Audix Technology Corp.
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FCC 15.247 & RSS-247
(Permissive Change)
2.4 GHz Test Report

for

LG Electronics Inc.

222, LG-ro, Jinwi-myeon Pyeongtaek-Si, Gyeonggi-Do, 17709 Republic of Korea

Product Name	**:**	**Notebook Computer**
Model Name	**:**	**(1)16Z90Q (2)16ZB90Q (3)16ZD90Q (4)16ZG90Q**
Brand		**LG**
FCC ID	**:**	**BEJNT-16Z90Q**
IC	**:**	**2703H-16Z90Q**

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

Testing Laboratory
1724

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
(Permissive Change)

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)16Z90Q (2)16ZB90Q (3)16ZD90Q (4)16ZG90Q
(3) Brand	:	LG
(4) Power Supply	:	DC 20V, 3.25A

Applicable Standards:

Title 47 CFR FCC Part 15 Subpart C
RSS-Gen (Issue 5), Amendment 2, February 2021
RSS-247 (Issue 2), February 2017

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: 2022. 06. 23

Reviewed by: Annie Yu (Annie Yu/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	2022. 06. 13	Original Report	EM-F220377
A	2022. 06. 23	To revise output power test data.	EM-F220377

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2. SUMMARY OF TEST RESULTS

Rule		Description	Results
FCC	**IC**		
15.207	RSS-Gen §8.8	Conducted Emission	**PASS**
15.247(d)/15.205	RSS-Gen §8.9 RSS-247 §5.5	Radiated Band Edge and Radiated Spurious Emission	**N/A, NOTE 2/3**
15.247(a)(1)	RSS-247 §5.1(2)	20dB/Occupied Bandwidth	**N/A, NOTE 2**
15.247(a)(1)	RSS-247 §5.1(2)	Carrier Frequency Separation	**N/A, NOTE 2**
15.247(a)(1)(iii)	RSS-247 §5.1(4)	Time of Occupancy	**N/A, NOTE 2**
15.247(a)(1)(iii)	RSS-247 §5.1(4)	Number of Hopping Channels	**N/A, NOTE 2**
15.247(b)(1)	RSS-247 §5.1(2)	Maximum Peak Output Power	**PASS**
15.247(d)	RSS-247 §5.5	Conducted Band Edges and Conducted Spurious Emission	**N/A, NOTE 2**
15.203	---	Antenna Requirement	**Compliance**

Note: 1. The uncertainties value is not used in determining the result.
2. To add new Configuration with new components is not influence on this item
3. Due to the above difference, it is unnecessary to test Radiated Band Edge.

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3. GENERAL INFORMATION

3.1. Description of Application

Applicant	LG Electronics Inc. 222, LG-ro, Jinwi-myeon Pyeongtaek-Si, Gyeonggi-Do, 17709 Republic of Korea
Manufacturer	LG Electronics Inc. 222, LG-ro, Jinwi-myeon Pyeongtaek-Si, Gyeonggi-Do, 17709 Republic of Korea
Factory	LG Electronics Nanjing New Technology Co., Ltd. No.346,Yaoxin Road, Economic & Technical Development Zone, Nanjing, China.
Product	Notebook Computer
Model	(1)16Z90Q (2)16ZB90Q (3)16ZD90Q (4)16ZG90Q The difference between all models is different in the sales customers.
Configuration (HVIN)	16Z90Q-K, 16Z90Q-N, 16Z90Q-A, 16Z90Q-R The difference please refer to the following.
Brand	LG

The difference list for Configuration (HVIN):

Difference / Configuration (HVIN)	Main Board	GPU	TPM (Trusted Platform Module)
16Z90Q-K	Queen MAIN B/D PCB	Intel Iris Xe UHD Graphics	Not Support
16Z90Q-N	Queen MAIN B/D PCB	Intel Iris Xe UHD Graphics	Support
16Z90Q-A	QUEEN NVIDIA MAIN B/D PCB	NVIDIA RTX2050	Not Support
16Z90Q-R	QUEEN NVIDIA MAIN B/D PCB	NVIDIA RTX2050	Support

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3.2. Description of EUT

<table>
<tr><td>Test Model</td><td>16Z90Q</td></tr>
<tr><td>Serial Number</td><td>N/A</td></tr>
<tr><td>Power Rating</td><td>DC 20V, 3.25A</td></tr>
<tr><td>Software Version</td><td>XY (X, Y can be 0 to 9 for different SW version not influence RF parameter)</td></tr>
<tr><td>RF Features</td><td>WLAN:802.11 a/b/g/n/ac/ax
Bluetooth: BT and BLE (BT 5.1)</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">U-NII 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>
The MIMO is uncorrelated and supported SDM mode only.</td></tr>
<tr><td>Test Sample</td><td>
<table>
<tr><th>Sample No.</th><th>Test Item</th><th>Firmware</th></tr>
<tr><td>03</td><td>AC Conduction</td><td>N/A</td></tr>
<tr><td>04</td><td>AC Conduction, RSE, RF Conducted</td><td>N/A</td></tr>
</table></td></tr>
<tr><td>Sample Status</td><td>Trial sample</td></tr>
<tr><td>Date of Receipt</td><td>2022. 03. 24</td></tr>
<tr><td>Date of Test</td><td>2022. 05. 21 ~ 06. 22</td></tr>
<tr><td>Interface Ports of EUT</td><td>• One HDMI Port
• Two USB Type C Ports
• One Earphone Port
• One Micro SD Card Slot
• Two USB 3.0 Ports</td></tr>
<tr><td>Accessories Supplied</td><td>• AC Adapter
• LAN Gender</td></tr>
</table>

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3.3. Reference Test Guidance

ANSI C63.10:2013

3.4. Information for Permissive Change

- The EUT is an addition version with original FCC ID: BEJNT-16Z90Q and IC: 2703H-16Z90Q is to add new Configuration (HVIN) and components, and the detail for component list please refer to section 3.7.1
- The differences between this application and original's ID as clarify in following list.

Difference / Configuration (HVIN)		Main Board	GPU	TPM (Trusted Platform Module)
Original	16Z90Q	Queen MAIN B/D PCB	Intel Iris Xe UHD Graphics	Not Support
		Queen MAIN B/D PCB	Intel Iris Xe UHD Graphics	Support
Permissive Change	16Z90Q-K	Queen MAIN B/D PCB	Intel Iris Xe UHD Graphics	Not Support
	16Z90Q-N	Queen MAIN B/D PCB	Intel Iris Xe UHD Graphics	Support
	16Z90Q-A	QUEEN NVIDIA MAIN B/D PCB	NVIDIA RTX2050	Not Support
	16Z90Q-R	QUEEN NVIDIA MAIN B/D PCB	NVIDIA RTX2050	Support
Note: 1. The Configuration (HVIN) 16Z90Q-K and 16Z90Q-N with original components were measured in the original application. 2 The Configuration (HVIN) 16Z90Q-A and 16Z90Q-R with new components were measured in this Permissive Change application.				

- Due to above different item, there have some test item should be re-tested (see section 2), the test data are recorded in this report.

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3.5. Antenna Information

No.	Antenna Part Number	Manufacture	Antenna Type	Frequency (MHz)	Max Gain(dBi)	
					Main	AUX
1.	WA-P-LELE-04-009	INPAQ	Mono-Pole	2400	2.3	2.0
				2450	2.4	**2.6**
				2500	**3.2**	2.4
				5150	4.2	3.5
				5400	4.2	**3.6**
				5850	**4.4**	3.5
				5925	4.1	3.4
				6525	4.1	3.2
				7125	4.2	2.3
Note 1. 2.4G: Directional gain = 10 log[($10^{3.2/10}$ +$10^{2.6/10}$)/2]= 2.91dBi Note 2. UNII Band (WLAN 5G): Directional gain = 10 log[($10^{4.4/10}$ +$10^{3.6/10}$)/2]= 4.02dBi Note 3. UNII Band (WLAN 6G): Directional gain = 10 log[($10^{4.2/10}$ +$10^{3.4/10}$)/2]= 3.82dBi						
2.	L1LRF008-CS-H	LUXSHARE-ICT	Mono-Pole	2400	**6.3**	0.9
				2450	5.7	1.6
				2500	2.7	**3.5**
				5150	-1.5	2.3
				5400	3.4	4.5
				5850	**3.3**	**5.8**
				5925	2.9	4.7
				6525	3.4	1.3
				7125	-4.9	-1.6
Note 1. 2.4G: Directional gain = 10 log[($10^{6.3/10}$ +$10^{3.5/10}$)/2]= 5.12dBi Note 2. UNII Band (WLAN 5G): Directional gain = 10 log[($10^{3.3/10}$ +$10^{5.8/10}$)/2]= 4.73dBi Note 3. UNII Band (WLAN 6G): Directional gain = 10 log[($10^{3.4/10}$ +$10^{4.7/10}$)/2]= 4.10dBi						

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3.6. EUT Specifications Assessed in Current Report

Mode	Fundamental Range (MHz)	Channel Number	Modulation	Data Rate (Mbps)
Bluetooth	2402-2480	79	FHSS (GFSK, π/4 DQPSK, 8-DPSK)	1/2/3

Channel List							
Channel Number	Frequency (MHz)	Channel Number	Frequency (MHz)	Channel Number	Frequency (MHz)	Channel Number	Frequency (MHz)
00	2402	20	2422	40	2442	60	2462
01	2403	21	2423	41	2443	61	2463
02	2404	22	2424	42	2444	62	2464
03	2405	23	2425	43	2445	63	2465
04	2406	24	2426	44	2446	64	2466
05	2407	25	2427	45	2447	65	2467
06	2408	26	2428	46	2448	66	2468
07	2409	27	2429	47	2449	67	2469
08	2410	28	2430	48	2450	68	2470
09	2411	29	2431	49	2451	69	2471
10	2412	30	2432	50	2452	70	2472
11	2413	31	2433	51	2453	71	2473
12	2414	32	2434	52	2454	72	2474
13	2415	33	2435	53	2455	73	2475
14	2416	34	2436	54	2456	74	2476
15	2417	35	2437	55	2457	75	2477
16	2418	36	2438	56	2458	76	2478
17	2419	37	2439	57	2459	77	2479
18	2420	38	2440	58	2460	78	2480
19	2421	39	2441	59	2461		

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3.7. Description of Key Components

3.7.1. For the All Component Lists

Item	Supplier	Model / Type	Character
System	Microsoft	Win11 Home	---
Main Board	LG	Queen MAIN B/D PCB	Main Board (GM) Manufacturer: #1 Hannstar Board Tech(Jiang Yin) Corp.,Ltd. #2 Elec & Eltek Company (MCO) Limited.
		QUEEN NVIDIA MAIN B/D PCB	**Main Board (PM)*** **Manufacturer:** **#1 Hannstar Board Tech(Jiang Yin) Corp.,Ltd.** **#2 Elec & Eltek Company (MCO) Limited.**
WLAN SUB Board	LG	16Z90Q 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)
CPU (Socket: BGA1744)	Intel	i7-1260P	2.5GHz
	Intel	i5-1240P	2.1GHz
16” LCD Panel	LG Display	LP160WQ1(SP)(B2)	Resolution: 2560 x 1600, 60Hz WQXGA IPS (Non Touch)
Storage (SSD)	SK hynix	HFM001TD3JX013N	1TB
		HFM512GD3JX013N	512GB
		HFM256GD3JX013N	256GB
	Samsung	MZ-VL21T00	1TB
		MZ-VL25120	512GB
		MZ-VL22560	256GB
		MZ-VL22T00	**2TB***
Memory (RAM)	Samsung	---	16GB LPDDR5x(On Board)
		---	8GB LPDDR5x(On Board)
		---	**32GB LPDDR5x(On Board)***
	SK Hynix	---	16GB LPDDR5x(On Board)
		---	8GB LPDDR5x(On Board)
		---	**32GB LPDDR5x(On Board)***
Battery Pack	LG	LBV7227E	80Wh, DC 7.74V, 80Wh Typ 10336mAh
	LG	LBY122CM	90Wh, DC 7.76V, 90Wh Typ 11600mAh
WLAN Combo Card	Intel	AX211D2W	WLAN and BT, 2x2 PCIe M.2 1216 SD adapter card FCC ID: PD9AX211D2 IC: 1000M-AX211D2
WLAN Combo Antenna	LG (INPAQ)	WA-P-LELE-04-009	PCB, Mono-pole Type Main: Black, Aux: Gray
	LG (LUXSHARE-ICT)	L1LRF008-CS-H	PCB, Mono-pole Type Main: Black, Aux: Gray

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Item	Supplier	Model / Type	Character
Keyboard	TIC	KT0120B8E	---
	LITE ON	SN8101	---
Web Camera	Chicony	CKFLF26	---
	Luxvisions	1BF225N3	---
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
		80-5946-230	(White) 10/100/1000 Megabit Ethernet
		80-5946-240	(Black) 10/100/1000 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
		GD-08MF-50-WH-LP12	(White) 10/100/1000 Megabit Ethernet
		GD-08MF-50-BK-LP13	(Black) 10/100/1000 Megabit Ethernet
	Type C to LAN: Shielded, Undetached, 0.12m		
AC Adapter (65W)	LG (HONOR)	ADT-65DSU-D03-2	I/P: AC 100-240V, 1.6A, 50-60Hz 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)		
Note: "*" Standing for adding new configuration.			

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

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

SKU (Mode)			**1**	**2**
Main Board		**LG, QUEEN NVIDIA MAIN B/D PCB (w/ TPM)**	V	
		LG, QUEEN NVIDIA MAIN B/D PCB (w/o TPM)		V
SUB Board		LG, 16Z90Q Sub B/D (Type A)	V	V
CPU		Intel, i7-1260P	V	V
16" LCD Panel		LG Display, LP160WQ1(SP)(B2)	V	V
Storage (SSD)		**Samsung, 2TB**	V	V
		SK hynix, 1TB	V	V
Memory (RAM)		**32GB**	V	V
Battery Pack		LG, 90Wh	V	V
Keyboard		TIC, KT0120B8E	V	V
Web Camera		Chicony, CKFLF26	V	V
WLAN Combo Card		Intel, AX211D2W	V	V
WLAN Combo Antenna		LG (INPAQ), WA-P-LELE-04-009	V	
		LG (LUXSHARE-ICT), L1LRF008-CS-H		V
Type C #1	AC Adapter	LG (HONOR), ADT-65DSU-D03-2	V	V
Type C #2	Link to LAN Gender	MEC	V	V

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3.8. Test Configuration

Mode	Duty Cycle (x)	T (ms)	Duty Cycle Correction Factor (dB)
BT	N/A	2.890	N/A

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

Item			Modulation	Data Rate	Test Channel
Radiated Test Case	SKU #1/ SKU #2	Radiated Spurious Emission (30MHz-1GHz) Note 1 & 2	GFSK	1Mbps	78
	SKU #2	Radiated Spurious Emission Note 1 & 2 (Above 1GHz)	GFSK	1Mbps	78
Conducted Test Case		Maximum Peak Output Power	GFSK	1Mbps	00/39/78
			8-DPSK	3Mbps	00/39/78

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: Both of the antennas are the same type. The max-gain condition with SISO (AUX port) is SKU #2 for BT mode. We present worst case with maximum power.

Note 3: We performed testing of the highest and lowest data rate.

3.9. Output Power Setting

Centre Frequency (MHz)	Power Setting	
	GFSK	8-DPSK
2402	12	7
2441	12	7
2480	12	7

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3.10. Tested Supporting System List

3.10.1. Support Peripheral Unit

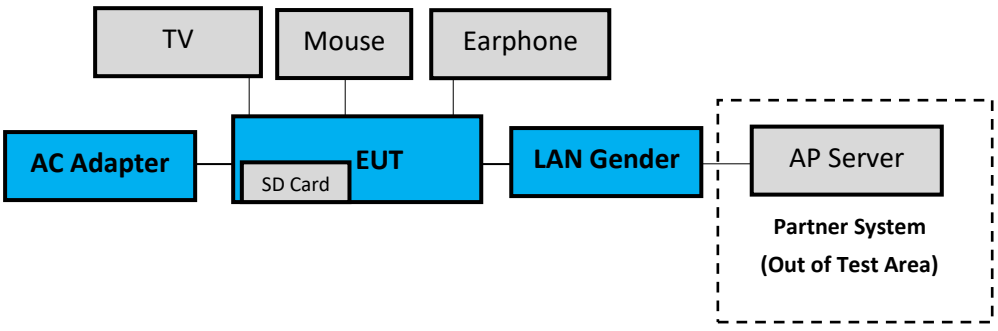
No.	Product	Brand	Model No.	Serial No.	Approval
1.	TV	LG	22LK330-DB	N/A	N/A
2.	USB Mouse	hp	M-U0026	N/A	N/A
3.	Earphone	APPLE	N/A	N/A	N/A
4.	SD Card	ADATA	MicroSDHC Card	N/A	N/A
Partner System					
5.	AP Server	ASUS	RT-AX88U	N/A	FCC ID: MSQ-RTAXHP00 IC: 3568A-RTAXHP00

3.10.2. Cable Lists

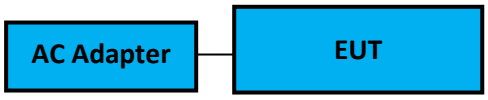
No.	Cable Description Of The Above Support Units
1.	HDMI Cable: Shielded, Detachable, 1.2m AC Power Cord: Unshielded, Detachable, 1.8m
2.	USB Cable: Shielded, Undetachable, 2.0m
3.	Earphone Cable: Unshielded, Undetachable, 1.2m
4.	N/A
5.	AC adapter: M/N:WA-30B12, Cable: Unshielded, Detachable, 1.2m LAN cable: Unshielded, Detachable,3.0m
6.	LAN cable: Unshielded, Detachable, 1.8m

3.11. Setup Configuration

3.11.1. EUT Configuration for Power Line & Radiated Emission



3.11.2. EUT Configuration for RF Conducted Test Items



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3.12.Operating Condition of EUT

Test program "DRTU" is used for enabling EUT BT function under continues transmitting and choosing data rate/ channel.

3.13.Description of Test Facility

Name of Test Firm	Audix Technology Corporation / EMC Department No. 491, Zhongfu Rd., 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

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3.14.Measurement Uncertainty

Test Items/Facilities			Frequency Range	Uncertainty
Conduction Test			9kHz-150kHz	±3.7dB
			150kHz-30MHz	±3.4dB
Radiation Test	☒	No.1 3m Semi Anechoic Chamber	30MHz-200MHz, 3m, Horizontal	±3.8dB
			200MHz-1000MHz, 3m, Horizontal	±4.1dB
			30MHz-200MHz, 3m, Vertical	±4.5dB
			200MHz-1000MHz, 3m, Vertical	±4.5dB
			1GHz-6GHz, 3m	±4.7dB
			6GHz-18GHz, 3m	±4.1dB
			18GHz-40GHz, 3m	±3.52dB
	☐	No.3 3m Semi Anechoic Chamber	30MHz-200MHz, 3m, Horizontal	±3.9dB
			200MHz-1000MHz, 3m, Horizontal	±4.2dB
			30MHz-200MHz, 3m, Vertical	±4.3dB
			200MHz-1000MHz, 3m, Vertical	±4.5dB
	☐	No.4 3m Semi Anechoic Chamber	30MHz-200MHz, 3m, Horizontal	±4.1dB
			200MHz-1000MHz, 3m, Horizontal	±4.5dB
			30MHz-200MHz, 3m, Vertical	±4.4dB
			200MHz-1000MHz, 3m, Vertical	±4.8dB
			1GHz-6GHz, 3m	±5.0dB
			6GHz-18GHz, 3m	±4.7dB
	☐	No.5 3m Semi Anechoic Chamber	30MHz-200MHz, 3m, Horizontal	±4.2dB
			200MHz-1000MHz, 3m, Horizontal	±4.3dB
			30MHz-200MHz, 3m, Vertical	±4.3dB
			200MHz-1000MHz, 3m, Vertical	±4.7dB
			1GHz-6GHz, 3m	±4.8dB
			6GHz-18GHz, 3m	±4.5dB

Remark：Uncertainty = $ku_c(y)$

Test Item	Uncertainty
20dB Bandwidth	±0.2kHz
99% Occupied Bandwidth	±0.38%
Carrier Frequency Separation	±0.2kHz
Time of Occupancy	±0.03sec
Maximum peak Output power	± 0.52dB
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	2022. 01. 11	1 Year
2.	A.M.N.	R&S	ENV4200	100169	2021. 11. 04	1 Year
3.	L.I.S.N.	Kyoritsu	KNW-407	8-855-9	2021. 12. 19	1 Year
4.	Pulse Limiter	R&S	ESH3-Z2	100354	2021. 12. 23	1 Year
5.	Digital Thermo-Hygro Meter	iMax	HTC-1	No.8 S/R	2022. 04. 14	1 Year
6.	Coaxial Cable	Yeida	RG/58AU	CE-08	2021. 09. 13	1 Year
7.	Test Software	Audix	e3	V6.120619c	N.C.R.	N.C.R.

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4.2. Radiated Emission Measurement

Item	Type	Manufacturer	Model No.	Serial No.	Cal. Date	Cal. Interval
1.	Spectrum Analyzer	Agilent	N9010A-526	MY53400071	2021. 09. 09	1 Year
2.	Spectrum Analyzer	Keysight	N9010B-544	MY55460198	2022. 04. 08	1 Year
3.	Test Receiver	R&S	ESCS30	100039	2022. 04. 08	1 Year
4.	Amplifier	HP	8447D	2944A06305	2022. 01. 05	1 Year
5.	Microwave Amplifier	Keysight	83051A	MY53010042	2021. 07. 30	1 Year
6.	Microwave Amplifier	Keysight	83017A	MY53270365	2021. 05. 27	1 Year
7.	Loop Antenna	ETS・LINDGREN	6512	00035867	2021. 09. 29	1 Year
8.	Bilog Antenna	TESEQ	CBL6112D	33821	2021. 07. 16	1 Year
9.	Double-Ridged Waveguide Horn	EMCO	3115	9609-4927	2021. 07. 02	1 Year
10.	Horn Antenna	COM-POWER	AH-840	101092	2022. 01. 06	1 Year
11.	2.4GHz Notch Filter	K&L Microwave	7NSL10-2441.5/E130.5-O/O	2	2021 .07. 24	1 Year
12.	3GHz Notch Filter	Microwave	H3G018G1	484796	2021 .07. 24	1 Year
13.	Coaxial Cable	MIYAZAKI	5D2W	RE-11	2022. 01. 20	1 Year
14.	Coaxial Cable	HUBER+SUHNER	SUCOFLEX 106	RE-14	2021. 01. 29	1 Year
15.	Coaxial Cable	HUBER+SUHNER	SUCOFLEX 102	RE-30	2021. 08. 25	1 Year
16.	Digital Thermo-Hygro Meter	iMax	HTC-1	No.3 3m A/C	2022. 04. 14	1 Year
17.	Test Software	Audix	e3	V6.120619c	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	N9030B	MY61330403	2021. 12. 21	1 Year
2.	Digital Thermo-Hygro Meter	iMax	HTC-1	RF-03	2022. 04. 14	1 Year

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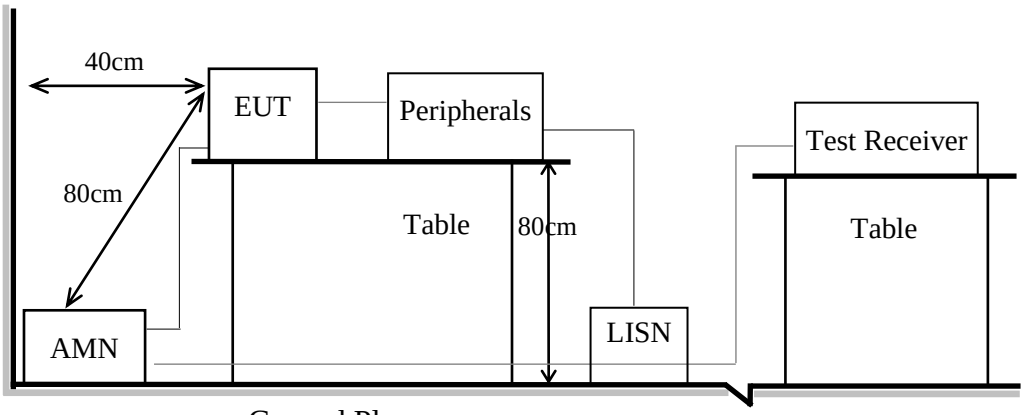
5. CONDUCTED EMISSION

5.1. Block Diagram of Test Setup

5.1.1. Block Diagram of EUT

Indicated as section 3.11

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 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.

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5.4. Test Results

Please refer to Appendix A.

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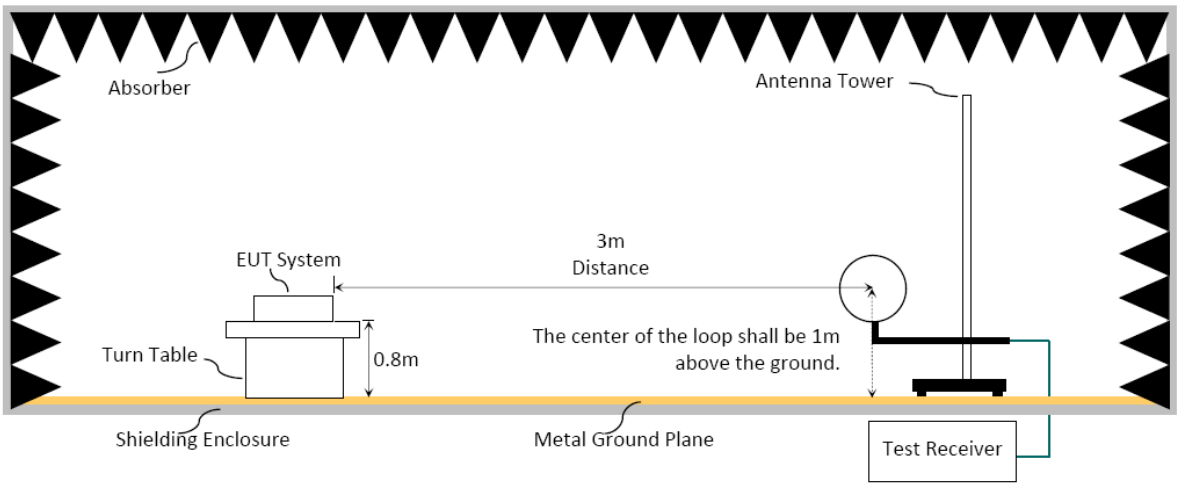
6. RADIATED EMISSION

6.1. Block Diagram of Test Setup

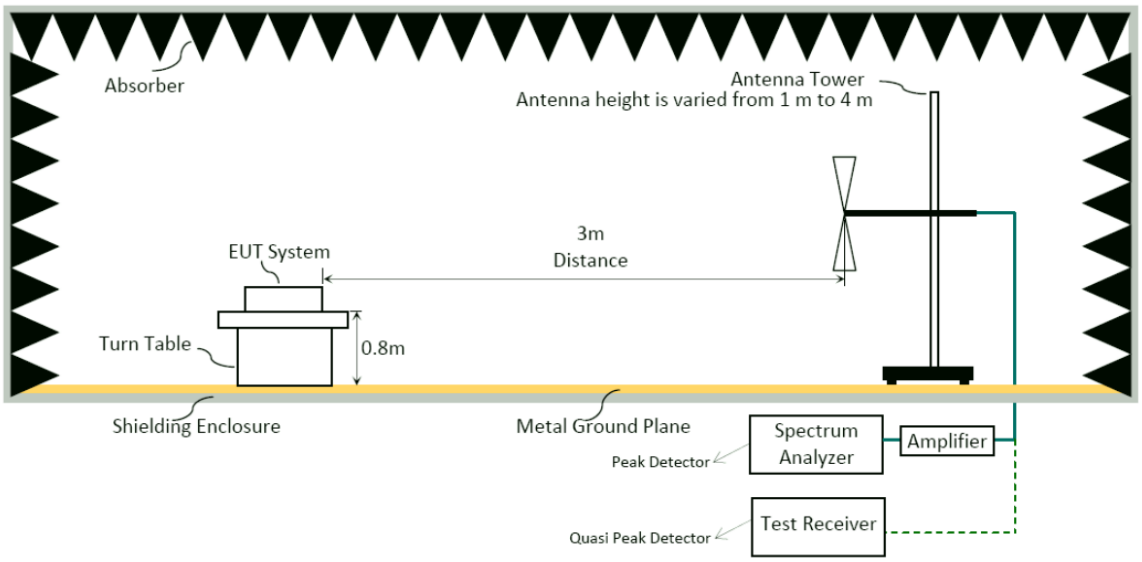
6.1.1. Block Diagram of EUT

Indicated as section 3.11

6.1.2. Setup Diagram for 9kHz-30MHz



6.1.3. Setup Diagram for 30-1000MHz



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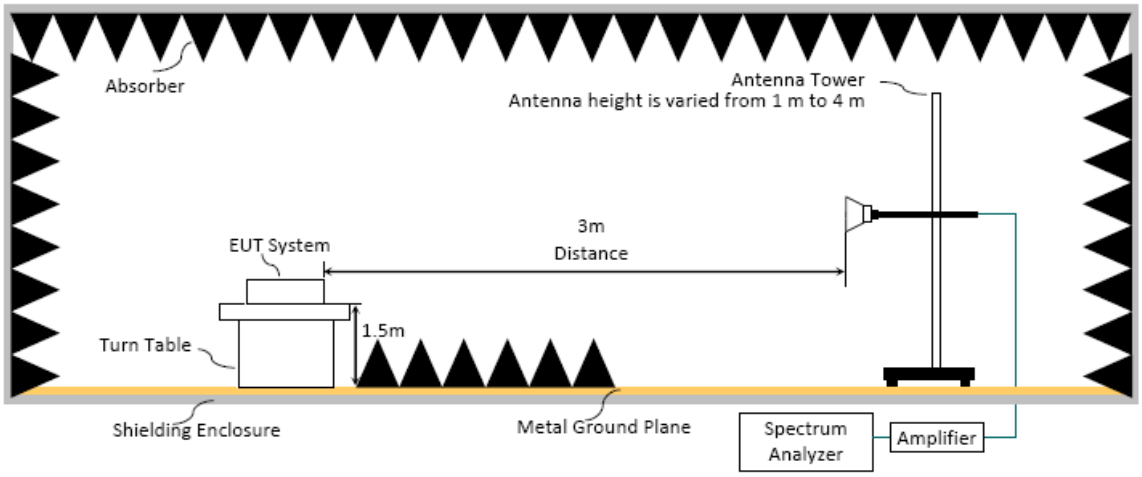
6.1.4. Setup Diagram for above 1GHz



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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 C63.10-2013 regulation.

(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 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 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 ≥ 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.
(3)Detector = Peak.
(4)Sweep time = auto.
(5)Trace mode = max hold.
(6)Allow sweeps to continue until the trace stabilizes.

□**Option 2:**

Average Emission Level(dBμV/m)= Peak Emission Level(dBμV/m)+ DCCF(dB).

6.4. Measurement Result Explanation

■Peak Emission Level (dBμV/m) =Antenna Factor (dB/m) + Cable Loss (dB) + Meter Reading (dBμV) (including Preamp factor if test used)

□Average Emission Level (dBμV/m) =Antenna Factor (dB/m) + Cable Loss (dB) + Meter Reading (dBμV) (including Preamp factor if test used)

□Average Emission Level (dBμV/m)= Peak Emission Level (dBμV/m)+ DCCF(dB)
Duty Cycle Correction Factor (DCCF)= 20log(TX_{on}/TX_{on+off}) presented in section 3.8.

□ERP= Peak Emission Level (dBμV/m) -95.2dB-2.14dB

6.5. Test Results

Please refer to Appendix A.

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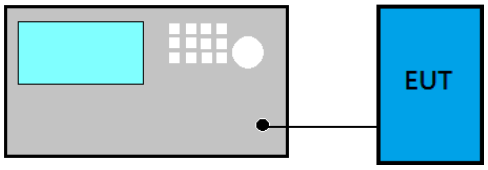
7. MAXIMUM PEAK OUTPUT POWER

7.1. Block Diagram of Test Setup



7.2. Specification Limits

The Limits of maximum Peak Output Power for frequency hopping systems in 2400-2483.5MHz is: 0.125Watt. (21dBm)

7.3. Test Procedure

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

(a) Use the following spectrum analyzer settings
- (1) Span: Approximately five times the 20 dB bandwidth, centered on a hopping channel.
- (2) RBW > 20 dB bandwidth of the emission being measured.
- (3) VBW ≥ RBW
- (4) Sweep: Auto
- (5) Detector function: Peak
- (6) Trace: Max hold

(b) Allow trace to stabilize.

(c) Use the marker-to-peak function to set the marker to the peak of the emission.

7.4. Test Results

Please refer to Appendix A

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8. DEVIATION TO TEST SPECIFICATIONS

【NONE】

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APPDNDIX A

TEST DATA AND PLOTS

(Model: 16Z90Q)

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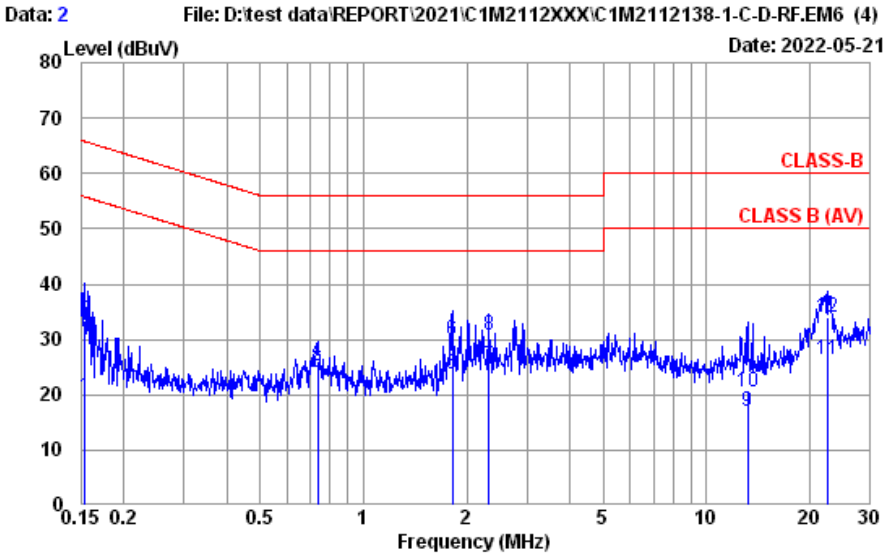
A.1 CONDUCTED EMISSION

Test Date	2022/05/21	Temp./Hum.	24°C/71%
Test Voltage	AC 120V 60Hz (Via AC Adapter)	Tested By	Chucky Chiu
Test SKU	SKU #1 (with INPAQ Antenna)		




```
Site No.        : No.8 Shielded Room              Data No.     : 2
Instrument 1    : Receiver ESR3(774)
Instrument 2    : ENV4200 (169)(A)|CE-08|ESH3-Z2 (354)
Limit           : CLASS-B                         Phase        : NEUTRAL
Environment     : 24°C / 71%                      Engineer     : Chucky Chiu
EUT Model       : 16Z90Q                          Test Rating : 120Vac/60Hz
Test Mode       : Operating
                  Inpaq
```

	Freq. (MHz)	AMN Factor (dB)	Cable Loss (dB)	Pulse Att. (dB)	Reading (dBµV)	Emission Level (dBµV)	Limits (dBµV)	Margin (dB)	Remark
1	0.154	10.64	0.03	9.85	-0.77	19.75	55.78	36.03	Average
2	0.154	10.64	0.03	9.85	12.97	33.49	65.78	32.29	QP
3	0.735	10.43	0.04	9.85	3.73	24.05	46.00	21.95	Average
4	0.735	10.43	0.04	9.85	5.75	26.07	56.00	29.93	QP
5	1.819	10.46	0.06	9.86	3.33	23.71	46.00	22.29	Average
6	1.819	10.46	0.06	9.86	9.56	29.94	56.00	26.06	QP
7	2.321	10.50	0.07	9.86	4.81	25.24	46.00	20.76	Average
8	2.321	10.50	0.07	9.86	10.30	30.73	56.00	25.27	QP
9	13.197	12.23	0.16	9.90	-5.28	17.01	50.00	32.99	Average
10	13.197	12.23	0.16	9.90	-1.84	20.45	60.00	39.55	QP
11	22.416	14.38	0.20	9.95	1.96	26.49	50.00	23.51	Average
12	22.416	14.38	0.20	9.95	9.55	34.08	60.00	25.92	QP

```
Remarks: 1. Emission Level= AMN Factor + Cable Loss + Pulse Att. + Reading.
         2. If the average limit is met when using a quasi-peak detector,
            the EUT shall be deemed to meet both limits and measurement
            with average detector is unnecessary.
```

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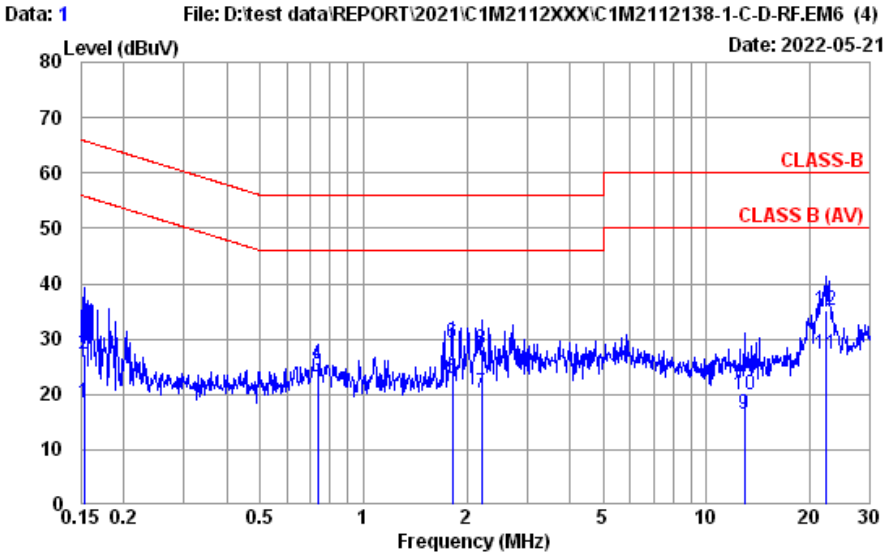
Test Date	2022/05/21	Temp./Hum.	24℃/71%
Test Voltage	AC 120V 60Hz (Via AC Adapter)	Tested By	Chucky Chiu
Test SKU	SKU #1 (with INPAQ Antenna)		




```
Site No.        : No.8 Shielded Room              Data No.     : 1
Instrument 1    : Receiver ESR3(774)
Instrument 2    : ENV4200 (169)(A)|CE-08|ESH3-Z2 (354)
Limit           : CLASS-B                         Phase        : LINE
Environment     : 24*C / 71%                      Engineer     : Chucky Chiu
EUT Model       : 16Z90Q                          Test Rating : 120Vac/60Hz
Test Mode       : Operating
                  Inpaq
```

	Freq. (MHz)	AMN Factor (dB)	Cable Loss (dB)	Pulse Att. (dB)	Reading (dBµV)	Emission Level (dBµV)	Limits (dBµV)	Margin (dB)	Remark
1	0.153	10.60	0.03	9.85	-1.99	18.49	55.82	37.33	Average
2	0.153	10.60	0.03	9.85	6.83	27.31	65.82	38.51	QP
3	0.735	10.41	0.04	9.85	2.99	23.29	46.00	22.71	Average
4	0.735	10.41	0.04	9.85	5.22	25.52	56.00	30.48	QP
5	1.819	10.43	0.06	9.86	2.58	22.93	46.00	23.07	Average
6	1.819	10.43	0.06	9.86	8.98	29.33	56.00	26.67	QP
7	2.213	10.44	0.06	9.86	-0.12	20.24	46.00	25.76	Average
8	2.213	10.44	0.06	9.86	7.67	28.03	56.00	27.97	QP
9	12.920	11.74	0.16	9.90	-5.25	16.55	50.00	33.45	Average
10	12.920	11.74	0.16	9.90	-1.86	19.94	60.00	40.06	QP
11	22.180	13.59	0.20	9.95	3.43	27.17	50.00	22.83	Average
12	22.180	13.59	0.20	9.95	11.28	35.02	60.00	24.98	QP

```
Remarks: 1. Emission Level= AMN Factor + Cable Loss + Pulse Att. + Reading.
         2. If the average limit is met when using a quasi-peak detector,
            the EUT shall be deemed to meet both limits and measurement
```

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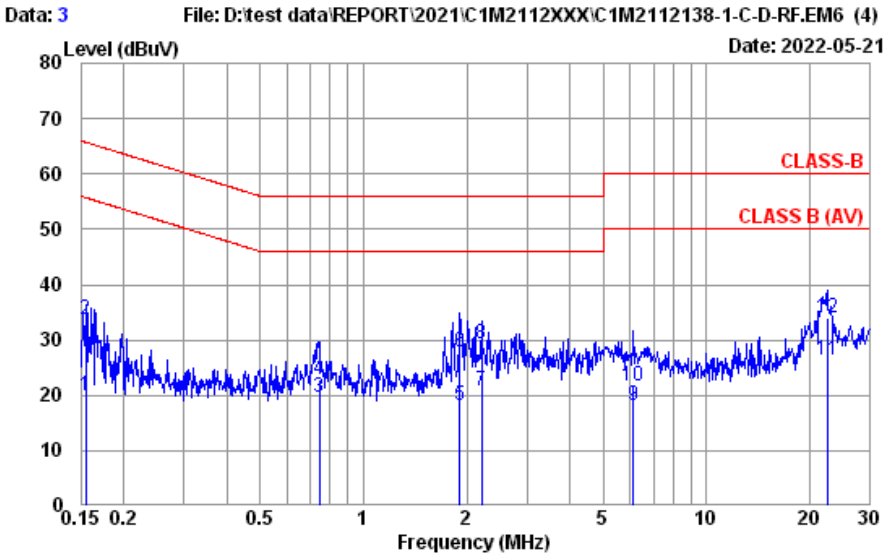
Test Date	2022/05/21	Temp./Hum.	24℃/71%
Test Voltage	AC 120V 60Hz (Via AC Adapter)	Tested By	Chucky Chiu
Test SKU	SKU #2 (with LUXSHARE-ICT Antenna)		



Site No. : No.8 Shielded Room
Instrument 1 : Receiver ESR3(774)
Instrument 2 : ENV4200 (169)(A)|CE-08|ESH3-Z2 (354)
Limit : CLASS-B
Environment : 24°C / 71%
EUT Model : 16Z90Q
Test Mode : Operating
Luxshare

Data No. : 3
Phase : NEUTRAL
Engineer : Chucky Chiu
Test Rating : 120Vac/60Hz

	Freq. (MHz)	AMN Factor (dB)	Cable Loss (dB)	Pulse Att. (dB)	Reading (dBµV)	Emission Level (dBµV)	Limits (dBµV)	Margin (dB)	Remark
1	0.155	10.64	0.03	9.85	-0.48	20.04	55.74	35.70	Average
2	0.155	10.64	0.03	9.85	13.18	33.70	65.74	32.04	QP
3	0.743	10.43	0.04	9.85	-0.82	19.50	46.00	26.50	Average
4	0.743	10.43	0.04	9.85	2.64	22.96	56.00	33.04	QP
5	1.908	10.47	0.06	9.86	-2.17	18.22	46.00	27.78	Average
6	1.908	10.47	0.06	9.86	7.48	27.87	56.00	28.13	QP
7	2.213	10.49	0.06	9.86	0.54	20.95	46.00	25.05	Average
8	2.213	10.49	0.06	9.86	8.75	29.16	56.00	26.84	QP
9	6.121	10.94	0.11	9.87	-2.77	18.15	50.00	31.85	Average
10	6.121	10.94	0.11	9.87	0.64	21.56	60.00	38.44	QP
11	22.416	14.38	0.20	9.95	1.90	26.43	50.00	23.57	Average
12	22.416	14.38	0.20	9.95	9.42	33.95	60.00	26.05	QP

Remarks: 1. Emission Level= AMN Factor + Cable Loss + Pulse Att. + Reading.
2. If the average limit is met when using a quasi-peak detector, the EUT shall be deemed to meet both limits and measurement with average detector is unnecessary.

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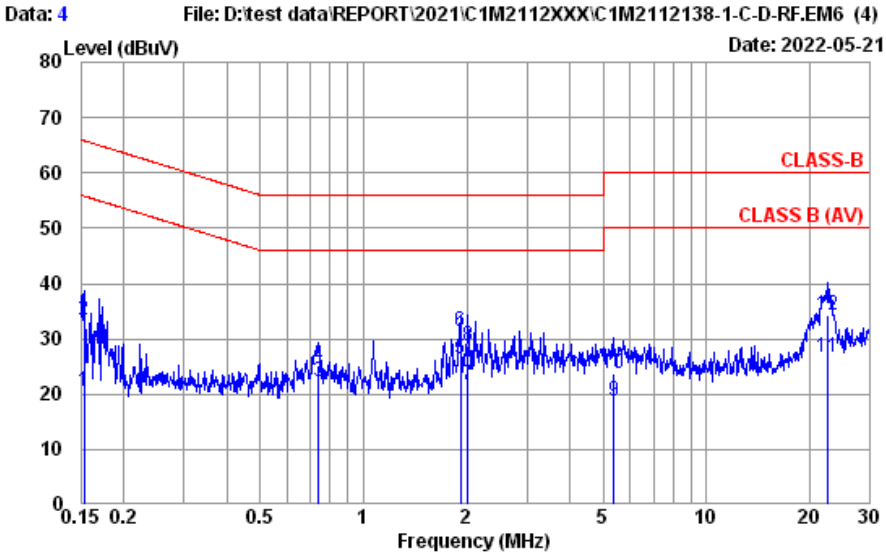
Test Date	2022/05/21	Temp./Hum.	24℃/71%
Test Voltage	AC 120V 60Hz (Via AC Adapter)	Tested By	Chucky Chiu
Test SKU	SKU #2 (with LUXSHARE-ICT Antenna)		



Site No. : No.8 Shielded Room Data No. : 4
Instrument 1 : Receiver ESR3(774)
Instrument 2 : ENV4200 (169)(A)|CE-08|ESH3-Z2 (354)
Limit : CLASS-B Phase : LINE
Environment : 24°C / 71% Engineer : Chucky Chiu
EUT Model : 16Z90Q Test Rating : 120Vac/60Hz
Test Mode : Operating
Luxshare

	Freq. (MHz)	AMN Factor (dB)	Cable Loss (dB)	Pulse Att. (dB)	Reading (dBµV)	Emission Level (dBµV)	Limits (dBµV)	Margin (dB)	Remark
1	0.153	10.60	0.03	9.85	-0.04	20.44	55.82	35.38	Average
2	0.153	10.60	0.03	9.85	12.87	33.35	65.82	32.47	QP
3	0.739	10.41	0.04	9.85	1.92	22.22	46.00	23.78	Average
4	0.739	10.41	0.04	9.85	4.82	25.12	56.00	30.88	QP
5	1.918	10.43	0.06	9.86	6.16	26.51	46.00	19.49	Average
6	1.918	10.43	0.06	9.86	10.92	31.27	56.00	24.73	QP
7	2.012	10.43	0.06	9.86	1.46	21.81	46.00	24.19	Average
8	2.012	10.43	0.06	9.86	8.36	28.71	56.00	27.29	QP
9	5.362	10.70	0.10	9.87	-1.95	18.72	50.00	31.28	Average
10	5.362	10.70	0.10	9.87	3.19	23.86	60.00	36.14	QP
11	22.535	13.70	0.21	9.96	2.85	26.72	50.00	23.28	Average
12	22.535	13.70	0.21	9.96	10.40	34.27	60.00	25.73	QP

Remarks: 1. Emission Level= AMN Factor + Cable Loss + Pulse Att. + Reading.
2. If the average limit is met when using a quasi-peak detector, the EUT shall be deemed to meet both limits and measurement with average detector is unnecessary.

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A.2 RADIATED EMISSION

Test Date	2022/05/23 ~ 06/08	Temp./Hum.	22 ~ 23℃/65%
Test Voltage	AC 120V 60Hz (Via AC Adapter)	Tested By	Biran Hsieh

A.2.1 Emissions within Restricted Frequency Bands

A.2.1.1 Frequency 9kHz~30MHz

The emissions (9kHz~30MHz) not reported for there is no emission be found.

A.2.1.2 Frequency Below 1GHz

- **Test SKU #1 (with INPAQ Antenna)**

Mode	GFSK	Frequency	TX 2480MHz

Antenna at Horizontal Polarization

Emission Frequency (MHz)	Antenna Factor (dB/m)	Cable Loss (dB)	Preamp Gain (dB)	Read Level (dBμV)	Emission Level (dBμV/m)	Limits (dBμV/m)	Margin (dB)	Detector
34.850	21.77	1.53	26.48	27.37	24.19	40.00	15.81	Peak
134.760	17.23	3.03	26.07	35.18	29.37	43.50	14.13	Peak
221.090	16.51	3.95	25.74	38.77	33.49	46.00	12.51	Peak
273.470	18.62	4.47	25.65	36.14	33.58	46.00	12.42	Peak
644.010	24.53	7.35	27.41	29.79	34.26	46.00	11.74	Peak
848.680	26.12	8.48	27.13	29.28	36.75	46.00	9.25	Peak

Antenna at Vertical Polarization

Emission Frequency (MHz)	Antenna Factor (dB/m)	Cable Loss (dB)	Preamp Gain (dB)	Read Level (dBμV)	Emission Level (dBμV/m)	Limits (dBμV/m)	Margin (dB)	Detector
36.790	20.71	1.57	26.48	35.98	31.78	40.00	8.22	Peak
129.910	17.46	2.98	26.10	39.62	33.96	43.50	9.54	Peak
162.890	15.59	3.33	25.93	39.59	32.58	43.50	10.92	Peak
359.800	20.52	5.46	26.12	29.63	29.49	46.00	16.51	Peak
487.840	22.92	6.67	27.07	28.82	31.34	46.00	14.66	Peak
599.390	24.30	7.10	27.40	33.10	37.10	46.00	8.90	Peak

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- **Test SKU #2 (with LUXSHARE-ICT Antenna)**

Mode	GFSK	Frequency	TX 2480MHz

Antenna at Horizontal Polarization

Emission Frequency (MHz)	Antenna Factor (dB/m)	Cable Loss (dB)	Preamp Gain (dB)	Read Level (dBμV)	Emission Level (dBμV/m)	Limits (dBμV/m)	Margin (dB)	Detector
45.520	16.09	1.74	26.47	32.11	23.47	40.00	16.53	Peak
117.300	17.81	2.82	26.17	33.80	28.26	43.50	15.24	Peak
191.990	15.05	3.62	25.82	37.40	30.25	43.50	13.25	Peak
296.750	19.02	4.67	25.61	33.69	31.77	46.00	14.23	Peak
445.160	22.21	6.33	26.77	34.41	36.18	46.00	9.82	Peak
689.600	24.74	7.58	27.43	31.67	36.56	46.00	9.44	Peak

Antenna at Vertical Polarization

Emission Frequency (MHz)	Antenna Factor (dB/m)	Cable Loss (dB)	Preamp Gain (dB)	Read Level (dBμV)	Emission Level (dBμV/m)	Limits (dBμV/m)	Margin (dB)	Detector
81.410	13.17	2.38	26.34	40.93	30.14	40.00	9.86	Peak
139.610	16.98	3.09	26.05	36.22	30.24	43.50	13.26	Peak
172.590	15.23	3.44	25.89	32.76	25.54	43.50	17.96	Peak
345.250	20.21	5.29	26.01	35.33	34.82	46.00	11.18	Peak
485.900	22.89	6.65	27.04	33.13	35.63	46.00	10.37	Peak
634.310	24.47	7.29	27.41	32.18	36.53	46.00	9.47	Peak

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A.2.2 Emissions outside the frequency band:

The emissions (up to 25GHz) not reported for there is no emission be found.

- **Test SKU #2 (with LUXSHARE-ICT Antenna)**

Mode	GFSK	Frequency	TX 2480MHz

Antenna at Horizontal Polarization

Emission Frequency (MHz)	Antenna Factor (dB/m)	Cable Loss (dB)	Preamp Gain (dB)	Read Level (dBμV)	Emission Level (dBμV/m)	Limits (dBμV/m)	Margin (dB)	Detector
4960.000	33.55	8.74	31.64	32.75	43.40	54.00	10.60	Peak

Antenna at Vertical Polarization

Emission Frequency (MHz)	Antenna Factor (dB/m)	Cable Loss (dB)	Preamp Gain (dB)	Read Level (dBμV)	Emission Level (dBμV/m)	Limits (dBμV/m)	Margin (dB)	Detector
4960.000	33.55	8.74	31.64	31.72	42.37	54.00	11.63	Peak

A.2.3 Emissions in Non-restricted Frequency Bands:

All emission levels below the FCC 15.209(a)/RSS-Gen Section 8.9 table 4 general radiated emissions limits is not required.

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A.3 MAXIMUM PEAK OUTPUT POWER

Test Date	2022/06/22	Temp./Hum.	25℃/49%
Cable Loss	1.00dB	Tested By	Biran Hsieh
Test Voltage	AC 120V 60Hz (Via AC Adapter)		

A.3.1 Maximum Peak Output Power

Mode	Centre Frequency (MHz)	Maximum Peak Output Power		Limit
		dBm	W	
GFSK	2402	8.77	0.008	21dBm (0.125W)
	2441	9.60	0.009	
	2480	**9.87**	**0.010**	
8-DPSK	2402	7.39	0.005	
	2441	7.92	0.006	
	2480	**7.96**	**0.006**	

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APPDNDIX B

TEST PHOTOGRAPHS

(Model: 16Z90Q)