

# FCC Part 15, Subpart C, Section 15.247 Test Report

Put Us To The Test"

On

IoT Sensor Hub FCC ID: Z5IHB1

Customer Name:	KCF Technologies, Inc.
Customer P.O:	04232020A
Date of Report:	September 17, 2020
Test Report No:	R-3248P-1
Test Start Date:	_July 28, 2020
Test Finish Date:	September 3, 2020
Test Technician:	M. Nowak
Approved Bv:	D. Rybicki
Report Prepared By:	B. Bolton

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## **Technical Information**

Report Number:	R-3248P-1	
Customer:	KCF Technologies, Inc.	
Address:	336 S. Fraser Street	
	State College, PA 16801	
Manufacturer:	KCF Technologies, Inc.	
Manufacturer Address:	336 S. Fraser Street	
	State College, PA 16801	
Test Sample:	IoT Sensor Hub	
Model Number:	SD-HUB-1-MB	
	SD-HUB-1-MA	
	SD-HUB-1-XB	
	SD-HUB-1-XA	
FCC ID:	ZSIHB1	
Туре:	2.405 to 2.480 GHz Digital Spread Spectrum Transceiver	
Power Requirements:	120 VAC, 60 Hz (SD-HUB-1-MA and SD-HUB-1-XA)	
Power Pequirements:	3.6 VDC internal battery derived from Li-SOCI2	
Fower Requirements.	(SD-HUB-1-MB and SD-HUB-1-XB)	
Frequency of Operation:	2400 – 2483.5 MHz	
Equipment Class:	DSS	
Equipment Use:	Fixed	

## **Test Specification:**

FCC Rules and Regulations Part 15, Subpart C, Section 15.247

## Test Procedure:

ANSI C63.4:2014 ANSI C63.10:2013

## **Test Facility:**

Retlif Testing Laboratories 3131 Detwiler Road Harleysville, PA 19438

FCC Accreditation Designation Number: US2321



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# **Tests Performed**

The test methods performed on the IoT Sensor Hub are shown in Table **1** below:

FCC Part 15, Subpart C	Test Method		
15.247(a)(2)	Occupied Bandwidth		
15.247(b)(3)	Power Output		
15.247(d)	Antenna Port, Conducted Emissions		
15.247(d)	Out of Band / Band Edge Radiated Emissions, 9kHz to 25 GHz		
15.247(e)	Antenna Port, Power Density		
15.207(a)	Conducted Limits, 150 kHz to 30 MHz		

The equipment utilized to operate the EUT are shown in Table 2 below:

Description	Manufacturer	Model Number	Serial Number
Test PC	Dell	Latitude 5490	GG1V7S2
Transceiver	KCF Technologies	SD-PRN-2	C00010D4
Vibration Sensor	KCF Technologies	SD-WVS-1	100004E
Vibration Sensor	KCF Technologies	SD-WVS-1	100003C
Vibration Sensor	KCF Technologies	SD-WVS-1	100002D
Vibration Sensor	KCF Technologies	SD-WVS-1	1000001F
Vibration Sensor	KCF Technologies	SD-WVS-1	1000004B
Vibration Sensor	KCF Technologies	SD-WVS-1	1000034
Vibration Sensor	KCF Technologies	SD-WVS-1	100003A

# Table 2 – Support Equipment



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## **Certification and Signatures**

We certify that this report is a true representation of the results obtained from the tests of the equipment stated. We further certify that the measurements shown in this report were made in accordance with the procedures indicated and vouch for the qualifications of all Retlif Testing Laboratories personnel taking them.

Arik L. Warwick EMI Test Engineer

David M. Rybicki Laboratory Supervisor

#### **Non-Warranty Provision**

The testing services have been performed, findings obtained and reports prepared in accordance with generally accepted laboratory principles and practices. This warranty is in lieu of all others, either expressed or implied.

### Non-Endorsement

This test report contains only findings and results arrived at after employing the specific test procedures and standards listed herein. It is not intended to constitute a recommendation, endorsement or certification of the product or material tested. This test report must not be used by the client to claim product endorsement by NVLAP or any agency of the U.S. Government.



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# **Requirements and Test Results**

## FCC Section 15.247(a)(2), Occupied Bandwidth

**Operation within the bands 902 - 928 MHz, 2400 - 2483.5 MHz and 5725 - 5850 MHz** Systems using digital modulation techniques may operate in the 902 - 928 MHz, 2400 - 2483.5 MHz and 5725 - 5850 MHz bands. The minimum 6 dB bandwidths shall be at least 500 kHz.

Results:

The EUT complies with the 6 dB bandwidth requirement. The minimum measured 6 dB bandwidth was 625.25 kHz.

## FCC Sections 15.247(b)(3), Power Output Operation within the bands 902 - 928 MHz, 2400 - 2483.5 MHz and 5725 - 5850 MHz The maximum peak conducted output power of the intentional radiator shall not exceed the following:

For systems using digital modulation in the 902 - 928 MHz, 2400 - 2483.5 MHz and 5725 - 5850 MHz bands: 1 Watt. As an alternative to a peak power measurement, compliance with the one Watt limit can be based on a measurement of the maximum conducted output power. Maximum Conducted Output Power is defined as the total transmit power delivered to all antenna and antenna elements averaged across all symbols in the signaling alphabet when the transmitter is operating at its maximum power control level. Power must be summed across all antenna and antenna elements. The average must not include any time intervals during which the transmitter is off or is transmitting at a reduced power level. If multiple modes of operation are possible (e.g., alternative modulation methods), the maximum conducted output power is the highest total transmit power occurring in any mode.

Results:

The EUT complies with the Power Output requirement. The device operates in the 2400 – 2483.5 MHz band. The maximum peak output power was measured and was found to be 34.20 mW.



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# Requirements and Test Results (con't)

# FCC Section 15.247(d), Antenna Port Conducted Emissions

## Operation within the bands 902 - 928 MHz, 2400 - 2483.5 MHz and 5725 - 5850 MHz

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, provided the transmitter demonstrates compliance with the peak conducted power limits. If the transmitter complies with the conducted power limits based on the use of RMS averaging over a time interval, as permitted under paragraph (b)(3) of this section, the attenuation required under this paragraph shall be 30 dB instead of 20 dB. Attenuation below the general limits specified in Section 15.209(a) is not required. In addition, radiated emissions which fall in the restricted bands, as defined in Section 15.205(a) must also comply with the radiated emissions limits specified in Section 15.209(a) (see Section 15.205(c)).

• Results:

In any 100 kHz bandwidth outside the frequency band in which the Spread spectrum intentional radiator was operating, the radio frequency power that was produced by the intentional radiator was at least 20 dB below that in the 100 kHz bandwidth within the band that contained the highest level of the desired power. All emissions, which fell within the restricted bands specified in 15.205(a), were measured and found to be in compliance with the limits specified in 15.209(a).

# FCC Section 15.247(e), Antenna Port, Power Density

# Operation within the bands 902 - 928 MHz, 2400 - 2483.5 MHz and 5725 - 5850 MHz

For digitally modulated systems, the power spectral density conducted from the intentional radiator to the antenna shall not be greater than 8 dBm in any 3 kHz band during any time interval of continuous transmission. This power spectral density shall be determined in accordance with the provisions of paragraph (b) of this section. The same method of determining the conducted output power shall be used to determine the power spectral density.

# • Results:

The power spectral density conducted from the intentional radiator to the antenna was not greater than 8 dBm in any 3 kHz band during any time interval of continuous transmission. This power spectral density was determined in accordance with Section 15.247(b)(3).

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# **Requirements and Test Results (con't)**

# FCC Section 15.209(a), Radiated Emission Limits, General Requirements

Except as provided elsewhere in this subpart, the emissions from an intentional radiator shall not exceed the field strength levels specified in Table 3.

Frequency of Emission (MHz)	Field Strength (microvolts/meter)	Measurement Distance (meters)
30 to 88	100	3
88 to 216	150	3
216 to 960	200	3
Above 960	500	3

Table 3 - Radiated Em	hission Limits
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Results:

The field strength of spurious radiated emissions did not exceed the limits specified in Table 3.

# FCC Section 15.207(a), Conducted Limits

For an intentional radiator that is designed to be connected to the public utility (AC) power line, the radio frequency voltage that is conducted back onto the AC power line on any frequency or frequencies within the band 150 kHz to 30 MHz shall not exceed the limits shown in Table 4, as measured using a 50  $\mu$ H/50 ohms line impedance stabilization network (LISN). Compliance with the provisions of the paragraph shall be based on the measurement of the radio frequency voltage between each power line and ground at the power terminal. The lower limit applies at the boundary between the frequency ranges.

## Table 4 - Conducted Emission Limits

	Conducted Limit (dBµV)		
Frequency of Emission (MHz)	Quasi-Peak	Average	
0.15 to 0.5	66 to 56*	56 to 46*	
0.5 to 5	56	46	
5 to 30	60	50	
*Decreases due to logarithm of the frequency			

Results:

The conducted emissions observed did not exceed the limits specified in Table 4.



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# Requirements and Test Results (con't)Field Strength Calculation/Conversion:The maximized field strength of the emission was obtained as follows: $C_R = M_R + C_F$ Where: $C_R = Corrected Reading in dB\muV/mM_R = Uncorrected Meter Reading in dB<math>\mu$ V $C_F = Correction Factor in dB (Antenna Factor, Pre-amp + Cable Loss)Example:M_R = 15.35 dB<math>\mu$ V $C_F = 16.85 dB$ $C_R = 15.35 dB\muV + 16.85 = 32.2 dB\mu$ V/m

 $dB\mu V/m$  is converted to uV/M for comparison to the specified limit using the formula:

invLog dBµV/M/20

32.2 dBuV/m = 40.74 uV/m

**RF** Power Conversion:

Power readings in dBm may be converted to mW using the formula:

InvLog dBm/10

Example: 20dBm = 100mW



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# Requirements and Test Results (con't)

# FCC Section 15.247 (i), RF Exposure Limits

Spread Spectrum Transmitters operating under 15.247 must be operated in a manner that ensures the public is not exposed to RF energy levels in access of the commission's guidelines. Based on the transmitter power and maximum antenna gain (see calculation below) the minimum separation distance was calculated to determine the distance for acceptable MPE power density levels to meet both the Occupational/Controlled Exposure and the General Population/Uncontrolled Exposure requirements of FCC Part 1.1310. The calculation below uses the more stringent General Population MPE Limits.

$$S = \frac{PG}{4\pi D^2}$$

D = Minimum Separation Distance in cm

S = Max allowed Power Density in mW/cm<sup>2</sup>

Per 1.1310 For the frequency range of 2400 - 2483.5 MHz S = 1mW/cm<sup>2</sup>

Power (P) = Max power Input to Antenna = 34.20 mW

Gain (G) = Max Power Gain of Antenna = 1.75dBi = 1.5 numeric

$$1 \text{mW/cm}^2 = \frac{34.20 \times 1.5}{4\pi \times D^2} = \frac{51.30}{12.57 \times D^2}$$

 $D^2 = 4.08$ 

D = 2.02 cm



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# Spectrum Analyzer Desensitization Considerations

Due to the nature of the emissions being measured, care was taken to ensure that the resolution bandwidth of the spectrum analyzer was adequate to provide accurate measurements. FCC specified bandwidths of 100 kHz and 1 MHz were utilized below and above 1 GHz, respectively.

# **General Notes**

- 1. All radiated readings were taken utilizing a detector function specified on each data sheet at a test distance of 3 meters.
- 2. All measurements for models SD-HUB-1-MA or SD-HUB-1-XA were made with the device powered by 120 VAC, 60 Hz.
- 3. All measurements for models SD-HUB-1-MB or SD-HUB-1-XB were made with the device powered by a fully charged 3.6VDC internal battery.
- 4. Each test method was performed on 2 representative models. The model tested will be noted on each data sheet.
- 5. The frequency range was scanned as specified in each method. For radiated measurements all emissions not reported were more than 20 dB below the specified limit.



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## Equipment List

## FCC Section 15.247(a)(2), Occupied Bandwidth FCC Section 15.247(b)(3), Power Output FCC Section 15.247(d), Antenna Port, Conducted Emissions FCC Section 15.247(e), Antenna Port, Power Density

EN	Manufacturer	Description	Range	Model No.	Cal Date	Due Date
713	ROHDE & SCHWARZ	RECEIVER, EMI	20 Hz - 26.5 GHz	ESIB26	3/19/2020	3/31/2021
713E	MICRO-COAX	CABLE, COAXIAL	6 FEET 50U50U	UFB311A1-0720-	10/14/2019	10/31/2020
8557	NARDA MICROWAVE	ATTENUATOR, COAXIAL	11 dB, DC - 11 GHz, 20 W	768-10	6/2/2020	6/30/2021
8619	OMEGA	HYGROMETER	-20 to 70 deg. C, 0-99% RH	OM-73	3/16/2020	3/31/2021

# FCC Section 15.247(d), Spurious Radiated Emissions

EN	Manufacturer	Description	Range	Model No.	Cal Date	Due Date
127A	ETS / EMCO	ANTENNA, BICONICAL	20 - 200 MHz	3104	5/6/2019	11/30/2020
8016	ETS / EMCO	ANTENNA, LOG PERIODIC	200 MHz - 1 GHz	3146	9/9/2019	3/31/2021
8080	ROHDE & SCHWARZ	RECEIVER, EMI	20 - 1300 MHz	354-3000.56ESVP	11/5/2019	11/30/2020
8300	RETLIF	OPEN AREA TEST SITE, ATTENUATION	3/10 Meter OATS	RPA	5/7/2020	5/31/2022
8300C	UNKNOWN	CABLE, COAXIAL	3/10 METER	3 METER CABLE	8/21/2020	2/28/2021
8644	AGILENT / HP	ANALYZER, SPECTRUM	100 Hz - 22 GHz	85662A	9/23/2019	9/30/2020
8644A	AGILENT / HP	ANALYZER, SPECTRUM	100 Hz - 22.5 GHz	8566B	9/23/2019	9/30/2020
8644B	AGILENT / HP	ANALYZER, RF PRESELECTOR	20 Hz - 2 GHz	85685A	9/23/2019	9/30/2020
8668	DIGI-SENSE	HYGROMETER RH	0 - 50 deg. c, 10 - 90 %	20250-31	3/16/2020	9/30/2020

## FCC Section 15.207(a), Conducted Limits

EN	Manufacturer	Description	Range	Model No.	Cal Date	Due Date
8079	ROHDE & SCHWARZ	RECEIVER, EMI	9 kHz - 30 MHz	ESH3	6/24/2020	6/30/2021
8366A	RETLIF	CABLE, COAXIAL	10 KHz - 1 GHz	20' BNC	5/14/2020	5/31/2021
8496	NARDA MICROWAVE	ATTENUATOR, COAXIAL	10 dB, DC - 11 GHz, 20 W	768-10	6/2/2020	6/30/2021
8619	OMEGA	HYGROMETER	-20 to 70 deg. C, 0-99% RH	OM-73	3/16/2020	3/31/2021
8633	SOLAR ELECTRONICS	LISN	50 uH, 150 kHz - 30 MHz	21106-50-BP-25-BNC	6/22/2020	6/30/2021
8634	SOLAR ELECTRONICS	LISN	50 uH, 150 kHz - 30 MHz	21106-50-BP-25-BNC	6/22/2020	6/30/2021
8749	RIGOL	ANALYZER, SPECTRUM	9 kHz - 3.2 GHz	DSA832E	5/19/2020	5/31/2021



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FCC 15.247(a)(2) Test Data, Occupied Bandwidth, SD-HUB-1-MA



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FCC 15.247(a)(2) Test Data, Occupied Bandwidth, SD-HUB-1-XA



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FCC 15.247(b)(3) Test Data, Power Output, SD-HUB-1-MA



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EMISSIONS TEST DATA SHEET	
Test Specification:	FCC Part 15, Subpart C Paragraph: 15.247 (b)(3)
Method:	ANSI C63.10, Section 11.9.1 Maximum peak conducted output power
Job Number/Customer:	R-3248P-1 / KCF Technologies, Inc
Test Sample:	IoT Sensor Hub
Part Number:	SD-HUB-1-MA
Serial Number:	1C00002D
Operating Mode:	Continuously transmitting a modulated signal at 2429 MHz
Technician:	S. Macdonald
Date(s):	8/31/20
Temperature:	21.6 °C
Relative Humidity:	49.5 %
Notes:	Peak Power Output = 3.01 dBm + 10.79 dB (attenuator) = 13.8 dBm = 23.99 mW



EMISSIONS TEST DATA SHEET	
Test Specification:	FCC Part 15, Subpart C Paragraph: 15.247 (b)(3)
Method:	ANSI C63.10, Section 11.9.1 Maximum peak conducted output power
Job Number/Customer:	R-3248P-1 / KCF Technologies, Inc
Test Sample:	IoT Sensor Hub
Part Number:	SD-HUB-1-MA
Serial Number:	1C00002D
Operating Mode:	Continuously transmitting a modulated signal at 2443 MHz
Technician:	S. Macdonald
Date(s):	8/31/20
Temperature:	21.6 °C
Relative Humidity:	49.5 %
Notes:	Peak Power Output = 3.75 dBm + 10.79 dB (attenuator) = 14.54 dBm = 28.44 mW



1	
EMISSIONS TEST DATA SHEET	
Test Specification:	FCC Part 15, Subpart C Paragraph: 15.247 (b)(3)
Method:	ANSI C63.10, Section 11.9.1 Maximum peak conducted output power
Job Number/Customer:	R-3248P-1 / KCF Technologies, Inc
Test Sample:	IoT Sensor Hub
Part Number:	SD-HUB-1-MA
Serial Number:	1C00002D
Operating Mode:	Continuously transmitting a modulated signal at 2457 MHz
Technician:	S. Macdonald
Date(s):	8/31/20
Temperature:	21.6 °C
Relative Humidity:	49.5 %
Notes:	Peak Power Output = 3.75 dBm + 10.79 dB (attenuator) = 14.54 dBm = 28.44 mW



FCC 15.247(b)(3) Test Data, Power Output, SD-HUB-1-MB



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EMISSIONS TEST DATA SHEET	
Test Specification:	FCC Part 15, Subpart C Paragraph: 15.247 (b)(3)
Method:	ANSI C63.10, Section 11.9.1 Maximum peak conducted output power
Job Number/Customer:	R-3248P-1 / KCF Technologies, Inc
Test Sample:	IoT Sensor Hub
Part Number:	SD-HUB-1-MB
Serial Number:	1C00002C
Operating Mode:	Continuously transmitting a modulated signal at 2429 MHz
Technician:	S. Macdonald
Date(s):	8/31/20
Temperature:	21.6 °C
Relative Humidity:	49.5 %
Notes:	Peak Power Output = 2.29 dBm + 10.79 dB (attenuator) = 13.08 dBm = 20.32 mW



EMISSIONS TEST DATA SHEET	
Test Specification:	FCC Part 15, Subpart C Paragraph: 15.247 (b)(3)
Method:	ANSI C63.10, Section 11.9.1 Maximum peak conducted output power
Job Number/Customer:	R-3248P-1 / KCF Technologies, Inc
Test Sample:	IoT Sensor Hub
Part Number:	SD-HUB-1-MB
Serial Number:	1C00002C
Operating Mode:	Continuously transmitting a modulated signal at 2443 MHz
Technician:	S. Macdonald
Date(s):	8/31/20
Temperature:	21.6 °C
Relative Humidity:	49.5 %
Notes:	Peak Power Output = 4.13 dBm + 10.79 dB (attenuator) = 14.92 dBm = 31.06 mW



EMISSIONS TEST DATA SHEET	
Test Specification:	FCC Part 15, Subpart C Paragraph: 15.247 (b)(3)
Method:	ANSI C63.10, Section 11.9.1 Maximum peak conducted output power
Job Number/Customer:	R-3248P-1 / KCF Technologies, Inc
Test Sample:	IoT Sensor Hub
Part Number:	SD-HUB-1-MB
Serial Number:	1C00002C
Operating Mode:	Continuously transmitting a modulated signal at 2457 MHz
Technician:	S. Macdonald
Date(s):	8/31/20
Temperature:	21.6 °C
Relative Humidity:	49.5 %
Notes:	Peak Power Output = 4.55 dBm + 10.79 dB (attenuator) = 15.34 dBm = 34.20 mW



FCC Part 15.247, Paragraph (d) Test Data, Out of Band Emissions, SD-HUB-1-MA



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### FCC Part 15.247 (d) Out of Band Emissions

Customer: KCF Technologies, Inc Test Sample: IoT Sensor Hub Part/Serial Number: SD-HUB-1-MA / 1C00002D Test Specification: FCC Part 15, Subpart C Mode of Operation: Continuously transmitting a modulated 2.429 GHz signal Technician/Date: S. Macdonald / 9/02/20 Port Tested: Antenna Notes:



### FCC Part 15.247 (d) Out of Band Emissions

Customer:	KCF Technologies, Inc
Test Sample:	IoT Sensor Hub
Part/Serial Number:	SD-HUB-1-MA / 1C00002D
Test Specification:	FCC Part 15, Subpart C
Mode of Operation:	Continuously transmitting a modulated 2.429 GHz signal
Technician/Date:	S. Macdonald / 9/02/20
Port Tested:	Antenna
Notes::	Zoomed in to show peak power and band edge



### FCC Part 15.247 (d) Out of Band Emissions

Customer: KCF Technologies, Inc Test Sample: IoT Sensor Hub Part/Serial Number: SD-HUB-1-MA / 1C00002D Test Specification: FCC Part 15, Subpart C Mode of Operation: Continuously transmitting a modulated 2.443 GHz signal Technician/Date: S. Macdonald / 9/02/20 Port Tested: Antenna Notes:



### FCC Part 15.247 (d) Out of Band Emissions

Customer:	KCF Technologies, Inc
Test Sample:	IoT Sensor Hub
Part/Serial Number:	SD-HUB-1-MA / 1C00002D
Test Specification:	FCC Part 15, Subpart C
Mode of Operation:	Continuously transmitting a modulated 2.443 GHz signal
Technician/Date:	S. Macdonald / 9/02/20
Port Tested:	Antenna
Notes:	Zoomed in to show peak power and band edge



### FCC Part 15.247 (d) Out of Band Emissions

Customer: KCF Technologies, Inc Test Sample: IoT Sensor Hub Part/Serial Number: SD-HUB-1-MA / 1C00002D Test Specification: FCC Part 15, Subpart C Mode of Operation: Continuously transmitting a modulated 2.457 GHz signal Technician/Date: S. Macdonald / 9/02/20 Port Tested: Antenna Notes:



### FCC Part 15.247 (d) Out of Band Emissions

Customer:	KCF Technologies, Inc
Test Sample:	IoT Sensor Hub
Part/Serial Number:	SD-HUB-1-MA / 1C00002D
Test Specification:	FCC Part 15, Subpart C
Mode of Operation:	Continuously transmitting a modulated 2.457 GHz signal
Technician/Date:	S. Macdonald / 9/02/20
Port Tested:	Antenna
Notes:	Zoomed in to show peak power and band edge



FCC Part 15.247, Paragraph (d) Sweep Table, Out of Band Emissions, SD-HUB-1-MA



**Retlif Testing Laboratories**
#### SWEEP TABLE: "R-3248P-1 OOB CE" Unit: dBm Detector: Mode: Curve 1: MaxPeak MaxHold Subrange 1: Start Frequency: 9.0 kHz Stop Frequency: 32.0 kHz Measure Time: Coupled IF Bandwidth: 1 kHz Receiver: ESIX Transducer: dBuV to dBm None System Transducer: None Lin Add. Transd. 1: EN71 Signal Path: Meas. Mode: EN713E 10/20 Add. Transd. 2: Tracking Gen.: \_ \_ None 1 Add. Transd. 3: Input: None Preamplifier: Off Op. Range: \_ \_ RF Att.: 20 dB Preselection: Off -10.0 dBm Rep. by Device: Ref. Level: \_ \_ Min. RF Att.: -- Option: \_ \_ IF Att.: -- Video Bandwidth: 5 kHz Curve 1: On Repetition: 10 Off Stop Mark: Off Curve 2: Curve 3: Off Stop Message: Off Curve 4: Off Stop Message: Subrange 2: 32.0 kHz Start Frequency: 200.0 kHz Stop Frequency: Measure Time: Coupled IF Bandwidth: 10 kHz Receiver: ESIX Transducer: dBuV to dBm None System Transducer: None Signal Path: Lin Add. Transd. 1: EN713E 10/20 Meas. Mode: -- Add. Transd. 2: Tracking Gen.: None 1 Add. Transd. 3: Input: None Preamplifier: Off Op. Range: 20 dB Preselection: RF Att.: Off -10.0 dBm Rep. by Device: Ref. Level: \_ \_ Min. RF Att.: Option: \_\_\_ \_ \_ IF Att.: -- Video Bandwidth: 10 MHz Curve 1: On Repetition: 10 Curve 2: Off Stop Mark: Off Curve 3: Off Stop Message: Off Curve 4: Off Stop Message: Subrange 3: Start Frequency: 200.0 kHz **Retlif Testing Laboratories**

Stop Frequency: 2.3 GHz Measure Time: Coupled IF Bandwidth: 100 kHz Receiver: ESIX Transducer: dBuV to dBm Signal Path: None System Transducer: None Lin Add. Transd. 1: EN713E 10/20 Meas. Mode: Tracking Gen.: -- Add. Transd. 2: None 1 Add. Transd. 3: None Input: Preamplifier: Off Op. Range: \_ \_ 20 dB Preselection: RF Att.: Off -10.0 dBm Rep. by Device: Ref. Level: \_ \_ Min. RF Att.: -- Option: \_ \_ IF Att.: -- Video Bandwidth: 10 MHz Curve 1: On Repetition: 10 Off Stop Mark: Curve 2: Off Off Stop Message: Curve 3: Off Off Stop Message: Curve 4: Subrange 4: 2.3 GHz Start Frequency: Stop Frequency: 2.5 GHz Measure Time: Coupled IF Bandwidth: 100 kHz ESIX Transducer: dBuV to dBm Receiver: None System Transducer: None Lin Add. Transd. 1: EN713D 10/20 -- Add. Transd. 2: None 1 Add. Transd. 3: None Signal Path: Meas. Mode: Tracking Gen.: Input: Preamplifier: Off Op. Range: \_\_\_ Normal Preselection: Off RF Att.: 10.0 dBm Rep. by Device: Ref. Level: \_ \_ \_ Min. RF Att.: -- Option: IF Att.: -- Video Bandwidth: 10 MHz Curve 1: On Repetition: 10 Curve 2: Off Stop Mark: Off Curve 3: Off Stop Message: Off Curve 4: Off Stop Message: Subrange 5: 2.5 GHz Start Frequency: 18.0 GHz Stop Frequency: Measure Time: Coupled 100 kHz IF Bandwidth: ESIX Transducer: Receiver: dBuV to dBm Signal Path: None System Transducer: None Lin Add. Transd. 1: EN713E 10/20 Meas. Mode: -- Add. Transd. 2: Tracking Gen.: None Input: 1 Add. Transd. 3: None Preamplifier: Off Op. Range: \_ \_ **Retlif Testing Laboratories** Report No. R-3248P-1

RF Att.: Ref. Level: Min. RF Att.: IF Att.:	20 dB -10.0 dBm  	Preselection: Rep. by Device: Option: Video Bandwidth:	Off   10 MHz
Curve 1: Curve 2: Curve 3: Curve 4:	On Off Off Off	Repetition: Stop Mark: Stop Message: Stop Message:	10 Off Off
Subrange 6:			
Start Frequency: Stop Frequency: Measure Time: IF Bandwidth:	18.0 GHz 25.0 GHz Coupled 100 kHz		
Receiver: Signal Path: Meas. Mode: Tracking Gen.: Input:	ESIX None Lin  1	Transducer: System Transducer: Add. Transd. 1: Add. Transd. 2: Add. Transd. 3:	dBuV to dBm None 40G EN713E 3/21 None None
Preamplifier: RF Att.: Ref. Level: Min. RF Att.: IF Att.:	Off 20 dB -10.0 dBm  	Op. Range: Preselection: Rep. by Device: Option: Video Bandwidth:	 Off  10 MHz
Curve 1: Curve 2: Curve 3: Curve 4:	On Off Off Off	Repetition: Stop Mark: Stop Message: Stop Message:	10 Off Off



**Retlif Testing Laboratories** 

FCC Part 15.247, Paragraph (d) Test Data, Out of Band Emissions in Restricted Band, SD-HUB-1-MA



**Retlif Testing Laboratories** 

Customer:	KCF Technologies, Inc
Test Sample:	IoT Sensor Hub
Part/Serial Number:	SD-HUB-1-MA / 1C00002D
Test Specification:	FCC Part 15, Subpart C
Mode of Operation:	Continuously transmitting a modulated 2.429 GHz signal
Technician/Date:	S. Macdonald / 9/02/20
Port Tested:	Antenna
Notes:	Peak Detector



Customer:	KCF Technologies, Inc
Test Sample:	IoT Sensor Hub
Part/Serial Number:	SD-HUB-1-MA / 1C00002D
Test Specification:	FCC Part 15, Subpart C
Mode of Operation:	Continuously transmitting a modulated 2.429 GHz signal
Technician/Date:	S. Macdonald / 9/02/20
Port Tested:	Antenna
Notes:	Peak Detector



Customer:	KCF Technologies, Inc
Test Sample:	IoT Sensor Hub
Part/Serial Number:	SD-HUB-1-MA / 1C00002D
Test Specification:	FCC Part 15, Subpart C
Mode of Operation:	Continuously transmitting a modulated 2.443 GHz signal
Technician/Date:	S. Macdonald / 9/02/20
Port Tested:	Antenna
Notes:	Peak Detector



Customer:	KCF Technologies, Inc			
Test Sample:	IoT Sensor Hub			
Part/Serial Number:	SD-HUB-1-MA / 1C00002D			
Test Specification:	FCC Part 15, Subpart C			
Mode of Operation:	Continuously transmitting a modulated 2.443 GHz signal			
Technician/Date:	S. Macdonald / 9/02/20			
Port Tested:	Antenna			
Notes:	Peak Detector			



Customer:	KCF Technologies, Inc
Test Sample:	IoT Sensor Hub
Part/Serial Number:	SD-HUB-1-MA / 1C00002D
Test Specification:	FCC Part 15, Subpart C
Mode of Operation:	Continuously transmitting a modulated 2.457 GHz signal
Technician/Date:	S. Macdonald / 9/02/20
Port Tested:	Antenna
Notes:	Peak Detector



Customer:	KCF Technologies, Inc
Test Sample:	IoT Sensor Hub
Part/Serial Number:	SD-HUB-1-MA / 1C00002D
Test Specification:	FCC Part 15, Subpart C
Mode of Operation:	Continuously transmitting a modulated 2.457 GHz signal
Technician/Date:	S. Macdonald / 9/02/20
Port Tested:	Antenna
Notes:	Peak Detector



FCC Part 15.247, Paragraph (d) Out of Band Emissions Sweep Table, Out of Band Emissions in Restricted Band, SD-HUB-1-MA



**Retlif Testing Laboratories** 

## SWEEP TABLE: "R-3248P-1 CE restric"

Unit:	dBµV/m			
	Detector:	Mode:		
Curve 1:	MaxPeak	MaxHold		
Subrange	1:			
Start F Stop Fr Measure IF Band	Frequency: requency: e Time: dwidth:	4.5 GHz 5.2 GHz Coupled 1 MHz		
Receive Signal Meas. M Trackin Input:	er: Path: Mode: ng Gen.:	ESIX None Lin  1	Transducer: System Transducer: Add. Transd. 1: Add. Transd. 2: Add. Transd. 3:	FCC Rest Band 3m2dBi None EN713E 10/20 None None
Preampl RF Att. Ref. Le Min. RF IF Att.	Lifier: .: evel: 7 Att.: .:	Off 20 dB -10.0 dBm  	Op. Range: Preselection: Rep. by Device: Option: Video Bandwidth:	 Off  10 MHz
Curve 1 Curve 3 Curve 4	L: 3: 1:	On Off Off	Repetition: Stop Mark: Stop Message: Stop Message:	Continuous Off Off
Subrange	2:			
Start F Stop Fr Measure IF Band	Frequency: cequency: e Time: dwidth:	7.3 GHz 7.8 GHz Coupled 1 MHz		
Receive Signal Meas. M Trackir Input:	er: Path: Mode: ng Gen.:	ESIX None Lin  1	Transducer: System Transducer: Add. Transd. 1: Add. Transd. 2: Add. Transd. 3:	FCC Rest Band 3m2dBi None EN713E 10/20 None None
Preampl RF Att. Ref. Le Min. RF IF Att.	lifier: .: evel: 7 Att.: .:	Off 20 dB -10.0 dBm  	Op. Range: Preselection: Rep. by Device: Option: Video Bandwidth:	 Off  10 MHz
Curve 1 Curve 3 Curve 4	L: 3: 1:	On Off Off	Repetition: Stop Mark: Stop Message: Stop Message:	Continuous Off Off

**Retlif Testing Laboratories** 

FCC Part 15.247, Paragraph (d) Test Data, Out of Band Emissions, SD-HUB-1-XA



**Retlif Testing Laboratories** 

## FCC Part 15.247 (d) Out of Band Emissions

Customer: KCF Technologies, Inc Test Sample: IoT Sensor Hub Part/Serial Number: SD-HUB-1-XA / 1C000007 Test Specification: FCC Part 15, Subpart C Mode of Operation: Continuously transmitting a modulated 2.429 GHz signal Technician/Date: S. Macdonald / 9/02/20 Port Tested: Antenna Notes:



# FCC Part 15.247 (d) Out of Band Emissions

Customer:	KCF Technologies, Inc			
Test Sample:	IoT Sensor Hub			
Part/Serial Number:	SD-HUB-XA / 1C000007			
Test Specification:	FCC Part 15, Subpart C			
Mode of Operation:	Continuously transmitting a modulated 2.429 GHz signal			
Technician/Date:	S. Macdonald / 9/02/20			
Port Tested:	Antenna			
Notes:	Zoomed in to show peak power and band edge			



## FCC Part 15.247 (d) Out of Band Emissions

Customer: KCF Technologies, Inc Test Sample: IoT Sensor Hub Part/Serial Number: SD-HUB-MA / 1C00002D Test Specification: FCC Part 15, Subpart C Mode of Operation: Continuously transmitting a modulated 2.443 GHz signal Technician/Date: S. Macdonald / 9/02/20 Port Tested: Antenna Notes:



# FCC Part 15.247 (d) Out of Band Emissions

Customer:	KCF Technologies, Inc
Test Sample:	IoT Sensor Hub
Part/Serial Number:	SD-HUB-MA / 1C00002D
Test Specification:	FCC Part 15, Subpart C
Mode of Operation:	Continuously transmitting a modulated 2.443 GHz signal
Technician/Date:	S. Macdonald / 9/02/20
Port Tested:	Antenna
Notes:	Zoomed in to show peak power and band edge



## FCC Part 15.247 (d) Out of Band Emissions

Customer: KCF Technologies, Inc Test Sample: IoT Sensor Hub Part/Serial Number: SD-HUB-MA / 1C00002D Test Specification: FCC Part 15, Subpart C Mode of Operation: Continuously transmitting a modulated 2.457 GHz signal Technician/Date: S. Macdonald / 9/02/20 Port Tested: Antenna Notes:



# FCC Part 15.247 (d) Out of Band Emissions

Customer:	KCF Technologies, Inc
Test Sample:	IoT Sensor Hub
Part/Serial Number:	SD-HUB-MA / 1C00002D
Test Specification:	FCC Part 15, Subpart C
Mode of Operation:	Continuously transmitting a modulated 2.457 GHz signal
Technician/Date:	S. Macdonald / 9/02/20
Port Tested:	Antenna
Notes:	Zoomed in to show peak power and band edge



FCC Part 15.247, Paragraph (d) Sweep Table, Out of Band Emissions, SD-HUB-1-XA



**Retlif Testing Laboratories** 

#### SWEEP TABLE: "R-3248P-1 OOB CE" Unit: dBm Detector: Mode: Curve 1: MaxPeak MaxHold Subrange 1: Start Frequency: 9.0 kHz Stop Frequency: 32.0 kHz Measure Time: Coupled IF Bandwidth: 1 kHz Receiver: ESIX Transducer: dBuV to dBm None System Transducer: None Lin Add. Transd. 1: EN71 Signal Path: Meas. Mode: EN713E 10/20 Add. Transd. 2: Tracking Gen.: \_ \_ None 1 Add. Transd. 3: Input: None Preamplifier: Off Op. Range: \_ \_ RF Att.: 20 dB Preselection: Off -10.0 dBm Rep. by Device: Ref. Level: \_ \_ Min. RF Att.: -- Option: \_ \_ IF Att.: -- Video Bandwidth: 5 kHz Curve 1: On Repetition: 10 Off Stop Mark: Off Curve 2: Curve 3: Off Stop Message: Off Curve 4: Off Stop Message: Subrange 2: 32.0 kHz Start Frequency: 200.0 kHz Stop Frequency: Measure Time: Coupled IF Bandwidth: 10 kHz Receiver: ESIX Transducer: dBuV to dBm None System Transducer: None Signal Path: Lin Add. Transd. 1: EN713E 10/20 Meas. Mode: -- Add. Transd. 2: Tracking Gen.: None 1 Add. Transd. 3: Input: None Preamplifier: Off Op. Range: 20 dB Preselection: RF Att.: Off -10.0 dBm Rep. by Device: Ref. Level: \_ \_ Min. RF Att.: Option: \_\_\_ \_ \_ IF Att.: -- Video Bandwidth: 10 MHz Curve 1: On Repetition: 10 Curve 2: Off Stop Mark: Off Curve 3: Off Stop Message: Off Curve 4: Off Stop Message: Subrange 3: Start Frequency: 200.0 kHz **Retlif Testing Laboratories**

Stop Frequency: 2.3 GHz Measure Time: Coupled IF Bandwidth: 100 kHz Receiver: ESIX Transducer: dBuV to dBm Signal Path: None System Transducer: None Lin Add. Transd. 1: EN713E 10/20 Meas. Mode: Tracking Gen.: -- Add. Transd. 2: None 1 Add. Transd. 3: None Input: Preamplifier: Off Op. Range: \_ \_ 20 dB Preselection: RF Att.: Off -10.0 dBm Rep. by Device: Ref. Level: \_ \_ Min. RF Att.: -- Option: \_ \_ IF Att.: -- Video Bandwidth: 10 MHz Curve 1: On Repetition: 10 Off Stop Mark: Curve 2: Off Off Stop Message: Curve 3: Off Off Stop Message: Curve 4: Subrange 4: 2.3 GHz Start Frequency: Stop Frequency: 2.5 GHz Measure Time: Coupled IF Bandwidth: 100 kHz ESIX Transducer: dBuV to dBm Receiver: None System Transducer: None Lin Add. Transd. 1: EN713D 10/20 -- Add. Transd. 2: None 1 Add. Transd. 3: None Signal Path: Meas. Mode: Tracking Gen.: Input: Preamplifier: Off Op. Range: \_\_\_ Normal Preselection: Off RF Att.: 10.0 dBm Rep. by Device: Ref. Level: \_ \_ \_ Min. RF Att.: -- Option: IF Att.: -- Video Bandwidth: 10 MHz Curve 1: On Repetition: 10 Curve 2: Off Stop Mark: Off Curve 3: Off Stop Message: Off Curve 4: Off Stop Message: Subrange 5: 2.5 GHz Start Frequency: 18.0 GHz Stop Frequency: Measure Time: Coupled 100 kHz IF Bandwidth: ESIX Transducer: Receiver: dBuV to dBm Signal Path: None System Transducer: None Lin Add. Transd. 1: EN713E 10/20 Meas. Mode: -- Add. Transd. 2: Tracking Gen.: None Input: 1 Add. Transd. 3: None Preamplifier: Off Op. Range: \_ \_ **Retlif Testing Laboratories** Report No. R-3248P-1

RF Att.: Ref. Level: Min. RF Att.: IF Att.:	20 dB -10.0 dBm  	Preselection: Rep. by Device: Option: Video Bandwidth:	Off   10 MHz
Curve 1: Curve 2: Curve 3: Curve 4:	On Off Off Off	Repetition: Stop Mark: Stop Message: Stop Message:	10 Off Off
Subrange 6:			
Start Frequency: Stop Frequency: Measure Time: IF Bandwidth:	18.0 GHz 25.0 GHz Coupled 100 kHz		
Receiver: Signal Path: Meas. Mode: Tracking Gen.: Input:	ESIX None Lin  1	Transducer: System Transducer: Add. Transd. 1: Add. Transd. 2: Add. Transd. 3:	dBuV to dBm None 40G EN713E 3/21 None None
Preamplifier: RF Att.: Ref. Level: Min. RF Att.: IF Att.:	Off 20 dB -10.0 dBm  	Op. Range: Preselection: Rep. by Device: Option: Video Bandwidth:	 Off  10 MHz
Curve 1: Curve 2: Curve 3: Curve 4:	On Off Off Off	Repetition: Stop Mark: Stop Message: Stop Message:	10 Off Off



**Retlif Testing Laboratories** 

FCC Part 15.247, Paragraph (d) Test Data, Out of Band Emissions in Restricted Band, SD-HUB-1-XA



**Retlif Testing Laboratories** 

Customer:	KCF Technologies, Inc		
Test Sample:	IoT Sensor Hub		
Part/Serial Number:	SD-HUB-XA / 1C000007		
Test Specification:	FCC Part 15, Subpart C		
Mode of Operation:	Continuously transmitting a modulated 2.429 GHz signal		
Technician/Date:	S. Macdonald / 9/02/20		
Port Tested:	Antenna		
Notes:	Peak Detector		



Customer:	KCF Technologies, Inc		
Test Sample:	IoT Sensor Hub		
Part/Serial Number:	SD-HUB-XA / 1C000007		
Test Specification:	FCC Part 15, Subpart C		
Mode of Operation:	Continuously transmitting a modulated 2.429 GHz signal		
Technician/Date:	S. Macdonald / 9/02/20		
Port Tested:	Antenna		
Notes:	Peak Detector		



Customer:	KCF Technologies, Inc		
Test Sample:	IoT Sensor Hub		
Part/Serial Number:	SD-HUB-XA / 1C000007		
Test Specification:	FCC Part 15, Subpart C		
Mode of Operation:	Continuously transmitting a modulated 2.443 GHz signal		
Technician/Date:	S. Macdonald / 9/02/20		
Port Tested:	Antenna		
Notes:	Peak Detector		



Customer:	KCF Technologies, Inc		
Test Sample:	IoT Sensor Hub		
Part/Serial Number:	SD-HUB-XA / 1C000007		
Test Specification:	FCC Part 15, Subpart C		
Mode of Operation:	Continuously transmitting a modulated 2.443 GHz signal		
Technician/Date:	S. Macdonald / 9/02/20		
Port Tested:	Antenna		
Notes:	Peak Detector		



Customer:	KCF Technologies, Inc		
Test Sample:	IoT Sensor Hub		
Part/Serial Number:	SD-HUB-XA / 1C000007		
Test Specification:	FCC Part 15, Subpart C		
Mode of Operation:	Continuously transmitting a modulated 2.457 GHz signal		
Technician/Date:	S. Macdonald / 9/02/20		
Port Tested:	Antenna		
Notes:	Peak Detector		



Customer:	KCF Technologies, Inc		
Test Sample:	IoT Sensor Hub		
Part/Serial Number:	SD-HUB-XA / 1C000007		
Test Specification:	FCC Part 15, Subpart C		
Mode of Operation:	Continuously transmitting a modulated 2.457 GHz signal		
Technician/Date:	S. Macdonald / 9/02/20		
Port Tested:	Antenna		
Notes:	Peak Detector		



FCC Part 15.247, Paragraph (d) Sweep Table, Out of Band Emissions in Restricted Band, SD-HUB-1-XA



**Retlif Testing Laboratories** 

## SWEEP TABLE: "R-3248P-1 CE restric"

Unit:	dBµV/m			
	Detector:	Mode:		
Curve 1:	MaxPeak	MaxHold		
Subrange	1:			
Start F Stop Fr Measure IF Band	Frequency: requency: e Time: dwidth:	4.5 GHz 5.2 GHz Coupled 1 MHz		
Receive Signal Meas. M Trackin Input:	er: Path: Mode: ng Gen.:	ESIX None Lin  1	Transducer: System Transducer: Add. Transd. 1: Add. Transd. 2: Add. Transd. 3:	FCC Rest Band 3m2dBi None EN713E 10/20 None None
Preampl RF Att. Ref. Le Min. RF IF Att.	Lifier: .: evel: 7 Att.: .:	Off 20 dB -10.0 dBm  	Op. Range: Preselection: Rep. by Device: Option: Video Bandwidth:	 Off  10 MHz
Curve 1 Curve 3 Curve 4	L: 3: 1:	On Off Off	Repetition: Stop Mark: Stop Message: Stop Message:	Continuous Off Off
Subrange	2:			
Start F Stop Fr Measure IF Band	Frequency: cequency: e Time: dwidth:	7.3 GHz 7.8 GHz Coupled 1 MHz		
Receive Signal Meas. M Trackir Input:	er: Path: Mode: ng Gen.:	ESIX None Lin  1	Transducer: System Transducer: Add. Transd. 1: Add. Transd. 2: Add. Transd. 3:	FCC Rest Band 3m2dBi None EN713E 10/20 None None
Preampl RF Att. Ref. Le Min. RF IF Att.	lifier: : evel: 7 Att.: .:	Off 20 dB -10.0 dBm  	Op. Range: Preselection: Rep. by Device: Option: Video Bandwidth:	 Off  10 MHz
Curve 1 Curve 3 Curve 4	L: 3: 1:	On Off Off	Repetition: Stop Mark: Stop Message: Stop Message:	Continuous Off Off

**Retlif Testing Laboratories** 

FCC 15.247(e) Test Data, Power Spectral Density, SD-HUB-1-MA



**Retlif Testing Laboratories** 

EMISSIONS TEST DATA SHEET		
Test Specification:	FCC Part 15, Subpart C Paragraph: 15.247 (e)	
Method:	ANSI C63.10, Section 11.10.2 Maximum power spectral density level in the fundamental emission	
Job Number/Customer:	R-3248P-1 / KCF Technologies, Inc	
Test Sample:	IoT Sensor Hub	
Part Number:	SD-HUB-1-MA	
Serial Number:	1C00002D	
Operating Mode:	Continuously transmitting a modulated signal at 2429 MHz	
Technician:	S. Macdonald	
Date(s):	8/31/20	
Temperature:	21.6 °C	
Relative Humidity:	49.5 %	
Notes:	Power Density = -10.21 dBm + 10.79 dB (attenuator) = 0.58 dBm	



Report No. R-3248P-1

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EMISSIONS TEST DATA SHEET		
Test Specification:	FCC Part 15, Subpart C Paragraph: 15.247 (e)	
Method:	ANSI C63.10, Section 11.10.2 Maximum power spectral density level in the fundamental emission	
Job Number/Customer:	R-3248P-1 / KCF Technologies, Inc	
Test Sample:	IoT Sensor Hub	
Part Number:	SD-HUB-1-MA	
Serial Number:	1C00002D	
Operating Mode:	Continuously transmitting a modulated signal at 2443 MHz	
Technician:	S. Macdonald	
Date(s):	8/31/20	
Temperature:	21.6 °C	
Relative Humidity:	49.5 %	
Notes:	Power Density = -8.50 dBm + 10.79 dB (attenuator) = 2.29 dBm	



EMISSIONS TEST DATA SHEET		
Test Specification:	FCC Part 15, Subpart C Paragraph: 15.247 (e)	
Method:	ANSI C63.10, Section 11.10.2 Maximum power spectral density level in the	
	fundamental emission	
Job Number/Customer:	R-3248P-1 / KCF Technologies, Inc	
Test Sample:	IoT Sensor Hub	
Part Number:	SD-HUB-1-MA	
Serial Number:	1C00002D	
Operating Mode:	Continuously transmitting a modulated signal at 2457 MHz	
Technician:	S. Macdonald	
Date(s):	8/31/20	
Temperature:	21.6 °C	
Relative Humidity:	49.5 %	
Notes:	Power Density =9.95 dBm + 10.79 dB (attenuator) = 0.84 dBm	


FCC 15.247(e) Test Data, Power Spectral Density, SD-HUB-1-XA



**Retlif Testing Laboratories** 





	EMISSIONS TEST DATA SHEET
Test Specification:	FCC Part 15, Subpart C Paragraph: 15.247 (e)
Method:	ANSI C63.10, Section 11.10.2 Maximum power spectral density level in the fundamental emission
Job Number/Customer:	R-3248P-1 / KCF Technologies, Inc
Test Sample:	IoT Sensor Hub
Part Number:	SD-HUB-1-XA
Serial Number:	1C000007
Operating Mode:	Continuously transmitting a modulated signal at 2443 MHz
Technician:	S. Macdonald
Date(s):	8/31/20
Temperature:	21.6 °C
Relative Humidity:	49.5 %
Notes:	Power Density =10.61 dBm + 10.79 dB (attenuator) = 0.18 dBm







FCC Part 15, Subpart C, Section 15.207, Test Data, Conducted Limits, SD-HUB-1-MA



**Retlif Testing Laboratories** 

	EMISSIONS TEST DATA SHEET
Test Specification:	FCC Part 15, Subpart C, Section 15.207, Conducted Emissions
Method:	ANSI C63.4, Section 7., AC power-line conducted emission measurements
Job Number/Customer:	R-3248P-1 / KCF Technologies, Inc.
Test Sample:	IoT Sensor Hub
Part Number:	SD-HUB-1-MA
Serial Number:	1C000006
Operating Mode:	Broadcasting Data at 60 Second Intervals
Technician:	M. Nowak
Date(s):	8/25/20
Temperature:	22.5 ℃
Relative Humidity:	49.9 %
Lead Tested:	120 VAC, 60 Hz, Hot
The frequency range was scar	nned from 0.15 MHz to 30 MHz.
The six highest emissions rela	tive to the limit are presented

Frequency	Detector	Meter Reading	Total Correction Factor	Corrected Reading	Limit	Margin
MHz	-	dBµV	dB	dBµV	dBµV	dB
0.4290	Peak	41.1	10.1	51.2*	-	-
0.4290	Quasi-Peak	31.9	10.1	42.0	57.3	15.3
0.4290	Average	21.0	10.1	31.1	47.3	16.2
0.6497	Peak	42.5	10.1	52.6*	_	
0.6497	Quasi-Peak	32.9	10.1	43.0	56.0	13.0
0.6497	Average	30.0	10.1	40.1	46.0	5.9
0.9667	Peak	48.1	10.1	58.2*	-	
0.9667	Quasi-Peak	38.7	10.1	48.8	56.0	7.2
0.9667	Average	26.4	10.1	36.5	46.0	9.5
1.9593	Peak	39.4	10.2	49.6*	_	
1.9593	Quasi-Peak	29.1	10.2	39.3	56.0	16.7
1.9593	Average	15.4	10.2	25.6	46.0	20.4
18.4584	Peak	38.1	10.5	48.6*	_	
18.4584	Quasi-Peak	25.8	10.5	36.3	60.0	23.7
18.4584	Average	10.4	10.5	20.9	50.0	29.1
25.2400	Peak	41.9	10.6	52.5*	-	-
25.2400	Quasi-Peak	30.1	10.6	40.7	60.0	19.3
25.2400	Average	15.0	10.6	25.6	50.0	24.4

\* Peak measurements are recorded for informational purposes only.



**Retlif Testing Laboratories** 

	EMISSIONS TEST DATA SHEET
Test Specification:	FCC Part 15, Subpart C, Section 15.207, Conducted Emissions
Method:	ANSI C63.4, Section 7., AC power-line conducted emission measurements
Job Number/Customer:	R-3248P-1 / KCF Technologies, Inc.
Test Sample:	IoT Sensor Hub
Part Number:	SD-HUB-1-MA
Serial Number:	1C000006
Operating Mode:	Broadcasting Data at 60 Second Intervals
Technician:	M. Nowak
Date(s):	8/25/20
Temperature:	22.5 °C
Relative Humidity:	49.9 %
Lead Tested:	120 VAC, 60 Hz, Neutral
The frequency range was scar	nned from 0.15 MHz to 30 MHz.
The six highest emissions related	tive to the limit are presented

Frequency	Detector	Meter Reading	Total Correction Factor	Corrected Reading	Limit	Margin
MHz	-	dBµV	dB	dBµV	dBµV	dB
0.2808	Peak	41.0	10.1	51.1*	—	-
0.2808	Quasi-Peak	31.7	10.1	41.8	60.8	19.0
0.2808	Average	23.1	10.1	33.2	50.8	17.6
0.4215	Peak	43.5	10.1	53.6*	_	
0.4215	Quasi-Peak	33.8	10.1	43.9	57.4	13.5
0.4215	Average	23.5	10.1	33.6	47.4	13.8
0.5896	Peak	35.8	10.1	45.9*	_	
0.5896	Quasi-Peak	27.0	10.1	37.1	56.0	18.9
0.5896	Average	24.2	10.1	34.3	46.0	11.7
0.9753	Peak	49.9	10.1	60.0*	_	_
0.9753	Quasi-Peak	39.3	10.1	49.4	56.0	6.6
0.9753	Average	27.4	10.1	37.5	46.0	8.5
18.2961	Peak	46.5	10.5	57.0*	_	-
18.2961	Quasi-Peak	34.4	10.5	44.9	60.0	15.1
18.2961	Average	15.1	10.5	25.6	50.0	24.4
24.7030	Peak	40.0	10.6	50.6*	_	-
24.7030	Quasi-Peak	27.4	10.6	38.0	60.0	22.0
24.7030	Average	13.7	10.6	24.3	50.0	25.7

\* Peak measurements are recorded for informational purposes only.

**Retlif Testing Laboratories** 

Report No. R-3248P-1

®

FCC Part 15, Subpart C, Section 15.207, Test Data, Conducted Limits, SD-HUB-1-XA



**Retlif Testing Laboratories** 

	EMISSIONS TEST DATA SHEET
Test Specification:	FCC Part 15, Subpart C, Section 15.207, Conducted Emissions
Method:	ANSI C63.4, Section 7., AC power-line conducted emission measurements
Job Number/Customer:	R-3248P-1 / KCF Technologies, Inc.
Test Sample:	IoT Sensor Hub
Part Number:	SD-HUB-1-XA
Serial Number:	1C00008
Operating Mode:	Broadcasting Data at 60 Second Intervals
Technician:	M. Nowak
Date(s):	8/25/20
Temperature:	22.5 ℃
Relative Humidity:	49.9 %
Lead Tested:	120 VAC, 60 Hz, Hot
The frequency range was scar	ned from 0.15 MHz to 30 MHz.
The six highest emissions rela-	tive to the limit are presented

Frequency	Detector	Meter Reading	Total Correction Factor	Corrected Reading	Limit	Margin
MHz	-	dBµV	dB	dBµV	dBµV	dB
		1				
0.2833	Peak	38.6	10.1	48.7*	-	-
0.2833	Quasi-Peak	27.7	10.1	37.8	60.7	22.9
0.2833	Average	18.9	10.1	29.0	50.7	21.7
0.4328	Peak	36.8	10.1	46.9*	_	
0.4328	Quasi-Peak	28.8	10.1	38.9	57.2	18.3
0.4328	Average	19.7	10.1	29.8	47.2	17.4
1.0193	Peak	46.3	10.1	56.4*	_	
1.0193	Quasi-Peak	35.7	10.1	45.8	56.0	10.2
1.0193	Average	23.5	10.1	33.6	46.0	12.4
1.9942	Peak	32.7	10.2	42.9*	_	
1.9942	Quasi-Peak	22.6	10.2	32.8	56.0	23.2
1.9942	Average	10.2	10.2	20.4	46.0	25.6
18.4584	Peak	49.6	10.5	60.1*	_	
18.4584	Quasi-Peak	34.3	10.5	44.8	60.0	15.2
18.4584	Average	14.8	10.5	25.3	50.0	24.7
19.9852	Peak	41.9	10.5	52.4*	_	-
19.9852	Quasi-Peak	30.9	10.5	41.4	60.0	18.6
19.9852	Average	14.8	10.5	25.3	50.0	24.7

\* Peak measurements are recorded for informational purposes only.

**Retlif Testing Laboratories** 

	EMISSIONS TEST DATA SHEET
Test Specification:	FCC Part 15, Subpart C, Section 15.207, Conducted Emissions
Method:	ANSI C63.4, Section 7., AC power-line conducted emission measurements
Job Number/Customer:	R-3248P-1 / KCF Technologies, Inc.
Test Sample:	IoT Sensor Hub
Part Number:	SD-HUB-1-XA
Serial Number:	1C00008
Operating Mode:	Broadcasting Data at 60 Second Intervals
Technician:	M. Nowak
Date(s):	8/25/20
Temperature:	22.5 °C
Relative Humidity:	49.9 %
Lead Tested:	120 VAC, 60 Hz, Neutral
The frequency range was scar	nned from 0.15 MHz to 30 MHz.
The six highest emissions related	tive to the limit are presented

Frequency	Detector	Meter Reading	Total Correction Factor	Corrected Reading	Limit	Margin
MHz	-	dBµV	dB	dBµV	dBµV	dB
0.2987	Peak	34.4	10.1	44.5*	-	-
0.2987	Quasi-Peak	25.2	10.1	35.3	60.3	25.0
0.2987	Average	13.4	10.1	23.5	50.3	26.8
0.4405	Peak	36.3	10.1	46.4*	_	-
0.4405	Quasi-Peak	27.5	10.1	37.6	57.1	19.5
0.4405	Average	16.1	10.1	26.2	47.1	20.9
1.0375	Peak	42.3	10.1	52.4*		_
1.0375	Quasi-Peak	32.0	10.1	42.1	56.0	13.9
1.0375	Average	21.2	10.1	31.3	46.0	14.7
18.6221	Peak	46.0	10.5	56.5*		_
18.6221	Quasi-Peak	32.1	10.5	42.6	60.0	17.4
18.6221	Average	14.9	10.5	25.4	50.0	24.6
20.1625	Peak	39.8	10.5	50.3*	_	-
20.1625	Quasi-Peak	29.1	10.5	39.6	60.0	20.4
20.1625	Average	13.6	10.5	24.1	50.0	25.9
25.1432	Peak	42.6	10.6	53.2*		_
25.1432	Quasi-Peak	31.1	10.6	41.7	60.0	18.3
25.1432	Average	16.3	10.6	26.9	50.0	23.1

\* Peak measurements are recorded for informational purposes only.



**Retlif Testing Laboratories** 

FCC Part 15, Subpart B, Section 15.109 (a) Test Data, Digital and Receiver Spurious Emissions, SD-HUB-1-MA



**Retlif Testing Laboratories** 

1001	Specification:	FCC Part 15.	Subpart B. Se	ction 15.109(a)	, Radiated Emi	ssions, Class B	
	Mathad		Castien 0. Das				1_
Lab Norma	Method:	ANSI C63.4,	Section 8, Rad	liated Emission	Measurements	s, 30MHz to 1GF	IZ
	Der/Customer:	R-3248P-1/	KCF LECHNOLO	gies, inc.			
	Test Sample:	IOT Sensor H	du				
	Part Number:	SD-HUB-1-M	A				
3	erial Number:	TC000006	Data at 60 Sa	aand Intonvala			
Ορ	Tachnicion:	M Nowok	Data at 60 Se	cond intervals			
	Data(a):						
	Tomporaturo:	9/3/20					
Pola	tivo Humidity:	23.2 0					
Reid	Detector:						
	Delector.	Quasi-Feak					
lotes. The fr		was scanned fr	rom 30 MHz to	1 GH7			
Noise floor n	neasurement, n	ninimum sensiti	vity of measure	ement system.			
Frequency	Antenna Pol /Height	EUT Orientation	Meter Reading	Correction Factor	Corrected Reading	Converted Reading	Limit
MHz	(V/H) / (m)	Degrees	dBuV	dB	dBuV/m	uV/m	uV/m
30.00							100
I							I
*35.00	H / 1.00	180.0	2.0	12.6	14.6	5.38	
							I
88.00							100
88.00							150
=	H/1.00	180.0	11.4	13.3	24.7	17.18	
*110 00	,	10010		1010			i
*110.00				40.0			
*110.00 I *195.00	H/100	180.0	41	18.9	23.0	14 13	
*110.00 I *195.00	H / 1.00	180.0	4.1	18.9	23.0	14.13	I
*110.00 I *195.00 I 216.00	H / 1.00	180.0	4.1	18.9	23.0	14.13	150
*110.00 I *195.00 I 216.00 216.00	H / 1.00	180.0	4.1	18.9	23.0	14.13	150 200
*110.00 I *195.00 I 216.00 216.00	H / 1.00	180.0	4.1	18.9	23.0	14.13	I 150 200 I
*110.00 I *195.00 I 216.00 216.00 I *218.00	H / 1.00	180.0	4.1	18.9	23.0	14.13	           
*110.00 I *195.00 I 216.00 216.00 I *218.00	H / 1.00	180.0	7.2	18.9	23.0	14.13	   150   200     
*110.00 I *195.00 I 216.00 216.00 I *218.00 I *218.00 I *605.00	H / 1.00	180.0 180.0	4.1   7.2   6.8	18.9	23.0	14.13 10.60	               
*110.00 I *195.00 I 216.00 216.00 I *218.00 I *605.00	H / 1.00 H / 1.00 H / 1.00	180.0 180.0 180.0	4.1     7.2     6.8	18.9	23.0 	14.13 10.60 31.27	 150 200         
*110.00 I *195.00 I 216.00 216.00 I *218.00 I *605.00 I 960.00	H / 1.00 H / 1.00 H / 1.00	180.0 180.0 180.0	4.1   7.2   6.8	18.9 13.3 23.1	23.0 20.5 29.9	14.13 10.60 31.27	 
*110.00 I *195.00 I 216.00 216.00 I *218.00 I *605.00 I 960.00 060.00	H / 1.00 H / 1.00 H / 1.00	180.0 180.0 180.0	4.1   7.2   6.8	18.9	23.0 20.5 29.9	14.13 10.60 31.27	 150 200   
*110.00 I *195.00 216.00 216.00 I *218.00 I *605.00 I 960.00 960.00	H / 1.00 H / 1.00 H / 1.00	180.0 180.0 180.0	4.1   7.2   6.8	18.9	23.0	14.13 10.60 31.27	 150 200                   200 500
*110.00 I *195.00 216.00 216.00 I *218.00 I *605.00 I 960.00 960.00 I	H / 1.00 H / 1.00 H / 1.00	180.0 180.0 180.0	4.1   7.2   6.8	18.9	23.0 20.5 29.9	14.13 10.60 31.27	I 150 200 I I I I 200 500 I I
*110.00 I *195.00 I 216.00 216.00 I *218.00 I *218.00 I *605.00 I 960.00 960.00 I \$995.00	H / 1.00 H / 1.00 H / 1.00 H / 1.00	180.0 180.0 180.0 180.0	4.1 7.2 6.8 5.1	18.9 13.3 23.1 30.2	23.0 20.5 29.9 35.3	14.13 10.60 31.27 58.22	I 150 200 I I I 1 200 500 I I I
*110.00 I *195.00 216.00 216.00 I *218.00 I *605.00 I 960.00 960.00 I *995.00 I *005.00 I	H / 1.00 H / 1.00 H / 1.00 H / 1.00	180.0 180.0 180.0 180.0	4.1   7.2   6.8   5.1	18.9 13.3 23.1 30.2	23.0 20.5 29.9 35.3	14.13 10.60 31.27 58.22	 

FCC Part 15, Subpart B, Section 15.109 (a) Test Data, Digital and Receiver Spurious Emissions, SD-HUB-1-XA



**Retlif Testing Laboratories** 

1631	Specification:	FCC Part 15.	Subpart B. Se	ction 15.109(a)	, Radiated Emi	ssions. Class B	
	Mathad						1_
Lab Maria	Method:	ANSI C63.4,	Section 8, Rad	liated Emission	Measurements	s, 30MHz to 1GF	IZ
	Der/Customer:	R-3248P-1/		gies, inc.			
	Test Sample:	IOT Sensor H					
	Part Number:	SD-HUB-1-X	A				
3	erial Number:	TC000008	Data at 60 Sa	aand Intonyala			
Op	Tachnician	M Nowek	Data at 60 Se				
	Data(a):						
	Tomporaturo:	9/3/20					
Rola	tive Humidity:	83 %					
Itela	Detector:	Ouasi-Peak					
	Detector:	3m					
lotes: The fr	equency range	was scanned fi	om 30 MHz to	1 GHz			
Noise floor n	neasurement, n	ninimum sensitiv	vity of measure	ement system.			
Frequency	Antenna Pol /Height	EUT Orientation	Meter Reading	Correction Factor	Corrected Reading	Converted Reading	Limit
MHz	(V/H) / (m)	Degrees	dBuV	dB	dBuV/m	uV/m	uV/m
30.00							100
*35.00	H / 1.00	180.0	2.0	12.6	14.6	5.38	I
88.00							100
88.00							150
							1
*110.00	H/100	180.0	11.4	13.3	24 7	17 18	
	117 1.00	100.0		10.0	2	17.10	i
110.00		100.0	4 1	18.9	23.0	14 13	1
110.00 I *195.00	H/100	180.0		10.0			•
110.00 I *195.00	H / 1.00	180.0			20.0		
110.00 I *195.00 I 216.00	H / 1.00	180.0			20.0		l 150
110.00 I *195.00 I 216.00 216.00	H / 1.00	180.0			20.0		l 150 200
I 10.00 I *195.00 I 216.00 216.00	H / 1.00	180.0			20.0		 150 200 
I 10.00 I *195.00 I 216.00 216.00 I *218.00	H / 1.00	180.0	72	13.3	20.5	10.60	 150 200   
I 10.00 I *195.00 I 216.00 216.00 I *218.00	H / 1.00 H / 1.00	180.0	7.2	13.3	20.5	10.60	 150 200     
I 10.00 I *195.00 I 216.00 216.00 I *218.00 I *605.00	H / 1.00 H / 1.00	180.0	7.2	13.3	20.5	10.60	 150 200         
I 10.00 I *195.00 I 216.00 216.00 I *218.00 I *605.00	H / 1.00 H / 1.00 H / 1.00	180.0 180.0 180.0	7.2 6.8	13.3	20.5	10.60	 150 200           
I 10.00 I *195.00 I 216.00 216.00 I *218.00 I *605.00 I 960.00	H / 1.00 H / 1.00 H / 1.00	180.0	7.2 6.8	13.3	20.5	10.60	 150 200   
I 10.00 I *195.00 I 216.00 216.00 I *218.00 I *605.00 I 960.00	H / 1.00 H / 1.00 H / 1.00	180.0	7.2 6.8	13.3	20.5	10.60	 150 200   
I 10.00 I *195.00 I 216.00 216.00 I *218.00 I *605.00 I 960.00 960.00	H / 1.00 H / 1.00 H / 1.00	180.0	7.2 6.8	13.3	20.5	10.60	 150 200           200 500
I 10.00 I *195.00 I 216.00 216.00 I *218.00 I *218.00 I *605.00 I 960.00 960.00 I \$005.00	H / 1.00 H / 1.00 H / 1.00	180.0	7.2 6.8	13.3	20.5	10.60	 150 200           200 500 
I 10.00 I *195.00 I 216.00 216.00 I *218.00 I *605.00 I 960.00 960.00 I \$995.00	H / 1.00 H / 1.00 H / 1.00 H / 1.00	180.0 180.0 180.0 180.0	7.2 6.8 5.1	13.3 23.1 30.2	20.5	10.60 31.27 58.22	 150 200         1   200 500     
I 10.00 I *195.00 I 216.00 216.00 I *218.00 I *605.00 I 960.00 960.00 I *995.00 I 4000.00	H / 1.00 H / 1.00 H / 1.00 H / 1.00	180.0 180.0 180.0 180.0	7.2 6.8 5.1	13.3 23.1 30.2	20.5 29.9 35.3	10.60 31.27 58.22	 150 200         100 500           

