



## Radio Test Report

**Cellular Highways Ltd**

**Highway1**

**10000-1001**

47 CFR Part 15.225 Effective Date 1st October 2022

Test Date: 11th January 2024 to 29th January 2024

Report Number: 01-14546-5-24 Issue 01

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

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A part of



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

## Certificate of Test 14546-5

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

Equipment:	Highway1
Model Number:	10000-1001
Unique Serial Number:	4500000021
Applicant:	Cellular Highways Ltd TTP Campus Cambridge Road Cambridgeshire SG8 6HQ
Proposed FCC ID	2BD8H-HIGHWAY1
Full measurement results are detailed in Report Number:	01-14546-5-24 Issue 01
Test Standards:	47 CFR Part 15.225 Effective Date 1st October 2022

NOTE:  
None.

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: 11th January 2024 to 29th January 2024

Test Engineer:  
Jack Chilvers

Approved By:  
Radio Approvals  
Manager

Customer  
Representative:



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## 2 Equipment under test (EUT)

### 2.1 Equipment specification

Applicant	Cellular Highways Ltd TTP Campus Cambridge Road Cambridgeshire SG8 6HQ	
Manufacturer of EUT	Cellular Highways Ltd	
Full Name of EUT	Highway1	
Model Number of EUT	10000-1001	
Serial Number of EUT	4500000021	
Date Received	11th January 2024	
Date of Test:	11th January 2024 to 29th January 2024	
Purpose of Test	To demonstrate design compliance to the relevant rules of Chapter 47 of the Code of Federal Regulations.	
Date Report Issued	8th February 2024	
Main Function	The Highway1 Cell Sorting System is a research-use only (RUO) tool that may be used to sort cells based on optical measurements of light scattering and fluorescent markers.	
Information Specification	Height	570 mm
	Width	210 mm
	Depth	318 mm
	Weight	20 kg
	Voltage	100-240 VAC
	Current	2A
EUT Supplied PSU	Manufacturer	TDK Lambda
	Model number	DTM250PW240D
	Serial number	22100061
	Input voltage	100-240 VAC
	Input current	01.4-2.8 A
	Output	24 VDC 10.416 A

## 2.2 Configurations for testing

General Parameters	
EUT Normal use position	Bench top
Choice of model(s) for type tests	10000-1001
Antenna details	Integral
Antenna port	Integral
Baseband Data port (yes/no)?	No
Highest Signal generated in EUT	2 GHz (main processor)
Lowest Signal generated in EUT	Not Declared
Hardware Version (HVIN)	revision B
Software Version	HW1B.1.12.0
Firmware Version (FVIN)	HW1B.1.12.98
Type of Equipment	RFID
Technology Type	RFID
Geo-location (yes/no)	No
TX Parameters	
Alignment range – transmitter	13.56 MHz
EUT Declared Modulation Parameters	type A miller
EUT Declared Power level	<1W
EUT Declared Signal Bandwidths	14 kHz
EUT Declared Channel Spacing's	14 kHz
EUT Declared Duty Cycle	100%
Unmodulated carrier available?	Yes
Declared frequency stability	30 ppm
FCC Parameters	
FCC Transmitter Class	DXX

## 2.3 Functional description

A user loads a single-use cartridge containing cells to be sorted into the Highway1 instrument and closes the door (laser safety interlock).

The user starts the run on the desktop PC interface, sets cell selection criteria (gates) and then the run is controlled by instrument automation (no user intervention).

The instrument reads the NFC tag on the cartridge to check type.

The instrument moves the cartridge into the optical field of view using a motorised XYZ stage.

The instrument controls fluid flow through the cartridge using a linear syringe drive and solenoid pinch valve.

The instrument controls temperature of the cartridge using a peltier cooling system.

The instrument actuates a magnetic stirrer in the cartridge using a motorised drive.

The instrument directs laser light into the cartridge and detects scattered & fluorescent light to make sorting decisions.

The instrument applies voltage to the cartridge to sort the selected cells.

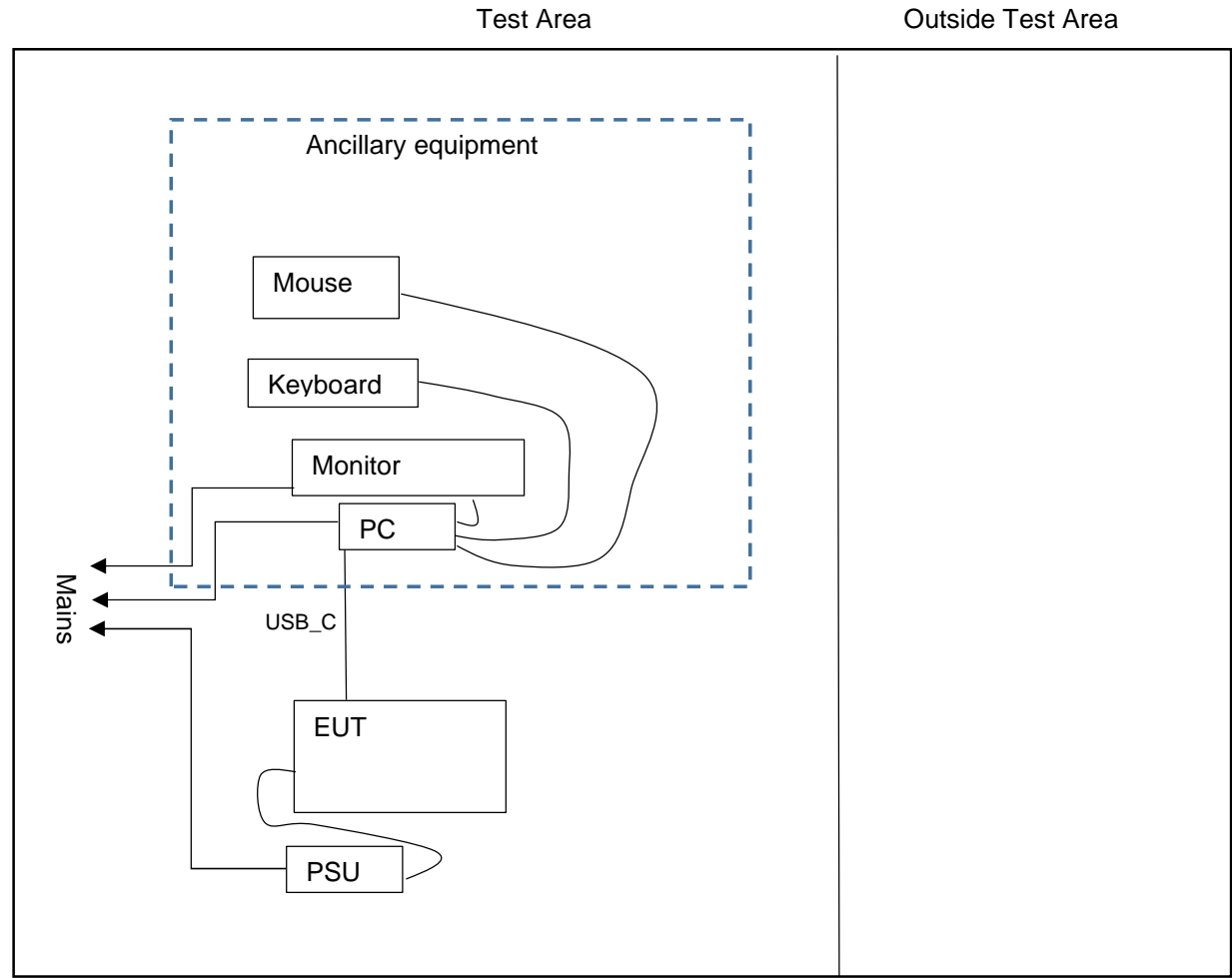
The instrument controls internal temperature using enclosure heaters & case fans to maintain stability.

The instrument reports to the user when the run is complete (LED display panel and desktop PC interface).

## 2.4 Modes of operation

Mode Reference	Description	Used for testing
Mode 1	Continuously performing present detection commands to the NFC tag over 13.56 MHz.	Yes
Mode 2	Continuously reading and writing to the NFC tag every 1 second at 13.56 MHz.	Yes
Mode 3	Continuously transmitting CW signal at 13.56 MHz.	Yes
Mode 4	PRBS constantly transmitting random binary bit stream (type A miller) at a rate of 106.	Yes

2.5 Emissions configuration



The unit was powered from the provided dedicated AC/DC adapter. The EUT was connected to the provided ancillary PC, monitor, Keyboard and Mouse and configured using the provided software on the ancillary PC. For conducted method tests a test fixture had to be used and was referenced to the fundamental radiated results from the OATS. The unit was configured with engineering menus in software to allow permanent transmit modes as stated within section 2.4 of this report. The transmit mode was 100% continuous with modulation at the default maximum power.

Single Channel – 13.56 MHz.

2.5.1 Signal leads

Port Name	Cable Type	Connected
Mains	3 Core	Yes
USB_C	USB	Yes

### 3 Summary of test results

The Highway1, 10000-1001 was tested for compliance to the following standard(s):

47 CFR Part 15.225 Effective Date 1st October 2022

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. 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 essential requirements of the directive, particularly under different conditions to those during testing. 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%.

Title	References	Results
<b>Transmitter Tests</b>		
1. AC power line conducted emissions	47 CFR Part 15C Part 15.207	PASSED
2. Radiated emissions 9 - 150 kHz	47 CFR Part 15C Part 15.209	PASSED
3. Radiated emissions 150 kHz - 30 MHz	47 CFR Part 15C Part 15.209	PASSED
4. Radiated emissions 30 MHz - 1 GHz	47 CFR Part 15C Part 15.225(d)	PASSED
5. Radiated emissions above 1 GHz	47 CFR Part 15C Part 15.209	PASSED <sup>1</sup>
6. Intentional radiator field strength	47 CFR Part 15C Part 15.225(a)	PASSED
7. Occupied bandwidth	47 CFR Part 15C Part 15.215	PASSED
8. Spectrum mask	47 CFR Part 15C Part 15.225	PASSED
9. Frequency stability	47 CFR Part 15C Part 15.225(e)	PASSED

<sup>1</sup> Highest frequency test of 20GHz based on 10 times highest signal used/generated in the equipment of 2GHz (Processor speed)

## 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 15C	2022	Federal Communications Commission PART 15 – RADIO FREQUENCY DEVICES
4.1.2	ANSI C63.10	2013	American National Standard of Procedures for Compliance Testing of Unlicensed Wireless Devices
4.1.3	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.

### 4.3 Tests at extremes of temperature & voltage

The following test conditions were used to simulate testing at nominal or extremes.

Temperature Test Conditions		Voltage Test Conditions	
T nominal	20 °C	V nominal	120V DC
T minimum	0 °C	V minimum	100V DC
T maximum	40 °C	V maximum	240V DC

Extremes of temperature are based upon manufacturer's declaration

The ambient test conditions of humidity and pressure in the laboratory were as specified in each specific test section within this report

### 4.4 Test fixtures

In order to measure RF parameters at temperature extremes, the EUT was tested in a temperature-controlled chamber as follows:

A test fixture was used for testing.



## 5 Tests, methods and results

### 5.1 AC power line conducted emissions

#### 5.1.1 Test methods

Test Requirements:	47 CFR Part 15C Part 15.207 [Reference 4.1.1 of this report]
Test Method:	ANSI C63.10 Clause 6.2 [Reference 4.1.2 of this report]
Limits:	47 CFR Part 15C Part 15.207 [Reference 4.1.1 of this report]

#### 5.1.2 Configuration of EUT

The EUT was placed on a wooden table 0.8m above the ground plane and connected to a LISN via a 1m mains cable.

Details of the Peripheral and Ancillary Equipment connected for this test are listed in section 10.

During the initial scan, Mode 4 was found to be worst case mode of operation.

#### 5.1.3 Test procedure

Tests were made in accordance with FCC Part 15 using the measuring equipment noted in the 'Test Equipment' Section. Measurements were made on the live and neutral conductors using both average and quasi-peak detection.

All signals within 20dB of the limit were investigated.

Tests were performed in Test Site F.

#### 5.1.4 Test equipment

E150, E035, ZSW1, E624, E411

See Section 9 for more details

#### 5.1.5 Test results

Temperature of test environment	20°C
Humidity of test environment	50%
Pressure of test environment	102kPa

Band	13.553-13.567 MHz
Power Level	Max Default
Channel Spacing	Single Channel
Mod Scheme	ASK
Single channel	13.56 MHz

Plot refs
14546-5 Cond 1 AC Live 150k-30M Average
14546-5 Cond 1 AC Live 150k-30M Quasi-Peak
14546-5 Cond 1 AC Neutral 150k-30M Average
14546-5 Cond 1 AC Neutral 150k-30M Quasi-Peak

Peak detector "Max held" Analyser plots against the Quasi-Peak / Average limit line(s) can be found in Section 6 of this report./ Only results within 20dB of limits have been reported.

#### LIMITS:

15.207: as given in the above tables / drawn on the respective plots.

These results show that the EUT has PASSED this test.

The uncertainty gives a 95% confidence interval in the measurement. Expanded uncertainty (K=2) is as follows:  
UE70 9kHz to 150kHz  $\pm 3.76$ dB, UE71 150kHz to 30MHz  $\pm 3.4$ dB

## 5.2 Radiated emissions 9 - 150 kHz

### 5.2.1 Test methods

Test Requirements:	47 CFR Part 15C Part 15.209 [Reference 4.1.1 of this report]
Test Method:	ANSI C63.10 Clause 6.4 [Reference 4.1.2 of this report]
Limits:	47 CFR Part 15C Part 15.225(d) [Reference 4.1.1 of this report]

### 5.2.2 Configuration of EUT

The EUT was placed on a 0.8 metres high turntable. The front edge of the EUT was initially positioned facing the antenna. The EUT was measured at a distance of 3 metres. The antenna was orientated in both Parallel and Perpendicular polarisations. The EUT was rotated in all three orthogonal planes. The EUT was powered using the mains power supply connected to a 120 VAC 60 Hz power source. The EUT was operated in Mode 4.

### 5.2.3 Test procedure

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

Measurements were made in a semi-anechoic chamber (pre-scan) with any final measurements required performed on an OATS without a ground plane. The antenna was placed 1m above the ground. The equipment was rotated 360 degrees to record the worst-case emissions.

All signals within 20dB of the limit were investigated.

Tests were performed using Test Site H.

### 5.2.4 Test equipment

TMS81, ZSW1, E642, F238

See Section 9 for more details

### 5.2.5 Test results

Temperature of test environment	20°C
Humidity of test environment	50%
Pressure of test environment	102 kPa

Band	13.553-13.567 MHz
Power Level	Max Default
Channel Spacing	Single Channel
Mod Scheme	ASK
Single channel	13.56 MHz

Plot refs
14546-5 Rad 1 9k-150kHz Para
14546-5 Rad 1 9k-150kHz Perp

Peak detector "Max held" Analyser plots against the Quasi-Peak / Average limit line(s) can be found in Section 6 of this report.

#### LIMITS:

15.209 limits are applicable in the restricted bands of 15.205 with the relevant detector.

n.b. the general limits of 15.209 are as drawn on the respective plots.

These results show that the EUT has PASSED this test.

The uncertainty gives a 95% confidence interval in the measurement. Expanded uncertainty (K=2) is as follows:  
9kHz - 30MHz  $\pm 3.9$ dB

## 5.3 Radiated emissions 150 kHz - 30 MHz

### 5.3.1 Test methods

Test Requirements:	47 CFR Part 15C Part 15.209 [Reference 4.1.1 of this report]
Test Method:	ANSI C63.10 Clause 6.4 [Reference 4.1.2 of this report]
Limits:	47 CFR Part 15C Part 15.225(d) [Reference 4.1.1 of this report]

### 5.3.2 Configuration of EUT

The EUT was placed on a 0.8 metres high turntable. The front edge of the EUT was initially positioned facing the antenna. The EUT was measured at a distance of 3 metres. The antenna was orientated in both Parallel and Perpendicular polarisations. The EUT was rotated in all three orthogonal planes. The EUT was powered using the mains power supply connected to a 120 VAC 60 Hz power source. The EUT was operated in Mode 4.

### 5.3.3 Test procedure

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

Measurements were made in a semi-anechoic chamber (pre-scan) with any final measurements required performed on an OATS without a ground plane. The antenna was placed 1m above the ground. The equipment was rotated 360 degrees to record the worst-case emissions.

All signals within 20dB of the limit were investigated.

Tests were performed using Test Site H.

### 5.3.4 Test equipment

TMS81, ZSW1, E642, F238

See Section 9 for more details

### 5.3.5 Test results

Temperature of test environment	20°C
Humidity of test environment	50%
Pressure of test environment	102 kPa

Band	13.553-13.567 MHz
Power Level	Max Default
Channel Spacing	Single Channel
Mod Scheme	ASK
Single channel	13.56 MHz

Plot refs
14546-5 Rad 1 150k-30MHz Para
14546-5 Rad 1 150k-30MHz Perp

Peak detector "Max held" Analyser plots against the Quasi-Peak / Average limit line(s) can be found in Section 6 of this report.

#### LIMITS:

15.209 limits are applicable in the restricted bands of 15.205 with the relevant detector.

n.b. the general limits of 15.209 are as drawn on the respective plots.

These results show that the EUT has PASSED this test.

The uncertainty gives a 95% confidence interval in the measurement. Expanded uncertainty (K=2) is as follows:  
9kHz - 30MHz  $\pm 3.9$ dB

## 5.4 Radiated emissions 30 MHz -1 GHz

### 5.4.1 Test methods

Test Requirements:	47 CFR Part 15C Part 15.225(d) [Reference 4.1.1 of this report]
Test Method:	ANSI C63.10 Clause 6.4 [Reference 4.1.2 of this report]
Limits:	47 CFR Part 15C Part 15.225(d) [Reference 4.1.1 of this report]

### 5.4.2 Configuration of EUT

The EUT was placed on a 0.8 metres high turntable. The front edge of the EUT was initially positioned facing the antenna. The EUT was measured at a distance of 3 metres. The EUT was rotated in all three orthogonal planes. The EUT was powered using the mains power supply connected to a 120 VAC 60 Hz power source. The EUT was operated in Mode 4.

### 5.4.3 Test procedure

Tests were made in accordance with FCC Part 15 using the measuring equipment noted below. Measurements were made in a semi-anechoic chamber. The antenna was height scanned between 1 and 4metres and the equipment was rotated 360 degrees to record the worst-case emissions. Both Horizontal and vertical polarisations of measuring antenna were tested. Tests were performed in Test Site H.

### 5.4.4 Test equipment

E914, E744, NSA-H, ZSW1, E642, F238

See Section 9 for more details

### 5.4.5 Test results

Temperature of test environment	20°C
Humidity of test environment	50%
Pressure of test environment	102 kPa

Band	13.553-13.567 MHz
Power Level	Max Default
Channel Spacing	Single Channel
Mod Scheme	ASK
Single channel	13.56 MHz

Plot refs
14546-5 Rad 1 VHF Horiz
14546-5 Rad 1 VHF Vert
14546-5 Rad 1 UHF Horiz
14546-5 Rad 1 UHF Vert

**Table of signals measured for Rad 1 Horizontal Signal List**

Signal No.	Freq (MHz)	Peak Amp (dBuV/m)	QP Amp (dBuV/m)	QP -Lim (dB)
1	51.186	29.8	23.9	-16.1
2	132.113	27.5	22.5	-21.0
3	185.533	31.5	26.4	-17.1
4	245.394	40.4	34.5	-11.5
5	247.803	44.0	38.0	-8.0
6	306.962	32.9	28.5	-17.5
7	394.522	31.9	27.6	-18.4
8	395.310	34.9	30.2	-15.8

### Table of signals measured for Rad 1 Vertical Signal List

Signal No.	Freq (MHz)	Peak Amp (dBuV/m)	QP Amp (dBuV/m)	QP -Lim (dB)
1	31.828	41.3	36.9	-3.1
2	35.249	40.2	35.3	-4.7
3	43.217	36.7	31.0	-9.0
4	78.077	32.6	25.4	-14.6
5	104.899	34.1	27.8	-15.7
6	124.982	30.9	24.5	-19.0
7	185.855	36.1	30.4	-13.1
8	480.000	37.6	34.5	-11.5
9	554.997	33.5	27.2	-18.8
10	627.981	33.9	28.3	-17.7

Peak detector "Max held" Analyser plots against the Quasi-Peak / Average limit line(s) can be found in Section 6 of this report.

#### LIMITS:

15.209 limits are applicable in the restricted bands of 15.205 with the relevant detector.

n.b. the general limits of 15.209 are as drawn on the respective plots.

These results show that the EUT has PASSED this test.

The uncertainty gives a 95% confidence interval in the measurement. Expanded uncertainty (K=2) is as follows:

30MHz - 1000MHz  $\pm 6.1$ dB

## 5.5 Radiated emissions above 1 GHz

### 5.5.1 Test methods

Test Requirements:	47 CFR Part 15C Part 15.209 [Reference 4.1.1 of this report]
Test Method:	ANSI C63.10 Clause 6.6 [Reference 4.1.2 of this report]
Limits:	47 CFR Part 15C Part 15.209/15.225(d) [Reference 4.1.1 of this report]

### 5.5.2 Configuration of EUT

The EUT was placed on a 1.5 metres high turntable. The front edge of the EUT was initially positioned facing the antenna. The EUT was measured at a distance of 3 metres. The EUT was rotated in all three orthogonal planes. The EUT was powered using the mains power supply connected to a 120 VAC 60 Hz power source.

The EUT was operated in Mode 4.

### 5.5.3 Test procedure

Tests were made in accordance with FCC Part 15 using the measuring equipment noted below. Measurements were made in a semi-anechoic chamber with appropriate absorbing material for use in this range. The EUT was raised, and antenna was placed 1.5m above the ground plane in line with the EUT. The EUT was rotated through 360 degrees to record the worst case emissions. A measurement distance of 3m was used between the test range 1GHz - 6GHz, 1.2m was used in the test range 6-18GHz and 0.3m was used in the test range 18-20GHz. Tests were performed in Test Site M.

### 5.5.4 Test equipment

E136, E411, E624, TMS78, TMS79, TMS82, VSWR-M, ZSW1

See Section 9 for more details

### 5.5.5 Test results

Temperature of test environment	20°C
Humidity of test environment	50%
Pressure of test environment	102kPa

Setup Table

Band	13.553-13.567 MHz
Power Level	Max Default
Channel Spacing	Single Channel
Mod Scheme	ASK
Single channel	13.56 MHz

Spurious Frequency (MHz)	Measured Peak Level (dBµV/m)	Difference to Peak Limit (dB)	Measured Average Level (dBµV/m)	Difference to Average Limit (dB)	EUT Polarisation	Antenna Polarisation
1597.824	50.9	-23.1	36.2	-17.8	Upright	Horizontal
1599.1	54.3	-19.7	38.9	-15.1	Upright	Vertical
1599.217	54	-20	38.7	-15.3	Upright	Vertical
1599.647	51	-23	35	-19	Upright	Horizontal

Plots	
14546-5 Rad 1 1-2GHz Horiz	
14546-5 Rad 1 1-2GHz Vert	
14546-5 Rad 1 2-5GHz Horiz	
14546-5 Rad 1 2-5GHz Vert	
14546-5 Rad 1 5-6GHz Horiz	
14546-5 Rad 1 5-6GHz Vert	
14546-5 Rad 1 6upto10GHz Horiz	
14546-5 Rad 1 6upto10GHz Vert	
14546-5 Rad 1 10upto12_5GHz Horiz	

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QMF21J - Issue 05 - RNE Issue 03; 47 CFR Part 15C 2021

14546-5 Rad 1 10upto12_5GHz Vert
14546-5 Rad 1 12-15GHz Horiz
14546-5 Rad 1 12-15GHz Vert
14546-5 Rad 1 15-18GHz Horiz
14546-5 Rad 1 15-18GHz Vert
14546-5 Rad 1 18-22GHz Horiz
14546-5 Rad 1 18-22GHz Vert

Note: Only signals within 20dB of limits using the applicable detector are reported. Peak detector “Max held” Analyser plots against the Average limit line can be found in Section 6 of this report.

**LIMITS:**

15.209 limits are applicable in the restricted bands of 15.205 with the relevant detector.

15.247(d) other emissions, outside the intentional band, must be attenuated by at least 20/30dB from the level of the fundamental / meet the general limits of 15.209.

The general limits of 15.209 are as drawn on the respective plots.

These results show that the EUT has PASSED this test.

The uncertainty gives a 95% confidence interval in the measurement. Expanded uncertainty (K=2) is as follows:

1 - 6 GHz  $\pm 4.7$ dB, 6 – 18 GHz  $\pm 4.95$ dB, 18 – 26.5 GHz  $\pm 3.1$ dB

## 5.6 Intentional radiator field strength

### 5.6.1 Test methods

Test Requirements:	47 CFR Part 15C Part 15.225(a) [Reference 4.1.1 of this report]
Test Method:	ANSI C63.10 Clause 6.4 [Reference 4.1.2 of this report]
Limits:	47 CFR Part 15C Part 15.225(a)/(b)/(c)/(d) [Reference 4.1.1 of this report]

### 5.6.2 Configuration of EUT

The EUT was placed on a 0.8 metres high turntable. The front edge of the EUT was initially positioned facing the antenna. The EUT was measured at a distance of 3 metres. The antenna was orientated in both Parallel and Perpendicular polarisations. The EUT was rotated in all three orthogonal planes. The EUT was operated in Mode 4.

### 5.6.3 Test procedure

Tests were made in accordance with FCC Part 15 using the measuring equipment noted below. Measurements were made in a semi-anechoic chamber (pre-scan) with final measurements performed on an OATS without a ground plane. The antenna was placed 1m above the ground. Both the equipment and the antenna were rotated 360 degrees to record the maximised emission.

Measurements were made at Site H.

### 5.6.4 Test equipment

TMS81, ZSW1, E642, F238

See Section 9 for more details

### 5.6.5 Test results

Temperature of test environment	20°C
Humidity of test environment	50%
Pressure of test environment	102kPa

Band	13.553-13.567 MHz
Power Level	Max Default
Channel Spacing	Single Channel
Mod Scheme	ASK
Single channel	13.56 MHz

	Single channel
Duty Cycle (%)	100.00
Duty Cycle correction	0.00

	Single channel
Peak Level (dBµV/m) @3m	51.84
Plot reference	Peak power Upright Parallel
Antenna Polarisation	Parallel
EUT Polarisation	Upright

Analyser plots can be found in Section 6 of this report.

An extrapolation factor of 40dB/decade per ANSI C63.10:2013 clause 6.4 is applied to the 3m results to give the following field strengths at 30m for comparison to the limits:

	Single channel
Peak Level (dBµV/m) @30m	11.84
Limit dBµV/m at 30M	84



**LIMITS:**

15.225(a) QP/Peak = the field strength of any emissions within the band 13.553-13.567 MHz shall not exceed 15,848  $\mu\text{V/m}$  @ 30m = 84 dB $\mu\text{V/m}$  @ 30m.

15.225(b) QP/Peak = within the bands 13.410-13.553 MHz and 13.567-13.710 MHz, the field strength of any emissions shall not exceed 334  $\mu\text{V/m}$  @ 30m = 50.5 dB $\mu\text{V/m}$  @ 30m.

15.225(c) QP/Peak = within the bands 13.110-13.410 MHz and 13.710-14.010 MHz the field strength of any emissions shall not exceed 106  $\mu\text{V/m}$  @ 30m = 40.5 dB $\mu\text{V/m}$  @ 30m.

15.225(d) QP/Peak = outside of the 13.110-14.010 MHz band shall not exceed the general radiated emissions limits of 15.209.

These results show that the EUT has PASSED this test.

The uncertainty gives a 95% confidence interval in the measurement. Expanded uncertainty (K=2) is as follows:  
< $\pm$  3.9 dB

## 5.7 Occupied bandwidth

### 5.7.1 Test methods

Test Requirements:	47 CFR Part 15C Part 15.215 [Reference 4.1.1 of this report]
Test Method:	ANSI C63.10 Clause 6.9 [Reference 4.1.2 of this report]
Limits:	47 CFR Part 15C Part 15.215 [Reference 4.1.1 of this report]

### 5.7.2 Configuration of EUT

The EUT was placed on a 0.8 metres high turntable. The front edge of the EUT was initially positioned facing the antenna. The EUT was measured at a distance of 3 metres. The EUT was tested whilst connected to the AC power for maximised emissions. The EUT was operated in Mode 4.

### 5.7.3 Test procedure

Tests were made in accordance with FCC Part 15 using the measuring equipment noted below. A 120kHz RBW, 3x VBW, auto sweep time and max hold settings were used for the 20 dB bandwidth.

Measurements were made in a semi-anechoic chamber. Tests were performed using Test Site H.

### 5.7.4 Test equipment

TMS81, ZSW1, E642, F238

See Section 9 for more details

### 5.7.5 Test results

Temperature of test environment	20°C
Humidity of test environment	50%
Pressure of test environment	102 kPa

Band	13.553-13.567 MHz
Power Level	Max Default
Channel Spacing	Single Channel
Mod Scheme	ASK
Single channel	13.56 MHz

	Single channel
99 % Bandwidth (MHz) Nominal Temp & Volts	956.3122
Plot for 99 % Bandwidth (MHz) Nominal Temp & Volts	14546-5 Tag in

Analyser plots can be found in Section 6 of this report.

#### LIMITS:

No limits apply however, per 15.215, the 20dB bandwidth of the emission is to remain within the band over expected variations in temperature and supply voltage. It is recommended that the fundamental emission be kept within at least the central 80% of the permitted band in order to minimise the possibility of out-of-band operation.

These results show that the EUT has PASSED this test.

The uncertainty gives a 95% confidence interval in the measurement. Expanded uncertainty (K=2) is as follows:  
<± 1.9 %

## 5.8 Spectrum mask

### 5.8.1 Test methods

Test Requirements:	47 CFR Part 15C Part 15.225 [Reference 4.1.1 of this report]
Test Method:	ANSI C63.10 Clause 6.4 [Reference 4.1.2 of this report]
Limits:	47 CFR Part 15C Part 15.225(a)/(b)/(c)/(d) [Reference 4.1.1 of this report]

### 5.8.2 Configuration of EUT

The EUT was placed on a 0.8 metres high turntable. The EUT was measured at a distance of 3 metres. The EUT and antenna were positioned for maximum field strength and referenced to the field strength measured on the OATS. The EUT was operated in Mode 4.

### 5.8.3 Test procedure

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

Plots were taken, and results were referenced to limits at 30m by using the extrapolation factor of 40dB/decade, per ANSI C63.10 clause 6.4 Measurements were made at Site H.

### 5.8.4 Test equipment

E642, F238, TMS81, ZSW1

See Section 9 for more details

### 5.8.5 Test results

Temperature of test environment	20°C
Humidity of test environment	50%
Pressure of test environment	102kPa

Band	13.553-13.567 MHz
Power Level	Max Default
Channel Spacing	Single Channel
Mod Scheme	ASK
Channel	13.56 MHz

	Single channel
Nominal, Maximised RF Output / field strength	51.84
Nominal plot reference	14546-5 Spectrum mask - RFID reading

3m result converted to 30m is 11.84 dBuV/m @30m. Analyser plots can be found in Section 6 of this report.

#### LIMITS:

15.225(a) QP/Peak = the field strength of any emissions within the band 13.553-13.567 MHz shall not exceed 15,848  $\mu\text{V/m}$  @ 30m = 84 dB $\mu\text{V/m}$  @ 30m.  
 15.225(b) QP/Peak = within the bands 13.410-13.553 MHz and 13.567-13.710 MHz, the field strength of any emissions shall not exceed 334  $\mu\text{V/m}$  @ 30m = 50.5 dB $\mu\text{V/m}$  @ 30m.  
 15.225(c) QP/Peak = within the bands 13.110-13.410 MHz and 13.710-14.010 MHz the field strength of any emissions shall not exceed 106  $\mu\text{V/m}$  @ 30m = 40.5 dB $\mu\text{V/m}$  @ 30m.  
 15.225(d) QP/Peak = outside of the 13.110-14.010 MHz band shall not exceed the general radiated emissions limits of 15.209.

These results show that the EUT has PASSED this test.

The uncertainty gives a 95% confidence interval in the measurement. Expanded uncertainty (K=2) is as follows:  
 $\leq \pm 4.1 \text{ dB}$

## 5.9 Frequency stability

### 5.9.1 Test methods

Test Requirements:	47 CFR Part 15C Part 15.225(e) [Reference 4.1.1 of this report]
Test Method:	ANSI C63.10 Clause 6.8 [Reference 4.1.2 of this report]
Limits:	47 CFR Part 15C Part 15.225(e) [Reference 4.1.1 of this report]

### 5.9.2 Configuration of EUT

The EUT's power port was connected to a variable power supply. This allowed the battery/voltage end points to be set as declared by the manufacturer/required by the specification.

The EUT was placed in a temperature controlled chamber. The EUT emissions were observed by means of a test fixture. The EUT was operated in Mode 3 mode.

### 5.9.3 Test procedure

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

Temperature stability was achieved at each test level before taking measurements. A frequency count was made on a CW signal. At nominal temperature the EUT supply was varied by the applicants declared max and min voltage.

A Frequency count was made using a spectrum analyser connected to an off-air frequency standard. The Analyser's frequency counter function was used to monitor the frequency of the carrier. The analyser was set with a suitable span, RBW and VBW to allow for a measurement resolution of 1Hz.

Tests were performed using Test Site A.

### 5.9.4 Test equipment

E555, E755, L264, LPE315, TMS38

See Section 9 for more details

### 5.9.5 Test results

Temperature of test environment	20°C
Humidity of test environment	50%
Pressure of test environment	102kPa

Band	13.553-13.567 MHz
Power Level	Max Default
Channel Spacing	Single Channel
Mod Scheme	ASK
Single channel	13.56 MHz

Test conditions		Frequency Error (MHz) Single channel
0°C	Volts Nominal (100)	13.560115
10°C	Volts Nominal (120)	13.560039
20°C	Volts Minimum (100)	13.560580
	Volts Nominal (120)	13.560560
	Volts Maximum (240)	13.560580
30°C	Volts Nominal (120)	13.560540
40°C	Volts Nominal (240)	13.560058
Max Frequency Error (Hz)		+20 / -521

**LIMITS:**

+/- 0.01%. (+/- 1.356kHz)

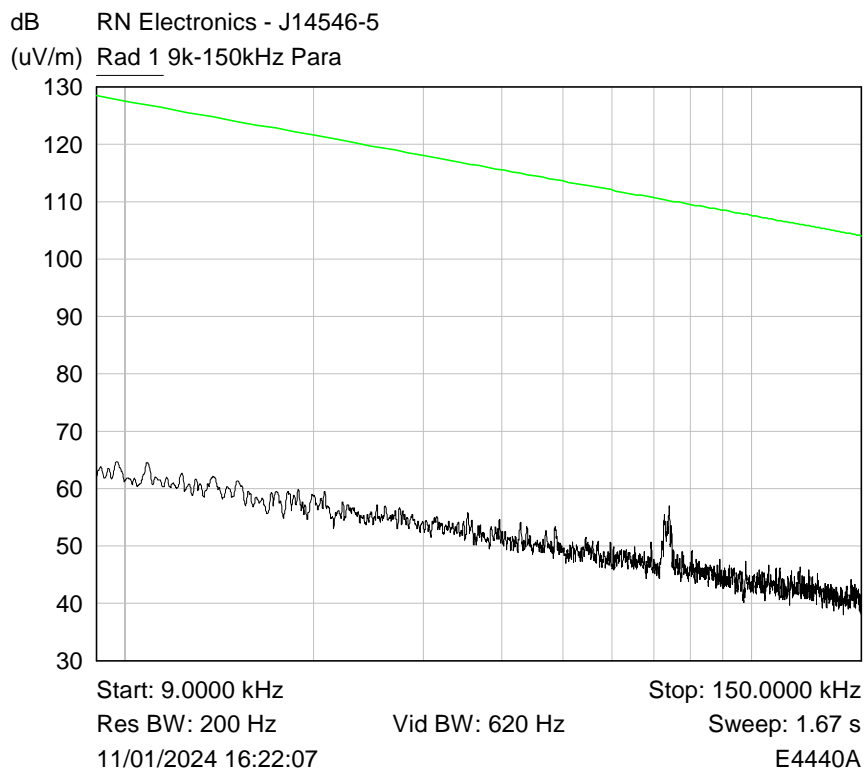
These results show that the EUT has PASSED this test.

The uncertainty gives a 95% confidence interval in the measurement. Expanded uncertainty (K=2) is as follows:  
<± 0.0002 ppm (PSA Ext Ref)

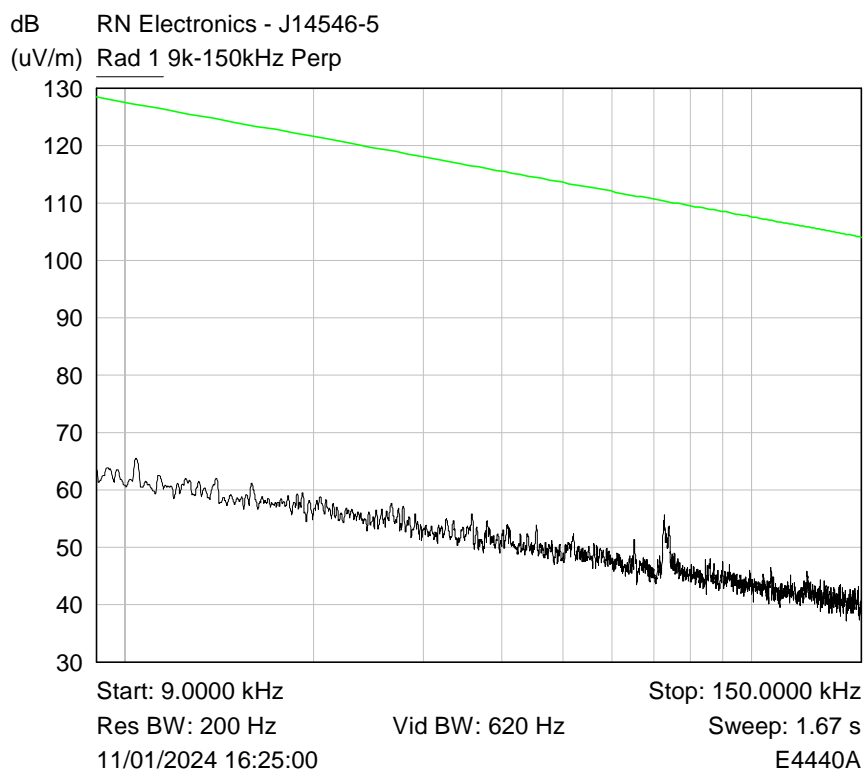
## 6 Plots/Graphical results

### 6.1 Radiated emissions 9 - 150 kHz

RF Parameters: Band 13.553-13.567 MHz, Power Max Default, Channel Spacing Single  
Channel, Modulation ASK, Channel 13.56 MHz



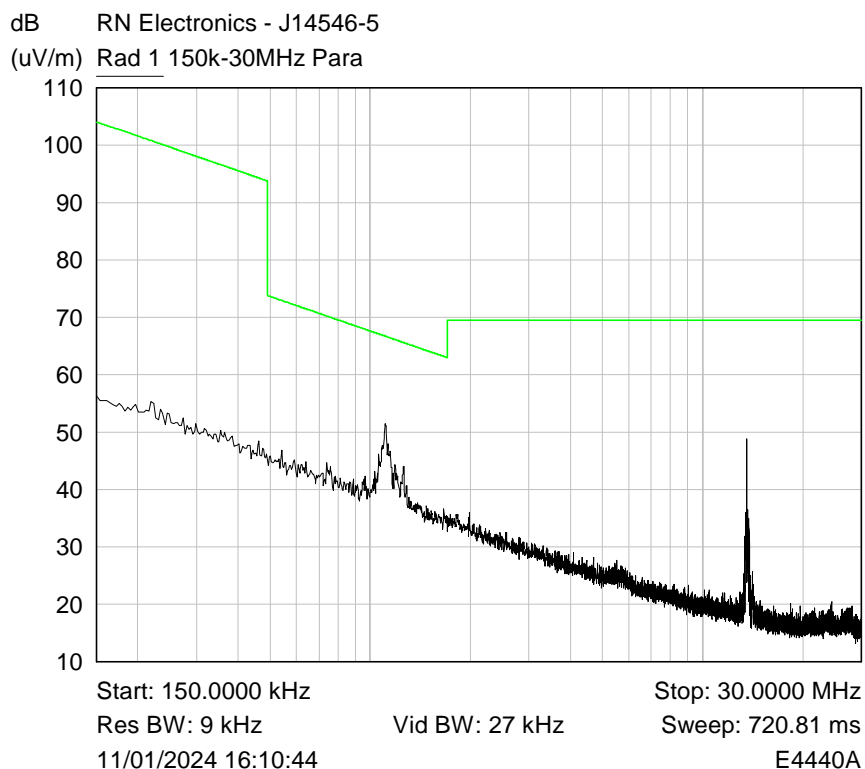
Plot of 9k-150kHz Parallel



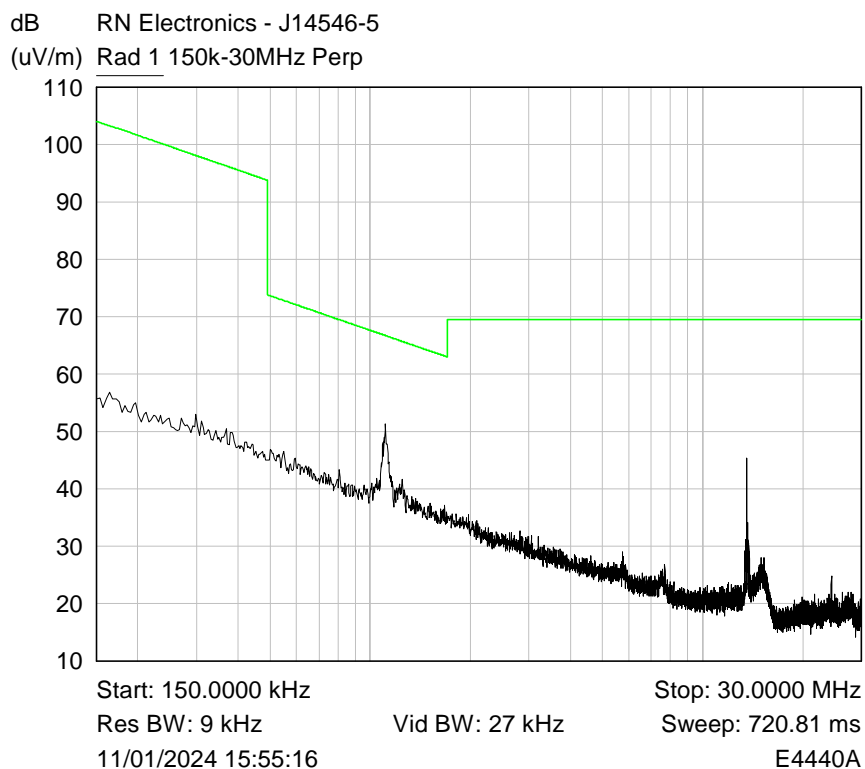
Plot of 9k-150kHz Perpendicular

## 6.2 Radiated emissions 150 kHz - 30 MHz

RF Parameters: Band 13.553-13.567 MHz, Power Max Default, Channel Spacing Single Channel, Modulation ASK, Channel 13.56 MHz



Plot of 150kHz-30MHz Parallel

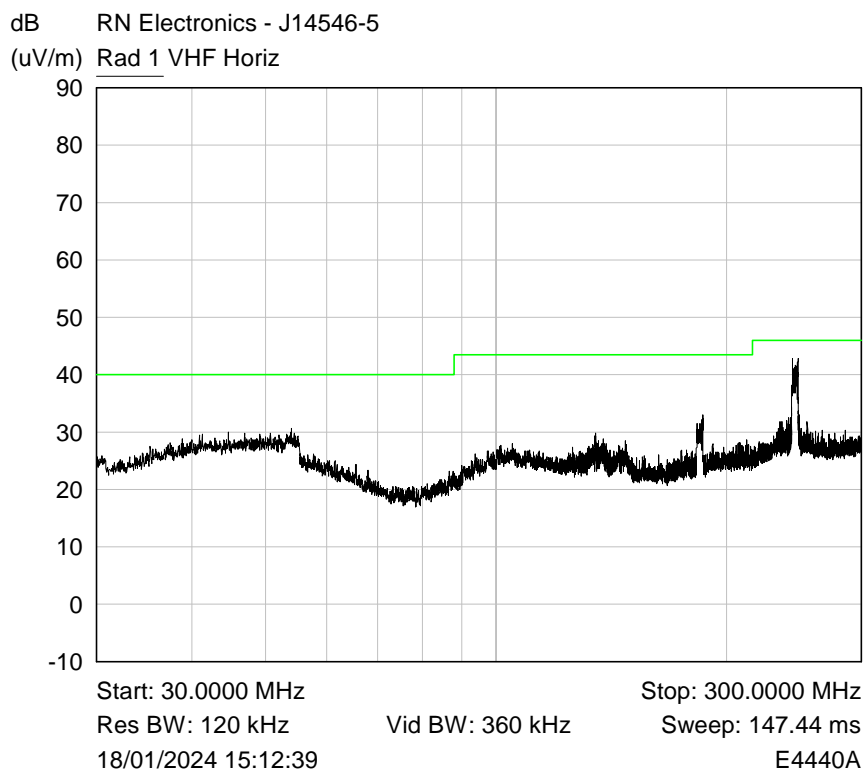


Plot of 150kHz-30MHz Perpendicular

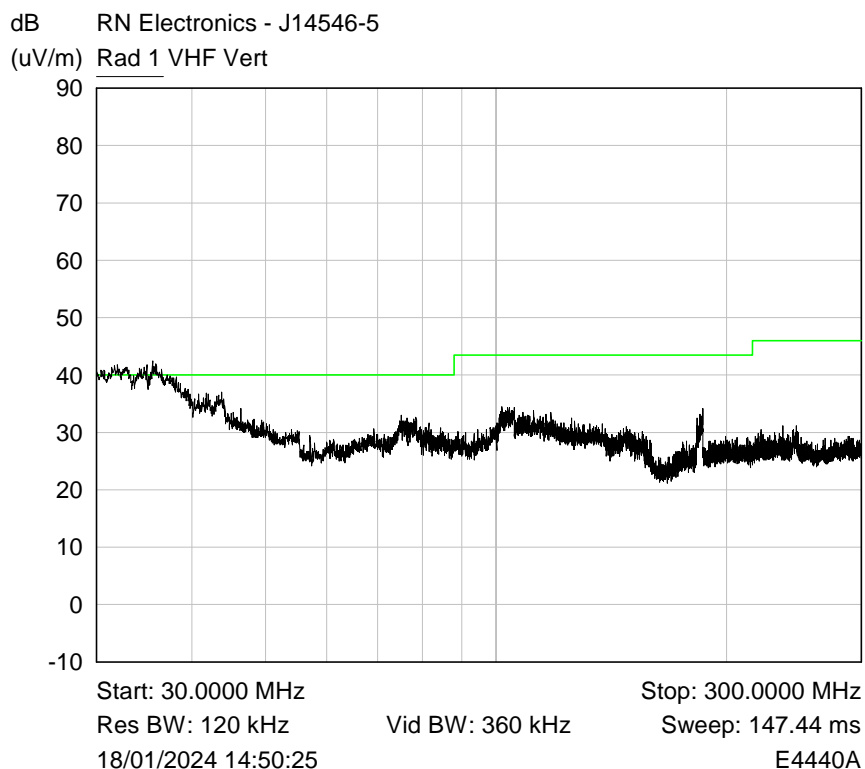
### 6.3 Radiated emissions 30 MHz -1 GHz

Note: Peak detector "Max held" Analyser plots are shown against the Quasi-Peak / Average limit line(s), refer to specific test section for results tables using the relevant detector.

RF Parameters: Band 13.553-13.567 MHz, Power Max Default, Channel Spacing Single Channel, Modulation ASK, Channel 13.56 MHz

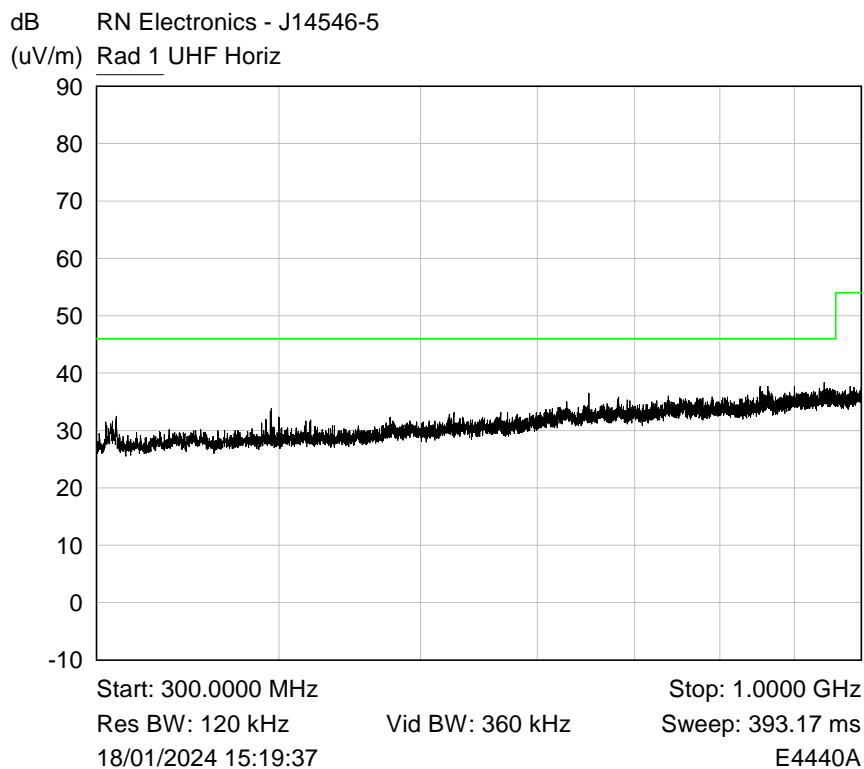


Plot of Peak emissions for VHF Horizontal against the QP limit line.

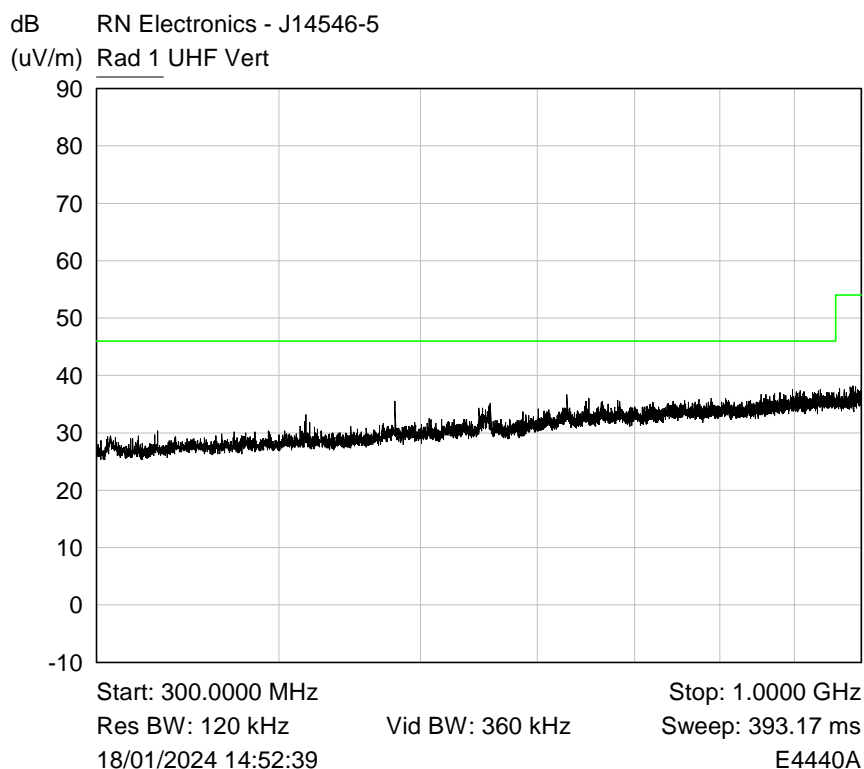


Plot of Peak emissions for VHF Vertical against the QP limit line.





Plot of Peak emissions for UHF Horizontal against the QP limit line.

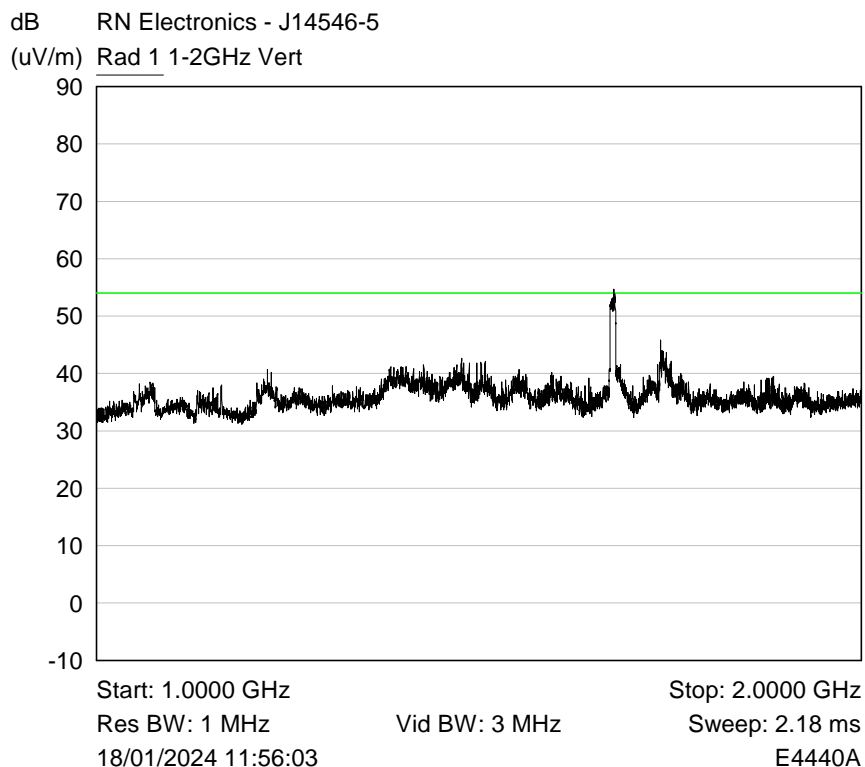
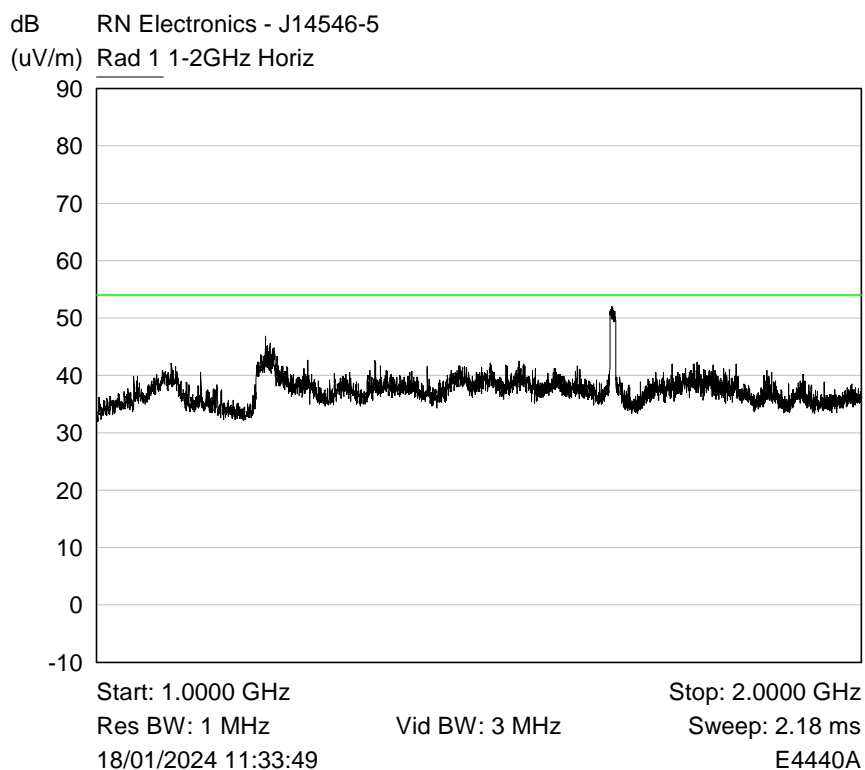


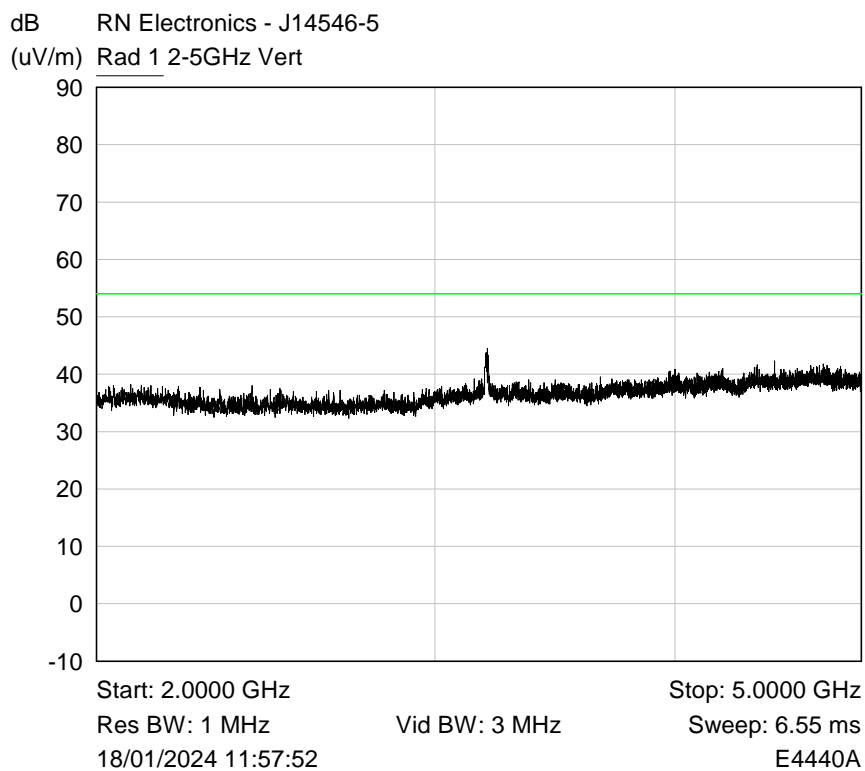
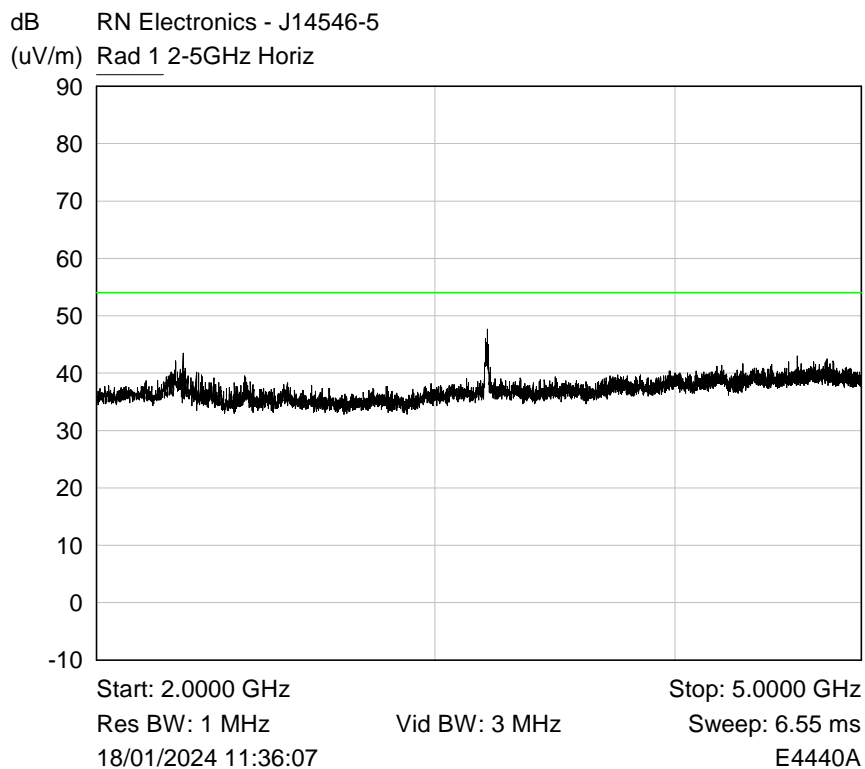
Plot of Peak emissions for UHF Vertical against the QP limit line.

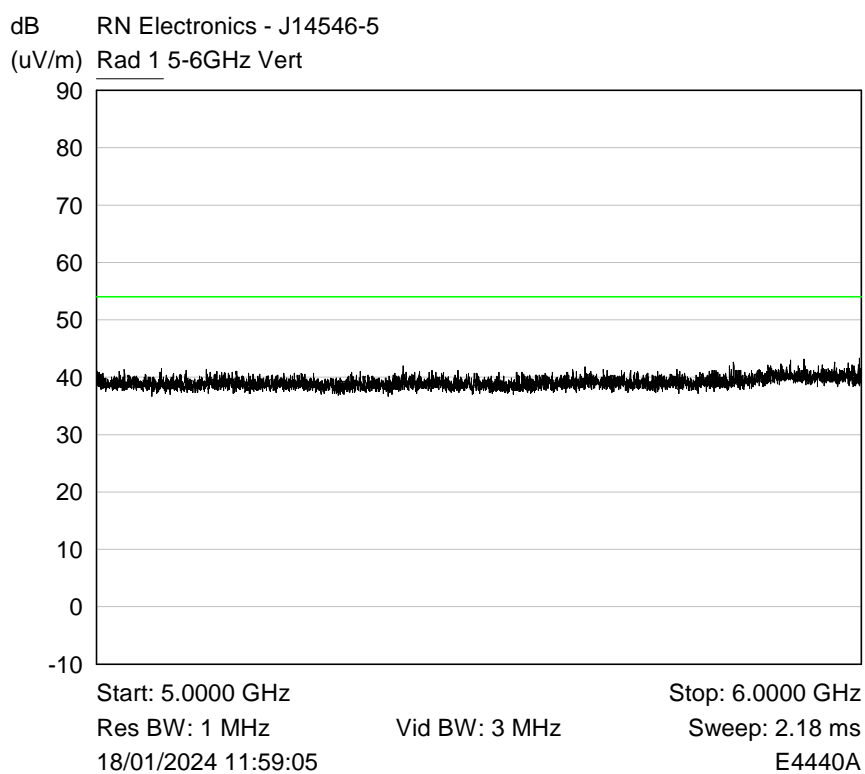
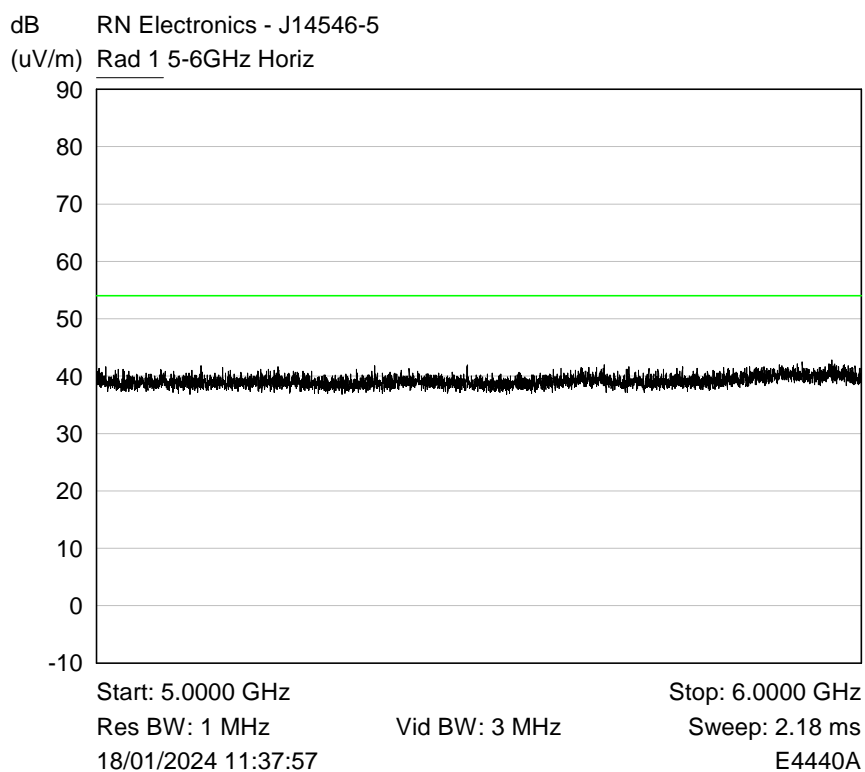
## 6.4 Radiated emissions above 1 GHz

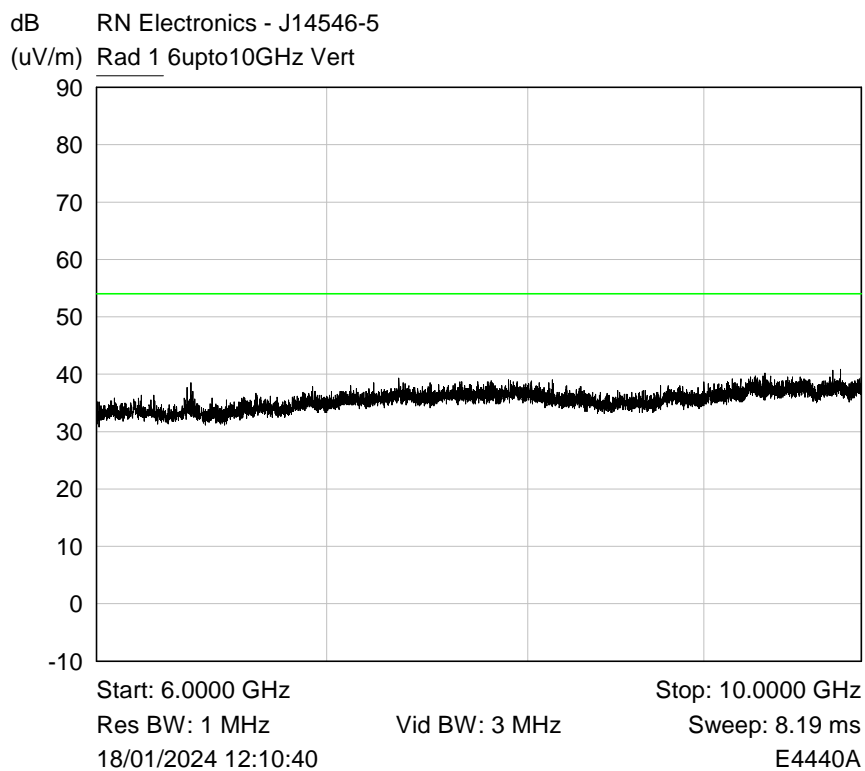
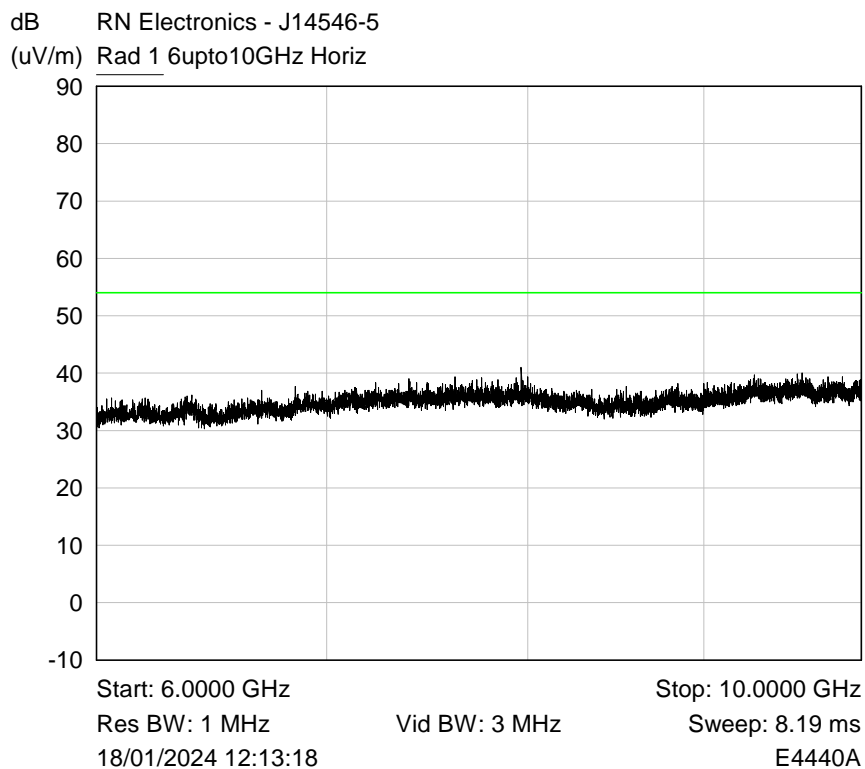
Note: Peak detector “Max held” Analyser plots are shown against the Average limit line, refer to specific test section for results tables using the relevant detector.

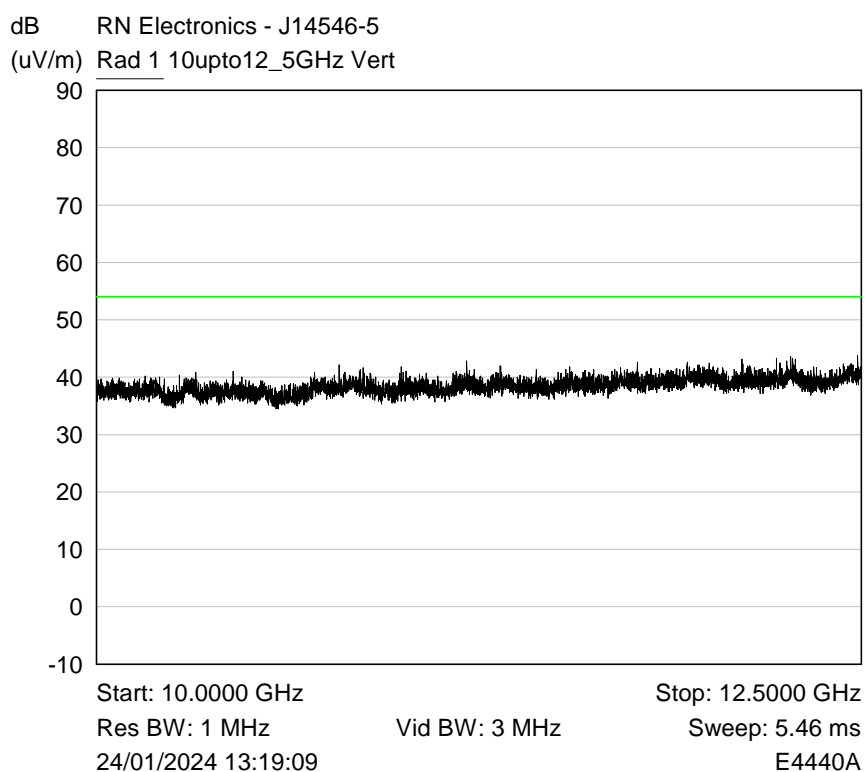
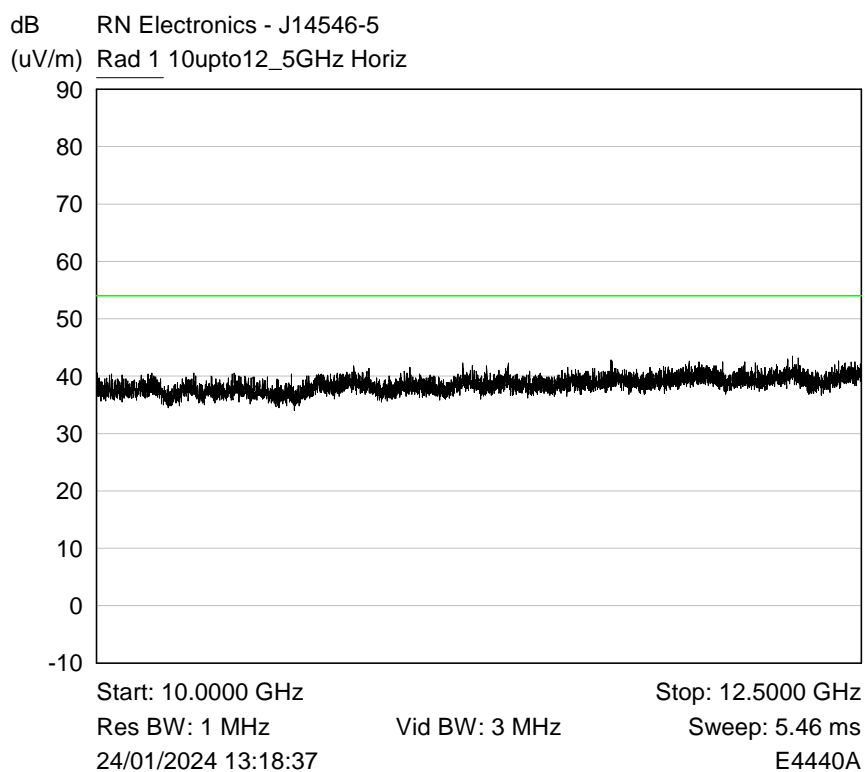
RF Parameters: Band 13.553-13.567 MHz, Power Max Default, Channel Spacing Single Channel, Modulation ASK, Channel 13.56 MHz

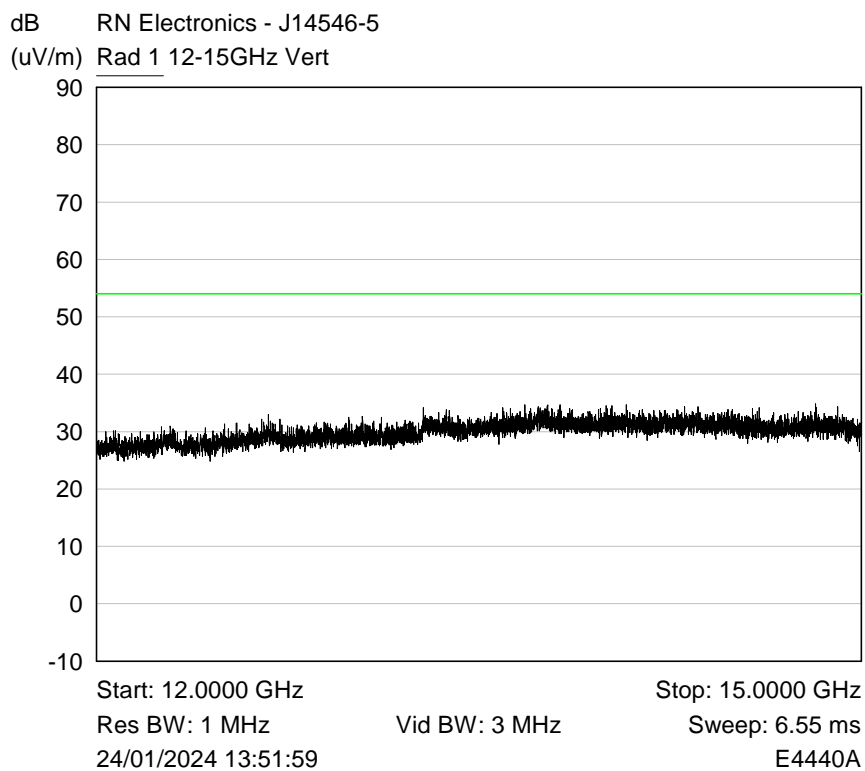
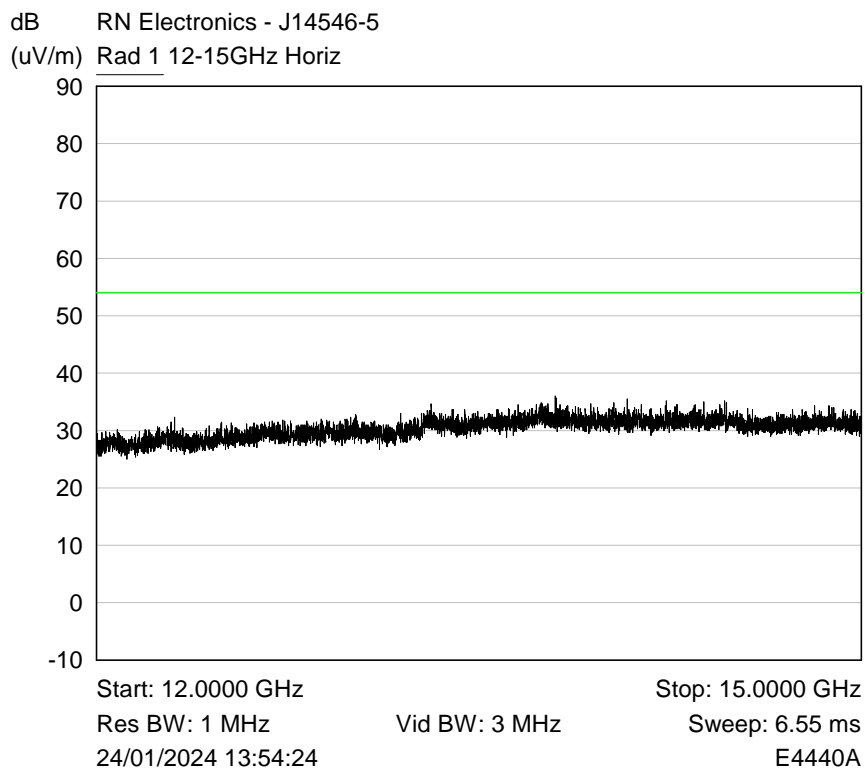


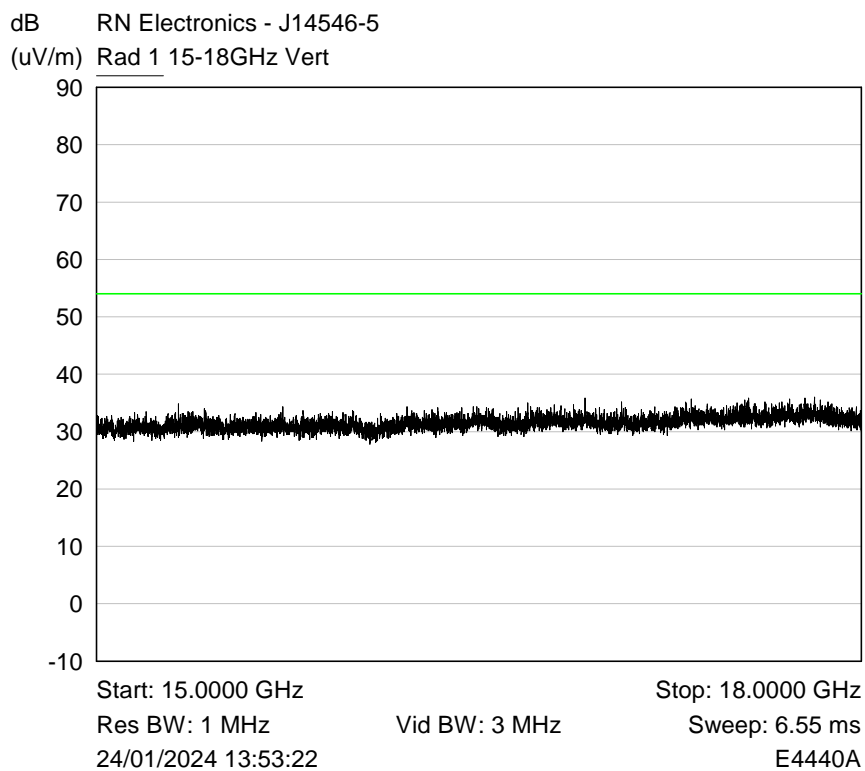
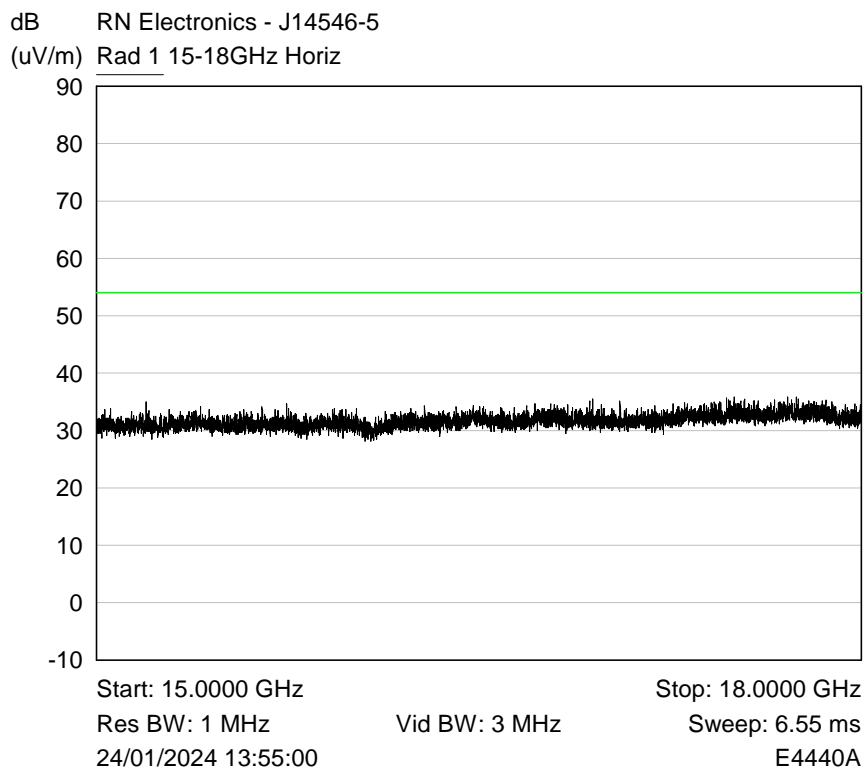




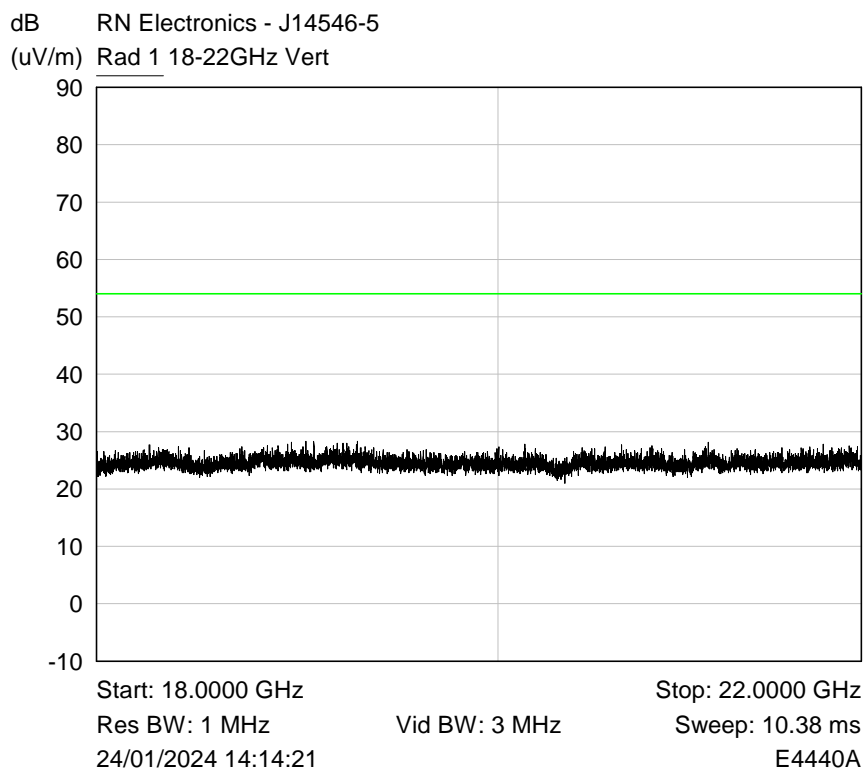
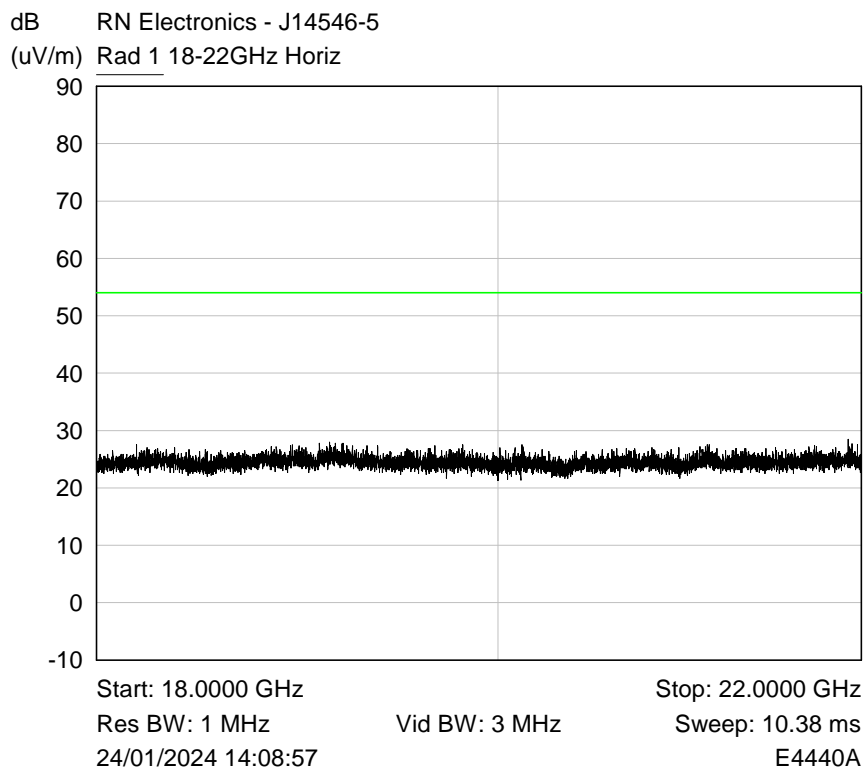






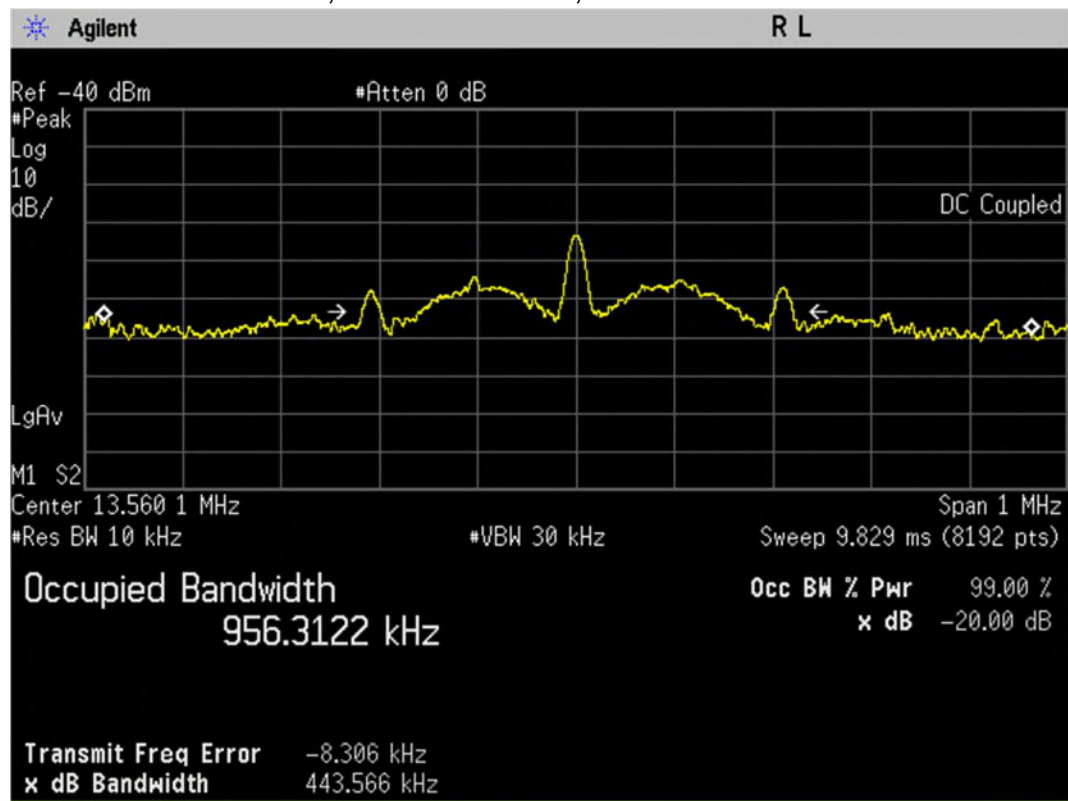






6.5 Occupied bandwidth

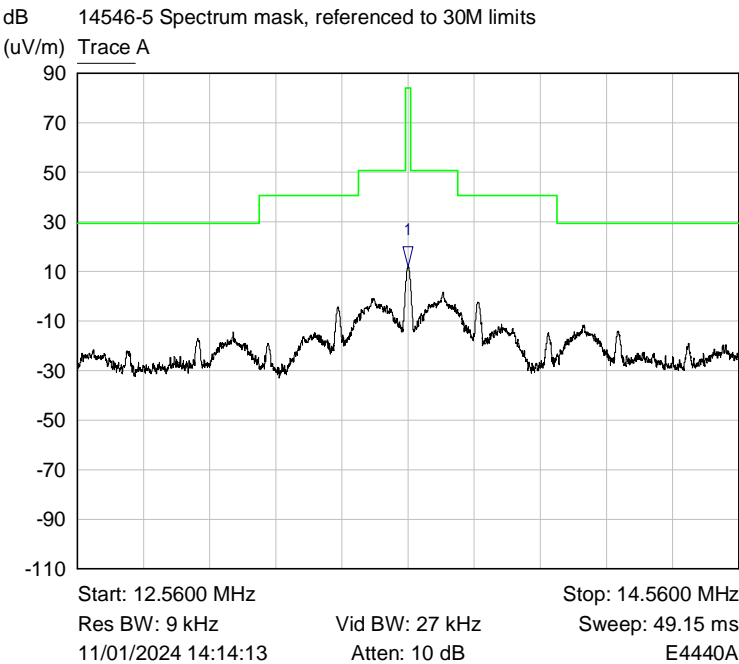
RF Parameters: Band 13.553-13.567 MHz, Power Max Default, Channel Spacing Single Channel, Modulation ASK, Channel 13.56 MHz



Plot for 99 % Bandwidth (MHz) Nominal Temp & Volts

6.6 Spectrum mask

RF Parameters: Band 13.553-13.567 MHz, Power Max Default, Channel Spacing Single Channel, Modulation ASK, Channel 13.56 MHz



Mkr	Trace	X-Axis	Value	Notes
1 ▽	Trace A	13.5599 MHz	11.84 dB(uV/m)	

Nominal Temperature, Nominal Voltage

## 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 (dBμV)	Pk – Lim 1 (dB)	QP Amp (dBμV)	QP - Lim1 (dB)	Av Amp (dBμV)	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 Explanation of limit line calculations for radiated measurements

The limits given in the test standard are normally expressed as absolute values (e.g. in μV/m at a specified distance), whereas the measured values are expressed as peak, quasi peak or average values in dBμV/m 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 500 μV/m equates to  $20.\log(500) = 54 \text{ dB } \mu\text{V/m}$ .

(b) limit of 300 μV/m at 10m equates to  $20.\log(300 \cdot 10/3) = 60 \text{ dB } \mu\text{V/m at 3m}$

(c) limit of 30 μV/m at 30m, but below 30MHz, equates to  $20.\log(30) + 40.\log(30/3) = 69.5 \text{ dB}\mu\text{V/m at 3m}$ , as extrapolation factor below 30MHz is 40dB/decade per 15.31(f)(2).

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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 (CL)	Field strength result (3m) (FS)
20dBuV	25 dB	3 dB	48dBuV/m

**Additional calculation examples per ANSI C63.10 clause 9.4 – 9.6 equations 21, 22, 25 & 26:**

**Equation 21:**  $E_{\text{Linear}} = 10^{((E_{\text{Log}} - 120)/20)}$

And therefore equation 21 transposed is:  $E_{\text{Log}} = 20 \times \text{Log}(E_{\text{Linear}}) + 120$

Where:

$E_{\text{Linear}}$  is the field strength of the emission in V/m

$E_{\text{Log}}$  is the field strength of the emissions in dBμV/m

**Equation 22:**  $\text{EIRP} = E_{\text{Meas}} + 20 \log(d_{\text{Meas}}) - 104.7$

Where:

EIRP is equivalent isotropically radiated power in dBm

$E_{\text{Meas}}$  is the field strength of the emission at the measurement distance in dBμV/m

$d_{\text{Meas}}$  is the measurement distance in metres

**Equation 25:**  $\text{PD} = \text{EIRP}_{\text{Linear}} / 4\pi d^2$

And therefore equation 25 transposed is:  $\text{EIRP}_{\text{Linear}} = \text{PD} \times 4\pi d^2$

Where:

PD is the power density at distance specified by the limit, in W/m<sup>2</sup>

$\text{EIRP}_{\text{Linear}}$  is the equivalent isotropically radiated power in Watts

d is the distance at which the power density limit is specified in metres

**Equation 26:**  $\text{PD} = E_{\text{Spec limit}}^2 / 377$

And therefore equation 26 transposed is:  $E_{\text{Spec limit}} = \sqrt{(\text{PD} \times 377)}$

Where:

PD is the power density at distance specified by the limit, in W/m<sup>2</sup>

$E_{\text{Spec limit}}$  is the field strength at the distance specified by the limit in V/m

**Example:**

Radiated spurious emissions limit at 3metres of 90pW/cm<sup>2</sup>.

$$90\text{pW/cm}^2 \times 100^2 = 0.9 \mu\text{W/m}^2 = (\text{EIRP Linear})$$

$$\text{Equation 25 transposed: } 0.9 \times 10^{-6} \times 4 \times \pi \times 3^2 = 0.0001017876 \text{ W}$$

And

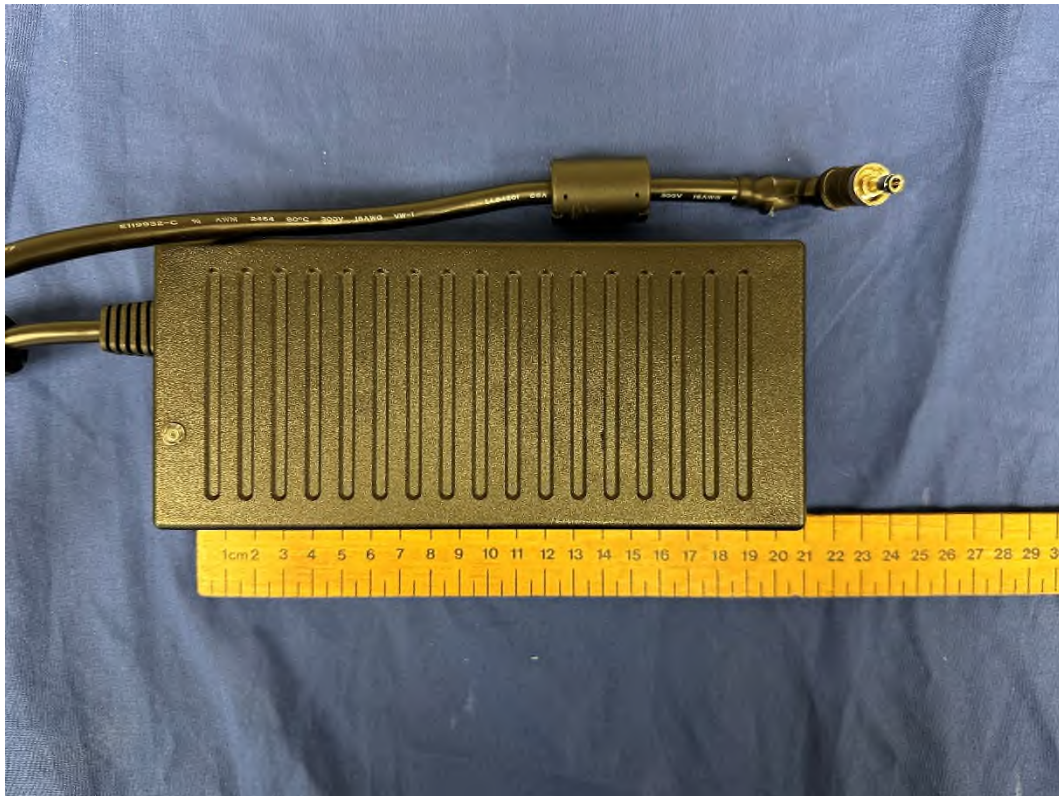
$$\text{Equation 26 transposed: } E_{\text{Spec limit}} = \sqrt{(0.9 \times 10^{-6} \times 377)} = 0.01842 \text{ V/m.}$$

And

$$\text{Equation 21 transposed: } E_{\text{Log}} = 20 \text{Log}(0.01842) + 120 = 85.3 \text{dB}\mu\text{V/m @ 3m.}$$

## 8 Photographs

### 8.1 EUT Front View



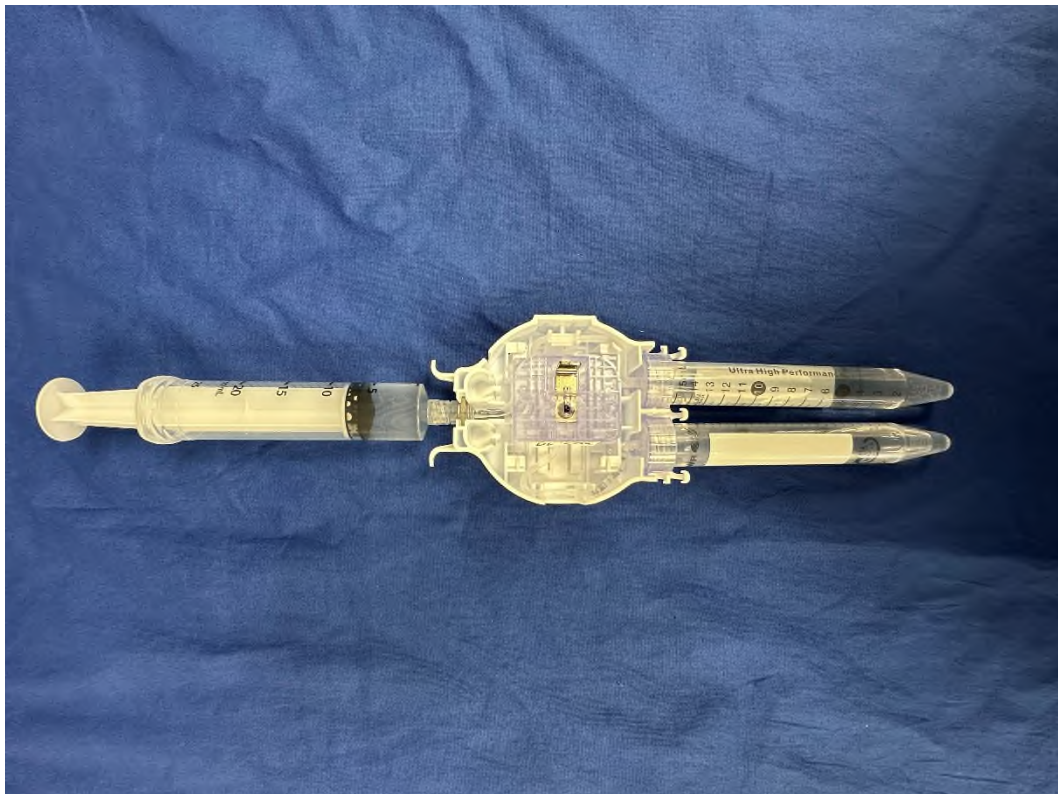








## 8.2 EUT Reverse Angle







### 8.3 EUT Left side View



### 8.4 EUT Right side View





## 8.5 EUT Display & Controls



## 8.6 EUT ID Label



## 8.7 EUT Chassis

See ID photos

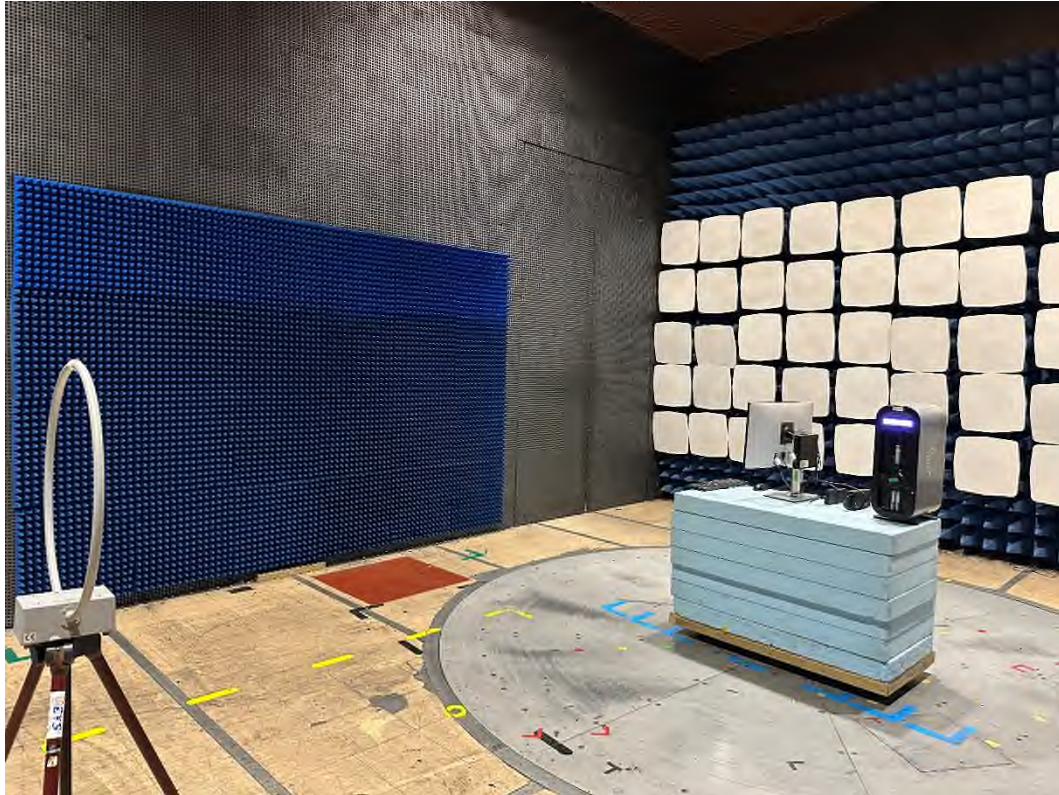


## 8.8 AC power line conducted emissions





## 8.9 Radiated emissions 9 - 150 kHz

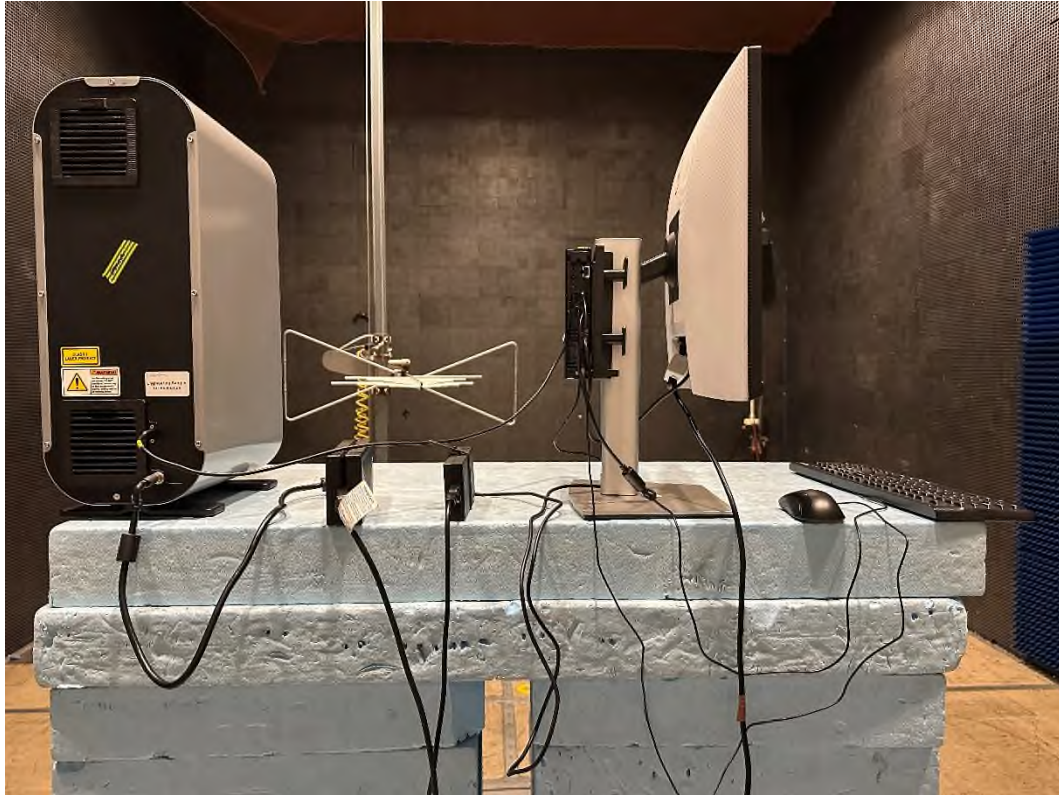


## 8.10 Radiated emissions 150 kHz - 30 MHz





## 8.11 Radiated emissions 30 MHz - 1 GHz



Upright Position





Side Position



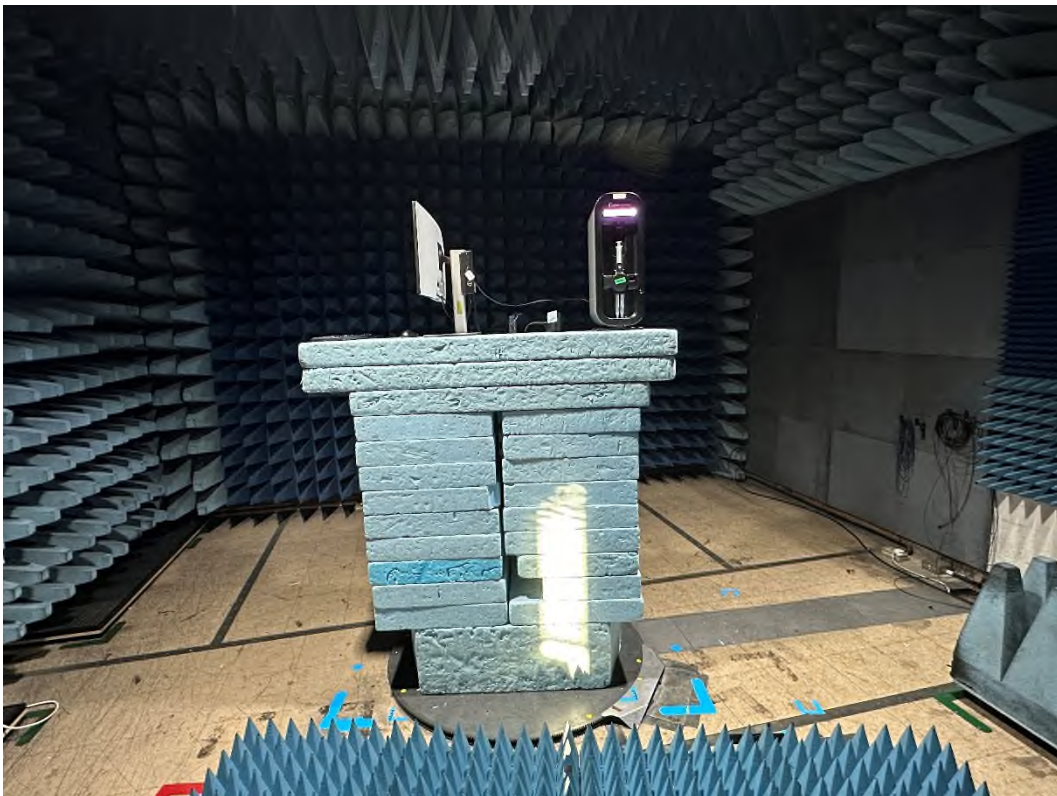
Flat Position



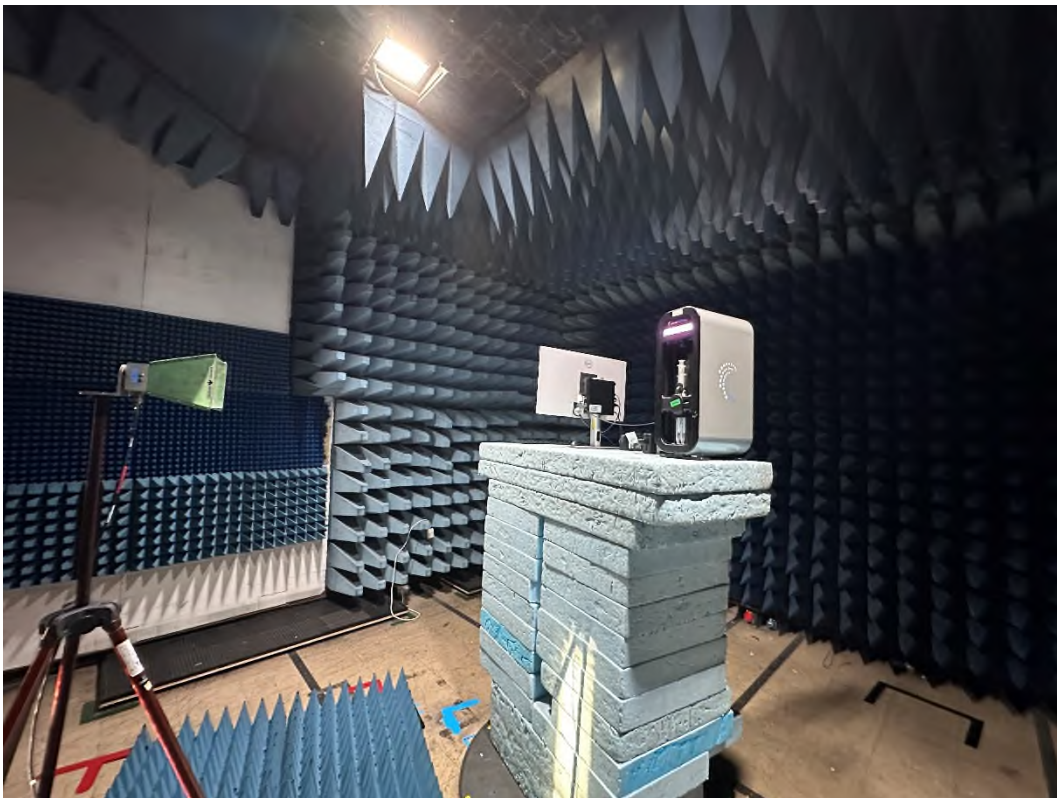




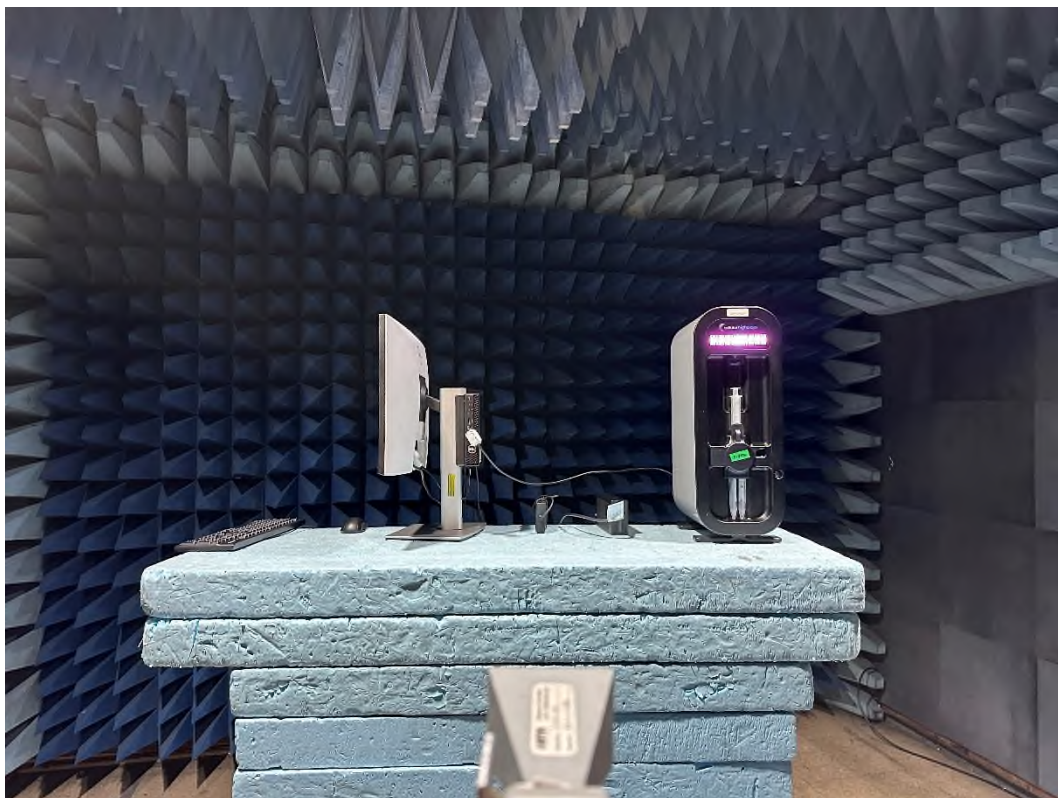
## 8.12 Radiated emissions above 1 GHz



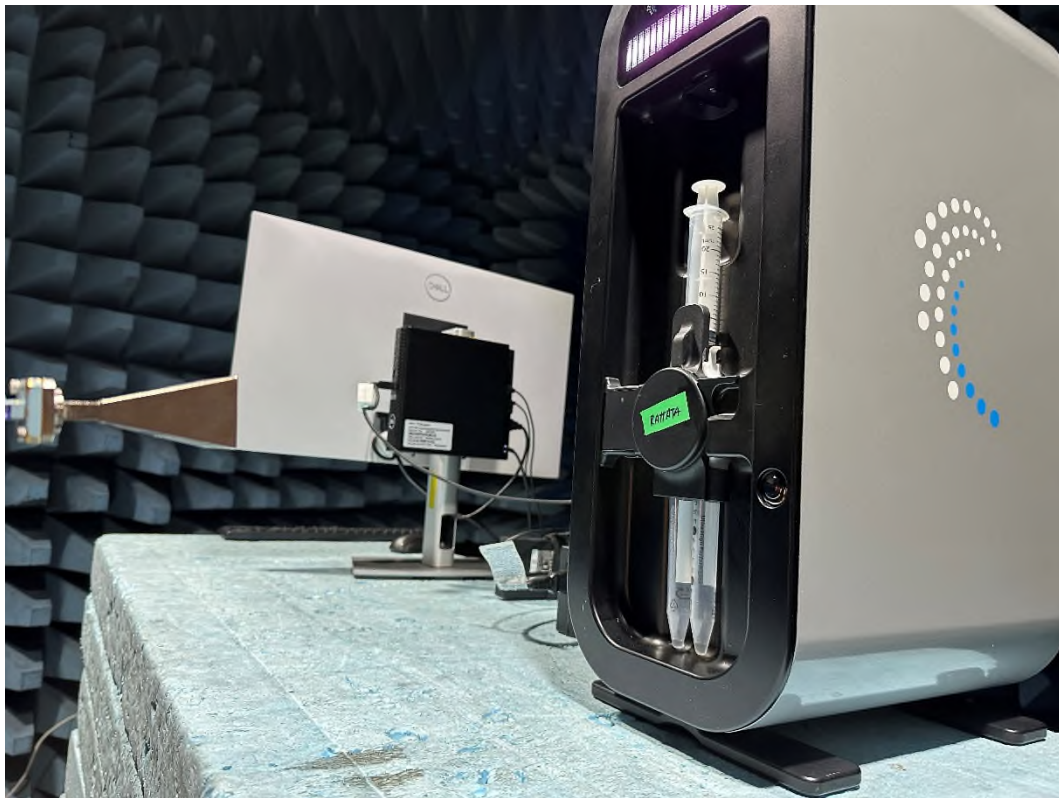














### 8.13 Radiated emission diagrams

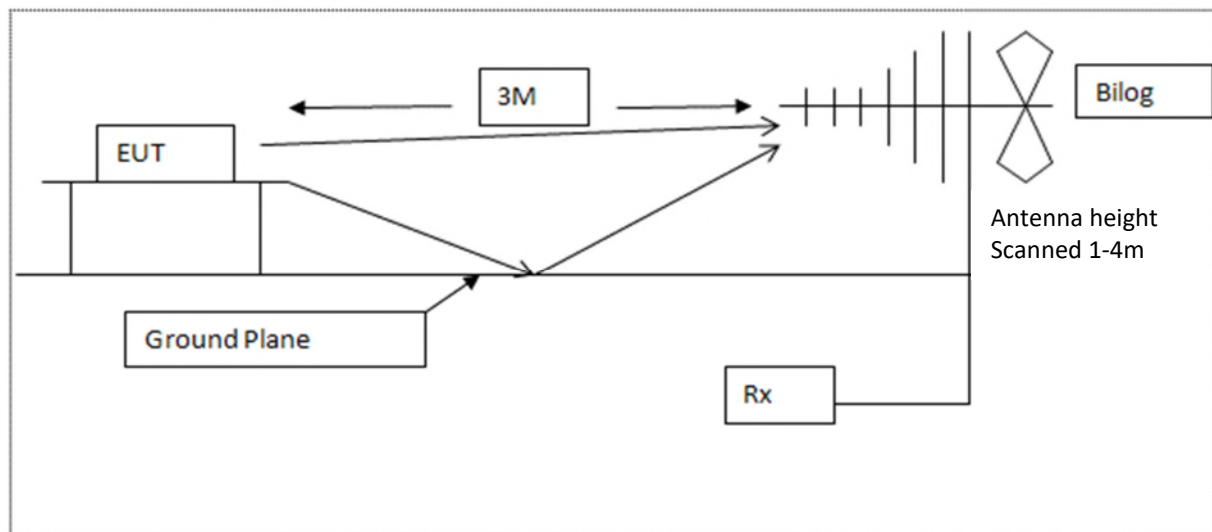


Diagram of the radiated emissions test setup 30 - 1000 MHz

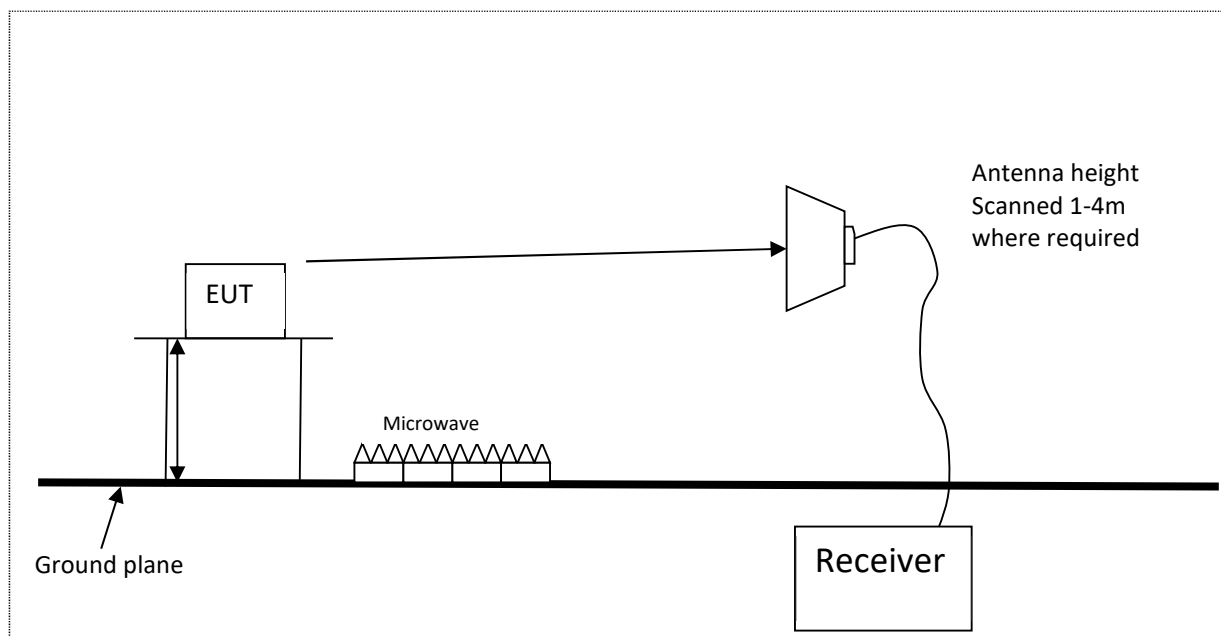


Diagram of the radiated emissions test setup above 1GHz

### 8.14 AC powerline conducted emission diagram

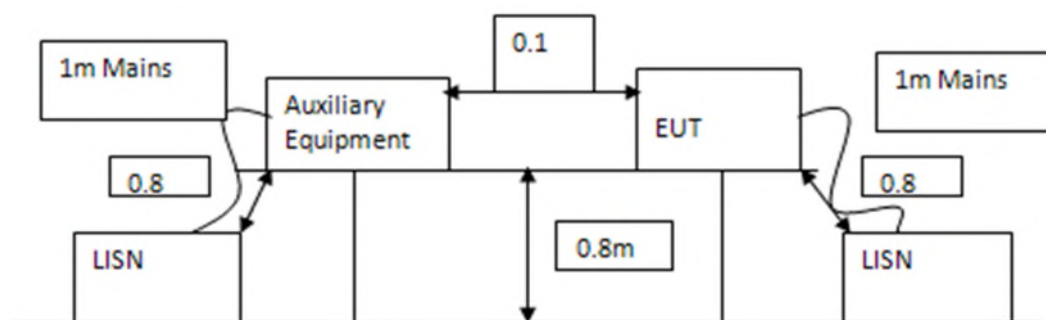


Diagram of the AC conducted emissions test setup



## 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.

RN No.	Model No.	Description	Manufacturer	Calibration date	Cal period
E035	11947A	Transient Limiter 9kHz - 200MHz	Hewlett Packard	03-Jan-2024	12 months
E136	3105	Horn Antenna 1 - 12.5 GHz	EMCO	02-Apr-2023	12 months
E150	MN2050	LISN 13A	Chase	03-May-2023	12 months
E411	N9039A	9 kHz - 1 GHz RF Filter Section	Agilent Technologies	05-Jul-2023	12 months
E555	CMV 5E-1	Variac 5A	Carroll & Meynell Ltd	08-Jan-2024	12 months
E624	E4440A	PSA 3 Hz - 26.5 GHz	Agilent Technologies	06-Jul-2023	24 months
E642	E4440A	PSA 3 Hz - 26.5 GHz	Agilent Technologies	24-Nov-2023	24 months
E744	2017 4/2dB	Attenuator 4/2dB 30-1000MHz	RN Electronics	24-Feb-2023	12 months
E755	N9030B	PXA Signal Analyser 3 Hz to 50 GHz	Keysight Technologies	14-Aug-2023	12 months
E914	VULB 9163	Antenna BiLog 30MHz to 3GHz	Schwarzbeck	23-Apr-2022	24 months
F238	N9039A	9 kHz - 1 GHz RF Filter Section	Agilent Technologies	23-Aug-2023	12 months
L264	DT75	Digital Thermometer	Instrotech Ltd	20-Dec-2021	24 months
LPE315	34401A	Digital Multimeter 6.5 digit	Agilent Technologies	05-Dec-2023	12 months
NSA-H	NSA - H	NSA - Site H	RN Electronics	17-May-2023	36 months
TMS38	VMT04/140	Environmental Oven	Heraeus Votsch	13-Mar-2023	12 months
TMS78	3160-08	Horn Std Gain 12.4 - 18 GHz	ETS Systems	05-Oct-2023	12 months
TMS79	3160-09	Horn Std Gain 18 - 26.5 GHz	ETS Systems	23-May-2023	12 months
TMS81	6502	Antenna Active Loop	EMCO	17-Aug-2023	24 months
TMS82	8449B	Pre-Amplifier 1GHz - 26.5GHz	Agilent Technologies	08-Jan-2024	12 months
VSWR-M	VSWR	VSWR 1-18GHz	RN Electronics	24-Nov-2021	36 months
ZSW1	V2.5.2	Measurement Software Suite	RN Electronics	Not Applicable	

## 10 Auxiliary and peripheral equipment

### 10.1 Customer supplied equipment

Item No.	Model No.	Description	Manufacturer	Serial No.
1	D15U	PC	Dell	WJ1J7 A00
2	S2722DZ	Flat Panel Monitor	Dell	CN-06T3CV-WSL00-237-CU4L-A01
3	0XN967	Mouse	Dell	J020OKIM
4	820-004515	Keyboard	Logitech	1311MG008H78
5	HA130PM190	PC AC/DC PSU	Dell	CN-0YJ6MW-CH200-28T-00MW-A01
6	100000-1015	Tag and Syringe	Cellular Highways	105

### 10.2 Kiwa electrical Compliance supplied equipment

No Kiwa Electrical Compliance supplied 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 OATS 3m 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

## 13 Abbreviations and units

%	Percent	dBμV	decibels relative to 1μV
λ	Wavelength	dBμV/m	decibels relative to 1μV/m
μA/m	microAmps per metre	dBc	decibels relative to Carrier
μV	microVolts	dBd	decibels relative to dipole gain
μW	microWatts	dBi	decibels relative to isotropic gain
AC	Alternating Current	dBm	decibels relative to 1mW
ACK	ACKnowledgement	dBm	decibels relative to a maximum value
ACP	Adjacent Channel Power	dBW	decibels relative to 1W
AFA	Adaptive Frequency Agility	DC	Direct Current
ALSE	Absorber Lined Screened Enclosure	DFS	Dynamic Frequency Selection
AM	Amplitude Modulation	DMO	Dynamic Modulation Order
Amb	Ambient	DSSS	Direct Sequence Spread Spectrum
ANSI	American National Standards Institute	DTA	Digital Transmission Analyser
ATPC	Automatic Transmit Power Control	EIRP	Equivalent Isotropic Radiated Power
AVG	Average	emf	electromotive force
AWGN	Additive White Gaussian Noise	ERC	European Radiocommunications Committee
BER	Bit Error Rate	ERP	Effective Radiated Power
BPSK	Binary Phase Shift Keying	ETSI	European Telecommunications Standards Institute
BT	Bluetooth	EU	European Union
BLE	Bluetooth Low Energy	EUT	Equipment Under Test
BW	Bandwidth	FCC	Federal Communications Commission
°C	Degrees Celsius	FER	Frame Error Rate
C/I	Carrier / Interferer	FHSS	Frequency Hopping Spread Spectrum
CAC	Channel Availability Check	FM	Frequency Modulation
CCA	Clear Channel Assessment	FSK	Frequency Shift Keying
CEPT	European Conference of Postal and Telecommunications Administrations	FSS	Fixed Satellite Service
CFR	Code of Federal Regulations	g	Grams
CISPR	Comité International Spécial des Perturbations Radioélectriques	GHz	GigaHertz
cm	centimetre	GNSS	Global Navigation Satellite System
COFDM	Coherent OFDM	GPS	Global Positioning System
COT	Channel Occupancy Time	Hz	Hertz
CS	Channel Spacing	IEEE	Institute of Electrical and Electronics Engineers
CW	Continuous Wave	IF	Intermediate Frequency
DAA	Detect And Avoid	ISED	Innovation Science and Economic Development
dB	decibels	ITU	International Telecommunications Union
dBμA/m	decibels relative to 1μA/m	KDB	Knowledge DataBase

kg	kilogram	pW	picoWatts
kHz	kiloHertz	QAM	Quadrature Amplitude Modulation
kPa	Kilopascal	QP	Quasi Peak
LBT	Listen Before Talk	QPSK	Quadrature Phase Shift Keying
LISN	Line Impedance Stabilisation Network	RBW	Resolution Band Width
LNA	Low Noise Amplifier	RED	Radio Equipment Directive
LNB	Low Noise Block	R&TTE	Radio and Telecommunication Terminal Equipment
LO	Local Oscillator	Ref	Reference
m	metre	RF	Radio Frequency
mA	milliAmps	RFC	Remote Frequency Control
max	maximum	RFID	Radio Frequency Identification
Mbit/s	MegaBits per second	RLAN	Radio Local Area Network
MCS	Modulation and Coding Scheme	RMS	Root Mean Square
MHz	MegaHertz	RNSS	Radio Navigation Satellite Service
mic	Microphone	RSL	Received Signal Level
MIMO	Multiple Input, Multiple Output	RSSI	Received Signal Strength Indicator
min	minimum	RTP	Room Temperature and Pressure
mm	millimetres	RTPC	Remote Transmit Power Control
ms	milliseconds	Rx	Receiver
mW	milliWatts	s	Seconds
NA	Not Applicable	SINAD	Signal to Noise and Distortion
NFC	Near Field Communications	SRD	Short Range Device
nom	Nominal	Tx	Transmitter
nW	nanoWatt	UKAS	United Kingdom Accreditation Service
OATS	Open Area Test Site	UKCA	United Kingdom Conformity Assessed
OBW	Occupied Band Width	UKRER	United Kingdom Radio Equipment Regulations
OCW	Occupied Channel Width	UHF	Ultra-High Frequency
OFDM	Orthogonal Frequency Division Multiplexing	U-NII	Unlicensed National Information Infrastructure
OOB	Out Of Band	USB	Universal Serial Bus
ppm	Parts per million	UWB	Ultra-Wide Band
PER	Packet Error Rate	V	Volts
PK	Peak	V/m	Volts per metre
PMR	Private Mobile Radio	VBW	Video Band Width
PRBS	Pseudo Random Bit Sequence	VHF	Very High Frequency
PRF	Pulse Repetition Frequency	VSAT	Very Small Aperture Terminal
PSD	Power Spectral Density	W	Watts
PSU	Power Supply Unit		

===== END OF TEST REPORT =====