	FCC Test Report
Report No.:	RFBEDW-WTW-P22090633
FCC ID:	E2K-DWRFID2203
Test Model:	DWRFID2203
Received Date:	Oct. 20, 2022
Test Date:	Oct. 20 ~ Oct. 27, 2022
Issued Date:	Nov. 21, 2022
Applicant:	Dell Inc.
Address:	One Dell Way, Round Rock, Texas 78682, USA
Issued By:	Bureau Veritas Consumer Products Services (H.K.) Ltd., Taoyuan Branch
	Lin Kou Laboratories
Lab Address:	No. 47-2, 14th Ling, Chia Pau Vil., Lin Kou Dist., New Taipei City, Taiwan
Test Location:	No. 19, Hwa Ya 2nd Rd., Wen Hwa Vil., Kwei Shan Dist., Taoyuan City 33383, TAIWAN
FCC Registration / Designation Number:	788550 / TW0003
	Testing Laboratory
	$\mathcal{I}_{\alpha}_{\alpha}_{\alpha}_{\alpha}_{\alpha}$
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notify us of any material error or omission ca shall specifically address the issue you wi completeness of this report, the tests condu	used by our negligence or if you require measurement uncertainty; provided, however, that such notice shall be in writing and ish to raise. A failure to raise such issue within the prescribed time shall constitute your unqualified acceptance of the cted and the correctness of the report contents.



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# **Release Control Record**

Issue No.	Description	Date Issued
RFBEDW-WTW-P22090633	Original release	Nov. 21, 2022

#### 1 **Certificate of Conformity**

Product:	RFID 13.56MHz Wireless Module	
Brand:	DELL	
Model:	DWRFID2203	
Sample Status:	Production Unit	
Applicant:	Dell Inc.	
Test Date:	Oct. 20 ~ Oct. 27, 2022	
Standards:	47 CFR FCC Part 15, Subpart C (Section 15.225)	
	47 CFR FCC Part 15, Subpart C (Section 15.215)	
	ANSI C63.10-2013	

The above equipment has been tested by Bureau Veritas Consumer Products Services (H.K.) Ltd., Taoyuan Branch, and found compliance with the requirement of the above standards. The test record, data evaluation & Equipment Under Test (EUT) configurations represented herein are true and accurate accounts of the measurements of the sample's RF characteristics under the conditions specified in this report.

Prepared by :

Polly Chien / Specialist , Date: Nov. 21, 2022

Approved by: \_\_\_\_\_\_ Jeremy Lin \_, Date: Nov. 21, 2022

Jeremy Lin / Project Engineer



# 2 Summary of Test Results

47 CFR FCC Part 15, Subpart C (Section 15.225, 15.215)				
FCC Clause	Test Item	Result	Remarks	
15.207	Conducted emission test	Pass	Meet the requirement of limit. Minimum passing margin is -9.62dB at 13.55800MHz	
15.225 (a)	The field strength of any emissions within the band 13.553-13.567 MHz	Pass	Meet the requirement of limit. Minimum passing margin is -79.7dB at 13.56MHz.	
15.225 (b)	The field strength of any emissions within the bands 13.410-13.553 MHz and 13.567-13.710 MHz	Pass	Meet the requirement of limit.	
15.225 (c)	The field strength of any emissions within the bands 13.110-13.410 MHz and 13.710-14.010 MHz	Pass	Meet the requirement of limit.	
15.225 (d)	The field strength of any emissions appearing outside of the 13.110-14.010 MHz band	Pass	Meet the requirement of limit. Minimum passing margin is -7.6dB at 41.64MHz.	
15.225 (e)	The frequency tolerance	Pass	Meet the requirement of limit.	
15.215 (c)	20dB Bandwidth	Pass	Meet the requirement of limit.	

Note: Determining compliance based on the results of the compliance measurement, not taking into account measurement instrumentation uncertainty.

# 2.1 Measurement Uncertainty

Where relevant, the following measurement uncertainty levels have been estimated for tests performed on the EUT as specified in CISPR 16-4-2:

Measurement	Frequency	Expanded Uncertainty (k=2) (±)
Conducted Emissions at mains ports	150kHz ~ 30MHz	2.79 dB
	9kHz ~ 30MHz	2.44 dB
Radiated Emissions up to 1 GHz	30MHz ~ 200MHz	2.93 dB
	200MHz ~1000MHz	2.95 dB

### 2.2 Modification Record

There were no modifications required for compliance.



# 3 General Information

# 3.1 General Description of EUT

Product	RFID 13.56MHz Wireless Module			
Brand	DELL			
Model	DWRFID2203			
Sample Status	Production Unit			
Power Supply Rating	3.3 Vdc (host equipment)			
Modulation Type	ASK			
	Type A: 106 kbit/s			
Data Pata	Type B: 106 kbit/s			
Dala Rale	Type F: 212 kbit/s, 424 kbit/s			
	Type V: 26.48 kbit/s			
Operating Frequency 13.56MHz				
Field Strength	4.3dBµV/m (30m)			
Antenna Type	Refer to Note as below			
Accessory Device	Refer to Note as below			
Data Cable Supplied	NA			

### Note:

1. The EUT is authorized for use in specific End-product. Please refer to below for more details.

Product	Brand	Model
Portable Computer	DELL	P126F

# 2. The antenna information is listed as below.

Antenna Manufacturer	Antenna Model No.	Antenna Type	Antenna Gain (dBi)	Note
Hong-Bo	350-24032 (DC33002RV0L)	Loop Antenna	N/A	Main source
Speedwire	F-0W-FH-6154-001-00 (DC33002RT4L)	Loop Antenna	N/A	2nd source

\* After the pretesting, the Hong-Bo antenna was the worst case and had been chosen for final test.

\* Detail antenna specification please refer to antenna datasheet and/or antenna report.

# 3. The End-product contains following accessory devices.

Product	Brand	Model	Description
Adapter	DELL	HA65NM190	I/P: 100-240 Vac, 50-60 Hz, 1.7 A O/P: 20Vdc, 3.25A or 15Vdc, 3A or 9Vdc, 3A or 5Vdc, 3A Power cord: 0.85 meter
Battery	DELL	WW8N8	57Wh (11.4Vdc) Rated Capacity:4878 mAh, Limited Charging Voltage:13.35Vdc

# 3.2 Description of Test Modes

### 1 channel is provided to this EUT

Channel	Freq. (MHz)
1	13.56



# 3.2.1 Test Mode Applicability and Tested Channel Deta

EUT Configure	Applicable to				Description	
Mode	RE	PLC	FS	EB	Description	
-	$\checkmark$	$\checkmark$	$\checkmark$	$\checkmark$	-	
Where RE: F	ere RE: Radiated Emission		PLC: Power Line Conducted Emission			
FS: F	FS: Frequency Stability		EB: 20dB Bandwidth measurement			

Note: The EUT had been pre-tested on Type A, Type B, Type F and Type V. The worst case was found when data rate was Type F, Type F was chosen for final test.

#### **Radiated Emission Test:**

Pre-Scan has been conducted to determine the worst-case mode from all possible combinations between available modulations, data rates and antenna ports (if EUT with antenna diversity architecture).
Following channel(s) was (were) selected for the final test as listed below.

EUT Configure Mode Available Channel		Tested Channel	Modulation Type
-	1	1	ASK

#### Power Line Conducted Emission Test:

Pre-Scan has been conducted to determine the worst-case mode from all possible combinations between available modulations, data rates and antenna ports (if EUT with antenna diversity architecture).
Following channel(s) was (were) selected for the final test as listed below.

EUT Configure Mode Available Channel		Tested Channel	Modulation Type
-	1	1	ASK

#### Frequency Stability:

Pre-Scan has been conducted to determine the worst-case mode from all possible combinations between available modulations, data rates and antenna ports (if EUT with antenna diversity architecture).
Following channel(c) was (wore) selected for the final test as listed below.

$\bigtriangleup$	Following channel(s) v	vas (were) selected for the	tinal test as listed below.	

EUT Configure Mode	Available Channel	Tested Channel	Modulation Type	
-	1	1	ASK	

#### 20dB Bandwidth:

Pre-Scan has been conducted to determine the worst-case mode from all possible combinations between available modulations, data rates and antenna ports (if EUT with antenna diversity architecture).

Following channel(s) was (were) selected for the final test as listed below.

EUT Configure Mode	Available Channel	Tested Channel	Modulation Type	
-	1	1	ASK	

#### Test Condition:

Applicable to	Environmental Conditions	Input Power	Tested by
<b>RE</b> 23 deg. C, 68% RH		120Vac, 60Hz	Thomas Cheng
PLC	25 deg. C, 75% RH	120Vac, 60Hz	Thomas Cheng
<b>FS</b> 23 deg. C, 68% RH		120Vac, 60Hz	Vincent chen
BW	23 deg. C, 68% RH	120Vac, 60Hz	Thomas Cheng



# 3.3 Description of Support Units

The EUT has been tested as an independent unit together with other necessary accessories or support units. The following support units or accessories were used to form a representative test configuration during the tests.

ID	Product	Brand	Model No.	Serial No.	FCC ID	Remarks
Α.	Portable Computer	DELL	P126F	NA	NA	Provided by client
В.	Adapter	DELL	DA65NM190	NA	NA	Provided by client
C.	Earphone	HTC	HTC_MAX320	NA	NA	-
D.	Monitor	DELL	SE2416Hc	CN-OWJKMC-64180 -66D-013B-A00	NA	-
E.	USB Flash	SanDisk	SDDDC3-032G	NA	NA	Туре С
F.	USB Flash x2	Transcend	USB3.0 32GB	NA	NA	Туре А
G.	NFC Card	NA	NA	NA	NA	-

Note: All power cords of the above support units are non-shielded (1.8m).

ID	Descriptions	Qty.	Length (m)	Shielding (Yes/No)	Cores (Qty.)	Remarks
1.	DC Power cable	1	1.8	N	0	Provided by client
2.	Audio cable	1	1.2	N	0	-
3.	HDMI cable	1	1.8	Y	0	-
4.	AC Power cable	1	0.85	N	0	Provided by client

# 3.3.1 Configuration of System under Test



#### 3.4 General Description of Applied Standards

The EUT is a RF Product. According to the specifications of the manufacturer, it must comply with the requirements of the following standards:

FCC Part 15, Subpart C (15.225) FCC Part 15, Subpart C (15.215) ANSI C63.10-2013

All test items have been performed and recorded as per the above standards.



# 4 Test Types and Results

### 4.1 Radiated Emission Measurement

#### 4.1.1 Limits of Radiated Emission Measurement

The field strength of any emissions within the band 13.553-13.567 MHz shall not exceed 15,848 microvolts/meter at 30 meters.

Within the bands 13.410-13.553 MHz and 13.567-13.710 MHz, the field strength of any emissions shall not exceed 334 microvolts/meter at 30 meters.

Within the bands 13.110-13.410 MHz and 13.710-14.010 MHz the field strength of any emissions shall not exceed 106 microvolts/meter at 30 meters.

The field strength of any emissions appearing outside of the 13.110-14.010 MHz band shall not exceed the general radiated emission limits in  $\S$  15.209.

Frequencies (MHz)	Field Strength (microvolts/meter)	Measurement Distance (meters)
0.009 ~ 0.490	2400/F(kHz)	300
0.490 ~ 1.705	24000/F(kHz)	30
1.705 ~ 30.0	30	30
30 ~ 88	100	3
88 ~ 216	150	3
216 ~ 960	200	3
Above 960	500	3

Note:

- 1. The lower limit shall apply at the transition frequencies.
- 2. Emission level (dBuV/m) = 20 log Emission level (uV/m).
- 3. For frequencies above 1000MHz, the field strength limits are based on average detector, however, the peak field strength of any emission shall not exceed the maximum permitted average limits, specified above by more than 20dB under any condition of modulation.



# 4.1.2 Test Instruments

Description & Manufacturer	Model No.	Serial No.	Cal. Date	Cal. Due
Test Receiver Agilent	N9038A	MY55420137	Apr. 27, 2022	Apr. 26, 2023
Spectrum Analyzer Agilent	N9010A	MY52220207	Jan. 06, 2022	Jan. 05, 2023
Spectrum Analyzer ROHDE & SCHWARZ	FSU43	101261	Apr. 11, 2022	Apr. 10, 2023
HORN Antenna SCHWARZBECK	BBHA 9120D	9120D-969	Nov. 14, 2021	Nov. 13, 2022
BILOG Antenna SCHWARZBECK	VULB 9168	9168-472	Oct. 28, 2021	Oct. 27, 2022
Fixed Attenuator WOKEN	MDCS18N-10	MDCS18N-10-01	Apr. 05, 2022	Apr. 04, 2023
Loop Antenna TESEQ	HLA 6121	45745	Jul. 27, 2022	Jul. 26, 2023
Preamplifier EMCI	EMC 330H	980112	Oct. 01, 2022	Sep. 30, 2023
Preamplifier EMCI	EMC 012645	980115	Oct. 01, 2022	Sep. 30, 2023
RF Coaxial Cable EMCI	EMC104-SM-SM-8 000	171005	Oct. 01, 2022	Sep. 30, 2023
RF Coaxial Cable HUBER+SUHNNER	SUCOFLEX 104	EMC104-SM-SM-1000(1 40807)	Oct. 01, 2022	Sep. 30, 2023
RF Coaxial Cable WOKEN	8D-FB	Cable-Ch10-01	Oct. 01, 2022	Sep. 30, 2023
Boresight Antenna Fixture	FBA-01	FBA-SIP01	NA	NA
Software BV ADT	E3 6.120103	NA	NA	NA
Antenna Tower MF	MFA-440H	NA	NA	NA
Turn Table MF	MFT-201SS	NA	NA	NA
Antenna Tower &Turn Table Controller MF	MF-7802	NA	NA	NA

Note: 1. The calibration interval of the above test instruments is 12 months and the calibrations are traceable to NML/ROC and NIST/USA.

2. The test was performed in HwaYa Chamber 10.



# 4.1.3 Test Procedures

#### For Radiated emission below 30MHz

- a. The EUT was placed on the top of a rotating table 0.8 meters above the ground at a 3 meter chamber room. The table was rotated 360 degrees to determine the position of the highest radiation.
- b. The EUT was set 3 meters away from the interference-receiving antenna, which was mounted on the top of a variable-height antenna tower.
- c. Parallel, perpendicular, and ground-parallel orientations of the antenna are set to make the measurement.
- d. For each suspected emission, the EUT was arranged to its worst case and the rotatable table was turned from 0 degrees to 360 degrees to find the maximum reading.
- e. The test-receiver system was set to Quasi-Peak Detect Function and Specified Bandwidth with Maximum Hold Mode, except for the frequency band (9kHz-90kHz, 110kHz-490kHz) set to average detect function and peak detect function.

Note:

- 1. The resolution bandwidth and video bandwidth of test receiver/spectrum analyzer is 200Hz at frequency band (9kHz-150kHz) and 9kHz at frequency below 30MHz (except 9kHz-150kHz).
- 2. There is a comparison data of both open-field test site and semi-Anechoic chamber, and the result came out very similar.

#### For Radiated emission above 30MHz

- a. The EUT was placed on the top of a rotating table 0.8 meters (for 30MHz ~ 1GHz) above the ground at 3 meter chamber room for test. The table was rotated 360 degrees to determine the position of the highest radiation.
- b. The EUT was set 3 meters away from the interference-receiving antenna, which was mounted on the top of a variable-height antenna tower.
- c. The height of antenna is varied from one meter to four meters above the ground to determine the maximum value of the field strength. Both horizontal and vertical polarizations of the antenna are set to make the measurement.
- d. For each suspected emission, the EUT was arranged to its worst case and then the antenna was tuned to heights from 1 meter to 4 meters and the rotatable table was turned from 0 degrees to 360 degrees to find the maximum reading.
- e. The test-receiver system was set to quasi-peak detect function and specified bandwidth with maximum hold mode when the test frequency is below 1 GHz.

Note:

- 1. The resolution bandwidth and video bandwidth of test receiver/spectrum analyzer is 120kHz for Quasi-peak detection (QP) at frequency below 1GHz.
- 2. All modes of operation were investigated and the worst-case emissions are reported.

# 4.1.4 Deviation from Test Standard

No deviation.

# 4.1.5 Test Set Up

# For Radiated emission below 30MHz



For the actual test configuration, please refer to the attached file (Test Setup Photo).

KDB 414788 OFS and Chamber Correlation Justification

- Based on FCC 15.31 (f) (2): measurements may be performed at a distance closer than that specified in regulations; however, an attempt should be made to avoid making measurements in the near field.
- Open-field site and chamber correlation testing had been performed and chamber measured test result is the worst case test result.

# 4.1.6 EUT Operating Conditions

a. Set the EUT under transmission condition continuously at specific channel frequency.



# 4.1.7 Test Results

# Type F

EUT Test Condition		Measurement Detail		
Channel Channel 1		Frequency Range	13.553 ~ 13.567MHz	
Input Power	120Vac, 60Hz	Detector Function	Quasi-Peak	
Environmental Conditions 21 deg. C, 68% RH		Tested By	Thomas Cheng	

	Antenna Polarity & Test Distance: Loop Antenna Parallel At 3m							
No.	Freq. (MHz)	Emission Level (dBuV/m) (30m)	Limit (dBuV/m)	Margin (dB)	Antenna Height (m)	Table Angle (Degree)	Raw Value (dBuV) (3m)	Correction Factor (dB/m)
1	*13.56	4.3 QP	84.0	-79.7	1.00	107	22.5	-18.2

Remarks:

- 1. Emission Level(dBuV/m) = Raw Value(dBuV) + Correction Factor(dB/m)
- 2. Correction Factor(dB/m) = Antenna Factor(dB/m) + Cable Factor(dB)
  - Pre-Amplifier Factor(dB)+Distance Factor
- 3. The other emission levels were very low against the limit.
- 4. Margin value = Emission Level Limit value
- 5. "\*": Fundamental frequency
- 6. Above limits have been translated by the formula

The measured field strength was extrapolated to distance 30 meters, using the formula that the limit of field strength varies as the inverse distance square (40dB per decade of distance)





EUT Test Condition		Measurement Detail		
Channel	Channel 1	Frequency Range	13.553 ~ 13.567MHz	
Input Power	120Vac, 60Hz	Detector Function Quasi-Peak		
Environmental Conditions	21 deg. C, 68% RH	Tested By	Thomas Cheng	

	Antenna Polarity & Test Distance: Loop Antenna Perpendicular At 3m							
No.	Freq. (MHz)	Emission Level (dBuV/m) (30m)	Limit (dBuV/m)	Margin (dB)	Antenna Height (m)	Table Angle (Degree)	Raw Value (dBuV) (3m)	Correction Factor (dB/m)
1	*13.56	-1.0 QP	84.0	-85.0	1.00	193	17.2	-18.2

- 1. Emission Level(dBuV/m) = Raw Value(dBuV) + Correction Factor(dB/m)
- 2. Correction Factor(dB/m) = Antenna Factor(dB/m) + Cable Factor(dB)
  - Pre-Amplifier Factor(dB)+Distance Factor
- 3. The other emission levels were very low against the limit.
- 4. Margin value = Emission Level Limit value
- 5. " \* " : Fundamental frequency
- 6. Above limits have been translated by the formula

The measured field strength was extrapolated to distance 30 meters, using the formula that the limit of field strength varies as the inverse distance square (40dB per decade of distance)





EUT Test Condition		Measurement Detail		
Channel	Channel 1	Frequency Range	13.553 ~ 13.567MHz	
Input Power	120Vac, 60Hz	Detector Function	Quasi-Peak	
Environmental Conditions	21 deg. C, 68% RH	Tested By	Thomas Cheng	

	Antenna Polarity & Test Distance: Loop Antenna Ground Parallel At 3m							
No.	Freq. (MHz)	Emission Level (dBuV/m) (30m)	Limit (dBuV/m)	Margin (dB)	Antenna Height (m)	Table Angle (Degree)	Raw Value (dBuV) (3m)	Correction Factor (dB/m)
1	*13.56	3.1 QP	84.0	-80.9	1.00	351	21.3	-18.2

1. Emission Level(dBuV/m) = Raw Value(dBuV) + Correction Factor(dB/m)

2. Correction Factor(dB/m) = Antenna Factor(dB/m) + Cable Factor(dB)

- Pre-Amplifier Factor(dB)+Distance Factor
- 3. The other emission levels were very low against the limit.
- 4. Margin value = Emission Level Limit value
- 5. "\* ": Fundamental frequency
- 6. Above limits have been translated by the formula

The measured field strength was extrapolated to distance 30 meters, using the formula that the limit of field strength varies as the inverse distance square (40dB per decade of distance)





EUT Test Condition		Neasurement Detail Frequency Range Below 30MHz		
Channel	Channel 1	Frequency Range	Below 30MHz	
Input Power	Input Power 120Vac, 60Hz		Quasi-Peak	
Environmental Conditions	21 deg. C, 68% RH	Tested By	Thomas Cheng	

	Antenna Polarity & Test Distance: Loop Antenna Parallel At 3m								
No.	Freq. (MHz)	Emission Level (dBuV/m) (30m)	Limit (dBuV/m)	Margin (dB)	Antenna Height (m)	Table Angle (Degree)	Raw Value (dBuV) (3m)	Correction Factor (dB/m)	
1	5.68	-6.4 QP	29.5	-35.9	1.00	134	13.4	-19.8	
2	9.67	-4.1 QP	29.5	-33.6	1.00	228	14.2	-18.3	
3	12.34	-5.3 QP	29.5	-34.8	1.00	63	12.9	-18.2	
4	16.59	-5.3 QP	29.5	-34.8	1.00	86	12.8	-18.1	
5	21.39	-5.6 QP	29.5	-35.1	1.00	292	12.5	-18.1	
6	27.12	-5.9 QP	29.5	-35.4	1.00	16	12.2	-18.1	

- 1. Emission Level(dBuV/m) = Raw Value(dBuV) + Correction Factor(dB/m)
- 2. Correction Factor(dB/m) = Antenna Factor(dB/m) + Cable Factor(dB)
- Pre-Amplifier Factor(dB) +Distance Factor
- 3. The other emission levels were very low against the limit.
- 4. Margin value = Emission Level Limit value
- 5. The measured field strength was extrapolated to distance 30 meters, using the formula that the limit of field strength varies as the inverse distance square (40dB per decade of distance)





EUT Test Condition		Measurement Detail Frequency Range Below 30MHz Detector Function Quasi-Peak		
Channel	Channel Channel 1		Below 30MHz	
Input Power	120Vac, 60Hz	Detector Function	Quasi-Peak	
Environmental Conditions	21 deg. C, 68% RH	Tested By	Thomas Cheng	

	Antenna Polarity & Test Distance: Loop Antenna Perpendicular At 3m							
No.	Freq. (MHz)	Emission Level (dBuV/m) (30m)	Limit (dBuV/m)	Margin (dB)	Antenna Height (m)	Table Angle (Degree)	Raw Value (dBuV) (3m)	Correction Factor (dB/m)
1	6.88	-2.3 QP	29.5	-31.8	1.00	212	17.1	-19.4
2	9.55	-3.8 QP	29.5	-33.3	1.00	282	14.6	-18.4
3	14.22	-3.1 QP	29.5	-32.6	1.00	66	15.1	-18.2
4	16.92	-3.0 QP	29.5	-32.5	1.00	187	15.1	-18.1
5	21.42	-4.7 QP	29.5	-34.2	1.00	126	13.4	-18.1
6	27.12	-3.1 QP	29.5	-32.6	1.00	133	15.0	-18.1

- 1. Emission Level(dBuV/m) = Raw Value(dBuV) + Correction Factor(dB/m)
- 2. Correction Factor(dB/m) = Antenna Factor(dB/m) + Cable Factor(dB)
- Pre-Amplifier Factor(dB) +Distance Factor
- 3. The other emission levels were very low against the limit.
- 4. Margin value = Emission Level Limit value
- 5. The measured field strength was extrapolated to distance 30 meters, using the formula that the limit of field strength varies as the inverse distance square (40dB per decade of distance)





EUT Test Condition		Measurement Detail Frequency Range Below 30MHz Detector Function Quasi-Peak		
Channel	Channel Channel 1		Below 30MHz	
Input Power	120Vac, 60Hz	Detector Function	Quasi-Peak	
Environmental Conditions	21 deg. C, 68% RH	Tested By	Thomas Cheng	

	Antenna Polarity & Test Distance: Loop Antenna Ground Paralle At 3m								
No.	Freq. (MHz)	Emission Level (dBuV/m) (30m)	Limit (dBuV/m)	Margin (dB)	Antenna Height (m)	Table Angle (Degree)	Raw Value (dBuV) (3m)	Correction Factor (dB/m)	
1	5.92	-6.4 QP	29.5	-35.9	1.00	93	13.4	-19.8	
2	9.88	-6.2 QP	29.5	-35.7	1.00	197	12.0	-18.2	
3	15.33	-4.7 QP	29.5	-34.2	1.00	2	13.4	-18.1	
4	18.81	-5.6 QP	29.5	-35.1	1.00	2	12.5	-18.1	
5	23.82	-6.3 QP	29.5	-35.8	1.00	110	11.8	-18.1	
6	27.12	-6.8 QP	29.5	-36.3	1.00	80	11.3	-18.1	

- 1. Emission Level(dBuV/m) = Raw Value(dBuV) + Correction Factor(dB/m)
- 2. Correction Factor(dB/m) = Antenna Factor(dB/m) + Cable Factor(dB)
- Pre-Amplifier Factor(dB) +Distance Factor
- 3. The other emission levels were very low against the limit.
- 4. Margin value = Emission Level Limit value
- 5. The measured field strength was extrapolated to distance 30 meters, using the formula that the limit of field strength varies as the inverse distance square (40dB per decade of distance)





EUT Test Condition		Measurement Detail		
Channel	Channel 1	Frequency Range	Below 1000MHz	
Input Power	120Vac, 60Hz	Detector Function	Quasi-Peak	
Environmental Conditions	23 deg. C, 68% RH	Tested By	Thomas Cheng	

	Antenna Polarity & Test Distance: Horizontal At 3m								
	Freq	Emission	Limit	Margin	Antenna	Table	Raw	Correction	
No.	теч. (МН <del>7</del> )	Level	(dBu)//m)	(dB)	Height	Angle	Value	Factor	
	(10172)	(dBuV/m)	(ubuv/iii)	(UB)	(m)	(Degree)	(dBuV)	(dB/m)	
1	61.04	29.0 QP	40.0	-11.0	1.69 H	295	42.2	-13.2	
2	159.02	30.8 QP	43.5	-12.7	1.32 H	90	43.2	-12.4	
3	307.45	31.8 QP	46.0	-14.2	1.96 H	158	43.4	-11.6	
4	507.29	26.7 QP	46.0	-19.3	1.29 H	116	33.4	-6.7	
5	644.07	27.5 QP	46.0	-18.5	3.09 H	104	31.8	-4.3	
6	885.63	30.0 QP	46.0	-16.0	2.14 H	61	31.1	-1.1	

- 1. Emission Level(dBuV/m) = Raw Value(dBuV) + Correction Factor(dB/m)
- 2. Correction Factor(dB/m) = Antenna Factor(dB/m) + Cable Factor(dB) Pre-Amplifier Factor(dB)
- 3. The other emission levels were very low against the limit.
- 4. Margin value = Emission Level Limit value





EUT Test Condition		Measurement Detail			
Channel	Channel 1	Frequency Range	Below 1000MHz		
Input Power	120Vac, 60Hz	Detector Function	Quasi-Peak		
Environmental Conditions	23 deg. C, 68% RH	Tested By	Thomas Cheng		

	Antenna Polarity & Test Distance: Vertical At 3m									
No.	Freq. (MHz)	Emission Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Antenna Height (m)	Table Angle (Degree)	Raw Value (dBuV)	Correction Factor (dB/m)		
1	41.64	32.4 QP	40.0	-7.6	1.22 V	70	44.7	-12.3		
2	144.47	34.6 QP	43.5	-8.9	2.21 V	295	47.1	-12.5		
3	314.24	30.9 QP	46.0	-15.1	1.31 V	133	42.3	-11.4		
4	529.60	34.2 QP	46.0	-11.8	1.27 V	2	40.5	-6.3		
5	692.58	26.3 QP	46.0	-19.7	1.41 V	214	30.1	-3.8		
6	869.14	29.6 QP	46.0	-16.4	1.69 V	108	31.0	-1.4		

- 1. Emission Level(dBuV/m) = Raw Value(dBuV) + Correction Factor(dB/m)
- 2. Correction Factor(dB/m) = Antenna Factor(dB/m) + Cable Factor(dB) Pre-Amplifier Factor(dB)
- 3. The other emission levels were very low against the limit.
- 4. Margin value = Emission Level Limit value





# 4.2 Conducted Emission Measurement

# 4.2.1 Limits of Conducted Emission Measurement

	Conducted Limit (dBuV)				
Frequency (MHZ)	Quasi-peak	Average			
0.15 - 0.5	66 - 56	56 - 46			
0.50 - 5.0	56	46			
5.0 - 30.0	60	50			

Note: 1. The lower limit shall apply at the transition frequencies.

2. The limit decreases in line with the logarithm of the frequency in the range of 0.15 to 0.50MHz.

#### 4.2.2 Test Instruments

Description & Manufacturer	Model No.	Serial No.	Cal. Date	Cal. Due
Test Receiver ROHDE & SCHWARZ	ESCI	100613	Dec. 03, 2021	Dec. 02, 2022
RF signal cable Woken	5D-FB	Cable-cond1-01	Jan. 15, 2022	Jan. 14, 2023
LISN/AMN ROHDE & SCHWARZ (EUT)	ENV216	101826	Mar. 14, 2022	Mar. 13, 2023
LISN/AMN ROHDE & SCHWARZ (Peripheral)	ESH3-Z5	100311	Sep. 12, 2022	Sep. 11, 2023
Software ADT	BV ADT_Cond_ V7.3.7.4	NA	NA	NA

Note: 1. The calibration interval of the above test instruments is 12 months and the calibrations are traceable to NML/ROC and NIST/USA.

2. The test was performed in HwaYa Shielded Room 1 (Conduction 1).

3. The VCCI Site Registration No. is C-12040.

4. Teste date: Oct. 27, 2022



### 4.2.3 Test Procedures

- a. The EUT was placed 0.4 meters from the conducting wall of the shielded room with EUT being connected to the power mains through a line impedance stabilization network (LISN). Other support units were connected to the power mains through another LISN. The two LISNs provide 50 ohm/ 50uH of coupling impedance for the measuring instrument.
- b. Both lines of the power mains connected to the EUT were checked for maximum conducted interference.
- c. The frequency range from 150kHz to 30MHz was searched. Emission levels under (Limit 20dB) was not recorded.
- Note: The resolution bandwidth and video bandwidth of test receiver is 9kHz for quasi-peak detection (QP) and average detection (AV) at frequency 0.15MHz-30MHz.

# 4.2.4 Deviation from Test Standard

No deviation.

# 4.2.5 Test Setup



Note: 1.Support units were connected to second LISN.

For the actual test configuration, please refer to the attached file (Test Setup Photo).

# 4.2.6 EUT Operating Conditions

Same as 4.1.6.



# 4.2.7 Test Results

# Type F

Phase Line (L) Detector F			etector Fur	nction	Quasi-F Average	Peak (QP) e (AV)	/			
	Гиса	Corr.	Readin	g Value	Emissi	Emission Level Limit		nit	Ma	rgin
No	Freq.	Factor	[dB	(uV)]	[dB	(uV)]	[dB (	[uV)]	(d	B)
	[MHz]	(dB)	Q.P.	AV.	Q.P.	AV.	Q.P.	AV.	Q.P.	AV.
1	0.15000	9.62	35.92	20.09	45.54	29.71	66.00	56.00	-20.46	-26.29
2	0.19000	9.64	30.42	13.28	40.06	22.92	64.04	54.04	-23.98	-31.12
3	0.67000	9.69	22.51	16.69	32.20	26.38	56.00	46.00	-23.80	-19.62
4	2.12200	9.72	11.67	4.00	21.39	13.72	56.00	46.00	-34.61	-32.28
5	13.55800	9.78	30.73	30.57	40.51	40.35	60.00	50.00	-19.49	-9.65
6	15.52200	9.78	19.12	12.79	28.90	22.57	60.00	50.00	-31.10	-27.43

- 1. Q.P. and AV. are abbreviations of quasi-peak and average individually.
- 2. The emission levels of other frequencies were very low against the limit.
- 3. Margin value = Emission level Limit value
- 4. Correction factor = Insertion loss + Cable loss
- 5. Emission Level = Correction Factor + Reading Value.



Phase Neutral (N)			D	Detector Function Quasi-Peak (QP) /				/		
								Triciage	5 (AV)	
	Frog	Corr.	Readin	g Value	Emissi	on Level	Lir	nit	Ма	rgin
No	Fleq.	Factor	[dB (	(uV)]	[dB	(uV)]	[dB (	uV)]	(d	B)
	[MHz]	(dB)	Q.P.	AV.	Q.P.	AV.	Q.P.	AV.	Q.P.	AV.
1	0.16600	9.62	35.20	16.35	44.82	25.97	65.16	55.16	-20.34	-29.19
2	0.19000	9.63	36.08	16.12	45.71	25.75	64.04	54.04	-18.33	-28.29
3	0.66200	9.69	20.74	15.53	30.43	25.22	56.00	46.00	-25.57	-20.78
4	3.84600	9.74	13.17	2.35	22.91	12.09	56.00	46.00	-33.09	-33.91
5	13.55800	9.82	30.70	30.56	40.52	40.38	60.00	50.00	-19.48	-9.62
6	15.64600	9.83	19.32	13.11	29.15	22.94	60.00	50.00	-30.85	-27.06

1. Q.P. and AV. are abbreviations of quasi-peak and average individually.

2. The emission levels of other frequencies were very low against the limit.

3. Margin value = Emission level - Limit value

4. Correction factor = Insertion loss + Cable loss

5. Emission Level = Correction Factor + Reading Value.





# 4.3 Frequency Stability

# 4.3.1 Limits of Frequency Stability Measurement

The frequency tolerance of the carrier signal shall be maintained within +/-0.01% of the operating frequency over a temperature variation of -20 degrees to 50 degrees C at normal supply voltage, and for a variation in the primary supply voltage from 85% to 115% of the rated supply voltage at a temperature of 20 degrees C.

# 4.3.2 Test Setup



#### 4.3.3 Test Instruments

Description & Manufacturer	Model No.	Serial No.	Cal. Date	Cal. Due
Spectrum Analyzer ROHDE & SCHWARZ	FSP40	100269	Jun. 01, 2022	May 30, 2023
Standard Temperature And Humidity Chamber TERCHY	MHU-225AU	920842	Jun. 21, 2022	Jun. 20, 2023
Three-phase coupling / decoupling network TESEQ	CDN 3063	4006	Mar. 08, 2022	Mar. 07, 2023
AC Power Supply Extech	CFW-105	E000603	NA	NA

Note: 1. The calibration interval of the above test instruments is 12 months and the calibrations are traceable to NML/ROC and NIST/USA.

#### 4.3.4 Test Procedure

- a. The EUT was placed inside the environmental test chamber and powered by nominal AC voltage.
- b. Turned the EUT on and coupled its output to a spectrum analyzer.
- c. Turned the EUT off and set the chamber to the highest temperature specified.
- d. Allowed sufficient time (approximately 30 min) for the temperature of the chamber to stabilize then turned the EUT on and measured the operating frequency after 2, 5, and 10 minutes.
- e. Repeat step (d) with the temperature chamber set to the next desired temperature until measurements down to the lowest specified temperature have been completed.
- f. The test chamber was allowed to stabilize at +20 degree C for a minimum of 30 minutes. The supply voltage was then adjusted on the EUT from 85% to 115% and the frequency record.

# 4.3.5 Deviation fromTest Standard

No deviation.

# 4.3.6 EUT Operating Conditions

Same as Item 4.1.6.

# 4.3.7 Test Result

# Type F

	Frequency Stability Versus Temp.									
		0 Mi	nute	2 Minute		5 Mi	nute	10 Minute		
TEMP. (℃)	Power Supply (Vac)	Measured Frequency	Frequency Drift	Measured Frequency	Frequency Drift	Measured Frequency	Frequency Drift	Measured Frequency	Frequency Drift	
		(MHz)	%	(MHz)	%	(MHz)	%	(MHz)	%	
50	120	13.56004	0.00029	13.56004	0.00029	13.56004	0.00029	13.56005	0.00037	
40	120	13.56001	0.00007	13.56001	0.00007	13.56001	0.00007	13.56000	0.00000	
30	120	13.56006	0.00044	13.56007	0.00052	13.56006	0.00044	13.56006	0.00044	
20	120	13.56000	0.00000	13.56001	0.00007	13.56001	0.00007	13.56002	0.00015	
10	120	13.55994	-0.00044	13.55993	-0.00052	13.55995	-0.00037	13.55994	-0.00044	
0	120	13.56001	0.00007	13.56001	0.00007	13.56001	0.00007	13.56001	0.00007	
-10	120	13.56006	0.00044	13.56006	0.00044	13.56006	0.00044	13.56007	0.00052	
-20	120	13.56001	0.00007	13.56000	0.00000	13.56000	0.00000	13.56000	0.00000	

	Frequency Stability Versus Voltage									
		0 Minute		2 Minute		5 Mi	nute	10 Minute		
TEMP. (℃)	Power Supply (Vac)	Measured Frequency	Frequency Drift	Measured Frequency	Frequency Drift	Measured Frequency	Frequency Drift	Measured Frequency	Frequency Drift	
		(MHz)	%	(MHz)	%	(MHz)	%	(MHz)	%	
	138	13.56	0.00000	13.56001	0.00007	13.56001	0.00007	13.56002	0.00015	
20	120	13.56	0.00000	13.56001	0.00007	13.56001	0.00007	13.56002	0.00015	
	102	13.56	0.00000	13.56001	0.00007	13.56001	0.00007	13.56002	0.00015	

# 4.4 20dB Bandwidth

# 4.4.1 Limits of 20dB Bandwidth Measurement

The 20dB bandwidth shall be specified in operating frequency band.

# 4.4.2 Test Setup



# 4.4.3 Test Instruments

Refer to section 4.1.2 to get information of above instrument.

# 4.4.4 Test Procedures

The bandwidth of the fundamental frequency was measured by spectrum analyzer with 1kHz RBW and 3kHz VBW. The 20dB bandwidth is defined as the total spectrum the power of which is higher than peak power minus 20dB.

# 4.4.5 Deviation from Test Standard

No deviation.

# 4.4.6 EUT Operating Conditions

Same as Item 4.1.6.



# 4.4.7 Test Results

# Type F

20dBc Bandwidth (kHz)	Operating frequency band (MHz)	Pass / Fail
2.6950	13.553~13.567	Pass



Note: The signal look like CW signal, so RBW can't be match 1~5 % OBW.



# 5 Pictures of Test Arrangements

Please refer to the attached file (Test Setup Photo).



# Appendix – Information of the Testing Laboratories

We, Bureau Veritas Consumer Products Services (H.K.) Ltd., Taoyuan Branch, were founded in 1988 to provide our best service in EMC, Radio, Telecom and Safety consultation. Our laboratories are FCC recognized accredited test firms and accredited and approved according to ISO/IEC 17025.

If you have any comments, please feel free to contact us at the following:

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The address and road map of all our labs can be found in our web site also.

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