EMC Test Report	
For:	**MysteryVibe Limited**
Product:	**Legato**
Model:	**6914**
FCC ID:	**2AHVA-6914**
	
Project Engineer:	**Matt Ingall**
	
Approval Signatory:	**Dan Tiroke**

Document Reference:	**H4971 FR**

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Eurofins Electrical & Electronic UK Ltd
Hursley Laboratory, Trafalgar House,
Trafalgar Close, Chandlers Ford,
Eastleigh, Hampshire, SO53 4BW,
United Kingdom

1871

Phone: +44 (0) 23 8027 1111
e-mail: adminhursley@eurofins.com
www.eurofins.co.uk/hursley

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1.0 OVERVIEW

1.1 Introduction

The equipment under test (EUT) as described within this document was submitted for testing as agreed with the customer.

1.2 Objective

The purpose of the test was to measure and report the EUT against limits and methods of the requested standards as listed in section 2.0 Test Summary.

1.3 Product Modifications

None to sample submitted.

1.4 Conclusion

The EUT met the emission requirements of the tests defined in section 2.0 Test Summary.

This report relates to the sample tested and may not represent the entire population. It is valid only for the product identified, either in part or in full, to the standards and/or tests covered in this document.

1.5 EMC Test Lab Reference

Eurofins Electrical & Electronic UK Ltd File Ref: H4971

1.6 Test Deviations

None.

2.0 TEST SUMMARY

2.1 Summary

The EUT, as described and reported within this document, complies with the applied requested sections of the standards listed below.

The EUT met the **emissions** test requirements of the following standards:			
Description	**General Standard**	**Referenced Standard**	**Status**
Radiated Emissions (30 MHz to 12.5 GHz)	FCC/CFR 47: Part 15B 15.109, Class B	ANSI C63.4:2014	Pass
Conducted Emissions	FCC/CFR 47: Part 15B 15.107, Class B		Pass
Radiated Emissions (30 MHz to 25 GHz)	FCC 15.249	ANSI C63.10:2013	Pass
Conducted Emissions	FCC 15.207		Pass
Occupied Bandwidth	FCC 15.215	ANSI C63.10: 2013 clause 6.9.3	Pass

Note(s):

- The highest internal operating frequency declared by the manufacturer is 2483.5 MHz.

3.0 EQUIPMENT AND TEST DETAILS

3.1 General

Product (EUT):	Legato		
Model:	6914	**Serial Number:**	001*
Sample Build:	Production Sample		
EUT Power:	Battery Powered / 110 V 60 Hz (while charging via PSU)		
Customer Test Plan:	Not Applicable		
Alternate Models:	Not Applicable		
EUT Manufacturer:	MysteryVibe Limited		
Customer Name:	MysteryVibe Limited		
Customer Address:	Dairy South Shoelands Farm Seale Lane Puttenham Surrey GU10 1HL United Kingdom		
Test Commissioned By:	Charlie Blackham, Sulis Consultants Limited		
Date EUT Received:	14th September 2023		
Test Date(s):	15th September 2023		
EMC Measurement Site:	Eurofins Electrical & Electronic UK Ltd | Hursley Laboratory Trafalgar Close, Chandlers Ford, Hampshire, United Kingdom		
Product Category:	Personal Vibrator Toy		

*Serial number designated by Eurofins Electrical & Electronic UK Ltd.

3.2 EUT Description

The EUT is a personal massage toy.

3.3 Support Equipment

Description	Manufacturer	Model	Serial Number
PSU	Apple	A1399	Not Applicable

3.4 EUT Test Exerciser

The transmitter has been operated on three static test channels. Channel 0: 2402 MHz, Channel 39: 2440 MHz and Channel 78: 2480 MHz.

The device operates inside the 2400 – 2483.5 MHz band:

- 40 channels with centre frequencies on 2 MHz spacing from 2402 to 2480 MHz inclusive
- The device includes a rechargeable Li-Ion battery and is charged from external mains to 5 V dc power supply

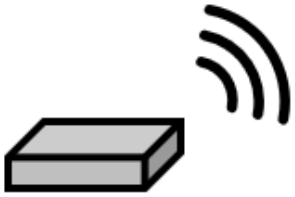
The following test frequencies were used to cover the full band of operation of the device:

Test channel	Description
Bottom	Continuous transmit on 2402 MHz
Middle	Continuous transmit on 2440 MHz
Top	Continuous transmit on 2480 MHz

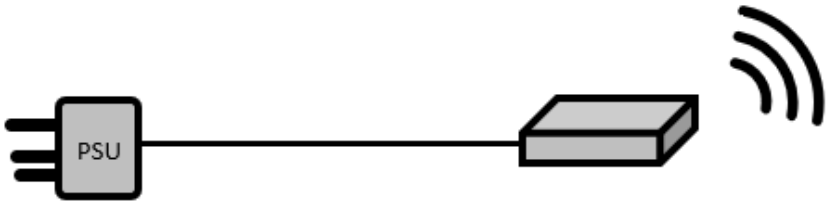
For EMC emissions testing, the EUT was either vibrating or charging via its USB connector.

3.5 EUT Test Configuration #1

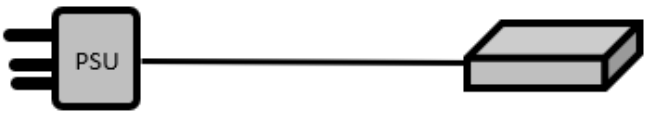
Config 1 - 15.249



Config 2 - 15.249 With Charging Cable



Config 3 - 15b With Charging Cable



3.6 EUT Ports

Port	Type	Length	Shielded
Enclosure	Not Applicable	Not Applicable	Not Applicable
Mains	230 V 50 Hz or 110 V 60 Hz	< 3 m	No

4.0 TEST RESULTS

4.1 Radiated Emissions; Charging Mode, FCC 15.249 (110 V 60 Hz)

4.1.1 Test Parameters

A profile scan was taken using an EMI receiver at a distance of three metres on eight azimuths of the EUT in both the vertical and horizontal polarisation of the field in a semi-anechoic chamber.

Using the pre-scan results as a guide, each emission from the EUT was maximised. Measurements were carried out at a distance of three metres using the specified detector in a CISPR 16-1-4 compliant semi-anechoic chamber. Antenna and turntable positions were then finally adjusted to produce the maximum emission levels. The worst-case results are reported below.

Test Equipment						
#ID	CP	Manufacturer	Type	Serial Number	Description	Calibration Due Date
053	1	HP	8449B	3008A01394	Pre-amplifier (1 to 26.5 GHz)	24/10/2023
068	1	EM	CWS500C	1001-07	Conducted immunity simulator	20/09/2024
073	3	Schwarzbeck	BBHA9120B	237	Horn Antenna (1 to 10 GHz)	20/05/2024
252	1	Rohde & Schwarz	ESH3-Z2	08970	10 dB pulse limiter	26/05/2024
340	1	Sucoflex with #053 Pre-amplifier	104	0	26.5 GHz	24/10/2023
652	1	TFA	Weather Station	Jupiter	Weather Station	02/11/2023
750	1	Global	CISPR16	1	11 x 7 x 6.2m, chamber	22/12/2023
762	3	Schwarzbeck	VULB9162	129	30 to 7000 MHz	04/03/2024
779	3	Steatite	QWH-SL-18-40-K-SG	17504	Horn Antenna (18 to 40 GHz)	05/08/2024
823	0	York EMC	1.5 to 7GHz	CNE 6507	High frequency Comparison Noise Emitter	Not required
877	1	Huber & Suhner	SUCOTEST_18A	602608/18A	ST_18A/Nm/Nm/3m	21/11/2023
893	1	Rohde & Schwarz	ESW 44	103044	EMI test receiver	11/11/2023
952	3	Schwarzbeck	HWRD750	66	Horn Antenna (7 to 18 GHz)	21/06/2026
Test Equipment Software						
#ID	CP	Manufacturer	Type		Description	Calibration Due Date
856	0	Rohde & Schwarz	Software	0	EMC32 v11.30.0	Not required

Environmental Test Conditions		
Frequency	**Below 1 GHz**	**Above 1 GHz**
Temperature	24.1° Celsius	24 and 25.3° Celsius
Relative Humidity	51 %	51 and 48 %
Atmospheric Pressure	1016.6 millibars	1024.3 and 1015 millibars
Test Date:	15th September 2023	14th and 15th September 2023
Test Engineer:	Matt Ingall	Graeme Lawler and Matt Ingall

Note: “Calibration due date” means the instrument is certified within UKAS or traceable calibration certificate. “Internal” means the instrument is calibrated using Eurofins E&E UK procedures. “Not required” means the asset does not require calibration. “CP” is the interval period [year] prescribed for external calibration.

4.1.2 Test Configuration

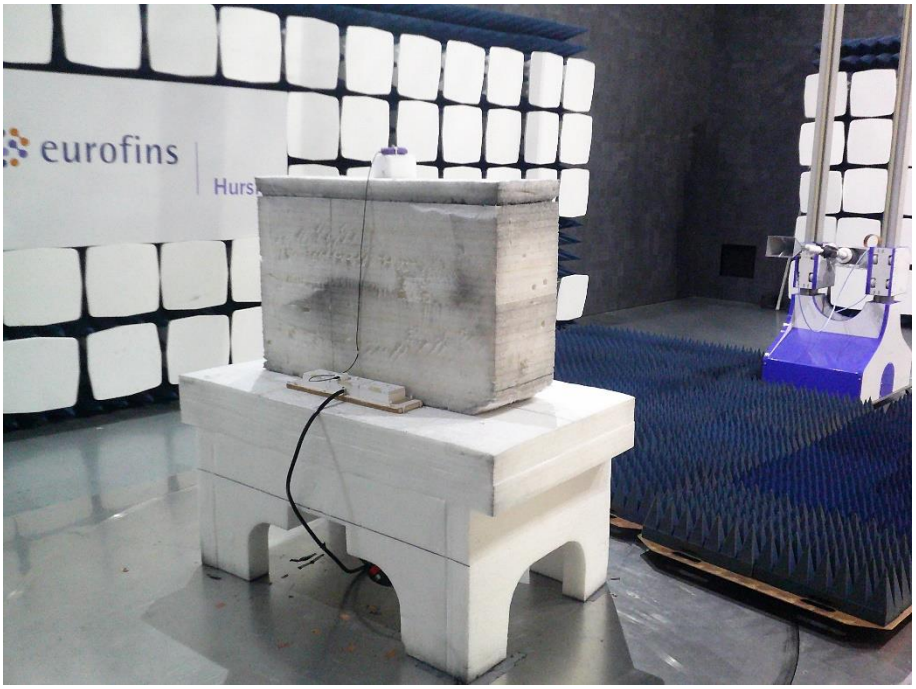
Please refer to EUT Test Configuration #2.

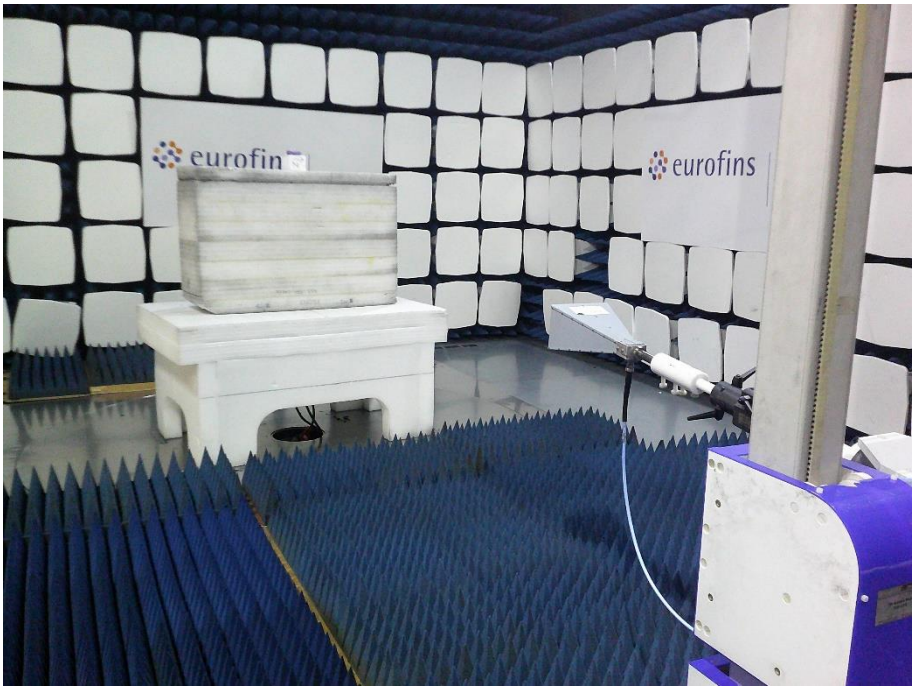
4.1.3 Set-up Photos; Charging Mode,

Radiated Emissions; Below 1 GHz

4.1.4 Set-up Photos; Charging Mode, (Continued)

Radiated Emissions; Above 1 GHz

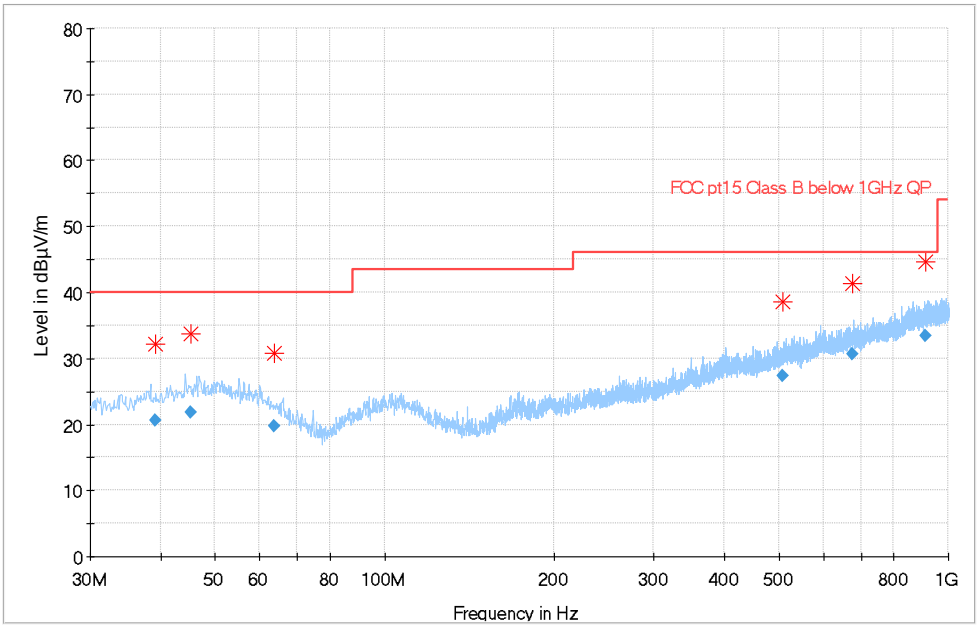




4.1.5 Profile; 30 MHz to 1 GHz, Charging Mode, FCC 15.249 (110 V 60 Hz)

Maximum peak hold trace with quasi-peak values (◆)
Peak measurements (✳)

30 MHz to 1 GHz



4.1.6 Data; 30 MHz to 1 GHz, Charging Mode, FCC 15.249 (110 V 60 Hz)

Emission Frequency	Measured Quasi-Peak Value	Class B Specified Quasi-Peak Limit	Pass Margin	Antenna Polarisation	Antenna Height	Turntable Azimuth	
MHz	dBµV/m	dBµV/m	dB	H/V	cm	deg	Status
39.103481	20.59	40.00	19.41	V	312.0	229.0	Pass
45.188308	21.87	40.00	18.13	V	202.0	202.0	Pass
63.636592	19.76	40.00	20.24	V	233.0	322.0	Pass
507.320722	27.37	46.00	18.63	H	322.0	287.0	Pass
676.074029	30.64	46.00	15.36	H	358.0	237.0	Pass
912.006126	33.48	46.00	12.52	V	300.0	57.0	Pass

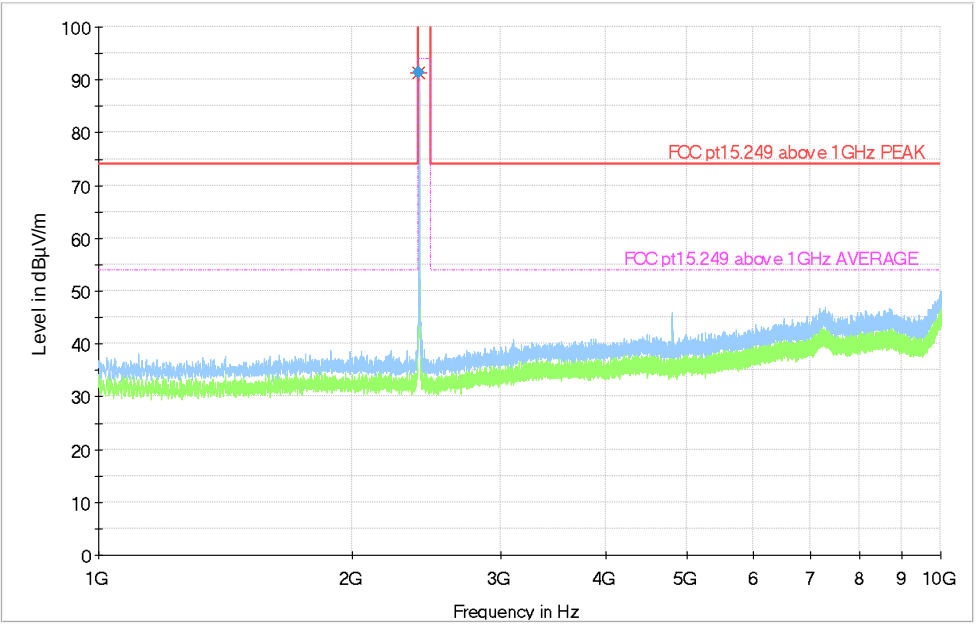
V = Vertical / H = Horizontal

The measurements reported are the highest emissions relative to the FCC/CISPR Class B limits and take into account the correction factor*. Measurements made according to the CISPR test standard and Eurofins E&E UK test procedure RAD-02.
*Correction factor (dB) = cable and antenna losses as summed positive values (dB) – pre-amp gain where applicable (dB).
The recorded measured value (dB) = measured receiver value (dB) + correction factor (dB).
Note: Path losses are factored into the limit value, and given by the test standard. Chamber calibration data contributes to the measurement uncertainty figure.

4.1.7 Profile; 1 to 10 GHz, Charging Mode, FCC 15.249 (110 V 60 Hz)

Maximum hold trace with peak values (◆)
Peak measurements (✳)
Average measurements (◆)

1 to 10 GHz



4.1.8 Data; 1 to 10 GHz, Charging Mode, FCC 15.249 (110 V 60 Hz)

Frequency	Peak	CISPR Average	15.249 Limit	Margin	Height	Pol	Azimuth	Corr.	
MHz	dBµV/m	dBµV/m	dBµV/m	dB	cm	H/V	Deg	dB/m	Status
2402.000000	91.31	---	94.00	2.69	167.0	H	198.0	-7.3	Pass

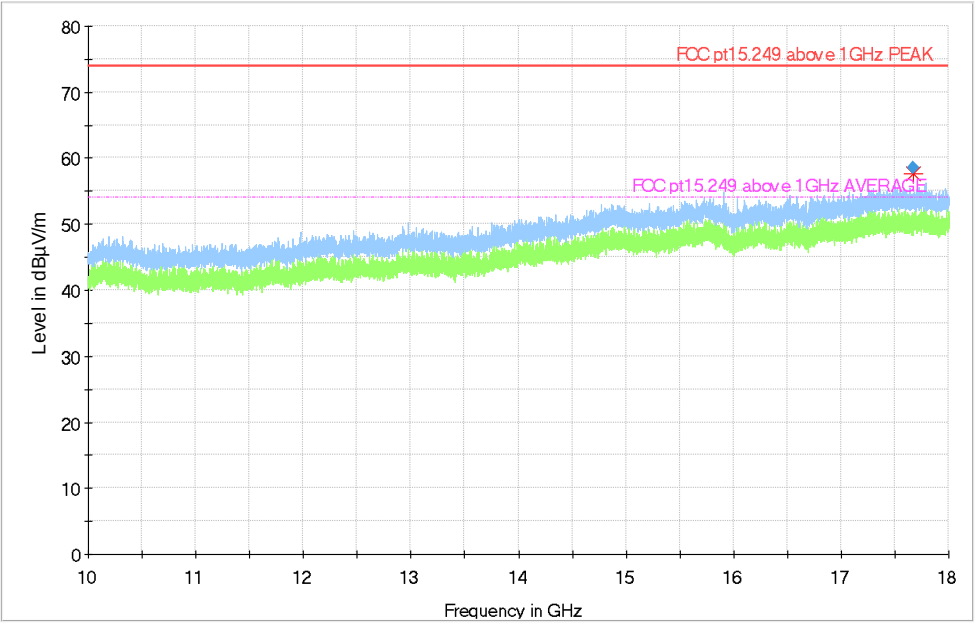
V = Vertical / H = Horizontal

The measurements reported are the highest emissions relative to the FCC/CISPR 15.249 limits and take into account the correction factor*. Measurements made according to the CISPR test standard and Eurofins E&E UK test procedure RAD-02.
*Correction factor (dB) = cable and antenna losses as summed positive values (dB) – pre-amp gain where applicable (dB).
The recorded measured value (dB) = measured receiver value (dB) + correction factor (dB).
Note: path losses are factored into the limit value, and given by the test standard. Chamber calibration data contributes to the measurement uncertainty figure.

4.1.9 Profile; 10 to 18 GHz, Charging Mode, FCC 15.249 (110 V 60 Hz)

Maximum hold trace with peak values (▽)
Maximum hold trace with average values (▼)

10 to 18 GHz



4.1.10 Data; 10 to 18 GHz Charging Mode, FCC 15.249 (110 V 60 Hz)

Frequency	Peak	CISPR Average	Class B Limit	Margin	Height	Pol	Azimuth	Corr.	
MHz	dBµV/m	dBµV/m	dBµV/m	dB	cm	H/V	Deg	dB/m	Status
17669.03105	58.46	---	74.00	15.54	210.0	V	263.0	14.4	Pass
17669.03100	---	45.50	54.00	8.50	210.0	V	263.0	14.4	Pass

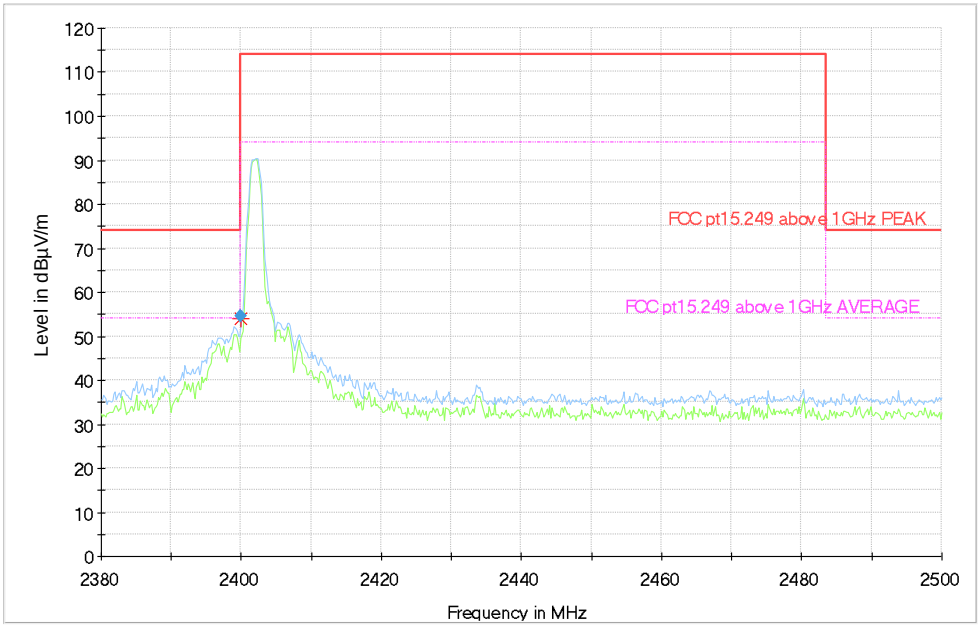
V = Vertical / H = Horizontal

The measurements reported are the highest emissions relative to the FCC/CISPR Class B limits and take into account the correction factor*. Measurements made according to the CISPR test standard and Eurofins E&E UK test procedure RAD-02.
*Correction factor (dB) = cable and antenna losses as summed positive values (dB) – pre-amp gain where applicable (dB).
The recorded measured value (dB) = measured receiver value (dB) + correction factor (dB).
Note: path losses are factored into the limit value, and given by the test standard. Chamber calibration data contributes to the measurement uncertainty figure.

4.1.11 Profile; Bottom Channel Charging Mode, FCC 15.249 (110V 60Hz), Band Edge, X Orientation

Maximum hold trace with peak values (▽)
Maximum hold trace with average values (▼)

Bottom Channel



4.1.12 Data; Bottom Channel Charging Mode, FCC 15.249 (110V 60Hz), Band Edge, X Orientation

Frequency	Peak	Average	Class B Limit	Margin	Height	Pol	Azimuth	Corr.	
MHz	dBµV/m	dBµV/m	dBµV/m	dB	cm	H/V	Deg	dB/m	Status
2400.000000	54.53	---	74.00	19.47	234.0	H	193.0	-7.3	Pass
2400.000000	---	15.97*	54.00	38.03	234.0	H	193.0	-7.3	Pass

V = Vertical / H = Horizontal

The measurements reported are the highest emissions relative to the FCC/CISPR Class B limits and take into account the correction factor*. Measurements made according to the CISPR test standard and Eurofins E&E UK test procedure RAD-02.
*Correction factor (dB) = cable and antenna losses as summed positive values (dB) – pre-amp gain where applicable (dB).
The recorded measured value (dB) = measured receiver value (dB) + correction factor (dB).
Note: path losses are factored into the limit value, and given by the test standard. Chamber calibration data contributes to the measurement uncertainty figure.

*The average value of the emission at 2400.000 MHz has been determined by calculation in accordance with ANSI c63.10 clause 7.5.
The EUT was found to transmit on 40 channels, repeating on each channel every 370mS. In accordance with ANSI c63.10 clause 7.5, the transmitter on time can be considered in a 100mS time interval only.
So, the number of transmissions in 100mS = 1 + (100/9.25) = 11.81 = 12 transmissions. Each burst duration was found to be 98.625uS.
The total transmitter on-time is 98.625uS x 12 = 1183.5uS = 1.1835mS
So, Duty Cycle Correction factor is given by δ (dB) = 20log(Δ) (ANSI c63.10 clause 7.5 equation (10))
δ (dB) = 20log(Δ)
δ (dB) = 20log(1.18/100) = -38.56 dB

4.2 Radiated Emissions; FCC 15.249, X Orientation

4.2.1 Test Parameters

A profile scan was taken using an EMI receiver at a distance of three metres on eight azimuths of the EUT in both the vertical and horizontal polarisation of the field in a semi-anechoic chamber.

Using the pre-scan results as a guide, each emission from the EUT was maximised. Measurements were carried out at a distance of three metres using the specified detector in a CISPR 16-1-4 compliant semi-anechoic chamber. Antenna and turntable positions were then finally adjusted to produce the maximum emission levels. The worst-case results are reported below.

Test Equipment						
#ID	CP	Manufacturer	Type	Serial Number	Description	Calibration Due Date
053	1	HP	8449B	3008A01394	Pre-amplifier (1 to 26.5 GHz)	24/10/2023
068	1	EM	CWS500C	1001-07	Conducted immunity simulator	20/09/2024
073	3	Schwarzbeck	BBHA9120B	237	Horn Antenna (1 to 10 GHz)	20/05/2024
252	1	Rohde & Schwarz	ESH3-Z2	08970	10 dB pulse limiter	26/05/2024
340	1	Sucoflex with #053 Pre-amplifier	104	0	26.5 GHz	24/10/2023
652	1	TFA	Weather Station	Jupiter	Weather Station	02/11/2023
750	1	Global	CISPR16	1	11 x 7 x 6.2m, chamber	22/12/2023
762	3	Schwarzbeck	VULB9162	129	30 to 7000 MHz	04/03/2024
779	3	Steatite	QWH-SL-18-40-K-SG	17504	Horn Antenna (18 to 40 GHz)	05/08/2024
823	0	York EMC	1.5 to 7GHz	CNE 6507	High frequency Comparison Noise Emitter	Not required
877	1	Huber & Suhner	SUCOTEST_18A	602608/18A	ST_18A/Nm/Nm/3m	21/11/2023
893	1	Rohde & Schwarz	ESW 44	103044	EMI test receiver	11/11/2023
952	3	Schwarzbeck	HWRD750	66	Horn Antenna (7 to 18 GHz)	21/06/2026
Test Equipment Software						
#ID	CP	Manufacturer	Type		Description	Calibration Due Date
856	0	Rohde & Schwarz	Software	0	EMC32 v11.30.0	Not required

Environmental Test Conditions		
Frequency	**Below 1 GHz**	**Above 1 GHz**
Temperature	24.1° Celsius	24 and 25.3° Celsius
Relative Humidity	51 %	51 and 48 %
Atmospheric Pressure	1016.6 millibars	1024.3 and 1015 millibars
Test Date:	15th September 2023	14th and 15th September 2023
Test Engineer:	Matt Ingall	Graeme Lawler and Matt Ingall

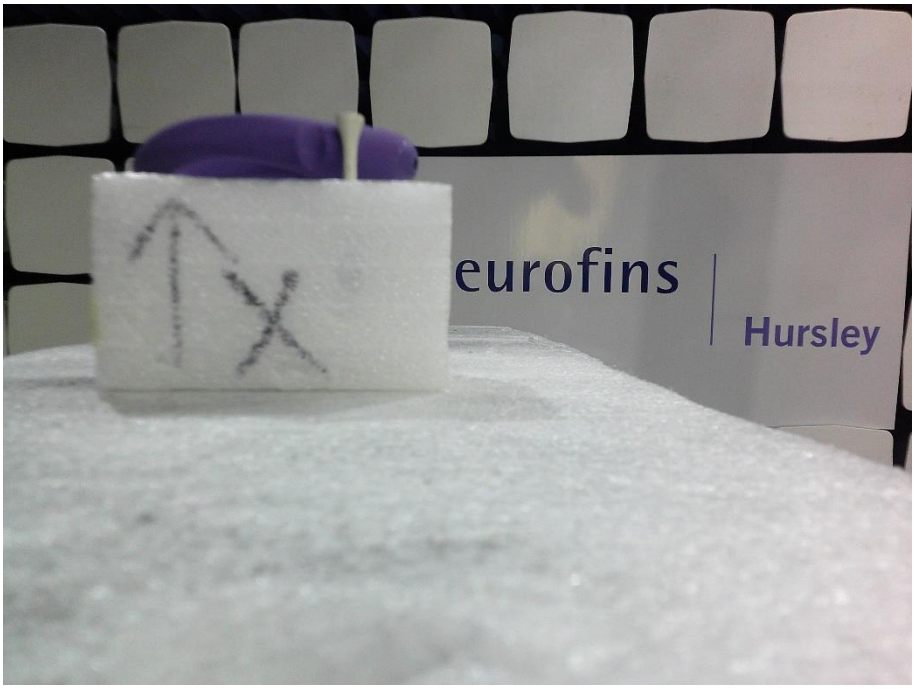
Note: “Calibration due date” means the instrument is certified within UKAS or traceable calibration certificate. “Internal” means the instrument is calibrated using Eurofins E&E UK procedures. “Not required” means the asset does not require calibration. “CP” is the interval period [year] prescribed for external calibration.

4.2.2 Test Configuration

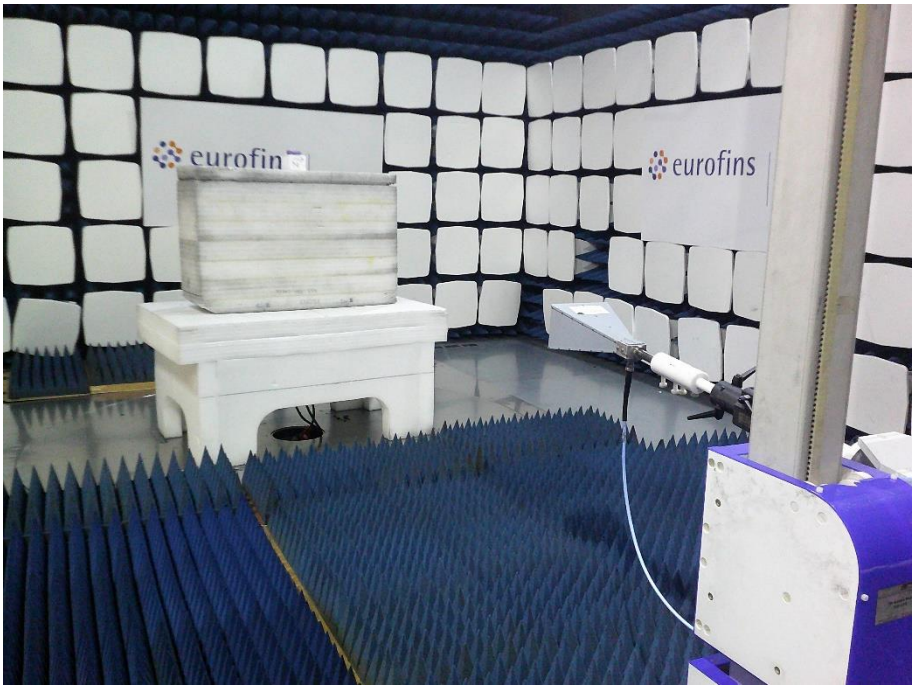
Please refer to EUT Test Configuration #1.

4.2.3 Set-up Photos

Radiated Emissions; Below 1 GHz



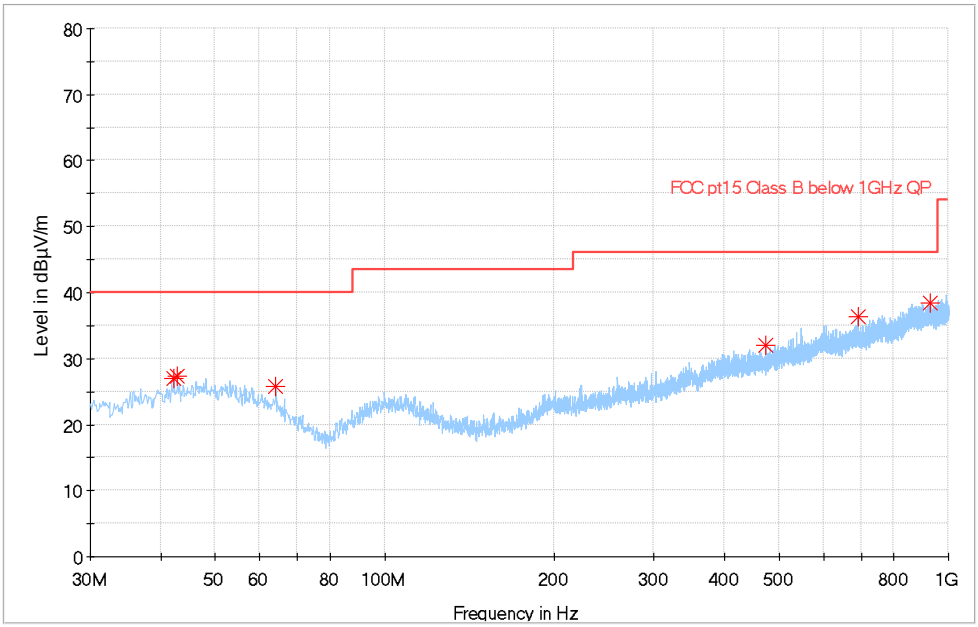
Radiated Emissions; Above 1 GHz



4.2.4 Profile; 30 MHz to 1 GHz, Top Channel, FCC 15.249, X Orientation

Maximum peak hold trace with quasi-peak values (◆)
Peak measurements (✳)

30 MHz to 1 GHz



4.2.5 Data; 30 MHz to 1 GHz, Top Channel, FCC 15.249, X Orientation

No measurements were taken based on the max peak data values high margins relative to the limit lines.

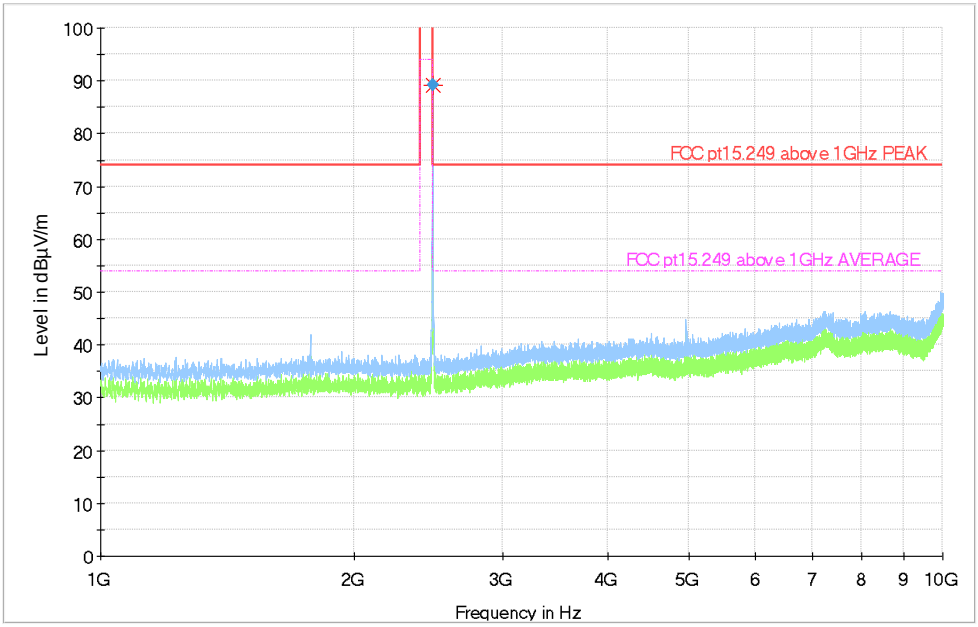
V = Vertical / H = Horizontal

The measurements reported are the highest emissions relative to the FCC/CISPR Class B limits and take into account the correction factor*. Measurements made according to the CISPR test standard and Eurofins E&E UK test procedure RAD-02.
*Correction factor (dB) = cable and antenna losses as summed positive values (dB) – pre-amp gain where applicable (dB).
The recorded measured value (dB) = measured receiver value (dB) + correction factor (dB).
Note: Path losses are factored into the limit value, and given by the test standard. Chamber calibration data contributes to the measurement uncertainty figure.

4.2.6 Profile; 1 to 10 GHz, Top Channel, FCC 15.249, X Orientation

Maximum hold trace with peak values (◆)
Peak measurements (✳)
Average measurements (◆)

1 to 10 GHz



4.2.7 Data; 1 to 10 GHz, Top Channel, FCC 15.249, X Orientation

Frequency	Peak	CISPR Average	15.249 Limit	Margin	Height	Pol	Azimuth	Corr.	
MHz	dBµV/m	dBµV/m	dBµV/m	dB	cm	H/V	Deg	dB/m	Status
2480.000000	89.23	---	94.00	4.77	156.0	H	353.0	-7.3	Pass

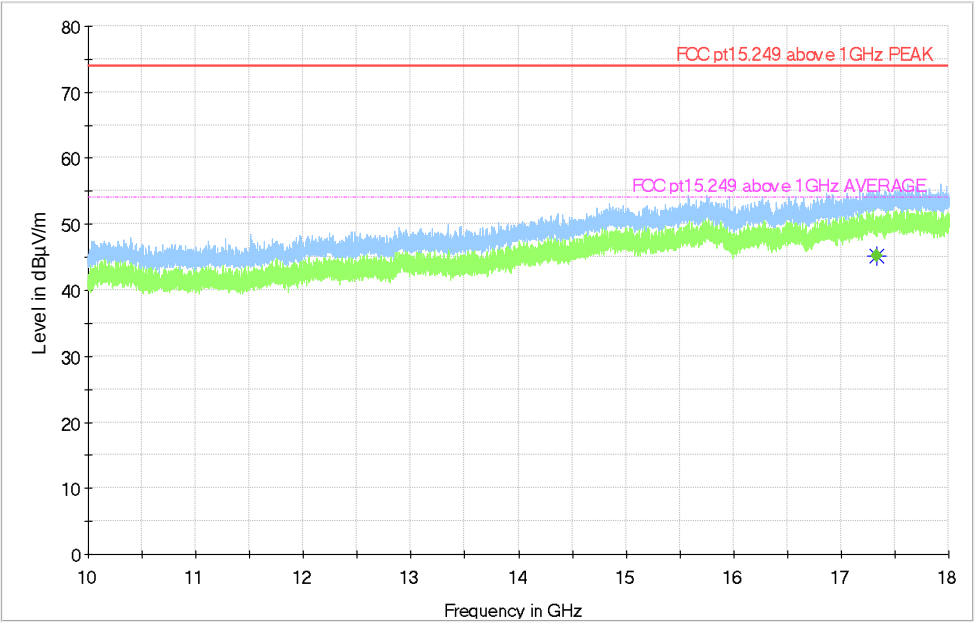
V = Vertical / H = Horizontal

The measurements reported are the highest emissions relative to the FCC/CISPR 15.249 limits and take into account the correction factor*. Measurements made according to the CISPR test standard and Eurofins E&E UK test procedure RAD-02.
*Correction factor (dB) = cable and antenna losses as summed positive values (dB) – pre-amp gain where applicable (dB).
The recorded measured value (dB) = measured receiver value (dB) + correction factor (dB).
Note: path losses are factored into the limit value, and given by the test standard. Chamber calibration data contributes to the measurement uncertainty figure.

4.2.8 Profile; 10 to 18 GHz, Top Channel, FCC 15.249, X Orientation

Maximum hold trace with peak values (▽)
Maximum hold trace with average values (▼)

10 to 18 GHz



4.2.9 Data; 10 to 18 GHz, Top Channel, FCC 15.249, X Orientation

Frequency	Peak	CISPR Average	Class B Limit	Margin	Height	Pol	Azimuth	Corr.	
MHz	dBµV/m	dBµV/m	dBµV/m	dB	cm	H/V	Deg	dB/m	Status
17330.81085	---	45.22	54.00	8.78	280.0	H	241.0	14.6	Pass

V = Vertical / H = Horizontal

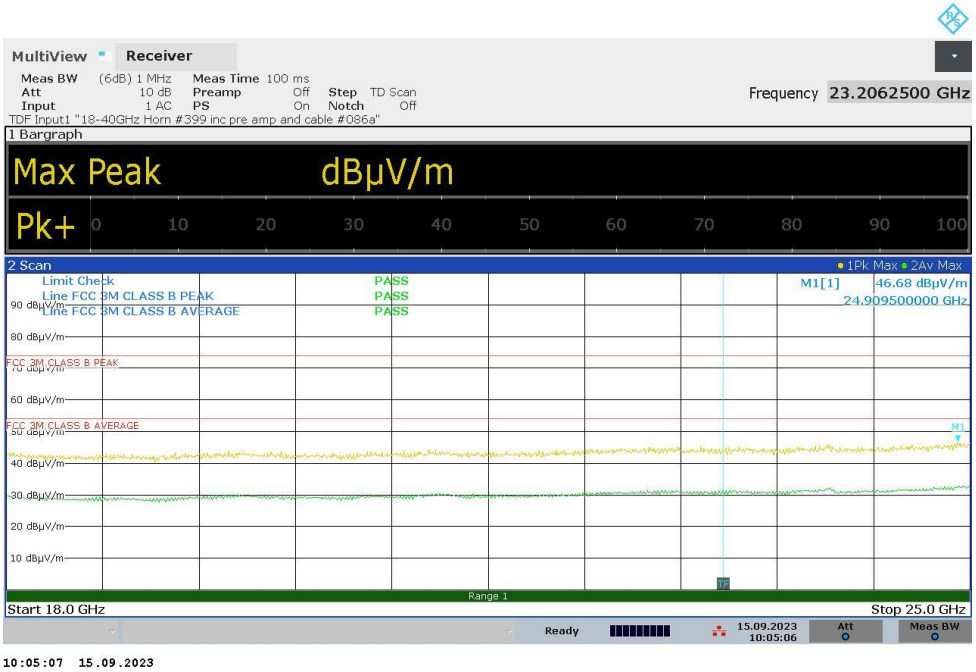
The measurements reported are the highest emissions relative to the FCC/CISPR Class B limits and take into account the correction factor*. Measurements made according to the CISPR test standard and Eurofins E&E UK test procedure RAD-02.
*Correction factor (dB) = cable and antenna losses as summed positive values (dB) – pre-amp gain where applicable (dB).
The recorded measured value (dB) = measured receiver value (dB) + correction factor (dB).
Note: path losses are factored into the limit value, and given by the test standard. Chamber calibration data contributes to the measurement uncertainty figure.

4.2.10 Profile; 18 to 25 GHz, Top Channel, FCC 15.249, X Orientation

Maximum hold trace with peak values (▽)

Maximum hold trace with average values (▼)

18 to 25 GHz



4.2.11 Data; 18 to 25 GHz, Top Channel, FCC 15.249, X Orientation

No measurements were taken based on the max peak data values high margins relative to the limit lines.

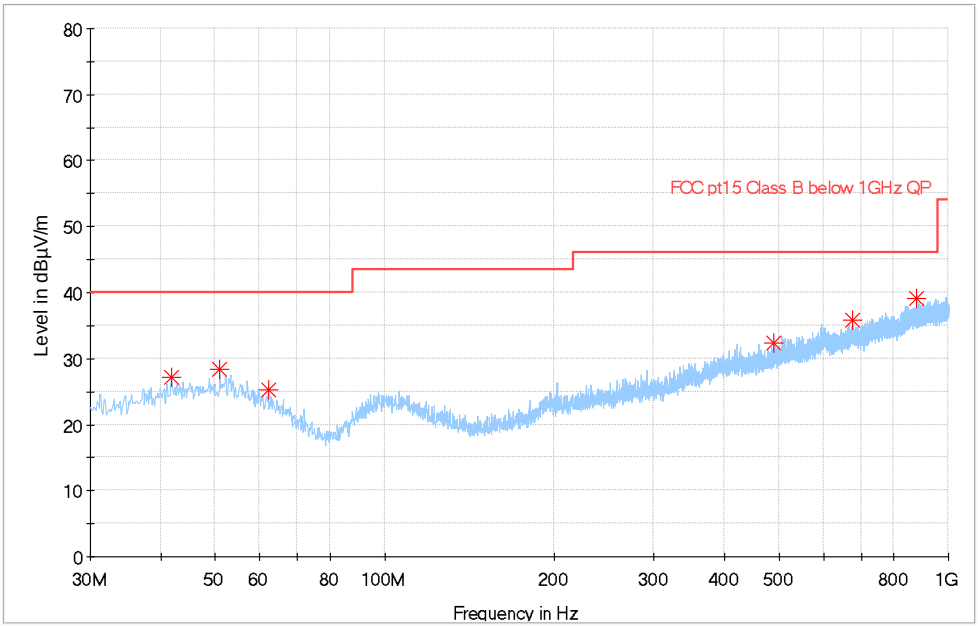
V = Vertical / H = Horizontal

The measurements reported are the highest emissions relative to the FCC/CISPR Class B limits and take into account the correction factor*. Measurements made according to the CISPR test standard and Eurofins E&E UK test procedure RAD-02.
*Correction factor (dB) = cable and antenna losses as summed positive values (dB) – pre-amp gain where applicable (dB).
The recorded measured value (dB) = measured receiver value (dB) + correction factor (dB).
Note: path losses are factored into the limit value, and given by the test standard. Chamber calibration data contributes to the measurement uncertainty figure.

4.2.12 Profile; 30 MHz to 1 GHz, Middle Channel, FCC 15.249, X Orientation

Maximum peak hold trace with quasi-peak values (◆)
Peak measurements (✳)

30 MHz to 1 GHz



4.2.13 Data; 30 MHz to 1 GHz, Middle Channel, FCC 15.249, X Orientation

No measurements were taken based on the max peak data values high margins relative to the limit lines.

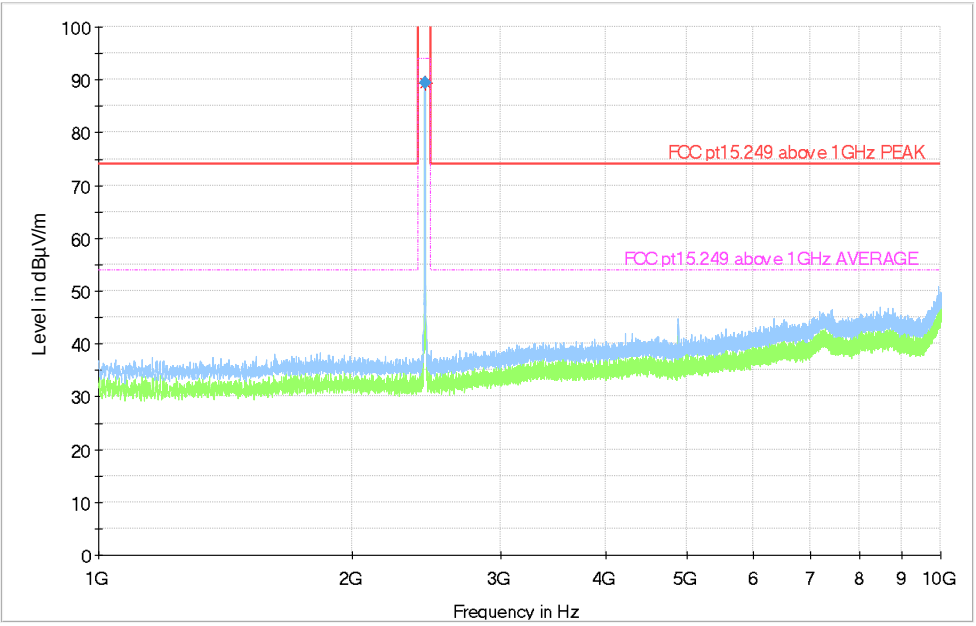
V = Vertical / H = Horizontal

The measurements reported are the highest emissions relative to the FCC/CISPR Class B limits and take into account the correction factor*. Measurements made according to the CISPR test standard and Eurofins E&E UK test procedure RAD-02.
*Correction factor (dB) = cable and antenna losses as summed positive values (dB) – pre-amp gain where applicable (dB).
The recorded measured value (dB) = measured receiver value (dB) + correction factor (dB).
Note: Path losses are factored into the limit value, and given by the test standard. Chamber calibration data contributes to the measurement uncertainty figure.

4.2.14 Profile; 1 to 10 GHz, Middle Channel, FCC 15.249, X Orientation

Maximum hold trace with peak values (◆)
Peak measurements (✳)
Average measurements (◆)

1 to 10 GHz



4.2.15 Data; 1 to 10 GHz, Middle Channel, FCC 15.249, X Orientation

Frequency	Peak	CISPR Average	15.249 Limit	Margin	Height	Pol	Azimuth	Corr.	
MHz	dBµV/m	dBµV/m	dBµV/m	dB	cm	H/V	Deg	dB/m	Status
2440.000000	89.47	---	94.00	4.53	108.0	H	354.0	-7.3	Pass

V = Vertical / H = Horizontal

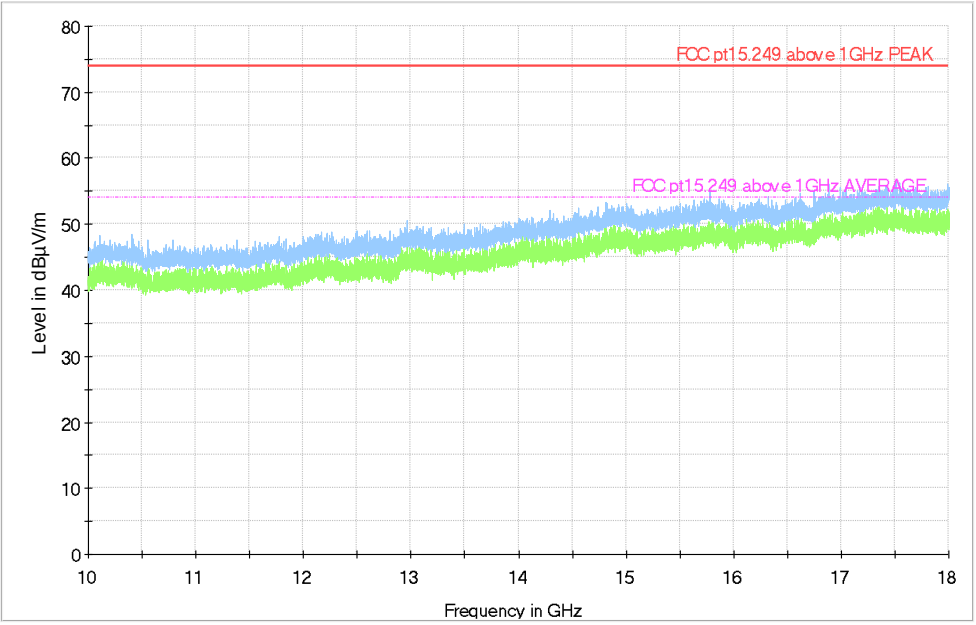
The measurements reported are the highest emissions relative to the FCC/CISPR 15.249 limits and take into account the correction factor*. Measurements made according to the CISPR test standard and Eurofins E&E UK test procedure RAD-02.
*Correction factor (dB) = cable and antenna losses as summed positive values (dB) – pre-amp gain where applicable (dB).
The recorded measured value (dB) = measured receiver value (dB) + correction factor (dB).
Note: path losses are factored into the limit value, and given by the test standard. Chamber calibration data contributes to the measurement uncertainty figure.

4.2.16 Profile; 10 to 18 GHz, Middle Channel, FCC 15.249, X Orientation

Maximum hold trace with peak values (▽)

Maximum hold trace with average values (▼)

10 to 18 GHz



4.2.17 Data; 10 to 18 GHz, Middle Channel, FCC 15.249, X Orientation

No measurements were taken based on the max peak data values high margins relative to the limit lines.

V = Vertical / H = Horizontal

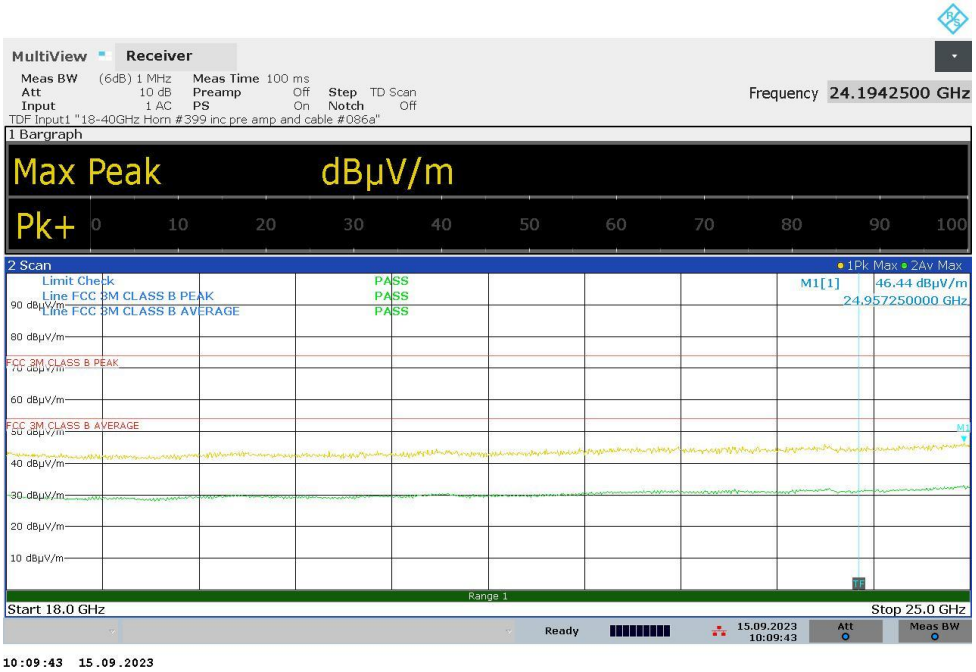
The measurements reported are the highest emissions relative to the FCC/CISPR Class B limits and take into account the correction factor*. Measurements made according to the CISPR test standard and Eurofins E&E UK test procedure RAD-02.
*Correction factor (dB) = cable and antenna losses as summed positive values (dB) – pre-amp gain where applicable (dB).
The recorded measured value (dB) = measured receiver value (dB) + correction factor (dB).
Note: path losses are factored into the limit value, and given by the test standard. Chamber calibration data contributes to the measurement uncertainty figure.

4.2.18 Profile; 18 to 25 GHz, Middle Channel, FCC 15.249, X Orientation

Maximum hold trace with peak values (▽)

Maximum hold trace with average values (▼)

18 to 25 GHz



4.2.19 Data; 18 to 25 GHz, Middle Channel, FCC 15.249, X Orientation

No measurements were taken based on the max peak data values high margins relative to the limit lines.

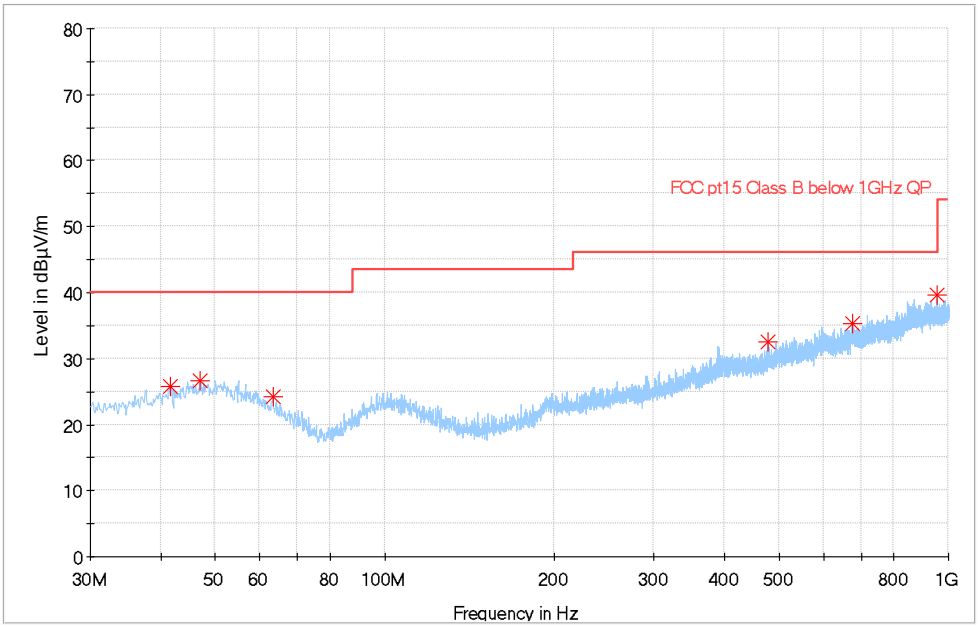
V = Vertical / H = Horizontal

The measurements reported are the highest emissions relative to the FCC/CISPR Class B limits and take into account the correction factor*. Measurements made according to the CISPR test standard and Eurofins E&E UK test procedure RAD-02.
*Correction factor (dB) = cable and antenna losses as summed positive values (dB) – pre-amp gain where applicable (dB).
The recorded measured value (dB) = measured receiver value (dB) + correction factor (dB).
Note: path losses are factored into the limit value, and given by the test standard. Chamber calibration data contributes to the measurement uncertainty figure.

4.2.20 Profile; 30 MHz to 1 GHz, Bottom Channel, FCC 15.249, X Orientation

Maximum peak hold trace with quasi-peak values (◆)
Peak measurements (✳)

30 MHz to 1 GHz



4.2.21 Data; 30 MHz to 1 GHz, Bottom Channel, FCC 15.249, X Orientation

No measurements were taken based on the max peak data values high margins relative to the limit lines.

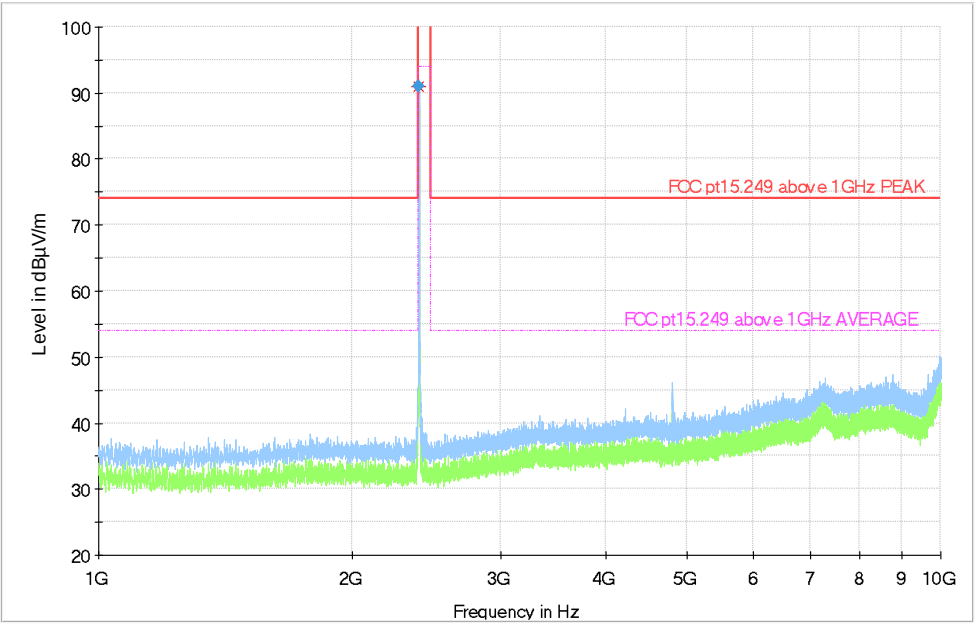
V = Vertical / H = Horizontal

The measurements reported are the highest emissions relative to the FCC/CISPR Class B limits and take into account the correction factor*. Measurements made according to the CISPR test standard and Eurofins E&E UK test procedure RAD-02.
*Correction factor (dB) = cable and antenna losses as summed positive values (dB) – pre-amp gain where applicable (dB).
The recorded measured value (dB) = measured receiver value (dB) + correction factor (dB).
Note: Path losses are factored into the limit value, and given by the test standard. Chamber calibration data contributes to the measurement uncertainty figure.

4.2.22 Profile; 1 to 10 GHz, Bottom Channel, FCC 15.249, X Orientation

Maximum hold trace with peak values (◆)
Peak measurements (✳)
Average measurements (◆)

1 to 10 GHz



4.2.23 Data; 1 to 10 GHz, Bottom Channel, FCC 15.249, X Orientation

Frequency	Peak	CISPR Average	15.249 Limit	Margin	Height	Pol	Azimuth	Corr.	
MHz	dBµV/m	dBµV/m	dBµV/m	dB	cm	H/V	Deg	dB/m	Status
2402.000000	90.95	---	94.00	3.05	115.0	H	357.0	-7.3	Pass

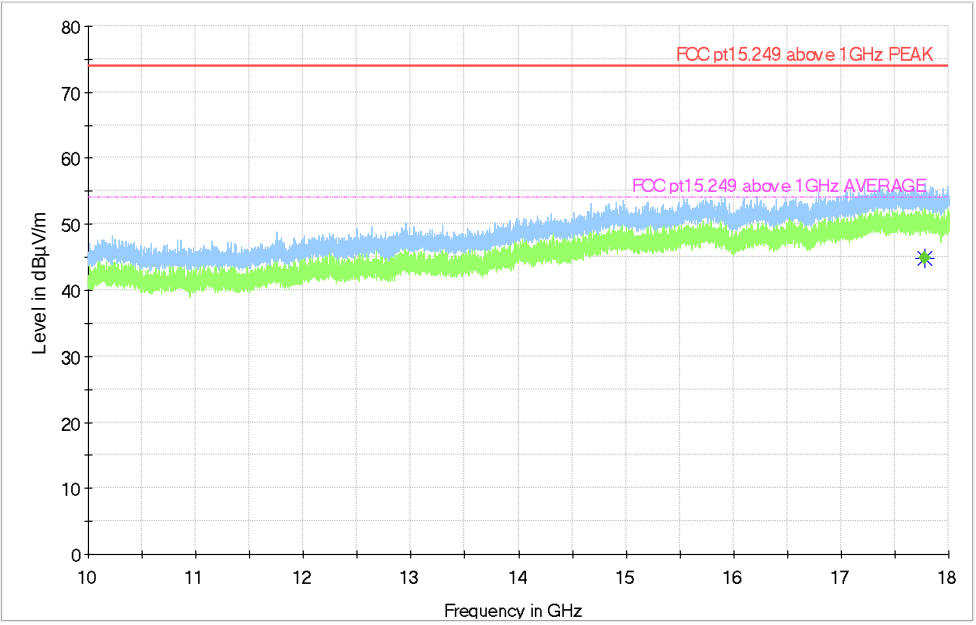
V = Vertical / H = Horizontal

The measurements reported are the highest emissions relative to the FCC/CISPR 15.249 limits and take into account the correction factor*. Measurements made according to the CISPR test standard and Eurofins E&E UK test procedure RAD-02.
*Correction factor (dB) = cable and antenna losses as summed positive values (dB) – pre-amp gain where applicable (dB).
The recorded measured value (dB) = measured receiver value (dB) + correction factor (dB).
Note: path losses are factored into the limit value, and given by the test standard. Chamber calibration data contributes to the measurement uncertainty figure.

4.2.24 Profile; 10 to 18 GHz, Bottom Channel, FCC 15.249, X Orientation

Maximum hold trace with peak values (▽)
Maximum hold trace with average values (▼)

10 to 18 GHz



4.2.25 Data; 10 to 18 GHz, Bottom Channel, FCC 15.249, X Orientation

Frequency	Peak	CISPR Average	Class B Limit	Margin	Height	Pol	Azimuth	Corr.	
MHz	dBµV/m	dBµV/m	dBµV/m	dB	cm	H/V	Deg	dB/m	Status
17774.42084	---	44.89	54.00	9.11	112.0	V	222.0	14.3	Pass

V = Vertical / H = Horizontal

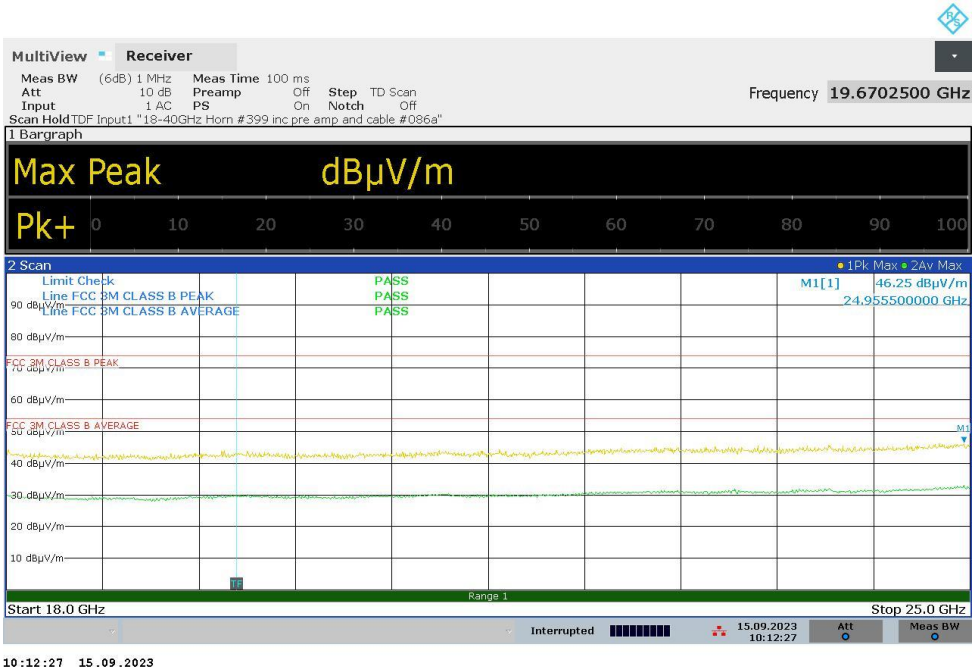
The measurements reported are the highest emissions relative to the FCC/CISPR Class B limits and take into account the correction factor*. Measurements made according to the CISPR test standard and Eurofins E&E UK test procedure RAD-02.
*Correction factor (dB) = cable and antenna losses as summed positive values (dB) – pre-amp gain where applicable (dB).
The recorded measured value (dB) = measured receiver value (dB) + correction factor (dB).
Note: path losses are factored into the limit value, and given by the test standard. Chamber calibration data contributes to the measurement uncertainty figure.

4.2.26 Profile; 18 to 25 GHz, Bottom Channel, FCC 15.249, X Orientation

Maximum hold trace with peak values (▽)

Maximum hold trace with average values (▼)

18 to 25 GHz



4.2.27 Data; 18 to 25 GHz, Bottom Channel, FCC 15.249, X Orientation

No measurements were taken based on the max peak data values high margins relative to the limit lines.

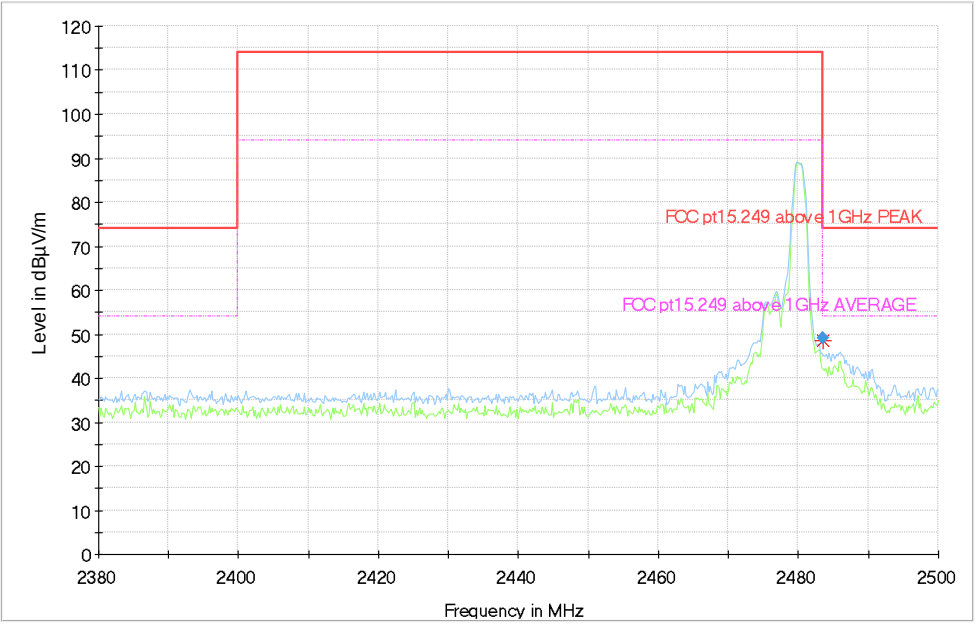
V = Vertical / H = Horizontal

The measurements reported are the highest emissions relative to the FCC/CISPR Class B limits and take into account the correction factor*. Measurements made according to the CISPR test standard and Eurofins E&E UK test procedure RAD-02.
*Correction factor (dB) = cable and antenna losses as summed positive values (dB) – pre-amp gain where applicable (dB).
The recorded measured value (dB) = measured receiver value (dB) + correction factor (dB).
Note: path losses are factored into the limit value, and given by the test standard. Chamber calibration data contributes to the measurement uncertainty figure.

4.2.28 Profile; Top Channel, FCC 15.249, Band Edge, X Orientation

Maximum hold trace with peak values (▽)
Maximum hold trace with average values (▼)

Top Channel



4.2.29 Data; FCC 15.249 (110 V 60 Hz), Top Channel, X Orientation

Frequency	Peak	CISPR Average	Class B Limit	Margin	Height	Pol	Azimuth	Corr.	
MHz	dBµV/m	dBµV/m	dBµV/m	dB	cm	H/V	Deg	dB/m	Status
2483.500000	49.07	---	54.00	4.93	163.0	H	343.0	-7.3	Pass

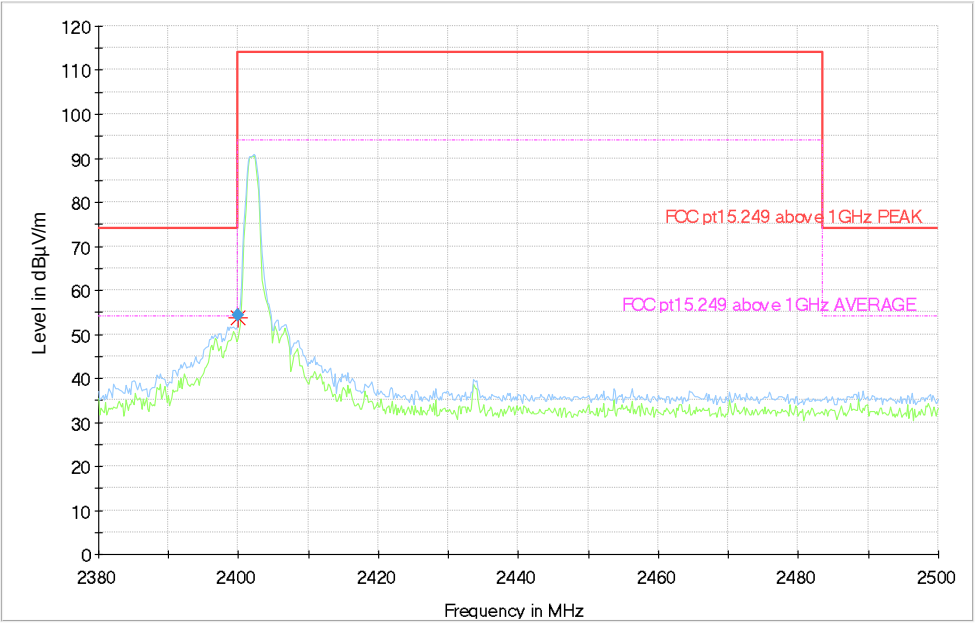
V = Vertical / H = Horizontal

The measurements reported are the highest emissions relative to the FCC/CISPR Class B limits and take into account the correction factor*. Measurements made according to the CISPR test standard and Eurofins E&E UK test procedure RAD-02.
*Correction factor (dB) = cable and antenna losses as summed positive values (dB) – pre-amp gain where applicable (dB).
The recorded measured value (dB) = measured receiver value (dB) + correction factor (dB).
Note: path losses are factored into the limit value, and given by the test standard. Chamber calibration data contributes to the measurement uncertainty figure.

4.2.30 Profile; Bottom Channel, FCC 15.249, Band Edge, X Orientation

Maximum hold trace with peak values (▽)
Maximum hold trace with average values (▼)

Bottom Channel



4.2.31 Data; Bottom Channel, FCC 15.249, Band Edge, X Orientation

Frequency	Peak	CISPR Average	Class B Limit	Margin	Height	Pol	Azimuth	Corr.	
MHz	dBµV/m	dBµV/m	dBµV/m	dB	cm	H/V	Deg	dB/m	Status
2400.000000	54.37	---	74.00	19.63	163.0	H	348.0	-7.3	Pass
2400.000000	---	15.81*	54.00	38.19	163.0	H	348.0	-7.3	Pass

V = Vertical / H = Horizontal

The measurements reported are the highest emissions relative to the FCC/CISPR Class B limits and take into account the correction factor*. Measurements made according to the CISPR test standard and Eurofins E&E UK test procedure RAD-02.
*Correction factor (dB) = cable and antenna losses as summed positive values (dB) – pre-amp gain where applicable (dB).
The recorded measured value (dB) = measured receiver value (dB) + correction factor (dB).
Note: path losses are factored into the limit value, and given by the test standard. Chamber calibration data contributes to the measurement uncertainty figure.

*The average value of the emission at 2400.000 MHz has been determined by calculation in accordance with ANSI c63.10 clause 7.5.
The EUT was found to transmit on 40 channels, repeating on each channel every 370mS. In accordance with ANSI c63.10 clause 7.5, the transmitter on time can be considered in a 100mS time interval only.
So, the number of transmissions in 100mS = 1 + (100/9.25) = 11.81 = 12 transmissions. Each burst duration was found to be 98.625uS.
The total transmitter on-time is 98.625uS x 12 = 1183.5uS = 1.1835mS
So, Duty Cycle Correction factor is given by δ (dB) = 20log(Δ) (ANSI c63.10 clause 7.5 equation (10))
δ (dB) = 20log(Δ)
δ (dB) = 20log(1.18/100) = -38.56 dB

4.3 Radiated Emissions; FCC 15.249, Y Orientation

4.3.1 Test Parameters

A profile scan was taken using an EMI receiver at a distance of three metres on eight azimuths of the EUT in both the vertical and horizontal polarisation of the field in a semi-anechoic chamber.

Using the pre-scan results as a guide, each emission from the EUT was maximised. Measurements were carried out at a distance of three metres using the specified detector in a CISPR 16-1-4 compliant semi-anechoic chamber. Antenna and turntable positions were then finally adjusted to produce the maximum emission levels. The worst-case results are reported below.

Test Equipment						
#ID	CP	Manufacturer	Type	Serial Number	Description	Calibration Due Date
053	1	HP	8449B	3008A01394	Pre-amplifier (1 to 26.5 GHz)	24/10/2023
068	1	EM	CWS500C	1001-07	Conducted immunity simulator	20/09/2024
073	3	Schwarzbeck	BBHA9120B	237	Horn Antenna (1 to 10 GHz)	20/05/2024
252	1	Rohde & Schwarz	ESH3-Z2	08970	10 dB pulse limiter	26/05/2024
340	1	Sucoflex with #053 Pre-amplifier	104	0	26.5 GHz	24/10/2023
652	1	TFA	Weather Station	Jupiter	Weather Station	02/11/2023
750	1	Global	CISPR16	1	11 x 7 x 6.2m, chamber	22/12/2023
762	3	Schwarzbeck	VULB9162	129	30 to 7000 MHz	04/03/2024
779	3	Steatite	QWH-SL-18-40-K-SG	17504	Horn Antenna (18 to 40 GHz)	05/08/2024
823	0	York EMC	1.5 to 7GHz	CNE 6507	High frequency Comparison Noise Emitter	Not required
877	1	Huber & Suhner	SUCOTEST_18A	602608/18A	ST_18A/Nm/Nm/3m	21/11/2023
893	1	Rohde & Schwarz	ESW 44	103044	EMI test receiver	11/11/2023
952	3	Schwarzbeck	HWRD750	66	Horn Antenna (7 to 18 GHz)	21/06/2026
Test Equipment Software						
#ID	CP	Manufacturer	Type		Description	Calibration Due Date
856	0	Rohde & Schwarz	Software	0	EMC32 v11.30.0	Not required

Environmental Test Conditions		
Frequency	**Below 1 GHz**	**Above 1 GHz**
Temperature	24.1° Celsius	24 and 25.3° Celsius
Relative Humidity	51 %	51 and 48 %
Atmospheric Pressure	1016.6 millibars	1024.3 and 1015 millibars
Test Date:	15th September 2023	14th and 15th September 2023
Test Engineer:	Matt Ingall	Graeme Lawler and Matt Ingall

Note: “Calibration due date” means the instrument is certified within UKAS or traceable calibration certificate. “Internal” means the instrument is calibrated using Eurofins E&E UK procedures. “Not required” means the asset does not require calibration. “CP” is the interval period [year] prescribed for external calibration.

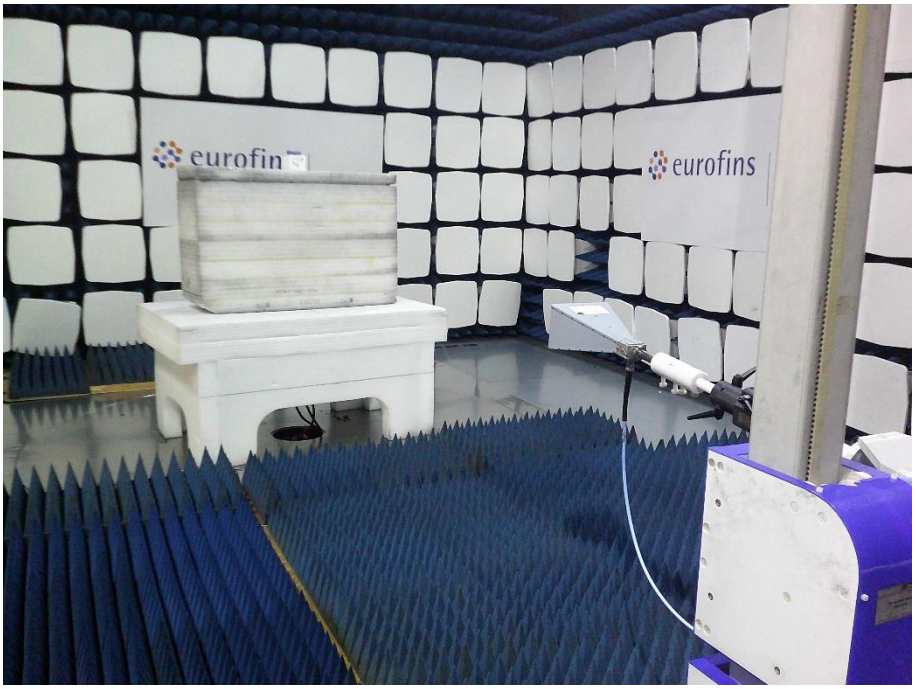
4.3.2 Test Configuration

Please refer to EUT Test Configuration #1.

4.3.3 Set-up Photos

Radiated Emissions; Below 1 GHz

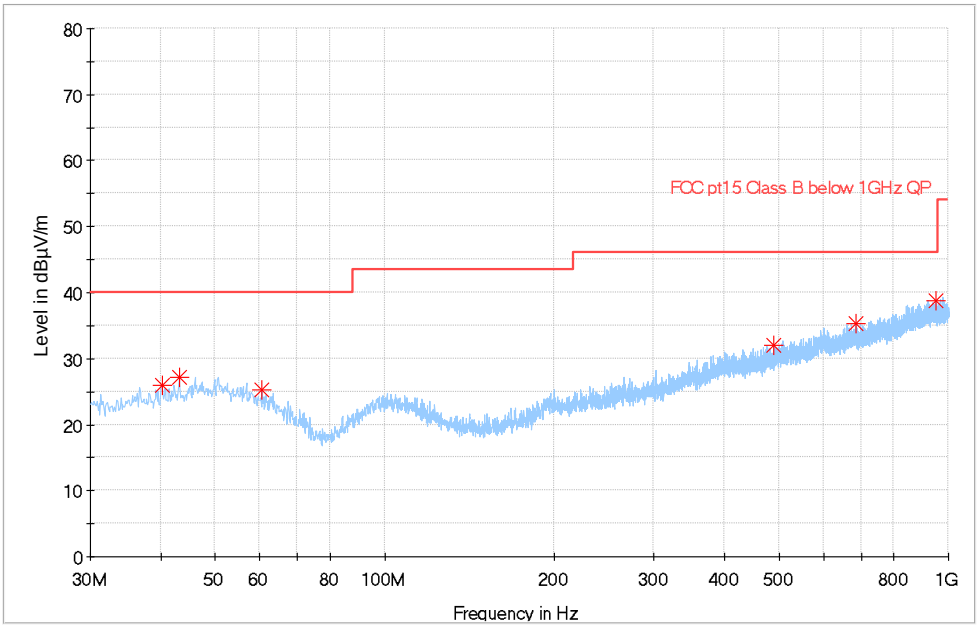
Radiated Emissions; Above 1 GHz



4.3.4 Profile; 30 MHz to 1 GHz, Middle Channel, FCC 15.249 (110 V 60 Hz), Y Orientation

Maximum peak hold trace with quasi-peak values (◆)
Peak measurements (✳)

30 MHz to 1 GHz



4.3.5 Data; 30 MHz to 1 GHz, Middle Channel, FCC 15.249, Y Orientation

No measurements were taken based on the max peak data values high margins relative to the limit lines.

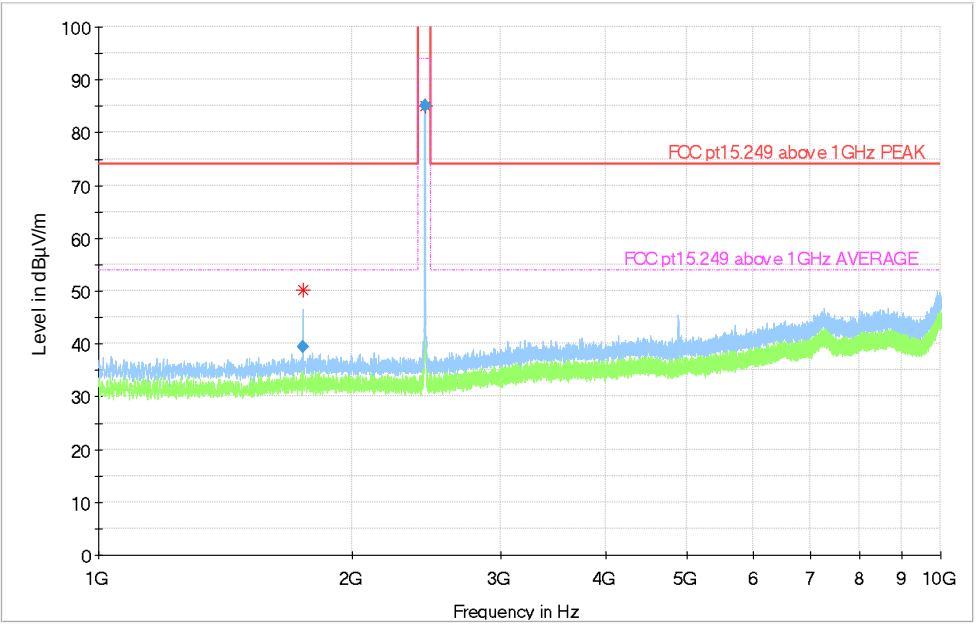
V = Vertical / H = Horizontal

The measurements reported are the highest emissions relative to the FCC/CISPR Class B limits and take into account the correction factor*. Measurements made according to the CISPR test standard and Eurofins E&E UK test procedure RAD-02.
*Correction factor (dB) = cable and antenna losses as summed positive values (dB) – pre-amp gain where applicable (dB).
The recorded measured value (dB) = measured receiver value (dB) + correction factor (dB).
Note: Path losses are factored into the limit value, and given by the test standard. Chamber calibration data contributes to the measurement uncertainty figure.

4.3.6 Profile; 1 to 10 GHz, Middle Channel, FCC 15.249, Y Orientation

Maximum hold trace with peak values (◆)
Peak measurements (✳)
Average measurements (◆)

1 to 10 GHz



4.3.7 Data; 1 to 10 GHz, Middle Channel, FCC 15.249 (110 V 60 Hz), Y Orientation

Frequency	Peak	CISPR Average	15.249 Limit	Margin	Height	Pol	Azimuth	Corr.	
MHz	dBµV/m	dBµV/m	dBµV/m	dB	cm	H/V	Deg	dB/m	Status
1749.000000	39.45	---	54.00	14.55	171.0	V	21.0	-7.9	Pass
2440.000000	85.08	---	94.00	8.92	214.0	V	143.0	-7.3	Pass

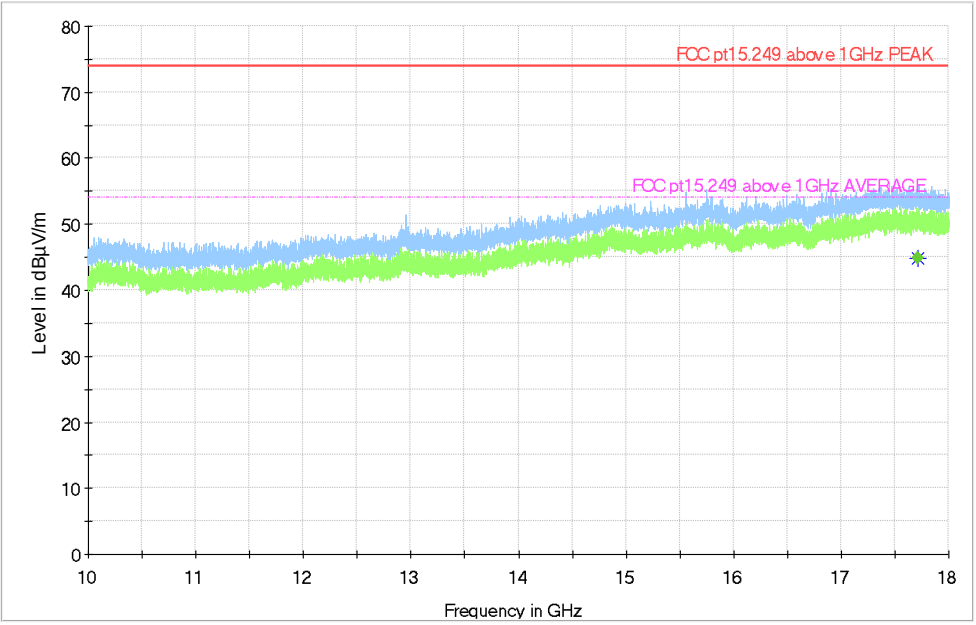
V = Vertical / H = Horizontal

The measurements reported are the highest emissions relative to the FCC/CISPR 15.249 limits and take into account the correction factor*. Measurements made according to the CISPR test standard and Eurofins E&E UK test procedure RAD-02.
*Correction factor (dB) = cable and antenna losses as summed positive values (dB) – pre-amp gain where applicable (dB).
The recorded measured value (dB) = measured receiver value (dB) + correction factor (dB).
Note: path losses are factored into the limit value, and given by the test standard. Chamber calibration data contributes to the measurement uncertainty figure.

4.3.8 Profile; 10 to 18 GHz, Middle Channel, FCC 15.249, Y Orientation

Maximum hold trace with peak values (▽)
Maximum hold trace with average values (▼)

10 to 18 GHz



4.3.9 Data; 10 to 18 GHz, Middle Channel, FCC 15.249, Y Orientation

Frequency	Peak	CISPR Average	Class B Limit	Margin	Height	Pol	Azimuth	Corr.	
MHz	dBµV/m	dBµV/m	dBµV/m	dB	cm	H/V	Deg	dB/m	Status
17714.74631	---	44.79	54.00	9.21	171.0	V	286.0	14.4	Pass

V = Vertical / H = Horizontal

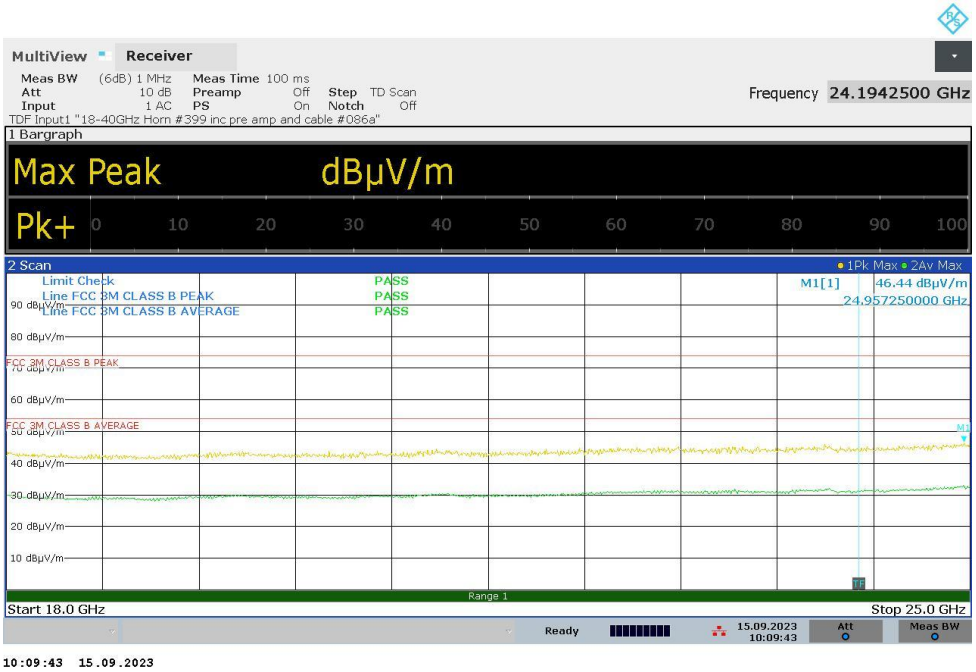
The measurements reported are the highest emissions relative to the FCC/CISPR Class B limits and take into account the correction factor*. Measurements made according to the CISPR test standard and Eurofins E&E UK test procedure RAD-02.
*Correction factor (dB) = cable and antenna losses as summed positive values (dB) – pre-amp gain where applicable (dB).
The recorded measured value (dB) = measured receiver value (dB) + correction factor (dB).
Note: path losses are factored into the limit value, and given by the test standard. Chamber calibration data contributes to the measurement uncertainty figure.

4.3.10 Profile; 18 to 25 GHz, Middle Channel, FCC 15.249, Y Orientation

Maximum hold trace with peak values (▽)

Maximum hold trace with average values (▼)

18 to 25 GHz



4.3.11 Data; 18 to 25 GHz, Middle Channel, FCC 15.249, Y Orientation

No measurements were taken based on the max peak data values high margins relative to the limit lines.

V = Vertical / H = Horizontal

The measurements reported are the highest emissions relative to the FCC/CISPR Class B limits and take into account the correction factor*. Measurements made according to the CISPR test standard and Eurofins E&E UK test procedure RAD-02.
*Correction factor (dB) = cable and antenna losses as summed positive values (dB) – pre-amp gain where applicable (dB).
The recorded measured value (dB) = measured receiver value (dB) + correction factor (dB).
Note: path losses are factored into the limit value, and given by the test standard. Chamber calibration data contributes to the measurement uncertainty figure.

4.4 Radiated Emissions; FCC 15.249, Z Orientation

4.4.1 Test Parameters

A profile scan was taken using an EMI receiver at a distance of three metres on eight azimuths of the EUT in both the vertical and horizontal polarisation of the field in a semi-anechoic chamber.

Using the pre-scan results as a guide, each emission from the EUT was maximised. Measurements were carried out at a distance of three metres using the specified detector in a CISPR 16-1-4 compliant semi-anechoic chamber. Antenna and turntable positions were then finally adjusted to produce the maximum emission levels. The worst-case results are reported below.

Test Equipment						
#ID	CP	Manufacturer	Type	Serial Number	Description	Calibration Due Date
053	1	HP	8449B	3008A01394	Pre-amplifier (1 to 26.5 GHz)	24/10/2023
068	1	EM	CWS500C	1001-07	Conducted immunity simulator	20/09/2024
073	3	Schwarzbeck	BBHA9120B	237	Horn Antenna (1 to 10 GHz)	20/05/2024
252	1	Rohde & Schwarz	ESH3-Z2	08970	10 dB pulse limiter	26/05/2024
340	1	Sucoflex with #053 Pre-amplifier	104	0	26.5 GHz	24/10/2023
652	1	TFA	Weather Station	Jupiter	Weather Station	02/11/2023
750	1	Global	CISPR16	1	11 x 7 x 6.2m, chamber	22/12/2023
762	3	Schwarzbeck	VULB9162	129	30 to 7000 MHz	04/03/2024
779	3	Steatite	QWH-SL-18-40-K-SG	17504	Horn Antenna (18 to 40 GHz)	05/08/2024
823	0	York EMC	1.5 to 7GHz	CNE 6507	High frequency Comparison Noise Emitter	Not required
877	1	Huber & Suhner	SUCOTEST_18A	602608/18A	ST_18A/Nm/Nm/3m	21/11/2023
893	1	Rohde & Schwarz	ESW 44	103044	EMI test receiver	11/11/2023
952	3	Schwarzbeck	HWRD750	66	Horn Antenna (7 to 18 GHz)	21/06/2026
Test Equipment Software						
#ID	CP	Manufacturer	Type		Description	Calibration Due Date
856	0	Rohde & Schwarz	Software	0	EMC32 v11.30.0	Not required

Environmental Test Conditions		
Frequency	**Below 1 GHz**	**Above 1 GHz**
Temperature	24.1° Celsius	24 and 25.3° Celsius
Relative Humidity	51 %	51 and 48 %
Atmospheric Pressure	1016.6 millibars	1024.3 and 1015 millibars
Test Date:	15th September 2023	14th and 15th September 2023
Test Engineer:	Matt Ingall	Graeme Lawler and Matt Ingall

Note: “Calibration due date” means the instrument is certified within UKAS or traceable calibration certificate. “Internal” means the instrument is calibrated using Eurofins E&E UK procedures. “Not required” means the asset does not require calibration. “CP” is the interval period [year] prescribed for external calibration.

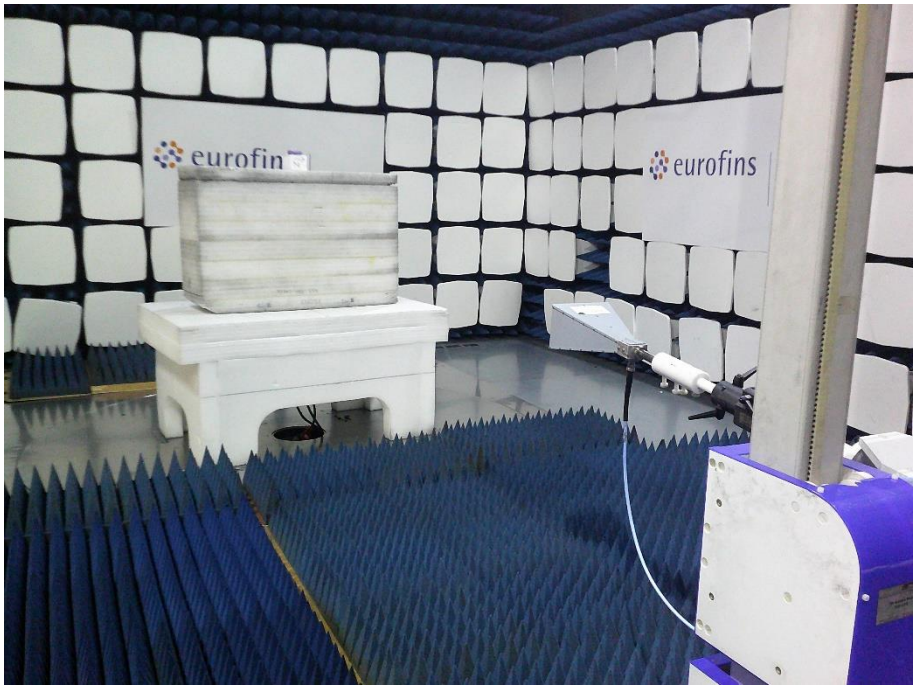
4.4.2 Test Configuration

Please refer to EUT Test Configuration #1.

4.4.3 Set-up Photos

Radiated Emissions; Below 1 GHz

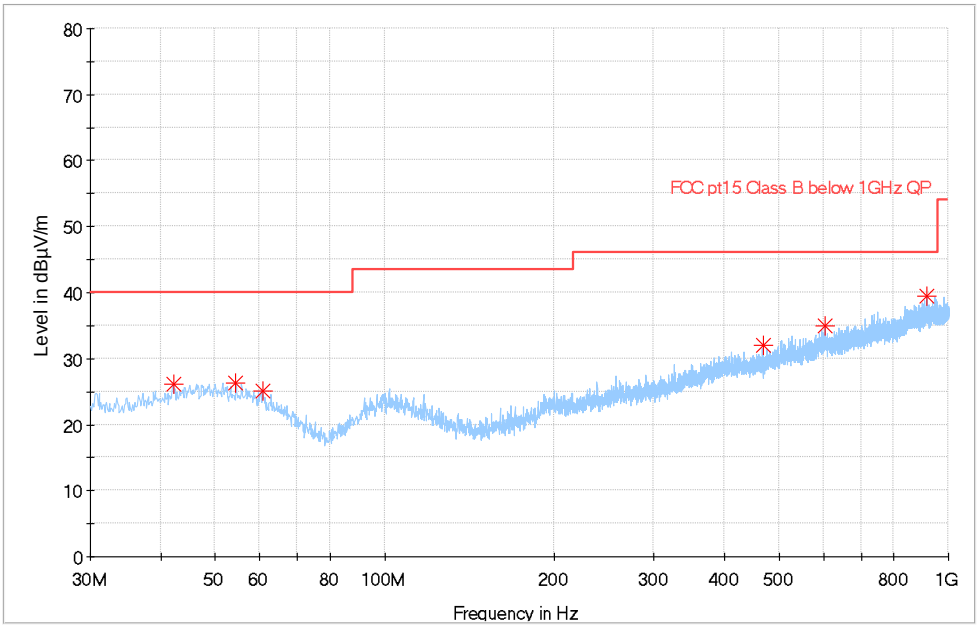
Radiated Emissions; Above 1 GHz



4.4.4 Profile; 30 MHz to 1 GHz, Middle Channel, FCC 15.249, Z Orientation

Maximum peak hold trace with quasi-peak values (◆)
Peak measurements (✳)

30 MHz to 1 GHz



4.4.5 Data; 30 MHz to 1 GHz, Middle Channel, FCC 15.249, Z Orientation

No measurements were taken based on the max peak data values high margins relative to the limit lines.

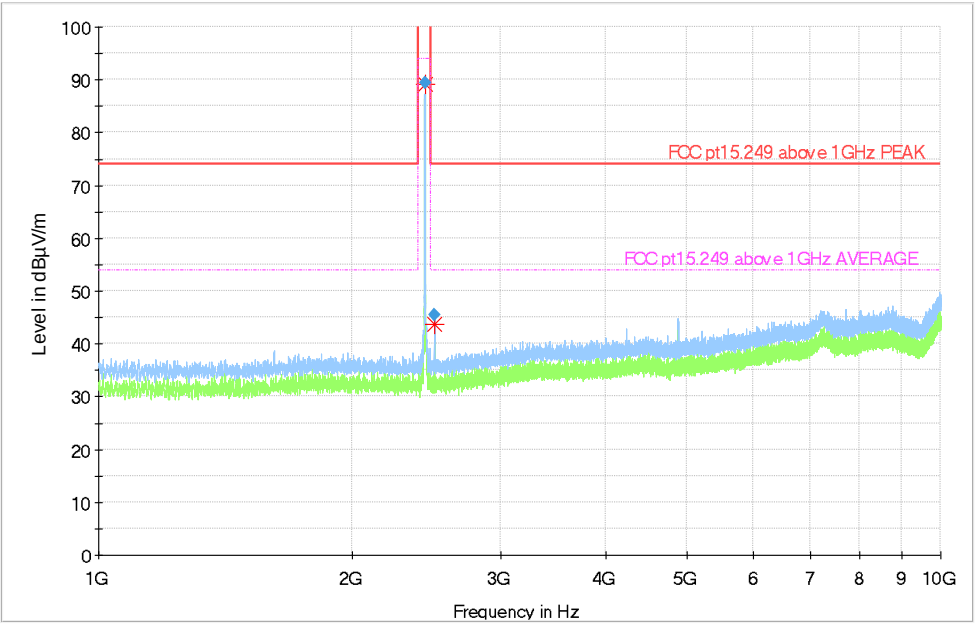
V = Vertical / H = Horizontal

The measurements reported are the highest emissions relative to the FCC/CISPR Class B limits and take into account the correction factor*. Measurements made according to the CISPR test standard and Eurofins E&E UK test procedure RAD-02.
*Correction factor (dB) = cable and antenna losses as summed positive values (dB) – pre-amp gain where applicable (dB).
The recorded measured value (dB) = measured receiver value (dB) + correction factor (dB).
Note: Path losses are factored into the limit value, and given by the test standard. Chamber calibration data contributes to the measurement uncertainty figure.

4.4.6 Profile; 1 to 10 GHz, Middle Channel, FCC 15.249, Z Orientation

Maximum hold trace with peak values (◆)
Peak measurements (✳)
Average measurements (◆)

1 to 10 GHz



4.4.7 Data; 1 to 10 GHz, Middle Channel, FCC 15.249, Z Orientation

Frequency	Peak	CISPR Average	15.249 Limit	Margin	Height	Pol	Azimuth	Corr.	
MHz	dBµV/m	dBµV/m	dBµV/m	dB	cm	H/V	Deg	dB/m	Status
2440.000000	89.30	---	94.00	4.70	215.0	V	71.0	-7.3	Pass
2502.500000	45.55	---	54.00	8.45	284.0	V	50.0	-7.3	Pass

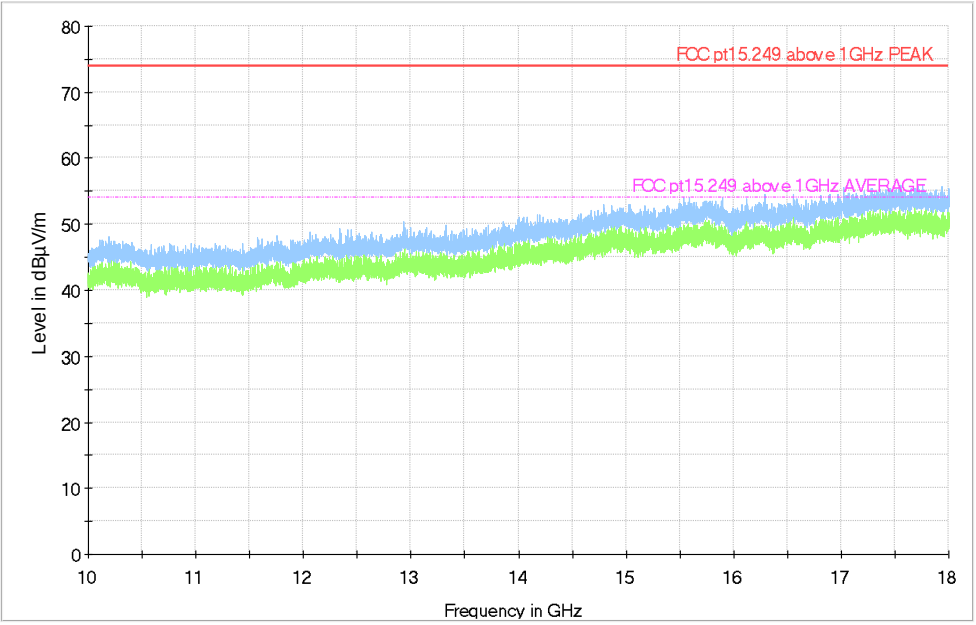
V = Vertical / H = Horizontal

The measurements reported are the highest emissions relative to the FCC/CISPR 15.249 limits and take into account the correction factor*. Measurements made according to the CISPR test standard and Eurofins E&E UK test procedure RAD-02.
*Correction factor (dB) = cable and antenna losses as summed positive values (dB) – pre-amp gain where applicable (dB).
The recorded measured value (dB) = measured receiver value (dB) + correction factor (dB).
Note: path losses are factored into the limit value, and given by the test standard. Chamber calibration data contributes to the measurement uncertainty figure.

4.4.8 Profile; 10 to 18 GHz, Middle Channel, FCC 15.249, Z Orientation

Maximum hold trace with peak values (▽)
Maximum hold trace with average values (▼)

10 to 18 GHz



4.4.9 Data; 10 to 18 GHz, Middle Channel, FCC 15.249, Z Orientation

No measurements were taken based on the max peak data values high margins relative to the limit lines.

V = Vertical / H = Horizontal

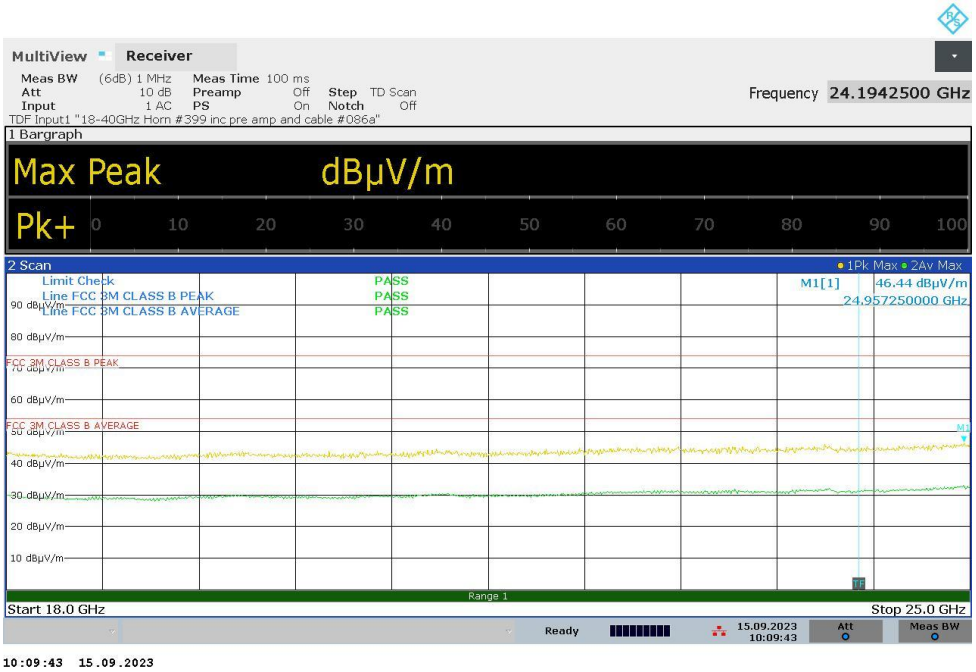
The measurements reported are the highest emissions relative to the FCC/CISPR Class B limits and take into account the correction factor*. Measurements made according to the CISPR test standard and Eurofins E&E UK test procedure RAD-02.
*Correction factor (dB) = cable and antenna losses as summed positive values (dB) – pre-amp gain where applicable (dB).
The recorded measured value (dB) = measured receiver value (dB) + correction factor (dB).
Note: path losses are factored into the limit value, and given by the test standard. Chamber calibration data contributes to the measurement uncertainty figure.

4.4.10 Profile; 18 to 25 GHz, Middle Channel, FCC 15.249, Z Orientation

Maximum hold trace with peak values (▽)

Maximum hold trace with average values (▼)

18 to 25 GHz



4.4.11 Data; 18 to 25 GHz, Middle Channel, FCC 15.249, Z Orientation

No measurements were taken based on the max peak data values high margins relative to the limit lines

V = Vertical / H = Horizontal

The measurements reported are the highest emissions relative to the FCC/CISPR Class B limits and take into account the correction factor*. Measurements made according to the CISPR test standard and Eurofins E&E UK test procedure RAD-02.
*Correction factor (dB) = cable and antenna losses as summed positive values (dB) – pre-amp gain where applicable (dB).
The recorded measured value (dB) = measured receiver value (dB) + correction factor (dB).
Note: path losses are factored into the limit value, and given by the test standard. Chamber calibration data contributes to the measurement uncertainty figure.

4.5 Radiated Emissions; FCC 15B (110 V 60 Hz)

4.5.1 Test Parameters

A profile scan was taken using an EMI receiver at a distance of three metres on eight azimuths of the EUT in both the vertical and horizontal polarisation of the field in a semi-anechoic chamber.

Using the pre-scan results as a guide, each emission from the EUT was maximised. Measurements were carried out at a distance of three metres using the specified detector in a CISPR 16-1-4 compliant semi-anechoic chamber. Antenna and turntable positions were then finally adjusted to produce the maximum emission levels. The worst-case results are reported below.

Test Equipment						
#ID	CP	Manufacturer	Type	Serial Number	Description	Calibration Due Date
053	1	HP	8449B	3008A01394	Pre-amplifier (1 to 26.5 GHz)	24/10/2023
068	1	EM	CWS500C	1001-07	Conducted immunity simulator	20/09/2024
073	3	Schwarzbeck	BBHA9120B	237	Horn Antenna (1 to 10 GHz)	20/05/2024
252	1	Rohde & Schwarz	ESH3-Z2	08970	10 dB pulse limiter	26/05/2024
340	1	Sucoflex with #053 Pre-amplifier	104	0	26.5 GHz	24/10/2023
652	1	TFA	Weather Station	Jupiter	Weather Station	02/11/2023
750	1	Global	CISPR16	1	11 x 7 x 6.2m, chamber	22/12/2023
762	3	Schwarzbeck	VULB9162	129	30 to 7000 MHz	04/03/2024
779	3	Steatite	QWH-SL-18-40-K-SG	17504	Horn Antenna (18 to 40 GHz)	05/08/2024
823	0	York EMC	1.5 to 7GHz	CNE 6507	High frequency Comparison Noise Emitter	Not required
877	1	Huber & Suhner	SUCOTEST_18A	602608/18A	ST_18A/Nm/Nm/3m	21/11/2023
893	1	Rohde & Schwarz	ESW 44	103044	EMI test receiver	11/11/2023
952	3	Schwarzbeck	HWRD750	66	Horn Antenna (7 to 18 GHz)	21/06/2026
Test Equipment Software						
#ID	CP	Manufacturer	Type		Description	Calibration Due Date
856	0	Rohde & Schwarz	Software	0	EMC32 v11.30.0	Not required

Environmental Test Conditions		
Frequency	**Below 1 GHz**	**Above 1 GHz**
Temperature	24.1° Celsius	24 and 25.3° Celsius
Relative Humidity	51 %	51 and 48 %
Atmospheric Pressure	1016.6 millibars	1024.3 and 1015 millibars
Test Date:	15th September 2023	14th and 15th September 2023
Test Engineer:	Matt Ingall	Graeme Lawler and Matt Ingall

Note: “Calibration due date” means the instrument is certified within UKAS or traceable calibration certificate. “Internal” means the instrument is calibrated using Eurofins E&E UK procedures. “Not required” means the asset does not require calibration. “CP” is the interval period [year] prescribed for external calibration.

4.5.2 Test Configuration

Please refer to EUT Test Configuration #3.

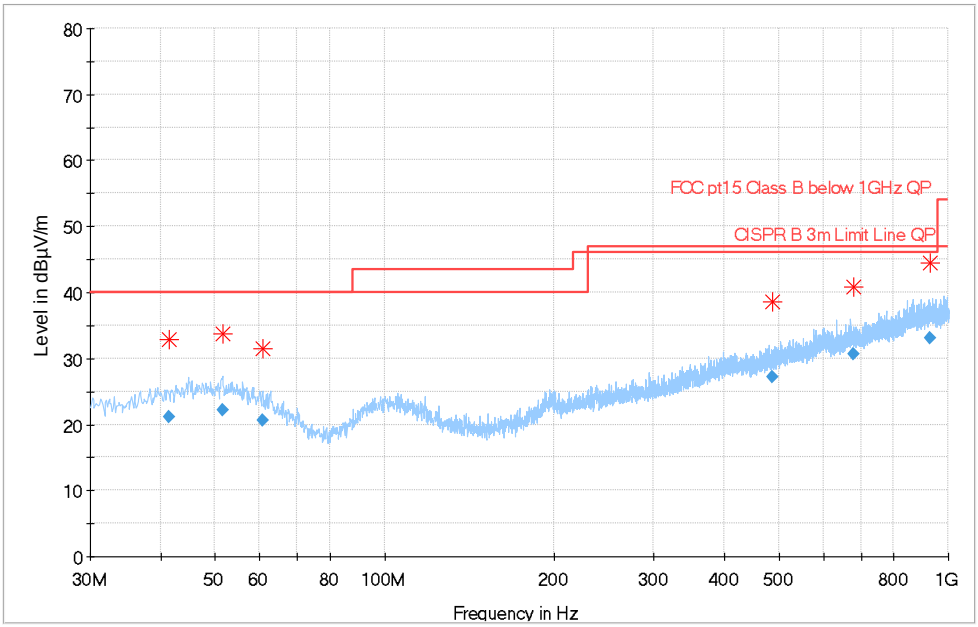
4.5.3 Set-up Photos

Radiated Emissions; Below 1 GHz

4.5.4 Profile; 30 MHz to 1 GHz, FCC 15B (110 V 60 Hz)

Maximum peak hold trace with quasi-peak values (◆)
Peak measurements (✳)

30 MHz to 1 GHz



4.5.5 Data; 30 MHz to 1 GHz, FCC 15B (110 V 60 Hz)

Emission Frequency	Measured Quasi-Peak Value	Class B Specified Quasi-Peak Limit	Pass Margin	Antenna Polarisation	Antenna Height	Turntable Azimuth	
MHz	dBµV/m	dBµV/m	dB	H/V	cm	deg	Status
41.499763	21.16	40.00	18.84	H	316.0	68.0	Pass
51.569316	22.15	40.00	17.85	H	254.0	223.0	Pass
60.742240	20.60	40.00	19.40	V	312.0	15.0	Pass
488.337825	27.23	46.00	18.77	V	224.0	39.0	Pass
680.268723	30.70	46.00	15.30	V	171.0	71.0	Pass
927.791326	33.14	46.00	12.86	H	224.0	73.0	Pass

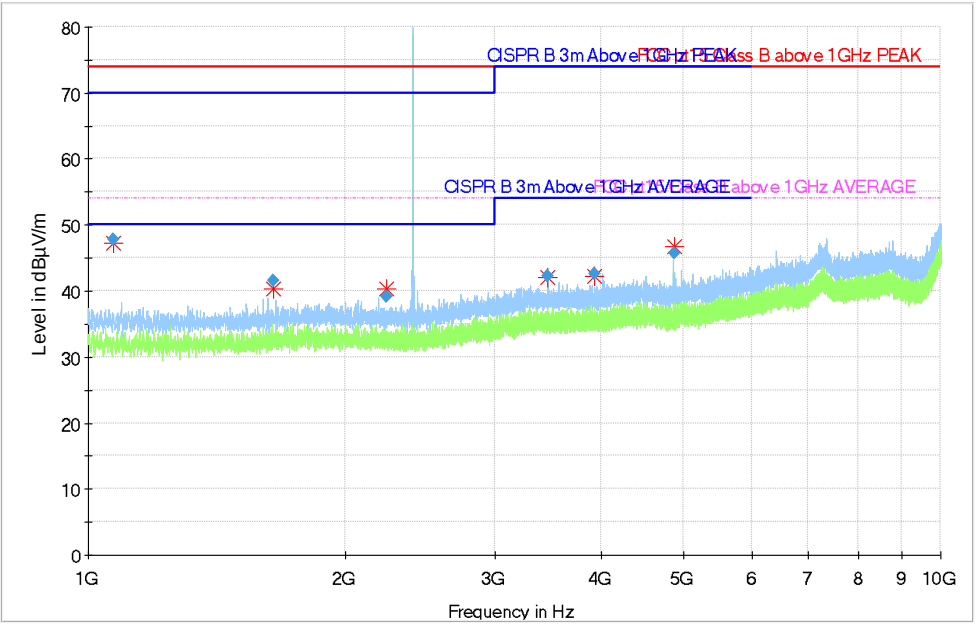
V = Vertical / H = Horizontal

The measurements reported are the highest emissions relative to the FCC/CISPR Class B limits and take into account the correction factor*. Measurements made according to the CISPR test standard and Eurofins E&E UK test procedure RAD-02.
*Correction factor (dB) = cable and antenna losses as summed positive values (dB) – pre-amp gain where applicable (dB).
The recorded measured value (dB) = measured receiver value (dB) + correction factor (dB).
Note: Path losses are factored into the limit value, and given by the test standard. Chamber calibration data contributes to the measurement uncertainty figure.

4.5.6 Profile; 1 to 10 GHz, FCC 15B (110 V 60 Hz)

Maximum hold trace with peak values (◆)
Peak measurements (✳)
Average measurements (◆)

1 to 10 GHz



4.5.7 Data; 1 to 10 GHz, FCC 15B (110 V 60 Hz)

Frequency	Peak	CISPR Average	Class B Limit	Margin	Height	Pol	Azimuth	Corr.	
MHz	dBµV/m	dBµV/m	dBµV/m	dB	cm	H/V	Deg	dB/m	Status
1069.500500	47.86	---	54.00	6.14	257.0	V	97.0	-10.2	Pass
1649.423433	41.51	---	54.00	12.49	356.0	H	353.0	-8.5	Pass
2235.433488	39.20	---	54.00	14.80	318.0	V	0.0	-7.4	Pass
3458.922083	42.20	---	54.00	11.80	385.0	H	127.0	-3.7	Pass
3922.726100	42.57	---	54.00	11.43	149.0	H	350.0	-2.8	Pass
4876.367822	45.75	---	54.00	8.25	165.0	H	115.0	-1.8	Pass

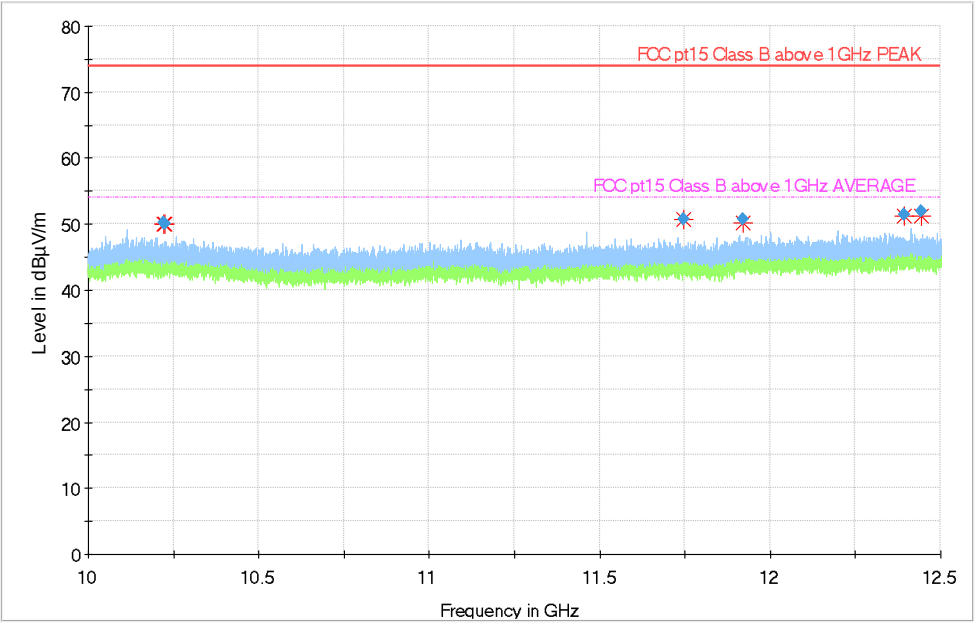
V = Vertical / H = Horizontal

The measurements reported are the highest emissions relative to the FCC/CISPR Class B limits and take into account the correction factor*. Measurements made according to the CISPR test standard and Eurofins E&E UK test procedure RAD-02.
*Correction factor (dB) = cable and antenna losses as summed positive values (dB) – pre-amp gain where applicable (dB).
The recorded measured value (dB) = measured receiver value (dB) + correction factor (dB).
Note: path losses are factored into the limit value, and given by the test standard. Chamber calibration data contributes to the measurement uncertainty figure.

4.5.8 Profile; 10 to 12.5 GHz, FCC 15B (110 V 60 Hz)

Maximum hold trace with peak values (▽)
Maximum hold trace with average values (▼)

10 to 12.5 GHz



4.5.9 Data; 10 to 12.5 GHz, FCC 15B (110 V 60 Hz)

Frequency	Peak	CISPR Average	Class B Limit	Margin	Height	Pol	Azimuth	Corr.	
MHz	dBµV/m	dBµV/m	dBµV/m	dB	cm	H/V	Deg	dB/m	Status
10222.58947	50.23	---	54.00	3.77	168.0	H	85.0	4.5	Pass
10224.67762	50.07	---	54.00	3.93	100.0	H	147.0	4.5	Pass
11745.89968	50.75	---	54.00	3.25	325.0	H	132.0	5.6	Pass
11921.06149	50.73	---	54.00	3.27	247.0	V	192.0	5.6	Pass
12394.12057	51.38	---	54.00	2.62	168.0	V	254.0	6.7	Pass
12442.96251	51.91	---	54.00	2.09	219.0	H	113.0	6.8	Pass

V = Vertical / H = Horizontal

The measurements reported are the highest emissions relative to the FCC/CISPR Class B limits and take into account the correction factor*. Measurements made according to the CISPR test standard and Eurofins E&E UK test procedure RAD-02.
*Correction factor (dB) = cable and antenna losses as summed positive values (dB) – pre-amp gain where applicable (dB).
The recorded measured value (dB) = measured receiver value (dB) + correction factor (dB).
Note: path losses are factored into the limit value, and given by the test standard. Chamber calibration data contributes to the measurement uncertainty figure.

4.6 Occupied Bandwidth

99% occupied bandwidth was measured using the inbuilt function in the spectrum analyser. The results are presented in the table below.

Channel	99% Occupied Bandwidth	Result
Top	1.083 MHz	Pass
Middle	1.073 MHz	Pass
Bottom	1.066 MHZ	Pass

4.6.1 Test Parameters

This testing was performed with the EUT located within the semi-anechoic chamber. No maximisation of the wanted signal is required as only relative measurements are performed for bandwidth tests.

Test Equipment						
#ID	CP	Manufacturer	Type	Serial Number	Description	Calibration Due Date
877	1	Huber & Suhner	SUCOTEST_18A	602608/18A	ST_18A/Nm/Nm/3m	21/11/2023
893	1	Rohde & Schwarz	ESW 44	103044	EMI test receiver	11/11/2023
073	3	Schwarzbeck	BBHA9120B	237	Horn Antenna (1 to 10 GHz)	20/05/2024
Test Equipment Software						
#ID	CP	Manufacturer	Type		Description	Calibration Due Date
No software used for this testing.						

Environmental Test Conditions	
Temperature	24.0
Relative Humidity	51
Atmospheric Pressure	1024.3
Test Date:	14 September 2023
Test Engineer:	Graeme Lawler

Note: “Calibration due date” means the instrument is certified within UKAS or traceable calibration certificate. “Internal” means the instrument is calibrated using Eurofins Hursley procedures. “Not required” means the asset does not require calibration. “CP” is the interval period [year] prescribed for external calibration.

4.6.2 Test Configuration

Please refer to EUT Test Configuration #1.

4.6.3 Set-up Photos

Occupied Bandwidth

4.6.4 Profiles; 99% Occupied Bandwidth

Top Channel (2480 MHz)

Middle Channel (2440 MHz)

Bottom Channel (2402 MHz)

4.7 Conducted Emissions; Charging Mode, FCC (110 V 60 Hz)

4.7.1 Test Parameters

A filtered supply was fed to the EUT via a 50Ω/50µH Artificial Mains Network (AMN). The AMN was bonded to a conductive ground plane. Line and neutral phases were measured separately.

An EMI receiver was set to scan between 0.15 MHz and 30.0 MHz with a 20s measurement time. A CISPR Average and Quasi-Peak trace was generated and compared to the limits and take into account the correction factor. Measurements made according to the test standard and Eurofins E&E UK test procedure CON-02.

Test Equipment						
#ID	CP	Manufacturer	Type	Serial Number	Description	Calibration Due Date
116	1	Rohde & Schwarz	ESH3-Z2	M458	Pulse limiter BNC type	26/05/2024
162	1	Rohde & Schwarz	ESH3 Z5	829996/003	Single phase LISN / AMN ANSI&CISPR	06/12/2023
482	1	-	Cable BNC	0	Cable BNC	10/02/2024
679	1	Gauss	TDEIM30M	1510003	30 MHzTD receiver	18/04/2024
Test Equipment Software						
#ID	CP	Manufacturer	Type		Description	Calibration Due Date
857	0	Gauss	Software	0	TDMI 30 v5.00	Not required

Environmental Test Conditions	
Temperature	25.3° Celsius
Relative Humidity	48 %
Atmospheric Pressure	1015 millibars
Test Date:	15th September 2023
Test Engineer:	Matt Ingall

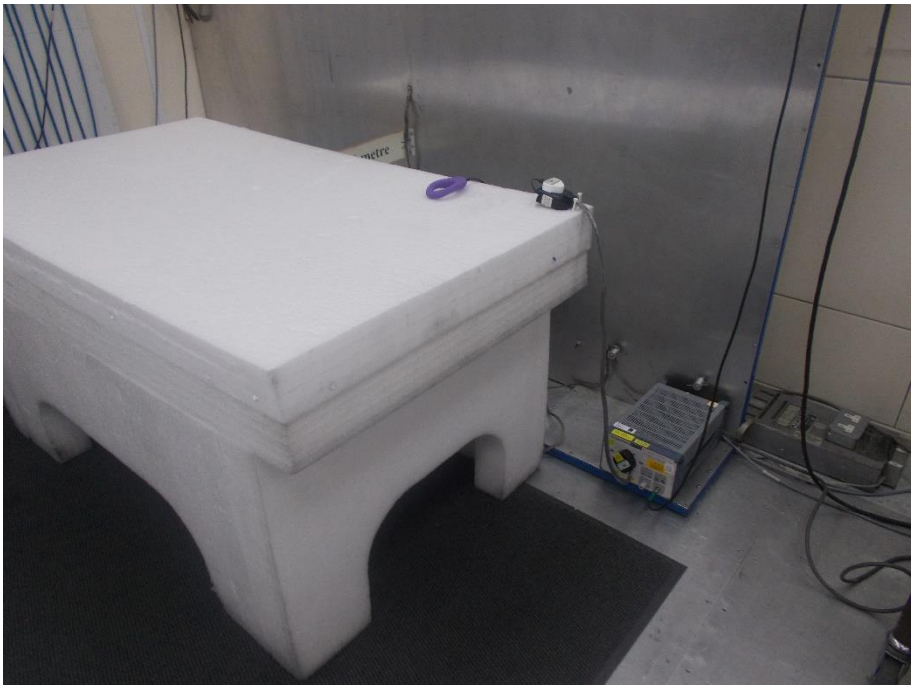
Note: “Calibration due date” means the instrument is certified within UKAS or traceable calibration certificate. “Internal” means the instrument is calibrated using Eurofins E&E UK procedures. “Not required” means the asset does not require calibration. “CP” is the interval period [year] prescribed for external calibration.

4.7.2 Test Configuration

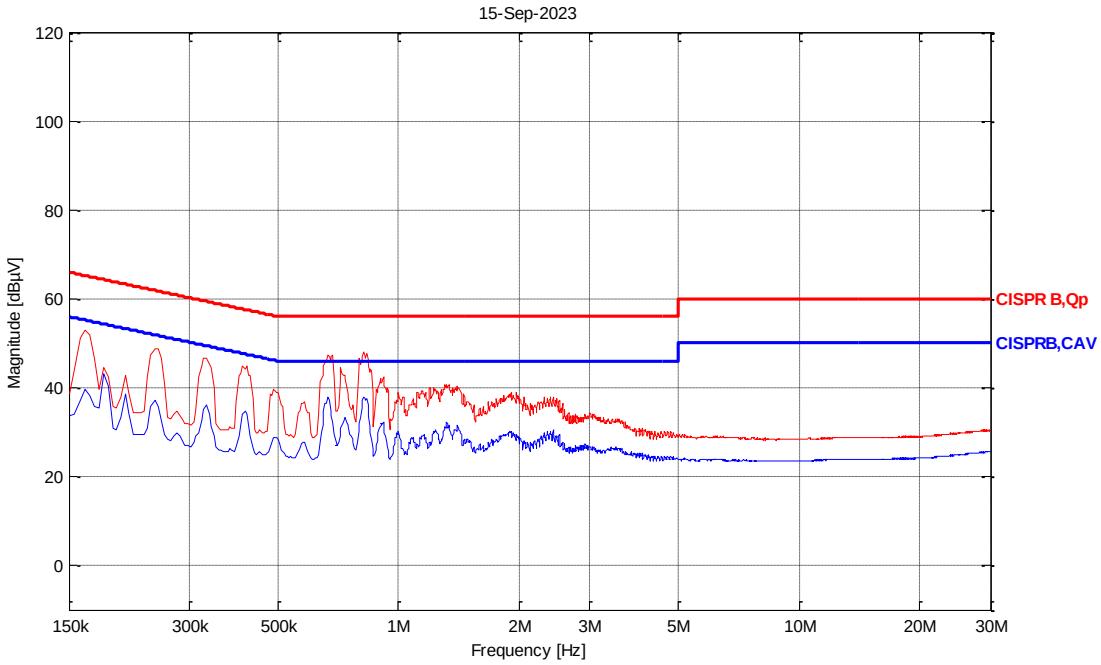
Please refer to EUT Test Configuration #3.

4.7.3 Set-up Photos

Conducted Emissions



4.7.4 Profile; Mains Neutral, Charging Mode, FCC (110 V 60 Hz)



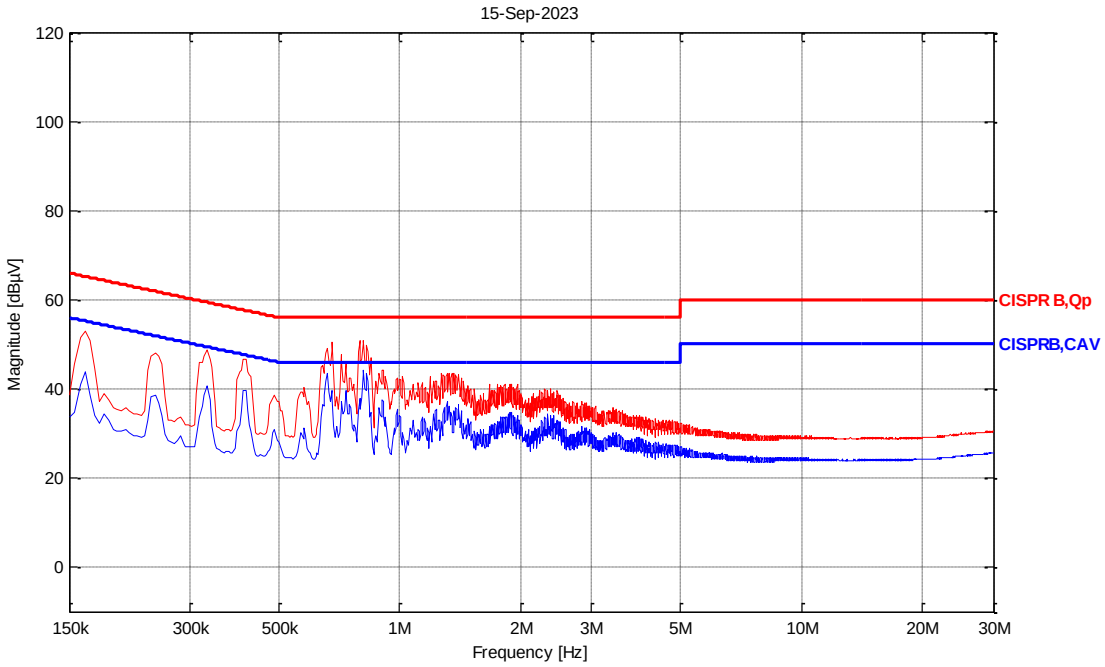
4.7.5 Data; Mains Neutral, Charging Mode, FCC (110 V 60 Hz)

Quasi-peak value (dBµV)				
Frequency	**Measured**	**Class B Limit**	**Margin**	**Status**
817.776 kHz	47.87	56.00	8.13	Pass
5.181 MHz	29.37	60.00	30.63	Pass
14.088 MHz	28.84	60.00	31.16	Pass
19.867 MHz	29.07	60.00	30.93	Pass
24.998 MHz	30.03	60.00	29.97	Pass
29.986 MHz	30.46	60.00	29.54	Pass

CISPR Average value (dBµV)				
Frequency	**Measured**	**Class B Limit**	**Margin**	**Status**
817.776 kHz	37.98	46.00	8.02	Pass
5.200 MHz	24.11	50.00	25.89	Pass
14.765 MHz	23.95	50.00	26.05	Pass
19.977 MHz	24.16	50.00	25.84	Pass
25.003 MHz	25.07	50.00	24.93	Pass
29.819 MHz	25.57	50.00	24.43	Pass

The measured value takes into account the correction factor.
Correction factor (dB) = cable, AMN, and pulse limiter losses as summed positive values (dB)
The recorded measured value (dB) = measured receiver value (dB) + correction factor (dB).

4.7.6 Profile; Mains Line, Charging Mode, FCC (110 V 60 Hz)



4.7.7 Data; Mains Line, Charging Mode, FCC (110 V 60 Hz)

Quasi-peak value (dBµV)				
Frequency	**Measured**	**Class B Limit**	**Margin**	**Status**
793.934 kHz	50.96	56.00	5.04	Pass
5.257 MHz	31.96	60.00	28.04	Pass
10.269 MHz	29.32	60.00	30.68	Pass
19.162 MHz	29.09	60.00	30.91	Pass
24.998 MHz	29.95	60.00	30.05	Pass
29.953 MHz	30.53	60.00	29.47	Pass

CISPR Average value (dBµV)				
Frequency	**Measured**	**Class B Limit**	**Margin**	**Status**
813.007 kHz	44.23	46.00	1.77	Pass
5.176 MHz	26.57	50.00	23.43	Pass
10.192 MHz	24.39	50.00	25.61	Pass
19.963 MHz	24.17	50.00	25.83	Pass
24.998 MHz	25.06	50.00	24.94	Pass
29.919 MHz	25.57	50.00	24.43	Pass

The measured value takes into account the correction factor.
Correction factor (dB) = cable, AMN, and pulse limiter losses as summed positive values (dB)
The recorded measured value (dB) = measured receiver value (dB) + correction factor (dB).

4.8 Conducted Emissions; Top Channel, FCC (110 V 60 Hz)

4.8.1 Test Parameters

A filtered supply was fed to the EUT via a 50Ω/50µH Artificial Mains Network (AMN). The AMN was bonded to a conductive ground plane. Line and neutral phases were measured separately.

An EMI receiver was set to scan between 0.15 MHz and 30.0 MHz with a 20s measurement time. A CISPR Average and Quasi-Peak trace was generated and compared to the limits and take into account the correction factor. Measurements made according to the test standard and Eurofins E&E UK test procedure CON-02.

Test Equipment						
#ID	CP	Manufacturer	Type	Serial Number	Description	Calibration Due Date
116	1	Rohde & Schwarz	ESH3-Z2	M458	Pulse limiter BNC type	26/05/2024
162	1	Rohde & Schwarz	ESH3 Z5	829996/003	Single phase LISN / AMN ANSI&CISPR	06/12/2023
482	1	-	Cable BNC	0	Cable BNC	10/02/2024
679	1	Gauss	TDEIM30M	1510003	30 MHz TD receiver	18/04/2024
Test Equipment Software						
#ID	CP	Manufacturer	Type		Description	Calibration Due Date
857	0	Gauss	Software	0	TDMI 30 v5.00	Not required

Environmental Test Conditions	
Temperature	25.3° Celsius
Relative Humidity	48 %
Atmospheric Pressure	1015 millibars
Test Date:	15th September 2023
Test Engineer:	Matt Ingall

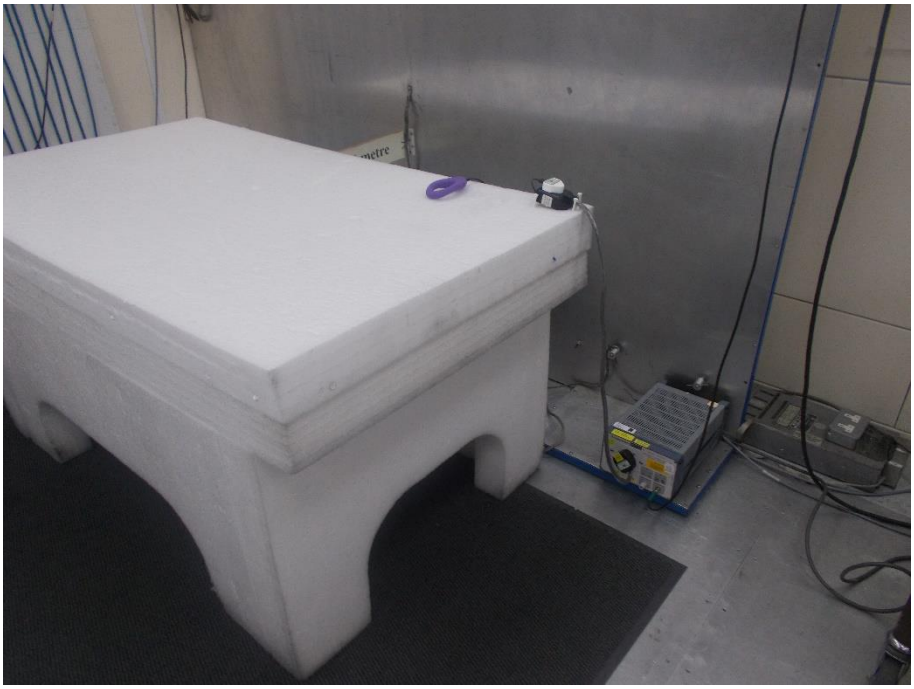
Note: “Calibration due date” means the instrument is certified within UKAS or traceable calibration certificate. “Internal” means the instrument is calibrated using Eurofins E&E UK procedures. “Not required” means the asset does not require calibration. “CP” is the interval period [year] prescribed for external calibration.

4.8.2 Test Configuration

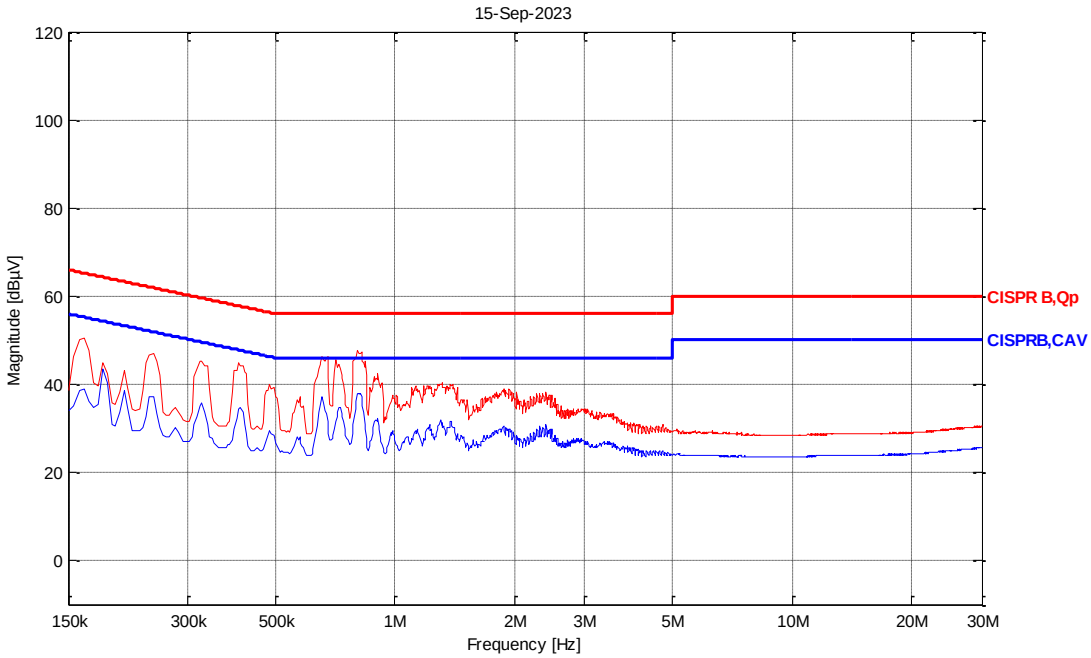
Please refer to EUT Test Configuration #2.

4.8.3 Set-up Photos

Conducted Emissions



4.8.4 Profile; Mains Neutral, Top Channel, FCC (110 V 60 Hz)



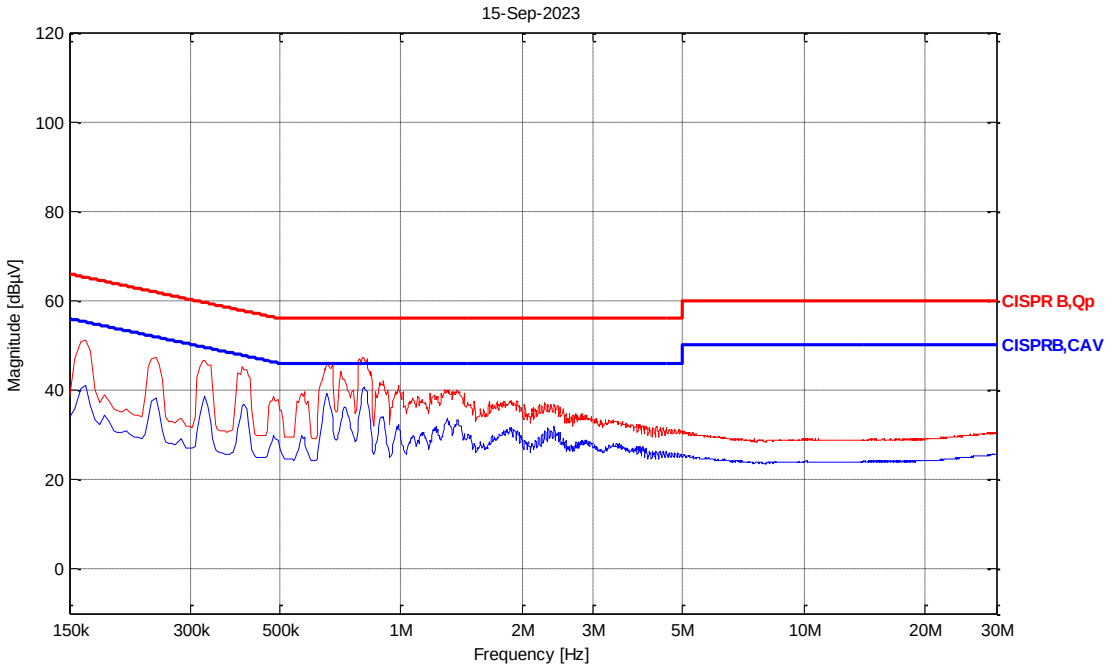
4.8.5 Data; Mains Neutral, Top Channel, FCC (110 V 60 Hz)

Quasi-peak value (dBµV)				
Frequency	**Measured**	**Class B Limit**	**Margin**	**Status**
803.471 kHz	47.56	56.00	8.44	Pass
5.128 MHz	29.61	60.00	30.39	Pass
13.630 MHz	28.85	60.00	31.15	Pass
19.801 MHz	29.07	60.00	30.93	Pass
24.998 MHz	30.03	60.00	29.97	Pass
29.790 MHz	30.47	60.00	29.53	Pass

CISPR Average value (dBµV)				
Frequency	**Measured**	**Class B Limit**	**Margin**	**Status**
808.239 kHz	38.08	46.00	7.92	Pass
5.128 MHz	24.24	50.00	25.76	Pass
14.732 MHz	23.94	50.00	26.06	Pass
20.034 MHz	24.12	50.00	25.88	Pass
24.998 MHz	25.13	50.00	24.87	Pass
29.824 MHz	25.59	50.00	24.41	Pass

The measured value takes into account the correction factor.
Correction factor (dB) = cable, AMN, and pulse limiter losses as summed positive values (dB)
The recorded measured value (dB) = measured receiver value (dB) + correction factor (dB).

4.8.6 Profile; Mains Line, Top Channel, FCC (110 V 60 Hz)



4.8.7 Data; Mains Line, Top Channel, FCC (110 V 60 Hz)

Quasi-peak value (dBµV)				
Frequency	**Measured**	**Class B Limit**	**Margin**	**Status**
803.471 kHz	47.41	56.00	8.59	Pass
5.133 MHz	30.61	60.00	29.39	Pass
10.889 MHz	29.00	60.00	31.00	Pass
19.801 MHz	29.07	60.00	30.93	Pass
24.998 MHz	29.92	60.00	30.08	Pass
29.910 MHz	30.55	60.00	29.45	Pass

CISPR Average value (dBµV)				
Frequency	**Measured**	**Class B Limit**	**Margin**	**Status**
808.239 kHz	40.53	46.00	5.47	Pass
5.133 MHz	25.34	50.00	24.66	Pass
14.160 MHz	24.05	50.00	25.95	Pass
19.896 MHz	24.18	50.00	25.82	Pass
24.998 MHz	25.08	50.00	24.92	Pass
29.809 MHz	25.57	50.00	24.43	Pass

The measured value takes into account the correction factor.
Correction factor (dB) = cable, AMN, and pulse limiter losses as summed positive values (dB)
The recorded measured value (dB) = measured receiver value (dB) + correction factor (dB).

4.9 Conducted Emissions; Middle Channel, FCC (110 V 60 Hz)

4.9.1 Test Parameters

A filtered supply was fed to the EUT via a 50Ω/50µH Artificial Mains Network (AMN). The AMN was bonded to a conductive ground plane. Line and neutral phases were measured separately.

An EMI receiver was set to scan between 0.15 MHz and 30.0 MHz with a 20s measurement time. A CISPR Average and Quasi-Peak trace was generated and compared to the limits and take into account the correction factor. Measurements made according to the test standard and Eurofins E&E UK test procedure CON-02.

Test Equipment						
#ID	CP	Manufacturer	Type	Serial Number	Description	Calibration Due Date
116	1	Rohde & Schwarz	ESH3-Z2	M458	Pulse limiter BNC type	26/05/2024
162	1	Rohde & Schwarz	ESH3 Z5	829996/003	Single phase LISN / AMN ANSI&CISPR	06/12/2023
482	1	-	Cable BNC	0	Cable BNC	10/02/2024
679	1	Gauss	TDEIM30M	1510003	30 MHz TD receiver	18/04/2024
Test Equipment Software						
#ID	CP	Manufacturer	Type		Description	Calibration Due Date
857	0	Gauss	Software	0	TDMI 30 v5.00	Not required

Environmental Test Conditions	
Temperature	25.3° Celsius
Relative Humidity	48 %
Atmospheric Pressure	1015 millibars
Test Date:	15th September 2023
Test Engineer:	Matt Ingall

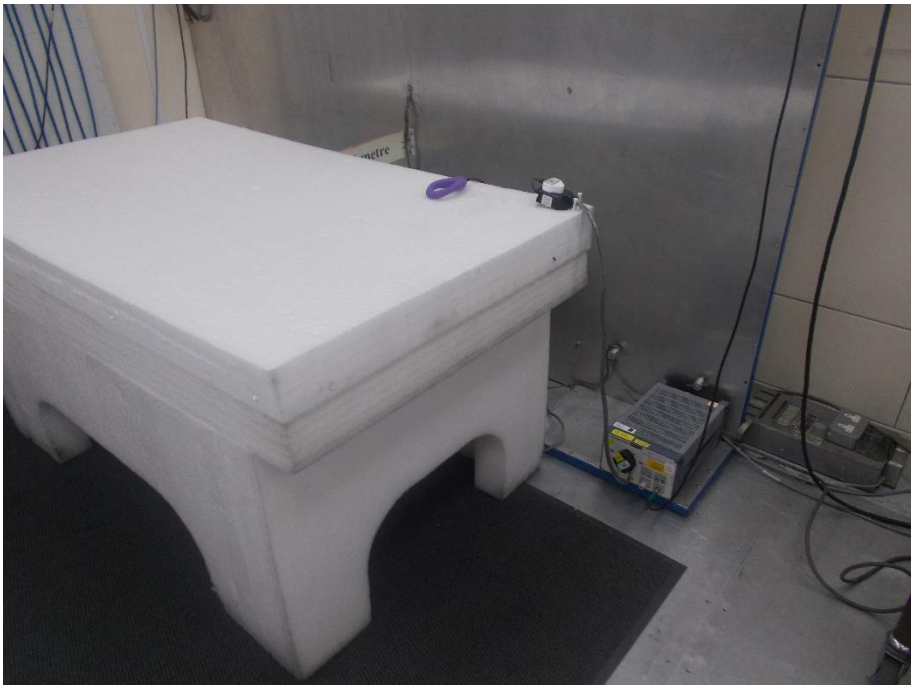
Note: “Calibration due date” means the instrument is certified within UKAS or traceable calibration certificate. “Internal” means the instrument is calibrated using Eurofins E&E UK procedures. “Not required” means the asset does not require calibration. “CP” is the interval period [year] prescribed for external calibration.

4.9.2 Test Configuration

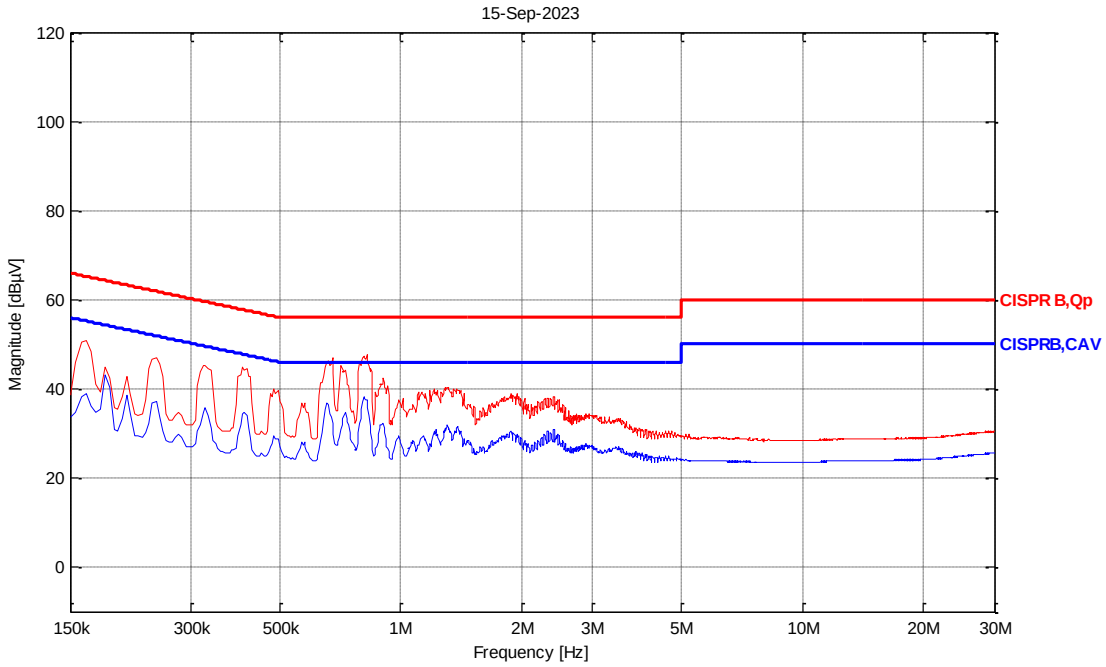
Please refer to EUT Test Configuration #2.

4.9.3 Set-up Photos

Conducted Emissions



4.9.4 Profile; Mains Neutral, Middle Channel, FCC (110 V 60 Hz)



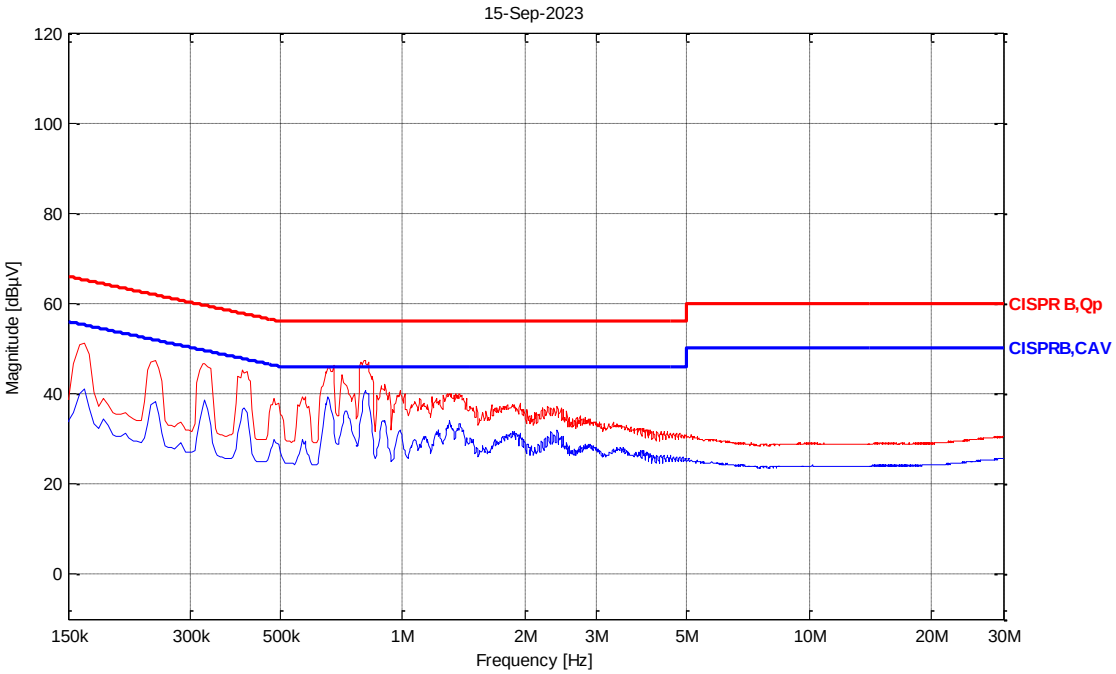
4.9.5 Data; Mains Neutral, Middle Channel, FCC (110 V 60 Hz)

Quasi-peak value (dBµV)				
Frequency	**Measured**	**Class B Limit**	**Margin**	**Status**
822.544 kHz	47.58	56.00	8.42	Pass
5.138 MHz	29.65	60.00	30.35	Pass
14.842 MHz	28.86	60.00	31.14	Pass
19.433 MHz	29.05	60.00	30.95	Pass
24.998 MHz	29.90	60.00	30.10	Pass
29.981 MHz	30.46	60.00	29.54	Pass

CISPR Average value (dBµV)				
Frequency	**Measured**	**Class B Limit**	**Margin**	**Status**
808.239 kHz	38.09	46.00	7.91	Pass
5.143 MHz	24.23	50.00	25.77	Pass
13.258 MHz	23.94	50.00	26.06	Pass
19.953 MHz	24.15	50.00	25.85	Pass
24.998 MHz	25.10	50.00	24.90	Pass
29.867 MHz	25.56	50.00	24.44	Pass

The measured value takes into account the correction factor.
Correction factor (dB) = cable, AMN, and pulse limiter losses as summed positive values (dB)
The recorded measured value (dB) = measured receiver value (dB) + correction factor (dB).

4.9.6 Profile; Mains Line, Middle Channel, FCC (110 V 60 Hz)



4.9.7 Data; Mains Line, Middle Channel, FCC (110 V 60 Hz)

Quasi-peak value (dBµV)				
Frequency	**Measured**	**Class B Limit**	**Margin**	**Status**
803.471 kHz	47.21	56.00	8.79	Pass
5.138 MHz	30.67	60.00	29.33	Pass
10.116 MHz	29.00	60.00	31.00	Pass
19.538 MHz	29.05	60.00	30.95	Pass
24.998 MHz	29.97	60.00	30.03	Pass
29.910 MHz	30.48	60.00	29.52	Pass

CISPR Average value (dBµV)				
Frequency	**Measured**	**Class B Limit**	**Margin**	**Status**
808.239 kHz	40.58	46.00	5.42	Pass
5.133 MHz	25.31	50.00	24.69	Pass
15.023 MHz	24.04	50.00	25.96	Pass
20.001 MHz	24.16	50.00	25.84	Pass
24.998 MHz	25.11	50.00	24.89	Pass
29.829 MHz	25.56	50.00	24.44	Pass

The measured value takes into account the correction factor.
Correction factor (dB) = cable, AMN, and pulse limiter losses as summed positive values (dB)
The recorded measured value (dB) = measured receiver value (dB) + correction factor (dB).

4.10 Conducted Emissions; Bottom Channel, FCC (110 V 60 Hz)

4.10.1 Test Parameters

A filtered supply was fed to the EUT via a 50Ω/50µH Artificial Mains Network (AMN). The AMN was bonded to a conductive ground plane. Line and neutral phases were measured separately.

An EMI receiver was set to scan between 0.15 MHz and 30.0 MHz with a 20s measurement time. A CISPR Average and Quasi-Peak trace was generated and compared to the limits and take into account the correction factor. Measurements made according to the test standard and Eurofins E&E UK test procedure CON-02.

Test Equipment						
#ID	CP	Manufacturer	Type	Serial Number	Description	Calibration Due Date
116	1	Rohde & Schwarz	ESH3-Z2	M458	Pulse limiter BNC type	26/05/2024
162	1	Rohde & Schwarz	ESH3 Z5	829996/003	Single phase LISN / AMN ANSI&CISPR	06/12/2023
482	1	-	Cable BNC	0	Cable BNC	10/02/2024
679	1	Gauss	TDEIM30M	1510003	30 MHz TD receiver	18/04/2024
Test Equipment Software						
#ID	CP	Manufacturer	Type		Description	Calibration Due Date
857	0	Gauss	Software	0	TDMI 30 v5.00	Not required

Environmental Test Conditions	
Temperature	25.3° Celsius
Relative Humidity	48 %
Atmospheric Pressure	1015 millibars
Test Date:	15th September 2023
Test Engineer:	Matt Ingall

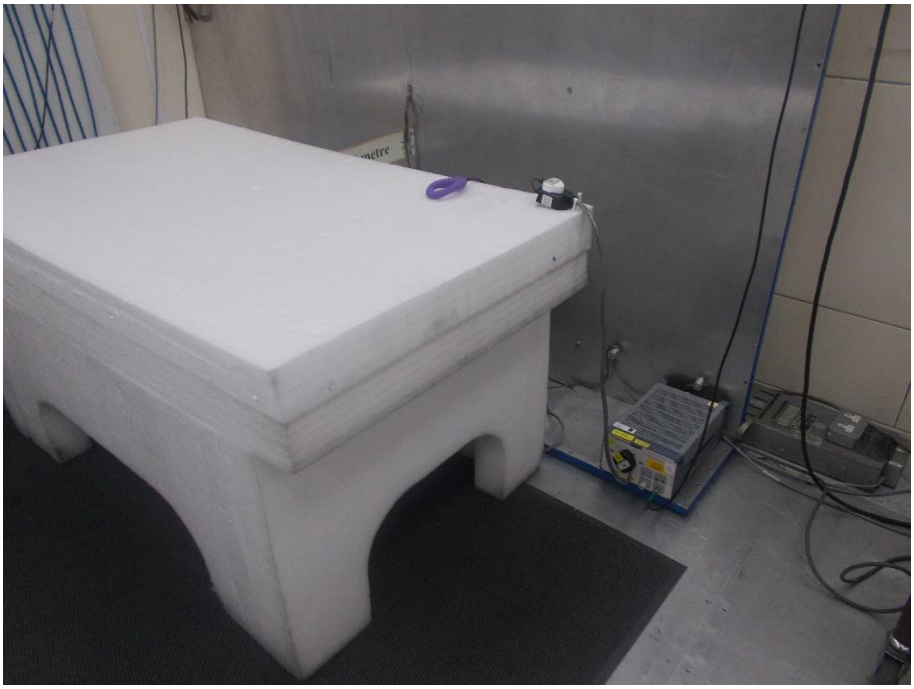
Note: “Calibration due date” means the instrument is certified within UKAS or traceable calibration certificate. “Internal” means the instrument is calibrated using Eurofins E&E UK procedures. “Not required” means the asset does not require calibration. “CP” is the interval period [year] prescribed for external calibration.

4.10.2 Test Configuration

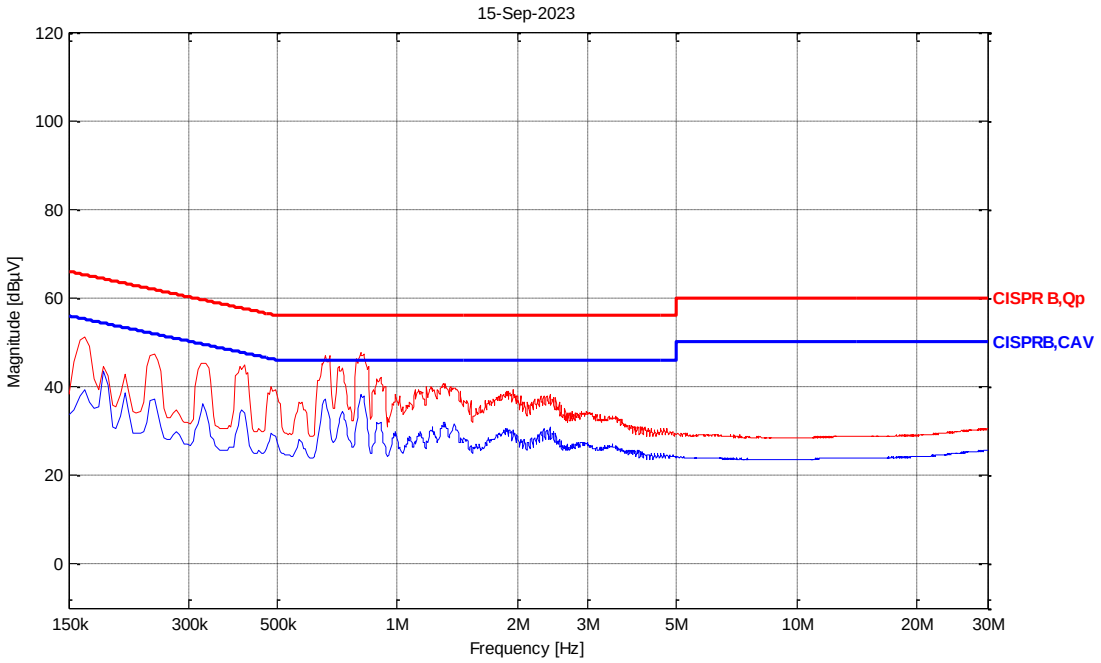
Please refer to EUT Test Configuration #2.

4.10.3 Set-up Photos

Conducted Emissions



4.10.4 Profile; Mains Neutral, Bottom Channel, FCC (110 V 60 Hz)



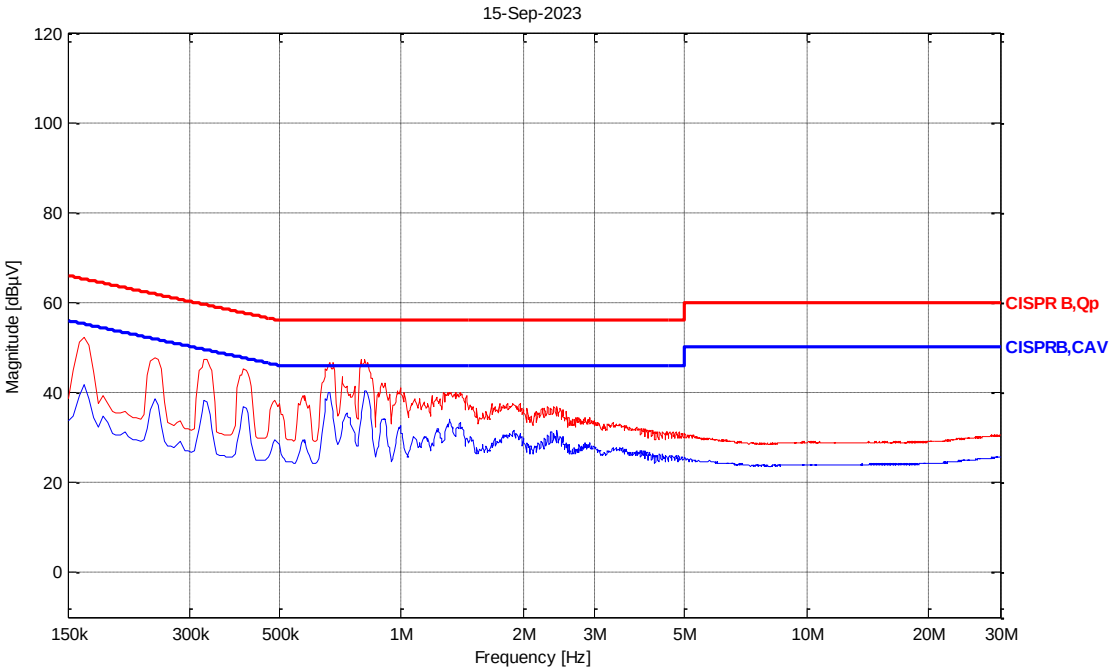
4.10.5 Data; Mains Neutral, Bottom Channel, FCC (110 V 60 Hz)

Quasi-peak value (dBµV)				
Frequency	**Measured**	**Class B Limit**	**Margin**	**Status**
808.239 kHz	47.77	56.00	8.23	Pass
5.147 MHz	29.58	60.00	30.42	Pass
13.874 MHz	28.81	60.00	31.19	Pass
20.034 MHz	29.03	60.00	30.97	Pass
24.998 MHz	29.97	60.00	30.03	Pass
29.676 MHz	30.50	60.00	29.50	Pass

CISPR Average value (dBµV)				
Frequency	**Measured**	**Class B Limit**	**Margin**	**Status**
808.239 kHz	38.04	46.00	7.96	Pass
5.152 MHz	24.15	50.00	25.85	Pass
14.851 MHz	23.93	50.00	26.07	Pass
19.944 MHz	24.11	50.00	25.89	Pass
24.998 MHz	25.13	50.00	24.87	Pass
29.719 MHz	25.58	50.00	24.42	Pass

The measured value takes into account the correction factor.
Correction factor (dB) = cable, AMN, and pulse limiter losses as summed positive values (dB)
The recorded measured value (dB) = measured receiver value (dB) + correction factor (dB).

4.10.6 Profile; Mains Line, Bottom Channel, FCC (110 V 60 Hz)



4.10.7 Data; Mains Line, Bottom Channel, FCC (110 V 60 Hz)

Quasi-peak value (dBµV)				
Frequency	**Measured**	**Class B Limit**	**Margin**	**Status**
813.007 kHz	47.37	56.00	8.63	Pass
5.257 MHz	30.64	60.00	29.36	Pass
10.235 MHz	29.00	60.00	31.00	Pass
19.767 MHz	29.15	60.00	30.85	Pass
24.998 MHz	29.97	60.00	30.03	Pass
29.948 MHz	30.47	60.00	29.53	Pass

CISPR Average value (dBµV)				
Frequency	**Measured**	**Class B Limit**	**Margin**	**Status**
813.007 kHz	40.42	46.00	5.58	Pass
5.176 MHz	25.33	50.00	24.67	Pass
14.336 MHz	24.06	50.00	25.94	Pass
19.720 MHz	24.16	50.00	25.84	Pass
24.998 MHz	25.08	50.00	24.92	Pass
29.976 MHz	25.57	50.00	24.43	Pass

The measured value takes into account the correction factor.
Correction factor (dB) = cable, AMN, and pulse limiter losses as summed positive values (dB)
The recorded measured value (dB) = measured receiver value (dB) + correction factor (dB).

4.11 Conducted Emissions; CISPR (230 V 50 Hz)

4.11.1 Test Parameters

A filtered supply was fed to the EUT via a 50Ω/50µH Artificial Mains Network (AMN). The AMN was bonded to a conductive ground plane. Line and neutral phases were measured separately.

An EMI receiver was set to scan between 0.15 MHz and 30.0 MHz with a 20s measurement time. A CISPR Average and Quasi-Peak trace was generated and compared to the limits and take into account the correction factor. Measurements made according to the test standard and Eurofins E&E UK test procedure CON-02.

Test Equipment						
#ID	CP	Manufacturer	Type	Serial Number	Description	Calibration Due Date
116	1	Rohde & Schwarz	ESH3-Z2	M458	Pulse limiter BNC type	26/05/2024
162	1	Rohde & Schwarz	ESH3 Z5	829996/003	Single phase LISN / AMN ANSI&CISPR	06/12/2023
482	1	-	Cable BNC	0	Cable BNC	10/02/2024
679	1	Gauss	TDEIM30M	1510003	30 MHz TD receiver	18/04/2024
Test Equipment Software						
#ID	CP	Manufacturer	Type		Description	Calibration Due Date
857	0	Gauss	Software	0	TDMI 30 v5.00	Not required

Environmental Test Conditions	
Temperature	25.3° Celsius
Relative Humidity	48 %
Atmospheric Pressure	1015 millibars
Test Date:	15th September 2023
Test Engineer:	Matt Ingall

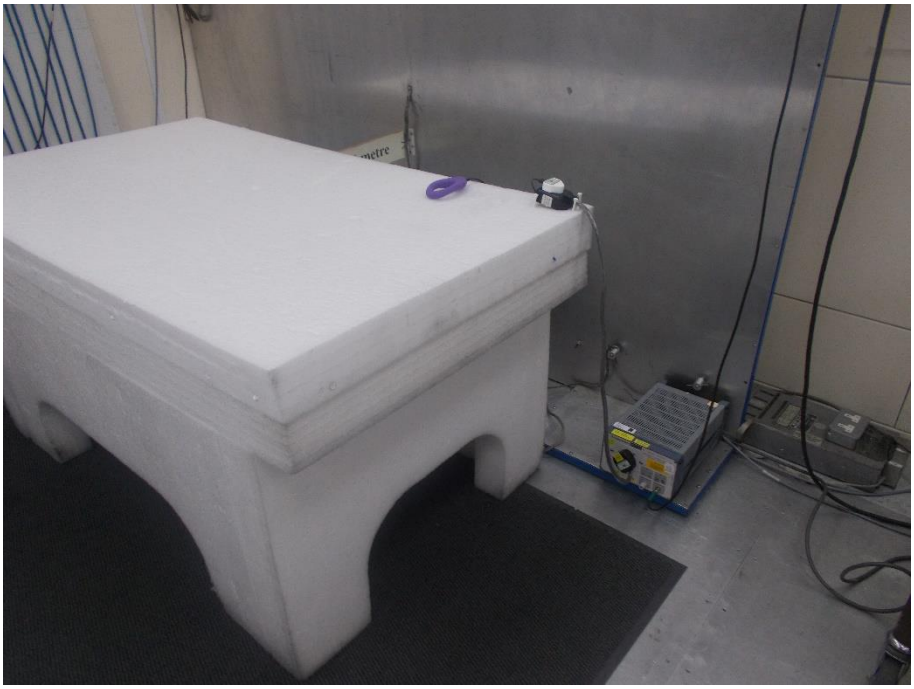
Note: “Calibration due date” means the instrument is certified within UKAS or traceable calibration certificate. “Internal” means the instrument is calibrated using Eurofins E&E UK procedures. “Not required” means the asset does not require calibration. “CP” is the interval period [year] prescribed for external calibration.

4.11.2 Test Configuration

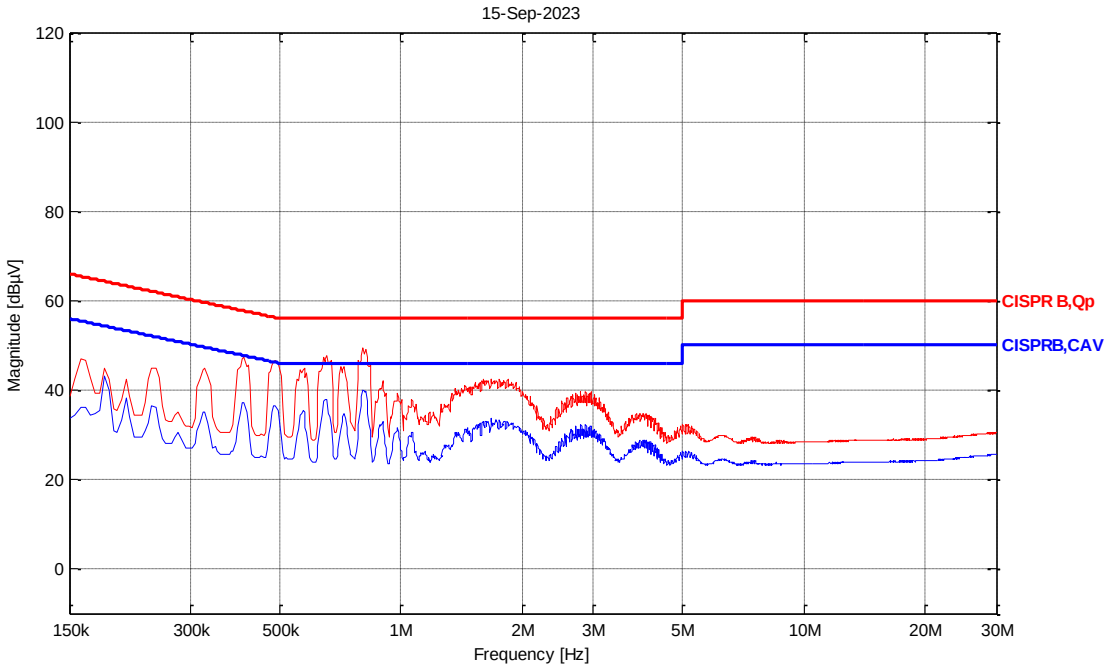
Please refer to EUT Test Configuration #3.

4.11.3 Set-up Photos

Conducted Emissions



4.11.4 Profile; Mains Neutral, CISPR (230 V 50 Hz)



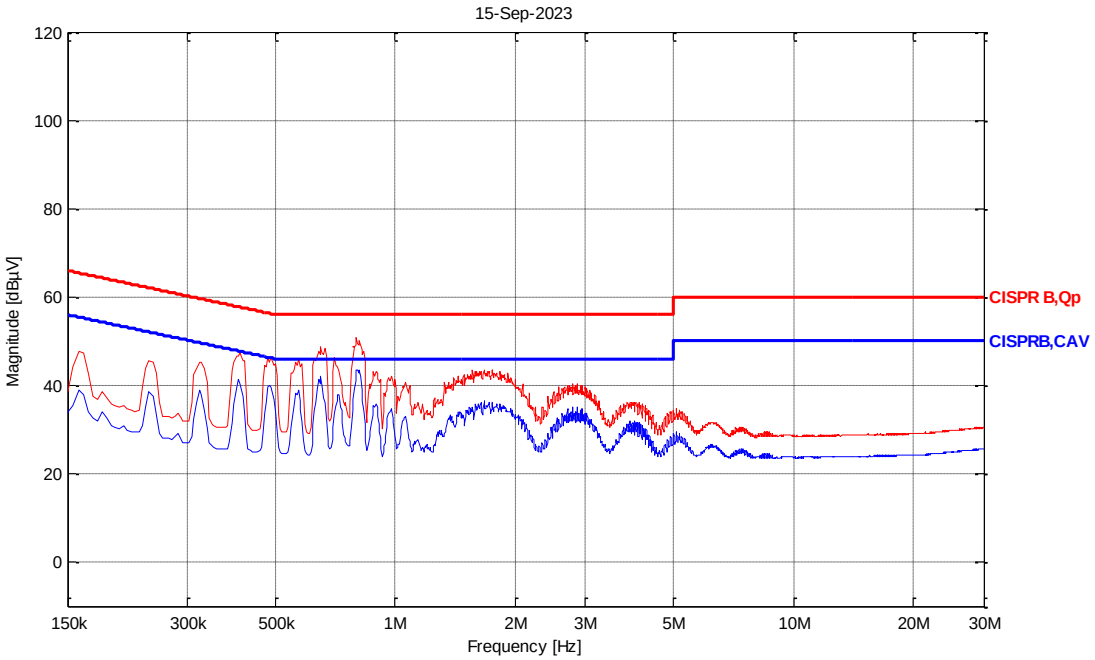
4.11.5 Data; Mains Neutral, CISPR (230 V 50 Hz)

Quasi-peak value (dBµV)				
Frequency	**Measured**	**Class B Limit**	**Margin**	**Status**
803.471 kHz	49.43	56.00	6.57	Pass
5.181 MHz	32.08	60.00	27.92	Pass
15.018 MHz	28.84	60.00	31.16	Pass
19.557 MHz	29.02	60.00	30.98	Pass
24.998 MHz	29.93	60.00	30.07	Pass
29.957 MHz	30.49	60.00	29.51	Pass

CISPR Average value (dBµV)				
Frequency	**Measured**	**Class B Limit**	**Margin**	**Status**
803.471 kHz	40.02	46.00	5.98	Pass
5.176 MHz	26.25	50.00	23.75	Pass
14.999 MHz	23.97	50.00	26.03	Pass
19.982 MHz	24.15	50.00	25.85	Pass
24.998 MHz	25.08	50.00	24.92	Pass
29.914 MHz	25.60	50.00	24.40	Pass

The measured value takes into account the correction factor.
Correction factor (dB) = cable, AMN, and pulse limiter losses as summed positive values (dB)
The recorded measured value (dB) = measured receiver value (dB) + correction factor (dB).

4.11.6 Profile; Mains Line, CISPR (230 V 50 Hz)



4.11.7 Data; Mains Line, CISPR (230 V 50 Hz)

Quasi-peak value (dBµV)				
Frequency	**Measured**	**Class B Limit**	**Margin**	**Status**
798.702 kHz	50.72	56.00	5.28	Pass
5.152 MHz	34.41	60.00	25.59	Pass
14.894 MHz	28.88	60.00	31.12	Pass
19.915 MHz	29.17	60.00	30.83	Pass
24.998 MHz	29.92	60.00	30.08	Pass
29.995 MHz	30.46	60.00	29.54	Pass

CISPR Average value (dBµV)				
Frequency	**Measured**	**Class B Limit**	**Margin**	**Status**
813.007 kHz	43.48	46.00	2.52	Pass
5.157 MHz	29.09	50.00	20.91	Pass
14.546 MHz	24.00	50.00	26.00	Pass
20.039 MHz	24.23	50.00	25.77	Pass
25.003 MHz	25.08	50.00	24.92	Pass
29.900 MHz	25.59	50.00	24.41	Pass

The measured value takes into account the correction factor.
Correction factor (dB) = cable, AMN, and pulse limiter losses as summed positive values (dB)
The recorded measured value (dB) = measured receiver value (dB) + correction factor (dB).

5.0 MEASUREMENT UNCERTAINTIES

Emissions tests

For all emissions tests, measurement uncertainties have been calculated in line with the requirements of CISPR 16-4-2 to give a confidence level of greater than 95 %. In all cases the laboratories calculated uncertainty values (known as Ulab) are equal to or are less than the expected uncertainty values contained in CISPR 16-4-2 (known as Ucispr). Below is a list of the laboratories calculated measurement uncertainties:

Conducted emissions:

Via AMN/LISN:	±3.27 dB (9 kHz – 150 kHz), ±3.27 dB (150 kHz – 30 MHz)
Via AAN/ISN:	±5.00 dB (150 kHz – 30 MHz)
Via CVP:	±3.47 dB (150 kHz – 30 MHz)
Via CP:	±2.69 dB (150 kHz – 30 MHz)
Via 100 Ω:	±2.68 dB (150 kHz – 30 MHz)
Clicks:	±2.83 dB (150 kHz – 30 MHz)
Harmonics:	±1.42 % (100 Hz – 2 kHz)
Flicker:	±1.76 % (worst case for all parameters)

Radiated emissions:

H-Field:	±2.84 dB (9 kHz – 3 MHz), ±2.92 dB (3 MHz – 3 0 MHz)
D = 3.0 m (Horizontal):	±3.91 dB (30 MHz – 1 GHz SAC), ±3.82 dB (30 MHz – 1 GHz FAC)
D = 3.0 m (Vertical):	±5.22 dB (30 MHz – 1 GHz SAC), ±3.82 dB (30 MHz – 1 GHz FAC)
D = 3.0 m:	±5.13 dB (1 GHz – 6 GHz SAC), ±5.15 dB (1 GHz – 10 GHz SAC), ±3.64 dB (10 GHz – 18 GHz SAC), ±3.10 dB (18 GHz – 40 GHz SAC). ±3.05 dB (1 GHz – 6 GHz FAC)

Radiated spurious emissions (RSE):

±1.71 dB (30 MHz – 1 GHz), ±1.81 dB (1 – 12.75 GHz), ±2.07 dB (12.75 – 18 GHz)

Immunity tests

For IEC 61000-4-2, IEC 61000-4-4, IEC 61000-4-5, IEC 61000-4-8, IEC 61000-4-9, IEC 61000-4-11 tests, the following applies:

Measurement uncertainty has been calculated or calibrated for the various required parameters to provide a confidence level of 95 % (k=2). These parameters have been compared to the basic standard tolerance requirements for each of the various parameters.
In all cases the calculated or calibrated uncertainty meets the basic standard requirements.

For IEC 61000-4-3, IEC 61000-4-6 tests, the following applies:

Measurement uncertainty has been calculated to provide a confidence level of 95 %, or k=2, but this has not been applied to the applied test level, therefore the applied test level has an uncertainty of ±50 %. This is in accordance with CENELEC and other international guidance.

In the case of Maritime equipment tested to EN/IEC 60945, there is a specific requirement that the applied test level be increased by the calculated measurement uncertainty. This is done by applying a coverage factor of k=1.64, which provides a 95 % confidence that the applied test level has been achieved.

Test Results - Decision Rules

As the decision is generally inherent in the standard for Commercial EMC a simple acceptance rule can be applied. The following statement will be added to EMC quotes and reports. "The Decision Rule is applied on the basis of CISPR16-4-2 and/or EN61000-4-x (TR61000-1-6) These standards provide guidance on how to calculate and apply measurement uncertainty whilst providing maximum uncertainties allowance. Due consideration will also be given to JCGM 106:2012, ILAC-G8:09/2019 and LAB 48. This laboratory has demonstrated by calibrating its equipment and facilities, and calculating its own uncertainties, that it complies with the above requirements and therefore no allowance of uncertainties has been given to the tolerances." Where a result is considered marginal in respect of its proximity to the limit line, for example, the customer would be made aware of situation so that they can make an informed decision on how to proceed.

Published 06/01/2023

End of Document