

Balancing Authority ACE Limit Proof-of-Concept Field Trial

Update Discussion
March 23, 2009

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Reliability-Based Control Standard Drafting Team

Balancing Authority ACE Limit Proof-of-Concept Field Trial

February Field Trial Participation

Balancing Authority Participants	2009 Est. Peak Demand	2009 Freq Bias*	Region	Reliability Coordinator	Start Date
American Electric Power (CSW)	10,230	-102.3	SPP	SPP	September 1, 2005
East Kentucky Power Cooperative (EKPC)	3,098	-37.9	SERC	TVA	July 6, 2005
Entergy (EES)	22,330	-223.3	SERC	ICTE	July 6, 2005
EON-US (LGEE)	7161	-72	SERC	TVA	April 1, 2008
Independent Electricity System Operator (IESO)	25,657	-285	NPCC	IESO	March 1, 2008
Manitoba Hydro (MHEB)	4,487	-44.9	MRO	MISO	July 6, 2005
Midwest Independent Transmission System Operator (MISO)	110,625	-1106	MRO, RFC, SERC	MISO	January 6, 2009
PJM Interconnection (PJM)	134,428	-1344	RFC	PJM	August 1, 2005
Santee Cooper (SC)	5,923	-79.6	SERC	VACS	March 1, 2006
Southern Company (SOCO)	46,500	-465	SERC	SOCO	October 15, 2005
Tennessee Valley Authority (TVA)	31,915	-319.2	SERC	TVA	October 1, 2005
TOTAL	402,354	-4,079			

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*

	JULY '05 - FEBRUARY '09 Performance under BAL-007		FEBRUARY 2009 Performance under BAL-007	
	Max MinCtLow	Max MinCtHigh	Max MinCtLow	Max MinCtHigh
BA01	10	11	6	4
BA02	7	12	4	6
BA03	13	15	4	7
BA04	26	16	5	3
BA05	20	16	6	11
BA06	19	18	7	11
BA07	17	20	7	12
BA08	16	22	8	12
BA09	15	23	6	4
BA10	28	26	9	15
BA11	27	40	17	12
BA12	28	43	6	6

MinCtLow = Count of consecutive clock-minutes BAAL_Low was exceeded

MinCtHigh = Count of consecutive clock-minutes BAAL_High was exceeded

*BAAL being exceeded for more than 30 consecutive clock-minutes would be a violation under the proposed BAL-007 standard.

Clock-Minutes of Actual Frequency <= FTL_Low												
Year	Month	>=1 Min	>=2 Min	>=3 Min	>=4 Min	>=5 Min	>=6 Min	>=7 Min	>=8 Min	>=9 Min	>=10 Min	Max_Duration
2005	7	32	14	7	3	2						5
2005	8	56	36	20	12	8	2	1	1	1	1	10
2005	9	33	20	9	4	2	1	1	1			8
2005	10	43	21	12	5	2	2	1	1	1	1	11
2005	11	58	26	14	5	4	1					6
2005	12	41	18	5	4	2	2	1				7
2006	1	43	20	7	2	2	1					6
2006	2	39	17	4	2	1	1					6
2006	3	50	23	4	2							4
2006	4	58	30	10	5	2						5
2006	5	54	30	15	10	4	4	1	1			8
2006	6	41	22	11	4	1						5
2006	7	34	18	9	4	2	1	1	1	1		9
2006	8	49	26	15	8	3						5
2006	9	39	21	11	4	3	1					6
2006	10	51	26	9	6	2	1					6
2006	11	47	22	10	8	4						5
2006	12	34	14	3	1							4
2007	1	44	21	10	7	3	2	1				7
2007	2	33	13	2								3
2007	3	76	39	18	10	3	2	2	1	1	1	15*
2007	4	45	18	7	4	3						5
2007	5	64	32	10	7	3						5
2007	6	47	24	12	6	2	1					6
2007	7	33	19	8	4	2	1					6
2007	8	31	16	9	3	2	1					6
2007	9	41	27	12	6	4	2	2	1			8
2007	10	73	25	15	8	1						5
2007	11	60	23	10	2							4
2007	12	38	13	4	2	1	1					6
2008	1	34	21	11	4	2	1	1	1			8
2008	2	46	27	8	4	1	1	1	1			8
2008	3	55	27	10	7	2	1					6
2008	4	60	28	11	4	3						5
2008	5	63	31	9	3							4
2008	6	34	16	6	4	1						5
2008	7	29	17	9	1	1	1	1				7
2008	8	35	18	5	1	1						5
2008	9	39	20	9	1							4
2008	10	38	18	8	3	1						5
2008	11	13	5	2	1	1						5
2008	12	35	11	3	1							4
2009	1	16	7	3	2							4
2009	2	18	10	5	1							4
SUM		1902	930	391	185	81	31	14	9	4	3	

This chart lists the number of times that the duration of the FTL_{Low} exceedance was greater than or equal to 1 minute, 2 minutes, 3 minutes and so on, with the maximum duration for the month noted in the right column. *The 15-minute duration in March 2007 was for the Monday morning after the change to the new Daylight Saving Time.

Clock-Minutes of Actual Frequency <= FTL _{Low} and 60 Hz Scheduled Frequency												
Year	Month	>=1 Min	>=2 Min	>=3 Min	>=4 Min	>=5 Min	>=6 Min	>=7 Min	>=8 Min	>=9 Min	>=10 Min	Max_Duration
2005	7	16	8	4	1	1						5
2005	8	39	23	13	9	6	1					6
2005	9	16	9	6	3	2	1	1	1			8
2005	10	22	10	5	2	2	2	1	1	1	1	11
2005	11	26	10	4	1	1	1					6
2005	12	23	8	2	1	1	1					6
2006	1	21	7	2	1	1	1					6
2006	2	39	17	4	2	1	1					6
2006	3	33	15	2	1							4
2006	4	46	25	9	4	2						5
2006	5	33	19	8	5	1	1					6
2006	6	19	9	5	1							4
2006	7	22	11	6	1							4
2006	8	38	22	14	8	3						5
2006	9	30	17	8	2	2	1					6
2006	10	24	14	2	2							4
2006	11	19	8	4	3	1						5
2006	12	10	5	2	1							4
2007	1	14	7	3	2	1	1	1				7
2007	2	22	8	1								3
2007	3	41	17	7	6	2	1	1	1	1	1	15*
2007	4	21	10	4	3	3						5
2007	5	26	10	4	4	2						5
2007	6	18	10	2								3
2007	7	12	5	2	1							4
2007	8	9	6	5	2	2	1					6
2007	9	28	22	10	6	4	2	2	1			8
2007	10	33	14	11	6	1						5
2007	11	14	5	2								3
2007	12	14	5	1	1	1	1					6
2008	1	34	21	11	4	2	1	1	1			8
2008	2	39	21	5	2	1	1	1	1			8
2008	3	38	19	4	3	1						5
2008	4	38	16	6	3	2						5
2008	5	23	12	3	1							4
2008	6	13	6	1	1							4
2008	7	10	5	2								3
2008	8	13	5	1								3
2008	9	25	11	7	1							4
2008	10	19	9	3	2							4
2008	11	6	2	1								3
2008	12	23	7	3	1							4
2009	1	15	6	3	2							4
2009	2	18	10	5	1							4
SUM		1042	506	207	100	46	18	8	6	2	2	

This chart lists the number of times that the duration of the FTL_{Low} exceedance was greater than or equal to 1 minute, 2 minutes, 3 minutes and so on, with the maximum duration for the month noted in the right column. *The 15-minute duration in March 2007 was for the Monday morning after the change to the new Daylight Saving Time.

Clock-Minutes of Actual Frequency >= FTL_High												
Year	Month	>=1 Min	>=2 Min	>=3 Min	>=4 Min	>=5 Min	>=6 Min	>=7 Min	>=8 Min	>=9 Min	>=10 Min	Max_Duration
2005	7	11	4	1								3
2005	8	21	7	4	2	1						5
2005	9	21	9	3	2	2	1	1				7
2005	10	23	6	2	1	1						5
2005	11	22	7	4	1	1	1	1				7
2005	12	19	6	2								3
2006	1	27	15	11	6	2						5
2006	2	24	10	7	5							4
2006	3	33	12	4	2	1	1	1	1			8
2006	4	46	22	3	1	1	1	1	1			8
2006	5	39	20	9	4	1						5
2006	6	24	10	7	4	4	3	3	2	1	1	10
2006	7	29	11	8	2							4
2006	8	26	13	10	5	1	1	1	1			8
2006	9	33	14	4	2							4
2006	10	28	14	4	3	2	1	1	1			8
2006	11	22	11	4								3
2006	12	29	12	7	3	2	1					6
2007	1	31	14	5	2	1	1	1				7
2007	2	21	13	4	1							4
2007	3	38	21	10	4	2	1	1	1			8
2007	4	31	15	8	4							4
2007	5	49	20	11	7	4	4	1				7
2007	6	25	14	7	2	1	1	1				7
2007	7	20	12	8	2							4
2007	8	32	14	7	3	2						5
2007	9	16	6	4	2	1						5
2007	10	36	16	4	1	1						5
2007	11	24	7	5	2	1						5
2007	12	38	16	7	2							4
2008	1	24	16	8	1							4
2008	2	24	11	6	3	3	2	1	1			8
2008	3	34	6									2
2008	4	33	12	8	3	3	1					6
2008	5	20	10	6	4	1						5
2008	6	19	10	3	2	1						5
2008	7	12	4	1								3
2008	8	17	6	3	1	1	1					6
2008	9	21	11	6	5	3	3	3	3	2	1	11
2008	10	19	7	1								3
2008	11	9	2	1	1							4
2008	12	8	2	1								3
2009	1	9	6	4								3
2009	2	10	3	1	1	1	1					6
SUM		1097	477	223	96	45	25	17	11	3	2	

This chart lists the number of times that the duration of the FTL_{HIGH} exceedance was greater than or equal to 1 minute, 2 minutes, 3 minutes and so on, with the maximum duration for the month noted in the right column.

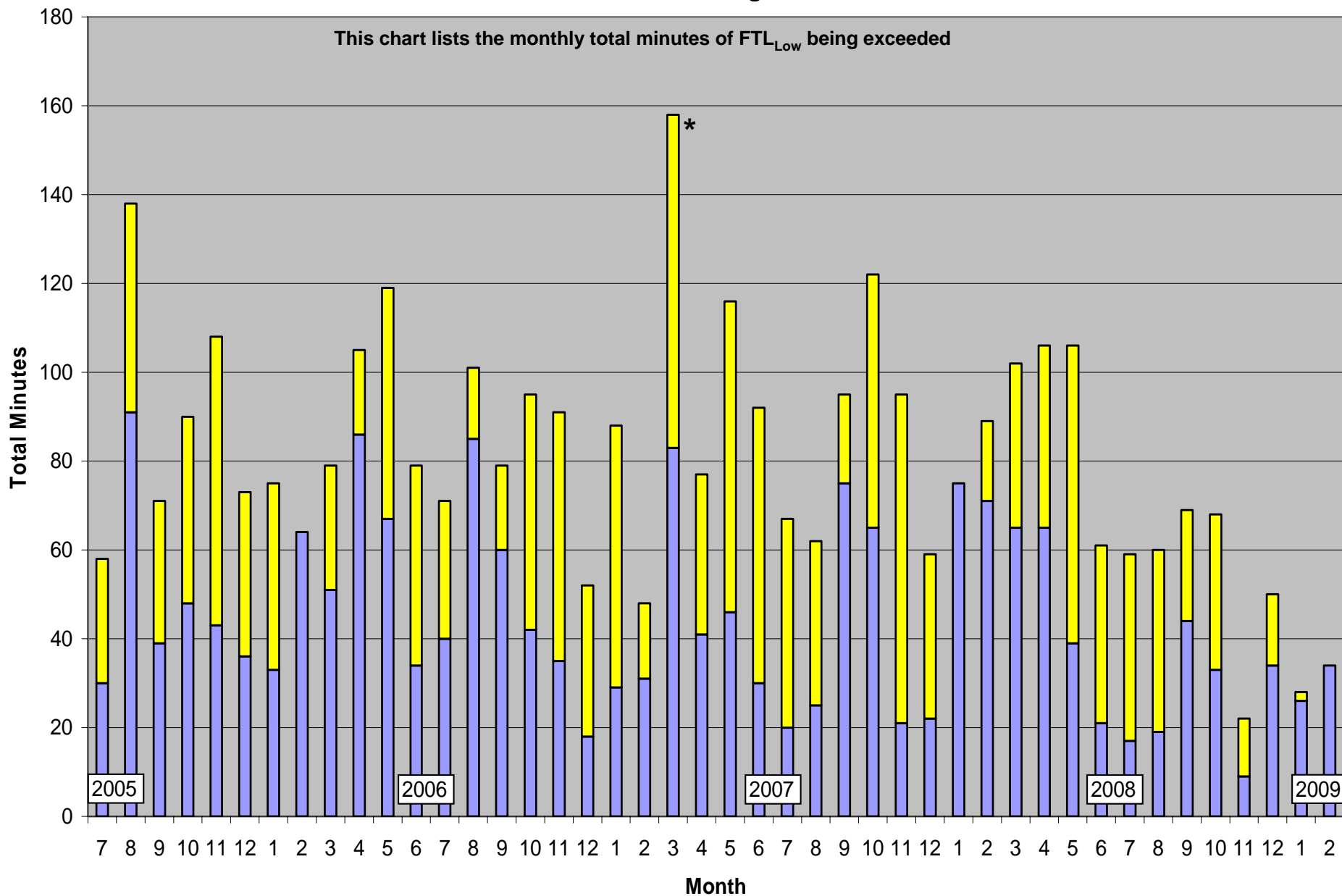
Frequency Statistics

Year	Month	Minutes FTL_Low at 59.98 Hz SF	Minutes FTL_Low at 60 Hz SF	Total FTL_Low Minutes	Percentage Low During TEC	FTL_Low Events	FTL_Low Max Duration	Minutes FTL_High at 60.02 Hz SF	Minutes FTL_High at 60 Hz SF	Total FTL_High Minutes	Percentage High During TEC	FTL_High Events	FTL_High Max Duration	Total FTL_Low and FTL_High Minutes at 60 Hz SF	Total FTL_Low and FTL_High Minutes	Percentage of Clock-Minutes at 59.98 SF
2005	7	28	30	58	48.28%	32	5	0	16	16	0.00%	11	3	46	74	14.38%
2005	8	47	91	138	34.06%	56	10	0	35	35	0.00%	21	5	126	173	6.86%
2005	9	32	39	71	45.07%	33	8	0	39	39	0.00%	21	7	78	110	10.43%
2005	10	42	48	90	46.67%	43	11	0	33	33	0.00%	23	5	81	123	15.79%
2005	11	65	43	108	60.19%	58	6	0	35	35	0.00%	22	7	78	143	19.32%
2005	12	37	36	73	50.68%	41	7	0	27	27	0.00%	19	3	63	100	12.90%
2006	1	42	33	75	56.00%	43	6	0	61	61	0.00%	27	5	94	136	15.52%
2006	2	0	64	64	0.00%	39	6	2	43	45	4.44%	24	4	107	109	0.38%
2006	3	28	51	79	35.44%	50	4	17	37	54	31.48%	33	8	88	133	4.67%
2006	4	19	86	105	18.10%	58	5	0	76	76	0.00%	46	8	162	181	6.42%
2006	5	52	67	119	43.70%	54	8	0	72	72	0.00%	39	5	139	191	15.31%
2006	6	45	34	79	56.96%	41	5	0	59	59	0.00%	24	10	93	138	20.00%
2006	7	31	40	71	43.66%	34	9	0	50	50	0.00%	29	4	90	121	8.17%
2006	8	16	85	101	15.84%	49	5	0	58	58	0.00%	26	8	143	159	9.57%
2006	9	19	60	79	24.05%	39	6	0	53	53	0.00%	33	4	113	132	7.77%
2006	10	53	42	95	55.79%	51	6	0	54	54	0.00%	28	8	96	149	12.23%
2006	11	56	35	91	61.54%	47	5	1	36	37	2.70%	22	3	71	128	15.63%
2006	12	34	18	52	65.38%	34	4	0	54	54	0.00%	29	6	72	106	18.98%
2007	1	59	29	88	67.05%	44	7	0	55	55	0.00%	31	7	84	143	22.58%
2007	2	17	31	48	35.42%	33	3	0	39	39	0.00%	21	4	70	87	11.98%
2007	3	75	83	158	47.47%	76	15	0	78	78	0.00%	38	8	161	236	10.47%
2007	4	36	41	77	46.75%	45	5	0	58	58	0.00%	31	4	99	135	16.69%
2007	5	70	46	116	60.34%	64	5	0	95	95	0.00%	49	7	141	211	25.86%
2007	6	62	30	92	67.39%	47	6	0	51	51	0.00%	25	7	81	143	22.86%
2007	7	47	20	67	70.15%	33	6	0	39	39	0.00%	20	4	59	106	13.41%
2007	8	37	25	62	59.68%	31	6	1	55	56	1.79%	32	5	80	118	16.67%
2007	9	20	75	95	21.05%	41	8	0	27	27	0.00%	16	5	102	122	11.53%
2007	10	57	65	122	46.72%	73	5	1	56	57	1.75%	36	5	121	179	25.31%
2007	11	74	21	95	77.89%	60	4	0	34	34	0.00%	24	5	55	129	26.51%
2007	12	37	22	59	62.71%	38	6	0	61	61	0.00%	38	4	83	120	16.22%
2008	1	0	75	75	0.00%	34	8	0	48	48	0.00%	24	4	123	123	0.67%
2008	2	18	71	89	20.22%	46	8	0	51	51	0.00%	24	8	122	140	4.02%
2008	3	37	65	102	36.27%	55	6	0	40	40	0.00%	34	2	105	142	5.78%
2008	4	41	65	106	38.68%	60	5	0	59	59	0.00%	33	6	124	165	9.88%
2008	5	67	39	106	63.21%	63	4	0	40	40	0.00%	20	5	79	146	18.51%
2008	6	40	21	61	65.57%	34	5	0	35	35	0.00%	19	5	56	96	18.09%
2008	7	42	17	59	71.19%	29	7	0	17	17	0.00%	12	3	34	76	16.39%
2008	8	41	19	60	68.33%	35	5	0	29	29	0.00%	17	6	48	89	18.84%
2008	9	25	44	69	36.23%	39	4	0	55	55	0.00%	21	11	99	124	13.05%
2008	10	35	33	68	51.47%	38	5	0	27	27	0.00%	19	3	60	95	18.96%
2008	11	13	9	22	59.09%	13	5	0	13	13	0.00%	9	4	22	35	8.45%
2008	12	16	34	50	32.00%	35	4	0	11	11	0.00%	8	3	45	61	9.97%
2009	1	2	26	28	7.14%	16	4	0	19	19	0.00%	9	3	45	47	1.48%
2009	2	0	34	34	0.00%	18	4	0	18	18	0.00%	10	6	52	52	0.00%

This chart is a summary of frequency-related statistics gathered since the start of the Field Trial. Of particular interest is the drop in operation outside of the FTL bounds, trending lower in the latter part of 2008 with November 2008 having the least number of clock-minutes of operation outside the FTL bounds, followed by January 2009, over the dataset.

Total Minutes Exceeding FTL_low

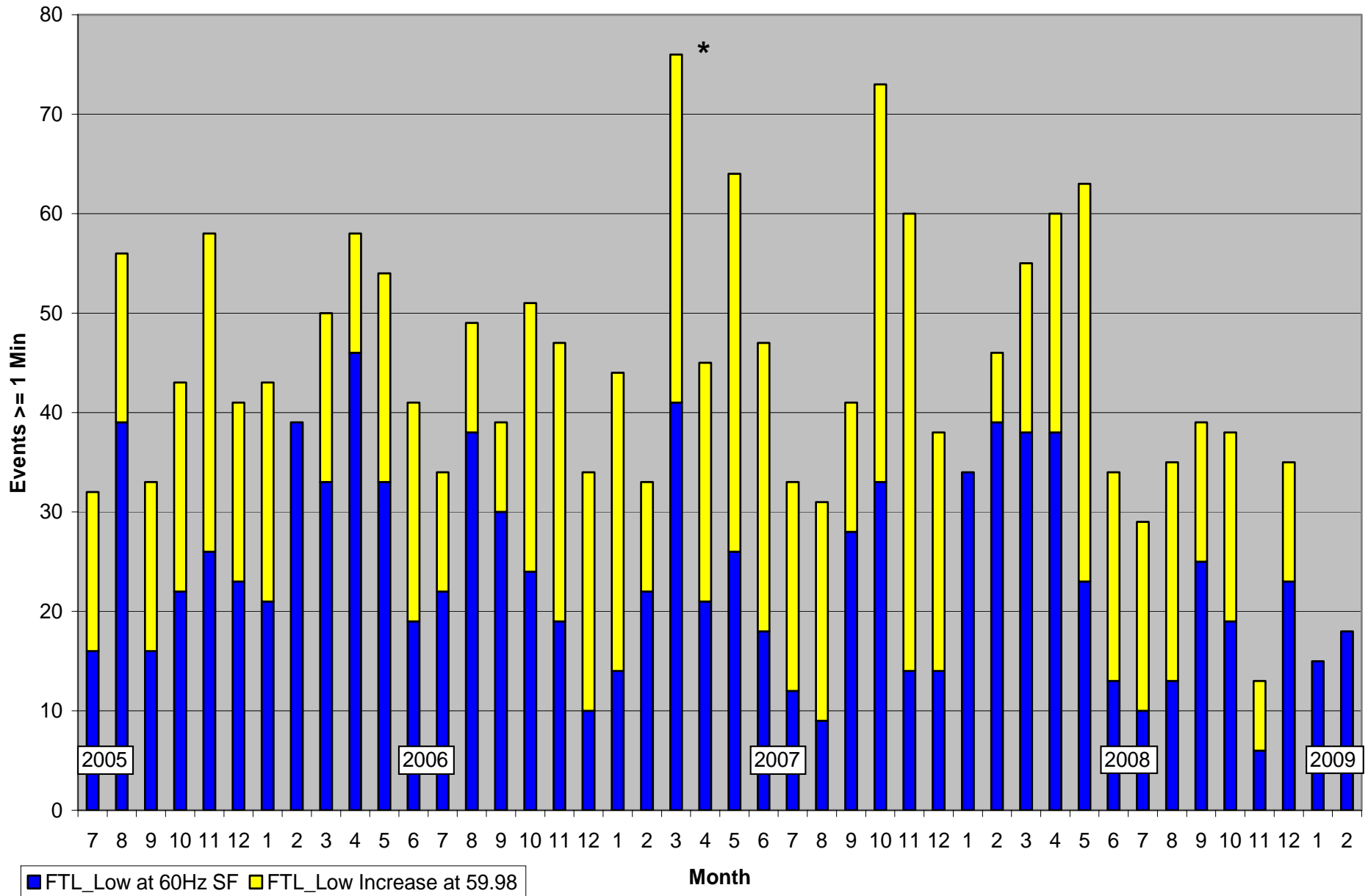
This chart lists the monthly total minutes of FTL_{Low} being exceeded



■ Total Minutes at 60 Hz
 ■ Addition Minutes During Time-Error Corrections

*March 2007- change to the new Daylight Saving Time.

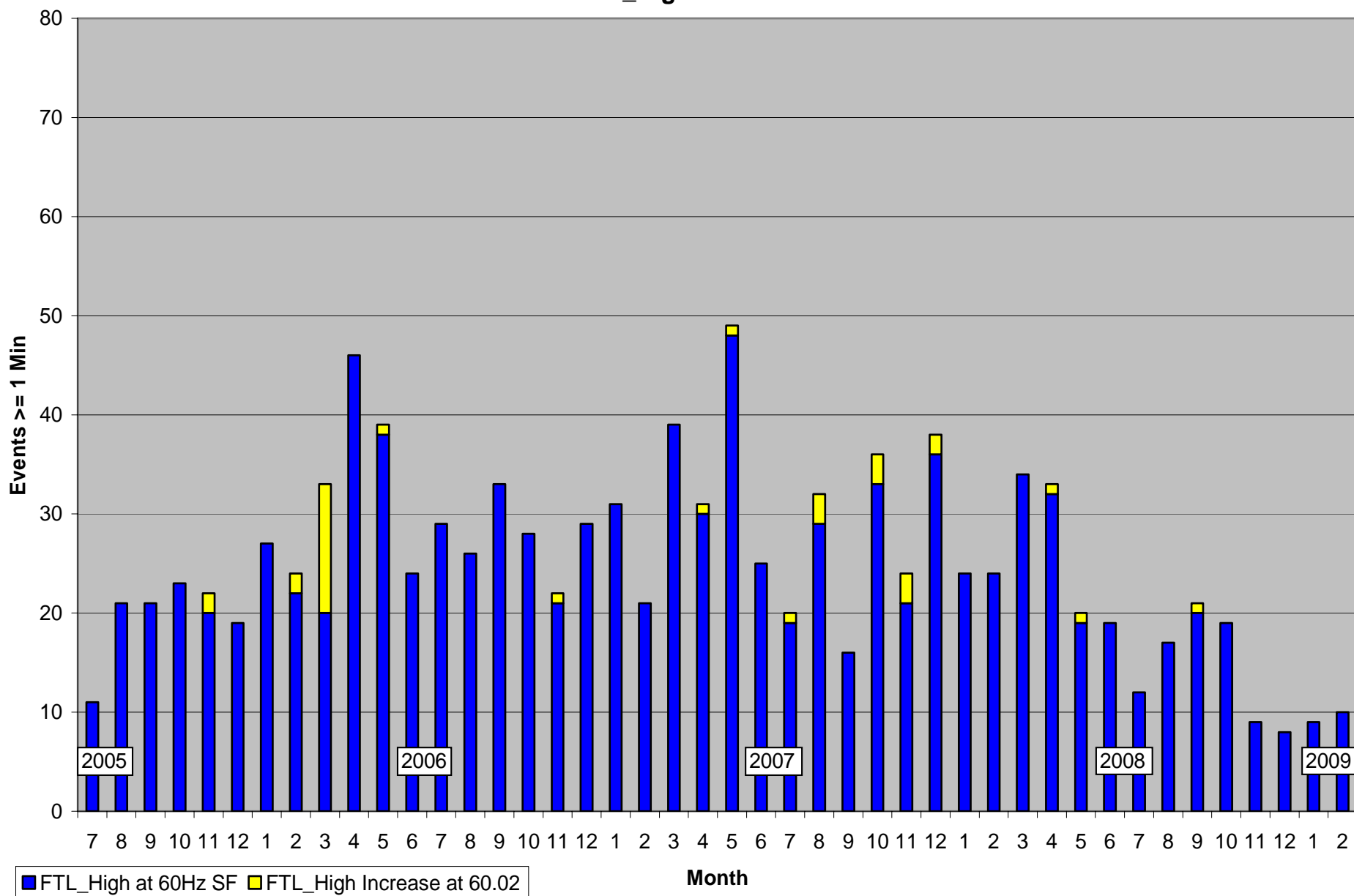
FTL_Low Events



This chart lists the monthly number of FTL_{LOW} events greater than or equal to 1 minute

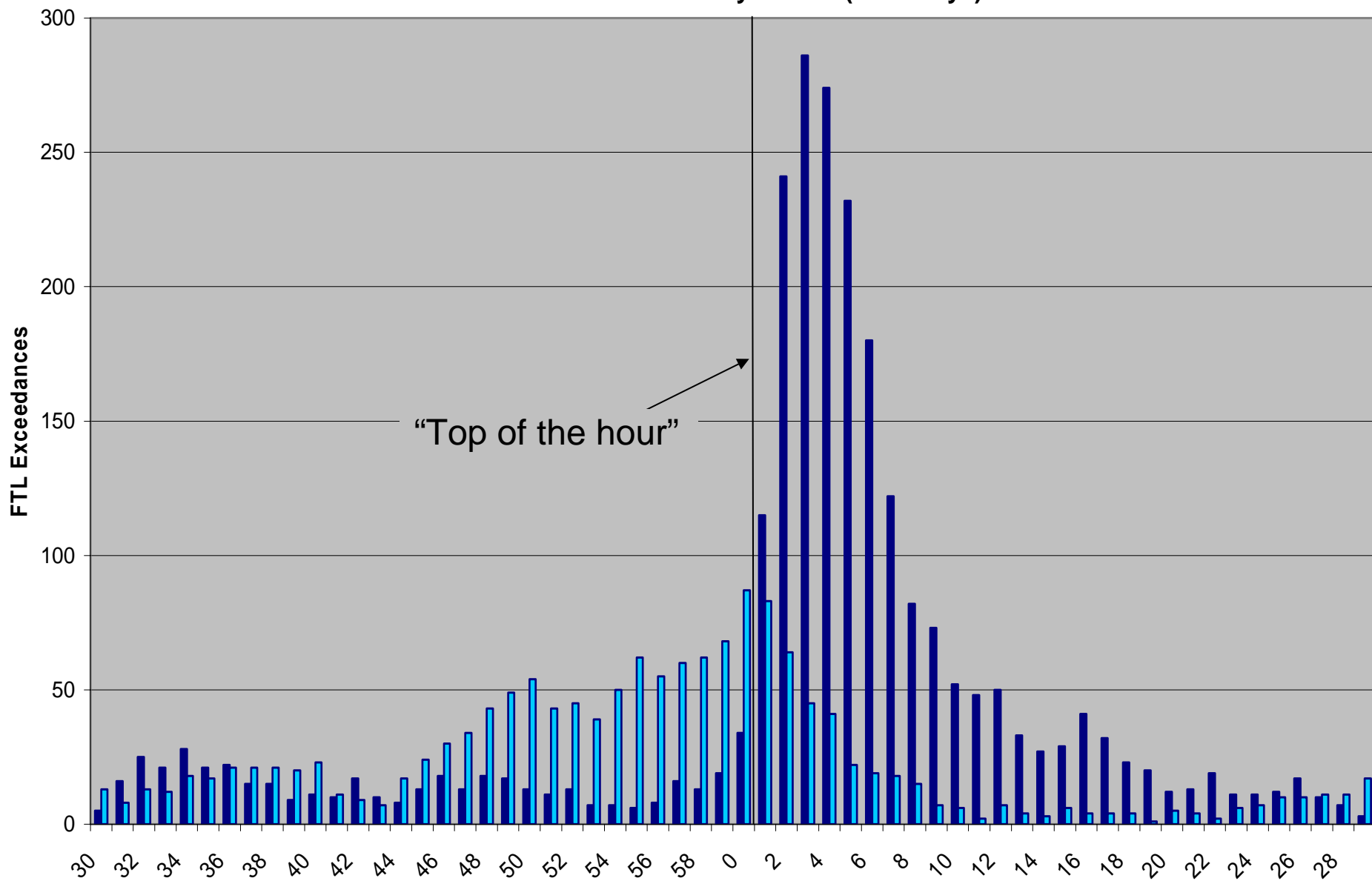
*March 2007 had an event of FTL_{LOW} being exceeded for 15-minutes the Monday morning after the change to the new Daylight Saving Time.

FTL_High Events



This chart lists the monthly number of FTL_{HIGH} events greater than or equal to 1 minute

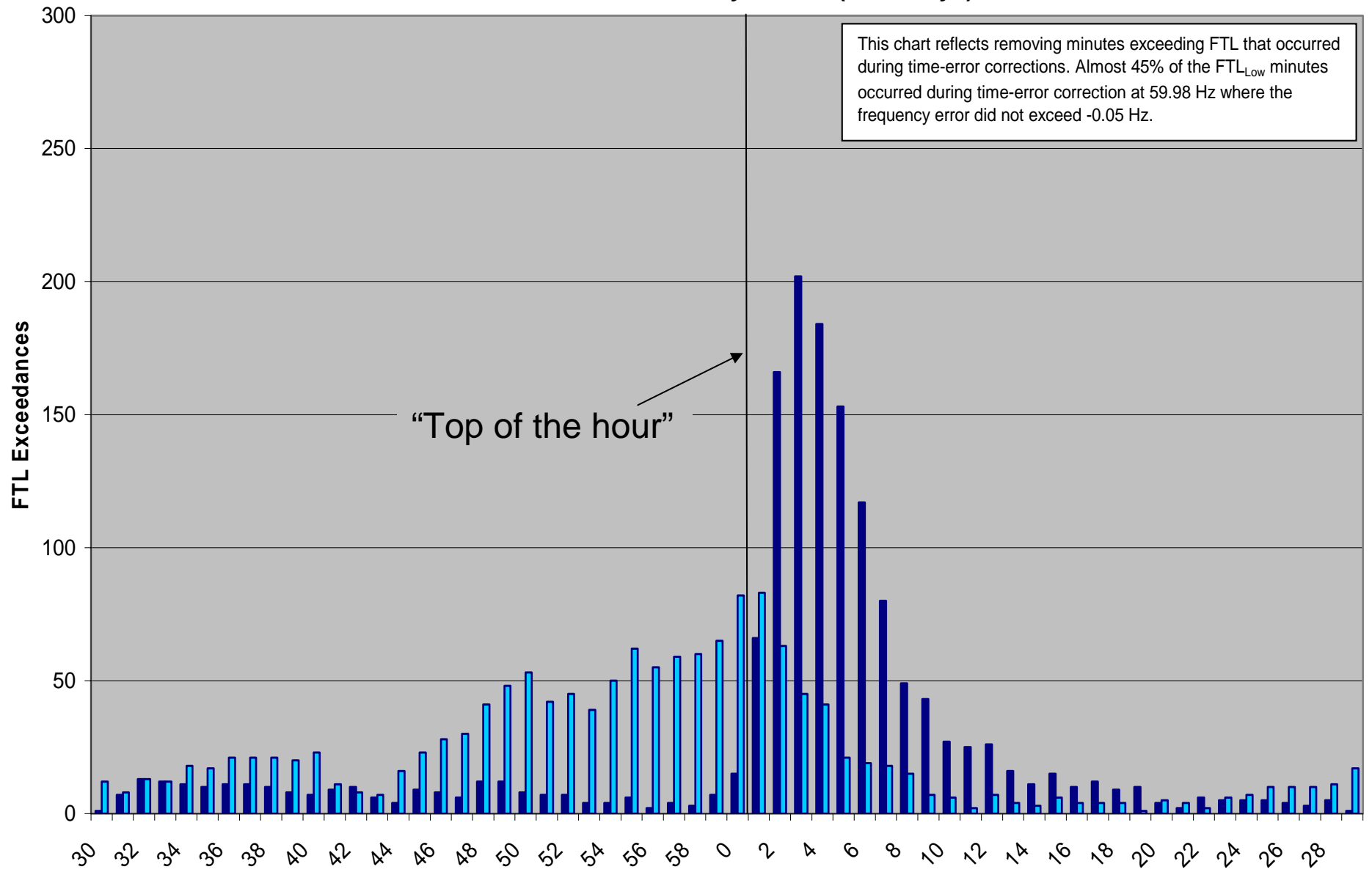
Count of FTL Exceedances by Minute (Weekdays)



For each minute of the hour, this chart illustrates the accumulated minutes that the Frequency Trigger Limit (FTL) has been exceeded, based upon data gathered since the start of the Field Trial.

■ FTL_Low ■ FTL_High

Count of FTL Exceedances by Minute (Weekdays)

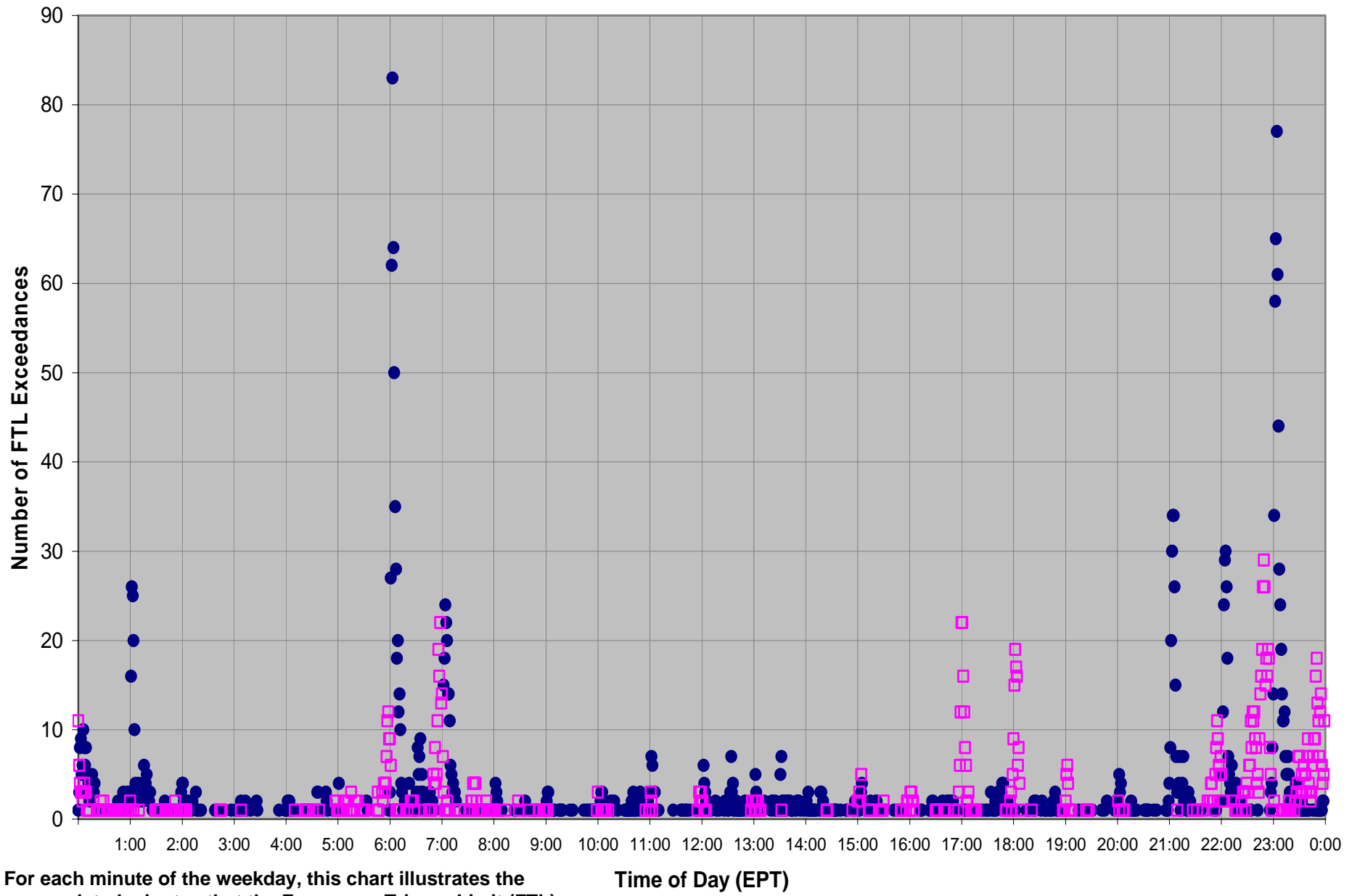


For each minute of the hour, this chart illustrates the accumulated minutes that the Frequency Trigger Limit (FTL) has been exceeded, based upon data gathered since the start of the Field Trial.

■ FTL_Low ■ FTL_High

Reduction in FTL events

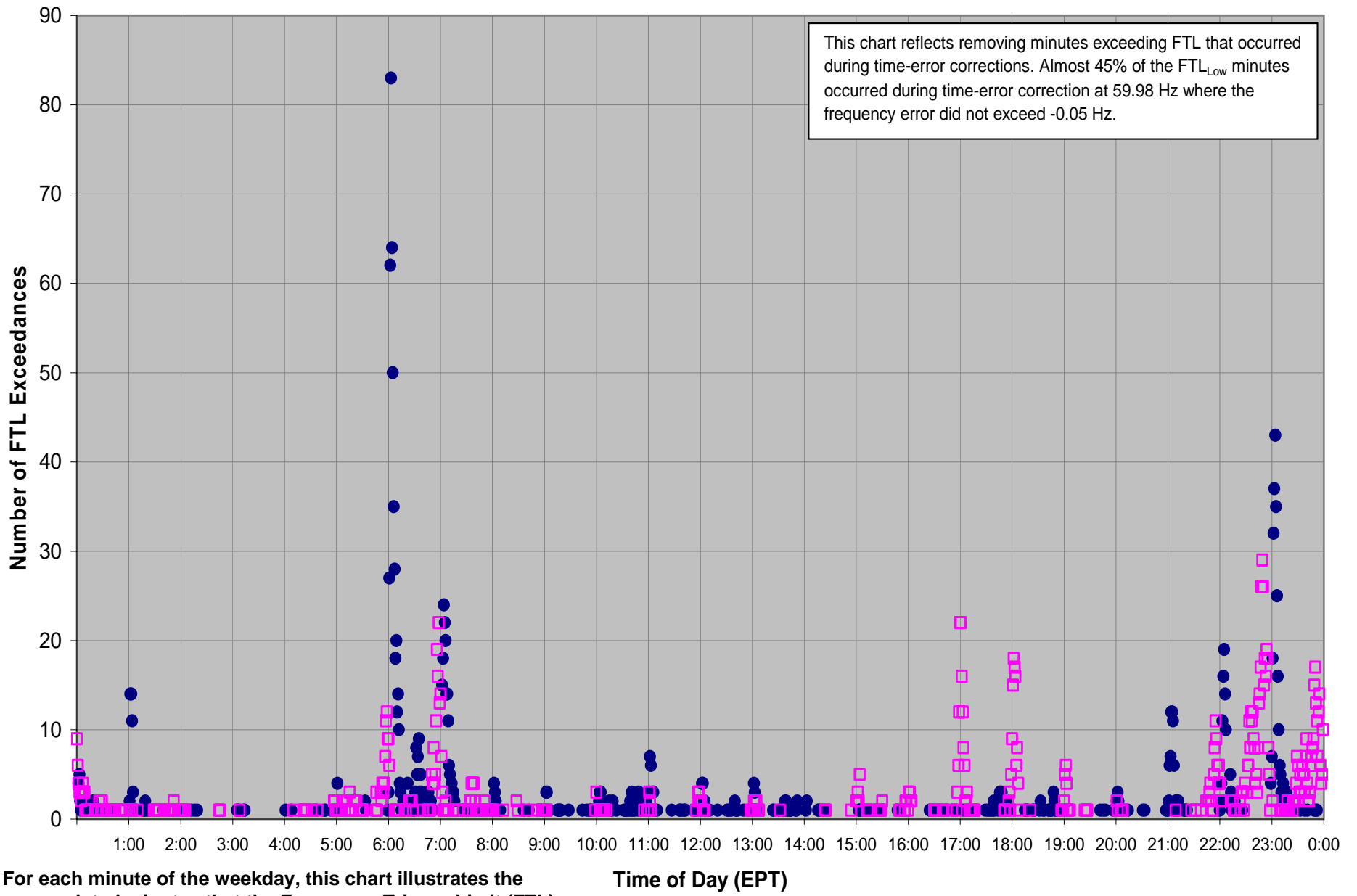
Count of Frequency Trigger Limit (FTL) Exceedances (Weekdays)



For each minute of the weekday, this chart illustrates the accumulated minutes that the Frequency Trigger Limit (FTL) has been exceeded, based upon data gathered since the start of the Field Trial.

● FTL_Low □ FTL_High

Count of Frequency Trigger Limit (FTL) Exceedances (Weekdays)



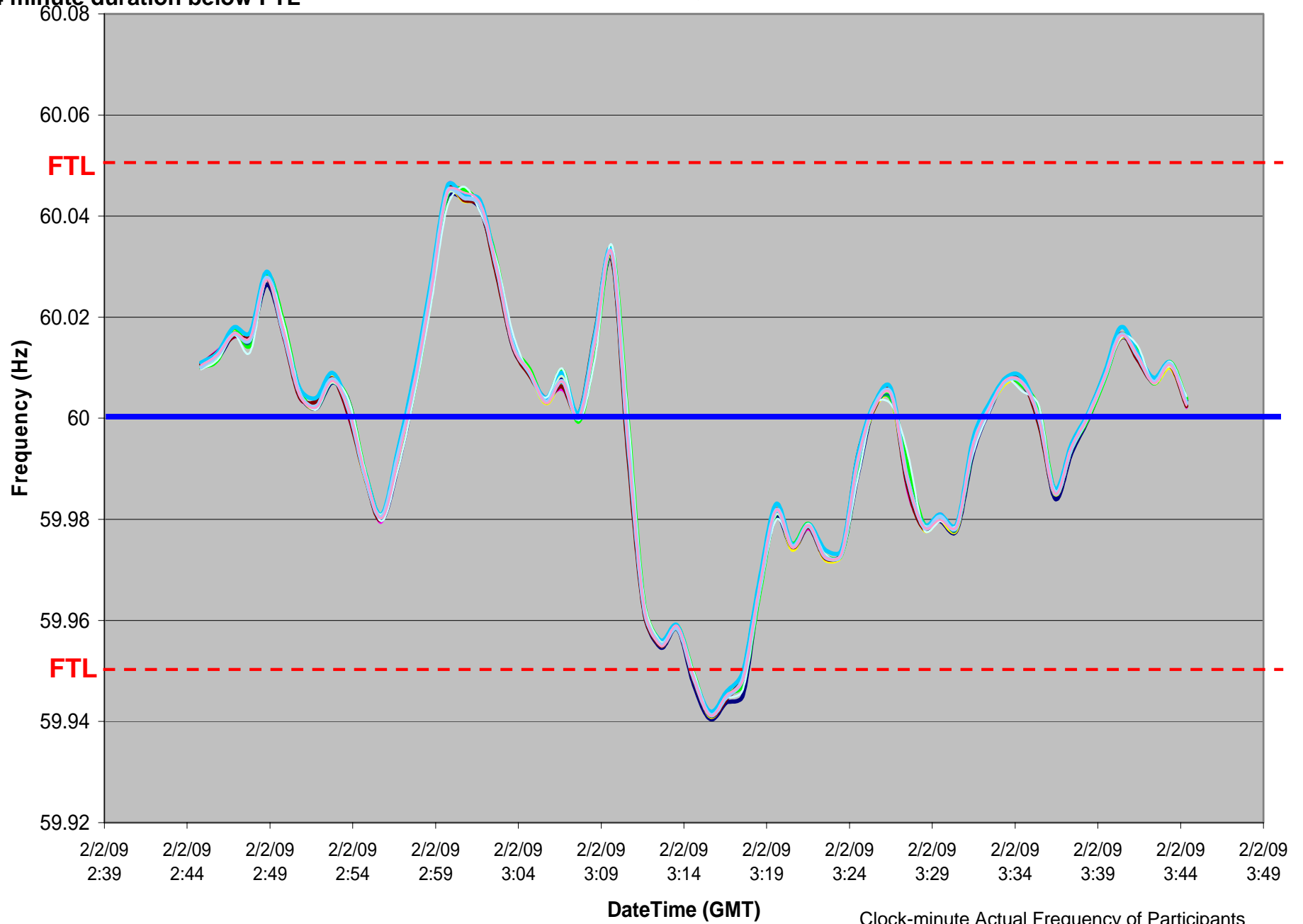
For each minute of the weekday, this chart illustrates the accumulated minutes that the Frequency Trigger Limit (FTL) has been exceeded, based upon data gathered since the start of the Field Trial.

● FTL_{Low} □ FTL_{High}

2/01/2009 22:15-22:19 EST

4 minute duration below FTL

Clock-Minute Average Frequency

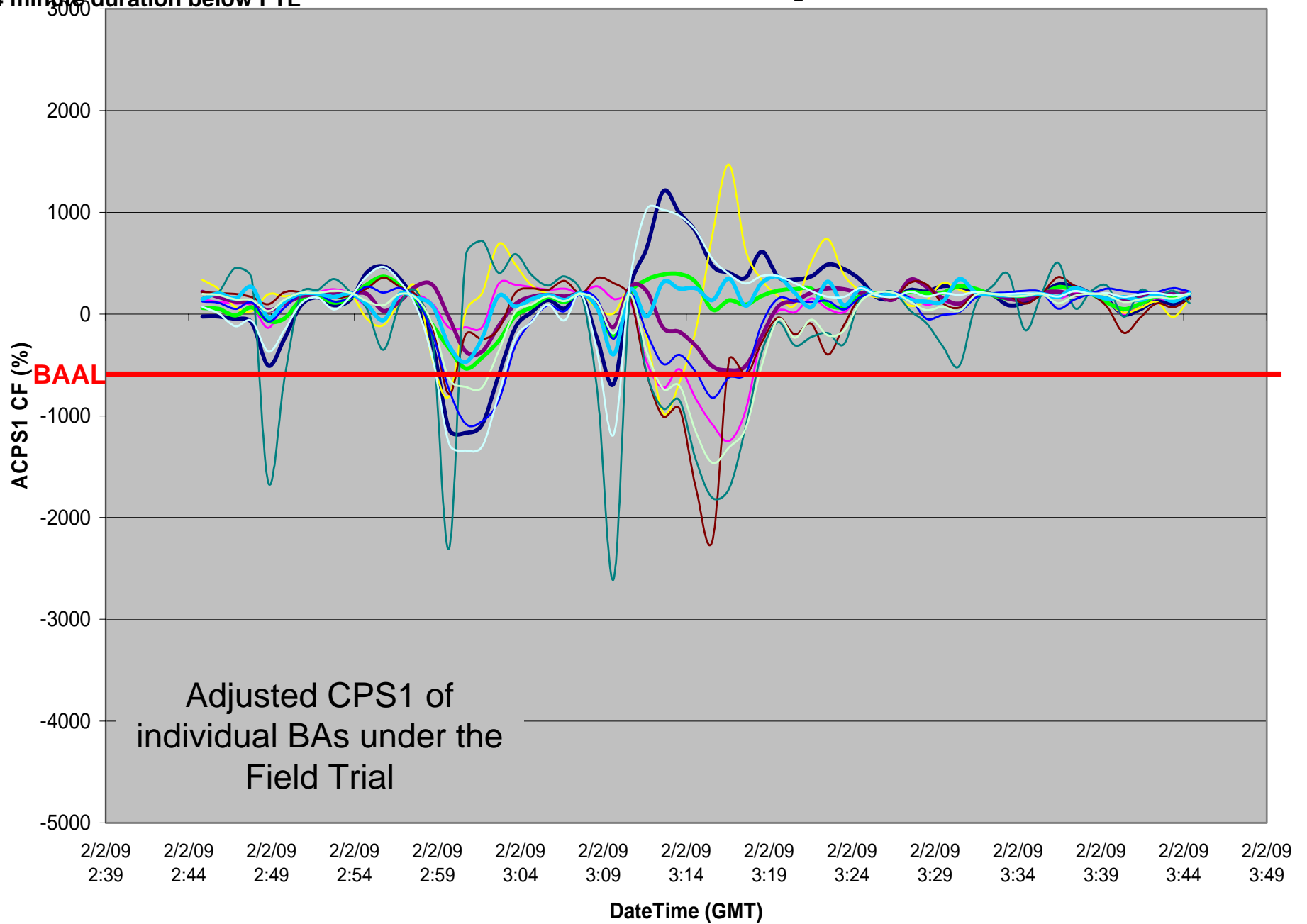


Clock-minute Actual Frequency of Participants

2/01/2009 22:15-22:19 EST

4 minute duration below FTL

ACPS1 Clock-Minute Averages

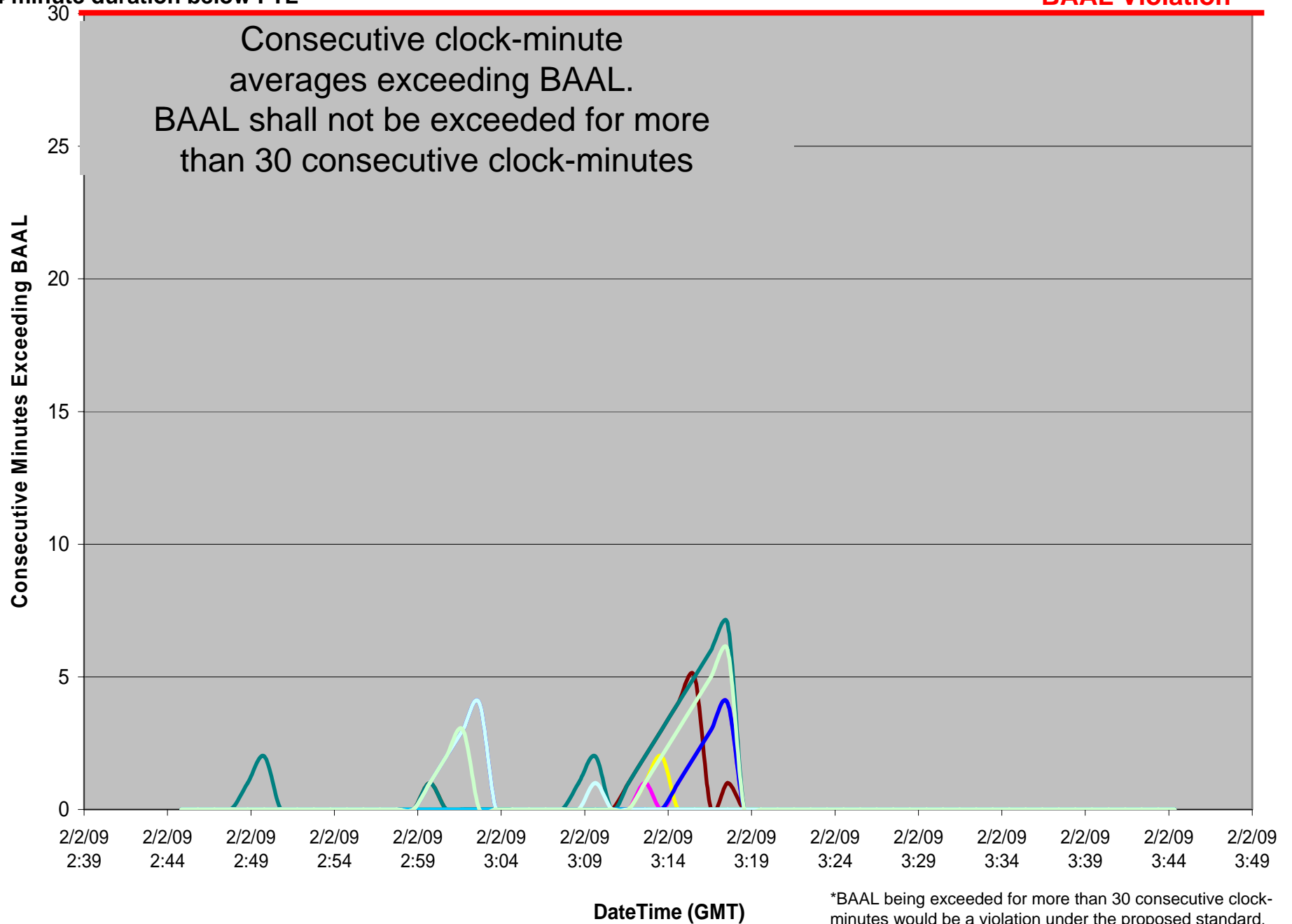


2/01/2009 22:15-22:19 EST

4 minute duration below FTL

Consecutive Minutes Exceeding BAAL

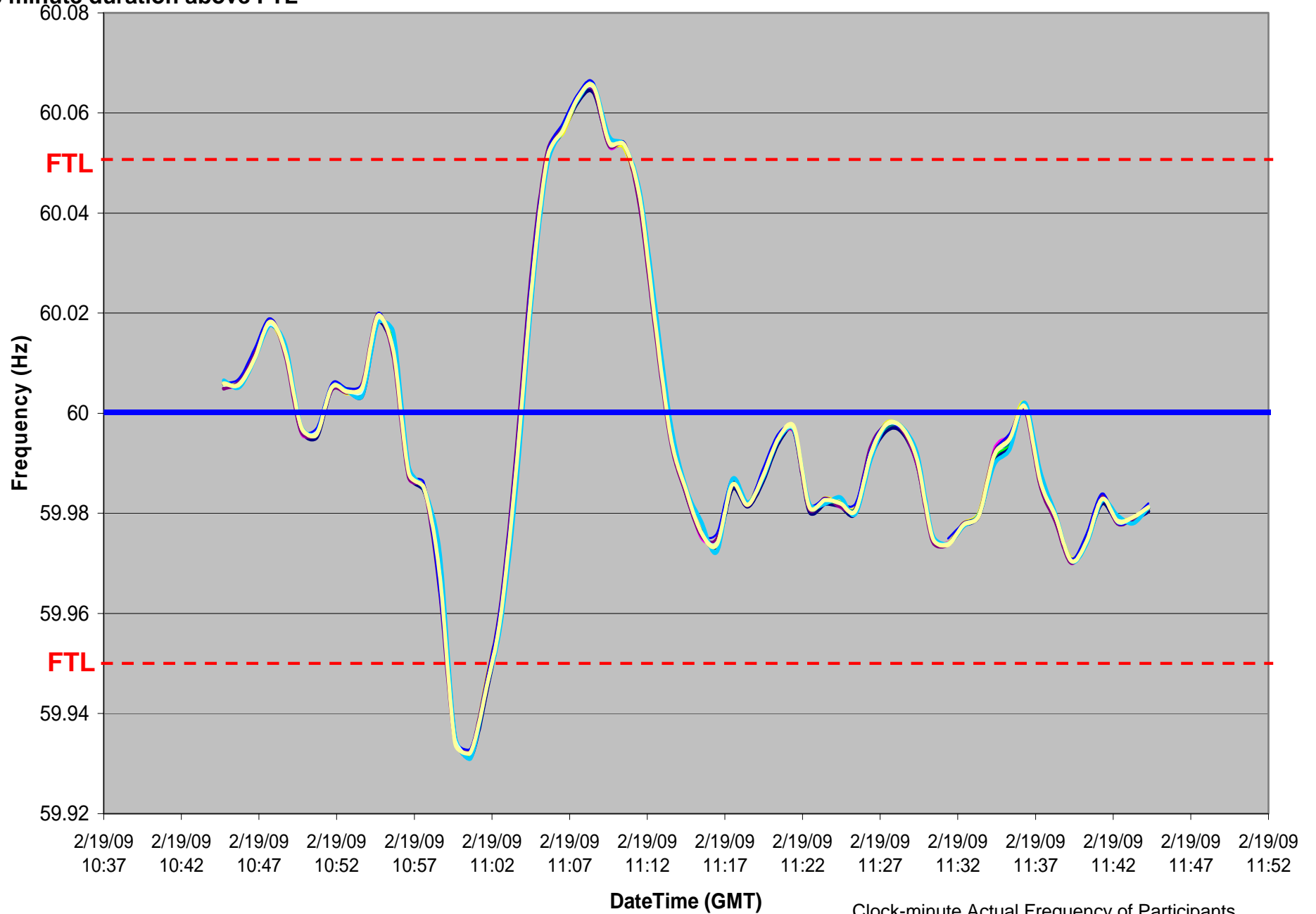
BAAL Violation*



2/19/2009 6:06-6:12 EST

6 minute duration above FTL

Clock-Minute Average Frequency

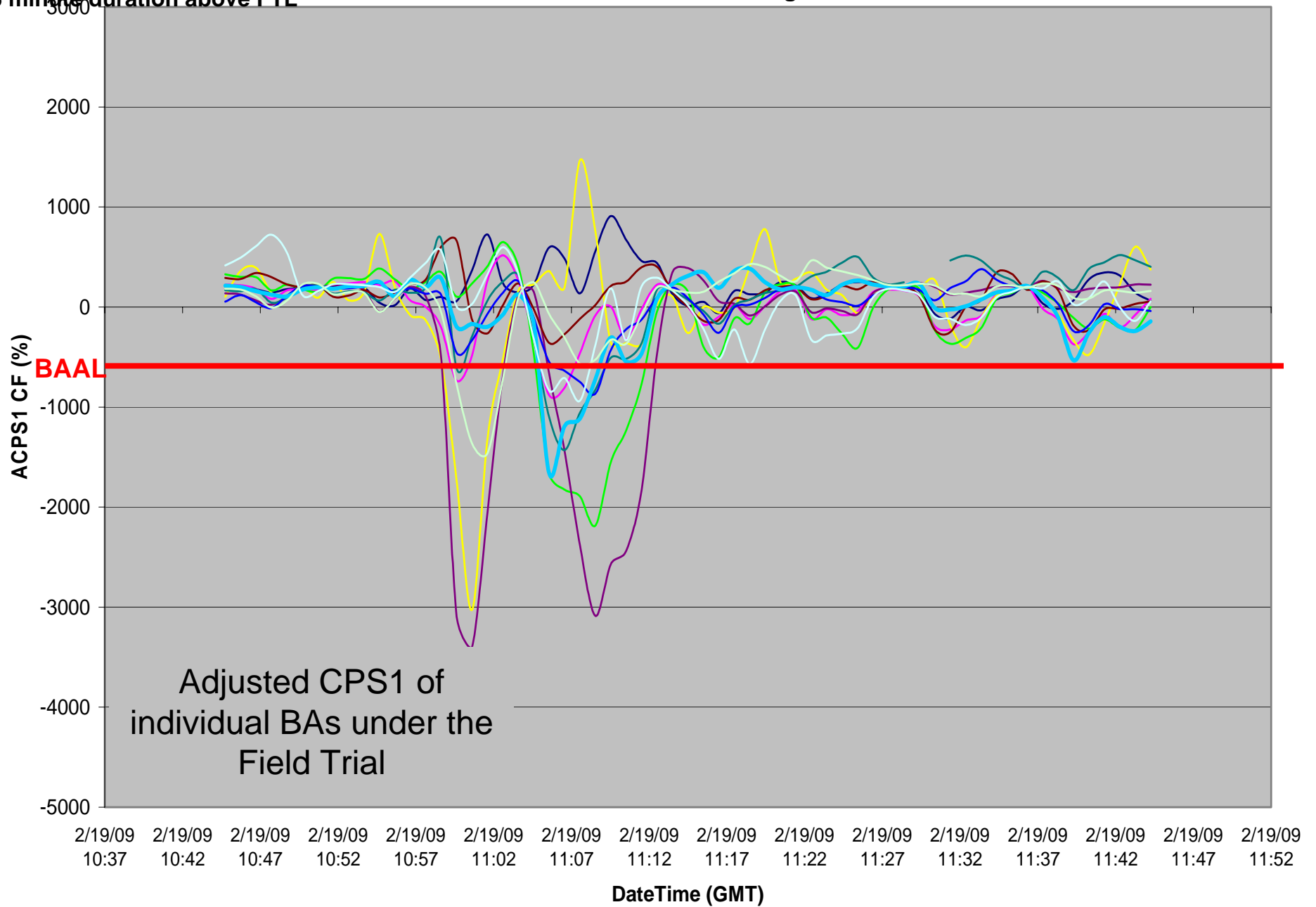


Clock-minute Actual Frequency of Participants

2/19/2009 6:06-6:12 EST

6 minute duration above FTL

ACPS1 Clock-Minute Averages

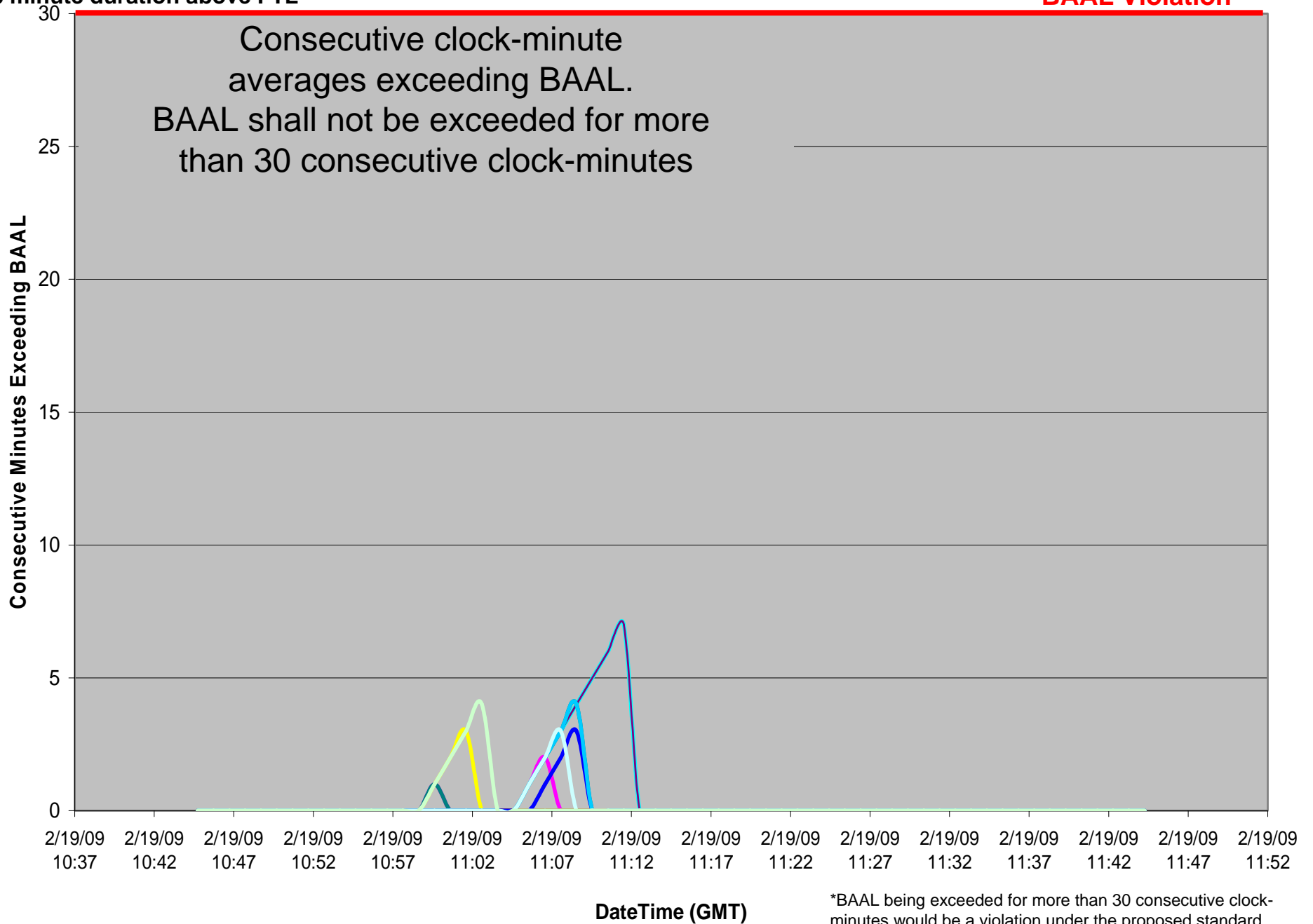


2/19/2009 6:06-6:12 EST

6 minute duration above FTL

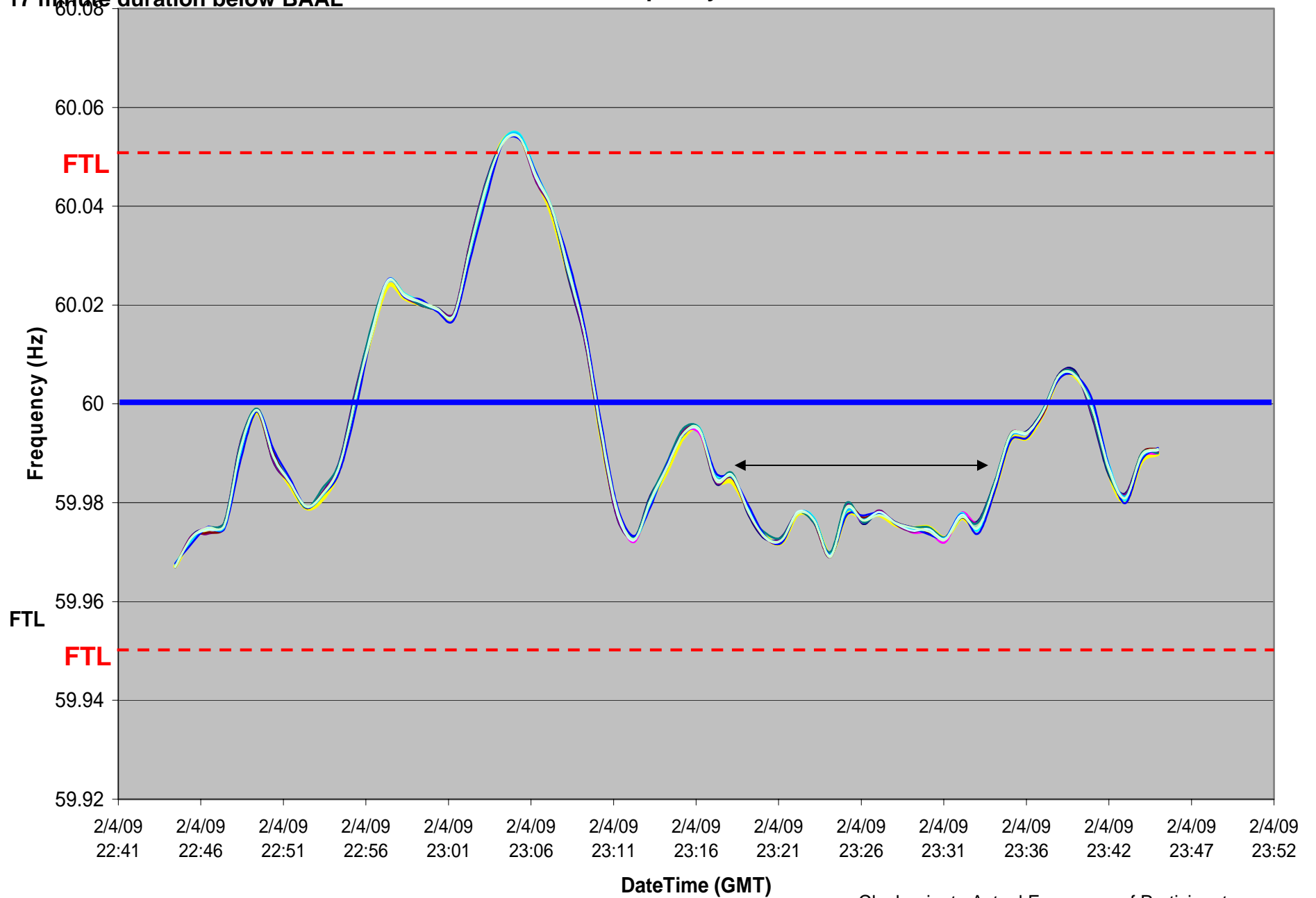
Consecutive Minutes Exceeding BAAL

BAAL Violation*



2/4/2009 18:19-18:36 EST
17 minute duration below BAAL

Frequency



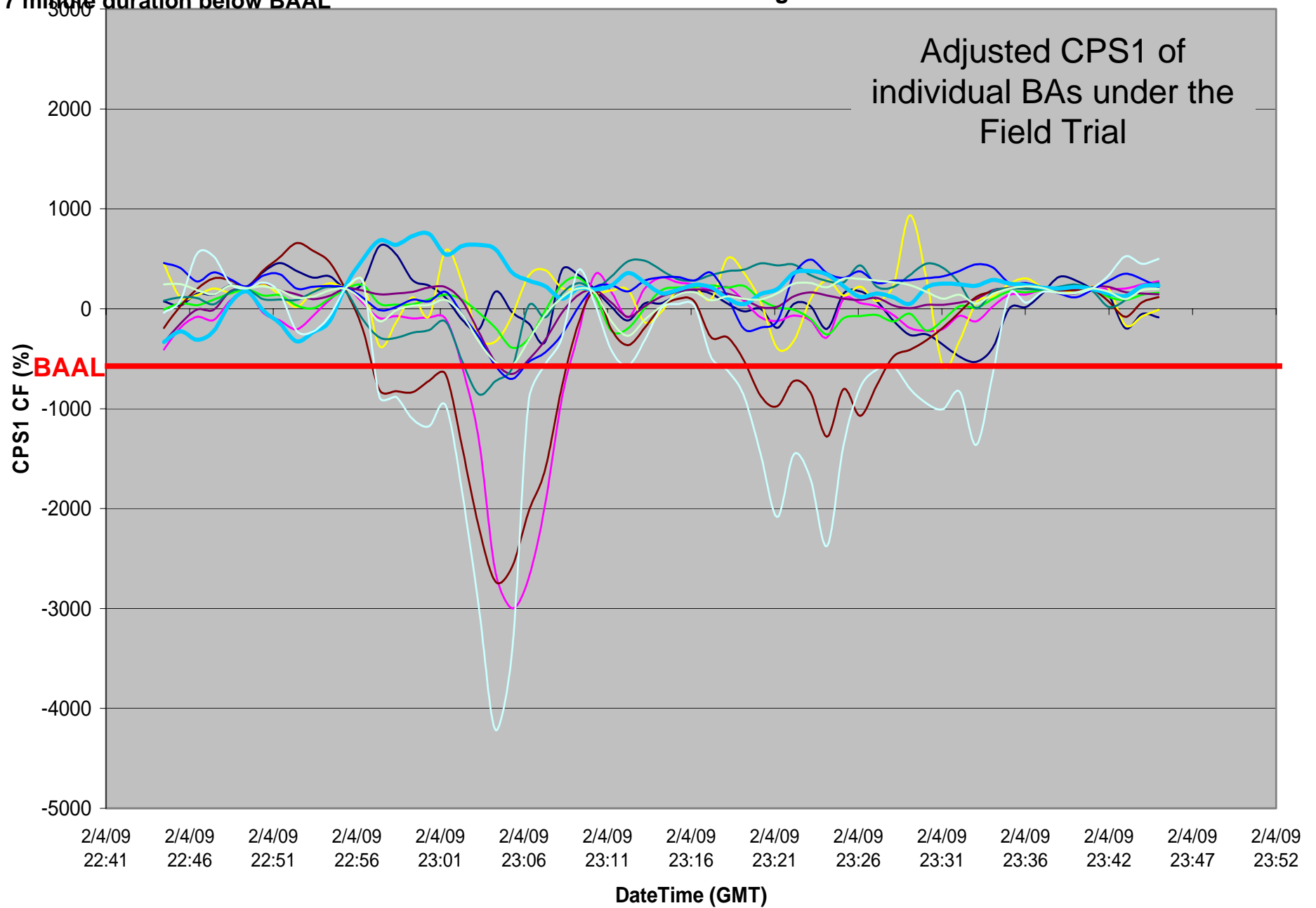
Clock-minute Actual Frequency of Participants

2/4/2009 18:19-18:36 EST

17 minute duration below BAAL

ACPS1 One-Minute Averages

Adjusted CPS1 of
individual BAs under the
Field Trial

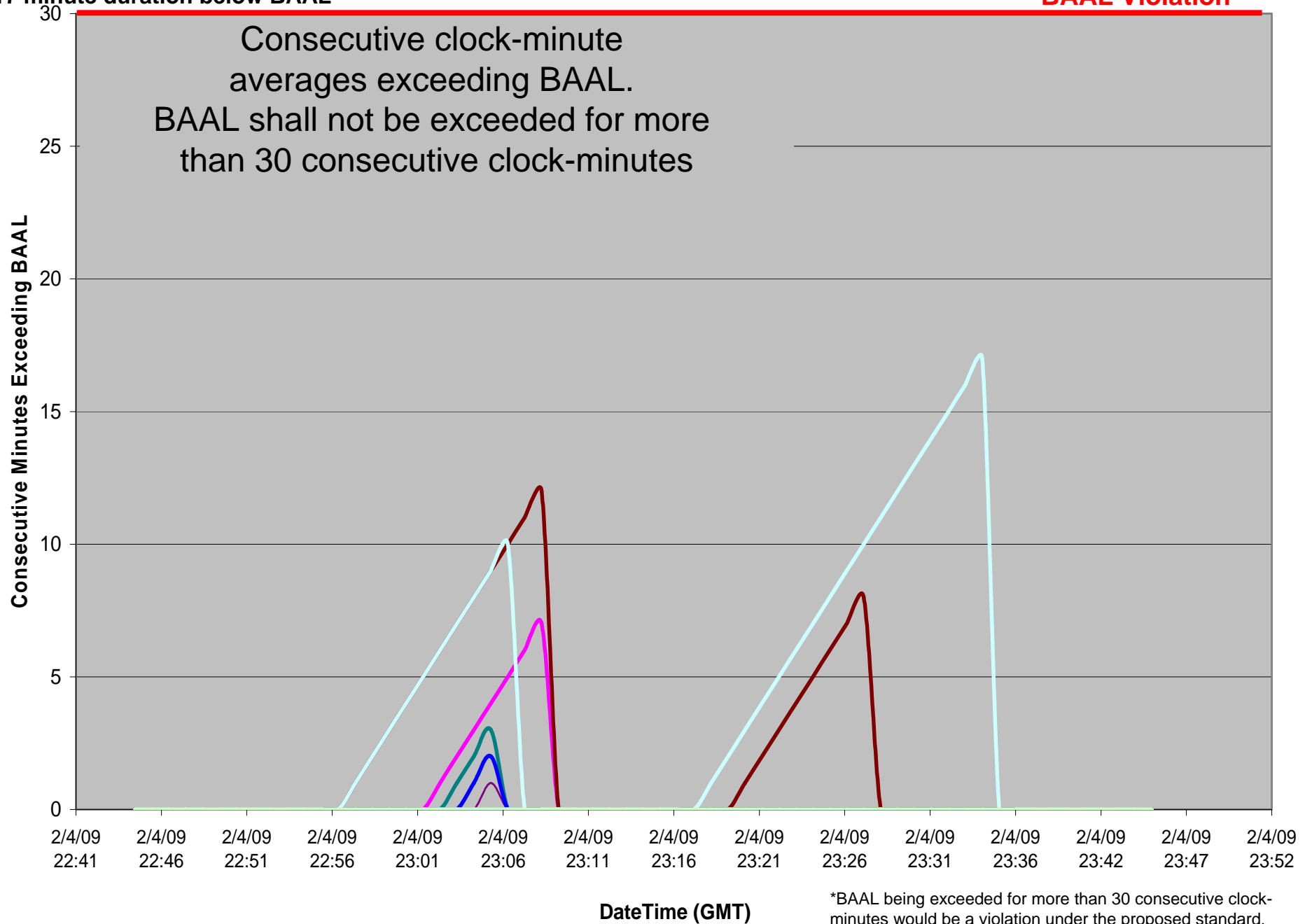


2/4/2009 18:19-18:36 EST

17 minute duration below BAAL

Consecutive Minutes Exceeding BAAL

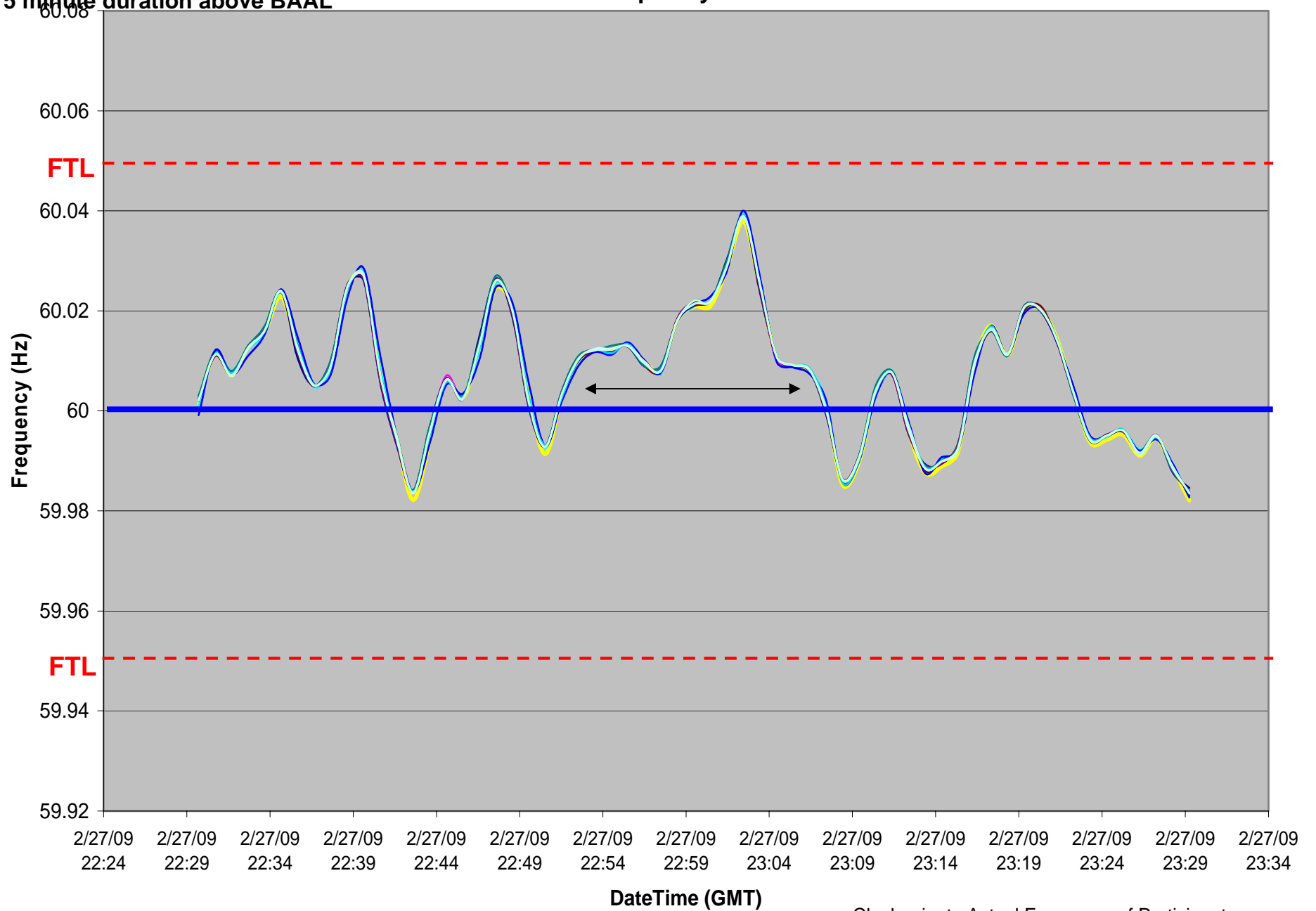
BAAL Violation*



2/27/2009 17:52-18:07 EST

15 minute duration above BAAL

Frequency

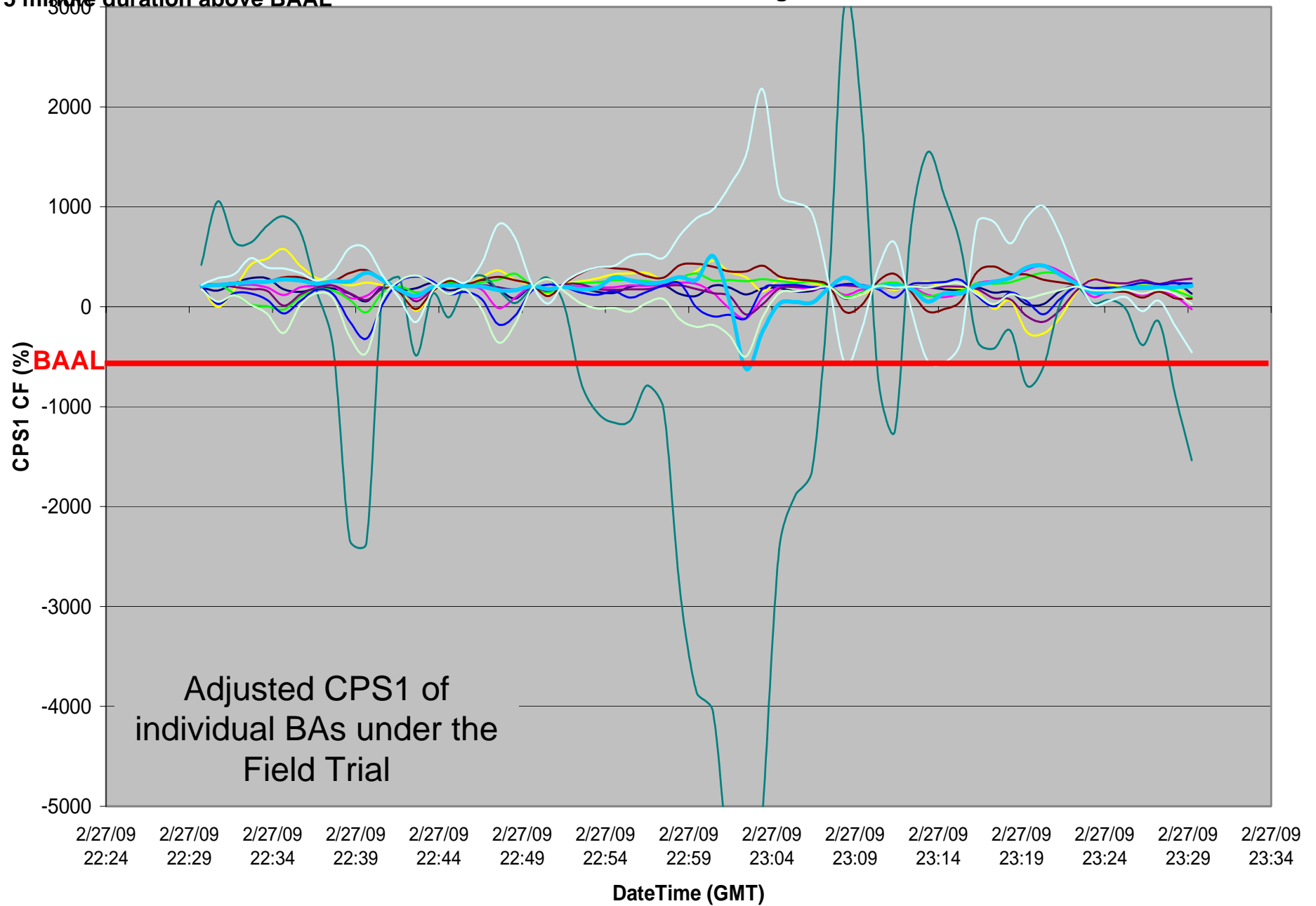


Clock-minute Actual Frequency of Participants

2/27/2009 17:52-18:07 EST

15 minute duration above BAAL

ACPS1 One-Minute Averages

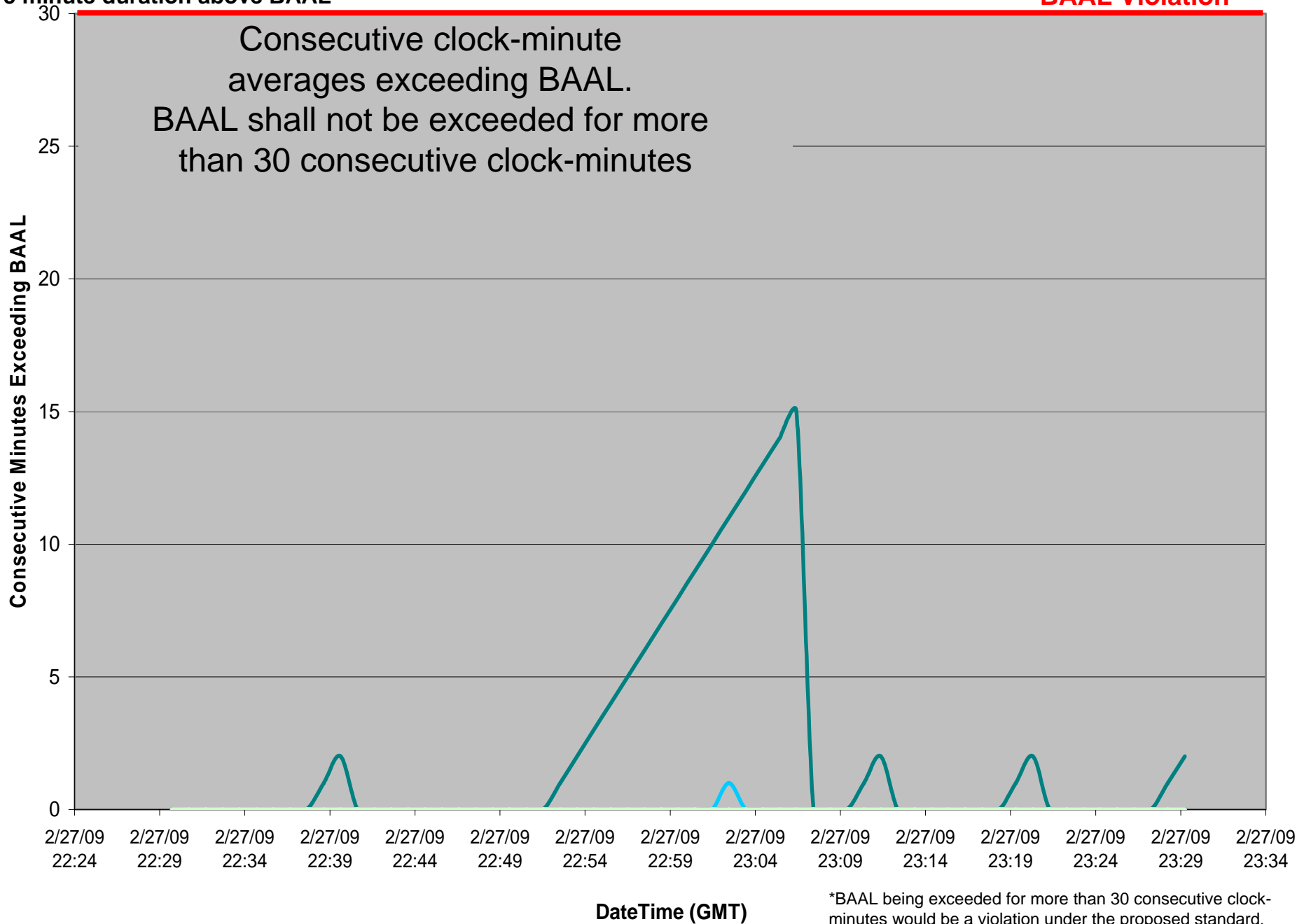


2/27/2009 17:52-18:07 EST

15 minute duration above BAAL

Consecutive Minutes Exceeding BAAL

BAAL Violation*



Balancing Authority ACE Limit Proof-of-Concept Field Trial

Discussion

Doug Hils

Reliability-Based Control Standard Drafting Team

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