EMC Test Report

China

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Applicant: SUZHOU TOSEVEN NEW ENERGY TECHNOLOGY CO., LTD.

Product: Hub Motor

Model: D7-175X, K7-135X

In accordance with EN 15194

Prepared for: SUZHOU TOSEVEN NEW ENERGY TECHNOLOGY CO., LTD.
3rd FL, Building no. 3 & 2nd FL, Building no. 4, No. 36 Tianedang Road, Yuexi, Wuzhong District, 215168 Suzhou, PEOPLE'S REPUBLIC OF CHINA

COMMERCIAL-IN-CONFIDENCE

Report Number: 4830021360500

RESPONSIBLE FOR	NAME	SIGNATURE	DATE
Approved By	Jun Bao	Jun Bao	2021.12.24
Prepared By	Xiaowei Wang	Xiaowei Wang	2021.12.24

Signatures in this approval box have checked this document in line with the requirements of TÜV SÜD Product Service document control rules.

EXECUTIVE SUMMARY
Two samples of this product were tested and found to be compliant with EN 15194:2017 Clause 4.2.15.

TÜV SÜD Certification and Testing (China) Co., Ltd.
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Revision:01
Effective:2019-06-25

Contents

1 Report Summary

1.1 Report Modification Record

Alterations and additions to this report will be issued to the holders of each copy in the form of a complete document.

Issue	Description of Change	Date of Issue
1	First Issue	24/12/2021

1.2 Introduction

The information contained in this report is intended to show verification of the EMC Qualification Approval Testing of the requirements of the standards for the tests listed in Section 1.3.

Applicant	SUZHOU TOSEVEN NEW ENERGY TECHNOLOGY CO., LTD.
address	3rd FL, Building no. 3 & 2nd FL, Building no. 4, No. 36 Tianedang Road, Yuexi, Wuzhong District, 215168 Suzhou, PEOPLE'S REPUBLIC OF CHINA
Manufacturer	SUZHOU TOSEVEN NEW ENERGY TECHNOLOGY CO., LTD.
address	3rd FL, Building no. 3 & 2nd FL, Building no. 4, No. 36 Tianedang Road, Yuexi, Wuzhong District, 215168 Suzhou, PEOPLE'S REPUBLIC OF CHINA
Factory	SUZHOU TOSEVEN NEW ENERGY TECHNOLOGY CO., LTD.
Model Number(s)	D7-175X, K7-135X
Rated input voltage	DC 36V/43V
Sample(s) Tested	D7-175X, K7-135X
Sample No.	613759-1, 613759-2
Test Specification	EN 15194:2017 Clause 4.2.15
Date of Receipt of EUT	16/11/2021
Start of Test	16/11/2021
Finish of Test	26/11/2021
Name of Engineer(s)	Xiaowei Wang

1.3 Brief Summary of Results

A brief summary of the tests carried out in accordance with EN 15194 is shown below.

Section	Specification	Clause	Test Description	Result	Comments/Base Standard
2.1	EN 15194:2017	Annex C.1.2. 5 & C.1.2. 6	Radiated Disturbance	Pass	
2.2	EN 15194:2017	Annex C.8	Electrostatic discharge immunity test	Pass	EN 61000-4-2
2.3	EN 15194:2017	Annex C.1.2. 7	Bulk current injection test	Pass	ISO 11451-4
2.4	EN 15194:2017	Annex C.1.2. 7	ESA immunity to electromagnetic radiation	Pass	ISO 11451-2

1.4 Product Information

1.4.1 Technical Description

The Equipment Under Test (EUT) is Hub Motor Drive System for EPAC.

Voltage	Motor	Controller	Display
48V	D7-175X	48V25A	SW900
36V	K7-135X	36V18A	G51

1.4.2 EUT Port/Cable Identification

Port	Max Cable Length specified	Usage	Type	Screened
Enclosure port	--	--	--	no
DC input port	1.8m	DC power line	--	no

1.4.3 Test Configuration

Configuration	Description
1	Battery Powered. 36V/43V DC.

1.4.4 Modes of Operation

Mode	Description
1	Power on. Motor Running.

1.4.5 Monitoring of Performance

The EUT works normally.

1.4.6 Performance Criteria

ESA immunity to electromagnetic radiation and Bulk current injection

There are no abnormal changes in the speed of the vehicle's drive wheels, there are no signs of operational deterioration which might mislead other road users and there are no other noticeable phenomena which could result in a deterioration in the direct control of the vehicle.

Electrostatic discharge immunity test

Performance criterion A: The apparatus shall continue to operate as intended during the test. No degradation of performance or loss of function is allowed below a performance level specified by the manufacturer, when the apparatus is used as intended. If the minimum performance level or the permissible performance loss is not specified by the manufacturer, then either of these may be

derived from the product description and documentation, and from what the user may reasonable expect from the apparatus if used as intended.

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

Performance criterion C: Temporary loss of function is allowed, provided the function is self-recoverable or can be restored by the operation of the controls, or by any operation specified in the instruction for use.

1.5 Deviations from the Standard

No deviations from the applicable test standard were made during testing.

1.6 Test Location

Site:
All tests conducted the following table were performed at TÜV SÜD Certification and Testing Co., Ltd.

Address:

No. 10 Huaxia Road (M)
Dongting
Wuxi
Jiangsu Province
214100
China

Test Name	Name of Engineer(s)
Radiated Disturbance	Quanyu Di
Electrostatic discharge immunity test	Jiaxing Wu
Bulk current injection test	Jiaxing Wu
ESA immunity to electromagnetic radiation	Jiaxing Wu

2 Test Details

2.1 Radiated Disturbance

2.1.1 Specification Reference

EN 15194:2017, Clause Annex C.1.2.2 & C.1.2.3

2.1.2 Equipment Under Test

D7-175X, K7-135X

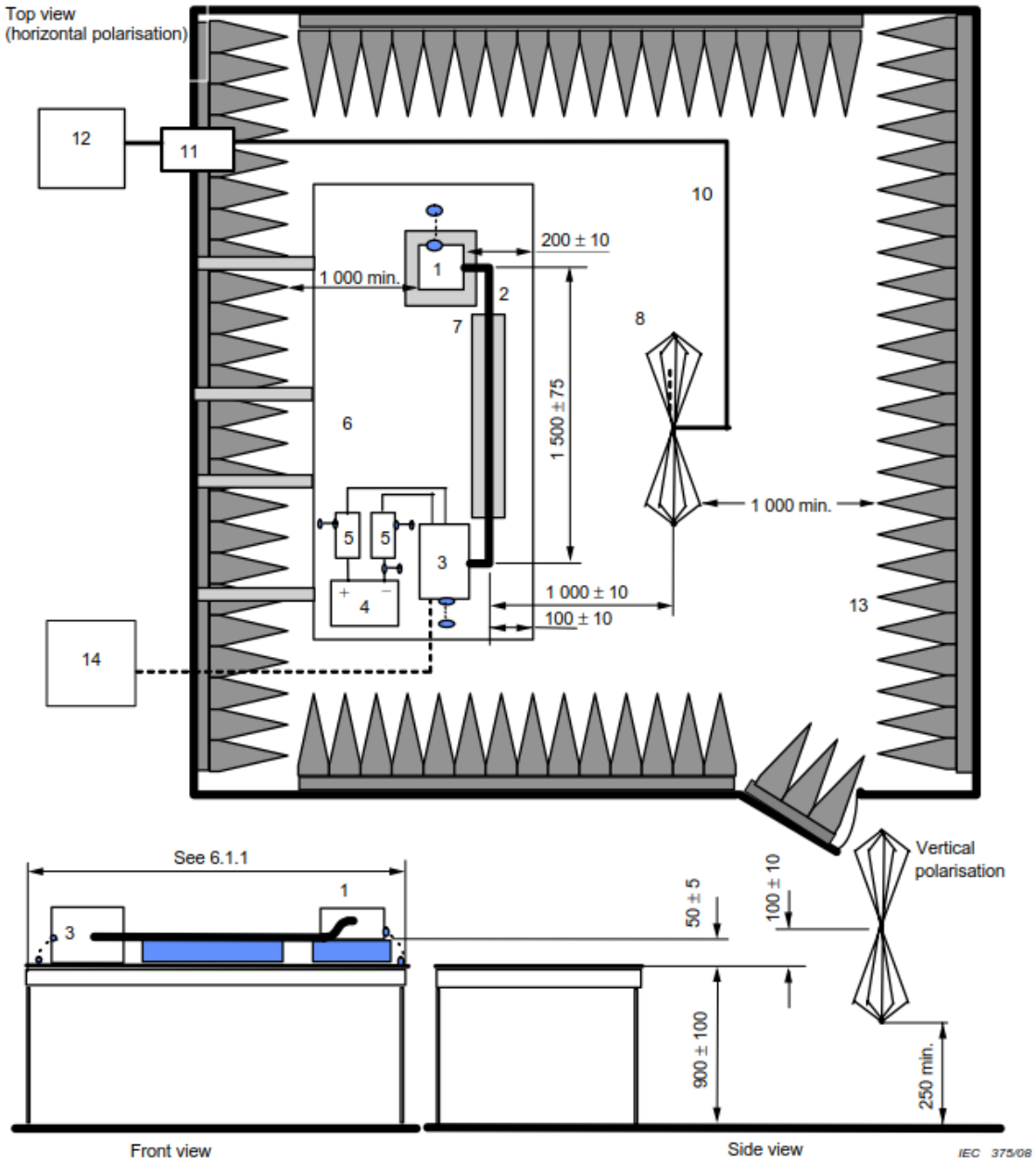
2.1.3 Date of Test

17/11/2021

2.1.4 Test Method

The EUT was set up in a semi-anechoic chamber and placed on a non-conductive table 0.9 ± 0.1m above a reference ground plane and 0.05 ± 0.005m away from a vertical coupling plane, the center of the antenna shall be 1m ± 0.1m above the ground.
A pre-scan of the EUT emissions profile was made while varying the antenna-to-EUT azimuth and antenna-to-EUT polarization using a peak and average detector; measurements were taken at a 1m± 0.1m distance. The EUT was then formally measured using a Quasi-Peak detector to measure broad-band electromagnetic radiation and using an average-value detector to measure narrow-band electromagnetic radiation.

30-300MHz



Key

1 EUT (grounded locally if required in test plan)

2 Test harness

3 Load simulator (placement and ground connection according to 6.4.2.5)

4 Power supply (location optional)

5 Artificial network (AN)

6 Ground plane (bonded to shielded enclosure)

7 Low relative permittivity support ($\varepsilon_r \leq 1,4$)

8 Biconical antenna

10 High-quality coaxial cable e.g. double-shielded (50 Ω)

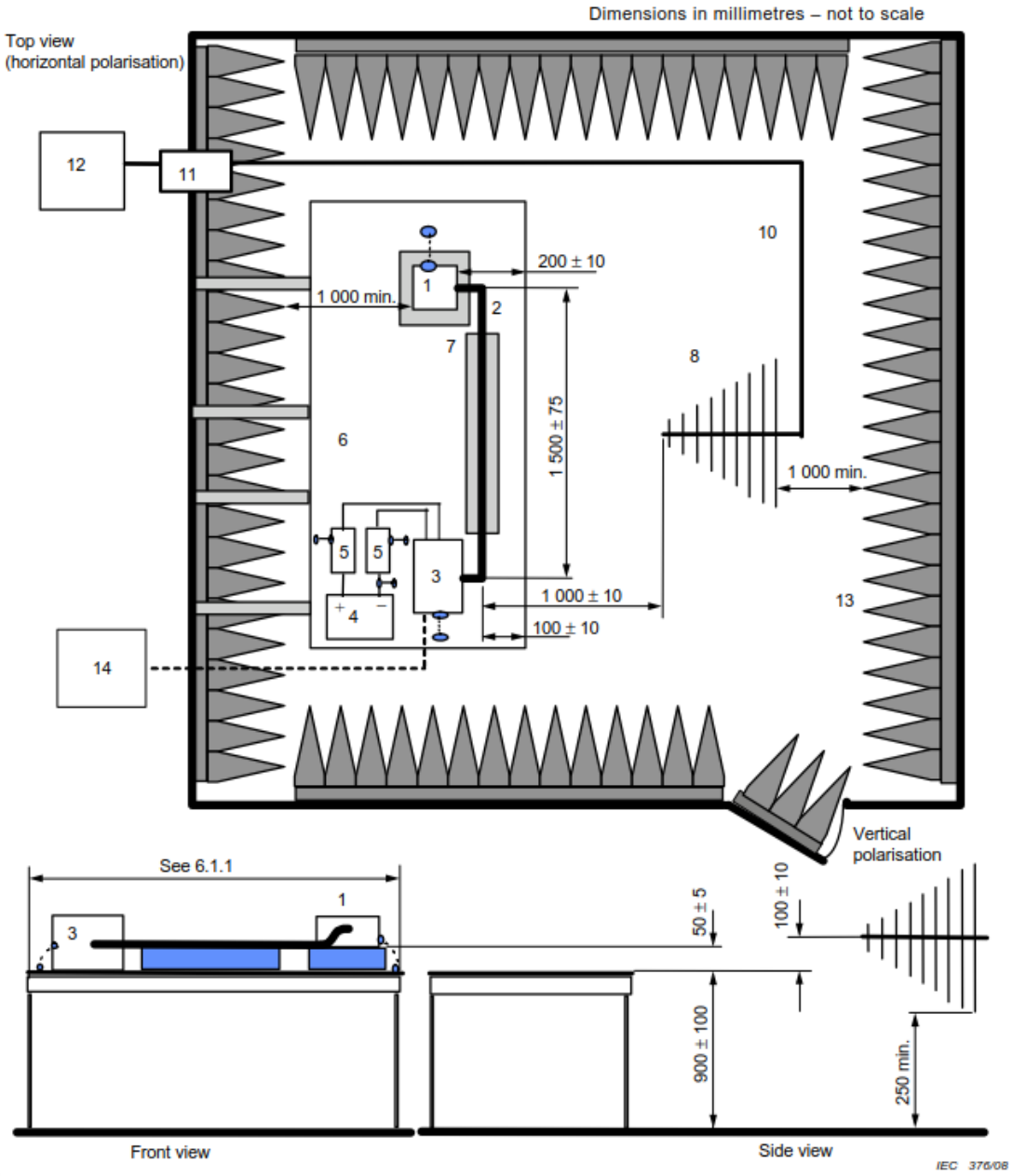
11 Bulkhead connector

12 Measuring instrument

13 RF absorber material

14 Stimulation and monitoring system

300–1000MHz



Key

1 EUT (grounded locally if required in test plan)

2 Test harness

3 Load simulator (placement and ground connection according to 6.4.2.5)

4 Power supply (location optional)

5 Artificial network (AN)

6 Ground plane (bonded to shielded enclosure)

7 Low relative permittivity support ($\varepsilon_r \leq 1{,}4$)

8 Log-periodic antenna

10 High-quality coaxial cable e.g. double-shielded (50 Ω)

11 Bulkhead connector

12 Measuring instrument

13 RF absorber material

14 Stimulation and monitoring system

2.1.5 Environmental Conditions

Ambient Temperature	23.1 °C
Relative Humidity	57.3 %
Atmospheric Pressure	1003.0 mbar

2.1.6 Specification Limits

Electromagnetic radiation emissions reference limits					
Value	Band-width	Antenna distance	Equation for L [dB(µV/m)] within f[MHz]		
			30…75	75…400	400…1000
Mean value	Narrow-band	1±0.1m	54-15,13log(f/30)	44+15,13log(f/75)	55
Quasi-peak	Broad-band	1±0.1m	64-15,13log(f/30)	54+15,13log(f/75)	65

2.1.7 Test Results

Results for Configuration and Mode: Configuration 1/ Mode 1.

Performance assessment of the EUT made during this test: Pass.

Detailed results are shown below.

30-200MHz Radiated Disturbance Test

Common Information

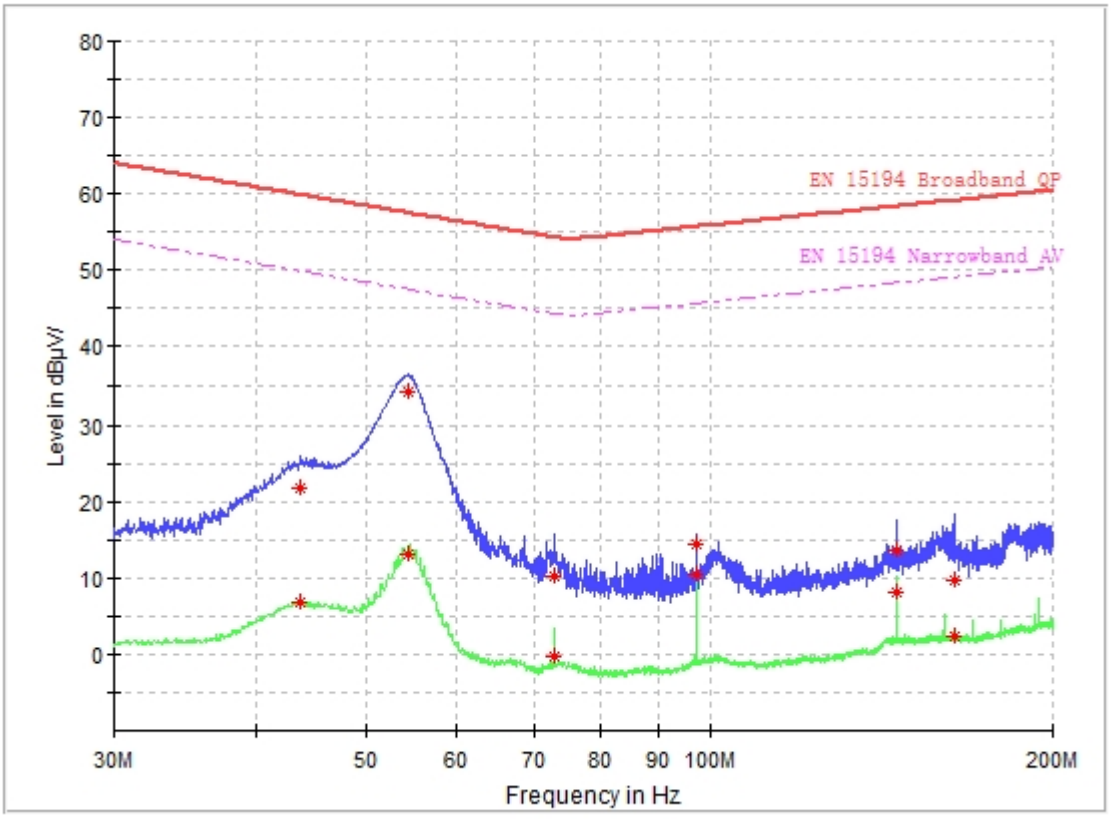
Test Description:	30-200MHz Radiated Emission
EUT Name:	Hub Motor
Model:	D7-175X
Client:	SUZHOU TOSEVEN NEW ENERGY TECHNOLOGY CO.,LTD
Op Cond:	power on (DC)
Operator:	Quanyu Di
Test Spec:	EN 15194
Sample No:	613759-1
Comment:	Horizontal
Comment:	T23.1C, H57.3%, P1003hPa

Automotive Setup: EN 15194 RE [EMI radiated]

Device Mode: Scan Mode

Band	Subrange	Steps	DET	IF BW	MT	PA	POL
9124	30 - 200 MHz	60 kHz	PK+; AVG	120 kHz	5 ms	0 dB	-
9118	200 MHz - 1 GHz	60 kHz	PK+; AVG	120 kHz	5 ms	0 dB	-

9124



QP

Frequency (MHz)	QuasiPeak (dB¦ìV/m)	Meas. Time (ms)	Bandwidth (kHz)	Corr. (dB/m)	Margin - QPK (dB)	Limit - QPK (dB¦ìV/m)
43.800000	21.6	1000.0	120.000	-15.4	38.3	59.9
54.360000	34.4	1000.0	120.000	-15.8	23.1	57.5
72.840000	10.3	1000.0	120.000	-16.3	44.0	54.3
97.140000	14.5	1000.0	120.000	-15.6	41.2	55.7
145.620000	13.6	1000.0	120.000	-12.3	44.8	58.4
163.980000	9.7	1000.0	120.000	-11.1	49.5	59.1

CAV

Frequency (MHz)	CAverage (dB¦ìV/m)	Meas. Time (ms)	Bandwidth (kHz)	Corr. (dB/m)	Margin - CAV (dB)	Limit - CAV (dB¦ìV/m)
43.800000	6.7	1000.0	120.000	-15.4	43.2	49.9
54.360000	13.2	1000.0	120.000	-15.8	34.3	47.5
72.840000	-0.3	1000.0	120.000	-16.3	44.6	44.3
97.140000	10.4	1000.0	120.000	-15.6	35.3	45.7
145.620000	8.1	1000.0	120.000	-12.3	40.3	48.4
163.980000	2.4	1000.0	120.000	-11.1	46.7	49.1

30-200MHz Radiated Disturbance Test

Common Information

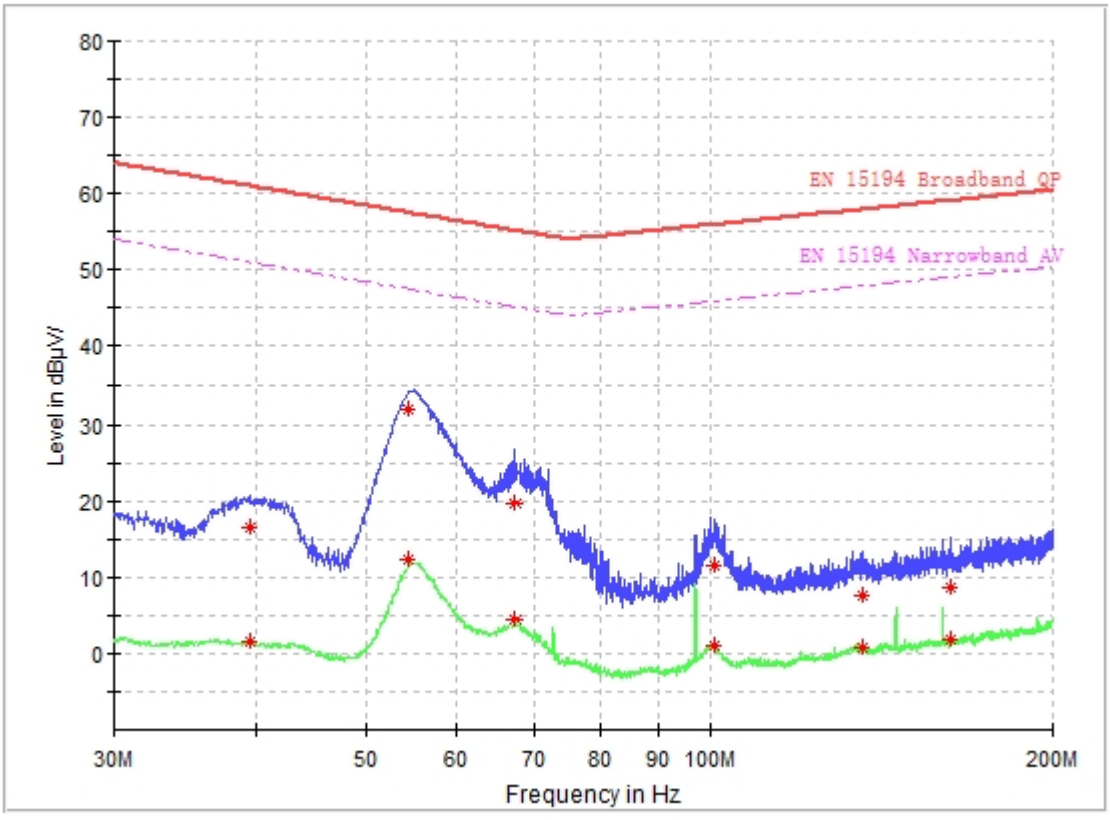
Test Description:	30-200MHz Radiated Emission
EUT Name:	Hub Motor
Model:	D7-175X
Client:	SUZHOU TOSEVEN NEW ENERGY TECHNOLOGY CO.,LTD
Op Cond:	power on (DC)
Operator:	Quanyu Di
Test Spec:	EN 15194
Sample No:	613759-1
Comment:	Vertical
Comment:	T23.1C, H57.3%, P1003hPa

Automotive Setup: EN 15194 RE [EMI radiated]

Device Mode: Scan Mode

Band	Subrange	Steps	DET	IF BW	MT	PA	POL
9124	30 - 200 MHz	60 kHz	PK+; AVG	120 kHz	5 ms	0 dB	-
9118	200 MHz - 1 GHz	60 kHz	PK+; AVG	120 kHz	5 ms	0 dB	-

9124



QP

Frequency (MHz)	QuasiPeak (dB¦ìV/m)	Meas. Time (ms)	Bandwidth (kHz)	Corr. (dB/m)	Margin - QPK (dB)	Limit - QPK (dB¦ìV/m)
39.480000	16.6	1000.0	120.000	-15.3	44.5	61.0
54.480000	32.0	1000.0	120.000	-15.9	25.5	57.5
67.620000	19.7	1000.0	120.000	-16.3	35.5	55.1
100.680000	11.6	1000.0	120.000	-15.5	44.4	55.9
136.140000	7.7	1000.0	120.000	-13.0	50.3	57.9
162.900000	8.8	1000.0	120.000	-11.2	50.3	59.1

CAV

Frequency (MHz)	CAverage (dB¦ìV/m)	Meas. Time (ms)	Bandwidth (kHz)	Corr. (dB/m)	Margin - QPK (dB)	Limit - QPK (dB¦ìV/m)
39.480000	1.6	1000.0	120.000	-15.3	49.4	51.0
54.480000	12.2	1000.0	120.000	-15.9	35.3	47.5
67.620000	4.4	1000.0	120.000	-16.3	40.7	45.1
100.680000	1.1	1000.0	120.000	-15.5	44.8	45.9
136.140000	0.7	1000.0	120.000	-13.0	47.2	47.9
162.900000	1.8	1000.0	120.000	-11.2	47.3	49.1

200-1000MHz Radiated Disturbance Test

Common Information

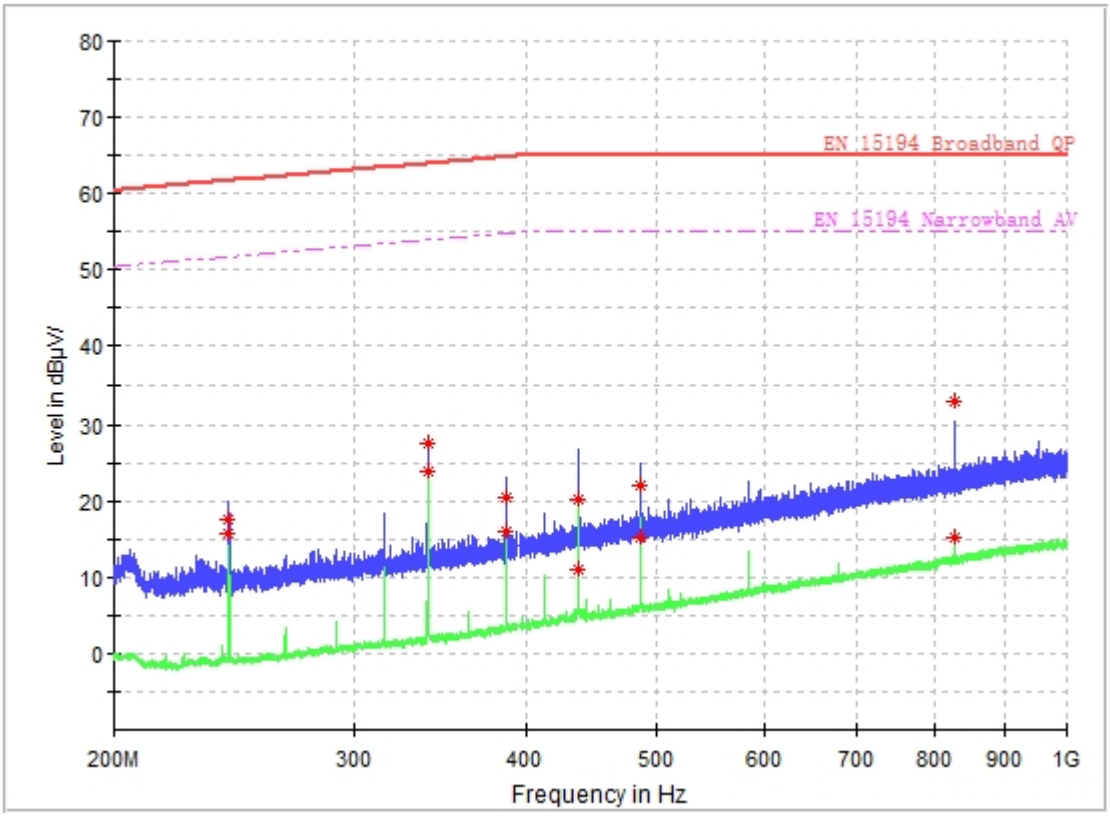
Test Description:	200-1000MHz Radiated Emission
EUT Name:	Hub Motor
Model:	D7-175X
Client:	SUZHOU TOSEVEN NEW ENERGY TECHNOLOGY CO.,LTD
Op Cond:	power on (DC)
Operator:	Quanyu Di
Test Spec:	EN 15194
Sample No:	613759-1
Comment:	Horizontal
Comment:	T23.1C, H57.3%, P1003hPa

Automotive Setup: EN 15194 RE [EMI radiated]

Device Mode: Scan Mode

Band	Subrange	Steps	DET	IF BW	MT	PA	POL
9124	30 - 200 MHz	60 kHz	PK+; AVG	120 kHz	5 ms	0 dB	-
9118	200 MHz - 1 GHz	60 kHz	PK+; AVG	120 kHz	5 ms	0 dB	-

9118



QP

Frequency (MHz)	QuasiPeak (dB¦ìV/m)	Meas. Time (ms)	Bandwidth (kHz)	Corr. (dB/m)	Margin - QPK (dB)	Limit - QPK (dB¦ìV/m)
243.020000	17.7	1000.0	120.000	-13.0	44.0	61.7
340.220000	27.5	1000.0	120.000	-9.8	36.4	63.9
388.760000	20.4	1000.0	120.000	-8.5	44.4	64.8
437.240000	20.2	1000.0	120.000	-7.3	44.8	65.0
485.900000	21.9	1000.0	120.000	-6.3	43.1	65.0
826.040000	33.2	1000.0	120.000	1.1	31.8	65.0

CAV

Frequency (MHz)	CAverage (dB¦ìV/m)	Meas. Time (ms)	Bandwidth (kHz)	Corr. (dB/m)	Margin - CAV (dB)	Limit - CAV (dB¦ìV/m)
243.020000	15.8	1000.0	120.000	-13.0	35.9	51.7
340.220000	23.7	1000.0	120.000	-9.8	30.2	53.9
388.760000	16.0	1000.0	120.000	-8.5	38.8	54.8
437.240000	11.0	1000.0	120.000	-7.3	44.0	55.0
485.900000	15.3	1000.0	120.000	-6.3	39.7	55.0
826.040000	15.3	1000.0	120.000	1.1	39.7	55.0

200-1000MHz Radiated Disturbance Test

Common Information

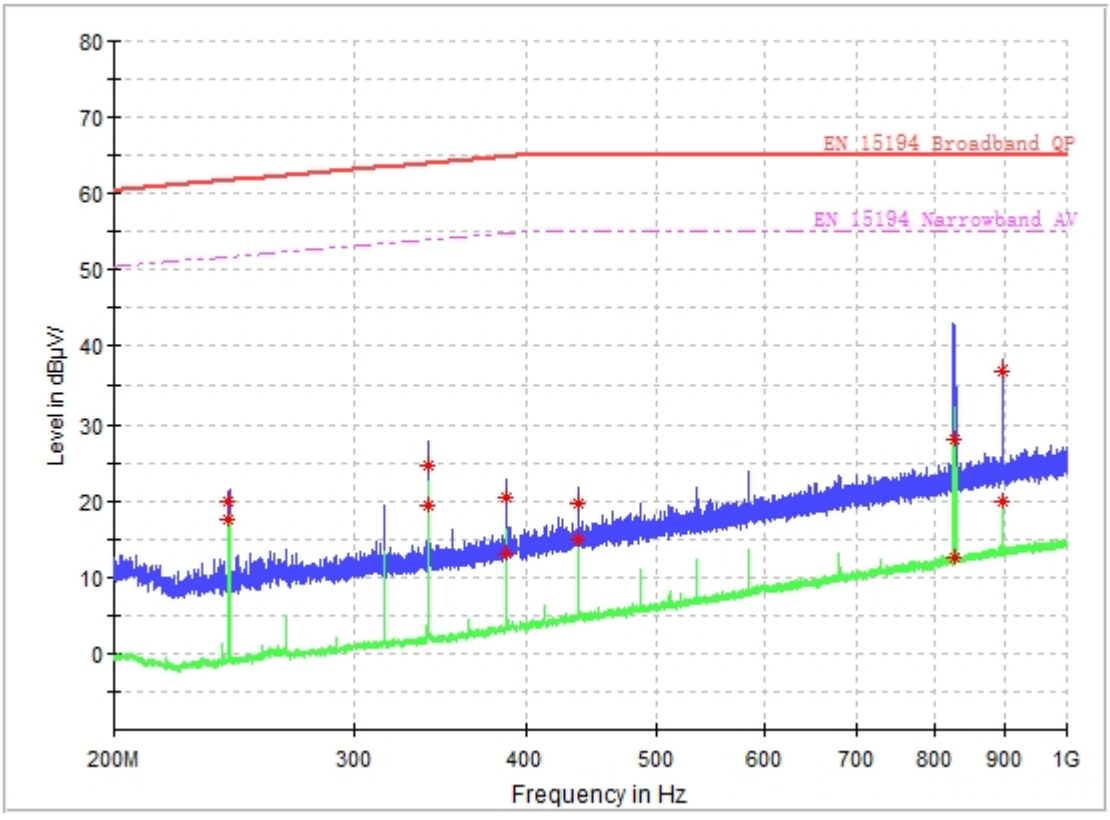
Test Description:	200-1000MHz Radiated Emission
EUT Name:	Hub Motor
Model:	D7-175X
Client:	SUZHOU TOSEVEN NEW ENERGY TECHNOLOGY CO.,LTD
Op Cond:	power on (DC)
Operator:	Quanyu Di
Test Spec:	EN 15194
Sample No:	613759-1
Comment:	Vertical
Comment:	T23.1C, H57.3%, P1003hPa

Automotive Setup: EN 15194 RE [EMI radiated]

Device Mode: Scan Mode

Band	Subrange	Steps	DET	IF BW	MT	PA	POL
9124	30 - 200 MHz	60 kHz	PK+; AVG	120 kHz	5 ms	0 dB	-
9118	200 MHz - 1 GHz	60 kHz	PK+; AVG	120 kHz	5 ms	0 dB	-

9118



QP

Frequency (MHz)	QuasiPeak (dB¦ÌV/m)	Meas. Time (ms)	Bandwidth (kHz)	Corr. (dB/m)	Margin - QPK (dB)	Limit - QPK (dB¦ÌV/m)
243.020000	19.9	1000.0	120.000	-13.0	41.9	61.7
340.340000	24.6	1000.0	120.000	-9.8	39.4	63.9
388.820000	20.4	1000.0	120.000	-8.5	44.4	64.8
437.480000	19.7	1000.0	120.000	-7.3	45.3	65.0
826.400000	28.1	1000.0	120.000	1.1	36.9	65.0
898.460000	37.1	1000.0	120.000	2.7	27.9	65.0

CAV

Frequency (MHz)	CAverage (dB¦ÌV/m)	Meas. Time (ms)	Bandwidth (kHz)	Corr. (dB/m)	Margin - CAV (dB)	Limit - CAV (dB¦ÌV/m)
243.020000	17.6	1000.0	120.000	-13.0	34.1	51.7
340.340000	19.5	1000.0	120.000	-9.8	34.4	53.9
388.820000	13.1	1000.0	120.000	-8.5	41.7	54.8
437.480000	14.9	1000.0	120.000	-7.3	40.1	55.0
826.400000	12.5	1000.0	120.000	1.1	42.5	55.0
898.460000	19.8	1000.0	120.000	2.7	35.2	55.0

30-200MHz Radiated Disturbance Test

Common Information

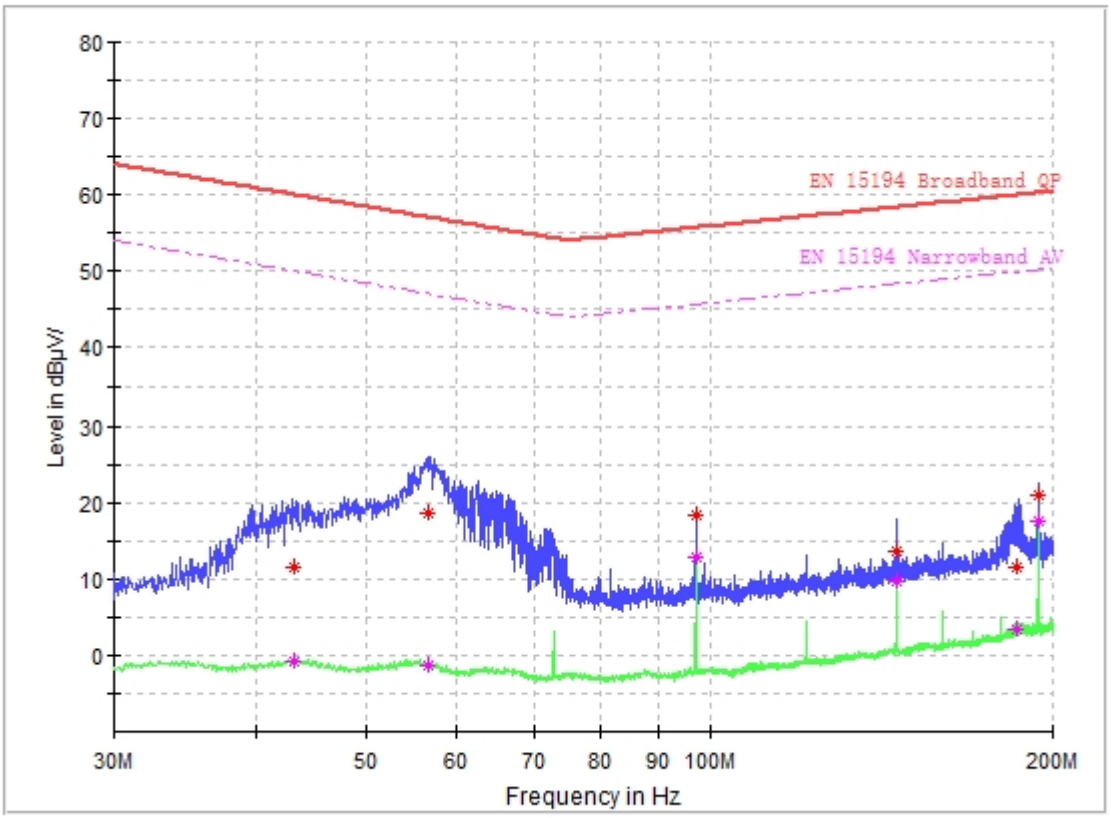
Test Description:	30-200MHz Radiated Emission
EUT Name:	Hub Motor
Model:	K7-135X
Client:	SUZHOU TOSEVEN NEW ENERGY TECHNOLOGY CO.,LTD
Op Cond:	power on (DC)
Operator:	Quanyu Di
Test Spec:	EN 15194
Sample No:	613759-2
Comment:	Horizontal
Comment:	T23.1C, H57.3%, P1003hPa

Automotive Setup: EN 15194 RE [EMI radiated]

Device Mode: Scan Mode

Band	Subrange	Steps	DET	IF BW	MT	PA	POL
9124	30 - 200 MHz	60 kHz	PK+; AVG	120 kHz	5 ms	0 dB	-
9118	200 MHz - 1 GHz	60 kHz	PK+; AVG	120 kHz	5 ms	0 dB	-

9124



QP

Frequency (MHz)	QuasiPeak (dB¦ÌV/m)	Meas. Time (ms)	Bandwidth (kHz)	Corr. (dB/m)	Margin - QPK (dB)	Limit - QPK (dB¦ÌV/m)
43.200000	11.4	1000.0	120.000	-15.4	48.6	60.0
56.760000	18.6	1000.0	120.000	-16.0	38.5	57.0
97.080000	18.2	1000.0	120.000	-15.6	37.5	55.7
145.620000	13.7	1000.0	120.000	-12.3	44.6	58.4
186.300000	11.6	1000.0	120.000	-9.7	48.3	60.0
194.100000	20.9	1000.0	120.000	-9.2	39.4	60.2

CAV

Frequency (MHz)	CAverage (dB¦ÌV/m)	Meas. Time (ms)	Bandwidth (kHz)	Corr. (dB/m)	Margin - CAV (dB)	Limit - CAV (dB¦ÌV/m)
43.200000	-0.8	1000.0	120.000	-15.4	50.8	50.0
56.760000	-1.2	1000.0	120.000	-16.0	48.3	47.0
97.080000	12.9	1000.0	120.000	-15.6	32.8	45.7
145.620000	9.8	1000.0	120.000	-12.3	38.6	48.4
186.300000	3.4	1000.0	120.000	-9.7	46.6	50.0
194.100000	17.4	1000.0	120.000	-9.2	32.8	50.2

30-200MHz Radiated Disturbance Test

Common Information

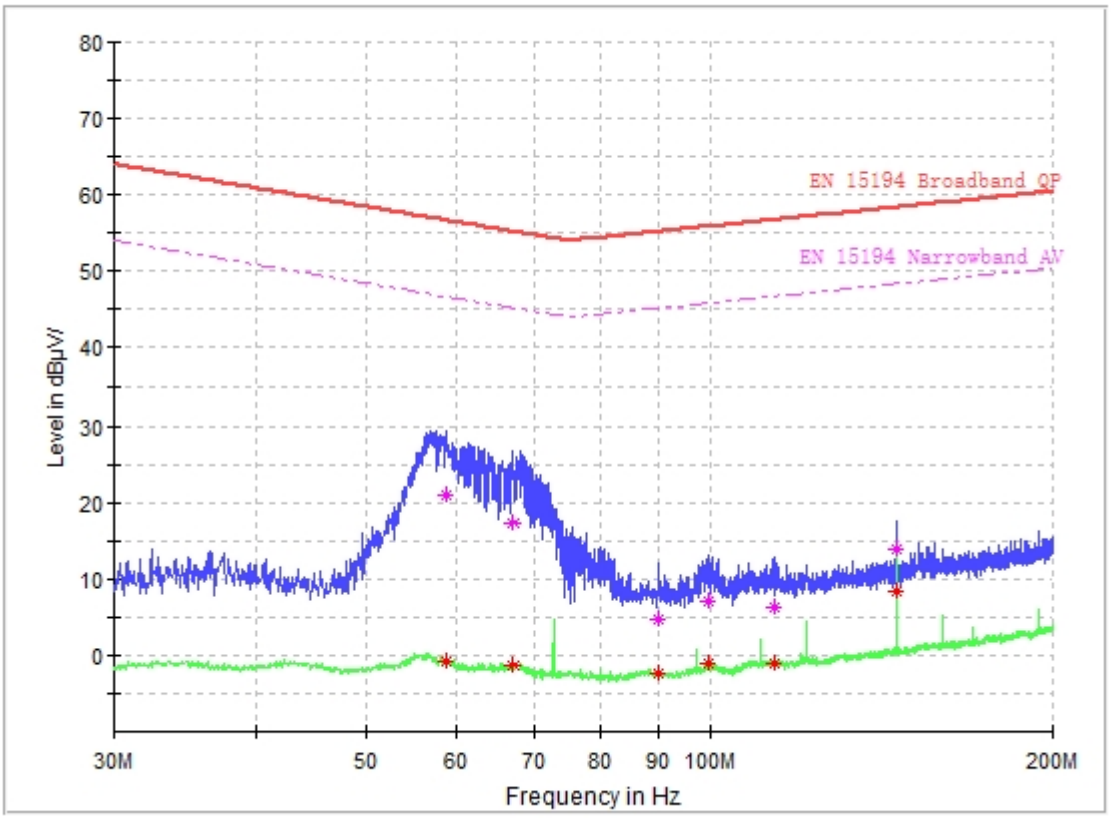
Test Description:	30-200MHz Radiated Emission
EUT Name:	Hub Motor
Model:	K7-135X
Client:	SUZHOU TOSEVEN NEW ENERGY TECHNOLOGY CO.,LTD
Op Cond:	power on (DC)
Operator:	Quanyu Di
Test Spec:	EN 15194
Sample No:	613759-2
Comment:	Vertical
Comment:	T23.1C, H57.3%, P1003hPa

Automotive Setup: EN 15194 RE [EMI radiated]

Device Mode: Scan Mode

Band	Subrange	Steps	DET	IF BW	MT	PA	POL
9124	30 - 200 MHz	60 kHz	PK+; AVG	120 kHz	5 ms	0 dB	-
9118	200 MHz - 1 GHz	60 kHz	PK+; AVG	120 kHz	5 ms	0 dB	-

9124



QP

Frequency (MHz)	QuasiPeak (dB¦ÌV/m)	Meas. Time (ms)	Bandwidth (kHz)	Corr. (dB/m)	Margin - QPK (dB)	Limit - QPK (dB¦ÌV/m)
58.740000	20.9	1000.0	120.000	-16.0	35.8	56.7
67.320000	17.3	1000.0	120.000	-16.3	37.9	55.2
90.120000	4.7	1000.0	120.000	-15.9	50.5	55.2
99.480000	7.1	1000.0	120.000	-15.5	48.7	55.9
114.000000	6.2	1000.0	120.000	-14.5	50.6	56.8
145.560000	13.8	1000.0	120.000	-12.3	44.6	58.4

CAV

Frequency (MHz)	CAverage (dB¦ÌV/m)	Meas. Time (ms)	Bandwidth (kHz)	Corr. (dB/m)	Margin - CAV (dB)	Limit - CAV (dB¦ÌV/m)
58.740000	-0.9	1000.0	120.000	-16.0	47.5	46.7
67.320000	-1.4	1000.0	120.000	-16.3	46.6	45.2
90.120000	-2.4	1000.0	120.000	-15.9	47.6	45.2
99.480000	-1.0	1000.0	120.000	-15.5	46.8	45.9
114.000000	-1.2	1000.0	120.000	-14.5	47.9	46.8
145.560000	8.4	1000.0	120.000	-12.3	39.9	48.4

200-1000MHz Radiated Disturbance Test

Common Information

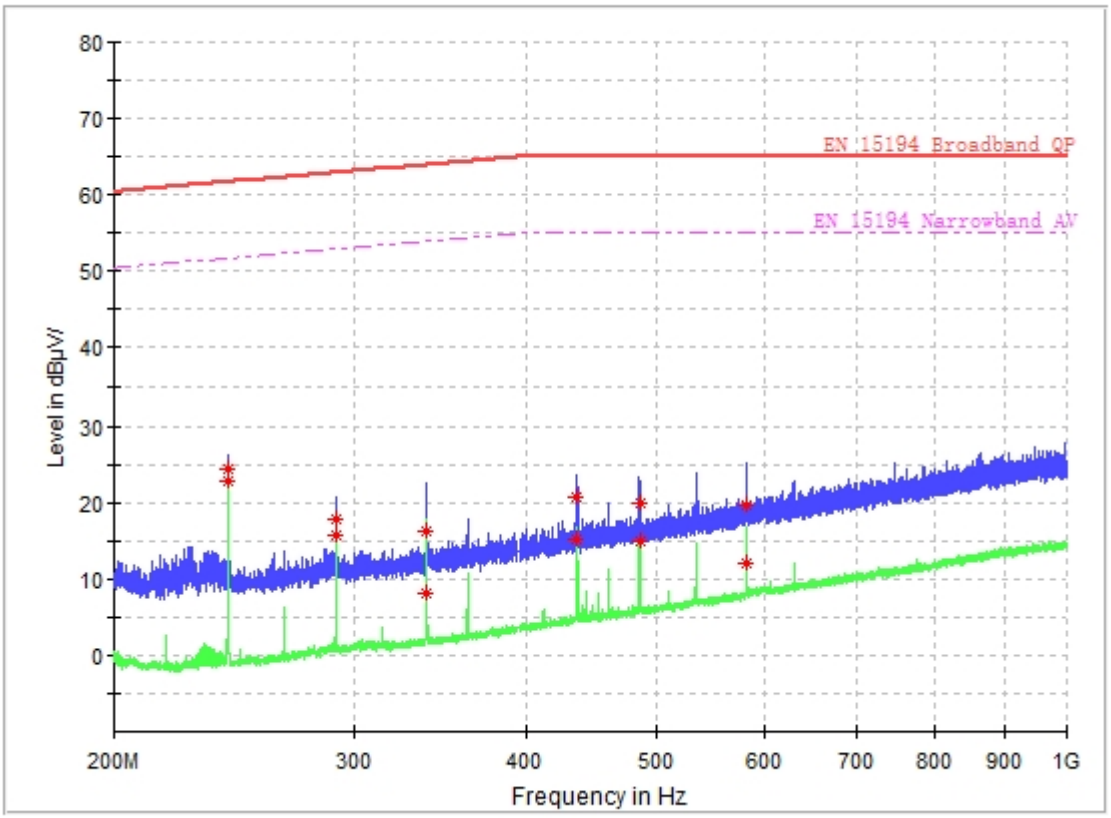
Test Description:	200-1000MHz Radiated Emission
EUT Name:	Hub Motor
Model:	K7-135X
Client:	SUZHOU TOSEVEN NEW ENERGY TECHNOLOGY CO.,LTD
Op Cond:	power on (DC)
Operator:	Quanyu Di
Test Spec:	EN 15194
Sample No:	613759-2
Comment:	Horizontal
Comment:	T23.1C, H57.3%, P1003hPa

Automotive Setup: EN 15194 RE [EMI radiated]

Device Mode: Scan Mode

Band	Subrange	Steps	DET	IF BW	MT	PA	POL
9124	30 - 200 MHz	60 kHz	PK+; AVG	120 kHz	5 ms	0 dB	-
9118	200 MHz - 1 GHz	60 kHz	PK+; AVG	120 kHz	5 ms	0 dB	-

9118



QP

Frequency (MHz)	QuasiPeak (dB¦ÌV/m)	Meas. Time (ms)	Bandwidth (kHz)	Corr. (dB/m)	Margin - QPK (dB)	Limit - QPK (dB¦ÌV/m)
242.540000	24.4	1000.0	120.000	-13.0	37.3	61.7
291.080000	17.9	1000.0	120.000	-11.1	45.1	62.9
339.440000	16.3	1000.0	120.000	-9.8	47.6	63.9
436.580000	20.7	1000.0	120.000	-7.4	44.3	65.0
485.120000	20.0	1000.0	120.000	-6.3	45.0	65.0
582.020000	19.6	1000.0	120.000	-4.0	45.4	65.0

CAV

Frequency (MHz)	CAverage (dB¦ÌV/m)	Meas. Time (ms)	Bandwidth (kHz)	Corr. (dB/m)	Margin - CAV (dB)	Limit - CAV (dB¦ÌV/m)
242.540000	22.7	1000.0	120.000	-13.0	29.0	51.7
291.080000	15.7	1000.0	120.000	-11.1	37.2	52.9
339.440000	8.2	1000.0	120.000	-9.8	45.7	53.9
436.580000	15.1	1000.0	120.000	-7.4	39.9	55.0
485.120000	14.8	1000.0	120.000	-6.3	40.2	55.0
582.020000	11.9	1000.0	120.000	-4.0	43.1	55.0

200-1000MHz Radiated Disturbance Test

Common Information

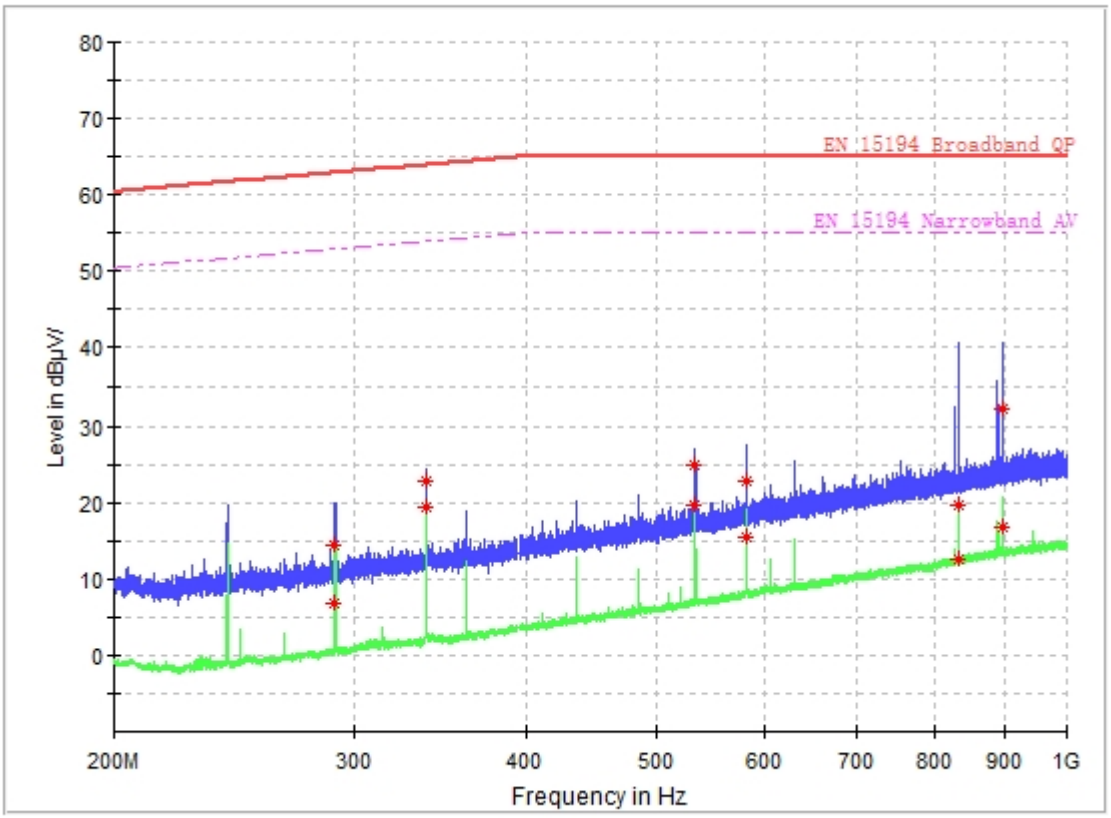
Test Description:	200-1000MHz Radiated Emission
EUT Name:	Hub Motor
Model:	K7-135X
Client:	SUZHOU TOSEVEN NEW ENERGY TECHNOLOGY CO.,LTD
Op Cond:	power on (DC)
Operator:	Quanyu Di
Test Spec:	EN 15194
Sample No:	613759-2
Comment:	Vertical
Comment:	T23.1C, H57.3%, P1003hPa

Automotive Setup: EN 15194 RE [EMI radiated]

Device Mode: Scan Mode

Band	Subrange	Steps	DET	IF BW	MT	PA	POL
9124	30 - 200 MHz	60 kHz	PK+; AVG	120 kHz	5 ms	0 dB	-
9118	200 MHz - 1 GHz	60 kHz	PK+; AVG	120 kHz	5 ms	0 dB	-

9118



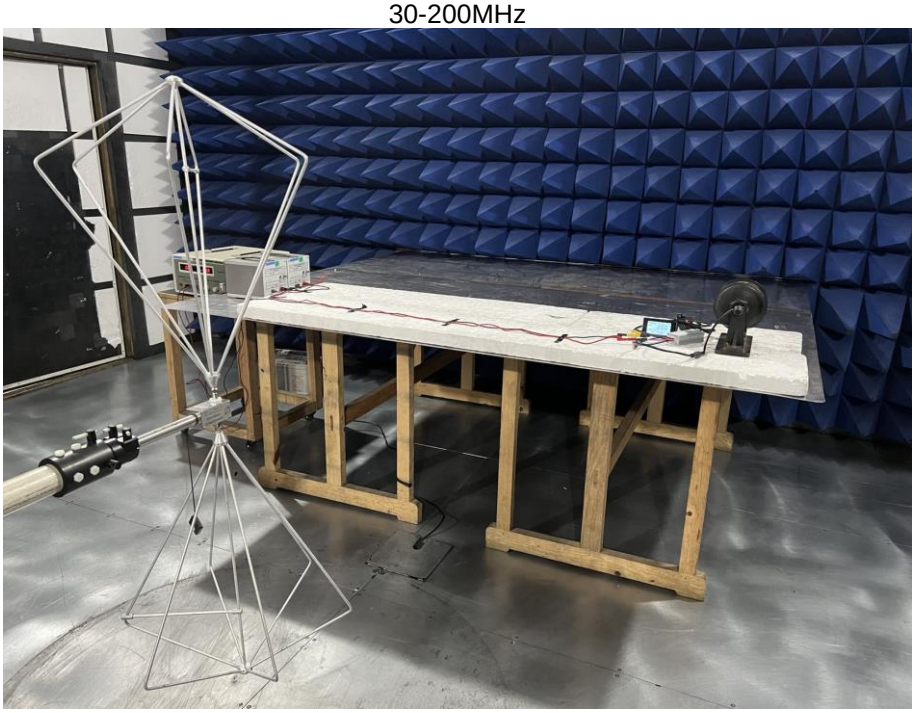
QP

Frequency (MHz)	QuasiPeak (dB¦ÌV/m)	Meas. Time (ms)	Bandwidth (kHz)	Corr. (dB/m)	Margin - QPK (dB)	Limit - QPK (dB¦ÌV/m)
290.780000	14.3	1000.0	120.000	-11.1	48.6	62.9
339.320000	22.8	1000.0	120.000	-9.8	41.1	63.9
533.300000	24.8	1000.0	120.000	-5.2	40.2	65.0
581.600000	22.9	1000.0	120.000	-4.0	42.1	65.0
832.280000	19.5	1000.0	120.000	1.2	45.5	65.0
898.400000	32.3	1000.0	120.000	2.7	32.7	65.0

CAV

Frequency (MHz)	CAverage (dB¦ÌV/m)	Meas. Time (ms)	Bandwidth (kHz)	Corr. (dB/m)	Margin - CAV (dB)	Limit - CAV (dB¦ÌV/m)
290.780000	6.8	1000.0	120.000	-11.1	46.1	52.9
339.320000	19.3	1000.0	120.000	-9.8	34.6	53.9
533.300000	19.7	1000.0	120.000	-5.2	35.3	55.0
581.600000	15.5	1000.0	120.000	-4.0	39.5	55.0
832.280000	12.5	1000.0	120.000	1.2	42.5	55.0
898.400000	16.7	1000.0	120.000	2.7	38.3	55.0

30-200MHz



Test Setup

200-1000MHz

Test Setup

2.1.8 Test Location

This test was carried out in 3m anechoic chamber.
.

2.2 Electrostatic discharge immunity test

2.2.1 Specification Reference

EN 15194:2017, Clause Annex C.8

2.2.2 Equipment Under Test

D7-175X, K7-135X

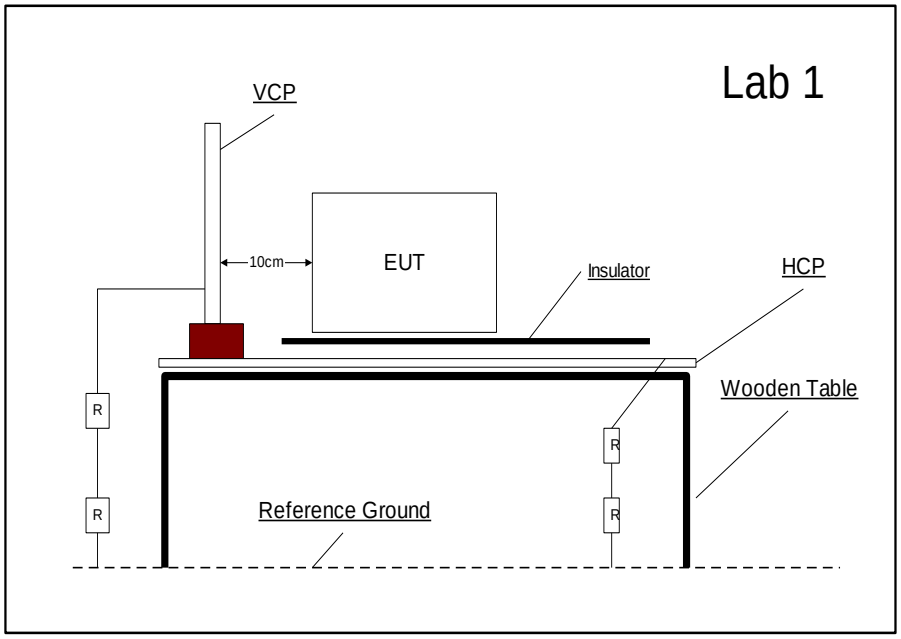
2.2.3 Date of Test

18/11/2021

2.2.4 Test Method

Using the air discharge method for non-metallic parts, contact discharge method for metallic parts with both vertical and horizontal couple plane discharge methods for the sides of the equipment under test, the required electrostatic discharge voltage levels in both voltage polarities were applied at the detailed pulse repartition rate.

During this testing any anomalies in the equipment under tests performance was recorded.



2.2.5 Environmental Conditions

Ambient Temperature	20.0°C
Relative Humidity	41.0 %
Atmospheric Pressure	1021.0 mbar

2.2.6 Specification Limits

Required Test Levels				Performance Criteria
Discharge type	Discharge Level (kV)		Number of discharges per location (each polarity)	
	Positive	Negative		
Air – Direct	2, 4 and 8	2, 4 and 8	<10>	B
Contact – Direct	2 and 4	2 and 4	<10>	B
Contact – Indirect	2 and 4	2 and 4	<10>	B

2.2.7 Test Results

Results for Configuration and Mode: Configuration 1/ Mode 1.

Performance assessment of the EUT made during this test: Pass.

Detailed results are shown below.

ID	Test Point	Discharge	Results									
			2kV		4kV		6kV		8kV		15kV	
			+	-	+	-	+	-	+	-	+	-
	HCP/VCP	Contact	✓	✓	✓	✓						
	Metal Enclosure	Contact	✓	✓	✓	✓						
	Gap	Air	✓	✓	✓	✓			✓	✓		
	Plastic Enclosure	Air	✓	✓	✓	✓			✓	✓		

Key to Results	
✓	The EUTs performance was not impacted when the ESD pulse was applied.
✓*	No discharge occurred at this point when the ESD pulse was applied
Ox	
Fx	
N/A	Not Appliance

Test Setup

2.2.8 Test Location

This test was carried out in shield room D.

2.3 Bulk current injection test

2.3.1 Specification Reference

EN 15194:2017, Clause Annex C.1.2.7

2.3.2 Equipment Under Test

D7-175X, K7-135X

2.3.3 Date of Test

16/11/2020

2.3.4 Test Method

The equipment under test was configured, on but insulted from, using a 0.05 m isolator, a horizontal coupling plane fitted to the top of a 0.9 m non-conductive table for table-top equipment; above a ground reference plane all within a test laboratory.

All associated cabling was configured, on but insulted from, using a 50 mm isolator, the same horizontal coupling plane as the equipment under test.

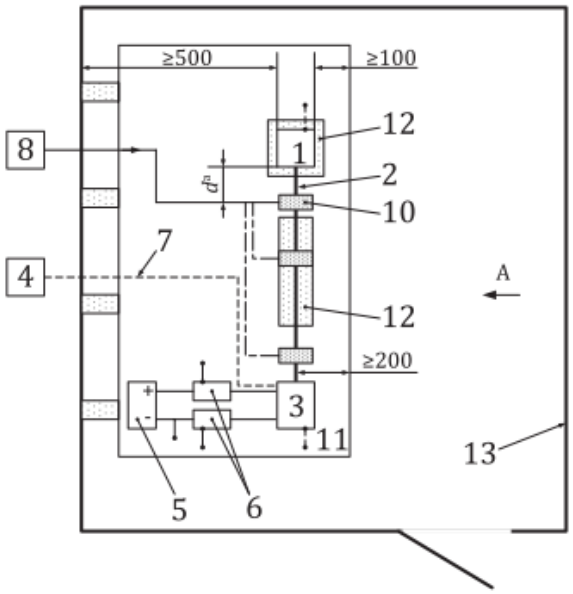
Using current clamps, the power ports and applicable signal and control ports were subjected to the required, pre calibrated RF injected signal strength, modulated as described, swept over the frequency range of test.

The injection probe shall be placed at (150 ± 50) mm from the connector of the DUT. Additional tests at d = (450 ± 50) mm and d = (750 ± 50) mm may be required.

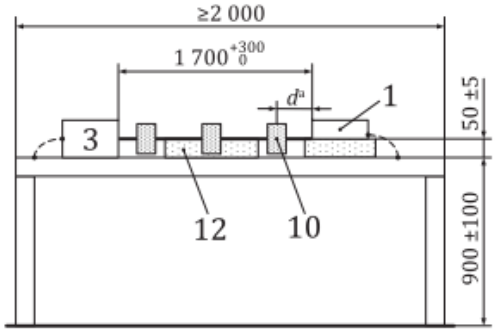
During this testing any anomalies in the equipment under tests performance was recorded.

Dimensions in millimetres

Top view



A



Side view

Key

1	DUT (grounded locally if required in test plan)	8	high frequency equipment (generator, amplifier and measuring instruments)
2	test harness	9	optional current measurement probe (not shown in this figure, but shown in Figure 2)
3	load simulator (placement and ground connection according to 7.5)	10	injection probe (represented at 3 positions)
4	stimulation and monitoring system	11	ground plane (bonded to shielded enclosure)
5	power supply	12	low relative permittivity support ($\varepsilon_r \leq 1{,}4$)
6	AN	13	shielded enclosure
7	optical fibres		

[a] See 7.6.1.1.

2.3.5 Environmental Conditions

Ambient Temperature	20.0°C
Relative Humidity	41.0 %
Atmospheric Pressure	1021.0 mbar

2.3.6 Specification Limits

Required Test Levels						Performance Criteria
Line Under Test	Frequency Range (MHz)	Level (mA)	Modulation	Step Size (%)	Dwell (s)	
DC Power Port	20 to 400	60	AM (80 %,1 kHz, sine wave)	1	2s	A
Supplementary information: --						

2.3.7 Test Results

Results for Configuration and Mode: Configuration 1/ Mode 1.

Performance assessment of the EUT made during this test: Pass.

Detailed results are shown below.

Tabulated Results for Bulk current injection test				
Modulation = 80% 1KHz sine wave	Step Size =1%		Dwell =2s	
Line Under Test	Frequency Range	Test Level	Distances from DUT	Result
DC power line	20MHz to 400MHz	60mA	150mm	Pass PC A
DC power line	20MHz to 400MHz	60mA	450mm	Pass PC A
DC power line	20MHz to 400MHz	60mA	750mm	Pass PC A

Test Setup

2.3.8 Test Location

This test was carried out in shield room A.

2.4 ESA immunity to electromagnetic radiation

2.4.1 Specification Reference

EN 15194:2017, Clause Annex C.1.2.7

2.4.2 Equipment Under Test

D7-175X, K7-135X

2.4.3 Date of Test

17/11/2021

2.4.4 Test Method

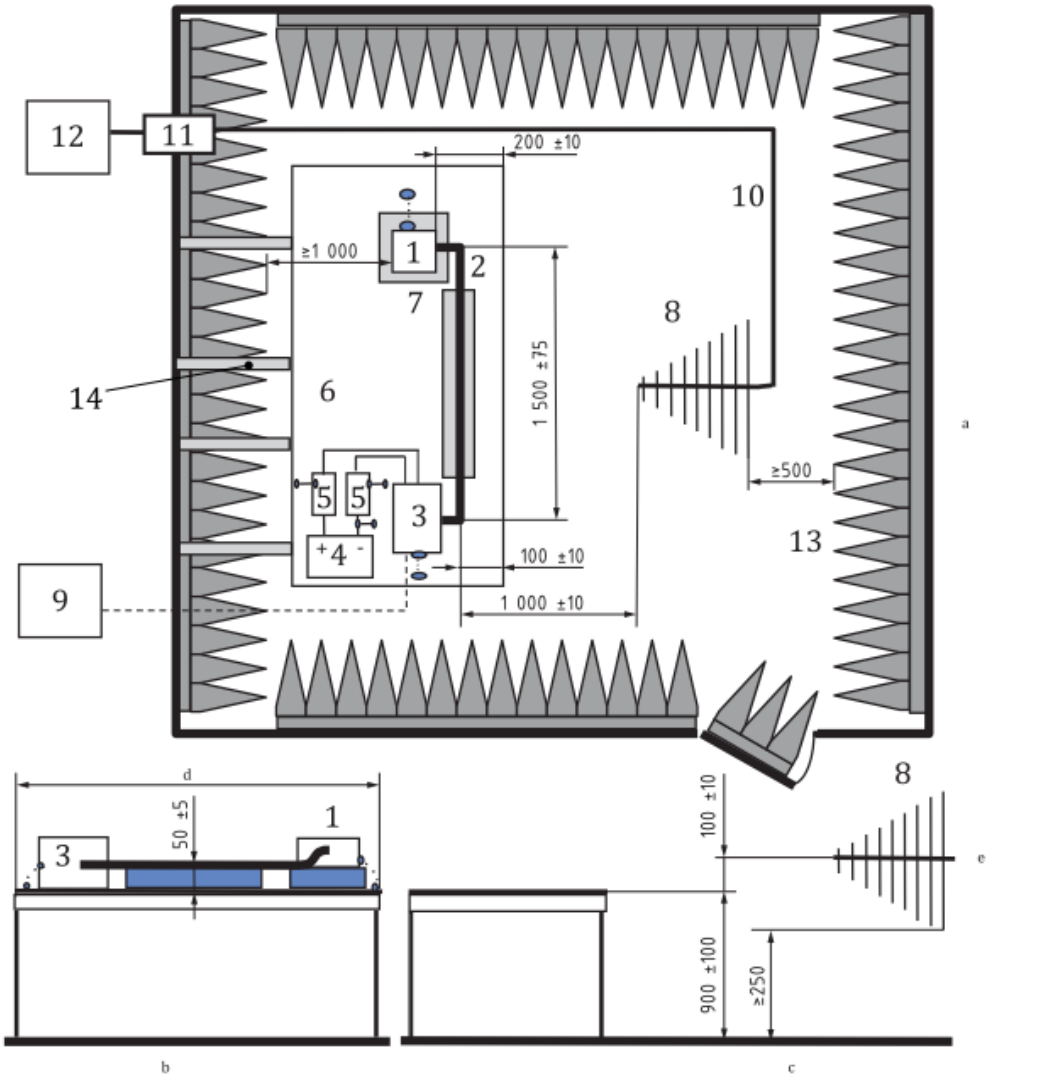
The equipment under test including associated cabling was configured, on a 0.9 m non-conductive table with a pre-calibrated semi anechoic chamber.

The equipment under test were subjected to the required RF field strength, modulated as described, swept over the frequency range of test with the antenna positioned in vertical polarizations.

During this testing any anomalies in the equipment under tests performance was recorded.

400-1000MHz

Dimensions in millimetres

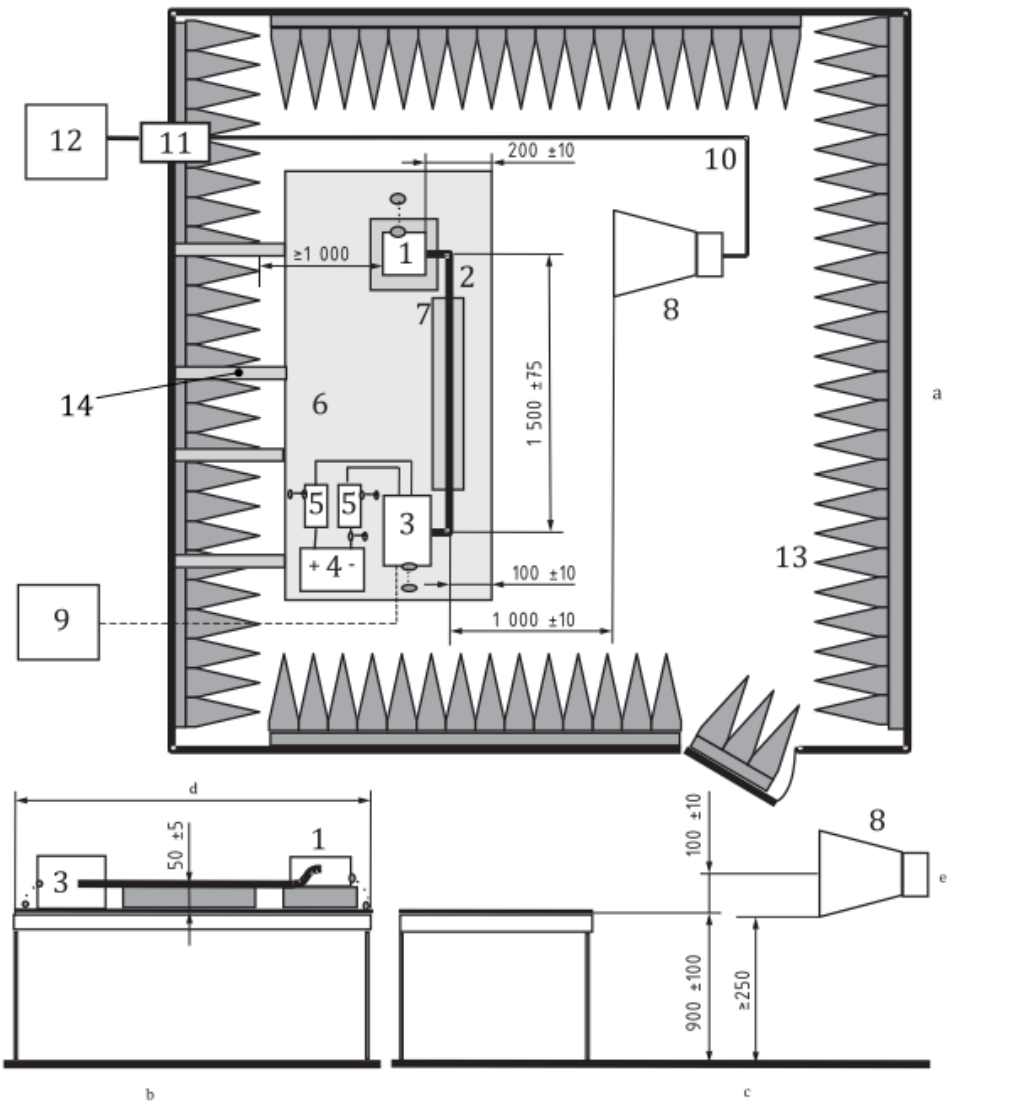


Key

1	DUT (grounded locally if required in test plan)	7	low relative permittivity support ($\varepsilon_r \leq 1{,}4$)
2	test harness	8	log-periodic antenna
3	load simulator (placement and ground: connection according to 7.5)	9	stimulation and monitoring system
4	power supply (location optional)	10	high quality double-shielded coaxial cable (50 Ω)
5	artificial network (AN)	11	bulkhead connector
6	ground plane (bonded to shielded enclosure)	12	RF signal generator and amplifier
a	Upper view (horizontal polarisation).	13	RF absorber material
b	Front view.	14	ground straps
c	Side view.		
d	See 7.1		

1000-2000MHz

Dimensions in millimetres



Key

1	DUT (grounded locally if required in test plan)	7	low relative permittivity support ($\varepsilon_r \leq 1{,}4$)
2	test harness	8	horn antenna
3	load simulator (placement and ground: connection according to 7.5)	9	stimulation and monitoring system
4	power supply (location optional)	10	high quality double-shielded coaxial cable (50 Ω)
5	artificial network (AN)	11	bulkhead connector
6	ground plane (bonded to shielded enclosure)	12	RF signal generator and amplifier
a	Upper view (horizontal polarisation).	13	RF absorber material
b	Front view.	14	ground straps
c	Side view.		
d	See 7.1		

2.4.5 Environmental Conditions

Ambient Temperature	19.1 °C
Relative Humidity	24.1 %
Atmospheric Pressure	1033.0 mbar

2.4.6 Specification Limits

Required Test Levels					
Frequency Range (MHz)	Level (V/m)	Modulation	Step Size (%)	Dwell (s)	Performance Criteria
400 to 2000	30	AM (80 %,1 kHz, sine wave)	1	2	A
Supplementary information: EUT powered at one of the Nominal input voltages and frequencies					

2.4.7 Test Results

Results for Configuration and Mode: Configuration 1/ Mode 1.

Performance assessment of the EUT made during this test: Pass.

Detailed results are shown below.

Tabulated Results for RF Electromagnetic Field 400-2000 MHz					
Antenna polarization	Test Level	step	Dwell Time	modulation	Result
Vertical	30 V/m	1%	2 s	1KHZ SINE 80% AM	Pass PC A

400-1000MHz

Test Setup

1000-2000MHz

Test Setup

2.4.8 Test Location

This test was carried out in 3m anechoic chamber.

3 Test Equipment Information

3.1 General Test Equipment Used

Instrument	Manufacturer	Type No	TE No	Calibration Date	Calibration Due
Radiated Emissions					
Biconical Antenna	Schwarzbeck	VHBB 9124	487/621534	2021/01/20	2024/01/19
Log Antenna	Schwarzbeck	VULP 9118A	487/621026	2018/12/28	2021/12/27
LISN	Schwarzbeck	NNBM 8124	487/601223	2021/07/02	2022/07/01
LISN	Schwarzbeck	NNBM 8124	487/601224	2021/07/02	2022/07/01
Semi-anechoic Chamber	Jinlida	3m	NA	NA	NA
Immunity					
ESD simulator	HAEFELY	ONYX 30	487/751520	2021/09/17	2022/09/16
Power Amplifier	TESEQ	CBA1G-500	487/400908	2020/12/07	2021/12/06
Power Amplifier	TESEQ	CBA3G-100	487/400909	2020/12/07	2021/12/06
Signal Generator	Rohde & Schwarz	SMB 100A	487/391120	2020/12/07	2021/12/06
Power Meter	Rohde & Schwarz	NRP2	487/741156	2020/12/07	2021/12/06
Antenna	Schwarzbeck	STLP 9128Ds	487/621432	2021/04/11	2023/04/10
Coupler	Amplifier Research	DC7144A	487/571117	2020/12/07	2021/12/06
Coupler	Amplifier Research	DC6180A	487/571116	2020/12/07	2021/12/06
LISN	Schwarzbeck	NNBM 8124	487/601223	2021/07/02	2022/07/01
LISN	Schwarzbeck	NNBM 8124	487/601224	2021/07/02	2022/07/01
Continuous Wave Simulator	EM TEST	CWS 500D	487/750812	2021/05/07	2022/05/06
Current Inject Probe	FCC	F-130A-1	487/750813	2021/05/07	2022/05/06

4 Measurement Uncertainty

For a 95% confidence level, the measurement uncertainties for defined systems are:

Test Name	Measurement Uncertainty
Radiated Disturbance	30MHz to 1GHz, ±3.88dB
Electrostatic discharge immunity test	The test was applied using proprietary equipment that meets the requirements of EN 61000-4-2
Bulk current injection test	The test was applied using proprietary equipment that meets the requirements of ISO 11451-4
EAS immunity to electromagnetic radiation	The test was applied using proprietary equipment that meets the requirements of ISO 11451-2

Measurement Uncertainty Decision Rule

Determination of conformity with the specification limits is based on the decision rule according to IEC Guide 115: 2007, clause 4.4.3 and 4.5.1.

5 Photographs

D7-175X


DC MOTO CONTROLLER BY LITHIUM BATTERY
VOLTAGE : DC48V
BRAKES: LOW LEVEL
CURRENT: 25A
BOOSTER: 1: 5
SPEET SET1. 1-4. 2VDUAL MODE
2021090001


SPEED
MODE
SW900

K7-135X


+
M
−


DC MOTO CONTROLLER BY LITHIUM BATTERY
VOLTAGE : DC36V
BRAKES: LOW LEVEL
CURRENT: 18A
BOOSTER: 1: 5
STREET SET1. 1-4. 2VDUAL MODE