

# Seiko Epson Corporation

**TEST REPORT** 

#### **SCOPE OF WORK**

FCC TESTING-B064E-02-W7

#### **REPORT NUMBER**

240326067SZN-001

#### **ISSUE DATE**

[REVISED DATE]

31 May 2024 [-----]

#### **PAGES**

31

#### **DOCUMENT CONTROL NUMBER**

FCC ID 247\_b © 2017 INTERTEK





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Intertek Report No.: 240326067SZN-001

# **Seiko Epson Corporation**

Application For Certification

FCC ID: BKMAE-B064E02W7

REMOTE CONTROLLER

Model: B064E-02-W7

2.4GHz Transceiver

Report No.: 240326067SZN-001

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]

Prepared and Checked by:	Approved by:	
Allen Qin	Ryan Chen	_
Engineer	Project Engineer	
	Date: 31 May 2024	

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#### Intertek Testing Services Shenzhen Ltd. Longhua Branch

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# **MEASUREMENT/TECHNICAL REPORT**

This report concerns (check one)	Original Grant X Class II Change
Equipment Type: <u>DTS - Part 15 Digital T</u>	<u>ransmission Systems</u>
Deferred grant requested per 47 CFR 0	0.457(d)(1)(ii)? Yes NoX
Company Name agrees to notify the Co	If yes, defer until: date ommission by:
Company Name agrees to notify the Co	date
of the intended date of announcement that date.	nt of the product so that the grant can be issued on
Transition Rules Request per 15.37?	Yes NoX
If no, assumed Part 15, Subpart C for Edition] provision.	r intentional radiator - the new 47 CFR [10-01-23]
Report prepared by:	
	Allen Qin Intertek Testing Services Shenzhen Ltd. Longhua Branch 101, 201, Building B, No. 308 Wuhe Avenue, Zhangkengjing Community, GuanHu Subdistrict, LongHua District, Shenzhen, P.R. China. Tel: (86 755) 8601 6288 Fax: (86 755) 8601 6661

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#### 1.0 Summary of Test Results

Applicant: Seiko Epson Corporation

Applicant Address: 3-3-5 Owa Suwa-shi Nagano-Ken 392-8502, Japan

Manufacturer: Wuxi Weida Intelligent Electronics Co., Ltd.

Manufacturer Address: 3/F, Building A, Sensor High-end Manufacturing Base 789 South Lake

Avenue

Model: B064E-02-W7 FCC ID: BKMAE-B064E02W7

TEST ITEM	REFERENCE	RESULTS	
Max. Output power	15.247(b)(3) Pass		
6 dB Bandwidth	15.247(a)(2)	Pass	
Max. Power Density	15.247(e)	Pass	
Out of Band Antenna Conducted Emission	15.247(d)	Pass	
Radiated Emission in Restricted Bands	15.247(d)	Pass	
Antenna Requirement	15.203	Pass	
Antenna nequirement	15.205	(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.

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#### 2.0 General Description

#### 2.1 Product Description

The Equipment Under Test (EUT) is a REMOTE CONTROLLER with Bluetooth 5.0 BLE function operating in 2402-2480MHz. The EUT is powered by DC 3.0V from 2\*AAA battery. For more detailed features description, please refer to the user's manual.

Antenna Type: Integral antenna

Modulation Type: GFSK

Antenna Gain: 1.92dBi Max (This information is provided by manufacturer, and the

manufacturer is responsible for the authenticity of the provided information.)

Bluetooth Version: 5.0 BLE (Single Mode)

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 a transceiver for the REMOTE CONTROLLER which has Bluetooth function.

#### 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.

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#### 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 DC 3.0V from 2\*AAA battery during the test.

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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.

3.3 Special Accessories

N/A.

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#### 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 Seiko Epson Corporation 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.
N/A	N/A	N/A

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Applicant: Seiko Epson Corporation

Date of Test: 08 April 2024 Model: B064E-02-W7

#### 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).

(Antenna Gain = 1.92dBi)							
Frequency (MHz)	Output in mWatt						
Low Channel: 2402	1.35	1.36					
Middle Channel: 2440	1.18	1.31					
High Channel: 2480	1.35	1.36					

Cable loss: 0.3 dB External Attenuation: 0 dB

Cable loss, external attenuation has been included in OFFSET function

EUT max. output level = 1.35dBm

EUT max. E.I.R.P = 1.35dBm + 1.92dBi = 3.27dBm = 2.12mW

For RF Exposure, the information is saved with filename: RF exposure.pdf.

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Date of Test: 08 April 2024 Model: B064E-02-W7

#### 4.2 Minimum 6 dB RF Bandwidth, FCC Rule 15.247(a) (2):

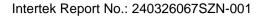
The antenna port of the EUT was connected to the input of a spectrum analyzer. Analyzer RES BW was set to 100 KHz according to FCC KDB 558074 D01 v05r02. For each RF output channel investigated, the spectrum analyzer center frequency was set to the channel carrier. A PEAK output reading was taken, a DISPLAY line was drawn 6 dB lower than PEAK level. The 6dB bandwidth was determined from where the channel output spectrum intersected the display line.

Limit: The 6 dB Bandwidth is at least 500 kHz.

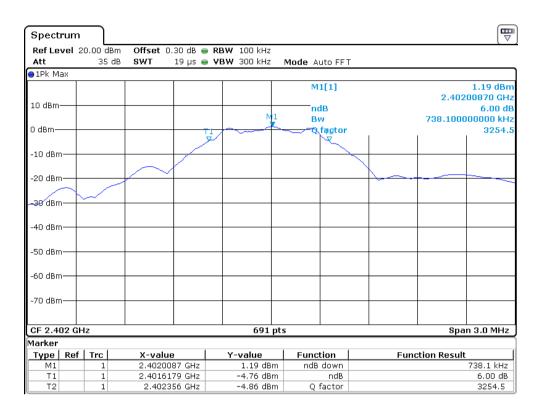
Frequency (MHz)	6 dB Bandwidth (KHz)		
2402	738.1		
2440	751.1		
2480	738.1		

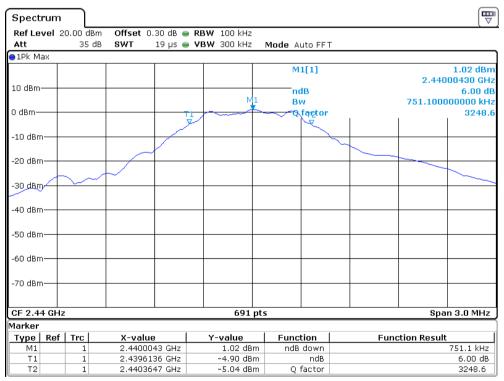
The test plots are attached as below.

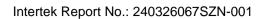
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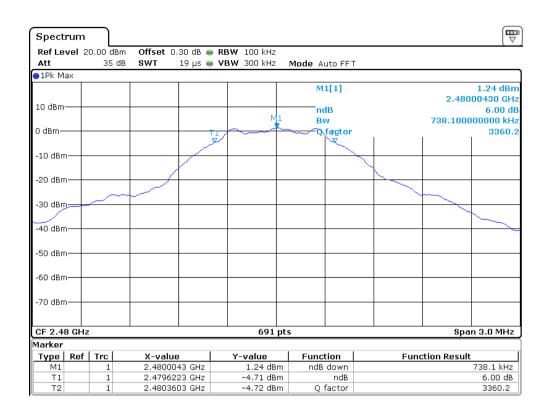














Applicant: Seiko Epson Corporation

Date of Test: 08 April 2024 Model: B064E-02-W7

#### 4.3 Maximum Power Density Reading, FCC Rule 15.247(e):

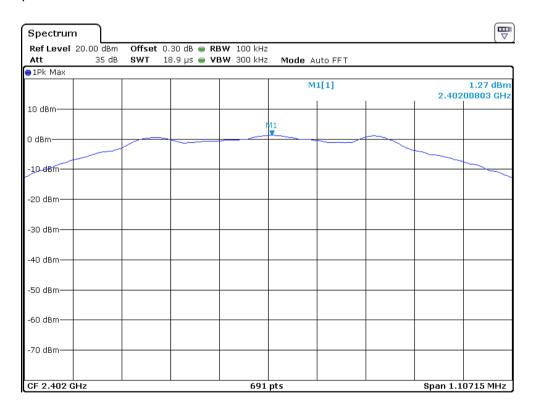
The Measurement Procedure PKPSD was set according to the FCC KDB 558074 D01 v05r02.

Antenna output of the EUT was coupled directly to spectrum analyzer; if an external attenuator and/or cable was used, these losses are compensated for with the analyzer OFFSET function.

Limit: The Power Density does not exceed 8dBm/3 kHz.

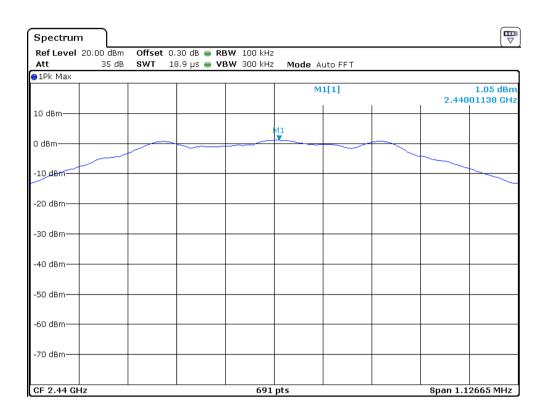
Frequency (MHz)	Power Density with RBW 100KHz
2402	1.27
2440	1.05
2480	1.27

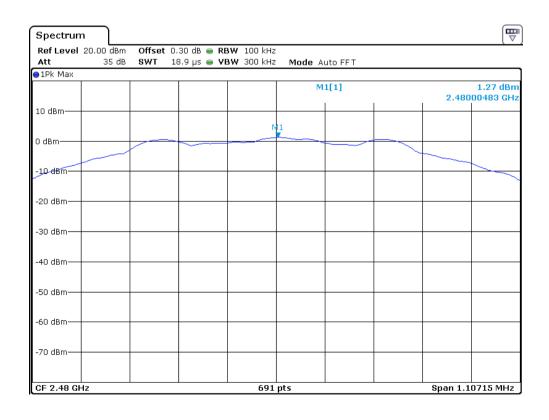
The test plots are attached as below.



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#### 4.4 Out of Band Conducted Emissions, FCC Rule 15.247(d)

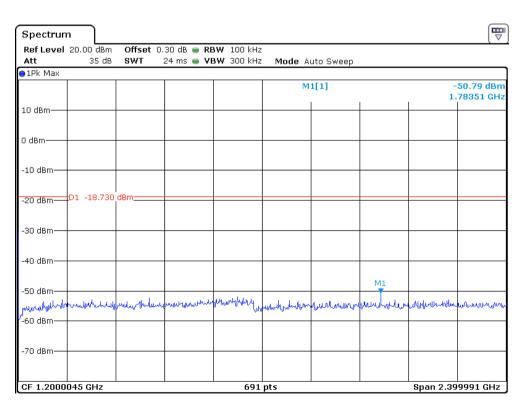
In any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20 dB below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power, based on either an RF conducted or a radiated measurement. The Measurement Procedure was set according to the FCC KDB 558074 D01 v05r02.

All other types of emissions from the EUT shall meet the general limits for radiated frequencies outside the passband.

Refer to the attached test plots for out of band conducted emissions data with rate of 1Mbps for 802.11b and 6Mbps for 802.11g and 6Mbps for 802.11n-HT20 and 13.5Mbps for 802.11n-HT40.

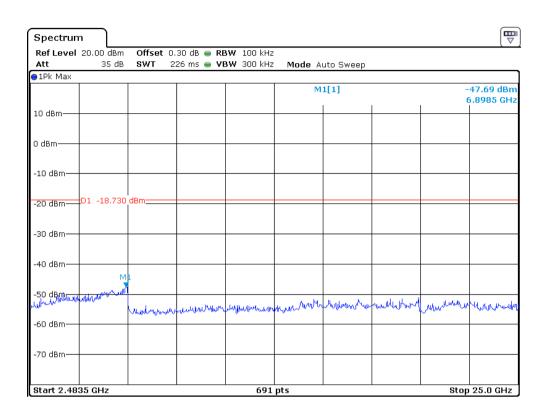
The test plots showed all spurious emission up to the tenth harmonic were measured and they were found to be at least 20 dB below the highest level of the desired power in the passband.

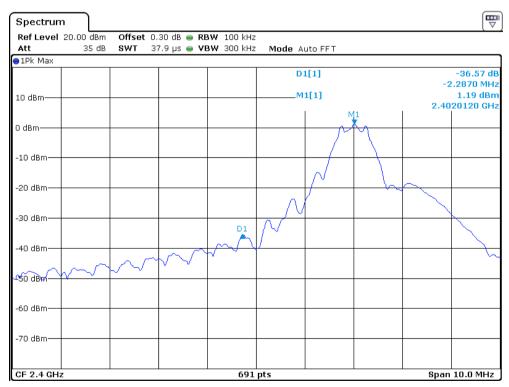
The test plots are attached as below. 2402MHz Reference Level: 1.27dBm



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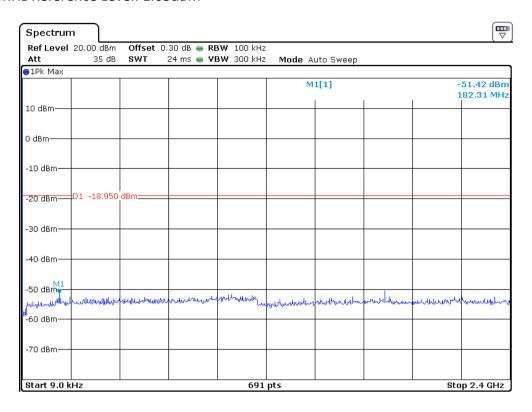


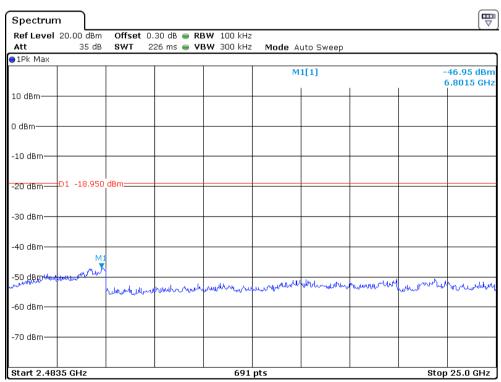






#### 2440MHz Reference Level: 1.05dBm

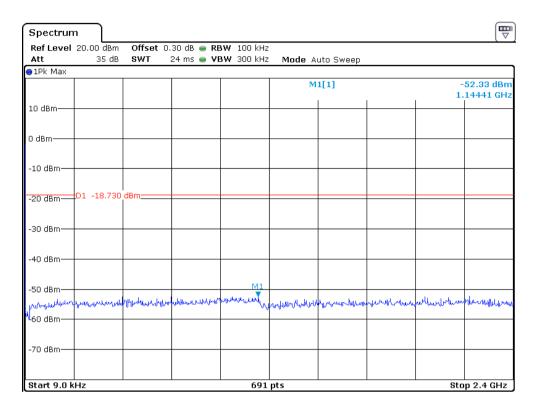


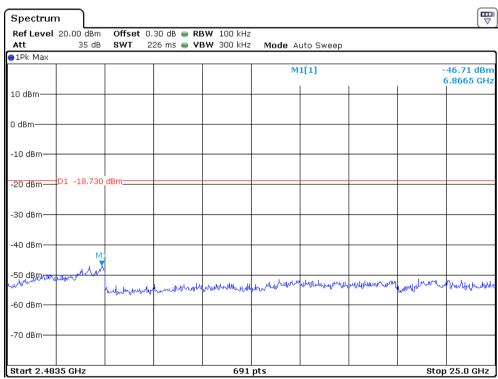


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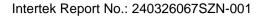


#### 2480MHz Reference Level: 1.27dBm

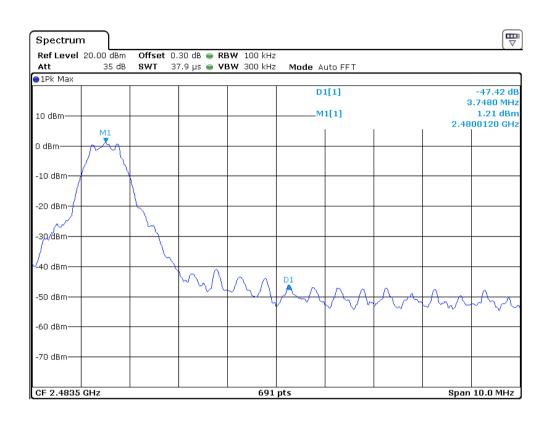




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4.5 Out of Band Radiated Emissions (for emissions in 4.4 above that are less than 20dB below carrier), FCC Rule 15.247(d):

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For out of band emissions that are close to or that exceed the 20dB attenuation requirement described in the specification, radiated measurements were performed at a 3m separation distance to determine whether these emissions complied with the general radiated emission requirement.

[×] Not required, since all emissions are more than 20dB below fundamental [ ] See attached data sheet

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#### 4.6 Transmitter Radiated Emissions in Restricted Bands, FCC Rule 15.35(b) (c):

Data is included of the worst case configuration (the configuration which resulted in the highest emission levels). A sample calculation, configuration photographs and data tables of the emissions are included. All measurements were performed with peak detection unless otherwise specified.

The data on the following pages list the significant emission frequencies, the limit and the margin of compliance.

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#### 4.7 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  $FS = Field Strength in dB\mu V/m$ 

RA = Receiver Amplitude (including preamplifier) in dBμV

CF = Cable Attenuation Factor in dB

AF = Antenna Factor in dB/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 dB $\mu$ V is obtained. The antenna factor of 7.4 dB/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 dB $\mu$ V/m. This value in dB $\mu$ V/m was converted to its corresponding level in  $\mu$ V/m.

RA =  $62.0 \text{ dB}\mu\text{V}$ AF = 7.4 dB/mCF = 1.6 dBAG = 29.0 dBPD = 0 dBFS =  $62 + 7.4 + 1.6 - 29 + 0 = 42 \text{ dB}\mu\text{V/m}$ 

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

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## 4.8 Radiated Spurious Emission

Worst Case Radiated Spurious Emission at 2390.000MHz is passed by 6.4dB margin.

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

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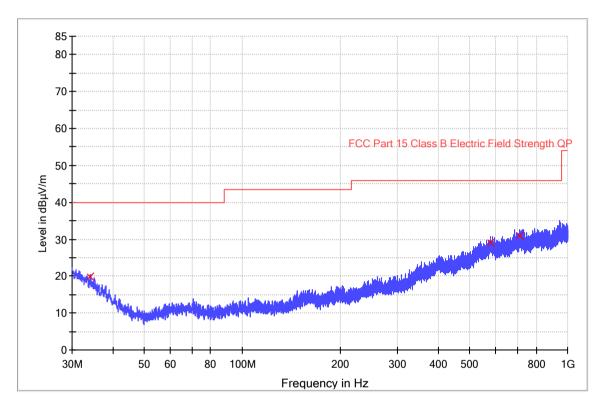
Applicant: Seiko Epson Corporation

Date of Test: 07 April 2024 Model: B064E-02-W7

Worst Case Operating Mode: BT Link

**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)
34.138667	19.7	1000.0	120.000	Н	20.3	20.3	40.0
580.442667	29.2	1000.0	120.000	Н	29.0	16.8	46.0
710.040000	31.1	1000.0	120.000	Н	30.9	14.9	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)

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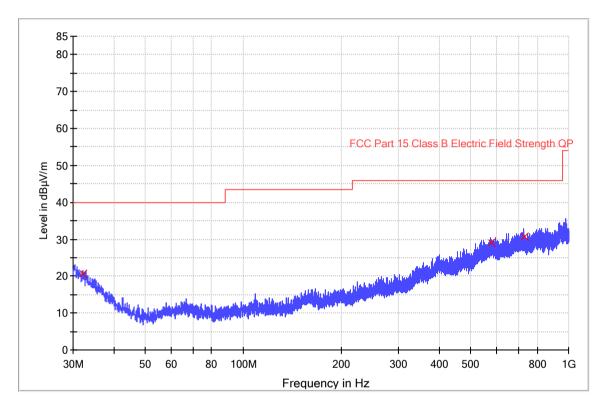
Applicant: Seiko Epson Corporation

Date of Test: 07 April 2024 Model: B064E-02-W7

Worst Case Operating Mode: BT Link

**ANT Polarity: Vertical** 

FCC Part 15



F	requency (MHz)	Quasi Peak (dBμV/m)	Meas. Time (ms)	Bandwidth (kHz)	Polarization	Corr. (dB/m)	Margin - QPK (dB)	Limit – QPK (dBµV/m)
3	2.134000	20.6	1000.0	120.000	V	21.8	19.4	40.0
57	77.759000	29.1	1000.0	120.000	V	29.0	16.9	46.0
73	31.760000	30.6	1000.0	120.000	V	30.9	15.4	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 (dB $\mu$ V/m) Level (dB $\mu$ V/m)

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Date of Test: 07 April 2024 Model: B064E-02-W7

Worst Case Operating Mode: 2402MHz

#### Radiated Emissions (above 1GHz)

Polarization	Frequency (MHz)	Reading (dBμV)	Pre- Amp Gain (dB)	Antenna Factor (dB/m)	Net at 3m (dBμV/m)	Peak Limit at 3m (dBμV/m)	Margin (dB)
Horizontal	*4804.000	52.0	36.8	33.5	48.7	74.0	-25.3
Horizontal	*2390.000	71.1	36.4	29.1	63.8	74.0	-10.2

Polarization	Frequency (MHz)	Reading (dBμV)	Pre- Amp Gain (dB)	Antenna Factor (dB/m)	Net at 3m (dBμV/m)	Average Limit at 3m (dBµV/m)	Margin (dB)
Horizontal	*4804.000	37.1	36.8	33.5	33.8	54.0	-20.2
Horizontal	*2390.000	54.9	36.4	29.1	47.6	54.0	-6.4

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.

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Date of Test: 07 April 2024 Model: B064E-02-W7

Worst Case Operating Mode: 2440MHz

#### Radiated Emissions (above 1GHz)

Polarization	Frequency (MHz)	Reading (dBμV)	Pre- Amp Gain (dB)	Antenna Factor (dB/m)	Net at 3m (dBμV/m)	Peak Limit at 3m (dBμV/m)	Margin (dB)
Horizontal	*4880.000	47.0	36.7	33.4	43.7	74.0	-30.3
Horizontal	*7320.000	47.1	36.6	35.8	46.3	74.0	-27.7

Polarization	Frequency (MHz)	Reading (dBμV)	Pre- Amp Gain (dB)	Antenna Factor (dB/m)	Net at 3m (dBμV/m)	Average Limit at 3m (dBµV/m)	Margin (dB)
Horizontal	*4880.000	34.3	36.7	33.4	31.0	54.0	-23.0
Horizontal	*7320.000	34.9	36.6	35.8	34.1	54.0	-19.9

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.

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Applicant: Seiko Epson Corporation

Date of Test: 07 April 2024 Model: B064E-02-W7

Worst Case Operating Mode: 2480MHz

# Radiated Emissions (above 1GHz)

Polarization	Frequency (MHz)	Reading (dBμV)	Pre- Amp Gain (dB)	Antenna Factor (dB/m)	Net at 3m (dBμV/m)	Peak Limit at 3m (dBμV/m)	Margin (dB)
Horizontal	*7440.000	52.9	36.8	33.3	49.4	74.0	-24.6
Horizontal	*9920.000	57.2	36.5	29.3	50.0	74.0	-24.0

Polarization	Frequency (MHz)	Reading (dBμV)	Pre- Amp Gain (dB)	Antenna Factor (dB/m)	Net at 3m (dBμV/m)	Average Limit at 3m (dBµV/m)	Margin (dB)
Horizontal	*7440.000	39.3	36.8	33.3	35.8	54.0	-18.2
Horizontal	*9920.000	45.1	36.5	29.3	37.9	54.0	-16.1

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.

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TEST REPORT		Intertek Report No.: 240326067SZN-001
4.9	Radiated Emissions from Digital Section of Transce	iver, FCC Ref: 15.109

Not required - No digital part

[ ] Test results are attached

[x] Included in the separated report.

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Applicant: Seiko Epson Corporation

Date of Test: 07 April 2024 Model: B064E-02-W7

# 4.10 Transmitter Duty Cycle Calculation and Measurements, FCC Rule 15.35(b), (c)

The EUT antenna output port was connected to the input of the spectrum analyzer. The analyzer center frequency was set to EUT RF channel carrier. The SWEP function on the analyzer was set to ZERO SPAN. The Transmitter ON time was determined from the resultant time-amplitude display:

	See attached spectrum analyzer chart (s) for Transmitter timing
	See Transmitter timing diagram provided by manufacturer
Х	Not applicable, duty cycle was not used.

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#### 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.

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## 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	2023-04-28	2024-04-28
SZ182-02-01	Power Sensor	Anritsu	MA2411B	1207429	2023-04-28	2024-04-28
SZ061-12	BiConiLog Antenna	ETS	3142E	00166158	2021-08-04	2024-08-04
SZ185-03	EMI Receiver	R&S	ESCI	100547	2023-04-27	2024-04-27
SZ061-08	Horn Antenna	ETS	3115	00092346	2021-09-05	2024-09-05
SZ061-06	Active Loop Antenna	Electro- Metrics	EM-6876	217	2021-05-18	2024-05-18
SZ056-03	Spectrum Analyzer	R&S	FSP 30	101148	2023-04-27	2024-04-27
SZ056-06	Signal Analyzer	R&S	FSV 40	101101	2023-12-13	2024-12-13
SZ181-04	Preamplifier	Agilent	8449B	3008A02474	2023-04-27	2024-04-27
SZ188-01	Anechoic Chamber	ETS	RFD-F/A- 100	4102	2021-12-12	2024-12-12
SZ062-02	RF Cable	RADIALL	RG 213U		2023-07-18	2024-07-18
SZ062-05	RF Cable	RADIALL	0.04- 26.5GHz		2023-07-18	2024-07-18
SZ062-12	RF Cable	RADIALL	0.04- 26.5GHz		2023-04-27	2024-04-27
SZ067-04	Notch Filter	Micro-Tronics	BRM50702- 02		2023-04-27	2024-04-27

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