

## EMC Technologies Pty. Ltd.

ABN 82 057 105 549

Melbourne 176 Harrick Road Keilor Park, Vic 3042 Tel: +61 3 9365 1000 Sydney
Unit 3/87 Station Road
Seven Hills, NSW 2147
Tel: +61 2 9624 2777

Email: emc-general@emctech.com.au

Web: www.emctech.com.au

# **Electromagnetic Compatibility Test Report**

Report No.: M2209034-1

**TESTED FOR:** 

DroneShield LLC

7140-B Farm Station Rd, Warrenton, VA 20187

**United States** 

Contact: Lachlan Giblett

Email: lachlan.giblett@droneshield.com

Tel: 0499487766

**ISSUED BY:** 

EMC Technologies Pty. Ltd.

176 Harrick Road, Keilor Park, VIC, 3042, Australia.

Web: www.emctech.com.au

Tel: +61 3 9365 1000

Product Name: RfPatrol MKII

Part Number: DRO-035

FCC ID: FCC ID: 2A9JZ-DRO-035 **Test Date(s):** 5 and 13 December 2022

**Issue Date:** 13 February 2023

**Specification(s):** 47 CFR Part 15 – Subpart B

The test sample, under the condition and operating mode described in this test report, complies with the standard/s listed above.

Test Engineer:

MM

Kevin Hansen

Authorized Signatory:

William Alam

Senior Test Engineer





## **Revision History**

Version	Issue Date	Reason / Comments
1	13 February 2023	Initial issue

### **General Remarks**

EMC Technologies Pty Ltd hereby certify that the device(s) described herein were tested as described in this report and that the data included is that which was obtained during such testing.

EMC Technologies Pty Ltd reports apply only to the specific samples tested under stated test conditions. It is the manufacturer's responsibility to assure that additional production units of this model are manufactured with identical electrical and mechanical components. EMC Technologies Pty Ltd shall have no liability for any deductions, inferences or generalisations drawn by the customer or others from EMC Technologies Pty Ltd issued reports. This report shall not be used to claim, constitute or imply product endorsement by EMC Technologies Pty Ltd.



# Content

1	Project Overview	4
1.1	Test Facility	
1.2	Standards Applied	5
1.3		
1.4		
1.5	Measurement Uncertainty	6
1.6	Test Equipment	7
2	Equipment Under Test	8
2.1	EUT Details	8
2.2	Test Configuration	9
2.3	Operating Test Mode	10
2.4	Modifications	10
2.5	Reference Document	10
3	Evaluation of Emission Test Results	11
3.1	Conducted Emission	1′
3.2	Radiated Emission	14
4	Device and Test Setup Photographs	21





## 1 Project Overview

### 1.1 Test Facility

Measurements were performed at the following location:

- Melbourne Laboratory 176 Harrick Road, Keilor Park, Vic 3042
- ☐ Sydney Laboratory Unit 3/87 Station Road, Seven Hills, NSW 2147

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**.

Country	Assessment Body	Lab Code / Member No.
Australia	NATA	Accreditation Number: 5292
Europe	European Union	Notified Body Number: 0819
USA	FCC	Designation Number: AU0001
Canada	ISED Canada	CAB Identifier Number: AU0001
Japan	VCCI	Company Number: 785
Taiwan	BSMI	Lab Code SL2-IN-E-5001R





### 1.2 Standards Applied

Unless otherwise noted, only the cited edition applies.

### 47 CFR Part 15 - Subpart B

Title 47 of the Code of Federal Regulations; Chapter 1; Part 15 – Radio Frequency devices, Subpart B – Unintentional Radiators.

### ANSI C63.4: 2014

American National Standard for Methods of Measurement of Radio-Noise Emissions from Low-Voltage Electrical and Electronic Equipment in the Range of 9 kHz to 40 GHz.

### 1.3 Results Summary

The test sample was provided by the client. All results herein apply only to the test sample.

47 CFR Part 15 – Subpart B						
Section	EMC Test	Range	Applicability	Limit	Result	
15.107	Conducted Emission	150 KHz to 30 MHz	AC Mains	Class A	Complied	
15.109	Radiated Emission	30 MHz to 30 GHz	Enclosure	Class A	Complied	
15.121(b) Scanning Receiver N/A*1						
*1 EUT is not capable of converting cellular communication transmission to analog voice audio.						

### 1.4 Additions to, Deviations and Exclusions from the Method/Standard

No additions to, deviations or exclusions from the method/standard were performed.





### 1.5 Measurement Uncertainty

EMC Technologies has evaluated the equipment and the methods used to perform the EMC testing. The estimated measurement uncertainties for the various tests shown within this report are as follows:

EMC Testing	Range	Value
Conducted Emission		
Mains Port	9kHz to 30 MHz	± 3.2 dB
Radiated Emission	150 kHz to 30 MHz	± 4.1 dB
	30 MHz to 300 MHz	± 5.1 dB
	300 MHz to 1000 MHz	± 4.7 dB
	1 GHz to 18 GHz	± 4.6 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%.

### Application of measurement uncertainty for this report:

The referenced uncertainty standard specifies that determination of compliance shall be based on measurements <u>without</u> taking into account measurement uncertainty. However, the measurement uncertainty shall appear in the test report.





## 1.6 Test Equipment

Measurement instrumentation and transducers were calibrated in accordance with the applicable standards by a NATA accredited laboratory or the National Measurement Institute (NMI).

Radiated Emission – Above 1 GHz						
Manufacturer	Model	Serial No.	Asset No.	Description	Cal. Date	Cal. Due
EMCO	3115	8908-3282	A-004	Antenna Horn	13/01/2022	13/01/2025
ETS-Lindgren	3160-10	64179	A-306	Antenna STD 26-40 GHz	30/04/2021	30/04/2024
ETS-Lindgren	3160-09	66032	A-307	Antenna STD 18-26 GHz	30/04/2021	30/04/2024
Sunar	JB1	A061917	A-425	Antenna Bilog	28/09/2021	28/09/2023
B&Z Technologies	BZ-00501800- 251040-352020	20705	A-439	RF Pre- Amplifier	07/02/2022	07/02/2023
B&Z Technologies	BZ-18002650- 201835-182525	20706	A-440	RF Preamplifier	11/03/2022	11/03/2023
Huber & Suhner	Sucoflex 106P	3109/6P	C-407	RF Cable	29/11/2022	29/11/2023
EMCT	P1to10mSR	N/A	C-422	RF Cable	28/11/2022	28/11/2023
Huber & Suhner	Sucoflex 106A	501211/6P	C-477	RF Cable	04/02/2022	04/02/2023
Huber & Suhner	Sucoflex 104A	507097/4A	C-487	RF Cable	28/11/2022	28/11/2023
Hewlett Packard	8447F	3113A07375	P-159	RF Pre- Amplifier	10/02/2022	10/02/2023
Frankonia	Room 12 SAC-10-2	-	R-139	Room 12 10m SAC	01/11/2021	01/11/2024
Keysight	N9038A	MY57290154	R-147	EMC Receiver	20/01/2021	20/01/2023

Conducted Emission						
Manufacturer	Model	Serial No.	Asset No.	Description	Cal. Date	Cal. Due
Huber & Suhner	Sucoflex 104A	800178/118	C-527	RF Cable	06/06/2022	06/06/2023
Teseq	NNB 51	47416	L-072	LISN	06/12/2022	06/12/2023
Rohde & Schwarz	ESR7	101804	R-142	EMC Receiver	15/07/2022	15/07/2023





# 2 Equipment Under Test

### 2.1 EUT Details

(EUT details are supplied by the customer)

0716BV / MP5355-7)		
1GHz CPU (runs at 666MHz),		
or		
tweight omni-directional drone		
ze allows it to be portable and worn		
•		
ile, completely passive/non-		
evice. The device offers the user		
listraction or complex operation. It		
ctive for a variety of operators in a		
The RfPatrol device automatically		
d.		
i		

Radio Module				
Manufacturer:	Analog Devices Inc			
Model	ADRV9361			
Operating Bands	433GHz ISM Band (400-470MHz), 915GHz ISM Band (860-942MHz), 2.4GHz ISM Band (2.4 to 2.4845GHz), 5.2GHz ISM Band (5.1-5.35GHz) & 5.8GHz ISM Band (5.725-5.850GHz)			
Technology:	OFDM, FHSS and DSSS Detection			
Modulation:	Detection only, signals are not demodulated			
Antenna Type and Gain:  Alpha antenna: 2000MHz-6000MHz linear, 2-4dBi, Bravo antenna: 420MHz-470MHz linear, 2dBi, Charlie antenna: 800MHz-2720MHz linear, 3.5dBi				
Comment:				
Module is a transceiver, but configu	red and programmed only as a receiver			





# 2.2 Test Configuration

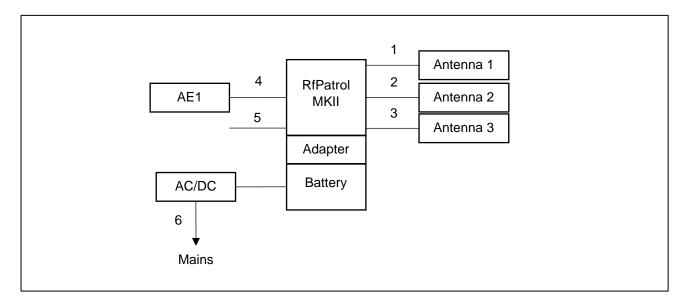
Installation Type:	⊠Tabletop
	□ Floor-Standing
	□Combination Tabletop and Floor-Standing

EUT composition					
Description	Model	Serial No.	Remark		
Alpha Antenna	DRO-555-200				
Bravo Antenna	DRO-555-201				
Charlie Antenna	DRO-555-202				
Battery	DRO-888-214	48152	RfPatrol MKII Battery (BT-70716BG)		
AC/DC Adaptor	DTD120-19SX-F- W6	3554818	MFG: ETA-USA AC Adapter Input: 100-240VAC 2A 50/60Hz Output: 19VDC/6.32A		
Battery Adaptor	TS3-022 Rev A 06324 2219	000561	Mfg.:Glenair		

Auxilia	Auxiliary Equipment				
No.	Description	Model	Serial No.	Remark	
AE1	Earphone				

Cable	Cable used for testing							
No.	Description	Length	Shielded	Remark				
1	TNC Extension cable (Red)	< 3m	Yes	DRO-111-408				
2	TNC Extension cable (Blue)	< 3m	Yes	DRO-111-409				
3	TNC Extension cable (Yellow)	< 3m	Yes	DRO-111-410				
4	Military connector to 3.5mm jack	< 3m	Yes	DRO-111-500				
5	Military connector to RJ45	< 3m	Yes	DRO-111-210 unterminated				
6	Power Cable	< 3m	No					





#### 2.3 **Operating Test Mode**

Mode No.	Description
1	The EUT was set up in accordance with FCC Part 15B and as per the customer's operating instructions.
	Testing was performed in GLIMPSE mode (position 3). The EUT was configured lying flat on the test bench with all accessories attached.

### Comment:

EUT has 4 configurations:

Battery operated – lying flat position Battery operated – standing position Battery charging – lying flat position

Battery charging - standing position

These modes were evaluated (scans performed in both configurations) with the worst case mode (battery charging - lying flat position) reported.

#### 2.4 **Modifications**

No modifications were required to achieve compliance.

#### 2.5 **Reference Document**

No.	Document Title	Issue No.
1	M2209034 Form 005 Customer and EUT Information (RfPatrolMKII)	





### 3 Evaluation of Emission Test Results

Conducted and Radiated Emission measurements were tested according to the following configuration/s:

Limit:	Class A				
Receiver Bandwidth:	6 dB				
Detector:	0.009 – 0.15 MHz:	QP			
	0.15 - 30 MHz:	QP,AV			
	30 - 1000 MHz:	QP			
	Above 1000 MHz:	PK,AV			
Antenna:	□ 0.009 - 30 MHz	Loop Antenna			
	⊠ 30 - 1000 MHz	Biconilog			
	⊠ 1 - 18 GHz	Double-Ridged Guide Horn			
	⊠ 18 - 40 GHz	Standard Gain Horn			

Margin is calculated by subtracting the emission level by limit value. Negative margin signifies emission level below the specified limit.

### 3.1 Conducted Emission

### 3.1.1 Measurement Procedure

The EMI Receiver was operated under program control using the Max-Hold function and automatic frequency scanning, measurement and data logging techniques. The specified 0.15 MHz to 30 MHz frequency range was sub-divided into sub-ranges to ensure that all short duration peaks were captured.

The various operating modes of the system were investigated. For each of the sub-ranges, the EMI receiver was set to continuous scan with the Peak detector set to Max-Hold mode. The Quasi-Peak detector and the Average detector were then invoked to measure the actual Quasi-Peak and Average level of the most significant peaks, which were detected.

### Calculation of voltage level

The voltage levels were automatically measured in software and compared to the test limit. The method of calculation was as follows:

$$V_{emi} = V_{rx} + L$$

Where:  $V_{emi}$  = The Measured EMI voltage in dB $\mu$ V to be compared to the limit.

 $V_{rx}$  = The Voltage in dBµV read directly at the EMI receiver.

L = The insertion loss in dB of the LISN, cables and transient Limiter

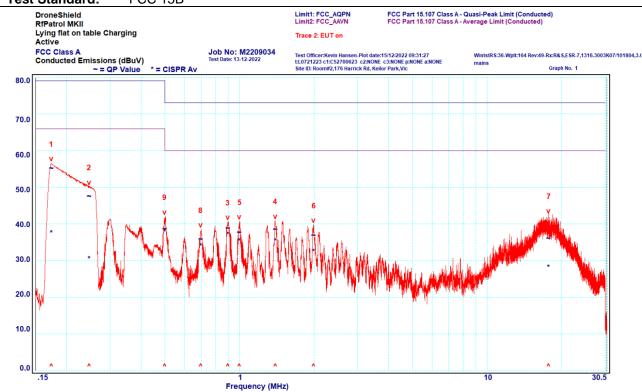




### 3.1.2 Measurement Data - 150kHz to 30 MHz

Operating Mode:Mode 1Test Date:13/12/2022Power Input:120VAC 60HzTemperature:20°CPort:AC Mains Port (Active Line)Humidity:55%

Test Standard: FCC 15B

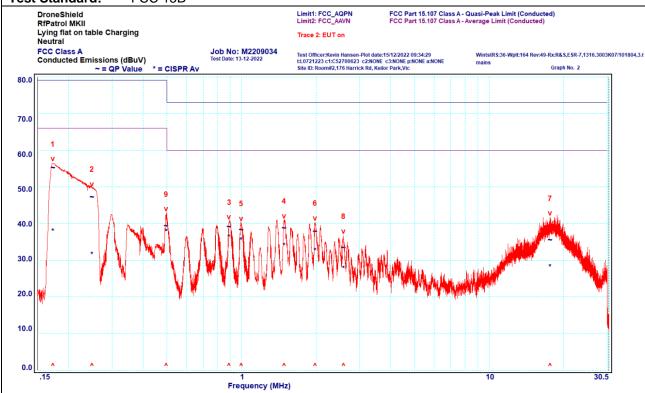


Peak	Frequency	Port	Quasi Peak				Average	
			Level	Limit	Margin	Level	Limit	Margin
	[MHz]		[dBµV]	[dBµV]	[dB]	[dBµV]	[dBµV]	[dB]
1	0.174	Active	55.6	79.0	-23.4	37.5	66.0	-28.5
2	0.247	Active	48.0	79.0	-31.0	30.5	66.0	-35.5
3	0.897	Active	39.3	73.0	-33.7	37.1	60.0	-22.9
4	1.394	Active	38.9	73.0	-34.1	35.3	60.0	-24.7
5	0.999	Active	38.2	73.0	-34.8	35.3	60.0	-24.7
6	1.992	Active	37.3	73.0	-35.7	32.5	60.0	-27.5
7	17.71	Active	36.5	73.0	-36.5	28.2	60.0	-31.8
8	0.696	Active	36.3	73.0	-36.7	34.0	60.0	-26.0
9	0.498	Active	39.1	79.0	-39.9	37.8	66.0	-28.2



Operating Mode:Mode 1Test Date:13/12/2022Power Input:120VAC 60HzTemperature:20°CPort:AC Mains Port (Neutral Line)Humidity:55%

Test Standard: FCC 15B



Peak	Frequency	Port	Quasi Peak Average					
. oun	rioquonoy	. 0.1	Level	Limit	Margin	Level	Limit	Margin
	[MHz]		[dBµV]	[dBµV]	[dB]	[dBµV]	[dBµV]	[dB]
1	0.173	Neutral	55.6	79.0	-23.4	37.9	66.0	-28.1
2	0.249	Neutral	47.7	79.0	-31.3	31.5	66.0	-34.5
3	0.892	Neutral	39.6	73.0	-33.4	36.3	60.0	-23.7
4	1.485	Neutral	39.2	73.0	-33.8	33.9	60.0	-26.1
5	0.997	Neutral	38.7	73.0	-34.3	35.5	60.0	-24.5
6	1.982	Neutral	38.3	73.0	-34.7	32.6	60.0	-27.4
7	17.61	Neutral	36.0	73.0	-37.0	28.2	60.0	-31.8
8	2.580	Neutral	33.9	73.0	-39.1	27.7	60.0	-32.3
9	0.496	Neutral	39.8	79.0	-39.2	37.8	66.0	-28.2

### 3.1.3 Minimum Margin

Mode	Line	Frequency	Detector	Margin		
Mode 2, 120VAC 60 Hz	Active	0.897 MHz	QP	-22.9 dB		
The EUT complied with the FCC 15B, Class A limit.						





### 3.2 Radiated Emission

### 3.2.1 Measurement Procedure

The EUT was set up on the middle of turntable above the ground plane. The EMI Receiver was operated under software control via the PC Controller through the IEEE.488 Interface Bus Card Adaptor. The test frequency range was sub-divided into smaller bands with sufficient frequency resolution to permit reliable display and identification of possible EMI peaks while also permitting fast frequency scan times.

The EUT was slowly rotated with the Peak Detector set to Max-Hold. This was performed for at least two antenna heights. Each significant peak was then investigated and maximised with the Quasi-Peak detector for measurements below 1 GHz; and an Average and a Peak detector for measurements above 1 GHz. The measurement data for each frequency range was automatically corrected by the software for cable losses, antenna factors and preamplifier gain and all data were then stored on disk in sequential data files. This process was performed for both horizontal and vertical antenna polarisations.

### Calculation of field strength

The field strength was calculated automatically by software using pre-stored calibration data. The method of calculation is shown below:

$$E = V + AF - G + L$$

Where:  $E = Radiated Field Strength in dB\mu V/m$ .

V = EMI Receiver Voltage in dBμV/m.

AF = Antenna Factor in dB/m. (stored as a data array)

G = Preamplifier Gain in dB. (stored as a data array)

L = Cable loss in dB. (stored as a data array of Insertion Loss versus frequency)





## 3.2.2 Measurement Data - 30 to 1000 MHz

Operating Mode: Test Date: Mode 1 5/12/2022 **Power Input:** 120VAC 60Hz Temperature: 20°C **Measurement Distance:** 10 m **Humidity:** 52% FCC 15B **Test Standard:** DroneShield RfPatrol MKII Lying flat on table Charging Vertical Limit1: FCC-A10 FCC CLASS A 10M LIMITS Trace 2: EUT on FCC Class A
Radiated Emissions (dBuV/m)
# = Ambient ~ = QP Value Job No: M2209034 Test Date: 01-12-2022 Test Officer:Kevin Hansen-Plot date:22/12/2022 12:04:18 WintstR::36-Wplt164 Rev:49-RxAgilient Technologies,N9038A,MY572: LA42/5022 1:C42/21/22 - 22/24/71/22 - 22/47/0223 pr.P1590223 a:NONE Room 12 Graph No. 1 60.0 50.0 40.0 30.0 20.0 10.0 0.0 100

Peak	Frequency	Polarisation	Level	QP Limit	Margin
	[MHz]		[dBµV/m]	[dBµV/m]	[dB]
1	77.87	Vertical	36.1	39.1	-3.0*
2	113.70	Vertical	38.1	43.5	-5.4
3	110.76	Vertical	37.3	43.5	-6.2
4	114.51	Vertical	34.4	43.5	-9.1
5	88.81	Vertical	28.6	43.5	-14.9
6	205.03	Vertical	25.6	43.5	-17.9

### Comment:

\*This result falls within the laboratory's measurement uncertainty.





Operating Mode: 5/12/2022 Mode 1 Test Date: Power Input: 120VAC 60Hz Temperature: 20°C **Measurement Distance: Humidity**: 52% 10 m Test Standard: FCC 15B DroneShield RfPatrol MKII Lying flat on table Charging Horizontal Limit1: FCC-A10 FCC CLASS A 10M LIMITS Trace 2: EUT on Horizonia:
FCC Class A
Radiated Emissions (dBuV/m)
# = Ambient ~ = QP Value Job No: M2209034 Test Date: 01-12-2022 Test Officer:Kevin Hansen-Plot date:22/12/2022 12:05:46 WintstRs:36-LA4250923 c1:C4221123 c2:C4071123 c3:C4770223 p:P1590223 a:NONE Room 12 Site ID: Room#12(iOATS),176 Harrick Rd, Kellor Park,Vic Graph No. 2 60.0 40.0 30.0 10.0 0.0 Frequency (MHz)

Peak	Frequency	Polarisation	Level	QP Limit	Margin
	[MHz]		[dBµV/m]	[dBµV/m]	[dB]
1	205.05	Horizontal	27.6	43.5	-15.9
2	113.45	Horizontal	27.4	43.5	-16.1
3	815.99	Horizontal	28.5	46.4	-17.9
4	372.63	Horizontal	26.0	46.4	-20.4

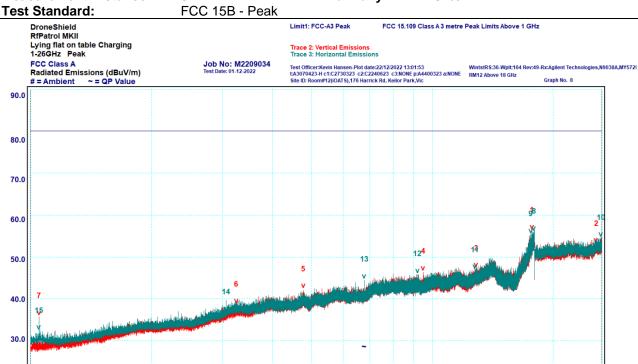


20.0

## 3.2.3 Measurement Data - 1 to 26.5 GHz

Operating Mode:Mode 1Test Date:5/12/2022Power Input:120VAC 60HzTemperature:20°CMeasurement Distance:3 mHumidity:52%

Frequency (MHz)

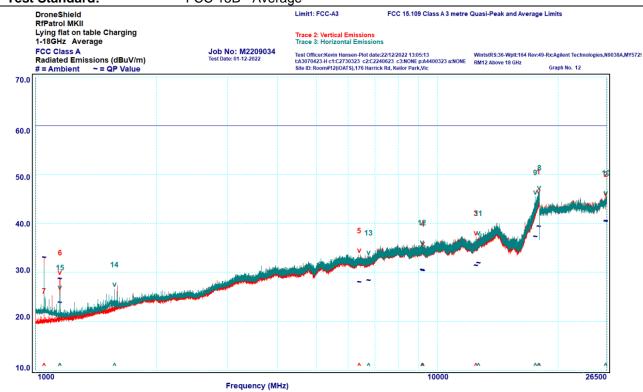


Peak	Frequency	Polarisation	Level	PK Limit	Margin
	[MHz]		[dBµV/m]	[dBµV/m]	[dB]
1	17733.00	Vertical	56.2	80.0	-23.8
2	25650.73	Vertical	53.0	80.0	-27.0
3	12876.63	Vertical	47.1	80.0	-32.9
4	9505.47	Vertical	46.3	80.0	-33.7
5	4780.97	Vertical	42.1	80.0	-37.9
6	3254.28	Vertical	38.5	80.0	-41.5
7	1049.92	Vertical	35.7	80.0	-44.3
8	17927.50	Horizontal	55.9	80.0	-24.1
9	17606.50	Horizontal	55.2	80.0	-24.8
10	26349.11	Horizontal	54.4	80.0	-25.6
11	12764.50	Horizontal	46.7	80.0	-33.3
12	9191.87	Horizontal	45.8	80.0	-34.2
13	6773.14	Horizontal	44.4	80.0	-35.6
14	3069.15	Horizontal	36.6	80.0	-43.4
15	1049.40	Horizontal	32.2	80.0	-47.8



Operating Mode:Mode 1Test Date:5/12/2022Power Input:120VAC 60HzTemperature:20°CMeasurement Distance:3 mHumidity:52%

**Test Standard:** FCC 15B - Average



Peak	Frequency	Polarisation	Level	AV Limit	Margin
	[MHz]		[dBµV/m]	[dBµV/m]	[dB]
1	17900.03	Vertical	45.7	60.0	-14.3
2	26336.37	Vertical	45.2	60.0	-14.8
3	12497.88	Vertical	37.2	60.0	-22.8
4	9217.75	Vertical	35.0	60.0	-25.0
5	6400.34	Vertical	33.6	60.0	-26.4
6	1149.99	Vertical	29.0	60.0	-31.0
7	1049.93	Vertical	21.3	60.0	-38.7
8	17976.00	Horizontal	46.4	60.0	-13.6
9	17562.00	Horizontal	45.5	60.0	-14.5
10	26319.38	Horizontal	45.4	60.0	-14.6
11	12691.65	Horizontal	37.2	60.0	-22.8
12	9174.78	Horizontal	35.2	60.0	-24.8
13	6754.70	Horizontal	33.2	60.0	-26.8
14	1572.04	Horizontal	26.6	60.0	-33.4
15	1150.04	Horizontal	26.0	60.0	-34.0

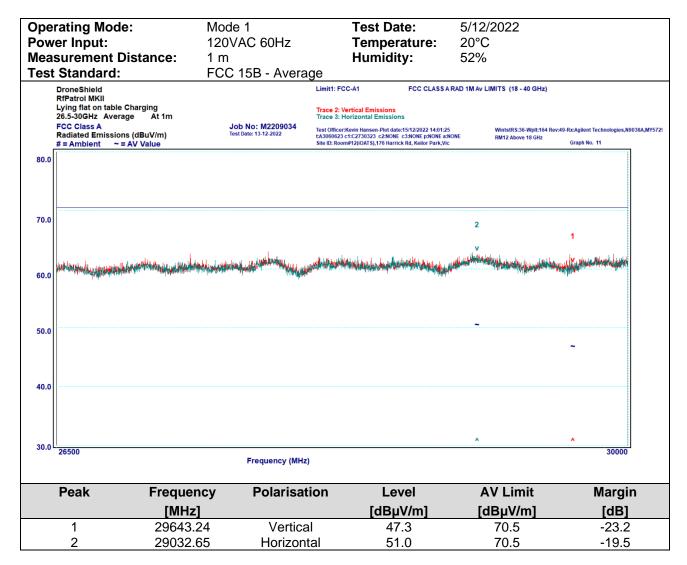


### 3.2.4 Measurement Data - 26.5 to 30 GHz

Operating Mode: Test Date: Mode 1 5/12/2022 **Power Input:** 120VAC 60Hz Temperature: 20°C **Measurement Distance: Humidity:** 52% 1 m Test Standard: FCC 15B - Peak DroneShield RfPatrol MKII Lying flat on table Charging 26.5-30GHz Peak Limit1: FCC-A1pk FCC CLASS A RAD 1M Pk LIMITS (18 - 40 GHz) Trace 2: Vertical Emissions
Trace 3: Horizontal Emissions FCC Class A
Radiated Emissions (dBuV/m)
# = Ambient ~ = AV Value Job No: M2209034 Test Date: 13-12-2022 Test Officer:Kevin Hansen-Plot date:22/12/2022 13:09:51 tA3060623 c1:C2730323 c2:NONE c3:NONE p:NONE a:NONE Site ID: Room#12(IOATS),176 Harrick Rd, Keilor Park,Vic WintstRS:36-Wplt:164 Rev:49-Rx:Agilent Technologies,N9038A,MY5729
RM12 Above 18 GHz 110.0 100.0 90.0 80.0 60.0 50.0 26500 Frequency (MHz)

Peak	Frequency	Polarisation	Level	PK Limit	Margin
	[MHz]		[dBµV/m]	[dBµV/m]	[dB]
1	28556.80	Vertical	69.7	90.5	-20.8
2	29838.93	Vertical	69.7	90.5	-20.8
3	27763.23	Horizontal	70.3	90.5	-20.2
4	29033.22	Horizontal	68.3	90.5	-22.2





### 3.2.5 Minimum Margin

Mode	Polarisation	Frequency	Detector	Margin
Mode 1, 120VAC 60 Hz	Vertical	77.87 MHz	QP	-3.0 dB*
*This result falls within the laboratory's measurement uncertainty.				
The EUT complied with the FCC 15B, Class A limit.				





# 4 Device and Test Setup Photographs

Refer to:

CONF\_ExtPhotos

CONF\_IntPhotos

**CONF\_ Test SetUp photos** 

