FCC Test Report

(Co-Located)

Report No.:	RFBDZB-WTW-P22100578A-2
FCC ID:	TK4WLE3000HX
Product:	WiFi 6 (802.11ax) 4×4 MU-MIMO Dual Band Module
Brand:	COMPEX
Model No.:	WLE3000HX
Received Date:	2023/6/28
Test Date:	2023/11/29
Issued Date:	2024/1/29
Applicant:	Compex Systems Pte Ltd
Address:	No:9 Harrison Road, Harrison Industrial Building, #05-01, Singapore 369651
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. 47-2, 14th Ling, Chia Pau Vil., Lin Kou Dist., New Taipei City, Taiwan
FCC Registration / Designation Number:	198487 / TW2021

This report is governed by, and incorporates by reference, the Conditions of Testing as posted at the date of issuance of this report at http://www.bureauveritas.com/home/about-us/our-business/cps/about-us/terms-conditions/ and is intended for your exclusive use. Any copying or replication of this report to or for any other person or entity, or use of our name or trademark, is permitted only with our prior written permission. This report sets forth our findings solely with respect to the test samples identified herein. The results set forth in this report are not indicative or representative of the quality or characteristics of the lot from which a test sample was taken or any similar or identical product unless specifically and expressly noted. Our report includes all of the tests requested by you and the results thereof based upon the information that you provided to us. Measurement uncertainty is only provided upon request for accredited tests. Statements of conformity are based on simple acceptance criteria without taking measurement uncertainty into account, unless otherwise requested in writing. You have 60 days from date of issuance of this report to notify us of any material error or omission caused by our negligence or if you require measurement uncertainty; provided, however, that such notice shall be in writing and shall specifically address the issue you wish to raise. A failure to raise such issue within the prescribed time shall constitute your unqualified acceptance of the completeness of this report, the tests conducted and the correctness of the report contents.

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Release Control Record

Issue No.	Description	Date Issued
RFBDZB-WTW-P22100578A-2	Original release	2024/1/29

1 Certificate of Conformity

Product:	WiFi 6 (802.11ax) 4×4 MU-MIMO Dual Band Module
Brand:	COMPEX
Test Model:	WLE3000HX
Sample Status:	Engineering sample
Applicant:	Compex Systems Pte Ltd
Test Date:	2023/11/29
Standard:	47 CFR FCC Part 15, Subpart E (Section 15.407)
Measurement procedure:	ANSI C63.10-2013 KDB 789033 D02 General UNII Test Procedure New Rules v02r01 KDB 662911 D01 Multiple Transmitter Output v02r01

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 : Jessica Cheng , **Date:** 2024/1/29

Jessica Cheng / Senior Specialist

Approved by : Jeremy Lin , **Date:** 2024/1/29

Jeremy Lin / Project Engineer

2 Summary of Test Results

Applied Standard	47 CFR FCC Part 15, Subpart E (Section 15.407)		
FCC Clause	Test Item	Result	Remarks
15.407(b)(9)	Unwanted Emissions below 1 GHz	Pass	Meet the requirement of limit. Minimum passing margin is -3.9dB at 35.67MHz.

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	Specification	Expanded Uncertainty (k=2) (±)
Unwanted Emissions below 1 GHz	9 kHz ~ 30 MHz	2.38 dB
	30 MHz ~ 1 GHz	5.7 dB

The other instruments specified are routine verified to remain within the calibrated levels, no measurement uncertainty is required to be calculated.

2.2 Modification Record

There were no modifications required for compliance.

3 General Information

3.1 General Description of EUT

Product	WiFi 6 (802.11ax) 4×4 MU-MIMO Dual Band Module
Brand	COMPEX
Test Model	WLE3000HX
Status of EUT	Engineering sample
Power Supply Rating	3.3Vdc
Modulation Type	64QAM, 16QAM, QPSK, BPSK for OFDM 256QAM for OFDM in 11ac mode 1024QAM for OFDMA in 11ax HE mode
Modulation Technology	OFDM, OFDMA
Transfer Rate	Up to 4804 Mbps
Operating Frequency	5.18 GHz ~ 5.25 GHz 5.26 GHz ~ 5.32 GHz 5.5 GHz ~ 5.72 GHz 5.745 GHz ~ 5.825 GHz
Number of Channel	802.11a, 802.11n (HT20), 802.11ac (VHT20), 802.11ax (HE20):25 802.11n (HT40), 802.11ac (VHT40), 802.11ax (HE40):12 802.11ac (VHT80), 802.11ax (HE80):6 802.11ac (VHT160), 802.11ax (HE160):2

Note:

1. This report is prepared for FCC class II permissive change.
2. The difference compared with original test report (2210RSU016-U3) is adding a platform: Network Security Appliance (Brand: Check Point / Model: V91WL) and the platform contain module (WIFI : TK4WLE3000HX, WWAN : N7NEM75T), therefore Unwanted Emissions below 1 GHz test was performed for this addendum.
3. The modular device installed in the new host (Model: V91WL) has the same DFS firmware/software and hardware (including antennas) as the previous host (Model: V91WC). After verification, all test items have met the requirements as stated in 15.407, and all test results have been recorded in the DFS test report, mirroring those of the previous report.
4. The platform information is listed as below:

WiFi 6 (802.11ax) 4×4 MU-MIMO Dual Band Module		Platform: Network Security Appliance			
		Approved Model			Additional Model
Brand	COMPEX	Brand	CHECK POINT™		CHECK POINT™
		Model	V91W	V91WC	V91WL
		Family	V1	V1	V1
Model	WLE3000HX	Flavor	Wifi6	Wifi6, 5G	Wifi6, LTE
		Wifi FCC	TK4WLE3000HX		TK4WLE3000HX
		Wifi IC	7849A-WLE3000HX		7849A-WLE3000HX
		Cellular	NA	EM9191	EM7590
		Cellular spec	NA	3G, 4G LTE, 5G	3G, 4G LTE
		Cellular FCC	NA	N7NEM91	N7NEM75T
		Cellular IC	NA	2417C-EM91	2417C-EM75T
Report No.: 2210RSU016-U3		Report No.: RFBDZB-WTW-P22100578			Report No.: RFBDZB-WTW-P22100578A-2

5. This report is issued for the Wifi module only, more information of LTE module refer to FCC ID: N7NEM75T.
6. The 2.4GHz WLAN & 5GHz WLAN can not transmit simultaneously.
7. The WLAN & WWAN can transmit simultaneously.
8. The Platform consumes power from the switching power adapters, as the following:

AC Adapter 1		
Brand	Model	Specification
FSP	FSP060-DHAN3	AC Input : 100-240Vac, 50-60Hz, 1.8A DC Output : 12Vdc, 5A, 60.0W Non-shielded DC cable 1.2m (with one core)
AC Adapter 2		
Brand	Model	Specification
EDAC	EA10731J-120	AC Input : 100-240V, 50-60Hz,2.0A DC Output : 12.0V, 5.0A, 60.0W Non-shielded AC 3 Pin cable 1.8m Non-shielded DC cable 1.2m (with one core)

9. The above EUT information is declared by manufacturer and for more detailed features description, please refer to the manufacturer's specifications or User's Manual.

3.2 Antenna Description of EUT

1. The antenna information is listed as below.

For WLAN

Gain (dBi)	Antenna Type	Connector Type
4.29	Omni	R-SMA

For LTE

Gain (dBi)	Antenna Type	Connector Type
3.72	Dipole	R-SMA

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

2. The EUT incorporates a MIMO function:

5 GHz Band		
Modulation Mode	**TX & RX Configuration**	
802.11a	4TX	4RX
802.11n (HT20)	4TX	4RX
802.11n (HT40)	4TX	4RX
802.11ac (VHT20)	4TX	4RX
802.11ac (VHT40)	4TX	4RX
802.11ac (VHT80)	4TX	4RX
802.11ac (VHT160)	4TX	4RX
802.11ax (HE20)	4TX	4RX
802.11ax (HE40)	4TX	4RX
802.11ax (HE80)	4TX	4RX
802.11ax (HE160)	4TX	4RX
Note: Beamforming mode not supported.		

3.3 Description of Test Modes

For 5180 ~ 5320MHz:

8 channels are provided for 802.11a, 802.11n (HT20), 802.11ac (VHT20), 802.11ax (HE20):

Channel	Frequency	Channel	Frequency
36	5180 MHz	52	5260 MHz
40	5200 MHz	56	5280 MHz
44	5220 MHz	60	5300 MHz
48	5240 MHz	64	5320 MHz

4 channels are provided for 802.11n (HT40), 802.11ac (VHT40), 802.11ax (HE40):

Channel	Frequency	Channel	Frequency
38	5190 MHz	54	5270 MHz
46	5230 MHz	62	5310 MHz

2 channels are provided for 802.11ac (VHT80), 802.11ax (HE80):

Channel	Frequency	Channel	Frequency
42	5210 MHz	58	5290 MHz

1 straddle channel is provided for 802.11ac (VHT160), 802.11ax (HE160):

Channel	Frequency
50	5250 MHz

For 5500 ~ 5720 MHz

12 channels are provided for 802.11a, 802.11n (HT20), 802.11ac (VHT20), 802.11ax (HE20):

Channel	Frequency	Channel	Frequency
100	5500 MHz	124	5620 MHz
104	5520 MHz	128	5640 MHz
108	5540 MHz	132	5660 MHz
112	5560 MHz	136	5680 MHz
116	5580 MHz	140	5700 MHz
120	5600 MHz	144	5720 MHz

6 channels are provided for 802.11n (HT40), 802.11ac (VHT40), 802.11ax (HE40):

Channel	Frequency	Channel	Frequency
102	5510 MHz	126	5630 MHz
110	5550 MHz	134	5670 MHz
118	5590 MHz	142	5710 MHz

3 channels are provided for 802.11ac (VHT80), 802.11ax (HE80):

Channel	Frequency	Channel	Frequency
106	5530 MHz	138	5690 MHz
122	5610 MHz		

1 straddle channel is provided for 802.11ac (VHT160), 802.11ax (HE160):

Channel	Frequency
114	5570 MHz

For 5745 ~ 5825 MHz:

5 channels are provided for 802.11a, 802.11n (HT20), 802.11ac (VHT20), 802.11ax (HE20):

Channel	Frequency	Channel	Frequency
149	5745 MHz	161	5805 MHz
153	5765 MHz	165	5825 MHz
157	5785 MHz		

2 channels are provided for 802.11n (HT40), 802.11ac (VHT40), 802.11ax (HE40):

Channel	Frequency	Channel	Frequency
151	5755 MHz	159	5795 MHz

1 channel is provided for 802.11ac (VHT80), 802.11ax (HE80):

Channel	Frequency
155	5775 MHz

3.3.1 Test Mode Applicability and Tested Channel Detail

EUT Configure Mode	Applicable To	Description
	RE<1G	
-	√	11ac40 5G+ LTE BAND2

Where **RE<1G:** Radiated Emission below 1GHz

Radiated Emission Test (Below 1GHz):

☒ 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	Mode	Signal Mode	Tested Channel	Modulation Technology
-	11ac40 5G	CDD	151	BPSK
	LTE BAND2	CDD	18607 (1850.7MHz)	QPSK

Test Condition:

Applicable To	Environmental Conditions	Input Power	Tested By
RE<1G	25deg. C, 75%RH	120Vac, 60Hz	Jed Wu

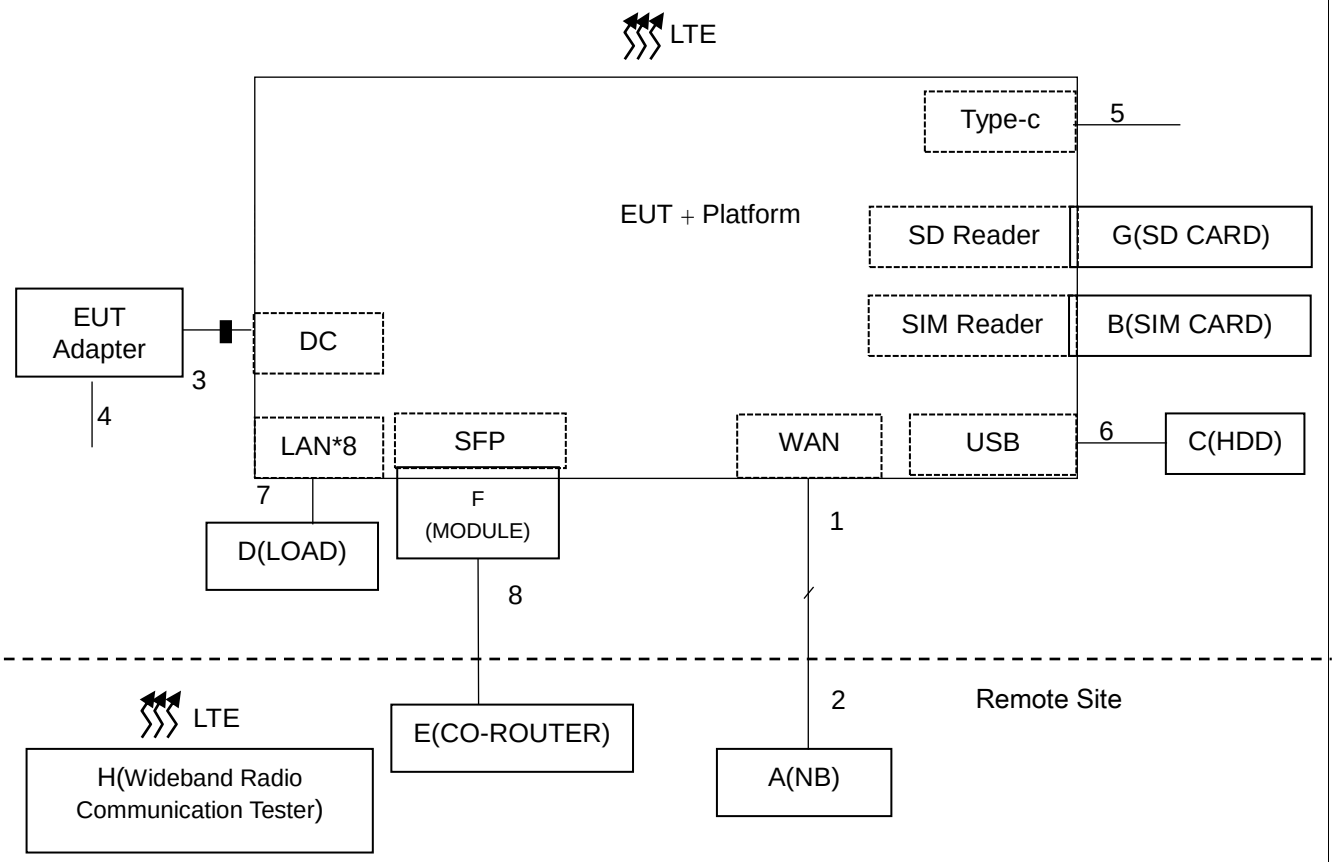
3.4 Description of Support Units

The ET 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
A	NB	Lenovo	80WG	YD01YRC9	N/A	Provided by Lab
B	SIM CARD	R&S	Mini-UICC Test card	N/A	N/A	Provided by Lab
C	HDD	TOSHIBA	DTB510 B 1TB	33NDT16PTV7H	N/A	Provided by Lab
D	LOAD	N/A	N/A	N/A	N/A	Provided by Lab
E	CO-ROUTER	ZyXEL	VES-1624CTA-54	S110Z16005097	N/A	Provided by Lab
F	MODULE	N/A	N/A	N/A	N/A	Supplied by applicant
G	SD CARD	SP	16G	N/A	N/A	Provided by Lab
H	Wideband Radio Communication Tester	R&S	CMW500	168045	N/A	Provided by Lab

ID	Cable Descriptions	Qty.	Length (m)	Shielding (Yes/No)	Cores (Qty.)	Remarks
1	LAN cable	1	1.9	N	0	Supplied by applicant
2	RJ45 cable	1	10	N	0	Provided by Lab
3	Adapter DC cable	1	1.2	N	1	Supplied by applicant
4	Adapter AC cable	1	1.8	N	0	Provided by Lab
5	Type C cable	1	1	Y	0	Supplied by applicant
6	USB cable	1	1.2	Y	0	Provided by Lab
7	LAN cable	8	1	N	0	Provided by Lab
8	RJ11 cable	1	10	N	0	Provided by Lab

3.4.1 Configuration of System under Test



3.5 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 and references:

Test Standard:
FCC Part 15, Subpart E (15.407)
ANSI C63.10-2013

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

References Test Guidance:
KDB 789033 D02 General UNII Test Procedure New Rules v02r01
KDB 662911 D01 Multiple Transmitter Output v02r01

All test items have been performed as a reference to the above KDB test guidance.

4 Test Types and Results

4.1 Radiated Emission and Bandedge Measurement

4.1.1 Limits of Radiated Emission and Bandedge Measurement

Radiated emissions up to 1 GHz which fall in the restricted bands must comply with the radiated emission limits specified as below table. Other emissions shall be at least 20 dB below the highest level of the desired power:

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

Notes:

1. The lower limit shall apply at the transition frequencies.
2. Emission level (dBuV/m) = 20 log Emission level (uV/m).

4.1.2 Test Instruments

Unwanted Emissions below 1 GHz

Description Manufacturer	Model No.	Serial No.	Calibrated Date	Calibrated Until
Bi_Log Antenna Schwarzbeck	VULB 9168	137	2023/10/13	2024/10/12
Coupling / Decoupling Network Schwarzbeck	CDNE-M2	00097	2023/5/25	2024/5/24
	CDNE-M3	00091	2023/5/25	2024/5/24
Loop Antenna EMCI	LPA600	270	2023/9/4	2024/9/3
MXE EMI Receiver Agilent	N9038A	MY51210129	2023/3/24	2024/3/23
		MY51210137	2023/6/5	2024/6/4
Preamplifier EMCI	EMC001340	980269	2023/6/27	2024/6/26
Preamplifier HP	8447D	2432A03504	2023/2/16	2024/2/15
RF Coaxial Cable Pacific	8D-FB	Cable-CH6-02	2023/6/27	2024/6/26
Signal Analyzer R&S	FSV40	101544	2023/5/9	2024/5/8
Software BVADT	Radiated_V8.7.08	N/A	N/A	N/A
Tower ADT	AT100	0306	N/A	N/A
Turn Table ADT	TT100	0306	N/A	N/A

Notes:

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 Linkou 966 Chamber 6 (CH 6).
3. Tested Date: 2023/11/29

4.1.3 Test Procedure

For Radiated emission below 30 MHz

1. The EUT was placed on the top of a rotating table 0.8 meters above the ground at 3 meter chamber room for test. The table was rotated 360 degrees to determine the position of the highest radiation.
2. The EUT was set 3 meters away from the interference-receiving antenna, which was mounted on the top of a variable-height antenna tower.
3. Parallel, perpendicular, and ground-parallel orientations of the antenna are set to make the measurement.
4. 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.
5. The test-receiver system was set to Quasi-Peak Detect Function and Specified Bandwidth with Maximum Hold Mode, except for the frequency band (9 kHz to 90 kHz and 110 kHz to 490 kHz) set to average detect function and peak detect function.

Notes:

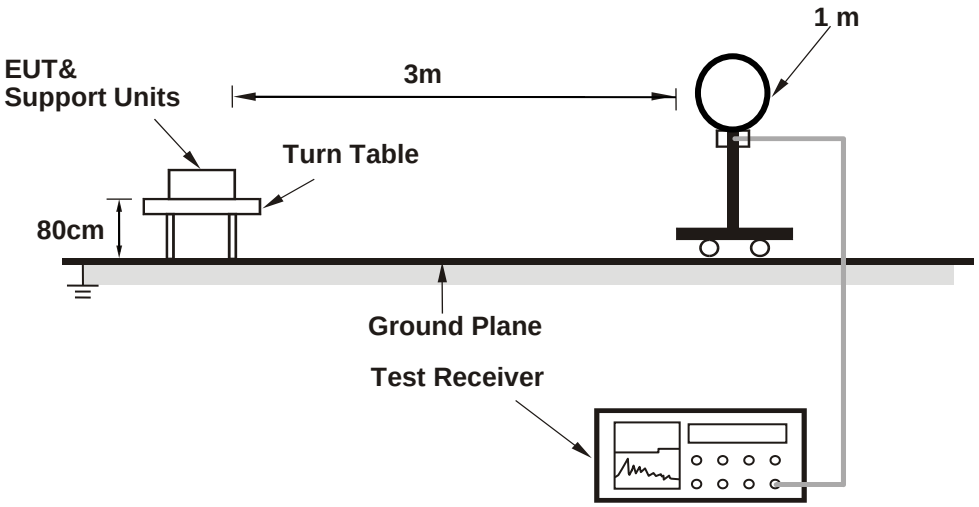
3. The resolution bandwidth and video bandwidth of test receiver/spectrum analyzer is 200 Hz at frequency below 150 kHz.
4. The resolution bandwidth and video bandwidth of test receiver/spectrum analyzer is 9 kHz or 10 kHz at frequency (150 kHz to 30 MHz).
5. All modes of operation were investigated and the worst-case emissions are reported.

4.1.4 Deviation from Test Standard

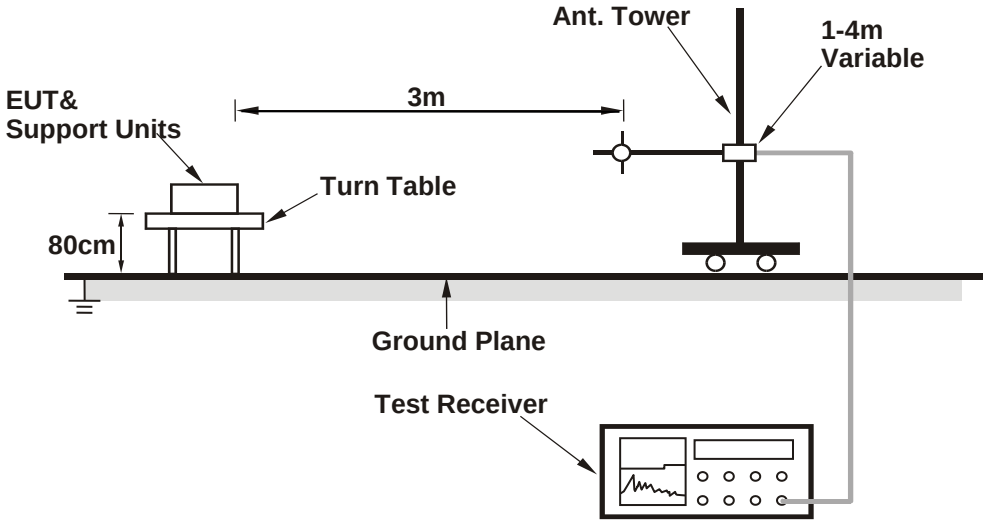
No deviation.

4.1.5 Test Setup

For Radiated emission below 30MHz



For Radiated emission 30MHz to 1GHz



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

4.1.6 EUT Operating Condition

Controlling software (teraterm v4.8) has been activated to set the EUT under transmission condition continuously at specific channel frequency.

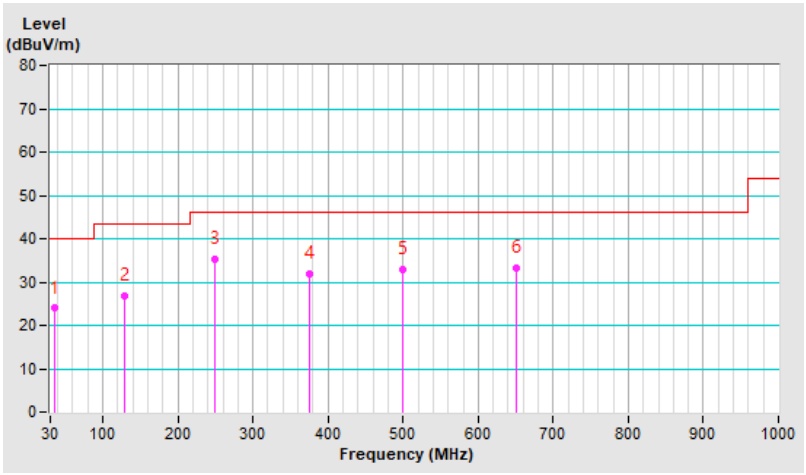
4.1.7 Test Results

RF Mode	11ac40 5G + LTE BAND2	Channel	CH 151 (5755 MHz) + CH 18607 (1850.7MHz)
Frequency Range	30 MHz ~ 1 GHz	Detector Function & Bandwidth	(QP) RB = 120kHz
Input Power	120 Vac, 60 Hz	Environmental Conditions	25°C, 75% RH
Tested By	Jed Wu		

Antenna Polarity & Test Distance : Horizontal at 3 m								
No	Frequency (MHz)	Emission Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Antenna Height (m)	Table Angle (Degree)	Raw Value (dBuV)	Correction Factor (dB/m)
1	35.43	23.9 QP	40.0	-16.1	1.27 H	107	34.3	-10.4
2	129.13	26.9 QP	43.5	-16.6	1.35 H	122	36.9	-10.0
3	250.00	35.2 QP	46.0	-10.8	1.46 H	73	43.7	-8.5
4	374.98	31.9 QP	46.0	-14.1	1.96 H	162	36.6	-4.7
5	500.01	32.8 QP	46.0	-13.2	1.22 H	107	34.8	-2.0
6	650.02	33.3 QP	46.0	-12.7	1.58 H	243	31.8	1.5

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)
3. Margin value = Emission Level – Limit value
4. The other emission levels were very low against the limit of frequency range 30 MHz ~ 1 GHz.
5. The emission levels were very low against the limit of frequency range 9 kHz ~ 30 MHz: the amplitude of spurious emissions attenuated more than 20 dB below the permissible value to be report.

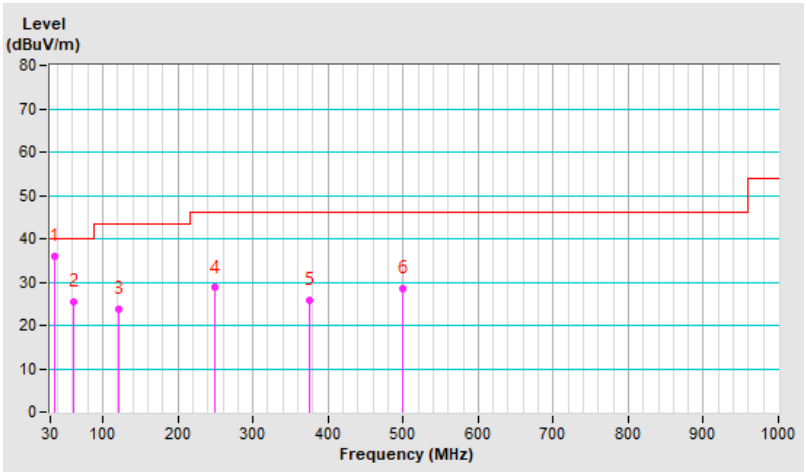


RF Mode	11ac40 5G + LTE BAND2	**Channel**	CH 151 (5755 MHz) + CH 18607 (1850.7MHz)
Frequency Range	30 MHz ~ 1 GHz	**Detector Function & Bandwidth**	(QP) RB = 120kHz
Input Power	120 Vac, 60 Hz	**Environmental Conditions**	25°C, 75% RH
Tested By	Jed Wu		

Antenna Polarity & Test Distance : Vertical at 3 m								
No	**Frequency (MHz)**	**Emission Level (dBuV/m)**	**Limit (dBuV/m)**	**Margin (dB)**	**Antenna Height (m)**	**Table Angle (Degree)**	**Raw Value (dBuV)**	**Correction Factor (dB/m)**
1	**35.67**	**36.1 QP**	**40.0**	**-3.9**	**1.24 V**	**32**	**46.4**	**-10.3**
2	61.33	25.4 QP	40.0	-14.6	1.43 V	205	35.2	-9.8
3	120.89	23.7 QP	43.5	-19.8	1.58 V	196	34.6	-10.9
4	250.00	28.7 QP	46.0	-17.3	1.79 V	165	37.2	-8.5
5	375.03	25.8 QP	46.0	-20.2	1.62 V	231	30.5	-4.7
6	499.96	28.6 QP	46.0	-17.4	1.10 V	42	30.6	-2.0

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)
3. Margin value = Emission Level – Limit value
4. The other emission levels were very low against the limit of frequency range 30 MHz ~ 1 GHz.
5. The emission levels were very low against the limit of frequency range 9 kHz ~ 30 MHz: the amplitude of spurious emissions attenuated more than 20 dB below the permissible value to be report.



5 Construction Photos of EUT.

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 according to ISO/IEC 17025.

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

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Fax: 886-2-26051924

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Tel: 886-3-3183232
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Email: service.adt@tw.bureauveritas.com
Web Site: http://ee.bureauveritas.com.tw

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

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