Audix Technology Corp.
No. 53-11, Dingfu, Linkou, Dist.,
New Taipei City244,Taiwan

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FCC 15.247& RSS-247
2.4GHz Test Report

for

LG Electronics Inc.

222, LG-roJinwi-myeon, Pyeongtaek-Si, Gyeonggi-Do, 451-713, Korea

Product Name	**:**	**Notebook Computer**
Model Name	**:**	**(1)14Z90N (2)14ZB90N (3)14ZD90N (4)14ZG90N (5)14ZC90N**
Brand		**LG**
FCC ID	**:**	**BEJNT-14Z90N**
IC	**:**	**2703H-14Z90N**

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

Testing Laboratory
1724

TESTING
NVLAP LAB CODE 200077-0

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. The report must not be used by the client to claim product certification, approval, or endorsement by NVLAP, NIST, or any agency of the U.S. Government.

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TEST REPORT CERTIFICATION

Applicant	:	LG Electronics Inc.
Manufacturer	:	LG Electronics Inc.
Factory #1	:	LG Electronics Nanjing New Technology Co., Ltd.
Factory #2	:	SEO HEUNG ELECTRONICS CO LTD
EUT Description		
(1) Product	:	Notebook Computer
(2) Model	:	(1)14Z90N (2)14ZB90N (3)14ZD90N (4)14ZG90N (5)14ZC90N
(3) Brand	:	LG
(4) Power Supply	:	DC 19V, 2.53A

Applicable Standards:

47CFRFCC Part 15 Subpart C
RSS-Gen (Issue 5), April2018
RSS-247 (Issue 2), February 2017
ANSI C63.10:2013

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: 2019. 10. 23

Reviewed by: Sabrina Wang (Sabrina Wang/Administrator)

Approved by: Johnny Hsueh (Johnny Hsueh/Section Manager)

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1. REVISION RECORD OF TEST REPORT

Edition No	Issued Date	Revision Summary	Report Number
0	2019. 10. 23	Original Report	EM-F190363

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2. SUMMARY OF TEST RESULTS

Rule		Description	Data Reused	Results
FCC	IC			
15.207	RSS-Gen §8.8	Conducted Emission	No	**PASS**
15.247(d)/ 15.205	RSS-Gen §8.9 RSS-247 §5.5	Radiated Band Edge and Radiated Spurious Emission	No	**PASS**
15.247(a)(2)	RSS-247 §5.2(1)	6dB/Occupied Bandwidth	Yes	**PASS**
15.247(b)(3)	RSS-247 §5.4(4)	Maximum Peak Output Power	SPOT CHECK Note 2	**PASS**
15.247(d)	RSS-247 §5.5	Conducted Band Edges and Conducted Spurious Emission	Yes	**PASS**
15.247 (e)	RSS-247 §5.2(2)	Peak Power Spectral Density	Yes	**PASS**
15.203	RSS-Gen §8.3	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, IC: 2703H-15Z90N.According to KDB 484596 D01, we did spot check for output power and all output power values keep identical thus we reuse all results except to E.I.R.P. test items.

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3. GENERAL INFORMATION

3.1. Description of Application

Applicant	LG Electronics Inc. 222, LG-roJinwi-myeon, Pyeongtaek-Si, Gyeonggi-Do, 451-713, Korea
Manufacturer	LG Electronics Inc. 222, LG-roJinwi-myeon, Pyeongtaek-Si, Gyeonggi-Do, 451-713, Korea
Factory #1	LG Electronics Nanjing New Technology Co., Ltd. No.346,Yaoxin Road, Economic & Technical Development Zone, Nanjing, China.
Factory #2	SEO HEUNG ELECTRONICS CO LTD 55 Asan valley Seo-ro, Dunpo-myeon,Asan-si, Chungcheongnam-do, 31409 Korea
Product	Notebook Computer The product has two colors (Dark Silver and White).
Model	(1)14Z90N (2)14ZB90N (3)14ZD90N (4)14ZG90N (5)14ZC90N The difference between all models is different in the sales customers.
Brand	LG

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3.2. Description of EUT

<table>
<tr><td>Test Model</td><td>14Z90N</td></tr>
<tr><td>Serial Number</td><td>N/A</td></tr>
<tr><td>Power Rating</td><td>DC 19V, 2.53A</td></tr>
<tr><td>Software Version</td><td>N/A</td></tr>
<tr><td>RF Features</td><td>WLAN:802.11 a/b/g/n/ac/ax
Bluetooth: BT and BLE (BT 5.0)</td></tr>
<tr><td>Transmit Type</td><td>
<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>802.11ax-HE20</td><td>2T2R</td></tr>
<tr><td>802.11ax-HE40</td><td>2T2R</td></tr>
<tr><td>BT/BLE</td><td>1T1R</td></tr>
</table>
<table>
<tr><th colspan="2">UNII Bands</th></tr>
<tr><td>802.11a</td><td>1T1R</td></tr>
<tr><td>802.11n-HT20/802.11ac-VHT20/802.11ax-HE20</td><td>2T2R</td></tr>
<tr><td>802.11n-HT40/802.11ac-VHT40/802.11ax-HE40</td><td>2T2R</td></tr>
<tr><td>802.11ac-VHT80/802.11ax-HE80</td><td>2T2R</td></tr>
<tr><td>802.11ac-VHT160/802.11ax-HE160</td><td>2T2R</td></tr>
</table>
</td></tr>
<tr><td>Sample Status</td><td>Mass production</td></tr>
<tr><td>Date of Receipt</td><td>2019. 09. 16</td></tr>
<tr><td>Date of Test</td><td>2019. 09. 18 ~ 10. 02</td></tr>
<tr><td>Interface Ports of EUT</td><td>• One Micro SD Card Slot
• One Earphone Port
• Two USB 3.0 Ports
• One USB Type C Port
• One HDMI Port
• One DC Input Port</td></tr>
<tr><td>Accessories Supplied</td><td>• AC Adapter
• LAN Gender</td></tr>
</table>

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3.3. Antenna Information

2.4G Antenna					
No.	Antenna Part Number	Manufacture	Antenna Type	Frequency (MHz)	Max Gain (dBi)
1.	WA-P-LBLB-04-069 (Main)	INPAQ	Mono-pole	2400	3.28
				2410	2.63
				2420	2.69
				2430	2.74
				2440	2.96
				2450	3.36
				2460	3.70
				2470	4.12
				2480	**4.29**
				2490	4.28
				2500	4.26
2.	WA-P-LBLB-04-069 (AUX)	INPAQ	Mono-pole	2400	4.52
				2410	3.99
				2420	4.14
				2430	4.55
				2440	4.78
				2450	5.06
				2460	5.23
				2470	**5.32**
				2480	5.13
				2490	4.87
				2500	4.70
3.	L1LRF002-CS-H (Main)	LUXSHARE-ICT	Mono-pole	2400	4.9
				2450	**4.9**
				2500	3.9
4.	L1LRF002-CS-H (AUX)	LUXSHARE-ICT	Mono-pole	2400	3.9
				2450	**4.2**
				2500	4.0

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5G Antenna					
No.	Antenna Part Number	Manufacture	Antenna Type	Frequency (MHz)	Max Gain (dBi)
1.	WA-P-LBLB-04-069 (Main)	INPAQ	Mono-pole	5100	2.48
				5150	2.17
				5200	1.71
				5250	2.69
				5300	3.06
				5350	4.42
				5400	3.73
				5450	3.84
				5500	3.73
				5550	3.17
				5600	3.06
				5650	3.96
				5700	3.69
				5750	4.77
				5800	**4.86**
2.	WA-P-LBLB-04-069 (AUX)	INPAQ	Mono-pole	5100	4.89
				5150	**5.28**
				5200	4.96
				5250	4.08
				5300	3.88
				5350	4.04
				5400	3.69
				5450	3.68
				5500	4.12
				5550	4.59
				5600	4.18
				5650	3.30
				5700	2.56
				5750	1.65
				5800	1.31

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5G Antenna					
No.	Antenna Part Number	Manufacture	Antenna Type	Frequency (MHz)	Max Gain (dBi)
3.	L1LRF002-CS-H (Main)	LUXSHARE-ICT	Mono-pole	5150	**4.1**
				5250	3.3
				5350	3.8
				5470	3.0
				5600	3.2
				5725	3.6
				5785	3.1
				5800	3.9
				5850	3.8
4.	L1LRF002-CS-H (AUX)	LUXSHARE-ICT	Mono-pole	5150	3.6
				5250	2.9
				5350	3.4
				5470	3.2
				5600	3.4
				5725	**3.7**
				5785	3.0
				5800	3.4
				5850	2.7

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3.4. EUT Specifications Assessed in Current Report

Mode	Fundamental Range (MHz)	Channel Number	Modulation	Data Rate (Mbps)
802.11b	2412-2472	13	DSSS (DBPSK/DQPSK/CCK)	Up to 11
802.11g		13	OFDM (BPSK/QPSK/16QAM/64QAM)	Up to 54
802.11n-HT20				Up to 144.4
802.11n-HT40	2422-2462	9	OFDM (BPSK/QPSK/16QAM/64QAM)	Up to 300
802.11ax-HE20	2412-2472	13	OFDMA (BPSK/ QPSK/ 16QAM/ 64QAM/ 256QAM/1024QAM)	Up to 144.4
802.11ax-HE40	2422-2462	9		Up to 300
BLE	2402-2480	40	GFSK (1M, 2M, PHY Coded S8, PHY Coded S2)	2

Channel List			
802.11 b/g/n-HT20/ax-HE20		802.11n-HT40/ax-HE40	
Channel Number	Frequency (MHz)	Channel Number	Frequency (MHz)
1	2412	3	2422
2	2417	4	2427
3	2422	5	2432
4	2427	6	2437
5	2432	7	2442
6	2437	8	2447
7	2442	9	2452
8	2447	10	2457
9	2452	11	2462
10	2457	---	
11	2462		
12	2467		
13	2472		

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Channel List							
BLE							
Channel Number	Frequency (MHz)	Channel Number	Frequency (MHz)	Channel Number	Frequency (MHz)	Channel Number	Frequency (MHz)
37	2402	09	2422	18	2442	28	2462
00	2404	10	2424	19	2444	29	2464
01	2406	38	2426	20	2446	30	2466
02	2408	11	2428	21	2448	31	2468
03	2410	12	2430	22	2450	32	2470
04	2412	13	2432	23	2452	33	2472
05	2414	14	2434	24	2454	34	2474
06	2416	15	2436	25	2456	35	2476
07	2418	16	2438	26	2458	36	2478
08	2420	17	2440	27	2460	39	2480

RMS Output Power (dBm)						
Channel	802.11b	802.11g	802.11n-HT20	802.11ax-HE20	802.11n-HT40	802.11ax-HE40
1	19.35	16.91	17.13	17.03	---	---
2	19.96	17.94	18.43	18.26		
3	20.01	18.02	18.38	18.28	16.83	16.69
4	19.98	17.99	18.41	18.31	15.78	15.56
5	19.99	17.92	18.43	18.34	15.83	15.64
6	20.1	18.06	18.48	18.35	15.74	15.52
7	20.04	19.74	20.15	20.05	17.63	17.46
8	20.00	18.24	18.68	18.54	17.77	17.58
9	19.98	18.18	18.64	18.52	16.19	15.99
10	20.02	18.21	18.60	18.49	12.49	12.27
11	19.08	17.47	17.74	17.64	4.01	3.63
12	18.18	14.79	14.91	14.80	---	---
13	13.08	1.52	2.58	2.5		

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3.5. Descriptions 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	1XZ90N MAIN B/D PCB	Manufacturer: #1 Hannstar Board Tech (Jiang Yin) Corp., Ltd. #2 Elec & Eltek Company (MCO) Limited.
WLAN SUB Board	LG	14Z90N WLAN SUB B/D	Manufacturer: #1 Hannstar Board Tech (Jiang Yin) Corp., Ltd. #2 Elec & Eltek Company (MCO) Limited.
CPU (Socket: FCBGA1526)	Intel	i7-1065G7	1.3GHz, up to 3.9GHz
	Intel	i5-1035G7	1.2GHz, up to 3.7GHz
14” LCD Panel	LG Display	LP140WFA-SPY1	Resolution: 1920X1080, 60Hz FHD IPS (Normal Non touch)
Storage (SSD) (Max. 2 pcs)	Samsung	MZ-VLB5120 (P/N MZVLB512HAJQ-00000)	512GB (M.2)
		MZ-VLB2560 (P/N MZVLB256HAHQ-00000)	256GB (M.2)
Memory (RAM)	Samsung	---	8GB DDR4 3200MHz SODIMM (on Card)
	SK Hynix	---	8GB DDR4 3200MHz SODIMM (on Card)
	Samsung	---	8GB DDR4 (On Board)
Battery Pack	LG	LBS1224E	DC 7.7V, 72Wh, Typ 9450mAh
WLAN Combo Card	Intel	AX201D2W	WLAN and BT, 2x2 CNVi1216 FCC ID: PD9AX201NG IC: 1000M-AX201NG NCC ID: CCAH18LP3410T5
WLAN Combo Antenna	LG (INPAQ)	WA-P-LBLB-04-069	PCB, Mono-pole Type Main: Black, Aux: Gray
	LG (LUXSHARE-ICT)	L1LRF002-CS-H	PCB, Mono-pole Type Main: Black, Aux: Gray
Keyboard	TIC	KT01-18B8	P/N: KT01-18B8BS03USRA000 (White KBD)
		KT01-18B8	P/N: KT01-18B8AS03USRA000 (Black KBD)
	LITE ON	SN3871BL	P/N: SG-91030-XUA (White KBD)
		SN3871BL	P/N: SG-91020-XUA (Black KBD)
Web Camera	Chicony	CKFIH2821005290LH	With two microphones
		CKFIH28-121005290LH	With one microphone
	Luxvisions	7BF109N2DC	With two microphones
		7BF109N2C	With one microphone

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Item	Supplier	Model / Type	Character
LAN Gender (Type C to LAN)	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		
	SUZHOU MEC ELECTRONICS	80-5946-111	(White) 10/100Megabit 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) 10/100Megabit Ethernet
		GD-08MF-36-BK-LP11	(Black) 10/100 Megabit Ethernet
	Type C to LAN: Shielded, Undetached, 0.12m		
AC Adapter (48W)	LG (HONOR)	ADS-48MS-19-2 19048E	I/P: AC 100-240V, 50-60Hz, 1.5A, O/P: DC 19V, 2.53A
	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			#1	#2
Main Board		LG, 1XZ90N Main B/D PCB	V	V
SUB Board		LG, 14Z90N WLAN SUB B/D	V	V
CPU		i7-1065G7	V	
		i5-1035G7		V
14" LCD Panel		LG Display, LP140WFA-SPY1	V	V
Storage (SSD) (Max. 2 pcs)		Samsung, 512GB NVMe	V	V
		Samsung, 512GB NVMe	V	V
Memory (RAM)		SK Hynix, 8GB (On Card)	V	V
		Samsung, 8GB (On Board)	V	V
Battery Pack		LG, LBS1224E	V	V
WLAN Combo Card		Intel, AX201D2W	V	V
WLAN Combo Antenna		LG (INPAQ), WA-P-LBLB-04-069	V	
		LG (LUXSHARE-ICT), L1LRF002-CS-H		V
Keyboard		TIC, KT01-18B8 (White)	V	V
Web Camera		Chicony, CKFIH2821005290LH	V	V
AC Adapter		LG (HONOR), ADS-48MS-19-2 19048E	V	V
Type C	Link to LAN Gender	SUZHOU MEC ELECTRONICS, 80-5946-200 (White)	V	V

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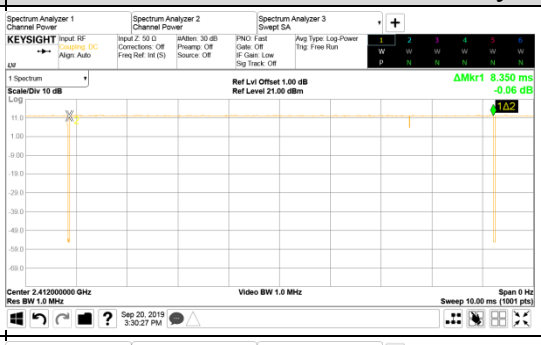
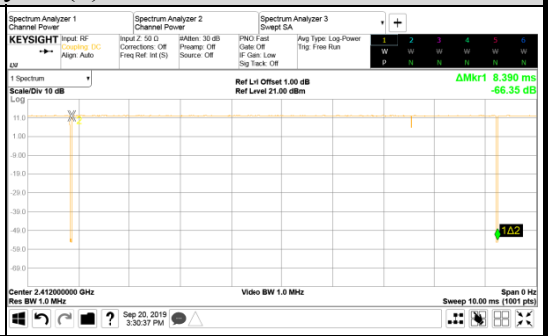
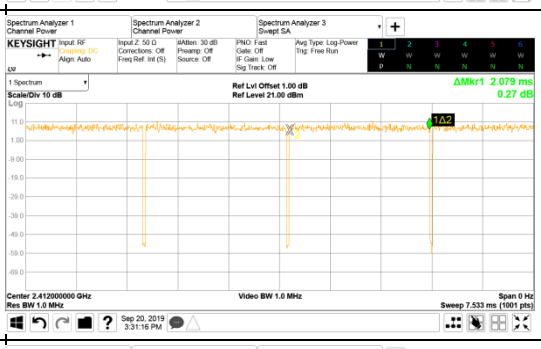
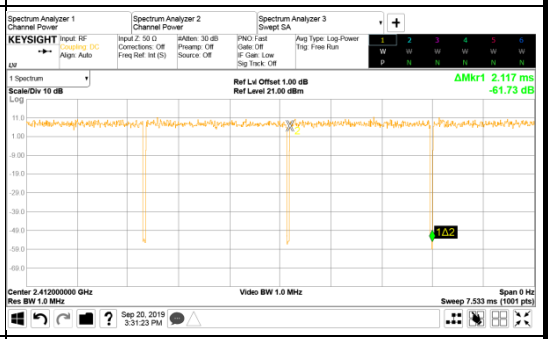
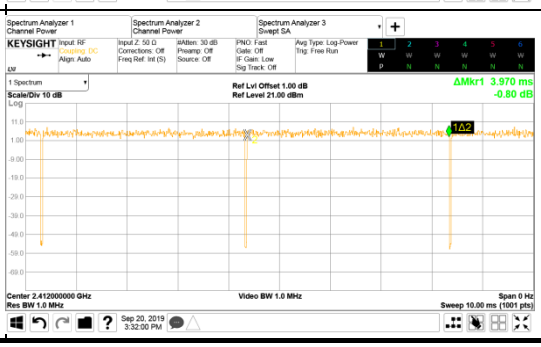
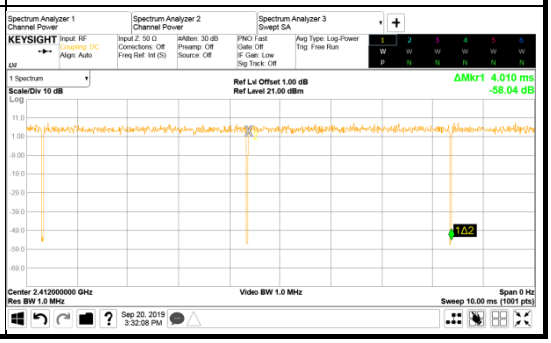
3.6. Test Configuration

Mode	Duty Cycle (x)	T (ms)	Duty Cycle Factor (dB)
802.11b	1.00	8.35	N/A
802.11g	0.98	2.079	N/A
802.11n-HT20	0.99	3.97	N/A
802.11n-HT40	0.99	3.96	N/A
802.11ax-HE20	0.99	3.95	N/A
802.11ax-HE40	0.98	3.93	N/A
BLE	---	0.390	---

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.

Mode	Duty Cycle (x)	
802.11b		
802.11g		
802.11n-HT20		

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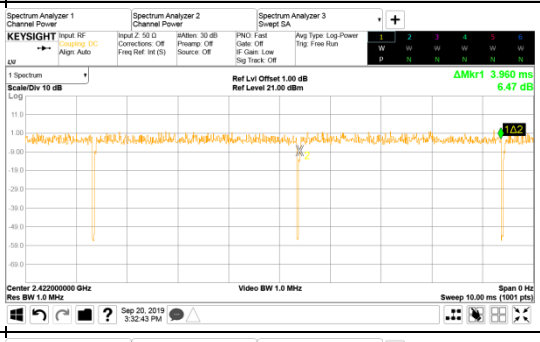
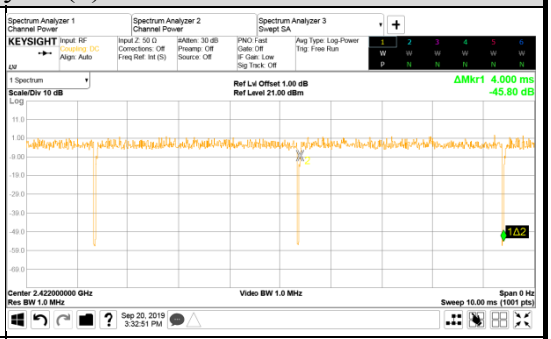
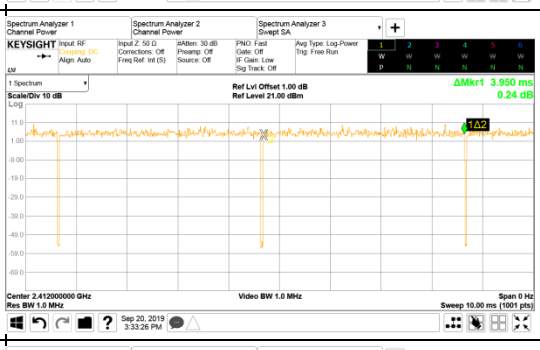
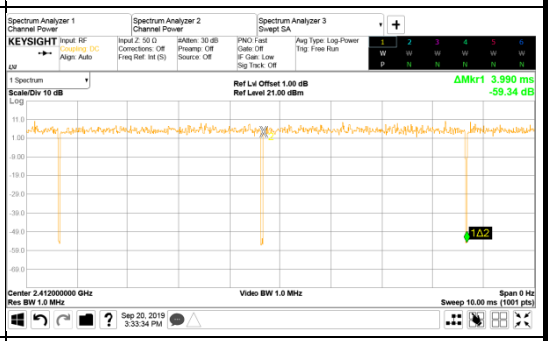
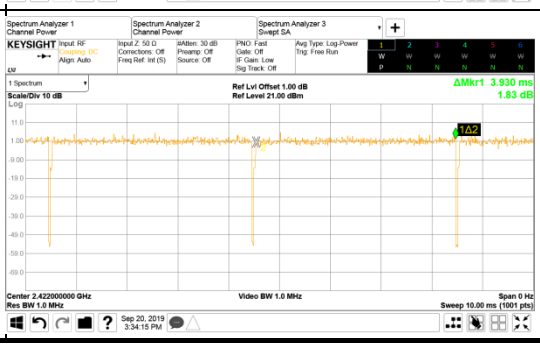
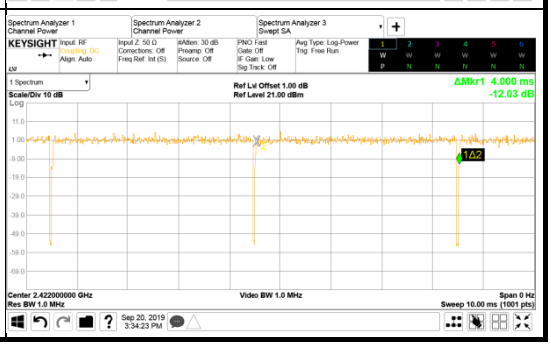
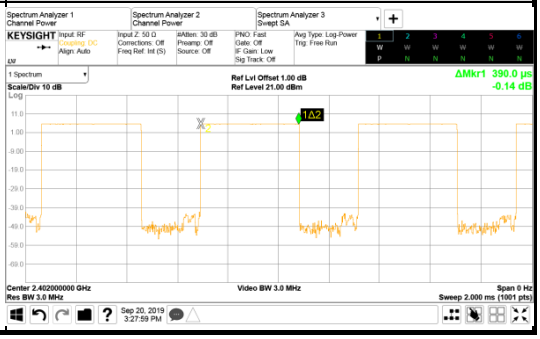
Mode	Duty Cycle (x)	
802.11n-HT40		
802.11ax-HE20		
802.11ax-HE40		

Mode	T (ms)
BLE	

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AC Conduction	
SKU #1	Normal operation
SKU #2	Normal operation

SKU	Item		Mode	Data Rate	Test Channel
#2	Radiated Test Case	Radiated Band Edge Note1	802.11b	1Mbps	1/2/10/11/12/13
			802.11g	6Mbps	1/2/10/11/12/13
			802.11n-HT20	MCS8	1/2/10/11/12/13
			802.11n-HT40	MCS8	3/4/8/9/10/11
			BLE	1Mbps	37/39
		Radiated Spurious Emission Note1& 2	802.11b	1Mbps	7
			802.11g	6Mbps	7
			802.11n-HT20	MCS8	7
			802.11n-HT40	MCS8	8
			802.11ax-HE20	HE0	7
			802.11ax-HE40	HE0	7
			BLE	1Mbps	37/17/39
#1	Radiated Test Case	Radiated Spurious Emission Note1	802.11n-HT20	MCS8	7

SKU	Item		Mode	Data Rate	RU Configuration	Test Channel
#2	Radiated Test Case	Radiated Band Edge Note1	802.11ax-HE20	HE0	26/0	1
					52/37	
					106/53	
				HE0	26/8	13
					52/40	
					106/54	
			802.11ax-HE40	HE0	242/61	3
				HE0	242/62	11

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SKU	Item		Mode	Data Rate	Test Channel
#1	Conducted Test Case	6dB/Occupied Bandwidth	802.11b	1Mbps	1/7/11/13
			802.11g	6Mbps	1/7/11/13
			802.11n-HT20	MCS8	1/7/11/13
			802.11n-HT40	MCS8	3/7/9/11
			802.11ax-HE20	HE0	1/7/11/13
			802.11ax-HE40	HE0	3/7/9/11
			BLE	1Mbps	37/17/39
		Peak Output Power	802.11b	1Mbps	1/2/7/10/11/12/13
			802.11g	6Mbps	1/2/7/10/11/12/13
			802.11n-HT20	MCS8	1/2/7/10/11/12/13
			802.11n-HT40	MCS8	3/4/7/8/9/10/11
			802.11ax-HE20	HE0	1/2/7/10/11/12/13
			802.11ax-HE40	HE0	3/4/7/8/9/10/11
			BLE	1Mbps	37/17/39
				2Mbps	37/17/39
				PHY Coded S2	37/17/39
				PHY Coded S8	37/17/39
		Band Edge	802.11b	1Mbps	1/11/13
			802.11g	6Mbps	1/11/13
			802.11n-HT20	MCS8	1/11/13
			802.11n-HT40	MCS8	3/9/11
			802.11ax-HE20	HE0	1/11/13
			802.11ax-HE40	HE0	3/9/11
			BLE	1Mbps	37/39
		Spurious Emission	802.11b	1Mbps	1/7/11/13
			802.11g	6Mbps	1/7/11/13
			802.11n-HT20	MCS8	1/7/11/13
			802.11n-HT40	MCS8	3/7/9/11
			802.11ax-HE20	HE0	1/7/11/13
			802.11ax-HE40	HE0	3/7/9/11
			BLE	1Mbps	37/17/39
		Peak Power Spectral Density	802.11b	1Mbps	1/7/11/13
			802.11g	6Mbps	1/7/11/13
			802.11n-HT20	MCS8	1/7/11/13
			802.11n-HT40	MCS8	3/7/9/11
			802.11ax-HE20	HE0	1/7/11/13
			802.11ax-HE40	HE0	3/7/9/11
			BLE	1Mbps	37/17/39

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SKU	Item		Mode	Data Rate	RU Configuration	Test Channel
#1	Conducted Test Case	6dB/Occupied Bandwidth	802.11ax-HE20	HE0	26/0	1
					52/37	
					106/53	
				HE0	26/8	13
					52/40	
					106/54	
			802.11ax-HE40	HE0	242/61	3
				HE0	242/62	11
		Peak Output Power	802.11ax-HE20	HE0	26/0	1
					52/37	
					106/53	
				HE0	26/8	13
					52/40	
					106/5	
			802.11ax-HE40	HE0	242/61	3
				HE0	242/62	11
		Peak Power Spectral Density	802.11ax-HE20	HE0	26/0	1
					52/37	
					106/53	
				HE0	26/8	13
					52/40	
					106/54	
			802.11ax-HE40	HE0	242/61	3
				HE0	242/62	11

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.

Note4: 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.

Note5: The data rates were selected based on preliminary testing that identified those rate as the worst case for output power.

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3.7. Tested Supporting System List

3.7.1. Support Peripheral Unit

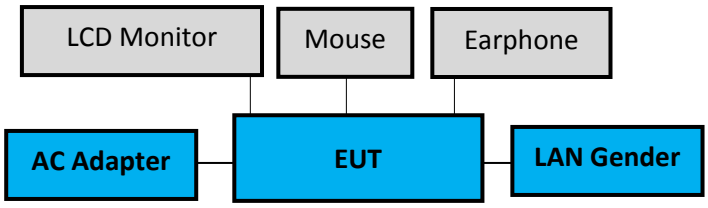
No.	Product	Brand	Model No.	Serial No.	Approval
1.	LCD Monitor	LG	22LK330-DB	N/A	N/A
2.	USB Mouse	acer	MOBVUO	N/A	FCC By DoC
3.	Earphone	APPLE	N/A	N/A	N/A

3.7.2. Cable Lists

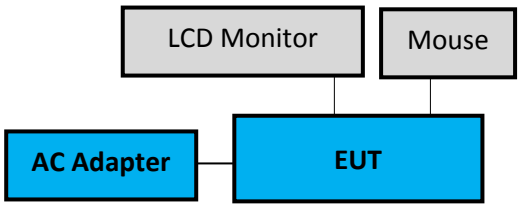
No.	Cable Description Of The Above Support Units
1.	HDMI Cable: Shielded, Detachable, 1.8m AC Power Cord: Unshielded, Detachable, 1.8m
2.	USB Cable: Unshielded, Undetachable, 1.8m
3.	Earphone Cable: Unshielded, Undetachable, 0.9m

3.8. Setup Configuration

3.8.1. EUT Configuration for Power Line & Radiated Emission



3.8.2. EUT Configuration for RF Conducted Test Items



3.9. Operating Condition of EUT

Test program "DRTU" is used for enabling EUT BT or 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)].

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3.10.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

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3.11.Measurement Uncertainty

Test Items/Facilities		Frequency Range	Uncertainty
Conduction Test		150kHz~30MHz	±3.50dB
Radiation Test	No.1 3m Semi Anechoic Chamber	30MHz-200MHz, 3m, Horizontal	±3.9dB
		200MHz-1000MHz, 3m, Horizontal	±4.3dB
		30MHz-200MHz, 3m, Vertical	±4.5dB
		200MHz-1000MHz, 3m, Vertical	±4.1dB
		1GHz-6GHz, 3m	±5.1dB
		6GHz-18GHz, 3m	±5.5dB
	No.3 3m Semi Anechoic Chamber	30MHz-200MHz, 3m, Horizontal	±4.7dB
		200MHz-1000MHz, 3m, Horizontal	±4.5dB
		30MHz-200MHz, 3m, Vertical	±4.3dB
		200MHz-1000MHz, 3m, Vertical	±4.1dB
	No.4 3m Semi Anechoic Chamber	30MHz-200MHz, 3m, Horizontal	±4.1dB
		200MHz-1000MHz, 3m, Horizontal	±4.4dB
		30MHz-200MHz, 3m, Vertical	±4.2dB
		200MHz-1000MHz, 3m, Vertical	±5.0dB
		1GHz-6GHz, 3m	±4.4dB
		6GHz-18GHz, 3m	±4.1dB
	No.5 3m Semi Anechoic Chamber	30MHz-200MHz, 3m, Horizontal	±4.0dB
		200MHz-1000MHz, 3m, Horizontal	±4.0dB
		30MHz-200MHz, 3m, Vertical	±4.2dB
		200MHz-1000MHz, 3m, Vertical	±4.4dB
		1GHz-6GHz, 3m	±4.3dB
		6GHz-18GHz, 3m	±4.6dB
	Fully Anechoic Chamber	30MHz~1000MHz	±4.7dB
		1GHz~18GHz	±5.3dB

Remark：Uncertainty = $ku_c(y)$

Test Item	Uncertainty
6dB Bandwidth	± 0.05kHz
Maximum peak output power	± 0.33dB
Power spectral density	± 0.13dB
Conducted Emission Limitations	± 0.13dB

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4. MEASUREMENT EQUIPMENTLIST

4.1. Conducted Emission Measurement

Item	Type	Manufacturer	Model No.	Serial No.	Cal. Date	Cal. Interval
1.	Test Receiver	R&S	ESR3	101774	2019. 01. 23	1 Year
2.	A.M.N.	R&S	ENV4200	100169	2018. 11. 04	1 Year
3.	L.I.S.N.	Kyoritsu	KNW-407	8-855-9	2018. 12. 19	1 Year
4.	Pulse Limiter	R&S	ESH3-Z2	100354	2019. 01. 12	1 Year
5.	Digital Thermo-Hygro Meter	iMax	HTC-1	No.8 S/R	2019. 04. 20	1 Year
6.	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	Agilent	N9010A-526	MY53400071	2019. 09. 11	1 Year
2.	Spectrum Analyzer	Agilent	N9030A-526	MY53310269	2019. 01. 30	1 Year
3.	Test Receiver	R & S	ESCS30	100338	2019. 06. 12	1 Year
4.	Amplifier	HP	8447D	2944A06305	2019. 01. 30	1 Year
5.	Amplifier	HP	8449B	3008A02678	2019. 03. 07	1 Year
6.	Amplifier	Keysight	83051A	MY53010042	2019. 08. 08	1 Year
7.	Bilog Antenna	TESEQ	CBL6112D	33821	2019. 01. 19	1 Year
8.	Loop Antenna	R&S	HFH2-Z2	891847/27	2017.12. 18	2 Years
9	Double-Ridged Waveguide Horn	ETS-Lindgren	3117	00135902	2019. 03. 13	1 Year
10.	Horn Antenna	COM-POWER	AH-840	101092	2019 .05. 14	1 Year
11.	2.4GHz Notch Filter	K&L	7NSL10-2441.5/E130.5-O/O	1	2019. 07. 23	1 Year
12.	3GHz Notch Filter	Microwave	H3G018G1	484796	2019. 08. 21	1 Year
13.	Coaxial Cable	MIYAZAKI	5D2W	RE-11	2019. 02. 01	1 Year
14.	Coaxial Cable	HUBER+SUHNER	SUCOFLEX 104	RF CABLE-01	2019. 09. 20	1 Year
15.	Coaxial Cable	HUBER+SUHNER	SUCOFLEX 102	MY1493/2	2019. 09. 20	1 Year
16.	Digital Thermo-Hygro Meter	iMax	HTC-1	No.1 3m A/C	2019. 04. 20	1 Year
17.	Digital Thermo-Hygro Meter	EVERY DAY	E-512	RF-02	2019. 04. 20	1 Year
18.	Test Software	Audix	e3	V6.120619c	N.C.R.	N.C.R.
19.	Test Software	Audix	e3	V6.110601	N.C.R.	N.C.R.

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4.3. RF Conducted Measurement

Item	Type	Manufacturer	Model No.	Serial No.	Cal. Date	Cal. Interval
1.	Spectrum Analyzer	Keysight	N9010B-544	MY55460198	2019. 05. 06	1 Year
2.	Power Meter	Anritsu	ML2495A	1145008	2018. 11. 07	1 Year
3.	Power Sensor	Anritsu	MA2411B	1126096	2018. 11. 07	1 Year
4.	Digital Thermo-Hygro Meter	Shenzhen Datronn Electronics	KT-905	RF	2019. 04. 20	1 Year

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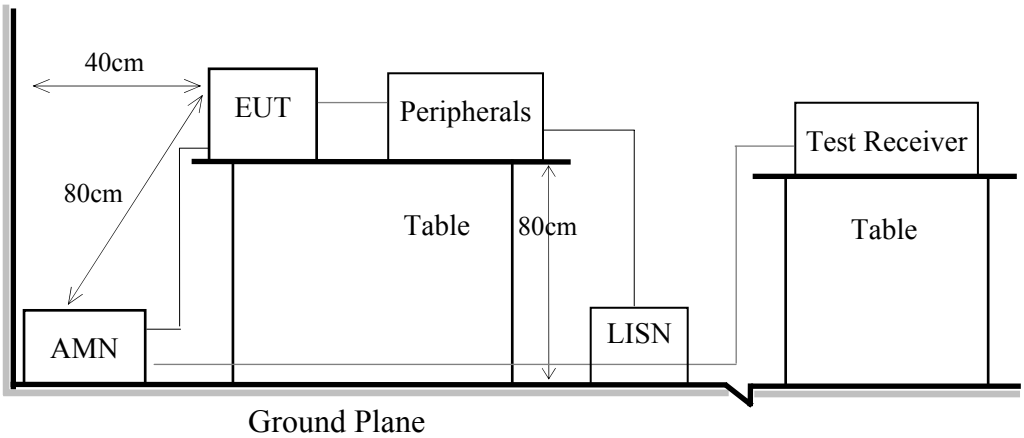
5. CONDUCTED EMISSION

5.1. Block Diagram of Test Setup

5.1.1. Block Diagram of EUT

Indicated as section 3.8

5.1.2. Shielded Room Setup Diagram



5.2. Conducted Emission Limit

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

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 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 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.

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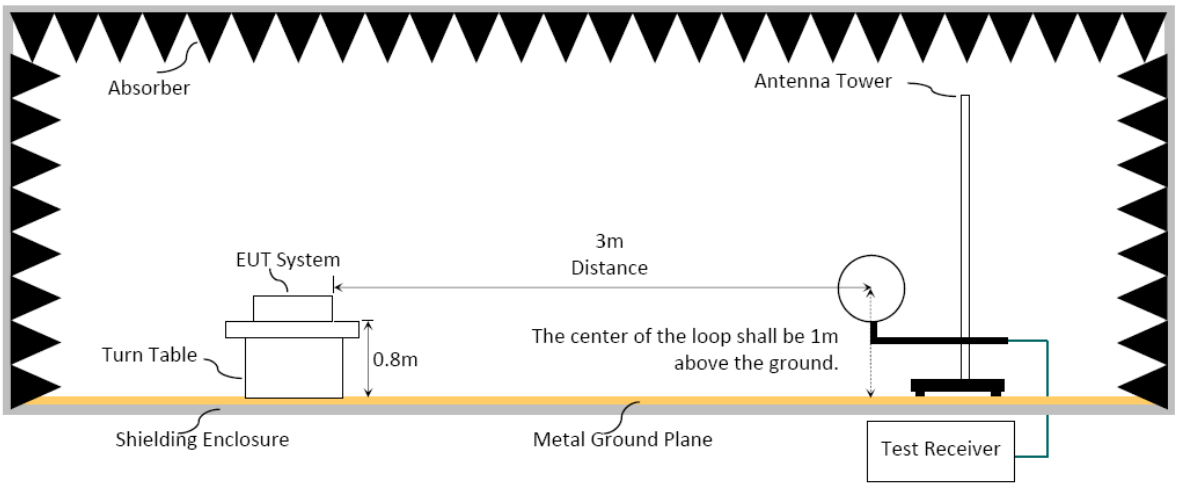
6. RADIATED EMISSION

6.1. Block Diagram of Test Setup

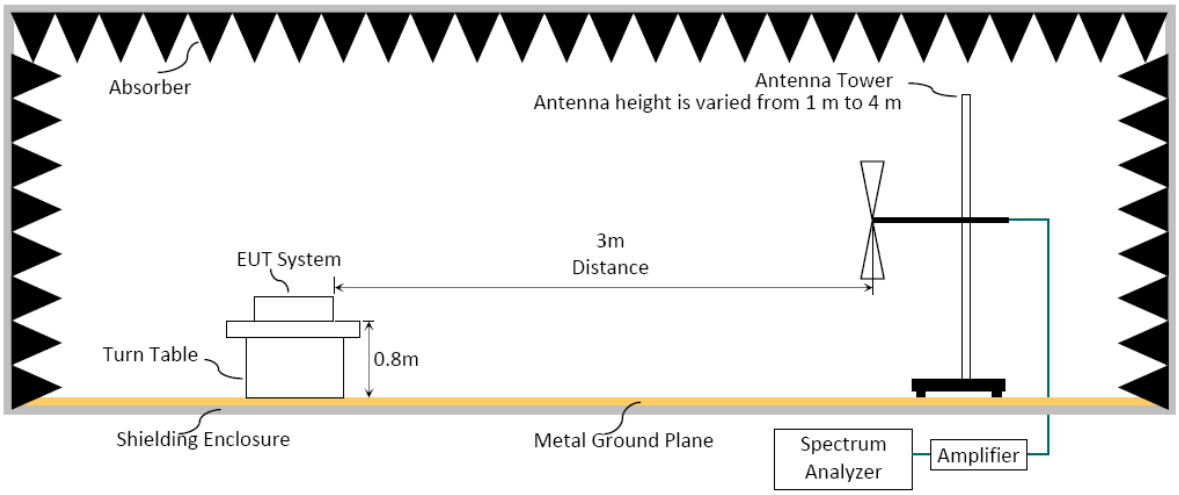
6.1.1. Block Diagram of EUT

Indicated as section 3.8

6.1.2. Setup Diagram for 9kHz-30MHz



6.1.3. Setup Diagram for 30-1000MHz



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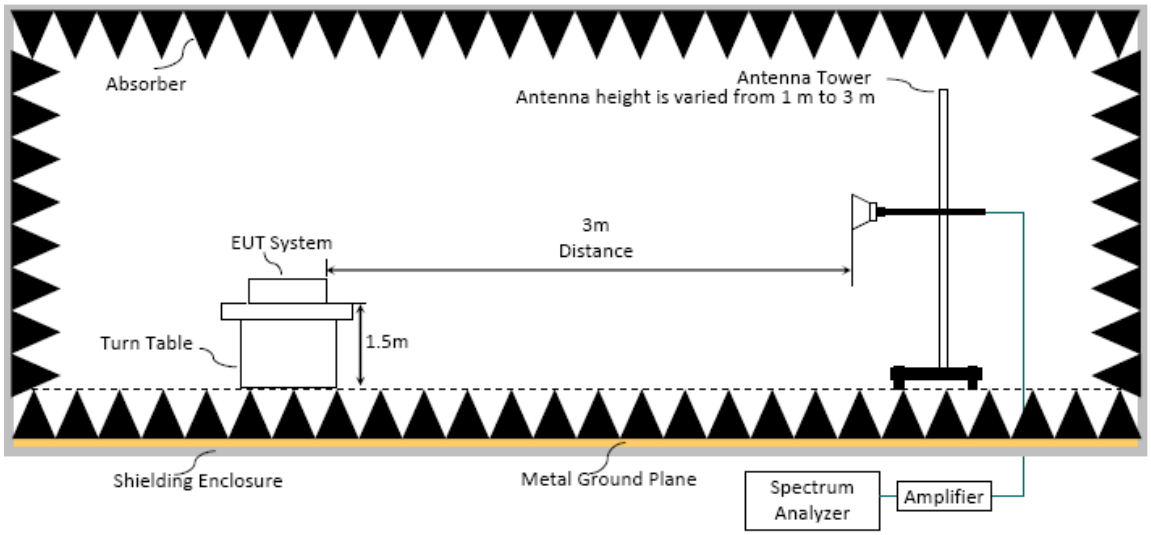
6.1.4. Setup Diagram for above 1GHz



6.2. Radiated Emission Limits

In any 100kHz bandwidth outside the frequency band, the radio frequency power produced by the intentional radiator shall be at least 20dB below that in the 100kHz bandwidth within the band that contains the highest level. In addition, radiated emissions which fall in restricted bands, as defined in Section 15.205/RSS-Gen Section 8.10 table 6, must also comply with the radiated emission limits specified as below.

Frequency (MHz)	Distance(m)	Limits	
		dBμV/m	μV/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 dBμV/m (Peak) 54.0 dBμV/m (Average)	

Remark：(1) dBμV/m = 20 log (μV/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.

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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 C63.10-2013regulation.

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

Frequency Range 30MHz ~ 25GHz:
The EUT setup on the turn 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 (for 30-1000MHz) or antenna varied from 1 m to 3 m (for above 1GHz) 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 C63.10-2013regulation.

Frequency below 1GHz:
Spectrum Analyzer is used for pre-testing with following setting:
(1)RBW = 120KHz
(2)VBW ≥ 3 x 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 theQ.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 25 GHz):
Peak Detector:
(1)RBW = 1MHz
(2)VBW ≥ 3 x 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.

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Average Detector:

■**Option 1:**

(1)RBW = 1MHz

(2)VBW ≥ 1/ T.

Modulation Type	T (ms)	1/ T (kHz)	VBW Setting(Hz)
BLE	0.90	1.111111	10Hz
802.11b	8.35	0.119760	10Hz
802.11g	2.079	0.481000	10Hz
802.11n-HT20	3.97	0.251889	10Hz
802.11n-HT40	3.96	0.252525	10Hz
802.11ax-HE20	3.95	0.253165	10Hz
802.11ax-HE40	3.93	0.254453	10Hz

N/A: 1/ T is not implemented when duty cycle presented in section 3.6 is ≥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 l=Antenna Factor + Cable Loss + Meter Reading (including Preamp factor if test used)

□Average Emission Level= Peak Emission Level+ DCCF

Duty Cycle Correction Factor (DCCF)= 20log(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.

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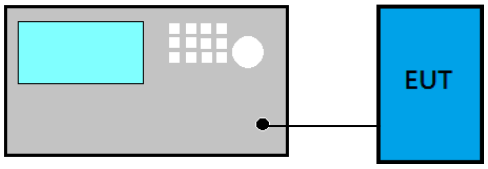
7. 6dB/OCCUPIED BANDWIDTH

7.1. Block Diagram of Test Setup



7.2. Specification Limits

The minimum 6dB bandwidth shall be at least 500kHz.

7.3. Test Procedure

Following measurement procedure is reference to ANSI C63.10:2013:

(1) Set RBW = 100 kHz.
(2) Set the video bandwidth (VBW) ≥ 3 × 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 to -6dB or 99% power to record the final bandwidth.

7.4. Test Results

Please refer to Appendix A

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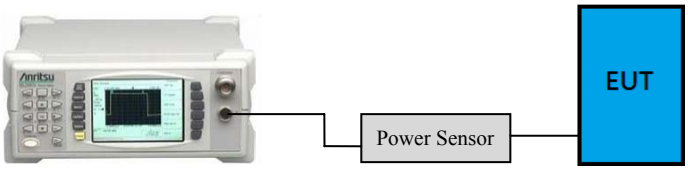
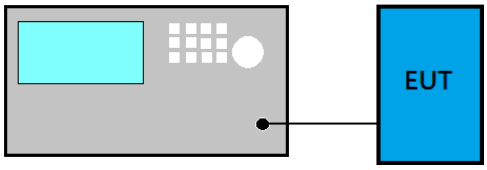
8. MAXIMUM PEAK OUTPUT POWER

8.1. Block Diagram of Test Setup

- For WLAN Function



- For BLE Function



8.2. Specification Limits

The Limits of maximum Peak Output Power for digital modulation in 2400 - 2483.5MHz is : 1Watt. (30dBm), and E.I.R.P.: 4Watt (36dBm)

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8.3. Test Procedure

Following measurement procedure is reference to ANSI C63.10:2013:

■PKPM1 Peak power meter method:

EUT is connected to power sensor and record the maximum output power.

■Maximum peak conducted output power method:

(1) Set the RBW ≥ DTS bandwidth
(2) Set VBW ≥ 3 × RBW
(3) Set span ≥ 3 × RBW.
(4) Sweep time = auto couple
(5) Detector = peak.
(6) Trace mode = max hold.
(7) Allow trace to fully stabilize.
(8) Use peak marker function to determine the peak amplitude level.

■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 3.6 is< 98%.

□Method AVGSA-2 (Spectrum channel power)

(1) Set span to at least 1.5 times the OBW
(2) Set RBW = 1 -5%of OBW
(3) Set the video bandwidth (VBW) ≥ 3 × RBW.
(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 3.6 is < 98%.

8.4. Test Results

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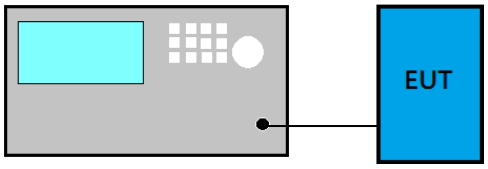
9. EMISSION LIMITATIONS

9.1. Block Diagram of Test Setup



9.2. Specification Limits

In any 100kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20dB below that in the100kHz bandwidth within the band that contains the highest level of the desired power, based on either an RF conducted or a radiated measurement. If the transmitter complies with the conducted power limits based on the use of RMS averaging over a time interval, that the required attenuation shall be 30 dB instead of 20 dB.

Attenuation below the general limits specified in Section 15.209(a)/RSS-Gen Section 8.9 table 4is not required. In addition, radiated emissions which fall in restricted bands, as defined in Section 15.205(a)/RSS-Gen Section 8.10 table 6, must also comply with the radiated emission limits specified in Section 15.209(a)/RSS-Gen Section 8.9 table 4 (See Section 15.205(c)).

9.3. Test Procedure

Following measurement procedure is reference to ANSI C63.10:2013:

■Reference Level

(1) Set analyzer center frequency to DTS channel center frequency.
(2) Set the span to 1.5 times the DTS bandwidth.
(3) Set the RBW to: 100 kHz.
(4) Set the VBW ≥ 3 × RBW.
(5) Detector = peak.
(6) Sweep time = auto couple.
(7) Trace mode = max hold.
(8) Allow trace to fully stabilize to find the max PSD as reference level.

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■Emission Level Measurement

(1) Set analyzer center frequency to DTS channel center frequency.
(2) Set the span to 1.5 times the DTS bandwidth.
(3) Set the RBW to: 100 kHz.
(4) Set the VBW ≥ 3 × RBW.
(5) Detector = peak.
(6) Sweep time = auto couple.
(7) Trace mode = max hold.
(8) Allow trace to fully stabilize to find the max level.

9.4. Test Results

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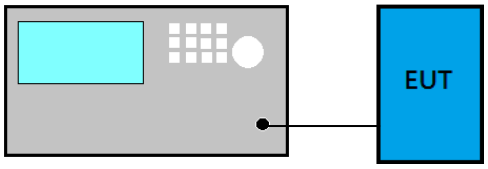
10. POWER SPECTRAL DENSITY

10.1. Block Diagram of Test Setup



10.2. Specification Limits

The peak power spectral density conducted from the intentional radiator to the antenna shall not be greater than 8dBm in any 3kHz band.

10.3. Test Procedure

Following measurement procedure is reference to ANSI C63.10:2013:

■Method PKPSD (peak PSD)

(1) Set analyzer center frequency to DTS channel center frequency.
(2) Set the span to 1.5 times the DTS bandwidth.
(3) Set the RBW to: 3 kHz ≤ RBW ≤ 100 kHz.
(4) Set the VBW ≥ 3 × RBW.
(5) Detector = peak.
(6) Sweep time = auto couple.
(7) Trace mode = max hold.
(8) Allow trace to fully stabilize.
(9) Use the peak marker function to determine the maximum amplitude level.
(10) If measured value exceeds limit, reduce RBW (no less than 3 kHz) and repeat.

□Method AVGPSD-2

(1) Using peak PSD procedure step 1 to step 4.
(2) Detector= RMS detector
(3) Sweep time = auto couple
(4) Trace mode = trace averaging over a minimum of 100 traces
(5) Use the peak marker function to determine the maximum amplitude level.
(6) Duty cycle factor is added when duty cycle presented in section 3.7< 98%.
(7) If measured value exceeds limit, reduce RBW (no less than 3 kHz) and repeat.

10.4. Test Results

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11. DEVIATION TO TEST SPECIFICATIONS

【NONE】

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APPDNDIX A

TEST DATA AND PLOTS

(Model: 14Z90N)

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APPDNDIX B

TEST PHOTOGRAPHS

(Model: 14Z90N)

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