

A. Introduction

1. **Title:** **Automatic Underfrequency Load Shedding Requirements**
2. **Number:** **PRC – 006 – RFC – 01**
3. **Purpose:** To establish ReliabilityFirst Regional requirements for automatic underfrequency load shedding (UFLS) programs to arrest declining frequency, assist recovery of frequency following underfrequency events and provide last resort system preservation measures.
4. **Applicability:**
 - 4.1 Distribution Providers
 - 4.2 Transmission Owners
 - 4.3 Generator Owners
 - 4.4 Planning Coordinators
5. **(Proposed) Effective Date:** Upon ReliabilityFirst Board Approval, the standard will be mandatory and enforceable (without monetary penalties for non-compliance) to applicable ReliabilityFirst members based on the PRC-006-RFC-01 Implementation Plan and the enforcement mechanism will be as a “Term Of Membership” under the ReliabilityFirst By-Laws.

Upon regulatory approval, the standard will be mandatory and enforceable (with monetary penalties for non-compliance) to all applicable NERC registered entities within the ReliabilityFirst footprint based on the PRC-006-RFC-01 Implementation Plan

B. Requirements

- R1** Each Planning Coordinator shall have a UFLS program that meets the following criteria for each Distribution Provider in its Planning Coordinator area that has more than 50 feeders: [*Violation Risk Factor: High*][*Time Horizon: Long-term Planning*]
 - 1.1 Shed at least 25 percent of the Load by implementing the Load shedding based on the Year One Peak Demand.
 - 1.2 Shed Load in a minimum of three steps.
 - 1.2.1 Size each Load shed step equally where the variance between any two steps is no more than two percent of the Year One Peak Demand (additional Load shedding required per Requirement R6 or Requirement R7 is excluded from this requirement).
 - 1.2.2 Set the first frequency set point (step) between 59.3 Hz and 59.5 Hz, inclusive.
 - 1.2.3 Set the last frequency set point (step) between 58.5 Hz and 58.7 Hz, inclusive (additional Load shedding required per Requirement R6 or Requirement R7 is excluded from this requirement).

- 1.2.4** Maintain a difference between frequency set points (steps) of between 0.2 Hz and 0.4 Hz, inclusive (additional Load shedding required per Requirement R6 or Requirement R7 is excluded from this requirement).
- 1.3** Set any intentional relay time delay no greater than 20 cycles.
- 1.4** Set undervoltage inhibit, when enabled, as low as practical but not greater than 75 percent of nominal primary voltage.
- R2** Each Planning Coordinator shall have a UFLS program that meets the following criteria for each Distribution Provider in its Planning Coordinator area that has 50 or fewer feeders: *[Violation Risk Factor: High][Time Horizon: Long-term Planning]*
- 2.1** Shed at least 25 percent of the Load by implementing the Load shedding based on the Year One Peak Demand.
- 2.2** Set any intentional relay time delay no greater than 20 cycles.
- 2.3** Set undervoltage inhibit, when enabled, as low as practical but not greater than 75 percent of nominal primary voltage.
- 2.4** Set frequency set point(s) to one of the following:
- Single frequency set point at 59.0 Hz.
 - Two frequency set points, with approximately equal amounts of Load at 59.0 Hz and 58.7 Hz (with a variance between steps of no more than five percent of Year One Peak Demand).
 - A minimum of three frequency set points, matching the criteria identified in Requirement R1 Part 1.2.1 through 1.2.4
- R3** Each Planning Coordinator shall include the following in its documented island identification criteria: *[Violation Risk Factor: Medium][Time Horizon: Long-term Planning]*
- 3.1** Consideration of islands with a Year One Peak Demand of greater than 1,000 MW.
- 3.2** Consideration of areas with a limited number of connecting lines.
- 3.3** Consideration of System Operating Limit interfaces which define importing areas.
- R4** Each Planning Coordinator shall make its island identification criteria available for technical review by those entities directly and materially affected by the reliability of Reliability *First* Bulk Electric System (BES), within 15 calendar

days of the receipt of a request. *[Violation Risk Factor: Lower][Time Horizon: Long-term Planning]*

- R5** Each Planning Coordinator that receives a request for clarification (in accordance with Requirement R4) on its island identification criteria shall provide a written response to that commenting entity within 45 calendar days of receipt of those comments. The response shall indicate whether a change will be made to the island identification criteria and, if no change will be made, the reason why. *[Violation Risk Factor: Lower][Time Horizon: Long-term Planning]*
- R6** Each Planning Coordinator shall identify and document islands, if any, at least every 60 months by applying its island identification criteria. *[Violation Risk Factor: Medium][Time Horizon: Long-term Planning]*
- 6.1** Each Planning Coordinator shall supply the results of applying its island identification criteria within 30 calendar days of completion of the process to the Distribution Providers, Transmission Owners and Generator Owners in the identified areas of islanding.
- 6.2** Each Planning Coordinator shall invite, in writing, the participation of Distribution Providers, Transmission Owners and Generator Owners, in an identified area of islanding, in the establishment of a mitigation plan that addresses generation/Load imbalances in excess of 25 percent.
- 6.3** Each Planning Coordinator shall, if necessary, establish a mitigation plan within six months of applying the island identification criteria to balance generation and Load and restore frequency in each area of islanding should the area of islanding become separated from the interconnection. No mitigation plan is necessary if the imbalance of Load and generation is within the capability of the UFLS systems satisfying Requirement R1 and Requirement R2 to correct, or if the imbalance is greater than 50 percent of the Year One Peak Demand in the island area.
- R7** Each Distribution Provider, Transmission Owner and Generator Owner shall implement its portion of any mitigation plan developed in accordance with Requirement R6 within 36 months of the date that the mitigation plan was established. *[Violation Risk Factor: High][Time Horizon: Long-term Planning]*
- R8** Each Generator Owner shall provide for appropriate underfrequency operation of its generators as indicated below: *[Violation Risk Factor: Medium][Time Horizon: Long-term Planning]*
- Where a generator has automatic underfrequency protection installed and such protection can be configured in accordance with PRC-006-RFC-01 Attachment 1, the Generator Owner shall set such protection in accordance with PRC-006-RFC-01 Attachment 1.
 - Where a generator does not have automatic underfrequency protection installed, but where underfrequency procedures can be implemented in

accordance with PRC-006-RFC-01 Attachment 1, the Generator Owner shall establish and follow procedures for underfrequency operation in accordance with PRC-006-RFC-01 Attachment 1.

- Where a generator cannot meet the specifications in PRC-006-RFC-01 Attachment 1, the Generator Owner shall arrange for Load shedding, to be installed by mutual agreement with Distribution Providers, in addition to that required by the Planning Coordinator in Requirement R1 or Requirement R2 that is (1) equal to or greater than the generator MW dispatch, (2) is within the same potential area of islanding as the generator, if applicable, and (3) is set to trip at the same frequency and time delay as the generator would be expected to trip.

R9 Each Generator Owner, required to comply with the relevant sections of Requirement R7 or Requirement R8, shall provide data to its Planning Coordinator according to the pre-arranged format specified by the Planning Coordinator within 45 calendar days of the Planning Coordinator's request. *[Violation Risk Factor: Lower][Time Horizon: Long-term Planning]*

R10 Each Planning Coordinator shall perform, document and make available an assessment of the effectiveness of the implementation of the UFLS programs within its Planning Coordinator area based on the information contained in its UFLS database. This assessment shall be conducted at least once every five calendar years and shall include the following: *[Violation Risk Factor: High][Time Horizon: Long-term Planning]*

10.1 A review of the existing frequency set points and timing.

10.2 A review of automatic switching of existing Bulk Electric System (BES) capacitor banks and reactors to control over-voltage as a result of an UFLS event.

10.3 Dynamic simulation of possible Disturbances that cause the Planning Coordinators' systems or portions of the Planning Coordinators' systems to experience imbalances between Load and generation sufficient to cause activation of one or more steps of UFLS.

10.4 The effects of neighboring Planning Coordinator areas.

10.5 The identification of any implementation deficiencies.

R11 Each Distribution Provider, Transmission Owner and/or Generator Owner shall complete the required changes to the implementation of the UFLS program, if any, within three calendar years of the date that the Planning Coordinator made the assessment of implementation available. *[Violation Risk Factor: Medium][Time Horizon: Long-term Planning]*

C. Measures –The following documentation will be used to determine compliance with the above requirements.

- M1** Each Planning Coordinator shall have evidence such as reports, memorandums, e-mails, program plans, or other documentation that its UFLS meets the criteria per Requirement R1 for Distribution Providers in the Planning Coordinator's area that have more than 50 feeders.
- M2** Each Planning Coordinator shall have evidence such as reports, memorandums, e-mails, program plans, or other documentation that its UFLS meets the criteria per Requirement R2 for Distribution Providers in the Planning Coordinator's area that have less than or equal to 50 feeders.
- M3** Each Planning Coordinator shall have evidence such as reports, or other documentation, of its island identification criteria, per Requirement R3.
- M4** Each Planning Coordinator shall have dated evidence such as letters, memorandums, meeting minutes, e-mails or other dated documentation that it made its island identification criteria available for technical review by those entities directly and materially affected by the reliability of ReliabilityFirst Bulk Electric System (BES), within 15 calendar days of the receipt of a request per Requirement R4.
- M5** Each Planning Coordinator that receives a request for clarification on its island identification criteria shall have dated evidence such as letters, memorandums, e-mails or other dated documentation that it provided a written response to the commenting entity, within 45 calendar days of receipt of those comments per Requirement R5.
- M6** Each Planning Coordinator shall have dated evidence such as reports, memorandums, e-mails, or other documentation that it identified and documented islands, if any, by applying its island identification criteria at least every 60 months including: 1) submittal of the results of applying its island identification criteria to entities in identified areas of islanding, 2) invitation of the participation of entities in the establishment of a mitigation plan and 3) establishment of a mitigation plan, per Requirement R6.
- M7** Each Distribution Provider, Transmission Owner and Generator Owner shall have dated evidence such as lists summarizing feeder load armed with UFLS relays, lists with UFLS relay settings, or other dated documentation that it implemented its portion of any mitigation plan developed in accordance with Requirement R6 within 36 months of the date the mitigation plan was established per Requirement R7.
- M8** Each Generator Owner, shall have dated evidence such as frequency setting sheets, procedures, or other documentation that it provided for appropriate underfrequency operation of its generators per Requirement R8.
- M9** Each Generator Owner, required to comply with the relevant sections of Requirement R7 or Requirement R8, shall have dated evidence such as responses to data requests, lists, letters, emails or other documentation that it provided data according to the pre-arranged format specified by the Planning Coordinator within 45 calendar days of the Planning Coordinators request, per Requirement R9.

- M10** Each Planning Coordinator shall have dated evidence such as reports, emails or other documentation that it performed, documented and made available an assessment of the effectiveness of the implementation of the UFLS programs within its Planning Coordinator area, based on the information contained in the Planning Coordinator's UFLS database, which is conducted at least once every five calendar years, per Requirement R10.
- M11** Each respective Distribution Provider, Transmission Owner and Generator Owner shall have dated evidence such as lists summarizing feeder load armed with UFLS relays, lists with UFLS relay settings, lists with other protection system settings or other dated documentation that it completed the required changes to the implementation of the UFLS program, within three calendar years of the date that the Planning Coordinator made the assessment of implementation available, per Requirement R11.

D. Compliance

1 Compliance Monitoring Process

1.1 Compliance Enforcement Authority

Compliance Monitor: Reliability *First* Corporation

1.2 Data Retention

Each Distribution Provider, Transmission Owner, Generator Owner and Planning Coordinator shall keep data or evidence to show compliance as identified below unless directed by its Compliance Enforcement Authority to retain specific evidence for a longer period of time as part of an investigation:

- Each Planning Coordinator shall retain the current evidence of Requirements R1, R2, R3, R4, R5, R6, and R10, Measures M1, M2, M3, M4, M5, M6, and M10 as well as any evidence necessary to show compliance since the last compliance audit.
- Each Distribution Provider, Transmission Owner and Generator Owner shall retain the current evidence of implementing its portion of any mitigation plan in accordance with Requirement R7, Measure M7, and evidence of implementation since the last compliance audit.
- Each Generator Owner shall retain the current evidence of providing for appropriate underfrequency operation of its generators since the last compliance audit in accordance with Requirement R8, Measure M8.
- Each Generator Owner shall retain the current evidence of providing data to the Planning Coordinator(s) since the last compliance audit in accordance with Requirement R9, Measure M9.
- Each Distribution Provider, Transmission Owner and Generator Owner shall retain the current evidence of completing the required changes to the implementation of the UFLS program in accordance with Requirement R11, Measure M11, and evidence of completion since the last compliance audit.

If a Distribution Provider, Transmission Owner, Generator Owner and Planning Coordinator is found non-compliant, it shall keep information related to the non-compliance until found compliant or for the retention period specified above, whichever is longer.

The Compliance Enforcement Authority shall keep the last audit records and all requested and submitted subsequent audit records.

1.3 Compliance Monitoring and Assessment Processes

- Compliance Audits
- Self-Certifications
- Spot Checking
- Compliance Violation Investigations
- Self-Reporting
- Complaints

1.4 Additional Compliance Information

None

2 Violation Severity Levels

Req. Number	VIOLATION SEVERITY LEVEL			
	LOWER	MODERATE	HIGH	SEVERE
R1	The Planning Coordinator has a UFLS program but failed to include the criteria for one (1) of the Parts as specified in Requirement R1, Part 1.1 through Part 1.4	The Planning Coordinator has a UFLS program but failed to include the criteria for two (2) of the Parts as specified in Requirement R1, Part 1.1 through Part 1.4	The Planning Coordinator has a UFLS program but failed to include the criteria for three (3) of the Parts as specified in Requirement R1, Part 1.1 through Part 1.4	The Planning Coordinator has a UFLS program but failed to include the criteria for four (4) or more of the Parts as specified in Requirement R1, Part 1.1 through Part 1.4 OR The Planning Coordinator failed to have a UFLS program, as specified in Requirement R1.
R2		The Planning Coordinator has a UFLS program but failed to include the criteria for one (1) of the Parts as specified in Requirement R2, Part 2.1 through Part 2.4		The Planning Coordinator has a UFLS program but failed to include the criteria for two (2) or more of the Parts as specified in Requirement R2, Part 2.1 through Part 2.4 OR

				The Planning Coordinator failed to have a UFLS program, as required in Requirement R2.
R3		The Planning Coordinator has a documented island identification criteria but failed to include one (1) of the Parts as specified in Requirement R3, Parts 3.1, 3.2 or 3.3	The Planning Coordinator has a documented island identification criteria but failed to include two (2) of the Parts as specified in Requirement R3, Parts 3.1, 3.2 or 3.3	<p>The Planning Coordinator has a documented island identification criteria but failed to include all three (3) of the Parts as specified in Requirement R3, Parts 3.1, 3.2 and 3.3</p> <p>OR</p> <p>The Planning Coordinator failed to have a documented island identification criteria as specified in Requirement R3</p>
R4	The Planning Coordinator made its island identification criteria available for technical review by those entities directly and materially affected by the reliability of ReliabilityFirst Bulk Electric System (BES), but was more than 15 calendar days but less than or equal to 20 business days of the receipt of a request.	The Planning Coordinator made its island identification criteria available for technical review by those entities directly and materially affected by the reliability of ReliabilityFirst Bulk Electric System (BES), but was more than 20 calendar days but less than or equal to 25 business days of the receipt of a request.	The Planning Coordinator made its island identification criteria available for technical review by those entities directly and materially affected by the reliability of ReliabilityFirst Bulk Electric System (BES), but was more than 25 calendar days but less than or equal to 30 business days of the receipt of a request.	<p>The Planning Coordinator made its island identification criteria available for technical review by those entities directly and materially affected by the reliability of ReliabilityFirst Bulk Electric System (BES), more than 30 calendar days of the receipt of a request.</p> <p>OR</p> <p>The Planning Coordinator failed to make its island identification criteria available for technical review by those entities directly and materially affected by the reliability of ReliabilityFirst Bulk Electric System (BES).</p>

<p>R5</p>	<p>The Planning Coordinator provided a written response to the commenting entity, but was more than 45 calendar days but less than or equal to 50 calendar days of the receipt of the comments.</p>	<p>The Planning Coordinator provided a written response to the commenting entity, but was more than 50 calendar days but less than or equal to 55 calendar days of the receipt of the comments.</p>	<p>The Planning Coordinator provided a written response to the commenting entity, but was more than 55 calendar days but less than or equal to 60 calendar days of the receipt of the comments.</p> <p>OR</p> <p>The Planning Coordinator provided a written response to the commenting entity, within 45 calendar days of receipt of those comments but the response failed to indicate whether a change was made to the island identification criteria and, if no change were to be made, the reason why</p>	<p>The Planning Coordinator provided a written response to the commenting entity, but was more than 60 calendar days of the receipt of the comments.</p> <p>OR</p> <p>The Planning Coordinator failed to provide a written response to the commenting entity.</p>
<p>R6</p>	<p>The Planning Coordinator identified and documented islands at least every 60 months by applying its island identification criteria, but failed to invite, in writing, the participation of Distribution Providers, Transmission Owners and Generator Owners, in an identified area of islanding, in the establishment of a mitigation plan as specified in Requirement R6, Part 6.2</p>	<p>The Planning Coordinator identified and documented islands at least every 60 months by applying its island identification criteria, but failed to supply the results of applying its island identification criteria within 30 calendar days of completion of the process to the Distribution Providers, Transmission Owners and Generator Owners in the identified areas of islanding as specified in Requirement R6, Part 6.1</p>	<p>The Planning Coordinator identified and documented islands at least every 60 months by applying its island identification criteria, but failed to establish a mitigation plan within six months of applying the island identification criteria to balance generation and Load and restore frequency in each area of islanding should the area of islanding become separated from the interconnection as specified in Requirement R6, Part 6.3</p>	<p>The Planning Coordinator failed to identify and document islands at least every 60 months by applying its island identification criteria.</p>
<p>R7</p>				<p>The Distribution Provider, Transmission Owner and Generator</p>

				Owner failed to implement its portion of any mitigation plan, developed in accordance with Requirement R6, within 36 months of the date the mitigation plan was established.
R8				The Generator Owner failed to provide for appropriate underfrequency operation of its generators as specified in the bullets listed under Requirement R8
R9	The Generator Owner, required to comply with the relevant sections of Requirement R7 or Requirement R8, provided data to its Planning Coordinator according to the pre-arranged format, but was more than 45 calendar days but less than or equal to 50 calendar days of the Planning Coordinators request	The Generator Owner, required to comply with the relevant sections of Requirement R7 or Requirement R8, provided data to its Planning Coordinator according to the pre-arranged format but was more than 50 calendar days but less than or equal to 55 calendar days of the Planning Coordinators request	The Generator Owner, required to comply with the relevant sections of Requirement R7 or Requirement R8, provided data to its Planning Coordinator according to the pre-arranged format but was more than 55 calendar days but less than or equal to 60 calendar days of the Planning Coordinators request	The Generator Owner, required to comply with the relevant sections of Requirement R7 or Requirement R8, provided data to its Planning Coordinator according to the pre-arranged format but was more than 60 calendar days of the Planning Coordinators request OR The Generator Owner, required to comply with the relevant sections of Requirement R7 or Requirement R8, failed to provide data to its Planning Coordinator according to the pre-arranged format.
R10			The Planning Coordinator performed, documented and made available an assessment of the effectiveness of the implementation of the UFLS program within its Planning Coordinator area but the assessment failed to	The Planning Coordinator performed documented, and made available an assessment of the effectiveness of the implementation of the UFLS program within its Planning Coordinator area but the assessment failed to

			include one (1) of the Parts as specified in Requirement R10, Parts 10.1, 10.2, 10.3, 10.4 or 10.5	include two (2) or more of the Parts as specified in Requirement R10, Parts 10.1, 10.2, 10.3, 10.4 or 10.5 OR The Planning Coordinator failed to perform, document and make available an assessment of the effectiveness of the implementation of the UFLS program within its Planning Coordinator area at least every five years.
R11				The Distribution Provider, Transmission Owner and Generator Owner, failed to complete the required changes to the implementation of the UFLS program within three calendar years of the date that the Planning Coordinator made the assessment of implementation available.

E. Definitions

None

F. Intraregional Differences

None

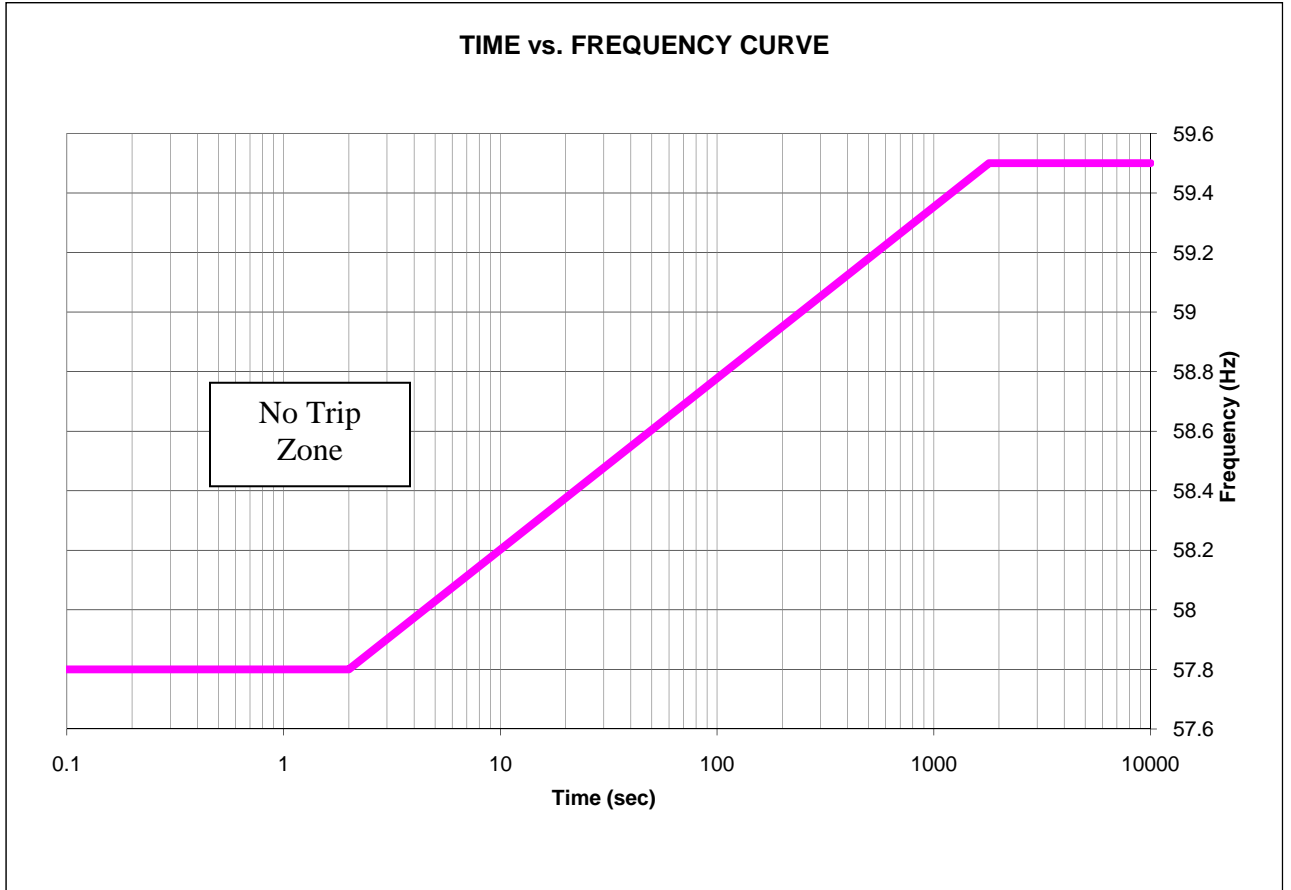
G. Notes

Version History

Version	Date	Action	Change Tracking
PRC-006-RFC-01 1 st Draft	05/16/07 Thru 06/14/07	Posted for 1 st Comment Period	
PRC-006-RFC-01 2 nd Draft	10/29/07 Thru 11/27/07	Posted for 2 nd Comment Period	

PRC-006-RFC-01 3 rd Draft	04/18/08 Thru 05/19/08	Posted for 3 rd Comment Period
PRC-006-RFC-01 4 th Draft	09/05/08 Thru 10/04/08	Posted for 4 th Comment Period
PRC-006-RFC-01 5 th Draft	01/21/09 Thru 02/19/09	Posted for 5 th Comment Period
PRC-006-RFC-01 6 th Draft	01/12/11 Thru 02/10/11	Posted for 6 th Comment Period
PRC-006-RFC-01 7 th Draft	09/28/11 Thru 10/27/11	Posted for 7 th Comment Period

PRC-006-RFC-01 Attachment 1



Frequency (hertz)	57.8	59.5
Time (seconds)	0 to 2	Over 1800