engagement under the umbrella of the Regional Group on QoS for the Africa Region, and consequently the fulfilment of bridging the standardization gap (BSG) targets and capacity development. RG-AFR strengthened and enhanced the harmonization action of the ITU-T Recommendations for the African ICT sector. African members, via RG-AFR, provided good discussion and a significant number of contributions to several work items mainly under Q12/12 which stimulated the development of several Recommendations in the study period.

RG-AFR conducted several well organized and programmed meetings, activities and events, steered and organized by the Quality of Service Development Group (QSDG) and the TSB. These activities played an essential role in linking Africa's ICT sector with the developed standardization society. Training courses, workshops and forums helped in capacity development and capability upgrade for the African ICT community, which is directly reflected positively in minimizing the standardization gap. African members are intentionally addressing their passion to ensure and upgrade their footprint in the ITU-T through active participation and presence.

### 3.3.4 Focus Groups

None.

# 4 Observations concerning future work

Proposed updates to the Study Group 12 mandate can be found in Annex 2 to this report, and in WTSA-20 Contribution 12 (Part II: Questions proposed for study during the next study period (2021-2024)).

In particular, Study Group 12 proposes a reduction of the number of Questions by three. The proposed consolidation reflects the status of the work programme of the Questions concerned, as well as the number of contributions and participants they were able to attract in recent meetings. Ongoing work and maintenance responsibility for in-force Recommendations is proposed to be assumed by other Questions under study.

Study Group 12 will continue its collaboration with ITU-T and ITU-R Study Groups in areas related to performance, QoS and QoE, and leverage its longstanding relationships with other relevant committees outside ITU active in this domain.

It is expected that a modified WTSA Resolution 95 will result in new contributions, discussions and workshops organized by the Quality of Service Development Group, aimed at raising awareness on best practices and policies related to service quality. The work on addressing Resolution 95 will continue to attract Member State participation in Study Group 12, in particular from developing countries, and contribute to bridging the standardization gap.

Through its activities and achievements, the study group will attempt to further extend its reach and visibility, attract participation and technical contributions, and develop new and revised ITU-T Recommendations of value to the performance and quality assessment community.

# 5 Updates to the WTSA Resolution 2 for the 2022-2024 study period

Annex 2 contains the updates to WTSA Resolution 2 proposed by Study Group 12 concerning the general areas of study, title, mandate, lead roles and points of guidance in the next study period.

ANNEX 1  
  
List of Recommendations, Supplements and   
other materials produced or deleted during the study period

The list of new and revised Recommendations approved during the study period is found in Table 7.

The list of Recommendations determined/consented at the last meeting of Study Group 12 is found in Table 8.

The list of Recommendations deleted by Study Group 12 during the study period is found in Table 9.

The List of Recommendations submitted by Study Group 12 to WTSA-20 for approval is found in Table 10.

Tables 11 onwards list other publications approved and/or deleted by Study Group 12 during the study period.

TABLE 7  
Study Group 12 – Recommendations approved during the study period

| **Recommendation** | **Approval** | **Status** | **TAP/AAP** | **Title** |
| --- | --- | --- | --- | --- |
| [E.475](http://handle.itu.int/11.1002/1000/14148) | 2020-01-13 | In force | AAP | Guidelines for intelligent network analytics and diagnostics |
| [E.802 (2007) Amd. 1](http://handle.itu.int/11.1002/1000/13167) | 2017-03-01 | In force | AAP | New Annex A on guidelines on selection of representative samples |
| [E.802 (2007) Amd. 2](http://handle.itu.int/11.1002/1000/13620) | 2018-06-13 | In force | AAP | Updates and additional information on the degree of variability function in support of E.802 |
| [E.804.1](http://handle.itu.int/11.1002/1000/14427) | 2020-10-14 | In force | AAP | Application guide for Recommendation ITU-T E.804 on quality of service aspects for popular services in mobile networks |
| [E.805](http://handle.itu.int/11.1002/1000/13949) | 2019-12-05 | In force | TAP | Strategies to establish quality regulatory frameworks |
| [E.805.1](http://handle.itu.int/11.1002/1000/14589) | 2021-01-07 | In force | TAP | Quality of service operational strategy for improved regulatory supervision of providers of mobile telecommunication services |
| [E.806](http://handle.itu.int/11.1002/1000/13924) | 2019-06-29 | In force | AAP | Measurement campaigns, monitoring systems and sampling methodologies to monitor the quality of service in mobile networks |
| [E.811](http://handle.itu.int/11.1002/1000/13168) | 2017-03-01 | In force | AAP | Quality measurement in major events |
| [E.812](http://handle.itu.int/11.1002/1000/14272) | 2020-05-29 | In force | AAP | Crowdsourcing approach for the assessment of end-to-end quality of service in fixed and mobile broadband networks |
| [E.812 (2020) Amd. 1](http://handle.itu.int/11.1002/1000/14489) | 2020-09-11 | In force | Agreement |  |
| [E.840](http://handle.itu.int/11.1002/1000/13621) | 2018-06-13 | In force | AAP | Statistical framework for end-to-end network-performance benchmark scoring and ranking |
| [E.847](http://handle.itu.int/11.1002/1000/13169) | 2017-03-01 | In force | AAP | Quality of service norms for time-division multiplexing interconnection between telecom networks |
| [G.107.1](http://handle.itu.int/11.1002/1000/13925) | 2019-06-29 | In force | AAP | Wideband E-model |
| [G.107.1 (2019) Cor. 1](http://handle.itu.int/11.1002/1000/14149) | 2020-01-13 | In force | AAP |  |
| [G.107.2](http://handle.itu.int/11.1002/1000/13926) | 2019-06-29 | In force | AAP | Fullband E-model |
| [G.113 (2007) Amd. 2](http://handle.itu.int/11.1002/1000/13923) | 2019-05-16 | In force | Agreement | New Appendix V – Provisional planning values for the fullband equipment impairment factor and the fullband packet loss robustness factor |
| [G.191](http://handle.itu.int/11.1002/1000/13830) | 2019-01-13 | In force | AAP | Software tools for speech and audio coding standardization |
| [G.1027](http://handle.itu.int/11.1002/1000/14822) | 2021-11-29 | In force | AAP | QoS metrics for the assessment of the impact of fixed geographic structures on telephony quality and call stability |
| [G.1028](http://handle.itu.int/11.1002/1000/13927) | 2019-06-29 | In force | AAP | End-to-end quality of service for voice over 4G mobile networks |
| [G.1028.1](http://handle.itu.int/11.1002/1000/13831) | 2019-02-06 | In force | AAP | End-to-end quality of service for video telephony over 4G mobile networks |
| [G.1028.2](http://handle.itu.int/11.1002/1000/13928) | 2019-06-29 | In force | AAP | Assessment of the LTE circuit switched fall back - Impact on voice quality of service |
| [G.1032](http://handle.itu.int/11.1002/1000/13396) | 2017-10-29 | In force | AAP | Influence factors on gaming quality of experience |
| [G.1033](http://handle.itu.int/11.1002/1000/14065) | 2019-10-14 | In force | AAP | Quality of service and quality of experience aspects of digital financial services |
| [G.1034](http://handle.itu.int/11.1002/1000/14150) | 2020-01-13 | In force | AAP | Quality of experience metrics for mobile telephony communication during rail travel |
| [G.1035](http://handle.itu.int/11.1002/1000/14274) | 2020-05-29 | Superseded | AAP | Influencing factors on quality of experience for virtual reality services |
| [G.1035](http://handle.itu.int/11.1002/1000/14826) | 2021-11-29 | In force | AAP | Influencing factors on quality of experience for virtual reality services |
| [G.1070](http://handle.itu.int/11.1002/1000/13622) | 2018-06-13 | In force | AAP | Opinion model for video-telephony applications |
| [G.1071](http://handle.itu.int/11.1002/1000/13125) | 2016-11-29 | In force | AAP | Opinion model for network planning of video and audio streaming applications |
| [G.1072](http://handle.itu.int/11.1002/1000/14151) | 2020-01-13 | In force | AAP | Opinion model predicting gaming quality of experience for cloud gaming services |
| [G.1072 (2020) Cor. 1](http://handle.itu.int/11.1002/1000/14464) | 2020-10-14 | In force | AAP |  |
| [J.343 (2014) Amd. 1](http://handle.itu.int/11.1002/1000/13619) | 2018-05-10 | In force | Agreement | Test vectors for the ITU-T J.343 family of standards |
| [P.10/G.100](http://handle.itu.int/11.1002/1000/13408) | 2017-11-13 | In force | AAP | Vocabulary for performance, quality of service and quality of experience |
| [P.10/G.100 (2017) Amd. 1](http://handle.itu.int/11.1002/1000/13929) | 2019-06-29 | In force | AAP | New definitions for inclusion in Recommendation ITU-T P.10/G.100 |
| [P.57](http://handle.itu.int/11.1002/1000/14599) | 2021-02-13 | Superseded | AAP | Artificial ears |
| [P.57](http://handle.itu.int/11.1002/1000/14662) | 2021-06-13 | In force | AAP | Artificial ears |
| [P.58](http://handle.itu.int/11.1002/1000/14600) | 2021-02-13 | Superseded | AAP | Head and torso simulator for telephonometry |
| [P.58](http://handle.itu.int/11.1002/1000/14663) | 2021-06-13 | In force | AAP | Head and torso simulator for telephonometry |
| [P.64](http://handle.itu.int/11.1002/1000/13930) | 2019-06-29 | In force | AAP | Determination of sensitivity/frequency characteristics of local telephone systems |
| [P.340 (2000) Amd. 2](http://handle.itu.int/11.1002/1000/13841) | 2019-01-13 | In force | AAP | Annex B: Objective test methods for multi-talker scenarios |
| [P.381](http://handle.itu.int/11.1002/1000/13172) | 2017-03-01 | Superseded | AAP | Technical requirements and test methods for the universal wired headset or headphone interface of digital mobile terminals |
| [P.381](http://handle.itu.int/11.1002/1000/14465) | 2020-10-14 | In force | AAP | Technical requirements and test methods for the universal wired headset or headphone interface of digital mobile terminals |
| [P.382](http://handle.itu.int/11.1002/1000/14466) | 2020-10-14 | In force | AAP | Technical requirements and test methods for multi-microphone wired headset or headphone interfaces of digital wireless terminals |
| [P.383](http://handle.itu.int/11.1002/1000/14691) | 2021-06-13 | In force | AAP | Technical requirements and test methods for digital wired or wireless headset interfaces |
| [P.501](http://handle.itu.int/11.1002/1000/13173) | 2017-03-01 | Superseded | AAP | Test signals for use in telephonometry |
| [P.501 (2017) Amd. 1](http://handle.itu.int/11.1002/1000/13623) | 2018-06-13 | Superseded | AAP | AM-FM test signal for super-wideband and fullband applications |
| [P.501](http://handle.itu.int/11.1002/1000/14271) | 2020-05-29 | In force | AAP | Test signals for use in telephony and other speech-based applications |
| [P.565](http://handle.itu.int/11.1002/1000/14152) | 2020-01-13 | Superseded | AAP | Framework for creation and performance testing of machine learning based models for the assessment of transmission network impact on speech quality for mobile packet-switched voice services |
| [P.565](http://handle.itu.int/11.1002/1000/14827) | 2021-11-29 | In force | AAP | Framework for creation and performance testing of machine learning based models for the assessment of transmission network impact on speech quality for mobile packet-switched voice services |
| [P.565.1](http://handle.itu.int/11.1002/1000/14823) | 2021-11-29 | In force | AAP | Machine learning model for the assessment of transmission network impact on speech quality for mobile packet-switched voice services |
| [P.570](http://handle.itu.int/11.1002/1000/13624) | 2018-06-13 | In force | AAP | Artificial noise fields under laboratory conditions |
| [P.700](http://handle.itu.int/11.1002/1000/13931) | 2019-06-29 | Superseded | AAP | Calculation of loudness for speech communication |
| [P.700](http://handle.itu.int/11.1002/1000/14664) | 2021-06-13 | In force | AAP | Calculation of loudness for speech communication |
| [P.804](http://handle.itu.int/11.1002/1000/13397) | 2017-10-29 | In force | AAP | Subjective diagnostic test method for conversational speech quality analysis |
| [P.808](http://handle.itu.int/11.1002/1000/13625) | 2018-06-13 | Superseded | AAP | Subjective evaluation of speech quality with a crowdsourcing approach |
| [P.808](http://handle.itu.int/11.1002/1000/14665) | 2021-06-13 | In force | AAP | Subjective evaluation of speech quality with a crowdsourcing approach |
| [P.809](http://handle.itu.int/11.1002/1000/13626) | 2018-06-13 | In force | AAP | Subjective evaluation methods for gaming quality |
| [P.811](http://handle.itu.int/11.1002/1000/13842) | 2019-01-13 | In force | AAP | Subjective test methodology for evaluating Speech oriented stereo communication systems over headphones |
| [P.862 (2001) Cor. 2](http://handle.itu.int/11.1002/1000/13569) | 2018-03-16 | In force | AAP |  |
| [P.862.2 (2007) Cor. 1](http://handle.itu.int/11.1002/1000/13398) | 2017-10-29 | In force | AAP |  |
| [P.863](http://handle.itu.int/11.1002/1000/13570) | 2018-03-16 | In force | AAP | Perceptual objective listening quality prediction |
| [P.863 (2018) Amd. 1](http://handle.itu.int/11.1002/1000/14283) | 2020-04-24 | In force | Agreement | Revised Appendix III – Prediction of acoustically recorded narrowband speech |
| [P.863.1](http://handle.itu.int/11.1002/1000/13966) | 2019-06-29 | In force | AAP | Application guide for Recommendation ITU-T P.863 |
| [P.910](http://handle.itu.int/11.1002/1000/14828) | 2021-11-29 | In force | AAP | Subjective video quality assessment methods for multimedia applications |
| [P.913](http://handle.itu.int/11.1002/1000/14704) | 2021-06-13 | In force | AAP | Methods for the subjective assessment of video quality, audio quality and audiovisual quality of Internet video and distribution quality television in any environment |
| [P.917](http://handle.itu.int/11.1002/1000/13843) | 2019-01-13 | In force | AAP | Subjective test methodology for assessing impact of initial loading delay on quality of experience |
| [P.918](http://handle.itu.int/11.1002/1000/14153) | 2020-01-13 | In force | AAP | Dimension-based subjective quality evaluation for video content |
| [P.919](http://handle.itu.int/11.1002/1000/14429) | 2020-10-14 | In force | AAP | Subjective test methodologies for 360º video on head-mounted displays |
| [P.1100](http://handle.itu.int/11.1002/1000/13174) | 2017-03-01 | Superseded | AAP | Narrowband hands-free communication in motor vehicles |
| [P.1100](http://handle.itu.int/11.1002/1000/13844) | 2019-01-13 | In force | AAP | Narrowband hands-free communication in motor vehicles |
| [P.1110](http://handle.itu.int/11.1002/1000/13175) | 2017-03-01 | Superseded | AAP | Wideband hands-free communication in motor vehicles |
| [P.1110](http://handle.itu.int/11.1002/1000/13847) | 2019-01-13 | In force | AAP | Wideband hands-free communication in motor vehicles |
| [P.1120](http://handle.itu.int/11.1002/1000/13176) | 2017-03-01 | In force | AAP | Super-wideband and fullband stereo hands-free communication in motor vehicles |
| [P.1140](http://handle.itu.int/11.1002/1000/13177) | 2017-03-01 | In force | AAP | Speech communication requirements for emergency calls originating from vehicles |
| [P.1150](http://handle.itu.int/11.1002/1000/14154) | 2020-01-13 | In force | AAP | In-car communication audio specification |
| [P.1201.2 (2012) Cor. 2](http://handle.itu.int/11.1002/1000/13932) | 2019-06-29 | In force | AAP |  |
| [P.1203](http://handle.itu.int/11.1002/1000/13158) | 2016-11-29 | Superseded | AAP | Parametric bitstream-based quality assessment of progressive download and adaptive audiovisual streaming services over reliable transport |
| [P.1203 (2016) Amd. 1](http://handle.itu.int/11.1002/1000/13166) | 2017-01-19 | Superseded | Agreement | Appendix I: Performance figures |
| [P.1203](http://handle.itu.int/11.1002/1000/13399) | 2017-10-29 | In force | AAP | Parametric bitstream-based quality assessment of progressive download and adaptive audiovisual streaming services over reliable transport |
| [P.1203.1](http://handle.itu.int/11.1002/1000/13159) | 2016-12-22 | Superseded | AAP | Parametric bitstream-based quality assessment of progressive download and adaptive audiovisual streaming services over reliable transport – Video quality estimation module |
| [P.1203.1](http://handle.itu.int/11.1002/1000/13400) | 2017-10-29 | Superseded | AAP | Parametric bitstream-based quality assessment of progressive download and adaptive audiovisual streaming services over reliable transport – Video quality estimation module |
| [P.1203.1](http://handle.itu.int/11.1002/1000/13845) | 2019-01-13 | In force | AAP | Parametric bitstream-based quality assessment of progressive download and adaptive audiovisual streaming services over reliable transport – Video quality estimation module |
| [P.1203.2](http://handle.itu.int/11.1002/1000/13160) | 2016-11-29 | Superseded | AAP | Parametric bitstream-based quality assessment of progressive download and adaptive audiovisual streaming services over reliable transport – Audio quality estimation module |
| [P.1203.2](http://handle.itu.int/11.1002/1000/13401) | 2017-10-29 | In force | AAP | Parametric bitstream-based quality assessment of progressive download and adaptive audiovisual streaming services over reliable transport – Audio quality estimation module |
| [P.1203.3](http://handle.itu.int/11.1002/1000/13161) | 2016-12-22 | Superseded | AAP | Parametric bitstream-based quality assessment of progressive download and adaptive audiovisual streaming services over reliable transport – Quality integration module |
| [P.1203.3](http://handle.itu.int/11.1002/1000/13402) | 2017-10-29 | Superseded | AAP | Parametric bitstream-based quality assessment of progressive download and adaptive audiovisual streaming services over reliable transport – Quality integration module |
| [P.1203.3](http://handle.itu.int/11.1002/1000/13846) | 2019-01-13 | In force | AAP | Parametric bitstream-based quality assessment of progressive download and adaptive audiovisual streaming services over reliable transport – Quality integration module |
| [P.1203.3 (2019) Amd. 1](http://handle.itu.int/11.1002/1000/14284) | 2020-05-29 | In force | AAP | Adjustment of the audiovisual quality |
| [P.1203.3 (2019) Cor. 1](http://handle.itu.int/11.1002/1000/14697) | 2021-06-13 | In force | AAP |  |
| [P.1204](http://handle.itu.int/11.1002/1000/14155) | 2020-01-13 | In force | AAP | Video quality assessment of streaming services over reliable transport for resolutions up to 4K |
| [P.1204.3](http://handle.itu.int/11.1002/1000/14156) | 2020-01-13 | In force | AAP | Video quality assessment of streaming services over reliable transport for resolutions up to 4K with access to full bitstream information |
| [P.1204.3 (2020) Amd. 1](http://handle.itu.int/11.1002/1000/14588) | 2021-01-07 | In force | Agreement | New Appendix II: Long term integration module (Pq) for ITU-T P.1204.3 |
| [P.1204.4](http://handle.itu.int/11.1002/1000/14157) | 2020-01-13 | In force | AAP | Video quality assessment of streaming services over reliable transport for resolutions up to 4K with access to full and reduced reference pixel information |
| [P.1204.4 (2020) Amd. 1](http://handle.itu.int/11.1002/1000/14592) | 2021-01-07 | In force | Agreement |  |
| [P.1204.5](http://handle.itu.int/11.1002/1000/14158) | 2020-01-13 | In force | AAP | Video quality assessment of streaming services over reliable transport for resolutions up to 4K with access to transport and received pixel information |
| [P.1204.5 (2020) Amd. 1](http://handle.itu.int/11.1002/1000/14593) | 2021-01-07 | In force | Agreement | New Appendix II: Long term integration module (Pq) for ITU-T P.1204.5 |
| [P.1301](http://handle.itu.int/11.1002/1000/13403) | 2017-10-29 | In force | AAP | Subjective quality evaluation of audio and audiovisual multiparty telemeetings |
| [P.1310](http://handle.itu.int/11.1002/1000/13181) | 2017-03-01 | In force | AAP | Spatial audio meetings quality evaluation |
| [P.1401](http://handle.itu.int/11.1002/1000/14159) | 2020-01-13 | In force | AAP | Methods, metrics and procedures for statistical evaluation, qualification and comparison of objective quality prediction models |
| [P.1502](http://handle.itu.int/11.1002/1000/14160) | 2020-01-13 | In force | AAP | Methodology for QoE testing of digital financial services |
| [Y.1222 (2007) Cor. 1](http://handle.itu.int/11.1002/1000/14698) | 2021-06-13 | In force | AAP |  |
| [Y.1540](http://handle.itu.int/11.1002/1000/13933) | 2019-12-05 | In force | AAP | Internet protocol data communication service – IP packet transfer and availability performance parameters |
| [Y.1540 (2019) Amd. 1](http://handle.itu.int/11.1002/1000/14161) | 2020-02-06 | In force | AAP | New Annex B - Additional search algorithm for IP-based capacity parameters and methods of measurement |
| [Y.1543](http://handle.itu.int/11.1002/1000/13627) | 2018-06-13 | In force | AAP | Measurements in Internet protocol networks for inter-domain performance assessment |
| [Y.1545 (2013) Cor. 1](http://handle.itu.int/11.1002/1000/14705) | 2021-05-13 | In force | Agreement |  |
| [Y.1545.1](http://handle.itu.int/11.1002/1000/13199) | 2017-03-01 | In force | AAP | Framework for monitoring the quality of service of IP network services |
| [Y.1545.1 (2017) Amd. 1](http://handle.itu.int/11.1002/1000/14699) | 2021-06-13 | In force | AAP |  |
| [Y.1546 (2014) Amd. 1](http://handle.itu.int/11.1002/1000/13628) | 2018-06-13 | In force | AAP | IP-based service availability function |
| [Y.1550](http://handle.itu.int/11.1002/1000/13848) | 2019-01-13 | In force | AAP | Considerations for realizing virtual measurement systems |
| [Y.1563 (2009) Cor. 1](http://handle.itu.int/11.1002/1000/14700) | 2021-06-13 | In force | AAP |  |
| [Y.1564 (2016) Cor. 1](http://handle.itu.int/11.1002/1000/14701) | 2021-06-13 | In force | AAP |  |

TABLE 8  
Study Group 12 – Recommendations consented/determined at the last meeting

| Recommendation | Consent/‌Determination | TAP/AAP | Title |
| --- | --- | --- | --- |
| None / All approved before submission of this report, see Table 7. | | | |

TABLE 9  
Study Group 12 – Recommendations deleted during study period

| Recommendation | Last version | Withdrawal date | Title |
| --- | --- | --- | --- |
| None | | | |

TABLE 10  
Study Group 12 – Recommendations submitted to WTSA-20

| Recommendation | Proposal | Title | Reference |
| --- | --- | --- | --- |
| None | | | |

TABLE 11  
Study Group 12 – Supplements

| **Recommendation** | **Approval** | **Status** | **Title** |
| --- | --- | --- | --- |
| [E-800 series Suppl. 9](http://handle.itu.int/11.1002/1000/14832) | 2021-10-21 | In force | Guidelines on regulatory aspects of quality of service |
| [G Suppl. 61](http://handle.itu.int/11.1002/1000/13393) | 2017-09-28 | In force | ITU-T G.1020 – Internet protocol aware quality of service management |
| [G Suppl. 73](http://handle.itu.int/11.1002/1000/14831) | 2021-10-21 | In force | Influencing factors on quality of experience for multiview video (MVV) services |
| [P Suppl. 26](http://handle.itu.int/11.1002/1000/13392) | 2017-09-28 | In force | Scenarios for the subjective evaluation of audio and audiovisual multiparty telemeeting quality |
| [P Suppl. 27](http://handle.itu.int/11.1002/1000/13242) | 2017-01-19 | In force | Application of ITU-T P.863 and ITU-T P.863.1 for speech processed by blind bandwidth extension approaches |
| [P Suppl. 28](http://handle.itu.int/11.1002/1000/14495) | 2020-09-11 | In force | Considerations for the development of new QoS and QoE related objective models to be embedded in Recommendations prepared by ITU-T Study Group 12 |
| [Y Suppl. 60](http://handle.itu.int/11.1002/1000/14285) | 2020-04-24 | Superseded | Interpreting ITU-T Y.1540 maximum IP-layer capacity measurements |
| [Y Suppl. 60](http://handle.itu.int/11.1002/1000/14496) | 2020-09-11 | Superseded | Interpreting ITU-T Y.1540 maximum IP-layer capacity measurements |
| [Y Suppl. 60](http://handle.itu.int/11.1002/1000/14707) | 2021-05-13 | Superseded | Interpreting ITU-T Y.1540 maximum IP-layer capacity measurements |
| [Y Suppl. 60](http://handle.itu.int/11.1002/1000/14830) | 2021-10-21 | In force | Interpreting ITU-T Y.1540 maximum IP-layer capacity measurements |

TABLE 12  
Study Group 12 – Technical Papers

| Recommendation | Date | Status | Title |
| --- | --- | --- | --- |
| GSTP-IPTV-QoS | 2020-04-24 | New | Performance metrics for end-to-end IPTV video quality |

TABLE 13  
Study Group 12 – Technical Reports

| Recommendation | Date | Status | Title |
| --- | --- | --- | --- |
| PSTR-CROWDS | 2018-05-10 | New | Subjective evaluation of media quality using a crowdsourcing approach |
| PSTR-PXNR | 2019-12-05 | New | No-reference pixel-based video quality estimation algorithm |

TABLE 14  
Study Group 12 – Other publications

| Recommendation | Date | Status | Title |
| --- | --- | --- | --- |
| P.863 Impl. | 2018-05-10 | New | Implementers' guide for P.863 |
| P.863 Impl. Guide | 2019-12-05 | New | P.863 Implementers' Guide |

ANNEX 2  
  
Proposed updates to the Study Group 12 mandate and Lead Study Group roles

**(WTSA Resolution 2)**

The following are the proposed changes to the Study Group 12 mandate and Lead Study Group roles agreed at the last Study Group 12 meeting in this study period, based on the relevant portions of [WTSA-16 Resolution 2](https://www.itu.int/dms_pub/itu-t/opb/res/T-RES-T.2-2016-PDF-E.pdf).

#### PART 1 ‑ General areas of study

*[No changes requested to the general areas of study]*

ITU‑T Study Group 12

Performance, quality of service and quality of experience

ITU‑T Study Group 12 is responsible for Recommendations on performance, quality of service (QoS) and quality of experience (QoE) for the full spectrum of terminals, networks, services and applications ranging from speech over fixed circuit-based networks to multimedia applications over networks that are mobile and packet based. Included in this scope are the operational aspects of performance, QoS and QoE; the end-to-end quality aspects of interoperability, and the development of multimedia quality assessment methodologies, both subjective and objective.

#### PART 2 ‑ Lead Study Groups in specific areas of study

*[No changes requested to the specific areas of study]*

SG12 Lead study group on quality of service and quality of experience  
Lead study group on driver distraction and voice aspects of car communications  
Lead study group on quality assessment of video communications and applications

Annex B  
(to WTSA Resolution 2)  
  
Points of guidance to study groups for the development  
of the post-2021 work programme

ITU‑T Study Group 12

A particular focus of ITU‑T Study Group 12 is on the end-to-end quality (as perceived by the customer) delivered using a path that, with increasing frequency, involves complex interactions between terminals and network technologies (e.g. mobile terminals, multiplexers, gateway and network signal processing equipment, and IP-based networks).

As the lead study group for quality of service (QoS) and quality of experience (QoE), Study Group 12 coordinates QoS and QoE activities not only within ITU‑T, but also with other standards development organizations (SDOs) and forums, and develops frameworks to improve collaboration.

Study Group 12 is the parent group for the Quality of Service Development Group (QSDG); and the Regional Group of Study Group 12 on QoS for the Africa region (SG12RG-AFR).

Examples of the work Study Group 12 plans to undertake:

• end-to-end QoS planning, focusing on all-packet networks, but also considering hybrid IP/digital circuit-based paths;

• QoS operational aspects and related interworking guidance and resource management to support QoS;

• technology-specific (e.g. IP, Ethernet, MPLS) performance guidance;

• application-specific (e.g. smart grid, IoT, M2M, HN, OTT) performance guidance;

• definition of QoE requirements and performance targets, and associated evaluation methodologies, for multimedia services;

• definition of objective prediction models based on subjective assessment methodologies, data collection via crowdsourcing and customer surveys;

• definition of crowdsourcing-based methodologies for the assessment of QoS and QoE;

• subjective quality assessment methodologies for existing and emerging technologies (e.g. telepresence, virtual reality (VR) and augmented reality (AR));

• quality modelling (psychophysical models, parametric models, intrusive and non-intrusive methods, opinion models) for multimedia and speech (including wideband, superwideband and fullband);

• speech based services in vehicles and aspects of mitigating driver distraction;

• speech terminal characteristics and electro-acoustic measurement methods (including wideband, superwideband and fullband);

• definition of QoS parameters and assessment methods related to artificial intelligence and machine learning;

• development of test specifications for ITU-T Recommendations on performance, QoS and QoE.

Annex C  
(to WTSA Resolution 2)  
  
List of Recommendations under the responsibility of the respective   
study groups and TSAG in the 2022-2024 study period

ITU‑T Study Group 12

ITU‑T E.420 - ITU‑T E.479, ITU‑T E.800 - ITU‑T E.859

ITU‑T G.100-series, except ITU‑T G.160- and ITU‑T G.180-series

ITU‑T G.1000-series

ITU‑T I.350-series (including ITU‑T G.820/I.351/Y.1501), ITU‑T I.371, ITU‑T I.378, ITU‑T I.381

ITU-T J.140-, ITU-T J.240- and ITU-T J.340-series

ITU‑T P-series

ITU‑T Y.1220-, ITU‑T Y.1530-, ITU‑T Y.1540-, ITU-T Y.1550-, ITU‑T Y.1560-series

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_