FCC Test Report
(Co-Located)

Report No.:	RFBDTL-WTW-P21060470-5 R1
FCC ID:	VUI-CFWM
Test Model:	84911790C
Received Date:	Feb. 15, 2022
Test Date:	Mar. 22, 2022
Issued Date:	Nov. 22, 2022
Applicant:	PEGATRON CORPORATION
Address:	5F, NO. 76, LIGONG ST., BEITOU DISTRICT, TAIPEI CITY 112, TAIWAN
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

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Release Control Record

Issue No.	Description	Date Issued
RFBDTL-WTW-P21060470-5	Original release.	May 18, 2022
RFBDTL-WTW-P21060470-5 R1	Revised antenna gain	Nov. 22, 2022

1 Certificate of Conformity

Product:	Customer Facing Wi-Fi Module (CFWM)
Brand:	
Test Model:	84911790C
Sample Status:	DV
Applicant:	PEGATRON CORPORATION
Test Date:	Mar. 22, 2022
Standards:	47 CFR FCC Part 15, Subpart C (Section 15.247) 47 CFR FCC Part 15, Subpart E (Section 15.407) FCC Part 22, Subpart H FCC Part 24, Subpart E FCC Part 27, Subpart C, F, H, L, M FCC Part 90, Subpart I, R, S ANSI 63.26-2015 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 , **Date:** Nov. 22, 2022

Polly Chien / Specialist

Approved by : Jeremy Lin , **Date:** Nov. 22, 2022

Jeremy Lin / Project Engineer

2 Summary of Test Results

Applied Standard:	47 CFR FCC Part 15, Subpart C (Section 15.247) 47 CFR FCC Part 15, Subpart E (Section 15.407) FCC Part 22, Subpart H FCC Part 24, Subpart E FCC Part 27, Subpart C, F, H, L, M FCC Part 90, Subpart I, R, S ANSI 63.26-2015 ANSI C63.10-2013		
FCC Clause	Test Item	Result	Remarks
15.205 / 15.209 / 15.247(d) 15.407(b) (1/2/3/4(i/ii)/9) 2.1053 22.917 24.238 27.53(a) 27.53(c)/(f) 27.53(h) 27.53 (m)(4)(6) 90.543 (e)(f)	Radiated Emissions	Pass	Meet the requirement of limit. Minimum passing margin is -3.7dB at 10600.00MHz.

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) (±)
Radiated Emissions up to 1 GHz	9kHz ~ 30MHz	3.04 dB
	30MHz ~ 200MHz	3.63 dB
	200MHz ~1000MHz	3.64 dB
Radiated Emissions above 1 GHz	1GHz ~ 18GHz	2.29 dB
	18GHz ~ 40GHz	2.29 dB

2.2 Modification Record

There were no modifications required for compliance.

3 General Information

3.1 General Description of EUT

Product	Customer Facing Wi-Fi Module (CFWM)	
Brand		
Test Model	84911790C	
Sample Status	DV	
Power Supply Rating	12Vdc	
Modulation Type	WLAN	CCK, DQPSK, DBPSK for DSSS 256QAM, 64QAM, 16QAM, QPSK, BPSK for OFDM 1024QAM, 256QAM, 64QAM, 16QAM, QPSK, BPSK for OFDMA
	BT EDR	GFSK, π/4-DQPSK, 8DPSK
	Bluetooth LE	GFSK
Modulation Technology	WLAN	DSSS, OFDM, OFDMA
Transfer Rate	WLAN	2.4GHz: 802.11b:11/5.5/2/1Mbps 802.11g: 54/48/36/24/18/12/9/6Mbps 802.11n: up to 144.4Mbps VHT20: up to 173.3Mbps 802.11ax: up to 286.8Mbps 5.0GHz 802.11a: 54/48/36/24/18/12/9/6Mbps 802.11n: up to 300Mbps 802.11ac: up to 866.7Mbps 802.11ax: up to 1201.0Mbps
	BT EDR	1/2/3 Mbps
	Bluetooth LE	Bluetooth LE 1M: 1Mbps Bluetooth LE 2M: 2Mbps

Operating Frequency	WLAN	2.4GHz: 2412 ~ 2462MHz 5.0GHz: 5180 ~ 5240MHz, 5260 ~ 5320MHz, 5500 ~ 5720MHz, 5745 ~ 5825MHz	
	BT EDR	2402 ~ 2480 MHz	
	Bluetooth LE	2402 ~ 2480MHz	
	LTE Band 2	Channel Bandwidth 1.4MHz	1850.7MHz ~ 1909.3MHz
		Channel Bandwidth 3MHz	1851.5MHz ~ 1908.5MHz
		Channel Bandwidth 5MHz	1852.5MHz ~ 1907.5MHz
		Channel Bandwidth 10MHz	1855.0MHz ~ 1905.0MHz
		Channel Bandwidth 15MHz	1857.5MHz ~ 1902.5MHz
		Channel Bandwidth 20MHz	1860.0MHz ~ 1900.0MHz
	LTE Band 4	Channel Bandwidth 1.4MHz	1710.7MHz ~ 1754.3MHz
		Channel Bandwidth 3MHz	1711.5MHz ~ 1753.5MHz
		Channel Bandwidth 5MHz	1712.5MHz ~ 1752.5MHz
		Channel Bandwidth 10MHz	1715.0MHz ~ 1750.0MHz
		Channel Bandwidth 15MHz	1717.5MHz ~ 1747.5MHz
		Channel Bandwidth 20MHz	1720.0MHz ~ 1745.0MHz
	LTE Band 5	Channel Bandwidth 1.4MHz	824.7MHz ~ 848.3MHz
		Channel Bandwidth 3MHz	825.5MHz ~ 847.5MHz
		Channel Bandwidth 5MHz	826.5MHz ~ 846.5MHz
		Channel Bandwidth 10MHz	829.0MHz ~ 844.0MHz
	LTE Band 7	Channel Bandwidth 5MHz	2502.5MHz ~ 2567.5MHz
		Channel Bandwidth 10MHz	2505.0MHz ~ 2565.0MHz
		Channel Bandwidth 15MHz	2507.5MHz ~ 2562.5MHz
		Channel Bandwidth 20MHz	2510.0MHz ~ 2560.0MHz
	LTE Band 12	Channel Bandwidth 1.4MHz	699.7MHz ~ 715.3MHz
		Channel Bandwidth 3MHz	700.5MHz ~ 714.5MHz
		Channel Bandwidth 5MHz	701.5MHz ~ 713.5MHz
		Channel Bandwidth 10MHz	704.0MHz ~ 711.0MHz
	LTE Band 13	Channel Bandwidth 5MHz	779.5MHz ~ 784.5MHz
		Channel Bandwidth 10MHz	782.0MHz
	LTE Band 14	Channel Bandwidth 5MHz	790.5MHz ~ 795.5MHz
		Channel Bandwidth 10MHz	793MHz
	LTE Band 25	Channel Bandwidth 1.4MHz	1850.7 ~ 1914.3 MHz
		Channel Bandwidth 3MHz	1851.5 ~ 1913.5 MHz
		Channel Bandwidth 5MHz	1852.5 ~ 1912.5 MHz
		Channel Bandwidth 10MHz	1855.0 ~ 1910.0 MHz
		Channel Bandwidth 15MHz	1857.5 ~ 1907.5 MHz
		Channel Bandwidth 20MHz	1860.0 ~ 1905.0 MHz
	LTE Band 26	Channel Bandwidth 1.4MHz	824.7~848.3MHz
		Channel Bandwidth 3MHz	825.5~847.5MHz
		Channel Bandwidth 5MHz	826.5~846.5MHz
		Channel Bandwidth 10MHz	829.0~844.0MHz
		Channel Bandwidth 15MHz	831.5~841.5MHz

Operating Frequency	LTE Band 66	Channel Bandwidth 1.4MHz	1710.7MHz ~ 1779.3MHz
		Channel Bandwidth 3MHz	1711.5MHz ~ 1778.5MHz
		Channel Bandwidth 5MHz	1712.5MHz ~ 1777.5MHz
		Channel Bandwidth 10MHz	1715.0MHz ~ 1775.0MHz
		Channel Bandwidth 15MHz	1717.5MHz ~ 1772.5MHz
		Channel Bandwidth 20MHz	1720.0MHz ~ 1770.0MHz
	LTE Band 71	Channel Bandwidth 5MHz	665.5MHz ~ 695.5MHz
		Channel Bandwidth 10MHz	668.0MHz ~ 693.0MHz
		Channel Bandwidth 15MHz	670.5MHz ~ 690.5MHz
		Channel Bandwidth 20MHz	673.0MHz ~ 688.0MHz
Number of Channel	WLAN	2412 ~ 2462MHz: 802.11b, 802.11g, 802.11n (HT20), VHT20, 802.11ax (HE20): 11 5180 ~ 5320MHz: 802.11a, 802.11n (HT20), 802.11ac (VHT20), 802.11ax (HE20): 8 802.11n (HT40), 802.11ac (VHT40), 802.11ax (HE40): 4 802.11ac (VHT80), 802.11ax (HE80): 2 5500 ~ 5720MHz: 802.11a, 802.11n (HT20), 802.11ac (VHT20), 802.11ax (HE20): 12 802.11n (HT40), 802.11ac (VHT40), 802.11ax (HE40): 6 802.11ac (VHT80), 802.11ax (HE80): 3 5745 ~ 5825MHz: 802.11a, 802.11n (HT20), 802.11ac (VHT20), 802.11ax (HE20): 5 802.11n (HT40), 802.11ac (VHT40), 802.11ax (HE40): 2 802.11ac (VHT80), 802.11ax (HE80): 1	
	BT EDR	79	
	Bluetooth LE	40	
Antenna Type	WLAN/WWAN	Refer to note	
	Bluetooth	PCB antenna with 4.07 dBi gain	
Antenna Connector	WLAN/WWAN	Refer to note	
	Bluetooth	I-pex	
Accessory Device	NA		
Cable Supplied	NA		

Note:

1. The EUT incorporates a MIMO function. Physically, the EUT provides 2 completed transmitters and 2 receivers.

Band	Modulation Mode	TX Function
2.4GHz Band	802.11b	2TX
	802.11g	2TX
	802.11n (HT20)	2TX
	VHT20	2TX
	802.11ax (HE20)	2TX
5GHz Band	802.11a	2TX
	802.11n (HT20)	2TX
	802.11n (HT40)	2TX
	802.11ac (VHT20)	2TX
	802.11ac (VHT40)	2TX
	802.11ac (VHT80)	2TX
	802.11ax (HE20)	2TX
	802.11ax (HE40)	2TX
	802.11ax (HE80)	2TX

* The bandwidth and modulation are similar for HT20/HT40 on 802.11n mode and VHT20/VHT40 on 802.11ac mode and HE20/HE40 on 802.11ax mode. The bandwidth and modulation are similar for VHT80 on 802.11ac mode and HE80 on 802.11ax mode. Therefore the investigated worst case is the representative mode in test report.

2. The EUT with follow antennas gain is listed as table below.

WLAN

Type	Dipole				
Connecter	Fakra				
Model	84623918				
Frequency (GHz)	2.4~2.4835	5.15~5.25	5.25~5.35	5.47~5.725	5.725~5.85
Gain (dBi)	2.70	2.49	2.63	2.88	3.43

WWAN

Type	Connector	Ant. No.	Gain (dBi)										
			LTE B2	LTE B4	LTE B5	LTE B7	LTE B12	LTE B13	LTE B14	LTE B25	LTE B26	LTE B66	LTE B71
Multi-Band Monopole	Fakra	85004261_ LTE/GNSS_ Primary	4.22	2.47	3.16	4.47	2.78	2.94	3.08	4.22	3.16	2.47	2.78
		85004261_ LTE/GNSS_ Secondary	3.50	3.31	2.39	3.80	1.86	2.02	2.06	3.50	2.39	3.31	1.87

*Detail antenna specification please refer to antenna photos/or drawings, including antenna dimensions.

3. The EUT contains certified WWAN module (FCC ID: VUI-DAV001).

3.2 Description of Test Modes

WLAN

For 2.4GHz

11 channels are provided for 802.11b, 802.11g, 802.11n (HT20), VHT20, 802.11ax (HE20):

Channel	Frequency	Channel	Frequency
1	2412MHz	7	2442MHz
2	2417MHz	8	2447MHz
3	2422MHz	9	2452MHz
4	2427MHz	10	2457MHz
5	2432MHz	11	2462MHz
6	2437MHz		

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	44	5220 MHz
40	5200 MHz	48	5240 MHz
52	5260 MHz	60	5300 MHz
56	5280 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	46	5230 MHz
54	5270 MHz	62	5310 MHz

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

Channel	Frequency	Channel	Frequency
42	5210MHz	58	5290MHz

For 5500 ~ 5720MHz:

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	122	5610 MHz
138	5690 MHz		

For 5745 ~ 5825MHz:

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

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

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

Channel	Frequency	Channel	Frequency
151	5755MHz	159	5795MHz

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

Channel	Frequency
155	5775MHz

BT EDR

79 channels are provided to this EUT:

Channel	Freq. (MHz)	Channel	Freq. (MHz)	Channel	Freq. (MHz)	Channel	Freq. (MHz)
0	2402	20	2422	40	2442	60	2462
1	2403	21	2423	41	2443	61	2463
2	2404	22	2424	42	2444	62	2464
3	2405	23	2425	43	2445	63	2465
4	2406	24	2426	44	2446	64	2466
5	2407	25	2427	45	2447	65	2467
6	2408	26	2428	46	2448	66	2468
7	2409	27	2429	47	2449	67	2469
8	2410	28	2430	48	2450	68	2470
9	2411	29	2431	49	2451	69	2471
10	2412	30	2432	50	2452	70	2472
11	2413	31	2433	51	2453	71	2473
12	2414	32	2434	52	2454	72	2474
13	2415	33	2435	53	2455	73	2475
14	2416	34	2436	54	2456	74	2476
15	2417	35	2437	55	2457	75	2477
16	2418	36	2438	56	2458	76	2478
17	2419	37	2439	57	2459	77	2479
18	2420	38	2440	58	2460	78	2480
19	2421	39	2441	59	2461		

BT LE

40 channels are provided to this EUT:

Channel	Freq. (MHz)	Channel	Freq. (MHz)	Channel	Freq. (MHz)	Channel	Freq. (MHz)
0	2402	10	2422	20	2442	30	2462
1	2404	11	2424	21	2444	31	2464
2	2406	12	2426	22	2446	32	2466
3	2408	13	2428	23	2448	33	2468
4	2410	14	2430	24	2450	34	2470
5	2412	15	2432	25	2452	35	2472
6	2414	16	2434	26	2454	36	2474
7	2416	17	2436	27	2456	37	2476
8	2418	18	2438	28	2458	38	2478
9	2420	19	2440	29	2460	39	2480

3.2.1 Test Mode Applicability and Tested Channel Detail

EUT Configure Mode	Applicable to			Description
	RE≥1G	RE<1G	OB	
-	√	√	√	-

Where RE≥1G: Radiated Emission above 1GHz & Bandedge Measurement RE<1G: Radiated Emission below 1GHz

OB: Conducted Out-Band Emission Measurement

NOTE:
1. For radiated emission (below 1GHz) and power line conducted emission test items, the worst radiated emission mode was selected.

Radiated Emission Test (Above 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	Freq. Range (MHz)	Available Channel	Tested Channel	Modulation Technology
-	802.11g + 802.11a + BT + LTE Band 25	2412-2462	1 to 11	1 + 60 + 19 + 26365	OFDM
		5250-5320	52 to 64		OFDM
		2402-2480	0 to 39		GFSK
		1850-1915	26140 to 26590		QPSK

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	Freq. Range (MHz)	Available Channel	Tested Channel	Modulation Technology
-	802.11g + 802.11a + BT + LTE Band 25	2412-2462	1 to 11	1 + 60 + 19 + 26365	OFDM
		5250-5320	52 to 64		OFDM
		2402-2480	0 to 39		GFSK
		1850-1915	26140 to 26590		QPSK

Conducted Out-Band Emission Measurement:

☒ 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	Freq. Range (MHz)	Available Channel	Tested Channel	Modulation Technology
-	802.11g + 802.11a	2412-2462	1 to 11	1 + 60	OFDM
		5250-5320	52 to 64		OFDM

Test Condition:

Applicable to	Environmental Conditions	Input Power (System)	Tested by
RE≥1G	23 deg. C, 66% RH	12Vdc	Titan Hsu
RE<1G	23 deg. C, 66% RH	12Vdc	Titan Hsu
OB	25 deg. C, 60% RH	12Vdc	Chris Lin

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.

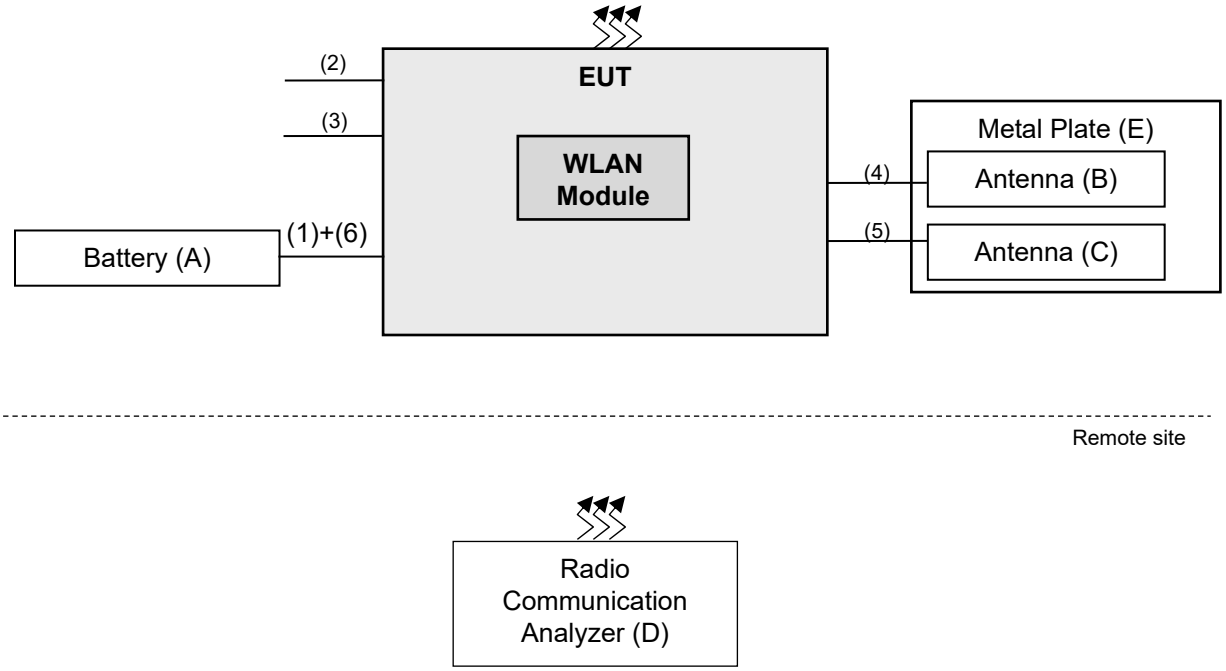
ID	Product	Brand	Model No.	Serial No.	FCC ID	Remarks
A.	Battery	YUASA	75D23R-CMF II	NA	NA	-
B.	Antenna	TE	84623918	NA	NA	Provided by client
C.	Antenna	Continental	85004261	NA	NA	Provided by client
D.	Radio Communication Analyzer	Anritsu	MT8821C	6261806803	NA	-
E.	Metal Plate	NA	NA	NA	NA	Provided by client

Note:

1. All power cords of the above support units are non-shielded (1.8m).
2. Item D acted as a communication partner to transfer data.

ID	Cable Descriptions	Qty.	Length (m)	Shielding (Yes/No)	Cores (Qty.)	Remarks
1.	Power cable	1	2	N	0	Provided by client 2M (With Power Supply 0.85M Cable, 0.3M Cable, 1.8M Cable)
2.	Combo B cable	1	5.2	N	0	Provided by client
3.	Combo A cable	1	5.2	N	0	Provided by client
4.	Rosenberger Harness_CFWM WiFi	1	0.15	N	0	Provided by client
5.	Rosenberger Harness_CFWM LTE	1	2.35	N	0	Provided by client
6.	Power cable	1	2	N	0	-

3.3.1 Configuration of System under Test



3.4 General Description of Applied Standards and References

The EUT is a RF Product. According to the specification of the EUT declared by the manufacturer, it must comply with the requirements of the following standards and references:

Test standard:
47 CFR FCC Part 15, Subpart C (Section 15.247)
47 CFR FCC Part 15, Subpart E (Section 15.407)
FCC Part 22, Subpart H
FCC Part 24, Subpart E
FCC Part 27, Subpart C, F, H, L, M
FCC Part 90, Subpart I, R, S
ANSI/TIA/EIA-603-E 2016
ANSI 63.26-2015
ANSI C63.10-2013

References Test Guidance:
KDB 558074 D01 15.247 Meas Guidance v05r02
KDB 789033 D02 General UNII Test Procedure New Rules v02r01
KDB 662911 D01 Multiple Transmitter Output v02r01
KDB 971168 D01 Power Meas License Digital Systems v03r01
KDB 971168 D02 Misc Rev Approv License Devices 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

For WLAN:

Radiated emissions which fall in the restricted bands must comply with the radiated emission limits specified as below table. Other emissions shall be at least 30dB 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

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.

Limits of unwanted emission out of the restricted bands

<table>
<tr><th colspan="3">Applicable To</th><th colspan="2">Limit</th></tr>
<tr><td colspan="3" rowspan="2">789033 D02 General UNII Test Procedure New Rules v02r01</td><td colspan="2">Field Strength at 3m</td></tr>
<tr><td>PK: 74 (dBµV/m)</td><td>AV: 54 (dBµV/m)</td></tr>
<tr><td>Frequency Band</td><td colspan="2">Applicable To</td><td>EIRP Limit</td><td>Equivalent Field Strength at 3m</td></tr>
<tr><td>5150~5250 MHz</td><td colspan="2">15.407(b)(1)</td><td rowspan="3">PK: -27 (dBm/MHz)</td><td rowspan="3">PK: 68.2(dBµV/m)</td></tr>
<tr><td>5250~5350 MHz</td><td colspan="2">15.407(b)(2)</td></tr>
<tr><td>5470~5725 MHz</td><td colspan="2">15.407(b)(3)</td></tr>
<tr><td rowspan="2">5725~5850 MHz</td><td>☒</td><td>15.407(b)(4)(i)</td><td>PK: -27 (dBm/MHz) *1
PK: 10 (dBm/MHz) *2
PK: 15.6 (dBm/MHz) *3
PK: 27 (dBm/MHz) *4</td><td>PK: 68.2(dBµV/m) *1
PK: 105.2 (dBµV/m) *2
PK: 110.8(dBµV/m) *3
PK: 122.2 (dBµV/m) *4</td></tr>
<tr><td>☐</td><td>15.407(b)(4)(ii)</td><td colspan="2">Emission limits in section 15.247(d)</td></tr>
<tr><td colspan="5">*1 beyond 75 MHz or more above of the band edge.
*2 below the band edge increasing linearly to 10 dBm/MHz at 25 MHz above.
*3 below the band edge increasing linearly to a level of 15.6 dBm/MHz at 5 MHz above.
*4 from 5 MHz above or below the band edge increasing linearly to a level of 27 dBm/MHz at the band edge.</td></tr>
</table>

Note: The following formula is used to convert the equipment isotropic radiated power (eirp) to field strength:

$$E = \frac{1000000\sqrt{30P}}{3}$$ µV/m, where P is the eirp (Watts).

For WWAN

The power of any emission outside of the authorized operating frequency ranges must be attenuated below the transmitting power (P) by a factor of at least 43 + 10 log(P) dB. The emission limit equal to –13dBm.

4.1.2 Test Instruments

Description & Manufacturer	Model No.	Serial No.	Cal. Date	Cal. Due
Test Receiver ROHDE & SCHWARZ	ESCI	100424	Dec. 30, 2021	Dec. 29, 2022
Spectrum Analyzer ROHDE & SCHWARZ	FSP40	100040	Sep. 15, 2021	Sep. 14, 2022
BILOG Antenna SCHWARZBECK	VULB9168	9168-155	Nov. 01, 2021	Oct. 31, 2022
HORN Antenna SCHWARZBECK	BBHA 9120D	9120D-1170	Nov. 14, 2021	Nov. 13, 2022
HORN Antenna SCHWARZBECK	BBHA 9170	BBHA9170241	Oct. 26, 2021	Oct. 35, 2022
Loop Antenna TESEQ	HLA 6121	45745	Jul. 21, 2021	Jul. 20, 2022
Preamplifier Agilent (Below 1GHz)	8447D	2944A10631	Jun. 05, 2021	Jun. 04, 2022
Preamplifier KEYSIGHT (Above 1GHz)	83017A	MY53270295	Jun. 05, 2021	Jun. 04, 2022
RF Coaxial Cable WOKEN With 5dB PAD	8D-FB	Cable-CH4-01	Jul. 24, 2021	Jul. 23, 2022
RF Coaxial Cable EMCI	EMC102-KM-KM-3000	150929	Jul. 24, 2021	Jul. 23, 2022
RF Coaxial Cable EMCI	EMC102-KM-KM-600	150928	Jul. 24, 2021	Jul. 23, 2022
RF signal cable HUBER+SUHNER	SUCOFLEX 104	MY 13380+295012/04	Jun. 05, 2021	Jun. 04, 2022
RF signal cable HUBER+SUHNER	SUCOFLEX 104	Cable-CH4-03 (250724)	Jun. 05, 2021	Jun. 04, 2022
Software BV ADT	ADT_Radiated_V7.6.15.9.5	NA	NA	NA
Antenna Tower inn-co GmbH	MA 4000	010303	NA	NA
Turn Table Controller BV ADT	SC100	SC93021702	NA	NA
Boresight Antenna Fixture	FBA-01	FBA-SIP01	NA	NA
Pre-amplifier (18GHz-40GHz) EMC	EMC184045B	980175	Sep. 04, 2021	Sep. 03, 2022
DC Power Supply Keysight	U8002A	MY56330015	NA	NA
Spectrum Analyzer ROHDE & SCHWARZ	FSV40	100979	Mar. 29, 2021	Mar. 28, 2022
Radio Communication Analyzer Anritsu	MT8820C	6201010284	Dec. 24, 2021	Dec. 23, 2022

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 4.

4.1.3 Test Procedures

For WLAN:

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.

Note:

1. The resolution bandwidth and video bandwidth of test receiver/spectrum analyzer is 9kHz at frequency below 30MHz.

For Radiated emission above 30MHz

a. The EUT was placed on the top of a rotating table 0.8 meters (for 30MHz ~ 1GHz) / 1.5 meters (for above 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.

f. The test-receiver system was set to peak and average detect function and specified bandwidth with maximum hold mode when the test frequency is above 1 GHz. If the peak reading value also meets average limit, measurement with the average detector is unnecessary.

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. The resolution bandwidth of test receiver/spectrum analyzer is 1 MHz and the video bandwidth is 3 MHz for Peak detection (PK) at frequency above 1GHz.

3. The resolution bandwidth of test receiver/spectrum analyzer is 1MHz and the video bandwidth is ≥ 1/T (Duty cycle < 98%) or 10Hz (Duty cycle ≥ 98%) for Average detection (AV) at frequency above 1GHz.

4. All modes of operation were investigated and the worst-case emissions are reported.

For WWAN

a. In the semi-anechoic chamber, EUT placed on the 0.8m (below or equal 1GHz) and/or 1.5m (above 1GHz) height of Turn Table, rotated the table around 360 degrees to search the maximum radiation power and receiver antenna shall be rotated vertical and horizontal polarization and moved height from 1m to 4m to find the maximum polar radiated power. The “Read Value” is the spectrum reading the maximum power value.

b. 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.

c. Perform a field strength measurement and record the worse read value, is the field strength value via a spectrum reading obtained corrected for antenna factor, cable loss and pre-amplifier factor and then mathematically convert the measured field strength level to EIRP/ERP level.

d. Following C63.26 section 5.5 and 5.2.7

- EIRP (dBm) = E (dBμV/m) + 20log(D) - 104.8; where D is the measurement distance (in the far field region) in m.
- ERP (dBm) = E (dBμV/m) + 20log(D) - 104.8 - 2.15; where D is the measurement distance (in the far field region) in m.

Note:

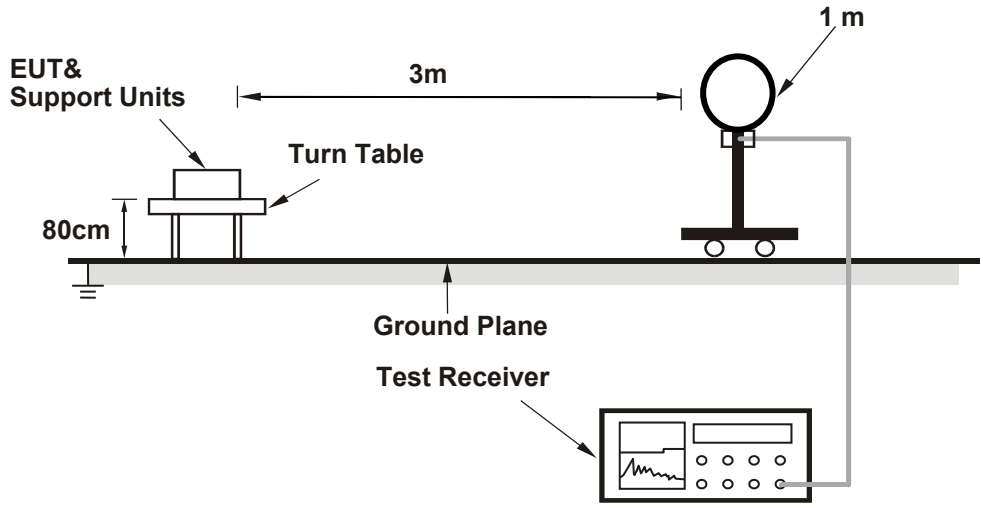
1. The resolution bandwidth and video bandwidth of test receiver/spectrum analyzer is 1MHz/3MHz.
2. The emission levels were against the limit of frequency range 9 kHz ~ 30 MHz:
   The amplitude of spurious emissions attenuated more than 20 dB below the permissible value is not required to be report.

4.1.4 Deviation from Test Standard

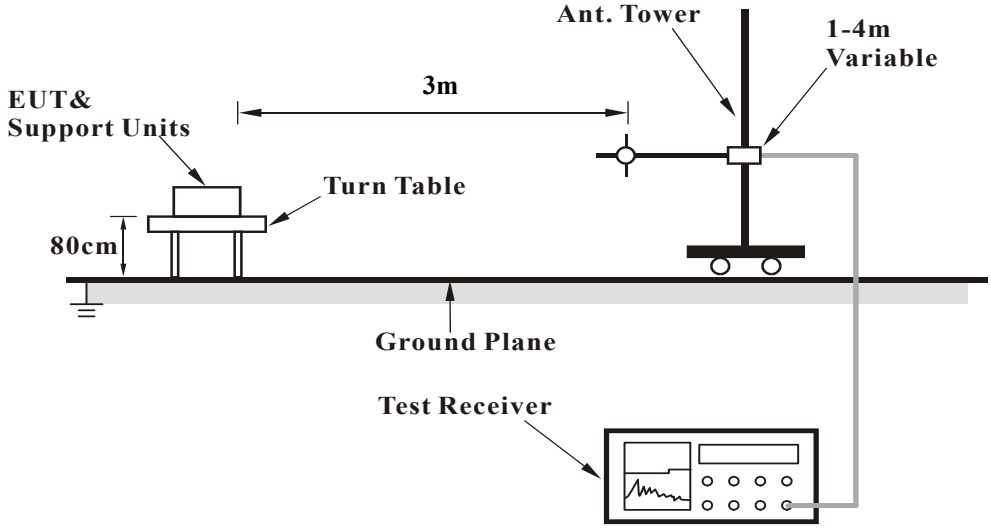
No deviation.

4.1.5 Test Setup

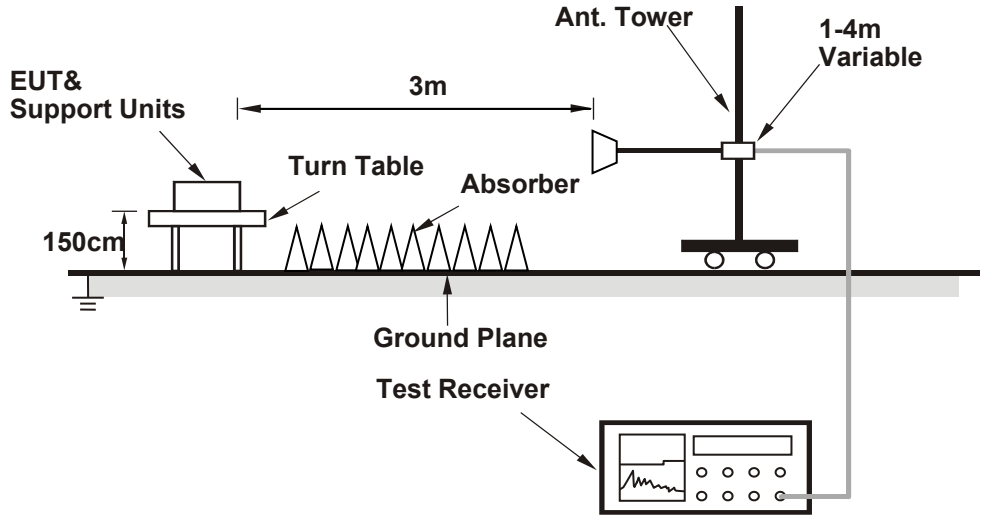
For Radiated emission below 30MHz



For Radiated emission 30MHz to 1GHz



For Radiated emission above 1GHz



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

4.1.6 EUT Operating Conditions

a. The EUT under transmission condition continuously at specific channel frequency.

4.1.7 Test Results

Above 1GHz Data:

802.11g + 802.11a + BT + LTE Band 25

CHANNEL	CH 1 + CH 60 + CH 19	DETECTOR FUNCTION	Peak (PK) Average (AV)
FREQUENCY RANGE	1GHz ~ 40GHz		

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	2390.00	58.30 PK	74.00	-15.70	1.88 H	175	24.20	34.10
2	2390.00	45.10 AV	54.00	-8.90	1.88 H	175	11.00	34.10
3	*2412.00	101.40 PK			1.88 H	175	67.30	34.10
4	*2412.00	90.40 AV			1.88 H	175	56.30	34.10
5	*2440.00	98.80 PK			1.09 H	135	64.50	34.30
6	*2440.00	97.60 AV			1.09 H	135	63.30	34.30
7	4824.00	50.10 PK	74.00	-23.90	2.58 H	148	36.50	13.60
8	4824.00	38.80 AV	54.00	-15.20	2.58 H	148	25.20	13.60
9	4880.00	51.10 PK	74.00	-22.90	2.26 H	199	37.50	13.60
10	4880.00	39.10 AV	54.00	-14.90	2.26 H	199	25.50	13.60
11	*5300.00	100.50 PK			1.22 H	225	58.20	42.30
12	*5300.00	89.50 AV			1.22 H	225	47.20	42.30
13	10600.00	61.70 PK	74.00	-12.30	2.18 H	166	38.20	23.50
14	10600.00	49.70 AV	54.00	-4.30	2.18 H	166	26.20	23.50
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	2390.00	66.30 PK	74.00	-7.70	1.16 V	169	32.20	34.10
2	2390.00	46.20 AV	54.00	-7.80	1.16 V	169	12.10	34.10
3	*2412.00	108.60 PK			1.16 V	168	74.50	34.10
4	*2412.00	98.50 AV			1.16 V	168	64.40	34.10
5	*2440.00	100.80 PK			2.02 V	255	66.50	34.30
6	*2440.00	99.60 AV			2.02 V	255	65.30	34.30
7	4824.00	50.90 PK	74.00	-23.10	1.82 V	233	37.30	13.60
8	4824.00	39.10 AV	54.00	-14.90	1.82 V	233	25.50	13.60
9	4880.00	51.60 PK	74.00	-22.40	1.44 V	235	38.00	13.60
10	4880.00	39.80 AV	54.00	-14.20	1.44 V	235	26.20	13.60
11	*5300.00	110.00 PK			1.18 V	275	67.70	42.30
12	*5300.00	100.10 AV			1.18 V	275	57.80	42.30
13	10600.00	62.30 PK	74.00	-11.70	3.08 V	177	38.80	23.50
14	**10600.00**	**50.30 AV**	**54.00**	**-3.70**	**3.08 V**	**177**	**26.80**	**23.50**

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.
5. " * ": Fundamental frequency.
6. " # ": The radiated frequency is out of the restricted band.

RF Mode	TX LTE Band 25	Channel	CH 26365
Frequency Range	1GHz ~ 20GHz		

Antenna Polarity & Test Distance : Horizontal at 3 m								
No	Frequency (MHz)	EIRP (dBm)	Limit (dBm)	Margin (dB)	Antenna Height (m)	Table Angle (Degree)	Raw Value (dBuV)	Correction Factor (dB/m)
1	3765.00	-47.88	-13.00	-34.88	1.10 H	138	39.36	-87.24
Antenna Polarity & Test Distance : Vertical at 3 m								
No	Frequency (MHz)	EIRP (dBm)	Limit (dBm)	Margin (dB)	Antenna Height (m)	Table Angle (Degree)	Raw Value (dBuV)	Correction Factor (dB/m)
1	3765.00	-47.46	-13.00	-34.46	2.26 V	318	39.78	-87.24

Remarks:

1. EIRP(dBm) = Raw Value(dBuV) + Correction Factor(dB/m)
2. Correction Factor(dB/m) = Antenna Factor(dB/m) + Cable Factor(dB) – Pre-Amplifier Factor(dB) + 20log(D) – 104.8
3. Margin value = EIRP – Limit value
4. The other EIRP levels were very low against the limit.

Below 1GHz data

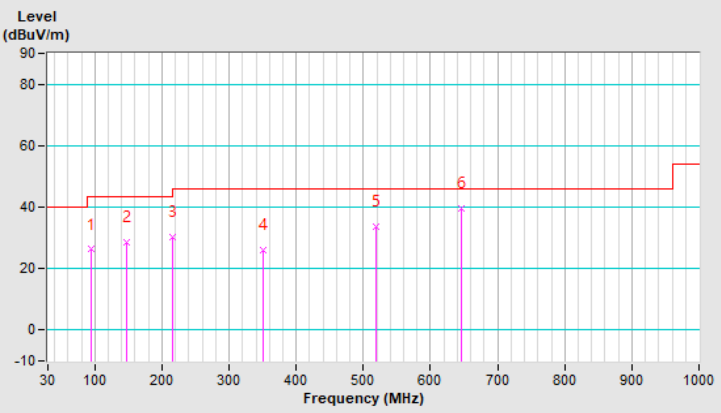
802.11g + 802.11a + BT + LTE Band 25

CHANNEL	CH 1 + CH 60 + CH 19	DETECTOR FUNCTION	Quasi-Peak (QP)
FREQUENCY RANGE	9kHz ~ 1GHz		

ANTENNA POLARITY & TEST DISTANCE: HORIZONTAL AT 3 M								
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	94.02	26.20 QP	43.50	-17.30	1.01 H	6	40.30	-14.10
2	146.40	28.40 QP	43.50	-15.10	1.50 H	73	37.20	-8.80
3	216.24	30.10 QP	46.00	-15.90	1.50 H	218	41.60	-11.50
4	350.10	26.20 QP	46.00	-19.80	1.01 H	285	32.90	-6.70
5	518.88	33.50 QP	46.00	-12.50	1.01 H	116	37.10	-3.60
6	646.92	39.70 QP	46.00	-6.30	1.01 H	229	40.50	-0.80

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. The other emission levels were very low against the limit of frequency range 30MHz ~ 1000MHz.
4. Margin value = Emission Level – Limit value.
5. The emission levels were very low against the limit of frequency range 9kHz ~ 30MHz: the amplitude of spurious emissions attenuated more than 20 dB below the permissible value to be report.

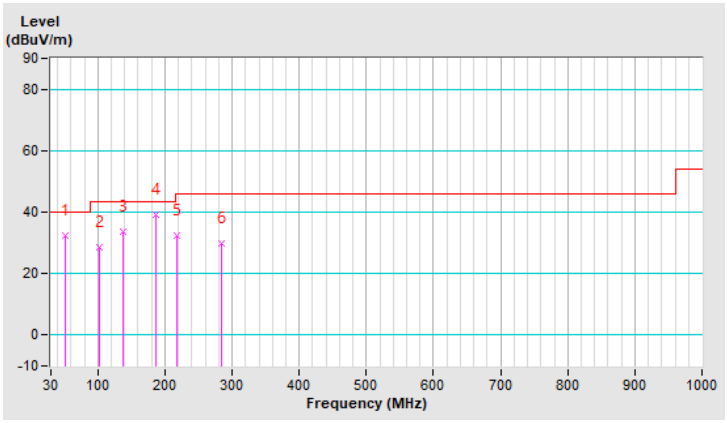


CHANNEL	CH 1 + CH 60 + CH 19	DETECTOR FUNCTION	Quasi-Peak (QP)
FREQUENCY RANGE	9kHz ~ 1GHz		

ANTENNA POLARITY & TEST DISTANCE: VERTICAL AT 3 M								
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	51.34	32.20 QP	40.00	-7.80	1.50 V	114	40.70	-8.50
2	101.78	28.50 QP	43.50	-15.00	1.00 V	279	41.60	-13.10
3	136.70	33.60 QP	43.50	-9.90	1.00 V	99	43.00	-9.40
4	187.14	39.20 QP	43.50	-4.30	1.50 V	236	50.20	-11.00
5	218.18	32.30 QP	46.00	-13.70	2.00 V	170	43.80	-11.50
6	284.14	29.80 QP	46.00	-16.20	1.00 V	230	37.70	-7.90

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. The other emission levels were very low against the limit of frequency range 30MHz ~ 1000MHz.
4. Margin value = Emission Level – Limit value.
5. The emission levels were very low against the limit of frequency range 9kHz ~ 30MHz: the amplitude of spurious emissions attenuated more than 20 dB below the permissible value to be report.

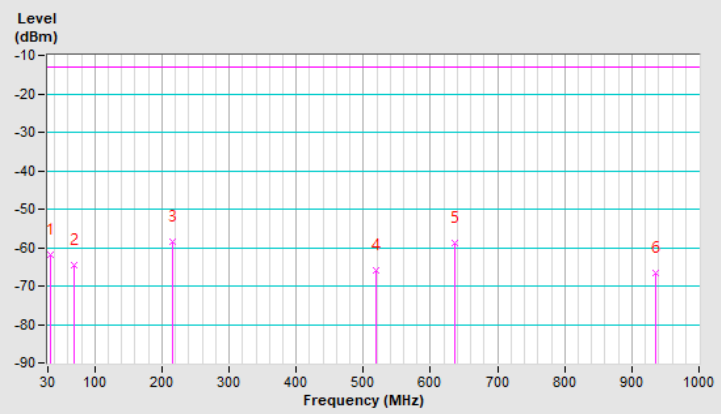


RF Mode	TX LTE Band 25	Channel	CH 26365
Frequency Range	Below 1000 MHz		

Antenna Polarity & Test Distance : Horizontal at 3 m								
No	Frequency (MHz)	EIRP (dBm)	Limit (dBm)	Margin (dB)	Antenna Height (m)	Table Angle (Degree)	Raw Value (dBuV)	Correction Factor (dB/m)
1	33.88	-61.71	-13.00	-48.71	1.50 H	45	43.69	-105.40
2	68.80	-64.47	-13.00	-51.47	1.50 H	231	41.42	-105.89
3	216.24	-58.63	-13.00	-45.63	1.00 H	96	48.07	-106.70
4	518.88	-65.78	-13.00	-52.78	1.00 H	120	33.17	-98.95
5	637.22	-58.78	-13.00	-45.78	1.00 H	59	37.46	-96.24
6	935.98	-66.55	-13.00	-53.55	1.50 H	244	23.32	-89.87

Remarks:

1. EIRP(dBm) = Raw Value(dBuV) + Correction Factor(dB/m)
2. Correction Factor(dB/m) = Antenna Factor(dB/m) + Cable Factor(dB) – Pre-Amplifier Factor(dB) + 20log(D) – 104.8
3. Margin value = EIRP – Limit value
4. The other EIRP levels were very low against the limit.

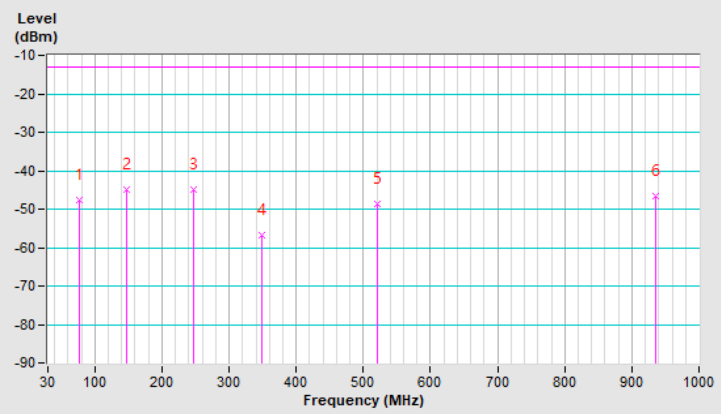


RF Mode	TX LTE Band 25	Channel	CH 26365
Frequency Range	Below 1000 MHz		

Antenna Polarity & Test Distance : Vertical at 3m								
No	Frequency (MHz)	EIRP (dBm)	Limit (dBm)	Margin (dB)	Antenna Height (m)	Table Angle (Degree)	Raw Value (dBuV)	Correction Factor (dB/m)
1	76.56	-47.63	-13.00	-34.63	1.00 V	269	59.76	-107.39
2	146.40	-44.88	-13.00	-31.88	1.50 V	252	59.23	-104.11
3	247.28	-45.02	-13.00	-32.02	1.00 V	144	59.78	-104.80
4	348.16	-56.75	-13.00	-43.75	1.50 V	130	45.34	-102.09
5	520.82	-48.72	-13.00	-35.72	1.50 V	130	50.19	-98.91
6	935.98	-46.53	-13.00	-33.53	1.50 V	37	43.34	-89.87

Remarks:

1. EIRP(dBm) = Raw Value(dBuV) + Correction Factor(dB/m)
2. Correction Factor(dB/m) = Antenna Factor(dB/m) + Cable Factor(dB) – Pre-Amplifier Factor(dB) + 20log(D) – 104.8
3. Margin value = EIRP – Limit value
4. The other EIRP levels were very low against the limit.

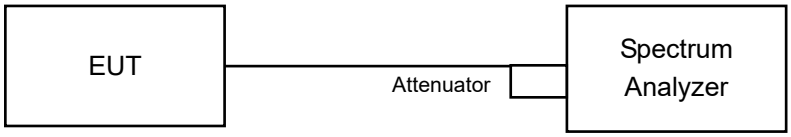


4.2 Conducted Out of Band Emission Measurement

4.2.1 Limits of Conducted Out of Band Emission Measurement

Below 30dB of the highest emission level of operating band (in 100kHz Resolution Bandwidth).

4.2.2 Test Setup



4.2.3 Test Instruments

Refer to section 4.1.2 to get information of above instrument.

4.2.4 Test Procedure

MEASUREMENT PROCEDURE REF

a. Set the RBW = 100 kHz.
b. Set the VBW ≥ 300 kHz.
c. Detector = peak.
d. Sweep time = auto couple.
e. Trace mode = max hold.
f. Allow trace to fully stabilize.
g. Use the peak marker function to determine the maximum power level in any 100 kHz band segment within the fundamental EBW.

MEASUREMENT PROCEDURE OOBE

a. Set RBW = 100 kHz.
b. Set VBW ≥ 300 kHz.
c. Detector = peak.
d. Sweep = auto couple.
e. Trace Mode = max hold.
f. Allow trace to fully stabilize.
g. Use the peak marker function to determine the maximum amplitude level.

4.2.5 Deviation from Test Standard

No deviation.

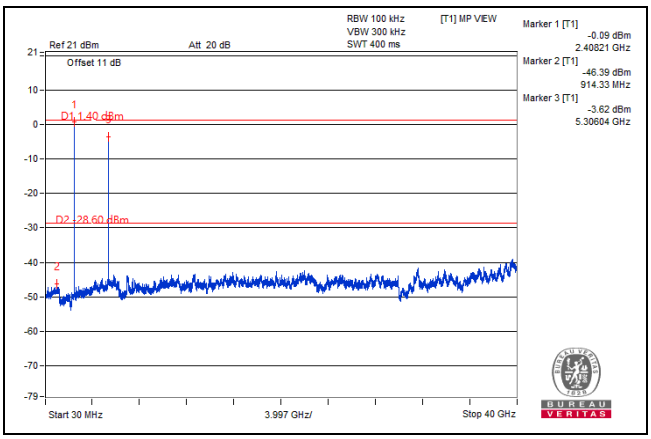
4.2.6 EUT Operating Condition

The software provided by client to enable the EUT under transmission condition continuously at lowest, middle and highest channel frequencies individually.

4.2.7 Test Results

The spectrum plots are attached on the following pages. D1 line indicates the highest level, and D2 line indicates the 30dB offset below D1. It shows compliance with the requirement.

802.11g + 802.11a



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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Tel: 886-2-26052180
Fax: 886-2-26051924

Hsin Chu EMC/RF/Telecom Lab
Tel: 886-3-6668565
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Tel: 886-3-3183232
Fax: 886-3-3270892

Email: service.adt@tw.bureauveritas.com
Web Site: www.bureauveritas-adt.com

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

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