

Prüfbericht-Nr.: <i>Test report no.:</i>	CN23T4C2 002	Auftrags-Nr.: <i>Order no.:</i>	168421836	Seite 1 von 23 Page 1 of 23
Kunden-Referenz-Nr.: <i>Client reference no.:</i>	N/A	Auftragsdatum: <i>Order date:</i>	2023-03-21	
Auftraggeber: <i>Client:</i>	Lenovo (Beijing) Limited 201-H2-6, Floor 2, Building 2, No.6 Shangdi West Road, Haidian District, 100085 Beijing, P. R. China			
Prüfgegenstand: <i>Test item:</i>	ThinkBook Wireless Dock			
Bezeichnung / Typ-Nr.: <i>Identification / Type no.:</i>	L01WC014-CS-H			
Auftrags-Inhalt: <i>Order content:</i>	Test Report			
Prüfgrundlage: <i>Test specification:</i>	CFR47 FCC Part 15: Subpart C Section 15.247 CFR47 FCC Part 15: Subpart C Section 15.207 CFR47 FCC Part 15: Subpart C Section 15.209			
Wareneingangsdatum: <i>Date of sample receipt:</i>	2023-03-21	Please refer to photo documents		
Prüfmuster-Nr.: <i>Test sample no.:</i>	A003448177-003, 004			
Prüfzeitraum: <i>Testing period:</i>	2023-03-27 to 2023-07-04			
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>	Hardy X <i>Hardy</i> <i>Suo</i>		genehmigt von: <i>authorized by:</i>	Lin Lin X <i>Lin Lin</i>
Datum: <i>Date:</i>	2023-07-18		Ausstellungsdatum: <i>Issue date:</i>	2023-07-18
Stellung / Position:	Sachverständige(r)/Expert		Stellung / Position:	Sachverständige(r)/Expert
Sonstiges / <i>Other:</i>	FCC ID: A5ML01WC014			
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

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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

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 2.4G Wi-Fi_AP6275PR3

Appendix B: Test Results of 2.4G Wi-Fi_AP6275S

Appendix C: Photographs of the Test Set-up

2 Test Sites

2.1 Test Facilities

TÜV Rheinland (Shenzhen) Co., Ltd.

362 Huanguan Road Middle Longhua District, Shenzhen 518110 People's Republic of 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

TÜV Rheinland (Shenzhen) Co., Ltd.

Radio Spectrum Testing (SRD-Tonscend)					
Equip. No.	Description	Manufacturer	Model	Serial No.	Calibrated until (DD.MM.YYYY)
9039436	EXA Signal Analyzer, Multi-touch	Keysight	N9010B	MY60241175	10.10.2023
9039437	MXG X-Series RF Vector Signal Generator	Keysight	N5182B	MY61250137	10.10.2023
9039438	EXG X-Series Microwave Analog Signal Generator	Keysight	N5173B	MY61250141	10.10.2023
9039439	DC Power Supply	Keysight	E3642A	MY61276100	10.10.2023
9039440	Wireless Connectivity Tester	R&S	CMW270	102505	10.10.2023
9039441	Power Control Unit	Tonscend	JS0806-4ADC	N/A	10.10.2023
9039442	Automation Control Unit	Tonscend	JS0806-2	21C8060396	10.10.2023
9039443	Test Software	Tonscend	JS1120-3	N/A	N/A
9039444	Control PC	Lenovo	TianYi510S-071MB	Y LX23JMF	N/A
Unwanted Emission Testing (TS9975)					
Equip. No.	Description	Manufacturer	Model	Serial No.	Calibrated until (DD.MM.YYYY)
G1826021	EMI Test Receiver	R&S	ESR 7	102021	02.08.2023
G1826023	Signal Analyzer	R&S	FSV 40	101439	01.08.2023
G1826024	System Controller Interface	R&S	SCI-100	S10010038	N/A
G1826025	Filterbank	R&S	Wlan	100759	01.08.2023
G1826026	OSP	R&S	OSP 120	102040	N/A
G1826028	Pre-amplifier	R&S	SCU08F1	08320031	02.08.2023
G1826029	Amplifier	R&S	SCU-18F	180070	02.08.2023
G1826030	Amplifier	R&S	SCU40A	100475	02.08.2023
G1826031	Trilog Broadband Antenna (30 MHz - 7 GHz)	Schwarzbeck	VULB 9162	193	06.08.2024
G1826032	Double-Ridged Antenna (1 - 18 GHz)	ETS-LINDGREN	3117	00218717	06.08.2024

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G1826033	Wideband Ridged Horn Antenna (18-40 GHz)	Steatite	QMS-00880	19067	27.08.2024
G1826034	Active Loop Antenna	Schwarzbeck	FMZB 1513	302	06.08.2024
G1826036	Test software	R&S	EMC32 (V10.60.10)	N/A	N/A
G1826037	Control PC	Dell	OptiPlex 7050	36NV9P2	N/A
G1826433	3m Semi-Anechoic Chamber	Albatross	SAC-3m	APC17151-SAC	22.06.2024

Conducted Emission					
Equipment	Manufacturer	Model No.	Serial No.	Cal. Until	
EMI Test Receiver	R&S	ESR3	102428	2023-07-31	
Artificial Mains Network	R&S	ENV216	102333	2023-08-01	
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 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.

Parameter	Uncertainty
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 & C 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 362 Huanguan Road Middle Longhua District, Shenzhen 518110 People's Republic of 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 (**E**quipment **U**nder **T**est) is a ThinkBook Wireless Dock. It supports 2.4/5G Wi-Fi and WPT functions.

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	ThinkBook Wireless Dock
Type Designation	L01WC014-CS-H
Trademark	Lenovo
Operating Temperature Range	0 °C ~ +40 °C
Operating Voltage:	DC 20V@6.75A input via AC Adapter
Testing Voltage:	AC 120V, 60Hz
Radiofrequency operating mode	1) 2.4GHz Wi-Fi: operating within 2400-2483.5MHz, supports 20MHz Bandwidth and IEEE 802.11 b/g/n20/ax20 2) 5GHz Wi-Fi: operating within 5150-5850MHz, supports 20MHz/40MHz/80MHz Bandwidth and IEEE 802.11 a/n20/n40/ac20/ac40/ac80/ax20/ax40/ax80 3) WPT: operating within 110~205KHz
Technical Specification of 2.4GHz Wi-Fi of AP6275PR3	
Operating Frequency	2412 - 2462MHz for 802.11b/g/n(HT20)/ax20(HE20)
Type of Modulation	DSSS(DBPSK/DQPSK/CCK) OFDM(BPSK/QPSK/16QAM/64QAM/256QAM)
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 HE0 ~ HE9 for 802.11ax
Multi-RU	No, full RU
Channel Number	11 channels for 802.11b/g/n(HT20)/ax20(HE20)
Channel Separation	5 MHz
Antenna Type	Integral Antenna
Antenna Number	1Tx1Rx for SISO mode (ANT2 or ANT4)

	2Tx2Rx for MIMO mode (ANT2+ANT4)
Antenna Gain	2.47dBi for ANT2 2.47dBi for ANT4 (provided by client)
The type of wideband data transmission equipment	DTS
Technical Specification of 2.4GHz Wi-Fi of AP6275S	
Operating Frequency	2412 - 2462MHz for 802.11b/g/n(HT20)/ax20(HE20)
Type of Modulation	DSSS(DBPSK/DQPSK/CCK) OFDM(BPSK/QPSK/16QAM/64QAM) OFDMA(BPSK/QPSK/16QAM/64QAM/256QAM)
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 HE0 ~ HE9 for 802.11ax
Multi-RU	Yes
Channel Number	11 channels for 802.11b/g/n(HT20)/ax20(HE20)
Channel Separation	5 MHz
Antenna Type	Integral Antenna
Antenna Number	1Tx1Rx for SISO mode (ANT1 or ANT3) 2Tx2Rx for MIMO mode (ANT1+ANT3)
Antenna Gain	2.9dBi for ANT1 2.74dBi for ANT3 (provided by client)
The type of wideband data transmission equipment	DTS
*Remark: L01WC014-CS-H has two 2.4GHz Wi-Fi modules AP6275PR3 and AP6275S.	

Table 3: RF Channel and Frequency of 2.4GHz Wi-Fi 802.11 b/g/n/ax

RF Channel	802.11 b/g/n(HT20)/ax20
	Frequency (MHz)
01	2412
02	2417
03	2422
04	2427
05	2432
06	2437
07	2442
08	2447
09	2452
10	2457
11	2462

3.3 Independent Operation Modes

The basic operation modes are:

- A. On, Wi-Fi 802.11 b/g/n/ax wireless transmitting mode
- 1) Low Channel
 - 2) Middle Channel

- 3) High Channel
- B. On, Normal Operation
- C. Off

3.4 Noise Generating and Noise Suppressing Parts

Refer to Circuit Diagram for further details.

3.5 Submitted Documents

- Application Form

-

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 and ANSI C63.4: 2014.

According to clause 3.1, all tests were performed on model L01WC014-CS-H in this report.

4.3 Special Accessories and Auxiliary Equipment

Table 4: Auxiliary Equipment Used during Test

Description	Manufacturer	Model	S/N	Rating
Laptop	Lenovo	T480	PF-16A6N8	N/A
Portable Laptop	Lenovo	ThinkPad T480	10Q67059	N/A
HDMI Display	PHILIPS	272P7V	N/A	AC 100-240V
USB-C Display	Lenovo	A19238QP1	V307KY40	AC 100-240V
USB Disk	Kingston	DTX/32G	N/A	N/A
Intelligent wireless charging full function test module	N/A	YBZ	N/A	5W, 7.5W, 10W, 15W
AC/DC Adapter	Lenovo	ADL135SLC3A	N/A	Input: 100-240V~2.5A, 50/60Hz Output: 20V, 6.75A, 135.0W

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)

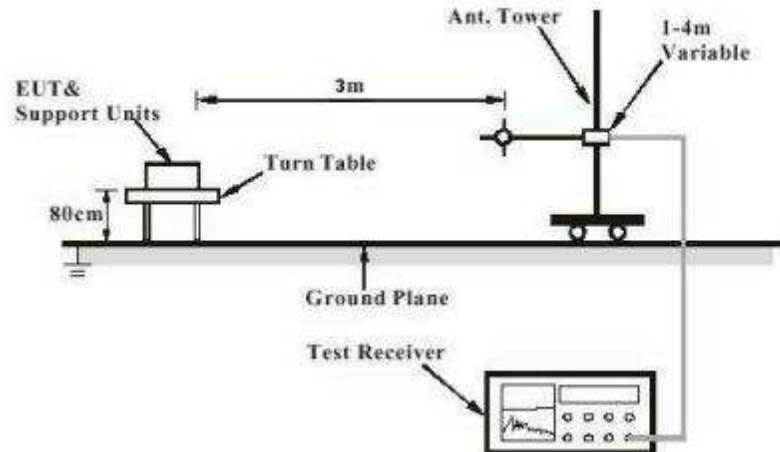


Diagram of Measurement Configuration for Radiation Test (Above 1GHz)

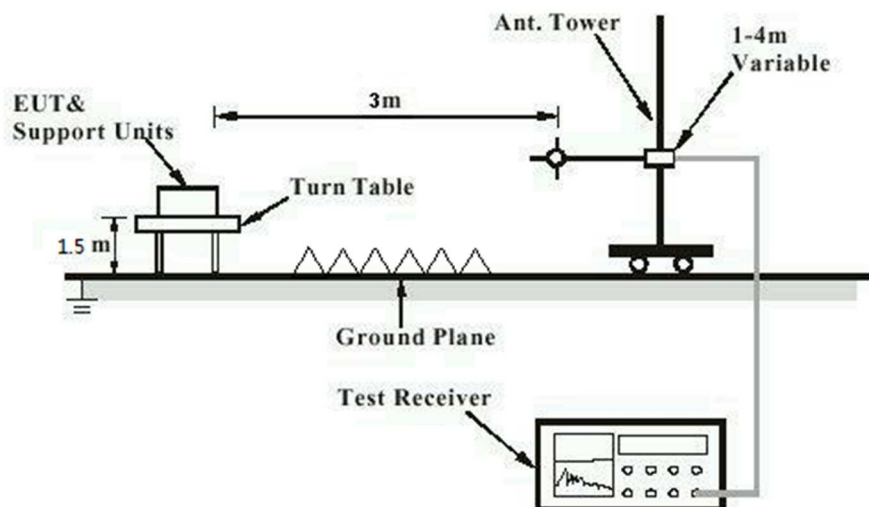


Diagram of Measurement Configuration for Mains Conduction Measurement

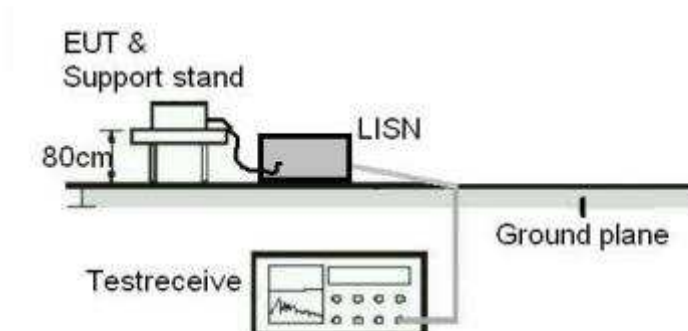
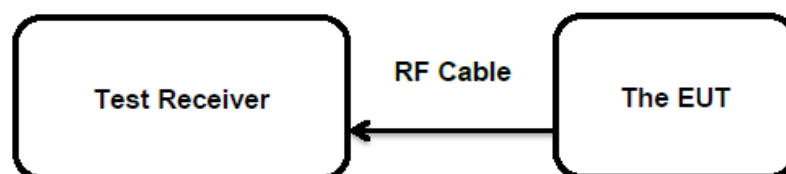


Diagram of Measurement Configuration for Conducted Transmitter Measurement



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 has integral antennas, the max. uncorrelated antenna gain antenna is 2.9dBi, permanent attachment and no consideration of replacement. Therefore the EUT is considered sufficient to comply with the provision.

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

Test Mode	Data Rate	Test Channel	ANT Port	Measured Peak Power		Limit (W)
				(dBm)	(W)	
802.11b	1 Mbps	1	1	18.31	0.0678	< 1.0
			2	18.85	0.0767	
		6	1	18.84	0.0766	
			2	19.27	0.0845	
		11	1	18.88	0.0773	
			2	18.46	0.0701	
802.11g	6 Mbps	1	1	24.41	0.2761	
			2	23.70	0.2344	
		6	1	24.76	0.2992	
			2	24.54	0.2844	
		11	1	24.85	0.3055	
			2	24.83	0.3041	
802.11n (HT20)	MCS7	1	1+2	22.84	0.1923	
		6	1+2	23.36	0.2168	
		11	1+2	23.65	0.2317	
802.11ax (HE20)	MCS7	1	1+2	23.28	0.2128	
		6	1+2	23.69	0.2339	
		11	1+2	23.99	0.2506	

Max. e.i.r.p.=24.83dBm+2.47dBi=27.30dBm, which is less than 36dBm=4W.

Table 6: Test Result of Maximum Peak Conducted Output Power of AP6275S

Worst case

Test Mode	Data Rate	Test Channel	ANT Port	Measured Peak Power		Limit (W)
				(dBm)	(W)	
802.11b	1 Mbps	1	1	19.17	0.0826	< 1.0
			2	18.21	0.0662	
		6	1	19.50	0.0891	
			2	18.11	0.0647	
		11	1	19.03	0.0800	
			2	18.44	0.0698	
802.11g	6 Mbps	1	1	25.55	0.3589	
			2	24.11	0.2576	
		6	1	25.90	0.3890	
			2	24.99	0.3155	
		11	1	25.63	0.3656	
			2	24.87	0.3069	
802.11n (HT20)	MCS7	1	1+2	25.05	0.3199	
		6	1+2	24.42	0.2767	
		11	1+2	24.40	0.2754	
802.11ax (HE20)	MCS7	1	1+2	25.70	0.3715	
		6	1+2	25.70	0.3715	
		11	1+2	25.56	0.3597	
802.11ax (HE20)_26 tone_RU1	MCS7	1	1+2	24.37	0.2735	
		6	1+2	24.01	0.2518	
		11	1+2	24.23	0.2649	
802.11ax (HE20)_242 tone_RU1	MCS7	1	1+2	23.72	0.2355	
		6	1+2	23.42	0.2198	
		11	1+2	23.34	0.2158	

Max. e.i.r.p.=25.90dBm+2.9dBi=28.80dBm, which is less than 36dBm=4W.

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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 : 2023-03-27 to 2023-07-04

Input voltage : AC 120V, 60Hz

Operation mode : A

Test channel : Low / Middle / High

Ambient temperature : 25 °C

Relative humidity : 56 %

Atmospheric pressure : 101 kPa

For the measurement records, refer to the appendix A, B.

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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 : 2023-03-27 to 2023-07-04

Input voltage : AC 120V, 60Hz

Operation mode : A

Test channel : Low / Middle / High

Ambient temperature : 25 °C

Relative humidity : 56 %

Atmospheric pressure : 101 kPa

For the measurement records, refer to the appendix A, B.

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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 : 2023-03-27 to 2023-07-04
Input voltage : AC 120V, 60Hz
Operation mode : A
Test channel : Low / Middle / High
Ambient temperature : 25 °C
Relative humidity : 56 %
Atmospheric pressure : 101 kPa

For the measurement records, refer to the appendix A, B.

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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)
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	: 2023-03-27 to 2023-07-04
Input voltage	: AC 120V, 60Hz
Operation mode	: A
Test channel	: Low / Middle / High
Ambient temperature	: 25 °C
Relative humidity	: 56 %
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, B.

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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 : 2023-03-27 to 2023-07-04

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. Only the worst case spurious emissions configuration of the each mode were reported.

For the measurement records, refer to the appendix A, B.

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5.1.8 Conducted Emission on AC Mains

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

Test standard	: FCC Part 15.207
Basic standard	: ANSI C63.4:2014
Frequency range	: 0.15 – 30MHz
Classification	: Class B
Limits	: FCC Part 15.107(a)
Kind of test site	: Shielded Room

Test Setup

Date of testing	: 2023-03-27
Input voltage	: AC 120V, 60Hz
Operation mode	: A
Earthing	: Connected
Ambient temperature	: 23.0 °C
Relative humidity	: 50.8 %
Atmospheric pressure	: 101 kPa

For the measurement records, refer to the appendix A, B.

6 Photographs of the Test Set-Up

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

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