



Prüfbericht-Nr.: <i>Test report no.:</i>	CN21W8ZE (P15E-WiFi) 001	Auftrags-Nr.: <i>Order no.:</i>	238517914	Seite 1 von 41 Page 1 of 41
Kunden-Referenz-Nr.: <i>Client reference no.:</i>	N/A	Auftragsdatum: <i>Order date:</i>	2021-07-27	
Auftraggeber: <i>Client:</i>	Emplus Technologies, Inc Bld B, 10F, No.209, Sec.1, Nangang Rd., Taipei City, Taiwan			
Prüfgegenstand: <i>Test item:</i>	4x4 AX Dual band AP			
Bezeichnung / Typ-Nr.: <i>Identification / Type no.:</i>	WAP380			
Auftrags-Inhalt: <i>Order content:</i>	FCC Part 15E Test report (WiFi 5GHz)			
Prüfgrundlage: <i>Test specification:</i>	FCC 47CFR Part 15: Subpart E Section 15.407			
Wareneingangsdatum: <i>Date of sample receipt:</i>	2021-08-04			
Prüfmuster-Nr.: <i>Test sample no.:</i>	A003104381-001			
Prüfzeitraum: <i>Testing period:</i>	2021-08-26 - 2022-01-12			
Ort der Prüfung: <i>Place of testing:</i>	EMC/RF Taipei Testing Site			
Prüflaboratorium: <i>Testing laboratory:</i>	Taipei Testing Laboratories			
Prüfergebnis*: <i>Test result*:</i>	Pass			
überprüft von: <i>compiled by:</i>	genehmigt von: <i>authorized by:</i>			
Datum: <i>Date:</i> 2022-02-16	 Ethan Shao	Ausstellungsdatum: <i>Issue date:</i> 2022-02-16	 Brenda Chen	
Stellung / Position:	Assistant Project Engineer	Stellung / Position:	Senior Project Manager	
Sonstiges / Other:				
Zustand des Prüfgegenstandes bei Anlieferung: <i>Condition of the test item at delivery:</i>		Prüfmuster vollständig und unbeschädigt <i>Test item complete and undamaged</i>		
* Legende:	1 = sehr gut P(ass) = entspricht o.g. Prüfgrundlage(n)	2 = gut F(ail) = entspricht nicht o.g. Prüfgrundlage(n)	3 = befriedigend N/A = nicht anwendbar	4 = ausreichend N/T = nicht getestet
* Legend:	1 = very good P(ass) = passed a.m. test specification(s)	2 = good F(ail) = failed a.m. test specification(s)	3 = satisfactory N/A = not applicable	4 = sufficient N/T = not tested
Dieser Prüfbericht bezieht sich nur auf das o.g. Prüfmuster und darf ohne Genehmigung der Prüfstelle nicht auszugsweise vervielfältigt werden. Dieser Bericht berechtigt nicht zur Verwendung eines Prüfzeichens. <i>This test report only relates to the a. m. test sample. Without permission of the test center this test report is not permitted to be duplicated in extracts. This test report does not entitle to carry any test mark.</i>				

TEST SUMMARY

Report Section	FCC Clause	Test Item	Result
5.1.1	15.407(a) & 15.203	Antenna Requirement	Pass
5.1.2	15.407(a)	Maximum Conducted Output Power	Pass
5.1.3	15.407(a)	26 dB Bandwidth	Pass
5.1.3	2.1049	99% Occupied Bandwidth	Pass
5.1.4	15.407(e)	6 dB Bandwidth (U-NII-3 Band only)	Pass
5.1.5	15.407(g)	Frequency Stability	Pass
5.1.6	15.407(a)	Power Spectral Density	Pass
5.1.7	15.407(b) & 15.205 & 15.209	Radiated Spurious Emissions and Band Edges	Pass
-	15.407(h) & KDB 905462 D02	Dynamic Frequency Selection	N/A
5.2.1	15.207	Mains Conducted Emission	Pass

Note: Determining compliance based on the results of the compliance measurement, not taking into account measurement instrumentation uncertainty.

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APPENDIX A - TEST RESULT OF CONDUCTED

APPENDIX B - TEST RESULT OF RADIATED EMISSIONS & MAINS CONDUCTED EMISSION

APPENDIX SP - PHOTOGRAPHS OF TEST SETUP

APPENDIX EP - PHOTOGRAPHS OF EUT

HISTORY OF THIS TEST REPORT

Report No.	Description	Date Issued
CN21W8ZE (P15E-WiFi) 001	Original Release	2022-02-16

1. General Remarks

1.1 Complementary Materials

All attachments are integral parts of this test report. This applies especially to the following appendix:

Appendix A - Test Result of Conducted

Appendix B - Test Result of Radiated Emissions & Mains Conducted Emission

Appendix SP - Photographs of Test Setup

Appendix EP - Photographs of EUT

Applied Standard and Test Levels

Radio
FCC 47CFR Part 15: Subpart E Section 15.407
FCC 47CFR Part 2: Subpart J Section 2.1049
ANSI C63.10:2013
KDB 789033 D02 General UNII Test Procedures New Rules v02r01
KDB 662911 D01 Multiple Transmitter Output v02r01

1.2 Decision Rule of Conformity

The decision rule of conformity of this test report is following the requirements of the requested standard in the quotation, and agreed among testing laboratory and manufacturer (applicant) to exclude the consideration of Measurement Uncertainty, unless it is required by the specific standard.

2. Test Sites

2.1 Test Laboratory

Taipei Testing Laboratories

11F. No.758, Sec. 4, Bade Rd., Songshan Dist.
Taipei City 105
Taiwan (R.O.C.)

2.2 Test Facility

Taipei Testing Laboratories

No.458-18, Sec. 2, Fenliao Rd., Linkou Dist.,
New Taipei City 244
Taiwan (R.O.C.)
FCC Registration No.: 226631
ISED Registration No.: 25563

2.3 Traceability

All measurement equipment calibrations are traceable to NML(Taiwan)/NIST(USA) or where calibration is performed outside Taiwan, to equivalent nationally recognized standards organizations.

2.4 Calibration

Equipment requiring calibration is calibrated periodically in a suitably accredited Calibration Lab. Additionally all equipment is verified for proper performance on a regular basis using in house standards or comparisons.

2.5 Measurement Uncertainty

All measurement uncertainty values are shown with a coverage factor of $k=2$ to indicate a 95% level of confidence.

Emission Measurement Uncertainty

Parameter	Uncertainty
Radiated Emission (9 kHz ~ 30 MHz)	± 1.15 dB
Radiated Emission (30 MHz ~ 200 MHz)	± 1.30 dB
Radiated Emission (200 MHz ~ 1 GHz)	± 1.30 dB
Radiated Emission (1 GHz ~ 18 GHz)	± 1.54 dB
Radiated Emission (18 GHz ~ 40 GHz)	± 2.52 dB
Mains Conducted Emission	± 1.65 dB

3. General Product Information

3.1 Product Function and Intended Use

The EUT is a 4x4 AX Dual band AP. It contains a WLAN compatible module enabling the user to communicate data through a Wireless interface.

For details refer to the User Guide, Data Sheet and Circuit Diagram.

3.2 System Details and Ratings

Basic Information of EUT

Item	EUT information
Kind of Equipment/Test Item	4x4 AX Dual band AP
Type Identification	WAP380
FCC ID	2AL6XWAP380-A1

Technical Specification of EUT

Item	EUT information	
Operating Frequency	Band 1: 5180 MHz ~ 5240 MHz Band 4: 5745 MHz ~ 5825 MHz	
Channel Number	Band 1: 4 for 802.11a, 802.11n HT20, 802.11ax HE20 2 for 802.11n HT40, 802.11ax HE40 1 for 802.11ac VHT80, 802.11ax HE80 Band 4: 5 for 802.11a, 802.11n HT20, 802.11ax HE20 2 802.11n HT40, 802.11ax HE40 1 for 802.11ac VHT80, 802.11ax HE80	
Data Rate	802.11a: 54.0 / 48.0 / 36.0 / 24.0 / 18.0 / 12.0 / 9.0 / 6.0 Mbps 802.11n: up to MCS7 802.11ac: up to MCS9 802.11ax: up to MCS11	
Operation Voltage	12 Vdc (Adapter) 54 Vdc (POE Injector)	
Modulation	OFDM (BPSK, QPSK, 16QAM, 64QAM, 256QAM) OFDMA (1024QAM)	
Maximum Output Power (mW)	CDD Mode	5180 ~ 5240 MHz: 370.51 5745 ~ 5825 MHz: 348.81
	Beamforming Mode	5180 ~ 5240 MHz: 92.64 5745 ~ 5825 MHz: 87.22
Antenna Information	Refer to 5.1.1	
Accessory Device	Refer to 4.4	

3.3 Noise Generating and Noise Suppressing Parts

Refer to the Circuit Diagram.

3.4 Submitted Documents

- Circuit Diagram
- Instruction Manual
- Rating Label
- Technical Description

4. Test Set-up and Operation Modes

4.1 Principle of Configuration Selection

The test modes were adapted accordingly in reference to the instructions for use.

During testing, Channel and Power Controlling Software provided by the customer was used to control the operating channel as well as the output power level. The RF output power selection is for the setting of RF output expected by the customer and is going to be fixed on the firmware of the final end product.

Table for Parameters of Test Software Setting

Channel	Power Setting			
	802.11a	802.11n HT20	802.11ac VHT20	802.11ax HE20
36	15	17	17	16.5
40	15.5	17.5	17.5	17
48	16	18	18	18
149	19	19	19	19
157	19	19	19	19
165	18.5	18.5	18.5	18.5

Channel	Power Setting		
	802.11n HT40	802.11ac VHT40	802.11ax HE40
38	15	15	15
46	18.5	18.5	19
151	18.5	18.5	18.5
159	18.5	18.5	18.5

Channel	Power Setting	
	802.11ac VHT80	802.11ax HE80
42	15.5	15
155	19	19

4.2 Carrier Frequency and Channel

Band	Channel	Frequency (MHz)	802.11a 802.11n HT20 802.11ac VHT20 802.11ax HE20	802.11n HT40 802.11ac VHT40 802.11ax HE40	802.11ac VHT80 802.11ax HE80
U-NII-1 (Band 1)	36	5180	V		
	38	5190		V	
	40	5200	V		
	42	5210			V
	44	5220	V		
	46	5230		V	
U-NII-3 (Band 4)	48	5240	V		
	149	5745	V		
	151	5755		V	
	153	5765	V		
	155	5775			V
	157	5785	V		
	159	5795		V	
	161	5805	V		
	165	5825	V		

4.3 Test Operation and Test Software

Setup for testing: Test samples are provided with a LAN interface which makes it possible to control them through a test software installed on a notebook computer.

This software was running on the laptop computer connected to the EUT. It was used to enable the operation modes listed as below.

Test Software	QSPR 5.0-00197
---------------	----------------

The samples were used as follows:
A003104381-001

Full test was applied on all test modes, but only worst case was shown.

The EUT incorporates a MIMO function. Physically, the EUT provides two completed transmitters and receivers.

Modulation Mode	Tx Function
802.11a	4TX (MIMO)
802.11n HT20	4TX (MIMO)
802.11n HT40	4TX (MIMO)
802.11ac VHT20	4TX (MIMO)
802.11ac VHT40	4TX (MIMO)
802.11ac VHT80	4TX (MIMO)
802.11ax HE20	4TX (MIMO)
802.11ax HE40	4TX (MIMO)
802.11ax HE80	4TX (MIMO)

* The modulation and bandwidth are similar for HT20/HT40 on 802.11n mode, VHT20/VHT40 on 802.11ac mode, and HE20/HE40/HE80 on 802.11ax mode. Therefore investigated worse case as representative mode in test report.

** For Beamforming mode, only output power is evaluated and presented in this report.

EUT Configure Mode	Applicable To				Description
	Antenna Port Conducted Measurement	Radiated Spurious Emissions above 1 GHz	Radiated Spurious Emissions below 1 GHz	Mains Conducted Emission	
-	√	√	√	√	-

Note:

1. The EUT had been pre-tested on the positioned of each 3 axis. The worst case was found when position on **Y-plane**.
2. "-" means no effect.
3. Only the worst case of Radiated Spurious Emissions and Mains Conducted Emission tests were verified for POE mode.

Antenna Port Conducted Measurement

- Pre-Scan full test was applied on all test modes, but only worst case was shown.
- Following channel(s) was (were) selected for the final test as listed below.

EUT Configure Mode	Mode	Frequency (MHz)	Available Channel	Tested Channel	Date Rate (Mbps)
CDD	802.11a	5180-5240	36 to 48	36, 40, 48	6.0
		5745-5825	149 to 165	149, 157, 165	
	802.11n HT20	5180-5240	36 to 48	36, 40, 48	MCS0
		5745-5825	149 to 165	149, 157, 165	
	802.11n HT40	5180-5240	38 to 46	38, 46	MCS0
		5745-5825	151 to 159	151, 159	
	802.11ac VHT80	5180-5240	42	42	MCS0
		5745-5825	155	155	
	802.11ax HE20	5180-5240	36 to 48	36, 40, 48	MCS0
		5745-5825	149 to 165	149, 157, 165	
	802.11ax HE40	5180-5240	38 to 46	38, 46	MCS0
		5745-5825	151 to 159	151, 159	
	802.11ax HE80	5180-5240	42	42	MCS0
		5745-5825	155	155	
Beamforming (Power only)	802.11n HT20	5180-5240	36 to 48	36, 40, 48	MCS0
		5745-5825	149 to 165	149, 157, 165	
	802.11n HT40	5180-5240	38 to 46	38, 46	MCS0
		5745-5825	151 to 159	151, 159	
	802.11ac VHT80	5180-5240	42	42	MCS0
		5745-5825	155	155	
	802.11ax HE20	5180-5240	36 to 48	36, 40, 48	MCS0
		5745-5825	149 to 165	149, 157, 165	
	802.11ax HE40	5180-5240	38 to 46	38, 46	MCS0
		5745-5825	151 to 159	151, 159	
	802.11ax HE80	5180-5240	42	42	MCS0
		5745-5825	155	155	

Radiated Spurious Emissions (Above 1 GHz)

- Pre-Scan full test was applied on all test modes, but only worst case was shown.
 Following channel(s) was (were) selected for the final test as listed below.

EUT Configure Mode	Mode	Frequency (MHz)	Available Channel	Tested Channel	Date Rate (Mbps)
Adapter	802.11a	5180-5240	36 to 48	36, 40, 48	6.0
		5745-5825	149 to 165	149, 157, 165	
	802.11ac VHT20	5180-5240	36 to 48	36, 40, 48	MCS0
		5745-5825	149 to 165	149, 157, 165	
	802.11ac VHT40	5180-5240	38 to 46	38, 46	MCS0
		5745-5825	151 to 159	151, 159	
	802.11ac VHT80	5180-5240	42	42	MCS0
		5745-5825	155	155	
	802.11ax HE20	5180-5240	36 to 48	36, 40, 48	MCS0
		5745-5825	149 to 165	149, 157, 165	
	802.11ax HE40	5180-5240	38 to 46	38, 46	MCS0
		5745-5825	151 to 159	151, 159	
	802.11ax HE80	5180-5240	42	42	MCS0
		5745-5825	155	155	
POE	802.11ax HE20	5180-5240	36 to 48	36	MCS0

Radiated Spurious Emissions (Below 1 GHz)

- Pre-Scan full test was applied on all test modes, but only worst case was shown.
 Following channel(s) was (were) selected for the final test as listed below.

EUT Configure Mode	Mode	Frequency (MHz)	Available Channel	Tested Channel	Date Rate (Mbps)
Adapter	802.11ax HE20	5180-5240	36 to 48	36	MCS0
POE	802.11ax HE20	5180-5240	36 to 48	36	MCS0

Mains Conducted Emission Test

- Pre-Scan full test was applied on all test modes, but only worst case was shown.
 Following channel(s) was (were) selected for the final test as listed below.

EUT Configure Mode	Mode	Frequency (MHz)	Available Channel	Tested Channel	Date Rate (Mbps)
Adapter	802.11ax HE20	5180-5240	36 to 48	36	MCS0
POE	802.11ax HE20	5180-5240	36 to 48	36	MCS0

Test Condition

Test Item	Ambient Temperature	Relative Humidity	Tested by
Conducted Measurement	18-23.1 °C	58-63 %	Nick Hsu
Radiated Spurious Emissions above 1 GHz	23.1-25.1 °C	50-60 %	Hunter Wang
Radiated Spurious Emissions below 1 GHz	23.1-25.1 °C	50-60 %	Hunter Wang
Mains Conducted Emission	22.1 °C	59 %	Hunter Wang

4.4 Special Accessories and Auxiliary Equipment

The product has been tested together with the following additional accessories:

Accessory of EUT

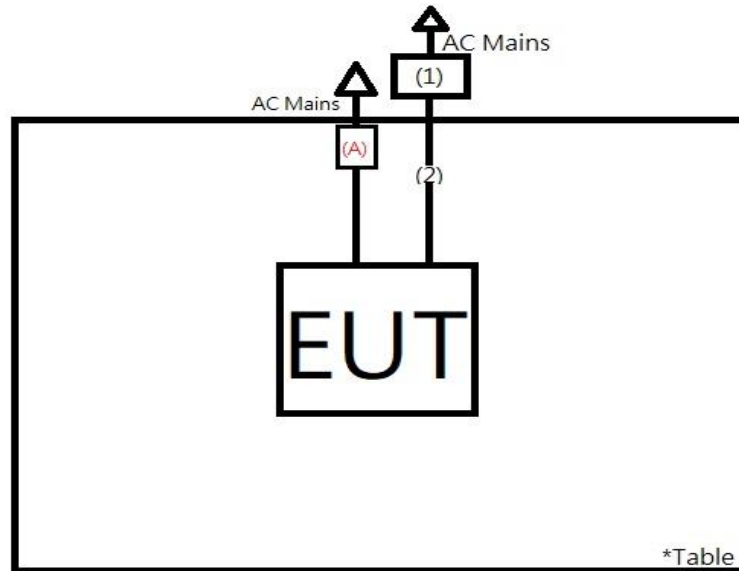
None

Support Unit

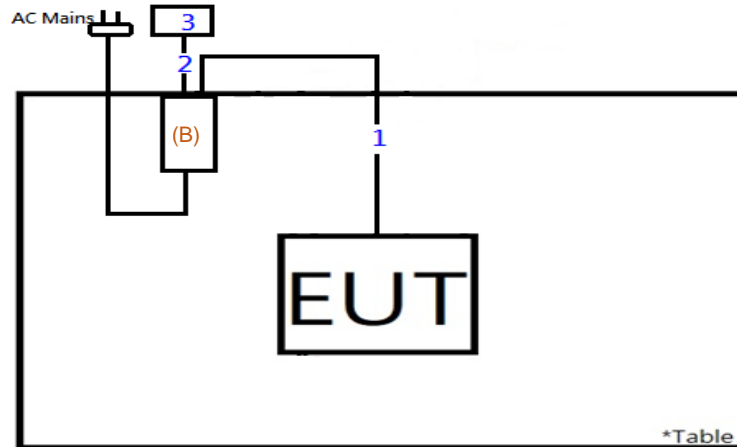
Support Unit								
No	Description	Brand	Model	S/N	Shielded	Ferrite Core (Qty)	Length (cm)	Remark
Adapter Mode								
1	Notebook	Lenovo	TP00094A	SL10Q37402	-	-	-	Radiated
2	LAN Cable	TUV	TUV-010	N/A	NO	NO	300	
A	Adapter	DEE VAN Enterprise	DSA-30PFG-12 FUS	N/A	NO	NO	148	
1	LAN Cable	N/A	N/A	11801	NO	NO	95	Mains Conducted
2	Notebook	Lenovo	81BL	MP1DCD6Y	-	-	-	
A	Adapter	DEE VAN Enterprise	DSA-30PFG-12 FUS	N/A	NO	NO	148	
-	Notebook	HP	TPN-C135	CND9111RJB	-	-	-	Conducted
POE Mode								
1	LAN Cable	TUV-JP	TUV-JP-001	NO	NO	NO	143	Radiated
2	LAN Cable	TUV-JP	TUV-JP-001	NO	NO	NO	300	
3	Notebook	HP	15s-du0007TX	CND93662VF	-	-	-	
B	POE Adapter	EPA	EPA5006GAT	N/A	NO	NO	55	Mains Conducted
1	LAN Cable	TUV-JP	TUV-JP-001	NO	NO	NO	120	
2	LAN Cable	TUV-JP	TUV-JP-001	NO	NO	NO	180	
3	Notebook	HP	15s-du0007TX	CND93662VF	-	-	-	
B	POE Adapter	EPA	EPA5006GAT	N/A	NO	NO	55	

4.5 Test Setup Diagram

<Radiated Spurious Emissions mode>
 Adapter Mode

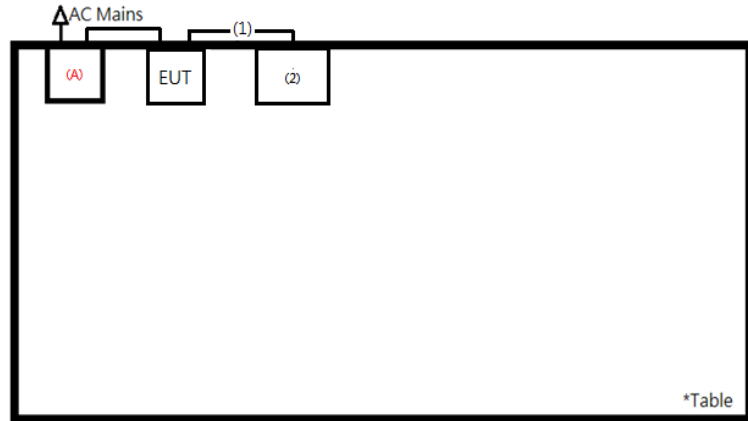


POE Mode

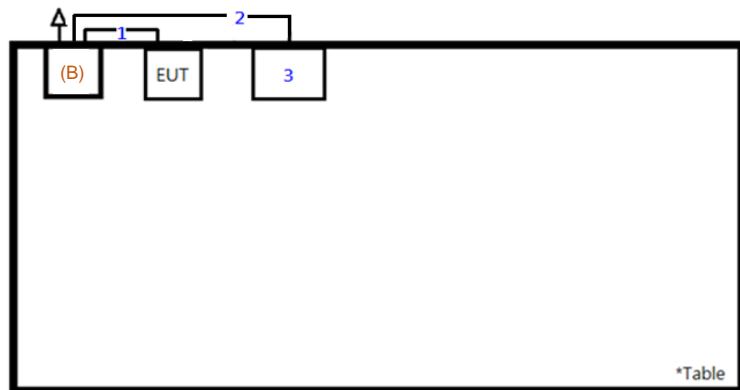


<Mains Conducted Emission mode>

Adapter Mode

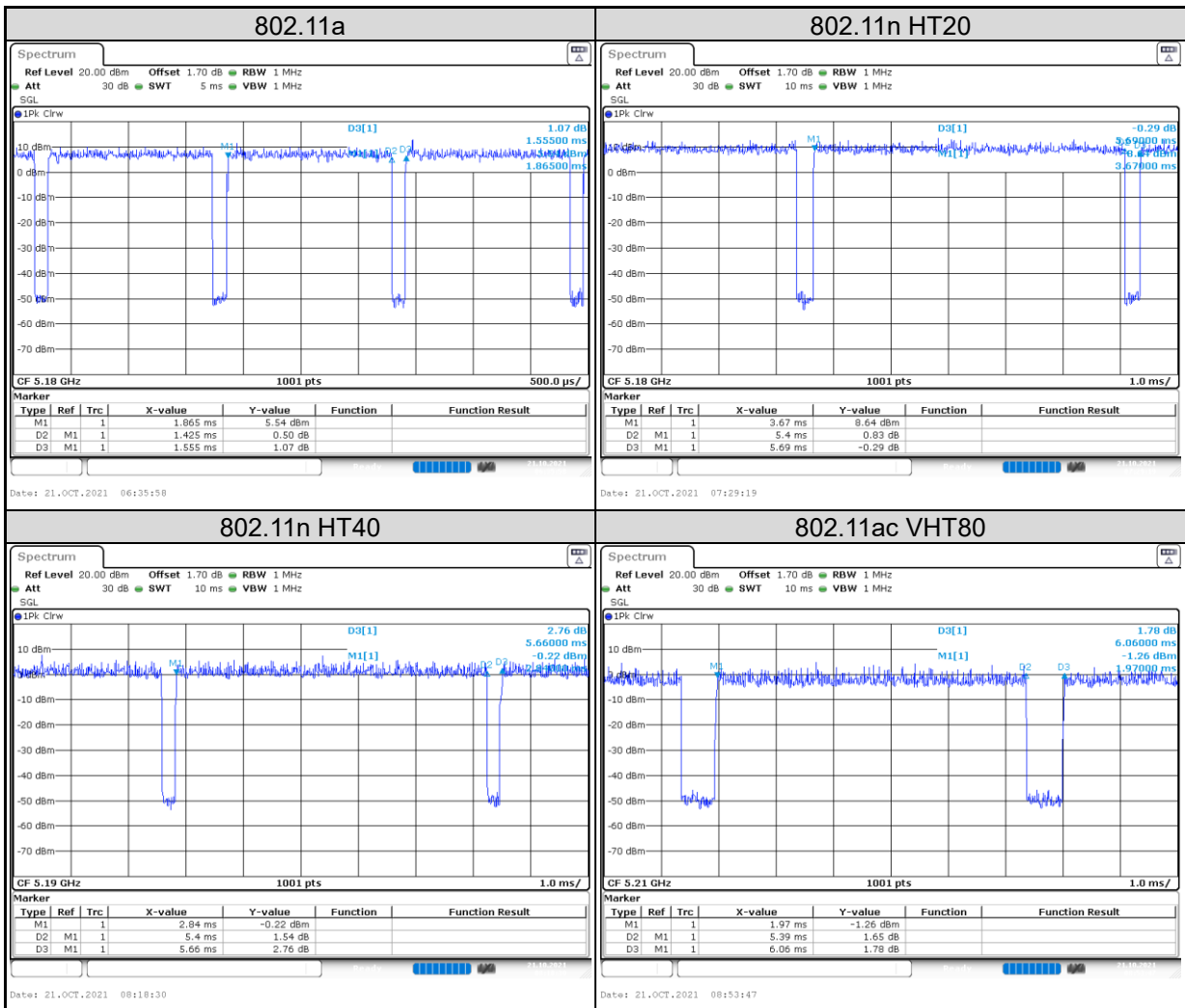


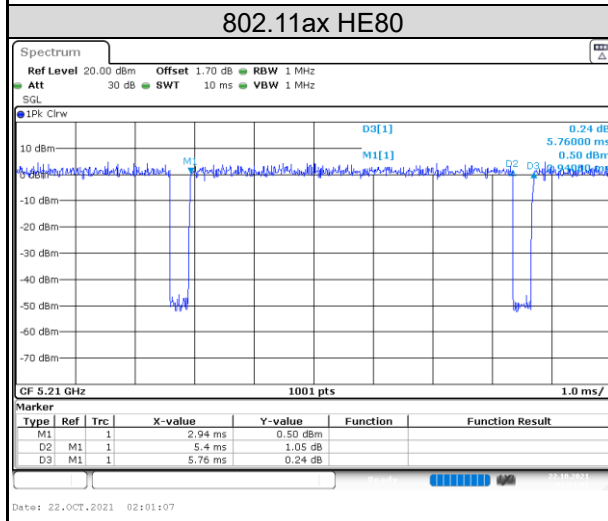
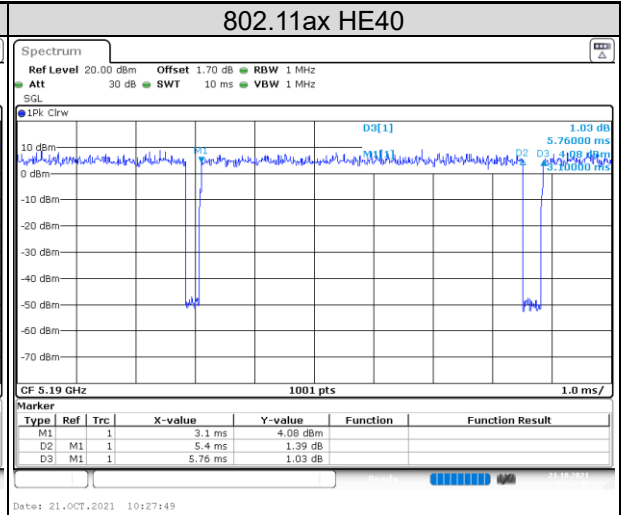
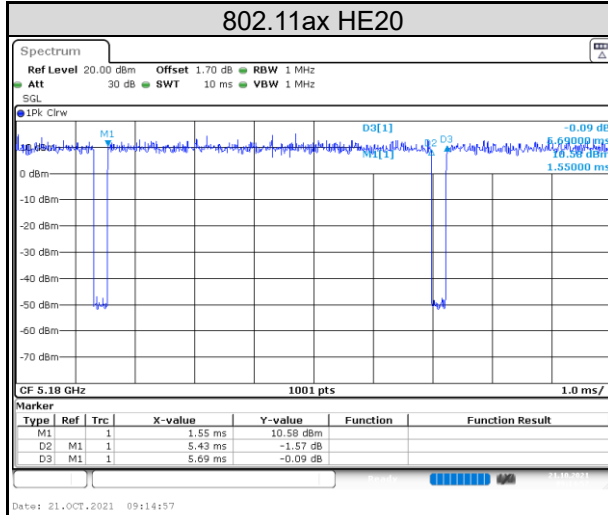
POE Mode



4.6 Duty Cycle of Test Signal

Mode	On + Off Time (ms)	On Time (ms)	Duty Cycle (%)	Duty Factor (dB)
802.11a	1.555	1.425	91.64	0.38
802.11n HT20	5.69	5.4	94.90	0.23
802.11n HT40	5.66	5.4	95.41	0.20
802.11ac VHT80	6.06	5.39	88.94	0.51
802.11ax HE20	5.69	5.43	95.43	0.20
802.11ax HE40	5.76	5.4	93.75	0.28
802.11ax HE80	5.76	5.4	93.75	0.28





5. Test Results

5.1 Transmitter Requirement & Test Suites

5.1.1 Antenna Requirement

Requirement Use of approved antennas only

According to the manufacturer declaration, the EUT's antenna specifications are described as below. The antenna is used with no possibility of replacement with a non-approved antenna by the end-user. Therefore, the EUT is considered to comply with this provision.

ANT	Type	Gain (dBi)	
		5180 ~ 5240 MHz	5745 ~ 5825 MHz
1	PIFA	5.13	5.19
2	PIFA	4.26	3.81
3	PIFA	4.03	4.56
4	PIFA	5.04	5.04
Max. Peak Gain		5.13	5.19
CDD Mode	Power Directional Gain =	5.13	5.19
	PSD Directional Gain = $10\log[(10^{G1/20} + 10^{G2/20} + \dots + 10^{GN/20})^2 / N_{ANT}] =$	10.65	10.69
Beamforming Mode	Power Directional Gain =	10.65	10.69
	PSD Directional Gain = $10\log[(10^{G1/20} + 10^{G2/20} + \dots + 10^{GN/20})^2 / N_{ANT}] =$	10.65	10.69

Refer to EUT photo for details.

5.1.2 Maximum Conducted Output Power

Limit

Operation Band	EUT Category	Limit
U-NII-1	Outdoor Access Point	1 Watt (30 dBm) (Max. e.i.r.p \leq 125 mW (21 dBm) at any elevation angle above 30 degrees as measured from the horizon)
	Fixed point-to-point Access Point	1 Watt (30 dBm)
	Indoor Access Point	1 Watt (30 dBm)
	Mobile and Portable client device	250 mW (24 dBm)
U-NII-2A	---	250 mW (24 dBm) or 11 dBm + 10 log B*
U-NII-2C	---	250 mW (24 dBm) or 11 dBm + 10 log B*
U-NII-3	---	1 Watt (30 dBm)

Note: B* is the 26 dB emission bandwidth in megahertz

Per KDB 662911 Method of conducted output power measurement on IEEE 802.11 devices,

Array Gain = 0 dB (i.e., no array gain) for $N_{ANT} \leq 4$;

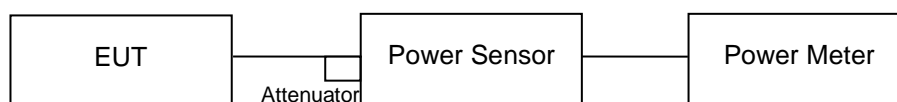
Array Gain = 0 dB (i.e., no array gain) for channel widths ≥ 40 MHz for any N_{ANT} ;

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.

Kind of Test Site Shielded room

Test Setup



Test Instruments

Kind of Equipment	Manufacturer	Type	S/N	Calibration Date	Calibration Due Date	Test Date	
						From	Until
Power Meter	Anritsu	ML2495A	1901008	2021/3/24	2022/3/23	2021/8/26	2021/10/22
Power Sensor	Anritsu	MA2411B	1725269	2021/3/24	2022/3/23	2021/8/26	2021/10/22

Test Procedures

Method PM is 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 and set the detector to AVERAGE. Duty factor is not added to measured value.

Test Result
CDD Mode
<802.11a>

Channel	Channel Frequency (MHz)	Average Output Power (dBm)				Total Power		Limit (dBm)
		Chain 0	Chain 1	Chain 2	Chain 3	(dBm)	(mW)	
36	5180	17.06	15.40	16.37	15.81	22.23	166.95	30
40	5200	17.17	15.62	16.74	15.99	22.44	175.52	30
48	5240	16.96	15.34	16.54	16.07	22.29	169.40	30
149	5745	19.96	18.33	19.23	18.76	25.13	326.08	30
157	5785	19.76	18.19	19.62	18.87	25.18	329.25	30
165	5825	19.42	18.35	19.81	18.73	25.14	326.25	30

<802.11n HT20>

Channel	Channel Frequency (MHz)	Average Output Power (dBm)				Total Power		Limit (dBm)
		Chain 0	Chain 1	Chain 2	Chain 3	(dBm)	(mW)	
36	5180	18.88	17.18	18.19	17.69	24.05	254.17	30
40	5200	18.89	17.24	18.10	17.73	24.05	254.27	30
48	5240	18.34	16.89	18.06	17.53	23.76	237.70	30
149	5745	19.86	18.03	19.28	18.48	24.99	315.55	30
157	5785	19.63	17.98	19.57	18.87	25.08	322.30	30
165	5825	19.43	18.26	19.55	18.79	25.06	320.53	30

<802.11n HT40>

Channel	Channel Frequency (MHz)	Average Output Power (dBm)				Total Power		Limit (dBm)
		Chain 0	Chain 1	Chain 2	Chain 3	(dBm)	(mW)	
38	5190	17.13	15.43	16.66	15.92	22.35	171.98	30
46	5230	19.92	18.15	19.55	18.72	25.16	328.12	30
151	5755	19.88	17.92	19.39	18.41	24.99	315.46	30
159	5795	19.86	18.04	19.74	18.81	25.19	330.73	30

<802.11ac VHT80>

Channel	Channel Frequency (MHz)	Average Output Power (dBm)				Total Power		Limit (dBm)
		Chain 0	Chain 1	Chain 2	Chain 3	(dBm)	(mW)	
42	5210	17.05	15.27	16.59	15.84	22.26	168.32	30
155	5775	19.84	18.19	19.72	18.67	25.18	329.68	30

<802.11ax HE20>

Channel	Channel Frequency (MHz)	Average Output Power (dBm)				Total Power		Limit (dBm)
		Chain 0	Chain 1	Chain 2	Chain 3	(dBm)	(mW)	
36	5180	18.71	16.91	18.21	17.32	23.87	243.57	30
40	5200	18.56	16.92	17.86	17.41	23.75	237.16	30
48	5240	18.58	17.13	18.30	17.77	24.00	251.20	30
149	5745	19.91	18.40	19.44	18.72	25.18	329.51	30
157	5785	19.86	18.28	19.64	19.02	25.26	335.97	30
165	5825	19.50	18.44	19.67	19.02	25.20	331.43	30

<802.11ax HE40>

Channel	Channel Frequency (MHz)	Average Output Power (dBm)				Total Power		Limit (dBm)
		Chain 0	Chain 1	Chain 2	Chain 3	(dBm)	(mW)	
38	5190	17.22	15.71	16.64	16.16	22.49	177.40	30
46	5230	20.36	18.65	20.14	19.31	25.69	370.51	30
151	5755	19.93	18.05	19.50	18.54	25.09	322.80	30
159	5795	19.96	18.12	19.74	19.13	25.31	339.98	30

<802.11ax HE80>

Channel	Channel Frequency (MHz)	Average Output Power (dBm)				Total Power		Limit (dBm)
		Chain 0	Chain 1	Chain 2	Chain 3	(dBm)	(mW)	
42	5210	16.80	15.06	16.30	15.59	22.01	158.81	30
155	5775	20.09	18.30	19.97	19.02	25.43	348.81	30

Beamforming Mode
<802.11n HT20>

Channel	Channel Frequency (MHz)	Average Output Power (dBm)				Total Power		Limit (dBm)
		Chain 0	Chain 1	Chain 2	Chain 3	(dBm)	(mW)	
36	5180	12.86	11.16	12.17	11.67	18.03	63.55	25.35
40	5200	12.87	11.22	12.08	11.71	18.03	63.58	25.35
48	5240	12.32	10.87	12.04	11.51	17.74	59.43	25.35
149	5745	13.84	12.01	13.26	12.46	18.97	78.90	25.31
157	5785	13.61	11.96	13.55	12.85	19.06	80.59	25.31
165	5825	13.41	12.24	13.53	12.77	19.04	80.14	25.31

<802.11n HT40>

Channel	Channel Frequency (MHz)	Average Output Power (dBm)				Total Power		Limit (dBm)
		Chain 0	Chain 1	Chain 2	Chain 3	(dBm)	(mW)	
38	5190	11.11	9.41	10.64	9.90	16.33	43.00	25.35
46	5230	13.90	12.13	13.53	12.70	19.14	82.04	25.35
151	5755	13.86	11.90	13.37	12.39	18.97	78.88	25.31
159	5795	13.84	12.02	13.72	12.79	19.17	82.69	25.31

<802.11ac VHT80>

Channel	Channel Frequency (MHz)	Average Output Power (dBm)				Total Power		Limit (dBm)
		Chain 0	Chain 1	Chain 2	Chain 3	(dBm)	(mW)	
42	5210	11.03	9.25	10.57	9.82	16.24	42.09	25.35
155	5775	13.82	12.17	13.70	12.65	19.16	82.43	25.31

<802.11ax HE20>

Channel	Channel Frequency (MHz)	Average Output Power (dBm)				Total Power		Limit (dBm)
		Chain 0	Chain 1	Chain 2	Chain 3	(dBm)	(mW)	
36	5180	12.69	10.89	12.19	11.30	17.85	60.90	25.35
40	5200	12.54	10.90	11.84	11.39	17.73	59.30	25.35
48	5240	12.56	11.11	12.28	11.75	17.98	62.81	25.35
149	5745	13.89	12.38	13.42	12.70	19.16	82.39	25.31
157	5785	13.84	12.26	13.62	13.00	19.24	84.00	25.31
165	5825	13.48	12.42	13.65	13.00	19.18	82.87	25.31

<802.11ax HE40>

Channel	Channel Frequency (MHz)	Average Output Power (dBm)				Total Power		Limit (dBm)
		Chain 0	Chain 1	Chain 2	Chain 3	(dBm)	(mW)	
38	5190	11.20	9.69	10.62	10.14	16.47	44.36	25.35
46	5230	14.34	12.63	14.12	13.29	19.67	92.64	25.35
151	5755	13.91	12.03	13.48	12.52	19.07	80.71	25.31
159	5795	13.94	12.10	13.72	13.11	19.29	85.01	25.31

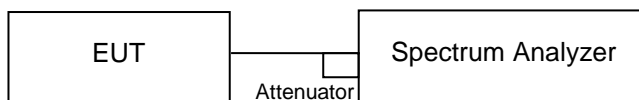
<802.11ax HE80>

Channel	Channel Frequency (MHz)	Average Output Power (dBm)				Total Power		Limit (dBm)
		Chain 0	Chain 1	Chain 2	Chain 3	(dBm)	(mW)	
42	5210	10.78	9.04	10.28	9.57	15.99	39.71	25.35
155	5775	14.07	12.28	13.95	13.00	19.41	87.22	25.31

5.1.3 26 dB Bandwidth and 99% Occupied Bandwidth

Kind of Test Site Shielded room

Test Setup



Test Instruments

Kind of Equipment	Manufacturer	Type	S/N	Calibration Date	Calibration Due Date	Test Date	
						From	Until
Spectrum Analyzer	R&S	FSV40	101512	2021/1/29	2022/1/28	2021/8/28	2021/10/22

Test Procedure

- a. Set RBW = approximately 1% of the emission bandwidth.
- b. Set the VBW > RBW.
- c. Detector = Peak.
- d. Trace mode = max hold.
- e. Measure the maximum width of the emission that is 26 dB down from the peak of the emission. Compare this with the RBW setting of the analyzer. Readjust RBW and repeat measurement as needed until the RBW/EBW ratio is approximately 1%.
- f. For 99% Bandwidth Measurement, the transmitter output was connected to the spectrum analyzer through an attenuator. The bandwidth of the fundamental frequency was measured by spectrum analyzer with resolution bandwidth in the range of 1% to 5% of the anticipated emission bandwidth, and a video bandwidth at least 3x the resolution bandwidth and set the detector to PEAK. The width of a frequency band such that, below the lower and above the upper frequency limits, the mean powers emitted are each equal to a specified percentage 0.5% of the total mean power of a given emission.

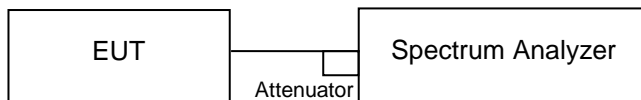
Test Results

Please refer to Appendix A

5.1.4 6 dB Bandwidth (5725-5850MHz)

Kind of Test Site Shielded room

Test Setup



Test Instruments

Kind of Equipment	Manufacturer	Type	S/N	Calibration Date	Calibration Due Date	Test Date	
						From	Until
Spectrum Analyzer	R&S	FSV40	101512	2021/1/29	2022/1/28	2021/8/28	2021/10/22

Test Procedure

MEASUREMENT PROCEDURE REF

- a. Set resolution bandwidth (RBW) = 100 kHz
- b. Set the video bandwidth (VBW) $\geq 3 \times$ RBW, Detector = Peak.
- c. Trace mode = max hold.
- d. Sweep = auto couple.
- e. Measure the maximum width of the emission that is constrained by the frequencies associated with the two amplitude points (upper and lower) that are attenuated by 6 dB relative to the maximum level measured in the fundamental emission.

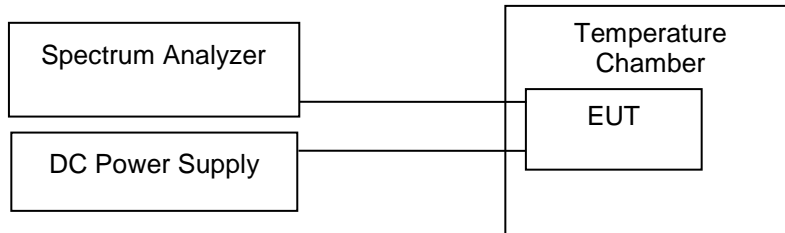
Test Results

Please refer to Appendix A

5.1.5 Frequency Stability Measurement

Kind of Test Site Shielded room

Test Setup



Test Instruments

Kind of Equipment	Manufacturer	Type	S/N	Calibration Date	Calibration Due Date	Test Date	
						From	Until
Spectrum Analyzer	R&S	FSV40	101512	2021/1/29	2022/1/28	2021/8/28	2021/11/29

Test Procedure

- a. To ensure emission at the band edge is maintained within the authorized band, those values shall be measured by radiation emissions at upper and lower frequency points, and finally compensated by frequency deviation as procedures below.
- b. The EUT was operated at the maximum output power, and connected to the spectrum analyzer, which is set to maximum hold function and peak detector. The peak value of the power envelope was measured and noted. The upper and lower frequency points were respectively measured relatively 10 dB lower than the measured peak value.
- c. The frequency deviation was calculated by adding the upper frequency point and the lower frequency point divided by two. Those detailed values of frequency deviation are provided in table below.

Test Results
<ANT 0>

Frequency (MHz)	5200			
Voltage (V)	Measurement Frequency (MHz)			Max. Deviation (ppm)
5.5	5199.95861			7.960
5	5199.95861			7.960
4.5	5199.95861			7.960
Temperature (°C)	Measurement Frequency (MHz)			
	0 Minute	2 Minute	5 Minute	10 Minute
50	5199.9314	5199.92504	5199.92272	5199.92272
40	5199.92764	5199.92764	5199.92764	5199.92764
30	5199.94096	5199.94096	5199.94096	5199.94096
20	5199.95861	5199.95861	5199.95861	5199.95861
10	5199.97742	5199.97742	5199.97742	5199.97742
0	5199.99768	5199.99768	5199.99768	5199.99768
-10	5200.01158	5200.01158	5200.01158	5200.01158
-20	5200.0136	5200.01447	5200.01505	5200.01563
Max. Deviation (ppm)	13.915	14.415	14.862	14.862

Frequency (MHz)	5785			
Voltage (V)	Measurement Frequency (MHz)			Max. Deviation (ppm)
5.5	5784.95369			8.005
5	5784.9644			6.154
4.5	5784.95369			8.005
Temperature (°C)	Measurement Frequency (MHz)			
	0 Minute	2 Minute	5 Minute	10 Minute
50	5784.91433	5784.91433	5784.91433	5784.91433
40	5784.91954	5784.91954	5784.91954	5784.91954
30	5784.9343	5784.9343	5784.93401	5784.9343
20	5784.9644	5784.96237	5784.95861	5784.9563
10	5784.97424	5784.97424	5784.97453	5784.97453
0	5784.99711	5784.99682	5784.99711	5784.99682
-10	5785.01245	5785.01245	5785.01245	5785.01245
-20	5785.01852	5785.01852	5785.01823	5785.01852
Max. Deviation (ppm)	14.809	14.809	14.809	14.809

<ANT 1>

Frequency (MHz)	5200			
Voltage (V)	Measurement Frequency (MHz)			Max. Deviation (ppm)
5.5	5199.95861			7.960
5	5199.95861			7.960
4.5	5199.95861			7.960
Temperature (°C)	Measurement Frequency (MHz)			
	0 Minute	2 Minute	5 Minute	10 Minute
50	5199.92272	5199.92272	5199.92272	5199.92272
40	5199.92764	5199.92764	5199.92764	5199.92764
30	5199.94124	5199.94096	5199.94124	5199.94096
20	5199.95861	5199.95861	5199.95861	5199.95861
10	5199.97742	5199.97742	5199.97742	5199.97742
0	5199.99768	5199.99768	5199.99768	5199.99768
-10	5200.01158	5200.01158	5200.01158	5200.01158
-20	5200.01563	5200.01563	5200.01592	5200.01592
Max. Deviation (ppm)	14.862	14.862	14.862	14.862

Frequency (MHz)	5785			
Voltage (V)	Measurement Frequency (MHz)			Max. Deviation (ppm)
5.5	5784.95369			8.005
5	5784.95601			7.604
4.5	5784.95369			8.005
Temperature (°C)	Measurement Frequency (MHz)			
	0 Minute	2 Minute	5 Minute	10 Minute
50	5784.91433	5784.91433	5784.91433	5784.91433
40	5784.91954	5784.91954	5784.91954	5784.91954
30	5784.9343	5784.93401	5784.93401	5784.93401
20	5784.95601	5784.95514	5784.95456	5784.95398
10	5784.97424	5784.97424	5784.97424	5784.97424
0	5784.99682	5784.99682	5784.99711	5784.99682
-10	5785.01216	5785.01216	5785.01216	5785.01245
-20	5785.01823	5785.01852	5785.01823	5785.01823
Max. Deviation (ppm)	14.809	14.809	14.809	14.809

<ANT 2>

Frequency (MHz)	5200			
Voltage (V)	Measurement Frequency (MHz)			Max. Deviation (ppm)
5.5	5199.96411			6.902
5	5199.97221			5.344
4.5	5199.96816			6.123
Temperature (°C)	Measurement Frequency (MHz)			
	0 Minute	2 Minute	5 Minute	10 Minute
50	5199.92301	5199.92272	5199.92272	5199.92272
40	5199.92764	5199.92764	5199.92764	5199.92764
30	5199.94182	5199.94153	5199.94124	5199.94124
20	5199.97221	5199.96151	5199.95977	5199.95919
10	5199.97742	5199.97742	5199.97742	5199.97742
0	5199.99768	5199.99768	5199.99768	5199.99768
-10	5200.01158	5200.01158	5200.01158	5200.01158
-20	5200.01592	5200.01592	5200.01592	5200.01592
Max. Deviation (ppm)	14.806	14.862	14.862	14.862

Frequency (MHz)	5785			
Voltage (V)	Measurement Frequency (MHz)			Max. Deviation (ppm)
5.5	5784.95369			8.005
5	5784.95398			7.955
4.5	5784.95369			8.005
Temperature (°C)	Measurement Frequency (MHz)			
	0 Minute	2 Minute	5 Minute	10 Minute
50	5784.91433	5784.91433	5784.91433	5784.91433
40	5784.92012	5784.91983	5784.91954	5784.91954
30	5784.93401	5784.9343	5784.93401	5784.93401
20	5784.95398	5784.95398	5784.95398	5784.95369
10	5784.97482	5784.97482	5784.97453	5784.97453
0	5784.99219	5784.99305	5784.99363	5784.9945
-10	5785.011	5785.011	5785.01187	5785.01216
-20	5785.01823	5785.01823	5785.01823	5785.01823
Max. Deviation (ppm)	14.809	14.809	14.809	14.809

<ANT 3>

Frequency (MHz)	5200			
Voltage (V)	Measurement Frequency (MHz)			Max. Deviation (ppm)
5.5	5199.95919			7.848
5	5199.95919			7.848
4.5	5199.95919			7.848
Temperature (°C)	Measurement Frequency (MHz)			
	0 Minute	2 Minute	5 Minute	10 Minute
50	5199.92562	5199.92475	5199.9233	5199.92301
40	5199.92764	5199.92764	5199.92764	5199.92764
30	5199.94385	5199.94327	5199.94269	5199.94182
20	5199.95919	5199.9589	5199.95861	5199.95861
10	5199.97742	5199.97742	5199.97742	5199.97742
0	5199.99768	5199.99797	5199.99797	5199.99768
-10	5200.01158	5200.01158	5200.01158	5200.01158
-20	5200.01621	5200.01621	5200.01621	5200.01621
Max. Deviation (ppm)	14.304	14.471	14.750	14.806

Frequency (MHz)	5785			
Voltage (V)	Measurement Frequency (MHz)			Max. Deviation (ppm)
5.5	5784.95369			8.005
5	5784.95369			8.005
4.5	5784.95369			8.005
Temperature (°C)	Measurement Frequency (MHz)			
	0 Minute	2 Minute	5 Minute	10 Minute
50	5784.91433	5784.91433	5784.91433	5784.91433
40	5784.92069	5784.92069	5784.92012	5784.92012
30	5784.93401	5784.93401	5784.93401	5784.93401
20	5784.95369	5784.95369	5784.95369	5784.95369
10	5784.97627	5784.97598	5784.97569	5784.97482
0	5784.9945	5784.9945	5784.99479	5784.99508
-10	5785.00405	5785.00637	5785.00839	5785.011
-20	5785.01823	5785.01823	5785.01823	5785.01823
Max. Deviation (ppm)	14.809	14.809	14.809	14.809

5.1.6 Power Spectral Density

Limit

For the 5.15~5.25GHz Bands:

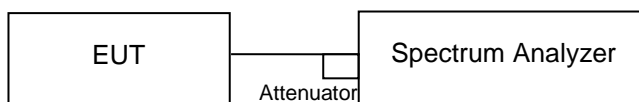
For mobile and portable client devices in the 5.15~5.25GHz band, the Maximum Power spectral density shall not exceed 11dBm/MHz. For an indoor access point operating in the band 5.15~5.25GHz, the maximum power spectral density shall not exceed 17dBm/MHz.

For the 5.745~5.85GHz Bands:

The maximum power spectral density shall not exceed 30dBm/500kHz.

Kind of Test Site Shielded room

Test Setup



Test Instruments

Kind of Equipment	Manufacturer	Type	S/N	Calibration Date	Calibration Due Date	Test Date	
						From	Until
Spectrum Analyzer	R&S	FSV40	101512	2021/1/29	2022/1/28	2021/8/28	2021/11/11

Test Procedure

For U-NII-1:

Using method SA-2

1. Set span to encompass the entire emission bandwidth (EBW) of the signal.
2. Set RBW = 1 MHz, Set VBW \geq 3 MHz, Detector = RMS
3. Sweep time = auto, trigger set to "free run".
4. Trace average at least 100 traces in power averaging mode.
5. Record the max value and add 10 log (1/duty cycle)

※For U-NII-3:

1. Set span to encompass the entire emission bandwidth (EBW) of the signal.
2. Set RBW = 500 kHz, Set VBW \geq 3 RBW, Detector = RMS
3. Use the peak marker function to determine the maximum power level in any 500 kHz band segment within the fundamental EBW.
4. Sweep time = auto, trigger set to "free run".
5. Trace average at least 100 traces in power averaging mode.
6. Record the max value and add 10 log (1/duty cycle)

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For MIMO mode, calculation method follows FCC KDB 662911 Method 2) a) of power density measurement using for calculating total power density. Total power density is summing entire spectra across corresponding frequency bins on the various outputs by computer.

Test Results

Please refer to Appendix A

5.1.7 Radiated Spurious Emissions

Limit

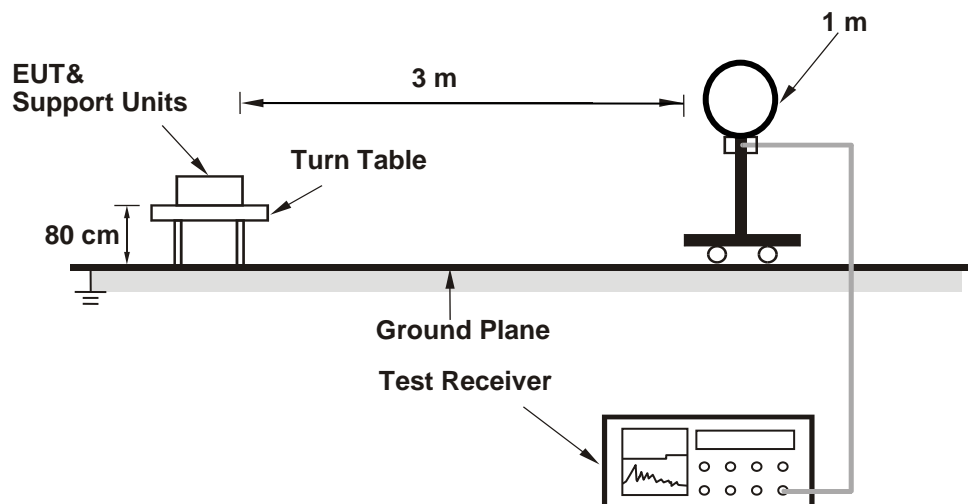
Radiated emissions which fall in the restricted bands, as defined in §15.205(a), must comply with the radiated emission limits specified in §15.209(a).

Emissions radiated outside the restricted and authorized frequency bands must either comply with the radiated emission limits specified for the restricted bands or in §15.407(b).

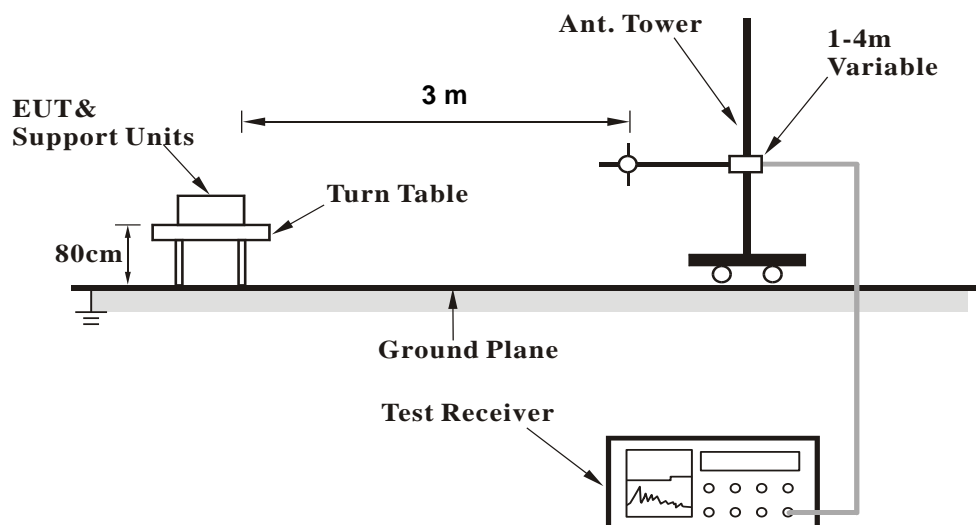
Kind of Test Site 3m Semi-Anechoic Chamber

Test Setup

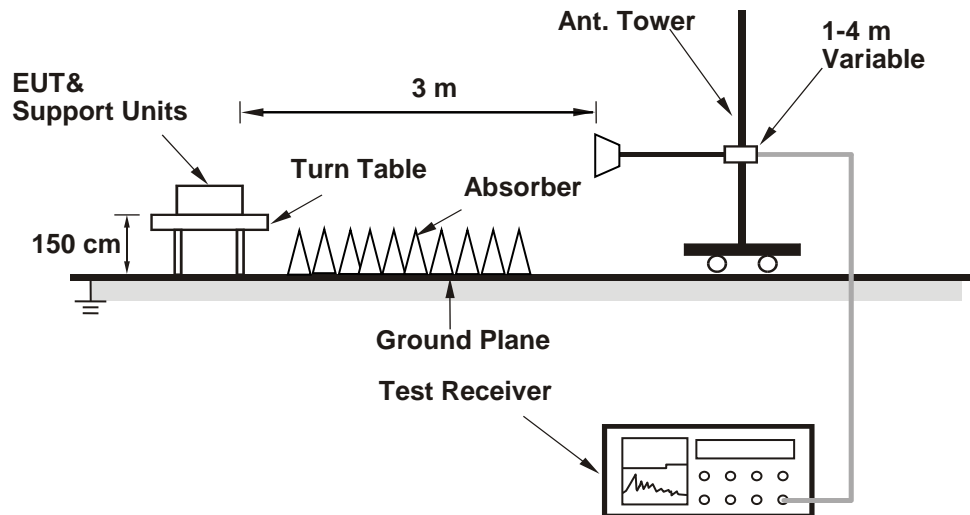
<Radiated Emissions below 30 MHz>



<Radiated Emissions 30 MHz to 1 GHz>



<Radiated Emissions above 1 GHz>



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

Test Instruments

Test Period: 2021-10-01 ~ 2021-12-11

Kind of Equipment	Manufacturer	Type	S/N	Calibration Date	Calibration Due Date
Signal Analyzer	R&S	FSV40	101508	2021/3/16	2022/3/15
Receiver	R&S	ESR7	102109	2021/3/16	2022/3/15
Bilog Antenna	SCHWARZBECK	VULB-9168	00951	2021/2/18	2022/2/17
Horn Antenna	ETS-Lindgren	3117	00218930	2020/12/1	2021/11/30
			00218929	2021/11/25	2022/11/24
LF-AMP	Agilent	8447D	2944A10772	2021/2/18	2022/2/17
HF-AMP + AC source	EMCI	EMC051845SE	980633	2021/2/9	2022/2/8
HF-AMP + AC source	EMCI	EMC184045SE	980657	2021/2/1	2022/1/31
Horn Antenna	SCHWARZBECK	BBHA 9170	00887	2021/4/8	2022/4/7
Microwave Cable	HUBER+SUHNER	SUCOFLEX 104EA	800056/4EA	2021/3/17	2022/3/16
Microwave Cable	HUBER+SUHNER	SUCOFLEX 104	804680/4	2021/3/17	2022/3/16
Microwave Cable	HUBER+SUHNER	SUCOFLEX 104	MY37202/4	2021/3/17	2022/3/16
Microwave Cable	HUBER+SUHNER	SUCOFLEX 102EA	800898/2EA	2021/4/16	2022/4/15
Microwave Cable	HUBER+SUHNER	SUCOFLEX 102EA	800901/2EA	2021/4/16	2022/4/15
Microwave Cable	HUBER+SUHNER	SUCOFLEX 102EA	801027/2EA	2021/4/16	2022/4/15
Loop Antenna	SCHWARZBECK	FNZB1519B	00215	2021/9/17	2022/9/16

Test Procedures**For Radiated Emissions below 30 MHz**

- 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 (OPEN), perpendicular (CLOSE), and ground-parallel (GROUND) 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 9 kHz at frequency below 30 MHz.
2. All modes of operation were investigated and the worst-case emissions are reported.

For Radiated Emissions above 30 MHz

- a. The EUT was placed on the top of a rotating table 0.8 meters (for 30 MHz ~ 1 GHz) / 1.5 meters (for above 1 GHz) 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 detected 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 120 kHz for Quasi-peak detection (QP) or Peak detection (PK) at frequency below 1 GHz.
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 1 GHz.
3. The resolution bandwidth of test receiver/spectrum analyzer is 1 MHz and the video bandwidth is $\geq 1/T$ (Duty cycle < 98 %) or 10 Hz (Duty cycle ≥ 98 %) for Average detection (AV) at frequency above 1 GHz.
4. All modes of operation were investigated and the worst-case emissions are reported.
5. The Radiated Emissions testing was performed in the X(E1), Y(H) and Z(E2) axis orientation. The worst-case Axis orientation is recorded in this test report.

Test Results

Factor (dB/m) = Antenna Factor (dB/m) + Cable Loss (dB)
Level (dBuV/m) = Reading (dBuV) + Factor (dB/m)

Please refer to Appendix B.

5.2 Mains Emission

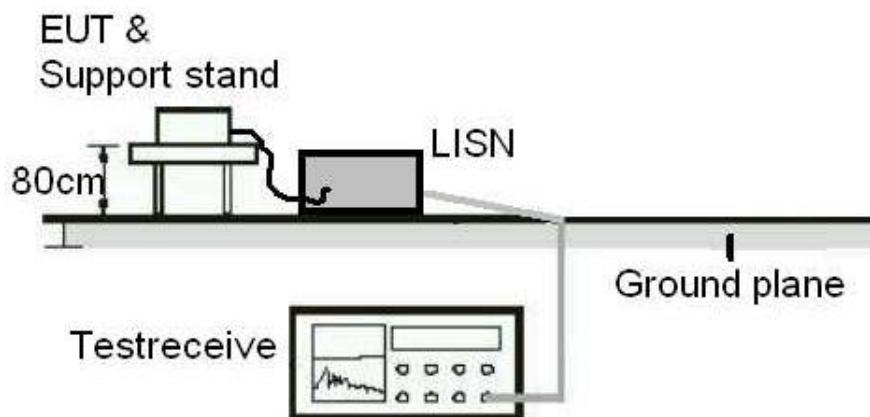
5.2.1 Mains Conducted Emission

Limit

Mains Conducted emissions as defined in §15.207 must comply with the mains conducted emission limits.

Kind of Test Site Shielded room

Test Setup



Test Instruments

Test Period: 2021-10-20

Kind of Equipment	Manufacturer	Type	S/N	Calibration Date	Calibration Due Date
TWO-LINE V-NETWORK	SCHWARZBECK	NSLK 8127	8127-00976	2020/11/3	2021/11/2
EMI Test Receiver	R&S	ESCI	1816063	2020/11/17	2021/11/16
RF Cable	N/A	N/A	EMC-003	2020/11/15	2021/11/14

Test Period: 2022-01-12

Kind of Equipment	Manufacturer	Type	S/N	Calibration Date	Calibration Due Date
RF Cable	N/A	N/A	EMC-003	2021/03/16	2022/03/15
Two-Line V-Network	Rohde & Schwarz	ENV216	101938	2021/09/23	2022/09/22
EMI Test Receiver	R&S	ESCI	1816063	2021/11/15	2022/11/14

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/50 uH 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 150 kHz to 30 MHz was searched. Emission levels under (Limit – 20 dB) was not recorded.

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

Test Results

Please refer to Appendix B.