



FCC CO-LOCATION RADIO TEST REPORT

FCC ID : PU5-TP00132A
Equipment : Notebook Computer
Brand Name : Lenovo
Model Name : TP00132A
Applicant : Wistron Corporation
21F, No. 88, Sec. 1, Hsin Tai Wu Rd., Hsichih
Dist, New Taipei City 221, Taiwan
Manufacturer : Wistron Corporation
21F, No. 88, Sec. 1, Hsin Tai Wu Rd., Hsichih
Dist, New Taipei City 221, Taiwan
Standard : FCC 47 CFR Part 2, 27

Equipment: Foxconn T99W175 tested inside of Lenovo Notebook Computer.

The product was received on May 04, 2021 and testing was started from Jul. 15, 2021 and completed on Jul. 16, 2021. We, Sporton International Inc. Wensan Laboratory, would like to declare that the tested sample has been evaluated in accordance with the test procedures given in ANSI / TIA-603-E and has been in compliance with the applicable technical standards.

The test results in this partial report apply exclusively to the tested model / sample. Without written approval of Sporton International Inc. Wensan Laboratory, the test report shall not be reproduced except in full.

Louis Wu

Approved by: Louis Wu

Sporton International Inc. Wensan Laboratory

No.58, Aly. 75, Ln. 564, Wenhua 3rd, Rd., Guishan Dist., Taoyuan City 333010, Taiwan



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History of this test report

Report No.	Version	Description	Issued Date
FG150417H	01	Initial issue of report	Jul. 20, 2021
FG150417H	02	1. Revise report title 2. Revise Product Feature of Equipment Under Test 3. Add remark in test mode 4. Revise report typo	Jul. 21, 2021



Summary of Test Result

Report Clause	Ref Std. Clause	Test Items	Result (PASS/FAIL)	Remark
3.2	§2.1053 §27.53 (a)(4)	Radiated Spurious Emission (Band 30)	Pass	Under limit 15.69 dB at 4614.000 MHz
	§2.1051 §27.53 (m)(4)	Radiated Spurious Emission (Band 7)		

Declaration of Conformity:

The test results with all measurement uncertainty excluded are presented in accordance with the regulation limits or requirements declared by manufacturers.

Comments and Explanations:

The declared of product specification for EUT presented in the report are provided by the manufacturer, and the manufacturer takes all the responsibilities for the accuracy of product specification.

Reviewed by: Sheng Kuo

Report Producer: Celery Wei



1 General Description

1.1 Product Feature of Equipment Under Test

Product Feature	
Equipment	Notebook Computer
Brand Name	Lenovo
Model Name	TP00132A
FCC ID	PU5-TP00132A
Sample 1	EUT with LUXSHARE-ICT Antenna
Sample 2	EUT with AVX/ Ethertronics Antenna
Integrated WLAN Module	FCC ID: PD9AX210D2 Brand Name: Intel® Wi-Fi 6E AX210 Model Name: AX210D2W
EUT supports Radios application	WCDMA/HSPA/LTE/5G NR/GNSS WLAN 11a/b/g/n HT20/HT40 WLAN 11ac VHT80/VHT160 WLAN 11ax HE20/HE40/HE80/HE160 Bluetooth BR/EDR/LE
EUT Stage	Production Unit

Remark:

1. The above EUT's information was declared by manufacturer.
2. Equipment: Foxconn T99W175 tested inside of Lenovo Notebook Computer.

Antenna Information						
WWAN					3G<E (dBi)	
Antenna 1	Manufacturer	AVX/ Ethertronics			Peak gain	1.93
	Part number	Main Antenna:	025.901TF.0001		Type	PIFA
		Auxiliary Antenna:	025.901TG.0001 (Rx only)			
		MIMO1 Antenna	025.901TF.0001 (Rx only)			
		MIMO2 Antenna	025.901TG.0001			
Antenna 2	Manufacturer	LUXSHARE-ICT			Peak gain	1.9
	Part number	Main Antenna:	025.901TK.0001		Type	PIFA
		Auxiliary Antenna:	025.901TL.0001 (Rx only)			
		MIMO1 Antenna	025.901TK.0001 (Rx only)			
		MIMO2 Antenna	025.901TL.0001			

Remark:

1. The above EUT's information was declared by manufacturer. Please refer to Comments and Explanations in report summary.
2. All test items were performed with Main Antenna (AVX/ Ethertronics).



1.2 Product Specification of Equipment Under Test

Product Specification subjective to this standard	
Tx Frequency	LTE Band 7 : 2502.5 MHz ~ 2567.5 MHz LTE Band 30 : 2307.5 MHz ~ 2312.5 MHz
Rx Frequency	LTE Band 7 : 2622.5MHz ~ 2687.5 MHz LTE Band 30 : 2352.5 MHz ~ 2357.5 MHz
Bandwidth	LTE Band 7 : 5MHz/ 10MHz / 15MHz / 20MHz LTE Band 30 : 5MHz / 10MHz
Type of Modulation	LTE: QPSK / 16QAM / 64QAM / 256QAM

1.3 Modification of EUT

No modifications are made to the EUT during all test items.

1.4 Testing Location

Test Site	Sporton International Inc. Wensan Laboratory
Test Site Location	No.58, Aly. 75, Ln. 564, Wenhua 3rd, Rd., Guishan Dist., Taoyuan City 333010, Taiwan
Test Site No.	Sporton Site No.
	03CH12-HY
Test Engineer	Jack Cheng, Lance Chiang, and Chuan Chu
Temperature	22.3~26.4°C
Relative Humidity	58~66%

Note: The test site complies with ANSI C63.4 2014 requirement.

FCC Designation No.: TW3786



1.5 Applicable Standards

According to the specifications of the manufacturer, the EUT must comply with the requirements of the following standards:

- ♦ ANSI C63.26-2015
- ♦ ANSI / TIA-603-E
- ♦ FCC 47 CFR Part 2, 27
- ♦ FCC KDB 971168 D01 Power Meas. License Digital Systems v03r01
- ♦ FCC KDB Publication No. 558074 D01 DTS Meas. Guidance v05r02
- ♦ FCC KDB 789033 D02 General UNII Test Procedures New Rules v02r01.
- ♦ FCC KDB 414788 D01 Radiated Test Site v01r01
- ♦ FCC KDB 662911 D01 Multiple Transmitter Output v02r01.

Remark:

1. All test items were verified and recorded according to the standards and without any deviation during the test.
2. The TAF code is not including all the FCC KDB listed without accreditation.

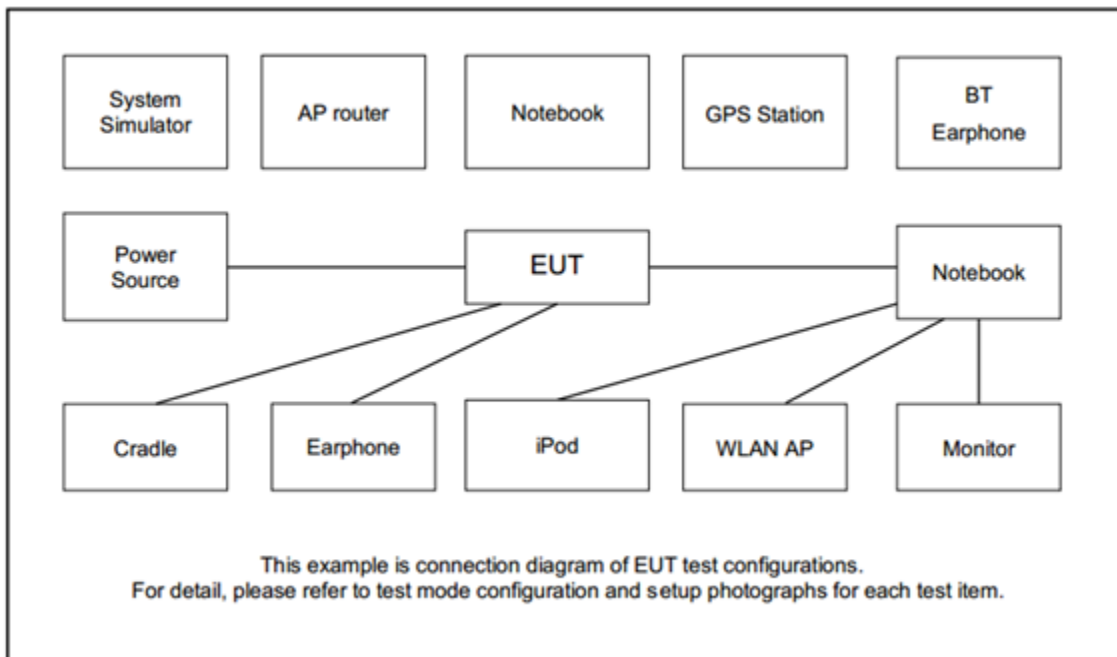
2 Test Configuration of Equipment Under Test

2.1 Test Mode

Antenna port conducted and radiated test items listed below are performed according to KDB 971168 D01 Power Meas. License Digital Systems v03r01 with maximum output power.

Test Items	Band	Bandwidth (MHz)						Modulation				RB #			Test Channel		
		1.4	3	5	10	15	20	QPSK	16QAM	64QAM	256QAM	1	Half	Full	L	M	H
Radiated Spurious Emission	7	-	-				v	v				v			v	v	v
	30	-	-	v	v	-	-	v				v			v	v	v
Remark	<ol style="list-style-type: none"> The mark "v" means that this configuration is chosen for testing The mark "-" means that this bandwidth is not supported. The device is investigated from 30MHz to 10 times of fundamental signal for radiated spurious emission test under different RB size/offset and modulations in exploratory test. Subsequently, only the worst case emissions are reported. During the Radiated Spurious Emission test, the EUT turn on the WLAN functions simultaneously. 																

2.2 Connection Diagram of Test System





2.3 Support Unit used in test configuration and system

Item	Equipment	Brand Name	Model No.	FCC ID	Data Cable	Power Cord
1.	System Simulator	Anritsu	MT8820C	N/A	N/A	Unshielded, 1.8 m
2.	iPod Earphone	Apple	N/A	Verification	Unshielded, 1.0 m	N/A

2.4 Frequency List of Low/Middle/High Channels

LTE Band 7 Channel and Frequency List				
BW [MHz]	Channel/Frequency(MHz)	Lowest	Middle	Highest
20	Channel	20850	21100	21350
	Frequency	2510	2535	2560
LTE Band 30 Channel and Frequency List				
BW [MHz]	Channel/Frequency(MHz)	Lowest	Middle	Highest
10	Channel	-	27710	-
	Frequency	-	2310	-
5	Channel	27685	27710	27735
	Frequency	2307.5	2310	2312.5

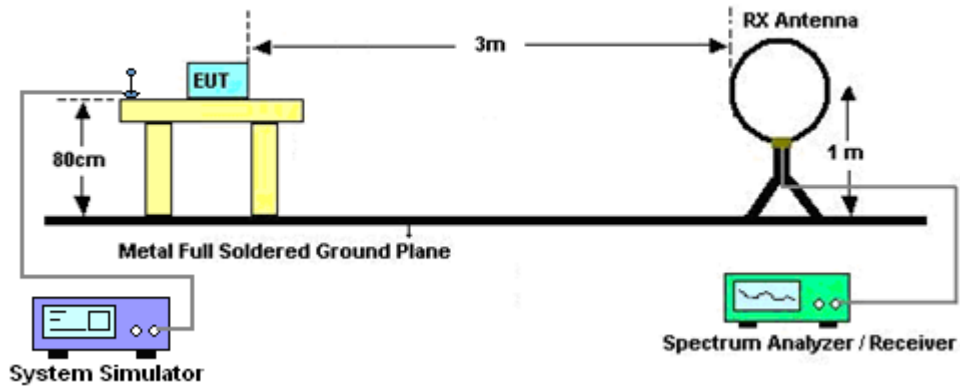
3 Radiated Test Items

3.1 Measuring Instruments

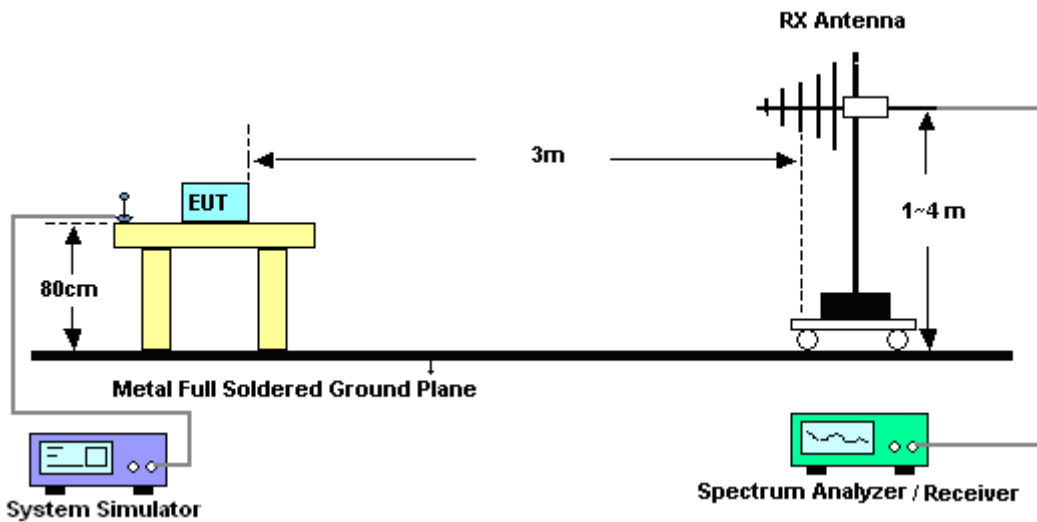
See list of measuring instruments of this test report.

3.1.1 Test Setup

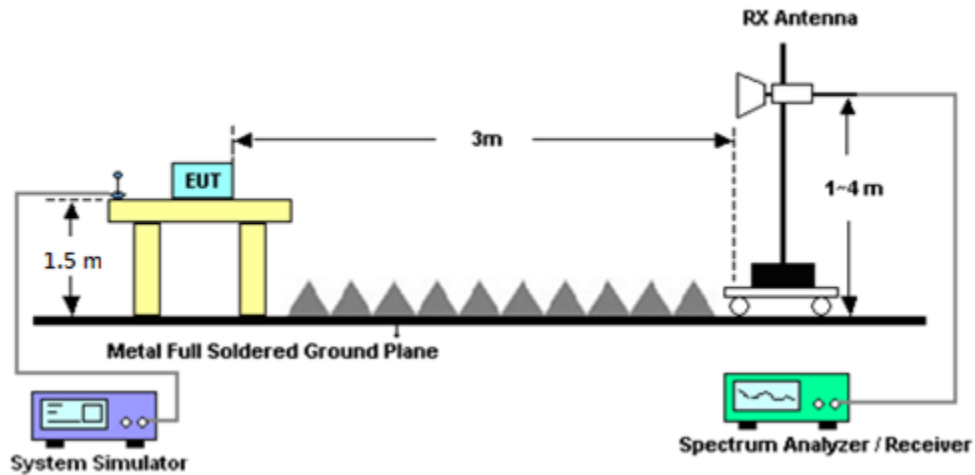
For radiated test below 30MHz



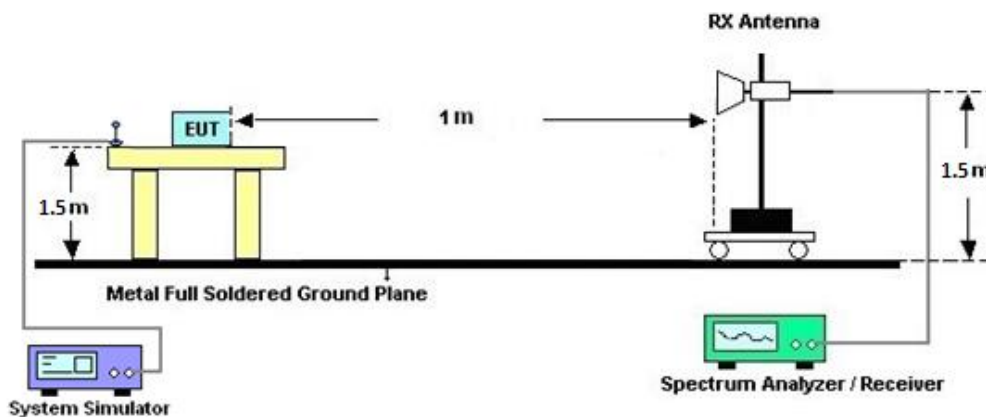
For radiated test from 30MHz to 1GHz



For radiated test from 1GHz to 18GHz



For radiated test above 18GHz



3.1.2 Test Result of Radiated Test

Please refer to Appendix A.

Note:

The low frequency, which started from 9 kHz to 30 MHz, was pre-scanned and the result which was 20 dB lower than the limit line was not reported.

There is adequate comparison measurement of both open-field test site and alternative test site - semi-Anechoic chamber according to 414788 D01 Radiated Test Site v01r01, and the result came out very similar.



3.2 Radiated Spurious Emission Measurement

3.2.1 Description of Radiated Spurious Emission Measurement

The radiated spurious emission was measured by substitution method according to ANSI / TIA-603-E.

For LTE Band 7

The power of any emission outside of the authorized operating frequency ranges must be attenuated below the transmitter power (P) by a factor of at least $55 + 10 \log (P)$ dB.

For LTE Band 30

The power of any emission outside of the authorized operating frequency ranges must be attenuated below the transmitter power (P) by a factor of at least $70 + 10 \log (P)$ dB.

The spectrum is scanned from 30 MHz up to a frequency including its 10th harmonic.



3.2.2 Test Procedures

The testing follows FCC KDB 971168 D01 v03r01 Section 7 and ANSI / TIA-603-E Section 2.2.12.

1. The EUT was placed on a turntable with 0.8 meter for frequency below 1GHz and 1.5 meter for frequency above 1GHz respectively above ground.
2. The EUT was set 3 meters from the receiving antenna, which was mounted on the antenna tower.
3. The table was rotated 360 degrees to determine the position of the highest spurious emission.
4. The height of the receiving antenna is varied between one meter and four meters to search the maximum spurious emission for both horizontal and vertical polarizations.
5. Make the measurement with the spectrum analyzer's RBW = 1MHz, VBW = 3MHz, taking the record of maximum spurious emission.
6. A horn antenna was substituted in place of the EUT and was driven by a signal generator.
7. Tune the output power of signal generator to the same emission level with EUT maximum spurious emission.
8. Taking the record of output power at antenna port.
9. Repeat step 7 to step 8 for another polarization.
10. The RF fundamental frequency should be excluded against the limit line in the operating frequency band.

For LTE Band 7

The limit line is derived from $55 + 10\log(P)$ dB below the transmitter power P(Watts)

$$\text{EIRP (dBm)} = \text{S.G. Power} - \text{Tx Cable Loss} + \text{Tx Antenna Gain}$$

$$\text{ERP (dBm)} = \text{EIRP} - 2.15$$

For LTE Band 30

The limit line is derived from $70 + 10\log(P)$ dB below the transmitter power P(Watts)

$$= P(W) - [70 + 10\log(P)] \text{ (dB)}$$

$$= [30 + 10\log(P)] \text{ (dBm)} - [70 + 10\log(P)] \text{ (dB)}$$

$$= -40\text{dBm.}$$



4 List of Measuring Equipment

Instrument	Brand Name	Model No.	Serial No.	Characteristics	Calibration Date	Test Date	Due Date	Remark
Loop Antenna	Rohde & Schwarz	HFH2-Z2	100315	9 kHz~30 MHz	Jan. 04, 2021	Jul. 15, 2021~ Jul. 16, 2021	Jan. 03, 2022	Radiation (03CH11-HY)
Bilog Antenna	TESEQ	CBL 6111D & 00800N1D01N -06	37059 & 01	30MHz~1GHz	Oct. 11, 2020	Jul. 15, 2021~ Jul. 16, 2021	Oct. 10, 2021	Radiation (03CH12-HY)
Bilog Antenna	TESEQ	CBL 6111D & N-6-06	35414 & AT-N0602	30MHz~1GHz	Oct. 11, 2020	Jul. 15, 2021~ Jul. 16, 2021	Oct. 10, 2021	Radiation (03CH12-HY)
Horn Antenna	SCHWARZBE CK	BBHA 9120 D	9120D-1328	1GHz~18GHz	Nov. 23, 2020	Jul. 15, 2021~ Jul. 16, 2021	Nov. 22, 2021	Radiation (03CH12-HY)
Horn Antenna	SCHWARZBE CK	BBHA 9120 D	9120D-1212	1GHz~18GHz	May 18, 2021	Jul. 15, 2021~ Jul. 16, 2021	May 17, 2022	Radiation (03CH12-HY)
SHF-EHF Horn Antenna	SCHWARZBE CK	BBHA 9170	00993	18GHz~40GHz	Nov. 19, 2020	Jul. 15, 2021~ Jul. 16, 2021	Nov. 18, 2021	Radiation (03CH12-HY)
SHF-EHF Horn Antenna	SCHWARZBE CK	BBHA 9170	BBHA917098 0	18GHz~40GHz	Jun. 11, 2021	Jul. 15, 2021~ Jul. 16, 2021	Jun. 10, 2022	Radiation (03CH12-HY)
Preamplifier	COM-POWER	PA-103	161075	10MHz~1GHz	Mar. 24, 2021	Jul. 15, 2021~ Jul. 16, 2021	Mar. 23, 2022	Radiation (03CH12-HY)
Preamplifier	Keysight	83017A	MY57280120	1GHz~26.5GHz	Jul. 20, 2020	Jul. 15, 2021~ Jul. 16, 2021	Jul. 19, 2021	Radiation (03CH12-HY)
Preamplifier	E-INSTRUME NT TECH LTD.	ERA-100M-18 G-56-01-A70	EC1900249	1GHz~18GHz	Dec. 05, 2020	Jul. 15, 2021~ Jul. 16, 2021	Dec. 04, 2021	Radiation (03CH12-HY)
Preamplifier	EMEC	EM18G40G	060715	18GHz~40GHz	Dec. 11, 2020	Jul. 15, 2021~ Jul. 16, 2021	Dec. 10, 2021	Radiation (03CH12-HY)
Spectrum Analyzer	Agilent	N9010A	MY53470118	10Hz~44GHz	Sep. 14, 2020	Jul. 15, 2021~ Jul. 16, 2021	Sep. 13, 2021	Radiation (03CH12-HY)
Signal Generator	Rohde & Schwarz	SMB100A	101107	100kHz~40GHz	Dec. 04, 2020	Jul. 15, 2021~ Jul. 16, 2021	Dec. 03, 2021	Radiation (03CH12-HY)
RF Cable	HUBER + SUHNER	SUCOFLEX 126E	0058/126E	30MHz~18GHz	Dec. 11, 2020	Jul. 15, 2021~ Jul. 16, 2021	Dec. 10, 2021	Radiation (03CH12-HY)
RF Cable	HUBER + SUHNER	SUCOFLEX 102	505134/2	30MHz~40GHz	Feb. 22, 2021	Jul. 15, 2021~ Jul. 16, 2021	Feb. 21, 2022	Radiation (03CH12-HY)
RF Cable	HUBER + SUHNER	SUCOFLEX 102	800740/2	30MHz~40GHz	Feb. 22, 2021	Jul. 15, 2021~ Jul. 16, 2021	Feb. 21, 2022	Radiation (03CH12-HY)
Filter	Wainwright	WLKS1200-12 SS	SN2	1.2GHz Low Pass Filter	Mar. 17, 2021	Jul. 15, 2021~ Jul. 16, 2021	Mar. 16, 2022	Radiation (03CH12-HY)
Filter	Wainwright	WHKX12-1080 -1200-15000-6 0SS	SN1	1.2GHz High Pass Filter	Mar. 17, 2021	Jul. 15, 2021~ Jul. 16, 2021	Mar. 16, 2022	Radiation (03CH12-HY)
Filter	Wainwright	WHKX12-2700 -3000-18000-6 0ST	SN2	3GHz High Pass Filter	Jul. 12, 2021	Jul. 15, 2021~ Jul. 16, 2021	Jul. 11, 2022	Radiation (03CH12-HY)
Controller	EMEC	EM1000	N/A	Control Turn table & Ant Mast	N/A	Jul. 15, 2021~ Jul. 16, 2021	N/A	Radiation (03CH12-HY)
Antenna Mast	EMEC	AM-BS-4500-B	N/A	1m~4m	N/A	Jul. 15, 2021~ Jul. 16, 2021	N/A	Radiation (03CH12-HY)
Turn Table	EMEC	TT2000	N/A	0~360 Degree	N/A	Jul. 15, 2021~ Jul. 16, 2021	N/A	Radiation (03CH12-HY)



5 Uncertainty of Evaluation

Uncertainty of Radiated Emission Measurement (30 MHz ~ 1000 MHz)

Measuring Uncertainty for a Level of Confidence of 95% ($U = 2Uc(y)$)	3.10
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Uncertainty of Radiated Emission Measurement (1 GHz ~ 18 GHz)

Measuring Uncertainty for a Level of Confidence of 95% ($U = 2Uc(y)$)	3.39
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Uncertainty of Radiated Emission Measurement (18 GHz ~ 40 GHz)

Measuring Uncertainty for a Level of Confidence of 95% ($U = 2Uc(y)$)	4.34
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Appendix A. Test Results of Radiated Test

LTE Band 7 + 5G WLAN 11ax(HE20) Ant1+2 Tx Ch36

LTE Band 7 / 20MHz / QPSK									
Channel	Frequency (MHz)	EIRP (dBm)	Limit (dBm)	Over Limit (dB)	SPA Reading (dBm)	S.G. Power (dBm)	TX Cable loss (dB)	TX Antenna Gain (dBi)	Polarization (H/V)
Lowest	5004	-49.23	-25	-24.23	-71.25	-60.22	1.61	12.61	H
	7500	-46.95	-25	-21.95	-73.32	-56.06	1.99	11.10	H
	10008	-44.51	-25	-19.51	-74.08	-53.40	2.40	11.29	H
									H
									H
									H
	5004	-51.59	-25	-26.59	-73.17	-62.58	1.61	12.61	V
	7500	-47.20	-25	-22.20	-73.52	-56.31	1.99	11.10	V
	10008	-43.73	-25	-18.73	-74.08	-52.62	2.40	11.29	V
									V
									V
									V
Middle	5052	-51.91	-25	-26.91	-73.91	-62.96	1.62	12.67	H
	7578	-47.85	-25	-22.85	-73.81	-56.96	2.00	11.12	H
	10107	-44.32	-25	-19.32	-74.14	-53.14	2.40	11.21	H
									H
									H
									H
	5052	-51.58	-25	-26.58	-73.21	-62.63	1.62	12.67	V
	7578	-48.40	-25	-23.40	-74.32	-57.51	2.00	11.12	V
	10107	-43.89	-25	-18.89	-74.28	-52.71	2.40	11.21	V
									V
									V
									V



Highest	5100	-48.47	-25	-23.47	-70.45	-59.57	1.64	12.74	H
	7656	-47.85	-25	-22.85	-73.72	-56.97	2.01	11.13	H
	10206	-43.96	-25	-18.96	-74.03	-52.70	2.40	11.14	H
									H
									H
									H
	5100	-52.44	-25	-27.44	-74.12	-63.54	1.64	12.74	V
	7653	-47.91	-25	-22.91	-73.66	-57.03	2.01	11.13	V
	10206	-43.59	-25	-18.59	-74.01	-52.33	2.40	11.14	V
									V
									V
									V

Remark: Spurious emissions within 30-1000MHz were found more than 20dB below limit line.



LTE Band 30 + WLAN 2.4G 11ax(HE20) Ant1+2 Tx ch1

LTE Band 30 / 5MHz / QPSK									
Channel	Frequency (MHz)	EIRP (dBm)	Limit (dBm)	Over Limit (dB)	SPA Reading (dBm)	S.G. Power (dBm)	TX Cable loss (dB)	TX Antenna Gain (dBi)	Polarization (H/V)
Lowest	4608	-58.31	-40	-18.31	-45.31	-69.54	1.45	12.68	H
	6916	-59.27	-40	-19.27	-53.87	-69.56	1.73	12.02	H
	9225	-59.04	-40	-19.04	-54.13	-68.66	2.16	11.78	H
									H
									H
									H
	4608	-56.46	-40	-16.46	-42.67	-67.69	1.45	12.68	V
	6918	-57.82	-40	-17.82	-51.99	-68.10	1.73	12.01	V
	9225	-58.17	-40	-18.17	-54.26	-67.79	2.16	11.78	V
									V
									V
									V
Middle	4614	-60.56	-40	-20.56	-47.57	-71.78	1.46	12.68	H
	6923	-59.18	-40	-19.18	-53.83	-69.46	1.73	12.01	H
	9234	-59.11	-40	-19.11	-54.2	-68.72	2.16	11.77	H
									H
									H
									H
	4614	-58.01	-40	-18.01	-44.25	-69.23	1.46	12.68	V
	6923	-57.32	-40	-17.32	-51.51	-67.60	1.73	12.01	V
	9234	-57.95	-40	-17.95	-54.05	-67.56	2.16	11.77	V
									V
									V
									V



Highest	4620	-59.93	-40	-19.93	-46.97	-71.15	1.46	12.68	H
	6930	-58.85	-40	-18.85	-53.53	-69.12	1.73	12.00	H
	9243	-59.02	-40	-19.02	-54.1	-68.61	2.16	11.76	H
									H
									H
									H
	4620	-57.77	-40	-17.77	-44.04	-68.99	1.46	12.68	V
	6930	-57.46	-40	-17.46	-51.69	-67.73	1.73	12.00	V
	9243	-57.86	-40	-17.86	-53.97	-67.45	2.16	11.76	V
									V
									V
									V

Remark: Spurious emissions within 30-1000MHz were found more than 20dB below limit line.



LTE Band 30 / 10MHz / QPSK									
Channel	Frequency (MHz)	EIRP (dBm)	Limit (dBm)	Over Limit (dB)	SPA Reading (dBm)	S.G. Power (dBm)	TX Cable loss (dB)	TX Antenna Gain (dBi)	Polarization (H/V)
Lowest	4614	-58.38	-40	-18.38	-45.39	-69.60	1.46	12.68	H
	6918	-57.60	-40	-17.60	-52.21	-67.88	1.73	12.01	H
	9225	-59.11	-40	-19.11	-54.2	-68.73	2.16	11.78	H
									H
									H
									H
									H
	4614	-55.69	-40	-15.69	-41.93	-66.91	1.46	12.68	V
	6918	-56.56	-40	-16.56	-50.73	-66.84	1.73	12.01	V
	9225	-57.91	-40	-17.91	-54	-67.53	2.16	11.78	V
									V
									V
									V
									V

Remark: Spurious emissions within 30-1000MHz were found more than 20dB below limit line.