

427 West 12800 South Draper, UT 84020

Test Report Certification

FCC ID	SWX-WAVEPC
IC ID	6545A-WAVEPC
Equipment Under Test	Wave-Pico
Test Report Serial Number	TR8610_02
Date of Test(s)	11, 16, 20 October and 3 November 2023
Report Issue Date	7 November 2023

Test Specification	Applicant
47 CFR FCC Part 15, Subpart C	Ubiquiti Inc.
	685 Third Avenue
	New York, NY 10017
	U.S.A.



NVLAP LAB CODE 600241-0



Certification of Engineering Report

This report has been prepared by Unified Compliance Laboratory (UCL) to document compliance of the device described below with the requirement of Federal Communication Commissions (FCC) Part 15, Subpart C. This report may be reproduced in full. Partial reproduction of this report may only be made with the written consent of the laboratory. The results in this report apply only to the sample tested.

Applicant	Ubiquiti Inc.
Manufacturer	Ubiquiti Inc.
Brand Name	UBIQUITI
Model Number	Wave-Pico
FCC ID	SWX-WAVEPC
IC ID	6545A-WAVEPC

On this 7th day of November 2023, I individually and for Unified Compliance Laboratory certify that the statements made in this engineering report are true, complete, and correct to the best of my knowledge and are made in good faith.

Although NVLAP has accredited the Unified Compliance Laboratory testing facilities, this report must not be used to claim product certification, approval, or endorsement by NVLAP, NIST or any agency of the U.S. federal government.

Unified Compliance Laboratory

Written By: Joseph W. Jackson

Reviewed By: Richard L. Winter



Revision History		
Revision	Description	Date
01	Original Report Release	7 November 2023
02	Amend Power Supply Model in Sections 2.2 and 2.3	19 December 2023



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1 Client Information

1.1 Applicant

Company	Ubiquiti Inc. 685 Third Avenue New York, NY 10017 U.S.A.
Contact Name	Alex Macon
Title	Compliance

1.2 Manufacturer

Company	Ubiquiti Inc. 685 Third Avenue New York, NY 10017 U.S.A.
Contact Name	Alex Macon
Title	Compliance

2 Equipment Under Test (EUT)

2.1 Identification of EUT

Brand Name	UBIQUITI
Model Number	Wave-Pico
Serial Number	A1A
Dimensions (cm)	15.2 x 15.2 x 5.6

2.2 Description of EUT

The Wave-Pico is a 60 GHz point-to-multipoint customer premise equipment that features wave technology with a high throughput rate. The Wave-Pico is also equipped with a 5 GHz WiFi 6 backup radio to sustain connectivity during a 60 GHz link disruption caused by inclement weather conditions. A Bluetooth LE transceiver is included for device management. The Wave-Pico is an outdoor device and has an Ethernet port which is used for data transfer and to provide power using a Model GP-H480-050G 48-volt PoE power adapter.

This report covers the circuitry of the device subject to FCC Part 15, Subpart C. The circuitry of the device subject to FCC Part 15 Subpart B was found to be compliant and is covered under a separate Unified Compliance Laboratory test report.

2.3 EUT and Support Equipment

The EUT and support equipment used during the test are listed below.

Brand Name Model Number Serial Number	Description	Name of Interface Ports / Interface Cables
BN: UBIQUITI MN: Wave-Pico (Note 1) SN: 3DC	Wireless Access Point	See Section 2.4
BN: UBIQUITI MN: GP-H480-050G SN: N/A	PoE Power Adapter	Shielded or Un-shielded cat 5e cable
BN: Dell MN: XPS 13 SN: N/A	Laptop Computer	Shielded or Un-shielded cat 5e cable

Notes: (1) EUT

(2) Interface port connected to EUT (See Section 2.4)

The support equipment listed above was not modified in order to achieve compliance with this standard.



2.4 Interface Ports on EUT

Name of Ports	No. of Ports Fitted to EUT	Cable Description/Length
AC Mains	1	3 conductor power cord/80cm
РоЕ	1	Shielded or Un-Shielded Cat 5e Cable/> 3 meters
Data	1	Shielded or Un-Shielded Cat 5e Cable/> 3 Meters

2.5 **Operating Environment**

Power Supply	120 Volts ac to 48 Volts PoE
AC Mains Frequency	60 Hz
Temperature	22.1 – 23.1 °C
Humidity	21.2 - 34.2 %
Barometric Pressure	1016 mBar

2.6 Operating Modes

The Wave-Pico was connected to a personal computer laptop and tested using test software in order to enable to constant duty cycle greater or equal to 98% of the Bluetooth transceiver

2.7 EUT Exercise Software

EUT firmware version 1.0 was used to operate the transmitter using a constant transmit mode.





2.8 Block Diagram of Test Configuration

Diagram 1: Test Configuration Block Diagram

2.9 Modification Incorporated/Special Accessories on EUT

There were no modifications made to the EUT during testing to comply with the specification.

2.10 Deviation, Opinions Additional Information or Interpretations from Test Standard

There were no deviations, opinions, additional information or interpretations from the test specification.

3 Test Specification, Method and Procedures

3.1 Test Specification

Title47 CFR FCC Part 15, Subpart C 15.203, 15.207 and 15.247 Limits and methods of measurement of radio interference charact radio frequency devices.	
Purpose of Test	The tests were performed to demonstrate initial compliance

3.2 Methods & Procedures

3.2.1 47 CFR FCC Part 15 Section 15.203

See test standard for details.

3.2.2 47 CFR FCC Part 15 Section 15.207

See test standard for details.

3.2.3 47 CFR FCC Part 15 Section 15.247

See test standard for details.

3.3 FCC Part 15, Subpart C

3.3.1 Summary of Tests

FCC Section	ISED Section	Environmental Phenomena	Frequency Range (MHZ)	Result
15.203	N/A	Antenna requirements	Structural Requirement	Compliant
15.207	RSS-Gen	Conducted Disturbance at Mains Port	0.15 to 30	Compliant
15.247(a)	RSS-247 § 5.2	Bandwidth Requirement	2400 to 2483.5	Compliant
15.247(b)	RSS-247 § 5.4	Peak Output Power	2400 to 2483.5	Compliant
15.247(d)	RSS-247 § 5.4	Antenna Conducted Spurious Emissions	0.009 to 26000	N/A
15.247(d)	RSS-247 § 5.4	Radiated Spurious Emissions	0.009 to 26000	Compliant
15.247(e)	RSS-247 § 5.2	Peak Power Spectral Density	2400 to 2483.5	Compliant
The testing was perf CFR Part 15. Where	ormed according to the applicable, KDB 6629	procedures in ANSI C63.10-20 11 was followed to sum require	013, KDB 558074 ed measurements.	4 and 47



3.4 Results

In the configuration tested, the EUT complied with the requirements of the specification.

3.5 Test Location

Testing was performed at the Unified Compliance Laboratory 3-Meter and 10-Meter chambers located at 427 West 12800 South, Draper, UT 84020. Unified Compliance Laboratory is accredited by National Voluntary Laboratory Accreditation Program (NVLAP); NVLAP Code 600241-0 which is effective until 30 June 2024. This site has also been registered with Innovations, Science and Economic Development (ISED) department and was accepted under Appendix B, Phase 1 procedures of the APEC Tel MRA for Canadian recognition. ISED No.: 25346, effective until 30 June 2024.

Unified Compliance Laboratory has been assigned Designation Number US5037 by the FCC and Conformity Assessment Number US0223 by ISED.



4 Test Equipment

4.1 Conducted Emissions at Mains Ports

Type of Equipment	Manufacturer	Model Number	Asset Number	Date of Last Calibration	Due Date of Calibration
EMI Receiver	AFJ	FFT3010	UCL-6754	2/22/2023	2/22/2024
LISN	AFJ	LS16C/10	UCL-6749	12/6/2021	12/6/2023
ISN	Teseq	ISN T800	UCL-2974	6/27/2022	6/27/2024
LISN	Com-Power	LIN-120C	UCL-2612	1/24/2023	1/24/2024
AC Power Source	Laplace Instruments	AC1000A	UCL-2857	N/A	N/A
Test Software	UCL	Revision 1	UCL-3107	N/A	N/A

 Table 1: List of equipment used for Conducted Emissions Testing at Mains Port



Figure 1: Conducted Emissions Test

4.2 Direct Connect at the Antenna Port Tests

Type of Equipment	Manufacturer	Model Number	Asset Number	Date of Last Calibration	Due Date of Calibration
Spectrum Analyzer	R&S	FSV40	UCL-2861	11/7/2022	11/7/2023
Signal Generator	R&S	SMB100A	UCL-2864	N/A	N/A
Vector Signal Generator	R&S	SMBV100A	UCL-2873	N/A	N/A
Switch Extension	R&S	R&S OSP- B157WX UCL-2867 2/22		2/22/2023	2/22/2024
Switch Extension	R&S	OSP-150W	UCL-2870	2/22/2023	2/22/2024

Table 2: List of equipment used for Direct Connect at the Antenna Port





Spectrum Analyzer

Figure 2: Direct Connect at the Antenna Port Te	est
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4.3 Radiated Emissions

Type of Equipment	Manufacturer	Model Number	Asset Number	Date of Last Calibration	Due Date of Calibration
EMI Receiver	Keysight	N9038A	UCL-2778	1/27/2023	1/27/2024
Pre-Amplifier 9 kHz – 1 GHz	Sonoma Instruments	310N	UCL-2889	10/7/2021	10/7/2023
Broadband Antenna	Scwarzbeck	VULB 9163	UCL-3062	2/22/2023	2/22/2025
Broadband Antenna	Scwarzbeck	VULB 9163	UCL-3071	1/11/2023	1/11/2025
Double Ridge Horn Antenna	Scwarzbeck	BBHA 9120D	UCL-3065	9/22/2022	9/22/2024
Log Periodic	Scwarzbeck	STLP 9129	UCL-3068	1/27/2023	1/27/2025
15 - 40 GHz Horn Antenna	Scwarzbeck	BBHA 9170	UCL-2487	6/09/2022	6/09/2024
1 – 18 GHz Amplifier	Com-Power	PAM 118A	UCL-3833	12/9/2022	12/9/2023
Test Software	UCL	Revision 1	UCL-3108	N/A	N/A

Table 3: List of equipment used for Radiated Emissions



Figure 3: Radiated Emissions Test

TR8610_Wave-Pico_FCC_15.247_BLE_02



4.4 Equipment Calibration

All applicable equipment is calibrated using either an independent calibration laboratory or Unified Compliance Laboratory personnel at intervals defined in ANSI C63.4:2014 following outlined calibration procedures. All measurement instrumentation is traceable to the National Institute of Standards and Technology (NIST). Supporting documentation relative to traceability is on file and is available for examination upon request.

4.5 Measurement Uncertainty

Test	Uncertainty (<u>+</u> dB)	Confidence (%)
Conducted Emissions	1.44	95
Radiated Emissions (9 kHz to 30 MHz)	2.50	95
Radiated Emissions (30 MHz to 1 GHz)	4.38	95
Radiated Emissions (1 GHz to 18 GHz)	4.37	95
Radiated Emissions (18 GHz to 40 GHz)	3.93	95
Direct Connect Tests	K Factor	Value
Emissions Bandwidth	2	2.0%
Output Power	2	1.0 dB
Peak Power Spectral Density	2	1.3 dB
Band Edge	2	0.8 dB
Transmitter Spurious Emissions	2	1.8 dB



5 Test Results

5.1 §15.203 Antenna Requirements

The EUT uses an internal integrated antenna. As per the manufacturer, the Maximum gain of the antenna is 2 dBi. The antenna is not user replaceable.

Results

The EUT complied with the specification

5.2 Conducted Emissions at Mains Ports Data

Result

The EUT complied with the specification limit.



ID	Frequency	Probe	Cable	Atten.	Detector	Meter Read	Meas Level	Limit 1	Limit 1 Dist.	Limit 2	Limit 2 Dist.	P/F
MU	MHz	dB	dB	dB	Туре	dBµV	dBµV	dBµV	dB	dBµV	dB	P/F
1	624,000kHz	9.58	0.00		QPeak	38.13	47.71	56.00	-8.29			
3	165,000kHz	9.62	0.00		QPeak	45.42	55.04	65.21	-10.17			
7	14.208	9.73	0.00		QPeak	32.88	42.61	60.00	-17.39			
5	3.693	9.60	0.00		QPeak	28.90	38.50	56.00	-17.50			
2	624,000kHz	9.58	0.00		C_AVG	31.16	40.74			46.00	-5.26	
4	168,000kHz	9.62	0.00		C_AVG	29.41	39.03			55.06	-16.03	
6	3.699	9.60	0.00		C_AVG	17.93	27.53			46.00	-18.47	
8	14.226	9.73	0.00		C_AVG	26.46	36.19			50.00	-13.81	

Graph 1: Conducted Emissions Plot - Neutral



14.184

3.678

621,000kHz

3.711

14.226

9.68

9.58

9.50

9.58

0.00

0.00

0.00

0.00

6

4

5

7



9.68	0.00		C_AVG	28.27	37.95		
	Grap	h 2: Co	onducted	Emissio	ons Plot	– Line	1

34.09

29.57

31.60

19.58

60.00

56.00

43.77

39.15

41.10

29.16

-16.23

-16.85

46.00

46.00

50.00

-4.90

-16.84

-12.05

QPeak

QPeak

C_AVG

C AVG

5.3 §15.247(a)(2) Emissions Bandwidth

Frequency (MHz)	Emissions 6 dB Bandwidth (MHz)	Emissions 99% Bandwidth (MHz)
2402	0.71	1.03
2442	0.71	1.03
2480	0.71	1.02

Result

In the configuration tested, the 6 dB bandwidth was greater than 500 kHz; therefore, the EUT complied with the requirements of the specification (see spectrum analyzer plot within the Annex).

5.4 §15.247(b)(3) Maximum Average Output Power

The maximum average RF conducted output power measured for this device was 13.28 dBm or 21.28 mW. The limit is 30 dBm or 1 Watt when using antennas with 6 dBi or less gain. The antenna has a gain of 2 dBi.

Frequency (MHz)	Measured Output Power (dBm)	Output Power (mW)
2402	13.28	21.28
2442	12.94	19.68
2480	12.83	19.19

Result

In the configuration tested, the maximum average RF output power was less than 1 watt; therefore, the EUT complied with the requirements of the specification (see spectrum analyzer plot within the Annex).



5.5 §15.247(d) Spurious Emissions

5.5.1 Conducted Spurious Emissions

The frequency range from the lowest frequency generated or used in the device to the tenth harmonic of the highest fundamental frequency was investigated to measure any antenna-conducted emissions. The table show the measurement data from spurious emissions noted across the frequency range when transmitting at the lowest frequency, middle frequency and upper frequency. Shown within the Annex are plot(s) with the EUT tuned to the upper and lower channels. These demonstrate compliance with the provisions of this section at the band edges.

The emissions must be attenuated 30 dB below the highest power spectral density level measured within the authorized band as measured with a 100 kHz RBW.

Result

Conducted spurious emissions were attenuated 30 dB or more below the fundamental; therefore, the EUT complies with the specification.

5.5.2 Radiated Spurious Emissions in the Restricted Bands of §15.205

The frequency range from the lowest frequency generated or used in the device to the tenth harmonic of the highest fundamental emissions was investigated to measure any radiated emissions in the restricted bands. The following tables show measurements of any emissions that fell into the restricted bands of §15.205. The tables show the worst-case emissions measured from the EUT. For frequencies above 18.0 GHz, a measurement distance of 1 meter was used. The noise floor was a minimum of 6 dB below the limits. The emissions in the restricted bans must meet the limits specified in §15.209. Tabular data for each of the spurious emissions is shown below for each of the units. Plots of the band edges are also shown.

Result

All emissions in the restricted bands of §15.205 met the limits specified in §15.209; therefore, the EUT complies with the specification.







QuasiPeak

Frequency	Level (dBµV/m)	Limit (dBµV/m)	Margin	Azimuth (°)	Height	Pol.	Correction (dB)
30.386 MHz	18.991	49	-30.009	183	3.66	Vertical	-7.957
192 MHz	31.232	53.5	-22.268	185	2.059	Vertical	-16.393
384.03 MHz	43.962	56	-12.038	109	2.401	Vertical	-12.176
480 MHz	48.842	56	-7.158	265	1.863	Vertical	-9.391
575.95 MHz	40.156	56	-15.844	216	1.681	Vertical	-8.42
30.229 MHz	21.821	49	-27.179	19	4	Horizontal	-7.836
191.99 MHz	37.968	53.5	-15.532	303	1.701	Horizontal	-16.394
287.95 MHz	39.99	56	-16.01	125	1.138	Horizontal	-14.117
384.04 MHz	47.542	56	-8.458	328	2.22	Horizontal	-12.176
480.02 MHz	55.57	56	-0.43	1	1.858	Horizontal	-9.39
575.96 MHz	51.906	56	-4.094	143	1.496	Horizontal	-8.421

Table 4: Radiated Emissions 30 – 1000 MHz





Frequency	Level (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Azimuth (°)	Height (m)	Pol.	Correction (dB)
1.44 GHz	48.321	74	-25.679	129	2.368	Vertical	-7.214
9.6071 GHz	56.388	74	-17.612	232	1.643	Vertical	12.704
14.714 GHz	55.405	74	-18.595	268	1.638	Vertical	17.301
9.609 GHz	55.898	74	-18.102	128	2.363	Horizontal	12.697
14.703 GHz	55.582	74	-18.418	105	2.721	Horizontal	17.428

Avg

Frequency	Level (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Azimuth (°)	Height (m)	Pol.	Correction (dB)
1.44 GHz	45.516	54	-8.484	129	2.368	Vertical	-7.214
9.6071 GHz	42.451	54	-11.549	232	1.643	Vertical	12.704
14.714 GHz	38.226	54	-15.774	268	1.638	Vertical	17.301
9.609 GHz	41.169	54	-12.831	128	2.363	Horizontal	12.697
14.703 GHz	38.211	54	-15.789	105	2.721	Horizontal	17.428

Table 5: Radiated Emissions 1 – 17 GHz at the Lowest Frequency







Frequency	Level (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Azimuth (°)	Height (m)	Pol.	Correction (dB)
9.7674 GHz	59.417	74	-14.583	235	1.638	Vertical	12.005
9.7692 GHz	59.382	74	-14.618	128	2.001	Horizontal	12
14.706 GHz	56.25	74	-17.75	308	3.621	Horizontal	17.394

Avg

Frequency	Level (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Azimuth (°)	Height (m)	Pol.	Correction (dB)
9.7674 GHz	47.742	54	-6.258	235	1.638	Vertical	12.005
9.7692 GHz	45.411	54	-8.589	128	2.001	Horizontal	12
14.706 GHz	38.19	54	-15.81	308	3.621	Horizontal	17.394

Table 6: Radiated Emissions 1 – 17 GHz at the Middle Frequency







Frequency	Level (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Azimuth (°)	Height (m)	Pol.	Correction (dB)
1.248 GHz	49.505	74	-24.495	107	1.82	Vertical	-7.9
1.4397 GHz	47.623	74	-26.377	109	2.362	Vertical	-7.215
9.9211 GHz	62.021	74	-11.979	177	2.001	Vertical	13.209
1.4399 GHz	48.001	74	-25.999	271	1.82	Horizontal	-7.214
9.9202 GHz	62.337	74	-11.663	135	1.997	Horizontal	13.205

Avg

Frequency	Level (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Azimuth (°)	Height (m)	Pol.	Correction (dB)
1.248 GHz	47.373	54	-6.627	107	1.82	Vertical	-7.9
1.4397 GHz	42.704	54	-11.296	109	2.362	Vertical	-7.215
9.9211 GHz	48.571	54	-5.429	177	2.001	Vertical	13.209
1.4399 GHz	44.819	54	-9.181	271	1.82	Horizontal	-7.214
9.9202 GHz	47.654	54	-6.346	135	1.997	Horizontal	13.205

Table 7: Radiated Emissions 1 – 17 GHz at the Highest Frequency





Frequency	Level (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Azimuth (°)	Pol.	Correction (dB)
16.598 GHz	49.562	74	-24.438	64	Vertical	0.07
17.915 GHz	50.631	74	-23.369	281	Vertical	-0.361
20.999 GHz	50.952	74	-23.048	175	Vertical	0.831
24.821 GHz	51.566	74	-22.434	241	Vertical	1.076
16.597 GHz	49.251	74	-24.749	3	Horizontal	0.069
17.946 GHz	49.659	74	-24.341	109	Horizontal	-0.437
20.475 GHz	50.625	74	-23.375	341	Horizontal	0.571
24.908 GHz	51.081	74	-22.919	212	Horizontal	1.126

Avg

Frequency	Level (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Azimuth (°)	Pol.	Correction (dB)
16.598 GHz	36.292	54	-17.708	64	Vertical	0.07
17.915 GHz	36.427	54	-17.573	281	Vertical	-0.361
20.999 GHz	36.563	54	-17.437	175	Vertical	0.831
24.821 GHz	36.023	54	-17.977	241	Vertical	1.076
16.597 GHz	36.038	54	-17.962	3	Horizontal	0.069
17.946 GHz	36.259	54	-17.741	109	Horizontal	-0.437
20.475 GHz	35.921	54	-18.079	341	Horizontal	0.571
24.908 GHz	36.297	54	-17.703	212	Horizontal	1.126

Table 8: Radiated Emissions 17 – 26 GHz at the Highest Frequency (worse case)

5.6 §15.247(e) Maximum Average Power Spectral Density

The maximum average power spectral density conducted from the intentional radiator of the antenna shall not be greater than 8 dBm in any 3 kHz band during any time interval of continuous transmission. Results of this testing are summarized.

Frequency (MHz)	Measurement (dBm)	Criteria (dBm)
2402	2.06	8.0
2442	2.21	8.0
2480	2.05	8.0

Result

The maximum average power spectral density was less than the limit of 8 dBm; therefore, the EUT complies with the specification.



-- End of Test Report --