

427 West 12800 South Draper, UT 84020

## Test Report Certification

FCC ID	SWX-LTUINS	
IC ID	6545A-LTUINS	
Equipment Under Test	der Test LTU-Instant	
Test Report Serial Number	TR6297_01	
Date of Test(s)	<ul><li>3, 4, 7, 29 June (Radiated and Conducted Emissions)</li><li>9 July 2021 (AC Mains Conducted Emissions)</li></ul>	
Report Issue Date21st July 2021		

Test Specification	Applicant
47 CFR FCC Part 15, Subpart C	Ubiquiti Inc.
	685 Third Avenue
	New York, NY 10019
	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	LTU
Model Number	LTU-Instant
FCC ID	SWX-LTUINS
IC ID	6545A-LTUINS

On this 21st day of July 2021, 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 I		Date
01	Original Report Release	21 <sup>st</sup> July 2021



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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	Mark Feil
Title	Compliance Manager

## 1.2 Manufacturer

Company	Ubiquiti Inc. 685 Third Avenue New York, NY 10017 U.S.A.
Contact Name	Mark Feil
Title	Compliance Manager

## 2 Equipment Under Test (EUT)

## 2.1 Identification of EUT

Brand Name	LTU
Model Number	LTU-Instant
Serial Number	68D79A1F3029
Dimensions (cm)	20.2 x 6.4 x 5.6

### 2.2 Description of EUT

The LTU-Instant is a fixed point-to-multi-point transceivers, meant for outdoor use, operating in the 5GHz frequency bands. A Bluetooth LE transceiver is included for device management. An Ethernet port is used for data transfer and to provide power using a POE-24V-5X-HD POE supply.

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

Brand Name Model Number Serial Number	Description	Name of Interface Ports / Interface Cables
BN: LTU MN: LTU-Instant SN: 68D79A1F3029	Point-to-multi-point Transceiver	See Section 2.4
BN: Ubiquiti Inc. MN: POE-24V-5X-HD SN: N/A	PoE Power Supply	See Section 2.4
BN: Dell MN: XPS 13 SN: N/A	Laptop Personal Computer	Ethernet/Shielded or Unshielded Cat 5e Cable
BN: HP MN: Spectre SN: N/A	Laptop Personal Computer	Ethernet/Shielded or Unshielded Cat 5e Cable

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

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 (PoE Injector)	1	3 conductor power cord/80 cm
PoE (PoE Injector)	1	Shielded Cat 5e cable/8 meters
Lan (PoE Injector)	1	Un-Shielded Cat 5e cable/1
		meters

### 2.5 Operating Environment

Power Supply	120 Vac to 24 Volt PoE Power
AC Mains Frequency	60 Hz
Temperature	25.4 – 26.6 °C
Humidity	30.9 - 38.3 %
Barometric Pressure	1015 mBar

### 2.6 Operating Modes

The LTU-Instant was connected to a personal computer laptop and tested using test software in order to enable to constant duty cycle of the Bluetooth transceiver. The measurements within this report are corrected to reference a 100% duty cycle.

### 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

Title	<ul><li>47 CFR FCC Part 15, Subpart C</li><li>15.203, 15.207 and 15.247</li><li>Limits and methods of measurement of radio interference characteristics of radio frequency devices.</li></ul>
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)	15.247(d)RSS-247 § 5.4Radiated Spurious Emissions								
15.247(e)	2400 to 2483.5	Compliant							
The testing was performed according to the procedures in ANSI C63.10-2013, KDB 558074 and 47 CFR Part 15. Where applicable, KDB 662911 was followed to sum required measurements.									

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## 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 2022. 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 2022. Unified Compliance Laboratory has been assigned 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-2500	9/18/2020	9/17/2021
LISN	AFJ	LS16C/10	UCL-2512	5/26/2020	5/26/2022
Cat6 ISN	Teseq	ISN T8- Cat6	UCL-2971	5/18/2020	5/18/2022
ISN	Teseq	ISN T800	UCL-2974	6/4/2021	6/4/2022
LISN	Com-Power	LIN-120C	UCL-2612	5/19/2021	5/19/2022
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	8/24/2020	8/24/2021
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	OSP- B157WX	UCL-2867	9/8/2020	9/8/2021
Switch Extension	R&S	OSP-150W	UCL-2870	3/3/2021	3/3/2022

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





Spectrum Analyzer

## 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	6/1/2020	8/1/2021
Pre-Amplifier 9 kHz – 1 GHz	Sonoma Instruments	310N	UCL-2889	9/10/2020	9/10/2021
Double Ridge Horn Antenna	Scwarzbeck	BBHA 9120D	UCL-3065	7/8/2020	7/8/2021
Log Periodic	Scwarzbeck	STLP 9129	UCL-3068	11/16/2020	11/16/2021
15 - 40 GHz Horn Antenna	Scwarzbeck	BBHA 9170	UCL-2487	5/21/2020	5/21/2022
1 – 18 GHz Amplifier	Com-Power	PAM 118A	UCL-3833	9/29/2020	9/29/2021
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

## 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

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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 a integral antenna. The Maximum gain of the antenna is 2.0 dBi. The antenna is not user replaceable.

### Results

The EUT complied with the specification

## 5.2 Conducted Emissions at Mains Ports Data



ID	Frequency	Probe	Cable	Atten.	Detector	Meter Read	Meas Level	Limit 1	Limit 1 Dist.	Limit 2	Limit 2 Dist.
1	165,000kHz	12.4	0.0		QPeak	42.7	55.1	65.2	-10.1		
3	19.155MHz	12.3	0.2		QPeak	35.0	47.5	60.0	-12.5		
4	21.285MHz	12.3	0.2		QPeak	33.6	46.1	60.0	-13.9		
2	17.028MHz	12.4	0.2		QPeak	32.4	45.0	60.0	-15.0		
9	14.898MHz	12.5	0.2		QPeak	32.3	45.0	60.0	-15.0		
6	17.028MHz	12.4	0.2		C_AVG	26.8	39.4			50.0	-10.6
7	19.155MHz	12.3	0.2		C_AVG	29.5	41.9			50.0	-8.1
8	21.285MHz	12.3	0.2		C_AVG	29.4	41.9			50.0	-8.1
10	14.898MHz	12.5	0.2		C_AVG	27.5	40.2			50.0	-9.8

**Graph 1: Conducted Emissions Plot - Neutral** 





ID	Frequency	Probe	Cable	Atten.	Detector	Meter Read	Meas Level	Limit 1	Limit 1 Dist.	Limit 2	Limit 2 Dist.
1	165,000kHz	12.4	0.0		QPeak	42.2	54.6	65.2	-10.6		
5	19.161MHz	12.3	0.2		QPeak	34.4	46.8	60.0	-13.2		
2	14.904MHz	12.5	0.2		QPeak	33.6	46.3	60.0	-13.7		
8	21.294MHz	12.3	0.2		QPeak	33.6	46.1	60.0	-13.9		
3	17.034MHz	12.4	0.2		QPeak	31.5	44.1	60.0	-15.9		
4	17.034MHz	12.4	0.2		C_AVG	25.6	38.2			50.0	-11.8
6	19.161MHz	12.3	0.2		C_AVG	28.2	40.6			50.0	-9.4
7	14.904MHz	12.5	0.2		C_AVG	30.8	43.5			50.0	-6.5
9	21.291MHz	12.3	0.2		C_AVG	28.9	41.4			50.0	-8.6

**Graph 2: Conducted Emissions Plot – Line 1** 

### Result

The EUT complied with the specification limit.

## 5.3 §15.247(a)(2) Emissions Bandwidth

Frequency (MHz)	Emissions 6 dB Bandwidth (MHz)	Emissions 99% Bandwidth (MHz)
2402	0.67	0.995
2442	0.67	0.995
2480	0.67	0.990

### 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 4.50 dBm or 2.82 mW. The limit is 30 dBm or 1 Watt when using antennas with 6 dBi or less gain. The antenna has a gain of 2.0 dBi.

Frequency (MHz)	Measured Output Power (dBm) *	Output Power (mW)
2402	4.50	2.82
2442	2.12	1.63
2480	-0.28	0.94

### 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).

\* Gated RMS (dBm) is the conducted measured output power.



## 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.





#### Vertical

Source	Frequency	Level (dBµV/m)	Limit (dBµV/m)	Margin	Azimuth (°)	Height	Pol.	Correction (dB)
QuasiPeak	44.757 MHz	30.346	40	-9.654	330	2.42	Vertical	-12.503
QuasiPeak	59.621 MHz	37.312	40	-2.688	15	3.755	Vertical	-13.354
QuasiPeak	68.125 MHz	33.808	40	-6.192	29	3.969	Vertical	-15.683
QuasiPeak	74.501 MHz	37.074	40	-2.926	2	3.916	Vertical	-18.179
QuasiPeak	76.612 MHz	32.787	40	-7.213	1	3.791	Vertical	-18.798

#### Horizontal

Source	Frequency	Level (dBµV/m)	Limit (dBµV/m)	Margin	Azimuth (°)	Height	Pol.	Correction (dB)
QuasiPeak	74.534 MHz	21.063	40	-18.937	15	1.593	Horizontal	-18.192





### Peak

Source	Frequency	Level (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Azimuth (°)	Height (m)	Pol.	Correction (dB)
Peak	7.2187 GHz	51.377	74	-22.623	78	3.315	Vertical	6.629
Peak	14.571 GHz	57.174	74	-16.826	301	3.806	Vertical	14.24
Peak	16.998 GHz	57.263	74	-16.737	239	2.822	Vertical	16.206

#### Average

Source	Frequency	Level (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Azimuth (°)	Height (m)	Pol.	Correction (dB)
Avg	7.2187 GHz	38.193	54	-15.807	78	3.315	Vertical	6.629
Avg	14.571 GHz	43.54	54	-10.46	301	3.806	Vertical	14.24
Avg	16.998 GHz	44.195	54	-9.805	239	2.822	Vertical	16.206

#### Peak

Source	Frequency	Level (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Azimuth (°)	Height (m)	Pol.	Correction (dB)
Peak	7.2185 GHz	49.862	74	-24.138	192	3.787	Horizontal	6.628
Peak	15.003 GHz	56.75	74	-17.25	43	1.5	Horizontal	14.192
Peak	16.951 GHz	57.654	74	-16.346	150	2.644	Horizontal	16.079

#### Avg



Source	Frequency	Level (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Azimuth (°)	Height (m)	Pol.	Correction (dB)
Avg	7.2185 GHz	36.632	54	-17.368	192	3.787	Horizontal	6.628
Avg	15.003 GHz	43.359	54	-10.641	43	1.5	Horizontal	14.192
Avg	16.951 GHz	43.886	54	-10.114	150	2.644	Horizontal	16.079





### Peak

Source	Frequency	Level (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Azimuth (°)	Height (m)	Pol.	Correction (dB)
Peak	7.3267 GHz	52.084	74	-21.916	78	3.317	Vertical	7.015
Peak	14.947 GHz	56.642	74	-17.358	244	2.33	Vertical	14.147

#### Average

Source	Frequency	Level (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Azimuth (°)	Height (m)	Pol.	Correction (dB)
Avg	7.3267 GHz	38.407	54	-15.593	78	3.317	Vertical	7.015
Avg	14.947 GHz	43.209	54	-10.791	244	2.33	Vertical	14.147

Peak

Source	Frequency	Level (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Azimuth (°)	Height (m)	Pol.	Correction (dB)
Peak	7.3267 GHz	51.268	74	-22.732	199	2.807	Horizontal	7.015
Peak	14.483 GHz	57.604	74	-16.396	184	2.333	Horizontal	14.352

#### Average

Source	Frequency	Level (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Azimuth (°)	Height (m)	Pol.	Correction (dB)
Avg	7.3267 GHz	37.478	54	-16.522	199	2.807	Horizontal	7.015
Avg	14.483 GHz	43.7	54	-10.3	184	2.333	Horizontal	14.352

Table 6:Transmitting at the Middle Frequency 1 – 17 GHz





Peak

Source	Frequency	Level (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Azimuth (°)	Height (m)	Pol.	Correction (dB)
Peak	14.64 GHz	56.807	74	-17.193	277	3.806	Vertical	14.43

#### Average

Source	Frequency	Level (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Azimuth (°)	Height (m)	Pol.	Correction (dB)
Avg	14.64 GHz	43.529	54	-10.471	277	3.806	Vertical	14.43

### Peak

Source	Frequency	Level (dBµV/m)	Limit (dBµV/m) (dBµV/m)	Margin (dB)	Azimuth (°)	Height (m)	Pol.	Correction (dB)
Peak	7.4406 GHz	51.312	74	-22.688	203	3.291	Horizontal	7.15

#### Average

Source	Frequency	Level (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Azimuth (°)	Height (m)	Pol.	Correction (dB)
Avg	7.4406 GHz	37.992	54	-16.008	203	3.291	Horizontal	7.15

Table 7: Transmitting at the Highest Frequency 1 – 17 GHz







Vertical: No significant emissions were observed in this orientation of the antenna Horizontal: No significant emissions were observed in this orientation of the antenna.

Graph 3: Radiated Emissions 17 – 26 GHz

## 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	-3.06	8.0
2442	-5.48	8.0
2480	-7.99	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 --