Report on the FCC and IC Testing of the Guardhat Inc.
Model: GHP2470
In accordance with FCC 47 CFR Part 1.1310 and Part 2.1091

Product Service

Choose certainty.
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Prepared for: Guardhat Inc.
1520 Woodward Ave 3rd Floor
Detroit, MI 48226
USA

FCC ID: 2AR6OGHP2470

COMMERCIAL-IN-CONFIDENCE

Date: 2019-06-11
TR-03867-42960-06 | Issue 3

RESPONSIBLE FOR	NAME	DATE	SIGNATURE
Project Management	Alex Fink	2019-06-11	
Authorised Signatory	Matthias Stumpe	2019-06-11	

Signatures in this approval box have checked this document in line with the requirements of TÜV SÜD Product Service document control rules.

ENGINEERING STATEMENT
The measurements shown in this report were made in accordance with the procedures described on test pages. All reported testing was carried out on a sample equipment to demonstrate limited compliance with FCC 47 CFR Part 1.1310 and Part 2.1091. The sample tested was found to comply with the requirements defined in the applied rules.

RESPONSIBLE FOR	NAME	DATE	SIGNATURE
Testing	Alex Fink	2019-06-11	

Laboratory Accreditation	Laboratory recognition	ISED Canada test site registration
DAkkS Reg. No. D-PL-11321-11-02	Registration No. BNetzA-CAB-16/21-15	3050A-2

EXECUTIVE SUMMARY
A sample of this product was tested and found to be compliant with FCC 47 CFR Part 1.1310 and Part 2.1091.

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Product Service

Contents

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1 Report Summary

1.1 Report Modification Record

Alterations and additions to this report will be issued to the holders of each copy in the form of a complete document.

Issue	Description of Change	Date of Issue
1	First Issue	2019-05-02
2	Evaluation distance changed from 5 cm to 2 cm	2019-05-27
3	OET Bulletin 65 evalution added to chapter 2.1	2019-06-11

Table 1

1.2 Introduction

Applicant	Guardhat Inc.
Manufacturer	Guardhat Inc.
Model Number(s)	GHP2470
Serial Number(s)	A49124
Hardware Version(s)	10554
Software Version(s)	0.0.8
Number of Samples Tested	1
Test Specification/Issue/Date	FCC 47 CFR Part 1.1310 and Part 2.1091
Test Plan/Issue/Date	NA
Order Number Date	B18-09018 2018-09-05
Date of Receipt of EUT	2018-09-20
Start of Test	2019-05-02
Finish of Test	2019-05-02
Name of Engineer(s)	Alex Fink
Related Document(s)	KDB 447498 D01 General RF Exposure Guidance v06 ANSI C63.10 (2013)

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1.3 Brief Summary of Results

A brief summary of the tests carried out in accordance with FCC 47 CFR Part 1.1310 and Part 2.1091 is shown below.

Section	Specification Clause	Test Description	Result	Comments/Base Standard
Configuration and Mode: Continuously transmitting				
2.1	1.1310	RF Exposure Evaluation	Pass	KDB 447498 D01 v06 OET Bulletin 65 (1997-01)

Table 2

Product Service

1.4 Product Information

1.4.1 Technical Description

GHP2470 is a radio device using UWB technology in range 30 MHz to 10.6 GHz and Wideband transmission in the range 2.4 to 2.4835 GHz.

1.5 Deviations from the Standard

none

1.6 EUT Modification Record

The table below details modifications made to the EUT during the test programme.
The modifications incorporated during each test are recorded on the appropriate test pages.

Modification State	Description of Modification still fitted to EUT	Modification Fitted By	Date Modification Fitted
0	As supplied by the customer	Not Applicable	Not Applicable

Table 3

1.7 Test Location

TÜV SÜD Product Service conducted the following tests at our Straubing Test Laboratory.

Test Name	Name of Engineer(s)
Configuration and Mode: Continuously transmitting	
RF Exposure Evaluation	Alex Fink

Table 4

Office Address:

Äußere Frühlingstraße 45
94315 Straubing
Germany

Product Service

2 Test Details

2.1 RF Exposure Assessment

2.1.1 Specification Reference

CFR 47 Pt.1.1310

2.1.2 Equipment Under Test and Modification State

GHP2470, S/N: A49124 - Modification State 0

2.1.3 Test Method

The test was performed in accordance with KDB 447498 D01 v06a and
OET Bulletin 65
Evaluation distance is 2 cm.

2.1.4 Test Results

In accordance with KDB 447498 D01 v06:

$$S = \frac{EIRP}{4\pi R^2}$$

S= power density

R= distance to the center of radiation of the antenna

Operation Mode	Operating frequency	Measured maximum EIRP [dBm]	Measured maximum EIRP [mW]	Duty cycle [%]	MPE-Value [mW/cm²]	MPE-Limit [mW/cm²]	Margin to Limit [mW/cm²]
ZigBee 2.4 GHz	2410 MHz	- 4.19	0.381	100	0.007580	1.0000	0.9924
	2444 MHz	+ 3.11	2.046		0.040704	1.0000	0.9593
	2480 MHz	+ 8.10	6.457		0.128458	1.0000	0.8715
UWB 4 GHz	3.75 GHz	- 2.3 [dBm/50MHz]	0.589	100	0.011718	1.0000	0.9883
UWB 6.4 GHz	6.49 GHz	- 4.8 [dBm/50MHz]	0.331	100	0.006585	1.0000	0.9934

Maximum calculated MPE value for co-location assessment (ZigBee 2444 MHz and UWB 4 GHz):

0.128458 + 0.011718 = 0.140176 [mW/cm²]

The measurements results comply with the FCC Limit per 47 CFR 2.1091 for the uncontrolled RF Exposure of mobile devices.

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In accordance with OET Bulletin 65:

$$S_{surface} = \frac{4P}{A}$$

where: $S_{surface}$ = maximum power density at the antenna surface
P = power fed to the antenna
A = physical area of the aperture antenna

Physical Area of the aperture antenna is 23.644 cm².

Operation Mode	Operating frequency	Measured maximum power P [dBm]	Measured maximum power P [mW]	Duty cycle [%]	MPE-Value [mW/cm²]	MPE-Limit [mW/cm²]	Margin to Limit [mW/cm²]
ZigBee 2.4 GHz	2410 MHz	5.91	3.899	100	0.659618	1.0000	0.3404
	2444 MHz	6.76	4.742		0.802233	1.0000	0.1978
	2480 MHz	6.02	3.999		0.686835	1.0000	0.3132
UWB 4 GHz	3.75 GHz	- 2.3 [dBm/50MHz]	0.589	100	0.099645	1.0000	0.9004
UWB 6.4 GHz	6.49 GHz	- 4.8 [dBm/50MHz]	0.331	100	0.055997	1.0000	0.9440

Maximum calculated MPE value for co-location assessment (ZigBee 2444 MHz and UWB 4 GHz):

0.802233 + 0.099645 = 0.901878 [mW/cm²]

The measurements results comply with the FCC Limit per 47 CFR 2.1091 for the uncontrolled RF Exposure of mobile devices.

Product Service

3 Photographs

3.1 Equipment Under Test (EUT)

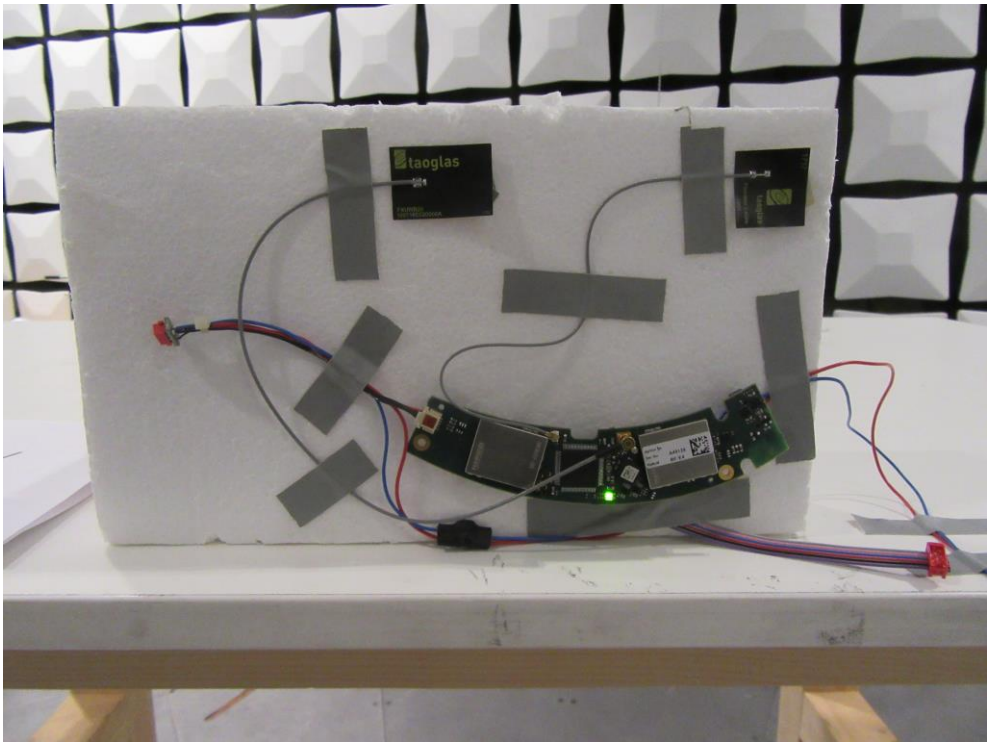

Figure 1

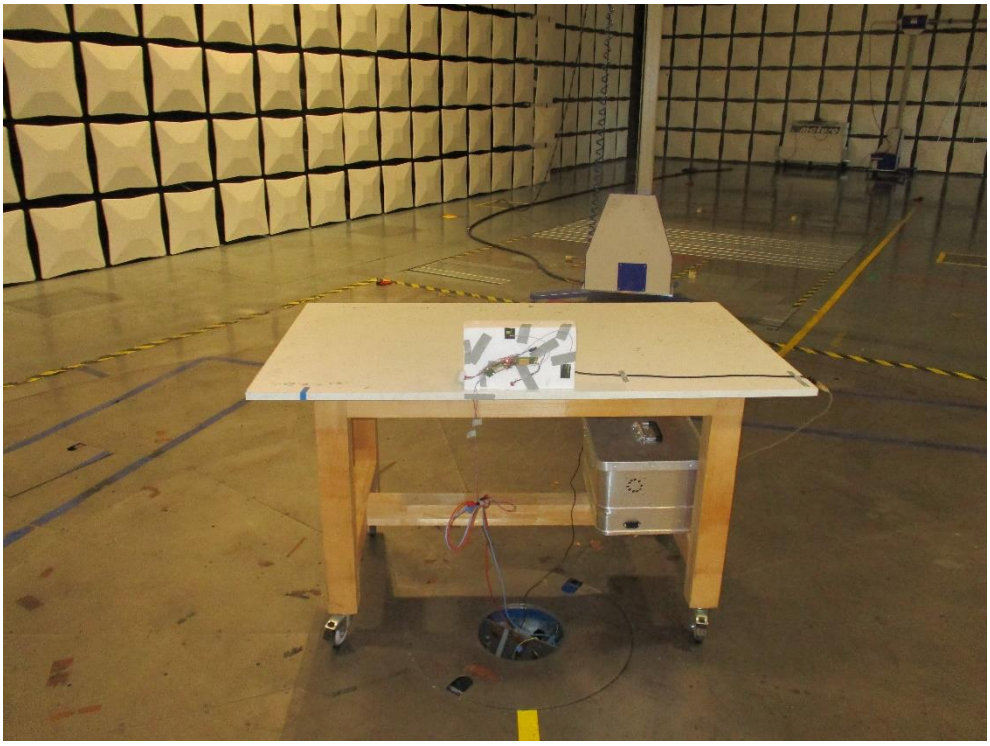

Figure 2

Product Service

Figure 3

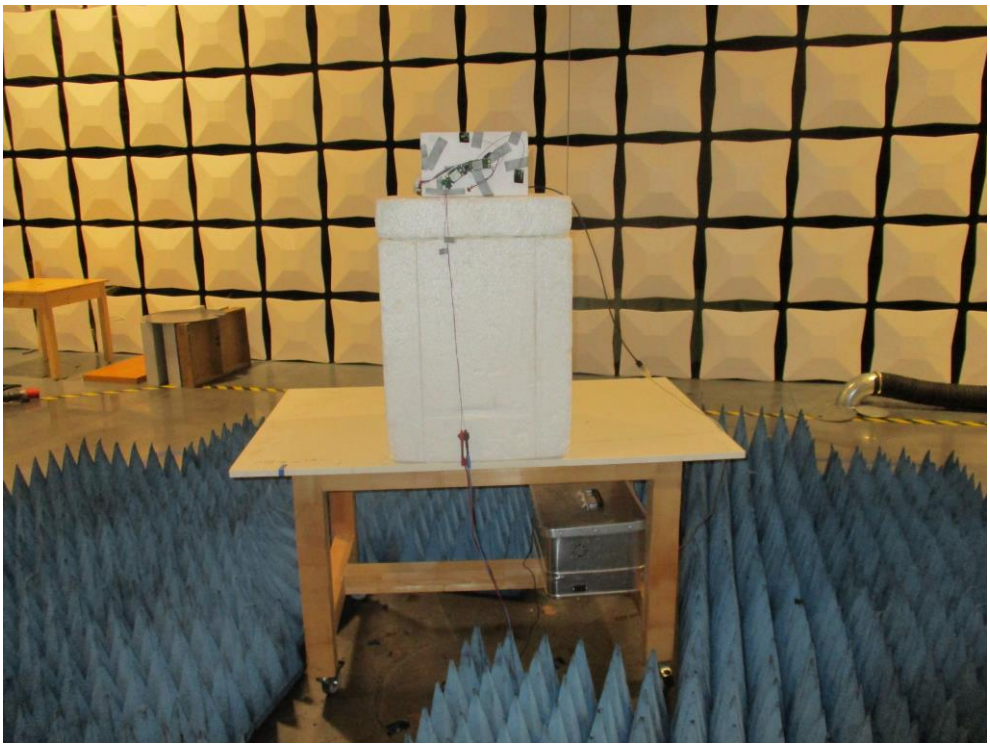

Figure 4

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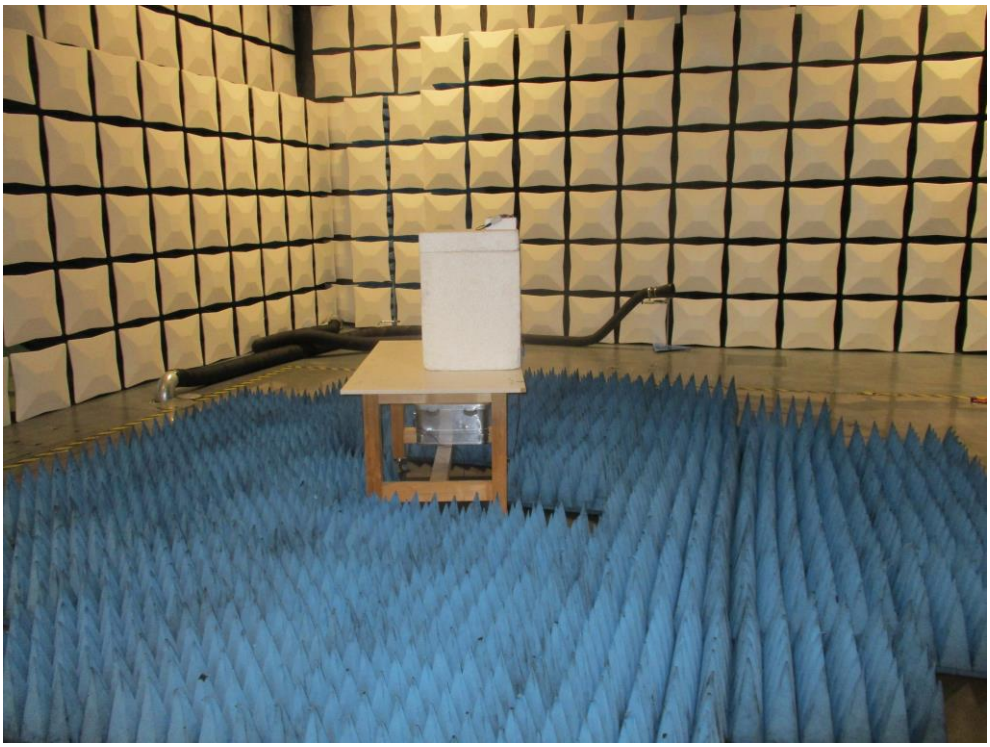

Figure 5

Product Service

4 Measurement Uncertainty

For a 95% confidence level. the measurement uncertainties for defined systems are:

Radio Testing			
Test Name	kp	Expanded Uncertainty	Note
Occupied Bandwidth	2.0	±1.14 %	2
RF-Frequency error	1.96	±1 · 10-7	7
RF-Power. conducted carrier	2	±0.079 dB	2
RF-Power uncertainty for given BER	1.96	+0.94 dB / -1.05	7
RF power. conducted. spurious emissions	1.96	+1.4 dB / -1.6 dB	7
RF power. radiated			
25 MHz – 4 GHz	1.96	+3.6 dB / -5.2 dB	8
1 GHz – 18 GHz	1.96	+3.8 dB / -5.6 dB	8
18 GHz – 26.5 GHz	1.96	+3.4 dB / -4.5 dB	8
40 GHz – 170 GHz	1.96	+4.2 dB / -7.1 dB	8
Spectral Power Density. conducted	2.0	±0.53 dB	2
Maximum frequency deviation			
300 Hz – 6 kHz	2	±2.89 %	2
6 kHz – 25 kHz	2	±0.2 dB	2
Maximum frequency deviation for FM	2	±2.89 %	2
Adjacent channel power 25 MHz – 1 GHz	2	±2.31 %	2
Temperature	2	±0.39 K	4
(Relative) Humidity	2	±2.28 %	2
DC- and low frequency AC voltage			
DC voltage	2	±0.01 %	2
AC voltage up to 1 kHz	2	±1.2 %	2
Time	2	±0.6 %	2

Table 5

Product Service

Radio Interference Emission Testing			
Test Name	kp	Expanded Uncertainty	Note
Conducted Voltage Emission			
9 kHz to 150 kHz (50Ω/50µH AMN)	2	± 3.8 dB	1
150 kHz to 30 MHz (50Ω/50µH AMN)	2	± 3.4 dB	1
100 kHz to 200 MHz (50Ω/5µH AMN)	2	± 3.6 dB	1
Discontinuous Conducted Emission			
9 kHz to 150 kHz (50Ω/50µH AMN)	2	± 3.8 dB	1
150 kHz to 30 MHz (50Ω/50µH AMN)	2	± 3.4 dB	1
Conducted Current Emission			
9 kHz to 200 MHz	2	± 3.5 dB	1
Magnetic Fieldstrength			
9 kHz to 30 MHz (with loop antenna)	2	± 3.9 dB	1
9 kHz to 30 MHz (large-loop antenna 2 m)	2	± 3.5 dB	1
Radiated Emission			
Test distance 1 m (ALSE)			
9 kHz to 150 kHz	2	± 4.6 dB	1
150 kHz to 30 MHz	2	± 4.1 dB	1
30 MHz to 200 MHz	2	± 5.2 dB	1
200 MHz to 2 GHz	2	± 4.4 dB	1
2 GHz to 3 GHz	2	± 4.6 dB	1
Test distance 3 m			
30 MHz to 300 MHz	2	± 4.9 dB	1
300 MHz to 1 GHz	2	± 5.0 dB	1
1 GHz to 6 GHz	2	± 4.6 dB	1
Test distance 10 m			
30 MHz to 300 MHz	2	± 4.9 dB	1
300 MHz to 1 GHz	2	± 4.9 dB	1
Radio Interference Power			
30 MHz to 300 MHz	2	± 3.5 dB	1
Harmonic Current Emissions			4
Voltage Changes. Voltage Fluctuations and Flicker			4

Table 6

Product Service

Immunity Testing			
Test Name	kp	Expanded Uncertainty	Note
Electrostatic Discharges			4
Radiated RF-Field			
Pre-calibrated field level	2	+32.2 / -24.3 %	5
Dynamic feedback field level	2.05	+21.2 / -17.5 %	3
Electrical Fast Transients (EFT) / Bursts			4
Surges			4
Conducted Disturbances. induced by RF-Fields			
via CDN	2	+15.1 / -13.1 %	6
via EM clamp	2	+42.6 / -29.9 %	6
via current clamp	2	+43.9 / -30.5 %	6
Power Frequency Magnetic Field	2	+20.7 / -17.1 %	2
Pulse Magnetic Field			4
Voltage Dips. Short Interruptions and Voltage Variations			4
Oscillatory Waves			4
Conducted Low Frequency Disturbances			
Voltage setting	2	± 0.9 %	2
Frequency setting	2	± 0.1 %	2
Electrical Transient Transmission in Road Vehicles			4

Table 7

Note 1:
The expanded uncertainty reported according to CISPR 16-4-2:2003-11 is based on a standard uncertainty multiplied by a coverage factor of kp = 2. providing a level of confidence of p = 95.45%
Note 2:
The expanded uncertainty reported according to UKAS Lab 34 (Edition 1. 2002-08) is based on a standard uncertainty multiplied by a coverage factor of kp = 2. providing a level of confidence of p = 95.45%
Note 3:
The expanded uncertainty reported according to UKAS Lab 34 (Edition 1. 2002-08) is based on a standard uncertainty multiplied by a coverage factor of kp = 2.05. providing a level of confidence of p = 95.45%
Note 4:
It has been demonstrated that the used test equipment meets the specified requirements in the standard with at least a 95%confidence.
Note 5:
The expanded uncertainty reported according to IEC 61000-4-3 is based on a standard uncertainty multiplied by a coverage factor of kp = 2. providing a level of confidence of p = 95.45%
Note 6:
The expanded uncertainty reported according to IEC 61000-4-6 is based on a standard uncertainty multiplied by a coverage factor of kp = 2. providing a level of confidence of p = 95.45%
Note 7:
The expanded uncertainty reported according ETSI TR 100 028 V1.4.1 (all parts) to is based on a standard uncertainty multiplied by a coverage factor of kp = 1.96. providing a level of confidence of p = 95.45%
Note 8:

Product Service

The expanded uncertainty reported according to ETSI TR 102 273 V1.2.1 (all parts) is based on a standard uncertainty multiplied by a coverage factor of kp = 1.96. providing a level of confidence of p = 95.45%