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TECHNICAL REPORT

Report No.:
28380IDT.001

REPORT ON: PERFORMANCE EVALUATION OF DIFFERENT IN-BAND MODEM SOLUTIONS FOR TRANSMISSION OF ECALL DATA DURING EMERGENCY CALLS

Product	:	Software executable files
Trade Mark	:	N/A
Model	:	N/A
Manufacturer	:	Candidate 1, Candidate 2, Candidate 3
Requested by	:	Service requested by ETSI TSG SA4, eCall subworking group.
Reference Documents(s)	:	Tdoc S4-080446: eCall Selection Test Plan (Permanent Document PD3 for eCall Phase 2: Version 1.2)

This test report includes 2 annexes and therefore, the total number of pages is 27.

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1. INTENDED AUDIENCE

This document is targetted to the 3GPP SA Working Group #4 (Codecs), mainly to the partners involved in the eCall Subworking Group.

eCall is a European-wide solution for automatically or manually initiated emergency voices calls. eCall will supplement E112 and 112 (TS112) emergency call with related data from the vehicle. The expected benefits is that emergency services will be made aware of accidents much more rapidly, will get precise information on location, vehicle type, etc, and therefore will be able to reach accident victims faster, with the potential to save many lives annually.

This report is the result of the testing of different eCall in-band software candidate solutions, under the scope of the European eSafety initiative.

Evaluation of Test Results for the different candidates is presented in this document, as well as a comparison between them, and an evaluation of the results with respect some eCall requirements.

2. COMPETENCE AND GUARANTEES

AT4 wireless is a testing laboratory competent to carry out the tests described in this report.

In order to assure the traceability to other national and international laboratories, AT4 wireless has a calibration and maintenance programme for its measurement equipment.

AT4 wireless guarantees the reliability of the data presented in this report, which is the result of the measurements and the tests performed to the item under test on the date and under the conditions stated on the report and, it is based on the knowledge and technical facilities available at AT4 wireless at the time of performance of the test.

AT4 wireless is liable to the client for the maintenance of the confidentiality of all information related to the item under test and the results of the test.

3. GENERAL CONDITIONS

1. This report is only referred to the item that has undergone the test.
2. This report does not constitute or imply on its own an approval of the product by the Certification Bodies or competent Authorities.
3. This document is only valid if complete; no partial reproduction can be made without previous written permission of AT4 wireless.
4. This test report cannot be used partially or in full for publicity and/or promotional purposes without previous written permission of AT4 wireless and the Accreditation Bodies.

4. CHARACTERISTICS OF ECALL TESTING

4.1. SERVICES REQUESTED

AT4 wireless contributes in SA4 Working group providing eCall testing services for several eCall candidates developed by different partners in this subworking group.

The service requested is to test the performance (figure of merit, overall average transmission time) of three (3) different eCall software candidates, as well as testing IVS candidate modem against a 30 minutes tone file in order to detect wrong behavior on it (incorrect false trigger detections).

As requested by the candidates, and following ETSI indications for the selection of one of the solutions, the names of the candidates are not disclosed in this report.

This test report is not an official report for Accreditation Bodies.

4.2. ECALL REQUIREMENTS AND METHOD

The test has been carried out according to the following document:

- [1] Tdoc S4-080446: PD3, v1.2, eCall Phase 2 Selection Test Plan.

Additionally, the following documents gather information related to the execution of the tests and requirements of the candidates:

- [2] Tdoc S4 080445: PD5, v1.0. Definition of Host Lab Tasks for eCall Selection Tests.
- [3] Tdoc S4-080425: PD1, v0.91, eCall Phase 2 Timeplan.
- [4] Tdoc S4-080424: PD2, v1.2, Performance Reqs/Objectives and Design Constraints.
- [5] Tdoc S4-080444: PD4, v1.0, eCall Phase 2 Selection Rules.
- [6] Tdoc S4-080358: v4 eCall Test Setup.
- [7] Tdoc S4-080370: Tone files for eCall Testing and Associated.

The following requirements and objectives have been extracted from the above document [1], applied to the test result evaluation and presentation of this report:

- 4.1.1 (FoM): The Candidates will be ranked according to their Figure of Merit (value calculated as per [4]).
- 4.1.2 (Incorrect MSD's): A Candidate that reports an incorrect MSD shall not be considered futher, unless it can be demontrated that the CRC checksum was zero fro that incorrect MSD.
- 4.2.1.6 (Error free conditions): In optimal conditions (error-free radio channel, GSM FR codec and AMR 12.2 kbit/s mode) the eCall candidate procedure shall be able to transmit the whole 140 bytes of the MSD reliably within 4 seconds, measured from the time when the transmission from the IVS to the PSAP begins (after a trigger from the PSAP has been detected).
- 4.2.3.3 (False trigger detections): The candidate IVS modem should not false detect the tones in the 30 minute test PSTN tone file as PSAP triggers.

4.3. ECALL TEST SETUP

The test setup configuration has been created following the description in [1], whose physical configuration is as follows:

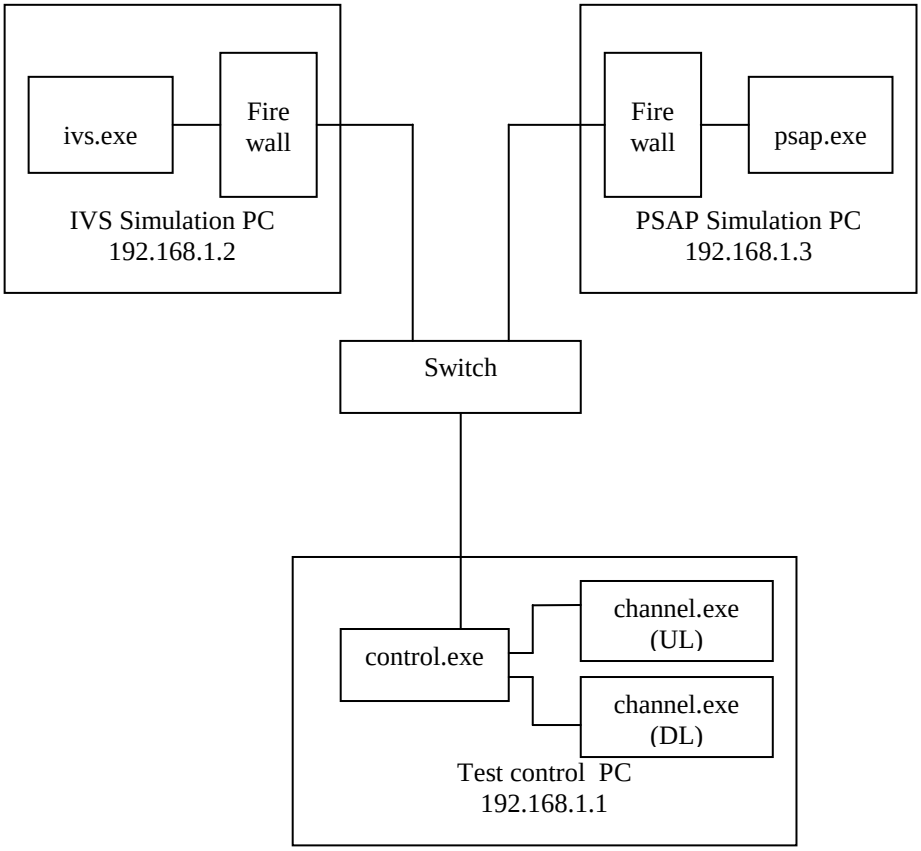

Figure 1: Physical Test setup for eCall candidate selection.

4.4. INSTRUMENTATION AND CONFIGURATION

The instrumentation used to perform the tests is listed below:

1. Personal Computer with Intel Core 2 Duo processor, and Windows XP Operating System, acting as the Control PC, where the error patterns, codecs, control software, and test campaign are installed. Fixed IP 192.168.1.1 was established on this PC. Results output files will be created on this PC.
2. Personal Computer with Intel Core 2 Duo processor, and Windows XP Operating System, acting as the IVS PC. Only the candidate IVS modem is installed on it. Fixed IP 192.168.1.2 was established on this PC. Firewall is installed on this PC, as described below.
3. Personal Computer with Intel Core 2 Duo processor, and Windows XP Operating System, acting as the PSAP PC. Only the candidate PSAP modem is installed on it. Fixed IP 192.168.1.3 was established on this PC. Firewall is installed on this PC, as described below.
4. D-Link 10/100 Fast Ethernet Switch.

Firewall: *Outpost Pro* V4 firewall from *Agnitum* has been used. This firewall, following the test setup proposal, has been installed on two computers, the ones acting as IVS and PSAP. They have been configured to block all traffic (incoming and outgoing) between IVS and PSAP IP's, but allowing the control PC to communicate either one. As a side effect of this security, the firewall blocks name resolution, so the test has been performed using plain IP addresses, instead of netbios names. This does not cause any difference in the test results
Note: *Windows default firewall* was initially considered, but finally discarded due to its inability to check outbound connections.

To ensure confidentiality, 3 different accounts have been created on the 3 PC's, one for each candidate solution, to be used during the software preparation phase. Official testing have been also executed using these candidate accounts to ensure reliability of conditions.

4.5. ECALL TEST PROCEDURE

Different tests have been carried out for each candidate solution.

1. **Execution of a common test campaign composed of 2600 test cases.**

The file contains 100 executions of each of the 26 codecs and conditions proposed for evaluation, as defined in the table below (marked with X those to be tested):

	GSM_FR	*12.2*	*10.2*	*7.95*	*7.4*	*6.7*	*5.9*	*5.15*	*4.75*
C/I = 1 dB									X
C/I = 4 dB							X	X	X
C/I = 7 dB	X	X	X	X	X	X	X	X	X
C/I = 10 dB	X	X	X	X	X				
C/I = 13 dB	X	X	X						
C/I = 16 dB	X								
error free	X	X							
RSSI = -100 dBm	X								X

Table 1: Test codec/radio configurations

The test configuration file is a human-readable file with 2600 rows, and 13 columns, as follows:
Index MSD Codec_Type Codec_Mode VAD UL_delay1 UL_delay2 UL_EP UL_EP_index DL_delay1 DL_delay2 DL_EP DL_EP_index.

The following parameters have been selected randomly in the following ranges:
MSD: 140 bytes with randomly generated data (each possible byte sequence is considered to be equally probable.
VAD for AMR: randomly chosen for each trial from VAD1 and VAD2.
UL_delay1, UL_delay2, DL_delay1, DL_delay2: values randomly chosen in the integer range [80, 240].
UL_EP_index, DL_EP_indes: values randomly chosen in the integer range [0, 2^31 -1].
The order of the test cases is randomized.

For all the test cases, 50 frames of silence shall be transmitted in both direcctions before the start of each test case (parameter *–-startframe:50* in the executable batch file).
For all the test cases, the maximum limit allowed to transmit the MSD is set to 200 seconds (equivalent to 10000 frames) (parameter *–-totalframes:10000*).

The Official Test Configuration File is released together to this report.

2. **Execution of a false trigger test on each Candidate Modem.**

In order to perform this test, AT4 wireless has implemented a PSAP modem which sends the contents of a predefined file on the downlink channel, configured with the AMR codec running in 12.2kbps mode with DTX deactivated. The execution will log if the IVS responds by sending the MSD data in response to the tone data (incorrect false trigger detected).
The file to be sent is provided in [7].

Additional tests carried out by the Host Lab**:**

3. **Creation of an alternative (second) Test configuration file of 2600 test cases, with random data.**

Main figures shall be compared to the ones obtained in the official test campaign.

4. **Reordering of the Official Test Configuration File, and evaluation of results with respect the unordered file.**

The Official Test Configuration file shall be ordered as created in the "gencampaign.m" file delivered in [6]. The ordered Test Configuration File is released together to this report.

4.6. ECALL TESTING PERIOD

Prior to the official testing period, a software verification phase has been carried out. In this phase, started on July 28 2008 and finished on August 1 2008, the candidates have been able to work with the final PC's and final test setup and configuration in order to prepare their software solutions for official testing.
Equal oportunities have been offered to all the candidates, dividing the pretesting period (July28 to Aug1) in 4-hour time slots each day.
All the candidate software solutions have been sent to the lab before end of August 1, 2008.

The official testing period started on August 4, 2008 and finished on August 7, 2008.
As specified in [2], the candidates have not been present during the execution of the official tests.

The tests have been performed at AT4 wireless permanent facilities.

5. EVALUATION RESULTS

Following the tests described in paragraph *4.5 eCall Test Procedure*, the evaluation of the next parameters and performance shall be presented for each Candidate:

1. **Evaluation of Official Test Results, executed with the Official Test Configuration file:**
   - Average value of the time to transmit the MSD over the 100 executions, for each of the 26 test conditions: $\mu c = (T1 + T2 + \ldots + T100) / 100$.
   - Figure of Merit (FoM), defined as the unweighted averaging of μc over all particular test conditions (C1 to C26). $FoM = (\mu 1 + \mu 2 + \ldots + \mu 26) / 26$.
   - Number of timeouts: as defined in [1], an upper limit is defined on the time required for sending the MSD (set to 200 seconds). It will be declared the number of timeouts during the execution of the test campaign.
   - Number of incorrect received MSD's.
   - Average time taken to transmit the MSD in error free conditions (with FR and AMR 12.2 codecs). Also, maximum and minimum times shall be specified.

2. **Evaluation of results for the false trigger detection test:**
   - It shall be stated how many false detections (if any) have occurred during the transmission of the 30-minutes tone file.

Evaluation of additional tests carried out by the Host Lab:

3. **Evaluation of results with an alternative (second) Test configuration file:**
   - A new alternative (second) Test Configuration File of 2600 test cases shall be created, and executed over the three candidates. This file is equivalent to the official test configuration file, in terms that all random data is again randomly generated. FoM, number of time outs, incorrect MSD's reported and average time in Error free conditions shall be compared to the ones obtained in the official test campaign.

4. **Evaluation of results with the ordered Test Configuration file:**

   - Comparison of test results between unordered test file and ordered file shall be shown. It will be checked if the results obtained with the ordered test campaign are identical to the unordered ones.

5.1. RESULTS FOR CANDIDATE 1

5.1.1. RESULTS WITH OFFICIAL TEST CONFIGURATION FILE

The following tables and figures show the main test results obtained for this candidate upon testing of the Official Test configuration file:

FINAL RESULTS	Unit	Candidate 1		
Figure of Merit	Frames	**885,23**		
	Seconds	**17,70**		
Number of timeouts	---	**5**		
Incorrect MSD's reported	---	**0**		
Average time in Optimal conditions (Error free radio channel, FR and AMR 12.2 codecs)	Seconds	**3,60**		
Error free: FR codec tmin/tmax/average	Seconds	**3,58**	**3,62**	**3,60**
Error free: AMR 12.2 codec tmin/tmax/average	Seconds	**3,58**	**3,62**	**3,61**
Number of false trigger detections	---	**0**		

Table 2: Summary of results

An overall view of the execution time for the 2600 test cases can be found in the following Figure:

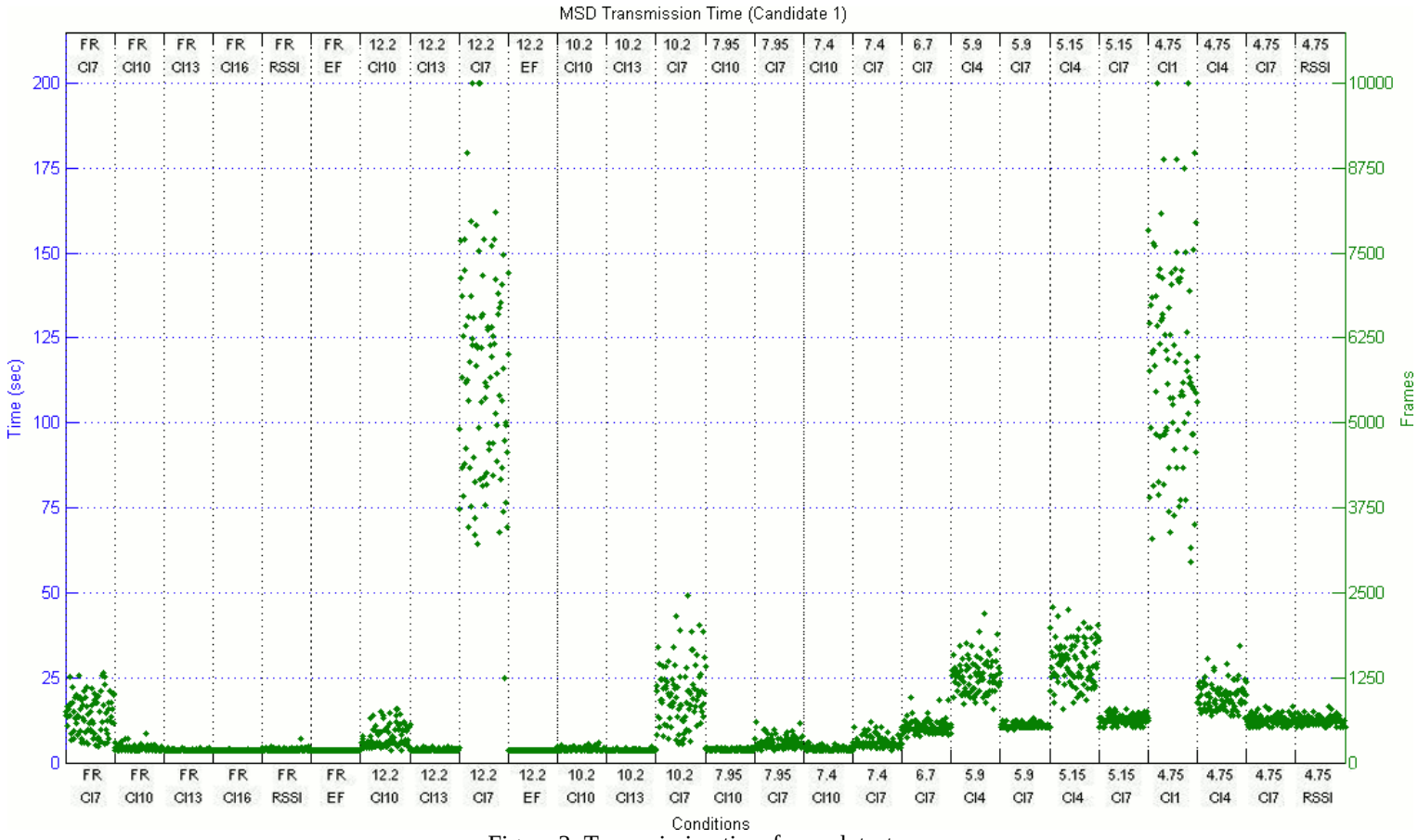

Figure 2: Transmission time for each test case.

The next figure and table show the averaged test results test results for the 2600 tests:

Candidate 1	Average MSD transmission time (in seconds) per Condition								
	GSM_FR	AMR 12.2	AMR 10.2	AMR 7.95	AMR 7.4	AMR 6.7	AMR 5.9	AMR 5.15	AMR 4.75
C/I = 1dB	-	-	-	-	-	-	-	-	117,06
C/I = 4dB	-	-	-	-	-	-	25,82	29,71	19,61
C/I = 7dB	14,06	113,97	20,06	5,66	5,99	10,52	10,90	12,66	12,61
C/I = 10dB	4,28	7,48	4,02	3,78	4,02	-	-	-	-
C/I = 13dB	3,66	3,75	3,66	-	-	-	-	-	-
C/I = 16dB	3,61	-	-	-	-	-	-	-	-
Error Free	3,60	3,61	-	-	-	-	-	-	-
RSSI = -100dBm	3,81	-	-	-	-	-	-	-	12,34

Table 3: Averaged transmission time for each test condition.

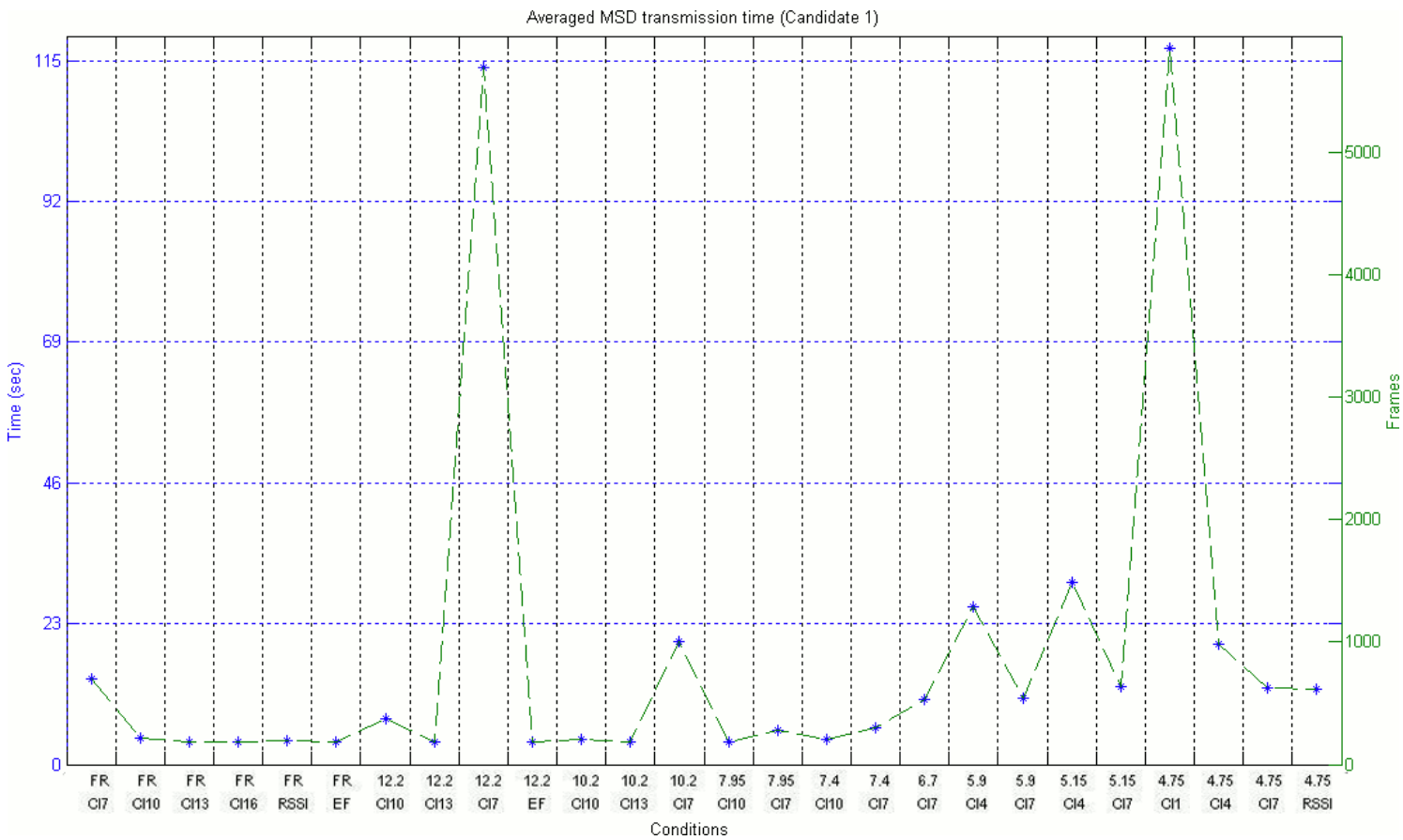

Figure 3: Averaged transmission time for each test condition.

Evaluation of requirements as per [5] (Selection rules) for this Candidate:

- Requirement 4.1.2 (Incorrect MSD's):

No incorrect MSD's were received by the PSAP during the tests. Hence this requirement **is fulfilled.**

- Service requirement 4.2.1.6: MSD transmission time in Error free conditions:

This service requirement is **fulfilled**, as the MSD transmission time in the 200 tests performed covering FR and AMR12.2 codecs has an upper limit of **3.62 seconds.** The following figure shows the MSD transmission time for all the iterations with both codecs in error free conditions:

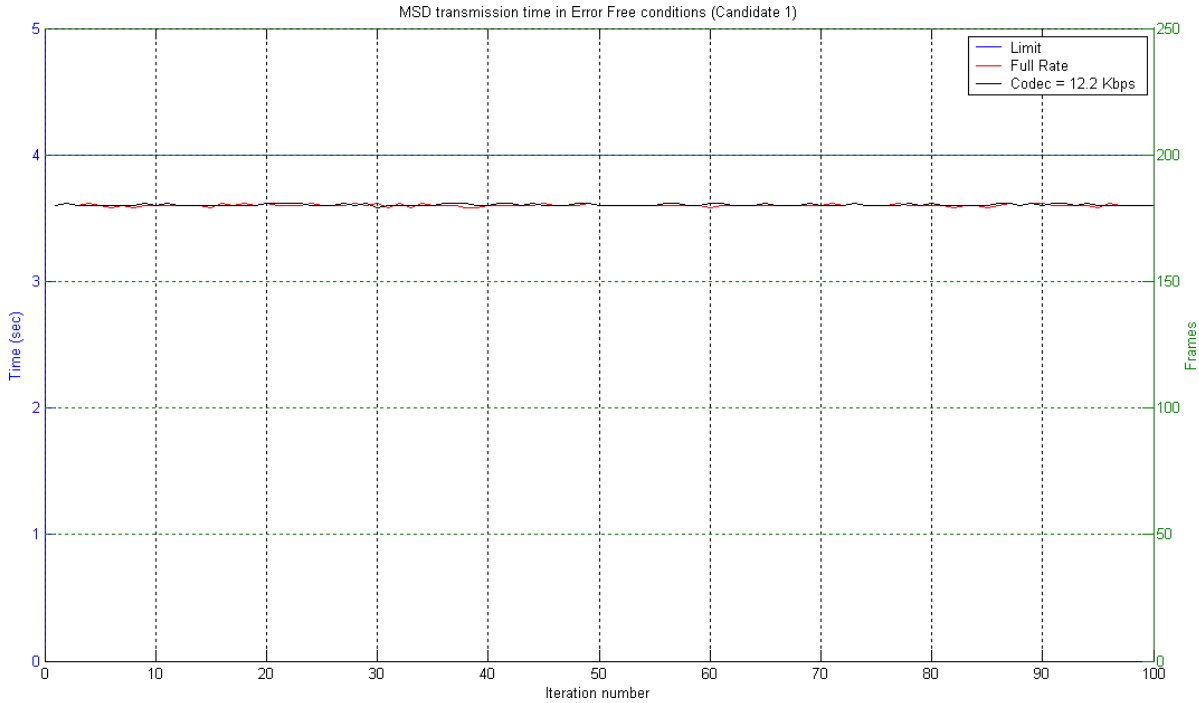

Figure 4: MSD transmission time in Error free Conditions.

- Performance Objective 1 (req. 4.2.3.1): FoM

The Figure of Merit averaging the 2600 tests is **885,23 frames** (**17,70 seconds**).
The minimum MSD transmission time obtained is **179 frames (3.58 seconds),** obtained in error free conditions.

5.1.2. RESULTS FOR THE FALSE TRIGGER DETECTION

- Performance Objective 3 (req. 4.2.3.3): False trigger detection test:

The candidate IVS software **did NOT detect** any false trigger during the 30 minute tone test. Hence, this objective is **fulfilled**.

5.1.3. RESULTS WITH ALTERNATIVE TEST CAMPAIGN

Evaluation of results using the alternative (second) Test Configuration File:
The simulation with the second test file shows close results compared to the official test campaign:

FINAL RESULTS	Unit	Official Test campaign	2nd campaign
Figure of Merit	Frames	**885,23**	**887,85**
	Seconds	**17,70**	**17,76**
Number of timeouts	---	**5**	**2**
Incorrect MSD's reported	---	**0**	**0**
Average time in Error free	Seconds	**3,60**	**3,60**

Table 4: Results with 2nd campaign vs official campaign.

5.1.4. RESULTS WITH ORDERED TEST CAMPAIGN

The execution of the modified test campaign with the ordered test cases showed **NO differences** with the original unordered official test configuration file.

5.2. RESULTS FOR CANDIDATE 2

5.2.1. OFFICIAL TEST CONFIGURATION FILE RESULTS

The following tables and figures show the main test results obtained for this candidate upon testing of the Official Test configuration file:

FINAL RESULTS	Unit	Candidate 2		
Figure of Merit	Frames	**360,39**		
	Seconds	**7,21**		
Number of timeouts	---	**0**		
Incorrect MSD's reported	---	**0**		
Average time in Optimal conditions (Error free radio channel, FR and AMR 12.2 codecs)	Seconds	**3,12**		
Error free: FR codec tmin/tmax/average	Seconds	**3,08**	**3,48**	**3,13**
Error free: AMR 12.2 codec tmin/tmax/average	Seconds	**3,1**	**3,12**	**3,11**
Number of false trigger detections	---	**0**		

Table 5: Summary of results

An overall view of the execution time for the 2600 test cases can be found in the following figure:

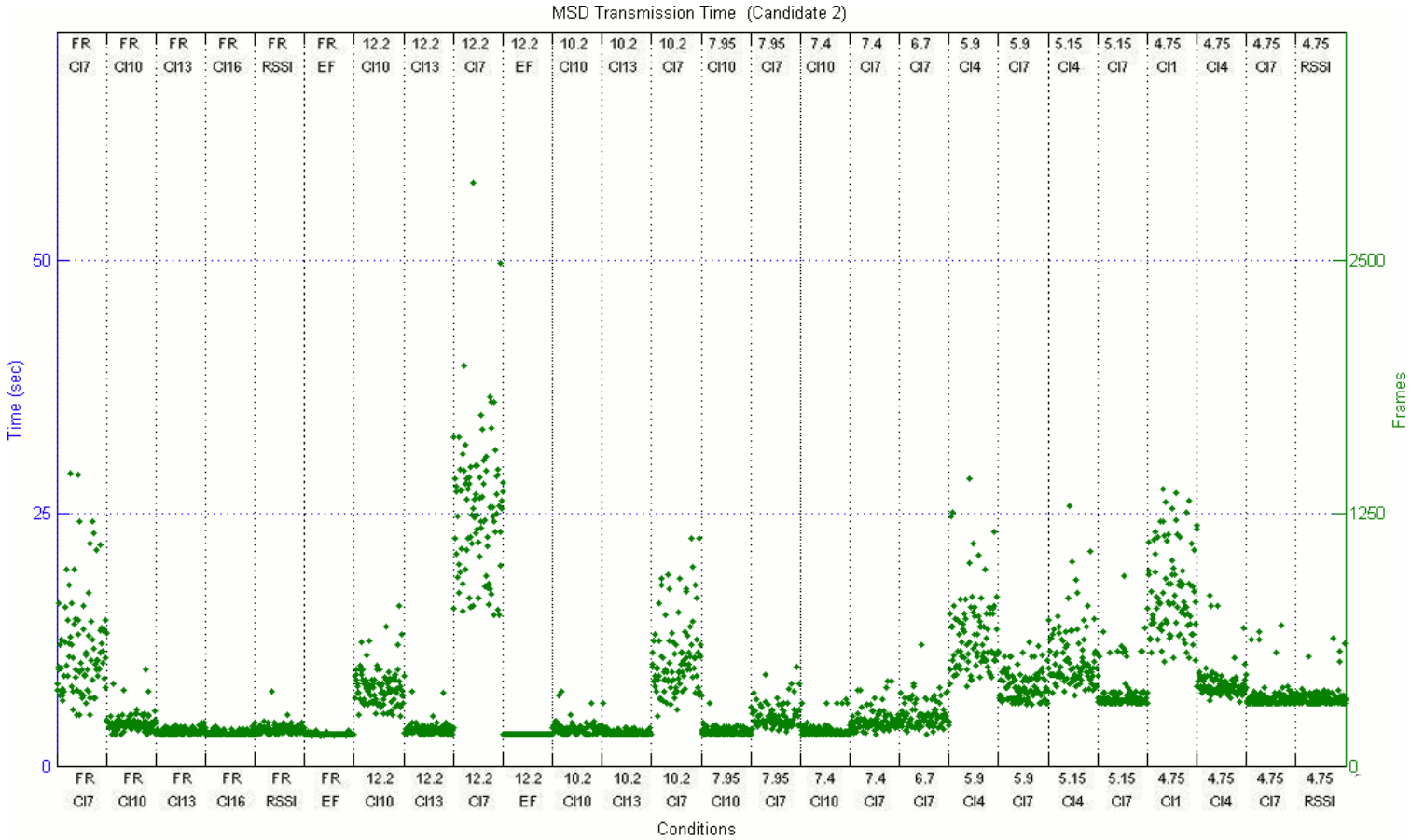

Figure 5: Transmission time for each test case.

The following figure and table show the averaged test results test results for the 2600 tests:

Candidate 2	Average MSD transmission time (in seconds) per Condition								
	GSM_FR	AMR 12.2	AMR 10.2	AMR 7.95	AMR 7.4	AMR 6.7	AMR 5.9	AMR 5.15	AMR 4.75
C/I = 1dB	-	-	-	-	-	-	-	-	17,28
C/I = 4dB	-	-	-	-	-	-	13,09	10,78	8,22
C/I = 7dB	11,61	25,43	10,77	4,97	4,57	5,09	7,95	7,37	6,88
C/I = 10dB	4,34	7,84	3,75	3,43	3,53	-	-	-	-
C/I = 13dB	3,45	3,66	3,28	-	-	-	-	-	-
C/I = 16dB	3,24	-	-	-	-	-	-	-	-
Error Free	3,13	3,11	-	-	-	-	-	-	-
RSSI = -100dBm	3,70	-	-	-	-	-	-	-	6,87

Table 6: Averaged transmission time for each test condition.

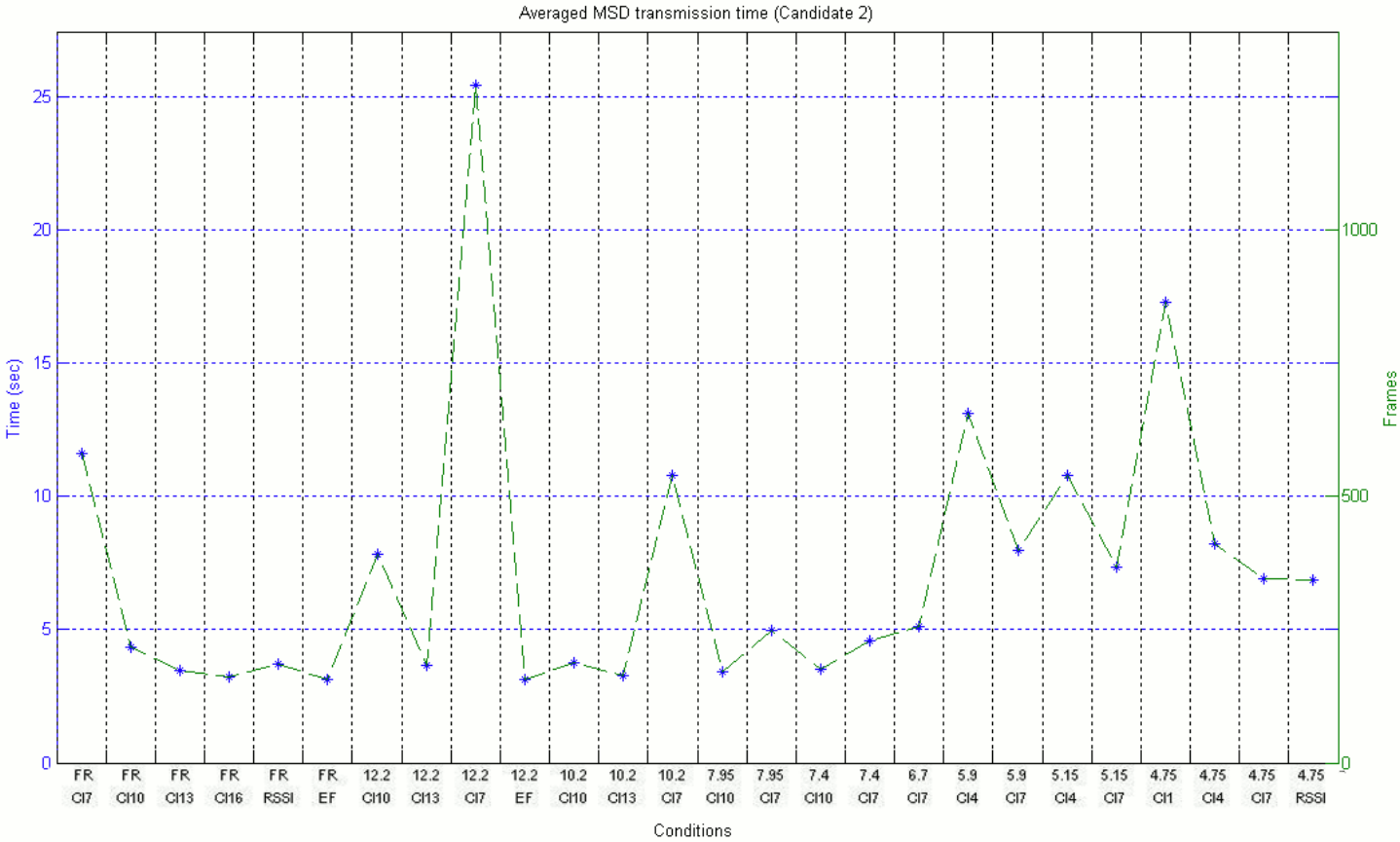

Figure 6: Averaged transmission time for each test condition.

Evaluation of requirements as per [5] (Selection rules) for this Candidate:

- Requirement 4.1.2 (Incorrect MSD's):

No incorrect MSD's were received by the PSAP during the tests. Hence this requirement **is fulfilled.**

- Service requirement 4.2.1.6: MSD transmission time in Error free conditions:

This service requirement is **fulfilled**, as the MSD transmission time in the 200 tests performed covering FR and AMR12.2 codecs has an upper limit of **3.48 seconds.** The following figure shows the MSD transmission time for all the iterations with both codecs in error free conditions:

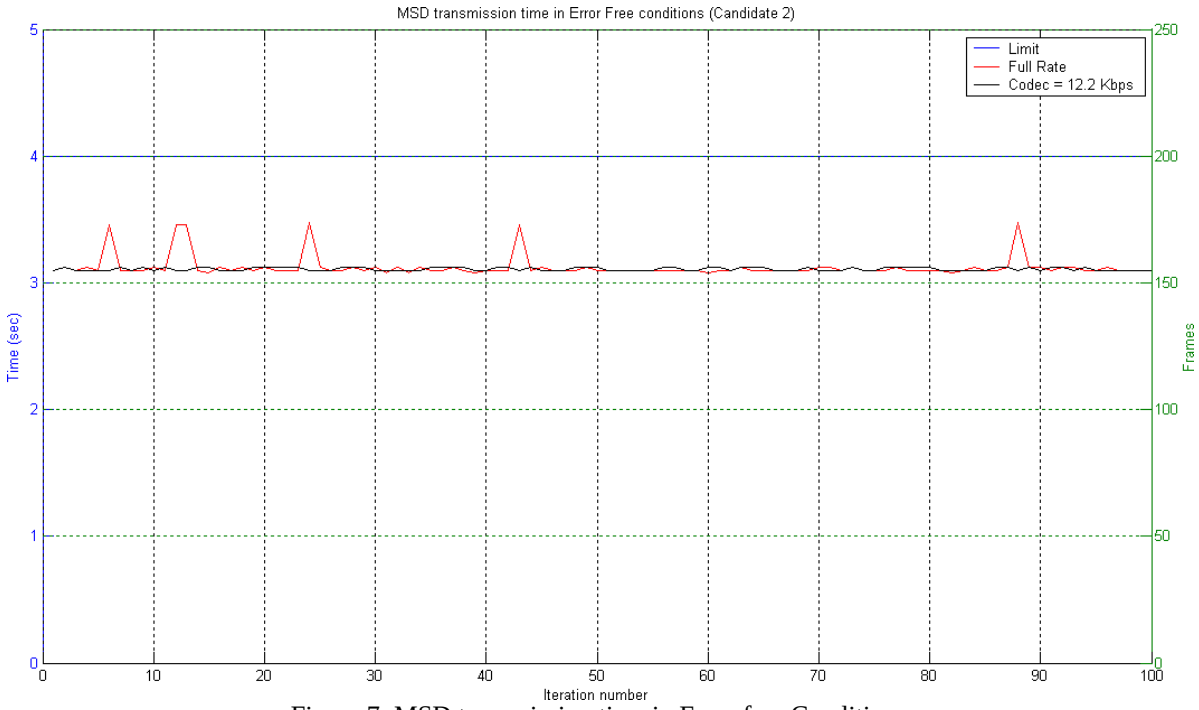

Figure 7: MSD transmission time in Error free Conditions.

- Performance Objective 1 (req. 4.2.3.1): FoM

The Figure of Merit averaging the 2600 tests is **360,39 frames** (**7,21 seconds**).
The minimum MSD transmission time obtained is **154 frames (3.08 seconds),** obtained in error free conditions.

5.2.2. RESULTS FOR THE FALSE TRIGGER DETECTION

- Performance Objective 3 (req. 4.2.3.3): False trigger detection test:

The candidate IVS software **did NOT detect** any false trigger during the 30 minute tone test. Hence, this objective is **fulfilled**.

5.2.3. RESULTS WITH ALTERNATIVE TEST CAMPAIGN

Evaluation of results using the alternative (second) Test Configuration File:
The simulation with the second test file shows close results compared to the official test campaign:

FINAL RESULTS	Unit	Official Test campaign	2nd campaign
Figure of Merit	Frames	**360,39**	**360,66**
	Seconds	**7,21**	**7,21**
Number of timeouts	---	**0**	**0**
Incorrect MSD's reported	---	**0**	**0**
Average time in Error free	Seconds	**3,12**	**3,12**

Table 7: Results with 2nd campaign vs official campaign.

5.2.4. RESULTS WITH ORDERED TEST CAMPAIGN

The execution of the modified test campaign with the ordered test cases **showed 34 differences** with respect the unordered official test configuration file. The differences are shown in the table below:

Index	Codec	VAD	Error Patern	Official Campaign (time in frames)	Ordered Campaign (time in frames)	Relative Error %
5	fr	2	fr-na-ci7.if1	806	815	1,12%
24	fr	2	fr-na-ci7.if1	897	902	0,56%
27	fr	2	fr-na-ci7.if1	1447	1462	1,04%
43	fr	1	fr-na-ci7.if1	1442	1430	0,83%
690	amr 12.2	2	amr-12_2-ci10.if1	791	797	0,76%
821	amr 12.2	2	amr-12_2-ci7	1977	2203	**11,43%**
827	amr 12.2	2	amr-12_2-ci7	1317	1372	4,18%
841	amr 12.2	2	amr-12_2-ci7	2883	2915	1,11%
855	amr 12.2	2	amr-12_2-ci7	1735	1692	2,48%
858	amr 12.2	2	amr-12_2-ci7	1668	1674	0,36%
866	amr 12.2	1	amr-12_2-ci7	1531	1483	3,14%
894	amr 12.2	1	amr-12_2-ci7	2488	2392	3,86%
1219	amr 10.2	1	amr-10_2-ci7.if1	896	928	3,57%
1221	amr 10.2	2	amr-10_2-ci7.if1	926	894	3,46%
1270	amr 10.2	2	amr-10_2-ci7.if1	865	871	0,69%
1291	amr 10.2	1	amr-10_2-ci7.if1	832	827	0,60%
1745	amr 6.7	2	amr-6_7-ci7.if1	601	618	2,83%
1848	amr 5.9	2	amr-5_9-ci4.if1	1100	1137	3,36%
1859	amr 5.9	1	amr-5_9-ci4.if1	1042	1048	0,58%
1890	amr 5.9	1	amr-5_9-ci4.if1	1161	1155	0,52%
2040	amr 5.15	1	amr-5_15-ci4.if1	830	824	0,72%
2049	amr 5.15	1	amr-5_15-ci4.if1	1013	986	2,67%
2059	amr 5.15	1	amr-5_15-ci4.if1	856	862	0,70%
2084	amr 5.15	1	amr-5_15-ci4.if1	1062	1068	0,56%
2153	amr 5.15	1	amr-5_15-ci7.if1	943	911	3,39%
2204	amr 4.75	2	amr-4_75-ci1.if1	1105	1089	1,45%
2256	amr 4.75	1	amr-4_75-ci1.if1	948	1067	**12,55%**

Index	Codec	VAD	Error Patern	Official Campaign (time in frames)	Ordered Campaign (time in frames)	Relative Error %
2300	amr 4.75	1	amr-4_75-ci1.if1	1174	1163	0,94%
2341	amr 4.75	2	amr-4_75-ci4.if1	792	776	2,02%
2375	amr 4.75	2	amr-4_75-ci4.if1	534	528	1,12%
2426	amr 4.75	1	amr-4_75-ci7.if1	667	673	0,90%
2484	amr 4.75	1	amr-4_75-ci7.if1	397	406	2,27%
2576	amr 4.75	2	amr-4_75-rssi100.if1	635	614	3,31%
2588	amr 4.75	2	amr-4_75-rssi100.if1	516	522	1,16%

Table 8: Differences found between ordered and unordered test campaigns

5.3. RESULTS FOR CANDIDATE 3

5.3.1. OFFICIAL TEST CONFIGURATION FILE RESULTS

The following tables and figures show the main test results obtained for this candidate upon testing of the Official Test configuration file:

FINAL RESULTS	Unit	Candidate 3		
Figure of Merit	Frames	**101,85**		
	Seconds	**2,04**		
Number of timeouts	---	**0**		
Incorrect MSD's reported	---	**0**		
Average time in Optimal conditions (Error free radio channel, FR and AMR 12.2 codecs)	Seconds	**1,36**		
Error free: FR codec tmin/tmax/average	Seconds	**1,34**	**1,7**	**1,36**
Error free: AMR 12.2 codec tmin/tmax/average	Seconds	**1,34**	**1,38**	**1,35**
Number of false trigger detections	---	**0**		

Table 9: Summary of results

An overall view of the execution time for the 2600 test cases can be found in the following Figure:

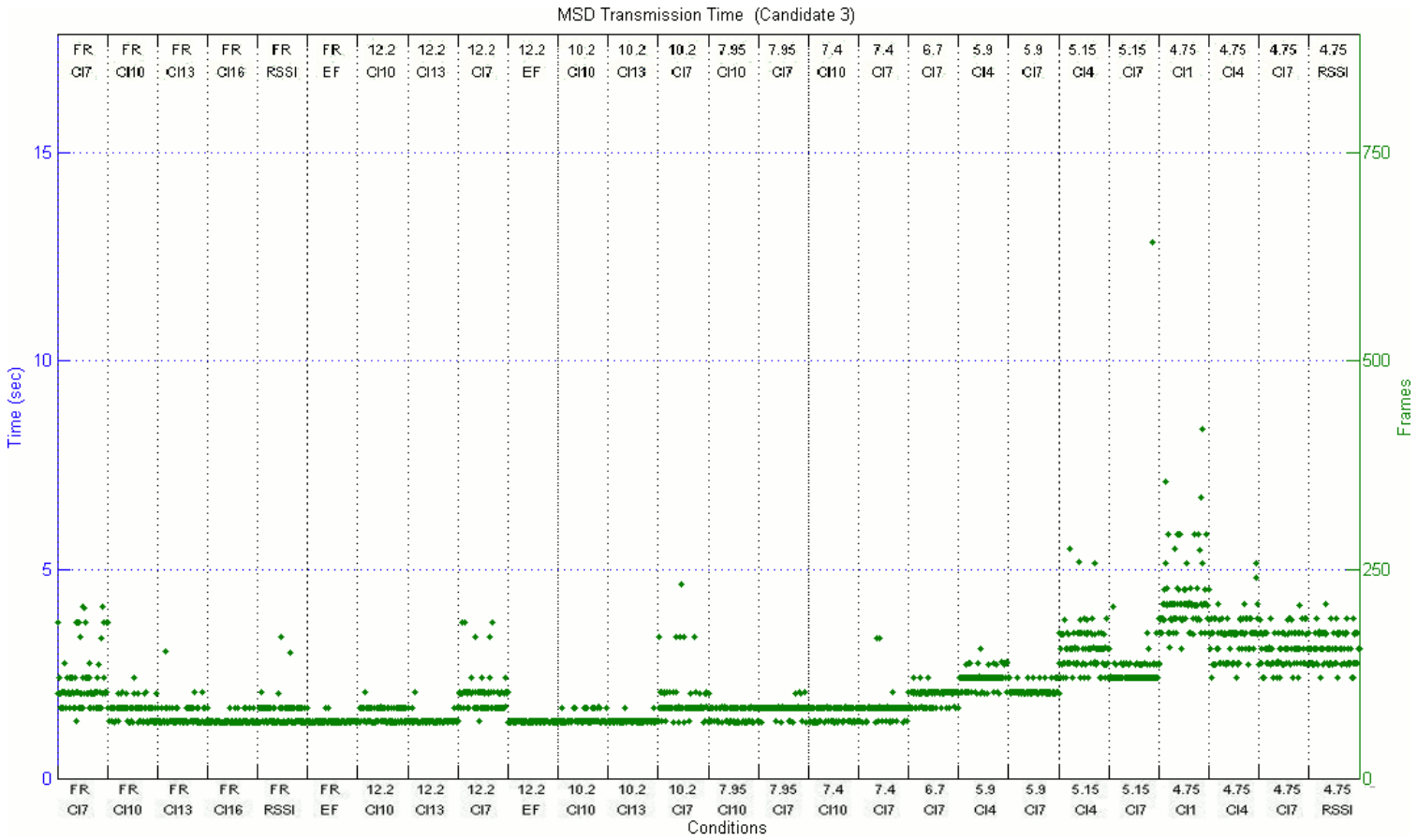

Figure 8: Transmission time for each test case.

The following figure and table show the averaged test results test results for each of the 26 test conditions:

Candidate 2	Average MSD transmission time (in seconds) per Condition								
	GSM_FR	AMR 12.2	AMR 10.2	AMR 7.95	AMR 7.4	AMR 6.7	AMR 5.9	AMR 5.15	AMR 4.75
C/I = 1dB	-	-	-	-	-	-	-	-	4,29
C/I = 4dB	-	-	-	-	-	-	2,41	3,12	3,36
C/I = 7dB	2,27	1,97	1,83	1,68	1,68	1,97	2,09	2,65	3,12
C/I = 10dB	1,61	1,51	1,40	1,53	1,53	-	-	-	-
C/I = 13dB	1,46	1,37	1,36	-	-	-	-	-	-
C/I = 16dB	1,37	-	-	-	-	-	-	-	-
Error Free	1,36	1,35	-	-	-	-	-	-	-
RSSI = -100dBm	1,52	-	-	-	-	-	-	-	3,11

Table 10: Averaged transmission time for each test condition.

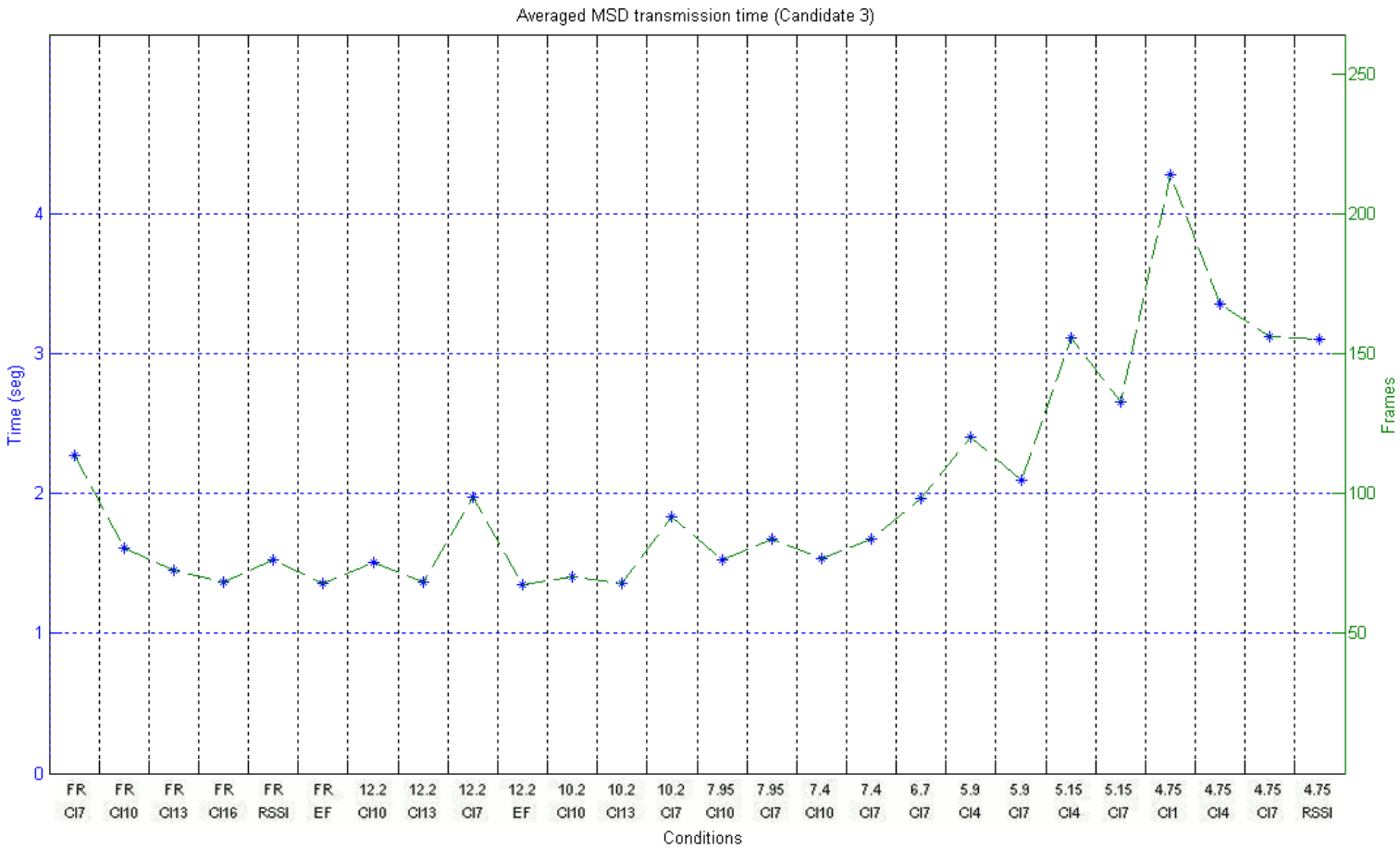

Figure 9: Averaged transmission time for each test condition.

Evaluation of requirements as per [5] (Selection rules) for this Candidate:

- Requirement 4.1.2 (Incorrect MSD's):

No incorrect MSD's were received by the PSAP during the tests. Hence this requirement **is fulfilled.**

- Service requirement 4.2.1.6: MSD transmission time in Error free conditions:

This service requirement is **fulfilled**, as the MSD transmission time in the 200 tests performed covering FR and AMR12.2 codecs has an upper limit of **1.70 seconds.** The following figure shows the MSD transmission time for all the iterations with both codecs in error free conditions:

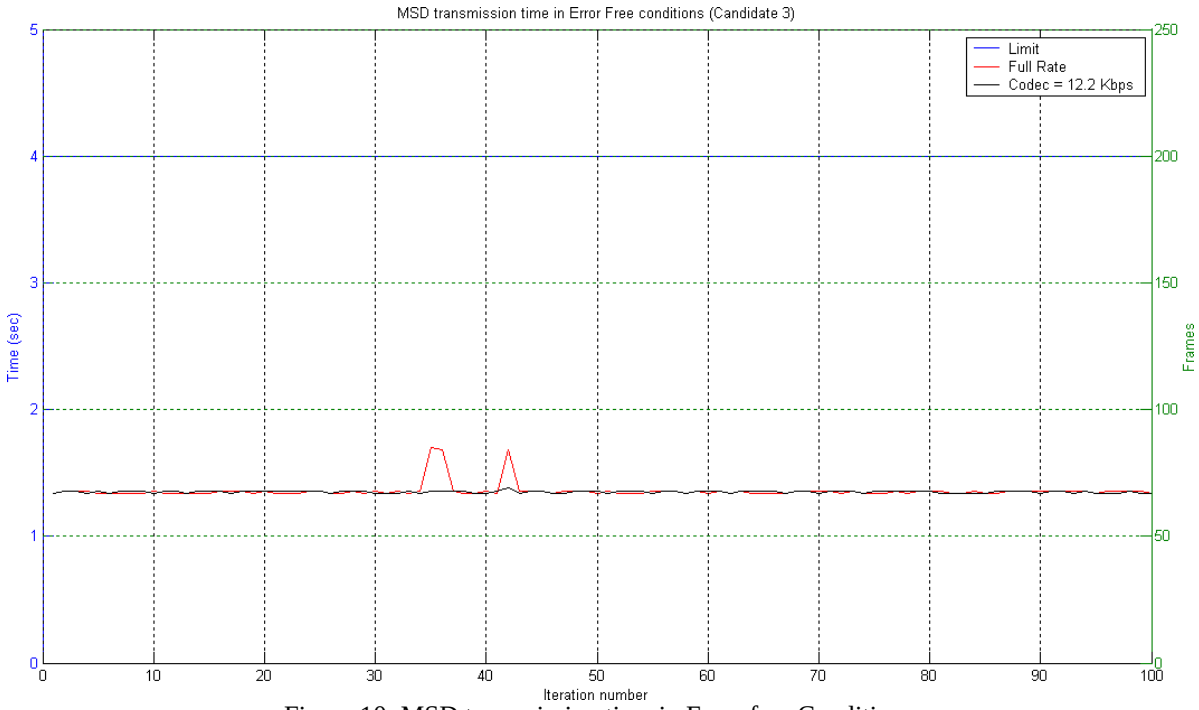

Figure 10: MSD transmission time in Error free Conditions.

- Performance Objective 1 (req. 4.2.3.1): FoM

The Figure of Merit averaging the 2600 tests is **101,85 frames (2.04 seconds).**
The minimum MSD transmission time obtained is **67 frames (1,34 seconds),** obtained in error free conditions and also with other codecs and conditions.

5.3.2. RESULTS FOR THE FALSE TRIGGER DETECTION

- Performance Objective 3 (req. 4.2.3.3): False trigger detection test:

The candidate IVS software **did NOT detect** any false trigger during the 30 minute tone test. Hence, this objective is **fulfilled**.

5.3.3. RESULTS WITH ALTERNATIVE TEST CAMPAIGN

Evaluation of results using the alternative (second) Test Configuration File:
The simulation with the second test file shows close results compared to the official test campaign:

FINAL RESULTS	Unit	Official Test campaign	2nd campaign
Figure of Merit	Frames	**101,85**	**102,25**
	Seconds	**2,04**	**2,05**
Number of timeouts	---	**0**	**0**
Incorrect MSD's reported	---	**0**	**0**
Average time in Error free	Seconds	**1,36**	**1,36**

Table 11: Results with 2nd campaign vs official campaign.

5.3.4. RESULTS WITH ORDERED TEST CAMPAIGN

The execution of the modified test campaign with the ordered test cases **showed 1 difference** with respect the unordered official test configuration file.

The difference is shown in the table below:

Index	Codec	VAD	Error Patern	Official Campaign (time in frames)	Ordered Campaign (time in frames)	Relative Error %
2054	fr	2	amr-5.15-ci4.if1	152	174	14,47%

Table 12: Differences found between ordered and unordered test campaigns

6. SUMMARY

As per [5], the Candidate solutions shall be ranked according to their performance in the Selection test. Following this document, the ranking is as follows:

Ranking #1: **Candidate 3** (**FoM: 2,04 seconds**, i.e: 101,85 frames)

Ranking #2: **Candidate 2** (**FoM: 7.21 seconds**, i.e: 360,39 frames)

Ranking #3: **Candidate 1** (**FoM: 17,70 seconds**, i.e: 885,23 frames).

The following table shows an overall summary comparing the main values for each candidate.

Summary of results for 3 candidates				
	Unit	**Candidate 1**	**Candidate 2**	**Candidate 3**
Figure of Merit	Frames	**885,23**	**360,39**	**101,85**
	Seconds	**17,70**	**7,21**	**2,04**
Number of timeouts	---	**5**	**0**	**0**
Incorrect MSD's reported	---	**0**	**0**	**0**
Average time in Optimal conditions (Error free radio channel, FR and AMR 12.2 codecs)	Seconds	**3,60**	**3,12**	**1,36**
Number of false trigger detections	---	**0**	**0**	**0**

Table 13: Summary of results for 3 candidates.

The following figures and table show the averaged test results test results for each of the 26 test conditions:

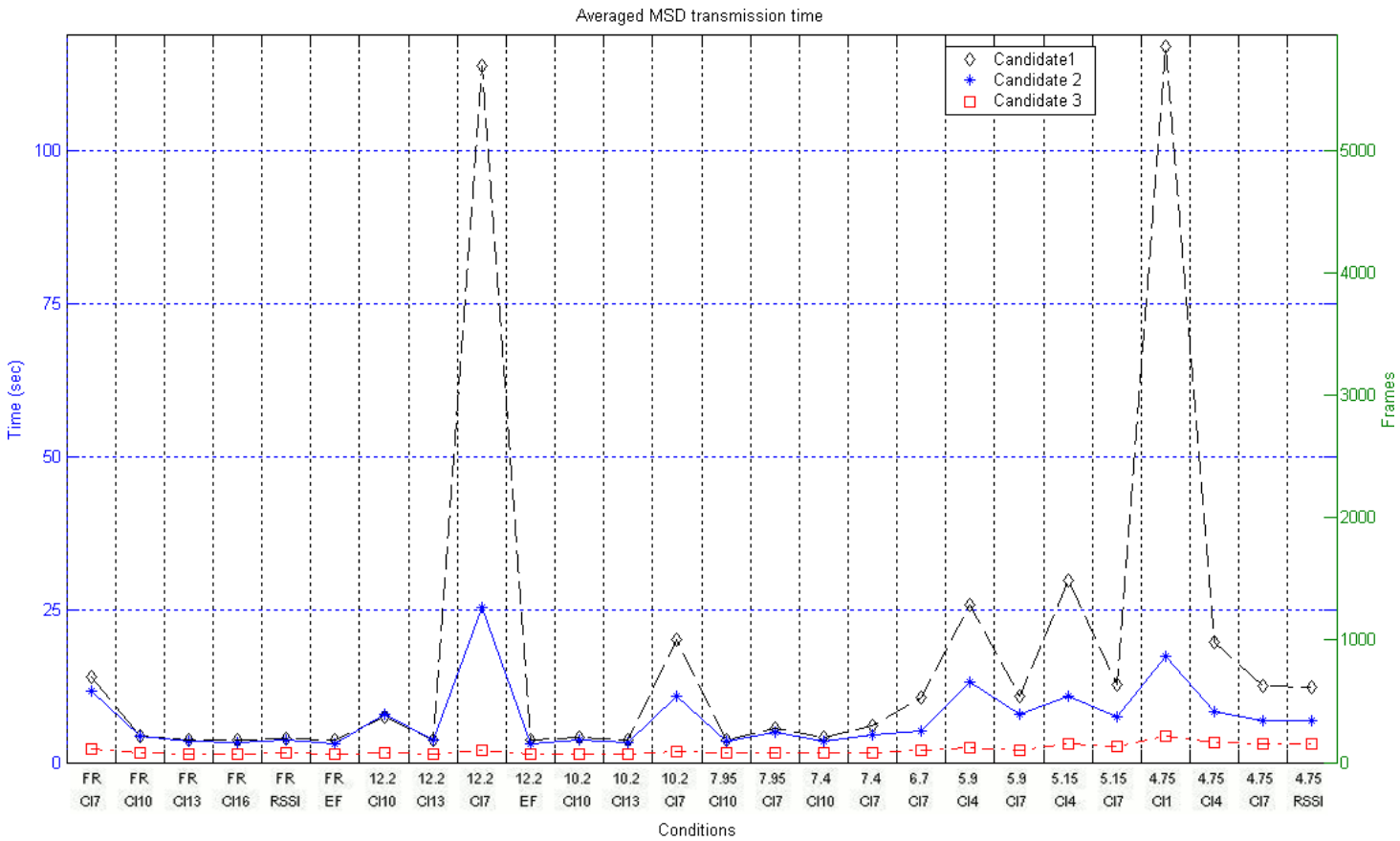

Figure 11: Comparison of Averaged transmission time for each test condition.

Due to the difference levels between the three averaged time lines, Figure 12 represents a zoomed figure with an upper limit of 30 seconds:

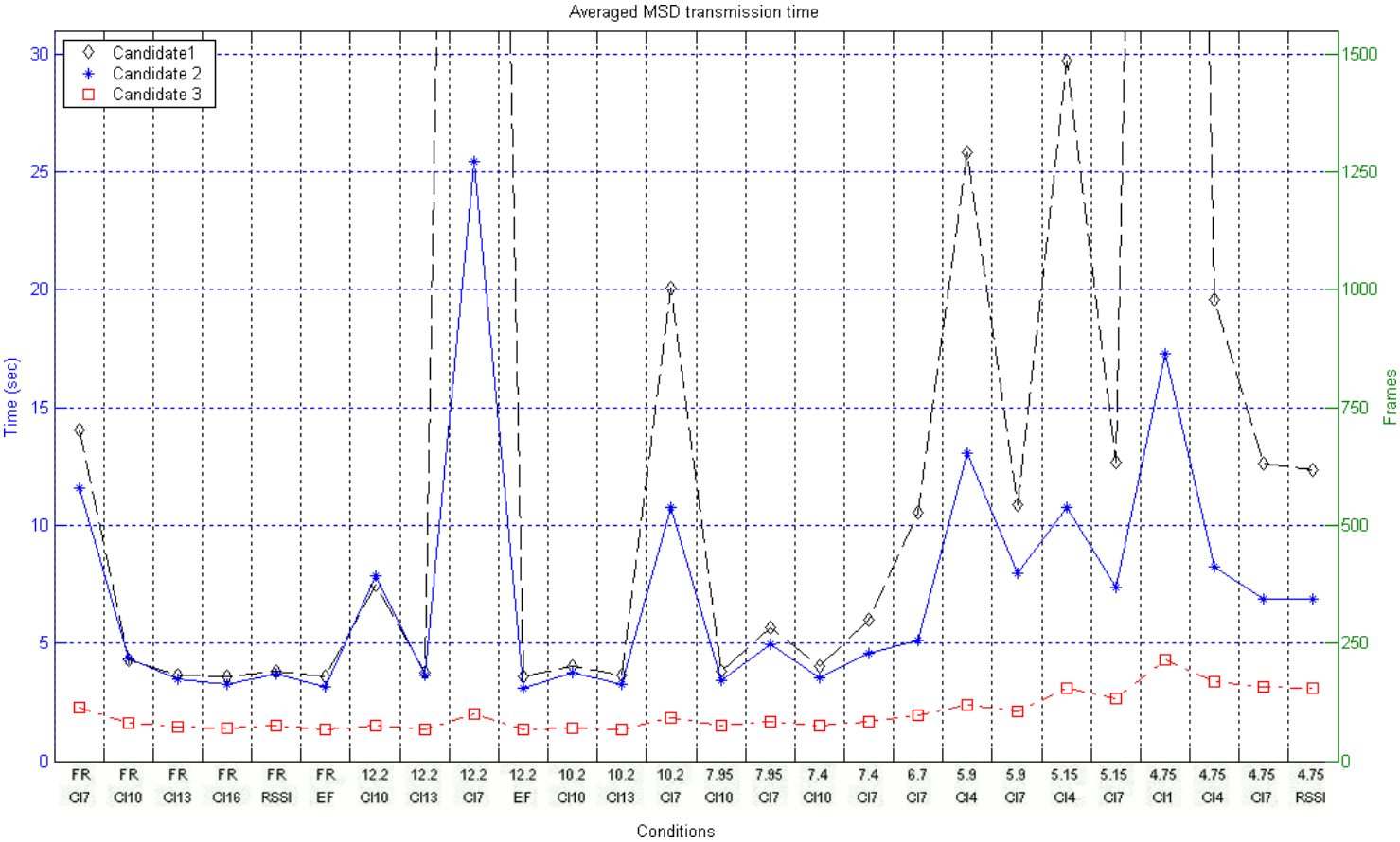

Figure 12: Zoomed comparison image, with upper limit set to 30 seconds.

	Average MSD transmission time (in seconds) per Condition														
	GSM_FR			AMR 12.2			AMR 10.2			AMR 7.95			AMR 7.4		
	C-1	C-2	C-3	C-1	C-2	C-3	C-1	C-2	C-3	C-1	C-2	C-3	C-1	C-2	C-3
C/I = 7dB	14,06	11,61	2,27	113,97	25,43	1,97	20,06	10,77	1,83	5,66	4,97	1,68	5,99	4,57	1,68
C/I = 10dB	4,28	4,34	1,61	7,48	7,84	1,51	4,02	3,75	1,40	3,78	3,43	1,53	4,02	3,53	1,53
C/I = 13dB	3,66	3,45	1,46	3,75	3,66	1,37	3,66	3,28	1,36	-			-		
C/I = 16dB	3,61	3,24	1,37	-			-			-			-		
Error Free	3,60	3,13	1,36	3,61	3,11	1,37	-			-			-		
RSSI = -100dBm	3,81	3,70	1,52	-			-			-			-		
	AMR 6.7			AMR 5.9			AMR 5.15			AMR 4.75					
	C-1	C-2	C-3	C-1	C-2	C-3	C-1	C-2	C-3	C-1	C-2	C-3			
C/I = 1dB	-			-			-			117,06	17,28	4,29			
C/I = 4dB	-			25,82	13,09	2,41	29,71	10,78	3,12	19,61	8,22	3,36			
C/I = 7dB	10,52	5,09	1,97	10,90	7,95	2,09	12,66	7,37	2,65	12,61	6,88	3,12			
RSSI = -100dBm	-			-			-			12,34	6,87	3,11			

Table 14: Summary of results for 3 candidates

ANNEX A

TEST RESULTS FILES

Report No.:
28380IDT.001

The list of attachments to this report is the following:

- **official_test_configuration_file.txt**: Test campaign used to run the simulations.
- **official_results_C1.txt**: results for Candidate 1.
- **official_results_C2.txt**: results for Candidate 2.
- **official_results_C3.txt**: results for Candidate 3.

- **ordered_test_configuration_file.txt**: ordered test campaign file (as per generated in 'gencampaign.m' from [6].
- **result_from_ordered-C1.txt:** results with ordered test campaign, for Candidate 1.
- **result_from_ordered-C2.txt:** results with ordered test campaign, for Candidate 2.
- **result_from_ordered-C3.txt:** results with ordered test campaign, for Candidate 3.

ANNEX B

PHOTOGRAPHS

Report No.:
28380IDT.001

Host Lab Test Setup