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47 CFR PART 2.1091

RADIOFREQUENCY RADIATION EXPOSURE EVALUATION: MOBILE DEVICES

REPORT NUMBER: M2107001-6

STANDARD: 47 CFR § 2.1091

MANUFACTURER: GREYSCAN AUSTRALIA PTY LTD

DEVICE: GREYSCAN ETD-100

MODEL: ETD-100

FCC ID: 2A2S7-ETD100

DATE OF ISSUE: 15 SEPTEMBER 2021

REVISION TABLE

Version	Sec/Para Changed	Change Made	Date
1		Initial issue of document	15/09/2021

CONTENTS

RADIOFREQUENCY RADIATION EXPOSURE EVALUATION REPORT - MPE

Device:	GreyScan ETD-100
Model Number:	ETD-100
Part Number:	GSN-1518-1092
FCC ID:	2A2S7-ETD100
Manufacturer:	GreyScan Australia Pty Ltd
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Standards:	**447498 D01 General RF Exposure Guidance v06** RF exposure procedures and equipment authorization policies for mobile and portable devices. **680106 D01 RF Exposure Wireless Charging App v03r01** RF exposure consideration for low power consumer wireless power transfer applications **47 CFR § 2.1091** Radiofrequency radiation exposure evaluation: mobile devices (Transmitter is more than 20 cm from human body).
Result:	Based on an assessment of the documentation provided the GreyScan ETD-100, model ETD-100 complies with the RF exposure requirements of 47 CFR Part 2.1091 and 680106 D01 RF Exposure Wireless Charging App v03r01. Refer to Report M2107001-6 for full details
Assessment Date:	23 August 2021
Issue Date:	15 September 2021
Assessment Officer:	Shaun Reid Trainee Test Engineer – EMR
Authorised Signatory:	Emad Mansour EMR and Sites Engineer

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1 INTRODUCTION

This report is intended to demonstrate compliance of the GreyScan ETD-100 model ETD-100 with the RF exposure requirements of 47 CFR Part 2.1091. Evaluation was performed in accordance with FCC KDB 447498 D01.

The test sample was provided by the Client. The conclusion herein is based on the information provided by the client.

1.1 Laboratory Overview

EMC Technologies Pty. Ltd. is an independently owned Australian company that is NATA accredited to ISO 17025 for both testing and calibration and ISO 17020 for Inspection. – **Accreditation Number 5292.**

1.2 Test Laboratory/Accreditations

Inspection was performed at EMC Technologies' laboratory in Keilor Park, Victoria Australia.

Table 1-1: Accreditations for Conformity Assessment

Country/Region	Body	
Australia/New Zealand	NATA	Accreditation Number: 5292
Europe	European Union	Notified Body Number: 0819
USA	FCC	Designation Number: AU0001 (Melb)
Canada	ISED Canada	Company Number: 3569B(Melb)
Japan	VCCI	Company Number: 785
Taiwan	BSMI	Lab Code SL2-IN-E-5001R

2 DEVICE DETAILS

(Information supplied by the Client)

GreyScan **ETD-100** is an explosive trace detection (ETD) device to detect homemade inorganic explosives. GreyScan **ETD-100** detects homemade inorganic explosives (nitrate, chlorate, perchlorate ions). Passengers and cargo can be screened with industry standard swabs, which are inserted into the GreyScan **ETD-100** by the operator. A proprietary reagent is then mixed with the sample to maximize sensitivity and is then injected into a specialised high voltage separator. Ions are separated in this process (Capillary Zone Electrophoresis), and their presence is measured as they pass through the detection system.

The GreyScan ETD-100 has on-board 2.4/5G Hz radio, NFC Runs at 13.56 MHz and wireless power transmitter 100 kHz to 200 kHz.

The wireless power transmitter uses the TI BQ500212 controller IC in conjunction with a pair of TI CSD97394Q4MT power stages to drive a Wurth p/n 760308111 transmitter coil. The wireless transmitter operates between 100 and 200 kHz depending on load. Power is coupled inductively between the transmitter and receiver coils.

Manufacturer: GreyScan Australia Pty Ltd
Inspected Sample: GreyScan ETD-100
Model Number: ETD-100
Serial Number: GSN-1518-1092

Transmit parameters were provided by the customer and are shown below:

Table 2-1: Transmitter Parameters

Transmitter	1	2	3
Wireless Interface:	Bluetooth & Wi-Fi Transceiver	RFID transceiver	Wireless Power Transfer
Manufacturer	Texas Instruments	ST Microelectronics	Wurth Elektronik
Module:	TI WL1837MOD	CR95HF	TI BQ500212
Operating Frequency:	2.4 GHz and 5 GHz	13.56 MHz	100 kHz and 200 kHz
Max. EIRP (dBm)	BR: 11.7 EDR: 7.2 BLE: 7.0 2.4GHz Wi-Fi: 17.3 5GHz Wi-Fi: 18.0 2.4GHz Wi-Fi (MIMO): 18.5	24	37 (5W) conducted
Antenna Type:	Integrated	Integrated	Wurth Elektronik 760308111 coil antenna
Max Antenna gain:	N/A	N/A	Unknown

3 LIMITS FOR MAXIMUM PERMISSIBLE EXPOSURE (MPE), §1.1310

Table 3-1 - Limits for Maximum Permissible Exposure (MPE)

Frequency range (MHz)	Electric field strength (V/m)	Magnetic field strength (A/m)	Power density (mW/cm^2)	Averaging time (minutes)
(A) Limits for Occupational/Controlled Exposure				
0.3-3.0	614	1.63	* 100	6
3.0-30	1842/f	4.89/f	* $900/f^2$	6
30-300	61.4	0.163	1.0	6
300-1,500			f/300	6
1,500-100,000			5	6
(B) Limits for General Population/Uncontrolled Exposure				
0.3-1.34	614	1.63	* 100	30
1.34-30	824/f	2.19/f	* $180/f^2$	30
30-300	27.5	0.073	0.2	30
300-1,500			f/1500	30
1,500-100,000			1.0	30

f = frequency in MHz * = Plane-wave equivalent power density

4 UNCERTAINTY

EMC Technologies has evaluated the tools and methods used to perform Radiated Electromagnetic Field predictions.

The estimated inspection uncertainties for the test shown within this report are as follows:

Electromagnetic Modelling

30 MHz to 100GHz ±2.8 dB

The above expanded uncertainties are based on standard uncertainties multiplied by a coverage factor of k=2, providing a level of confidence of approximately 95%.

5 ASSUMPTIONS IN THIS ASSESSMENT

This assessment does not include accumulated RF fields from nearby sites/antennas or possible radio signal reflections or attenuation due to buildings or the general environment.

Antenna Parameters and power settings were supplied by the customer or manufacturer datasheets.

A 100% duty cycle is assumed.

The aperture of the radiating element assumed to be a point source in free space and far field conditions.

6 RF EXPOSURE MEASUREMENT

The measurements were performed in report M2107001-7B between the 100 Hz to 18 GHz frequency range using the WaveControl meter and different probes for magnetic and electric field. The levels recorded were then compared against the limits in Section 3.

Transmission for the WPT at 100 kHz to 200 kHz and RFID/NFC at 13.56 MHz were activated during the test, measurements were taken using the Wavecontrol Meter/Probe described above (mounted on a non-magnetic aluminium tripod) in units of Ampere per meter (A/m) and Volts per metre (V/m) respectively. The field meter was set to current RMS. Measurements were performed in all the direction around the GreyScan ETD-100 at 15 cm distance probe centre to face (corrected from 10 cm probe tip to face in the M2107001-7B report).

6.1 RF Exposure Measurement Results (RFID and WPT)

	Highest Measured Values	Limit	Percentage of the Limit %	
Incident E-field strength (V/m)	4.3	614	0.7	**WPT @ 200 kHz**
	0.87	60	1.5	**RFID**
Incident H-field strength (A/m)	0.140	1.63	8.59	**WPT @ 200 kHz**
	0.020	0.16	12.5	**RFID**

6.2 RF Exposure Calculations (WiFi/BT)

The reference level was evaluated at 20 cm to show compliance with the power density listed in Table 3-1.

The following formula was used to calculate the power density at 20 cm:

$$S = \frac{P * G}{4\pi R^2}$$

$$S = \frac{EIRP}{4\pi R^2}$$

Where:

(S): Power density (mW/cm^2)
(P): Output power at antenna terminal (mW)
(G): Gain (ratio)
(R): Minimum test separation distance (20 cm)

Table 6-1: Calculations

Technology	Frequency Band (MHz)	Power	Gain	Duty Cycle	EIRP	EIRP	Flux Density at 20 cm	Flux Density Limit	Percentage of the Limit
		dBm	dBi	%	dBm	mW	mW/cm^2	mW/cm^2	%
BT – BR	2402-2480	11.7	0	100%	11.7	14.8	0.0	1.0	0.3%
BT – EDR	2402-2480	7.2	0	100%	7.2	5.2	0.0	1.0	0.2%
BT – BLE	2402-2480	7	0	100%	7.0	5.0	0.0	1.0	0.1%
2.4GHz WLAN – SISO	2412-2482	17.3	0	100%	17.3	53.7	0.0	1.0	1.1%
2.4GHz WLAN – MIMO	2412-2482	18.5		100%	18.5	70.8	0.0	1.0	1.5%
5GHz	4920-5825	18	0	100%	18.0	63.1	0.0	1.0	1.3%
Total percentage of the limit at 20 cm for simultaneous transmission (worst-case)									**3.1%**

6.3 Co-location Consideration:

Simultaneous transmission MPE test exclusion applies when the sum of the MPE ratios for all simultaneously transmitting antennas incorporated in a host device is ≤ 1.0.

$$\sum_{1}^{N} \frac{S_{eqN}}{S_{limN}} = \frac{S_{eq1}}{S_{lim1}} + \frac{S_{eq2}}{S_{lim2}} + \cdots + \frac{S_{eqN}}{S_{limN}} \leq 1$$

Where: Seq = Power Spectral density (mw/cm^2) of a specific transmitter
Slim = MPE limit (mW/cm^2)

The following simultaneous transmissions are possible:

2.4 GHz Wi-Fi	5 GHz Wi-Fi	Bluetooth	RFID	WPT	MPE Ratio Sum	Result
0.015	0.013	0.003	0.13+0.02	0.09+0.007	0.28	Pass

Note: The E-Field and H-Field ratios are summed for both the RFID and WPT transmitters

7 CONCLUSION

Based on an assessment of the documentation provided the GreyScan ETD-100, model ETD-100 complies with the 47 CFR Part 2.1091 and 680106 D01 RF Exposure Wireless Charging App v03r01.

APPENDIX A

Referenced Documents

Document	Comments
WL18x7MOD WiLink™ 8 Dual-Band Industrial Module – Wi-Fi®, Bluetooth®, and Bluetooth Low Energy (LE)	Wi-Fi and Bluetooth Tx parameters
13.56-MHz multi-protocol contactless transceiver IC with SPI and UART serial access	13.56MHz Tx parameters
M2107001-7B	WPT and RFID MPE test report