

Test report

Number T251-0704/22 A1

Project file: C20221443

Date: 2023-08-17

Pages: 47

Product: Charger System Wireless (30 kW PRIM BOX) and
CSW 30KW PRIM PAD

Type reference: EOE18010815, EOE18010851

Ratings: Input:
400 V~; 50 Hz
480 V~; 60 Hz
48 A 3Ph + Pe

Trademark:



Applicant: Delta Energy Systems
Tscheulinstrasse 21, 79331 Teningen, Germany

Manufacturer: Delta Energy Systems
Tscheulinstrasse 21, 79331 Teningen, Germany

Place of manufacture: Delta Slovakia s.r.o.
Priemyselná 4600/1, 01841 Dubnica nad Váhom, Slovakia

Summary of testing

Testing method: 47 CFR Part 18

Testing location: SIQ Ljubljana
Mašera-Spasičeva ulica 10, SI-1000 Ljubljana, Slovenia

Remarks: Date of receipt of test items: 2022-07-15
Number of items tested: 1
Date of performance of tests: 2022-07-25 – 2022-08-04
The test results presented in this report relate only to the items tested.
The product complies with the requirements of the testing methods.

Tested by: Mitja Rozman

Approved by: Marjan Mak

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1 GENERAL

History sheet			
Date	Report No.	Change	Revision
2022-12-13	T251-0704/22	Initial Test Report issued.	--
2023-08-17	T251-0704/22 A1	This test report substitutes previously issued test report T251-0704/22, dated 2022-12-13, due to amendment of the test report. Amendment of initial test report was issued due to following changes: - corrected type reference for WPP from EOE18010850 to EOE18010851 - corrected dates of calibration - added section 3.1 – operating modes	1.0

Environmental conditions:

Ambient temperature: 15 °C to 35 °C

Relative humidity: 30 % to 60 %

Atmospheric pressure: 860 mbar to 1060 mbar

1.1 Measurement uncertainty

The following measurement uncertainty levels have been estimated for tests performed on the product, as specified in CISPR 16-4-2 and EN 55016-4-2. This represents an expanded uncertainty expressed at 95% confidence level using a coverage factor k=2.

Emission test		U _{LAB}	U _{CISPR}
Conducted emission measurement	(150 kHz to 30 MHz)	2.7 dB	3.4 dB
Radiated emission measurement (electric field strength at an OATS or in a SAC)	(150 kHz to 30 MHz)	4.8 dB	/
Radiated emission measurement (electric field strength at an OATS or in a SAC)	(30 MHz to 1000 MHz)	5.3 dB	6.3 dB

The measurement uncertainty is calculated in document EN208.



1.2 Equipment under test

Charger System Wireless (30 kW PRIM BOX) and CSW 30KW PRIM PAD

Type: EOE18010815, EOE18010851

General product information

Device is a wireless charger for charging of batteries with BMS.

Device consists of 3 parts:

- Wireless Primary Box (EOE18010815): In short marked as »WPB«
- Wireless Primary Pad (EOE18010851). In short marked as »WPP«
- Wireless Secondary Unit (EOE18010850). In short marked as »WSU«

This test report covers Wireless Primary Box (WPB) and Wireless Primary Pad (WPP).

Input / Output Ports

Port No.	Name	Type*	Cable Length / m	Cable Shielded	Connected during tests	Comments
0	Enclosure	N/E	—	—	—	/
1	AC Power input port	AC	/	NO	Connection of Primary Box to AC mains	/
2	Communication between Primary box and Primary pad	I/O	5	YES	Connection between Primary Box and Primary Pad	Feed in a single cable
3	Power transfer between primary box and Primary pad	I/O	5	YES		
4	Ground connection between Primary pad and Primary box	GND	5	/		
*Note:	AC = AC Power Port		DC = DC Power Port			
	I/O = Signal Input or Output Port		TP = telecommunication Port			
	GND = Grounding		N/E = Non-Electrical			

Equipment Description

Software version :	V12.99 for WPB, V7.99 for WPP
Hardware version :	01 for WPB, 00 for WPP
One/two/three phase EUT:	Three phase device
Floor standing / table-top equipment or a combination:	Table top (primary box), Wall mounted (primary pad)

EUT Internal Frequencies

Frequency (MHz)	Description
<108	Maximum clock frequency

Copy of marking plate

The artwork below may be only a draft. The use of certification marks on a product must be authorized by the respective NCBS that own these marks.

WPBA (EOE18010815):



WPP (EOE18010851):



Pictures of EUT

Primary box:





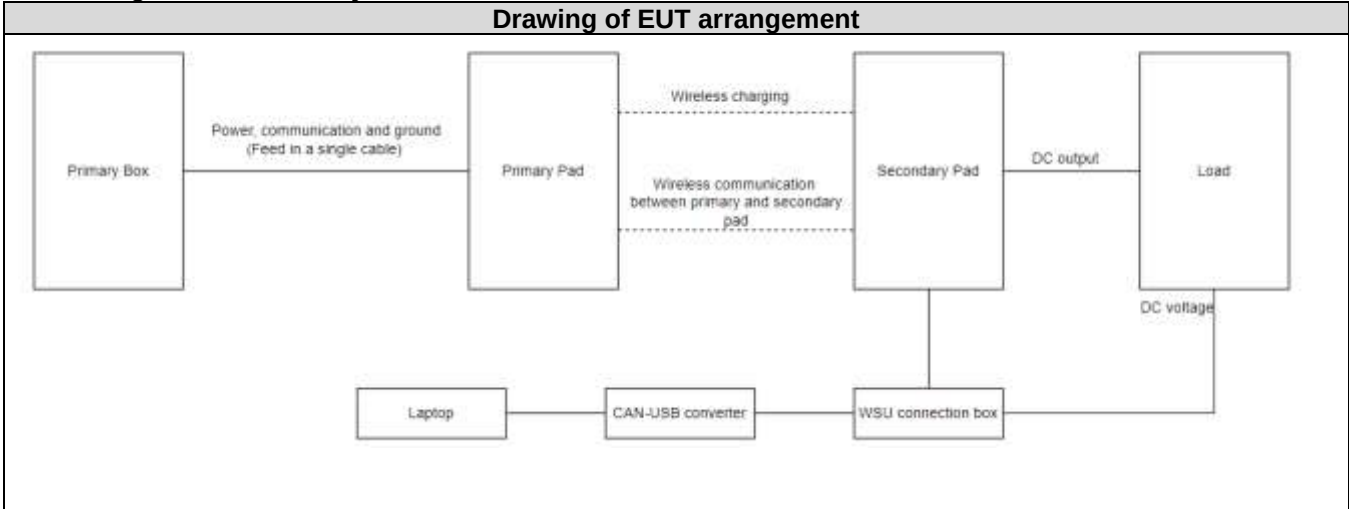


Primary pad:





EUT arrangement defined by the manufacturer



1.3 Supporting equipment used during testing

List of used supporting equipment

Use*	Product Type	Manufacturer	Model	Comments
AE	WSU Connection box	Delta	/	Built for testing purposes.
AE	CAN-USB converter	Peak	IPEH-002022-205950	/
AE	Resistive load	Delta	/	Built for testing purposes.
AE	Secondary Pad	Delta	EOE18010850	/

*Note:

EUT - Equipment Under Test

AE - Auxiliary/Associated Equipment

SIM - Simulator (Not subjected to Test)

Pictures of supporting equipment

WSU connection box:



CAN-USB converter:



Secondary Pad:





2 ALL TEST EQUIPMENT AND THEIR DESCRIPTION

2.1 General information

Description	Model No.	SIQ No.	Last calibration	Calibrated until	Calibration period	Used
Rohde-Schwarz, EMI receiver	ESR7	111549	2022-01-03	2023-07-03	18 months	X
Rohde-Schwarz, EMI receiver	ESW	109875	2022-05-19	2023-11-19	18 months	X
Schwarzbeck & Schwarz, Artificial main network	NNLK 8130	111462	2022-01-12	2023-07-12	24 months	X
Comtest Engineering, Semi Anechoic Chamber SAC 1	SAC 3m	NPS001	2022-04-14	2025-04-14	36 months	X
Rohde & Schwarz, Ultra Broadband Antenna	HL562E	109063	2020-07-23	2023-07-23	36 months	X
Maturo, Turn table (2 m diameter)	TT 2.0 SI	/	N/A	N/A	N/A	X
Maturo, Bore-sight antenna mast	BAM-4.0-P	/	N/A	N/A	N/A	X
Maturo, Multi-channel positioning equipment	Maturo NCD	/	N/A	N/A	N/A	X
Schwarzbeck, Loop Antenna	FMZB 1519 B	109082	2021-04-09	2022-10-09	18 months	X
Open Area Test Site	10 m	/	2020-08-26	2023-08-26	36 months	X



2.2 Other instrument information and auxiliary equipment

Description	Model No.	Bandwidth	Detector functions	Antenna factors	Cable loss	Range
Rohde-Schwarz, AMN	ENV216	/	/	/	/	9 kHz – 30 MHz
Rohde & Schwarz, Artificial main network	ESH 2-Z5	/	/	/	/	9 kHz – 30 MHz
Rohde-Schwarz, RFI receiver	ESU8	200Hz, 9kHz, 120kHz, 1MHz	Peak, Q-peak, Average	/	/	20 Hz – 8 GHz
Rohde-Schwarz, EMI receiver	ESW	200Hz, 9kHz, 120kHz, 1MHz	Peak, Q-peak, Average	/	/	20 Hz – 8 GHz
Rohde-Schwarz, RFI receiver	ESU26	200Hz, 9kHz, 120kHz, 1MHz	Peak, Q-peak, Average	/	/	20 Hz – 26.5 GHz
Hewlett Packard, RF Spectrum Analyzer	8593E	200Hz, 9kHz, 120kHz, 1MHz	Peak, Q-peak, Average	/	/	9 kHz – 26.5 GHz
Comtest Engineering, Semi Anechoic Chamber SAC 1	SAC 3m	/	/	/	/	30 MHz – 18 GHz
Comtest Engineering, Semi Anechoic Chamber SAC 2	SAC 3m	/	/	/	/	30 MHz – 18 GHz
Rohde & Schwarz, Horn Antenna	HF907 (SN 102508)	/	/	See section 3.2.2	/	0.8 GHz – 18 GHz
Rohde & Schwarz, Ultra Broadband Antenna	HL562E (SN 100842)	/	/	See section 3.2.2	/	30 MHz – 6 GHz
Rohde & Schwarz, Ultra Broadband Antenna	HL562E (SN 100983)	/	/	See section 3.2.2	/	30 MHz – 6 GHz
Rohde & Schwarz, Horn Antenna	HF907 (SN 102494)	/	/	See section 3.2.2	/	0.8 GHz – 18 GHz
Rohde & Schwarz, Ultra Broadband Antenna	HL562E (SN 100843)	/	/	See section 3.2.2	/	30 MHz – 6 GHz
Schwarzbeck, Biconical antenna	VHBB9124 (SN 9124-317)	/	/	See section 3.2.2	/	30 MHz – 300 MHz
Schwarzbeck, Loop Antenna	FMZB 1519 B	/	/	See section 3.2.2	/	9 kHz – 30 MHz

2.2.1 Cable loss and attenuation of radiated emission

3.2.1.1 Conducted emission cable (SIQ-K024)

Point	Frequency (9kHz-30MHz)	Cable length (meters)	Loss (dB)
1	190 kHz	1	0.4
2	530 kHz	1	0.26
3	2.53 MHz	1	0.16
4	5.19 MHz	1	0.07
5	11.05 MHz	1	0.03
6	22.01 MHz	1	0.06
7	24.03 MHz	1	0.04

3.2.1.2 Radiated emission attenuation

Point	Frequency (30 MHz – 26.5 GHz)	Attenuation (dB)
1	30 MHz	0.501
2	150 MHz	1.174
3	400 MHz	2.034
4	800 MHz	2.995
5	1 GHz	3.416
6	1.363	1.666667
7	2.686	3.583333
8	5.332	5.25
9	7.978	6.25
10	10.624	7.5
11	13.27	8.333333
12	15.916	9.166666
13	18.562	9.833333
14	21.208	10.66667
15	23.854	11.5
16	26.5	12.16667



2.2.2 Antenna factors

3.2.2.1 Antenna VHBB9124

Frequency (MHz)	Antenna factor VHBB9124 (SN 9124-317)
20	15.3
21	15.1
22	14.8
23	14.5
24	14.3
25	14.1
26	13.8
27	13.6
28	13.3
29	13.1
30	12.6
31	12.4
32	12.2
33	12.0
34	11.8
35	11.7
36	11.4
37	11.3
38	11.1
39	11.0
40	10.8
41	10.7
42	10.5
43	10.3
44	10.2
45	10.1
46	9.9
47	9.9
48	9.7
49	9.7
50	9.5
51	9.5
52	9.3
53	9.3
54	9.2
55	9.1
56	9.0
57	9.0
58	9.0
59	9.0
60	9.0
61	9.0
62	8.9
63	8.9
64	8.8
65	8.8
66	8.8
67	8.9
68	8.9
69	8.9

70	8.9
71	8.9
72	8.9
73	8.9
74	8.9
75	8.9
76	8.9
77	8.9
78	8.9
79	9.0
80	9.0
81	9.0
82	9.1
83	9.0
84	9.0
85	9.0
86	9.1
87	9.1
88	9.2
89	9.2
90	9.3
91	9.3
92	9.3
93	9.3
94	9.3
95	9.3
96	9.4
97	9.4
98	9.5
99	9.5
100	9.6
102	9.7
104	9.7
106	9.9
108	10.0
110	10.2
112	10.2
114	10.3
116	10.4
118	10.5
120	10.5
122	10.7
124	10.7
126	10.8
128	10.9
130	11.0
132	11.1
134	11.2
136	11.4
138	11.5
140	11.6
142	11.8
144	11.8
146	12.0
148	11.9
150	12.0
152	12.1



154	12.4
156	12.6
158	12.8
160	12.9
162	12.9
164	13.0
166	13.0
168	12.8
170	12.8
172	12.9
174	13.0
176	13.2
178	13.3
180	13.4
182	13.5
184	13.5
186	13.5
188	13.6
190	13.7
192	13.8
194	13.8
196	13.9
198	14.0
200	14.1
202	14.2
204	14.3
206	14.4
208	14.3
210	14.4
212	14.7
214	14.6
216	14.5
218	14.5
220	14.6
222	14.4
224	14.6
226	14.8
228	14.9
230	15.0
232	15.0
234	15.0
236	15.0
238	15.2
240	15.3
242	15.3
244	15.4
246	15.3
248	15.2
250	15.2
252	15.2
254	15.4
256	15.4
258	15.5
260	15.6
262	15.7
264	15.7
266	15.8

268	15.9
270	15.9
272	16.0
274	16.0
276	16.2
278	16.2
280	16.4
282	16.7
284	16.8
286	17.0
288	16.9
290	16.9
292	17.2
294	17.4
296	17.6
298	17.9
300	18.2



3.2.2.2 Antenna FMZB 1519 B

Frequency (MHz)	Antenna factor (dB)
0.0	-30.6
0.0	-30.8
0.0	-31.8
0.0	-32.0
0.0	-32.1
0.1	-32.2
0.1	-32.2
0.1	-32.2
0.1	-32.2
0.1	-32.3
0.1	-32.3
0.2	-32.3
0.2	-32.4
0.3	-32.4
0.4	-32.4
0.5	-32.4
0.6	-32.4
0.7	-32.5
0.8	-32.5
0.9	-32.5
1.0	-32.5
2.0	-32.5
3.0	-32.5
4.0	-32.5
5.0	-32.5
6.0	-32.5
7.0	-32.5
8.0	-32.5
9.0	-32.5
10.0	-32.5
11.0	-32.5
12.0	-32.5
13.0	-32.5
14.0	-32.4
15.0	-32.4
16.0	-32.4
17.0	-32.4
18.0	-32.3
19.0	-32.3
20.0	-32.2
21.0	-32.1
22.0	-32.1
23.0	-32.0
24.0	-31.9
25.0	-31.8
26.0	-31.7
27.0	-31.6
28.0	-31.5
29.0	-31.4
30.0	-31.3

3.2.2.3 Antenna HL562E

Frequency (MHz)	Antenna factor HL562E (SN 100842)	Antenna factor HL562E (SN 100843)
30	18.12	18.17
32	17.08	17.07
34	16.01	16.00
36	14.91	14.94
38	13.76	13.75
40	12.64	12.61
42	11.43	11.40
44	10.17	10.15
46	8.86	8.81
48	7.42	7.44
50	6.01	5.96
52	4.59	4.56
54	3.38	3.37
56	2.84	2.85
58	3.06	3.14
60	3.78	3.76
62	4.44	4.40
64	5.36	5.32
66	6.19	6.18
68	6.96	6.92
70	7.56	7.52
72	8.04	8.01
74	8.38	8.35
76	8.67	8.64
78	8.88	8.85
80	9.04	9.03
82	9.14	9.09
84	9.20	9.14
86	9.22	9.16
88	9.22	9.17
90	9.21	9.17
92	9.22	9.15
94	9.22	9.16
96	9.21	9.16
98	9.22	9.17
100	9.33	9.05
105	9.38	9.39
110	9.67	9.74
115	9.55	10.33
120	10.51	9.88
125	10.15	9.87
130	9.23	9.13
135	8.79	8.71
140	8.40	8.40
145	7.93	7.82
150	7.74	7.75
155	7.68	7.76
160	7.86	7.78
165	8.47	8.33
170	9.83	9.66
175	10.29	10.30
180	7.86	7.93



185	7.19	7.27
190	7.54	7.21
195	7.32	7.20
200	7.56	7.49
205	7.56	7.68
210	7.71	7.95
215	8.68	8.29
220	8.43	8.49
225	8.51	8.62
230	8.85	8.82
235	9.10	9.05
240	9.31	9.29
245	9.33	9.33
250	9.50	9.45
255	9.71	9.64
260	9.86	9.81
265	9.95	9.90
270	10.00	10.02
275	10.15	10.15
280	10.37	10.36
285	10.58	10.61
290	10.76	10.80
295	10.84	10.90
300	10.83	11.12
305	11.38	11.37
310	11.36	11.32
315	11.53	11.48
320	11.70	11.67
325	11.84	11.81
330	11.98	11.94
335	12.32	12.13
340	12.19	12.22
345	12.29	12.35
350	12.43	12.47
355	12.59	12.61
360	12.72	12.73
365	12.83	12.81
370	12.99	12.99
375	13.08	13.10
380	13.12	13.11
385	13.21	13.20
390	13.38	13.33
395	13.54	13.50
400	13.65	13.63
405	13.74	13.73
410	13.84	13.83
415	14.14	13.96
420	14.10	14.00
425	14.13	14.08
430	14.24	14.20
435	14.40	14.40
440	14.55	14.49
445	14.70	14.65
450	14.82	14.79
455	14.89	14.91
460	14.90	15.09
465	15.16	15.19

470	15.24	15.22
475	15.31	15.25
480	15.38	15.32
485	15.48	15.43
490	15.58	15.52
495	15.66	15.60
500	15.72	15.70
505	15.74	15.75
510	15.83	15.82
515	16.05	15.92
520	15.95	15.93
525	15.97	15.97
530	16.05	16.01
535	16.09	16.07
540	16.16	16.15
545	16.21	16.21
550	16.29	16.30
555	16.38	16.41
560	16.51	16.53
565	16.67	16.68
570	16.78	16.85
575	16.87	17.02
580	17.03	17.11
585	17.06	17.08
590	17.10	17.09
595	17.15	17.13
600	17.22	17.18
605	17.28	17.25
610	17.35	17.33
615	17.42	17.37
620	17.41	17.42
625	17.48	17.48
630	17.56	17.55
635	17.67	17.65
640	17.80	17.79
645	17.94	17.95
650	18.08	18.13
655	18.16	18.12
660	18.18	18.03
665	18.12	17.99
670	18.13	18.01
675	18.19	18.09
680	18.26	18.24
685	18.42	18.41
690	18.56	18.56
695	18.62	18.61
700	18.67	18.67
705	18.70	18.74
710	18.74	18.79
715	18.81	18.86
720	18.89	18.95
725	19.09	19.09
730	19.22	19.26
735	19.17	19.23
740	19.19	19.14
745	19.14	19.10
750	19.13	19.09



755	19.17	19.10
760	19.19	19.15
765	19.24	19.21
770	19.34	19.29
775	19.37	19.36
780	19.36	19.36
785	19.43	19.41
790	19.51	19.48
795	19.59	19.56
800	19.70	19.66
805	19.83	19.79
810	19.98	19.95
815	20.07	20.04
820	20.10	19.96
825	20.11	19.92
830	20.09	19.94
835	20.09	19.96
840	20.14	20.05
845	20.19	20.11
850	20.27	20.20
855	20.36	20.29
860	20.42	20.37
865	20.46	20.44
870	20.50	20.51
875	20.52	20.55
880	20.59	20.61
885	20.70	20.69
890	20.82	20.77
895	20.89	20.83
900	20.88	20.92
905	20.83	21.08
910	20.93	21.21
915	21.19	21.17
920	21.22	21.10
925	21.09	21.03
930	20.98	21.00
935	20.95	21.00
940	20.96	21.01
945	21.00	21.04
950	21.05	21.06
955	21.09	21.07
960	21.15	21.13
965	21.23	21.20
970	21.27	21.26
975	21.31	21.30
980	21.36	21.37
985	21.43	21.44
990	21.52	21.53
995	21.63	21.64
1000	21.73	21.73

3.2.2.4 Antenna HF907

Frequency (GHz)	Antenna factor HF907 (SN 102508)	Antenna factor HF907 (SN 102494)
1.00	24.36	24.36
1.01	24.34	24.38
1.02	24.53	24.55
1.03	24.60	24.63
1.04	24.46	24.51
1.05	24.35	24.41
1.06	24.48	24.49
1.07	24.51	24.56
1.08	24.32	24.37
1.09	24.26	24.29
1.10	24.33	24.35
1.11	24.38	24.44
1.12	24.23	24.25
1.13	24.18	24.19
1.14	24.23	24.24
1.15	24.35	24.38
1.16	24.30	24.30
1.17	24.23	24.26
1.18	24.37	24.40
1.19	24.56	24.57
1.20	24.52	24.55
1.21	24.39	24.42
1.22	24.51	24.52
1.23	24.66	24.70
1.24	24.64	24.68
1.25	24.51	24.54
1.26	24.53	24.55
1.27	24.69	24.72
1.28	24.65	24.65
1.29	24.46	24.47
1.30	24.48	24.52
1.31	24.66	24.68
1.32	24.64	24.65
1.33	24.49	24.50
1.34	24.53	24.53
1.35	24.75	24.75
1.36	24.73	24.76
1.37	24.62	24.65
1.38	24.74	24.76
1.39	24.96	24.99
1.40	25.02	25.05
1.41	24.94	24.95
1.42	25.02	25.03
1.43	25.31	25.37
1.44	25.39	25.43
1.45	25.27	25.29
1.46	25.37	25.42
1.47	25.70	25.70
1.48	25.77	25.76
1.49	25.66	25.67
1.50	25.76	25.77
1.51	26.04	26.03



1.52	26.12	26.12
1.53	26.01	26.03
1.54	26.06	26.03
1.55	26.29	26.29
1.56	26.35	26.36
1.57	26.25	26.25
1.58	26.27	26.27
1.59	26.41	26.45
1.60	26.51	26.50
1.61	26.37	26.36
1.62	26.33	26.33
1.63	26.48	26.52
1.64	26.58	26.57
1.65	26.42	26.44
1.66	26.35	26.37
1.67	26.51	26.53
1.68	26.64	26.59
1.69	26.46	26.47
1.70	26.36	26.34
1.71	26.52	26.50
1.72	26.70	26.70
1.73	26.54	26.53
1.74	26.40	26.38
1.75	26.62	26.64
1.76	26.85	26.83
1.77	26.72	26.73
1.78	26.59	26.57
1.79	26.75	26.80
1.80	27.08	27.07
1.81	26.92	26.92
1.82	26.77	26.76
1.83	27.00	27.00
1.84	27.26	27.23
1.85	27.09	27.06
1.86	26.92	26.88
1.87	27.17	27.14
1.88	27.40	27.35
1.89	27.27	27.22
1.90	27.14	27.12
1.91	27.43	27.38
1.92	27.72	27.71
1.93	27.59	27.56
1.94	27.55	27.52
1.95	27.90	27.90
1.96	28.25	28.24
1.97	28.13	28.10
1.98	28.06	28.04
1.99	28.43	28.44
2.00	28.67	28.63
2.01	28.50	28.45
2.02	28.37	28.39
2.03	28.67	28.63
2.04	28.76	28.76
2.05	28.48	28.46
2.06	28.37	28.36
2.07	28.49	28.48
2.08	28.52	28.51

2.09	28.31	28.29
2.10	28.16	28.14
2.11	28.24	28.23
2.12	28.28	28.27
2.13	28.15	28.13
2.14	28.01	28.00
2.15	28.10	28.09
2.16	28.22	28.21
2.17	28.14	28.10
2.18	28.02	28.00
2.19	28.11	28.08
2.20	28.29	28.28
2.21	28.24	28.21
2.22	28.11	28.08
2.23	28.21	28.18
2.24	28.37	28.36
2.25	28.31	28.28
2.26	28.16	28.13
2.27	28.21	28.19
2.28	28.40	28.38
2.29	28.37	28.35
2.30	28.21	28.19
2.31	28.28	28.25
2.32	28.46	28.43
2.33	28.47	28.44
2.34	28.35	28.33
2.35	28.41	28.38
2.36	28.56	28.54
2.37	28.62	28.59
2.38	28.54	28.49
2.39	28.56	28.55
2.40	28.73	28.71
2.41	28.77	28.74
2.42	28.72	28.69
2.43	28.74	28.72
2.44	28.86	28.85
2.45	28.90	28.89
2.46	28.86	28.84
2.47	28.89	28.88
2.48	29.02	29.01
2.49	29.08	29.07
2.50	29.05	29.03
2.51	29.10	29.09
2.52	29.30	29.29
2.53	29.39	29.39
2.54	29.38	29.35
2.55	29.39	29.38
2.56	29.58	29.57
2.57	29.74	29.73
2.58	29.65	29.62
2.59	29.54	29.52
2.60	29.71	29.68
2.61	29.90	29.87
2.62	29.71	29.68
2.63	29.53	29.50
2.64	29.67	29.65
2.65	29.87	29.84



2.66	29.72	29.66
2.67	29.50	29.48
2.68	29.60	29.58
2.69	29.82	29.79
2.70	29.71	29.69
2.71	29.51	29.48
2.72	29.59	29.55
2.73	29.77	29.76
2.74	29.72	29.68
2.75	29.56	29.51
2.76	29.59	29.56
2.77	29.74	29.71
2.78	29.69	29.63
2.79	29.53	29.48
2.80	29.54	29.51
2.81	29.65	29.61
2.82	29.60	29.55
2.83	29.44	29.42
2.84	29.49	29.47
2.85	29.63	29.60
2.86	29.60	29.56
2.87	29.49	29.47
2.88	29.59	29.57
2.89	29.79	29.78
2.90	29.79	29.77
2.91	29.73	29.71
2.92	29.88	29.86
2.93	30.10	30.09
2.94	30.16	30.14
2.95	30.08	30.06
2.96	30.23	30.21
2.97	30.54	30.52
2.98	30.57	30.55
2.99	30.46	30.43
3.00	30.58	30.56
3.05	31.17	31.18
3.10	31.68	31.64
3.15	31.58	31.55
3.20	31.75	31.72
3.25	31.89	31.85
3.30	31.71	31.68
3.35	31.64	31.60
3.40	31.70	31.67
3.45	31.84	31.83
3.50	31.95	31.91
3.55	32.01	31.96
3.60	32.09	32.07
3.65	32.32	32.29
3.70	32.52	32.48
3.75	32.62	32.57
3.80	32.85	32.80
3.85	32.93	32.89
3.90	32.94	32.91
3.95	33.02	32.98
4.00	32.97	32.91
4.05	33.07	33.01
4.10	33.21	33.17

4.15	33.33	33.31
4.20	33.48	33.43
4.25	33.71	33.66
4.30	33.87	33.83
4.35	34.02	33.99
4.40	33.83	33.82
4.45	33.57	33.53
4.50	33.61	33.58
4.55	33.61	33.59
4.60	33.51	33.49
4.65	33.44	33.39
4.70	33.60	33.58
4.75	33.93	33.92
4.80	34.06	34.05
4.85	34.13	34.13
4.90	34.27	34.25
4.95	34.38	34.36
5.00	34.38	34.34
5.05	34.19	34.17
5.10	33.99	33.97
5.15	33.93	33.93
5.20	33.97	33.96
5.25	33.92	33.91
5.30	33.93	33.93
5.35	34.17	34.18
5.40	34.37	34.38
5.45	34.43	34.44
5.50	34.38	34.38
5.55	34.42	34.42
5.60	34.45	34.45
5.65	34.28	34.28
5.70	34.05	34.04
5.75	34.04	34.05
5.80	34.20	34.20
5.85	34.31	34.31
5.90	34.35	34.35
5.95	34.47	34.49
6.00	34.69	34.70
6.05	34.87	34.86
6.10	34.82	34.82
6.15	34.75	34.75
6.20	34.78	34.79
6.25	34.77	34.79
6.30	34.68	34.69
6.35	34.66	34.68
6.40	34.84	34.87
6.45	35.03	35.07
6.50	35.13	35.14
6.55	35.13	35.13
6.60	35.26	35.26
6.65	35.36	35.36
6.70	35.29	35.29
6.75	35.17	35.16
6.80	35.16	35.15
6.85	35.26	35.28
6.90	35.37	35.38
6.95	35.35	35.36



7.00	35.44	35.45
7.05	35.59	35.61
7.10	35.74	35.76
7.15	35.73	35.74
7.20	35.61	35.63
7.25	35.65	35.66
7.30	35.65	35.67
7.35	35.64	35.64
7.40	35.63	35.64
7.45	35.71	35.74
7.50	35.89	35.90
7.55	35.99	36.01
7.60	36.09	36.10
7.65	36.18	36.21
7.70	36.23	36.25
7.75	36.26	36.29
7.80	36.21	36.22
7.85	36.20	36.20
7.90	36.14	36.16
7.95	36.16	36.17
8.00	36.14	36.15
8.05	36.19	36.19
8.10	36.30	36.32
8.15	36.46	36.47
8.20	36.50	36.50
8.25	36.51	36.53
8.30	36.51	36.50
8.35	36.48	36.48
8.40	36.46	36.45
8.45	36.40	36.39
8.50	36.41	36.40
8.55	36.45	36.45
8.60	36.56	36.58
8.65	36.70	36.71
8.70	36.71	36.70
8.75	36.79	36.83
8.80	36.85	36.88
8.85	36.88	36.85
8.90	36.79	36.75
8.95	36.79	36.81
9.00	36.87	36.84
9.05	36.82	36.75
9.10	36.85	36.81
9.15	36.90	36.88
9.20	36.89	36.90
9.25	36.92	36.91
9.30	36.97	36.97
9.35	37.07	37.07
9.40	37.11	37.11
9.45	37.14	37.16
9.50	37.20	37.19
9.55	37.10	37.08
9.60	37.06	37.03
9.65	37.04	37.05
9.70	36.96	36.97
9.75	36.93	36.93
9.80	37.00	37.00

9.85	37.15	37.16
9.90	37.23	37.24
9.95	37.25	37.22
10.00	37.31	37.30
10.05	37.31	37.30
10.10	37.23	37.20
10.15	37.15	37.13
10.20	37.11	37.13
10.25	37.11	37.15
10.30	37.11	37.13
10.35	37.15	37.19
10.40	37.21	37.24
10.45	37.25	37.27
10.50	37.27	37.28
10.55	37.24	37.24
10.60	37.18	37.18
10.65	37.17	37.19
10.70	37.19	37.19
10.75	37.16	37.17
10.80	37.16	37.18
10.85	37.26	37.26
10.90	37.32	37.32
10.95	37.33	37.32
11.00	37.36	37.35
11.05	37.34	37.33
11.10	37.34	37.36
11.15	37.35	37.34
11.20	37.34	37.33
11.25	37.29	37.29
11.30	37.28	37.29
11.35	37.34	37.31
11.40	37.31	37.30
11.45	37.32	37.33
11.50	37.38	37.39
11.55	37.41	37.42
11.60	37.44	37.43
11.65	37.44	37.42
11.70	37.43	37.42
11.75	37.48	37.48
11.80	37.39	37.38
11.85	37.40	37.38
11.90	37.45	37.39
11.95	37.45	37.43
12.00	37.48	37.47
12.05	37.51	37.50
12.10	37.54	37.51
12.15	37.58	37.58
12.20	37.59	37.60
12.25	37.62	37.60
12.30	37.62	37.60
12.35	37.61	37.62
12.40	37.61	37.65
12.45	37.65	37.63
12.50	37.67	37.66
12.55	37.71	37.71
12.60	37.80	37.76
12.65	37.86	37.82



12.70	37.89	37.86
12.75	37.92	37.90
12.80	38.00	37.98
12.85	38.05	38.02
12.90	38.06	38.02
12.95	38.09	38.05
13.00	38.14	38.10
13.05	38.21	38.19
13.10	38.29	38.24
13.15	38.36	38.35
13.20	38.44	38.47
13.25	38.57	38.55
13.30	38.63	38.59
13.35	38.68	38.67
13.40	38.77	38.73
13.45	38.84	38.77
13.50	38.90	38.80
13.55	38.92	38.88
13.60	39.03	39.00
13.65	39.15	39.11
13.70	39.30	39.23
13.75	39.42	39.33
13.80	39.53	39.49
13.85	39.66	39.59
13.90	39.74	39.65
13.95	39.81	39.70
14.00	39.89	39.83
14.05	39.96	39.92
14.10	40.02	39.96
14.15	40.08	40.04
14.20	40.16	40.11
14.25	40.25	40.18
14.30	40.33	40.27
14.35	40.37	40.28
14.40	40.44	40.32
14.45	40.50	40.40
14.50	40.62	40.56
14.55	40.70	40.61
14.60	40.77	40.64
14.65	40.83	40.71
14.70	40.86	40.77
14.75	40.83	40.72
14.80	40.79	40.65
14.85	40.76	40.65
14.90	40.84	40.76
14.95	40.87	40.77
15.00	40.89	40.79
15.05	40.95	40.85
15.10	41.03	40.94
15.15	41.08	40.96
15.20	41.02	40.93
15.25	40.99	40.88
15.30	41.01	40.91
15.35	41.04	40.88
15.40	41.08	40.92
15.45	41.12	40.96
15.50	41.15	40.97

15.55	41.18	41.00
15.60	41.14	41.01
15.65	41.05	40.99
15.70	40.99	40.95
15.75	40.99	40.92
15.80	41.03	41.00
15.85	41.14	41.11
15.90	41.18	41.15
15.95	41.27	41.22
16.00	41.34	41.33
16.05	41.40	41.36
16.10	41.39	41.34
16.15	41.33	41.32
16.20	41.31	41.31
16.25	41.40	41.37
16.30	41.47	41.43
16.35	41.53	41.52
16.40	41.66	41.66
16.45	41.77	41.75
16.50	41.82	41.77
16.55	41.84	41.87
16.60	41.83	41.95
16.65	41.85	41.94
16.70	41.91	42.00
16.75	42.09	42.20
16.80	42.23	42.35
16.85	42.36	42.39
16.90	42.50	42.49
16.95	42.61	42.59
17.00	42.63	42.60
17.05	42.63	42.57
17.10	42.64	42.54
17.15	42.76	42.58
17.20	42.82	42.63
17.25	42.86	42.75
17.30	43.02	42.90
17.35	43.15	42.98
17.40	43.28	43.10
17.45	43.30	43.17
17.50	43.32	43.16
17.55	43.37	43.19
17.60	43.39	43.23
17.65	43.50	43.35
17.70	43.52	43.41
17.75	43.62	43.49
17.80	43.74	43.60
17.85	43.89	43.69
17.90	43.92	43.81
17.95	44.02	43.89
18.00	44.18	43.98



3 TEST SUMMARY

STANDARDS (details on first page)	Tested		Sample	
	yes	no	pass	not pass
47 CFR Part 18	☒	☐	☒	☐

Test	Section within the report	Conclusion
Conducted emission measurement	5.1	N/A
Radiated emission measurement	5.2	PASS

3.1 Operating modes

Section	Test	Operating mode
5.1	Conducted emission measurement	N/A
5.2	Radiated emission measurement	Full rated transmit power: 30 kW

3.2 Operating voltages/frequencies used for testing

Section	Test	Operating conditions
5.1	Conducted emission measurement	N/A
5.2	Radiated emission measurement	3 x 480V; 60 Hz

3.3 Test methodology

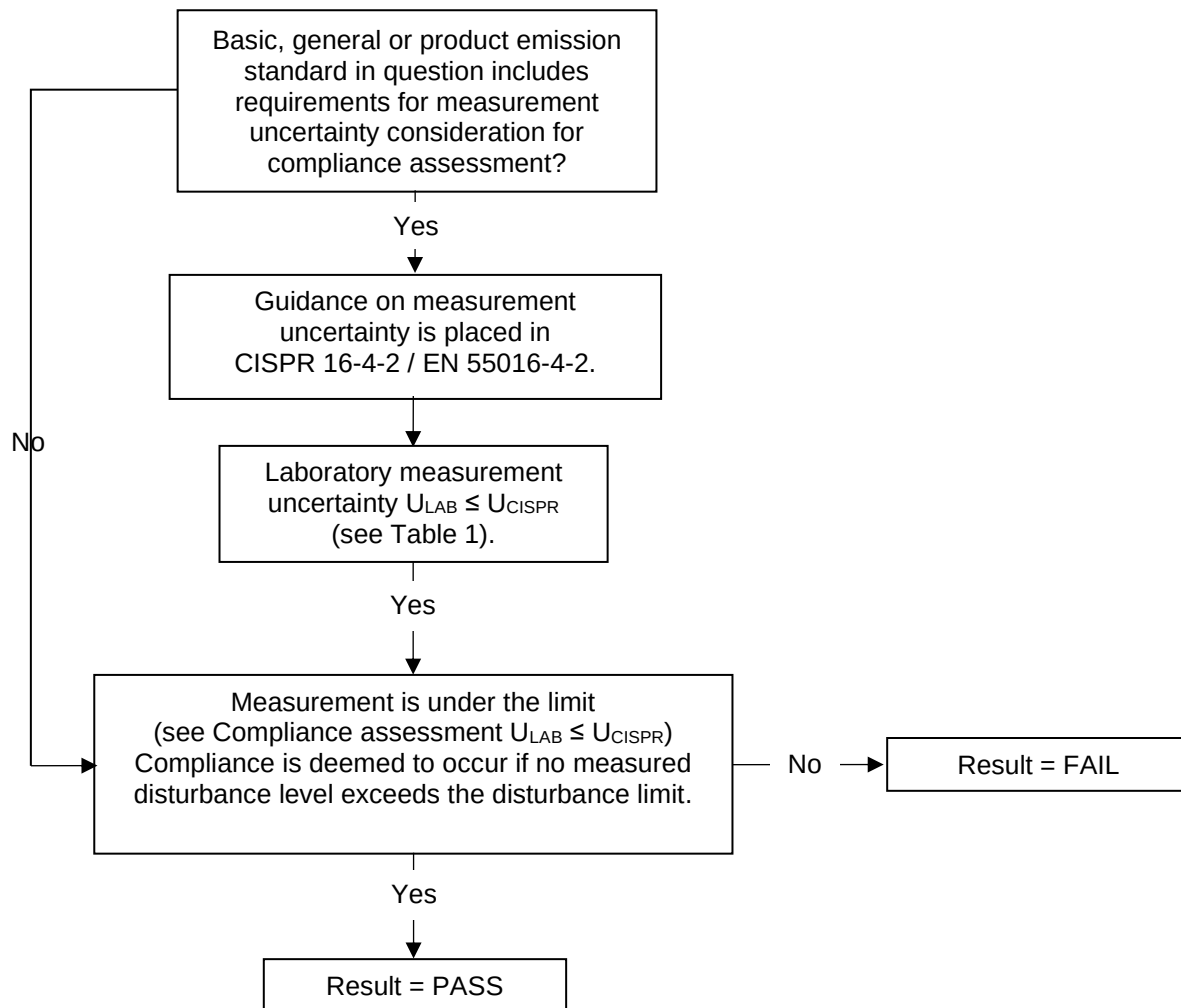
The EUT was configured as shown in the block diagram and photographs herein. The sample was tested per FCC measurement Procedure MP-5, "Methods of Measurement of Radio Noise Emissions from Industrial, Scientific and Medical Equipment" (1986) as well as per CFR 47 part 18.

3.4 Application of decision rule

Application of decision rule and statement of conformity is defined in document TN023 Decision rule and measurement uncertainty.

As a general rule Pass/Fail decisions are based on simple acceptance rule and acceptance limits chosen based on simple acceptance ($w = 0$, $AL = TL$) except if a decision rule is governed by particular standard or guidance document.

Decision rule applicable for emission





4 EMISSION TESTS

4.1 Conducted emission measurement

Device is not intended for connection to public low mains voltage system and is not a consumer device. No limits are defined in the standard, test is not applicable.

4.2 Radiated emission measurement

4.2.1 Limits of Radiated emission measurement

- ISM equipment operating on a frequency specified in §18.301 is permitted unlimited radiated energy in the band specified for that frequency.
- The field strength levels of emissions which lie outside the bands specified in §18.301, unless otherwise indicated, shall not exceed the following:

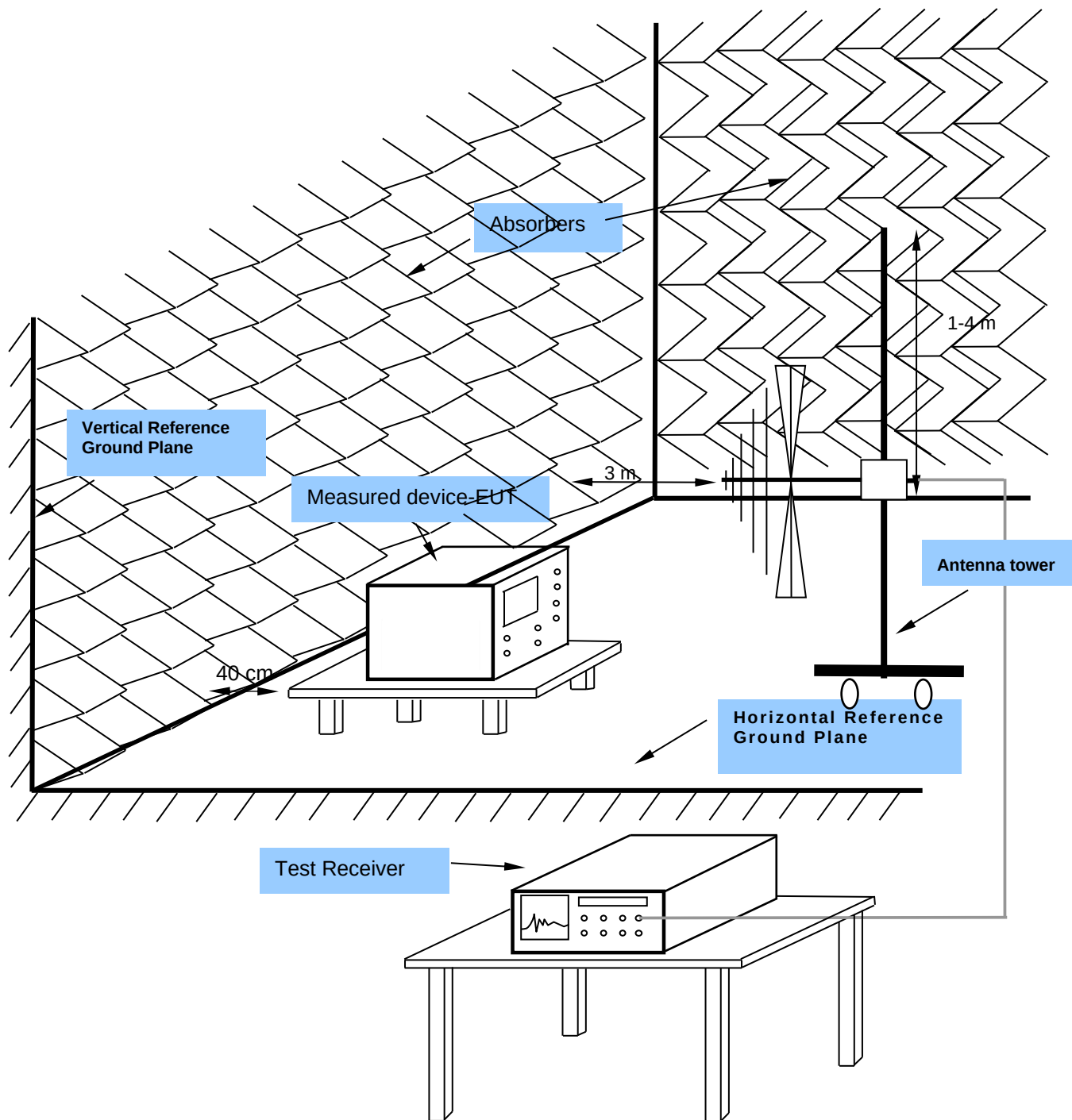
Equipment	Operating frequency	RF Power generated by equipment (watts)	Field strength limit (uV/m)	Distance (meters)
Any type unless otherwise specified (miscellaneous)	Any ISM frequency	Below 500 500 or more	25 25 × SQRT(power/500)	300 ¹ 300
	Any non-ISM frequency	Below 500 500 or more	15 15 × SQRT(power/500)	300 ¹ 300

Transmit power:	30 kW
Limit line at 300 m:	$15 \times \text{SQRT}(\text{power}/500) = 15 \times \text{SQRT}(30000/500) = 116.19 \mu\text{V/m}$ $= 41.30 \text{ dB}\mu\text{V/m}$
Limit line at 3 m (below 30 MHz):	$\text{Limit } 300 \text{ m (dB}\mu\text{V/m)} + 40 \times \text{Log}(300 \text{ m} / 3 \text{ m}) = 121.30 \text{ dB}\mu\text{V/m}$
Limit line at 3 m (Above 30 MHz):	$\text{Limit } 300 \text{ m (dB}\mu\text{V/m)} + 20 \times \text{Log}(300 \text{ m} / 3 \text{ m}) = 81.30 \text{ dB}\mu\text{V/m}$
Limit line at 10 m (below 30 MHz):	$\text{Limit } 300 \text{ m (dB}\mu\text{V/m)} + 40 \times \text{Log}(300 \text{ m} / 10 \text{ m}) = 100.38 \text{ dB}\mu\text{V/m}$
Limit line at 10 m (Above 30 MHz):	$\text{Limit } 300 \text{ m (dB}\mu\text{V/m)} + 20 \times \text{Log}(300 \text{ m} / 10 \text{ m}) = 70.84 \text{ dB}\mu\text{V/m}$

4.2.2 Test procedure

- The EUT was placed on the top of a rotating table 0.8 meters above the ground in an Anechoic Chamber. The table was rotated 360 degrees to determine the position of the highest radiation.
- The EUT was set 3 m away from the interference-receiving antenna, which was mounted on the top of variable-height antenna tower.
- The antenna is a broadband antenna, and its height is varied from one meter to four meters 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 heights from 1 meter to 4 meters and the turn table was turned from 0 degrees to 360 degrees to find the maximum reading.
- The test-receiver system was set to PEAK and QUASI-PEAK Detect Function and Specified Bandwidth with Maximum Hold Mode.
- The highest points would be re-tested one by one using the quasi-peak method.

4.2.3 Test setup



For the actual test configuration, please refer to the related item – Photographs of the Test Configuration.

4.2.4 Test result

Preliminary measurements were performed in SAC with 3 m test distance. Final measurements were performed in OATS with 10 m measurement distance.

For Main power transfer frequency in the range 55 – 65 kHz, device was rotated to a position with highest emission readings. Measurements were performed at measurement distance from 3 to 10 meters by increment of 1 meter. Extrapolation of measurement results was performed to show that at distance of 300 meters, device produce disturbances that are lower than 116.19 $\mu\text{V/m}$ which results in 41.30 dB $\mu\text{V/m}$.

Final measurement results in OATS (10 m distance) in frequency range: 9 kHz – 30 MHz:

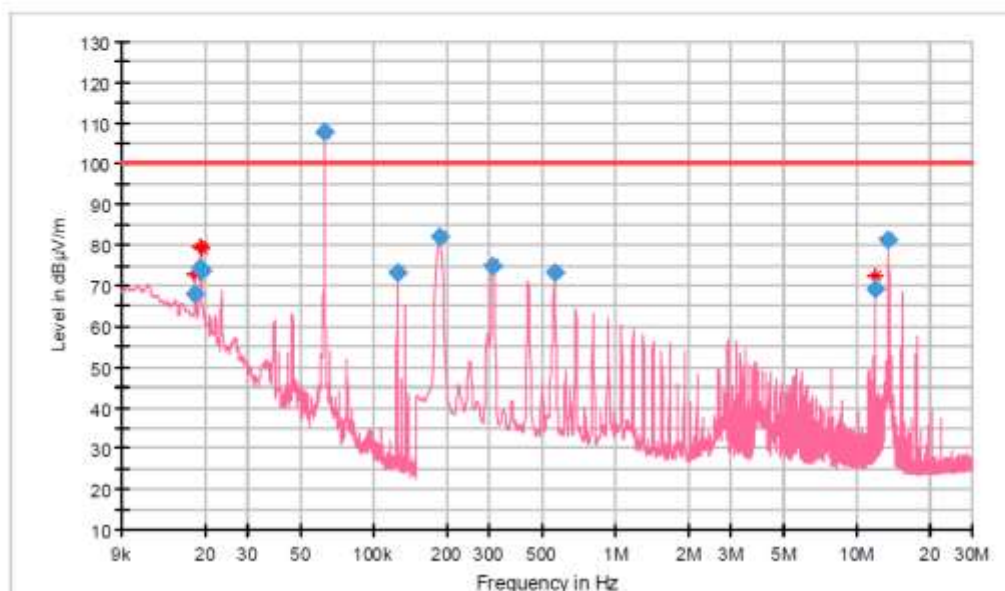
Vertical polarization:

Radiated emission

EUT Information

EUT: Delta 30 kW charger
Operating mode: Full load

Full Spectrum



Final Result

Frequency (MHz)	Quasi-Peak (dB $\mu\text{V/m}$)	Limit (dB $\mu\text{V/m}$)	Margin (dB)	Corr. (dB/m)
0.018150	67.85	100.38	32.53	19.5
0.019200	74.47	100.38	25.91	19.4
0.019300	73.81	100.38	26.57	19.4
0.062250	107.79	100.38	-7.41	18.8
0.124450	73.22	100.38	27.16	18.8
0.186000	82.10	100.38	18.28	18.7
0.312000	75.00	100.38	25.38	18.5
0.559500	73.42	100.38	26.96	18.5
11.949000	69.06	100.38	31.32	18.1
13.580000	81.13	100.38	19.25	18.0



Horizontal polarization:

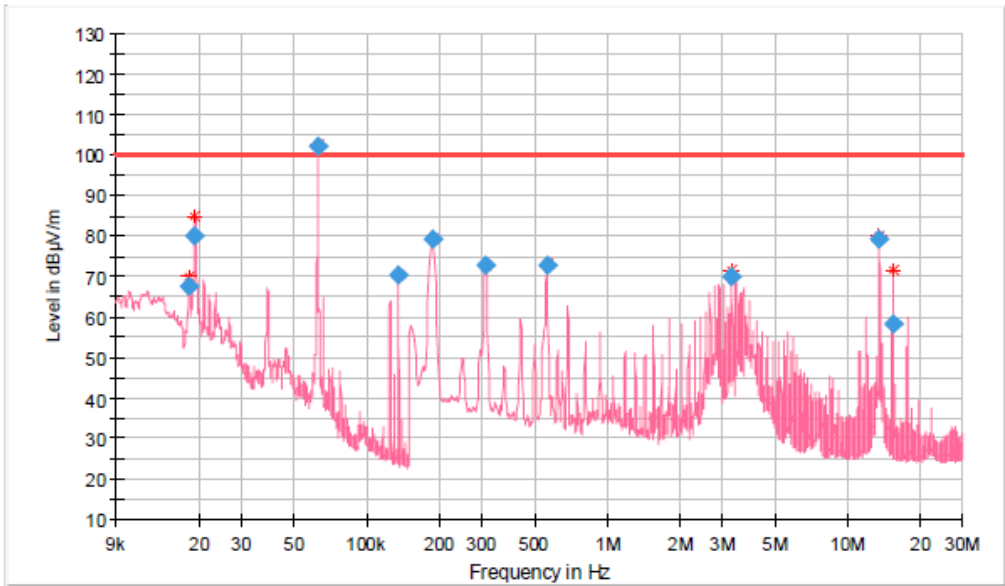
Radiated emission

EUT Information

EUT:
Operating mode:

Delta 30 kW charger
Full load

Full Spectrum



Final Result

Frequency (MHz)	QuasiPeak (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Pol	Corr. (dB/m)
0.018150	67.61	100.38	32.77	V	19.5
0.019200	80.03	100.38	20.35	V	19.4
0.062150	102.22	100.38	-1.84	V	18.8
0.135450	70.47	100.38	29.91	V	18.8
0.186000	79.21	100.38	21.17	V	18.7
0.309750	72.72	100.38	27.66	V	18.5
0.559500	72.84	100.38	27.54	V	18.5
3.293250	69.86	100.38	30.52	V	18.6
13.560000	79.37	100.38	21.01	V	18.0
15.339750	58.35	100.38	42.03	V	17.9

Precheck measurement results in SAC with measurement distance of 3 meters, EUT rotation 0° - 90°:
30 MHz – 1 GHz:

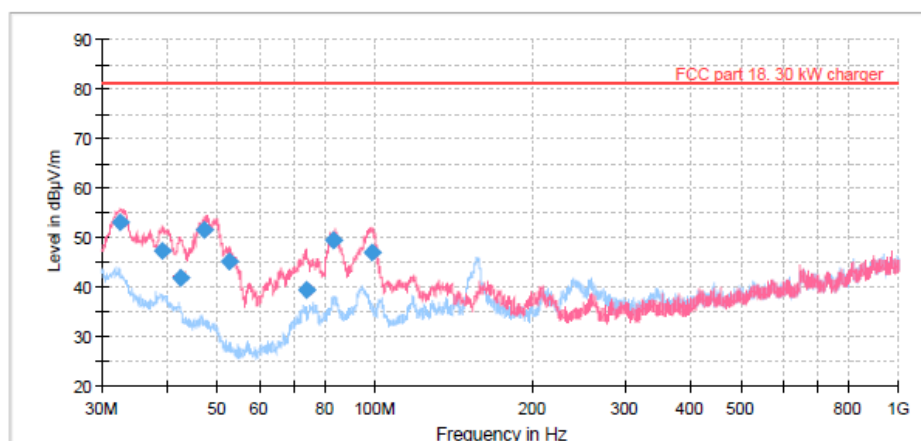
1 / 1

Radiated emission

EUT Information

EUT: DELTA 30 kW wireless charger
Test condition: Uin 3x277V/60Hz, Full load

Full Spectrum



— Preview Result 1H-PK+ [Preview Result 1H.Result:1]
— Preview Result 1V-PK+ [Preview Result 1V.Result:1]
* Critical_Freqs PK+ [Critical_Freqs.Result:4]
— FCC part 18, 30 kW charger [..EMI radiated]
◆ Final_Result QPK [Final_Result.Result:4]

Final Result

Frequency (MHz)	QuasiPeak (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)
32.520000	52.88	81.30	28.42	1000.0	120.000	100.0	V	2.0
39.240000	47.17	81.30	34.13	1000.0	120.000	100.0	V	78.0
42.300000	41.67	81.30	39.63	1000.0	120.000	100.0	V	11.0
47.010000	51.45	81.30	29.85	1000.0	120.000	100.0	V	62.0
52.500000	45.25	81.30	36.05	1000.0	120.000	104.0	V	78.0
73.590000	39.30	81.30	42.00	1000.0	120.000	126.0	V	90.0
83.040000	49.29	81.30	32.01	1000.0	120.000	104.0	V	86.0
98.430000	46.91	81.30	34.39	1000.0	120.000	100.0	V	90.0

Precheck measurement results in SAC with measurement distance of 3 meters, EUT rotation 90° - 360°:
30 MHz – 1 GHz:

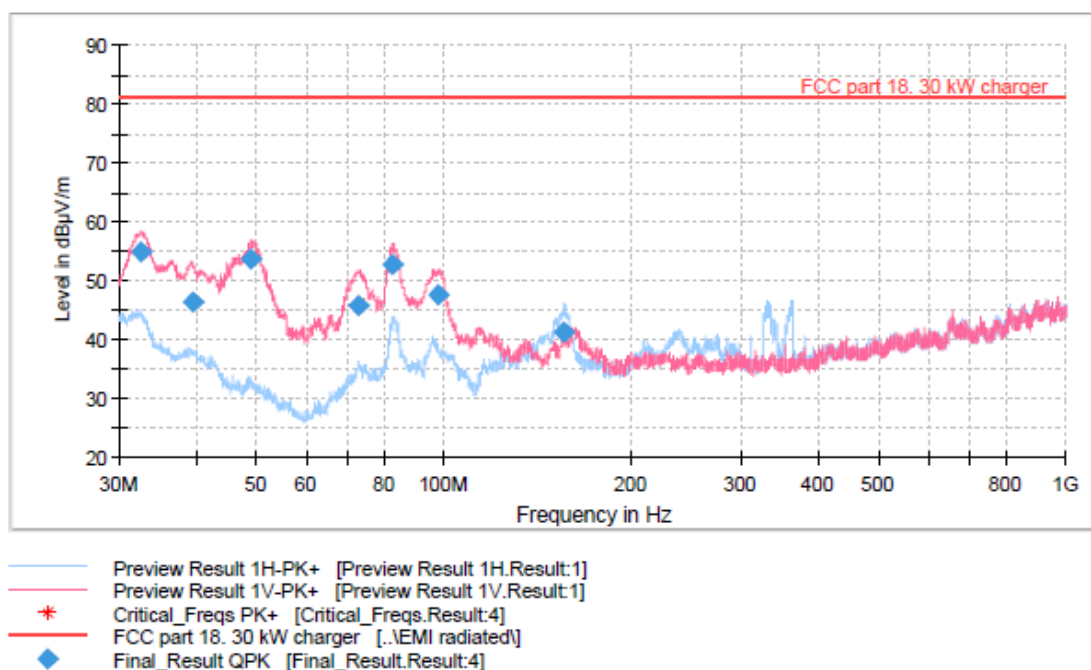
1 / 1

Radiated emission

EUT Information

EUT: DELTA 30 kW wireless charger
Test condition: Uin 3x277V/60Hz, Full load

Full Spectrum



Final Result

Frequency (MHz)	QuasiPeak (dBμV/m)	Limit (dBμV/m)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)
32.520000	54.82	81.30	26.48	1000.0	120.000	100.0	V	299.0
39.300000	46.50	81.30	34.80	1000.0	120.000	100.0	V	111.0
48.900000	53.76	81.30	27.54	1000.0	120.000	100.0	V	273.0
72.780000	45.90	81.30	35.40	1000.0	120.000	124.0	V	249.0
82.440000	52.76	81.30	28.54	1000.0	120.000	103.0	V	267.0
98.010000	47.56	81.30	33.74	1000.0	120.000	100.0	V	289.0
156.060000	41.25	81.30	40.05	1000.0	120.000	150.0	H	90.0



Final measurement results in OATS with measurement distance of 10 meters: 30 MHz – 1 GHz:
All reading more than 10 dB under the limit


Measurement of fundamental power transfer frequency and extrapolation calculations:

Fundamental power transfer frequency: 62.20 kHz			
Measurement distance (m)	Measured value (dB μ V/m)	Measured value (μ V/m)	Extrapolation factor with comparison to 3 m results
3	144.34	16481624	/
4	140.69	10826797	1.46
5	135.32	5834451	2.03
6	130.10	3198895	2.37
7	124.78	1733804	2.66
8	119.09	900534	2.96
9	113.80	489779	3.20
10	107.79	245188	3.50

Median of all values results in extrapolation value of 2.66 which results in calculated level at 300 meters to 38.03 dB μ V/m.

Since measurement uncertainty decreases with the measurement distance, it is safe to assume measurements up to 5 meters are less accurate. Median of values between 5 and 10 meters is most likely a better indication of the precise extrapolation factor. Median value of measurements taken between 5 and 10 meters is 2.81 which results in a calculated level at 300m of 31.91 dB μ V/m. In both cases, it is safe to assume the device does not exceed the set limit at 300 meters which is 41.30 dB μ V/m

Calculated level at 1600 m is: $144.34 - 20 \cdot \log((1600/3)^{2.81}) = -8.9$ dB μ V/m = 0.36 μ V/m which is less than 10 μ V/m

Conclusion: disturbances produced by the device do not exceed 41.30 dB μ V/m at 300 meters distance and 10 μ V/m at 1600 m distance.

5 PHOTOS OF THE TEST CONFIGURATION



Figure 1: Radiated emission test 9 kHz – 30 MHz: measurement in SAC with 3 m measurement distance



Figure 2: Radiated emission test 9 kHz – 30 MHz: measurement in OATS with 10 m measurement distance



Figure 3: Radiated emission test 30 MHz – 1000 MHz: measurement in SAC with 3 m measurement distance



Figure 4: Radiated emission test 30 MHz – 200 MHz: measurement in OATS with 10 m measurement distance



Figure 5: Radiated emission test 200 MHz – 1000 MHz: measurement in OATS with 10 m measurement distance