

*Testing Tomorrow's Technology*

**Class 2 Permissive Change Test Report**

**For**

**Part 2, Subpart J, Paragraph 2.907 Equipment Authorization of Certification for an Intentional Radiator per Part 15, Subpart C, paragraphs 15.207, 15.209 and Part 15, Subpart F, paragraph 15.509**

**And**

**Innovation, Science, and Economic Development Canada  
Certification Per  
Industry Canada, RSS-GEN Issue 5, April 2018 General Requirements for  
Compliance of Radio Apparatus  
And  
Industry Canada RSS-220 Issue 1+ Amd 1, July 2018 Devices Using Ultra-  
Wideband (UWB) Technology**

**For the**

**Headsight, Inc.**

**Terrahawk  
Model: HT5200 and HT5230**

**FCC ID: 2AEP2-THAWK1  
IC: 20168-THAWK1**

**UST Project: 20-0112  
Report Issue Date: April 17, 2020**

Total Pages in This Report: 24


**3505 Francis Circle Alpharetta, GA 30004  
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I certify that I am authorized to sign for the Test Agency and that all of the statements in this report and in the Exhibits attached hereto are true and correct to the best of my knowledge and belief:

US TECH (Agent Responsible For Test):

By: Alan Ghasiani

Name: 

Title: Compliance Engineer – President

Date: April 17, 2020



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### MEASUREMENT TECHNICAL REPORT

**COMPANY NAME:** Headsight, Inc.  
**MODEL:** HT5200 and HT5230  
**FCC ID:** 2AEP2-THAWK1  
**IC:** 20168-THAWK1  
**DATE:** April 17, 2020

This report concerns (check one): Original grant  
Class 2 change

Equipment type: UWB Transmitter, GPR device

Deferred grant requested per 47 CFR 0.457(d)(1)(ii)?    yes\_\_\_\_\_ No X

If yes, defer until: N/A  
date

agrees to notify the Commission by N/A  
date

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

Report prepared by:

US Tech  
3505 Francis Circle  
Alpharetta, GA 30004

Phone Number: (770) 740-0717  
Fax Number: (770) 740-1508

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## **1 General Information**

### **1.1 Purpose of this Report**

This report is prepared to show that the modifications made to the EUT do not impact the performance of the EUT in such a way that it would warrant full retesting and submittal of new test data according to the FCC Rules and Regulations Part 15, Section 509, 521, 525 and based on the FCC Waiver docket DA 17-207, released March 1, 2017.

The modifications consist of the following:

DNI/De-population:

- C61, C49, R4, C57

Replaced components:

- C51 replaced with 100 pF (p/n: 500R07N101JV4T)
- L1 with 15nH (HK100515NJ-T)
- U9 with TQP3M9037 (this is a drop in replacement for the QPL9503SR that was replaced)

Addition of a version of the device with external USB port access. The previous design did not allow the USB port to be accessible by the user therefore a second version of the unit has been designed that will allow the USB port to be accessible. The change involves adding an access port to the device enclosure; no other mechanical or electrical changes were made.

The changes made do not affect the electrical characteristics of the device. The previously reported modulation and frequency determining circuitry remain the same. No radio parameters changed.

### **1.2 Characterization of Test Sample**

The sample used for testing was received by US Tech on February 25, 2020 in good operating condition.

### **1.3 Product Description**

The Equipment under Test (EUT) is the Headsight, Inc. Terrahawk, Model HT5200 and HT5230. The difference between the two models is that the HT5200 will not have the USB port accessible and the HT5230 will have an accessible USB port. Besides having an access port, both models are exactly identical. The EUT is a DC powered, non-contact radar height sensor used exclusively on mobile agricultural equipment to determine the distance between the ground and mounting

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position. The EUT is normally mounted between 1 inch and 12 feet above the ground and during operation is always positioned to emit towards the ground. The EUT includes one user access port to connect a USB cable to the device for data acquisition purposes.

Frequency of operation: 1.510 GHz to 6.425 GHz  
Center Frequency: 3.9675 GHz  
Maximum Radiated Emission Frequency: 5.209 GHz  
Number of channels: 1 ch  
Antenna Type: Flat Earth Planar Modified Bowtie Antenna  
Antenna Gain: 4 to 6.0 dBi  
Firmware version: Onyx339c

For testing the EUT with USB access port, HT5230, was tested in a dual configuration, where two EUT were separated by 1.5 m from each other. The EUT was also tested at two different heights, 1.0 m and 3.7 m. This data is collected as the representative data to cover both versions of the EUT.

#### **1.4 Configuration of Tested System**

The Test Sample was tested per *ANSI C63.10:2013, American National Standard of Procedures for Compliance Testing of Unlicensed Wireless Devices (2013)* and per FCC Part 15 Subpart F.

A list of EUT and Peripherals is found in Table 1 below. A block diagram of the tested system is shown in Figure 1. Test configuration photographs are provided in separate Appendices.

#### **1.5 Test Facility**

Testing was performed at US Tech's measurement facility at 3505 Francis Circle, Alpharetta, GA 30004. This site has been fully described and registered with the FCC, with designation number US5301.

#### **1.6 Related Submittals**

No related submittals were made by US Tech.

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**Table 1. EUT and Peripherals**

PERIPHERAL MANUFACTURER.	MODEL NUMBER	SERIAL NUMBER	FCC/IC ID	CABLES P/D
Headsight, Inc.	HT5230	1500653, 1550055	FCC ID: 2AEP2-THAWK1 IC: 20168- THAWK1	1 m U P
Antenna See antenna details	--	--	--	--
Laptop computer	Dell	Various	Various	1.5 m U P

U= Unshielded  
S= Shielded  
P= Power  
D= Data



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## 2 Tests and Measurements

### 2.1 Test Equipment

The table below lists test equipment used to evaluate this product. Model numbers, serial numbers and their calibration status are indicated.

**Table 2. Test Instruments**

TEST INSTRUMENT	MODEL NUMBER	MANUFACTURER	SERIAL NUMBER	CALIBRATION DUE DATE
SPECTRUM ANALYZER	E4407B	AGILENT	US41442935	8/17/2020 2 yr.
SPECTRUM ANALYZER	8593E	HEWLETT PACKARD	3205A00124	1/29/2022 2 yr.
HORN ANTENNA	3115	EMCO	9107-3723	11/28/2020 2 yr
LOG PERIODIC ANTENNA	3146	EMCO	9305-3600	2/1/2021 2 yr.
BICONICAL ANTENNA	3110B	EMCO	9306-1708	6/27/2021 2 yr
LOOP ANTENNA	6502	ETS Lindgren	9810-3246	4/6/2022 2 yr
PRE-AMPLIFER	8447D	HEWLETT-PACKARD	1937A02980	5/7/2020
PRE-AMPLIFER	8447E	HEWLETT-PACKARD	1937A01828	5/7/2020
PRE-AMPLIFER	8449B	HEWLETT-PACKARD	3008A00480	4/8/2020*

Note: The calibration interval of the above test instruments are 12 months unless stated otherwise and all calibrations are traceable to NIST/USA.

\*All Testing completed before 4/8/2020.

### 2.2 Modifications to EUT Hardware

No physical modifications were made by US Tech in order to bring the EUT into compliance with FCC Part 15, Subpart F Intentional Radiator Limits for the transmitter portion of the EUT.

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## **2.3 Frequency Range of Radiated Measurements (Part 15.33, 15.521(h))**

### **2.3.1 Intentional Radiator**

The spectrum shall be investigated for the intentional radiator from the lowest RF signal generated in the EUT, without going below 9 kHz to the 5<sup>th</sup> harmonic of the peak level of fundamental frequency generated or 40 GHz, whichever is the lowest.

The highest frequency used to determine the frequency range over which measurements are made shall be based on the center frequency (fc). If the center frequency is less than 10 GHz there is no requirement to measure beyond 40 GHz.

## **2.4 Measurement Detector Function and Bandwidth (CFR 15.35, RSS-220 Section 7)**

The radiated and conducted emissions limits shown herein are based on the following:

FCC Part 15.207, 15.209, 15.509 and RSS-220 Section 6.2.1

### **2.4.1 Detector Function and Associated Bandwidth**

On frequencies below 1000 MHz, the limits herein are based upon measurement equipment employing a CISPR Quasi-peak detector function and related measurement bandwidths (i.e. 9 kHz from 150 kHz to 30 MHz and 120 kHz from 30 MHz to 1000 MHz). Alternatively, measurements may be made with equipment employing a peak detector function as long as the same bandwidths specified for the Quasi-peak device are used.

### **2.4.2 Corresponding Peak and Average Requirements**

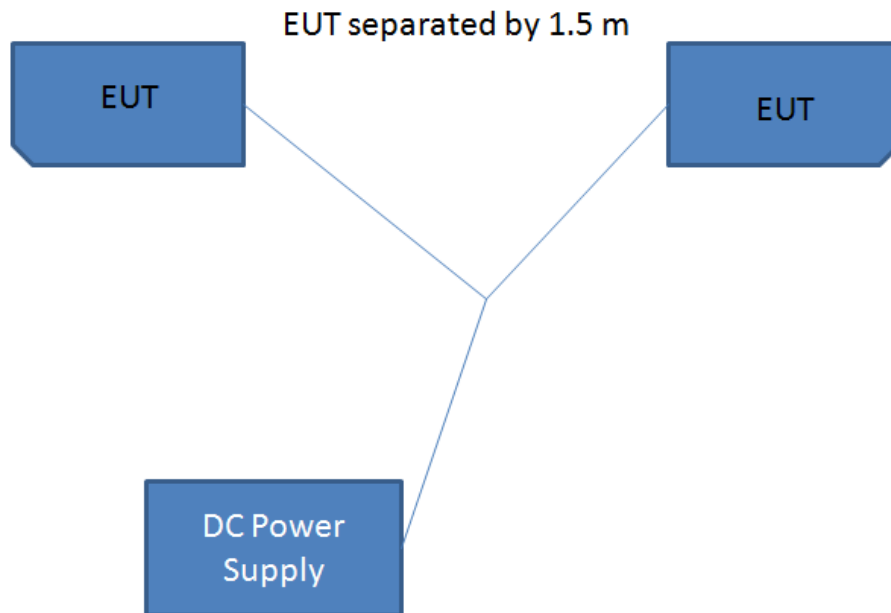
Above 1000 MHz, radiated limits are based on measuring instrumentation employing an average detector function. When average radiated emissions are specified there is also a corresponding Peak requirement, as measured using a peak detector, of 20 dB greater than the average limit. For all measurements above 1000 MHz the Resolution Bandwidth shall be at least 1 MHz.

## 2.5 EUT Antenna Requirements (CFR 15.203, RSS-Gen 6.8)

An intentional radiator shall be designed to ensure that no antenna other than that furnished by the responsible party shall be used with the device. The use of a permanently attached antenna or of an antenna that uses a unique coupling to the intentional radiator shall be considered sufficient to comply with the provisions of this section. Only the antenna(s) listed in Table 4 will be used with this module.

**Table 3. Allowed Antenna(s)**

REPORT REFERENCE	MANUFACTURER	TYPE OF ANTENNA	MODEL	GAIN dB <sub>i</sub>	TYPE OF CONNECTOR
Antenna	Flat Earth, Inc	Bowtie	BT6100	4.0 to 6.0dBi	Internally connected



**Figure 1. Block Diagram of Test Configuration**

Note: EUT was tested in a dual configuration.

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## 2.6 Restricted Bands of Operation (Part 15.205, RSS-Gen 8.10)

Only spurious emissions can fall in the frequency bands of CFR 15.205. The field strength of these spurious cannot exceed the limits of 15.209. Radiated harmonics and other Spurious are examined for this requirement see paragraph 2.1

## 2.7 Intentional Radiator, Power Line Conducted Emissions (CFR 15.207, RSS-Gen 8.8)

The EUT is battery powered. The EUT is indirectly connected the AC mains for testing purposes only. During normal operation the EUT is battery powered and will not be operated while directly or indirectly connected to the AC mains. This test was not applicable.

## 2.8 Intentional Radiator, Radiated Emissions (CFR 15.509 (f), 15.521 (g), RSS-220 Section 6.2.1, RSS-Gen 8.9)

UWB devices where the highest radiated emission,  $f_M$  (The frequency at which the highest radiated emission occurs), is above 960 MHz have a limit on the peak level of the emission within a 50 MHz bandwidth of 0 dBm EIRP. A different RBW was used, therefore the peak emissions limit was adjusted per CFR 15.521 (g). The limit was also converted to peak field strength at 3 meters.

The antenna was positioned as it would be in normal operation and the fundamental emission was maximized to ensure the maximum reading and measured with the receiving antenna in both horizontal and vertical position. Below is the measured peak radiated emission at 3 meters.

RBW used: 1 MHz

$$\begin{aligned} \text{Peak EIRP Limit} &= 20 \log (\text{RBW}/50) \text{ dBm EIRP} \\ &= 20 \log (1/50) \text{ dBm EIRP} \\ &= -33.97 \text{ dBm EIRP} \end{aligned}$$

$$\begin{aligned} \text{Peak Field Strength Limit} &= -33.97 \text{ dBm EIRP} + 95.2 \\ &= 61.22 \text{ dBuV/m} \end{aligned}$$

The EUT was tested at both 1.0 meter and 3.7 meter heights. The worst case emission was recorded at a height of 1.0 meter. That data is presented following.

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**Table 4. Intentional Radiated Emissions (CFR 15.509 (f), RSS-220 Sect 6.2.1)**

Frequency (MHz)	Distance / Polarization	Raw Test Data (dBuV)	Correction Factors (dB/m)	Results (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Detection
5188.00	3.0m./VERT	45.88	-10.10	35.78	62.2	26.4	PK
5188.00	3.0m./HORZ	42.47	-9.91	32.56	62.2	29.6	PK

Note: Worst Case fundamental reading recorded at 1.0 meter configuration.

Sample Calculation at 5000 MHz:

Raw Test Data	45.88	dBuV
+ Correction Factors	-10.10	dBm
Results	35.78	dBuV/m

Test Date: March 31, 2020

Tested By  
 Signature: *Afzal Fazal*

Name: Afzal Fazal

### 2.8.1 Pulse Repetition Frequency and Duty Cycle

The device employs pulse modulation and has a repetition rate of 41.66 Hz. The pulse signal has been verified below.

Pulse Rate: 37.0 Hz  
 Period= 27 mSec  
 Frequency= 1/seconds= 1/0.027 secs = 37.0 Hz

Duty Cycle correction factor: -15.1 dB  
 $20 \log (TX_{on}/TX_{on}+TX_{off}) = 20 \log (4.75ms/27ms) = -15.1 \text{ dB}$

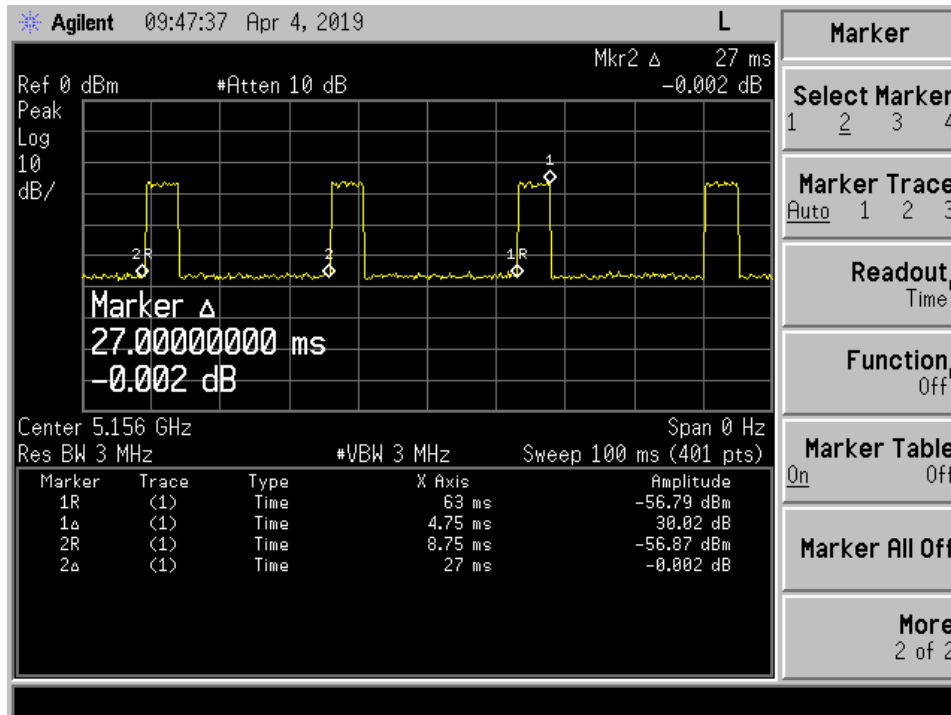


Figure 2. Pulse Repetition Frequency

Note: Duty cycle was not changed therefore this test was not repeated.

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## **2.9 UWB Purpose, Part 90 License, and Coordination (CFR 15.509 (b))**

The EUT, operating under CFR 15.509, is limited to GPR and wall imaging systems operating under the FCC Waiver agreement, DA 17-207, Waiver conditions. The details of the waiver conditions are include as a separate exhibit.

Based on the waiver, operation of this device shall be limited to parties eligible for licensing under the provisions of Part 90 of the Commission's rules (e.g. persons regularly involved in activities such as the operation of farms, ranches, or similar land areas, for the quantity production of crops or plants; including soil plowing, soil conditioning, seeding, fertilizing, or harvesting for agricultural activities. No operation in city gardens or on trees is permitted.

## **2.10 Remote Switch (CFR 15.509 (c), RSS-220 Section 6.2.1(b))**

A GPR that is designed to operate while being hand-held or a wall-imaging system must contain a manually operated switch or a remote switch that causes the transmitter to cease operation within 10 seconds of being released.

Since the EUT is not hand-held, and is not a wall-imaging system, it is exempt from this requirement.

## **2.11 Unintentional Radiator, Power line Emissions (CFR 15.207, 15.521 (j), RSS-Gen 8.8)**

This EUT will not have access to the AC Main power line; therefore this requirement is not applicable.

## **2.12 Radiated Emissions at or Below 960 MHz (CFR 15.509 (d), 15.209, RSS-Gen 8.9)**

The radiated emissions at or below 960 MHz from the transmitter shall not exceed the emissions levels in CFR 15.209. Furthermore the emissions due to the digital circuitry of the EUT must also comply with the limits for 15.109.

EUT was tested in dual configuration at two different heights. The test results are presented below.

The worst-case radiated emission for the EUT in the range of below 960 MHz was 3.4 dB below the limit at 750.00 MHz at a test height of 1.0m. All other radiated emissions were at least 6.0 dB below the limits. This data can be found in the tables below.

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**Table 5. Radiated Emissions Test Data below 960 MHz @ 1.0 m**

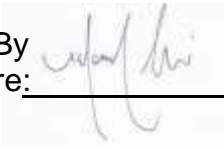

30 MHz to 960 MHz							
Test: Radiated Emissions				Client: Headsight, Inc.			
Project: 20-0112				Model: HT5230			
Frequency (MHz)	Test Data (dBuV)	AF+CA-AMP (dB/m)	Results (dBuV/m)	Limits (dBuV/m)	Antenna Distance/Polarization	Margin (dB)	Detector PK or QP
0.615	64.59	1.22	65.81	71.8	3m./LOOP	6.0	PK
34.88	48.26	-24.10	24.16	39.0	3m./VERT	14.8	QP
230.06	56.63	-19.36	37.27	46.4	3m./HORZ	9.1	QP
230.08	63.36	-23.83	39.53	46.4	3m./VERT	6.9	PK
269.72	56.25	-17.29	38.96	46.4	3m./HORZ	7.4	PK
300.01	58.20	-20.30	37.90	46.4	3m./VERT	8.5	PK
449.98	53.21	-13.07	40.14	46.4	3m./HORZ	6.3	QP
450.00	59.19	-17.99	41.20	46.4	3m./VERT	5.2	QP
550.11	49.15	-10.91	38.24	46.4	3m./HORZ	8.2	PK
600.00	54.01	-15.20	38.81	46.4	3m./VERT	7.6	PK
750.00	43.64	-6.75	36.89	46.4	3m./HORZ	9.5	QP
750.00	53.06	-11.63	41.43	46.4	3m./VERT	5.0	QP
900.00	49.64	-10.98	38.66	46.4	3m./VERT	7.7	PK

All other emission found are 20 dB or greater from the applicable limit.  
 All emissions from the lowest operating clock frequency to 30 MHz were at greater than 20 dB from the applicable limits.

Sample Calculation at 34.88 MHz:

Magnitude of Measured Frequency	48.26 dBuV
+Antenna Factor + Cable Loss+ Amplifier Gain	-24.10 dB/m
Corrected Result	24.16 dBuV/m

Test Date: March 13, 2020

Tested By  
 Signature:  

Name: Mark Afroози; Afzal Fazal



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**Table 6. Radiated Emissions Test Data below 960 MHz @ 3.7 m**

30 MHz to 960 MHz							
Test: Radiated Emissions				Client: Headsight, Inc.			
Project: 20-0112				Model: HT5230			
Frequency (MHz)	Test Data (dBuV)	AF+CA-AMP (dB/m)	Results (dBuV/m)	Limits (dBuV/m)	Antenna Distance/ Polarization	Margin (dB)	Detector PK or QP
0.615	52.92	11.72	64.64	71.8	3m./LOOP	7.2	PK
41.23	50.50	-26.13	24.37	39.0	3m./VERT	14.6	QP
60.05	60.60	-28.33	32.27	39.0	3m./VERT	6.7	QP
65.84	57.02	-27.35	29.67	39.0	3m./HORZ	9.3	PK
72.07	54.06	-27.55	26.51	39.0	3m./HORZ	12.5	QP
72.07	53.68	-28.15	25.53	39.0	3m./VERT	13.5	QP
83.98	55.03	-27.29	27.74	39.0	3m./HORZ	11.3	QP
83.98	53.75	-27.09	26.66	39.0	3m./VERT	12.3	QP
90.11	56.97	-27.16	29.81	43.5	3m./HORZ	13.7	PK
133.66	58.69	-23.83	34.86	43.5	3m./VERT	8.6	PK
168.02	55.48	-22.12	33.36	43.5	3m./VERT	10.1	PK
186.50	52.02	-21.40	30.62	43.5	3m./VERT	12.9	PK
200.46	52.75	-24.14	28.61	43.5	3m./VERT	14.9	PK
330.30	54.12	-20.72	33.40	46.4	3m./HORZ	13.0	PK
396.02	53.62	-20.16	33.46	46.4	3m./VERT	12.9	PK

All other emission found are 20 dB or greater from the applicable limit.  
 All emissions from the lowest operating clock frequency to 30 MHz were at greater than 20 dB from the applicable limits.

Sample Calculation at 41.23 MHz:

Magnitude of Measured Frequency	50.50 dBuV
+Antenna Factor + Cable Loss+ Amplifier Gain	-26.13 dB/m
Corrected Result	24.37 dBuV/m

Test Date: March 14, 2020

Tested By  
 Signature: 

Name: Afzal Fazal

US Tech Test Report:  
FCC ID:  
IC:  
Test Report Number:  
Issue Date:  
Customer:  
Model:

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### 2.13 Radiated Emissions above 960 MHz (CFR 15.509 (d), 15.521(d,g,h), RSS-220 Section 6.2.1(d))

The radiated emissions above 960 MHz from the transmitter shall comply with the AVG limits in Table 5 when measured using a resolution bandwidth of 1 MHz. The following are the worst case emissions with the receiving antenna in both horizontal and vertical polarities. The emissions were maximized using a Peak Detector, and the final measurement was taken using an Average Detector.

**Table 7. Radiated Emissions above 960 MHz, CFR 15.509 (d), 15.521(g), RSS-220 Section 6.2.1(d)**

Frequency Range (MHz)	EIRP Limit (dBm)	Field Strength Limit at 3 meters (dBuV/m)
960 -1610	-65.3	30.0
1610 – 1990	-53.3	42.0
1990 – 3100	-51.3	44.0
3100 - 10600	-41.3	54.0
Above 10600	-51.3	44.0

EUT was tested in single configuration and with dual configuration. The test results show that there are negligible differences between having a single configuration or dual configuration. The test results for dual configuration have been selected and presented here as a representative case.

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**Table 8. Radiated Emissions from Transmitter above 960 MHz @ 1.0 m**

Above 960 MHz							
Test: Radiated Emissions				Client: Headsight, Inc.			
Project: 20-0112				Model: HT5230			
Frequency (MHz)	Test Data (dBuv)	AF+CA-AMP (dB/m)	Results (dBuV/m)	AVG Limits (dBuV/m)	Antenna Distance/ Polarization	Margin (dB)	Detector AVG
973.88	36.23	-11.54	24.69	30.0	3.0m./HORZ	5.3	AVG
977.08	37.18	-11.73	25.45	30.0	3.0m./VERT	4.6	AVG
1127.57	36.58	-19.69	16.89	30.0	3.0m./VERT	13.1	AVG
1200.00	23.57	-18.87	4.70	19.9	3.0m./HORZ	15.2	AVG
1272.73	34.99	-20.11	14.88	30.0	3.0m./HORZ	15.1	AVG
1423.22	34.83	-18.00	16.83	30.0	3.0m./HORZ	13.2	AVG
1423.22	34.76	-18.41	16.35	30.0	3.0m./VERT	13.6	AVG
1500.07	46.36	-18.98	27.38	30.0	3.0m./HORZ	2.6	AVG
1500.07	39.43	-18.83	20.60	30.0	3.0m./VERT	9.4	AVG
1573.71	34.53	-19.62	14.91	30.0	3.0m./VERT	15.1	AVG
All other emissions were more than 20 dB below from applicable limit.							

Sample Calculation at 973.88 MHz:

Magnitude of Measured Frequency	36.23	dBuV
+ Antenna Factor + Cable Loss + Amplifier Gain	-11.54	dB/m
Corrected Result	24.69	dBuV/m

Test Date: March 31, 2020

Tested By  
 Signature:                     Afzal Fazal                    

Name: Afzal Fazal

US Tech Test Report:  
 FCC ID:  
 IC:  
 Test Report Number:  
 Issue Date:  
 Customer:  
 Model:

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**Table 9. Radiated Emissions from Transmitter above 960 MHz @ 3.7 m**


Above 960 MHz							
Test: Radiated Emissions				Client: Headsight, Inc.			
Project: 20-0112				Model: HT5230			
Frequency (MHz)	Test Data (dBuv)	AF+CA-AMP (dB/m)	Results (dBuV/m)	AVG Limits (dBuV/m)	Antenna Distance/ Polarization	Margin (dB)	Detector AVG
1009.10	37.09	-21.70	15.39	30.0	3.0m./HORZ	14.6	<b>AVG</b>
1011.23	37.05	-21.84	15.21	30.0	3.0m./VERT	14.8	<b>AVG</b>
1655.12	33.69	-18.20	15.49	42.0	3.0m./VERT	26.5	<b>AVG</b>
1956.91	33.09	-15.62	17.47	42.0	3.0m./HORZ	24.5	<b>AVG</b>
2937.85	32.75	-14.67	18.08	54.0	3.0m./HORZ	35.9	<b>AVG</b>
2970.88	33.17	-13.46	19.71	54.0	3.0m./VERT	34.3	<b>AVG</b>
3135.01	32.33	-14.35	17.98	44.0	3.0m./VERT	26.0	<b>AVG</b>
3172.02	32.37	-13.52	18.85	44.0	3.0m./HORZ	25.2	<b>AVG</b>

Sample Calculation at 1009.10 MHz:

Magnitude of Measured Frequency	37.09 dBuV
+Antenna Factor + Cable Loss+ Amplifier Gain	-21.70 dB/m
Corrected Result	15.39 dBuV/m

Test Date: April 1, 2020

Tested By

Signature: 

Name: Afzal Fazal

**2.14 Radiated Emissions in the GPS band (CFR 15.509 (e), 15.521(g), RSS-220 Section 6.2.1(e))**

In addition to the radiated emissions limits from CFR 15.509 (d), the transmitter shall not exceed the following average limits, in Table 8 when measured using a resolution bandwidth of no less than 1 kHz.

Note: measurement taken with a resolution bandwidth of greater than 1 kHz was corrected using the following equation: recorded measurement (dBuV) + 10 log (RBW<sub>ref</sub>/RBW<sub>meas</sub>)

**Table 10. Radiated Emissions in the GPS band (CFR 15.509 (e), 15.221(g), RSS-220 Section 6.2.1(e))**

Frequency Range (MHz)	EIRP Limit (dBm)	Field Strength Limit at 3 meters (dBuV/m)
1164-1240	-75.3	19.9
1559-1610	-75.3	19.9

The EUT was configured according to ANSI C63.10, Clause 10. During the testing the EUT was rated 360 degrees and the receive antenna was elevated between 1m and 4m to measure and record the maximum emissions being generated by the EUT. The receive antenna was oriented in both the horizontal and vertical polarity. The worst case data is recorded and presented in the tables below.

In each of these bands, the emissions from the transmitter were maximized using a larger bandwidth and the peak detector, then the resolution bandwidth was decreased and the final measurement was taken using the average detector. The spectrum analyzer settings were set to the following parameters:

Frequency start and stop: 1164 MHz to 1240 MHz and 1559 MHz to 1610 MHz. The resolution bandwidth was set to 1 kHz or 3 kHz, when the measurements were performed at 3 kHz a correction factor was used to correct the data collected at 3 kHz back to 1 kHz using the equation noted in the paragraph above. The video bandwidth was set to greater than or equal to the resolution bandwidth. The detector used was Peak or Average. The worse case emissions are seen below.

EUT was tested in single configuration and in dual configuration. The test results show that there are negligible differences between having a single configuration or dual configuration. The test results for dual configuration have been selected and presented here as a representative case.

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**Table 11. Radiated Emissions Test Data in the GPS Bands @ 1.0 m**

1164 – 1240 MHz and 1559- 1610 MHz								
Test: Radiated Emissions					Client: Headsight, Inc.			
Project: 20-0112					Model: HT5230			
Frequency (MHz)	Test Data (dBuv)	Additional Factor	AF+CA-AMP (dB/m)	Results (dBuV/m)	AVG Limits (dBuV/m)	Antenna Distance/ Polarization	Margin (dB)	Detector AVG
1200.00	23.57	--	-18.87	4.70	19.9	3.0m./HORZ	15.2	AVG
1200.00	24.31	--	-18.84	5.47	19.9	3.0m./VERT	14.4	AVG
1581.86	19.44	--	-19.61	-0.17	19.9	3.0m./HORZ	20.1	AVG
1591.16	18.77	--	-19.59	-0.82	19.9	3.0m./VERT	20.7	AVG

Note: measurements collected with a RBW of 3 kHz therefore a correction factor was applied in the additional factor column.


Note: A duty cycle correction factor of -13.6 dB was included in the AF+CA-AMP column to correct from PK to AVG detection.

Sample Calculation at 1200.00 MHz:

Magnitude of Measured Frequency	23.57 dBuV
+Additional Factor	-0.00 dB
+Antenna Factor + Cable Loss+ Amplifier Gain	-18.87 dB/m
Corrected Result	4.70 dBuV/m

Test Date: March 31, 2020

Tested By

Signature: 

Name: Afzal Fazal

US Tech Test Report:  
 FCC ID:  
 IC:  
 Test Report Number:  
 Issue Date:  
 Customer:  
 Model:

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**Table 12. Radiated Emissions Test Data in the GPS Bands @ 3.7 m**

1164 – 1240 MHz and 1559- 1610 MHz								
Test: Radiated Emissions					Client: Headsight, Inc.			
Project: 20-0112					Model: HT5230			
Frequency (MHz)	Test Data (dBuv)	Additional Factor	AF+CA-AMP (dB/m)	Results (dBuV/m)	AVG Limits (dBuV/m)	Antenna Distance/ Polarization	Margin (dB)	Detector AVG
1177.35	19.86	--	-19.12	0.74	19.9	3.0m./HORZ	19.2	AVG
1177.48	20.61	--	-19.08	1.53	19.9	3.0m./VERT	18.4	AVG
1583.37	19.49	--	-19.72	-0.23	19.9	3.0m./VERT	20.1	AVG
1586.64	19.80	--	-19.63	0.17	19.9	3.0m./HORZ	19.7	AVG

Note: measurements collected with a RBW of 3 kHz therefore a correction factor was applied in the additional factor column.

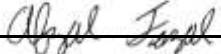
Note: A duty cycle correction factor of -13.6 dB was included in the AF+CA-AMP column to correct from PK to AVG detection.

Sample Calculation at 1177.35 MHz:

Magnitude of Measured Frequency	19.86 dBuV
+Additional Factor	-0.00 dB
+Antenna Factor + Cable Loss+ Amplifier Gain	-19.12 dB/m
Corrected Result	0.74 dBuV/m

Test Date: April 1, 2020

Tested By

Signature: 

Name: Afzal Fazal

US Tech Test Report:  
FCC ID:  
IC:  
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Customer:  
Model:

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## **2.15 Measurement Uncertainty**

The measurement uncertainties given were calculated using the method detailed in CISPR 16-4. A coverage factor of  $k=2$  was used to give a level of confidence of approximately 95%.

### **2.15.1 Conducted Emissions Measurement Uncertainty**

Measurement Uncertainty (within a 95% confidence level) for this test is  $\pm 2.85$  dB.

### **2.15.2 Radiated Emissions Measurement Uncertainty**

For a measurement distance of 3 m the measurement uncertainty (with a 95% confidence level) for this test using a Biconical Antenna (30 MHz to 200 MHz) is  $\pm 5.40$  dB.

The measurement uncertainty (with a 95% confidence level) for this test using a Log Periodic Antenna (200 MHz to 1000 MHz) is  $\pm 5.19$  dB.

The measurement uncertainty (with a 95% confidence level) for this test using a Horn Antenna is  $\pm 5.20$  dB.

**END TEST REPORT**