WIDE-AREA AUGMENTATION SYSTEM PERFORMANCE ANALYSIS REPORT

Report #31

Reporting Period: October 1 to December 31, 2009

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Executive Summary

Since 1999 the WAAS Test Team at the William J. Hughes Technical Center has reported GPS performance as measured against the GPS Standard Positioning Service (SPS) Signal Specification. These quarterly reports are known as the PAN (Performance Analysis Network) Report. In addition to that report, the WAAS Test Team reports on the performance of the Wide-Area Augmentation System (WAAS). This report is the thirtieth such WAAS quarterly report. This report covers WAAS performance during the period from October 1, 2009 to December 31, 2009.

The following table shows observations for accuracy and availability made during the reporting period for CONUS and Alaska sites. The international sites are excluded from this table, but are included in the body of the report. See the body of the report for additional results in accuracy, availability, safety index, range accuracy, WAAS broadcast message rates and GEO ranging availability. Please note that the results in the table below are valid when the Localizer Precision with Vertical Guidance (LPV) service is available. LPV service is available when the calculated Horizontal Protection Level (HPL) is less than 40 meters and the Vertical Protection Level (VPL) is less than 50 meters. LPV 200 service is available when the calculated HPL is less than 40 meters and the VPL is less than 35 meters.

Parameter	CONUS Site/Maximum	CONUS Site/Minimum	Alaska Site/Maximum	Alaska Site/Minimum
95% Horizontal Accuracy	Arcata 1.541 meters	Denver 0.691 meters	Cold Bay 0.776 meters	Fairbanks 0.525 meters
95% Vertical Accuracy	Arcata 1.887 meters	Chicago 0.941 meters	Kotzebue 1.387 meters	Bethel 0.973 meters
LPV Availability (HPL < 40 meters & VPL < 50 meters)	Seattle 100%	Oakland 99.96%	Juneau 100%	Cold Bay 95.51%
LPV 200 Availability (HPL < 40 meters & VPL < 35 meters)	Dallas 99.99%	Oakland 95.91%	Juneau 99.97%	Cold Bay 77.83%
95% HPL	Arcata 17.079 meters	Dallas 11.601 meters	Cold Bay 29.877 meters	Fairbanks 13.886 meters
95% VPL	Oakland 37.707 meters	Memphis 19.753 meters	Cold Bay 45.51 meters	Juneau 22.076 meters

TABLE OF CONTENTS

1.0 INTRODUCTION 1
1.1 Event Summary 4
1.2 Report Overview 7
2.0 WAAS POSITION ACCURACY 7
3.0 AVAILABILITY 24
4.0 COVERAGE 42
5.0 INTEGRITY 49
5.1 HMI Analysis 49
5.2 Broadcast Alerts 51
5.3 Availability of WAAS Messages (CRE and CRW) 52
6.0 SV RANGE ACCURACY 60
7.0 GEO RANGING PERFORMANCE 69
8.0 WAAS PROBLEM SUMMARY 70
9.0 WAAS AIRPORT AVAILABILITY 71
10.0 WAAS DETERMINISTIC CODE NOISE AND MULTIPATH BOUNDING ANALYSIS . 91
11.0 WAAS REFERENCE STATION SURVEY VALIDATION 94
12.0 SIGNAL QUALITY MONITOR (SQM) 104
12.1 Alpha Metrics 104
12.2 Event Summary 104
12.3 Type Bias 104
12.4 PRN Bias 107
12.5 SQM Trips 119
13.0 GPS Broadcast Orbit vs. IGS Precise Orbits Analysis 119

LIST OF FIGURES

Figure 2-1 95% Horizontal Accuracy at LPV 12
Figure 2-2 95% Horizontal Accuracy at LPV 13
Figure 2-3 95% Horizontal Accuracy at LPV 14
Figure 2-4 95% Vertical Accuracy at LPV 15
Figure 2-5 95% Vertical Accuracy at LPV 16
Figure 2-6 95% Vertical Accuracy at LPV 17
Figure 2-7 NPA 95% Horizontal Accuracy 18
Figure 2-8 NPA 95% Horizontal Accuracy 19
Figure 2-9 Horizontal Triangle Chart for the Quarter 20
Figure 2-10 Vertical Triangle Chart for the Quarter 21
Figure 2-11 2-D Horizontal Histogram for the Quarter 22
Figure 2-12 2-D Vertical Histogram for the Quarter 23
Figure 3-1 LPV Instantaneous Availability (HAL=40m & VAL=50m) 30
Figure 3-2 LPV Instantaneous Availability (HAL=40m & VAL=50m) 31
Figure 3-3 LPV Instantaneous Availability (HAL=40m & VAL=50m) 32
Figure 3-4 LPV 200 Instantaneous Availability (HAL=40m & VAL=35m) 33
Figure 3-5 LPV 200 Instantaneous Availability (HAL=40m & VAL=35m) 34
Figure 3-6 LPV 200 Instantaneous Availability (HAL=40m & VAL=35m) 35
Figure 3-7 LPV Outages (HAL=40m & VAL=50m) 36
Figure 3-8 LPV Outages (HAL=40m & VAL=50m) 37
Figure 3-9 LPV Outages (HAL=40m & VAL=50m) 38
Figure 3-10 LPV 200 Outages (HAL=40m & VAL=35m) 39
Figure 3-11 LPV 200 Outages (HAL=40m & VAL=35m) 40
Figure 3-12 LPV 200 Outages (HAL=40m & VAL=35m) 41
Figure 4-1 LP North America Coverage for the Quarter 43
Figure 4-2 LPV North America Coverage for the Quarter 44
Figure 4-3 LPV 200 North America Coverage for the Quarter 45
Figure 4-4 RNP 0.1 World Coverage for the Quarter 46
Figure 4-5 RNP 0.3 World Coverage for the Quarter 47
Figure 4-6 Daily LPV and LPV 200 CONUS Coverage 48
Figure 4-7 Daily LPV Alaska Coverage 48
Figure 4-8 Daily RNP Coverage 49
Figure 5-1 SV Daily Alert Trends 52
Figure 6-1 95% Range Error (PRN 1 – PRN 16) – Washington DC 65
Figure 6-2 95% Range Error (PRN 17 – PRN 32) – Washington DC 66
Figure 6-3 95% Ionospheric Error (PRN 1 – PRN 16) – Washington DC 67
Figure 6-4 95% Ionospheric Error (PRN 17 - PRN 32) – Washington DC 68
Figure 7-1 Daily PA CRW GEO Ranging Availability Trend 69
Figure 7-2 Daily PA CRE GEO Ranging Availability Trend 70
Figure 9-1 WAAS LPV Availability 89
Figure 9-2 WAAS LPV Outage 90
Figure 11-1 WAAS Build 6.012 Antenna Positions Deltas from OPUS Survey 98
Figure 11-2 WAAS Build 6.012 Antenna Positions Deltas from OPUS Survey 98
Figure 11-3 WAAS Build 6.012 Antenna Positions Deltas from OPUS Survey 99
Figure 11-4 OPUS Overall RMS Qualitites 99

Figure 11-5 OPUS Survey Overall RMS Qualities 100
Figure 11-6 OPUS Survey Overall RMS Qualities 100
Figure 11-7 OPUS vs. CSRS RSS ECEF Deltas 101
Figure 11-8 OPUS vs. CSRS RSS ECEF Deltas 101
Figure 11-9 OPUS vs. CSRS RSS ECEF Deltas 102
Figure 11-10 CSRS Survey Qualities 102
Figure 11-11 CSRS Survey Qualities 103
Figure 11-12 CSRS Survey Qualities 103
Figure 12-1 Type Bias Average Trend 106
Figure 12-2 PRN Bias Average for the Quarter........ 110
Figure 12-3 PRN Bias Average Trend (PRN 1 – PRN 4)........ 111
Figure 12-4 PRN Bias Average Trend (PRN 5 – PRN 8)........ 112
Figure 12-5 PRN Bias Average Trend (PRN 9 – PRN 12)........ 113
Figure 12-6 PRN Bias Average Trend (PRN 13 – PRN 16)........ 114
Figure 12-7 PRN Bias Average Trend (PRN 17 – PRN 20)........ 115
Figure 12-8 PRN Bias Average Trend (PRN 21 – PRN 24)........ 116
Figure 12-9 PRN Bias Average Trend (PRN 25 – PRN 28)........ 117
Figure 12-10 PRN Bias Average Trend (PRN 29 – PRN 32) 118
Figure 13-1 GPS Broadcast Orbit Accuracy Standard Deviations 120
Figure 13-2 GPS Broadcast Orbit Error Means........ 120
Figure 13-3 PRN 2 Orbit Error 121
Figure 13-4 PRN 3 Orbit Error 121
Figure 13-5 PRN 4 Orbit Error 122
Figure 13-6 PRN 5 Orbit Error 122
Figure 13-7 PRN 6 Orbit Error 123
Figure 13-8 PRN 7 Orbit Error 123
Figure 13-9 PRN 8 Orbit Error 124
Figure 13-10 PRN 9 Orbit Error 124
Figure 13-11 PRN 10 Orbit Error 125
Figure 13-12 RN 11 Obit Error........ 125
Figure 13-13 PRN 12 Orbit Error 126
Figure 13-14 PRN 13 Orbit Error 126
Figure 13-15 PRN 14 Orbit Error 127
Figure 13-16 PRN 15 Orbit Error 127
Figure 13-17 PRN 16 Orbit Error 128
Figure 13-18 PRN 17 Orbit Error 128
Figure 13-19 PRN 18 Orbit Error 129
Figure 13-20 PRN 19 Orbit Error 129
Figure 13-21 PRN 20 Orbit Error 130
Figure 13-22 PRN 21 Orbit Error 130
Figure 13-23 PRN 22 Orbit Error 131
Figure 13-24 PRN 23 Orbit Error 131
Figure 13-25 PRN 24 Orbit Error 132
Figure 13-26 PRN 25 Orbit Error 132
Figure 13-27 PRN 26 Orbit Error 133
Figure 13-28 PRN 27 Orbit Error 133

Figure 13-29 PRN 28 Orbit Error 134
Figure 13-30 PRN 29 Orbit Error 134
Figure 13-31 PRN 30 Orbit Error 135
Figure 13-32 PRN 31 Orbit Error 135
Figure 13-33 PRN 32 Orbit Error 136

LIST OF TABLES

Table 1-1 PA Sites 2
Table 1-2 NPA Sites 3
Table 1-3 WAAS Performance Parameters 4
Table 1-4 Test Events 4
Table 1-5 WAAS Release 1 Upgrades........ 6
Table 2-1 Operational Service Levels........ 8
Table 2-2 PA 95% Horizontal and Vertical Accuracy........ 9
Table 2-3 NPA 95% and 99.999% Horizontal Accuracy 10
Table 2-4 Maximum Position Errors and Position Error/Protection Level Ratio........ 11
Table 3-1 95% Protection Level 25
Table 3-2 Quarterly Availability Statistics 26
Table 3-3 NPA Availability 27
Table 3-4 LPV and LPV 200 Outage Rate 28
Table 3-5 NPA Outage Rates........ 29
Table 5-1 Safety Margin Index and HMI Statistics 50
Table 5-2 WAAS SV Alert 51
Table 5-3 Update Rates for WAAS Messages........ 53
Table 5-4 WAAS Fast Correction and Degradation Message Rates – CRW 53
Table 5-5 WAAS Long Correction Message Rates (Type 24 and 25) - CRW........ 54
Table 5-6 WAAS Ephemeris Covariance Message Rates (Type 28) – CRW 55
Table 5-7 WAAS Ionospheric Correction Message Rates (Type 26) – CRW 56
Table 5-8 WAAS Ionospheric Mask Message Rates (Type 18) – CRW........ 56
Table 5-9 WAAS Fast Correction and Degradation Message Rates – CRE 56
Table 5-10 WAAS Long Correction Message Rates (Type 24 and 25) - CRE 57
Table 5-11 WAAS Ephemeris Covariance Message Rates (Type 28) – CRE 58
Table 5-12 WAAS Ionospheric Correction Message Rates (Type 26) – CRE........ 59
Table 5-13 WAAS Ionospheric Mask Message Rates (Type 18) - CRE........ 59
Table 6-1 Range Error 95% index and 3.29 Sigma Bounding 61
Table 6-2 Range Error 95% index and 3.29 Sigma Bounding 62
Table 6-3 Ionospheric Error 95% index and 3.29 Sigma Bounding........ 63
Table 6-4 Ionospheric Error 95% index and 3.29 Sigma Bounding........ 64
Table 7-1 GEO Ranging Availability 69
Table 8-1 WAAS Problem Summary 70
Table 9-1 WAAS LPV Outages and Availability........ 71
Table 10-1 CNMP Bounding Statistics........ 92
Table 11-1 WAAS Survey Positions (OPUS ITRF-2000) as of 1/3/10........ 95
Table 12-1 Alpha Metrics 104
Table 12-2 Event Summary 104
Table 12-3 Type Bias Average for the Quarter 105
Table 12-4 Type Bias Average Since January 1, 2008........ 105
Table 12-5 PRN Bias Average for the Quarter........ 108
Table 12-6 PRN Bias Average Since January 1, 2008 109

APPENDIX

Appendix A: Glossary........ 137

Appendix B: Additional Coverage Plots... 140

1.0 INTRODUCTION

The FAA began monitoring GPS SPS performance in order to ensure the safe and effective use of the satellite navigation system in the National Airspace System (NAS). The Wide Area Augmentation System (WAAS) adds more timely integrity monitoring of GPS and improves position accuracy and availability of GPS within the WAAS coverage area.

Objectives of this report are:

a. To evaluate and monitor the ability of WAAS to augment GPS by characterizing important performance parameters.
b. To analyze the effects of GPS satellite operation and maintenance, and ionospheric activity on the WAAS performance.
c. To investigate any GPS and WAAS anomalies and determine their impact on potential users.
d. To archive performance of GPS and WAAS for future evaluations.

The WAAS data transmitted from Geostationary satellites (GEO) PRN#135 (CRW) and PRN#138 (CRE) were used in the evaluation. For this evaluation period, both CRW and CRE GEOs provide a ranging capability for enroute through NPA and PA service.

Table 1.1 and Table 1.2 list NSTB and WAAS reference station receivers used in Precision Approach (PA) and Non-Precision Approach (NPA) evaluation process, respectively. This report presents results from three months of data, collected from October 1, 2009 to December 31, 2009.

Table 1-1 PA Sites

	Number of Days Evaluated	Number of Samples
NSTB:		
Arcata	91	7874555
Oklahoma City	75	6490249
WAAS:		
Albuquerque	92	7927889
Anchorage	91	7828454
Atlanta	90	7796645
Barrow	92	7925349
Bethel	88	7579433
Billings	92	7929903
Boston	92	7930331
Chicago	92	7930322
Cleveland	92	7930167
Cold Bay	52	4529323
Dallas	92	7928045
Denver	92	7925801
Fairbanks	92	7924727
Gander	92	7926503
Goose Bay	91	7902669
Houston	86	7405498
Iqaluit	92	7918349
Jacksonville	92	7930243
Juneau	92	7924749
Kansas City	92	7930085
Kotzebue	91	7826731
Los Angeles	92	7930216
Memphis	92	7906063
Merida	92	7926766
Mexico City	92	7922822
Miami	92	7929837
Minneapolis	92	7930272
New York	92	7930166
Oakland	92	7926195
Puerto Vallarta	92	7928607
Salt Lake City	92	7928383
San Jose Del Cabo	92	7924551
San Juan	91	7895924
Seattle	86	7472394
Tapachula	90	7753152
Washington DC	91	7888024
Winnipeg	92	7930292

Table 1-2 NPA Sites

Location	Number of Days Evaluated	Number of Samples
Albuquerque	92	7926807
Anchorage	91	7828403
Atlanta	92	7907095
Barrow	92	7927251
Bethel	80	6872713
Billings	92	7928533
Boston	92	7926105
Cleveland	90	7776980
Cold Bay	57	4932685
Fairbanks	92	7928586
Gander	92	7923404
Honolulu	92	7928742
Houston	87	7506923
Iqaluit	92	7920730
Juneau	92	7928765
Kansas City	92	7928918
Kotzebue	91	7889995
Los Angeles	92	7928987
Merida	92	7928345
Miami	92	7928804
Minneapolis	92	7929500
Oakland	92	7927971
Salt Lake City	92	7926302
San Jose Del Cabo	92	7926941
San Juan	92	7928269
Seattle	87	7484736
Tapachula	91	7840836
Washington DC	90	7814885

The report is divided in the performance categories listed below. This report also includes WAAS LPV and LPV 200 Service Availability at Selected Airports, WAAS Deterministic Code Noise and Multipath (CNMP) Bounding Analysis, WAAS reference station survey validation and SQM type and PRN bias monitoring.

1. WAAS Position Accuracy
2. WAAS Operational Service Availability
3. Coverage
4. Integrity
5. WAAS Range Domain Accuracy
6. GEO Ranging Performance

Table 1.3 lists the performance parameters evaluated for the WAAS in this report. Please note that these are the performance parameters associated with the WAAS IOC system. These requirements are extracted from the FAA Specification FAA-E-2892B Change 1 and FAA Specification FAA-E-2976, as applicable.

Table 1-3 WAAS Performance Parameters

Performance Parameter	Expected WAAS Performance
LPV Accuracy Horizontal	≤ 1.5m error 95% of the time
LPV Accuracy Vertical	≤ 2m error 95% of the time
LNAV Accuracy Horizontal	≤ 36m error 95% of the time
Availability LPV CONUS	99% availability of 100% of CONUS
Availability LPV Alaska	95% availability of 75% of Alaska
Availability LNAV CONUS	99.99% availability with HPL < 556m
Availability LNAV Alaska	99.9% availability with HPL < 556m
Availability Enroute OCONUS	99.9% availability with HPL < 2nmi
Probability of HMI	< 10e-7 per approach

* Instantaneous availability (i.e. Availability is calculated every second.)

1.1 Event Summary

Table 1.4 lists test events that occurred during the reporting period that affected WAAS performance or the ability to determine the WAAS performance. These events include GPS or WAAS anomalies, relevant receiver malfunctions, and receiver maintenance conducted. Detailed analyses of particular events are documented in the Discrepancy Reports (DR). The DRs are posted on the website http://www.nstb.tc.faa.gov under 'WAAS Technical Reports' and can also be accessed via hyperlink from Table 1.4 below.

Table 1.5 lists events related to Release 1 upgrades that happened in November and December.

Table 1-4 Test Events

GPS Week	Date	Sites	Events
1551 day 5	10/2/09	Alaska	Two manual CRW GUS switchovers. CRW PA availability down to 44%. AK LPV Coverage dropped 92% to 78%.
1551 day 6 to	10/3/09	Alaska	Manual GUS switchover. CRW PA availability down to 56%. AK LPV Coverage dropped 92% to 74%. LPV200 dropped 60% to 45%.
1552 day 0	10/4/09		CRW PA availability down to 91% due to the CRW GUS switchover the previous day. AK LPV/LPV 200 Coverage dropped.
1553 day 4 to 1555 day 1	10/16/09 to 10/26/09	CONUS, Alaska	NANU 2009079 (PRN 8 unusable) decreased WAAS Coverage. See DR 87 PRN 8 NANU Affected WAAS Coverage.
1553 day 5	10/16/09	Alaska	Two CRW GUS switchovers caused Alaska LPV Coverage to drop.
1554 day 6	10/24/09	Alaska	NANU 2009099 (PRN 30 unusable) caused a drop in Alaska Coverage.
1555 day 1	10/26/09	Alaska	NANU 2009101 (PRN 25 unusable) caused a drop in Alaska Coverage.
1555 day 5	10/30/09	Barrow	Localized scintillation at Barrow with higher than expected VPE of 6 meters.

GPS Week	Date	Sites	Events
1555 day 6	10/31/09	Alaska, West Coast	NANU 2009106 (PRN 30 unusable) caused WAAS coverage to drop.
1556 day 1	11/2/09	Alaska, West Coast	NANU 2009109 (PRN 30 unusable) caused WAAS coverage to drop.
1556 day 2	11/3/09	Alaska	Two CRW GUS switchovers caused Alaska coverage to drop.
1556 day 2	11/3/09	None	PRN2 SV alert after a short ephemeris update. See DR78, "False WAAS satellite alert for PRN 29" on 3/29/09 (Week 1525 Day 0) for description of anomaly.
1556 day 3	11/4/09	Alaska	Two CRW GUS switchovers caused Alaska coverage to drop.
1556 day 5	11/6/09	Alaska	Four CRW GUS switchovers, CRW PA availability down to 32%. Alaska LPV Coverage affected.
1556 day 5 to 1558 day 5	11/6/09 to 11/20/09	Alaska	NANU 2009116 (PRN 8 unusable) caused a significant drop in Alaska Coverage.
1557 day 0	11/8/09	Iqaluit	Localized scintillation caused Iqualuit VPE to increase to 6.01 meters.
1557 day 0	11/8/09	Alaska	CRE GUS switchover caused Alaska Coverage to drop.
1557 day 2	11/10/09	None	NANU2009115 (PRN 25 unusable) has no effect on WAAS Coverage.
1557 day 2 to 1557 day 3	11/10/09 to 11/11/09	Alaska	CRE GUS switchover caused Alaska Coverage to drop.
1557 day 6	11/14/09	Alaska	PRN 138 was set to DNU, PA ranging availability dropped to 79% causing a slight drop in Alaska Coverage.
1558 day 2	11/17/09	All sites	The combination of several events led to a significant reduction in WAAS Coverage: NANU 2009118 (PRN 12 unusable), CRW GUS switchover, and PRN 8 outage.
1561 day 1	12/7/09	Alaska	PRN 138 SV alert with PA ranging availability to drop to 72% causing a drop in Alaska LPV200 Coverage.
1561 day 4	12/10/09	None	CRE GUS switchover has no effect on Coverage.
1561 day 5	12/11/09	Alaska	NANU 2009124 (PRN 8 unusable) caused a significant drop in Alaska Coverage.
1562 day 5	12/18/09	None	NANU 2009130 (PRN 25 unusable) has no impact on Coverage.
1563 day 0	12/20/09	Alaska	CRW GUS switchover caused Alaska Coverage to drop.
1563 day 3	12/23/09	All	NANU 2009129 (PRN 24 back in service after being out for most of the quarter) increases Alaska Coverage.

Table 1-5 WAAS Release 1 Upgrades

Date	Site
11/3/2009	Upgrade HW/SW at Napa
11/4/2009	Upgrade HW/SW at Littleton
11/9/2009	Upgrade HW/SW at Brewster
11/10/2009	Upgrade HW/SW at Woodbine
11/11/2009 – 11/16/2009	Upgrade HW/SW/Comm at Seattle
11/16/2009	Upgrade SW at Los Angeles (CnV)
11/17/2009	Upgrade SW at Washington D.C. (CnV)
11/18/2009	Upgrade SW at Atlanta (CnV)
12/1/2009	Upgrade SW at Barrow
12/1/2009	Upgrade SW at Bethel
12/2/2009	Upgrade SW at Billings
12/2/2009	Upgrade SW at Fairbanks
12/3/2009	Upgrade SW at Gander
12/3/2009	Upgrade SW at Goose bay
12/4/2009	Upgrade SW at Iqaluit
12/4/2009	Upgrade SW at Kotzebue
12/5/2009	Upgrade SW at Merida
12/5/2009	Upgrade SW at Mexico City
12/6/2009	Upgrade SW at Puerto Vallarta
12/6/2009	Upgrade SW at San Jose Del Cabot
12/7/2009	Upgrade SW at Tapachula
12/7/2009	Upgrade SW at Winnipeg
12/9/2009 – 12/11/2009	Upgrade HW/SW at Atlanta
12/10/2009 – 12/11/2009	Upgrade HW/SW at Anchorage
12/16/2009	Upgrade HW/SW at Washington D.C.

1.2 Report Overview

Section 2 provides the vertical and horizontal position accuracies from data collected, on a daily basis, at one-second intervals. The 95% accuracy index and the maximum accuracy for the reporting period are tabulated. The daily 95% accuracy index is plotted graphically for each receiver. Histograms of the vertical and horizontal error distribution are provided for the combined 38 WAAS receiver location within the WAAS service area.

Section 3 summarizes the WAAS instantaneous availability performance, at each receiver, for three operational service levels during the reporting period. Daily availability is also plotted for each receiver evaluated. The number of outages and outage rate for each site is reported.

Section 4 provides the percent of coverage provided by WAAS on a daily basis. Quarterly roll-up graphs presented indicate the portions of service volume covered, and the percentage of time that WAAS was available.

Section 5 summarizes the number of HMI's detected during the reporting period and presents a safety margin index for each receiver. The safety index reflects the amount of over bounding of position error by WAAS protection levels. This section also includes update rates of WAAS messages transmitted from CRE and CRW.

Section 6 provides the UDRE and GIVE bounding percentage and the 95% index of the range and ionospheric accuracy for each satellite tracked by the WAAS receiver at 12 locations.

Section 7 provides the GEO ranging performance for CRE and CRW.

Section 8 summarizes WAAS anomalies and problems identified during the reporting period, which adversely affect WAAS performance described in Table 1.3.

Section 9 provides WAAS LPV availability and outages at selected airports.

Section 10 provides the assessment of WAAS CNMP bounding for 114 WAAS receivers.

Section 11 provides the surveyed positions of all WREs and the difference between the WRE survey in the current software and the survey in this report.

Section 12 provides the daily and quarterly average of SQM PRN type biases and PRN biases.

Section 13 compares GPS broadcast orbits verse IGS precise orbits.

2.0 WAAS POSITION ACCURACY

Navigation error data, collected from WAAS and NSTB reference stations, was processed to determine position accuracy at each location. This was accomplished by utilizing the GPS/WAAS position solution tool to compute a MOPS-weighted least squares user navigation solution, and WAAS horizontal and vertical protection levels (HPL & VPL), once every second. The user position calculated for each receiver was compared to the surveyed position of the antenna to assess position error associated with the WAAS SIS over time. The position errors were analyzed and statistics were generated for three operational service levels: WAAS LPV, WAAS LPV 200, and WAAS LNAV/VNAV, as shown in Table 2.1. For this evaluation, the WAAS operational service level is considered available at a given time and location, if the computed WAAS HPL and VPL are within the horizontal and vertical alarm limits (HAL & VAL) specified in Table 2.1.

Table 2-1 Operational Service Levels

WAAS Operational Service Levels	Horizontal Alert Limit HAL (meters)	Vertical Alert Limit VAL (meters)
LPV (LOC/VNAV)	40	50
LNAV/VNAV	556	50
LPV 200	40	35

Table 2.2 shows PA horizontal and vertical position accuracy maintained for 95% of the time at LPV and LNAV/VNAV operational service levels for the quarter. The table also includes 95% SPS accuracy for certain locations. Figures 2.1 to 2.6 show the daily horizontal and vertical 95% accuracy for LPV operational service level for the period. Note that WAAS accuracy statistics presented are compiled only when all WAAS corrections (fast, long term, and ionospheric) for at least 4 satellites are available. This is referred to as PA navigation mode. The percentage of time that PA navigation mode was supported by WAAS at each receiver is also shown in Table 2.2. A user is considered to be in NPA navigation mode if only WAAS fast and long term corrections are available to a user (i.e. no ionospheric corrections). Table 2.3 shows NPA horizontal position accuracy for 95% and 99.999% of the time. This table also shows the maximum NPA horizontal position error for the quarter. Figures 2.7 to 2.8 show the daily horizontal 95% accuracy for NPA.

During this reporting period, the maximum 95% CONUS horizontal and vertical LPV errors are 1.541 meters and 1.887 meters both at Arcata, respectively. The minimum 95% CONUS horizontal and vertical LPV errors are 0.691 meters at Denver and 0.941 meters at Chicago. The maximum 95% and 99.999% NPA horizontal errors are 2.33 meters and 5.818 meters both at Honolulu, respectively. The minimum 95% and 99.999% horizontal errors are 0.741 meters and 1.738 meters both at Barrow, respectively.

Table 2.4 shows the maximum horizontal and vertical position errors while the calculated HPL and VPL met the LPV service levels. The column marked 'Horizontal (or Vertical) Error/HPL (or VPL)' is the ratio of position error to protection level at the time the maximum error occurred. The column marked 'Horizontal (or Vertical) Maximum Ratio' is the maximum position error to protection level ratio for the quarter.

Figures 2.9 to 2.12 show the distributions of the vertical and horizontal errors at all 38 WAAS receiver locations combined in triangle charts and 2-D histogram plots for the quarter. The triangle charts in Figure 2.9 and 2.10 show the distributions of vertical position errors (VPE) versus vertical protection levels (VPL) and horizontal position errors (HPE) versus horizontal protection levels (HPL). The horizontal axis is the position error and the vertical axis is the WAAS protection levels. Lower protection levels equate to better availability. The diagonal line shows the point where error equals protection level. Above and to the left of the diagonal line in the chart, errors are bounded (WAAS is providing integrity in the position domain); below and to the right, errors are not bounded (HMI could be present). The 2-D histogram plots in Figure 2.11 and 2.12 show the distributions of vertical and horizontal position errors and normalized position errors. The blue trace shows the distributions of the actual vertical and horizontal errors. The horizontal axis is the position errors and the vertical axis is the total count of data samples (log scale) in each 0.1-meter bin. The magenta trace show the distributions of the actual vertical and horizontal errors normalized by one-sigma value of the protection level; vertical - (VPL/5.33) and horizontal - (HPL/6.0). The horizontal axis is the standard units and vertical axis is the observed distribution of normalized errors data samples in each 0.1-sigma bin. Narrowness of the normalized error distributions shows very good observed safety performance.

Table 2-2 PA 95% Horizontal and Vertical Accuracy

Location	Horizontal (HAL=40m) (Meters)	Horizontal (HAL=556m) (Meters)	Vertical (VAL=50m) (Meters)	Percentage in PA mode (%)	SPS Accuracy	
					95% Horizontal (Meters)	95% Vertical (Meters)
Arcata	1.541	1.541	1.887	100	*	*
Oklahoma City	0.815	0.815	1.226	99.99999	*	*
Albuquerque	0.716	0.716	0.978	100	1.926	3.838
Anchorage	0.663	0.663	1.154	99.99797	*	*
Atlanta	0.819	0.819	1.143	99.99636	2.375	4.370
Barrow	0.585	0.585	1.248	99.92949	*	*
Bethel	0.590	0.590	0.973	99.99755	1.954	4.764
Billings	0.937	0.937	1.105	100	2.222	3.787
Boston	0.812	0.812	1.192	100	2.497	3.958
Chicago	1.017	1.017	0.914	100	*	*
Cleveland	0.709	0.709	1.152	100	2.362	3.840
Cold Bay	0.776	0.785	1.238	100	*	*
Dallas	0.733	0.733	1.183	100	*	*
Denver	0.691	0.691	1.108	100	*	*
Fairbanks	0.525	0.525	1.133	100	1.635	4.553
Gander	0.945	0.946	1.157	99.97466	*	*
Goose Bay	0.779	0.779	1.252	99.96982	*	*
Houston	0.830	0.830	1.351	99.99548	2.259	4.125
Iqaluit	0.847	0.847	1.766	99.96829	*	*
Jacksonville	0.810	0.810	1.332	100	*	*
Juneau	0.695	0.695	1.155	100	*	*
Kansas City	0.786	0.786	0.972	100	2.269	4.005
Kotzebue	0.557	0.557	1.387	99.92993	1.625	4.553
Los Angeles	0.869	0.869	0.975	100	1.915	4.474
Memphis	0.744	0.744	1.025	100	*	*
Merida	0.648	0.648	1.461	100	*	*
Mexico City	0.656	0.656	1.100	99.99758	*	*
Miami	0.928	0.928	1.612	100	2.076	4.790
Minneapolis	0.920	0.920	1.080	100	2.328	3.898
New York	0.951	0.951	1.077	100	*	*
Oakland	0.954	0.954	0.974	100	1.987	4.421
Puerto Vallarta	0.652	0.652	1.394	99.99871	*	*
Salt Lake City	0.749	0.749	0.954	100	2.053	3.903
San Jose Del Cabo	0.643	0.643	1.470	100	*	*
San Juan	1.074	1.251	1.824	99.99253	*	*
Seattle	0.853	0.853	0.982	99.99782	2.064	4.039
Tapachula	0.832	0.839	1.578	99.99678	*	*
Washington DC	0.820	0.820	1.030	100	2.445	4.059
Winnipeg	0.789	0.789	1.060	100	*	*

*SPS Data not available.

Table 2-3 NPA 95% and 99.999% Horizontal Accuracy

Location	95% Horizontal (meters)	99.999% Horizontal (meters)	Percentage in NPA mode (%)	Maximum Horizontal Error
Albuquerque	1.069	2.356	100	2.610
Anchorage	1.142	2.253	100	2.353
Atlanta	1.425	2.969	100	4.030
Barrow	0.741	1.738	99.97	4.499
Bethel	1.434	2.935	100	3.084
Billings	1.787	3.085	100	3.299
Boston	1.615	2.494	100	4.799
Cleveland	1.318	2.447	100	2.756
Cold Bay	1.417	2.820	83.65	3.208
Fairbanks	1.019	2.555	100	3.058
Gander	1.755	2.895	99.99	3.364
Honolulu	2.330	5.818	100	6.251
Houston	1.479	2.318	100	2.559
Iqaluit	0.973	2.713	99.99	3.180
Juneau	1.090	2.315	100	2.442
Kansas City	1.423	2.638	100	2.855
Kotzebue	1.075	2.043	99.97	2.921
Los Angeles	1.189	2.730	100	2.936
Merida	1.083	2.188	100	2.512
Miami	1.337	2.569	100	2.757
Minneapolis	1.657	3.052	100	3.218
Oakland	1.364	3.047	100	4.141
Salt Lake City	1.270	2.499	100	2.665
San Jose Del Cabo	0.932	3.107	100	3.367
San Juan	1.142	3.027	100	3.639
Seattle	1.350	2.840	100	3.677
Tapachula	1.246	4.189	100	4.637
Washington DC	1.674	2.478	100	2.644

Table 2-4 Maximum Position Errors and Position Error/Protection Level Ratio

Location	Horizontal Error (m)	Horizontal Error/HPL	Horizontal Maximum Ratio	Vertical Error (m)	Vertical Error/VPL	Vertical Maximum Ratio
Arcata	5.007	0.217	0.246	5.800	0.197	0.211
Oklahoma City	2.348	0.195	0.195	5.367	0.214	0.230
Albuquerque	1.947	0.143	0.168	3.228	0.098	0.137
Anchorage	2.032	0.110	0.161	2.981	0.074	0.146
Atlanta	2.167	0.100	0.181	3.579	0.103	0.164
Barrow	2.536	0.181	0.181	6.151	0.197	0.197
Bethel	1.736	0.071	0.112	2.968	0.072	0.117
Billings	2.248	0.163	0.199	3.252	0.149	0.156
Boston	1.865	0.102	0.138	3.009	0.100	0.181
Chicago	2.133	0.165	0.190	3.475	0.129	0.170
Cleveland	2.224	0.166	0.186	3.442	0.174	0.224
Cold Bay	3.058	0.085	0.100	3.075	0.063	0.114
Dallas	1.761	0.158	0.175	3.044	0.121	0.200
Denver	1.958	0.170	0.185	5.045	0.195	0.204
Fairbanks	1.775	0.092	0.147	2.994	0.119	0.127
Gander	2.588	0.081	0.107	2.978	0.077	0.106
Goose Bay	2.084	0.105	0.108	2.978	0.103	0.115
Houston	2.230	0.095	0.192	3.594	0.211	0.211
Iqaluit	4.014	0.193	0.193	7.556	0.271	0.271
Jacksonville	1.740	0.143	0.160	3.731	0.192	0.195
Juneau	1.747	0.108	0.146	3.595	0.084	0.159
Kansas City	1.986	0.183	0.193	2.983	0.131	0.140
Kotzebue	1.660	0.060	0.115	4.810	0.098	0.131
Los Angeles	2.058	0.142	0.160	2.832	0.080	0.131
Memphis	2.343	0.076	0.192	3.821	0.096	0.159
Merida	1.733	0.115	0.115	3.850	0.120	0.150
Mexico City	2.010	0.058	0.090	2.982	0.071	0.114
Miami	2.040	0.161	0.176	4.240	0.175	0.195
Minneapolis	2.014	0.192	0.207	2.748	0.110	0.158
New York	2.070	0.130	0.147	3.260	0.146	0.151
Oakland	2.652	0.221	0.221	2.915	0.079	0.141
Puerto Vallarta	2.788	0.116	0.116	4.030	0.088	0.152
Salt Lake City	1.770	0.149	0.161	2.834	0.158	0.167
San Jose Del Cabo	1.801	0.109	0.109	4.332	0.090	0.162
San Juan	2.798	0.079	0.081	6.652	0.199	0.199
Seattle	2.360	0.184	0.210	3.445	0.187	0.204
Tapachula	3.633	0.093	0.093	4.088	0.082	0.149
Washington DC	1.912	0.073	0.149	3.007	0.120	0.144
Winnipeg	2.029	0.084	0.159	2.416	0.110	0.143

Figure 2-1 95% Horizontal Accuracy at LPV

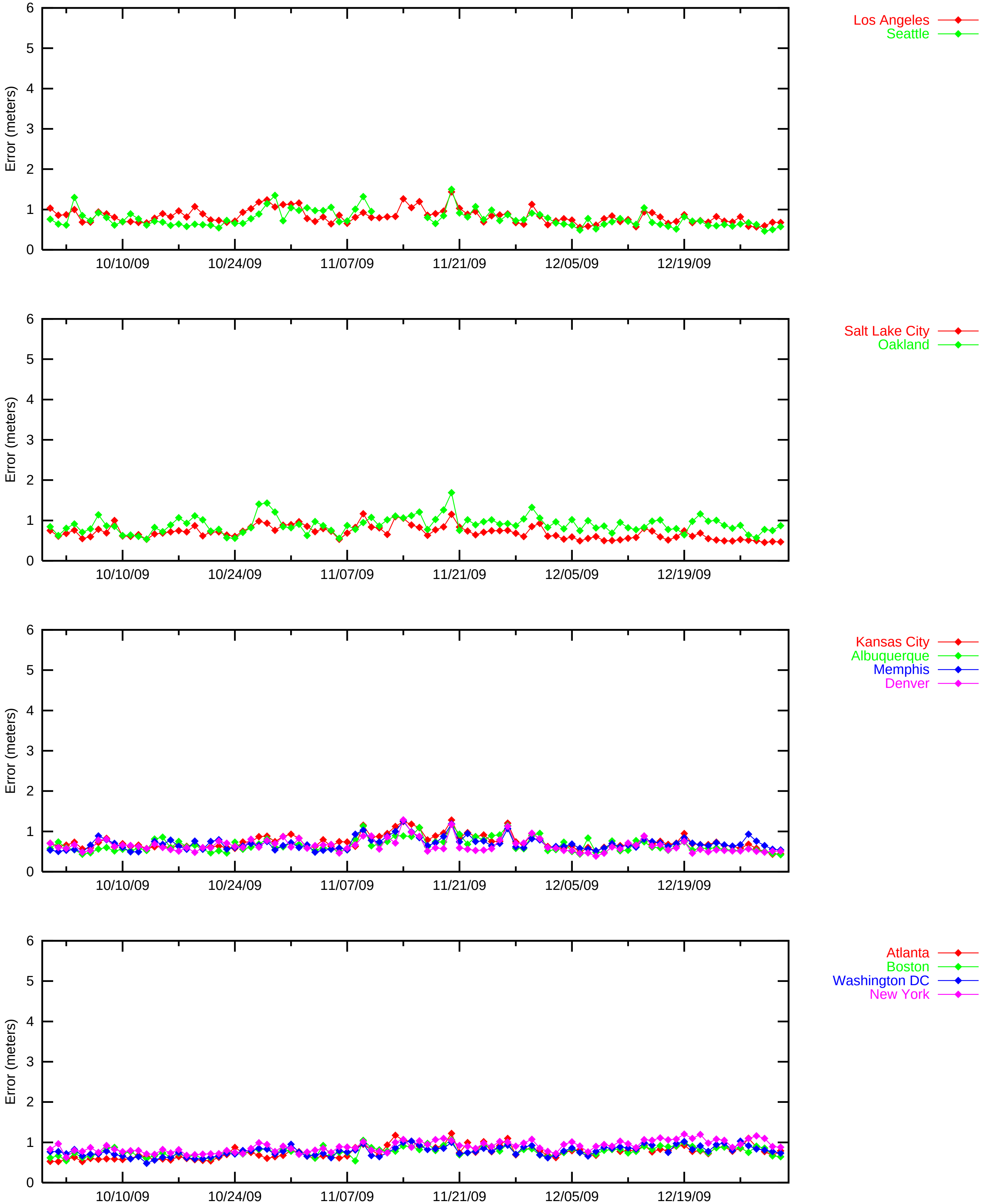


Figure 2-2 95% Horizontal Accuracy at LPV

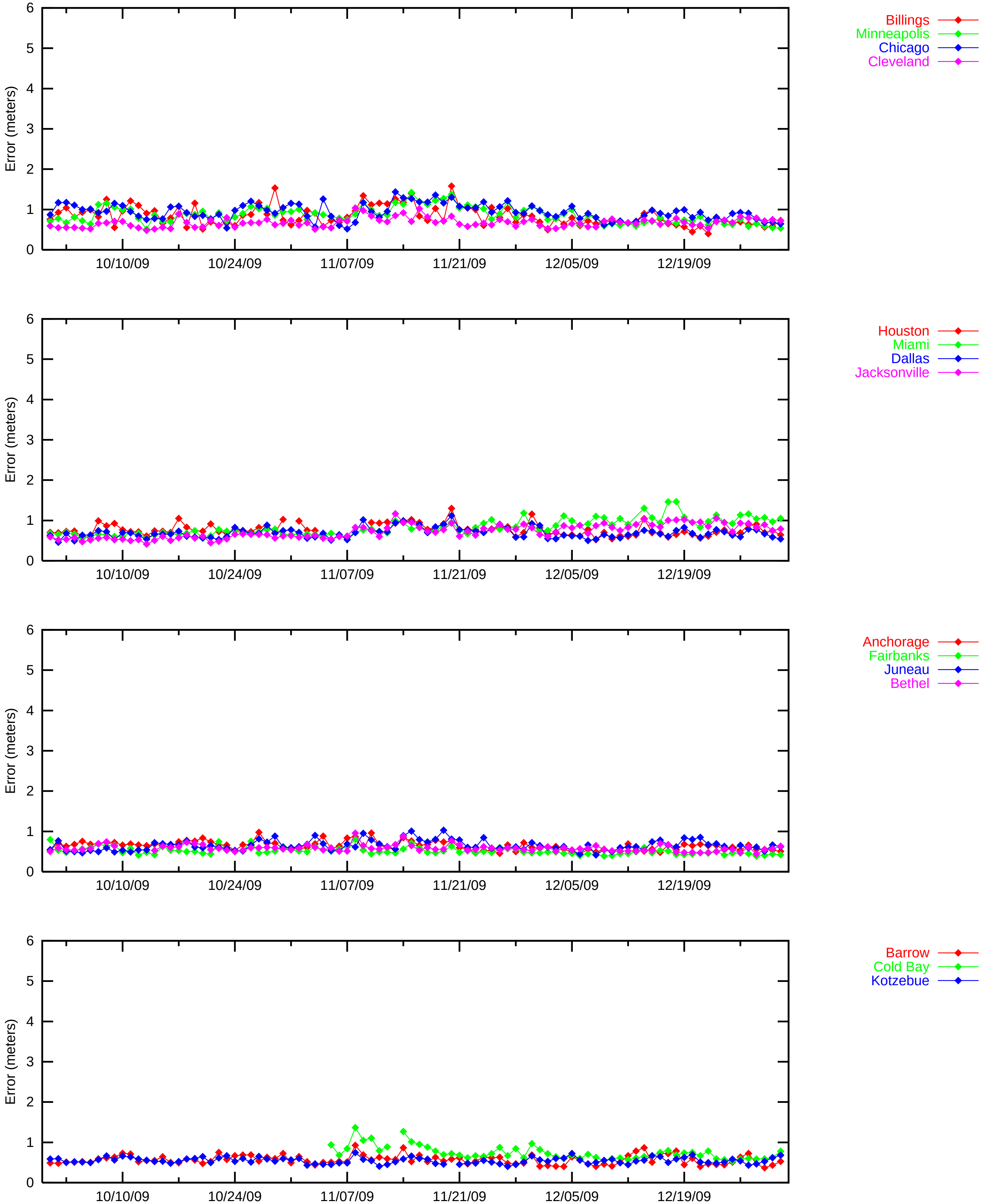


Figure 2-3 95% Horizontal Accuracy at LPV

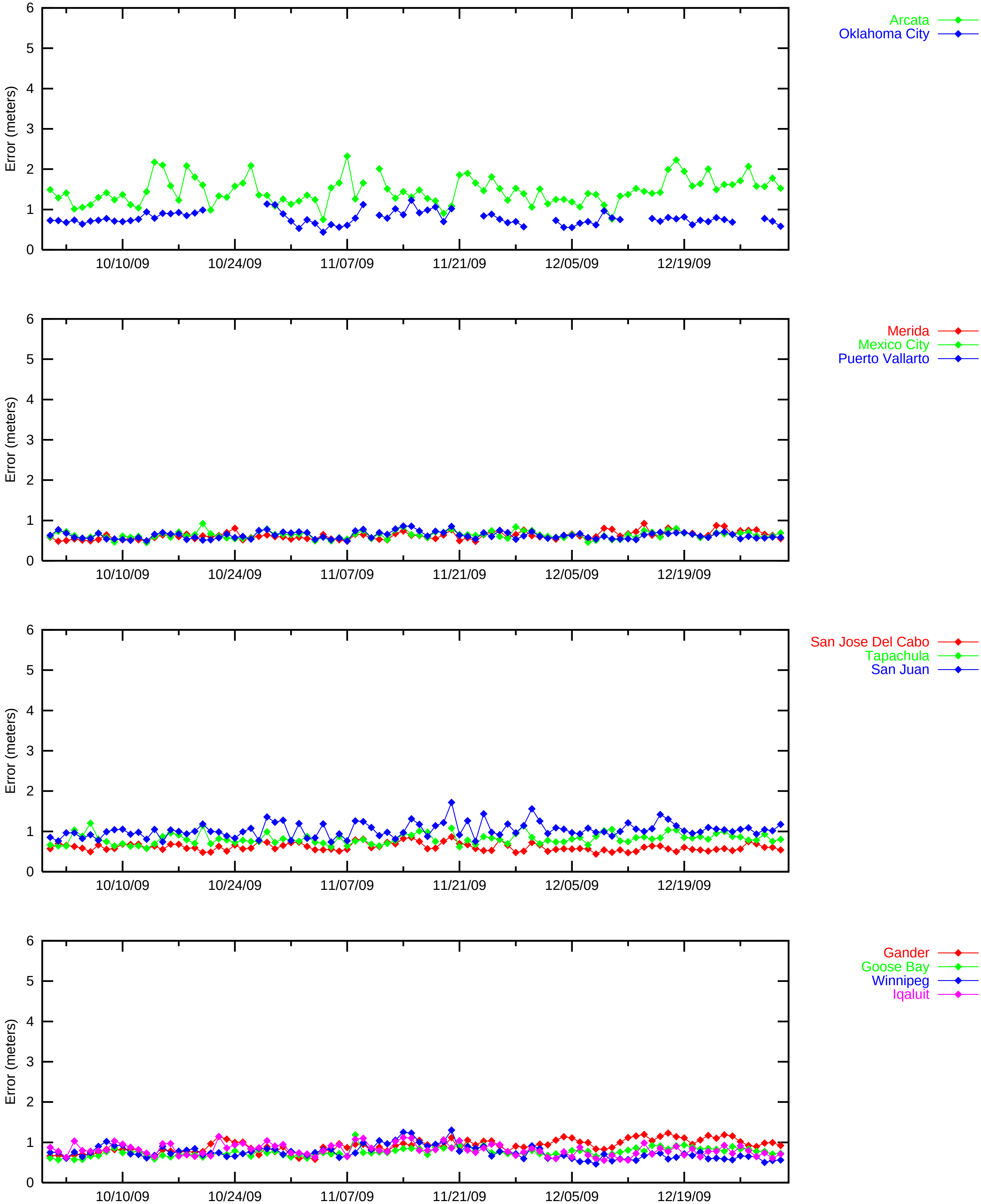


Figure 2-4 95% Vertical Accuracy at LPV

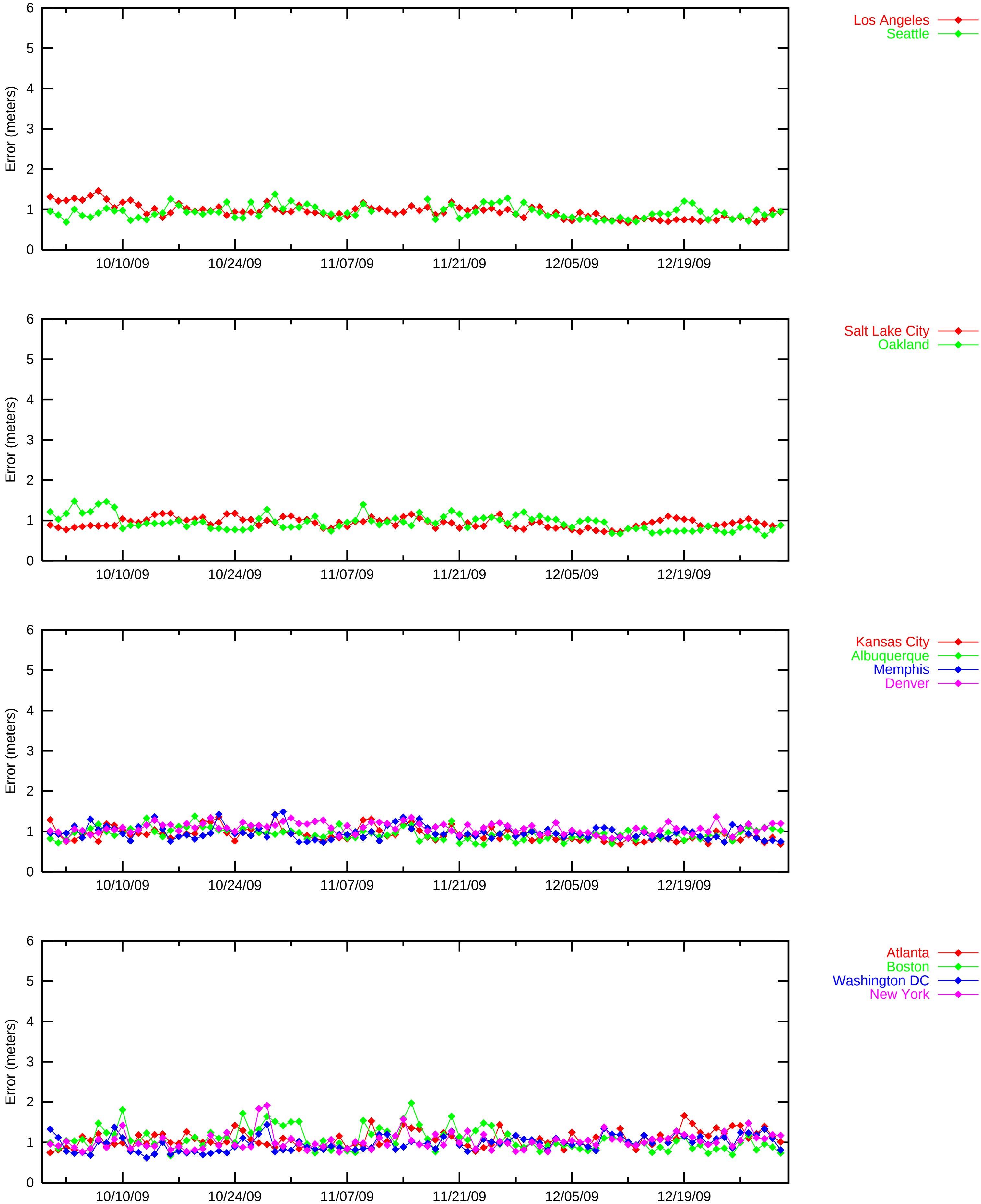
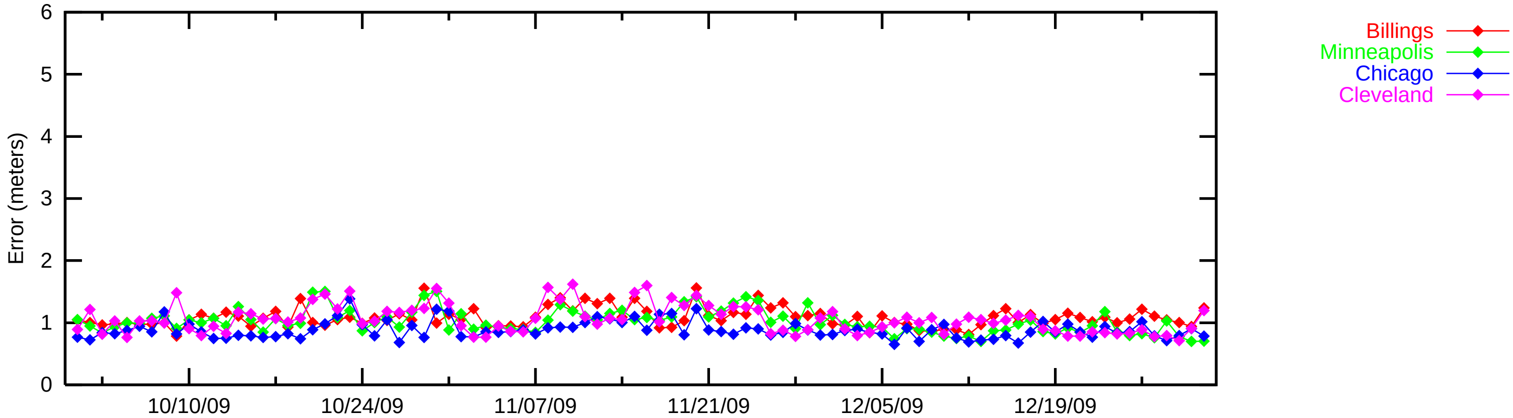
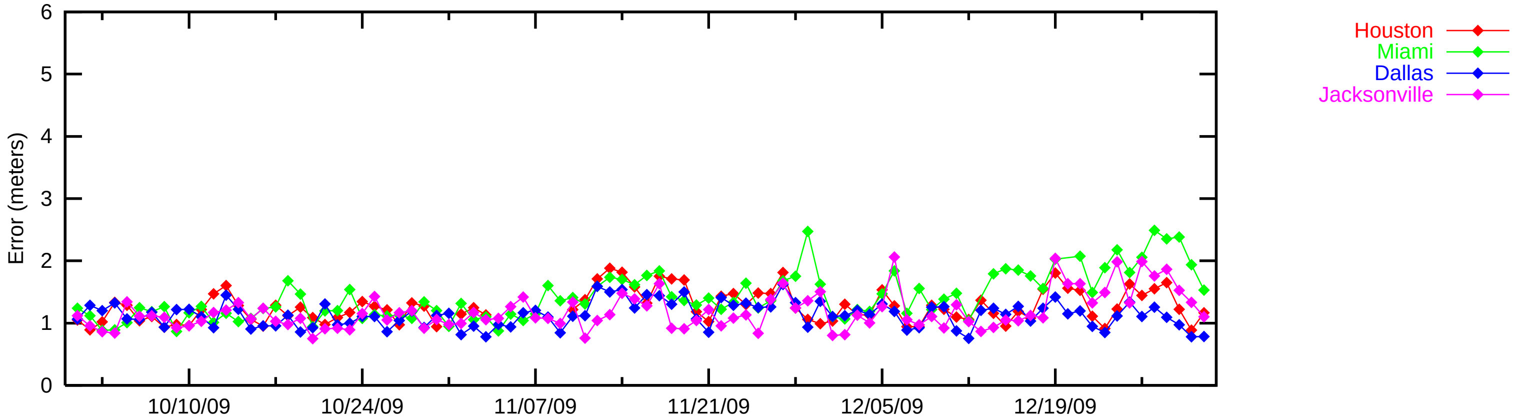
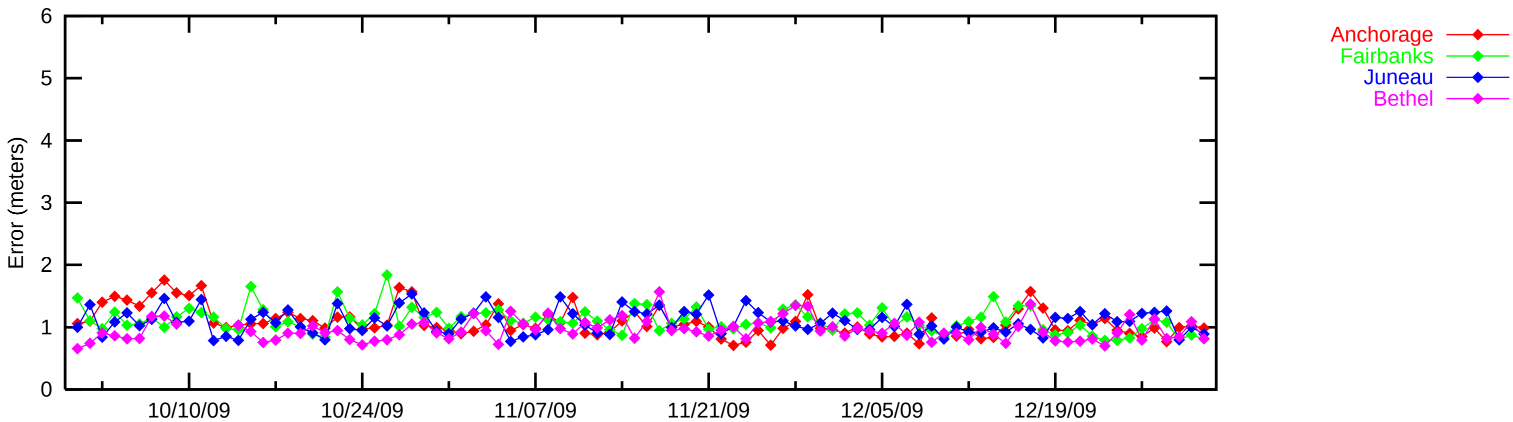


Figure 2-5 95% Vertical Accuracy at LPV







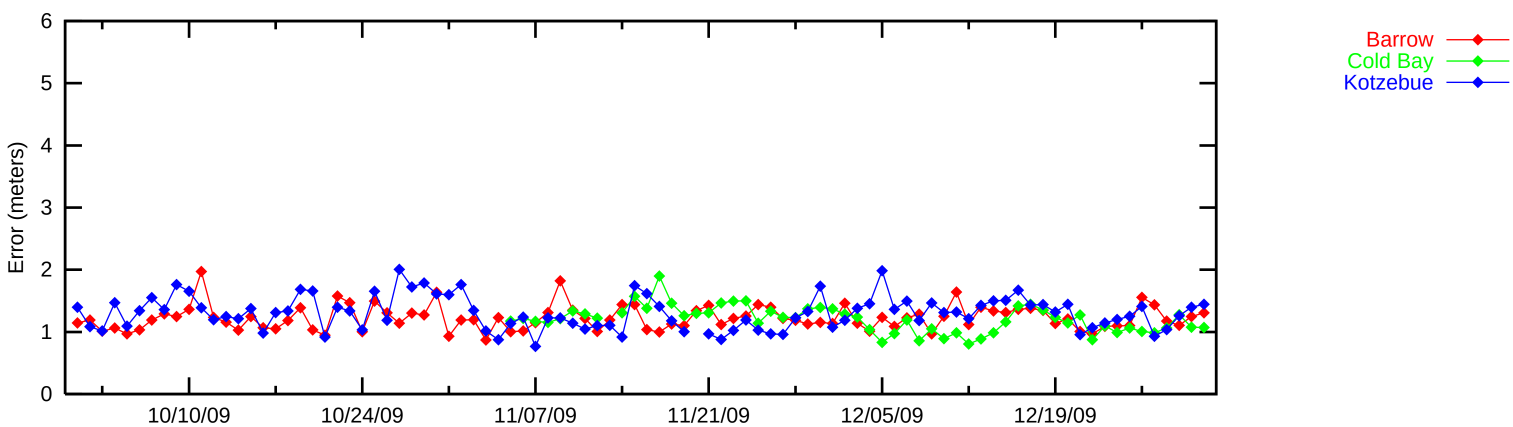


Figure 2-6 95% Vertical Accuracy at LPV

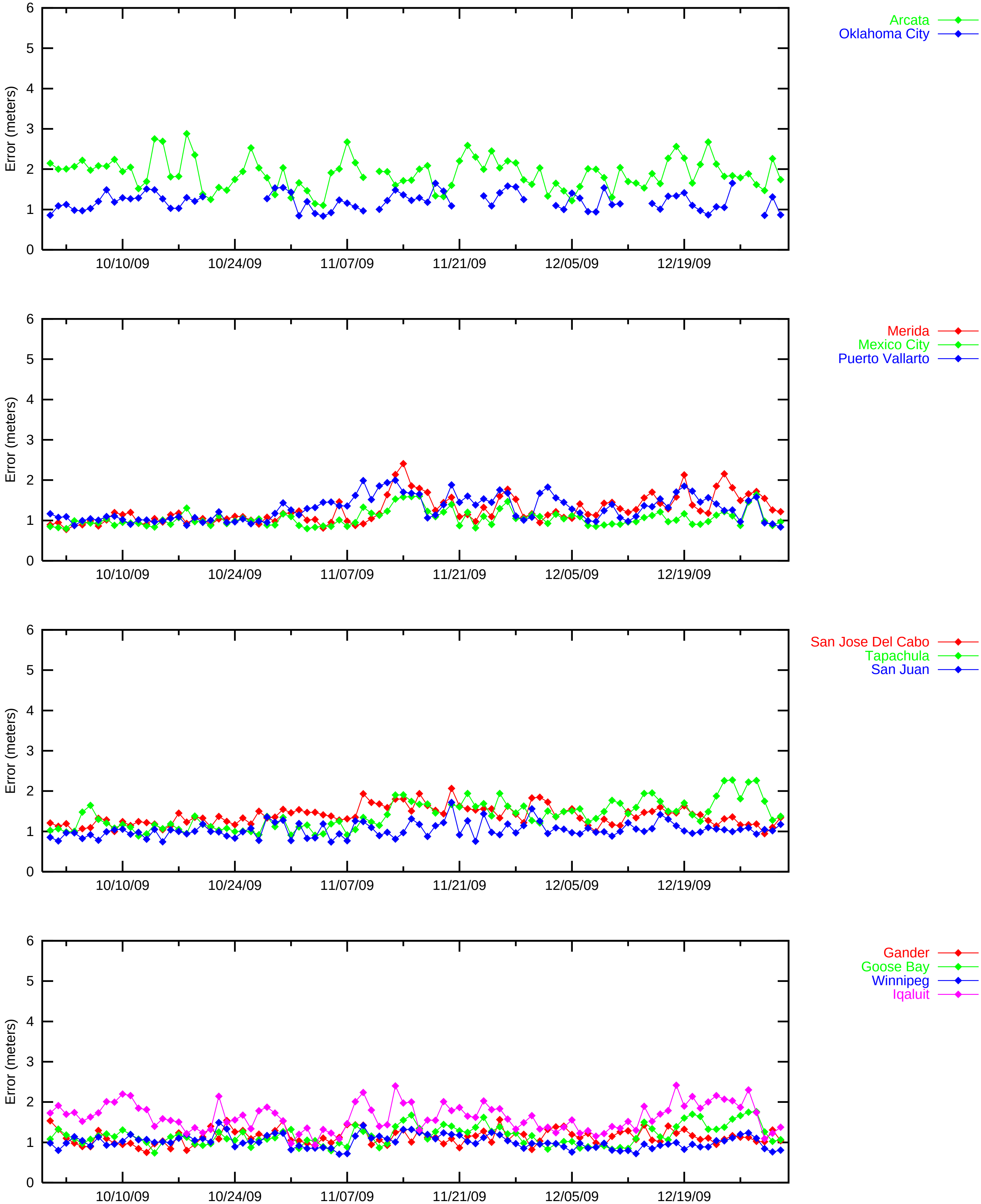
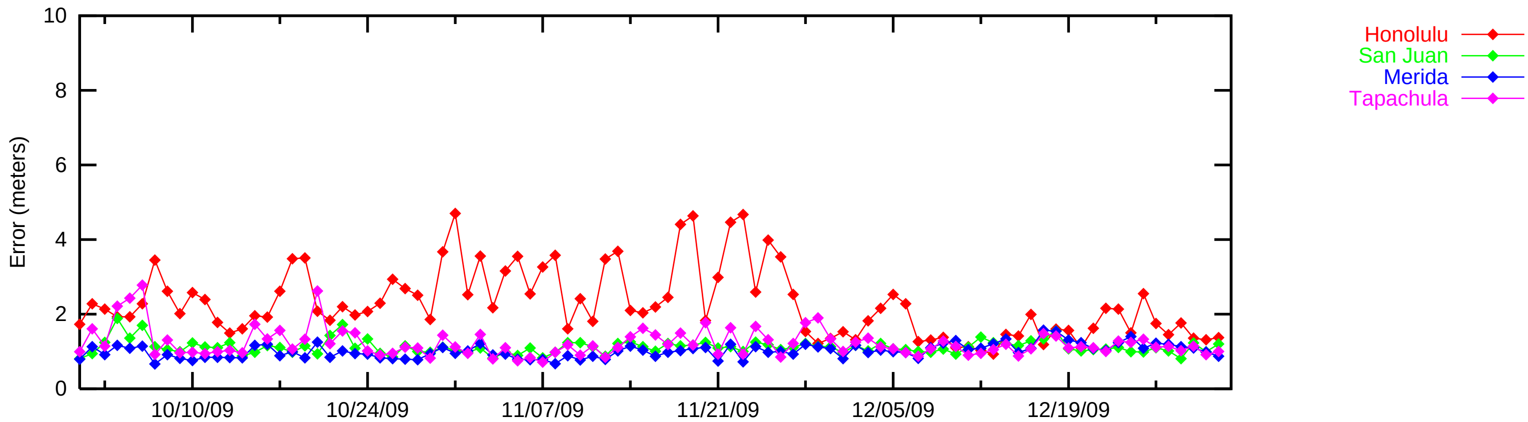
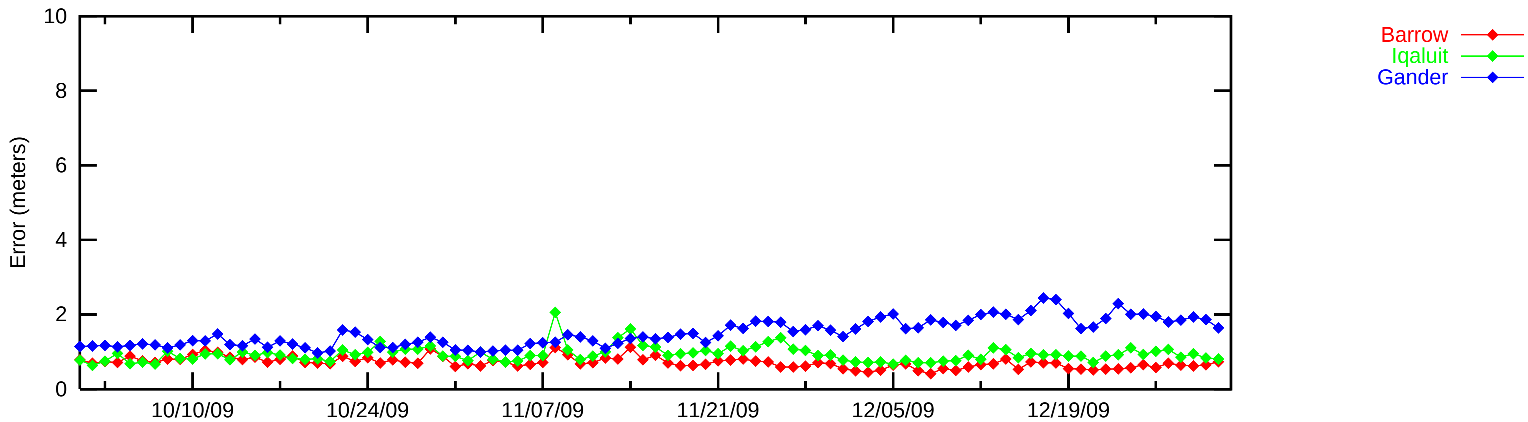
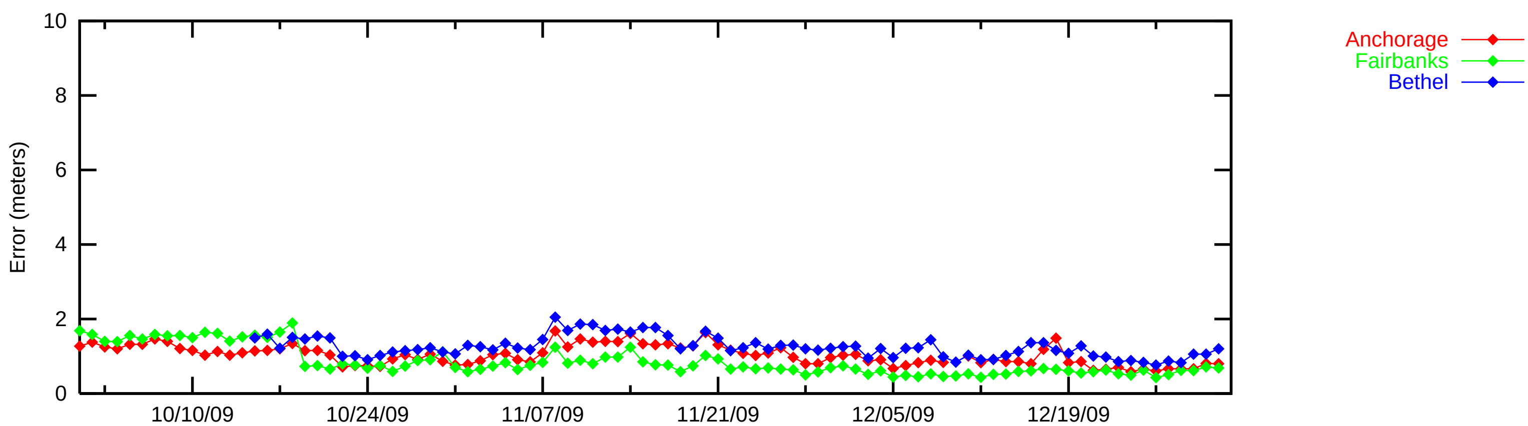


Figure 2-7 95% NPA Horizontal Accuracy







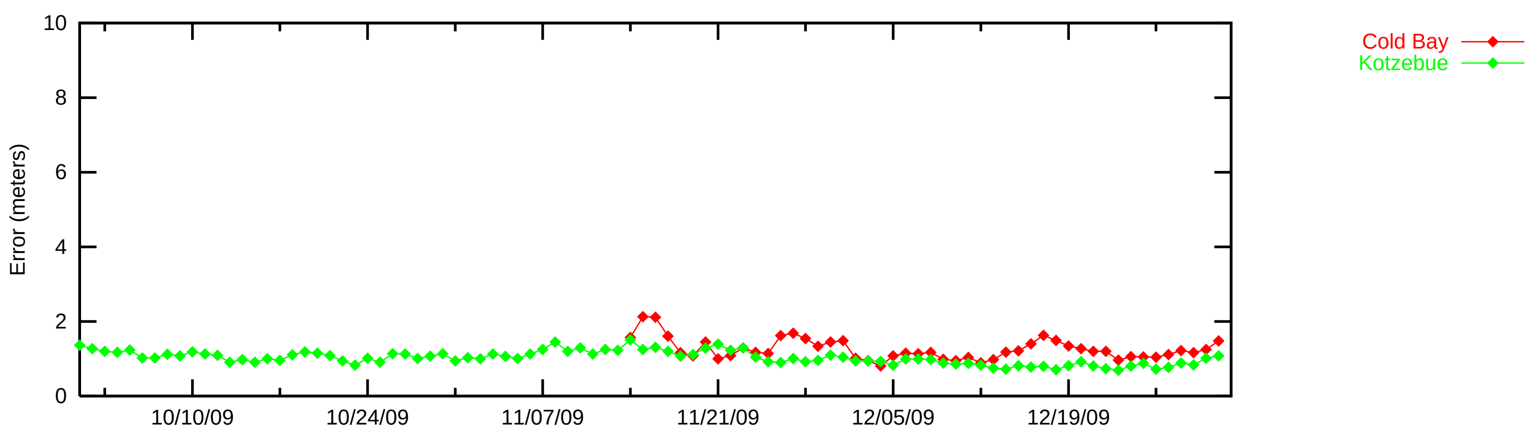


Figure 2-8 95% NPA Horizontal Accuracy

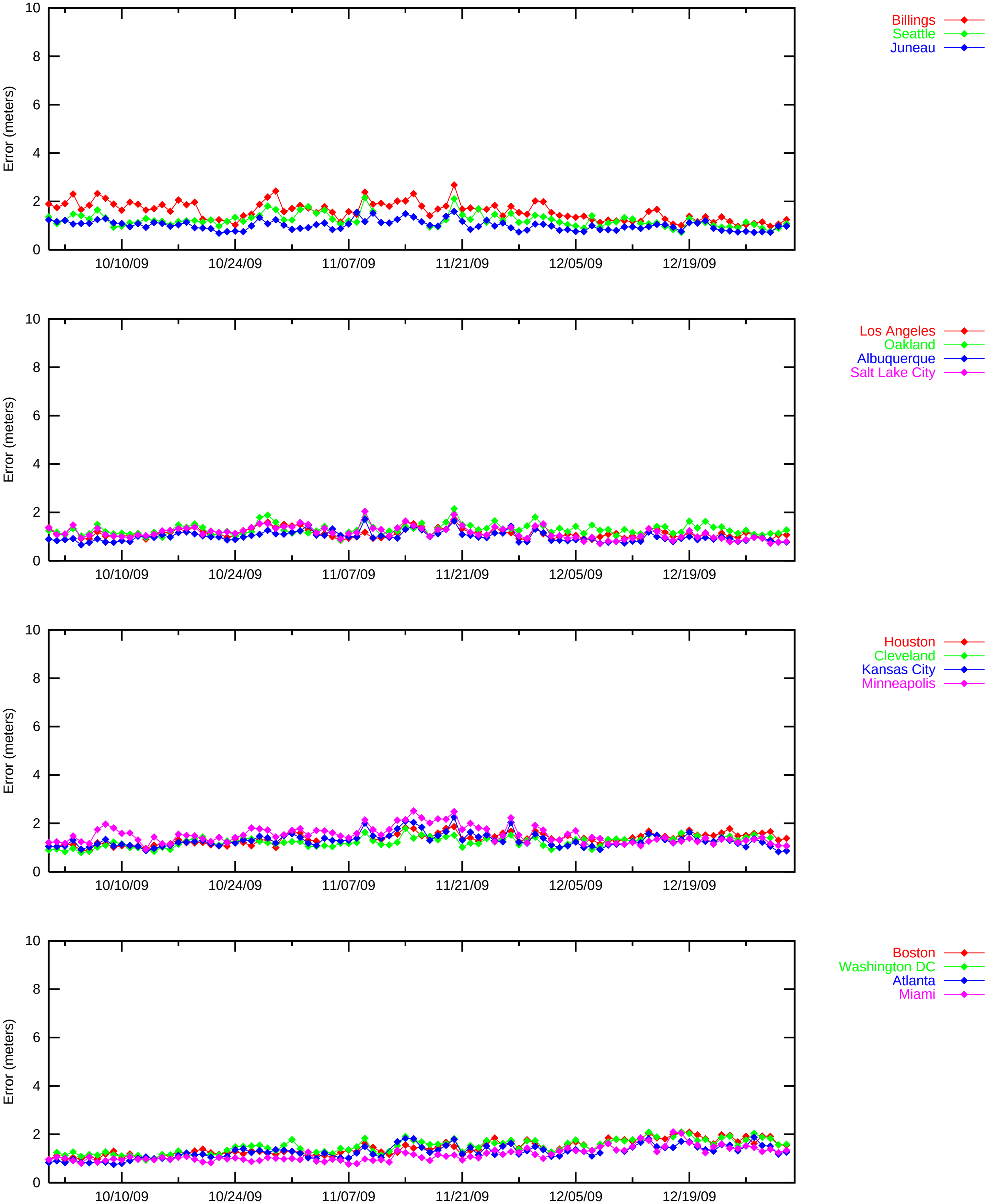


Figure 2-9 Horizontal Triangle Chart for the Quarter

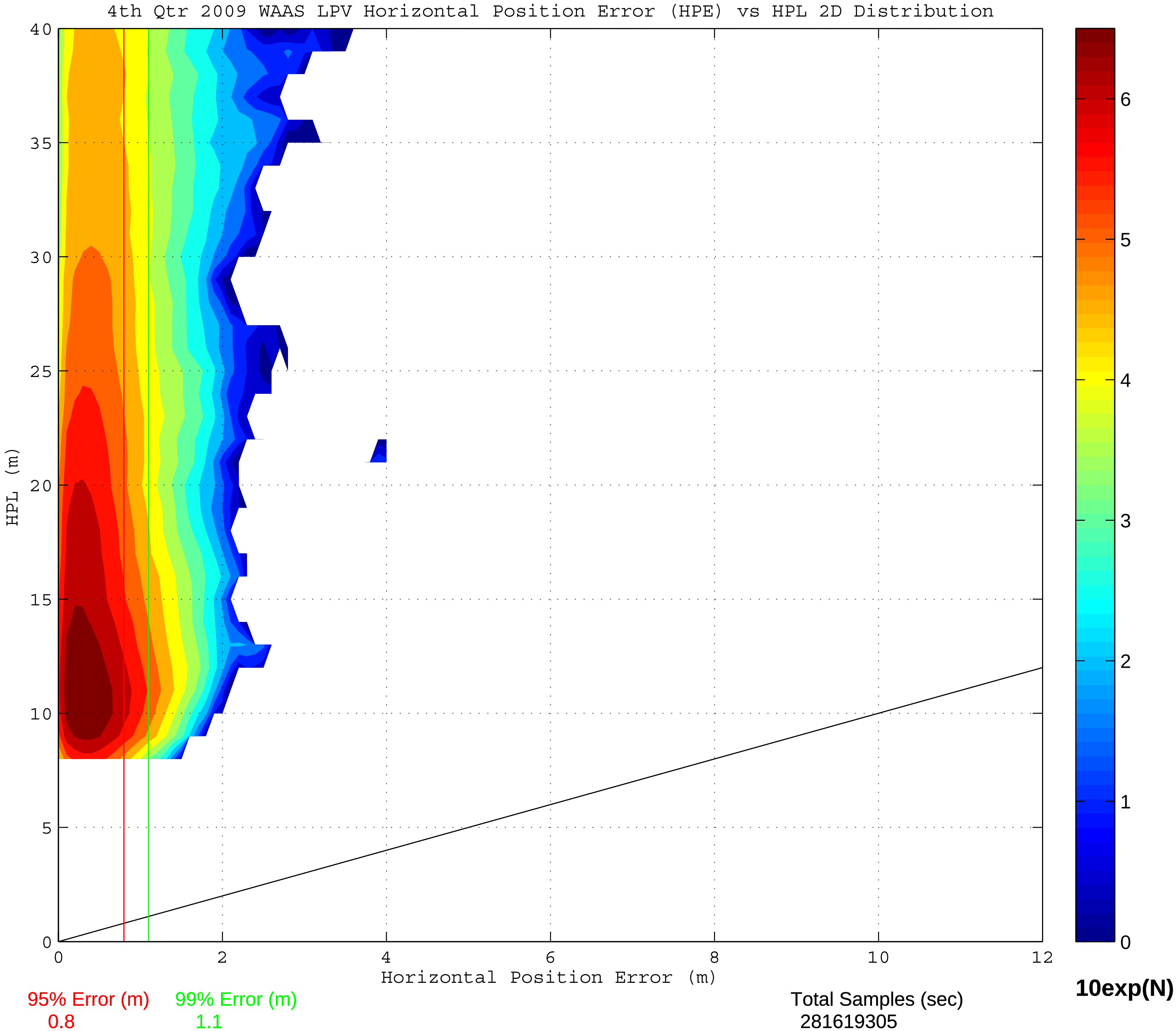


Figure 2-10 Vertical Triangle Chart for the Quarter

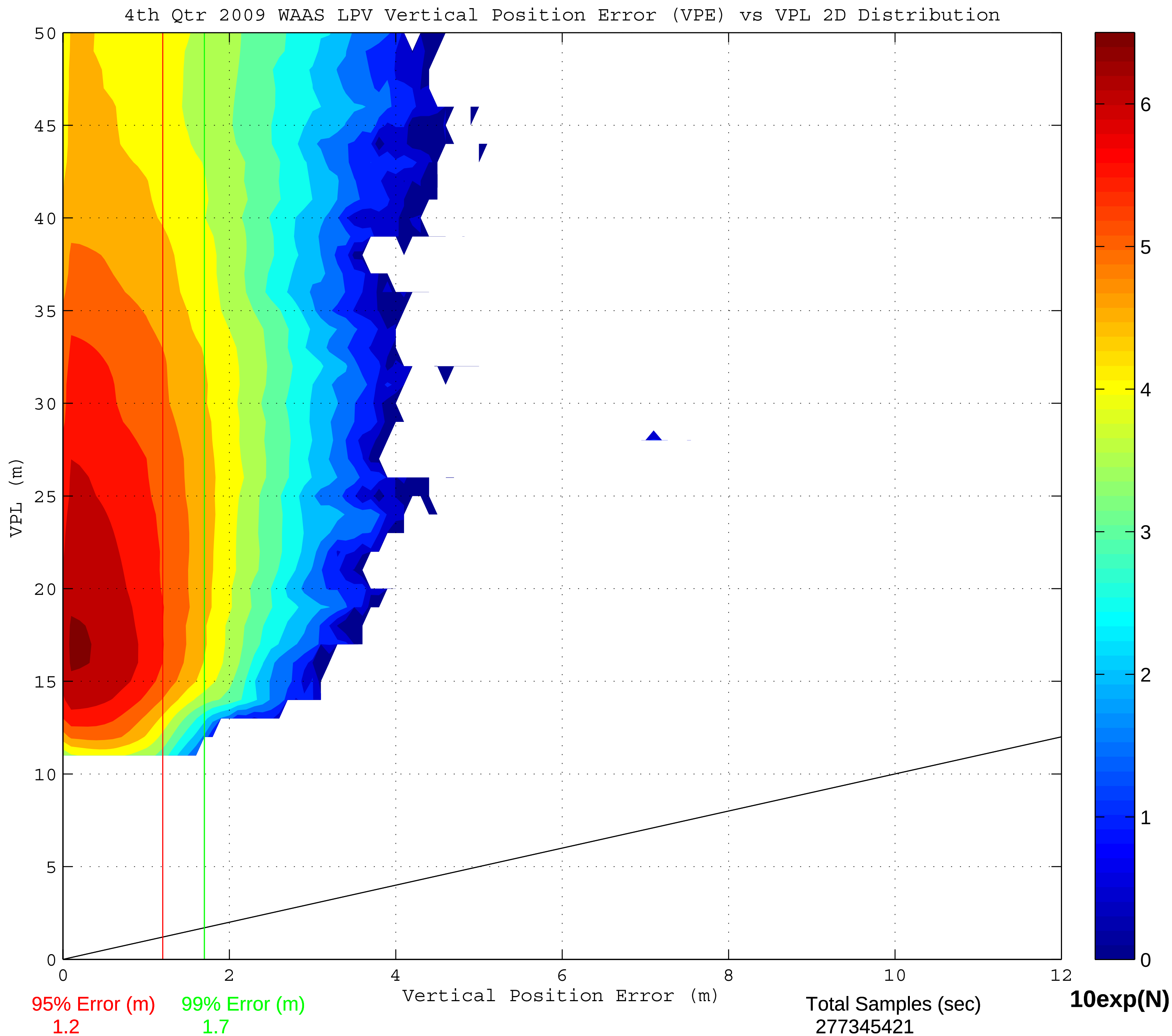


Figure 2-11 2-D Horizontal Histogram for the Quarter

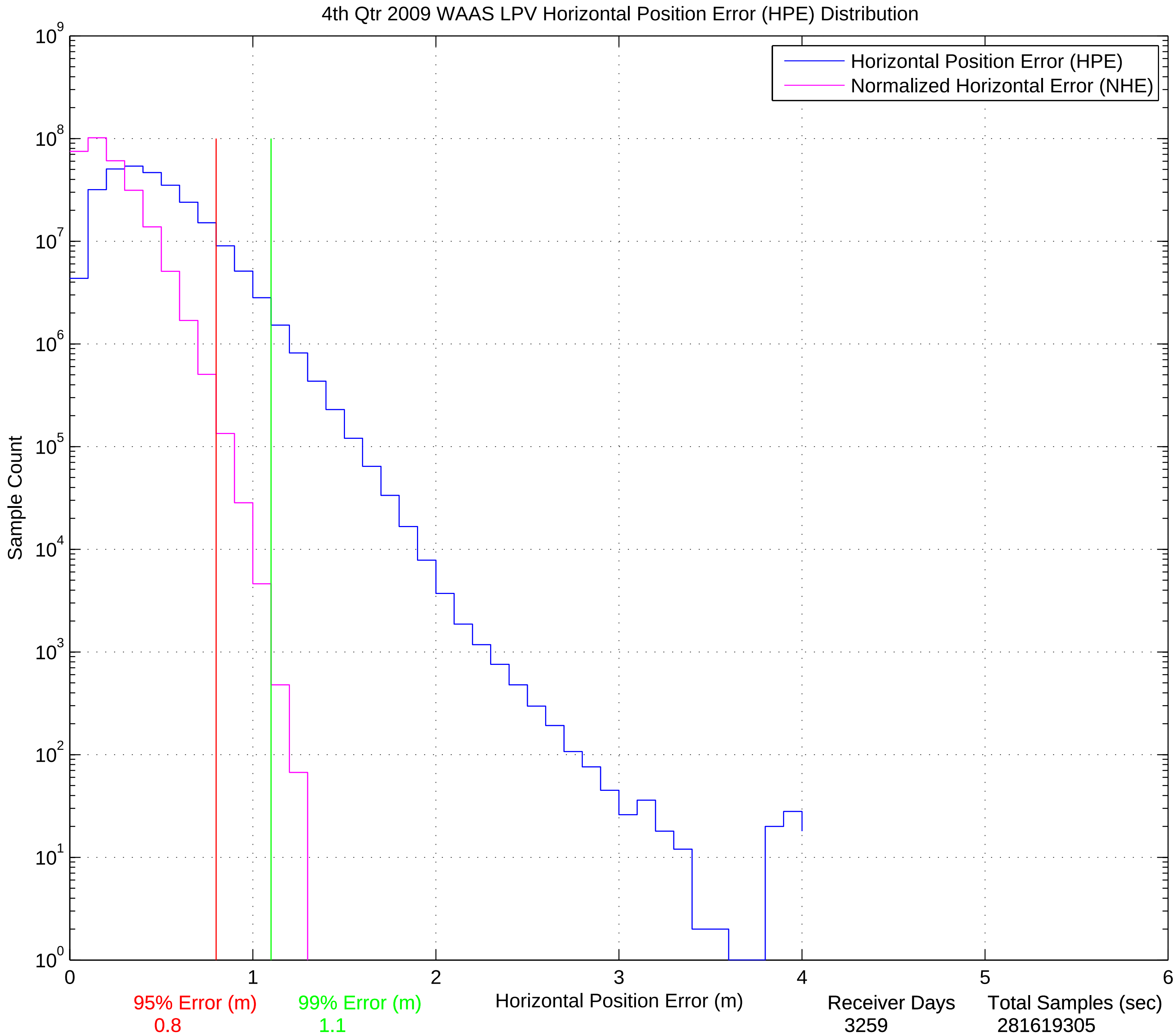
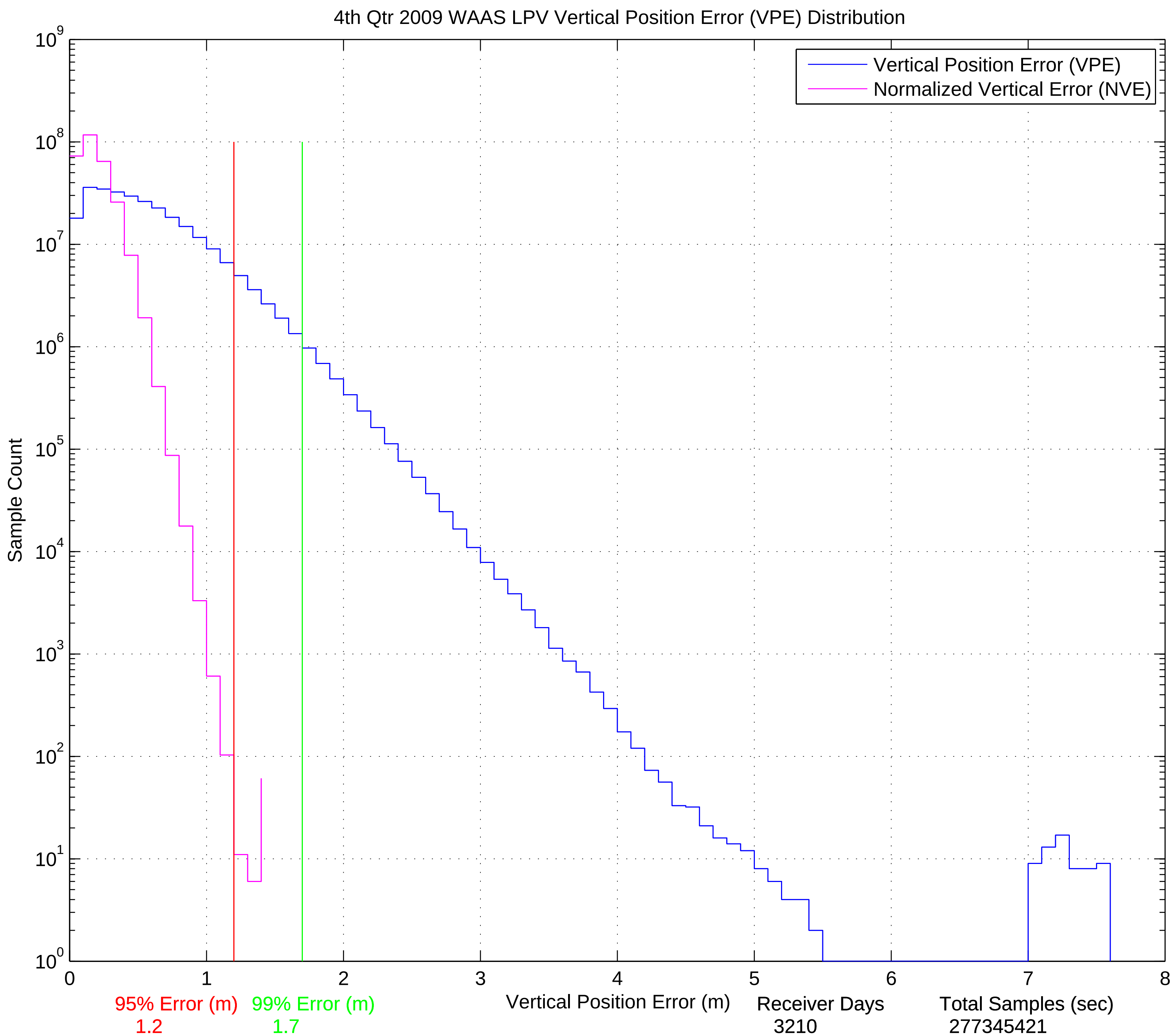


Figure 2-12 2-D Vertical Histogram for the Quarter



3.0 AVAILABILITY

WAAS availability evaluation estimates the probability that the WAAS can provide service for the operational service levels (LPV and LPV 200) defined in Table 2.1. At each receiver, the WAAS message along with the GPS/GEO satellites tracked were used to produce WAAS protection levels in accordance with the WAAS MOPS. Table 3.1 shows the protection levels that were maintained for 95% of the time for each receiver location for the quarter. The table also included the percentage in PA mode as described in section 2.0.

Availability LPV and LPV 200 service is evaluated by monitoring the WAAS protection levels at receiver locations throughout the test period. If both the vertical and horizontal protection levels are not greater than their respective alert limits (VAL and HAL) then the service is available. If either of the protection levels exceeds the required alert level then the operational service at that location is considered unavailable and an outage in service is recorded with its duration. The operational service is not considered available again until the protection levels are both within the alert limits for at least 15 minutes. Although this will reduce operational service availability minimally, it substantially reduces the number of service outages and prevents excessive switching in and out of service availability. The percent of time that LPV and LPV 200 service is available using the fifteen-minute window criteria is presented in Table 3.2. The LPV and LPV 200 service outages and associated outage rate for the test period is presented in Table 3.4. The outage rate is the percent of approaches that theoretically would be interrupted by a loss of operational service once the approach had started. Figures 3.1 through 3.6 show the daily availability of LPV and LPV 200 service levels, and Figures 3.7 through 3.12 show the daily interruptions of LPV and LPV 200 service levels for the evaluation period.

The following table shows the maximum and minimum 95% HPL and VPL observed at the evaluated CONUS and Alaska sites this evaluation period. The international sites are excluded from this table, but can be found in Table 3.1.

Parameter	CONUS Site/Maximum	CONUS Site/Minimum	Alaska Site/Maximum	Alaska Site/Minimum
95% HPL	Arcata 17.079 meters	Dallas 11.601 meters	Cold Bay 29.877 meters	Fairbanks 13.886 meters
95% VPL	Oakland 37.707 meters	Memphis 19.753 meters	Cold Bay 45.51 meters	Juneau 22.076 meters

Availability of NPA service is evaluated by monitoring the WAAS horizontal protection level at receiver locations throughout the test period. If the horizontal protection level is not greater than the horizontal alert limit (HAL = 556m) then the service is available. If the horizontal protection level exceeds the required alert level or if WAAS navigation message is not received then the NPA service at that location is considered unavailable and an outage in service is recorded with its duration. The NPA service is not considered available again until the horizontal protection level is within the alert limit for at least 15 minutes. The percent of time that NPA service is available using the fifteen-minute window criteria is presented in Table 3.3. The NPA service outages and associated outage rate for this period is presented in Table 3.5. The outage rate is the percent of NPA approaches that theoretically would be interrupted by a loss of operational service once the approach had started.

During this evaluation period, reduced PA and NPA availability are mainly due to satellite outages and GUS switchovers. Please refer to Table 1.4 for events that affected availability. NPA outages at Iqaluit and Gander are due to CRE GUS switchovers; NPA outages at Barrow and Kotzebue are due to CRW GUS switchovers. PRN 24 outage from 10/1/09 to 12/24/09 led to a reduction in Alaska availability. Reduced availability from 10/8/09 to 11/6/09, from 10/31/09 to 11/2/09, and 12/11/09 are due to PRN 8 outage (see DR#87 PRN 8 NANU Affects WAAS Coverage). Reduced availability on 10/31/09 and 11/2/09 are due to PRN 30 outage.

Table 3-1 95% Protection Level

Location	95% HPL (meters)	95% VPL (meters)	Percentage in PA mode
Arcata	17.079	30.771	100
Oklahoma City	11.982	21.165	99.999990
Albuquerque	12.634	22.656	100
Anchorage	15.263	25.022	99.997970
Atlanta	12.167	21.074	99.996360
Barrow	17.876	36.729	99.929490
Bethel	21.177	33.070	99.997550
Billings	12.628	22.018	100
Boston	15.364	21.400	100
Chicago	12.760	20.351	100
Cleveland	13.541	21.182	100
Cold Bay	29.877	45.510	100
Dallas	11.601	21.971	100
Denver	11.673	21.888	100
Fairbanks	13.886	24.822	100
Gander	25.513	37.223	99.974660
Goose Bay	20.422	29.095	99.969820
Houston	11.775	22.129	99.995480
Iqaluit	27.995	40.820	99.968290
Jacksonville	12.715	23.524	100
Juneau	13.946	23.076	100
Kansas City	12.225	20.383	100
Kotzebue	17.575	34.696	99.929930
Los Angeles	16.010	28.667	100
Memphis	11.629	19.753	100
Merida	17.379	33.395	100
Mexico City	21.535	37.453	99.997580
Miami	14.523	27.513	100
Minneapolis	12.518	21.281	100
New York	15.042	21.265	100
Oakland	16.703	32.707	100
Puerto Vallarta	24.161	37.697	99.998710
Salt Lake City	12.180	22.071	100
San Jose Del Cabo	22.350	38.502	100
San Juan	70.119	102.923	99.992530
Seattle	14.028	23.519	99.997820
Tapachula	34.675	62.508	99.996780
Washington DC	13.744	21.700	100
Winnipeg	14.397	22.434	100

Table 3-2 Quarterly Availability Statistics

Location	LPV WAAS *With 15 minute window*	LPV 200 WAAS *With 15 minute window*
Arcata	0.99989536	0.97654039
Oklahoma City	0.99999923	0.99998922
Albuquerque	1	0.99985406
Anchorage	0.99990637	0.99489377
Atlanta	1	0.99904125
Barrow	0.99073989	0.90599071
Bethel	0.99398533	0.95810114
Billings	1	0.99994817
Boston	1	0.99986596
Chicago	1	0.99999496
Cleveland	1	0.99989685
Cold Bay	0.95512300	0.77832219
Dallas	1	0.99999912
Denver	1	0.99996707
Fairbanks	0.99996883	0.99526104
Gander	0.99478408	0.83608875
Goose Bay	0.99942828	0.99690399
Houston	1	0.99998663
Iqaluit	0.98703470	0.81148628
Jacksonville	1	0.99508426
Juneau	1	0.99971280
Kansas City	1	0.99997730
Kotzebue	0.99243963	0.94274779
Los Angeles	0.99995675	0.98916612
Memphis	1	0.99989097
Merida	0.98658671	0.95702421
Mexico City	0.98840060	0.92306504
Miami	0.99972863	0.98910976
Minneapolis	1	0.99992535
New York	1	0.99989798
Oakland	0.99964851	0.95919177
Puerto Vallarta	0.99411750	0.88733153
Salt Lake City	1	0.99997906
San Jose Del Cabo	0.99875148	0.89927770
San Juan	0.16720768	0.00412054
Seattle	1	0.99918979
Tapachula	0.85673965	0.45195698
Washington DC	1	0.99917673
Winnipeg	1	0.99976331

Table 3-3 NPA Availability

Location	NPA Availability (Excluding RAIM/FDE)
Albuquerque	1
Anchorage	1
Atlanta	1
Barrow	0.99968009
Bethel	1
Billings	1
Boston	1
Cleveland	1
Cold Bay	1
Fairbanks	1
Gander	0.99993160
Honolulu	1
Houston	1
Iqaluit	0.99994167
Juneau	1
Kansas City	1
Kotzebue	0.99967592
Los Angeles	1
Merida	1
Miami	1
Minneapolis	1
Oakland	1
Salt Lake City	1
San Jose Del Cabo	1
San Juan	1
Seattle	1
Tapachula	1
Washington DC	1

Table 3-4 LPV and LPV 200 Outage Rate

Location	LPV Outages	LPV Outage Rates	LPV 200 Outages	LPV 200 Outage Rates
Arcata	3	0.000057	221	0.004311
Oklahoma City	1	0.000023	5	0.000116
Albuquerque	0	0.00	3	0.000057
Anchorage	3	0.000057	39	0.000751
Atlanta	0	0.00	26	0.000511
Barrow	89	0.001700	689	0.014394
Bethel	39	0.000777	266	0.005495
Billings	0	0.00	2	0.000038
Boston	0	0.00	3	0.000057
Chicago	0	0.00	1	0.000019
Cleveland	0	0.00	3	0.000057
Cold Bay	135	0.004429	452	0.018196
Dallas	0	0.00	2	0.000038
Denver	0	0.00	6	0.000114
Fairbanks	1	0.000019	40	0.000761
Gander	70	0.001332	874	0.019782
Goose Bay	13	0.000247	58	0.001104
Houston	0	0.00	2	0.000041
Iqaluit	163	0.003128	1175	0.027428
Jacksonville	0	0.00	30	0.000570
Juneau	0	0.00	7	0.000133
Kansas City	0	0.00	1	0.000019
Kotzebue	78	0.001506	452	0.009189
Los Angeles	3	0.000057	194	0.003710
Memphis	0	0.00	10	0.000190
Merida	59	0.001132	334	0.006604
Mexico City	96	0.001839	484	0.009927
Miami	3	0.000058	40	0.000782
Minneapolis	0	0.00	2	0.000038
New York	0	0.00	3	0.000057
Oakland	6	0.000114	373	0.007359
Puerto Vallarta	99	0.001884	741	0.015799
Salt Lake City	0	0.00	1	0.000019
San Jose Del Cabo	48	0.000910	496	0.010440
San Juan	779	0.090119	39	0.183081
Seattle	0	0.00	60	0.001205
Tapachula	749	0.016963	1394	0.059845
Washington DC	0	0.00	30	0.000571
Winnipeg	0	0.00	8	0.000151

Table 3-5 NPA Outage Rates

Location	NPA Outages	NPA Outage Rate
Albuquerque	0	0
Anchorage	0	0
Atlanta	0	0
Barrow	14	0.00026499
Bethel	0	0
Billings	0	0
Boston	0	0
Cleveland	0	0
Cold Bay	0	0
Fairbanks	0	0
Gander	8	0.00015146
Honolulu	0	0
Houston	0	0
Iqaluit	8	0.00015151
Juneau	0	0
Kansas City	0	0
Kotzebue	14	0.00026625
Los Angeles	0	0
Merida	0	0
Miami	0	0
Minneapolis	0	0
Oakland	0	0
Salt Lake City	0	0
San Jose Del Cabo	0	0
San Juan	0	0
Seattle	0	0
Tapachula	0	0
Washington DC	0	0

Figure 3-1 LPV Instantaneous Availability (HAL = 40m & VAL=50m)

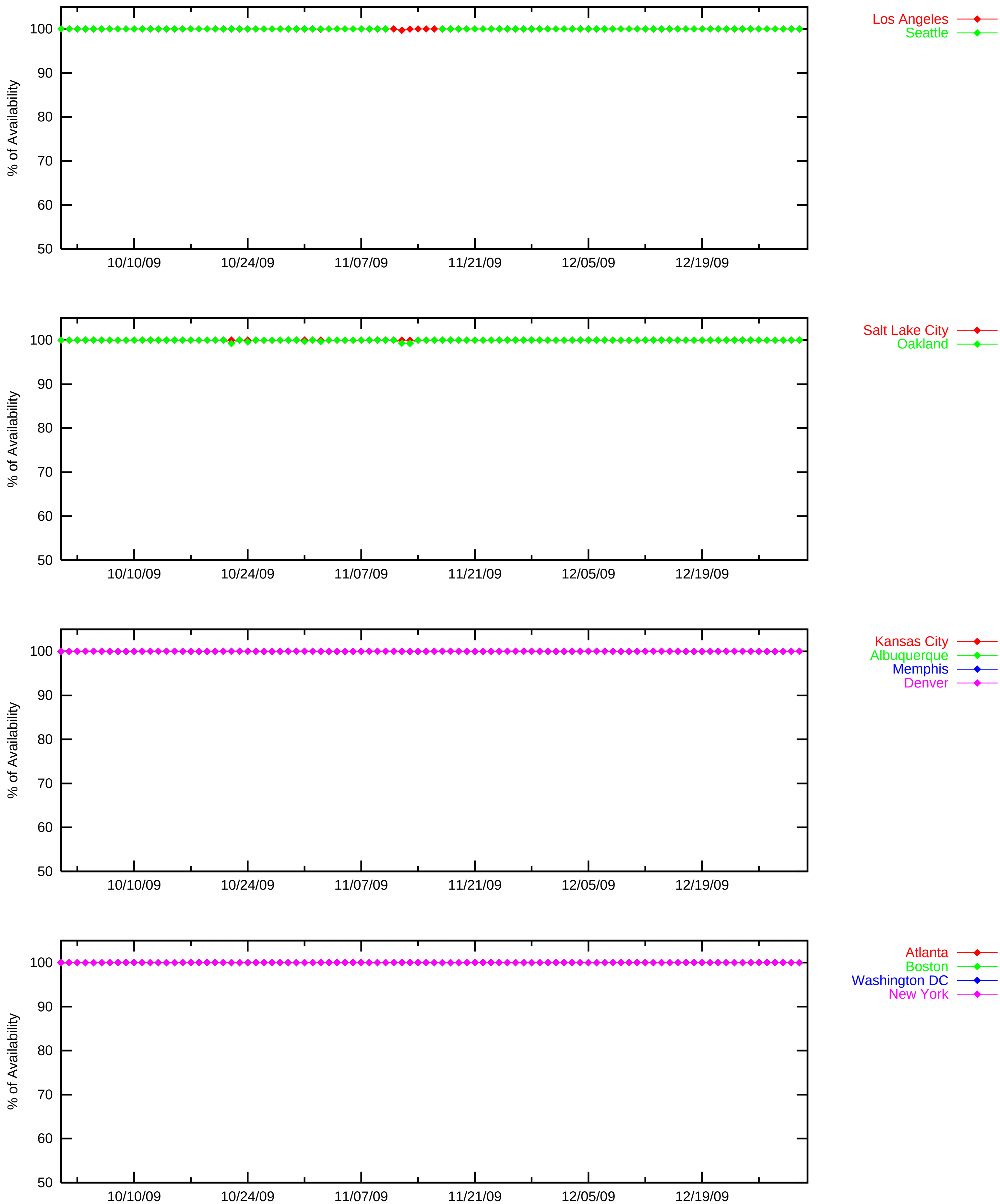
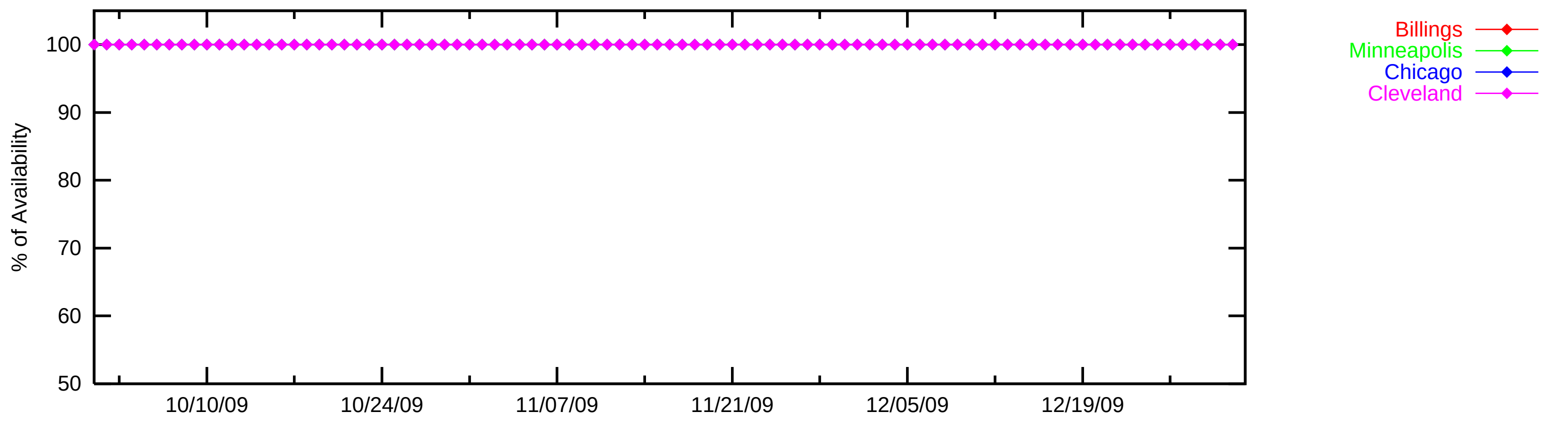
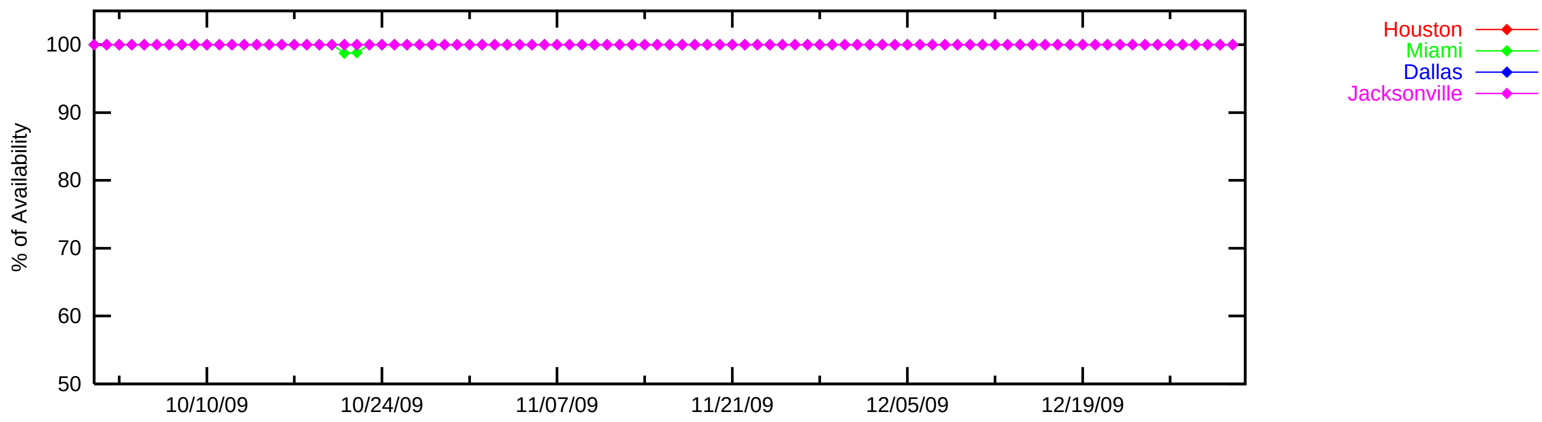
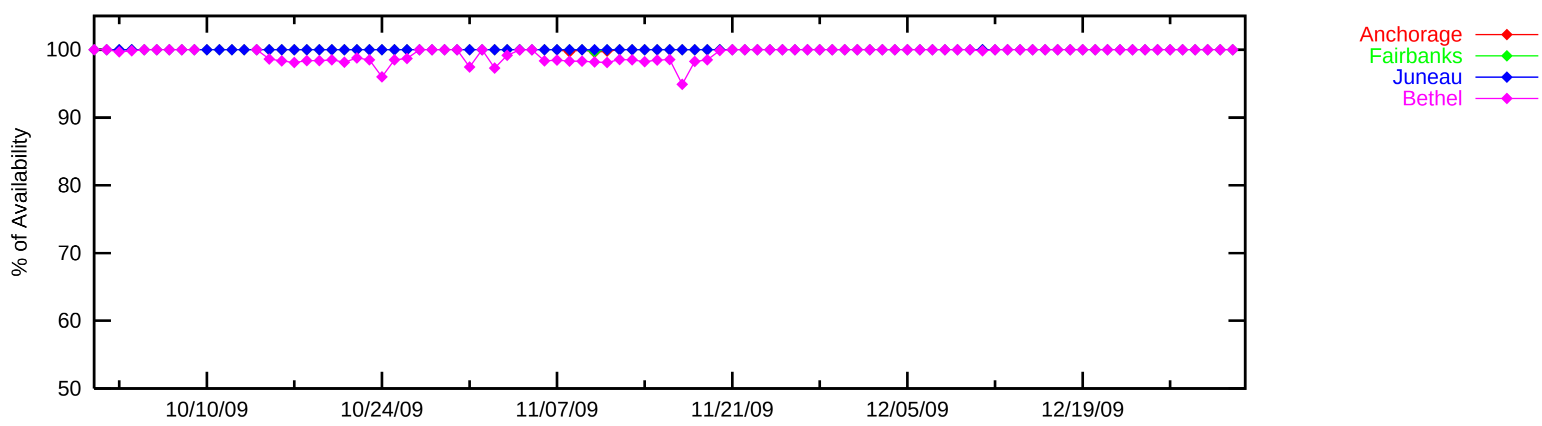


Figure 3-2 LPV Instantaneous Availability (HAL = 40m & VAL=50m)







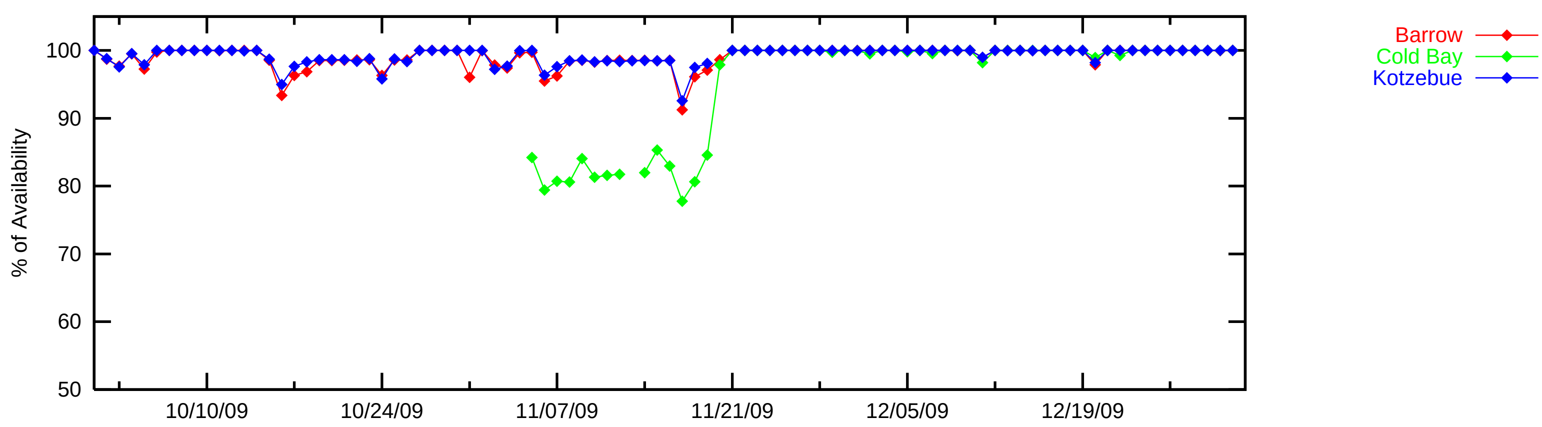
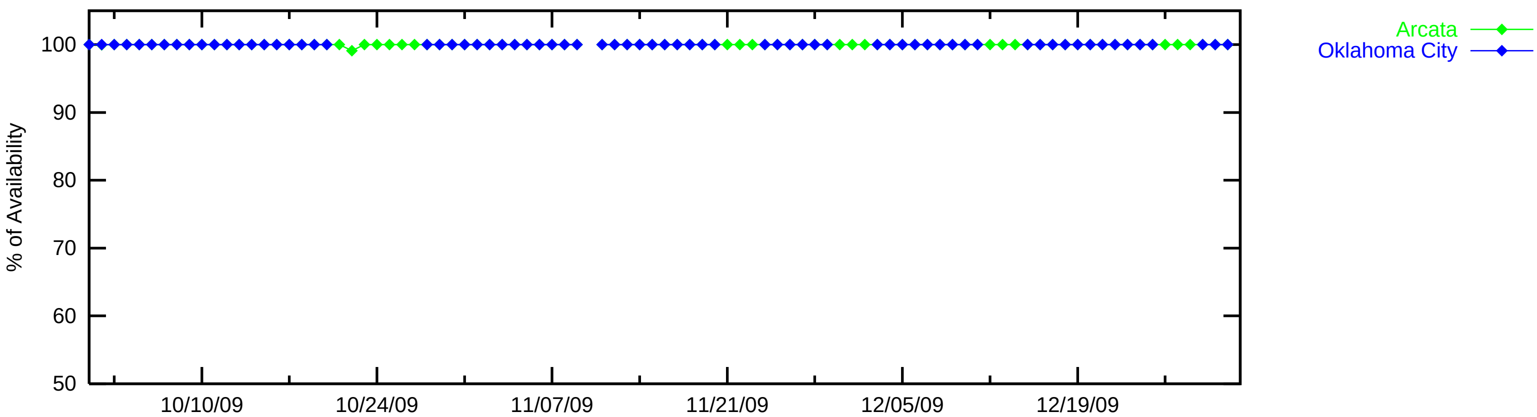
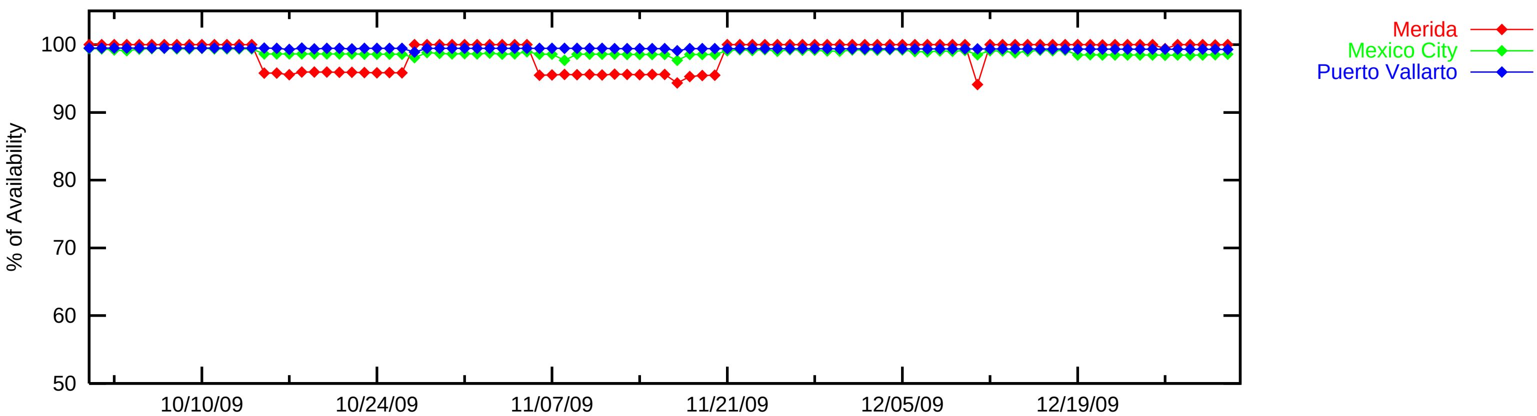
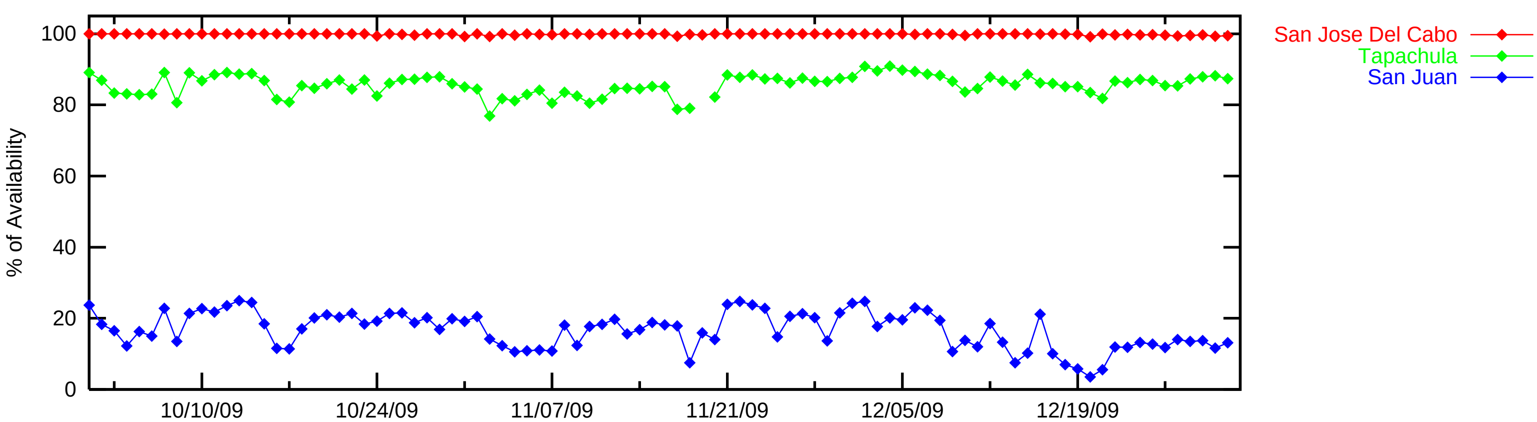


Figure 3-3 LPV Instantaneous Availability (HAL = 40m & VAL=50m)







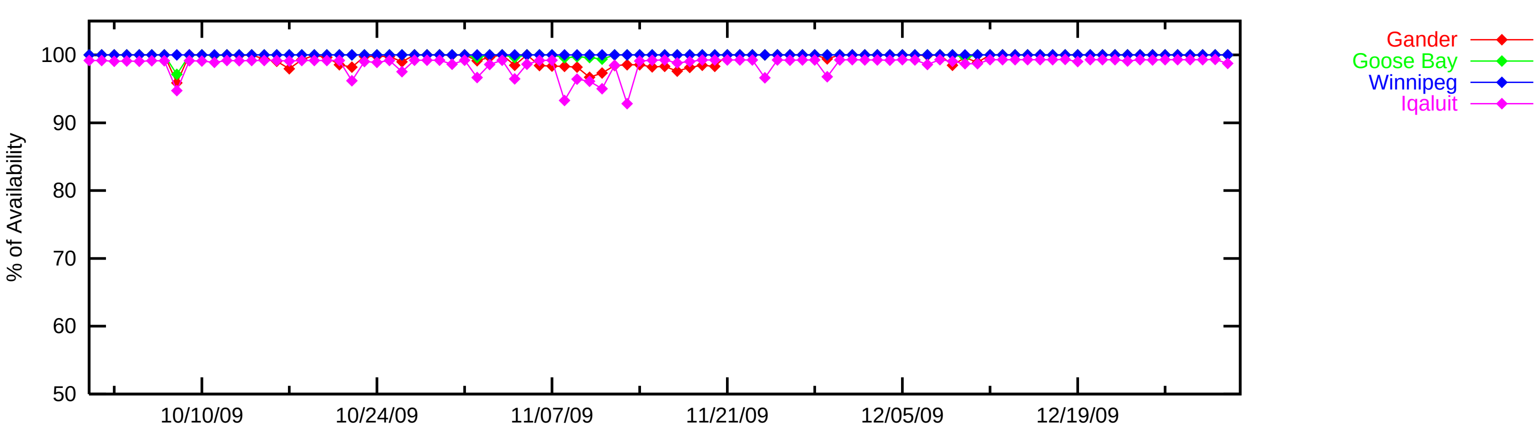
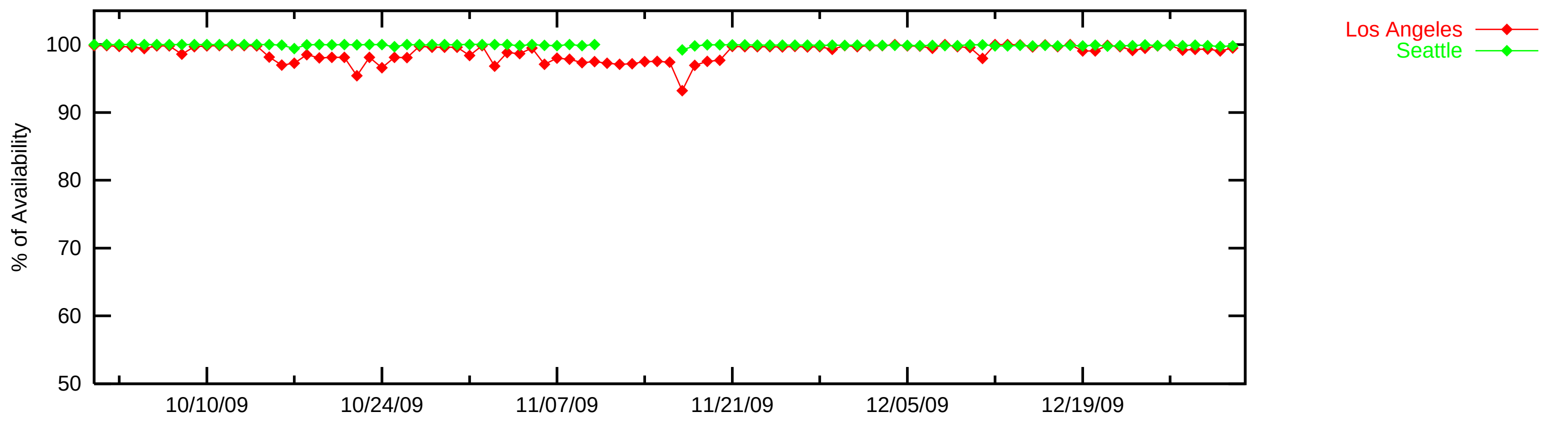
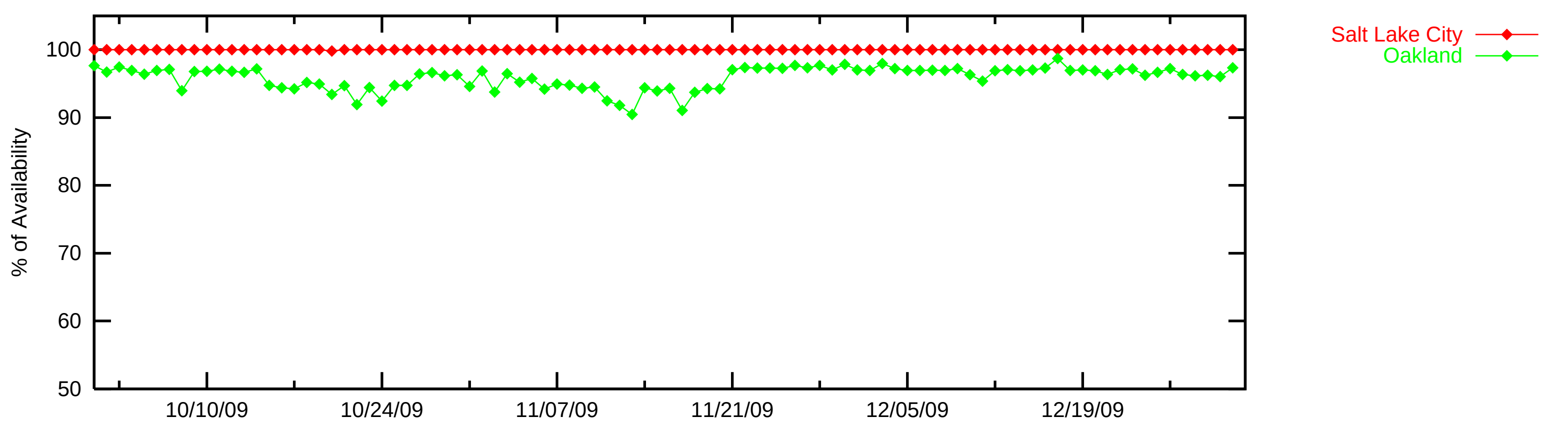
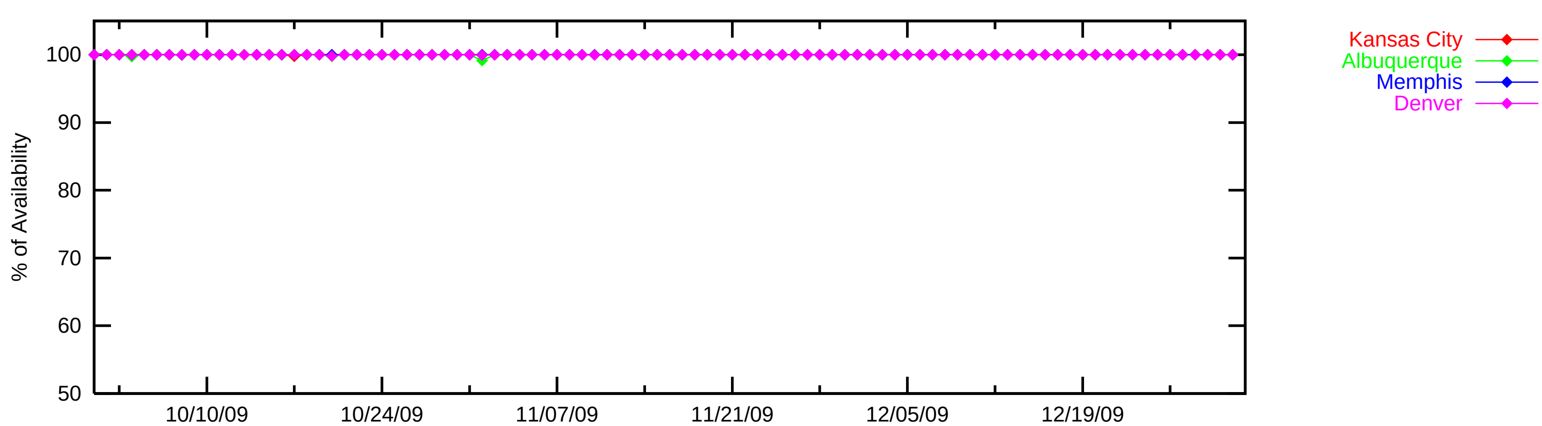


Figure 3-4 LPV 200 Instantaneous Availability (HAL = 40m & VAL=35m)







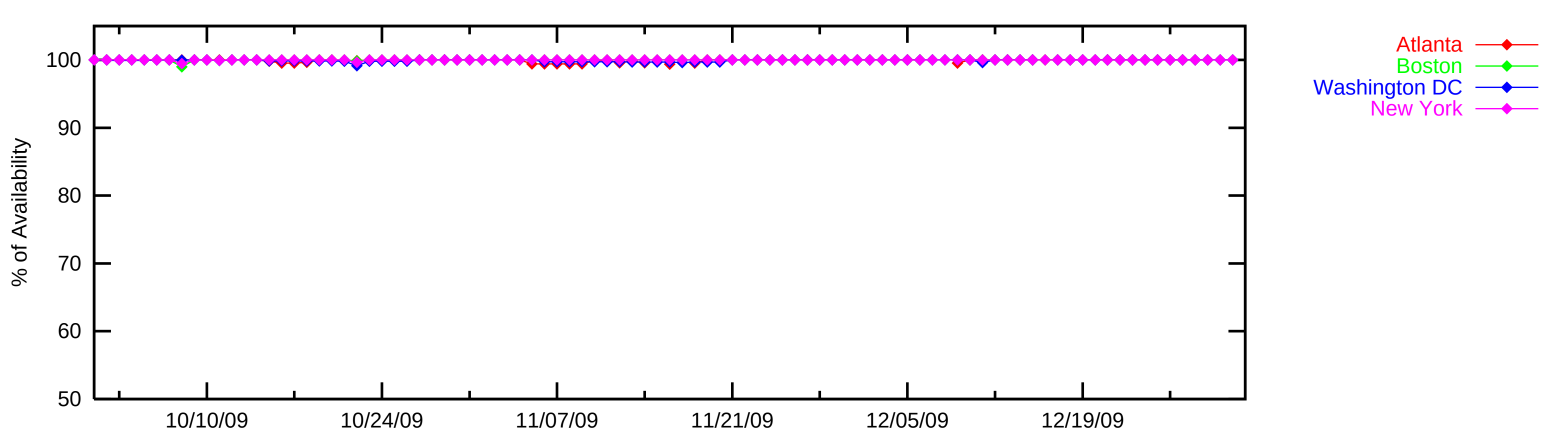


Figure 3-5 LPV 200 Instantaneous Availability (HAL = 40m & VAL=35m)

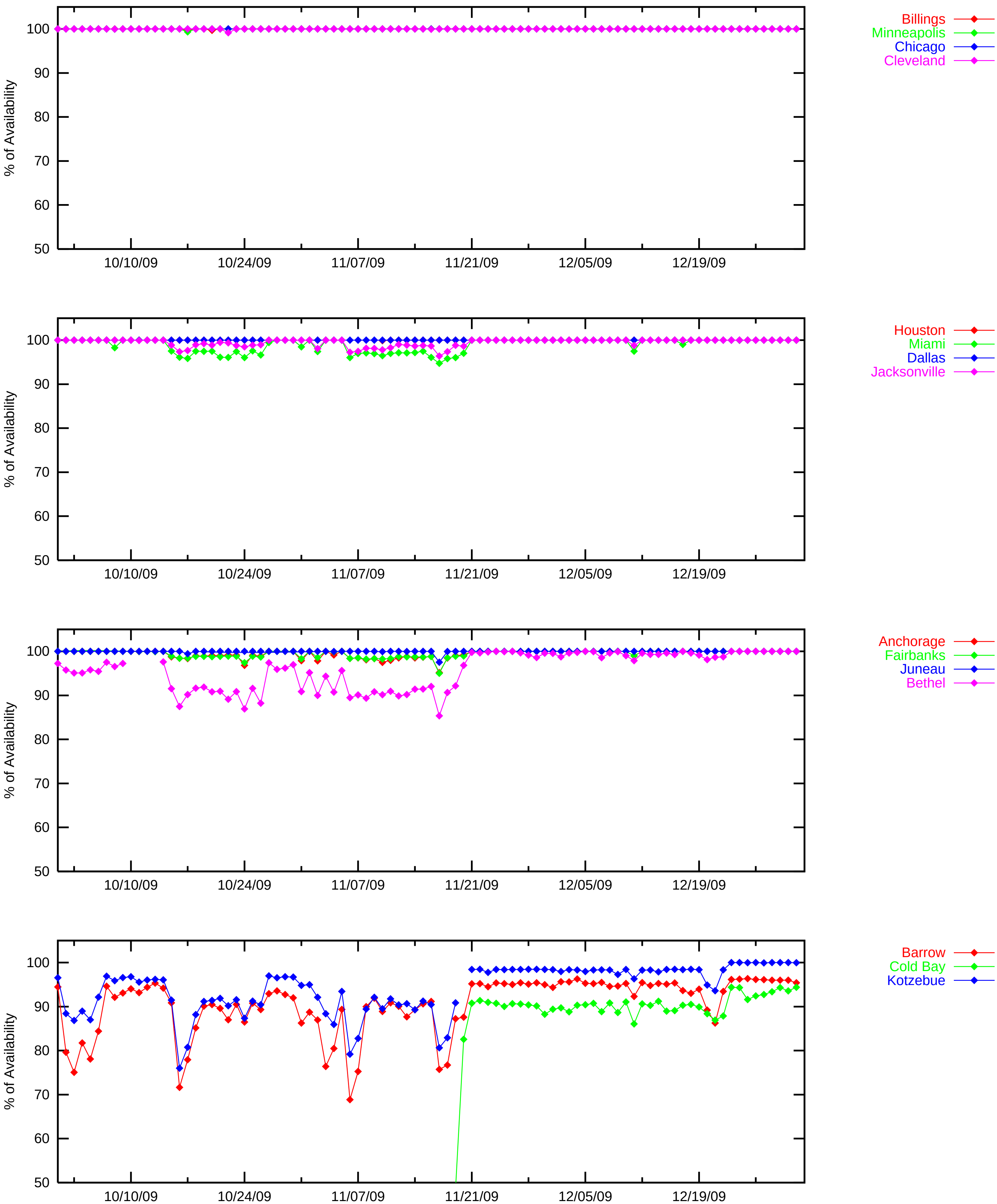


Figure 3-6 LPV 200 Instantaneous Availability (HAL = 40m & VAL=35m)

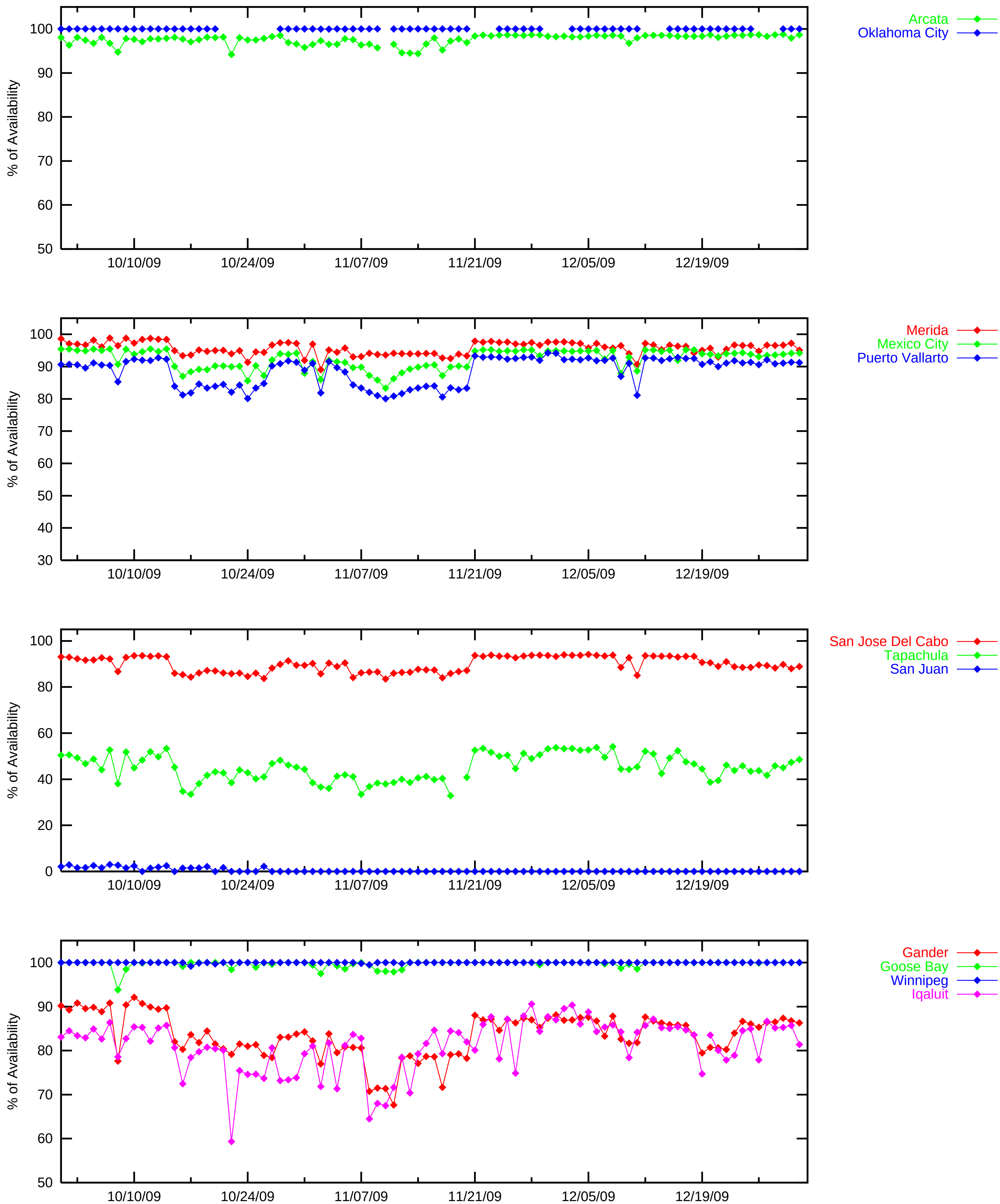
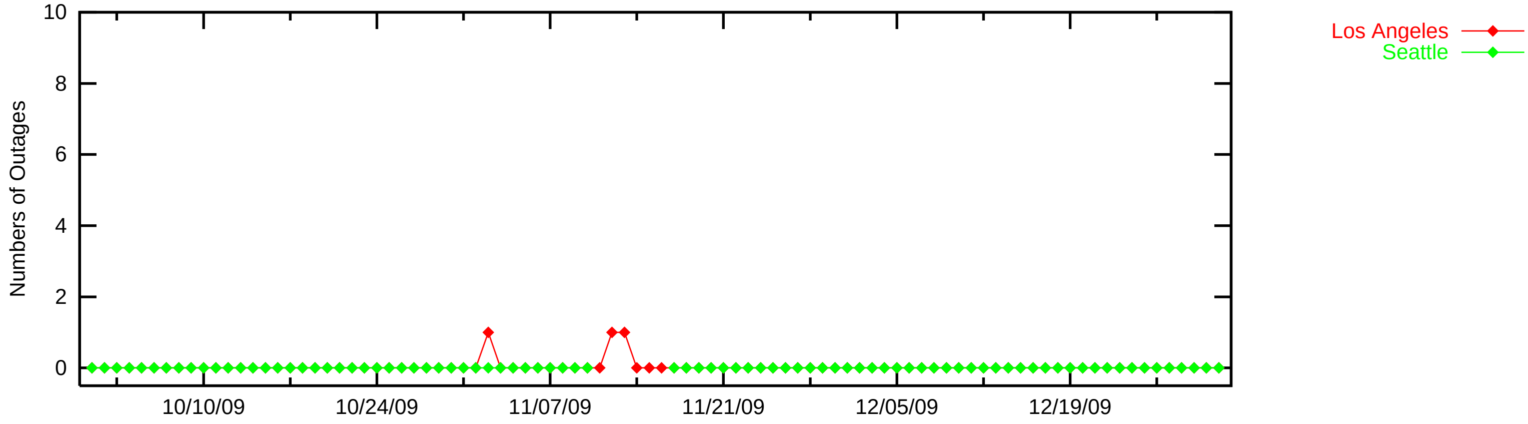
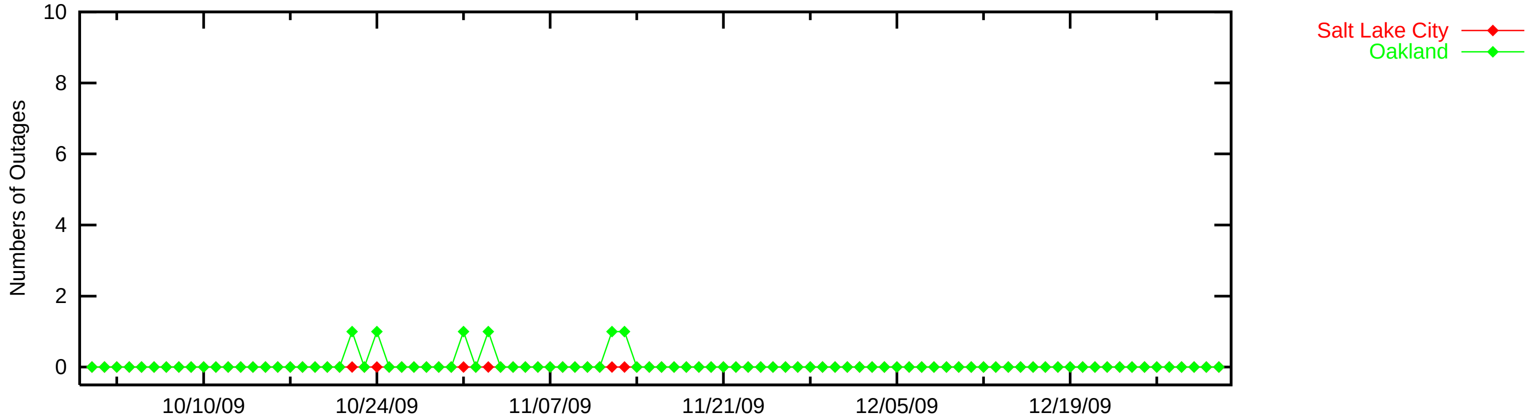
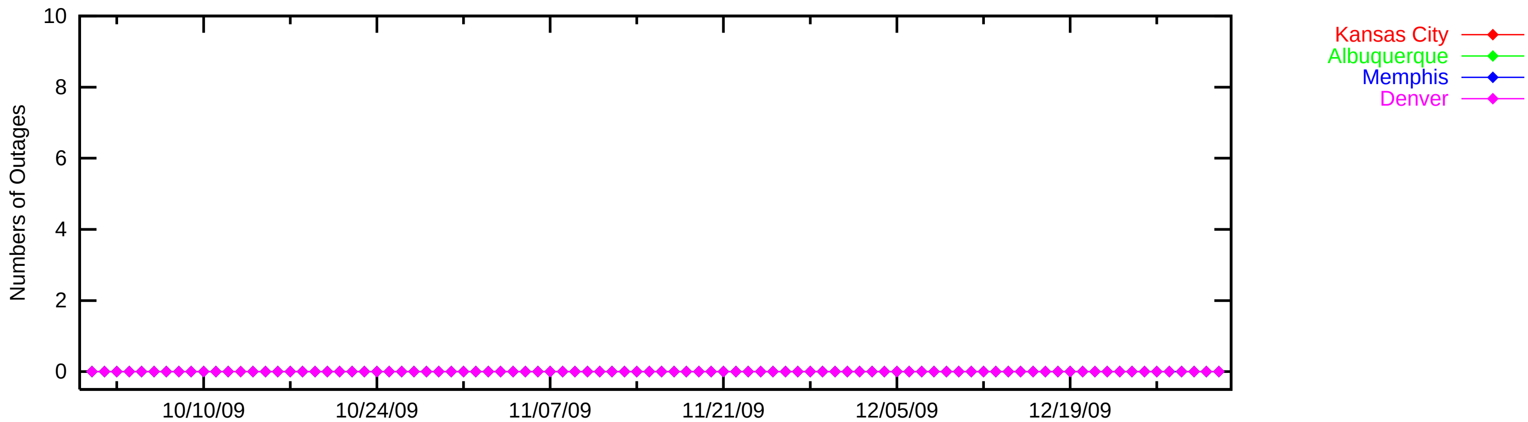


Figure 3-7 LPV Outages (HAL = 40m & VAL=50m)







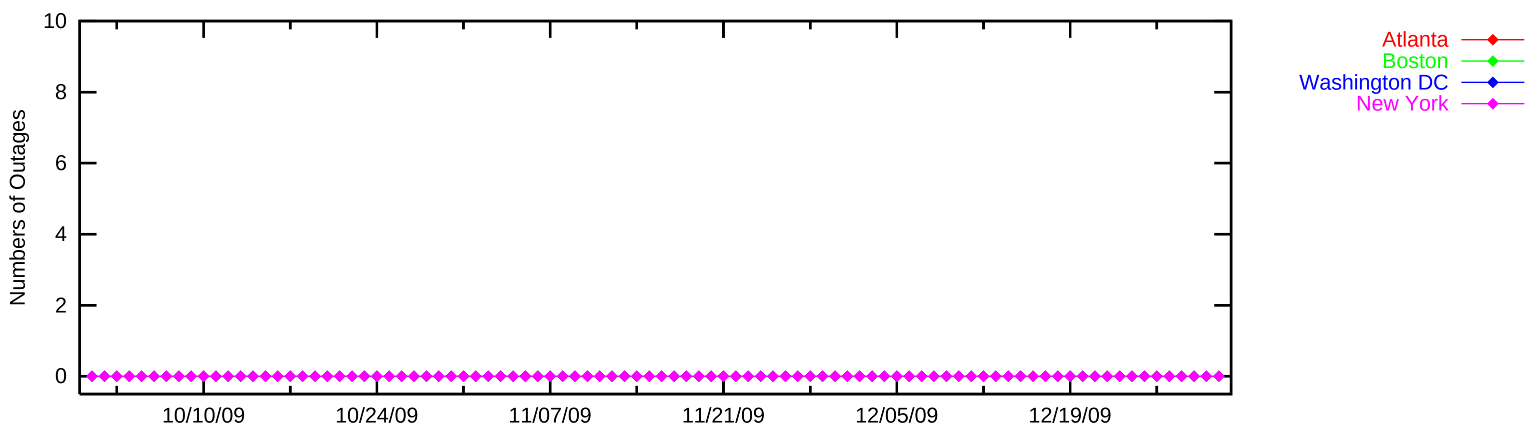


Figure 3-8 LPV Outages (HAL = 40m & VAL=50m)

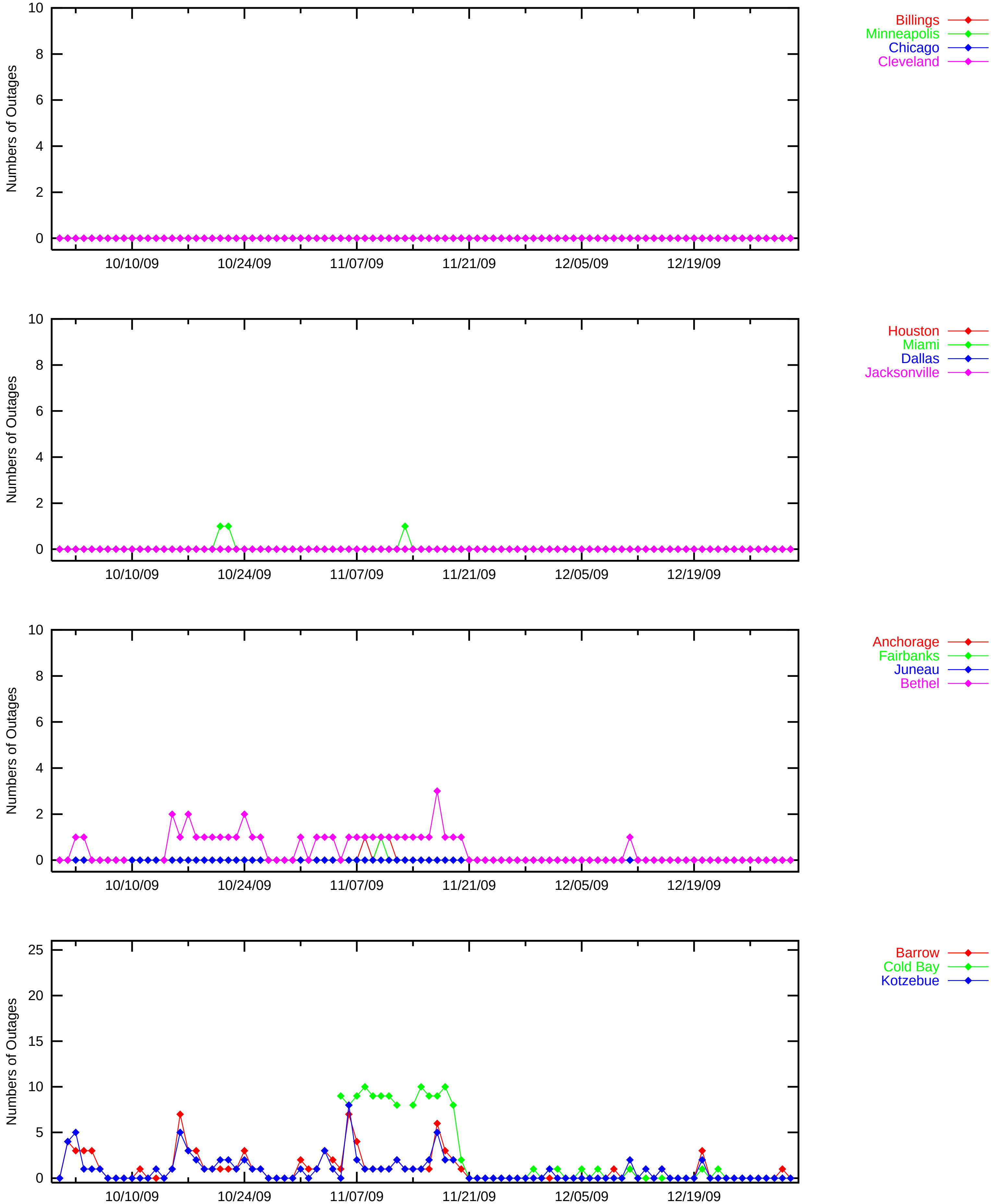


Figure 3-9 LPV Outages (HAL = 40m & VAL=50m)

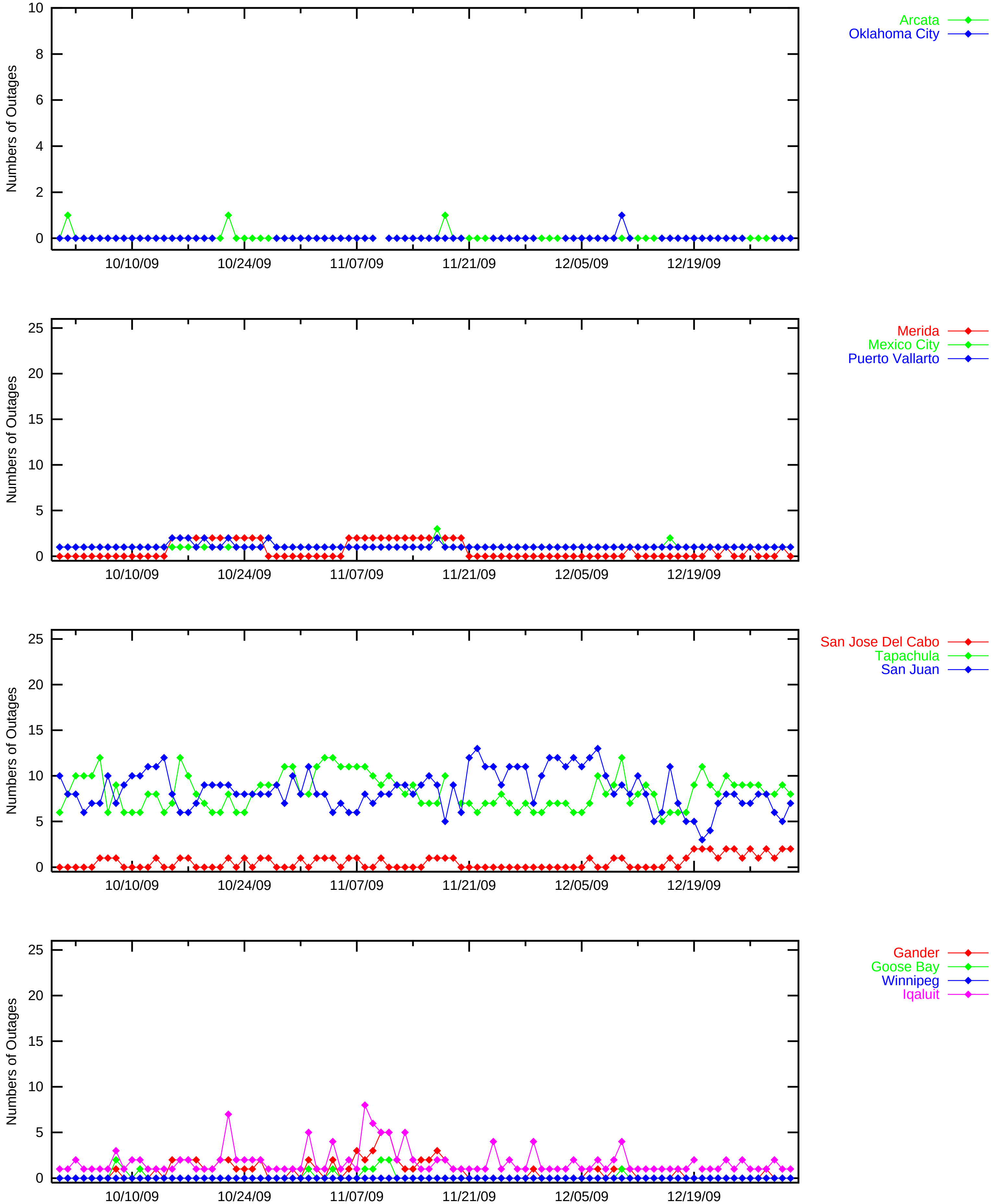


Figure 3-10 LPV 200 Outages (HAL = 40m & VAL=35m)

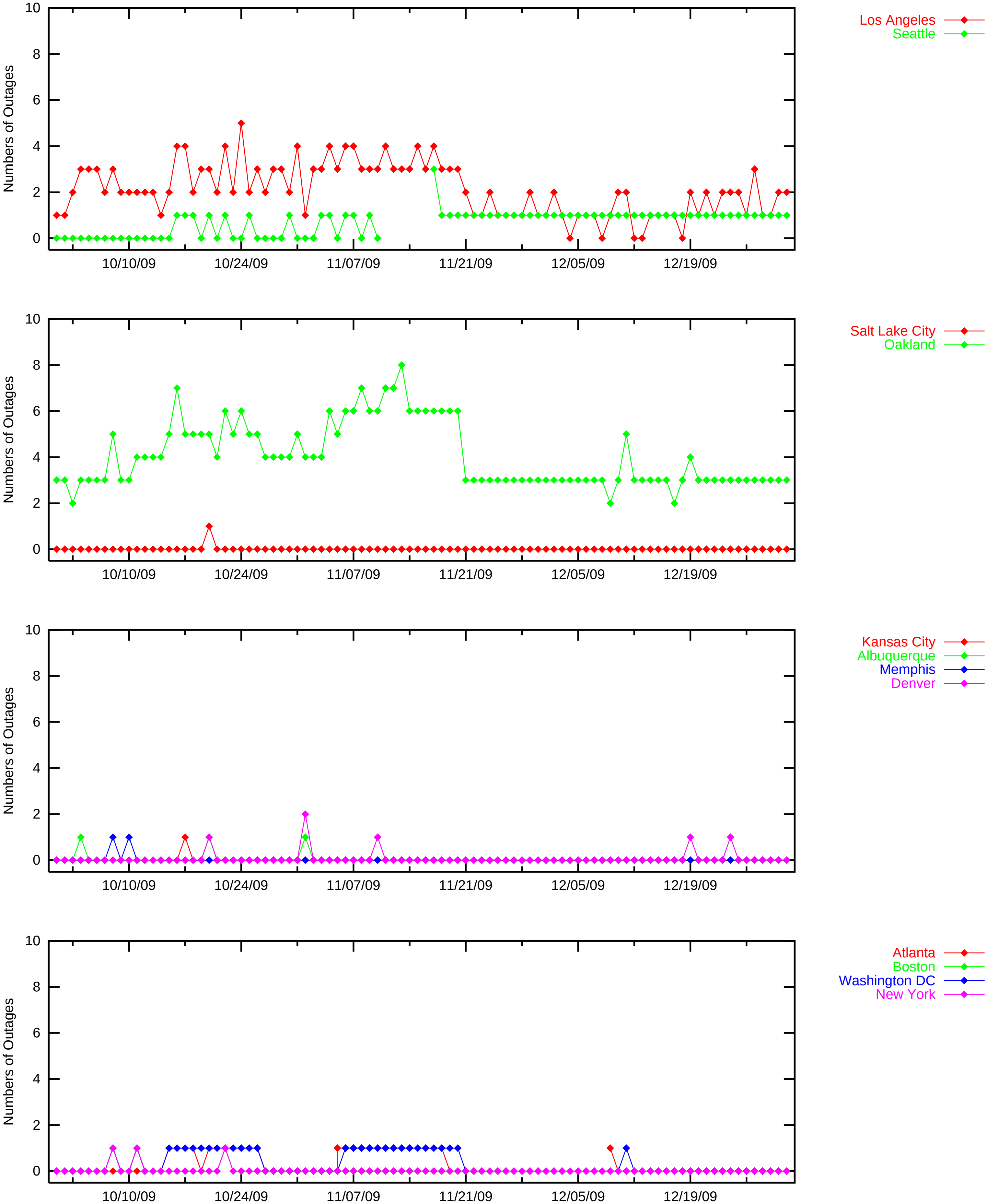
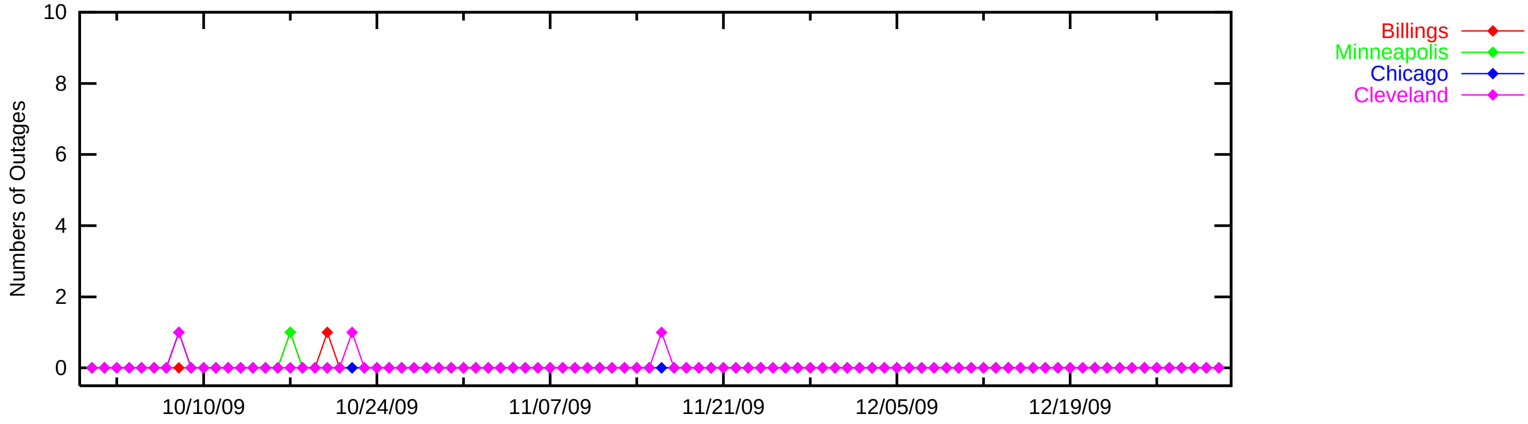
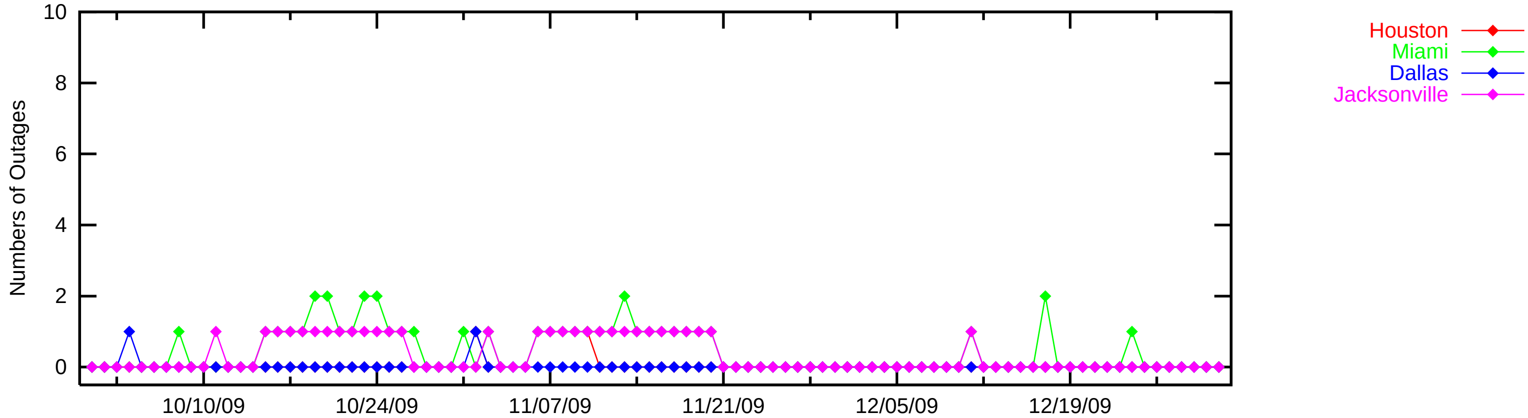
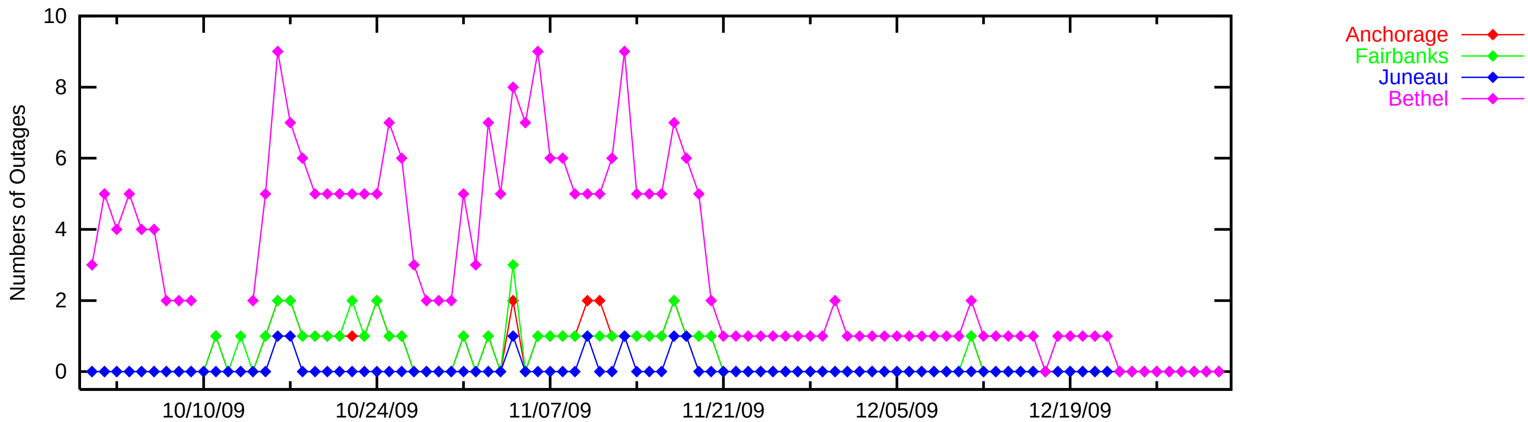


Figure 3-11 LPV 200 Outages (HAL = 40m & VAL=35m)







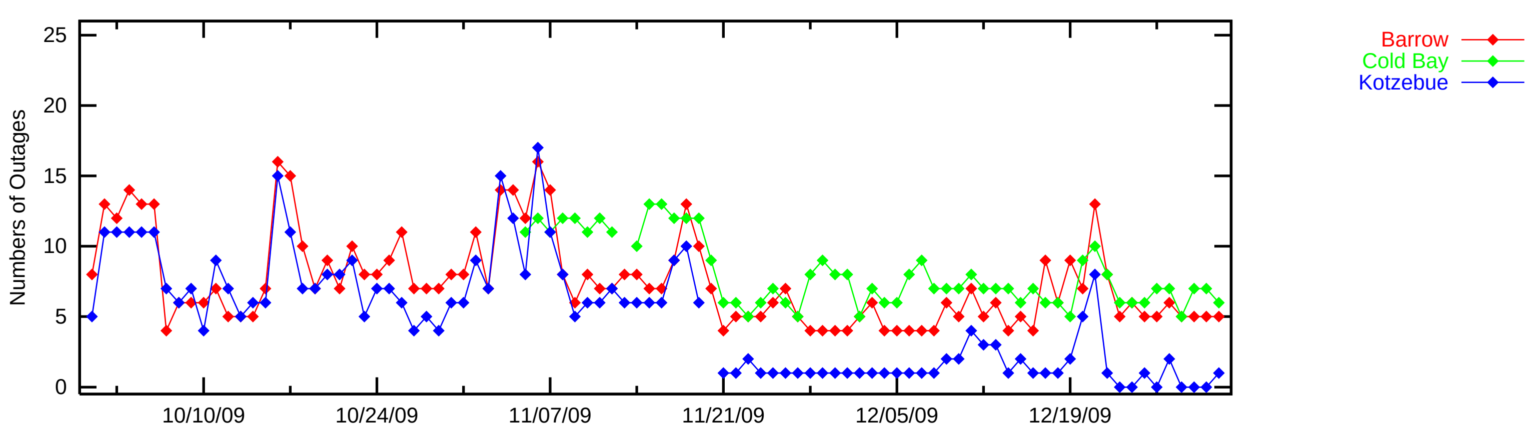
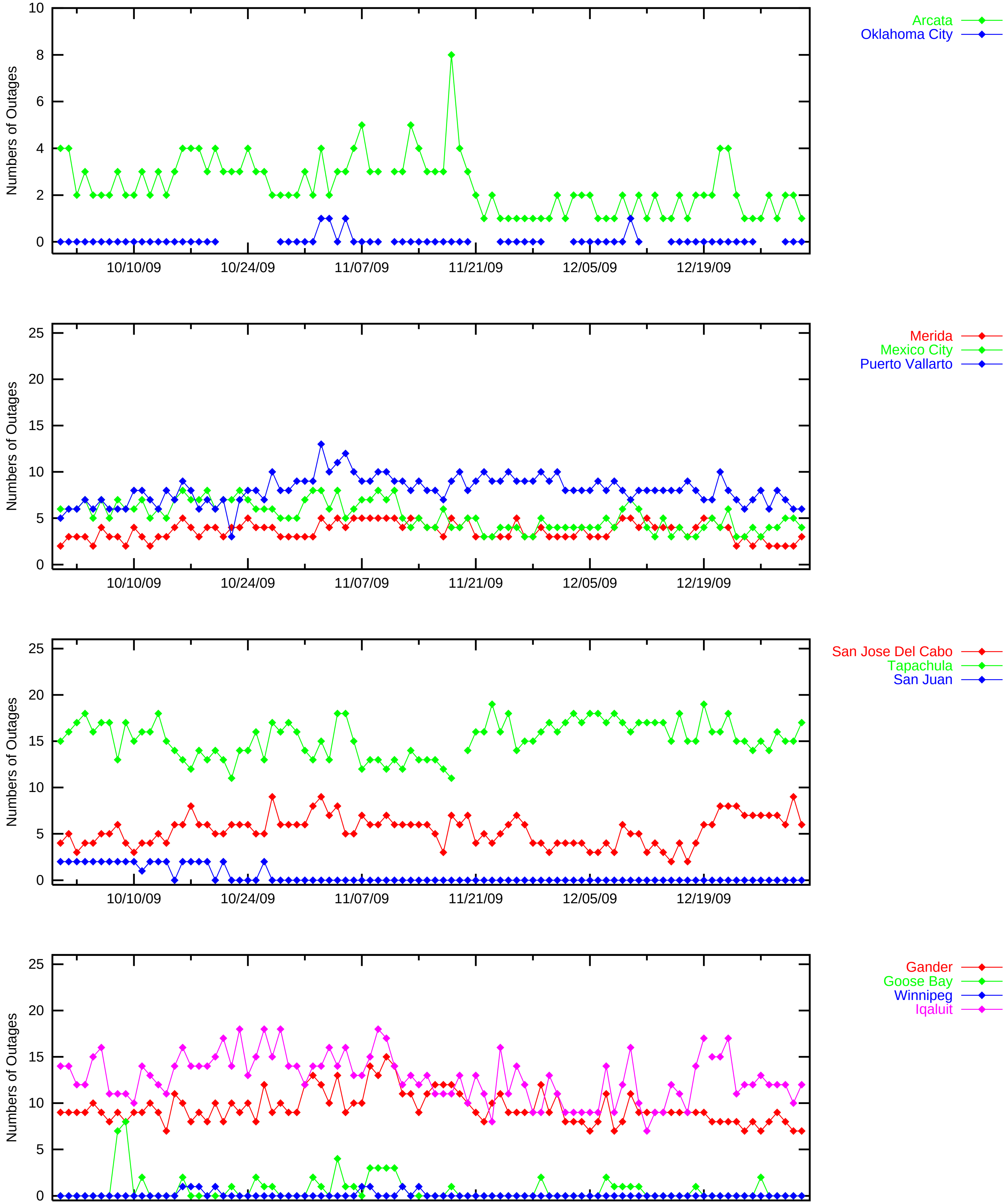


Figure 3-12 LPV 200 Outages (HAL = 40m & VAL=35m)



4.0 COVERAGE

WAAS coverage area evaluation estimates the percent of service volume where WAAS is providing LPV, LPV 200, and NPA services. The WAAS message and the GPS/GEO satellite status are used to determine WAAS availability across North America. For PA coverage, protection levels were calculated at 30-sec intervals and at one degree spacing over the PA service volume, while NPA coverage were calculated at 30-sec intervals and five degree spacing over the NPA service volume.

Daily analysis for PA was conducted for LP, LPV and LPV 200 service levels. LP service is available when HPL is less than 40 meters. LPV service is available when HPL is less than 40 metes and VPL is less than 50 meters. LPV 200 service is available when HPL is less than 40 metes and VPL is less than 35 meters. The coverage plots provide 100, 99.9, 99, 98 and 95% availability contours. Figure 4.1 shows the rollup LP North America coverage. Figure 4.2 shows the rollup LPV North America coverage. Figure 4.3 shows the rollup LPV 200 North America coverage. Figure 4.6 shows the daily LPV and LPV 200 CONUS coverage, and Figure 4.7 shows the daily LPV Alaska coverage at 99% availability and ionosphere KP index values for this quarter. Please see Appendix B for coverage plots of 99% LPV 200 availability contour and 98% LPV availability contour.

Daily analysis for NPA was conducted for RNP 0.1 and RNP 0.3 service levels based on a 100% availability requirement. RNP 0.1 service is available when HPL is less than 185 meters and RNP 0.3 service is available when HPL is less than 556 meters. The NPA coverage plots provide 100, 99.9 and 99% availability contours. Figure 4.4 shows the rollup RNP 0.1 coverage and Figure 4.5 shows the rollup RNP 0.3 coverage for the quarter. Figure 4.8 shows the daily RNP coverage at 100% availability and ionosphere Kp index values for this quarter.

During this evaluation period, low PA and NPA coverage are mainly due to satellite outages and GUS switchovers. Please refer to Table 1.4 for events that affected coverage. PRN 24 outage from 10/1/09 to 12/24/09 led to a reduction in Alaska PA coverage. PRN 8 outage from 10/8/09 to 11/6/09, from 10/31/09 to 11/2/09, and 12/11/09 caused significant drop in both CONUS and Alaska PA coverage (see DR#87 PRN 8 NANU Affects WAAS Coverage). Low PA coverage on 10/31/09 and 11/2/09 is due to PRN 30 outage. Alaska LPV 200 coverage drop on 11/17/09 is due to a combination of PRN 8 outage, PRN 12 outage and CRW GUS switchover. Spikes in NPA coverage are due to CRW GUS switchovers and satellite outages.

Figure 4-1 LP North America Coverage for the Quarater

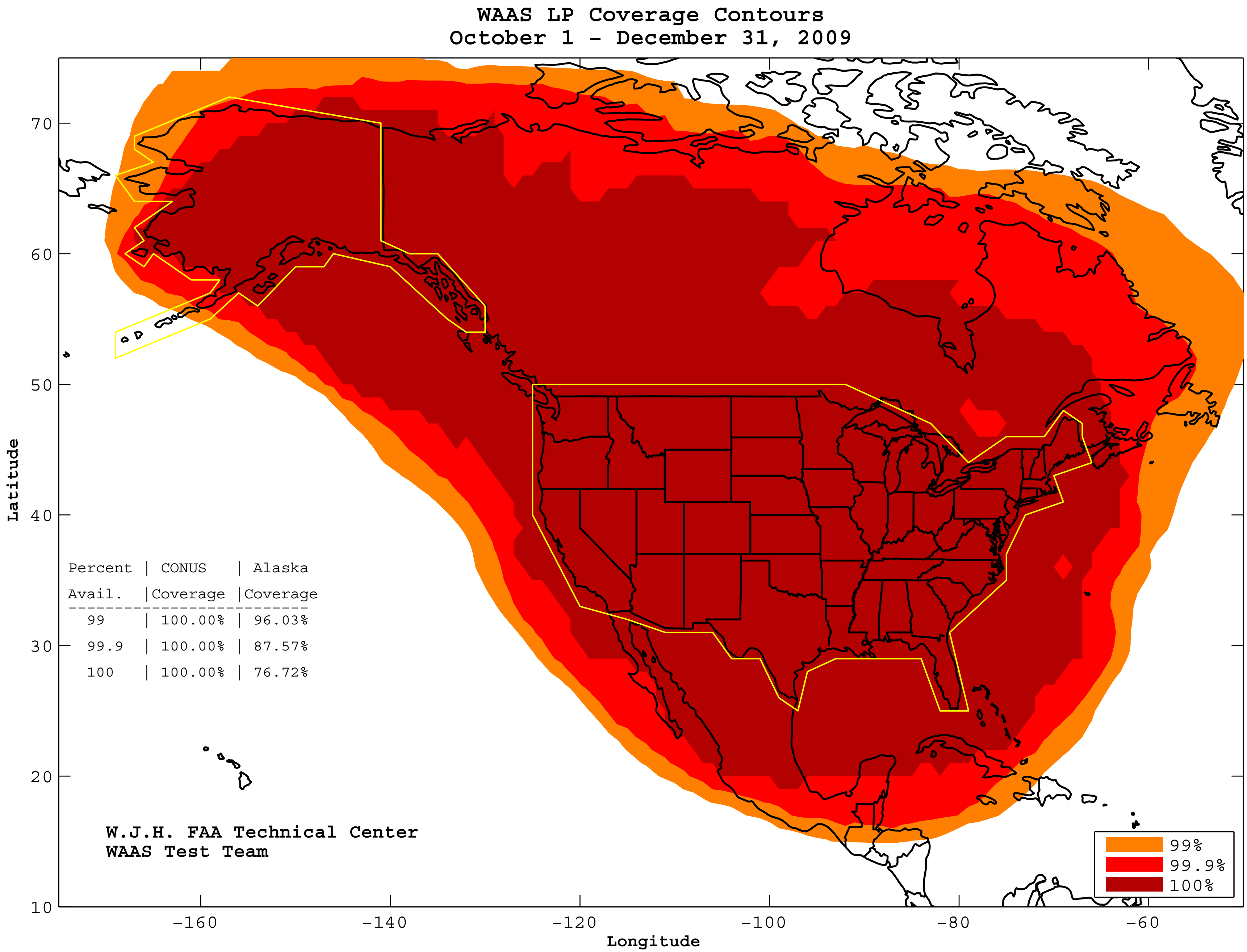


Figure 4-2 LPV North America Coverage for the Quarter

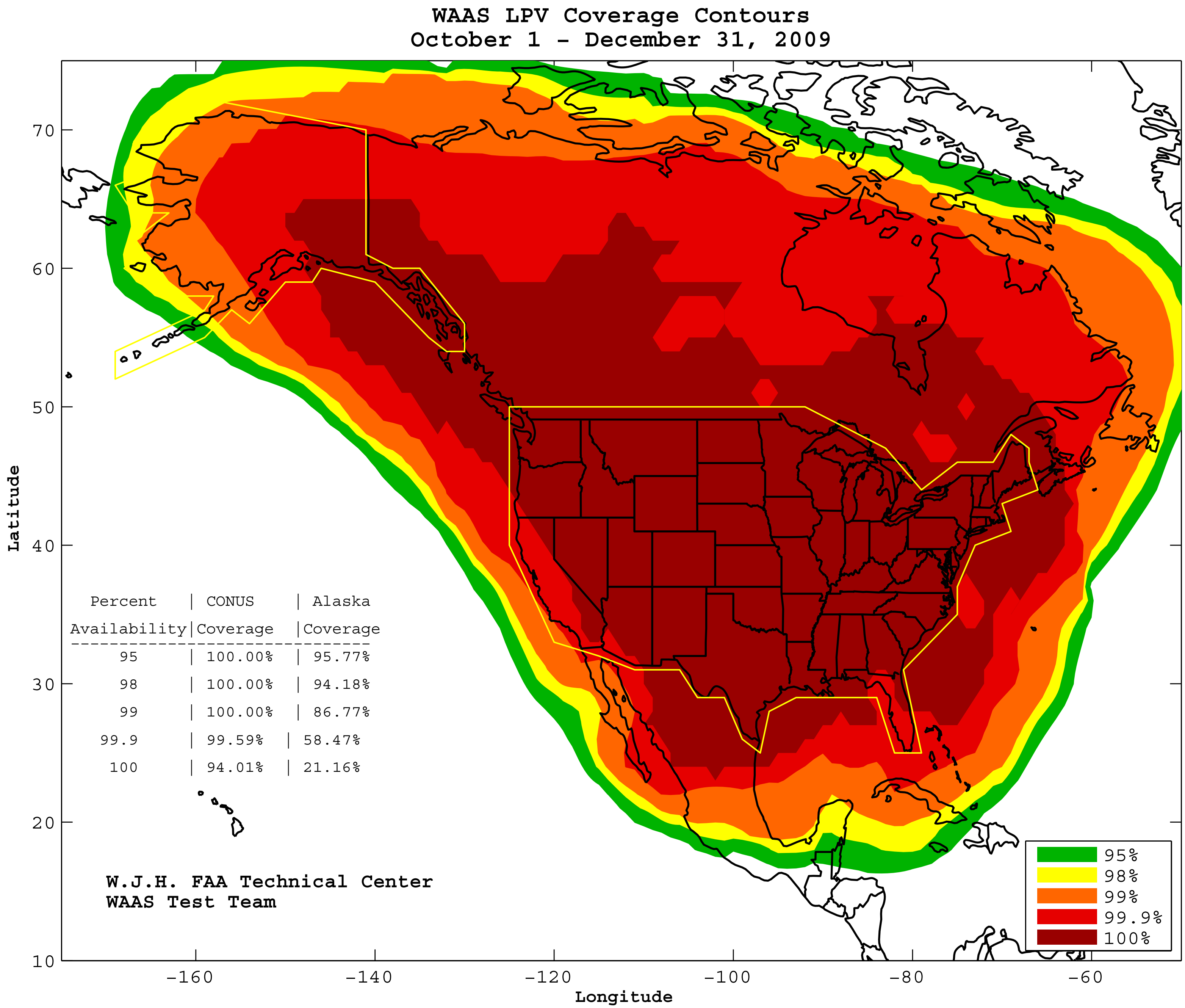


Figure 4-3 LPV 200 North America Coverage for the Quarter

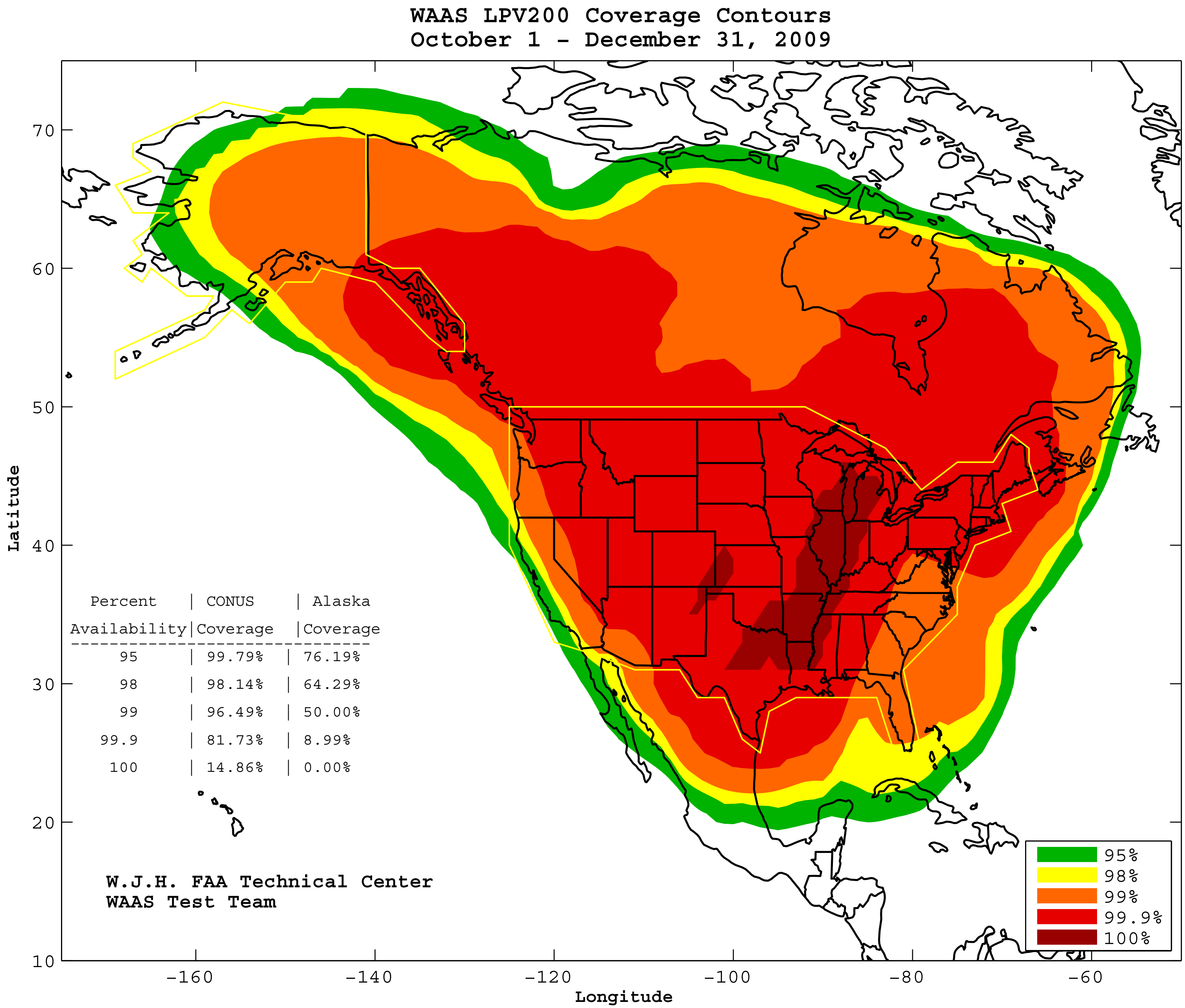


Figure 4-4 RNP 0.1 World Coverage for the Quarter

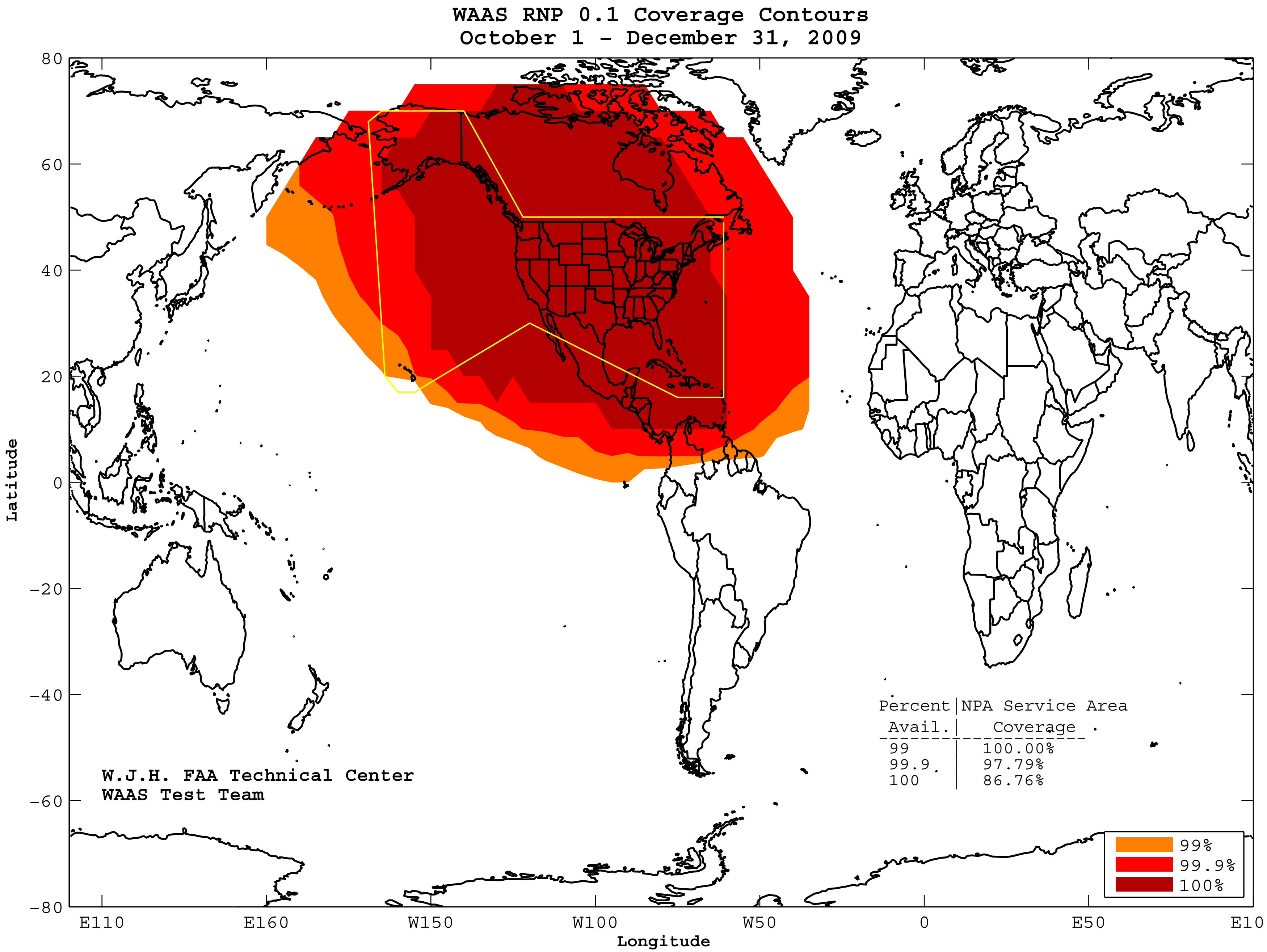


Figure 4-5 RNP 0.3 World Coverage for the Quarter

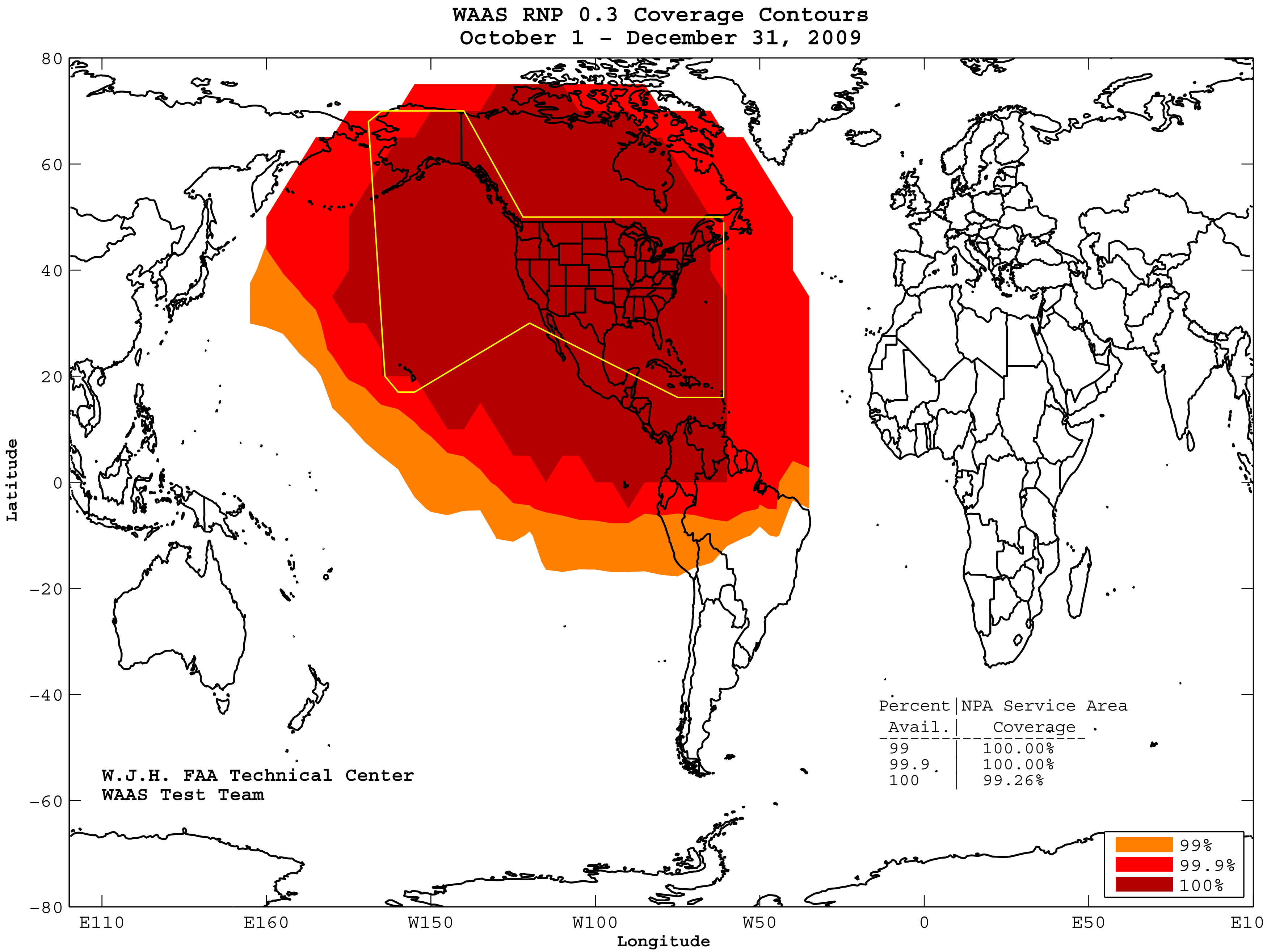


Figure 4-6 Daily LPV and LPV 200 CONUS Coverage

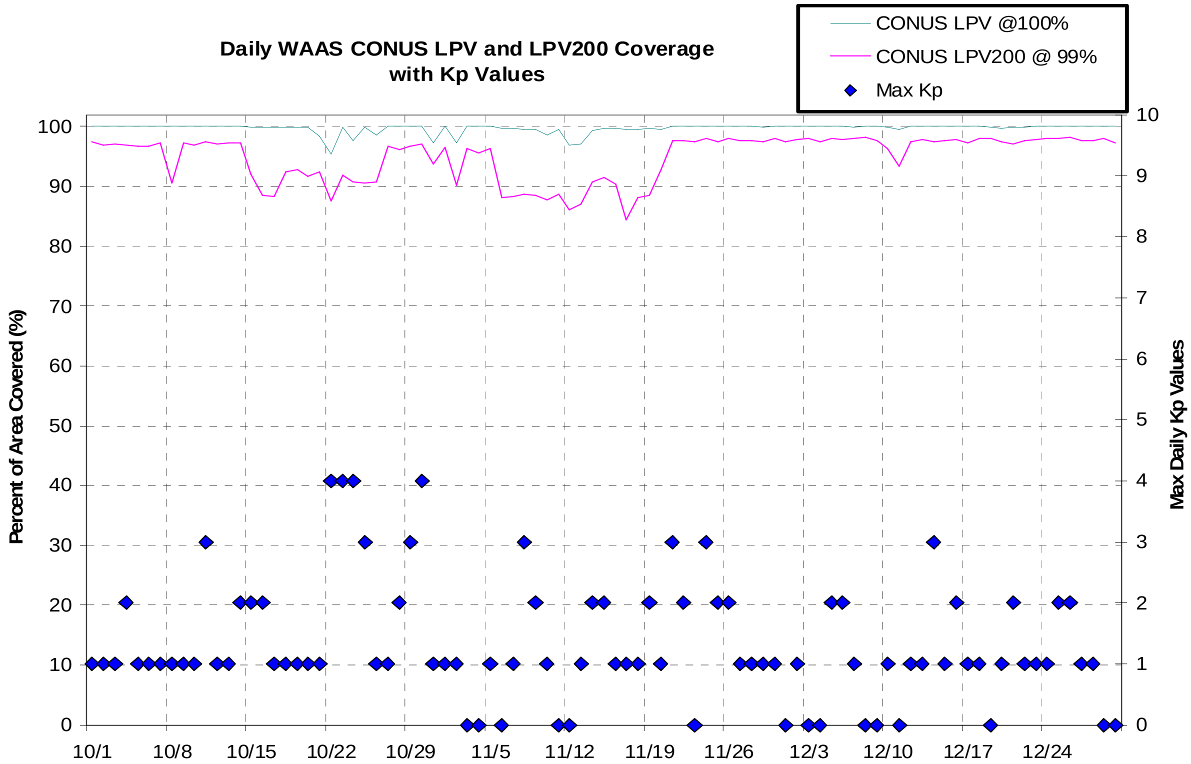


Figure 4-7 Daily LPV Alaska Coverage

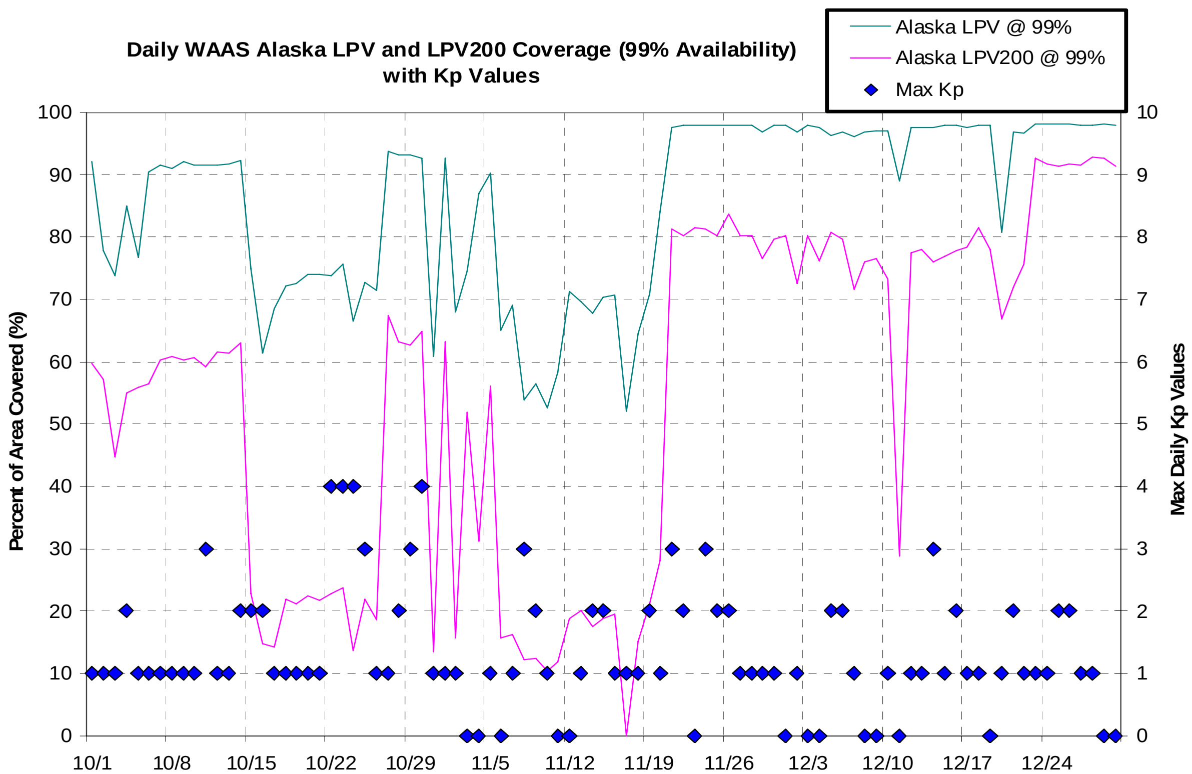
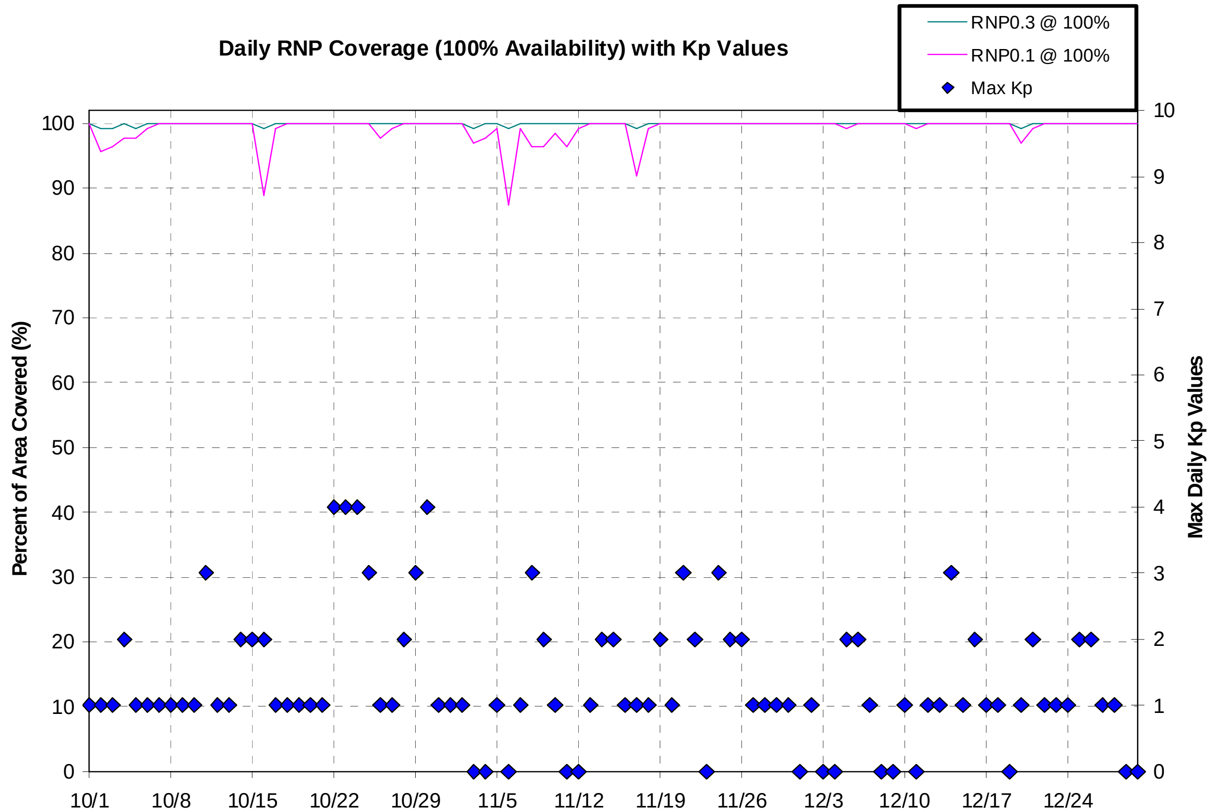


Figure 4-8 Daily RNP Coverage



5.0 INTEGRITY

5.1 HMI Analysis

Analysis of integrity includes the identification and evaluation of HMI (hazardously misleading information), as well as the generation of a safety index to illustrate the margin of safety that WAAS protection levels are providing. The safety index is a metric that shows how well the protection levels are bounding the maximum observed error when LPV service is available. The process for determining this index involves dividing the protection limit observed by the maximum observed error. An observed safety index of greater than one indicates safe bounding of the greatest observed error, less than one indicates that the maximum error was not bounded, and a result equal to one means that the error was equal to the protection level. An HMI occurs if the position error exceeds the protection level in the vertical or horizontal dimensions at any time and 6.2 seconds or more passes before this event is corrected by WAAS.

Table 5.1 lists the safety index and the number of HMIs. For this evaluation period, the lowest safety margin index is 4.52 at Oakland. There was no HMI event. Since WAAS was made available to the public in August 2000 there has not been an HMI event. WAAS was commissioned by the FAA for safety of life services in July 2003.

Table 5-1 Safety Margin Index and HMI Statistics

Location	Safety Index		Number of HMIs
	Horizontal	Vertical	
Arcata	4.62	5.09	0
Oklahoma City	5.12	4.67	0
Albuquerque	7.00	10.22	0
Anchorage	9.10	13.52	0
Atlanta	13.43	9.73	0
Barrow	5.53	5.07	0
Bethel	14.01	13.80	0
Billings	6.14	6.73	0
Boston	9.84	9.95	0
Chicago	6.06	7.75	0
Cleveland	6.03	5.76	0
Cold Bay	11.71	15.88	0
Dallas	6.32	8.28	0
Denver	5.88	5.13	0
Fairbanks	10.87	8.37	0
Gander	12.33	13.02	0
Goose Bay	10.79	9.68	0
Houston	10.54	4.73	0
Iqaluit	10.56	4.89	0
Jacksonville	7.00	5.22	0
Juneau	9.22	11.84	0
Kansas City	5.45	7.63	0
Kotzebue	16.80	10.24	0
Los Angeles	7.06	12.43	0
Memphis	13.15	10.44	0
Merida	8.69	8.32	0
Mexico City	17.10	14.09	0
Miami	6.59	5.71	0
Minneapolis	5.20	9.09	0
New York	7.70	6.83	0
Oakland	4.52	12.60	0
Puerto Vallarta	8.62	11.34	0
Salt Lake City	6.69	6.31	0
San Jose Del Cabo	9.15	11.16	0
San Juan	12.61	5.02	0
Seattle	5.43	5.34	0
Tapachula	10.76	12.18	0
Washington DC	13.83	8.35	0
Winnipeg	11.96	9.13	0

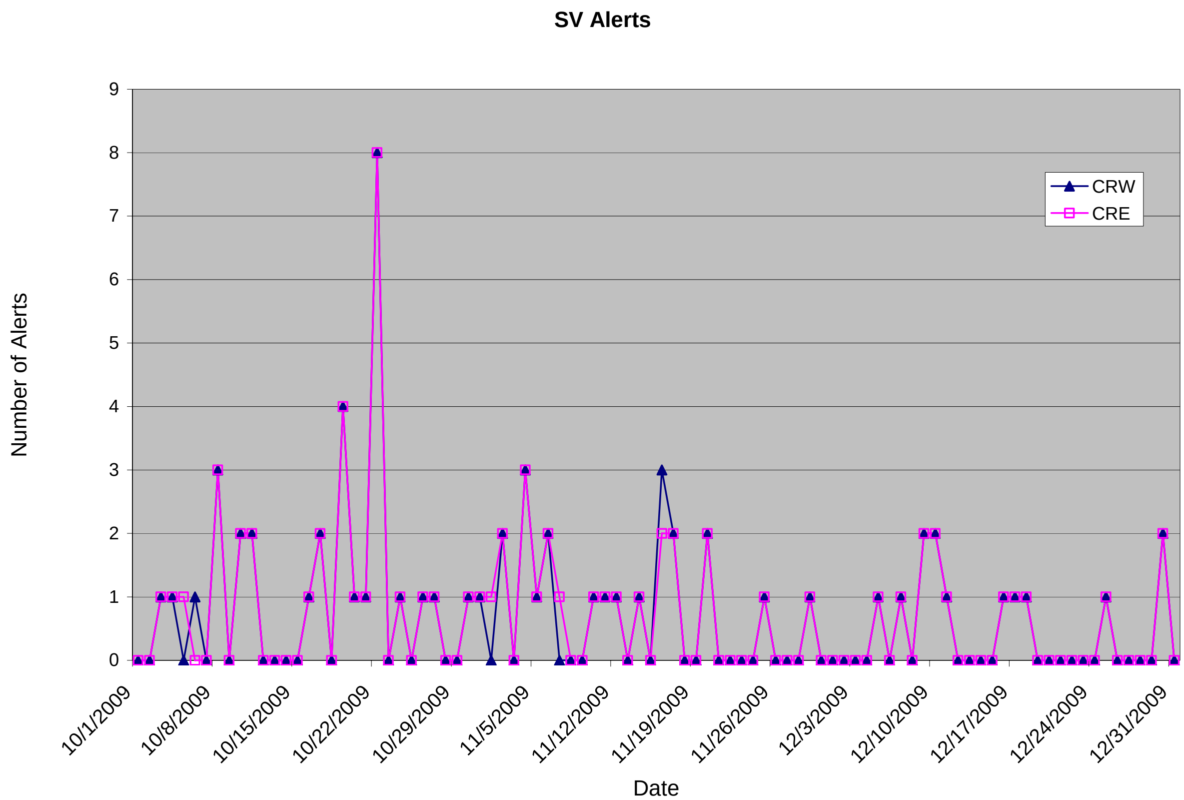
5.2 Broadcast Alerts

The WAAS transmits alert messages to protect the users from satellite degradation or severe ionospheric activity, both of which can cause unsafe conditions for a user. Space Vehicle (SV) alerts increase the User Differential Range Error (UDRE) of satellites, which can reduce the weighting of the satellite in the navigation solution, or completely exclude it from the navigation solution. An increase in UDRE's after an alert effectively increases the user protection levels (HPL and VPL), which affect the availability. Additionally, if an alert message sequence lasts for more than 12 seconds, WAAS fast corrections can time out, causing a loss of continuity. Table 5.2 shows the total number of alerts and the average number of alerts per day. Figure 5.1 shows the number of SV alerts that occurred daily during the reporting period. Often the number of alerts on one GEO is the same as the number of alerts on the other GEO. Therefore, lines tend to overlap in most points on this plot.

Table 5-2 WAAS SV Alert

	Number of Alerts		Average Alerts Per Day	
Message Type	**CRW**	**CRE**	**CRW**	**CRE**
2	17	18	0.1868	0.1978
3	28	25	0.3077	0.2747
4	21	23	0.2308	0.2527
5	0	0	0	0
6	0	0	0	0
24	0	0	0	0
26	0	0	0	0
Total Alerts	66	66	0.7253	0.7253

Figure 5-1 SV Daily Alert Trends



5.3 Availability of WAAS Messages (CRE and CRW)

For an accurate and current user position to be calculated, the content of the WAAS message must be broadcast and received within precise time specifications. This aspect of the WAAS is critical to maintaining integrity requirements. Each message type in the WAAS SIS has a specific amount of time for which it must be received anew. Although the content of every message is relevant to the functionality of the system, the importance of different messages varies along with the frequency with which they must be received. Table 5.3 lists the maximum intervals at which each message must broadcast to meet system requirements.

GUS switchovers or broadcast WAAS alerts can interrupt the normal broadcast message stream. If these events occur at a time when the maximum interval of a specific message is approaching, that message may be delayed, resulting in its late transmittal.

Late messages statistics reported during the quarter were mainly caused by GEO SIS outages, GUS switchovers and SV alerts except message type 7 and 10. Occasionally, message type 7 and 10 were late and they were not caused by GEO SIS outages, GUS switchovers or SV alerts. The lateness of type 7 and type 10 messages has little or no impact on user performance and safety.

Tables 5.4 to 5.8 show fast correction, long correction, ephemeris covariance, ionosphere correction, and ionospheric mask message rates statistics broadcasted on CRW. Table 5.9 to 5.13 show message rates statistics broadcasted on CRE.

Table 5-3 Update Rates for WAAS Messages

Data	**Associated Message Types**	**Maximum Update Interval** (seconds)	**En Route, Terminal, NPA Timeout** (seconds)	**Precision Approach Timeout** (seconds)
WAAS in Test Mode	0	6	N/A	N/A
PRN Mask	1	60	None	None
UDREI	2-6, 24	6	18	12
Fast Corrections	2-5, 24	See Table A-8 in RTCA DO-229C	See Table A-8 in RTCA DO-229C	See Table A-8 in RTCA DO-229C
Long Term Corrections	24, 25	120	360	240
GEO Nav. Data	9	120	360	240
Fast Correction Degradation	7	120	360	240
Weighting Factors	8	120	240	240
Degradation Parameters	10	120	360	240
Ionospheric Grid Mask	18	300	None	None
Ionospheric Corrections	26	300	600	600
UTC Timing Data	12	300	None	None
Almanac Data	17	300	None	None

Table 5-4 WAAS Fast Correction and Degradation Message Rates – CRW

Message Type	**On Time**	**Late**	**Max Late Length (seconds)**
1	105585	2	1504
2	1324500	55	1457
3	1324562	43	1456
4	1324531	50	1461
7	98336	4	1486
9	93130	1	1528
10	98268	4	1588
17	31505	3	1666

Table 5-5 WAAS Long Correction Message Rates (Type 24 and 25) - CRW

PRN	On Time	Late	Max Late Length (seconds)
2	48158	1	167
3	51523	0	0
4	48898	0	0
5	49280	0	0
6	52018	0	0
7	48543	0	0
8	33525	0	0
9	50664	0	0
10	49411	0	0
11	52610	0	0
12	49361	0	0
13	48345	0	0
14	48676	0	0
15	51785	0	0
16	49559	0	0
17	48154	0	0
18	48378	0	0
19	51718	0	0
20	50958	0	0
21	48076	0	0
22	49109	0	0
23	47607	0	0
24	4684	0	0
25	36810	0	0
26	47939	0	0
27	52810	0	0
28	49100	0	0
29	48474	0	0
30	50643	0	0
31	49121	0	0
32	48793	1	1534

Table 5-6 WAAS Ephemeris Covariance Message Rates (Type 28) – CRW

PRN	On Time	Late	Max Late Length (seconds)
2	39514	0	0
3	42326	1	192
4	40159	2	1643
5	40395	0	0
6	42724	1	121
7	39822	0	0
8	27552	1	121
9	41635	1	162
10	40549	2	130
11	43210	1	129
12	40537	1	209
13	39748	1	196
14	39974	0	0
15	42472	1	192
16	40673	0	0
17	39587	0	0
18	39677	1	206
19	42418	0	0
20	41859	0	0
21	39464	3	176
22	40337	6	216
23	39099	1	1552
24	3846	0	0
25	30207	5	240
26	39342	1	1571
27	43413	0	0
28	40334	4	312
29	39873	1	144
30	41652	1	208
31	40321	0	0
32	40098	0	0
135	75755	0	0
138	75277	2	1556

Table 5-7 WAAS Ionospheric Correction Message Rates (Type 26) – CRW

Band	Block	On Time	Late	Max Late Length (seconds)
0	0	27592	7	1719
0	1	27589	6	1739
0	2	27604	4	1629
1	0	27592	4	1642
1	1	27597	3	1647
1	2	27588	4	1653
1	3	27587	5	1700
1	4	27590	6	1714
2	0	27605	3	1689
2	1	27597	3	1696
2	2	27588	7	1714
2	3	27590	5	1708
2	4	27586	5	1708
2	5	27590	5	1712
3	0	27606	5	1696
3	1	27600	3	1684
3	2	27594	5	1684
9	0	27594	5	1689
9	1	27592	6	1943
9	2	27588	6	1953
9	3	27597	5	1959
9	4	27595	7	1960
9	5	27593	7	1667
9	6	27585	6	1659

Table 5-8 WAAS Ionospheric Mask Message Rates (Type 18) – CRW

Band	On Time	Late	Max Late Length (seconds)
0	35850	2	1852
1	35869	2	1509
2	35808	2	1769
3	35813	2	1846
9	35847	1	1715

Table 5-9 WAAS Fast Correction and Degradation Message Rates – CRE

Message Type	On Time	Late	Max Late Length (seconds)
0	51	6	337871
1	105988	156	523
2	1320268	1713	150
3	1320276	1703	156
4	1320239	1727	156
7	98726	155	463
9	92819	149	419
10	98763	164	366
17	31457	65	1020

Table 5-10 WAAS Long Correction Message Rates (Type 24 and 25) - CRE

PRN	On Time	Late	Max Late Length (seconds)
2	47937	93	346
3	51282	102	433
4	48690	97	407
5	49030	98	437
6	51765	102	424
7	48298	96	511
8	33318	91	360
9	50441	93	529
10	49197	92	418
11	52402	100	425
12	49171	86	602
13	48139	89	516
14	48481	93	433
15	51569	92	515
16	49359	87	512
17	47934	103	343
18	48154	90	433
19	51496	95	437
20	50720	104	522
21	47861	87	450
22	48920	90	443
23	47404	97	529
24	4680	0	0
25	36612	85	426
26	47743	95	348
27	52573	89	424
28	48851	103	433
29	48288	84	433
30	50435	98	515
31	48907	93	512
32	48596	89	346

Table 5-11 WAAS Ephemeris Covariance Message Rates (Type 28) – CRE

PRN	On Time	Late	Max Late Length (seconds)
2	39286	95	522
3	42135	86	528
4	39986	79	521
5	40203	82	520
6	42496	93	522
7	39618	87	419
8	27392	74	521
9	41411	94	528
10	40346	90	624
11	43052	76	521
12	40360	90	414
13	39577	78	523
14	39796	83	414
15	42315	79	521
16	40501	84	415
17	39368	88	521
18	39533	66	516
19	42206	87	419
20	41669	77	419
21	39283	88	624
22	40165	89	413
23	38934	79	420
24	3845	0	0
25	30045	71	521
26	39206	75	419
27	43192	93	517
28	40163	75	521
29	39681	89	624
30	41452	84	624
31	40095	92	416
32	39921	80	521
135	75009	152	516
138	75203	151	516

Table 5-12 WAAS Ionospheric Correction Message Rates (Type 26) – CRE

Band	Block	On Time	Late	Max Late Length (seconds)
0	0	27478	60	1440
0	1	27504	58	1440
0	2	27472	62	1440
0	3	0	1	6456
0	4	1	2	22200
1	0	27468	66	1444
1	1	27480	66	1728
1	2	27511	60	1152
1	3	27490	59	1165
1	4	27462	64	1159
1	5	0	1	39462
2	0	27495	52	1440
2	1	27486	64	1152
2	2	27485	58	1152
2	3	27484	62	1152
2	4	27491	57	1728
2	5	27475	63	1440
3	0	27489	61	871
3	1	27470	63	1152
3	2	27485	54	1440
3	3	0	2	35454
9	0	27488	55	1158
9	1	27486	54	1992
9	2	27522	49	1440
9	3	27456	69	1728
9	4	27462	63	1728
9	5	27503	51	1440
9	6	27492	55	1152

Table 5-13 WAAS Ionospheric Mask Message Rates (Type 18) - CRE

Band	On Time	Late	Max Late Length (seconds)
0	35821	83	881
1	35800	73	1146
2	35775	73	1466
3	35769	77	936
9	35874	65	1081

6.0 SV RANGE ACCURACY

Range accuracy evaluation computes the probability that the WAAS User Differential Range Error (UDRE) and Grid Ionospheric Vertical Error (GIVE) statistically bound 99.9% of the range residuals for each satellite tracked by the receiver. A UDRE is broadcast by the WAAS for each satellite that is monitored by the system and the 99.9% bound (3.29 sigma) of the residual error on a pseudorange after application of fast and long-term corrections is checked. The pseudorange residual error is determined by taking the difference between the raw pseudorange and a calculated reference range. The reference range is equal to the true range between the corrected satellite position and surveyed user antenna plus all corrections (WAAS Fast Clock, WAAS Long-Term Clock, WAAS Ionospheric delay, Tropospheric delay, Receiver Clock Bias, and Multipath). Since the true ionospheric delay and multipath error are not precisely known, the estimated variance in these error sources are added to the UDRE before the comparing it to the residual error.

GPS satellite range residual errors were calculated for twelve WAAS receivers during the quarter. Table 6.1 and 6.2 show the range error 95% index and 99.9% (3.29 sigma) bounding statistics for each SV at the selected locations. Figures 6.1 and 6.2 show the range error for each SV as measured by the WAAS receivers at the Washington DC reference station.

A GIVE is broadcast by the WAAS for each IGP that is monitored by the system and the 99.9% (3.29 sigma) bound of the ionospheric error is checked. The WAAS broadcasts the ionospheric model using IGP's at predefined geographic locations. Each IGP contains the vertical ionospheric delay and the error in that delay in the form of the GIVE. The ionospheric error is determined by taking the difference between the WAAS vertical ionospheric delay interpolated from the IGP's and GPS dual frequency measurement at that GPS satellite.

GPS satellite ionospheric errors were calculated for twelve WAAS receivers during the quarter. Table 6.3 and 6.4 show the ionospheric error 95% index and 99.9% (3.29 sigma) bounding statistics for each SV at the selected locations. Figures 6.3 and 6.4 show the ionospheric error for each SV as measured by the WAAS receiver at the Washington DC reference station.

Table 6-1 Range Error 95% index and 3.29 Sigma Bounding

Site →	Billings		Albuquerque		Boston		Washington DC		Houston		Kansas City	
SV ↓	95% Range Error	3.29 Sigma Bounding(%)	95% Range Error	3.29 Sigma Bounding(%)	95% Range Error	3.29 Sigma Bounding(%)	95% Range Error	3.29 Sigma Bounding(%)	95% Range Error	3.29 Sigma Bounding(%)	95% Range Error	3.29 Sigma Bounding(%)
1	-	-	-	-	-	-	-	-	-	-	-	-
2	1.472	100	1.284	100	1.904	100	1.886	100	2.321	100	2.082	100
3	0.986	100	1.480	100	1.233	100	1.203	100	1.436	100	1.361	100
4	1.624	100	1.900	100	1.278	100	1.268	100	1.980	100	1.708	100
5	1.796	100	1.651	100	1.388	100	1.914	100	1.727	100	1.425	100
6	1.708	100	1.726	100	1.267	100	1.373	100	2.001	100	1.505	100
7	1.594	100	1.587	100	1.218	100	1.005	100	1.279	100	1.349	100
8	1.217	100	1.273	100	1.096	100	1.034	100	1.144	100	1.239	100
9	1.275	100	1.334	100	1.346	100	0.910	100	1.432	100	1.075	100
10	1.112	100	1.063	100	1.079	100	1.282	100	1.720	100	1.573	100
11	0.961	100	1.248	100	1.036	100	1.307	100	1.783	100	0.790	100
12	1.344	100	1.406	100	1.321	100	0.942	100	1.354	100	1.559	100
13	1.382	100	1.494	100	1.154	100	1.013	100	1.591	100	1.360	100
14	1.119	100	1.175	100	1.313	100	1.254	100	1.313	100	0.935	100
15	1.399	100	1.482	100	1.783	100	1.542	100	1.817	100	1.611	100
16	0.900	100	0.925	100	1.094	100	1.034	100	1.758	100	1.154	100
17	2.280	100	1.675	100	1.231	100	0.944	100	1.674	100	1.124	100
18	0.956	100	0.745	100	1.258	100	1.647	100	1.475	100	1.087	100
19	2.120	100	1.773	100	2.257	100	2.119	100	2.421	100	1.728	100
20	0.942	100	1.062	100	1.513	100	1.119	100	1.465	100	1.295	100
21	1.156	100	1.024	100	1.216	100	1.707	100	1.836	100	1.148	100
22	0.968	100	0.745	100	1.561	100	1.703	100	1.645	100	1.106	100
23	1.416	100	1.204	100	1.892	100	1.998	100	1.985	100	1.692	100
24	2.076	100	2.051	100	0.952	100	0.874	100	1.279	100	1.200	100
25	1.300	100	1.469	100	1.435	100	0.983	100	1.632	100	1.287	100
26	1.524	100	1.939	100	1.843	100	1.172	100	2.177	100	1.519	100
27	1.440	100	1.523	100	1.516	100	1.164	100	1.524	100	1.424	100
28	0.788	100	0.851	100	1.174	100	1.153	100	1.536	100	0.777	100
29	1.304	100	1.610	100	1.434	100	1.229	100	1.276	100	1.405	100
30	1.192	100	1.513	100	1.525	100	1.666	100	1.646	100	2.131	100
31	2.295	100	1.478	100	1.182	100	0.920	100	1.725	100	1.368	100
32	1.482	100	1.361	100	1.106	100	0.907	100	1.118	100	1.645	100
135	1.864	100	1.658	100	3.092	100	2.021	100	2.067	100	1.687	100
138	1.364	100	1.557	100	1.626	100	1.545	100	2.515	100	1.642	100

Table 6-2 Range Error 95% index and 3.29 Sigma Bounding

Site →	Los Angeles		Salt Lake City		Miami		Minneapolis		Atlanta		Juneau	
PRN ↓	95% Range Error	3.29 Sigma Bounding(%)	95% Range Error	3.29 Sigma Bounding(%)	95% Range Error	3.29 Sigma Bounding(%)	95% Range Error	3.29 Sigma Bounding(%)	95% Range Error	3.29 Sigma Bounding(%)	95% Range Error	3.29 Sigma Bounding(%)
1	-	-	-	-	-	-	-	-	-	-	-	-
2	1.816	100	1.532	100	2.375	100	1.686	100	1.719	100	1.699	100
3	0.880	100	1.073	100	1.334	100	1.868	100	1.253	100	1.184	100
4	1.576	100	1.702	100	2.192	100	1.345	100	1.653	100	1.564	100
5	0.983	100	1.905	100	1.227	100	2.078	100	1.188	100	1.317	100
6	1.707	100	1.803	100	1.566	100	1.486	100	1.610	100	1.650	100
7	1.044	100	1.361	100	2.110	100	1.271	100	1.541	100	1.497	100
8	0.868	100	1.134	100	1.219	100	1.492	100	1.292	100	1.251	100
9	1.278	100	1.721	100	1.216	100	1.358	100	1.435	100	1.421	100
10	0.998	100	0.807	100	1.653	100	1.180	100	1.012	100	0.848	100
11	0.998	100	1.313	100	1.197	100	0.795	100	1.081	100	1.070	100
12	0.945	100	1.084	100	1.690	100	1.601	100	1.313	100	1.163	100
13	0.917	100	1.370	100	1.478	100	1.376	100	1.567	100	1.376	100
14	1.023	100	0.678	100	1.448	100	0.882	100	0.895	100	0.720	100
15	1.175	100	1.248	100	1.347	100	1.550	100	1.546	100	1.637	100
16	1.208	100	0.938	100	1.793	100	0.967	100	1.250	100	0.727	100
17	1.121	100	1.235	100	1.129	100	0.985	100	1.223	100	1.055	100
18	1.156	100	1.475	100	2.247	100	1.348	100	1.160	100	1.193	100
19	2.177	100	1.909	100	2.415	100	2.007	100	2.170	100	2.046	100
20	0.983	100	1.497	100	1.554	100	0.904	100	1.142	100	0.995	100
21	1.689	100	0.716	100	2.489	100	0.878	100	1.321	100	1.061	100
22	1.688	100	1.743	100	2.521	100	1.262	100	1.292	100	1.109	100
23	1.770	100	1.425	100	2.277	100	1.345	100	1.873	100	1.578	100
24	1.688	100	1.641	100	1.070	100	1.739	100	1.502	100	1.806	100
25	0.960	100	1.331	100	1.301	100	1.443	100	1.485	100	1.557	100
26	1.240	100	1.578	100	1.735	100	1.553	100	1.334	100	1.609	100
27	1.427	100	1.272	100	1.331	100	1.955	100	1.521	100	1.332	100
28	1.147	100	1.096	100	2.116	100	0.833	100	0.957	100	0.979	100
29	0.865	100	1.327	100	1.465	100	1.651	100	1.245	100	1.441	100
30	1.766	100	1.576	100	1.319	100	1.910	100	1.744	100	1.561	100
31	1.034	100	1.393	100	1.637	100	1.322	100	1.036	100	1.151	100
32	0.827	100	1.552	100	1.365	100	1.645	100	1.137	100	1.317	100
135	2.080	100	1.438	100	2.153	100	1.837	100	2.449	100	1.555	100
138	2.245	100	1.552	100	2.111	100	1.833	100	1.666	100	1.640	100

Table 6-3 Ionospheric Error 95% index and 3.29 Sigma Bounding

Site →	Billings		Albuquerque		Boston		Washington DC		Houston		Kansas City	
PRN ↓	95% Iono Error	3.29 Sigma Bounding(%)	95% Iono Error	3.29 Sigma Bounding(%)	95% Iono Error	3.29 Sigma Bounding(%)	95% Iono Error	3.29 Sigma Bounding(%)	95% Iono Error	3.29 Sigma Bounding(%)	95% Iono Error	3.29 Sigma Bounding(%)
1	-	-	-	-	-	-	-	-	-	-	-	-
2	1.233	100	0.758	100	1.247	100	1.144	100	1.433	100	1.036	100
3	0.366	100	0.711	100	0.555	100	0.406	100	0.702	100	0.672	100
4	0.979	100	1.207	100	0.833	100	1.030	100	1.275	100	1.391	100
5	1.006	100	1.082	100	0.454	100	0.887	100	1.236	100	0.867	100
6	0.718	100	0.843	100	0.505	100	0.707	100	1.176	100	0.758	100
7	0.861	100	0.782	100	0.612	100	0.552	100	0.612	100	0.805	100
8	0.439	100	0.588	100	0.617	100	0.482	100	0.431	100	0.693	100
9	0.535	100	0.718	100	0.431	100	0.420	100	0.779	100	0.452	100
10	0.698	100	0.510	100	0.508	100	0.567	100	0.817	100	0.685	100
11	0.394	100	0.412	100	0.510	100	0.585	100	0.791	100	0.369	100
12	0.612	100	0.760	100	0.574	100	0.414	100	0.570	100	0.667	100
13	0.709	100	0.835	100	0.583	100	0.440	100	0.718	100	0.761	100
14	0.530	100	0.553	100	0.499	100	0.493	100	0.497	100	0.397	100
15	0.549	100	0.881	100	0.747	100	0.986	100	1.029	100	0.946	100
16	0.699	100	0.488	100	0.531	100	0.567	100	0.984	100	0.724	100
17	1.263	100	0.850	100	0.923	100	0.562	100	1.059	100	0.671	100
18	1.002	100	0.478	100	0.697	100	0.943	100	0.690	100	0.593	100
19	1.577	100	1.223	100	1.578	100	1.496	100	1.571	100	1.277	100
20	0.516	100	0.569	100	0.891	100	0.570	100	0.764	100	0.535	100
21	0.994	100	0.596	100	1.014	100	1.056	100	1.195	100	0.577	100
22	0.935	100	0.460	100	0.950	100	1.034	100	0.933	100	0.716	100
23	1.238	100	0.944	100	1.560	100	1.504	100	1.170	100	1.179	100
24	1.175	100	1.149	100	1.056	100	0.939	100	0.904	100	1.047	100
25	0.658	100	0.808	100	0.714	100	0.500	100	1.060	100	0.635	100
26	0.754	100	1.243	100	0.811	100	0.831	100	1.420	100	0.859	100
27	0.493	100	0.725	100	0.602	100	0.638	100	0.639	100	0.662	100
28	0.660	100	0.317	100	0.725	100	0.677	100	0.776	100	0.460	100
29	0.738	100	1.113	100	0.678	100	0.706	100	0.953	100	0.968	100
30	0.488	100	0.837	100	0.757	100	0.867	100	0.682	100	1.018	100
31	1.370	100	0.793	100	0.432	100	0.546	100	0.954	100	0.782	100
32	0.734	100	0.741	100	0.523	100	0.440	100	0.708	100	0.903	100

Table 6-4 Ionospheric Error 95% index and 3.29 Sigma Bounding

Site →	Los Angeles		Salt Lake City		Miami		Minneapolis		Atlanta		Juneau	
PRN ↓	95% Iono Error	3.29 Sigma Bounding(%)	95% Iono Error	3.29 Sigma Bounding(%)	95% Iono Error	3.29 Sigma Bounding(%)	95% Iono Error	3.29 Sigma Bounding(%)	95% Iono Error	3.29 Sigma Bounding(%)	95% Iono Error	3.29 Sigma Bounding(%)
1	-	-	-	-	-	-	-	-	-	-	-	-
2	0.960	100	0.896	100	1.345	100	1.005	100	0.944	100	1.030	100
3	0.419	100	0.552	100	0.658	100	0.753	100	0.542	100	0.446	100
4	1.071	100	1.038	100	1.364	100	1.010	100	1.039	100	0.918	100
5	0.560	100	0.915	100	0.878	100	0.774	100	0.767	100	0.665	100
6	0.822	100	0.781	100	0.778	100	0.662	100	0.749	100	0.762	100
7	0.597	100	0.753	100	0.889	100	0.769	100	0.817	100	0.710	100
8	0.492	100	0.641	100	0.650	100	0.703	100	0.526	100	0.480	100
9	0.630	100	0.683	100	0.570	100	0.631	100	0.737	100	0.627	100
10	0.353	100	0.370	100	0.676	100	0.408	100	0.423	100	0.436	100
11	0.439	100	0.585	100	0.436	100	0.388	100	0.478	100	0.480	100
12	0.430	100	0.442	100	0.731	100	0.771	100	0.684	100	0.531	100
13	0.573	100	0.740	100	0.827	100	0.699	100	0.758	100	0.618	100
14	0.351	100	0.437	100	0.694	100	0.408	100	0.405	100	0.357	100
15	0.752	100	0.704	100	0.890	100	0.724	100	0.854	100	0.757	100
16	0.569	100	0.623	100	0.644	100	0.593	100	0.559	100	0.428	100
17	0.696	100	0.692	100	0.742	100	0.552	100	0.668	100	0.471	100
18	0.530	100	0.963	100	0.936	100	0.932	100	0.697	100	1.019	100
19	1.403	100	1.272	100	1.282	100	1.482	100	1.496	100	1.510	100
20	0.375	100	0.581	100	0.774	100	0.514	100	0.551	100	0.567	100
21	0.714	100	0.449	100	1.425	100	0.710	100	0.853	100	0.775	100
22	0.876	100	1.116	100	1.458	100	0.875	100	0.849	100	0.871	100
23	1.143	100	1.163	100	1.404	100	1.099	100	1.379	100	1.263	100
24	1.209	100	1.210	100	1.120	100	1.155	100	1.226	100	1.197	100
25	0.621	100	0.735	100	0.722	100	0.875	100	0.766	100	0.785	100
26	0.843	100	0.899	100	1.095	100	0.705	100	0.918	100	0.932	100
27	0.695	100	0.557	100	0.739	100	0.893	100	0.730	100	0.635	100
28	0.480	100	0.429	100	1.071	100	0.505	100	0.551	100	0.544	100
29	0.814	100	0.895	100	1.052	100	0.890	100	0.851	100	0.852	100
30	0.834	100	0.849	100	1.019	100	0.898	100	0.916	100	0.771	100
31	0.676	100	0.632	100	0.780	100	0.585	100	0.616	100	0.475	100
32	0.518	100	0.652	100	0.856	100	0.786	100	0.643	100	0.593	100

Figure 6-1 95% Range Error (PRN 1 - PRN 16) - Washington DC

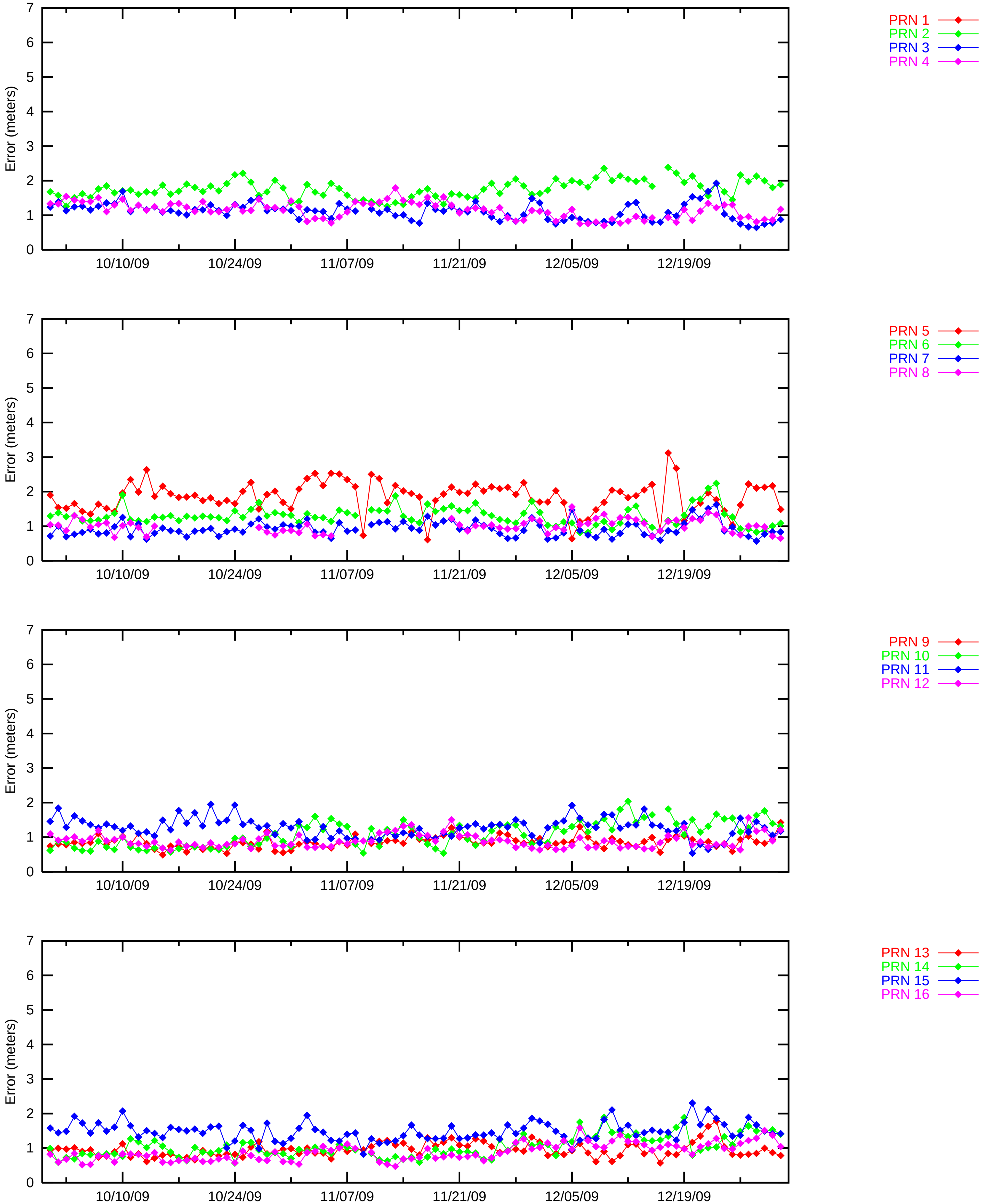


Figure 6-2 95% Range Error (PRN 17 - PRN 32) - Washington DC

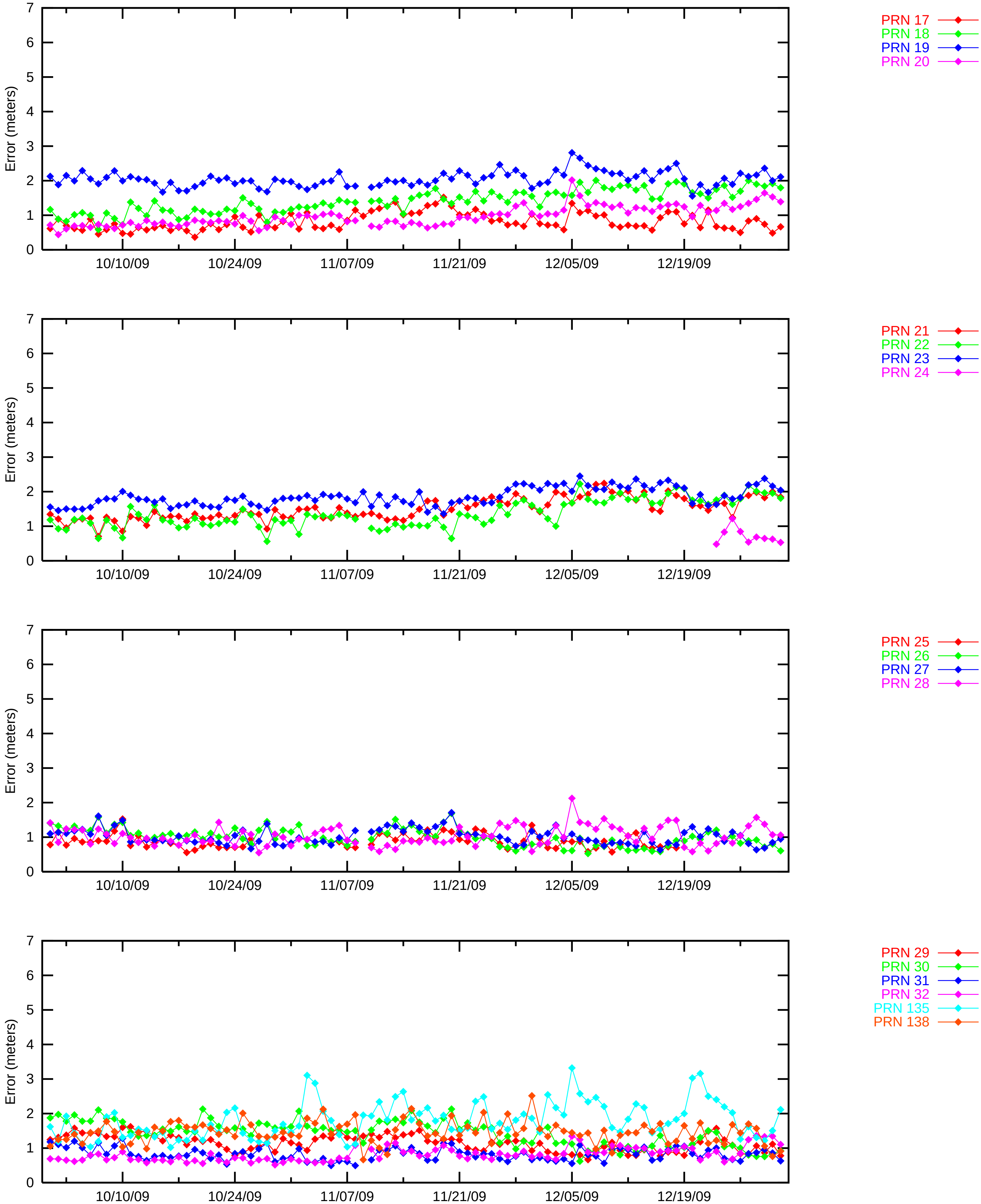


Figure 6-3 95% Ionospheric (PRN 1 - PRN 16) - Washington DC

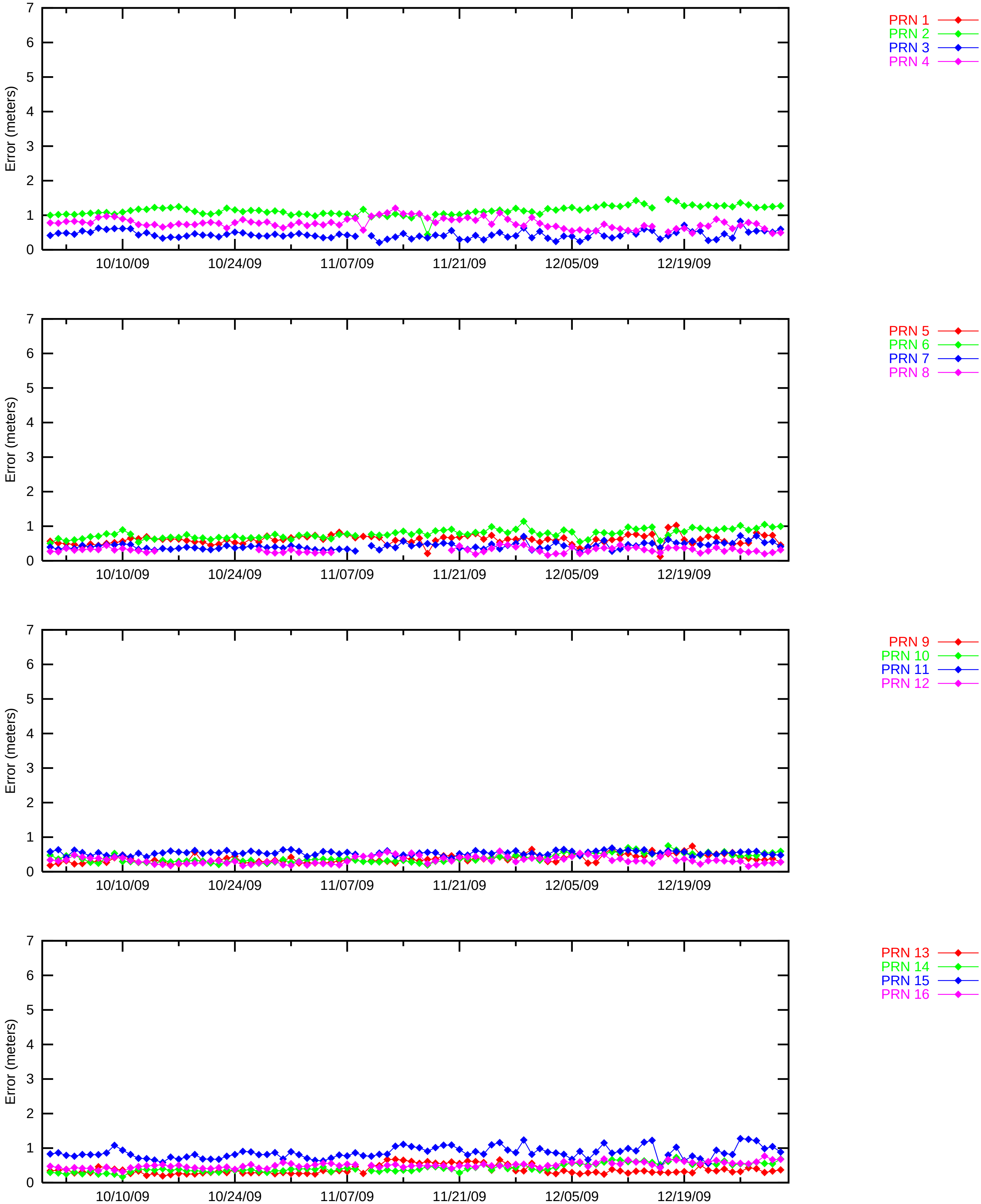
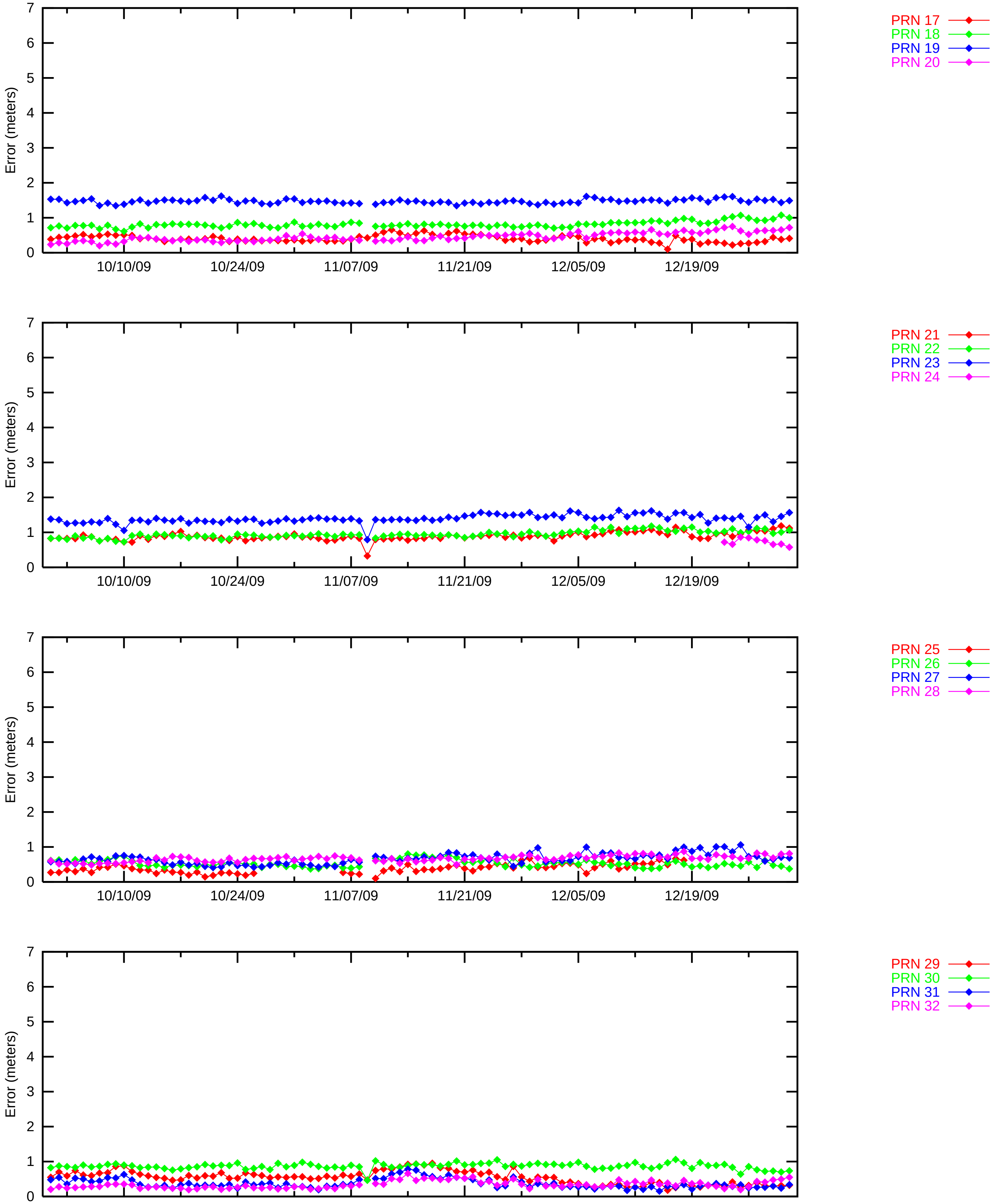


Figure 6-4 95% Ionospheric (PRN 17 - PRN 32) - Washington DC



7.0 GEO RANGING PERFORMANCE

WAAS GEO navigation messages provide corrections and UDRE values for each satellite. The GEO ranging availability from each GEO navigation message source was evaluated separately to determine the quality of service provided. For the evaluation period, both CRW (PRN 135) and CRE (PRN 138) GEO satellites provide ranging capability for enroute through NPA and PA service. Table 7.1 shows the GEO-Ranging performance for CRE and CRW GEO satellites throughout the evaluation period. Figure 7.1 shows the trend of CRW GEO PA Ranging Availability and Figure 7.2 shows the trend of CRE GEO PA Ranging Availability.

Table 7-1 GEO Ranging Availability

GEO Source	GEO	PA (%)	NPA (%)	Not Monitored (%)	Do Not Use (%)
CRW 135	CRW	95.766	3.277	0.832	0.104
CRW135	CRE	97.301	1.105	0.681	0.892
CRE 138	CRW	94.815	3.468	1.395	0.105
CRE 138	CRE	97.268	1.246	0.377	0.892

Figure 7-1 Daily PA CRW GEO Ranging Availability Trend

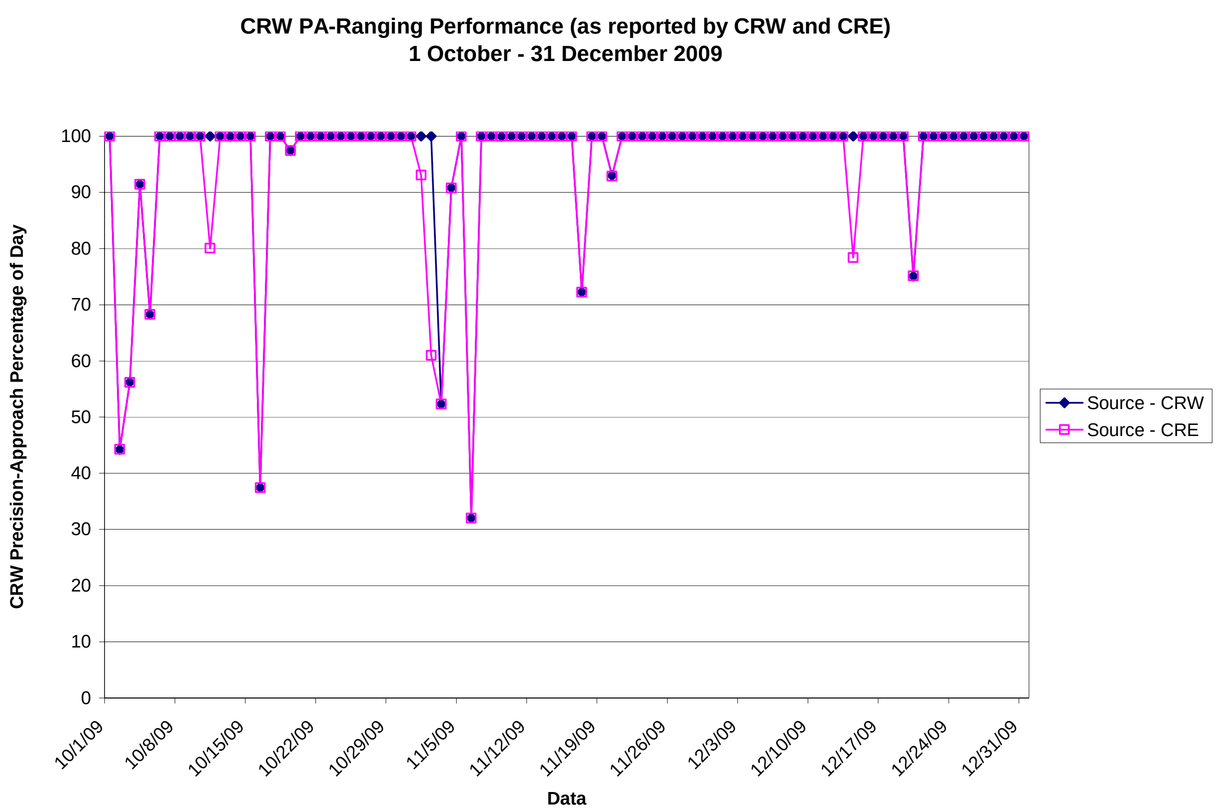
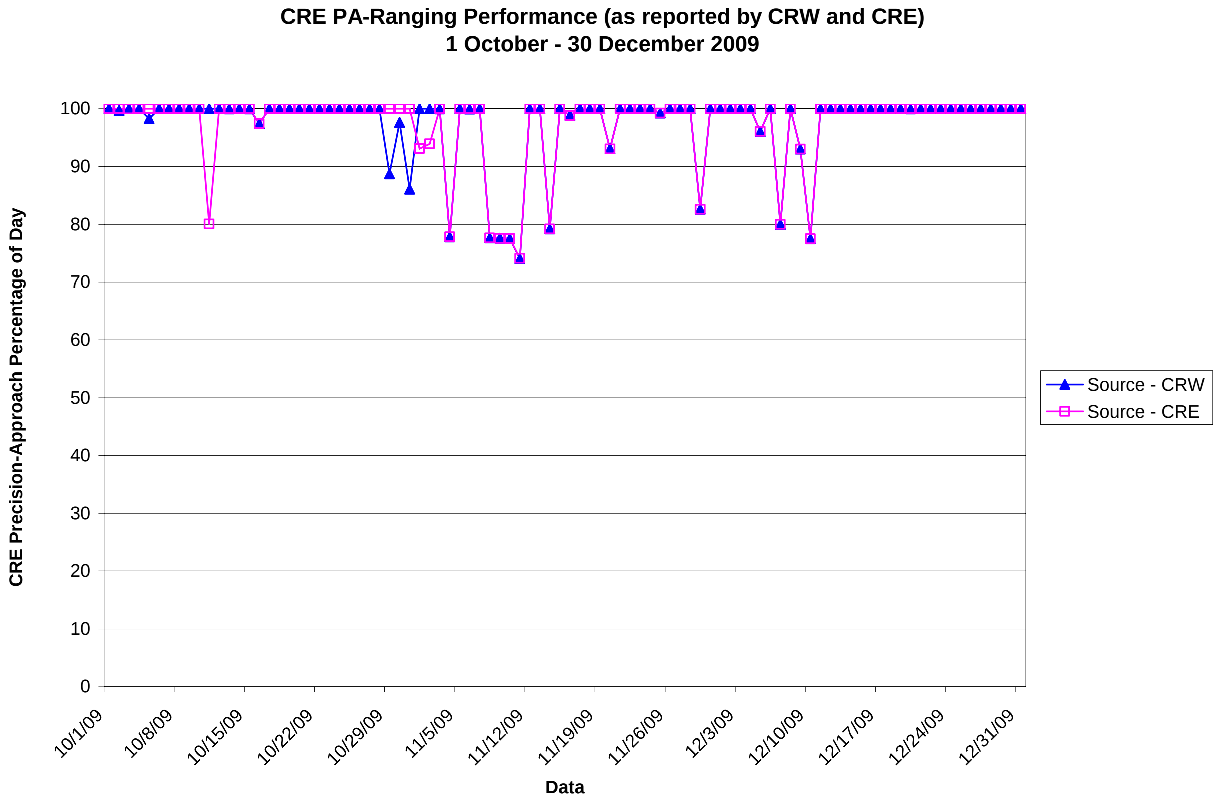


Figure 7-2 Daily PA CRE GEO Ranging Availability Trend



8.0 WAAS PROBLEM SUMMARY

Events that adversely affected the WAAS service for this evaluation period are listed in Table 8.1. These events include any WAAS anomalies and problems that affected the WAAS performance. Detailed analyses of particular events are documented in the Discrepancy Reports (DR). The DRs are posted on the website http://www.nstb.tc.faa.gov under 'WAAS Technical Reports', and can also be accessed via hyperlink from Table 8.1 below.

Table 8-1 WAAS Problem Summary

GPS Week	Date	Events
Week 1553 Day 4 to Week 1555 Day 2	10/15/09 to 10/27/09	PRN 8 Unusable affected coverage (see DR#87 PRN 8 NANU Affects WAAS Coverage).
Week 1556 day 2	11/3/09	PRN2 SV alert after a short ephemeris update. See DR78, "False WAAS satellite alert for PRN 29" on 3/29/09 (Week 1525 Day 0) for description of anomaly.

9.0 WAAS AIRPORT AVAILABILITY

The WAAS airport availability evaluation determines the number and length LVP service outages at selected airports from the transmitted WAAS navigation message. The navigation messages transmitted from all GEO satellites are processed simultaneously, and WAAS protection levels (VPL and HPL) are computed at each airport once a second in accordance with the WAAS MOPS. Once the protection levels have been produced at each airport an LPV service evaluation is conducted to identify outages in service (i.e. when protection levels exceed alert limits). WAAS LPV service is available for a user when the vertical protection level (VPL) is less than or equal to vertical alert limit (VAL) of 50 meters and the horizontal protection level (HPL) is less than or equal to horizontal alert limit (HAL) of 40 meters. If both conditions are met at a specified airport location then WAAS LPV service is available at that airport. If either one of the conditions are not met at a specified airport location then WAAS LPV service at that airport is unavailable and an outage in LPV service is recorded with its duration. When the LPV service becomes unavailable it is not considered available again until protection levels are below or equal to alert limits for at least 15 minutes. Although this will reduce LPV service availability minimally, it substantially reduces the number of service outages and prevents excessive switching in and out of service availability. When computing LPV service availability, an extra two minutes of outage time was prefixed to each outage. The number of WAAS LPV service outages and the availability at selected airports for this evaluation period of WAAS operation is presented in Table 9.1. Figures 9.1 and 9.2 provide a graphical representation of WAAS LPV service availability and outage counts for the same period, respectively.

Table 9-1 WAAS LPV Outages and Availability

Airport Id	Airport Name	State	LPV Outages	LPV Availability	LPV 200 Outages	LPV 200 Availability
PACD	COLD BAY	AK	377	0.916248	819	0.651360
PAGA	EDWARD G. PITKA SR	AK	8	0.999392	59	0.990742
PAEM	EMMONAK	AK	33	0.994705	301	0.951421
PAFA	FAIRBANKS INTL	AK	1	0.999968	39	0.995123
PAGB	GALBRAITH LAKE	AK	5	0.999708	73	0.990725
PAGK	GULKANA	AK	0	1	36	0.996643
PAHO	HOMER	AK	4	0.999832	70	0.992415
PAHL	HUSLIA	AK	8	0.999406	51	0.990884
PAEN	KENAI MUNICIPAL	AK	4	0.999858	43	0.993400
PAKT	KETCHIKAN INTL	AK	0	1	4	0.999734
PAKN	KING SALMON	AK	33	0.997110	278	0.961692
PARY	RUBY	AK	7	0.999653	46	0.991909
PASK	SELAWIK	AK	13	0.998611	134	0.981177
PASM	ST MARY'S	AK	34	0.994939	265	0.956807
PAMK	ST MICHAEL	AK	24	0.997781	144	0.977398
PANC	TED STEVENS ANCHORAGE INTL	AK	4	0.999928	39	0.994623
PAYA	YAKUTAT	AK	0	1	16	0.999522
8A0	ALBERTVILLE RGNL-THOMAS J BRUM	AL	0	1	0	1
ANB	ANNISTON METROPOLITAN	AL	0	1	1	0.999998
AUO	AUBURN-OPELIKA ROBERT G PITTS	AL	0	1	29	0.999633
EKY	BESSEMER	AL	0	1	0	1
BHM	BIRMINGHAM INTL	AL	0	1	0	1
SEM	CRAIG FIELD	AL	0	1	0	1
DHN	DOTHAN RGNL	AL	0	1	29	0.998119
HSV	HUNTSVILLE INTL-CARL T JONES F	AL	0	1	0	1
JKA	JACK EDWARDS	AL	0	1	2	0.999969
MDQ	MADISON COUNTY EXECUTIVE/TOM S	AL	0	1	0	1
BFM	MOBILE DOWNTOWN	AL	0	1	1	0.999990
MOB	MOBILE RGNL	AL	0	1	1	0.999993
MGM	MONTGOMERY RGNL (DANNELLY FIEL	AL	0	1	1	0.999979

Airport Id	Airport Name	State	LPV Outages	LPV Availability	LPV 200 Outages	LPV 200 Availability
GAD	NORTHEAST ALABAMA RGNL	AL	0	1	0	1
MSL	NORTHWEST ALABAMA RGNL	AL	0	1	0	1
DCU	PRYOR FIELD RGNL	AL	0	1	0	1
79J	SOUTH ALABAMA RGNL AT BILL BEN	AL	0	1	13	0.999929
PLR	ST CLAIR COUNTY	AL	0	1	0	1
2R5	ST ELMO	AL	0	1	1	0.999987
ASN	TALLADEGA MUNICIPAL	AL	0	1	0	1
TOI	TROY MUNICIPAL	AL	0	1	18	0.999835
TCL	TUSCALOOSA RGNL	AL	0	1	0	1
LIT	ADAMS FIELD	AR	0	1	0	1
M73	ALMYRA MUNICIPAL	AR	0	1	0	1
BYH	ARKANSAS INTL	AR	0	1	0	1
VBT	BENTONVILLE MUNICIPAL/LOUISE M THAD	AR	0	1	1	0.999996
HRO	BOONE COUNTY	AR	0	1	0	1
FSM	FORT SMITH RGNL	AR	0	1	1	1
PBF	GRIDER FIELD	AR	0	1	0	1
JBR	JONESBORO MUNICIPAL	AR	0	1	0	1
M19	NEWPORT MUNICIPAL	AR	0	1	0	1
ORK	NORTH LITTLE ROCK MUNICIPAL	AR	0	1	0	1
XNA	NORTHWEST ARKANSAS RGNL	AR	0	1	1	0.999994
BPK	OZARK RGNL	AR	0	1	0	1
ROG	ROGERS MUNICIPAL-CARTER FIELD	AR	0	1	1	0.999998
RUE	RUSSELLVILLE RGNL	AR	0	1	0	1
SUZ	SALINE COUNTY RGNL	AR	0	1	0	1
SRC	SEARCY MUNICIPAL	AR	0	1	0	1
SLG	SMITH FIELD	AR	0	1	1	0.999992
ELD	SOUTH ARKANSAS RGNL AT GOODWIN	AR	0	1	0	1
ASG	SPRINGDALE MUNICIPAL	AR	0	1	1	0.999999
SGT	STUTTGART MUNICIPAL	AR	0	1	0	1
ARG	WALNUT RIDGE RGNL	AR	0	1	0	1
PRC	ERNEST A. LOVE FIELD	AZ	0	1	19	0.999371
GEU	GLENDALE MUNICIPAL	AZ	0	1	75	0.997126
GCN	GRAND CANYON NATIONAL PARK	AZ	0	1	5	0.999809
IFP	LAUGHLIN/BULLHEAD INTL	AZ	0	1	12	0.999427
PGA	PAGE MUNICIPAL	AZ	0	1	5	0.999937
DVT	PHOENIX DEER VALLEY	AZ	0	1	61	0.998008
PHX	PHOENIX SKY HARBOR INTL	AZ	0	1	72	0.997309
IWA	PHOENIX-MESA GATEWAY	AZ	0	1	67	0.997554
SJN	ST JOHNS INDUSTRIAL AIR PARK	AZ	0	1	9	0.999781
TUS	TUCSON INTL	AZ	0	1	85	0.995754
APV	APPLE VALLEY	CA	0	1	53	0.992732
ACV	ARCATA	CA	1	0.999895	206	0.978121
DAG	BARSTOW-DAGGETT	CA	0	1	43	0.994621
C83	BYRON	CA	6	0.999657	281	0.965789
CMA	CAMARILLO	CA	7	0.999420	298	0.968333
CNO	CHINO	CA	2	0.999964	200	0.985677
FAT	FRESNO YOSEMITE INTL	CA	5	0.999800	206	0.984127
WJF	GENERAL WM J FOX AIRFIELD	CA	4	0.999918	237	0.985465
HAF	HALF MOON BAY	CA	8	0.999473	415	0.948777

Airport Id	Airport Name	State	LPV Outages	LPV Availability	LPV 200 Outages	LPV 200 Availability
HWD	HAYWARD EXECUTIVE	CA	6	0.999647	372	0.955846
CVH	HOLLISTER MUNICIPAL	CA	6	0.999621	336	0.959186
SNA	JOHN WAYNE AIRPORT-ORANGE COUNTY	CA	7	0.999711	268	0.979088
LGB	LONG BEACH /DAUGHERTY FIELD/	CA	7	0.999567	272	0.976978
LAX	LOS ANGELES INTL	CA	7	0.999518	282	0.974972
MAE	MADERA MUNICIPAL	CA	5	0.999751	222	0.981016
CRQ	MC CLELLAN-PALOMAR	CA	6	0.999760	182	0.980434
BFL	MEADOWS FIELD	CA	5	0.999814	250	0.979600
MCE	MERCED MUNICIPAL/ MACREADY FIELD	CA	6	0.999705	230	0.977857
OAK	METROPOLITAN OAKLAND INTL	CA	6	0.999647	376	0.954916
MOD	MODESTO CITY-CO-HARRY SHAM FLD	CA	6	0.999716	236	0.974117
MRY	MONTEREY PENINSULA	CA	8	0.999327	412	0.949399
APC	NAPA COUNTY	CA	6	0.999680	351	0.961972
O02	NERVINO	CA	0	1	105	0.993636
SJC	NORMAN Y. MINETA SAN JOSE INTL	CA	6	0.999633	371	0.955736
VCB	NUT TREE	CA	6	0.999709	285	0.969761
ONT	ONTARIO INTL	CA	1	0.999975	182	0.987059
OXR	OXNARD	CA	7	0.999392	321	0.966753
PMD	PALMDALE RGNL/USAF PLANT 42	CA	3	0.999938	228	0.986666
RBL	RED BLUFF MUNICIPAL	CA	1	0.999963	148	0.987380
RDD	REDDING MUNICIPAL	CA	1	0.999972	126	0.988530
RAL	RIVERSIDE MUNICIPAL	CA	1	0.999987	136	0.987345
SMF	SACRAMENTO INTL	CA	4	0.999814	216	0.979821
MHR	SACRAMENTO MATHER	CA	4	0.999809	183	0.982258
SFO	SAN FRANCISCO INTL	CA	8	0.999586	398	0.951740
SBA	SANTA BARBARA MUNICIPAL	CA	8	0.999287	381	0.958780
TCY	TRACY MUNICIPAL	CA	6	0.999713	286	0.967499
APA	CENTENNIAL	CO	0	1	2	0.999978
COS	CITY OF COLORADO SPRINGS MUNICIPAL	CO	0	1	2	0.999980
AKO	COLORADO PLAINS RGNL	CO	0	1	2	0.999969
CEZ	CORTEZ MUNICIPAL	CO	0	1	5	0.999816
DEN	DENVER INTL	CO	0	1	2	0.999977
FTG	FRONT RANGE	CO	0	1	2	0.999977
RIL	GARFIELD COUNTY RGNL	CO	0	1	3	0.999978
GXY	GREELEY-WELD COUNTY	CO	0	1	1	0.999977
ITR	KIT CARSON COUNTY	CO	0	1	2	0.999986
LAA	LAMAR MUNICIPAL	CO	0	1	2	0.999998
PUB	PUEBLO MEMORIAL	CO	0	1	2	0.999980
ALS	SAN LUIS VALLEY RGNL/ BERGMAN FIELD	CO	0	1	2	0.999901
HDN	YAMPA VALLEY	CO	0	1	2	0.999979
BDL	BRADLEY INTL	CT	0	1	2	0.999876
GON	GROTON-NEW LONDON	CT	0	1	2	0.999879
HVN	TWEED-NEW HAVEN	CT	0	1	2	0.999892
OXC	WATERBURY-OXFORD	CT	0	1	2	0.999889
DCA	RONALD REAGAN WASHINGTON NATIONAL	DC	0	1	29	0.999065
EVY	SUMMIT	DE	0	1	17	0.999828
GED	SUSSEX COUNTY	DE	0	1	28	0.999271

Airport Id	Airport Name	State	LPV Outages	LPV Availability	LPV 200 Outages	LPV 200 Availability
AAF	APALACHICOLA MUNICIPAL	FL	0	1	29	0.995065
CEW	BOB SIKES	FL	0	1	22	0.999725
BCT	BOCA RATON	FL	2	0.999860	37	0.989518
PGD	CHARLOTTE COUNTY	FL	2	0.999863	34	0.990914
DAB	DAYTONA BEACH INTL	FL	0	1	31	0.993023
DED	DELAND MUNICIPAL-SIDNEY H TAYLOR FI	FL	0	1	31	0.992985
XFL	FLAGLER COUNTY	FL	0	1	31	0.993295
FXE	FORT LAUDERDALE EXECUTIVE	FL	2	0.999787	37	0.989131
FLL	FORT LAUDERDALE/ HOLLYWOOD INTL	FL	2	0.999760	38	0.988993
GNV	GAINESVILLE RGNL	FL	0	1	32	0.993744
BKV	HERNANDO COUNTY	FL	0	1	31	0.992937
JAX	JACKSONVILLE INTL	FL	0	1	30	0.994337
TMB	KENDALL-TAMIAMI EXECUTIVE	FL	2	0.999647	40	0.988624
EYW	KEY WEST INTL	FL	2	0.999516	40	0.984907
ISM	KISSIMMEE GATEWAY	FL	0	1	33	0.992611
X14	LA BELLE MUNICIPAL	FL	2	0.999875	35	0.990469
LCQ	LAKE CITY MUNICIPAL	FL	0	1	30	0.994048
LAL	LAKELAND LINDER RGNL	FL	2	0.999978	33	0.992466
LEE	LEESBURG INTL	FL	0	1	31	0.993023
MLB	MELBOURNE INTL	FL	0	1	33	0.992047
COI	MERRITT ISLAND	FL	0	1	33	0.992306
MIA	MIAMI INTL	FL	2	0.999690	39	0.988779
APF	NAPLES MUNICIPAL	FL	2	0.999804	43	0.989404
EVB	NEW SMYRNA BEACH MUNICIPAL	FL	0	1	31	0.992887
OCF	OCALA INTL-JIM TAYLOR FIELD	FL	0	1	31	0.993301
MCO	ORLANDO INTL	FL	0	1	32	0.992628
SFB	ORLANDO SANFORD INTL	FL	0	1	31	0.992823
PHK	PALM BEACH CO GLADES	FL	2	0.999890	35	0.990182
PBI	PALM BEACH INTL	FL	2	0.999903	34	0.989936
PFN	PANAMA CITY-BAY CO INTL	FL	0	1	29	0.997163
PNS	PENSACOLA RGNL	FL	0	1	3	0.999980
PMP	POMPANO BEACH AIRPARK	FL	2	0.999823	37	0.989207
SRQ	SARASOTA/BRADENTON INTL	FL	2	0.999863	35	0.991754
RSW	SOUTHWEST FLORIDA INTL	FL	2	0.999869	35	0.990103
FPR	ST LUCIE COUNTY INTL	FL	2	0.999964	34	0.991322
PIE	ST PETERSBURG-CLEARWATER INTL	FL	2	0.999950	55	0.992308
TLH	TALLAHASSEE RGNL	FL	0	1	29	0.995311
TPA	TAMPA INTL	FL	2	0.999964	32	0.992559
MTH	THE FLORIDA KEYS MARATHON	FL	2	0.999509	41	0.985154
VDF	VANDENBERG	FL	2	0.999974	32	0.992545
GIF	WINTER HAVEN'S GILBERT	FL	1	1	33	0.992453
AGS	AUGUSTA RGNL AT BUSH FIELD	GA	0	1	29	0.994656
BQK	BRUNSWICK GOLDEN ISLES	GA	0	1	29	0.994460
VPC	CARTERSVILLE	GA	0	1	5	0.999988
47A	CHEROKEE COUNTY	GA	0	1	23	0.999692
RYY	COBB COUNTY-MC COLLUM FIELD	GA	0	1	26	0.999671
CSG	COLUMBUS METROPOLITAN	GA	0	1	29	0.998547
15J	COOK COUNTY	GA	0	1	47	0.993880
CKF	CRISP COUNTY-CORDELE	GA	0	1	29	0.996239
DNN	DALTON MUNICIPAL	GA	0	1	0	1

Airport Id	Airport Name	State	LPV Outages	LPV Availability	LPV 200 Outages	LPV 200 Availability
SBO	EMANUEL COUNTY	GA	0	1	29	0.994471
18A	FRANKLIN COUNTY	GA	0	1	29	0.997587
FTY	FULTON COUNTY AIRPORT-BROWN FI	GA	0	1	29	0.999251
ATL	HARTSFIELD - JACKSON ATLANTA I	GA	0	1	29	0.998870
EZM	HEART OF GEORGIA RGNL	GA	0	1	30	0.994815
19A	JACKSON COUNTY	GA	0	1	29	0.997919
GVL	LEE GILMER MEMORIAL	GA	0	1	29	0.998496
MCN	MIDDLE GEORGIA RGNL	GA	0	1	29	0.996748
MGR	MOULTRIE MUNICIPAL	GA	0	1	29	0.994902
CCO	NEWNAN COWETA COUNTY	GA	0	1	29	0.999157
FFC	PEACHTREE CITY-FALCON FIELD	GA	0	1	29	0.998818
PXE	PERRY-HOUSTON COUNTY	GA	0	1	29	0.996715
JZP	PICKENS COUNTY	GA	0	1	17	0.999839
JYL	PLANTATION ARPK	GA	0	1	29	0.994488
SAV	SAVANNAH/HILTON HEAD INTL	GA	0	1	29	0.994147
ACJ	SOUTHER FIELD	GA	0	1	29	0.996717
ABY	SOUTHWEST GEORGIA RGNL	GA	0	1	29	0.996123
TBR	STATESBORO-BULLOCH COUNTY	GA	0	1	29	0.994419
MQW	TELFAIR-WHEELER	GA	0	1	29	0.994790
TVI	THOMASVILLE RGNL	GA	0	1	30	0.994739
TOC	TOCCOA RG LETOURNEAU FIELD	GA	0	1	29	0.998025
VLD	VALDOSTA RGNL	GA	1	1	48	0.993809
VDI	VIDALIA RGNL	GA	0	1	29	0.994511
IIY	WASHINGTON-WILKES COUNTY	GA	0	1	29	0.995994
AYS	WAYCROSS-WARE COUNTY	GA	0	1	29	0.994727
CTJ	WEST GEORGIA RGNL - O V GRAY F	GA	0	1	5	0.999985
WDR	WINDER-BARROW	GA	0	1	29	0.997913
IKV	ANKENY RGNL	IA	0	1	2	0.999953
CBF	COUNCIL BLUFFS MUNICIPAL	IA	0	1	1	0.999940
DVN	DAVENPORT MUNICIPAL	IA	0	1	0	1
DNS	DENISON MUNICIPAL	IA	0	1	1	0.999938
DSM	DES MOINES INTL	IA	0	1	2	0.999957
DBQ	DUBUQUE RGNL	IA	0	1	1	0.999998
EST	ESTHERVILLE MUNICIPAL	IA	0	1	4	0.999918
FFL	FAIRFIELD MUNICIPAL	IA	0	1	0	1
GGI	GRINNELL RGNL	IA	0	1	1	0.999983
EOK	KEOKUK MUNICIPAL	IA	0	1	0	1
MCW	MASON CITY MUNICIPAL	IA	0	1	1	0.999963
MXO	MONTICELLO RGNL	IA	0	1	0	1
MUT	MUSCATINE MUNICIPAL	IA	0	1	0	1
TNU	NEWTON MUNICIPAL	IA	0	1	2	0.999975
OTM	OTTUMWA INDUSTRIAL	IA	0	1	1	0.999993
PRO	PERRY MUNICIPAL	IA	0	1	2	0.999937
SDA	SHENANDOAH MUNICIPAL	IA	0	1	1	0.999965
SLB	STORM LAKE MUNICIPAL	IA	0	1	2	0.999937
CID	THE EASTERN IOWA	IA	0	1	1	0.999998
ALO	WATERLOO RGNL	IA	0	1	1	0.999982
BOI	BOISE AIR TERMINAL/GOWEN FLD	ID	0	1	1	0.999978
EUL	CALDWELL INDUSTRIAL	ID	0	1	1	0.999978
GNG	GOODING MUNICIPAL	ID	0	1	1	0.999977
IDA	IDAHO FALLS RGNL	ID	0	1	1	0.999979
LWS	LEWISTON-NEZ PERCE COUNTY	ID	0	1	2	0.999977

Airport Id	Airport Name	State	LPV Outages	LPV Availability	LPV 200 Outages	LPV 200 Availability
S67	NAMPA MUNICIPAL	ID	0	1	1	0.999978
PIH	POCATELLO RGNL	ID	0	1	1	0.999979
SPI	ABRAHAM LINCOLN CAPITAL	IL	0	1	0	1
FEP	ALBERTUS	IL	0	1	0	1
ARR	AURORA MUNICIPAL	IL	0	1	0	1
BMI	CENTRAL IL REGL ARPT AT BLOOMI	IL	0	1	0	1
ENL	CENTRALIA MUNICIPAL	IL	0	1	0	1
MDW	CHICAGO MIDWAY INTL	IL	0	1	0	1
ORD	CHICAGO O'HARE INTL	IL	0	1	0	1
RFD	CHICAGO/ROCKFORD INTL	IL	0	1	0	1
DKB	DE KALB TAYLOR MUNICIPAL	IL	0	1	0	1
DEC	DECATUR	IL	0	1	0	1
FOA	FLORA MUNICIPAL	IL	0	1	0	1
IKK	GREATER KANKAKEE	IL	0	1	0	1
PIA	GREATER PEORIA RGNL	IL	0	1	0	1
IGQ	LANSING MUNICIPAL	IL	0	1	0	1
LOT	LEWIS UNIVERSITY	IL	0	1	0	1
3LF	LITCHFIELD MUNICIPAL	IL	0	1	0	1
C15	PEKIN MUNICIPAL	IL	0	1	0	1
PPQ	PITTSFIELD PENSTONE MUNICIPAL	IL	0	1	0	1
PNT	PONTIAC MUNICIPAL	IL	0	1	0	1
MLI	QUAD CITY INTL	IL	0	1	0	1
UIN	QUINCY RGNL-BALDWIN FIELD	IL	0	1	0	1
TIP	RANTOUL NATL AVN CNTR-FRANK EL	IL	0	1	0	1
RSV	ROBINSON MUNICIPAL	IL	0	1	0	1
SLO	SALEM-LECKRONE	IL	0	1	0	1
ALN	ST LOUIS RGNL	IL	0	1	0	1
DNV	VERMILION COUNTY	IL	0	1	0	1
UGN	WAUKEGAN RGNL	IL	0	1	0	1
MWA	WILLIAMSON COUNTY RGNL	IL	0	1	0	1
BAK	COLUMBUS MUNICIPAL	IN	0	1	0	1
GWB	DE KALB COUNTY	IN	0	1	0	1
MIE	DELAWARE COUNTY - JOHNSON FIEL	IN	0	1	0	1
EYE	EAGLE CREEK AIRPARK	IN	0	1	0	1
EKM	ELKHART MUNICIPAL	IN	0	1	0	1
FWA	FORT WAYNE INTL	IN	0	1	0	1
SER	FREEMAN MUNICIPAL	IN	0	1	0	1
RCR	FULTON COUNTY	IN	0	1	0	1
GSH	GOSHEN MUNICIPAL	IN	0	1	0	1
HFY	GREENWOOD MUNICIPAL	IN	0	1	0	1
TYQ	INDIANAPOLIS EXECUTIVE	IN	0	1	0	1
IND	INDIANAPOLIS INTL	IN	0	1	0	1
GGP	LOGANSPORT/CASS COUNTY	IN	0	1	0	1
IMS	MADISON MUNICIPAL	IN	0	1	0	1
MZZ	MARION MUNICIPAL	IN	0	1	0	1
CEV	METTEL FIELD	IN	0	1	0	1
BMG	MONROE COUNTY	IN	0	1	0	1
VPZ	PORTER COUNTY MUNICIPAL	IN	0	1	0	1
LAF	PURDUE UNIVERSITY	IN	0	1	0	1
4I7	PUTNAM COUNTY	IN	0	1	0	1
GEZ	SHELBYVILLE MUNICIPAL	IN	0	1	0	1
SBN	SOUTH BEND RGNL	IN	0	1	0	1

Airport Id	Airport Name	State	LPV Outages	LPV Availability	LPV 200 Outages	LPV 200 Availability
OXI	STARKE COUNTY	IN	0	1	0	1
ANQ	TRI-STATE STEUBEN COUNTY	IN	0	1	0	1
PTS	ATKINSON MUNICIPAL	KS	0	1	1	0.999985
AAO	COLONEL JAMES JABARA	KS	0	1	4	0.999809
DDC	DODGE CITY RGNL	KS	0	1	1	0.999984
EMP	EMPORIA MUNICIPAL	KS	0	1	1	0.999979
FOE	FORBES FIELD	KS	0	1	1	0.999974
FSK	FORT SCOTT MUNICIPAL	KS	0	1	1	0.999982
GCK	GARDEN CITY RGNL	KS	0	1	0	1
HYS	HAYS RGNL	KS	0	1	2	0.999973
HQG	HUGOTON MUNICIPAL	KS	0	1	0	1
OJC	JOHNSON COUNTY EXECUTIVE	KS	0	1	1	0.999973
LWC	LAWRENCE MUNICIPAL	KS	0	1	1	0.999973
LBL	LIBERAL MID-AMERICA RGNL	KS	0	1	0	1
MHK	MANHATTAN RGNL	KS	0	1	1	0.999973
MPR	MC PHERSON	KS	0	1	4	0.999768
IXD	NEW CENTURY AIRCENTER	KS	0	1	1	0.999974
EWK	NEWTON-CITY-COUNTY	KS	0	1	4	0.999906
OEL	OAKLEY MUNICIPAL	KS	0	1	0	1
TOP	PHILIP BILLARD MUNICIPAL	KS	0	1	1	0.999973
PTT	PRATT INDUSTRIAL	KS	0	1	4	0.999903
GLD	RENNER FLD /GOODLAND MUNICIPAL/	KS	0	1	1	0.999991
RSL	RUSSELL MUNICIPAL	KS	0	1	2	0.999934
SLN	SALINA MUNICIPAL	KS	0	1	1	0.999976
TQK	SCOTT CITY MUNICIPAL	KS	0	1	0	1
CBK	SHALZ FIELD	KS	0	1	1	0.999997
WLD	STROTHER FIELD	KS	0	1	4	0.999869
PPF	TRI-CITY	KS	0	1	1	0.999985
ULS	ULYSSES	KS	0	1	0	1
EGT	WELLINGTON MUNICIPAL	KS	0	1	4	0.999829
ICT	WICHITA MID-CONTINENT	KS	0	1	4	0.999800
EKX	ADDINGTON FIELD	KY	0	1	0	1
PAH	BARKLEY RGNL	KY	0	1	0	1
K22	BIG SANDY RGNL	KY	0	1	2	0.999964
LEX	BLUE GRASS	KY	0	1	0	1
LOU	BOWMAN FIELD	KY	0	1	0	1
CVG	CINCINNATI/NORTHERN KENTUCKY I	KY	0	1	0	1
27K	GEORGETOWN SCOTT COUNTY - MARS	KY	0	1	0	1
GLW	GLASGOW MUNICIPAL	KY	0	1	0	1
EHR	HENDERSON CITY-COUNTY	KY	0	1	0	1
SME	LAKE CUMBERLAND RGNL	KY	0	1	0	1
LOZ	LONDON-CORBIN ARPT-MAGEE FLD	KY	0	1	0	1
SDF	LOUISVILLE INTL-STANDIFORD FIELD	KY	0	1	0	1
OWB	OWENSBORO-DAVIESS COUNTY	KY	0	1	0	1
DVK	STUART POWELL FIELD	KY	0	1	0	1
W38	WILLIAMSBURG-WHITLEY COUNTY	KY	0	1	0	1
ARA	ACADIANA RGNL	LA	0	1	1	0.999994
AEX	ALEXANDRIA INTL	LA	0	1	0	1
BTR	BATON ROUGE METROPOLITAN` RYAN	LA	0	1	0	1
DRI	BEAUREGARD RGNL	LA	0	1	0	1
CWF	CHENNAULT INTL	LA	0	1	0	1

Airport Id	Airport Name	State	LPV Outages	LPV Availability	LPV 200 Outages	LPV 200 Availability
ESF	ESLER RGNL	LA	0	1	0	1
HZR	FALSE RIVER RGNL	LA	0	1	0	1
PTN	HARRY P WILLIAMS MEMORIAL	LA	0	1	2	0.999979
LFT	LAFAYETTE RGNL	LA	0	1	1	1
LCH	LAKE CHARLES RGNL	LA	0	1	0	1
NEW	LAKEFRONT	LA	0	1	1	0.999981
MSY	LOUIS ARMSTRONG NEW ORLEANS IN	LA	0	1	1	0.999982
BQP	MOREHOUSE MEMORIAL	LA	0	1	0	1
DTN	SHREVEPORT DOWNTOWN	LA	0	1	0	1
SHV	SHREVEPORT RGNL	LA	0	1	0	1
GAO	SOUTH LAFOURCHE LEONARD MILLER	LA	0	1	2	0.999939
TVR	VICKSBURG TALLULAH RGNL	LA	0	1	0	1
BAF	BARNES MUNICIPAL	MA	0	1	2	0.999870
HYA	BARNSTABLE MUNICIPAL-BOARDMAN/POLAN	MA	0	1	2	0.999818
BOS	GENERAL EDWARD LAWRENCE LOGAN	MA	0	1	2	0.999832
BED	LAURENCE G HANSCOM FLD	MA	0	1	2	0.999835
MVY	MARTHAS VINEYARD	MA	0	1	2	0.999834
OWD	NORWOOD MEMORIAL	MA	0	1	2	0.999835
PVC	PROVINCETOWN MUNICIPAL	MA	0	1	2	0.999817
ORH	WORCESTER RGNL	MA	0	1	2	0.999877
BWI	BALTIMORE/WASHINGTON INTL THUR	MD	0	1	28	0.999374
DMW	CARROLL COUNTY RGNL/JACK B POA	MD	0	1	21	0.999703
ESN	EASTON/NEWNAM FIELD	MD	0	1	28	0.999224
FDK	FREDERICK MUNICIPAL	MD	0	1	28	0.999486
GAI	MONTGOMERY COUNTY AIRPARK	MD	0	1	29	0.999313
2W6	ST. MARY'S COUNTY RGNL	MD	0	1	29	0.998694
LEW	AUBURN/LEWISTON MUNICIPAL	ME	0	1	1	0.999751
AUG	AUGUSTA STATE	ME	1	0.999999	2	0.999739
BGR	BANGOR INTL	ME	1	0.999999	2	0.999725
BHB	HANCOCK COUNTY-BAR HARBOR	ME	1	0.999999	2	0.999720
PQI	NORTHERN MAINE RGNL ARPT AT PR	ME	1	0.999999	2	0.999701
PWM	PORTLAND INTL JETPORT	ME	0	1	1	0.999808
WVL	WATERVILLE ROBERT LAFLEUR	ME	1	0.999999	2	0.999734
ARB	ANN ARBOR MUNICIPAL	MI	0	1	0	1
ACB	ANTRIM COUNTY	MI	0	1	0	1
FNT	BISHOP INTL	MI	0	1	0	1
OEB	BRANCH COUNTY MEMORIAL	MI	0	1	0	1
CVX	CHARLEVOIX MUNICIPAL	MI	0	1	0	1
CIU	CHIPPEWA COUNTY INTL	MI	0	1	2	0.999874
TTF	CUSTER	MI	0	1	0	1
DTW	DETROIT METROPOLITAN WAYNE COUNTY	MI	0	1	0	1
FFX	FREMONT MUNICIPAL	MI	0	1	0	1
GRR	GERALD R. FORD INTL	MI	0	1	0	1
CMX	HOUGHTON COUNTY MEMORIAL	MI	0	1	4	0.999881
BAX	HURON COUNTY MEMORIAL	MI	0	1	0	1
AZO	KALAMAZOO/BATTLE CREEK INTL	MI	0	1	0	1
ADG	LENAWEE COUNTY	MI	0	1	0	1
OZW	LIVINGSTON COUNTY SPENCER J. H	MI	0	1	0	1

Airport Id	Airport Name	State	LPV Outages	LPV Availability	LPV 200 Outages	LPV 200 Availability
LDM	MASON COUNTY	MI	0	1	0	1
MBS	MBS INTL	MI	0	1	0	1
MKG	MUSKEGON COUNTY	MI	0	1	0	1
RNP	OWOSSO COMMUNICIPALTY	MI	0	1	0	1
HYX	SAGINAW COUNTY H.W. BROWNE	MI	0	1	0	1
BIV	TULIP CITY	MI	0	1	0	1
YIP	WILLOW RUN	MI	0	1	0	1
AEL	ALBERT LEA MUNICIPAL	MN	0	1	1	0.999959
ANE	ANOKA COUNTY-BLAINE ARPT	MN	0	1	1	0.999932
AUM	AUSTIN MUNICIPAL	MN	0	1	1	0.999966
BDE	BAUDETTE INTL	MN	0	1	4	0.999872
BRD	BRAINERD LAKES RGNL	MN	0	1	2	0.999909
AXN	CHANDLER FIELD	MN	0	1	2	0.999903
HIB	CHISHOLM-HIBBING	MN	0	1	4	0.999907
CKN	CROOKSTON MUNICIPAL KIRKWOOD FLD	MN	0	1	2	0.999885
DTL	DETROIT LAKES-WETHING FIELD	MN	0	1	2	0.999885
DLH	DULUTH INTL	MN	0	1	3	0.999929
INL	FALLS INTL	MN	0	1	5	0.999853
MSP	MINNEAPOLIS-ST PAUL INTL	MN	0	1	1	0.999936
RGK	RED WING RGNL	MN	0	1	1	0.999948
RST	ROCHESTER INTL	MN	0	1	1	0.999971
ROX	ROSEAU MUNICIPAL/RUDY BILLBERG FIELD	MN	0	1	4	0.999882
MML	SOUTHWEST MINNESOTA RGNL MARSH	MN	0	1	2	0.999935
STC	ST CLOUD RGNL	MN	0	1	1	0.999918
JYG	ST JAMES MUNICIPAL	MN	0	1	2	0.999934
STP	ST PAUL DOWNTOWN HOLMAN FLD	MN	0	1	1	0.999936
RRT	WARROAD INTL MEMORIAL	MN	0	1	4	0.999872
BDH	WILLMAR MUNICIPAL-JOHN L RICE FIELD	MN	0	1	2	0.999935
M17	BOLIVAR MUNICIPAL	MO	0	1	0	1
CGI	CAPE GIRARDEAU RGNL	MO	0	1	0	1
M05	CARUTHERSVILLE MEMORIAL	MO	0	1	0	1
MKC	CHARLES B. WHEELER DOWNTOWN	MO	0	1	1	0.999972
COU	COLUMBIA RGNL	MO	0	1	0	1
1H0	CREVE COEUR	MO	0	1	0	1
DXE	DEXTER MUNICIPAL	MO	0	1	0	1
LBO	FLOYD W. JONES LEBANON	MO	0	1	0	1
K57	GOULD PETERSON MUNICIPAL	MO	0	1	1	0.999967
HIG	HIGGINSVILLE INDUSTRIAL MUNICIPAL	MO	0	1	1	0.999986
JEF	JEFFERSON CITY MEMORIAL	MO	0	1	0	1
VER	JESSE VIERTEL MEMORIAL	MO	0	1	0	1
JLN	JOPLIN RGNL	MO	0	1	1	0.999985
MCI	KANSAS CITY INTL	MO	0	1	1	0.999972
TKX	KENNETT MEMORIAL	MO	0	1	0	1
IRK	KIRKSVILLE RGNL	MO	0	1	1	0.999999
STL	LAMBERT-ST LOUIS INTL	MO	0	1	0	1
LRY	LAWRENCE SMITH MEMORIAL	MO	0	1	1	0.999978
AIZ	LEE C FINE MEMORIAL	MO	0	1	0	1
LXT	LEE'S SUMMIT MUNICIPAL	MO	0	1	1	0.999975

Airport Id	Airport Name	State	LPV Outages	LPV Availability	LPV 200 Outages	LPV 200 Availability
6M6	LEWIS COUNTY RGNL	MO	0	1	0	1
MHL	MARSHALL MEMORIAL MUNICIPAL	MO	0	1	1	0.999995
MYJ	MEXICO MEMORIAL	MO	0	1	0	1
GPH	MIDWEST NATIONAL AIR CENTER	MO	0	1	1	0.999973
M58	MONETT MUNICIPAL	MO	0	1	1	0.999996
EOS	NEOSHO HUGH ROBINSON	MO	0	1	1	0.999989
POF	POPLAR BLUFF MUNICIPAL	MO	0	1	0	1
STJ	ROSECRANS MEMORIAL	MO	0	1	1	0.999972
DMO	SEDALIA MEMORIAL	MO	0	1	1	0.999998
SIK	SIKESTON MEMORIAL MUNICIPAL	MO	0	1	0	1
RCM	SKYHAVEN	MO	0	1	1	0.999986
SGF	SPRINGFIELD-BRANSON NATIONAL	MO	0	1	0	1
TBN	WAYNESVILLE RGNL ARPT AT FORNE	MO	0	1	0	1
UNO	WEST PLAINS MUNICIPAL	MO	0	1	0	1
STF	GEORGE M BRYAN	MS	0	1	0	1
GTR	GOLDEN TRIANGLE RGNL	MS	0	1	0	1
GWO	GREENWOOD-LEFLORE	MS	0	1	0	1
GNF	GRENADA MUNICIPAL	MS	0	1	0	1
GPT	GULFPORT-BILOXI INTL	MS	0	1	1	0.999993
HEZ	HARDY-ANDERS FIELD NATCHEZ-ADA	MS	0	1	0	1
HBG	HATTIESBURG BOBBY L CHAIN MUNICIPAL	MS	0	1	0	1
PIB	HATTIESBURG-LAUREL RGNL	MS	0	1	0	1
LUL	HESLER-NOBLE FIELD	MS	0	1	0	1
JAN	JACKSON-EVERS INTL	MS	0	1	0	1
M16	JOHN BELL WILLIAMS	MS	0	1	0	1
MEI	KEY FIELD	MS	0	1	0	1
MCB	MC COMB/PIKE COUNTY/ JOHN E LEWIS	MS	0	1	0	1
M40	MONROE COUNTY	MS	0	1	0	1
OLV	OLIVE BRANCH	MS	0	1	0	1
MJD	PICAYUNE MUNICIPAL	MS	0	1	1	0.999998
M43	PRENTISS- JEFFERSON DAVIS COUNTY	MS	0	1	0	1
CRX	ROSCOE TURNER	MS	0	1	0	1
HSA	STENNIS INTL	MS	0	1	1	0.999992
PQL	TRENT LOTT INTL	MS	0	1	1	0.999988
UTA	TUNICA MUNICIPAL	MS	0	1	0	1
UOX	UNIVERSITY-OXFORD	MS	0	1	0	1
BTM	BERT MOONEY	MT	0	1	1	0.999967
BIL	BILLINGS LOGAN INTL	MT	0	1	2	0.999948
MLS	FRANK WILEY FIELD	MT	0	1	2	0.999910
GPI	GLACIER PARK INTL	MT	0	1	1	0.999996
GTF	GREAT FALLS INTL	MT	0	1	2	0.999953
HLN	HELENA RGNL	MT	0	1	1	0.999966
LWT	LEWISTOWN MUNICIPAL	MT	0	1	3	0.999939
OAJ	ALBERT J ELLIS	NC	0	1	29	0.995394
AFP	ANSON COUNTY	NC	0	1	29	0.995318
HBI	ASHEBORO RGNL	NC	0	1	28	0.995716
AVL	ASHEVILLE RGNL	NC	0	1	28	0.997669
CLT	CHARLOTTE/DOUGLAS INTL	NC	0	1	29	0.995447
JQF	CONCORD RGNL	NC	0	1	29	0.995549

Airport Id	Airport Name	State	LPV Outages	LPV Availability	LPV 200 Outages	LPV 200 Availability
EWN	CRAVEN COUNTY RGNL	NC	0	1	29	0.995698
ECG	ELIZABETH CITY CG AIR STATION/	NC	0	1	28	0.996929
FAY	FAYETTEVILLE RGNL/GRANNIS FIELD	NC	0	1	28	0.995291
LHZ	FRANKLIN COUNTY	NC	0	1	28	0.996282
AKH	GASTONIA MUNICIPAL	NC	0	1	29	0.995465
GWW	GOLDSBORO-WAYNE MUNICIPAL	NC	0	1	29	0.995852
HRJ	HARNETT RGNL JETPORT	NC	0	1	28	0.995639
HNZ	HENDERSON-OXFORD	NC	0	1	28	0.996561
ISO	KINSTON RGNL JETPORT	NC	0	1	29	0.995798
EQY	MONROE RGNL	NC	0	1	29	0.995328
EDE	NORTHEASTERN RGNL	NC	0	1	28	0.996637
GSO	PIEDMONT TRIAD INTL	NC	0	1	28	0.996070
PGV	PITT-GREENVILLE	NC	0	1	29	0.996118
RDU	RALEIGH-DURHAM INTL	NC	0	1	28	0.996070
RWI	ROCKY MOUNT-WILSON RGNL	NC	0	1	29	0.996217
RUQ	ROWAN COUNTY	NC	0	1	29	0.995701
TTA	SANFORD-LEE COUNTY RGNL	NC	0	1	28	0.995756
SVH	STATESVILLE RGNL	NC	0	1	29	0.995800
ILM	WILMINGTON INTL	NC	0	1	29	0.994901
BIS	BISMARCK MUNICIPAL	ND	0	1	2	0.999904
5N8	CASSELTON ROBERT MILLER RGNL	ND	0	1	2	0.999885
DVL	DEVILS LAKE RGNL	ND	0	1	2	0.999885
DIK	DICKINSON - THEODORE ROOSEVELT	ND	0	1	2	0.999904
GFK	GRAND FORKS INTL	ND	0	1	2	0.999885
FAR	HECTOR INTL	ND	0	1	2	0.999885
JMS	JAMESTOWN RGNL	ND	0	1	2	0.999891
MOT	MINOT INTL	ND	0	1	2	0.999886
ANW	AINSWORTH MUNICIPAL	NE	0	1	2	0.999908
BVN	ALBION MUNICIPAL	NE	0	1	1	0.999938
AIA	ALLIANCE MUNICIPAL	NE	0	1	2	0.999929
AUH	AURORA MUNICIPAL – AL POTTER FIELD	NE	0	1	1	0.999940
BIE	BEATRICE MUNICIPAL	NE	0	1	1	0.999970
FNB	BRENNER FIELD	NE	0	1	1	0.999972
HDE	BREWSTER FIELD	NE	0	1	1	0.999940
BBW	BROKEN BOW MUNICIPAL	NE	0	1	2	0.999927
GRI	CENTRAL NEBRASKA RGNL	NE	0	1	1	0.999940
CDR	CHADRON MUNICIPAL	NE	0	1	2	0.999922
OLU	COLUMBUS MUNICIPAL	NE	0	1	1	0.999938
CZD	COZAD MUNICIPAL	NE	0	1	2	0.999931
CEK	CRETE MUNICIPAL	NE	0	1	1	0.999940
OMA	EPPLEY AIRFIELD	NE	0	1	1	0.999940
FBY	FAIRBURY MUNICIPAL	NE	0	1	1	0.999972
FET	FREMONT MUNICIPAL	NE	0	1	1	0.999938
OKS	GARDEN COUNTY	NE	0	1	2	0.999931
GRN	GORDON MUNICIPAL	NE	0	1	2	0.999911
GGF	GRANT MUNICIPAL	NE	0	1	2	0.999931
HSI	HASTINGS MUNICIPAL	NE	0	1	1	0.999940
IML	IMPERIAL MUNICIPAL	NE	0	1	2	0.999942
LXN	JIM KELLY FIELD	NE	0	1	2	0.999935
OFK	KARL STEFAN MEMORIAL	NE	0	1	1	0.999938

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EAR	KEARNEY RGNL	NE	0	1	1	0.999940
IBM	KIMBALL MUNICIPAL/ ROBERT E ARRAJ FIELD	NE	0	1	2	0.999965
LNK	LINCOLN	NE	0	1	1	0.999940
MCK	MC COOK RGNL	NE	0	1	2	0.999949
MLE	MILLARD	NE	0	1	1	0.999940
VTN	MILLER FIELD	NE	0	1	2	0.999904
AFK	NEBRASKA CITY MUNICIPAL	NE	0	1	1	0.999940
LBF	NORTH PLATTE RGNL AIRPORT LEE	NE	0	1	2	0.999924
PMV	PLATTSMOUTH MUNICIPAL	NE	0	1	1	0.999940
SCB	SCRIBNER STATE	NE	0	1	1	0.999938
OGA	SEARLE FIELD	NE	0	1	2	0.999927
SWT	SEWARD MUNICIPAL	NE	0	1	1	0.999940
SNY	SIDNEY MUNICIPAL/ LLOYD W. CARR FIELD	NE	0	1	2	0.999964
ONL	THE O'NEILL MUNICIPAL- JOHN L BAKER	NE	0	1	2	0.999927
AHQ	WAHOO MUNICIPAL	NE	0	1	1	0.999940
LCG	WAYNE MUNICIPAL	NE	0	1	1	0.999938
BFF	WESTERN NEB. RGNL/WILLIAM B. H	NE	0	1	2	0.999942
JYR	YORK MUNICIPAL	NE	0	1	1	0.999940
ASH	BOIRE FIELD	NH	0	1	2	0.999831
CON	CONCORD MUNICIPAL	NH	0	1	2	0.999832
EEN	DILLANT-HOPKINS	NH	0	1	2	0.999874
LCI	LACONIA MUNICIPAL	NH	0	1	1	0.999828
MHT	MANCHESTER	NH	0	1	2	0.999831
PSM	PORTSMOUTH INTL AT PEASE	NH	0	1	2	0.999827
ACY	ATLANTIC CITY INTL	NJ	0	1	8	0.999914
WWD	CAPE MAY COUNTY	NJ	0	1	25	0.999643
MIV	MILLVILLE MUNICIPAL	NJ	0	1	18	0.999831
EWR	NEWARK LIBERTY INTL	NJ	0	1	2	0.999894
TEB	TETERBORO	NJ	0	1	2	0.999891
ABQ	ALBUQUERQUE INTL SUNPORT	NM	0	1	6	0.999756
CVN	CLOVIS MUNICIPAL	NM	0	1	2	0.999949
AEG	DOUBLE EAGLE II	NM	0	1	6	0.999750
FMN	FOUR CORNERS RGNL	NM	0	1	4	0.999803
SVC	GRANT COUNTY	NM	0	1	14	0.999510
LRU	LAS CRUCES INTL	NM	0	1	13	0.999449
ROW	ROSWELL INTL AIR CENTER	NM	0	1	7	0.999730
LAS	MC CARRAN INTL	NV	0	1	9	0.999626
4SD	RENO/STEAD	NV	0	1	105	0.994639
RNO	RENO/TAHOE INTL	NV	0	1	105	0.994678
WMC	WINNEMUCCA MUNICIPAL	NV	0	1	61	0.999023
9G3	AKRON	NY	0	1	2	0.999829
ALB	ALBANY INTL	NY	0	1	2	0.999856
HWV	BROOKHAVEN	NY	0	1	2	0.999902
BUF	BUFFALO NIAGARA INTL	NY	0	1	2	0.999834
OLE	CATTARAUGUS COUNTY-OLEAN	NY	0	1	2	0.999884
JHW	CHAUTAUQUA COUNTY/JAMESTOWN	NY	0	1	1	0.999898
ELM	ELMIRA/CORNING RGNL	NY	0	1	2	0.999820
FOK	FRANCIS S GABRESKI	NY	0	1	2	0.999903
BGM	GREATER BINGHAMTON/EDWIN A LIN	NY	0	1	2	0.999828

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ROC	GREATER ROCHESTER INTL	NY	0	1	2	0.999796
JFK	JOHN F KENNEDY INTL	NY	0	1	2	0.999901
LGA	LA GUARDIA	NY	0	1	2	0.999895
MSS	MASSENA INTL-RICHARDS FIELD	NY	0	1	2	0.999797
N66	ONEONTA MUNICIPAL	NY	0	1	2	0.999838
PEO	PENN YAN	NY	0	1	2	0.999804
PBG	PLATTSBURGH INTL	NY	0	1	2	0.999815
44N	SKY ACRES	NY	0	1	2	0.999875
SWF	STEWART INTL	NY	0	1	2	0.999871
SYR	SYRACUSE HANCOCK INTL	NY	0	1	2	0.999806
ELZ	WELLSVILLE MUNICIPAL ARPT`TARANTINE	NY	0	1	2	0.999866
HPN	WESTCHESTER COUNTY	NY	0	1	2	0.999885
SDC	WILLIAMSON-SODUS	NY	0	1	2	0.999784
HAO	BUTLER CO RGNL	OH	0	1	0	1
CXY	CAPITAL CITY	OH	0	1	2	0.999914
LUK	CINCINNATI MUNICIPAL AIRPORT LUNKEN	OH	0	1	0	1
CLE	CLEVELAND-HOPKINS INTL	OH	0	1	1	0.999962
MGY	DAYTON-WRIGHT BROTHERS	OH	0	1	0	1
DLZ	DELAWARE MUNICIPAL	OH	0	1	0	1
LHQ	FAIRFIELD COUNTY	OH	0	1	1	0.999995
FDY	FINDLAY	OH	0	1	0	1
PMH	GREATER PORTSMOUTH RGNL	OH	0	1	1	0.999992
I19	GREENE COUNTY-LEWIS A. JACKSON	OH	0	1	0	1
DAY	JAMES M COX DAYTON INTL	OH	0	1	0	1
1G3	KENT STATE UNIV	OH	0	1	1	0.999946
I68	LEBANON-WARREN COUNTY	OH	0	1	0	1
UYF	MADISON COUNTY	OH	0	1	0	1
MNN	MARION MUNICIPAL	OH	0	1	0	1
AXV	NEIL ARMSTRONG	OH	0	1	0	1
OSU	OHIO STATE UNIVERSITY	OH	0	1	0	1
UNI	OHIO UNIVERSITY SNYDER FIELD	OH	0	1	1	0.999971
CMH	PORT COLUMBUS INTL	OH	0	1	0	1
RZT	ROSS COUNTY	OH	0	1	0	1
TOL	TOLEDO EXPRESS	OH	0	1	0	1
1G0	WOOD COUNTY	OH	0	1	0	1
YNG	YOUNGSTOWN-WARREN RGNL	OH	0	1	1	0.999915
AVK	ALVA RGNL	OK	0	1	3	0.999837
BVO	BARTLESVILLE MUNICIPAL	OK	0	1	1	0.999984
CQB	CHANDLER RGNL	OK	0	1	1	0.999997
CHK	CHICKASHA MUNICIPAL	OK	0	1	3	0.999989
GCM	CLAREMORE RGNL	OK	0	1	1	0.999986
F29	CLARENCE E PAGE MUNICIPAL	OK	0	1	3	0.999969
1K4	DAVID JAY PERRY	OK	0	1	0	1
MKO	DAVIS FIELD	OK	0	1	1	0.999986
DUA	EAKER FIELD	OK	0	1	0	1
ELK	ELK CITY RGNL BUSINESS	OK	0	1	3	0.999858
GMJ	GROVE MUNICIPAL	OK	0	1	1	0.999986
GOK	GUTHRIE-EDMOND RGNL	OK	0	1	3	0.999975
2O8	HINTON MUNICIPAL	OK	0	1	3	0.999924
HBR	HOBART RGNL	OK	0	1	3	0.999901

Airport Id	Airport Name	State	LPV Outages	LPV Availability	LPV 200 Outages	LPV 200 Availability
MLC	MC ALESTER RGNL	OK	0	1	1	0.999988
MIO	MIAMI MUNICIPAL	OK	0	1	1	0.999985
MDF	MOORELAND MUNICIPAL	OK	0	1	3	0.999855
OKM	OKMULGEE RGNL	OK	0	1	1	0.999986
PVJ	PAULS VALLEY MUNICIPAL	OK	0	1	0	1
PNC	PONCA CITY RGNL	OK	0	1	4	0.999899
RVS	RICHARD LLOYD JONES JR	OK	0	1	1	0.999986
2K4	SCOTT FIELD	OK	0	1	4	0.999891
SNL	SHAWNEE RGNL	OK	0	1	0	1
SWO	STILLWATER RGNL	OK	0	1	3	0.999973
TQH	TAHLEQUAH MUNICIPAL	OK	0	1	1	0.999986
TUL	TULSA INTL	OK	0	1	1	0.999986
OUN	UNIVERSITY OF OKLAHOMA WESTHEI	OK	0	1	0	1
OKC	WILL ROGERS WORLD	OK	0	1	3	0.999994
UAO	AURORA STATE	OR	0	1	95	0.996356
BDN	BEND MUNICIPAL	OR	0	1	74	0.998099
LMT	KLAMATH FALLS	OR	0	1	101	0.995117
LGD	LA GRANDE/UNION COUNTY	OR	0	1	25	0.999801
EUG	MAHLON SWEET FIELD	OR	0	1	96	0.994023
MMV	MC MINNVILLE MUNICIPAL	OR	0	1	95	0.995443
SLE	MCNARY FLD	OR	0	1	95	0.995551
ONP	NEWPORT MUNICIPAL	OR	0	1	97	0.990639
ONO	ONTARIO MUNICIPAL	OR	0	1	13	0.999959
PDX	PORTLAND INTL	OR	0	1	91	0.996972
AGC	ALLEGHENY COUNTY	PA	0	1	17	0.999743
AOO	ALTOONA-BLAIR COUNTY	PA	0	1	8	0.999884
LBE	ARNOLD PALMER RGNL	PA	0	1	17	0.999764
BFD	BRADFORD RGNL	PA	0	1	1	0.999902
BTP	BUTLER COUNTY/ K W SCHOLTER FIELD	PA	0	1	2	0.999885
MQS	CHESTER COUNTY G O CARLSON	PA	0	1	2	0.999924
AXQ	CLARION COUNTY	PA	0	1	1	0.999897
9D4	DECK	PA	0	1	1	0.999926
DUJ	DUBOIS RGNL	PA	0	1	1	0.999903
WAY	GREENE COUNTY	PA	0	1	28	0.999387
HZL	HAZLETON MUNICIPAL	PA	0	1	2	0.999868
JST	JOHN MURTHA JOHNSTOWN-CAMBRIA	PA	0	1	15	0.999849
LNS	LANCASTER	PA	0	1	2	0.999923
ABE	LEHIGH VALLEY INTL	PA	0	1	2	0.999886
RVL	MIFFLIN COUNTY	PA	0	1	1	0.999912
UCP	NEW CASTLE MUNICIPAL	PA	0	1	1	0.999904
PNE	NORTHEAST PHILADELPHIA	PA	0	1	2	0.999912
PHL	PHILADELPHIA INTL	PA	0	1	3	0.999911
PIT	PITTSBURGH INTL	PA	0	1	17	0.999828
FWQ	ROSTRAVER	PA	0	1	21	0.999674
2G9	SOMERSET COUNTY	PA	0	1	21	0.999679
OYM	ST MARYS MUNICIPAL	PA	0	1	1	0.999905
UNV	UNIVERSITY PARK	PA	0	1	1	0.999911
FKL	VENANGO RGNL	PA	0	1	1	0.999892
BID	BLOCK ISLAND STATE	RI	0	1	2	0.999875
OQU	QUONSET STATE	RI	0	1	2	0.999870
PVD	THEODORE FRANCIS GREEN STATE	RI	0	1	2	0.999869

Airport Id	Airport Name	State	LPV Outages	LPV Availability	LPV 200 Outages	LPV 200 Availability
AIK	AIKEN MUNICIPAL	SC	0	1	30	0.994748
AND	ANDERSON RGNL	SC	0	1	29	0.996868
CHS	CHARLESTON AFB/INTL	SC	0	1	29	0.994202
JZI	CHARLESTON EXECUTIVE	SC	0	1	29	0.994074
CAE	COLUMBIA METROPOLITAN	SC	0	1	30	0.994462
UDG	DARLINGTON COUNTY JETPORT	SC	0	1	29	0.994971
GYH	DONALDSON CENTER	SC	0	1	28	0.996305
GGE	GEORGETOWN COUNTY	SC	0	1	30	0.994305
GSP	GREENVILLE SPARTANBURG INTL	SC	0	1	28	0.996183
MYR	MYRTLE BEACH INTL	SC	0	1	30	0.994487
CEU	OCONEE COUNTY RGNL	SC	0	1	29	0.997614
CDN	WOODWARD FIELD	SC	0	1	29	0.995001
ABR	ABERDEEN RGNL	SD	0	1	2	0.999904
BKX	BROOKINGS RGNL	SD	0	1	2	0.999926
YKN	CHAN GURNEY MUNICIPAL	SD	0	1	2	0.999937
HON	HURON RGNL	SD	0	1	2	0.999908
FSD	JOE FOSS FIELD	SD	0	1	2	0.999936
MHE	MITCHELL MUNICIPAL	SD	0	1	2	0.999918
PIR	PIERRE RGNL	SD	0	1	2	0.999904
RAP	RAPID CITY RGNL	SD	0	1	2	0.999907
ATY	WATERTOWN RGNL	SD	0	1	2	0.999914
PVE	BEECH RIVER RGNL	TN	0	1	0	1
SYI	BOMAR FIELD-SHELBYVILLE MUNICIPAL	TN	0	1	0	1
UCY	EVERETT-STEWART RGNL	TN	0	1	0	1
CHA	LOVELL FIELD	TN	0	1	0	1
TYS	MC GHEE TYSON	TN	0	1	1	0.999993
MEM	MEMPHIS INTL	TN	0	1	0	1
NQA	MILLINGTON RGNL JETPORT	TN	0	1	0	1
BNA	NASHVILLE INTL	TN	0	1	0	1
SZY	ROBERT SIBLEY	TN	0	1	0	1
TRI	TRI-CITIES RGNL TN/VA	TN	0	1	28	0.998637
BGF	WINCHESTER MUNICIPAL	TN	0	1	0	1
ABI	ABILENE RGNL	TX	0	1	1	0.999999
ADS	ADDISON	TX	0	1	0	1
ALI	ALICE INTL	TX	0	1	4	0.999895
LFK	ANGELINA COUNTY	TX	0	1	0	1
GKY	ARLINGTON MUNICIPAL	TX	0	1	1	0.999999
AUS	AUSTIN-BERGSTROM INTL	TX	0	1	3	0.999957
LBX	BRAZORIA COUNTY	TX	0	1	3	0.999936
BWD	BROWNWOOD RGNL	TX	0	1	1	0.999999
E30	BRUCE FIELD	TX	0	1	1	0.999999
TKI	COLLIN COUNTY RGNL AT MC KINNE	TX	0	1	0	1
CRP	CORPUS CHRISTI INTL	TX	0	1	3	0.999906
CFD	COULTER FIELD	TX	0	1	2	0.999986
PRX	COX FIELD	TX	0	1	1	0.999999
BBD	CURTIS FIELD	TX	0	1	1	0.999999
RBD	DALLAS EXECUTIVE	TX	0	1	1	0.999999
DAL	DALLAS LOVE FIELD	TX	0	1	0	1
DFW	DALLAS/FORT WORTH INTL	TX	0	1	1	0.999999
DWH	DAVID WAYNE HOOKS MEMORIAL	TX	0	1	2	0.999986
LUD	DECATUR MUNICIPAL	TX	0	1	1	0.999999

Airport Id	Airport Name	State	LPV Outages	LPV Availability	LPV 200 Outages	LPV 200 Availability
DRT	DEL RIO INTL	TX	0	1	4	0.999835
TPL	DRAUGHON-MILLER CENTRAL TEXAS	TX	0	1	1	0.999999
GGG	EAST TEXAS RGNL	TX	0	1	0	1
CLL	EASTERWOOD FIELD	TX	0	1	3	0.999984
ELP	EL PASO INTL	TX	0	1	12	0.999410
AFW	FORT WORTH ALLIANCE	TX	0	1	1	0.999999
FWS	FORT WORTH SPINKS	TX	0	1	1	0.999999
IAH	GEORGE BUSH INTERCONTINENTAL	TX	0	1	2	0.999988
PVW	HALE COUNTY	TX	0	1	4	0.999890
INJ	HILLSBORO MUNICIPAL	TX	0	1	1	0.999999
TME	HOUSTON EXECUTIVE	TX	0	1	3	0.999971
AXH	HOUSTON-SOUTHWEST	TX	0	1	3	0.999973
ERV	KERRVILLE MUNICIPAL/ LOUIS SCHREINER	TX	0	1	4	0.999956
LNC	LANCASTER	TX	0	1	1	0.999999
LRD	LAREDO INTL	TX	0	1	6	0.999751
CXO	LONE STAR EXECUTIVE	TX	0	1	2	0.999993
LBB	LUBBOCK PRESTON SMITH INTL	TX	0	1	4	0.999913
GVT	MAJORS	TX	0	1	0	1
5T9	MAVERICK COUNTY MEMORIAL INTL	TX	0	1	4	0.999808
MFE	MC ALLEN MILLER INTL	TX	0	1	4	0.999673
HQZ	MESQUITE METRO	TX	0	1	0	1
MAF	MIDLAND INTL	TX	0	1	6	0.999864
OSA	MOUNT PLEASANT RGNL	TX	0	1	0	1
RAS	MUSTANG BEACH	TX	0	1	3	0.999902
BAZ	NEW BRAUNFELS MUNICIPAL	TX	0	1	3	0.999917
PIL	PORT ISABEL-CAMERON COUNTY	TX	0	1	3	0.999678
AMA	RICK HUSBAND AMARILLO INTL	TX	0	1	2	0.999948
SJT	SAN ANGELO RGNL/MATHIS FIELD	TX	0	1	1	0.999999
SAT	SAN ANTONIO INTL	TX	0	1	3	0.999935
HYI	SAN MARCOS MUNICIPAL	TX	0	1	3	0.999932
GLS	SCHOLES INTL AT GALVESTON	TX	0	1	2	0.999951
SPS	SHEPPARD AFB/WICHITA FALLS MUN	TX	0	1	1	0.999999
EBG	SOUTH TEXAS INTL AT EDINBURG	TX	0	1	5	0.999696
SGR	SUGAR LAND RGNL	TX	0	1	3	0.999972
TFP	T P MC CAMPBELL	TX	0	1	3	0.999906
TRL	TERRELL MUNICIPAL	TX	0	1	0	1
TYR	TYLER POUNDS RGNL	TX	0	1	0	1
HRL	VALLEY INTL	TX	0	1	4	0.999678
IWS	WEST HOUSTON	TX	0	1	3	0.999977
HOU	WILLIAM P HOBBY	TX	0	1	3	0.999983
CDC	CEDAR CITY RGNL	UT	0	1	2	0.999923
KNB	KANAB MUNICIPAL	UT	0	1	2	0.999919
LGU	LOGAN-CACHE	UT	0	1	1	0.999979
OGD	OGDEN-HINCKLEY	UT	0	1	1	0.999977
PVU	PROVO MUNICIPAL	UT	0	1	1	0.999976
SLC	SALT LAKE CITY INTL	UT	0	1	1	0.999977
SGU	ST GEORGE MUNICIPAL	UT	0	1	2	0.999866
MFV	ACCOMACK COUNTY	VA	0	1	28	0.998266
MTV	BLUE RIDGE	VA	0	1	28	0.996524
CHO	CHARLOTTESVILLE-ALBEMARLE	VA	0	1	28	0.998162
FCI	CHESTERFIELD COUNTY	VA	0	1	28	0.997690

Airport Id	Airport Name	State	LPV Outages	LPV Availability	LPV 200 Outages	LPV 200 Availability
CJR	CULPEPER RGNL	VA	0	1	29	0.998612
PTB	DINWIDDIE COUNTY	VA	0	1	29	0.997494
OFP	HANOVER COUNTY MUNICIPAL	VA	0	1	29	0.997977
JYO	LEESBURG EXECUTIVE	VA	0	1	29	0.999154
LNP	LONESOME PINE	VA	0	1	28	0.999428
LYH	LYNCHBURG RGNL/ PRESTON GLENN FIELD	VA	0	1	28	0.997299
HEF	MANASSAS RGNL/HARRY P. DAVIS F	VA	0	1	29	0.998853
MKJ	MOUNTAIN EMPIRE	VA	0	1	28	0.997314
PSK	NEW RIVER VALLEY	VA	0	1	28	0.996857
PHF	NEWPORT NEWS/WILLIAMSBURG INTL	VA	0	1	29	0.997655
ORF	NORFOLK INTL	VA	0	1	28	0.997498
RIC	RICHMOND INTL	VA	0	1	29	0.997819
RMN	STAFFORD RGNL	VA	0	1	29	0.998582
XSA	TAPPAHANNOCK-ESSEX COUNTY	VA	0	1	29	0.998221
BCB	VIRGINIA TECH/ MONTGOMERY EXECU	VA	0	1	28	0.996965
IAD	WASHINGTON DULLES INTL	VA	0	1	29	0.999059
BTV	BURLINGTON INTL	VT	0	1	2	0.999819
FSO	FRANKLIN COUNTY STATE	VT	0	1	2	0.999807
BLI	BELLINGHAM INTL	WA	0	1	40	0.999562
HQM	BOWERMAN	WA	0	1	95	0.995480
PWT	BREMERTON NATIONAL	WA	0	1	77	0.998603
DEW	DEER PARK	WA	0	1	1	0.999996
FHR	FRIDAY HARBOR	WA	0	1	59	0.999196
MWH	GRANT CO INTL	WA	0	1	15	0.999889
OLM	OLYMPIA	WA	0	1	86	0.997975
PUW	PULLMAN/MOSCOW RGNL	WA	0	1	2	0.999977
RLD	RICHLAND	WA	0	1	28	0.999817
SEA	SEATTLE-TACOMA INTL	WA	0	1	64	0.998866
BVS	SKAGIT RGNL	WA	0	1	43	0.999338
PAE	SNOHOMISH COUNTY (PAINE FLD)	WA	0	1	7	0.998763
GEG	SPOKANE INTL	WA	0	1	1	0.999996
TIW	TACOMA NARROWS	WA	0	1	71	0.998585
PSC	TRI-CITIES	WA	0	1	27	0.999805
ALW	WALLA WALLA RGNL	WA	0	1	23	0.999840
CLM	WILLIAM R FAIRCHILD INTL	WA	0	1	87	0.998337
GRB	AUSTIN STRAUBEL INTL	WI	0	1	1	0.999998
DLL	BARABOO WISCONSIN DELLS	WI	0	1	2	0.999996
OVS	BOSCOBEL	WI	0	1	1	0.999998
CWA	CENTRAL WISCONSIN	WI	0	1	2	0.999985
EAU	CHIPPEWA VALLEY RGNL	WI	0	1	2	0.999958
MSN	DANE COUNTY RGNL-TRUAX FIELD	WI	0	1	1	1
UNU	DODGE COUNTY	WI	0	1	0	1
SUE	DOOR COUNTY CHERRYLAND	WI	0	1	1	0.999998
EGV	EAGLE RIVER UNION	WI	0	1	2	0.999981
FLD	FOND DU LAC COUNTY	WI	0	1	1	0.999998
MKE	GENERAL MITCHELL INTL	WI	0	1	0	1
ASX	JOHN F KENNEDY MEMORIAL	WI	0	1	3	0.999949
LSE	LA CROSSE MUNICIPAL	WI	0	1	2	0.999974
MTW	MANITOWOC COUNTY	WI	0	1	1	0.999999
MFI	MARSHFIELD MUNICIPAL	WI	0	1	2	0.999979

Airport Id	Airport Name	State	LPV Outages	LPV Availability	LPV 200 Outages	LPV 200 Availability
LUM	MENOMONIE MUNICIPAL-SCORE FIELD	WI	0	1	2	0.999952
RRL	MERRILL MUNICIPAL	WI	0	1	2	0.999981
C29	MIDDLETON MUNICIPAL – MOREY FIELD	WI	0	1	1	0.999998
ATW	OUTAGAMIE COUNTY RGNL	WI	0	1	1	0.999998
PBH	PRICE COUNTY	WI	0	1	2	0.999967
RHI	RHINELANDER-ONEIDA COUNTY	WI	0	1	2	0.999981
RPD	RICE LAKE RGNL - CARL'S FIELD	WI	0	1	2	0.999949
HYR	SAWYER COUNTY	WI	0	1	3	0.999946
SBM	SHEBOYGAN COUNTY MEMORIAL	WI	0	1	0	1
JVL	SOUTHERN WISCONSIN RGNL	WI	0	1	0	1
TKV	TOMAHAWK RGNL	WI	0	1	2	0.999977
LNR	TRI-COUNTY RGNL	WI	0	1	2	0.999998
OSH	WITTMAN RGNL	WI	0	1	1	0.999998
MRB	EASTERN WV RGNL/SHEPHERD FLD	WV	0	1	29	0.999357
PKB	MID-OHIO VALLEY RGNL	WV	0	1	2	0.999939
HTS	TRI-STATE/ MILTON J. FERGUSON FIELD	WV	0	1	1	0.999971
CYS	CHEYENNE RGNL/ JERRY OLSON FIELD	WY	0	1	1	0.999972
EVW	EVANSTON-UINTA COUNTY BURNS FIELD	WY	0	1	1	0.999979
GCC	GILLETTE-CAMPBELL COUNTY	WY	0	1	2	0.999933
JAC	JACKSON HOLE	WY	0	1	1	0.999977
LAR	LARAMIE RGNL	WY	0	1	1	0.999976
CPR	NATRONA COUNTY INTL	WY	0	1	2	0.999966
RIW	RIVERTON RGNL	WY	0	1	1	0.999977
RKS	ROCK SPRINGS-SWEETWATER COUNTY	WY	0	1	1	0.999980
SHR	SHERIDAN COUNTY	WY	0	1	2	0.999944
COD	YELLOWSTONE RGNL	WY	0	1	1	0.999967

Figure 9-1 WAAS LPV Availability

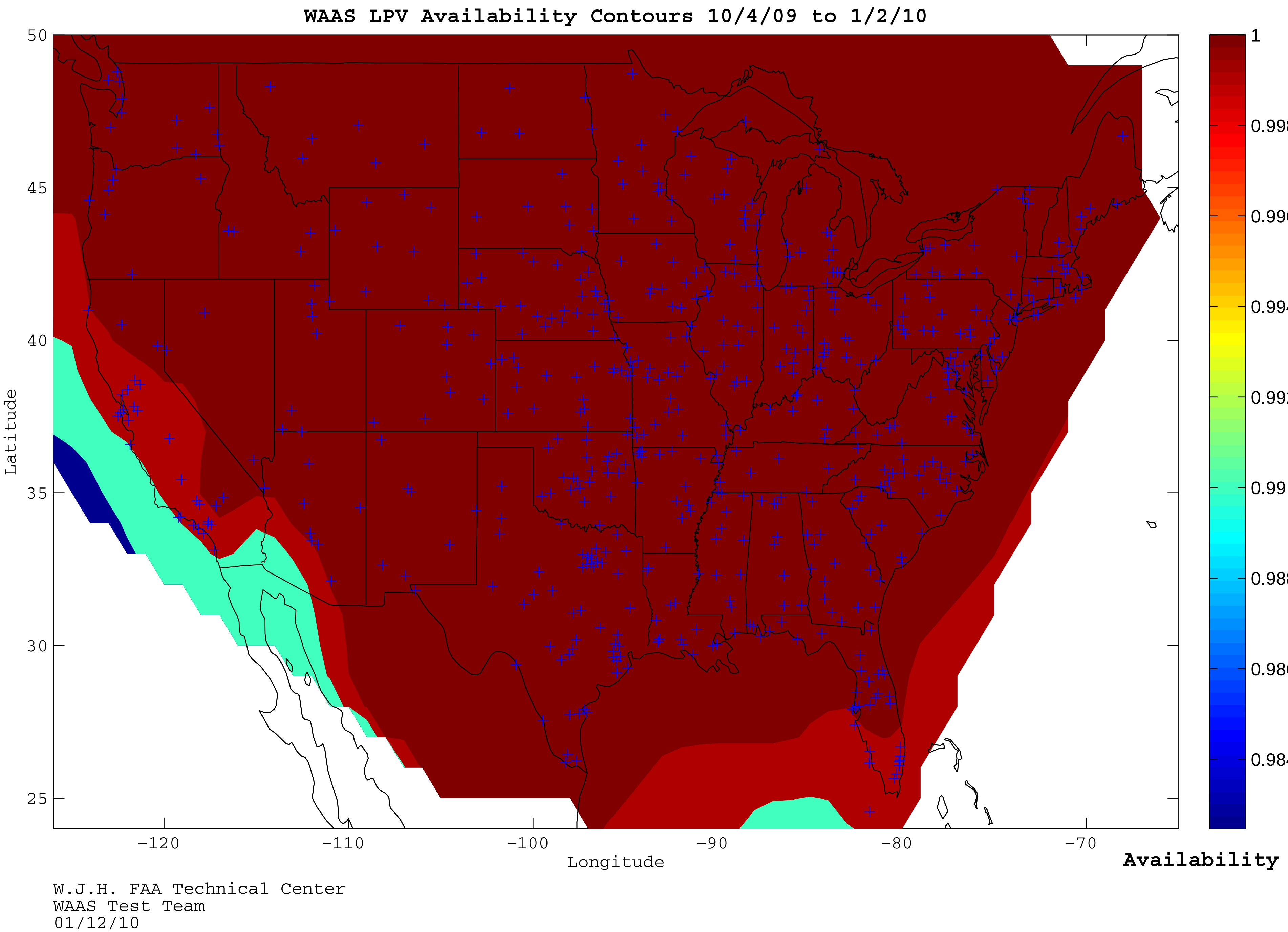
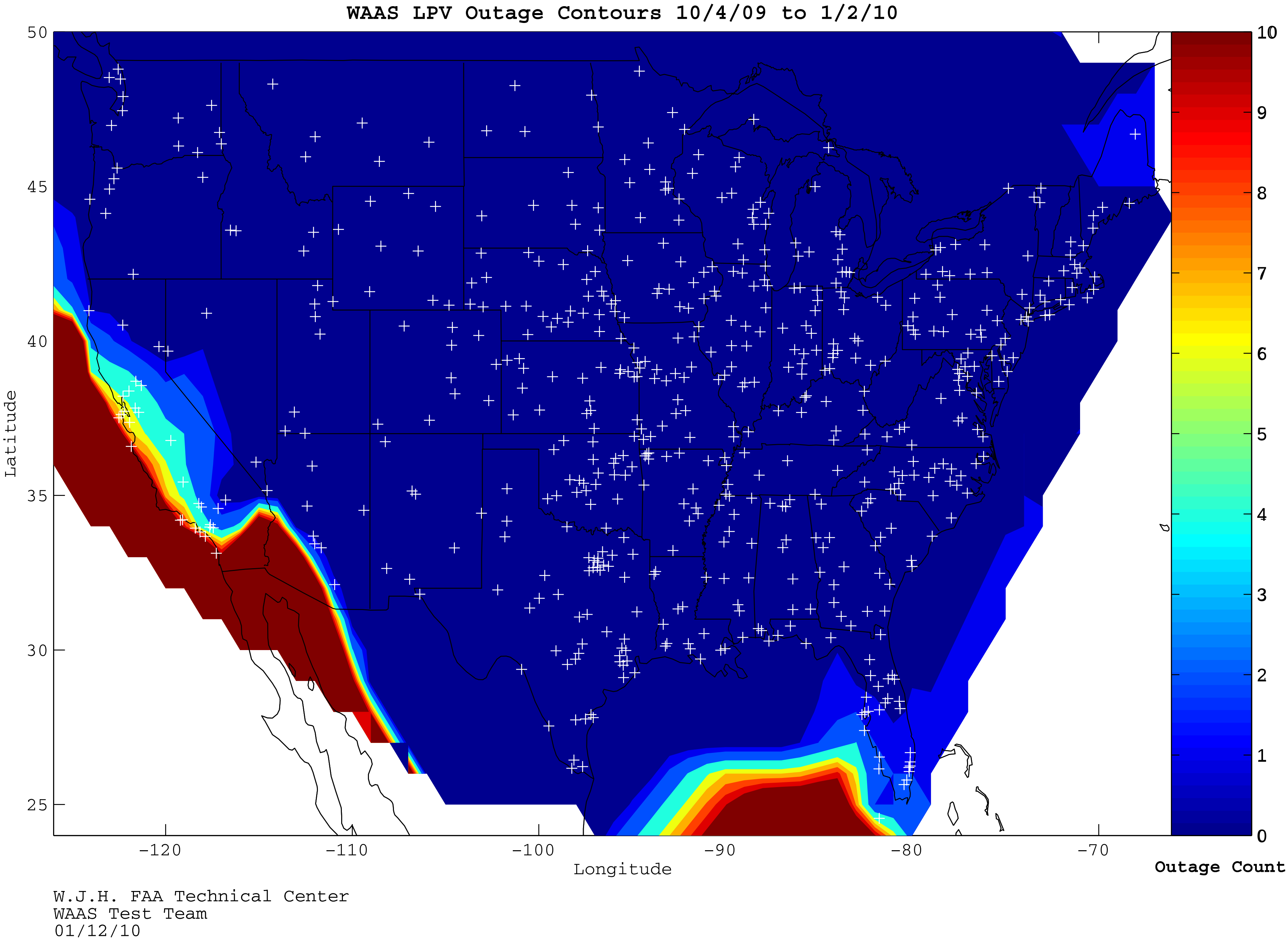


Figure 9-2 WAAS LPV Outage



10.0 WAAS DETERMINISTIC CODE NOISE AND MULTIPATH BOUNDING ANALYSIS

WAAS utilizes a deterministic model to estimate the residual CNMP noise after the application of standard dual frequency carrier smoothing techniques to minimize the effects of multipath and code noise. This analysis performs an assessment of how well that deterministic model bounds the actual errors. This analysis is periodically performed as part of the WAAS Test Team's off-line monitoring to ensure that there are no drastic detrimental changes to the multipath environment at the WAAS Reference Stations (WRSs). This analysis also ensures that WAAS system is not indefinitely exposed to conspiring receiver failure symptoms that would invalidate the CNMP bounding estimate in a manner that would exceed the assumption that no more than one receiver is conspiring to deceive the WAAS monitors at any time by underestimating the residual measurement noise the safety monitors. Although some failures mechanisms that cause CNMP bounding issues are occasionally seen, no "conspiring" errors have ever been detected. That is, data has caused the safety monitors to trip unnecessarily versus missing a necessary trip.

The analysis post processes measurement data to estimate the pseudorange code to carrier ambiguity for each entire arc of measurements for each satellite pass. The ambiguity estimate is then used to level the carrier measurement. The leveled carrier is then used as a multipath free truth estimate. The WAAS real time deterministic CNMP smoothing algorithm is then applied to the original measurements. The difference between the smoothed measurements and the leveled truth measurements is compared to the deterministic noise estimates. Only arcs with continuous carrier phase greater in length than 7200 seconds are utilized for this analysis to minimize the impacts of non-zero mean multipath biasing the truth estimates. The WAAS dual frequency cycle slip detector algorithm is used to detect any discontinuities in the carrier phase.

Statistics are calculated on how well the 0.1 multiples of the deterministically estimated standard deviation bounds the difference between the leveled truth and the real time smoothed measurements. Those statistics are then compared to a theoretical gaussian distribution and an extensive set of plots are generated and manually reviewed. Table 10.1 recaps the results of that manual analysis.

Table 10-1 CNMP Bounding Statistics

WAAS Site	WRE	Jan 09	Feb 09	Mar 09	Apr 09	May 09	Jun 09	Jul 09	Aug 09	Sep 09	Oct 09	Nov 09	Dec 09
	A	blue	blue	blue	blue	blue	blue	blue	blue	blue	blue	blue	blue
Albuquerque	B	green	blue	blue	blue	blue	blue	blue	blue	blue	blue	blue	yellow
	C	blue	blue	blue	yellow	blue	yellow	red	yellow	green	blue	blue	blue
	A	blue	blue	yellow	green	blue	blue	blue	blue	blue	green	green	blue
Anchorage	B	blue	blue	blue	blue	green	blue	green	blue	yellow	blue	blue	green
	C	blue	blue	blue	blue	blue	blue	green	blue	blue	blue	blue	yellow
	A	blue	blue	blue	blue	blue	blue	blue	blue	blue	blue	–	blue
Atlanta	B	blue	blue	blue	blue	blue	blue	blue	yellow	blue	blue	blue	blue
	C	blue	blue	yellow	yellow	blue	blue	blue	blue	blue	blue	blue	blue
	A	blue	yellow	blue	blue	blue	blue	green	yellow	green	blue	yellow	green
Barrow	B	yellow	yellow	blue	blue	blue	yellow	blue	blue	blue	blue	green	blue
	C	blue	green	blue	green	blue	blue	blue	green	yellow	blue	yellow	blue
	A	blue	blue	blue	blue	blue	blue	blue	blue	blue	blue	blue	blue
Bethel	B	blue	blue	blue	blue	blue	blue	blue	blue	blue	blue	green	blue
	C	blue	blue	blue	blue	blue	blue	blue	blue	blue	blue	blue	blue
	A	blue	blue	blue	blue	blue	blue	green	blue	green	blue	green	blue
Billings	B	blue	blue	blue	blue	blue	blue	blue	blue	green	blue	blue	blue
	C	green	blue	blue	blue	blue	blue	blue	blue	blue	blue	blue	blue
	A	blue	blue	blue	blue	blue	blue	blue	blue	blue	blue	blue	blue
Boston	B	blue	blue	blue	blue	blue	yellow	blue	blue	green	blue	blue	yellow
	C	yellow	blue	blue	blue	blue	blue	blue	blue	blue	blue	blue	blue
	A	blue	blue	blue	blue	blue	blue	blue	blue	blue	blue	blue	blue
Chicago	B	blue	blue	blue	blue	blue	blue	blue	blue	blue	blue	blue	blue
	C	blue	blue	blue	blue	green	yellow	blue	blue	blue	green	blue	green
	A	yellow	green	blue	green	yellow	yellow	green	red	blue	yellow	blue	blue
Cleveland	B	blue	blue	red	blue	blue	blue	blue	blue	blue	blue	blue	blue
	C	yellow	blue	blue	green	blue	yellow	blue	blue	green	green	blue	green
	A	blue	blue	blue	blue	blue	yellow	blue	green	–	–	blue	blue
Cold Bay	B	blue	green	blue	yellow	yellow	blue	blue	blue	–	–	yellow	red
	C	blue	blue	blue	blue	blue	blue	blue	blue	–	–	yellow	blue
	A	blue	blue	blue	blue	red	blue	blue	blue	red	blue	blue	blue
Dallas	B	red	red	yellow	yellow	green	blue	yellow	yellow	yellow	blue	yellow	red
	C	yellow	yellow	green	blue	yellow	blue	blue	blue	blue	green	blue	blue
	A	blue	blue	blue	blue	blue	blue	blue	blue	blue	blue	blue	blue
Denver	B	blue	blue	blue	blue	blue	blue	blue	blue	blue	blue	blue	blue
	C	green	green	green	yellow	green	blue	green	blue	blue	yellow	green	blue
	A	blue	blue	blue	blue	blue	blue	blue	blue	blue	blue	blue	blue
Fairbanks	B	blue	blue	blue	blue	blue	blue	blue	blue	blue	yellow	blue	yellow
	C	green	green	blue	yellow	blue	green	blue	yellow	blue	blue	red	red
	A	green	blue	blue	yellow	blue	blue	blue	yellow	blue	blue	blue	green
Gander	B	blue	blue	blue	blue	blue	blue	blue	blue	blue	blue	blue	blue
	C	blue	blue	blue	blue	blue	blue	blue	blue	blue	blue	blue	blue
	A	blue	blue	blue	blue	blue	blue	blue	yellow	blue	yellow	blue	yellow
Goose Bay	B	blue	blue	blue	blue	green	yellow	yellow	yellow	blue	blue	green	blue
	C	blue	blue	blue	blue	blue	blue	yellow	blue	blue	blue	blue	blue
	A	blue	blue	blue	yellow	blue	blue	blue	blue	yellow	blue	blue	yellow
Honolulu	B	blue	blue	blue	blue	blue	blue	blue	blue	blue	blue	blue	blue
	C	blue	blue	green	blue	blue	blue	blue	yellow	blue	blue	yellow	blue
	A	green	green	yellow	green	green	yellow	green	green	green	yellow	red	green
Houston	B	yellow	yellow	red	yellow	red	red	yellow	yellow	red	red	red	yellow
	C	red	yellow	green	yellow	green	green	red	red	red	yellow	yellow	yellow
	A	blue	yellow	blue	yellow	blue	red	green	green	yellow	red	yellow	yellow
Iqaluit	B	blue	blue	green	blue	blue	blue	blue	blue	blue	blue	green	green
	C	yellow	yellow	blue	blue	blue	blue	blue	yellow	blue	yellow	blue	blue
	A	blue	blue	blue	blue	blue	blue	blue	blue	blue	blue	blue	blue
Jacksonville	B	blue	blue	blue	blue	blue	blue	blue	blue	blue	blue	blue	blue
	C	blue	yellow	blue	blue	blue	blue	blue	blue	blue	blue	blue	blue

• **Excellent** - 3.29σ bounded 100% (blue)
• **Good** - 4σ bounded 100% (green)
• **Fair** - 4σ bounded 100% with one worst satellite excluded (Requires manual review if symptoms repeat from month to month) (yellow)
• **Poor** – Requires manual review (red)
– No data available

WAAS Site	WRE	Jan 09	Feb 09	Mar 09	Apr 09	May 09	Jun 09	Jul 09	Aug 09	Sep 09	Oct 09	Nov 09	Dec 09
Juneau	A	blue	blue	blue	blue	blue	blue	blue	blue	green	yellow	blue	blue
	B	blue	blue	green	blue	blue	blue	yellow	green	blue	green	yellow	blue
	C	yellow	blue	yellow	red	yellow	green	yellow	blue	blue	blue	yellow	blue
Kansas City	A	blue	blue	blue	green	blue	blue	yellow	blue	green	blue	blue	blue
	B	blue	blue	green	green	blue	blue	green	green	yellow	blue	blue	yellow
	C	green	blue	yellow	yellow	yellow	green	blue	blue	blue	blue	blue	blue
Kotzebue	A	yellow	blue	blue	blue	blue	blue	red	blue	yellow	blue	–	blue
	B	blue	blue	blue	blue	yellow	blue	blue	blue	blue	yellow	–	blue
	C	blue	blue	blue	blue	blue	blue	yellow	yellow	yellow	blue	–	blue
Los Angeles	A	yellow	blue	yellow	blue	blue	green	blue	blue	blue	blue	blue	yellow
	B	blue	blue	blue	blue	yellow	blue	blue	blue	blue	blue	blue	blue
	C	yellow	blue	green	blue	blue	blue	blue	blue	blue	green	blue	blue
Memphis	A	blue	blue	blue	blue	blue	blue	green	blue	yellow	blue	blue	blue
	B	blue	blue	blue	blue	blue	blue	blue	blue	blue	blue	blue	blue
	C	blue	blue	blue	blue	blue	blue	blue	blue	blue	blue	blue	blue
Merida	A	blue	blue	blue	blue	blue	blue	blue	blue	blue	blue	blue	blue
	B	blue	green	blue	green	blue	blue	blue	blue	blue	blue	blue	blue
	C	blue	yellow	blue	blue	yellow	blue	green	blue	blue	blue	yellow	blue
Mexico City	A	blue	blue	yellow	blue	blue	yellow	blue	red	blue	yellow	blue	yellow
	B	blue	blue	blue	blue	blue	blue	green	blue	green	green	blue	green
	C	red	yellow	yellow	yellow	yellow	blue	yellow	green	yellow	blue	blue	blue
Miami	A	blue	blue	blue	green	red	green	yellow	yellow	yellow	green	green	blue
	B	blue	green	blue	green	blue	blue	blue	green	yellow	blue	blue	blue
	C	green	green	green	green	blue	blue	yellow	red	blue	blue	red	yellow
Minneapolis	A	blue	blue	blue	blue	blue	blue	blue	blue	blue	blue	blue	blue
	B	yellow	green	blue	green	blue	blue	blue	blue	blue	red	blue	green
	C	yellow	blue	blue	blue	blue	blue	yellow	blue	blue	blue	blue	blue
New York	A	blue	blue	blue	blue	blue	yellow	green	blue	yellow	blue	blue	blue
	B	blue	blue	blue	blue	blue	blue	blue	blue	yellow	blue	blue	blue
	C	green	blue	blue	green	blue	blue	blue	blue	yellow	blue	blue	blue
Oakland	A	blue	yellow	yellow	blue	green	yellow	blue	blue	blue	green	blue	blue
	B	yellow	yellow	yellow	yellow	yellow	yellow	yellow	yellow	blue	blue	yellow	blue
	C	red	red	red	red	red	green	yellow	yellow	green	green	yellow	green
Puerto Vallarta	A	yellow	yellow	yellow	yellow	blue	blue	blue	blue	blue	blue	blue	blue
	B	yellow	blue	yellow	green	blue	blue	yellow	yellow	green	blue	blue	blue
	C	blue	blue	green	yellow	blue	blue	yellow	blue	yellow	blue	blue	blue
Salt Lake City	A	blue	blue	yellow	blue	blue	blue	blue	blue	blue	blue	yellow	yellow
	B	blue	yellow	blue	blue	blue	yellow	red	blue	blue	yellow	red	yellow
	C	yellow	yellow	yellow	green	yellow	yellow	red	green	red	blue	yellow	yellow
San Jose Del Cabo	A	yellow	red	red	red	red	red	red	red	red	yellow	blue	green
	B	yellow	yellow	red	yellow	green	yellow	yellow	yellow	green	red	blue	yellow
	C	red	red	red	red	red	blue	red	red	yellow	green	blue	yellow
San Juan	A	blue	green	blue	blue	green	green	blue	green	blue	blue	blue	blue
	B	blue	red	blue	blue	blue	blue	blue	blue	blue	blue	blue	blue
	C	blue	blue	blue	blue	blue	blue	blue	blue	blue	blue	blue	blue
Seattle	A	blue	blue	blue	blue	green	blue	blue	blue	blue	blue	blue	blue
	B	blue	blue	blue	blue	blue	blue	blue	blue	blue	blue	blue	blue
	C	blue	blue	blue	blue	blue	blue	blue	blue	blue	blue	blue	blue
Tapachula	A	red	yellow	yellow	red	red	yellow	green	yellow	blue	red	red	green
	B	red	red	yellow	red	yellow	yellow	green	green	red	yellow	yellow	green
	C	red	red	red	red	red	red	red	yellow	green	green	red	red
Washington, DC	A	blue	blue	blue	blue	blue	blue	blue	blue	blue	blue	blue	blue
	B	blue	blue	blue	blue	blue	blue	blue	blue	blue	blue	blue	blue
	C	blue	blue	blue	blue	blue	blue	blue	blue	blue	blue	blue	green
Winnipeg	A	blue	blue	blue	blue	blue	blue	blue	blue	blue	blue	blue	blue
	B	blue	blue	–	blue	blue	blue	blue	blue	blue	blue	blue	blue
	C	blue	blue	blue	blue	blue	blue	blue	blue	blue	blue	blue	blue

• (blue) **Excellent** - 3.29σ bounded 100%
• (green) **Good** - 4σ bounded 100%
• (yellow) **Fair** - 4σ bounded 100% with one worst satellite excluded (Requires manual review if symptoms repeat from month to month)
• (red) **Poor** – Requires manual review
– No data available

11.0 WAAS REFERENCE STATION SURVEY VALIDATION

The precisely surveyed location of each WAAS WRS is updated occasionally. This update requires a change to the WAAS software. To ensure there is no large (> 10cm RSS) change in the WAAS reference station position between software updates, a new survey is calculated each quarter. The RSS difference between the current survey location and the newly calculated survey location is shown in this section.

The surveys calculate the L1 phase center positions (ECEF X, Y, and Z) of each WRS antenna in IRTF-2000. The latitude, longitude, and height are in WGS-84 computed from the IRTF ECEF using a GraftNet utility after interpolation. The results are cross-checked against OPUS (USA and Mexico) or CSRS (Canada) using 24 hours worth of data.

Antenna L1 phase center position surveys were preformed for the WAAS antennas using a 25 hour set of data from 23:00 on 1/2/10 to 23:59:30 on 1/3/10 for all of the WAAS receivers.

Surveys were performed using the National Geodetic Survey (NGS) Online Positioning User Service (OPUS) and the Canadian Spatial Reference System (CSRS) Precise Point Positioning (PPP) service. The overall RMS qualities reported by OPUS were all less than or equal to 2.3 cm. The RSS of the ECEF sigma's were all less than 15 mm for the CSRS surveys. The OPUS and CSRS surveys agreed to 6.6 cm or better, Anchorage, Barrow, and Juneau were the only sites greater than 4.5 cm.

The positions were then compared to the positions in the current WAAS software build, WFO release 1, build 6.012 that was fielded during November 2009. The WFO Release 1 antenna positions have been interpolated forward to 8/1/10.

The OPUS surveys agree with the WFO RLS1 positions to better than or equal to 5.3 cm with the exceptions of Mexico City (17 cm), Iqaluit (7 cm), and Cold Bay (6 cm). Mexico City is high movement because it is sinking due to depletion of water from an underground lake. The Mexico City WFO Release 1 offsets have been approved by the WIPP. There was a small displacement of the Cold Bay antennas (2 cm) between the initial survey used to provide the input data for WFO RLS1 and the final mounting of the antennas due to a correction in the arrangement of the mounting hardware that contributes to Cold Bay being a minor outlier. The cause of YFB being a minor outlier is unknown, but is suspected to be a combination of the extreme northern remoteness of Iqaluit and the temperature in Iqaluit in January. The 7 cm YFB outlier is below the 10 cm take action threshold. The CORS trend plots show a 2 cm bias in the YFB-1 position, but no significant changes which would warrant additional analysis.

Table 11.1 lists the WAAS antenna L1 phase center positions as of 1/3/10. The positions are in IRTF-2000 and are the OPUS estimated positions. OPUS is now using GEOID 09.

Figure 11.1 to 11.3 show the RSS of the ECEF difference between the 1/3/10 OPUS survey antenna phase center locations and the locations in the current WFO release 1 software which was fielded this November 2009. Each reference station has three independent strings of WAAS receiving equipment (WRE). A surveyed antenna phase center location is required for each WRE. All three strings of a reference station are shown in the three figures. For example, BET1 identifies the RSS delta for the Bethel WRS string 1. The next two bars in the chart are Bethel string 2 and Bethel string 3. Figure 11.4 to 11.6 shows the OPUS overall RMS quality indications.

Figure 11.7 to 11.9 show the RSS of the ECEF difference between the positions obtained from OPUS and the positions obtained from the Canadian Spatial Reference System (CSRS). Note that that OPUS positions are in ITRF-2000 and the CSRS positions are in ITRF-2005. Figures 11.10 to 11.12 show the RSS of ECEF sigma's report by CSRS.

Table 11-1 WAAS Survey Positions (OPUS ITRF-2000) as of 1/3/10

WRE	X(m)	Y(m)	Z(m)	Latitude	Longitude	H(m)
BET1	-2965384.985	-972576.642	5543892.953	60.78791611666670	-161.84172427500000	52.206
BET2	-2965385.752	-972580.364	5543891.899	60.78789670555560	-161.84166373055600	52.208
BET3	-2965388.320	-972577.495	5543891.028	60.78788078055560	-161.84172847500000	52.202
BIL1	-1416445.846	-4223577.030	4550862.164	45.80370691111110	-108.53972260000000	1112.253
BIL2	-1416449.824	-4223574.613	4550862.591	45.80371621111110	-108.53978099444400	1111.843
BIL3	-1416441.536	-4223574.292	4550866.011	45.80375661666670	-108.53968124166700	1112.246
BRW1	-1886758.853	-809058.703	6018494.512	71.28276543888890	-156.78992297500000	15.590
BRW2	-1886756.262	-809055.966	6018495.685	71.28279818055560	-156.78996468333300	15.590
BRW3	-1886755.178	-809059.743	6018495.521	71.28279353055560	-156.78985587777800	15.593
CDB1	-3484098.990	-1084748.820	5213678.697	55.19237484444440	-162.70640383333300	49.725
CDB2	-3484105.642	-1084741.603	5213675.742	55.19232867500000	-162.70654307500000	49.700
CDB3	-3484111.891	-1084734.865	5213673.001	55.19228538888890	-162.70667325833300	49.711
FAI1	-2304741.725	-1448715.273	5748843.698	64.80963067500000	-147.84734001666700	149.915
FAI2	-2304741.253	-1448706.466	5748846.090	64.80968109166670	-147.84749166388900	149.914
FAI3	-2304732.721	-1448707.404	5748849.245	64.80974771111110	-147.84737938611100	149.907
HNL1	-5508637.062	-2234493.482	2303722.098	21.31298938055560	-157.92082583888900	24.662
HNL2	-5508656.229	-2234483.797	2303686.850	21.31264645277780	-157.92098178055600	25.006
HNL3	-5508647.638	-2234497.737	2303693.942	21.31271505555560	-157.92082615000000	25.049
JNU1	-2354254.824	-2388549.653	5407043.075	58.36257478055560	-134.58570615277800	16.043
JNU2	-2354252.743	-2388565.762	5407036.911	58.36246922222220	-134.58548764444400	16.047
JNU3	-2354239.527	-2388568.616	5407041.369	58.36254559166670	-134.58529261388900	16.042
MMD1	35070.445	-5959686.692	2264365.757	20.93190910000000	-89.66284045000000	29.139
MMD2	35065.520	-5959687.061	2264364.970	20.93190136388890	-89.66288781666670	29.176
MMD3	35065.186	-5959685.277	2264369.629	20.93194642777780	-89.66289092777780	29.172
MMX1	-948701.186	-5943936.206	2109212.891	19.43165328611110	-99.06838956944440	2236.229
MMX2	-948696.757	-5943936.039	2109215.321	19.43167657500000	-99.06834818888890	2236.223
MMX3	-948705.604	-5943936.391	2109210.464	19.43162997777780	-99.06843082222220	2236.250
MPR1	-1570142.202	-5759530.637	2238184.757	20.67900324722220	-105.24920295555600	11.004
MPR2	-1570139.383	-5759530.146	2238188.808	20.67904135555560	-105.24917809166700	11.297
MPR3	-1570143.490	-5759528.022	2238190.573	20.67905936111110	-105.24922148333300	11.014
MSD1	-1979519.627	-5523223.136	2493106.742	23.16044633333330	-109.71764692222200	104.309
MSD2	-1979521.195	-5523225.472	2493100.341	23.16038350555560	-109.71765364166700	104.299
MSD3	-1979525.643	-5523222.201	2493104.013	23.16041959722220	-109.71770530555600	104.292
MTP1	-254854.348	-6162909.187	1617805.084	14.79136610833330	-92.36799912500000	54.967
MTP2	-254850.734	-6162910.226	1617801.657	14.79133411388890	-92.36796518333330	54.951
MTP3	-254855.498	-6162910.334	1617800.131	14.79132007500000	-92.36800935833330	54.856
OTZ1	-2396055.945	-750356.184	5843502.560	66.88733286111110	-162.61137190555600	10.901
OTZ2	-2396052.773	-750354.356	5843504.085	66.88736770000000	-162.61139008055600	10.901
OTZ3	-2396052.754	-750358.294	5843503.594	66.88735641388890	-162.61130419444400	10.904
YFB1	1035381.531	-2634289.651	5696539.523	63.73149013055560	-68.54318192777780	10.030
YFB2	1035372.311	-2634296.052	5696538.165	63.73146394722220	-68.54340302500000	9.956
YFB3	1035366.233	-2634306.814	5696534.389	63.73138626666670	-68.54359722222220	10.019

WRE	X(m)	Y(m)	Z(m)	Latitude	Longitude	H(m)
YQX1	2430424.674	-3419640.391	4788223.788	48.96648959722220	-54.59763170555560	146.860
YQX2	2430432.639	-3419639.046	4788220.729	48.96644767777780	-54.59753240000000	146.862
YQX3	2430440.546	-3419637.682	4788217.732	48.96640645555560	-54.59743358888890	146.878
YWG1	-520164.311	-4083475.899	4855842.979	49.90057432500000	-97.25939679722220	222.022
YWG2	-520150.452	-4083468.848	4855850.355	49.90067718055560	-97.25921784444450	222.031
YWG3	-520152.314	-4083477.960	4855842.544	49.90056817222220	-97.25922752777780	222.030
YYR1	1885341.469	-3321428.368	5091171.609	53.30864664444440	-60.41946777222220	37.826
YYR2	1885344.432	-3321419.887	5091176.023	53.30871294722220	-60.41936630833330	37.833
YYR3	1885340.142	-3321413.068	5091182.027	53.30880316666670	-60.41937177777780	37.839
ZAB1	-1488636.804	-5003946.563	3654557.692	35.17357521666670	-106.56734929444400	1620.126
ZAB2	-1488631.470	-5003948.238	3654557.684	35.17357471666670	-106.56728794444400	1620.190
ZAB3	-1488632.241	-5003950.818	3654553.820	35.17353227777780	-106.56728798055600	1620.165
ZAN1	-2659536.551	-1549114.826	5567750.751	61.22920219722220	-149.78024910833300	80.663
ZAN2	-2659548.303	-1549110.868	5567746.269	61.22911863055560	-149.78042288888900	80.663
ZAN3	-2659541.249	-1549106.745	5567750.734	61.22920218611110	-149.78042311666700	80.644
ZAU1	138704.159	-4761244.165	4227763.936	41.78265793333330	-88.33133617777780	195.909
ZAU2	138704.425	-4761248.777	4227758.778	41.78259560555560	-88.33133459444440	195.916
ZAU3	138711.118	-4761248.514	4227758.855	41.78259653055560	-88.33125402777780	195.917
ZBW1	1490299.273	-4448983.179	4306010.481	42.73572025000000	-71.48042528055560	39.122
ZBW2	1490304.383	-4448981.160	4306010.818	42.73572425833330	-71.48035828055560	39.137
ZBW3	1490306.089	-4448984.785	4306006.512	42.73567148055560	-71.48035258888890	39.137
ZDC1	1069125.822	-4839598.995	4001126.484	39.10159561944440	-77.54274588333330	80.065
ZDC2	1069128.213	-4839603.626	4001120.277	39.10152361111110	-77.54273044166670	80.060
ZDC3	1069124.109	-4839602.721	4001122.477	39.10154903888890	-77.54277451111110	80.074
ZDV1	-1273628.577	-4711375.602	4094890.124	40.18730325833330	-105.12722387500000	1541.377
ZDV2	-1273622.868	-4711377.117	4094890.138	40.18730351388890	-105.12715453333300	1541.366
ZDV3	-1273624.876	-4711380.305	4094885.854	40.18725312222220	-105.12716752222200	1541.353
ZFW1	-659983.165	-5324060.796	3438276.469	32.83064963611110	-97.06647140555550	155.630
ZFW2	-659988.430	-5324063.346	3438271.468	32.83059620833330	-97.06652385833330	155.589
ZFW3	-659983.455	-5324063.874	3438271.684	32.83059827500000	-97.06647043611110	155.632
ZHU1	-513864.436	-5506451.757	3166720.480	29.96189619166670	-95.33142585833330	10.895
ZHU2	-513867.077	-5506455.146	3166714.317	29.96183171666670	-95.33144983888890	10.953
ZHU3	-513873.363	-5506457.789	3166708.721	29.96177349444440	-95.33151213611110	10.944
ZJX1	772646.474	-5434462.224	3237231.737	30.69885943055560	-81.90818485000000	2.167
ZJX2	772649.805	-5434463.767	3237228.330	30.69882381388890	-81.90815269444450	2.144
ZJX3	772645.745	-5434466.199	3237225.229	30.69879130555560	-81.90819822500000	2.140
ZKC1	-415247.478	-4954556.403	3982161.110	38.88015930833330	-94.79083337222220	305.902
ZKC2	-415231.081	-4954557.720	3982161.166	38.88016002222220	-94.79064380833330	305.893
ZKC3	-415237.204	-4954561.076	3982155.974	38.88010181666670	-94.79071089166670	305.636
ZLA1	-2474409.870	-4637294.725	3602183.499	34.60351786111110	-118.08389435277800	763.521
ZLA2	-2474404.590	-4637297.509	3602183.501	34.60351802777780	-118.08382928611100	763.498
ZLA3	-2474411.203	-4637297.197	3602179.527	34.60347401666670	-118.08389448611100	763.577

WRE	X(m)	Y(m)	Z(m)	Latitude	Longitude	H(m)
ZLC1	-1808273.164	-4486410.853	4145303.029	40.78604330277780	-111.95217686944400	1287.446
ZLC2	-1808274.553	-4486414.448	4145298.531	40.78598997777780	-111.95217621111100	1287.425
ZLC3	-1808270.342	-4486416.139	4145298.522	40.78598995000000	-111.95212246111100	1287.415
ZMA1	966042.340	-5662999.851	2761581.492	25.82461200277780	-80.31918945277780	-7.560
ZMA2	966029.360	-5662999.133	2761585.969	25.82465974444440	-80.31931586111110	-8.211
ZMA3	966037.436	-5662997.971	2761586.311	25.82466168888890	-80.31923451111110	-7.871
ZME1	4070.937	-5226189.315	3644028.418	35.06739398333330	-89.95536949722220	68.615
ZME2	4070.966	-5226186.773	3644032.536	35.06743752777780	-89.95536915555560	68.900
ZME3	4064.770	-5226186.645	3644032.688	35.06743933611110	-89.95543708333330	68.879
ZMP1	-249978.329	-4539297.518	4458955.053	44.63746317500000	-93.15208481111110	262.666
ZMP2	-249972.529	-4539297.862	4458955.056	44.63746303888890	-93.15201158611110	262.686
ZMP3	-249973.620	-4539302.131	4458950.581	44.63740705555560	-93.15202235555560	262.617
ZNY1	1406144.688	-4627344.004	4144322.045	40.78432829722220	-73.09716515555550	6.468
ZNY2	1406146.479	-4627347.047	4144317.270	40.78427555000000	-73.09715533611110	5.948
ZNY3	1406140.923	-4627348.694	4144317.303	40.78427600833330	-73.09722398888890	5.939
ZOA1	-2684436.803	-4293337.536	3865351.817	37.54305314166670	-122.01594634444400	-3.471
ZOA2	-2684433.790	-4293341.602	3865349.399	37.54302570833330	-122.01589304444400	-3.477
ZOA3	-2684438.159	-4293342.487	3865345.538	37.54298128888890	-122.01592965277800	-3.398
ZOB1	650770.233	-4754715.695	4187420.749	41.29715426666670	-82.20644418611110	223.703
ZOB2	650777.915	-4754714.870	4187422.769	41.29716660000000	-82.20635198055560	225.204
ZOB3	650776.241	-4754719.692	4187414.975	41.29708683611110	-82.20637958888890	223.479
ZSE1	-2308930.235	-3668169.695	4663526.485	47.28699332777780	-122.18837229722200	82.103
ZSE2	-2308934.626	-3668175.244	4663520.077	47.28690773611110	-122.18838234722200	82.167
ZSE3	-2308935.686	-3668179.519	4663516.134	47.28685603611110	-122.18836410000000	82.107
ZSU1	2462589.348	-5529371.570	2003724.598	18.43133837222220	-65.99347542777780	-28.571
ZSU2	2462587.277	-5529377.323	2003711.603	18.43121438333330	-65.99351549166670	-28.493
ZSU3	2462593.910	-5529375.115	2003709.546	18.43119480555560	-65.99344963333330	-28.497
ZTL1	529840.445	-5305248.826	3489342.838	33.37968840277780	-84.29672557777780	261.145
ZTL2	529846.816	-5305247.984	3489343.127	33.37969159444440	-84.29665655277780	261.133
ZTL3	529847.495	-5305251.429	3489337.885	33.37963478888890	-84.29665297222220	261.168

Figure 11-1 WAAS Build 6.012 Antenna Positions Deltas from OPUS Survey

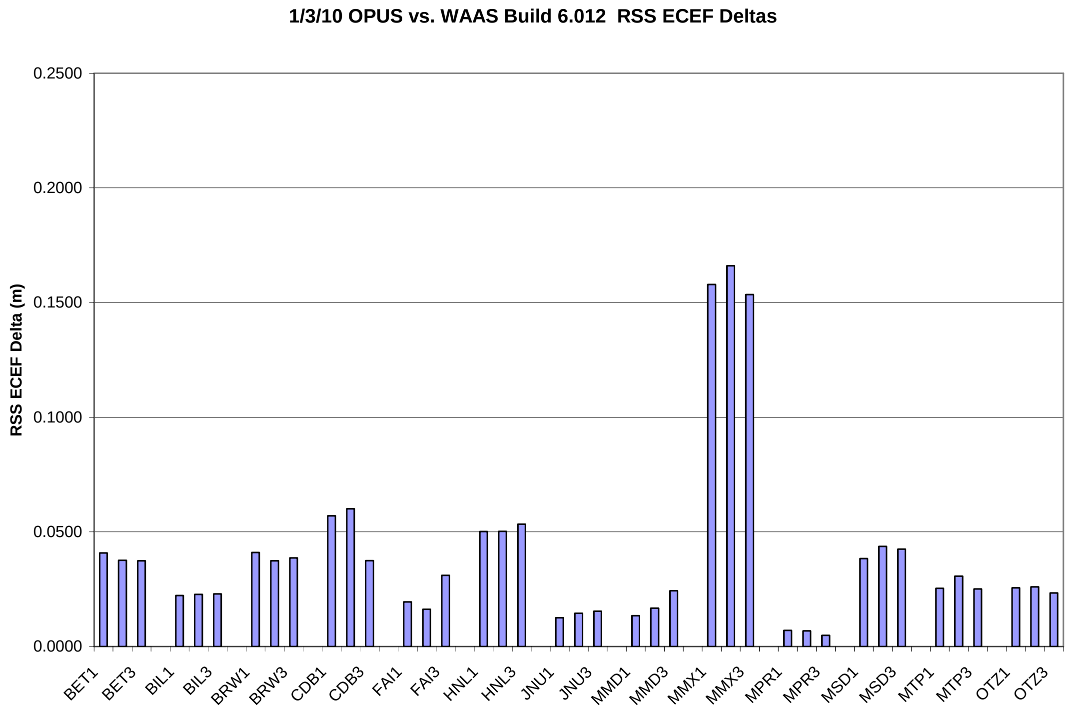


Figure 11-2 WAAS Build 6.012 Antenna Positions Deltas from OPUS Survey

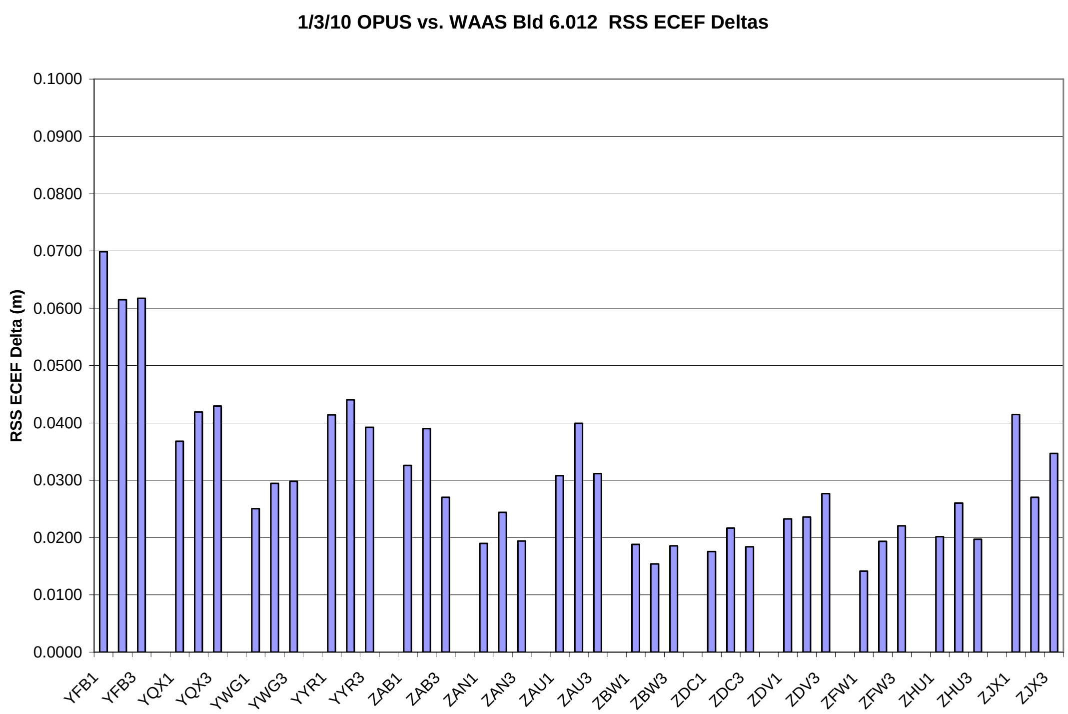


Figure 11-3 WAAS Build 6.012 Antenna Positions Deltas from OPUS Survey

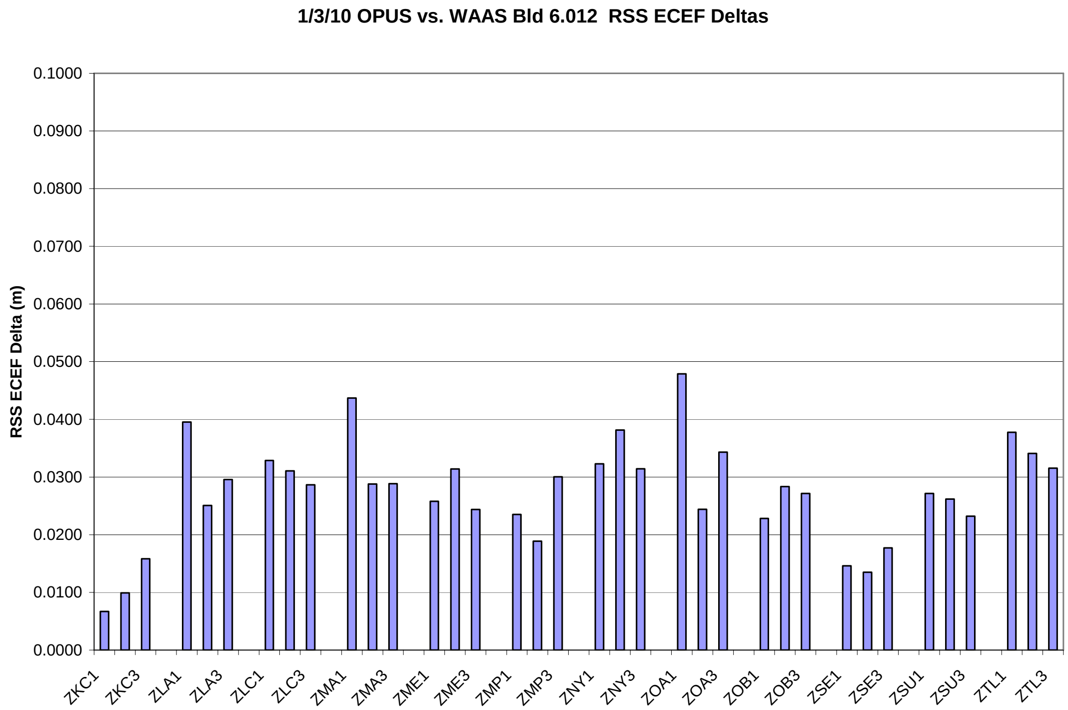


Figure 11-4 OPUS Overall RMS Qualitites

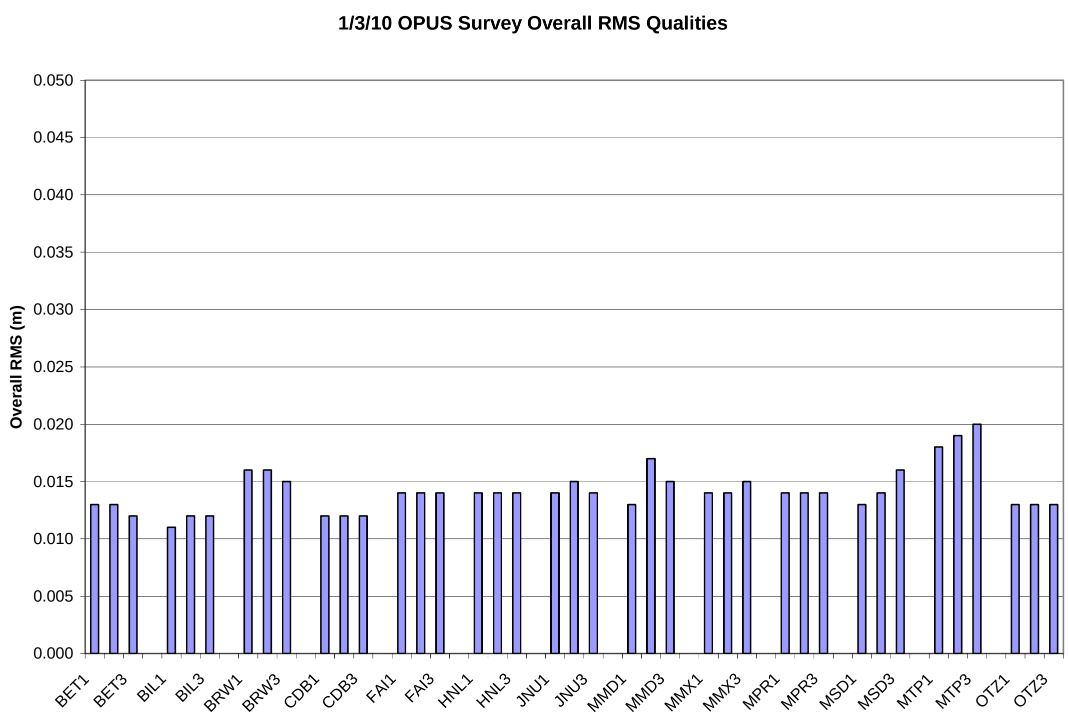


Figure 11-5 OPUS Survey Overall RMS Qualities

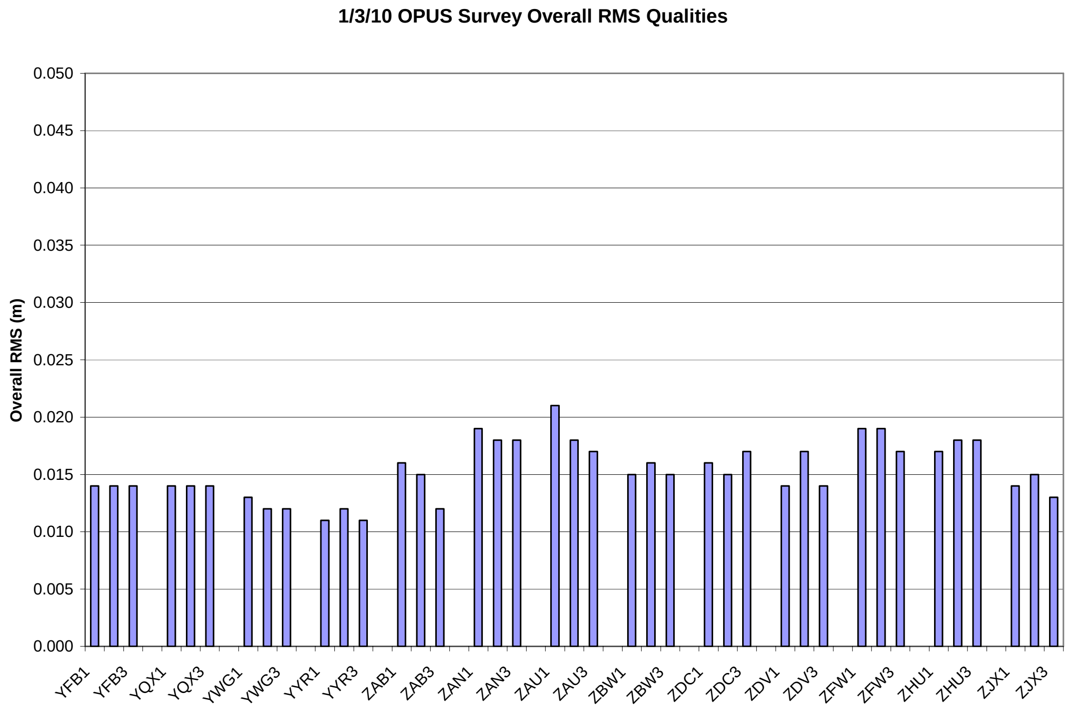


Figure 11-6 OPUS Survey Overall RMS Qualities

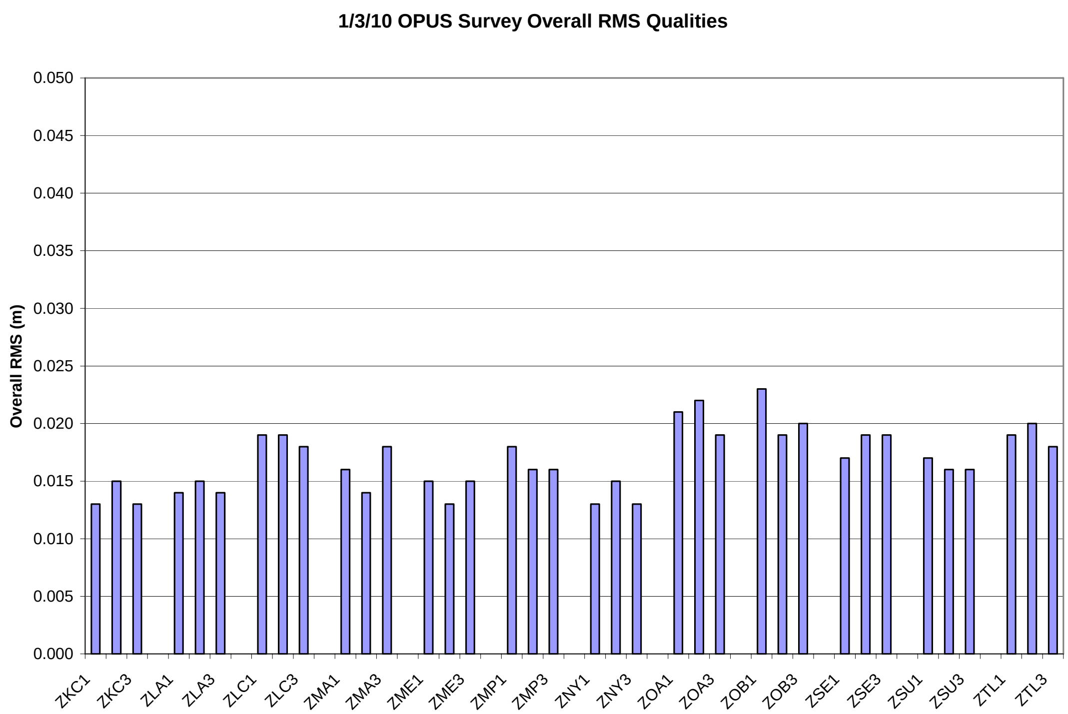


Figure 11-7 OPUS vs. CSRS RSS ECEF Deltas

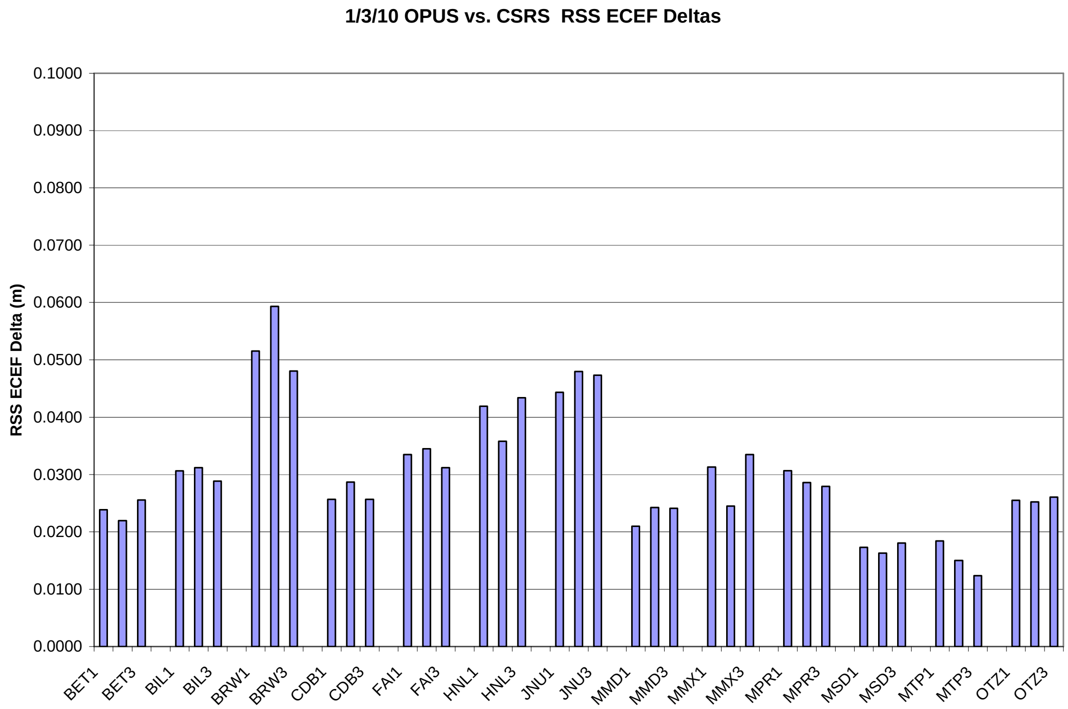


Figure 11-8 OPUS vs. CSRS RSS ECEF Deltas

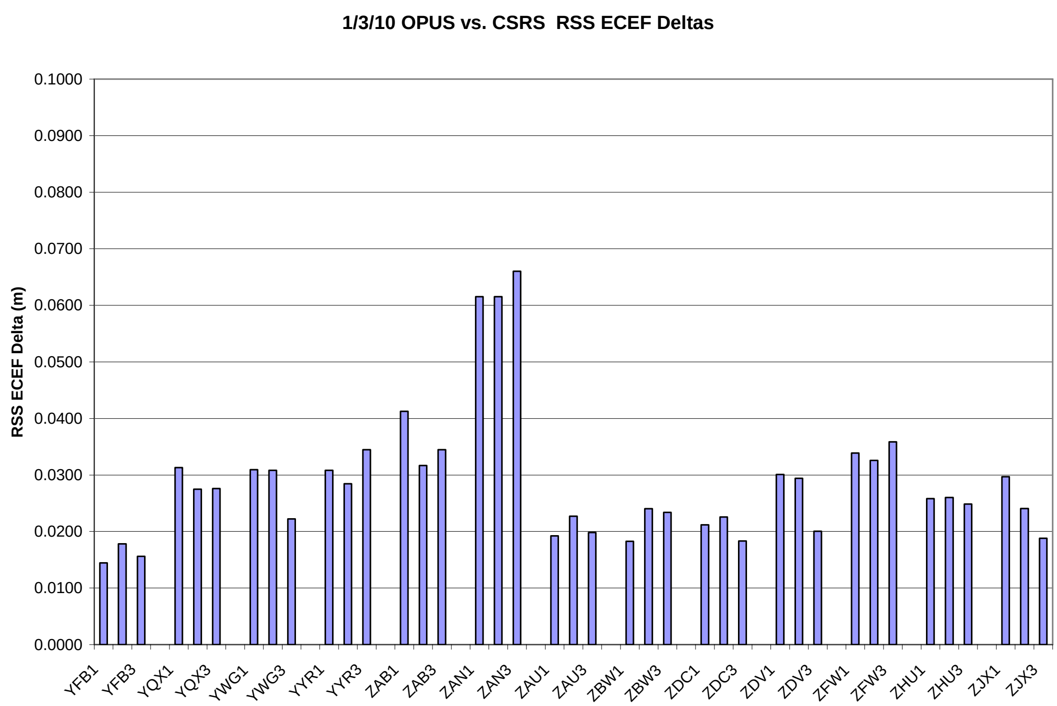


Figure 11-9 OPUS vs. CSRS RSS ECEF Deltas

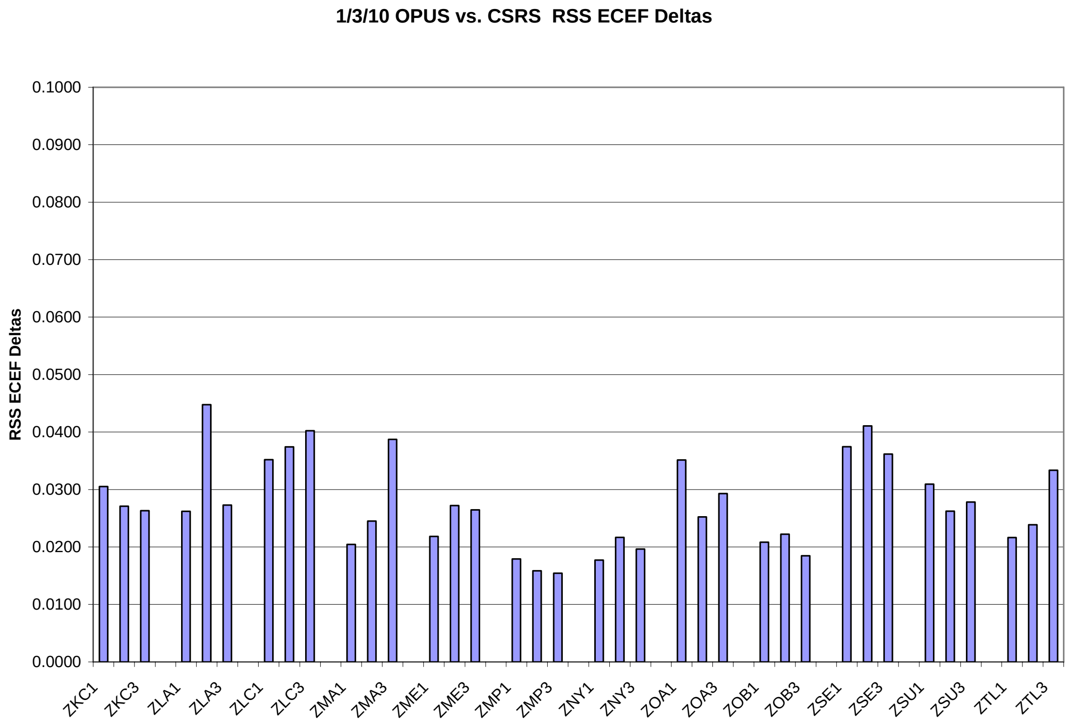


Figure 11-10 CSRS Survey Qualities

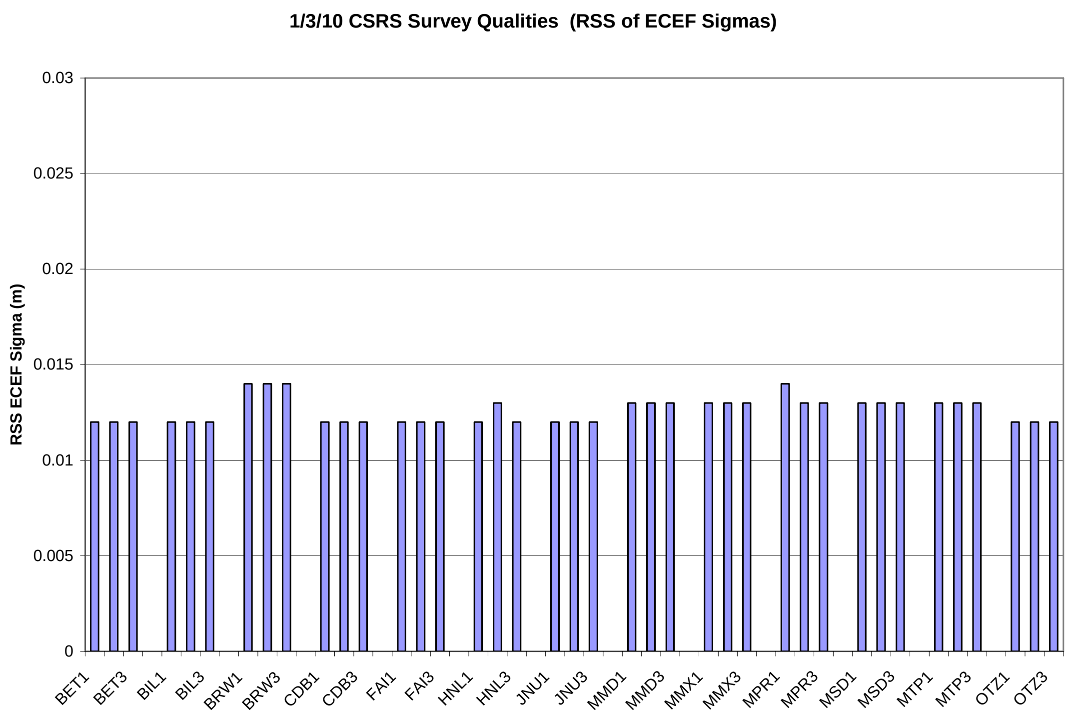


Figure 11-11 CSRS Survey Qualities

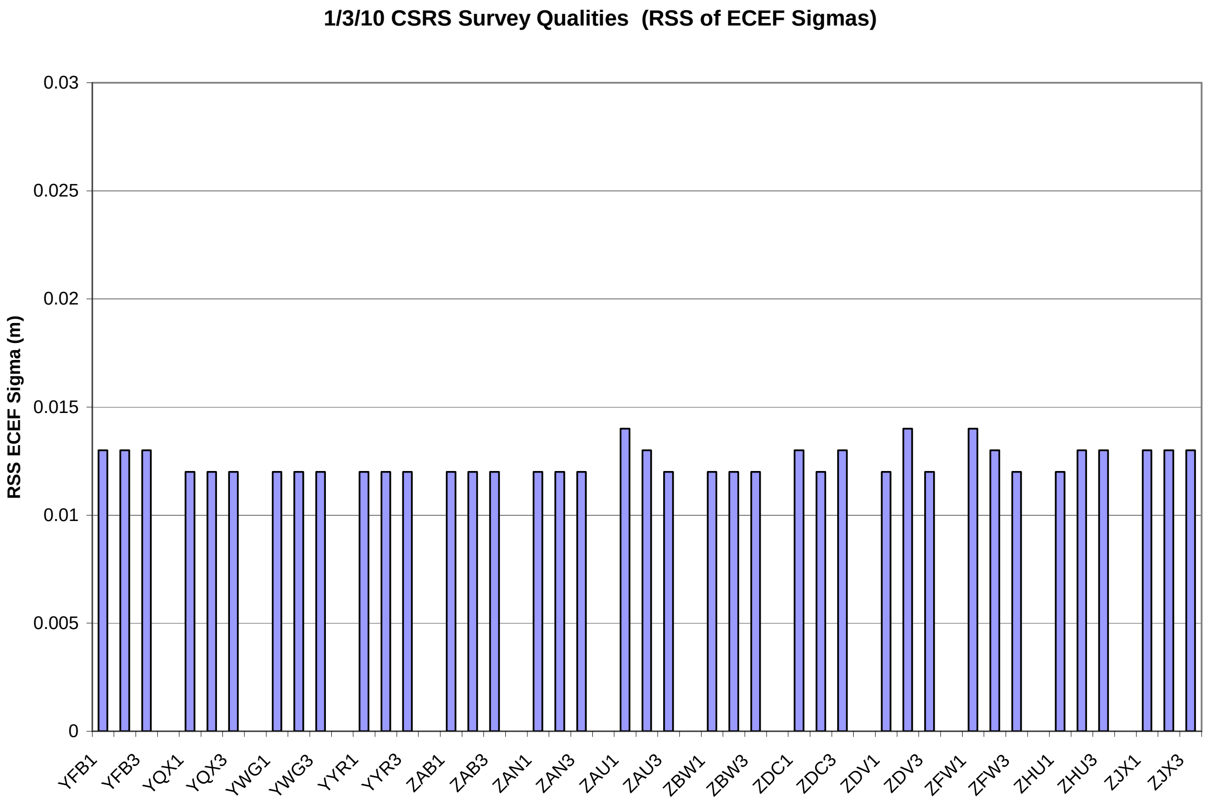
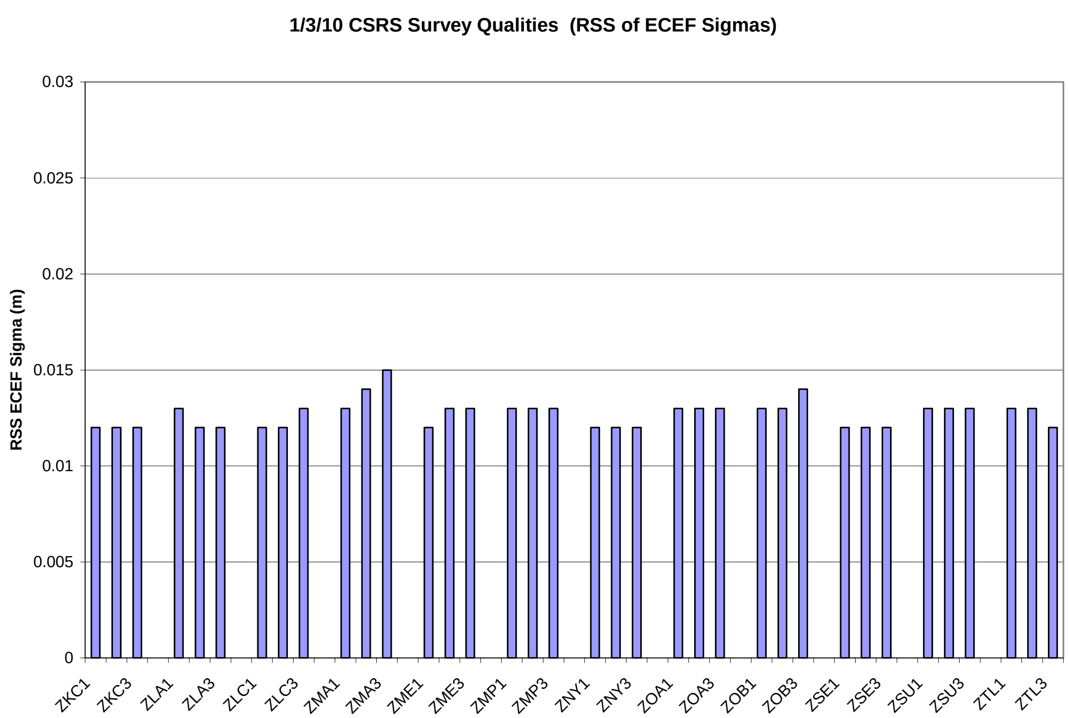


Figure 11-12 CSRS Survey Qualities



12.0 SIGNAL QUALITY MONITOR (SQM)

The Signal Quality Monitor (SQM) is designed to detect signal deformations that originate in the GPS or GEO satellites and ensures that the UDREs are sufficiently inflated to protect given the monitor's current observations. SQM processes correlator measurements produced at the reference station receivers forming four detection metrics for each receiver channel and calculates statistics based on the observed performance against "ideal" signal correlation peaks. This results in an estimate of the overall deformation per satellite. The deformation level calculated is then compared against threshold values, which includes the acceptable error levels per UDRE. If the estimated deformation exceeds threshold, the monitor trips for the given satellite, the UDRE is set to 'Don't use'. The monitor depends on the entire ground network in order to ensure that the satellite is the source of any problem detected rather than a localized affect. Currently all 114 receivers are being used in the SQM computations.

WAAS SQM offline monitoring effort includes the monitoring of the PRN type biases, trips, and the estimated deformation for each satellite that will be referred to as PRN bias in this report.

12.1 Alpha Metrics

The alpha metrics values are pre-determined by offline integrity analysis and are defined as constants in the SQM algorithm. These values remained unchanged for this reporting period and are listed in Table 12.1. Currently there are 4 sets of alpha metrics in the WAAS SQM algorithm that form four detection metrics for each receiver channel. For this report, the four detection metrics will be referred to as: DM1, DM2, DM3, and DM4.

Table 12-1 Alpha Metrics

Correlator Spacing	DM1	DM2	DM3	DM4
-0.1	0	0.43407318	0	-0.36110353
-0.075	0	0.48570652	-0.0058771682	-0.74860302
-0.05	-0.4071265	-0.69931105	-0.011382325	0.23726003
-0.025	1	-0.010099034	0.00037033029	-0.0076011735
0	0	0	0	0
0.025	-0.25	0.13317879	0.99991788	-0.062414070
0.05	1.008525	-0.22851782	0	0.25177272
0.075	0	0.10209042	0	0.42875623
0.1	0	0.078436452	0	0.41602138

12.2 Event Summary

Table 12.2 lists the events that occurred during the reporting period that affected the SQM statistics.

Table 12-2 Event Summary

GPS Week	Date	Events
Week 1552 Day 6 to Week 1553 Day 2	10/01/09 to 10/13/09	Loss of data due to power outage.
Week 1553 Day 4 to Week 1555 Day 2	10/15/09 to 10/27/09	PRN 8 unusable affected Type 0 bias daily average.

12.3 Type Bias

PRN Type biases are evaluated as part of the WAAS SQM offline monitoring effort. Depending on the PRN number of any given satellite, it can be classified into three categories of correlation function shapes: skinny (Type 0), nominal (Type 1), and broad (Type 2). Wideband geostationary satellites are considered a different type (Type

3). PRN-type estimates are computed at each epoch and daily averages are computed for each type, for four detection metrics.

For this reporting period, geostationary satellites type biases are not evaluated. Table12.3 shows the rollup average for the quarter. Table 12.4 shows the rollup average since January 1, 2008. Figure 12.1 shows the daily average for the four detection metrics for the quarter. Slight increase in Type 0 bias is caused by PRN 8 outage from 10/15/09 to 10/27/09 and from 11/6/09 to 11/20/09.

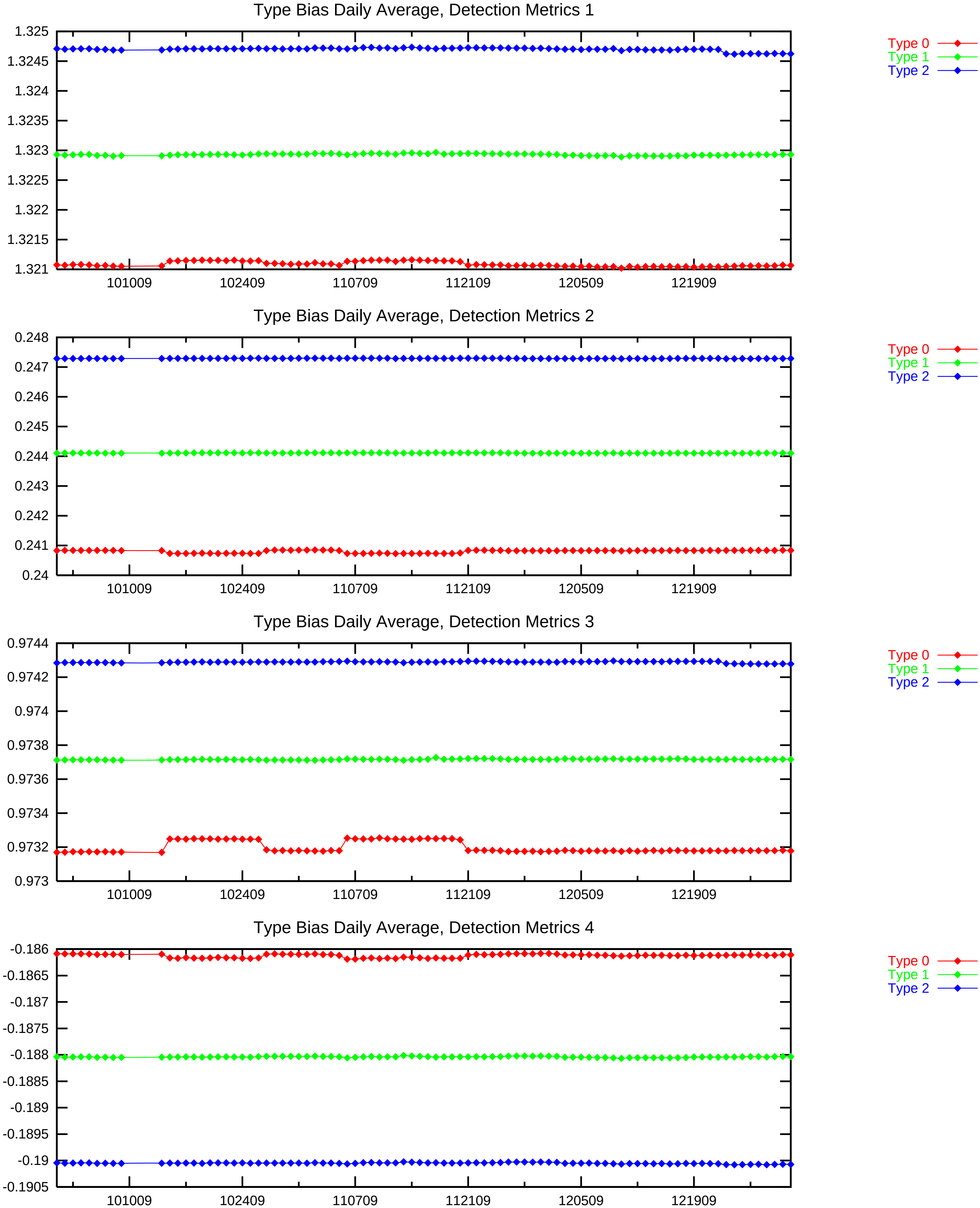
Table 12-3 Type Bias Average for the Quarter

Detection Metric	Type 0	Type 1	Type 2
DM 1	1.32109	1.32293	1.3247
DM 2	0.240802	0.244109	0.247279
DM 3	0.973199	0.973716	0.974289
DM 4	-0.186126	-0.188039	-0.190049

Table 12-4 Type Bias Average Since January 1, 2008

Detection Metric	Type 0	Type 1	Type 2
DM 1	1.32108	1.32293	1.32464
DM 2	0.240836	0.244114	0.247284
DM 3	0.973179	0.973714	0.974277
DM 4	-0.186113	-0.188051	-0.190077

Figure 12-1 PRN Type Bias Average Trend



12.4 PRN Bias

PRN biases are evaluated as part of the WAAS SQM offline monitoring effort. PRN bias is the overall estimated deformation per satellite across receivers. Detection metrics are adjusted for inter-receiver bias, corrected for PRN type bias, and combined across receivers for each satellite. Relying on the assertion that the majority of the SV signals are healthy and normal, detection metrics are normalized over all the satellites on orbit resulting in an overall PRN bias for each satellite. PRN biases are collected at each epoch and daily averages are computed for each satellite, for four detection metrics.

Table 12.5 and Figure 12.2 show the rollup PRN bias average for the quarter. Table 12.6 shows the rollup PRN bias average since January 1, 2008. Figure 12.3 to 12.10 show the PRN bias average trend for each SV. The maximum average for DM1 for this quarter is PRN 23 at 0.00094655. The maximum average for DM2 is PRN 21 at 0.00018716. The maximum average for DM3 is PRN 10 at 0.00027142 and the maximum average for DM4 is PRN 23 at 0.00041539.

For this reporting period, geostationary satellite biases are not evaluated. Please refer to Table 1.4 and Table 12.2 for events that may have an impact on PRN bias statistics. Small spikes in PRN bias daily average are due to satellite outages.

Table 12-5 PRN Bias Average for the Quarter

PRN	DM1	DM2	DM3	DM4
2	0.00017278	0.00005440	0.00002349	0.00008466
3	0.00023961	0.00005658	0.00008874	0.00037466
4	0.00023908	0.00004235	0.00007203	0.00013630
5	0.00014711	0.00013433	0.00006863	0.00009291
6	0.00014032	0.00005397	0.00004256	0.00013334
7	0.00014030	0.00008780	0.00003683	0.00011580
8	0.00015601	0.00012275	0.00004607	0.00010024
9	0.00021742	0.00005581	0.00006769	0.00010892
10	0.00067753	0.00006782	0.00027142	0.00009691
11	0.00085356	0.00017496	0.00004621	0.00023192
12	0.00023830	0.00008913	0.00010619	0.00008074
13	0.00049041	0.00005176	0.00005807	0.00014584
14	0.00060050	0.00010903	0.00010858	0.00010554
15	0.00011295	0.00006807	0.00002881	0.00012361
16	0.00016694	0.00006784	0.00010810	0.00034658
17	0.00011928	0.00007328	0.00003514	0.00011784
18	0.00056963	0.00009328	0.00003713	0.00019499
19	0.00036864	0.00013734	0.00003402	0.00008047
20	0.00015493	0.00004833	0.00003753	0.00013617
21	0.00059718	0.00018716	0.00019870	0.00008823
22	0.00012791	0.00009726	0.00010102	0.00010104
23	0.00094655	0.00014730	0.00003542	0.00041539
24	0.00030247	0.00004392	0.00003207	0.00010893
25	0.00016885	0.00011699	0.00007969	0.00030757
26	0.00027299	0.00009146	0.00015041	0.00007834
27	0.00049161	0.00008246	0.00006374	0.00033220
28	0.00020947	0.00005338	0.00003710	0.00008358
29	0.00021172	0.00006667	0.00010787	0.00028208
30	0.00029004	0.00008904	0.00002858	0.00011646
31	0.00047967	0.00015424	0.00003902	0.00025901
32	0.00031990	0.00004509	0.00011372	0.00010318

Table 12-6 PRN Bias Average Since January 1, 2008

PRN	DM1	DM2	DM3	DM4
2	0.00018094	0.00005858	0.00002277	0.00009357
3	0.00021530	0.00005268	0.00008553	0.00034689
4	0.00023750	0.00004487	0.00007452	0.00012964
5	0.00014600	0.00013315	0.00006738	0.00009461
6	0.00015846	0.00005374	0.00004328	0.00012257
7	0.00013090	0.00009295	0.00003645	0.00012090
8	0.00015527	0.00011972	0.00004499	0.00010076
9	0.00022951	0.00005436	0.00006951	0.00011162
10	0.00065610	0.00007266	0.00027053	0.00009328
11	0.00091439	0.00018467	0.00006216	0.00023151
12	0.00023897	0.00008817	0.00010612	0.00008016
13	0.00051104	0.00005746	0.00005821	0.00015923
14	0.00066465	0.00012640	0.00011344	0.00012683
15	0.00011939	0.00007010	0.00002815	0.00013383
16	0.00016245	0.00007561	0.00010745	0.00033887
17	0.00011802	0.00007957	0.00003192	0.00011627
18	0.00061399	0.00010384	0.00004055	0.00021421
19	0.00037516	0.00013169	0.00003306	0.00008356
20	0.00015479	0.00004751	0.00004223	0.00011443
21	0.00062422	0.00018747	0.00020175	0.00008646
22	0.00014355	0.00009259	0.00010135	0.00010073
23	0.00095450	0.00014037	0.00003547	0.00042261
24	0.00030088	0.00004515	0.00003524	0.00010179
25	0.00015833	0.00011328	0.00008136	0.00030547
26	0.00026944	0.00009231	0.00015372	0.00008831
27	0.00047320	0.00007857	0.00006748	0.00032068
28	0.00024769	0.00005331	0.00003322	0.00008929
29	0.00022272	0.00006752	0.00010753	0.00029204
30	0.00029338	0.00009368	0.00002812	0.00011681
31	0.00047160	0.00015831	0.00003896	0.00025191
32	0.00031659	0.00004718	0.00011375	0.00010267

Figure 12-2 PRN Bias Average for the Quarter

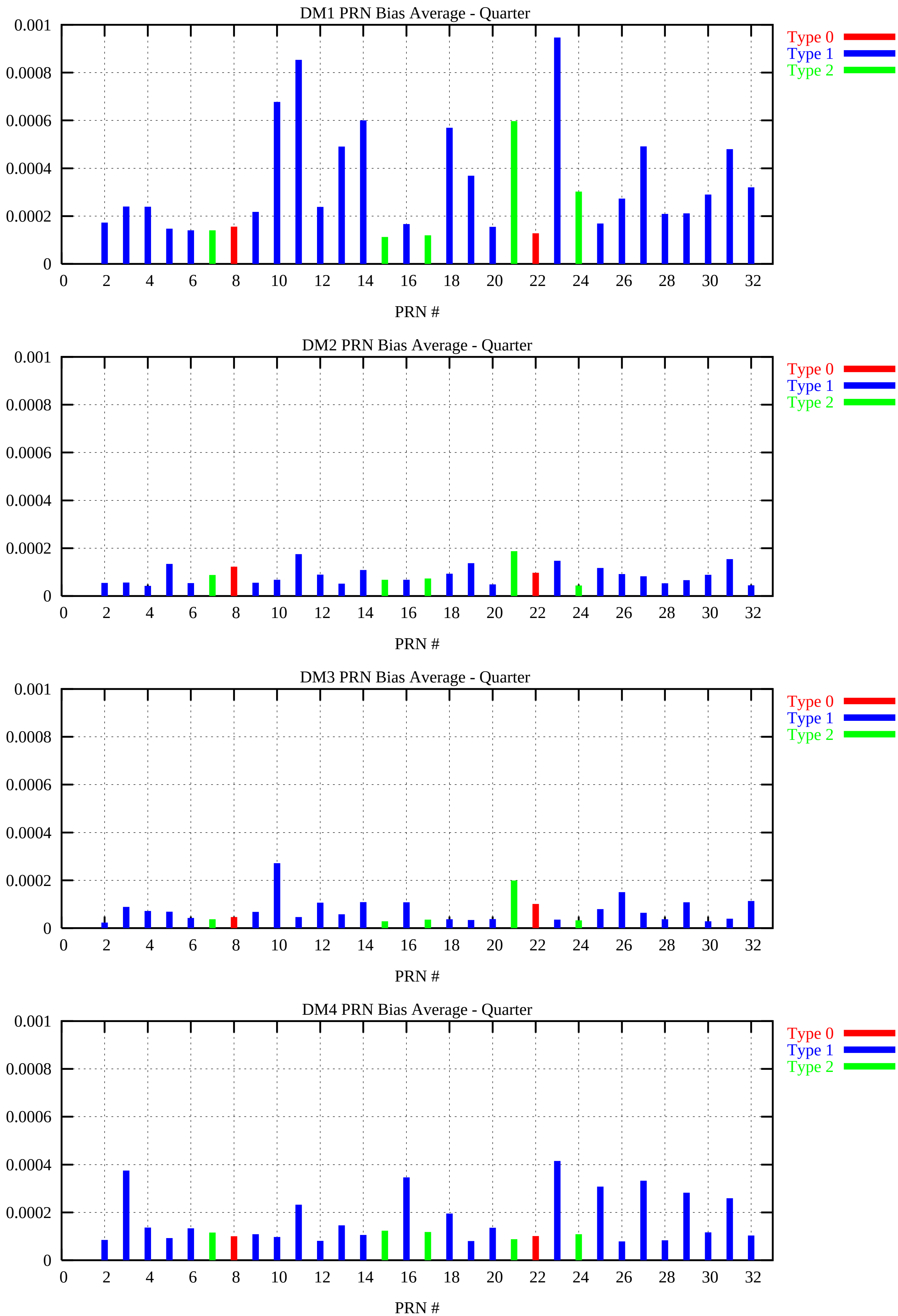
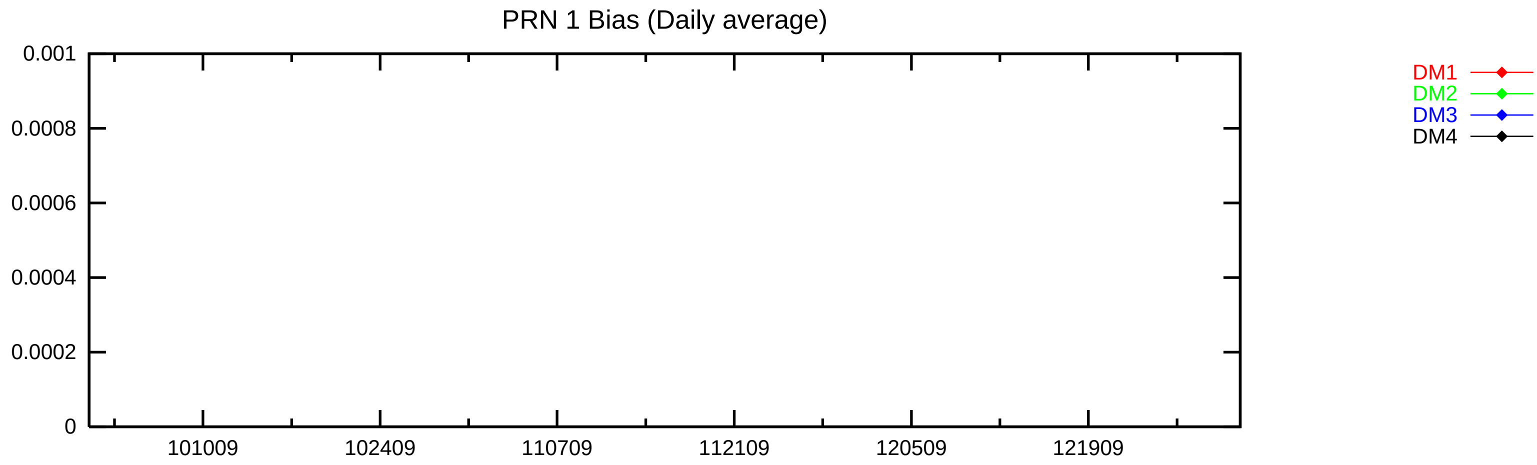
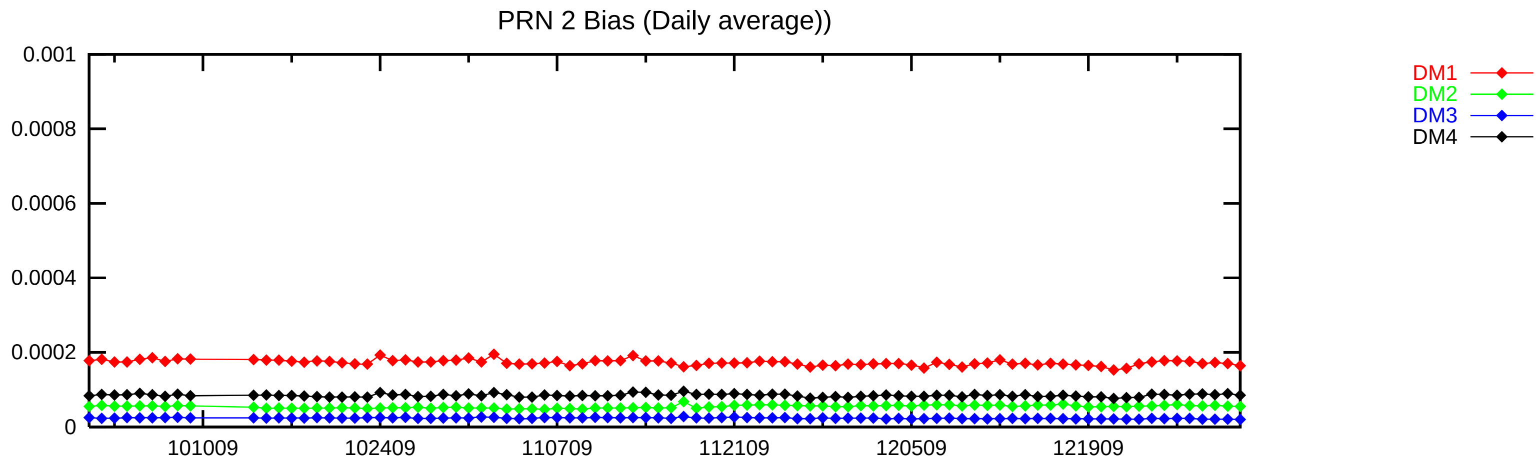
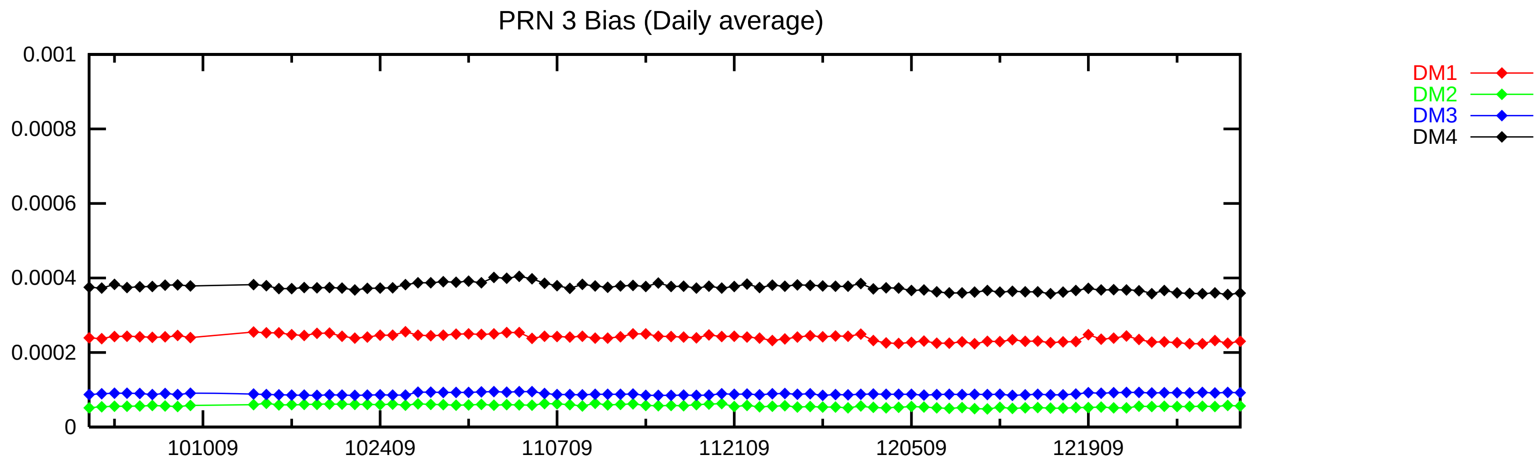


Figure 12-3 PRN Bias Average Trend (PRN 1 - PRN 4)







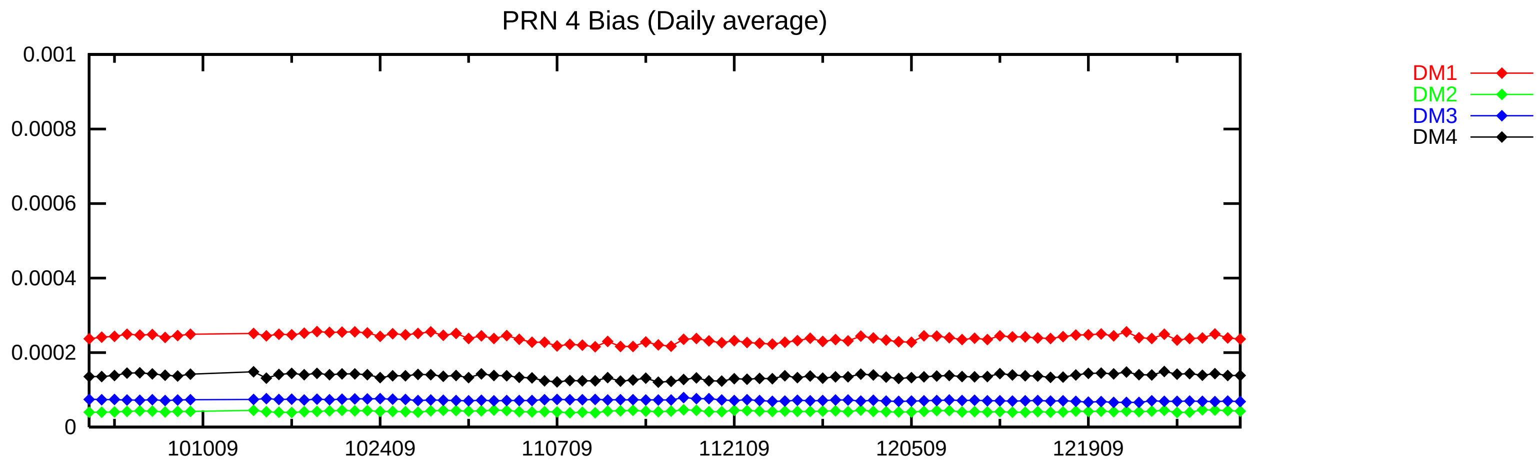


Figure 12-4 PRN Bias Average Trend (PRN 5 - PRN 8)

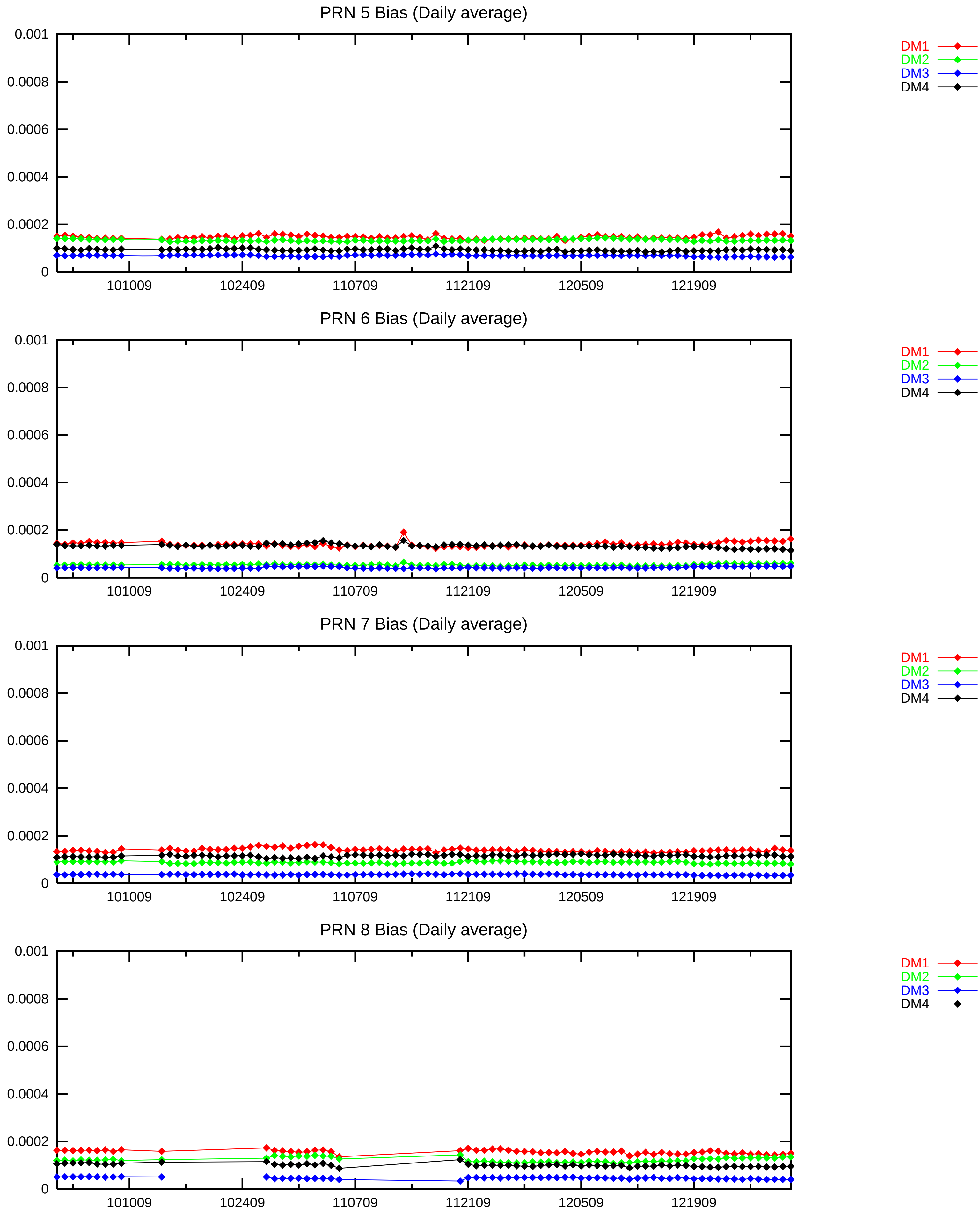
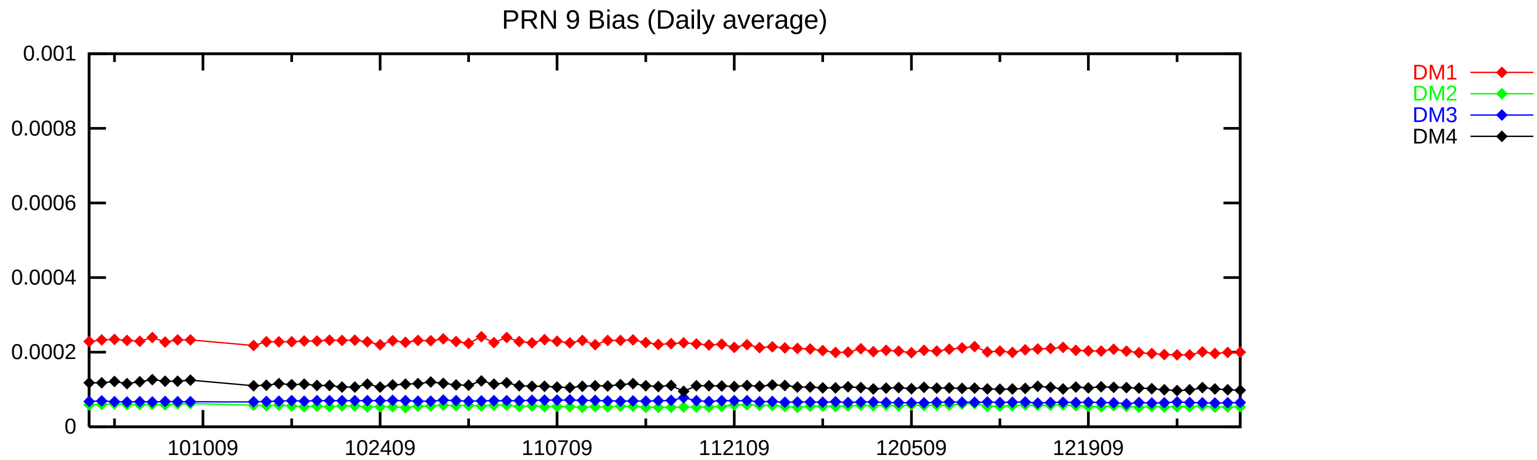
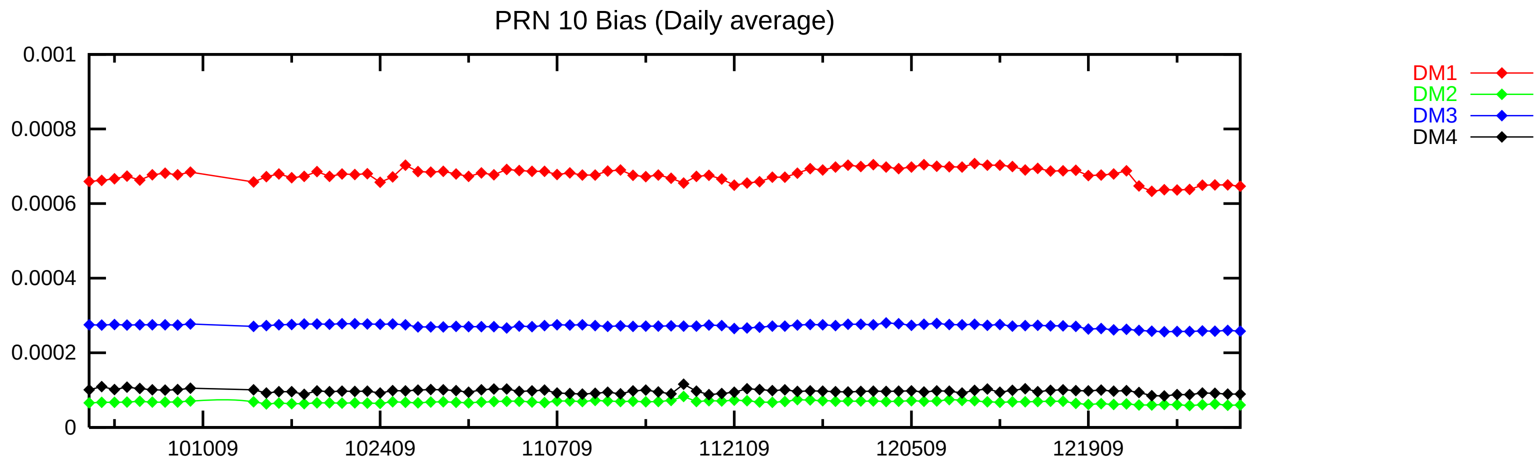
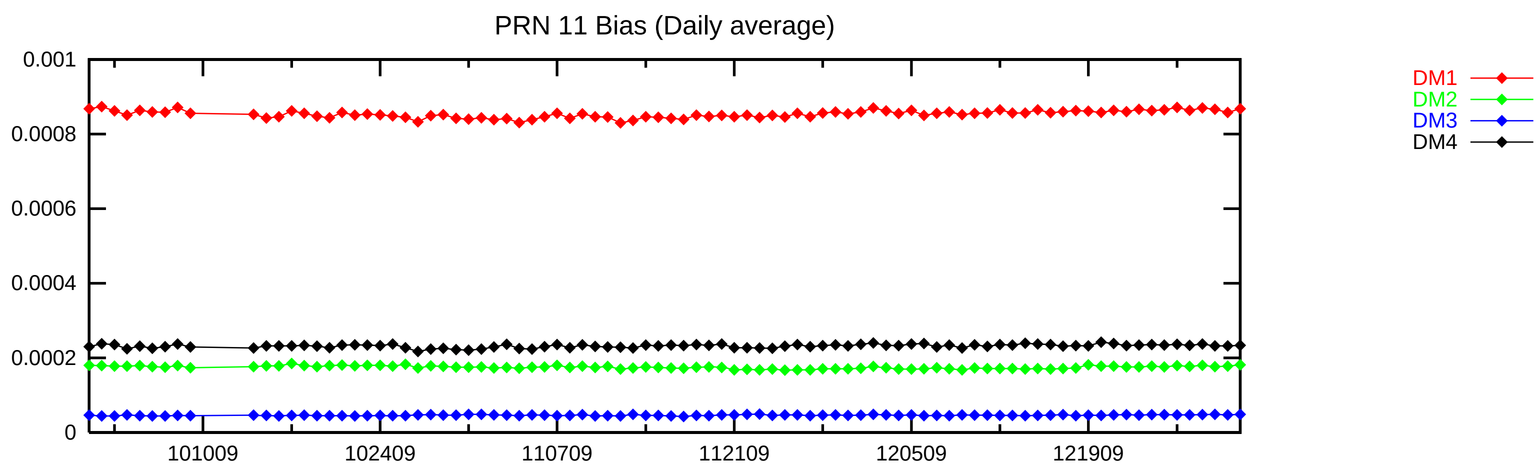


Figure 12-5 PRN Bias Average Trend (PRN 9 - PRN 12)







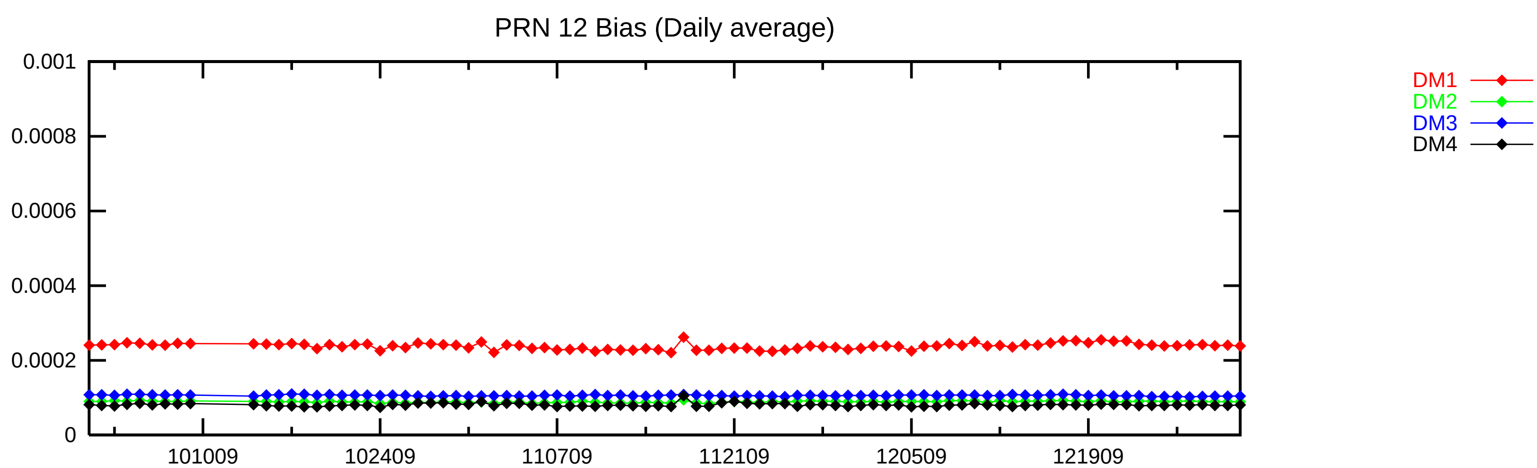


Figure 12-6 PRN Bias Average Trend (PRN 13 - PRN 16)

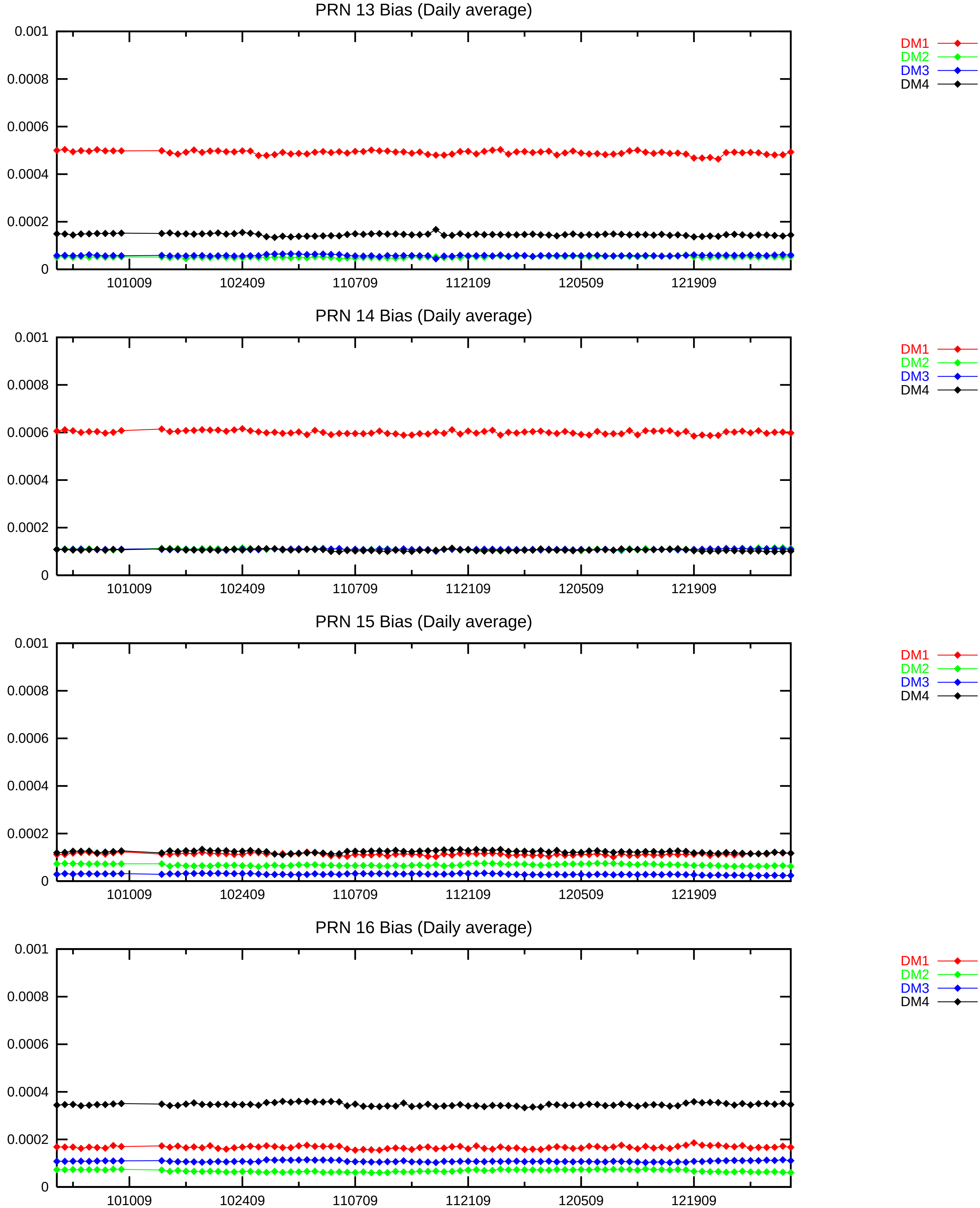
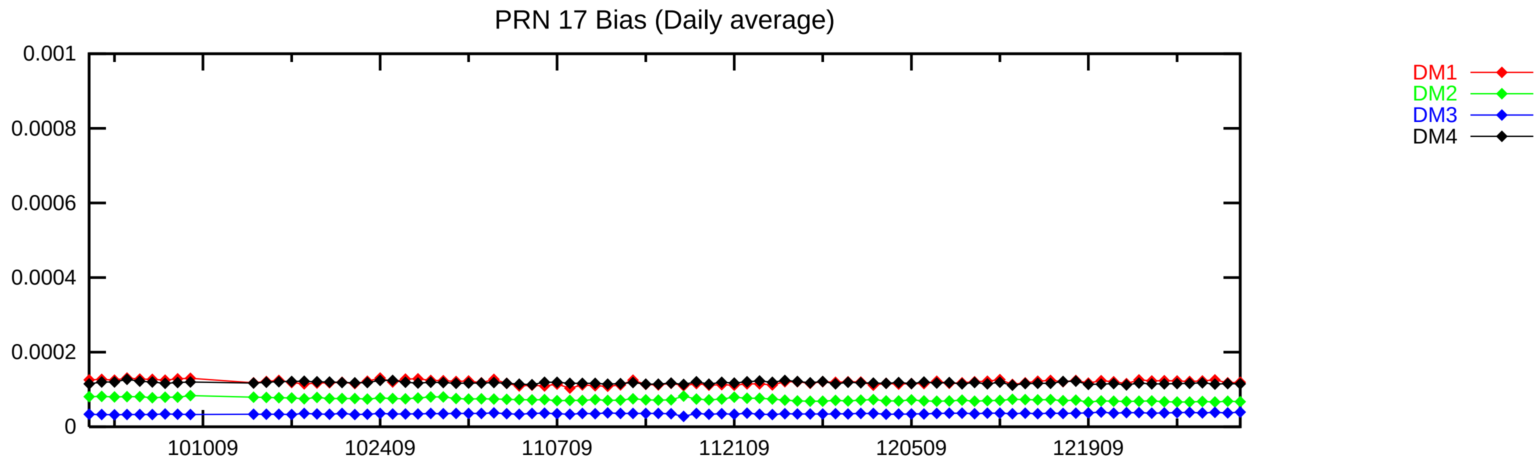
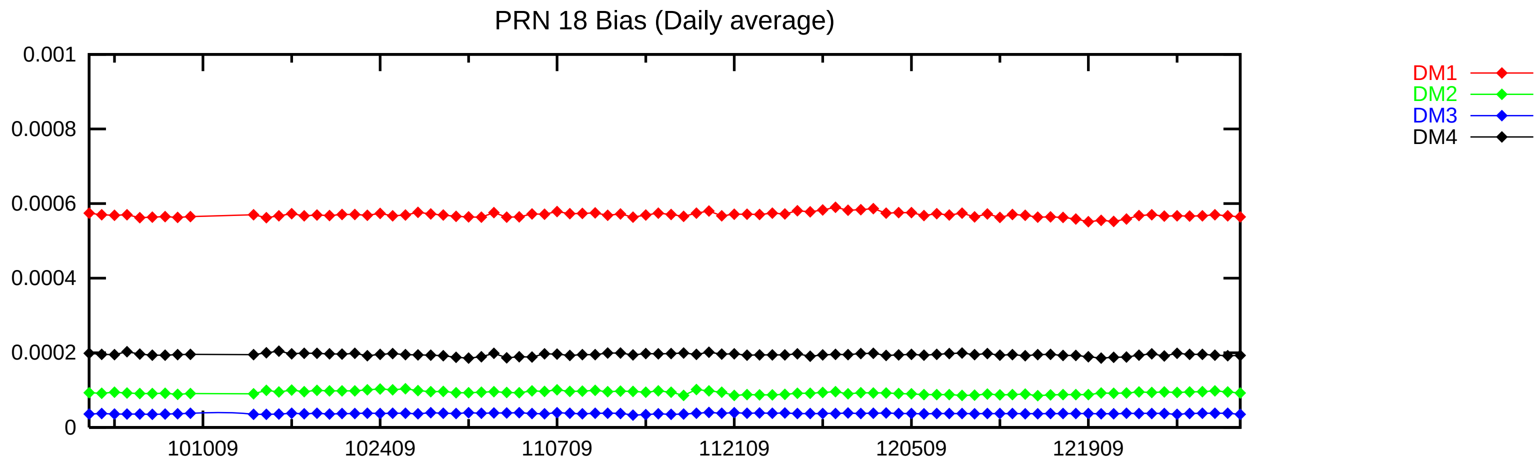
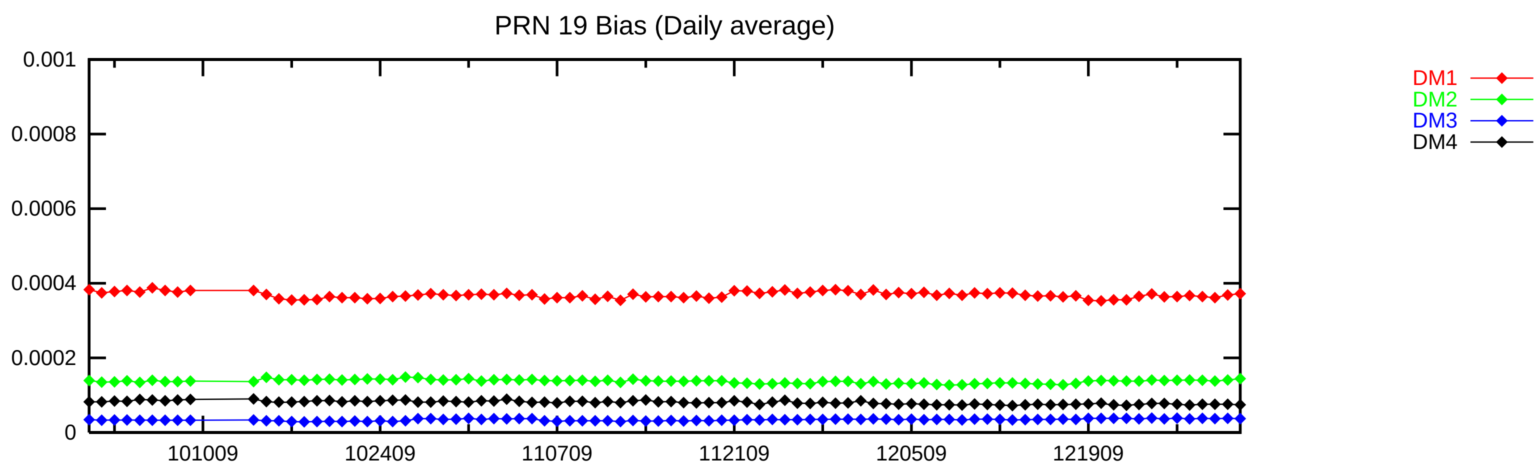


Figure 12-7 PRN Bias Average Trend (PRN 17 - PRN 20)







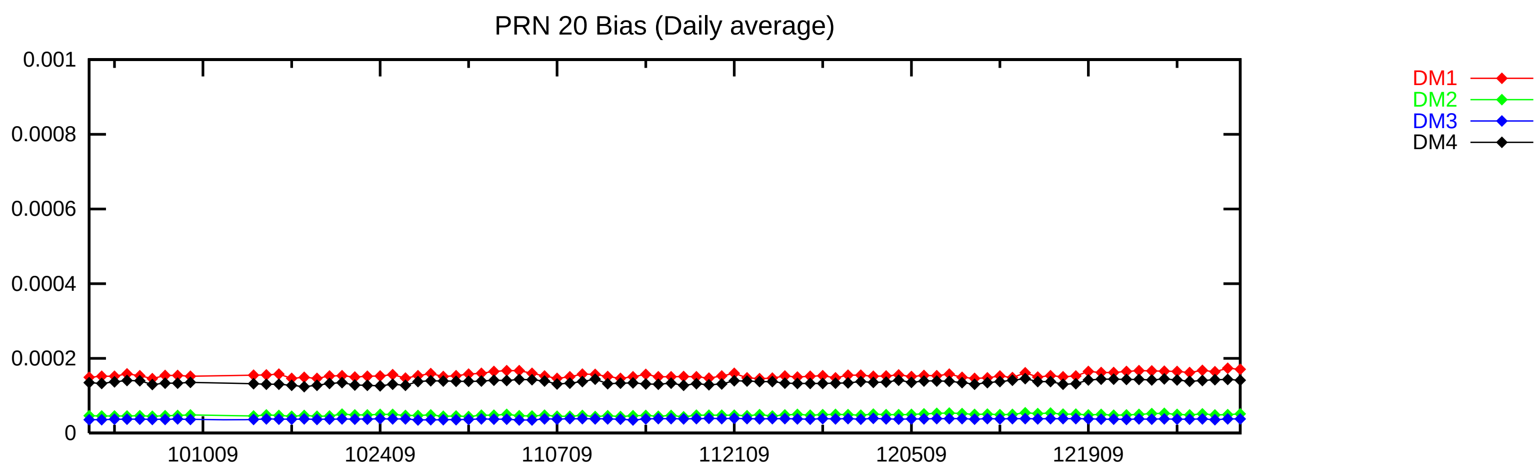
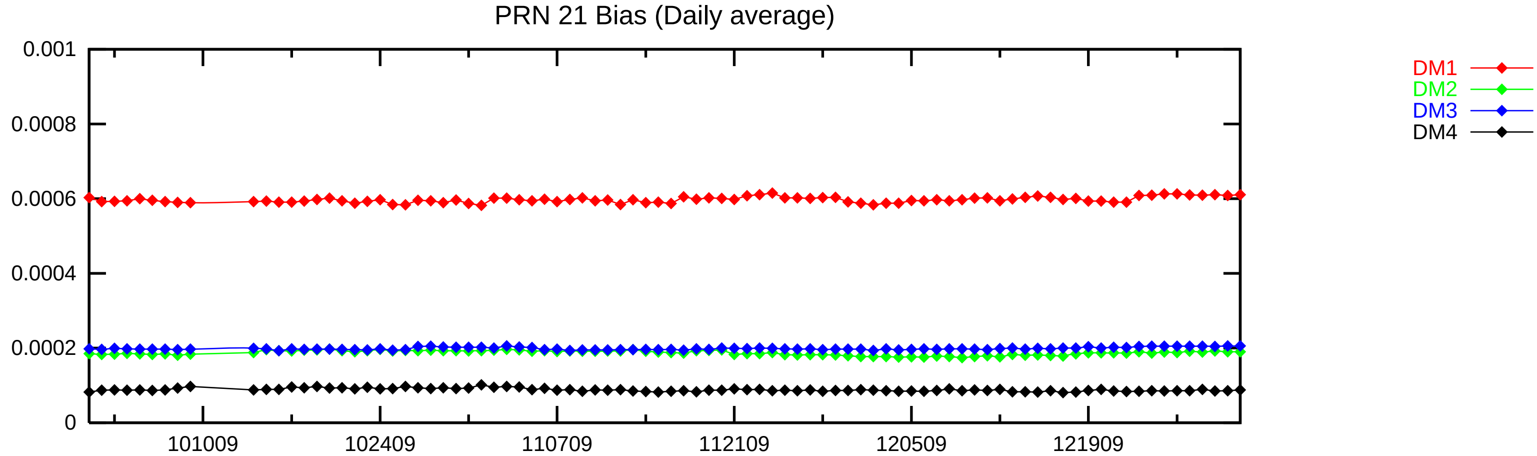
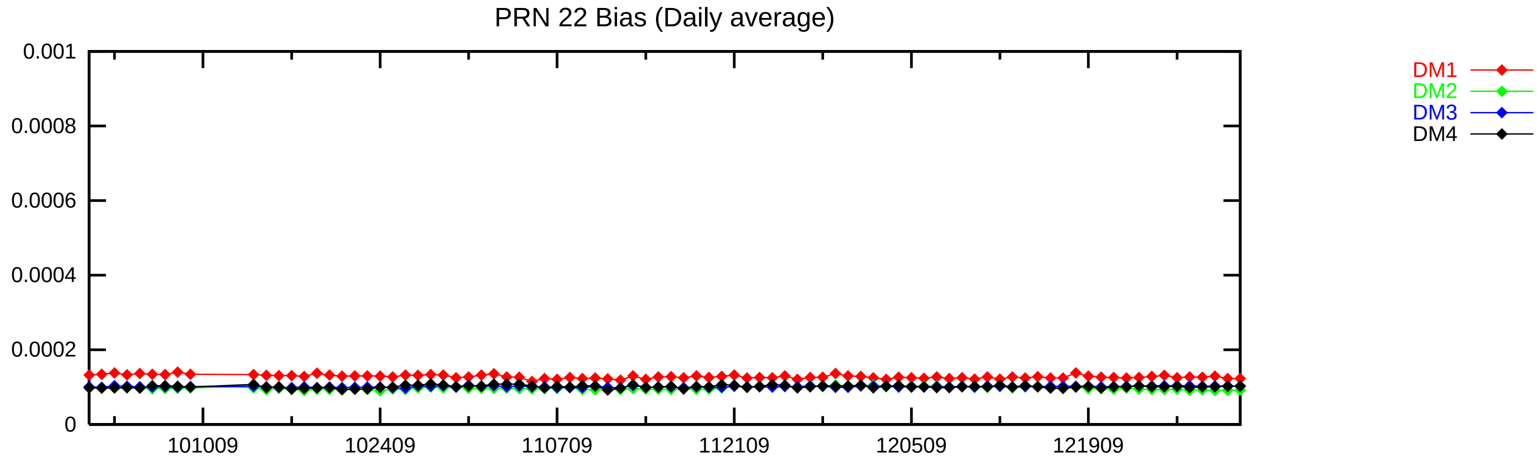
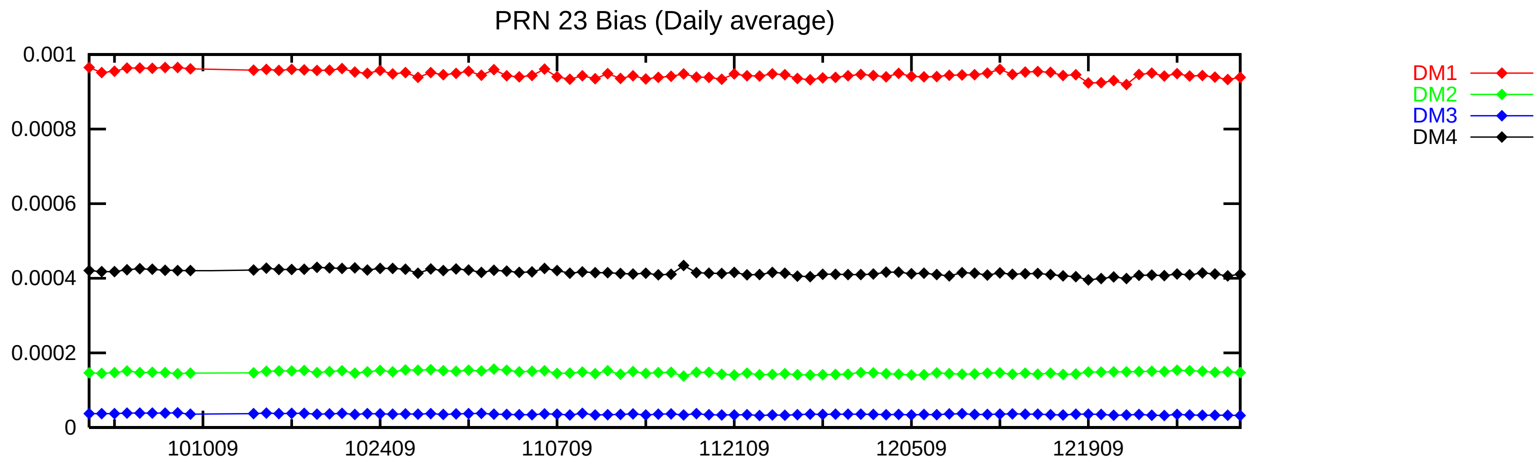


Figure 12-8 PRN Bias Average Trend (PRN 21 - PRN 24)







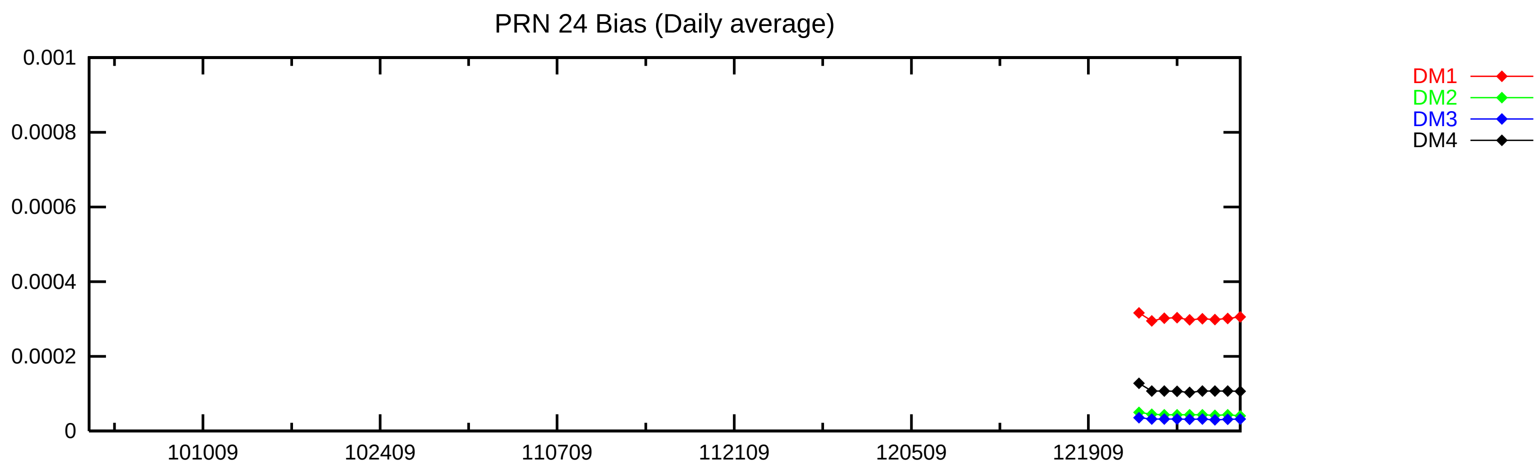


Figure 12-9 PRN Bias Average Trend (PRN 25 - PRN 28)

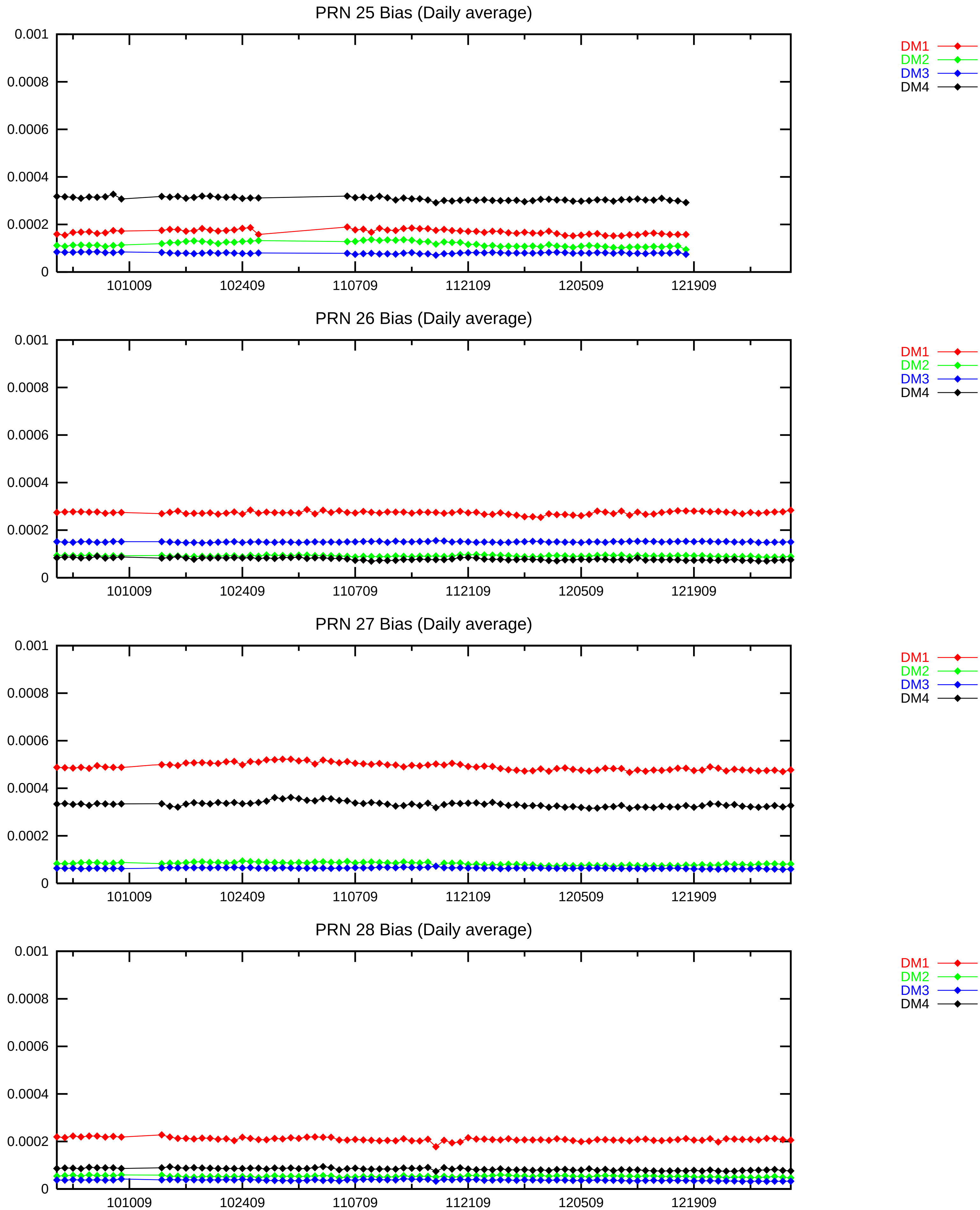
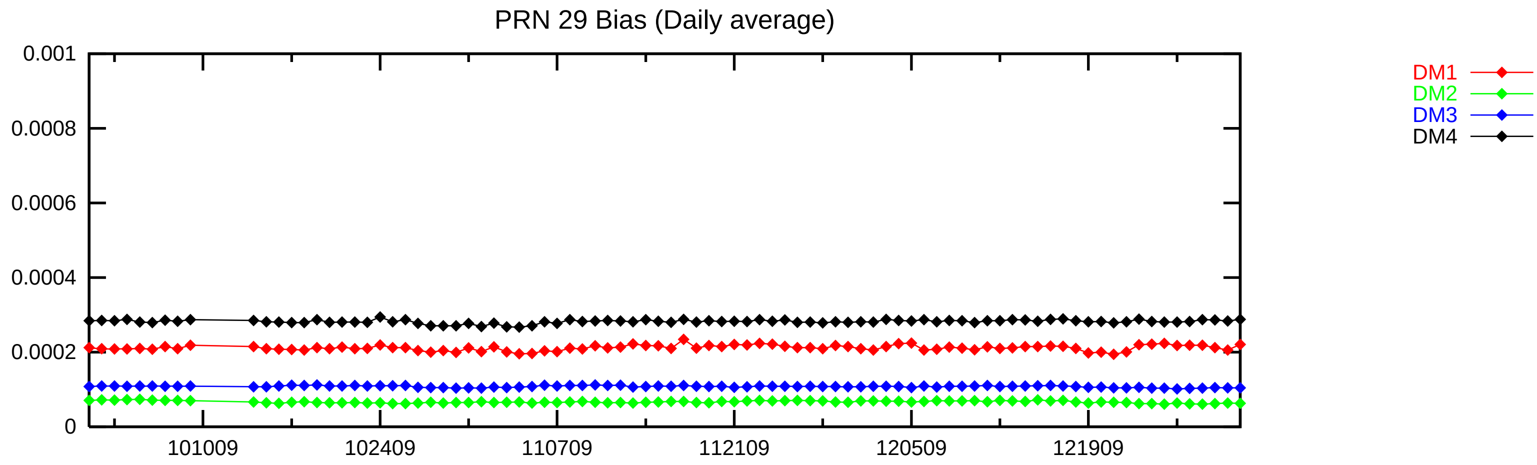
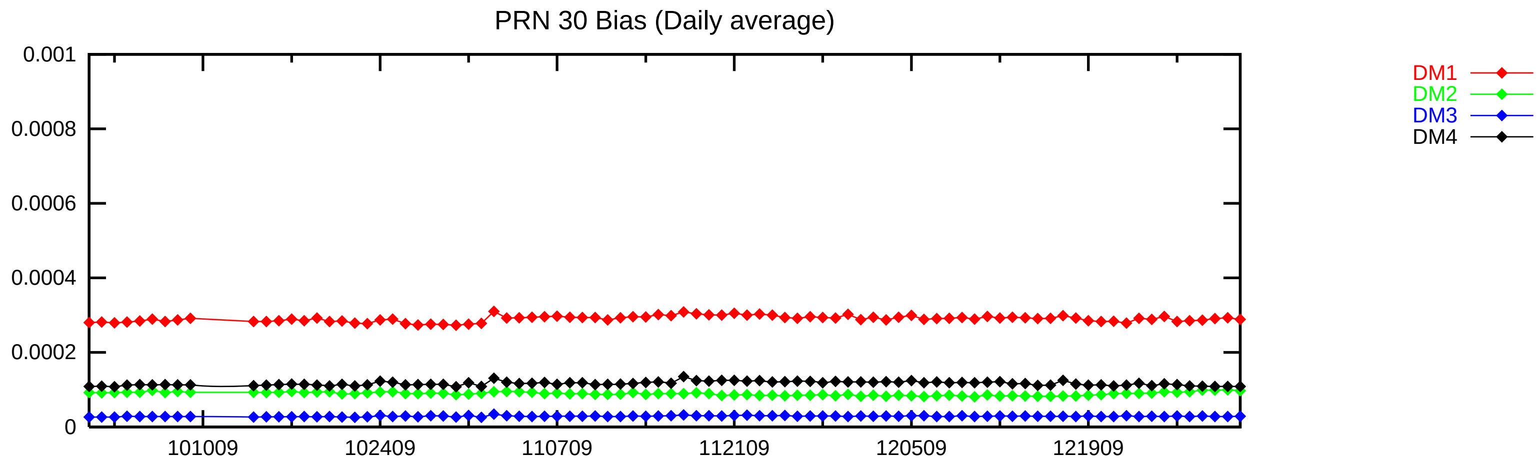
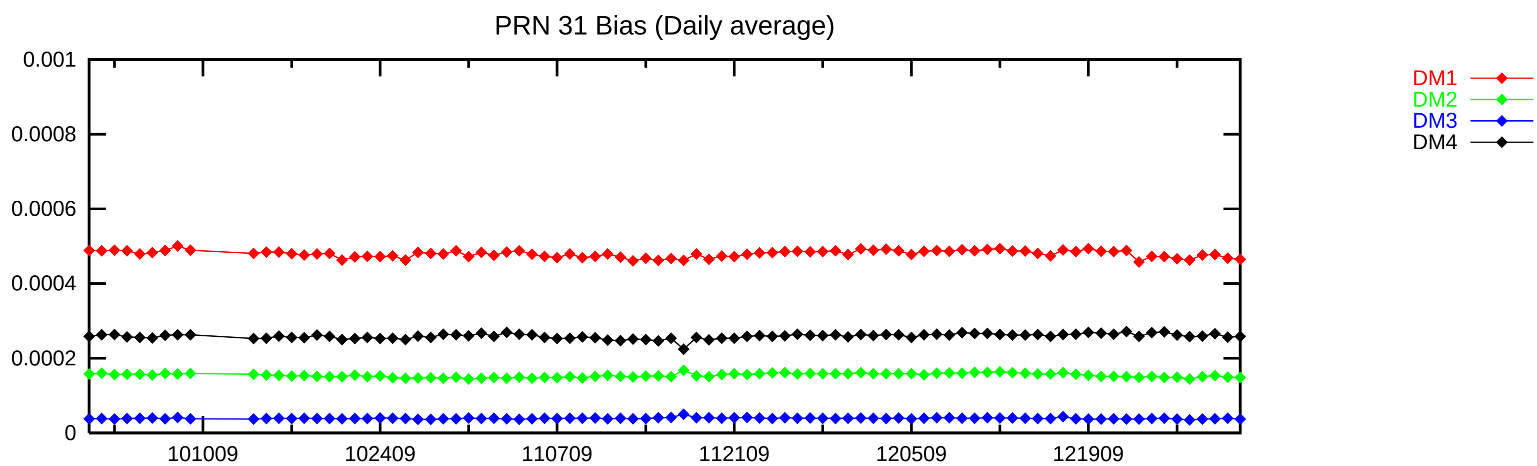
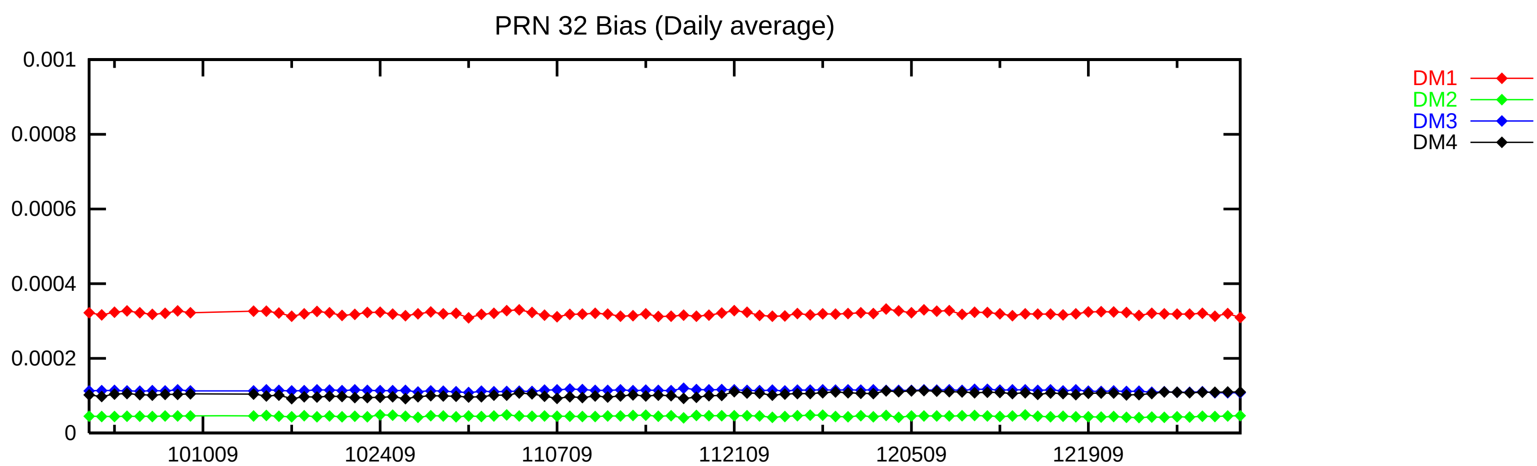


Figure 12-10 PRN Bias Average Trend (PRN 29 - PRN 32)









12.5 SQM Trips

SQM trip occurs when the estimated deformation exceeds threshold. There are no SQM trips for this quarter.

13.0 GPS Broadcast Orbit vs. IGS Precise Orbits Analysis

As part of the WAAS off-line monitoring process, the accuracy of the GPS broadcast ephemeris is periodically compared to the NGA precise orbit information to monitor the validity of an a priori assumption concerning the accuracy of the GPS broadcast ephemeris information that is part of a brute force computer simulation analysis utilized as part of the safety proof of the WAAS MT-28 functionality. That brute force analysis searches a simulated error sphere around a GPS satellite for a worst-case projection of post correction ephemeris error to any user. A pessimistic extrapolation of historical data was used as an a priori to limit the radius of the searched sphere to a finite distance. This periodic off-line monitoring verifies that the original logic of the a priori assumption remains sound.

The assumption being validated is:

Height Error:	+/- 15 meters (standard deviation < 2.8 m),
Along Track Error:	+/- 65 meters (standard deviation < 12.2 m)
Cross Track Error:	+/- 30 meters (standard deviation < 5.6 m)

All IGS high rate 15 minute broadcast navigation data RINEX format files are downloaded and merged into 24 hour broadcast navigation data files. A majority voting algorithm is used to screen the high rate data after a LSB recovery algorithm is applied. NGA precise ephemeris referenced to the GPS satellite antenna phase center is downloaded from the NGA site. GPS satellite positions are computed every 15 minutes and differenced with the precise orbits. The resulting error information is then segregated into the Height, Along Track, and Cross Track (HAC) error data. The standard deviation of the error is then computed for each dimension for each satellite.

The assumption if valid if a 5.33 scaling of the standard deviation across all satellites is within the a priori. Only data points where GPS is healthy and valid precise data is available are considered.

One year of data from 1/1/09 to 12/31/09 is presented. Figure 13-1 is a plot of the standard deviations. Figure 13-2 is a plot of the error means. The worst case standard deviations meet the criteria, therefore the assumption is validated.

Figures 13-3 through 13-33 are plots of the height, along track, and cross track error relative to NGA precise orbits by PRN number. PRN 1 was not in use or unhealthy for all 2009.

The sign convention for this analysis is error = broadcast ECEF - precise ECEF. Along track is positive in the direction of the velocity vector. Cross track completes a right hand system with height and along track.

Figure 13-1 GPS Broadcast Orbit Accuracy Standard Deviations

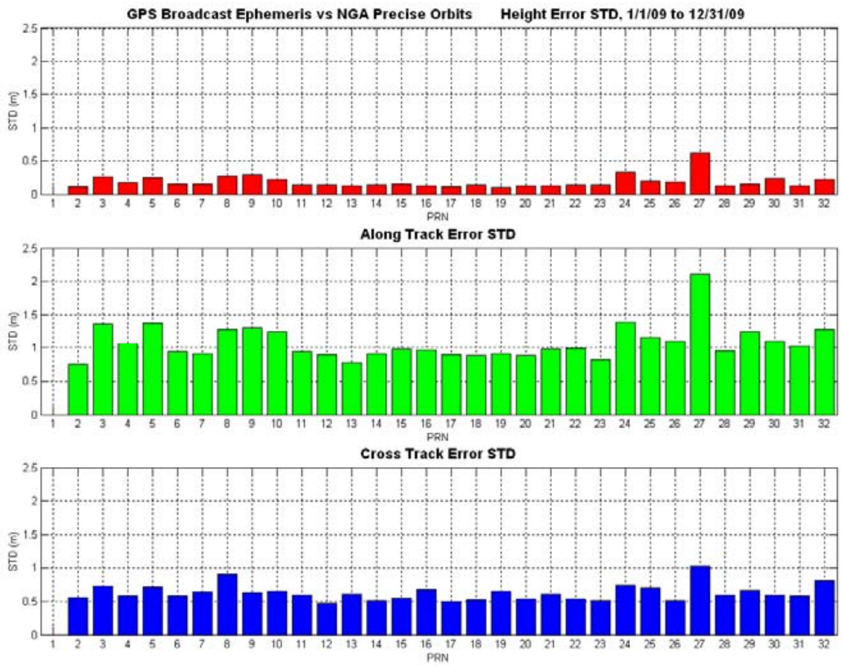


Figure 13-2 GPS Broadcast Orbit Error Means

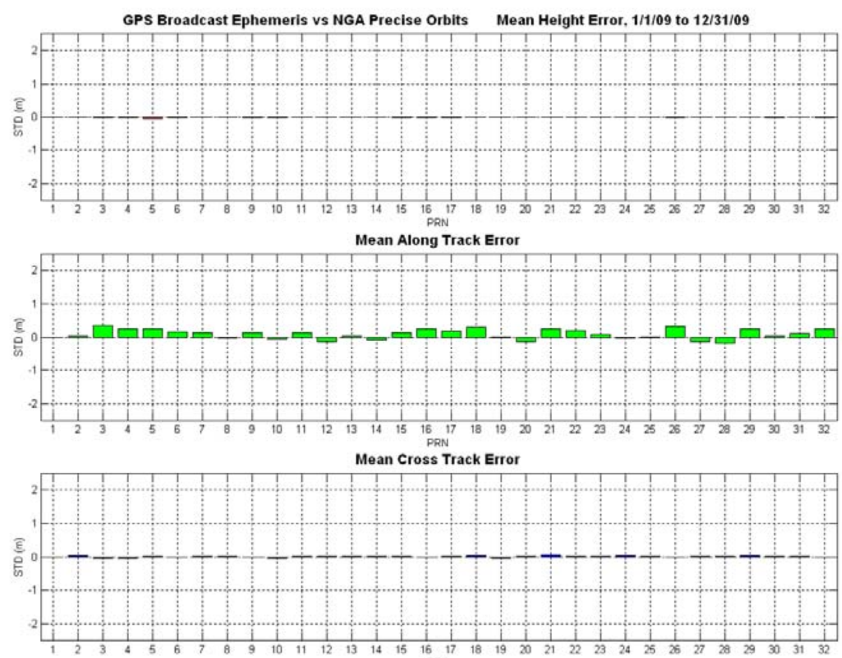


Figure 13-3 PRN 2 Orbit Error

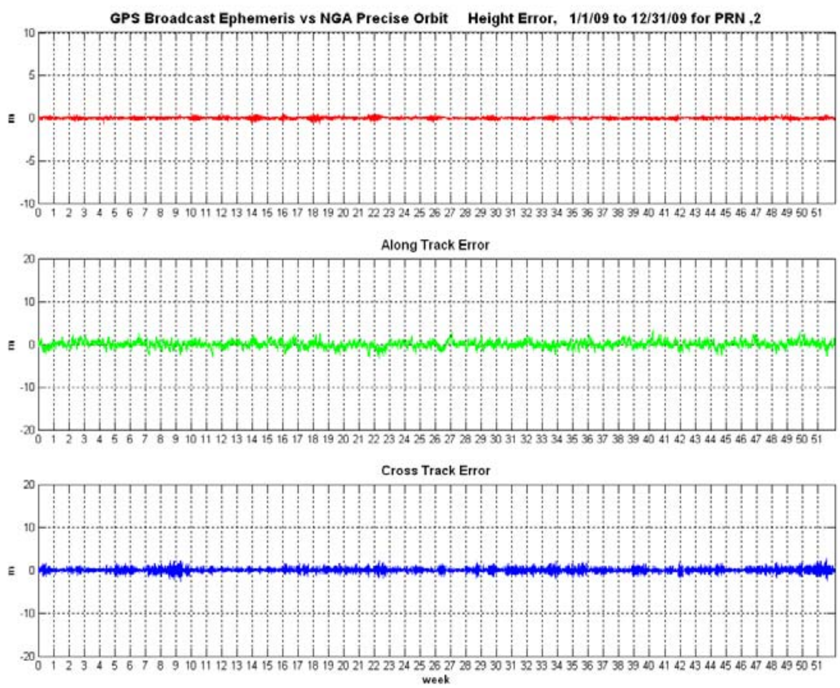


Figure 13-4 PRN 3 Orbit Error

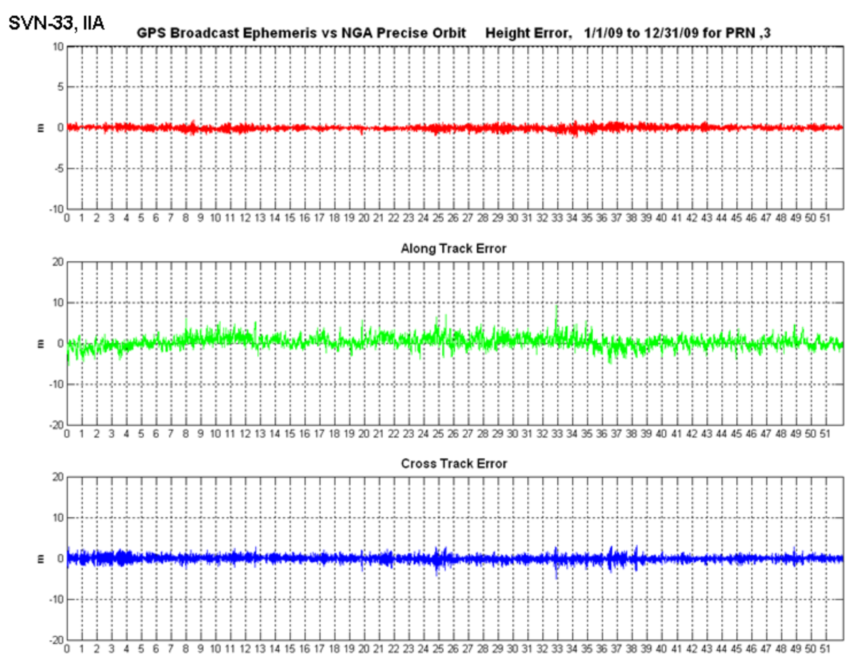


Figure 13-5 PRN 4 Orbit Error

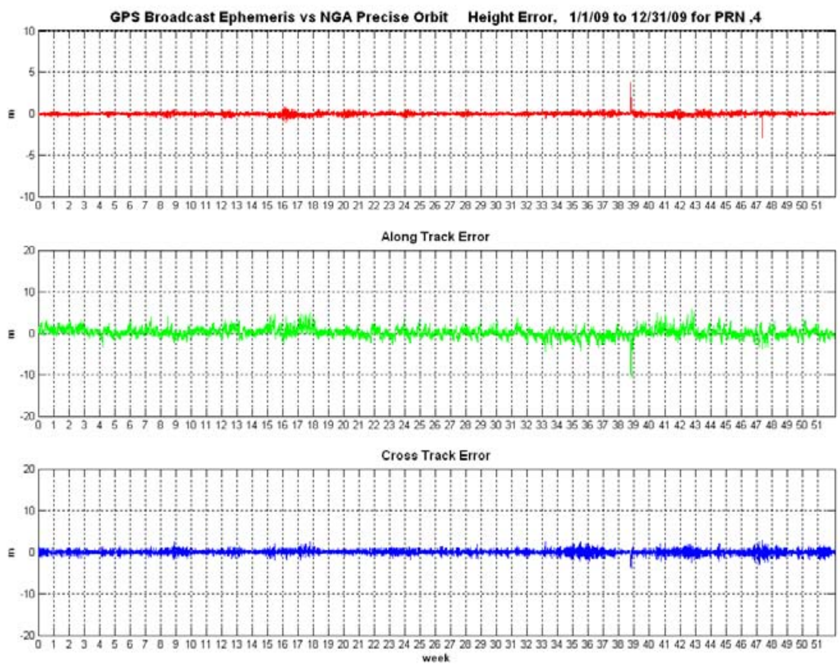


Figure 13-6 PRN 5 Orbit Error

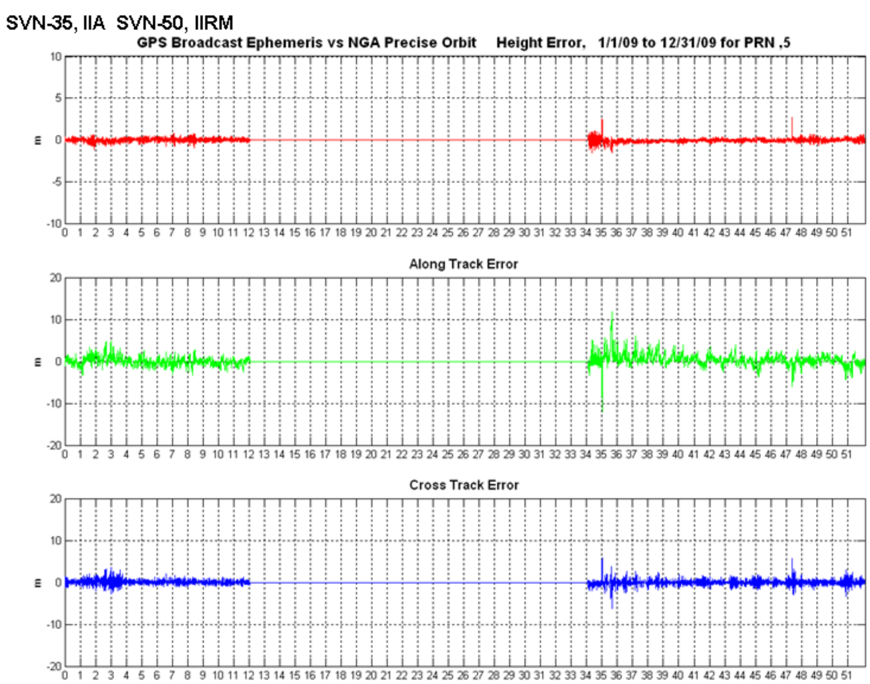


Figure 13-7 PRN 6 Orbit Error

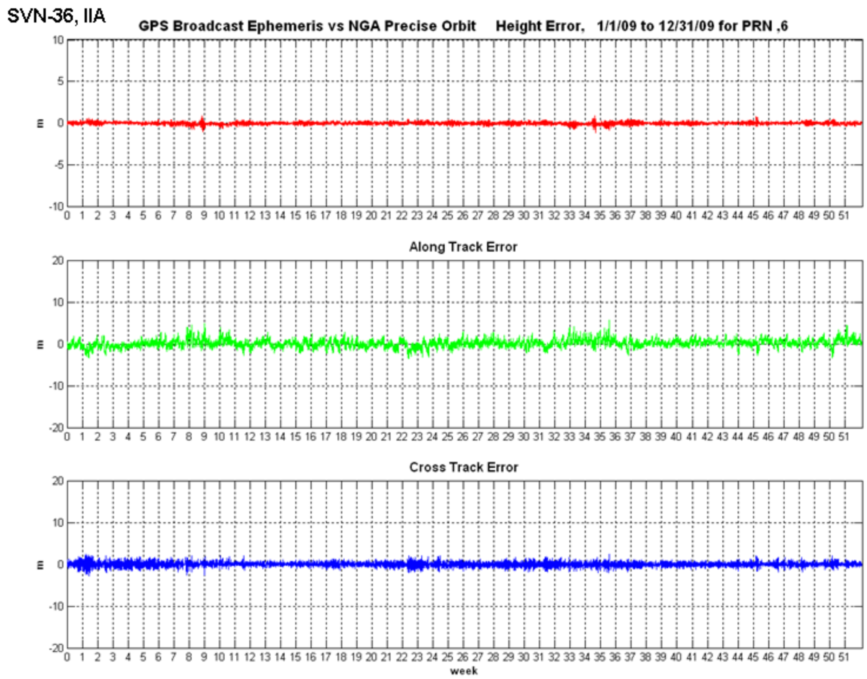


Figure 13-8 PRN 7 Orbit Error

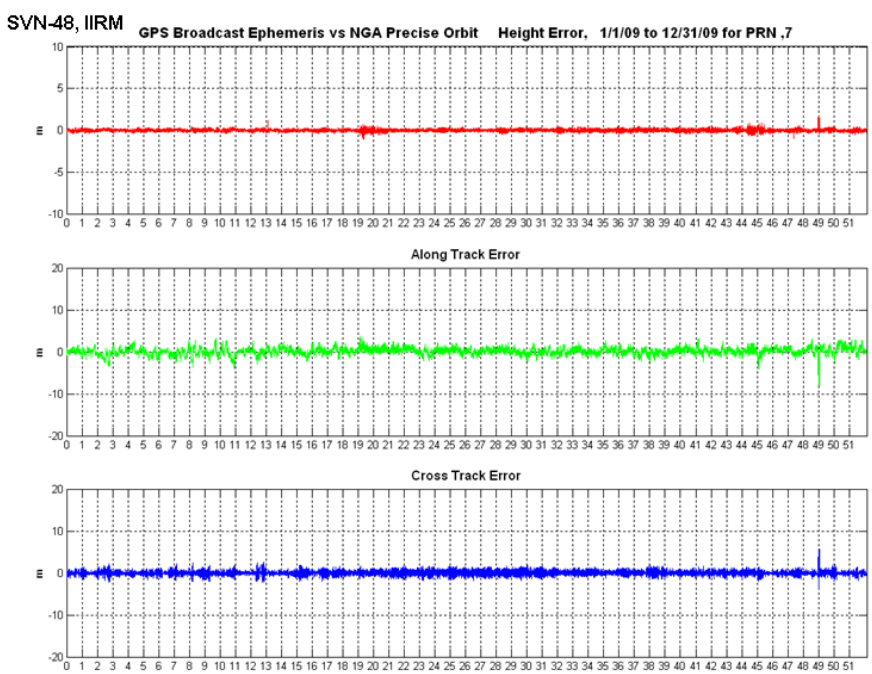


Figure 13-9 PRN 8 Orbit Error

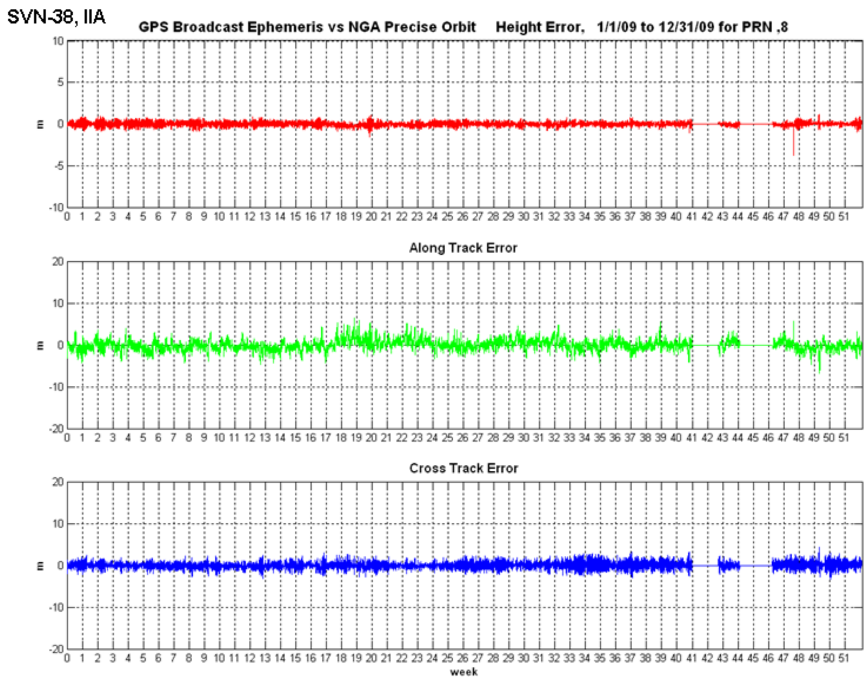


Figure 13-10 PRN 9 Orbit Error

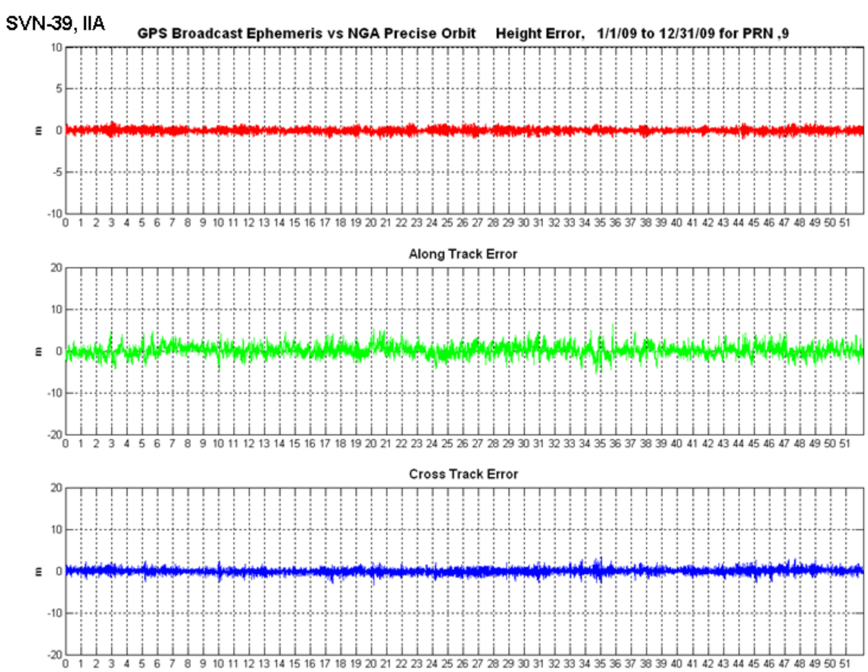


Figure 13-11 PRN 10 Orbit Error

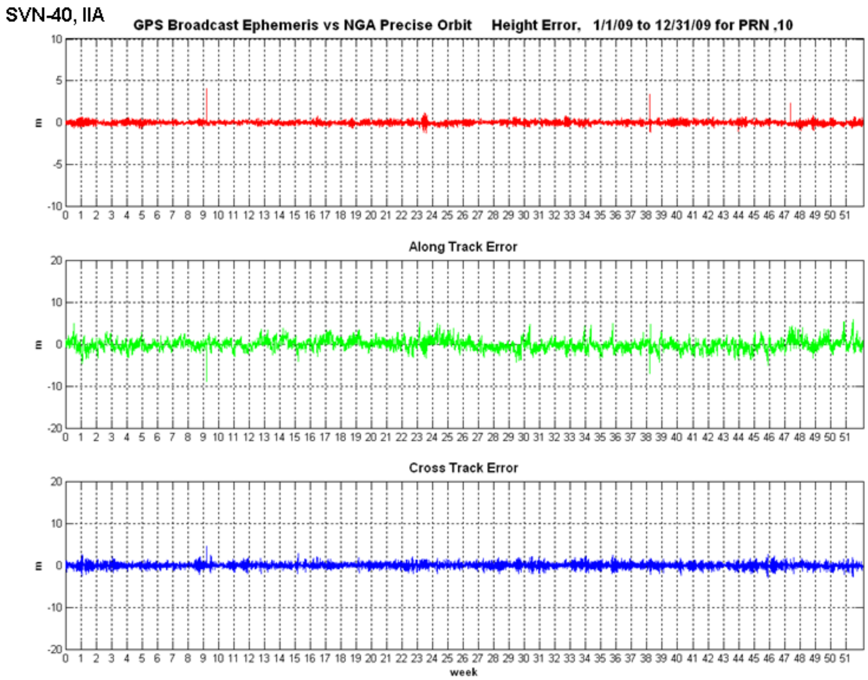


Figure 13-12 RN 11 Obit Error

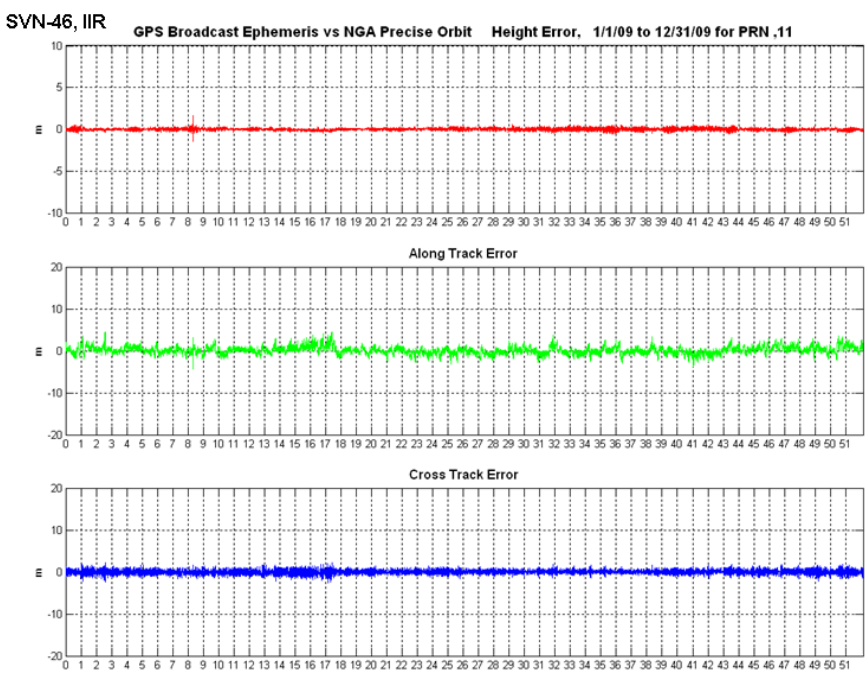


Figure 13-13 PRN 12 Orbit Error

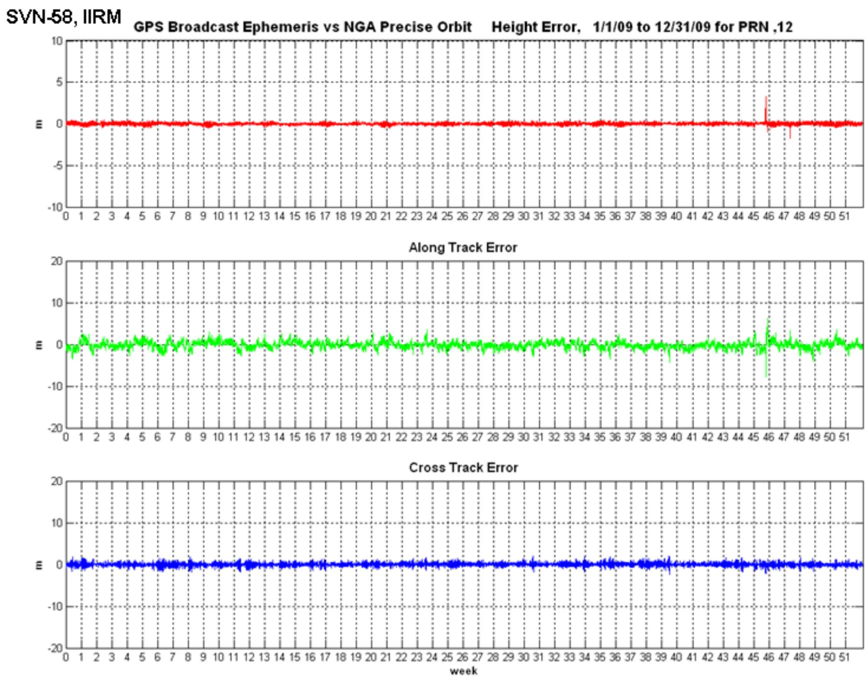


Figure 13-14 PRN 13 Orbit Error

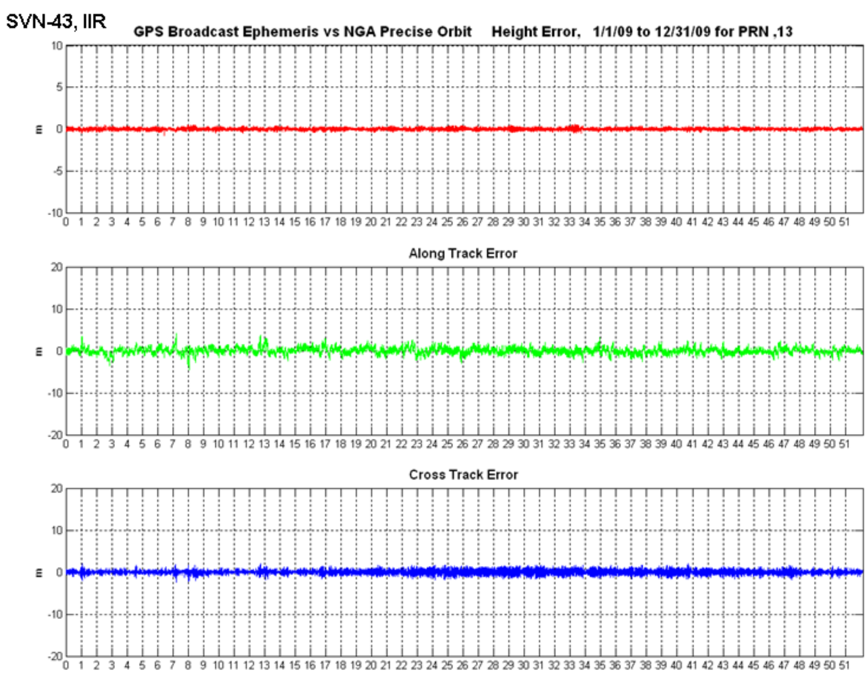


Figure 13-15 PRN 14 Orbit Error

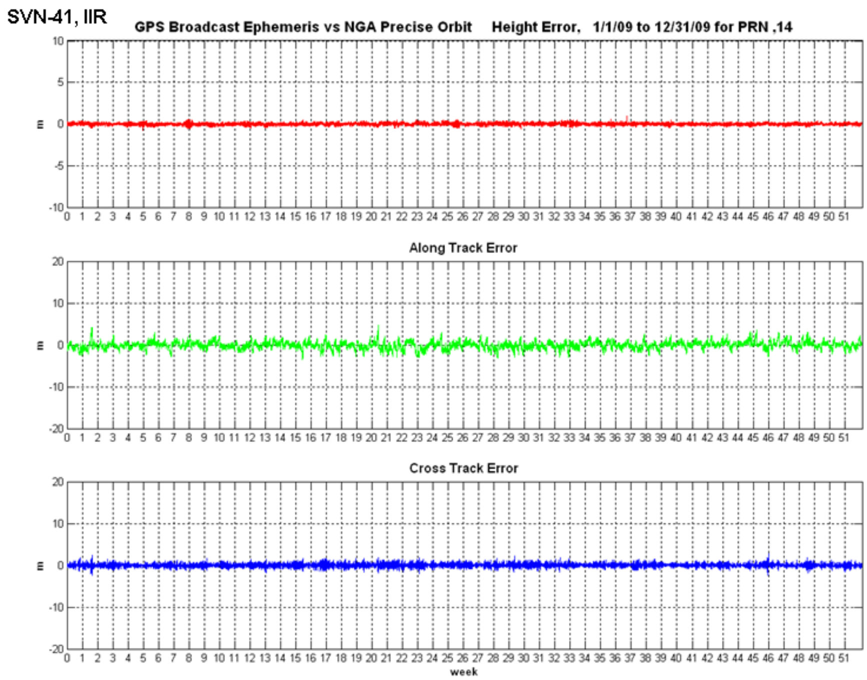


Figure 13-16 PRN 15 Orbit Error

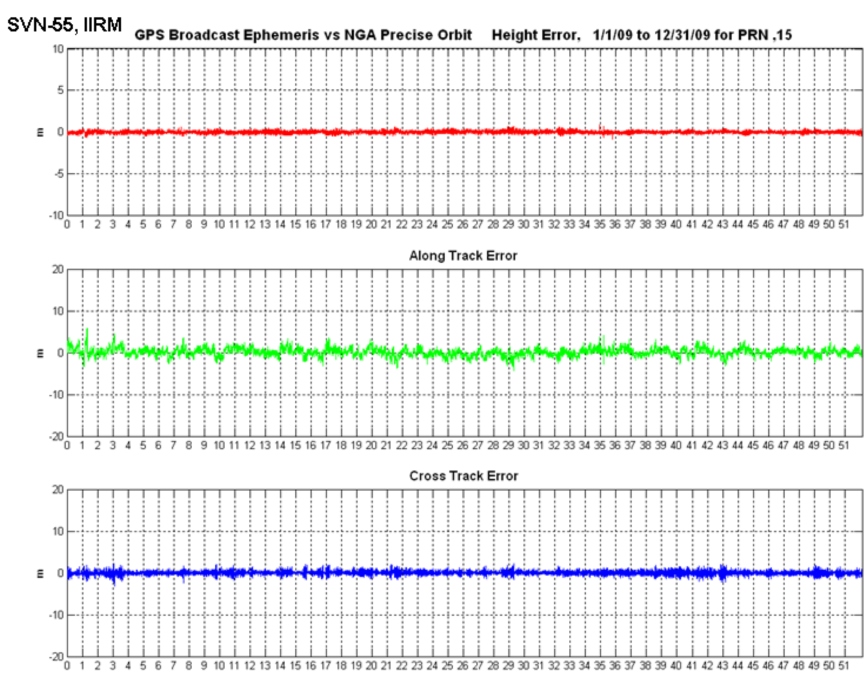


Figure 13-17 PRN 16 Orbit Error

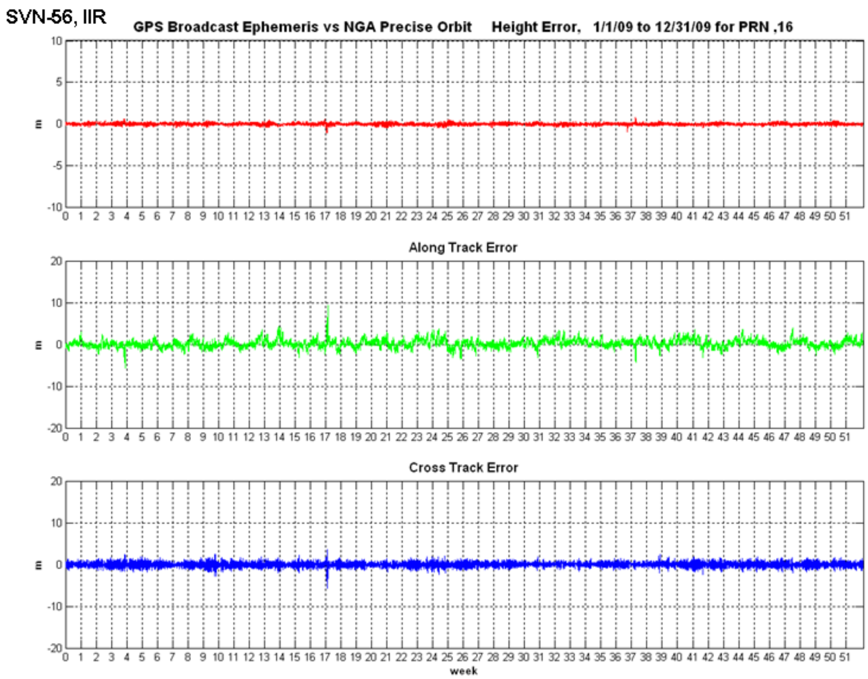


Figure 13-18 PRN 17 Orbit Error

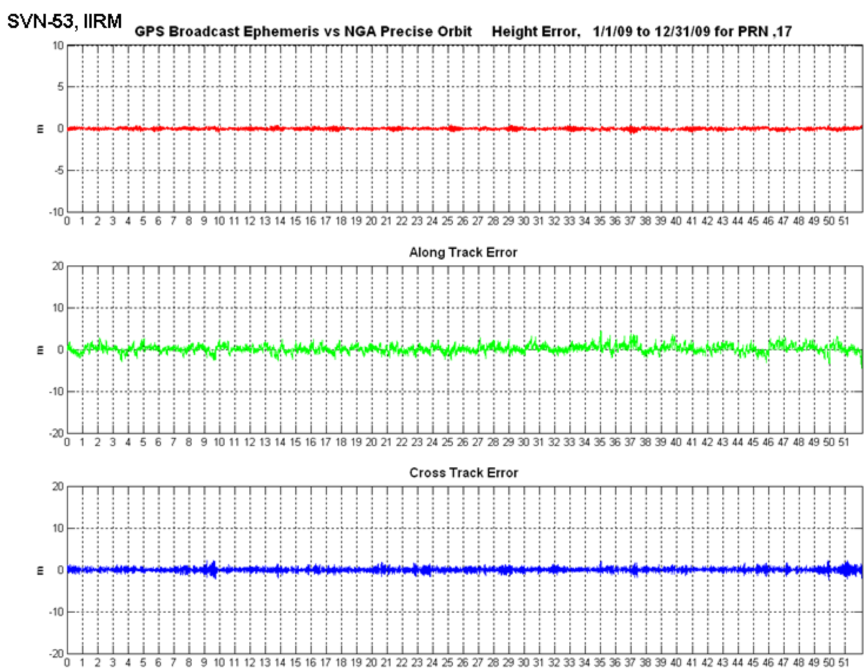


Figure 13-19 PRN 18 Orbit Error

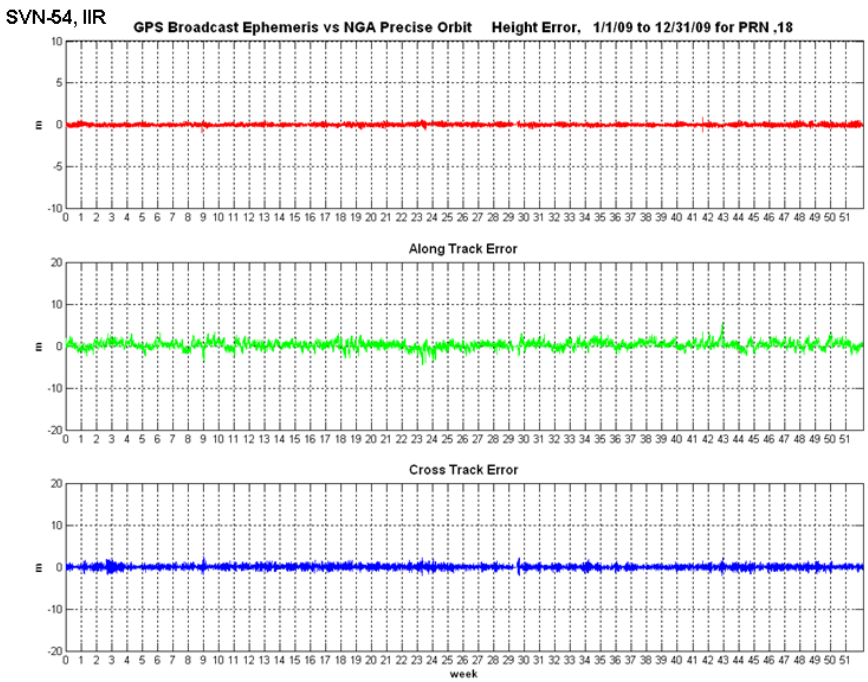


Figure 13-20 PRN 19 Orbit Error

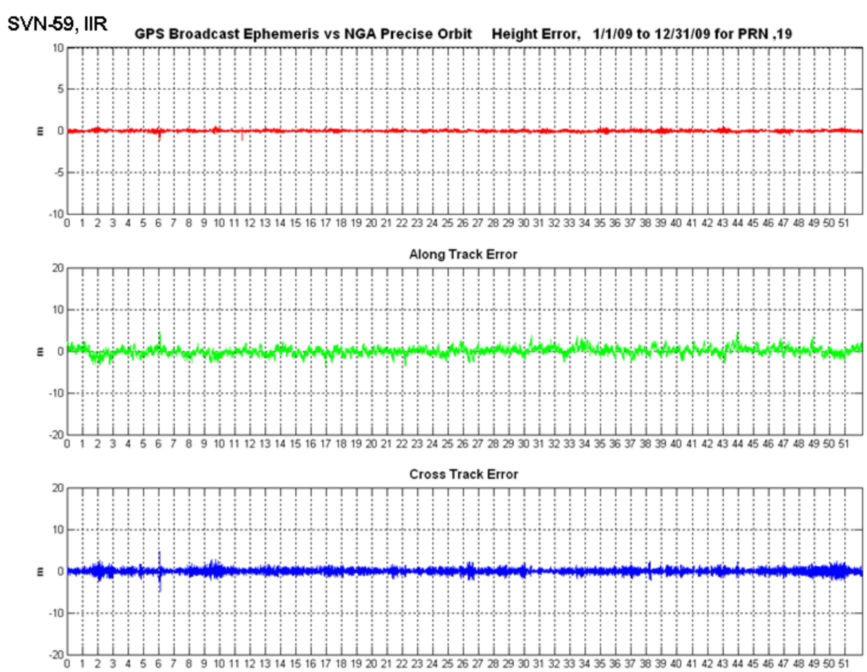


Figure 13-21 PRN 20 Orbit Error

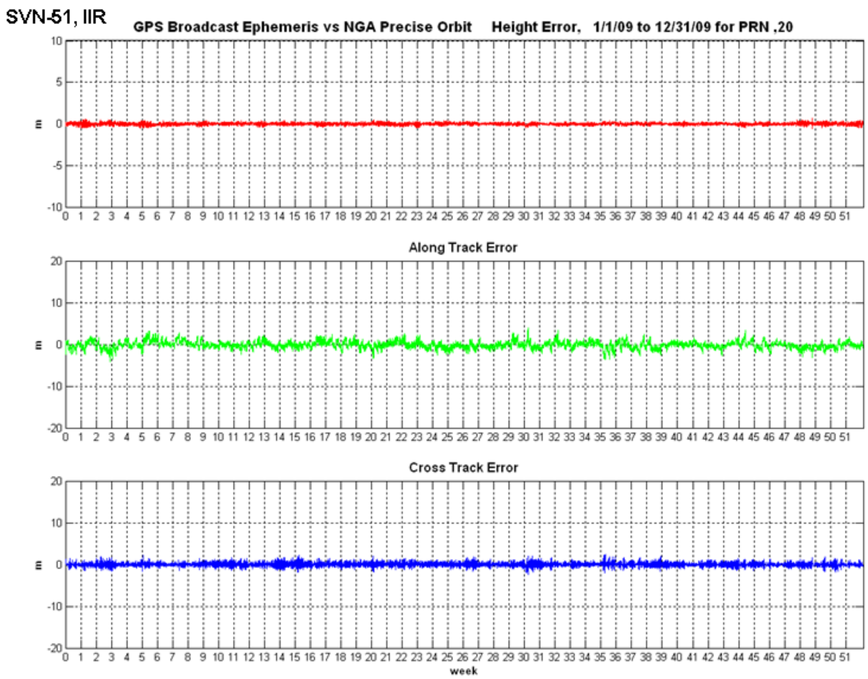


Figure 13-22 PRN 21 Orbit Error

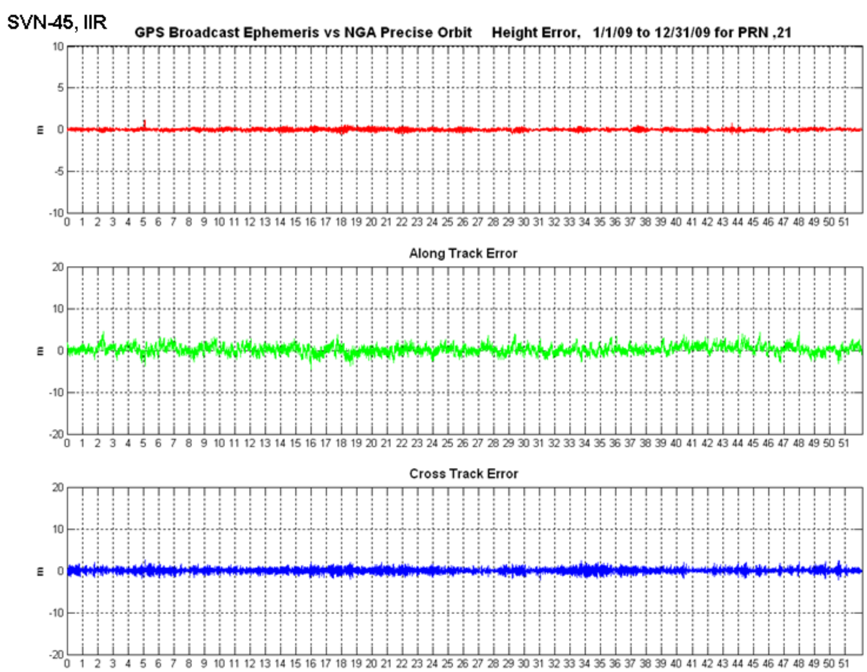


Figure 13-23 PRN 22 Orbit Error

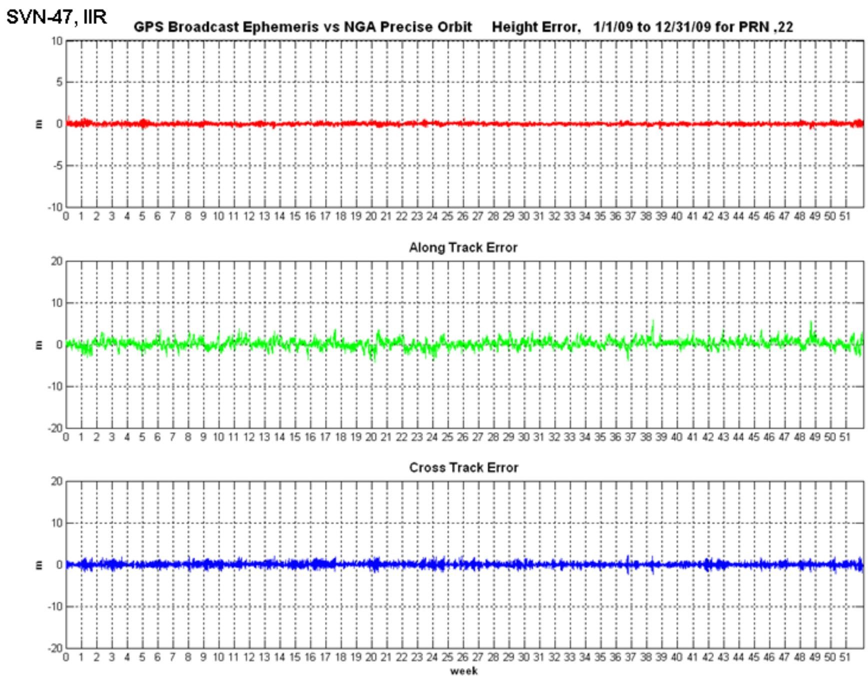


Figure 13-24 PRN 23 Orbit Error

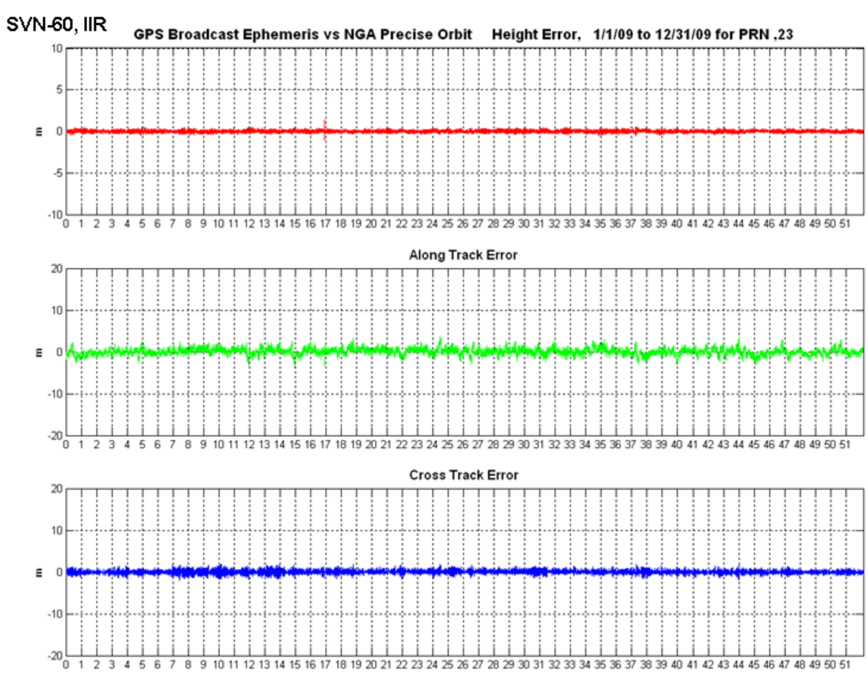


Figure 13-25 PRN 24 Orbit Error

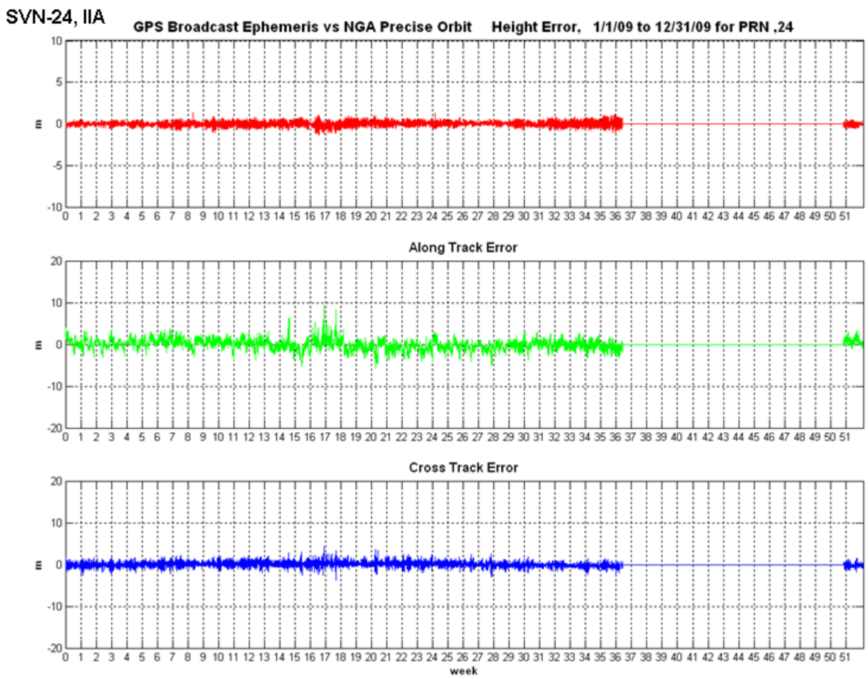


Figure 13-26 PRN 25 Orbit Error

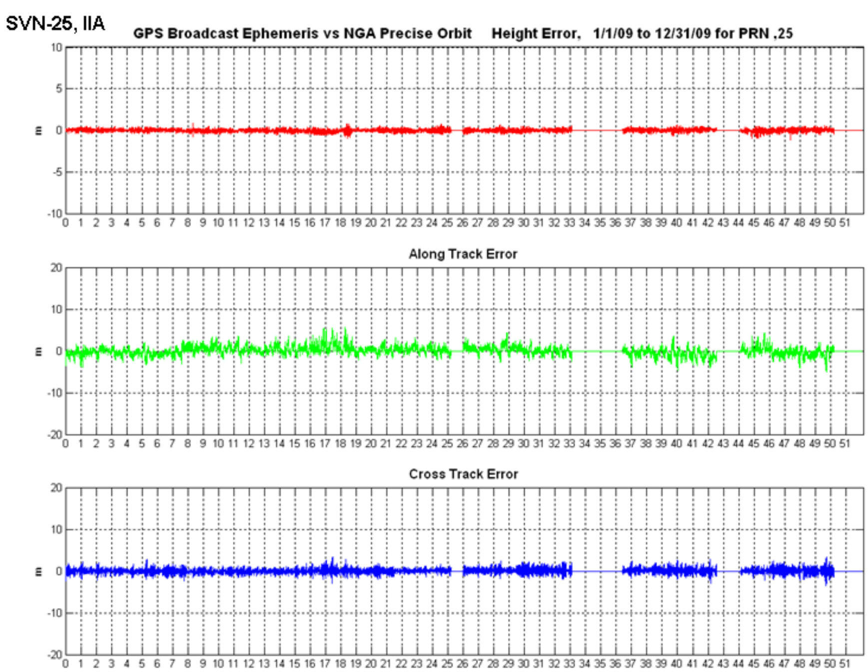


Figure 13-27 PRN 26 Orbit Error

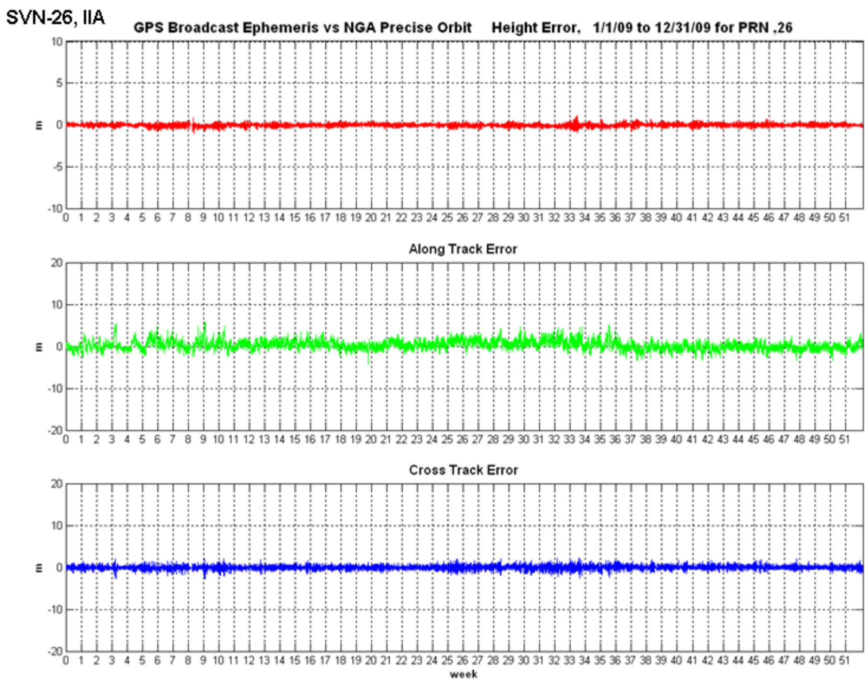


Figure 13-28 PRN 27 Orbit Error

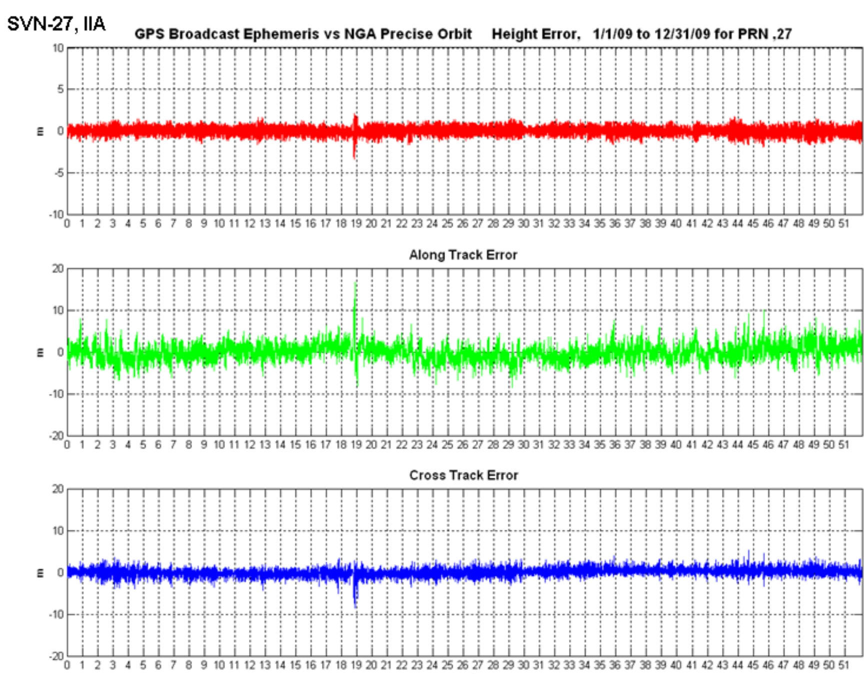


Figure 13-29 PRN 28 Orbit Error

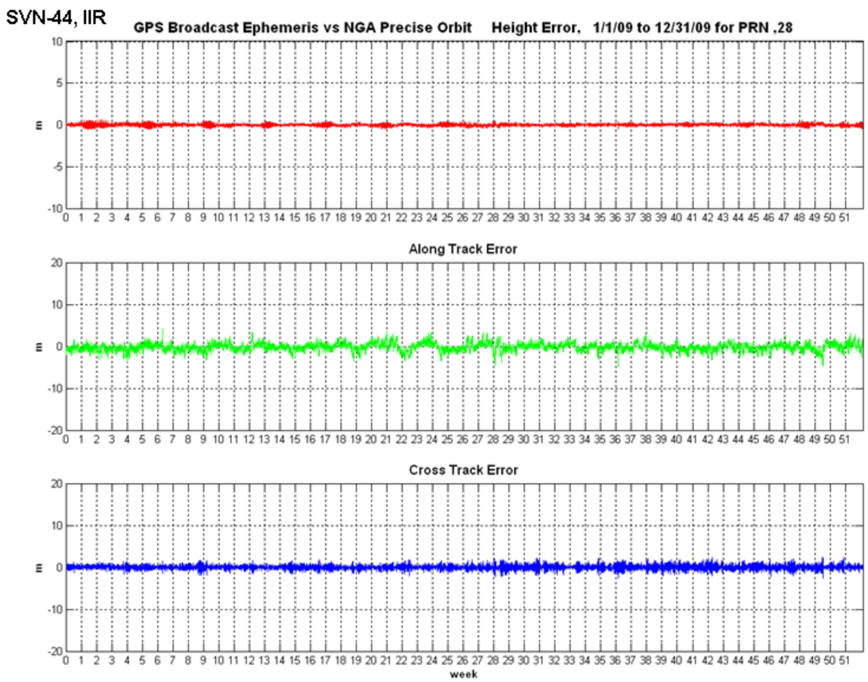


Figure 13-30 PRN 29 Orbit Error

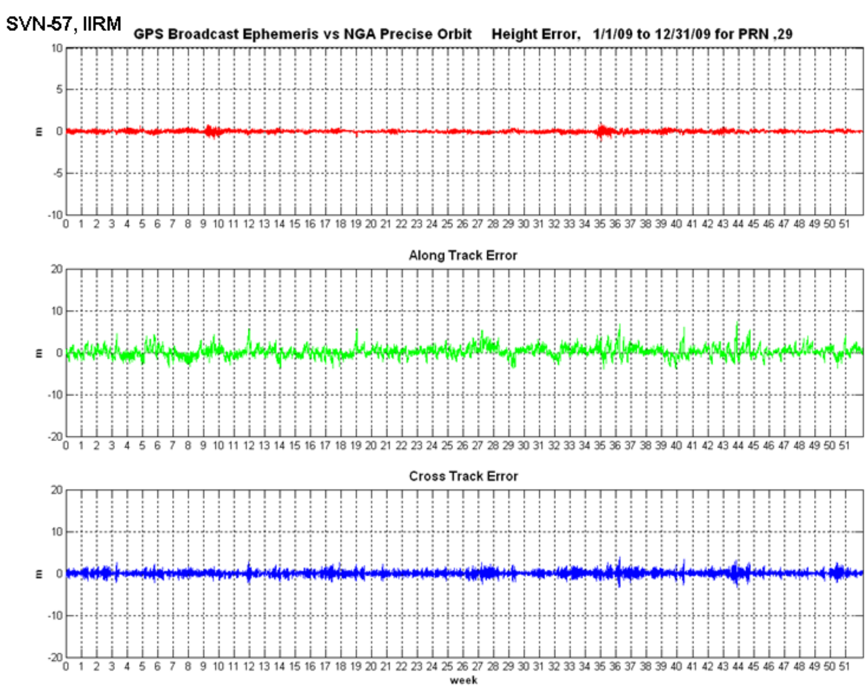


Figure 13-31 PRN 30 Orbit Error

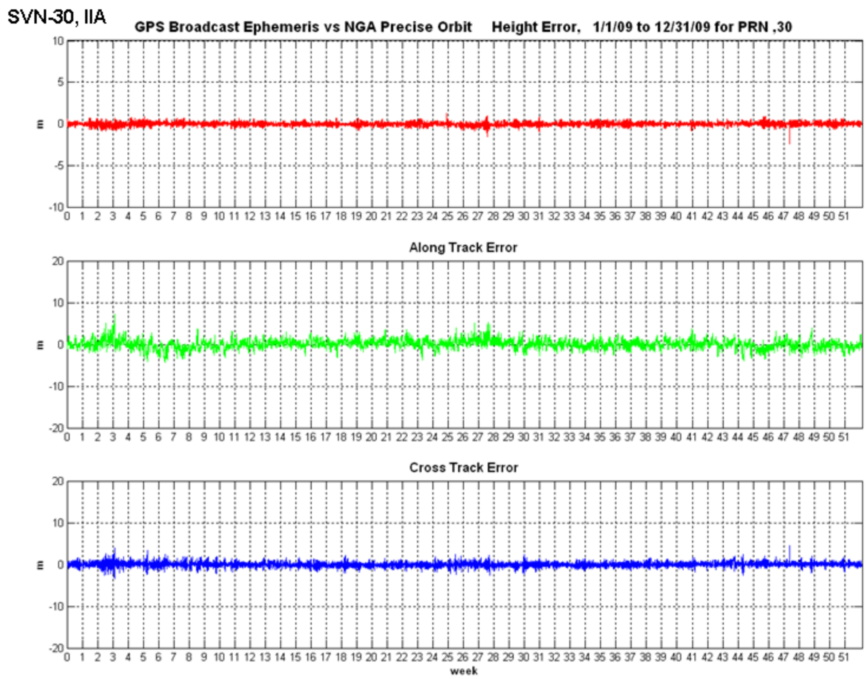


Figure 13-32 PRN 31 Orbit Error

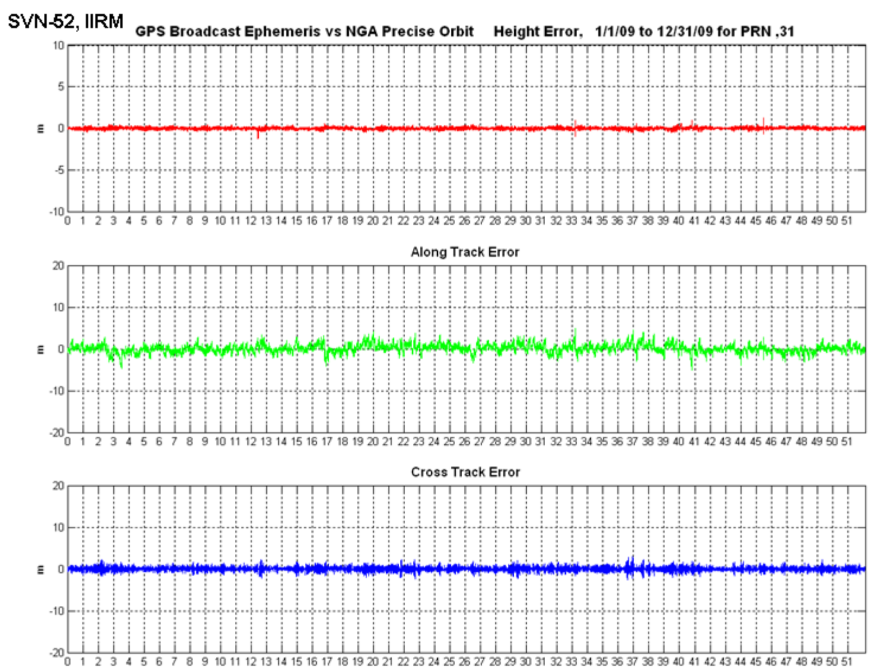
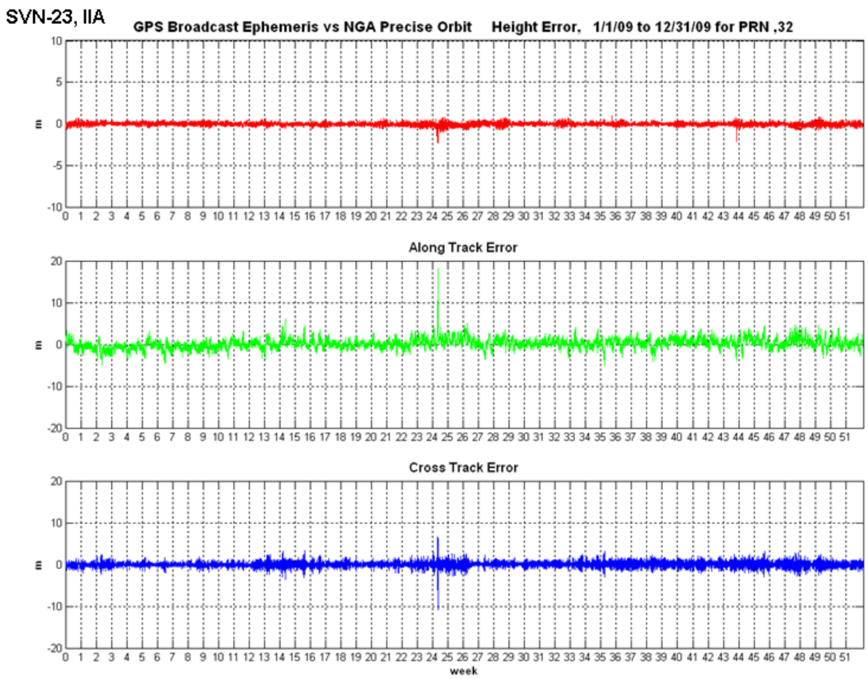


Figure 13-33 PRN 32 Orbit Error



Appendix A: Glossary

General Terms and Definitions

Alert. An alert is an indication provided by the GPS/WAAS equipment to inform the user when the positioning performance achieved by the equipment does not meet the integrity requirements.

Availability. The availability of a navigation system is the ability of the system to provide the required function and performance at the initiation of the intended operation. Availability is an indication of the ability of the system to provide usable service within the specified coverage area.

C&V. The Correction and Verification Subsystem.

CONUS. Continental United States.

Continuity. The continuity of a system is the ability of the total system (comprising all elements necessary to maintain aircraft position within the defined airspace) to perform its function without interruption during the intended operation. More specifically, continuity is the probability that the specified system performance will be maintained for the duration of a phase of operation, presuming that the system was available at the beginning of that phase of operation.

Coverage. The coverage provided by a radio navigation system is that surface area or space volume in which the signals are adequate to permit the user to determine position to a specified level of accuracy. Coverage is influenced by system geometry, signal power levels, receiver sensitivity, atmospheric noise conditions, and other factors that affect signal availability.

Dilution of Precision (DOP). The magnifying effect on GPS position error induced by mapping GPS ranging errors into position through the position solution. The DOP may be represented in any user local coordinate desired. Examples are HDOP for local horizontal, VDOP for local vertical, PDOP for all three coordinates, and TDOP for time.

DR. Discrepancy Report

Fault Detection and Exclusion (FDE). Fault detection and exclusion is a receiver processing scheme that autonomously provides integrity monitoring for the position solution, using redundant range measurements. The FDE consists of two distinct parts: fault detection and fault exclusion. The fault detection part detects the presence of an unacceptably large position error for a given mode of flight. Upon the detection, fault exclusion follows and excludes the source of the unacceptably large position error, thereby allowing navigation to return to normal performance without an interruption in service.

GEO. Geostationary Satellite.

Global Positioning System (GPS). A space-based positioning, velocity, and time system composed of space, control, and user segments. The space segment, when fully operational, will be composed of 24 satellites in six orbital planes. The control segment consists of five monitor stations, three ground antennas, and a master control station. The user segment consists of antennas and receiver-processors that provide positioning, velocity, and precise timing to the user.

Grid Ionospheric Vertical Error (GIVE). GIVEs indicate the accuracy of ionospheric vertical delay correction at a geographically defined ionospheric grid point (IGP). WAAS transmits one GIVE for each IGP in the mask.

Hazardous Misleading Information (HMI). Hazardous misleading information is any position data, that is output, that has an error larger than the current protection level (HPL/VPL), without any indication of the error (e.g., alert message sequence).

Horizontal Alert Limit (HAL). The Horizontal Alert Limit (HAL) is the radius of a circle in the horizontal plane (the local plane tangent to the WGS-84 ellipsoid), with its center being at the true position, which describes the region that is required to contain the indicated horizontal position with a probability of $1\text{-}10^{-7}$ per flight hour, for a particular navigation mode, assuming the probability of a GPS satellite integrity failure being included in the position solution is less than or equal to 10^{-4} per hour.

Horizontal Protection Level (HPL). The Horizontal Protection Level is the radius of a circle in the horizontal plane (the plane tangent to the WGS-84 ellipsoid), with its center being at the true position, which describes the region that is assured to contain the indicated horizontal position. It is based upon the error estimates provided by WAAS.

IGS. International GPS Service.

Ionospheric Grid Point (IGP). IGP is a geographically defined point for which the WAAS provides the vertical ionospheric delay.

LNAV. Lateral Navigation.

LPV. Localizer Precision with Vertical Guidance. LPV is a WAAS operational service level with a HAL equal to 40 meters and a VAL equal to 50 meters.

LPV 200. Localizer Precision with Vertical Guidance to 200 ft decision height. LPV 200 is a WAAS operational service level with a HAL equal to 40 meters and a VAL equal to 35 meters.

MOPS. Minimum Operational Performance Standards.

Navigation Message. Message structure designed to carry navigation data.

Non-Precision Approach (NPA) Navigation Mode. The Non-Precision Approach navigation mode refers to the navigation solution operating with a minimum of four satellites with fast and long term WAAS corrections (no WAAS ionospheric corrections) available.

Position Solution. The use of ranging signal measurements and navigation data from at least four satellites to solve for three position coordinates and a time offset.

Precision Approach (PA) Navigation Mode. The Precision Approach navigation mode refers to the navigation solution operating with a minimum of four satellites with all WAAS corrections (fast, long term, and ionospheric) available.

Selective Availability. Protection technique employed by the DOD to deny full system accuracy to unauthorized users.

Signal Quality Monitor (SQM). SQM monitors correlator measurements to detect signal deformations that originate in the GPS or GEO satellites and ensures that the UDREs are sufficiently inflated to protect given the monitor's current observations.

Standard Positioning Service (SPS). Three-dimensional position and time determination capability provided to a user equipped with a minimum capability GPS SPS receiver in accordance with GPS national policy and the performance specifications.

SV. Space Vehicle.

User Differential Range Error (UDRE). UDRE's indicate the accuracy of combined fast and slow error corrections. WAAS transmits one UDRE for each satellite in the mask.

Vertical Alert Limit (VAL). The Vertical Alert Limit is half the length of a segment on the vertical axis (perpendicular to the horizontal plane of WGS-84 ellipsoid), with its center being at the true position, which describes the region that is required to contain the indicated vertical position with a probability of $1\text{-}10^{-7}$ per flight hour, for a particular navigation mode, assuming the probability of a GPS satellite integrity failure being included in the position solution is less than or equal to 10^{-4} per hour.

Vertical Protection Level (VPL). The Vertical Protection Level is half the length of a segment on the vertical axis (perpendicular to the horizontal plane of WGS-84 ellipsoid), with its center being at the true position, which describes the region that is assured to contain the indicated vertical position. It is based upon the error estimates provided by WAAS.

VNAV. Vertical Navigation.

Wide Area Augmentation System (WAAS). The WAAS is made up of an integrity reference monitoring network, processing facilities, geostationary satellites, and control facilities. Wide area reference stations and integrity monitors are widely dispersed data collection sites that contain GPS/WAAS ranging receivers that monitor all signals from the GPS, as well as the WAAS geostationary satellites. The reference stations collect measurements from the GPS and WAAS satellites so that differential corrections, ionospheric delay information, GPS/WAAS accuracy, WAAS network time, GPS time, and UTC can be determined. The wide area reference station and integrity monitor data are forwarded to the central data processing sites. These sites process the data in order to determine differential corrections, ionospheric delay information, and GPS/WAAS accuracy, as well as verify residual error bounds for each monitored satellite. The central data processing sites also generate navigation messages for the geostationary satellites and WAAS messages. This information is modulated on the GPS-like signal and broadcast to the users from geostationary satellites.

Appendix B: Additional Coverage Plots

This section includes coverage plots with 99% LPV 200 availability contour and 98% LPV availability contours for the quarter. Figure B-1 shows CONUS coverage with 98% LPV availability contour. Figure B-2 shows Alaska coverage with 98% LPV availability contour. Figure B-3 shows CONUS coverage with 99% LPV 200 availability contour. Figure B-4 shows Alaska coverage with 99% LPV 200 availability contour.

Figure B-1 98% CONUS LPV Availability Contour for the Quarter

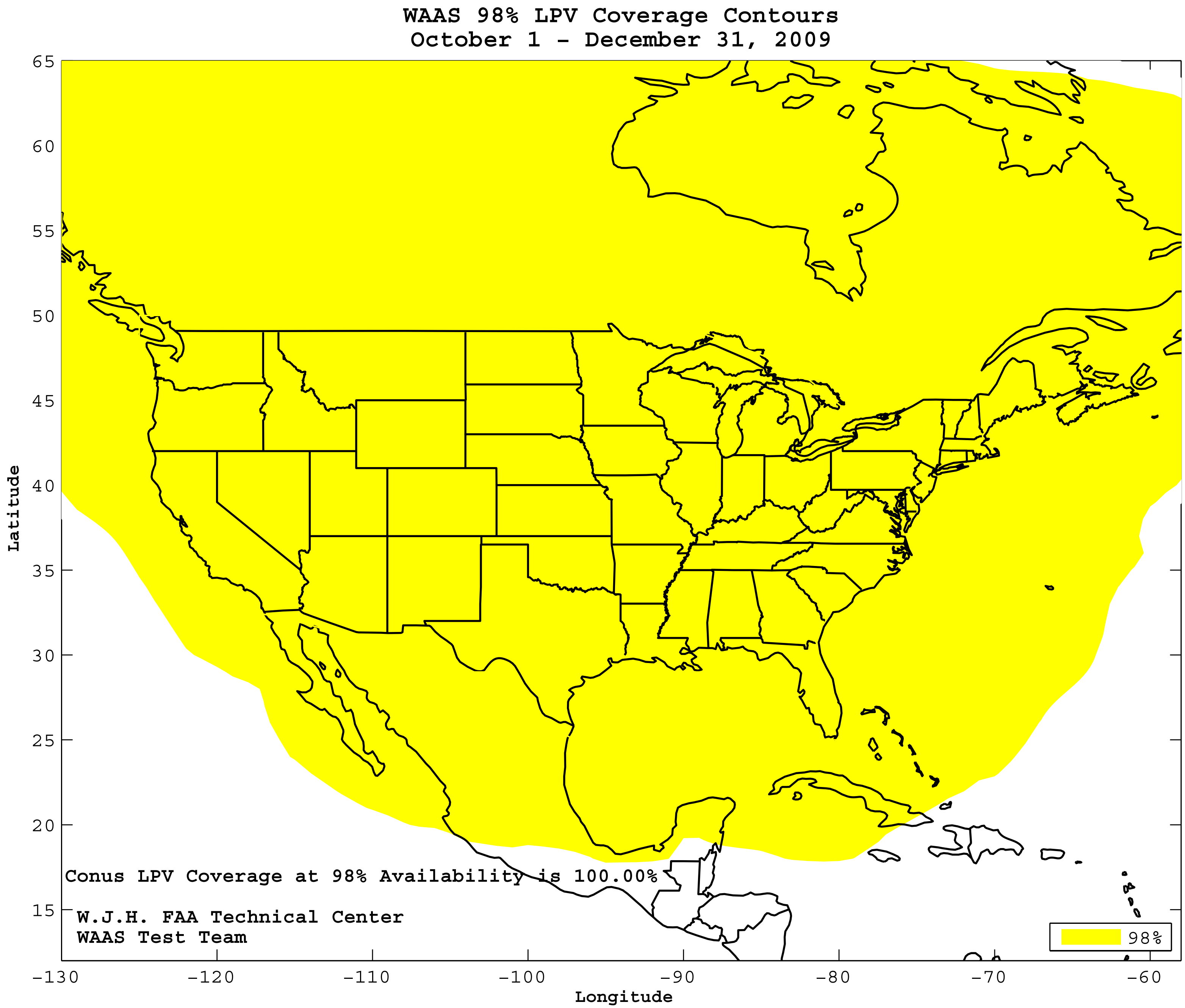


Figure B-2 98% Alaska LPV Availability Contour for the Quarter

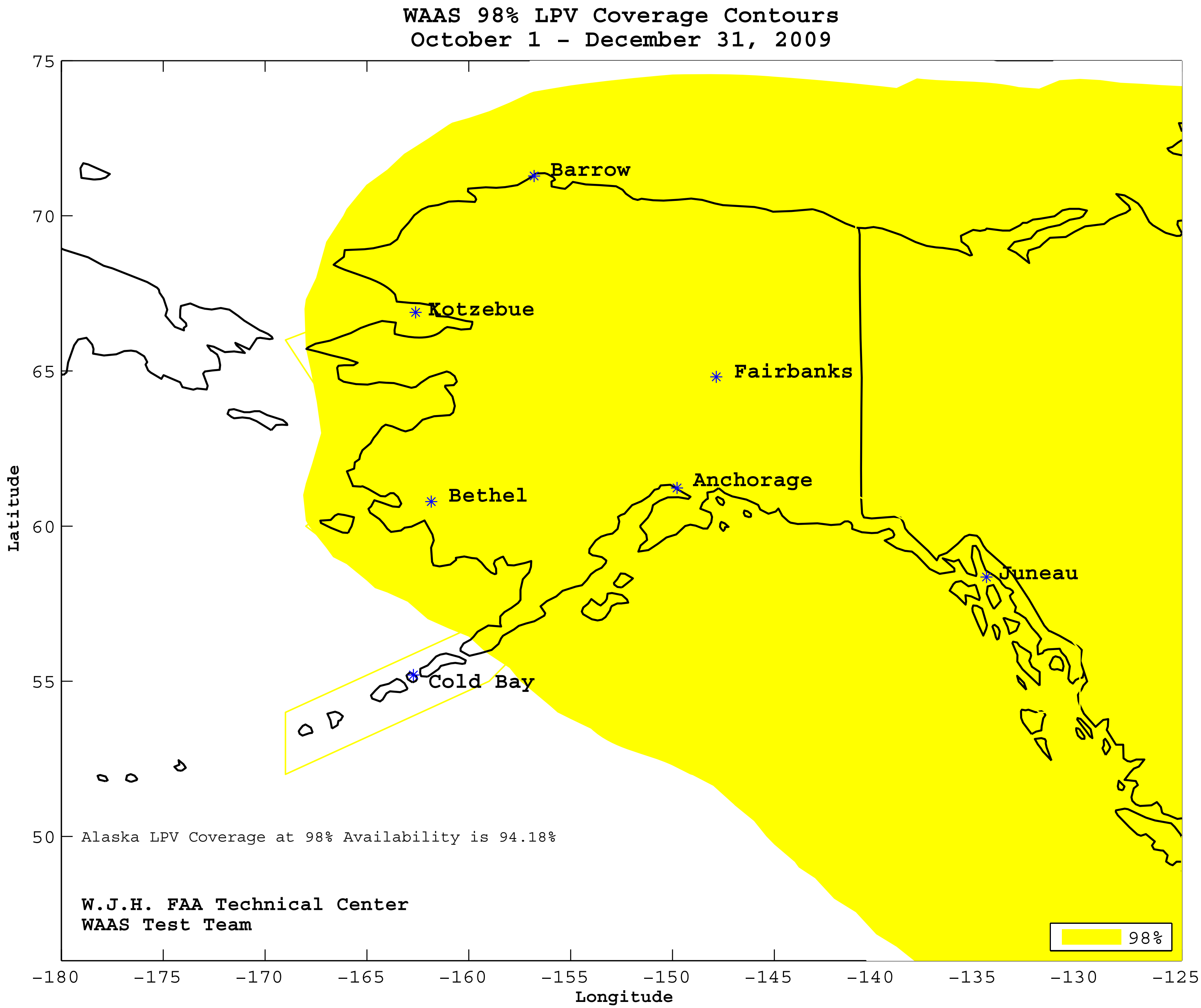


Figure B-3 99% CONUS LPV 200 Availability Contour for the Quarter

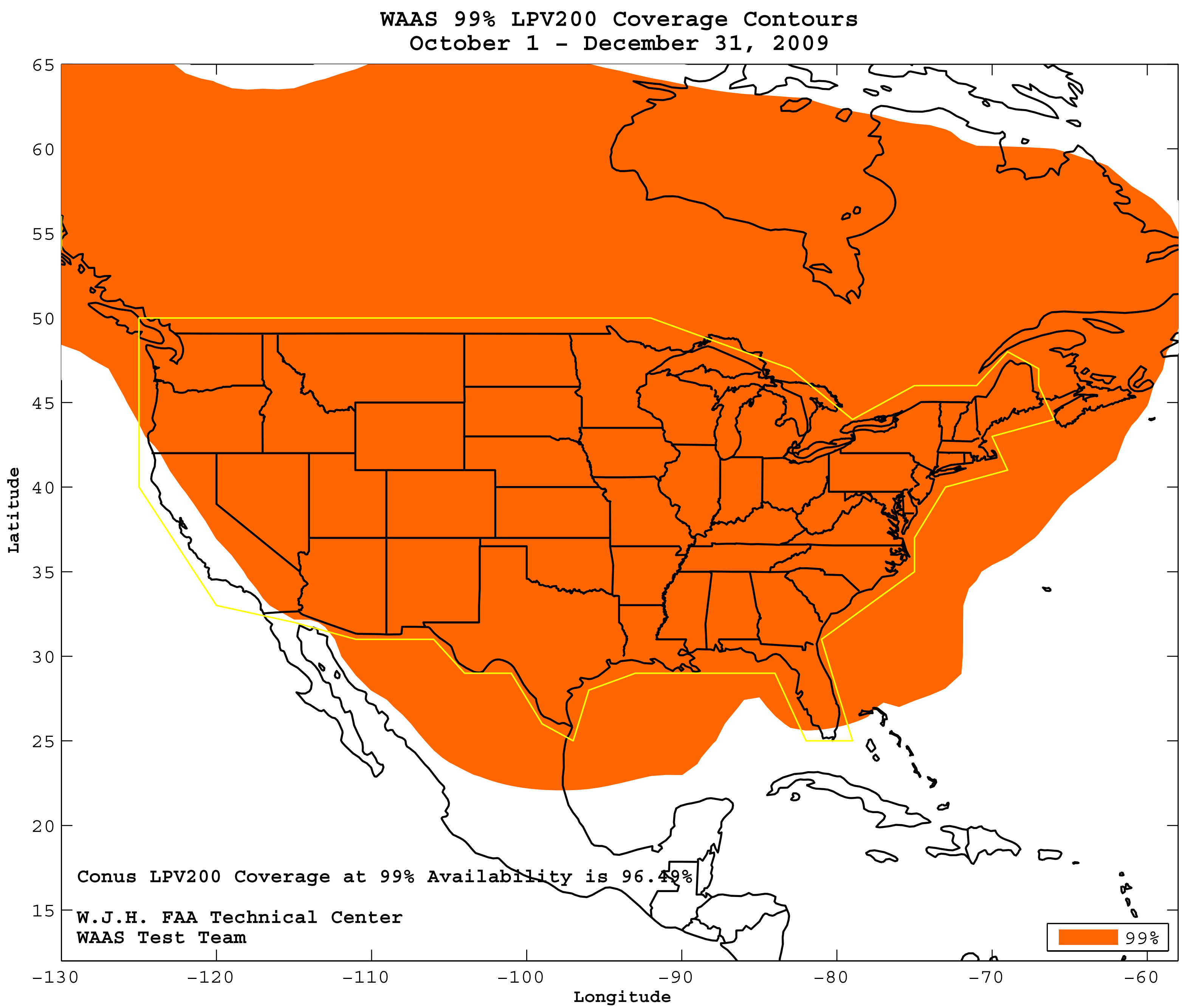


Figure B-4 99% Alaska LPV 200 Availability Contour for the Quarter