



# element

## **CINCH Systems**

**RF-SHK-319**

**FCC 15.231:2019**

**Low Power Periodic Radio**

**Report # CINC0045**



NVLAP LAB CODE: 200881-0



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# CERTIFICATE OF TEST

**Last Date of Test: May 31, 2019**  
**CINCH Systems**  
**Model: RF-SHK-319**

## 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/RRR, 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.

Test	+ MU	- MU
Frequency Accuracy (Hz)	0.0007%	-0.0007%
Amplitude Accuracy (dB)	1.2 dB	-1.2 dB
Conducted Power (dB)	1.2 dB	-1.2 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

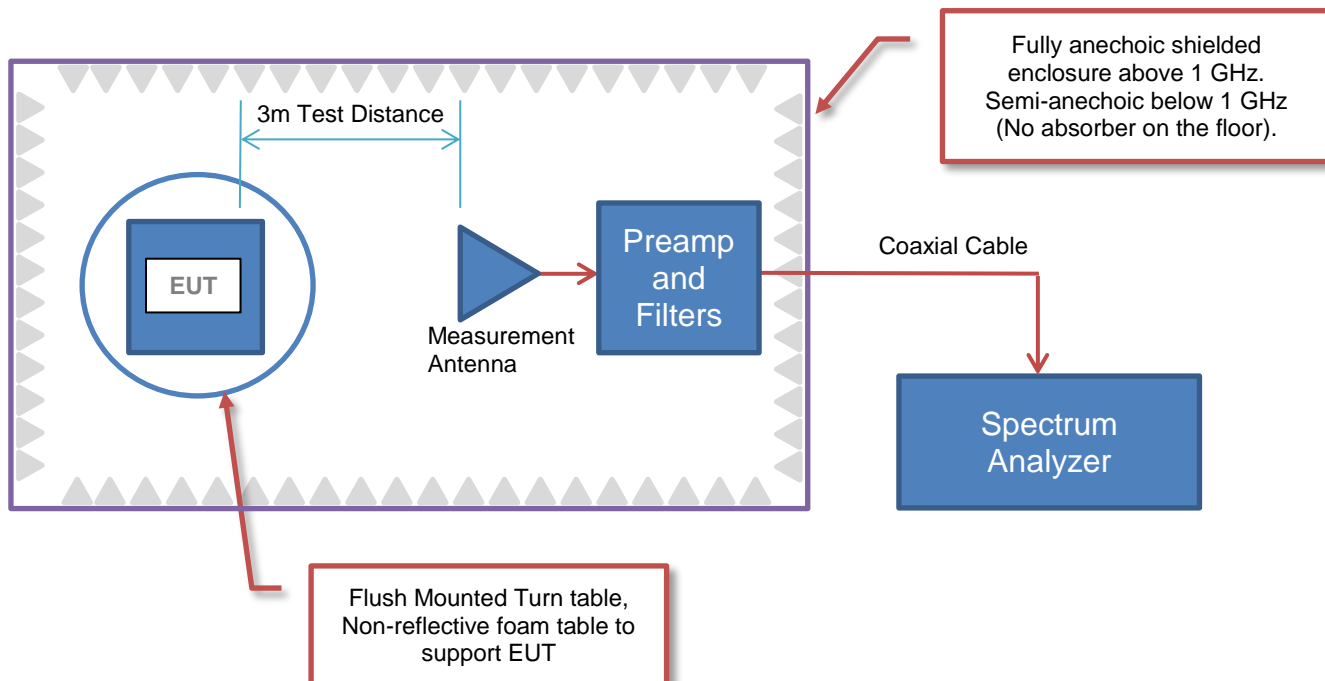
## Antenna Port Conducted Measurements



## Near Field Test Fixture Measurements



## Spurious Radiated Emissions





# PRODUCT DESCRIPTION



## Client and Equipment Under Test (EUT) Information

Company Name:	CINCH Systems
Address:	12075 43rd Street NE Suite 300
City, State, Zip:	St. Michael, MN 55376
Test Requested By:	Jibril Aga
Model:	RF-SHK-319
First Date of Test:	May 31, 2019
Last Date of Test:	May 31, 2019
Receipt Date of Samples:	May 31, 2019
Equipment Design Stage:	Production
Equipment Condition:	No Damage
Purchase Authorization:	Verified

## Information Provided by the Party Requesting the Test

### Functional Description of the EUT:

Shock Sensor containing a low power periodic transmitter which operates at 319.508 MHz utilizing OOK modulation.

### Testing Objective:

To demonstrate compliance of the periodic radio to FCC 15.231 specifications.



# CONFIGURATIONS



## Configuration CINC0045- 1

EUT			
Description	Manufacturer	Model/Part Number	Serial Number
Shock Transmitter Sensor	CINCH Systems	RF-SHK-319	0A1F2EA

## Configuration CINC0045- 2

EUT			
Description	Manufacturer	Model/Part Number	Serial Number
Shock Transmitter Sensor	CINCH Systems	RF-SHK-319	0A55F92

## Configuration CINC0045- 3

EUT			
Description	Manufacturer	Model/Part Number	Serial Number
Shock Transmitter Sensor	CINCH Systems	RF-SHK-319	0A55F92

# MODIFICATIONS



## Equipment Modifications

Item	Date	Test	Modification	Note	Disposition of EUT
1	2019-05-31	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.
2	2019-05-31	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.
3	2019-05-31	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	2019-05-31	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

CW at 319.508 MHz

## POWER SETTINGS INVESTIGATED

Battery

## CONFIGURATIONS INVESTIGATED

CINC0045 - 3

## FREQUENCY RANGE INVESTIGATED

Start Frequency	30 MHz	Stop Frequency	1000 MHz
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## 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
Amplifier - Pre-Amplifier	Miteq	AM-1616-1000	AVO	2-Nov-2018	12 mo
Cable	ESM Cable Corp.	Bilog Cables	MNH	2-Nov-2018	12 mo
Antenna - Biconilog	Teseq	CBL 6141B	AYD	25-Jan-2018	24 mo
Analyzer - Spectrum Analyzer	Keysight	N9010A (EXA)	AFQ	13-Dec-2018	12 mo

## 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 = 0.1474 mSec  
Pulsewidth of Type 2 Pulse = 0.4906 mSec  
Number of Type 1 Pulses = 59  
Number of Type 2 Pulses = 1


Duty Cycle =  $20 \log [(59)(0.1474) + (1)(0.4906)]/Pd] = -20.74 \text{ dB}$

The duty cycle correction factor of -20.74 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

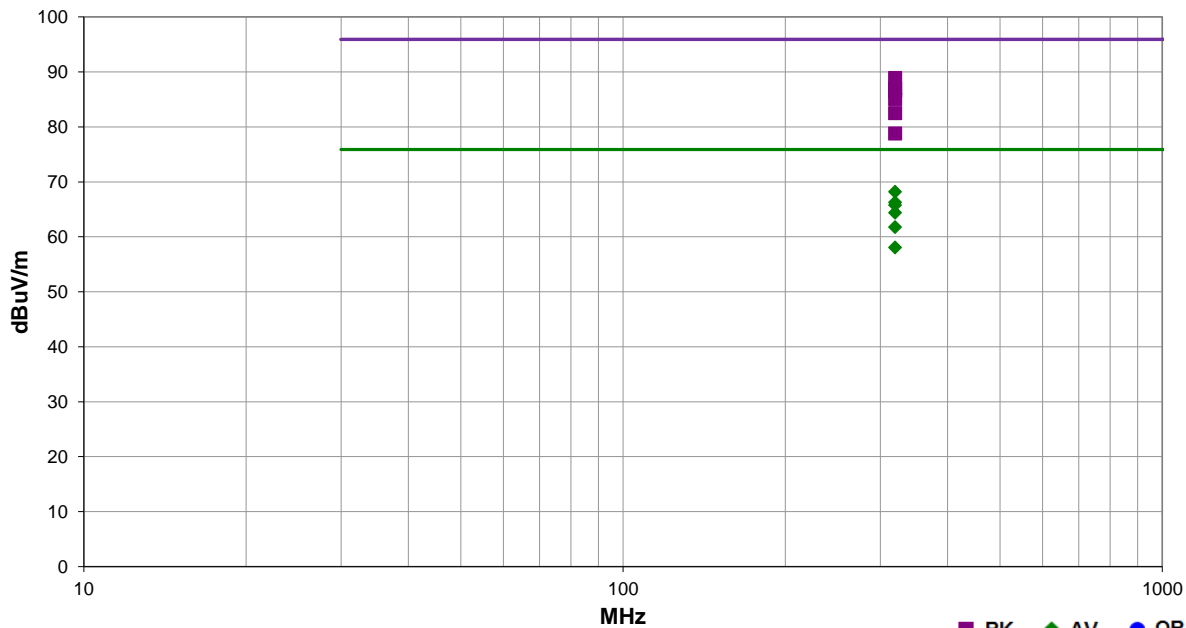


EmiRS 2019.05.20 PSA-ESCI 2019.05.10

Work Order:	CINC0045	Date:	31-May-2019	
Project:	None	Temperature:	23.3 °C	
Job Site:	MN05	Humidity:	50.4% RH	
Serial Number:	0A55F92	Barometric Pres.:	1012 mbar	
EUT:	RF-SHK-319			Tested by: Andrew Rogstad
Configuration:	3			
Customer:	CINCH Systems			
Attendees:	Jabril Aga			
EUT Power:	Battery			
Operating Mode:	CW at 319.508 MHz			
Deviations:	None			
Comments:	None			

Test Specifications	Test Method
FCC 15.231:2019	ANSI C63.10:2013

Run #	1	Test Distance (m)	3	Antenna Height(s)	1 to 4(m)	Results	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
319.503	69.2	19.7	1.0	282.9		0.0	Horz	PK	0.0	88.9	95.9	-7.0	EUT horz
319.503	69.2	19.7	1.0	282.9	-20.7	0.0	Horz	AV	0.0	68.2	75.9	-7.7	EUT horz
319.505	67.3	19.7	1.65	231.0		0.0	Vert	PK	0.0	87.0	95.9	-8.9	EUT on side
319.505	66.8	19.7	1.75	240.9		0.0	Vert	PK	0.0	86.5	95.9	-9.4	EUT vert
319.505	67.3	19.7	1.65	231.0	-20.7	0.0	Vert	AV	0.0	66.3	75.9	-9.6	EUT on side
319.505	66.8	19.7	1.75	240.9	-20.7	0.0	Vert	AV	0.0	65.8	75.9	-10.1	EUT vert
319.506	65.4	19.7	1.06	117.0		0.0	Horz	PK	0.0	85.1	95.9	-10.8	EUT on side
319.506	65.4	19.7	1.06	117.0	-20.7	0.0	Horz	AV	0.0	64.4	75.9	-11.5	EUT on side
319.506	62.8	19.7	1.0	247.9		0.0	Horz	PK	0.0	82.5	95.9	-13.4	EUT vert
319.506	62.8	19.7	1.0	247.9	-20.7	0.0	Horz	AV	0.0	61.8	75.9	-14.1	EUT vert
319.503	59.1	19.7	1.49	288.0		0.0	Vert	PK	0.0	78.8	95.9	-17.1	EUT horz
319.503	59.1	19.7	1.49	288.0	-20.7	0.0	Vert	AV	0.0	58.1	75.9	-17.8	EUT horz

# 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 319.508 MHz, CW

## POWER SETTINGS INVESTIGATED

Battery

## CONFIGURATIONS INVESTIGATED

CINC0045 - 3

## FREQUENCY RANGE INVESTIGATED

Start Frequency	30 MHz	Stop Frequency	4000 MHz
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## 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
Amplifier - Pre-Amplifier	Miteq	AM-1616-1000	AVO	2-Nov-2018	12 mo
Cable	ESM Cable Corp.	Bilog Cables	MNH	2-Nov-2018	12 mo
Antenna - Biconilog	Teseq	CBL 6141B	AYD	25-Jan-2018	24 mo
Analyzer - Spectrum Analyzer	Keysight	N9010A (EXA)	AFQ	13-Dec-2018	12 mo
Amplifier - Pre-Amplifier	Miteq	AMF-3D-00100800-32-13P	AVT	8-Feb-2019	12 mo
Cable	ESM Cable Corp.	Double Ridge Guide Horn Cables	MNI	24-Sep-2018	12 mo
Antenna - Double Ridge	ETS-Lindgren	3115	AJQ	NCR	0 mo

## 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.

# SPURIOUS RADIATED EMISSIONS

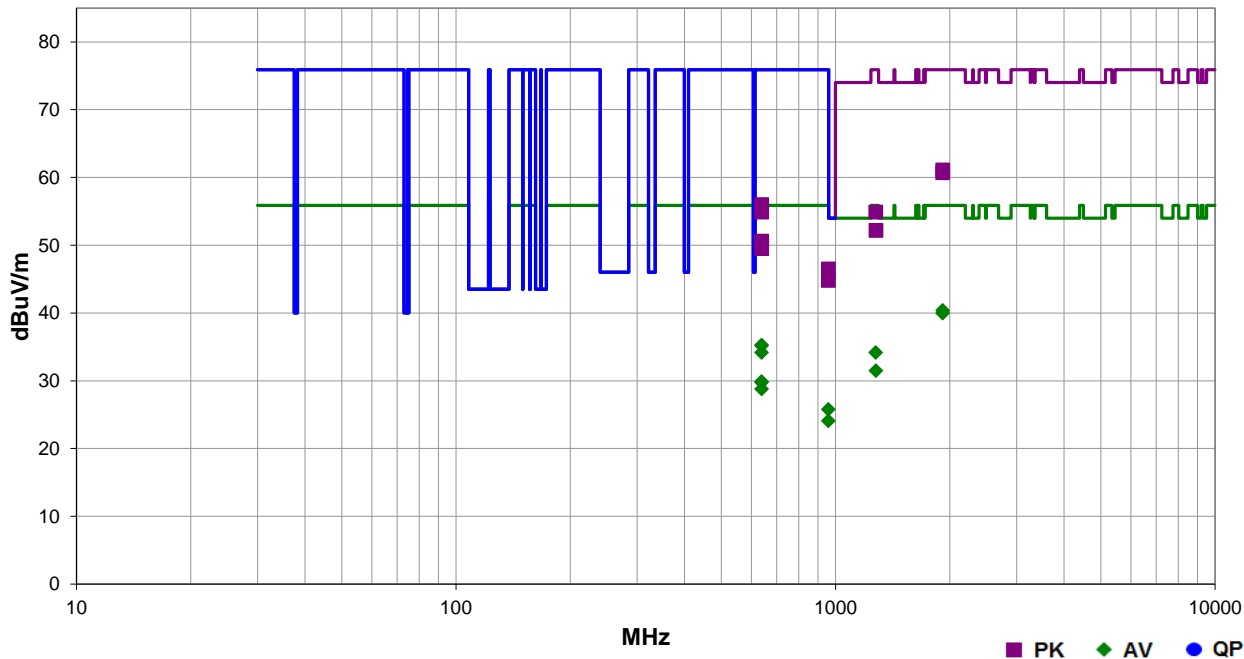


EmiR5 2019.05.20 PSA-ESCI 2019.05.10

Work Order:	CINC0045	Date:	31-May-2019	
Project:	None	Temperature:	23.3 °C	
Job Site:	MN05	Humidity:	50.4% RH	
Serial Number:	0A55F92	Barometric Pres.:	1012 mbar	
EUT:	RF-SHK-319			Tested by: Andrew Rogstad
Configuration:	3			
Customer:	CINCH Systems			
Attendees:	Jabril Aga			
EUT Power:	Battery			
Operating Mode:	Tx at 319.508 MHz, CW			
Deviations:	None			
Comments:	None			

Test Specifications	Test Method
FCC 15.231:2019	ANSI C63.10:2013

Run #	2	Test Distance (m)	3	Antenna Height(s)	1 to 4(m)	Results	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
1916.908	64.7	-3.6	1.5	24.9		0.0	Horz	PK	0.0	61.1	75.9	-14.8	EUT horz
1917.092	64.3	-3.6	1.5	47.0		0.0	Vert	PK	0.0	60.7	75.9	-15.2	EUT vert
1916.908	64.7	-3.6	1.5	24.9	-20.7	0.0	Horz	AV	0.0	40.4	55.9	-15.5	EUT horz
1917.092	64.3	-3.6	1.5	47.0	-20.7	0.0	Vert	AV	0.0	40.0	55.9	-15.9	EUT vert
639.021	49.2	6.8	1.3	232.9		0.0	Horz	PK	0.0	56.0	75.9	-19.9	EUT horz
639.014	49.1	6.8	1.0	348.9		0.0	Vert	PK	0.0	55.9	75.9	-20.0	EUT vert
639.021	49.2	6.8	1.3	232.9	-20.7	0.0	Horz	AV	0.0	35.3	55.9	-20.6	EUT horz
639.014	49.1	6.8	1.0	348.9	-20.7	0.0	Vert	AV	0.0	35.2	55.9	-20.7	EUT vert
639.024	48.1	6.8	1.0	304.9		0.0	Vert	PK	0.0	54.9	75.9	-21.0	EUT on side
1278.030	61.9	-7.0	1.5	347.0		0.0	Vert	PK	0.0	54.9	75.9	-21.0	EUT vert
639.024	48.1	6.8	1.0	304.9	-20.7	0.0	Vert	AV	0.0	34.2	55.9	-21.7	EUT on side
1278.030	61.9	-7.0	1.5	347.0	-20.7	0.0	Vert	AV	0.0	34.2	55.9	-21.7	EUT vert
1278.105	59.2	-7.0	1.5	178.9		0.0	Horz	PK	0.0	52.2	75.9	-23.7	EUT horz
1278.105	59.2	-7.0	1.5	178.9	-20.7	0.0	Horz	AV	0.0	31.5	55.9	-24.4	EUT horz

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
639.023	43.8	6.8	1.2	222.9		0.0	Horz	PK	0.0	50.6	75.9	-25.3	EUT on side
639.011	43.7	6.8	1.0	228.9		0.0	Vert	PK	0.0	50.5	75.9	-25.4	EUT horz
639.023	43.8	6.8	1.2	222.9	-20.7	0.0	Horz	AV	0.0	29.9	55.9	-26.0	EUT on side
639.011	43.7	6.8	1.0	228.9	-20.7	0.0	Vert	AV	0.0	29.8	55.9	-26.1	EUT horz
639.021	42.7	6.8	1.1	232.0		0.0	Horz	PK	0.0	49.5	75.9	-26.4	EUT vert
639.021	42.7	6.8	1.1	232.0	-20.7	0.0	Horz	AV	0.0	28.8	55.9	-27.1	EUT vert
958.519	33.3	13.2	1.0	173.0		0.0	Vert	PK	0.0	46.5	75.9	-29.4	EUT vert
958.519	33.3	13.2	1.0	173.0	-20.7	0.0	Vert	AV	0.0	25.8	55.9	-30.1	EUT vert
958.526	31.6	13.2	1.0	6.9		0.0	Horz	PK	0.0	44.8	75.9	-31.1	EUT horz
958.526	31.6	13.2	1.0	6.9	-20.7	0.0	Horz	AV	0.0	24.1	55.9	-31.8	EUT horz



# OCCUPIED BANDWIDTH



XMit 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-1616-1000	AVO	2-Nov-2018	2-Nov-2019
Cable	ESM Cable Corp.	Bilog Cables	MNH	2-Nov-2018	2-Nov-2019
Antenna - Biconilog	Teseq	CBL 6141B	AYD	25-Jan-2018	25-Jan-2020
Analyzer - Spectrum Analyzer	Agilent	E4440A	AFG	5-Jul-2018	5-Jul-2019

## 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



XM8 2019.02.26

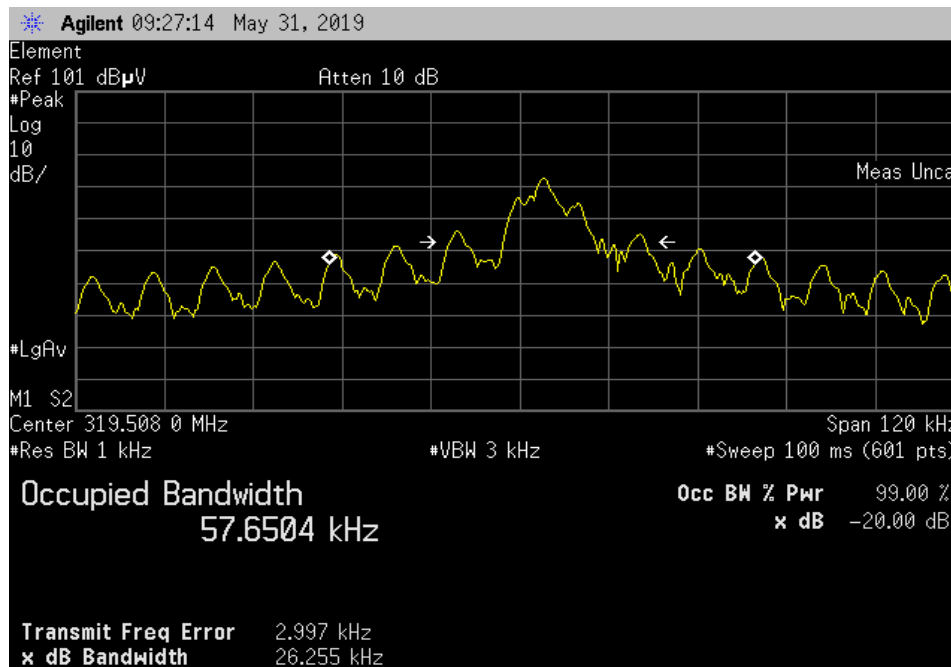
EUT: RF-SHK-319		Work Order: CINC0045	
Serial Number: 0A55F92		Date: 31-May-19	
Customer: CINCH Systems		Temperature: 23.3 °C	
Attendees: Jibril Aga		Humidity: 51.5% RH	
Project: None		Barometric Pres.: 1008.5 mbar	
Tested by: Andrew Rogstad		Power: Battery	
		Job Site: MN05	
TEST SPECIFICATIONS		Test Method	
FCC 15.231:2019		ANSI C63.10:2013	
COMMENTS			
Tx at 319.508 MHz, modulated			
DEVIATIONS FROM TEST STANDARD			
None			
Configuration #	2	Signature <i>Andrew Rogstad</i>	
		Value (kHz)	Limit (kHz)
319.508 MHz		26.255	798.77
			Result
			Pass

# OCCUPIED BANDWIDTH



XMM 2019.02.28

433.42 MHz						
				Value (kHz)	Limit (kHz)	Result
				26.255	798.77	Pass



# DUTY CYCLE



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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
Cable	ESM Cable Corp.	Bilog Cables	MNH	2-Nov-2018	2-Nov-2019
Antenna - Biconilog	Teseq	CBL 6141B	AYD	25-Jan-2018	25-Jan-2020
Analyzer - Spectrum Analyzer	Agilent	E4440A	AFG	5-Jul-2018	5-Jul-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 = .1474 mSec

Pulsewidth of Type 2 Pulse = .4906 mSec

Number of Type 1 Pulses = 59

Number of Type 2 Pulses = 1

Duty Cycle =  $20 \log [(1)(.8929) + (1)(.4835) + (58)(.1159)/100] = -20.74 \text{ dB}$

The duty cycle correction factor of **-20.74 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



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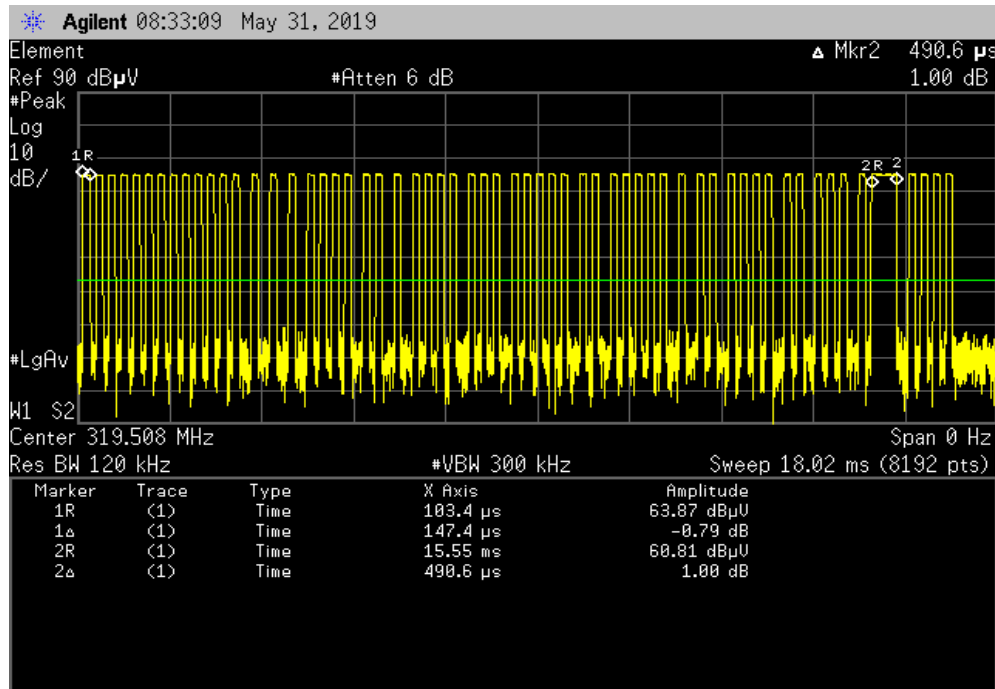
EUT: RF-SHK-319		Work Order: CINC0045	
Serial Number: 0A1F2EA		Date: 31-May-19	
Customer: CINCH Systems		Temperature: 23.3 °C	
Attendees: Jibril Aga		Humidity: 51.5% RH	
Project: None		Barometric Pres.: 1008.5 mbar	
Tested by: Andrew Rogstad		Power: Battery	
Job Site: MN05			
TEST SPECIFICATIONS			
FCC 15.231:2018		Test Method	
		ANSI C63.10:2013	
COMMENTS			
Transmitting at 319.508 MHz			
DEVIATIONS FROM TEST STANDARD			
None			
Configuration #	1	Signature <i>Andrew Rogstad</i>	
		Number of Type 1 Pulses	Type 1 Pulse length (ms)
18 ms		59	0.1474
100 ms		N/A	N/A
5 s		N/A	N/A
10 s		N/A	N/A
		Number of Type 2 Pulses	Type 2 Pulse length (ms)
		1	0.4906
		N/A	N/A
		N/A	N/A
		N/A	N/A
		DCCF	Result
		-20.74	N/A
		N/A	N/A
		N/A	N/A
		N/A	N/A

# DUTY CYCLE

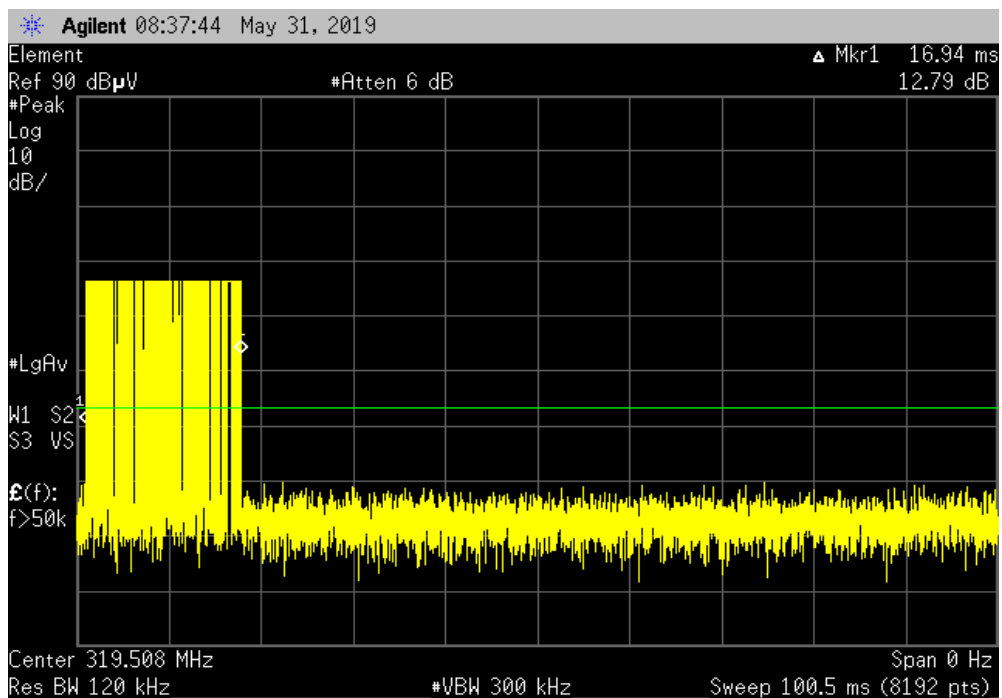


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18 ms						
	Number of Type 1 Pulses	Type 1 Pulse length (ms)	Number of Type 2 Pulses	Type 2 Pulse length (ms)	DCCF	
	59	0.1474	1	0.4906	-20.74	



100 ms						
	Number of Type 1 Pulses	Type 1 Pulse length (ms)	Number of Type 2 Pulses	Type 2 Pulse length (ms)	DCCF	
	N/A	N/A	N/A	N/A	N/A	

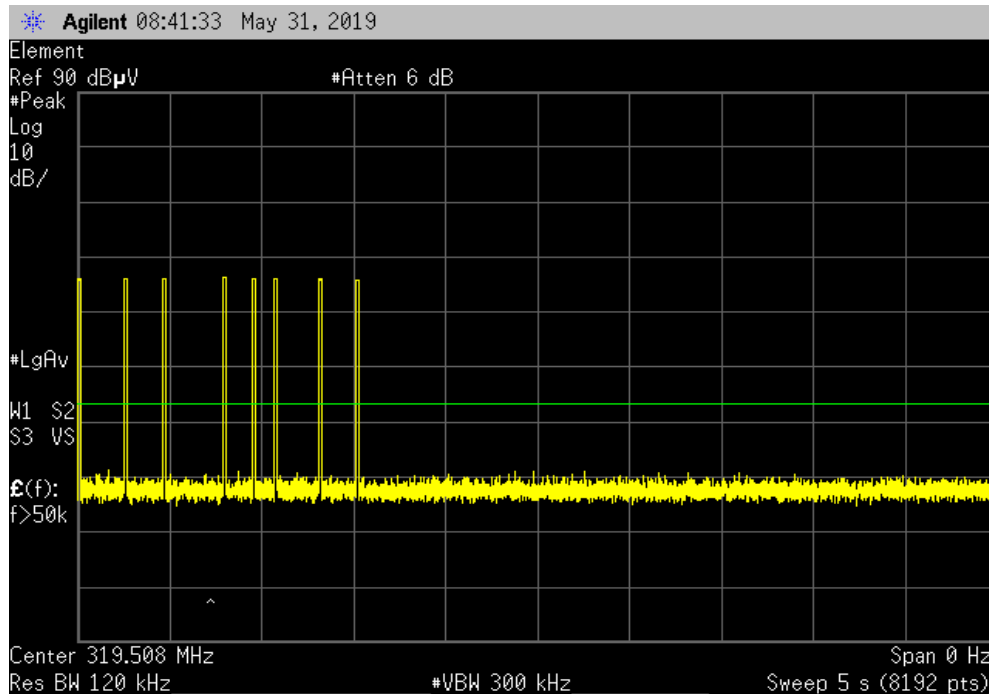


# DUTY CYCLE



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



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

