510(k) SUBSTANTIAL EQUIVALENCE DETERMINATION
DECISION SUMMARY
ASSAY AND INSTRUMENT

I Background Information:

A 510(k) Number

K212132

B Applicant

Abbott Diabetes Care Inc.

C Proprietary and Established Names

FreeStyle Libre 3 Continuous Glucose Monitoring System

D Regulatory Information

Product Code(s)	Classification	Regulation Section	Panel
QLG	Class II	21 CFR 862.1355 - Integrated Continuous Glucose Monitoring System	CH - Clinical Chemistry

II Submission/Device Overview:

A Purpose for Submission:

Modifications to the cleared FreeStyle Libre 2 Flash Glucose Monitoring System to display real-time glucose data via Bluetooth without scanning the Sensor.

B Measurand:

Glucose in Interstitial Fluid

C Type of Test:

Quantitative, amperometric assay (Glucose Oxidase)

III Intended Use/Indications for Use:

A Intended Use(s):

See Indications for Use below.

B Indication(s) for Use:

The FreeStyle Libre 3 Continuous Glucose Monitoring System is a real time continuous glucose monitoring (CGM) device with alarms capability indicated for the management of diabetes in persons age 4 and older. It is intended to replace blood glucose testing for diabetes treatment decisions, unless otherwise indicated.

The System also detects trends and tracks patterns and aids in the detection of episodes of hyperglycemia and hypoglycemia, facilitating both acute and long-term therapy adjustments. Interpretation of the System readings should be based on the glucose trends and several sequential readings over time.

The System is also intended to autonomously communicate with digitally connected devices. The System can be used alone or in conjunction with these digitally connected devices where the user manually controls actions for therapy decisions.

C Contraindication(s)

Due to an administrative error, the reference to wear period was erroneously included in the Contraindications section of the previous 510(k) Decision Summary. It is now removed from this section and added to the Special Conditions for Use Statements section below.

The System must not be used with automated insulin dosing (AID) systems, including closed loop and insulin suspend systems.

The System must be removed prior to Magnetic Resonance Imaging (MRI), Computed Tomography (CT) scan, or high-frequency electrical heat (diathermy) treatment. The effect of MRI, CT scans, or diathermy on the performance of the System has not been evaluated. The exposure may damage the Sensor and may impact proper function of the device which could cause incorrect readings.

D Special Conditions for Use Statement(s):

Rx - For Prescription Use Only

The sensor can be worn up to 14 days. Remember to always have your next Sensor available before your current one ends so you can keep getting your glucose readings.

Do not use the System in people less than 4 years of age. The System is not cleared for use in people under 4 years of age.

Do not use the System if you are pregnant, on dialysis, or critically ill. The System is not cleared for use in these groups and it is not known how different conditions or medications common to these populations may affect performance of the System.

The FreeStyle Libre 3 app installed on a phone is intended for use by a single person. It must not be used by more than one person due to the risk of misinterpreting glucose information.

Performance of the System when used with other implanted medical devices, such as pacemakers, has not been evaluated.

Taking ascorbic acid (vitamin C) supplements while wearing the Sensor may falsely raise Sensor glucose readings. Taking more than 500 mg of ascorbic acid per day may affect the Sensor readings which could cause you to miss a severe low glucose event. Ascorbic acid can be found in supplements including multivitamins. Some supplements, including cold remedies such as Airborne® and Emergen-C®, may contain high doses of 1000 mg of ascorbic acid and should not be taken while using the Sensor. See your health care professional to understand how long ascorbic acid is active in your body.

Do not ignore symptoms that may be due to low or high blood glucose: if you are experiencing symptoms that are not consistent with the glucose readings, consult your health care professional.

Use your blood glucose meter to make diabetes treatment decisions when you see the symbol during the first 12 hours of wearing a Sensor, if your Sensor glucose reading does not match how you feel or if the reading does not include a number.

For you to receive alarms, they must be on and your device should be within 33 feet of you at all times. The transmission range is 33 feet unobstructed. If you are out of range, you may not receive alarms.

If you suspect that the temperature may exceed 82°F (for example, in an unairconditioned home in summer), you should refrigerate your Sensor Kit. Do not freeze your Sensor Kit.

Do not force close the App. The App must be running in the background to receive alarms. If you force close the App you will not receive alarms. Re-open the App to ensure you will receive alarms.

E Special Instrument Requirements:

N/A

IV Device/System Characteristics:

A Device Description:

The FreeStyle Libre 3 Continuous Glucose Monitoring System is an integrated continuous glucose monitoring system (iCGM) that provides continuous glucose measurements every minute to provide glucose levels, trends, and alerts. The System consists of the following components: a Sensor which transmits via Bluetooth Low Energy (BLE), and a mobile application, FreeStyle Libre 3 App, downloaded to a compatible smartphone running on iOS operating system. When used with the FSL 3 the proposed mobile app allows the user to activate FSL3 sensors, provides real-time glucose measurements (glucose values) accompanied by trend information (glucose arrows) and historical glucose information (glucose graph) thus allowing the user may make treatment decisions, and connect with cloud-based applications to store as shareable data (e.g. LibreView).

<u>System Components and Features</u>
Alarms: The FSL3 App can issue the following glucose and system alarms:

- Mandatory Alarms: Urgent Low Glucose, Replace Sensor, Sensor Ended, App Stopped (Force Closed)
    - These alarms cannot be turned off or modified and will always sound regardless of the phone's sound and vibe or Do Not Disturb (DND) settings.

- Optional Alarms: Low Glucose Alarm, High Glucose Alarm, Signal Loss Alarm
    - For the optional alarms above, the Override DND setting is turned on by default; therefore, the user receives these alarms regardless of the phone's sound, vibe or DND settings. If the user wishes to have the optional alarms follow the phone's sound and vibe settings, the user must turn off Override DND from the App.

Hardware / Software compatibility: The FreeStyle Libre 3 Continuous Glucose Monitoring System is intended for use with Field Communication (NFC) and BLE-enabled smartphones running compatible iOS. The FSL3 app is compatible with FSL3 Sensors.

Secondary Viewers: LibreView and LibreLinkUp (LLU) provide a cloud-based repository for glucose measurement data and mobile app that allows caregivers to receive and view glucose data (including glucose alarms) from users who use the FSL3 App with their sensor. Secondary viewers are not intended to be used for immediate clinical decision making.

B Principle of Operation:

The FreeStyle Libre 3 System provides the user with real-time glucose measurements (glucose values) accompanied by trend information (glucose arrows) and historic 12-hour glucose results (glucose graph) that are presented on the App. The real-time glucose measurements and glucose arrows are calculated by the Sensor software based upon glucose sampling, also performed by the Sensor.

The Sensor is designed to measure glucose levels in the user's interstitial fluid through an amperometric electrochemical sensor component. The sensor tail is inserted into the subcutaneous tissue and generates an electrical current via the oxidation of glucose from the interstitial fluid. The FreeStyle Libre 3 System is intended for single patient use. The App can only pair to one Sensor at a time. The Sensor is disposable and may be worn up to 14 days. The Sensor automatically terminates after 14 days of use.

C Instrument Description Information:

1. Instrument Name:

   Freestyle Libre 3 Continuous Glucose Monitoring System

2. Specimen Identification:

   N/A

3. Specimen Sampling and Handling:

   N/A

4. Calibration:

   The sensor is factory calibrated and cannot be calibrated by the user.

5. Quality Control:

   N/A

V Substantial Equivalence Information:

A Predicate Device Name(s):
FreeStyle Libre 2 Flash Glucose Monitoring System (with FreeStyle Libre 2 App)

B Predicate 510(k) Number(s):
K201761

C Comparison with Predicate(s):

Device & Predicate Device(s):	K212132	K201761
Device Trade Name	Freestyle Libre 3 Continuous Glucose Monitoring System	FreeStyle Libre 2 Flash Glucose Monitoring System (with FreeStyle Libre 2 App)
General Device Characteristic Similarities		
Intended Use/Indications For Use	A real time continuous glucose monitoring (CGM) device with alarms capability indicated for the management of diabetes in persons age 4 and older. It is intended to replace blood glucose testing for diabetes treatment decisions, unless otherwise indicated. The System also detects trends and tracks patterns and aids in the detection of episodes of hyperglycemia and hypoglycemia, facilitating both acute	Same

	and long-term therapy adjustments. Interpretation of the System readings should be based on the glucose trends and several sequential readings over time. The System is also intended to autonomously communicate with digitally connected devices. The System can be used alone or in conjunction with these digitally connected devices where the user manually controls actions for therapy decisions.	
General Device Characteristic Differences		
Applicator Assembly	No assembly required	Assembly of sensor to applicator required
Primary display device	FreeStyle Libre 3 App	FreeStyle Libre 2 App (iOS) or FreeStyle Libre 2 Reader
Transmitter Dimension	2.9 mm height/ 21 mm diameter	5 mm height/ 30 mm diameter
Information provided with glucose alarm	Alarm type, glucose result and trend arrow	Alarm type
Method of Data transfer from Sensor	Bluetooth Low Energy (BLE) for both glucose data and alarms	BLE for glucose alarms. User-initiated scan via NFC required to display glucose data.
BLE communication range	33 feet unobstructed	20 feet unobstructed

VI Standards/Guidance Documents Referenced:

- 21 CFR 862.1355 integrated continuous glucose monitoring system (iCGM)) special controls
- ISO 14971- "Medical Devices – Application of risk management to medical devices"

- ANSI AAMI 60601-1- "Medical electrical equipment – Part 1: General requirements for basic safety"
- AAMI TIR69 – "Risk Management of Radio-frequency Wireless Coexistence for Medical Devices and Systems"
- ANSI AAMI IEC 62366-1 – "Medical devices - Application of usability engineering to medical devices"
- AAMI / ANSI HE75- "Human Factors Engineering - Design of Medical Devices"
- AAMI TIR57: 2016- "Principles for medical device security – Risk management"
- IEC 60601-1-11 - "Medical electrical equipment — Part 1-11: General requirements for basic safety and essential performance — Collateral standard: Requirements for medical electrical equipment and medical electrical systems used in the home healthcare environment"
- ANSI C63.27-2017 - "American National Standard for Evaluation of Wireless Coexistence"
- IEC 60601-1-2 - "General requirements for basic safety and essential performance – Collateral standard: Electromagnetic"
- IEC 62304 - "Medical device software – Software life cycle processes"
- ISO 15223-1- "Medical device – Symbols to be used with medical device labels, labeling and information to be supplied – Pt 1: General Requirements"
- AAMI / ANSI / ISO 10993-1- "Biological Evaluation of Medical Devices - Part 1: Evaluation and Testing within a risk management process"
- ISO 11607-1 - "Packaging for terminally sterilized medical devices - Part 1: Requirements for materials, sterile barrier systems and package"
- ISO 11607-2 - "Packaging for terminally sterilized medical devices - Part 2: Validation requirements for forming, sealing and assembly processes"
- ASTM D4169 - "Standard Practice for Performance Testing of Shipping Containers and System"
- IEC 60417 - "DB Graphical Symbols for Use on Equipment"
- FAA AC no. 91.21-1C - "Use of Portable Electronic Devices Aboard Aircraft"
- FCC Title 47: Part 15 - "Radio Frequency Devices, Conducted Limits, Section 15.225 and Section 15.247"

VII Performance Characteristics (if/when applicable):

A Analytical Performance:

1. Precision/Reproducibility:

The iCGM performance was evaluated in clinical studies described below in section C(3) below. A sub-set of study participants wore two sensors concurrently, one on the back of each upper arm, to evaluate device precision for a period of up to 14 days.

For adults, the paired absolute relative difference (PARD) between the two Sensors was 5.9% with coefficient of variation (CV) of 4.2%. For children ages 4-5, PARD was 4.7% with CV of 3.3%. For children ages 6-17, PARD was 8.1% with CV of 5.7%. Paired absolute difference (PAD) is a measurement of absolute difference (in mg/ dL) between paired CGM readings, while PARD is the absolute relative difference (in %) between paired CGM readings.

Precision by subject age group (total subjects n=385)

Subject age group	Coefficient of Variation (%)	Paired Absolute Difference (mg/dL)	Paired Absolute Relative Difference (%)	Number of Subjects	Number of Paired Readings
Adults (18+)	4.8	10.3	6.8	201	249388
Pediatric 4-5 years	3.5	9.4	4.9	11	17152
Pediatric 6-17 years	5.5	12.5	7.8	169	175994

2. Linearity:

See Assay Reportable Range below.

3. Analytical Specificity/Interference:

Previously established in K193371. Refer to warnings in the labeling for risks associated with ascorbic acid (vitamin C) interference.

4. Assay Reportable Range:

The reportable range for the FreeStyle Libre 3 System is 40 to 400 mg/dL. Data supporting this claimed measurement range was generated in the clinical study described in Section C(3) below.

5. Traceability, Stability, Expected Values (Controls, Calibrators, or Methods):

The FreeStyle Libre 2 sensor has a storage shelf-life of 3 months. Shelf-life was evaluated at 36°–82° Fahrenheit within the humidity range of 10% - 90%.

6. Detection Limit:

If a glucose measurement is less than 40 mg/dL, the result will be displayed by the system as 'LO'. If the glucose measurement exceeds 400 mg/dL, the result will be displayed as 'HI'. Data supporting this claimed measurement range was generated in the clinical study described in Section C(3) below.

7. Assay Cut-Off:

See Assay Reportable Range and Detection Limit above.

8. Accuracy (Instrument):

Not applicable

9. Carry-Over:

Not applicable

B Comparison Studies:

1. Method Comparison with Predicate Device:

Not applicable. Accuracy is determined by comparing device values to an FDA cleared laboratory grade glucose measurement method.

2. Matrix Comparison:

Not applicable. Interstitial fluid is the only indicated matrix.

C Clinical Studies:

1. Clinical Sensitivity:

Not applicable.

2. Clinical Specificity:

See section A(3) above.

3. Other Clinical Supportive Data (When 1. and 2. Are Not Applicable):

The FreeStyle Libre 3 Continuous Glucose Monitoring System is physically identical to the predicate FreeStyle Libre 2 Flash Glucose Monitoring System (with the Libre 2 App) except for the differences in sensor transmission dimensions as noted in Section V.C above. Therefore, pivotal clinical studies for the FreeStyle Libre 2 Flash Glucose Monitoring System (Studies 1 and 2 in the table below) was leveraged. Additionally, Abbott Diabetes Care conducted a confirmatory clinical study (referred to as Study 3 hereafter) to evaluate the clinical impact of the design modifications made to the device hardware.

Study Element	Study 1	Study 2	Study 3
Subject Population	**Adult** 18 + years of age Type 1 or Type 2 Diabetes	**Pediatric** 4 – 17 years of age Type 1 or Type 2 Diabetes	**Adult and Pediatric** 4 + years of age Type 1 or Type 2 Diabetes
Sample size	146 subjects	139 subjects, of which 8 subjects were between ages 4 and 5	Adult: 56 subjects Pediatric: 44 subjects 17 years of age or younger, of which 5 subjects were between ages4 and 5
Glycemic Challenging	Yes		No

Study 3 was conducted at 4 centers in the US with 100 adult and pediatric subjects in total (83.0 % Type 1, 17.0% Type 2). All subjects required insulin to manage their diabetes. 56 adult subjects were aged 18 and older, 39 pediatric subjects were aged six to seventeen and 5 pediatric subjects were aged four to five. 81 subjects were analyzed during the beginning of the Sensor wear period (day 1, 2 or 3), 46 subjects were analyzed during the early middle period (day 7 or 8), 47 subjects were analyzed during the late middle period (day 9 or 12), and 34 subjects were analyzed during the end period (day 13 or 14).

Subjects aged six and older had their venous blood glucose analyzed for up to 16 hours over one or two separate visits to the clinical center. Each visit lasted up to eight hours. The venous blood samples were analyzed using a laboratory reference method, the Yellow Springs Instrument Life Sciences 2300 STAT Plus™ Glucose & Lactate Analyzer (YSI). Self-monitoring blood glucose meter (SMBG) was used as the comparator method for subjects 4-5 years of age.

Glucose values were obtained from the system and from the comparator at the same or similar time. Data from Study 1 (the adult Libre 2 study) was combined with data from the adult cohort in Study 3, and data from Study 2 (the pediatric Libre 2 study) was combined with data from the pediatric cohort in Study 3.

For values below 70 mg/dL, absolute differences in mg/dL were compared to the comparator method. For values of 70 mg/dL and above, percentage differences compared to the comparator method were calculated.

Percent and Point Accuracy by iCGM Glucose Range (Adult; n=200, combined)

CGM Glucose Range (mg/dL)	No. Pair	Percent within 15 mg/dL (95% LCL)	Percent within 40 mg/dL (95% LCL)	Percent within 15% (95% LCL)	Percent within 40% (95% LCL)	Mean Bias, mg/dL (95 % UCL*)
<70	3667	88.1 (86.2)	99.2 (98.9)			-4.7 (-3.4)
70-180	11128			79.8 (77.7)	99.7 (99.6)	-5.7 (-4.4)
>180	8708			92.6 (91.1)	100.0 (99.9)	-5.0 (-3.1)

* 95 % LCL is the lower bound of the 95 % confidence limit and the 95% UCL is the upper bound of the 95% confidence limit

Percent and Point Accuracy by iCGM Glucose Range (Pediatric* n=168,Combined)

CGM Glucose Range (mg/dL)	No. Pair	Percent within 15 mg/dL (95% LCL)	Percent within 40 mg/dL (95% LCL)	Percent within 15% (95% LCL)	Percent within 40% (95% LCL)	Mean Bias, mg/dL (95 % UCL)
<70	1068	82.3 (77.5)	98.1 (96.8)			- 8.9 (-6.1)
70-180	4149			78.8 (75.9)	99.4 (99.1)	- 5.1 (-3.3)
>180	3397			90.4 (88.4)	99.7 (99.5)	- 1.5 (1.2)

*Includes children 6-17 years of age. No YSI Comparator measurements were obtained for children 4-5 years of age.

Percent and Point Accuracy by Comparator Method (CM) Glucose Range (Adults)

CM Glucose Range (mg/dL)	No. Pair	Percent within 15 mg/dL (95% LCL)	Percent within 40 mg/dL (95% LCL)	Percent within 15% (95% LCL)	Percent within 40% (95% LCL)	Mean Bias, mg/dL (95 % UCL)
<70	913	95.6 (93.8)	99.9 (99.7)			1.7 (2.6)
70-180	4168			76.7 (73.6)	99.1 (98.7)	-4.6 (-3.5)
>180	3533			89.0 (86.7)	99.8 (99.6)	-8.0 (-6.1)

Percent and Point Accuracy by Comparator Method (CM) Glucose Range (Pediatric*)

CM Glucose Range (mg/dL)	No. Pair	Percent within 15 mg/dL (95% LCL)	Percent within 40 mg/dL (95% LCL)	Percen twithin 15% (95% LCL)	Percent within 40% (95% LCL)	Mean Bias, mg/dL (95 % UCL)
<70	913	95.6 (93.8)	99.9 (99.7)			2.2 (3.5)
70-180	4168			76.7 (73.6)	99.1 (98.7)	-3.5 (-1.9)
>180	3533			89.0 (86.7)	99.8 (99.6)	-5.2 (-2.3)

*Includes children 6-17 years of age. No YSI Comparator measurements were obtained for children 4-5 years of age.

Percent of iCGM values within 20% of Comparator Glucose Values

CGM Glucose Range(mg/dL)	No. Pair	No. Subject	Percent within 20% (95% LCL)
Adult (18 years and up)	23503	200	91.0 (89.9)
Pediatric (6- 17 years)	8614	168	90.2 (88.3)
Pediatric (4-5 years old)*	413	13	85.2 (81.3)

* Subjects 4-5 years old were compared to an SMBG meter

Percent values within 15%/15 mg/dL, 20%/20 mg/dL and 40%/40 mg/dL stratified by glucose ranges of <54, 54-69, 70-180. 181-250 and >250 mg/dL for iCGM and laboratory comparator were also provided. For pediatric subjects ages 4-5, values were compared to SMBG.

Accuracy to Comparator within iCGM Glucose Ranges (Adult; n=200, combined)

CGM Glucose Level †(mg/dL)	Number of CGM-Reference Pairs	Percent Within ±15 mg/dL	Percent Within ±20 mg/dL	Percent Within ±40 mg/dL	Percent Within ±15%	Percent Within ±20%	Percent Within ±40%	Mean bias (mg/dL)	MARD *(%)
<54	543	84.7	92.6	99.4				-6.7	14.2
54-69	3124	88.7	93.7	99.0				-3.6	11.0
70-180	11128				79.8	88.8	99.3	-4.9	9.8
181-250	4112				90.9	96.0	99.9	-7.7	7.2
>250	4596				94.1	98.0	100.0	-5.9	6.0

* Mean Absolute Relative Difference

Accuracy to Comparator within iCGM Glucose Ranges (Pediatric*)

CGM Glucose Level †(mg/dL)	Number of CGM-Reference Pairs	Percent Within ±15 mg/dL	Percent Within ±20 mg/dL	Percent Within ±40 mg/dL	Percent Within ±15%	Percent Within ±20%	Percent Within ±40%	Mean bias (mg/dL)	MARD (%)
<54	153	68.6	75.8	95.4				-12.1	18.8
54-69	915	84.6	88.9	96.7				-5.6	12.6
70-180	4149				78.8	87.8	98.9	-4.9	10.1
181-250	1640				87.9	95.4	99.7	-7.1	7.7
>250	1757				92.7	97.8	99.8	-2.1	6.9

* Includes children 6-17 years of age. No YSI measurements were obtained for children 4-5 years of age.

Accuracy to Comparator within Comparator Glucose Ranges (Adult; n=200, Combined)

CM Glucose Level (mg/dL)	Number of CGM-Reference Pairs	Percent Within ±15 mg/dL	Percent Within ±20 mg/dL	Percent Within ±40 mg/dL	Percent Within ±15%	Percent Within ±20%	Percent Within ±40%	Mean bias (mg/dL)	MARD (%)
<54	446	91.0	97.5	100.0				7.4	15.5
54-69	3111	94.5	98.5	100.0				1.4	10.3
70-180	10748				80.2	88.7	99.5	-4.5	9.7
181-250	4122				89.7	95.1	99.8	-7.3	7.5
>250	5076				91.3	96.1	99.7	-11.5	6.9

Accuracy to Comparator within Comparator Glucose Ranges (Pediatric*; n=168, Combined)

CM Glucose Level (mg/dL)	Number of CGM-Reference Pairs	Percent Within ±15 mg/dL	Percent Within ±20 mg/dL	Percent Within ±40 mg/dL	Percent Within ±15%	Percent Within ±20%	Percent Within ±40%	Mean bias (mg/dL)	MARD (%)
<54	140	91.4	96.4	99.3				7.6	16.4
54-69	773	96.4	98.7	100.0				1.0	9.4
70-180	4168				76.7	85.7	98.3	-4.2	10.7
181-250	1559				86.8	92.9	99.1	-5.0	8.1
>250	1974				90.8	97.7	99.9	-9.9	7.4

* Includes children 6-17 years of age. No YSI measurements were obtained for children 4-5 years of age.

Concurrence of iCGM values compared to the comparator method across the entire measuring range was also evaluated. iCGM glucose ranges of <40, 40-60, 61-80, 81-120, 121-160, 161-200, 201-250, 251-300, 351-400 and >400 mg/dL were evaluated against the comparator glucose ranges and percent of iCGM values within those ranges were reported.

Concurrence Analysis by CGM Glucose Level (Adult; n=200, Combined)

CGM Glucose Level (mg/dL)	CM Glucose Level (mg/dL)											N
	<40	40-60	61-80	81-120	121-160	161-200	201-250	251-300	301-350	351-400	>400	
<40†	20.0	20.0	40.0	20.0	.	.	.	.	.	.	.	5
40-60	0.4	52.0	43.7	3.8	.	0.1	.	.	.	.	.	1950
61-80	.	17.8	62.2	19.6	0.4	0.0	.	.	.	.	.	3317
81-120	.	0.2	9.2	70.5	19.4	0.7	0.1	.	.	.	.	4147
121-160	.	.	0.1	8.4	71.1	19.1	1.0	0.2	0.1	.	.	3883
161-200	.	.	.	.	10.4	66.4	22.1	1.0	0.2	.	.	2806
201-250	.	.	.	.	.	8.6	67.8	22.0	1.5	0.1	.	2804
251-300	.	.	.	.	.	0.1	8.8	67.6	21.7	1.7	0.1	2469
301-350	.	.	.	.	.	.	0.4	13.9	68.9	15.8	1.1	1580
351-400	.	.	.	.	.	.	.	0.5	27.8	62.9	8.8	547
>400†	.	.	.	.	.	.	.	.	2.4	63.4	34.1	123

Concurrence Analysis by CGM Glucose Level (Pediatric*; n=168,Combined)

CGM Glucose Level (mg/dL)	CM Glucose Level (mg/dL)											N
	<40	40-60	61-80	81-120	121-160	161-200	201-250	251-300	301-350	351-400	>400	
<40†	.	33.3	66.7	.	.	.	.	.	.	.	.	3
40-60	0.5	47.5	41.3	9.6	0.9	0.2	.	.	.	.	.	554
61-80	.	11.4	59.7	26.8	2.0	.	.	.	.	.	.	1025
81-120	.	0.2	8.2	67.4	22.8	1.3	0.1	.	.	.	.	1590
121-160	.	.	.	9.1	71.1	18.4	1.3	.	.	.	.	1437
161-200	.	.	.	0.1	15.5	66.0	18.2	0.2	.	.	.	1094
201-250	.	.	.	.	0.3	10.6	59.1	29.0	1.0	0.1	.	1157
251-300	.	.	.	.	.	0.1	13.6	63.8	21.3	1.2	.	933
301-350	.	.	.	.	.	.	0.3	24.4	58.4	16.7	0.2	616
351-400	.	.	.	.	.	1.0	.	0.5	34.1	59.1	5.3	208
>400†	.	.	.	.	.	.	.	4.4	6.7	33.3	55.6	45

*Includes children 6-17 years of age. No YSI measurements were obtained for children 4-5 years of age.

† Levels out of System dynamic range.

Concurrence Analysis by CM Glucose Level (Adult; n=200, Combined)

CM Glucose Level (mg/dL)	CGM Glucose Level (mg/dL)											N
	<40†	40-60	61-80	81-120	121-160	161-200	201-250	251-300	301-350	351-400	>400†	
<40	12.5	87.5	.	.	.	.	.	.	.	.	.	8
40-60	0.1	62.9	36.6	0.4	.	.	.	.	.	.	.	1612
61-80	0.1	25.8	62.5	11.5	0.1	.	.	.	.	.	.	3301
81-120	0.0	1.9	16.3	73.5	8.2	.	.	.	.	.	.	3977
121-160	.	.	0.3	20.8	71.4	7.5	.	.	.	.	.	3871
161-200	.	0.0	0.0	0.9	25.7	64.8	8.4	0.1	.	.	.	2876
201-250	.	.	.	0.1	1.4	22.2	68.2	7.8	0.2	.	.	2787
251-300	.	.	.	.	0.3	1.1	24.3	65.6	8.6	0.1	.	2543
301-350	.	.	.	.	0.3	0.3	2.2	29.3	59.5	8.3	0.2	1830
351-400	.	.	.	.	.	.	0.3	6.0	34.8	48.0	10.9	716
>400	.	.	.	.	.	.	.	1.8	16.4	43.6	38.2	110

Concurrence Analysis by CM Glucose Level (Pediatric*; n=168)

CM Glucose Level (mg/dL)	CGM Glucose Level (mg/dL)											N
	<40†	40-60	61-80	81-120	121-160	161-200	201-250	251-300	301-350	351-400	>400†	
<40	.	100.0	.	.	.	.	.	.	.	.	.	3
40-60	0.3	68.5	30.5	0.8	.	.	.	.	.	.	.	384
61-80	0.2	23.5	62.8	13.4	.	.	.	.	.	.	.	974
81-120	.	3.5	18.0	70.0	8.6	0.1	.	.	.	.	.	1532
121-160	.	0.3	1.3	22.9	64.6	10.7	0.2	.	.	.	.	1583
161-200	.	0.1	.	1.8	23.4	63.7	10.8	0.1	.	0.2	.	1134
201-250	.	.	.	0.2	1.8	19.3	66.2	12.3	0.2	.	.	1033
251-300	.	.	.	.	.	0.2	30.9	54.8	13.8	0.1	0.2	1085
301-350	.	.	.	.	.	.	1.7	30.9	55.9	11.0	0.5	644
351-400	.	.	.	.	.	.	0.4	4.3	40.7	48.6	5.9	253
>400	.	.	.	.	.	.	.	.	2.7	29.7	67.6	37

*Includes children 6-17 years of age. No YSI measurements were obtained for children 4-5 years of age.

Trend Accuracy

Trend accuracy describes the accuracy of the sensor during times of rapidly changing glucose and is characterized by slopes, such as from > 2mg/dL/min to <-2 mg/dL/min. Trend accuracy was assessed by the concurrence rate of the glucose rate of change from the iCGM and the corresponding comparator values for each iCGM-comparator measurement pair.

Concurrence Analysis by Glucose Rate of Change (Adult; n=200,Combined)

CGM (mg/dL/min)	CM (mg/dL/min)						N
	<-2	[-2, -1)	[-1, 0)	[0, 1]	(1, 2]	>2	
<-2	34.5	44.9	18.0	2.3	0.3	.	345
-2 to -1	6.9	46.6	41.2	4.0	0.8	0.5	1210
-1 to 0	1.0	7.7	68.0	19.9	2.3	1.0	11735
0 to 1	0.7	2.8	26.0	50.3	14.3	5.8	7270
1 to 2	0.2	1.7	7.7	32.7	38.0	19.8	1322
>2	0.1	0.4	3.1	14.9	33.2	48.4	941

Concurrence Analysis by Glucose Rate of Change (Pediatric*; n=168,Combined)

CGM (mg/dL/min)	CM (mg/dL/min)						N
	<-2	[-2, -1)	[-1, 0)	[0, 1]	(1, 2]	>2	
<-2	41.7	44.3	10.9	3.1	.	.	192
-2 to -1	10.5	50.3	33.1	5.0	0.4	0.7	543
-1 to 0	1.7	10.1	62.7	20.5	3.4	1.5	3481
0 to 1	1.1	4.5	24.6	49.0	13.4	7.5	2923
1 to 2	0.2	2.5	9.5	29.0	38.1	20.7	603
>2	.	1.0	3.9	14.8	29.9	50.4	488

* Includes children 6-17 years of age. No YSI comparator measurements were obtained for children 4-5 years of age.

Agreement when iCGM reads “LO” or “HI”

The FreeStyle Libre 3 Glucose Monitoring System reports glucose readings between 40 and 400 mg/dL. When the system determines that the glucose reading is below 40 mg/dL, it will display ‘LO’ whenever the sensor is scanned. When the system determines that the glucose reading is above 400 mg/dL, it will display ‘HI’ whenever the sensor is scanned. Because the system does not display glucose values below 40 mg/dL or above 400 mg/dL, the comparisons to the actual blood glucose levels (as determined by the comparator) when the iCGM value is classified as ‘LO’ or ‘HI’ are evaluated separately. The cumulative percentages of when the comparator values were less than certain glucose values (for ‘LO’) and when comparator values were more that certain glucose values (for ‘HI’) are presented in the tables below.

Concurrence Analysis with ‘LO’ CGM Reading (Adult; n=200, Combined)

CGM-CMPairs	CM (mg/dL)					N
	<50	<60	<70	<80	≥80	
n	1	2	2	4	1	5
Cumulative %	20.0	40.0	40.0	80.0	20.0	

Concurrence Analysis with 'LO' CGM Reading (Pediatric*; n=168, Combined)

CGM-CMPairs	CM (mg/dL)					N
	<50	<60	<70	<80	≥80	
n	0	1	3	3	0	3
Cumulative %	0.0	33.3	100.0	100.0	0.0	

*includes children 6-17 years of age. No YSI comparator measurements were obtained for children 4-5 years of age

Concurrence Analysis with 'HI' CGM Reading (Adult; n=200, Combined)

CGM-CMPairs	CM (mg/dL)				N
	>350	>300	>250	≤250	
n	120	123	123	0	123
Cumulative %	97.6	100.0	100.0	0.0	

Concurrence Analysis with 'HI' CGM Reading (Pediatric*; n=168, Combined)

CGM-CMPairs	CM (mg/dL)				N
	>350	>300	>250	≤250	
n	40	43	45	0	45
Cumulative %	88.9	95.6	100.0	0.0	

*includes children 6-17 years of age. No comparator measurements were obtained for children 4-5 years of age

Alarm Performance

The tables in this section show the accuracy of the System's Low and High Glucose Alarms. The Alarm Rate tells the user how often the alarm is right or wrong. The Detection Rate tells the user how often the System is able to recognize and notify the user about a low or high glucose event (within 15 minutes before or after the event).

Low Glucose Alarm Performance

True Alarm Rate: Percentage of time the alarm issued, and blood glucose was below the alarm level within 15 minutes before or after the alarm.

False Alarm Rate: Percentage of time the alarm issued, and blood glucose was not below the alarm level within 15 minutes before or after the alarm.

Detection Rate: Percentage of time blood glucose was below the alarm level and the alarm issued within 15 minutes before or after the glucose event.

Missed Detection Rate: Amount of time blood glucose was below the alarm level and the alarm didn't issue within 15 minutes before or after the glucose event.

Low Glucose Alarm Performance (Adult; n=200, Combined)

Low Glucose Alarm level (mg/dL)	Alarm Rate			Detection Rate		
	Number of Events (n)	True Alarm Rate (%)	False Alarm Rate (%)	Number of Events (n)	Correct Detection Rate (%)	Missed Detection Rate (%)
60	10267	70.9	29.1	1546	75.8	24.2
70	22568	84.3	15.7	3747	89.0	11.0
80	35140	90.3	9.7	4977	97.0	3.0
90	45665	92.3	7.7	5972	98.4	1.6

Low Glucose Alarm Performance (Pediatric*; n=168 combined)

Low Glucose Alarm level (mg/dL)	Alarm Rate			Detection Rate		
	Number of Events (n)	True Alarm Rate (%)	False Alarm Rate (%)	Number of Events (n)	Correct Detection Rate (%)	Missed Detection Rate (%)
60	2988	60.5	39.5	386	86.8	13.2
70	6886	77.1	22.9	995	92.8	7.2
80	10901	82.3	17.7	1399	96.2	3.8
90	14710	90.0	10.0	1822	97.5	2.5

* Includes children 6-17 years of age. No YSI Comparator measurements were obtained for children 4-5 years of age.

<u>High Glucose Alarm Performance</u>

True Alarm Rate: Percentage of time the alarm issued, and blood glucose was above the alarm level within 15 minutes before or after the alarm.

False Alarm Rate: Percentage of time the alarm issued, and blood glucose was not above the alarm level within 15 minutes before or after the alarm.

Detection Rate: Percentage of time blood glucose was above the alarm level and the alarm issued within 15 minutes before or after the glucose event.

Missed Detection Rate: Amount of time blood glucose was above the alarm level and the alarm didn't issue within 15 minutes before or after the glucose event.

High Glucose Alarm Performance (Adult; n=200, Combined)

High Glucose Alarm level (mg/dL)	Alarm Rate			Detection Rate		
	Number of Events (n)	True Alarm Rate (%)	False Alarm Rate (%)	Number of Events (n)	Correct Detection Rate (%)	Missed Detection Rate (%)
120	139120	99.0	1.0	14957	98.0	2.0
140	119404	98.7	1.3	12928	97.5	2.5
180	86584	98.7	1.3	9523	96.8	3.2
200	73754	98.7	1.3	8173	96.7	3.3
220	61864	98.3	1.7	6935	96.7	3.3
240	50803	98.0	2.0	5861	95.5	4.5
300	22019	96.2	3.8	2740	90.2	9.8

High Glucose Alarm Performance (Pediatric*; n=168, Combined)

High Glucose Alarm level (mg/dL)	Alarm Rate			Detection Rate		
	Number of Events (n)	True Alarm Rate (%)	False Alarm Rate (%)	Number of Events (n)	Correct Detection Rate (%)	Missed Detection Rate (%)
120	47334	98.9	1.1	5953	97.2	2.8
140	40247	97.8	2.2	5131	97.0	3.0
180	27357	98.1	1.9	3742	97.0	3.0
200	22790	97.4	2.6	3205	97.6	2.4
220	18537	97.7	2.3	2770	96.8	3.2
240	14640	97.6	2.4	2372	95.2	4.8
300	6219	90.9	9.1	989	91.0	9.0

* Includes children 6-17 years of age. No YSI comparator measurements were obtained for children 4-5 years of age.

Sensor Stability

Sensor stability describes the performance of the sensor over the sensor lifetime. Sensors can be worn for up to 14 days. Performance was estimated by calculating the mean of the absolute relative differences between iCGM and comparator measurement and percentage of device readings within 15 mg/dL or 15% (15/15%), 20 mg/dL or 20% (20/20%) and 40 mg/dL or 40% (40/40%) of the comparator values during the beginning, early middle, late middle, and end of the wear period. These times were defined as follows:

- Beginning (Adult Days 1-3, Pediatric: Days 1-2)
- Early Middle (Adult: Days 7-8, Pediatric: Days 7-8),
- Late Middle (Adult: Days 9-12, Pediatric: Days 9-12), and
- End (Adult: Days 13-14, Pediatric: Days 13-14).

The mean absolute relative difference (MARD) and agreement rates with the comparator method were evaluated over 14-day life of the sensor. For these tables the adult data for FreeStyle Libre 2 study were combined with the adult data for FreeStyle Libre 3. The same approach was also implemented for pediatric subjects.

Sensor Accuracy Relative to Comparator Over the Wear Duration (Adult; n=200)

Wear Period	Number of CGM-reference pairs	MARD (%)	Within ±15% / ±15mg/dL	Within ±20% / ±20mg/dL	Within ±40% / ±40mg/dL
Beginning	8753	9.6	84.2	91.1	99.4
Early Middle	5540	8.4	88.2	94.7	99.8
Late Middle	4753	8.3	87.9	93.8	99.7
End	4457	8.8	86.8	93.2	99.9

Sensor Accuracy Relative to Comparator Over the Wear Duration (Pediatric*; n=168)

Wear Period	Number of CGM-reference pairs	MARD (%)	Within ±15% / ±15mg/dL	Within ±20% / ±20mg/dL	Within ±40% / ±40mg/dL
Beginning	2695	10.2	80.3	88.6	98.6
Early Middle	2031	9.0	85.5	90.9	98.4
Late Middle	1947	8.9	86.4	94.1	99.6
End	1941	9.5	84.1	91.7	99.4

* Includes children 6-17 years of age. No YSI Comparator measurements were obtained for children 4-5 years of age.

Sensor Life

The Sensor can be worn for up to 14 days. To estimate how long a Sensor will work over the wear duration, 101 Sensors were evaluated in Study 3 to determine how many days of readings each Sensor provided. Of the 56 Sensors used in adults, 66.1% lasted until the final day; while of the 45 sensors used in pediatric patients, 71.1% lasted until the final day. Abbott performed a retrospective analysis and concluded that the survival rate of the FSL3 in Study 3 was negatively affected by a software configuration unique to the investigational device, and that the actual survival rates should be higher.

A subsequent study was conducted in adults to assess the impact of this software configuration on early sensor shut-off as well as to determine the survival rate after eliminating for physical factors (e.g., getting caught in car seat belt, accidental knocking off the sensor etc.). A total of 34 of the 39 (87.2%) of the sensors gave glucose results over the entire intended wear period of 14 days. After correcting for several factors, the actual survival rate was 94.4 %.

Glucose Reading Availability

The capture rates for real-time glucose values in Study 3 for adults and pediatric population are provided below.

Glucose Reading Capture Rate Over Wear Duration (Adult; n=56)

Day of Wear	Number of Sensors	Capture Rate (%)
1	56	99.8
2	56	99.9
3	56	99.8
4	56	99.9
5	55	100.0
6	53	99.5
7	53	100.0
8	50	100.0
9	50	100.0
10	49	100.0
11	46	99.6
12	43	100.0
13	39	99.9
14	38	100.0

Glucose Reading Capture Rate Over Wear Duration (Pediatric; n=45)

Day of Wear	Number of Sensors	Capture Rate (%)
1	45	99.8
2	43	99.9
3	43	99.8
4	43	99.7
5	43	99.8
6	43	99.9
7	43	99.9
8	43	99.8
9	42	99.8
10	41	99.8
11	39	99.4
12	37	99.6
13	34	99.4
14	32	99.9

D Clinical Cut-Off:
Not applicable.

E Expected Values/Reference Range:
Not applicable.

F Other Supportive Instrument Performance Characteristics Data:

Human Factors
Human factors and usability testing of the FreeStyle Libre 3 System was conducted to determine whether the user interface design and labeling would impact the performance of the device. Human factors testing was conducted in accordance with:

- Applying Human Factors and Usability Engineering to Medical Devices, Guidance to FDA Staff and Industry, February 3, 2016
- ANSI/AAMI/IEC 62366: Medical devices - Application of Usability Engineering to Medical Devices
- IEC 60601-1-6: Medical electrical equipment - Part 1-6: General requirements for basic safety and essential performance - Collateral standard: Usability

Specific use scenarios and tasks the user would have to carry out correctly in order to use the device safely were identified. An analysis of hazards and risks was conducted on the FreeStyle Libre 3 System to determine safety risks associated with use of the system.or were leveraged from K201761 if applicable.

Software Verification and Validation

Software verification and validation testing was conducted to confirm that the software used in the FreeStyle Libre 3 System performed in accordance with established specifications, EN 62304 and FDA Guidance document "Guidance for the Content of Premarket Submissions for Software Contained in Medical Devices," May 11, 2005. Evaluation activities included unit, system integration (SIT), and system level testing which verified functionality of the device against established software requirements. Results of the software executed protocols for FreeStyle Libre 3 met the acceptance criteria and therefore supports that the System's iOS App software is acceptable for its intended use.

Biocompatibility

Biocompatibility testing was performed in accordance with ISO10993-10 on housing, sheath, cap, sharp, sensor shell and sensor tail. Biological evaluation included cytotoxicity, genotoxicity, irritation, sensitization, and system toxicity testing. All biocompatibility testing met the acceptance criteria.

Sterilization

The sterile subassembly underwent electron beam sterilization validation per ISO11137-1 and ISO 11137-2. Sterilization validation confirmed that the Sterility Assurance Level (SAL) of 10^{-6} is achieved. All sterilization testing conducted met the acceptance criteria and supports sterility of the patient contact components of the device.

Shelf-Life Stability

The Sensor Kit shelf-life stability testing supports a shelf life of 3 months. Additional testing was conducted to support sensor kit storage temperature range of 36°F and 82°F. Results demonstrated no impact to sensor stability when stored at these storage temperatures.

Packaging Integrity/Shipping Integrity

Device shelf life and packaging integrity over the shelf life was demonstrated by subjecting test units to worst case sealing parameters, sterilization parameters, and shipping configuration. Integrity testing included activities and requirements to demonstrate compliance to ISO 11607-1, ISO 11137-1 and ISO 11137-2. Attributes related to seal integrity, user accessibility, and device functionality including sterile barrier system integrity met acceptance criteria.

Electromagnetic Compatibility

Electromagnetic compatibility (EMC) testing was performed for the FreeStyle Libre 3 System to verify that the system is able to withstand the electromagnetic interference and emissions in compliance with IEC 60601-1-2 and IEC CISPR 11. The FreeStyle Libre 3 System also demonstrated compliance with Federal Communication Commission (FCC) Regulations Part 15.225 and Part 15.247, and Federal Aviation Administration (FAA) Advisory Circular RTCA DO-160.

Electrical Safety
The basic safety and essential performance of the Sensor of the FreeStyle Libre 3 System was conducted to demonstrate compliance to IEC 60601-1: 2005(r)2012, IEC 60601-1-6:2010+A1:2013, and IEC 60601-1-11:2015.

Environmental Testing
Environmental testing on the FreeStyle Libre 3 System was performed in accordance with IEC 60601-1 to ensure the device specifications for operating temperature, operating humidity, operating pressure, impact resistance, vibration resistance, shock resistance, drop resistance, and storage conditions were met.

Interoperability
The FreeStyle Libre 3 System incorporates an approach for interoperability developed in alignment with FDA guidance, "Design Considerations and Pre-market Submission Recommendations for Interoperable Medical Devices," September 6, 2017, which includes expectations, requirements, and interface specifications to potential interoperable devices. In addition, the ADC approach to interoperability includes working with connected device companies regarding contractual approaches, interfaces for data communication and exchange, and post-market reporting procedures and responsibilities with respect to managing complaints (e.g., who is responsible for investigating and reporting complaints, malfunctions, and adverse events).

Cybersecurity
ADC has provided cybersecurity risk management documentation for the System that includes analysis of confidentiality, integrity, and availability for data, information and software related to the System accordance with FDA Draft Guidance "*Content of Premarket Submissions for Management of Cybersecurity in Medical Devices*." For each identified threat and vulnerability risk event scenario, risk assessment of impact to confidentiality integrity, and availability was performed and documented within the cybersecurity risk management documentation. Appropriate risk mitigation controls have been implemented and tested.

In addition, ADC has controls and processes in place to ensure continued support for keeping the device secure and to ensure that the device firmware, software and components are malware free. Additional controls are also in place in manufacturing through distribution to ensure that the medical device firmware and software are malware free from point of origin to the hands of the end user.

Wireless Coexistence
The FreeStyle Libre 3 System underwent coexistence testing in the presence of common RF interfering devices that are likely to be encountered by users in a home environment. Wireless coexistence testing was performed to confirm that the Patch remains functional and perform within acceptable limits while in the presence of common radiating electronic devices in accordance with FDA Guidance "*Radio Frequency Wireless Technology in Medical Devices*." A representative set of devices known to operate in the same frequency band (2.4 GHz) was selected. The subject device underwent coexistence testing consistent with AAMI TIR69 and ANSI C63.27 and included test challenges from in-band interference sources defined in ANSI C63.27 as well as other expected wireless interference sources from the intended use environment. The test results showed that the FreeStyle Libre 3 System could tolerate interference generated by these RF interfering devices and still meet the target performance criteria.

Mechanical Engineering

The subject device underwent performance testing at the System level as well as on individual components of the Sensor Applicator. The test results showed that mechanical, electrical, and functional testing all met the acceptance criteria.

VIII Proposed Labeling:

The labeling supports the finding of substantial equivalence for this device.

IX Conclusion:

The submitted information in this premarket notification is complete and supports a substantial equivalence decision.