



Global Product Certification
EMC-EMF Safety Approvals

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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@dronesshield.com

Tel: 0499487766

ISSUED BY:

EMC Technologies Pty. Ltd.

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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:

Kevin Hansen

Authorized Signatory:

William Alam
Senior Test Engineer



NATA Accreditation No. 5292

Accredited for compliance with ISO/IEC 17025 – Testing.

NATA is a signatory to the ILAC Mutual Recognition Arrangement for the mutual recognition of the equivalence of testing, medical testing, calibration, inspection and proficiency testing scheme providers reports.

This report shall not be reproduced except in full.

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.

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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 without 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)

Product Name:	RfPatrol MKII
Part Number:	DRO-035
Manufacturer:	DroneShield LLC
Serial No:	0350198542046
Power Rating:	10.8V Battery (BT-70716BG / BT-70716BV / MP5355-7)
Software Version:	4.0.0 (Q3 2022)
Hardware Version:	BATCH6
Highest Internal Frequency:	1GHz CPU (runs at 666MHz), 70MHz to 6000MHz internal oscillator
Description:	<p>RfPatrol MKII is a compact and lightweight omni-directional drone detection solution. Its design and size allows it to be portable and worn by the operator.</p> <p>The RfPatrol MKII is a highly versatile, completely passive/non-emitting wearable UAS detection device. The device offers the user real situational awareness without distraction or complex operation. It has been designed to be highly effective for a variety of operators in a range of demanding environments. The RfPatrol device automatically detects drones moving at any speed.</p>

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 configured and programmed only as a receiver	

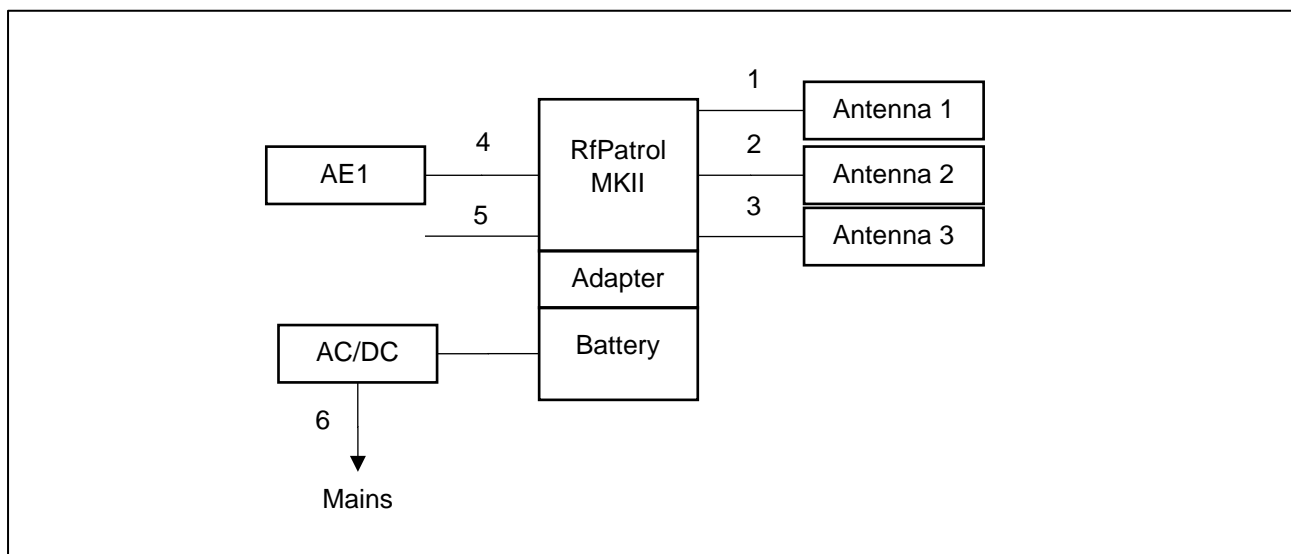
2.2 Test Configuration

Installation Type:	<input checked="" type="checkbox"/> Tabletop <input type="checkbox"/> Floor-Standing <input type="checkbox"/> 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

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

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	<p>The EUT was set up in accordance with FCC Part 15B and as per the customer's operating instructions.</p> <p>Testing was performed in GLIMPSE mode (position 3). The EUT was configured lying flat on the test bench with all accessories attached.</p>
<p>Comment:</p> <p>EUT has 4 configurations:</p> <p>Battery operated – lying flat position</p> <p>Battery operated – standing position</p> <p>Battery charging – lying flat position</p> <p>Battery charging – standing position</p> <p>These modes were evaluated (scans performed in both configurations) with the worst case mode (battery charging – lying flat position) reported.</p>	

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:	<input type="checkbox"/> 0.009 - 30 MHz	Loop Antenna
	<input checked="" type="checkbox"/> 30 - 1000 MHz	Biconilog
	<input checked="" type="checkbox"/> 1 - 18 GHz	Double-Ridged Guide Horn
	<input checked="" type="checkbox"/> 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:

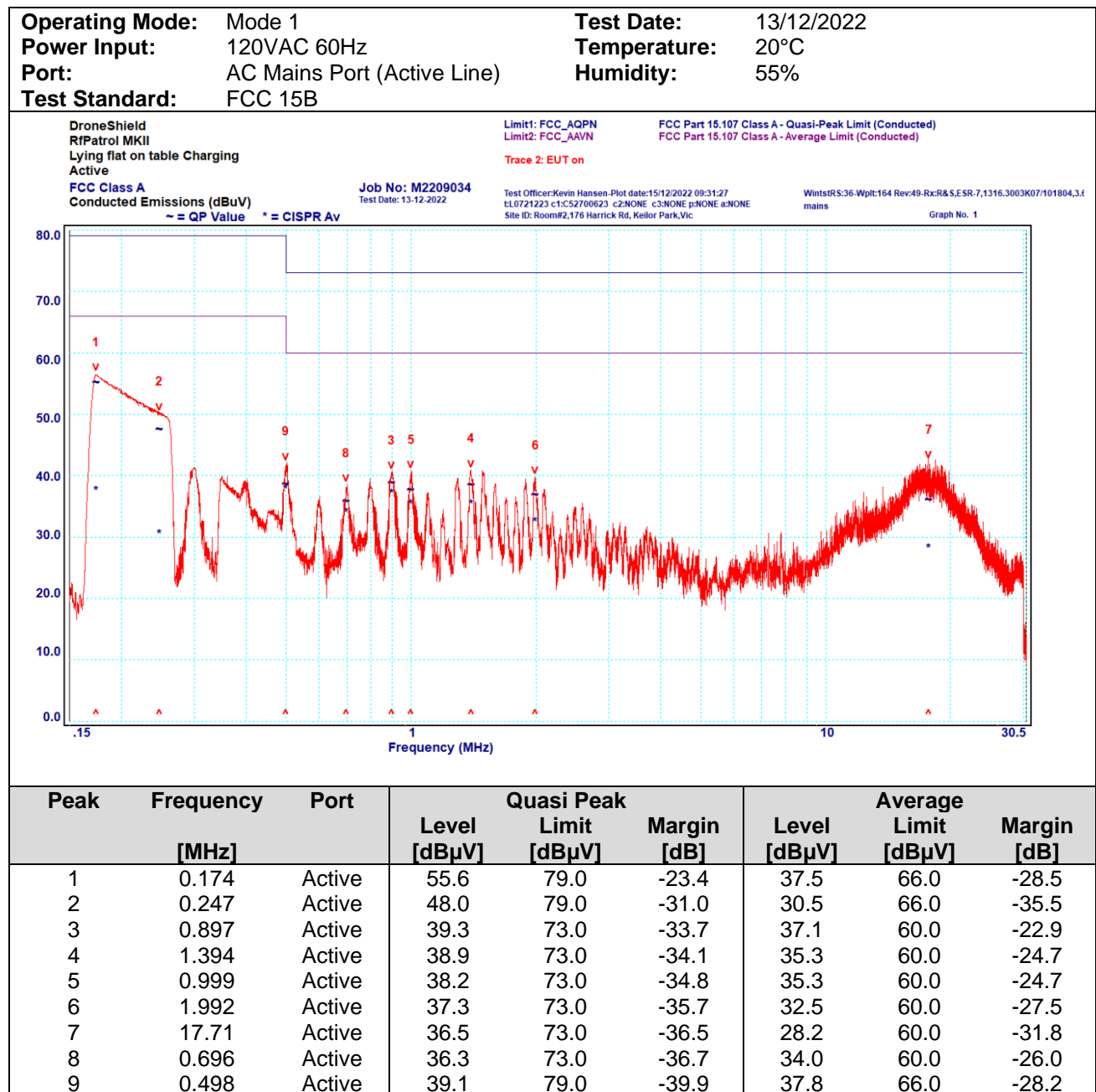
$$V_{emi} = V_{rx} + L$$

Where: V_{emi} = The Measured EMI voltage in dBμV 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 1	Test Date:	13/12/2022
Power Input:	120VAC 60Hz	Temperature:	20°C
Port:	AC Mains Port (Neutral Line)	Humidity:	55%
Test Standard:	FCC 15B		

DroneShield
RfPatrol MKII
Lying flat on table Charging
Neutral
FCC Class A
Conducted Emissions (dBuV)

Job No: M2209034
Test Date: 13-12-2022

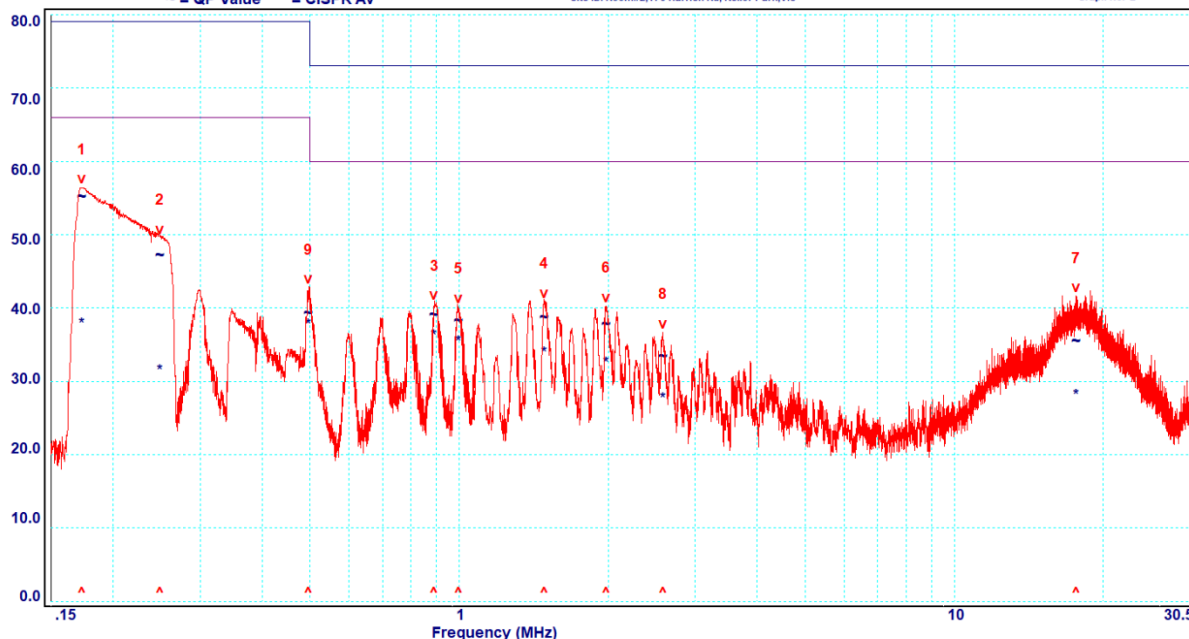
Limit1: FCC_AQPN
Limit2: FCC_AAVN

FCC Part 15.107 Class A - Quasi-Peak Limit (Conducted)
FCC Part 15.107 Class A - Average Limit (Conducted)

Trace 2: EUT on

Test Officer: Kevin Hansen-Plot date: 15/12/2022 09:34:29
t1:0721223 c1:C52700623 c2:NONE c3:NONE p:NONE a:NONE
Site ID: Room#2,176 Harrick Rd, Kellor Park,Vic

WintstrS:36.Wplt:164 Rev:49-RxR&S,ESR:7,1316.3003K07/101804,3,1
mains
Graph No. 2



Peak	Frequency [MHz]	Port	Quasi Peak			Average		
			Level [dBuV]	Limit [dBuV]	Margin [dB]	Level [dBuV]	Limit [dBuV]	Margin [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 μ V/m.

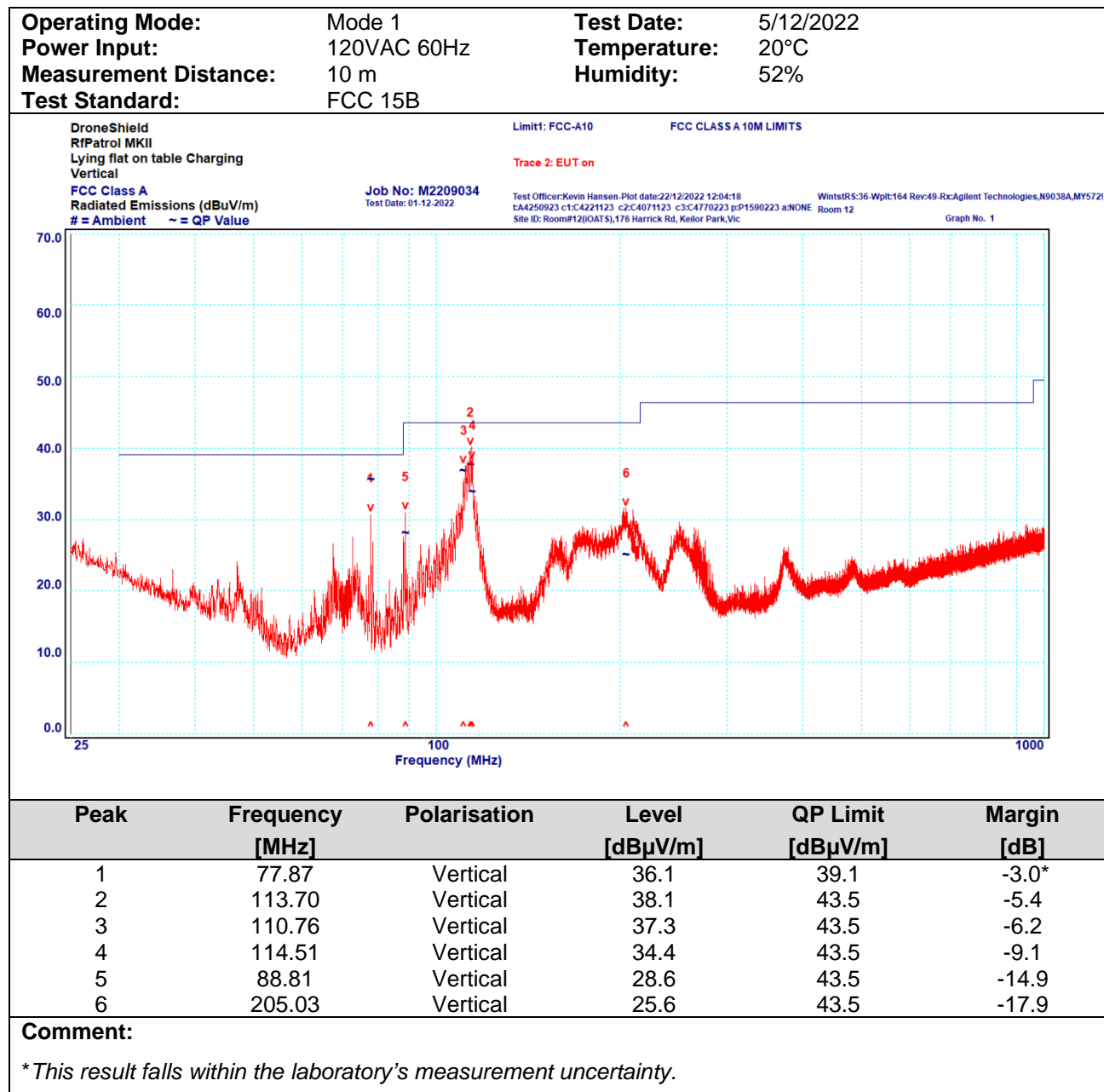
V = EMI Receiver Voltage in dB μ V/m.

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:	Mode 1	Test Date:	5/12/2022
Power Input:	120VAC 60Hz	Temperature:	20°C
Measurement Distance:	10 m	Humidity:	52%
Test Standard:	FCC 15B		

DroneShield
RfPatrol MKII
Lying flat on table Charging
Horizontal
FCC Class A
Radiated Emissions (dBuV/m)
= Ambient ~ = QP Value

Job No: M2209034
Test Date: 01-12-2022

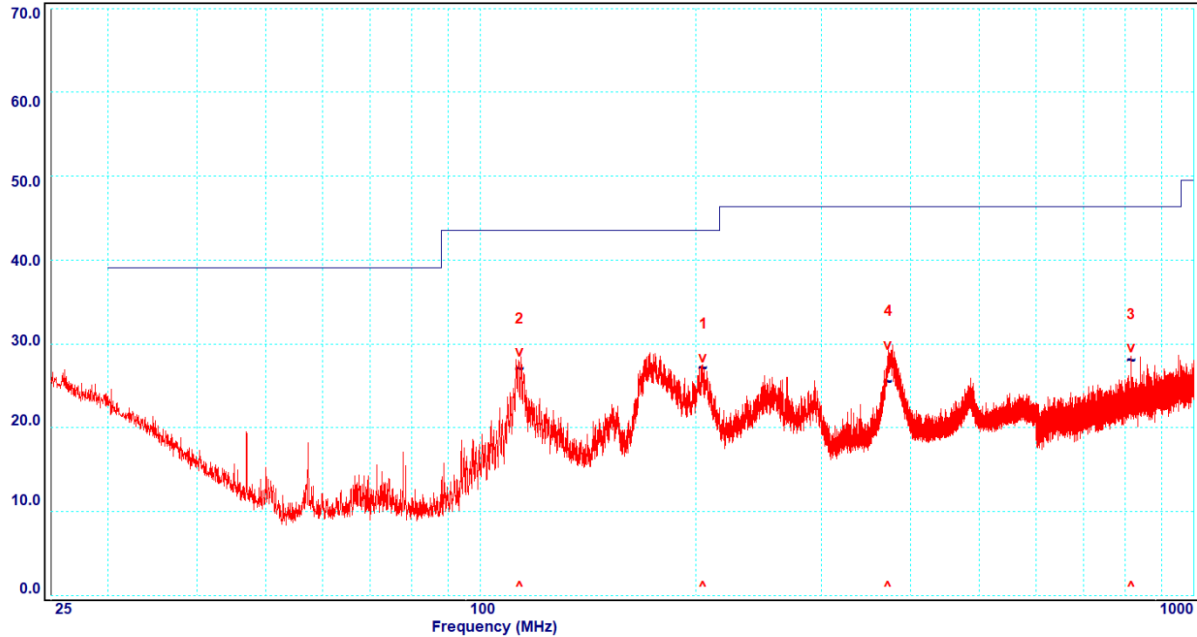
Limit1: FCC-A10

FCC CLASS A 10M LIMITS

Trace 2: EUT on

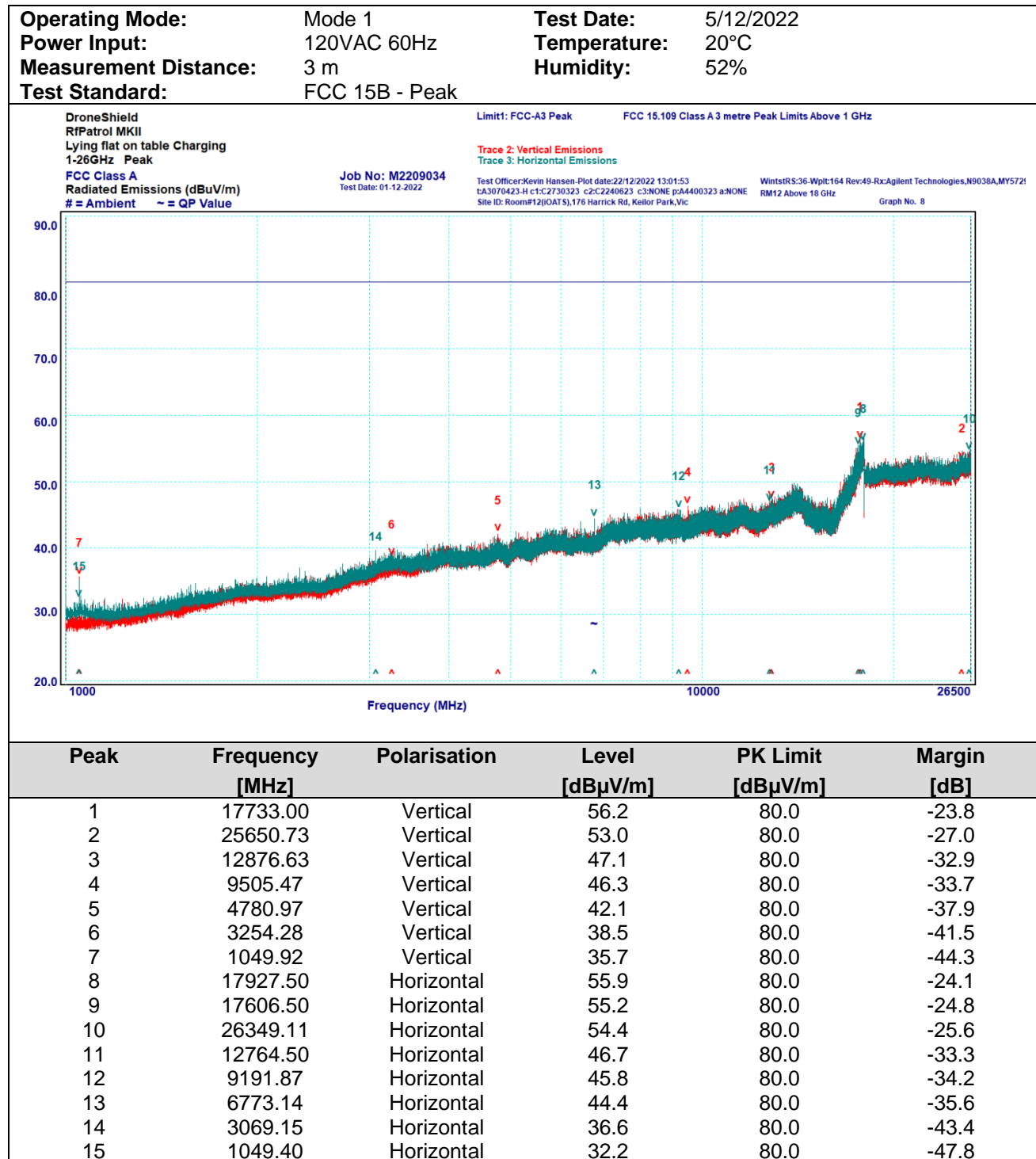
Test Officer: Kevin Hansen-Plot date: 22/12/2022 12:05:46
t:A4250923 c1:C4221123 c2:C4071123 c3:C4770223 p:P1590223 a:NONE
Site ID: Room#12(IQAT S), 176 Harrick Rd, Keilor Park, Vic

WintstRS:36.Wplt:164 Rev:49-Rx:Agilent Technologies,N9038A,MY5721
Room 12
Graph No. 2



Peak	Frequency [MHz]	Polarisation	Level [dBuV/m]	QP Limit [dBuV/m]	Margin [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

3.2.3 Measurement Data – 1 to 26.5 GHz



Operating Mode:	Mode 1	Test Date:	5/12/2022
Power Input:	120VAC 60Hz	Temperature:	20°C
Measurement Distance:	3 m	Humidity:	52%
Test Standard:	FCC 15B - Average		

DroneShield
RfPatrol MKII
Lying flat on table Charging
1-18GHz Average
FCC Class A
Radiated Emissions (dBuV/m)
= Ambient ~ = QP Value

Job No: M2209034
Test Date: 01-12-2022

Limit1: FCC-A3

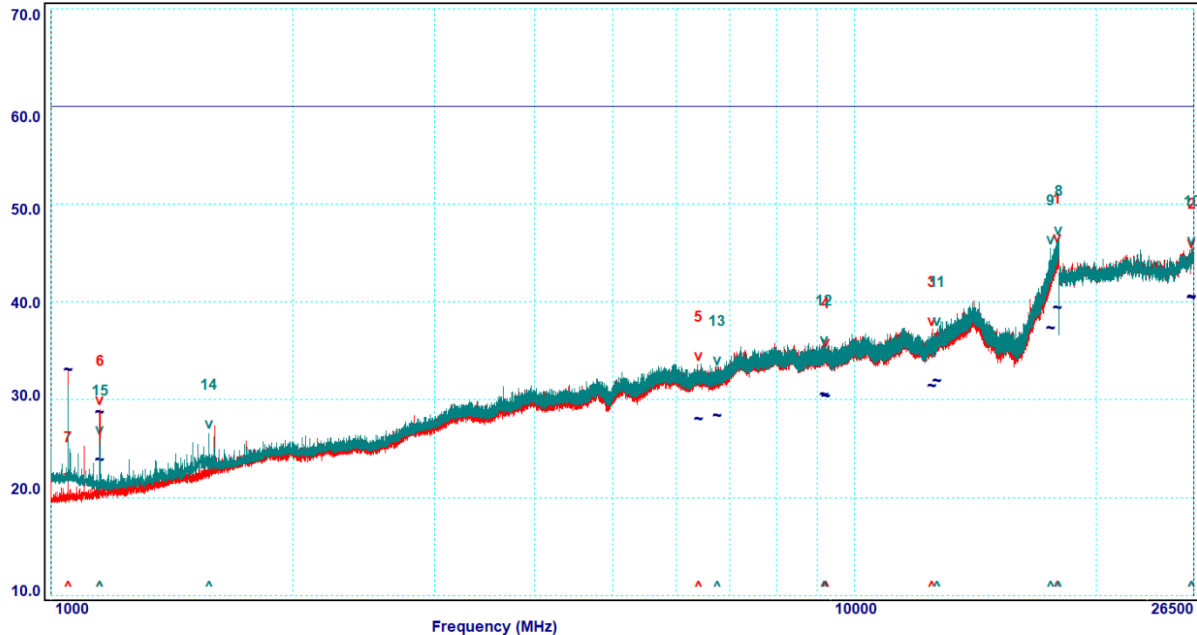
FCC 15.109 Class A 3 metre Quasi-Peak and Average Limits

Trace 2: Vertical Emissions
Trace 3: Horizontal Emissions

Test Officer: Kevin Hansen-Plot date: 22/12/2022 13:05:13
tA3070423-H c1:C2730323 c2:C2240623 c3:NONE pA4400323 a:NONE
Site ID: Room#12(OATS), 176 Harrick Rd, Kellor Park, Vic

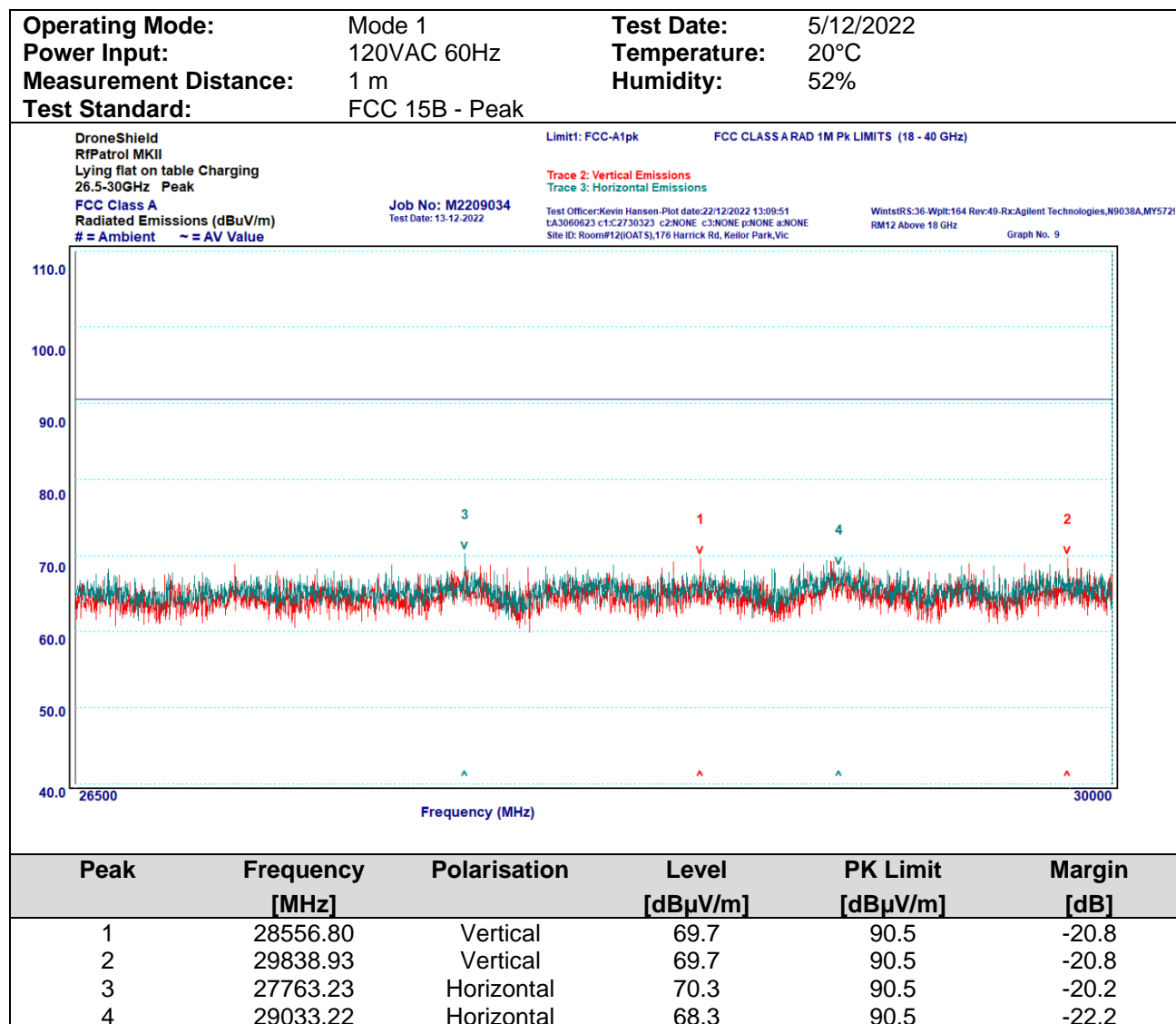
WintSR5:36-Wp1t:164 Rev:49-Rx:Agilent Technologies,N9038A,MY5721
RM12 Above 18 GHz

Graph No. 12

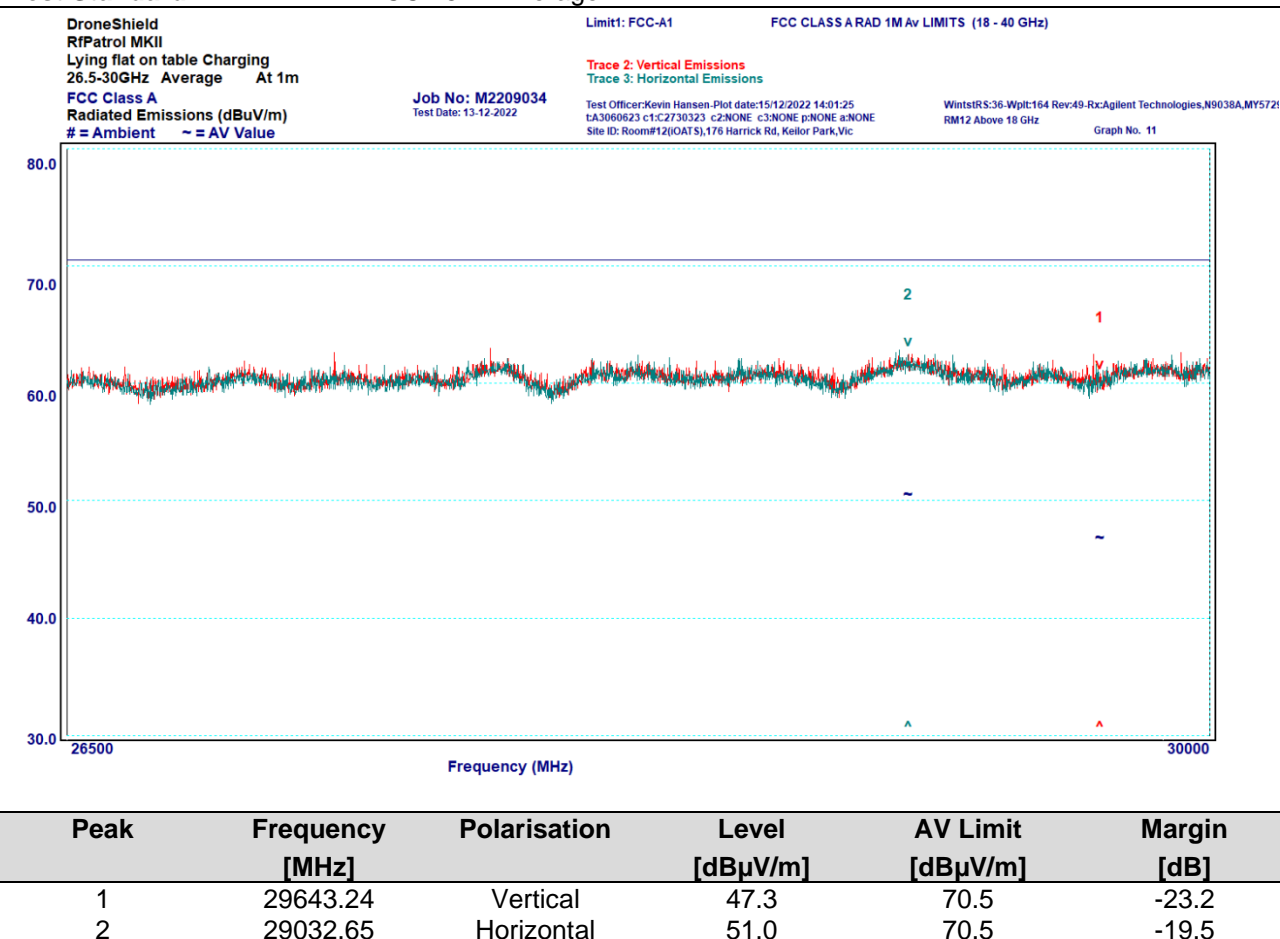


Peak	Frequency [MHz]	Polarisation	Level [dBuV/m]	AV Limit [dBuV/m]	Margin [dB]
1	17900.03	Vertical	45.7	60.0	-14.3
2	26336.37	Vertical	45.2	60.0	-14.8
3	12497.88	Vertical	37.2	60.0	-22.8
4	9217.75	Vertical	35.0	60.0	-25.0
5	6400.34	Vertical	33.6	60.0	-26.4
6	1149.99	Vertical	29.0	60.0	-31.0
7	1049.93	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:	Mode 1	Test Date:	5/12/2022
Power Input:	120VAC 60Hz	Temperature:	20°C
Measurement Distance:	1 m	Humidity:	52%
Test Standard:	FCC 15B - Average		



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