Worldwide Testing and Certification

TEST REPORT
ELECTROMAGNETIC COMPATIBILITY (EMC) AND ASSESSMENT RELATED TO HUMAN EXPOSURE TO ELECTROMAGNETIC FIELDS (EMF)

Report Reference No.....:	**423896/EMC**
Supervised by (name & signature) ...:	Jianbo Ru
Approved by (name & signature).....:	Juno Wong
Date of issue.....:	2022-05-10
Report issued by.....:	**Nemko Shanghai Ltd Shenzhen Branch**
Address.....:	**Unit C&D, Floor 10, Tower 2, Financial Base, Kefa Road 8#, Hi-Technology Park, Nanshan District, Shenzhen 518057, China**
Testing procedure.....:	Supervised testing at external laboratory
Testing location/ address.....:	See page 10
Applicant's name.....:	**SPARKELEC PTY LTD**
Address.....:	**56 Parramatta Rd Croydon NSW 2132, Sydney, Australia**
Test specification:	
Standards for EMC .....:	**EN IEC 55015:2019+A11:2020** **EN 61547:2009** **EN IEC 61000-3-2:2019+A1:2021** **EN 61000-3-3:2013+A1:2019**
Standards for EMF.....:	**EN 62493:2015**
Arrival of EUT .....:	2021-09-20
Test date of EUT	2021-09-21 to 2021-10-25
Test item description ..... :	**LED lighting lamps and lanterns with emergency lighting**
TradeMark .....:	SPARKELEC
Manufacturer.....:	**SPARKELEC PTY LTD**
Address .....:	**56 Parramatta Rd Croydon NSW 2132, Sydney, Australia**
Type.....:	**SPxxxxyy-zz Series**
Serial number .....:	**See page 9**

Index of the test report:

1 Summary Emission of EN IEC 55015

1.1 Standards

Generic standard	**EN 61000-3-3:2013+A1:2019** **EN IEC 61000-3-2:2019+A1:2021**
Product or product family standard	**EN IEC 55015:2019+A11:2020**
Product category	**/**

1.2 Results

Environmental phenomena	Port / Test module	Basic standard and test setup	Limit class	Result
Conducted Emission	AC input power ports	EN IEC 55015 /CISPR 16	**Table 1**	**Pass**
Conducted Emission	wired network ports	EN IEC 55015 /CISPR 16	**Table 2 or Table 3**	**N/A**
Conducted Emission	Local wired ports	EN IEC 55015 /CISPR 16	**Table 2b**	**N/A**
Radiated emission	Enclosure port	EN IEC 55015 /CISPR 16	**Table 10(3m)**	**Pass**
Radiated Electromagnetic Disturbance	Enclosure port	EN IEC 55015 /CISPR 16	**Table 8**	**Pass**
Harmonic current emission	AC input power ports	EN IEC 61000-3-2: 2019+A1:2021	**Class C**	**Pass**
Voltage fluctuations and flicker	AC input power ports	EN 61000-3-3: 2013+A1:2019	**Clause 5**	**Pass**

Remarks: N/A-Not Applicable

2 Summary Immunity of EN 61547

2.1 Standards

Generic standard /

Product or product family standard **EN 61547:2009**

Product category: /

Performance criteria: **See as below**

2.2 Results

Environmental phenomena	Port / Test module	Basic standard and test setup	Performance criteria	Result
Electrostatic Discharge	Enclosure port	EN 61000-4-2:2009	**B**	**Pass**
Radiated Electromagnetic field Susceptibility Test	Enclosure port	EN IEC 61000-4-3: 2020	**A**	**Pass**
Electrical Fast Transient /Burst Test	Input Ac Power port;	EN 61000-4-4:2012	**B**	**Pass**
Surge Test	Input Ac Power port	EN 61000-4-5:2014+A1:2017	**C**	**Pass**
Conducted Susceptibility Test	Input Ac Power port;	EN 61000-4-6:2014	**A**	**Pass**
Voltage Dips and Interruptions Test	Input Ac Power port	EN 61000-4-11:2020	**Table 11 of EN61547:C** **Table 12 of EN61547:B**	**N/A**
Power frequency magnetic fields	Enclosure port	EN 61000-4-8:2010	**A**	**N/A****

Remarks: N/A-Not Applicable

**) Not contain components susceptible to magnetic fields

2.3 Performance criteria according to product or product family standards

Performance criterion A

During the test no change of the luminous intensity shall be observed and the regulating control, if any shall operate during the test as intended.

Performance criterion B

During the test the luminous intensity may change to any value. After the test the luminous intensity shall be restored to its initial value within 1 min. Regulating controls need not function during the test, but after the test the mode of the control shall be the same as before the test provided that during the test no mode changing commands were given.

Performance criterion C

During and after the test any change of the luminous intensity is allowed and the lamp(s) may be extinguished. After the test, within 30 min,all functions shall return to normal if necessary by temporary interruption of the mains supply and/or operating the regulating control. Additional requirement for lighting equipment incorporating a starting device: After the test the lighting equipment is switched off. After half an hour it is switched on again. The lighting equipment shall start and operate as intended.

3 Summary EMF of EN 62493

3.1 Standards

Generic standard	/
Product or product family standard	**EN 62493:2015**
Product category	**Unintentional radiating lighting equipment**

3.2 Results

Environmental phenomena	Port / Test module	Basic standard and test setup	Test frequency range	Result
Van der Hoofden test	Enclosure port	EN62493	**20 kHz to 10 MHz**	**Pass**

4 General information

4.1 Description of Equipment under test (EUT)

Type of equipment

Self-ballasted lamps and semi-luminaires	☐
Independent auxiliaries	☐
Luminaries or equivalent appliances	☒

The EUT is LED emergency lighting

The model name is SPxxxxyy-zz series:
The “xxxx” in the type designation can be 2001, 2002, 2003, indicating different enclosure.
The “yy” can be DA or FE, indicating different function.
DA is manual test with DALI function, FE is manual test without DALI function.
The “zz” can be WH or BK, indicating different enclosure / exit signs colour.
WH: white, BK: black.

Rating(s):
Charging mode: 220-240 VAC, 50/60 Hz, Class II, 4 W.
Emergency lighting mode: LiFePO4 battery, 3.2 V d.c., 1500 mAh.

Model list:

Model name	Ratings and characteristics	Installation	Enclosure colour
SP2001DA-WH	4 W, 3 hours duration, LiFePO4 battery 3.2 V, 1.5Ah; Maintained, manual test & DALI.	Ceiling mounting & wall mounting	White
SP2001DA-BK			Black
SP2001FE-WH	4 W, 3 hours duration, LiFePO4 battery 3.2 V, 1.5Ah; Maintained, manual test.		White
SP2001FE-BK			Black
SP2003DA-WH	4 W, 3 hours duration, LiFePO4 battery 3.2 V, 1.5Ah; Maintained, manual test & DALI.	Ceiling mounting & wall mounting	White
SP2003DA-BK			Black
SP2003FE-WH	4 W, 3 hours duration, LiFePO4 battery 3.2 V, 1.5Ah; Maintained, manual test.		White
SP2003FE-BK			Black
SP2002DA-WH	4 W, 3 hours duration, LiFePO4 battery 3.2 V, 1.5Ah; Maintained, manual test & DALI.	Recessed mounting	White
SP2002DA-BK			Black
SP2002FE-WH	4 W, 3 hours duration, LiFePO4 battery 3.2 V, 1.5Ah; Maintained, manual test.		White
SP2002FE-BK			Black

Model difference:
All models have the same parameters and similar construction.
The emergency driver of SP2001yy-zz and SP2003yy-zz have same circuit diagram, same PCB layout and same transformer.
The emergency driver of SP2001yy-zz and SP2002yy-zz have same circuit diagram and same transformer, only differ in PCB layout.
The emergency driver of SPxxxxDA-zz is identical to the emergency driver of SPxxxxFE-zz, only differ in the emergency driver with a DALI subsidiary circuit board for model SPxxxxDA-zz.

Remark:
All models are different in appearance and color temperature, so we chose SP2001DA-BK, SP2003DA-WH and SP2002DA-WH for the representative test.

4.2 Measurement uncertainty

Conducted Emission:	**9-150KHz**	**3.23dB**
	150KHz-30MHz	**2.63dB**
Radiated Emission:	**30MHz~1000MHz**	**4.22dB**
Magnetic Field Emission:	**9KHz ~ 30MHz**	**1.73dB**

4.3 Test Mode (TM)

TM1 230VAC 50Hz, Charging mode (Lamp ON)

TM2 Internal batteries, Emergency mode

Remark: By pre-scan, only list the mode which test result is worst in report.

4.4 Climatic conditions

parameter	**admissible range**	**actual range**	
Ambient temperature	**15 °C - 25 °C**	**24-25°C**	**OK**
Relative humidity	**30 % - 60 %RH**	**46-50%RH**	**OK**
Atmospheric pressure	**86-106kPa**	**101.1-101.2kPa**	**OK**

4.5 Testing location

AUDIX Technology (Shenzhen) Co., Ltd.
No.6, Ke Feng Rd.,52 Block, Shenzhen Science & Industrial Park, Nantou, Shenzhen, Guangdong, China. – ELA 135
Nemko Shanghai Ltd. Shenzhen Branch
Unit C&D, Floor 10, Tower 2, Financial Base, Kefa Road 8#, Hi-Technology Park, Nanshan District, Shenzhen 518057, China
Remark: All tests have been supervised by a Nemko engineer.

5 Measurement of Conducted Disturbance

5.1 Standards

Generic standard	/
Product or product family standard	**EN IEC 55015:2019+A11:2020**
Limit class	**Table 1 of EN IEC55015**
Basic standard	**CISPR 16**
Date of testing	**2021-09-21**

5.2 Measurement equipment

	Equipment	Calibration due	Type	Serial No.	Manufacturer
☒	EMI Test Receiver	2023.01.03	ESCI	100657	ROHDE & SCHWARZ
☒	Artificial Mains	2023.01.03	ESH2-Z5	100065	ROHDE & SCHWARZ
☒	Pulse Limiter	2023.01.03	ESH3-Z2	100806	ROHDE & SCHWARZ
☒	EMI Test Software	N/A	EMC32	N/A	ROHDE & SCHWARZ

5.3 Test set-up

Annex B with a photo or a rough figure of the test set-up is attached.
The test has been performed as following:

The cable connecting to the V-network shall not exceed 0,8 m. The lamp is placed 0,4 m above a metal plate of dimensions at least 2 m × 2 m and shall be kept at least 0,8 m from any other earthed conducting surface. The artificial mains network (V-network) shall also be placed at a distance of at least 0,8 m from the lamp. The plate shall be connected to the reference earth of the V-network.
A EMI test receiver used to test the emission from both side of AC line.

Scan setting:

Freq range			Receiver setting		
Start	Stop	Step	IF BW	Detector	Meas Time
9k	150k	100Hz	200Hz	PK+AV	10ms
150k	30M	4.5k	9k	PK+AV	10ms

Final measurement:

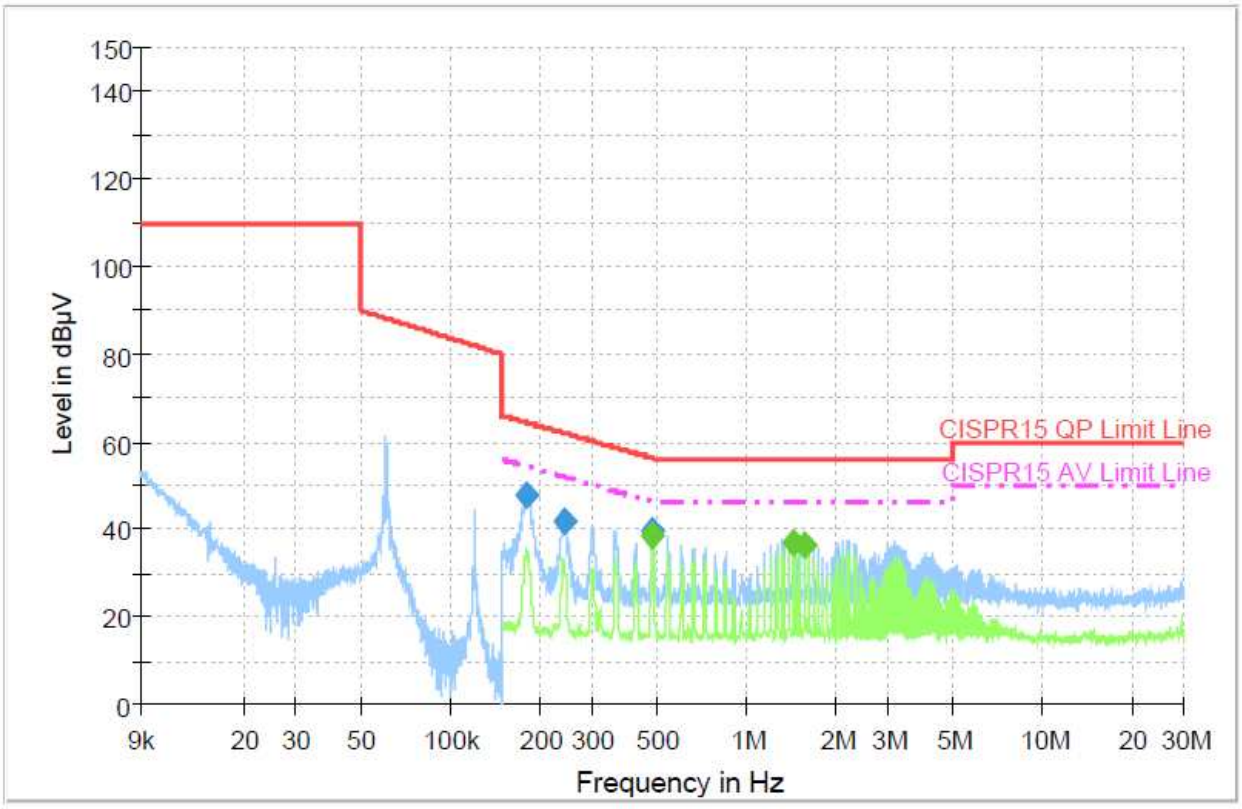
Detector	Meas time
QP/AV	1s

5.4 Test result

Model	Test Mode	Diagram	Test port	Remarks	Result
SP2001DA-BK	TM1	001	AC input port	Line L	**Pass**
		002		Line N	**Pass**
	TM2	003	AC input port	Line L	**Pass**
		004		Line N	**Pass**
SP2003DA-WH	TM1	005	AC input port	Line L	**Pass**
		006		Line N	**Pass**
	TM2	007	AC input port	Line L	**Pass**
		008		Line N	**Pass**
SP2002DA-WH	TM1	009	AC input port	Line L	**Pass**
		010		Line N	**Pass**
	TM2	011	AC input port	Line L	**Pass**
		012		Line N	**Pass**
Remark:	When the PK result is comply with AV limit, then both of QP and AV are comply with their limit. Only list the diagram in the report if the result is too low to the limit.				

5.5 Diagrams

5.5.1 Diagram 001



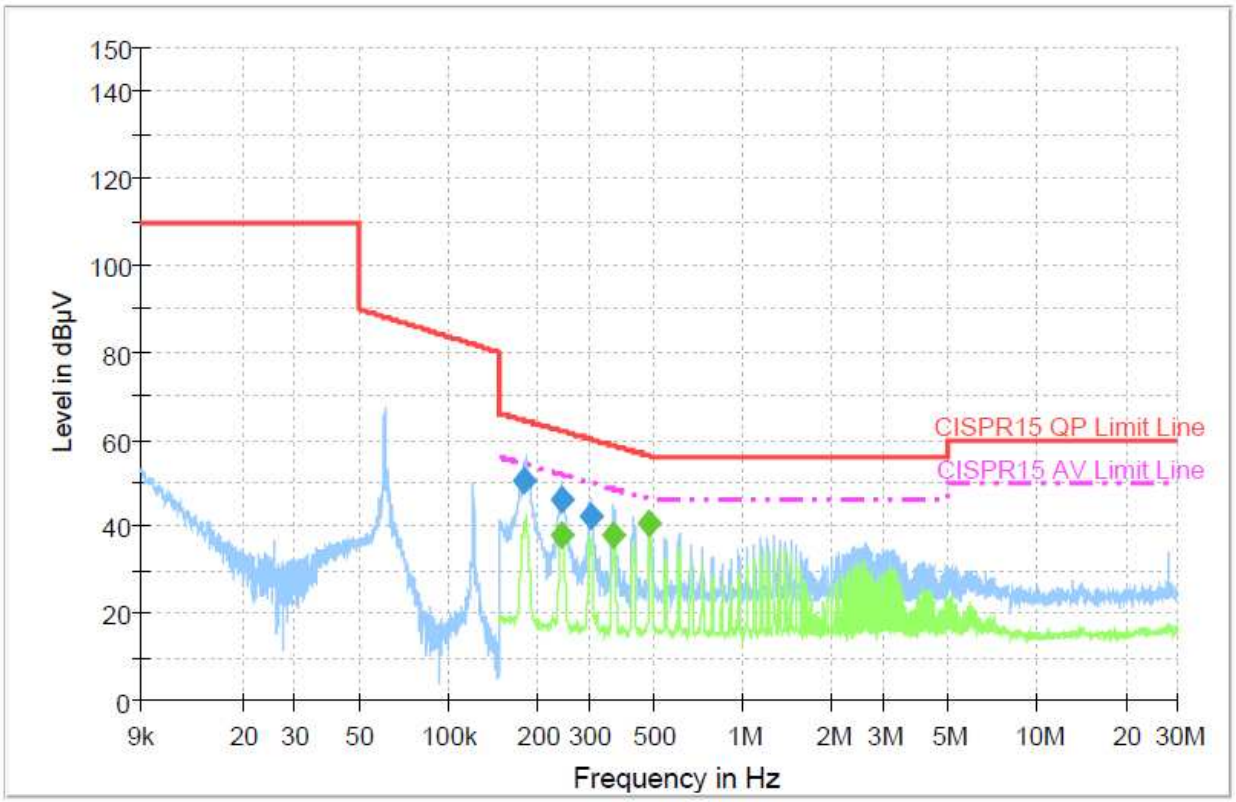
Final Result 1

Frequency (MHz)	QuasiPeak (dBµV)	Line	Corr. (dB)	Margin (dB)	Limit (dBµV)
0.181200	47.9	L1	19.9	16.5	64.4
0.243147	41.9	L1	19.9	20.1	62.0
0.482768	39.6	L1	20.0	16.7	56.3

Final Result 2

Frequency (MHz)	Average (dBµV)	Line	Corr. (dB)	Margin (dB)	Limit (dBµV)
0.483035	38.8	L1	20.0	7.5	46.3
1.450521	37.1	L1	20.0	8.9	46.0
1.571088	36.4	L1	20.0	9.6	46.0

5.5.2 Diagram 002



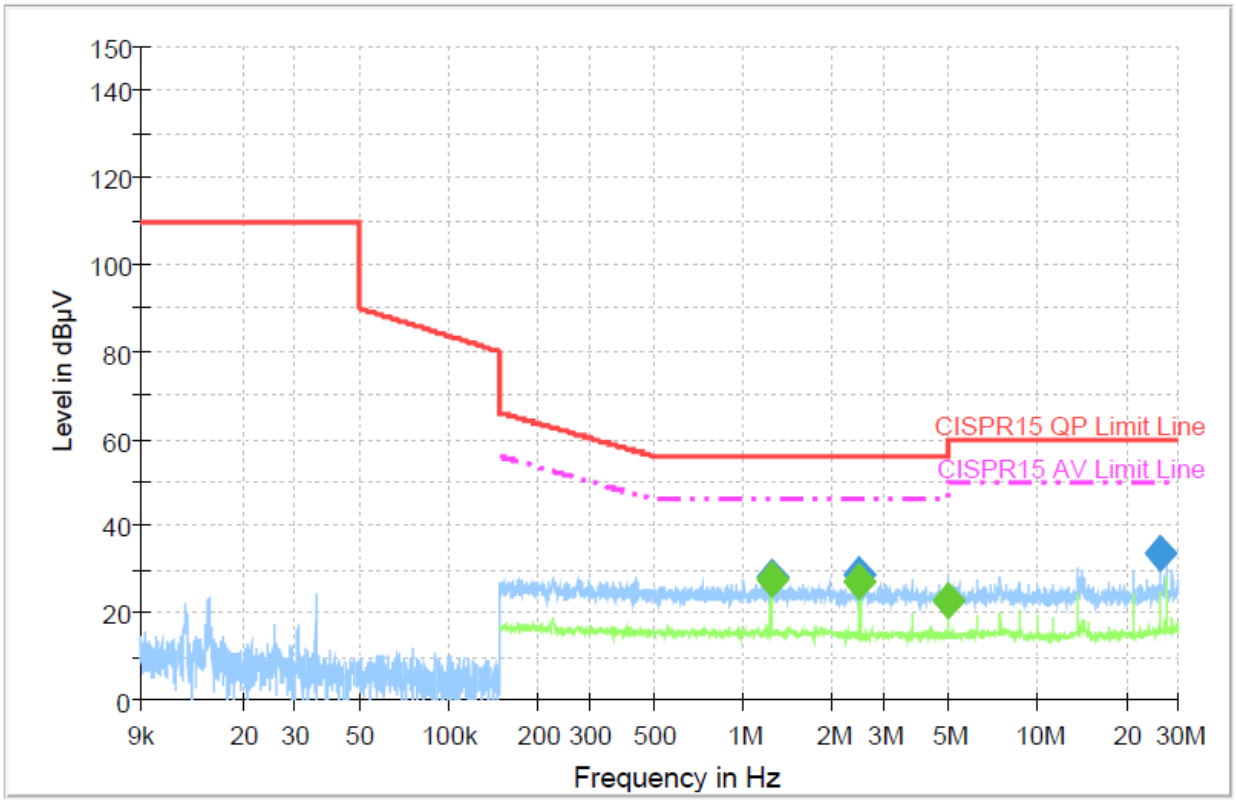
Final Result 1

Frequency (MHz)	QuasiPeak (dBµV)	Line	Corr. (dB)	Margin (dB)	Limit (dBµV)
0.182000	50.6	N	19.9	13.8	64.4
0.242865	46.2	N	19.9	15.8	62.0
0.303767	42.3	N	20.0	17.8	60.1

Final Result 2

Frequency (MHz)	Average (dBµV)	Line	Corr. (dB)	Margin (dB)	Limit (dBµV)
0.242565	38.3	N	19.9	13.7	52.0
0.363575	38.2	N	20.0	10.4	48.6
0.484208	40.5	N	20.0	5.8	46.3

5.5.3 Diagram 003



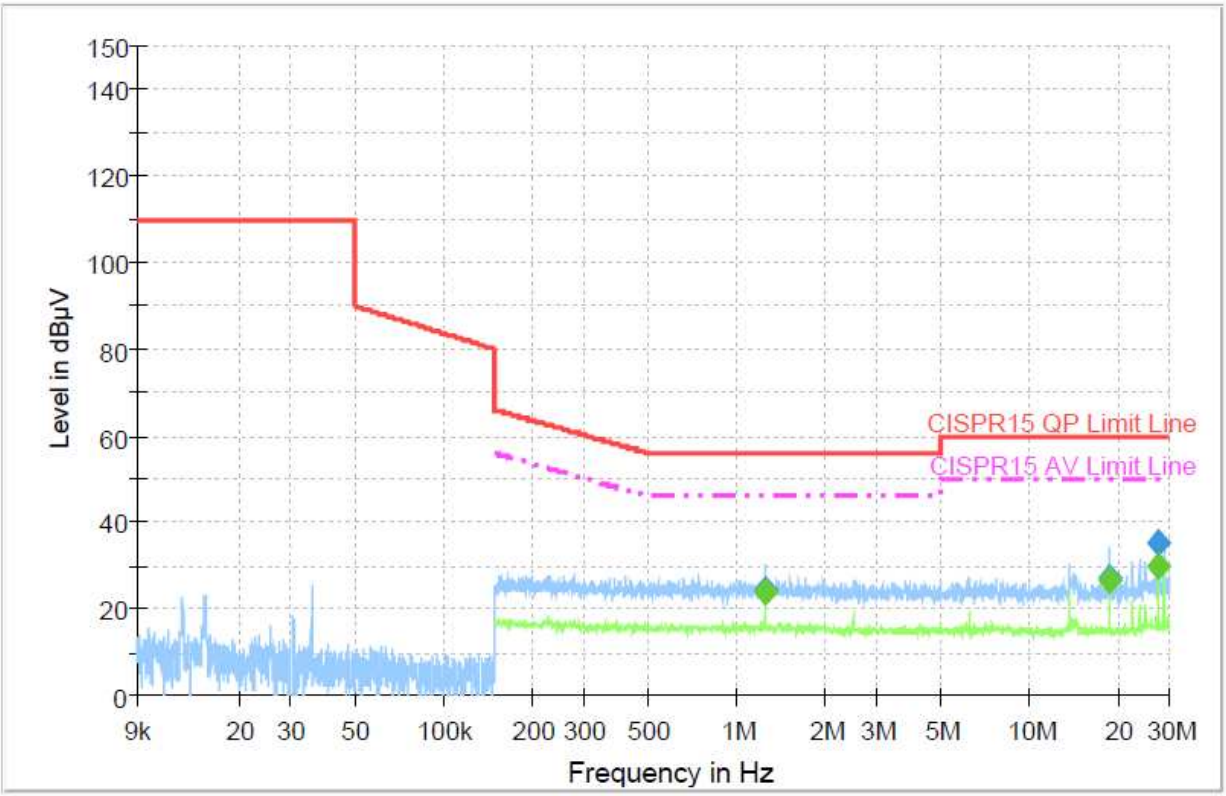
Final Result 1

Frequency (MHz)	QuasiPeak (dBµV)	Line	Corr. (dB)	Margin (dB)	Limit (dBµV)
1.249928	28.0	L1	20.0	28.0	56.0
2.495455	29.0	L1	20.0	27.0	56.0
26.217156	33.5	L1	20.2	26.5	60.0

Final Result 2

Frequency (MHz)	Average (dBµV)	Line	Corr. (dB)	Margin (dB)	Limit (dBµV)
1.248328	27.6	L1	20.0	18.4	46.0
2.496055	27.4	L1	20.0	18.6	46.0
4.994108	22.7	L1	20.0	23.3	46.0

5.5.4 Diagram 004



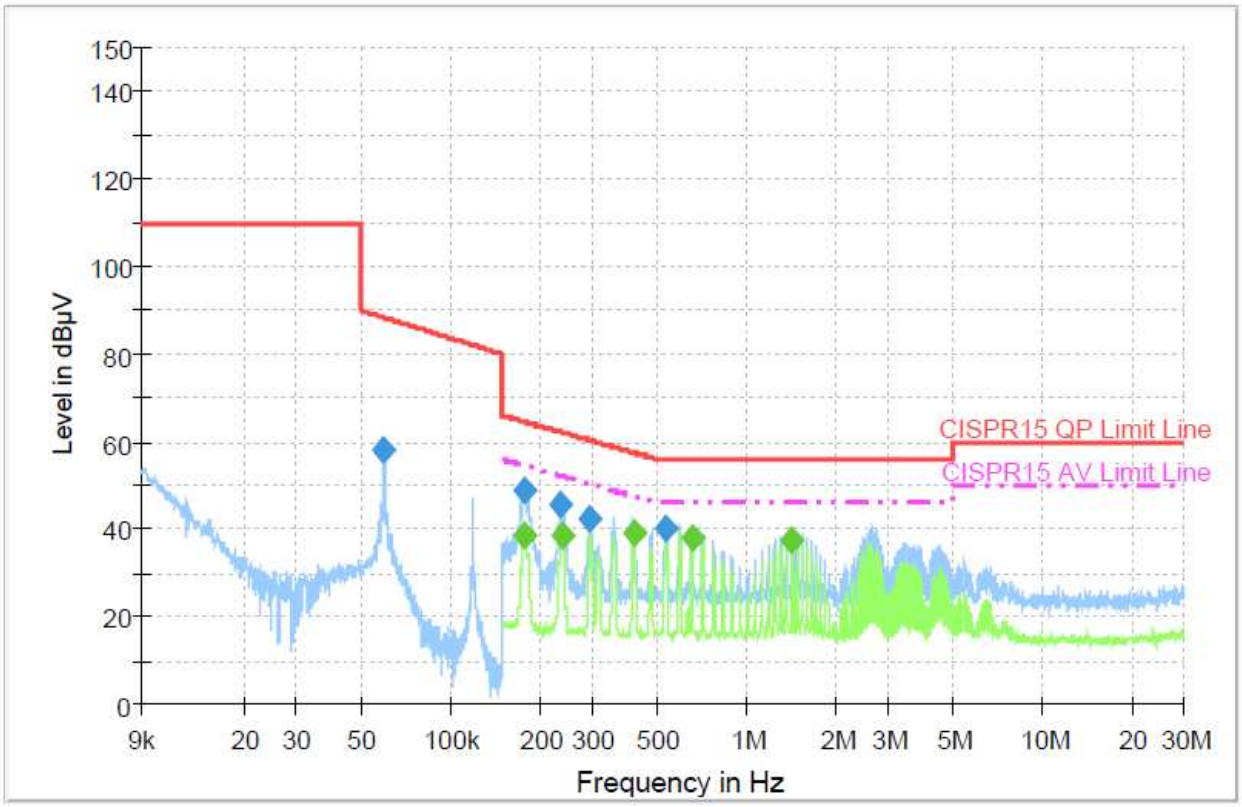
Final Result 1

Frequency (MHz)	QuasiPeak (dBµV)	Line	Corr. (dB)	Margin (dB)	Limit (dBµV)
1.247528	24.7	N	20.0	31.3	56.0
18.753763	27.3	N	20.1	32.7	60.0
27.495358	35.4	N	20.2	24.6	60.0

Final Result 2

Frequency (MHz)	Average (dBµV)	Line	Corr. (dB)	Margin (dB)	Limit (dBµV)
1.248523	23.6	N	20.0	22.4	46.0
18.740563	26.5	N	20.1	23.5	50.0
27.484758	29.7	N	20.2	20.3	50.0

5.5.5 Diagram 005



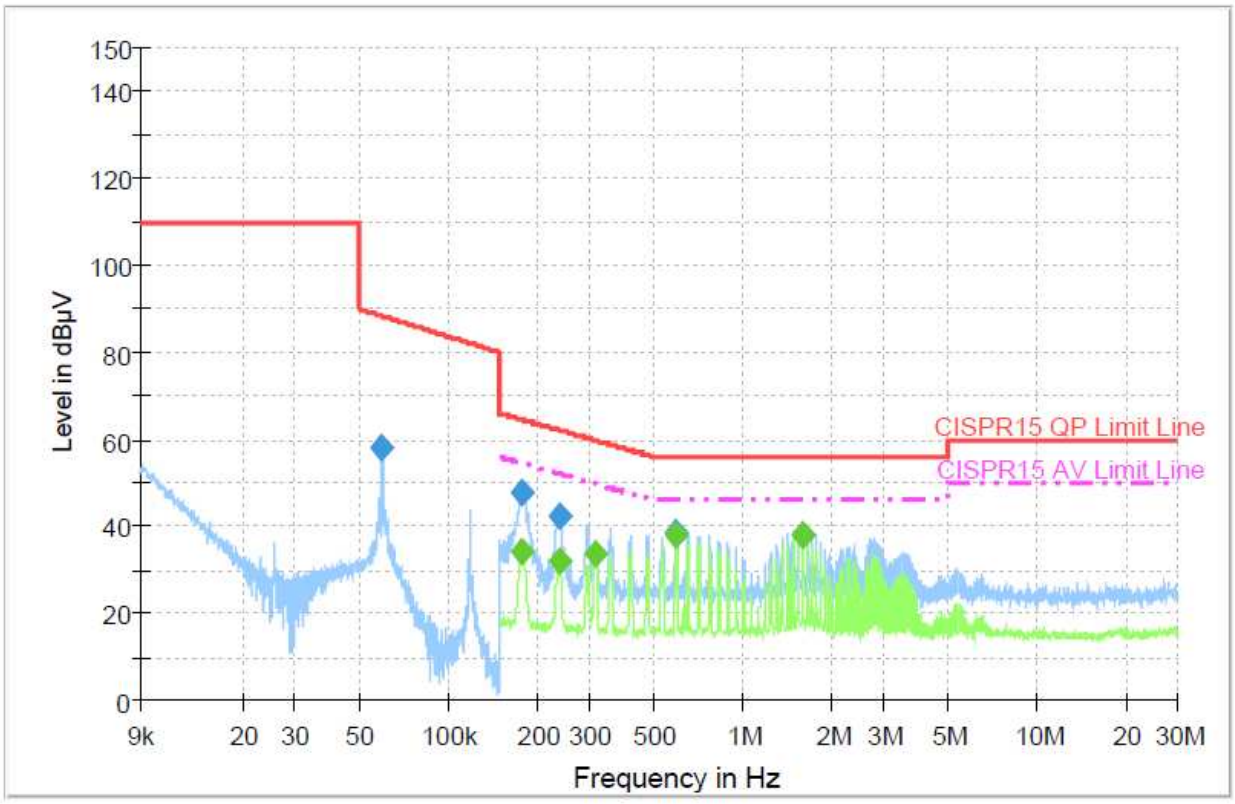
Final Result 1

Frequency (MHz)	QuasiPeak (dBµV)	Line	Corr. (dB)	Margin (dB)	Limit (dBµV)
0.059362	58.3	L1	19.9	30.1	88.4
0.178300	49.2	L1	19.9	15.4	64.6
0.236802	45.5	L1	19.9	16.7	62.2
0.296966	42.3	L1	19.9	18.0	60.3
0.533518	40.4	L1	20.0	15.6	56.0

Final Result 2

Frequency (MHz)	Average (dBµV)	Line	Corr. (dB)	Margin (dB)	Limit (dBµV)
0.178100	38.5	L1	19.9	16.1	54.6
0.237630	38.7	L1	19.9	13.5	52.2
0.415387	39.4	L1	20.0	8.1	47.5
0.652832	38.1	L1	20.0	7.9	46.0
1.425253	37.5	L1	20.0	8.5	46.0

5.5.6 Diagram 006



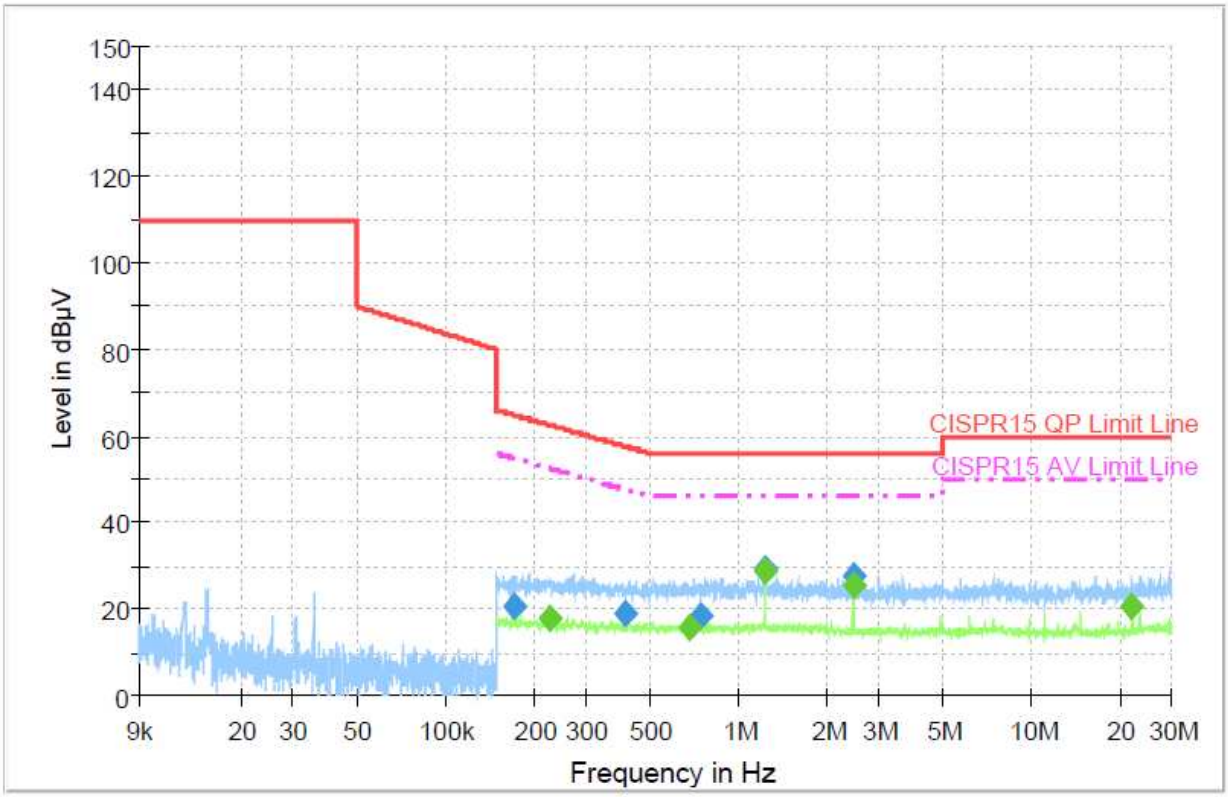
Final Result 1

Frequency (MHz)	QuasiPeak (dBµV)	Line	Corr. (dB)	Margin (dB)	Limit (dBµV)
0.059381	58.0	N	19.9	30.4	88.4
0.178000	47.9	N	19.9	16.7	64.6
0.237977	42.4	N	19.9	19.8	62.2
0.593840	38.4	N	20.0	17.6	56.0
1.604718	38.0	N	20.0	18.0	56.0

Final Result 2

Frequency (MHz)	Average (dBµV)	Line	Corr. (dB)	Margin (dB)	Limit (dBµV)
0.177800	34.4	N	19.9	20.2	54.6
0.237955	32.1	N	19.9	20.1	52.2
0.315088	33.9	N	20.0	15.9	49.8
0.593626	38.2	N	20.0	7.8	46.0
1.602718	37.8	N	20.0	8.2	46.0

5.5.7 Diagram 007



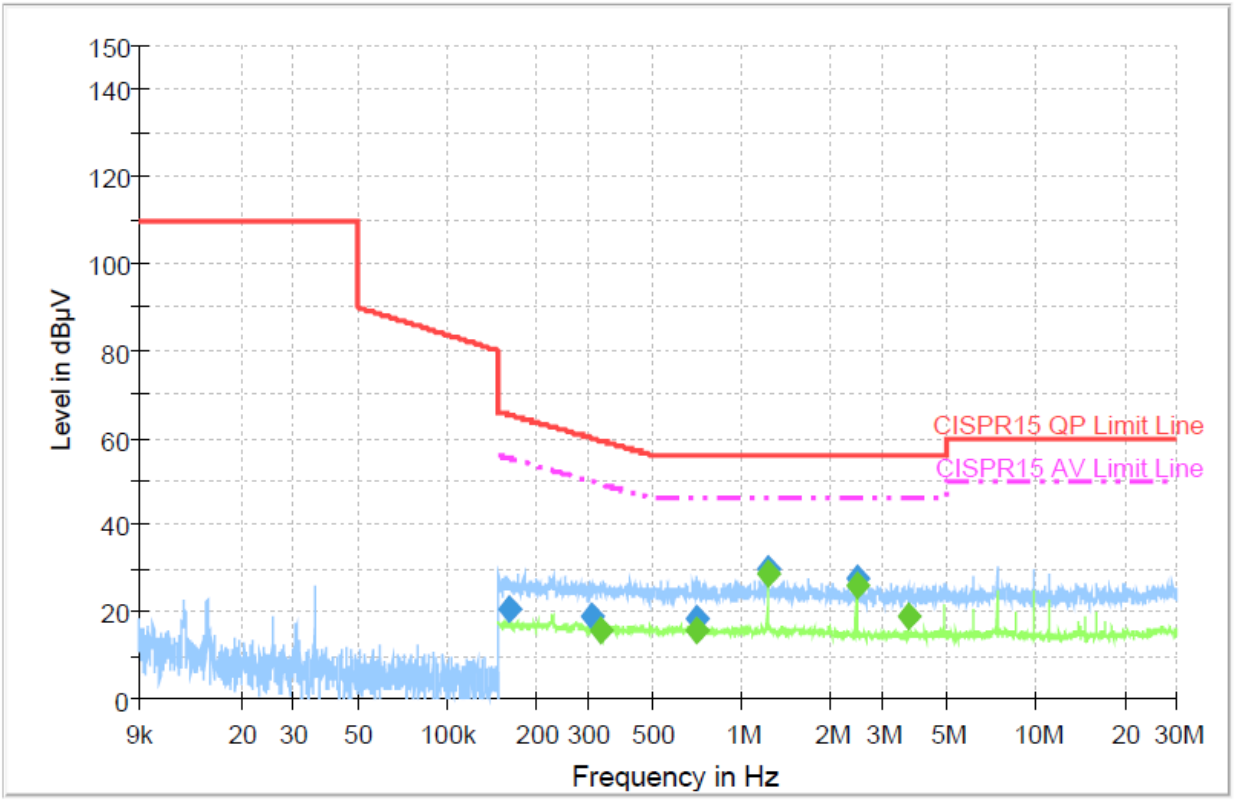
Final Result 1

Frequency (MHz)	QuasiPeak (dBµV)	Line	Corr. (dB)	Margin (dB)	Limit (dBµV)
0.172900	20.5	L1	19.9	44.3	64.8
0.413504	18.9	L1	20.0	38.7	57.6
0.744853	18.6	L1	20.0	37.4	56.0
1.227609	29.5	L1	20.0	26.5	56.0
2.455301	27.6	L1	20.0	28.4	56.0

Final Result 2

Frequency (MHz)	Average (dBµV)	Line	Corr. (dB)	Margin (dB)	Limit (dBµV)
0.226755	17.9	L1	19.9	34.7	52.6
0.677942	15.7	L1	20.0	30.3	46.0
1.227109	28.6	L1	20.0	17.4	46.0
2.454601	25.8	L1	20.0	20.2	46.0
22.092290	20.4	L1	20.1	29.6	50.0

5.5.8 Diagram 008



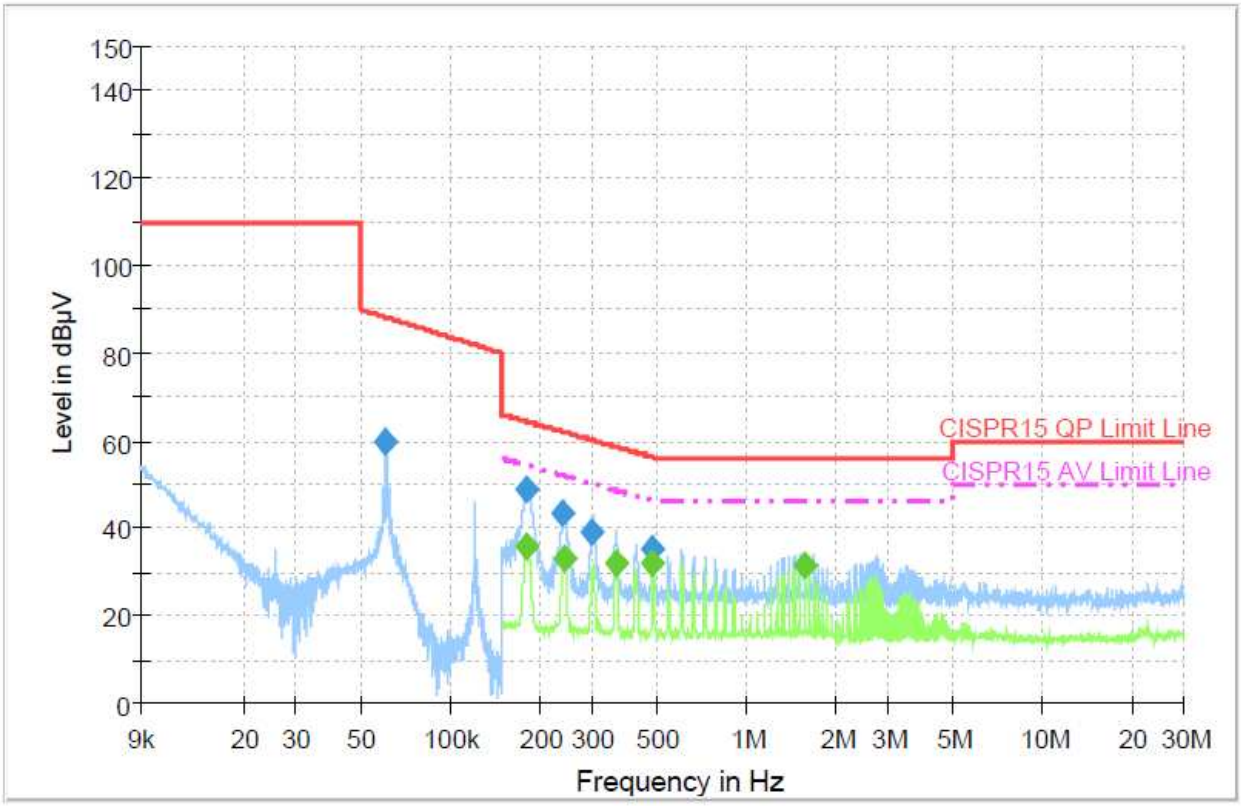
Final Result 1

Frequency (MHz)	QuasiPeak (dBµV)	Line	Corr. (dB)	Margin (dB)	Limit (dBµV)
0.162900	20.4	N	19.9	44.9	65.3
0.312399	19.2	N	20.0	40.7	59.9
0.702439	18.5	N	20.0	37.5	56.0
1.227854	29.7	N	20.0	26.3	56.0
2.454701	27.5	N	20.0	28.5	56.0

Final Result 2

Frequency (MHz)	Average (dBµV)	Line	Corr. (dB)	Margin (dB)	Limit (dBµV)
0.335378	16.0	N	20.0	33.3	49.3
0.704808	15.7	N	20.0	30.3	46.0
1.228054	29.0	N	20.0	17.0	46.0
2.455701	26.3	N	20.0	19.7	46.0
3.683528	19.0	N	20.0	27.0	46.0

5.5.9 Diagram 009



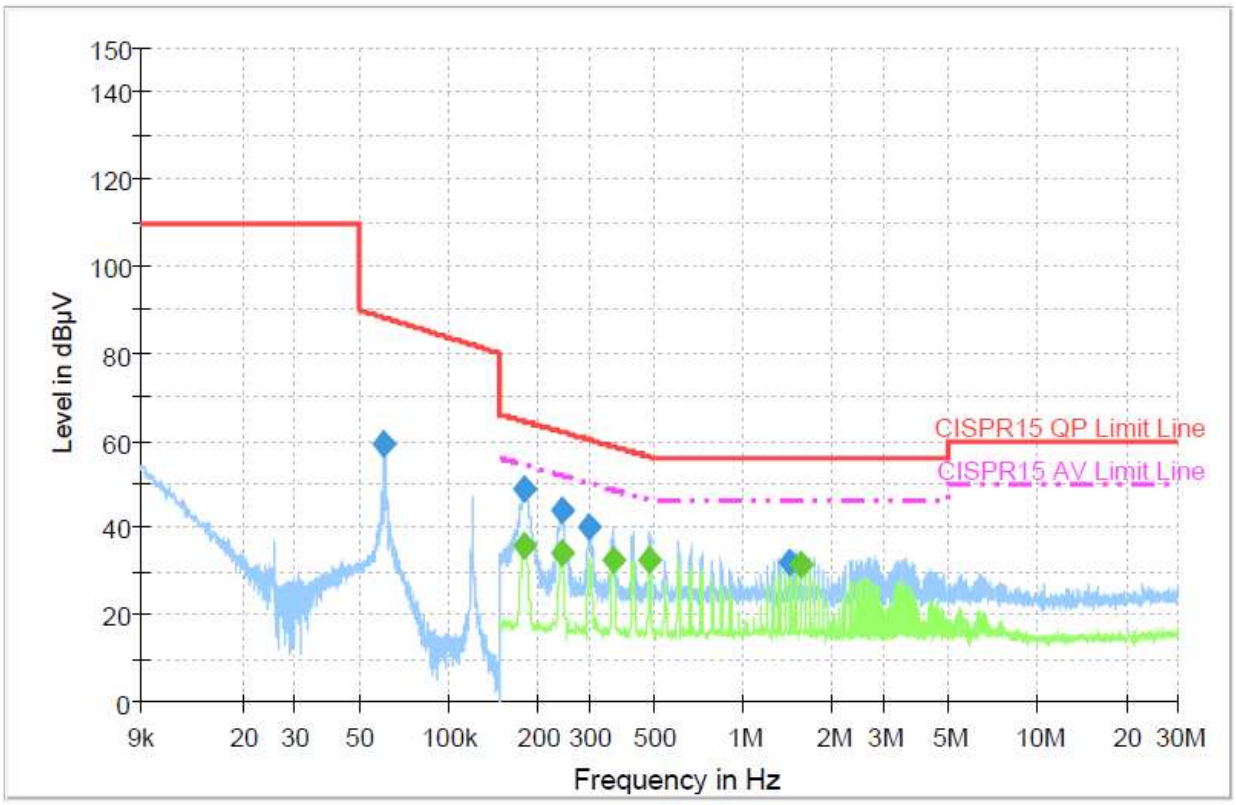
Final Result 1

Frequency (MHz)	QuasiPeak (dBµV)	Line	Corr. (dB)	Margin (dB)	Limit (dBµV)
0.060562	59.7	L1	19.9	28.6	88.3
0.181800	49.2	L1	19.9	15.2	64.4
0.241029	43.5	L1	19.9	18.6	62.1
0.302461	39.4	L1	20.0	20.8	60.2
0.483468	35.2	L1	20.0	21.1	56.3

Final Result 2

Frequency (MHz)	Average (dBµV)	Line	Corr. (dB)	Margin (dB)	Limit (dBµV)
0.181100	35.8	L1	19.9	18.6	54.4
0.242180	33.4	L1	19.9	18.6	52.0
0.363064	31.8	L1	20.0	16.9	48.7
0.483600	32.1	L1	20.0	14.2	46.3
1.572932	31.5	L1	20.0	14.5	46.0

5.5.10 Diagram 010



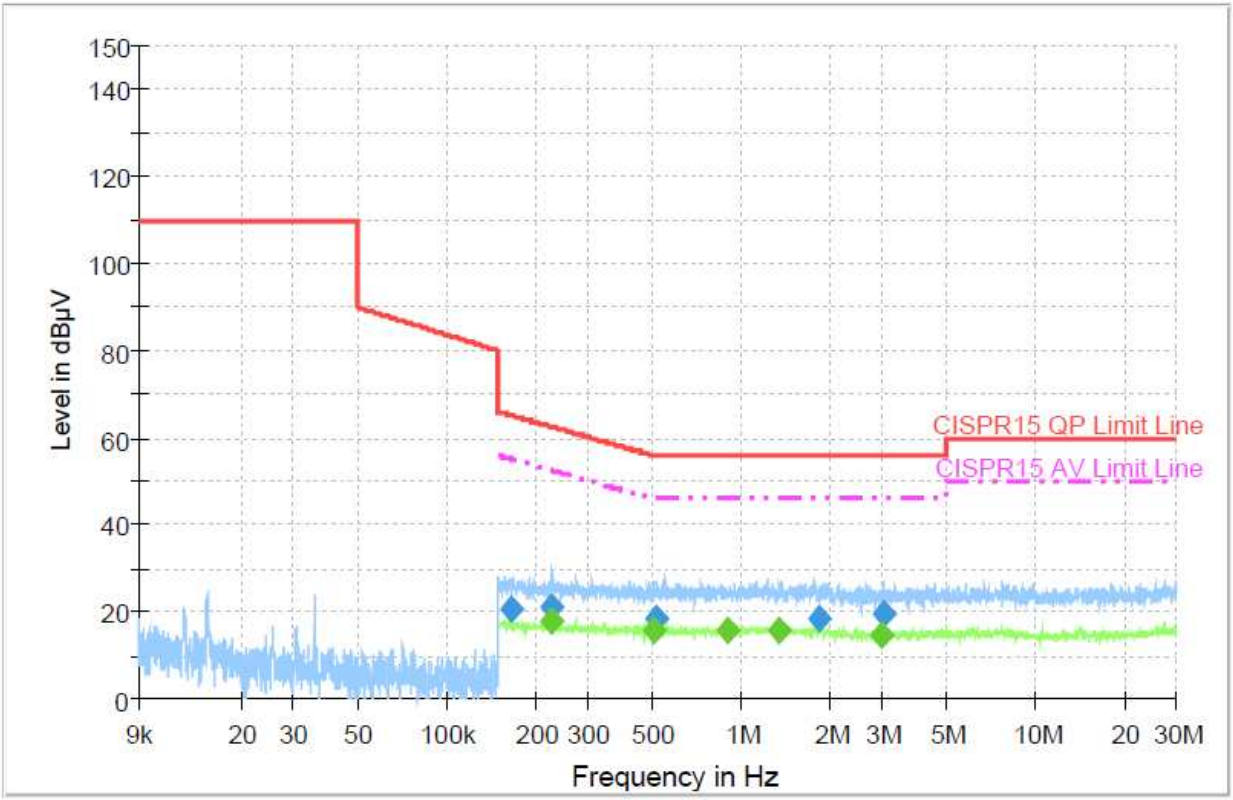
Final Result 1

Frequency (MHz)	QuasiPeak (dBµV)	Line	Corr. (dB)	Margin (dB)	Limit (dBµV)
0.060441	59.0	N	19.9	29.3	88.3
0.181800	48.7	N	19.9	15.7	64.4
0.242412	44.0	N	19.9	18.0	62.0
0.302156	40.1	N	20.0	20.1	60.2
1.450821	31.8	N	20.0	24.2	56.0

Final Result 2

Frequency (MHz)	Average (dBµV)	Line	Corr. (dB)	Margin (dB)	Limit (dBµV)
0.181600	36.0	N	19.9	18.4	54.4
0.241747	34.2	N	19.9	17.8	52.0
0.362945	32.6	N	20.0	16.1	48.7
0.483471	32.8	N	20.0	13.5	46.3
1.571388	31.6	N	20.0	14.4	46.0

5.5.11 Diagram 011



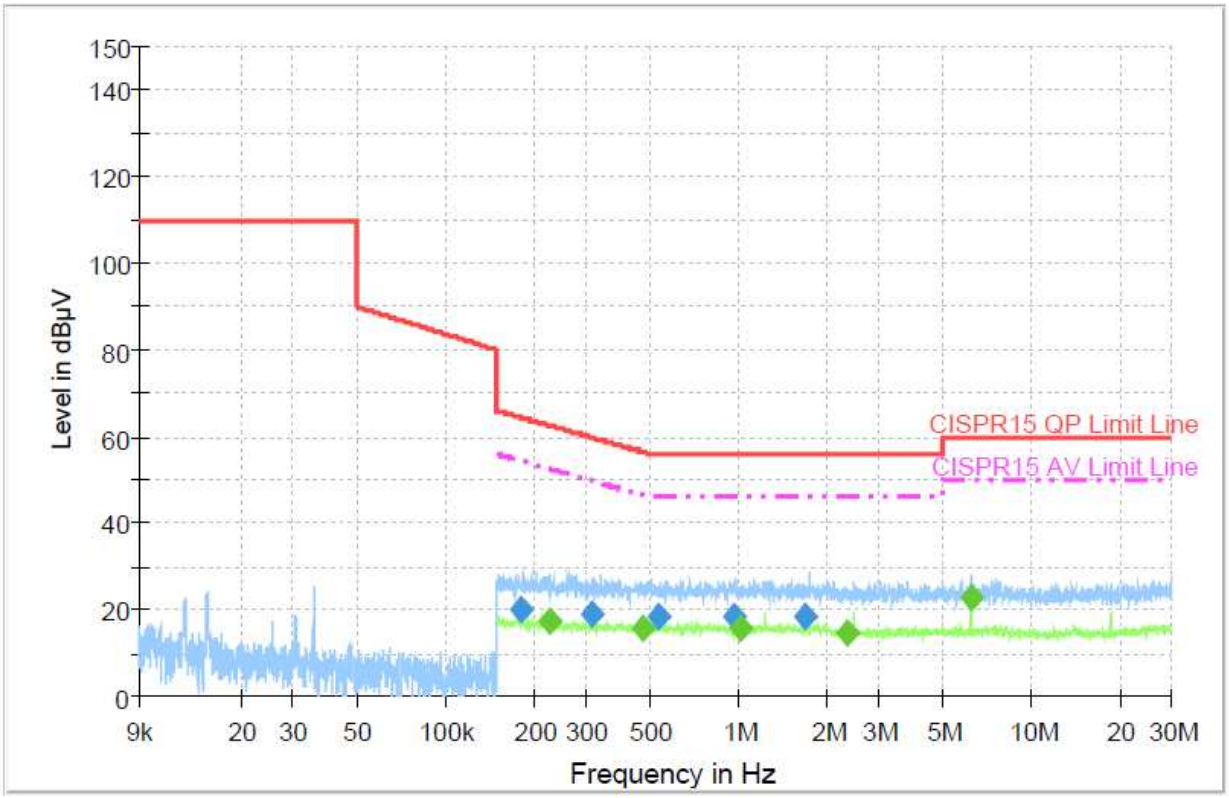
Final Result 1

Frequency (MHz)	QuasiPeak (dBµV)	Line	Corr. (dB)	Margin (dB)	Limit (dBµV)
0.166700	20.4	L1	19.9	44.7	65.1
0.225999	21.2	L1	19.9	41.4	62.6
0.513810	18.7	L1	20.0	37.3	56.0
1.832534	18.6	L1	20.0	37.4	56.0
3.050823	19.3	L1	20.0	36.7	56.0

Final Result 2

Frequency (MHz)	Average (dBµV)	Line	Corr. (dB)	Margin (dB)	Limit (dBµV)
0.227655	18.0	L1	19.9	34.5	52.5
0.510260	15.8	L1	20.0	30.2	46.0
0.898334	15.7	L1	20.0	30.3	46.0
1.348442	15.6	L1	20.0	30.4	46.0
3.005120	14.7	L1	20.0	31.3	46.0

5.5.12 Diagram 012



Final Result 1

Frequency (MHz)	QuasiPeak (dBµV)	Line	Corr. (dB)	Margin (dB)	Limit (dBµV)
0.181400	20.0	N	19.9	44.4	64.4
0.317103	19.2	N	20.0	40.6	59.8
0.532360	18.7	N	20.0	37.3	56.0
0.964273	18.7	N	20.0	37.3	56.0
1.699930	18.7	N	20.0	37.3	56.0

Final Result 2

Frequency (MHz)	Average (dBµV)	Line	Corr. (dB)	Margin (dB)	Limit (dBµV)
0.225180	17.6	N	19.9	35.0	52.6
0.468238	15.8	N	20.0	30.7	46.5
1.015945	15.7	N	20.0	30.3	46.0
2.351455	14.7	N	20.0	31.3	46.0
6.193703	23.0	N	20.0	27.0	50.0

6 Measurement of Radiated Emission

6.1 Standards

Generic standard	/
Product or product family standard	**EN IEC 55015:2019+A11:2020**
Limit class	**Table 10 (3m) of EN IEC55015**
Basic standard	**CISPR 16**
Date of testing	**2021-09-24 to 2021-10-21**

6.2 Measurement equipment

	Equipment	Cal. due	Model No.	Serial No.	Manufacturer
☒	3#Chamber	Nov.23,22	N/A	N/A	AUDIX
☒	EMI Spectrum	Jun.18,22	E4407B	MY41440292	Agilent
☒	Test Receiver	Jun.18,22	ESVS10	834468/011	Rohde & Schwarz
☒	Amplifier	Jun.18,22	8447D	2648A04738	HP
☒	Bilog Antenna	Jun.18,22	CBL6112D	35375	TESEQ
☒	RF Cable	Jun.18,22	CFD400-NL	3# Chamber No.1	MIYAZAKI
☒	Coaxial Switch	Jun.18,22	MP59B	6200313662	Anritsu
☒	Horn Antenna	Jun.18,22	3115	9607-4877	ETS

6.3 Test set-up

The EUT has been tested according to the above-mentioned standard, as following:
The EUT was placed on the top of an insulating table 0.8 meters above the ground at a semi-anechoic chamber. The table was rotated 360 degrees to determine the position of the highest radiation. The EUT was set 3 meters away from the interference-receiving antenna, which was mounted on the top of a variable-height antenna tower. The antenna is a broadband antenna, and its height is varied from 1 to 4 meter above the ground to determine the maximum value of the field strength. Both horizontal and vertical polarizations of the antenna are set to make the measurement. For each suspected emission, the EUT was arranged to its worst case and then the antenna was tuned to the heights from 1 to 4 meters and the ratable table was turned from 0 degrees to 360 degrees to find the maximum reading. The test-receiver system was set to Peak Detector Function and Specified Bandwidth with Maximum Hold Mode.

If more details are necessary, e.g. because of wiring or auxiliary equipment, annex B with a photo or a rough figure of the test set-up is attached.

The test has been performed as following:

1) Preview test; Peak; IF BW=100kHz, VBW=300kHz, Antenna: from 1 to 4m Turntable 0-360deg
2) Find frequencies with maximum emission:

   Acceptance-analysis: Limit minus 10 dB

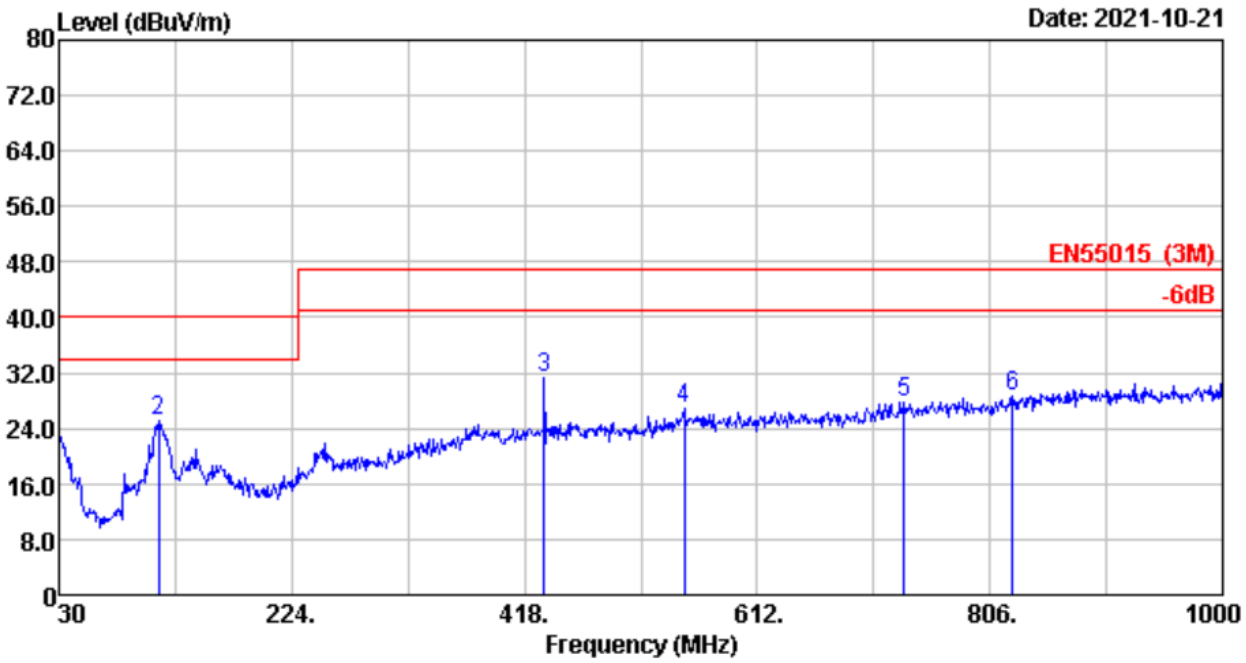
   Peak-reduction: Peaks frequency range 30 MHz - 1000 MHz
3) Final test; Quasi-Peak; measuring time 1 s; at frequencies from step 2); Search maximum: vary turntable and antenna position to find the maximum readings
4) If there are more than 10 peaks within the 10 dB margin a manual test with all settings is necessary to find the maximum readings.

6.4 Test result

Model	Test Mode	Test port	Diagram	Remarks	Result
SP2001DA-BK	TM1	Enclosure port	013	H	**Pass**
			014	V	**Pass**
	TM2	Enclosure port	015	H	**Pass**
			016	V	**Pass**
SP2003DA-WH	TM1	Enclosure port	017	H	**Pass**
			018	V	**Pass**
	TM2	Enclosure port	019	H	**Pass**
			020	V	**Pass**
SP2002DA-WH	TM1	Enclosure port	021	H	**Pass**
			022	V	**Pass**
	TM2	Enclosure port	023	H	**Pass**
			024	V	**Pass**

6.5 Diagrams

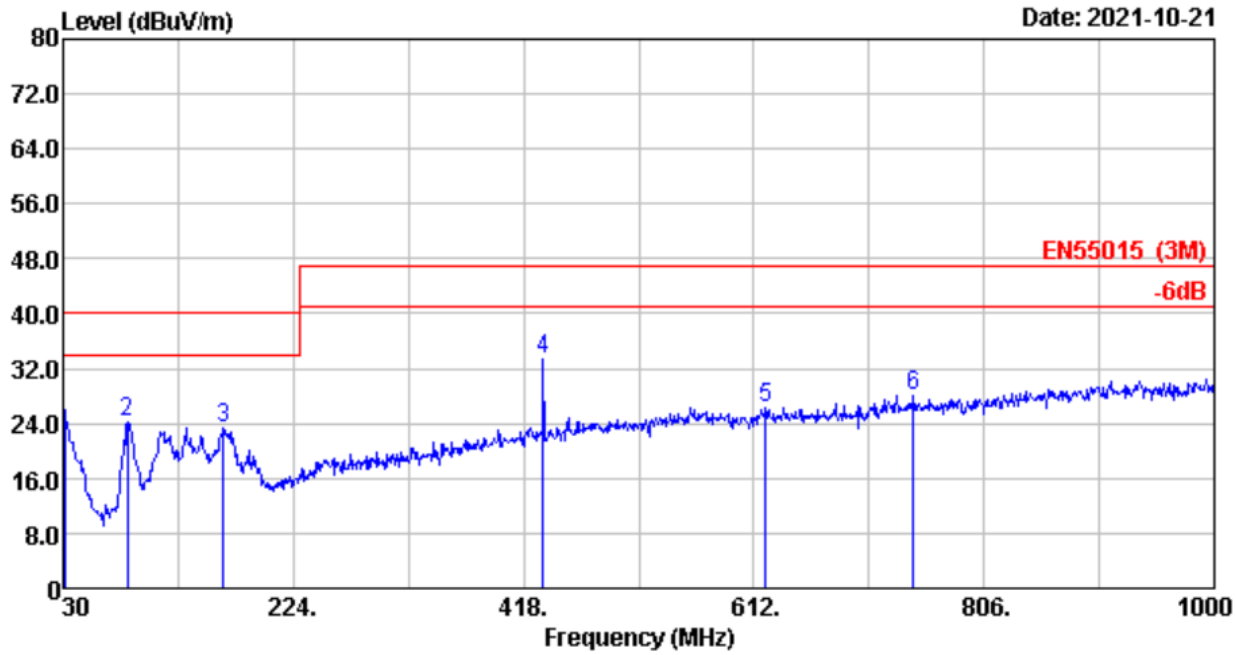
6.5.1 Diagram 013



No.	Freq. (MHz)	Ant. Factor (dB/m)	Cable Loss (dB)	Reading (dBuV)	Emission Level (dBuV/m)	Limits (dBuV/m)	Margin (dB)	Remark
1	30.000	24.80	0.63	-2.41	23.02	40.00	16.98	QP
2	113.420	17.86	1.07	6.16	25.09	40.00	14.91	QP
3	434.490	22.23	2.14	6.95	31.32	47.00	15.68	QP
4	550.890	24.69	2.46	-0.15	27.00	47.00	20.00	QP
5	734.220	25.39	2.92	-0.43	27.88	47.00	19.12	QP
6	824.430	25.79	3.18	-0.38	28.59	47.00	18.41	QP

Remarks: 1. Emission Level= Antenna Factor + Cable Loss + Reading.
2. The emission levels that are 20dB below the official limit are not reported.

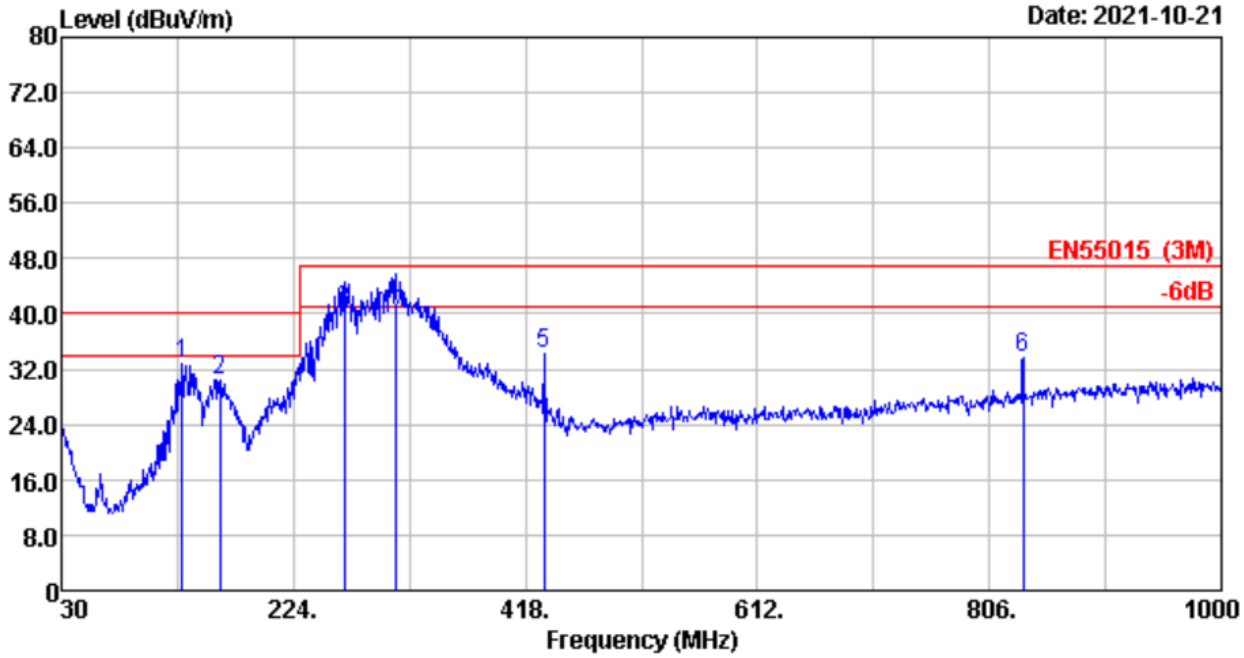
6.5.2 Diagram 014



No.	Freq. (MHz)	Ant. Factor (dB/m)	Cable Loss (dB)	Reading (dBuV)	Emission Level (dBuV/m)	Limits (dBuV/m)	Margin (dB)	Remark
1	30.970	24.26	0.64	1.04	25.94	40.00	14.06	QP
2	84.320	13.82	0.88	9.61	24.31	40.00	15.69	QP
3	164.830	15.55	1.31	6.37	23.23	40.00	16.77	QP
4	434.490	22.23	2.14	8.89	33.26	47.00	13.74	QP
5	621.700	24.42	2.62	-0.66	26.38	47.00	20.62	QP
6	746.830	25.64	2.96	-0.47	28.13	47.00	18.87	QP

Remarks: 1. Emission Level= Antenna Factor + Cable Loss + Reading.
2. The emission levels that are 20dB below the official limit are not reported.

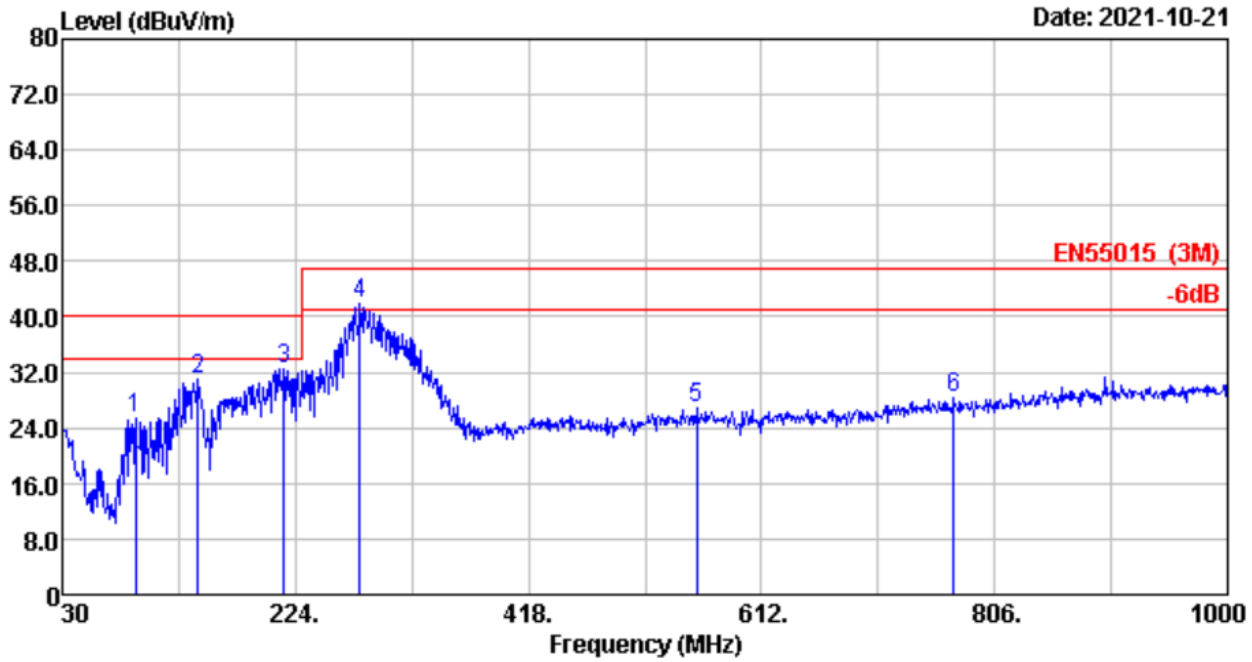
6.5.3 Diagram 015



No.	Freq. (MHz)	Ant. Factor (dB/m)	Cable Loss (dB)	Reading (dBuV)	Emission Level (dBuV/m)	Limits (dBuV/m)	Margin (dB)	Remark
1	130.880	17.83	1.15	13.89	32.87	40.00	7.13	QP
2	162.890	15.61	1.30	13.63	30.54	40.00	9.46	QP
3	266.680	18.50	1.63	20.34	40.47	47.00	6.53	QP
4	309.360	19.15	1.77	20.82	41.74	47.00	5.26	QP
5	433.520	22.21	2.14	10.04	34.39	47.00	12.61	QP
6	834.130	25.91	3.20	4.45	33.56	47.00	13.44	QP

Remarks: 1. Emission Level= Antenna Factor + Cable Loss + Reading.
2. The emission levels that are 20dB below the official limit are not reported.

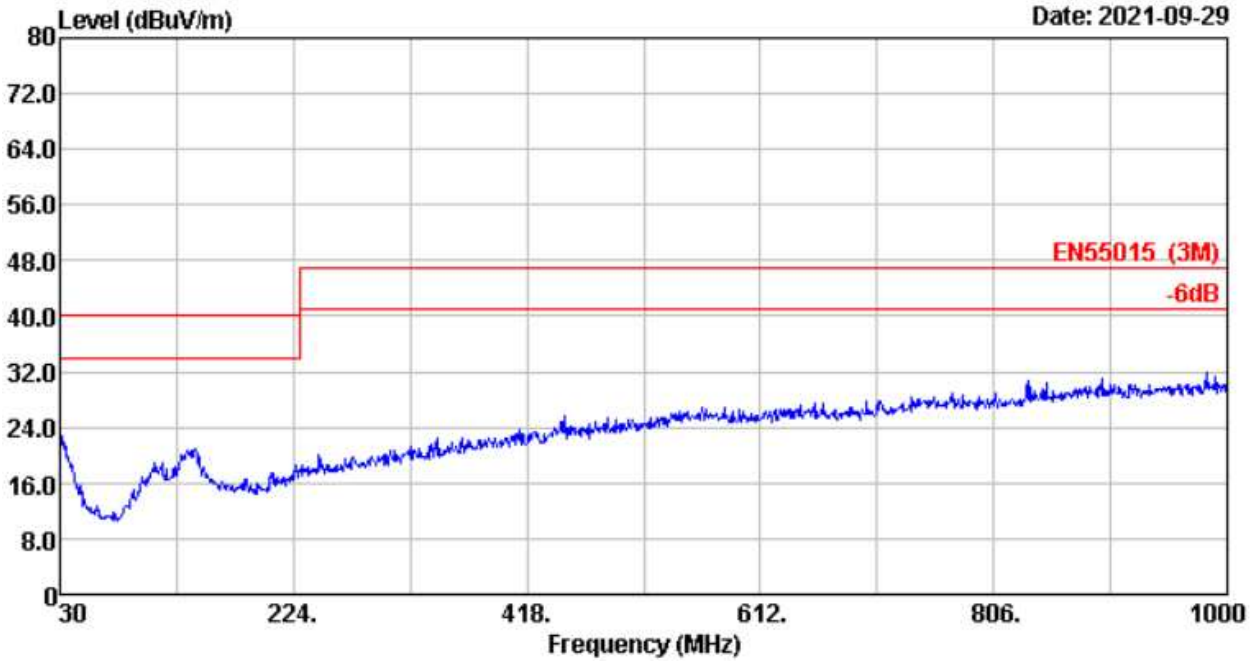
6.5.4 Diagram 016



No.	Freq. (MHz)	Ant. Factor (dB/m)	Cable Loss (dB)	Reading (dBuV)	Emission Level (dBuV/m)	Limits (dBuV/m)	Margin (dB)	Remark
1	91.110	15.11	0.94	9.31	25.36	40.00	14.64	QP
2	142.520	16.93	1.20	12.80	30.93	40.00	9.07	QP
3	214.300	15.95	1.50	14.96	32.41	40.00	7.59	QP
4	277.350	18.63	1.66	21.65	41.94	47.00	5.06	QP
5	557.680	24.62	2.47	-0.35	26.74	47.00	20.26	QP
6	772.050	25.61	3.04	-0.39	28.26	47.00	18.74	QP

Remarks: 1. Emission Level= Antenna Factor + Cable Loss + Reading.
2. The emission levels that are 20dB below the official limit are not reported.

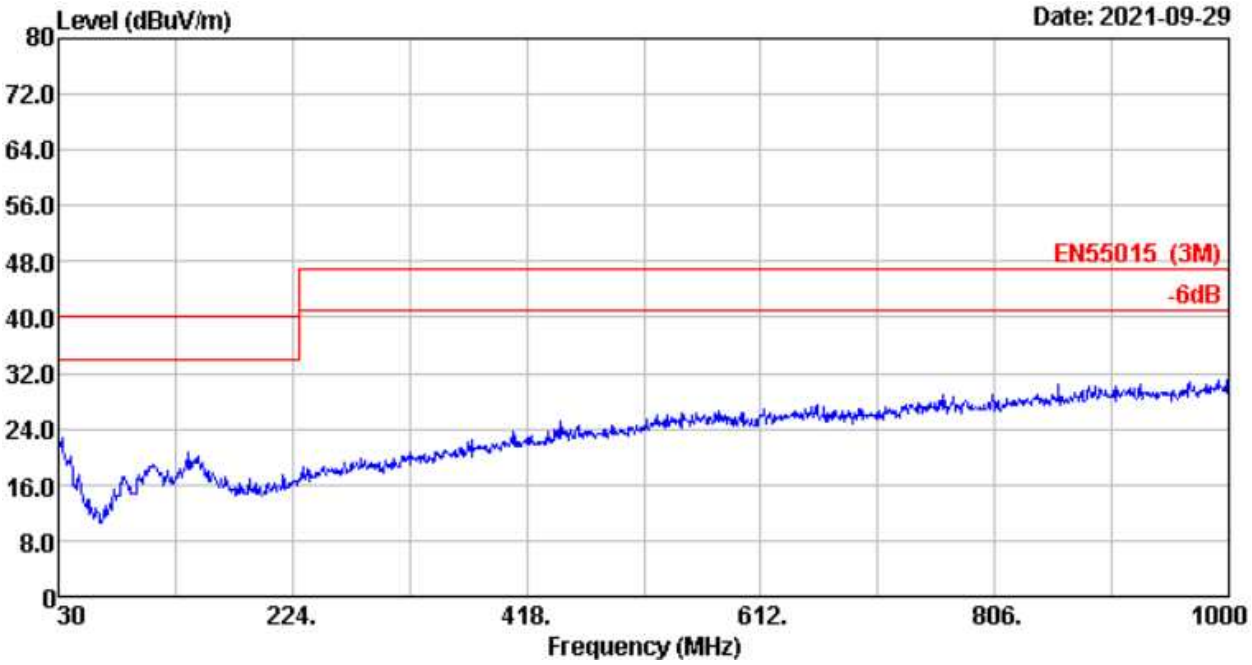
6.5.5 Diagram 017



No.	Freq. (MHz)	Ant. Factor (dB/m)	Cable Loss (dB)	AMP factor (dB)	Reading (dBuV)	Emission Level (dBuV/m)	Limits (dBuV/m)	Margin (dB)	Remark
1	30.000	24.80	0.63	0.00	-2.85	22.58	40.00	17.42	QP

Remarks: 1. Emission Level= Antenna Factor + Cable Loss + Reading -Amp Factor
2. The emission levels that are 20dB below the official limit are not reported.

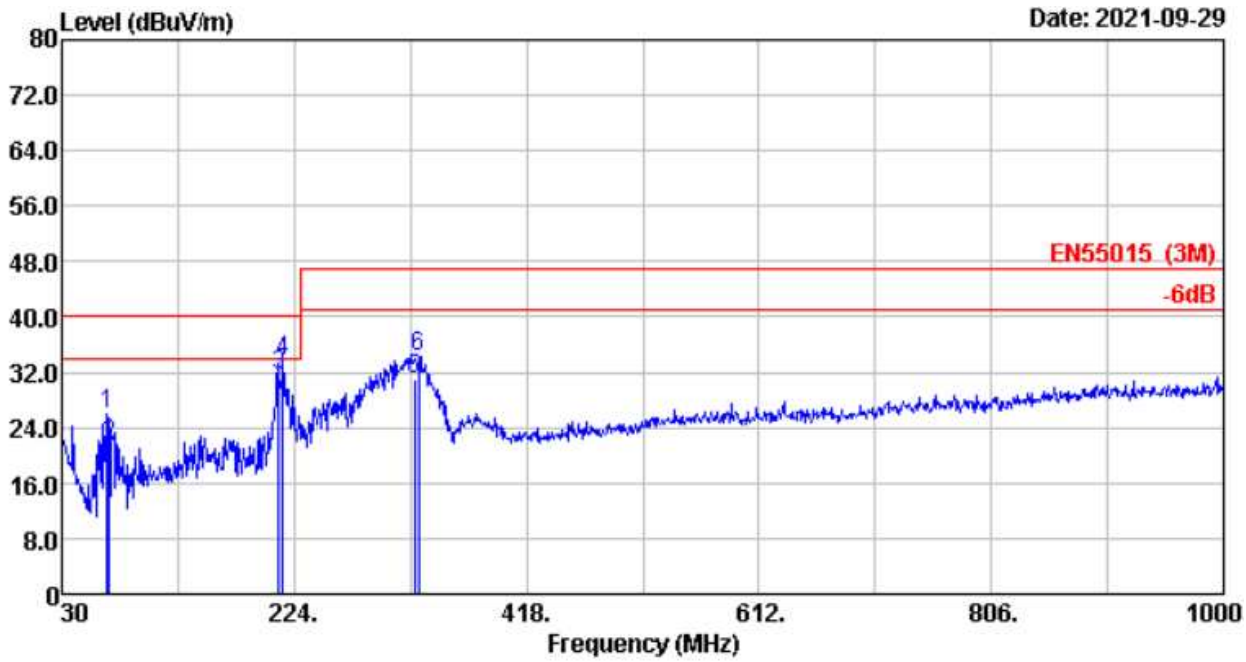
6.5.6 Diagram 018



No.	Freq. (MHz)	Ant. Factor (dB/m)	Cable Loss (dB)	AMP factor (dB)	Reading (dBuV)	Emission Level (dBuV/m)	Limits (dBuV/m)	Margin (dB)	Remark
1	30.000	24.80	0.63	0.00	-3.88	21.55	40.00	18.45	QP

Remarks: 1. Emission Level= Antenna Factor + Cable Loss + Reading -Amp Factor
2. The emission levels that are 20dB below the official limit are not reported.

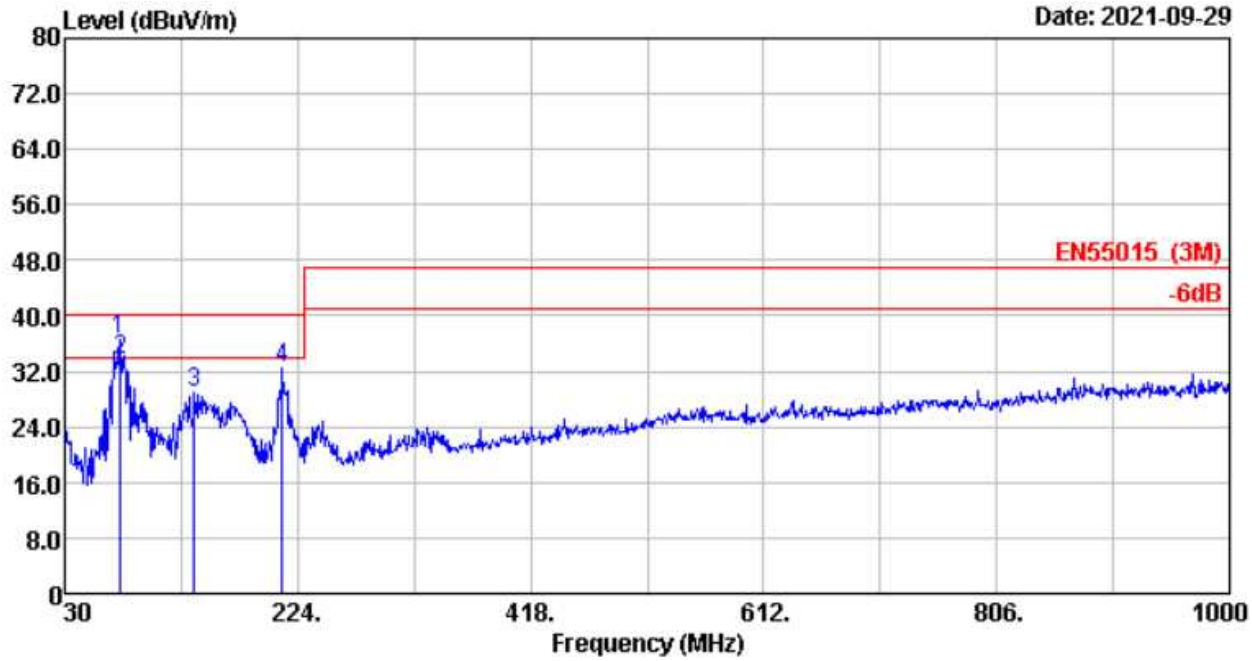
6.5.7 Diagram 019



No.	Freq. (MHz)	Ant. Factor (dB/m)	Cable Loss (dB)	AMP factor (dB)	Reading (dBuV)	Emission Level (dBuV/m)	Limits (dBuV/m)	Margin (dB)	Remark
1	67.830	12.40	0.80	30.25	42.98	25.93	40.00	14.07	Peak
2	69.832	12.40	0.81	0.00	8.20	21.41	40.00	18.59	QP
3	210.898	15.70	1.50	0.00	14.50	31.70	40.00	8.30	QP
4	214.300	15.95	1.50	29.35	45.61	33.71	40.00	6.29	Peak
5	324.083	19.52	1.81	0.00	9.80	31.13	47.00	15.87	QP
6	327.790	19.62	1.82	29.11	41.88	34.21	47.00	12.79	Peak

Remarks: 1. Emission Level= Antenna Factor + Cable Loss + Reading -Amp Factor
2. The emission levels that are 20dB below the official limit are not reported.

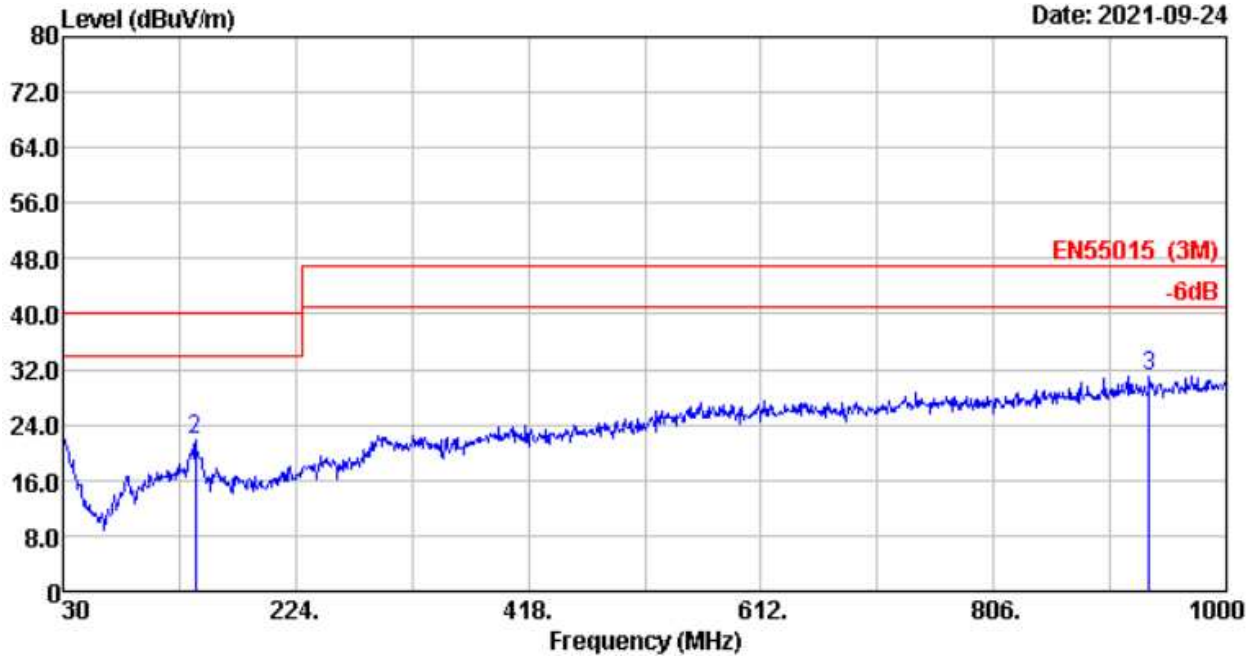
6.5.8 Diagram 020



No.	Freq. (MHz)	Ant. Factor (dB/m)	Cable Loss (dB)	AMP factor (dB)	Reading (dBuV)	Emission Level (dBuV/m)	Limits (dBuV/m)	Margin (dB)	Remark
1	75.590	12.78	0.83	30.22	53.35	36.74	40.00	3.26	Peak
2	76.109	12.85	0.83	0.00	20.09	33.77	40.00	6.23	QP
3	137.670	17.34	1.18	29.89	40.30	28.93	40.00	11.07	Peak
4	211.390	15.76	1.50	29.36	44.43	32.33	40.00	7.67	Peak

Remarks: 1. Emission Level= Antenna Factor + Cable Loss + Reading -Amp Factor
2. The emission levels that are 20dB below the official limit are not reported.

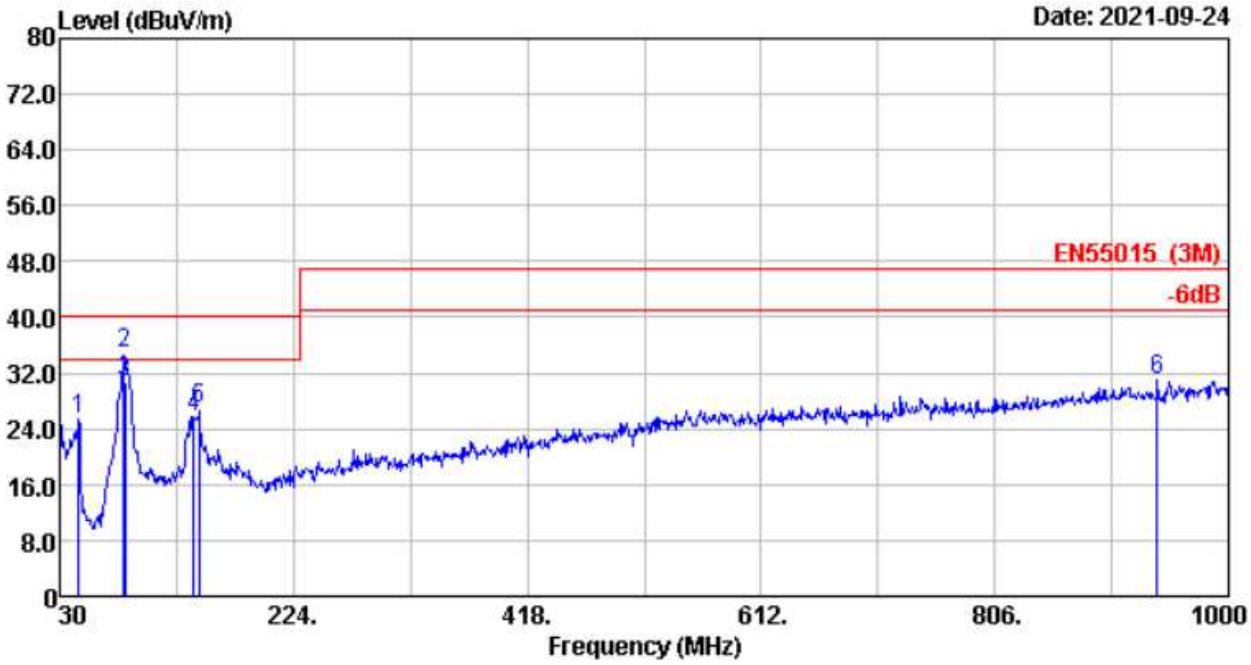
6.5.9 Diagram 021



No.	Freq. (MHz)	Ant. Factor (dB/m)	Cable Loss (dB)	Reading (dBuV)	Emission Level (dBuV/m)	Limits (dBuV/m)	Margin (dB)	Remark
1	30.000	24.80	0.63	27.48	22.51	40.00	17.49	Peak
2	140.580	17.11	1.19	33.53	21.96	40.00	18.04	Peak
3	935.980	26.45	3.42	29.14	31.11	47.00	15.89	Peak

Remarks: 1. Emission Level= Antenna Factor + Cable Loss + Reading.
2. The emission levels that are 20dB below the official limit are not reported.

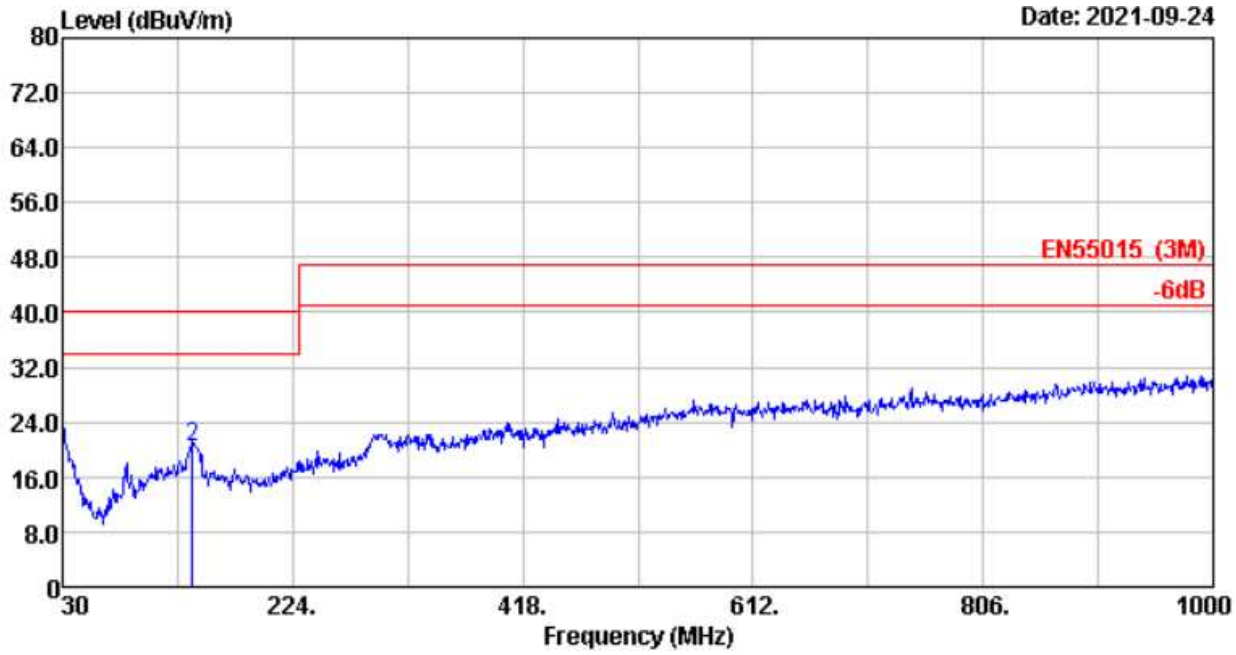
6.5.10 Diagram 022



No.	Freq. (MHz)	Ant. Factor (dB/m)	Cable Loss (dB)	Reading (dBuV)	Emission Level (dBuV/m)	Limits (dBuV/m)	Margin (dB)	Remark
1	45.520	16.51	0.73	38.62	25.52	40.00	14.48	Peak
2	83.221	13.64	0.87	20.30	34.81	40.00	5.19	QP
3	84.320	13.82	0.88	46.26	30.76	40.00	9.24	Peak
4	141.550	17.02	1.20	37.45	25.81	40.00	14.19	Peak
5	145.376	16.65	1.21	9.09	26.95	40.00	13.05	QP
6	940.830	26.46	3.44	28.87	30.87	47.00	16.13	Peak

Remarks: 1. Emission Level= Antenna Factor + Cable Loss + Reading
2. The emission levels that are 20dB below the official limit are not reported.

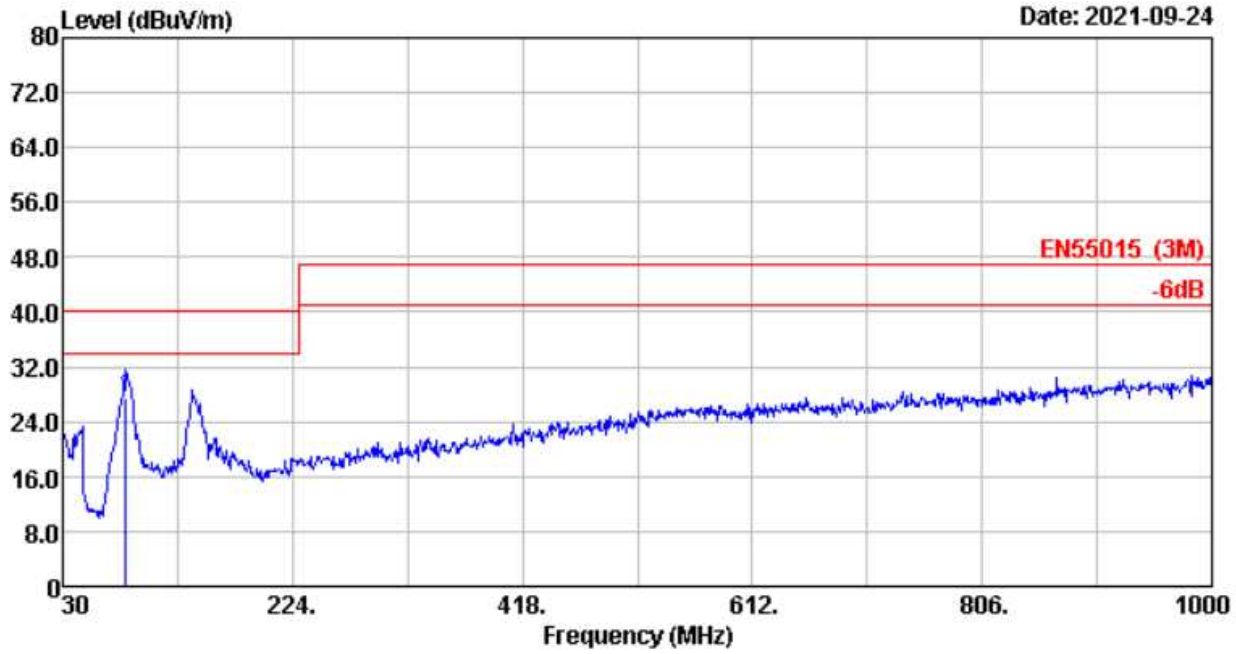
6.5.11 Diagram 023



No.	Freq. (MHz)	Ant. Factor (dB/m)	Cable Loss (dB)	Reading (dBuV)	Emission Level (dBuV/m)	Limits (dBuV/m)	Margin (dB)	Remark
1	30.000	24.80	0.63	-3.10	22.33	40.00	17.67	QP
2	139.610	17.20	1.19	2.02	20.41	40.00	19.59	QP

Remarks: 1. Emission Level= Antenna Factor + Cable Loss + Reading.
2. The emission levels that are 20dB below the official limit are not reported.

6.5.12 Diagram 024



No.	Freq. (MHz)	Ant. Factor (dB/m)	Cable Loss (dB)	Reading (dBuV)	Emission Level (dBuV/m)	Limits (dBuV/m)	Margin (dB)	Remark
1	83.350	13.64	0.87	13.07	27.58	40.00	12.42	QP

Remarks: 1. Emission Level= Antenna Factor + Cable Loss + Reading.
2. The emission levels that are 20dB below the official limit are not reported.

7 Measurement of Radiated Electromagnetic Disturbances

7.1 Standards

Generic standard	/
Product or product family standard	**EN IEC 55015:2019+A11:2020**
Limit class	**Table 8 of EN IEC55015**
Basic standard	**CISPR 16**
Date of testing	**2021-09-22**

7.2 Measurement equipment

	Equipment	Calibration due	Type	Equipment No.	Manufacturer
☒	EMI TEST RECEIVER	2023.01.03	ESCI	100657	R & S
☒	TRIPLE-LOOP ANTENNA(2m)	2023.01.03	HM020	100043	R & S
☒	EMI Test Software	N/A	EMC32	N/A	ROHDE & SCHWARZ

7.3 Test set-up

Annex B with a photo or a rough figure of the test set-up is attached.
The test has been performed as following:
The magnetic component shall be measured by means of a loop antenna as described in EN 55015 .The lighting equipment shall be placed in the center of the antenna ,and the position is not critical.

The inducted current in the loop antenna is measured by means of a current probe(1V/A) and the CISPR measuring receiver . By means of a coaxial switch the three field directions can be measured in sequence. Each value shall fulfil the requirements given.

Self-ballasted lamps and semi-luminaries shall be measured when inserted in a relevant lamp-holder, mounted on a piece of insulating material.

Scan setting：

Freq range			Receiver setting		
Start	Stop	Step	IF BW	Detector	Meas Time
9k	150k	100Hz	200Hz	PK	10ms
150k	30M	4.5k	9k	PK	20ms

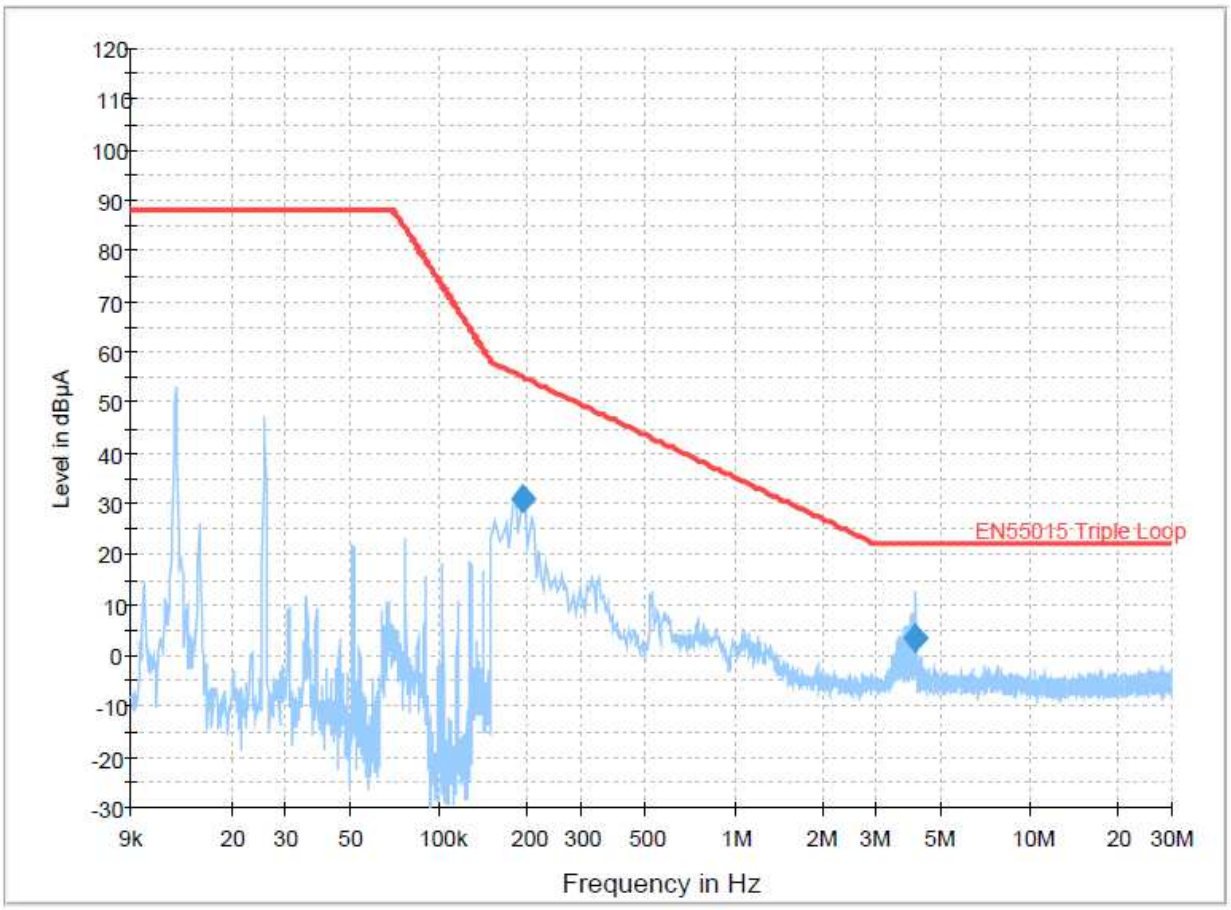
Final measurement：
Meas time :1s
Detector QP

7.4 Test result

Test port:		Enclosure		
Model	**Test Mode**	**Diagram**	**Remarks**	**Result**
SP2001DA-BK	TM1	025	X	**Pass**
		026	Y	**Pass**
		027	Z	**Pass**
SP2003DA-WH	TM1	028	X	**Pass**
		029	Y	**Pass**
		030	Z	**Pass**
SP2002DA-WH	TM1	031	X	**Pass**
		032	Y	**Pass**
		033	Z	**Pass**

7.5 Diagrams

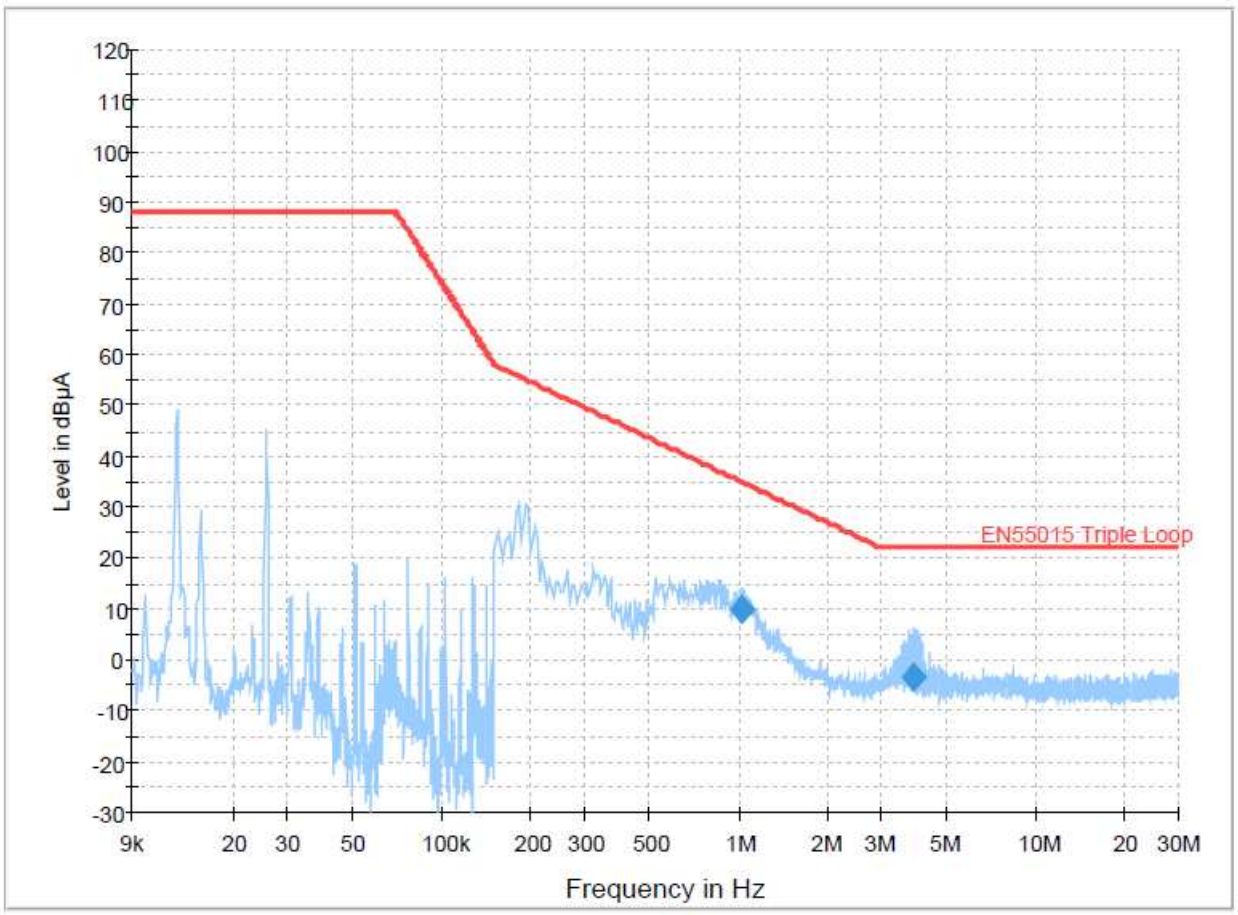
7.5.1 Diagram 025



Final Result 1

Frequency (MHz)	QuasiPeak (dBµA)	Triple Loop frame	Corr. (dB)	Margin (dB)	Limit (dBµA)
0.190500	30.9	X	0.0	24.2	55.1
4.110000	3.2	X	0.1	18.8	22.0

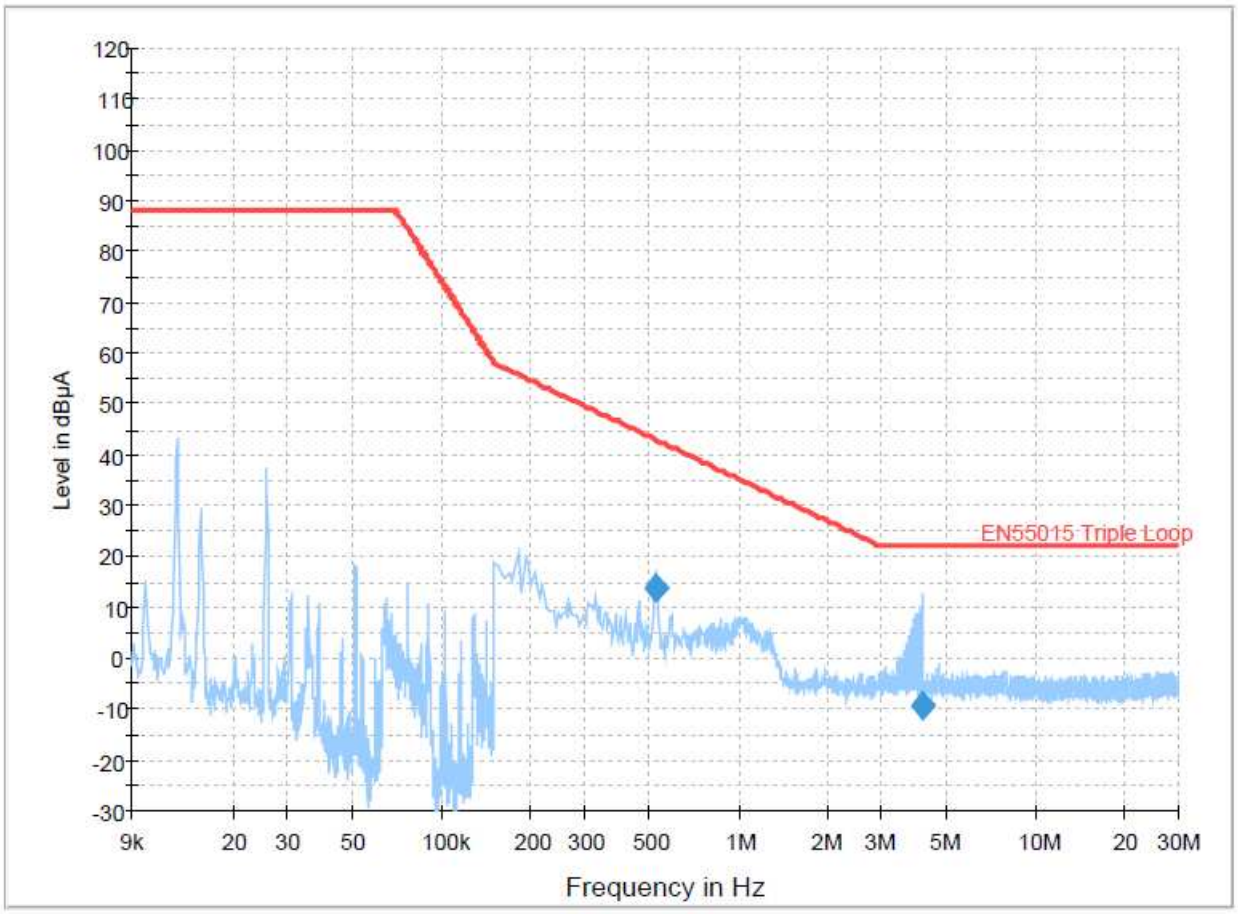
7.5.2 Diagram 026



Final Result 1

Frequency (MHz)	QuasiPeak (dBµA)	Triple Loop frame	Corr. (dB)	Margin (dB)	Limit (dBµA)
1.027500	9.8	Y	0.1	25.1	34.9
3.880500	-3.3	Y	0.1	25.3	22.0

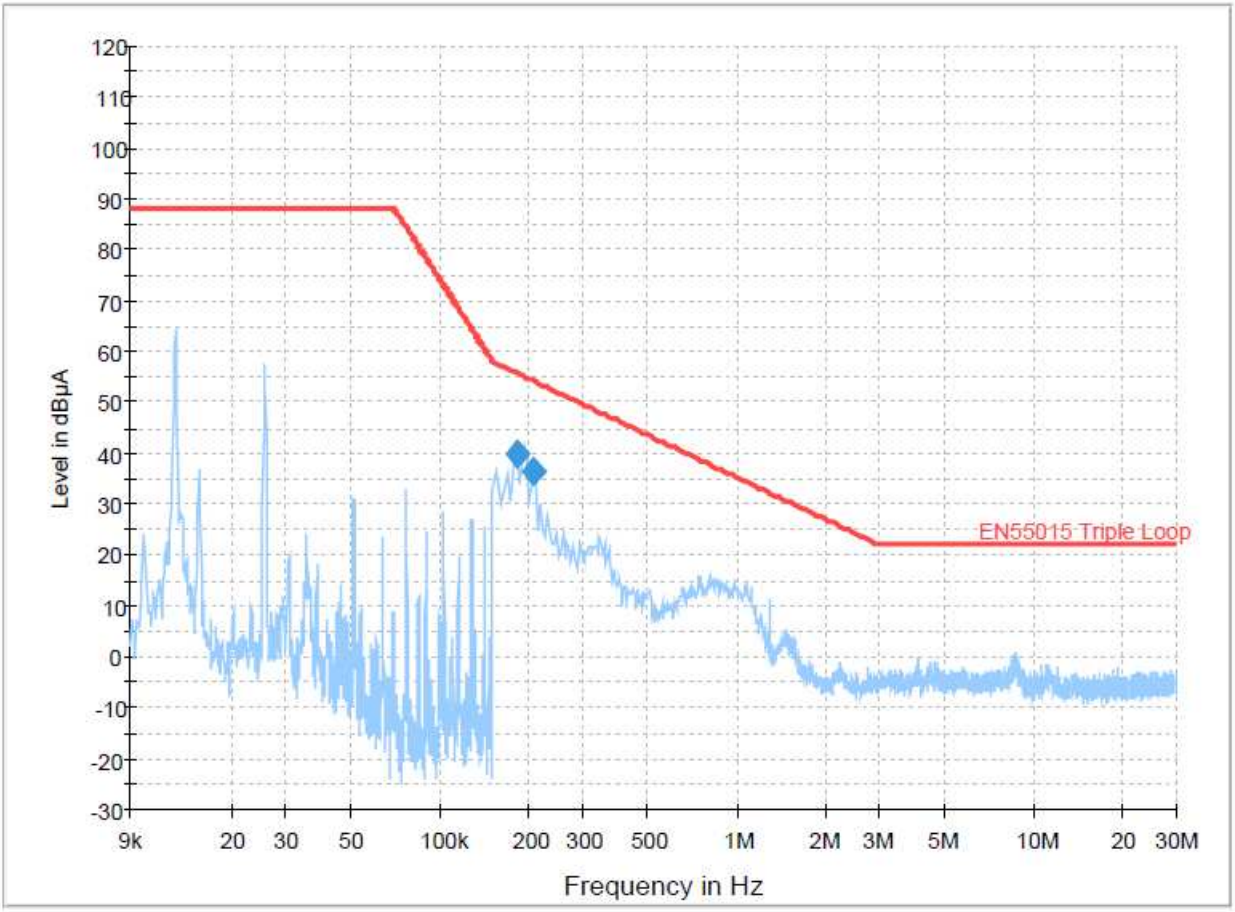
7.5.3 Diagram 027



Final Result 1

Frequency (MHz)	QuasiPeak (dBµA)	Triple Loop frame	Corr. (dB)	Margin (dB)	Limit (dBµA)
0.523500	14.0	Z	0.0	29.0	43.0
4.123500	-9.6	Z	0.1	31.6	22.0

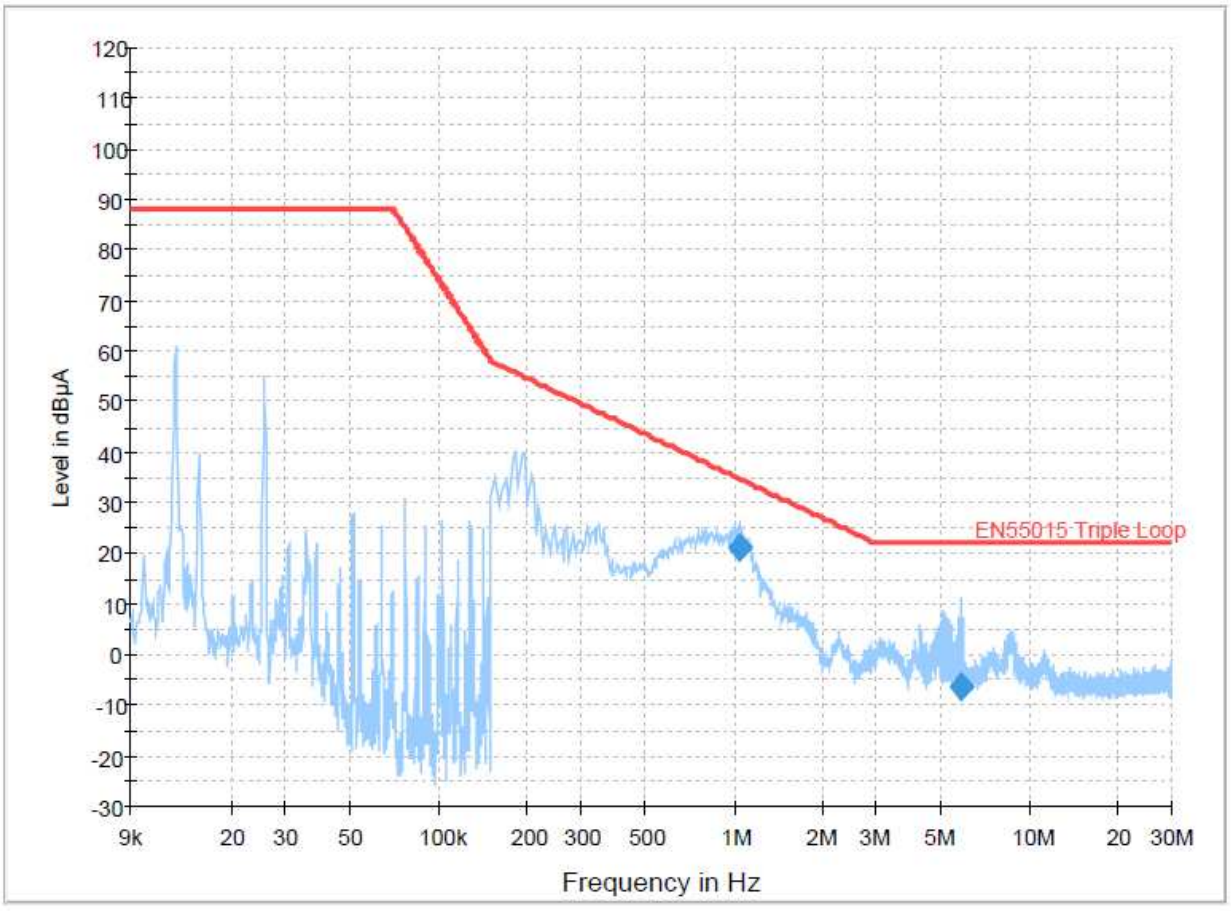
7.5.4 Diagram 028



Final Result 1

Frequency (MHz)	QuasiPeak (dBµA)	Triple Loop frame	Corr. (dB)	Margin (dB)	Limit (dBµA)
0.181500	39.8	X	0.0	15.9	55.7
0.204000	36.5	X	0.0	17.8	54.3

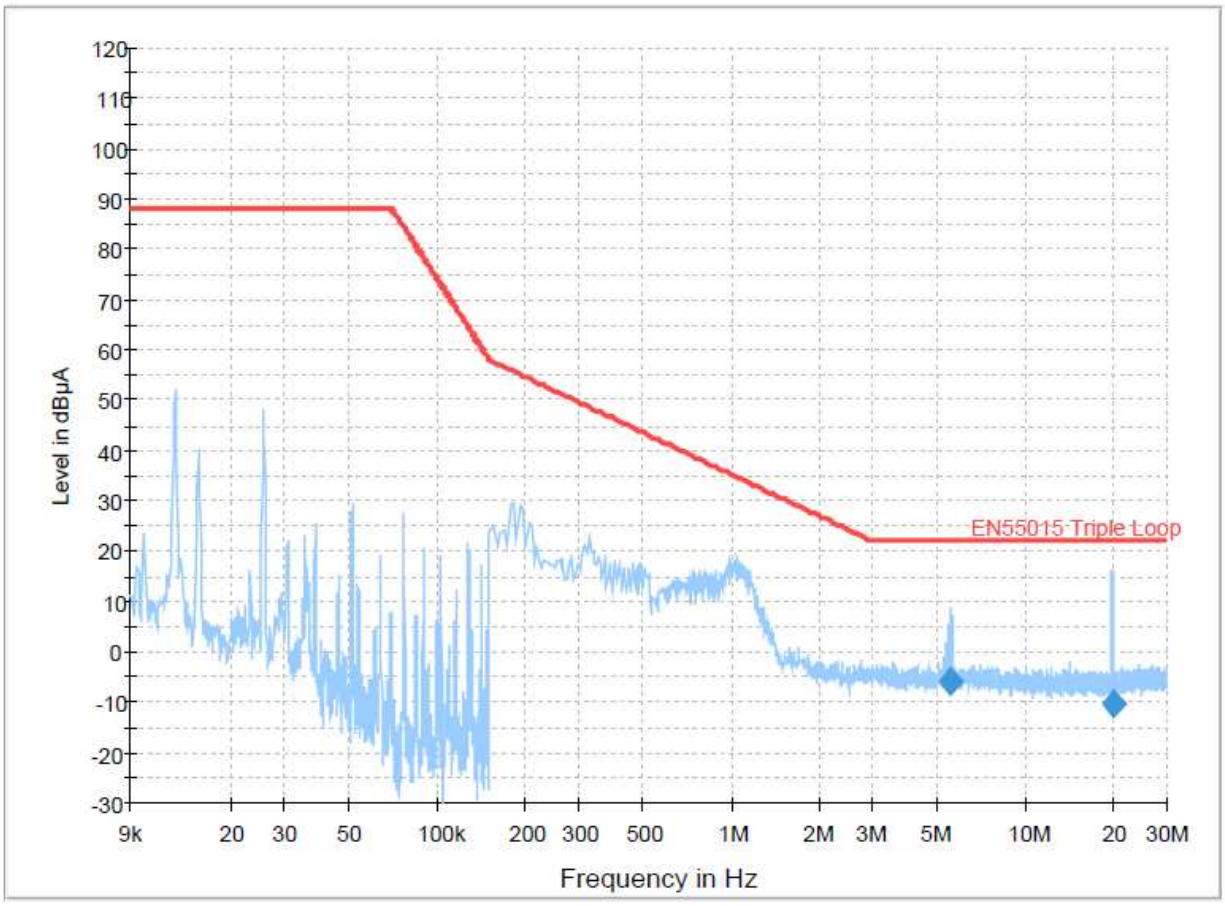
7.5.5 Diagram 029



Final Result 1

Frequency (MHz)	QuasiPeak (dBµA)	Triple Loop frame	Corr. (dB)	Margin (dB)	Limit (dBµA)
1.032000	21.1	Y	0.1	13.7	34.8
5.883000	-6.5	Y	0.1	28.5	22.0

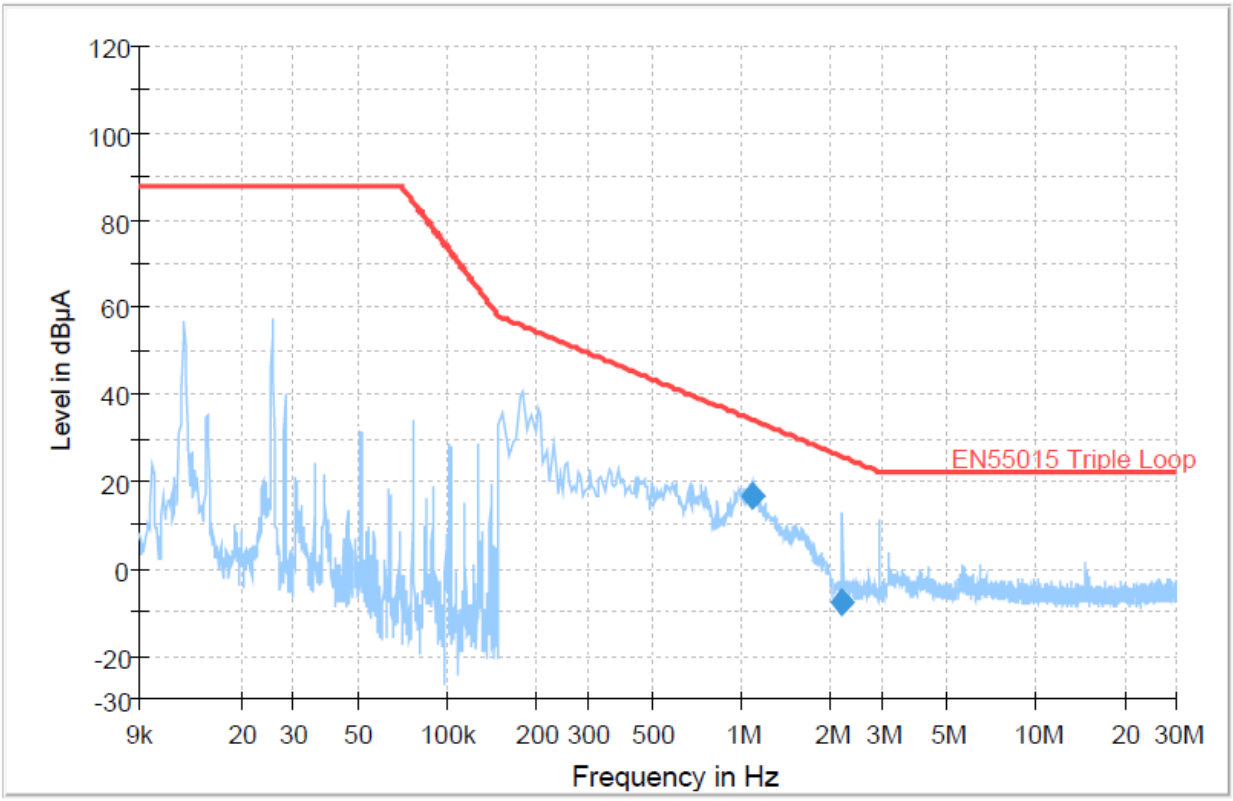
7.5.6 Diagram 030



Final Result 1

Frequency (MHz)	QuasiPeak (dBµA)	Triple Loop frame	Corr. (dB)	Margin (dB)	Limit (dBµA)
5.568000	-5.7	Z	0.1	27.7	22.0
19.851000	-10.3	Z	0.3	32.3	22.0

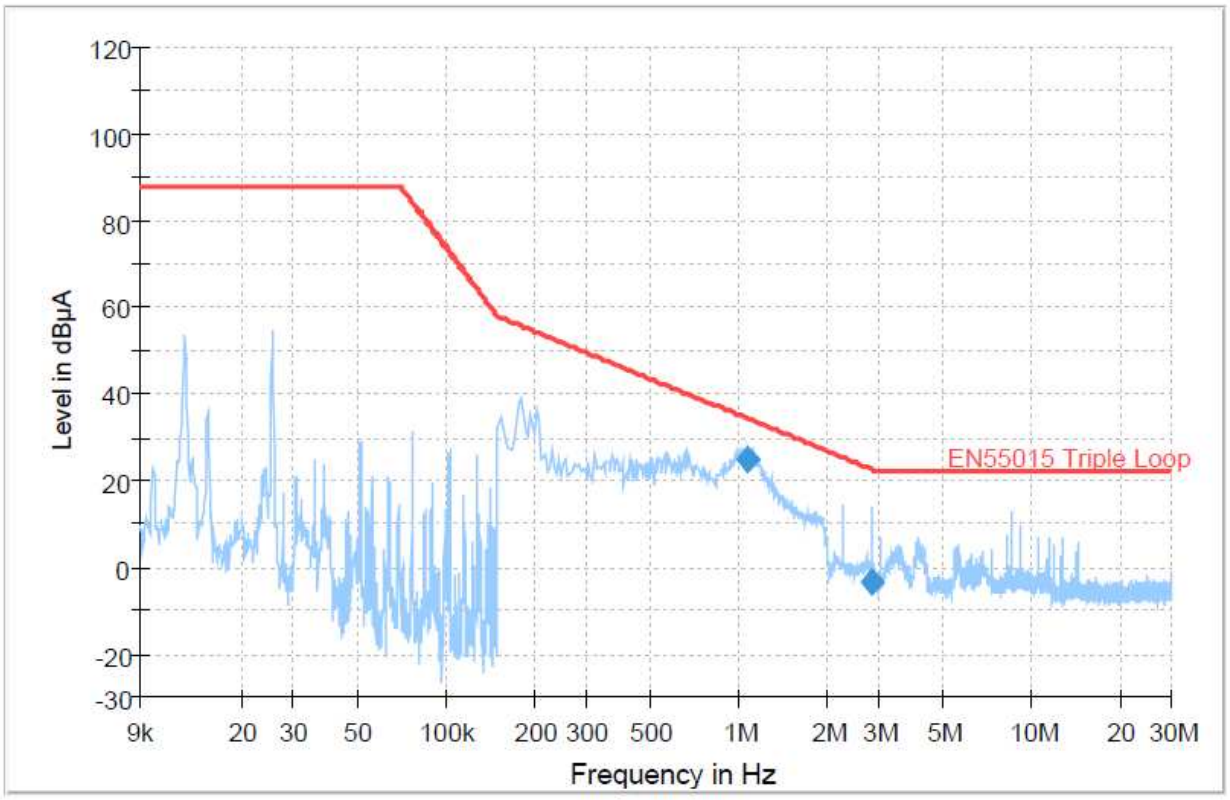
7.5.7 Diagram 031



Final Result 1

Frequency (MHz)	QuasiPeak (dBµA)	Triple Loop frame	Corr. (dB)	Margin (dB)	Limit (dBµA)
1.081500	16.7	X	0.2	17.6	34.3
2.206500	-7.5	X	0.2	33.2	25.7

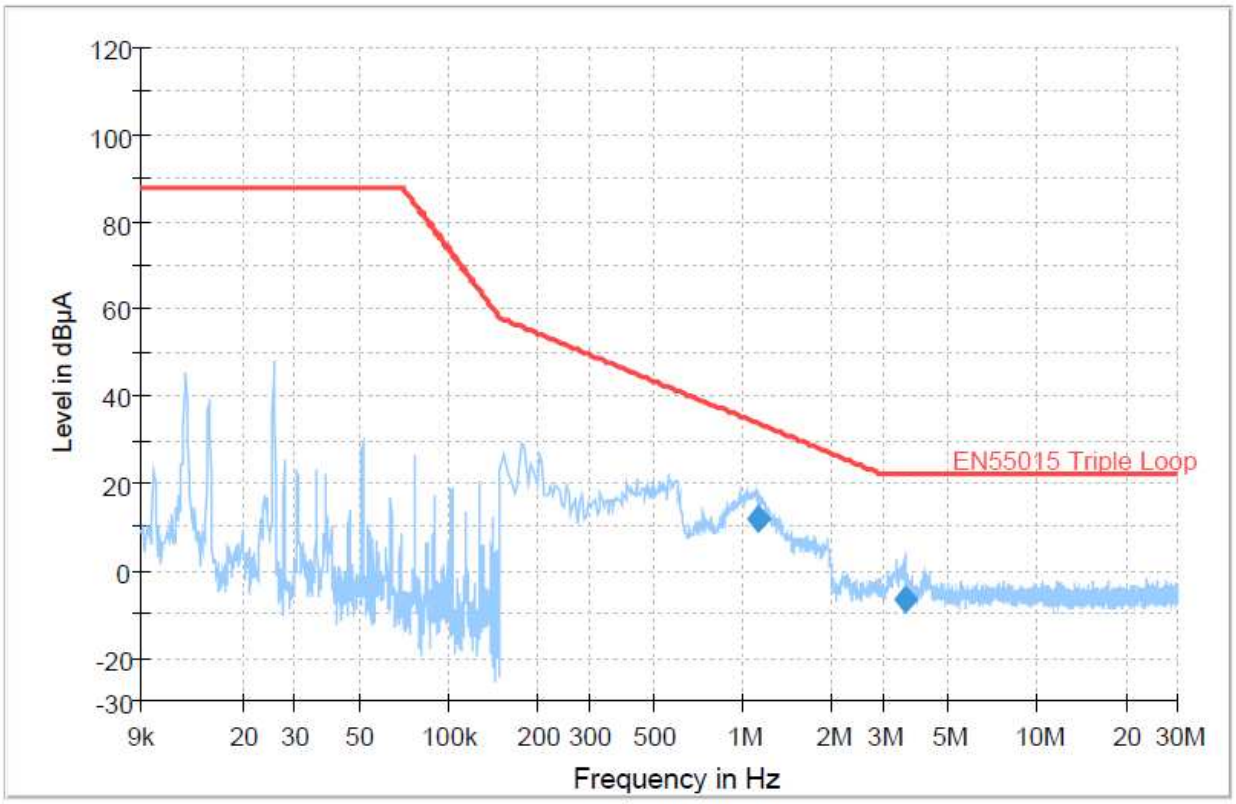
7.5.8 Diagram 032



Final Result 1

Frequency (MHz)	QuasiPeak (dBµA)	Triple Loop frame	Corr. (dB)	Margin (dB)	Limit (dBµA)
1.072500	25.1	Y	0.2	9.3	34.4
2.832000	-3.5	Y	0.2	26.2	22.7

7.5.9 Diagram 033



Final Result 1

Frequency (MHz)	QuasiPeak (dBµA)	Triple Loop frame	Corr. (dB)	Margin (dB)	Limit (dBµA)
1.131000	12.1	Z	0.2	21.6	33.7
3.543000	-6.4	Z	0.2	28.4	22.0

8 Harmonic current

8.1 Standard

Generic standard	**EN IEC 61000-3-2:2019+A1:2021**
Limit class	**Class C**
Date of testing	**/**

8.2 Measurement equipment

	Equipment	Calibration due	Type	Serial No.	Manufacturer
☒	AC Power Source	2023.01.03	NSG 1007	57877	SCHAFFNER
☒	Signal Conditioning unit	2023.01.03	CCN1000-1	72538	SCHAFFNER

8.3 Test set-up

Annex B with a photo or a rough figure of the test set-up is attached.

Devices with an active input power of P < 25 W		☒
Balanced three-phase equipment and all other equipment, expect that stated in one of the following classes	**Class A**	☐
Portable tools	**Class B**	☐
Lighting equipment, including dimming devices	**Class C**	☒
Equipment having an input current with a "special wave shape" as defined in figure 1 in the standard and an active input power, P ≤ 600 W and motor driven with phase angle control	**Class D**	☐

The power cord of the EUT is connected to the output of the test systems, Turn on the power of the EUT and use the test system to test the harmonic current level. Observation time: 150s

If Harmonic current less than 0.6% of the input current measured under the test condition, or less than 5mA, then whichever is greater, are disregarded.

8.4 Test results

Model	Mode	Table	Test port	Power	Result
SP2001DA-BK	TM1	/	AC Input	3.7 W	N/A*
SP2003DA-WH	TM1	/	AC Input	3.3 W	N/A*
SP2002DA-WH	TM1	/	AC Input	3.5 W	N/A*

Remark:
The active input power equal to or less than 5W Therefore there are no harmonic limits for LED equipment below 5 W.

9 Voltage fluctuations and flicker

9.1 Standard

Generic standard **EN61000-3-3:2013+A1:2019**

Date of testing **2021-09-23**

9.2 Measurement equipment

	Equipment	Calibration due	Type	Serial No.	Manufacturer
☒	AC Power Source	2023.01.03	NSG 1007	57877	SCHAFFNER
☒	Signal Conditioning unit	2023.01.03	CCN1000-1	72538	SCHAFFNER

9.3 Test set-up

Annex B with a photo or a rough figure of the test set-up is attached.

The power cord of the EUT is connected to the output of the test systems , Turn on the power of the EUT and use the test system to test the voltage fluctuation and flicker.

There is no testing required if the device does not generate any significant voltage fluctuations or flicker. A short time measurement confirmed the assumption that this is the fact. The details in the test module are representing the results of the short time measurement.

Short time (Pst): 10 min

9.4 Test results

Model	Test mode	Table	Description	Result
SP2001DA-BK	TM1	034	AC Input Port	**Pass**
SP2003DA-WH	TM1	035	AC Input Port	**Pass**
SP2002DA-WH	TM1	036	AC Input Port	**Pass**

9.5 Table

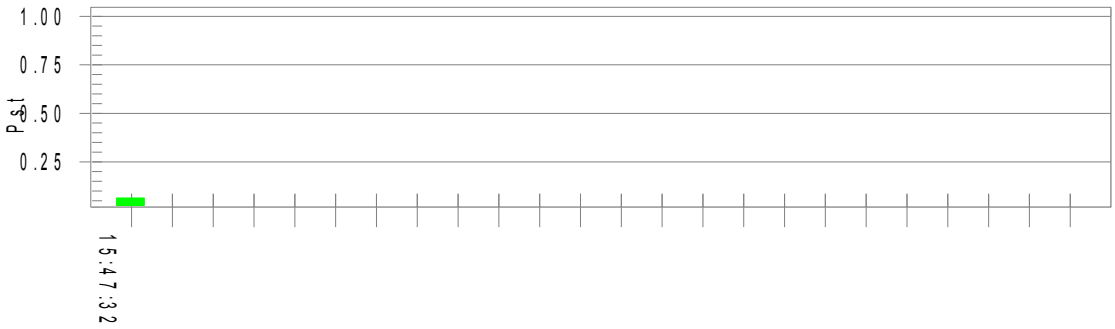
9.5.1 Table 034

Flicker Test Summary per EN/IEC61000-3-3 Ed. 3.0 (2013) (Run time)

EUT: SP2001DA-BK **Tested by: RJB**
Test category: dt,dmax,dc and Pst (European limits) **Test Margin: 100**
Test date: 2021/9/23 **Start time: 15:37:11** **End time: 15:47:38**
Test duration (min): 10 **Data file name: F-001268.cts_data**
Comment: Charging
Customer: Customer information

Test Result: Pass **Status: Test Completed**

Pst_i and limit line **European Limits**



Parameter values recorded during the test:

Vrms at the end of test (Volt):	**229.96**			
T-max (mS):	**0**	**Test limit (mS):**	**500.0**	**Pass**
Highest dc (%):	**0.00**	**Test limit (%):**	**3.30**	**Pass**
Highest dmax (%):	**0.00**	**Test limit (%):**	**4.00**	**Pass**
Highest Pst (10 min. period):	**0.064**	**Test limit:**	**1.000**	**Pass**

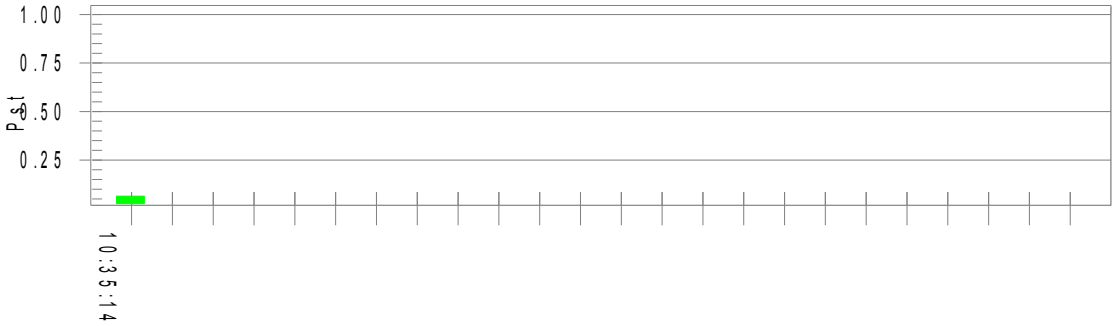
9.5.2 Table 035

Flicker Test Summary per EN/IEC61000-3-3 Ed. 3.0 (2013) (Run time)

EUT: SP2003DA-WH **Tested by: RJB**
Test category: dt,dmax,dc and Pst (European limits) **Test Margin: 100**
Test date: 2021/9/23 **Start time: 10:24:53** **End time: 10:35:21**
Test duration (min): 10 **Data file name: F-001252.cts_data**
Comment: ON
Customer: Customer information

Test Result: Pass **Status: Test Completed**

Pst_i and limit line **European Limits**



Parameter values recorded during the test:

Vrms at the end of test (Volt):	**229.90**			
T-max (mS):	**0**	**Test limit (mS):**	**500.0**	**Pass**
Highest dc (%):	**0.00**	**Test limit (%):**	**3.30**	**Pass**
Highest dmax (%):	**0.00**	**Test limit (%):**	**4.00**	**Pass**
Highest Pst (10 min. period):	**0.064**	**Test limit:**	**1.000**	**Pass**

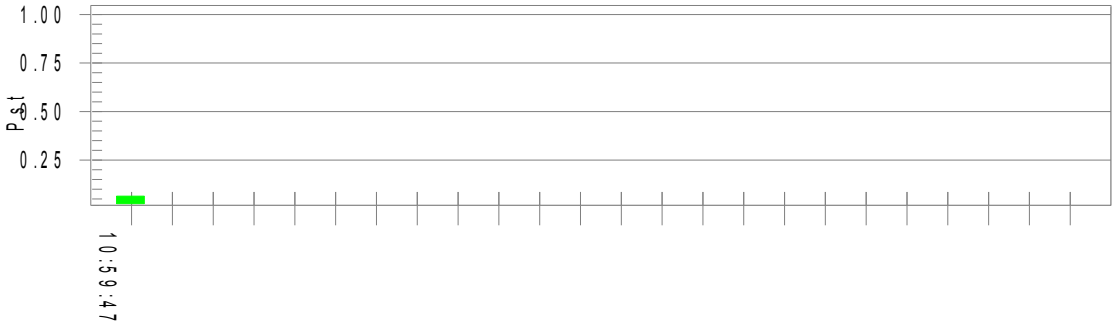
9.5.3 Table 036

Flicker Test Summary per EN/IEC61000-3-3 Ed. 3.0 (2013) (Run time)

EUT: SP2002DA-WH **Tested by: RJB**
Test category: dt,dmax,dc and Pst (European limits) **Test Margin: 100**
Test date: 2021/9/23 **Start time: 10:49:26** **End time: 10:59:53**
Test duration (min): 10 **Data file name: F-001255.cts_data**
Comment: ON
Customer: Customer information

Test Result: Pass **Status: Test Completed**

Pst_i and limit line **European Limits**



Parameter values recorded during the test:

Vrms at the end of test (Volt):	**229.89**			
T-max (mS):	**0**	**Test limit (mS):**	**500.0**	**Pass**
Highest dc (%):	**0.00**	**Test limit (%):**	**3.30**	**Pass**
Highest dmax (%):	**0.00**	**Test limit (%):**	**4.00**	**Pass**
Highest Pst (10 min. period):	**0.064**	**Test limit:**	**1.000**	**Pass**

10 Electrostatic Discharge

10.1 Standard

Generic standard **EN 61000-4-2:2009**

Date of testing **2021-10-25**

Performance criteria: **B**

10.2 Measurement equipment

	Equipment	Calibration due.	Type	Serial No.	Manufacturer
☒	ESD generator power	2023.01.03	NSG437	161	TESEQ
☒	ESD generator	2023.01.03	NSG437	130-149	TESEQ

10.3 Test set-up

Annex B with a photo or a rough figure of the test set-up is attached.

These tests are carried out according to IEC 61000-4-2, with test levels as given in Table 1 of this standard. Contact discharge is the preferred test method. Twenty discharges (10 with positive and 10 with negative polarity) shall be applied on each accessible metallic part of the enclosure (terminals are excluded). Air discharges shall be used where contact discharges cannot be applied. Discharges shall be applied on the horizontal or vertical coupling planes, as specified in
IEC 61000-4-2.

Contact Discharge: The ESD generator is held perpendicular to the surface to which the discharge is applied and the tip of the discharge electrode touch the surface of EUT. Then turn the discharge switch. The generator is then re-triggered for a new single discharge and repeated 20 times for each pre-selected test point. This procedure shall be repeated until all the air discharge completed.

Air Discharge: Air discharge is used where contact discharge can't be applied.. The round discharge tip of the discharge electrode shall be approached as fast as possible to touch the EUT. After each discharge, the discharge electrode shall be removed from the EUT. The generator is then re-triggered for a new single discharge and repeated 10 times for each pre-selected test point. This procedure shall be repeated until all the air discharge completed .Indirect discharge for horizontal coupling plane At least 20 single discharges shall be applied to the horizontal coupling plane, at points on each side of the EUT. Indirect discharge for vertical coupling plane At least 20 single discharge shall be applied to the centre of one vertical edge of the coupling plane. The coupling plane, of dimensions 0.5m X 0.5m, is placed parallel to, and positioned at a distance of 0.1m from the EUT. Discharges shall be applied to the coupling plane, with this plane in sufficient different positions that the four faces of the EUT are completely illuminated.

10.4 Test results

Port: Enclosure			
Test Model	**Test Mode**	**Table**	**Result**
SP2001DA-BK, SP2003DA-WH, SP2002DA-WH	TM1, TM2	037	**Pass**

10.5 Table

10.5.1 Table 037

Location	Voltage	Amount of test points	Amount of discharge	Discharge Method	Performance
Conductive Enclosure:Screws	±2,4kV	10	200	Contact	A
Nonconductive Enclosure: slot Button	±2,4,8kV	20	400	Air	A
HCP	±2,4kV	4	80	Contact	A
VCP	±2,4kV	4	80	Contact	A

11 Radiated Electromagnetic Field Immunity

11.1 Standard

Generic standard **EN IEC 61000-4-3:2020**

Date of testing **2021-10-25**

Performance criteria: **A**

11.2 Measurement equipment

	Equipment	Calibration due	Model No.	Serial No.	Manufacturer
☒	2#Chamber	Apr.28,22	N/A	N/A	AUDIX
☒	Signal Generator	Oct.29,22	N5181A	MY49061013	Agilent
☒	Amplifier	NCR	100W/1000M1	17028	A&R
☒	Power Meter	Aug.20,22	ML2487A	6K00002472	Anritsu
☒	Power Sensor	Aug.20,22	MA2491A	032516	Anritsu
☒	Log-periodic Antenna	NCR	AT1080	16512	A&R
☒	Test Software	N/A	I2	3.2010-1-8	AUDIX

11.3 Test set-up

Annex B with a photo or a rough figure of the test set-up is attached.

The EUT and its simulators are placed on a turn table which is 0.8 meter above ground. EUT is set 3 meter away from the transmitting antenna which is mounted on an antenna tower. Both horizontal and vertical polarization of the antenna are set on Test. Each of the four sides of EUT must be faced this transmitting antenna and measured individually. In order to judge the EUT performance, a CCD camera is used to monitor EUT screen.

11.4 Test results

Test Model	Test Mode	Table	Description	Result
SP2001DA-BK, SP2003DA-WH, SP2002DA-WH	TM1, TM2	038	Enclosure Port	**Pass**

11.5 Table

11.5.1 Table 038

Frequency Range (MHz)	80-1000MHz	
Field Strength(V/m)	3V/m; 1kHz 80%AM (sine wave)	
Steps (%)	1%	
Dwell time	1s	
Polarization	Horizontal	Vertical
Front	A	A
Rear	A	A
Left	A	A
Right	A	A

12 Electrical Fast Transients/Bursts Immunity

12.1 Standard

Generic standard **EN 61000-4-4:2012**

Date of testing **2021-10-25**

Performance criteria: **B**

12.2 Measurement equipment

	Equipment	Calibration due	Type	Serial No.	Manufacturer
☒	Multi-function generator	2023.01.03	NSG 3060	083	TESEQ
☒	Coupling- decoupling Network	2023.01.03	CDN3061	083	TESEQ

12.3 Test set-up

Annex B with a photo or a rough figure of the test set-up is attached.

The EUT located 0.1m±0.01m above the ground reference plane. The ground reference plane shall project beyond the EUT at least 0.1m on all side, All cables to the EUT shall be placed on the insulation support 0.1m above the ground reference plane.

When using the coupling clamp, the minimum distance between the coupling plates and all other conductive surfaces, except the ground reference plane beneath the coupling clamp, shall be 0,5 m. Unless otherwise specified in the product standard or the product family standard, the length of the signal and power lines between the coupling device and the EUT shall be 0,5 m ± 0,05 m. If the manufacturer provides a non-detachable supply cable more than 0,5 m ± 0,05 m long with the equipment, the excess length of this cable shall be folded to avoid a flat coil and situated at a distance of 0,1 m above the ground reference plane.

Fast transients are carried out during 2min with a positive polarity and during 2min with a negative polarity.

Test level at input is as below:
1kV (peak); 5/50ns;5kHz

and Test level output dc. power ports is as below:
0.5kV (peak); 5/50ns;5kHz

12.4 Test results

Port: AC input			
Test Model	**Test Mode**	**Table**	**Result**
SP2001DA-BK, SP2003DA-WH, SP2002DA-WH	TM1, TM2	039	**Pass**

12.5 Test results

12.5.1 Table 039

Test specification	AC input: 1KV; 5/50ns Tr/Th;5kHz repetition frequency			
Injected Line	Voltage (kV)	Test Time (s)	Injected Method	Performance
L	+1	120	Direct	A
	-1	120	Direct	A
N	+1	120	Direct	A
	-1	120	Direct	A
L, N	+1	120	Direct	A
	-1	120	Direct	A
	-1	120	Direct	A

13 Surge Immunity

13.1 Standard

Basic standard **EN 61000-4-5:2014+A1:2017**

Date of testing **2021-10-25**

Performance criteria: **B**

13.2 Measurement equipment

	Equipment	Calibration due	Type	Serial No.	Manufacturer
☒	Multi-function generator	2023.01.03	NSG 3060	083	TESEQ
☒	Coupling- decoupling Network	2023.01.03	CDN 3061	083	TESEQ

13.3 Test set-up

Annex B with a photo or a rough figure of the test set-up is attached.

If not otherwise specified the power cord between the EUT and the coupling/decoupling network shall not exceed 2m in length.

These tests are carried out according to IEC 61000-4-5, with test levels as given in Table 10 of this standard. Lower levels need not to be tested. Pulses shall be applied to the a.c. voltage wave as follows; five positive polarity pulses at the 90º phase angle, five negative polarity pulses at the 270º phase angle. Two test levels are given for different types of lighting equipment.

13.4 Test results

Port：AC input				
Test model	**Test mode**	**Table**	**Test specification**	**Result**
SP2001DA-BK, SP2003DA-WH, SP2002DA-WH	TM1, TM2	040	Input AC power Port 1.2/50(8/20) μs Tr/Th ■<=25W 0.5KV L-N,1KV L-PE,N-PE □> 25W 1.0KV L-N ,2KV L-PE,N-PE	**Pass**

13.5 Table

13.5.1 Table 040

Injected Line	Wave Form	Voltage(kV)	Phase	Number of Pulse/per phase	Interval time	Performance
L-N	1.2/50μs	+0.5	90°	5	60s	A
		-0.5	270°	5	60s	A

14 Conducted Immunity

14.1 Standard

Basic standard **EN 61000-4-6:2014**

Date of testing **2021-10-25**

Performance criteria: **A**

14.2 Measurement equipment

	Equipment	Calibration due	Type	Serial No.	Manufacturer
☒	Conducted immunity test system	2023.01.03	NSG4070	25795	SCHAFFNER
☒	Attenuator	2023.01.03	ATN6075	25366	TESEQ
☒	CDN	2023.01.03	M016	25127	TESEQ

14.3 Test set-up

Annex B with a photo or a rough figure of the test set-up is attached.

Set up the EUT, CDN and test generators as shown above. The equipment to be tested is placed on an insulating support of 0.1m height above a ground reference plane, all cable exiting the EUT shall be supported at a height of at least 30mm above the ground reference plane.

The test is performed with the generator contacted to each CDN in turn. The frequency range is swept from 150kHz to 80MHz, using the signal levels established during the setting process, and with the disturbance signal 80% amplitude modulated with a 1kHz sine wave.

14.4 Test results

Port: AC input				
Test model	**Test mode**	**Table**	**Test specification**	**Result**
SP2001DA-BK, SP2003DA-WH, SP2002DA-WH	TM1, TM2	041	0.15MHz~80MHz 3V(r.m.s.) (unmodulated) 1kHz ,80%AM, sine wave Source impedance 150Ω	**Pass**

14.5 Table

14.5.1 Table 041

Frequency Range (MHz)	Injecteded Position	Strength	Performance
0.15MHz ~ 80MHz	AC main port	3V(r.m.s, Unmodulated)	A
Dwell time: 1s; Steps: 1%			

15 Induced current density

15.1 Standard

Generic standard **EN 62493:2015**

Date of testing **2021-10-25**

15.2 Measurement equipment

	Equipment	Calibration due	Type	Serial No.	Manufacturer
☒	EMI Test Receiver	2023.01.03	ESCI	100657	ROHDE & SCHWARZ
☒	Protection Network for "Van der Hoofden" Test-Head	2023.01.03	VDH30	SC069O	AFJ
☒	EMI Test Software	N/A	EMC32	N/A	ROHDE & SCHWARZ

15.3 Test set-up

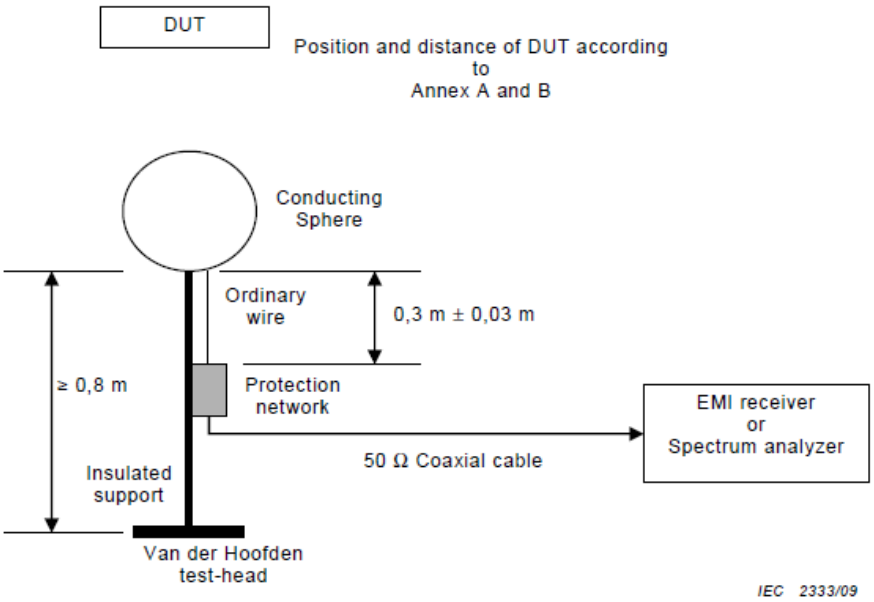
Annex B with a photo or a rough figure of the test set-up is attached.

30mins stabilisation time.

Receiver setting:

Frequency range	B_6 according to CISPR 16-1-1	Measurement time	f_{step}	Detector
20 kHz – 150 kHz	200 Hz	100 ms	220 Hz	Peak
150 kHz – 10 MHz	9 kHz	20 ms	10 kHz	Peak

Measurement setup:



If the lighting equipment is provided with an earthing terminal, the lighting equipment shall be connected by means of an earth conductor contained in the power cable to the lighting equipment.

During the tests no conductive plane or object or human being should be closer to the lighting equipment than 0,8 m.
The height of the insulated support is minimum 0,8 m. The conducting sphere is connected to the protection network via an ordinary wire of length 30 cm ± 3 cm. The protection network is then connected to the EMI receiver, or spectrum analyser, by a 50 Ω coaxial cable having a maximum cable loss of 0,2 dB and a d.c. resistance of ≤10Ω.

$$\sum_{\substack{f_i=20\text{kHz} \\ \text{Step}=220\text{Hz}}}^{150\text{kHz}} \frac{E_{\text{cap}}(f_i,d)}{E_{\text{Lim}}(f_i)} + \sum_{\substack{f_i=150\text{kHz} \\ \text{Step}=10\text{kHz}}}^{10\text{MHz}} \frac{E_{\text{cap}}(f_i,d)}{E_{\text{Lim}}(f_i)} \leq 1$$

15.4 Test results

Test Model	Test	Tables	Description*	Result
SP2001DA-BK	TM1	042	Set over against to the central to the point of illumination	**Pass**
SP2003DA-WH	TM1	043	Set over against to the central to the point of illumination	**Pass**
SP2002DA-WH	TM1	044	Set over against to the central to the point of illumination	**Pass**

15.5 Tables 042

Test position	Test distance	Test mode	Model	Factor (F)	Limit	Result
Set over against to the central to the point of illumination	50cm	TM1	SP2001DA-BK	0.04153	1	**Pass**
Remark:	*:The measured (weighted and summarized) induced current density due to the electric field in the frequency range 20 kHz to 10 MHz does not exceed the factor (*F*) 1 as defined in Annex D of EN62493.					

15.6 Tables 043

Test position	Test distance	Test mode	Model	Factor (F)	Limit	Result
Set over against to the central to the point of illumination	50cm	TM1	SP2003DA-WH	0.03386	1	**Pass**
Remark:	*:The measured (weighted and summarized) induced current density due to the electric field in the frequency range 20 kHz to 10 MHz does not exceed the factor (*F*) 1 as defined in Annex D of EN62493.					

15.7 Tables 044

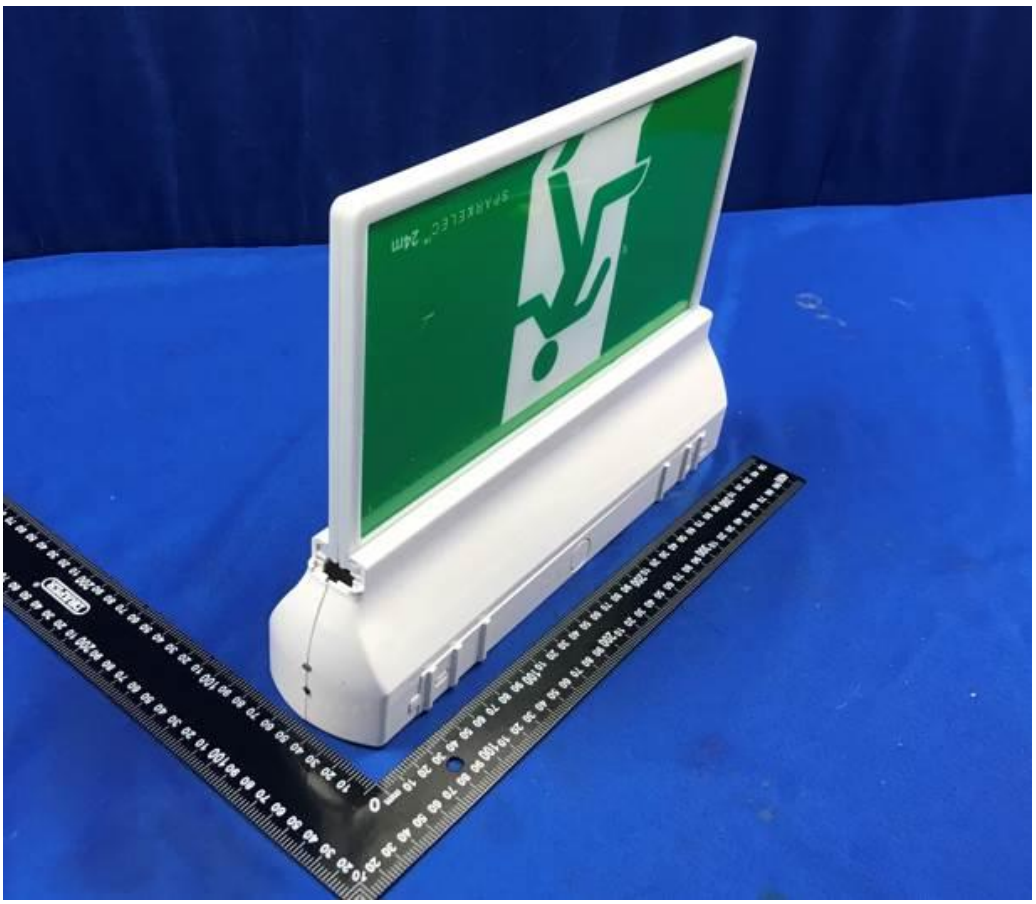
Test position	Test distance	Test mode	Model	Factor (F)	Limit	Result
Set over against to the central to the point of illumination	50cm	TM1	SP2002DA-WH	0.03813	1	**Pass**
Remark:	*:The measured (weighted and summarized) induced current density due to the electric field in the frequency range 20 kHz to 10 MHz does not exceed the factor (*F*) 1 as defined in Annex D of EN62493.					

Annex A

EUT / technical data

Port	Label	Description		
Enclosure	GH	Enclosure port Metal & Plastic		
Mains input AC	NAC.E	220-240V,50/60Hz		
Mains input DC	NDC.E	N.A		
Mains output AC	NAC.E	N.A		
Mains output DC	NAC.A	N.A		
Process measurement and control ports	PMS.E/A	N.A		
I/O and communication ports	SD.E/A	N.A		
Protective earth connection	EA	N.A		
Interface Cables	**Length**	**Shielded**	**Type**	**Special**
		☐	☐	☐

Overall view of SP2003DA-WH and SP2003FE-WH

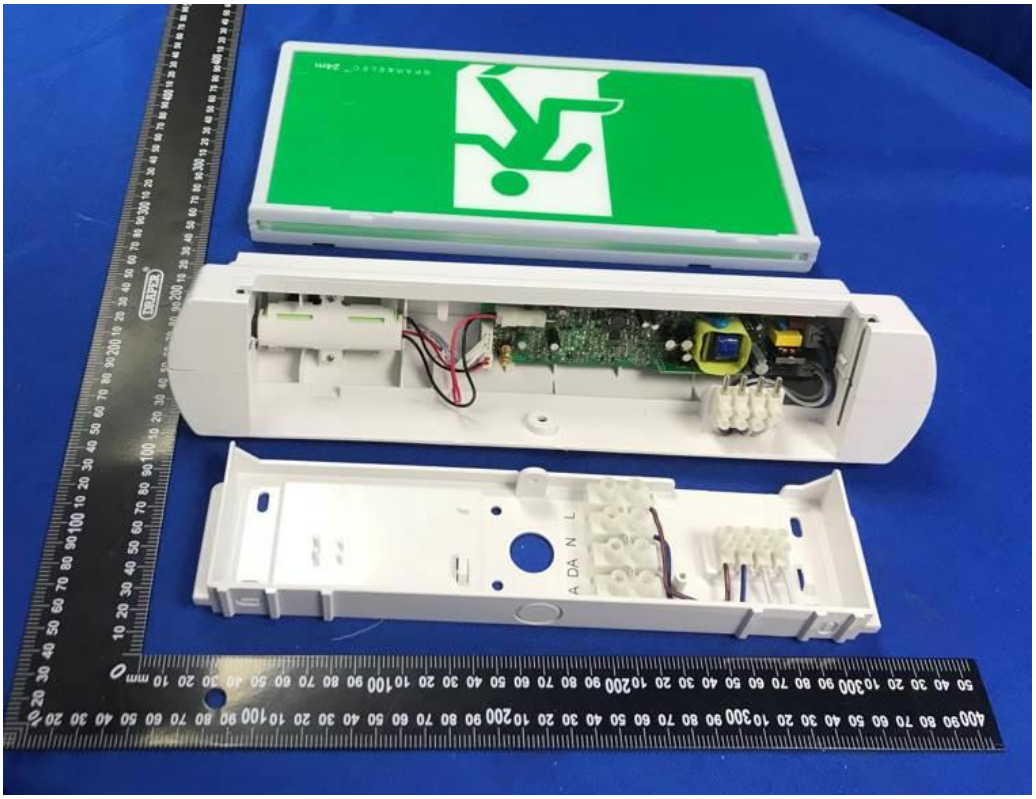


Overall view of SP2003DA-WH and SP2003FE-WH

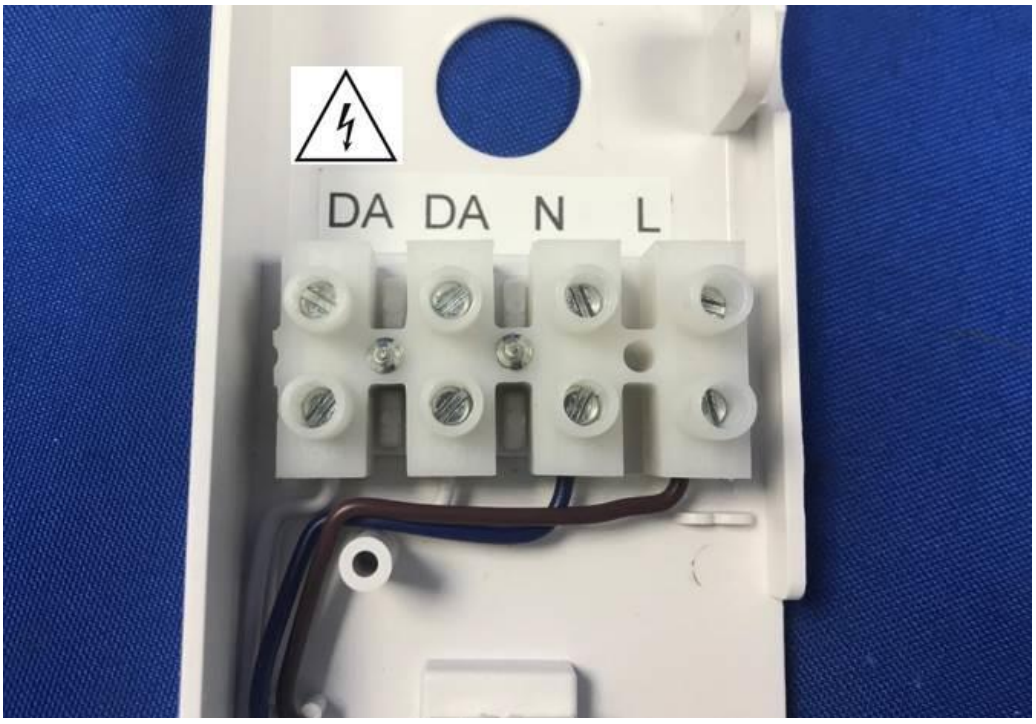
Indicator and test switch

Internal view of SP2003DA-WH and SP2003FE-WH

LED module of internal view of SP2003 series

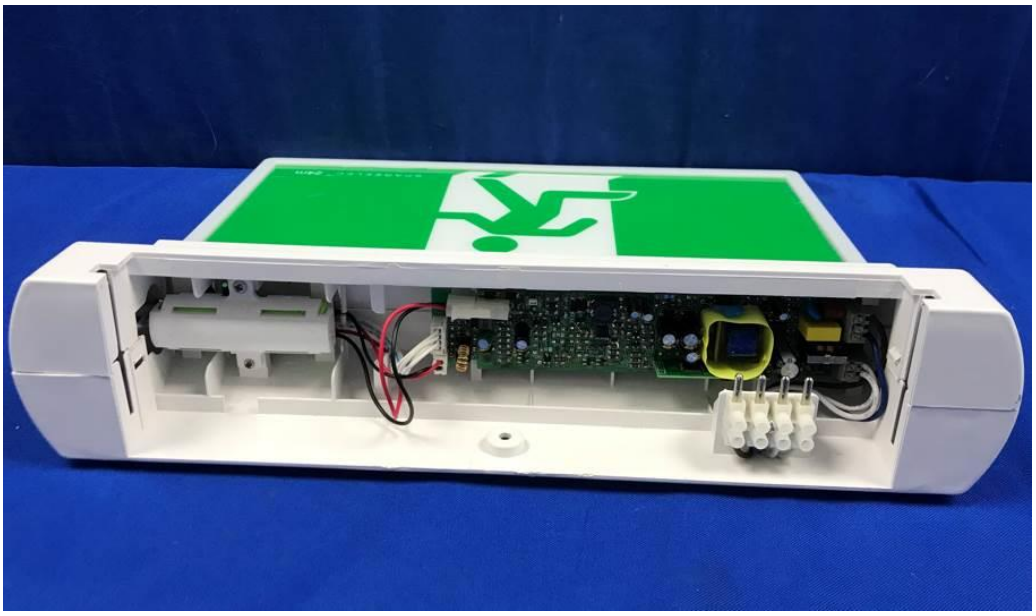


disassembly view of SP2003DA-WH



Input terminal block of SP2003DA-WH

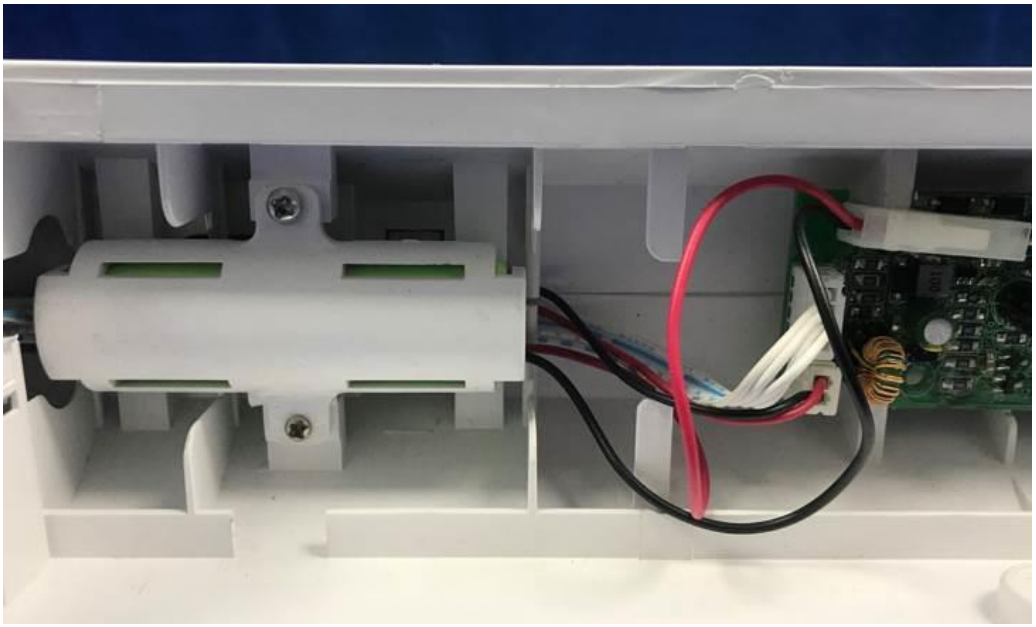
AC Connector



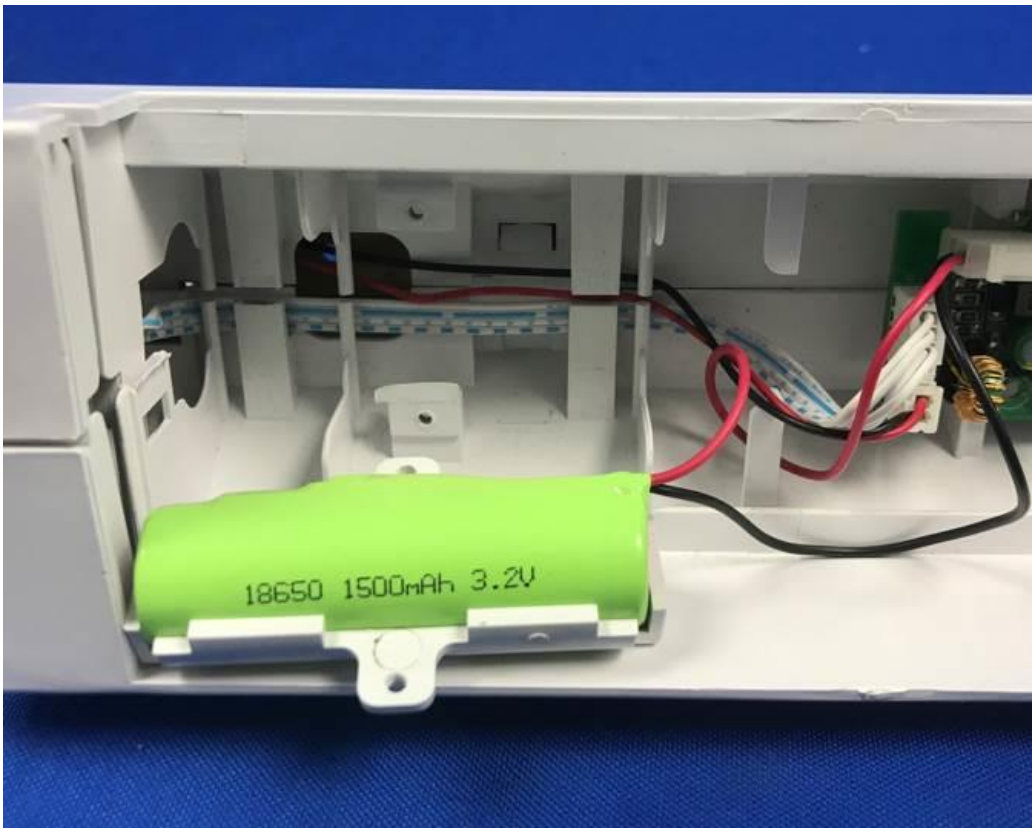
Internal view of SP2003DA-WH

Emergency controlgear

Internal wire (connected emergency controlgear and AC connector)



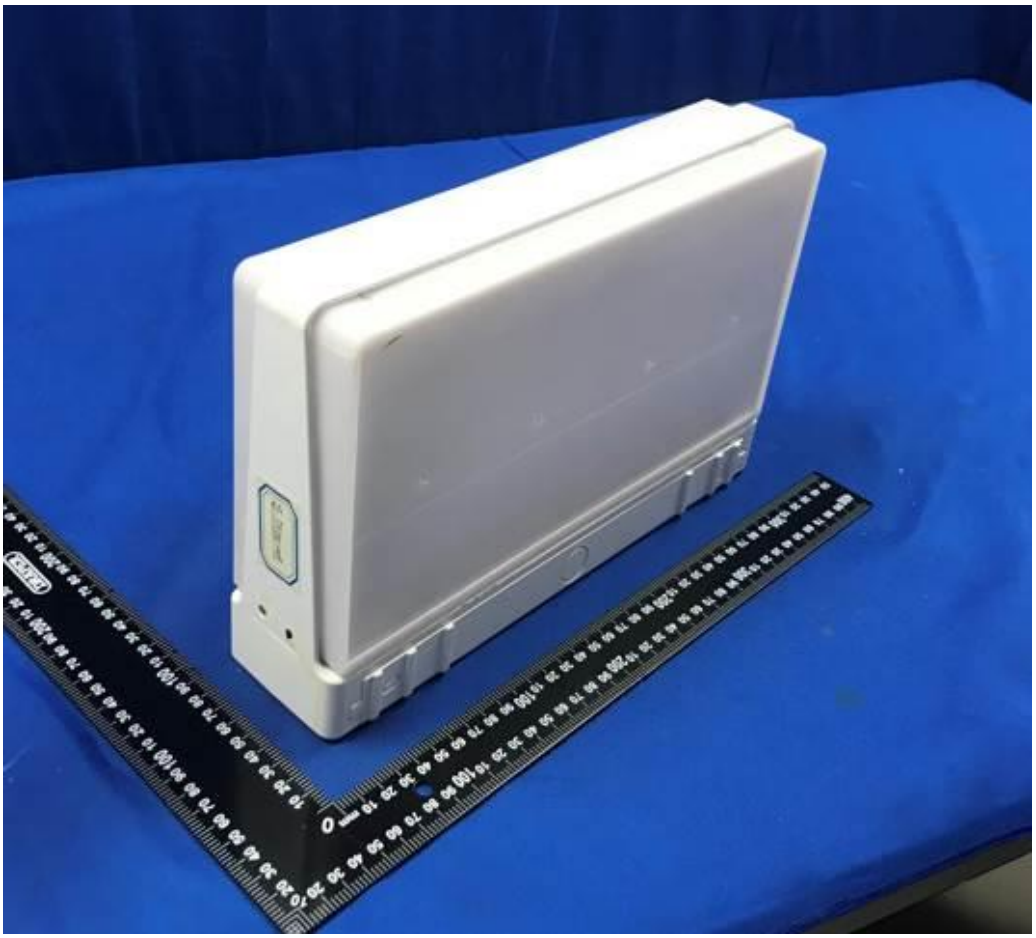
Battery



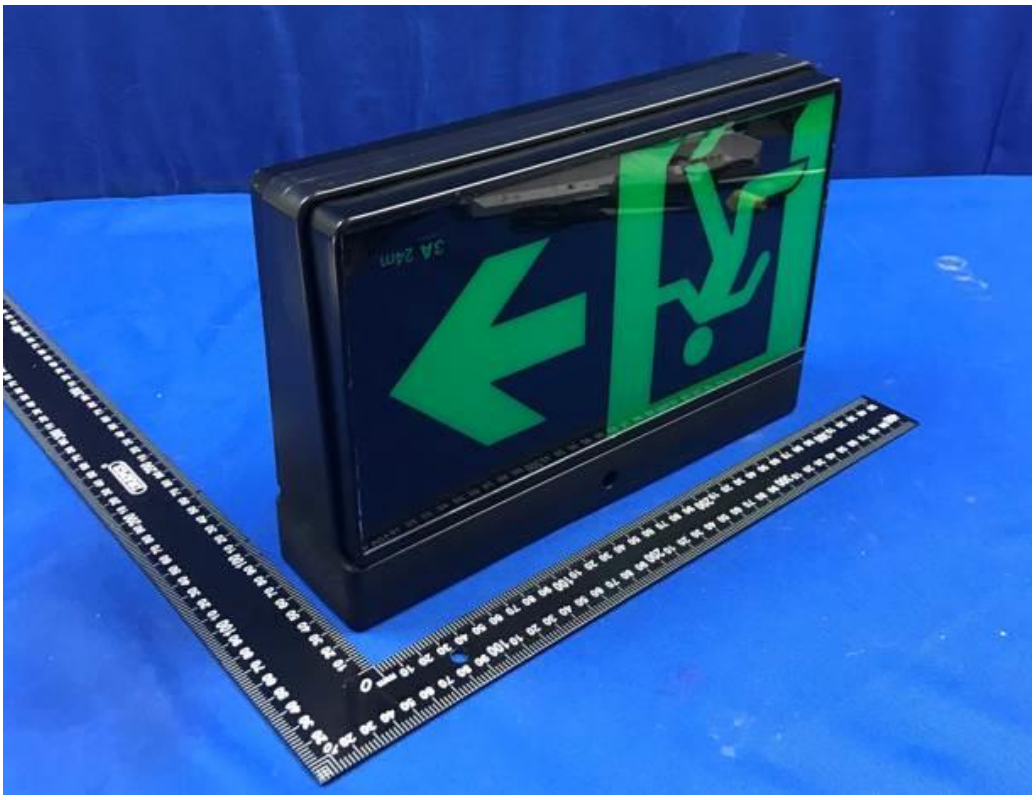
Overall view of battery

Overall view of SP2001DA-WH and SP2001FE-WH

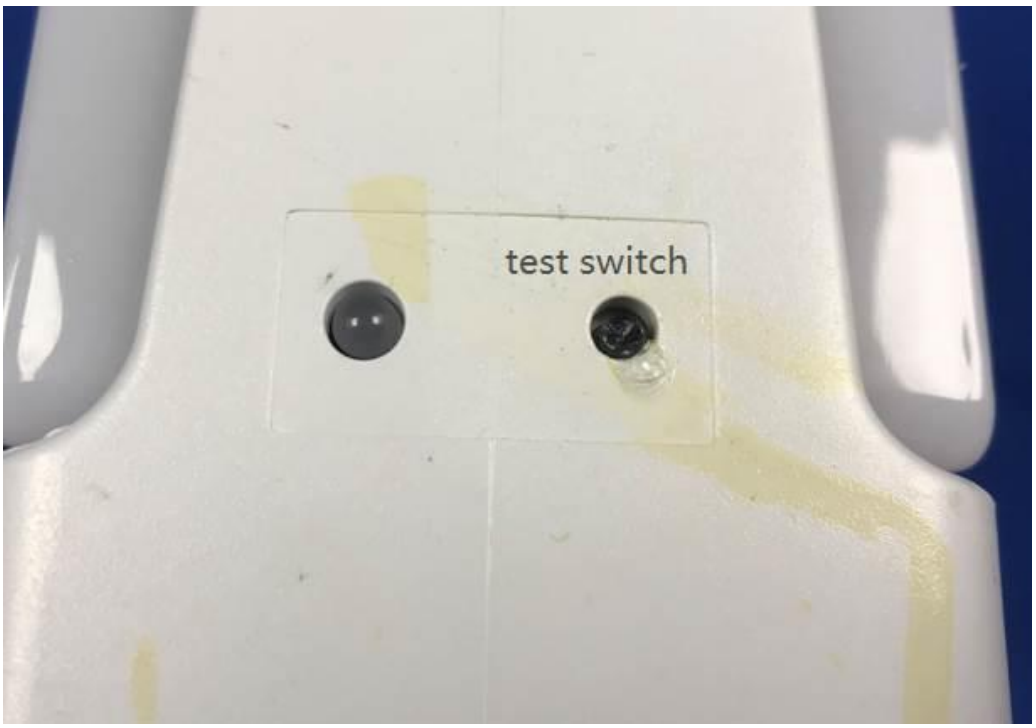
Overall view of SP2001DA-WH and SP2001FE-WH



Overall view of SP2001DA-WH and SP2001FE-WH



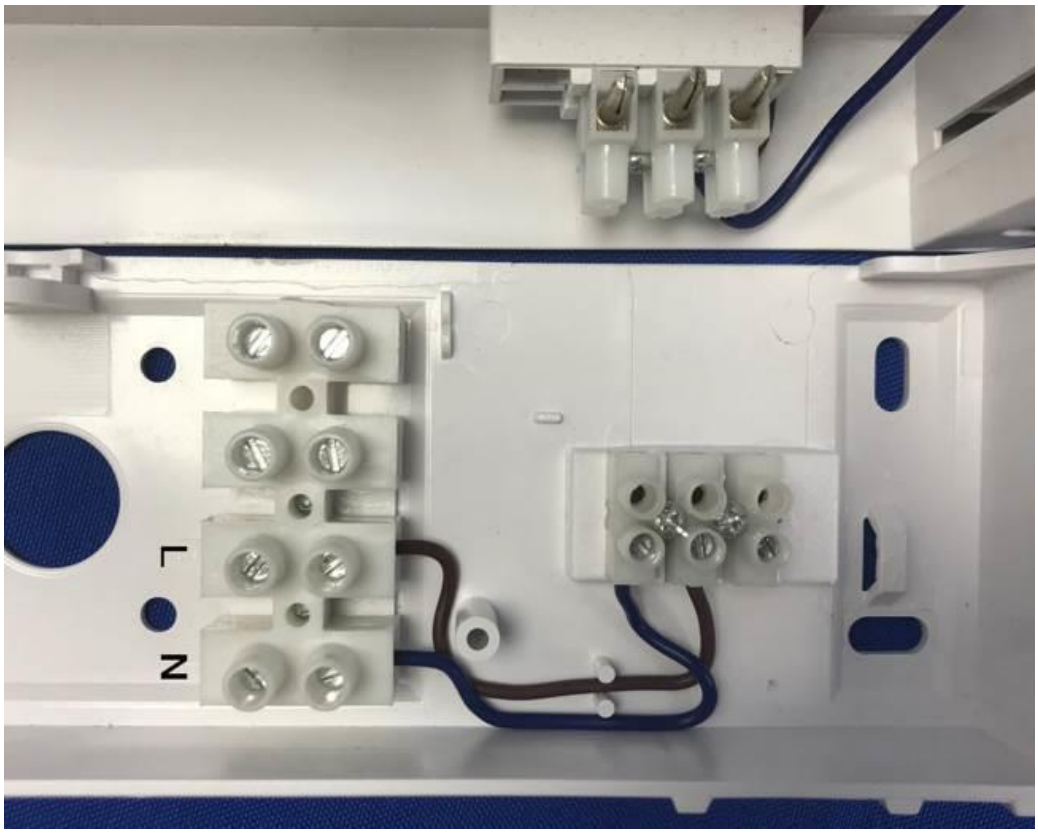
Overall view of SP2001DA-BK and SP2001FE-BK



LED indicator and test switch

Internal view of SP2001DA-WH

Input terminal block and AC Connector for SPxxxxDA-ZZ series

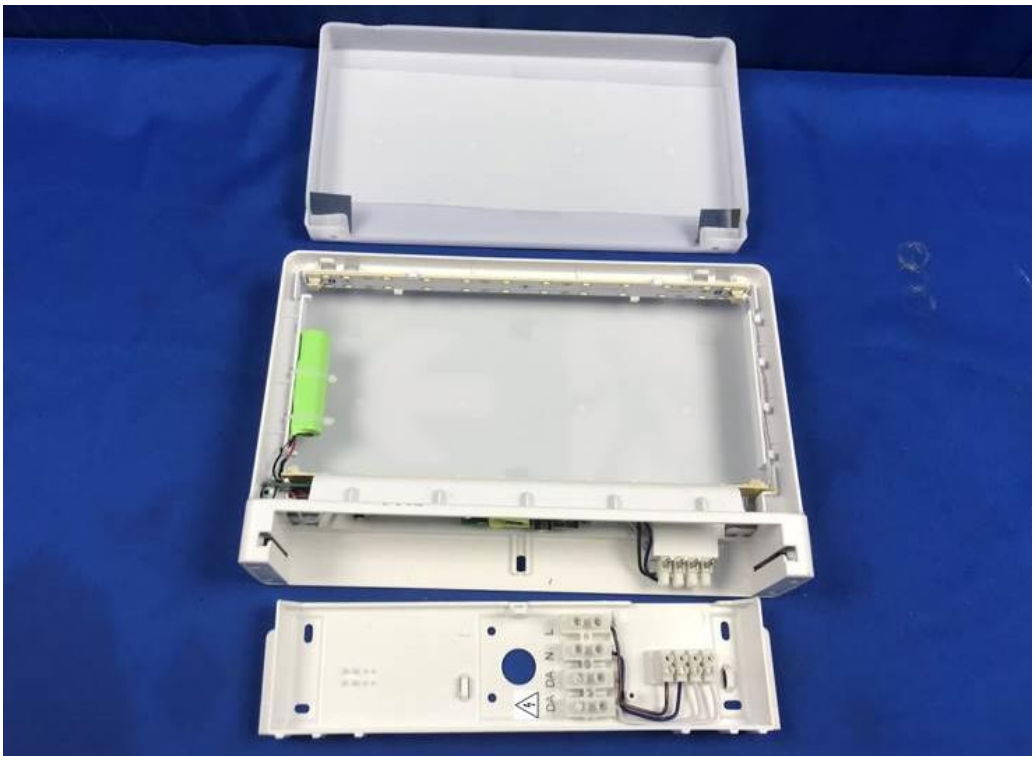


Input terminal block and AC Connector for SPxxxxFE-ZZ series

Internal view of SP2001DA-WH

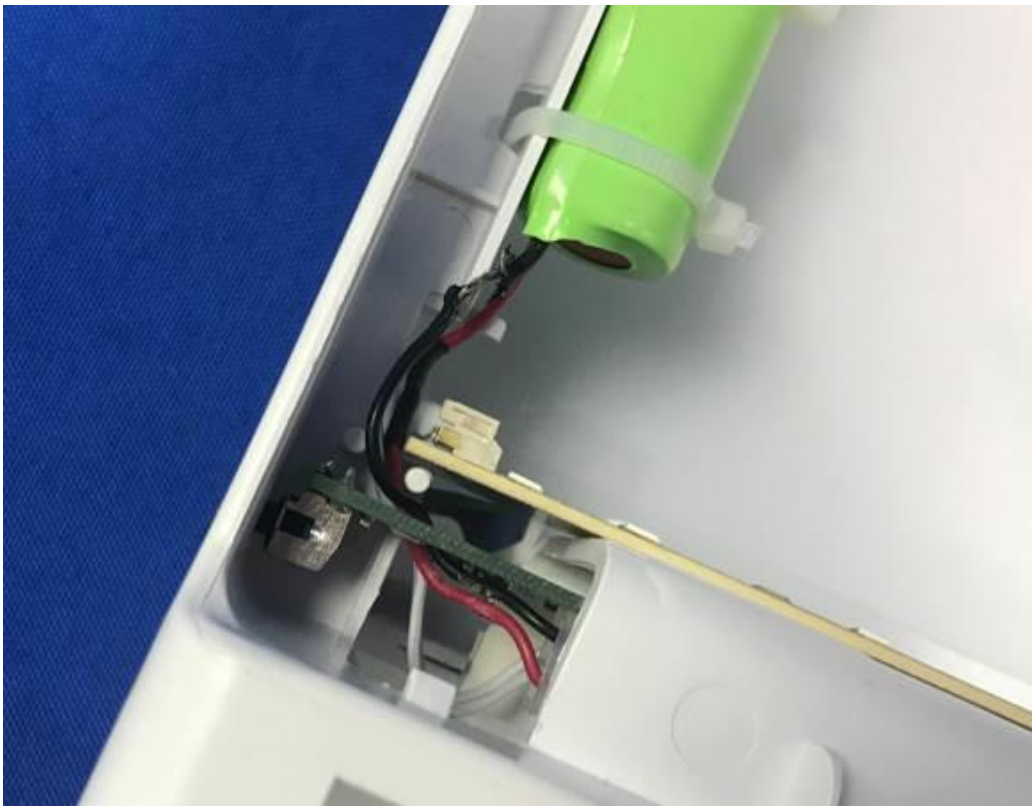
Internal wire connected emergency controlgear and AC connector

Emergency controlgear



Internal view of SP2001DA-WH

Internal view of SP2001DA-WH



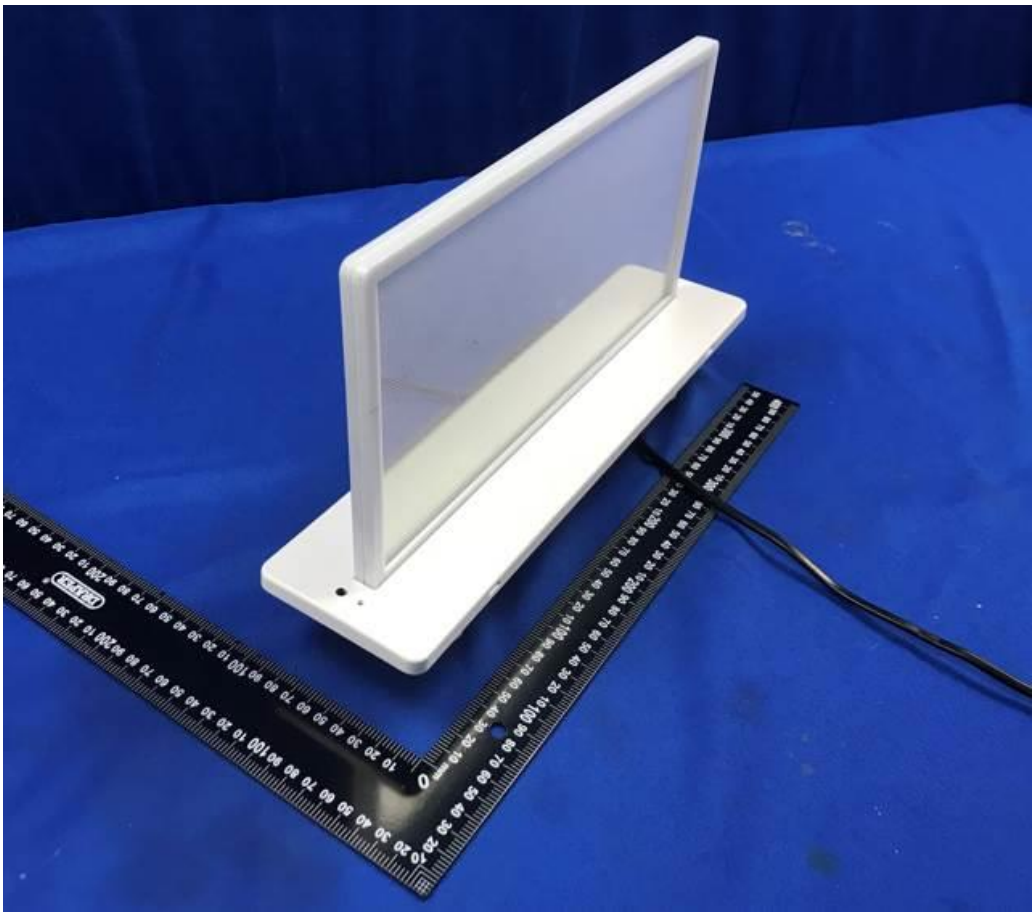
Internal wire

LED modules

LED module

LED module (other one)

Overall view of SP2002DA-WH and SP2002FE-WH

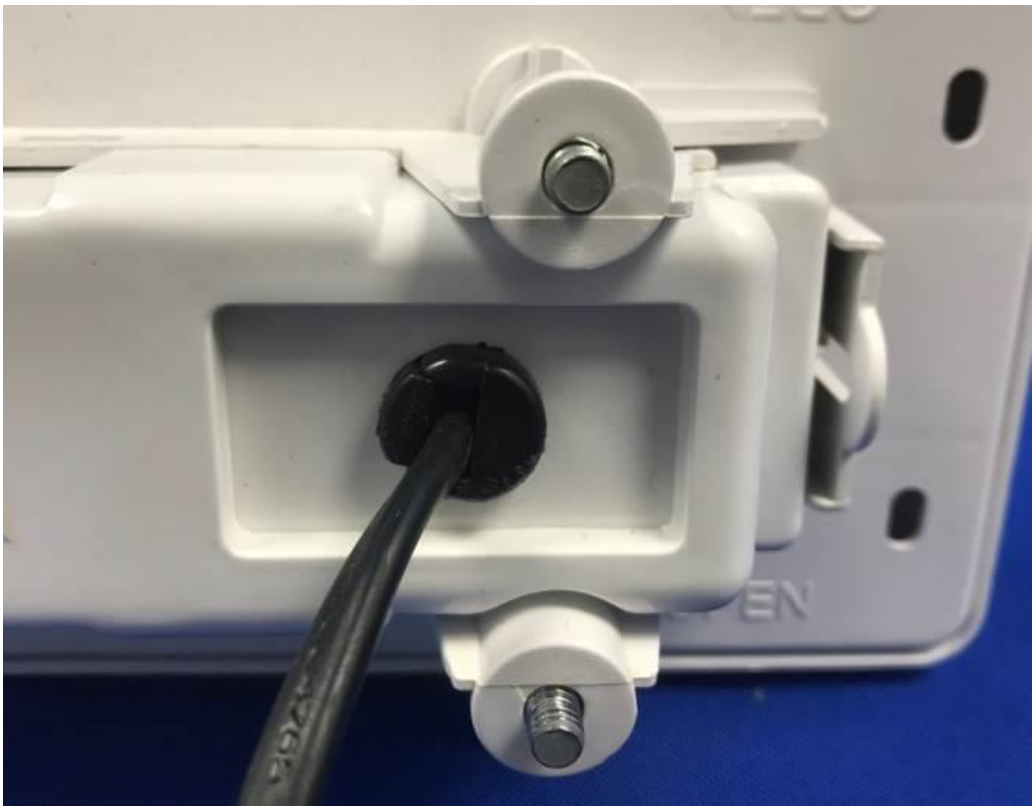


Overall view of SP2002DA-WH and SP2002FE-WH

Overall view of SP2002DA-WH and SP2002FE-WH

Test switch and LED indicator

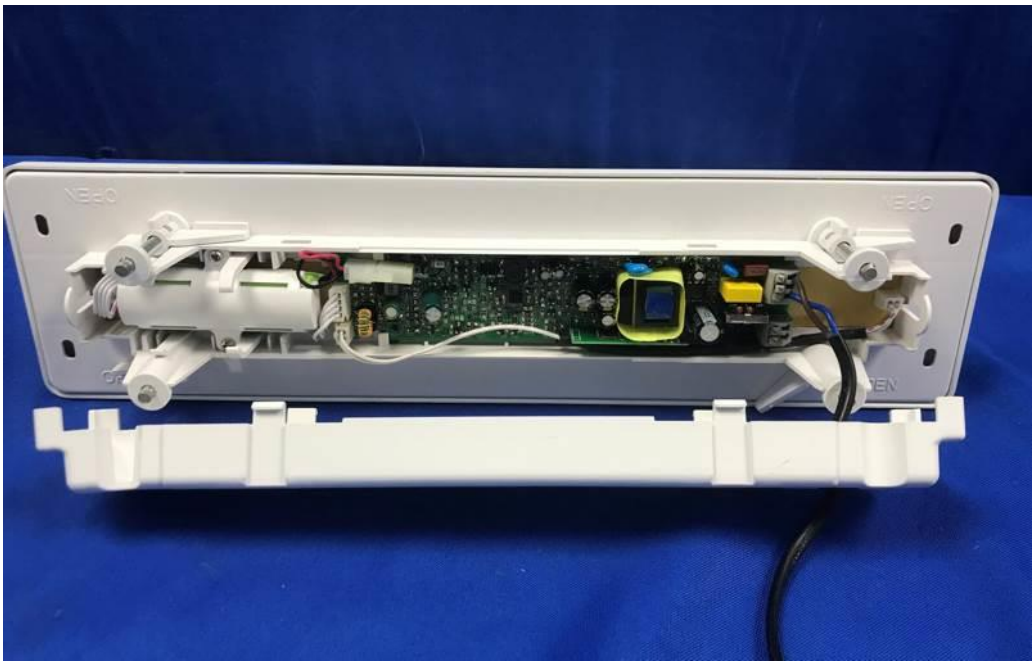
Mains plug



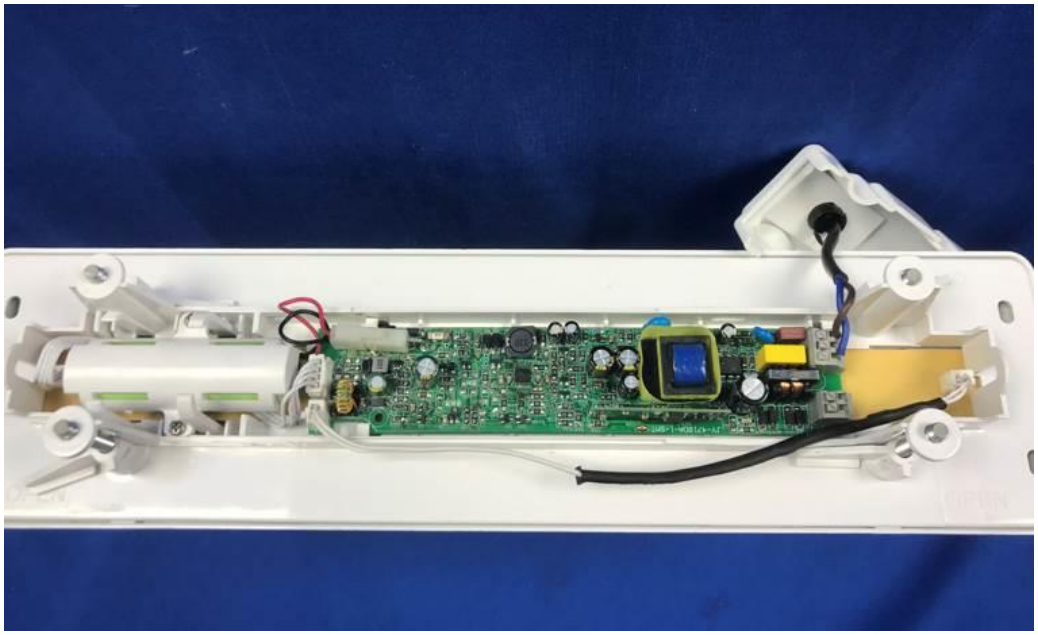
Cord entry and cord anchorage

Internal view of cord entry and cord anchorage (fixed by glue)

Internal view of cord entry and cord anchorage (removed the glue)



Internal view of SP2002DA-WH and SP2002FE-WH



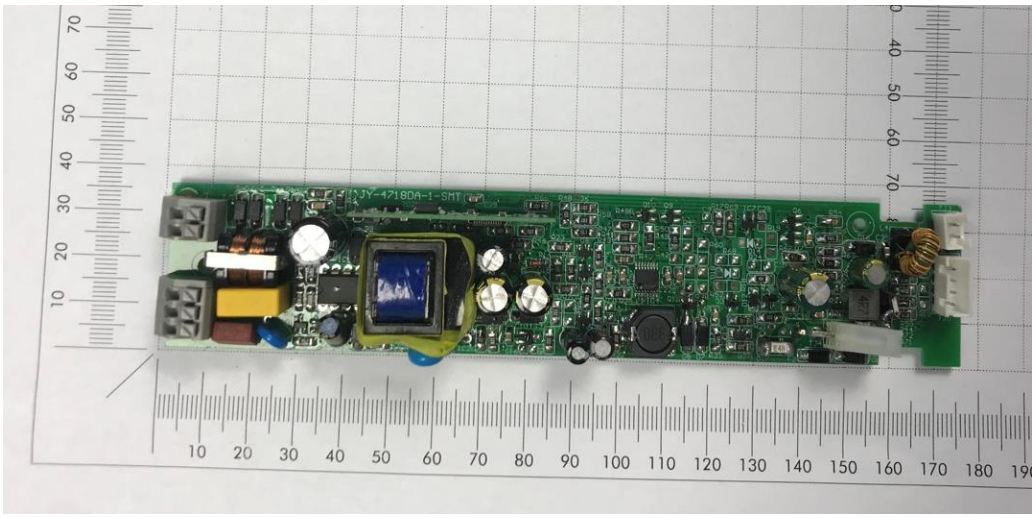
Emergency controlgear (heat-shrinkable tubing covering on input wire of LED module)

Battery

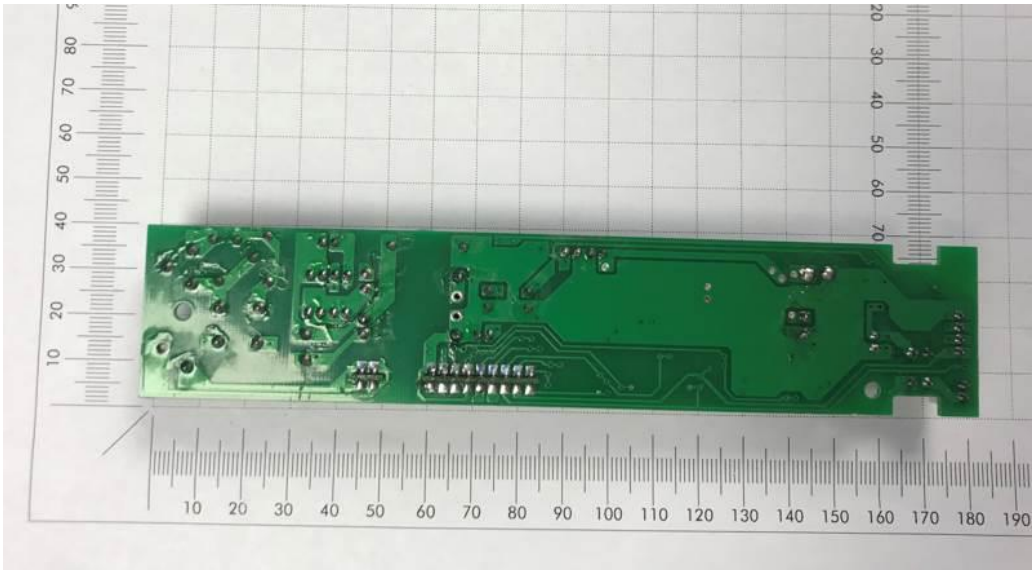
Disassembly view of LED module part

LED module for SP2002 series

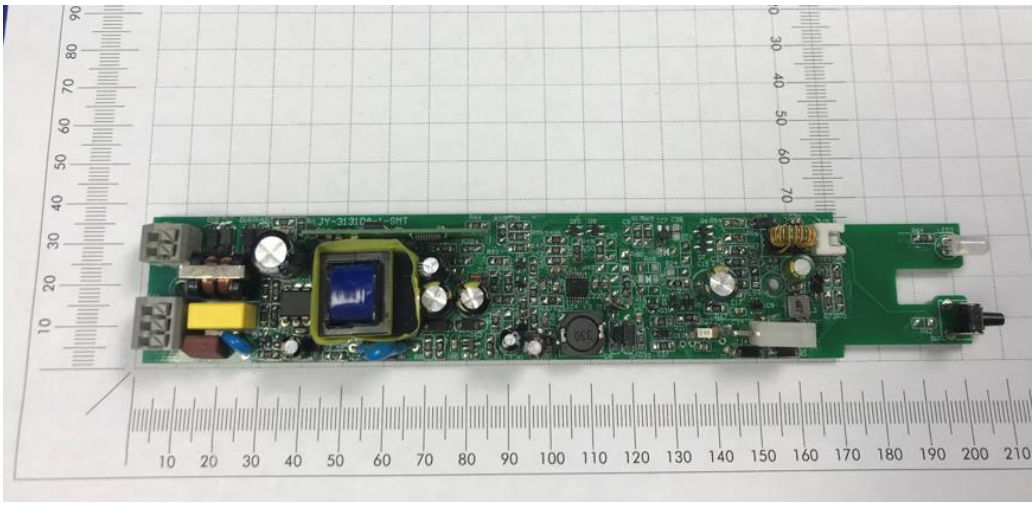
Test switch and LED indicator



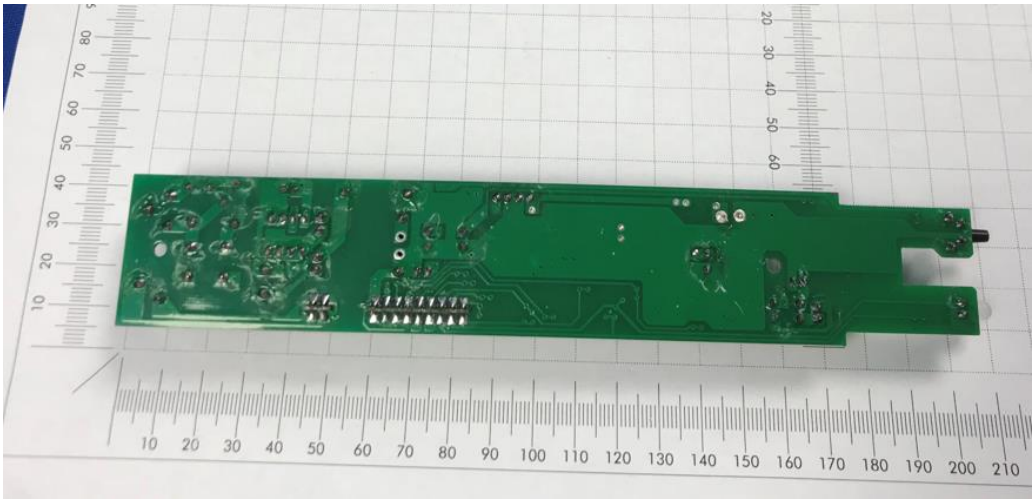
Components view of emergency controlgear for SP2002DA-zz and SP2003DA-zz



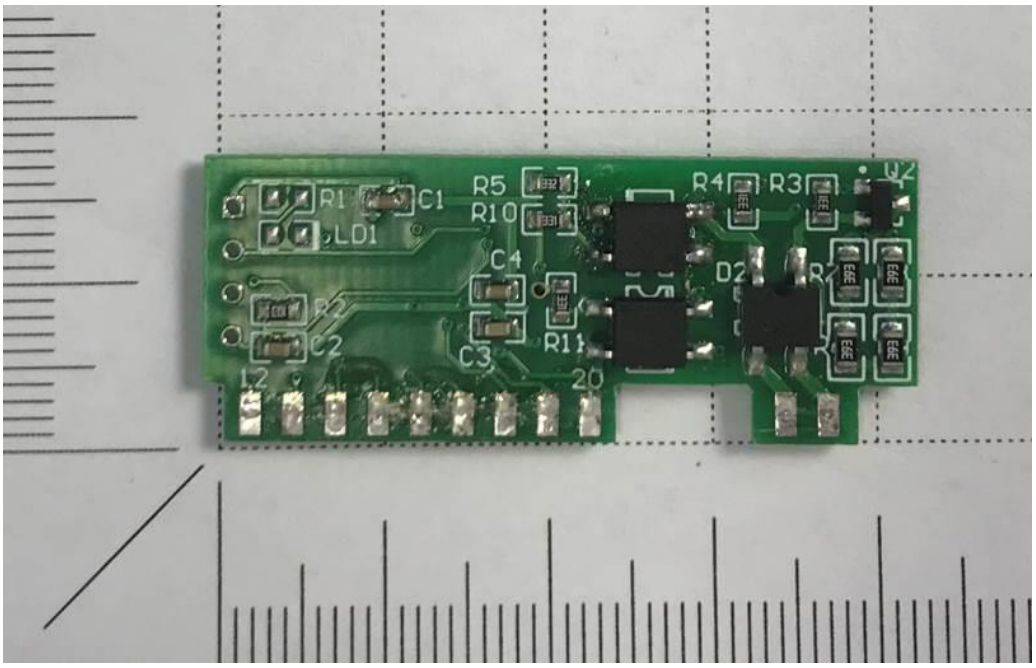
Solider side of emergency controlgear for SP2002DA-zz and SP2003DA-zz



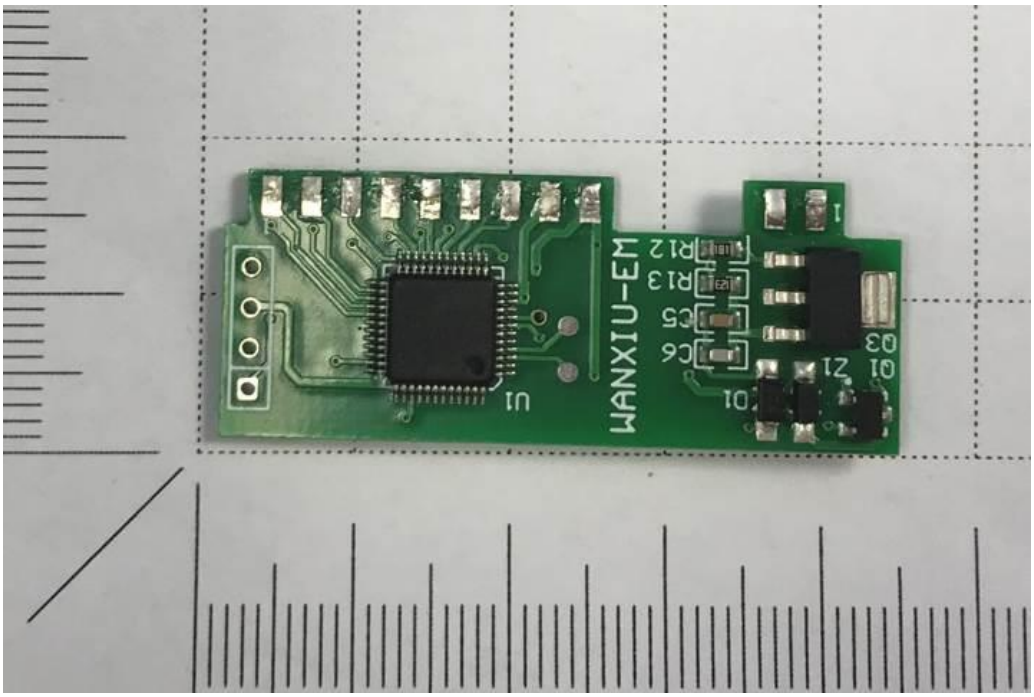
Components view of emergency controlgear for SP2001DA-zz



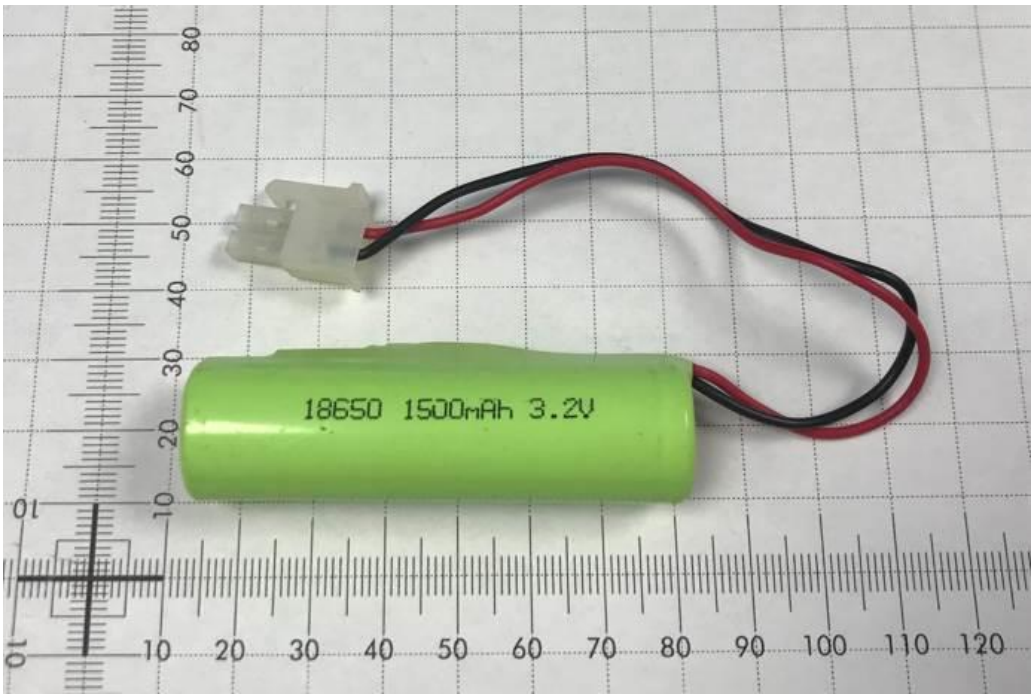
Solider side of emergency controlgear for SP2001DA-zz



Subsidary circuit board



Subsidary circuit board



Overall view of battery for all models

Exit signs

Annex B

EUT set-up -details-

Figure B-1 Setup for Conducted Emission (Charging)

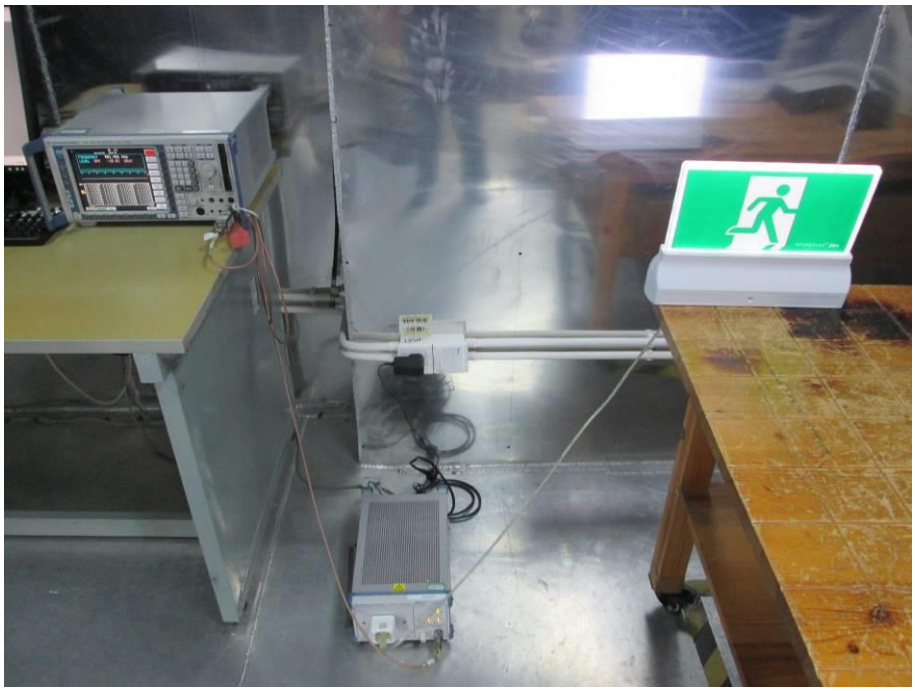


Figure B-2 Setup for Conducted Emission (Emergency)

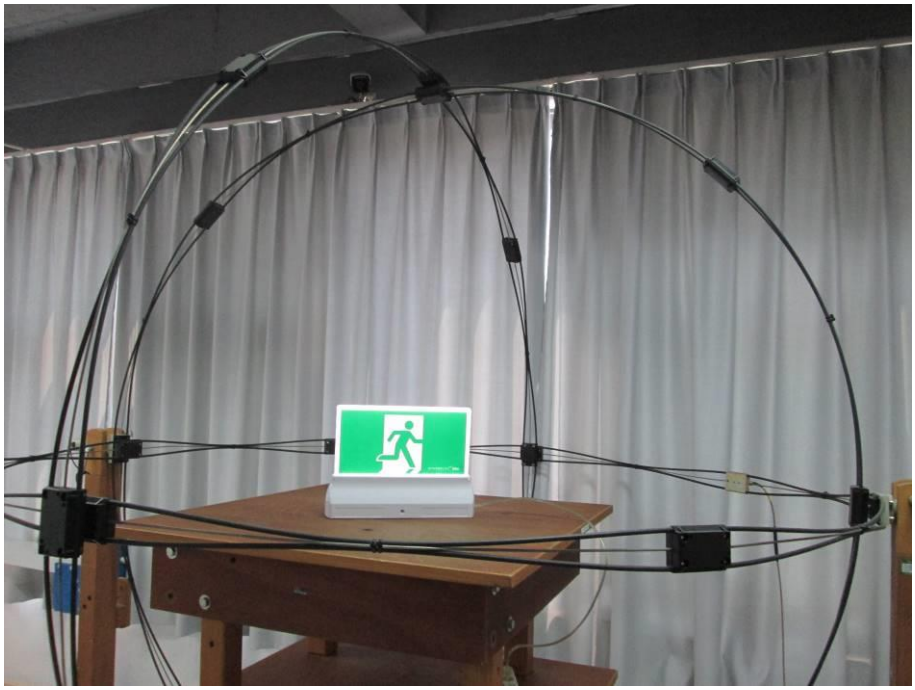


Figure B-3 Setup for Radiated Electromagnetic Disturbances (Emergency)

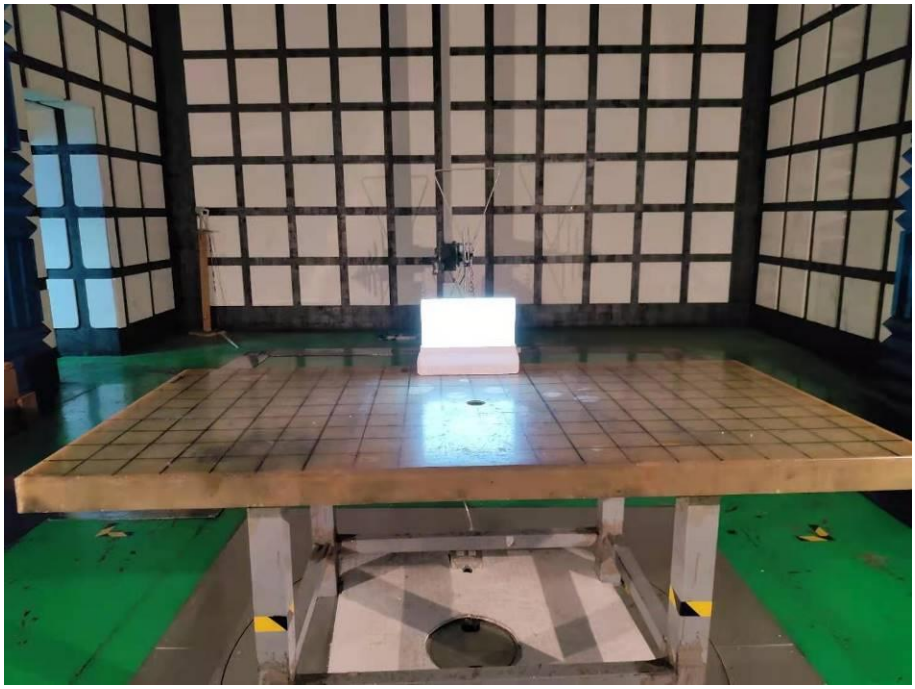


Figure B-4 Setup for Radiated Emission (Charging)

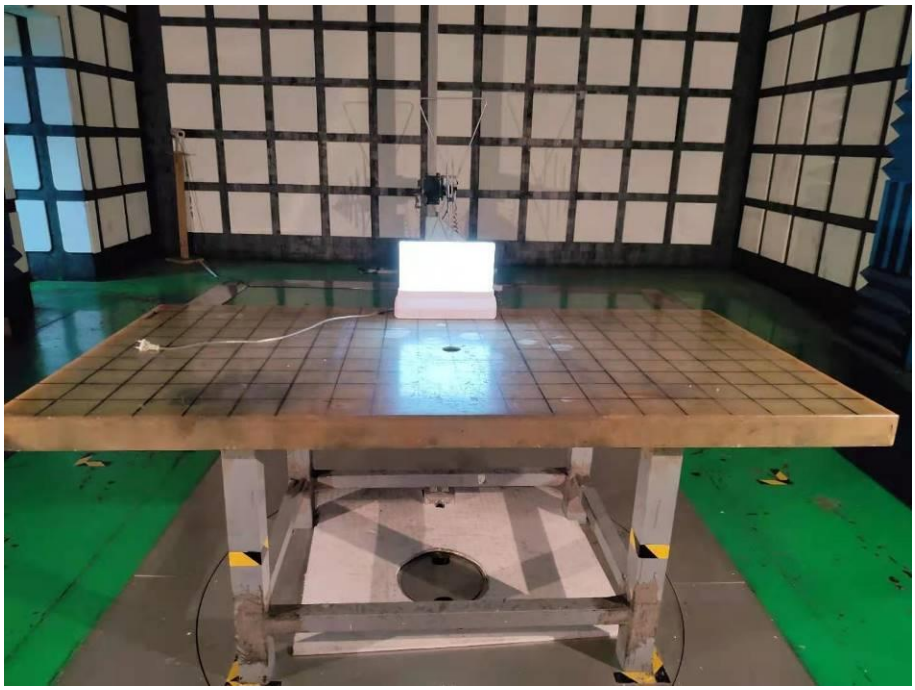


Figure B-5 Setup for Radiated Emission (Emergency)

Figure B-6 Setup for Voltage fluctuations and flicker (Charging)

Figure B-7 Setup for Electrostatic Discharge (Charging)

Figure B-8 Setup for Electrostatic Discharge (Emergency)

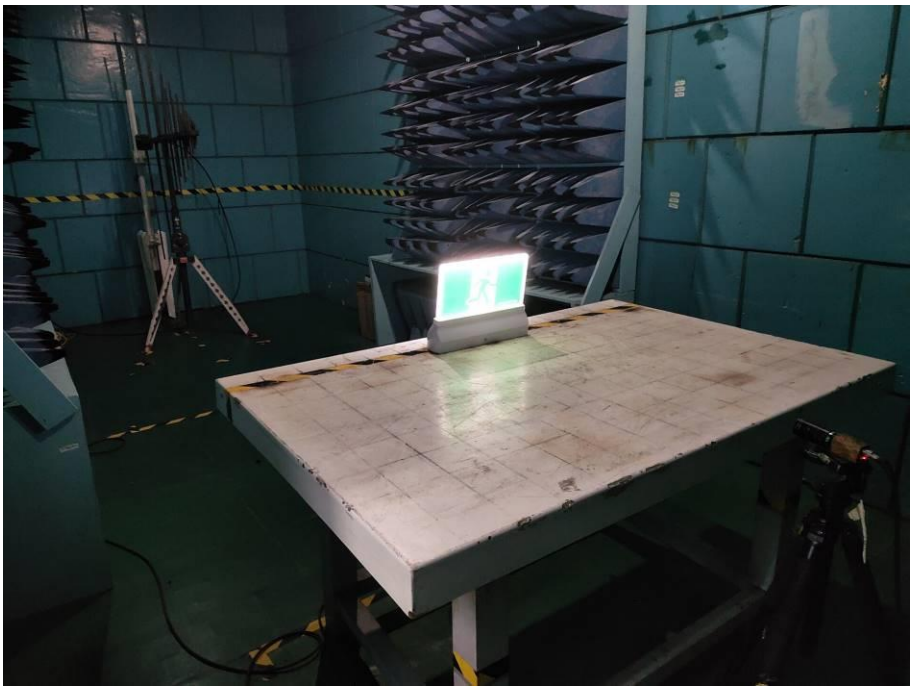


Figure B-9 Setup for Radiated Immunity (Emergency)

Figure B-10 Setup for Electrical Fast Transients/Bursts, Surge (Charging)

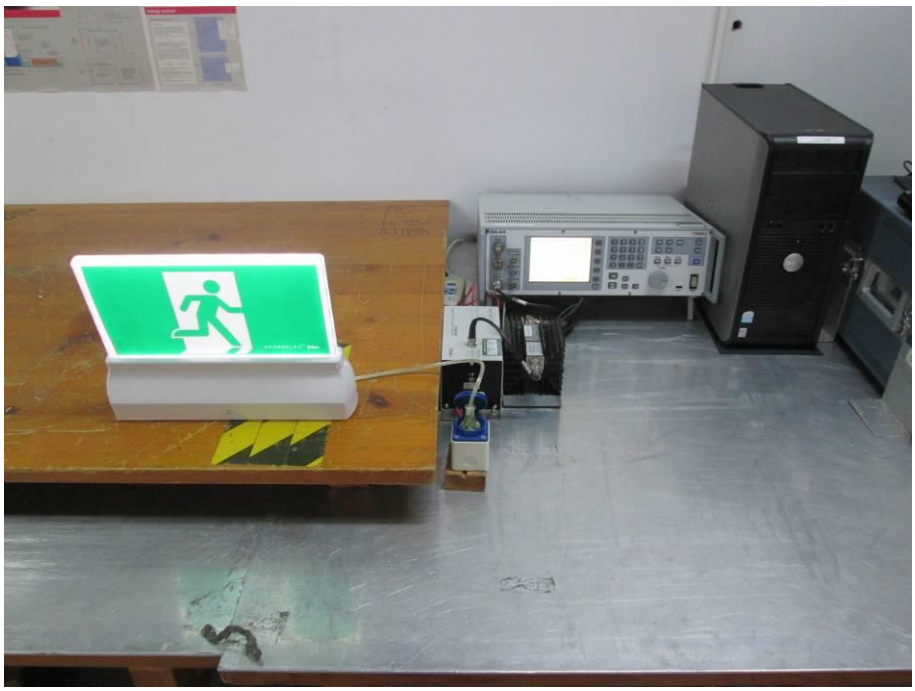


Figure B-11 Conducted Immunity (Charging)

Figure B-12 Setup for Induced current density (Emergency)

***** End of Test Report *****