

FCC 15.407 NII 5GHz Test Report

for

LG Electronics Inc.

**222, LG-ro Jinwi-myeon, Pyeongtaek-Si, Gyeonggi-Do,
451-713, Korea**

Product Name : Notebook Computer
Model Name : (1)16Z90P (2)16ZB90P
(3)16ZD90P (4)16ZG90P
(5)16ZC90P
Brand LG
FCC ID : BEJNT-16Z90P

Prepared by: : AUDIX Technology Corporation,
EMC Department



The test report is based on a single evaluation of one sample of the above-mentioned products. It does not imply an assessment of the whole production and does not permit the use of the test lab logo.

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TEST REPORT

Applicant : LG Electronics Inc.
Manufacturer : LG Electronics Inc.
Factory : LG Electronics Nanjing New Technology Co., Ltd.
EUT Description
(1) Product : Notebook Computer
(2) Model : (1)16Z90P (2)16ZB90P (3)16ZD90P (4)16ZG90P (5)16ZC90P
(3) Brand : LG
(4) Power Supply: DC 20V, 3.25A

Applicable Standards:

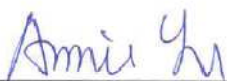
Title 47 FCC CFR Part 15 Subpart E
ANSI C63.10:2013
KDB 789033 D02 General UNII Test Procedures New Rules v02r01

Audix Technology Corp. tested the equipment mentioned in accordance with the requirements set forth in the above standards. Test results indicate that the equipment tested is capable of demonstrating compliance with the requirements as documented within this report.

Audix Technology Corp. does not assume responsibility for any conclusions and generalizations drawn from the test results with regard to other specimens and samples.

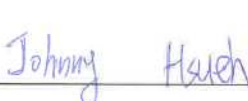
Date of Report: 2020. 11. 18

Reviewed by:



(Annie Yu/Administrator)

Approved by:



(Johnny Hsueh/Section Manager)

1. REVISION RECORD OF TEST REPORT

Edition No	Issued Data	Revision Summary	Report Number
0	2020. 11. 18	Original Report	EM-F200514

2. SUMMARY OF TEST RESULTS

Rule	Description	Data Reused	Results
15.207	Conducted Emission	No	PASS
15.205/15.209	Radiated Band Edge and Radiated Spurious Emission	No	PASS
15.407(a)(5)/15.407(e)	26dB/6dB Bandwidth	Yes	PASS
15.407(a)	Maximum Output Power	SPOT CHECK Note 2	PASS
15.407(b)	Conducted Band Edges	No	N/A
15.407(a)	Power Spectral Density	Yes	PASS
15.407	Frequency Stability	Yes	PASS
15.203	Antenna Requirement	---	Compliance
Note: 1. The uncertainties value is not used in determining the result. 2. This device embedded with same radio transmitter with FCC ID: BEJNT-15Z90N (Report No.: EM-F190341) grant on 11/29 2019. According to KDB 484596 D01, we did spot check for output power and all output power values keep identical thus we reuse all results.			

3. GENERAL INFORMATION

3.1. Description of Application

Applicant	LG Electronics Inc. 222, LG-ro Jinwi-myeon, Pyeongtaek-Si, Gyeonggi-Do, 451-713, Korea
Manufacturer	LG Electronics Inc. 222, LG-ro Jinwi-myeon, Pyeongtaek-Si, Gyeonggi-Do, 451-713, Korea
Factory	LG Electronics Nanjing New Technology Co., Ltd. No.346,Yaoxin Road, Economic & Technical Development Zone, Nanjing, China.
Product	Notebook Computer
Model	(1)16Z90P (2)16ZB90P (3)16ZD90P (4)16ZG90P (5)16ZC90P The difference between all models is different in the sales customers.
Brand	LG

3.2. Description of EUT

Test Model	16Z90P			
Serial Number	N/A			
Power Rating	DC 20V, 3.25A			
Software Version	XY (X, Y can be 0 to 9 for different SW version not influence RF parameter)			
RF Features	WLAN:802.11 a/b/g/n/ac/ax Bluetooth: BT and BLE (BT 5.0)			
Transmit Type	2.4 GHz			
	802.11b	1T1R		
	802.11g	1T1R		
	802.11n-HT20	2T2R		
	802.11n-HT40	2T2R		
	802.11ax-HE20	2T2R		
	802.11ax-HE40	2T2R		
	BT/BLE	1T1R		
	UNII Bands			
	802.11a	1T1R		
	802.11n-HT20/802.11ac-VHT20/802.11ax-HE20	2T2R		
	802.11n-HT40/802.11ac-VHT40/802.11ax-HE40	2T2R		
	802.11ac-VHT80/802.11ax-HE80	2T2R		
	802.11ac-VHT160/802.11ax-HE160	2T2R		
	The MIMO is uncorrelated and supported SDM mode only.			
	Device Category	☐ Outdoor Access Point		
		☐ Fixed point-to-point Access Point		
		☐ Indoor Access Point		
		☒ Mobile and Portable client device		
Test Sample	Sample No.	Test Item	Firmware	
	02	AC Conduction, Output Power	N/A	
	03	AC Conduction, RSE, Output Power	N/A	
Sample Status	Mass production			
Date of Receipt	2020. 10. 19			
Date of Test	2020. 10. 30 ~ 11. 06			

Interface Ports of EUT	• One Micro SD Card Slot • One Earphone Port • Two USB 3.0 Ports • Two USB Type C Ports • One HDMI Port
Accessories Supplied	• AC Adapter • LAN Gender

3.3. Antenna Information

No.	Antenna Part Number	Manufacture	Antenna Type	Frequency (MHz)	Max Gain(dBi)
1.	WA-P-LELE-04-002 (Main)	INPAQ	Mono-Pole	2400~2500	5.0
				5100-5250	3.8
				5250-5350	3.8
				5350-5750	2.4
				5750~5850	2.7
	WA-P-LELE-04-002 (AUX)	INPAQ	Mono-Pole	2400~2500	5.7
				5100-5250	3.8
				5250-5350	3.8
				5350-5750	2.4
				5750~5850	2.7
2	L1LRF004-CS-H (Main)	LUXSHARE- ICT	Mono-Pole	2400~2500	1.8
				5150-5250	2.0
				5250-5350	2.2
				5350-5725	2.8
				5725~5850	2.2
	L1LRF004-CS-H (AUX)	LUXSHARE- ICT	Mono-Pole	2400~2500	1.5
				5150-5250	2.0
				5250-5350	2.0
				5350-5725	2.6
				5725~5850	2.7

3.4. EUT Specifications Assessed in Current Report

Mode	Band	Fundamental Range (MHz)	Channel Number
802.11a	NII-I	5180-5240	4
	NII-2A	5260-5320	4
	NII-2C	5500-5720	12
	NII-III	5745-5825	5
802.11n-HT20/ 802.11ac-VHT20 802.11ax-HE20	NII-I	5180-5240	4
	NII-2A	5260-5320	4
	NII-2C	5500-5720	12
	NII-III	5745-5825	5
802.11n-HT40/ 802.11ac-VHT40 802.11ax-HE40	NII-I	5190-5230	2
	NII-2A	5270-5310	2
	NII-2C	5510-5710	6
	NII-III	5755-5795	2
802.11ac-VHT80 802.11ax-HE80	NII-I	5210	1
	NII-2A	5290	1
	NII-2C	5530-5690	3
	NII-III	5775	1
802.11ac-VHT160 802.11ax-HE160	NII-I	5250	1
	NII-2A		
	NII-2C	5570	1
Remark: Band NII-2A and NII-2C (DFS Function, Slave/no In service monitor, no Ad-Hoc mode)			

Mode	Modulation	Data Rate (Mbps)
802.11a	OFDM (BPSK/QPSK/16QAM/64QAM)	Up to 54
802.11n-HT20	OFDM (BPSK/QPSK/16QAM/64QAM)	Up to 144.4
802.11n-HT40		Up to 300
802.11ac-VHT20	OFDM (BPSK/QPSK/16QAM/64QAM/256QAM)	Up to 173.3
802.11ac-VHT40		Up to 400
802.11ac-VHT80		Up to 866.7
802.11ac-VHT160		Up to 1733.3
802.11ax-HE20	OFDMA (BPSK/ QPSK/ 16QAM/ 64QAM/ 256QAM/1024QAM)	Up to 287
802.11ax-HE40		Up to 574
802.11ax-HE80		Up to 1201
802.11ax-HE160		Up to 2402

Channel List					
802.11a/802.11n-HT20/802.11ac-VHT20/802.11ax-HE20					
Band	Channel Number	Frequency (MHz)	Band	Channel Number	Frequency (MHz)
NII-I	36	5180	NII-2C	120	5600
	40	5200		124	5620
	44	5220		128	5640
	48	5240		132	5660
NII-2A	52	5260		136	5680
	56	5280		140	5700
	60	5300		144	5720
	64	5320		149	5745
NII-2C	100	5500	NII-III	153	5765
	104	5520		157	5785
	108	5540		161	5805
	112	5560		165	5825
	116	5580			

Channel List					
802.11n-HT40/802.11ac-VHT40/802.11ax-HE40					
Band	Channel Number	Frequency (MHz)	Band	Channel Number	Frequency (MHz)
NII-I	38	5190	NII-2C	118	5590
	46	5230		126	5630
NII-2A	54	5270		134	5670
	62	5310		142	5710
NII-2C	102	5510	NII-III	151	5755
	110	5550		159	5795

Channel List					
802.11ac-VHT80/802.11ax-HE80					
Band	Channel Number	Frequency (MHz)	Band	Channel Number	Frequency (MHz)
NII-I	42	5210	NII-2C	138	5690
NII-2A	58	5290	NII-III	155	5775
NII-2C	106	5530			
	122	5610			

Channel List					
802.11ac-VHT160/802.11ax-HE160					
UNII Band	Channel Number	Frequency (MHz)	UNII Band	Channel Number	Frequency (MHz)
NII-I	50	5250	NII-2C	114	5570
NII-2A					

Note: Test modes are presented at section 3.7.

3.5. Description of Key Components

3.5.1. For the All Component Lists

Item	Supplier	Model / Type	Character
System	Microsoft	Win10 Home	---
		Win10 Pro	---
Main Board	LG	Blanc MAIN B/D PCB	Manufacturer: #1 Hannstar Board Tech(Jiang Yin) Corp.,Ltd. #2 Elec & Eltek Company (MCO) Limited.
WLAN SUB Board	LG	16Z90P SUB B/D	Manufacturer: #1 Hannstar Board Tech(Jiang Yin) Corp.,Ltd. #2 Elec & Eltek Company (MCO) Limited. #3 JiangSu HuaShen Electronic co.,ltd (HXF)
Intel CPU (Socket: FCBGA1449)	Intel	i7-1165G7	2.80GHz
	Intel	i5-1135G7	2.4GHz
	Intel	i3-1115G4	3.00GHz
16" LCD Panel	LG Display	LP160WQ1(SP)(A1)	Resolution: 2560 x 1600, 60Hz WQXGA IPS (Non Touch)
Storage (SSD)	SK hynix	HFS256GD9TNG-L2A0A	256GB (M.2)
		HFS512GD9TNG-L2A0A	512GB (M.2)
		HFS001TD9TNG-L2A0A	1TB (M.2)
	Samsung	MZ-VLB256B	256GB (M.2)
		MZ-VLB512B	512GB (M.2)
		MZ-VLB1T0B	1TB(M.2)
Memory (RAM)	Samsung	---	16GB LPDDR4x(On Board)
	Samsung	---	8GB LPDDR4x(On Board)
	SK Hynix	---	16GB LPDDR4x(On Board)
	SK Hynix	---	8GB LPDDR4x(On Board)
Battery Pack	LG	LBV7227E	80Wh, DC 7.74V, 80Wh Typ 10336mAh
WLAN Combo Card	Intel	AX201D2W	WLAN and BT, 2x2 CNVi 1216 FCC ID: PD9AX201NG IC: 1000M-AX201NG NCC ID: CCAH18LP3410T5
WLAN Combo Antenna	LG (INPAQ)	WA-P-LELE-04-002	PCB, Mono-pole Type Main: Black, Aux: Gray
	LG (LUXSHARE-ICT)	L1LRF004-CS-H	PCB, Mono-pole Typ Main: Black, Aux: Gray

Item	Supplier	Model / Type	Character
Keyboard	TIC	KT0120B9	---
	LITE ON	SN8002	---
Web Camera	Chicony	CKFKH33-0	---
	Luxvisions	0BF108N3	---
LAN Gender (Type C to LAN)	SUZHOU MEC ELECTRONICS	80-5946-111	(White) 10/100 Megabit Ethernet
		80-5946-101	(Black) 10/100 Megabit Ethernet
	Type C to LAN: Shielded, Undetached, 0.12m		
	ARIN TECH CO. LTD	GD-08MF-36-WH-LP10	(White) 10/100 Megabit Ethernet
		GD-08MF-36-BK-LP11	(Black) 10/100 Megabit Ethernet
	Type C to LAN: Shielded, Undetached, 0.12m		
	SUZHOU MEC ELECTRONICS	80-5946-200	(White) 10/100/1000 Megabit Ethernet
		80-5946-210	(Black) 10/100/1000 Megabit Ethernet
	Type C to LAN: Shielded, Undetached, 0.13m		
	AC Adapter (65W)	LG (HONOR)	ADT-65DSU-D03-2
O/P: DC 20V, 3.25A			
DC Power Cord: Non-Shielded, Undetached, 1.5m			
AC Power Cord: Non-Shielded, Detached, 1.0m (2C) (For Other Countries)			
AC Power Cord: Non-Shielded, Detached, 1.55m (2C) (For US, Canada, Mexico)			

Remark: For more detailed features description, please refer to the manufacturer's specifications or the user manual.

3.5.2. The EUT collocates with following worst components, which are used to establish a basic configuration of system during test:

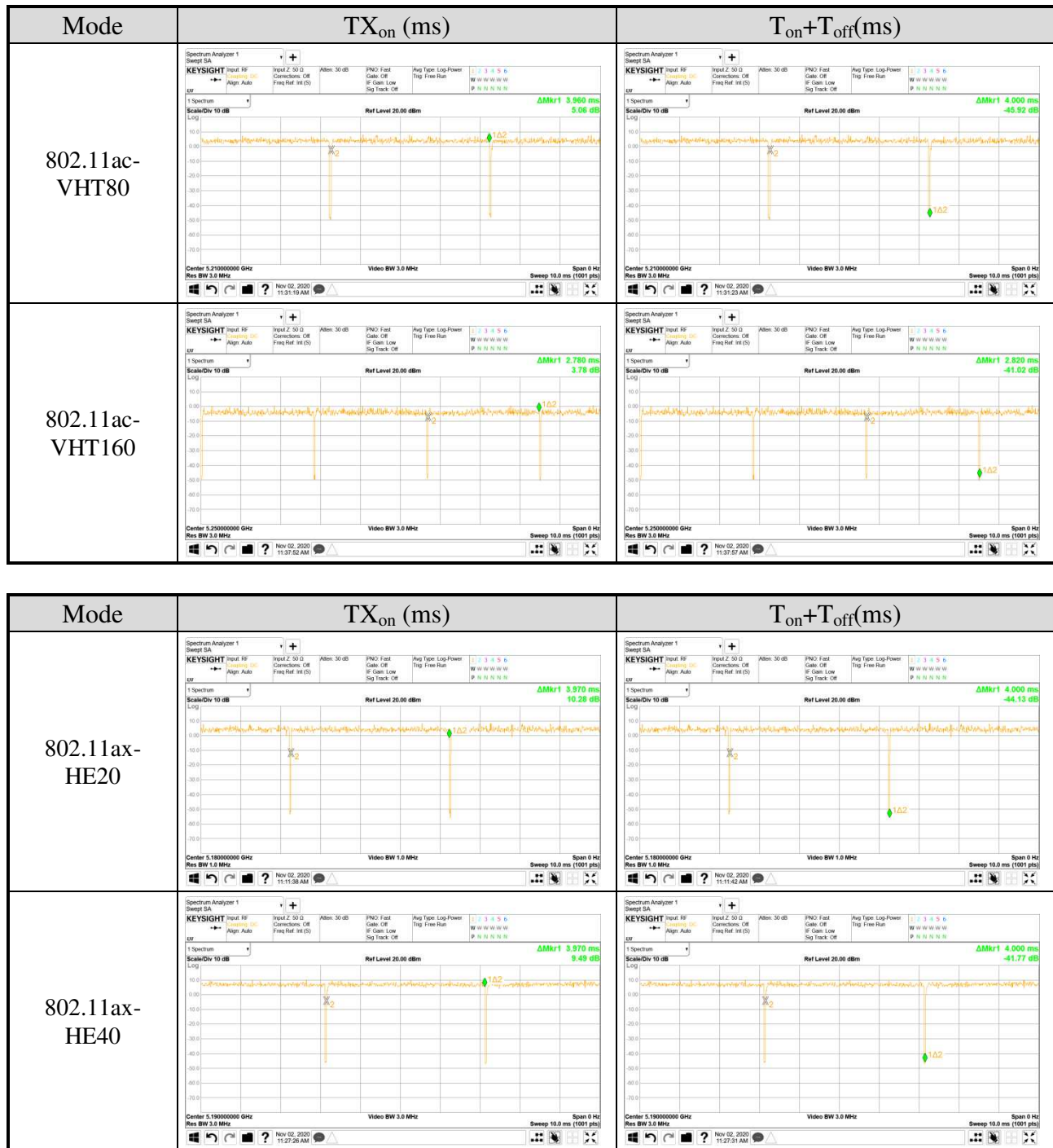
SKU (Mode) 1 ~ 2		1	2
Main Board	LG, Blanc MAIN B/D PCB	V	V
WLAN SUB Board	LG, 16Z90P SUB B/D	V	V
CPU	Intel, i7-1165G7	V	
	Intel, i5-1135G7		V
16" LCD Panel	LG Display, LP160WQ1(SP)(A1)	V	V
Storage (SSD)	Samsung, 1TB *1	V	
	Samsung, 512GB *1		V
	SK Hynix, 1TB *1	V	
	SK Hynix, 512GB *1		V
Memory (RAM)	SAMSUNG, 16GB	V	
	SAMSUNG, 8GB		V
Battery Pack	LG, LBV7227E	V	V
WLAN Combo Card	Intel, AX201D2W	V	V
WLAN Combo Antenna	LG (INPAQ), WA-P-LELE-04-002		V
	LG (LUXSHARE-ICT), L1LRF004-CS-H	V	
Keyboard	TIC, KT0120B9		V
	LITE ON, SN8002	V	
Web Camera	Chicony, CKFKH33-0	V	
	Luxvisions, 0BF108N3		V
Type C Link to LAN Gender	SUZHOU MEC ELECTRONICS, 80-5946-111 (White)	V	
	ARIN TECH CO. LTD, GD-08MF-36-WH-LP10 (White)		V
HDMI	3840 x 2160, 30Hz ("H" Pattern)	V	V
AC Adapter	LG (HONOR), ADT-65DSU-D03-2	V	V

3.6. Test Configuration

Mode	TX _{on} (ms)	1/ TX _{on} (kHz)	Duty Cycle (x)	Duty Cycle Factor [10log(1/x)] (dB)
802.11a	2.087	0.479	0.983	N/A
802.11n-HT20	3.980	0.251	0.990	N/A
802.11n-HT40	3.980	0.251	0.993	N/A
802.11ac-VHT80	3.960	0.253	0.990	N/A
802.11ac-VHT160	2.780	0.360	0.986	N/A
802.11ax-HE20	3.970	0.252	0.993	N/A
802.11ax-HE40	3.970	0.252	0.993	N/A
802.11ax-HE80	3.980	0.251	0.990	N/A
802.11ax-HE160	2.280	0.439	0.983	N/A

Note: When duty cycle is less than 98% (0.98) that duty cycle factor 10log(1/x) is needed to add in conducted test items measured in average detector.







AC Conduction	
SKU #1	Normal operation (with LUXSHARE-ICT Antenna)
SKU #2	Normal operation (with INPAQ Antenna)

Item			Mode	Data Rate	Test Channel
Radiated Test Case	SKU#2	Radiated Band Edge Note1 & 3	802.11a	6 Mbps	36/64/100/140/144/149/165
			802.11n-HT20	MCS8	36/64/100/140/144/149/165
			802.11n-HT40	MCS8	38/62/102/134/142/151/159
			802.11ac-VHT80	MCS0	42/58/106/122/138/155
			802.11ac-VHT160	MCS0	50/114
			802.11ax-HE20	HE0	36/64/100/140/144/149/165
			802.11ax-HE40	HE0	38/62/102/134/142/151/159
			802.11ax-HE80	HE0	42/58/106/122/138/155
			802.11ax-HE160	HE0	50/114
		Radiated Spurious Emission ^{Note} 1 & 2 & 3	802.11a	6 Mbps	48/52/116/144/157
			802.11n-HT20	MCS8	48/52/116/144/157
			802.11n-HT40	MCS8	46/54/134/142/159
			802.11ac-VHT80	MCS0	42/58/122/138/155
			802.11ac-VHT160	MCS0	50/114
			802.11ax-HE20	HE0	48/52/116/144/157
			802.11ax-HE40	HE0	46/54/134/142/159
			802.11ax-HE80	HE0	42/58/122/138/155
			802.11ax-HE160	HE0	50/114

Item			Mode	Data Rate	RU Configuration	Test Channel
Radiated Test Case	SKU#2	Radiated Band Edge Note1 & 3	802.11ax-HE20	HE0	26/0	36/100/149
					52/37	
					106/53	
			802.11ax-HE20	HE0	26/8	64/140/165
					52/40	
					106/54	
			802.11ax-HE40	HE0	242/61	38/102/151
				HE0	242/62	62/134/159
			802.11ax-HE80	HE0	484/65	42/106/155
				HE0	484/66	58/122/155
			802.11ax-HE160	HE0	996/67	50/114
				HE0	996/S67	50/114
HE0	996/S67	50/114				

Item		Mode	Data Rate	Test Channel
Conducted Test Case	26dB/6dB Bandwidth (Data Reused)	802.11a	6 Mbps	36/40/48/52/60/64/100/116/140/144/149/157/165
		802.11n-HT20	MCS8	36/40/48/52/60/64/100/116/140/144/149/157/165
		802.11n-HT40	MCS8	38/46/54/62/102/110/134/142/151/159
		802.11ac-VHT80	MCS0	42/58/106/122/138/155
		802.11ac-VHT160	MCS0	50/114
		802.11ax-HE20	HE0	36/40/48/52/60/64/100/116/140/144/149/157/165
		802.11ax-HE40	HE0	38/46/54/62/102/110/134/142/151/159
		802.11ax-HE80	HE0	42/58/106/122/138/155
		802.11ax-HE160	HE0	50/114
	Maximum output power (SPOT Check)	802.11a	6 Mbps	36/40/48/52/60/64/100/116/140/144/149/157/165
		802.11n-HT20	MCS8	36/40/48/52/60/64/100/116/140/144/149/157/165
		802.11n-HT40	MCS8	38/46/54/62/102/110/134/142/151/159
		802.11ac-VHT80	MCS0	42/58/106/122/138/155
		802.11ac-VHT160	MCS0	50/114
		802.11ax-HE20	HE0	36/40/48/52/60/64/100/116/140/144/149/157/165
		802.11ax-HE40	HE0	38/46/54/62/102/110/134/142/151/159
		802.11ax-HE80	HE0	42/58/106/122/138/155
		802.11ax-HE160	HE0	50/114
	Power spectral density (Data Reused)	802.11a	6 Mbps	36/40/48/52/60/64/100/116/140/144/149/157/165
		802.11n-HT20	MCS8	36/40/48/52/60/64/100/116/140/144/149/157/165
		802.11n-HT40	MCS8	38/46/54/62/102/110/134/142/151/159
		802.11ac-VHT80	MCS0	42/58/106/122/138/155
		802.11ac-VHT160	MCS0	50/114
		802.11ax-HE20	HE0	36/40/48/52/60/64/100/116/140/144/149/157/165
		802.11ax-HE40	HE0	38/46/54/62/102/110/134/142/151/159
		802.11ax-HE80	HE0	42/58/106/122/138/155
		802.11ax-HE160	HE0	50/114

Item		Mode	Data Rate	RU Configuration	Test Channel
Conducted Test Case	26dB/6dB Bandwidth (Data Reused)	802.11ax-HE20	HE0	26/0	36/100/149
				52/37	
				106/53	
		802.11ax-HE20	HE0	26/8	64/140/165
				52/40	
				106/54	
		802.11ax-HE40	HE0	242/61	38/102/151
			HE0	242/62	62/134/159
		802.11ax-HE80	HE0	484/65	42/106/155
			HE0	484/66	58/122/155
Conducted Test Case	Maximum output power (SPOT Check)	802.11ax-HE20	HE0	26/0	36/100/149
				52/37	
				106/53	
		802.11ax-HE20	HE0	26/8	64/140/165
				52/40	
				106/5	
		802.11ax-HE40	HE0	242/61	38/102/151
			HE0	242/62	62/134/159
		802.11ax-HE80	HE0	484/65	42/106/155
			HE0	484/66	58/122/155
		802.11ax-HE160	HE0	996/67	50/114
			HE0	996/S67	50/114

Item		Mode	Data Rate	RU Configuration	Test Channel
Conducted Test Case	Power spectral density (Data Reused)	802.11ax-HE20	HE0	26/0	36/100/149
				52/37	
				106/53	
		802.11ax-HE40	HE0	26/8	64/140/165
				52/40	
				106/54	
		802.11ax-HE80	HE0	242/61	38/102/151
			HE0	242/62	62/134/159
		802.11ax-HE160	HE0	484/65	42/106/155
			HE0	484/66	58/122/155
		802.11ax-HE160	HE0	996/67	50/114
			HE0	996/S67	50/114

Note 1: ☐ Mobile Device

☒ Portable Device, and 3 axis were assessed. The worst scenario for Radiated Spurious Emission as follow: ☒ Lie ☐ Side ☐ Stand

Note 2: Low, mid, and high channels were measured, only the worst channel of each modulation was presented in this report.

Note 3: Both of the antennas are the same type, and we presented the worst case in the report. The max-gain condition with SISO (main port) and MIMO is SKU 2. The MIMO is uncorrelated and supported SDM mode only.

Note 4: The modulation and bandwidth are similar for 802.11n mode for HT20/HT40 and 802.11ac mode for VHT20/VHT40, therefore investigated worst case to representative mode in the test report.

Note 5: The data rates were selected based on preliminary testing that identified rate as the worst case for output power.

3.7. Output Power Setting

SPOT CHECK

Mode	Band	Centre Frequency (MHz)	Power Setting	
			Chain 0 (AUX)	Chain 1 (Main)
802.11a	NII-I	5180	18	18
		5200	18.75	18.75
		5240	20	20
	NII-2A	5260	20	20
		5300	19	19
		5320	18.5	18
	NII-2C	5500	18.5	18.5
		5580	20	20
		5700	17.675	18.75
		5720	20	20
	NII-III	5745	20	20.25
		5785	20	20.5
		5825	20	20

Mode	Band	Centre Frequency (MHz)	Power Setting	Mode	Band	Centre Frequency (MHz)	Power Setting
802.11n-HT20	NII-I	5180	15	802.11ax-HE20	NII-I	5180	15.375
		5200	15.75			5200	16.125
		5240	17.25			5240	17.5
	NII-2A	5260	17.5		NII-2A	5260	17.75
		5300	16.25			5300	16.375
		5320	15.125			5320	15.375
	NII-2C	5500	15.5		NII-2C	5500	16
		5580	17.25			5580	17.25
		5700	14.75			5700	15
		5720	17.25			5720	17.5
	NII-III	5745	17.25		NII-III	5745	17.625
		5785	17.25			5785	17.625
		5825	17.25			5825	17.625

Mode	Band	Centre Frequency (MHz)	Power Setting	Mode	Band	Centre Frequency (MHz)	Power Setting
802.11n-HT40	NII-I	5190	15.25	802.11ax-HE40	NII-I	5190	15.125
		5230	17			5230	17
	NII-2A	5270	16.25		NII-2A	5270	16.25
		5310	14.25			5310	14.25
	NII-2C	5510	14.625		NII-2C	5510	14.625
		5550	15.5			5550	15.75
		5670	17			5670	17
		5710	17.5			5710	17.75
	NII-III	5755	17.5		NII-III	5755	17.5
		5795	17.5			5795	17.75

Mode	Band	Centre Frequency (MHz)	Power Setting	Mode	Band	Centre Frequency (MHz)	Power Setting
802.11ac-VT80	NII-I	5210	15.25	802.11ax-HE80	NII-I	5210	15.25
	NII-2A	5290	14.25		NII-2A	5290	14
	NII-2C	5530	15.25		NII-2C	5530	15
		5610	17.25			5610	17.5
		5690	17.5			5690	17.75
	NII-III	5775	16		NII-III	5775	16

Mode	Band	Centre Frequency (MHz)	Power Setting	Mode	Band	Centre Frequency (MHz)	Power Setting
802.11ac-VT160	NII-I /NII-2A	5250	10.625	802.11ax-HE160	NII-I /NII-2A	5250	10.625
	NII-2C	5570	10.25		NII-2C	5570	10.25

Mode	Band	Centre Frequency (MHz)	RU Configuration	Power Setting
802.11ax- HE20	NII-I	5180	26/0	11.25
			52/37	14.125
			106/53	14.625
	NII-2A	5320	26/8	11.625
			52/40	11.625
			106/54	14.5
	NII-2C	5500	26/0	11.875
			52/37	14.75
			106/53	15.875
		5700	26/8	12
			52/40	12.875
			106/54	14.25
	NII-III	5745	26/0	11
			52/37	14
			106/53	17
		5825	26/8	15
			52/40	16.75
			106/54	16.75
802.11ax- HE40	NII-I	5190	242/61	15
	NII-2A	5310	242/62	13.5
	NII-2C	5510	242/61	14.5
		5670	242/62	17
	NII-III	5755	242/61	17
		5795	242/62	16.875
802.11ax- HE80	NII-I	5210	484/65	15
	NII-2A	5290	484/66	11.375
	NII-2C	5530	484/65	13.5
		5610	484/66	15.875
	NII-III	5775	484/65	15.5
			484/66	15.25
802.11ax- HE160	NII-I/ NII-2A	5250	996/67	9.875
			996/S67	9.625
	NII-2C	5570	996/67	9.375
			996/S67	9.5

3.8. Tested Supporting System List

3.8.1. Support Peripheral Unit

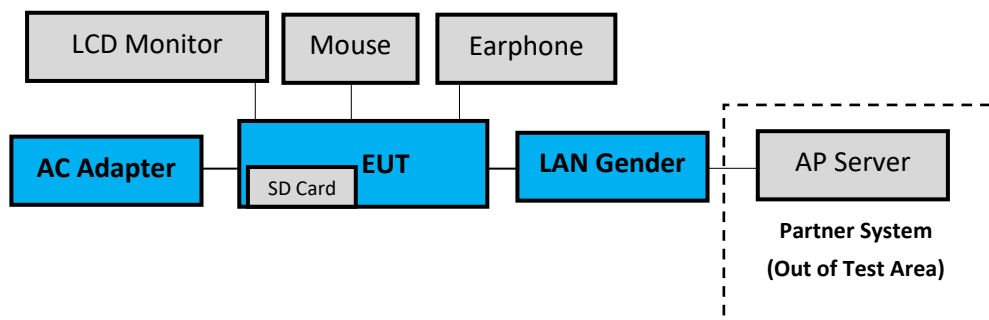
No.	Product	Brand	Model No.	Serial No.	Approval
1.	LCD Monitor	DELL	U2718Qb	N/A	N/A
2.	USB Mouse	LENOVO	SM-8823	8SSM50L24506A VLC99H049R	FCC By DoC
3.	Earphone	APPLE	N/A	N/A	N/A
4.	SD Card	ADATA	MicroSDHC Card	N/A	N/A
Partner System					
5.	AP Server	ASUS	RT-AX88U	N/A	FCC ID: MSQ-RTAXHP00 IC: 3568A-RTAXHP00

3.8.2. Cable Lists

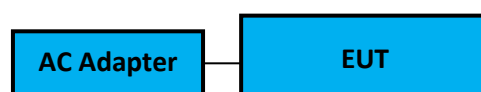
No.	Cable Description Of The Above Support Units
1.	HDMI Cable: Shielded, Detachable, 1.8m AC Power Cord: Unshielded, Detachable, 1.8m
2.	USB Cable: Unshielded, Undetachable, 1.8m
3.	Earphone Cable: Unshielded, Undetachable, 0.9m
4.	N/A
5.	AC adapter: M/N:WA-30B12, Cable: Unshielded, Detachable, 1.2m LAN cable: Unshielded, Detachable, 3.0m
6.	LAN cable: Unshielded, Detachable, 1.8m

3.9. Setup Configuration

3.9.1. EUT Configuration for Power Line & Radiated Emission



3.9.2. EUT Configuration for RF Conducted Test Items



3.10. Operating Condition of EUT

Test program “DRTU” is used for enabling EUT WLAN function under continues transmitting and choosing data rate/ channel.

[Chain 0 is aux port (A Button in DRTU) Chain 1 is main port (B Button in DRTU)].

3.11. Description of Test Facility

Name of Test Firm	Audix Technology Corporation / EMC Department No. 53-11, Dingfu, Linkou Dist., New Taipei City 244, Taiwan Tel: +886-2-26092133 Fax: +886-2-26099303 Website : www.audixtech.com Contact e-mail: attemc_report@audixtech.com
Accreditations	The laboratory is accredited by following organizations under ISO/IEC 17025:2017 (1) NVLAP(USA) NVLAP Lab Code 200077-0 (2) TAF(Taiwan) No. 1724
Test Facilities	FCC OET Designation Number under APEC MRA by NCC is : TW1724 ISED CAB Identifier Number under APEC TEL MRA by NCC is TW1724 (1) No.8 Shielded Room (2) No.1 3m Semi Anechoic Chamber (3) Fully Anechoic Chamber

3.12.Measurement Uncertainty

Test Items/Facilities			Frequency Range	Uncertainty
Conduction Test			9kHz-150kHz	±3.7dB
			150kHz-30MHz	±3.5dB
Radiation Test	☒	No.1 3m Semi Anechoic Chamber	30MHz-200MHz, 3m, Horizontal	±4.1dB
			200MHz-1000MHz, 3m, Horizontal	±3.9dB
			30MHz-200MHz, 3m, Vertical	±4.2dB
			200MHz-1000MHz, 3m, Vertical	±4.1dB
			1GHz-6GHz, 3m	±4.2dB
			6GHz-18GHz, 3m	±4.6dB
	☐	No.3 3m Semi Anechoic Chamber	30MHz-200MHz, 3m, Horizontal	±3.9dB
			200MHz-1000MHz, 3m, Horizontal	±3.9dB
			30MHz-200MHz, 3m, Vertical	±4.4dB
			200MHz-1000MHz, 3m, Vertical	±4.1dB
	☐	No.4 3m Semi Anechoic Chamber	30MHz-200MHz, 3m, Horizontal	±4.3dB
			200MHz-1000MHz, 3m, Horizontal	±4.0dB
			30MHz-200MHz, 3m, Vertical	±4.3dB
			200MHz-1000MHz, 3m, Vertical	±4.4dB
			1GHz-6GHz, 3m	±4.5dB
			6GHz-18GHz, 3m	±4.6dB
	☐	No.5 3m Semi Anechoic Chamber	30MHz-200MHz, 3m, Horizontal	±4.0dB
			200MHz-1000MHz, 3m, Horizontal	±3.9dB
			30MHz-200MHz, 3m, Vertical	±4.2dB
			200MHz-1000MHz, 3m, Vertical	±4.3dB
			1GHz-6GHz, 3m	±4.3dB
			6GHz-18GHz, 3m	±4.7dB
	☒	Fully Anechoic Chamber	30MHz~1000MHz	±4.6dB
			1GHz~18GHz	±5.4dB
			18GHz~40GHz	±3.52dB
			40GHz~260GHz	±3.56dB

Remark : Uncertainty = $ku_c(y)$

Test Items	Uncertainty
Emission Bandwidth	± 0.2kHz
Maximum output power	± 0.33dB
Power spectral density	± 0.13dB

4. MEASUREMENT EQUIPMENT LIST

4.1. Conducted Emission Measurement

Item	Type	Manufacturer	Model No.	Serial No.	Cal. Date	Cal. Interval
1.	Test Receiver	R&S	ESR3	101774	2020. 02. 04	1 Year
2.	A.M.N.	R&S	ENV4200	100169	2020. 11. 05	1 Year
3.	L.I.S.N.	Kyoritsu	KNW-407	8-855-9	2019. 12. 10	1 Year
4.	Pulse Limiter	R&S	ESH3-Z2	100354	2020. 01. 05	1 Year
5.	Digital Thermo-Hygro Meter	iMax	HTC-1	No.8 S/R	2020. 04. 17	1 Year
6.	Coaxial Cable	Yeida	RG/58AU	CE-08	2020. 09. 19	1 Year
7.	Test Software	Audix	e3	V6.120619c	N.C.R.	N.C.R.

4.2. Radiated Emission Measurement

Item	Type	Manufacturer	Model No.	Serial No.	Cal. Date	Cal. Interval
1.	Spectrum Analyzer	Keysight	N9010B-544	MY55460198	2020. 04. 29	1 Year
2.	Spectrum Analyzer	Agilent	N9030A-526	MY53310269	2020. 01. 16	1 Year
3.	Test Receiver	R&S	ESCS30	100338	2020. 06. 10	1 Year
4.	Amplifier	HP	8447D	2944A06305	2020. 01. 16	1 Year
5.	Microwave Preamplifier	Agilent	8449B	3008A02678	2020. 02. 27	1 Year
6.	Microwave Amplifier	Keysight	83051A	MY53010042	2020. 08. 05	1 Year
7.	Loop Antenna	R&S	HFH2-Z2	891847/27	2019. 12. 26	2 Years
8.	Bilog Antenna	TESEQ	CBL6112D	33821	2020. 01. 17	1 Year
9.	Horn Antenna	ETS-Lindgren	3117	00135902	2020. 03. 10	1 Year
10.	Horn Antenna	COM-POWER	AH-840	101092	2020. 05. 08	1 Year
11.	5G Notch Filter	Microwave Circuits	N0452502	459775	2020. 05. 06	1 Year
12.	5G Notch Filter	Microwave Circuits	N0555983	504921	2020. 08. 05	1 Year
13.	5G Notch Filter	Microwave Circuits	N0257881	459776	2020. 08. 20	1 Year
15.	Coaxial Cable	MIYAZAKI	5D2W	RE-11	2020. 01. 31	1 Year
16.	Coaxial Cable	HUBER+SUHNER	SUCOFLEX 104	RE-29	2020. 09. 19	1 Year
17.	Coaxial Cable	HUBER+SUHNER	SUCOFLEX 102	RE-30	2020. 09. 19	1 Year
18.	Digital Thermo-Hygro Meter	iMax	HTC-1	No.1 3m A/C	2020. 04. 17	1 Year
19.	Digital Thermo-Hygro Meter	EVERY DAY	E-512	RF-02	2020. 04. 17	1 Year
20.	Test Software	Audix	e3	V6.120619c	N.C.R.	N.C.R.
21.	Test Software	Audix	e3	V6.110601	N.C.R.	N.C.R.

4.3. RF Conducted Measurement

Item	Type	Manufacturer	Model No.	Serial No.	Cal. Date	Cal. Interval
1.	Spectrum Analyzer	Keysight	N9020B-544	MY57120357	2020. 01. 10	1 Year
2.	Power Meter	Anritsu	ML2487A	6K00005406	2020. 04. 29	1 Year
3.	Power Sensor	Anritsu	MA2491A	030873	2020. 04. 29	1 Year
4.	Digital Thermo-Hygro Meter	Shenzhen Datronn Electronics	KT-905	RF	2020. 04. 17	1 Year

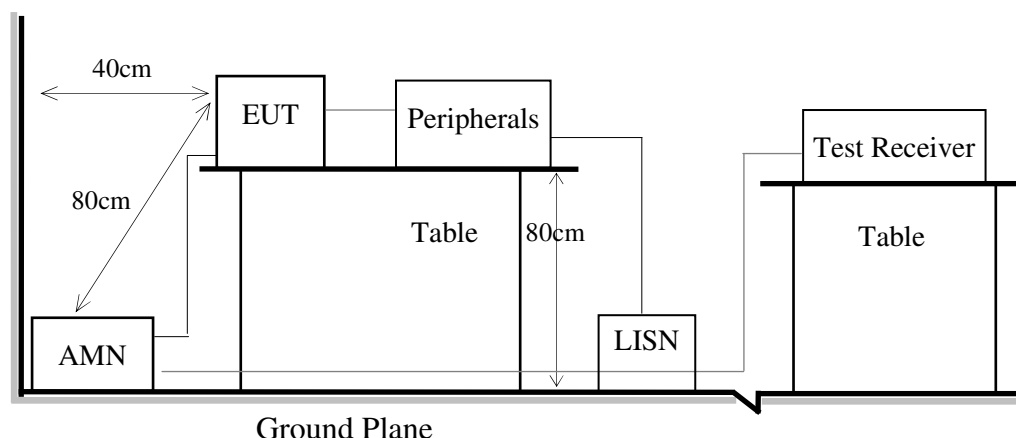
5. CONDUCTED EMISSION

5.1. Block Diagram of Test Setup

5.1.1. Block Diagram of EUT

Indicated as section 3.9

5.1.2. Shielded Room Setup Diagram



5.2. Conducted Emission Limit

Frequency	Conducted Limit	
	Quasi-Peak Level	Average Level
150kHz ~ 500kHz	66 ~ 56 dB μ V	56 ~ 46 dB μ V
500kHz ~ 5MHz	56 dB μ V	46 dB μ V
5MHz ~ 30MHz	60 dB μ V	50 dB μ V

Remark1.: If the average limit is met when using a Quasi-Peak detector, the measurement using the average detector is not required.

2.: The lower limit applies to the band edges.

5.3. Test Procedure

- 5.3.1. To set up the EUT as indicated in ANSI C63.10. The EUT was placed on the table which has 80 cm height to the ground and 40 cm distance to the conducting wall.
- 5.3.2. Power supplier of the EUT was connected to the AC mains through an Artificial Mains Network (A.M.N.).
- 5.3.3. The AC power supplies to all peripheral devices must be provided through line impedance stabilization network (L.I.S.N.).
- 5.3.4. Checking frequency range from 150kHz to 30 MHz and record the emission which does not have 20 dB below limit.

5.4. Test Results

Please refer to Appendix A.

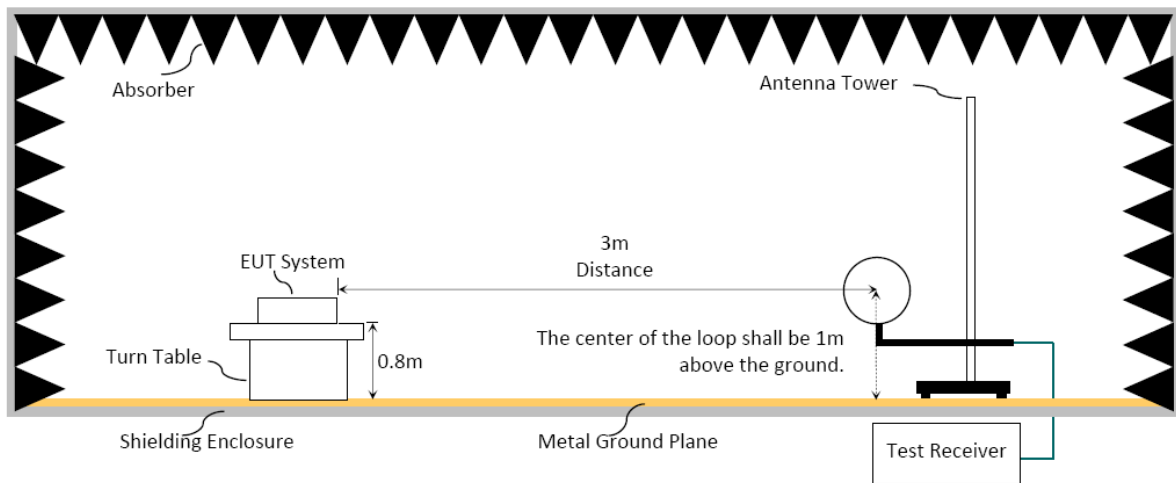
6. RADIATED EMISSION

6.1. Block Diagram of Test Setup

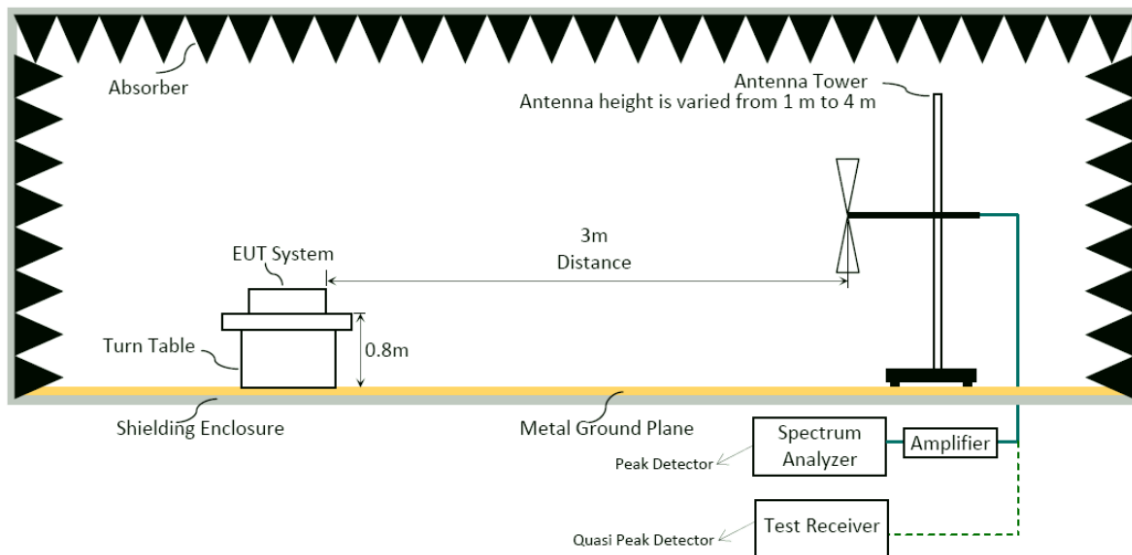
6.1.1. Block Diagram of EUT

Indicated as section 3.9

6.1.2. Setup Diagram for 9kHz-30MHz

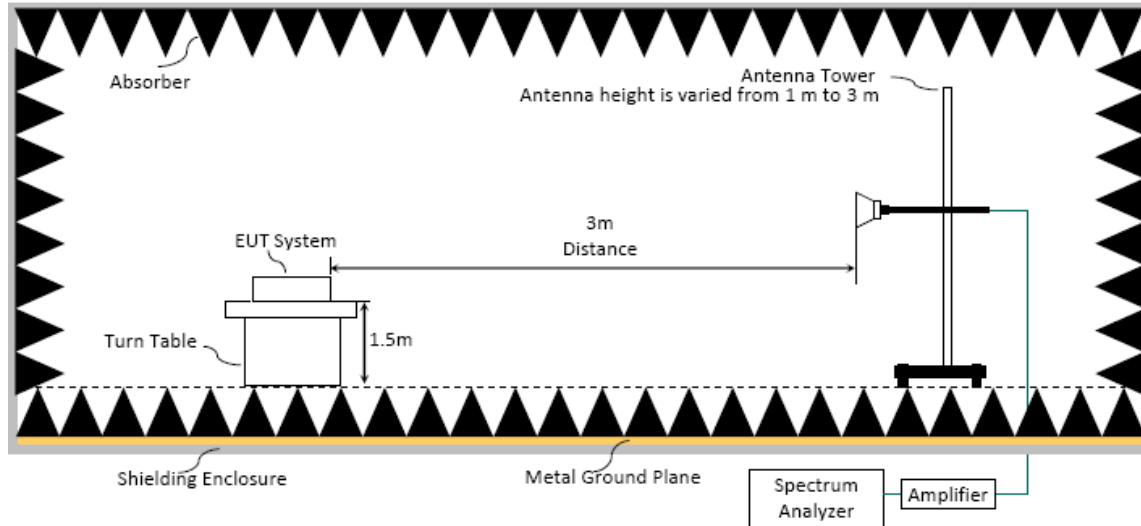


6.1.3. Setup Diagram for 30-1000MHz

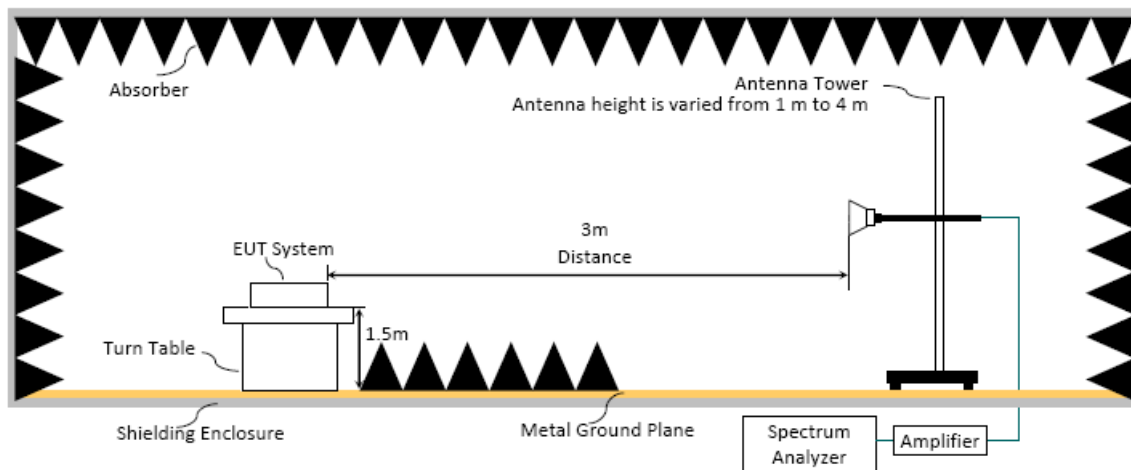


6.1.4. Setup Diagram for above 1GHz

Fully Anechoic Chamber



Semi Anechoic Chamber



6.2. Radiated Emission Limits

Radiated emissions fall in restricted bands, as defined in Section 15.205 must be in compliance with the radiated emission limits specified in 15.209 as below.

6.2.1. General Limit

Frequency (MHz)	Distance(m)	Limits	
		dB μ V/m	μ V/m
0.009 - 0.490	300	67.6-20 log f(kHz)	2400/f kHz
0.490 - 1.705	30	87.6-20 log f(kHz)	24000/f kHz
1.705 - 30	30	29.5	30
30 - 88	3	40.0	100
88- 216	3	43.5	150
216- 960	3	46.0	200
Above 960	3	54.0	500
Above 1000	3	74.0 dB μ V/m (Peak) 54.0 dB μ V/m (Average)	

Remark : (1) dB μ V/m = 20 log (μ V/m)

(2) The tighter limit applies to the edge between two frequency bands.

(3) Distance refers to the distance in meters between the measuring instrument antenna and the closed point of any part of the device or system.

(4) Fundamental and emission fall within operation band are exempted from this section.

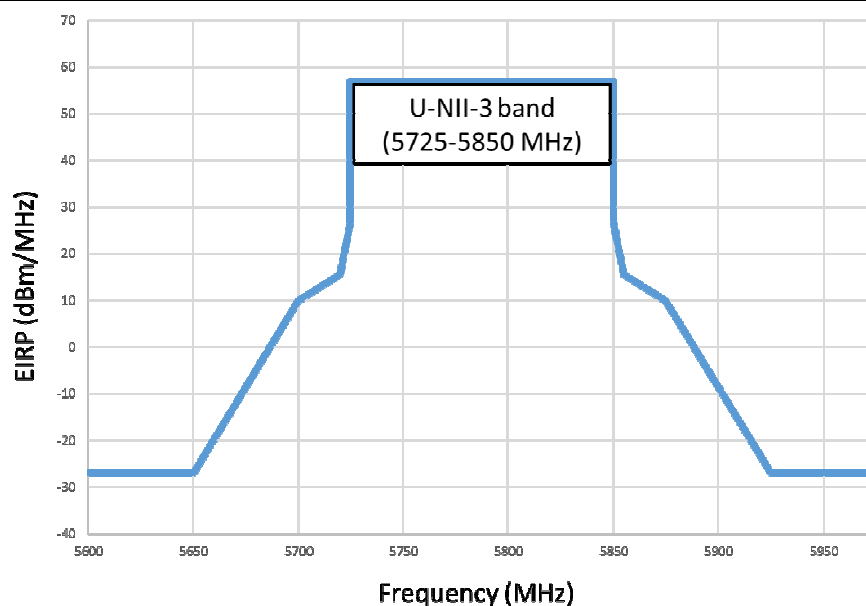
(5) Pursuant to ANSI C63.10: 6.6.4.3, if the maximized peak measured value complies with the average limit, then it is unnecessary to perform an average measurement.

6.2.2. Limit for non-restricted frequency above 1 GHz

Frequency Band (MHz)	E.I.R.P. Limit	Field Strength Limit at 3 m
5150 to 5250	-27 dBm	68.2
5250 to 5350		68.2
5470 to 5725		68.2

Note: Field Strength at 3 m= E.I.R.P. + 95.2 dB

Frequency Band (MHz)	Field Strength Limit at 3 m	
5725 to 5850	☒	15.407(b)(4)(i) All emissions shall be limited to a level of 68.2 dBμV/m at 75 MHz or more above or below the band edge increasing linearly to 105.2dBμV/m 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 110.8 dBμV/m 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 68.2 dBμV/m at the band edge.
	☐	15.407(b)(4)(ii) ,compliance with the emission limits in § 15.247(d) Shall be at least 30dB below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power,. Attenuation below the general limits specified in §15.209(a) is not required. In addition, radiated emissions which fall in the restricted bands, as defined in §15.205(a), must also comply with the radiated emission limits specified in §15.209(a) (see §15.205(c))



6.3. Test Procedure

Frequency Range 9kHz~30MHz:

The EUT setup on the turntable which has 0.8 m height to the ground. The turn table rotated 360 degrees and antenna fixed to 1 m to find the maximum emission level. In order to find the maximum emission, all of the interface cables were manipulated according to ANSI C63.10-2013 regulation.

- (1) RBW = 9kHz with peak and average detector.
- (2) Detector: average and peak (9kHz-490kHz)
Q.P. (490kHz-30MHz)

Frequency Range 30MHz ~ 40GHz:

The EUT setup on the turn table which has 80cm (for 30-1000MHz) and 1.5m (for above 1GHz) height to the ground. The turn table rotated 360 degrees and antenna varied from 1 m to 4 m (for 30-1000MHz) and from 1m to 3m (for above 1GHz at fully Anechoic Chamber) or from 1 m to 4 m (for above 1GHz at Semi Anechoic Chamber) to find the maximum emission level. Both horizontal and vertical polarization are required. In order to find the maximum emission, all of the interface cables were manipulated according to ANSI C63.10-2013 regulation.

Frequency below 1GHz:

Spectrum Analyzer is used for pre-testing with following setting:

- (1) RBW = 120KHz
- (2) VBW $\geq 3 \times$ RBW.
- (3) Detector = Peak.
- (4) Sweep time = auto.
- (5) Trace mode = max hold.
- (6) Allow sweeps to continue until the trace stabilizes.

Note 1: When peak-detected value is lower than limit that the measurement using the Q.P. detector is not required, otherwise using Q.P. for final measurement.

Note 2: When the radiated emissions limits are expressed in terms of the average value of the emissions, and pulsed operation is employed, the measurement field strength shall be determined by averaging over one complete pulse train, including blanking intervals, as long as the pulse train does not exceed 0.1 seconds.

Frequency above 1GHz to 10th harmonic (up to 40 GHz):

Peak Detector:

- (1) RBW = 1MHz
- (2) VBW $\geq 3 \times$ RBW.
- (3) Detector = Peak.
- (4) Sweep time = auto.
- (5) Trace mode = max hold.
- (6) Allow sweeps to continue until the trace stabilizes.

Note: When peak-detected value is lower than limit that the measurement using the average detector is not required, otherwise using average detector for final measurement.

Average Detector:**■ Option 1:**

(1) RBW = 1MHz

(2) VBW $\geq$ 1/ T.

Modulation Type	T (ms)	1/ T (kHz)	VBW Setting(kHz)
802.11a	2.087	0.479	10Hz
802.11n-HT20	3.980	0.251	10Hz
802.11n-HT40	3.980	0.251	10Hz
802.11ac-VHT80	3.960	0.253	10Hz
802.11ac-VHT160	2.780	0.360	10Hz
802.11ax-HE20	3.970	0.252	10Hz
802.11ax-HE40	3.970	0.252	10Hz
802.11ax-HE80	3.980	0.251	10Hz
802.11ax-HE160	2.280	0.439	10Hz

N/A: 1/ T is not implemented when duty cycle presented in section 3.6 is $\geq$ 98%.

(1) Detector = Peak.

(2) Sweep time = auto.

(3) Trace mode = max hold.

(4) Allow sweeps to continue until the trace stabilizes.

□ Option 2:

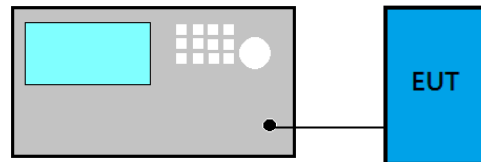
Average Emission Level= Peak Emission Level+ D.C.C.F.

6.4. Measurement Result Explanation**■** Peak Emission Level=Antenna Factor + Cable Loss + Meter Reading (including Preamp factor if test used)**■** Average Emission Level=Antenna Factor + Cable Loss + Meter Reading (including Preamp factor if test used)**□** Average Emission Level= Peak Emission Level+ DCCFDuty Cycle Correction Factor (DCCF)= $20\log(TX_{on}/TX_{on+off})$ presented in section 3.6.**□** ERP= Peak Emission Level-95.2dB-2.14dB**6.5. Test Results**

Please refer to Appendix A.

7. 26dB/6dB BANDWIDTH

7.1. Block Diagram of Test Setup



7.2. Specification Limits

Frequency Band (MHz)	Limit
5150 to 5250	Reference only
5250 to 5350	
5470 to 5725	
5725 to 5850	$\geq 500\text{kHz}$

7.3. Test Procedure

Following measurement procedure is reference to KDB 789033 D02 General UNII Test Procedures New Rules v02r01:

■ Applicable to all bands except to 5725 MHz- 5850 MHz

- (1) Set RBW= 1% of the emission bandwidth
- (2) Set VBW > RBW
- (3) Detector = Peak
- (4) Trace mode = max hold
- (5) Setting channel bandwidth function x dB to -26 dB to record the final bandwidth.

■ 5725 MHz- 5850 MHz

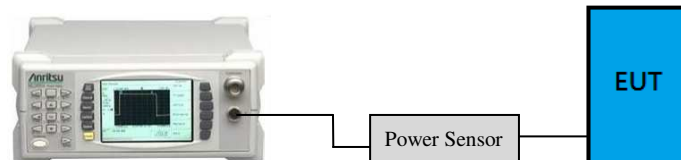
- (1) Set RBW = 100 kHz.
- (2) Set the video bandwidth (VBW) $\geq 3 \times \text{RBW}$.
- (3) Detector = Peak.
- (4) Trace mode = max hold.
- (5) Sweep = auto couple.
- (6) Allow the trace to stabilize.
- (7) Setting channel bandwidth function x dB to -6 dB to record the final bandwidth.

7.4. Test Results

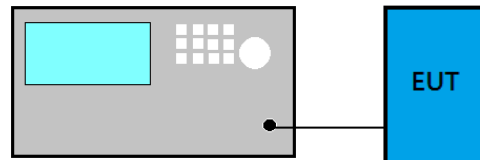
Please refer to Appendix A

8. MAXIMUM OUTPUT POWER

8.1. Block Diagram of Test Setup



- For 802.11ac-VHT80/160, 802.11ax-HE160 modes only



8.2. Specification Limits

Frequency Band (MHz)	Category	Limit
5150 to 5250	Outdoor Access Point	1 W(30 dBm)/ Max e.i.r.p. ≤ 125 mW(21 dBm) at any elevation angle above 30 degrees as measured from the horizon
	Fixed point-to-point Access Point	1 W(30 dBm)
	Indoor Access Point	1 W(30 dBm)
	Mobile and Portable client device	250 mW(24 dBm)
5250 to 5350	N/A	250 mW or $11 \text{ dBm} + 10 \log B$ ^{Note1}
5470 to 5725		250 mW or $11 \text{ dBm} + 10 \log B$ ^{Note1}
5725 to 5850		1 W(30 dBm)

Note 1: B is the 26 dB emission bandwidth, which presented in section 7 and appendix A.1.

8.3. Test Procedure

Following measurement procedure is reference to KDB 789033 D02 General UNII Test Procedures New Rules v02r01:

■ **Method AVGPM (Measurement using an RF average power meter):**

EUT is connected to power sensor and record the maximum average output power and duty cycle factor is added when duty cycle presented in section 3.7 is < 98%.

■ **Method AVGSA-2 (Spectrum channel power) for 802.11ac-VHT80/160, 802.11ax-HE80/160 modes only**

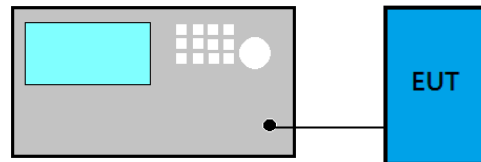
- (1) Set span to at least 1.5 times the OBW
- (2) Set RBW = 1 MHz
- (3) Set the video bandwidth (VBW) ≥ 3 MHz.
- (4) Detector = RMS.
- (5) Trace mode = trace average at least 100 traces
- (6) Sweep = auto couple.
- (7) Compute power by integrating the spectrum across the OBW of the signal using the instrument's band power measurement function with band limits set equal to the OBW band edges.
- (8) Duty cycle factor is added when duty cycle presented in section 3.7 is < 98%.

8.4. Test Results

Please refer to Appendix A

9. POWER SPECTRAL DENSITY

9.1. Block Diagram of Test Setup



9.2. Specification Limits

Frequency Band (MHz)	Category	Limit
5150 to 5250	Outdoor Access Point	17dBm/MHz
	Fixed point-to-point Access Point	
	Indoor Access Point	
	Mobile and Portable client device	11 dBm/MHz
5250 to 5350	N/A	11 dBm/MHz
5470 to 5725		11 dBm/MHz
5725 to 5850		30dBm/500 kHz

9.3. Test Procedure

Following measurement procedure is reference to KDB 789033 D02 General UNII Test Procedures New Rules v02r01:

■ Method AVGSA-2 (Spectrum channel power)

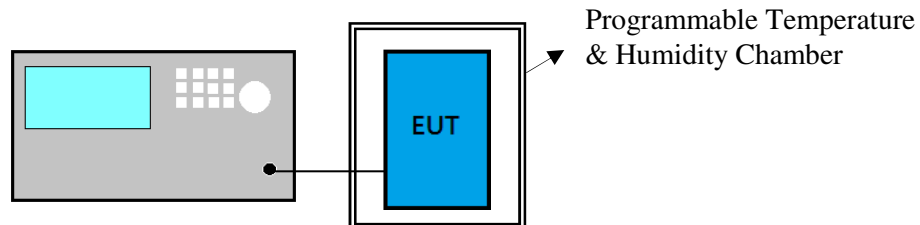
- (1) Set span to at least 1.5 times the OBW
- (2) Set RBW = 1 MHz
- (3) Set the video bandwidth (VBW) ≥ 3 MHz.
- (4) Detector = RMS.
- (5) Trace mode = trace average at least 100 traces
- (6) Sweep = auto couple.
- (7) Use peak search function to find out the maximum power density.
- (8) Duty cycle factor is added when duty cycle presented in section 3.7 is $< 98\%$.

9.4. Test Results

Please refer to Appendix A

10. FREQUENCY STABILITY

10.1. Block Diagram of Test Setup



10.2. Specification Limits

NONE

10.3. Test Procedure

- (1) Frequency: Test frequency.
- (2) Span: enough to cover the complete power envelope
- (3) RBW: 1MHz(modulation ON) ; 10KHz(CW)
- (4) VBW: 1MHz(modulation ON) ; 10KHz(CW)
- (5) Detector Mode: Positive Peak
- (6) Indication mode: Max hold
- (7) Find the peak frequency and take calculate by the formula:
(Measurement Value-declaration frequency)/ declaration frequency)

10.4. Test Results

Please refer to Appendix A



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11.DEVIATION TO TEST SPECIFICATIONS

【NONE】



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APPDNDIX A

TEST DATA AND PLOTS

(Model: 16Z90P)



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APPENDIX B

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APPDNDIX B

TEST PHOTOGRAPHS

(Model: 16Z90P)