

FCC 15.407 NII 5 GHz Test Report

for

LG Electronics Inc.

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

Product Name : Notebook Computer
Model Name : 15Z980
Brand : LG
FCC ID : BEJNT-15Z980

**Prepared by: : AUDIX Technology Corporation,
EMC Department**



TABLE OF CONTENTS

Description	Page
TEST REPORT CERTIFICATION.....	4
1. REVISION RECORD OF TEST REPORT	5
2. SUMMARY OF TEST RESULTS	6
3. GENERAL INFORMATION	7
3.1. Description of Application	7
3.2. Description of EUT	8
3.3. Antenna Information	9
3.4. EUT Specifications Assessed in Current Report	10
3.5. Description of Key Components	12
3.6. Data Rate Relative to Output Power	14
3.7. Test Configuration	15
3.8. Tested Supporting System List	18
3.9. Setup Configuration	18
3.10. Operating Condition of EUT	18
3.11. Description of Test Facility	19
3.12. Measurement Uncertainty	19
4. MEASUREMENT EQUIPMENT LIST	20
4.1. Conducted Emission Measurement	20
4.2. Radiated Emission Measurement	20
4.3. RF Conducted Measurement	20
5. CONDUCTED EMISSION	21
5.1. Block Diagram of Test Setup	21
5.2. Conducted Emission Limit	21
5.3. Test Procedure	21
5.4. Test Results	22
6. RADIATED EMISSION	23
6.1. Block Diagram of Test Setup	23
6.2. Radiated Emission Limits	24
6.3. Test Procedure	26
6.4. Measurement Result Explanation	27
6.5. Test Results	27
7. EMISSION BANDWIDTH	28
7.1. Block Diagram of Test Setup	28
7.2. Specification Limits	28
7.3. Test Procedure	28
7.4. Test Results	28
8. MAXIMUM OUTPUT POWER	29
8.1. Block Diagram of Test Setup	29
8.2. Specification Limits	29
8.3. Test Procedure	29
8.4. Test Results	30
9. EMISSION LIMITATIONS MEASUREMENT	31
9.1. Block Diagram of Test Setup	31

9.2. Specification Limits.....	31
9.3. Test Procedure	33
9.4. Test Results	33
10. POWER SPECTRAL DENSITY	34
10.1. Block Diagram of Test Setup	34
10.2. Specification Limits.....	34
10.3. Test Procedure	34
10.4. Test Results	34
11. FREQUENCY STABILITY	35
11.1. Block Diagram of Test Setup	35
11.2. Specification Limits.....	35
11.3. Test Procedure	35
11.4. Test Results	35
12. DEVIATION TO TEST SPECIFICATIONS	36

APPENDIX A TEST DATA AND PLOTS

APPENDIX B TEST PHOTOGRAPHS

TEST REPORT CERTIFICATION

Applicant : LG Electronics Inc.
Factory : LG Electronics Nanjing New Technology Co., Ltd.
EUT Description
(1) Product : Notebook Computer
(2) Model : 15Z980
(3) Brand : LG
(4) Power Rating : DC 19V, 2.53A

Applicable Standards:

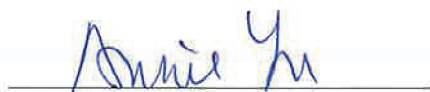
47 CFR FCC Part 15 Subpart E
ANSI C63.10:2013
KDB 789033 D02 General UNII Test Procedures New Rules v01r04

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: 2017. 11. 30

Reviewed by:



(Annie Yu/Administrator)

Approved by:



(Ben Cheng/Manager)

1. REVISION RECORD OF TEST REPORT

Edition No	Issued Data	Revision Summary	Report Number
0	2017. 11. 30	Original Report	EM-F170751

2. SUMMARY OF TEST RESULTS

Rule	Description	Results
15.207	Conducted Emission	PASS
15.205	Radiated Band Edge and Radiated Spurious Emission	PASS
15.407(a)(5)/15.407(e)	Emission Bandwidth Measurement	PASS
15.407(a)	Maximum Output	PASS
15.407(b)	Conducted Band Edges and Conducted Spurious Emission	PASS
15.407(a)	Power Spectral Density	PASS
15.203	Antenna Requirement	Compliance
15.407	Frequency Stability	PASS

3. GENERAL INFORMATION

3.1. Description of Application

Applicant	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	15Z980
Brand	LG

3.2. Description of EUT

Test Model	15Z980																						
Serial Number	N/A																						
Power Rating	DC 19V, 2.53A																						
RF Features	WLAN: 802.11a/b/g/n/ac Bluetooth: BT and BLE																						
Transmit Type	<table><tr><th colspan="2">2.4 GHz</th></tr><tr><td>802.11b</td><td>1T1R</td></tr><tr><td>802.11g</td><td>1T1R</td></tr><tr><td>802.11n-HT20</td><td>2T2R</td></tr><tr><td>802.11n-HT40</td><td>2T2R</td></tr><tr><td>BT/BLE</td><td>1T1R</td></tr><tr><th colspan="2">UNII Bands</th></tr><tr><td>802.11a</td><td>1T1R</td></tr><tr><td>802.11n-HT20/ 802.11ac-VHT20</td><td>2T2R</td></tr><tr><td>802.11n-HT40/ 802.11ac-VHT40</td><td>2T2R</td></tr><tr><td>802.11ac-VHT80</td><td>2T2R</td></tr></table>	2.4 GHz		802.11b	1T1R	802.11g	1T1R	802.11n-HT20	2T2R	802.11n-HT40	2T2R	BT/BLE	1T1R	UNII Bands		802.11a	1T1R	802.11n-HT20/ 802.11ac-VHT20	2T2R	802.11n-HT40/ 802.11ac-VHT40	2T2R	802.11ac-VHT80	2T2R
2.4 GHz																							
802.11b	1T1R																						
802.11g	1T1R																						
802.11n-HT20	2T2R																						
802.11n-HT40	2T2R																						
BT/BLE	1T1R																						
UNII Bands																							
802.11a	1T1R																						
802.11n-HT20/ 802.11ac-VHT20	2T2R																						
802.11n-HT40/ 802.11ac-VHT40	2T2R																						
802.11ac-VHT80	2T2R																						
Device Category	☐ Outdoor Access Point ☐ Fixed point-to-point Access Point ☐ Indoor Access Point ☒ Mobile and Portable client device																						
Sample Status	Production																						
Date of Receipt	2017. 11. 21																						
Date of Test	2017. 11. 28 ~ 30																						
I/O Ports List	• One SD Card Slot • One Earphone Port • Three USB 3.0 Ports • One USB Type C Port • One HDMI Port • One DC Input Port																						
Accessories Supplied	• AC Adapter																						

3.3. Antenna Information

2.4G Antenna					
No.	Antenna Part Number	Manufacture	Antenna Type	Frequency (MHz)	Max Gain (dBi)
1	WA-F-LBLB-04-056 (Main)	INPAQ	FPCB	2400	1.39
2				2450	1.54
3				2500	2.06
4	WA-F-LBLB-04-056 (AUX)		FPCB	2400	1.41
5				2450	1.40
6				2500	1.83

5G Antenna					
No.	Antenna Part Number	Manufacture	Antenna Type	Frequency (MHz)	Max Gain (dBi)
1	WA-F-LBLB-04-056 (Main)	INPAQ	FPCB	5100	2.49
2				5400	2.93
3				5800	1.59
4	WA-F-LBLB-04-056 (AUX)		FPCB	5100	2.57
5				5400	2.97
6				5800	2.84

3.4. EUT Specifications Assessed in Current Report

Mode	UNII Band	Fundamental Range (MHz)	Channel Number
802.11a	I	5180-5240	4
	II-2A	5260-5320	4
	II-2C	5500-5720	12
	III	5745-5825	5
802.11n-HT20/ 802.11ac-VHT20	I	5180-5240	4
	II-2A	5260-5320	4
	II-2C	5500-5720	12
	III	5745-5825	5
802.11n-HT40/ 802.11ac-VHT40	I	5190-5230	2
	II-2A	5270-5310	2
	II-2C	5510-5710	6
	III	5755-5795	2
802.11ac-VHT80	I	5210	1
	II-2A	5290	1
	II-2C	5530-5690	3
	III	5775	1
Remark: UNII Band II-2A and II-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

Channel List					
802.11a/802.11n-HT20/802.11ac-VHT20					
UNII Band	Channel Number	Frequency (MHz)	UNII Band	Channel Number	Frequency (MHz)
I	36	5180	II-2C	120	5600
	40	5200		124	5620
	44	5220		128	5640
	48	5240		132	5660
II-2A	52	5260		136	5680
	56	5280		140	5700
	60	5300		144	5720
	64	5320		149	5745
II-2C	100	5500	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					
UNII Band	Channel Number	Frequency (MHz)	UNII Band	Channel Number	Frequency (MHz)
I	38	5190	II-2C	118	5590
	46	5230		126	5630
II-2A	54	5270		134	5670
	62	5310		142	5710
II-2C	102	5510	III	151	5755
	110	5550		159	5795

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

Note Test modes are presented at section 3.7.

3.5. Description of Key Components

3.5.1. For the All Component Lists

Item	Vendor	Model name	Description
System	Microsoft	Windows 10 Home	---
Main Board	LG	14/15Z980 Main B/D PCB	(with Thunderbolt) Manufacturer: (1) Elec & Eltek Company (MCO) Limited (2) Hannstar Board Tech(Jiang Yin) Corp.,Ltd. (3) LG Innotek Co., Ltd.
	LG	14/15Z980 Main B/D PCB	(without Thunderbolt) Manufacturer: (1) Elec & Eltek Company (MCO) Limited (2) Hannstar Board Tech(Jiang Yin) Corp.,Ltd. (3) LG Innotek Co., Ltd.
SUB Board	LG	15Z980 WLAN SUB B/D	(with Finger Printer) Manufacturer: (1) Hannstar Board Tech(Jiang Yin) Corp.,Ltd. (2) HYUNWOO
	LG	15Z980 WLAN SUB B/D	(without Finger Printer) Manufacturer: (1) Hannstar Board Tech(Jiang Yin) Corp.,Ltd. (2) HYUNWOO
CPU (Socket: BGA1356)	Intel	i7-8550U	1.80GHz, up to 4.0GHz
	Intel	i5-8250U	1.60GHz, up to 3.4GHz
15.6" LCD Panel	LG Display	LP156WFA(SP)(G1)	Resolution: 1920 x 1080, 60Hz FHD IPSW/ Touch (AIT Including touch)
	LG Display	LP156WF9(SP)(N1)	Resolution: 1920 x 1080, 60Hz FHD IPS (Normal Non touch)
Storage (SSD)	SK hynix	HFS512G39TND-N210A BB	512GB (SATA)
	SK hynix	HFS256G39TND-N210A BB	256GB (SATA)
Memory (RAM) (On Board)	SK hynix	H5ANAG6NAMR-UHC	16GB DDR4 2400MHz * 4ea
	Samsung	K4A8G165WB-BCRC	8GB DDR4 2400MHz * 4ea
Memory (RAM)	SK hynix	HMA81GS6AFR8N-UHN0	8GB DDR4 2400MHz
	Samsung	M471A5244CB0-CRC	4GB DDR4 2400MHz
Battery Pack	LG	LBS1224E	DC 7.7V, 72Wh, Typ 9450mAh

Item	Vendor	Model name	Description
WLAN Combo Card	Intel	8265D2W	802.11a/b/g/n/ac 2.4GHz/5GHz + BT 4.2 BLE
WLAN Combo Antenna	LG (INPAQ)	WA-F-LBLB-04-056	FPCB Type Main: Black, Aux: Gray
Keyboard	LG	SN3870	Black: BL, White: BL 1
Web Camera	Lite-On	7BF109N2	With two MIC
Finger Print	SUNTEL	SFPC-L0016A(White)	---
	SUNTEL	SFPC-L0016B(Black)	---
LAN Gender (Type C to LAN)	LG	80-5946-111 (White)	10/100 Megabit Ethernet Manufacturer: SUZHOU MEC ELECTRONICS
		80-5946-101 (Black)	
	LG	GD-08MF-36-WH-LP05 (White)	10/100 Megabit Ethernet Manufacturer: ARIN TECH CO. LTD
		GD-08MF-36-BK-LP06 (Black)	
	Type C to LAN: Shielded, Undetached, 0.12m		
AC Adapter	LG (Lite-on)	PA-1650-43	I/P: AC 100-240V, 50/60Hz, 1.6A, O/P: DC 19V, 3.42A
	DC Power Cord: Non-Shielded, Undetached, 1.8m, Bonded a ferrite core AC Power Cord: Non-Shielded, Detached, 1.0m (3C)		

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

3.5.2. For the All Component Lists

SKU #1	
Main Board	LG, 14/15Z980 Main B/D PCB(with Thunderbolt)
SUB Board	LG, 15Z980 WLAN SUB B/D/(with Finger Printer)
CPU	Intel, i7-8550U
15.6" LCD Panel	LG Display, LP156WFA(SP)(G1)/(AIT Including touch)
Storage (SSD)	SK hynix, 512GB*2
Memory (RAM) (On Board)	SK hynix, 16GB
Memory (RAM)	SK hynix, 8G
Battery Pack	LG, LBS1224E
WLAN Combo Card	Intel, 8265D2W
WLAN Combo Antenna	LG (INPAQ), WA-F-LBLB-04-056
Keyboard	LG, SN3870
Web Camera	Lite-On, 7BF109N2
Finger Print	SUNTEL, SFPC-L0016B(Black)
LAN Gender (Type C to LAN)	LG, 80-5946-111 (White)
AC Adapter	LG (Lite-on), PA-1650-43

3.6. Data Rate Relative to Output Power

802.11a				802.11n-HT20			
Channel	Modulation	Date Rate	Power (dBm)	Channel	Modulation	Date Rate	Power (dBm)
36	BPSK	6	16.87	36	BPSK	HT MCS8	19.27
36	QPSK	9	16.71	36	QPSK	HT MCS9	19.13
36	QPSK	12	16.58	36	QPSK	HT MCS10	18.98
36	16-QAM	18	16.41	36	16-QAM	HT MCS11	18.82
36	16-QAM	24	16.28	36	16-QAM	HT MCS12	18.69
36	64-QAM	36	16.11	36	64-QAM	HT MCS13	18.53
36	64-QAM	48	16.03	36	64-QAM	HT MCS14	18.40
36	64-QAM	54	15.92	36	64-QAM	HT MCS15	18.31

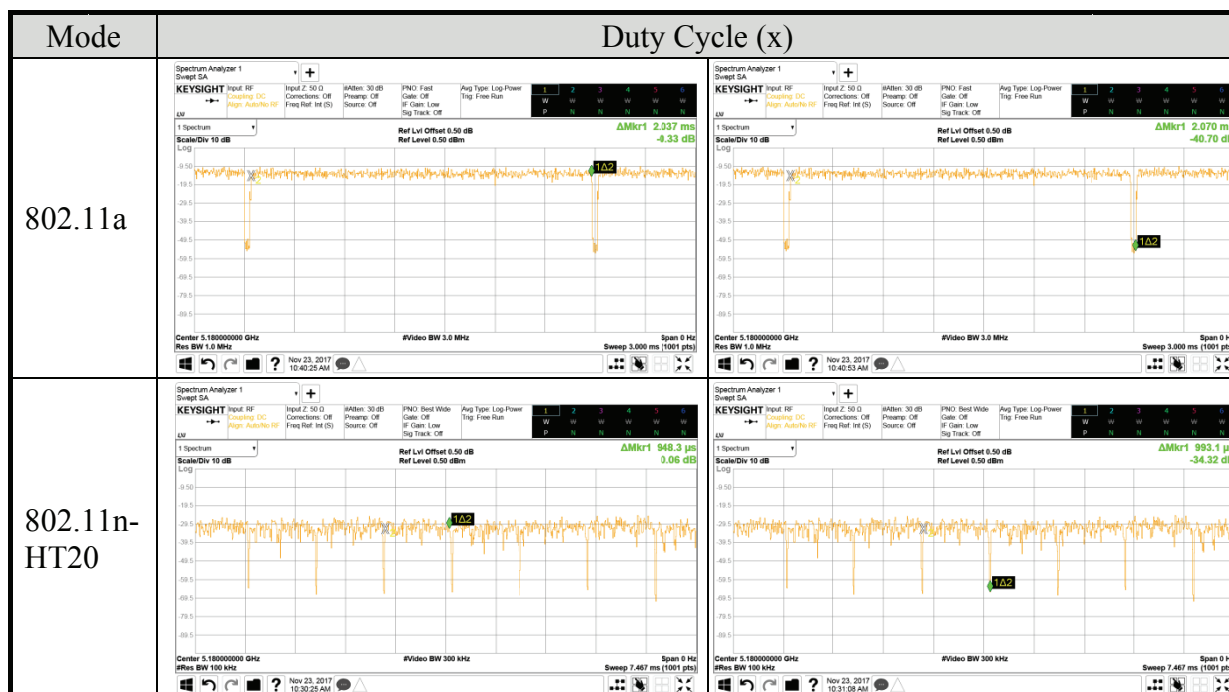
802.11n-HT40				802.11ac-VHT80			
Channel	Modulation	Date Rate	Power (dBm)	Channel	Modulation	Date Rate	Power (dBm)
38	BPSK	HT MCS8	15.43	42	BPSK	VHT MCS0	13.90
38	QPSK	HT MCS9	15.28	42	QPSK	VHT MCS1	13.74
38	QPSK	HT MCS10	15.10	42	QPSK	VHT MCS2	13.61
38	16-QAM	HT MCS11	14.98	42	16-QAM	VHT MCS3	13.49
38	16-QAM	HT MCS12	14.84	42	16-QAM	VHT MCS4	13.32
38	64-QAM	HT MCS13	14.72	42	64-QAM	VHT MCS5	13.18
38	64-QAM	HT MCS14	14.58	42	64-QAM	VHT MCS6	13.04
38	64-QAM	HT MCS15	15.43	42	64-QAM	VHT MCS7	13.90
				42	256-QAM	VHT MCS8	13.75
				42	256-QAM	VHT MCS9	13.52

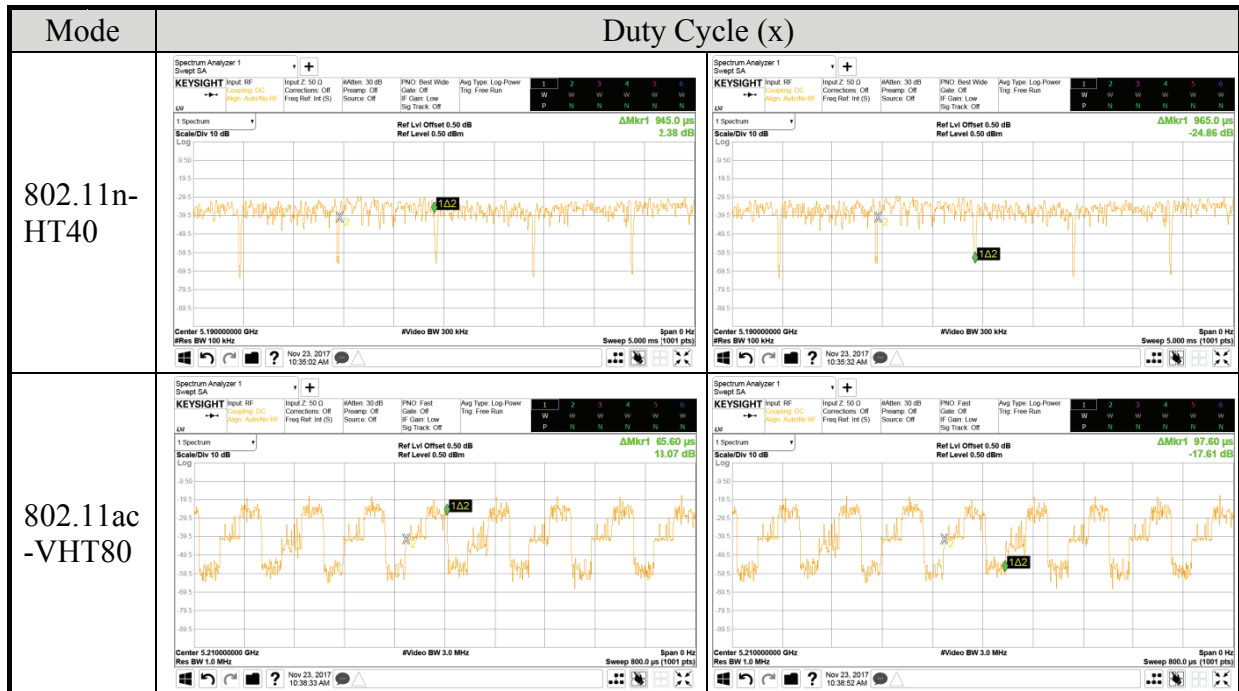
Note: Above results are assessed in average power.

3.7. Test Configuration

Mode	Duty Cycle (x)	T (ms)	Duty Cycle Factor (dB)
802.11a	1.00	2.037	0
802.11n-HT20	0.95	0.9483	0.22
802.11n-HT40	0.97	0.9450	0.13
802.11ac-VHT80	0.67	0.0656	1.74

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





AC Conduction	
Test Case	Normal operation

Item	Mode	Data Rate	Test Channel
Radiated Test Case	Radiated Band Edge ^{Note1}	802.11a	36/64/100/140
		802.11n-HT20	MCS8
		802.11n-HT40	MCS8
		802.11ac-VHT80	MCS8
	Radiated Spurious Emission ^{Note1 & 2}	802.11a	40/52/116/140/157
		802.11n-HT20	MCS8
		802.11n-HT40	MCS8
		802.11ac-VHT80	MCS8
Conducted Test Case	Emission Bandwidth	802.11a	36/40/48/52/60/64/100/116/140/149/157/165
		802.11n-HT20	MCS8
		802.11n-HT40	MCS8
		802.11ac-VHT80	MCS8

Item		Mode	Data Rate	Test Channel
Conducted Test Case	Maximum output power	802.11a	6 Mbps	36/40/48/52/60/64/100/116/140/149/157/165
		802.11n-HT20	MCS8	36/40/48/52/60/64/100/116/140/149/157/165
		802.11n-HT40	MCS8	38/46/54/62/102/110/134/142/151/159
		802.11ac-VHT80	MCS8	42/58/106/122/138/155
	Emission Limitations	802.11a	6 Mbps	36/40/48/52/60/64/100/116/140/149/157/165
		802.11n-HT20	MCS8	36/40/48/52/60/64/100/116/140/149/157/165
		802.11n-HT40	MCS8	38/46/54/62/102/110/134/142/151/159
		802.11ac-VHT80	MCS8	42/58/106/122/138/155
	Power spectral density	802.11a	6 Mbps	36/40/48/52/60/64/100/116/140/149/157/165
		802.11n-HT20	MCS8	36/40/48/52/60/64/100/116/140/149/157/165
		802.11n-HT40	MCS8	38/46/54/62/102/110/134/142/151/159
		802.11ac-VHT80	MCS8	42/58/106/122/138/155

Note 1:

☒ Mobile Device

☐ Portable Device, and 3 axis were assessed.

☐ Lie

☐ Side

☐ Stand

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

3.8. Tested Supporting System List

3.8.1. Support Peripheral Unit

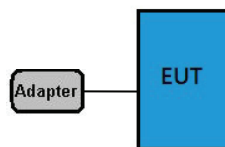
No.	Product	Brand	Model No.	Serial No.	Approval
1.	LCD Monitor	ASUS	VE228	N/A	FCC By DoC
2.	USB Mouse	Lenovo	45J4886	N/A	FCC By DoC
3.	Earphone	APPLE	N/A	N/A	FCC By DoC

3.8.2. Cable Lists

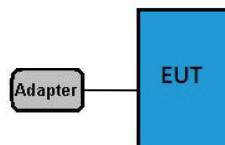
No.	Cable Description Of The Above Support Units
1.	HDMI Cable: Shielded, Detachable, 1.8m AC Power Cord: Unshielded, Detachable, 1.8m
2.	USB Cable: Unshielded, Undetachable, 1.8m
3.	Earphone Cable: Unshielded, Undetachable, 2.0m

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.

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 17025:2005 (1) NVLAP(USA) NVLAP Lab Code 200077-0 (2) TAF(Taiwan) No. 1724 (3) FCC OET Designation No. TW1004 & TW1090 & TW1724
Test Facilities	(1) No. 7 Shielding Room (2) Semi-Anechoic Chamber (IC Test Site Registration No.: 5183B-1) (3) Fully Anechoic Chamber (IC Test Site Registration No.: 5183B-4)

3.12. Measurement Uncertainty

Test Item	Frequency Range	Uncertainty
Conduction Test	150kHz~30MHz	±3.50dB
Radiation Test (Distance: 3m)	30MHz~1000MHz	± 3.68dB
	Above 1GHz	± 5.82dB

Remark : Uncertainty = $ku_c(y)$

Test Item	Uncertainty
Emission Bandwidth	± 0.2kHz
Maximum output power	± 0.33dB
Power spectral density	± 0.13dB
Conducted Emission Limitations	± 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	ESCI	101276	2017. 03. 23	1 Year
2.	A.M.N.	R&S	ESH2-Z5	100366	2017. 07. 20	1 Year
3.	L.I.S.N.	Kyoritsu	KNW-407	8-881-13	2016. 12. 28	1 Year
4.	Pulse Limiter	R&S	ESH3-Z2	101495	2017. 01. 16	1 Year
5.	Test Software	Audix	e3	V.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	Agilent	N9010A-526	MY53400071	2017. 09. 13	1 Year
2.	Spectrum Analyzer	Agilent	N9010A-526	MY52220368	2016. 12. 01	1 Year
3.	Test Receiver	R & S	ESCS30	100338	2017. 06. 19	1 Year
4.	Amplifier	HP	8447D	2944A06305	2017. 02. 16	1 Year
5.	Amplifier	Sonoma	310N	187161	2017. 06. 08	1 Year
6.	Bilog Antenna	CHASE	CBL6112D	33821	2017. 01. 21	1 Year
7.	Loop Antenna	R&S	HFH2-Z2	891847/27	2016. 12. 23	1 Year
8.	Double-Ridged Waveguide Horn	ETS-Lindgren	3117	00135902	2017. 03. 08	1 Year
10.	5G Notch Filter	Microwave Circuits	N0452502	459775	2016. 12. 28	1 Year
11.	5G Notch Filter	Microwave Circuits	N0555983	459481	2017. 05. 05	1 Year
12.	5G Notch Filter	Microwave Circuits	N0257881	459776	2017. 02. 03	1 Year
13.	Test Software	Audix	e3	V.6.110601	N.C.R.	N.C.R.

4.3. RF Conducted Measurement

Item	Type	Manufacturer	Model No.	Serial No.	Cal. Date	Cal. Due
1.	Spectrum Analyzer	Keysight	N9010B-544	MY55460198	2017. 04. 18	1 Year
2.	Power Meter	Anritsu	ML2495A	1145008	2017. 11. 03	1 Year
3.	Power Sensor	Anritsu	MA2411B	1126096	2017. 11. 03	1 Year

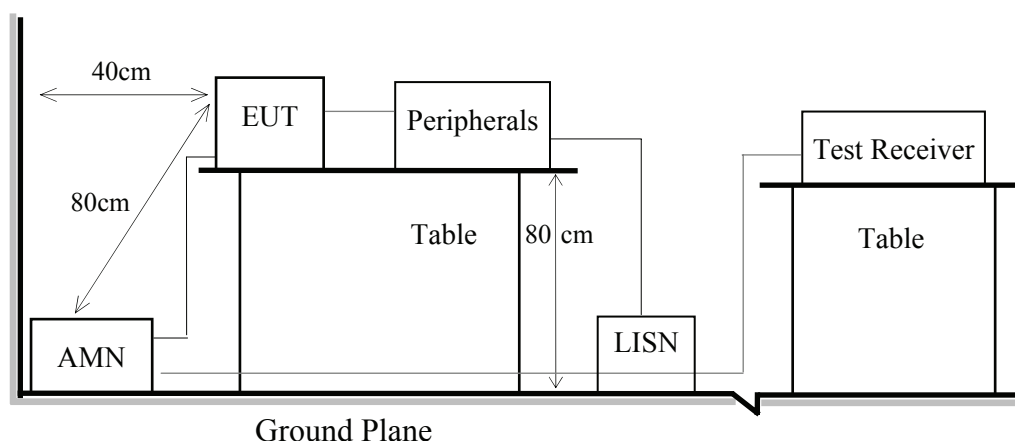
5. CONDUCTED EMISSION

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

Remark 1.: 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 C 63.10. 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 150 kHz to 30 MHz and record the emission which does not have 20 dB below limit.

5.4. Test Results

Please refer to Appendix A.

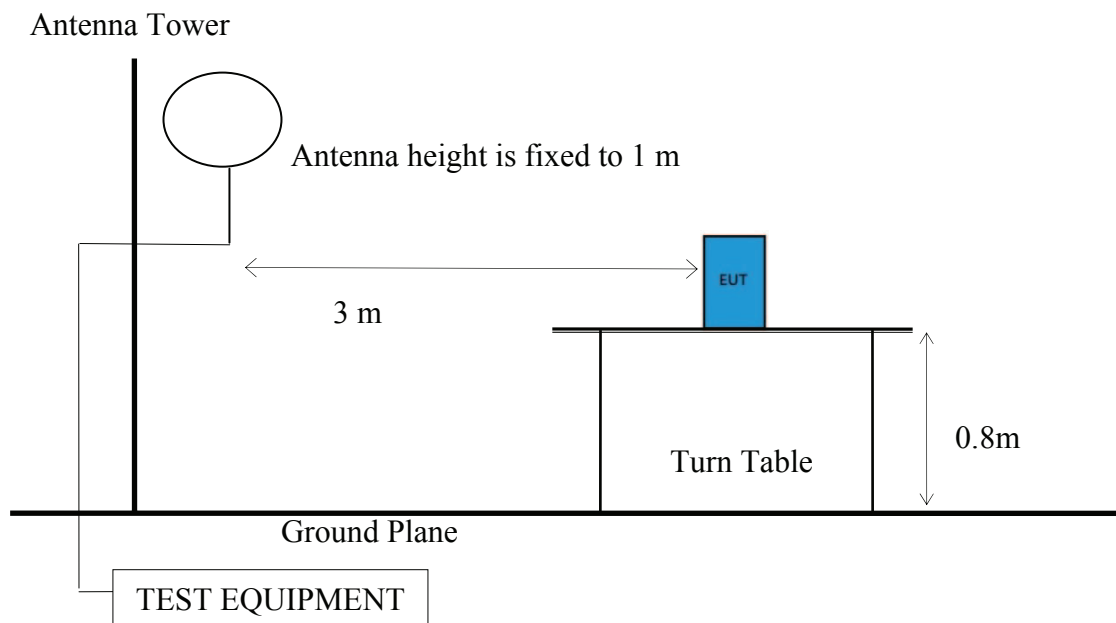
6. RADIATED EMISSION

6.1. Block Diagram of Test Setup

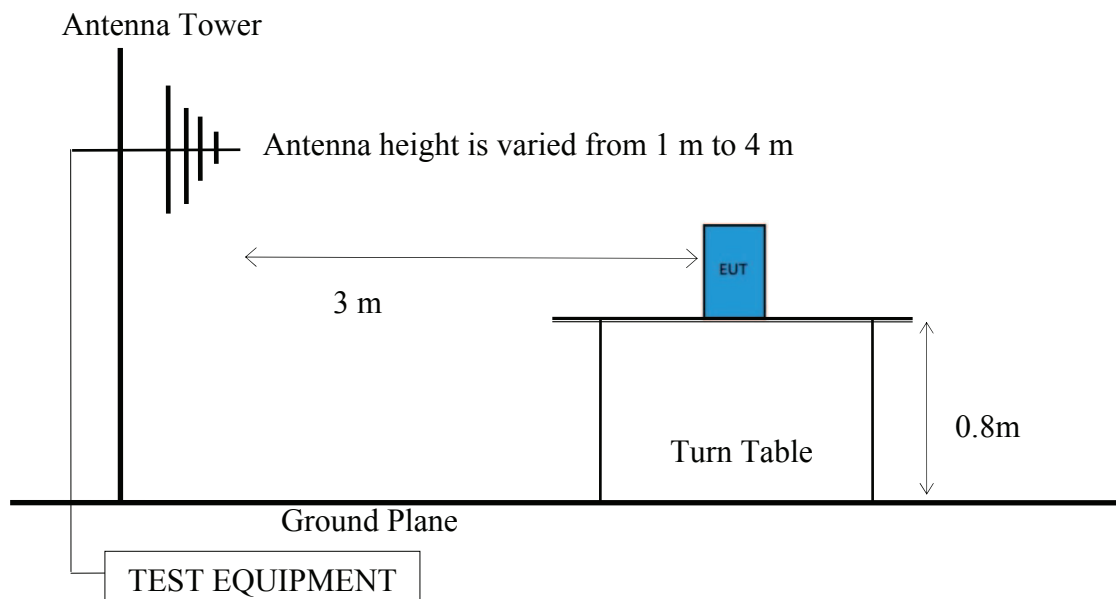
6.1.1. Block Diagram of EUT

Indicated as section 3.9

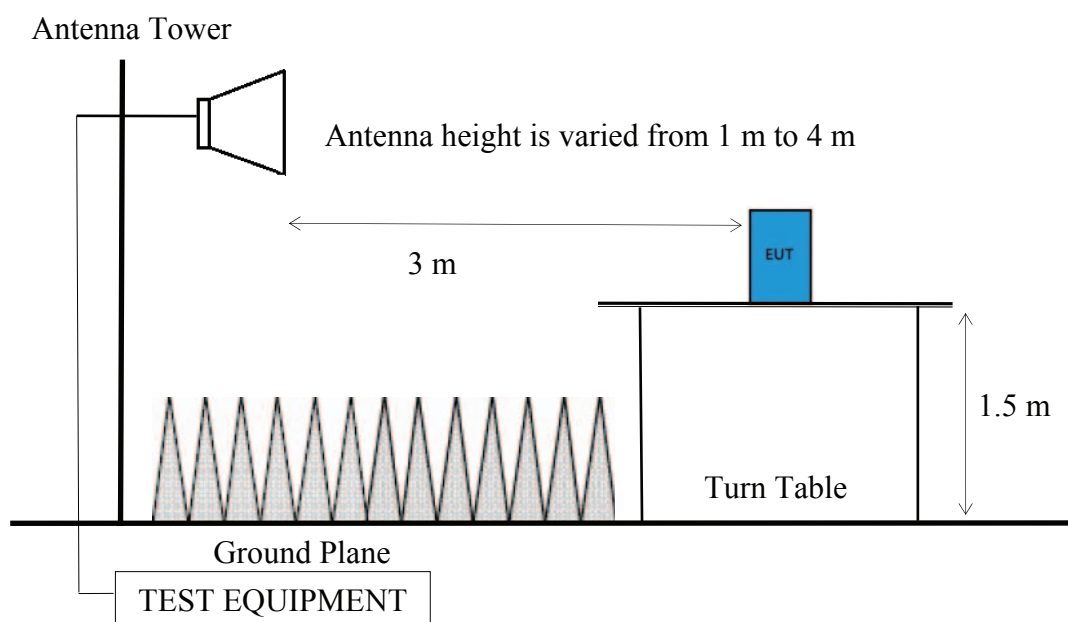
6.1.2. Setup Diagram for 9kHz-30MHz



6.1.3. Setup Diagram for 30-1000 MHz



6.1.4. Setup Diagram for above 1GHz



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	2400/kHz
0.490 - 1.705	30	87.6	24000/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)

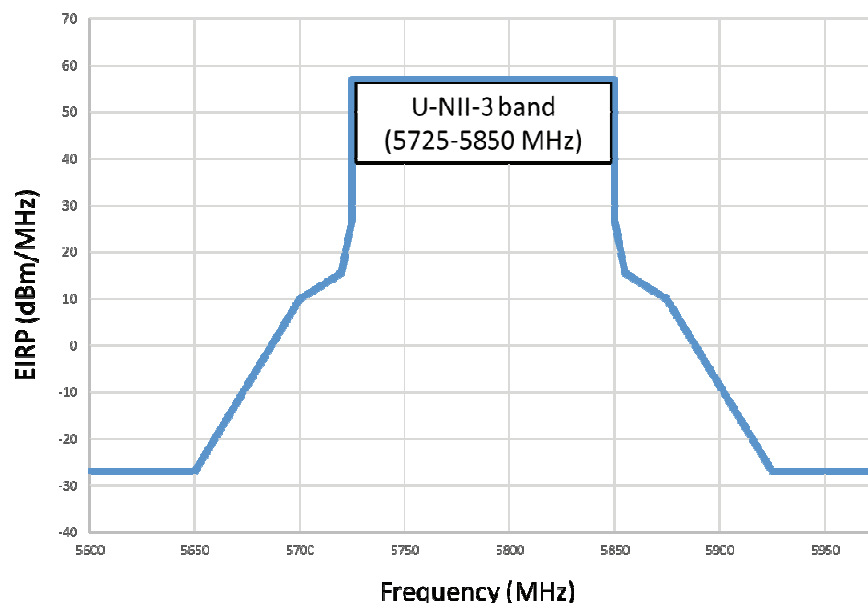
- (2) The tighter limit applies to the edge between two frequency bands.
- (3) Distance refers to the distance in meters between the measuring instrument antenna and the closed point of any part of the device or system.
- (4) Fundamental and emission fall within operation band are exempted from this 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 105.2 dBμV/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 turn table 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 find table which has 80 cm (for 30-1000 MHz) 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 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 1 GHz:

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.
- (7) When peak-detected value is lower than limit that the measurement using the Q.P. detector is not required. Otherwise using Q.P. for finally measurement.

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.
- (7) When peak-detected value is lower than limit that the measurement using the average detector is not required. Otherwise using average detector for finally 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	2.037	0.491	10Hz
802.11n-HT20	0.9483	1.055	1kHz
802.11n-HT40	0.9450	1.058	2kHz
802.11ac-VHT80	0.0656	1.524	15kHz

N/A: 1/ T is not implemented when duty cycle presented in section 3.7 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:**

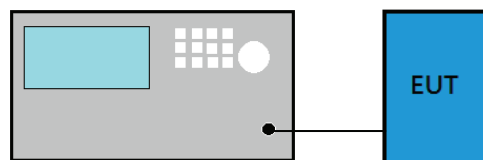
Average Emission Level = Peak Emission Level + D.C.C.F.

6.4. Measurement Result Explanation☒ Peak Emission Level = Antenna Factor + Cable Loss + Meter Reading☒ Average Emission Level = Antenna Factor + Cable Loss + Meter Reading☐ Average Emission Level = Peak Emission Level + DCCFDuty Cycle Correction Factor (DCCF) = $20\log(TX_{on}/TX_{on+off})$ presented in section 3.7☐ ERP = Peak Emission Level - 95.2dB - 2.14dB**6.5. Test Results**

Please refer to Appendix A.

7. EMISSION 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 v01r04:

■ 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

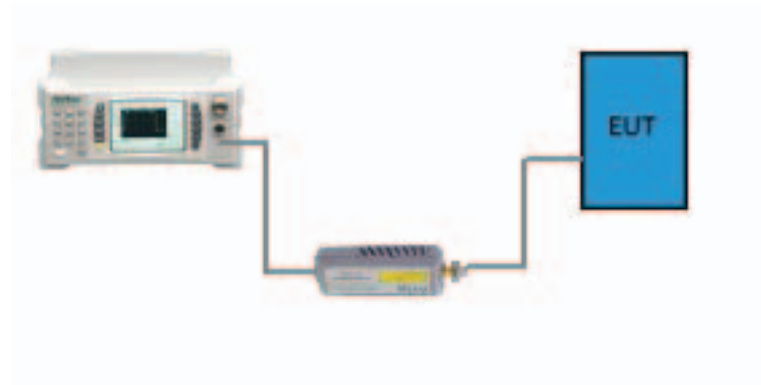
- (1) Set RBW = 100 kHz.
- (2) Set the video bandwidth (VBW) $\geq 3 \times \text{RBW}$.
- (3) Detector = Peak.
- (4) Trace mode = max hold.
- (5) Sweep = auto couple.
- (6) Allow the trace to stabilize.
- (7) Setting channel bandwidth function x dB to -6 dB to record the final bandwidth.

7.4. Test Results

Please refer to Appendix A

8. MAXIMUM OUTPUT POWER

8.1. Block Diagram of Test Setup



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 $11 \text{ dBm} + 10 \log B^{\text{Note1}}$
5470 to 5725		250 mW or $11 \text{ dBm} + 10 \log B^{\text{Note1}}$
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 v01r04:

☒ **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)**

- (1) Set span to at least 1.5 times the OBW
- (2) Set RBW = 1 MHz

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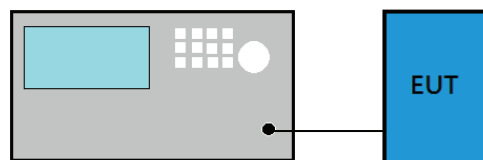
-
- (3) Set the video bandwidth (VBW) ≥ 3 MHz.
 - (4) Detector = RMS.
 - (5) Trace mode = trace average at least 100 traces
 - (6) Sweep = auto couple.
 - (7) Compute power by integrating the spectrum across the OBW of the signal using the instrument's band power measurement function with band limits 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

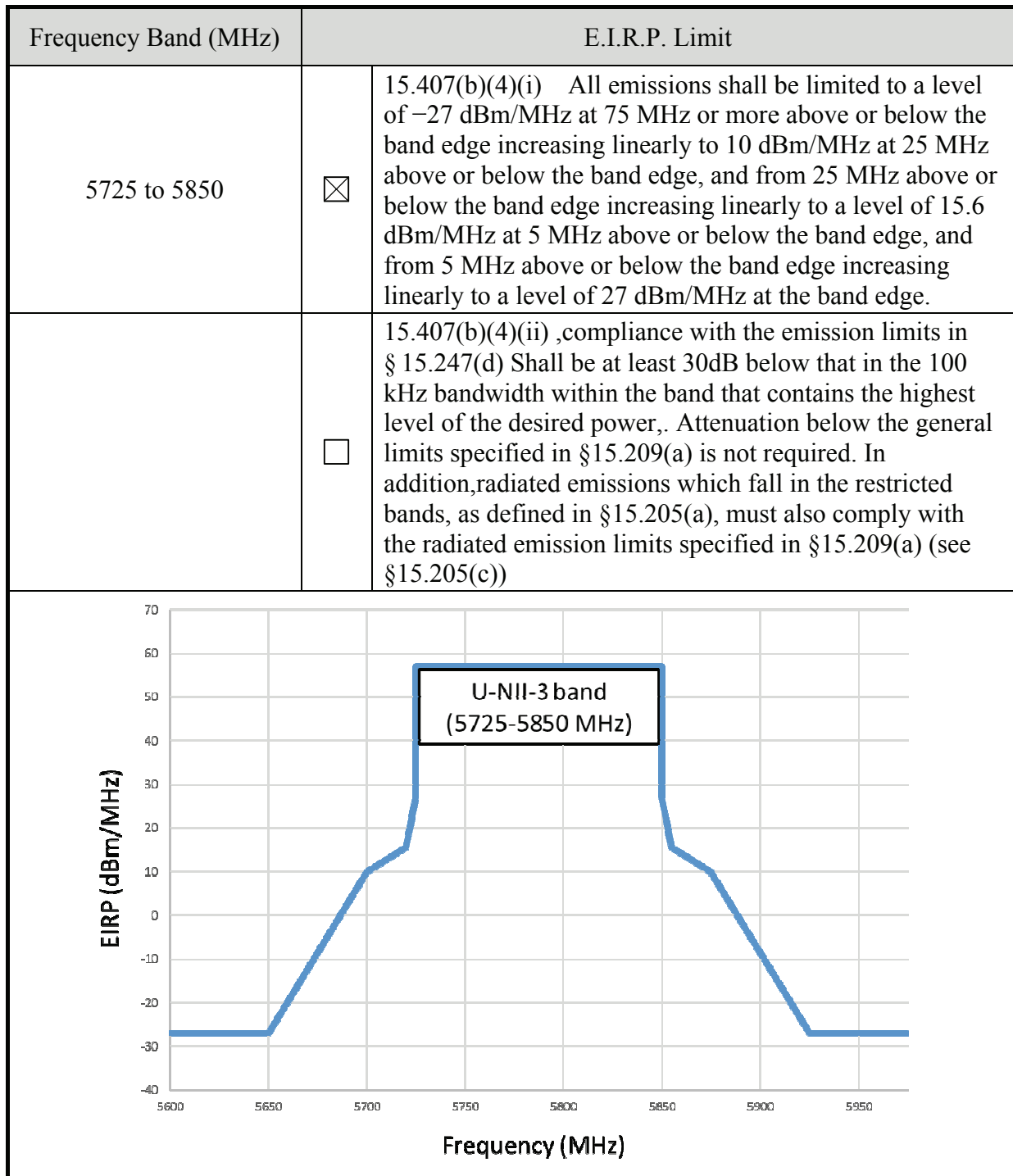
9. EMISSION LIMITATIONS MEASUREMENT

9.1. Block Diagram of Test Setup



9.2. Specification Limits

Frequency Band (MHz)	E.I.R.P. Limit
5150 to 5250	-27 dBm
5250 to 5350	
5470 to 5725	



9.3. Test Procedure

Following measurement procedure is reference to KDB 789033 D02 General UNII Test Procedures New Rules v01r04:

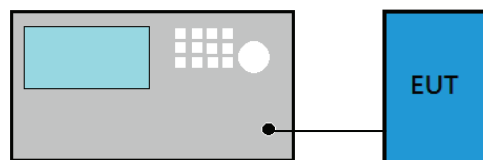
- (1) RBW = 1 MHz
- (2) VBW $\geq 3 \times$ RBW
- (3) Detector = Peak
- (4) Sweep time = auto
- (5) Trace mode = max hold
- (6) Allow sweeps to continue until the trace stabilizes.

9.4. Test Results

Please refer to Appendix A

10. POWER SPECTRAL DENSITY

10.1. Block Diagram of Test Setup



10.2. Specification Limits

Frequency Band (MHz)	Category	Limit
5150 to 5250	Outdoor Access Point	17dBm
	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

10.3. Test Procedure

Following measurement procedure is reference to KDB 789033 D02 General UNII Test Procedures New Rules v01r04:

■ Method AVGSA-2 (Spectrum channel power)

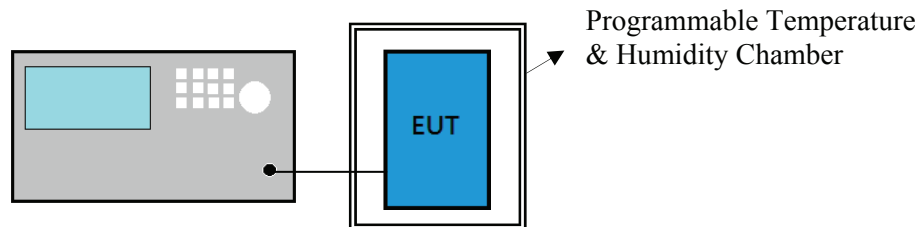
- (1) Set span to at least 1.5 times the OBW
- (2) Set RBW = 1 MHz
- (3) Set the video bandwidth (VBW) ≥ 3 MHz.
- (4) Detector = RMS.
- (5) Trace mode = trace average at least 100 traces
- (6) Sweep = auto couple.
- (7) Use peak search function to find out the maximum power density.
- (8) Duty cycle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

10.4. Test Results

Please refer to Appendix A

11. FREQUENCY STABILITY

11.1. Block Diagram of Test Setup



11.2. Specification Limits

NONE

11.3. 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)

11.4. Test Results

Please refer to Appendix A

12.DEVIATION TO TEST SPECIFICATIONS

【NONE】



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APPENDIX A

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APPDNDIX A

TEST DATA AND PLOTS

(Model: 15Z980)



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APPENDIX B

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APPDNDIX B

TEST PHOTOGRAPHS

(Model: 15Z980)