
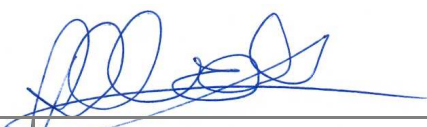


EMC Spot Check Test Report	
<b>For:</b>	Displaydata Limited
<b>Product:</b>	Electronic Shelf Label
<b>Models:</b>	Chroma 21+ (DD21-3A), FCC ID: VC7-A001452, IC: 8910A-A001452 Chroma 27+ (DD27-3A), FCC ID: VC7-A001460, IC: 8910A-A001460 Chroma 29+ (DD29-3A), FCC ID: VC7-A001463, IC: 8910A-A001463
	
<b>Project Engineer:</b>	Danny Dzenis
	
<b>Approval Signatory:</b>	Andy Coombes

<b>Document Reference:</b>	4786 ER
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Issue Number:	Date:	Test Report Revisions History:
1	14 <sup>th</sup> April 2023	Original Report Issued

<b>UKAS Accredited:</b>	1871
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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 E&E Hursley File: 4786

### 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 <b>emissions</b> test requirements of the following standards:			
Description	General Standard	Referenced Standard	Status
Radiated Emissions (30MHz to 10GHz)	FCC/CFR 47:Part 15B 15.109 FCC/CFR 47:Part 15C 15.249 ICES 003:Issue 7	ANSI C63.4:2014	Pass

Note:

The highest internal operating frequency declared by the manufacturer is 927.5MHz.

### 3.0 EQUIPMENT AND TEST DETAILS

#### 3.1 General

<b>Product (EUT):</b>	Electronic Shelf Label		
<b>Models:</b>	<b>FCC ID:</b>	<b>IC:</b>	<b>Serial Numbers:</b>
Chroma 21+ (DD21-3A)	VC7-A001452	8910A-A001452	SC10000020C
Chroma 27+ (DD27-3A)	VC7-A001460	8910A-A001460	TE10000084C
Chroma 29+ (DD29-3A)	VC7-A001463	8910A-A001463	TG10000037C
<b>Sample Build:</b>	Production Sample		
<b>EUT Power:</b>	Battery Powered		
<b>Customer Test Plan:</b>	Not Applicable		
<b>Alternate Models:</b>	Not Applicable		
<b>EUT Manufacturer:</b>	Displaydata Limited		
<b>Customer Name:</b>	Displaydata Limited		
<b>Customer Address:</b>	Unit 12 Headley Park 10 Headly Road East Woodley Reading RG5 4SW United Kingdom		
<b>Test Commissioned By:</b>	Andy Lee		
<b>Date EUT Received:</b>	5 <sup>th</sup> April 2023		
<b>Test Date(s):</b>	5 <sup>th</sup> and 6 <sup>th</sup> April 2023		
<b>EMC Measurement Site:</b>	Eurofins E&E Hursley Limited Trafalgar Close, Chandlers Ford, Hampshire, United Kingdom		
<b>Product Category:</b>	IT and Multimedia Electrical Equipment		

### 3.2 EUT Description

The EUT is an electronic shelf label using radio technology which operates within the band 902MHz to 928MHz.

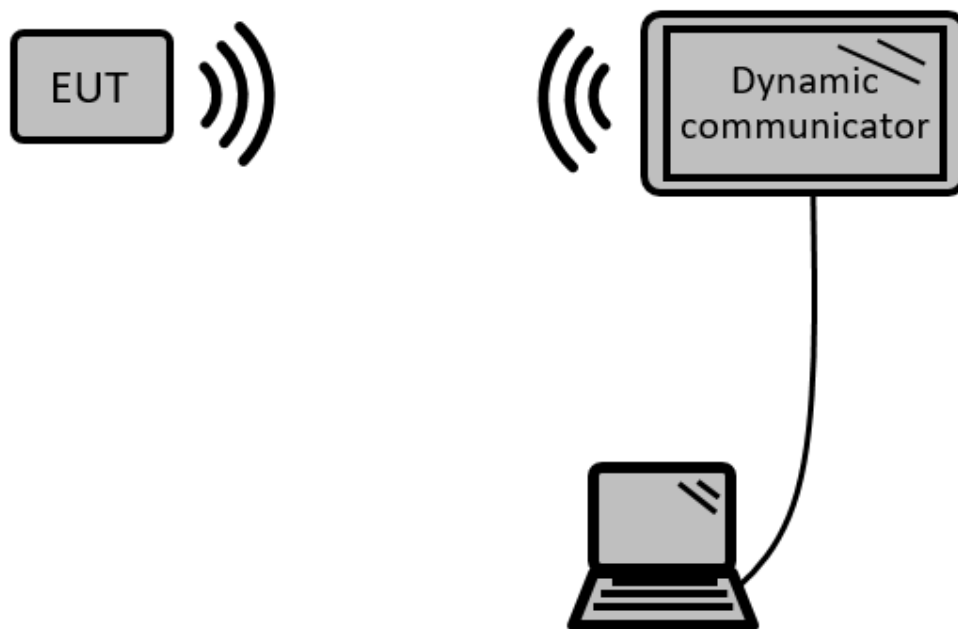
### 3.3 Support Equipment

Description	Manufacturer	Model	Serial Number
Laptop	Dell	Latitude E6520	H067T A00
Dynamic Communicator	Not Applicable	E2	ZC00018022

### 3.4 EUT Test Exerciser

For Radiated Emissions testing, the radio was set to transmit at power level 5 for the Chroma 21+ (DD21-3A) and Chroma 27+ (DD27-3A) units and power level 7 for the Chroma 29+ (DD29-3A) unit, at 100kbps continuously on the middle channel (913.5MHz).

### 3.5 EUT Test Configuration #1



## 4.0 TEST RESULTS

### 4.1 Radiated Emissions; Chroma 21+ (DD21-3A), Middle Frequency Channel (913.5MHz)

#### 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 (1.0-26.5GHz)	24/10/2023
073	3	Schwarzbeck	BBHA9120B	237	Horn Antenna (1-10GHz)	20/05/2024
340	1	Sucoflex with #053 Pre-amplifier	104	0	26.5GHz	24/10/2023
750	1	Global	CISPR16	1	11 x 7 x 6.2m, chamber	22/12/2023
762	3	Schwarzbeck	VULB9162	129	30-7000MHz	04/03/2024
762a	3	Schwarzbeck	DGA 9552N	0	Attenuator (6dB) for #762	04/03/2024
778	1	IntelliConnect	Cable N-Type	I5071	Cable N-Type	21/11/2023
877	1	Huber & Suhner	SUCOTEST_18A	602608/18A	ST_18A/Nm/Nm/3m	19/04/2023
893	1	Rohde & Schwarz	ESW 44	103044	EMI test receiver	11/11/2023
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 1GHz	Above 1GHz
Temperature	19.8° Celsius	19.4° Celsius
Relative Humidity	44%	52%
Atmospheric Pressure	1021 millibars	1016.5 millibars
<b>Test Date:</b>	5 <sup>th</sup> April 2023	6 <sup>th</sup> April 2023
<b>Test Engineer:</b>	Danny Dzenis	Danny Dzenis

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.

#### 4.1.2 Test Configuration

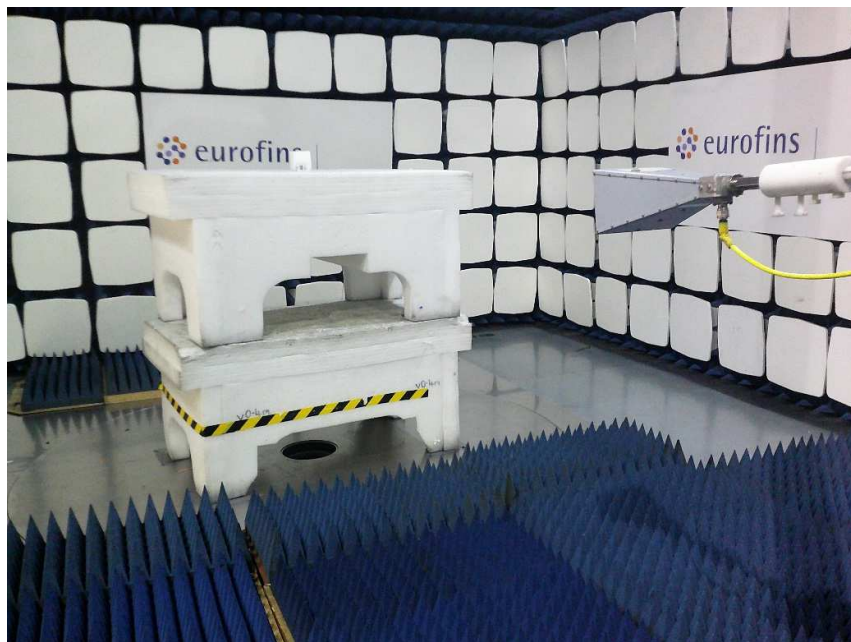
Please refer to EUT Test Configuration #1.

4.1.3 Set-up Photos; Chroma 21+ (DD21-3A), Middle Frequency Channel (913.5MHz)

Radiated Emissions; Below 1GHz



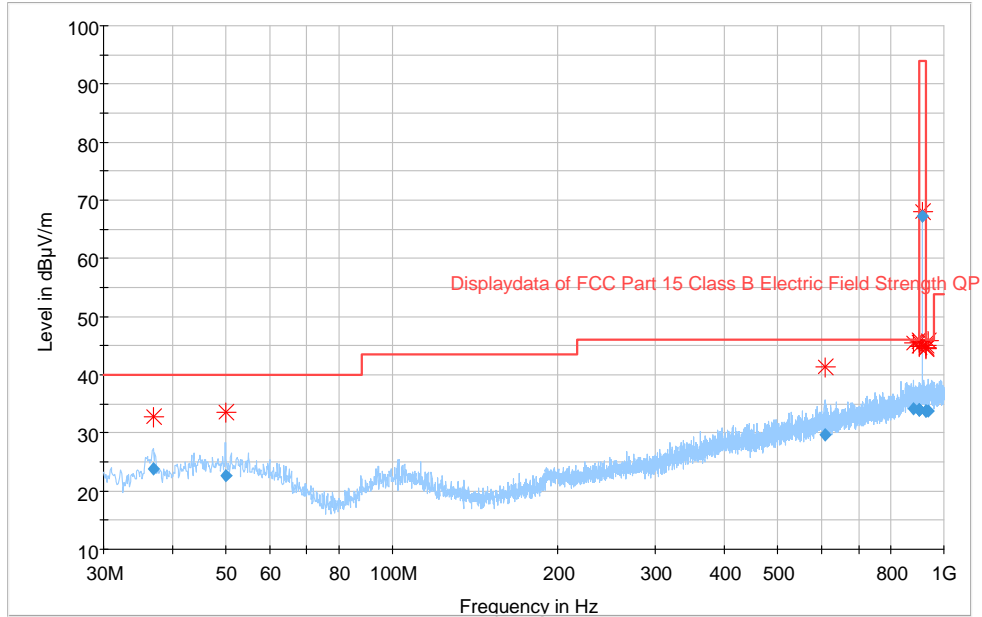
Radiated Emissions; Above 1GHz





4.1.4 Profile; 30MHz to 1GHz, Chroma 21+ (DD21-3A), Middle Frequency Channel (913.5MHz), Orientation, Landscape  
 Maximum peak hold trace with quasi-peak values (◆)  
 Peak measurements (\*)

30MHz to 1GHz



4.1.5 Data; 30MHz to 1GHz, Chroma 21+ (DD21-3A), Middle Frequency Channel (913.5MHz), Orientation, Landscape

Emission Frequency	Measured Quasi-Peak Value	Class B Specified Quasi-Peak Limit	Pass Margin	Antenna Polarisation	Antenna Height	Turntable Azimuth	Status
MHz	dBµV/m	dBµV/m	dB	H/V	cm	deg	
36.932500	23.75	40.00	16.25	V	236.0	5.0	Pass
49.975000	22.67	40.00	17.33	V	247.0	16.0	Pass
607.500000	29.76	46.00	16.24	H	243.0	216.0	Pass
878.500000	34.20	46.00	11.80	H	265.0	199.0	Pass
901.950000	33.91	46.00	12.09	H	324.0	223.0	Pass
902.000000	33.95	94.00	60.05	V	177.0	327.0	Pass
902.500000	33.88	94.00	60.12	V	284.0	309.0	Pass
913.500000	67.18	94.00	26.82	V	118.0	101.0	Pass
927.500000	33.77	94.00	60.23	V	356.0	73.0	Pass
928.000000	33.81	94.00	60.19	H	147.0	27.0	Pass
928.050000	33.79	46.00	12.21	V	209.0	293.0	Pass
934.750000	33.86	46.00	12.14	H	392.0	33.0	Pass

V = Vertical / H = Horizontal

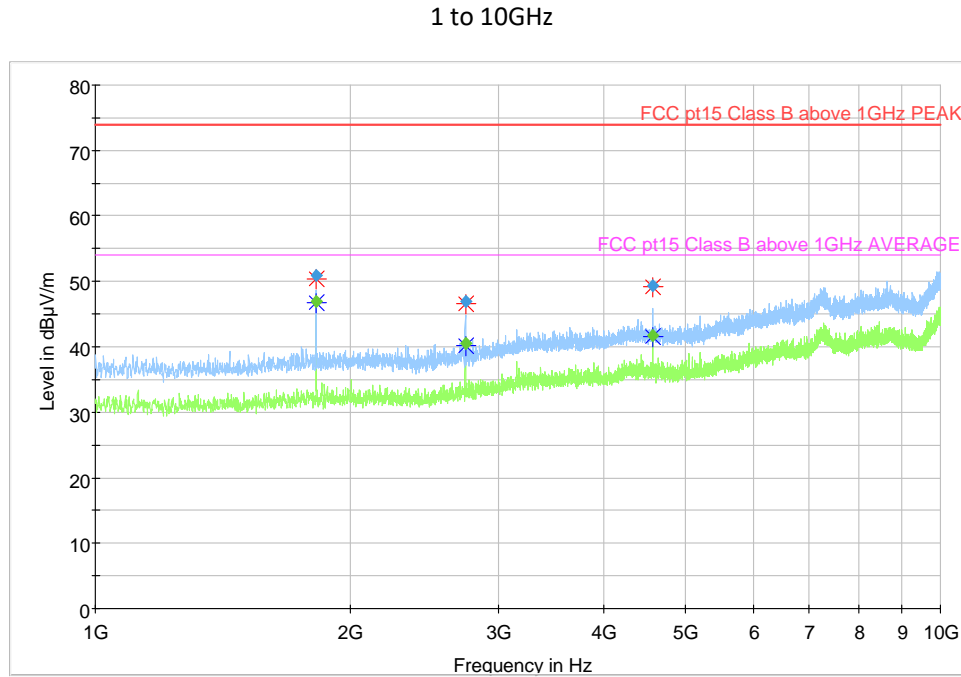
The measurements reported are the highest emissions relative to the FCC/CISPR Class B limits and take into account the correction factor\*. Measurements made according to the ANSI C63.4 test standard and Eurofins Hursley test procedure RAD-01.

\*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.

- 4.1.6 Profile; 1 to 10GHz, Chroma 21+ (DD21-3A), Middle Frequency Channel (913.5MHz), Orientation, Landscape  
 Maximum hold trace with peak values (◆)  
 Peak measurements (✱)  
 Average measurements (◆)



4.1.7 Data; 1 to 10GHz, Chroma 21+ (DD21-3A), Middle Frequency Channel (913.5MHz), Orientation, Landscape

Frequency	Peak	CISPR Average	Class B Limit	Margin	Height	Pol	Azimuth	Corr.	Status
MHz	dBµV/m	dBµV/m	dBµV/m	dB	cm	H/V	Deg	dB/m	
1827.012016	50.84	---	74.00	23.16	138.0	H	17.0	-6.9	Pass
1827.160450	---	46.92	54.00	7.08	138.0	H	19.0	-6.9	Pass
2740.272236	---	40.57	54.00	13.43	147.0	H	44.0	-5.0	Pass
2740.392127	46.94	---	74.00	27.06	167.0	H	343.0	-5.0	Pass
4567.346454	---	41.76	54.00	12.24	100.0	V	199.0	-0.5	Pass
4567.831738	49.36	---	74.00	24.64	119.0	V	190.0	-0.5	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 ANSI C63.4 test standard and Eurofins Hursley test procedure RAD-01.

\*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 Radiated Emissions; Chroma 27+ (DD27-3A), Middle Frequency Channel (913.5MHz)

### 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 (1.0-26.5GHz)	24/10/2023
073	3	Schwarzbeck	BBHA9120B	237	Horn Antenna (1-10GHz)	20/05/2024
340	1	Sucoflex with #053 Pre-amplifier	104	0	26.5GHz	24/10/2023
750	1	Global	CISPR16	1	11 x 7 x 6.2m, chamber	22/12/2023
762	3	Schwarzbeck	VULB9162	129	30-7000MHz	04/03/2024
762a	3	Schwarzbeck	DGA 9552N	0	Attenuator (6dB) for #762	04/03/2024
778	1	IntelliConnect	Cable N-Type	I5071	Cable N-Type	21/11/2023
877	1	Huber & Suhner	SUCOTEST_18A	602608/18A	ST_18A/Nm/Nm/3m	19/04/2023
893	1	Rohde & Schwarz	ESW 44	103044	EMI test receiver	11/11/2023
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 1GHz	Above 1GHz
Temperature	19.8° Celsius	19.4° Celsius
Relative Humidity	44%	52%
Atmospheric Pressure	1021 millibars	1016.5 millibars
<b>Test Date:</b>	5 <sup>th</sup> April 2023	6 <sup>th</sup> April 2023
<b>Test Engineer:</b>	Danny Dzenis	Danny Dzenis

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.

### 4.2.2 Test Configuration

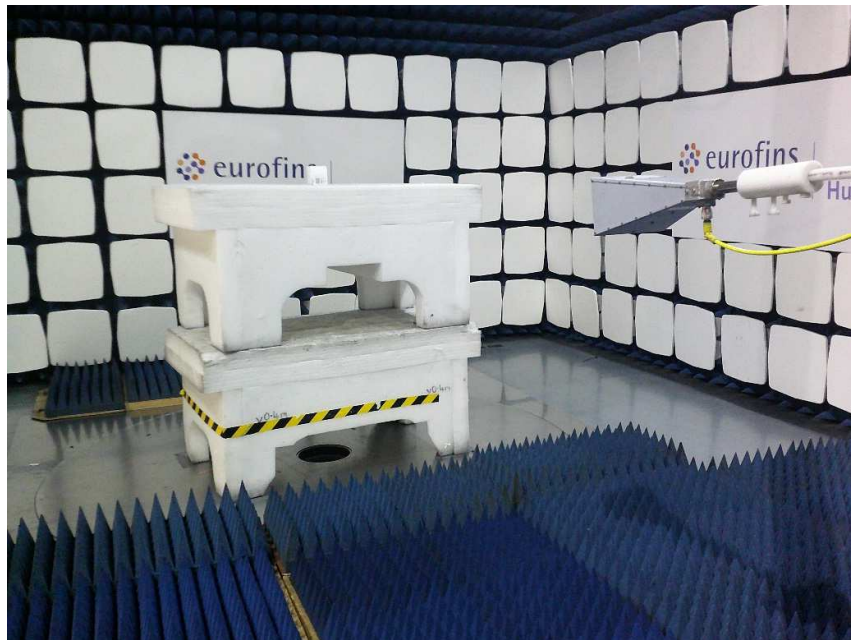
Please refer to EUT Test Configuration #1.

4.2.3 Set-up Photos; Chroma 27+ (DD27-3A), Middle Frequency Channel (913.5MHz)

Radiated Emissions; Below 1GHz

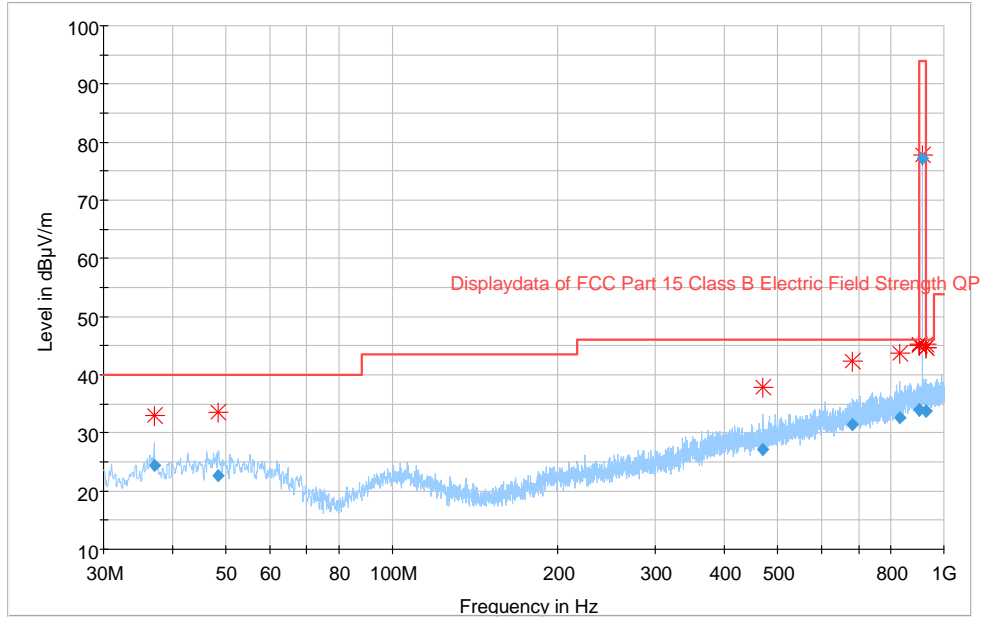


Radiated Emissions; Above 1GHz



4.2.4 Profile; 30MHz to 1GHz, Chroma 27+ (DD27-3A), Middle Frequency Channel (913.5MHz), Orientation, Landscape  
 Maximum peak hold trace with quasi-peak values (◆)  
 Peak measurements (\*)

30MHz to 1GHz



4.2.5 Data; 30MHz to 1GHz, Chroma 27+ (DD27-3A), Middle Frequency Channel (913.5MHz), Orientation, Landscape

Emission Frequency	Measured Quasi-Peak Value	Class B Specified Quasi-Peak Limit	Pass Margin	Antenna Polarisation	Antenna Height	Turntable Azimuth	Status
MHz	dBµV/m	dBµV/m	dB	H/V	cm	deg	
37.050000	24.43	40.00	15.57	V	100.0	139.0	Pass
48.447500	22.70	40.00	17.30	H	339.0	113.0	Pass
468.510000	27.19	46.00	18.81	H	160.0	272.0	Pass
680.750000	31.45	46.00	14.55	H	219.0	140.0	Pass
830.625000	32.50	46.00	13.50	V	237.0	356.0	Pass
901.950000	34.05	46.00	11.95	V	376.0	129.0	Pass
902.000000	33.90	94.00	60.10	V	197.0	230.0	Pass
902.500000	33.93	94.00	60.07	V	219.0	358.0	Pass
913.500000	77.23	94.00	16.77	V	129.0	70.0	Pass
927.500000	33.75	94.00	60.25	V	374.0	329.0	Pass
928.000000	33.83	94.00	60.17	H	197.0	201.0	Pass
928.050000	33.80	46.00	12.20	H	158.0	243.0	Pass

V = Vertical / H = Horizontal

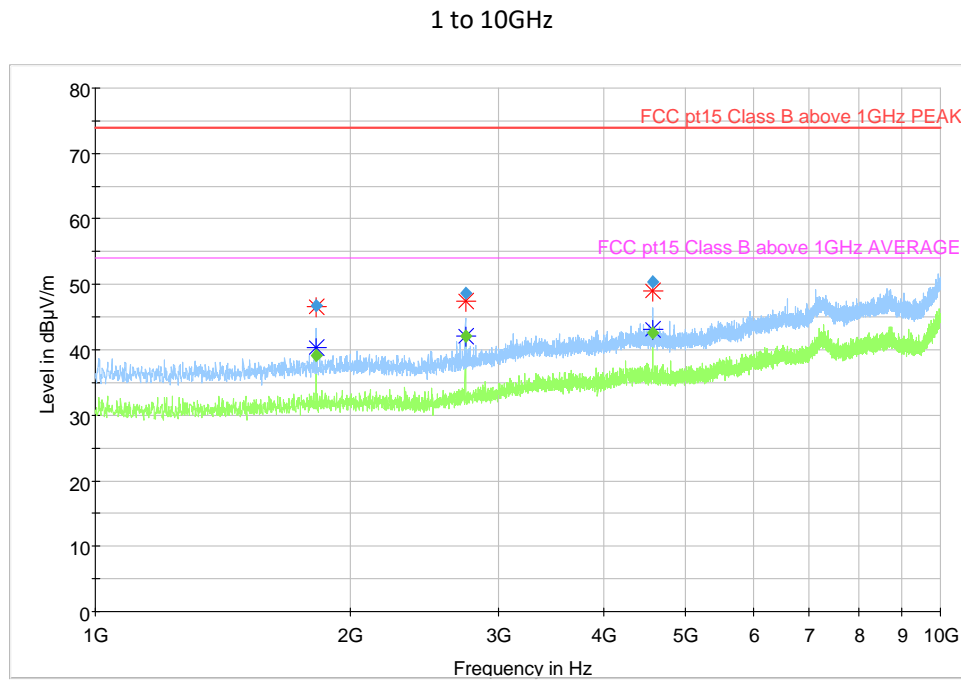
The measurements reported are the highest emissions relative to the FCC/CISPR Class B limits and take into account the correction factor\*. Measurements made according to the ANSI C63.4 test standard and Eurofins Hursley test procedure RAD-01.

\*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 10GHz, Chroma 27+ (DD27-3A), Middle Frequency Channel (913.5MHz), Orientation, Landscape  
 Maximum hold trace with peak values (◆)  
 Peak measurements (✱)  
 Average measurements (◆)



4.2.7 Data; 1 to 10GHz, Chroma 27+ (DD27-3A), Middle Frequency Channel (913.5MHz), Orientation, Landscape

Frequency	Peak	CISPR Average	Class B Limit	Margin	Height	Pol	Azimuth	Corr.	Status
MHz	dBµV/m	dBµV/m	dBµV/m	dB	cm	H/V	Deg	dB/m	
1827.046270	46.69	---	74.00	27.31	109.0	H	356.0	-6.9	Pass
1827.286048	---	39.21	54.00	14.79	109.0	H	8.0	-6.9	Pass
2740.392127	---	42.16	54.00	11.84	100.0	H	43.0	-5.0	Pass
2740.529146	48.65	---	74.00	25.35	109.0	H	33.0	-5.0	Pass
4567.689007	---	42.62	54.00	11.38	109.0	V	171.0	-0.5	Pass
4567.774646	50.36	---	74.00	23.64	100.0	V	197.0	-0.5	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 ANSI C63.4 test standard and Eurofins Hursley test procedure RAD-01.

\*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 Radiated Emissions; Chroma 29+ (DD29-3A), Middle Frequency Channel (913.5MHz)

#### 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 (1.0-26.5GHz)	24/10/2023
073	3	Schwarzbeck	BBHA9120B	237	Horn Antenna (1-10GHz)	20/05/2024
340	1	Sucoflex with #053 Pre-amplifier	104	0	26.5GHz	24/10/2023
750	1	Global	CISPR16	1	11 x 7 x 6.2m, chamber	22/12/2023
762	3	Schwarzbeck	VULB9162	129	30-7000MHz	04/03/2024
762a	3	Schwarzbeck	DGA 9552N	0	Attenuator (6dB) for #762	04/03/2024
778	1	IntelliConnect	Cable N-Type	I5071	Cable N-Type	21/11/2023
877	1	Huber & Suhner	SUCOTEST_18A	602608/18A	ST_18A/Nm/Nm/3m	19/04/2023
893	1	Rohde & Schwarz	ESW 44	103044	EMI test receiver	11/11/2023
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 1GHz	Above 1GHz
Temperature	19.8° Celsius	19.4° Celsius
Relative Humidity	44%	52%
Atmospheric Pressure	1021 millibars	1016.5 millibars
<b>Test Date:</b>	5 <sup>th</sup> April 2023	6 <sup>th</sup> April 2023
<b>Test Engineer:</b>	Danny Dzenis	Danny Dzenis

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.

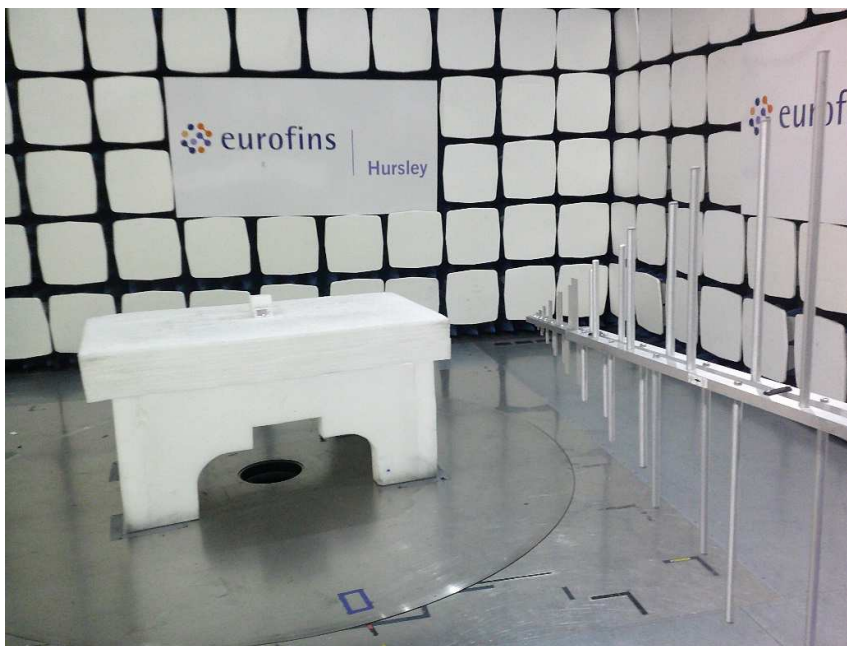
#### 4.3.2 Test Configuration

Please refer to EUT Test Configuration #1.

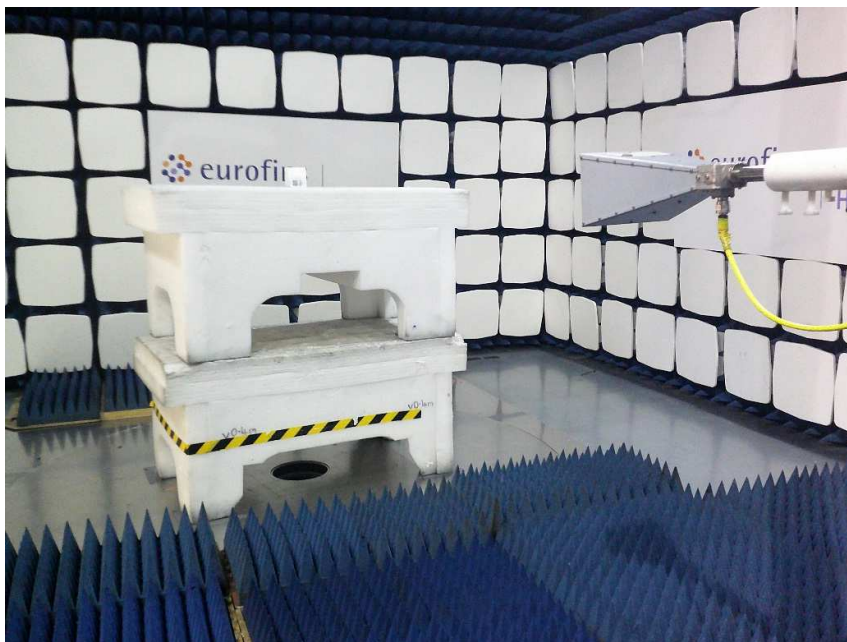


4.3.3 Set-up Photos; Chroma 29+ (DD29-3A), Middle Frequency Channel (913.5MHz)

Radiated Emissions; Below 1GHz



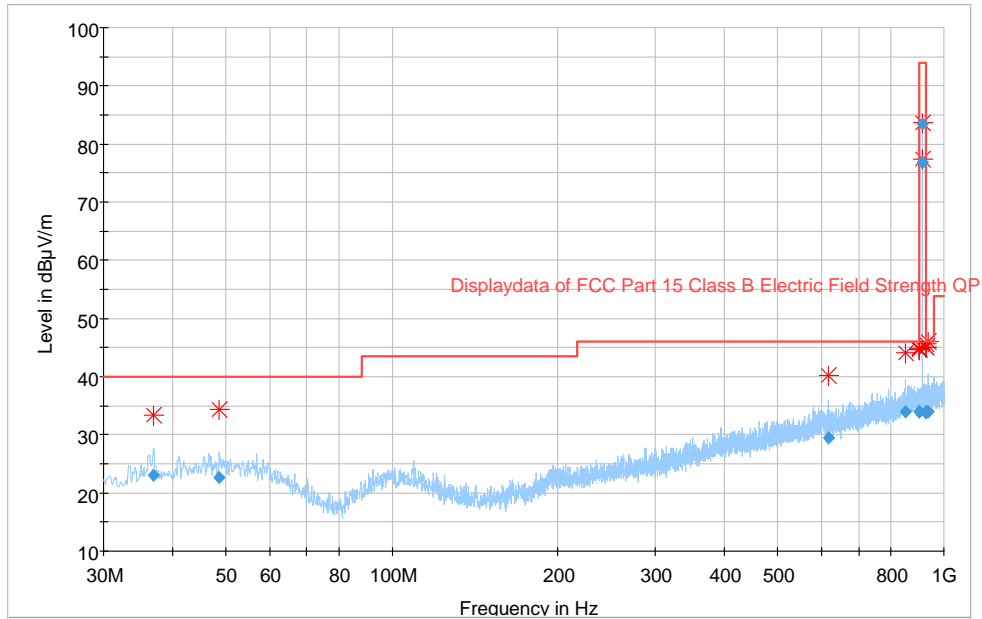
Radiated Emissions; Above 1GHz





4.3.4 Profile; 30MHz to 1GHz, Chroma 29+ (DD29-3A), Middle Frequency Channel (913.5MHz), Orientation, Landscape  
 Maximum peak hold trace with quasi-peak values (◆)  
 Peak measurements (✱)

30MHz to 1GHz



4.3.5 Data; 30MHz to 1GHz, Chroma 29+ (DD29-3A), Middle Frequency Channel (913.5MHz), Orientation, Landscape

Emission Frequency	Measured Quasi-Peak Value	Class B Specified Quasi-Peak Limit	Pass Margin	Antenna Polarisation	Antenna Height	Turntable Azimuth	Status
MHz	dBµV/m	dBµV/m	dB	H/V	cm	deg	
36.932500	23.06	40.00	16.94	V	227.0	186.0	Pass
48.682500	22.70	40.00	17.30	V	315.0	335.0	Pass
616.375000	29.57	46.00	16.43	H	229.0	76.0	Pass
850.875000	33.87	46.00	12.13	V	355.0	299.0	Pass
901.950000	33.94	46.00	12.06	H	297.0	170.0	Pass
902.000000	33.96	94.00	60.04	H	267.0	349.0	Pass
902.500000	34.01	94.00	59.99	V	365.0	140.0	Pass
913.500000	83.42	94.00	10.58	V	128.0	112.0	Pass
913.625000	76.74	94.00	17.26	V	129.0	78.0	Pass
927.500000	33.91	94.00	60.09	H	247.0	225.0	Pass
928.000000	33.87	94.00	60.13	H	255.0	356.0	Pass
928.050000	33.82	46.00	12.18	H	277.0	107.0	Pass
936.625000	33.95	46.00	12.05	H	266.0	151.0	Pass

V = Vertical / H = Horizontal

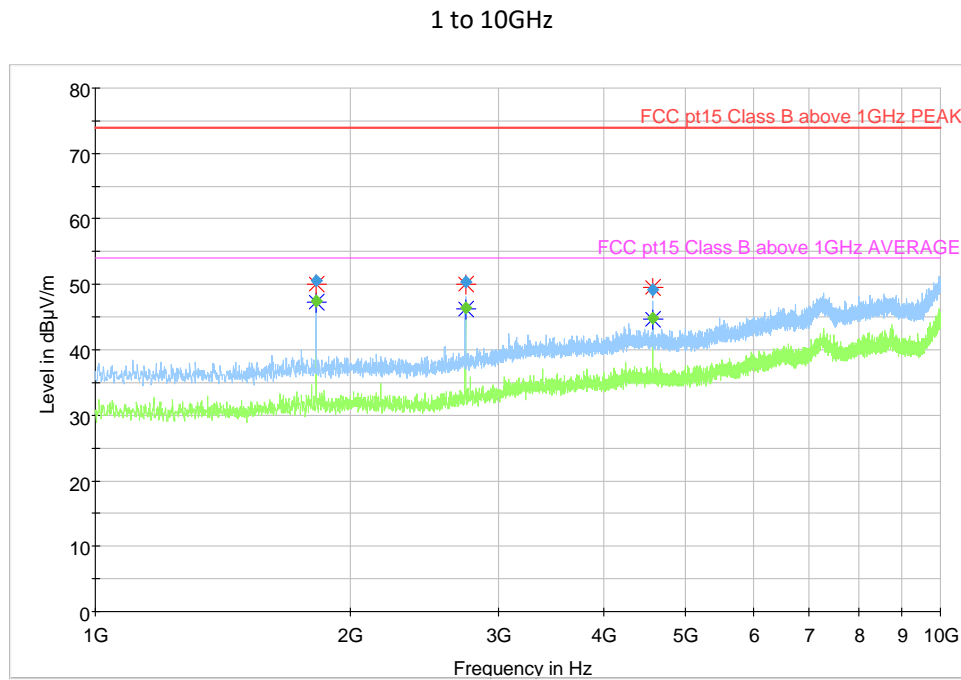
The measurements reported are the highest emissions relative to the FCC/CISPR Class B limits and take into account the correction factor\*. Measurements made according to the ANSI C63.4 test standard and Eurofins Hursley test procedure RAD-01.

\*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 10GHz, Chroma 29+ (DD29-3A), Middle Frequency Channel (913.5MHz), Orientation, Landscape  
 Maximum hold trace with peak values (◆)  
 Peak measurements (✱)  
 Average measurements (◆)



4.3.7 Data; 1 to 10GHz, Chroma 29+ (DD29-3A), Middle Frequency Channel (913.5MHz), Orientation, Landscape

Frequency	Peak	CISPR Average	Class B Limit	Margin	Height	Pol	Azimuth	Corr.	Status
MHz	dBµV/m	dBµV/m	dBµV/m	dB	cm	H/V	Deg	dB/m	
1826.966344	---	47.38	54.00	6.62	322.0	H	192.0	-6.9	Pass
1827.251794	50.50	---	74.00	23.50	258.0	H	191.0	-6.9	Pass
2740.426382	50.39	---	74.00	23.61	167.0	V	170.0	-5.0	Pass
2740.649038	---	46.37	54.00	7.63	167.0	V	173.0	-5.0	Pass
4567.432092	49.24	---	74.00	24.76	100.0	V	199.0	-0.5	Pass
4567.546277	---	44.84	54.00	9.16	100.0	V	177.0	-0.5	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 ANSI C63.4 test standard and Eurofins Hursley test procedure RAD-01.

\*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.

## 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 U<sub>lab</sub>) are equal to or are less than the expected uncertainty values contained in CISPR 16-4-2 (known as U<sub>cispr</sub>). Below is a list of the laboratories calculated measurement uncertainties:

#### Conducted emissions:

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

#### Radiated emissions:

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

#### Radiated spurious emissions (RSE):

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

### 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.

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