International Civil Aviation Organization

The 3rd Meeting of the Future Air Navigation Systems Interoperability Team-Asia (FIT-Asia/3)

Pattaya, Thailand, 26 – 27 May 2014

Agenda Item 3:   Review of ADS/CPDLC Operations

DATA LINK PERFORMANCE REPORT FOR L888 ROUTE

(Presented by China)

SUMMARY
This paper presents data link performance data for Feb. 2013 to March. 2014 for Chinese L888 FANS route.

1.   INTRODUCTION

1.1   Data-link communications have been used for CPDLC and ADS-C for many years, and data-link performance requirements have been established. Specific requirements are published in the Global Operational Data-link Document (GOLD), and reflect those contained in Doc 9869, Manual on Required Communication Performance. States are invited to ensure that the appropriate data link performance monitoring is undertaken and reported to CRAs/FITs, as required, in a timely manner.

1.2   China has officially started providing data link services on FANS-L888 routes in the remote airspace Western China since 2001. The data link system in this airspace comprises a variety of ground systems that may provide data link services to FANS 1/A aircraft.

1.3   This paper provides observed performance of the operational data link system along L888 route, collected from centres of Kunming ZPPP, Chengdu ZUUU, Lanzhou ZLLL and Urumqi ZWWW. The purpose of this paper is to present recent observed performance of the data link system.

1.4   The performance data observed from the Controller Pilot Data Link Communication (CPDLC) and Automatic Dependent Surveillance - Contract (ADS-C) systems are measured against the Required Communication Performance (RCP) 400 specification to demonstrate that safety objectives which rely on the communications infrastructure can be met by the aircraft and ground systems.

1.5   The provision of the data-link performance of L888 route in this paper are presented in the Data Link performance reporting template developed in WP 10 of FIT-ASIA/2 meeting, 2013.

2.   DISCUSSION

L888 route CPDLC Actual Communications Performance (ACP)

2.1.   The ACP is used for monitoring the RCP requirement time allocation for the communication transaction (TRN). The TRN is the portion of the total transaction time that does not include the message composition time or recognition of the operational response.

2.2.　　　　**Table 1** summarizes overall CPDLC Actual Communications Performance (ACP) for messages sent within four centres (ZLLL, ZPPP, ZUUU, ZWWW). **Figure 1** graphs ACP measurement by media type (Satellite, VHF and HF) against the 95% 320" and 99.9% 370" requirements for RCP400 using the 10536 CPDLC transactions recorded during the period of Feb. 2013 to March. 2014. in the four centres.

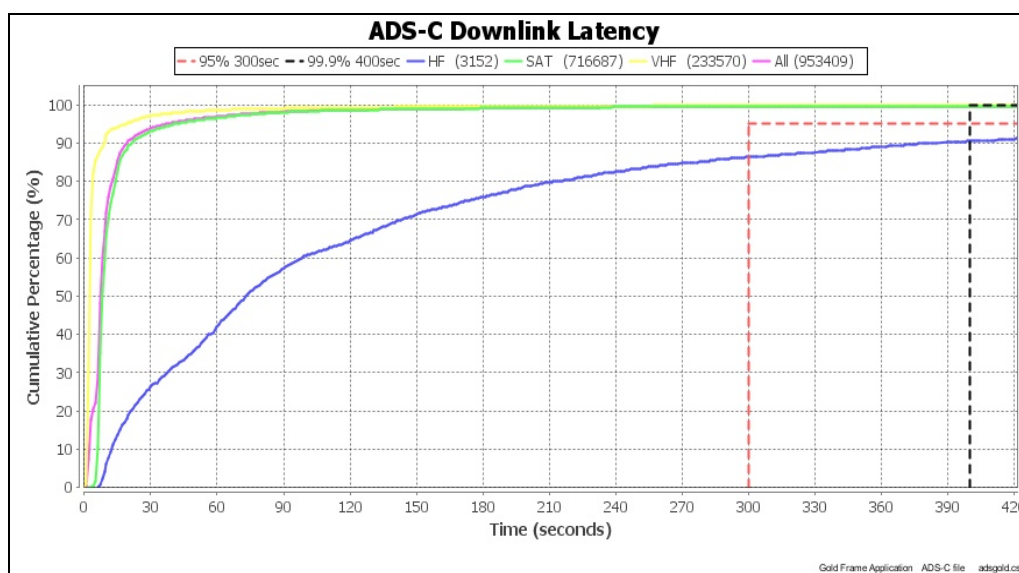| CPDLC ACP				
Messages		**%< 320 sec (Target 95%)**	**%< 370 sec (Target 99.9%)**	**Remarks**
Satellite	6899	100.00%	100.00%	-
VHF	3627	100.00%	100.00%	-
HF	10	100.00%	100.00%	-
Total	10536	100.00%	100.00%	-

Table 1: CPDLC ACP per Media Type of L888 route
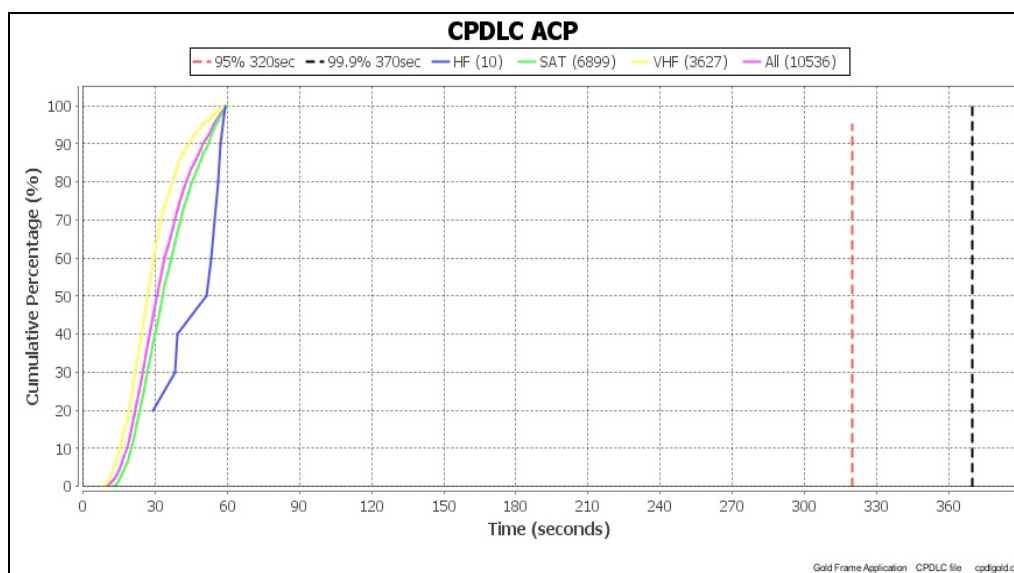
Figure 1: ACP by Data Link Media Type of L888 route

ADS-C Downlink Latency

2.3.　　　　Table 2 summarizes overall ADS-C Downlink Latency for messages sent within four centres (ZLLL, ZPPP, ZUUU, ZWWW). **Figure 2** graphs ADS-C Downlink Latency measurement by media type (Satellite, VHF and HF) against the 95% 300" and 99.9% 400" requirements for **S**urveillance performance type 400 specification using 953409 ADS-C messages recorded during the period Feb. 2013 to March. 2014. in the four centres.

ADS-C Downlink Latency				
Messages		**% < 300 sec (Target 95%)**	**%< 400 sec (Target 99.9%)**	**Remarks**
Satellite	716687	99.59%	99.73%	-
VHF	233570	99.83%	99.90%	-
HF	3152	86.34%	90.51%	-
Total	953409	99.60%	99.74%	-

Table 2: ADS-C Downlink Latency per Media Type of L888 route

Figure 2: ADS-C Downlink Latency of L888 route

CPDLC Actual Communications Performance (ACP) per Operator (de-identified)

2.4.   Table 3 summarizes CPDLC Actual Communications Performance per Operator for messages sent within four centres (ZLLL, ZPPP, ZUUU, ZWWW). **Figure 3** presents the CPDLC Actual Communications Performance per Operator for the period Feb. 2013 to March. 2014.

3. CPDLC ACP per Operator				
Operator (de-identified)	**Messages**	**% < 320 sec (Target 95%)**	**%< 370 sec (Target 99.9%)**	**Remarks**
A1	372	100.00%	100.00%	-
A2	61	100.00%	100.00%	-
A3	114	100.00%	100.00%	-
A4	1	100.00%	100.00%	-
A5	2	100.00%	100.00%	-
A6	111	100.00%	100.00%	-
A7	408	100.00%	100.00%	-
A8	2477	100.00%	100.00%	-
A9	3459	100.00%	100.00%	-
A10	2	100.00%	100.00%	-
A11	86	100.00%	100.00%	-
A12	756	100.00%	100.00%	-
A13	2	100.00%	100.00%	-
A14	746	100.00%	100.00%	-
A15	2	100.00%	100.00%	-
A16	112	100.00%	100.00%	-
A17	13	100.00%	100.00%	-
A18	143	100.00%	100.00%	-
A19	48	100.00%	100.00%	-
A20	94	100.00%	100.00%	-
A21	21	100.00%	100.00%	-
A22	2	100.00%	100.00%	-
A23	121	100.00%	100.00%	-
A24	1283	100.00%	100.00%	-
Total	10436	100.00%	100.00%	-

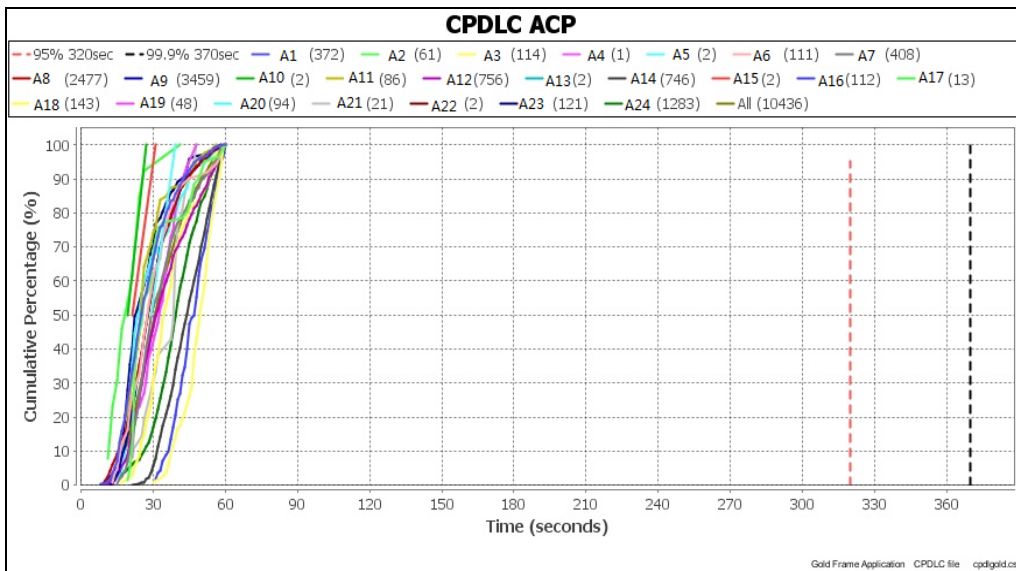**Table 3: CPDLC ACP per Operator of L888 route**

Figure 3: CPDLC ACP per Operator of L888 route

3.1.   **Appendix A** provides further detail of CPDLC ACP and ACTP, and ADS-C performance.

3.   ACTION BY THE MEETING

3.1   The meeting is invited to:

   a) note the information contained in this paper; and

   b) discuss any relevant matters as appropriate.

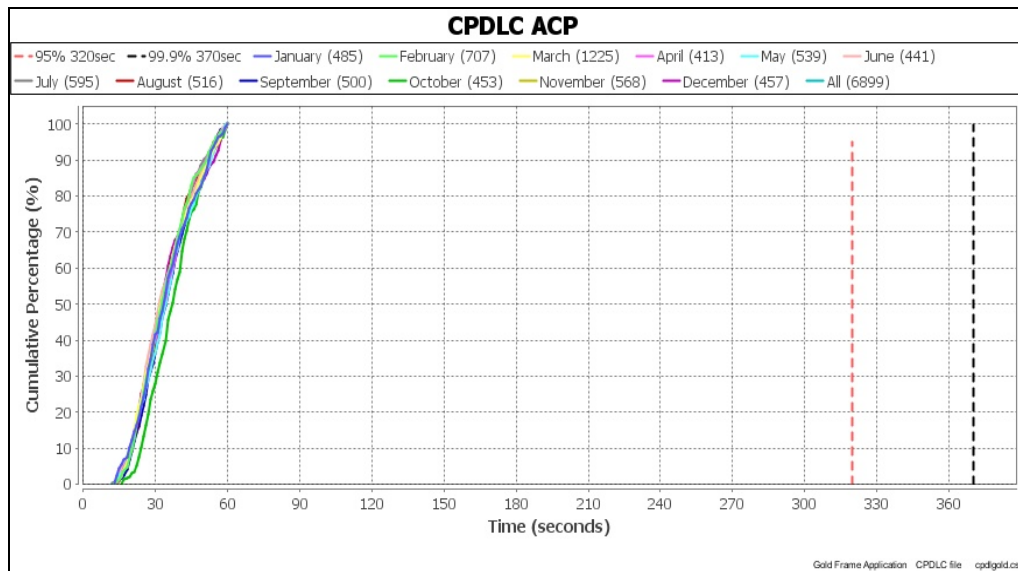………………………….

APPENDIX A

1.   Data Link Performance by Month For L888 Route

L888 route Actual Communications Performance (ACP) per Month – Satellite

1.1.   **Table 4** summarizes CPDLC ACP (Satellite) per month for messages sent within four centres (ZLLL, ZPPP, ZUUU, ZWWW). **Figure 4** graphs the ACP (Satellite) measurement per month for the period of Feb. 2013 to March. 2014. in the four centres.

CPDLC ACP per Month - Satellite				
Month	**Messages**	**% < 320 sec (Target 95%)**	**%< 370 sec (Target 99.9%)**	**Remarks**
1-Jan	485	100.00%	100.00%	-
2-Feb	707	100.00%	100.00%	-
3-Mar	1225	100.00%	100.00%	-
4-Apr	413	100.00%	100.00%	-
5-May	539	100.00%	100.00%	-
6-Jun	441	100.00%	100.00%	-
7-Jul	595	100.00%	100.00%	-
8-Aug	516	100.00%	100.00%	-
9-Sep	500	100.00%	100.00%	-
10-Oct	453	100.00%	100.00%	-
11-Nov	568	100.00%	100.00%	-
12-Dec	457	100.00%	100.00%	-
Total	6899	100.00%	100.00%	-

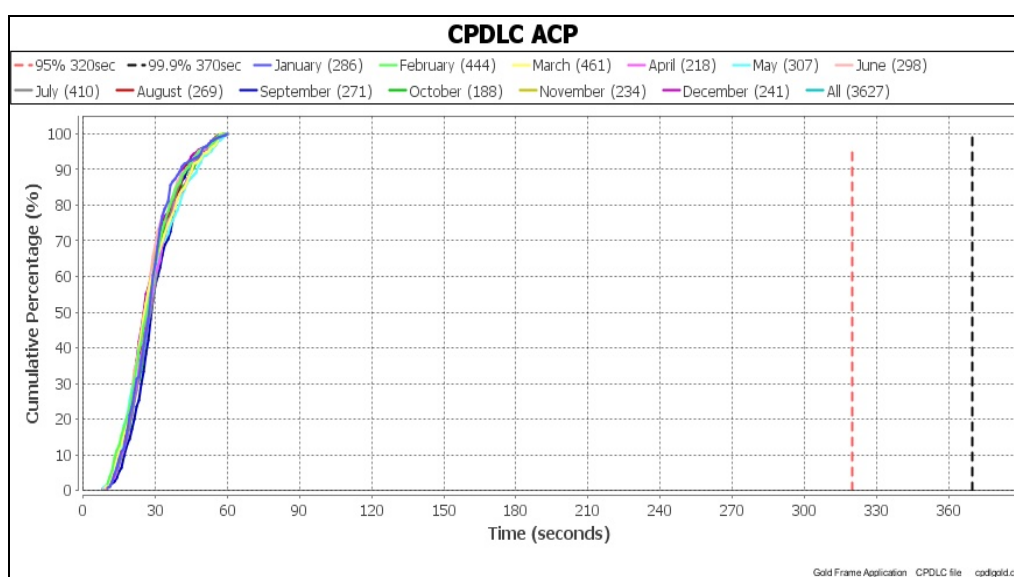**Table 4: CPDLC ACP (Satellite) per month of L888 route**

Figure 4: CPDLC ACP (Satellite) per month of L888 route

L888 route Actual Communications Performance (ACP) per Month – VHF

1.2   **Table 5** summarizes CPDLC ACP (VHF) per month for messages sent within four centres (ZLLL, ZPPP, ZUUU, ZWWW). **Figure 5** graphs the ACP (VHF) measurement per month for the period of Feb. 2013 to March. 2014. in the four centres.

CPDLC ACP per Month - VHF				
Month	**Messages**	**% < 320 sec (Target 95%)**	**%< 370 sec (Target 99.9%)**	**Remarks**
1-Jan	286	100.00%	100.00%	-
2-Feb	444	100.00%	100.00%	-
3-Mar	461	100.00%	100.00%	-
4-Apr	218	100.00%	100.00%	-
5-May	307	100.00%	100.00%	-
6-Jun	298	100.00%	100.00%	-
7-Jul	410	100.00%	100.00%	-
8-Aug	269	100.00%	100.00%	-
9-Sep	271	100.00%	100.00%	-
10-Oct	188	100.00%	100.00%	-
11-Nov	234	100.00%	100.00%	-
12-Dec	241	100.00%	100.00%	-
Total	3627	100.00%	100.00%	-

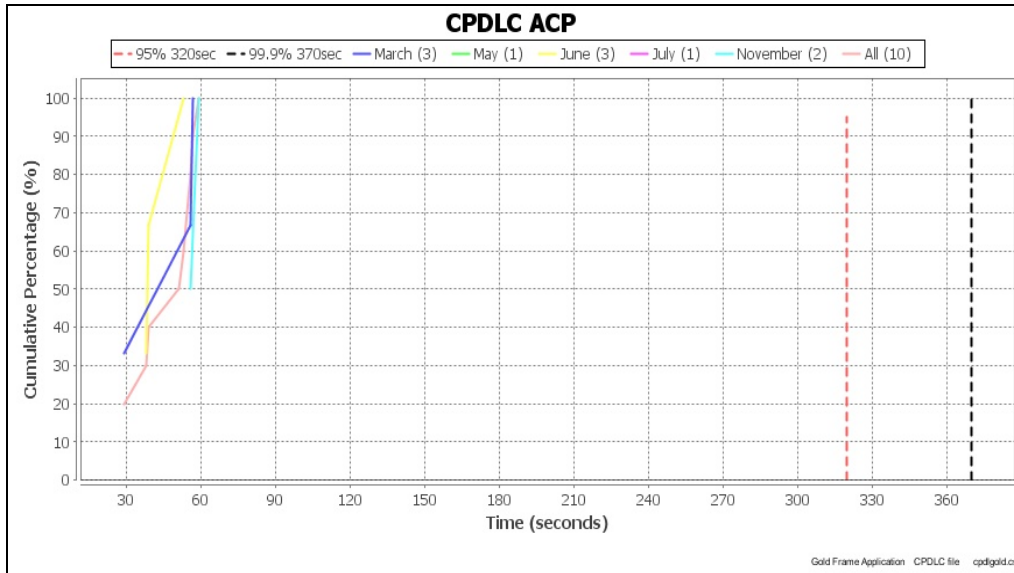**Table 5: CPDLC ACP (VHF) per month of L888 route**

Figure 5: CPDLC ACP (VHF) per month of L888 route

L888 route Actual Communications Performance (ACP) per Month – HF

1.3   **Table 6** summarizes CPDLC ACP (HF) per month for messages sent within four centres (ZLLL, ZPPP, ZUUU, ZWWW). **Figure 6** graphs the ACP (HF) measurement per month for the period of Feb. 2013 to March. 2014. in the four centres.

CPDLC ACP per Month - HF				
Month	**Messages**	**% < 320 sec (Target 95%)**	**%< 370 sec (Target 99.9%)**	**Remarks**
3-Mar	3	100.00%	100.00%	-
5-May	1	100.00%	100.00%	-
6-Jun	3	100.00%	100.00%	-
7-Jul	1	100.00%	100.00%	-
11-Nov	2	100.00%	100.00%	-
Total	10	100.00%	100.00%	-

Table 6: CPDLC ACP (HF) per month of L888 route

Figure 6: CPDLC ACP (HF) per month of L888 route

CPDLC Actual Communications Technical Performance (ACTP)

1.4 Actual communications technical performance (ACTP) is used to monitor required communication technical performance (RCTP) time allocations. The ACTP is computed in three steps. The first step is to estimate the downlink time from the difference between the time stamp on the aircraft-originated downlink message and the ATSP received time. Then, the round trip time of the uplink message is estimated from the difference between the time the uplink message was sent from the ATSP and the receipt of the message assurance (MAS) response for the uplink at the ATSP. The last step is to divide the estimated round trip time by two and add the result to the estimated downlink time. Equation 1 provides the estimate of ACTP:

((MAS receipt – Uplink transmission time)/2 + Downlink time) (1)

1.5 **Table 7** summarizes overall CPDLC Actual Communications Technical Performance (ACTP) for messages sent within four centres (ZLLL, ZPPP, ZUUU, ZWWW). **Figure 7** graphs ACTP measurement by media type (Satellite, VHF and HF) against the 95% 260" and 99.9% 310" requirements for RCP400 using the 10536 CPDLC transactions recorded during the period Feb. 2013 to March. 2014. in the four centres.

CPDLC ATCP				
Messages		**% <260 sec (Target 95%)**	**%<310 sec (Target 99.9%)**	**Remarks**
Satellite	6899	99.64%	99.64%	-
VHF	3627	99.81%	99.84%	-
HF	10	100.00%	100.00%	-
Total	10536	99.70%	99.71%	-

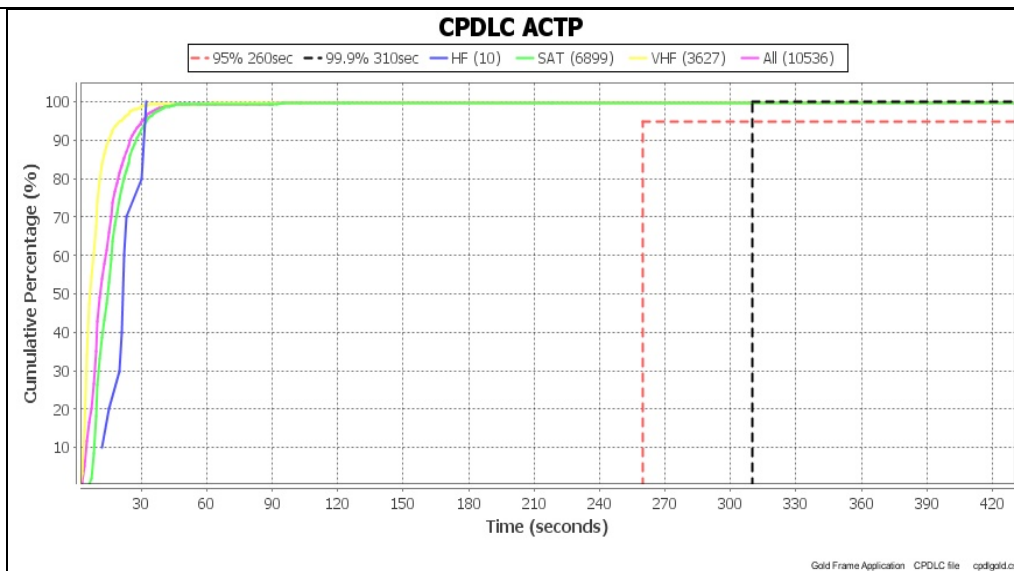**Table 7: CPDLC ATCP per Media Type of L888 Route**

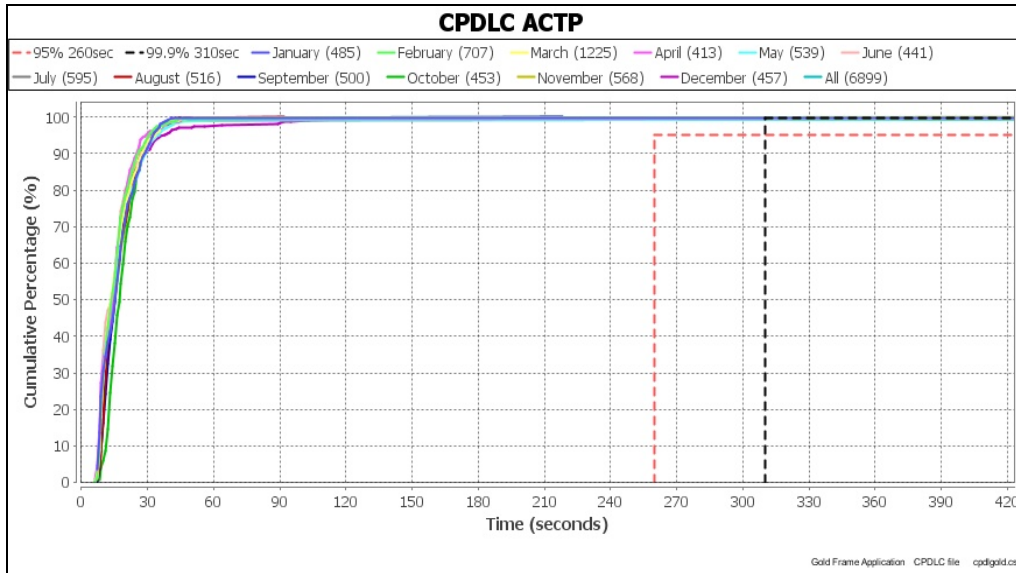**Figure 7: CPDLC ATCP by Data Link Media Type of L888 Route**

CPDLC Actual Communications Technical Performance (ACTP) per month - Satellite

1.6   **Table 8** summarizes CPDLC ACTP (Satellite) per month for messages sent within four centres (ZLLL, ZPPP, ZUUU, ZWWW). **Figure 8** graphs the ACTP (Satellite) measurement per month for the period of Feb. 2013 to March. 2014. in the four centres.

CPDLC ACTP per Month - Satellite				
Month	**Messages**	**% < 260sec (Target 95%)**	**%< 310sec (Target 99.9%)**	**Remarks**
1-Jan	485	99.62%	99.63%	-
2-Feb	707	99.79%	99.81%	-
3-Mar	1225	99.69%	99.70%	-
4-Apr	413	99.59%	99.62%	-
5-May	539	99.17%	99.19%	-
6-Jun	441	99.84%	99.86%	-
7-Jul	595	99.88%	99.89%	-
8-Aug	516	100.00%	100.00%	-
9-Sep	500	100.00%	100.00%	-
10-Oct	453	99.23%	99.25%	-
11-Nov	568	99.90%	99.92%	-
12-Dec	457	99.38%	99.40%	-
Total	6899	99.64%	99.64%	-

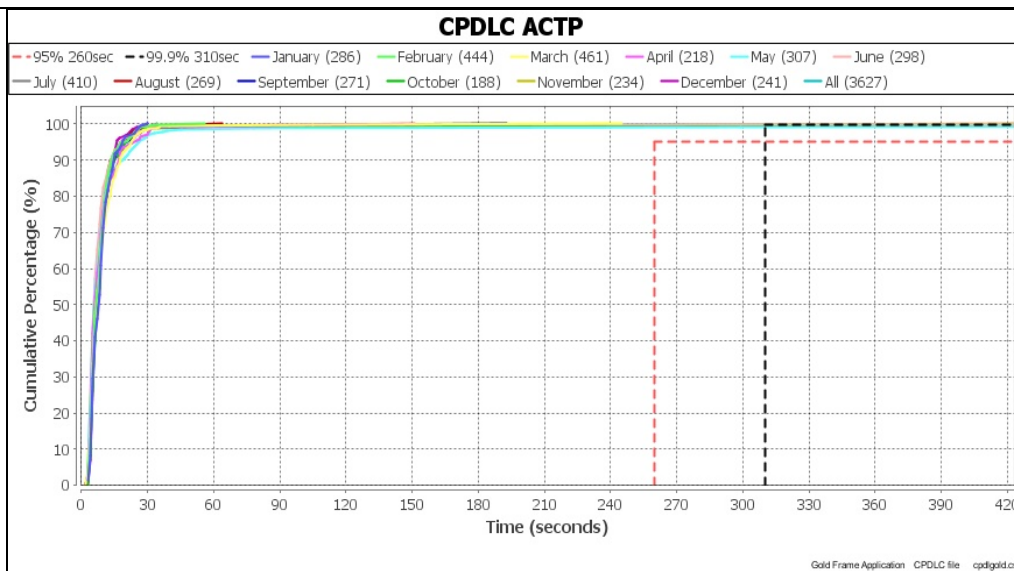**Table 8: CPDLC ACTP (Satellite) per month of L888 route**

Figure 8: CPDLC ACTP (Satellite) per month of L888 route

CPDLC Actual Communications Technical Performance (ACTP) per month - VHF

1.7   **Table 9** summarizes CPDLC ACTP (VHF) per month for messages sent within four centres (ZLLL, ZPPP, ZUUU, ZWWW). **Figure 9** graphs the ACTP (VHF) measurement per month for the period of Feb. 2013 to March. 2014. in the four centres.

CPDLC ACTP per Month - VHF				
Month	Messages	% < 260sec (Target 95%)	%< 310sec (Target 99.9%)	Remarks
1-Jan	286	100.00%	100.00%	-
2-Feb	444	100.00%	100.00%	-
3-Mar	461	100.00%	100.00%	-
4-Apr	218	100.00%	100.00%	-
5-May	307	98.97%	99.03%	-
6-Jun	298	99.72%	99.74%	-
7-Jul	410	100.00%	100.00%	-
8-Aug	269	100.00%	100.00%	-
9-Sep	271	100.00%	100.00%	-
10-Oct	188	99.54%	99.56%	-
11-Nov	234	99.71%	99.79%	-
12-Dec	241	100.00%	100.00%	-
Total	3627	99.81%	99.84%	-

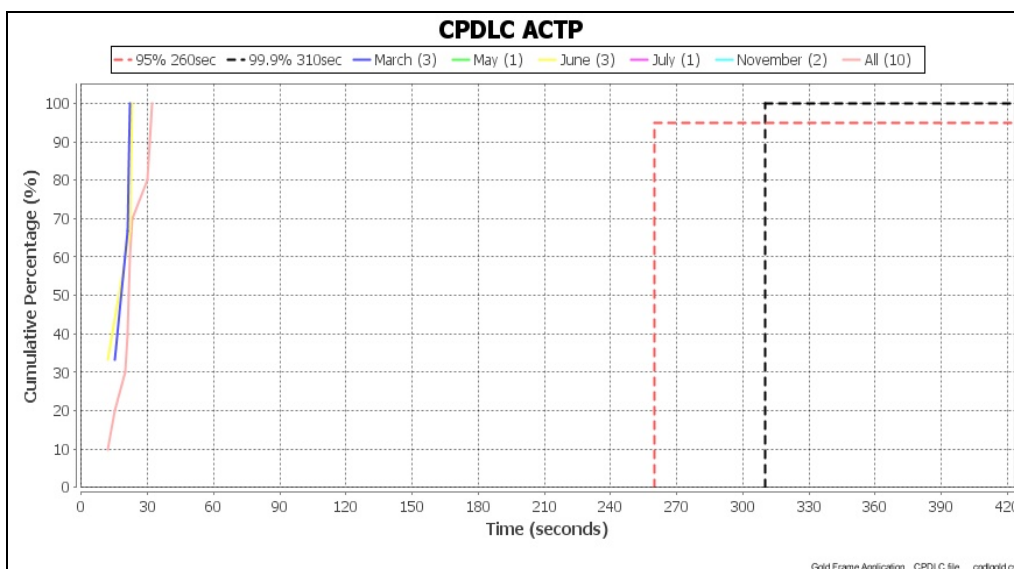**Table 9: CPDLC ACTP (VHF) per month of L888 route**

Figure 9: CPDLC ACTP (VHF) per month of L888 route

CPDLC Actual Communications Technical Performance (ACTP) per month - HF

1.8   **Table 10** summarizes CPDLC ACTP (HF) per month for messages sent within four centres (ZLLL, ZPPP, ZUUU, ZWWW). **Figure 10** graphs the ACTP (HF) measurement per month for the period of Feb. 2013 to March. 2014. in the four centres.

CPDLC ACTP per Month - HF				
Month	**Messages**	**% < 260 sec (Target 95%)**	**%< 310sec (Target 99.9%)**	**Remarks**
3-Mar	3	100.00%	100.00%	
5-May	1	100.00%	100.00%	
6-Jun	3	100.00%	100.00%	
7-Jul	1	100.00%	100.00%	
11-Nov	2	100.00%	100.00%	
Total	10	100.00%	100.00%	-

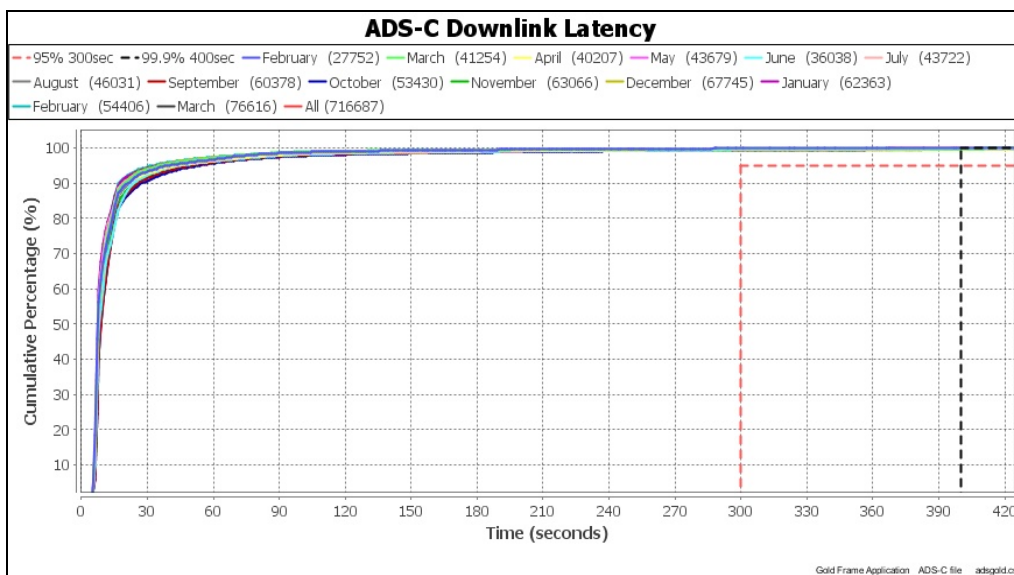**Table 10: CPDLC ACTP (HF) per month of L888 route**

Figure 10: CPDLC ACTP (HF) per month of L888 route
L888 route ADS-C Downlink Latency per Month - Satellite

1.9   **Table 11** summarizes ADS-C Downlink Latency (Satellite) per month for messages sent within four centres (ZLLL, ZPPP, ZUUU, ZWWW). **Figure 11** graphs the ADS-C Downlink Latency (Satellite) per month measurement per month for the period of Feb. 2013 to March. 2014. in the four centres.

ADS-C Downlink Latency per Month – Satellite				
Month	**Messages**	**% < 300sec (Target 95%)**	**%< 400sec (Target 99.9%)**	**Remarks**
2013-02	27752	99.84%	99.89%	-
2013-03	41254	99.70%	99.80%	-
2013-04	40207	99.56%	99.69	-
2013-05	43679	99.69%	99.83%	-
2013-06	36038	99.48%	99.62%	-
2013-07	43722	99.38%	99.50%	-
2013-08	46031	99.54%	99.71%	-
2013-09	60378	99.63%	99.80%	-
2013-10	53430	99.37%	99.54%	-
2013-11	63066	99.57%	99.73%	-
2013-12	67745	99.63%	99.77%	-
2014-01	62363	99.56%	99.72%	-
2014-02	54406	99.69%	99.81%	-
2014-03	76616	99.64%	99.76%	-
Total	716687	99.59%	99.73%	-

Table 11: ADS-C Downlink Latency (Satellite) per month of L888 route

Figure 11: ADS-C Downlink Latency (Satellite) per month of L888 route
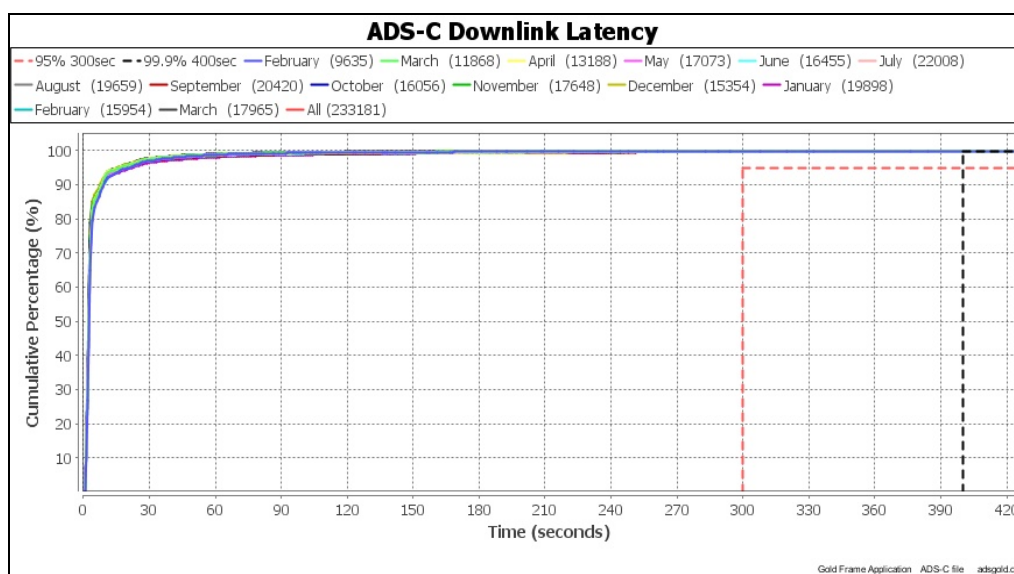
L888 route ADS-C Downlink Latency per Month - VHF

1.10   **Table 12** summarizes ADS-C Downlink Latency (VHF) per month for messages sent within four centres (ZLLL, ZPPP, ZUUU, ZWWW). **Figure 12** graphs the ADS-C Downlink Latency (VHF) per month measurement per month for the period of Feb. 2013 to March. 2014. in the four centres.

ADS-C Downlink Latency per Month – VHF

Month	Messages	% < 300sec (Target 95%)	%< 400sec (Target 99.9%)	Remarks
2013-02	9635	99.87%	99.93%	-
2013-03	11868	99.90%	99.97%	-
2013-04	13188	99.73%	99.79%	-
2013-05	17073	99.91%	99.96%	-
2013-06	16455	99.83%	99.88%	-
2013-07	22008	99.86%	99.91%	-
2013-08	19659	99.89%	99.95%	-
2013-09	20420	99.74%	99.83%	-
2013-10	16056	99.77%	99.85%	-
2013-11	17648	99.80%	99.87%	-
2013-12	15354	99.88%	99.94%	-
2014-01	19898	99.81%	99.90%	-
2014-02	15954	99.72%	99.85%	-
2014-03	17965	99.91%	99.95%	-
Total	233181	99.83%	99.90%	-

Table 12: ADS-C Downlink Latency (VHF) per month of L888 route

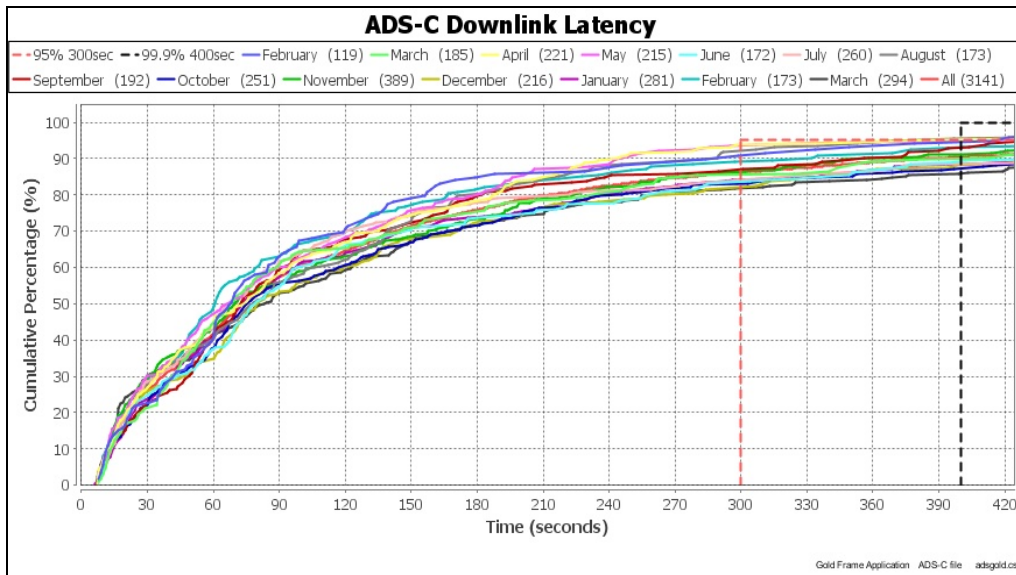**Figure 12: ADS-C Downlink Latency (VHF) per month of L888 route**

L888 route ADS-C Downlink Latency per Month - HF

1.11   **Table 13** summarizes ADS-C Downlink Latency (HF) per month for messages sent within four centres (ZLLL, ZPPP, ZUUU, ZWWW). **Figure 13** graphs the ADS-C Downlink Latency (HF) per month measurement per month for the period of Feb. 2013 to March. 2014. in the four centres.

ADS-C Downlink Latency per Month – HF				
Month	Messages	% < 300sec (Target 95%)	%< 400sec (Target 99.9%)	Remarks
2013-02	119	90.83%	94.61%	-
2013-03	185	85.65%	90.04%	-
2013-04	221	93.69%	95.15%	-
2013-05	215	93.68%	94.95%	-
2013-06	172	83.60%	89.39%	-
2013-07	260	84.28%	88.54%	-
2013-08	173	92.22%	95.43%	-

2013-09	192	86.93%	93.02%	-
2013-10	251	83.22%	87.34%	-
2013-11	389	86.32%	91.26%	-
2013-12	216	82.13%	88.06%	-
2014-01	281	84.06%	88.55%	-
2014-02	173	89.12%	93.04%	-
2014-03	294	81.71%	85.80%	-
Total	3141	86.29%	90.48%	-

Table 13: ADS-C Downlink Latency (HF) per month of L888 route

Figure 13: ADS-C Downlink Latency (HF) per month of L888 route
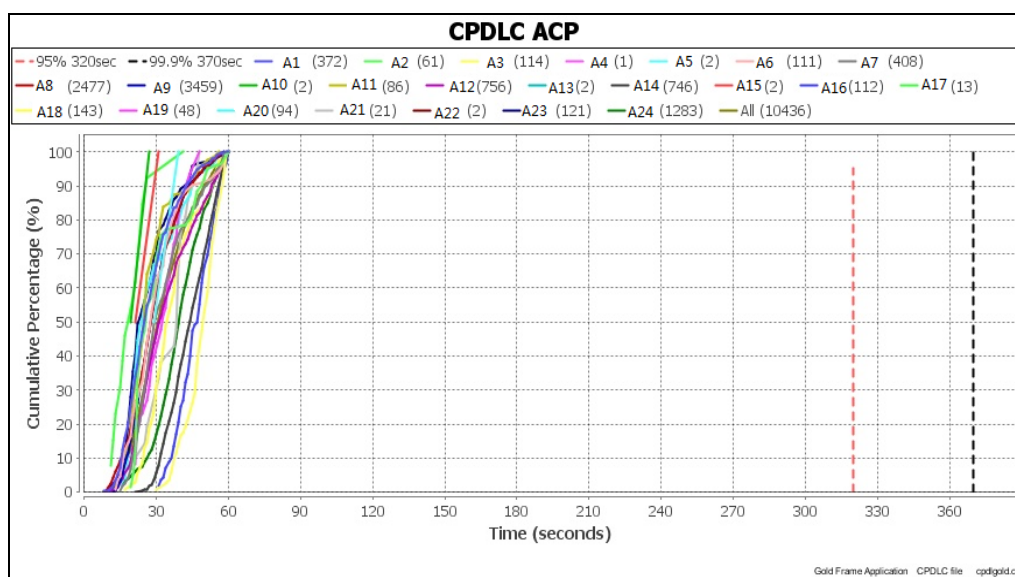
CPDLC Actual Communications Performance (ACP) per Operator (de-identified)

1.12   **Table 14** summarizes CPDLC Actual Communications Performance per Operator for messages sent within four centres (ZLLL, ZPPP, ZUUU, ZWWW). **Figure 14** presents the CPDLC Actual Communications Performance per Operator for the period Feb. 2013 to March. 2014.

CPDLC ACP per Operator				
Operator (de-identified)	Messages	% < 320 sec (Target 95%)	%< 370 sec (Target 99.9%)	Remarks
A1	372	100.00%	100.00%	-
A2	61	100.00%	100.00%	-
A3	114	100.00%	100.00%	-
A4	1	100.00%	100.00%	-
A5	2	100.00%	100.00%	-
A6	111	100.00%	100.00%	-
A7	408	100.00%	100.00%	-
A8	2477	100.00%	100.00%	-
A9	3459	100.00%	100.00%	-
A10	2	100.00%	100.00%	-
A11	86	100.00%	100.00%	-
A12	756	100.00%	100.00%	-
A13	2	100.00%	100.00%	-
A14	746	100.00%	100.00%	-
A15	2	100.00%	100.00%	-

A16	112	100.00%	100.00%	-
A17	13	100.00%	100.00%	-
A18	143	100.00%	100.00%	-
A19	48	100.00%	100.00%	-
A20	94	100.00%	100.00%	-
A21	21	100.00%	100.00%	-
A22	2	100.00%	100.00%	-
A23	121	100.00%	100.00%	-
A24	1283	100.00%	100.00%	-
Total	10436	100.00%	100.00%	-

Table 14: CPDLC ACP per Operator of L888 route

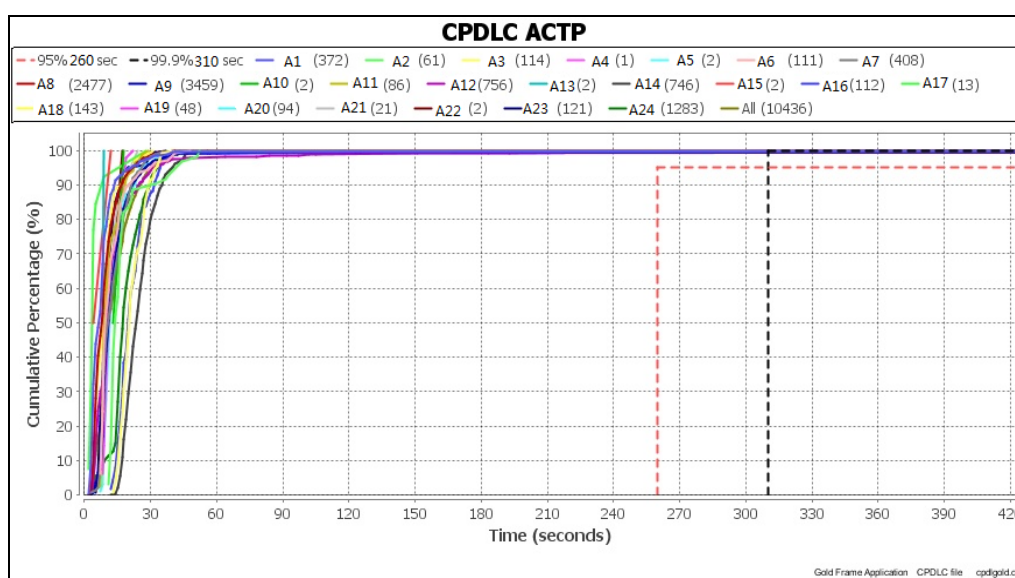**Figure 14: CPLC ACP per Operator of L888 route**

CPDLC Actual Communications Technical Performance (ACTP) per Operator (de-identified)

1.13   **Table 15** summarizes CPDLC Actual Communications Technical Performance per Operator for messages sent within four centres (ZLLL, ZPPP, ZUUU, ZWWW). Figure 15 presents the CPDLC Actual Communications Technical Performance per Operator for the period Feb. 2013 to March. 2014.

CPDLC ACTP per Operator				
Operator (de-identified)	Messages	% < 260sec (Target 95%)	%<310sec (Target 99.9%)	Remarks
A1	372	99.88%	99.92%	-
A2	61	100.00%	100.00%	-
A3	114	100.00%	100.00%	-
A4	1	100.00%	100.00%	-
A5	2	100.00%	100.00%	-
A6	111	100.00%	100.00%	-
A7	408	99.81%	99.83%	-
A8	2477	99.89%	99.90%	-
A9	3459	99.61%	99.61%	-
A10	2	100.00%	100.00%	-
A11	86	100.00%	100.00%	-
A12	756	99.47%	99.48%	-
A13	2	100.00%	100.00%	-

A14	746	99.63%	99.66%	-
A15	2	100.00%	100.00%	-
A16	112	99.29%	99.33%	-
A17	13	100.00%	100.00%	-
A18	143	100.00%	100.00%	-
A19	48	100.00%	100.00%	-
A20	94	100.00%	100.00%	-
A21	21	100.00%	100.00%	-
A22	2	100.00%	100.00%	-
A23	121	100.00%	100.00%	-
A24	1283	99.72%	99.73%	-
Total	10436	99.70%	99.71%	-

Table 15: ACTP per Operator (de-identified)of L888 route

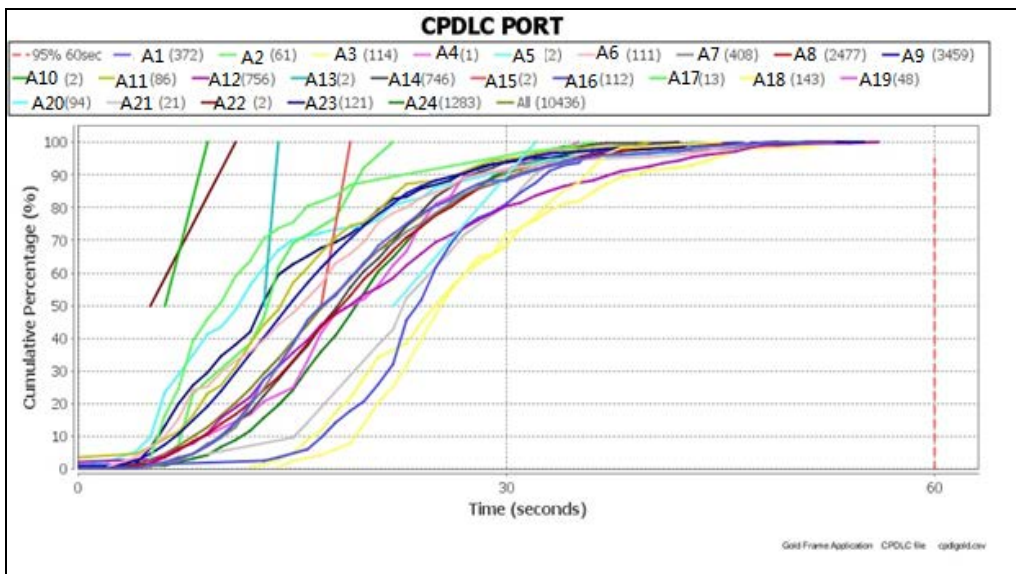**Figure 15: ACTP per Operator (de-identified) of L888 route**

Pilot Operational Response Time (PORT) per Operator (de-identified)

1.14   **Table 16** summarizes Pilot Operational Response Time (PORT) per Operator (de-identified) for messages sent within four centres (ZLLL, ZPPP, ZUUU, ZWWW). **Figure 16** presents the Pilot Operational Response Time (PORT) per Operator (de-identified) for the period Feb. 2013 to March. 2014.

CPDLC PORT per Operator				
Operator (de-identified)	**Messages**	**% < 60sec (Target 95%)**	**%<60sec (Target 99.9%)**	**Remarks**
A1	372	100.00%	100.00%	-
A2	61	100.00%	100.00%	-
A3	114	100.00%	100.00%	-
A4	1	100.00%	100.00%	-
A5	2	100.00%	100.00%	-
A6	111	100.00%	100.00%	-
A7	408	100.00%	100.00%	-
A8	2477	100.00%	100.00%	-
A9	3459	100.00%	100.00%	-
A10	2	100.00%	100.00%	-

A11	86	100.00%	100.00%	-
A12	756	100.00%	100.00%	-
A13	2	100.00%	100.00%	-
A14	746	100.00%	100.00%	-
A15	2	100.00%	100.00%	-
A16	112	100.00%	100.00%	-
A17	13	100.00%	100.00%	-
A18	143	100.00%	100.00%	-
A19	48	100.00%	100.00%	-
A20	94	100.00%	100.00%	-
A21	21	100.00%	100.00%	-
A22	2	100.00%	100.00%	-
A23	121	100.00%	100.00%	-
A24	1283	100.00%	100.00%	-
Total	10436	100.00%	100.00%	-

Table 16: PORT per Operator (de-identified) of L888 route

Figure 16: PORT per Operator (de-identified) of L888 route

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