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Wootton Wawen, Henley-in-Arden, Warwickshire, B95 6HJ
Tel: 01564 792349

EMC TEST REPORT

Client:	TEAL PATENTS LTD Unit 2 Waterloo Avenue Chelmsley Wood Industrial Estate BIRMINGHAM West Midlands United Kingdom (UK) B37 6QQ	**Report Number:** 60561-A-R0
Contact:	Mr Noel Doyle	

Item Tested:	Hand Wash Unit	
Model:	Super Stallette +	
Serial Number:	2009399	
Overall Spec:	EN 61000-6-1: 2007 - Generic standards - Immunity for residential, commercial and light-industrial environments EN 61000-6-3: 2007+A1: 2011+AC: 2012 - Generic standards - Emission standard for residential, commercial and light-industrial EN 61000-3-2: 2014 - Limits for harmonic current emissions (equipment input current ≤ 16 A per phase) EN 61000-3-3: 2013 – voltage changes, voltage fluctuations and flicker in public low-voltage supply systems, for equipment with rated current ≤ 16 A per phase	
Specifications:	EN 61000-6-3	Emissions – Low voltage AC mains port
	EN 61000-6-3	Emissions – Enclosure port
	EN 61000-3-2	Harmonic Current Emissions
	EN 61000-3-3	Voltage Change, Voltage Fluctuations and Flicker
	EN 61000-4-2	Immunity to Electrostatic Discharge
	EN 61000-4-3	Immunity to Radiated Fields
	EN 61000-4-4	Immunity to Fast Transient Bursts
	EN 61000-4-5	Immunity to Surges
	EN 61000-4-6	Immunity to Conducted Disturbances
	EN 61000-4-11	Immunity to Voltage Dips and Short Interruptions

Written By:	Chris Zivoder	**Signed:**	
Report Date:	1st April 2019	**Test Dates:**	25th Feb & 12th March 2019

TEST SUMMARY

Equipment Under Test:	Super Stallette +
Equipment Description:	The Super Stallette Plus is a lightweight portable unit designed to be used in a variety of environments. By placing your hands in the basin the infrared sensor is triggered to start the wash cycle. The wash cycle delivers low pressure water that is instantly heated to temperatures of 40°C to 43°C for 10 seconds.
Test Dates(s):	25th Feb & 12th March 2019
Tested by:	Chris Zivoder, Senior Product Compliance Engineers at the CE Marking Association

Test Objective/Specification:

The objective of the EMC assessment was to assess the performance with respect to the requirements set out in EN 61000-6-1 and EN 61000-6-3 for the Super Stallette Plus

Summary of Test Results

Result	Spec	Requirements
Pass	EN 61000-6-3	Emissions – Low voltage AC mains port
Pass	EN 61000-6-3	Emissions – Enclosure port
Pass	EN 61000-3-2	Harmonic Current Emissions
Pass	EN 61000-3-3	Voltage Change, Voltage Fluctuations and Flicker
Pass	EN 61000-4-2	Immunity to Electrostatic Discharge
Pass	EN 61000-4-3	Immunity to Radiated Fields
Pass	EN 61000-4-4	Immunity to Fast Transient Bursts – AC mains terminal
Pass	EN 61000-4-5	Immunity to Surges – AC mains terminal
Pass	EN 61000-4-6	Immunity to Conducted Disturbances – AC mains terminal
Pass	EN 61000-4-11	Immunity to Voltage Dips and Interruptions

Notes:

1. The Super Stallette Plus was tested at the CE Marking Association, The Great Barn, Wootton Park, Alcester Road, Wootton Wawen, B95 6HJ.
2. The power frequency magnetic field test wasn't performed on the basis that the EUT doesn't include any devices/components that are deemed to be magnetically sensitive.
3. The highest internal generating frequency was specified as being < 108MHz therefore radiated emissions tests were performed up to 1GHz.

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TEST PLAN

EUT: Super Stallette +

Spec: EN 61000-6-1: 2007 - Generic standards - Immunity for residential, commercial and light-industrial environments
EN 61000-6-3: 2007+A1: 2011 - Generic standards - Emission standard for residential, commercial and light-industrial environments
EN 61000-3-2: 2013 – Harmonic current emissions
EN 61000-3-3: 2014 - Voltage change, fluctuations and flicker

Standard	Description	Details
EN 61000-6-3 – Table 2	Emissions – Low voltage AC mains port	150kHz to 30MHz
EN 61000-6-3 – Table 1	Emissions – Enclosure port	30MHz – 1000MHz (E Field)
EN 61000-3-2	Harmonics current emissions	Class A limits (≥75Watt limit applies)
EN 61000-3-3 – Clause 5	Voltage change and fluctuations	Maximum voltage change (d_{max}) caused by manual switching Annex B and Voltage fluctuation as specified in Annex A (A.12).
EN 61000-6-1 – Table 1	ESD	4kV Contact, 8kV Air Discharge Performance criteria B
EN 61000-6-1 – Table 1	RF Electromagnetic Fields	80 – 1000 MHz at 3V/m, 1.4 GHz – 2 GHz at 3V/m 2 GHz – 2.7 GHz at 1V/m Amplitude Modulation 1kHz at 80% sine Performance criteria A
EN 61000-6-1 – Table 4	Voltage dips and short interruptions	0% during 0.5 cycle (Performance criteria B) 0% during 1 cycles (Performance criteria B) 70% during 25 cycles (Performance criteria C) 0% during 250 cycles (Performance criteria C)
EN 61000-6-1 – Table 4	Fast Transient Bursts	AC power Ports - +/-1kV 5/50ns 5kHz Performance criteria B
EN 61000-6-1 – Table 4	Conducted RF Immunity	AC power Ports - 150kHz - 80MHz at 3V, Amplitude Modulation 1kHz at 80% sine Performance criteria A
EN 61000-6-1 – Table 4	Surges	AC power Ports Line to line +/- 1.0kV Line to ground +/-2.0kV Performance criteria B

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1. The Equipment Under Test (EUT)

1.1 General description

The Super Stallette Plus is a lightweight portable unit designed to be used in a variety of environments. By placing your hands in the basin the infrared sensor is triggered to start the wash cycle. The wash cycle delivers low pressure water that is instantly heated to temperatures of 40°C to 43°C for 10 seconds.

1.2 Test set-up

Emissions

During the emissions tests the EUT was operated by triggering the infrared sensor which would activate the wash cycle. This meant that both the heater and the pump would operate simultaneously to produce instant heated water at low pressure. The wash cycle continued to operate for 10 seconds then stopped for a few seconds whilst the infrared sensor was triggered again. The wash cycles were repeated continuously during the emissions measurements.

Immunity

During the immunity testing the EUT was left in a ready to operate state i.e. if the infrared sensor was triggered, the wash cycle would operate. After each immunity test was carried out, the function of the EUT was checked by triggering the infrared sensor to start the wash cycle.

1.3 Product Identification Plates

1.4 Classification of the Equipment

The EUT is to be used within the residential, commercial and light industrial environments as specified by the manufacturer.

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2. Performance Criteria for Immunity Tests

The following performance criteria A, B and C are defined in section 4 of EN 61000-6-1:

2.2 Performance Criterion A

The equipment shall continue to operate as intended during and after the test. No degradation of performance or loss of function is allowed below a performance level specified by the manufacturer, when the equipment is used as intended. The performance level may be replaced by a permissible loss of performance. If the minimum performance level or the permissible performance loss is not specified by the manufacturer, either of these may be derived from the product description and documentation and what the user may reasonably expect from the equipment if used as intended.

2.3 Performance Criterion B

The equipment shall continue to operate as intended after the test. No degradation of performance or loss of function is allowed below a performance level specified by the manufacturer, when the equipment is used as intended. The performance level may be replaced by a permissible loss of performance. During the test, degradation of performance is however allowed. No change of actual operating state or stored data is allowed. If the minimum performance level or the permissible performance loss is not specified by the manufacturer, either of these may be derived from the product description and documentation and what the user may reasonably expect from the equipment if used as intended.

2.4 Performance Criterion C

Temporary loss of function is allowed, provided the function is self-recoverable or can be restored by the operation of the controls.

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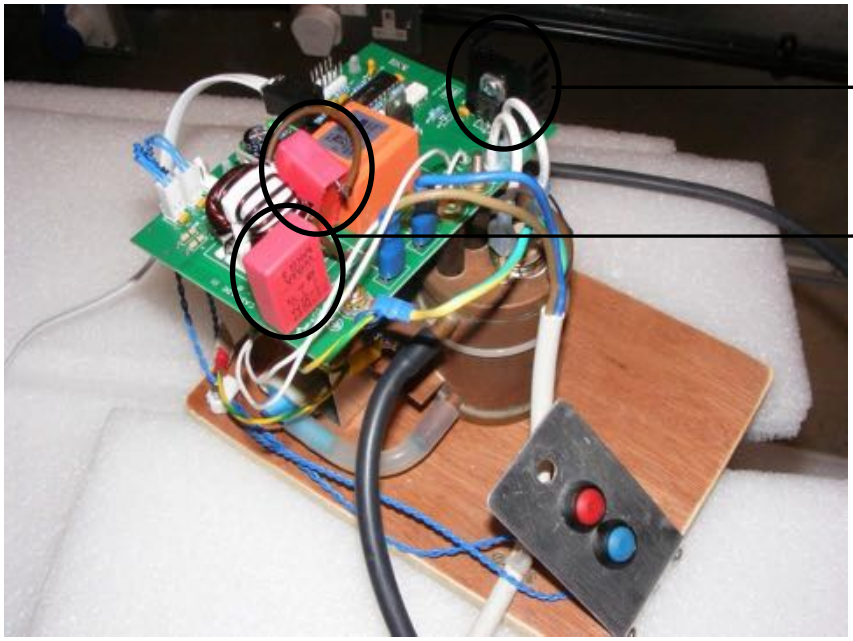
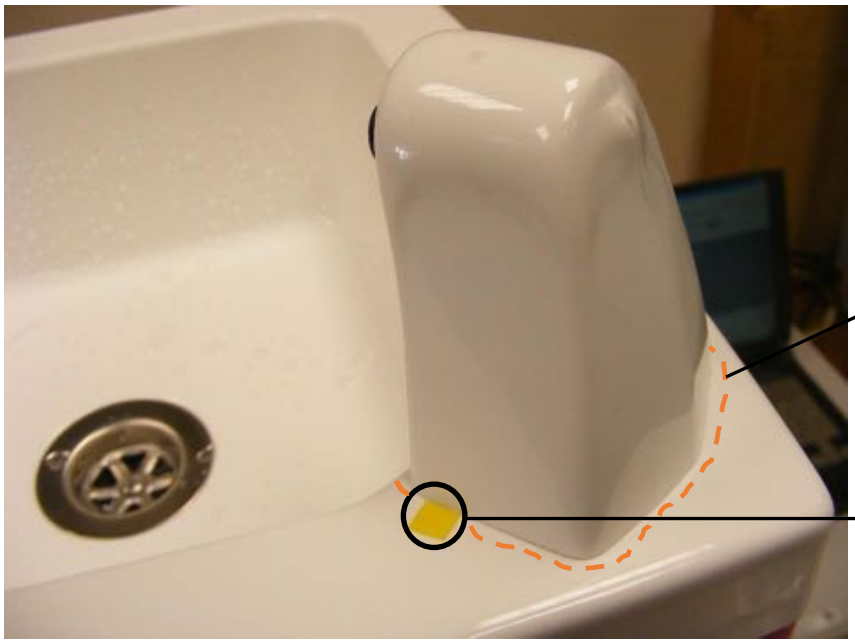
3. EMC Modifications



During the conducted emissions testing, the QP measurements exceeded the specified limit. After the modifications to the input EMI filter shown above the emissions were found to be below the specified limit.



During the ESD test, a discharge to the area marked with yellow tape causes the EUT to reset, upon start up the EUT runs a purge cycle before returning to the ready to operate state.

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4. Emissions – Low Voltage AC Port

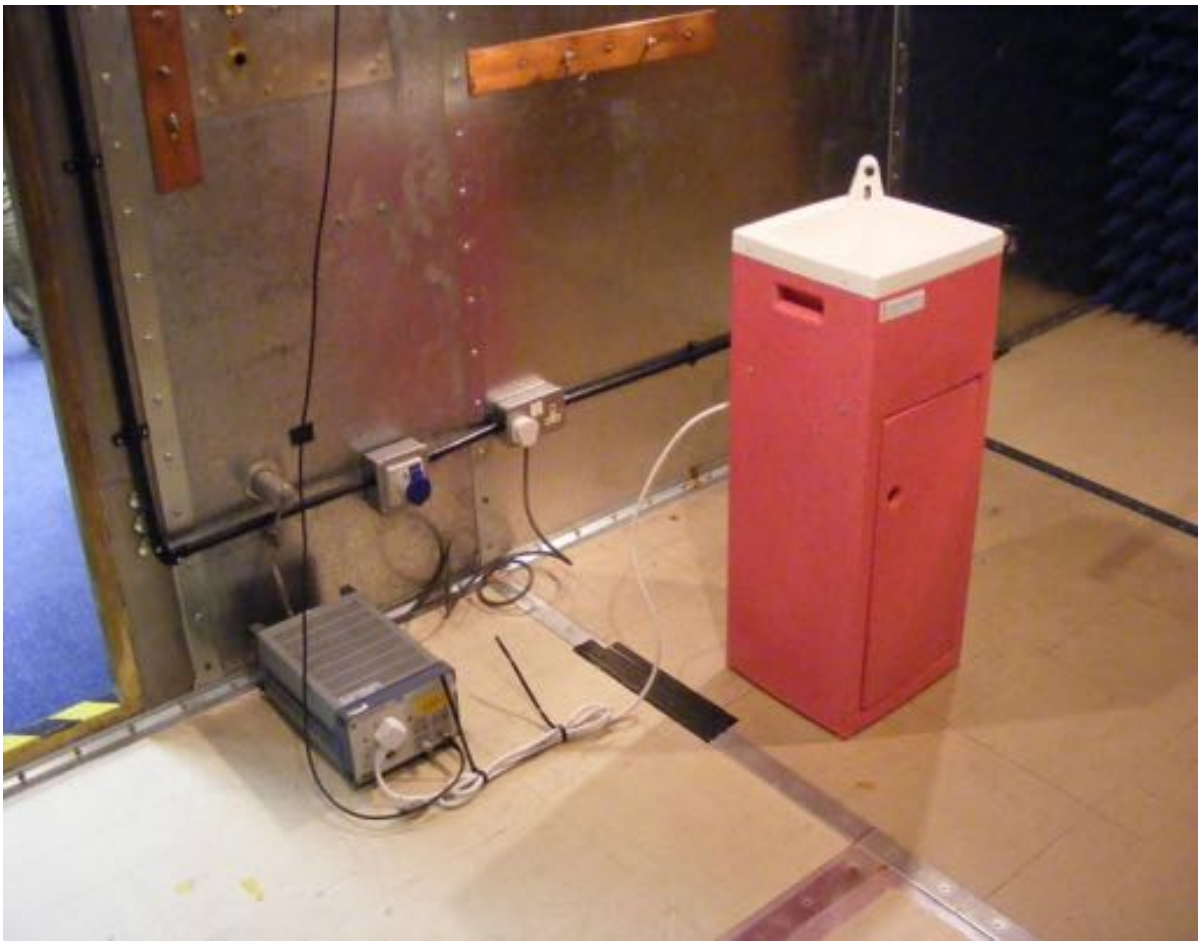
4.1 Test Method

The conducted emissions of the product submitted for test were assessed within a screened room. The EUT was measured using a Quasi-Peak (QP) and average detector, the limits are given in Table 2 of EN 61000-6-3. A receiver was used in conjunction with an (AMN) Artificial Mains Network to measure the conducted noise content on the mains supply. Two scans were performed using an average and quasi-peak detector, both the average and the quasi-peak scans must not exceed the average and quasi-peak limits as specified in the standard.

4.2 Configuration

Refer to section 1.2 Test Setup (Emissions)

Pic: Conducted Emissions Testing



4.3 Results

Line	Quasi-Peak Limit	Average Limit
Live	Pass	Pass
Neutral	Pass	Pass

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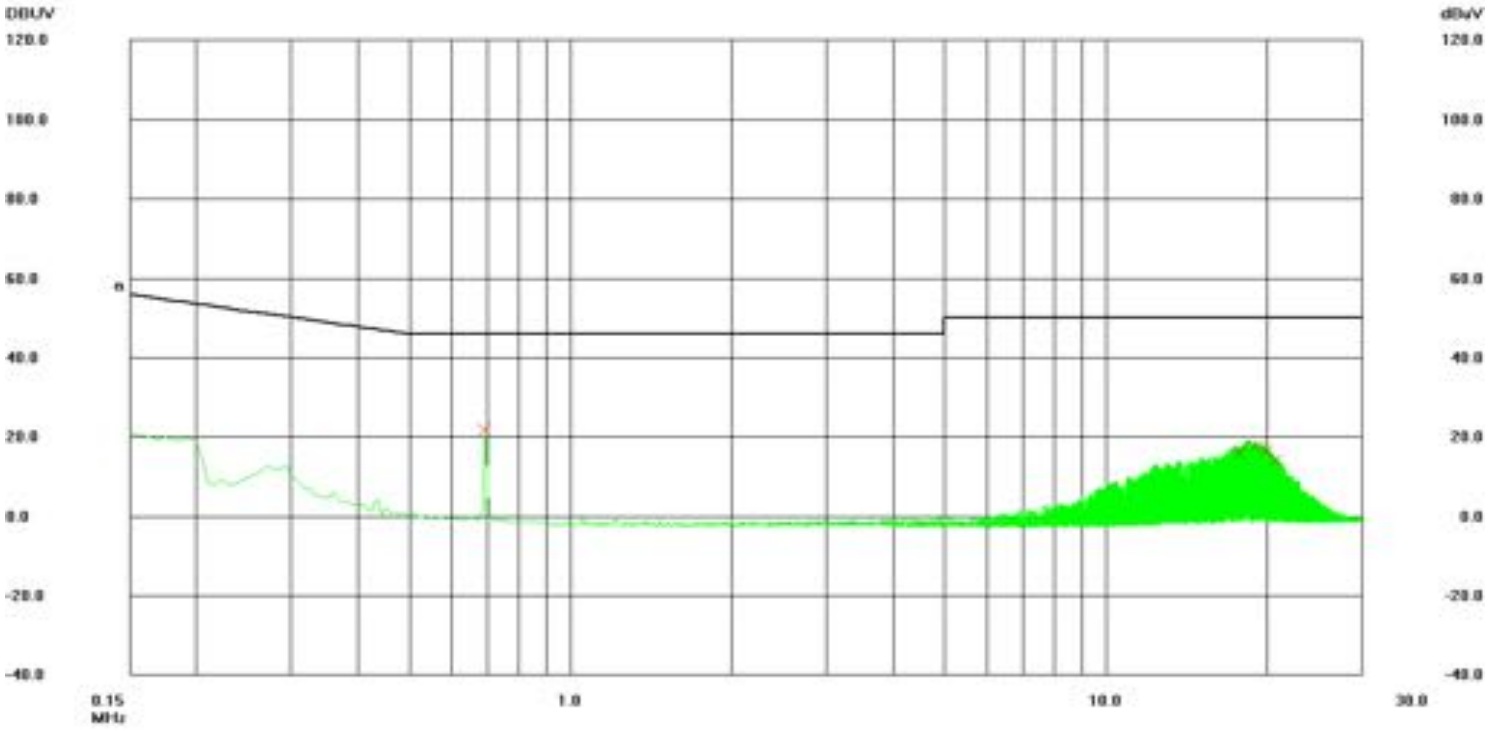
Neutral Line – Average measurement

/\/\/ Average Pre-Measurement **X** Average Final Measurement

a = Average Limit



Final Measurements with the Average Detector Conducted Emissions – Neutral Line				
Frequency (MHz)	Average (dBuV)	Average Limit (dBuV)	Margin (dB)	Pass/Fail
0.69	21.90	46	24.10	Pass
17.74	16.12	50	33.88	Pass
18.99	17.62	50	32.38	Pass
19.94	16.57	50	33.43	Pass
20.74	14.11	50	35.89	Pass

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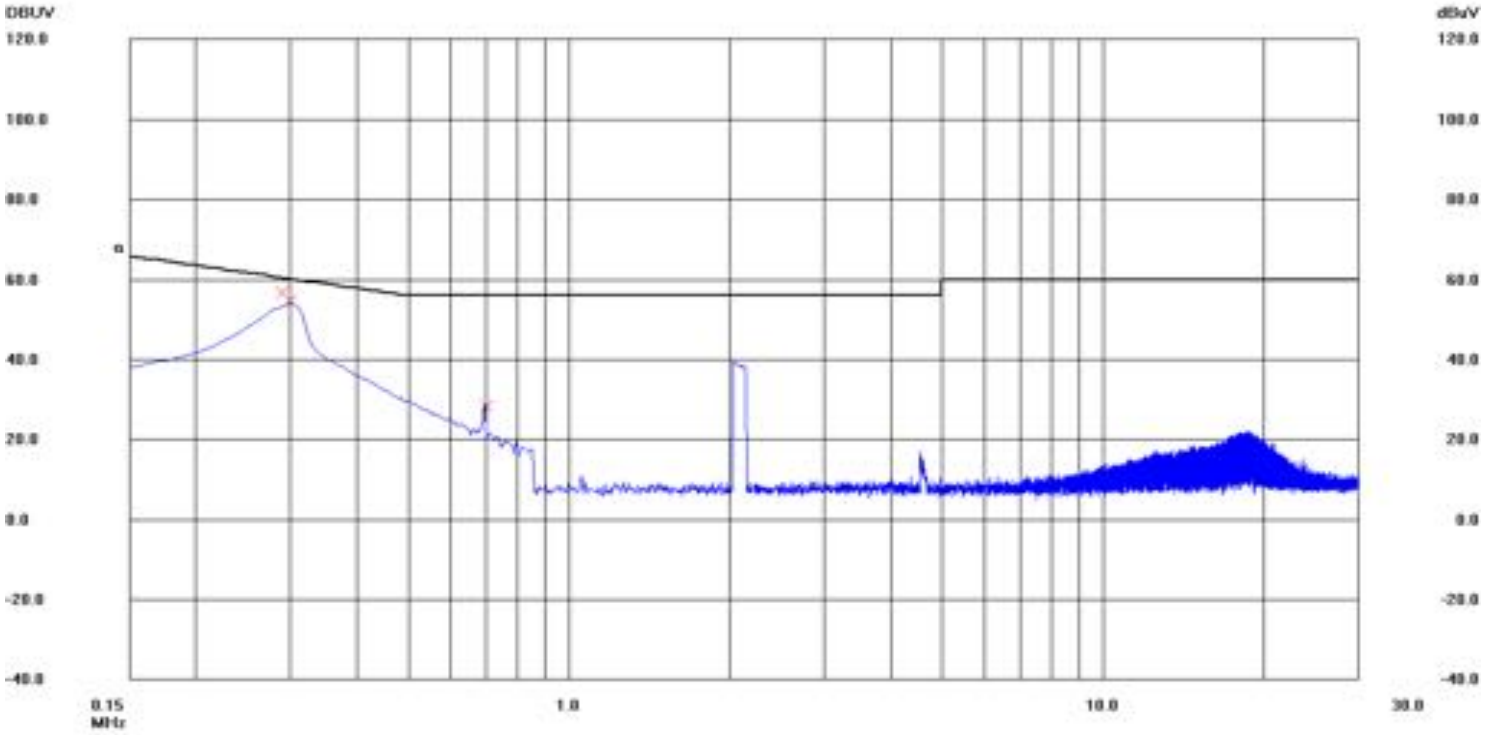
Neutral Line – Quasi-Peak measurement

/\/\/ Peak Measurement **X** Quasi-Peak Measurement

a = QP Limit



Final Measurements with the QP Detector Conducted Emissions – Neutral Line				
Frequency (MHz)	Quasi peak (dBuV)	Quasi peak Limit (dBuV)	Margin (dB)	Pass/Fail
0.29	56.69	60.52	3.83	Pass
0.30	54.72	60.24	5.52	Pass
0.70	28.22	56	27.78	Pass

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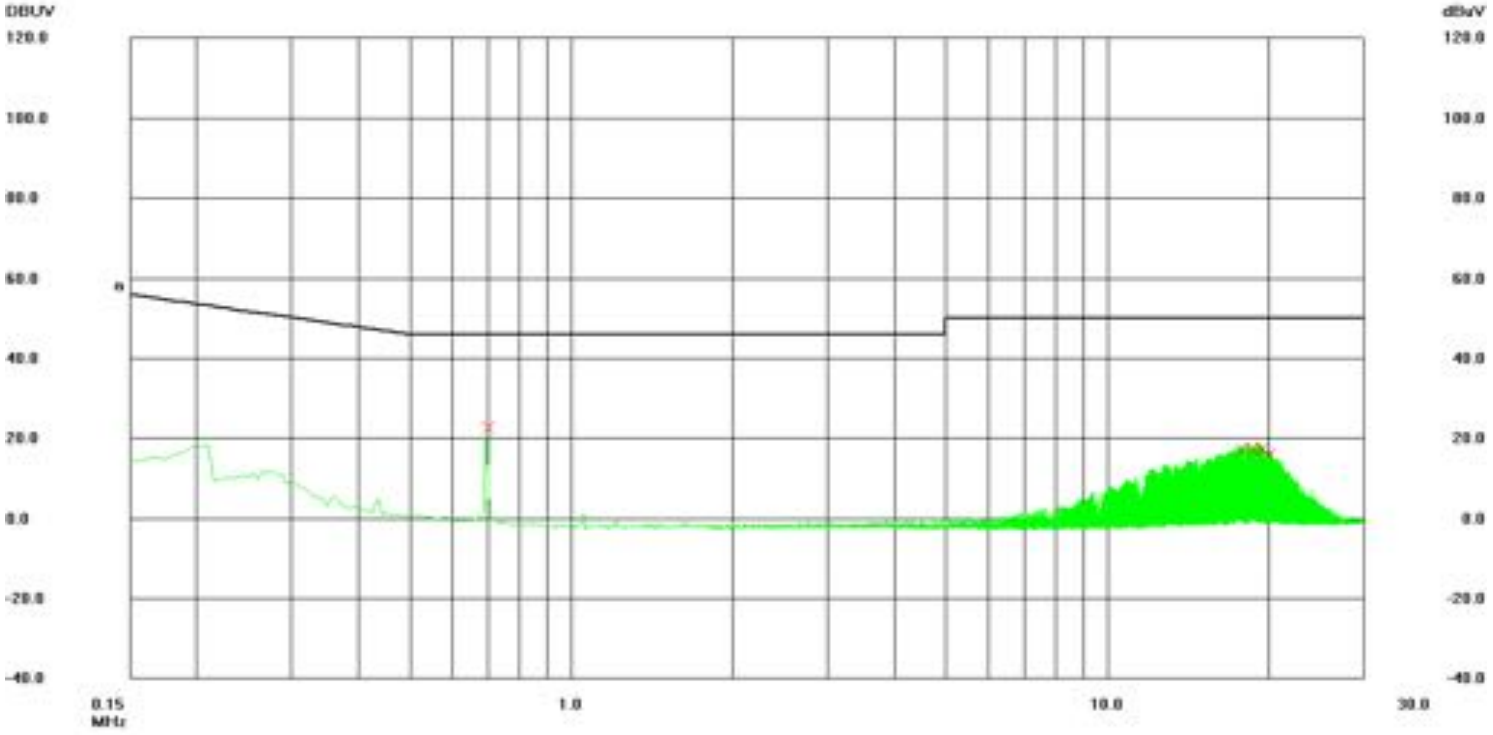
Live Line – Average measurement

/\/\/ Average Pre-Measurement **X** Average Final Measurement

a = Average Limit



Final Measurements with the Average Detector Conducted Emissions – Live Line				
Frequency (MHz)	Average (dBuV)	Average Limit (dBuV)	Margin (dB)	Pass/Fail
0.70	22.63	46	23.37	Pass
17.87	16.99	50	33.01	Pass
18.69	17.50	50	32.50	Pass
19.36	17.27	50	32.73	Pass
19.99	15.81	50	34.19	Pass

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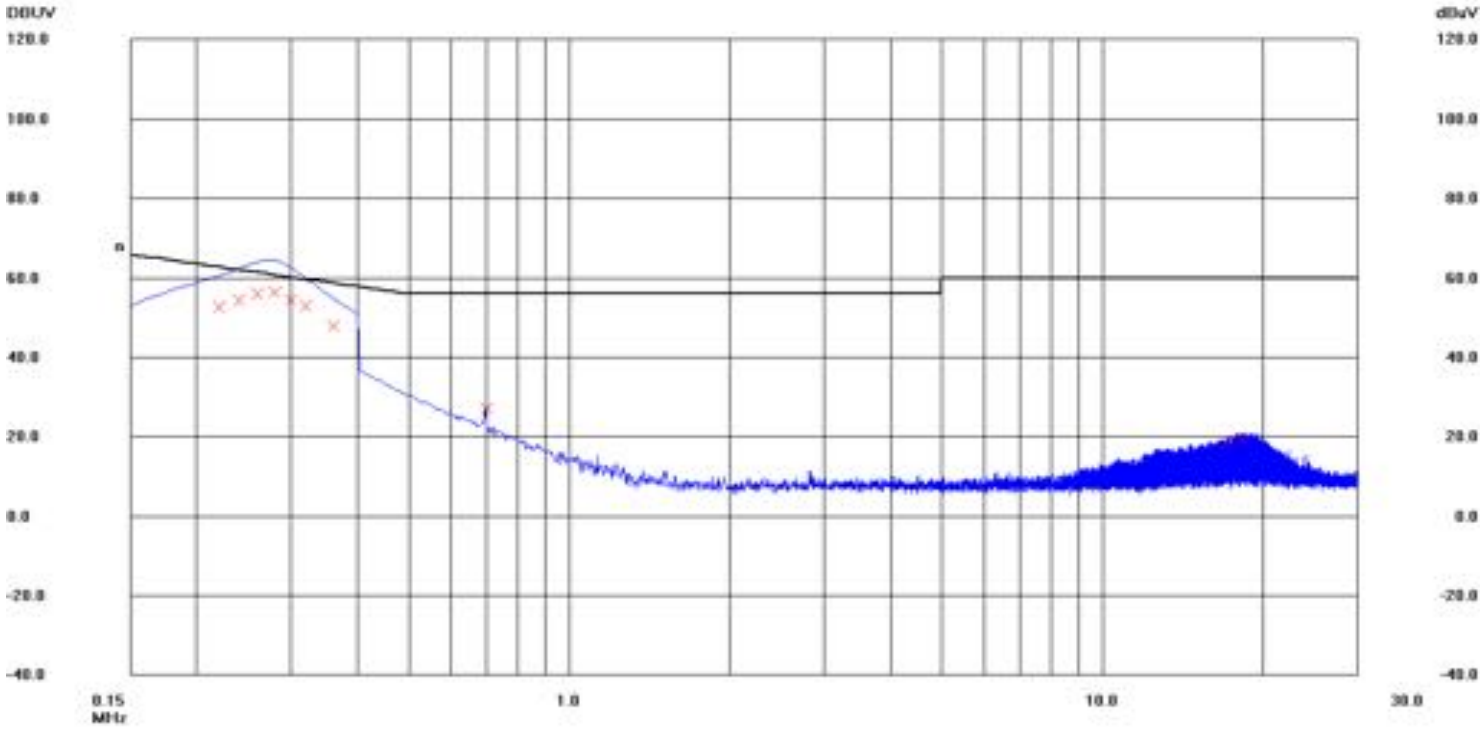
Live Line – Quasi-Peak measurement

/\/\/ Peak Measurement **X** Quasi-Peak Measurement

a = QP Limit



Final Measurements with the QP Detector Conducted Emissions – Live Line				
Frequency (MHz)	Quasi peak (dBuV)	Quasi peak Limit (dBuV)	Margin (dB)	Pass/Fail
0.22	52.68	62.82	10.14	Pass
0.24	54.30	62.10	7.80	Pass
0.26	55.85	61.43	5.58	Pass
0.28	56.35	60.82	4.47	Pass
0.30	54.41	60.24	5.83	Pass
0.32	52.99	59.71	6.72	Pass
0.36	47.88	58.73	10.85	Pass
0.70	27.16	56	28.84	Pass
17.09	18.30	60	41.70	Pass
18.24	19.46	60	40.54	Pass

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5. Radiated Emissions

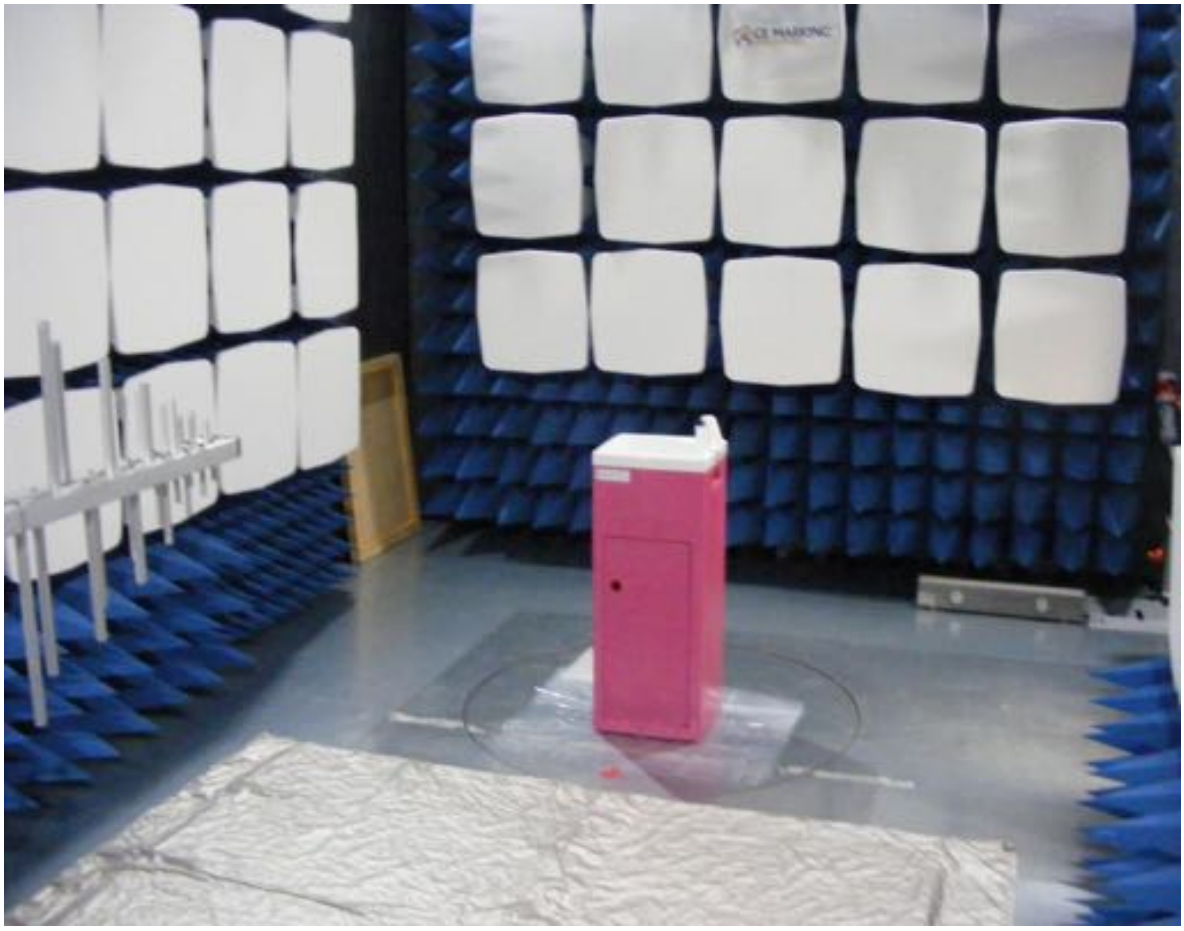
5.1 Test Method

The radiated electromagnetic disturbances of the EUT were assessed in a semi-anechoic test chamber. The EUT was measured using Peak and Quasi-Peak (QP) detectors, the QP limit is given in EN 61000-6-3, Table 1. Tests were performed over the frequency range of 30 - 1000 MHz to determine if any radiated emissions were in excess or close to the specified limits. If the recorded measurements using the peak detector exceed or found to be close to the QP limit line then those points are re-measured using a QP detector. The emissions measurements were maximized by rotating the EUT and varying the height of the receiving antenna during the emissions scan, this ensures that the worse-case emissions are measured.

5.2 Configuration

Refer to section 1.2 Test Setup (Emissions)

Pic: Radiated Emissions Testing



5.3 Results

Frequency Range	Quasi-Peak Limit Horizontal	Quasi-Peak Limit Vertical
30 – 1000 MHz	Pass	Pass

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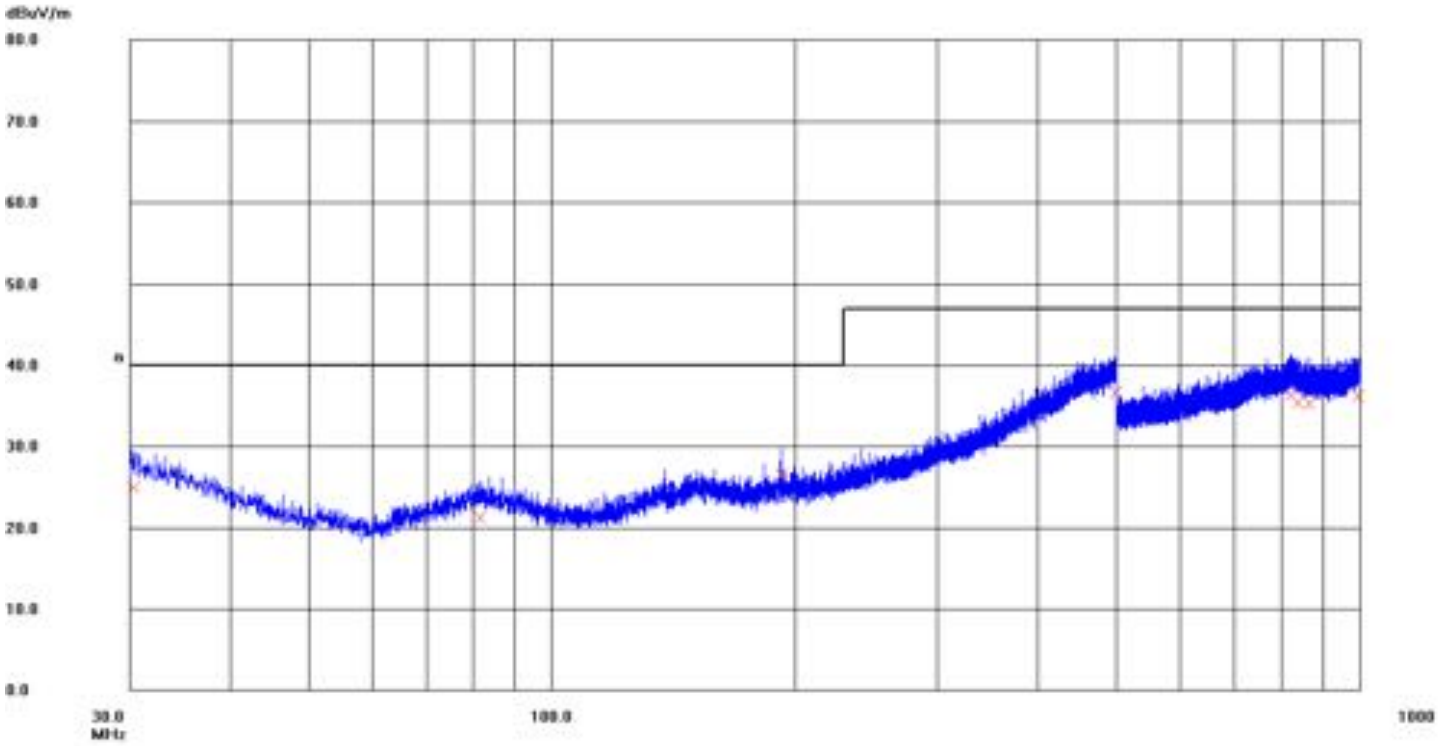
Maximised Orientation – Horizontal Polarization

/\/\/ Peak X Quasi-peak

a = QP Limit



Final Measurements with the QP Detector Radiated Emissions				
Frequency (MHz)	Quasi peak (dBuV/m)	Quasi peak Limit (dBuV/m)	Margin (dB)	Pass/Fail
30.30	24.98	40	15.02	Pass
81.36	21.26	40	18.74	Pass
192.12	26.54	40	13.46	Pass
497.82	36.64	47	10.36	Pass
821.82	36.31	47	10.69	Pass
838.02	35.42	47	11.58	Pass
866.04	35.25	47	11.75	Pass
995.88	36.28	47	10.72	Pass

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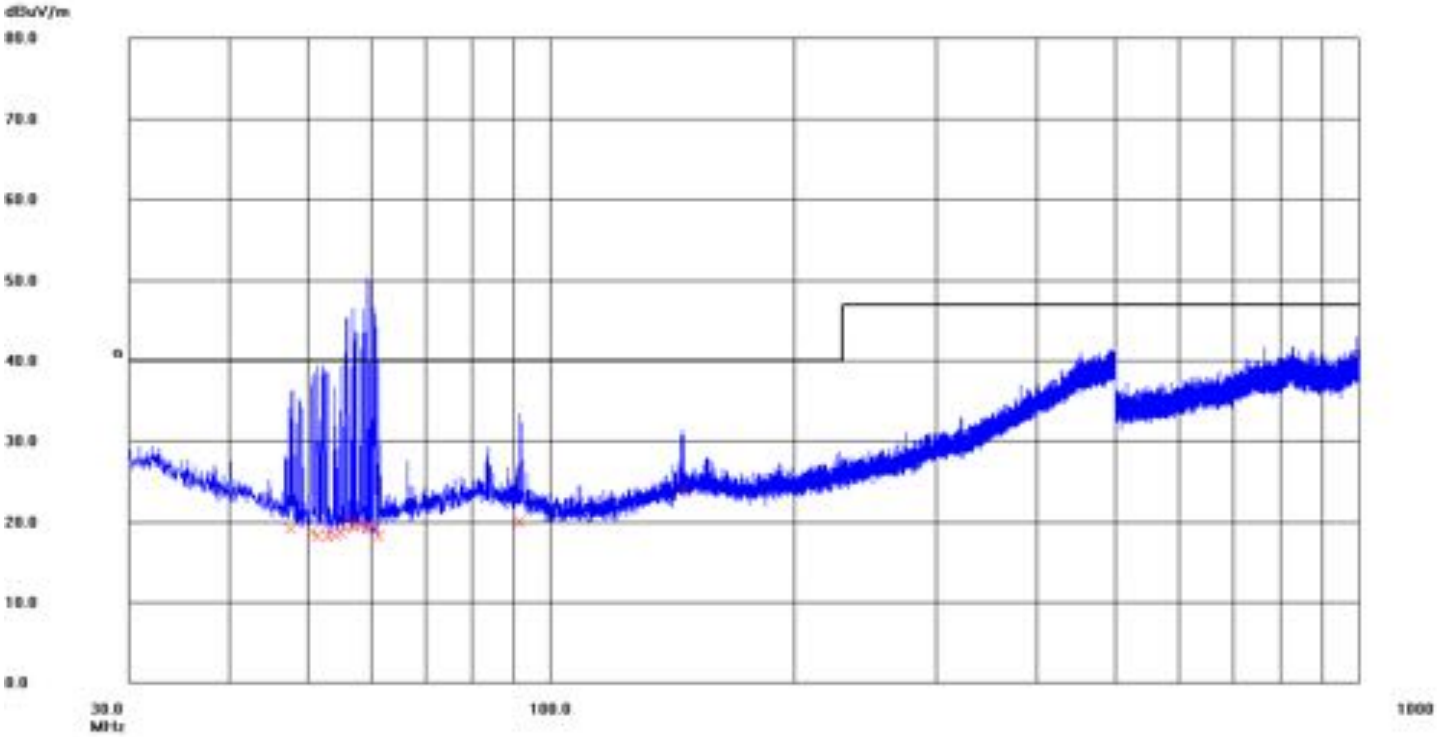
Maximised Orientation – Vertical Polarization

/\/\/ Peak X Quasi-peak

a = QP Limit



Final Measurements with the QP Detector Radiated Emissions				
Frequency (MHz)	Quasi peak (dBuV/m)	Quasi peak Limit (dBuV/m)	Margin (dB)	Pass/Fail
47.64	19.13	40	20.87	Pass
50.64	18.77	40	21.23	Pass
51.36	18.27	40	21.73	Pass
52.92	18.22	40	21.78	Pass
53.94	18.30	40	21.70	Pass
55.08	18.67	40	21.33	Pass
55.86	19.29	40	20.71	Pass
56.94	20.17	40	19.83	Pass
58.44	19.56	40	20.44	Pass
59.22	19.29	40	20.71	Pass
60.48	19.09	40	20.91	Pass
61.26	18.26	40	21.74	Pass
91.38	20.02	40	19.98	Pass
145.86	24.15	40	15.85	Pass

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6. Mains Harmonic Emissions

6.1 Test Method

The harmonic current emissions of the unit submitted for tests were assessed in accordance with EN 61000-3-2 for (Class A) equipment. A low impedance AC supply source with low distortion and high voltage stability was not used for the AC supply to the harmonics analyser due to the excessive load of the EUT. A harmonics analyser was used to measure the harmonics content introduced to the mains supply from the EUT. Tests were performed to determine if any harmonic current emissions were more than the specified limits. The emissions up to the 40th harmonic was measured from the EUT.

6.2 Configuration

Refer to section 1.2 Test Setup (Emissions)

Pic: Mains Harmonic Emissions

6.3 Results

Equipment Class in EN 61000-3-2	Rated Power	Limits	Result
Class A	2545 Watts	EUT > 75 W, limits apply	Pass (see report below)

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Mains Harmonic Emissions – Test Report

Tested On : 26 February 2019 16:32 for 150 Seconds.
Equipment Under Test : Super Stallette +
Serial Number : 2009399
Tested by : CZ

Supply Voltage : 245.7 to 246.1 Vrms 335.9 Vpk Frequency : 49.98 to 50.04 Hz
Supply Fails : Harmonic Requirements Crest Limits.

Load Power : 1.00 to 2545.00 W 69 VA Power Factor 0.014
Load Current : 0.2 to 11.0 Arms 0.4 to 15.2 Apk Crest Factor: 1.507

Measurement Standard : EN61000-4-7:2002
Limits Applied : EN61000-3-2 No Limits, Actual Power below Minimum Threshold.

Harmonic Number	Limit Current Amp	Average (filtered) Amp	% Limit	max. Value (Filtered) Amp	% Limit	Assessment
Fundamental :		1.516				
2 :	1.080	0.025	2.3	0.199	18.4	Pass
3 :	2.300	0.011	0.5	0.097	4.2	Pass
4 :	0.430	0.006	1.4	0.063	14.7	Pass
5 :	1.140	0.090	7.9	0.414	36.3	Pass
6 :	0.300	0.004	1.3	0.043	14.3	Pass
7 :	0.770	0.033	4.3	0.126	16.4	Pass
8 :	0.230	0.003	1.3	0.032	13.9	Pass
9 :	0.400	0.005	1.3	0.032	8.0	Pass
10 :	0.184	0.002	1.1	0.025	13.6	Pass
11 :	0.330	0.009	2.7	0.038	11.5	Pass
12 :	0.153	0.002	1.3	0.021	13.7	Pass
13 :	0.210	0.005	2.4	0.025	11.9	Pass
14 :	0.131	0.002	1.5	0.017	13.0	Pass
15 :	0.150	0.003	2.0	0.021	14.0	Pass
16 :	0.115	0.002	1.7	0.015	13.0	Pass
17 :	0.132	0.007	5.3	0.023	17.4	Pass
18 :	0.102	0.002	2.0	0.015	14.7	Pass
19 :	0.118	0.005	4.2	0.021	17.8	Pass
20 :	0.092	0.002	2.2	0.013	14.1	Pass
21 :	0.107	0.004	3.7	0.017	15.9	Pass
22 :	0.084	0.003	3.6	0.013	15.5	Pass
23 :	0.098	0.005	5.1	0.016	16.3	Pass
24 :	0.077	0.003	3.9	0.012	15.6	Pass
25 :	0.090	0.008	8.9	0.022	24.4	Pass
26 :	0.071	0.003	4.2	0.011	15.5	Pass
27 :	0.083	0.007	8.4	0.015	18.1	Pass
28 :	0.066	0.004	6.1	0.012	18.2	Pass
29 :	0.078	0.010	12.8	0.016	20.5	Pass
30 :	0.061	0.004	6.6	0.012	19.7	Pass
31 :	0.073	0.012	16.4	0.017	23.3	Pass
32 :	0.057	0.004	7.0	0.011	19.3	Pass
33 :	0.068	0.006	8.8	0.014	20.6	Pass
34 :	0.054	0.004	7.4	0.011	20.4	Pass
35 :	0.064	0.011	17.2	0.023	35.9	Pass
36 :	0.051	0.004	7.8	0.010	19.6	Pass
37 :	0.061	0.010	16.4	0.020	32.8	Pass
38 :	0.048	0.004	8.3	0.010	20.8	Pass
39 :	0.058	0.008	13.8	0.017	29.3	Pass
40 :	0.046	0.004	8.7	0.010	21.7	Pass
21 - 39 :	0.251	0.027	10.8	0.054	21.5	-

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7. Voltage Change and Voltage Fluctuations

7.1 Test Method

The voltage change and fluctuations generated by the EUT submitted for test were assessed in accordance with the limits given in Clause 5 of EN 61000-3-3. A low impedance AC supply source with low distortion and high voltage stability was not used for the AC supply due to the excessive load of the EUT. As stated in Clause 6 of EN 61000-3-3, the procedure described in Annex B of EN 61000-3-3 was used to measure the maximum relative voltage change for manually switched equipment. The maximum steady state voltage change was measured using the procedure set out in Annex A (A.12). The flicker assessment was not carried out on the basis that the EUT is a manually switched piece of equipment. Tests were performed to determine if any voltage change and fluctuations generated by the unit were in excess or close to the specified limits.

7.2 Configuration

Refer to section 1.2 Test Setup (Emissions)

Pic: Voltage Change and Voltage Fluctuations

7.3 Results

Parameter	Limit	Measured value	Result
T_{max} exceeding 3.3%	> 500 ms	20 ms	Pass
d_c relative steady-state voltage change	3.3%	2.04%	Pass
d_{max} max relative voltage change	6%	4.37%	Pass

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Voltage Change d_{max} Test Report

```
Report Number        : 740     Per Step
Equipment Under Test : Super Stallette +
Serial Number        : 2009399
Tested by            : CZ

Supply Voltage : 231.1 to 240.9 Vrms  329.6 Vpk   Frequency : 49.91 to 49.99 Hz
Load Current   : 0.2 to 11.1 Arms    0.4 to 15.2 Apk Crest Factor: 1.477

Test Method: EN61000-3-3:2008


Manual Results :


       1  10:02:34     4.13   -
       2  10:03:43     5.19   -
       3  10:04:53     4.36   -
       4  10:06:09     4.16   -
       5  10:07:44     5.23   Max
       6  10:08:51     4.20   -
       7  10:09:55     4.18   -
       8  10:10:59     4.32   -
       9  10:12:07     4.46   -
      10 10:13:13     4.42   -
      11 10:14:20     4.60   -
      12 10:16:01     4.28   -
      13 10:17:40     4.34   -
      14 10:21:33     4.17   -
      15 10:22:40     4.42   -
      16 10:24:53     4.47   -
      17 10:26:30     4.02   Min
      18 10:29:13     5.20   -
      19 10:30:33     4.03   -
      20 10:32:03     4.20   -
      21 10:33:20     4.09   -
      22 10:36:35     4.19   -
      23 10:38:10     4.23   -
      24 10:39:40     4.47   -

Combined Result : 4.37
```


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Voltage Change and Voltage Fluctuations d_c & d_t Test Report

```
Tested On            : 12 March 2019 11:16 for 600 Seconds.
Equipment Under Test : Super Stallette +
Serial Number        : 2009399
Tested by            : CZ

Supply Voltage : 234.1 to 243.6 Vrms  333.9 Vpk   Frequency : 49.95 to 50.01 Hz
Load Current   : 0.2 to 11.3 Arms    0.4 to 15.7 Apk Crest Factor: 1.567

Test Method: EN61000-3-3:2008


     Highest d(t) of 500ms:   2.04%            PASS
   Present d(t) over 3.33%:   0.00 Seconds
   Longest d(t) over 3.33%:   0.02 Seconds
      Highest Steady State:  +1.39%
       Lowest Steady State:  -2.38%
 Max d(c) Between Adjacent:   3.26%            PASS
      Max d(c) Between Any:   3.77%
```


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8. Immunity to Electrostatic Discharge - Enclosure Port

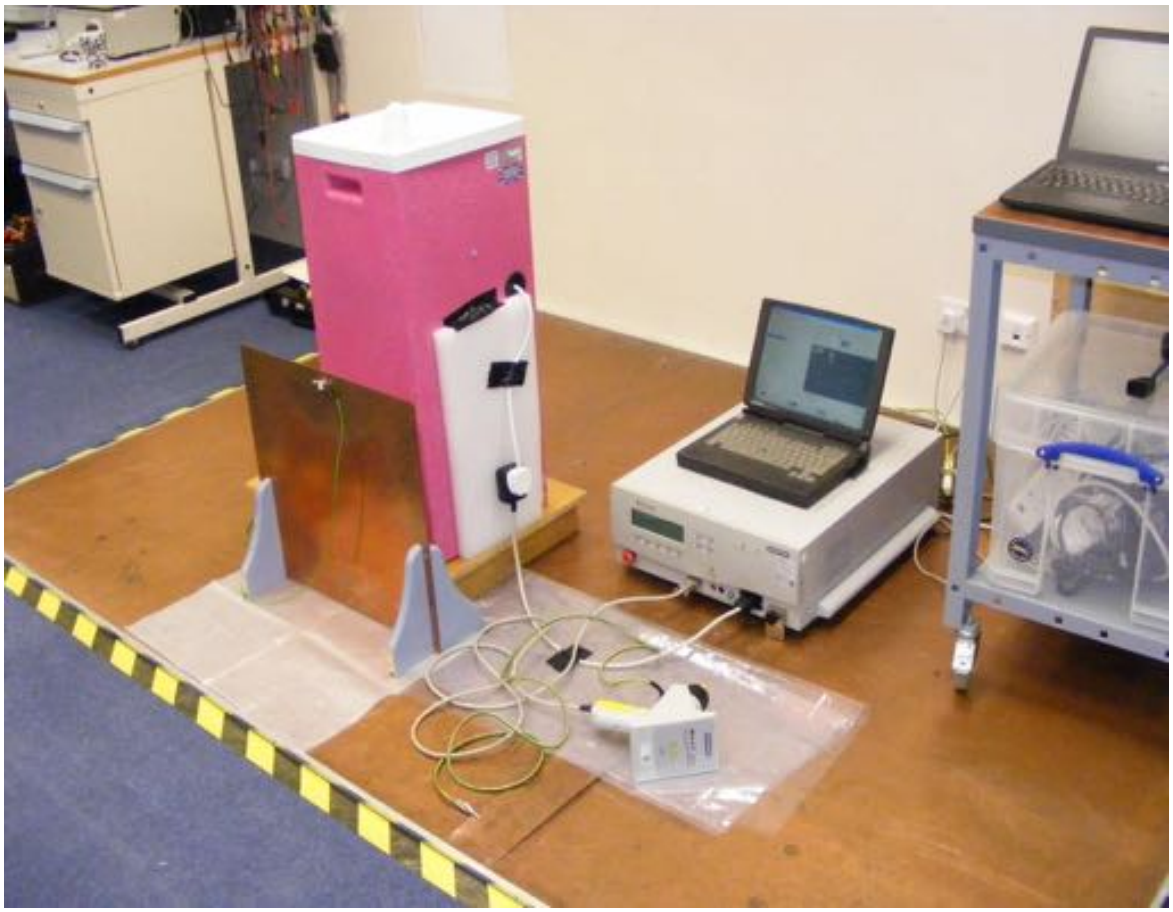
8.1 Test Method

The immunity of the device submitted for test to electrostatic discharge was assessed in accordance with the methods given in specification EN 61000-4-2 as referred to in Table 1 of EN 61000-6-1. The unit was subjected to electrostatic discharges using a hand held ESD generator. Two modes of application were applied to the unit; these consisted of a contact discharge with an output voltage of 4kV and air discharge with an output voltage of up to and including 8kV, both were tested using positive and negative polarities. Direct application i.e. discharges directly to the relevant points on the EUT were tested using either a contact or air or both discharge applications. For indirect discharge application i.e. the simulation of electrostatic discharge to objects adjacent to the EUT, a vertical coupling plane was used.

8.2 Configuration

Refer to section 1.2 Test Setup (Immunity)

Pic: Electrostatic Discharge Testing



8.3 Results

After modification as described in section 3, the EUT continued to function as intended with no errors or change of status. The EUT achieved performance criteria A, thereby exceeding the minimum requirements of performance criteria B.

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9. Immunity to RF Electromagnetic Fields – Enclosure Port

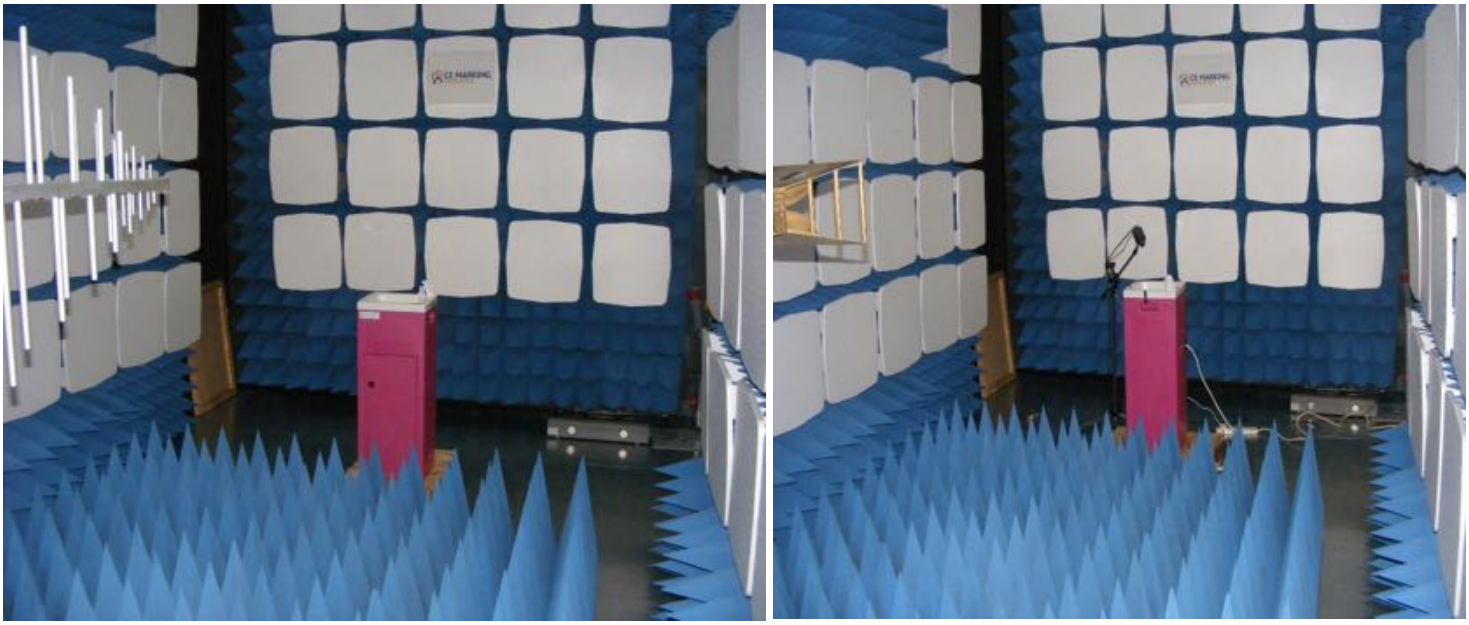
9.1 Test Method

The method for RF electromagnetic field immunity was set according to EN 61000-4-3. The electromagnetic field was generated using a signal generator in conjunction with an RF amplifier and connected to the antenna located in a Fully Anechoic room (FAR). The antenna was placed 3m from the EUT with the antenna height set to 1.55m above the floor of the test chamber. The EUT was tested over a frequency of 80MHz - 1GHz and 1.4GHz - 2.7GHz with an amplitude modulation frequency of 1kHz with 80% depth. The carrier frequency was incremented logarithmically by 1%. The tests were carried out in both horizontal and vertical polarizations and all four sides of the EUT was tested each in turn.

9.2 Configuration

Refer to section 1.2 Test Setup (Immunity)

Pic: Immunity to RF Electromagnetic Fields



9.3 Results

The EUT continued to function as intended with no errors or change of status. The EUT continued to function in accordance with the manufacturers specification thereby meeting the requirements for performance criteria A.

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10. Immunity to Fast Transient Bursts – Input AC Port

10.1 Test Method

The immunity of the device submitted for test to fast transients was assessed in accordance with the methods given in specification EN61000-4-4 as referred to in Table 4 of EN 61000-6-1. The unit was subjected to fast transient bursts on the mains power supply as detailed in the basic standard EN61000-4-4 Figure 9. The fast-transient pulses were applied simultaneously between all supply lines to ground. The duration of each test was 1 minute and were tested using both positive and negative transients. Tests were performed to a level of +/-1kV with a rise time/pulse width of 5/50ns and with a repetition frequency of 5kHz.

10.2 Configuration

Refer to section 1.2 Test Setup (Immunity)

Pic. Fast Transients Testing

10.3 Results

The EUT continued to function as intended with no errors or change of status. The EUT achieves performance criteria A, thereby exceeding the minimum requirements of performance criteria B.

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11. Immunity to Surges – Input AC Port

11.1 Test Method

The immunity to surges on the device submitted for test was assessed in accordance with the methods given in specification EN 61000-4-5 as referred to in Table 4 of EN 61000-6-1. The unit was subjected to surges on the mains power port. A total of 30 surges were applied each in turn between line to line and lines to ground. Surges between lines and lines to ground was tested using both positive and negative surges and the tests were performed to a level of +/-1kV and +/-2kV respectively. A total of 10 surges were applied in each mode and were synchronised with the mains supply such that 5 positive and negative pulses were applied at phase angles of (0°, 90° and 270°). The time duration between each of the applied surges was 15 seconds.

11.2 Configuration

Refer to section 1.2 Test Setup (Immunity)

Pic. Surge Testing

11.3 Results

Application	Voltage Applied	Where Applied	Polarity	0°	90°	270°	Pass/Fail
AC Main Port	1 kV	L - N	+ ve	5 surges	5 surges	5 surges	Pass
			- ve	5 surges	5 surges	5 surges	Pass
	2kV	L + N - GND	+ ve	5 surges	5 surges	5 surges	Pass
			- ve	5 surges	5 surges	5 surges	Pass

The EUT continued to function as intended with no errors or change of status. The EUT achieves performance criteria A, thereby exceeding the requirement of performance criteria B.

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12. Immunity to Conducted RF Disturbances – Input AC Port

12.1 Test Method

The immunity of the unit submitted for test to conducted disturbances was assessed in accordance with the specification EN61000-4-6 as referred to in Table 4 of EN 61000-6-1. The EUT was subjected to an RF test level of 3Vrms with a 1kHz modulation at 80% depth in the frequency range from 150 kHz to 80 MHz. The RF disturbance was introduced using the direct CDN (Coupling Decoupling Network) method onto the AC mains.

12.2 Configuration

Refer to section 1.2 Test Setup (Immunity)

Pic. Conducted Immunity Testing

12.3 Results

The EUT continued to function as intended with no errors or change of status. The EUT achieved performance criteria A, thereby meeting the requirement.

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13. Immunity to Voltage Dips and Short Interruptions – Input AC Port

13.1 Test Method

The immunity of the unit submitted for test to voltage dips and interruptions was assessed in accordance with the specification EN 61000-4-11 as referred to in Table 4 of EN 61000-6-1. The EUT was subjected to voltage dips at 100% reduction in line voltage for a period of 10ms and 20ms respectively, 30% reduction for a period of 500ms and a short interruption of the supply for a period of 5s. Each reduction and interruption were triggered synchronously on a 0° phase angle of the AC mains sinusoidal waveform.

13.2 Configuration

Refer to section 1.2 Test Setup (Immunity)

Pic. Voltage Dips and Short Interruptions Testing

13.3 Results

% of Nominal Voltage	Duration	Number Applied	Interval Between Dips / Interruptions	Phase (angle)	Performance Criteria	Performance Criteria Achieved	Pass/Fail
0 %	0.5 cycle (10 ms)	10	10 seconds	0°	B	A	Pass
0 %	1 cycles (20 ms)	10	10 seconds	0°	B	A	Pass
70 %	25 cycles (500 ms)	10	10 seconds	0°	C	B	Pass
0 %	250 cycles (5 secs)	3	10 seconds	0°	C	C	Pass

During the 30% dip of the nominal supply voltage for 500ms, the pressure of the water had reduced. After the test was completed and the supply was normalized, the EUT recovered to its normal operating condition. The EUT exceeds the minimum criteria B for 100% dips of the nominal supply voltage and meets the performance Criteria B and C for the 30% dip and short interruption respectively.

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14. Test Equipment Used

The list below indicates the equipment used during the EMC testing. An X indicates item of equipment was used.

Equipment Details	Used
Emco 3143 Broadband Antenna	X
AH Systems SAS571 Double Ridged Horn Antenna	X
Rohde and Schwarz EMC Receiver – ESHS 10	X
Rohde and Schwarz EMC Receiver – ESVS 10	
Rohde and Schwarz EMC Receiver – ESPC	
Rohde and Schwarz SMT 03 Signal Generator	X
Rohde and Schwarz SMY 02 Signal Generator	
Rohde and Schwarz SMG Signal Generator	X
TTi HA1600A Harmonics, Flicker and Power Analyser	X
TTi - 1000A Low Distortion Power Supply	
ETPS EAC – SMM05R Single Phase AC Source	
EM Test UCS 500M4 – Transient, Voltage Dips, Surge Generator	
Schaffner Best EMC v2.1 Transient, Voltage Dips, Surge Generator	X
Kalmus 737LC RF Power Amp	X
Milmega AS0825-18 RF Power Amplifier	X
Rohde and Schwarz ESH3-Z5 Artificial Mains Network	X
Mess Electonik Mains LISN – NNLK 8129	
Hewlett Packard 11947A Transient Limiter 9 kHz – 200 MHz	X
Rohde and Schwarz T Network	
Schaffner CDN M2/M3	X
Schaffner CDN USB/pS	
Schaffner CDN T4S	
Schaffner CDN S501A	
Schaffner CDN126 Capacitive Coupling Clamp	
EXP Fast Transient Clamp	
Schaffner NSG 453 ESD Simulator	
Schaffner Best EMC v2.1 ESD Generator	X
Vertical Coupling Plane	X
Fischer Injection Clamp – F-140-A	
Fischer Injection Clamp – F-120-9A	
Solar Injection Clamp – 9120	
6dB Attenuator	X
Holiday HI 6005 Isotropic Field Probe	
H.P. 54502A Digitizing Oscilloscope	
Elditest GE8115 High Impedance, High Voltage Differential Probe.	
Philips Automatic Meter PM2519	
Fluke 83 Digital Multimeter	

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15. Glossary

EUT	Equipment Under Test
ISM	Industrial, Scientific and Medical
BCI	Bulk Current Injection
Hz	Hertz (cycles per second)
kHz	Hz x 10^3
MHz	Hz x 10^6
GHz	Hz x 10^9
PFC	Power Factor Correction (Cos. 0)
A	Amperes
V	Volts
kV	V x 10^3
H	Henries (Inductance)
mH	H x 10^{-3}
µH	H x 10^{-6}
F	Farads (Capacitance)
mF	F x 10^{-3}
µF	F x 10^{-6}
Rt	Rise Time
Pw	Pulse Width
Ft	Fall Time
s	Seconds
ms	S x 10^{-3}
µs	S x 10^{-6}
dB/µV	Decibel/micro-volts. Ratio with 1 µV Reference
P	Peak
QP	Quasi Peak
Av	Average

END OF REPORT

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