



EMC Test Report

Redtail Telematics Ltd

VLU6M4SP-EW

47 CFR Part 15B

Effective Date October 2023

Test Date: 4th July 2024

Report Number: 07-14765-2-24 Issue 01

The testing was carried out by Kiwa Electrical Compliance, an independent test house, at their test facility located at:

Kiwa Electrical Compliance

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This laboratory is accredited in accordance with the recognised International Standard ISO/IEC 17025. This accreditation demonstrates technical competence for a defined scope and the operation of a laboratory quality management system (refer joint ISO-ILAC-IAF communiqué dated April 2017).

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Arnolds Court, Arnolds Farm Lane, Mountnessing, Brentwood Essex, CM13 1UT

Certificate of Test 14765-2

The equipment noted below has been fully tested by Kiwa Electrical Compliance and, where appropriate, conforms to the relevant subpart of 47 CFR Part 15B. This is a certificate of test only and should not be confused with an equipment authorisation. Other standards may also apply.

Equipment:	VLU6M4SP-EW
Model Number:	VLU6M4SP-EW
Unique Serial Number:	13D700B
Applicant:	Redtail Telematics Ltd Plextek Building London Road Great Chesterford Essex CB10 1NY
Full measurement results are detailed in Report Number:	07-14765-2-24 Issue 01
Test Standards:	47 CFR Part 15B, Effective Date October 2023 Class B Digital Device ↪ ANSI C63.4:2014

NOTE:

Certain tests were not performed based upon applicant's declarations. For details refer to section 3 of this report.

DEVIATIONS:

No deviations have been applied.

This certificate relates only to the unit tested as identified by a unique serial number and in the condition at the time it was tested. It does not relate to any other similar equipment and performance of the product before or after the test cannot be guaranteed. Whilst every effort is made to assure quality of testing, type tests are not exhaustive and although no non-conformances may be found, this doesn't exclude the possibility of unit not meeting the intentions of the standard or the requirements of the Federal Regulations, particularly under different conditions to those during testing. Any compliance statements are made reliant on (a) the application of the product and use of the assigned band being acceptable to the FCC and (b) the modes of operation as instructed to us by the Customer based on their specific knowledge of the application and functionality of the EUT. Statements of compliance, where measurements were made, do not include the measurement uncertainty. The measurement uncertainty, where stated, is the expanded uncertainty based on a standard uncertainty multiplied by a coverage factor of $k=2$, providing a level of confidence of approximately 95%.

Date of Test: 4th July 2024

Test Engineer:
Graham Blake

Approved By:
Quality Manager

Authorised
Representative:



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2 Equipment under test (EUT)

2.1 Equipment specification

Applicant	Redtail Telematics Ltd Plextek Building London Road Great Chesterford Essex CB10 1NY	
Manufacturer of EUT	Redtail Telematics Ltd	
Full Name of EUT	VLU6M4SP-EW	
Model Number of EUT	VLU6M4SP-EW	
Serial Number of EUT	13D700B	
Hardware Version	2	
Firmware Version	114.5	
Date Received	1st July 2024	
Date of Test:	4th July 2024	
Purpose of Test	To demonstrate design compliance to relevant rules of Title 47 of the Code of Federal Regulations.	
Date Report Issued	9th July 2024	
Main Function	Vehicle location tracker.	
Information Specification	Height	130 mm
	Width	60 mm
	Depth	40 mm
	Weight	0.2 kg
	Voltage	3 – 6 VDC
	Current	<1 Amp
	Highest Signal	2480 MHz

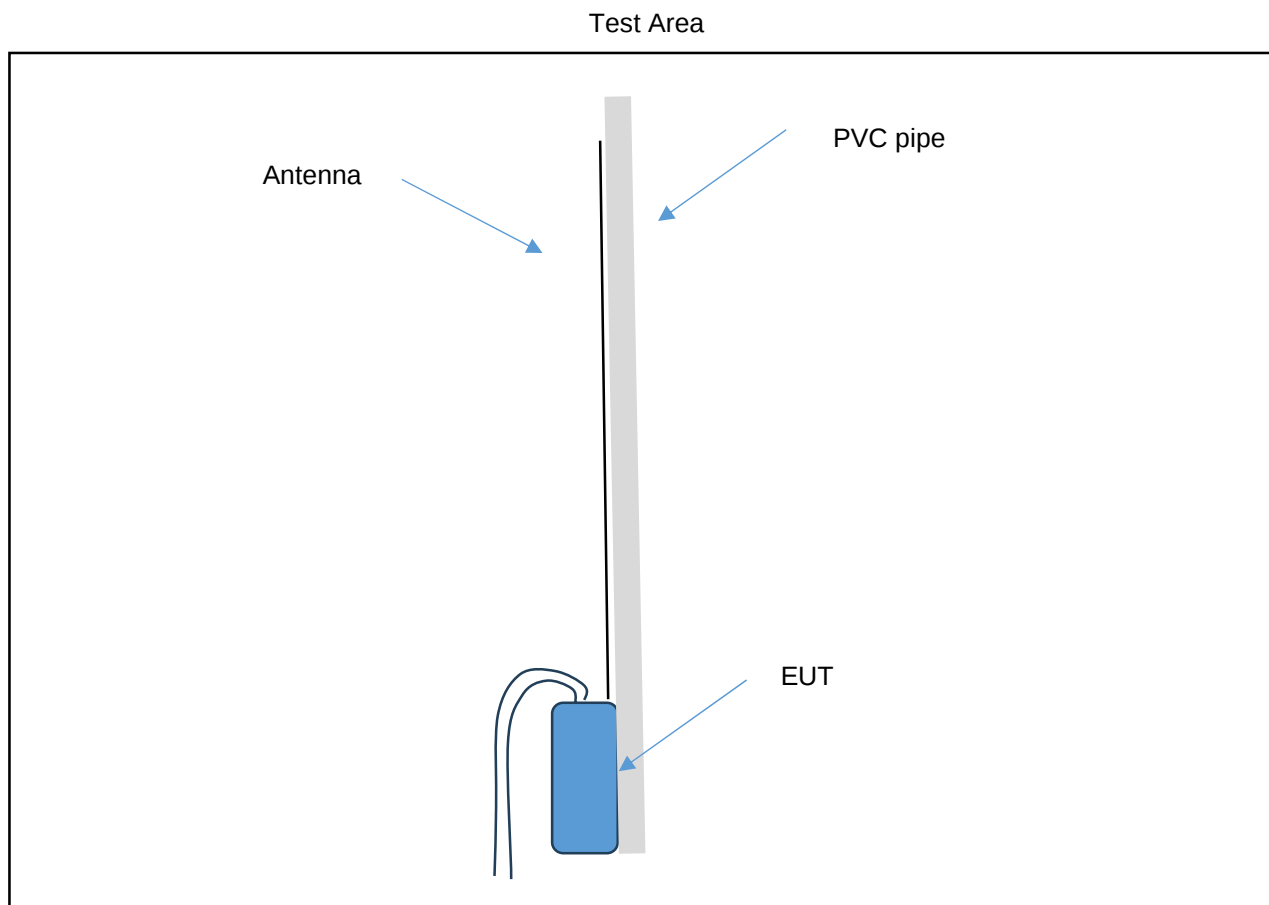
2.2 Functional description

A self-powered VHF radio based around a single transceiver, a PA and a receiver RF front end. Two internal power sources, a 3V battery pack and a 6V battery pack. Both batteries are non-rechargeable. The EUT has a Bluetooth transceiver.

2.3 Modes of operation

Mode Reference	Description	Used for testing
Mode 1	The VHF radio within the EUT is in a continuous receive mode. The Bluetooth receiver is also in a receive mode.	Yes

2.4 Emissions configuration



The equipment under test was powered using its brand-new internal batteries. The EUT was placed on a turntable and the integral antenna was extended fully and attached to a length of PVC pipe. The other cables were allowed to drape down. The EUT was configured by the applicant prior to test into a 100% receive configuration. The UHF radio and the Bluetooth radios were powered and active at the same time. This single test mode was used throughout testing.

3 Summary of test results

The VLU6M4SP-EW was tested for compliance to the following standard(s):

47 CFR Part 15B - Class B Digital Device
Effective Date October 2023

Any compliance statements are made reliant on the modes of operation and the failure criteria as instructed to us by the applicant based on their specific knowledge of the application and functionality of the equipment tested. Whilst every effort is made to assure quality of testing, type tests are not exhaustive and although no non-conformances may be found, this doesn't exclude the possibility of equipment not meeting the intentions of the standard or the relevant rules, particularly under different conditions to those during testing. Statements of compliance, where measurements were made, do not include the measurement uncertainty.

Title	References	Results
1. AC powerline conducted emission	ANSI C63.4	NOT APPLICABLE ¹
2. Antenna power conducted emission	ANSI C63.4	NOT APPLICABLE ²
3. Radiated emissions 30 MHz - 1 GHz	ANSI C63.4 Class - B	PASSED
4. Radiated Emissions above 1 GHz	ANSI C63.4 Class - B	PASSED ³

¹ The EUT is battery powered.

² The EUT does not have an Antenna Port

³ Applicant declares highest internal source of the EUT to be 2480 MHz. The measurement is therefore only required to be made up to 12.5GHz.

3.1 Electromagnetic Environment

Emissions categories as described in 47 CFR Part 15B

Class A digital device.

A digital device that is marketed for use in a commercial, industrial or business environment, exclusive of a device which is marketed for use by the general public or is intended to be used in the home.

Class B digital device.

A digital device that is marketed for use in a residential environment notwithstanding use in commercial, business and industrial environments. Examples of such devices include, but are not limited to, personal computers, calculators, and similar electronic devices that are marketed for use by the general public.

NOTE: The responsible party may also qualify a device intended to be marketed in a commercial, business or industrial environment as a Class B device, and in fact is encouraged to do so, provided the device complies with the technical specifications for a Class B digital device. In the event that a particular type of device has been found to repeatedly cause harmful interference to radio communications, the Commission may classify such a digital device as a Class B digital device, regardless of its intended use.

The VLU6M4SP-EW was deemed by Redtail Telematics Ltd to be tested as Class B Digital Device.

4 Specifications

The tests were performed and operated in accordance with Kiwa Electrical Compliance procedures and the relevant standards listed below.

4.1 Relevant standards

Ref.	Standard Number	Version	Description
4.1.1	47 CFR Part 15B	2023	Part 15: Radio frequency devices. Sub part B: Unintentional Radiators.
4.1.2	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

4.2 Deviations

No deviations were applied.

5 Tests, methods and results

5.1 AC powerline conducted emission

NOT APPLICABLE: The EUT is battery powered.

5.2 Antenna power conducted emission

NOT APPLICABLE: The EUT does not have an Antenna Port.

5.3 Radiated emissions 30 MHz - 1 GHz

5.3.1 Test methods

Test Requirements: 47 CFR Part 15B [Reference 4.1.1 of this report]

Test Method: ANSI C63.4 [Reference 4.1.2 of this report]

5.3.2 Configuration of EUT

The EUT was placed on a turntable 0.8m above the ground plane. The EUT was powered from the brand new internal batteries. The front edge of the EUT was initially positioned facing the antenna. The horizontal projection onto the ground plane of the front edge of the EUT and the measuring point of the antenna were 3m apart.

Refer to section 8 for a photograph and diagram of this test set-up.

Details of the peripheral and ancillary equipment connected for this test is listed in section 10.

Mode 1 mode (refer to section 2.3) was used for this test.

Port Name	Cable Type	Connected
Antenna	PVC insulated cable	Yes
Connection cables (x5)	PVC insulated cable	Yes

5.3.3 Test procedure

Tests were made in accordance with FCC Part 15 using the measuring equipment listed below. Measurements were made on a site listed with the FCC. The equipment was rotated 360 degrees and the antenna scanned 1 – 4 metres in both horizontal and vertical polarisations to record the worst-case emissions.

The EUT was rotated in all three orthogonal planes.

At least 6 signals within 20dB and all signals within 10dB of the limit were investigated.

Tests were performed using Test Site H.

5.3.4 Test equipment

E642, E745, E914, F238, NSA-H, ZSW1

See Section 9 for more details

5.3.5 Test results

Temperature of test environment 20°C

Humidity of test environment 50%

Rad 1

Plot References
Peak Horizontal emissions 30 MHz - 300 MHz against the quasi-peak limit line.
Peak Vertical emissions 30 MHz - 300 MHz against the quasi-peak limit line.
Peak Horizontal emissions 300 MHz - 1 GHz against the quasi-peak limit line.
Peak Vertical emissions 300 MHz - 1 GHz against the quasi-peak limit line.

These results show that the EUT has PASSED this test.

Receiver plots showing peak values can be found in Section 6 of this report along with tables of peak / quasi-peak values.

The uncertainty gives a 95% confidence interval in which the emissions from the EUT fall. Expanded uncertainty (K=2) is as follows:

30MHz to 1GHz ±6.16dB (UE60a & UE 60b)

5.4 Radiated Emissions above 1 GHz

5.4.1 Test methods

Test Requirements: 47 CFR Part 15B [Reference 4.1.1 of this report]

Test Method: ANSI C63.4 [Reference 4.1.2 of this report]

5.4.2 Configuration of EUT

The EUT was placed on a 0.8 metre high turntable. The front edge of the EUT was initially positioned facing the antenna.

Refer to section 8 for a photograph and diagram of this test set-up.

Details of the peripheral and ancillary equipment connected for this test is listed in section 10.

Mode 1 mode (refer to section 2.3) was used for this test.

Port Name	Cable Type	Connected
Antenna	PVC insulated cable	Yes
Connection cables (x5)	PVC insulated cable	Yes

5.4.3 Test procedure

Tests were made in accordance with FCC Part 15 using the measuring equipment listed below.

The frequency range of the test was chosen as per Section 15.33 of FCC Part 15. The EUT was test up to a frequency of 12.5 GHz based on the supplier declared highest internal source frequency of 2480 MHz.

Measurements were made in a semi-anechoic chamber with appropriate absorbing material for use in this range. Horn antennas were used at heights where the whole of the EUT was contained within the main beam in both horizontal and vertical polarisations. The EUT was rotated through 360 degrees to record the worst case emissions. The EUT was rotated in all three orthogonal planes.

A measurement distance of 3m was used for the test range 1 - 6GHz, 1.2m was used for the test range 6 – 12.5GHz.

Where measurement distances other than 3 metres are specified, the appropriate correction factor has been determined and applied in the measurement software, corrected for a 3 metre measurement distance.

At least 6 signals within 20dB and all signals within 10dB of the limit were investigated.

Tests were performed using test Site H.

5.4.4 Test equipment

E642, F238, LPE261, LPE333, VSWR-H, ZSW1

See Section 9 for more details

5.4.5 Test results

Temperature of test environment	20°C
Humidity of test environment	50%

Rad 1

Plot References
Peak Horizontal emissions 1 - 2 GHz against the average limit line
Peak Vertical emissions 1 - 2 GHz against the average limit line
Peak Horizontal emissions 2 - 5 GHz against the average limit line
Peak Vertical emissions 2 - 5 GHz against the average limit line
Peak Horizontal emissions 5 - 6 GHz against the average limit line
Peak Vertical emissions 5 - 6 GHz against the average limit line
Peak Horizontal emissions 6 - 10 GHz against the average limit line
Peak Vertical emissions 6 - 10 GHz against the average limit line
Peak Horizontal emissions 10 – 12.5 GHz against the average limit line
Peak Vertical emissions 10 – 12.5 GHz against the average limit line

These results show that the EUT has PASSED this test.

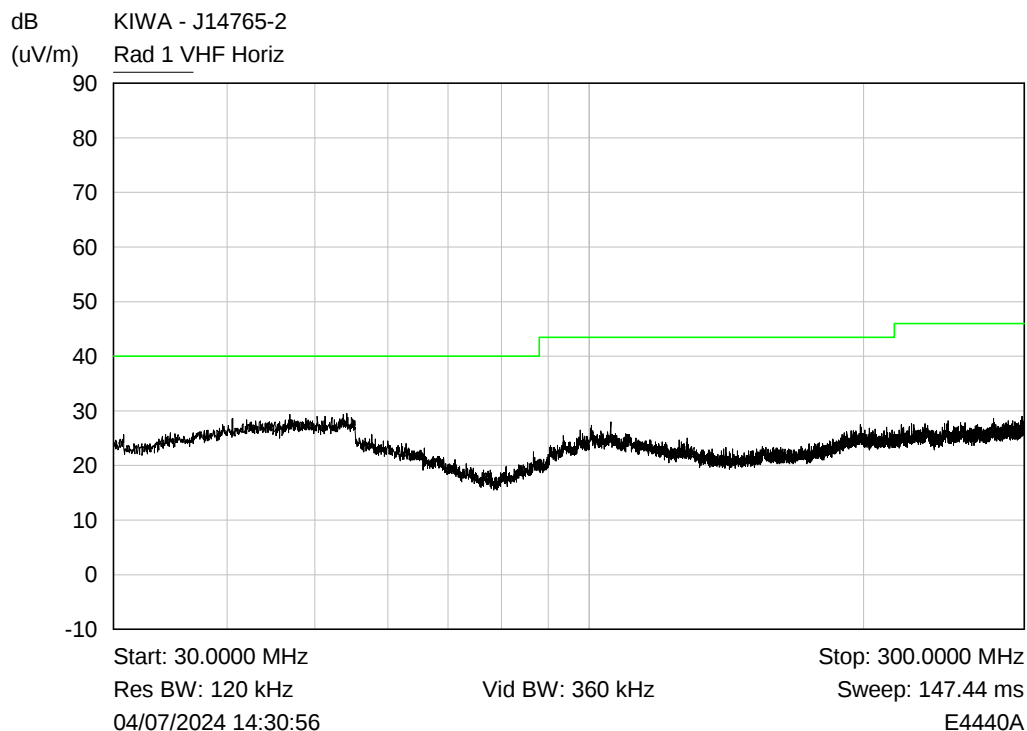
Receiver plots showing peak values can be found in Section 6 of this report along with tables of peak & average values.

The uncertainty gives a 95% confidence interval in which the emissions from the EUT fall. Expanded uncertainty (K=2) is as follows:

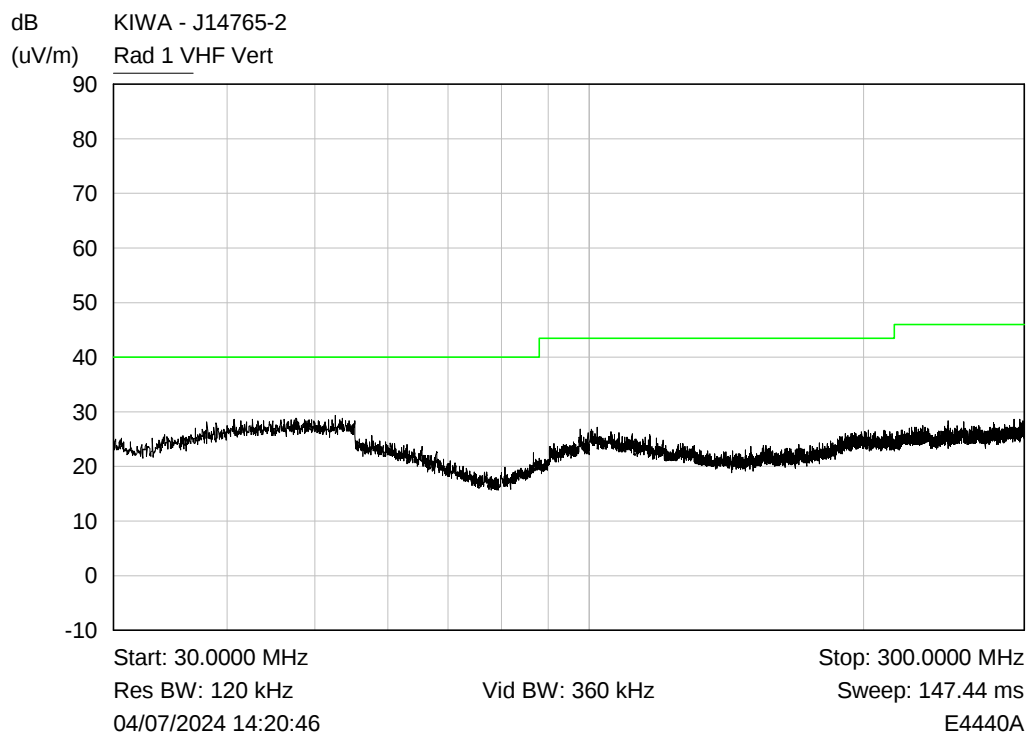
1GHz to 3GHz $\pm 4.81\text{dB}$ (UE77)
3GHz to 6GHz $\pm 4.81\text{dB}$ (UE78)
6GHz to 12.5GHz $\pm 5.39\text{dB}$ (UE79)

6 Plots/Graphical results

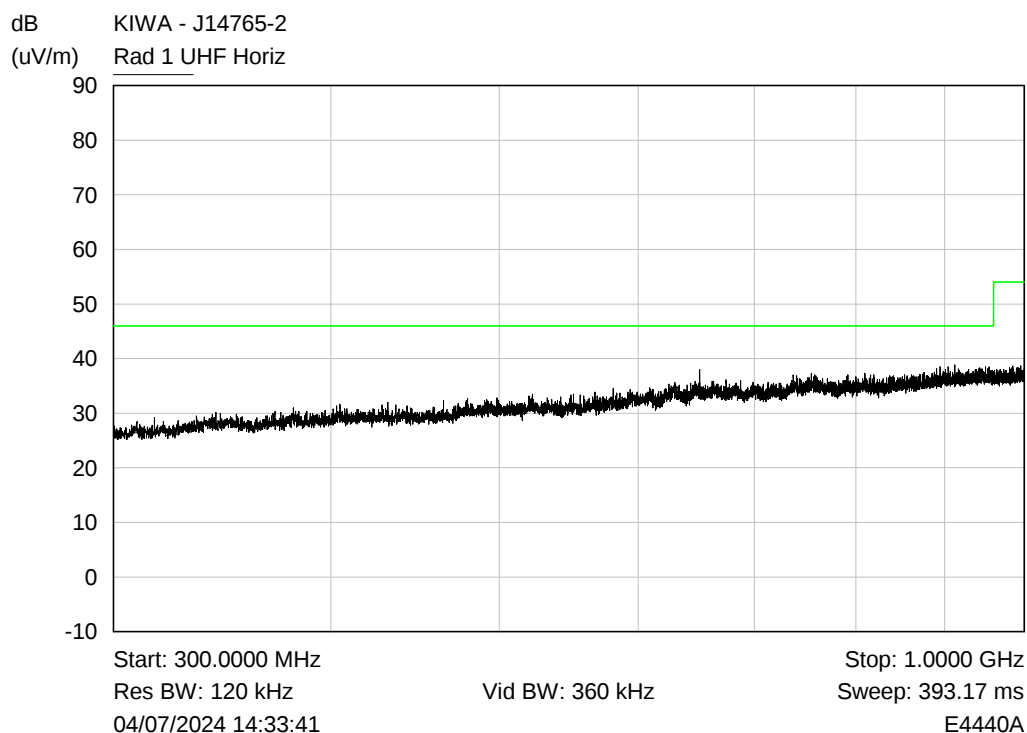
6.1 Radiated emissions 30 MHz - 1 GHz



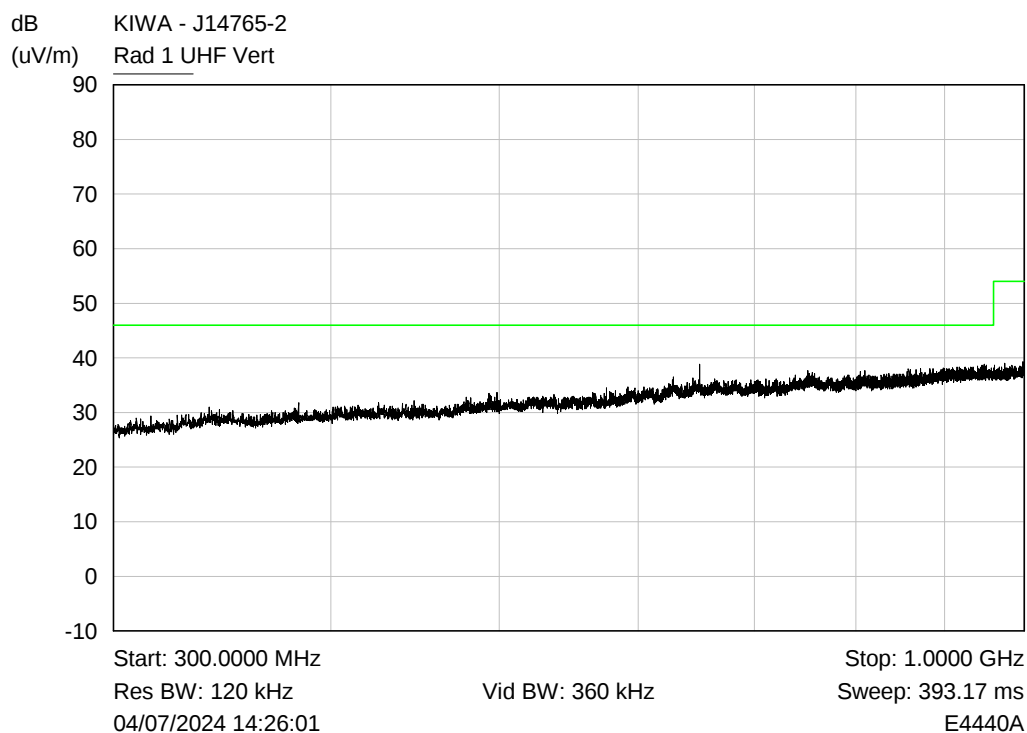
Peak Horizontal emissions 30 MHz - 300 MHz against the quasi-peak limit line.



Peak Vertical emissions 30 MHz - 300 MHz against the quasi-peak limit line.



Peak Horizontal emissions 300 MHz - 1 GHz against the quasi-peak limit line.



Peak Vertical emissions 300 MHz - 1 GHz against the quasi-peak limit line.

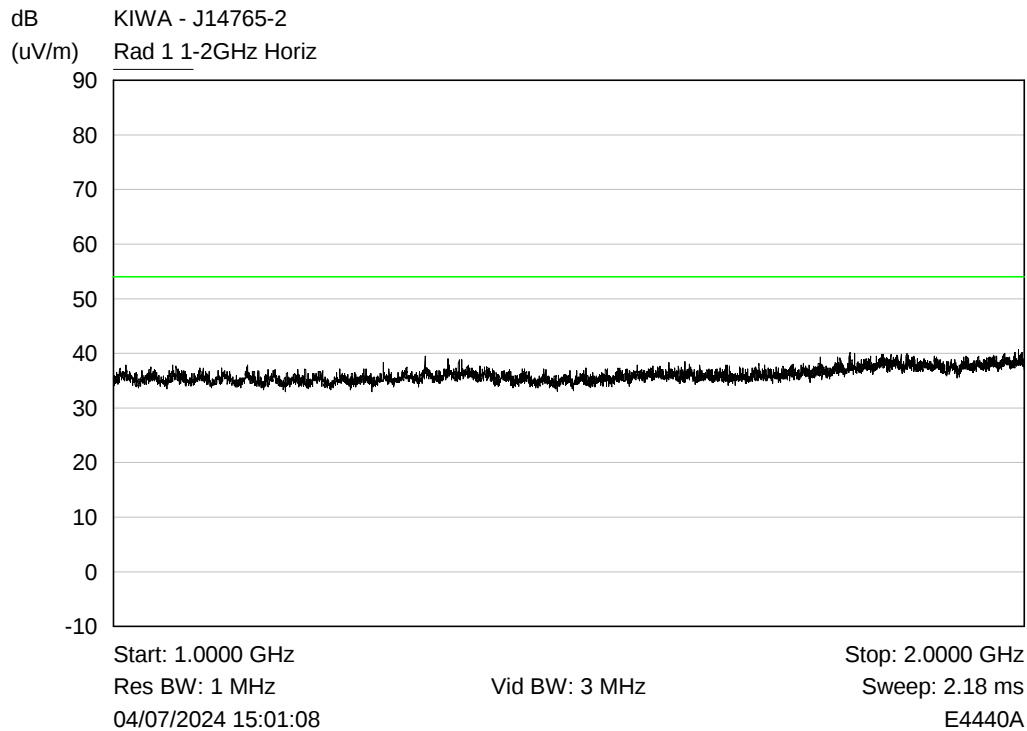
Table of signals measured for Horizontal Signal List

Signal No.	Freq (MHz)	Peak Amp (dBuV/m)	QP Amp (dBuV/m)	QP -Lim (dB)
1	651.512	39.2	34.0	-12.0

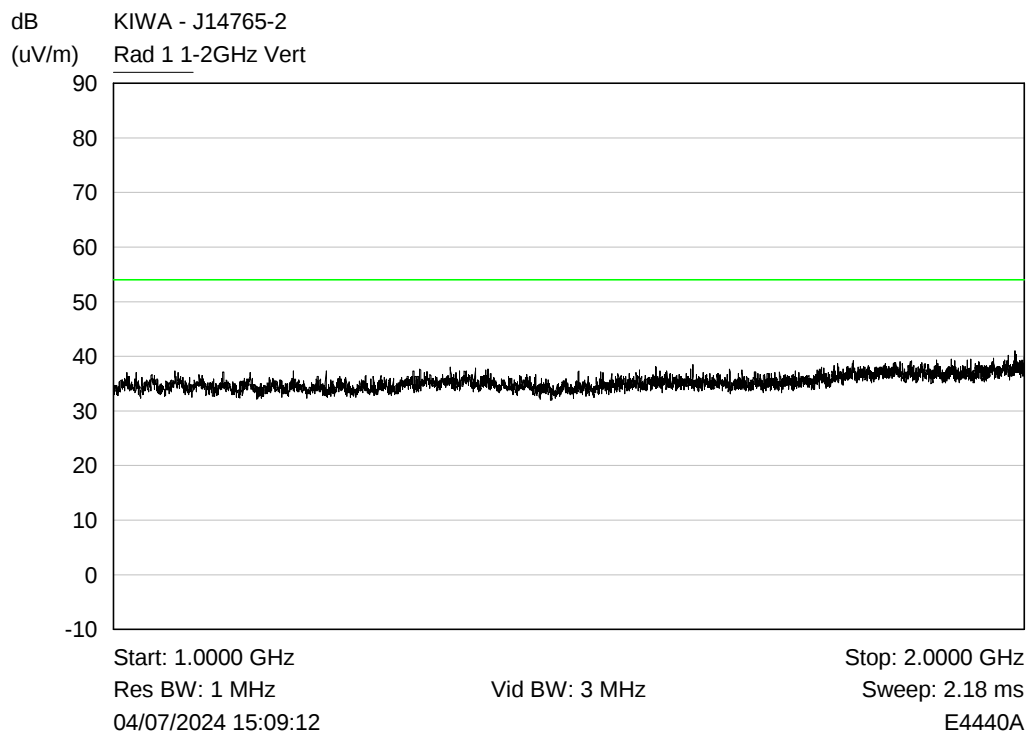
Table of signals measured for Vertical Signal List

Signal No.	Freq (MHz)	Peak Amp (dBuV/m)	QP Amp (dBuV/m)	QP -Lim (dB)
1	651.535	40.2	34.6	-11.4

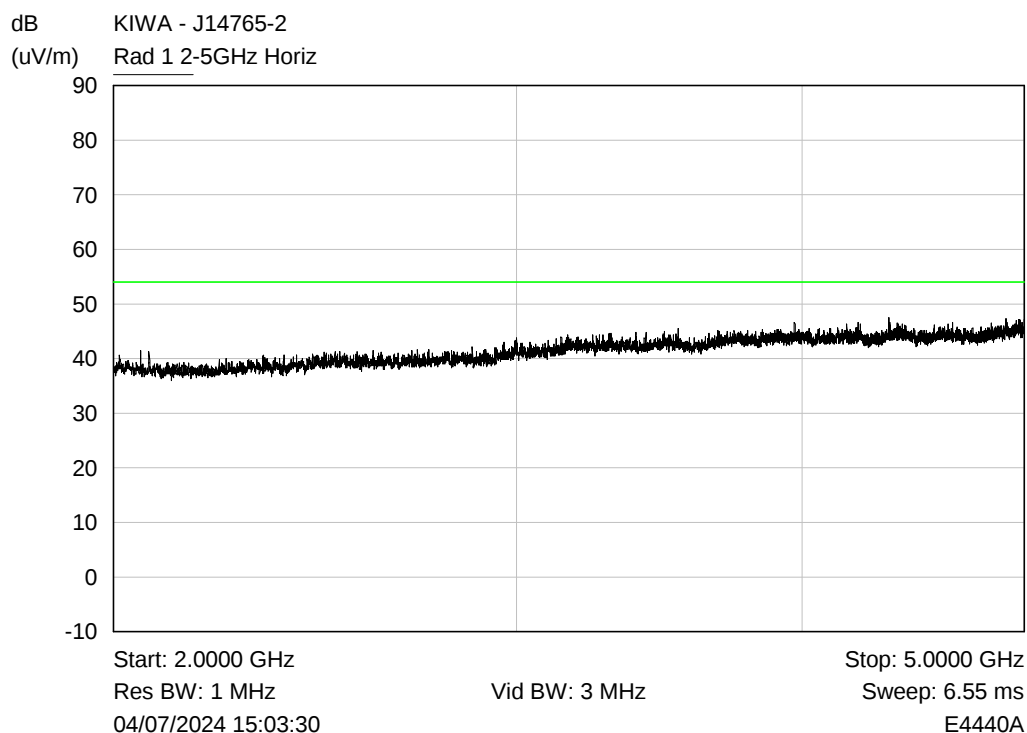
6.2 Radiated Emissions above 1 GHz



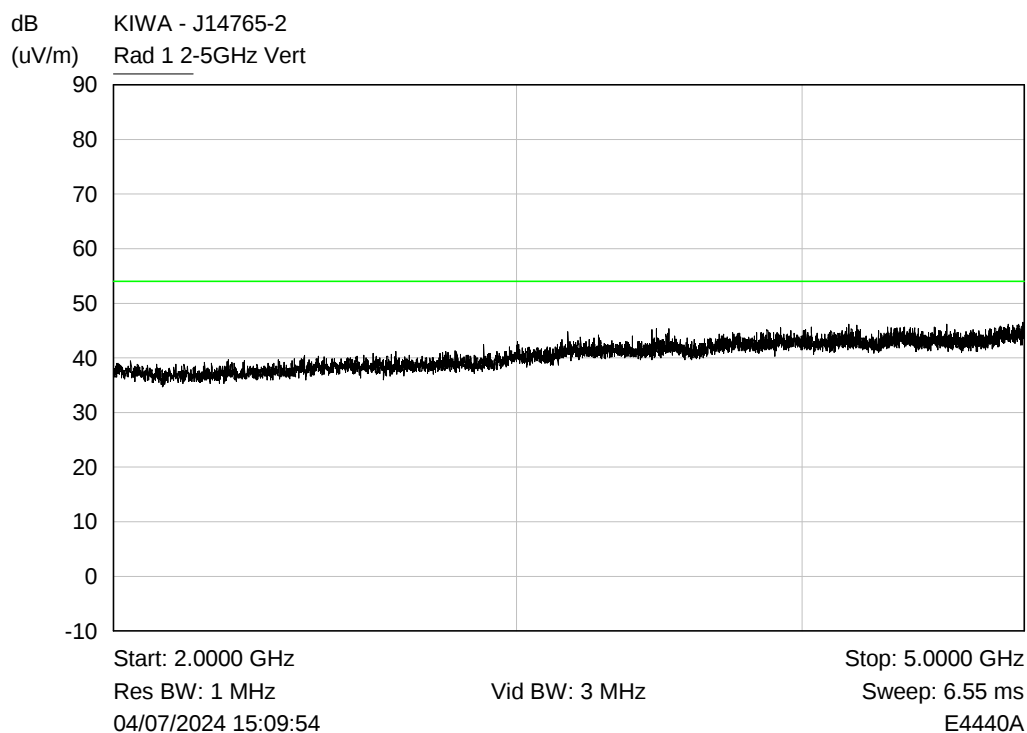
Peak Horizontal emissions 1 - 2 GHz against the average limit line



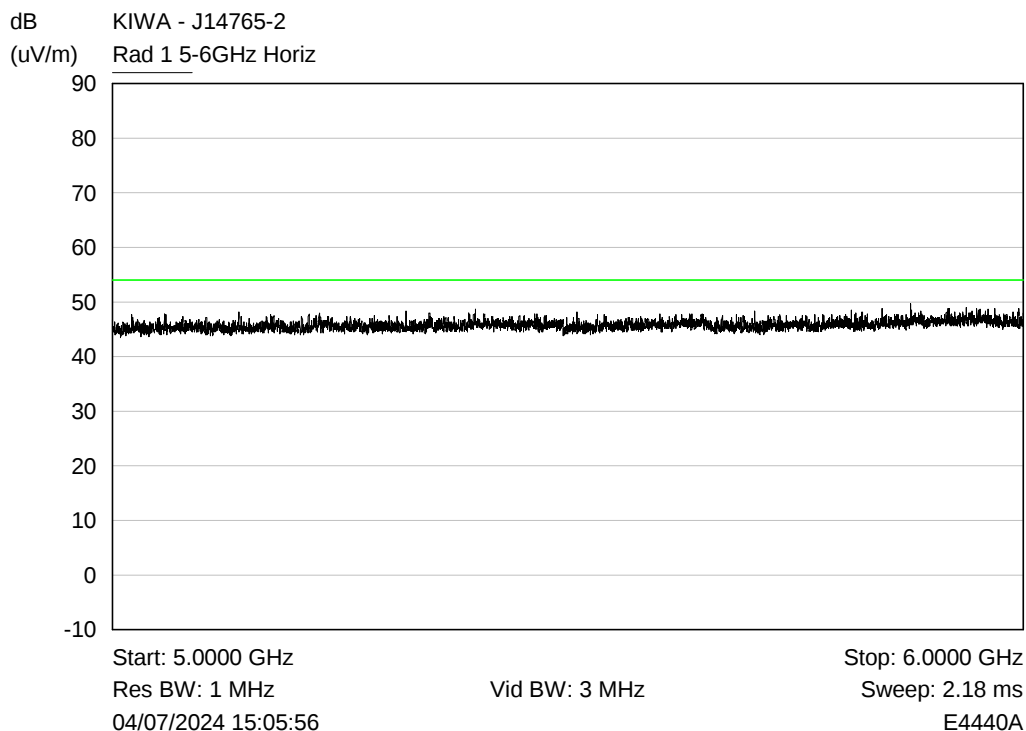
Peak Vertical emissions 1 - 2 GHz against the average limit line



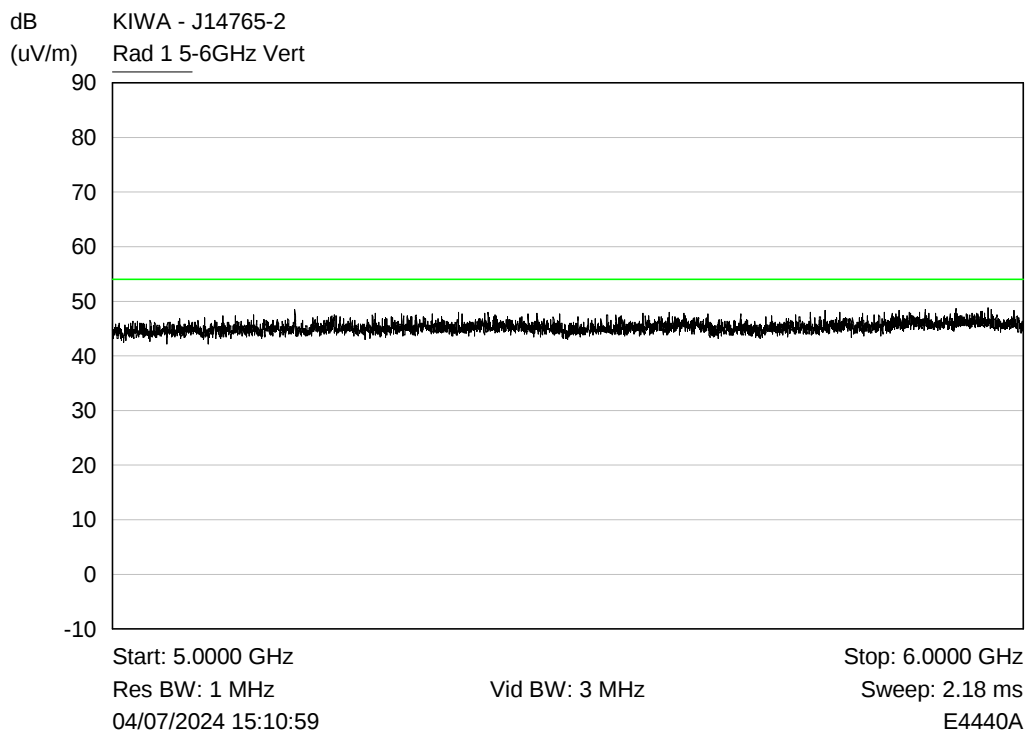
Peak Horizontal emissions 2 - 5 GHz against the average limit line



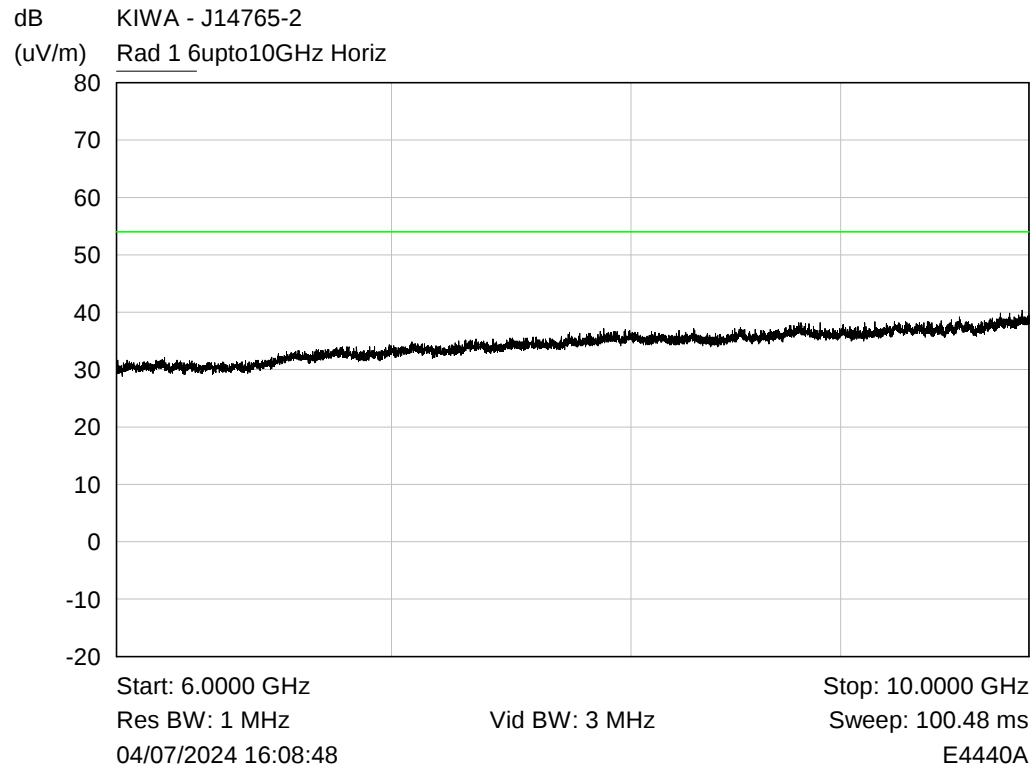
Peak Vertical emissions 2 - 5 GHz against the average limit line



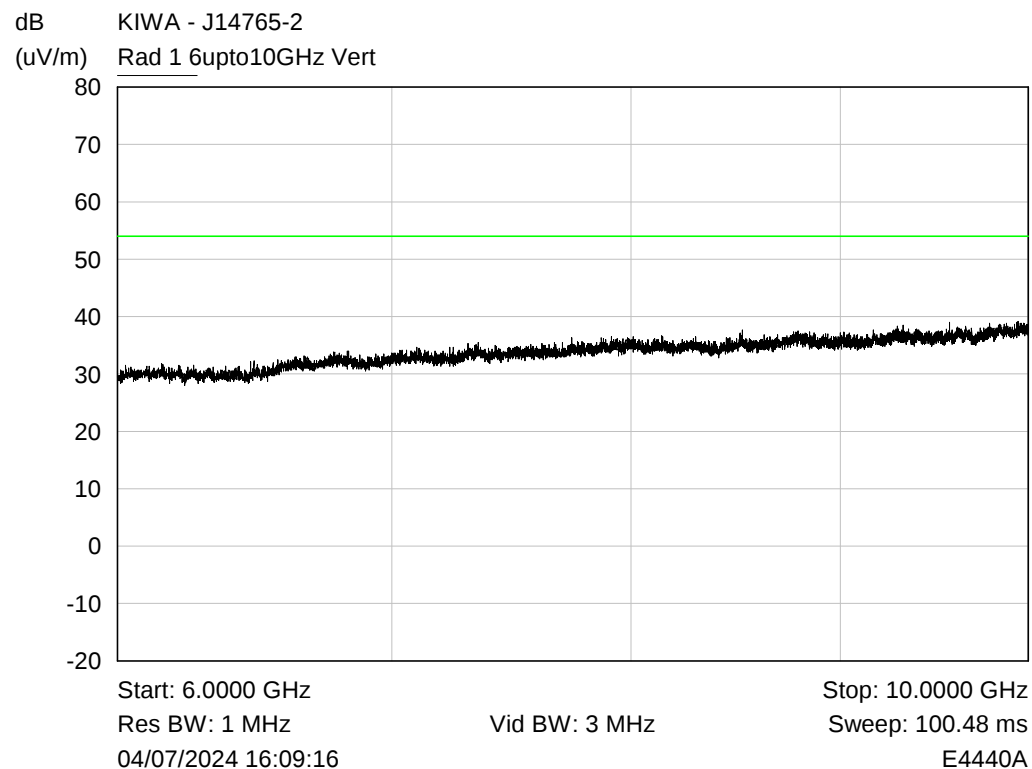
Peak Horizontal emissions 5 - 6 GHz against the average limit line



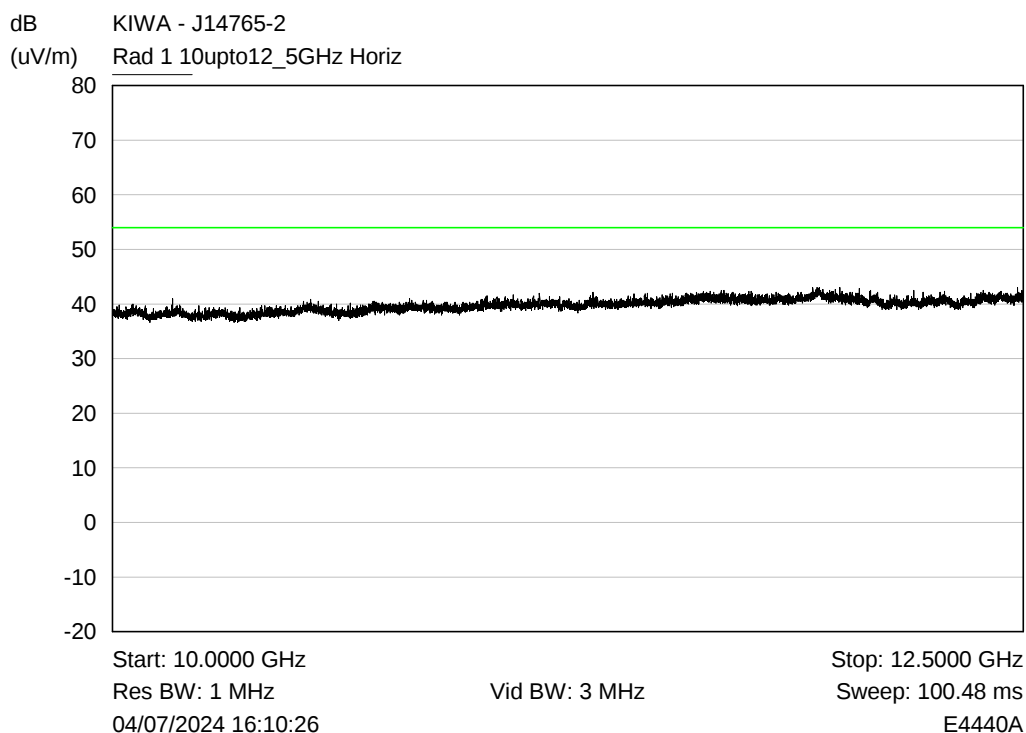
Peak Vertical emissions 5 - 6 GHz against the average limit line



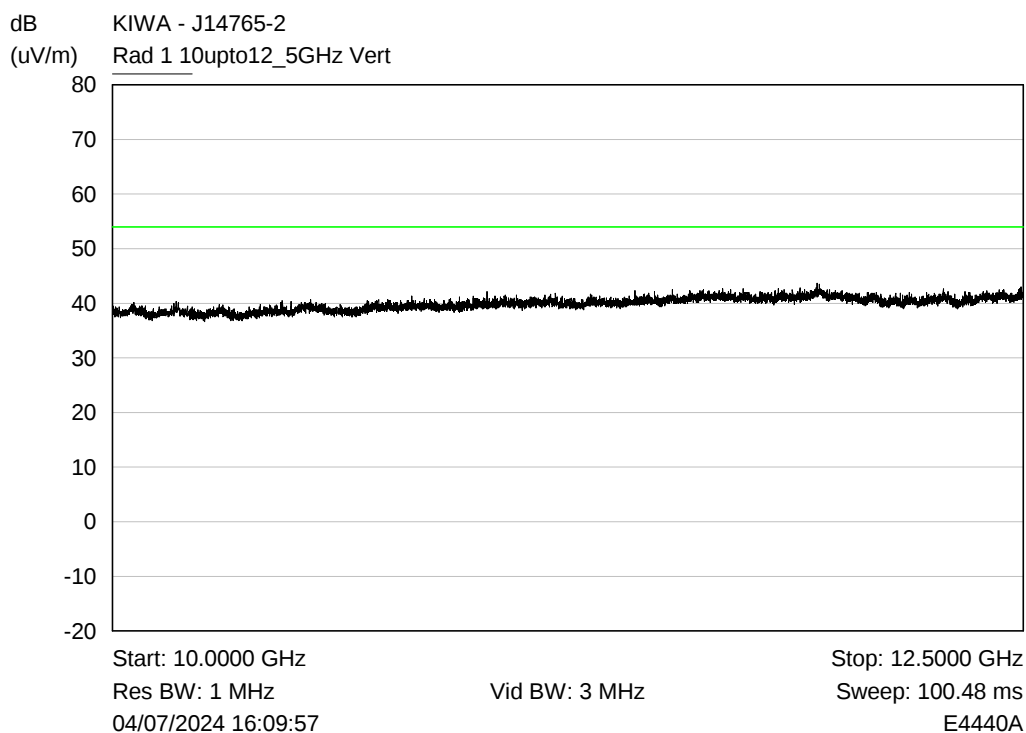
Peak Horizontal emissions 6 - 10 GHz against the average limit line



Peak Vertical emissions 6 – 10 GHz against the average limit line



Peak Horizontal emissions 10 – 12.5 GHz against the average limit line



Peak Vertical emissions 10 – 12.5 GHz against the average limit line

Table of signals measured for Horizontal signal list above 1GHz

Signal No.	Freq (MHz)	Peak Amp (dBuV/m)	Pk -Lim (dB)	AV Amp (dBuV/m)	AV -Lim (dB)
1	1266.253	38.9	-35.1	25.6	-28.4
2	1290.076	38.0	-36.0	26.0	-28.0
3	1295.113	37.9	-36.1	25.3	-28.7
4	4363.116	46.5	-27.5	33.8	-20.2
5	5060.882	47.4	-26.6	35.1	-18.9
6	5867.371	48.9	-25.1	36.4	-17.6
7	11480.801	50.3	-23.7	38.1	-15.9
8	11619.608	51.0	-23.0	38.8	-15.2
9	11889.392	51.8	-22.2	39.9	-14.1

Table of signals measured for Vertical signal list above 1GHz

Signal No.	Freq (MHz)	Peak Amp (dBuV/m)	Pk -Lim (dB)	AV Amp (dBuV/m)	AV -Lim (dB)
1	1424.119	37.1	-36.9	24.4	-29.6
2	1544.195	37.6	-36.4	25.2	-28.8
3	1968.223	39.9	-34.1	27.8	-26.2
4	4224.229	45.9	-28.1	33.5	-20.5
5	5183.599	47.9	-26.1	35.3	-18.7
6	5358.657	49.0	-25.0	35.5	-18.5
7	11840.086	52.0	-22.0	39.1	-14.9
8	11975.086	50.8	-23.2	38.4	-15.6

7 Explanatory Notes

7.1 Explanation of Table of Signals Measured

Measurements are made as required by the standard. These measurements are made and recorded using detectors, either peak, quasi peak or average dependant on the test. A table of results has been given following the relevant plots. This table looks similar to the one illustrated below dependant on the measurements required by the test: -

Signal No.	Freq (MHz)	Peak Amp (dBuV)	Pk – Lim 1 (dB)	QP Amp (dBuV)	QP - Lim1 (dB)	Av Amp (dBuV)	Av - Lim1 (dB)
1	12345	54.9	-10.5	48	-12.6	37.6	-14.4

Column One - Labelled Signal No. is an incremental number that the receiver has given to each signal that has been measured.

Column Two - Labelled Freq (MHz) is the approximate frequency of the signal received.

Column Three - Labelled Peak Amp (dBμV) is the level of received signal that was measured in dB above 1μV using the peak detector.

Column Four - Labelled Pk - Lim1 (dB) is the difference in level from the peak signal given to the active limit line. If this column appears in the table the peak detector measurement is required by the standard for this test. The results entered in this column indicate the signal level relative to the compliance limit required. Negative numbers indicate that the product is compliant.

Column Five - Labelled QP Amp (dBμV) is the level of received signal that was measured in dB above 1μV using the quasi-peak detector.

Column Six - Labelled QP - Lim1 (dB) is the difference in level from the quasi-peak signal given to the active limit line. If this column appears in the table the quasi-peak detector measurement is required by the standard for this test. The results entered in this column indicate the signal level relative to the compliance limit required. Negative numbers indicate that the product is compliant.

Column Seven - Labelled Av Amp (dBμV) is the level of received signal that was measured in dB above 1μV using the average detector.

Column Eight - Labelled Av - Lim1 (dB) is the difference in level from the average signal given to the active limit line. If this column appears in the table the average detector measurement is required by the standard for this test. The results entered in this column indicate the signal level relative to the compliance limit required. Negative numbers indicate that the product is compliant.

Only signals highlighted in red are deemed to exceed the limit of the detector required.

7.2 Limit line calculations for radiated measurements

The limits given in the test standard are normally expressed as absolute values (e.g. in mV/m at a specified distance), whereas the measured values are expressed in dBmV referenced to the measuring instrument inputs. Kiwa Electrical Compliance calibrate the test set-up to account for any path losses, antenna gains, etc. so that the value read at the receiver relates directly to the absolute value required, except that it is expressed in dB relative to one microvolt and may need to take account of any alternative measuring distance used.

Examples:

(a) Limit of 500mV/m equates to $20 \cdot \log(500) = 54$ dBmV/m.

(b) Limit of 300mV/m at 10m equates to $20 \cdot \log(300 \cdot 10/3) = 60$ dBmV/m at 3m.

7.3 Example Calculation

The measurement receiver used for emissions testing, performs the field strength (FS) calculations automatically. The receiver combines the signal amplitude (RA), Antenna Factor (AF) and Cable Loss (CL) factors for the frequency to be measured.

Example calculation: - $FS = RA + AF + CL$.

Receiver amplitude (RA)	Antenna factor (3m) (AF)	Cable loss	Field strength result (3m) (FS)
20dBuV/m	25 dB	3 dB	48dBuV/m

8 Photographs

8.1 EUT Front View





8.2 EUT Back View



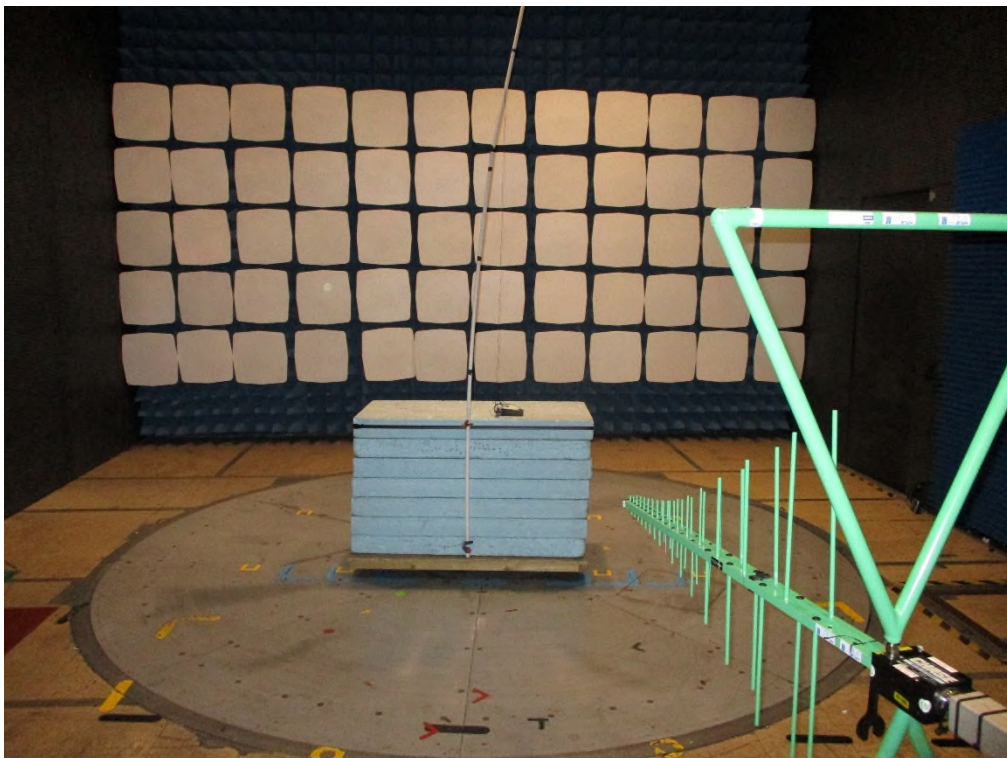
8.3 EUT Left Side Angle



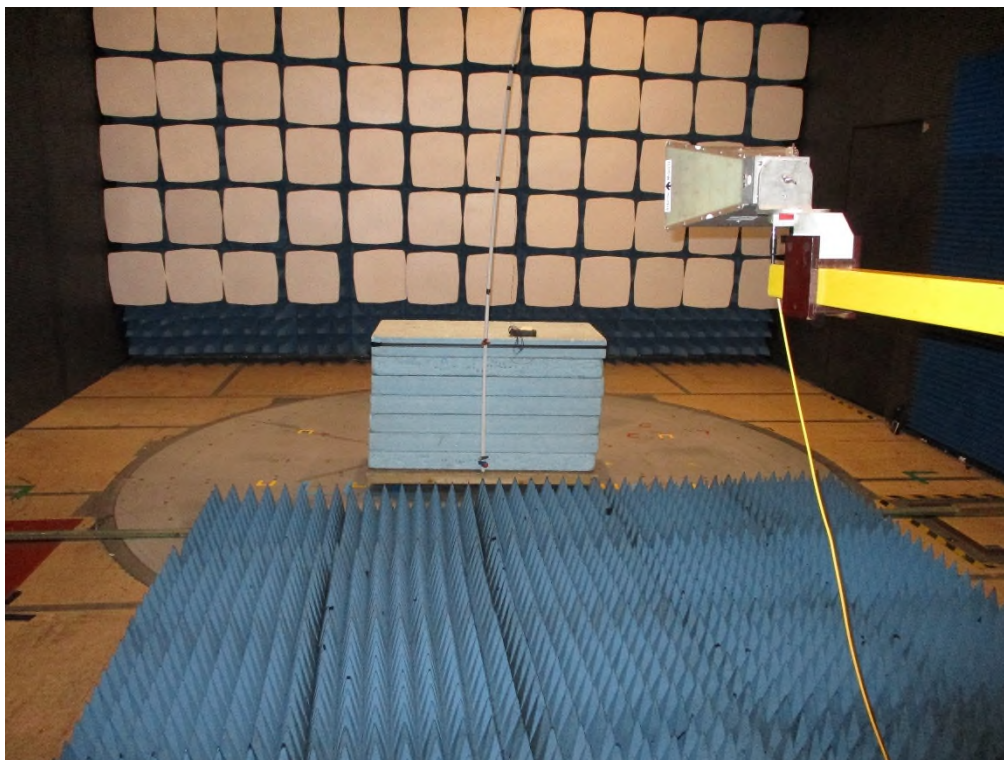
8.4 EUT Right Side Angle



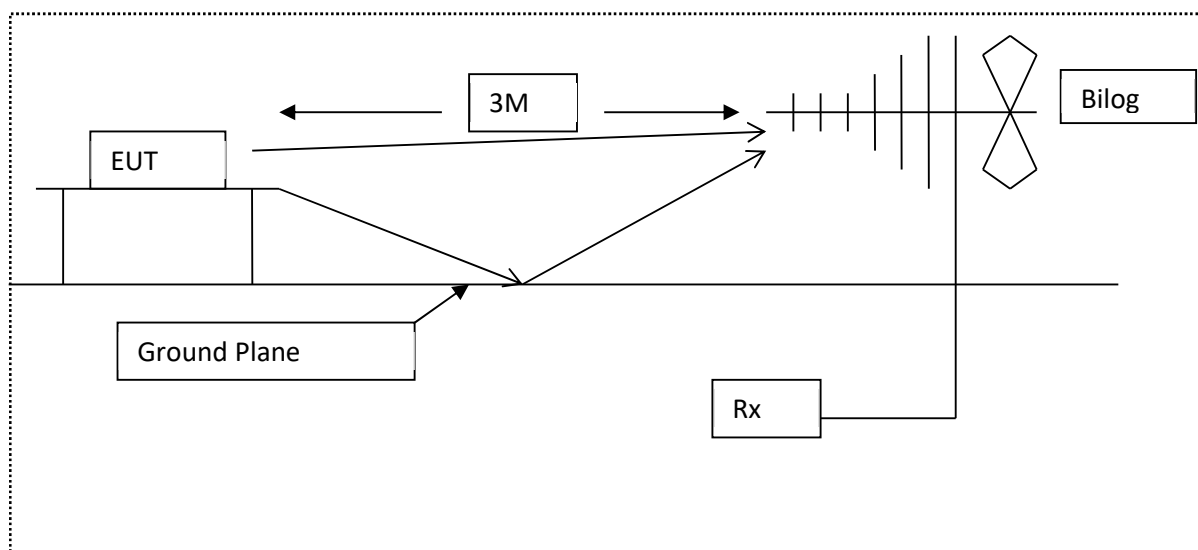
8.5 Radiated emissions 30 MHz - 1 GHz



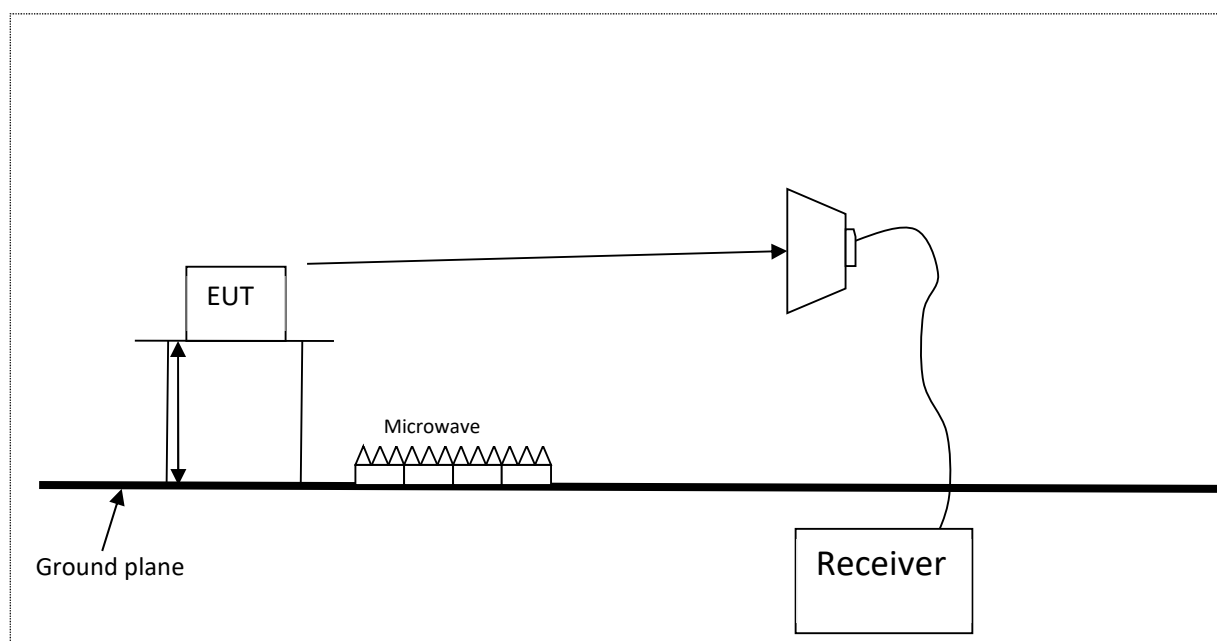
8.6 Radiated Emissions above 1 GHz



8.7 Set-up diagrams



Radiated Emissions test setup below 1GHz for bench top equipment



Radiated Emissions test setup above 1GHz for bench top equipment

9 Test equipment calibration list

The following is a list of the test equipment used by Kiwa Electrical Compliance to test the unit detailed within this report. In line with our procedures, the equipment was within calibration for the period during which testing was carried out.

KEC No	Model	Description	Manufacturer	Calibrated Date	Period
E642	E4440A	PSA 3 Hz - 26.5 GHz	Agilent Technologies	20/02/2024	24 months
E745	2017 4/2dB	Attenuator 4/2dB 30-1000MHz	RN Electronics	22/02/2024	12 months
E914	VULB 9163	Antenna BiLog 30MHz to 3GHz	Schwarzbeck	23/04/2024	24 months
F238	N9039A	9 kHz - 1 GHz RF Filter Section	Agilent Technologies	23/08/2023	12 months
LPE261	3115	Horn Antenna 1 - 18 GHz	EMCO	15/05/2024	12 months
LPE333	8449B	Pre-Amplifier 1GHz - 26.5GHz	Hewlett Packard	01/06/2023	12 months
NSA-H	NSA - H	NSA - Site H	RN Electronics	17/05/2023	36 months
VSWR-H	VSWR	VSWR 1-18GHz	RN Electronics	08/01/2023	36 months
ZSW1	V2.5.7	KEC Measurement Software Suite	KEC	Not applicable	

10 Support equipment

10.1 Customer supplied equipment

No customer support equipment was supplied.

10.2 Kiwa Electrical Compliance supplied equipment

No Kiwa Electrical Compliance support equipment was used.

11 Condition of the equipment tested

In order for the EUT to produce the results shown within this report the following modifications, if any, were implemented.

11.1 Modifications before test

No modifications were made before test by Kiwa Electrical Compliance.

11.2 Modifications during test

No modifications were made during test by Kiwa Electrical Compliance.

12 Description of test sites

Site A	Radio Laboratory and Anechoic Chamber
Site B	Semi-Anechoic Chamber and Control Room FCC Registration No. 654321, ISED Registration No. 5612A-4
Site C	Transient Laboratory
Site D	Screened Room (Conducted Immunity)
Site E	Screened Room (Control Room for Site D)
Site F	Screened Room (Conducted Emissions)
Site G	Screened Room (Control Room for Site H)
Site H	3m Semi-Anechoic Chamber (indoor OATS) FCC Registration No. 654321, ISED Registration No. 5612A-2, VCCI Registration No. 4065
Site J	Transient Laboratory
Site K	Screened Room (Control Room for Site M)
Site M	3m Semi-Anechoic Chamber (indoor OATS) FCC Registration No. 654321, ISED Registration No. 5612A-3
Site N	Radio Laboratory
Site Q	Fully-Anechoic Chamber
Site OATS3m and 10m Open Area Test Site	FCC Registration No. 654321, ISED Registration No. 5612A-1
Site R	Screened Room (Conducted Immunity)
Site S	Safety Laboratory
Site T	Transient Laboratory

CAB identifier as issued by Innovation, Science and Economic Development Canada is UK0002
CAB identifier as issued by FCC is UK2015