

Traco Power

Model: TIB240-148*

EMC – Test Report

EUT: Traco Power - Model: TIB240-148

Serial No.: 21804100043

Manufacturer No.: 240PSX185

Manufacturer: Traco Power Solutions Ltd.
Whitemill Industrial Estate
Wexford
Republic of Ireland

Tester: BOR, Traco Power Solutions Ltd

Date: 15/03/2019

***Also covers models with EX designation**

It should be noted, that combining two or more CE compliant finished appliances does not automatically produce a compliant system. The manufacturer of an apparatus or a fixed installation as defined in the “Guide for the EMC Directive 2004/108EC, 21. May 2007” is responsible for the EMC-compliance of the final apparatus.

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1. Conducted Emissions Measurement at Mains Terminals

Equipment under Test: TIB240-148
EUT Serial No.: 21804100043
Customer Spec: CS-XXXPSX18X
Date: 12/02/2018
Standards: IEC61000-6-3: 2011 referring to CISPR 16-2-1: 2005

Notes:

- EUT tested under normal operating conditions of 230V 50Hz input at full nominal load (48V/5A Resistive).
- Emissions measured using Agilent E7402A EMC Analyzer and LISN Schwarzbeck NSLK 8127.
- Tested to IEC 61000-6-3:Ed 2.1 Class B limits.
- Transient limiter is used to protect the Agilent E7402A, with appropriate correction factors applied.
- Tests carried out in a shielded room.

1.1. Test Setup

Test Equipment Settings:

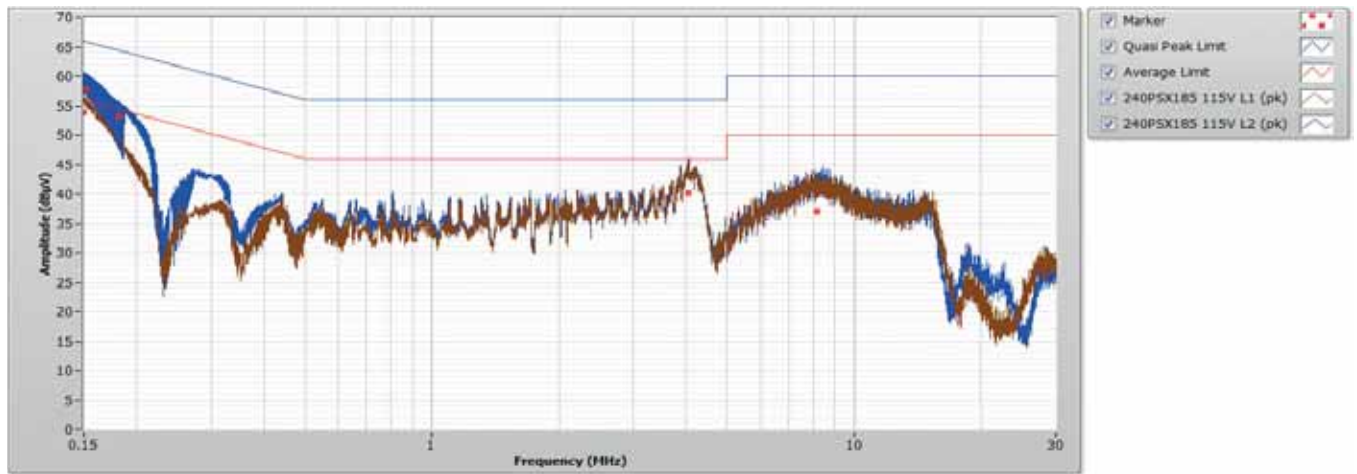
Start Freq.	Stop Freq.	Pk Time	Qpk Time	Avg Time
150kHz	30MHz	200ms	200ms	200ms

Test Setup:



1.2. Conducted Emissions Test Results (Mains Terminals)

L and N



Measurement-List

Frequency (MHz)	Peak (dBµV)	Quasi Peak (dBµV)	Average (dBµV)	Delta Quasi Peak (dBµV)	Delta Average (dBµV)
0.140	61.530	59.470	46.090	-6.970	-10.35
0.150	60.490	57.650	38.970	-8.240	-16.92
0.180	55.660	53.190	31.900	-11.200	-22.5
0.150	56.200	53.800	36.160	-12.100	-19.73
4.030	44.420	40.230	28.850	-15.770	-17.15
8.170	41.670	37.030	30.170	-22.970	-19.83

Table 1 - Average and Quasi Peak Measurements of the TIB240-148

Remarks:

The Brown graph represents peak measurements of Live and the Blue graph represents peak measurements of Neutral. Quasi peak and average measurements are measured if the peak measurement is above the relevant limit. See Table 1.

PASS

2. Conducted Emissions Measurements at DC output Terminals

Equipment under Test: TIB240-148
EUT Serial No.: 21804100043
Customer Spec: CS-XXXPSX18X
Date: 12/02/2018
Standards: EN50121-4: referring to CISPR 16-2-1: 2005

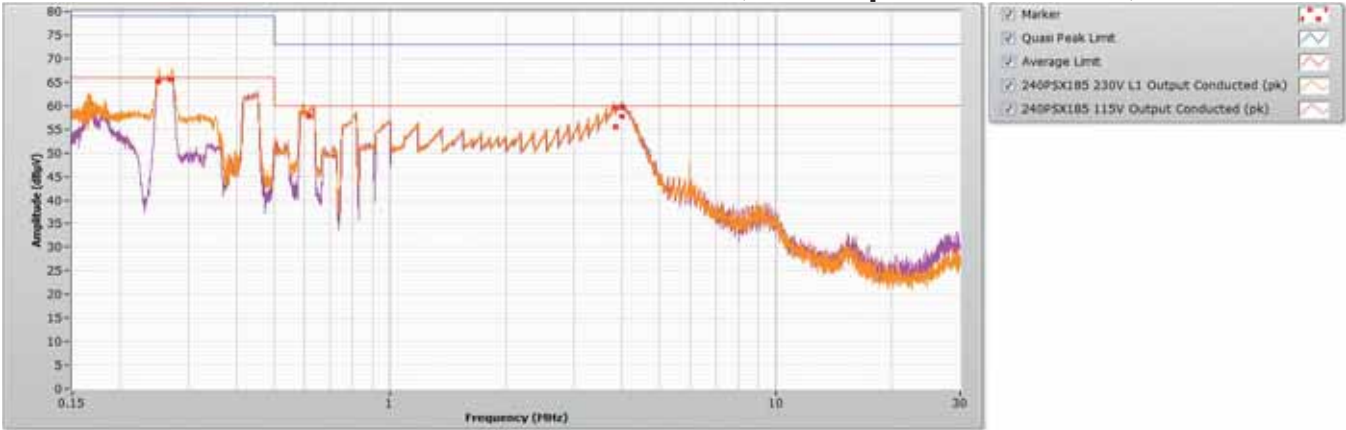
Notes:

- EUT tested under normal operating conditions of 220V 50Hz input at full nominal load (48V/5A Resistive).
- Emissions measured using Agilent E7402A and FCC-801-M2-50A Coupling/Decoupling network.
- Tested to EN50121-4: Class B limits.
- Transient limiter used to protect Agilent E7402A, with appropriate correction factors applied.
- Appropriate correction factors also applied for output Coupling/Decoupling network.
- Tests carried out in a shielded room.

2.1 Test Setup



2.2 Conducted Emissions Test Results (DC output Terminals)



Measurement-List

Table 2 - Average and Quasi Peak Measurements of the TIB240-148

PASS

3. Radiated Emissions Measurements

Equipment under Test:	TIB240-148
EUT Serial No.:	21804100043
Customer Spec:	CS-XXXPSX18X
Date:	12/02/2018
Standards:	IEC61000-6-3: 2011 referring to CISPR 16-2-3: 2003

For an apparatus to comply with EMC radiated emissions requirements as set down in CISPR 16-2-3, free field measurements need to be performed. A test method similar to that described in IEC61204-3 (for low-voltage power supplies) section 6.4.2 shall be used here instead of free field measurements. This test is designed to give a good indication of whether an EUT will pass free field measurements or not. The absorber clamp used in this method is replaced by a Fischer high frequency current probe (Model: F-33-1). The limits used are set by comparison with open field measurements and are compensated by 20dB per frequency decade. Two limit lines are indicated; Fis_a and Fis_b, and the results may be interpreted as follows:

- Below limit line Fis_b: Limits are kept.
- Below limit line Fis_a: Limits probably kept.
- Above limit line Fis_a: Limits most likely not kept.

Final Compliance can only be established by free field measurements in accordance to the relevant standard applicable to the apparatus or enclosure in which the power supply is used.

Notes:

- EUT tested under normal operating conditions of 230V 50Hz input at full nominal load (48V/5A Resistive).
- Emissions measured using receiver Agilent E7402A and FCC RF current probe.
- RF current probe kept a distance of 10cm from input/output.
- Tests carried out in shielded room.
- Tested to IEC 61000-6-3:Ed 2.1 Class B limits.

3.1. Test Setup

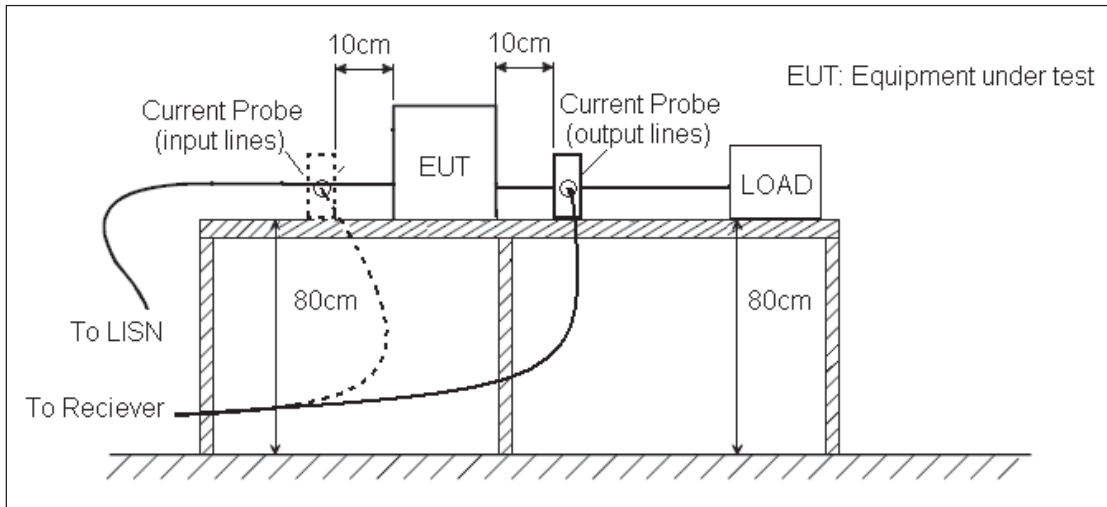


Figure 1. Test set-up for measurement of disturbance power similar to IEC61204-3

Test Equipment Settings:

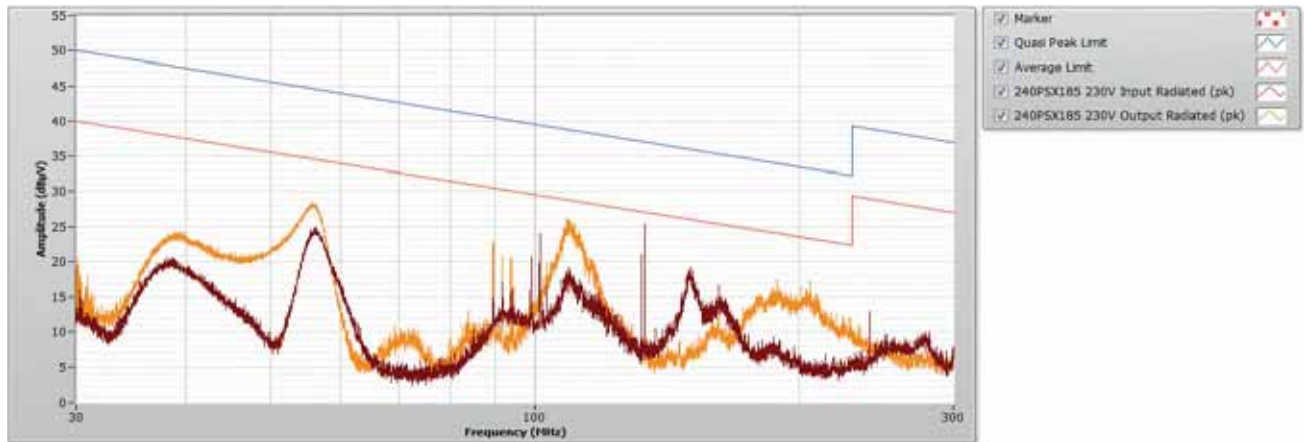
Start Freq.	Stop Freq.	Pk Time
30MHz	300MHz	200ms

Test Setup: The following shows the setup used for input lines, the setup used for the output lines is the same with the clamp on the output lines.



3.2. Radiated Emissions Test Results

Input Lines and Output Lines:



PASS

4. Harmonic Current Emissions Measurement at Mains Terminal

Equipment under Test: TIB240-148
EUT Serial No.: 21804100043
Customer Spec: CS-XXXPSX18X
Date: 03/10/2018
Standards: IEC61000-6-3: 2006 referring to IEC 61000-3-2: 2005

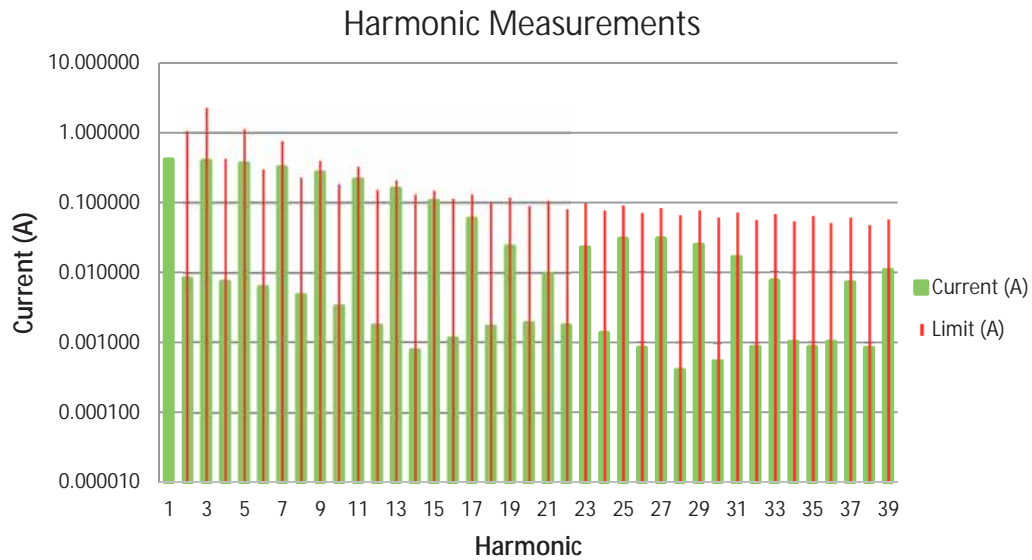
Notes:

- EUT tested under normal operating conditions of 230V 50Hz input at full nominal load (48V/5A Resistive).
- EUT powered by low-distortion AC Voltage Source, TTI AC-1000.
- Harmonic Limits measured using LMG 95 Power Meter.
- Tested to IEC61000-3-2 Table 1 Class A and Class D.

4.1. Test Setup:



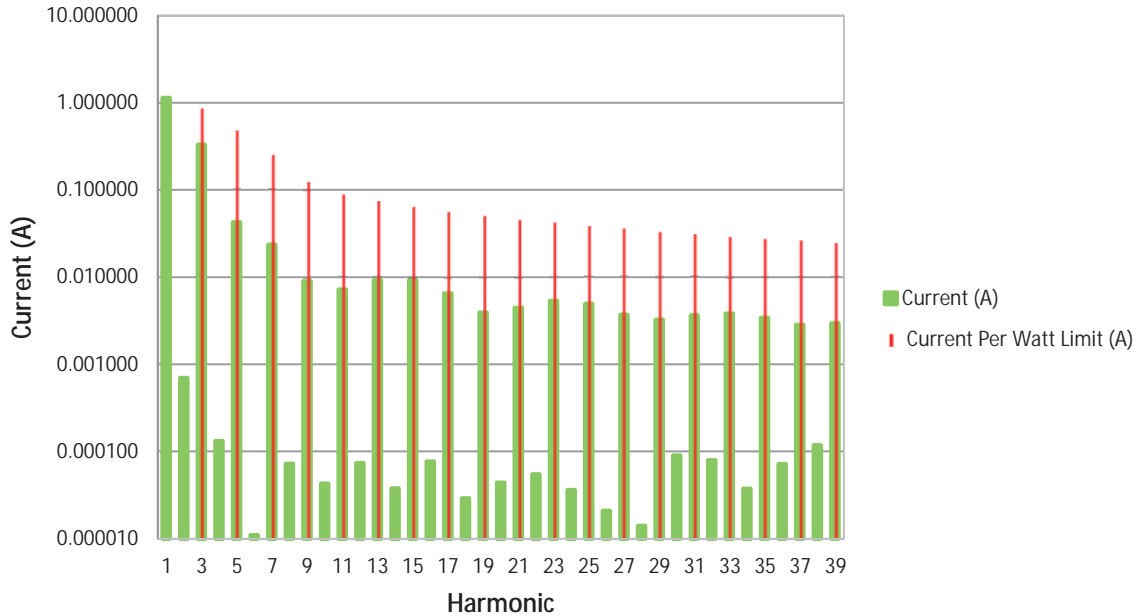
4.2. Harmonic Current Emissions Test Results



Harmonic	Current (A)	Limit (A)	Harmonic	Current (A)	Limit (A)
0	0.000132		20	0.000044	0.092000
1	1.134850		21	0.004462	0.107143
2	0.000697	1.080000	22	0.000055	0.083636
3	0.328223	2.300000	23	0.005319	0.097826
4	0.000131	0.430000	24	0.000036	0.076667
5	0.042222	1.140000	25	0.004899	0.090000
6	0.000011	0.300000	26	0.000021	0.070769
7	0.023354	0.770000	27	0.003664	0.083333
8	0.000072	0.230000	28	0.000014	0.065714
9	0.009048	0.400000	29	0.003228	0.077586
10	0.000043	0.184000	30	0.000090	0.061333
11	0.007192	0.330000	31	0.003607	0.072581
12	0.000073	0.153333	32	0.000079	0.057500
13	0.009218	0.210000	33	0.003843	0.068182
14	0.000037	0.131429	34	0.000037	0.054118
15	0.009169	0.150000	35	0.003402	0.064286
16	0.000076	0.115000	36	0.000071	0.051111
17	0.006558	0.132353	37	0.002819	0.060811
18	0.000029	0.102222	38	0.000118	0.048421
19	0.003943	0.118421	39	0.002945	0.057692

PASS

Harmonic Measurements



Harmonic	Current (A)	Current Per Watt Limit (A)	Max Current Limit (A)	Harmonic	Current (A)	Current Per Watt Limit (A)	Max Current Limit (A)
0	0.000132			20	0.000044		
1	1.134850			21	0.004462	0.045772	0.107143
2	0.000697			22	0.000055		
3	0.328223	0.848854	2.300000	23	0.005319	0.041791	0.097826
4	0.000131			24	0.000036		
5	0.042222	0.474360	1.140000	25	0.004899	0.038448	0.090000
6	0.000011			26	0.000021		
7	0.023354	0.249663	0.770000	27	0.003664	0.035600	0.083333
8	0.000072			28	0.000014		
9	0.009048	0.124832	0.400000	29	0.003228	0.033145	0.077586
10	0.000043			30	0.000090		
11	0.007192	0.087382	0.330000	31	0.003607	0.031007	0.072581
12	0.000073			32	0.000079		
13	0.009218	0.073939	0.210000	33	0.003843	0.029127	0.068182
14	0.000037			34	0.000037		
15	0.009169	0.064080	0.150000	35	0.003402	0.027463	0.064286
16	0.000076			36	0.000071		
17	0.006558	0.056541	0.132353	37	0.002819	0.025978	0.060811
18	0.000029			38	0.000118		
19	0.003943	0.050590	0.118421	39	0.002945	0.024646	0.057692

PASS

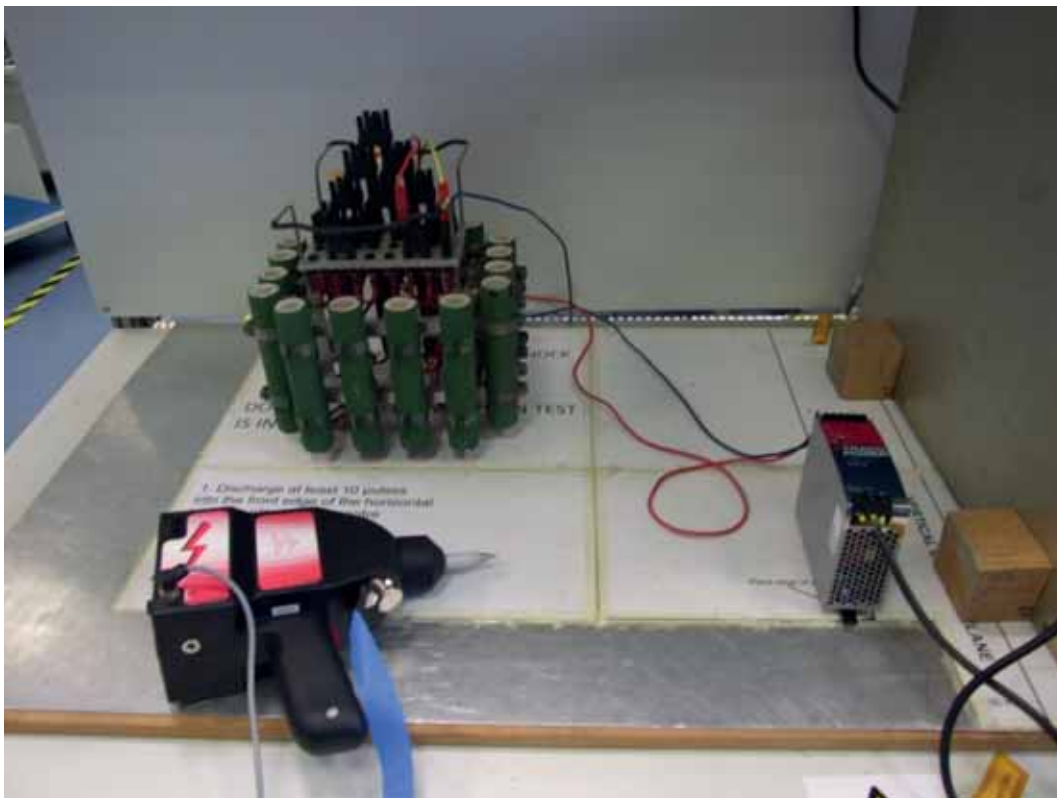
5. Electrostatic Discharge Immunity Test

Equipment under Test: TIB240-148
EUT Serial No.: 21804100043
Customer Spec: CS-XXXPSX18X
Date: 12/02/2018
Standards: IEC61000-6-2: 2005 referring to IEC 61000-4-2: 2000

Notes:

- EUT tested under normal operating conditions of 230V 50Hz input at full nominal load (48V/5A Resistive).
- Since the EUT output is isolated from earth, a 470K HV resistor was placed between output and Earth to provide a discharge path between spikes.
- Contact discharge tests shall be applied to all areas exposed to the end user under final installation using ESD gun SEDS 200.
- Test voltage shall be increased from 2kV up to the max 8kV/4kV (air/contact) as required by the standard IEC/EN 61000-4-2.
- At least 10 discharges were applied per test point (in both polarities).
- A time interval between discharges of a least 1s was used.
- The ESD generator was held perpendicular to the test point wherever possible for repeatability of results.
- In the case of air discharges, the trigger is engaged at about 20cm and the tester is moved quickly toward the test point until a spark occurs and trigger is released.

5.1. Test Set-Up:



5.2. Electrostatic Discharge Immunity Test Results

All exposed metal screw heads and ground planes were tested as contact test points and also as air test points. The connector pins and all vents and inlets were also tested as air test points.

	Contact Test points:	Air Test points:
EUT	PASS	PASS

Conclusion:

The EUT still functions as expected after tests therefore it meets classification B in accordance with IEC61000-4-2.

PASS

Environmental conditions during ESD Test

	Environmental condition required according IEC61000-4-2	Environmental conditions measured
Ambient Temperature in [°C]	15 - 35	22
Air Humidity in [%]	30 - 60	45
Atmospheric Pressure in [kPa]	86.0 - 106.0	102

Environmental conditions during the test:

☒ kept

☐ not kept

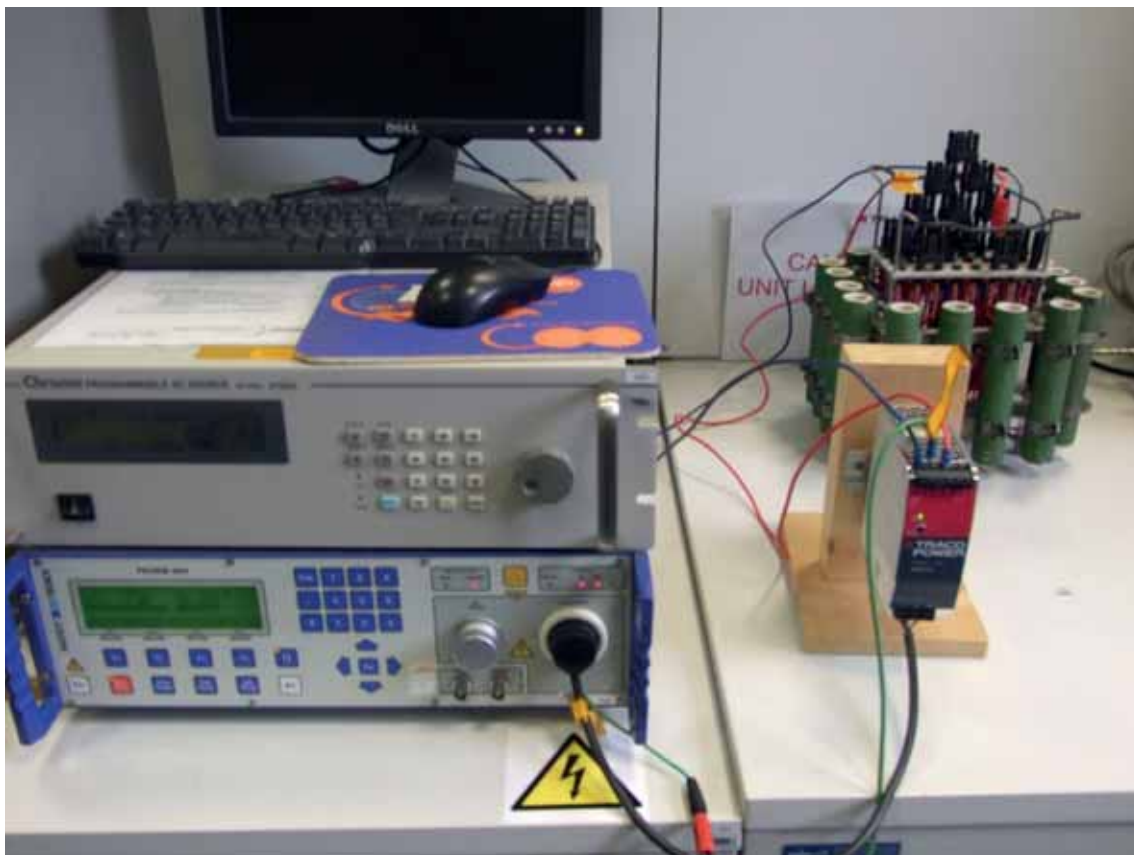
6. Surge Voltage Immunity Test

Equipment under Test: TIB240-148
EUT Serial No.: 21804100043
Customer Spec: CS-XXXPSX18X
Date: 03/10/2018
Standards: IEC61000-6-2: 2005 referring to IEC 61000-4-5: 2005

Notes:

- EUT tested under normal operating conditions of 230V 50Hz input at full nominal load (48V/5A Resistive).
- Used Haefely Surge generator PSURGE 4010.
- Voltage test level: AC port Line-Line +/-0.5KV and +/- 1kV, AC port Line-Earth +/- 0.5KV, +/- 1KV and +/- 2kV (installation class 3).
- DC ports Line-Line & DC ports Line-Earth +/-0,5kV & Signal Ports Line-Earth +/- 1kV (Not tested due to lack of suitable equipment).
- No. of Surges per set: 5 tests Positive and 5 tests Negative.
- Interval Between Surges: 10s.

6.1. Test Setup



6.2. Surge Voltage Immunity Test Results

	L+VE to L-VE	L+VE to PE	L-VE to PE
EUT	PASS	PASS	PASS

Conclusion:

The EUT meets classification B as required per Table 4, IEC 61000-6-2.

PASS

7. Fast Transient Voltage Immunity Test (Burst)

Equipment under Test: TIB240-148
EUT Serial No.: 21804100043
Customer Spec: CS-XXXPSX18X
Date: 12/02/2018
Standard: IEC61000-6-2: 2005 referring to IEC 61000-4-4: 2004

Notes:

- EUT tested under normal operating conditions of 230V 50Hz input at full nominal load (48V/5A Resistive).
- Units tested to IEC61000-4-4 test level 3.
- Used Haefely Burst tester PEFT 4010.
- AC & DC Power ports Voltage test level: $\pm 2\text{kV}$.
- Signal Ports Voltage test level: $\pm 1\text{kV}$.
- Burst Duration: 0.75ms.
- Spike frequency: 100kHz.
- Burst Period: 300ms.
- Individual test time: 1 min.
- Polarity: Positive and Negative.

The Output lines and Signal lines were tested to the above mentioned limits with Haefely coupling capacitor IP4A.

7.1. Test Setup



7.2. Fast Transient Voltage (Burst) Test Results.

EUT:	+VE-G	-VE-G	PE-G	+VE, -VE-G	+VE,PE-G	-VE,PE-G	+VE, -VE,PE-G	Outputs -G	Signals -G
Positive	PASS	PASS	PASS	PASS	PASS	PASS	PASS	PASS	PASS
Negative	PASS	PASS	PASS	PASS	PASS	PASS	PASS	PASS	PASS

Conclusion:

The EUT meets classification B as required per Table 2, 3 & 4, IEC 61000-6-2.

PASS

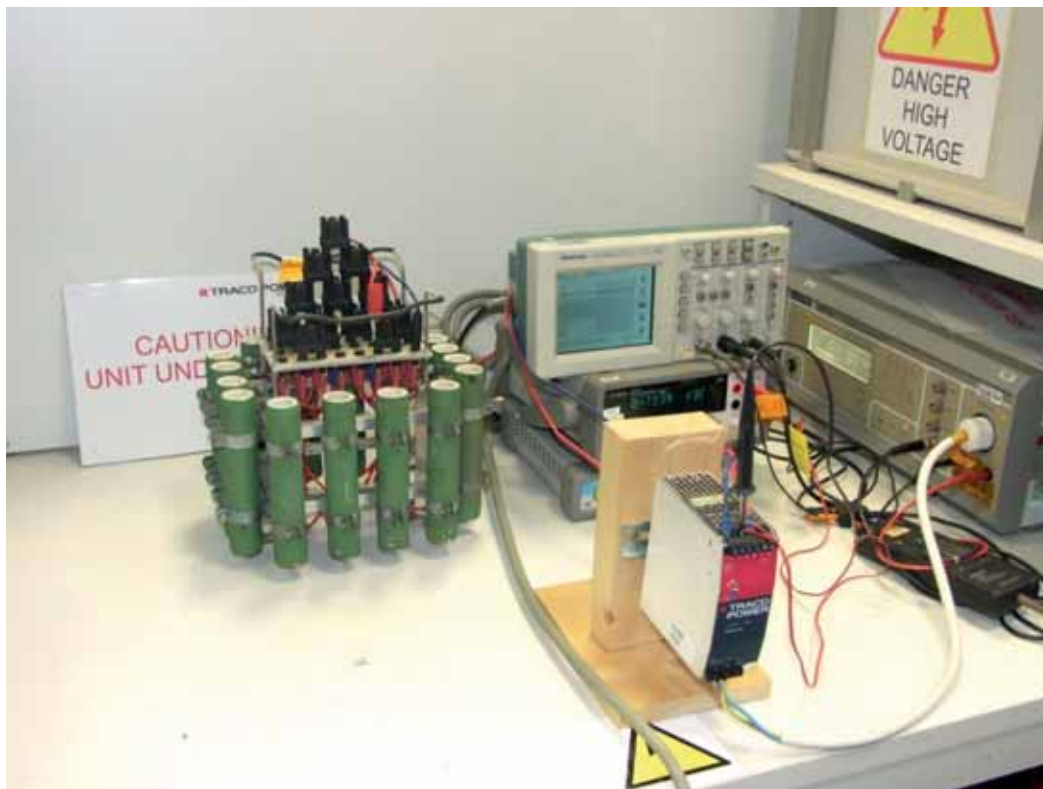
8. Voltage Dips and Short Interruptions Test at AC Input Terminals

Equipment under Test: TIB240-148
EUT Serial No.: 21804100043
Customer Spec: CS-XXXPSX18X
Date: 12/02/2018
Standard: IEC61000-6-2:2005 referring to IEC 61000-4-11:2004

Notes:

- EUT tested at full nominal load (48V/5A Resistive).
- Test carried out using 2 Variacs and dropout simulator NSG 1003.
- Tested according to class 3 IEC61000-4-11 (as per Annex B).
- Unit tested with input voltages 115V and 230V in accordance with IEC61000-4-11 section 5.
- Interval between dropouts and short interruptions was 10s.
- Phase angle was set to 0°, 90°, 180°, 270° for each voltage level tested.
- Voltage Dips were tested from 100%-80% for 250 Mains cycles in accordance with IEC61000-4-11 table 1.
- Voltage Dips were tested from 100%-70% for 25 Mains cycles in accordance with IEC61000-4-11 table 1.
- Voltage Dips were tested from 100%-40% for 10 Mains cycles in accordance with IEC61000-4-11 table 1.
- Voltage Dips were tested from 100%-0% for 1 Mains cycle in accordance with IEC61000-4-11 table 1.
- Voltage Dips were tested from 100%-0% for ½ Mains cycle in accordance with IEC61000-4-11 table 1.
- 3 Voltage dips and 3 Short Interruptions were carried out per test.
- Short interruptions tests were carried out at 100% to 0% for each duration 0.1s, 0.2s, 0.5s, 1s, 2s, and 5s. Voltage interruption of 250 cycles @ 50Hz (5s) required for Class 3, IEC61000-4-11 table 2.
- Short interruptions were done at worst case 0° phase angle.
- Classification of performance in accordance to IEC61000-4-11 Section 9.
- Pass/Fail. The test results shall be classified in terms of loss of function or degradation of performance of the equipment under test. The recommended classification is as follows.
 - A. Normal performance within limits specified by the manufacturer, requestor or purchaser (Pass).
 - B. Temporary loss of function or degradation of performance which ceases after the disturbance ceases, and from which the equipment under test recovers its normal performance, without operator intervention (Pass).
 - C. Temporary loss of function or degradation of performance, the correction of which requires operator intervention (Pass).
 - D. Loss of function or degradation of performance which is not recoverable, owing to damage to hardware or software, or loss of data (Fail).

8.1. Test Setup



8.2. Voltage Dips & Short Interruptions Results (Classifications)

Voltage Dips Test Results						
230VAC						
Input Voltage		Phase Angle				Mains Cycles (50Hz)
		0°	90°	180°	270°	
100% - 80%	184VAC	A	A	A	A	250
100% - 70%	161VAC	A	A	A	A	25
100% - 40%	92VAC	A	A	A	A	10
100% - 0%	0VAC	A	A	A	A	1
100% - 0%	0VAC	A	A	A	A	0.5

115VAC						
Input Voltage		Phase Angle				Mains Cycles (50Hz)
		0°	90°	180°	270°	
100% - 80%	92VAC	A	A	A	A	250
100% - 70%	80.5VAC	A	A	A	A	25
100% - 40%	46VAC	B	B	B	B	10
100% - 0%	0VAC	B	B	B	A	1
100% - 0%	0VAC	A	A	A	A	0.5

Voltage Interruptions Test Results						
Mains Cycles	5	10	25	50	100	250
100% - 0%	0.1s	0.2s	0.5s	1s	2s	5s
230VAC	B	B	B	B	B	B
115VAC	B	B	B	B	B	B

Conclusion:

The test results were evaluated in relation to the Customer Specification CS-XXXPSX18X and the EUT was considered to have PASSED the tests.

PASS

9. Conducted RF Immunity Test at AC Mains Terminals

Equipment under Test: TIB240-148
EUT Serial No.: 21804100043
Customer Spec: CS-XXXPSX18X
Date: 12/02/2018
Standard: IEC61000-6-2: 2005 referring to IEC 61000-4-6:2004

Notes:

- EUT tested under normal operating conditions of 230V 50Hz input at full nominal load (48V/5A Resistive).
- Test carried out using test generator “EM Test CWS 500N”, Coupling/Decoupling network “EM Test CDN M2/M3”, an attenuator “EM Test ATT6/75” and measurement instrument “Agilent 34410A”.
- Unit tested to IEC61000-4-6 test level 3.

9.1. Test Setup

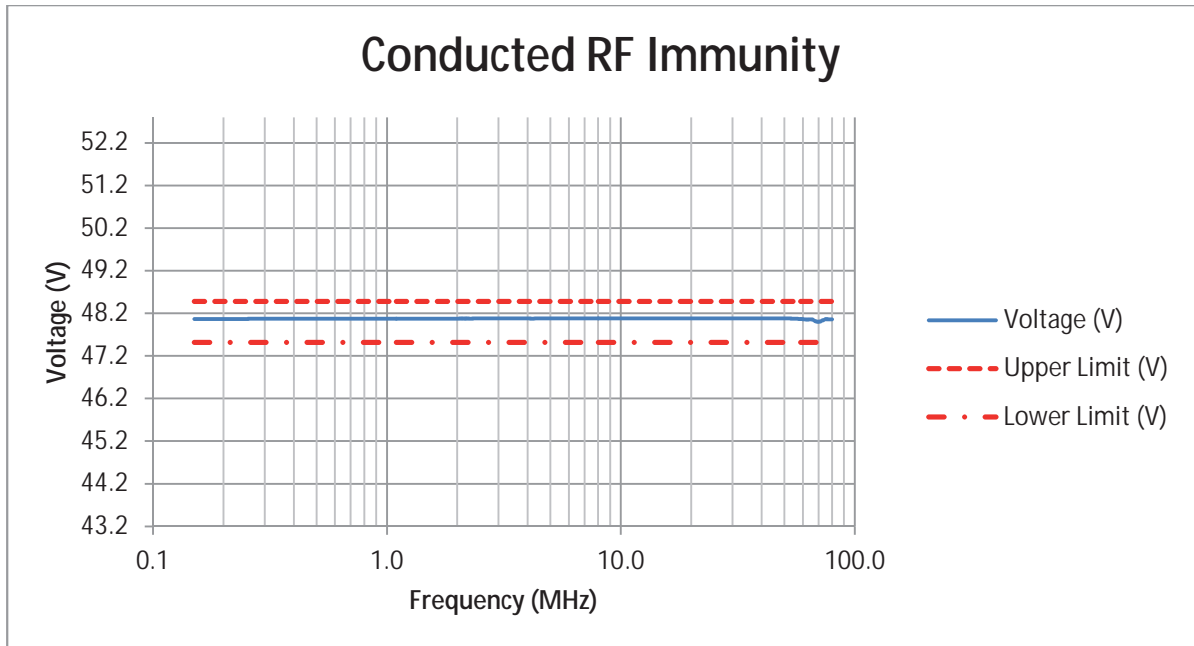
Test Equipment Settings:

Frq. start [MHz]	Level start [V]	Frq. stop [MHz]	Level stop [V]	Frq. step	td [s]	tp [s]	Modulation
0.150	10.0	80.000	10.0	1.0 %	0.5	0.0	AM 1kHz 80%

Test Setup:



9.2. Conducted RF Immunity Test Results



Conclusion:

The EUT meets Classification A (Ref. Section 9, IEC 61000-4-3).

The test results were evaluated in relation to the Customer Specification CS-XXXPSX18X and the output did not change by more than $\pm 480\text{mV}$ therefore the EUT was considered to have PASSED the tests.

PASS

10. Conducted RF Immunity Test at DC Output Terminals

Equipment under Test: TIB240-148
EUT Serial No.: 21804100043
Customer Spec: CS-XXXPSX18X
Date: 12/02/2018
Standard: IEC61000-6-2: 2005 referring to IEC 61000-4-6:2004

Notes:

- EUT tested under normal operating conditions of 230V 50Hz input at full nominal load (48V/5A Resistive).
- Test carried out using test generator “EM Test CWS 500N”, Coupling/Decoupling network “EM Test CDN M2/M3”, an attenuator “EM Test ATT6/75”, measurement instrument “Agilent 34410A” and FCC-801-M2-50A Coupling/Decoupling network.
- Unit tested to IEC61000-4-6 test level 3.

10.1. Test Setup:

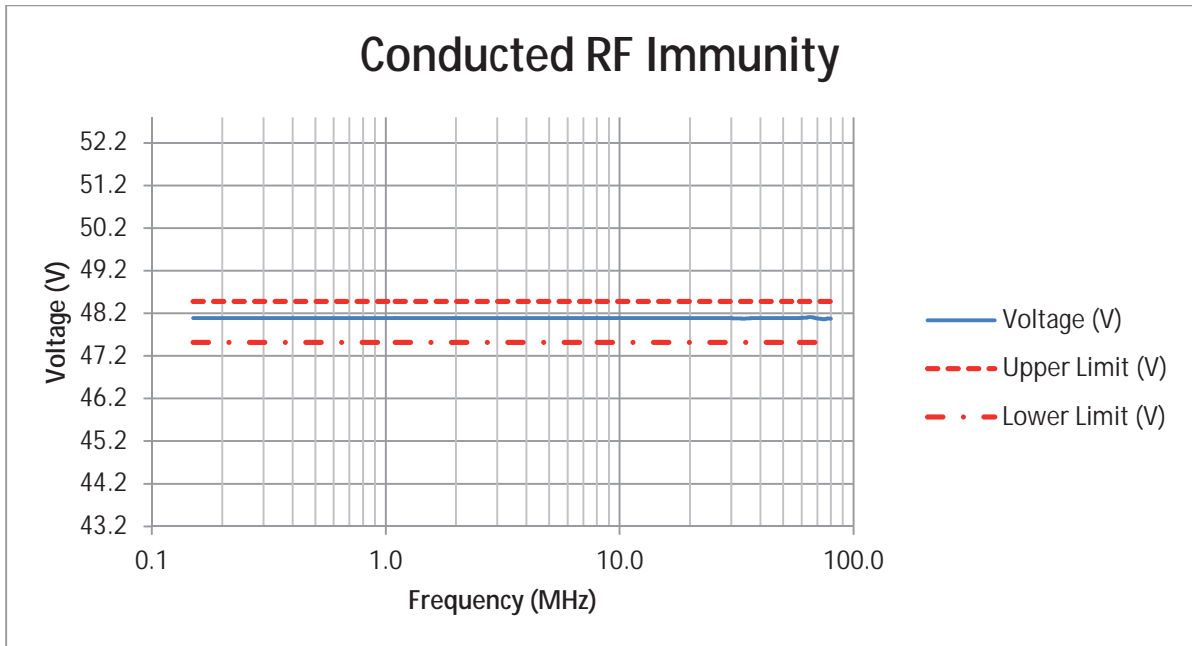
Test Equipment Settings:

Frq. start [MHz]	Level start [V]	Frq. stop [MHz]	Level stop [V]	Frq. step	td [s]	tp [s]	Modulation
0.150	10.0	80.000	10.0	1.0 %	0.5	0.0	AM 1kHz 80%

Test Setup:



10.2. Conducted RF Immunity Test Results



Conclusion:

Meets Classification A (Ref. Section 9, IEC 61000-4-3)

Test Results were evaluated in relation to the Customer Specification

CS-XXXPSX18X and the output did not change by more than $\pm 480\text{mV}$ therefore the EUT was considered to have PASSED the tests.

PASS

11. Radiated RF Immunity Test

Equipment under Test: TIB240-148
EUT Serial No.: 21804100043
Customer Spec: CS-XXXPSX18X
Date: 12/02/2018
Standard: IEC61000-6-2: 2005 referring to IEC61000-4-3: 2004

Notes:

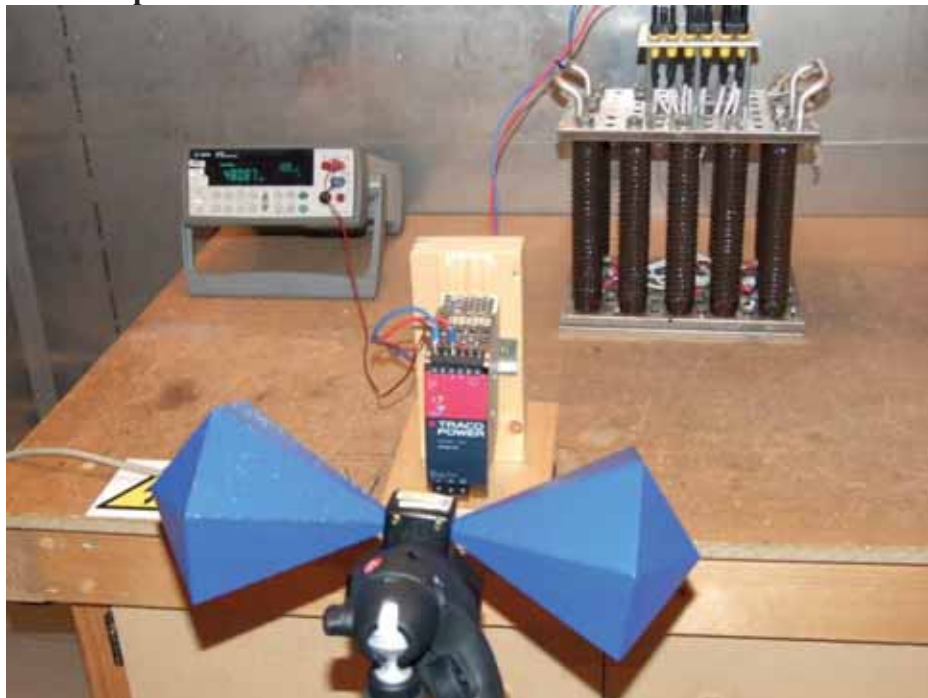
- EUT tested under normal operating conditions of 230V 50Hz input at full nominal load (48V/5A Resistive).
- Test carried out using test generator “EM Test CWS 500N”, Antenna BicoLOG 30100 X and Digitizing Multi Meter “Agilent 34405A”
- Measurement was carried out in a shielded room
- The input power port of the EUT was connected to mains via a 1.5m 3-core cable
- The output power port of the EUT was connected to the resistor bank via 1.5m long single core wires –wire size 14AWG

11.1. Test Setup

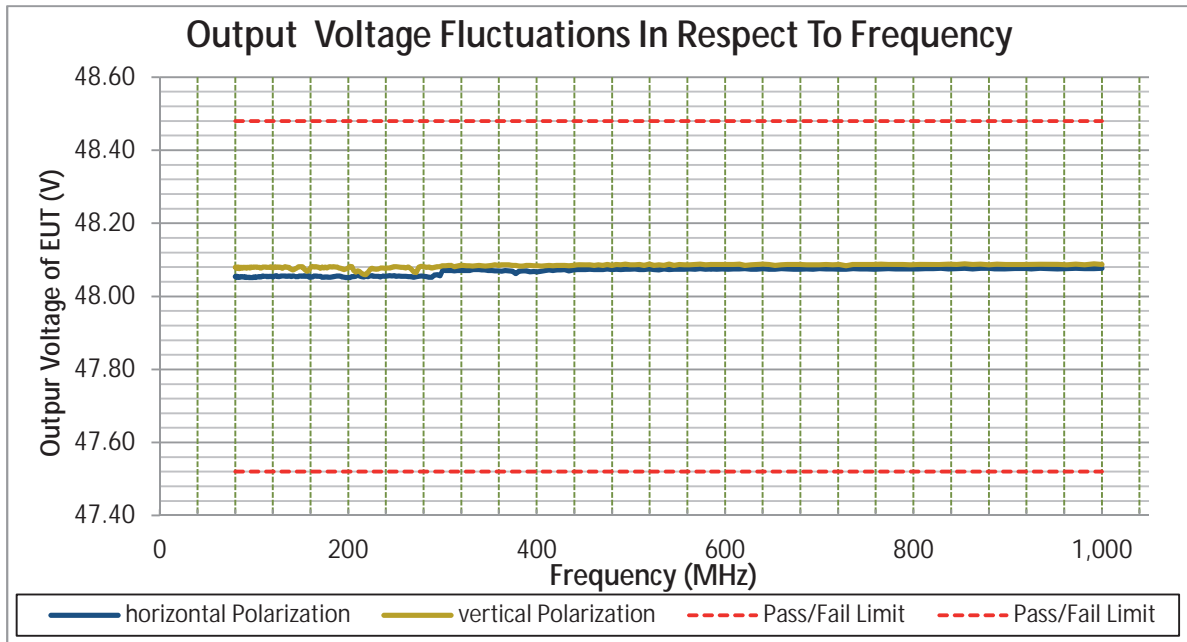
Test Equipment Settings:

Frq. start [MHz]	Level start [V]	Frq. stop [MHz]	Level stop [V]	Frq. step	td [s]
80.0	10.0	1000.0	10.0	1.0 %	1

Test Setup:



11.2. Radiated RF Immunity Test Results



Conclusion:

The EUT meets classification A (Ref. Section 9, IEC 61000-4-3). The test results were evaluated in relation to the Customer Specification CS-XXXPSX18X and the output did not change by more than $\pm 480\text{mV}$ therefore the EUT was considered to have PASSED the tests.

PASS

12. Power Frequency Magnetic Field Immunity Test

Equipment under Test: TIB240-148
EUT Serial No.: 21804100043
Customer Spec: CS-XXXPSX18X
Date: 12/02/2018
Standard: IEC61000-6-2: 2005 referring to IEC61000-4-8: 2001

Notes:

- EUT tested under normal operating conditions of 230V 50Hz input at full nominal load (48V/5A Resistive).
- Test carried out using test generator “Chroma Programmable AC Source”, “1meter x 1meter 100 turn Induction Coil” and measurement instrument “Agilent 34405A”.
- Unit only required to meet test level 4 but tested to IEC61000-4-8 test levels 5.

12.1. Test Setup

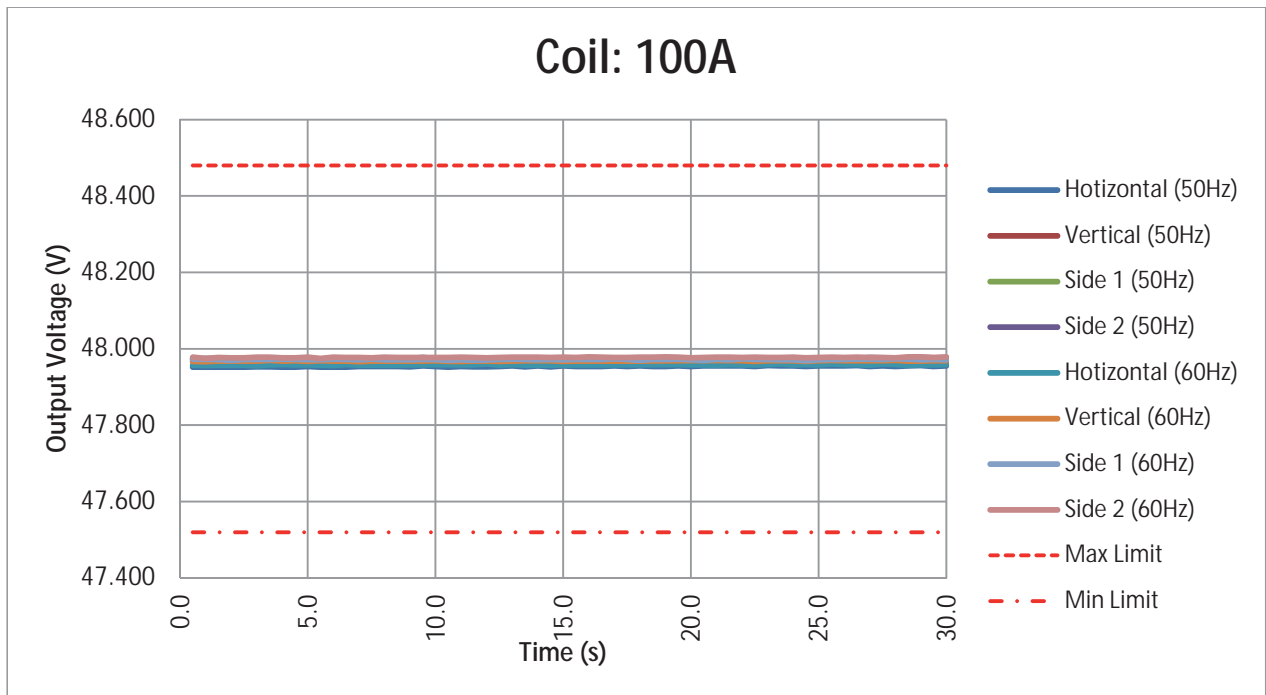
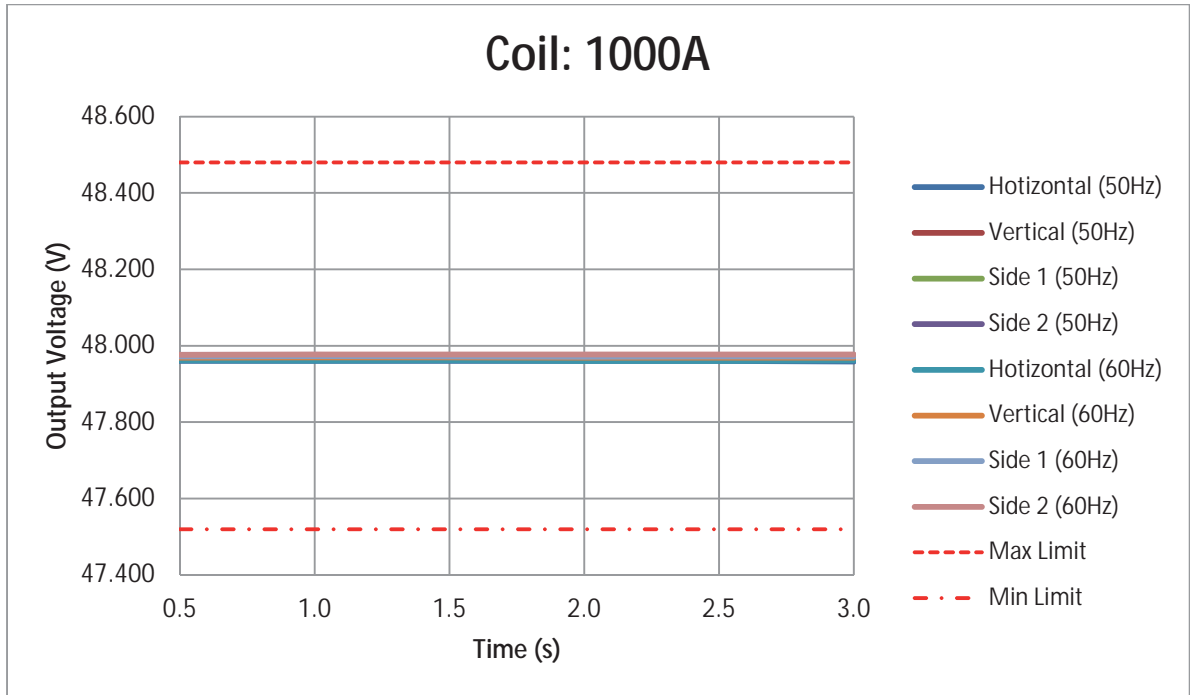
Test Equipment Settings:

Test generator settings			
Frequency	AC Current through Induction Coil (Arms)	Magnetic Field Strength (A/m)	Applied Field duration [s]
50Hz	1	100	Continuous
60Hz	1	100	Continuous
50Hz	10	1000	3
60Hz	10	1000	3

Test Setup:



12.2. Power Frequency Magnetic Field Immunity Test Results



Conclusion:

The EUT meets classification A (Ref. Section 9, IEC 61000-4-8). The test results were evaluated in relation to the Customer Specification CS-XXXPSX18X and the output did not change by more than $\pm 480\text{mV}$ therefore the EUT was considered to have PASSED the tests.

PASS

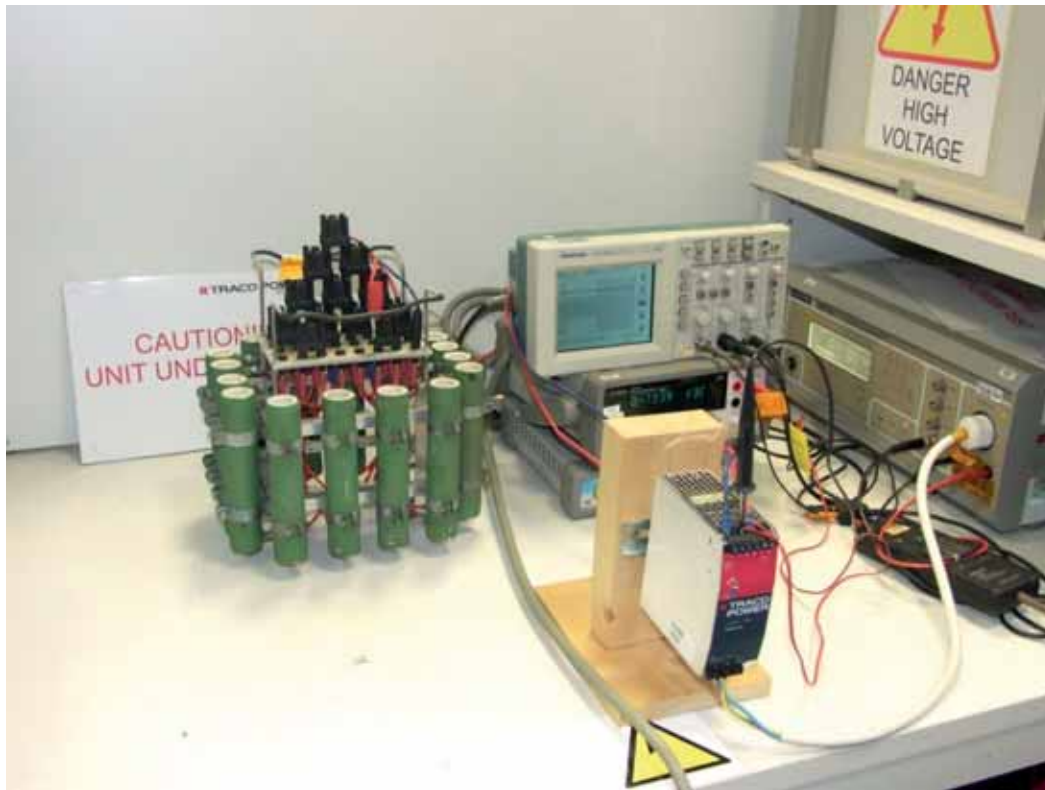
13. Voltage Sag Immunity Test (Semi F47)

Equipment under Test: TIB240-148
EUT Serial No.: 21804100043
Customer Spec: CS-XXXPSX18X
Date: 12/02/2018
Standard: SEMI F47-0706

Notes:

- EUT tested under operating conditions of 230V and 115V 50Hz input at full nominal load (48V/5A Resistive).
- Test carried out using test generator using Voltage Sag Generator: Schaffner NSG1003: Dropout and Variation Simulator and Oscilloscope Tektronix: TDS2014C.
- Pass/Fail Criteria for Subsystems and Components-Voltage sag immunity testing of subsystems and components should meet the following as required by Semi-F47:
 - A. Performs at full rated operation.
 - B. May not perform at full rated operation but recovers operation without operator and/or host controller intervention. Must not send error signals to the equipment host controller indicating when full rated operation is not achieved.
 - C. May not perform at full rated operation but recovers operation without operator and/or host controller intervention. May send signals to the equipment host controller indicating when full rated operation is not achieved.
 - D. Does not perform at full rated operation and requires an operator and/or host controller intervention for recovering.

13.1. Test Setup



13.2. Voltage Sag Immunity test Results (Semi F47)

Input Voltage = 230VAC, Output = 48V, 5A

230VAC						
Voltage Sag	Duration	Duration	Output Voltage	% delta of nominal output voltage	Semi F47	Criteria
[V]	[s]	[cycles]	[V]	DUT 50Hz [%]	[%]	[Class]
207	20	1000	47.98	0.0	90	A
207	10	500	47.98	0.0	90	A
184	10	500	47.97	0.1	80	A
184	1	50	47.97	0.1	80	A
184	0.5	25	47.97	0.1	80	A
161	0.5	25	47.97	0.1	70	A
161	0.5	10	47.97	0.1	70	A
115	0.2	10	47.96	0.1	50	A
115	0.02	1	47.96	0.1	50	A
0	0.02	1	47.94	0.1	0	A

*Yellow indicates the required Voltage SAG Immunity Levels. Other levels are recommended.

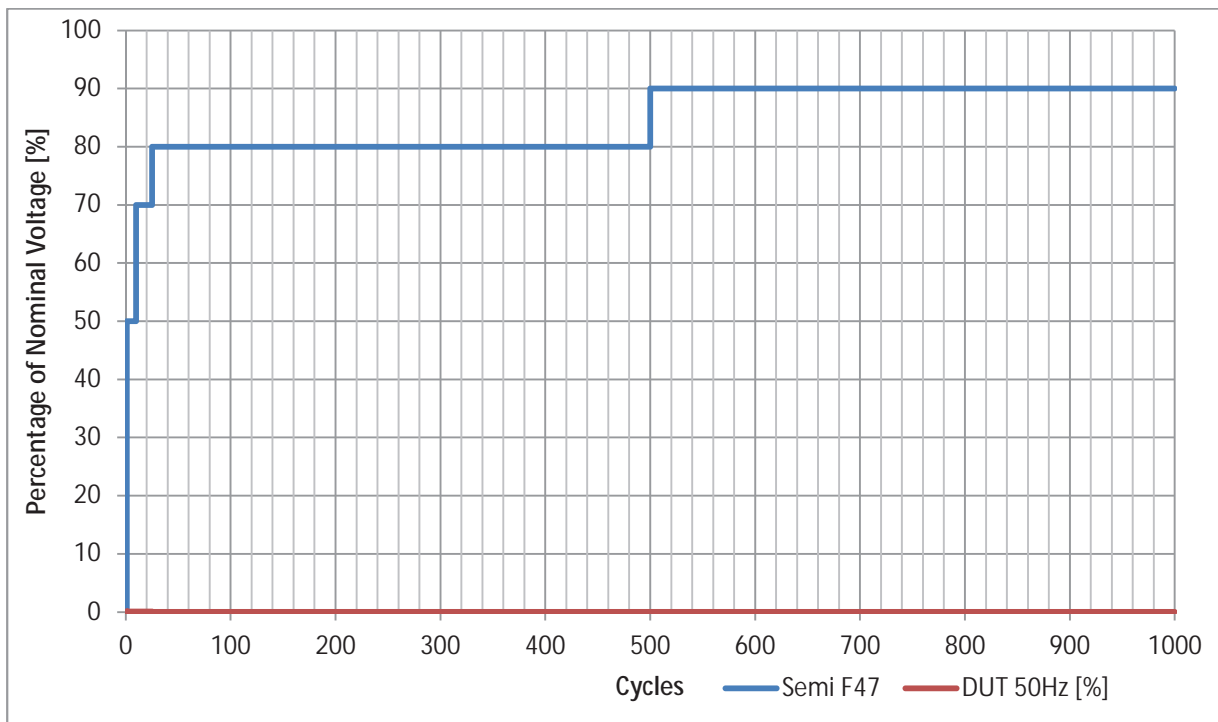


Figure 1: TIB240-148/ 0-1000 cycles

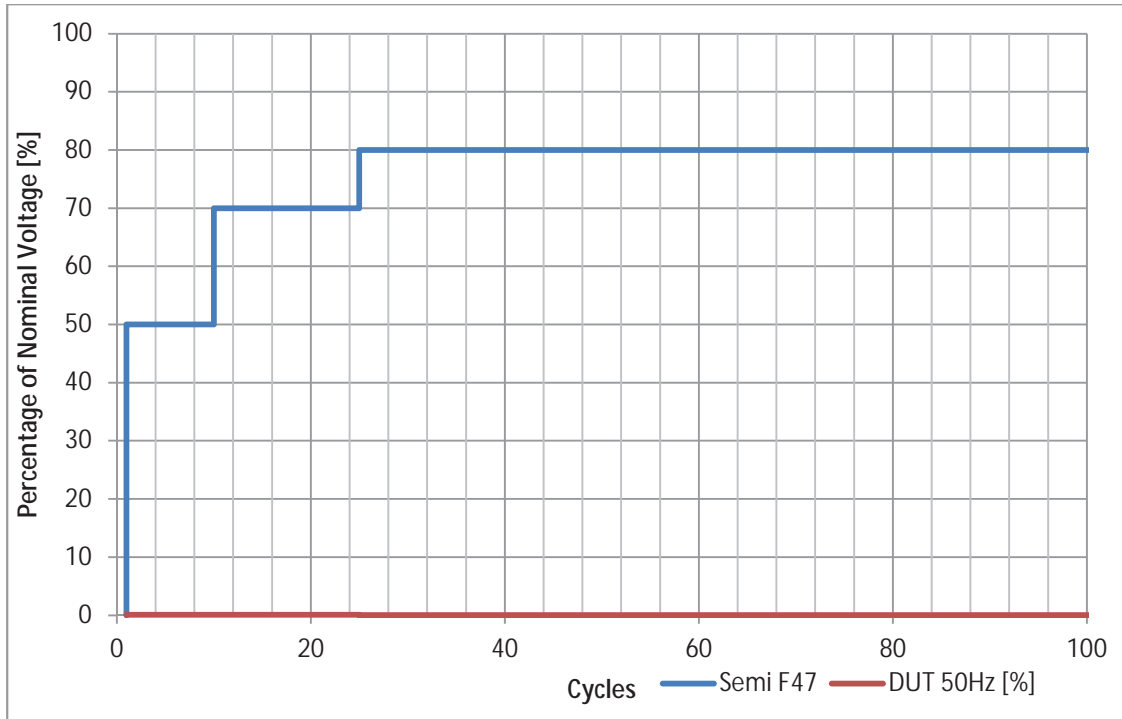


Figure 2: TIB240-148/ 0-100 cycles

Input Voltage = 115VAC, Output = 48V, 5A

115VAC						
Voltage Sag	Duration	Duration	Output Voltage	% delta of nominal output voltage	Semi F47	Criteria
[V]	[s]	[cycles]	[V]	DUT 50Hz [%]	[%]	[Class]
103.5	20	1000	47.97	0.1	90	A
103.5	10	500	47.97	0.1	90	A
92	10	500	47.97	0.1	80	A
92	1	50	47.98	0.1	80	A
92	0.5	25	47.98	0.0	80	A
80.5	0.5	25	47.97	0.1	70	A
80.5	0.5	10	47.98	0.1	70	A
57.5	0.2	10	0.03	99.9	50	B
57.5	0.02	1	47.97	0.1	50	A
0	0.02	1	5.23	89.1	0	B

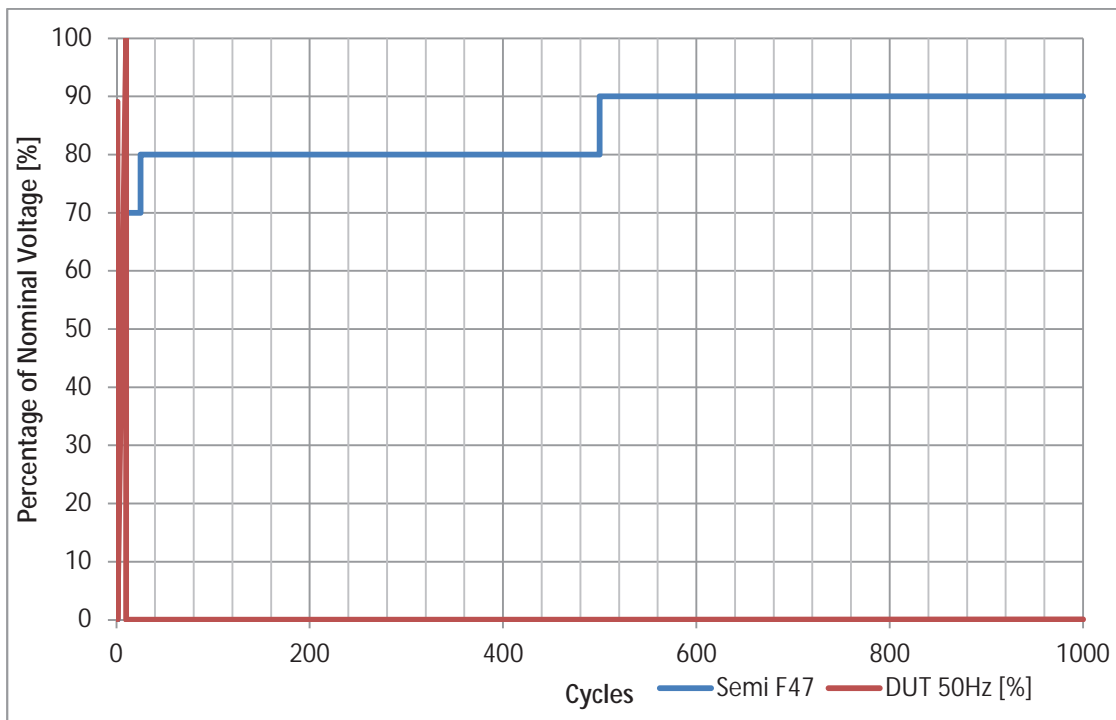


Figure 3: TIB240-148/ 0-1000 cycles

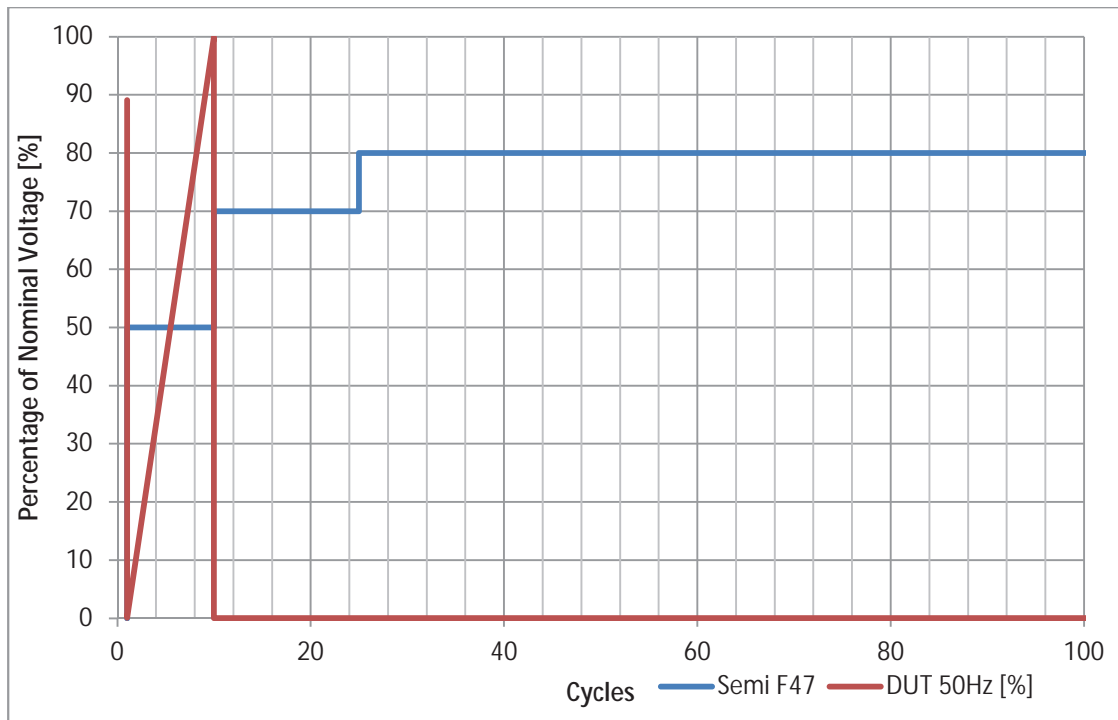


Figure 4: TIB240-148/ 0-100 cycles

Conclusion:

The EUT meets classification B (Ref. SEMI F47-0706). The test results were evaluated in relation to the Customer Specification CS-XXXPSX18X and the EUT was considered to have PASSED the tests.

PASS

14. Summary

Regulation	Class/Test Level	Result	Comments
IEC61000-6-3: 2006 + CISPR 16-1-2: 2003 + CISPR 16-2-3: 2003			
Conducted Input (0.15-30MHz)	Class B	PASS	
Radiated (30-300MHz)	Class B	PASS	
EN50121-4 Railway DC Output			
Conducted Output (0.15-30MHz)	Class B	PASS	
IEC61000-6-3: 2011 + IEC 61000-3-2: 2005			
Harmonic Current Emissions Measurement at Mains Terminal	Class A ,Class D	PASS	
IEC61000-6-2: 2005 + IEC 61000-4-2:2005			
Electrostatic Discharge			
- Air Discharge	+/- 2/8kV (Class B)	PASS	
- Contact Discharge	+/- 2/4kV (Class B)	PASS	
IEC61000-6-2: 2005 + IEC 61000-4-5:2005			
Surge			
- AC Power Ports	+/- 0.5KV,1kV (Class B) +VE to -VE	PASS	
- AC Power Ports	+/- 0.5KV,1KV, 2kV (Class B) +VE to PE	PASS	
- AC Power Ports	+/- 0.5KV,1KV,2kV (Class B) -VE to PE	PASS	
IEC61000-6-2: 2005 + IEC 61000-4-4: 2004			
Fast Transient (Burst)			
- AC & DC Power Ports	+/- 2kV (Class B) between all lines and ground plane	PASS	
- Signal Ports	+/- 1kV (Class B) between all lines and ground plane	PASS	
IEC61000-6-2: 2005 + IEC61000-4-6:2004			
Conducted Input RF Immunity	Level III 10V (Class A)	PASS	
Conducted Output RF Immunity	Level III 10V (Class A)	PASS	
Signal Ports RF Immunity	Level III 10V (Class A)	PASS	
IEC61000-6-2: 2005 + IEC61000-4-3:2004			
Radiated RF Immunity	Level III 10V (Class A)	PASS	

IEC61000-6-2: 2005 + IEC61000-4-8: 2001			
Power Frequency Magnetic Field Immunity	Level 5 (Class A)	PASS	
IEC61000-6-2:2005 + IEC 61000-4-11:2004			
Voltage Dips			
-AC Supply (240VAC and 115VAC)	100%-0% (Class B)	PASS	
	100%-40% (Class C)	PASS	
	100%-70% (Class C)	PASS	
	100%-80% (Class C)	PASS	
Short Interruptions (100%-0% for: 0.1s, 0.2s, 0.5s, 1s, 2s and 5s)	100%-0% (Class C)	PASS	
SEMI F47-0706			
Semi F47 Voltage SAG Immunity			
-AC Supply (230VAC and 115VAC)	(Class C)	PASS	
IEC61000-6-2:2005 + IEC 61000-4-11:2004			
Voltage Dips			
DC Supply (240VDC and 115VDC)	100%-70% (Class B)	N/A	
	100%-40% (Class B)	N/A	
Short Interruptions (100%-0% for: 1mS, 3mS, 10mS, 30mS, 100mS, 300mS, 1S)	100%-0% (Class B)	N/A	

List of Equipment Used:

Revision History			
Revision	Date	Name	Description
1.0	12/02/2018	Barry O'Reilly	Full EMC report
1.1	03/10/2018	Barry O'Reilly	Harmonic measurements update
1.2	15/03/2019	Sarah Evans	Add reference for EX models and revision history