

Prüfbericht-Nr.: <i>Test report no.:</i>	CN23GDAD 001	Auftrags-Nr.: <i>Order no.:</i>	168361679	Seite 1 von 20 Page 1 of 20
Kunden-Referenz-Nr.: <i>Client reference no.:</i>	N/A	Auftragsdatum: <i>Order date:</i>	2022-03-04	
Auftraggeber: <i>Client:</i>	Hui Zhou Gaoshengda Technology Co.,LTD No.2, Jin-da Road, Huinan High-tech Industrial Park, Hui-ao Avenue, Huizhou City, Guangdong, China			
Prüfgegenstand: <i>Test item:</i>	WIFI Module			
Bezeichnung / Typ-Nr.: <i>Identification / Type no.:</i>	D31R1601F, D31R1601 (Trademark: GSD)			
Auftrags-Inhalt: <i>Order content:</i>	Test Report			
Prüfgrundlage: <i>Test specification:</i>	CFR47 FCC Part 15: Subpart C Section 15.247 RSS-247 Issue 3 August 2023 RSS-Gen Issue 5 February 2021			
Wareneingangsdatum: <i>Date of sample receipt:</i>	2022-03-08	Please refer to Photo Document		
Prüfmuster-Nr.: <i>Test sample no.:</i>	A003220063-005~010			
Prüfzeitraum: <i>Testing period:</i>	2023-11-07 - 2023-11-14			
Ort der Prüfung: <i>Place of testing:</i>	TÜV Rheinland (Shenzhen) Co., Ltd.			
Prüflaboratorium: <i>Testing laboratory:</i>	TÜV Rheinland (Shenzhen) Co., Ltd.			
Prüfergebnis*: <i>Test result*:</i>	Pass			
geprüft von: <i>tested by:</i>	genehmigt von: <i>authorized by:</i>			
Datum: <i>Date:</i> 2023-12-01	Ausstellungsdatum: <i>Issue date:</i> 2023-12-01			
Stellung / Position:	Sachverständige(r)/Expert	Stellung / Position:	Sachverständige(r)/Expert	
Sonstiges / <i>Other:</i>	FCC ID: 2AC23-D31 IC: 12290A-D31 HVIN: 1.0			
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>			
* Legende: P(ass) = entspricht o.g. Prüfgrundlage(n) F(ail) = entspricht nicht o.g. Prüfgrundlage(n) N/A = nicht anwendbar N/T = nicht getestet * Legend: P(ass) = passed a.m. test specification(s) F(ail) = failed a.m. test specification(s) N/A = not applicable N/T = not tested				
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Anmerkungen
Remarks

1	Alle eingesetzten Prüfmittel waren zum angegebenen Prüfzeitraum gemäß eines festgelegten Kalibrierungsprogramms unseres Prüfhauses kalibriert. Sie entsprechen den in den Prüfprogrammen hinterlegten Anforderungen. Die Rückverfolgbarkeit der eingesetzten Prüfmittel ist durch die Einhaltung der Regelungen unseres Managementsystems gegeben. Detaillierte Informationen bezüglich Prüfkonditionen, Prüfequipment und Messunsicherheiten sind im Prüflabor vorhanden und können auf Wunsch bereitgestellt werden. <i>The equipment used during the specified testing period was calibrated according to our test laboratory calibration program. The equipment fulfils the requirements included in the relevant standards. The traceability of the test equipment used is ensured by compliance with the regulations of our management system. Detailed information regarding test conditions, equipment and measurement uncertainty is available in the test laboratory and could be provided on request.</i>
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4	Die Entscheidungsregel für Konformitätserklärungen basierend auf numerischen Messergebnissen in diesem Prüfbericht basiert auf der "Null-Grenzwert-Regel" und der "Einfachen Akzeptanz" gemäß ILAC G8:2019 und IEC Guide 115:2021, es sei denn, in der auf Seite 1 dieses Berichts genannten angewandten Norm ist etwas anderes festgelegt oder vom Kunden gewünscht. Dies bedeutet, dass die Messunsicherheit nicht berücksichtigt wird und daher auch nicht im Prüfbericht angegeben wird. Zu weiteren Informationen bezüglich des Risikos durch diese Entscheidungsregel siehe ILAC G8:2019. <i>The decision rule for statements of conformity, based on numerical measurement results, in this test report is based on the "Zero Guard Band Rule" and "Simple Acceptance" in accordance with ILAC G8:2019 and IEC Guide 115:2021, unless otherwise specified in the applied standard mentioned on Page 1 of this report or requested by the customer. This means that measurement uncertainty is not taken in account and hence also not declared in the test report. For additional information to the resulting risk based of this decision rule please refer to ILAC G8:2019.</i>

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Test Summary

5.1.1 ANTENNA REQUIREMENT

RESULT: Pass

5.1.2 MAXIMUM PEAK CONDUCTED OUTPUT POWER

RESULT: Pass

5.1.3 CONDUCTED POWER SPECTRAL DENSITY

RESULT: Pass

5.1.4 99%dB BANDWIDTH

RESULT: Pass

5.1.5 6dB BANDWIDTH

RESULT: Pass

5.1.6 CONDUCTED SPURIOUS EMISSIONS MEASURED IN 100 KHz BANDWIDTH

RESULT: Pass

5.1.7 RADIATED SPURIOUS EMISSION

RESULT: Pass

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1 General Remarks

1.1 Complementary Materials

All attachments are integral parts of this test report. This applies especially to the following appendix:

Appendix A: Test Results of 2.4GHz Wi-Fi.

Appendix B: Photographs of the Test Set-up.

2 Test Sites

2.1 Test Facilities

TÜV Rheinland (Shenzhen) Co., Ltd.

No. 362 Huanguan Road Middle, Longhua District, 518110, Shenzhen, P. R. China.

FCC Accreditation Designation No.: 694916

ISED wireless device testing laboratory: 25069

2.2 List of Test and Measurement Instruments

Table 1: List of Test and Measurement Equipment

Radio Spectrum Testing (SRD-Tonscend)				
Equipment	Manufacturer	Model	Serial No.	Cal. until
EXA Signal Analyzer, Multi-touch	Keysight	N9010B	MY60241175	2024-09-21
MXG X-Series RF Vector Signal Generator	Keysight	N5182B	MY61250137	2024-09-21
EXG X-Series Microwave Analog Signal Generator	Keysight	N5173B	MY61250141	2024-09-21
DC power supply	Keysight	E3642A	MY61276100	2024-09-21
Power Control Unit	Tonscend	JS0806-4ADC	N/A	2024-09-21
Automation Control Unit	Tonscend	JS0806-2	21C8060396	2024-09-21
Test Software	Tonscend	JS1120-3	N/A	N/A
Control PC	Lenovo	TianYi510S-071MB	Y LX23JMF	N/A
Shielding Room 8#	Albatross	SR8	APC17151-SR8	2024-06-22
Unwanted Emission Testing (TS9975)				
Equipment	Manufacturer	Model	Serial No.	Cal. until
EMI Test Receiver	R&S	ESR 7	102021	2024-07-25
Signal Analyzer	R&S	FSV 40	101439	2024-07-25
System Controller Interface	R&S	SCI-100	S10010038	N/A
Filterbank	R&S	Wlan	100759	2024-07-25
OSP	R&S	OSP 120	102040	N/A
Pre-amplifier	R&S	SCU08F1	08320031	2024-07-25
Amplifier	R&S	SCU-18F	180070	2024-07-25
Amplifier	R&S	SCU40A	100475	2024-07-25
Trilog Broadband Antenna (30 MHz - 7 GHz)	Schwarzbeck	VULB 9162	193	2024-08-06
Double-Ridged Antenna (1 -18 GHz)	ETS-LINDGREN	3117	00218717	2024-08-06

Wideband Ridged Horn Antenna (18-40 GHz)	Steatite	QMS-00880	19067	2024-08-27
Active Loop Antenna	Schwarzbeck	FMZB 1513	302	2024-08-06
Test software	R&S	EMC32 (V10.60.10)	N/A	N/A
Control PC	Dell	OptiPlex 7050	36NV9P2	N/A
3m Semi-Anechoic Chamber	Albatross	SAC-3m	APC17151-SAC	2024-06-22

2.3 Traceability

All measurement equipment calibrations are traceable to NIM (National Institute of Metrology) or where calibration is performed in other countries, to equivalent nationally recognized standards organizations.

2.4 Calibration

Equipment requiring calibration is calibrated periodically by the manufacturer or according to manufacturer's specifications. Additionally all equipment is verified for proper performance on a regular basis using in house standards or comparisons.

2.5 Measurement Uncertainty

The estimated combined standard uncertainty for radiated emissions and conducted emissions measurements as below table.

Table 2: Measurement Uncertainty

Parameter	Uncertainty (k=2)
RF output power, conducted	± 0.99 dB
Occupied Channel Bandwidth	± 2.08 %
RF power density, conducted	± 0.99 dB
Unwanted Emissions, conducted	± 0.89 dB
All emissions, radiated	±4.17 dB

2.6 Location of Original Data

The original copies of all test data taken during actual testing were attached at Appendix A & B of this report and delivered to the applicant. A copy has been retained in the TÜV Rheinland (Shenzhen) file for certification follow-up purposes.

2.7 Status of Facility Used for Testing

The TÜV Rheinland (Shenzhen) Co., Ltd. Test facility located at No. 362 Huanguan Road Middle, Longhua District, 518110, Shenzhen, P. R. China. is listed on the US Federal Communications Commission list of facilities approved to perform measurements.

3 General Product Information

3.1 Product Function and Intended Use

The EUT is a WIFI Module which supports 2.4GHz Wi-Fi and 5GHz Wi-Fi functions.

According to the client's declaration, the models D31R1601 are the same as the original ones D31R1601F in circuit design, layout only difference modular debug port type.

For details refer to the User Manual, Technical Description and Circuit Diagram.

3.2 Ratings and System Details

Table 3: Technical Specification of EUT

General Information of EUT	Value
Kind of Equipment:	WIFI Module
Type Designation:	D31R1601F, D31R1601
Trademark:	GSD
FCC ID:	2AC23-D31
IC:	12290A-D31
HVIN:	1.0
Operating Voltage:	DC 3.3V
Technical Specification of Wi-Fi 802.11 b/g/n	
Operating Frequency:	2412 - 2462 MHz for 802.11b/g/n(HT20) 2422 - 2452 MHz for 802.11n(HT40)
Type of Modulation:	DSSS(DBPSK/DQPSK/CCK) OFDM(BPSK/QPSK/16QAM/64QAM)
Data Rate:	1/2/5.5/11 Mbps for 802.11b 6/9/12/18/24/36/48/54 Mbps for 802.11g MCS0 ~ MCS7 for 802.11n
Channel Number:	11 channels for 802.11b/g/n(HT20) 7 channels for 802.11n(HT40)
Channel Separation:	5 MHz
Antenna Type:	PIFA Antenna
Antenna Number:	2
Antenna Gain:	1.72 dBi for ANT1, 2.97 dBi for ANT2 (Provided by the Client)
Technical Specification of Wi-Fi 802.11 a/n	
Operating Frequency:	5180-5320MHz, 5500-5720MHz, 5745-5825MHz
Type of Modulation:	OFDM(BPSK/QPSK/16QAM/64QAM/256QAM)
Channel Number:	5180-5320MHz, 12CHs, 802.11 a/n20/n40 5500-5700MHz, 11CHs, 802.11 a/n20/n40 5745-5825MHz, 7CHs, 802.11 a/n20/n40
Channel Separation:	20 MHz, 40MHz
Antenna Type:	PIFA Antenna

Antenna Number:	2
Antenna Gain:	2.57 dBi for ANT1, 2.80 dBi for ANT2 (Provided by the Client)

Table 4: RF Channel and Frequency of Wi-Fi 802.11 b/g/n

RF Channel	802.11 b/g/n(HT20)	802.11 n(HT40)
	Frequency (MHz)	Frequency (MHz)
01	2412	/
02	2417	/
03	2422	2422
04	2427	2427
05	2432	2432
06	2437	2437
07	2442	2442
08	2447	2447
09	2452	2452
10	2457	/
11	2462	/

Test frequencies are lowest channel: 2412 MHz, middle channel: 2437 MHz and highest channel: 2462 MHz for 802.11b/g/n(HT20)

Test frequencies are lowest channel: 2422 MHz, middle channel: 2437 MHz and highest channel: 2452 MHz for 802.11n(HT40)

3.3 Independent Operation Modes

The basic operation modes are:

A. On, 2.4G Wi-Fi transmitting mode

- 1) Low Channel
- 2) Middle Channel
- 3) High Channel

B. Off

3.4 Noise Generating and Noise Suppressing Parts

Refer to Circuit Diagram for further details.

3.5 Submitted Documents

- Application Form
- User Manual
- ID Label and Location Info
- Operation Description

4 Test Set-up and Operation Modes

4.1 Principle of Configuration Selection

Radio Spectrum: The equipment under test (EUT) was configured at its highest power output in order to measure its highest possible radiation and conducted level. The test modes were adapted accordingly in reference to the instructions for use.

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

4.2 Test Operation and Test Software

Test operation refers to test setup in chapter 5. All testing were performed according to the procedures in ANSI C63.10: 2013.

According to clause 3.1, all tests were performed on model D31R1601 in this report.

4.3 Special Accessories and Auxiliary Equipment

Table 5: List of Accessories and Auxiliary Equipment

Description	Manufacturer	Model	S/N
Laptop	Lenovo	T480	PF-16A6N8

4.4 Countermeasures to Achieve EMC Compliance

The test sample which has been tested contained the noise suppression parts as described in the Technical Construction File (TCF).

No additional measures were employed to achieve compliance.

4.5 Test Setup Diagram

Diagram of Measurement Configuration for Radiation Test (Below 1GHz)

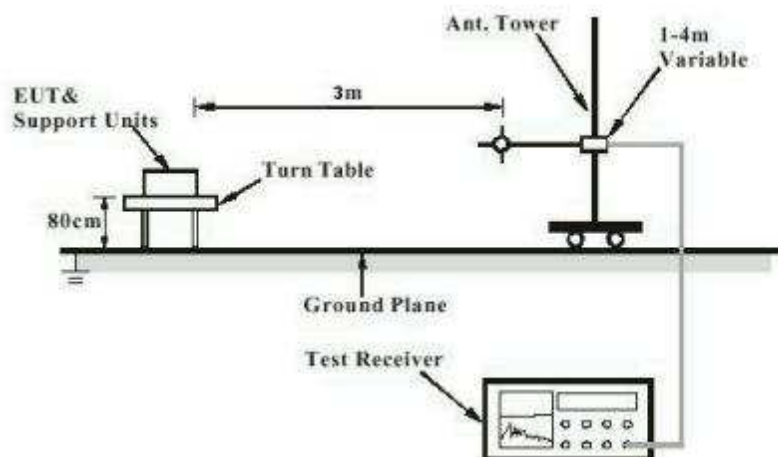


Diagram of Measurement Configuration for Radiation Test (Above 1GHz)

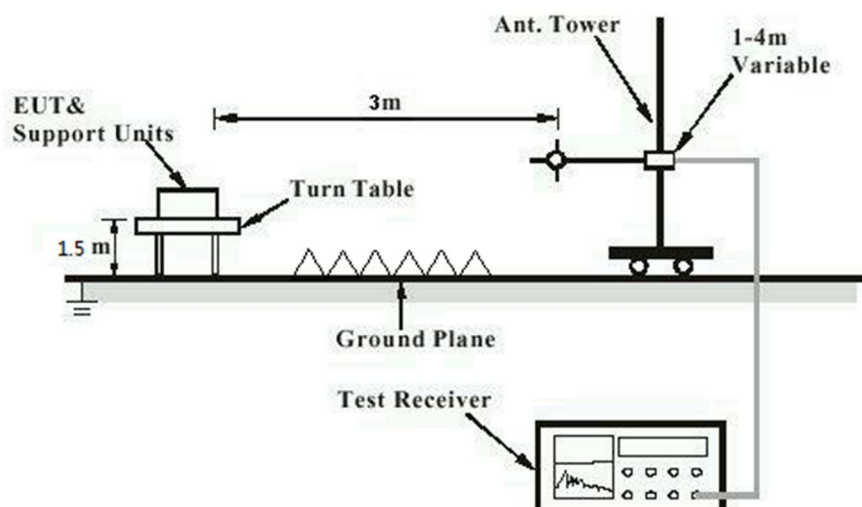
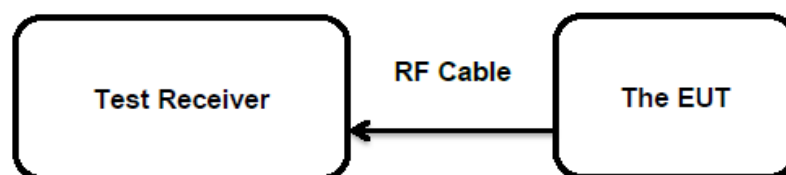


Diagram of Measurement Configuration for Conducted Transmitter Measurement



5 Test Results

5.1 Transmitter Requirement & Test Suites

5.1.1 Antenna Requirement

RESULT:**Pass****Test Specification**

Test standard : FCC Part 15.247(b)(4) and Part 15.203
RSS-Gen Clause 6.8
Limit : the use of antennas with directional gains that do not
exceed 6 dBi

According to the manufacturer declared, the EUT have two PIFA Antennas, the uncorrelated antenna gains are 1.72 dBi for ANT1 & 2.97 dBi for ANT2, and the antenna connector is designed with permanent attachment and no consideration of replacement.

Therefore the EUT is considered sufficient to comply with the provision.

Refer to EUT Photo for further details.

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5.1.2 Maximum Peak Conducted Output Power

RESULT:

Pass

Test Specification

Test standard	: FCC Part 15.247(b)(3) RSS-247 Clause 5.4(d)
Basic standard	: ANSI C63.10: 2013
Limits	: < 1 W (Maximum Conducted Peak Power) e.i.r.p. <4W
Kind of test site	: Shielded Room

Test Setup

Date of testing	: 2023-11-07 to 2023-11-08
Input voltage	: DC 3.3V
Operation mode	: A
Test channel	: Low / Middle / High
Ambient temperature	: 24.8 °C
Relative humidity	: 47 %
Atmospheric pressure	: 101 kPa

For details refer to following test result.

Table 6: Test Result of Maximum Peak Conducted Output Power

SISO Mode_ANT1

Test Mode	Data Rate	Test Channel (MHz)	Measured Peak Power		Limit (W)	
			(dBm)	(W)		
802.11b	1 Mbps	2412	19.75	0.0944	< 1.0	
		2437	19.03	0.0800		
		2462	19.07	0.0807		
802.11g	6 Mbps	2412	22.14	0.1637		
		2437	22.10	0.1622		
		2462	22.06	0.1607		
802.11n (HT20)	MCS0	2412	22.31	0.1702		
		2437	22.05	0.1603		
		2462	22.30	0.1698		
802.11n (HT40)	MCS0	2422	22.48	0.1770		
		2437	22.35	0.1718		
		2452	22.20	0.1660		
Maximum Measured Value			22.48	0.1770		
Max. e.i.r.p.=22.48dBm+1.72dBi=24.20dBm, which is less than 36dBm=4W.						

SISO Mode_ANT2

Test Mode	Data Rate	Test Channel (MHz)	Measured Peak Power		Limit (W)	
			(dBm)	(W)		
802.11b	1 Mbps	2412	20.05	0.1012	< 1.0	
		2437	19.19	0.0830		
		2462	19.27	0.0845		
802.11g	6 Mbps	2412	22.30	0.1698		
		2437	22.22	0.1667		
		2462	22.23	0.1671		
802.11n (HT20)	MCS0	2412	22.45	0.1758		
		2437	22.23	0.1671		
		2462	22.52	0.1786		
802.11n (HT40)	MCS0	2422	22.64	0.1837		
		2437	22.51	0.1782		
		2452	22.38	0.1730		
Maximum Measured Value			22.64	0.1837		
Max. e.i.r.p.=22.64dBm+2.97dBi=25.61dBm, which is less than 36dBm=4W.						

Note:

- 1) The cable loss is taken into account in results.
- 2) Antenna gain(G): 1.72 dBi for ANT1, 2.97 dBi for ANT2

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5.1.3 Conducted Power Spectral Density

RESULT:**Pass****Test Specification**

Test standard	: FCC Part 15.247(e) RSS-247 Clause 5.2(b)
Basic standard	: ANSI C63.10: 2013
Limits	: 8 dBm / 3kHz
Kind of test site	: Shielded Room

Test Setup

Date of testing	: 2023-11-07 to 2023-11-08
Input voltage	: DC 3.3V
Operation mode	: A
Test channel	: Low / Middle / High
Ambient temperature	: 24.8 °C
Relative humidity	: 47 %
Atmospheric pressure	: 101 kPa

For the measurement records, refer to the appendix A.

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5.1.4 99%dB Bandwidth

RESULT:**Pass****Test Specification**

Test standard	: RSS-Gen clause 6.7
Basic standard	: ANSI C63.10: 2013
Kind of test site	: Shielded Room

Test Setup

Date of testing	: 2023-11-07 to 2023-11-08
Input voltage	: DC 3.3V
Operation mode	: A
Test channel	: Low / Middle / High
Ambient temperature	: 24.8 °C
Relative humidity	: 47 %
Atmospheric pressure	: 101 kPa

For the measurement records, refer to the appendix A.

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5.1.5 6dB Bandwidth

RESULT:**Pass****Test Specification**

Test standard	:	FCC Part 15.247(a)(2) RSS-247 Clause 5.2(a)
Basic standard	:	ANSI C63.10: 2013
Limits	:	> 500 KHz
Kind of test site	:	Shielded Room

Test Setup

Date of testing	:	2023-11-07 to 2023-11-08
Input voltage	:	DC 3.3V
Operation mode	:	A
Test channel	:	Low / Middle / High
Ambient temperature	:	24.8 °C
Relative humidity	:	47 %
Atmospheric pressure	:	101 kPa

For the measurement records, refer to the appendix A.

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5.1.6 Conducted Spurious Emissions Measured in 100 kHz Bandwidth

RESULT:**Pass****Test Specification**

Test standard	: FCC Part 15.247(d) RSS-247 Clause 5.5
Basic standard	: ANSI C63.10: 2013
Limits	: 20dB (below that in the 100kHz bandwidth within the band that contains the highest level of the desired power); In addition, radiated emissions which fall in the restricted bands, must also comply with the radiated emission limits specified in 15.209(a)
Kind of test site	: Shielded Room

Test Setup

Date of testing	: 2023-11-07 to 2023-11-08
Input voltage	: DC 3.3V
Operation mode	: A
Test channel	: Low / Middle / High
Ambient temperature	: 24.8 °C
Relative humidity	: 47 %
Atmospheric pressure	: 101 kPa

Test results of 100kHz Bandwidth of Frequency Band Edge by Conducted method refer to test plots, and compliance is achieved as well.

For the measurement records, refer to the appendix A.

5.1.7 Radiated Spurious Emission

RESULT:**Pass****Test Specification**

Test standard	: FCC Part 15.247(d) & FCC Part 15.205 RSS-247 Clause 3.3 & 5.5
Basic standard	: ANSI C63.10: 2013
Limits	: Refer to 15.209(a) of FCC part 15.247(d) RSS-Gen Table 5
Kind of test site	: 3m Semi-anechoic Chamber

Test Setup

Date of testing	: 2023-11-13 to 2023-11-14
Input voltage	: DC 3.3V
Operation mode	: A
Test channel	: Low / Middle / High
Ambient temperature	: Refer to test result
Relative humidity	: Refer to test result
Atmospheric pressure	: 101 kPa

Remark:

Testing was carried out within frequency range 9kHz to the tenth harmonics. Only the worst case spurious emissions configuration of the each mode were reported.

For the measurement records, refer to the appendix A.

6 Photographs of the Test Set-Up

For photographs of the test set-up, refer to the appendix B.

7 List of Tables

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