UNIFIED COMPLIANCE LABORATORY

427 West 12800 South
Draper, UT 84020

Test Report

Certification

FCC ID	SWX-LBEAX
IC ID	6545A-LBEAX
Equipment Under Test	LBE-AX
Test Report Serial Number	TR6453_01
Date of Test(s)	10, 13 August and 16, 19, 22 July 2021
Report Issue Date	13 September 2021

Test Specification	Applicant
47 CFR FCC Part 15, Subpart C	Ubiquiti Inc. 685 Third Avenue New York, NY 10019 U.S.A.

NVLAP TESTING ilac-MRA

NVLAP LAB CODE 600241-0

Certification of Engineering Report

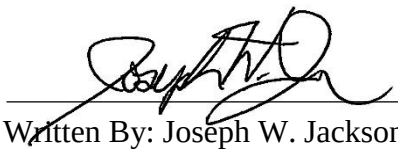
This report has been prepared by Unified Compliance Laboratory (UCL) to document compliance of the device described below with the requirement of Federal Communication Commissions (FCC) Part 15, Subpart C. This report may be reproduced in full. Partial reproduction of this report may only be made with 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	airMAX
Model Number	LBE-AX
FCC ID	SWX-LBEAX
IC ID	6545A-LBEAX

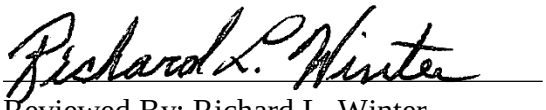
On this 13th day of September 2021, I individually and for Unified Compliance Laboratory certify that the statements made in this engineering report are true, complete, and correct to the best of my knowledge and are made in good faith.

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**	**Date**
01	Original Report Release	13 September 2021

Table of Contents

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	airMAX
Model Number	LBE-AX
Serial Number	68D79A1FA536
Dimensions (cm)	35.8 x 27.2 x 27.3

2.2 Description of EUT

The LBE-AX is a point-to-point transceiver intended for outdoor use and operating in the 5 GHz WiFi, UNII-1, UNII-2A/2C and UNII-3 frequency bands. The 5 GHz WiFi is a 2x2 radio with cross polarized elements. The LBE-AX is designed to be lightweight and aimed to create extremely long-distance wireless links. The LBE-AX also has a Bluetooth LE transceiver for device management. An Ethernet port is used for data transfer and to provide power using a POE-24V-24W 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: airMAX MN: LBE-AX (Note 1) SN: 68D79A1FA536	Wireless Transceiver	See Section 2.4
BN: Ubiquiti Inc. MN: POE-24-24W (Note 1) SN: None	POE Supply	POE Port See Section 2.4
BN: Dell MN: XPS 13 SN: None	Laptop PC	LAN Port / Shielded or Unshielded Cat 5e cable (Note 2)

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/80cm
LAN (PoE Injector)	1	Shielded or Unshielded Cat 5e cable/1 meter
Data	1	Shielded or Unshielded Cat 5e cable/8meters

2.5 Operating Environment

Power Supply	120 Vac to 24 Volts PoE Power
AC Mains Frequency	60 Hz
Temperature	24.6 – 26.8 °C
Humidity	33.3 – 43.8 %
Barometric Pressure	1019 mBar

2.6 Operating Modes

The LBE-AX 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

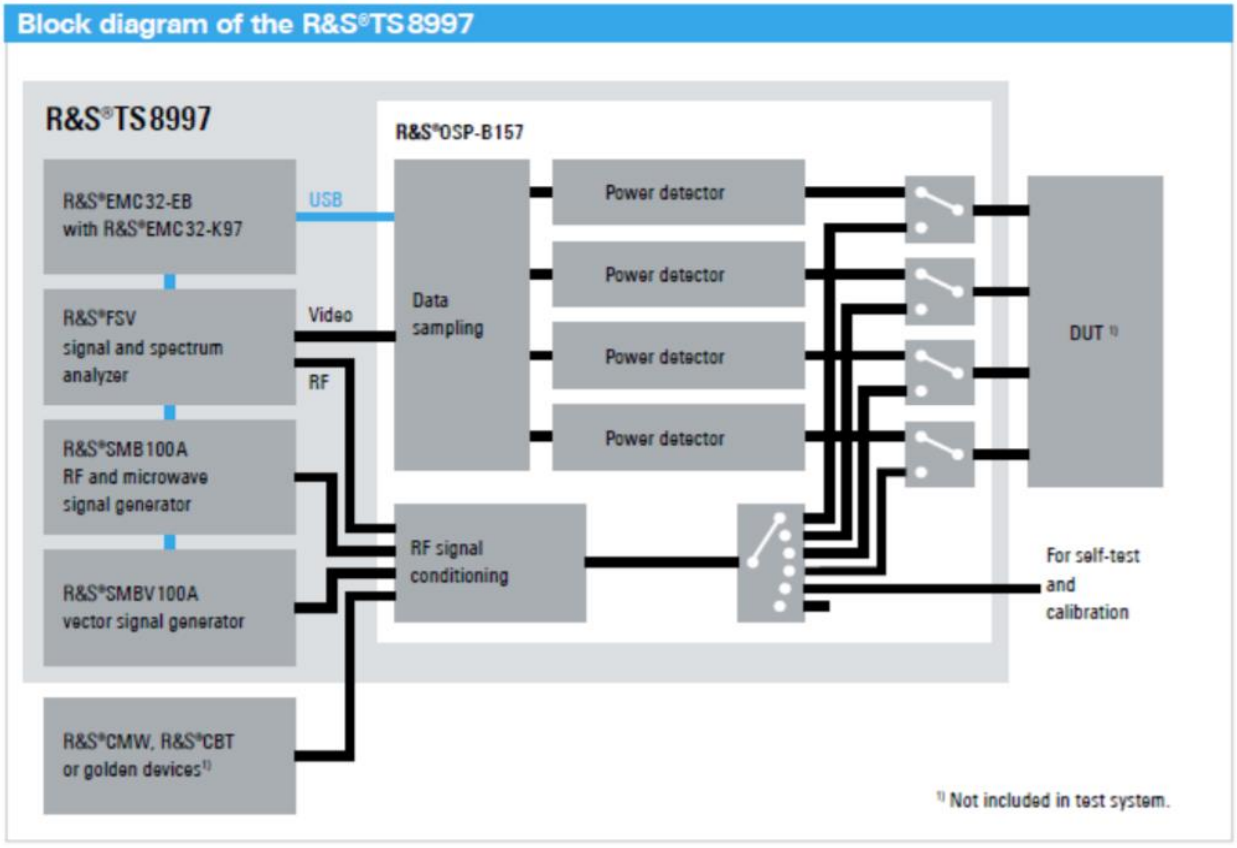


Diagram 1: Test Configuration Block Diagram

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	47 CFR FCC Part 15, Subpart C 15.203, 15.207 and 15.247 Limits and methods of measurement of radio interference characteristics of 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	2402 to 2480	Compliant
15.247(b)	RSS-247 § 5.4	Peak Output Power	2402 to 2480	Compliant
15.247(d)	RSS-247 § 5.4	Antenna Conducted Spurious Emissions	0.009 to 40000	N/A
15.247(d)	RSS-247 § 5.4	Radiated Spurious Emissions	0.009 to 40000	Compliant
15.247(e)	RSS-247 § 5.2	Peak Power Spectral Density	2402 to 2480	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.				

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

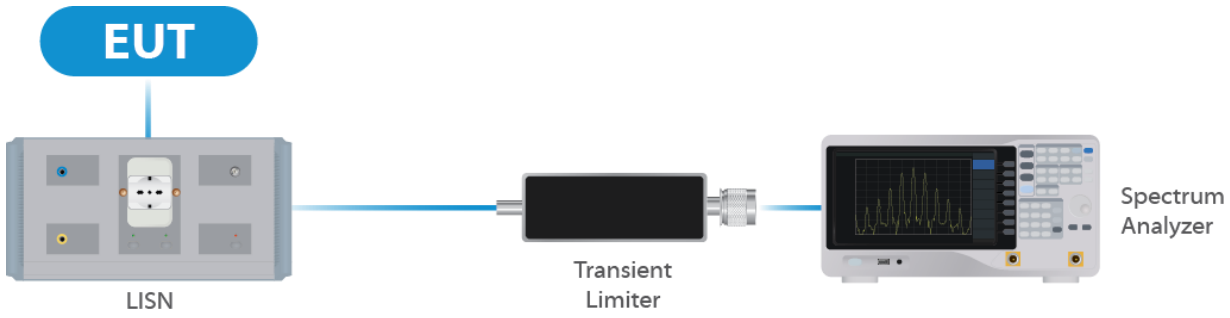


Figure 1: Conducted Emissions Test

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	10/23/2021
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

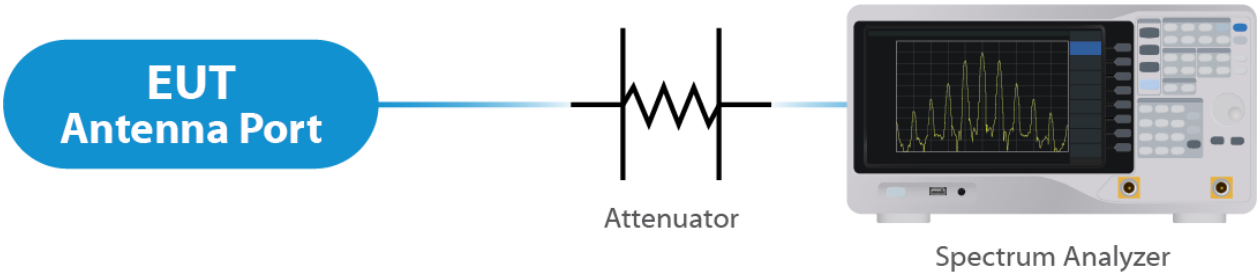


Figure 2: Direct Connect at the Antenna Port Test

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	6/21/2021	6/21/2022
Pre-Amplifier 9 kHz – 1 GHz	Sonoma Instruments	310N	UCL-2889	9/10/2020	9/10/2021
Broadband Antenna	Scwarzbeck	VULB 9163	UCL-3062	8/28/2020	8/27/2022
Broadband Antenna	Scwarzbeck	VULB 9163	UCL-3071	5/19/2020	5/19/2022
Double Ridge Horn Antenna	Scwarzbeck	BBHA 9120D	UCL-3065	7/8/2021	7/8/2022
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

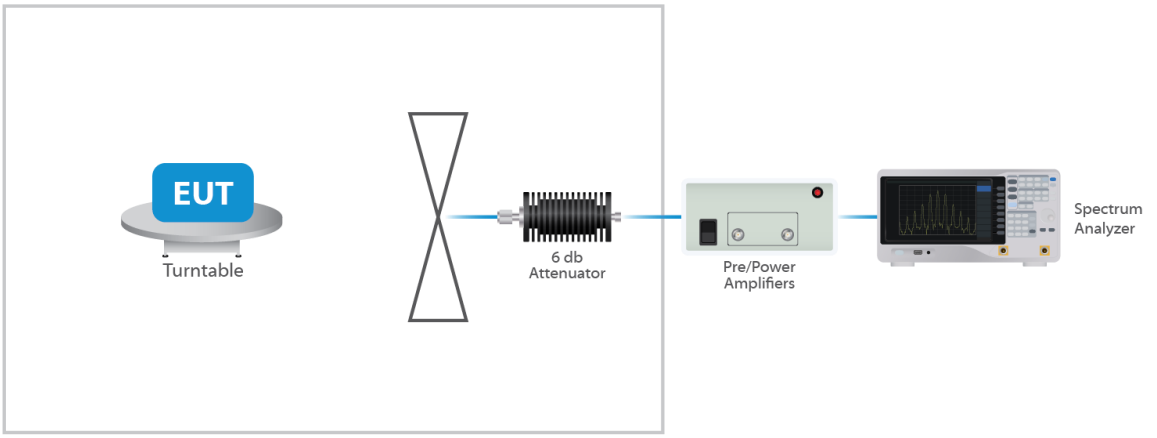


Figure 3: Radiated Emissions Test

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 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 (± 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

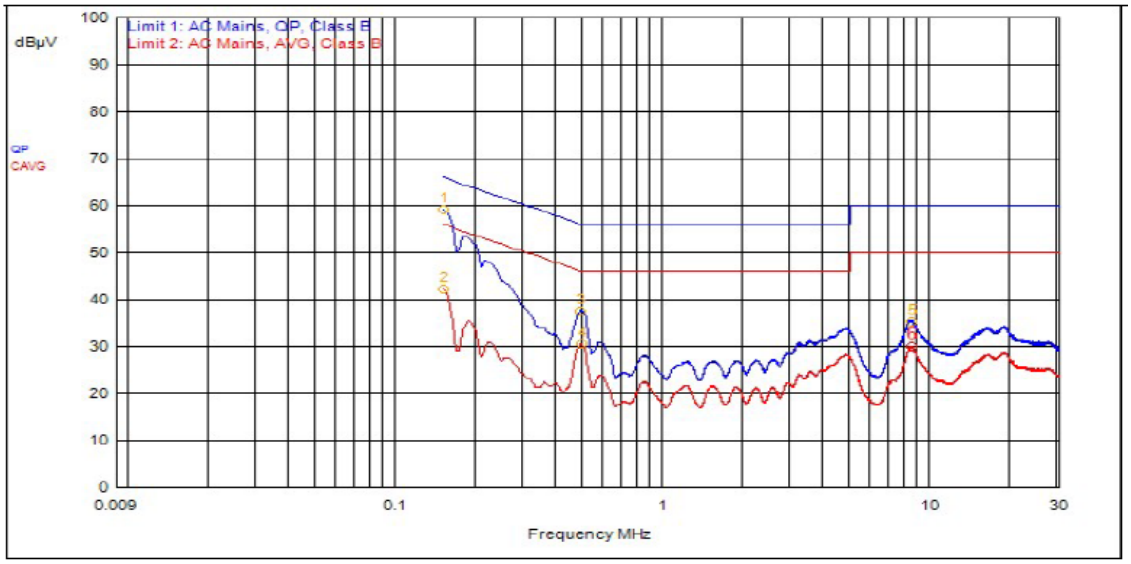
The EUT uses an integral antenna. The Maximum gain of the antenna is 2 dBi. The antenna is not user replaceable.

Results

The EUT complied with the specification

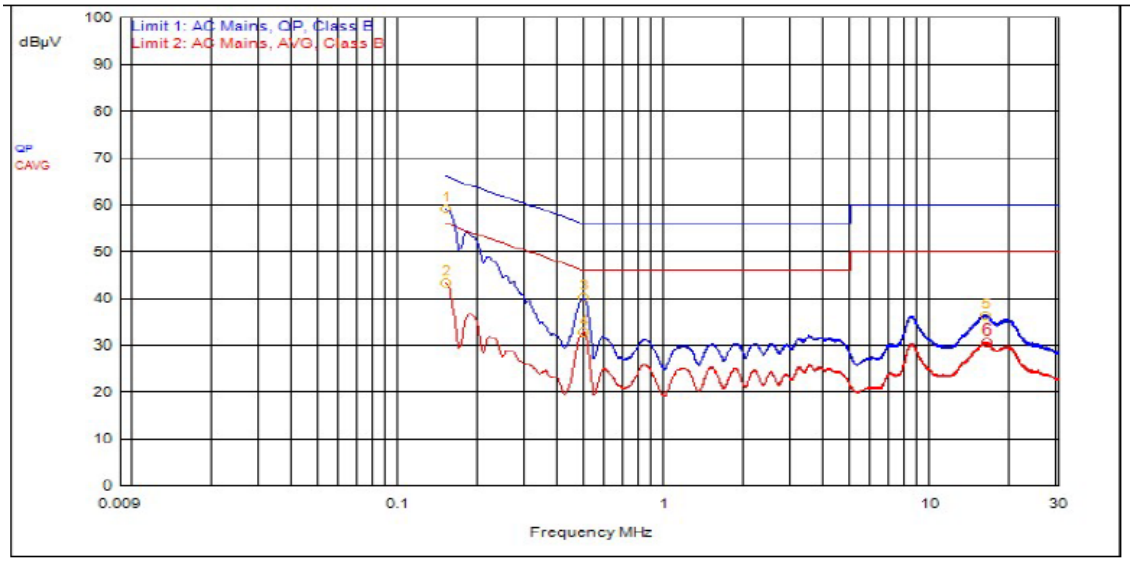
5.2 Conducted Emissions at Mains Ports Data

5.2.1 Line



ID	Frequency	Probe	Cable	Atten.	Detector	Meter Read	Meas Level	Limit 1	Limit 1 Dist.	Limit 2	Limit 2 Dist.
1	150,000kHz	12.4	0.0		QPeak	46.7	59.1	66.0	-6.9		
3	483,000kHz	12.4	0.0		QPeak	25.2	37.6	56.3	-18.7		
5	8.373MHz	12.3	0.2		QPeak	22.8	35.3	60.0	-24.7		
2	150,000kHz	12.4	0.0		C_AVG	29.7	42.1			56.0	-13.9
4	492,000kHz	12.4	0.0		C_AVG	18.1	30.5			46.1	-15.6
6	8.436MHz	12.3	0.2		C_AVG	17.4	29.9			50.0	-20.1

5.2.2 Neutral



ID	Frequency	Probe	Cable	Atten.	Detector	Meter Read	Meas Level	Limit 1	Limit 1 Dist.	Limit 2	Limit 2 Dist.
1	150,000kHz	12.4	0.0		QPeak	46.8	59.2	66.0	-6.8		
3	489,000kHz	12.4	0.0		QPeak	27.7	40.2	56.2	-16.0		
5	15.858MHz	12.4	0.2		QPeak	23.7	36.4	60.0	-23.6		
2	150,000kHz	12.4	0.0		C_AVG	30.8	43.2			56.0	-12.8
4	492,000kHz	12.4	0.0		C_AVG	20.5	32.9			46.1	-13.2
6	16.020MHz	12.4	0.2		C_AVG	18.0	30.6			50.0	-19.4

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	0.733	1.03
2442	0.733	1.03
2480	0.693	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 12.6 dBm or 18.20 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	12.6	18.20
2442	12.5	17.78
2480	12.5	17.78

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 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

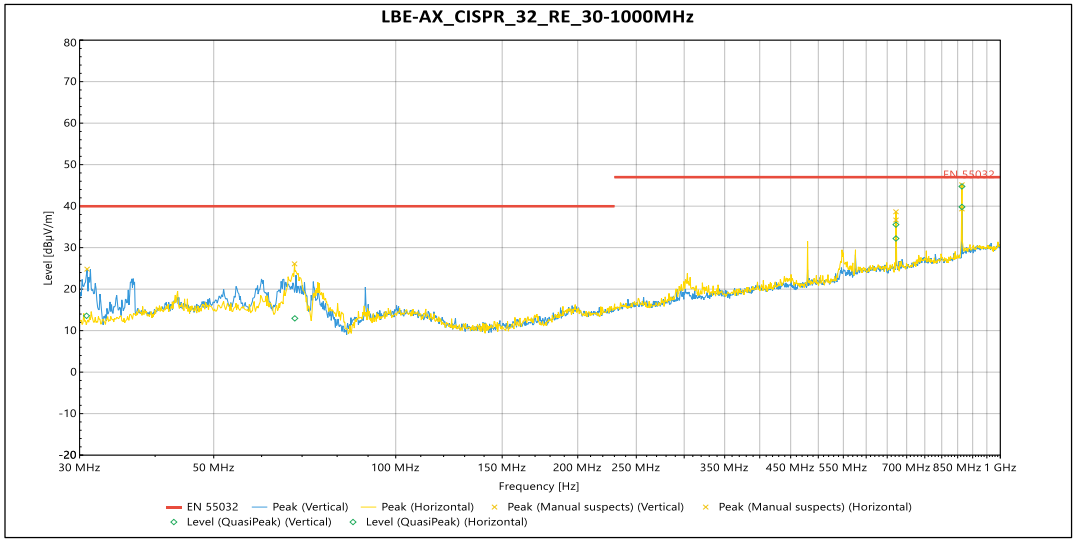
Conducted spurious emissions were attenuated 30 dB or more below the fundamental; therefore, the EUT complies with the specification.

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

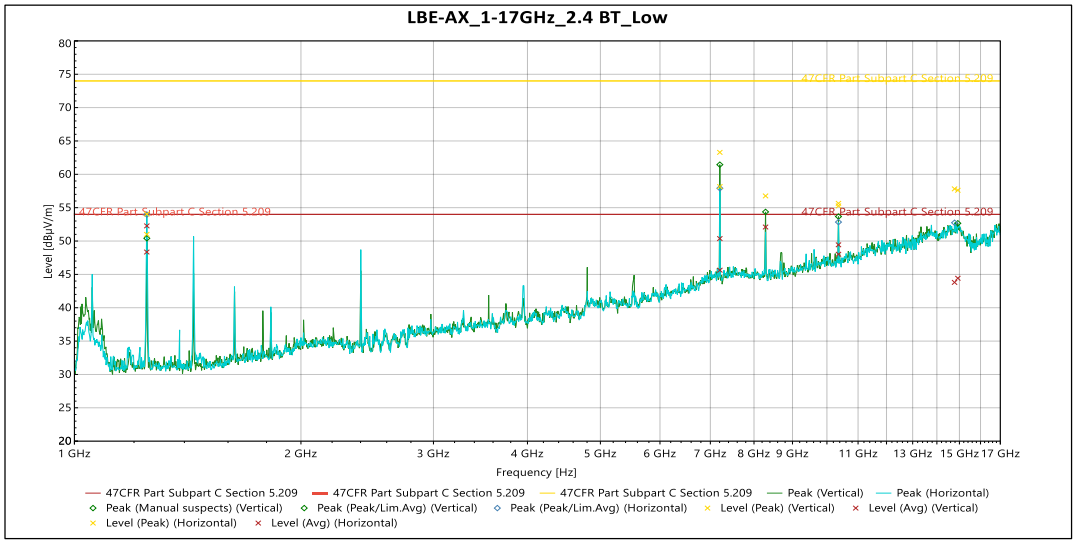
All emissions in the restricted bands of §15.205 met the limits specified in §15.209; therefore, the EUT complies with the specification.



QuasiPeak

Source	Frequency	Level (dBµV/m)	Limit (dBµV/m)	Margin	Azimuth (°)	Height	Pol.	Correction (dB)
QuasiPeak	30.806 MHz	13.565	40	-26.435	224	2.59	Vertical	-15.5
QuasiPeak	672 MHz	32.198	47	-14.802	177	2.234	Vertical	-4.703
QuasiPeak	863.99 MHz	39.808	47	-7.192	334	2.628	Vertical	-1.466
QuasiPeak	68.093 MHz	12.963	40	-27.037	148	2.923	Horizontal	-15.671
QuasiPeak	671.94 MHz	35.553	47	-11.447	16	3.804	Horizontal	-4.704
QuasiPeak	863.99 MHz	44.752	47	-2.248	358	1.246	Horizontal	-1.466

Table 4: Radiated Emissions 30 – 1000 MHz



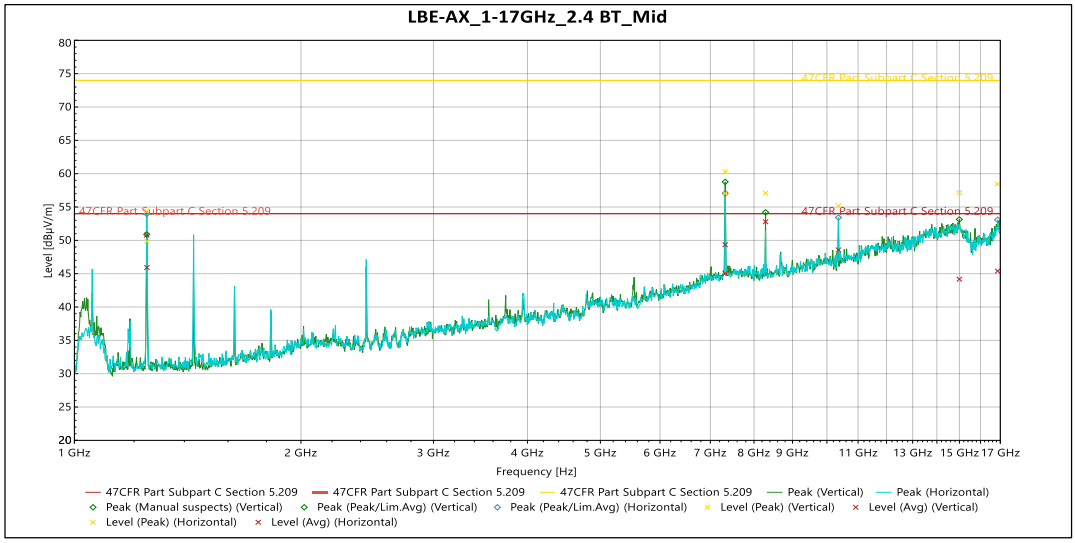
Peak

Source	Frequency	Level (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Azimuth (°)	Height (m)	Pol.	Correction (dB)
Peak	1.2478 GHz	51	74	-23	18	1.5	Vertical	-11.564
Peak	7.2061 GHz	63.285	74	-10.715	106	1.647	Vertical	7.128
Peak	8.288 GHz	56.763	74	-17.237	108	1.643	Vertical	8.102
Peak	10.36 GHz	55.274	74	-18.726	108	1.828	Vertical	9.932
Peak	14.928 GHz	57.605	74	-16.395	182	3.083	Vertical	15.131
Peak	1.248 GHz	54.04	74	-19.96	140	1.5	Horizontal	-11.561
Peak	7.2068 GHz	58.164	74	-15.836	31	2.363	Horizontal	7.127
Peak	10.36 GHz	55.653	74	-18.347	325	1.647	Horizontal	9.932
Peak	14.778 GHz	57.825	74	-16.175	87	2.544	Horizontal	14.408

Avg

Source	Frequency	Level (dBµV/m)	Limit (dBµV/m) (dBµV/m)	Margin (dB)	Azimuth (°)	Height (m)	Pol.	Correction (dB)
Avg	1.2478 GHz	48.355	54	-5.645	18	1.5	Vertical	-11.564
Avg	7.2061 GHz	50.372	54	-3.628	106	1.647	Vertical	7.128
Avg	8.288 GHz	52.104	54	-1.896	108	1.643	Vertical	8.102
Avg	10.36 GHz	48.019	54	-5.981	108	1.828	Vertical	9.932
Avg	14.928 GHz	44.422	54	-9.578	182	3.083	Vertical	15.131
Avg	1.248 GHz	52.272	54	-1.728	140	1.5	Horizontal	-11.561
Avg	7.2068 GHz	45.629	54	-8.371	31	2.363	Horizontal	7.127
Avg	10.36 GHz	49.43	54	-4.57	325	1.647	Horizontal	9.932
Avg	14.778 GHz	43.798	54	-10.202	87	2.544	Horizontal	14.408

Table 5: Transmitting at the Lowest Frequency 1 – 17 GHz



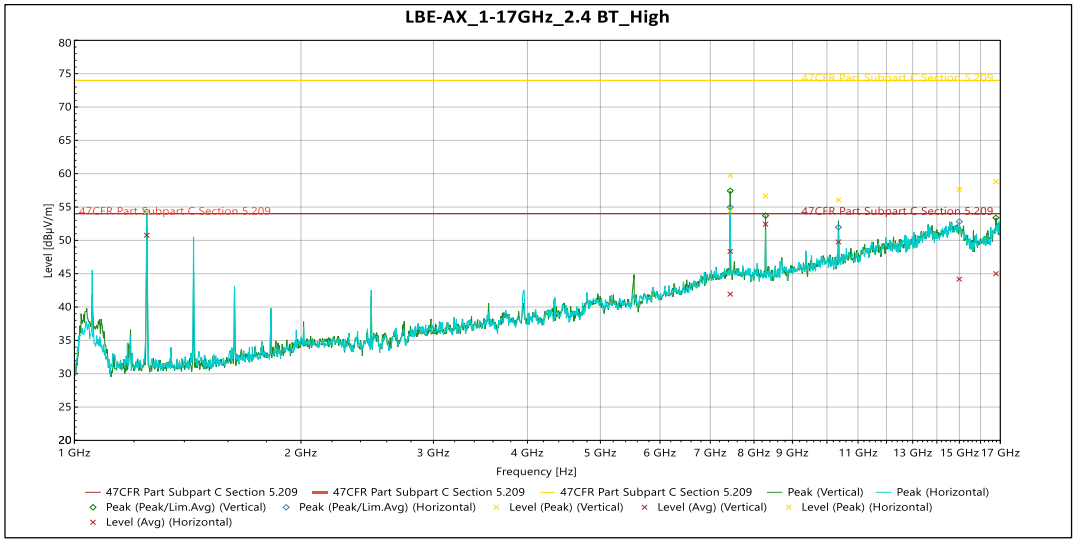
Peak

Source	Frequency	Level (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Azimuth (°)	Height (m)	Pol.	Correction (dB)
Peak	1.2483 GHz	49.857	74	-24.143	2	2.208	Vertical	-11.556
Peak	7.3253 GHz	60.294	74	-13.706	125	2.362	Vertical	7.568
Peak	8.2879 GHz	57.104	74	-16.896	97	2.014	Vertical	8.102
Peak	14.997 GHz	57.173	74	-16.827	355	1.643	Vertical	14.824
Peak	1.2477 GHz	54.375	74	-19.625	139	1.5	Horizontal	-11.565
Peak	7.3266 GHz	57.058	74	-16.942	254	3.458	Horizontal	7.569
Peak	10.36 GHz	55.195	74	-18.805	7	3.267	Horizontal	9.932
Peak	16.857 GHz	58.438	74	-15.562	338	2.919	Horizontal	17.028

Avg

Source	Frequency	Level (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Azimuth (°)	Height (m)	Pol.	Correction (dB)
Avg	1.2483 GHz	45.924	54	-8.076	2	2.208	Vertical	-11.556
Avg	7.3253 GHz	49.341	54	-4.659	125	2.362	Vertical	7.568
Avg	8.2879 GHz	52.792	54	-1.208	97	2.014	Vertical	8.102
Avg	14.997 GHz	44.176	54	-9.824	355	1.643	Vertical	14.824
Avg	1.2477 GHz	50.789	54	-3.211	139	1.5	Horizontal	-11.565
Avg	7.3266 GHz	45.035	54	-8.965	254	3.458	Horizontal	7.569
Avg	10.36 GHz	48.571	54	-5.429	7	3.267	Horizontal	9.932
Avg	16.857 GHz	45.391	54	-8.609	338	2.919	Horizontal	17.028

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



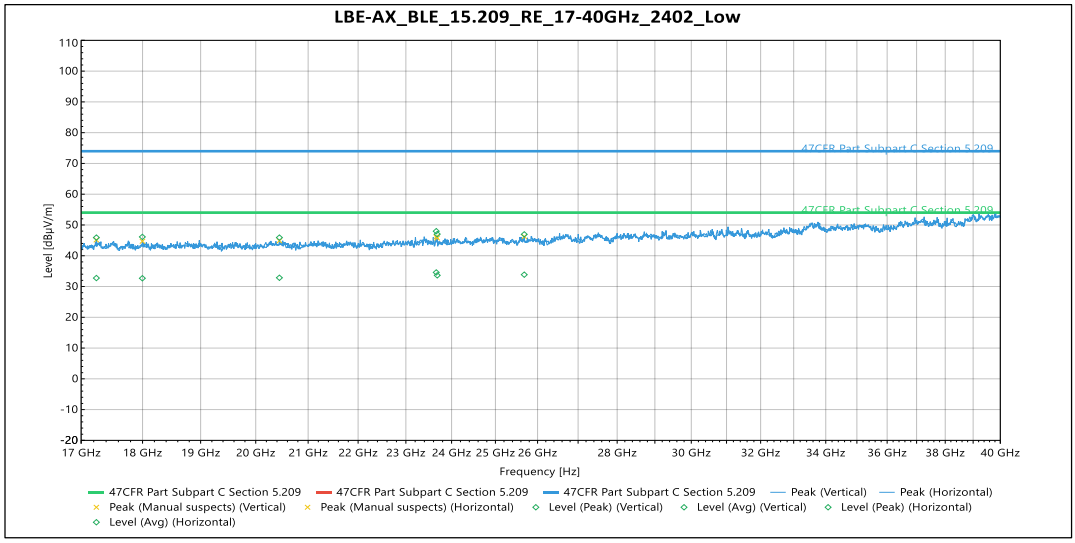
Peak

Source	Frequency	Level (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Azimuth (°)	Height (m)	Pol.	Correction (dB)
Peak	7.4398 GHz	59.758	74	-14.242	138	1.851	Vertical	7.699
Peak	8.288 GHz	56.678	74	-17.322	104	2.009	Vertical	8.102
Peak	16.772 GHz	58.817	74	-15.183	323	2.005	Vertical	16.649
Peak	1.2477 GHz	54.335	74	-19.665	140	1.5	Horizontal	-11.565
Peak	7.4393 GHz	54.413	74	-19.587	131	2.362	Horizontal	7.703
Peak	10.36 GHz	56.063	74	-17.937	321	2.195	Horizontal	9.932
Peak	14.994 GHz	57.643	74	-16.357	180	2.915	Horizontal	14.866

Avg

Source	Frequency	Level (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Azimuth (°)	Height (m)	Pol.	Correction (dB)
Avg	7.4398 GHz	48.343	54	-5.657	138	1.851	Vertical	7.699
Avg	8.288 GHz	52.425	54	-1.575	104	2.009	Vertical	8.102
Avg	16.772 GHz	45.013	54	-8.987	323	2.005	Vertical	16.649
Avg	1.2477 GHz	50.765	54	-3.235	140	1.5	Horizontal	-11.565
Avg	7.4393 GHz	41.932	54	-12.068	131	2.362	Horizontal	7.703
Avg	10.36 GHz	49.756	54	-4.244	321	2.195	Horizontal	9.932
Avg	14.994 GHz	44.193	54	-9.807	180	2.915	Horizontal	14.866

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



Peak

Source	Frequency	Level (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Azimuth (°)	Pol.	Correction (dB)
Peak	17.997 GHz	46.119	74	-27.881	227	Vertical	-6.245
Peak	20.446 GHz	45.895	74	-28.105	183	Vertical	-5.498
Peak	23.682 GHz	47.026	74	-26.974	237	Vertical	-5.161
Peak	17.243 GHz	45.901	74	-28.099	326	Horizontal	-5.642
Peak	23.66 GHz	47.978	74	-26.022	304	Horizontal	-4.385
Peak	25.68 GHz	46.949	74	-27.051	212	Horizontal	-5.911

Avg

Source	Frequency	Level (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Azimuth (°)	Pol.	Correction (dB)
Avg	17.997 GHz	32.683	54	-21.317	227	Vertical	-6.245
Avg	20.446 GHz	32.838	54	-21.162	183	Vertical	-5.498
Avg	23.682 GHz	33.632	54	-20.368	237	Vertical	-5.161
Avg	17.243 GHz	32.754	54	-21.246	326	Horizontal	-5.642
Avg	23.66 GHz	34.581	54	-19.419	304	Horizontal	-4.385
Avg	25.68 GHz	33.849	54	-20.151	212	Horizontal	-5.911

Table 8: Transmitting at the Lowest Frequency 17 – 40 GHz (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	0.3	8.0
2442	0.11	8.0
2480	0.55	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 --