



Engineering Test Report No. 2201228-02	
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Manufacturer Name	Fleetwood Group Inc
Manufacturer Address	11832 James Street Holland, MI 49424
Product Name Brand/Model No.	VER5854
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Test Facility	Elite Electronic Engineering, Inc. 1516 Centre Circle, Downers Grove, IL 60515
Signature	<i>Nathaniel Bouchie</i>
Tested by	Nathaniel Bouchie
Signature	<i>Raymond J Klouda</i>
Approved by	Raymond J. Klouda, Registered Professional Engineer of Illinois – 44894
PO Number	R63037
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Table of Contents

1.	Report Revision History	3
2.	Introduction	4
3.	Subject of Investigation	4
4.	Standards and Requirements	4
5.	Sample Calculations	5
6.	Photographs of EUT	6
7.	Limits and Requirements	8
7.1.	Requirements mandated by the FCC	8
7.2.	Requirements mandated by Innovation, Science and Economic Development Canada	9
7.3.	Requirements mandated by the European Union and outlined in EN 62311	10
7.4.	Requirements mandated by Australia/New Zealand and outlined in AS/NZS 2772.2.....	11
8.	Assessment Results.....	12
8.1.	RF Exposure Evaluation Relevant to the Requirements of the FCC	12
8.2.	RF Exposure Evaluation Relevant to the Requirements of ISED	13
8.1.	RF Exposure Evaluation Relevant to the Requirements of the EU	14
8.1.	RF Exposure Evaluation Relevant to the Requirements of Australia/New Zealand	15
9.	Statement of Compliance.....	16

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1. Report Revision History

Revision	Date	Description
-	14 APR 2022	Initial Release of Engineering Test Report No. ETR 2201228-02

2. Introduction

The FCC, Innovation, Science and Economic Development Canada, European Union and Australia/New Zealand publish standards regarding the evaluation of the RF Exposure hazard of radio communications devices. An evaluation has been performed on the Fleetwood Group Inc BLE Clearview Badge, Model No. VER5854 pursuant to the relevant requirements.

3. Subject of Investigation

This document presents the demonstration of RF Exposure compliance on a BLE Clearview Badge, (hereinafter referred to as the Equipment under Test (EUT)). The EUT was identified as follows:

EUT Identification	
Description	BLE Clearview Badge
Model/Part No.	VER5854
S/N	Unit 1
Radio Access Technology	Bluetooth Low Energy
Equipment Class	Portable
Minimum Separation Distance	0.5cm
Conducted Output Power	1.4dBm
EIRP	4.4dBm
Bands of Operation	2.4 GHz Bluetooth
Antenna Gain	0

4. Standards and Requirements

The tests were performed to selected portions of, and in accordance with the following specifications.

- 47 CFR Parts 1.1310, 2.1091 and 2.1093 Code of Federal Regulations, Title 47, Telecommunications
- KDB 447498 D01 – “RF Exposure Procedures and Equipment Authorization Policies for Mobile and Portable Devices, General RF Exposure Guidance v06”
- OET Bulletin 65 Edition 97-01:1997 – “Evaluating Compliance with FCC Guidelines for Human Exposure to Radiofrequency Electromagnetic Fields”
- ANSI/IEEE C95.1:1992 – "Safety Levels with Respect to Human Exposure to Radio Frequency Electromagnetic Fields, 3 kHz to 300 GHz,"
- RSS-102, Issue 5 Radio Frequency (RF) Exposure Compliance of Radiocommunication Apparatus (All Frequency Bands)
- EN 62311:2020 Assessment of electronic and electrical equipment related to human exposure restrictions for electromagnetic fields (0 Hz - 300 GHz)
- EN 62479:2010 Assessment of the Compliance of Low Power Electronic and Electrical Equipment with the Basic Restrictions Related to Human Exposure to Electromagnetic Fields (10MHz-300GHz)
- 1999/519/EC Council Recommendation on the Limitation of Exposure of The General Public to Electromagnetic fields (0Hz-300GHz)
- AS/NZS 2772.2: 2016 Principles and methods of measurement and computation-3 kHz to 300 GHz
- RSP 3 Maximum Exposure Levels to Radiofrequency Fields – 3 kHz to 300 GHz

5. Sample Calculations

The far field power density can be calculated using the following formula:

$$S = \frac{PG}{4\pi R^2} \quad (1)$$

where P is the transmit output power (mW), G is the maximum antenna gain relative to an isotropic antenna (linear) and R is the evaluation distance (cm).

In cases where multiple antennas are utilized for a single signal, the following formula is applied to calculate the maximum antenna gain:

$$\text{Gain (dBi)} = G + 10 \log N \quad (2)$$

where N is the number of antennas, G is the gain of a single antenna.

A minimum separation distance can be calculated using the following formulas

$$\text{Minimum Separation Distance} = \sqrt{\frac{PG}{4\pi(\text{Power Density Limit})}} \quad (3)$$

where P is the transmit output power (mW) and G is the maximum antenna gain relative to an isotropic antenna (linear).

For sources with frequencies <30MHz

$$\text{Separation Distance} = R \left(10^{\frac{(FS_{Limit}-FS_R)}{40}} \right)^{-1} \quad (4)$$

For sources with frequencies >30MHz

$$\text{Separation Distance} = R \left(10^{\frac{(FS_{Limit}-FS_R)}{20}} \right)^{-1} \quad (5)$$

where R is the measurement distance, FS_{Limit} is the field strength limit and FS_R is the measured field strength at distance R.

6. Photographs of EUT





7. Limits and Requirements

7.1. Requirements mandated by the FCC

The first step is to determine if the product is categorically exempt from RF exposure evaluation based on the criteria listed in 1.1307(b)(1)

The next step is to evaluate RF exposure either by measurement or by calculating the power density at distance of 0.2m, as specified by ANSI/IEEE C95.1-1992. If it is determined that the resulting power density does not meet the basic restrictions, a separation distance must be measured or calculated such that the basic restrictions are met.

Per 1.1310(e), the power density shall not exceed the levels below:

Limits for Occupational/Controlled Exposure			
Frequency Range (MHz)	Electric Field Strength (V/m)	Magnetic Field Strength (A/m)	Power Density (mW/cm ²)
0.3 - 3.0	614	1.63	*100
3.0 – 30	1842 / f	4.89 / f	*900 / f ²
30 – 300	61.4	0.163	1.0
300 – 1,500	—	—	f / 300
1,500 – 100,000	—	—	5
Limits for General/Uncontrolled Exposure			
Frequency Range (MHz)	Electric Field Strength (V/m)	Magnetic Field Strength (A/m)	Power Density (mW/cm ²)
0.3 – 1.34	614	1.63	*100
1.34 – 30	842 / f	2.19 / f	*180 / f ²
30 – 300	27.5	0.073	0.2
300 – 1,500	—	—	f / 1500
1,500 – 100,000	—	—	1.0
f – Frequency in MHz * – Plane wave Equivalent Power Density			

7.2. Requirements mandated by Innovation, Science and Economic Development Canada

The RF exposure level is determined by either measurement or by calculating the power density at an evaluation distance of 0.2m, as specified by ANSI/IEEE C95.1-1992. If it is determined that the measured or calculated power density does not meet the basic restrictions, a separation distance must be measured or calculated such that the basic restrictions are met. If it is found that the product meets the low power exclusion level criteria listed in RSS 102 Section 2.5.2, no further RF exposure evaluation is required.

Per RSS 102 Section 4, the power density shall not exceed the levels below:

Limits for Occupational/Controlled Exposure			
Frequency Range (MHz)	Electric Field Strength (V/m)	Magnetic Field Strength (A/m)	Power Density (W/m ²)
0.003 – 10	170	180	—
0.1 – 10	—	1.6 / f	—
1.29 – 10	193 / f ^{0.5}	—	—
10 – 20	61.4	0.163	10
20 – 48	129.8 / f ^{0.25}	0.3444 / f ^{0.25}	44.72 / f ^{0.5}
48 – 100	49.33	0.1309	6.455
100 – 6000	15.60 f ^{0.25}	0.04138 f ^{0.25}	0.6455 f ^{0.5}
6000 – 15000	137	0.364	50
15000 – 150000	137	0.364	50
150000 – 300000	0.354 f ^{0.5}	9.40x10 ⁻⁴ f ^{0.5}	3.33x10 ⁻⁴ f
Limits for General/Uncontrolled Exposure			
Frequency Range (MHz)	Electric Field Strength (V/m)	Magnetic Field Strength (A/m)	Power Density (W/m ²)
0.003 – 10	83	90	—
0.1 – 10	—	0.73 / f	—
1.1 – 10	87 / f ^{0.5}	—	—
10 – 20	27.46	0.0728	2
20 – 48	58.07 / f ^{0.25}	0.1540 / f ^{0.25}	8.944 / f ^{0.5}
48 – 300	22.06	0.05852	1.291
300 – 6000	3.142 f ^{0.3417}	0.008335 f ^{0.3417}	0.02619 f ^{0.6834}
6000 – 15000	61.4	0.163	10
15000 – 150000	61.4	0.163	10
150000 – 300000	0.158 f ^{0.5}	4.21x10 ⁻⁴ f ^{0.5}	6.67x10 ⁻⁵ f

f – Frequency in MHz

7.3. Requirements mandated by the European Union and outlined in EN 62311

The RF exposure level is determined by either measurement or by calculating the power density at an evaluation distance of 0.2m, as specified by ANSI/IEEE C95.1-1992. If it is determined that the measured or calculated power density does not meet the basic restrictions, a separation distance must be measured or calculated such that the basic restrictions are met. If the device output power is less than the low power exclusion level, then the device is deemed to comply with the basic restrictions listed in the 1999/519/EC Council Recommendation.

Per the 1999/519/EC Council Recommendation, the measured field strength shall not exceed the levels below:

Reference Levels for Maximum Exposure			
Frequency Range	Electric Field Strength (V/m)	Magnetic Field Strength (A/m)	Power Density (W/m ²)
0 – 1Hz	—	3.2×10^4	—
1 – 8Hz	10000	$3.2 \times 10^4 / f^2$	—
8 – 25Hz	10000	$4000 / f$	—
0.025 – 0.8kHz	$250 / f$	$4 / f$	—
0.8 – 3kHz	$250 / f$	5	—
3 – 150kHz	87	5	—
0.15 – 1MHz	87	$0.73 / f$	—
1 – 10MHz	$87 / f^{1/2}$	$0.73 / f$	—
10 – 400MHz	28	0.073	2
400 – 2000MHz	$1.375 f^{0.5}$	$0.0037 / f^{0.5}$	$f / 200$
2 – 300GHz	61	0.16	10

f as indicated in the frequency range column

7.4. Requirements mandated by Australia/New Zealand and outlined in AS/NZS 2772.2

As stated in Schedule 5 of RPS 3, S5.2.2, the evaluation of transmitting equipment for compliance with RPS 3 is not required where the nominal mean power output does not exceed 100mW. For devices exceeding 100mW, evaluation of transmitting equipment for compliance with this standard is not required where it can be demonstrated that in normal use the mean radiated power output does not exceed the alternative low-power exclusion levels as defined in IEC 62479 (2010).

The RF exposure levels are assessed either by measurement or by calculating the power density at an evaluation distance of 0.2m, as specified by ANSI/IEEE C95.1-1992. If it is determined that the measured or calculated power density does not meet the basic restrictions, a minimum separation distance must be measured or calculated such that the basic restrictions are met. The assessment is based on transmitter power levels, transmit frequency(s) and antenna parameters.

Per RPS 3, the calculated power density shall not exceed the levels below:

Limits for Occupational/Controlled Exposure			
Frequency Range	Electric Field Strength (V/m)	Magnetic Field Strength (A/m)	Power Density (W/m ²)
100kHz – 1MHz	614	1.63 / f	-
1MHz – 10MHz	614 / f	1.63 / f	1000 / f ²
10MHz – 400MHz	61.4	0.163	10
400MHz – 2GHz	3.07 x f ^{0.5}	0.00814 / f ^{0.5}	f / 40
2GHz – 300GHz	137	0.364	50
Limits for General/Uncontrolled Exposure			
Frequency Range (MHz)	Electric Field Strength (V/m)	Magnetic Field Strength (A/m)	Power Density (W/m ²)
100kHz – 150kHz	86.8	4.86	-
150kHz – 1MHz	86.8	0.729 / f	-
1MHz – 10MHz	86.8 / f ^{0.5}	0.729 / f	-
10MHz – 400MHz	27.4	0.0729	2
400MHz – 2GHz	1.37 x f ^{0.5}	0.00364 x f ^{0.5}	f / 200
2GHz – 300GHz	61.4	0.163	10
f – Frequency in MHz			

8. Assessment Results

8.1. RF Exposure Evaluation Relevant to the Requirements of the FCC

Radio Access Technology	f Transmit Frequency (MHz)	ERP/P (dBm)	ERP/P (mW)	ERP/P Exemption Threshold (mW)	Exempt/Not Exempt
BLE	2402	4.4	2.754228703	2.788	Exempt - Option B

8.2. RF Exposure Evaluation Relevant to the Requirements of ISED

Limits for Head/Torso worn Devices:

Radio Access Technology	f Transmit Frequency (MHz)	EIRP (dBm)	EIRP (W)	SAR Exemption Threshold (W)	Exempt/Not Exempt
BLE	2402	4.4	0.002754229	0.004	Exempt

Limits for Limb worn Devices:

Radio Access Technology	f Transmit Frequency (MHz)	EIRP (dBm)	EIRP (W)	SAR Exemption Threshold (W)	Exempt/Not Exempt
BLE	2402	4.4	0.002754229	0.010	Exempt

8.3. RF Exposure Evaluation Relevant to the Requirements of the EU

Occupational Limits:

Radio Access Technology	f Transmit Frequency (MHz)	EIRP (dBm)	EIRP (W)	SAR Exemption Threshold (W)	Exempt/Not Exempt
BLE	2402	4.4	0.002754229	0.10	Exempt

General Limits:

Radio Access Technology	f Transmit Frequency (MHz)	EIRP (dBm)	EIRP (W)	SAR Exemption Threshold (W)	Exempt/Not Exempt
BLE	2402	4.4	0.002754229	0.02	Exempt

8.4. RF Exposure Evaluation Relevant to the Requirements of Australia/New Zealand

Radio Access Technology	f Transmit Frequency (MHz)	EIRP (dBm)	EIRP (W)	General Population Exemption Threshold (W)	Controlled Environment Exemption Threshold (W)
BLE	2402	4.4	0.002754229	0.200	1

9. Statement of Compliance

The Fleetwood Group Inc BLE Clearview Badge, Model VER5854 is in compliance with the FCC, Innovation, Science and Economic Development Canada, European Union and Australia/New Zealand requirements for RF Exposure at a minimum separation distance of 0.5cm.