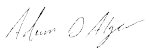
Test Report # 316392 B

Equipment Under Test:	Cor 7C
Test Date(s):	March 30, 2017 April 11, 2017 April 6, 2017 April 14, 2017
Prepared for:	United Technology Electronic Controls, Inc. Attn: Raj Chadichal 3650 W 200 N Huntington, IN 46750

Report Issued by:

Signature:  Date: May 19, 2017

Report Reviewed by: Adam Alger, Quality Systems Engineer

Signature:  Date: May 19, 2017

Report Constructed by:

Signature:  Date: May 18, 2017

CONTENTS

Laird Technologies Test Services in Review

The Laird Technologies, Inc. laboratory located at W66 N220 Commerce Court Cedarburg, Wisconsin, 53012 USA is recognized through the following organizations:

TESTING CERT #1255.01

A2LA – American Association for Laboratory Accreditation

Accreditation based on ISO/IEC 17025: 2005 with Electrical (EMC) Scope
A2LA Certificate Number: 1255.01
Scope of accreditation includes all test methods listed herein, unless otherwise noted.

Federal Communications Commission (FCC) – USA

Accredited recognition of two 3 meter Semi-Anechoic Chambers

Accredited Test Firm Registration Number: 953492

Government of Canada

Innovation, Science and Economic Development Canada

ISED Site listing of two 3 meter Semi-Anechoic Chambers based on RSS-GEN – Issue 4
File Number: IC 3088A-2
File Number: IC 3088A-3

1 TEST REPORT SUMMARY

During **March 30 – April 14, 2017** the Equipment Under Test (EUT), **Cor 7C**, as provided by **United Technology Electronic Controls, Inc.** was tested to the following requirements:

Requirement	Description	Specification	Method	Result
FCC: 1.1307, 1.1310, 2.1093 IC: RSS-102	Radiofrequency radiation exposure	MPE	KDB 447498 / OET Bulletin 65	Pass
FCC: 15.247 (b)(3) IC: RSS-247 5.4 (d)	Maximum Conducted Output Power	30 dBm	ANSI C63.10	Pass

Notice:

The results relate only to the item tested and described in this report. Any modifications made to the equipment under test after the specified test date(s) may invalidate the data herein.

If the resulting measurement margin is seen to be within the uncertainty value, as listed in this report, the possibility exists that this unit may not meet the required limit specification if subsequently tested.

2 CLIENT INFORMATION

Company Name	United Technology Electronic Controls, Inc. (UTC)
Contact Person	Raj Chadichal
Address	3650 W 200 N, Huntington, IN 46750

2.1 Equipment Under Test (EUT) Information

The following information has been supplied by the client

Product Name	Cor 7C
Model Number	TSTWRH01
Serial Number	Engineering Sample
FCC ID	2AK6N – TSTWRH01
IC ID	703A – TSTWRH01

2.2 Product Description

The Côr 7C thermostat model is a Wi-Fi connected device and can be remotely controlled by the free mobile app* (Android or iOS compatible devices). The Côr 7 series thermostats combines temperature and humidity control for added home comfort. They are 7-day, 5/2-day, 1-day programmable, wall-mounted and low-voltage controls. They have no need for batteries to store user-configured settings in memory. During power loss its internal memory saves settings for an unlimited time, and the clock continues to run for at least 24 hours.

When using the Côr thermostat programmable schedule you can customize your homes comfort for times you are home, sleeping or want to save energy while you're away with different heating and cooling setpoints and times. You can set your schedule for 4 periods per day or 2 periods per day. Programming the days of the week is simple and flexible. The Côr Thermostats features Touch-N-Go® on the thermostat and in the mobile app* for quick and easy temperature change without changing programming schedules.
* Thermostat must be connected to the internet and registered to a user account.

A. Fan (On or Auto)
B. Touch-N-Go®
C. Weather icon
D. Hold
E. View Menu Options (Schedule, Alerts, Settings, Wi-Fi®)
F. Start Button – wakes up the screen from idle
G. Information button scrolls through display options for test box
H. Active period (wake, away, home, sleep) and day of the week icons
I. Temperature adjustment (up/dn)
J. Indoor temperature
K. Change equipment mode (heat, cool, etc.)
L. Current equipment mode icon
M. Wi-Fi® signal strength icon

2.3 Modifications Incorporated for Compliance

Client understands the modifications.

For WLAN testing, the high channel (11 – 2462 MHz) must operate at a reduced power for the 802.11n standard to meet compliance. As a result, channel 10 at full power was tested as high channel, in addition to channel 11 at reduced power, for testing 802.11n data rates.

2.4 Deviations and Exclusions from Test Specifications

None noted at time of test

2.5 Additional Information

WLAN

Real Time Tuning Tool (RTTT or RT^3) software Version 2.0.0.55 was used to program WLAN. Firmware file wl18xx-fw-4.bin was loaded through the RTTT program and all radio settings are accessed and set through drop down boxes and radio buttons.

The software runs on a laptop computer physically connected to the EUT via a USB to UART cable. The EUT operates on WLAN channels 1 (2412 MHz) to 11 (2462 MHz).

BLE

HCITester software Version 3.0.0.37 was used to program BLE. Firmware file TIInit_11.8.3.bts is opened and run by user when software is started, then the EUT is programmed by entering HCI commands in the software command window.

The software runs on a laptop computer that is physically connected to the EUT via a USB to UART cable. The EUT operates on frequencies 2402 MHz to 2480 MHz.

Antenna

EUT has a PCB inverted-f trace antenna with a gain of 3.3 dBi.

Power Supply

Throughout testing, the EUT was powered by the following off-the-shelf 120 VAC to 24 VAC power supply:

Manufacturer	TRIAD
Description	Class 2 Power Supply
Model Number	WAU24-450
Input	120 V, 60 Hz, 15 W
Output	20 VAC, 450 mA

3 REFERENCES

Publication	Edition	Date
47 CFR, Parts 0-15 (FCC)		2017
RSS 247	2	2017
RSS GEN	4	2014
ANSI C63.10		2013
FCC KDB 558074 D01 v04		2017
FCC KDB 447498 D01 v06		2015

4 UNCERTAINTY SUMMARY

Using the guidance of the following publications the calculated measurement uncertainty represents an expanded uncertainty expressed at approximately the 95 % confidence level, using a coverage factor of k = 2.

References	Version / Date
CISPR 16-4-1	Ed. 2 (2009-02)
CISPR 16-4-2	Ed. 2 (2011-06)
CISPR 32	Ed. 1 (2012-01)
ANSI C63.23	2012
A2LA P103	February 4, 2016
A2LA P103c	August 10, 2015
ETSI TR 100-028	V1.3.1 (2001-03)

Measurement Type	Configuration	Uncertainty ±
Radiated Emissions	Biconical Antenna	5.0 dB
Radiated Emissions	Log Periodic Antenna	5.3 dB
Radiated Emissions	Horn Antenna	4.7 dB
AC Line Conducted Emissions	Artificial Mains Network	3.4 dB
Telecom Conducted Emissions	Asymmetric Artificial Network	4.9 dB
Disturbance Power Emissions	Absorbing Clamp	4.1 dB
Radiated Immunity	3 Volts/meter	2.2 dB
Conducted Immunity	CDN/EM/BCI	2.4/3.5/3.4 dB
EFT Burst/Surge	Peak pulse voltage	164 volts
ESD Immunity	15 kV level	1377 Volts

Parameter	ETSI U.C. ±	U.C. ±
Radio Frequency, from F0	$1x10^{-7}$	$0.55x10^{-7}$
Occupied Channel Bandwidth	5 %	2 %
RF conducted Power (Power Meter)	1.5 dB	1.2 dB
RF conducted emissions (Spectrum Analyzer)	3.0 dB	1.7 dB
All emissions, radiated	6.0 dB	5.3 dB
Temperature	1° C	0.65° C
Humidity	5 %	2.9 %
Supply voltages	3 %	1 %

5 TEST DATA

5.1 Fundamental Emission

Operator	Shane Dock / Kimberly Bay
QA	Kimberly Bay / Aidi Zainal
Test Date	March 30, 2017 / April 6 & 11 & 14, 2017
Location	Conducted RF Test Bench
Temp. / R.H.	21-22°C / 36-40% R.H.
Requirement	FCC 15.247 (b) / RSS-247 Section 5.4
Method	WLAN: ANSI C63.10 2013 Section 11.9.2.2.4 Method AVGSA-2 BLE: KDB 558074 D01 v04 Section 9.1.1

Test Parameters

Frequency	WLAN: 2412, 2437, and 2462 MHz; MCS0 & MCS7 also used 2457 MHz (see Note) BLE: 2402, 2440, and 2480 MHz
Settings	Detector – WLAN: Average, BLE: Peak
Settings	Span – WLAN: 30 MHz, BLE: 3 MHz
Settings	BW – WLAN: RBW = 470 kHz, VBW= 3 MHz; BLE: RBW = 1 MHz, VBW = 3 MHz
EUT	Modulated signal
Note	Channel 11 operated in reduced power for 802.11n, due to exceeding limits at full power. Both channels 10 (at full power) and 11 (at reduced power) are tested here to show compliance.
Example Calculation	Conducted Average output power = average power + duty cycle correction Power margin = Power limit – Conducted output power

Instrumentation

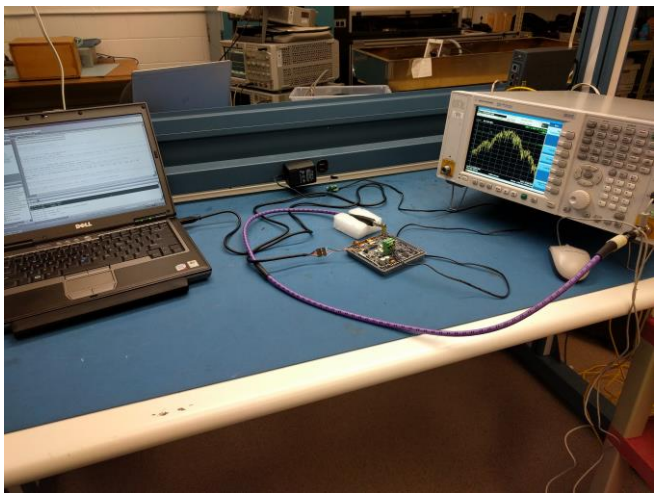
LSR a Laird Business

Date: 20-Dec-2016 Test: Conducted Power Output Job #: C-2630

PE: Kim Customer: United Technology Electronic Controls Quote #: 316392

No.	Asset #	Description	Manufacturer	Model #	Serial #	Cal Date	Cal Due Date	Equipment Status
1	EE 960085	EMI Receiver	Agilent	N9038A	MY51210148	5/12/2016	5/12/2017	Active Calibration
2	AA 960143	Phaseflex	Gore	EKD01D01048.0	5546519	6/26/2015	6/25/2017	Active Calibration

Setup Photos



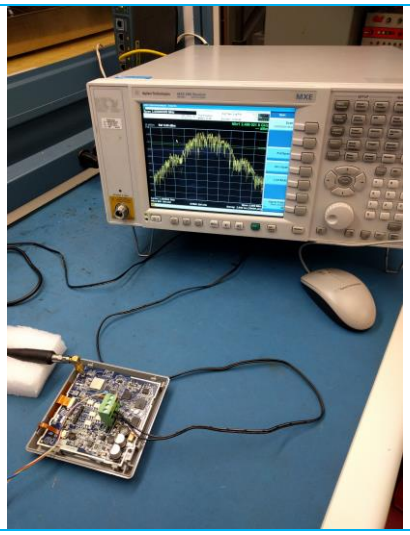
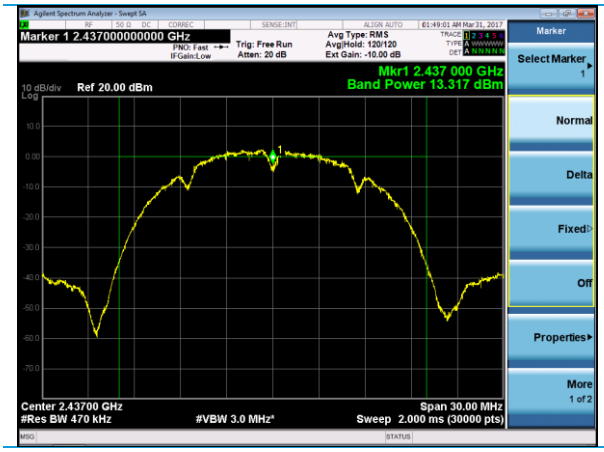


Table – Conducted Output Power

802.11 Standard	Data Rate (Mbps)	Channel	Pout Measured (dBm)	Duty Cycle Correction (dB)	Maximum Pout (dBm)	Pout Limit (dBm)	Pout Margin (dB)
b	1	1	12.7	3.9	16.6	30	13.4
		6	13.3	3.9	17.2	30	12.8
		11	13.1	3.9	17.0	30	13.0
b	11	1	11.8	5.0	16.8	30	13.2
		6	11.6	5.0	16.6	30	13.4
		11	11.9	5.0	16.9	30	13.1
g	6	1	9.2	4.4	13.6	30	16.4
		6	12.2	4.4	16.6	30	13.4
		11	9.5	4.4	13.9	30	16.1
g	54	1	7.9	5.1	13.0	30	17.0
		6	8.3	5.1	13.4	30	16.6
		11	8.1	5.1	13.2	30	16.8
n	MCS0	1	7.4	4.9	12.3	30	17.7
		6	9.3	4.9	14.2	30	15.8
		10	9.5	4.9	14.4	30	15.6
		11	6.0	4.9	10.9	30	19.1
n	MCS7	1	6.6	5.2	11.8	30	18.2
		6	7.1	5.2	12.3	30	17.7
		10	6.3	5.2	11.5	30	18.5
		11	5.7	5.2	10.9	30	19.1

Plot – Output Power



Highest Conducted Output Power

6 EXCLUSION CALCULATION

6.1 FCC

The following MPE calculations are based on a measured conducted RF power of +13.3 dBm as presented to the antenna plus 1.5 dBm for the tune-up tolerance. The peak gain of this antenna is +3.3 dBi. Tune-up tolerance was declared by the manufacturer.

Prediction of MPE limit at a given distance

Equation from page 18 of OET Bulletin 65, Edition 97-01

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

where: S = power density

P = power input to the antenna

G = power gain of the antenna in the direction of interest relative to an isotropic radiator

R = distance to the center of radiation of the antenna

Maximum peak output power at antenna input terminal:	14.80	(dBm)
Maximum peak output power at antenna input terminal:	30.200	(mW)
Antenna gain(typical):	3.3	(dBi)
Maximum antenna gain:	2.138	(numeric)
Prediction distance:	20	(cm)
Prediction frequency:	2437	(MHz)
MPE limit for uncontrolled exposure at prediction frequency:	1	(mW/cm^2)
Power density at prediction frequency:	0.012845	(mW/cm^2)

6.2 ISED Canada

The following MPE calculations are based on a measured conducted RF power of +13.3 dBm as presented to the antenna plus 1.5 dBm for the tune-up tolerance. The peak gain of this antenna is +3.3 dBi. Tune-up tolerance was declared by the manufacturer.

Prediction of MPE limit at a given distance

Equation from page 18 of OET Bulletin 65, Edition 97-01

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

where: S = power density
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R = distance to the center of radiation of the antenna

Maximum peak output power at antenna input terminal:	14.80	(dBm)
Maximum peak output power at antenna input terminal:	30.200	(mW)
Antenna gain(typical):	3.3	(dBi)
Maximum antenna gain:	2.138	(numeric)
Prediction distance:	20	(cm)
Prediction frequency:	2437	(MHz)
MPE limit for uncontrolled exposure at prediction frequency:	5.37	(W/m^2)
Power density at prediction frequency:	0.12845	(W/m^2)

7 REVISION HISTORY

Version	Date	Notes	Person
V0	5/18/2017	Initial Draft Release	KB
V1	5/19/2017	Final	KB

END OF REPORT