# **FCC Test Report**

APPLICANT : Lenovo(Shanghai) Electronics Technology

Co., Ltd.

**EQUIPMENT**: Portable Tablet Computer

BRAND NAME : Lenovo MODEL NAME : TB351FU

FCC ID : O57TB351FU

STANDARD : 47 CFR Part 15 Subpart B

**CLASSIFICATION**: Certification

TEST DATE(S) : Mar. 11, 2024 ~ Mar. 16, 2024

We, Sporton International Inc. (Kunshan), would like to declare that the tested sample has been evaluated in accordance with the test procedures given in ANSI C63.4-2014 and has been in compliance with the applicable technical standards.

The test results in this report apply exclusively to the tested model / sample. Without written approval of Sporton International Inc. (Kunshan), the test report shall not be reproduced except in full.

JasonJia

Approved by: Jason Jia





**Report No. : FC413101** 

Sporton International Inc. (Kunshan)

No. 1098, Pengxi North Road, Kunshan Economic Development Zone Jiangsu Province 215300 People's Republic of China

Sporton International Inc.(Kunshan)

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# **REVISION HISTORY**

REPORT NO.	VERSION	DESCRIPTION	ISSUED DATE
FC413101	Rev. 01	Initial issue of report	Apr. 07, 2024

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## SUMMARY OF TEST RESULT

Report Section	FCC Rule	Description	Limit	Result	Remark
					Under limit
3.1	15.107	AC Conducted Emission	< 15.107 limits	PASS	9.08 dB at
					0.156 MHz
					Under limit
3.2	15.109 Radiated Emission < 15.1	< 15.109 limits	PASS	5.26 dB at	
					30.97 MHz

#### **Conformity Assessment Condition:**

The test results (PASS/FAIL) with all measurement uncertainty excluded are presented against the regulation limits or in accordance with the requirements stipulated by the applicant/manufacturer who shall bear all the risks of non-compliance that may potentially occur if measurement uncertainty is taken into account. Please refer to each test results in the section "Measurement Uncertainty".

#### Disclaimer:

The product specifications of the EUT presented in the test report that may affect the test assessments are declared by the manufacturer who shall take full responsibility for the authenticity.

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# 1. General Description

# 1.1. Applicant

Lenovo(Shanghai) Electronics Technology Co., Ltd.

Section 304-305, Building No. 4, # 222, Meiyue Road, China (Shanghai) Pilot Free Trade Zone

### 1.2. Manufacturer

#### **Lenovo PC HK Limited**

23/F, Lincoln House, Taikoo Place 979 King's Road, Quarry Bay, Hong Kong, China

# 1.3. Product Feature of Equipment Under Test

	Product Feature
Equipment	Portable Tablet Computer
Brand Name	Lenovo
Model Name	TB351FU
FCC ID	O57TB351FU
EUT supports Radios application	WLAN 2.4GHz 802.11b/g/n HT20 WLAN 5GHz 802.11a/n HT20/HT40 WLAN 5GHz 802.11ac VHT20/VHT40/VHT80 Bluetooth BR/EDR/LE GNSS/FM
SN Code	Conduction: HA1YPDRF for Sample 1 HA1ZWVWX for Sample 2 Radiation: HA1YPDRF for Sample 1 HA11WVWX for Sample 2 HA1Z9Y0W for Sample 3
HW Version	TB351FU
SW Version	TB351FU_RF01_240221
EUT Stage	Identical Prototype

#### Remark:

- 1. The above EUT's information was declared by manufacturer. Please refer to the specifications or user's manual for more detailed description.
- 2. There are three types of EUT, the differences could be referred to the TB351FU\_Operational Description of Product Equality Declaration which is exhibit separately. According to the difference, we choose sample 1 to full test and the sample 2 /3 is verified for the difference.

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# 1.4. Product Specification of Equipment Under Test

Standards-related Product Specification				
Tx Frequency	802.11b/g/n: 2400 MHz ~ 2483.5 MHz 802.11a/n/ac: 5150 MHz ~ 5250 MHz; 5250 MHz ~ 5350 MHz; 5470 MHz ~ 5725 MHz 5725 MHz ~ 5850 MHz Bluetooth: 2400 MHz ~ 2483.5 MHz			
Rx Frequency	802.11b/g/n: 2400 MHz ~ 2483.5 MHz 802.11a/n/ac: 5150 MHz ~ 5250 MHz; 5250 MHz ~ 5350 MHz; 5470 MHz ~ 5725 MHz 5725 MHz ~ 5850 MHz Bluetooth: 2400 MHz ~ 2483.5 MHz GNSS: 1559 MHz ~ 1610 MHz FM: 88 MHz ~ 108 MHz			
Antenna Type	WLAN: PIFA Antenna Bluetooth: PIFA Antenna GNSS: PIFA Antenna FM: External Earphone Antenna			
Type of Modulation	802.11b: DSSS (DBPSK / DQPSK / CCK) 802.11a/g/n: OFDM (BPSK / QPSK / 16QAM / 64QAM) 802.11ac: OFDM (BPSK / QPSK / 16QAM / 64QAM / 256QAM) Bluetooth LE: GFSK Bluetooth (1Mbps): GFSK Bluetooth (2Mbps): π/4-DQPSK Bluetooth (3Mbps): 8-DPSK GNSS: BPSK			

# 1.5. Modification of EUT

No modifications are made to the EUT during all test items.

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### 1.6. Test Location

Sporton International Inc. (Kunshan) is accredited to ISO/IEC 17025:2017 by American Association for Laboratory Accreditation with Certificate Number 5145.02.

Test Firm	Sporton International Inc. (Kunshan)					
Test Site Location	No. 1098, Pengxi North Road, Kunshan Economic Development Zone Jiangsu Province 215300 People's Republic of China TEL: +86-512-57900158					
Test Site No.	Sporton Site No.	FCC Test Find Registration				
	CO01-KS 03CH02-KS	CN1257	314309			

### 1.7. Test Software

	ltem	Site	Manufacturer	Name	Version
I	1.	03CH02-KS	AUDIX	E3	6.2009-8-24al
	2.	CO01-KS	AUDIX	E3	6.2009-8-24

# 1.8. Applicable Standards

According to the specifications of the manufacturer, the EUT must comply with the requirements of the following standards:

- 47 CFR Part 15 Subpart B
- ANSI C63.4-2014

**Remark:** All test items were verified and recorded according to the standards and without any deviation during the test.

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# 2. Test Configuration of Equipment Under Test

## 2.1. Test Mode

The EUT has been associated with peripherals pursuant to ANSI C63.4-2014 and configuration operated in a manner tended to maximize its emission characteristics in a typical application.

Frequency range investigated: conduction emission (150 kHz to 30 MHz), radiation emission (30MHz to the 5th harmonic of the highest frequency or to 40 GHz, whichever is lower).

Test Items	Function Type
	Mode 1: Bluetooth Idle With pen & Keyboard + WLAN (2.4G) Idle + Camera(Rear) + Earphone + Battery 1 + USB Cable1 (Charging from Adapter1) for Sample 1
	Mode 2: Bluetooth Idle With pen & Keyboard + WLAN (5G) Idle + Camera(Front) + Earphone + Battery 1 + USB Cable2 (Charging from Adapter2 ) for Sample 1
	Mode 3: Bluetooth Idle With pen & Keyboard + WLAN (2.4G) Idle + MPEG4(Run Color Bar) + Earphone + Battery 1 + USB Cable 1 + EUT (eMMC) USB Data Link to Notebook for Sample 1
	Mode 4: Bluetooth Idle With pen & Keyboard + WLAN (5G) Idle + FM Rx(98Mhz) + Earphone + Battery 1 + USB Cable 1 + Notebook USB Data Link to EUT (eMMC) for Sample 1
AC Conducted Emission	Mode 5: Bluetooth Idle With pen & Keyboard + WLAN (2.4G) Idle + GNSS Rx + Earphone + Battery 1 + USB Cable 1 + EUT (SD) USB Data Link to Notebook for Sample 1
	Mode 6: Bluetooth Idle With pen & Keyboard + WLAN (2.4G) Idle + MPEG4(Run Color Bar) + Earphone + Battery 1 + USB Cable 1 + Notebook USB Data Link to EUT (SD)for Sample 1
	Mode 7: Bluetooth Idle With pen & Keyboard + WLAN (2.4G) Idle + MPEG4(Run Color Bar) + Earphone + Battery 1 + USB Cable 2 + EUT (eMMC) USB Data Link to Notebook for Sample 1
	Mode 8: Bluetooth Idle With pen & Keyboard + WLAN (2.4G) Idle + MPEG4(Run Color Bar) + Earphone + Battery 2 + Open the stand + USB Cable 1 + EUT (eMMC) USB Data Link to Notebook for Sample 2
	Mode 9: Bluetooth Idle With pen & Keyboard + WLAN (2.4G) Idle + Camera(Rear) + Earphone + Battery 2 + USB Cable 1 + EUT (eMMC) USB Data Link to Notebook for Sample 2

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Mode 1: Bluetooth Idle With pen & Keyboard + WLAN (2.4G) Idle Camera(Rear) + Earphone + Battery 1 + USB Cable1 (Charging from Adapter1) for Sample 1 Mode 2: Bluetooth Idle With pen & Keyboard + WLAN (5G) Idle + Camera(Front) + Earphone + Battery 1 + USB Cable2 (Charging from Adapter2) for Sample 1 Mode 3: Bluetooth Idle With pen & Keyboard + WLAN (2.4G) Idle + MPEG4(Run Color Bar) + Earphone + Battery 1 + Open the stand + USB Cable 1 + EUT (eMMC) USB Data Link to Notebook for Sample 1 Mode 4: Bluetooth Idle With pen & Keyboard + WLAN (5G) Idle + FM Rx(98Mhz) + Earphone + Battery 1 + USB Cable 1 + Notebook USB Data Link to EUT (eMMC) for Sample 1 Mode 5: Bluetooth Idle With pen & Keyboard + WLAN (2.4G) Idle + GNSS Rx + Earphone + Battery 1 + USB Cable 1 + EUT (SD) USB Data Link to Notebook for Sample 1 Mode 6: Bluetooth Idle With pen & Keyboard + WLAN (5G) Idle + FM Rx(98Mhz) Radiated **Emissions** + Earphone +Battery 1 + USB Cable 1 + Notebook USB Data Link to EUT (SD) for Sample 1 Mode 7: Bluetooth Idle With pen & Keyboard + WLAN (5G) Idle + FM Rx98(Mhz) + Earphone + Battery 1 + USB Cable 2 + Notebook USB Data Link to EUT (eMMC) for Sample 1 Mode 8: Bluetooth Idle With pen & Keyboard + WLAN (5G) Idle + FM Rx(98Mhz) + Earphone + USB Cable (EUT Charging to Keyboard ) for Sample 1 Mode 9: Bluetooth Idle With pen & Keyboard + WLAN (5G) Idle + MPEG4(Run Color Bar) + Earphone + Battery 2 + Open the stand + USB Cable 1 + Notebook USB Data Link to EUT (eMMC) for Sample 2 Mode 10: Bluetooth Idle With pen & Keyboard + WLAN (5G) Idle + Camera(Front) + Earphone + Battery 2 + USB Cable 1 + Notebook USB Data Link to EUT (eMMC) for Sample 2 Mode 11: Bluetooth Idle With pen & Keyboard + WLAN (5G) Idle + FM Rx(98Mhz) + Earphone + Battery 2 + USB Cable 1 + Notebook USB Data Link to EUT (eMMC) for Sample 3

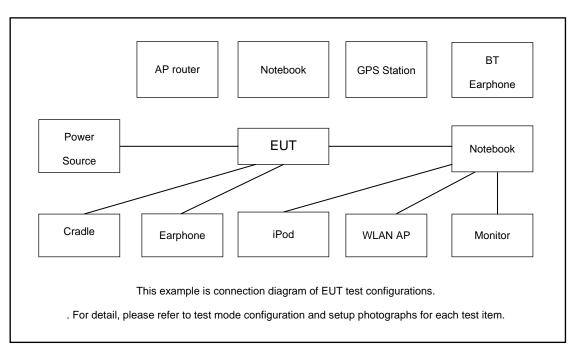
#### Remark:

- 1. The worst case of AC is mode 3; only the test data of this mode is reported.
- 2. The worst case of RE is mode 4; only the test data of this mode is reported.
- Data Link with Notebook means data application transferred mode between EUT and Notebook.

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# 2.2. Connection Diagram of Test System



The EUT has been associated with peripherals pursuant to ANSI C63.4-2014 and configuration operated in a manner tended to maximize its emission characteristics in a typical application

# 2.3. Support Unit used in test configuration and system

Item	Equipment	Trade Name	Model Name	FCC ID	Data Cable	Power Cord
1.	Vector Signal Generator	R&S	SMBV100A	258305	N/A	N/A
2.	WLAN AP	HUAWEI	WS7100	N/A	N/A	N/A
3.	WLAN AP	D-link	DIR-655	KA21R655B1	N/A	Unshielded,1.8m
4.	Notebook	Acer	N20C5	N/A	N/A	N/A
5.	Notebook	Lenovo	G480	QDS-BRCM1050I	N/A	shielded cable DC O/P 1.8m , Unshielded AC I/P cable 1.8m
6.	Hard disk	KINGSHARE	KSP6120G	N/A	N/A	N/A
7.	Hard Disk	Lenovo	F310	DoC	Shielded, 1.2m	N/A
8.	SD Card	SanDisk	Uitra	N/A	N/A	N/A
9.	SD Card	Kingston	8GB	N/A	N/A	N/A
10.	Earphone	Lenovo	P121	N/A	N/A	Unshielded,1.2m

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## 2.4. EUT Operation Test Setup

The EUT was synchronized to the BCCH, and is in continuous receiving mode by setting system simulator's paging reorganization.

At the same time, the EUT was attached to the Bluetooth earphone or WLAN AP, and the following programs installed in the EUT were programmed during the test.

- 1. Data application is transferred between notebook and EUT via USB cable.
- 2. Turn on camera to capture images.
- 3. Turn on MPEG4 function.
- 4. Turn on FM function to make the EUT receive continuous signals from FM station.
- 5. Turn on GNSS function to make the EUT receive continuous signals from GNSS station.

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## 3. Test Result

### 3.1. Test of AC Conducted Emission Measurement

#### 3.1.1 Limits of AC Conducted Emission

For equipment that is designed to be connected to the public utility (AC) power line, the radio frequency voltage that is conducted back onto the AC power line on any frequency or frequencies within the band 150 kHz to 30 MHz shall not exceed the limits in the following table.

#### <Class B Limit>

Frequency of emission	Conducted limit (dBuV)				
(MHz)	Quasi-peak	Average			
0.15-0.5	66 to 56*	56 to 46*			
0.5-5	56	46			
5-30	60	50			

<sup>\*</sup>Decreases with the logarithm of the frequency.

### 3.1.2 Measuring Instruments

The measuring equipment is listed in the section 4 of this test report.

#### 3.1.3 Test Procedure

- 1. The EUT was placed 0.4 meter from the conducting wall of the shielding room was kept at least 80 centimeters from any other grounded conducting surface.
- 2. Connect EUT to the power mains through a line impedance stabilization network (LISN).
- 3. All the support units are connecting to the other LISN.
- 4. The LISN provides 50 ohm coupling impedance for the measuring instrument.
- 5. The FCC states that a 50 ohm, 50 microhenry LISN should be used.
- 6. Both sides of AC line were checked for maximum conducted interference.
- 7. The frequency range from 150 kHz to 30 MHz was searched.
- 8. Set the test-receiver system to Peak Detect Function and specified bandwidth (IF Bandwidth = 9kHz) with Maximum Hold Mode. Then measurement is also conducted by Average Detector and Quasi-Peak Detector Function respectively.

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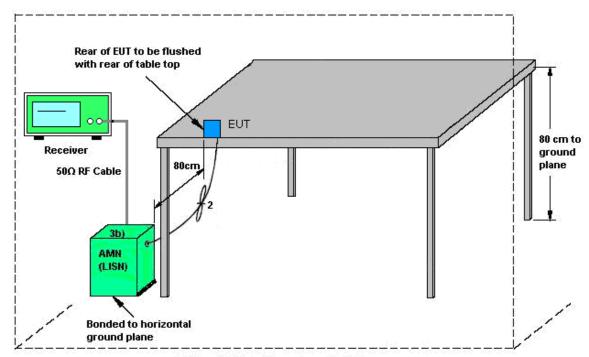
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## 3.1.4 Test Setup



AMN = Artificial mains network (LISN)

AE = Associated equipment

EUT = Equipment under test

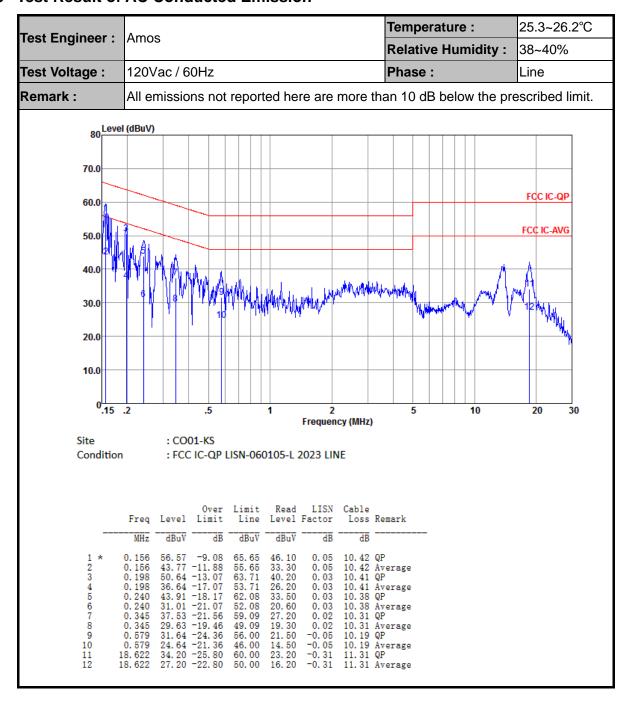
ISN = Impedance stabilization network

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### 3.1.5 Test Result of AC Conducted Emission



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Temperature : 25.3~26.2°C Test Engineer: Amos Relative Humidity: 38~40% Test Voltage: 120Vac / 60Hz Phase: Neutral Remark: All emissions not reported here are more than 10 dB below the prescribed limit. 70.0 FCC IC-QP 60.0 FCC IC-AVG 50.0 40.0 30.0 20.0 10.0 30 Frequency (MHz) : FCC IC-QP LISN-060105-N 2023 NEUTRAL Condition

	Freq	Level dBuV	Over Limit dB	Limit Line dBuV	Read Level	LISN Factor	Cable Loss dB	Remark
1 * 2 3 4 5 6 7 8 9 10 11 12	0. 150 0. 150 0. 169 0. 169 0. 203 0. 203 0. 246 0. 246 0. 431 0. 431 17. 475	43. 56 50. 66 33. 66 47. 25 33. 35 42. 57 35. 27 38. 10 34. 80 37. 29	-9. 52 -12. 44 -14. 37 -21. 37 -16. 24 -20. 14 -19. 34 -16. 64 -19. 14 -12. 44 -22. 71 -18. 61	66. 00 56. 00 65. 03 55. 03 63. 49 53. 49 61. 91 51. 91 57. 24 47. 24 60. 00 50. 00	46. 02 33. 10 40. 20 23. 20 36. 79 22. 89 32. 20 24. 90 27. 90 24. 60 26. 20 20. 30	0. 04 0. 04 0. 04 0. 05 0. 05 0. 00 0. 00 -0. 06 -0. 19	10. 42 10. 42 10. 41 10. 37 10. 37 10. 26 10. 26 11. 28	Average QP Average QP Average QP Average QP Average

#### Note:

- 1. Level( $dB\mu V$ ) = Read Level( $dB\mu V$ ) + LISN Factor(dB) + Cable Loss(dB)
- 2. Over Limit(dB) = Level(dB $\mu$ V) Limit Line(dB $\mu$ V)

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## 3.2. Test of Radiated Emission Measurement

### 3.2.1. Limit of Radiated Emission

The emissions from an unintentional radiator shall not exceed the field strength levels specified in the following table:

#### <Class B Limit>

Frequency	Field Strength	Measurement Distance		
(MHz)	(microvolts/meter)	(meters)		
30 – 88	100	3		
88 – 216	150	3		
216 - 960	200	3		
Above 960	500	3		

# 3.2.2. Measuring Instruments

The measuring equipment is listed in the section 4 of this test report.

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#### 3.2.3. Test Procedures

- 1. The EUT was placed on a turntable with 0.8 meter above ground.
- 2. The EUT was set 3 meters from the interference receiving antenna, which was mounted on the top of a variable height antenna tower.
- 3. The table was rotated 360 degrees to determine the position of the highest radiation.
- 4. The antenna is a Bi-Log antenna and its height is adjusted between one to four meters above ground to find the maximum value of the field strength for both horizontal polarization and vertical polarization of the antenna.
- 5. For each suspected emission, the EUT was arranged to its worst case and then tune the antenna tower (from 1 m to 4 m) and turntable (from 0 degree to 360 degrees) to find the maximum reading.
- 6. Set the test-receiver system to Peak Detect Function and specified bandwidth with Maximum Hold Mode (RBW=120kHz/VBW=300kHz for frequency below 1GHz; RBW=1MHz VBW=3MHz (Peak), RBW=1MHz/VBW=10Hz (Average) for frequency above 1GHz).
- 7. If the emission level of the EUT in peak mode was 3 dB lower than the limit specified, peak values of EUT will be reported. Otherwise, the emission will be repeated by using the quasi-peak method and reported.
- 8. Emission level  $(dB\mu V/m) = 20 \log Emission level (\mu V/m)$
- 9. Corrected Reading: Antenna Factor + Cable Loss + Read Level Preamp Factor = Level
- 10. Exploratory radiated emissions testing of handheld and/or body-worn devices shall include rotation of the EUT through three orthogonal axes (X/Y/Z Plane) to determine the orientation (attitude) that maximizes the emissions.

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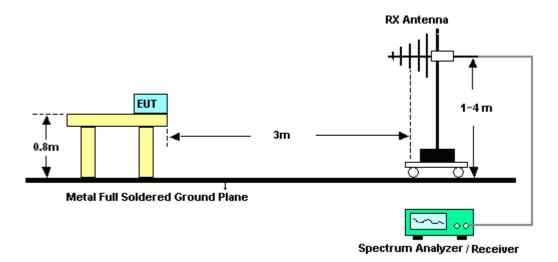
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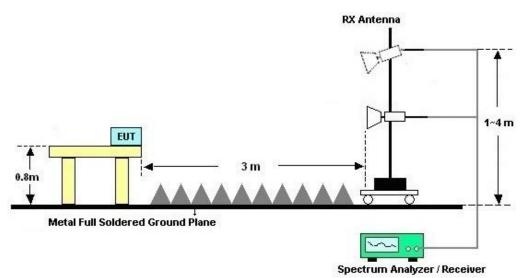
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# 3.2.4. Test Setup of Radiated Emission

### For radiated emissions from 30MHz to 1GHz



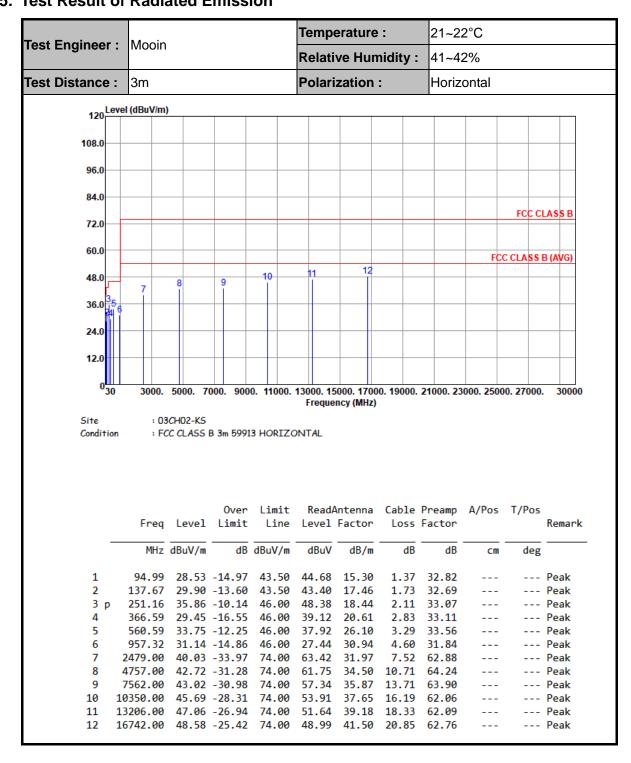
For radiated emissions above 1GHz



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# 3.2.5. Test Result of Radiated Emission



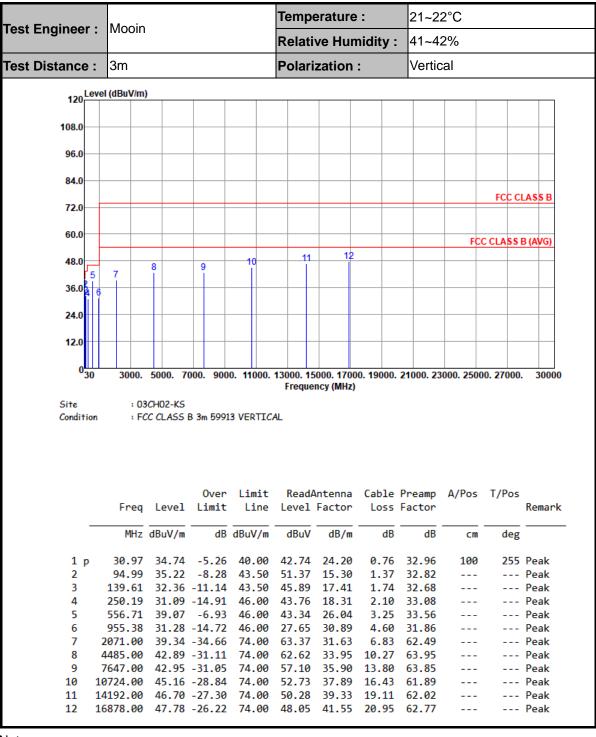
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#### Note:

- 1. Level(dBμV/m) = Read Level(dBμV) + Antenna Factor(dB/m) + Cable Loss(dB) Preamp Factor(dB)
- 2. Over Limit(dB) = Level(dB $\mu$ V/m) Limit Line(dB $\mu$ V/m)

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# 4. List of Measuring Equipment

Instrument	Manufacturer	Model No.	Serial No.	Characteristics	Calibration Date	Test Date	Due Date	Remark
EMI Test Receiver	R&S	ESR7	101403	9kHz~7GHz;Ma x 30dBm	Oct. 10, 2023	Mar. 11, 2024	Oct. 09, 2024	Radiation (03CH02-KS)
EXA Spectrum Analyzer	Keysight	N9010A	MY55370528	10Hz-44G,MAX 30dB	Oct. 10, 2023	Mar. 11, 2024	Oct. 09, 2024	Radiation (03CH02-KS)
Bilog Antenna	TeseQ	CBL6111D	44483	30MHz-1GHz	Dec. 21, 2023	Mar. 11, 2024	Dec. 20, 2024	Radiation (03CH02-KS)
Double Ridge Horn Antenna	ETS-Lindgren	3117	75957	1GHz~18GHz	Nov. 23, 2024	Mar. 11, 2024	Nov. 22, 2024	Radiation (03CH02-KS)
SHF-EHF Horn	Com-power	AH-840	101070	18GHz~40GHz	Jan. 05, 2024	Mar. 11, 2024	Jan. 04, 2025	Radiation (03CH02-KS)
Amplifier	EM	EM18G40GGA	060852	18~40GHz	Jan. 05, 2024	Mar. 11, 2024	Jan. 04, 2025	Radiation (03CH02-KS)
Amplifier	SONOMA	310N	380826	9KHz-1GHz	Jul 06, 2023	Mar. 11, 2024	Jul 05, 2024	Radiation (03CH02-KS)
Amplifier	EM	EM01G18G	060806	1GHz~18GHz	Oct. 10, 2023	Mar. 11, 2024	Oct. 09, 2024	Radiation (03CH02-KS)
AC Power Source	Chroma	61601	616010002473	N/A	NCR	Mar. 11, 2024	NCR	Radiation (03CH02-KS)
Turn Table	MF	MF7802	N/A	0~360 degree	NCR	Mar. 11, 2024	NCR	Radiation (03CH02-KS)
Antenna Mast	MF	MF7802	N/A	1 m~4 m	NCR	Mar. 11, 2024	NCR	Radiation (03CH02-KS)
EMI Receiver	R&S	ESCI7	100768	9kHz~7GHz;	May 16, 2023	Mar. 16, 2024	May 15, 2024	Conduction (CO01-KS)
AC LISN (for auxiliary equipment)	MessTec	AN3016	060103	9kHz~30MHz	Oct. 11, 2023	Mar. 16, 2024	Oct. 10, 2024	Conduction (CO01-KS)
AC LISN	MessTec	AN3016	060105	9kHz~30MHz	May 16, 2023	Mar. 16, 2024	May 15, 2024	Conduction (CO01-KS)
AC Power Source	Chroma	61602	ABP000000811	AC 0V~300V, 45Hz~1000Hz	Oct. 11, 2023	Mar. 16, 2024	Oct. 10, 2024	Conduction (CO01-KS)

NCR: No Calibration Required

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# 5. Measurement Uncertainty

### **Uncertainty of Conducted Emission Measurement (150 kHz ~ 30 MHz)**

Measuring Uncertainty for a Level of Confidence	2.84 dB
of 95% (U = 2Uc(y))	2.04 UD

### Uncertainty of Radiated Emission Measurement (30 MHz ~ 1000 MHz)

Measuring Uncertainty for a Level of Confidence	C 0.4 -ID
of 95% (U = 2Uc(y))	6.04 dB

### <u>Uncertainty of Radiated Emission Measurement (1000 MHz ~ 18000 MHz)</u>

Measuring Uncertainty for a Level of Confidence	5.16 dB
of 95% (U = 2Uc(y))	3.10 dB

### Uncertainty of Radiated Emission Measurement (18000 MHz ~ 40000 MHz)

Measuring Uncertainty for a Level of Confidence	
of 95% (U = 2Uc(y))	4.96 dB

----- THE END -----

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