TEST REPORT

Report Number: 104424286MPK-001
Project Number: G104424286
October 12, 2020

Testing performed on the
Bigfoot Unity System
Model Number: RCAP

FCC ID: 2AVAYUR001

to

FCC Part 15 Subpart C (15.225)
Industry Canada RSS-210 Issue 10

For

Bigfoot Biomedical, Inc

Test Performed by:	Test Authorized by:
Intertek	Bigfoot Biomedical, Inc
1365 Adams Court	1820 McCarthy Blvd
Menlo Park, CA 94025 USA	Milpitas, CA 95035

Prepared by: _____ **Date:** October 12, 2020
Todd Moy

Reviewed by: _____ **Date:** October 12, 2020
Krishna Vemuri

Report No. 104424286MPK-001

Equipment Under Test:	Bigfoot Unity System
Trade Name:	Bigfoot Biomedical, Inc
Model Number:	RCAP
Serial Number:	TR202470001
Applicant:	Bigfoot Biomedical, Inc
Contact:	Ravi Shankar
Address:	1820 McCarthy Blvd Milpitas, CA 95035
Country	USA
Email	rshankar@bigfootbiomedical.com
Applicable Regulation:	FCC Part 15 Subpart C (15.225) Industry Canada RSS-210 Issue 10
Test Site Location:	ITS – Site 1 1365 Adams Drive Menlo Park, CA 94025
Date of Test:	September 15-21, 2020

We attest to the accuracy of this report:

Todd Moy	Krishna K Vemuri
Project Engineer	EMC Manager

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1.0 Summary of Tests

TEST	REFERENCE FCC 15.225	REFERENCE RSS-210	RESULTS
Field Strength of Fundamental	15.225(a)	B.6	Complies
Radiated Emissions Outside the band	15.225(b), 15.225(c), 15.225(d), 15.209	B.6	Complies
Frequency Tolerance of the Carrier	15.225(e)	B.6	Complies
Line Conducted Emissions	15.207	RSS-GEN	Not Applicable[1]
Occupied Bandwidth	15.215	RSS-GEN	Complies
Antenna requirement	15.203	RSS-GEN	Complies[2]

[1] The EUT uses changeable batteries. Per manufacturer, the NFC does not operate while the EUT is charging.

[2] The EUT utilizes an internal Antenna

2.0 General Description

2.1 Product Description

Bigfoot Biomedical, Inc supplied the following description of the EUT:

The rapid-acting insulin pen (RCAP) works with the Bigfoot Inject v1 System to provide continuous glucose monitoring. The RCAP wireless communicates with the tags through NFC.

Overview of the EUT

Applicant name & address	Bigfoot Biomedical, Inc 1820 McCarthy Blvd Milpitas, CA 95035
Contact info / Email	Ravi Shankar / rshankar@bigfootbiomedical.com
Model	RCAP
FCC Identifier	2AVAYUR001
Operating Frequency	13.56 MHz
Number of Channels	1
Type of Modulation	ASK Modulation (RFID)
Antenna Type	Printed Loop Antenna (13.56 MHz)

EUT receive date: September 15, 2020
EUT receive condition: The EUT was received in good condition with no apparent damage. As declared by the Applicant it is identical to the production units.
Test start date: September 15, 2020
Test completion date: September 21, 2020

2.2 Related Submittal(s) Grants

None

2.3 Test Methodology

Both AC mains line-conducted and radiated emissions measurements were performed according to the procedures in ANSI C63.4: 2014. Radiated tests were performed at an antenna to EUT distance of 10 meters, unless stated otherwise in this test report. All other measurements were made in accordance with the procedures in part 2 of CFR 47 7, ANSI C63.10: 2013, ANSI C63.4-2014 & RSS-GEN Issue 5.

2.4 Test Facility

The radiated emission test site and conducted measurement facility used to collect the data is 10m semi-anechoic chamber located in Menlo Park, California. This test facility and site measurement data have been fully placed on file with the FCC and Industry Canada (Site # 2042L-1).

2.5 Measurement Uncertainty

Compliance with the limits was based on the results of the measurements and doesn't take into account the measurement uncertainty.

Estimated Measurement Uncertainty

Measurement	Expanded Uncertainty (k=2)		
	0.15 MHz – 1 GHz	1 GHz – 2.5 GHz	> 2.5 GHz
RF Power and Power Density – antenna conducted	-	0.7 dB	-
Unwanted emissions - antenna conducted	1.1 dB	1.3 dB	1.9 dB
Bandwidth – antenna conducted	-	30 Hz	-

Measurement	Expanded Uncertainty (k=2)		
	0.15 MHz – 30MHz	30 MHz – 1 GHz	1 GHz – 18 GHz
Radiated emissions	-	4.7	5.1 dB
AC mains conducted emissions	2.1 dB	-	-

3.0 System Test Configuration

3.1 EUT Photo

3.2 Support Equipment

3.2 Block Diagram of Test Setup

The diagram shown below details the interconnection of the EUT and support equipment. For specific layout, refer to the test configuration photograph in the relevant section of this report.

Support Equipment		
Description	**Manufacturer**	**Model No.**
Sensor	Abbott	Frestyle Libre 2

3.3 Justification

For radiated emission measurements the EUT is placed on a non-conductive table. The EUT was configured to continuously transmit. Per manufacturer, the NFC does not operate while the EUT is charging.

3.4 Software Exercise Program

None

3.5 Mode of Operation during test

The RCAP was set up to continuously transmitting at 13.56MHz.

3.6 Modifications required for Compliance

No modifications were made by the manufacturer to bring the EUT into compliance.

3.7 Additions, deviations and exclusions from standards

No additions, deviations or exclusion have been made from standard.

4.0 Measurement Results

4.1 Field Strength of Fundamental and Radiated Emissions Outside the band

4.1.1 Requirements

FCC Rules 15.225, 15.209

a) The field strength of any emissions within the band 13.553-13.567 MHz shall not exceed 15,848 microvolts/meter (84 dBuV) at 30 meters.

b) Within the bands 13.410-13.553 MHz and 13.567-13.710 MHz, the field strength of any emissions shall not exceed 334 microvolts/meter at 30 meters.

c) Within the bands 13.110-13.410 MHz and 13.710-14.010 MHz the field strength of any emissions shall not exceed 106 microvolts/meter at 30 meters.

d) The field strength of any emissions appearing outside of the 13.110-14.010 MHz band shall not exceed the general radiated emission limits in §15.209.

§15.209 Radiated emission limits; general requirements.

Frequency (MHz)	Field strength (microvolts/meter)	Measurement distance (meters)
0.009-0.490	2400/F(kHz)	300
0.490-1.705	24000/F(kHz)	30
1.705-30.0	30	30
30-88	100	3
88-216	150	3
216-960	200	3
Above 960	500	3

4.1.2 Procedure

Radiated Measurements Below 30 MHz

During the test the EUT is rotated and the measuring antenna angles are varied during the search for maximum signal level.

Radiated emissions are taken at ten meters unless the signal level is too low for measurement at that distance. If necessary, a pre-amplifier is used and/or the test is conducted at a closer distance. Measurements for below 30 MHz were made at 10 meters. Data results below are corrected for distance back to 30 meters.

Radiated Measurements Above 30 MHz

During the test the EUT is rotated and the measuring antenna height and polarization are varied during the search for maximum signal level. The antenna height is varied from 1 to 4 meters.

Radiated emissions are taken at ten meters unless the signal level is too low for measurement at that distance. If necessary, a pre-amplifier is used and/or the test is conducted at a closer distance. Measurements for above 30 MHz were made at 10 meters.

Radiated emission measurements were performed from 9kHz to 1 GHz.
Analyzer resolution is:

200Hz or greater for 9kHz to 150kHz
9 kHz or greater for 150kHz to 30 MHz
120 kHz or greater for 30MHz to 1000 MHz
For those frequencies quasi-peak detector applies

Data includes of the worst-case configuration (the configuration which resulted in the highest emission levels). A sample calculation, configuration photographs and data tables of the emissions are included.

Field Strength Calculation

The field strength is calculated by adding the Antenna Factor and Cable Factor, and subtracting the Amplifier Gain (if any) from the measured reading. The basic equation is as follows:

FS = RA + AF + CF – AG – DCF

Where FS = Field Strength in dB (μV/m)

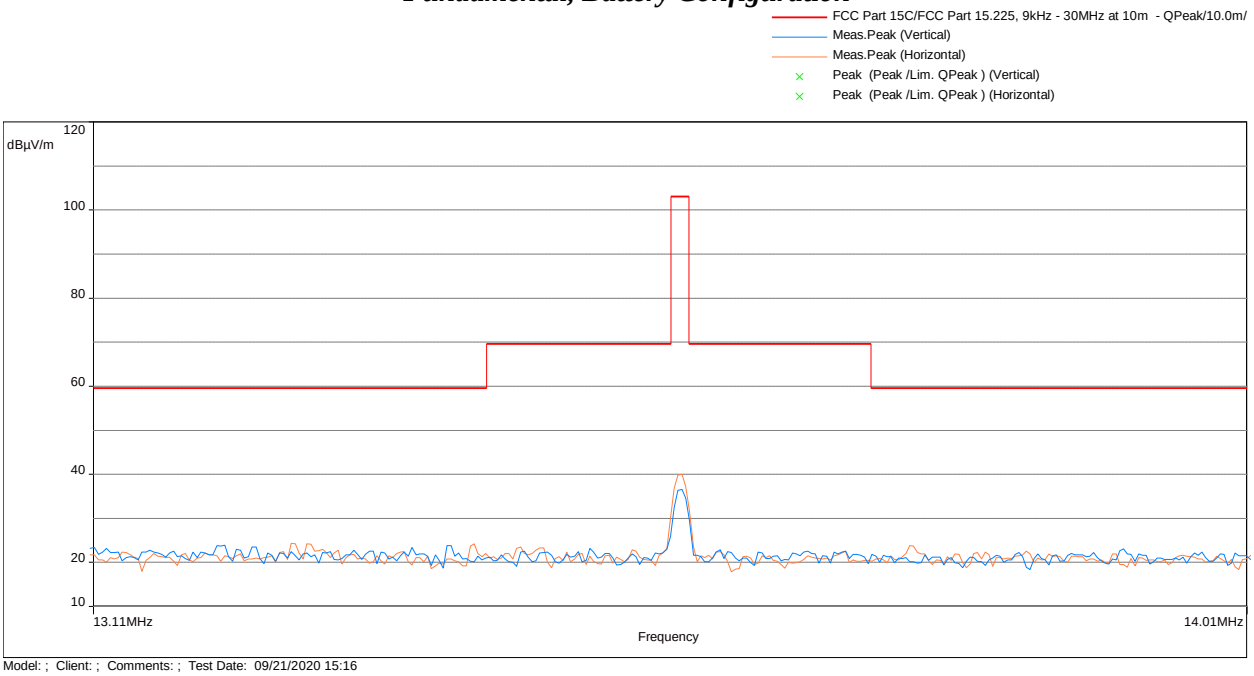
RA = Receiver Amplitude (including preamplifier) in dB (μV)
CF = Cable Attenuation Factor in dB
AF = Antenna Factor in dB (1/m)
AG = Amplifier Gain in dB
DCF = Distance Correction Factor

Note: FS was measured with loop antenna below 30MHz

4.1.3 Test Result 15.225 (a)(b)(c)

The data below shows the significant emission frequencies, the limit and the margin of compliance. Note: The EUT was tested in X, Y, Z orientations. Measurements were performed at parallel and perpendicular orientation of loop antenna. The worst-case data was presented below.

Fundamental, Battery Configuration

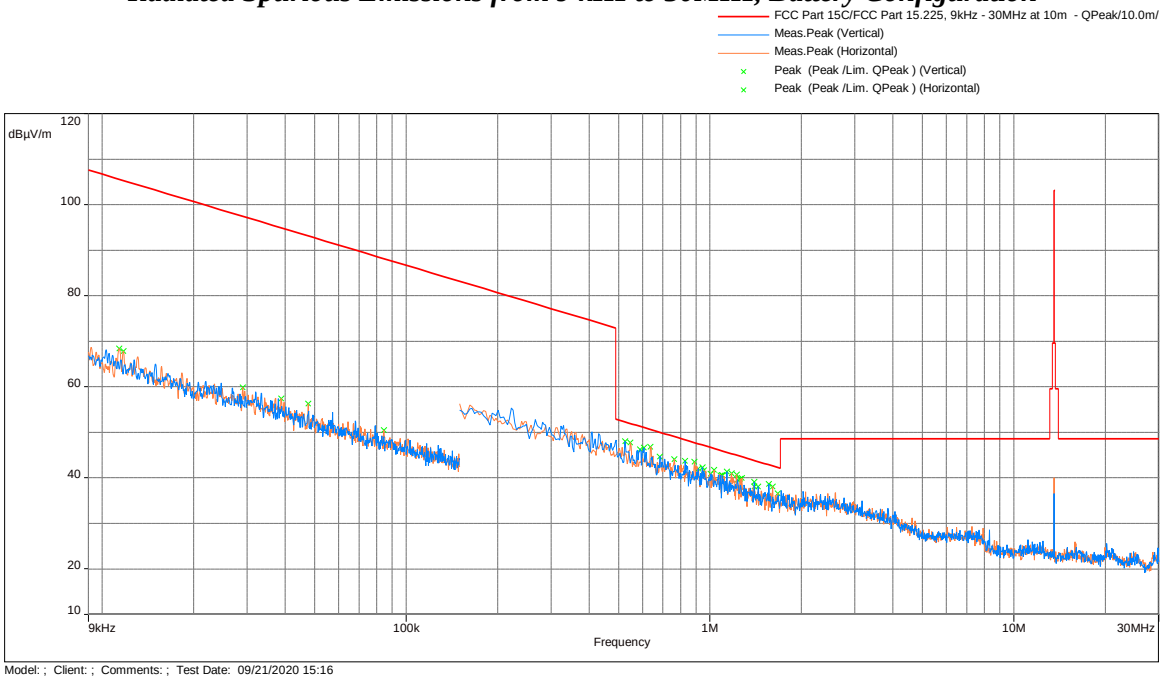


Frequency (MHz)	Peak FS@10m dB(uV/m)	Limit@10m dB(uV/m)	Margin dB	Polarity	RA@10m dB(uV)	Correction dB
13.56	40.0	103.1	-63.1	Parallel	24.9	15.1
13.56	36.6	103.1	-66.5	Perpendicular	21.5	15.1

Note: Correction = AF+CF–AG- distance correction factor
Distance correction factor=40*log10(limit distance/measured distance)

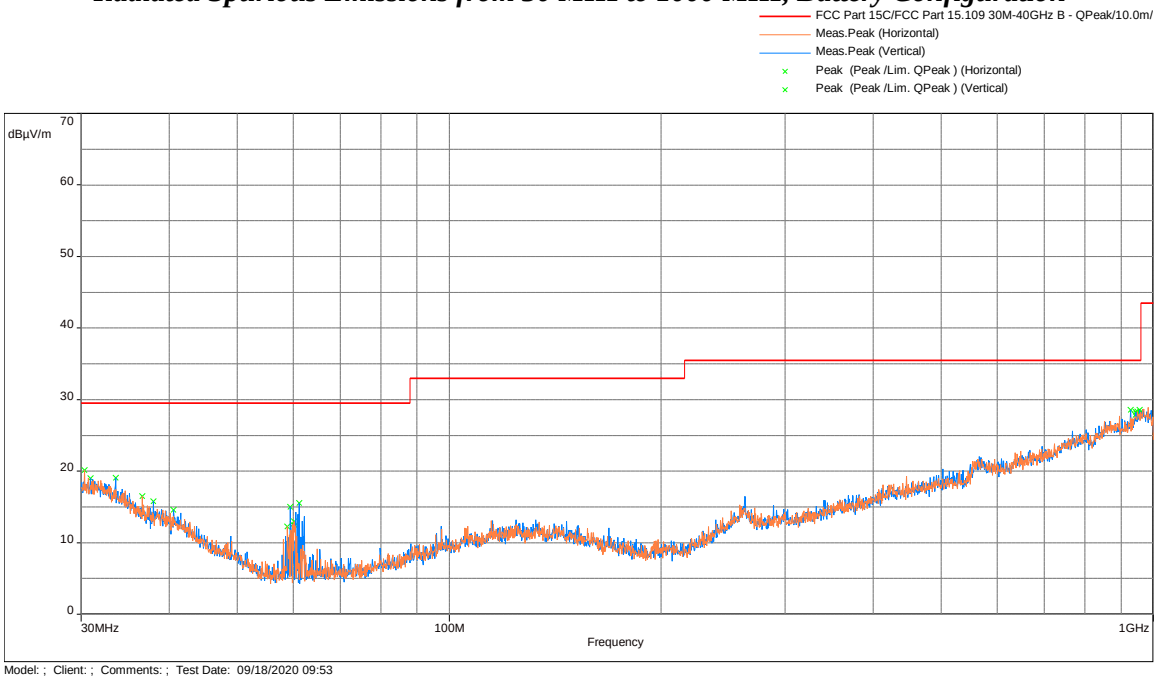
4.1.4 Test Result 15.225 (d) and 15.209

Radiated Spurious Emissions from 9 kHz to 30MHz, Battery Configuration



Model: ; Client: ; Comments: ; Test Date: 09/21/2020 15:16

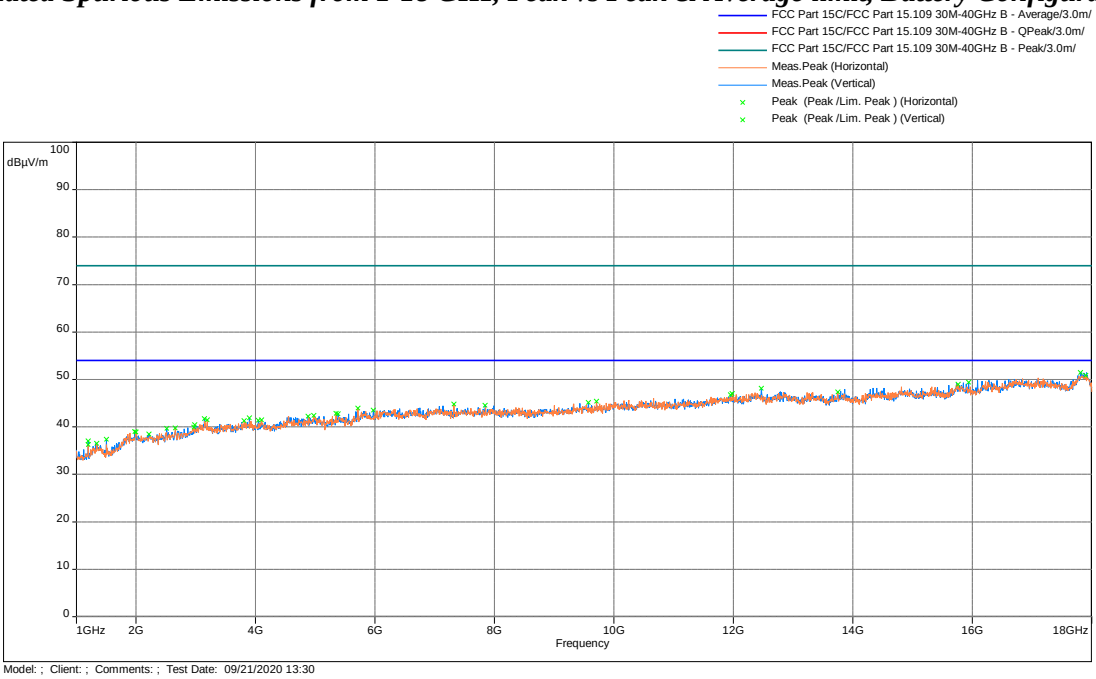
Radiated Spurious Emissions from 30 MHz to 1000 MHz, Battery Configuration



Freq (MHz)	FS @10m dB(uV/m)	Limit dB(uV/m)	Margin (dB)	Azimuth (Deg)	Height (m)	Polarity	RA (dBuV)	Correction (dB)
30.356	20.1	29.5	-9.4	263.75	3.98	Horizontal	28.9	-8.8
30.938	19.0	29.5	-10.5	80.5	1.02	Vertical	28.0	-9.1
59.456	15.0	29.5	-14.5	359.75	4.00	Vertical	36.8	-21.8
59.973	12.6	29.5	-16.9	123.5	2.98	Horizontal	34.4	-21.9
956.900	28.6	35.5	-6.9	325	2.02	Vertical	26.4	2.2
959.583	28.3	35.5	-7.2	92	1.00	Horizontal	26.0	2.3

Note: FS = RA + Correction
Correction = AF + CF – Preamp

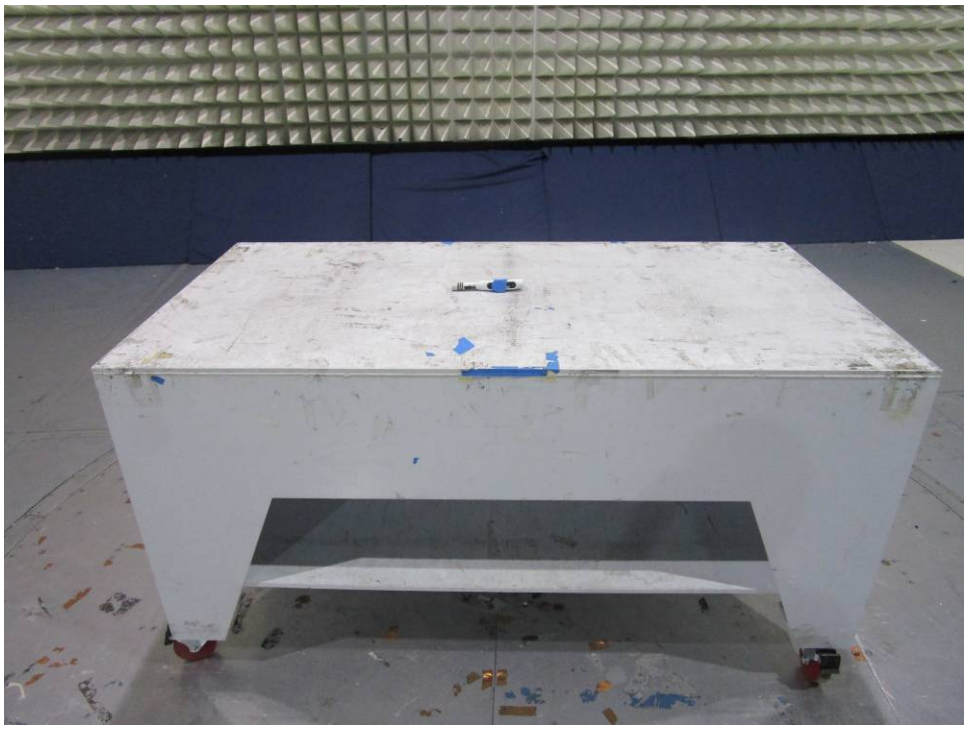
Radiated Spurious Emissions from 1-18 GHz, Peak vs Peak & Average limit, Battery Configuration

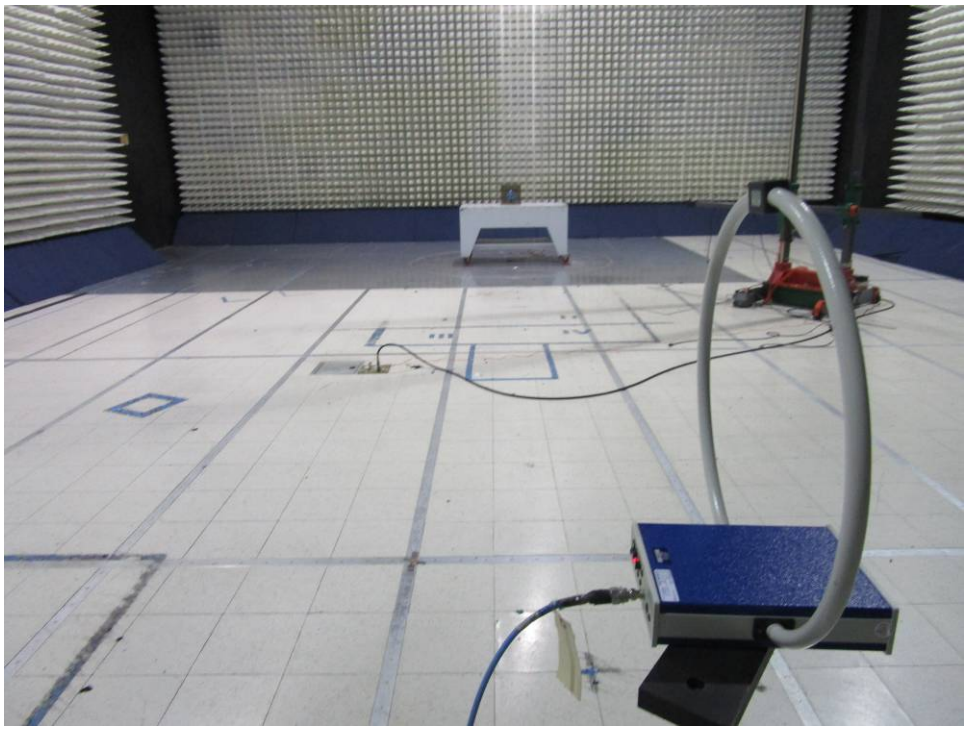


Result	**Complies** by 6.9 dB

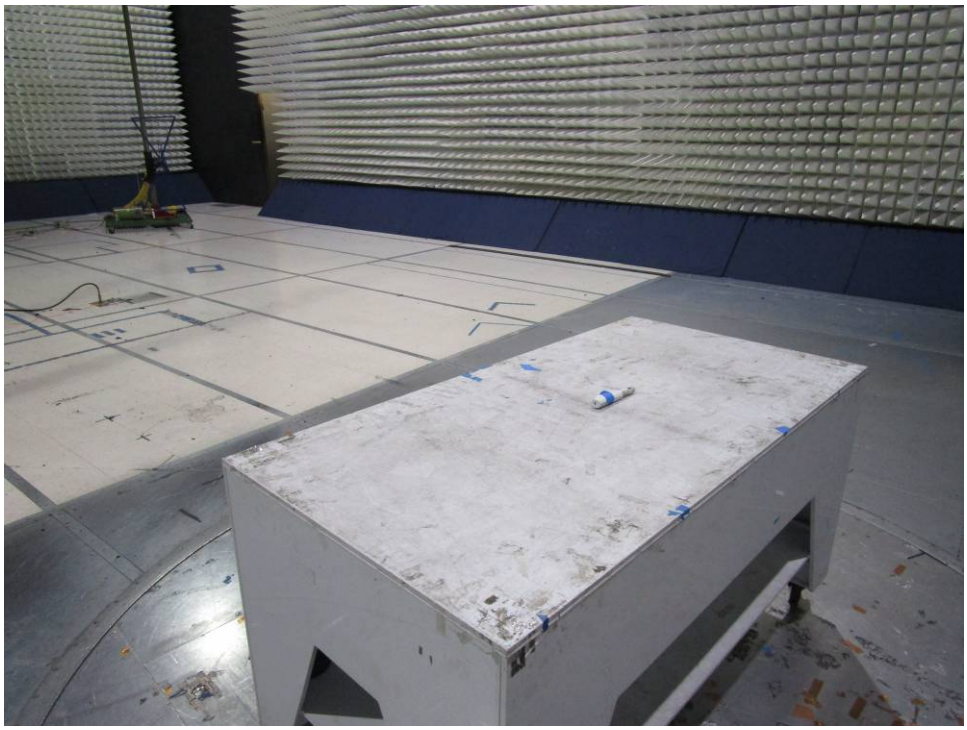
4.1.5 Test Configuration Photographs

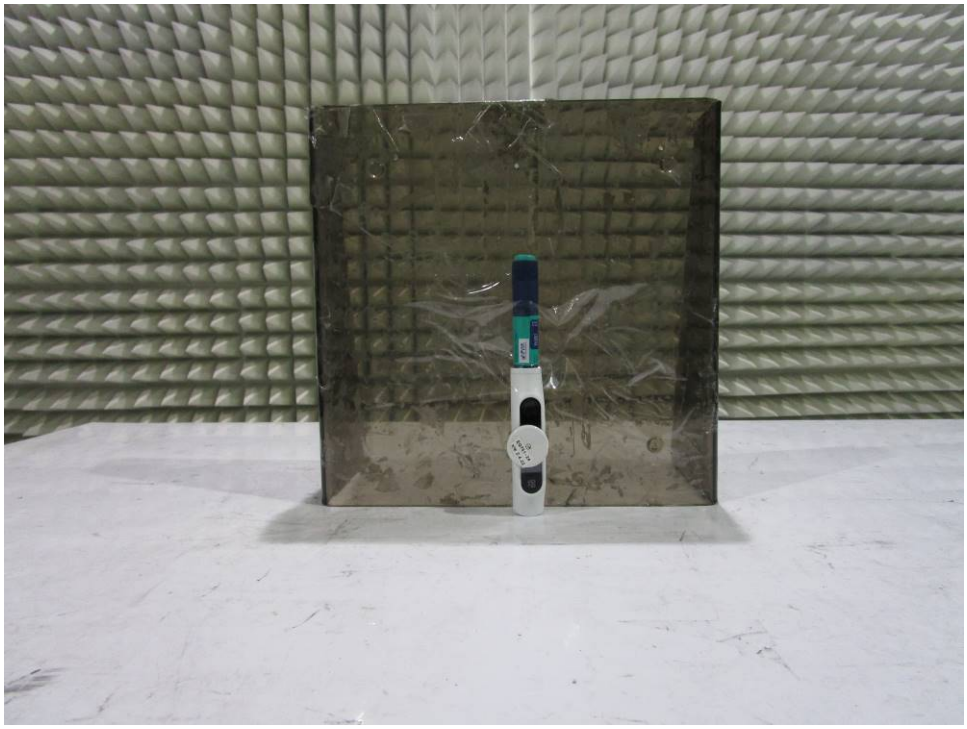
The following photographs show the testing configurations used.





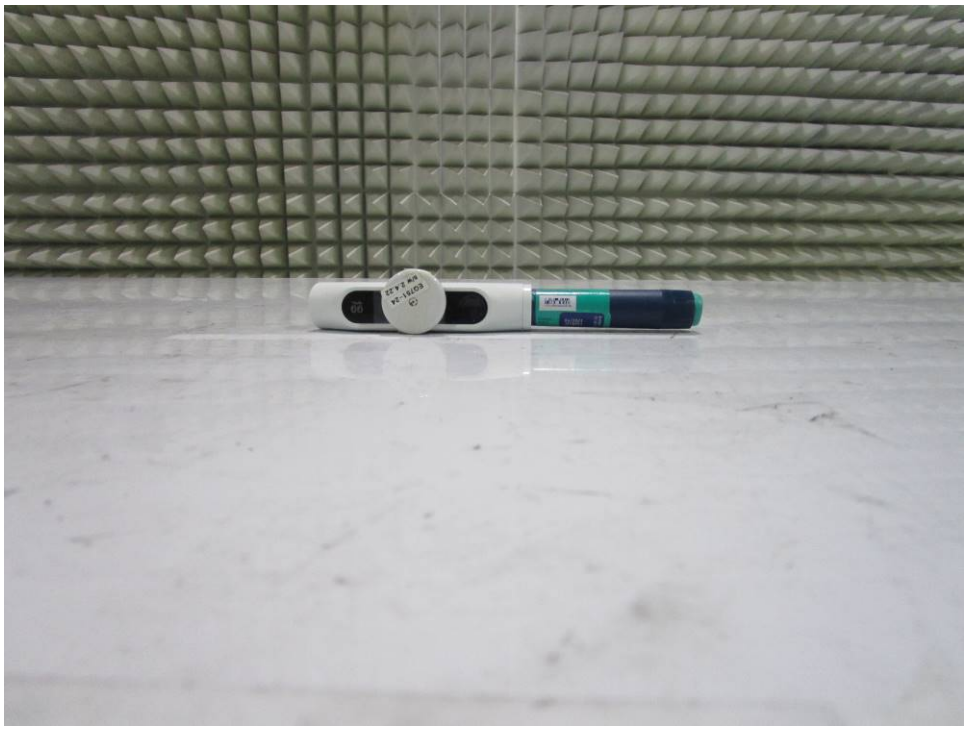
4.1.5 Test Configuration Photographs

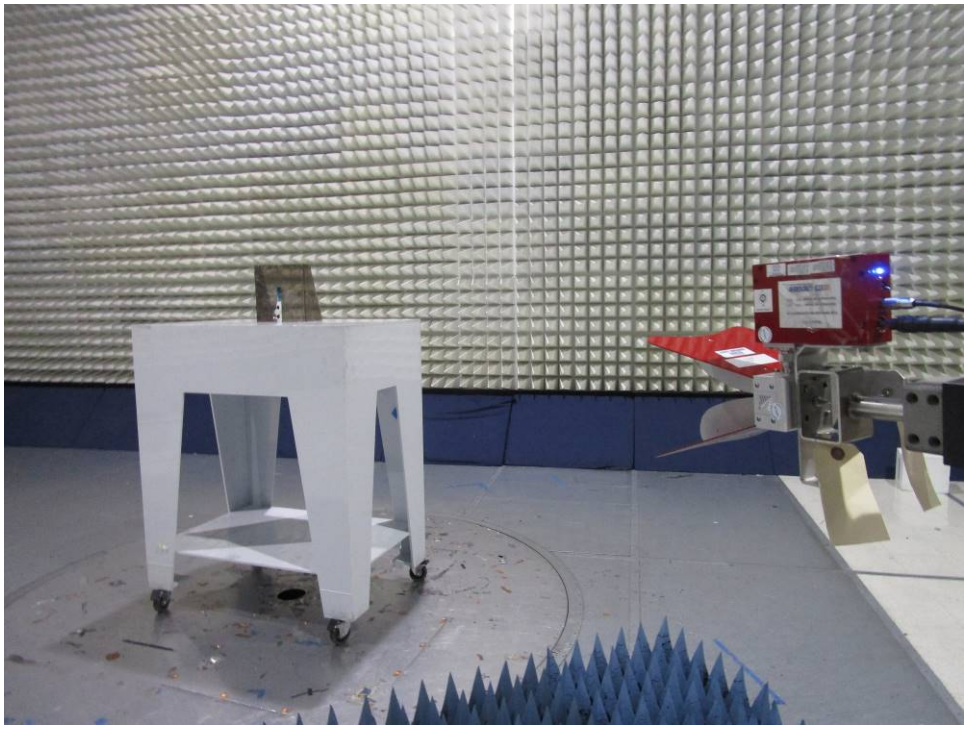




Electromagnetic Radiated Disturbance Setup Photograph

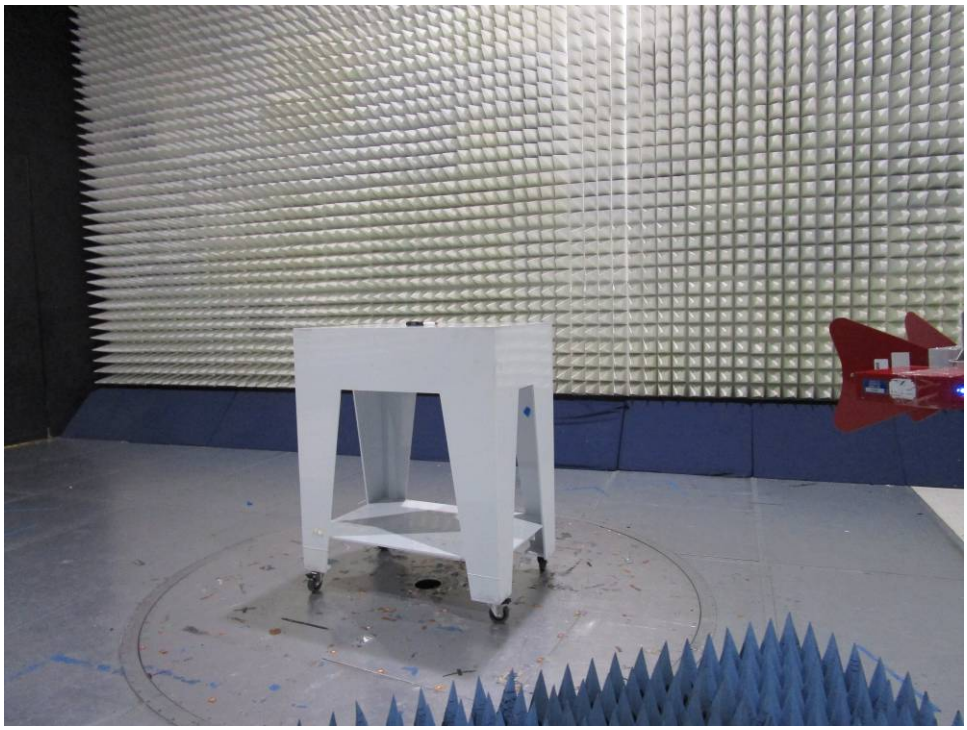
4.1.5 Test Configuration Photographs





Electromagnetic Radiated Disturbance Setup Photograph

4.1.5 Test Configuration Photographs



4.2 Frequency Tolerance

4.2.1 Requirement
FCC 15.225 (e)

The frequency tolerance of the carrier signal shall be maintained within ±0.01% of the operating frequency over a temperature variation of −20 degrees to +50 degrees C at normal supply voltage, and for a variation in the primary supply voltage from 85% to 115% of the rated supply voltage at a temperature of 20 degrees C. For battery operated equipment, the equipment tests shall be performed using a new battery.

4.2.2 Procedure

The EUT was placed in the temperature chamber. The frequency counter was connected to the transmitter output. For each temperature, the carrier frequency was recorded. Fully charged batteries were used to measure the frequency tolerance of the carrier.

4.2.3 Test Results 15.225 (e)

Nominal Frequency: 13559972 Hz

Voltage (DC)	Temperature (C)	Measured Frequency (Hz)	Deviation from Reference (Hz)	Deviation (%)
Fully charged Battery	-20	13560049	49.4235	0.000569
Fully charged Battery	-10	13560045	73.1085	0.000539
Fully charged Battery	0	13560053	80.32	0.000592
Fully charged Battery	10	13559953	-19.0385	-0.00014
Fully charged Battery	20	13559972	0	-0.0002
Fully charged Battery	30	13559950	-22.244	-0.00016
Fully charged Battery	40	13559928	-43.8785	-0.00032
Fully charged Battery	50	13559913	-59.103	-0.00044

4.3 Occupied Bandwidth
FCC 15.215

4.3.1 Requirements

Intentional radiators operating under the alternative provisions to the general emission limits, as contained in §§15.217 through 15.257, must be designed to ensure that the 20 dB bandwidth of the emission, or whatever bandwidth may otherwise be specified in the specific rule section under which the equipment operates, is contained within the frequency band designated in the rule section under which the equipment is operated. The requirement to contain the designated bandwidth of the emission within the specified frequency band includes the effects from frequency sweeping, frequency hopping and other modulation techniques that may be employed as well as the frequency stability of the transmitter over expected variations in temperature and supply voltage.

4.3.2 Procedure

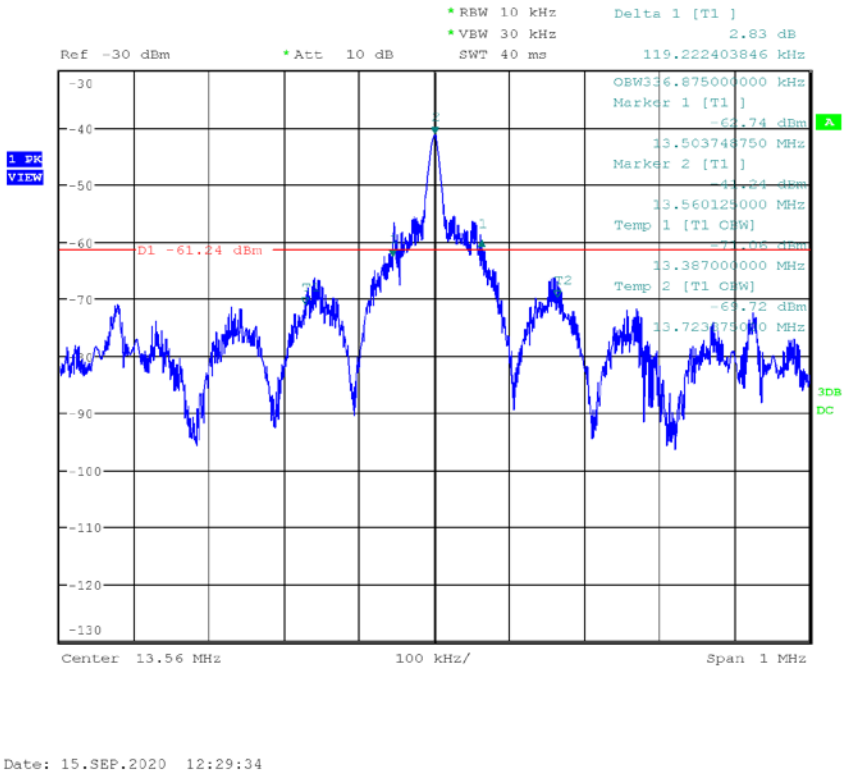
The EUT was setup to transmit in normal operating condition.

Measurements were made with the loop antenna in close proximity of the EUT. Following the procedures of ANSI 63.10: 2013, the 20dB bandwidth measurements were taken. The following plots show Occupied Bandwidth.

4.3.3 Test Results

Frequency (MHz)	-20 dB Channel Bandwidth (kHz)	99% Channel Bandwidth (kHz)
13.56	119.22	336.88

-20dB & 99% Channel Bandwidth Plot



4.4 AC Line Conducted Emission
FCC Rule 15.207

4.4.1 Requirement

Frequency Band MHz	Class B Limit dB(µV)		Class A Limit dB(µV)	
	Quasi-Peak	Average	Quasi-Peak	Average
0.15-0.50	66 to 56 *	56 to 46 *	79	66
0.50-5.00	56	46	73	60
5.00-30.00	60	50	73	60

*Note: *Decreases linearly with the logarithm of the frequency. At the transition frequency the lower limit applies.*

4.4.2 Procedure

Measurements are carried out using quasi-peak and average detector receivers in accordance with CISPR 16. An AMN is required to provide a defined impedance at high frequencies across the power feed at the point of measurement of terminal voltage and also to provide isolation of the circuit under test from the ambient noise on the power lines. An AMN as defined in CISPR 16 shall be used.

The EUT is located so that the distance between the boundary of the EUT and the closest surface of the AMN is 0.8m.

Where a flexible mains cord is provided by the manufacturer, this shall be 1m long or if in excess of 1m, the excess cable is folded back and forth as far as possible so as to form a bundle not exceeding 0.4m in length.

The EUT is arranged and connected with cables terminated in accordance with the product specification.

Conducted disturbance is measured between the phase lead and the reference ground, and between the neutral lead and the reference ground. Both measured values are reported.

The EUT, where intended for tabletop use, is placed on a table whose top is 0.8m above the ground plane. A vertical, metal reference plane is placed 0.4m from the EUT. The vertical metal reference-plane is at least 2m by 2m. The EUT shall be kept at least 0.8m from any other metal surface or other ground plane not being part of the EUT. The table is constructed of non-conductive materials. Its dimensions are 1m by 1.5m, but may be extended for larger EUT.

Floor standing EUT are placed on a horizontal metal ground plane and isolated from the ground plane by resting on an insulating material. The metal ground plane extends at least 0.5m beyond the boundaries of the EUT and has minimum dimensions of 2m by 2m.

EUT was placed in transmission mode then tested for conducted emissions per ANSI C63.10: 2013, ANSI C63.4-2014 to ensure the device complies with 15.207 & 15.107.

4.4.3 Test Result

No applicable, the NFC does not operate while the EUT is charging.

5.0 List of test equipment

Measurement equipment used for emission compliance testing utilized the equipment on the following list:

Equipment	Manufacturer	Model/Type	Asset No.	Calibration	Cal Due
EMI Receiver	Rohde and Schwarz	ESU40	ITS 00961	12	03/09/21
Spectrum Analyzer	Rohde and Schwarz	FSU	ITS 00913	12	03/26/21
Active Loop Antenna	COM-POWER	AL-130R	ITS 01589	12	10/22/20
Pre-Amplifier	Sonoma	310	ITS 00942	12	03/15/21
BI-Log Antenna	Antenna Research	LPB-2513	ITS 00355	12	04/24/21
Horn Antenna	ETS-Lindgren	3117-PA	ITS 01636	12	01/17/21
RF Cable	Megaphase	EMC1-K1K1-236	ITS 01537	12	04/17/21
RF Cable	TRU Corporation	TRU CORE 300	ITS 01330	12	05/09/21
RF Cable	TRU Corporation	TRU CORE 300	ITS 00465	12	08/16/21
RF Cable	TRU Corporation	TRU CORE 300	ITS 01470	12	08/16/21

Software used for emission compliance testing utilized the following:

Name	Manufacturer	Version	Template/Profile
BAT-EMC	Nexio	3.19.1.19	Bigfoot Medical Sept 16 RE.bpp

6.0 Document History

Revision/ Job Number	Writer Initials	Reviewer Initials	Date	Change
1.0 / G104424286	TM	KV	October 12, 2020	Original document

END OF REPORT