



BUREAU
VERITAS Test Report No.: W7L-211129W003RF14



VARIANT FCC TEST REPORT

(Part 15, Subpart E)

Applicant:	Honeywell International Inc Honeywell Safety and Productivity Solutions
Address:	9680 Old Bailes Road, Fort Mill, SC 29707 United States

Manufacturer or Supplier:	Honeywell International Inc Honeywell Safety and Productivity Solutions
Address:	9680 Old Bailes Road, Fort Mill, SC 29707 United States
Product:	Mobile Computer
Brand Name:	Honeywell
Model Name:	CT45-L1N-G
FCC ID:	HD5-CT45L1NG
Date of tests:	Oct. 25, 2021 ~ Jan. 17, 2022

The tests have been carried out according to the requirements of the following standard:

FCC Part 15, Subpart E, Section 15.407

CONCLUSION: The submitted sample was found to COMPLY with the test requirement

Prepared by Simon Wang Engineer / Mobile Department	Approved by Luke Lu Manager / Mobile Department

Date: Jan. 18, 2022 Date: Jan. 18, 2022

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RELEASE CONTROL RECORD

ISSUE NO.	REASON FOR CHANGE	DATE ISSUED
W7L-P21080006RF14	Original release	Sep. 01, 2021
W7L-P21040030RF14	Based on the original report W7L-P21080006RF14 Changed LCM to screen HD(1280*720), removing a 2nd BLE and Supercap, Increase the RTC battery, Detail refer to Product Equality Declaration	Sep. 26, 2021
W7L-P21110009RF14	Based on the original report W7L-P21040030RF14 Changing components, add a new screen, added band CA_41C by Software.	Nov. 09, 2021
W7L-211129W003RF14	Based on the original report W7L-P21110009RF14 Changing components.	Jan. 18, 2022



1 SUMMARY OF TEST RESULTS

The EUT has been tested according to the following specifications:

APPLIED STANDARD: FCC PART 15, SUBPART E		
STANDARD SECTION	TEST TYPE AND LIMIT	RESULT
15.407(b)(6)	AC Power Conducted Emission	(See Note 2)
15.407(b) (1/2/3/4/5)	Radiated Emission & Band Edge Measurement	Compliance (See Note 1)
15.407(a/1/2/3)	Maximum conducted output Power	Compliance (See Note 1)
15.407(a/1/2/3)	Peak Power Spectral Density	(See Note 2)
15.403(i)	26 dB Bandwidth	(See Note 2)
15.407(e)	6 dB Bandwidth	(See Note 2)
15.203	Antenna Requirement	(See Note 2)
15.407(c)	Automatically Discontinue Transmission	(See Note 2)

NOTE:

1. Per the change notice provide by manufactory, the difference is changing components, all the change no effect any RF parameter, Therefore only verify the power and radiated emission worse case. The report only show the verify test data.
2. Please refer to original report W7L-P21110009RF14.



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2 GENERAL INFORMATION

2.1 GENERAL DESCRIPTION OF EUT

PRODUCT	Mobile Computer
BRAND NAME	Honeywell
MODEL NAME	CT45-L1N-G
NOMINAL VOLTAGE	3.85Vdc (Lithium-ion cell, battery)
MODULATION	OFDM
TRANSFER RATE	802.11a: 54.0/ 48.0/ 36.0/ 24.0/ 18.0/ 12.0/ 9.0/ 6.0Mbps 802.11n: up to MCS7 802.11ac: up to 390.0Mbps
OPERATING FREQUENCY	5180 ~ 5240MHz, 5260 ~ 5320MHz, 5500 ~ 5720MHz, 5745 ~ 5825MHz
NUMBER OF CHANNEL	5180 ~ 5240MHz: 4 for 802.11a, 802.11n, 802.11ac (20MHz) 2 for 802.11n, 802.11ac (40MHz) 1 for 802.11ac (80MHz) 5260 ~ 5320MHz: 4 for 802.11a, 802.11n, 802.11ac (20MHz) 2 for 802.11n, 802.11ac (40MHz) 1 for 802.11ac (80MHz) 5500 ~ 5720MHz: 12 for 802.11a, 802.11n, 802.11ac(20MHz) 6 for 802.11n, 802.11ac (40MHz) 3 for 802.11ac (80MHz) 5745 ~ 5825MHz: 5 for 802.11a, 802.11n, 802.11ac (20MHz) 3 for 802.11n, 802.11ac (40MHz) 2 for 802.11ac (80MHz)
AVERAGE POWER	40.18mW for 5180 ~ 5240MHz 39.99mW for 5260 ~ 5320MHz 48.98mW for 5500 ~ 5720MHz 56.49mW for 5745 ~ 5825MHz
ANTENNA TYPE	PIFA Antenna
ANTENNA GAIN	0.72 dBi for 5180 ~ 5240MHz 0.62 dBi for 5260 ~ 5320MHz 0.52 dBi for 5500 ~ 5720MHz 0.78 dBi for 5745 ~ 5825MHz
HW VERSION	V1.0
SW VERSION	OS.11.002-HON.11.002
I/O PORTS	Refer to user's manual
CABLE SUPPLIED	USB CUP: unshielded without ferrite, 1.25 meter Earphone cable: unshielded without ferrite, 1.27 meter



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NOTE:

1. For a more detailed features description, please refer to the manufacturer's specifications or the user's manual.
2. This product includes the following six SKU which hardware is exactly same, the difference is described as following, Sample 1 was full test, sample 2 verify the worst case, check worst case Radiated emission:

SAMPLE	EUT CONFIGURATION INFORMATION
1	SKU ID:CT45-L1N-27D120G ,Assembled Scanner Imager: 7-S0703
2	SKU ID:CT45-L1N-28D120G ,Assembled Scanner Imager: 8 - N6803/S0803
3	SKU ID: CT45-L1N-28D120T, Assembled with Scanner: 8 - N6803/S0803 for Turkey Only
4	SKU ID: CT45-L1N-27D120T, Assembled with Scanner: 7-S0703 for Turkey Only
5	SKU ID:CT45-L1N-28D220C, Assembled with Scanner: 8 - N6803/S0803 for China Only with Android non-GMS
6	SKU ID:CT45-L1N-27D220C, Assembled with Scanner: 7-S0703 for China Only with Android non-GMS

3. The EUT incorporates a SISO function. Physically, the EUT provides one completed transmitter and one receiver.

MODULATION MODE	TX FUNCTION
802.11a	1TX/1RX
802.11n/802.11ac (20MHz)	1TX/1RX
802.11n/802.11ac (40MHz)	1TX/1RX
802.11ac (80MHz)	1TX/1RX

4. For the test results, the EUT had been tested with all conditions. But only the worst case was shown in test report.

List of Accessory:

ACCESSORIES	BRAND	MODEL	SPECIFICATION
Battery	Honeywell	CT50-BTSC	Capacity: 3.85vdc 4020mAh
AC Adapter	HONOR	ADS-12B-06 05010E	I/P:100-240Vac, 0.3A O/P: 5Vdc, 2A
USB CUP	Honeywell	CT40-SN	Shielded, 1.25meter
Earphone	VIVO	N/A	Shielded, 1.27meter
LCD Panel 1	TZD	TS5099	5.0" HD(1280*720)
LCD Panel 2	TIANMA	TM050JVZG53	5.0" HD(1280*720)



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2.2 DESCRIPTION OF TEST MODES

FOR 5180 ~ 5240MHz

4 channels are provided for 802.11a, 802.11n, 802.11ac (20MHz):

CHANNEL	FREQUENCY	CHANNEL	FREQUENCY
36	5180 MHz	44	5220 MHz
40	5200 MHz	48	5240 MHz

2 channels are provided for 802.11n, 802.11ac (40MHz):

CHANNEL	FREQUENCY	CHANNEL	FREQUENCY
38	5190 MHz	46	5230 MHz

1 channel is provided for 802.11ac (80MHz):

CHANNEL	FREQUENCY	CHANNEL	FREQUENCY
42	5210 MHz		

FOR 5260 ~ 5320MHz

4 channels are provided for 802.11a, 802.11n, 802.11ac (20MHz):

CHANNEL	FREQUENCY	CHANNEL	FREQUENCY
52	5260 MHz	60	5300 MHz
56	5280 MHz	64	5320 MHz

2 channels are provided for 802.11n, 802.11ac (40MHz):

CHANNEL	FREQUENCY	CHANNEL	FREQUENCY
54	5270 MHz	62	5310 MHz

1 channel is provided for 802.11ac (80MHz):

CHANNEL	FREQUENCY	CHANNEL	FREQUENCY
58	5290 MHz		



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FOR 5500 ~ 5720MHz

12 channels are provided for 802.11a, 802.11n, 802.11ac (20MHz):

CHANNEL	FREQUENCY	CHANNEL	FREQUENCY
100	5500 MHz	124	5620MHz
104	5520 MHz	128	5640MHz
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, 802.11ac (40MHz):

CHANNEL	FREQUENCY	CHANNEL	FREQUENCY
102	5510 MHz	126	5630MHz
110	5550 MHz	134	5670 MHz
118	5590 MHz	142	5710 MHz

3 channel is provided for 802.11ac (80MHz):

CHANNEL	FREQUENCY	CHANNEL	FREQUENCY
106	5530 MHz	138	5690 MHz
122	5610 MHz		

FOR 5745 ~ 5825MHz

5 channels are provided for 802.11a, 802.11n, 802.11ac (20MHz):

CHANNEL	FREQUENCY	CHANNEL	FREQUENCY
144	5720MHz	157	5785 MHz
149	5745 MHz	165	5825 MHz
153	5765 MHz		

3 channels are provided for 802.11n, 802.11ac (40MHz):

CHANNEL	FREQUENCY	CHANNEL	FREQUENCY
142	5710 MHz	159	5795 MHz
151	5755 MHz		

2 channel is provided for 802.11ac (80MHz):

CHANNEL	FREQUENCY	CHANNEL	FREQUENCY
138	5690MHz	155	5775 MHz

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2.2.1 TEST MODE APPLICABILITY AND TESTED CHANNEL DETAIL

EUT CONFIGURE MODE	APPLICABLE TO				DESCRIPTION
	RE≥1G	RE<1G	PLC	APCM	
A	√	√	-	√	Powered by Adapter with wifi(5G) link
B	-	-	-	-	Powered by Battery with wifi(5G) link
C	-	-	-	-	Powered by USB with wifi(5G) link

Where

RE≥1G: Radiated Emission above 1GHz

RE<1G: Radiated Emission below 1GHz

PLC: Power Line Conducted Emission

APCM: Antenna Port Conducted Measurement

NOTE:The EUT had been pre-tested on the positioned of each 3 axis. The worst case was found when positioned on **X-plane**.**NOTE:** “-”means no effect.

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. BAND (MHz)	AVAILABLE CHANNEL	TESTED CHANNEL	MODULATION	DATA RATE (Mbps)
A	802.11n (40MHz)	5180-5240	38 to 46	38,	OFDM	MCS0

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. BAND (MHz)	AVAILABLE CHANNEL	TESTED CHANNEL	MODULATION	DATA RATE (Mbps)
A	802.11n (40MHz)	5180-5240	38 to 46	38,	OFDM	MCS0



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ANTENNA PORT CONDUCTED MEASUREMENT:

- This item includes all test value of each mode, but only includes spectrum plot of worst value of each mode.
- 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. BAND (MHz)	AVAILABLE CHANNEL	TESTED CHANNEL	MODULATION	DATA RATE (Mbps)
A	802.11a	5180-5240	36 to 48	36, 40, 48	OFDM	6.0
	802.11n (20MHz)		36 to 48	36, 40, 48	OFDM	MCS0
	802.11n (40MHz)		38 to 46	38, 46	OFDM	MCS0
	802.11ac (20MHz)		36 to 48	36, 40, 48	OFDM	MCS0
	802.11ac (40MHz)		38 to 46	38, 46	OFDM	MCS0
	802.11ac (80MHz)		42	42	OFDM	MCS0
A	802.11a	5260-5320	52 to 64	52, 60, 64	OFDM	6.0
	802.11n (20MHz)		52 to 64	52, 60, 64	OFDM	MCS0
	802.11n (40MHz)		54 to 62	54, 62	OFDM	MCS0
	802.11ac (20MHz)		52 to 64	52, 60, 64	OFDM	MCS0
	802.11ac (40MHz)		54 to 62	54, 62	OFDM	MCS0
	802.11ac (80MHz)		58	58	OFDM	MCS0



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A	802.11a	5500-5720	100 to 144	100, 116, 140, 144	OFDM	6.0
A	802.11n (20MHz)		100 to 144	100, 116, 140, 144	OFDM	MCS0
A	802.11n (40MHz)		102 to 142	102, 110, 134, 142	OFDM	MCS0
A	802.11ac (20MHz)		100 to 144	100, 116, 140, 144	OFDM	MCS0
A	802.11ac (40MHz)		102 to 142	102, 110, 134, 142	OFDM	MCS0
A	802.11ac (80MHz)		106 to 138	106, 138	OFDM	MCS0
A	802.11a	5745-5825	144 to 165	144, 149, 157,165	OFDM	6.0
A	802.11n (20MHz)		144 to 165	144, 149, 157,165	OFDM	MCS0
A	802.11n (40MHz)		142 to 159	142, 151, 159	OFDM	MCS0
A	802.11ac (20MHz)		144 to 165	144, 149, 157,165	OFDM	MCS0
A	802.11ac (40MHz)		142 to 159	142, 151, 159	OFDM	MCS0
A	802.11ac (80MHz)		138,155	138, 155	OFDM	MCS0

TEST CONDITION:

APPLICABLE TO	ENVIRONMENTAL CONDITIONS	INPUT POWER	TESTED BY
RE<1G	23deg. C, 70%RH	DC 3.85V By Battery	Jace Hu
RE≥1G	23deg. C, 70%RH	DC 3.85V By Battery	Jace Hu
APCM	25deg. C, 60%RH	DC 3.85V By Battery	Lily Zhao



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2.3 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.

NO.	PRODUCT	BRAND	MODEL NO.	SERIAL NO.	FCC ID
1	Desktop	Lenovo	M73 SFF	PC04GRQV	N/A
2	Desktop	Lenovo	M73 SFF	PC06CS27	N/A
3	Laptop	Lenovo	Thnikpad L440	R90FTFKN	N/A
4	DC source	Kikusui/JP	PMX18-5A	0000001	N/A

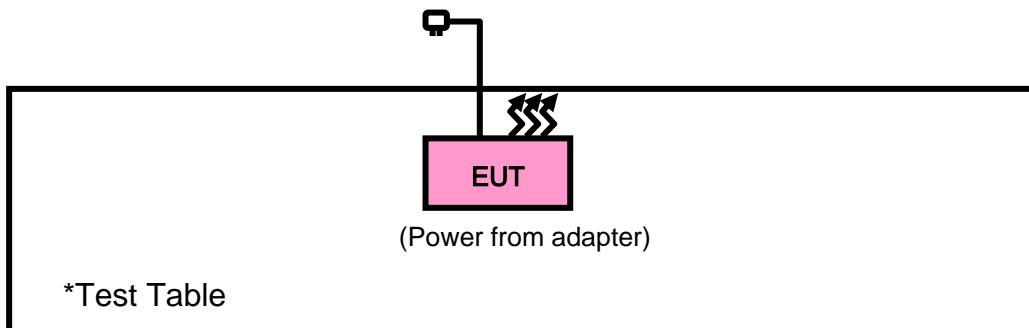
NO.	SIGNAL CABLE DESCRIPTION OF THE ABOVE SUPPORT UNITS
1	AC Line: Unshielded, Detachable 1.5m
2	AC Line: Unshielded, Detachable 1.5m
3	AC Line: Unshielded, Detachable 1.5m
4	DC Line: Unshielded, Detachable 1.0m



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2.3.1 CONFIGURATION OF SYSTEM UNDER TEST



2.4 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 E (15.407)

KDB 789033 D02 General U-NII Test Procedures New Rules v02r01

ANSI C63.10-2013

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

NOTE: The EUT is also considered as a kind of computer peripheral, because the connection to computer is necessary for typical use. It has been verified to comply with the requirements of FCC Part 15, Subpart B, Class B (Certification). The test report has been issued separately.



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3 TEST TYPES AND RESULTS

3.1 RADIATED EMISSION AND BANDEDGE MEASUREMENT

3.1.1 LIMITS OF RADIATED EMISSION AND BANDEDGE MEASUREMENT

Radiated emissions which fall in the restricted bands must comply with the radiated emission limits specified as below table:

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 (dB μ V/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.

3.1.2 LIMITS OF UNWANTED EMISSION

RESTRICTED BANDS	APPLICABLE TO	LIMIT	
		FIELD STRENGTH AT 3m (dB μ V/m)	
	789033 D02 General UNII Test Procedures New Rules v02r01	PK : 74	AV : 54
OUT OF THE RESTRICTED BANDS	APPLICABLE TO	EIRP LIMIT (dBm/MHz)	EQUIVALENT FIELD STRENGTH AT 3m (dB μ V/m)
	15.407(b)(1)		
	15.407(b)(2)	PK : -27	PK : 68.2
	15.407(b)(3)		
	15.407(b)(4)	See note 2 (FCC 16-24)	



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

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

2. All emissions shall be limited to a level of -27 dBm/MHz at 75 MHz or more above or below the band edge increasing linearly to 10 dBm/MHz at 25 MHz above or below the band edge, and from 25 MHz above or below the band edge increasing linearly to a level of 15.6 dBm/MHz at 5 MHz above or below the band edge, and from 5 MHz above or below the band edge increasing linearly to a level of 27 dBm/MHz at the band edge.

3.1.3 TEST INSTRUMENTS

Equipment	Manufacturer	Model No.	Serial No.	Last Cal.	Next Cal.
3m Semi-anechoic Chamber	ETS-LINDGREN	9m*6m*6m	Euroshieldpn-CT0001143-1216	May. 19,20	May. 18,23
Bilog Antenna	ETS-LINDGREN	3143B	00161965	Mar. 05,21	Mar. 04,22
Horn Antenna	ETS-LINDGREN	3117	00168728	Apr. 02, 21	Apr. 01, 22
Horn Antenna (18GHz-40GHz)	N/A	QWH-SL-18-40-K-SG/QMS-00361	15433	Aug. 25, 21	Aug. 24, 22
Test Software	E3	V 9.160323	N/A	N/A	N/A
Test Software	ADT	ADT_Radiated_V7.6.15.9.2	N/A	N/A	N/A
10dB Attenuator	JFW/USA	50HF-010-SMA	1505	Jun. 04,20	Jun. 03,21
10dB Attenuator	JFW/USA	50HF-010-SMA	1505	Jun. 03,21	Jun. 02,22
MXE EMI Receiver	KEYSIGHT	N9038A-544	MY54450026	Apr. 27,21	Apr. 26,22
Signal Pre-Amplifier	EMSI	EMC 9135	980249	Jun. 02,21	Jun. 01,22
Signal Pre-Amplifier	EMSI	EMC 012645B	980257	Jun. 02,21	Jun. 01,22
Signal Pre-Amplifier	EMSI	EMC 184045B	980259	Apr. 30,21	Apr. 29,22

NOTE: 1. The calibration interval of the above test instruments is 12 months or 36 months and the calibrations are traceable to CEPREI/CHINA, GRRGT/CHINA and NIM/CHINA.
2. The test was performed in 3m Chamber.
3. The FCC Site Registration No. is 525120; The Designation No. is CN1171.



3.1.4 TEST PROCEDURES

- a. The EUT was placed on the top of a rotating table 0.8 meters (for below 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 antenna is a broadband antenna, and its height 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 Peak Detect Function and Specified Bandwidth with Maximum Hold Mode.
- f. If the emission level of the EUT in peak mode was 10dB lower than the limit specified, then testing could be stopped and the peak values of the EUT would be reported. Otherwise the emissions that did not have 10dB margin would be re-tested one by one using peak, quasi-peak or average method as specified and then reported in a data sheet.

NOTE:

1. The resolution bandwidth and video bandwidth of test receiver/spectrum analyzer is 120kHz for Peak detection (PK) and Quasi-peak detection (QP) at frequency below 1GHz.
2. The resolution bandwidth of test receiver/spectrum analyzer is 1MHz and video bandwidth is 3MHz for Peak detection at frequency above 1GHz.
3. The resolution bandwidth of test receiver/spectrum analyzer is 1MHz and the video bandwidth is 3MHz for RMS Average (Duty cycle < 98%) for Average detection (AV) at frequency above 1GHz, then the measurement results was added to a correction factor (10 log(1/duty cycle)).
4. The resolution bandwidth of test receiver/spectrum analyzer is 1MHz and the video bandwidth is 10Hz (Duty cycle ≥ 98%) for Average detection (AV) at frequency above 1GHz.
5. All modes of operation were investigated and the worst-case emissions are reported.

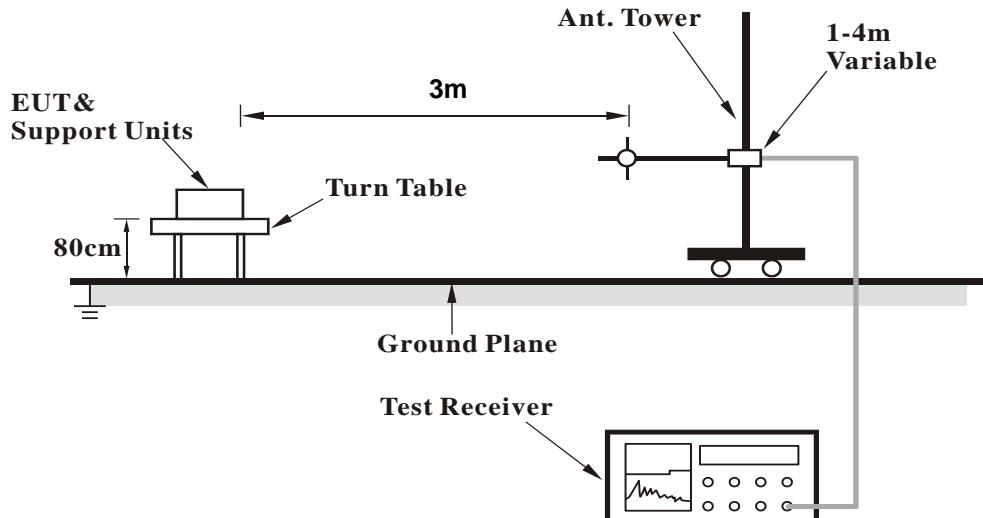
3.1.5 DEVIATION FROM TEST STANDARD

No deviation.

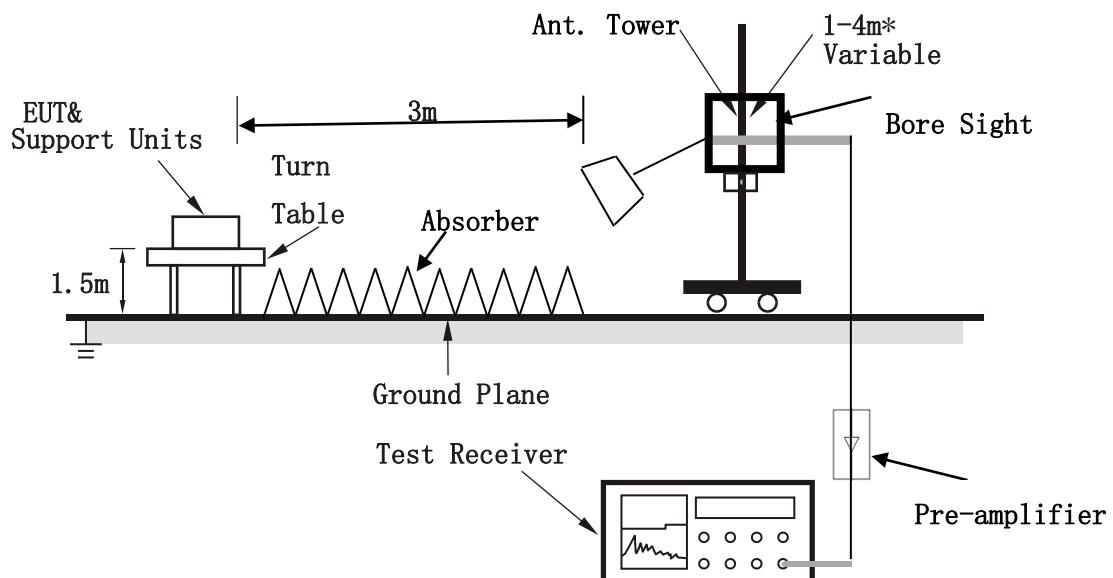


3.1.6 TEST SETUP

< Frequency Range 30MHz~1GHz >



<Frequency Range above 1GHz>



Note: Above 1G is a directional antenna

Depends on the EUT height and the antenna 3dB beamwidth both, refer to section 7.3 of CISPR 16-2-3.

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



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3.1.7 EUT OPERATING CONDITION

- a. Set the EUT under full load condition and placed them on a testing table.
- b. Set the transmitter part of EUT under transmission condition continuously at specific channel frequency.
- c. The necessary accessories enable the EUT in full functions.



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3.1.8 TEST RESULTS

BELOW 1GHz WORST-CASE DATA:

30 MHz – 1GHz data:

Band 1

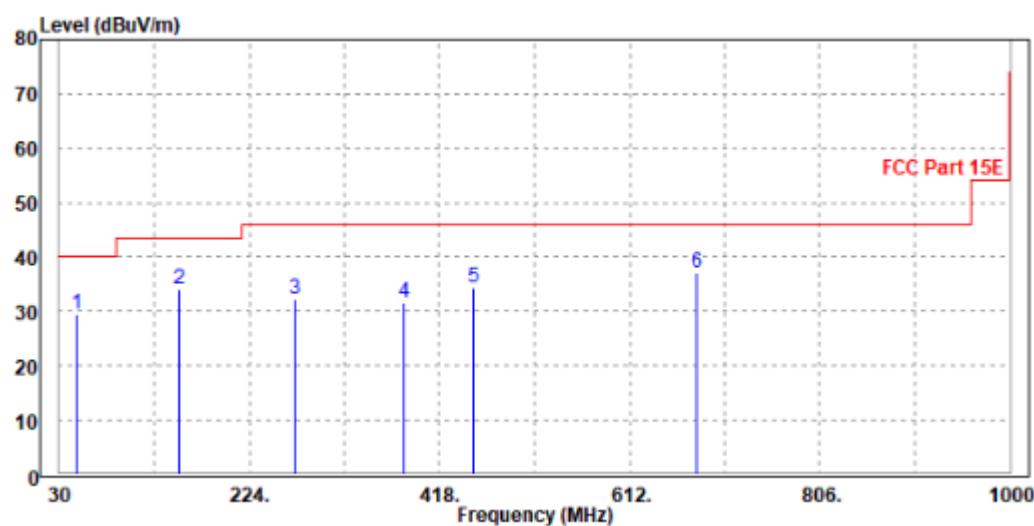
802.11n (40MHz)

CHANNEL	TX Channel 38	DETECTOR FUNCTION	Quasi-Peak (QP)
FREQUENCY RANGE	30MHz ~ 1GHz		

ANTENNA POLARITY & TEST DISTANCE: HORIZONTAL AT 3 M										
FREQ. (MHz)	EMISSION LEVEL (dBuV/m)	READ LEVEL (dBuV)	LIMIT (dBuV/m)	MARGIN (dB)	ANTENNA FACTOR (dB /m)	CABLE LOSS (dB)	PREAMP FACTOR (dB)	ANTENNA HEIGHT (cm)	TABLE ANGLE (Degree)	REMARK
48.318	29.44	57.32	40	-10.56	9.51	0.89	38.28	200	0	Peak
152.278	33.93	60.1	43.5	-9.57	9.9	1.58	37.65	200	0	Peak
270.158	32.33	53.98	46	-13.67	13.52	2.09	37.26	200	0	Peak
382.335	31.61	50.05	46	-14.39	16.39	2.49	37.32	200	0	Peak
452.31	34.5	51.34	46	-11.5	17.84	2.75	37.43	200	0	Peak
680.318	37	49.3	46	-9	22.31	3.49	38.1	200	0	Peak

REMARKS:

1. Emission level (dBuV/m) = Read level (dBuV) + Correction Factor (dB/m).
2. Correction Factor (dB/m) = Antenna Factor (dB/m) + Cable Factor (dB).
3. The other emission levels were very low against the limit.
4. Margin value = Emission level – Limit value.





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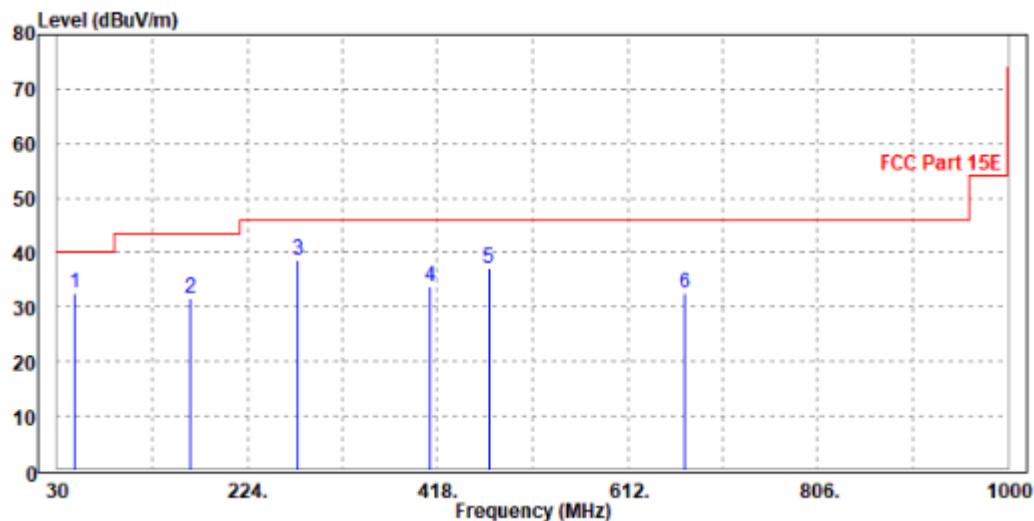
Test Report No.: W7L-211129W003RF14

CHANNEL	Channel 38	DETECTOR FUNCTION	Quasi-Peak (QP)
FREQUENCY RANGE	30MHz ~ 1GHz		

ANTENNA POLARITY & TEST DISTANCE: VERTICAL AT 3 M											
FREQ. (MHz)	EMISSION LEVEL (dBuV/m)	READ LEVEL (dBuV)	LIMIT (dBuV/m)	MARGIN (dB)	ANTENNA FACTOR (dB /m)	CABLE LOSS (dB)	PREAMP FACTOR (dB)	ANTENNA HEIGHT (cm)	TABLE ANGLE (Degree)	REMARK	
48.48	32.44	60.33	40	-7.56	9.49	0.9	38.28	300	0	Peak	
165.318	31.59	56.35	43.5	-11.91	11.18	1.63	37.57	300	0	Peak	
275.318	38.64	59.37	46	-7.36	14.41	2.11	37.25	300	0	Peak	
410.58	33.91	51.28	46	-12.09	17.4	2.59	37.36	300	0	Peak	
470.358	37.22	53.33	46	-8.78	18.54	2.82	37.47	300	0	Peak	
670.357	32.59	45.33	46	-13.41	21.88	3.45	38.07	300	0	Peak	

REMARKS:

1. Emission level (dBuV/m) = Read level (dBuV) + Correction Factor (dB/m).
2. Correction Factor (dB/m) = Antenna Factor (dB/m) + Cable Factor (dB).
3. The other emission levels were very low against the limit.
4. Margin value = Emission level – Limit value.





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ABOVE 1GHz WORST-CASE DATA:

Note: For higher frequency, the emission is too low to be detected.

Band 1

802.11n (40MHz)

CHANNEL	TX Channel 38	DETECTOR FUNCTION	Peak (PK)
FREQUENCY RANGE	1GHz ~ 40GHz		Average (AV)

ANTENNA POLARITY & TEST DISTANCE: HORIZONTAL AT 3 M										
FREQ. (MHz)	EMISSION LEVEL (dBuV/m)	READ LEVEL (dBuV)	LIMIT (dBuV/m)	MARGIN (dB)	ANTENNA FACTOR (dB /m)	CABLE LOSS (dB)	PREAMP FACTOR (dB)	ANTENNA HEIGHT (cm)	TABLE ANGLE (Degree)	REMARK
5150	56.22	57.52	74	-17.78	34.52	9.52	45.34	100	300	Peak
5150	50.63	51.93	54	-3.37	34.52	9.52	45.34	100	300	Average
5190	92.76	93.94	—	—	34.55	9.6	45.33	100	300	Peak
5190	87.76	88.94	—	—	34.55	9.6	45.33	100	300	Average
5350	56.16	56.82	74	-17.84	34.68	9.94	45.28	100	300	Peak
5350	49.65	50.31	54	-4.35	34.68	9.94	45.28	100	300	Average
ANTENNA POLARITY & TEST DISTANCE: VERTICAL AT 3 M										
FREQ. (MHz)	EMISSION LEVEL (dBuV/m)	READ LEVEL (dBuV)	LIMIT (dBuV/m)	MARGIN (dB)	ANTENNA FACTOR (dB /m)	CABLE LOSS (dB)	PREAMP FACTOR (dB)	ANTENNA HEIGHT (cm)	TABLE ANGLE (Degree)	REMARK
5150	55.6	56.82	74	-18.4	34.6	9.52	45.34	100	110	Peak
5150	50.6	51.82	54	-3.4	34.6	9.52	45.34	100	110	Average
5190	93.46	94.59	—	—	34.6	9.6	45.33	100	110	Peak
5190	86.12	87.25	—	—	34.6	9.6	45.33	100	110	Average
5350	54.95	55.69	74	-19.05	34.6	9.94	45.28	100	110	Peak
5350	49.97	50.71	54	-4.03	34.6	9.94	45.28	100	110	Average

REMARKS:

1. Emission Level = Read Level+ Antenna Factor + Cable Loss- Preamp Factor
Margin value = Emission level – Limit value.
2. 5180MHz: Fundamental frequency.



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3.2 MAXIMUM CONDUCTED OUTPUT POWER MEASUREMENT

3.2.1 LIMITS OF MAXIMUM CONDUCTED OUTPUT POWER MEASUREMENT

Operation Band	EUT Category		LIMIT
U-NII-1	Outdoor Access Point		1 Watt (30 dBm) (Max. e.i.r.p \leq 125mW(21 dBm) at any elevation angle above 30 degrees as measured from the horizon)
	Fixed point-to-point Access Point		1 Watt (30 dBm)
	B	Indoor Access Point	1 Watt (30 dBm)
	\checkmark	Client devices	250mW (24 dBm)
U-NII-2A	\checkmark		250mW (24 dBm) or 11 dBm+10 log B*
U-NII-2C	\checkmark		250mW (24 dBm) or 11 dBm+10 log B*
U-NII-3	\checkmark		1 Watt (30 dBm)

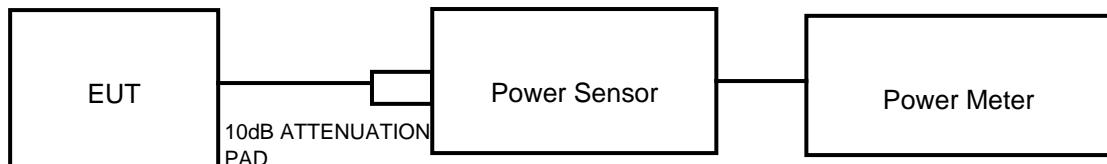
NOTE: Where B is the 26dB emission bandwidth in MHz.



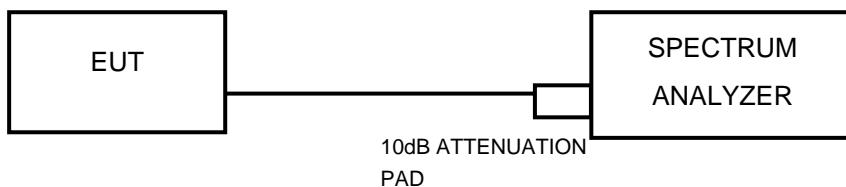
3.2.2 TEST SETUP

FOR POWER OUTPUT MEASUREMENT

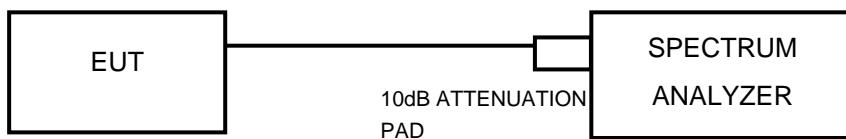
802.11a, 802.11n (20MHz), 802.11n (40MHz) TEST CONFIGURATION



11ac TEST CONFIGURATION



FOR 26dB BANDWIDTH



3.2.3 TEST INSTRUMENTS

Equipment	Manufacturer	Model No.	Serial No.	Last Cal.	Next Cal.
Power Meter	ANRITSU	ML2495A	1506002	Feb. 22,21	Feb. 21,22
EXA Signal Analyzer	KEYSIGHT	N9010A-526	MY54510322	Feb. 25,21	Feb. 24,22
EXA Signal Analyzer	KEYSIGHT	N9010A-544	MY54510355	Jun. 03,21	Jun. 02,22
Power Sensor	ANRITSU	MA2411B	1339352	May. 07,21	May. 08,22

NOTE:

1. The calibration interval of the above test instruments is 12 months and the calibrations are traceable to CEPREI/CHINA, GRGT/CHINA and NIM/CHINA.
2. The test was performed in RF Oven room.



3.2.4 TEST PROCEDURE

FOR POWER MEASUREMENT

For 802.11a, 802.11n (20MHz), 802.11n (40MHz)

Method PM is used to perform output power measurement, trigger and gating function of wide band power meter is enabled to measure max output power of TX on burst. Duty factor is not added to measured value.

For 802.11ac (80MHz)

1. Measure the duty cycle, x, of the transmitter output signal as described in II.B.
2. Set span to encompass the EBW (or, alternatively, the entire 99% occupied bandwidth) of the signal.
3. Set RBW = 1 MHz.
4. Set VBW \geq 3 MHz.
5. Number of points in sweep $\geq 2 \times$ span / RBW. (This ensures that bin-to-bin spacing is \leq RBW/2, so that narrowband signals are not lost between frequency bins.)
6. Sweep time = auto.
7. Detector = power averaging (rms), if available. Otherwise, use sample detector mode.
8. Do not use sweep triggering. Allow the sweep to “free run.”
9. Trace average at least 100 traces in power averaging (rms) mode; however, the number of traces to be averaged shall be increased above 100 as needed to ensure that the average accurately represents the true average over the on and off periods of the transmitter.
10. Add $10 \log (1/x)$, where x is the duty cycle, to the measured power to compute the average power during the actual transmission times (because the measurement represents an average over both the on and off times of the transmission). For example, add $10 \log (1/0.25) = 6$ dB if the duty cycle is 25%.



FOR 99 PERCENT OCCUPIED BANDWIDTH

The following procedure shall be used for measuring (99 %) power bandwidth:

1. Set center frequency to the nominal EUT channel center frequency.
2. Set span = 1.5 times to 5.0 times the OBW.
3. Set RBW = 1 % to 5 % of the OBW
4. Set VBW $\geq 3 \cdot \text{RBW}$
5. Video averaging is not permitted. Where practical, a sample detection and single sweep mode shall be used. Otherwise, peak detection and max hold mode (until the trace stabilizes) shall be used.
6. Use the 99 % power bandwidth function of the instrument (if available).
7. If the instrument does not have a 99 % power bandwidth function, the trace data points are recovered and directly summed in power units. The recovered amplitude data points, beginning at the lowest frequency, are placed in a running sum until 0.5 % of the total is reached; that frequency is recorded as the lower frequency. The process is repeated until 99.5 % of the total is reached; that frequency is recorded as the upper frequency. The 99% occupied bandwidth is the difference between these two frequencies.

FOR 26dB BANDWIDTH

- 1) Set RBW = approximately 1% of the emission bandwidth.
- 2) Set the VBW $> \text{RBW}$.
- 3) Detector = Peak.
- 4) Trace mode = max hold.
- 5) Measure the maximum width of the emission that is 26 dB down from the peak of the emission. Compare this with the RBW setting of the analyzer. Readjust RBW and repeat measurement as needed until the RBW/EBW ratio is approximately 1%.

FOR 6dB BANDWIDTH

1. Set RBW = 100 kHz.
2. Set the video bandwidth (VBW) $\geq 3 \cdot \text{RBW}$.
3. Detector = Peak.
4. Trace mode = max hold.
5. Sweep = auto couple.
6. Allow the trace to stabilize.
7. Measure the maximum width of the emission that is constrained by the frequencies associated with the two outermost amplitude points (upper and lower frequencies) that are attenuated by 6 dB relative to the maximum level measured in the fundamental emission.



3.2.5 DEVIATION FROM TEST STANDARD

No deviation.

3.2.6 EUT OPERATING CONDITIONS

The software provided by client to enable the EUT under transmission condition continuously at specific channel frequencies individually.



3.2.7 TEST RESULTS

OUTPUT POWER:

802.11a

CHANNEL	CHANNEL FREQUENCY (MHz)	AVERAGE POWER (dBm)	Duty Factor	FINAL AVERAGE POWER (dBm)	FINAL AVERAGE POWER (mW)	POWER LIMIT (dBm)	PASS/FAIL
36	5180	13.38	0.12	13.50	22.39	24	PASS
40	5200	15.37	0.12	15.49	35.40	24	PASS
48	5240	15.90	0.12	16.02	39.99	24	PASS
52	5260	15.51	0.12	15.63	36.56	24	PASS
60	5300	15.84	0.12	15.96	39.45	24	PASS
64	5320	14.52	0.12	14.64	29.11	24	PASS
100	5500	14.00	0.12	14.12	25.82	24	PASS
116	5580	14.48	0.12	14.60	28.84	24	PASS
124	5620	16.64	0.12	16.76	47.42	24	PASS
140	5700	14.26	0.12	14.38	27.42	24	PASS
144	5720	16.28	0.12	16.40	43.65	24	PASS
144	5720	16.07	0.00	16.07	40.46	30	PASS
149	5745	17.11	0.00	17.11	51.40	30	PASS
157	5785	17.39	0.00	17.39	54.83	30	PASS
165	5825	16.66	0.00	16.66	46.34	30	PASS



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802.11n (20MHz)

CHANNEL	CHANNEL FREQUENCY (MHz)	AVERAGE POWER (dBm)	Duty Factor	FINAL AVERAGE POWER (dBm)	FINAL AVERAGE POWER (mW)	POWER LIMIT (dBm)	PASS/FAIL
36	5180	12.65	0.09	12.74	18.79	24	PASS
40	5200	15.09	0.09	15.18	32.96	24	PASS
48	5240	15.47	0.09	15.56	35.97	24	PASS
52	5260	15.78	0.09	15.87	38.64	24	PASS
60	5300	15.38	0.09	15.47	35.24	24	PASS
64	5320	13.34	0.09	13.43	22.03	24	PASS
100	5500	14.15	0.09	14.24	26.55	24	PASS
116	5580	14.36	0.09	14.45	27.86	24	PASS
124	5620	15.70	0.09	15.79	37.93	24	PASS
140	5700	14.12	0.09	14.21	26.36	24	PASS
144	5720	15.21	0.09	15.30	33.88	24	PASS
144	5720	15.13	0.09	15.22	33.27	30	PASS
149	5745	16.32	0.09	16.41	43.75	30	PASS
157	5785	16.34	0.09	16.43	43.95	30	PASS
165	5825	15.64	0.09	15.73	37.41	30	PASS



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802.11n (40MHz)

CHANNEL	CHANNEL FREQUENCY (MHz)	AVERAGE POWER (dBm)	Duty Factor	FINAL AVERAGE POWER (dBm)	FINAL AVERAGE POWER (mW)	POWER LIMIT (dBm)	PASS/FAIL
38	5190	8.86	0.21	9.07	8.07	24	PASS
46	5230	15.14	0.21	15.35	34.28	24	PASS
54	5270	14.70	0.21	14.91	30.97	24	PASS
62	5310	8.83	0.21	9.04	8.02	24	PASS
102	5510	13.45	0.21	13.66	23.23	24	PASS
110	5550	13.69	0.21	13.90	24.55	24	PASS
126	5630	15.87	0.21	16.08	40.55	24	PASS
134	5670	13.67	0.21	13.88	24.43	24	PASS
142	5710	15.48	0.21	15.69	37.07	24	PASS
142	5710	15.25	0.21	15.46	35.16	30	PASS
151	5755	16.31	0.21	16.52	44.87	30	PASS
159	5798	16.50	0.21	16.71	46.88	30	PASS



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802.11ac (20MHz)

CHANNEL	CHANNEL FREQUENCY (MHz)	AVERAGE POWER (dBm)	Duty Factor	FINAL AVERAGE POWER (dBm)	FINAL AVERAGE POWER (mW)	POWER LIMIT (dBm)	PASS/FAIL
36	5180	12.81	0.09	12.90	19.50	24	PASS
40	5200	15.27	0.09	15.36	34.36	24	PASS
48	5240	15.4	0.09	15.49	35.40	24	PASS
52	5260	15.72	0.09	15.81	38.11	24	PASS
60	5300	15.37	0.09	15.46	35.16	24	PASS
64	5320	13.41	0.09	13.50	22.39	24	PASS
100	5500	13.93	0.09	14.02	25.23	24	PASS
116	5580	14.26	0.09	14.35	27.23	24	PASS
124	5620	15.49	0.09	15.58	36.14	24	PASS
140	5700	13.06	0.09	13.15	20.65	24	PASS
144	5720	15.38	0.09	15.47	35.24	24	PASS
144	5720	15.15	0.09	15.24	33.42	30	PASS
149	5745	16.28	0.09	16.37	43.35	30	PASS
157	5785	16.48	0.09	16.57	45.39	30	PASS
165	5825	15.85	0.09	15.94	39.26	30	PASS



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802.11ac (40MHz)

CHANNEL	CHANNEL FREQUENCY (MHz)	AVERAGE POWER (dBm)	Duty Factor	FINAL AVERAGE POWER (dBm)	FINAL AVERAGE POWER (mW)	POWER LIMIT (dBm)	PASS/FAIL
38	5190	8.65	0.20	8.85	7.67	24	PASS
46	5230	15.13	0.20	15.33	34.12	24	PASS
54	5270	15.06	0.20	15.26	33.57	24	PASS
62	5310	10.18	0.20	10.38	10.91	24	PASS
102	5510	12.74	0.20	12.94	19.68	24	PASS
110	5550	13.65	0.20	13.85	24.27	24	PASS
126	5630	14.99	0.20	15.19	33.04	24	PASS
134	5670	15.26	0.20	15.46	35.16	24	PASS
142	5710	14.76	0.20	14.96	31.33	24	PASS
142	5710	14.52	0.19	14.71	29.58	30	PASS
151	5755	15.38	0.19	15.57	36.06	30	PASS
159	5798	15.68	0.19	15.87	38.64	30	PASS

802.11ac (80MHz)

CHANNEL	CHANNEL FREQUENCY (MHz)	AVERAGE POWER (dBm)	Duty Factor	FINAL AVERAGE POWER (dBm)	FINAL AVERAGE POWER (mW)	POWER LIMIT (dBm)	PASS/FAIL
42	5210	7.17	0.39	7.56	5.70	24	PASS
58	5290	9.45	0.39	9.84	9.64	24	PASS
106	5530	10.49	0.39	10.88	12.25	24	PASS
122	5610	13.93	0.39	13.93	24.72	24	PASS
138	5690	13.23	0.39	13.62	23.01	24	PASS
138	5690	13.39	0.42	13.81	24.04	30	PASS
155	5775	14.60	0.42	15.02	31.77	30	PASS



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4 PHOTOGRAPHS OF THE TEST CONFIGURATION

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



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5 APPENDIX A – MODIFICATIONS RECORDERS FOR ENGINEERING CHANGES TO THE EUT BY THE LAB

No modifications were made to the EUT by the lab during the test.

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