

Balancing Authority ACE Limit Proof-of-Concept Field Trial

Update Discussion
December 17, 2007

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Reliability-Based Control Standard Drafting Team

Balancing Authority ACE Limit Proof-of-Concept Field Trial

Balancing Authorities under Field Trial	Region	RC	2007 Bias (MW/0.1Hz)	Projected Peak (MWH)
AEP - Central and Southwest	SPP	SPP	-100.2	10,024
Alliant Energy (ALTE)	MRO	MISO	-42	2,989
Alliant Energy (ALTW)	MRO	MISO	-57	3,778
Duke Energy - Cinergy BA	RFC	MISO	-130	12,704
East Kentucky Power Cooperative	SERC	TVA	-36	2,901
Entergy Services Inc	SERC	Entergy	-223.46	22,346
Manitoba Hydro	MRO	MISO	-45	4,181
Michigan Electric Coordinated Systems	RFC	MISO	-231	23,077
Northern Indiana Public Service	RFC	MISO	-59	3,547
PJM	RFC	PJM	-1370	136,962
Santee Cooper	SERC	VACAR	-87.1	5,611
Southern Company	SERC	SOCO	-454	45,424
Tennessee Valley Authority	SERC	TVA	-326.78	32,678
Wisconsin Energy Corporation	RFC	MISO	-73	7,238
				313,460
ERCOT	ERCOT	ERCOT	-636	63,312

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 - OCTOBER '07 Performance under BAL-007		OCTOBER 2007 Performance under BAL-007		
	Max MinCtLow	Max MinCtHigh	Max MinCtLow	Max MinCtHigh	
BA1	13	15	9	6	MinCtLow = Count of consecutive clock-minutes BAAL_Low was exceeded
BA2	16	22	10	12	
BA3	17	18	7	10	
BA4	20	16	7	11	
BA5	22	38	11	16	
BA6	24	29	15	13	MinCtHigh = Count of consecutive clock-minutes BAAL_High was exceeded
BA7	24	33	14	12	
BA8	25	31	21	14	
BA9	26	16	12	6	
BA10	26	23	15	10	
BA11	27	40	20	19	
BA12	28	43	16	13	
BA13	28	26	15	16	
BA14	33	24	11	9	

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 - NOVEMBER '07 Performance under BAL-007		NOVEMBER 2007 Performance under BAL-007		
	Max MinCtLow	Max MinCtHigh	Max MinCtLow	Max MinCtHigh	
BA1	13	15	5	13	MinCtLow = Count of consecutive clock- minutes BAAL_Low was exceeded
BA2	16	22	10	8	
BA3	17	18	10	8	
BA4	20	16	5	5	
BA5	22	38	13	11	MinCtHigh = Count of consecutive clock- minutes BAAL_High was exceeded
BA6	24	29	13	14	
BA7	24	33	10	11	
BA8	25	31	15	10	
BA9	26	16	14	10	
BA10	26	23	4	5	
BA11	27	40	21	18	
BA12	28	43	9	14	
BA13	28	26	17	19	
BA14	33	24	15	7	

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	50	26	15	8	3						5
2006	9	38	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	48	24	12	6	2	1					6
2007	7	32	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
SUM		1349	661	288	146	67	26	11	7	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	39	22	14	8	3						5
2006	9	29	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	19	10	2								3
2007	7	11	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
SUM		714	351	151	78	39	15	6	4	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_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						
2006	1	21	7	2	1	1						
2006	2	39	17	4	2	1						
2006	3	33	15	2	1							
2006	4	46	25	9	4	2						
2006	5	33	19	8	5	1						
2006	6	19	9	5	1							
2006	7	22	11	6	1							
2006	8	39	22	14	8	3						
2006	9	29	17	8	2	2						
2006	10	24	14	2	2							
2006	11	19	8	4	3	1						
2006	12	10	5	2	1							
2007	1	14	7	3	2	1						
2007	2	22	8	1								
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	19	10	2								3
2007	7	11	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
SUM		714	351	151	78	39	15	6	4	2	2	

Since the start of the Field Trial in July 2005, FTL_{Low} has been exceeded 0.20% of the clock-minutes.

Approximately 43.8% of the FTL_{Low} exceedances occurred during time-error correction at 59.98 Hz where the frequency error did not exceed -0.05 Hz, indicating that FTL_{Low} exceedances could be reduced by over 43% if time-error correction was eliminated.

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.

FTL_{Low} Exceedances by Hour

July 2005 – November 2007

Clock-Minutes of Actual Frequency <= FTL _{Low}											
Hour	>=1 Min	>=2 Min	>=3 Min	>=4 Min	>=5 Min	>=6 Min	>=7 Min	>=8 Min	>=9 Min	>=10 Min	Max_Duration
0	78	40	17	9	4	2					6
1	44	19	9	5	1						5
2	15	7	2	1							4
3	11	5	1								3
4	14	5	2								3
5	124	77	40	21	10	4	2	2			8
6	111	43	16	7	4	3	2	1	1	1	15
7	72	36	13	2	1						5
8	80	43	18	9	5	2	1	1	1	1	10
9	46	14	8	2							4
10	29	12	4	3							4
11	47	22	9	5	1	1	1				7
12	38	9	1	1							4
13	24	9	2	1							4
14	27	11	2								3
15	13	7	2								3
16	15	6	4	2	1	1					6
17	36	14	5	2							4
18	34	15	4	3							4
19	29	9	4	3	1						5
20	63	28	12	6	4						5
21	112	65	28	18	8	2	1				7
22	178	107	61	38	22	9	4	3	2	1	11
23	109	58	24	8	5	2					6
Sum	1349	661	288	146	67	26	11	7	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.

FTL_{Low} Exceedances by Hour at 60 Hz Scheduled Frequency

July 2005 – November 2007

Clock-Minutes of Actual Frequency <= FTL _{Low} at 60 Hz Scheduled Frequency											
Hour	>=1 Min	>=2 Min	>=3 Min	>=4 Min	>=5 Min	>=6 Min	>=7 Min	>=8 Min	>=9 Min	>=10 Min	Max_Duration
0	26	14	7	4	1						5
1	13	5	2	1							4
2	5	4	1								3
3	2	1									2
4	3	1									2
5	123	77	40	21	10	4	2	2			8
6	109	43	16	7	4	3	2	1	1	1	15
7	42	22	5								3
8	36	16	7	4	2	1					6
9	26	13	7	1							4
10	18	7	2	1							4
11	20	7	3	3	1	1	1				7
12	7	2									2
13	5	2	1	1							4
14	5	1									2
15	4	2									2
16	4	2	1	1	1	1					6
17	22	9	2								3
18	20	8	1								3
19	13	7	3	2	1						5
20	21	11	4	2	2						5
21	51	26	9	6	1						5
22	98	56	33	21	13	3	1	1	1	1	11
23	41	15	7	3	3	2					6
Sum	714	351	151	78	39	15	6	4	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	39	21	10	4	2	1	1	1			8
2007	4	30	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	17	7	5	2	1						5
2007	10	35	15	3	1	1						5
2007	11	24	7	5	2	1						5
SUM		800	355	167	73	32	17	13	7	1	1	

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.

Clock-Minutes of Actual Frequency >= FTL_High 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	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	20	7	4	1	1	1	1				7
2005	12	19	6	2								3
2006	1	27	15	11	6	2						5
2006	2	22	9	7	5							4
2006	3	20	8	3	2	1	1	1	1			8
2006	4	46	22	3	1	1	1	1	1			8
2006	5	38	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	21	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	39	21	10	4	2	1	1	1			8
2007	4	30	15	8	4							4
2007	5	48	20	11	7	4	4	1				7
2007	6	25	14	7	2	1	1	1				7
2007	7	19	11	7	2							4
2007	8	29	14	7	3	2						5
2007	9	16	6	5	2	1						5
2007	10	33	15	3	1	1						5
2007	11	21	6	4	2	1						5
SUM		770	347	164	73	32	17	13	7	1	1	

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.

FTL_{High} Exceedances by Hour

July 2005 – November 2007

Clock-Minutes of Actual Frequency >= FTL _{High}											
Hour	>=1 Min	>=2 Min	>=3 Min	>=4 Min	>=5 Min	>=6 Min	>=7 Min	>=8 Min	>=9 Min	>=10 Min	Max_Duration
0	28	9	2	1							4
1	7										1
2	5	4	1	1							4
3	4	1									2
4	16	6	1	1	1	1	1	1			8
5	82	37	21	7	4	2	1	1	1	1	10
6	56	23	16	10	8	3	2	2			8
7	14	3	2	1							4
8	1	1	1								3
9	6	3									2
10	8	4	2								3
11	10	3	2								3
12	6	5	2								3
13	3	1									2
14	9	7	1								3
15	5	3	2	1							4
16	18	8	2								3
17	58	33	12	6	1	1	1				7
18	38	18	11	6	3	2	2	1			8
19	4	1									2
20	32	7	2	1	1	1					6
21	181	80	37	23	9	4	4	2			8
22	136	74	39	9	4	3	2				7
23	73	24	11	6	1						5
Sum	800	355	167	73	32	17	13	7	1	1	

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.

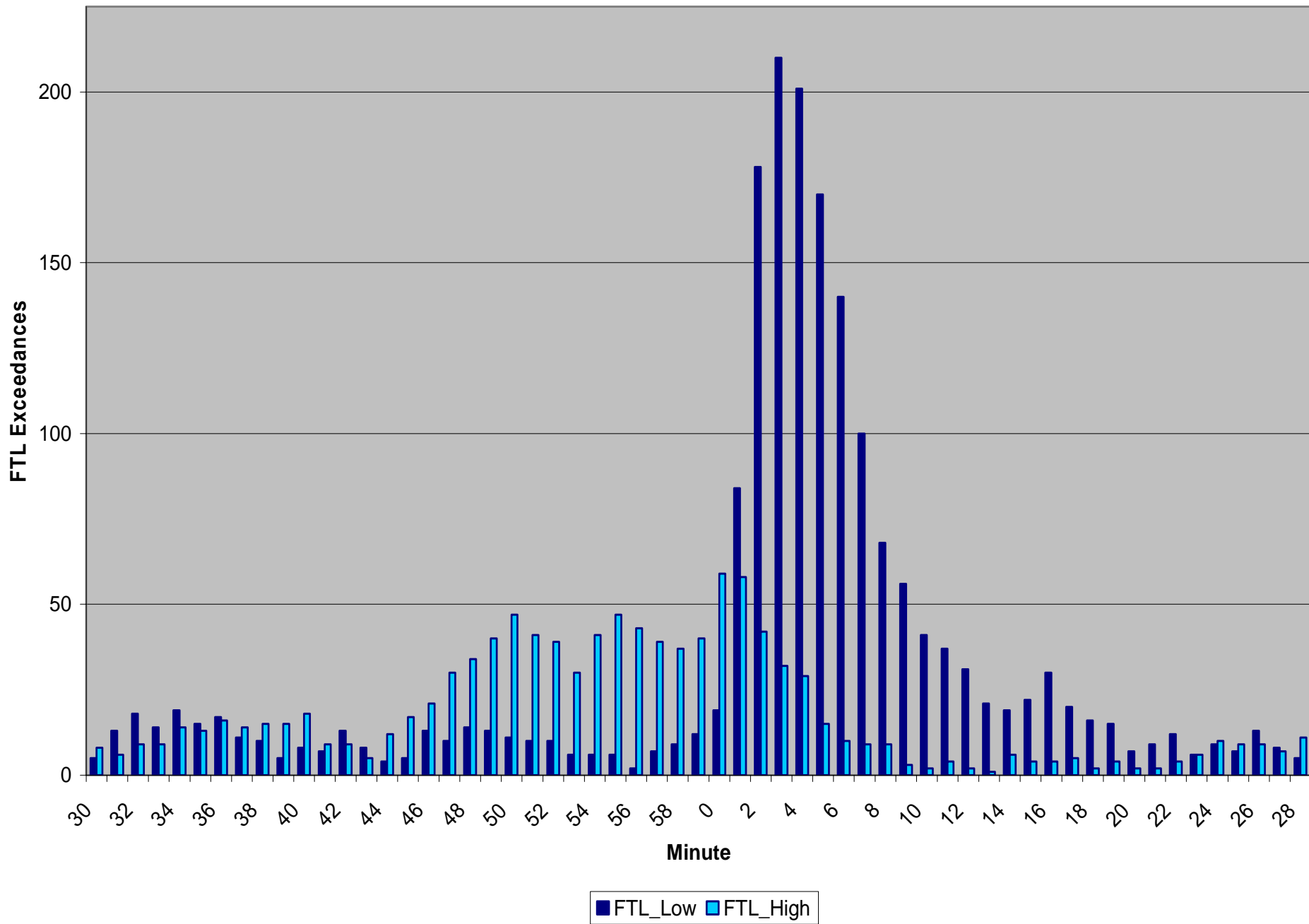
FTL_{High} Exceedances by Hour and 60 Hz Scheduled Frequency

July 2005 – November 2007

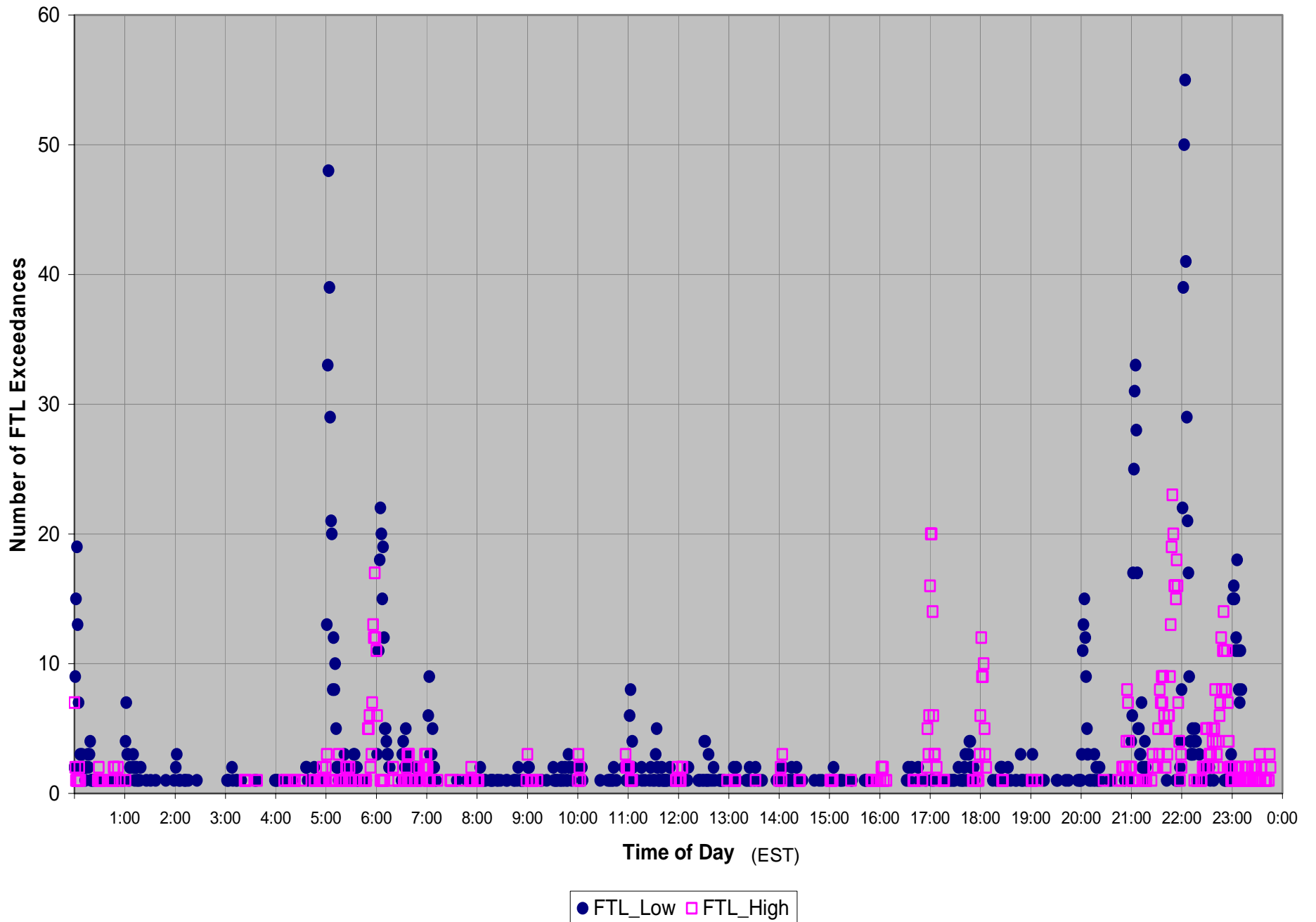
Clock-Minutes of Actual Frequency >= FTL _{High} at 60 Hz Scheduled Frequency											
Hour	>=1 Min	>=2 Min	>=3 Min	>=4 Min	>=5 Min	>=6 Min	>=7 Min	>=8 Min	>=9 Min	>=10 Min	Max_Duration
0	22	8	2	1							4
1	7										1
2	5	4	1	1							4
3	4	1									2
4	16	6	1	1	1	1	1	1			8
5	82	37	21	7	4	2	1	1	1	1	10
6	55	23	16	10	8	3	2	2			8
7	14	3	2	1							4
8	1	1	1								3
9	6	3									2
10	8	4	2								3
11	9	2	1								3
12	5	4	2								3
13	2	1									2
14	8	6									2
15	5	3	2	1							4
16	17	8	2								3
17	55	32	12	6	1	1	1				7
18	38	18	11	6	3	2	2	1			8
19	4	1									2
20	32	7	2	1	1	1					6
21	178	80	37	23	9	4	4	2			8
22	132	73	38	9	4	3	2				7
23	65	22	11	6	1						5
Sum	770	347	164	73	32	17	13	7	1	1	

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.

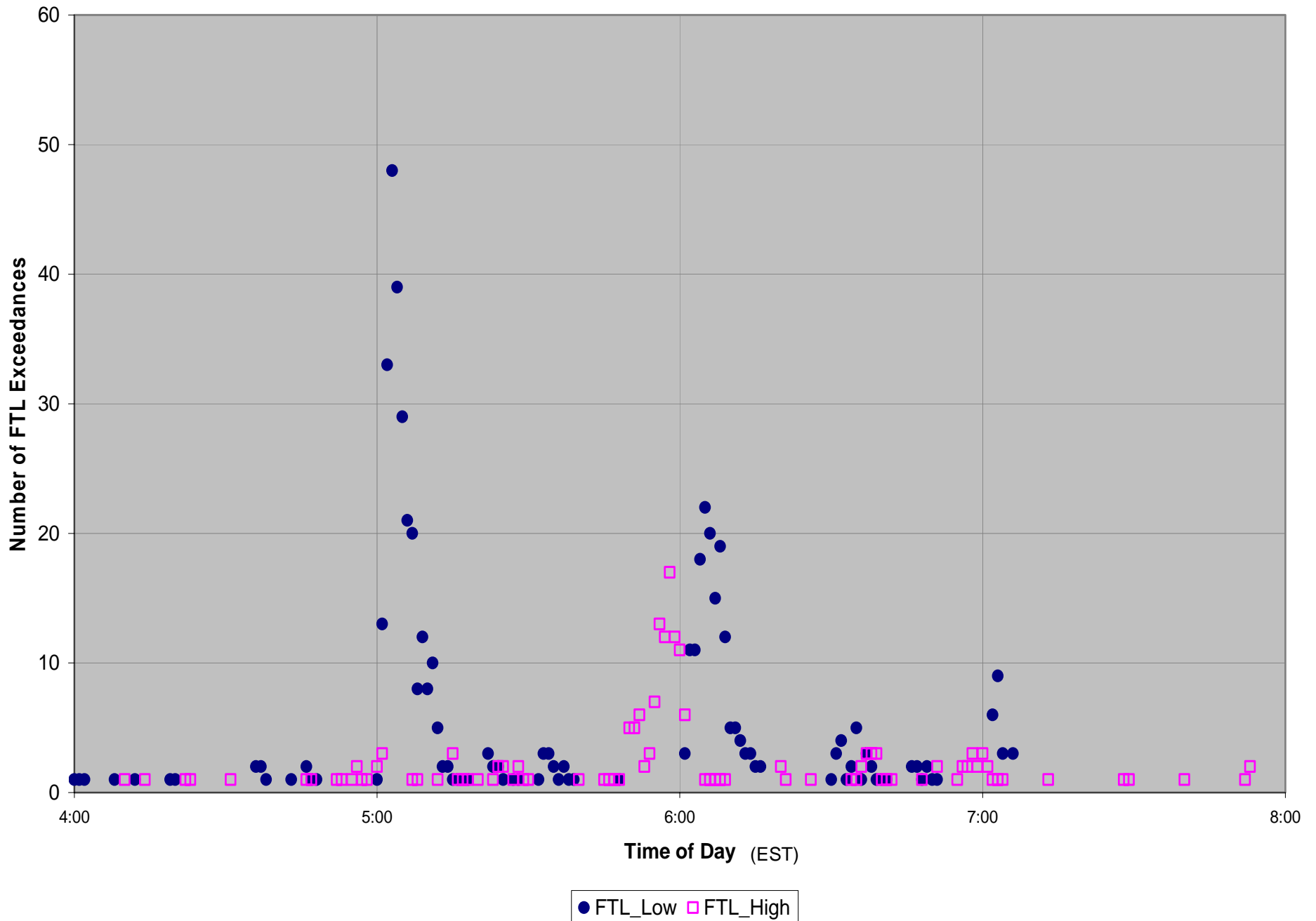
Count of FTL Exceedances by Minute (Weekdays)



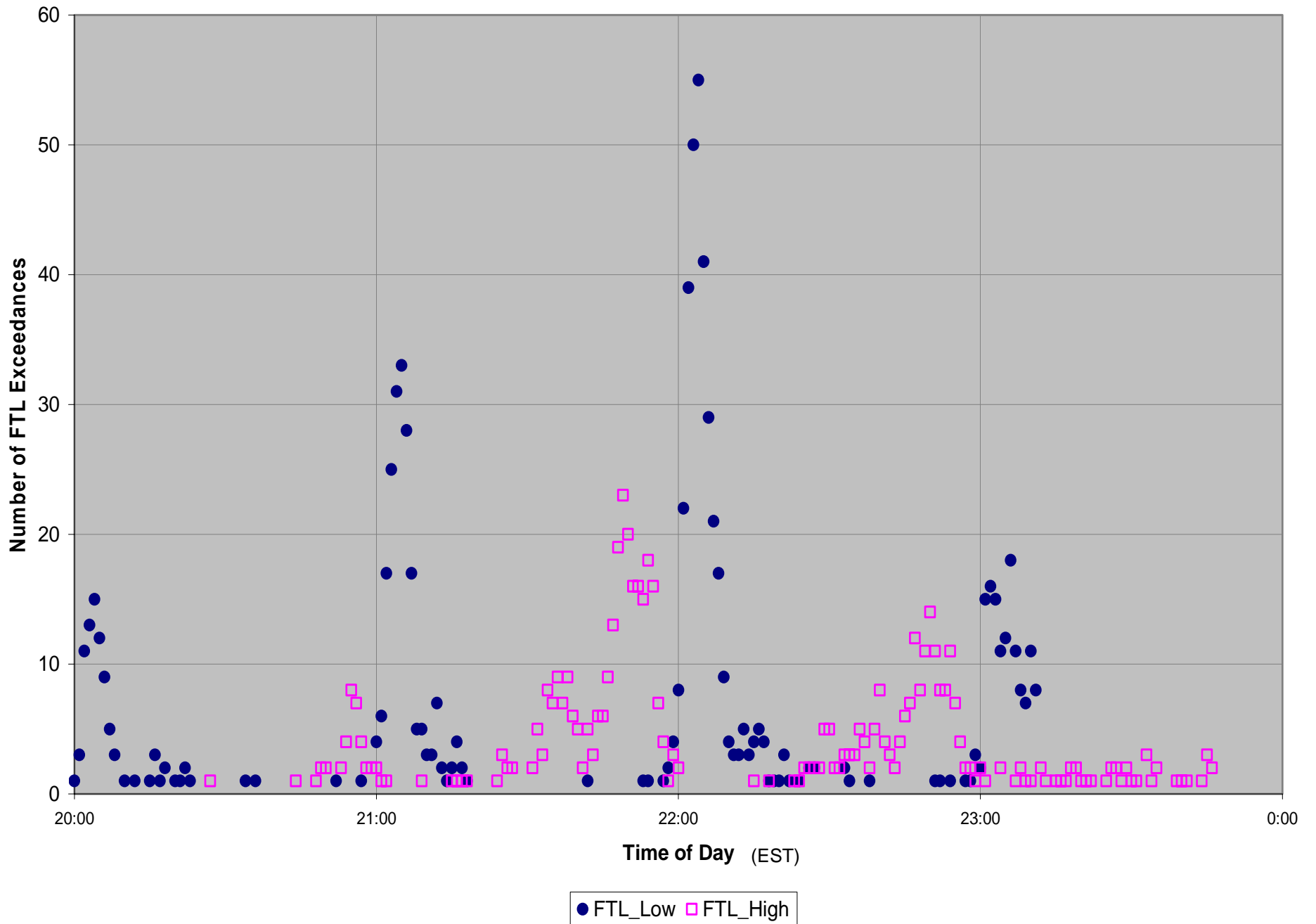
Count of Frequency Trigger Limit (FTL) Exceedances (Weekdays)



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



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



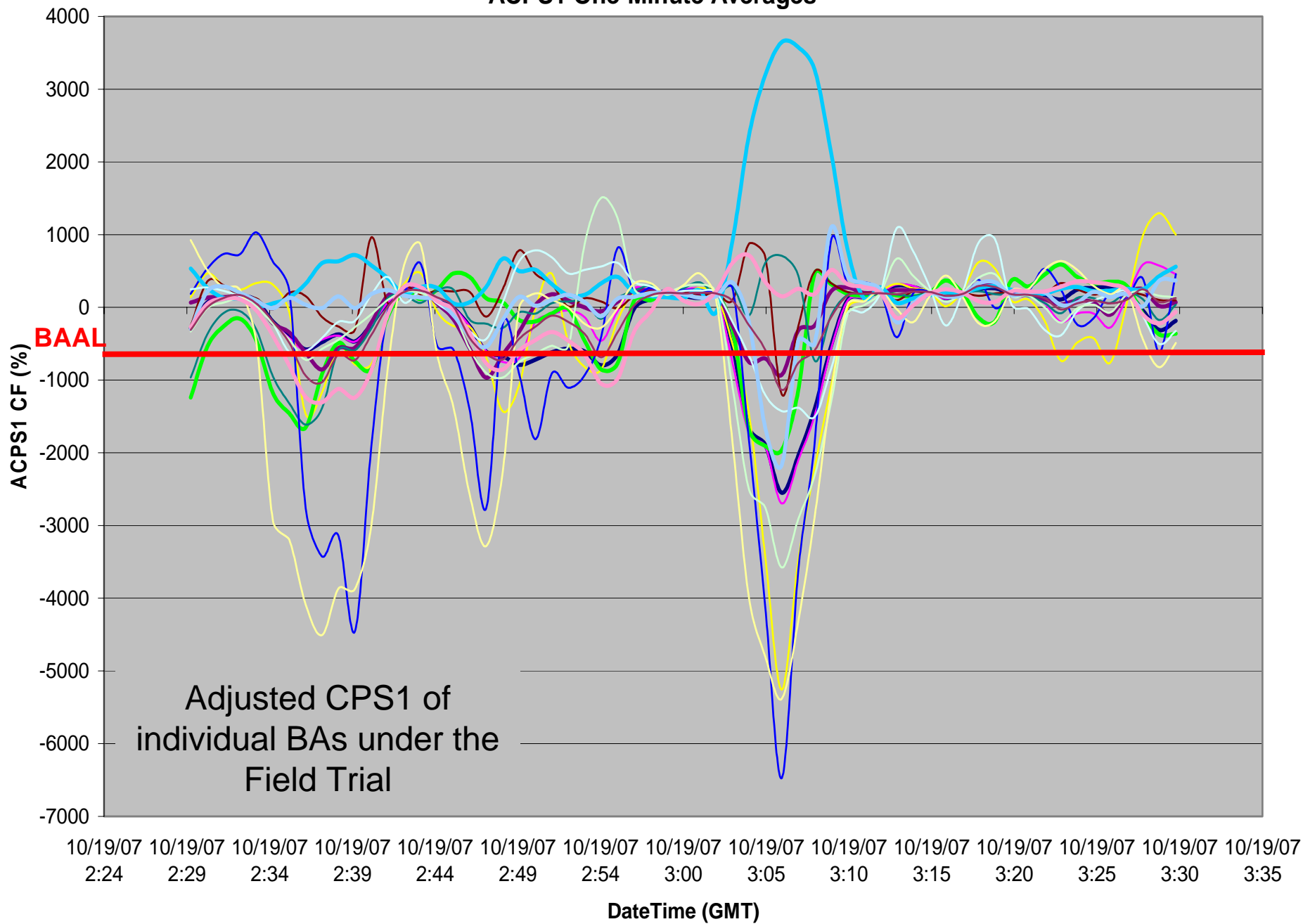
10/18/2007 22:03-22:07 EST

5 minute duration below FTL

Clock-Minute Average Frequency

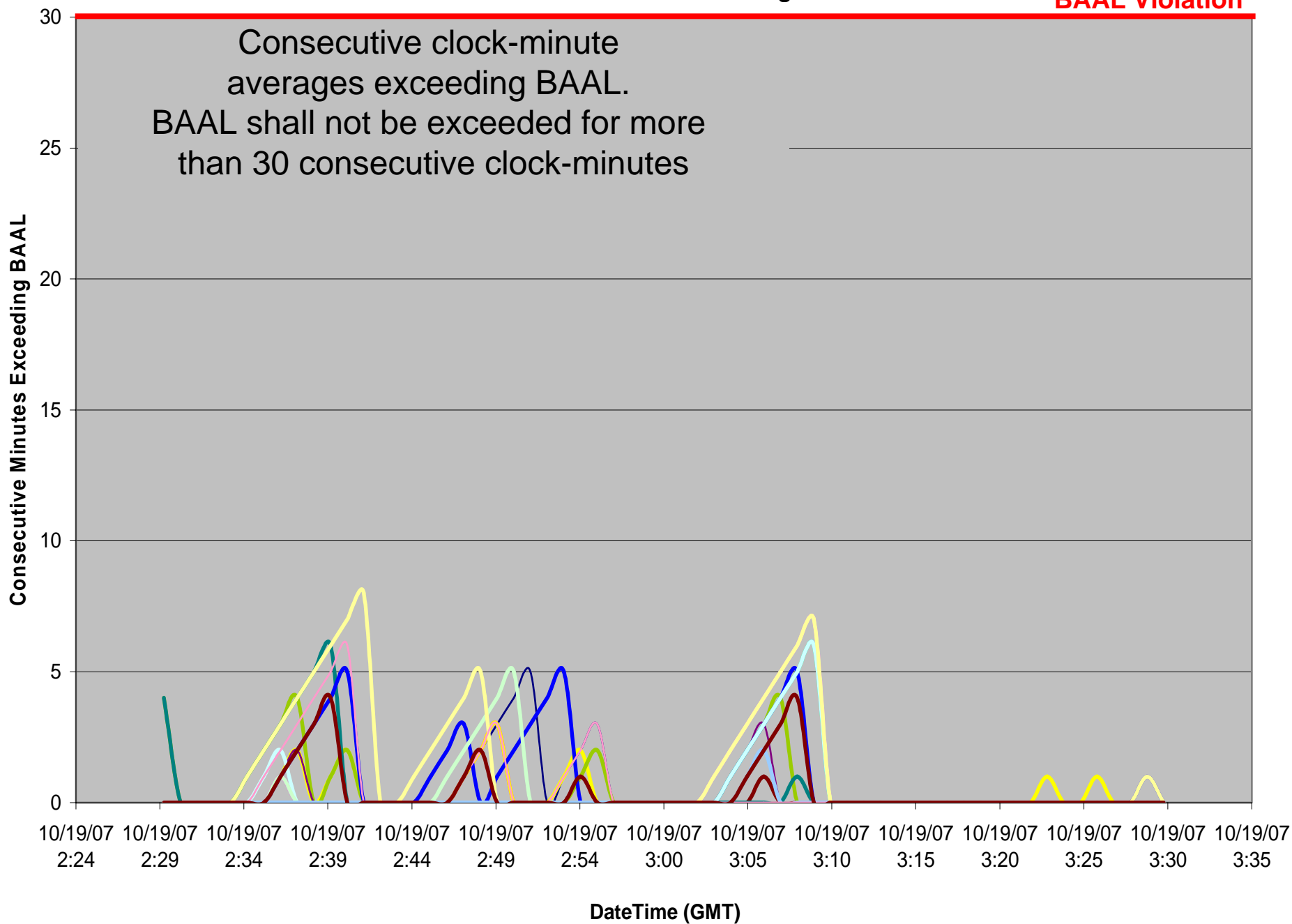


ACPS1 One-Minute Averages



Consecutive Minutes Exceeding BAAL

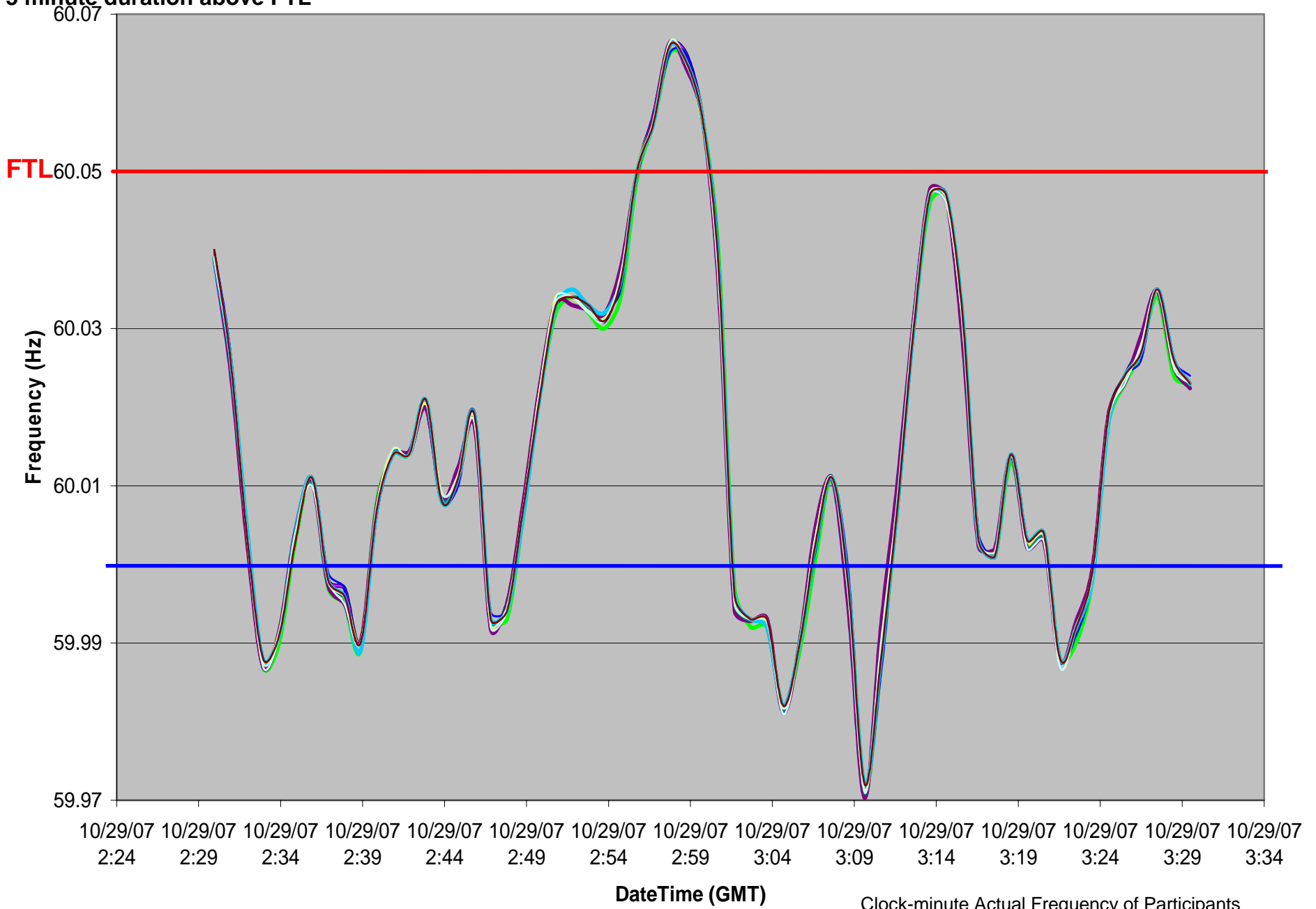
BAAL Violation



10/28/2007 21:55-21:59 EST

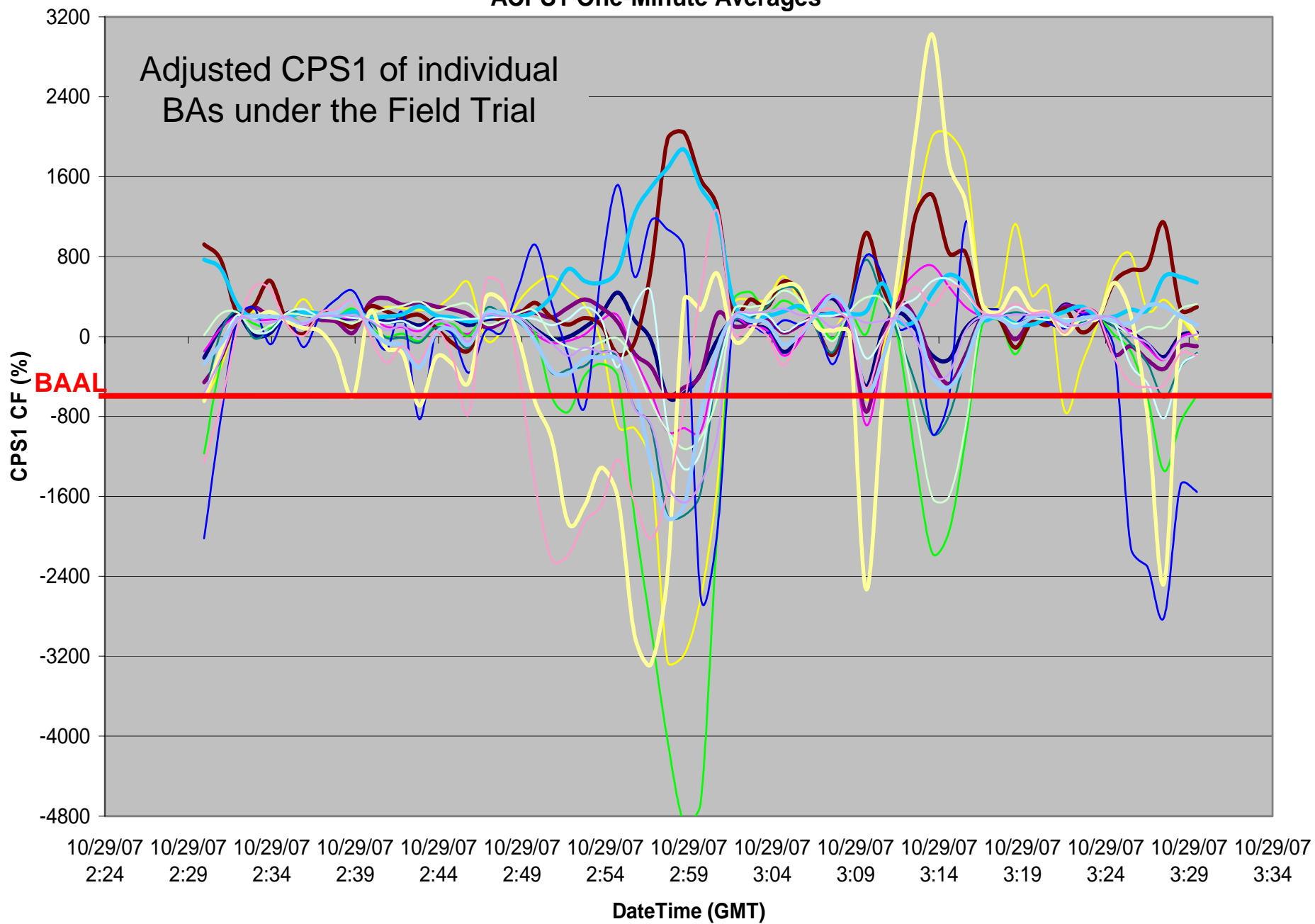
5 minute duration above FTL

Clock-Minute Average Frequency



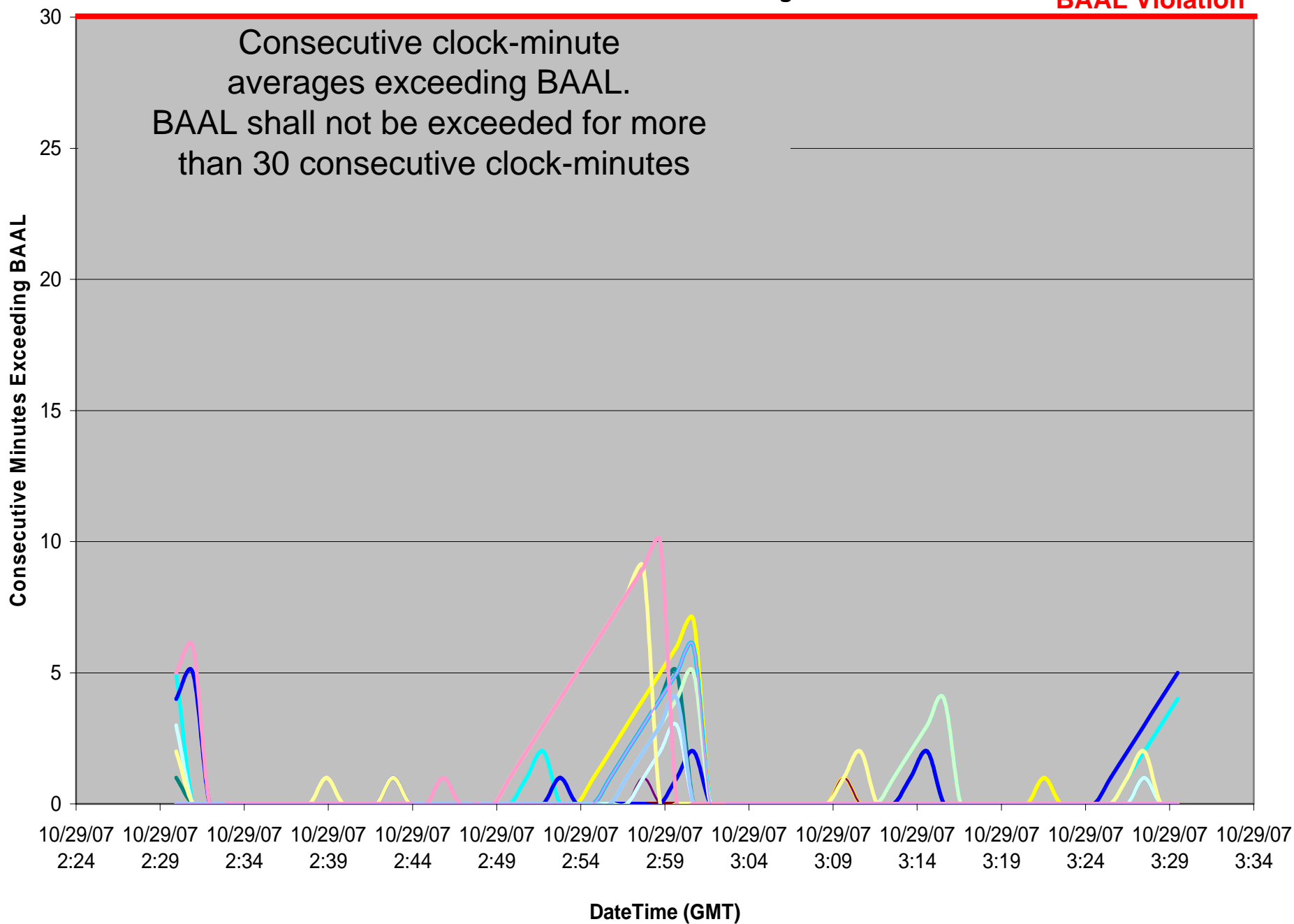
Clock-minute Actual Frequency of Participants

ACPS1 One-Minute Averages



Consecutive Minutes Exceeding BAAL

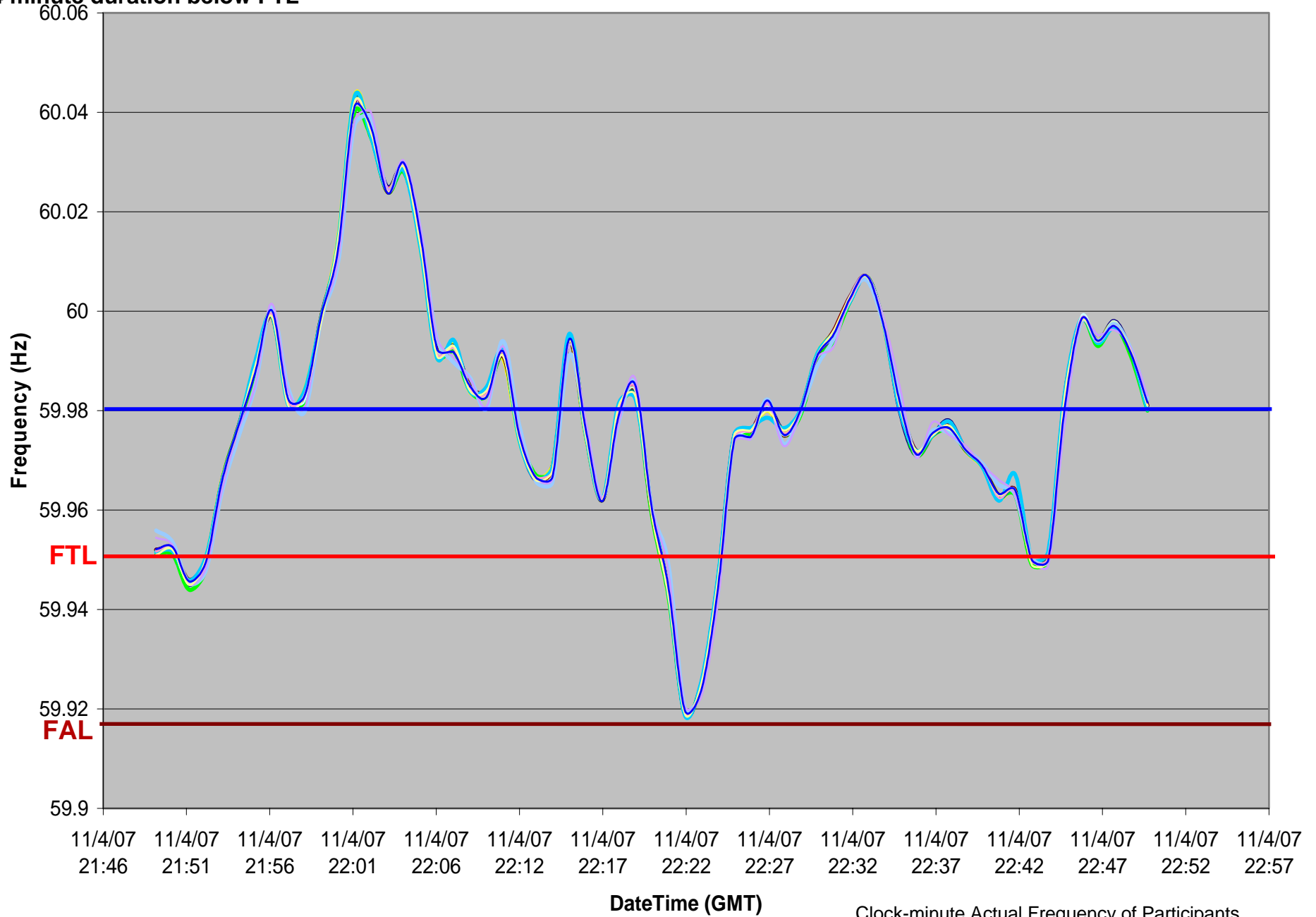
BAAL Violation



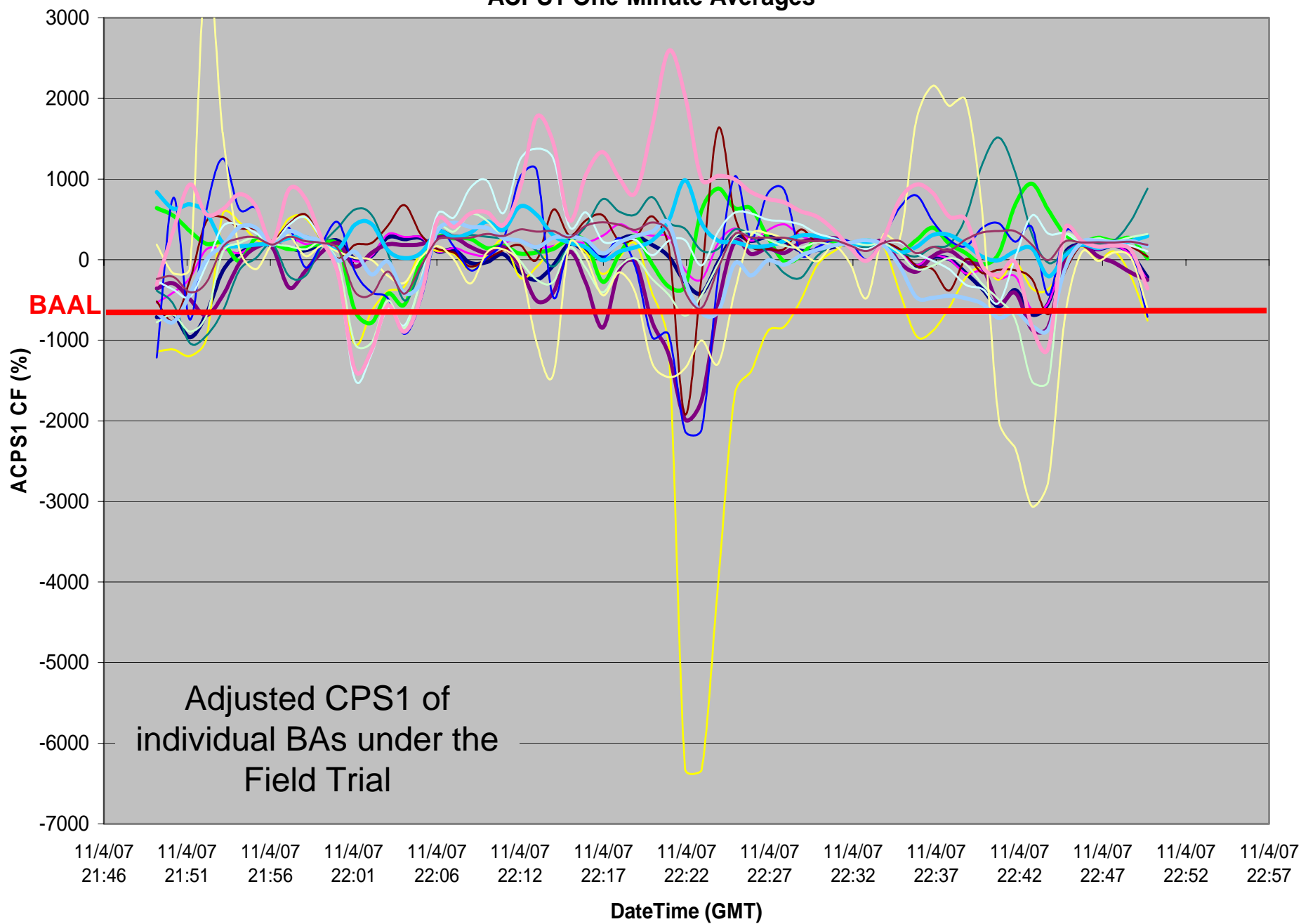
11/04/2007 17:20-17:23 EST

4 minute duration below FTL

Clock-Minute Average Frequency

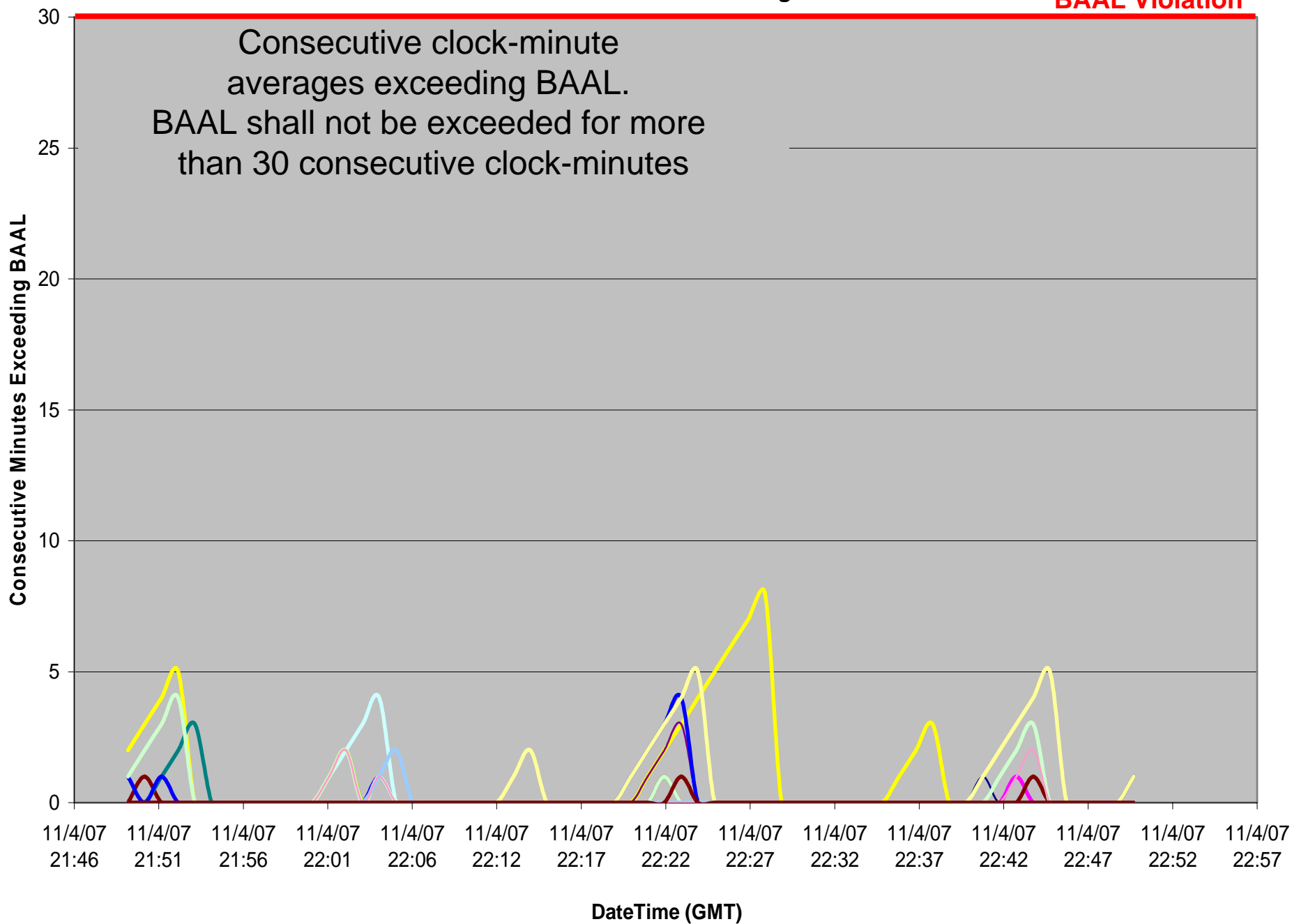


ACPS1 One-Minute Averages



Consecutive Minutes Exceeding BAAL

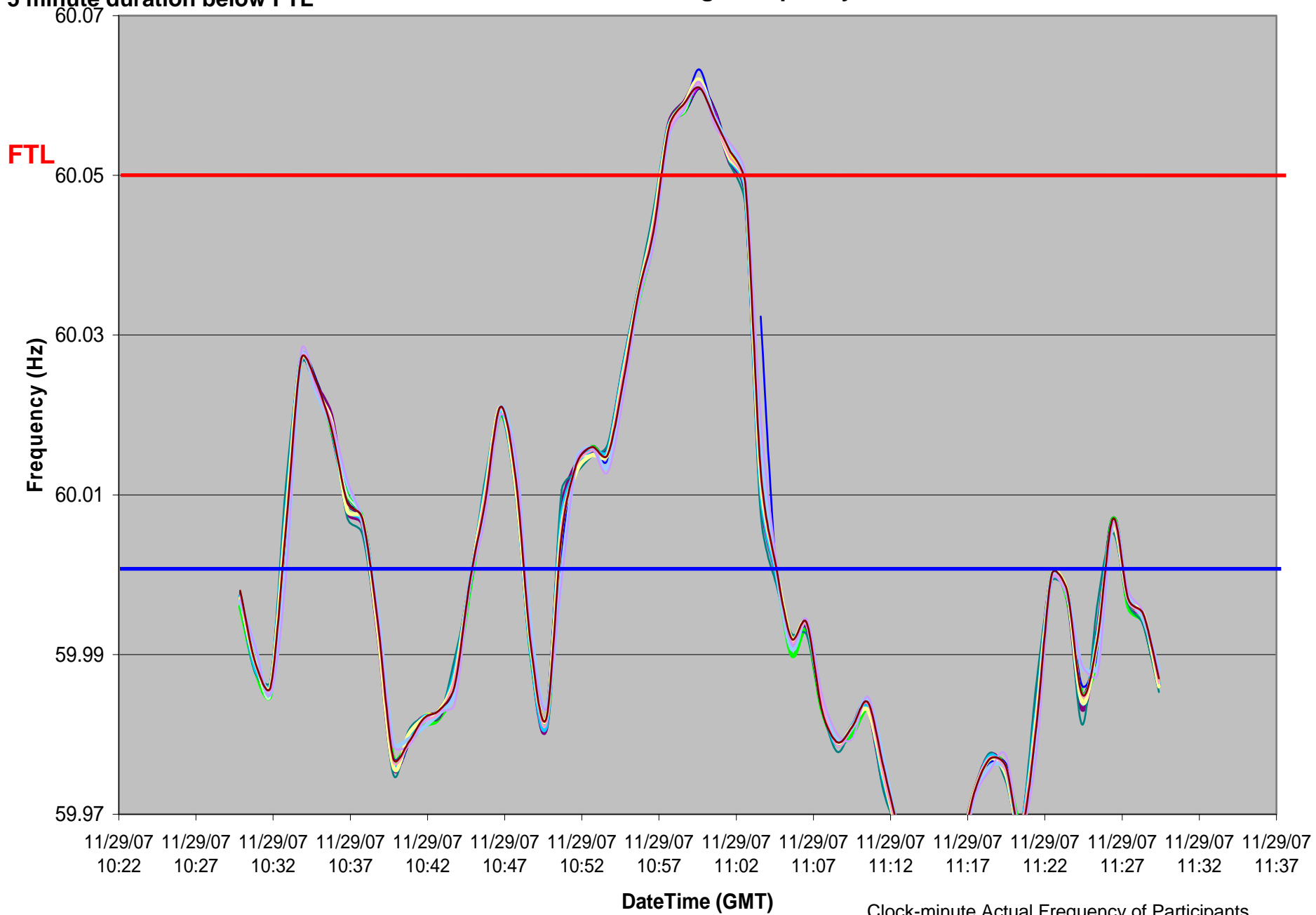
BAAL Violation



11/29/2007 5:57-6:01 EST

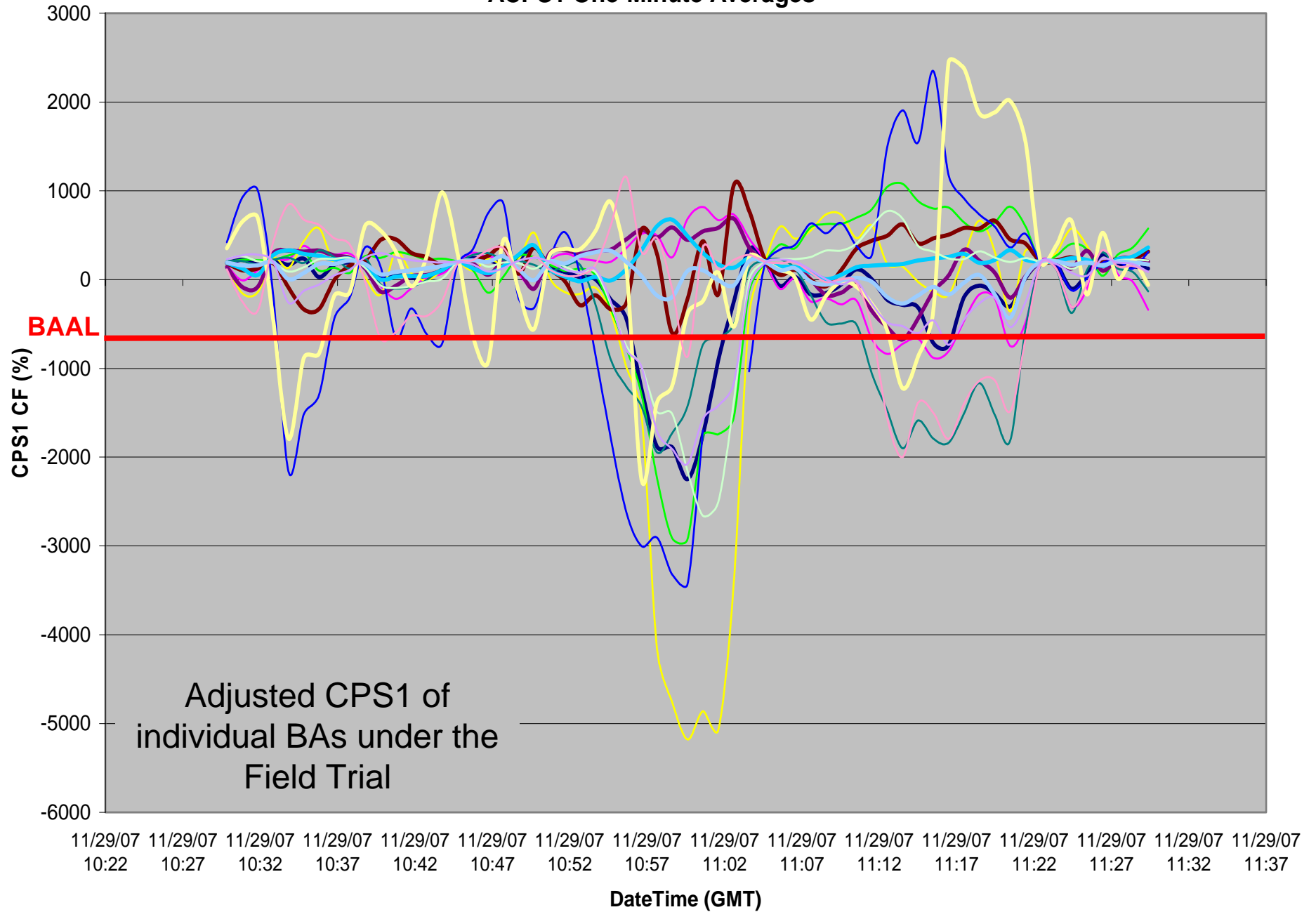
5 minute duration below FTL

Clock-Minute Average Frequency



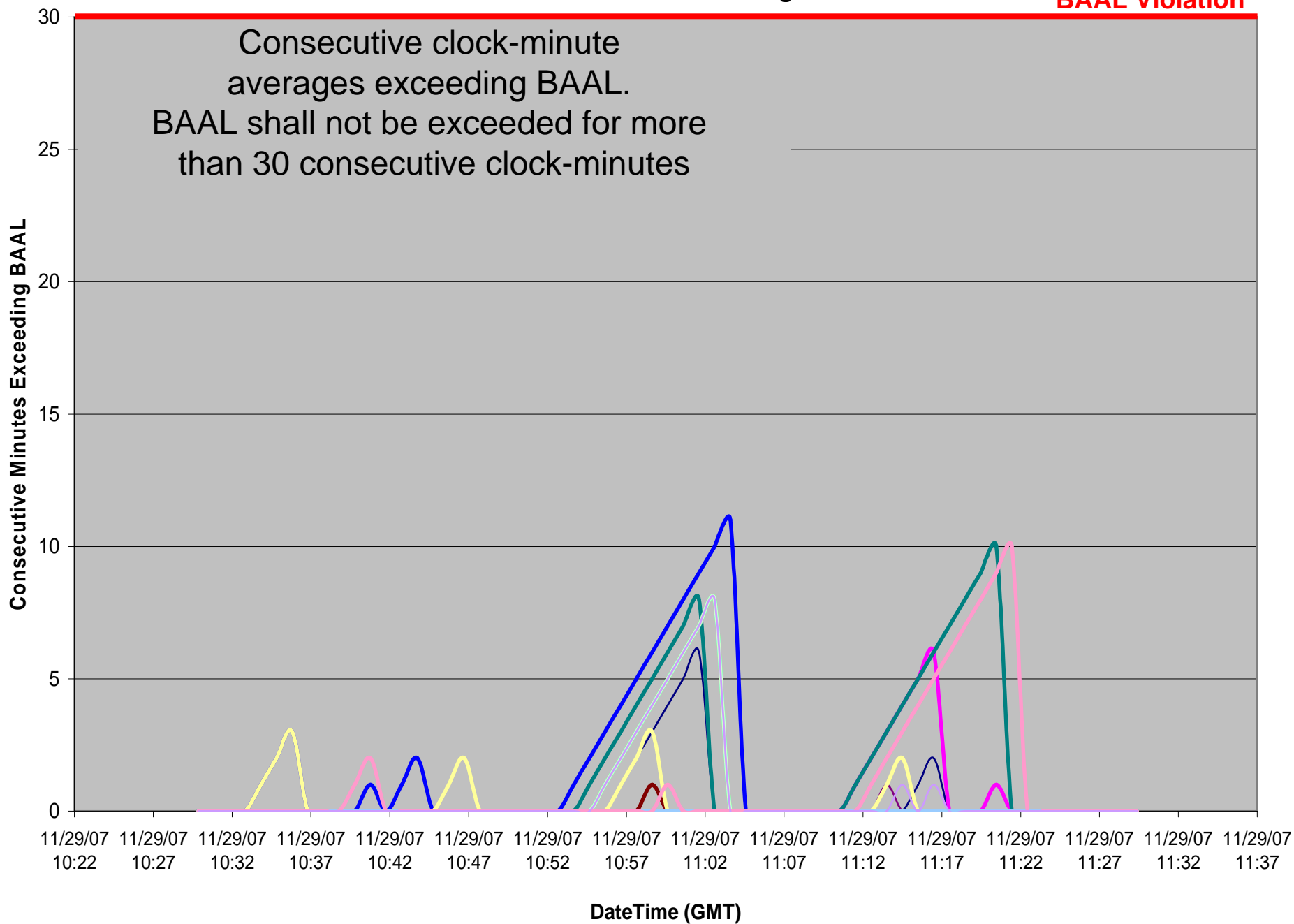
Clock-minute Actual Frequency of Participants

ACPS1 One-Minute Averages



Consecutive Minutes Exceeding BAAL

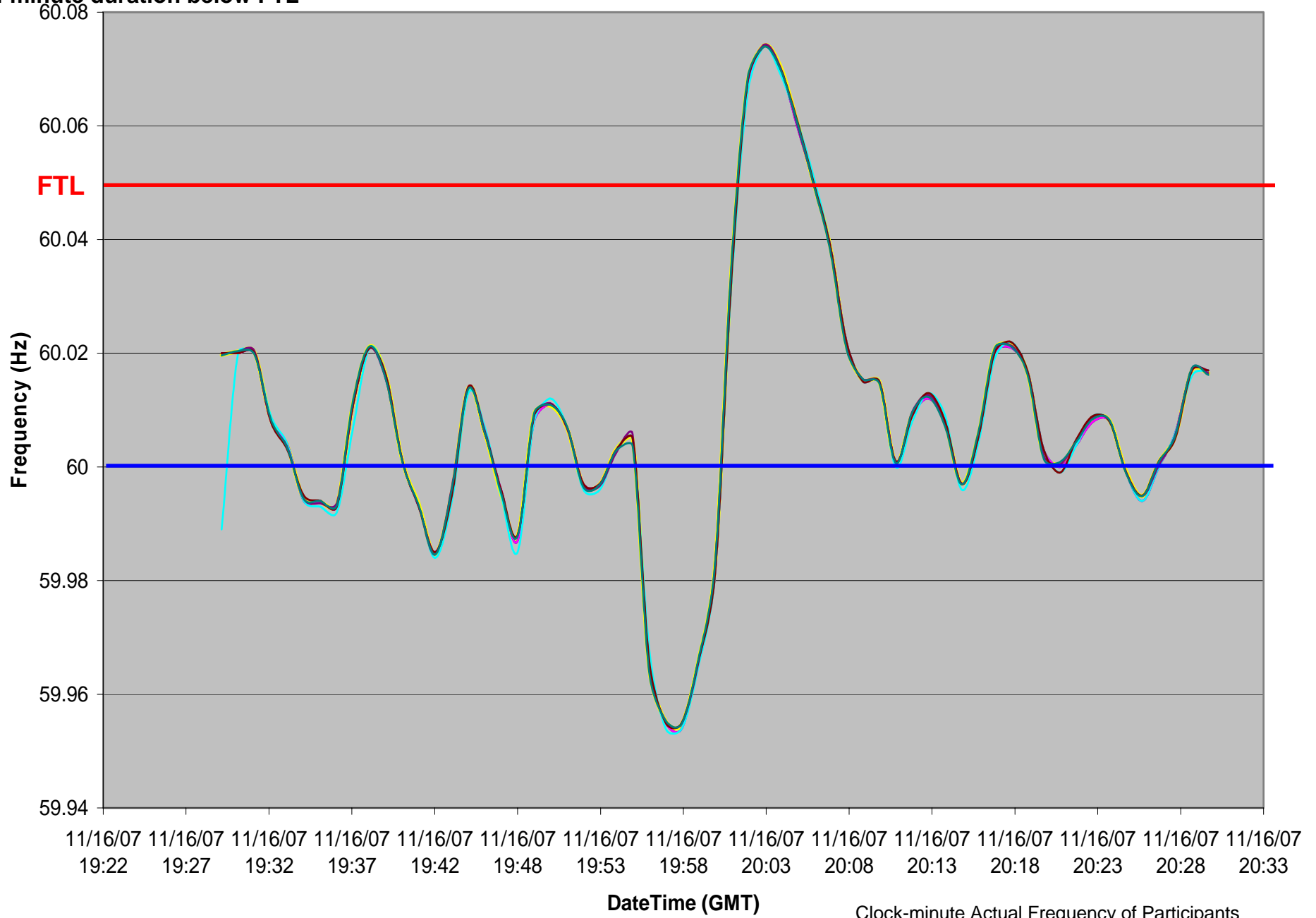
BAAL Violation



11/16/2007 15:01-15:04 EST

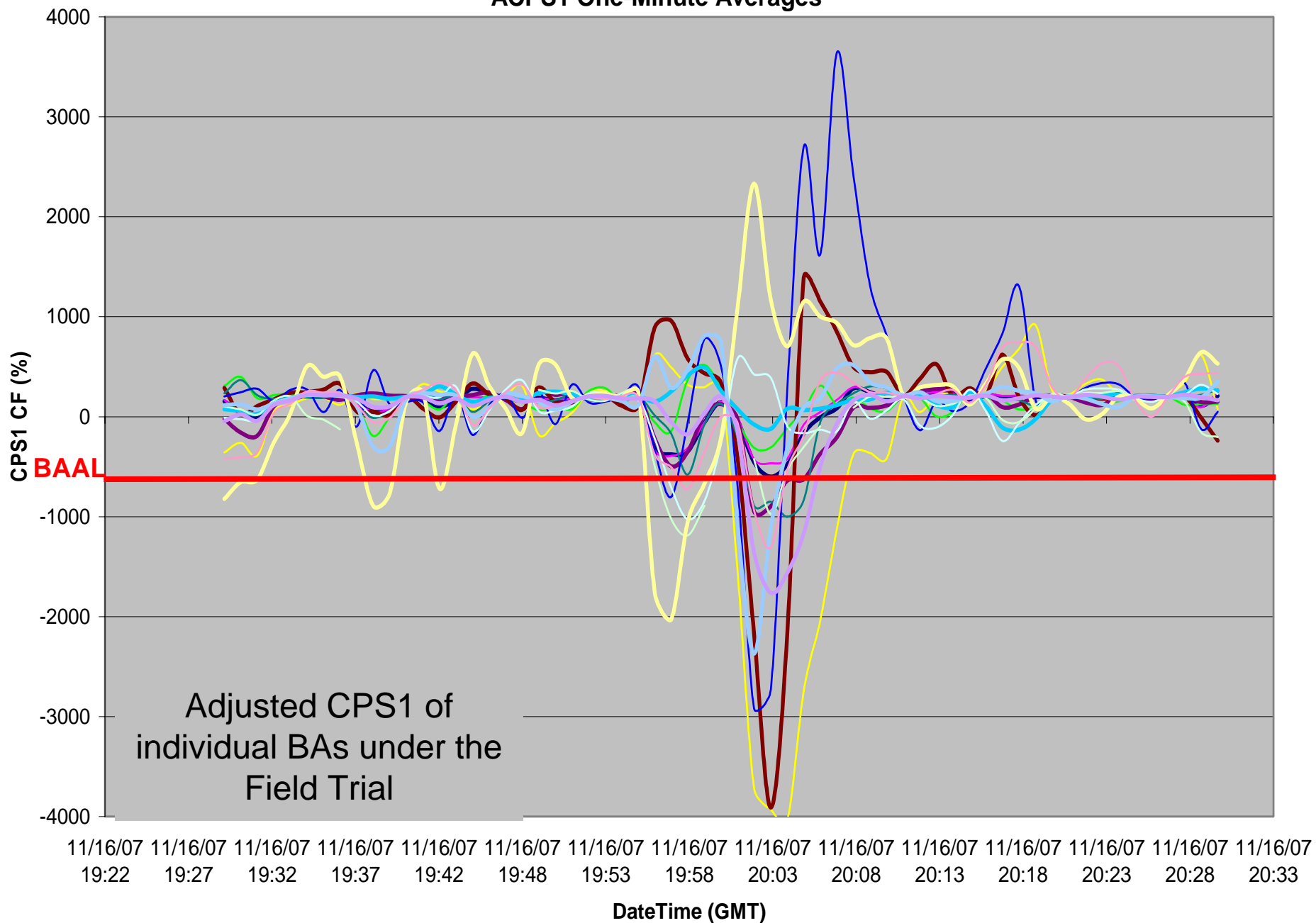
4 minute duration below FTL

Frequency



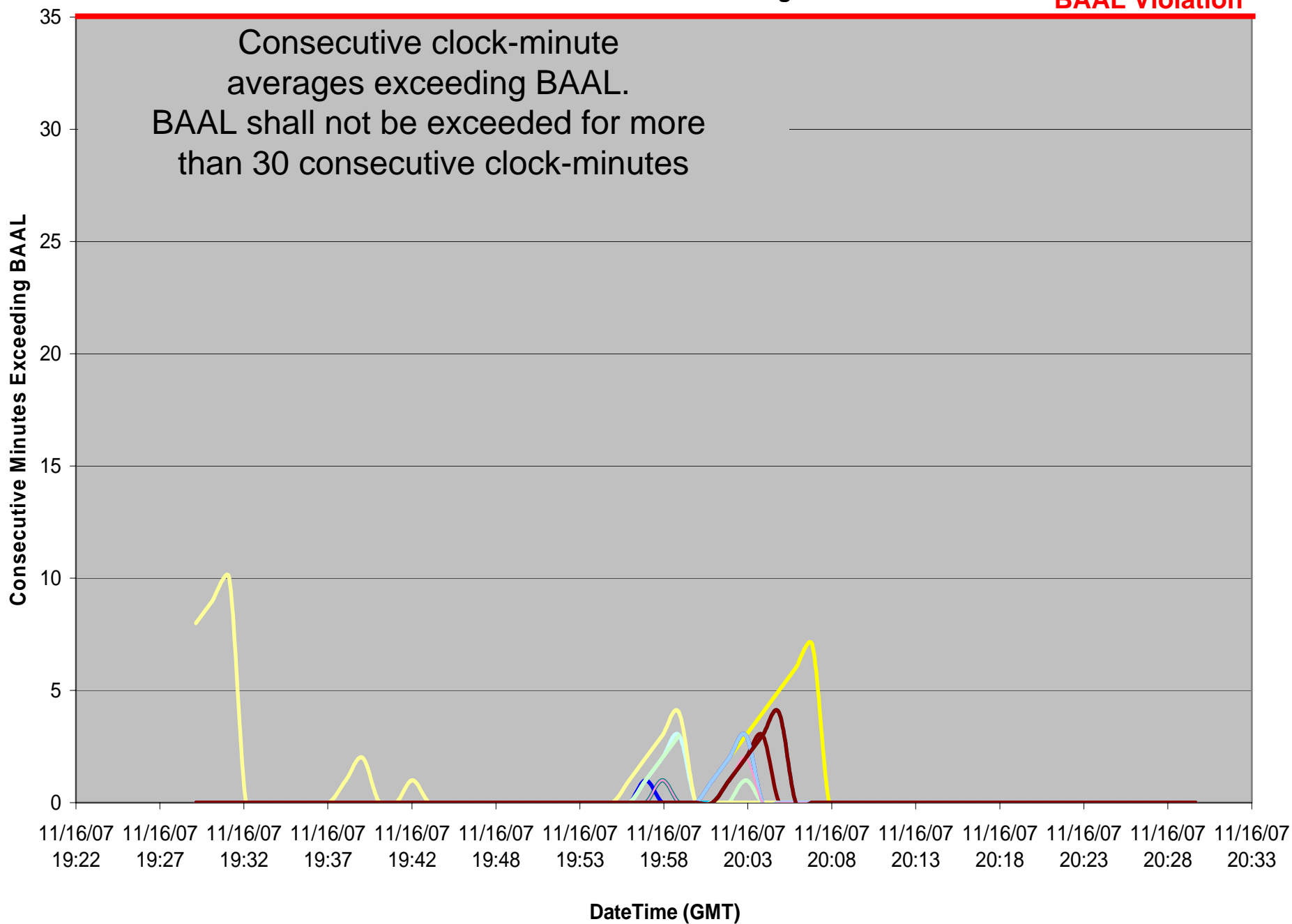
Clock-minute Actual Frequency of Participants

ACPS1 One-Minute Averages



Consecutive Minutes Exceeding BAAL

BAAL Violation



Balancing Authority ACE Limit Proof-of-Concept Field Trial

Discussion

Doug Hils

Reliability-Based Control Standard Drafting Team