



International Civil Aviation Organization

The Fourth Meeting of the Future Air Navigation Systems Interoperability Team-Asia (FIT-Asia/4)

Bangkok, Thailand, 25 – 26 May 2014

Agenda Item 3: Review of ADS/CPDLC Operations

FANS1/A PERFORMANCE IN CHENNAI FIR

(Presented by Airports Authority of India)

SUMMARY

This paper presents the observed performance of the ADS/CPDLC data link within the Chennai Flight Information Region during a twelve month period from January 2014 to December 2014.

1. INTRODUCTION

1.1 BOBASMA being the nodal point for conducting the End-to-End Safety and system performance monitoring of the four ATS Data link ground systems in India had endeavored to collect the ADS & CPDLC data as per GOLD document from the four ground systems at Chennai, Mumbai, Delhi and Kolkata.

1.2 The ATM automation systems at Mumbai, Delhi and Kolkata are being upgraded so as to enable collection of ADS & CPDLC data as per the provisions in the GOLD document which will enable conducting of the data link performance monitoring of the ground systems at these three stations.

1.3 The paper presents the observed performance of FANS1/A system in the Chennai FIR. Data extracted from the data link system recordings for the months of January 2014 to December 2014 is used to measure FANS1A System performance against the Required Communication Performance (RCP) and Required Surveillance Performance (RSP) as per the guidelines contained in the Global Operational Data-Link Document (GOLD).

2. DISCUSSION

VOMF FIR CPDLC Actual Communications Performance (ACP).

2.1 The GPAT tool version 3 was used for monitoring Chennai FIR data link performance for 12 months starting from January 2014 to December 2014. **Figure 1** comprises of ACP for SAT-COM and VHF media that provides data link services to FANS 1/A aircraft. There were total of 89085 from SATCOM and VHF messages in which 33541 messages were from SATCOM and 55544 VHF messages in the data set. As per the GOLD document the RCP-240 requirement is 99.9% transactions to be completed within 210 seconds and 95% to be completed within 180 seconds. The ACP for CPDLC messages sent via satellite and VHF meet the 95 percentage but fall just below the 99.9 percentage criteria. **Table 1** summarizes the ACP for messages sent within VOMF FIR of SAT-COM, VHF media.

VOMF FIR CPDLC ACP				
Messages		% >180 sec (Target 95%)	% >210 sec (Target 99.9%)	Remarks
SAT	33541	99.29%	99.64%	
VHF	55544	99.67%	99.77%	
ALL	89085	99.53%	99.72%	

Table 1: VOMF FIR CPDLC ACP per Media Type

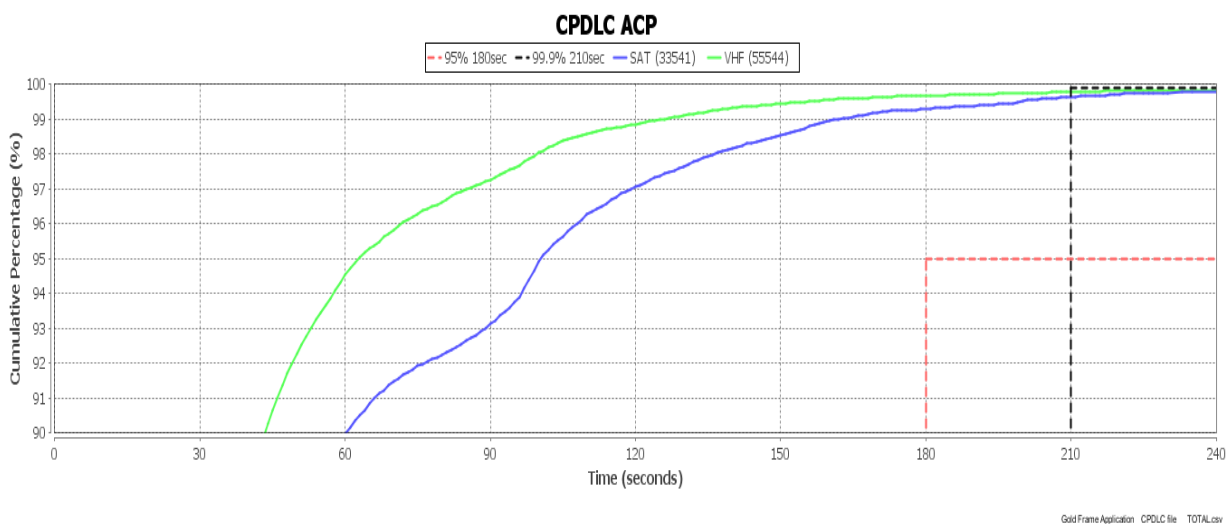


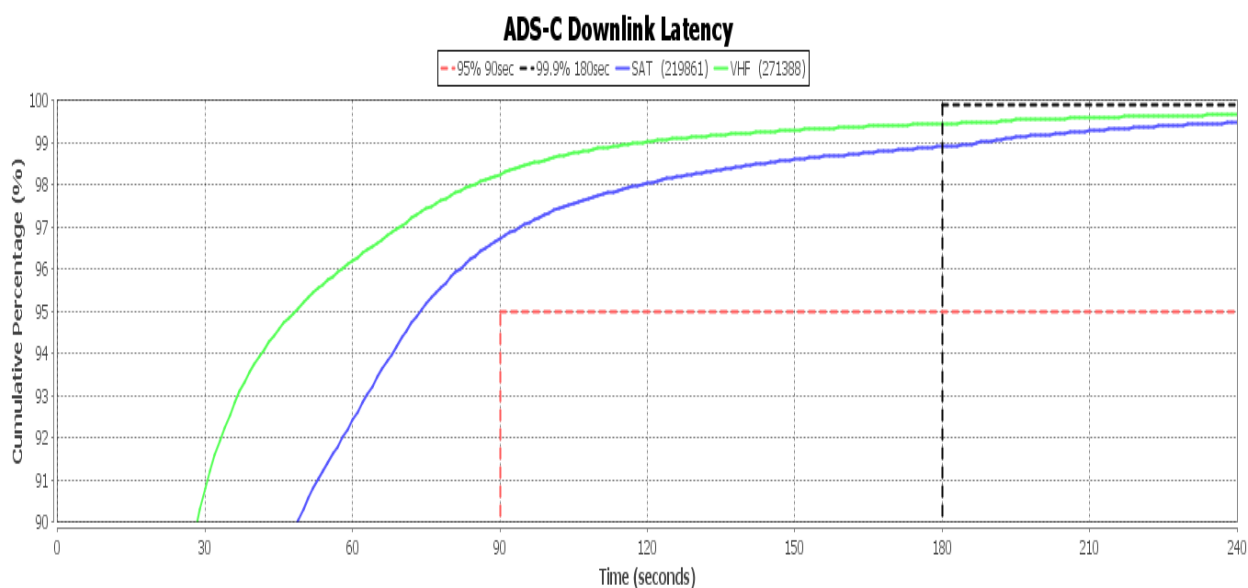
Figure 1: VOMF FIR ACP by Data Link Media Type

VOMF FIR ADS-C downlink latency.

2.2 **Figure 2** presents ADS- C downlink latency of Chennai FIR for SAT-COM and VHF media for the period of January 2014 to December 2014. The data set contains a total of 491249 ADS messages in which 219861 messages were through SATCOM and 271388 through VHF media. GOLD describes the RSP-180 criteria as 95percent transactions to be completed within 90 sec and 99.9 percentage transactions to be completed within 180 seconds. **Table 2** summarizes the VOMF FIRs ADS-C downlink latency of SAT-COM and VHF media. It is observed that the RSP ADS-C data link messages sent via satellite and VHF meet the 95 percentage but fall below the 99.9 percentage criteria.

VOMF FIR ADS-C Downlink Latency				
Messages		% >90 sec (Target 95%)	% >180sec (Target 99.9%)	Remarks
SAT	2,19,861	96.71%	98.90%	
VHF	2,71,388	98.24%	99.45%	
All	4,91,249	97.56%	99.20%	

Table2: VOMF FIR ADS-C Downlink latency per Media Type



GridFrameApplication ADS-C file ADSFINALOUTPUT.csv

Figure 2: VOMF FIR ADS-C Downlink Latency

VOMF FIR CPDLC ACP per operator (de-identified).

2.3 **Figure 3** presents CPDLC ACP per operator within Chennai FIR for the period of January 2014 to December 2014. The data set contains a total of 78708 CPDLC messages for available media with system like HF, SAT-COM, VHF or a combination of any. **Table 3** shows the top 10 operators transactions which utilized the data link system with in the FIR. All the operators satisfy RCP-240 criteria of 95 percentage transactions within 180 seconds and only few operators satisfied the criteria of 99.9 percentage transitions within 210seconds.

VOMF FIR CPDLC ACP per Operator				
Operator	Messages	% >180 sec (Target 95%)	% >210 sec (Target 99.9%)	Remarks
UAE	21,394	99.72%	99.81%	
SIA	16,608	99.39%	99.67%	
QTR	12,685	99.33%	99.59%	
MAS	9,198	99.82%	99.92%	
ETD	8,880	99.62%	99.80%	
THA	3,209	99.35%	99.60%	
CPA	3,154	99.23%	99.56%	
ALK	1,378	99.42%	99.60%	

VOMF FIR CPDLC ACP per Operator				
THY	1,102	99.43%	99.60%	
XAX	1,100	99.61%	99.72%	
Total	78708	99.53%	99.73%	

Table3: VOMF FIR CPDLC ACP per operator

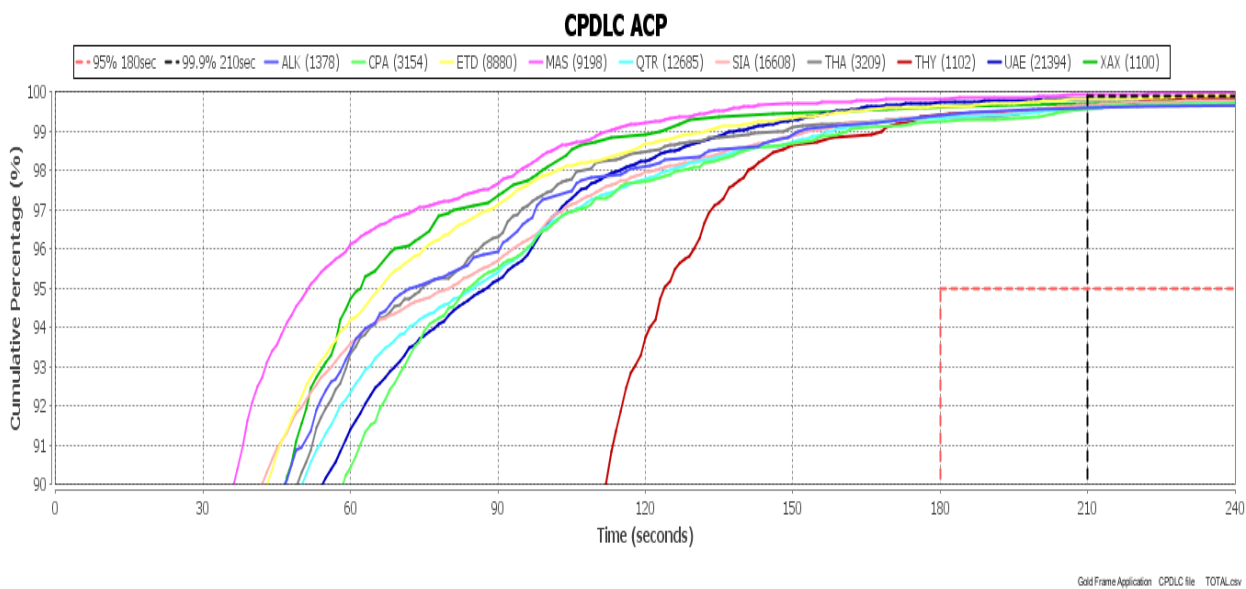


Figure 3: VOMF FIR CPDLC ACP per operator

2.4 **Appendix A** provides further detail on data link performance for the Chennai FIR.

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.

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Appendix-A

1. Data Link Performance by Month for Chennai (VOMF) FIR.

VOMF FIR CPDLC Actual Communications Performance (ACP) per Month – Satellite

1.1 **Table 1** summarizes CPDLC ACP (Satellite) per month for messages sent within the VOMF FIR. **Figure 1** presents the ACP (Satellite) measurement per month for the period January 2014 To December 2014.

VOMF FIR CPDLC ACP Per Month- Satellite				
Month	Messages	% > 180sec (Target 95%)	% > 210sec (Target 99.9%)	Remarks
January	2,658	99.33%	99.68%	
February	1,814	99.18%	99.47%	
March	2,108	99.26%	99.74%	
April	2,937	99.32%	99.67%	
May	3,340	99.41%	99.67%	
June	2,690	99.19%	99.67%	
July	3,129	99.09%	99.42%	
August	3,048	99.28%	99.69%	
September	2,684	99.40%	99.68%	
October	3,044	99.45%	99.68%	
November	2,992	99.08%	99.63%	
December	3,097	99.53%	99.78%	

Table 1: VOMF FIR CPDLC ACP per Month – Satellite

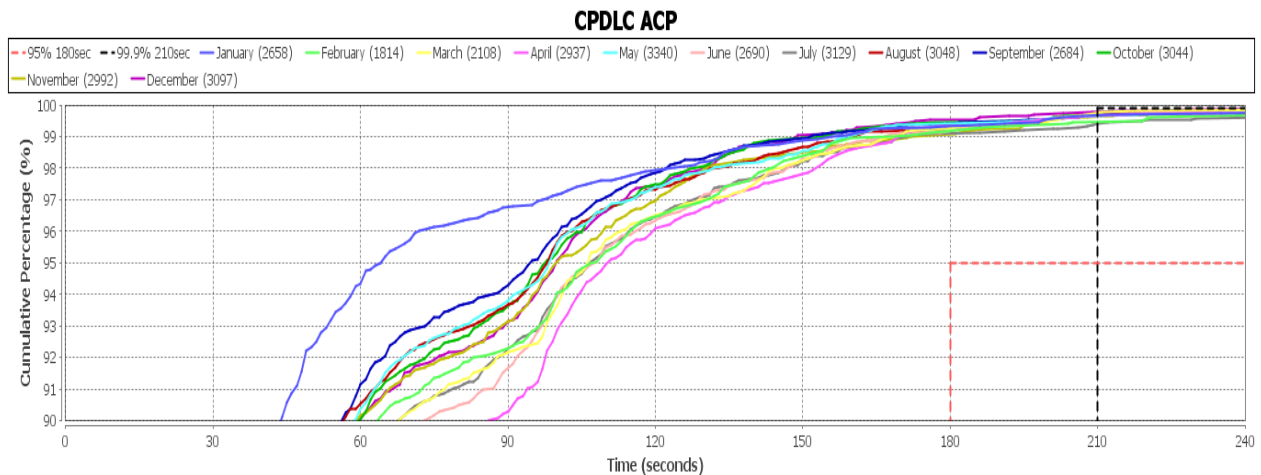


Figure 1: VOMF FIR ACP per Month – Satellite

VOMF FIR CPDLC Actual Communications Performance (ACP) per Month - VHF

1.2 **Table 2** summarizes CPDLC ACP (VHF) per month for messages sent within the VOMF FIR. **Figure 2** presents the ACP (VHF) measurement per month for the period January 2014 to December 2014

VOMF FIR CPDLC ACP Per Month- VHF				
Month	Messages	% > 180sec (Target 95%)	% > 210sec (Target 99.9%)	Remarks
January	4,084	99.65%	99.72%	
February	3,464	99.87%	99.93%	
March	3,914	99.80%	99.90%	
April	4,005	99.69%	99.76%	
May	5,021	99.62%	99.73%	
June	4,426	99.39%	99.62%	
July	4,923	99.73%	99.80%	
August	4,860	99.73%	99.76%	
September	4,781	99.80%	99.90%	
October	5,641	99.67%	99.76%	
November	5,094	99.58%	99.73%	
December	5,331	99.70%	99.82%	

Table 2: VOMF FIR CPDLC ACP per Month – VHF

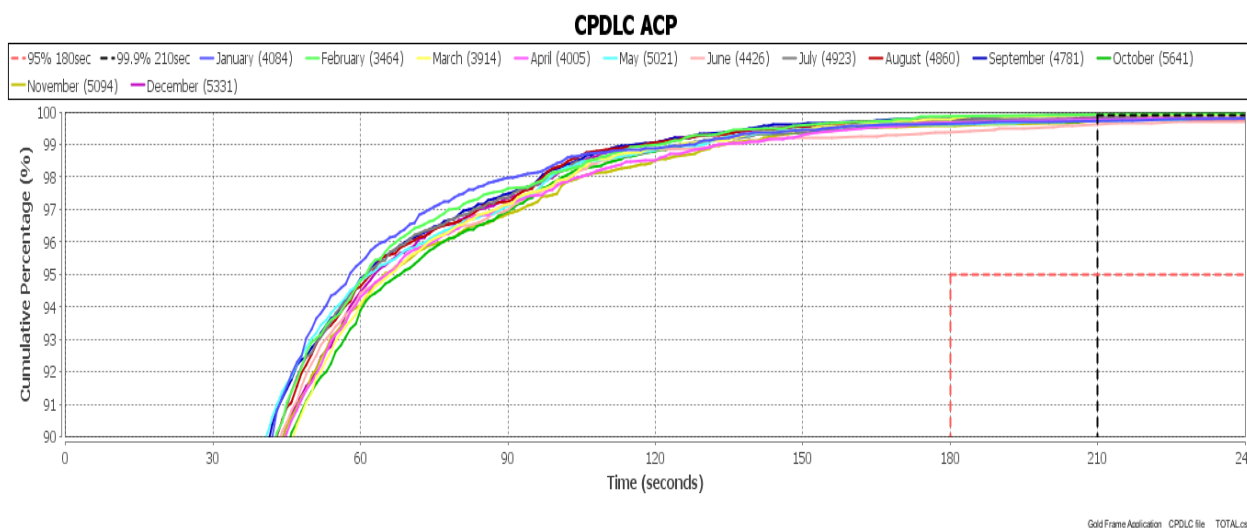


Figure2: VOMF FIR CPDLC ACP per Month – VHF

VOMF FIR CPDLC Actual Communications Technical Performance (ACTP)

1.3 **Table 3** summarizes overall CPDLC Actual Communications Technical Performance (ACTP) for messages sent within the VOMF FIR. **Figure 3** presents the ACTP measurement by media type (Satellite, VHF and the combined total of both) for the period January 2014 to December 2014.

VOMF FIR CPDLC ACTP				
Month	Messages	% > 120sec (Target 95%)	% > 150sec (Target 99.9%)	Remarks
SAT	33,541	99.34%	99.57%	
VHF	55,544	99.86%	99.92%	
All	89,085	99.66%	99.79%	

Table 3: VOMF FIR CPDLC ACTP

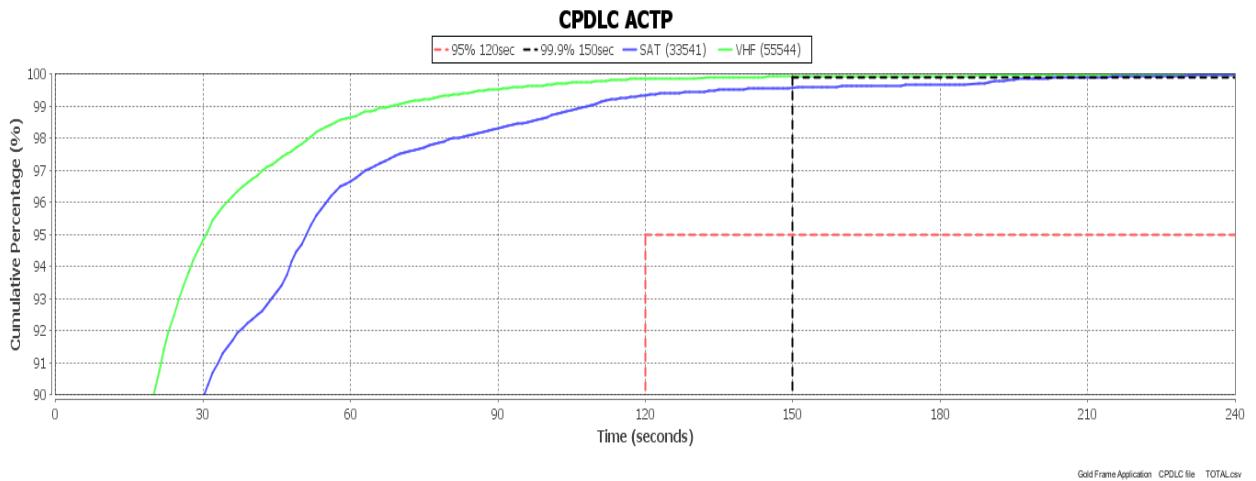


Figure 3: VOMF FIR ACTP by Data Link Media Type

VOMF FIR CPDLC Actual Communications Technical Performance (ACTP) per Month – Satellite

1.4 **Table 4** summarizes CPDLC ACTP (Satellite) per month for messages sent within the VOMF FIR. **Figure 4** presents the ACTP (Satellite) measurement per month for the period January 2014 to December 2014.

VOMF FIR CPDLC ACTP - Satellite				
Month	Messages	% > 120sec (Target 95%)	% > 150sec (Target 99.9%)	Remarks
January	2,658	99.54%	99.74%	
February	1,814	99.40%	99.48%	
March	2,108	98.98%	99.49%	
April	2,937	99.18%	99.53%	
May	3,340	99.39%	99.60%	
June	2,690	99.21%	99.60%	
July	3,129	99.23%	99.37%	
August	3,048	99.39%	99.56%	
September	2,684	99.57%	99.71%	
October	3,044	99.47%	99.67%	
November	2,992	99.14%	99.37%	
December	3,097	99.63%	99.86%	
January	4,084	99.65%	99.72%	
February	3,464	99.87%	99.93%	

Table 4: VOMF FIR CPDLC ACTP per Month – Satellite

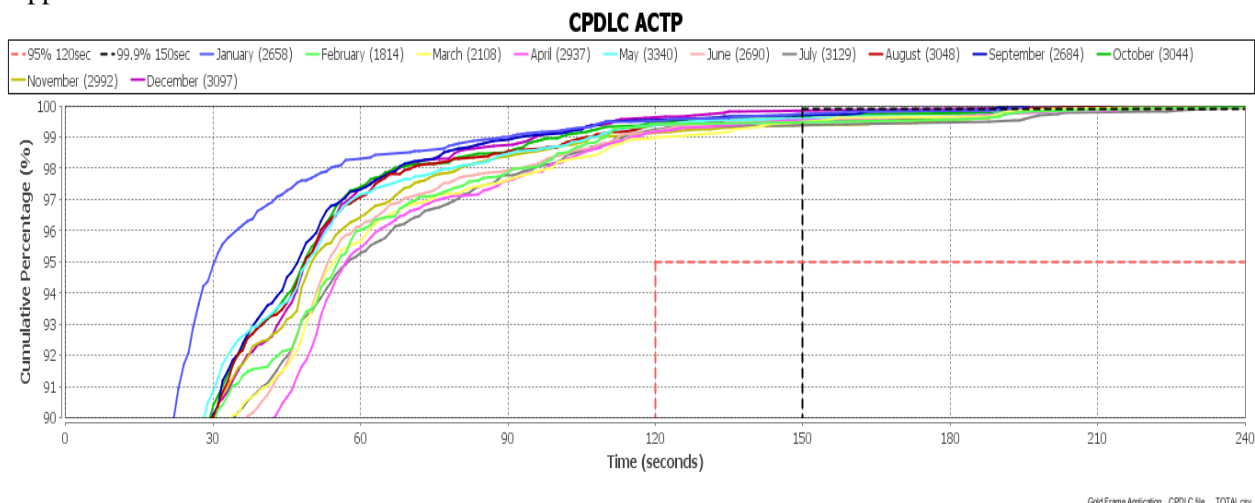


Figure 4: VOMF FIR ACTP per Month – Satellite

VOMF FIR CPDLC Actual Communications Technical Performance (ACTP) per Month – VHF

1.5 **Table 5** summarizes CPDLC ACTP (VHF) per month for messages sent within the VOMF FIR. **Figure 5** presents the ACTP (VHF) measurement per month for the period January 2014 to December 2014.

VOMF FIR CPDLC ACTP - Satellite				
Month	Messages	% > 120sec (Target 95%)	% > 150sec (Target 99.9%)	Remarks
January	4,084	99.92%	99.95%	
February	3,464	99.95%	99.98%	
March	3,914	99.85%	99.95%	
April	4,005	99.98%	99.98%	
May	5,021	99.76%	99.82%	
June	4,426	99.75%	99.86%	
July	4,923	99.90%	99.97%	
August	4,860	99.94%	99.96%	
September	4,781	99.86%	99.92%	
October	5,641	99.85%	99.90%	
November	5,094	99.88%	99.96%	
December	5,331	99.77%	99.88%	

Table 5: VOMF FIR CPDLC ACTP (VHF) per Month

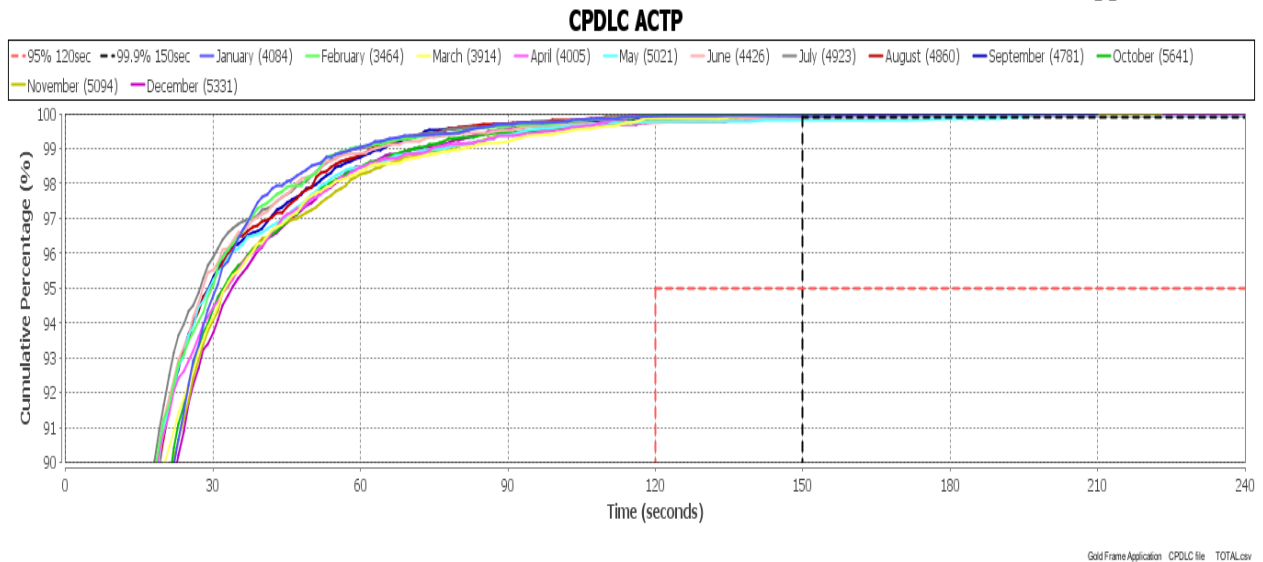


Figure 5: VOMF FIR CPDLC ACTP (VHF) per Month

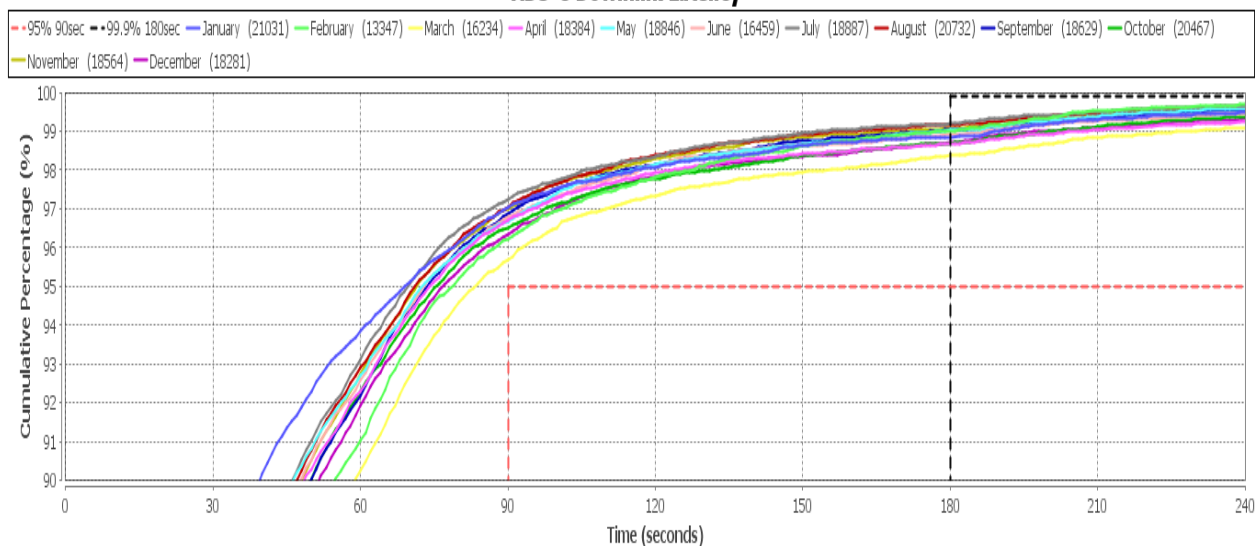
VOMF FIR ADS-C Downlink Latency per Month – Satellite

1.6 **Table 6** summarizes ADS-C Downlink Latency (satellite) measurements per month for messages sent within the VOMF FIR. **Figure 6** presents the ADS-C Downlink Latency (satellite) measurement per month for the period January 2014 to December 2014.

VOMF FIR ADS-C Downlink Latency - Satellite				
Month	Messages	% > 90sec (Target 95%)	% > 180sec (Target 99.9%)	Remarks
January	21,031	97.02%	98.86%	
February	13,347	96.22%	99.01%	
March	16,234	95.68%	98.37%	
April	18,384	96.70%	98.69%	
May	18,846	96.67%	99.02%	
June	16,459	96.77%	98.91%	
July	18,887	97.26%	99.20%	
August	20,732	97.06%	99.18%	
September	18,629	96.89%	99.03%	
October	20,467	96.53%	98.69%	
November	18,564	97.00%	99.08%	
December	18,281	96.36%	98.71%	

Table 6: VOMF FIR ADS-C Downlink Latency per Month – Satellite

ADS-C Downlink Latency



GoldFrameApplication ADS-C file ADSFINALOUTPUT.csv

Figure 6: VOMF FIR ADS-C Downlink Latency per Month - Satellite

VOMF FIR ADS-C Downlink Latency per Month – VHF

1.7 **Table 7** summarizes ADS-C Downlink Latency (VHF) measurements per month for messages sent within the VOMF FIR. **Figure 7** presents the ADS-C Downlink Latency (VHF) measurement per month for the period January 2014 to December 2014.

VOMF FIR ADS-C Downlink Latency -VHF				
Month	Messages	% > 90sec (Target 95%)	% > 180sec (Target 99.9%)	Remarks
January	17,299	98.06%	99.30%	
February	16,872	98.12%	99.41%	
March	22,405	98.23%	99.42%	
April	20,871	98.31%	99.47%	
May	23,669	98.39%	99.35%	
June	20,856	98.62%	99.54%	
July	23,393	98.65%	99.57%	
August	23,798	98.38%	99.44%	
September	23,779	98.22%	99.36%	
October	27,333	97.87%	99.43%	
November	25,495	98.11%	99.56%	
December	25,618	98.01%	99.48%	

Table 7: VOMF FIR ADS-C Downlink Latency per Month – VHF

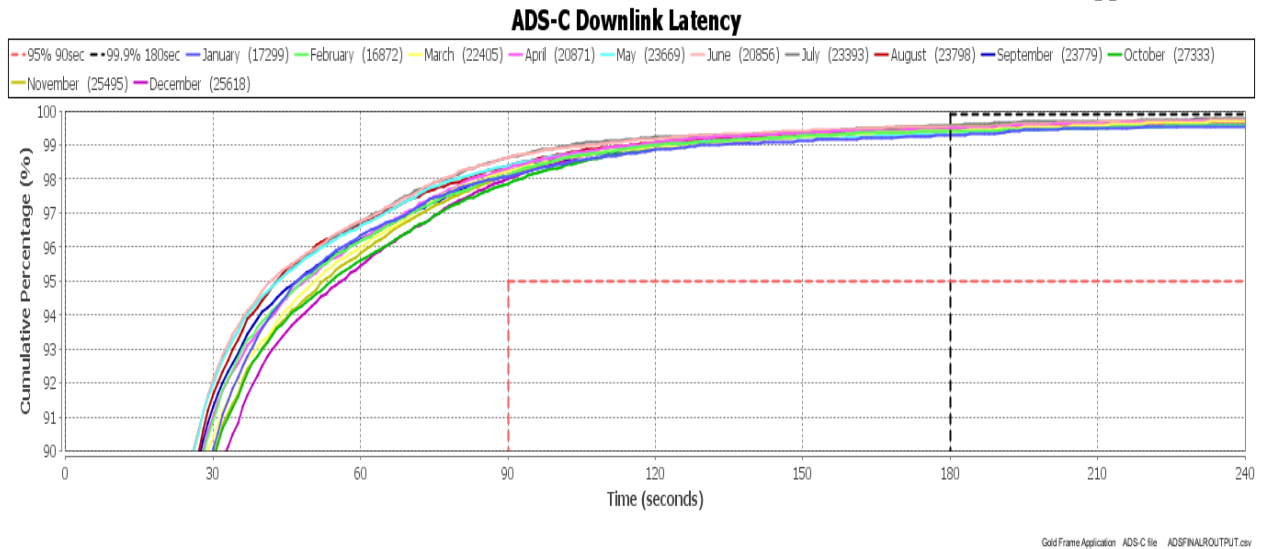


Figure 7: VOMF FIR ADS-C Downlink Latency per Month - VHF

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

1.8 **Table 8** summarizes CPDLC Actual Communications Performance per Operator for messages sent within VOMF FIR. **Figure 8** presents the CPDLC Actual Communications Performance per Operator for the period January 2014 to December 2014.

VOMF FIR CPDLC ACP per Operator				
Operator	Messages	% > 180sec (Target 95%)	% > 210sec (Target 99.9%)	Remarks
OP01	21,394	99.72%	99.81%	
OP02	16,608	99.39%	99.67%	
OP03	12,685	99.33%	99.59%	
OP04	9,198	99.82%	99.92%	
OP05	8,880	99.62%	99.80%	
OP06	3,209	99.35%	99.60%	
OP07	3,154	99.23%	99.56%	
OP08	1,378	99.42%	99.60%	
OP09	1,102	99.43%	99.60%	
OP10	1,100	99.61%	99.72%	

Table 8: VOMF FIR CPDLC ACP per Operator

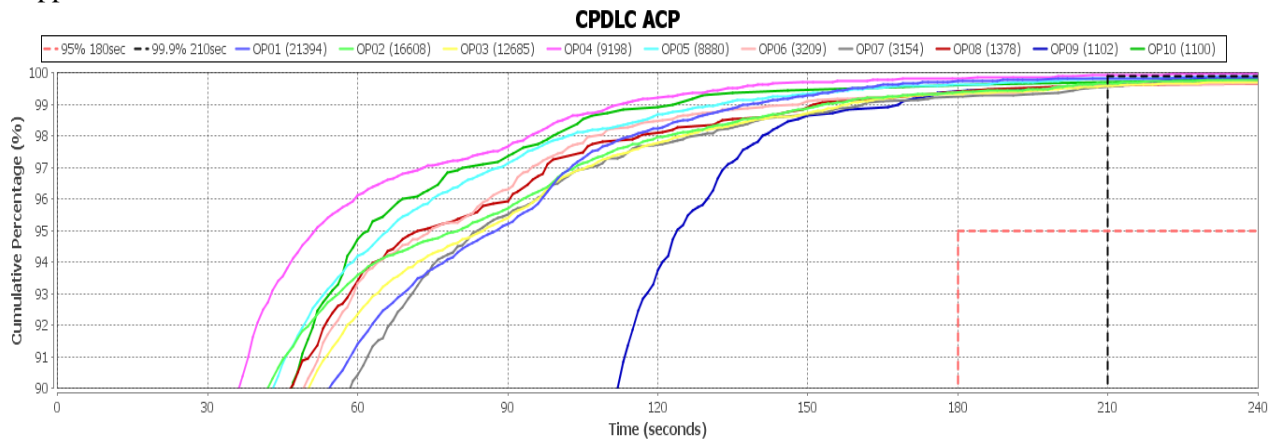


Figure 8: VOMM FIR CPDLC ACP per Operator

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

1.9 **Table 9** summarizes CPDLC Actual Communications Technical Performance per Operator for messages sent within the VOMF FIR. **Figure 9** presents the CPDLC Actual Communications Performance per Operator for the period January 2014 to December 2014.

VOMF FIR CPDLC ACTP per Operator				
Month	Messages	% > 120sec (Target 95%)	% > 150sec (Target 99.9%)	Remarks
OP01	21,394	99.72%	99.85%	
OP02	16,608	99.31%	99.50%	
OP03	12,685	99.57%	99.71%	
OP04	9,198	99.81%	99.89%	
OP05	8,880	99.80%	99.85%	
OP06	3,209	99.52%	99.67%	
OP07	3,154	99.65%	99.85%	
OP08	1,378	99.94%	99.98%	
OP09	1,102	99.86%	99.93%	
OP10	1,100	99.80%	99.92%	

Table 9: VOMF FIR CPDLC ACTP per Operator

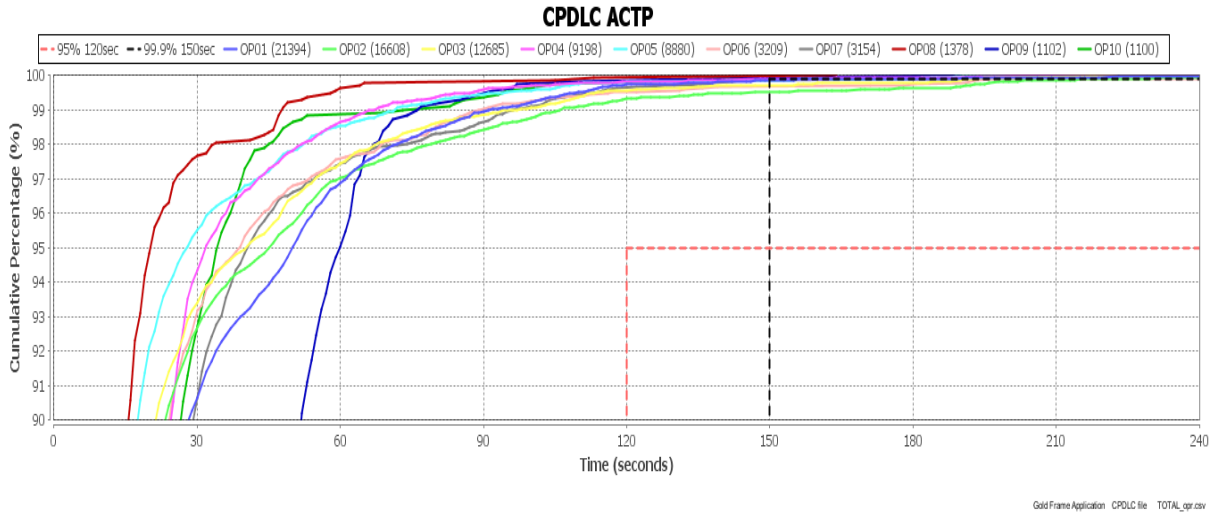


Figure 9: VOMM FIR CPDLC ACP per Operator

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

1.10 **Table 10** summarizes CPDLC Pilot Operational Response Time per Operator for messages sent within the VOMF FIR. **Figure 10** presents the CPDLC Pilot Operational Response Time per Operator for the period January 2014 to December 2014.

VOMF FIR CPDLC PORT per Operator				
Month	Messages	% > 60sec (Target 95%)	% > 60sec (Target 99.9%)	Remarks
OP01	21,394	98.76%	98.76%	
OP02	16,608	99.17%	99.17%	
OP03	12,685	97.77%	97.77%	
OP04	9,198	99.35%	99.35%	
OP05	8,880	98.09%	98.09%	
OP06	3,209	98.35%	98.35%	
OP07	3,154	96.92%	96.92%	
OP08	1,378	96.37%	96.37%	
OP09	1,102	90.38%	90.38%	
OP10	1,100	98.36%	98.36%	

Table 10: VOMF FIR CPDLC PORT per Operator

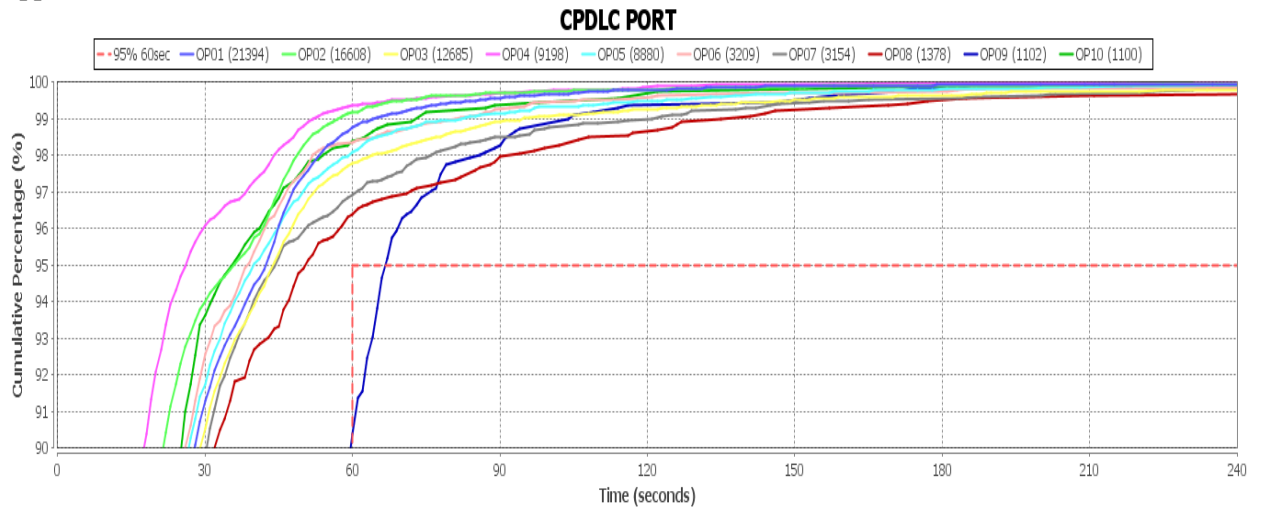


Figure 10: VOMF FIR CPLC PORT per Operator