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Abbreviations

ADDS	Automatic Deception Detection System
BCAT	Integrated Border Control Analytics Tool
BCP	Border Crossing Point
DAAT	Document Authenticity Analysis Tool
FMT	Face Matching Tool
HHD	Hidden Human Detection
iBorderCtrl	Intelligent Portable Control System
KPI	Key Performance Indicator
PU	Portable Unit
RBAT	Risk Based Assessment Tool
TRL	Technology Readiness Level
TUA	Traveller User Interface

Executive Summary

In Deliverable D6.2 “Feedback of components evaluation with end-users”, the entire pilot deployment and system evaluation re-planning is described in detail. According to this, a stepwise approach is followed to gradually test the system in all its dimensions.

Three main Test Phases for the pilot implementation, validation and evaluation of the iBorderCtrl platform are envisioned. Each Phase addresses specific and separate needs in terms of integration and testing of all deployment dimensions; to this respect, different targets are set for each Phase and different aspects are tested, all of which add to an overall cumulative piloting experience. The three phases (namely the “Convergence of all preparatory actions” phase, the “Testing of all tools in terms of ergonomics and usability and first validation feedback” phase, and the “Final overall evaluation through full-scale deployment and scenarios testing” phase) are expected to provide valuable feedback that will finally lead to a successful operational functionality of the whole iBorderCtrl system (as well as to the expected functionality of individual iBorderCtrl sub-systems).

For this reason, a total of more than 2,000 man-hours have been spent by the iBorderCtrl consortium members in testing the network equipment, software applications and hardware devices, at the selected pilot sites, to successfully validate the iBorderCtrl concept and to enable the iBorderCtrl system to further develop and reach higher TRL that would even go beyond the proposal objectives.

This deliverable contains the description of the pilot tests held during Test Phase 2, along with the outcomes of the system evaluation by Border Guards and consortium members playing the roles of travellers and by Border Guards playing the roles of Border Guards. In more detail, the pilot tests that were held during Test Phase 2 are the following:

a) the Greek Pilot Tests in [redacted]
b) the Latvian Pilot Test in [redacted]
c) the ADDS testing

1 Introduction

This document is presenting the feedback received during Test Phase 2 with the conductance of pilot tests in Greek and Latvian sites. In Test Phase 2, the final integrated iBorderCtrl prototype comprised of the final version of the Portable Unit and the overall iBorderCtrl platform (including the final versions of user interfaces TUA, BGUA) was tested on real conditions. The focus of Test Phase 2 was on gathering feedback in different operational environments (road border gate, railway border checks). The second validation feedback was gathered and assessed achieved development goals as well as mapping potential improvements in terms of the TUA and BGUA usability and in terms of ergonomics and usability of the Portable Unit.

On Section 2 the pilot tests taking place in Greece, in road and railway border checks scenarios (both stationary and on-board) are presented. More specifically, the description of the test environment and an overview of the organisation of actions at the pilot site are presented in Section 2.1. The qualitative and quantitative feedback received from the participants by using the methodology (questionnaires, surveys, logs, interviews etc.) -presented in D6.2- is analysed in Sections 2.2 and 2.3. In Section 2.4, certain statements and conclusions, are provided as a roadmap enabling further technical development in an end-user friendly way. The test experience is presented fully, resulting in a list of valuable test remarks and feedbacks.

On Section 3 the pilot test taking place in Latvia[redacted] the typical land border check scenario is presented. More specifically, the description of the test environment and an overview of the organisation of actions at the pilot site are presented in Section 3.1. The qualitative and quantitative feedback received from the participants is presented in Sections 3.2 and 3.3. In Section 3.4, certain statements and conclusions, are provided as a roadmap enabling further technical development in an end-user friendly way. The test experience is presented fully, resulting in a lists of valuable test remarks and feedbacks.

On Section 4, a full and detailed description of the specific scenarios conducted in Greece and Latvia for the evaluation of the overall solution and the validation of its components in realistic environments is presented, including the train pilots. The content is enriched with the description of the conducted pilots along with many images and snapshots of the tests performed. Furthermore, the test outcomes on combined scenarios is provided along with evaluation results of a separate testing of ADDS performed by MMU.

Finally, the overall evaluation feedback is extensively assessed in Chapter 5 while Chapter 6 concludes this report.

2 Greek Pilot Tests – Test Phase 2

2.1 Test environment aspects

The Greek pilots involved two test cases performed in two different sites and coordinated by KEMEA involving in both tests the participation of the Greek Border Authorities from Hellenic Police:

a) [redacted] case with a Train passengers test at [redacted]
b) KEMEA case with Pedestrians/Vehicles passengers BCP test at [redacted]

The two test cases were performed almost in parallel and personnel from the Greek Border Authorities participated in both of them. Thus, the main validation and evaluation outcomes will be described in the following referring to both sites throughout the whole Test Phase 2 conductance period for the Greek pilot sites, while certain highlights will be presented per site where needed.

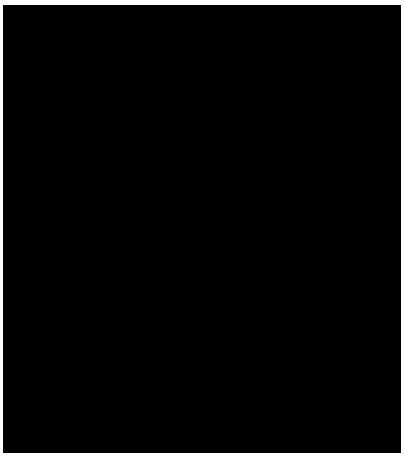
It should be also mentioned that within this Chapter the usability implementation outcomes in terms of quantitative and qualitative results as these are represented by i.e. statistical values or "short-term feeling" (provided by the Border Guards test reports) will be presented. On the other hand, the evaluation outcomes of the specific Scenarios testing within the piloting cases (Greek and Latvian) for the whole Test Phase 2 will be presented in a following Chapter where the "overall feeling" of the involved players captured during the final validation and evaluation will be analyzed.

2.1.1 Test Cases & Sites

The Greek pilots were mainly located [redacted] sites both for the KEMEA's BCP tests and the train pilots (especially for the train stationary mode). Brief descriptions of the main sites are given below:

KEMEA Site:

[redacted]



However, taking into account the heavy passenger flow at the time that the Greek pilot BCP testing would be conducted (beginning of the summer "high season" period, which might had a serious impact - both on the proper conductance of the real border checks and on the full control of the conditions for hosting the Greek test for iBorderCtrl project – it would be difficult for KEMEA to guarantee the requested restricted encapsulated environment [redacted] For this reason an alternative test pilot site was selected to conduct the Greek piloting which was the so called "KEMEA's site in Athens".

[redacted]. Hence, similar conditions as the ones expected at the Hellenic BCP sites could be provided, while, simultaneously an encapsulated environment resembling laboratory settings could be guaranteed in order to reduce risks associated with any interference with the real-life border crossing operating environment and to comply with the project's first ethical review report recommendations. All types of scenarios (both legitimate and illegitimate ones) were conducted according to the prescribed cases of D6.2, the outcomes of which will be presented in a following Chapter of this report.

TRAINOSE Site: [redacted]

As it is stated in D6.2, the main aim of the train pilots is to prove **the Border Guard's mobility concept**, using the iBorderCtrl Portable Unit. The aim is to prove that the Border Guard can use the iBorderCtrl Portable Unit and perform the border control checks at the train: either when the train is stopped at the border train station or even when the train is on the move. According to the above, the train piloting is not location dependent. Therefore, any tests concerning the impact of the train carriage specificities, are consequently related to the control checks through the iBorderCtrl Portable Unit and the BGUA and can be conducted at any location: either at a train station (within the train route), at the train's garage stations, or even while the train is on the move (irrespective of the actual train location).

[redacted]

In order to accommodate the conductance of train pilots at any desired train station or even when the train is on the move, special arrangement were made for providing network connectivity to the iBorderCtrl Portable Units when used inside the train wagons. This included a joint LTE/WiFi solution consisting of a cellular modem that connects to a mobile operator using LTE and shares the internet connection over WiFi to the inner part of the train wagons. Hence, the radio network, the communication equipment were prepared, installed and tested in one of the compartments of the train by ICCS, while the Portable Unit and accompanying server were installed by JAS.

Since the focus of the train pilots was to prove the Border Guard's mobility, only the legitimate scenarios were conducted according to the prescribed cases of D6.2, the outcomes of which will be presented in a following Chapter of this report.

2.1.2 Final prototype description used in the Greek tests

During Test Phase 2 and for all the Greek pilot tests, both in TRAINOSE & KEMEA sites [redacted], the status of the Portable Unit and its components used for the testing, was as follows:

[redacted]	[redacted]	[redacted]
[redacted]	[redacted]	[redacted]

2.1.3 Test participants and Timeline of testing

All the Greek piloting activities, both for the train pilot ([redacted]) and for the BCP actions (KEMEA's site [redacted]) were conducted with the participation of the Hellenic Police.

The role of travelers was primarily "played" both by the Border Guards and Hellenic Police Officers with former large experience in border crossing checks which was fully exploited especially for the suspicious illegitimate test scenarios (acting with similar behavior as regular illegal passengers). Furthermore, actors from KEMEA's staff (either research personnel or former Police Officers) along with consortium members played on a voluntarily basis as research participants the role of travellers in accordance to the pre-described legitimate scenarios. It has to be denoted that adequate number of the consortium members' staff was present, since 4 partners participated in the Greek pilots (KEMEA, TRAINOSE, ICCS and ED).

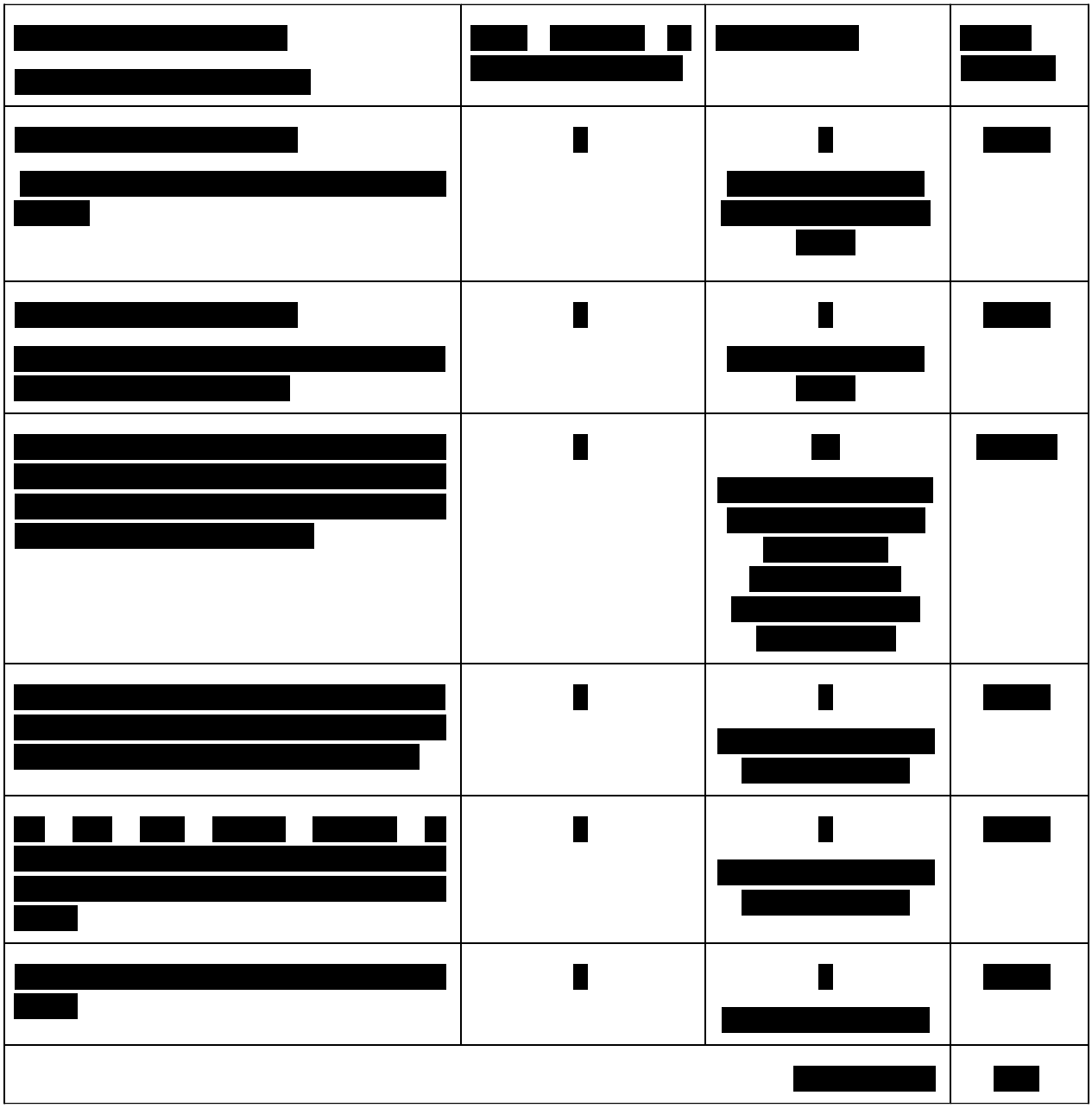
The role of Border Guards was played by actual Border Guards who performed their role exactly as this would be done in the borders, especially for the conductance of the Scenarios testing; with the same questions posed to the real travelers and the same professional attitude for that purpose. For that, the Hellenic Police provided Border Guards to be involved in the tests as well as Police Officers from different divisions with former experience in border checks. Three Border Guards participated in the tests as Border Guards, two of them in both TRAINOSE and KEMEA sites obtaining the experience from both different environments. [redacted]

The test shift services were 8-hour long each and average 2 Border Guards per shift were involved.

The Greek piloting started on beginning of July 2019 while adequate time was planned to be dedicated (approximately 2 months, until the end of the project) to anticipate for the Border Guards leaves during the summer time. The train piloting in TRAINOSE was conducted almost in parallel with the BCP tests at KEMEAs site [redacted]. Due to the summer period it was evident that most of the BCP checks piloting at the KEMEA's site [redacted] took place during July; the piloting was conducted for several days on a regular, although not continuous, basis depending on the day-to-day availability of the Border Guards. Furthermore, the plan for the train piloting needed to anticipate for the train itineraries since an operational passengers' train and carriages was used; hence, the days devoted for the train piloting lasted cumulatively around a week.

However, it was proven that the overall time periods used for the tests were adequate enough in order to conduct both the BCP checks and the foreseen legitimate and illegitimate scenarios and to extract valuable comments and feedback on the usability of the tools as well as the overall iBorderCtrl approach. It should be also noted that the Border Guards participating also devoted adequate time to get familiarised with the pre-registration procedure (TUA and avatar interview); for that reason, internal workshops of "seminars type" were conducted by the KEMEA staff in order to fully explain the project's aims and technologies to the Border Guards prior to the actual visits at the piloting sites and use of the Portable Unit and BGUA. Finally, the BMUA was tested by the Border Managers during the piloting days as well as the "debriefing" ones to capture the aftermath approach.

Based on the above the overall time duration dedicated to all the Greek piloting tests, is given on a cumulative basis in the table below.



2.2 Tests Preparation & Implementation Methodology

The methodology applied at TRAINOSE and KEMEA sites prior and during the tests was the same at both sites simulating the conditions as these would occur in a real operational environment taking significantly into consideration and applying all the appropriate measures and precautions needed for data protection and ethical issues involved in all processes for all volunteer participants. The methodology was comprised by the following steps:

[redacted]	[redacted]
[redacted]	[redacted]
[redacted]	[redacted]
[redacted]	[redacted]
[redacted]	[redacted]
[redacted]	[redacted]
[redacted]	[redacted]
[redacted]	[redacted]
[redacted]	[redacted]

[redacted]	[redacted]
[redacted]	[redacted]
[redacted]	[redacted]

[redacted]

2.3 Evaluation of the Traveller User Application (TUA)

The evaluation of the TUA consists of two parts: (a) the quantitative evaluation, which is a set of results derived from questionnaires that had to be filled after the tests by the participants who played the role of travelers and, (b) the qualitative evaluation, which was formulated from the comments reported by the participants either via email or after an informal interview and discussion arranged with them.

2.3.1 Quantitative Evaluation of TUA

The following evaluation is focused on the TUA's usability and functionality and is based on the results extracted from the 20 questionnaires answered by the actors, who played the role of travelers. Out of the 31 questions in the questionnaire we grouped and listed the following main results and conclusions.

[redacted]

[redacted]

[redacted]

[redacted]

[redacted]

[redacted]

[redacted]

[redacted]

[redacted]

[redacted]

[redacted]

[redacted]

[redacted]

[redacted]

[redacted]

[redacted]

[redacted]

[redacted]

[redacted]

[redacted]

2.3.2 Qualitative Evaluation of TUA & Recommendations

The qualitative evaluation includes comments, issues and recommendations for improvements of TUA, reported to KEMEA by the 'traveler' role playing participants either by email or through informal interviews arranged with them after they completed their tests as well as during debriefing. Most of the issues reported were purely technically oriented for further improvement.

It should be noted that, during the informal interviews as well as during the debriefing, free discussions took place with all the players involved both the "travelers" and the Border Guards. During these free discussions, answers were provided on the spot by the consortium members and technical partners to the "travelers", in order to clear out any possible misunderstandings or misconceptions concerning especially the reported technical issues. Furthermore, the respective recommendations especially from the Border Guards were considered well-based and are seriously taken into account.

An attempt to distinguish the most significant qualitative evaluation comments and the recommendations received for further improvements will take place in the Tables to follow. For the testers qualitative comments, the responses provided on the spot by the technical partners are also given as well in a separate column.

[redacted]

[redacted]

2.4 Evaluation of the BCP Phase – Portable Unit (PU) & BGUA

All involved steps of the BCP phase using the Portable Unit (PU) and the Border Guard User Application (BGUA) were evaluated by KEMEA together with the Border Guards from Hellenic Police.

The BCP piloting tests were conducted at the KEMEA's site [redacted], including usability tests and the legitimate and illegitimate scenarios. Certain Border Guards played "themselves", while the rest of them and the Consortium staff who had registered their trip details within TUA, played the "travelers".

The train pilot in stationary mode [redacted] while the train-on-the-move mode was also enabled for a short period. Again, a Border Guard acted as the Police Officer conducting the checks and the legitimate scenarios; the rest of the testers (other Border Guards and consortium staff) acted as passengers sitting within the train carriages and the Border Guard with the Portable Unit moved along the seats within the carriage performing the checks.

In the following the overall evaluation feedback from both piloting cases is described, indicating the most significant positive or negative outcomes of the whole process. As previously for the TUA, the evaluation is composed by the quantitative evaluation derived from the results of the questionnaires filled by the border guards and the qualitative evaluation with the issues identified during the tests, the feedback and the recommendations from the border guards reported after the completion of the tests. As denoted previously the results from the specific scenarios testing will be presented in a following Chapter of this report.

2.4.1 Quantitative Evaluation of BCP Phase – PU & BGUA

Based on the results from the 3 Border Guards' questionnaires, the following quantitative observations were extracted from the overall testing (train pilot and BCP tests). In similar way like

the TUA previously, accompanying comments or "free text responses" are also provided to highlight more the captured "feelings" by the testers.

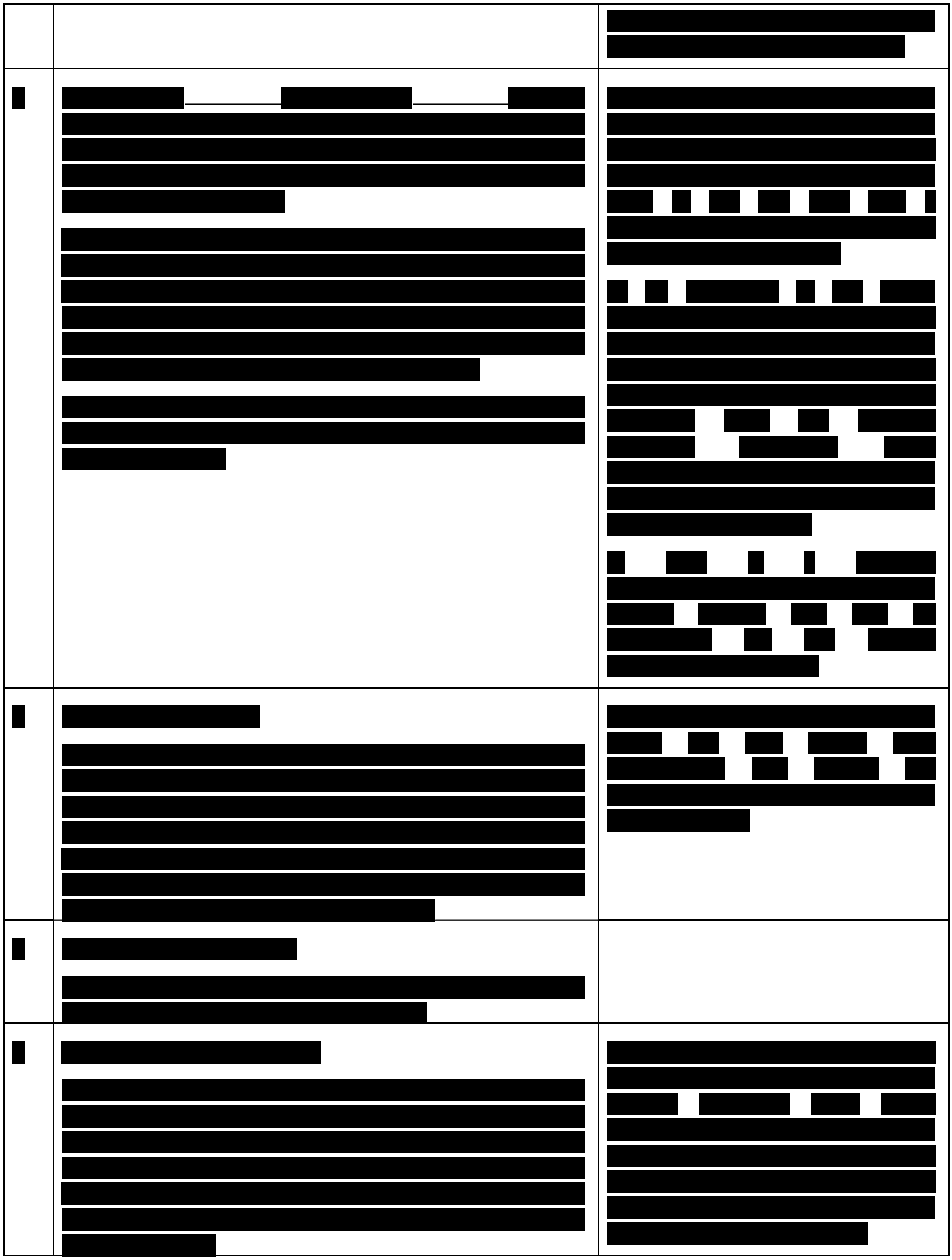
[redacted]

		[redacted]
[redacted]	[redacted]	[redacted]
[redacted]	[redacted]	[redacted]

2.4.2 Qualitative Evaluation of BCP Phase – PU & BGUA

2.4.2.1 Identified Issues during the BCP Phase Tests

The following issues concerning the various discrete steps below were identified during the tests. The presentation follows a similar manner to the feedback described in the previous sections



It's worth mentioning that certain issues were resolved and improvements have been made during the tests while the whole progress was overall very promising. It was felt that the Greek testers and especially the Border Guards were keen on testing and depicting the "deep details" of the whole process which was considered a valuable feedback at that time leaving room for further refinements in case of future exploitation. To this respect, certain really valuable recommendations were received that are shown in the following Table.

2.4.2.2 Border Guards Recommendations

[redacted]	[redacted]
[redacted]	[redacted]
[redacted]	[redacted]

	[redacted]
[redacted]	[redacted]

[redacted]

[redacted]

[redacted]

2.5 Evaluation of Border Control Analytics Tool (BCAT) & BMUA

BCAT is the module of iBorderCtrl platform, which is responsible for analyzing all the data in the iBorderCtrl database to: discover patterns in the data linked to increased risk of illicit activities, identify passed border crossings that may be linked to newly discovered illicit activities, as well as to

predict future traffic and risk levels at each participating border, increasing the ability of border managers to plan ahead on how to manage their resources.

The objective of this evaluation process was to demonstrate BCAT through the Border Manager User Application (BMUA) to the back-office staff, at Border Management level, of the Border Protection division and collect their corresponding feedback and recommendations.

Two Border Managers from the Border Protection Division of Hellenic Police attended a live demonstration organized by Stremble, the partner who developed the module, and they provided their feedback in both quantitative and qualitative ways filling a questionnaire of 2 parts: a simple questionnaire by ranking the rate to which statements were agreed or not, and a second part where a feedback was provided in free text. A summary of their quantitative and qualitative evaluation follows below in the two corresponding sub-sections:

2.5.1 Quantitative Evaluation of BCAT

Based on the answers given in the first part of the questionnaire both Border Managers agreed on the following points which all represent a positive feedback:

[redacted]	[redacted]
[redacted]	[redacted]
[redacted]	[redacted]
[redacted]	[redacted]
[redacted]	[redacted]
[redacted]	[redacted]

2.5.2 Qualitative Evaluation of BCAT

Based on the answers given in free text format in the second part of the questionnaire both Border Managers fully agreed on the following points:

[redacted]	[redacted]
[redacted]	[redacted]

[redacted]	[redacted]
[redacted]	[redacted]
[redacted]	[redacted]
[redacted]	[redacted]
[redacted]	[redacted]

2.6 Overall Conclusion of Greek Pilot sites [redacted]

The iBorderCtrl tests at the Greek sites, TRAINOSE and KEMEA, were successfully performed as scheduled, with role-playing "travelers" being volunteer consortium members, Border guards and Police officers, taking part in an encapsulated environment and in compliance with all the legal and ethical requirements. Adequate number of Border Guards and Border managers participated as "themselves" in order to conduct the piloting tests both for the train pilot and the BCP checks at the specific sites.

All scheduled "good" and "bad" scenarios were prepared and tested, emulating as much as possible the conductance of the tests under real operating conditions. [redacted]

[redacted]

3 Pilot site [redacted] at Latvian - [redacted]

3.1 Test environment

The environment for testing of the prototype of the portable unit delivered by the technical partners has been organized and set according previously agreed and approved conditions including dedication of special isolated facility and technical installations in the territory of the Terehova BCP. There were no significant obstacles identified prior to the testing phase and during the testing that may have a negative impact to the process or result of testing.

3.1.1 Location and local border traffic situation

[redacted]

Two types of flows of people crossing the border prevail at [redacted] BCP:

- the persons living near or in close proximity to the borders (such as local population, mainly commuters);
- International transit traffic.

The intensity of traffic flow of the persons crossing the border depends on the seasonal conditions and holidays periods [redacted]

3.1.2 Test site preparation

In order to conduct the tests, an appropriate lane and booth has been selected at [redacted] BCP which was located at the entry side [redacted]) and it was separate from the regular border lanes with the usual traffic and real travellers. Only the Border Guards who were involved in the pilot testing, the technical personnel and staff representing members of the iBorderCtrl had access to the test location.

Public internet connection had already been organized by the ICCS and provided by the [redacted] (internet provider) while the WiFi radio network had already been installed at [redacted] BCP for the purpose of testing and the covered testing location. All required wire-building connections were set in order to facilitate the testing activities at the dedicated location. The relevant details have already been analytically presented in the corresponding Deliverable D5.4.

Indicative photos of the [redacted] test location are given below:

[redacted]

[redacted]

The main challenges identified prior to the testing were:

- July and August are peak season for border crossings, and at that time [redacted] BCP reaches top numbers concerning the flow of traffic while its personnel have maximum workload during the shift hours (the staff leaves for the summer holidays needed also to be taken into consideration when planning the shifts for the pilot testing).
- [redacted]

[redacted]

3.1.3 Final prototype description used in the Latvian tests

During Test Phase 2 and for the pilot tests in [redacted] BCP site, the status of the Portable Unit and its components used for testing, was as follows:

[redacted]	[redacted]	[redacted]
[redacted]	[redacted]	[redacted]
[redacted]	[redacted]	[redacted]
[redacted]	[redacted]	[redacted]

3.1.4 Timeline of testing

As mentioned previously, the testing period was intensified until the 10th of August, including the time needed for training of the testers, interviews and completing surveys. Adequate time was also given for the testers participating as "travellers" to conduct the TUA pre-registration process. In most of the cases (except the training dates), the tests were organized in 4 shifts, 4 teams x 2 Border Guards in each (one was playing the role of "traveller" and the other playing the role of "Border Guard").

In a similar way to the Greek pilots, again the main aim of the Latvian ones was, apart from the relative usability tests, to conduct both the BCP checks and the foreseen legitimate and illegitimate scenarios.

For that it was again proven that the overall time period used for the tests was more than adequate in order to extract valuable comments and feedback on the usability of the tools as well as the overall iBorderCtrl approach. The shifts usually were of 12 hours each; except of the training (5 hours) and certain days where more Border Guards were involved with varying shifts between 8 and 10 hours.

Based on the above the overall time duration dedicated to all the Latvian piloting tests, is given on a cumulative basis in the table below.

[redacted]	[redacted]	[redacted]	[redacted]
[redacted]	[redacted]	[redacted]	[redacted]
[redacted]			
[redacted]	[redacted]	[redacted]	[redacted]
[redacted]	[redacted]	[redacted]	[redacted]
[redacted]	[redacted]	[redacted]	[redacted]
[redacted]			[redacted]

3.1.5 Test participants

The iBorderCtrl Test Team at [redacted] BCP consists of 8 Border Guards (4 of them are males, 4 of them are females) and 1 coordinator (male) who are members of the State Border Guard of Latvia.

[redacted]

[redacted]

[redacted]

[redacted]

[redacted]

[redacted]

[redacted]

3.2 Qualitative feedback

The qualitative evaluation gathered from the [redacted] pilot testing includes comments, issues found and recommendations for improvements for all system components (TUA, PU and BGUA, BMUA) based on the feedback and the answers to the interviews conducted with the Border Guards involved in the pilot testing.

It should be noted that, during the above, free discussions took place with all the players involved. Explanations were provided either on the spot or afterwards by the consortium members and technical partners, in order to clear out any possible misunderstandings or misconceptions concerning especially the reported technical issues.

In the following, the most significant qualitative evaluation comments along with the valuable recommendations received for further improvements will be presented in the Tables below for all the three main discrete iBorderCtrl system components (TUA, PU / BGUA and BMUA).

As it will be seen many comments are positive for all the 3 main applications: TUA, PU/BGUA and BMUA. Of course, certain comments were depicted mainly on the usability and the ergonomics of the solution which are described in the following. Unlike the Greek pilots where these aspects were addressed by the Consortium rather on the spot, the Latvian piloting issues were addressed afterwards by the consortium. In the following tables, the consortium notes are given in these aspects, while the totally positive comments are left as stated by the Latvian Border Guards.

3.2.1 Portable Unit (PU) and BGUA

[redacted]	[redacted]
[redacted]	[redacted]

	[redacted]
[redacted]	[redacted]
[redacted]	[redacted]
[redacted]	[redacted]
[redacted]	[redacted]
[redacted]	[redacted]

	[redacted]
[redacted]	[redacted]
[redacted]	[redacted]
[redacted]	[redacted]
[redacted]	[redacted]
[redacted]	[redacted]
[redacted]	[redacted]

	[redacted]
[redacted]	[redacted]
[redacted]	[redacted]
[redacted]	[redacted]
[redacted]	[redacted]
[redacted]	[redacted]
[redacted]	[redacted]

	[redacted]

[redacted]

[redacted]

3.2.2 Pre-registration (TUA)

[redacted]	[redacted]
[redacted]	[redacted]
[redacted]	[redacted]
[redacted]	[redacted]
[redacted]	[redacted]
[redacted]	[redacted]

	[redacted]
[redacted]	[redacted]
[redacted]	[redacted]

[redacted]

[redacted]	[redacted]
[redacted]	[redacted]
[redacted]	[redacted]
[redacted]	[redacted]
[redacted]	[redacted]
[redacted]	[redacted]

	[redacted]
[redacted]	[redacted]

[redacted]

[redacted]

[redacted]	[redacted]
[redacted]	[redacted]
[redacted]	[redacted]
[redacted]	[redacted]
[redacted]	[redacted]
[redacted]	[redacted]
[redacted]	[redacted]
[redacted]	[redacted]
[redacted]	[redacted]
[redacted]	[redacted]
[redacted]	[redacted]

[redacted]

[redacted]

3.3 Quantitative feedback gathering

3.3.1 Technical measures

Most of the remarks received by the Border Guards, related to technical issues have already been identified and fixed during the first and second end-to-end tests. These are presented in detail in D5.5.

It shall be remarked that certain improvements have been made during the testing of the first prototype, especially in the design of the harness so that the progress seen in the 2nd final prototype is very promising.

3.3.2 Survey

During the Latvian pilots, 10 surveys were completed by the border guards: in total, 4 were completed by those playing the role of Border Guards, 4 by those playing the role of "travellers" and 2 by border managers involved in the analytics process.

[redacted]

[redacted]

Summary of the results of survey completed by players who played the role of TRAVELLERS:

Prior to the testing all involved persons read the informed consent forms and confirmed that the content is clear and understandable. For testing of the TUA user registration and trip pre-registration all available types of devices have been used, including laptop, mobile phone, desktop computer and tablet. The device used had no major impact to the user registration and trip pre-registration process.

[redacted]

[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]
[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]
[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]
[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]
[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]
[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]
[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]
[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]
[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]
[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]
[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]
[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]
[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]
[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]
[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]
[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]
[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]
[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]

[redacted]

[redacted] [redacted]

[redacted]

[redacted]

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[redacted]

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[redacted]

[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]
[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]
[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]
[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]
[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]
[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]
[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]
[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]
[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]
[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]

[redacted]

[redacted]

- [redacted]
- [redacted]
- [redacted]

[redacted]

3.4 Overall Conclusion of [redacted] BCP tests at Latvian - [redacted] border

The tests at [redacted] border crossing point site were successfully conducted in accordance with the schedule. Officials of the State Border Guard of Latvia, representing [redacted] BCP, [redacted] were involved in the testing phase, playing the roles of border guards, travellers and border managers accordingly. The testing was organized in separated area at the BCP with no disturbance to the regular border traffic according to the requirements agreed among the consortium partners and following the scenarios developed for testing.

[redacted]

[redacted]

4 Specific Scenarios Testing: Test Phase 2 - Greek and Latvian sites)

The testing of specific scenarios as described in D6.2 were foreseen during the Greek and Latvian pilot tests in order to be able to evaluate the complete iBorderCtrl system behaviour as well as the performance of its individual sub-components. For this reason, some very targeted legitimate and illegitimate scenarios were role-played during the pilot Test Phase 2. These scenarios enabled the Border Guards to stress test the iBorderCtrl system under the most common illicit behaviours encountered at the land border checks and give the chance to identify situations of false positives, false negatives, or undetermined situations. As a result, the technologies that are independent in producing their risk scores, namely DAAT, FMT, ELSI, ADDS, DAAT, HHD and all biometrics: technologies of this category were tested independently, where each test process was designed to run in realistic conditions.

[redacted]

Highlighted facts:

[redacted]

[redacted]

4.1 Results on the legitimate scenarios testing (non-frequent and frequent traveller)

The legitimate scenarios presented in D6.2 for the non-frequent and frequent travellers were performed many times during both the pilot tests in Latvia and Greece.

These scenarios **were most focused to test the correct functionality and performance of the iBorderCtrl system** during the pre-registration and the border crossing phases and while performing checks on Border Guards and consortium members who acted as legitimate travellers (themselves). The aim was **to compare the expected behaviour of the iBorderCtrl system with the actual test outcomes** in each of the legitimate traveller cases: frequent and non-frequent traveller. In most test cases, the iBorderCtrl system functioned as expected.

[redacted]

[redacted]

4.2 Results on the DAAT test scenario: Holder of counterfeit or fake passport

[redacted]

[redacted]

[redacted]

[redacted]

[redacted]

[redacted]

4.4 Results on the ELSI test scenario: Fugitive known to authorities

[redacted]

[redacted]

[redacted]

[redacted]

[redacted]

[redacted]

[redacted]

[redacted]

[redacted]

[redacted]

[redacted]

[redacted]

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[redacted]

[redacted]

[redacted]

[redacted]

[redacted]

[redacted]

[redacted]

[redacted]

[redacted]

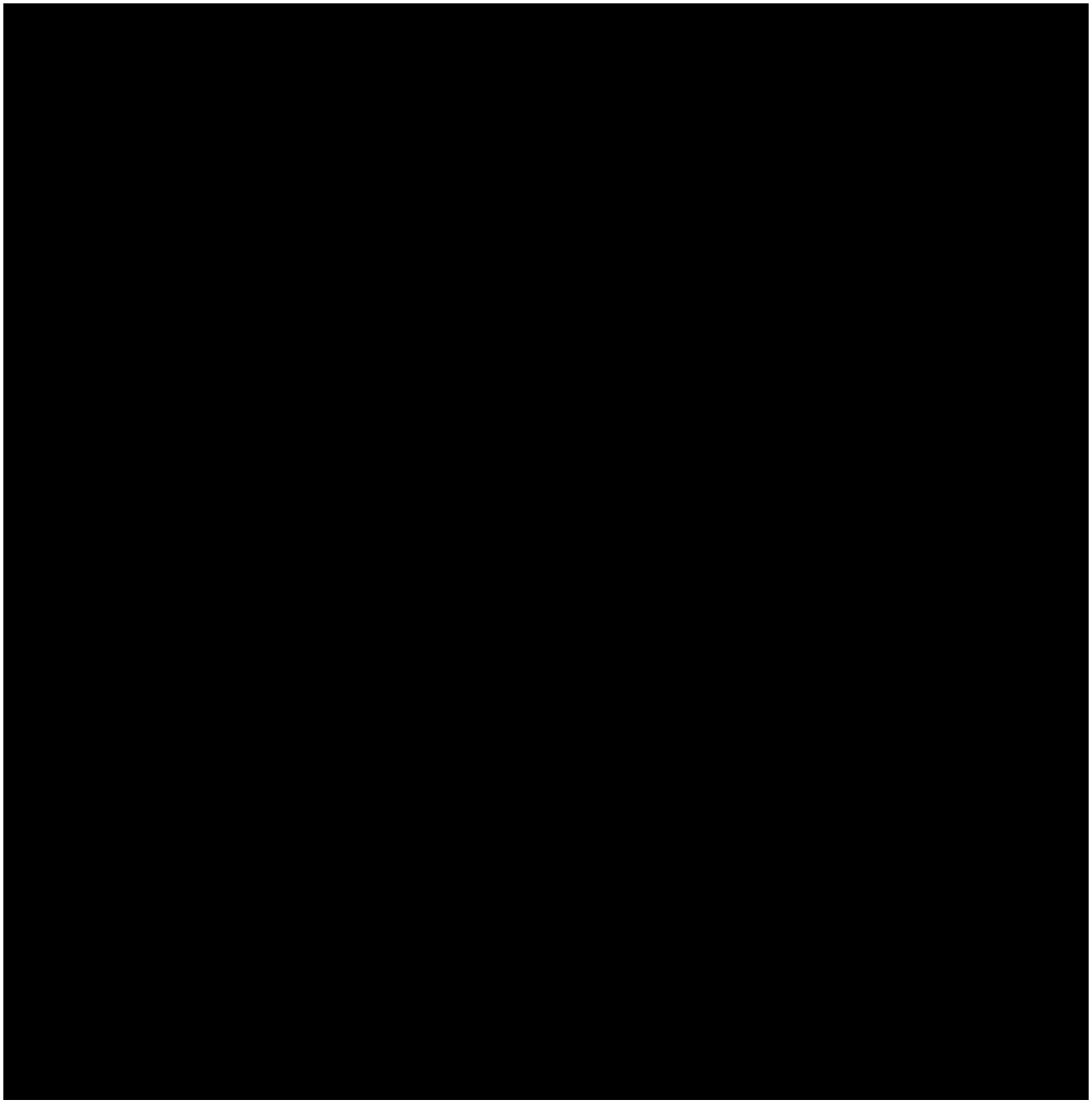
4.6 Results on the interconnected scenario to test the combined functionality of RBAT and BCAT: Use of travel pattern of terrorists known to authorities to catch terrorists unknown to authorities

4.6.1 The overall scenario

[redacted]

[redacted]

[redacted]



[redacted]

4.7 Results on the train pilot testing

The general characteristics of the train pilots were described in detail in Chapter 2, where a thorough description of the organization and implementation of the Greek pilots was given along with the main quantitative and qualitative evaluation results.

It is reminded the train pilots were conducted at the TRAINOSE [redacted]

The train pilot quantitative and qualitative evaluation outcomes were merged and analyzed together with those of the KEMEA site [redacted] (since the same Border Guards were involved and were presented in the first Section of the present report. However, especially for the train pilots, additional

scenarios were foreseen addressing the technical verification checks in order to guarantee adequate technical usability and durability of the iBorderCtrl system when used within trains.

As has already been explained in previous deliverables (namely D5.4 and D6.2), **the primary goal of the train piloting is to prove the Border Guard's mobility while using the iBorderCtrl solution and performing checks on-board, even when the train is stationary or it is on-the-move.**

The border control checks (i.e. checking the papers) within the train follow the existing procedures as in regular BCPs. Actually, according to the procedures employed currently, the everyday practice in relevant situations foresees that the train stops at the border and the border police agent boards the train and collects all papers and passports, bringing them to his office booth nearby to check. When the checking is done, the Border Guard brings them back to the train and gives them to the passengers. It is clear that this process would be more facilitated if the Border Guard could adequately, quickly and reliably, make the whole process on-board the train without having him/herself stepping out of the train and having the passengers waiting.

With the use of the iBorderCtrl solution, the Border Guard could make the BCP control checks while the train approaches the borders; the Border Guard could embark the train from a main train station or a station in a town close to the borders, conduct on-board the BCP checks to the "outgoing" passengers and then disembark at the border's station (while waiting for the return train to conduct the same process to the incoming ones), saving time and effort.

Figure 31: The train environment

In order to address the above scenarios, adequate internet connectivity should be guaranteed on-board the train. Then the control checks process is the same as in land borders BCPs. To this end, different technical verification scenarios were tested and evaluated both in technical as well as in usability terms. As far as the operational procedure is concerned, the legitimate BCP scenarios were tested within the train, as these were described earlier in the beginning of Section 4.

In the following, the outcomes of the technical verification scenarios when conducted within the train will be presented, while an overview of the conductance specifically of the train pilots will be given.

4.7.1 Conductance of the train technical verification scenarios – main outcomes

As already mentioned in the relevant Deliverables D5.4 and D6.2, a joint LTE/WiFi solution has been devised for providing network connectivity to the iBorderCtrl Portable Units when used inside the train wagons and carriages.

The solution comprises of a cellular modem connected to a mobile operator e.g. using LTE and shares the internet connection over WiFi to the inner part of the train wagons. This solution consists of a custom-made prototype by ICCS which was implemented and tested successfully within the train.

Figure 32: The custom-made prototype as a train radio network solution

Since the proposed solution consists of two parts (i.e. a cellular part and a WiFi one), technical testing can be divided into two parts, one affecting the WiFi signal (inner of the wagon) and one affecting the cellular signal (outdoor environment).

This solution resulted in making the train pilots independent of the specific location of a train station; thus, by this way the project tackled the fact that no passengers' trains were crossing the borders at [redacted] border train station and enabled the conductance of the tests at any preferred train station.

As stated in D6.2, the inner geometry/architecture of the train influences the WiFi signal propagation and thus is wagon dependent, **not location dependent**. Therefore, any tests concerning the impact of the wagon specificities, **are consequently related to the control checks through the iBorderCtrl Portable Unit and the BGUA and can be conducted at any location:** either at a train station (at the borders or those within the train route), at the train's garage stations, or even while the train is on the move **(irrespective of the actual train location)**.

As seen from the specified train technical verification scenarios in D6.2, the specified tests were meant to be used with the Portable Unit on-board, so that to verify and validate the following general aspects:

- Check the coverage and throughput in the installation point (wagon) within the train but also in the rest of the train wagons (first class, economy class, restaurant etc) in order to verify that the Portable Unit achieves adequate connection and can be always on-line.
- Conduct Walk tests alongside the wagons: move inside the wagon to perform the control checks with the Portable Unit and BGUA, to check if constant internet connectivity is maintained or if additional access point repeaters are needed. The same checks should be made and in the outer vicinity of the train and wagon.

- Check if the coverage and the throughput obtained are adequate for the conductance of the train piloting tests.
- Check if the passengers and / or if their devices (mobile phones, smart phones, tablets etc.) impact the signal propagation (scattering, attenuation) and thus the connectivity of the Portable Unit.
- Performs checks when the train power is cut-off or shut done to verify if the system continues to operate normally.
- The above should be conducted both when the train is in stationary mode and when the train is on the move. Actual "passenger" control checks (with the iBorderCtrl Portable Unit and BGUA) while the train is on the move, to verify the constant connectivity of the Portable Unit.

The relevant technical verification tests have been conducted within the train at the beginning of the train pilots and with the Portable Unit, while the main outcomes are the following:

From a technical standpoint, the outcomes of the train piloting have all been successful considering the cases devised in deliverable D6.2. The technical verification scenarios were subdivided to two main parts, namely while the train was stationary and while the train was on the move.

The joint LTE/WiFi prototype solution was deployed in the train escort's room (within a first-class wagon) for installation convenience; however, this is not mandatory, as the prototype is portable and can be temporarily mounted to any surface within a wagon.

Technical findings during installation:

Regarding the installation, the technical findings are the following:

- voltage at the train outlets is quite unstable, rendering the use of a small UPS or other capable power bank a must for trouble-free operation as expected.
- power outlets are abundant throughout all wagons.
- overhead storage area is available throughout all wagons, allowing the temporary installation of the radio equipment.
- Although in general substantially adequate connectivity can be achieved using an embedded LTE antenna, for better performance and stability the use of an external antenna is highly recommended as indicated by the testing.
- ideal placement of the LTE (and optional GPS antenna) is by the window facing outside; as the wagons make use of thick steel plates, the choice of LTE antenna installation can significantly improve reception; also the use of a directional LTE antenna is preferred and is the one chosen for the purposes of the train piloting.

[redacted]

Internet connectivity assessment within the train (through walk tests):

To assess the WiFi connectivity and the possible need for multiple Access Points in order to cover a particular area inside the train, elaborate testing was performed through walk tests. The walk tests were performed with a mobile phone (held on hand at a person's usual height) and the Portable Unit and its tablet to check if adequate internet connectivity is maintained throughout the whole BGUA checks. Apart from the BGUA, mainstream mobile applications were also used to check and measure the throughput in downloading / uploading.

Using the train escort's room as a baseline, the connection was evaluated in terms of stability (i.e. received signal strength) and achieved throughput, while moving away from it (both walking and standing). As expected, despite the use of steel plates inside most of the train, its geometry causes a "waveguide effect", resulting in particularly strong signal even very far away from the installation location. The speed test values achieved throughout the train are shown in the following table.

[redacted]

[redacted]

[redacted]

Download	Upload
48,8	27,0
26,4	14,0
20,5	14,6
17,4	11,3
17,5	13,1
19,2	12,7
20,6	11,1
18,9	12,4

24,3	14,3
20,5	13,3
19,0	15,0
38,1	16,4
41,1	19,1
37,0	13,6
41,5	44,4
29,9	26,2
25,8	28,4
15,0	27,8
28,1	31,7
21,8	25,0
27,2	23,0
36,1	22,5
46,0	26,9
29,7	19,2
35,9	24,0

Figure 35: Sample speed test values achieved throughout the train using the iBorderCtrl radio network

[redacted]

[redacted]

[redacted]

[redacted]

Assessment of train's power supply impact:

As mentioned before, the train power is highly unstable, both while on-the-move and while parked; there is no guarantee that train power will be constantly available during a border check.

Therefore the radio equipment uses its own stand-alone power source (from a high capacity power bank). The selection of a capable power bank is crucial, as most of them either cannot sustain continuous operation while grid power is removed and restored.

[redacted]

Assessment when the train is on the move:

In the second type of testing, i.e. while the train was conducting its regular itinerary, the network statistics were collected by means of the ICCS monitoring platform, assisted by GPS.

The relevant issue has been described in detail within D5.4. In summary the following can be stated:

Prior to the actual piloting tests with the Border Guards **an extensive technical testing of the radio network proposed solution was conducted when the train was on the move.** Such network tests have already been conducted, for adequate time (10/5/2019 – 24/5/2019) prior to the Border Guards piloting, with the train going through its regular itinerary [redacted]) for this entire period. To this respect, all the above metrics were also evaluated.

During the Greek train pilots, the same metrics were also verified with the use of the iBorderCtrl Portable Unit, however for a more limited train movement, since the internet connectivity had already been successfully validated for larger distances. The results indicate that most of the time cellular internet connectivity (i.e. 3G/4G) is present providing adequate speed for the iBorderCtrl to operate.

The main conclusion is the fact that train piloting tests could adequately take place on-board the train even when the train is on the move to its official itineraries. Thus, **the train piloting with the Border Guards can be held at ANY train station within the itinerary and in between them**.

The relevant train-on-the-move testing was facilitated through the custom monitoring platform developed by ICCS (for the 3 BCPs described previously) which has been expanded to correlate the train location (GPS coordinates, speed, bearing) with the various network metrics of interest (e.g. Network Type, Signal Strength, SINR, CQI etc.) as described in D5.4.

In the following an indicative screenshot for the ICCS monitoring platform is given for the train-on-the-move case; the red line shows the train route. The screenshot shows an instance where the train is about to leave [redacted].

4.7.2 Conductance of the train pilots

Training within the train

Following the technical verification scenarios within the train, a detailed training of the Border Guards was conducted. The training was repeated again at the KEMEA's site [redacted].

Members from all Greek consortium partners (KEMEA, TRAINOSE, ICCS and ED) along with JAS developers were present to assist at the training of the Border Authorities personnel. The trainees were both Border Guards from the Hellenic Police, the Hellenic Border Authorities [redacted] along with police-related members of staff from KEMEA.

In the following various snapshots from the Border Guards training that took place within the train are shown. JAS provided an extended training session with active involvement of the Border Guards in getting familiarised with the BGUA sequence and the operation of the iBorderCtrl Portable Unit.

[redacted]

[redacted]

[redacted]

Train Pilot testing

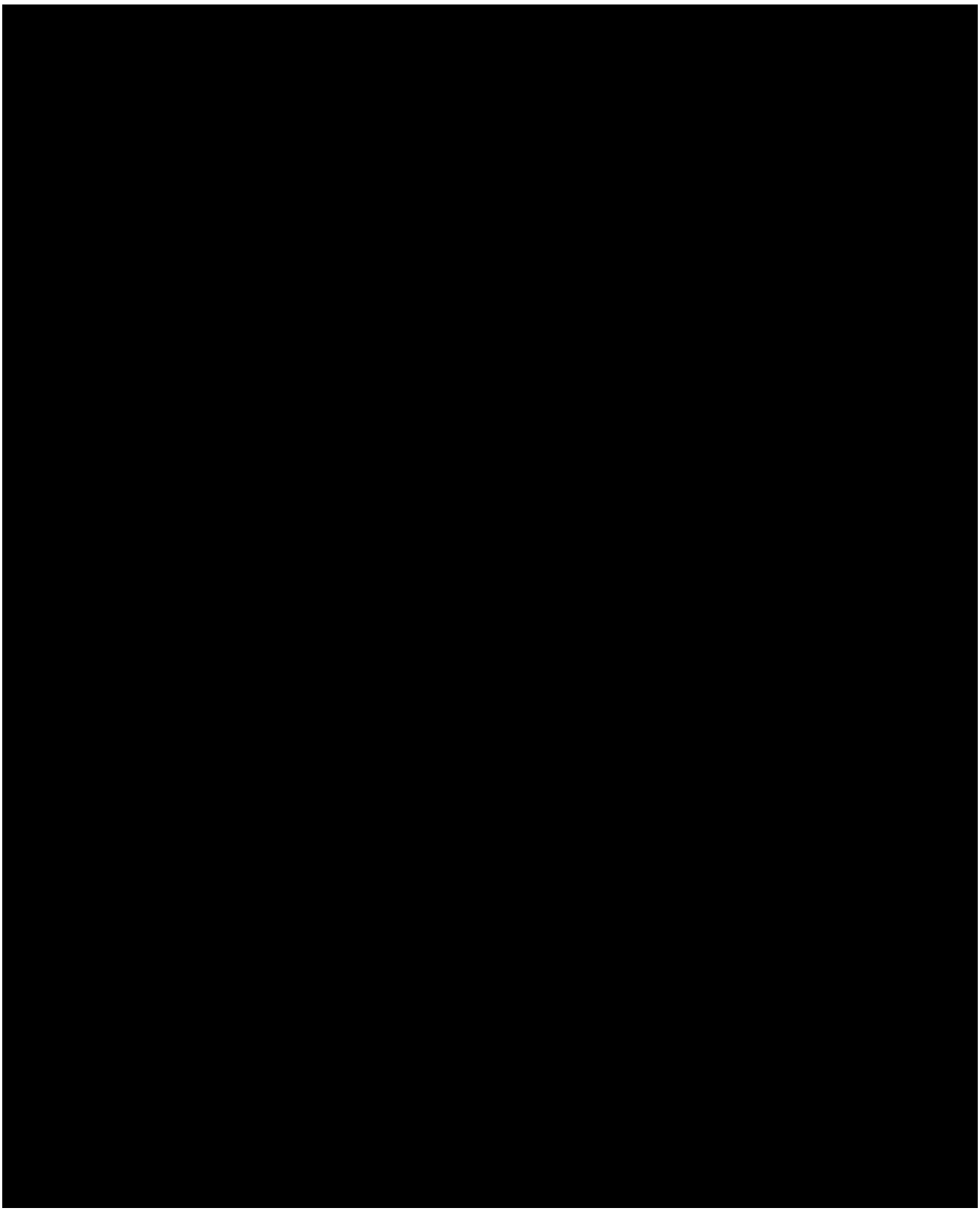
In the days following the training and according to the train availability, the train pilots took place at the TRAINOSE

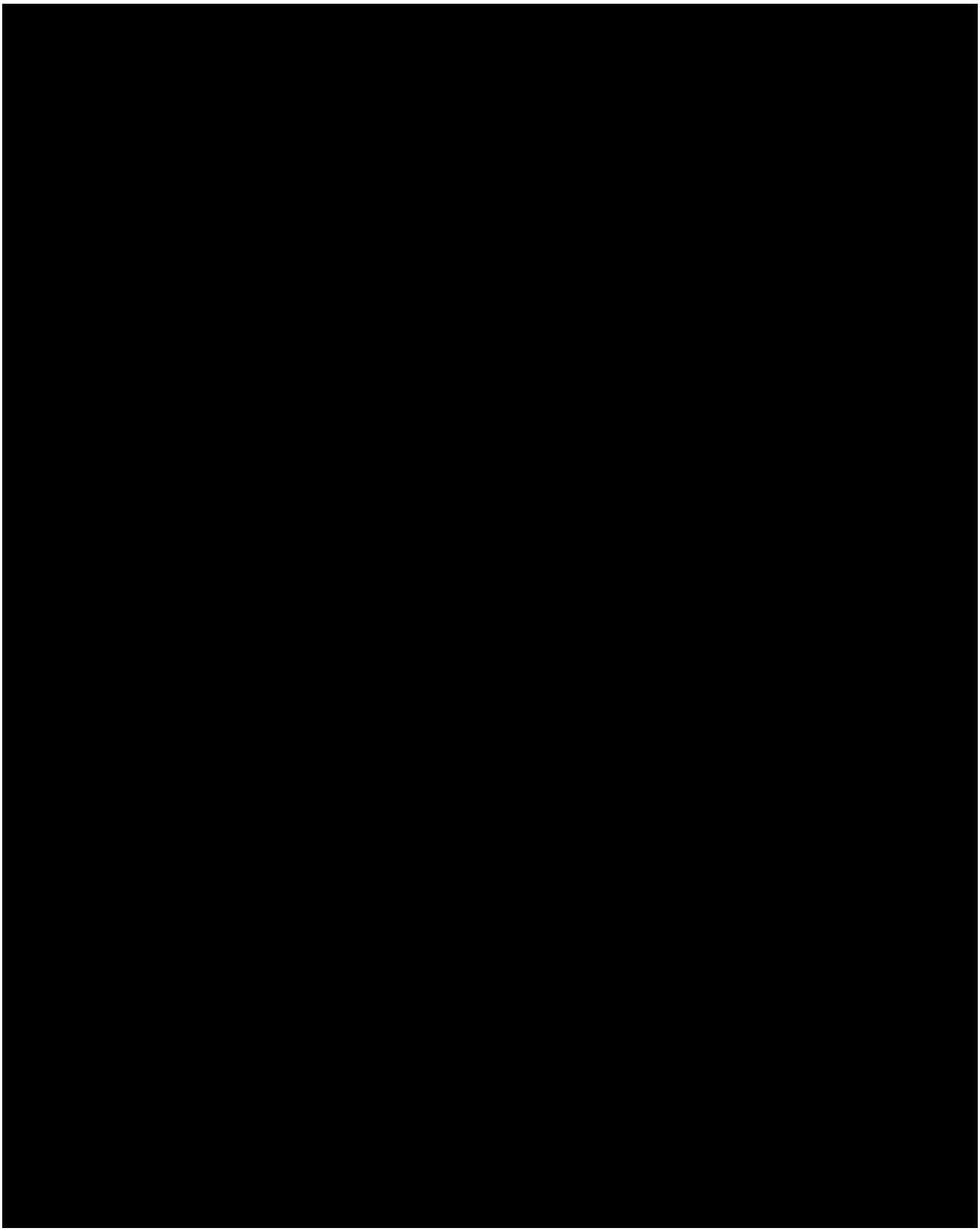
During the train pilots the legitimate scenarios were conducted, while the Border Guard was moving along the train wagon to perform the BCP tests with the Portable Unit and the BGUA. Members from all Greek consortium partners (KEMEA, TRAINOSE, ICCS and ED) played the role of travellers.

It was verified that with the iBorderCtrl overall solution there is no need for the Border Guard to gather all passports and step out of the train to perform the checks at his / her office. With the Portable Unit / BGUA, the BCP checks can be performed on the spot, upon the train wagon, as long as adequate internet connectivity is maintained, as this was the case during the train pilots in Greece.

Moreover, not only passport checks are being held, but a lot more checks instead (fingerprints, face biometric model etc.)through the DAAT, FMT, BIO-FP and BIO-PV modules while additional functionalities are in order as with the risk score calculation. The Border Guard was able to perform his duties and obtain a lot more information that he used to be. As it was mentioned in a previous paragraph, certain experiments were also made with the HHD tool as well.

In the following various snapshots from the train pilots with the Border Guard conducting the BCP check on-board the train are given for the whole sequence of the test.





Train on the move pilot testing

Apart from conducting th4e BCP tests within the train in a stationary mode at the Rentis garage station), the BCP tests were also conducted when the train was on the move. The train on the move piloting was conducted for rather limited time, just to conduct a BGUA sequence, in order not to get mixed with real passengers in the next train station of its usual itinerary. However, even in this case, the train on the move pilots were conducted successfully and internet connectivity was stable between the Portable Unit and the radio network within the train for the whole duration.

In the following a sequence of snapshots while the train is on the move are shown, while the train movement is much better shown in the related video captured.

[redacted]

[redacted]

[redacted]

[redacted]

[redacted] [redacted]

[redacted] [redacted]

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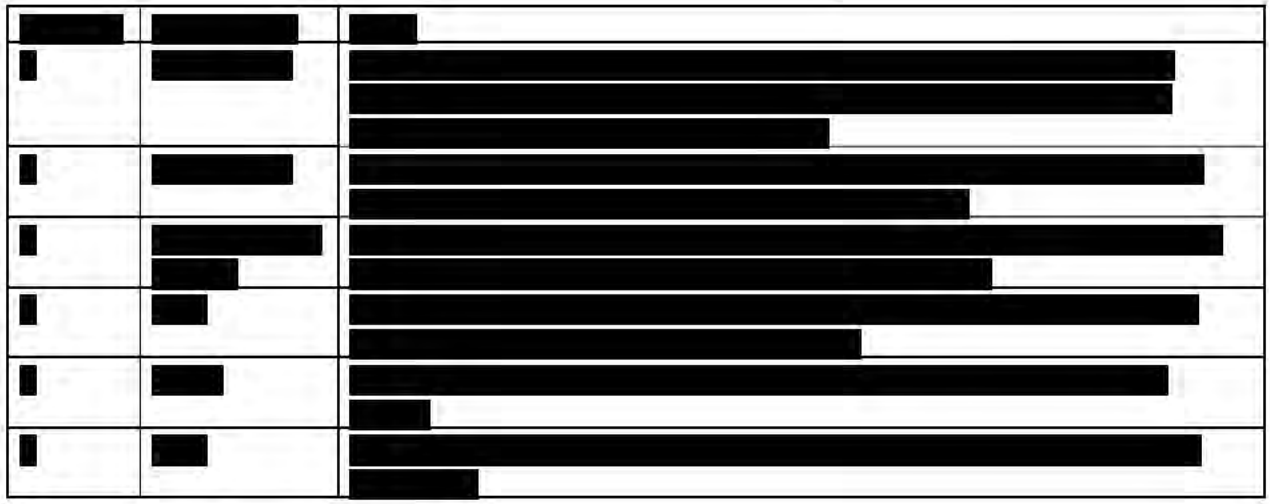

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4.9 Evaluation of individual modules by BCAT

BCAT in its design offers the opportunity to study correlation between pairs of tools, and calculate a dissimilarity matrix across all risks. It is also able to calculate the distribution of each risk score. It can also filter the data based on border crossing point, dates and passport issue country. This was provided as a way for the system administrators to assess the performance of every tool at their disposal, and assess their correlation (identifying the same high risk travellers, potentially making the deployment of both redundant).

For figures bellow we use all entries from the 1st of January 2018 until the end of evaluations (August). We focus on the overall risk scores of each module to reduce the number of graphs making the outcomes easier to follow, although the platform is also capable of including a significantly higher level of granularity (such as individual risk scores from each ADDS question, SIS, VIS EES independently and not just as ELSI output, etc.).

For this tools to provide accurate evaluation of the tools in iBorderCtrl real and large number of crossings would be needed. The evaluation of iBorderCtrl is structured on a scenario based evaluation in operational environment thus the number of evaluation crossings is limited and most scenarios had an objective for a traveller to be caught by 1 or more modules. Thus, the distributions are not representative of what we would get in a real world deployment. However, the outcomes of these analyses are provided as a way to study the outcomes of the evaluation, and to demonstrate the build-in ability of iBorderCtrl to evaluate all modules in the platform that generate risk scores.

4.9.1 Pairwise correlations

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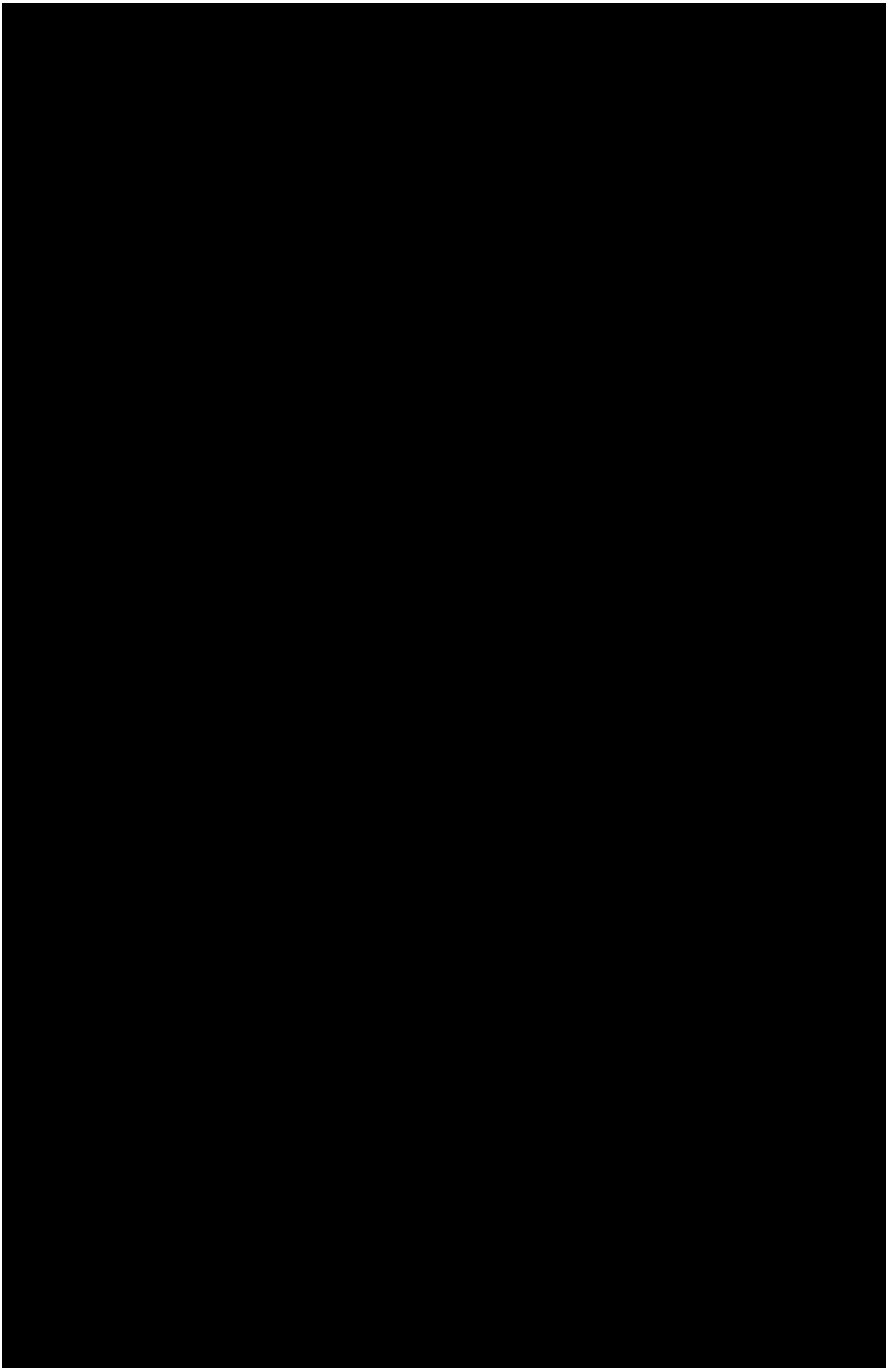

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4.9.4 Potential Impact of BCAT evaluations

The biggest potential impact shown in this section would be evident primarily once such tools are deployed in real life as part of ETIAS or similar platforms. These would allow the calculation in real time over period of interest and across single or multiple border crossings points of correlation, dissimilarity and distributions of risk calculating modules.

This would enable the fast, efficient and low cost evaluation of the performance of modules, not only independent to all others deployed at the border, but in conjunction with them, essentially revealing were each module fits. Enabling the quick identification of modules that duplicate the outcomes (even though functionally they may be different) and would enable the system administrators to better select the combination of tools they would deploy in order to maximize the impact of their resources while reducing the amount of information and time it takes to go through both pre-registration and border crossing.

Finally questions are often asked about newly deployed models when Border Guards first experience the risk score of what is typical, exposing new Border Guards to the distributions will help them understand the likelihood of each tool to produce a given risk score so they can attribute to it the relevant significance. [redacted]

5 Overall Conclusions for Pilot Test Phase 1 and 2 (all pilot sites)

Existing land border control systems frequently struggle to cope with the increased number of travellers and enhanced security measures while new requirements (due to the new regulations by the EC[3]) threaten to stress already overloaded processes and systems to breaking point. These are the key challenges for land border control in the European Union.

Thus, in order to address those challenges the iBorderCtrl project has established and demonstrated a unified solution with aim to speed up the border crossing and at the same time enhance the security and confidence regarding border control checks by bringing together many state of the art technologies ranging from biometric verification, automated deception detection, document authentication and risk assessment.

The iBorderCtrl solution was designed and developed taking into consideration the requirements, guidance and expertise of the 3 end-users participating in the project, namely the Hungarian Border Guards (HNP), the Latvian State Border Guards (BSG) and the Greek Border Control and Hellenic Police officers (KEMEA). These experts were the ones who also evaluated the iBorderCtrl complete system and individual components in their early and final versions during extensive piloting tests that took place in 3 countries and in two pilot test phases (Test Phase 1 and 2). During the pilots, the Border Guards and Border Managers were familiarised and actively involved with iBorderCtrl and provided their constructive input.

The conclusions of the pilot tests based on the valuable feedback received by the Border Guards and the Border Managers that participated in the pilots in relation to the iBorderCtrl innovations can be summarised to the following:

Traveller User Application (TUA) - Pre-Registration Phase:

According to the opinion of the Border Guards and Border Managers in all pilot sites, the concept of [redacted]

[3] Since 7 April 2017, new EU rules ensure that all travellers crossing the EU's external borders are systematically checked against relevant databases, such as the Schengen Information System

[redacted]

Portable Unit:

The concept of the Portable Unit (PU) (all elements necessary for border checks in one place) was [redacted]

Border Guard User Application:

[redacted]

Border Managers User Application (BMUA):

[redacted]

[redacted]

[redacted] unique invention and a popular tool for respective organizations in conducting advanced data analytics.

Risk Assessment:

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Evaluation results of DAAT, FMT, BIOF, ELSI and HHD

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5.1 KPI-based validation (for all pilot sites)

In D6.1, Key Performance Indicators (KPIs) were defined for the pilot deployment. However, those KPIs were defined for a different test methodology involving volunteers in large numbers. Therefore, not all KPIs could be addressed in both Test Phases 1 and 2. In the following table the KPI table is presented with the values that were applicable for the pilot tests in Hungary, in Greece and in Latvia.

KPI UID	KPI Description	Source and formula	Value	
			Test Phase 1	Test Phase 2
KPI001	Percentage drop in the number of refusals preventable by pre-registration.	From system log and statistical data of pilot site. Total number of alerts on entry requirements provided to testers of pre-registration system divided by the (three years) average number of refusals at the given border gate (pilot site).	[redacted]	[redacted]
KPI002	Total number of completed pre-registrations.	From system log, total number of completed pre-registrations.	[redacted]	[redacted]

			[redacted]	
KPI003	Time spent for border check.	Average, minimum and maximum time spent from reading the QR code with the portable unit (start of 1st line border check) to closing the process on the portable unit (end of 1st line border check), regardless of the result, compared with currently required time.	[redacted]	[redacted]
KPI004	List of compatible devices.	From system log, using MobileDetect function or similar, listing by type.	[redacted]	[redacted]
KPI005	List of incompatible devices.	From system log, using MobileDetect function or similar, listing by type.	[redacted]	[redacted]
KPI006	Percentage of successful identification with palm vein scanners.	From system log, number of successful identifications with palm vein scanner divided by number of total identification attempts with palm vein scanner.	[redacted]	[redacted]
KPI007	Percentage of successful identification with face recognition.	From system log, number of successful identifications with face recognition divided by number of total identification attempts with face recognition.	[redacted]	[redacted]

KPI008	Percentage of successful identification with fingerprint.	From system log, number of successful identifications with fingerprint divided by number of total identification attempts with fingerprint.	[redacted]	[redacted]
KPI009	Ergonomics for border guards.	Average score from the border guard survey.	[redacted]	[redacted]
KPI010	Number of devices damaged during testing.	From border guard interviews.	[redacted]	[redacted]
KPI011	Total number of vehicle checks performed.	From border guard interviews.	[redacted]	[redacted]
KPI012	Total number of travellers (who pre-registered and crossed the border at one of the pilot sites).	From system logs.	[redacted]	[redacted]
KPI013	Total number of feedback surveys completed by travellers or volunteers.	From system logs.	[redacted]	[redacted]
KPI014	Encryption.	From system logs. Binary value: either is encryption on all transaction or there is not.	[redacted]	[redacted]
KPI015	Average score on ergonomics by volunteers and travellers.	Average score from the volunteer and traveler survey.	[redacted]	[redacted]

6 Conclusions

This document presented the outcomes of Test Phase 2. The aim of test phase 2 was to test the iBorderCtrl system under some very specific legitimate and illegitimate scenarios that would facilitate the consortium to draw conclusions of the functionality and performance of the system. This was made possible through the tests performed at the pilot site in Greece (KEMEA hosted both the Pilot tests at the KEMEA's site and the train pilot with the contribution of TRAINOSE) and at the [redacted] at the Latvian-[redacted] borders. Test phase 2 also included the independent evaluation of ADDS through the Traveller User Application (TUA).

The validation feedback received by the Greek and Latvian Border Guards and the Greek Hellenic Police officers that played the role of travellers and the role of Border Guards was gathered, assessed and presented in this deliverable. The pilots were successful on validating the basic concept and the lessons learned mapped further development in order to reach higher TRLs (beyond the proposal objectives). Especially BCAT and TUA achieved significant advance since the first prototype deployed in Test Phase 1. The hardware of the PU served well as a testbed for the software and fulfilled all durability requirements, but there is still place for development in ergonomics.

The results of the testing of the specific scenarios were also presented thoroughly in this deliverable. The analysis provided some very interesting and promising results regarding the evaluation of individual modules and their performance. The main outcomes of the pilot tests are presented as a summary in section 5 of the deliverable.

7 Annex I: Pilot raw test results per scenario

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