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| ETSI_logo_Office_Colour_Small | ToR STF CZ (TC STQ) |
| Version: 0.17 |
| Author: Jovana Torres Menendez – Date:05 June 2018  |
| Last updated by: Hans W. Gierlich– Date:26 March 2019 |
| page 1 of 14 |

Terms of Reference - Specialist Task Force

STF CZ (TC STQ)

Methods for Objective assessment of Listening Effort based on subjective test data bases – MOLE Project Step 1

Summary information

|  |  |
| --- | --- |
| Approval status | Approved by TC STQ via RC, 25 Nov 2018 (doc ref: STQ(19)059007r7)Modified (split into 2 steps) after feedback from OCG/board review committee 17, Jan 2019 – Step 1 proposalAproved by Board#121 (31 Jan 2019) |
| Funding | **Maximum budget: 73 500 € ETSI FWP** |
| Time scale | May 2019 to Jul 2020 |
| Work Items  | DTS/STQ-264 (TS 103 558) |
| Board priority  | [ETSI STF funding criteria](http://portal.etsi.org/stfs/process/item2_PropApprFund/item2_A1_FundCriteria.asp)Emerging domains for ETSIHorizontal activities (quality, security, etc.)Standards enablers/facilitators (conformance testing, interoperability, methodology)Societal good / environmental |

Part I – Reason for proposing the STF

# Rationale

Listening effort (LE) is a concept that is widely used to describe the impact of acoustic challenges in communication [ref: Peelle, J.E. (2018) Listening Effort: How the Cognitive Consequences of Acoustic Challenge are Reflected in Brain and Behavior, *Ear and Hearing*, 39(2): 204-214, DOI: 10.1097/AUD.0000000000000494]. Listening effort has been recognized as an important aspect of telecommunication systems and services that determines user satisfaction. For example, Recommendation ITU-T P.800 lists a rating scale for Listening Quality (LQ (B.4.5a) and a rating scale for Listening Effort (LE) (B.4.5b) among others.

Another widely used measure of user satisfaction for telecommunication systems and services is speech intelligibility (SI), with methods defined, for example, in Recommendation ITU-T P.807. While there exist predictive metrics for LQ, such as Recommendation ITU-T P.863, and for SI, such as ANSI S3.5, as of today, there is no predictive metric for Listening Effort. The three aspects of satisfaction with telecommunications systems and services, LQ, LE, and SI, are interrelated; effort and intelligibility are considered dimensions of speech quality. LE has become an important aspect in the evaluation of communication systems. LE can explain, for example, in some situations, why speech enhancement technology (e.g., noise reduction algorithms) may improve LQ, but may not improve or may even degrade SI in complex listening environments [ref: Sarampalis, A., Kalluri, S., Edwards, B., & Hafter, E. (2009). Objective measures of listening effort: Effects of background noise and noise reduction. *Journal of Speech, Language, and Hearing Research*, *52*(5), 1230-1240.].

LQ and LE are inherently subjective, while SI is objective: there is an external means to know if the words transmitted are properly received. The subjective nature of LQ and LE dictates that particular attention is given to design of experiments intended to measure the phenomena. Because speech understanding involves significant cognitive processes and listening effort addresses the cognitive resources required to understand speech, dual-task paradigms may need to be considered as a means to assess listening effort during specific listening conditions, particularly when attempting to relate LQ, LE, and SI.

It is also important to consider specific aspects of the Standardization Rolling Plan 2018:

**“ACCESSIBILITY OF ICT PRODUCTS AND SERVICES**

Page 55:

**ACTION 3** SDOs to produce a technical report, based on the relevant European projects, delivering quality of service parameters addressing intelligibility of telecommunication as perceived by people with disabilities.

Page 56

**ETSI**

ETSI continues to produce accessibility standards on specific ICT topics and is planning to produce a guide to user-centred terminology for existing and upcoming devices and services and recommendations for the design of ICT devices for persons with cognitive disabilities; initial early investigations are being made into transmission quality and its possible link to reported intelligibility problems for some hearing impaired people; see also EG 202 952, a set of guidelines to identify “Design for All” aspects in ETSI deliverables.”

To meet the Accessibility objectives stated above, the work on LE must accommodate the specific needs of persons with cognitive and perceptual disabilities. In particular, experiments designed to measure LE must be designed so that the work can be readily extended to service the needs of the population with such disabilities.

In light of the points made above, we propose the following general approach:

1. Design experiments to measure LE, using methods that include all relevant aspects of accessibility for persons with hearing impairment.
2. Collect a corpus of results over a wide range of conditions relevant to contemporary telecommunications systems, with initial focus on persons without hearing impairment
3. Development of an objective model for the prediction of LE for persons without hearing impairment.
4. Explore relations between listening quality, listening effort and intelligibility for users with normal hearing using the new LE model. This step may require additional listening tests.
5. Collect a corpus of results over the same conditions as noted in b), but for persons with hearing impairment. Due to the complexity of hearing impairments, this may require extensive work,
6. Use the LE predictive model developed in step c) with the additional data collected in step e) to extend the LE predictive model for use with persons with hearing impairment.

The present STF proposal is intended to cover steps a) and b) above, but limited to the acoustical interface. For the electrical interface similar steps a) and b) will be contained in separate STF proposal. The development of the LE predictive model, step c) will be accomplished as part of the expected workflow of STQ. Further explorations, and in particular, the extension of the LE predictive model to persons with hearing impairment, are expected to be the topic of yet another future STF.

# Objective

The work to be performed is to create a set of

1. high quality reference speech samples
2. definition and implementation of test conditions which impair the reference items
3. high quality recordings of the impaired reference items (test sequences)

and conduct a statistically sufficiently large number of auditory tests (subjective tests) for the following scenario:

* at acoustical interfaces in the presence of background noise.

There are 2 main tasks to be completed:

* creation of a set of test sequences at the acoustic interface
* designing, conducting and analysing subjective tests for the acoustic interface

# Relation with ETSI strategy and priorities

Emerging domains for ETSI

The domain of intelligibility and related listening effort is on the agenda of ITU-T Study Group 12 since several study periods, but no progress has been made so far. ETSI has now the opportunity to take the leadership in this important domain.

Standards enablers/facilitators (conformance testing, interoperability, methodology)

The objective model(s) for the prediction of listening effort, which will be developed and standardized by ETSI members after the completion of the STF will open new ways to better assess QoS of end-to-end telecommunication scenarios, customer satisfaction and aspects of QoE. It will make it possible to improve all existing terminal and gateway standards which have been produced by STQ in the past.

Horizontal activities (quality, security, etc.)

Objective assessment of listening effort will be used for all transmission technologies including 5G from a user’s perspective.

Societal good / environmental

The STF constitutes a mandatory first step to address the needs of the hearing-impaired community with respect to aspects of intelligibility as stipulated by the Standardization Rolling Plan 2018.

Accessibility standards such as EN 301 549 could take benefits of the results of the STF.

# Context of the proposal

## ETSI Members support

|  |  |  |
| --- | --- | --- |
| **ETSI Member** | **Supporting delegate** | **Motivation** |
| OPTICOM | Jovana Torres Menendez | Validation of the objective model for LE for user without hearing impairments with the intent to extent this after the completion of the proposed STF towards LE for hearing impaired user and towards intelligibility if possible |
| HEAD acoustics | Jan Reimes |
| Mesaqin.com | Jan Holub | Support of ETSI’s horizontal activities and support towards the rolling standardization plan |
| Focus Infocom | Wolfgang Balzer |
| Ministry of Transport and Construction of the Slovak Republic | Peter Pocta |

## Market impact

The proposed activity will help to make progress in developing the guidance and methodology regarding intelligibility for hearing impaired users, for which it is necessary to follow the following steps:

1. development of an objective model for the assessment of listening effort for users with normal hearing
2. explore relations between listening effort and intelligibility for users with normal hearing
3. use the objective LE model from a) with hearing impaired users and explore whether the model can be adapted to be used for hearing impaired users
4. depending on the outcome of b) explore relations of the outcome of c) for LE with intelligibility.

The present STF proposal is intended to cover the subjective testing which is a pre-requisite for a).

As the user perception of listening effort and intelligibility will be at the centre we may expect a larger usage of the tools and applications that can be standardized in case the actions listed above are followed consequently. It is expected that the developed methods can be used for various applications, such as evaluation of terminals and networks, up to hearing aid optimization. This can have a substantial market impact, for the expert users but moreover for the population with impaired hearing capabilities.

With age for humans the ability to discriminate background noise from speech signals is reducing; in such a situation listening effort becomes more and more a crucial factor. In addition, the average age across society is increasing.

The aim is also to enable conversations across telecommunication systems in the presence of background noise without damaging people’s hearing.

## Tasks for which the STF support is necessary

Subjective tests must be designed and carried out. The reference items, definition and implementation of the test conditions as well as recordings of the impaired sequences for the subjective test must be created.

TC STQ members do not have sufficient equipment and capability to organize and run a subjective test campaign with multiple independent test labs involved.

## Related voluntary activities in the TB

TC STQ members will develop the objective model(s) based on the subjective test data provided by this STF.

Some members have expressed that they are in close contact with relevant universities and are willing to provide initial studies in collaboration with such universities in which the objective model(s) will be applied to subjective data from hearing impaired users of the different impairment classes.

The subjective tests data bases may be used in the future by STQ members to provide input on new standards regarding testing with parallel task as outlined in ETSI TR 103 503.

## Previous funded activities in the same domain

TC STQ did benefit of STF support in this domain during the past 5 years for STF 504 on Detection of Emotions in Telecommunication Measurement Applications. The resources used amounted approximately to 60kEUR.

This work dealt with development of a standard on emotion detectors. Initially, the classification of Emotion Detectors for written text and its performance assessment have been made. This included analysis of existing solutions. Consequently, a classification of Emotion Detectors for spoken speech and its performance assessment has been performed, including analysis of existing solutions.

As a next step and based on the results of previous tasks, the set of minimum requirements for emotion detectors in telecommunications was defined. The final clause contains minimum mandatory and optional input and output requirements, memory and power requirements, and types of operation.

## Consequences if not agreed

If the STF is not accepted, the work will not be undertaken in the way that the rolling standardization plan could be addressed in the near future.

The market will be fragmented by non-standardized solutions claiming to address the telecommunication intelligibility of the hearing-impaired community.

Part II – Execution of the work

# Technical Bodies and other stakeholders

## Reference TB

TC STQ will be the TB responsible for the technical guidance of the STF.

## Other interested ETSI Technical Bodies

The overall concept to address the rolling plan will be shared and further elaborated with other ETSI groups as necessary. However, for the STF proposed here the interaction will be limited to dissemination to the USER group and to TC HF.

## Other stakeholders

ITU-T SG 12:

Question 9 of SG12 mentions the objective prediction of speech intelligibility in their ToR; However, SG12 has not made much progress on this topic during the past study periods. It is expected that fruitful input can be received from an active interaction with SG12 during the STF.

TIA TR-41 “Performance and Accessibility for Communications Products” specifically address issues on accessibility to telecommunications services. <http://standards.tiaonline.org/all-standards/committees/tr-41>

The Technology Access Program (TAP) at Gallaudet University conducts research related to communications technologies and services, with the goal of producing knowledge useful to industry, government, and deaf and hard of hearing consumers in the quest for equality in communications. The program provides education to Gallaudet students through coursework and mentored research projects related to TAP’s research mission.

# Base documents and deliverables

## Base documents

|  |  |  |  |
| --- | --- | --- | --- |
| **Document** | **Title** | **Current Status** | **Expected date for stable document** |
| ETSI TS 103 558 | Methods for objective assessment of listening effort | Early Draft |  |
| ETSI TR 103 225 | Transmission quality and speech intelligibility for hearing impaired people | Published |  |

## Deliverables

|  |  |  |
| --- | --- | --- |
| **Deliv.** | **Work Item code****Standard number** | **Working title****Scope** |
| D1 | DTS/STQ-264TS 103 558 | Working title: Reference items, recordings of degraded items using test conditions and subjective test databases Appendix to TS 103 558Scope: Reference items, recordings of degraded items using test conditions and subjective test databases  |

## Deliverables schedule:

Appendix to TS 103 558: Reference items, recordings of test conditions and subjective test databases for the acoustical model

* Start of work 27-May-2019
* Early draft 27-Sep-2019 STQ#62
* Stable draft 21-Feb-2020 STQ#63
* TB approval 03 Jul 2020 STQ#64
* Publication 31-Jul-2020

# Work plan, time scale and resources

## Organization of the work

The set of test sentences must be ready and agreed on before the subjective tests can be started. Therefore, the most important milestone is the completion of the test sentences.

A steering committee will be created. This will meet in conjunction with STQ and by conference call as necessary. The steering committee will be chaired by a member of the STQ management team or a Rapporteur from STQ.

Linda Kozma-Spytek from the Technology Access Program at Gallaudet University (see section 5.3) has already expressed interest to join and actively support the steering committee.

The relation with other stakeholders will be managed via liaison communication and attendance of their meeting(s) to present the status of the STF work.

## Task description

Task 1 – Creation of a set of test sequences at the acoustic interface

Objectives

The objective of task 1 is to create recordings of speech samples with various speakers in the presence of different types of acoustical background noise. The types of background noise must cover a wide variety of different noises and the recordings must be at least wideband, preferably super-wideband or fullband. These recordings must be provided in a quality suitable for the use in auditory tests. The recording procedures shall comply with the corresponding clauses of TS 103 558. The background noise simulation in these experiments has to be compliant with ETSI TS 103 224.

Input

None.

Output

The output of task 1 will be a set of recordings of speech samples suitable for subjective testing with the following properties:

number of training databases = min. 3

number of validation databases = min.3

number of conditions per database = 48 test+12 reference conditions

number of samples per condition for training db = 16

number of samples per condition for validation db = 8

number of votes per sample for training db= 12

number of votes per sample for validation db= 16

Interactions

Approval of the output by the steering committee.

Resources required

Recording lab facilities. Expertise in the fields of speech quality, background noise, subjective test design and development of objective models in telecommunication.

Task 2 – Designing, conducting and analysing subjective tests at the acoustic interface

Objectives

The aim of Task 2 is to conduct subjective tests for the relevant conditions as defined in Task 1. The results of the subjective tests are compared to the output of the objective model. One set of subjective tests is used to further train the objective model in order to achieve a maximum correlation between the subjective scores and the scores predicted by the objective model. The second set of subjective tests is used for model validation.

Input

Task 1 must be completed and approved. The test sequences from task 1 must be available.

Output

The output of task 2 will be a number of databases giving the relation between the test sentences created in task 1 and the average scoring by the subjects; it will also provide a statistical analysis of the scores following the principles that can be found in Recommendation ITU-T P.1401.

The following databases are planned:

* At least 3 training databases (design, constructing & verification) following the requirements as defined in Task 1
* At least 3 validation databases (design, constructing, & objective model correlation analysis) following the requirements as defined in Task 1

The databases have to be setup as follows:

|  |  |  |  |
| --- | --- | --- | --- |
| Type | Description | Training | Validation |
| Listening Test Design | **Nbr test conditions** | **48** | **48** |
|  | **Nbr reference conditions** | **12** | **12** |
|  | *Nbr conditions* | *60* | *60* |
|  | **Samples per condition** | **16** | **8** |
|  | **Votes per Sample** | **12** | **16** |
|  |  |  |  |
|  | *Nbr Samples per DB* | *960* | *480* |
|  | *Nbr Votes per DB* | *11520* | *7680* |
|  |  |  |  |
| Subjects | *Nbr of votes per subject* | *240* | *240* |
|  |  |  |  |
|  | *Nbr of subjects needed* | *48* | *32* |
|  |  |  |  |

The average costs of one training database is estimated to **9 000 €** resulting in a total of **27 000 €.**

The average costs of one validation database is estimated to **7 500 €** resulting in a total of **22 500 €.**

Interactions

The design of the subjective tests must be confirmed by the steering committee before the actual test can be launched.

Resources required

Subjective test lab facilities. Expertise in the fields of speech quality, background noise, subjective test design and conducting and statistical analysis of the scores in telecommunication.

Task 3 – Overall coordination and project management

Since it is envisaged that tasks 1 to 2 will be performed by different labs (one or more labs per task) it is important that there is an independent task defined which is responsible to compile the various activities into the final deliverables and to make sure that the requirement of the ToR are met in full and in time. Task 3 requires senior expertise in the field of telecommunications and subjective testing without being part of a test lab.

Task 3 will be responsible for all activities, which are not done by the participating test labs, which includes but is not necessarily limited to the following action items:

* STF coordination and management
* Dissemination of STF intermediate and final results and collection of feedback
* Monitoring of the output of tasks 1 to 2 to make sure the content complies with the requirements of the ToRs.
* Production of STF milestone and final reports up to the acceptance by ETSI
* Production of the deliverable up to acceptance by the ETSI Secretariat

## Milestones

Milestone 1 – Test sequences for subjective testing approved and available

Tasks 1 completed at latest 2 months after project start and approved by steering committee. Early draft of Appendix to TS 103 558 available for review. Progress report approved by TC STQ# 62 (Sep 2019). Documents must be uploaded on the STQ docbox at least two weeks before the start of the STQ plenary.

Milestone 2 – Design of Test Plans for subjective test agreed

Design of Test Plans for subjective test agreed by steering committee. 3Feb

Milestone 3 – Conducting and analysing subjective tests completed and Consolidation of test results for different domains

Final draft of Appendix to TS 103 558 approved by TC STQ#64 and accepted by the ETSI Secretariat for publication. STF Final Report approved by TC STQ#64 .

Milestone 4 – Deliverables published, STF closed

## Task summary

|  |  |  |  |
| --- | --- | --- | --- |
| **N** | **Task / Milestone / Deliverable** | Target date | Estimated cost |
| EUR |
| M0 | Start of work | 27-May-19 |  |
| T1 | Creation of a set of test sequences at the acoustic interface | 27-May to27-Sep-19 | 12 000 |
| M1 | Test sequences for subjective testing and Progress report to be approved at TC STQ#62Early Draft available | 27-Sep-19 |  |
| T2 | Designing, conducting and analysing subjective tests at the acoustic interfaceTraining databases 3 x 9000 €Validation Databases 3 x 7500 €(Details see Task 2) | 30-Sep-19 to21-Feb-20 | 49 500 |
| M2 | Design of Test Plans for subjective test and Progress Report to be approved at TC STQ#63Stable draft available | 21-Feb-20 |  |
| M3 | Conducting and analysing subjective tests completedConsolidation of test resultsFinal Report and deliverable to be approved TC STQ#64 | 03-Jul-20 |  |
| T3 | Overall coordination and project management | 27-May-19 to 03-Jul 20 | 7 000 |
| M4 | Deliverables published, STF closed | 31-Jul-20 |  |
| **Total** | **68 500** |

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Task Milest.** | **Description** | **M** | **J** | **J** | **A** | **S** | **O** | **N** | **D** | **J** | **F** | **M** | **A** | **M** | **J** | **J** |
| T1 | Creation of a set of test sequences at the acoustic interface | X | X | X | X |  |  |  |  |  |  |  |  |  |  |  |
| M1 | Test sequences for subjective testing approved and available |  |  |  |  | X |  |  |  |  |  |  |  |  |  |  |
| T2 | Designing, conducting and analysing subjective tests at the acoustic interface |  |  |  |  | X | X | X | X | X | X |  |  |  |  |  |
| M2 | Design of Test Plans for subjective test agreed |  |  |  |  |  |  |  |  |  | X |  |  |  |  |  |
| M3 | Conducting and analysing subjective tests completedConsolidation of test resultsFinal Report and deliverable to be approved |  |  |  |  |  |  |  |  |  |  |  |  |  |  | X |
| T3 | Overall coordination and project management | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X |
| M4 | Deliverables published, STF closed |  |  |  |  |  |  |  |  |  |  |  |  |  |  | X |

## Working methods and travel cost

The working methods will follow the principle of Cognitive Interleaving Teamwork.

It is expected that for tasks 1 to 2 qualified test labs will submit bids with a full package price tag which includes cost of manpower, operational costs of the lab and for task 2 remuneration of test subjects and that the internal split-up of these costs must not be revealed.

For task 3, a team of two senior experts should be responsible. Therefore, the following working structure can be foreseen:

* Tasks 1 and 3: 1 coordination session, location tbd (cost included in contracts)
* Tasks 1, 2,and 3: optional 1 handover sessions, location tbd (cost included in contracts)
* Tasks 2 and 3: 1 or 2 coordination sessions, location tbd (cost included in contracts)
* Task 3: stakeholder consultation (reimbursed as real cost from travel budget)
* otherwise the work can be done remotely

# Expertise required

## Team structure

For Task 1:

One testlab capable of creating recordings of speech samples with various speakers in the presence of different types of acoustical background noise. These recordings must be provided in a quality suitable for the use in auditory tests. The lab must provide proof of relevant experience in such work in the past.

For Task 2:

One or more Testlabs capable of designing the subjective tests as outlined in ETSI TR 103 503 providing as output a number of data bases giving the relation between the test sentences and the average scoring by the subjects, also providing a statistical analysis of the scores. The lab must provide proof of relevant experience in such work in the past.

For Task 3:

Senior expert with the following experiences and competences:

* design of subjective tests
* conducting of subjective test
* statistical analysis in telecommunications
* objective modelling in telecommunications
* sound understanding in user perception

Part III: Financial conditions

# Maximum budget

## Manpower cost

The total cost of contracts is estimated to be a maximum of 68 500 EUR.

It is expected that for tasks 1 to 2 qualified test labs will submit bids with a full package price tag which includes cost of manpower, operational costs of the lab and for task 2 remuneration of test subjects and that the internal split-up of these costs must not be revealed.

## Travel cost

|  |  |
| --- | --- |
| **Expected travels** | **Cost estimate** |
| 2 times STF leader to attend TB meeting | 2 000 |
| 1 times STF leader to disseminate work to ITU-T SG12 | 1 500 |
| 1 times Steering Committee Member to attend TB/STF meeting | 1 500 |
| **Total cost** | **5 000** |

Part IV: STF performance evaluation criteria

# Key Performance Indicators

Contribution from ETSI Members to STF work

* Direct financial contribution (co-funding)
* Support to the STF work (e.g., provision of test–beds, organization of workshops, events)
* Steering Group meetings (number of meetings / participants / duration)
* Number of delegates directly involved in the review of the deliverables
* Contributions/comments received from the reference TBs
* Contributions/comments received from other TBs

Contribution from the STF to ETSI work

* Contributions to TC/WG meetings (number of documents / meetings / participants)
* Contributions to other TBs
* Presentations in workshops, conferences, stakeholder meetings

Liaison with other stakeholders

* Stakeholder participation in the project (category, business area)
* Cooperation with other standardization bodies
* Potential interest of new members to join ETSI
* Liaison to identify requirements and raise awareness on ETSI deliverables
* Comments received on drafts (e.g. on WEB site, mailing lists, etc.)

Quality of deliverables

* Approval of deliverables according to schedule
* Respect of time scale, with reference to start/end dates in the approved ToR
* Comments from Quality review by TB
* Comments from Quality review by ETSI Secretariat

Time recording

For reporting purposes, the STF experts shall fill in the time sheet provided by ETSI with the days spent for the performance of the services

In the course of the activity, the STF Leader shall collect the relevant information, as necessary to measure the performance indicators. The result will be presented in the Final Report.

# Document history

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
|  | **Date** | **Author** | **Status** | **Comments** |
| 0.1 | 05-June-2018 | Jovana Torres Menendez |  | initial proposal to STQ |
| 0.6 | 30-August-2018 | Joachim Pomy |  | first draft |
| 0.7 | 07-September-2018 | Joachim Pomy |  | comments on clause 7.2 added for discussion at STQ#59 |
| 0.8 | 20-September-2018 | Joachim Pomy |  | after first discussion at STQ#59 |
| 0.9 | 20-September-2018 | Joachim Pomy |  | output from STQ#59 |
| 0.10 | 6 November 2018 | Scott Isabelle |  | result of ongoing discussion |
| 0.11 | 7 November 2018 | Joachim Pomy |  | minor corrections |
| 0.12 | 8 November 2018 | Linda Kozma-Spytek |  | Comments and minor edits |
| 0.13 | 21 January 2019 | Hans W. Gierlich (TB Chair) |  | Split of proposal based on the evaluation result of the STF review committee  |
| 0.14 | 21 January 2019 | Youssouf Sakho |  | Editorial corrections |
| 0.15 | 22 January 2019 | Hans W. Gierlich |  | Updates (Task 2 objectives) |
| 0.16 | 18 February 2019 | Youssouf Sakho | Board Approved | Updates before CL publication |
| 0.17 | 26 March 2019 | Youssouf Sakho | Board Approved | Updates before CfE extension (new publication) |