



# element

**CINCH Systems**

**RFCO-A**

**FCC 15.231:2019**

**433 MHz Periodic Radio**

**Report # CINC0042.2**



NVLAP LAB CODE: 200881-0



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# CERTIFICATE OF TEST

**Last Date of Test: August 5, 2019**  
**CINCH Systems**  
**Model: RFCO-A**

## Radio Equipment Testing

### Standards

Specification	Method
FCC 15.231:2019	ANSI C63.10:2013

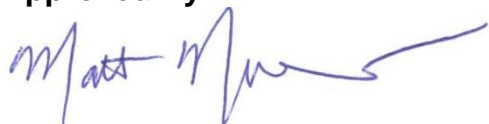
### Results

Method Clause	Test Description	Applied	Results	Comments
6.2	Powerline Conducted Emissions	No	N/A	Not required for a battery powered EUT.
6.5, 6.6	Field Strength of Fundamental	Yes	Pass	
6.5, 6.6	Spurious Radiated Emissions	Yes	Pass	
6.9.2	Occupied Bandwidth	Yes	Pass	
7.5	Duty Cycle	Yes	Pass	

### Deviations From Test Standards

None

### Approved By:



Matt Nuernberg, Operations Manager

*Product compliance is the responsibility of the client; therefore, the tests and equipment modes of operation represented in this report were agreed upon by the client, prior to testing. The results of this test pertain only to the sample(s) tested. The specific description is noted in each of the individual sections of the test report supporting this certificate of test. This report reflects only those tests from the referenced standards shown in the certificate of test. It does not include inspection or verification of labels, identification, marking or user information. As indicated in the Statement of Work sent with the quotation, Element's standard process is to always use the latest published version of the test methods even when earlier versions are cited in the test specification. Issuance of a purchase order was de facto acceptance of this approach. Otherwise, the client would have advised Element in writing of the specific version of the test methods they wanted applied to the subject testing.*

# REVISION HISTORY



Revision Number	Description	Date (yyyy-mm-dd)	Page Number
00	None		

# ACCREDITATIONS AND AUTHORIZATIONS



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## United States

**FCC** - Designated by the FCC as a Telecommunications Certification Body (TCB). Certification chambers, Open Area Test Sites, and conducted measurement facilities are listed with the FCC.

**A2LA** - Accredited by A2LA to ISO / IEC 17065 as a product certifier. This allows Element to certify transmitters to FCC and IC specifications.

**NVLAP** - Each laboratory is accredited by NVLAP to ISO 17025

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## Canada

**ISED** - Recognized by Innovation, Science and Economic Development Canada as a Certification Body (CB) and as a CAB for the acceptance of test data.

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## European Union

**European Commission** – Within Element, we have a EU Notified Body validated for the EMCD and RED Directives.

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## Australia/New Zealand

**ACMA** - Recognized by ACMA as a CAB for the acceptance of test data.

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## Korea

**MSIT / RRA** - Recognized by KCC's RRA as a CAB for the acceptance of test data.

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## Japan

**VCCI** - Associate Member of the VCCI. Conducted and radiated measurement facilities are registered.

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## Taiwan

**BSMI** – Recognized by BSMI as a CAB for the acceptance of test data.

**NCC** - Recognized by NCC as a CAB for the acceptance of test data.

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## Singapore

**IDA** – Recognized by IDA as a CAB for the acceptance of test data.

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## Israel

**MOC** – Recognized by MOC as a CAB for the acceptance of test data.

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## Hong Kong

**OFCA** – Recognized by OFCA as a CAB for the acceptance of test data.

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## Vietnam

**MIC** – Recognized by MIC as a CAB for the acceptance of test data.

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## SCOPE

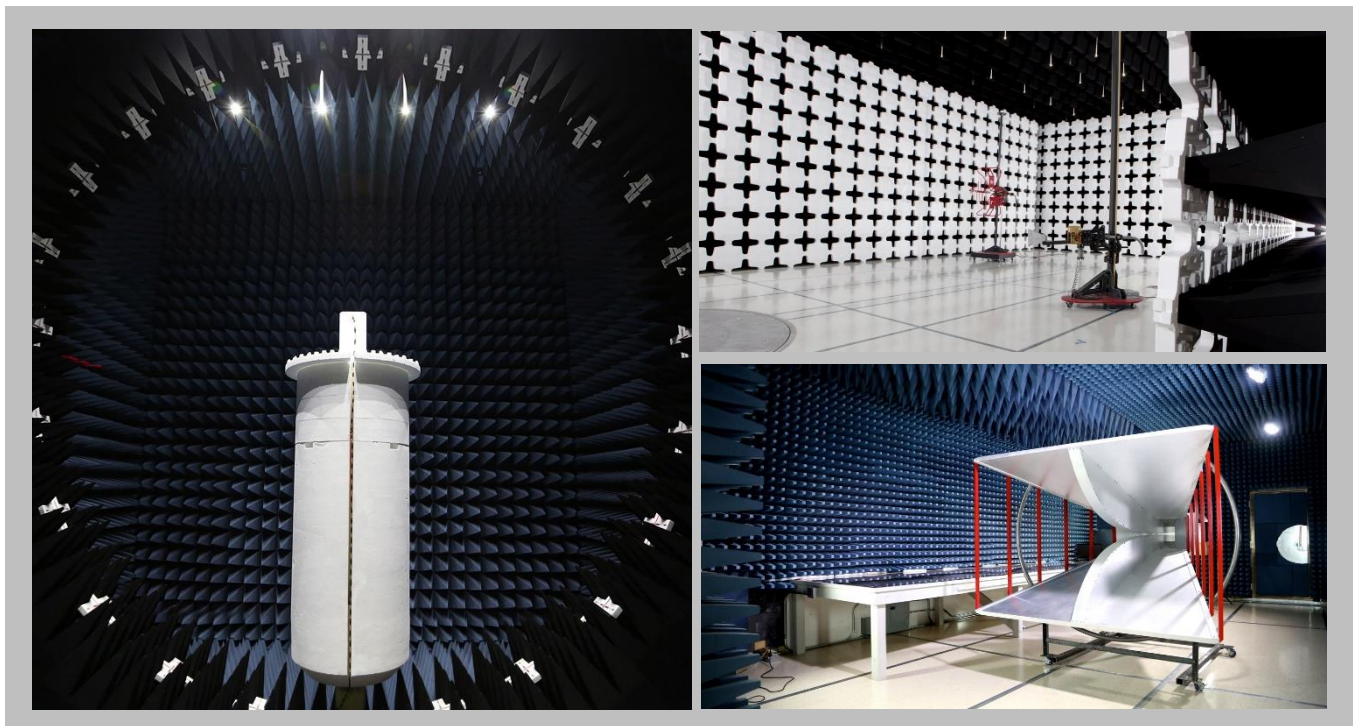
For details on the Scopes of our Accreditations, please visit:

<https://www.nwemc.com/emc-testing-accreditations>

# FACILITIES



<b>California</b> Labs OC01-17 41 Tesla Irvine, CA 92618 (949) 861-8918	<b>Minnesota</b> Labs MN01-10 9349 W Broadway Ave. Brooklyn Park, MN 55445 (612)-638-5136	<b>Oregon</b> Labs EV01-12 6775 NE Evergreen Pkwy #400 Hillsboro, OR 97124 (503) 844-4066	<b>Texas</b> Labs TX01-09 3801 E Plano Pkwy Plano, TX 75074 (469) 304-5255	<b>Washington</b> Labs NC01-05 19201 120 <sup>th</sup> Ave NE Bothell, WA 98011 (425)984-6600
<b>NVLAP</b>				
NVLAP Lab Code: 200676-0	NVLAP Lab Code: 200881-0	NVLAP Lab Code: 200630-0	NVLAP Lab Code:201049-0	NVLAP Lab Code: 200629-0
<b>Innovation, Science and Economic Development Canada</b>				
2834B-1, 2834B-3	2834E-1, 2834E-3	2834D-1	2834G-1	2834F-1
<b>BSMI</b>				
SL2-IN-E-1154R	SL2-IN-E-1152R	SL2-IN-E-1017	SL2-IN-E-1158R	SL2-IN-E-1153R
<b>VCCI</b>				
A-0029	A-0109	A-0108	A-0201	A-0110
<b>Recognized Phase I CAB for ISED, ACMA, BSMI, IDA, KCC/RRA, MIC, MOC, NCC, OFCA</b>				
US0158	US0175	US0017	US0191	US0157



# MEASUREMENT UNCERTAINTY



## Measurement Uncertainty

When a measurement is made, the result will be different from the true or theoretically correct value. The difference is the result of tolerances in the measurement system that cannot be completely eliminated. To the extent that technology allows us, it has been our aim to minimize this error. Measurement uncertainty is a statistical expression of measurement error qualified by a probability distribution.

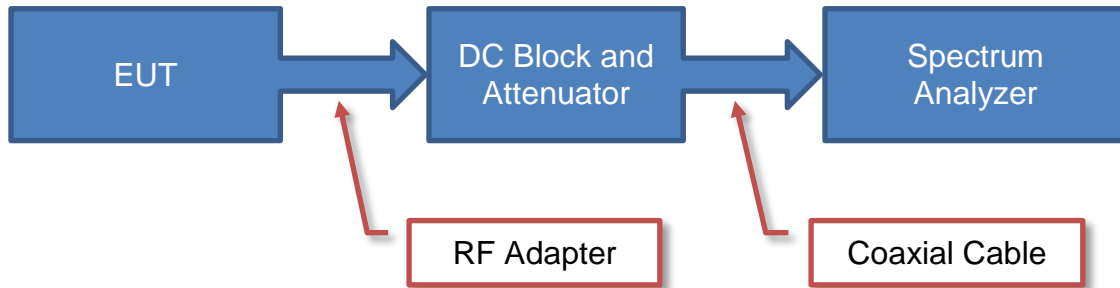
A measurement uncertainty estimation has been performed for each test per our internal quality document QM205.4.6. The estimation is used to compare the measured result with its "true" or theoretically correct value. The expanded measurement uncertainty (K=2) can be found included as part of the applicable test description page. Our measurement data meets or exceeds the measurement uncertainty requirements of the applicable specification; therefore, the test data can be compared directly to the specification limit to determine compliance. The calculations for estimating measurement uncertainty are based upon ETSI TR 100 028 (or CISPR 16-4-2 as applicable), and are available upon request.

The following table represents the Measurement Uncertainty (MU) budgets for each of the tests that may be contained in this report.

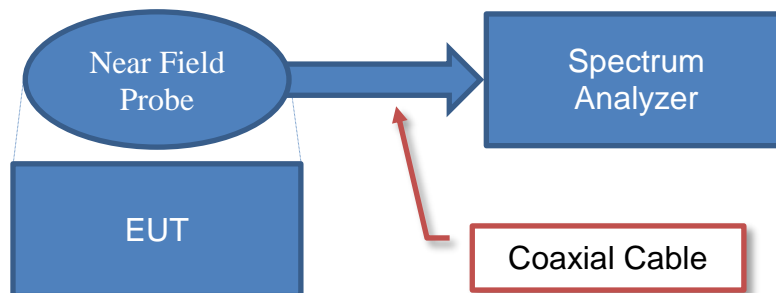
<b>Test</b>	<b>+ MU</b>	<b>- MU</b>
Frequency Accuracy (Hz)	0.0007%	-0.0007%
Amplitude Accuracy (dB)	1.2 dB	-1.2 dB
Conducted Power (dB)	0.3 dB	-0.3 dB
Radiated Power via Substitution (dB)	0.7 dB	-0.7 dB
Temperature (degrees C)	0.7°C	-0.7°C
Humidity (% RH)	2.5% RH	-2.5% RH
Voltage (AC)	1.0%	-1.0%
Voltage (DC)	0.7%	-0.7%
Field Strength (dB)	5.2 dB	-5.2 dB
AC Powerline Conducted Emissions (dB)	2.4 dB	-2.4 dB

# Test Setup Block Diagrams

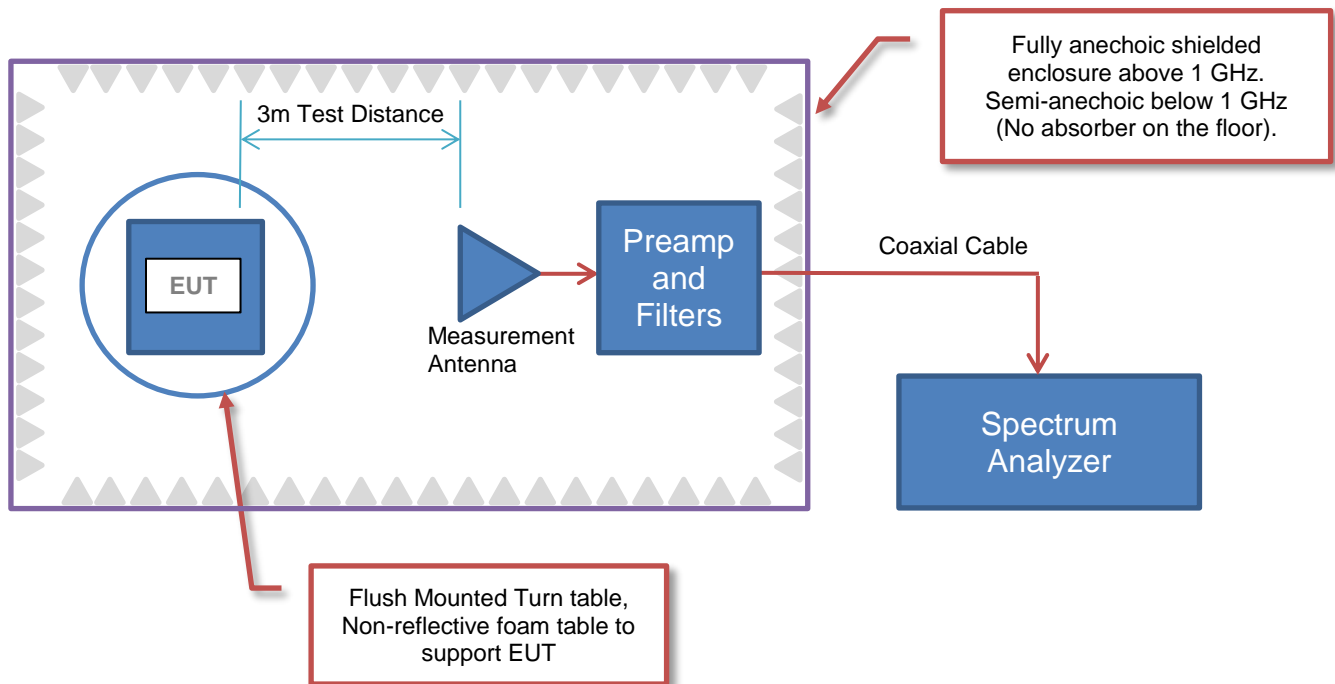
## Antenna Port Conducted Measurements



## Near Field Test Fixture Measurements



## Spurious Radiated Emissions



# PRODUCT DESCRIPTION



## Client and Equipment Under Test (EUT) Information

<b>Company Name:</b>	CINCH Systems
<b>Address:</b>	12075 43rd Street NE Suite 300
<b>City, State, Zip:</b>	St. Michael, MN 55376
<b>Test Requested By:</b>	Jibril Aga
<b>Model:</b>	RFCO-A
<b>First Date of Test:</b>	April 4, 2019
<b>Last Date of Test:</b>	August 5, 2019
<b>Receipt Date of Samples:</b>	April 4, 2019
<b>Equipment Design Stage:</b>	Production
<b>Equipment Condition:</b>	No Damage
<b>Purchase Authorization:</b>	Verified

## Information Provided by the Party Requesting the Test

### Functional Description of the EUT:

Low power periodic radio with one antenna operating at 433.42 MHz used in a fire system sensor for communication with a fire alarm control panel.

### Testing Objective:

To demonstrate compliance of the Low Power radio to FCC 15.231 specifications.



# CONFIGURATIONS



## Configuration CINC0042- 1

EUT			
Description	Manufacturer	Model/Part Number	Serial Number
CO2 Detector	CINCH Systems	RFCO-A	331720

# CONFIGURATIONS



## Configuration CINC0046- 1

EUT			
Description	Manufacturer	Model/Part Number	Serial Number
CO Detector	CINCH Systems	RFCO-A	136316011

# MODIFICATIONS



## Equipment Modifications

Item	Date	Test	Modification	Note	Disposition of EUT
1	2019-04-04	Occupied Bandwidth	Tested as delivered to Test Station.	No EMI suppression devices were added or modified during this test.	EUT remained at Element following the test.
2	2019-04-05	Duty Cycle	Tested as delivered to Test Station.	No EMI suppression devices were added or modified during this test.	EUT remained at Element following the test.
3	2019-06-25	Field Strength of Fundamental	Tested as delivered to Test Station.	No EMI suppression devices were added or modified during this test.	EUT remained at Element following the test.
4	2019-08-05	Spurious Radiated Emissions	Tested as delivered to Test Station.	No EMI suppression devices were added or modified during this test.	Scheduled testing was completed.

# FIELD STRENGTH OF FUNDAMENTAL



PSA-ESCI 2019.05.10

Testing was performed using the mode(s) of operation and configuration(s) noted within the report. The individuals and/or the organization requesting the test provided the modes, configurations and settings used to complete the evaluation. The actual test parameters are specified in the test data, this includes items such as investigated frequency range (scanned) and test levels. The testing methods and performance specifications, as well as the test site used for the evaluation are indicated in the test data. The test data represents the configuration / operating mode/ model that produced the highest emission levels as compared to the specification limit.

## MODES OF OPERATION

Tx continuous packet at 433.42 MHz. Power level of 37 and 3F.

## POWER SETTINGS INVESTIGATED

Battery

## CONFIGURATIONS INVESTIGATED

CINC0046 - 1

## FREQUENCY RANGE INVESTIGATED

Start Frequency | 423 MHz | Stop Frequency | 443 MHz

## SAMPLE CALCULATIONS

Radiated Emissions: Field Strength = Measured Level + Antenna Factor + Cable Factor - Amplifier Gain + Distance Adjustment Factor + External Attenuation

## TEST EQUIPMENT

Description	Manufacturer	Model	ID	Last Cal.	Interval
Analyzer - Spectrum Analyzer	Agilent	E4440A	AFG	5-Jul-2018	12 mo
Amplifier - Pre-Amplifier	Miteq	AMF-3D-00100800-32-13P	AVX	23-Feb-2019	12 mo
Cable	Element	Double Ridge Guide Horn Cables	MNV	23-Feb-2019	12 mo
Antenna - Double Ridge	ETS-Lindgren	3115	AJQ	NCR	0 mo
Amplifier - Pre-Amplifier	Miteq	AM-1064-9079 and SA18E-10	AOO	23-Feb-2019	12 mo
Cable	Element	Biconilog Cable	MNX	23-Feb-2019	12 mo
Antenna - Biconilog	ETS Lindgren	3142D	AXO	15-Dec-2017	24 mo

## MEASUREMENT BANDWIDTHS

Frequency Range (MHz)	Peak Data (kHz)	Quasi-Peak Data (kHz)	Average Data (kHz)
0.01 - 0.15	1.0	0.2	0.2
0.15 - 30.0	10.0	9.0	9.0
30.0 - 1000	100.0	120.0	120.0
Above 1000	1000.0	N/A	1000.0

## TEST DESCRIPTION

The antennas to be used with the EUT were tested. The EUT was configured for continuous un-modulated CW operation at its single transmit frequency. The field strength of the transmit frequency was maximized by rotating the EUT, adjusting the measurement antenna height and polarization, and manipulating the EUT in 3 orthogonal planes (per ANSI C63.10:2013).

To derive average emission measurements, a duty cycle correction factor was utilized:

Duty Cycle = On time/100 milliseconds (or the period, whichever is less)

Where "On time" =  $N1L1 + N2L2 + \dots$

Where N1 is the number of type 1 pulses, L1 is length of type 1 pulses, N2 is the number of type 2 pulses, L2 is the length of type 2 pulses, etc.

Therefore, Duty Cycle =  $(N1L1 + N2L2 + \dots)/100\text{mS}$  or T, whichever is less. (Where T is the period of the pulse train.)

The measured values for the EUT's pulse train are as follows:

Period = 100 mSec

Pulsewidth of Type 1 Pulse = 1951 mSec

Pulsewidth of Type 2 Pulse = 0.0962 mSec

Number of Type 1 Pulses = 20

Number of Type 2 Pulses = 40

Duty Cycle =  $20 \log [(20)(.1951) + (40)(.0962)]/100 = -22.2 \text{ dB}$

The duty cycle correction factor of  $-22.2 \text{ dB}$  was added to the peak readings to mathematically derive the average levels. Peak measurements were made with a resolution bandwidth of 100kHz and a video bandwidth of 300kHz.

# FIELD STRENGTH OF FUNDAMENTAL

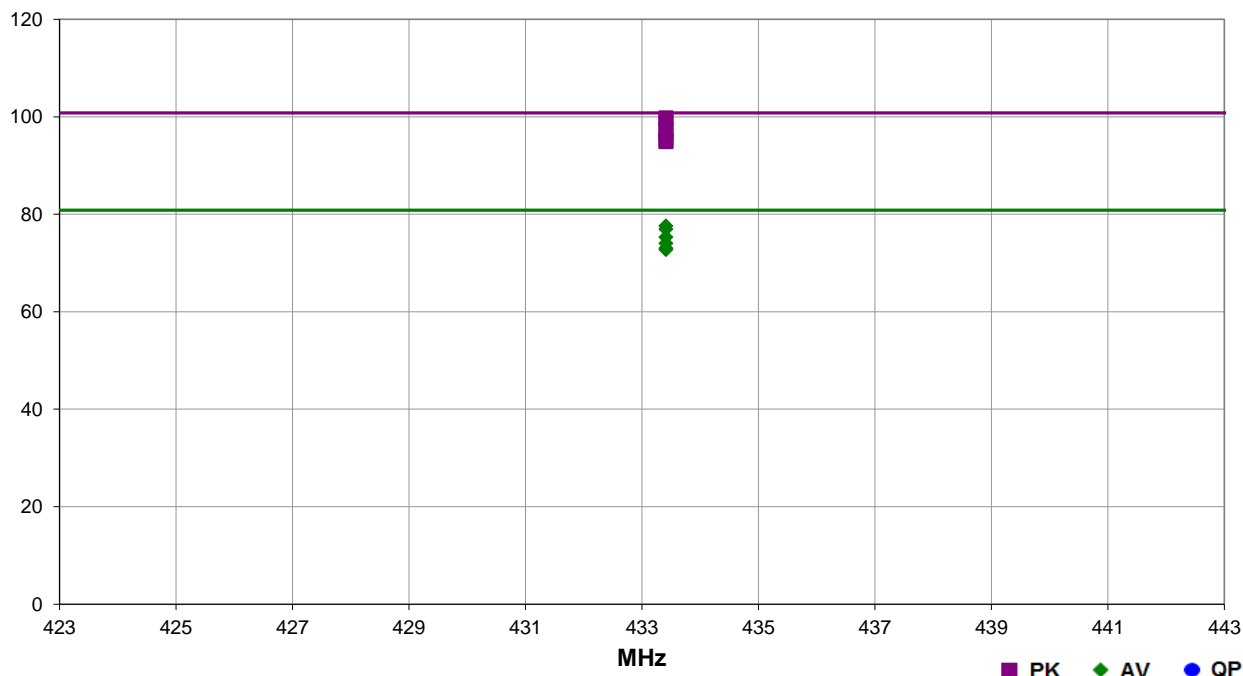


EmiR5 2019.05.20 PSA-ESCI 2019.05.10

<b>Work Order:</b>	CINC0046	<b>Date:</b>	25-Jun-2019	<i>Kyle McMullan</i>
<b>Project:</b>	None	<b>Temperature:</b>	21.6 °C	
<b>Job Site:</b>	MN09	<b>Humidity:</b>	59.7% RH	
<b>Serial Number:</b>	136316011	<b>Barometric Pres.:</b>	1011 mbar	
<b>EUT:</b>	RFCO-A			
<b>Configuration:</b>	1			
<b>Customer:</b>	CINCH Systems			
<b>Attendees:</b>	Jibril Aga			
<b>EUT Power:</b>	Battery			
<b>Operating Mode:</b>	Tx continuous packet at 433.42 MHz. Power level of 37 and 3F.			
<b>Deviations:</b>	None			
<b>Comments:</b>	None			

<b>Test Specifications</b>	<b>Test Method</b>
FCC 15.231:2019	ANSI C63.10:2013

<b>Run #</b>	6	<b>Test Distance (m)</b>	3	<b>Antenna Height(s)</b>	1 to 4(m)	<b>Results</b>	Pass
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Freq (MHz)	Amplitude (dBuV)	Factor (dB)	Antenna Height (meters)	Azimuth (degrees)	Duty Cycle Correction Factor (dB)	External Attenuation (dB)	Polarity/Transducer Type	Detector	Distance Adjustment (dB)	Adjusted (dBuV/m)	Spec. Limit (dBuV/m)	Compared to Spec. (dB)	Comments
433.415	76.5	23.3	1.0	144.0		0.0	Vert	PK	0.0	99.8	100.8	-1.0	EUT On Side
433.415	75.8	23.3	1.9	343.0		0.0	Horz	PK	0.0	99.1	100.8	-1.7	EUT Vert
433.415	76.5	23.3	1.0	144.0	-22.2	0.0	Vert	AV	0.0	77.6	80.8	-3.2	EUT On Side
433.415	74.2	23.3	2.1	283.0		0.0	Horz	PK	0.0	97.5	100.8	-3.3	EUT Horz
433.415	75.8	23.3	1.9	343.0	-22.2	0.0	Horz	AV	0.0	76.9	80.8	-3.9	EUT Vert
433.415	72.9	23.3	1.3	200.0		0.0	Vert	PK	0.0	96.2	100.8	-4.6	EUT Horz
433.415	74.2	23.3	2.1	283.0	-22.2	0.0	Horz	AV	0.0	75.3	80.8	-5.5	EUT Horz
433.415	71.9	23.3	1.5	69.0		0.0	Vert	PK	0.0	95.2	100.8	-5.6	EUT Vert
433.415	71.6	23.3	1.8	191.0		0.0	Horz	PK	0.0	94.9	100.8	-5.9	EUT On Side
433.415	72.9	23.3	1.3	200.0	-22.2	0.0	Vert	AV	0.0	74.0	80.8	-6.8	EUT Horz
433.415	71.9	23.3	1.5	69.0	-22.2	0.0	Vert	AV	0.0	73.0	80.8	-7.8	EUT Vert
433.415	71.6	23.3	1.8	191.0	-22.2	0.0	Horz	AV	0.0	72.7	80.8	-8.1	EUT On Side

# SPURIOUS RADIATED EMISSIONS



PSA-ESCI 2019.05.10

Testing was performed using the mode(s) of operation and configuration(s) noted within the report. The individuals and/or the organization requesting the test provided the modes, configurations and settings used to complete the evaluation. The actual test parameters are specified in the test data, this includes items such as investigated frequency range (scanned) and test levels. The testing methods and performance specifications, as well as the test site used for the evaluation are indicated in the test data. The test data represents the configuration / operating mode/ model that produced the highest emission levels as compared to the specification limit.

## MODES OF OPERATION

Tx at 433.42 MHz modulated. Power level 37 and 3F.

## POWER SETTINGS INVESTIGATED

Battery

## CONFIGURATIONS INVESTIGATED

CINC0046 - 1

## FREQUENCY RANGE INVESTIGATED

Start Frequency | 30 MHz | Stop Frequency | 5 GHz

## SAMPLE CALCULATIONS

Radiated Emissions: Field Strength = Measured Level + Antenna Factor + Cable Factor - Amplifier Gain + Distance Adjustment Factor + External Attenuation

## TEST EQUIPMENT

Description	Manufacturer	Model	ID	Last Cal.	Interval
Attenuator	Coaxicom	3910-10	AWZ	26-Sep-2018	12 mo
Amplifier - Pre-Amplifier	Miteq	AMF-3D-00100800-32-13P	AVX	23-Feb-2019	12 mo
Cable	Element	Double Ridge Guide Horn Cables	MNV	23-Feb-2019	12 mo
Antenna - Double Ridge	ETS-Lindgren	3115	AJQ	NCR	0 mo
Amplifier - Pre-Amplifier	Miteq	AM-1064-9079 and SA18E-10	AOO	23-Feb-2019	12 mo
Cable	Element	Biconilog Cable	MNX	23-Feb-2019	12 mo
Antenna - Biconilog	ETS Lindgren	3142D	AXO	15-Dec-2017	24 mo
Analyzer - Spectrum Analyzer	Agilent	E4440A	AFG	5-Jul-2018	12 mo

## MEASUREMENT BANDWIDTHS

Frequency Range (MHz)	Peak Data (kHz)	Quasi-Peak Data (kHz)	Average Data (kHz)
0.01 - 0.15	1.0	0.2	0.2
0.15 - 30.0	10.0	9.0	9.0
30.0 - 1000	100.0	120.0	120.0
Above 1000	1000.0	N/A	1000.0

## TEST DESCRIPTION

The highest gain antenna of each type to be used with the EUT was tested. The EUT was configured for the required transmit frequency in each operational band and the modes as showed in the data sheets.

For each configuration, the spectrum was scanned throughout the specified range as part of the exploratory investigation of the emissions. These "pre-scans" are not included in the report. Final measurements on individual emissions were then made and included in this test report.

The individual emissions from the EUT were maximized by rotating the EUT on a turntable, adjusting the position of the EUT and EUT antenna in three orthogonal axis, and adjusting the measurement antenna height and polarization (per ANSI C63.10). A preamp and high pass filter (and notch filter) were used for this test in order to provide sufficient measurement sensitivity.

Measurements were made with the required detectors and annotated on the data for each individual point using the following annotation:

QP = Quasi-Peak Detector  
PK = Peak Detector  
AV = RMS Detector

To derive average emission measurements, a duty cycle correction factor was utilized:

Duty Cycle = On time/100 milliseconds (or the period, whichever is less)

Where "On time" =  $N1L1 + N2L2 + \dots$

Where N1 is the number of type 1 pulses, L1 is length of type 1 pulses, N2 is the number of type 2 pulses, L2 is the length of type 2 pulses, etc.

Therefore, Duty Cycle =  $(N1L1 + N2L2 + \dots)/100\text{ms}$  or T, whichever is less. Where T is the period of the pulse train.

The measured values for the EUT's pulse train are as follows:

Period = 100 mSec  
Pulsewidth of Type 1 Pulse = 1951 mSec  
Pulsewidth of Type 2 Pulse = 0.0962 mSec  
Number of Type 1 Pulses = 20  
Number of Type 2 Pulses = 40

Duty Cycle =  $20 \log [((20)(.1951) + (40)(.0962))/100] = -22.2 \text{ dB}$

The duty cycle correction factor of  $-22.2 \text{ dB}$  was added to the peak readings to mathematically derive the average levels. Peak measurements were made with a resolution bandwidth of 100kHz and a video bandwidth of 300kHz for measurements at or below 1GHz. Above 1GHz, a resolution bandwidth of 1MHz and a video bandwidth of 3MHz was used.



# SPURIOUS RADIATED EMISSIONS

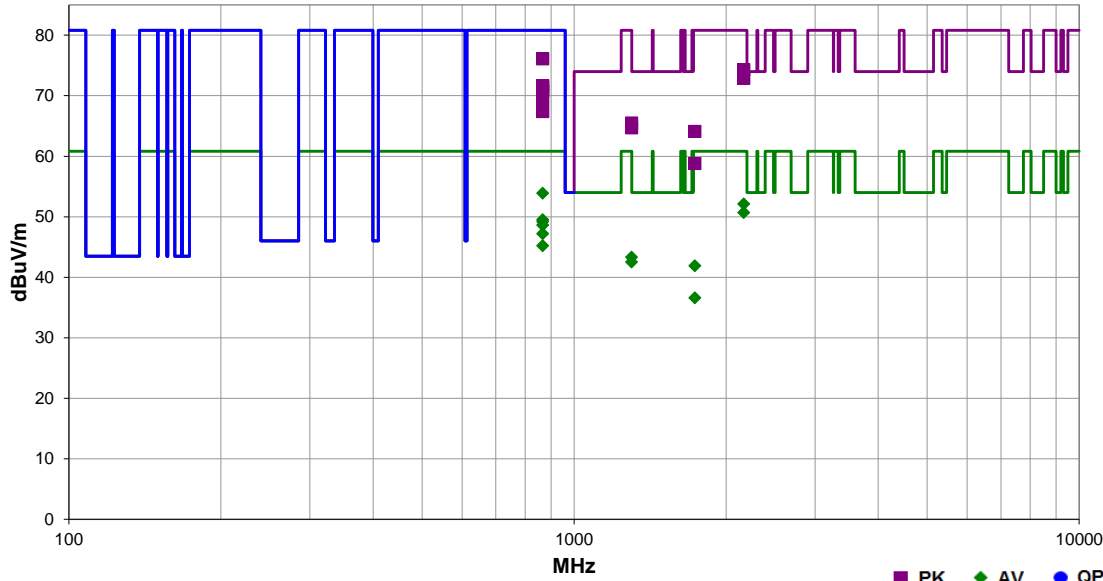


EmiRS 2019.05.20 PSA-ESCI 2019.05.10

<b>Work Order:</b>	CINC0046	<b>Date:</b>	5-Aug-2019	<i>Kyle McMullan</i>
<b>Project:</b>	None	<b>Temperature:</b>	21.7 °C	
<b>Job Site:</b>	MN09	<b>Humidity:</b>	77.4% RH	
<b>Serial Number:</b>	136316011	<b>Barometric Pres.:</b>	1015 mbar	
<b>EUT:</b>	RFCO-A			
<b>Configuration:</b>	CINC0046 - 1			
<b>Customer:</b>	CINCH Systems			
<b>Attendees:</b>	Jibril Aga			
<b>EUT Power:</b>	Battery			
<b>Operating Mode:</b>	Tx at 433.42 MHz modulated. Power level 37 and 3F.			
<b>Deviations:</b>	None			
<b>Comments:</b>	None			

<b>Test Specifications</b>	FCC 15.231:2019	<b>Test Method</b>	ANSI C63.10:2013
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<b>Run #</b>	2	<b>Test Distance (m)</b>	3	<b>Antenna Height(s)</b>	1 to 4(m)	<b>Results</b>	Pass
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Freq (MHz)	Amplitude (dBuV)	Factor (dB)	Antenna Height (meters)	Azimuth (degrees)	Duty Cycle Correction Factor (dB)	External Attenuation (dB)	Polarity/Transducer Type	Detector	Distance Adjustment (dB)	Adjusted (dBuV/m)	Spec. Limit (dBuV/m)	Compared to Spec. (dB)	Comments
866.840	55.5	10.6	1.0	159.0		10.0	Horz	PK	0.0	76.1	80.8	-4.7	EUT Horz
2167.100	77.6	-3.3	3.5	56.0		0.0	Vert	PK	0.0	74.3	80.8	-6.5	EUT On Side
866.840	55.5	10.6	1.0	159.0	-22.2	10.0	Horz	AV	0.0	53.9	60.8	-6.9	EUT Horz
2167.100	76.2	-3.3	1.1	162.0		0.0	Horz	PK	0.0	72.9	80.8	-7.9	EUT Horz
1300.302	71.8	-6.3	1.0	275.0		0.0	Horz	PK	0.0	65.5	74.0	-8.5	EUT Horz
2167.100	77.6	-3.3	3.5	56.0	-22.2	0.0	Vert	AV	0.0	52.1	60.8	-8.7	EUT On Side
866.840	51.1	10.6	1.0	211.0		10.0	Horz	PK	0.0	71.7	80.8	-9.1	EUT On Side
1300.260	71.0	-6.3	1.0	43.0		0.0	Vert	PK	0.0	64.7	74.0	-9.3	EUT On Side
866.845	50.8	10.6	2.4	180.0		10.0	Horz	PK	0.0	71.4	80.8	-9.4	EUT Vertical
866.845	50.2	10.6	1.2	118.0		10.0	Vert	PK	0.0	70.8	80.8	-10.0	EUT On Side
2167.100	76.2	-3.3	1.1	162.0	-22.2	0.0	Horz	AV	0.0	50.7	60.8	-10.1	EUT Horz
1300.302	71.8	-6.3	1.0	275.0	-22.2	0.0	Horz	AV	0.0	43.3	54.0	-10.7	EUT Horz
866.840	51.1	10.6	1.0	211.0	-22.2	10.0	Horz	AV	0.0	49.5	60.8	-11.3	EUT On Side
866.835	48.8	10.6	2.1	279.0		10.0	Vert	PK	0.0	69.4	80.8	-11.4	EUT Vertical
1300.260	71.0	-6.3	1.0	43.0	-22.2	0.0	Vert	AV	0.0	42.5	54.0	-11.5	EUT On Side
866.845	50.8	10.6	2.4	180.0	-22.2	10.0	Horz	AV	0.0	49.2	60.8	-11.6	EUT Vertical
866.845	50.2	10.6	1.2	118.0	-22.2	10.0	Vert	AV	0.0	48.6	60.8	-12.2	EUT On Side
866.845	46.8	10.6	1.0	82.0		10.0	Vert	PK	0.0	67.4	80.8	-13.4	EUT Horz
866.835	48.8	10.6	2.1	279.0	-22.2	10.0	Vert	AV	0.0	47.2	60.8	-13.6	EUT Vertical
866.845	46.8	10.6	1.0	82.0	-22.2	10.0	Vert	AV	0.0	45.2	60.8	-15.6	EUT Horz
1733.638	70.4	-6.3	1.0	77.0		0.0	Horz	PK	0.0	64.1	80.8	-16.7	EUT Horz
1733.638	70.4	-6.3	1.0	77.0	-22.2	0.0	Horz	AV	0.0	41.9	60.8	-18.9	EUT Horz
1733.680	65.1	-6.3	3.5	180.0		0.0	Vert	PK	0.0	58.8	80.8	-22.0	EUT On Side
1733.680	65.1	-6.3	3.5	180.0	-22.2	0.0	Vert	AV	0.0	36.6	60.8	-24.2	EUT On Side

# OCCUPIED BANDWIDTH



XMM 2019.02.26

Testing was performed using the mode(s) of operation and configuration(s) noted within the report. The individuals and/or the organization requesting the test provided the modes, configurations and settings used to complete the evaluation. The actual test parameters are specified in the test data, this includes items such as investigated frequency range (scanned) and test levels. The testing methods and performance specifications, as well as the test site used for the evaluation are indicated in the test data.

## TEST EQUIPMENT

Description	Manufacturer	Model	ID	Last Cal.	Cal. Due
Amplifier - Pre-Amplifier	Miteq	AM-1064-9079 and SA18E-10	AOO	23-Feb-19	23-Feb-20
Cable	Element	Biconilog Cable	MNX	23-Feb-19	23-Feb-20
Antenna - Biconilog	ETS Lindgren	3142D	AXO	15-Dec-17	15-Dec-19
Analyzer - Spectrum Analyzer	Keysight	N9010A (EXA)	AFQ	13-Dec-18	13-Dec-19

## TEST DESCRIPTION

The measurement was made in a radiated configuration of the fundamental with the carrier fully maximized for its highest radiated power. The EUT was transmitting at its maximum data rate.

The 20 dB occupied bandwidth is required to be no wider than 0.25% of the center frequency for devices operating above 70 MHz and below 900 MHz.

# OCCUPIED BANDWIDTH



XMI 2019.02.26

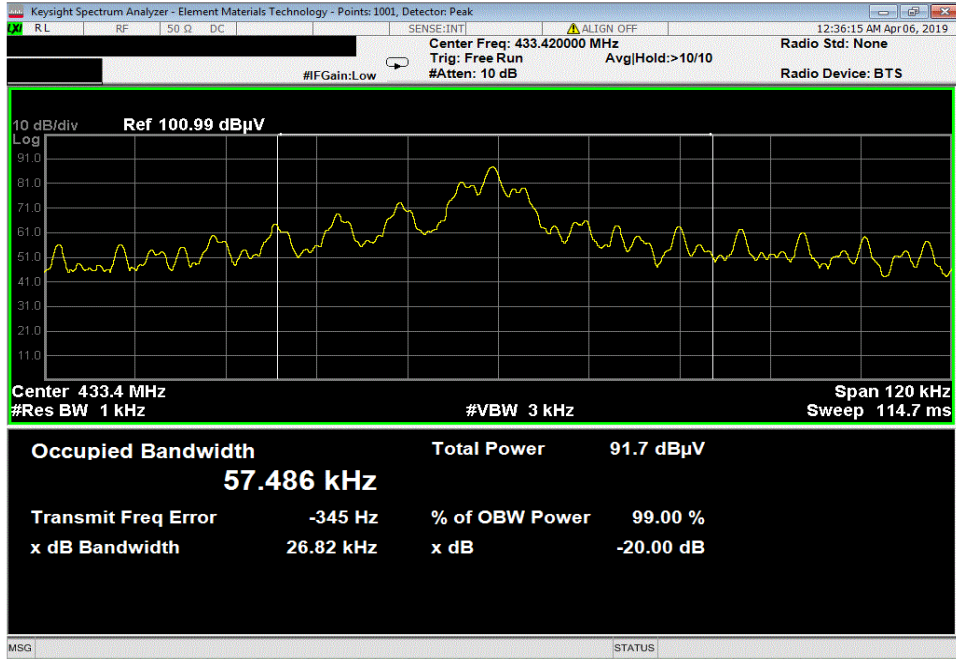
EUT: RFCO-A		Work Order: CINC0042	
Serial Number: 331720		Date: 5-Apr-19	
Customer: CINCH Systems		Temperature: 23.3 °C	
Attendees: Jibril Aga		Humidity: 28.9% RH	
Project: None		Barometric Pres.: 1020 mbar	
Tested by: Andrew Rogstad		Power: Battery	
Job Site: MN09			
<b>TEST SPECIFICATIONS</b>			
FCC 15.231:2019		Test Method	
		ANSI C63.10:2013	
<b>COMMENTS</b>			
None			
<b>DEVIATIONS FROM TEST STANDARD</b>			
None			
Configuration #	1	Signature	<i>Andrew Rogstad</i>
		Value (kHz)	Limit (kHz)
433.42 MHz		26.82	1083.55
		Result	
		Pass	

# OCCUPIED BANDWIDTH



XMI 2019.02.26

433.42 MHz						
				<b>Value (kHz)</b>	<b>Limit (kHz)</b>	<b>Result</b>
				26.82	1083.55	Pass



# DUTY CYCLE



XMI 2017.12.13

Testing was performed using the mode(s) of operation and configuration(s) noted within the report. The individuals and/or the organization requesting the test provided the modes, configurations and settings used to complete the evaluation. The actual test parameters are specified in the test data, this includes items such as investigated frequency range (scanned) and test levels. The testing methods and performance specifications, as well as the test site used for the evaluation are indicated in the test data.

## TEST EQUIPMENT

Description	Manufacturer	Model	ID	Last Cal.	Cal. Due
Antenna - Biconilog	Teseg	CBL 6141B	AYD	25-Jan-2018	25-Jan-2020
Cable	ESM Cable Corp.	Bilog Cables	MNH	2-Nov-2018	2-Nov-2019
Analyzer - Spectrum Analyzer	Keysight	N9010A	AFN	27-Apr-2018	27-Apr-2019

## TEST DESCRIPTION

The measurement was made in a radiated configuration of the fundamental with the carrier fully maximized for its highest radiated power. For software controlled or pre-programmed devices, the manufacturer shall declare the duty cycle class or classes for the equipment under test. For manually operated or event dependant devices, with or without software controlled functions, the manufacturer shall declare whether the device once triggered, follows a pre-programmed cycle, or whether the transmission is constant until the trigger is released or manually reset. The manufacturer shall also give a description of the application for the device and include a typical usage pattern. The typical usage pattern as declared by the manufacturer shall be used to determine the duty cycle and hence the duty class.

Where an acknowledgement is required, the additional transmitter on-time shall be included and declared by the manufacturer.

To derive average emission measurements, a duty cycle correction factor was utilized:

Duty Cycle = On time/100 milliseconds (or the period, whichever is less)

Where "On time" =  $N1L1 + N2L2 + \dots$

Where N1 is the number of type 1 pulses, L1 is length of type 1 pulses, N2 is the number of type 2 pulses, L2 is the length of type 2 pulses, etc.

Therefore, Duty Cycle =  $(N1L1 + N2L2 + \dots)/100\text{mS}$  or T, whichever is less. (Where T is the period of the pulse train.)

The measured values for the EUT's pulse train are as follows:

Period = 100 mSec

Pulsewidth of Type 1 Pulse = .1951 mSec

Pulsewidth of Type 2 Pulse = .0962 mSec

Number of Type 1 Pulses = 20

Number of Type 2 Pulses = 40


Duty Cycle =  $20 \log [((20)(.1951) + (40)(.0962))/100] = -22.2 \text{ dB}$

The duty cycle correction factor of  $-22.2 \text{ dB}$  was added to the peak readings to mathematically derive the average levels. Peak measurements were made with a resolution bandwidth of 100kHz and a video bandwidth of 300kHz.

# DUTY CYCLE



XMI 2019.02.26

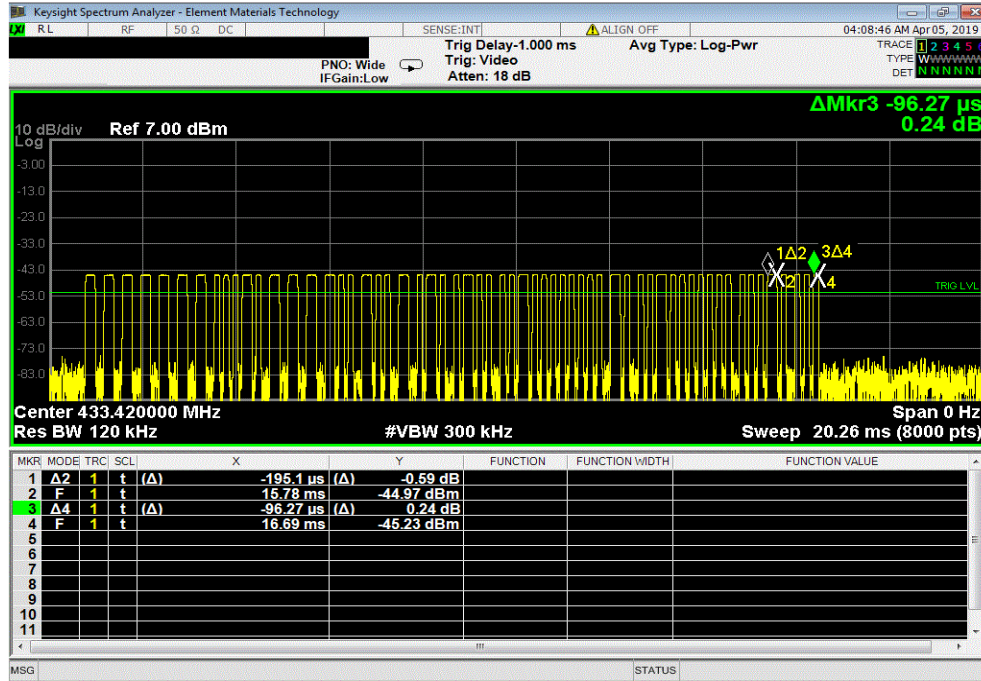
EUT: RFCO-A		Work Order: CINC0042	
Serial Number: 331720		Date: 4-Apr-19	
Customer: CINCH Systems		Temperature: 22.4 °C	
Attendees: Jibril Aga		Humidity: 22.6% RH	
Project: None		Barometric Pres.: 1029 mbar	
Tested by: Chris Patterson		Power: Battery	
Job Site: MN05			
<b>TEST SPECIFICATIONS</b>			
FCC 15.231:2019		Test Method	
		ANSI C63.10:2013	
<b>COMMENTS</b>			
Tx at 433.42 MHz			
<b>DEVIATIONS FROM TEST STANDARD</b>			
None			
Configuration #	1	Signature 	
		Number of Type 1 Pulses	Type 1 Pulse length (ms)
100 ms		20	0.1951
5 s		N/A	N/A
		Number of Type 2 Pulses	Type 2 Pulse length (ms)
		40	0.09627
		N/A	N/A
		DCCF	Result
		-22.2	N/A
		N/A	N/A

# DUTY CYCLE



XMI 2019.02.26

100 ms						
Number of Type 1 Pulses	Type 1 Pulse length (ms)	Number of Type 2 Pulses	Type 2 Pulse length (ms)	DCCF	Result	
20	0.1951	40	0.09627	-22.2	N/A	



5 s						
Number of Type 1 Pulses	Type 1 Pulse length (ms)	Number of Type 2 Pulses	Type 2 Pulse length (ms)	DCCF	Result	
N/A	N/A	N/A	N/A	N/A	N/A	

