


Prüfbericht-Nr.: <i>Test report no.:</i>	CN21J5RW 001	Auftrags-Nr.: <i>Order no.:</i>	190133610	Seite 1 von 27 Page 1 of 27
Kunden-Referenz-Nr.: <i>Client reference no.:</i>	N/A	Auftragsdatum: <i>Order date:</i>	2021-06-22	
Auftraggeber: <i>Client:</i>	Shanghai Himo electric technology co., ltd Room K50, Floor 1, Building 6, No.4299 Jindu Road, Minhang District, Shanghai, P.R. China			
Prüfgegenstand: <i>Test item:</i>	electric bicycle			
Bezeichnung / Typ-Nr.: <i>Identification / Type no.:</i>	ZB20			
Auftrags-Inhalt: <i>Order content:</i>	EMC report			
Prüfgrundlage: <i>Test specification:</i>	EN 15194:2017 Clause 4.2.15.1, 4.2.15.2			
Wareneingangsdatum: <i>Date of sample receipt:</i>	2021-06-23			
Prüfmuster-Nr.: <i>Test sample no.:</i>	Engineering sample			
Prüfzeitraum: <i>Testing period:</i>	2021-06-23 to 2021-06-24			
Ort der Prüfung: <i>Place of testing:</i>	Refer to section 1.1			
Prüflaboratorium: <i>Testing laboratory:</i>	TÜV Rheinland (China) Ltd.			
Prüfergebnis*: <i>Test result*:</i>	Pass			
geprüft von: <i>tested by:</i>	Wu Yanping	genehmigt von: <i>authorized by:</i>	Zhu Qiusheng	
Datum: <i>Date:</i>	2021-07-19	Ausstellungsdatum: <i>Issue date:</i>	2021-07-19	
Stellung / Position	PE	Stellung / Position	Reviewer	
Sonstiges / Other:				
Zustand des Prüfgegenstandes bei Anlieferung: <i>Condition of the test item at delivery:</i>		Prüfmuster vollständig und unbeschädigt <i>Test item complete and undamaged:</i>		
<p>* Legende: 1 = sehr gut 2 = gut 3 = befriedigend 4 = ausreichend 5 = mangelhaft P(ass) = entspricht o.g. Prüfgrundlage(n) F(ail) = entspricht nicht o.g. Prüfgrundlage(n) N/A = nicht anwendbar N/T = nicht getestet</p> <p>Legend: 1 = very good 2 = good 3 = satisfactory 4 = sufficient 5 = poor P(ass) = passed a.m. test specifications(s) F(ail) = failed a.m. test specifications(s) N/A = not applicable N/T = not tested</p>				
<p>Dieser Prüfbericht bezieht sich nur auf das o.g. Prüfmuster und darf ohne Genehmigung der Prüfstelle nicht auszugsweise vervielfältigt werden. Dieser Bericht berechtigt nicht zur Verwendung eines Prüfzeichens.</p> <p><i>This test report only relates to the a. m. test sample. Without permission of the test center this test report is not permitted to be duplicated in extracts. This test report does not entitle to carry any test mark.</i></p>				

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TEST SUMMARY

4.1.1 RADIATED EMISSION

Result:

Pass

5.1.1 ELECTROSTATIC DISCHARGE

Result:

Pass

5.1.2 RADIO FREQUENCY ELECTROMAGNETIC FIELD

Result:

Pass

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1 Test Sites

1.1 Test Facilities

Laboratory: GRG METROLOGY&TEST BEIJING CO., LTD
Address: 1-2Floor,Building 5,No.8,Liangshuihe No.2 Street, Beijing Development Area, Beijing

The used test equipment is in accordance with CISPR 16-1 series standards for measurement of radio interference.

1.2 List of Test and Measurement Instruments

Table 1: List of Test and Measurement Equipment

Lab : (Radiated Electromagnetic Field Emission, Electrostatic Discharge and Radio Frequency Electromagnetic Field)

No.	Equipment	Manufacturer	Model	Serial no.	Cal. due date
1	EMI receiver	R & S	ESW 8	101151	2021-12-08
2	Bi-conical antenna	SCHWARZ BECK	BBA9106+VHB B9124	01330	2021-11-26
3	Log-periodic antenna	SCHWARZ BECK	VUSLP 9111B	00437	2021-11-26
4	Pre-amplifier	SONOMA	310N	391677	2021-11-26
5	Signal Generator	Keysight	N5171B	MY59100294	2021-11-23
6	Log-periodic antenna	SCHWARZ BECK	STLP 9128E	3119	2021-11-26
7	Horn antenna	SCHWARZ BECK	BBHA 9120J	00231	2021-11-26
8	Power Amplifier	RFLIGHT	NTWPA-008101000E	19103308	2021-11-23
9	Power Amplifier	RFLIGHT	NTWPA-1060200E	19109059	2021-11-23
10	Field probe	DARE	RSS2010S-SET	RS10H-1901006	2021-12-15
11	Signal Generator	R & S	SMC100A	105556	2022-03-15
12	Power Amplifier	RFLIGHT	NTWPA-000001013500E	16069027	2022-04-12
13	Antenna	AR	ATP 10K100M	0345849	2022-04-11
14	Power probe	AR	FL7040	0344781	2021-11-28
15	ESD Simulator	TESEQ	NSG437	1009	2021-11-22

1.3 Measurement Uncertainties

Where relevant, the following measurement uncertainty levels have been estimated for tests performed on the apparatus.

The reported expanded uncertainty of measurement is stated as the standard uncertainty of measurement multiplied by the coverage factor of $k=2$, which for a normal distribution corresponds to a coverage probability of approximately 95%.

Table 2: Measurement Uncertainty levels

Test	Parameters	Expanded uncertainty (U_{cispr})
Conducted Emission	Level accuracy (150kHz to 30MHz)	N/A
Electromagnetic Radiated Emission (3-loop)	Level accuracy (9kHz to 30MHz)	N/A
Radiated Emission	Level accuracy (9kHz to 30MHz)	N/A
Radiated Emission	Level accuracy (30MHz to 200MHz)	$\pm 3.2\text{dB}$ (Horizontal and Vertical polarization)
	Level accuracy (200MHz to 1000MHz)	$\pm 3.3\text{dB}$ (Horizontal and Vertical polarization)
Radiated Emission	Level accuracy (1 to 6GHz) (6 to 18GHz)	N/A
Insertion Loss	Level accuracy (150kHz to 1605kHz)	N/A
Mains Harmonic	Voltage	N/A
Voltage Fluctuations & Flicker	Voltage	N/A

As U_{lab} in all applicable tests listed above are less than U_{cispr} according to CISPR 16-4-2:2003,

- compliance is deemed to occur if no measured disturbance exceeds the disturbance limit;
- non-compliance is deemed to occur if any measured disturbance exceeds the disturbance limit.

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2 General Product Information

2.1 Product Function and Intended Use

The EUT (equipment under test) is an electric bicycle. For the further information, refer to the user's manual.

2.2 Ratings and System Details

Product name	:	electric bicycle
Type	:	ZB20
System input voltage	:	DC48V
Max. Speed	:	25 km/h
Max. continuous rated power	:	250W
Protection class	:	III

2.3 Independent Operation Modes

Emission according to C.2.2.2 and C.3.1.4,
Immunity according to C.4.4 of EN15194:2017.

2.4 Noise Generating and Noise Suppressing Parts

Refer to the circuit diagram for further information.

2.5 Submitted Documents

Construction diagram, BOM, User's manual, Nameplate

3 Test Set-up and Operation Modes

3.1 Principle of Configuration Selection

Emission: The equipment under test (EUT) was configured to measure its highest possible emission level. The test conditions were adapted accordingly in reference to the instructions for use.

Refer to the related paragraph of this report.

Immunity: The equipment under test (EUT) was configured to have its highest possible susceptibility against the tested phenomena. The test conditions were adapted accordingly in reference to the instructions for use.

Refer to the related paragraph of this report.

3.2 Physical Configuration for Testing

Refer to the related paragraph of this report.

3.3 Test Operation and Test Software

Refer to the related paragraph of this report.
No software was used.

3.4 Special Accessories and Auxiliary Equipment

None.

3.5 Countermeasures to achieve EMC Compliance

None.

4 Test Results Emission

4.1 Emission in the Frequency Range above 30 MHz

4.1.1 Radiated emission

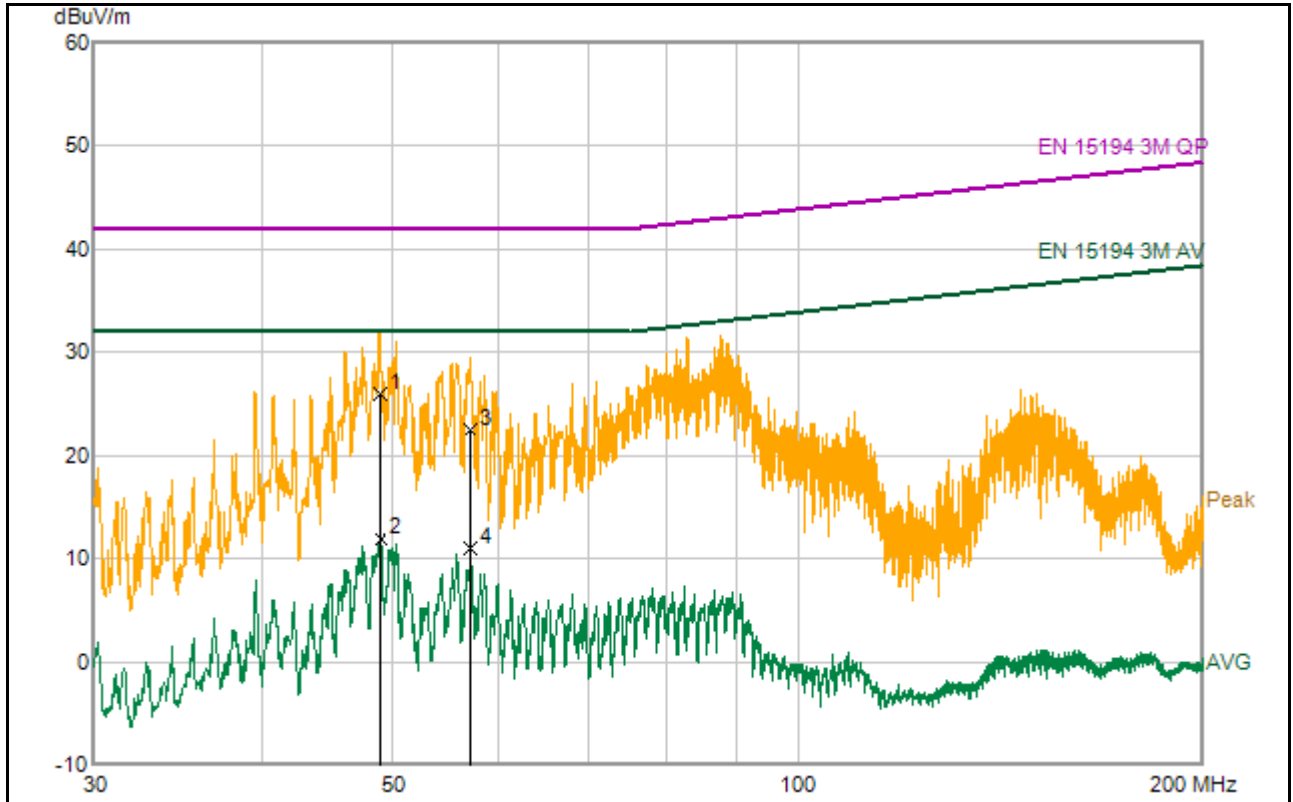
Result:	Pass
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Date of testing	: 2021.06.24
Test procedure	: EN 15194:2017
Frequency range	: 30-1000MHz
Limits	: Peak limits (3m test distance): 30MHz-75MHz: 42dB(uV/m) 75MHz-400MHz: 42-53 dB(uV/m), Increasing linearly with the logarithm of the frequency 400MHz-1000MHz: 53dB(uV/m) Average limits (3m test distance): 30MHz-75MHz: 32dB(uV/m) 75MHz-400MHz: 32-43 dB(uV/m), Increasing linearly with the logarithm of the frequency 400MHz-1000MHz: 43dB(uV/m)
Kind of test site	: Semi-anechoic chamber
Operation mode	: According to C.2.2.2 and C.3.1.4

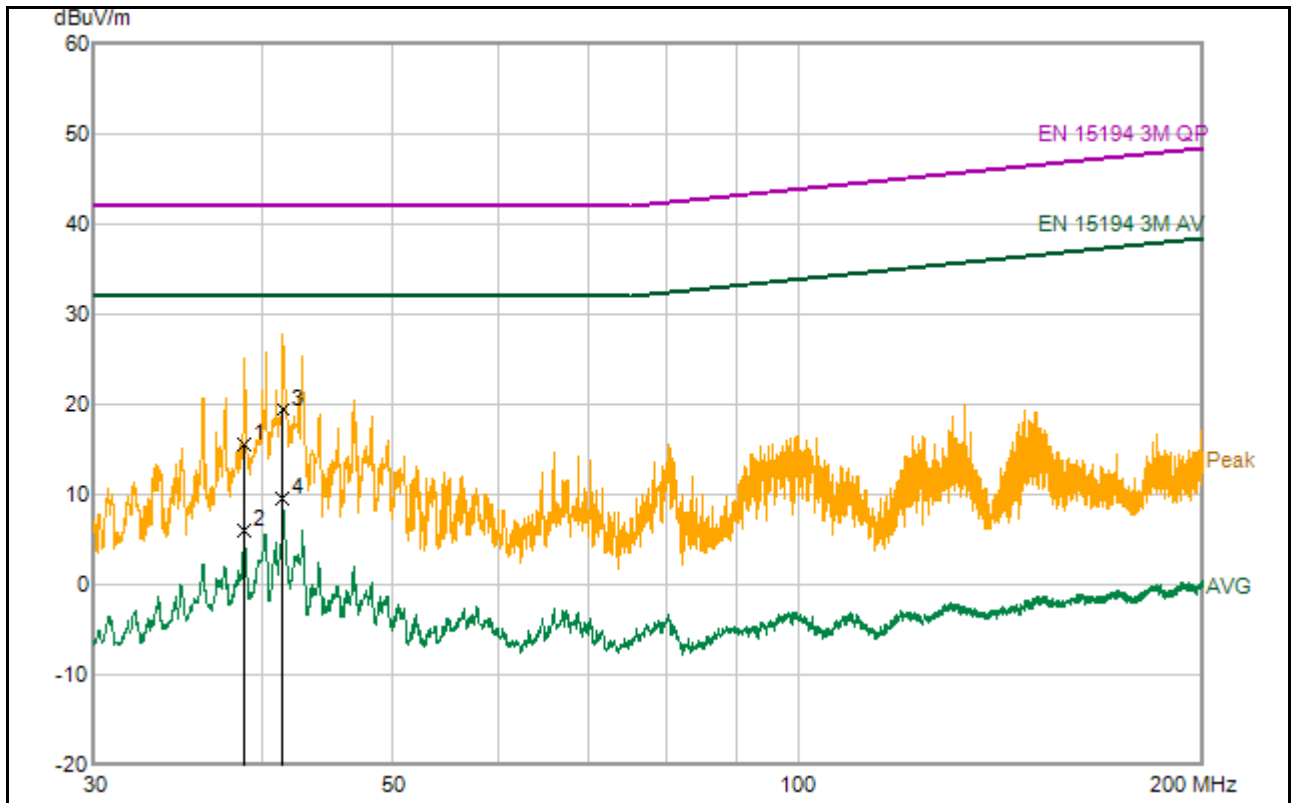
The radiated disturbance test was carried out in a semi-anechoic chamber. The test distance from the receiving antenna to the EUT is 3m. The normalized site attenuation of the semi-anechoic chamber is regularly calibrated to ensure the radiated disturbance test results are valid. The height of the antenna is 1.8m±0.05m for vertical and horizontal polarity. When the test antenna is horizontal polarity, the engine midpoint should be positioned on normal from antenna midpoint. The test was performed with the antenna both in its horizontal and vertical polarizations.

The EUT is achieved by braking to apply a load in order to test at 75% ± 10% of the continuous rated power.

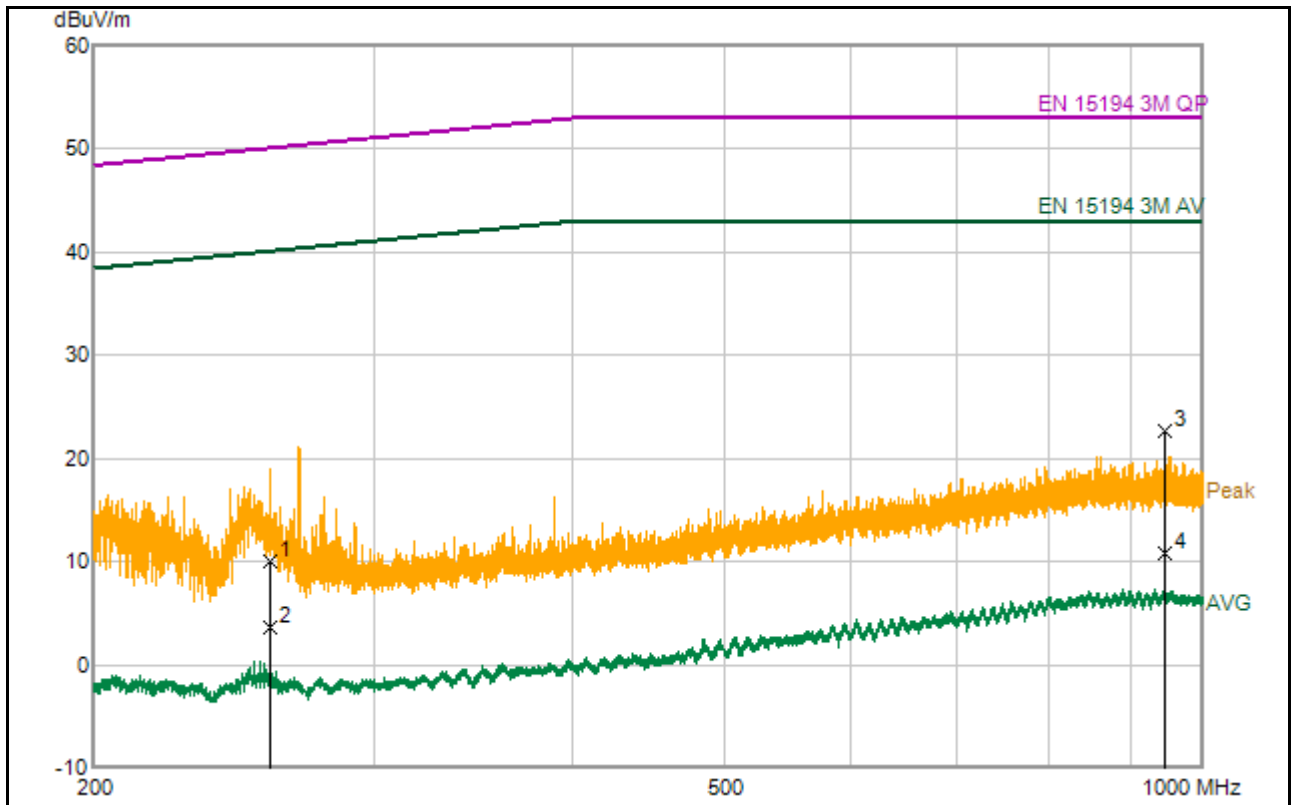
The following figures were those measured and recorded by a test receiver. The curves in the figure were those measured with a quasi peak detector for broad-band radiation and average detector for narrow-band radiation for the max. measurement result.

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Figure 1: Spectral diagram and measurement results of broad-band radiated disturbance and narrow-band radiated disturbance, Vertical, 30MHz-200MHz

Final measurement results:

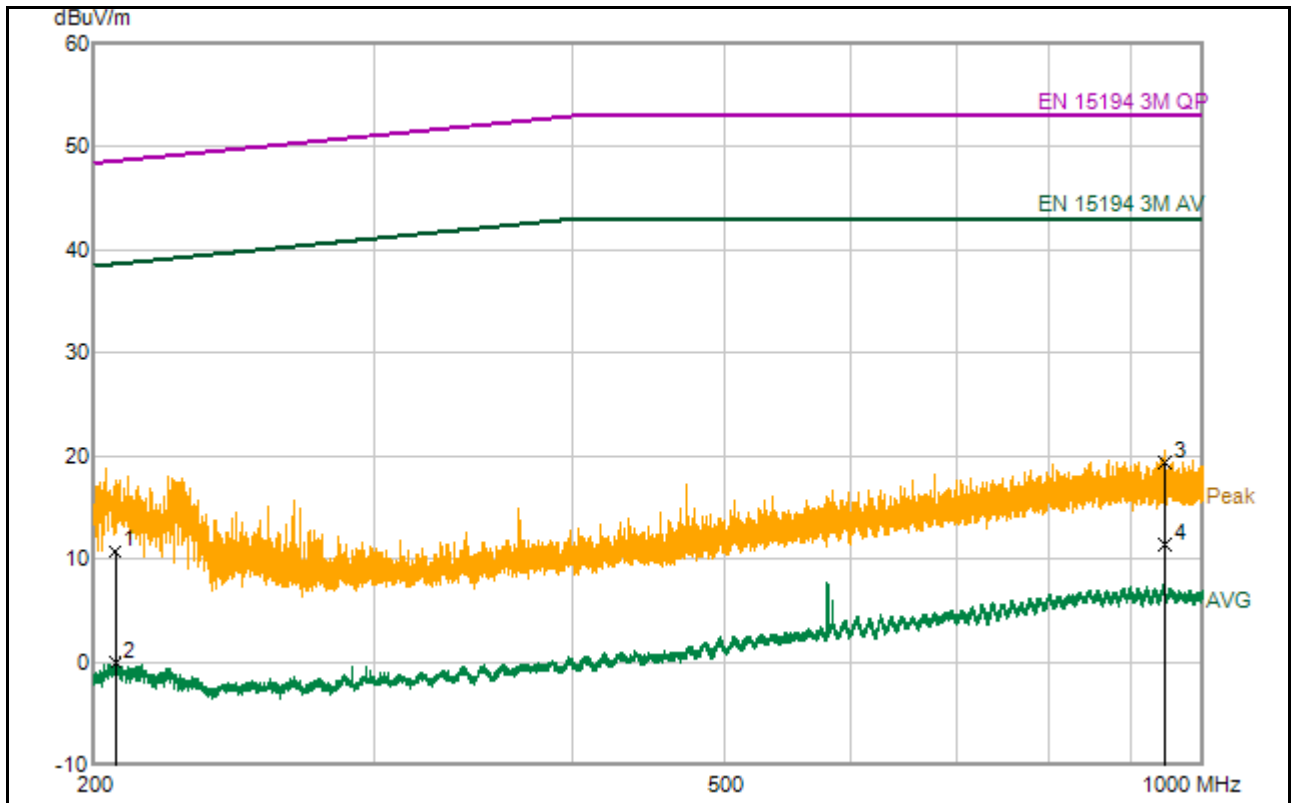
No	Frequency (MHz)	Level (dBuV)	Factor (dB)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Remark
1	48.96	46.73	-20.75	25.98	42	16.02	QP
2	48.96	32.64	-20.75	11.89	32	20.11	AVG
3	57.12	43.43	-20.87	22.56	42	19.44	QP
4	57.12	31.86	-20.87	10.99	32	21.01	AVG

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Figure 2: Spectral diagram and measurement results of broad-band radiated disturbance and narrow-band radiated disturbance, Horizontal, 30-200MHz

Final measurement results:

No	Frequency (MHz)	Level (dBuV)	Factor (dB)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Remark
1	38.8	35.52	-19.93	15.59	42	26.41	QP
2	38.8	25.93	-19.93	6	32	26	AVG
3	41.44	39.57	-20.12	19.45	42	22.55	QP
4	41.44	29.68	-20.12	9.56	32	22.44	AVG

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Figure 3: Spectral diagram and measurement results of broad-band radiated disturbance and narrow-band radiated disturbance, Vertical, 200MHz-1000MHz

Final measurement results:

No	Frequency (MHz)	Level (dBuV)	Factor (dB)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Remark
1	258.36	28.66	-18.61	10.05	50.13	40.08	QP
2	258.36	22.26	-18.61	3.65	40.13	36.48	AVG
3	946.4	32.01	-9.37	22.64	53	30.36	QP
4	946.4	20.15	-9.37	10.78	43	32.22	AVG

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Figure 4: Spectral diagram and measurement results of broad-band radiated disturbance and narrow-band radiated disturbance, Horizontal, 200MHz-1000MHz

Final measurement results:

No.	Frequenc y (MHz)	Level (dBuV)	Factor (dB)	Result (dBuV/ m)	Limit (dBuV/ m)	Margin (dB)	Remark
1	206.24	29.21	-18.44	10.77	48.65	37.88	QP
2	206.24	18.39	-18.44	-0.05	38.65	38.7	AVG
3	946.4	28.67	-9.37	19.3	53	33.7	QP
4	946.4	20.81	-9.37	11.44	43	31.56	AVG

5 Test Results Immunity

During the immunity tests, the EUT was operated under conditions specified by clause 3.1 of this report.

A vehicle is deemed to fulfil the electromagnetic radiation immunity conditions if:
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.

For electrostatic discharge:

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 (or permissible loss of performance) specified by the manufacturer, when the apparatus is used as intended. During the test, degradation of performance is however allowed. No change of actual operating state or stored data is allowed. If the minimum performance level or the permissible performance loss is not specified by the manufacturer, either of these may be derived from the product description and documentation and what the user may reasonably expect from the apparatus if used as intended.

Date of testing: 2021.06.24

Room temperature : 23.7°C
Relative humidity : 38%

5.1 Enclosure

5.1.1 Electrostatic Discharge

Result:	Pass
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The immunity against electrostatic discharge was tested in accordance with EN 15194:2009+A1. Test setup and ESD-Generator are according to EN 61000-4-2:2001.

The EUT is placed on 0,1m wood table above the ground plane. And the minimum distance between the EUT and all other conductive structures except the ground plane beneath the EUT is more than 0,5m.

The reference ground plane is an aluminum sheet of 0,25mm minimum thickness. The reference ground plane is connected to the protective earth. The size of the ground plane is 2m x 2m.

A Vertical coupling plane of dimensions 0,5m x 0,5m is placed parallel to and positioned at a distance of 0,1m from the EUT.

Charge voltage	:	±4.0kV (Contact Discharge) ±2.0kV, ±4.0kV, ±8.0kV (Air Discharge)
Polarity	:	positive / negative
Number of discharges	:	≥10
Performance criteria	:	B

Table 3: ESD, Positive / Negative Polarity

Position	Kind of Discharge	Result	Remarks
Non-metallic enclosure, Seam, Switch	Air discharge ±2.0kV, ±4.0kV, ±8.0kV	Pass	No disturbance of function
Metallic enclosure	Contact discharge ±4kV	Pass	No disturbance of function
Coupling plane (VCP)	Contact discharge ±4kV	Pass	No disturbance of function

5.1.2 Radio Frequency Electromagnetic Field

Result:	Pass
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The test was performed inside a semi-anechoic chamber with a test distance of 3m. The phase of mid-point of antenna is at a height of 1.5m above the vehicle plane. No part of the antenna radiator elements was less than 0,25 m from the vehicle plane. The reference point was defined according to C.4.5.3 and electromagnetic field strength at reference point and either side were calibrated according to C.4.5.3 and C.4.7. The substitution method was used for the purpose of creating the field test conditions. Only vertical polarization mode was selected according to C.4.6.1 b).

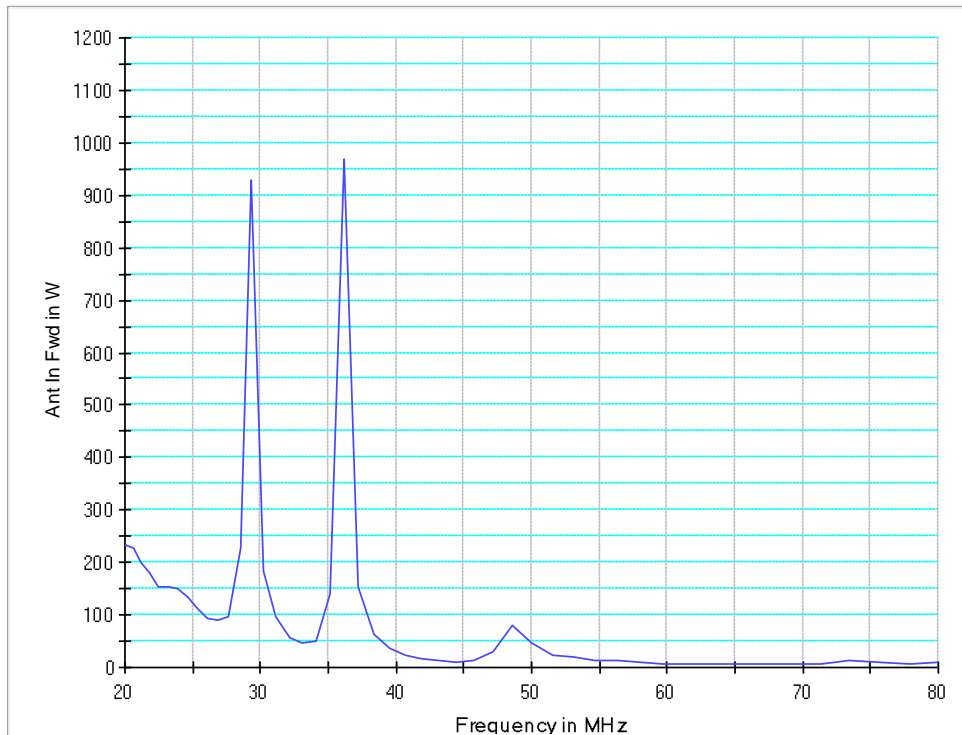
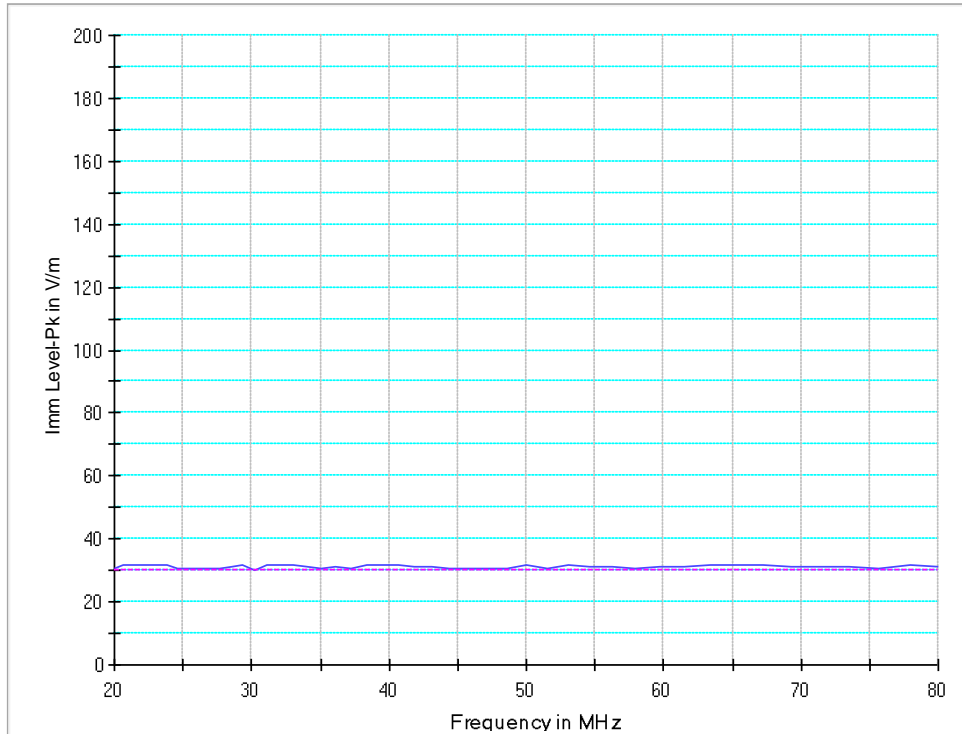
Date of testing	:	2021.06.24
Basic standard	:	EN 15194:2017 and ISO11451-1:2005+A1
Test level	:	30V/m
Modulation	:	80% AM, 1kHz
Frequency scan speed	:	Frequency step: 20MHz~200MHz: 5MHz 200MHz~400MHz: 10MHz 400MHz~1000MHz: 20MHz 1000MHz~2000MHz: 40MHz Dwell time: 2s
Performance criteria	:	Refer to the first page of clause 5 of this report
Ambient conditions	:	Temperature: 23.7°C; Relative humidity: 38%

Table 4: Radiated electromagnetic field test results

Field polarization	Result	Observation
Vertical polarization	Pass	No disturbance of function

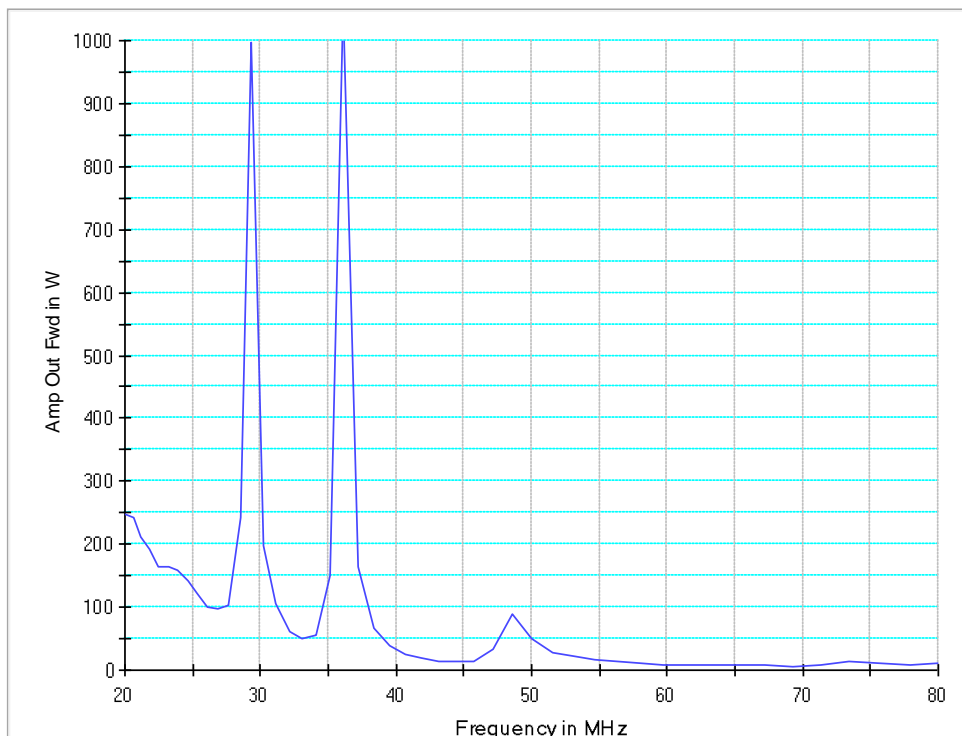
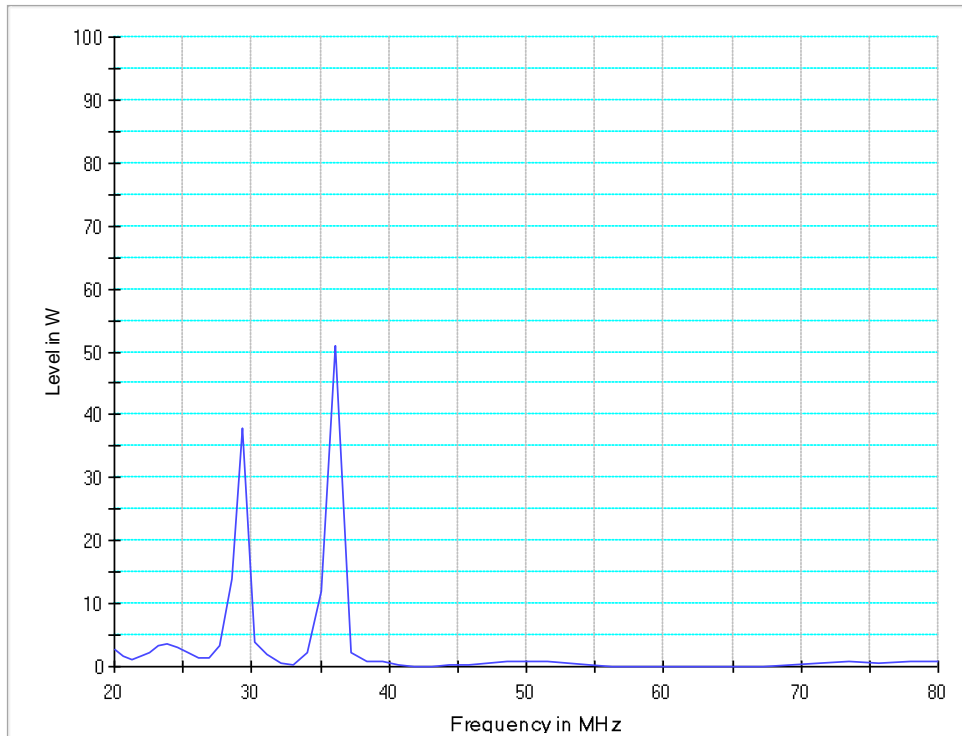
The following are the test curves such as immunity level, Sensor level, VSWR, Antenna in forward power, amplifier in for each mode for the whole frequency range.

Figure 5: Radio frequency electromagnetic field for 20MHz-80MHz



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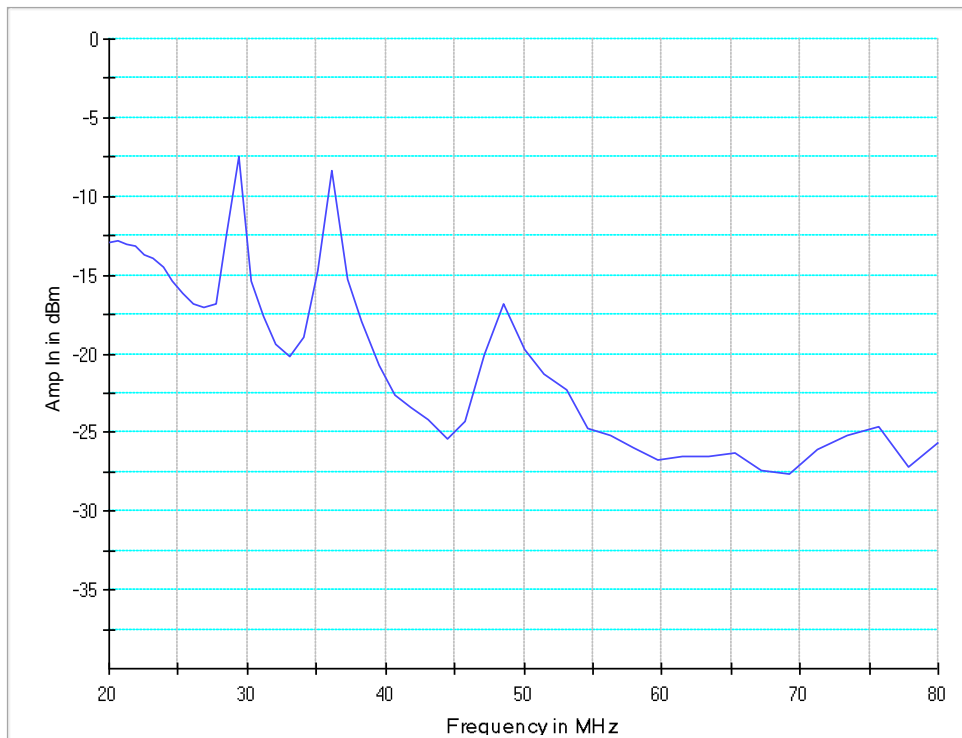
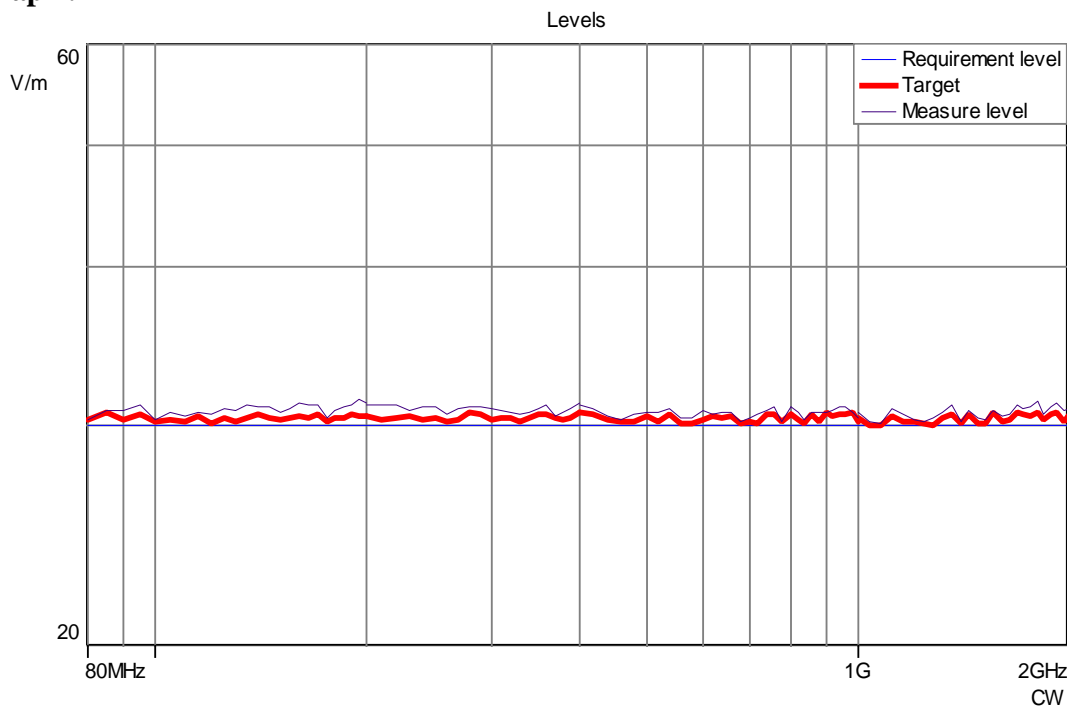
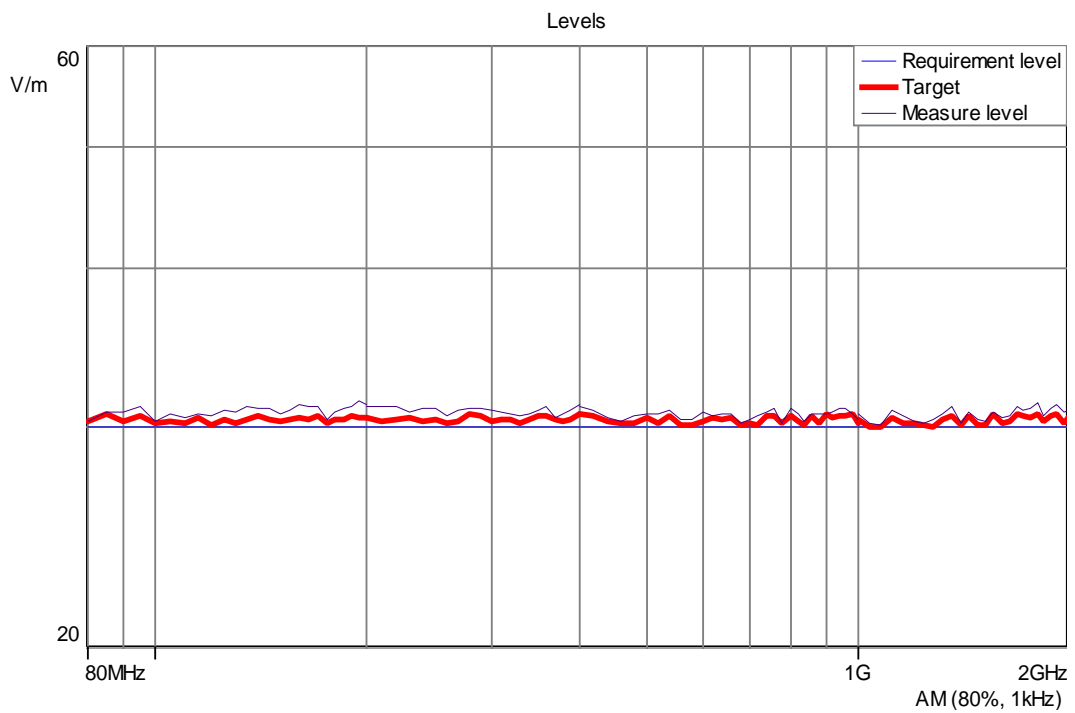
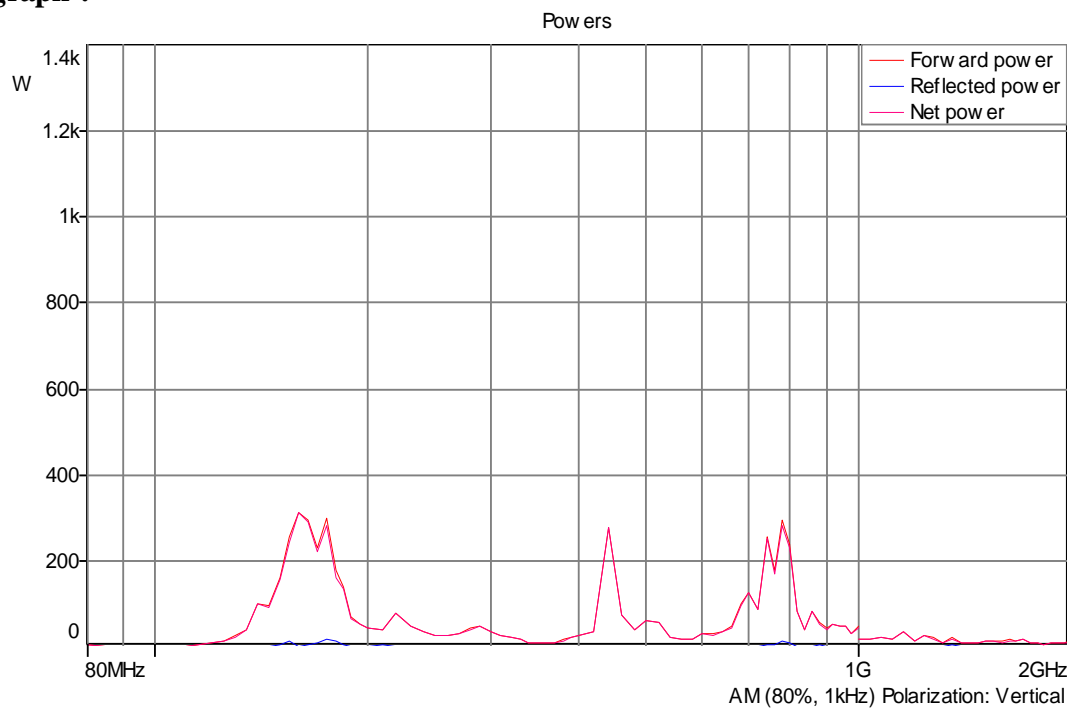
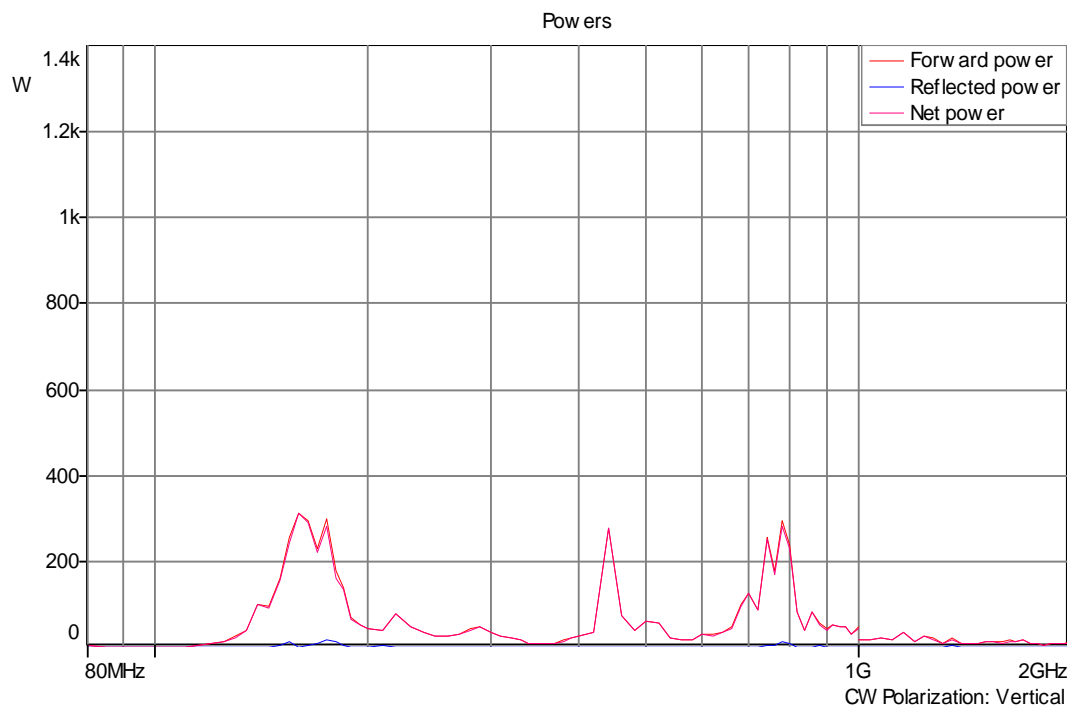
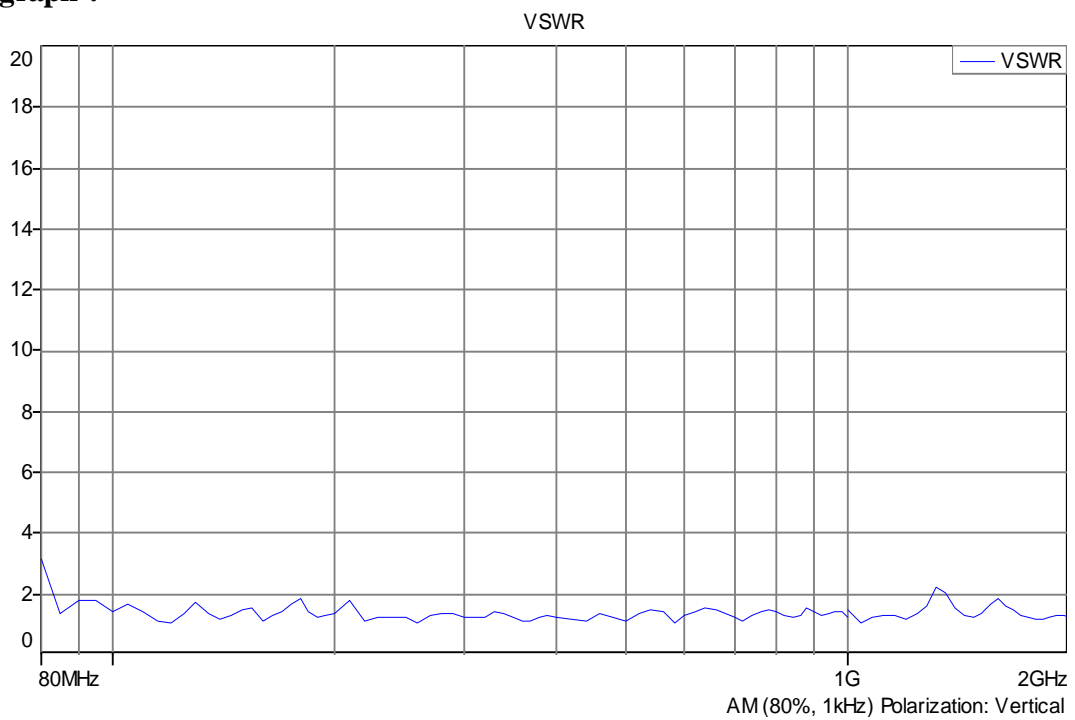


Figure 6: Radio frequency electromagnetic field for 80MHz-2000MHz

Level graph :

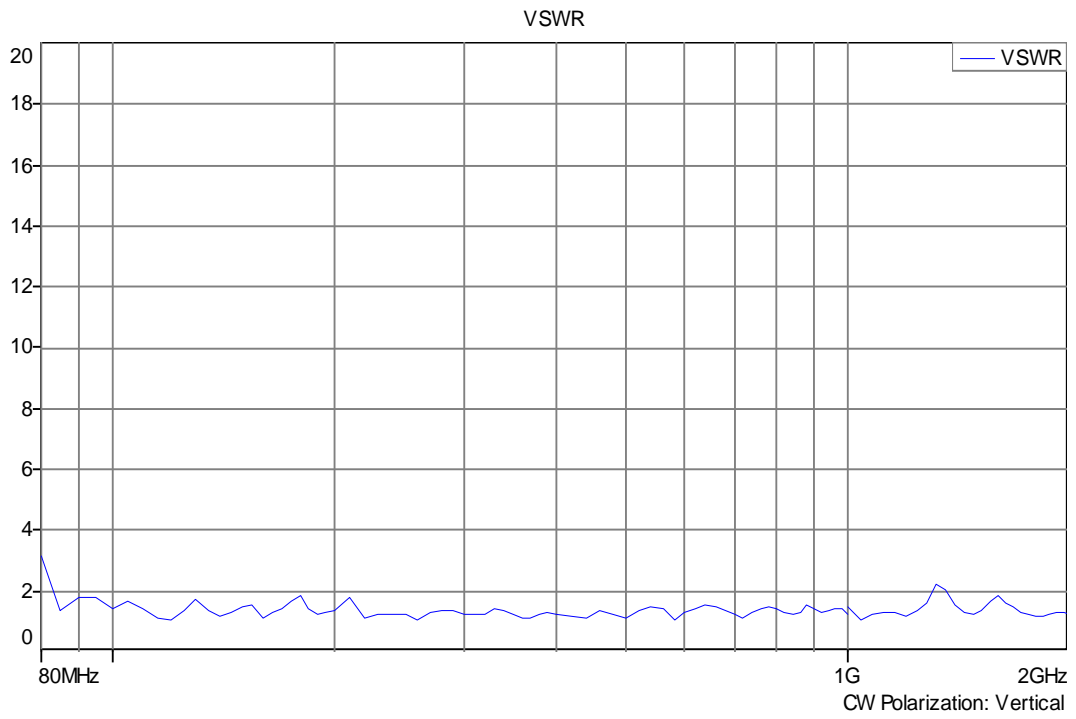



Power graph :



VSWR graph :


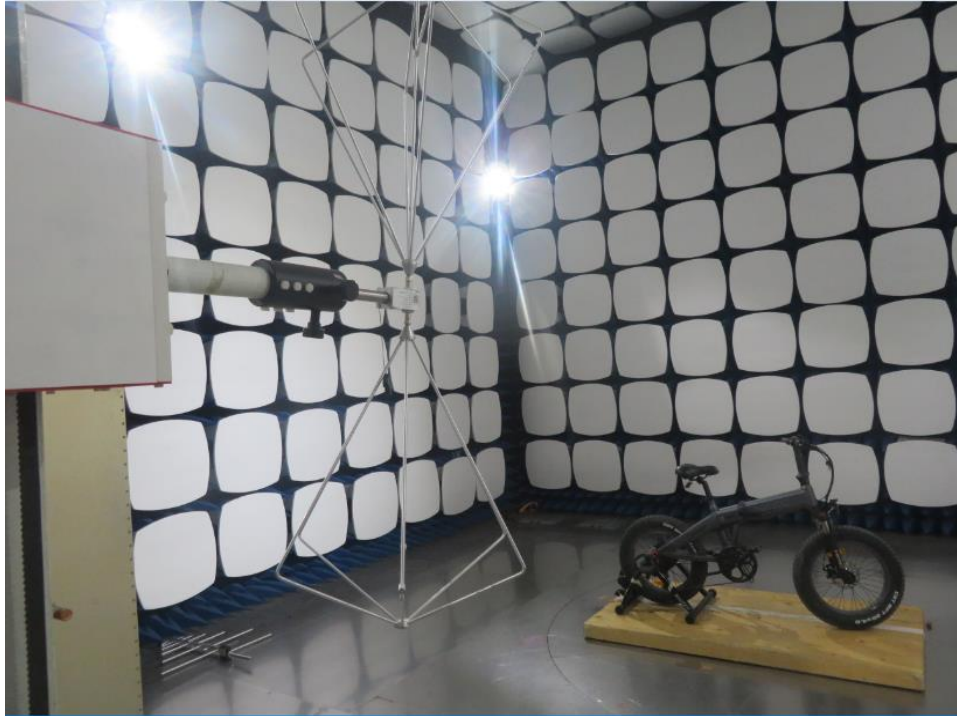
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6 Photographs of the Test Set-Up

Photograph 1: Set-up for measurement of broad-band and narrow-band radiated electromagnetic field emission



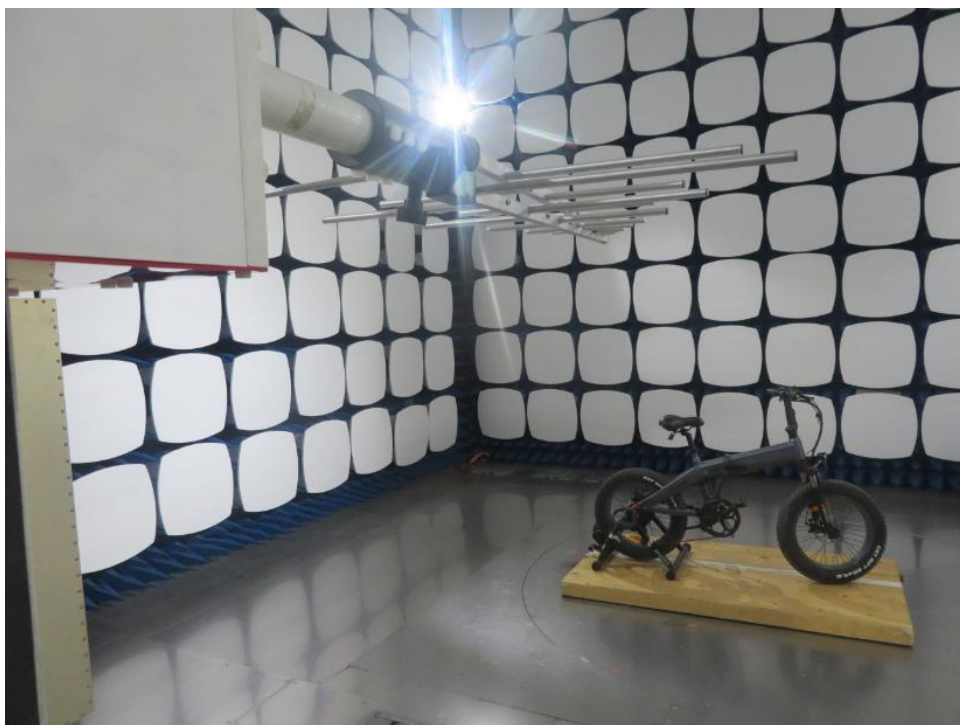
30MHz-200MHz of Vertical



30MHz-200MHz of Horizontal



200MHz-1000MHz of Vertical

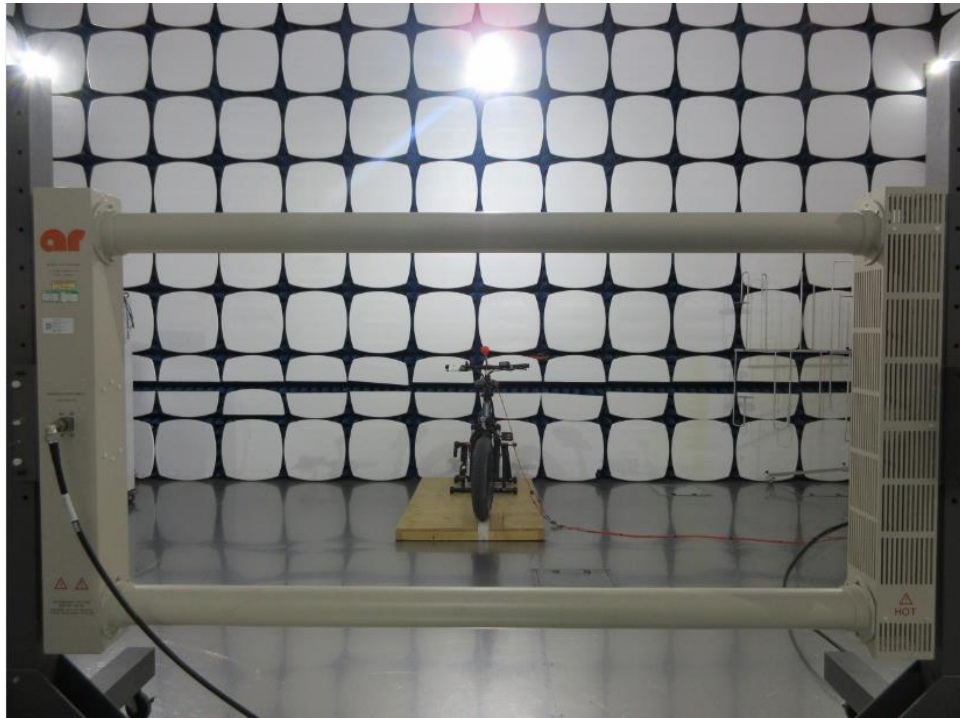


200MHz-1000MHz of Horizontal

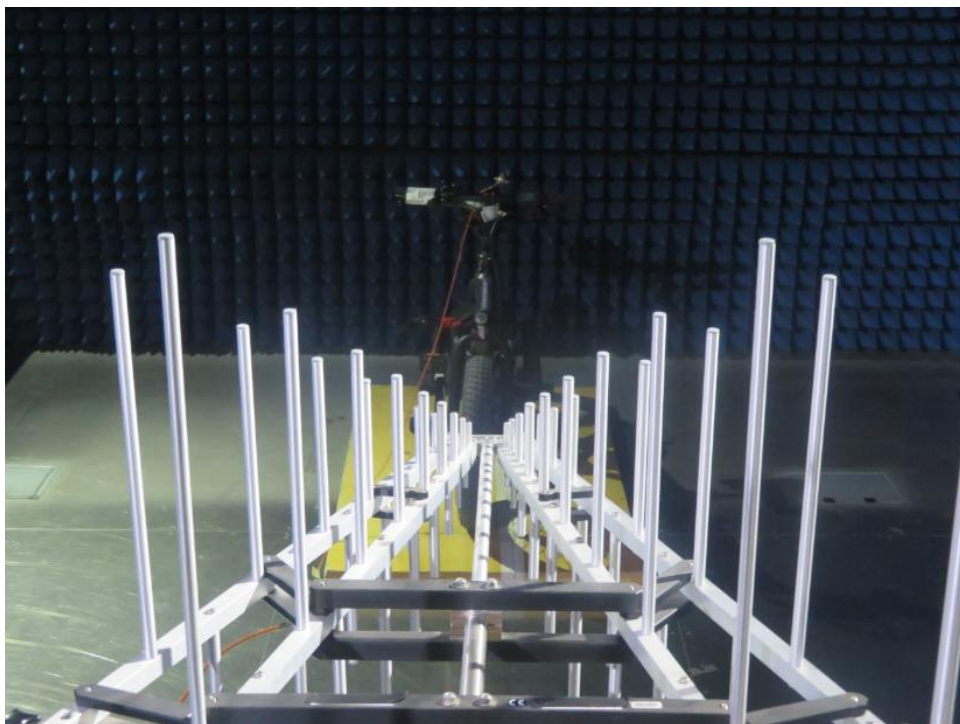
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Photograph 2: Set up for RF radiated immunity test



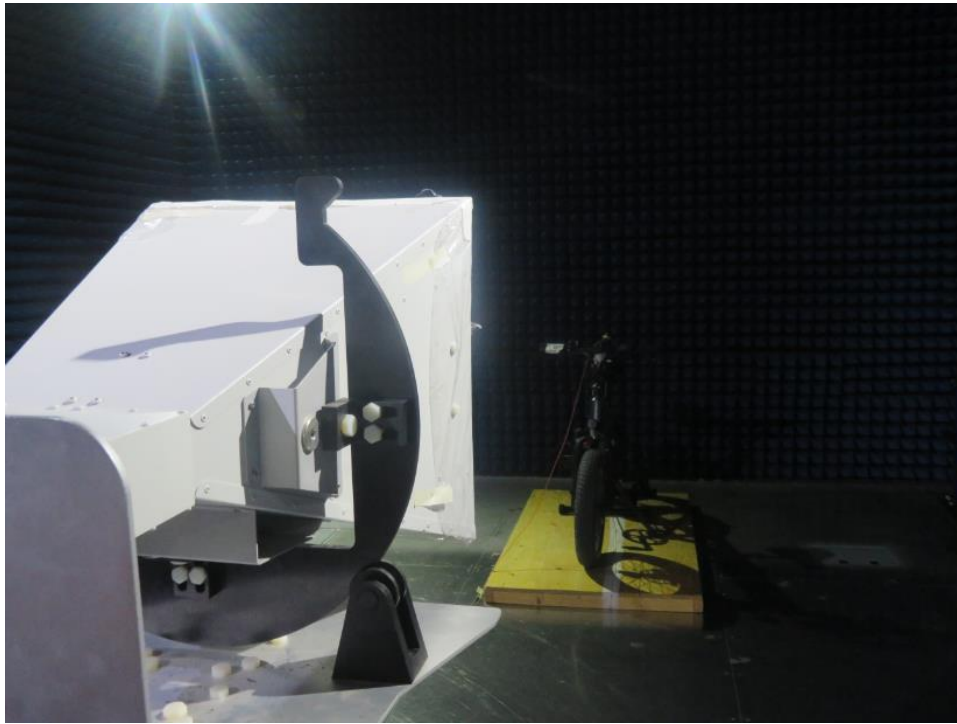
20MHz-80MHz



80MHz-1GHz

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1GHz-2GHz

Photograph 3: Set-up for ESD immunity test



Air Discharge

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Contact Discharge

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