

Kibeam Learning, Inc.

# TEST REPORT

**SCOPE OF WORK**

FCC TESTING-KW1

**REPORT NUMBER**

SZHH01864819-001S1

**ISSUE DATE**

Aug 13, 2024

**[REVISED DATE]**

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# Kibeam Learning, Inc.

Application  
For  
Class II Change

**FCC ID: 2A3DM-ESPS3WROOM1**

**Kibeam Wand Reading System**

**Model: KW1**

**2.4GHz Wi-Fi Transceiver**

Report No.: SZHH01864819-001S1

We hereby certify that the sample of the above item is considered to comply with the requirements of FCC Part 15, Subpart C for Intentional Radiator, mention 47 CFR [10-1-23]

Remark: This report bases on the previous report with Report Number: SZHH01864819-001, Dec 26, 2023.

**Prepared and Checked by:**



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**Approved by:**



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Date: Aug 13, 2024

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**MEASUREMENT/TECHNICAL REPORT**

This report concerns (check one)      Original Grant       Class II Change

Equipment Type: DTS - Part 15 Digital Transmission Systems (Wi-Fi transmitter portion)

Deferred grant requested per 47 CFR 0.457(d)(1)(ii)?      Yes       No

If yes, defer until: \_\_\_\_\_  
date

Company Name agrees to notify the Commission by: \_\_\_\_\_  
date

of the intended date of announcement of the product so that the grant can be issued on  
that date.

Transition Rules Request per 15.37?      Yes       No

If no, assumed Part 15, Subpart C for intentional radiator - the new 47 CFR [10-01-23]  
Edition] provision.

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**1.0 Summary of Test Results**

Applicant: Kibeam Learning, Inc.

Applicant Address: 1423 Broadway Ste 199 Oakland, California United States

Model: KW1

FCC ID: 2A3DM-ESPS3WROOM1

TEST ITEM	REFERENCE	RESULTS
Max. Output power	15.247(b)(3)	Pass
Radiated Emission in Restricted Bands	15.247(d)	Pass
Antenna Requirement	15.203	Pass (See Notes)

Notes: The EUT uses an Integral Antenna which in accordance to Section 15.203 is considered sufficient to comply with the provisions of this section.

## 2.0 General Description

### 2.1 Product Description

The Equipment Under Test (EUT) is a Kibeam Wand Reading System with Wi-Fi function operating at 2412-2462MHz for 802.11b/g/n-HT20, 11 channels with 5MHz channel spacing and 2422-2452MHz for 802.11n-HT40, 7 channels with 5MHz channel spacing, and Bluetooth 5.0 (BLE single mode) function operating in 2402-2480MHz. The EUT is powered by DC 3.7V rechargeable battery. For more detailed features description, please refer to the user's manual.

Type of Modulation: BPSK, QPSK, 16QAM, 64QAM for OFDM; CCK, DQPSK, DBPSK for DSSS.

Antenna Type: Integral Antenna

Antenna Gain: 3.4dBi

Simultaneous transmissions for BT BLE and Wi-Fi 2.4GHz have been tested, but only the worst-case testing data were recorded in this report.

For electronic filing, the brief circuit description is saved with filename: descri.pdf.

### 2.2 Related Submittal(s) Grants

This is an application for certification of:

DTS- Part 15 Digital Transmission Systems (2.4GHz Wi-Fi transmitter portion).

Remaining portions are subject to the following procedures:

1. Receiver portion of Wi-Fi and Bluetooth: exempt from technical requirement of this Part.
2. The Bluetooth Function subject to FCC Part 15C report No. whit: SZHH01864819-002S1
3. Other Digital Function: Subject to FCC Part 15B SDOC.

### 2.3 Test Methodology

Radiated emission measurements were performed according to the procedures in ANSI C63.10 (2013) and KDB 558074 D01 v05r02. Radiated emission measurement was performed in semi-anechoic chamber. For radiated emission measurement, preliminary scans were performed in the semi-anechoic chamber only to determine the worst case modes. All radiated tests were performed at an antenna to EUT distance of 3 meters, unless stated otherwise in the "Justification Section" of this Application.

### 2.4 Test Facility

The Semi-anechoic chamber used to collect the radiated data is **Intertek Testing Services Shenzhen Ltd. Longhua Branch** and located at 101, 201, Building B, No. 308 Wuhe Avenue, Zhangkengjing Community, GuanHu Subdistrict, LongHua District, Shenzhen, P.R. China. This test facility and site measurement data have been fully placed on file with File Number: CN1188.

### **3.0 System Test Configuration**

#### **3.1 Justification**

For emissions testing, the equipment under test (EUT) setup to transmit continuously to simplify the measurement methodology. Care was taken to ensure proper power supply voltages during testing. During testing, all cables were manipulated to produce worst case emissions. The EUT was powered by a fully DC 3.7V rechargeable battery during the test.

On 802.11b/g/n-HT20/n-HT40 mode, only one antenna is used, and all data rate were tested and only the worst case data is shown in the report.

For maximizing emissions, the EUT was rotated through 360°, the EUT was placed on the styrene turntable with 0.8m up to 1GHz and 1.5 m above 1GHz. The antenna height and polarization are varied during the search for maximum signal level. The antenna height is varied from 1 to 4 meters. Radiated emissions are taken at three meters unless the signal level is too low for measurement at that distance. If necessary, a pre-amplifier is used and/or the test is conducted at a closer distance.

All readings are extrapolated back to the equivalent three meter reading using inverse scaling with distance. Analyzer resolution is 100 kHz or greater for frequencies below 1000 MHz. The resolution is 1 MHz or greater for frequencies above 1000 MHz. The spurious emissions more than 20 dB below the permissible value are not reported.

The EUT and transmitting antenna was centered on the turntable.

Radiated emission measurement were performed the lowest radio frequency signal generated in the device which is greater than 9 kHz to the tenth harmonic of the highest fundamental frequency or to 40 GHz, whichever is lower.

#### **3.2 EUT Exercising Software**

The EUT exercise program (provided by client) used during radiated and conducted testing was designed to exercise the various system components in a manner similar to a typical use. The worst case configuration is used in all specified testing.

The parameters of test software setting:

During the test, Channel and power controlling software provided by the applicant 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 power expected by the application and is going to be fixed on the firmware of the end product.

Test software: EspRFTestTool\_v2.8

#### **3.3 Special Accessories**

N/A.

### 3.4 Measurement Uncertainty

When determining of the test conclusion, the Measurement Uncertainty of test has been considered.

### 3.5 Equipment Modification

Any modifications installed previous to testing by Kibeam Learning, Inc. will be incorporated in each production model sold / leased in the United States.

No modifications were installed by Intertek Testing Services Shenzhen Ltd. Longhua Branch.

### 3.6 Support Equipment List and Description

Description	Manufacturer	Model No.
Earphone	EDIFIER	H180
Router(remote)	TP-Link	TL-WR842N

Applicant: Kibeam Learning, Inc.

Date of Test: Aug 2, 2024

Model: KW1

**4.0 Measurement Results****4.1 Maximum Conducted Output Power at Antenna Terminals, FCC Rules 15.247(b)(3):**

The antenna power of the EUT was connected to the input of a broadband peak RF power meter. The power meter has a video bandwidth that is greater than DTS bandwidth and utilize a fast-responding diode detector. Power was read directly at the EUT antenna terminals with cable loss added.

For antennas with gains of 6 dBi or less, maximum allowed Transmitter output is 1 watt (+30 dBm).

IEEE 802.11b (Antenna Gain = 3.4dBi) (CCK, 1Mbps)		
Frequency (MHz)	Output in dBm (Peak Reading)	Output in mWatt
Low Channel: 2412	20.1	102.3
Middle Channel: 2437	21.0	125.9
High Channel: 2462	21.2	131.8

IEEE 802.11g (Antenna Gain = 3.4dBi) (16QAM, 6Mbps)		
Frequency (MHz)	Output in dBm (Peak Reading)	Output in mWatt
Low Channel: 2412	24.3	269.2
Middle Channel: 2437	24.0	251.2
High Channel: 2462	24.2	263.0

IEEE 802.11n-HT20 (Antenna Gain = 3.4dBi) (64QAM, 6Mbps)		
Frequency (MHz)	Output in dBm (Peak Reading)	Output in mWatt
Low Channel: 2412	24.0	251.2
Middle Channel: 2437	24.1	257.0
High Channel: 2462	24.2	263.0

IEEE 802.11n-HT40 (Antenna Gain = 3.4 dBi) (64QAM, 13.5Mbps)		
Frequency (MHz)	Output in dBm (Peak Reading)	Output in mWatt
Low Channel: 2422	22.0	158.5
Middle Channel: 2437	21.5	141.3
High Channel: 2452	22.6	182.0

Cable loss: 0.5 dB    External Attenuation: 0 dB

Cable loss, external attenuation has been included in OFFSET function

EUT max. output level = 24.2dBm

EUT max. E.I.R.P = 24.2dBm + 3.4dBi = 27.6dBm = 575.4mW

Applicant: Kibeam Learning, Inc.

Date of Test: Aug 2, 2024

Model: KW1

#### 4.2 Field Strength Calculation

The field strength is calculated by adding the reading on the Spectrum Analyzer to the factors associated with preamplifiers (if any), antennas, cables, pulse desensitization and average factors (when specified limit is in average and measurements are made with peak detectors). A sample calculation is included below.

$$FS = RA + AF + CF - AG + PD$$

Where

FS = Field Strength in  $\text{dB}\mu\text{V}/\text{m}$ RA = Receiver Amplitude (including preamplifier) in  $\text{dB}\mu\text{V}$ 

CF = Cable Attenuation Factor in dB

AF = Antenna Factor in  $\text{dB}/\text{m}$ 

AG = Amplifier Gain in dB

PD = Pulse Desensitization in dB

In the radiated emission table which follows, the reading shown on the data table may reflect the preamplifier gain. An example of the calculations, where the reading does not reflect the preamplifier gain, follows:

$$FS = RA + AF + CF - AG + PD$$

**Example**

Assume a receiver reading of 62.0  $\text{dB}\mu\text{V}$  is obtained. The antenna factor of 7.4  $\text{dB}/\text{m}$  and cable factor of 1.6 dB is added. The amplifier gain of 29 dB is subtracted. The pulse desensitization factor of the spectrum analyzer was 0 dB. The net field strength for comparison to the appropriate emission limit is 42  $\text{dB}\mu\text{V}/\text{m}$ . This value in  $\text{dB}\mu\text{V}/\text{m}$  was converted to its corresponding level in  $\mu\text{V}/\text{m}$ .

$$RA = 62.0 \text{ dB}\mu\text{V}$$

$$AF = 7.4 \text{ dB}/\text{m}$$

$$CF = 1.6 \text{ dB}$$

$$AG = 29.0 \text{ dB}$$

$$PD = 0 \text{ dB}$$

$$FS = 62 + 7.4 + 1.6 - 29 + 0 = 42 \text{ dB}\mu\text{V}/\text{m}$$

$$\text{Level in mV/m} = \text{Common Antilogarithm} [(42 \text{ dB}\mu\text{V}/\text{m})/20] = 125.9 \mu\text{V}/\text{m}$$

Applicant: Kibeam Learning, Inc.

Date of Test: Aug 2, 2024

Model: KW1

### 4.3 Radiated Spurious Emission

Worst Case Radiated Spurious Emission  
at 2390.000MHz  
is passed by 0.9dB margin.

For the electronic filing, the worst case radiated emission configuration photographs are saved with filename: radiated photos.pdf.

Applicant: Kibeam Learning, Inc.

Date of Test: Aug 2, 2024

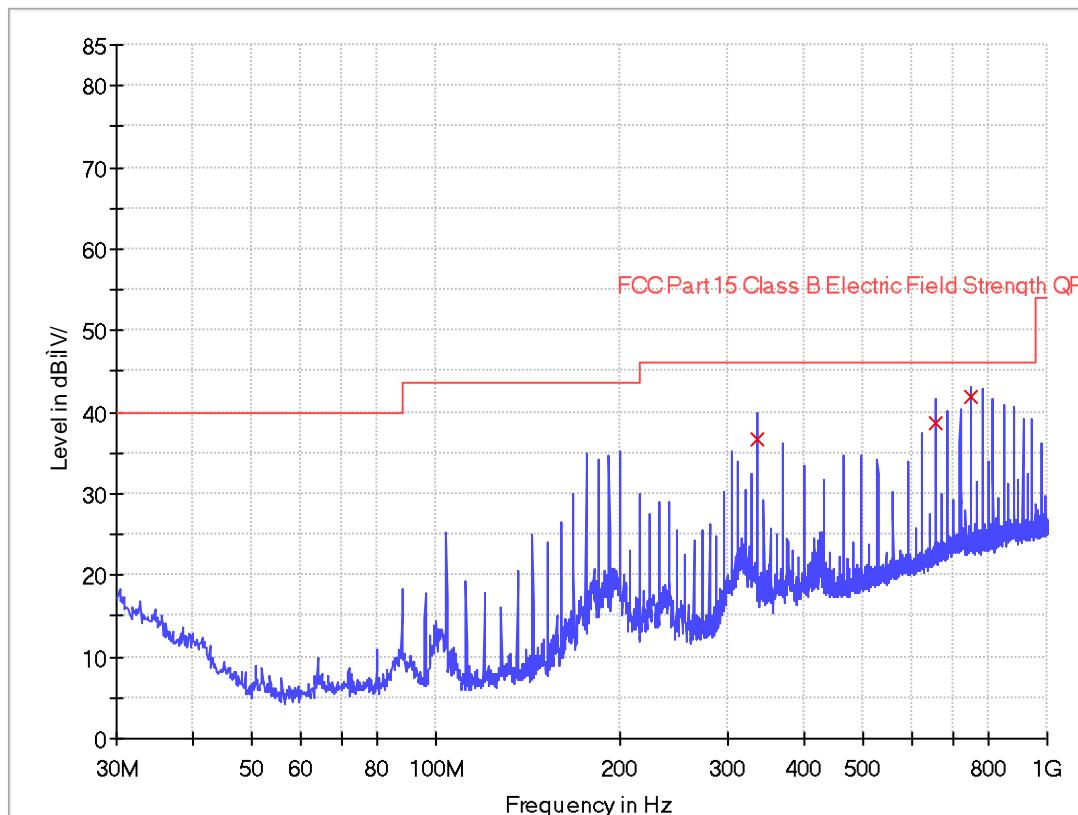
Worst Case Operating Mode:

Model: KW1

Simultaneous transmission

ANT Polarity: Horizontal

FCC Part 15



Frequency (MHz)	Quasi Peak (dBμV/m)	Meas. Time (ms)	Bandwidth (kHz)	Polarization	Corr. (dB/m)	Margin - QPK (dB)	Limit - QPK (dBμV/m)
335.913750	36.8	1000.0	120.000	H	16.1	9.2	46.0
656.013750	38.6	1000.0	120.000	H	23.1	7.4	46.0
752.002350	41.9	1000.0	120.000	H	24.2	4.1	46.0

## Remark:

1. Corr. (dB/m) = Antenna Factor (dB/m) + Cable Loss (dB)
2. Quasi Peak (dBμV/m) = Corr. (dB/m) + Read Level (dBμV)
3. Margin (dB) = Limit Line (dBμV/m) – Level (dBμV/m)

Applicant: Kibeam Learning, Inc.

Date of Test: Aug 2, 2024

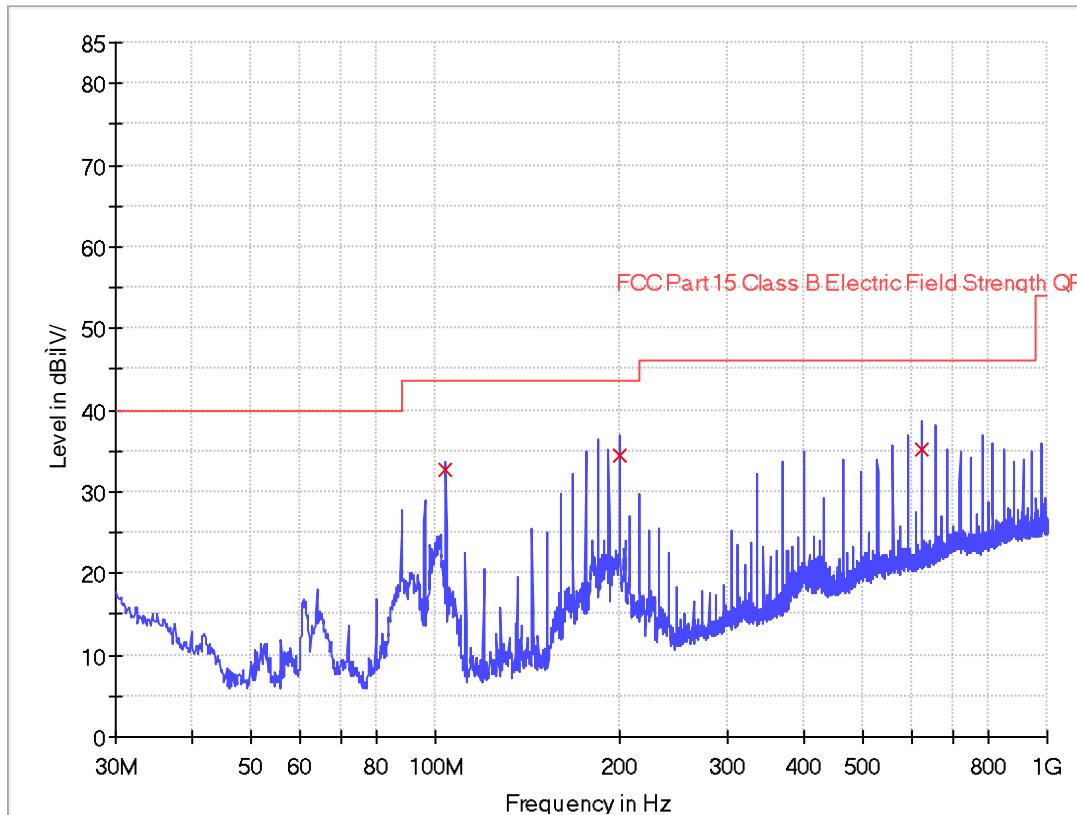
Worst Case Operating Mode:

Model: KW1

Simultaneous transmission

ANT Polarity: Vertical

### FCC Part 15



Frequency (MHz)	Quasi Peak (dB $\mu$ V/m)	Meas. Time (ms)	Bandwidth (kHz)	Polarization	Corr. (dB/m)	Margin - QPK (dB)	Limit - QPK (dB $\mu$ V/m)
103.962500	32.7	1000.0	120.000	V	8.9	10.8	43.5
199.992500	34.5	1000.0	120.000	V	11.4	9.0	43.5
624.003750	35.2	1000.0	120.000	V	22.4	10.8	46.0

#### Remark:

1. Corr. (dB/m) = Antenna Factor (dB/m) + Cable Loss (dB)
2. Quasi Peak (dB $\mu$ V/m) = Corr. (dB/m) + Read Level (dB $\mu$ V)
3. Margin (dB) = Limit Line (dB $\mu$ V/m) – Level (dB $\mu$ V/m)

Applicant: Kibeam Learning, Inc.

Date of Test: Aug 2, 2024

Worst Case Operating Mode:

Model: KW1

Transmitting (802.11g-Channel 01)

**Radiated Emissions (above 1GHz)**

Polarization	Frequency (MHz)	Reading (dB $\mu$ V)	Pre-Amp Gain (dB)	Antenna Factor (dB/m)	Net at 3m (dB $\mu$ V/m)	Peak Limit at 3m (dB $\mu$ V/m)	Margin (dB)
Horizontal	*4824.000	52.2	36.8	33.5	48.9	74.0	-25.1
Horizontal	*2390.000	80.4	36.4	29.1	73.1	74.0	-0.9

Polarization	Frequency (MHz)	Reading (dB $\mu$ V)	Pre-Amp Gain (dB)	Antenna Factor (dB/m)	Net at 3m (dB $\mu$ V/m)	Average Limit at 3m (dB $\mu$ V/m)	Margin (dB)
Horizontal	*4824.000	43.5	36.8	33.5	40.2	54.0	-13.8
Horizontal	*2390.000	58.8	36.4	29.1	51.5	54.0	-2.5

## NOTES:

1. Peak detector is used, RBW=1MHz/VBW=3MHz for peak value and RBW=1MHz/VBW=10Hz for average value.
2. All measurements were made at 3 meters. Radiated emissions not detected at the 3-meter distance were measured at 0.3-meter and an inverse proportional extrapolation was performed to compare the signal level to the 3-meter limit. No other radiated emissions than those reported were detected at a test distance of 0.3-meter.
3. Negative value in the margin column shows emission below limit.
4. Horn antenna used for the emission over 1000MHz.

\* Emission within the restricted band meets the requirement of section 15.205. The corresponding limit as per 15.209 is based on Quasi peak limit for frequencies below 1000 MHz and average limit for frequencies over 1000 MHz. The radio frequency emissions above 1GHz also meet corresponding 20dB permitted peak limit with a peak detector function.

Applicant: Kibeam Learning, Inc.

Date of Test: Aug 2, 2024

Worst Case Operating Mode:

Model: KW1

Transmitting (802.11g-Channel 06)

**Radiated Emissions (above 1GHz)**

Polarization	Frequency (MHz)	Reading (dB $\mu$ V)	Pre-Amp Gain (dB)	Antenna Factor (dB/m)	Net at 3m (dB $\mu$ V/m)	Peak Limit at 3m (dB $\mu$ V/m)	Margin (dB)
Horizontal	*4874.000	52.5	36.7	33.4	49.2	74.0	-24.8
Horizontal	*7311.000	50.9	36.6	35.8	50.1	74.0	-23.9

Polarization	Frequency (MHz)	Reading (dB $\mu$ V)	Pre-Amp Gain (dB)	Antenna Factor (dB/m)	Net at 3m (dB $\mu$ V/m)	Average Limit at 3m (dB $\mu$ V/m)	Margin (dB)
Horizontal	*4874.000	42.8	36.7	33.4	39.5	54.0	-14.5
Horizontal	*7311.000	40.2	36.6	35.8	39.4	54.0	-14.6

## NOTES:

1. Peak detector is used, RBW=1MHz/VBW=3MHz for peak value and RBW=1MHz / VBW=10Hz for average value.
2. All measurements were made at 3 meters. Radiated emissions not detected at the 3-meter distance were measured at 0.3-meter and an inverse proportional extrapolation was performed to compare the signal level to the 3-meter limit. No other radiated emissions than those reported were detected at a test distance of 0.3-meter.
3. Negative value in the margin column shows emission below limit.
4. Horn antenna used for the emission over 1000MHz.

\* Emission within the restricted band meets the requirement of section 15.205. The corresponding limit as per 15.209 is based on Quasi peak limit for frequencies below 1000 MHz and average limit for frequencies over 1000 MHz. The radio frequency emissions above 1GHz also meet corresponding 20dB permitted peak limit with a peak detector function.

Applicant: Kibeam Learning, Inc.

Date of Test: Aug 2, 2024

Worst Case Operating Mode:

Model: KW1

Transmitting (802.11g-Channel 11)

**Radiated Emissions (above 1GHz)**

Polarization	Frequency (MHz)	Reading (dB $\mu$ V)	Pre-Amp Gain (dB)	Antenna Factor (dB/m)	Net at 3m (dB $\mu$ V/m)	Peak Limit at 3m (dB $\mu$ V/m)	Margin (dB)
Horizontal	*4924.000	52.0	36.8	33.3	48.5	74.0	-25.5
Horizontal	*2483.500	69.1	36.5	29.3	61.9	74.0	-12.1

Polarization	Frequency (MHz)	Reading (dB $\mu$ V)	Pre-Amp Gain (dB)	Antenna Factor (dB/m)	Net at 3m (dB $\mu$ V/m)	Average Limit at 3m (dB $\mu$ V/m)	Margin (dB)
Horizontal	*4924.000	43.7	36.8	33.3	40.2	54.0	-13.8
Horizontal	*2483.500	53.1	36.5	29.3	45.9	54.0	-8.1

## NOTES:

1. Peak detector is used, RBW=1MHz/VBW=3MHz for peak value and RBW=1MHz / VBW=10Hz for average value.
2. All measurements were made at 3 meters. Radiated emissions not detected at the 3-meter distance were measured at 0.3-meter and an inverse proportional extrapolation was performed to compare the signal level to the 3-meter limit. No other radiated emissions than those reported were detected at a test distance of 0.3-meter.
3. Negative value in the margin column shows emission below limit.
4. Horn antenna used for the emission over 1000MHz.

\* Emission within the restricted band meets the requirement of section 15.205. The corresponding limit as per 15.209 is based on Quasi peak limit for frequencies below 1000 MHz and average limit for frequencies over 1000 MHz. The radio frequency emissions above 1GHz also meet corresponding 20dB permitted peak limit with a peak detector function.

## **5.0 Equipment Photographs**

For electronic filing, the photographs are saved with filename: external photos.pdf & internal photos.pdf.

## **6.0 Product Labeling**

For electronic filing, the FCC ID label artwork and location is saved with filename: label.pdf.

## **7.0 Technical Specifications**

For electronic filing, the block diagram and circuit diagram are saved with filename: block.pdf and circuit.pdf respectively.

## **8.0 Instruction Manual**

For electronic filing, a preliminary copy of the Instruction Manual is saved with filename: manual.pdf.

This manual will be provided to the end-user with each unit sold/leased in the United States.

## **9.0 Confidentiality Request**

For electronic filing, the confidentiality request of the tested EUT is saved with filename: request.pdf.

## **10.0 Discussion of Pulse Desensitization**

The determination of pulse desensitivity was made in accordance with Hewlett Packard Application Note 150-2, *Spectrum Analysis ... Pulsed RF*.

Pulse desensitivity is not applicable for this device since the transmitter transmits the RF signal continuously.

**11.0 Test Equipment List**

Equipment No.	Equipment	Manufacturer	Model No.	Serial No.	Cal. Date	Due Date
SZ182-02	RF Power Meter	Anritsu	ML2496A	1302005	2024-04-22	2025-04-22
SZ182-02-01	Power Sensor	Anritsu	MA2411B	1207429	2024-04-22	2025-04-22
SZ061-13	BiConiLog Antenna	ETS	3142E	00217919	2021-09-05	2024-09-05
SZ185-02	EMI Receiver	R&S	ESCI	100692	2024-07-09	2025-07-09
SZ061-08	Horn Antenna	ETS	3115	00092346	2021-09-05	2024-09-05
SZ061-06	Active Loop Antenna	Electro-Metrics	EM-6876	217	2024-05-05	2027-05-05
SZ056-03	Spectrum Analyzer	R&S	FSP 30	101148	2024-04-22	2025-04-22
SZ056-08	Signal Analyzer	R&S	FSV 40	101430	2023-12-13	2024-12-13
SZ181-04	Preamplifier	Agilent	8449B	3008A02474	2024-04-22	2025-04-22
SZ188-01	Anechoic Chamber	ETS	RFD-F/A-100	4102	2021-12-12	2024-12-12
SZ062-24	RF Cable	RADIALL	RG 213U	--	2023-09-26	2024-09-26
SZ062-25	RF Cable	RADIALL	0.04-26.5GHz	--	2023-09-26	2024-09-26
SZ062-38	RF Cable	RADIALL	0.04-26.5GHz	--	2023-11-14	2024-11-14
SZ067-04	Notch Filter	Micro-Tronics	BRM50702-02	--	2024-04-22	2025-04-22

\*\*\*\*\* End of Report\*\*\*\*\*