Balancing Authority ACE Limit Proof-of-Concept Field Trial

Update Discussion

January 26, 2009

Doug Hils

Reliability-Based Control Standard Drafting Team

Balancing Authority ACE Limit Proof-of-Concept Field Trial

December 2008

Balancing Authority Participants - Eastern Interconnection	2008 Bias (MW/0.1Hz)	Region	Reliability Coordinator	Start Date
Alliant Energy (ALTE)	-42	MRO	MISO	July 6, 2005
Alliant Energy (ALTW)	-57	MRO	MISO	July 6, 2005
American Electric Power (CSW)	-101.9	SPP	SPP	September 1, 2005
Duke Energy (CIN)	-136	RFC	MISO	July 6, 2005
East Kentucky Power Cooperative (EKPC)	-37.9	SERC	TVA	July 6, 2005
Entergy (EES)	-222.4	SERC	ICTE	July 6, 2005
E.ON U.S. (LGEE)	-92	SERC	TVA	April 1, 2008
Independent Electricity System Operator (IESO)	-303	NPCC	IESO	March 1, 2008
Manitoba Hydro (MHEB)	-43.9	MRO	MISO	July 6, 2005
Michigan Electric Coordinated Systems (MECS)	-233	RFC	MISO	September 1, 2005
Northern Indiana Public Service (NIPS)	-59	RFC	MISO	July 6, 2005
PJM Interconnection (PJM)	-1418	RFC	PJM	August 1, 2005
Santee Cooper (SC)	-88.3	SERC	VACS	March 1, 2006
Southern Company (SOCO)	-463	SERC	SOCO	October 15, 2005
Tennessee Valley Authority (TVA)	-328.32	SERC	TVA	October 1, 2005
We Energies (WEC)	-73	RFC	MISO	September 1, 2005

The Midwest Independent Transmission System Operator (MISO) began operations under the Field Trial on January 6, 2009; at that time ALTE, ALTW, CIN, MECS, NIPS and WEC dropped out of the Field Trial coincident with the MISO start, as those systems are now within metered boundary of the MISO Balancing Authority Area.

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 - DECEMBER '08 Performance under BAL-007		DECEMBER 2008 Performance under BAL-007	
	Max MinCtLow	**Max MinCtHigh**	**Max MinCtLow**	**Max MinCtHigh**
BA01	10	11	5	4
BA02	13	15	6	6
BA03	26	16	4	3
BA04	20	16	9	14
BA05	19	18	10	13
BA06	17	20	9	8
BA07	16	22	8	9
BA08	26	23	13	12
BA09	15	23	10	5
BA10	**33**	24	7	9
BA11	28	26	15	15
BA12	**32**	29	18	11
BA13	25	**31**	15	16
BA14	27	**37**	19	12
BA15	25	**38**	11	13
BA16	27	**40**	14	12
BA17	28	**43**	10	11

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 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
SUM		1833	902	380	181	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
SUM		986	483	196	96	46	18	8	6	2	2	

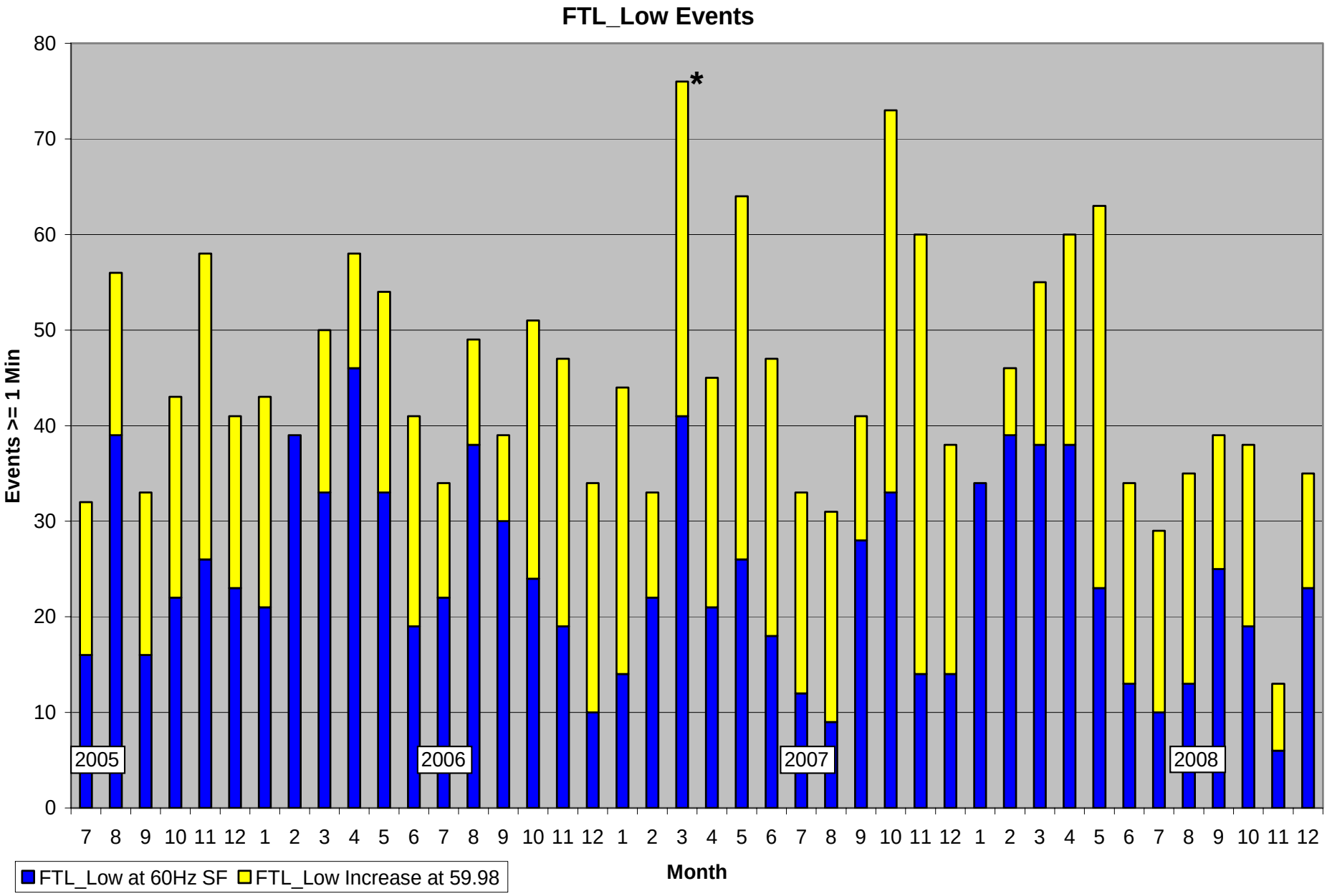
This chart lists the number of times that the duration of the FTL_{LOW} exceedance was greater than or equal to 1 minute, 2 minutes, 3 minutes and so on, with the maximum duration for the month noted in the right column. *The 15-minute duration in March 2007 was for the Monday morning after the change 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
SUM		1070	466	217	95	44	24	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.

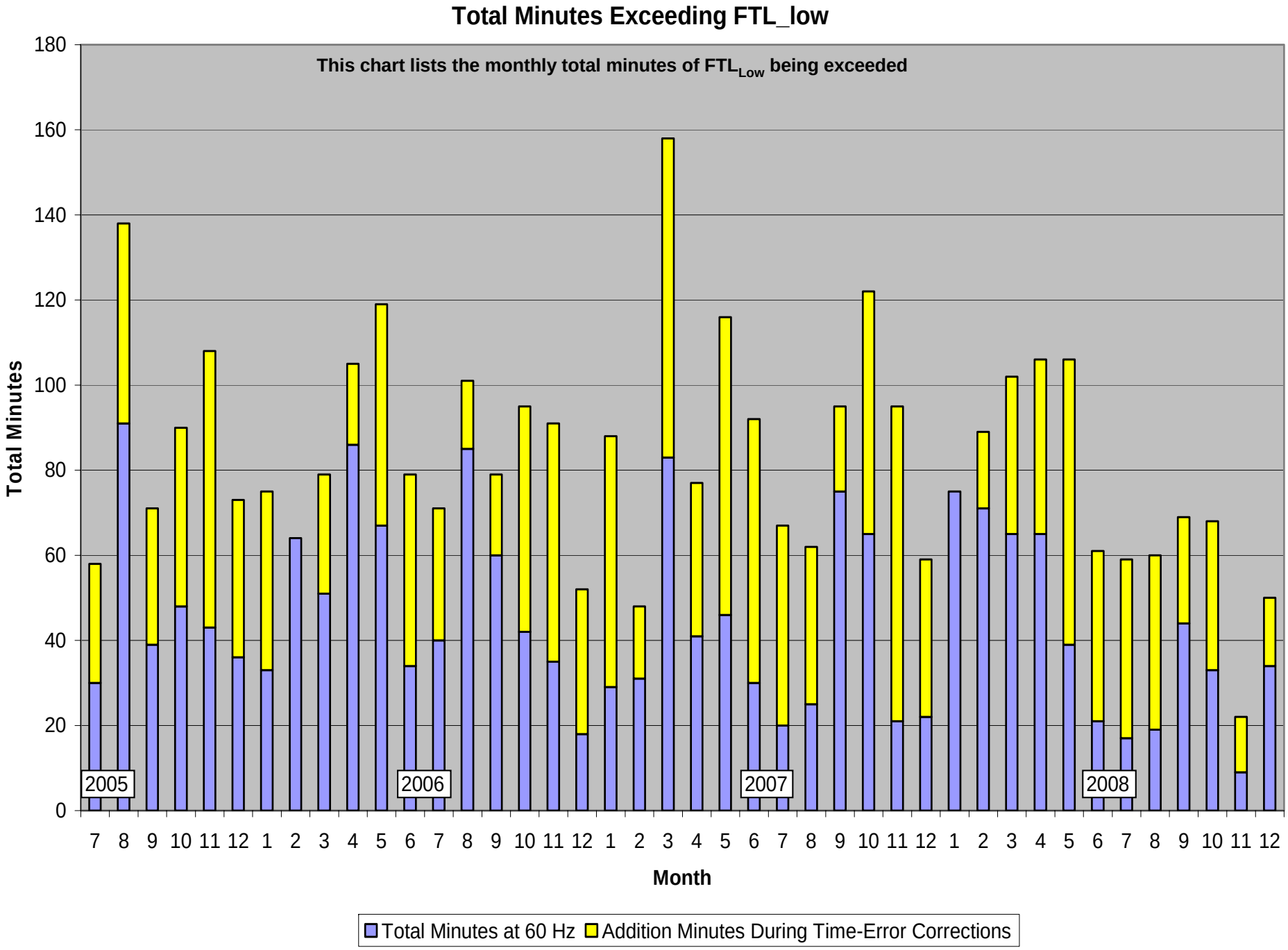
Year	Month	Minutes FTL_Low at 59.98 Hz SF	Minutes FTL_Low at 60 Hz SF	Total FTL_Low Minutes	Percentage Low During TEC	FTL_Low Events	FTL_Low Max Duration	Minutes FTL_High at 60.02 Hz SF	Minutes FTL_High at 60 Hz SF	Total FTL_High Minutes	Percentage High During TEC	FTL_High Events	FTL_High Max Duration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

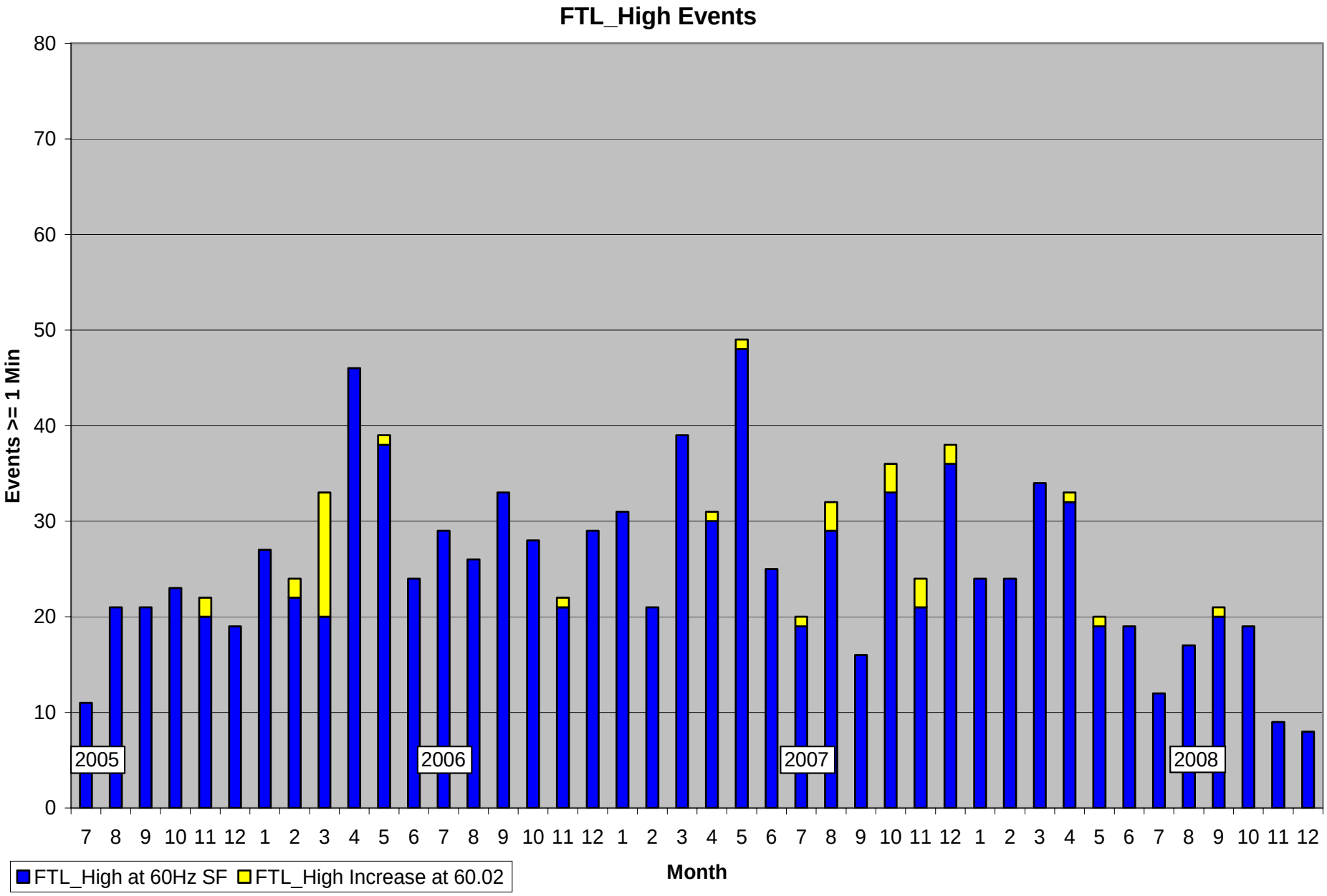
As of the end of 1/23/09, FTL_{Low} has been exceeded for 25 minutes in January, and FTL_{High} has been exceeded for 9 minutes in January.



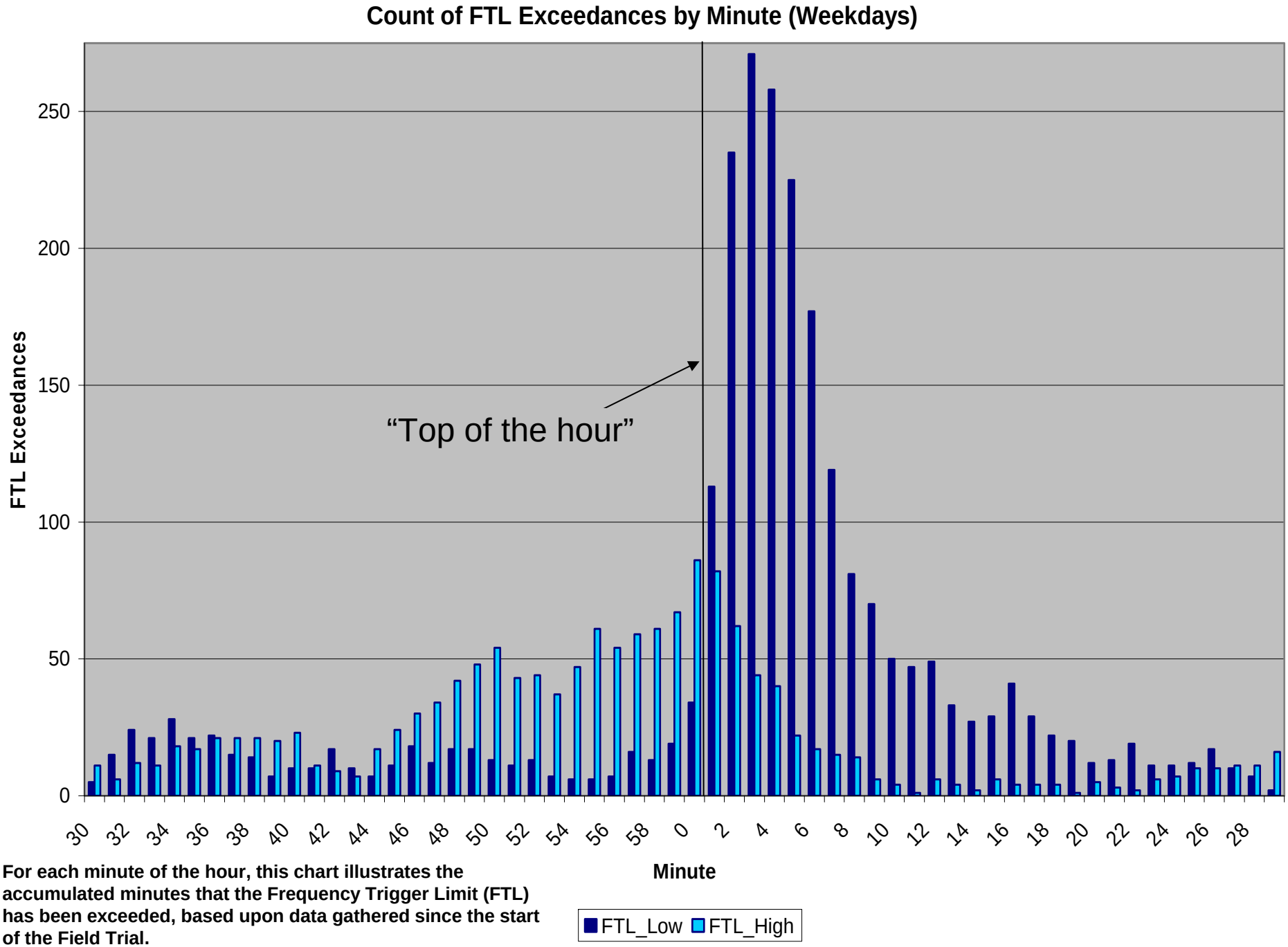
This chart lists the monthly number of FTL_{LOW} events greater than or equal to 1 minute

*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.


Total Minutes Exceeding FTL_low
This chart lists the monthly total minutes of FTL$_{Low}$ being exceeded
Total Minutes
180
160
140
120
100
80
60
40
20
0
2005
2006
2007
2008
7 8 9 10 11 12 1 2 3 4 5 6 7 8 9 10 11 12 1 2 3 4 5 6 7 8 9 10 11 12 1 2 3 4 5 6 7 8 9 10 11 12
Month
Total Minutes at 60 Hz
Addition Minutes During Time-Error Corrections

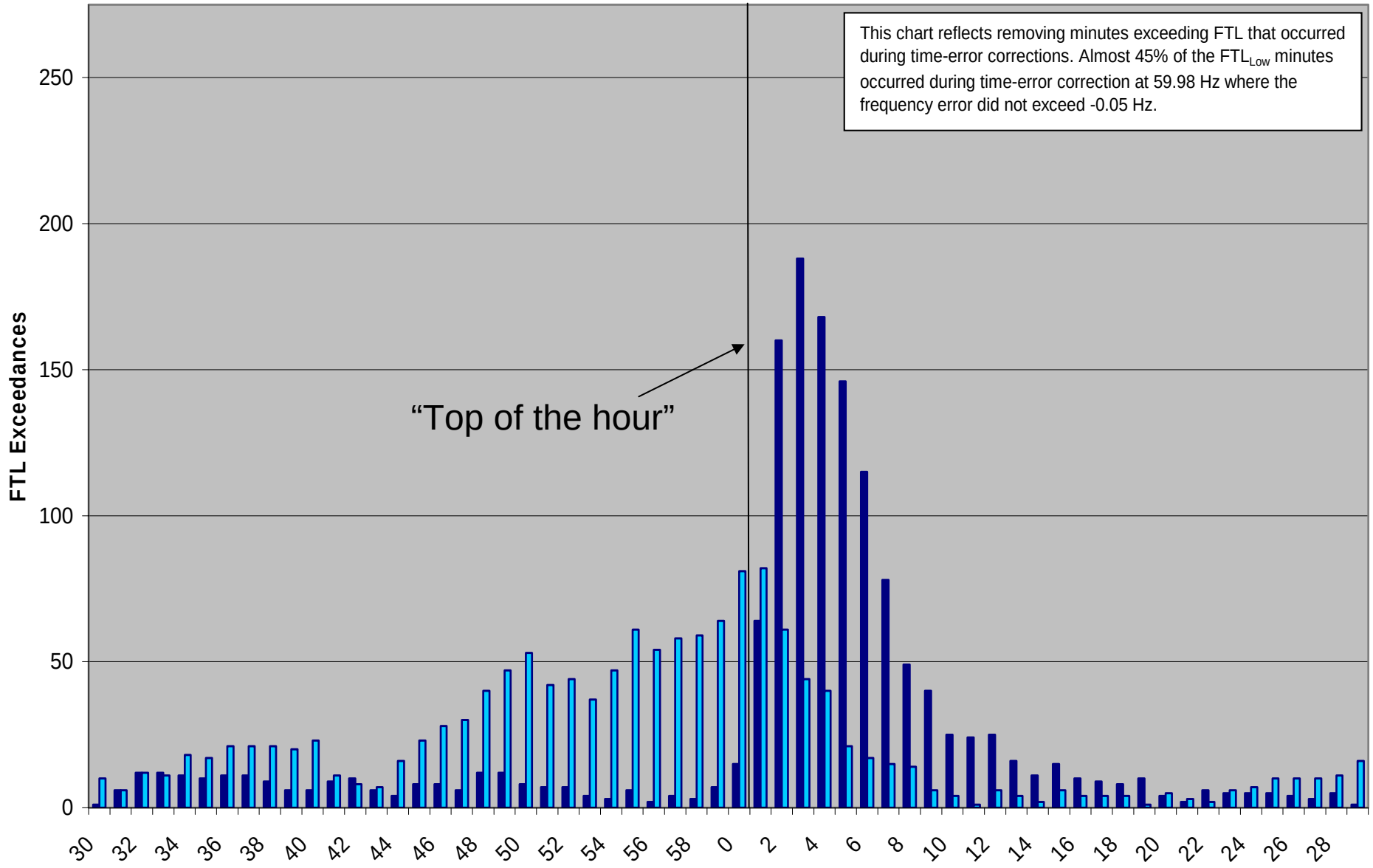


This chart lists the monthly number of FTL_{HIGH} events greater than or equal to 1 minute



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.

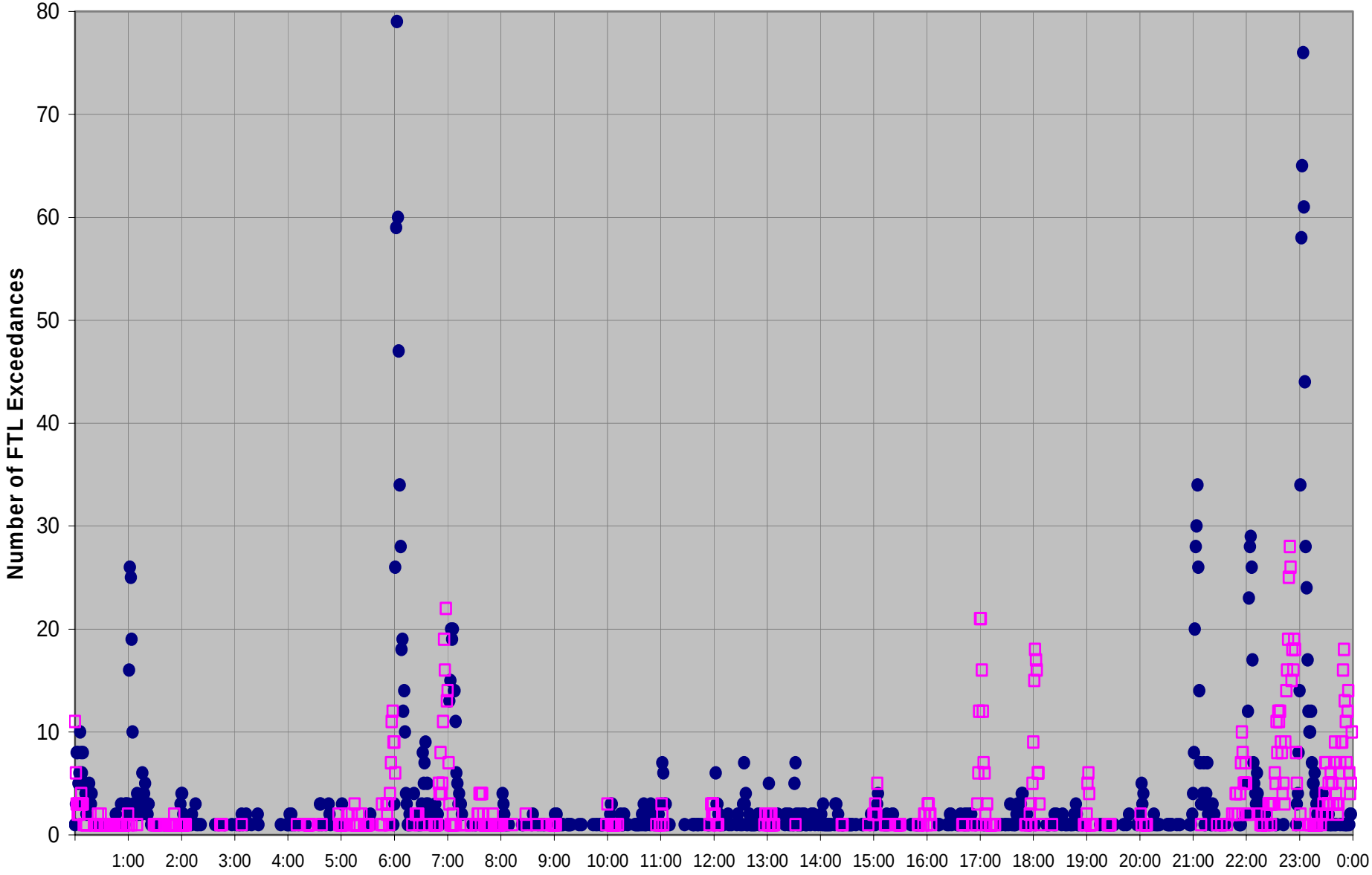
Count of FTL Exceedances by Minute (Weekdays)



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.

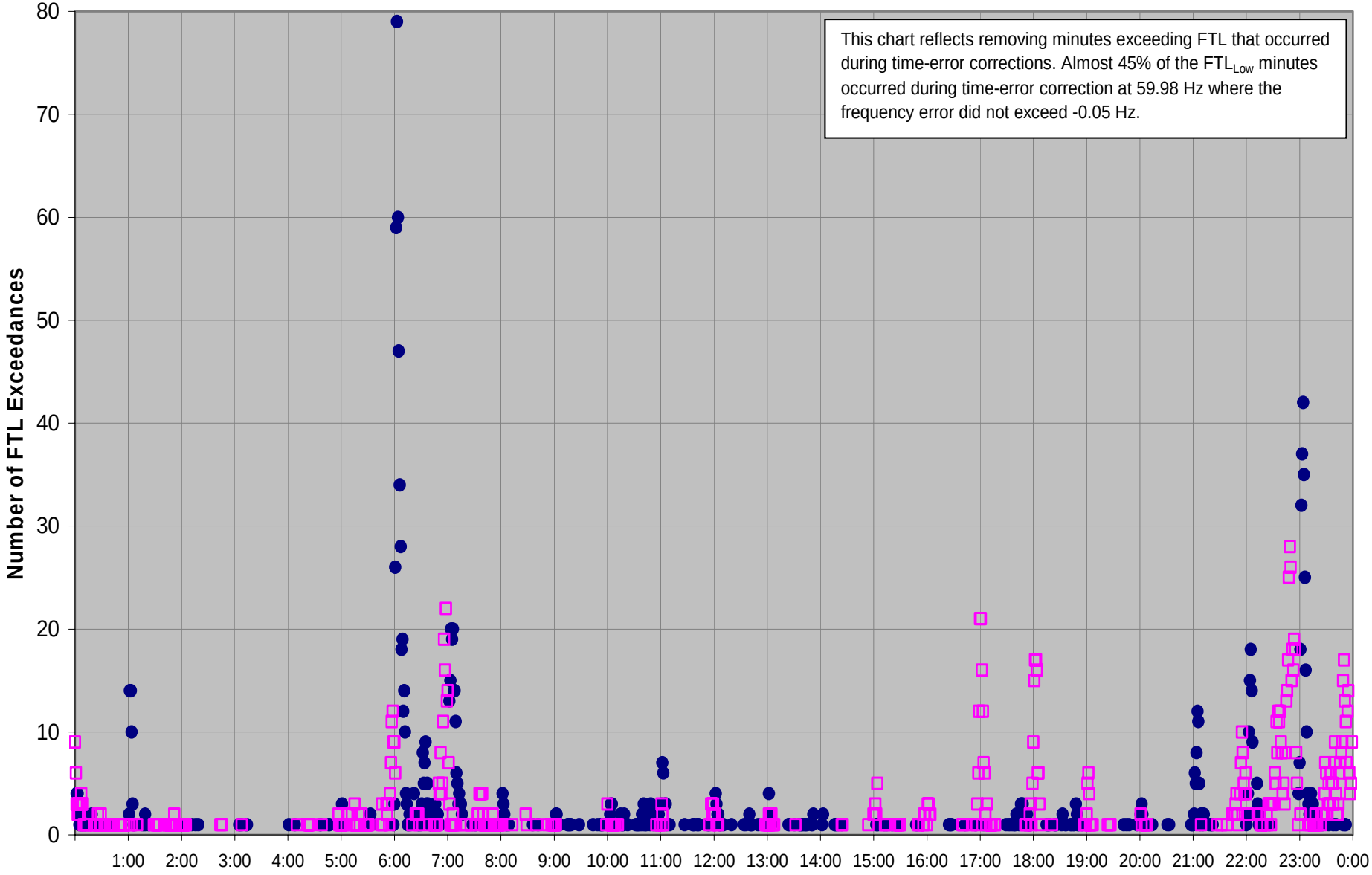
Reduction in FTL events

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.

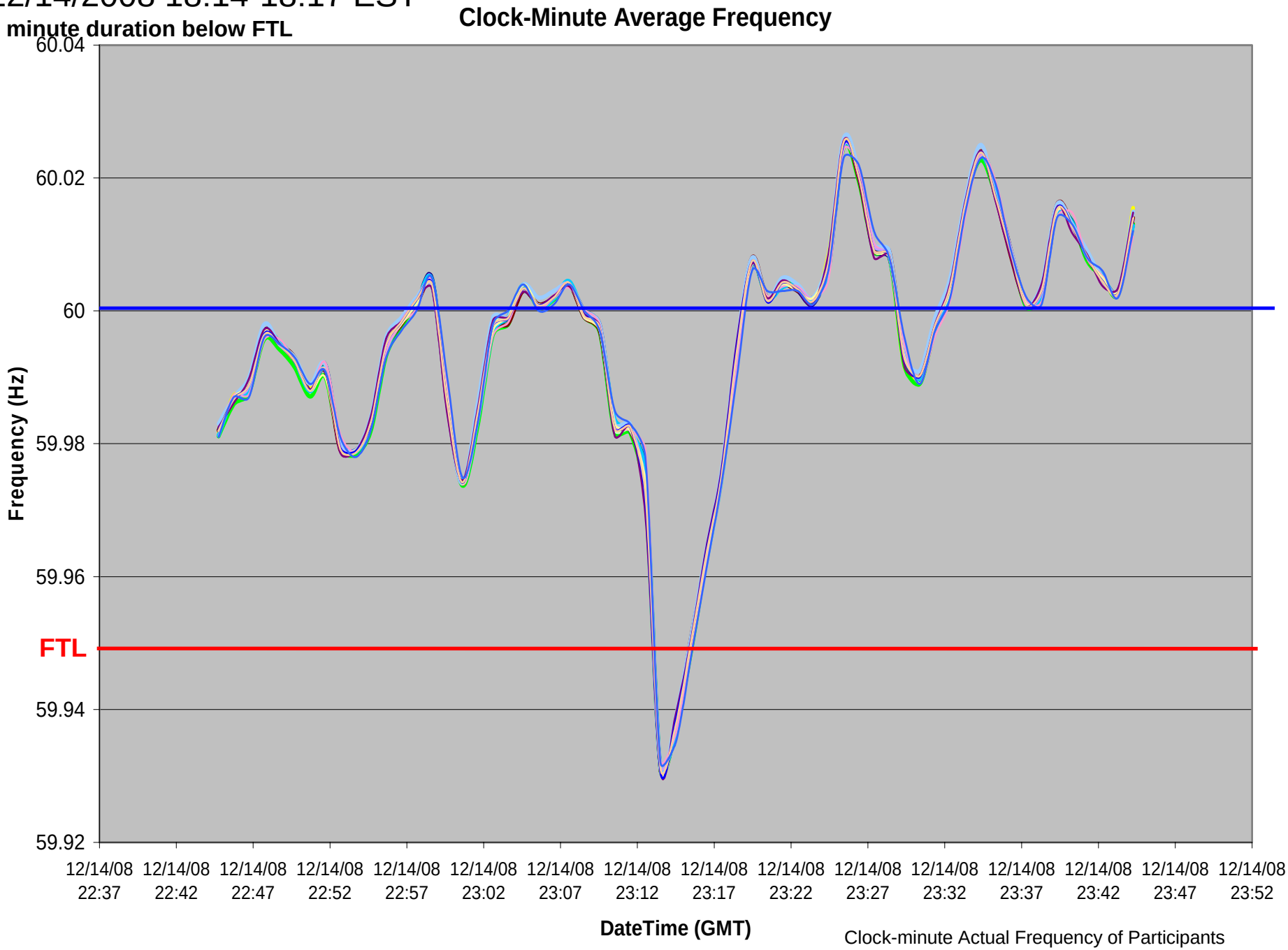
Count of Frequency Trigger Limit (FTL) Exceedances (Weekdays)



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.

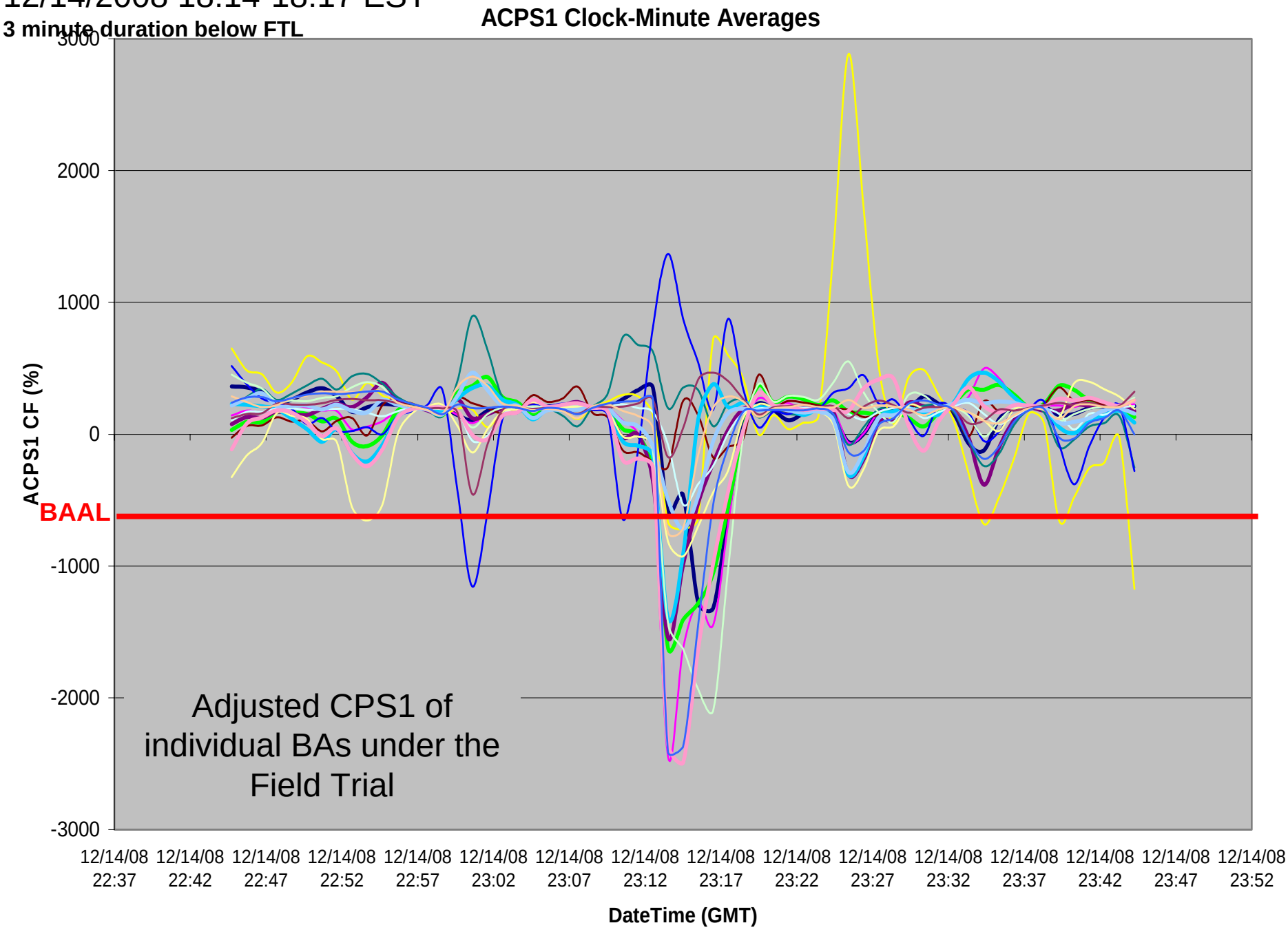
12/14/2008 18:14-18:17 EST

3 minute duration below FTL



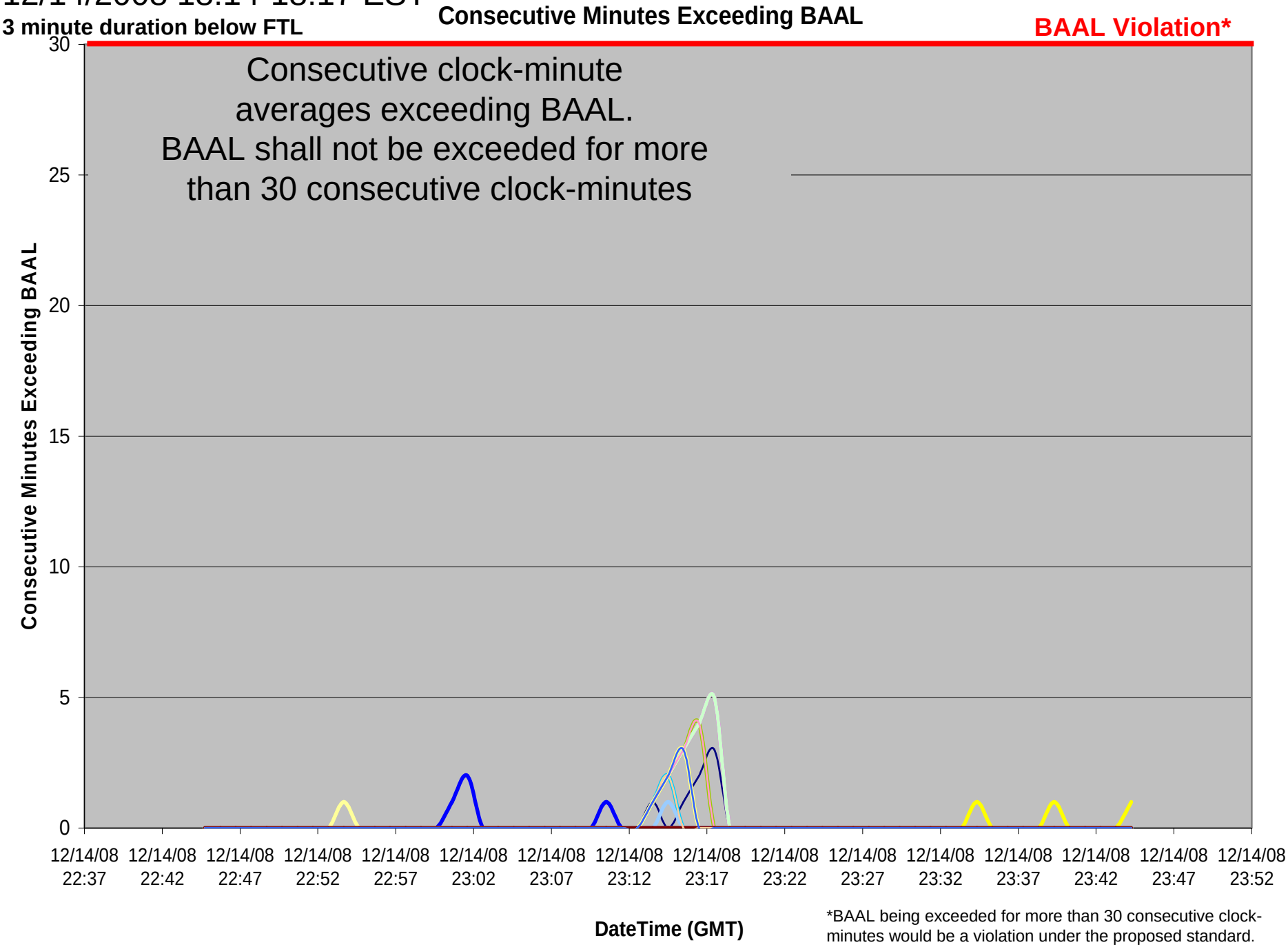
12/14/2008 18:14-18:17 EST

3 minute duration below FTL



12/14/2008 18:14-18:17 EST

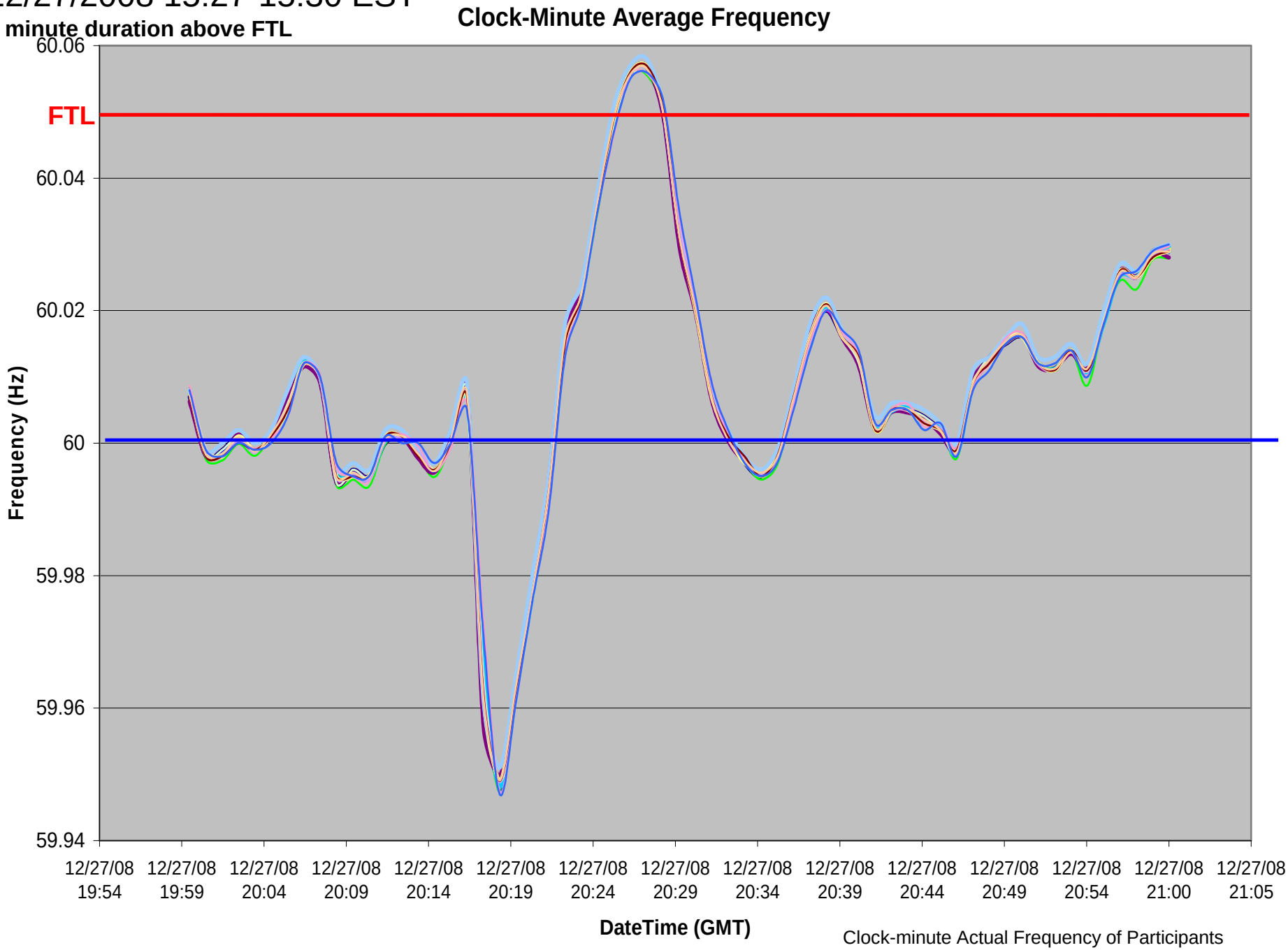
3 minute duration below FTL



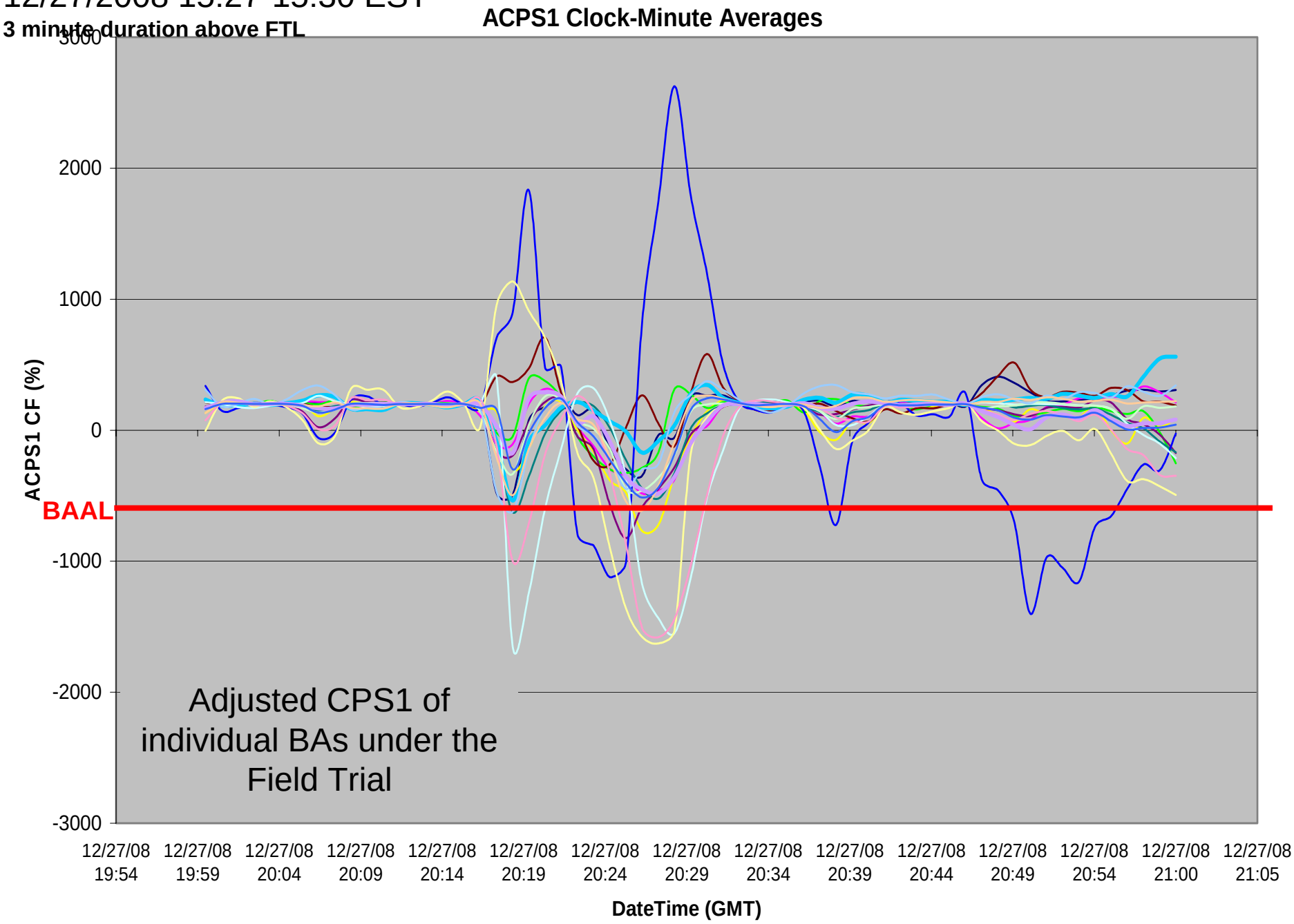
*BAAL being exceeded for more than 30 consecutive clock-minutes would be a violation under the proposed standard.

12/27/2008 15:27-15:30 EST

3 minute duration above FTL

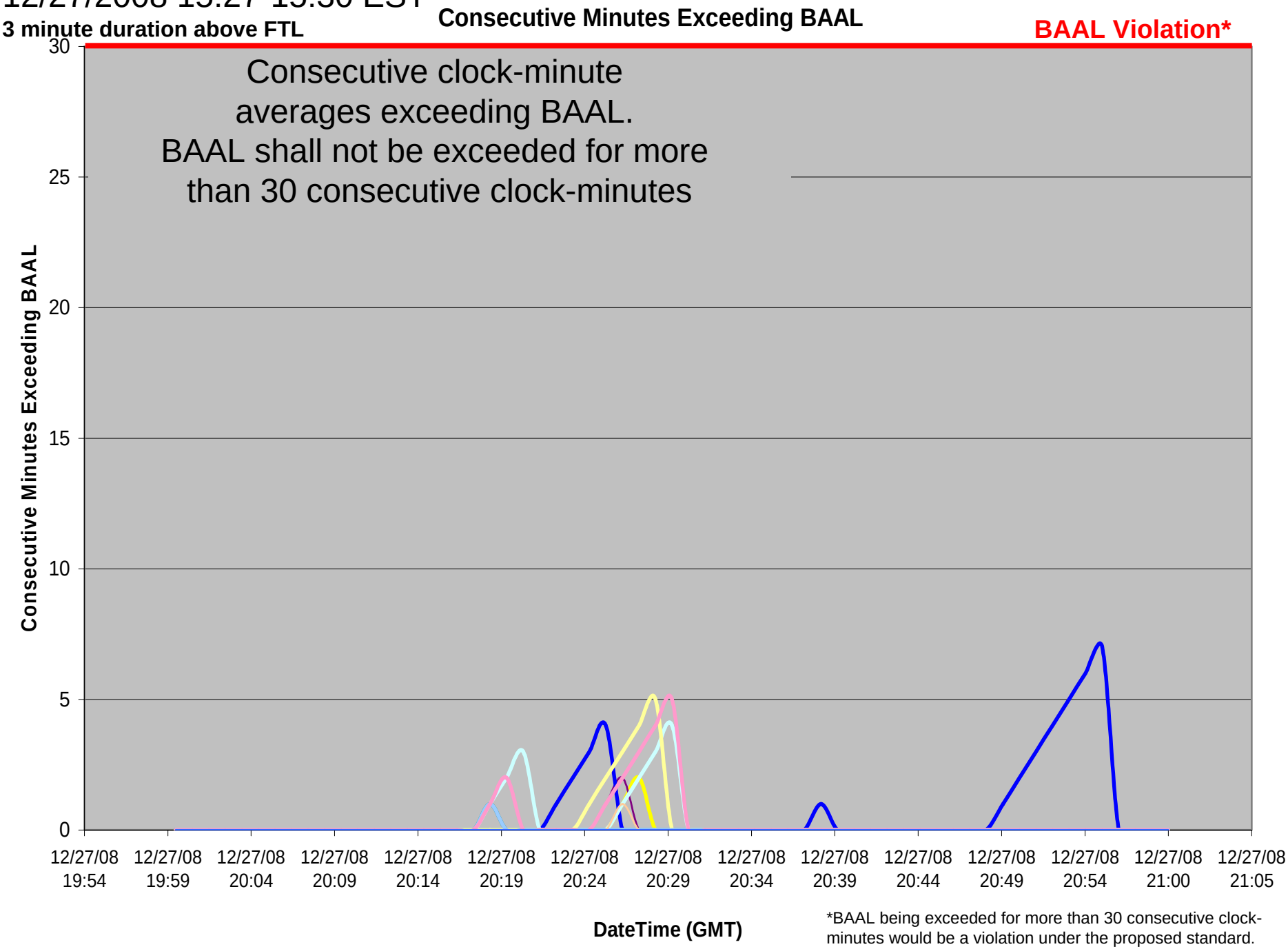


12/27/2008 15:27-15:30 EST



12/27/2008 15:27-15:30 EST

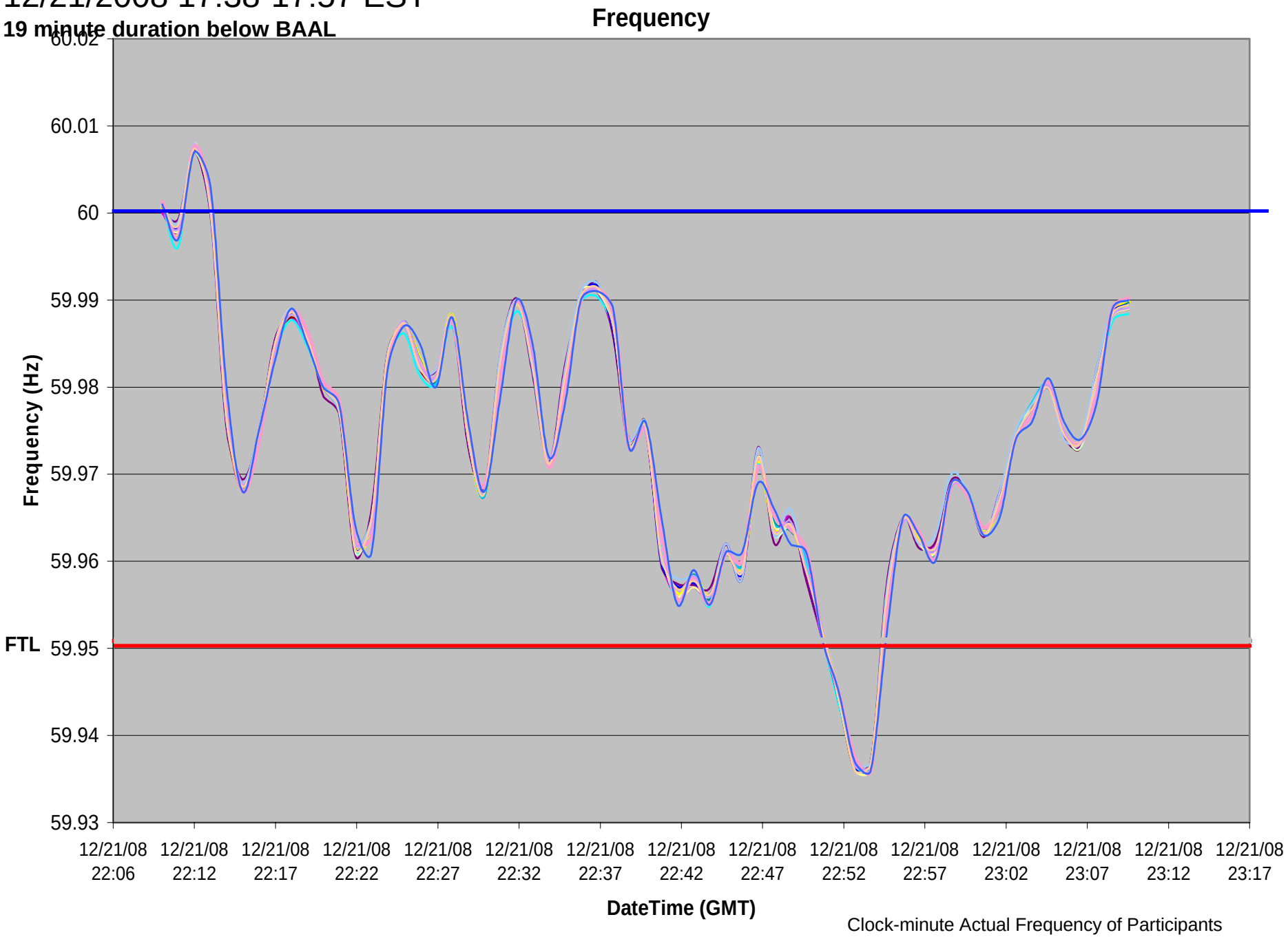
3 minute duration above FTL



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

12/21/2008 17:38-17:57 EST

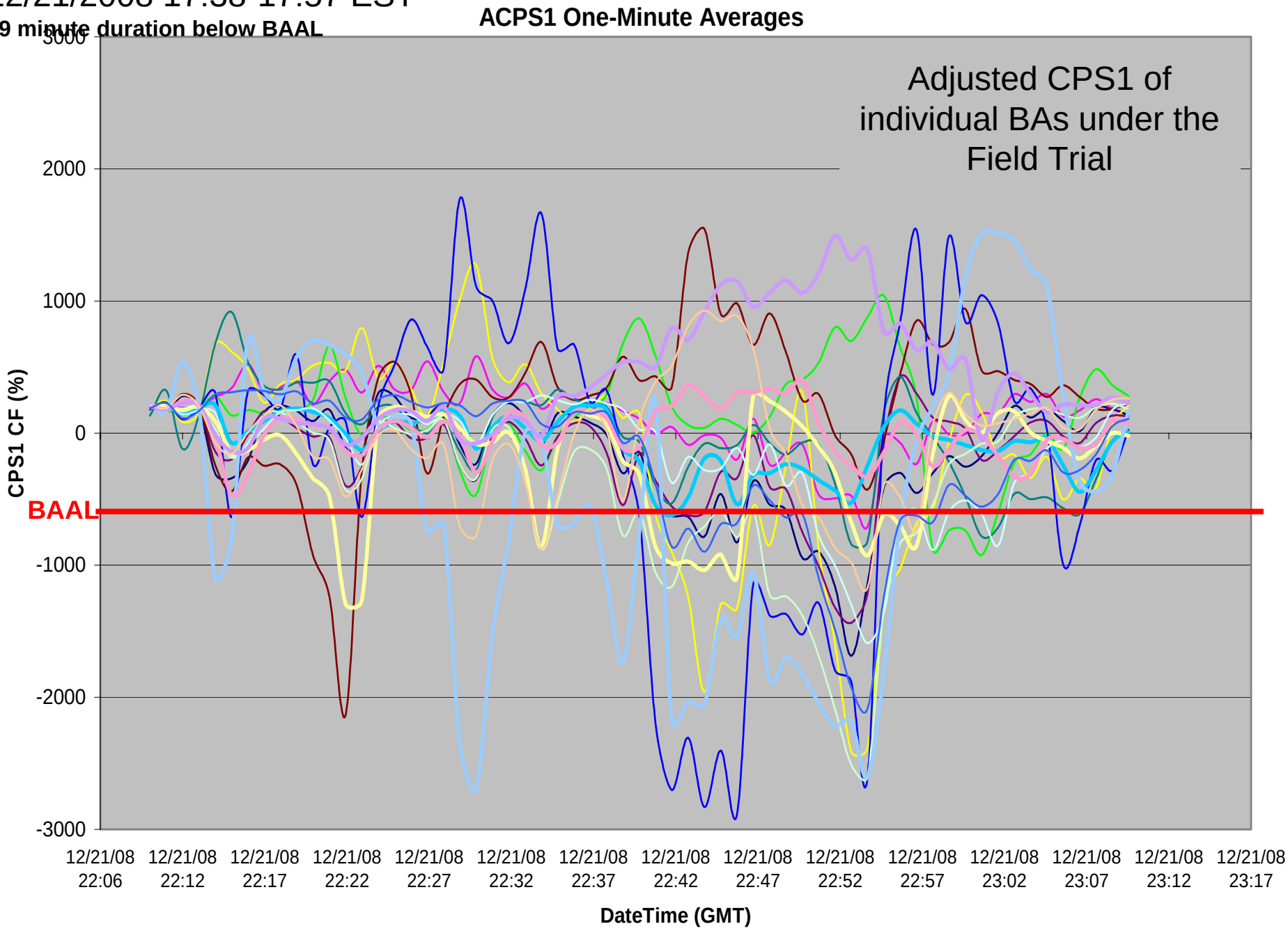
19 minute duration below BAAL



Clock-minute Actual Frequency of Participants

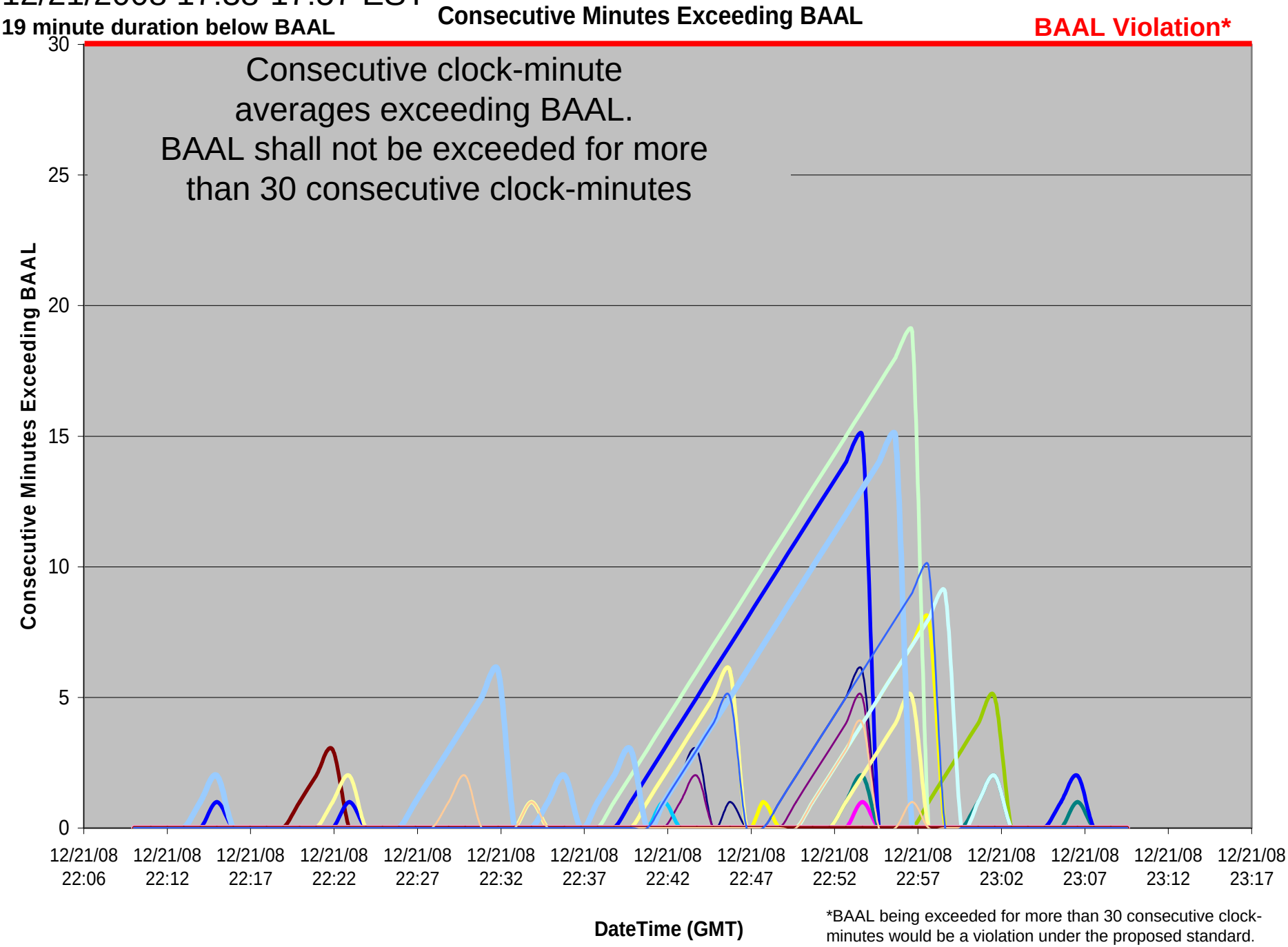
12/21/2008 17:38-17:57 EST

19 minute duration below BAAL



12/21/2008 17:38-17:57 EST

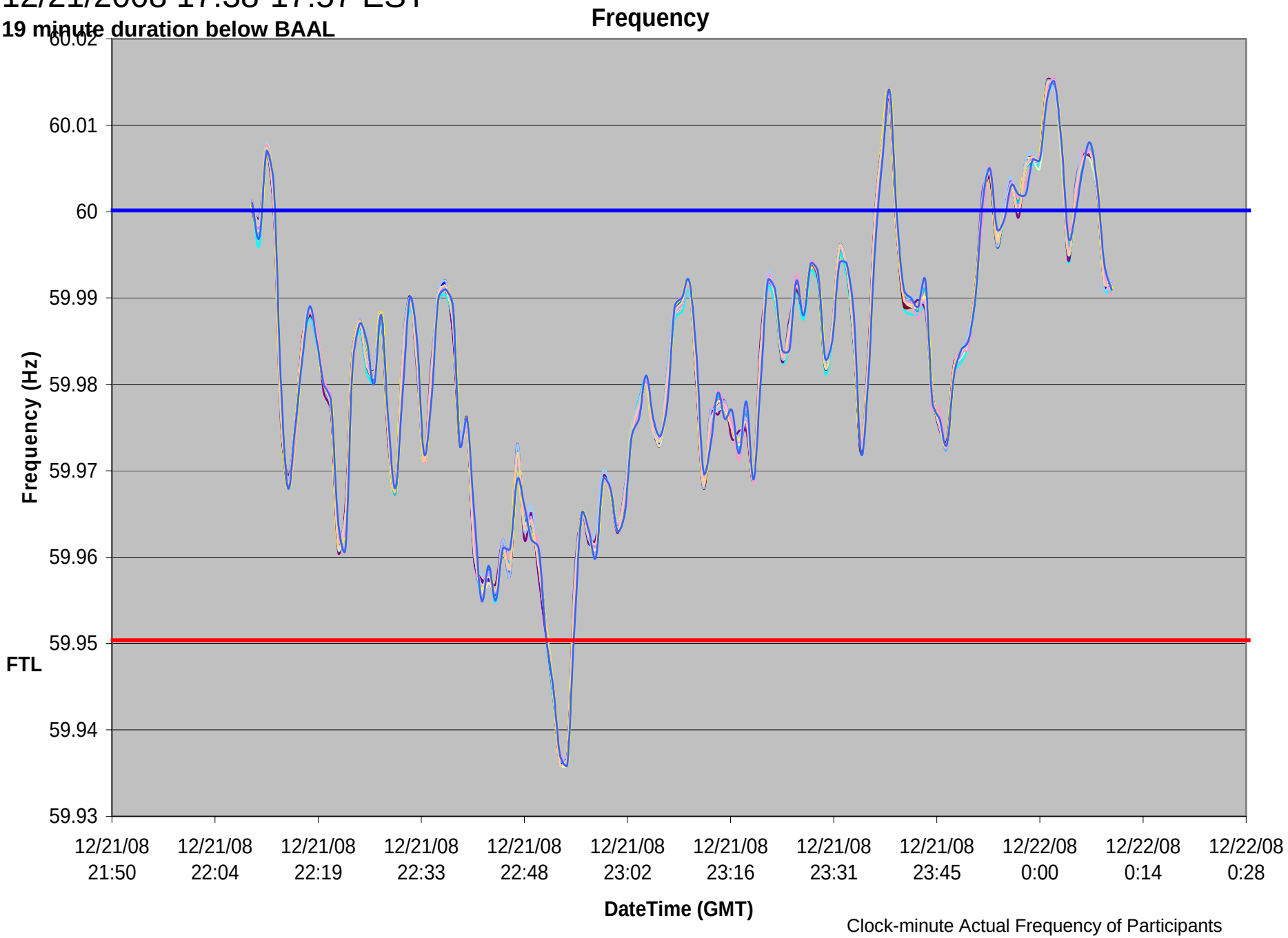
19 minute duration below BAAL



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

12/21/2008 17:38-17:57 EST

19 minute duration below BAAL



Clock-minute Actual Frequency of Participants

Balancing Authority ACE Limit Proof-of-Concept Field Trial

Discussion

Doug Hils

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