FCC Test Report (Spot Check)

Report No.:	RFBCKS-WTW-P21070349
FCC ID:	2AYRA-08315
Original FCC ID:	2AYRA-03580
Test Model:	MX4300
Series Model:	MX4300S
Received Date:	July 12, 2021
Test Date:	Aug. 01 to 04, 2021
Issued Date:	Oct. 04, 2021
Applicant:	Linksys USA, Inc.
Address:	12045 E. Waterfront Drive, Playa Vista, CA 90094
Issued By:	Bureau Veritas Consumer Products Services (H.K.) Ltd., Taoyuan Branch Hsin Chu Laboratory
Lab Address:	E-2, No.1, Li Hsin 1st Road, Hsinchu Science Park, Hsinchu City 300, Taiwan
Test Location :	E-2, No.1, Li Hsin 1st Road, Hsinchu Science Park, Hsinchu City 300, Taiwan
FCC Registration / Designation Number:	723255 / TW2022

Testing Laboratory
2022

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Release Control Record

Issue No.	Description	Date Issued
RFBCKS-WTW-P21070349	Original release.	Oct. 04, 2021

1 Certificate of Conformity

Product:	Linksys HomeWRK for Business
Brand:	Linksys
Test Model:	MX4300
Series Model:	MX4300S
Sample Status:	Engineering sample
Applicant:	Linksys USA, Inc.
Test Date:	Aug. 01 to 04, 2021
Standards:	47 CFR FCC Part 15, Subpart C (Section 15.247) ANSI C63.10: 2013

The above equipment has been tested by **Bureau Veritas Consumer Products Services (H.K.) Ltd., Taoyuan Branch**, and found compliance with the requirement of the above standards. The test record, data evaluation & Equipment Under Test (EUT) configurations represented herein are true and accurate accounts of the measurements of the sample's EMC characteristics under the conditions specified in this report.

Prepared by : Vivian Huang , **Date:** Oct. 04, 2021

Vivian Huang / Specialist

Approved by : , **Date:** Oct. 04, 2021

Clark Lin / Technical Manager

2 Summary of Test Results

47 CFR FCC Part 15, Subpart C (Section 15.247)			
FCC Clause	Test Item	Result	Remarks
15.207	AC Power Conducted Emission	PASS	Meet the requirement of limit. Minimum passing margin is -21.57 dB at 0.15000 MHz.
15.205 / 15.209 / 15.247(d)	Radiated Emissions and Band Edge Measurement	PASS	Meet the requirement of limit. Minimum passing margin is -6.4 dB at 2390.00MHz
15.247(d)	Antenna Port Emission	PASS	Meet the requirement of limit.
15.247(a)(2)	6dB bandwidth	NA	Refer to Note 1 below
15.247(b)	Conducted power	PASS	Meet the requirement of limit.
15.247(e)	Power Spectral Density	NA	Refer to Note 1 below
15.203	Antenna Requirement	PASS	No antenna connector is used.

Note:
1. AC Power Conducted Emission & Radiated Emissions Measurement & Conducted power were performed for this addendum. The others testing data refer to original test report.
2. Determining compliance based on the results of the compliance measurement, not taking into account measurement instrumentation uncertainty.

2.1 Measurement Uncertainty

Where relevant, the following measurement uncertainty levels have been estimated for tests performed on the EUT as specified in CISPR 16-4-2:

Measurement	Frequency	Expanded Uncertainty (k=2) (±)
Conducted Emissions at mains ports	150kHz ~ 30MHz	1.9 dB
Conducted Emissions	-	2.5 dB
Radiated Emissions up to 1 GHz	9kHz ~ 30MHz	3.1 dB
	30MHz ~ 1GHz	5.4 dB
Radiated Emissions above 1 GHz	1GHz ~ 18GHz	5.0 dB
	18GHz ~ 40GHz	5.3 dB

2.2 Modification Record

There were no modifications required for compliance.

3 General Information

3.1 General Description of EUT

Product	Linksys HomeWRK for Business
Brand	Linksys
Test Model	MX4300
Series Model	MX4300S
Status of EUT	Engineering sample
Power Supply Rating	12Vdc from power adapter
Modulation Type	CCK, DQPSK, DBPSK for DSSS 64QAM, 16QAM, QPSK, BPSK for OFDM 256QAM for OFDM in 11ac mode and VHT (20/40) mode in 2.4GHz 1024QAM for OFDMA in 11ax HE mode
Modulation Technology	DSSS, OFDM, OFDMA
Transfer Rate	802.11b: up to 11 Mbps 802.11a/g: up to 54 Mbps 802.11n: up to 600 Mbps 802.11ac: up to 1733.3 Mbps 802.11ax: up to 2401.9 Mbps
Operating Frequency	**2.4GHz:** 2.412GHz ~ 2.462GHz **5GHz:** 5.18 ~ 5.24GHz, 5.745 ~ 5.825GHz
Number of Channel	**2.4GHz:** 802.11b, 802.11g, 802.11n (HT20), VHT20, 802.11ax (HE20): 11 802.11n (HT40), VHT40, 802.11ax (HE40): 7 **5GHz:** 802.11a, 802.11n (HT20), 802.11ac (VHT20), 802.11ax (HE20): 9 802.11n (HT40), 802.11ac (VHT40), 802.11ax (HE40): 4 802.11ac (VHT80), 802.11ax (HE80): 2
Output Power	**CDD Mode:** **2.412 ~ 2.462 GHz:** 732.883 mW **5.18 ~ 5.24 GHz:** 579.272 mW **5.745 ~ 5.825 GHz:** 892.871 mW **Beamforming Mode:** **2.412 ~ 2.462 GHz:** 584.844 mW **5.18 ~ 5.24 GHz:** 522.678 mW **5.745 ~ 5.825 GHz:** 405.364mW
Antenna Type	Refer to Note
Antenna Connector	Refer to Note
Accessory Device	Adapter x 1
Data Cable Supplied	NA

Note:

1. FCC ID: 2AYRA-03580 and FCC ID: 2AYRA-08315 use identical hardware and PCB layouts; the only difference is the removal of BT-LE components for FCC ID: 2AYRA-08315.
2. The changes described above do not affect the WiFi_2.4G, WiFi_5G RF test items of the equipment. Consequently, the WiFi_2.4G, 5G test data retrieved from the initial application (FCC ID: 2AYRA-03580) can be re-used for FCC ID: 2AYRA-08315.
3. Spot-checks for worst-case have been performed; please see test reports for more details on test items selected.
4. The EUT has below model names which are identical to each other in all aspects except for the following table:

Brand	Model Name	Difference
Linksys	MX4300	1. NAND flash 2. DDR
	MX4300S	
Note: From the above models, model: **MX4300** was selected as representative model for the test and its data was recorded in this report.		

5. The EUT must be supplied power adapter and following different models could be chosen as following table:

No	Brand	Model No.	Spec.	Plug
1.	APD	WA-36N12FU	Input: 100-240Vac, 0.9A MAX, 50-60Hz Output: 12V, 3A DC output cable (Unshielded, 1.5 m)	US
2.	Ktec	KSA-36W-120300HU	Input: 100-240Vac, 1A, 50/60Hz Output: 12V, 3A DC output cable (Unshielded, 1.5 m)	US
3.	LEI	MU36B1120300-A1	Input: 100-240Vac, 1A, 50/60Hz Output: 12V, 3A DC output cable (Unshielded, 1.5 m)	US
4	APD	WA-36N12R	Input: 100-240Vac, 0.9A, 50-60Hz Output: 12V, 3A DC output cable (Unshielded, 1.5 m)	Interchangeable
Note: From the above adapters, the worst radiated emission & conducted emission test were found in **Adapter 2**. Therefore only the test data of the modes were recorded in this report.				

6. The EUT has three radios as following table:

Radio 1	Radio 2	Radio 3
WLAN 2.4GHz	WLAN 5GHz (low band)	WLAN 5GHz (high band)

7. Simultaneously transmission condition.

Condition	Technology		
1	WLAN 2.4GHz	WLAN 5GHz (low band)	WLAN 5GHz (high band)
Note: The emission of the simultaneous operation has been evaluated and no non-compliance was found.			

8. The antennas provided to the EUT, please refer to the following table:

Ant. No.	Transmitter Circuit	Ant.Net Gain (dBi)	Freq. Range (GHz)	Ant. Type	Connector Type
WIFi LB_1	Dual A	3.1	2.4~2.4835	PCB	i-pex(MHF)
		3.5	5.15~5.25		
		5	5.25~5.35		
		3.7	5.47~5.725		
		4.6	5.725~5.85		
WIFi LB_2	Dual B	2.8	2.4~2.4835	PCB	i-pex(MHF)
		4.8	5.15~5.25		
		5.1	5.25~5.35		
		5	5.47~5.725		
		4.7	5.725~5.85		
WIFi HB_1	5/6G A	3	5.15~5.25	PCB	i-pex(MHF)
		3.8	5.25~5.35		
		3.7	5.47~5.725		
		3.7	5.725~5.85		
WIFi HB_2	5/6G B	3.3	5.15~5.25	PCB	i-pex(MHF)
		4.1	5.25~5.35		
		3.3	5.47~5.725		
		3.3	5.725~5.85		
WIFi HB_3	5/6G C	2.6	5.15~5.25	PCB	i-pex(MHF)
		3.6	5.25~5.35		
		4.1	5.47~5.725		
		3.9	5.725~5.85		
WIFi HB_4	5/6G D	2.4	5.15~5.25	PCB	i-pex(MHF)
		2.9	5.25~5.35		
		2.6	5.47~5.725		
		3.8	5.725~5.85		

9. The EUT incorporates a MIMO function.

MODULATION MODE	Radio 1 - 2.4GHz Band	
	TX & RX CONFIGURATION	
802.11b	2TX	2RX
802.11g	2TX	2RX
802.11n (HT20)	2TX	2RX
802.11n (HT40)	2TX	2RX
VHT20	2TX	2RX
VHT40	2TX	2RX
802.11ax (HE20)	2TX	2RX
802.11ax (HE40)	2TX	2RX

MODULATION MODE	Radio 2 - 5GHz Band (low band)		Radio 3 - 5GHz Band (high band)	
	TX & RX CONFIGURATION		TX & RX CONFIGURATION	
802.11a	2TX	2RX	4TX	4RX
802.11n (HT20)	2TX	2RX	4TX	4RX
802.11n (HT40)	2TX	2RX	4TX	4RX
802.11ac (VHT20)	2TX	2RX	4TX	4RX
802.11ac (VHT40)	2TX	2RX	4TX	4RX
802.11ac (VHT80)	2TX	2RX	4TX	4RX
802.11ax (HE20)	2TX	2RX	4TX	4RX
802.11ax (HE40)	2TX	2RX	4TX	4RX
802.11ax (HE80)	2TX	2RX	4TX	4RX

Note:
1. All of modulation mode support beamforming function except 802.11a/b/g modulation mode.
2. The EUT support Beamforming and CDD mode, therefore both mode were investigated and the worst case scenario was identified. The worst case data were presented in test report.
3. The modulation and bandwidth are similar for 802.11n mode for 20MHz (40MHz), VHT mode for 20MHz (40MHz) and 802.11ax mode for 20MHz (40MHz), therefore the manufacturer will control the power for 802.11n/VHT mode is the same as the 802.11ax or more lower than it and investigated worst case to representative mode in test report. (Final test mode refer to section 3.2.1)

10. The above EUT information is declared by manufacturer and for more detailed features description, please refers to the manufacturer's specifications or user's manual.

11. The above Antenna information is declared by manufacturer and for more detailed features description, please refer to the manufacturer's specifications, the laboratory shall not be held responsible.

3.2 Description of Test Modes

11 channels are provided for 802.11b, 802.11g and 802.11n (HT20), VHT20, 802.11ax (HE20):

Channel	Frequency (MHz)	Channel	Frequency (MHz)
1	2412	7	2442
2	2417	8	2447
3	2422	9	2452
4	2427	10	2457
5	2432	11	2462
6	2437		

7 channels are provided for 802.11n (HT40), VHT40, 802.11ax (HE40):

Channel	Frequency (MHz)	Channel	Frequency (MHz)
3	2422	7	2442
4	2427	8	2447
5	2432	9	2452
6	2437		

3.2.1 Test Mode Applicability and Tested Channel Detail

EUT CONFIGURE MODE	APPLICABLE TO				DESCRIPTION
	RE≥1G	RE<1G	PLC	APCM	
-	√	√	√	√	-

Where **RE≥1G:** Radiated Emission above 1GHz & Bandedge Measurement **RE<1G:** Radiated Emission below 1GHz

PLC: Power Line Conducted Emission **APCM:** Antenna Port Conducted Measurement

Radiated Emission Test (Above 1GHz):

☒ Pre-Scan has been conducted to determine the worst-case mode from all possible combinations between available modulations, data rates and antenna ports (if EUT with antenna diversity architecture).

☒ Following channel(s) was (were) selected for the final test as listed below.

CDD Mode					
MODE	AVAILABLE CHANNEL	TESTED CHANNEL	MODULATION TECHNOLOGY	MODULATION TYPE	DATA RATE PARAMETER
802.11b	1 to 11	6	DSSS	DBPSK	1Mb/s

Radiated Emission Test (Below 1GHz):

☒ Pre-Scan has been conducted to determine the worst-case mode from all possible combinations between available modulations, data rates and antenna ports (if EUT with antenna diversity architecture).

☒ Following channel(s) was (were) selected for the final test as listed below.

CDD Mode					
MODE	AVAILABLE CHANNEL	TESTED CHANNEL	MODULATION TECHNOLOGY	MODULATION TYPE	DATA RATE PARAMETER
802.11b	1 to 11	6	DSSS	DBPSK	1Mb/s

Power Line Conducted Emission Test:

☒ Pre-Scan has been conducted to determine the worst-case mode from all possible combinations between available modulations, data rates and antenna ports (if EUT with antenna diversity architecture).

☒ Following channel(s) was (were) selected for the final test as listed below.

CDD Mode					
MODE	AVAILABLE CHANNEL	TESTED CHANNEL	MODULATION TECHNOLOGY	MODULATION TYPE	DATA RATE PARAMETER
802.11b	1 to 11	6	DSSS	DBPSK	1Mb/s

Antenna Port Conducted Measurement:

☒ Pre-Scan has been conducted to determine the worst-case mode from all possible combinations between available modulations, data rates and antenna ports (if EUT with antenna diversity architecture).

☒ Following channel(s) was (were) selected for the final test as listed below.

CDD Mode					
MODE	AVAILABLE CHANNEL	TESTED CHANNEL	MODULATION TECHNOLOGY	MODULATION TYPE	DATA RATE PARAMETER
802.11b	1 to 11	1, 6, 11	DSSS	DBPSK	1Mb/s
802.11g	1 to 11	1, 6, 11	OFDM	BPSK	6Mb/s
VHT20	1 to 11	1, 6, 11	OFDM	BPSK	MCS0
VHT40	3 to 9	3, 6, 9	OFDM	BPSK	MCS0
802.11ax (HE20)	1 to 11	1, 6, 11	OFDMA	BPSK	MCS0
802.11ax (HE40)	3 to 9	3, 6, 9	OFDMA	BPSK	MCS0
Beamforming Mode					
MODE	AVAILABLE CHANNEL	TESTED CHANNEL	MODULATION TECHNOLOGY	MODULATION TYPE	DATA RATE PARAMETER
VHT20	1 to 11	1, 6, 11	OFDM	BPSK	MCS0
VHT40	3 to 9	3, 6, 9	OFDM	BPSK	MCS0
802.11ax (HE20)	1 to 11	1, 6, 11	OFDMA	BPSK	MCS0
802.11ax (HE40)	3 to 9	3, 6, 9	OFDMA	BPSK	MCS0

Test Condition:

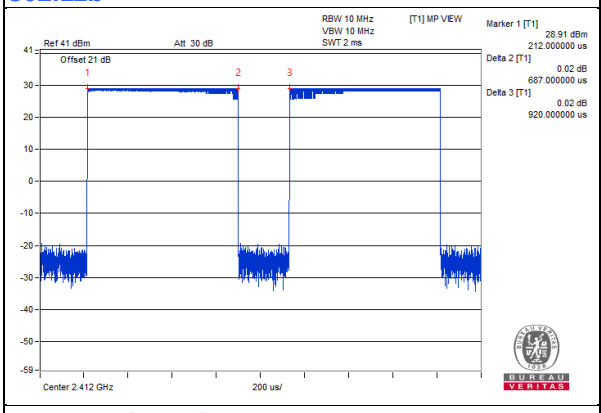
Applicable To	Environmental Conditions	Input Power	Tested By
RE≥1G	20deg. C, 70%RH	120Vac, 60Hz	Ryan Du
RE<1G	25deg. C, 66%RH	120Vac, 60Hz	Tom Yang
PLC	25deg. C, 66%RH	120Vac, 60Hz	Tom Yang
APCM	25deg. C, 60%RH	120Vac, 60Hz	Jyunchun Lin

3.3 Duty Cycle of Test Signal

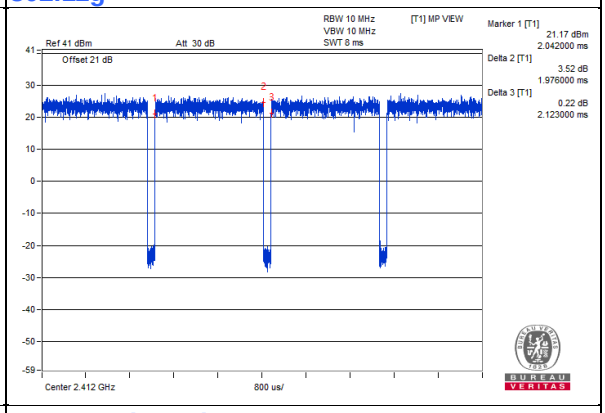
Duty cycle of test signal is < 98%, duty factor shall be considered.

802.11b: Duty cycle = 0.687 ms/0.92 ms = 0.747, Duty factor = 10 * log (1/Duty cycle) = 1.27 dB
802.11g: Duty cycle = 1.976 ms/2.123 ms = 0.931, Duty factor = 10 * log (1/Duty cycle) = 0.31 dB
802.11ax (HE20): Duty cycle = 5.446 ms/5.731 ms = 0.95, Duty factor = 10 * log (1/Duty cycle) = 0.22 dB
802.11ax (HE40): Duty cycle = 5.443 ms/5.775 ms = 0.943, Duty factor = 10 * log (1/Duty cycle) = 0.26 dB

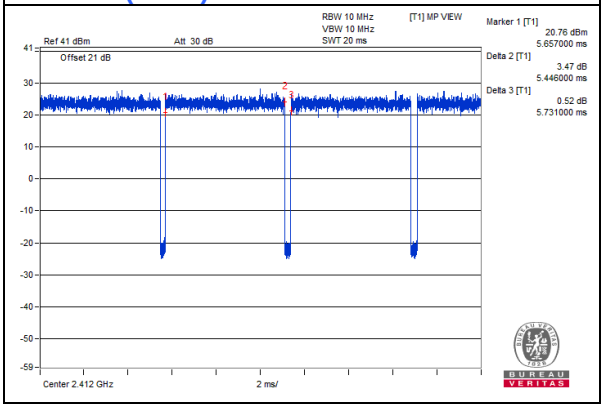
802.11b



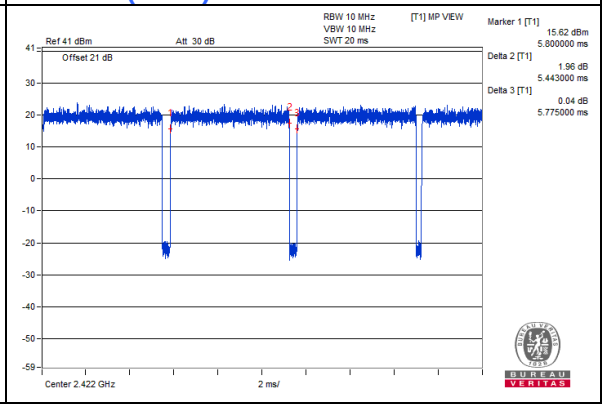
802.11g



802.11ax (HE20)



802.11ax (HE40)



3.4 Description of Support Units

The EUT has been tested as an independent unit together with other necessary accessories or support units. The following support units or accessories were used to form a representative test configuration during the tests.

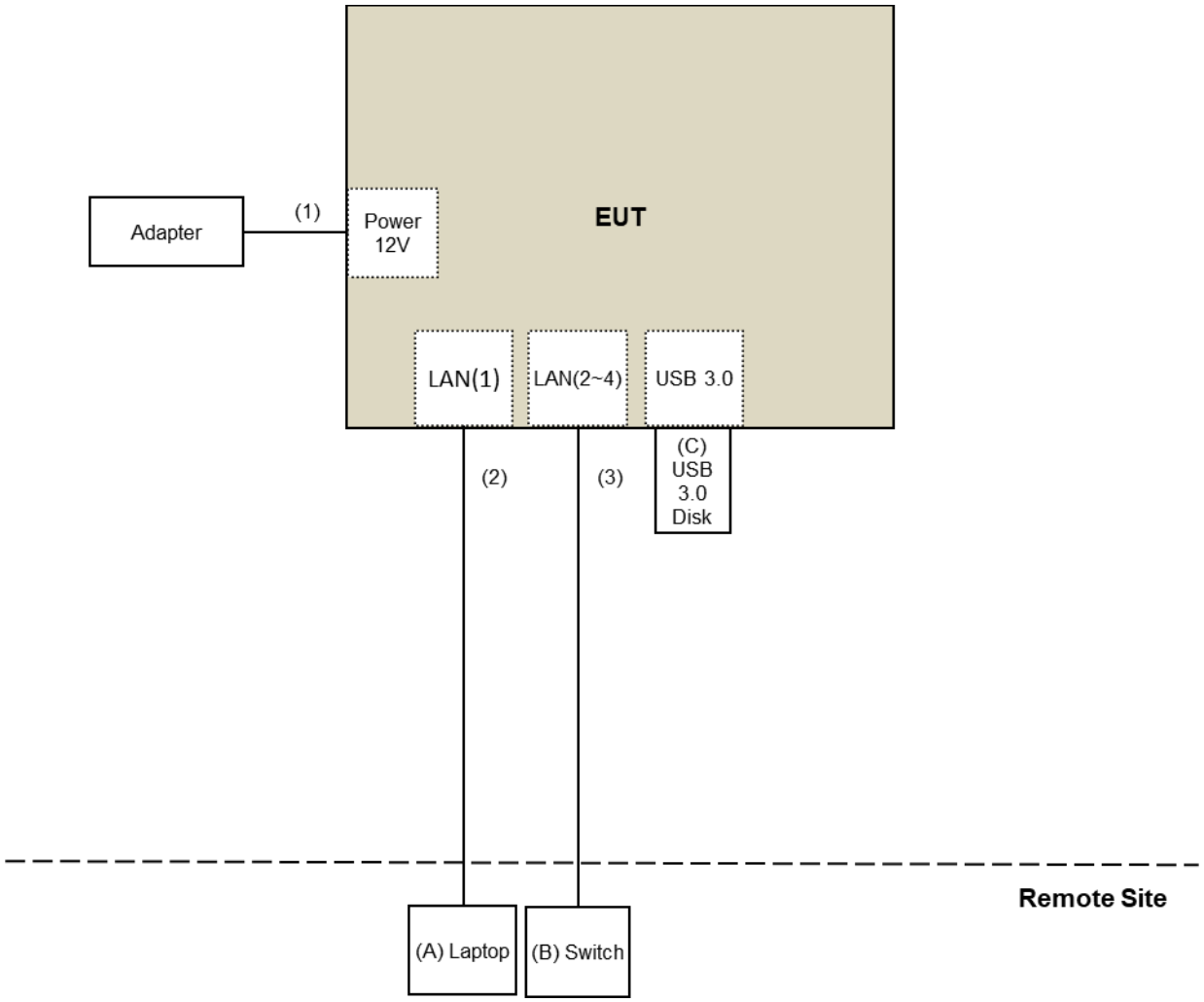
ID	Product	Brand	Model No.	Serial No.	FCC ID	Remarks
A.	Laptop	Lenovo	20U5S01X00 L14	PF-1ANPYA	NA	Provided by Lab
B.	Switch	D-Link	DGS-1005D	DR8WC92000523	NA	Provided by Lab
C.	USB 3.0 Disk	SanDisk	Ultra Flalr USB 3.0	NA	NA	Provided by Lab

Note:

1. All power cords of the above support units are non-shielded (1.8m).

ID	Descriptions	Qty.	Length (m)	Shielding (Yes/No)	Cores (Qty.)	Remarks
1.	DC Cable	1	1.5	No	0	Supplied by client
2.	RJ-45 Cable	1	10	No	0	Provided by Lab
3.	RJ-45 Cable	3	10	No	0	Provided by Lab

3.4.1 Configuration of System under Test



3.5 General Description of Applied Standards and references

The EUT is a RF Product. According to the specifications of the manufacturer, it must comply with the requirements of the following standards and references:

Test standard:

FCC Part 15, Subpart C (15.247)
ANSI C63.10-2013

All test items have been performed and recorded as per the above standards.

References Test Guidance :

KDB 558074 D01 15.247 Meas Guidance v05r02
KDB 662911 D01 Multiple Transmitter Output v02r01

All test items have been performed as a reference to the above KDB test guidance.

4 Test Types and Results

4.1 Radiated Emission and Bandedge Measurement

4.1.1 Limits of Radiated Emission and Bandedge Measurement

Radiated emissions which fall in the restricted bands must comply with the radiated emission limits specified as below table. Other emissions shall be at least 30dB below the highest level of the desired power:

Frequencies (MHz)	Field Strength (microvolts/meter)	Measurement Distance (meters)
0.009 ~ 0.490	2400/F(kHz)	300
0.490 ~ 1.705	24000/F(kHz)	30
1.705 ~ 30.0	30	30
30 ~ 88	100	3
88 ~ 216	150	3
216 ~ 960	200	3
Above 960	500	3

NOTE:

1. The lower limit shall apply at the transition frequencies.
2. Emission level (dBuV/m) = 20 log Emission level (uV/m).
3. For frequencies above 1000MHz, the field strength limits are based on average detector, however, the peak field strength of any emission shall not exceed the maximum permitted average limits, specified above by more than 20dB under any condition of modulation.

4.1.2 Test Instruments

For Radiated Emission & Bandedge test:

DESCRIPTION & MANUFACTURER	MODEL NO.	SERIAL NO.	CALIBRATED DATE	CALIBRATED UNTIL
Test Receiver Keysight	N9038A	MY54450088	July 06, 2021	July 05, 2022
Pre-Amplifier EMCI	EMC001340	980142	May 24, 2021	May 23, 2022
Loop Antenna Electro-Metrics	EM-6879	264	Mar. 05, 2021	Mar. 04, 2022
RF Cable	5D-FB	LOOPCAB-001	Jan. 07, 2021	Jan. 06, 2022
RF Cable	5D-FB	LOOPCAB-002	Jan. 07, 2021	Jan. 06, 2022
Pre-Amplifier Mini-Circuits	ZFL-1000VH2	QA0838008	Oct. 20, 2020	Oct. 19, 2021
Trilog Broadband Antenna SCHWARZBECK	VULB 9168	9168-361	Nov. 05, 2020	Nov. 04, 2021
RF Cable	8D	966-3-1	Mar. 16, 2021	Mar. 15, 2022
RF Cable	8D	966-3-2	Mar. 16, 2021	Mar. 15, 2022
RF Cable	8D	966-3-3	Mar. 16, 2021	Mar. 15, 2022
Fixed attenuator Mini-Circuits	UNAT-5+	PAD-3m-3-01	Sep. 24, 2020	Sep. 23, 2021
Horn_Antenna SCHWARZBECK	BBHA9120-D	9120D-406	Nov. 22, 2020	Nov. 21, 2021
Pre-Amplifier EMCI	EMC12630SE	980384	Jan. 11, 2021	Jan. 10, 2022
RF Cable	EMC104-SM-SM-1500	180504	Apr. 26, 2021	Apr. 25, 2022
RF Cable	EMC104-SM-SM-2000	180601	June 08, 2021	June 07, 2022
RF Cable	EMC104-SM-SM-6000	210201	May 13, 2021	May 12, 2022
Spectrum Analyzer Keysight	N9030A	MY54490679	July 09, 2021	July 08, 2022
Pre-Amplifier EMCI	EMC184045SE	980387	Jan. 11, 2021	Jan. 10, 2022
Horn_Antenna SCHWARZBECK	BBHA 9170	BBHA9170519	Nov. 22, 2020	Nov. 21, 2021
RF Cable	EMC102-KM-KM-1200	160924	Jan. 11, 2021	Jan. 10, 2022
RF Cable	EMC-KM-KM-4000	200214	Mar. 10, 2021	Mar. 09, 2022
Software	ADT_Radiated_V8.7.08	NA	NA	NA
Antenna Tower & Turn Table Max-Full	MF-7802	MF780208406	NA	NA
Boresight Antenna Fixture	FBA-01	FBA-SIP01	NA	NA

Note:

1. The calibration interval of the above test instruments is 12 months and the calibrations are traceable to NML/ROC and NIST/USA.
2. The test was performed in 966 Chamber No. 3.
3. Tested Date: Aug. 01 to 03, 2021

For other test:

DESCRIPTION & MANUFACTURER	MODEL NO.	SERIAL NO.	CALIBRATED DATE	CALIBRATED UNTIL
Power meter Anritsu	ML2495A	1529002	June 21, 2021	June 20, 2022
Power sensor Anritsu	MA2411B	1339443	May 31, 2021	May 30, 2022
10dB Attenuator Woken	MDCS18N-10	MDCS18N-10-01	Apr. 13, 2021	Apr. 12, 2022
Software	ADT_RF Test Software V6.6.5.4	NA	NA	NA

NOTE: 1. The test was performed in Oven room 2.
2. The calibration interval of the above test instruments is 12 months and the calibrations are traceable to NML/ROC and NIST/USA.
3. Tested Date: Aug. 04, 2021

4.1.3 Test Procedures

For Radiated emission below 30MHz

a. The EUT was placed on the top of a rotating table 0.8 meters above the ground at a 3 meter chamber room. The table was rotated 360 degrees to determine the position of the highest radiation.

b. The EUT was set 3 meters away from the interference-receiving antenna, which was mounted on the top of a variable-height antenna tower.

c. Parallel, perpendicular, and ground-parallel orientations of the antenna are set to make the measurement.

d. For each suspected emission, the EUT was arranged to its worst case and the rotatable table was turned from 0 degrees to 360 degrees to find the maximum reading.

e. The test-receiver system was set to Quasi-Peak Detect Function and Specified Bandwidth with Maximum Hold Mode.

NOTE:

1. The resolution bandwidth and video bandwidth of test receiver/spectrum analyzer is 9kHz at frequency below 30MHz.

For Radiated emission above 30MHz

a. The EUT was placed on the top of a rotating table 0.8 meters (for 30MHz ~ 1GHz) / 1.5 meters (for above 1GHz) above the ground at 3 meter chamber room for test. The table was rotated 360 degrees to determine the position of the highest radiation.

b. The EUT was set 3 meters away from the interference-receiving antenna, which was mounted on the top of a variable-height antenna tower.

c. The height of antenna is varied from one meter to four meters above the ground to determine the maximum value of the field strength. Both horizontal and vertical polarizations of the antenna are set to make the measurement.

d. For each suspected emission, the EUT was arranged to its worst case and then the antenna was tuned to heights from 1 meter to 4 meters and the rotatable table was turned from 0 degrees to 360 degrees to find the maximum reading.

e. The test-receiver system was set to quasi-peak detect function and specified bandwidth with maximum hold mode when the test frequency is below 1 GHz.

f. The test-receiver system was set to peak and average detects function and specified bandwidth with maximum hold mode when the test frequency is above 1 GHz. If the peak reading value also meets average limit, measurement with the average detector is unnecessary.

Note:

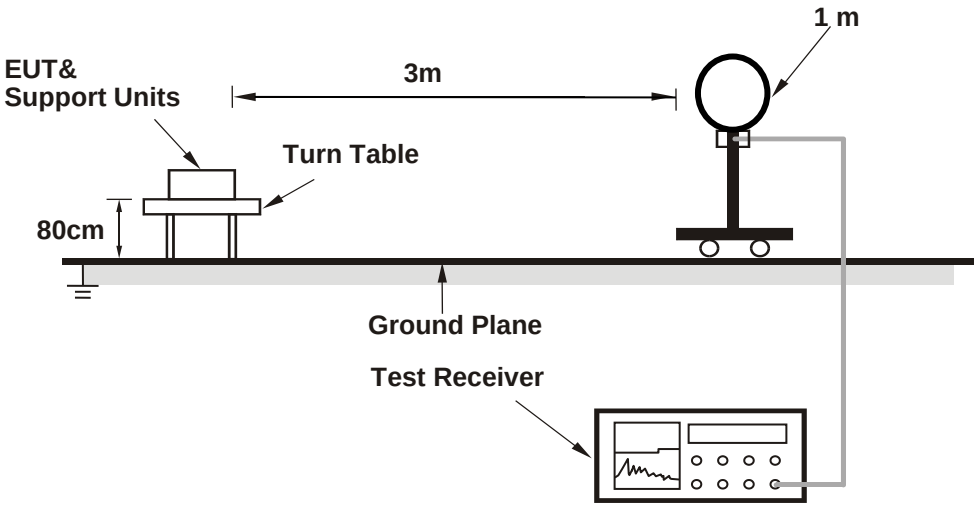
1. The resolution bandwidth and video bandwidth of test receiver/spectrum analyzer is 120kHz for Quasi-peak detection (QP) at frequency below 1GHz.
2. The resolution bandwidth of test receiver/spectrum analyzer is 1 MHz and the video bandwidth is 3 MHz for Peak detection (PK) at frequency above 1GHz.
3. The resolution bandwidth of test receiver/spectrum analyzer is 1MHz and the video bandwidth is ≥ 1/T (Duty cycle < 98%) or 10Hz (Duty cycle ≥ 98%) for Average detection (AV) at frequency above 1GHz.
4. All modes of operation were investigated and the worst-case emissions are reported.

4.1.4 Deviation from Test Standard

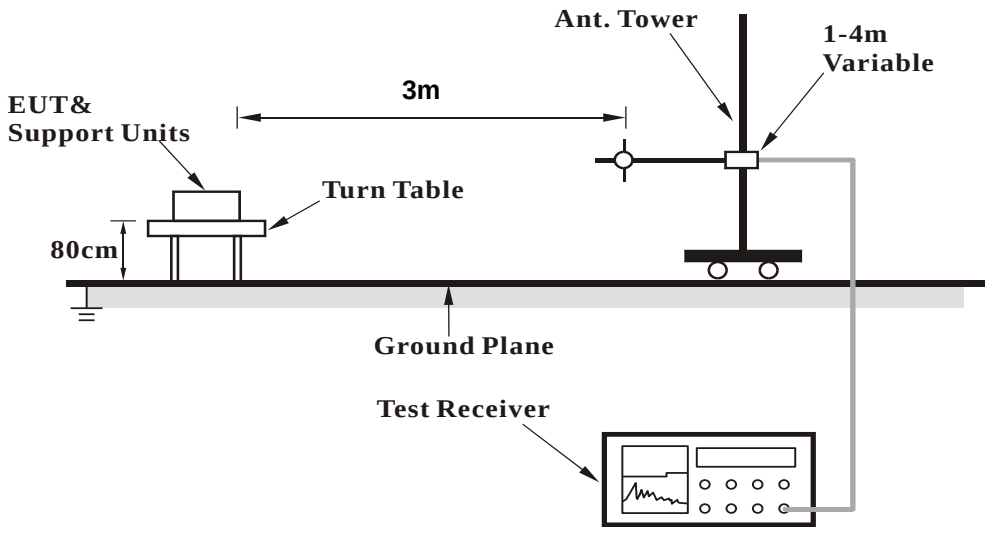
No deviation.

4.1.5 Test Setup

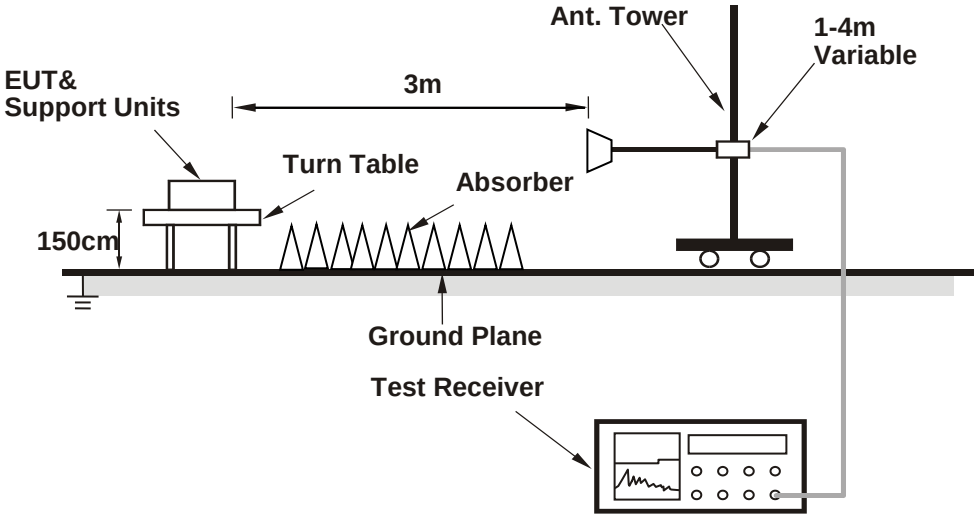
For Radiated emission below 30MHz



For Radiated emission 30MHz to 1GHz



For Radiated emission above 1GHz



For the actual test configuration, please refer to the attached file (Test Setup Photo).

4.1.6 EUT Operating Conditions

a. Connected the EUT with the Laptop which is placed on remote site.
b. Controlling software (QDART-Connectivity1.0-00074.1) has been activated to set the EUT under transmission condition continuously at specific channel frequency.

4.1.7 Test Results

Above 1GHz Data：

RF Mode	TX 802.11b	**Channel**	CH 6：2437 MHz
Frequency Range	1GHz ~ 25GHz	**Detector Function**	Peak (PK) Average (AV)

Antenna Polarity & Test Distance : Horizontal at 3 m								
No	**Frequency (MHz)**	**Emission Level (dBuV/m)**	**Limit (dBuV/m)**	**Margin (dB)**	**Antenna Height (m)**	**Table Angle (Degree)**	**Raw Value (dBuV)**	**Correction Factor (dB/m)**
1	2390.00	59.8 PK	74.0	-14.2	1.79 H	269	61.0	-1.2
2	2390.00	45.9 AV	54.0	-8.1	1.79 H	269	47.1	-1.2
3	*2437.00	116.6 PK			1.79 H	269	117.8	-1.2
4	*2437.00	114.6 AV			1.79 H	269	115.8	-1.2
5	2483.50	56.3 PK	74.0	-17.7	1.79 H	269	57.5	-1.2
6	2483.50	44.4 AV	54.0	-9.6	1.79 H	269	45.6	-1.2
7	4874.00	45.7 PK	74.0	-28.3	1.63 H	360	41.9	3.8
8	4874.00	35.2 AV	54.0	-18.8	1.63 H	360	31.4	3.8
9	7311.00	51.5 PK	74.0	-22.5	1.97 H	145	41.8	9.7
10	7311.00	44.4 AV	54.0	-9.6	1.97 H	145	34.7	9.7
Antenna Polarity & Test Distance : Vertical at 3 m								
No	**Frequency (MHz)**	**Emission Level (dBuV/m)**	**Limit (dBuV/m)**	**Margin (dB)**	**Antenna Height (m)**	**Table Angle (Degree)**	**Raw Value (dBuV)**	**Correction Factor (dB/m)**
1	2390.00	61.4 PK	74.0	-12.6	2.35 V	264	62.6	-1.2
2	**2390.00**	**47.6 AV**	**54.0**	**-6.4**	**2.35 V**	**264**	**48.8**	**-1.2**
3	*2437.00	119.2 PK			2.35 V	264	120.4	-1.2
4	*2437.00	116.1 AV			2.35 V	264	117.3	-1.2
5	2483.50	58.9 PK	74.0	-15.1	2.35 V	264	60.1	-1.2
6	2483.50	47.1 AV	54.0	-6.9	2.35 V	264	48.3	-1.2
7	4874.00	45.9 PK	74.0	-28.1	1.54 V	140	42.1	3.8
8	4874.00	36.4 AV	54.0	-17.6	1.54 V	140	32.6	3.8
9	7311.00	49.7 PK	74.0	-24.3	2.07 V	154	40.0	9.7
10	7311.00	39.3 AV	54.0	-14.7	2.07 V	154	29.6	9.7

Remarks:

1. Emission Level(dBuV/m) = Raw Value(dBuV) + Correction Factor(dB/m)
2. Correction Factor(dB/m) = Antenna Factor(dB/m) + Cable Factor(dB) – Pre-Amplifier Factor(dB)
3. Margin value = Emission Level – Limit value
4. The other emission levels were very low against the limit.
5. " * ": Fundamental frequency.

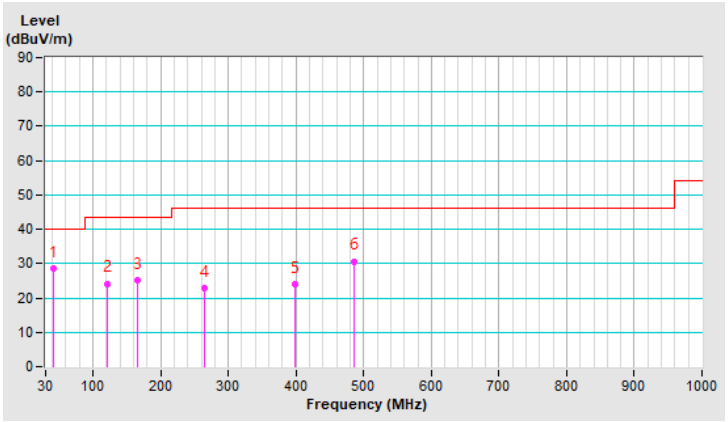
Below 1GHz Data:

RF Mode	TX 802.11b	Channel	CH 6：2437 MHz
Frequency Range	9kHz ~ 1GHz	Detector Function	Quasi-Peak (QP)

Antenna Polarity & Test Distance : Horizontal at 3 m								
No	Frequency (MHz)	Emission Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Antenna Height (m)	Table Angle (Degree)	Raw Value (dBuV)	Correction Factor (dB/m)
1	40.77	28.7 QP	40.0	-11.3	1.50 H	360	37.2	-8.5
2	121.91	24.2 QP	43.5	-19.3	3.00 H	81	33.9	-9.7
3	166.50	25.2 QP	43.5	-18.3	1.50 H	267	33.2	-8.0
4	265.32	22.8 QP	46.0	-23.2	1.50 H	160	30.8	-8.0
5	398.21	23.9 QP	46.0	-22.1	1.50 H	114	27.7	-3.8
6	484.93	30.7 QP	46.0	-15.3	1.50 H	360	32.2	-1.5

Remarks:

1. Emission Level(dBuV/m) = Raw Value(dBuV) + Correction Factor(dB/m)
2. Correction Factor(dB/m) = Antenna Factor(dB/m) + Cable Factor(dB) – Pre-Amplifier Factor(dB)
3. Margin value = Emission Level – Limit value
4. The other emission levels were very low against the limit of frequency range 30MHz~1000MHz.
5. The emission levels were very low against the limit of frequency range 9kHz~30MHz: the amplitude of spurious emissions attenuated more than 20 dB below the permissible value to be report.

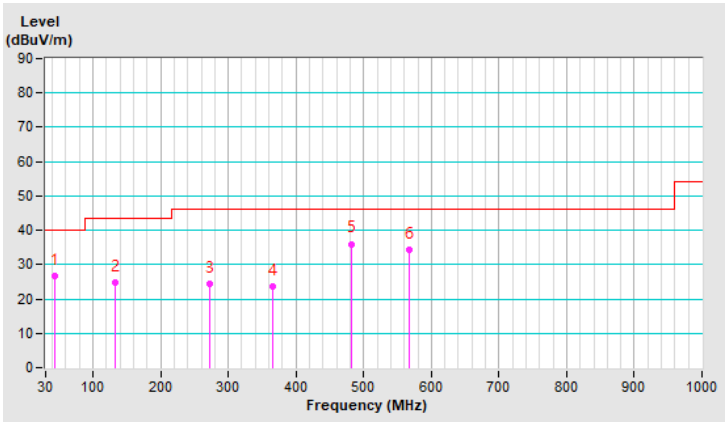


RF Mode	TX 802.11b	Channel	CH 6：2437 MHz
Frequency Range	9kHz ~ 1GHz	Detector Function	Quasi-Peak (QP)

Antenna Polarity & Test Distance : Vertical at 3 m								
No	Frequency (MHz)	Emission Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Antenna Height (m)	Table Angle (Degree)	Raw Value (dBuV)	Correction Factor (dB/m)
1	42.83	26.7 QP	40.0	-13.3	1.00 V	176	35.1	-8.4
2	132.72	24.7 QP	43.5	-18.8	1.00 V	183	33.3	-8.6
3	272.82	24.3 QP	46.0	-21.7	1.00 V	351	31.9	-7.6
4	364.67	23.7 QP	46.0	-22.3	1.50 V	64	28.4	-4.7
5	481.07	36.0 QP	46.0	-10.0	1.00 V	106	37.5	-1.5
6	567.02	34.4 QP	46.0	-11.6	1.00 V	252	34.2	0.2

Remarks:

1. Emission Level(dBuV/m) = Raw Value(dBuV) + Correction Factor(dB/m)
2. Correction Factor(dB/m) = Antenna Factor(dB/m) + Cable Factor(dB) – Pre-Amplifier Factor(dB)
3. Margin value = Emission Level – Limit value
4. The other emission levels were very low against the limit of frequency range 30MHz~1000MHz.
5. The emission levels were very low against the limit of frequency range 9kHz~30MHz: the amplitude of spurious emissions attenuated more than 20 dB below the permissible value to be report.



4.2 Conducted Emission Measurement

4.2.1 Limits of Conducted Emission Measurement

Frequency (MHz)	Conducted Limit (dBuV)	
	Quasi-peak	Average
0.15 - 0.5	66 - 56	56 - 46
0.50 - 5.0	56	46
5.0 - 30.0	60	50

Note: 1. The lower limit shall apply at the transition frequencies.
2. The limit decreases in line with the logarithm of the frequency in the range of 0.15 to 0.50MHz.

4.2.2 Test Instruments

DESCRIPTION & MANUFACTURER	MODEL NO.	SERIAL NO.	CALIBRATED DATE	CALIBRATED UNTIL
Test Receiver R&S	ESCS 30	847124/029	Oct. 20, 2020	Oct. 19, 2021
Line-Impedance Stabilization Network (for EUT) R&S	ESH3-Z5	848773/004	Oct. 27, 2020	Oct. 26, 2021
Line-Impedance Stabilization Network (for Peripheral) R&S	ESH3-Z5	835239/001	Mar. 26, 2021	Mar. 25, 2022
50 ohms Terminator	50	3	Oct. 26, 2020	Oct. 25, 2021
RF Cable	5D-FB	COCCAB-001	Sep. 26, 2020	Sep. 25, 2021
Fixed attenuator EMCI	STI02-2200-10	005	Aug. 29, 2020	Aug. 28, 2021
Software BVADT	BVADT_Cond_ V7.3.7.4	NA	NA	NA

Note:
1. The calibration interval of the above test instruments are 12 months and the calibrations are traceable to NML/ROC and NIST/USA.
2. The test was performed in Conduction 1.
3 Tested Date: Aug. 01, 2021

4.2.3 Test Procedures

a. The EUT was placed 0.4 meters from the conducting wall of the shielded room with EUT being connected to the power mains through a line impedance stabilization network (LISN). Other support units were connected to the power mains through another LISN. The two LISNs provide 50 ohm/ 50uH of coupling impedance for the measuring instrument.

b. Both lines of the power mains connected to the EUT were checked for maximum conducted interference.

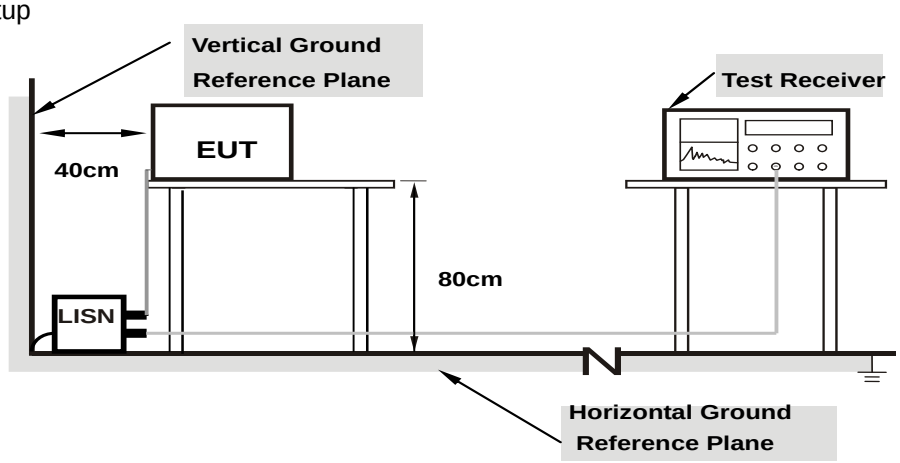
c. The frequency range from 150kHz to 30MHz was searched. Emission levels under (Limit - 20dB) was not recorded.

NOTE: The resolution bandwidth and video bandwidth of test receiver is 9kHz for quasi-peak detection (QP) and average detection (AV) at frequency 0.15MHz-30MHz.

4.2.4 Deviation from Test Standard

No deviation.

4.2.5 Test Setup



Note: 1.Support units were connected to second LISN.

For the actual test configuration, please refer to the attached file (Test Setup Photo).

4.2.6 EUT Operating Conditions

Same as 4.1.6.

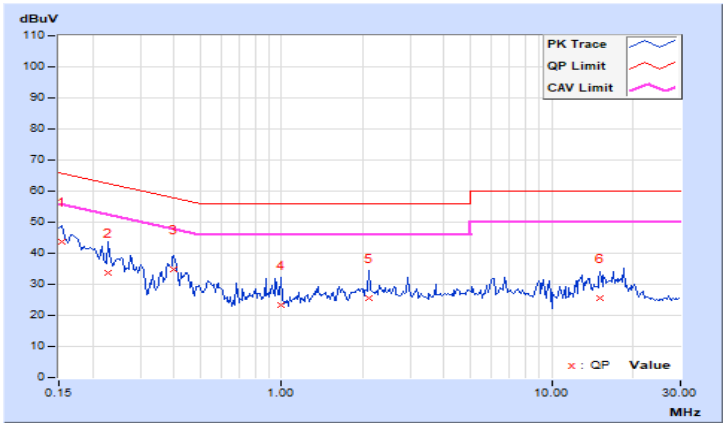
4.2.7 Test Results

RF Mode	TX 802.11b	Channel	CH 6：2437 MHz
Frequency Range	150kHz ~ 30MHz	Detector Function & Resolution Bandwidth	Quasi-Peak (QP) / Average (AV), 9kHz

Phase Of Power : Line (L)										
No	Frequency (MHz)	Correction Factor (dB)	Reading Value (dBuV)		Emission Level (dBuV)		Limit (dBuV)		Margin (dB)	
			Q.P.	AV.	Q.P.	AV.	Q.P.	AV.	Q.P.	AV.
1	0.15391	9.97	33.83	17.80	43.80	27.77	65.79	55.79	-21.99	-28.02
2	0.22812	10.00	23.79	10.18	33.79	20.18	62.52	52.52	-28.73	-32.34
3	0.40000	10.03	24.73	14.86	34.76	24.89	57.85	47.85	-23.09	-22.96
4	0.99766	10.07	13.16	5.62	23.23	15.69	56.00	46.00	-32.77	-30.31
5	2.11328	10.13	15.51	7.44	25.64	17.57	56.00	46.00	-30.36	-28.43
6	15.14844	11.10	14.37	7.11	25.47	18.21	60.00	50.00	-34.53	-31.79

Remarks:

1. Q.P. and AV. are abbreviations of quasi-peak and average individually.
2. The emission levels of other frequencies were very low against the limit.
3. Margin value = Emission level – Limit value
4. Correction factor = Insertion loss + Cable loss
5. Emission Level = Correction Factor + Reading Value

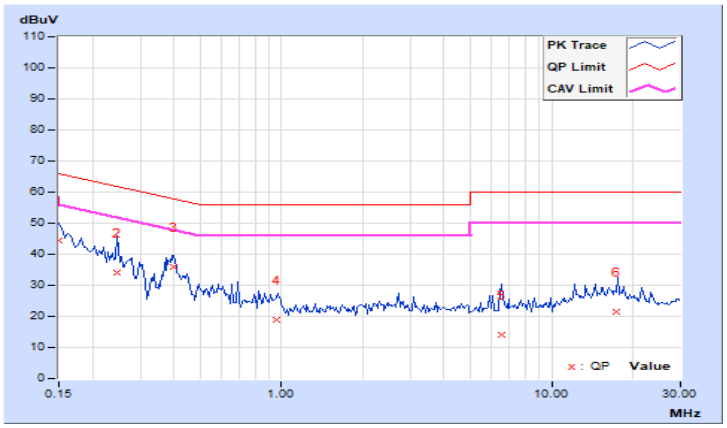


RF Mode	TX 802.11b	Channel	CH 6：2437 MHz
Frequency Range	150kHz ~ 30MHz	Detector Function & Resolution Bandwidth	Quasi-Peak (QP) / Average (AV), 9kHz

Phase Of Power : Neutral (N)										
No	Frequency (MHz)	Correction Factor (dB)	Reading Value (dBuV)		Emission Level (dBuV)		Limit (dBuV)		Margin (dB)	
			Q.P.	AV.	Q.P.	AV.	Q.P.	AV.	Q.P.	AV.
1	**0.15000**	**9.95**	**34.48**	**17.89**	**44.43**	**27.84**	**66.00**	**56.00**	**-21.57**	**-28.16**
2	0.24766	10.00	23.90	11.08	33.90	21.08	61.84	51.84	-27.94	-30.76
3	0.40000	10.02	25.84	16.02	35.86	26.04	57.85	47.85	-21.99	-21.81
4	0.95469	10.06	8.84	-0.37	18.90	9.69	56.00	46.00	-37.10	-36.31
5	6.57031	10.39	3.62	-6.60	14.01	3.79	60.00	50.00	-45.99	-46.21
6	17.38281	11.03	10.35	0.10	21.38	11.13	60.00	50.00	-38.62	-38.87

Remarks:

1. Q.P. and AV. are abbreviations of quasi-peak and average individually.
2. The emission levels of other frequencies were very low against the limit.
3. Margin value = Emission level – Limit value
4. Correction factor = Insertion loss + Cable loss
5. Emission Level = Correction Factor + Reading Value



4.3 Conducted Output Power Measurement

4.3.1 Limits of Conducted Output Power Measurement

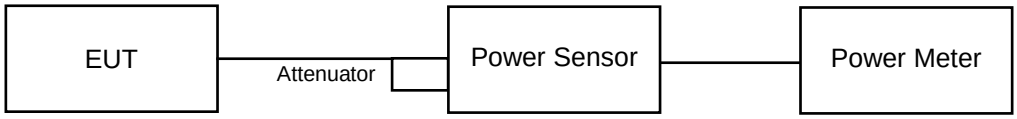
For systems using digital modulation in the 2400–2483.5 MHz bands: 1 Watt (30dBm)

Per KDB 662911 D01 Multiple Transmitter Output Method of conducted output power measurement on IEEE 802.11 devices,

Array Gain = 0 dB (i.e., no array gain) for $N_{ANT} \leq 4$;
Array Gain = 0 dB (i.e., no array gain) for channel widths ≥ 40 MHz for any N_{ANT};
Array Gain = 5 log(N_{ANT}/N_{SS}) dB or 3 dB, whichever is less for 20-MHz channel widths with $N_{ANT} \geq 5$.

For power measurements on all other devices: Array Gain = 10 log(N_{ANT}/N_{SS}) dB.

4.3.2 Test Setup



4.3.3 Test Instruments

Refer to section 4.1.2 to get information of above instrument.

4.3.4 Test Procedures

Average power sensor was used to perform output power measurement, trigger and gating function of wide band power meter is enabled to measure max output power of TX on burst. Duty factor is not added to measured value.

4.3.5 Deviation from Test Standard

No deviation.

4.3.6 EUT Operating Conditions

Same as Item 4.1.6.

4.3.7 Test Results

CDD Mode:

802.11b

Chan.	Chan. Freq. (MHz)	Average Power (dBm)		Total Power (mW)	Total Power (dBm)	Limit (dBm)	Pass / Fail
		Chain 0	Chain 1				
1	2412	24.47	24.56	565.657	27.53	30.00	Pass
6	2437	25.62	25.66	732.883	28.65	30.00	Pass
11	2462	24.65	24.53	575.535	27.60	30.00	Pass

802.11b

Chan.	Chan. Freq. (MHz)	Average Power (dBm)		Total Power (mW)	Total Power (dBm)	Limit (dBm)	Pass / Fail
		Chain 0	Chain 1				
1	2412	20.06	20.05	202.549	23.07	30.00	Pass
6	2437	24.15	24.11	517.648	27.14	30.00	Pass
11	2462	19.63	19.41	179.13	22.53	30.00	Pass

VHT20

Chan.	Chan. Freq. (MHz)	Average Power (dBm)		Total Power (mW)	Total Power (dBm)	Limit (dBm)	Pass / Fail
		Chain 0	Chain 1				
1	2412	19.48	19.52	178.252	22.51	30.00	Pass
6	2437	24.41	24.43	553.39	27.43	30.00	Pass
11	2462	18.06	17.87	125.209	20.98	30.00	Pass

VHT40

Chan.	Chan. Freq. (MHz)	Average Power (dBm)		Total Power (mW)	Total Power (dBm)	Limit (dBm)	Pass / Fail
		Chain 0	Chain 1				
3	2422	17.98	18.00	125.902	21.00	30.00	Pass
6	2437	19.15	19.07	162.948	22.12	30.00	Pass
9	2452	16.14	16.04	81.294	19.10	30.00	Pass

802.11ax (HE20)

Chan.	Chan. Freq. (MHz)	Average Power (dBm)		Total Power (mW)	Total Power (dBm)	Limit (dBm)	Pass / Fail
		Chain 0	Chain 1				
1	2412	19.65	19.66	184.727	22.67	30.00	Pass
6	2437	24.63	24.69	584.844	27.67	30.00	Pass
11	2462	18.19	18.05	129.744	21.13	30.00	Pass

802.11ax (HE40)

Chan.	Chan. Freq. (MHz)	Average Power (dBm)		Total Power (mW)	Total Power (dBm)	Limit (dBm)	Pass / Fail
		Chain 0	Chain 1				
3	2422	18.27	18.21	133.365	21.25	30.00	Pass
6	2437	19.35	19.33	171.803	22.35	30.00	Pass
9	2452	16.43	16.25	86.124	19.35	30.00	Pass

Beamforming Mode:

VHT20

Chan.	Chan. Freq. (MHz)	Average Power (dBm)		Total Power (mW)	Total Power (dBm)	Limit (dBm)	Pass / Fail
		Chain 0	Chain 1				
1	2412	19.48	19.52	178.252	22.51	30.00	Pass
6	2437	24.41	24.43	553.39	27.43	30.00	Pass
11	2462	18.06	17.87	125.209	20.98	30.00	Pass

Note: The directional gain = 10 log[$(10^{G0/20} + 10^{G1/20})^2$ / 2] = 5.96dBi < 6dBi , so the power limit shall not be reduced.

VHT40

Chan.	Chan. Freq. (MHz)	Average Power (dBm)		Total Power (mW)	Total Power (dBm)	Limit (dBm)	Pass / Fail
		Chain 0	Chain 1				
3	2422	17.98	18.00	125.902	21.00	30.00	Pass
6	2437	19.15	19.07	162.948	22.12	30.00	Pass
9	2452	16.14	16.04	81.294	19.10	30.00	Pass

Note: The directional gain = 10 log[$(10^{G0/20} + 10^{G1/20})^2$ / 2] = 5.96dBi < 6dBi , so the power limit shall not be reduced.

802.11ax (HE20)

Chan.	Chan. Freq. (MHz)	Average Power (dBm)		Total Power (mW)	Total Power (dBm)	Limit (dBm)	Pass / Fail
		Chain 0	Chain 1				
1	2412	19.65	19.66	184.727	22.67	30.00	Pass
6	2437	24.63	24.69	584.844	27.67	30.00	Pass
11	2462	18.19	18.05	129.744	21.13	30.00	Pass

Note: The directional gain = 10 log[$(10^{G0/20} + 10^{G1/20})^2$ / 2] = 5.96dBi < 6dBi , so the power limit shall not be reduced.

802.11ax (HE40)

Chan.	Chan. Freq. (MHz)	Average Power (dBm)		Total Power (mW)	Total Power (dBm)	Limit (dBm)	Pass / Fail
		Chain 0	Chain 1				
3	2422	18.27	18.21	133.365	21.25	30.00	Pass
6	2437	19.35	19.33	171.803	22.35	30.00	Pass
9	2452	16.43	16.25	86.124	19.35	30.00	Pass

Note: The directional gain = 10 log[$(10^{G0/20} + 10^{G1/20})^2$ / 2] = 5.96dBi < 6dBi , so the power limit shall not be reduced.

5 Pictures of Test Arrangements

Please refer to the attached file (Test Setup Photo).

Appendix – Information of the Testing Laboratories

We, Bureau Veritas Consumer Products Services (H.K.) Ltd., Taoyuan Branch, were founded in 1988 to provide our best service in EMC, Radio, Telecom and Safety consultation. Our laboratories are FCC recognized accredited test firms and accredited according to ISO/IEC 17025.

If you have any comments, please feel free to contact us at the following:

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Email: service.adt@tw.bureauveritas.com
Web Site: www.bureauveritas-adt.com

The address and road map of all our labs can be found in our web site also.

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