Prüfbericht-Nr.: *Test report no.:*	**NN22J89O 002**	**Auftrags-Nr.:** *Order no.:*	**168365112**	**Seite 1 von 22** *Page 1 of 22*
Kunden-Referenz-Nr.: *Client reference no.:*	**N/A**	**Auftragsdatum:** *Order date:*	2022-03-24	
Auftraggeber: *Client:*	Hui Zhou Gaoshengda Technology Co.,LTD No.75 Zhongkai Development Area, Huizhou, Guangdong, China			
Prüfgegenstand: *Test item:*	WIFI+BT module			
Bezeichnung / Typ-Nr.: *Identification / Type no.:*	DCT2VM2511 (Trademark: GSD)			
Auftrags-Inhalt: *Order content:*	Test Report			
Prüfgrundlage: *Test specification:*	CFR47 FCC Part 15: Subpart C Section 15.247 FCC KDB 558074 D01 15.247 Meas Guidance v05r02 FCC KDB 662911 D01 Multiple Transmitter Output v02r01 RSS-247 Issue 2 February 2017 RSS-Gen Issue 5 February 2021 ANSI C63.10:2013			

Wareneingangsdatum: *Date of sample receipt:*	2022-03-30	Please refer to Photo Document
Prüfmuster-Nr.: *Test sample no:*	A003224451-001--005	
Prüfzeitraum: *Testing period:*	2022-03-30 - 2022-04-19	
Ort der Prüfung: *Place of testing:*	TÜV Rheinland (Shenzhen) Co., Ltd.	
Prüflaboratorium: *Testing laboratory:*	TÜV Rheinland (Shenzhen) Co., Ltd.	
Prüfergebnis*: *Test result*:*	Pass	

geprüft von: *tested by:*	X Breeze Jiang 签署者: Breeze Jiang	**genehmigt von:** *authorized by:*	X Lin Lin Signed by: Lin Lin
Datum: *Date:* 2022-06-22		**Ausstellungsdatum:** *Issue date:* 2022-06-22	
Stellung */ Position:*	Assistant Project Manager	**Stellung** */ Position:*	Reviewer

Sonstiges */ Other:*
FCC ID: 2AC23-DCT2V
IC: 12290A-DCT2V
HVIN: DCT2VM2511

Zustand des Prüfgegenstandes bei Anlieferung: Prüfmuster vollständig und unbeschädigt
Condition of the test item at delivery: *Test item complete and undamaged*

* 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
** Legend:*	*1 = very good*	*2 = good*	*3 = satisfactory*	*4 = sufficient*	*5 = poor*
	P(ass) = passed a.m. test specification(s)		*F(ail) = failed a.m. test specification(s)*	*N/A = not applicable*	*N/T = not tested*

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.
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.
V05

Test Summary

5.1.1 ANTENNA REQUIREMENT
RESULT: Pass

5.1.2 MAXIMUM CONDUCTED OUTPUT POWER
RESULT: Pass

5.1.3 CONDUCTED POWER SPECTRAL DENSITY
RESULT: Pass

5.1.4 6DB BANDWIDTH
RESULT: Pass

5.1.5 99% BANDWIDTH
RESULT: Pass

5.1.6 CONDUCTED SPURIOUS EMISSIONS MEASURED IN 100 KHZ BANDWIDTH
RESULT: Pass

5.1.7 RADIATED SPURIOUS EMISSION
RESULT: Pass

5.1.8 CONDUCTED EMISSION ON AC MAINS
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 Wi-Fi 802.11 b/g/n

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 Registration 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	2022-09-28
MXG X-Series RF Vector Signal Generator	Keysight	N5182B	MY61250137	2022-09-28
EXG X-Series Microwave Analog Signal Generator	Keysight	N5173B	MY61250141	2022-09-28
DC power supply	Keysight	E3642A	MY61276100	2022-09-28
Power Control Unit	Tonscend	JS0806-4ADC	N/A	2022-09-28
Automation Control Unit	Tonscend	JS0806-2	21C8060396	2022-09-28
Test Software	Tonscend	JS1120-3	N/A	N/A
Control PC	Lenovo	TianYi510S-071MB	YLX23JMF	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	2022-08-10
Signal Analyzer	R&S	FSV 40	101439	2022-08-09
System Controller Interface	R&S	SCI-100	S10010038	N/A
Filterbank	R&S	Wlan	100759	2022-08-09
OSP	R&S	OSP 120	102040	N/A
Pre-amplifier	R&S	SCU08F1	08320031	2022-08-09
Amplifier	R&S	SCU-18F	180070	2022-08-09
Amplifier	R&S	SCU40A	100475	2022-08-09
Trilog Broadband Antenna (30 MHz - 7 GHz)	Schwarzbeck	VULB 9162	193	2022-08-08
Double-Ridged Antenna (1 -18 GHz)	ETS-LINDGREN	3117	00218717	2022-08-08
Wideband Ridged Horn Antenna (18-40 GHz)	Steatite	QMS-00880	19067	2022-08-08
Active Loop Antenna	Schwarzbeck	FMZB 1513	302	2022-09-13
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

Conducted Emission				
Equipment	**Manufacturer**	**Model No.**	**Serial No.**	**Cal. Until**
EMI Test Receiver	R&S	ESR3	102428	2022-08-10
Artificial Mains Network	R&S	ENV216	102333	2022-08-10
Artificial Mains Network	R&S	ENV432	101411	2022-08-10
EMC32 test software	R&S	EMC32(Ver.10.50.00)	N/A	N/A

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 basics 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.

Parameter	Uncertainty
Radio Frequency	±1 x 10-7
RF Power (conducted)	±2.5 dB
Radiated Emission of Transmitter, valid up to 26.5 GHz	±6 dB
Radiated Emission of Receiver, valid up to 26.5 GHz	±6 dB
Conducted Emission, (9kHz to 150kHz)/(150kHz to 30MHz)	± 3.70 dB / ± 3.30 dB
Temperature	±1 °C
Humidity	±5 %
Voltage (DC)	±1 %
Voltage (AC, <10kHz)	±2 %

2.6 Location of Original Data

The original copies of all test data taken during actual testing were attached at Appendix A of this report and delivered to the applicant. A copy has been retained in the TÜV Rheinland (Shenzhen) Co., Ltd. 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+BT module, which supports Bluetooth (dual mode), 2.4GHz Wi-Fi 802.11 b/g/n and 5GHz Wi-Fi 802.11a/n/ac wireless technology.

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

3.2 Ratings and System Details

Table 2: Technical Specification of EUT

General Information of EUT	Value
Kind of Equipment:	WIFI+BT module
Type Designation:	DCT2VM2511
Trademark:	GSD
FCC ID:	2AC23-DCT
Operating Voltage:	DC 3.3V
Testing Voltage:	DC 5V
Technical Specification of Bluetooth (dual mode)	
Operating Frequency:	2402 MHz to 2480 MHz
Type of Modulation:	GFSK, π/4-DQPSK, 8DPSK
Channel Number:	BDR & EDR mode:79 channels, Low Energy mode:40 channels
Channel Separation:	BDR & EDR mode: 1MHz, Low Energy mode: 2MHz
Data Rate:	BDR & EDR mode: 1Mbps, 3Mbps Low Energy mode: 1Mbps
Antenna Type:	PCB layout Antenna
Antenna Gain of Bluetooth:	2.0 dBi
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:	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:	PCB layout Antenna
Number of Antenna:	2
Antenna Gain 1:	3.0 dBi
Antenna Gain 2:	3.0 dBi
Note: 1. The EUT supports MIMO 2*2, any transmit signals are correlated with each other, so Directional gain = G_{ANT} + 10 log(N_{ANT}) dBi=6.01dBi≈6;	

The limit of output power is 30-(6.01-6) ≈30 The limit of power spectral density is 8.	
Technical Specification of Wi-Fi 802.11 a/n/ac	
Operating Frequency:	5180-5240MHz, 5745-5825MHz
Type of Modulation:	OFDM(BPSK/QPSK/16QAM/64QAM/256QAM)
Channel Number:	5180-5240MHz, 14CHs, 802.11 a/n20/n40/ac20/ac40/ac80 5745-5825MHz, 8CHs, 802.11 a/n20/n40/ac20/ac40/ac80
Channel Separation	5 MHz
Antenna Type:	PCB layout Antenna
Number of Antenna:	2
Antenna Gain 1:	4.0 dBi
Antenna Gain 2:	4.0 dBi

Table 3: 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, Wi-Fi 802.11 b/g/n wireless transmitting mode
   1) Low Channel
   2) Middle Channel
   3) High Channel

B. On, Normal operation (Wi-Fi Link)

C. Off

3.4 Noise Generating and Noise Suppressing Parts

Refer to Circuit Diagram for further details.

3.5 Submitted Documents

- Application Form
- Operation Description
- Schematics
- PCB Layout
- User Manual
- Block Diagram
- Rating Label
- Parts List

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 tests were performed according to the procedures in ANSI C63.10: 2013.

According to clause 3.1, all tests were performed on model DCT2VM2511 in this report.

4.3 Special Accessories and Auxiliary Equipment

Table 4: Auxiliary Equipment Used during Test

Description	Manufacturer	Model	S/N
Laptop	Lenovo	T480	10Q67059

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)

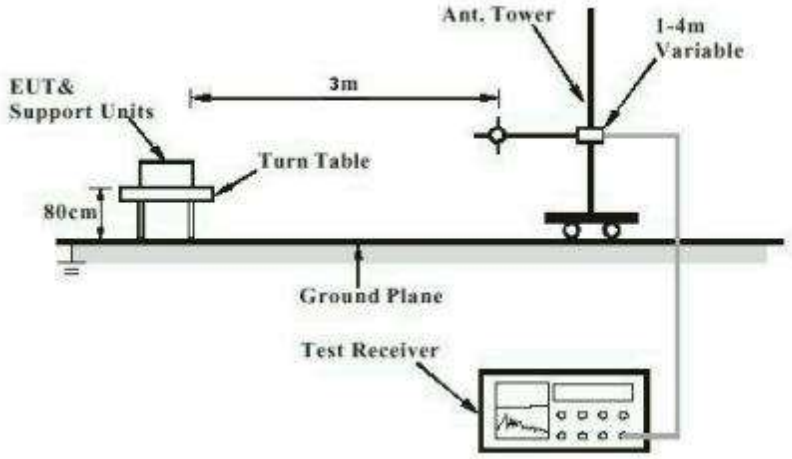


Diagram of Measurement Configuration for Radiation Test (Above 1GHz)

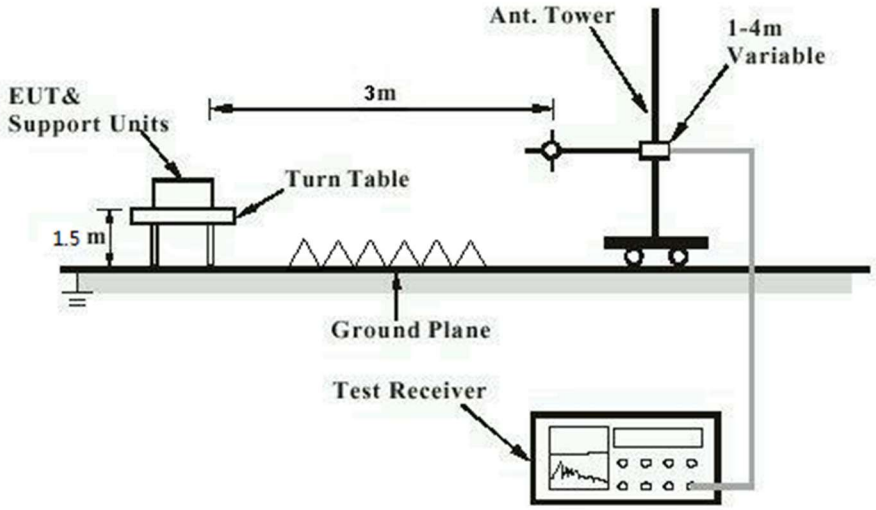


Diagram of Measurement Configuration for Mains Conduction Measurement

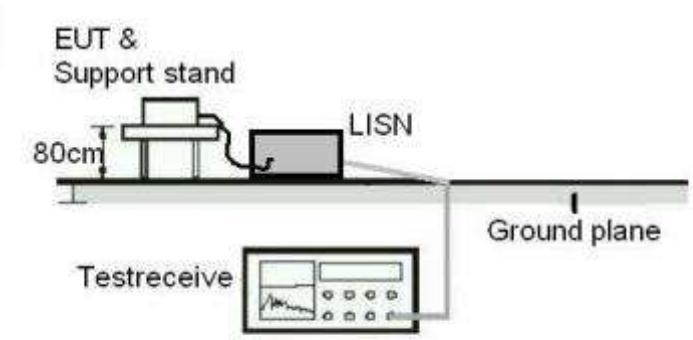
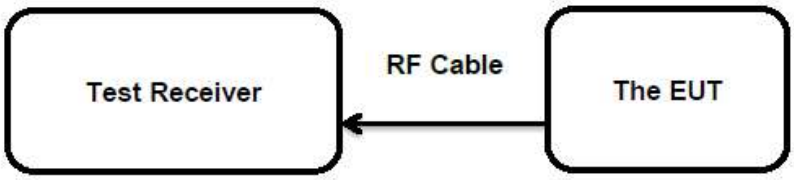


Diagram of Measurement Configuration for Conducted Transmitter Measurement



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

According to the manufacturer declared, the EUT have two internal antennas, Each antenna has a Max. antenna gain of 3 dBi, 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.

5.1.2 Maximum Conducted Output Power

RESULT: **Pass**

Test Specification

Test standard	:	FCC Part 15.247(b)(3)
Basic standard	:	ANSI C63.10: 2013
Limits	:	1.0 Watts
Kind of test site	:	Shielded Room

Test Setup

Date of testing	:	2022-04-08
Input voltage	:	AC 120V, 60Hz
Operation mode	:	A
Test channel	:	Low / Middle / High
Ambient temperature	:	24.8 ℃
Relative humidity	:	55 %
Atmospheric pressure	:	101 kPa

Table 5: Test Result of Maximum 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	15.98	0.0396	< 1.0
		2437	16.70	0.0468	
		2462	16.41	0.0438	
802.11g	6 Mbps	2412	22.47	0.1766	
		2437	22.55	0.1799	
		2462	22.71	0.1866	
802.11n (HT20)	MCS0	2412	21.54	0.1426	
		2437	21.64	0.1459	
		2462	21.56	0.1432	
802.11n (HT40)	MCS0	2422	21.95	0.1567	
		2437	22.05	0.1603	
		2452	21.95	0.1567	
Maximum Measured Value			22.71	0.1866	

Table 6: Test Result of Maximum Conducted Output Power, SISO mode (Ant2)

Test Mode	Data Rate	Test Channel (MHz)	Measured Peak Power		Limit (W)
			(dBm)	(W)	
802.11b	1 Mbps	2412	15.65	0.0367	< 1.0
		2437	16.62	0.0459	
		2462	16.37	0.0434	
802.11g	6 Mbps	2412	21.68	0.1472	
		2437	22.43	0.1750	
		2462	22.87	0.1936	
802.11n (HT20)	MCS0	2412	20.41	0.1099	
		2437	21.31	0.1352	
		2462	21.31	0.1352	
802.11n (HT40)	MCS0	2422	21.22	0.1324	
		2437	21.25	0.1334	
		2452	21.62	0.1452	
Maximum Measured Value			22.87	0.1936	

Table 7: Test Result of Maximum Conducted Output Power, MIMO mode (Ant1+2)

Test Mode	Data Rate	Test Channel (MHz)	Measured Peak Power		Limit (W)
			(dBm)	(W)	
802.11n (HT20)	MCS0	2412	24.02	0.2523	< 1.0
		2437	24.49	0.2812	
		2462	24.45	0.2786	
802.11n (HT40)	MCS0	2422	24.61	0.2891	
		2437	24.68	0.2938	
		2452	24.80	0.3020	
Maximum Measured Value			24.80	0.3020	

Note:
1) The cable loss is taken into account in results.
2) Antenna gain(G) 1: 3.0 dBi
3) Antenna gain(G) 2: 3.0 dBi
4) Directional gain(G)=G_{ANT} + 10 log(N_{ANT}) dBi=6.01 dBi

5.1.3 Conducted Power Spectral Density

RESULT: **Pass**

Test Specification

Test standard	:	FCC Part 15.247(e)
Basic standard	:	ANSI C63.10: 2013
Limits	:	< 8 dBm / 3kHz
Kind of test site	:	Shielded Room

Test Setup

Date of testing	:	2022-04-08
Input voltage	:	AC 120V, 60Hz
Operation mode	:	A
Test channel	:	Low / Middle / High
Ambient temperature	:	24.8 ℃
Relative humidity	:	55 %
Atmospheric pressure	:	101 kPa

For the measurement records, refer to the appendix A.

5.1.4 6dB Bandwidth

RESULT: **Pass**

Test Specification

Test standard	:	FCC Part 15.247(a)(2)
Basic standard	:	ANSI C63.10: 2013
Limits	:	> 500 kHz
Kind of test site	:	Shielded Room

Test Setup

Date of testing	:	2022-04-08
Input voltage	:	AC 120V, 60Hz
Operation mode	:	A
Test channel	:	Low / Middle / High
Ambient temperature	:	24.8 ℃
Relative humidity	:	55 %
Atmospheric pressure	:	101 kPa

For the measurement records, refer to the appendix A.

5.1.5 99% Bandwidth

RESULT: **Pass**

Test Specification

Test standard	:	FCC Part 15.247(a)
Basic standard	:	ANSI C63.10: 2013
Kind of test site	:	Shielded Room

Test Setup

Date of testing	:	2022-04-08
Input voltage	:	AC 120V, 60Hz
Operation mode	:	A
Test channel	:	Low / Middle / High
Ambient temperature	:	24.8 ℃
Relative humidity	:	55 %
Atmospheric pressure	:	101 kPa

For the measurement records, refer to the appendix A.

5.1.6 Conducted Spurious Emissions Measured in 100 kHz Bandwidth

RESULT: **Pass**

Test Specification

Test standard	:	FCC Part 15.247(d)
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	:	2022-04-08
Input voltage	:	AC 120V, 60Hz
Operation mode	:	A
Test channel	:	Low / Middle / High
Ambient temperature	:	24.8 ℃
Relative humidity	:	55 %
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
Basic standard	:	ANSI C63.10: 2013
Limits	:	Refer to 15.209(a) of FCC part 15.247(d)
Kind of test site	:	3m Semi-anechoic Chamber

Test Setup

Date of testing	:	2022-04-10 to 2022-04-12
Input voltage	:	AC 120V, 60Hz
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. All configurations tested for both MIMO and SISO, only worst-case mode data reported.

For the measurement records, refer to the appendix A.

5.1.8 Conducted Emission on AC Mains

RESULT: **Pass**

Test Specification

Test standard	:	FCC Part 15.207(a)
Basic standard	:	ANSI C63.10: 2013
Frequency range	:	0.15 – 30MHz
Limits	:	FCC Part 15.207(a)
Kind of test site	:	Shielded Room

Test Setup

Date of testing	:	2022-04-16
Input voltage	:	AC 120V, 60Hz
Operation mode	:	B
Earthing	:	Not connected
Ambient temperature	:	23.1 ℃
Relative humidity	:	52 %
Atmospheric pressure	:	101 kPa

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 C.

7 List of Tables

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