

Balancing Authority ACE Limit Proof-of-Concept Field Trial Project 2010-14

WECC Update Discussion
June 27, 2011

DISCUSSION STARTING AT 3:30 PM EDT

Bob Klueber- Midwest ISO

Balancing Authority Reliability-based Control Standard Drafting Team
(BARCSDT)

Balancing Authority ACE Limit Proof-of-Concept Field Trial

Western Interconnection Field Trial Participation

Western Interconnection Balancing Authority Participants	2010 Frequency Bias	WECC Region	Reliability Coordinator	Start Date
Alberta Electric System Operator (AESO)	-125	NWPP	WECC	3/1/2010
Arizona Public Service Company (AZPS)	-74.5	AZNMSNV	WECC	3/1/2010
Bonneville Power Administration (BPAT)	-157.3	NWPP	WECC	3/1/2010
British Columbia Transmission Corporation (BCTC)	-118	NWPP	WECC	4/1/2010
California Independent System Operator (CISO)	-485	CAMX	WECC	3/1/2010
El Paso Electric Company (EPE)	-19	AZNMSNV	WECC	3/1/2010
NaturEner Power Watch, LLC (GWA)	-2.1	NWPP	WECC	3/1/2010
Idaho Power Company (IPCO)	-40	NWPP	WECC	3/1/2010
Los Angeles Department of Water and Power (LDWP)	-62.3	CAMX	WECC	3/1/2010
Nevada Power Company (NEVP)	-62.29	AZNMSNV	WECC	3/1/2010
PacifiCorp East (PACE)	-77	NWPP	WECC	3/1/2010
PacifiCorp West (PACW)	-45	NWPP	WECC	3/1/2010
Portland General Electric (PGE)	-50	NWPP	WECC	4/1/2010
Public Service Company of Colorado (PSCO)	-80	RMPA	WECC	3/1/2010
Public Utility District No. 1 of Chelan County (CHPD)	-12	NWPP	WECC	3/1/2010
Public Utility District No. 1 of Douglas County (DOPD)	-7	NWPP	WECC	4/1/2010
Public Utility District No. 2 of Grant County (GCPD)	-25	NWPP	WECC	3/1/2010
Seattle City Light (SCL)	-40	NWPP	WECC	3/1/2010
Sacramento Municipal Utility District (SMUD)	-45.18	NWPP	WECC	3/1/2010
Salt River Project (SRP)	-65.2	AZNMSNV	WECC	5/1/2010
Sierra Pacific Power Company (SPPC)	-20.04	NWPP	WECC	3/1/2010
Tucson Electric Power (TEPC)	-30.4	AZNMSNV	WECC	3/1/2010
Turlock Irrigation District (TIDC)	-6.7	NWPP	WECC	3/1/2010
Western Area Power Administration- Rocky Mountain Region (WACM)	-55	RMPA	WECC	3/1/2010
Western Area Power Administration- Desert Southwest Region (WALC)	-54.8	AZNMSNV	WECC	3/1/2010

Clock-Minute Frequency Below 59.932 Hz FTL_{Low} or Above 60.068 Hz FTL_{High}

PrevailingTime	PTimeZone	FreqError	ActualFreq	SchedFreq
5/5/11 12:39	PDT	-0.157	59.843	60
5/5/11 12:40	PDT	-0.1531	59.8469	60
5/5/11 12:41	PDT	-0.1409	59.8591	60
5/5/11 12:42	PDT	-0.1069	59.8931	60
5/5/11 12:43	PDT	-0.0895	59.9105	60
5/5/11 12:44	PDT	-0.0687	59.9313	60
5/5/11 12:45	PDT	-0.0722	59.9278	60
5/31/11 0:58	PDT	-0.0489	59.9311	59.98
5/31/11 1:00	PDT	-0.0533	59.9267	59.98
PrevailingTime	PTimeZone	FreqError	ActualFreq	SchedFreq
5/11/11 5:59	PDT	0.0782	60.0782	60

05/05/11 – Loss of 2371 MW generation in Pacific NW.

05/31/11 – Loss of 580 MW of generation in SW.

05/11/11 – Multiple BA's over-generating in Pacific NW and ISO. Reason unknown.

Balancing Authority ACE Limit Proof-of-Concept Field Trial

The Balancing Authority ACE Limit (BAAL) shall not be exceeded for more than 30 consecutive clock-minutes*

BA_Number	Performance Since Entering the Field Trial				Current Month Statistics					
	BAAL _{Low}	BAAL _{High}	ATL _{Low}	ATL _{High}	BAAL _{Low}	BAAL _{High}	ATL _{Low}	ATL _{High}	BAAL _{Low} or ATL _{Low}	BAAL _{High} or ATL _{High}
	Max_MinCtLow	Max_MinCtHigh	Max_MinCtLow2	Max_MinCtHigh2	Max_MinCtLow	Max_MinCtHigh	Max_MinCtLow2	Max_MinCtHigh2	Max_LowLimitCt	Max_HighLimitCt
BA05	44	42	58	49	36	24	0	0	36	24
BA06	16	15	13	15	7	14	0	0	7	14
BA07	25	36	29	41	23	25	0	0	23	25
BA08	35	41	19	34	35	17	0	0	35	17
BA09	11	9	15	55	1	1	0	0	1	1
BA11	10	14	16	7	9	7	0	0	9	7
BA12	14	13	14	17	5	4	0	0	5	4
BA13	7	27	12	45	6	18	0	0	6	18
BA14	23	31	13	55	5	22	0	0	5	22
BA15	5	7	7	5	4	0	0	0	4	0
BA16	14	20	25	34	5	14	0	0	5	14
BA18	10	13	25	15	5	1	0	0	5	1
BA19	24	34	30	34	24	34	0	0	24	34
BA22	7	10	15	14	6	8	0	0	6	8
BA23	20	18	13	27	10	7	0	0	10	7
BA25	15	22	21	14	9	8	0	0	9	8
BA26	19	23	43	41	17	23	0	0	17	23
BA27	23	22	16	15	4	0	0	0	4	0
BA28	22	24	38	39	7	12	0	0	7	12
BA29	17	10	16	16	6	10	0	0	6	10
BA30	26	18	47	39	26	11	0	0	26	11
BA31	20	23	29	28	18	19	0	0	18	19
BA33	26	19	28	58	9	19	0	0	9	19
BA34	16	17	23	29	13	9	0	0	13	9
BA36	69	33	114	25	19	25	0	0	19	25

MinCtLow = Count of consecutive clock-minutes BAAL_{Low} was exceeded
 MinCtHigh = Count of consecutive clock-minutes BAAL_{High} was exceeded
 MinCtLow2 = Count of consecutive clock-minutes ATL_{Low} was exceeded
 MinCtHigh2 = Count of consecutive clock-minutes ATL_{High} was exceeded

***BAAL being exceeded for more than 30 consecutive clock-minutes would be a violation under the draft BAAL standard.**

Statistics of BAAL being exceeded > 20 consecutive clock-minutes :

Date	Time	TimeZone	ActualFreq	SchedFreq	MinCtLow	MinCtHigh	CPS1	ACPS1	MinCtLow2	MinCtHigh2	LowLimitCt	HighLimitCt
05/02/11	8:25	MDT	59.98620	60	26	0	-1341.7	-1341.7	0	0	26	0
05/10/11	5:51	MDT	59.96460	59.98	26	0	-398.4	-1175.6	0	0	26	0
05/12/11	21:21	MDT	59.97900	60	26	0	-9932.3	-9932.3	0	0	26	0
05/12/11	21:22	MDT	59.97950	60	27	0	-8397.1	-8397.1	0	0	27	0
05/17/11	20:35	MDT	59.96730	60	26	0	-3147.5	-3147.5	0	0	26	0
05/17/11	20:36	MDT	59.96490	60	27	0	-1363.2	-1363.2	0	0	27	0
05/20/11	7:30	MDT	59.98010	59.98	26	0	220.3	-3846.0	0	0	26	0
05/20/11	7:31	MDT	59.99150	59.98	27	0	2527.5	-1520.3	0	0	27	0
05/20/11	8:23	MDT	59.95910	59.98	26	0	-2035.8	-4175.3	0	0	26	0
05/20/11	8:24	MDT	59.96230	59.98	27	0	-1551.4	-3530.5	0	0	27	0
05/20/11	8:25	MDT	59.97010	59.98	28	0	-720.3	-2579.6	0	0	28	0
05/20/11	23:42	MST	60.04285	60	0	26	-4261.6	-4261.6	0	0	0	26
05/20/11	23:43	MST	60.03454	60	0	27	-2978.6	-2978.6	0	0	0	27
05/20/11	23:44	MST	60.03244	60	0	28	-2633.4	-2633.4	0	0	0	28
05/20/11	23:45	MST	60.03497	60	0	29	-2627.7	-2627.7	0	0	0	29
05/20/11	23:46	MST	60.04178	60	0	30	-2954.2	-2954.2	0	0	0	30
05/20/11	23:47	MST	60.04602	60	0	31	-2720.8	-2720.8	0	0	0	31
05/20/11	23:48	MST	60.04868	60	0	32	-2525.1	-2525.1	0	0	0	32
05/20/11	23:49	MST	60.04876	60	0	33	-2354.1	-2354.1	0	0	0	33
05/20/11	23:50	MST	60.04053	60	0	34	-1766.7	-1766.7	0	0	0	34
05/21/11	7:42	MDT	59.96980	59.98	26	0	-668.2	-2370.6	0	0	26	0
05/21/11	7:43	MDT	59.98170	59.98	27	0	345.6	-1367.8	0	0	27	0
05/21/11	7:44	MDT	59.97440	59.98	28	0	-275.5	-1973.6	0	0	28	0
05/24/11	21:50	MDT	59.96920	60	26	0	-5279.4	-5279.4	0	0	26	0
05/24/11	21:51	MDT	59.97230	60	27	0	-5029.2	-5029.2	0	0	27	0
05/24/11	21:52	MDT	59.97840	60	28	0	-3510.0	-3510.0	0	0	28	0
05/24/11	21:53	MDT	59.98340	60	29	0	-2436.0	-2436.0	0	0	29	0
05/24/11	21:54	MDT	59.98040	60	30	0	-3229.6	-3229.6	0	0	30	0
05/24/11	21:55	MDT	59.97650	60	31	0	-3676.8	-3676.8	0	0	31	0
05/24/11	21:56	MDT	59.98550	60	32	0	-1497.6	-1497.6	0	0	32	0
05/24/11	21:57	MDT	59.97900	60	33	0	-2800.9	-2800.9	0	0	33	0
05/24/11	21:58	MDT	59.97930	60	34	0	-1707.0	-1707.0	0	0	34	0
05/24/11	21:59	MDT	59.97610	60	35	0	-2384.8	-2384.8	0	0	35	0
05/24/11	22:00	MDT	59.98000	60	36	0	-990.1	-990.1	0	0	36	0

Statistics of BAAL being exceeded > 20 consecutive clock-minutes :

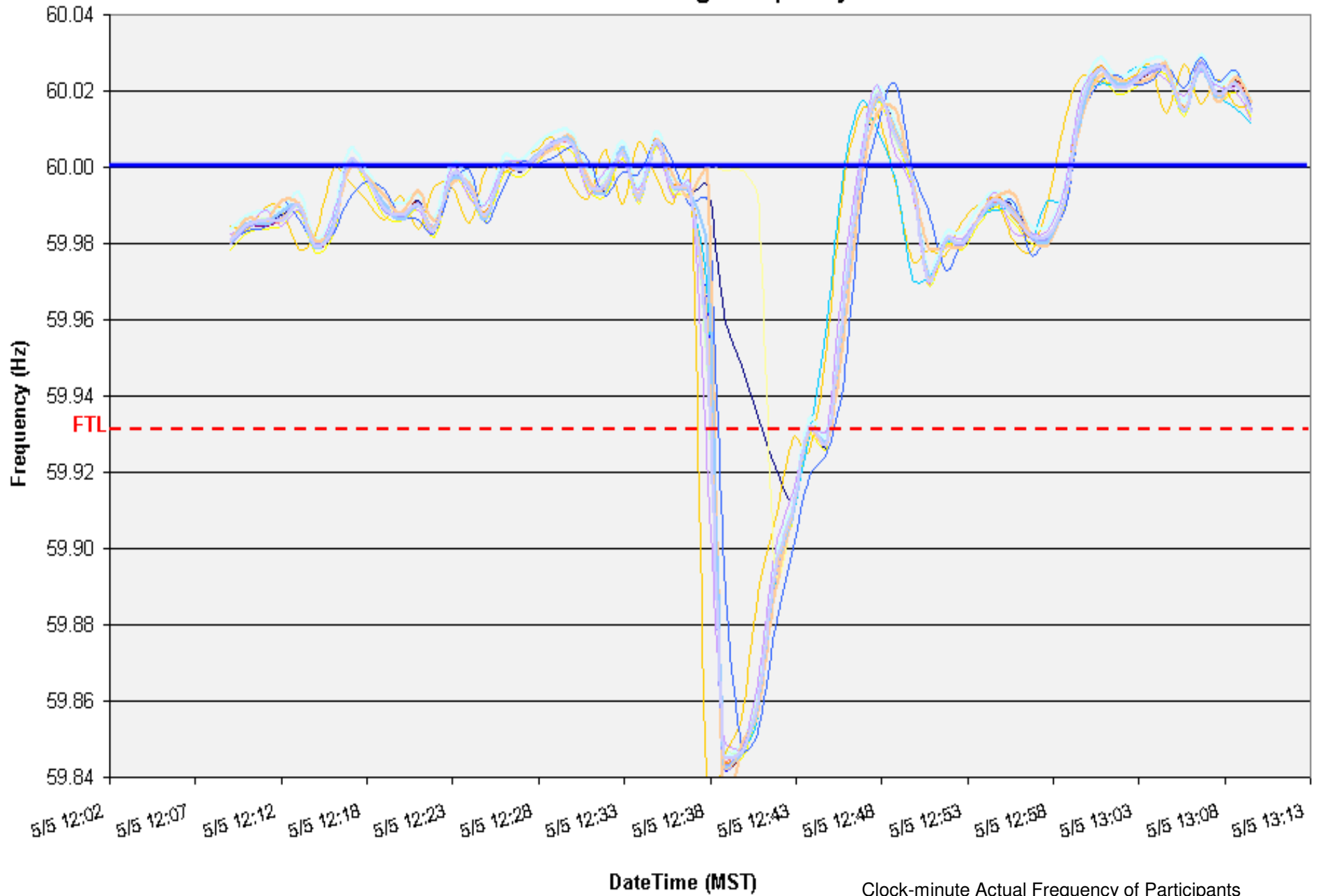
Date	Time	TimeZone	ActualFreq	SchedFreq	MinCtLow	MinCtHigh	CPS1	ACPS1	MinCtLow2	MinCtHigh2	LowLimitCt	HighLimitCt
05/27/11	6:28	PDT	59.95401	59.98	26	0	-805.6	-805.6	0	0	26	0
05/28/11	8:26	MDT	59.96940	59.98	26	0	-335.0	-1344.5	0	0	26	0
05/28/11	8:27	MDT	59.97770	59.98	27	0	73.7	-1024.3	0	0	27	0
05/28/11	9:38	PDT	59.95272	59.98	26	0	-660.3	-1291.1	0	0	26	0
05/28/11	9:39	PDT	59.95850	59.98	27	0	-425.1	-1006.5	0	0	27	0
05/28/11	9:40	PDT	59.95647	59.98	28	0	-584.7	-1251.6	0	0	28	0
05/28/11	9:41	PDT	59.94864	59.98	29	0	-796.4	-1431.9	0	0	29	0
05/28/11	9:42	PDT	59.94939	59.98	30	0	-873.8	-1575.4	0	0	30	0
05/28/11	9:43	PDT	59.95218	59.98	31	0	-745.6	-1425.4	0	0	31	0
05/28/11	9:44	PDT	59.95679	59.98	32	0	-638.5	-1361.1	0	0	32	0
05/28/11	9:45	PDT	59.95935	59.98	33	0	-575.1	-1325.7	0	0	33	0
05/28/11	9:46	PDT	59.95047	59.98	34	0	-758.5	-1407.6	0	0	34	0
05/28/11	9:47	PDT	59.95443	59.98	35	0	-473.3	-999.9	0	0	35	0
05/30/11	18:43	MST	60.01632	60	0	26	-3140.5	-3140.5	0	0	0	26
05/30/11	18:44	MST	60.02285	60	0	27	-4475.1	-4475.1	0	0	0	27
05/30/11	18:45	MST	60.02015	60	0	28	-3980.1	-3980.1	0	0	0	28
05/30/11	18:46	MST	60.01334	60	0	29	-2691.1	-2691.1	0	0	0	29
05/30/11	18:47	MST	60.00717	60	0	30	-1135.3	-1135.3	0	0	0	30
05/30/11	18:48	MST	60.00520	60	0	31	-691.2	-691.2	0	0	0	31
05/30/11	22:48	MST	60.02843	59.98	0	26	-3466.4	-3466.4	0	0	0	26
05/30/11	22:49	MST	60.02733	59.98	0	27	-3430.5	-3430.5	0	0	0	27
05/30/11	22:50	MST	60.02205	59.98	0	28	-2656.7	-2656.7	0	0	0	28

EXAMPLE 1

05/05/11 ending 12:45 PDT

7 minute duration below FTL_{Low}

Clock-Minute Average Frequency

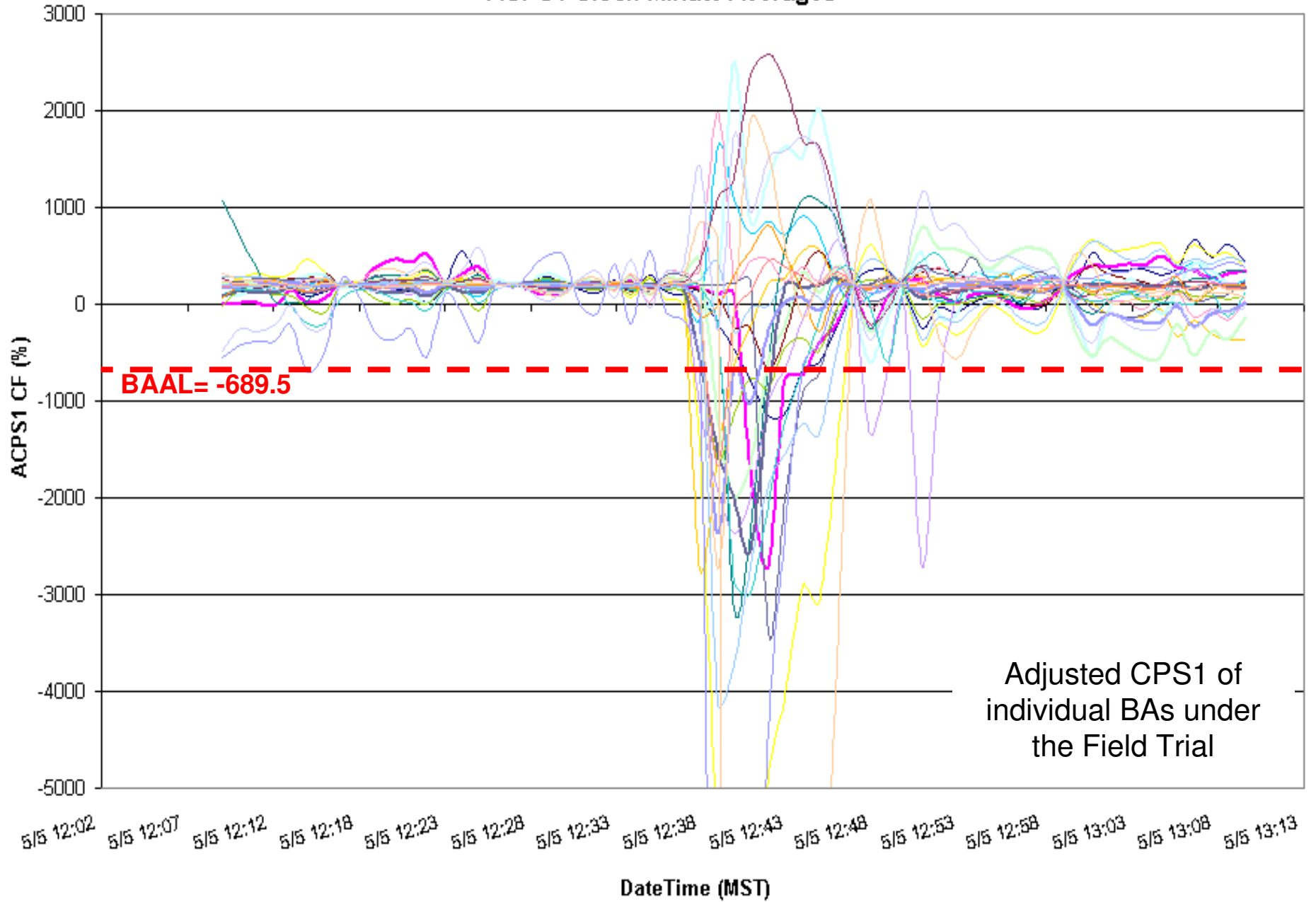


Clock-minute Actual Frequency of Participants

05/05/11 ending 12:45 PDT

7 minute duration below FTL_{Low}

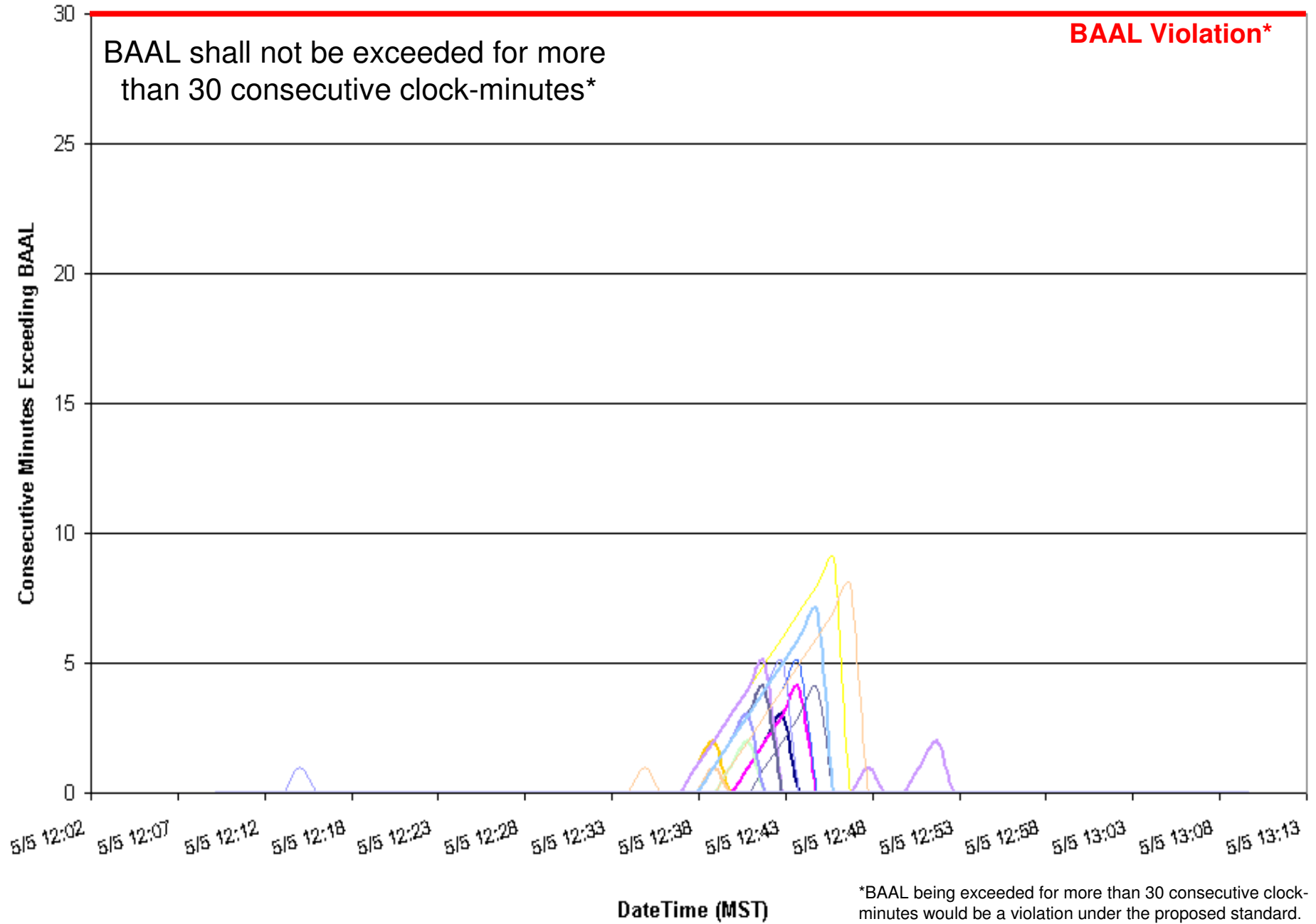
ACPS1 Clock-Minute Averages



05/05/11 ending 12:45 PDT

7 minute duration below FTL_{Low}

Consecutive Minutes Exceeding BAAL



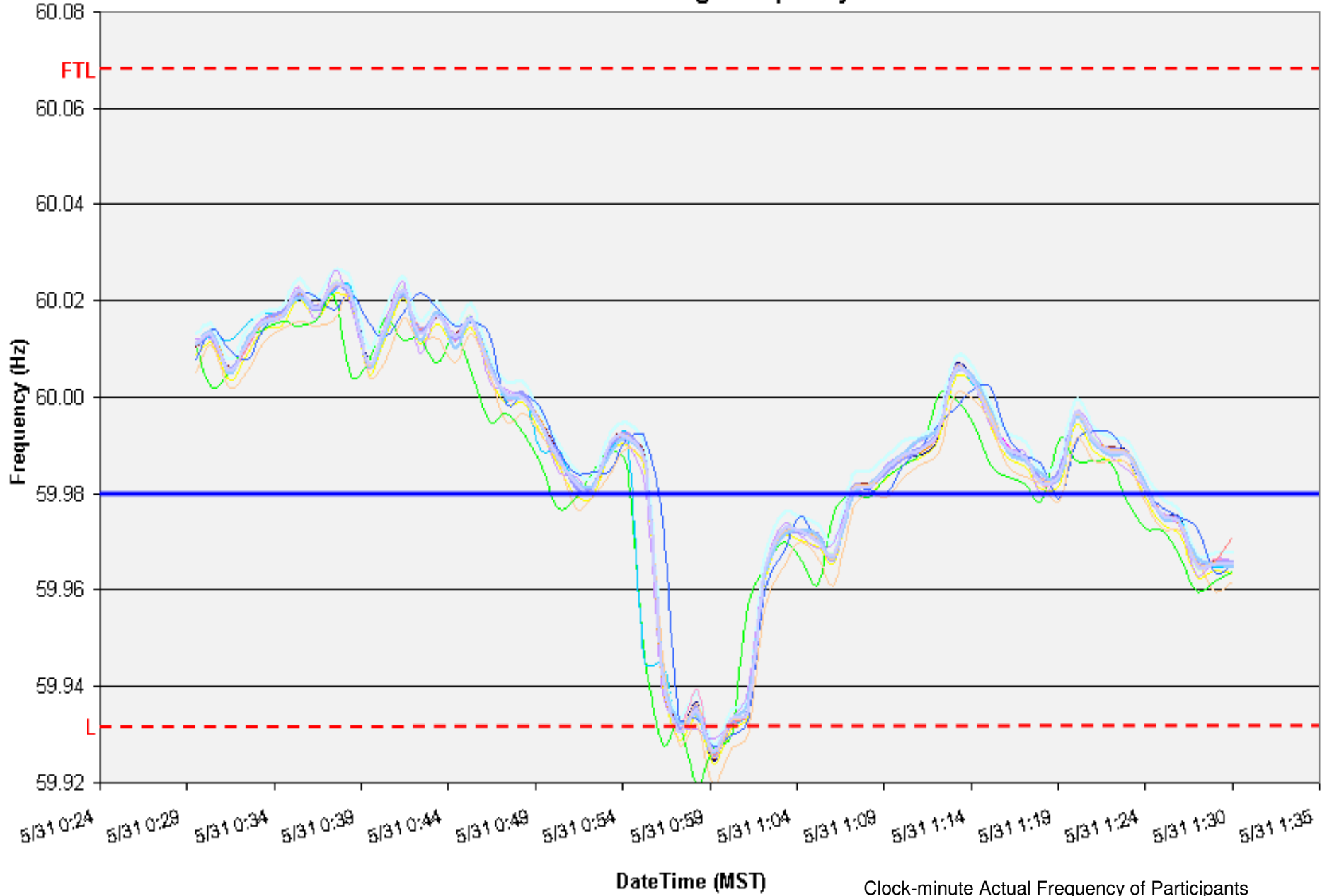
EXAMPLE 2

05/31/11 ending 01:00 PDT

2-1 minute durations below FTL_{Low}

59.98 Scheduled Frequency TEC

Clock-Minute Average Frequency



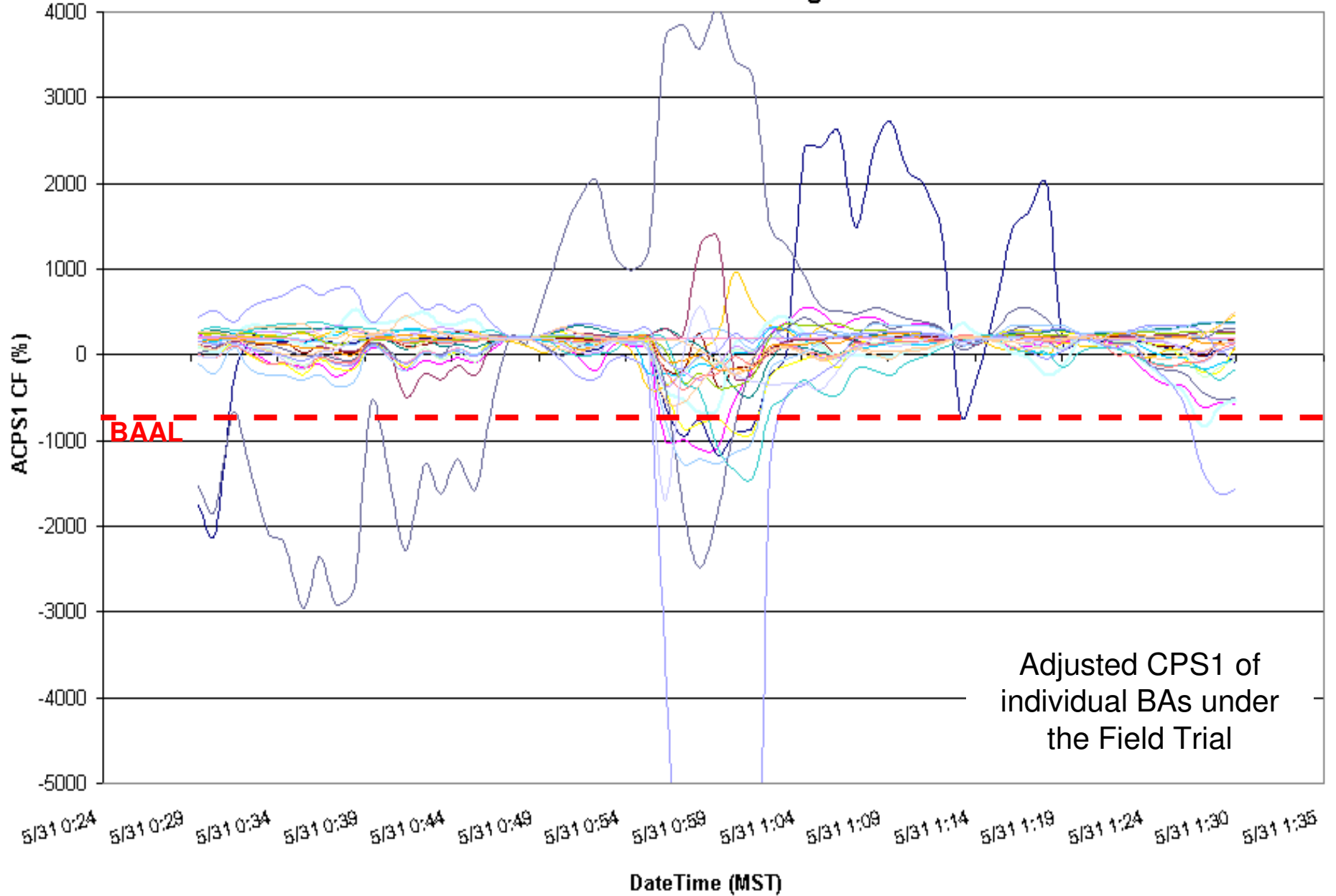
Clock-minute Actual Frequency of Participants

05/31/11 ending 01:00 PDT

2-1 minute durations below FTL_{Low}

59.98 Scheduled Frequency TEC

ACPS1 Clock-Minute Averages

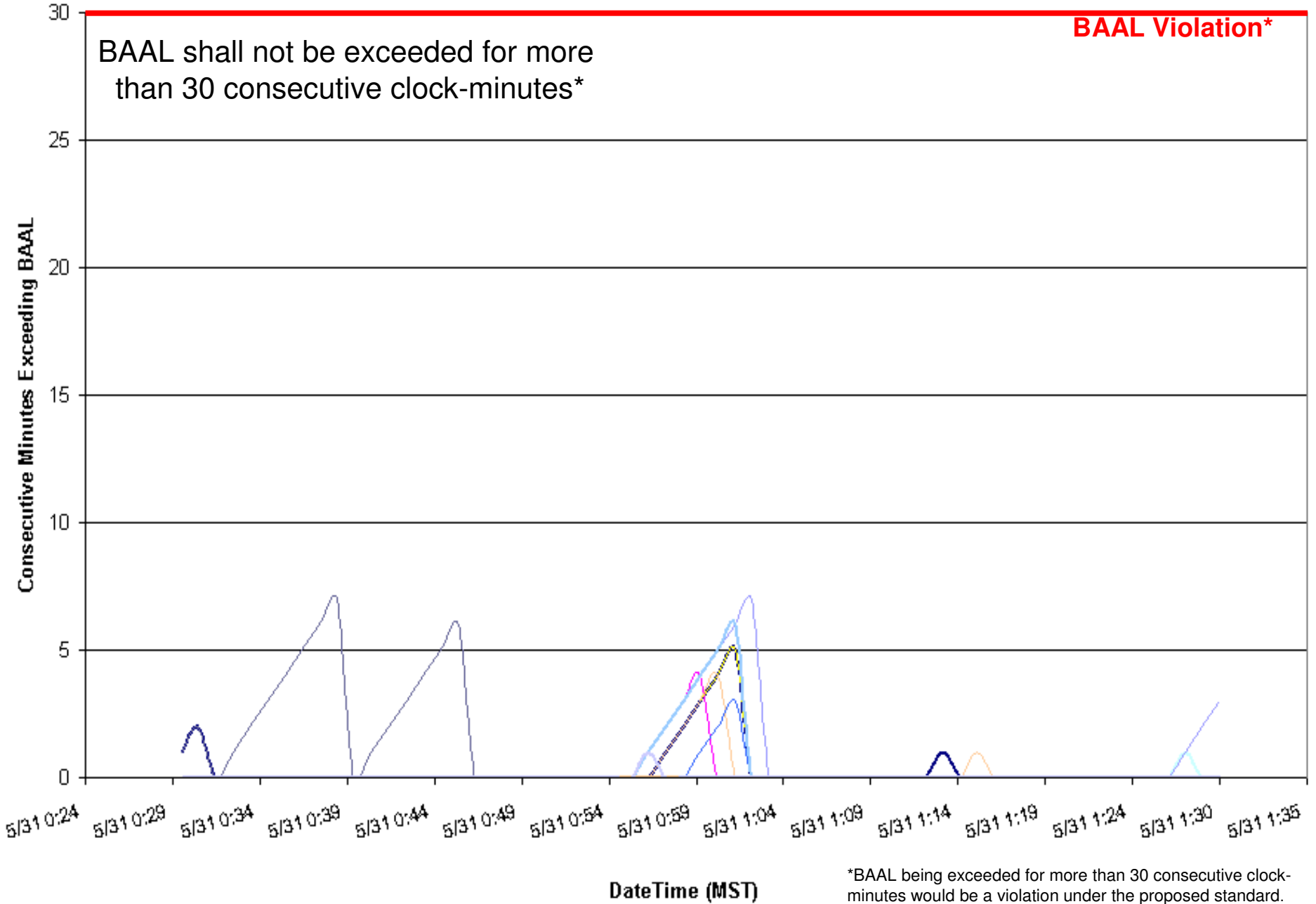


Adjusted CPS1 of individual BAs under the Field Trial

05/31/11 ending 01:00 PDT

2-1 minute durations below FTL_{Low}
59.98 Scheduled Frequency TEC

Consecutive Minutes Exceeding BAAL



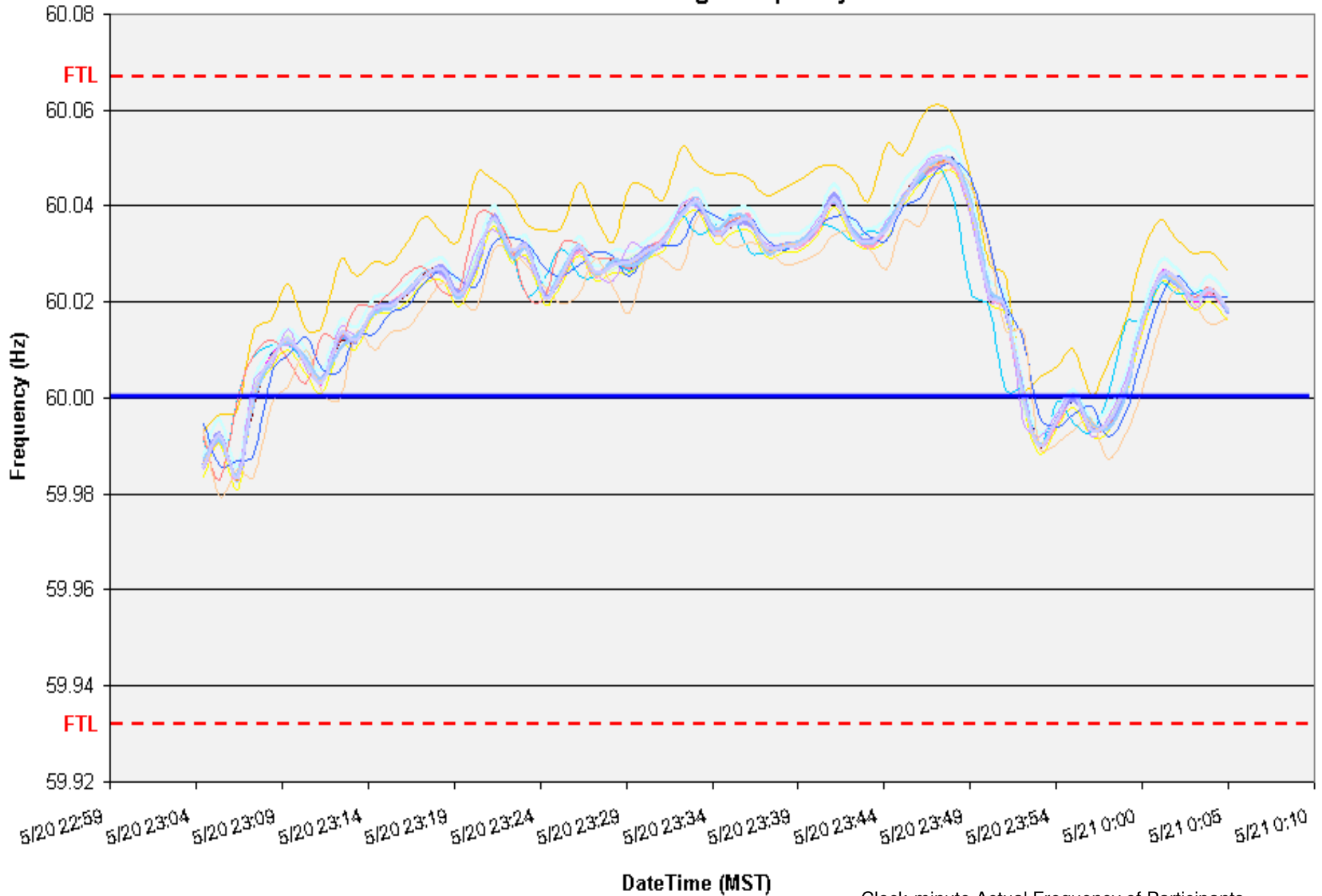
*BAAL being exceeded for more than 30 consecutive clock-minutes would be a violation under the proposed standard.

EXAMPLE 3

05/20/11 ending 23:50 MST

34 minute duration above BAAL_{High}

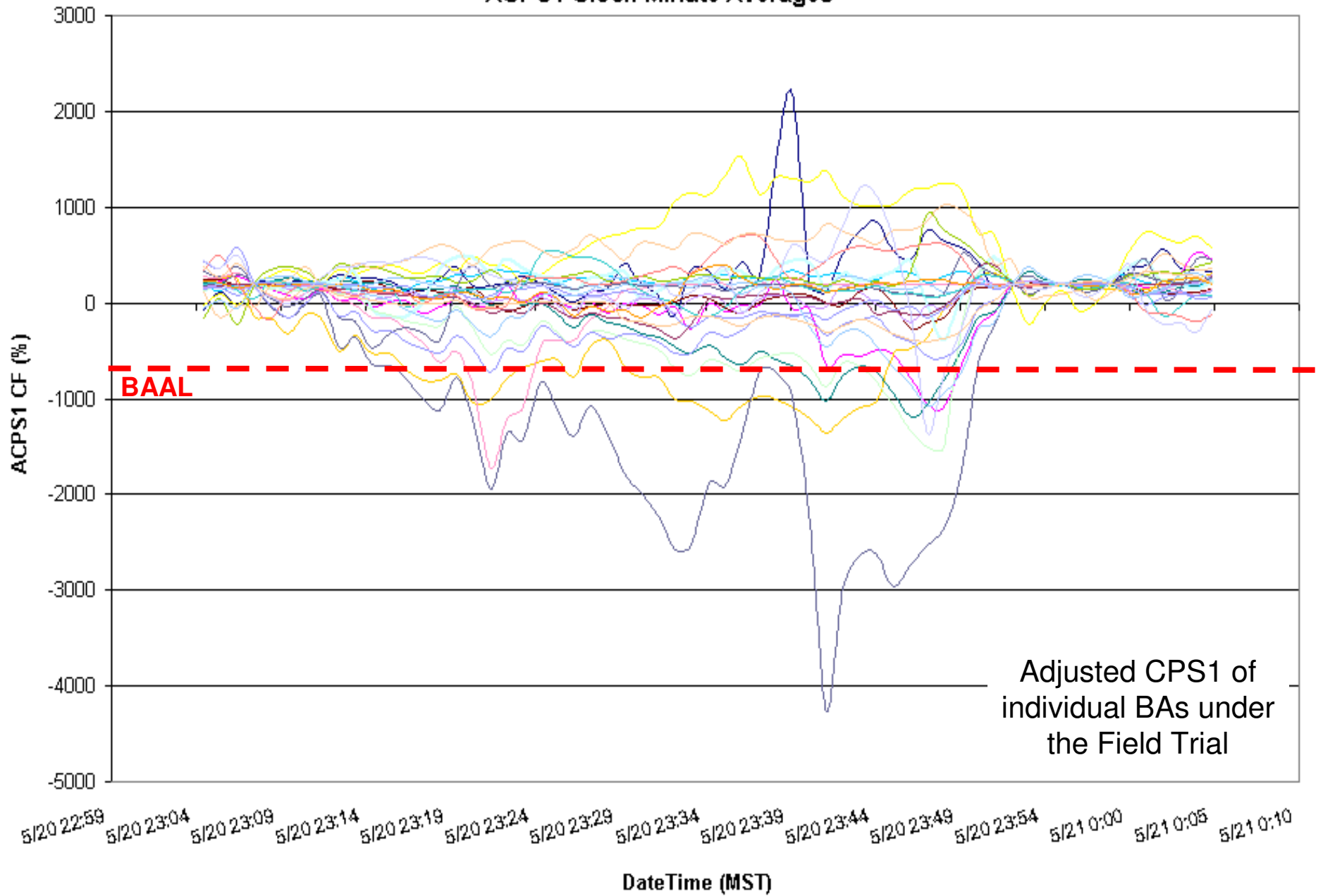
Clock-Minute Average Frequency



Clock-minute Actual Frequency of Participants

05/20/11 ending 23:50 MST
34 minute duration above BAAL_{High}

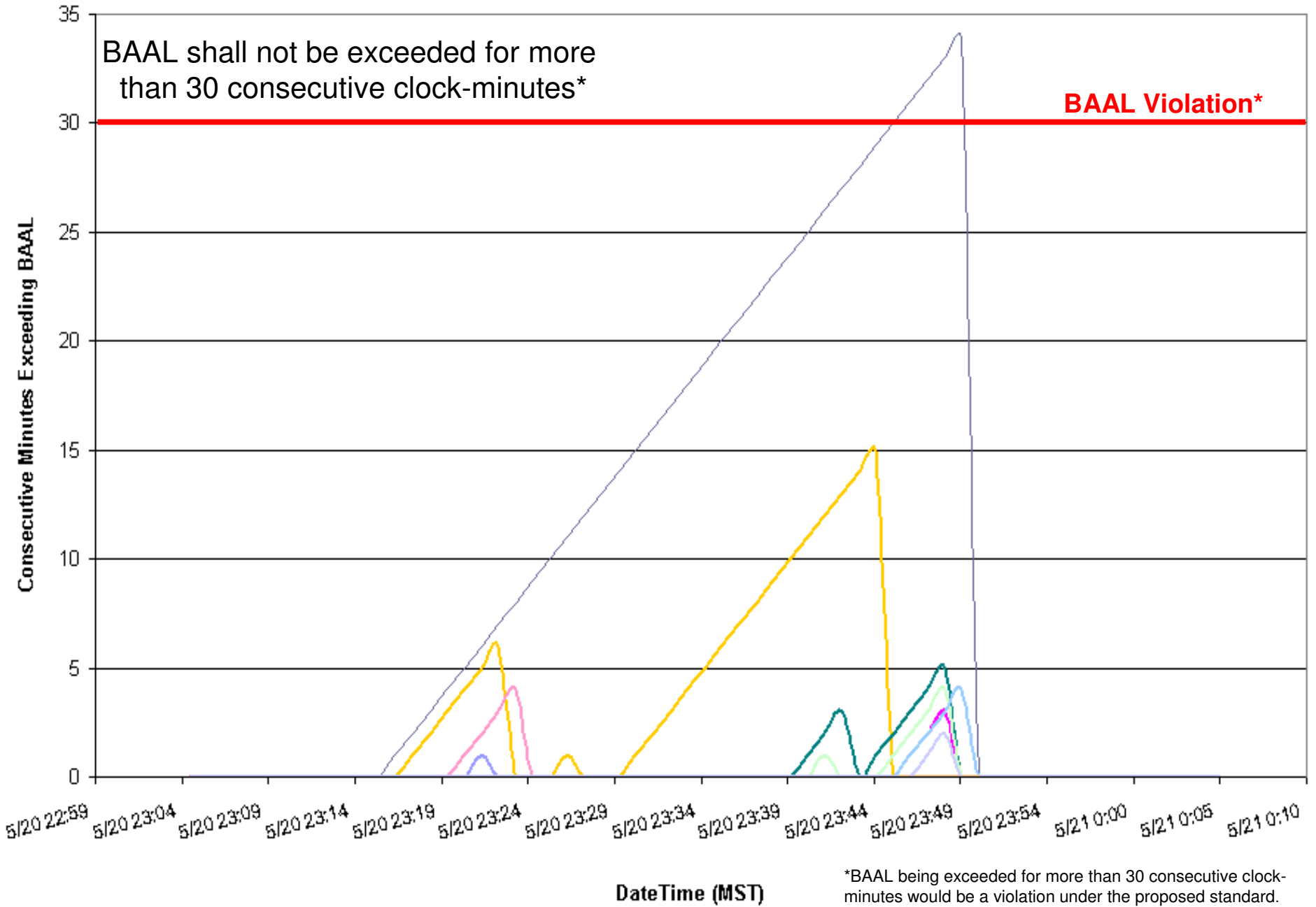
ACPS1 Clock-Minute Averages



05/20/11 ending 23:50 MST

34 minute duration above BAAL_{High}

Consecutive Minutes Exceeding BAAL

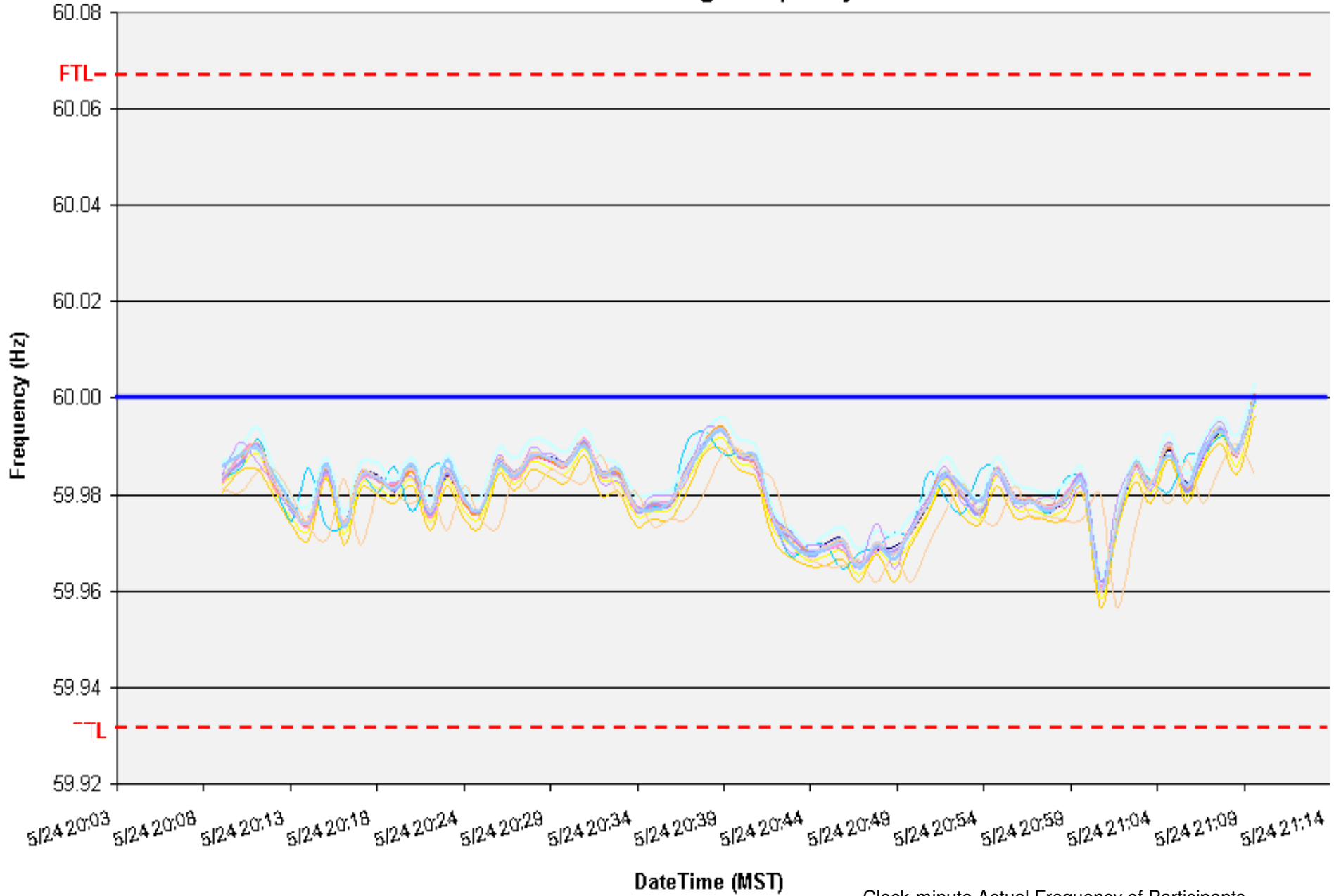


EXAMPLE 4

05/24/11 ending 22:00 MDT

36 minute duration below BAAL_{Low}

Clock-Minute Average Frequency

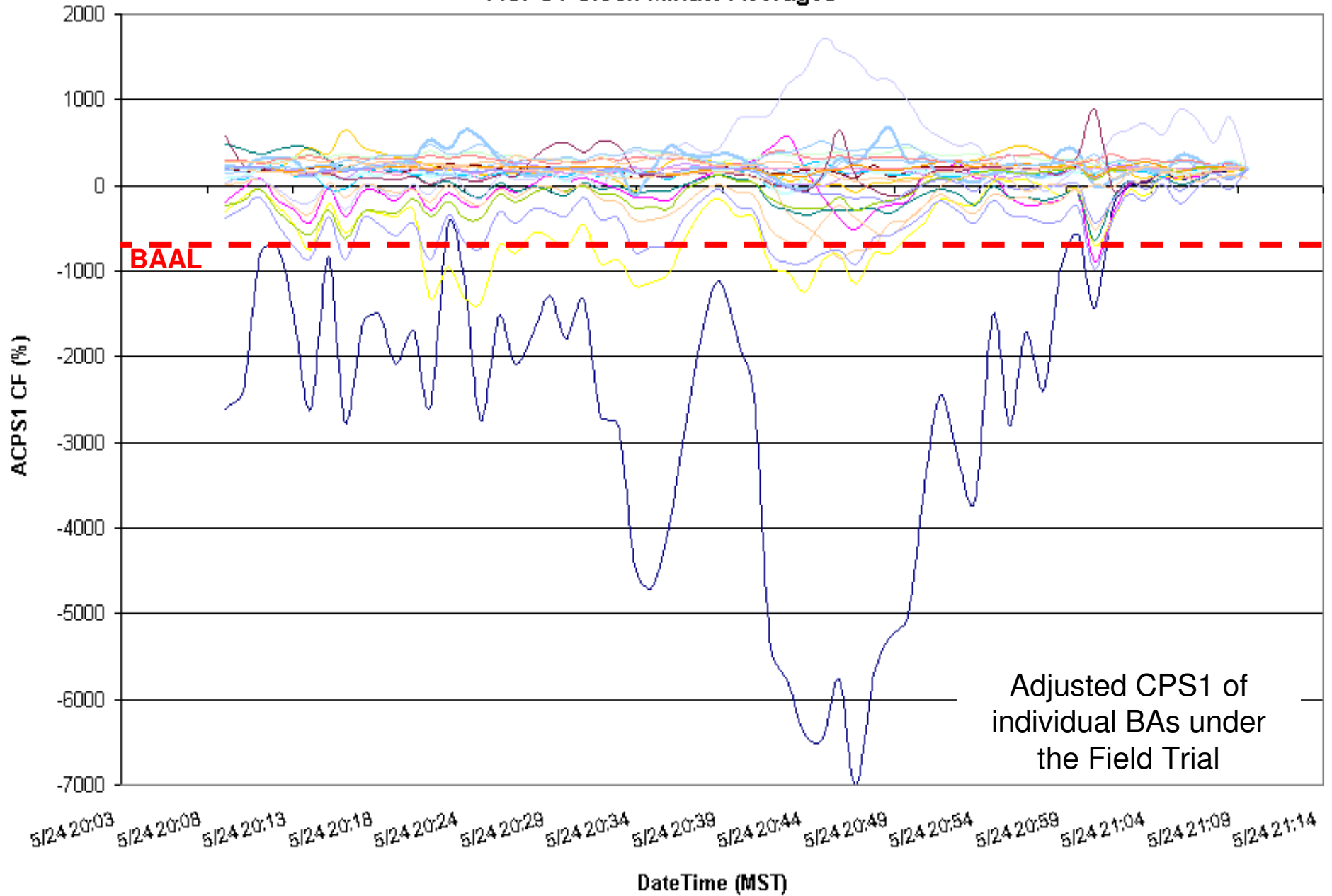


Clock-minute Actual Frequency of Participants

05/24/11 ending 22:00 MDT

36 minute duration below BAAL_{Low}

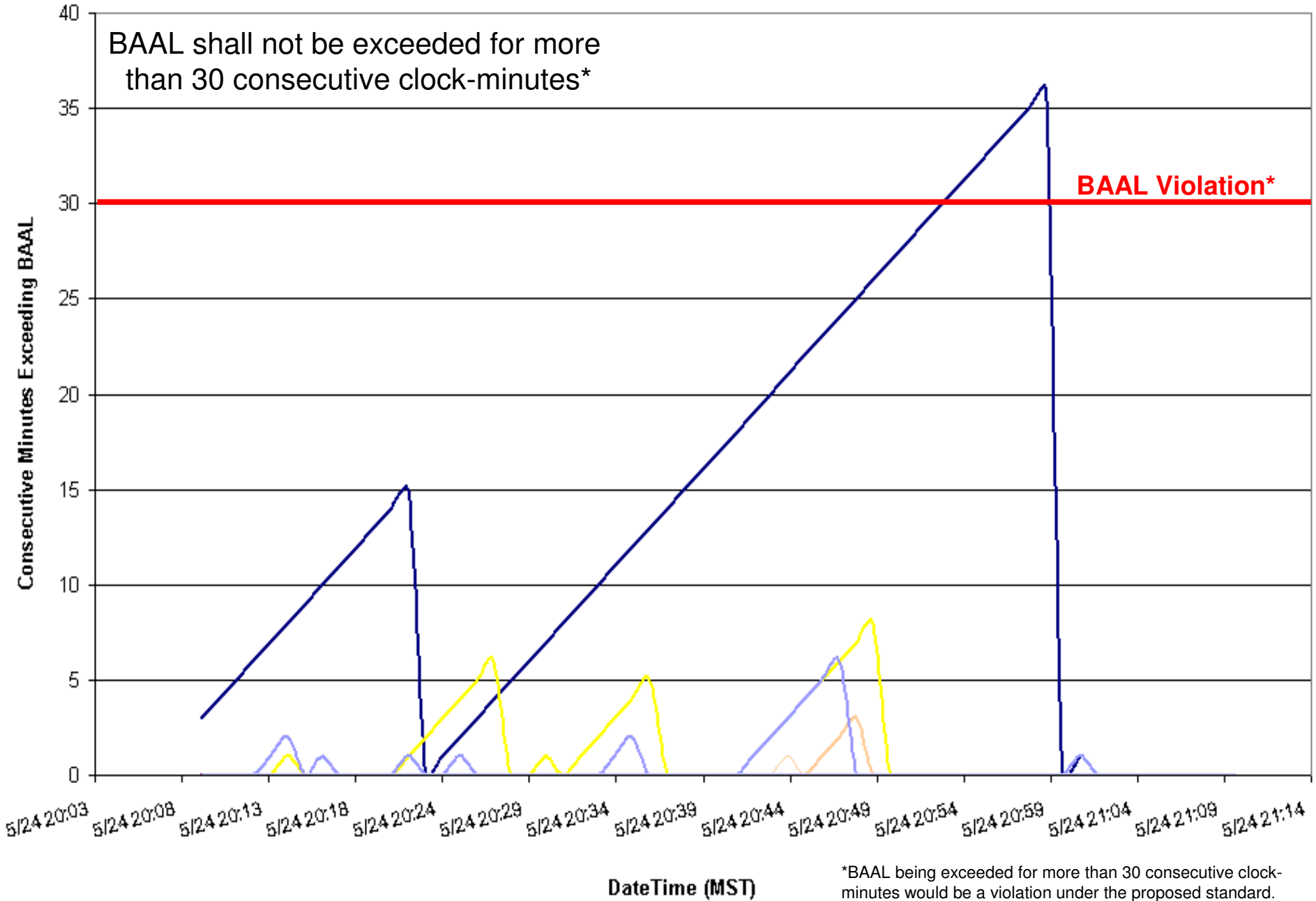
ACPS1 Clock-Minute Averages



05/24/11 ending 22:00 MDT

36 minute duration below BAAL_{Low}

Consecutive Minutes Exceeding BAAL



EXAMPLE 5

05/28/11 ending 09:47 PDT

35 minute duration below BAAL_{Low}

59.98 Scheduled Frequency TEC

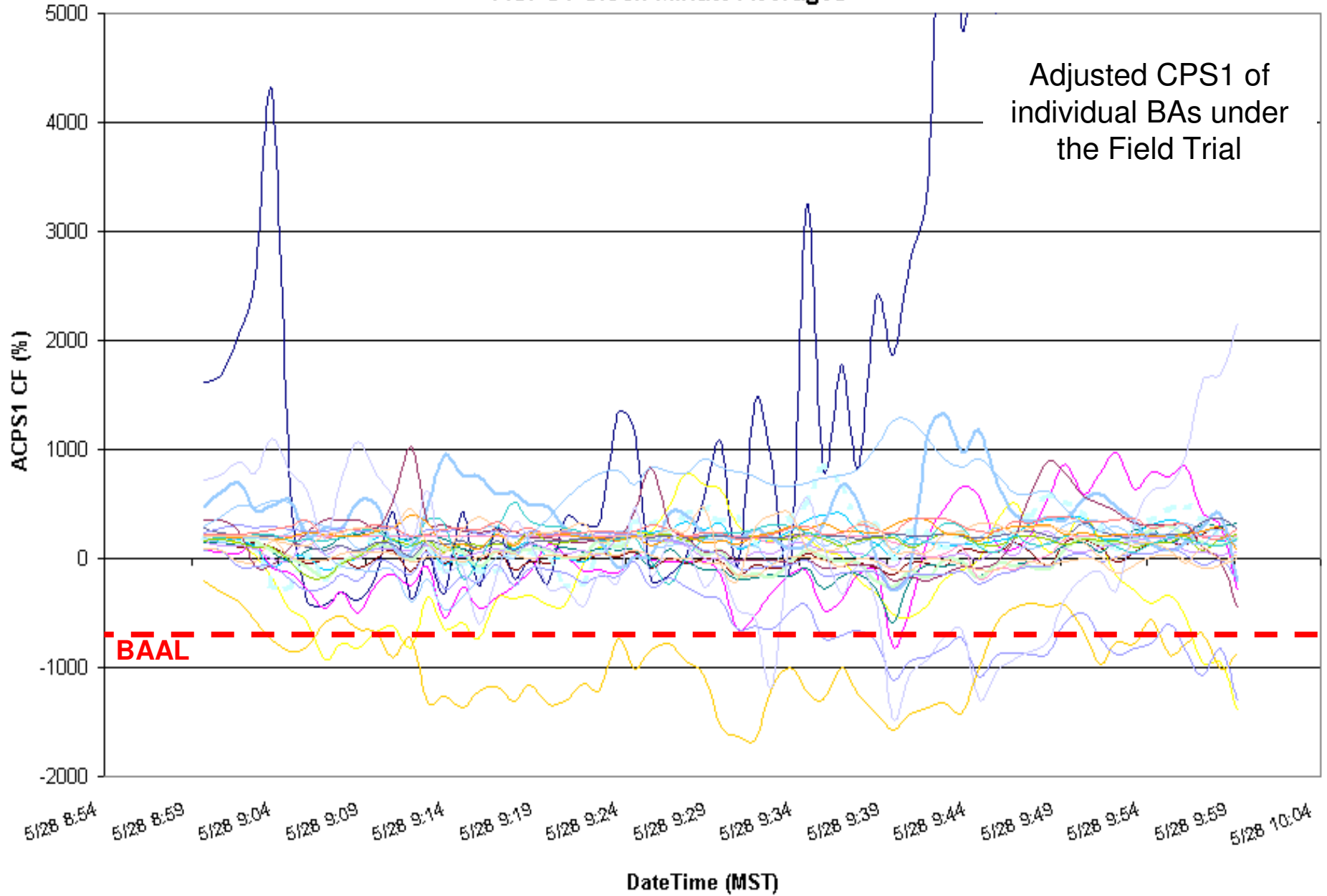
Clock-Minute Average Frequency



Clock-minute Actual Frequency of Participants

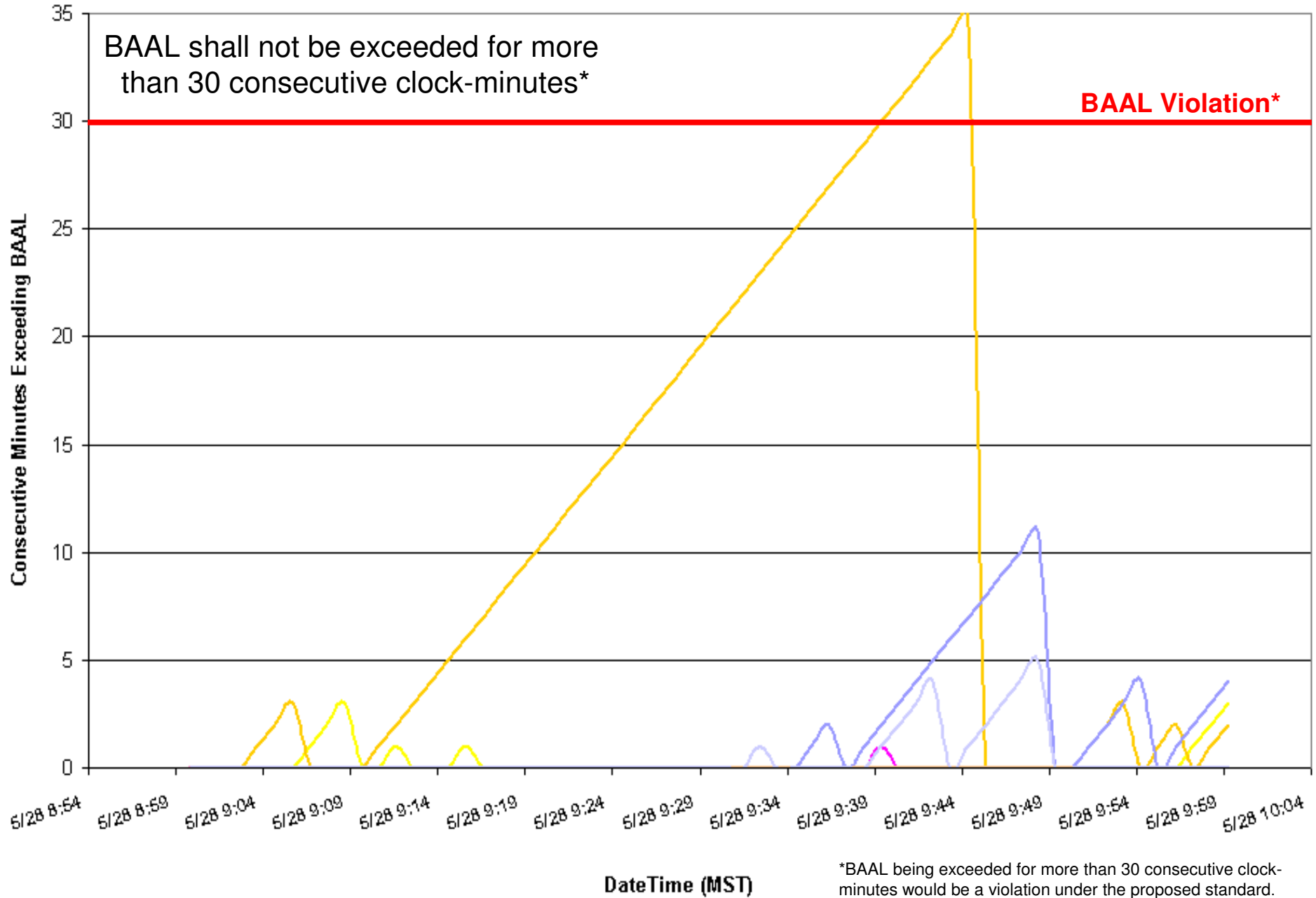
05/28/11 ending 09:47 PDT
35 minute duration below BAAL_{Low}
59.98 Scheduled Frequency TEC

ACPS1 Clock-Minute Averages



05/28/11 ending 09:47 PDT
35 minute duration below BAAL_{Low}
59.98 Scheduled Frequency TEC

Consecutive Minutes Exceeding BAAL



*BAAL being exceeded for more than 30 consecutive clock-minutes would be a violation under the proposed standard.

EXAMPLE 6

05/30/11 ending 18:48 MST

31 minute duration above BAAL_{High}

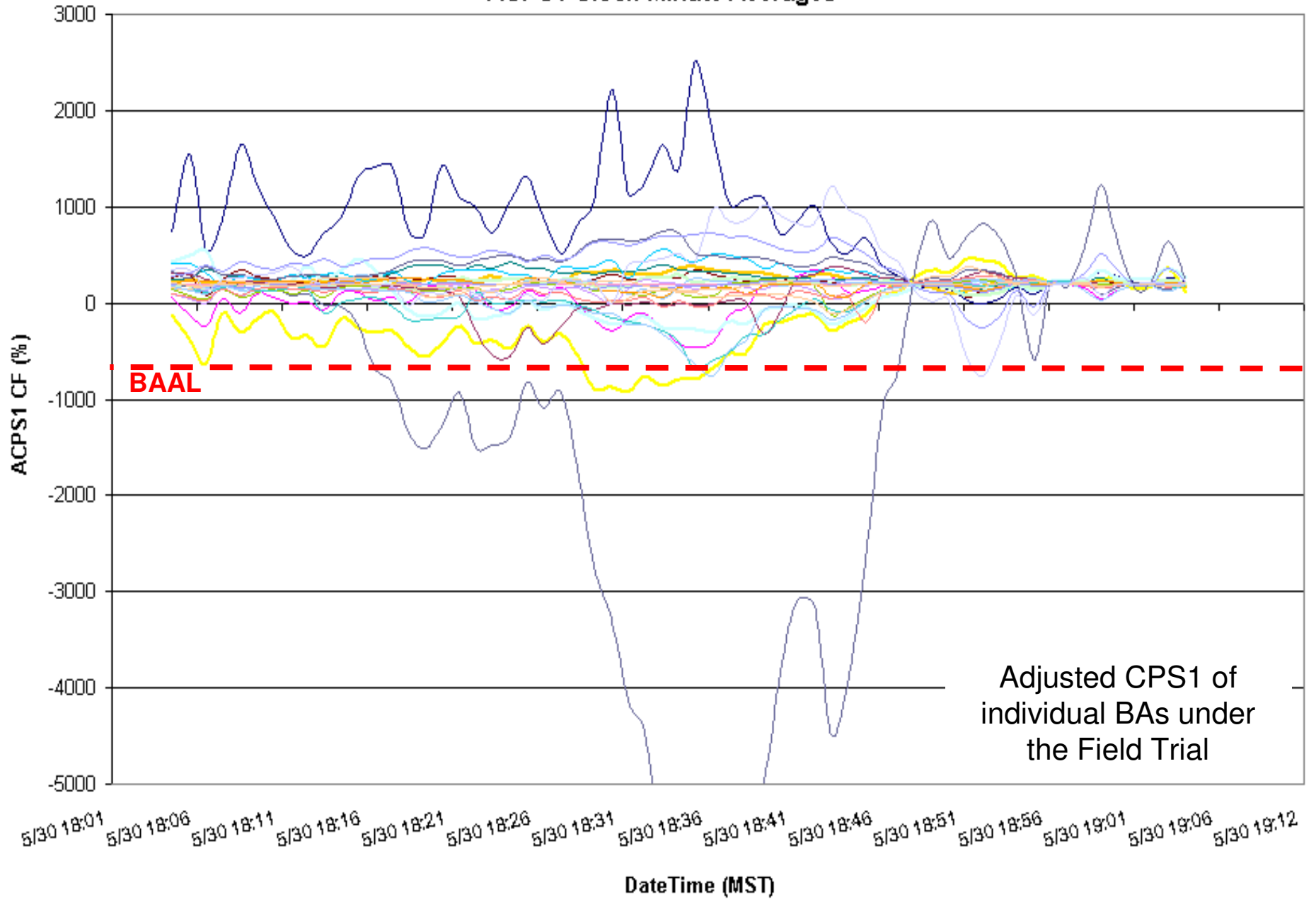
Clock-Minute Average Frequency



Clock-minute Actual Frequency of Participants

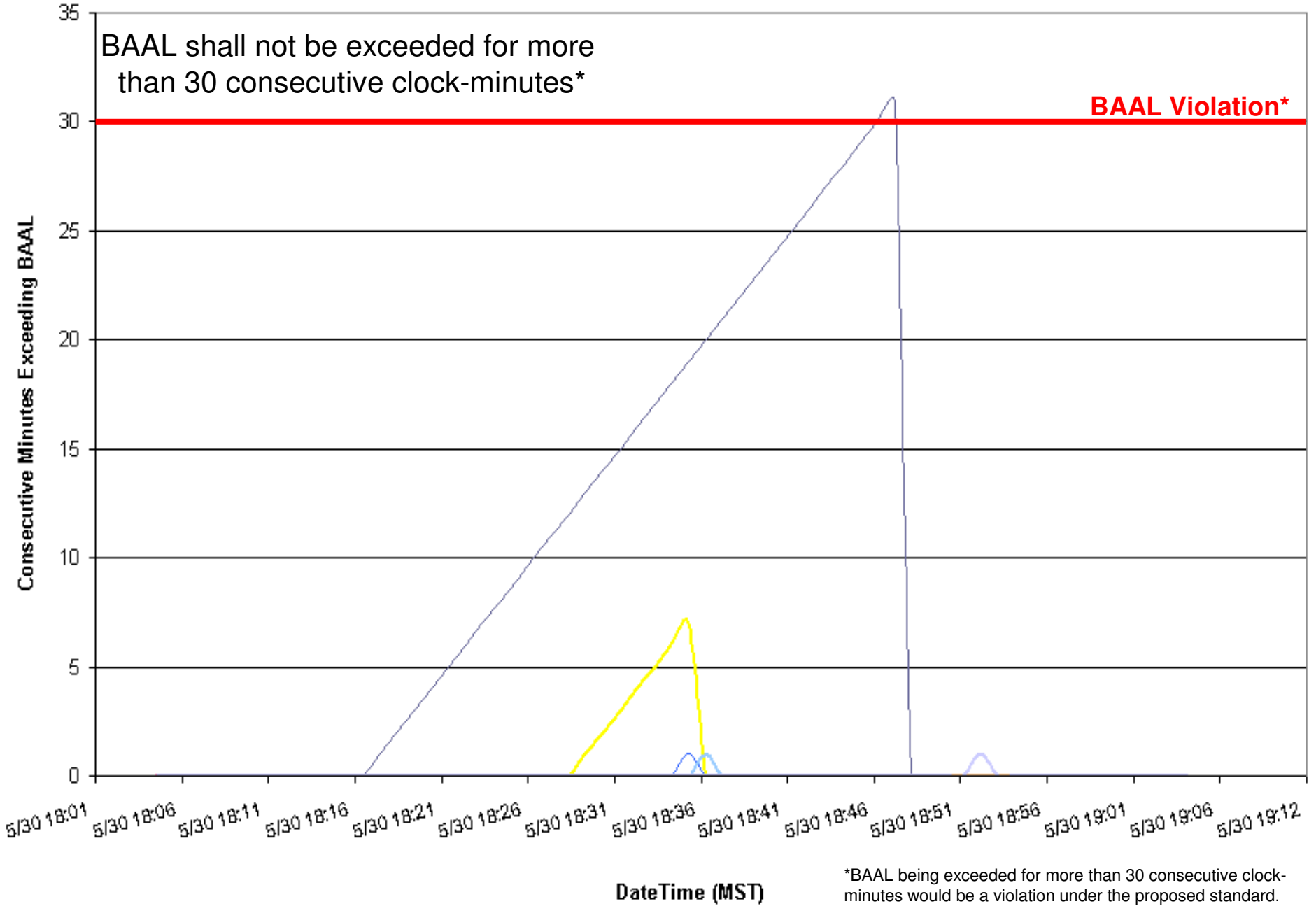
05/30/11 ending 18:48 MST
31 minute duration above BAAL_{High}

ACPS1 Clock-Minute Averages



05/30/11 ending 18:48 MST
31 minute duration above BAAL_{High}

Consecutive Minutes Exceeding BAAL



Balancing Authority ACE Limit Proof-of-Concept Field Trial

Examples of circumstances when BAAL was exceeded and actions taken if appropriate

On a monthly basis, each Balancing Authority will review its performance for the prior month and identify any periods where the ACE exceeded the low BAAL ("BAAL_{Low}"), the high BAAL ("BAAL_{High}"), the low ATL or high ATL for more than 30 consecutive clock-minutes. To help the RBCSDT gain a better understanding of the circumstances that all Balancing Authorities may be faced while operating under BAL-007, each Balancing Authority will provide a brief explanation of the circumstances related to any periods where the duration of consecutive clock-minutes exceeded 30 minutes. In the event that no period exceeded 30 minutes in the prior month, but the longest duration exceeded 25 minutes, the Balancing Authority will provide a brief explanation of the circumstances related to that longest-duration event.

Limit Exceeded (Enter one of the following: BAAL high, BAAL low, ATL high, ATL low)	Clock-minute of ACE exceeding the BAAL or ATL (mm/dd/yy hh:mm)	Clock-minute of ACE returning within the BAAL or ATL (mm/dd/yy hh:mm)	Time Zone	Total duration of ACE exceeding the BAAL or ATL (minutes)	Event associated with a DCS-Reportable Event? (0=No, 1=Yes)	Event associated with a resource loss other than a DCS-Reportable Event? (0=No, 1=Yes)	Brief explanation of circumstances and notable actions taken if applicable
BAAL high	5/20/11 23:17	5/20/11 23:50	MST	34	0	0	High ACE was caused by a JOU not ramping down as expected.
BAAL Low	5/24/11 21:25	5/24/11 22:00	MDT	36	0	0	Wind speed dropped earlier than was forecast causing generation to decrease with frequency trending below 60.00 Hz. Operator deployed all available INC resources to attempt to recover ACE to zero. Operator took action to curtail NF schedules at 21:50, but failed to realize that schedules being curtailed were already ramping out, and were being replaced by new schedules ramping in at the top of the hour. As soon as the operator realized his error, he curtailed new schedules to recover ACE within BAAL limits.
BAAL Low	5/27/11 6:03	5/27/11 6:28	PDT	26.00	0	0	Event coincides with a large positive net schedule change from HE6 to HE7. While one may focus on insufficient regulation as the sole cause, such large positive schedule ramps are a daily occurrence, while the BAAL exceedance is rare. This particular event is unique in that it coincides with a large frequency degradation (-0.088 Hz) making for a relatively small BAAL limit.
BAAL Low	5/28/11 9:13	5/28/11 9:47	PDT	35.00	0	0	Event coincided with ATEC payback. SPPC had a large positive IA for HE 8. Began a corresponding payback equal to negative 1/3 of the IA. The resultant negative ACE coincided with a downward trend in interconnection frequency. The low frequency, ~59.95 Hz, created another ~10 MW negative ACE. The two together, ACE due to ATEC and due to low freq., caused SPPC to exceed the BAAL low limit.
BAAL high	5/30/11 18:18	5/30/11 18:48	MST	31	0	0	Report came in of a 345 KV transmission line structure fire. Tripping of this transmission line would cause a System Operating Limit violation; hence, all on-line local generation was being ramped up.
BAAL high	5/30/11 22:23	5/30/11 22:50	MST	28	0	0	The 345 KV transmission line mentioned above did trip due to a structure fire. This caused a System Operating Limit violation; hence, more local generation was brought online.

Balancing Authority ACE Limit Proof-of-Concept Field Trial Project 2010-14

Discussion

Bob Klueber- Midwest ISO

Balancing Authority Reliability-based Control Standard Drafting Team (BARCSDT)

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