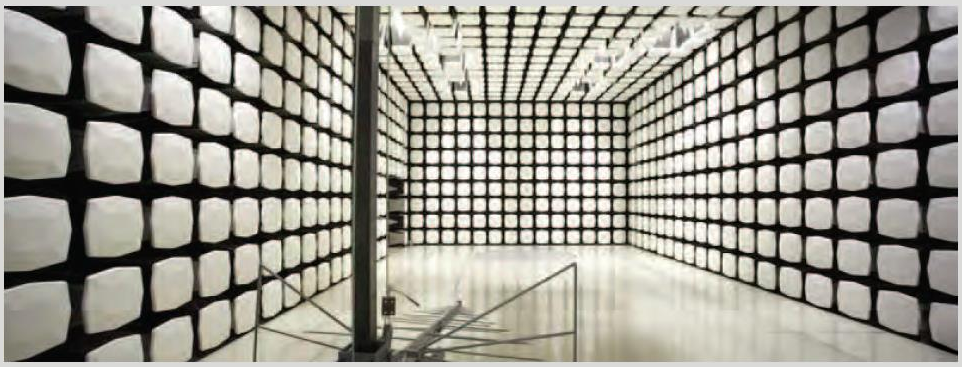
CINCH Systems

RF-CMDWS-433-CLR-W

FCC 15.231:2020

Low Power Radio

Report # CINC0049



NVLAP LAB CODE: 200881-0

CERTIFICATE OF TEST

Last Date of Test: March 3, 2020
CINCH Systems
EUT: RF-CMDWS-433-CLR-W

Radio Equipment Testing

Standards

Specification	Method
FCC 15.231:2020	ANSI C63.10:2013

Results

Method Clause	Test Description	Applied	Results	Comments
6.2	Powerline Conducted Emissions (Transmitter)	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:

Eric Brandon, Department 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

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

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.

European Union

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

Australia/New Zealand

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

Korea

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

Japan

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

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.

Singapore

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

Israel

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

Hong Kong

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

Vietnam

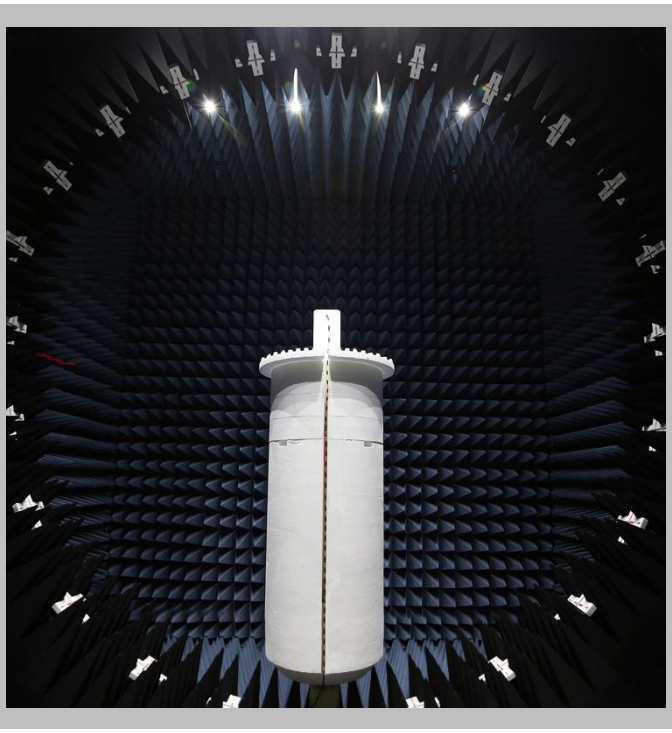
MIC – Recognized by MIC as a CAB for the acceptance of test data.

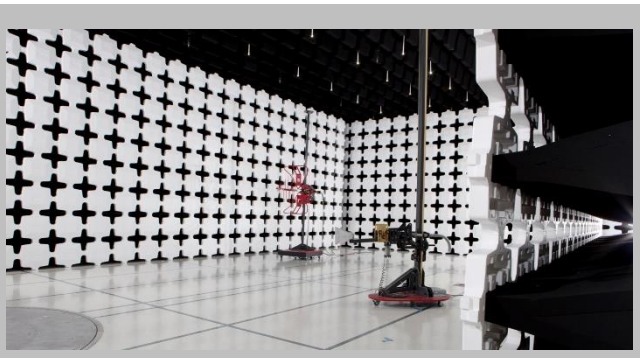
SCOPE

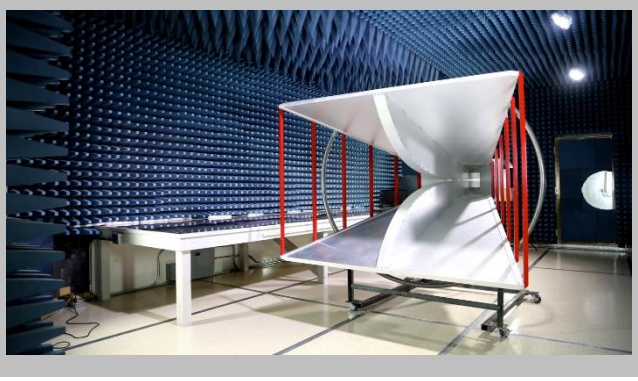
For details on the Scopes of our Accreditations, please visit:
https://www.nwemc.com/emc-testing-accreditations

FACILITIES

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







MEASUREMENT UNCERTAINTY

element
TMU.2015.07.10

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.

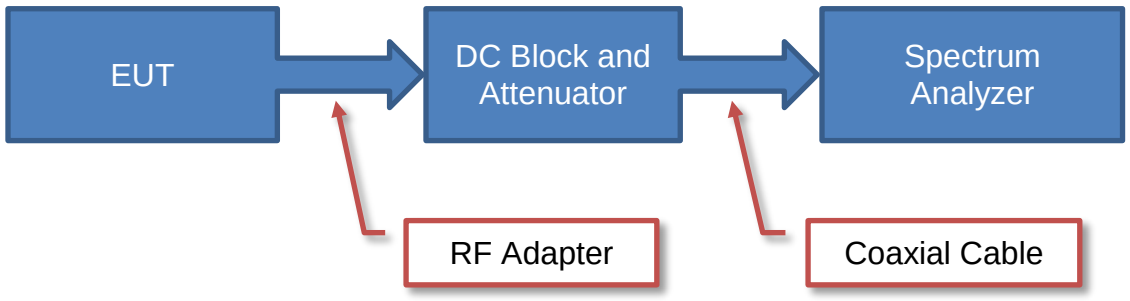
A measurement uncertainty estimation has been performed for each test per our internal quality document QM205.4.6. The estimation is used to compare the measured result with its "true" or theoretically correct value. The expanded measurement uncertainty (K=2) can be found included as part of the applicable 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.

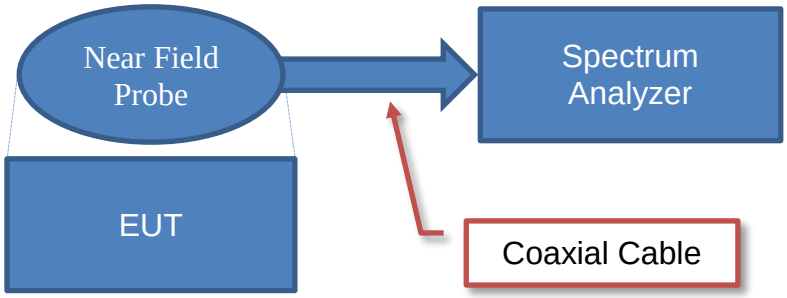
Test	+ MU	- MU
Frequency Accuracy	0.0007%	-0.0007%
Amplitude Accuracy (dB)	1.2 dB	-1.2 dB
Conducted Power (dB)	1.2 dB	-1.2 dB
Radiated Power via Substitution (dB)	0.7 dB	-0.7 dB
Temperature (degrees C)	0.7°C	-0.7°C
Humidity (% RH)	2.5% RH	-2.5% RH
Voltage (AC)	1.0%	-1.0%
Voltage (DC)	0.7%	-0.7%
Field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

Test Setup Block Diagrams

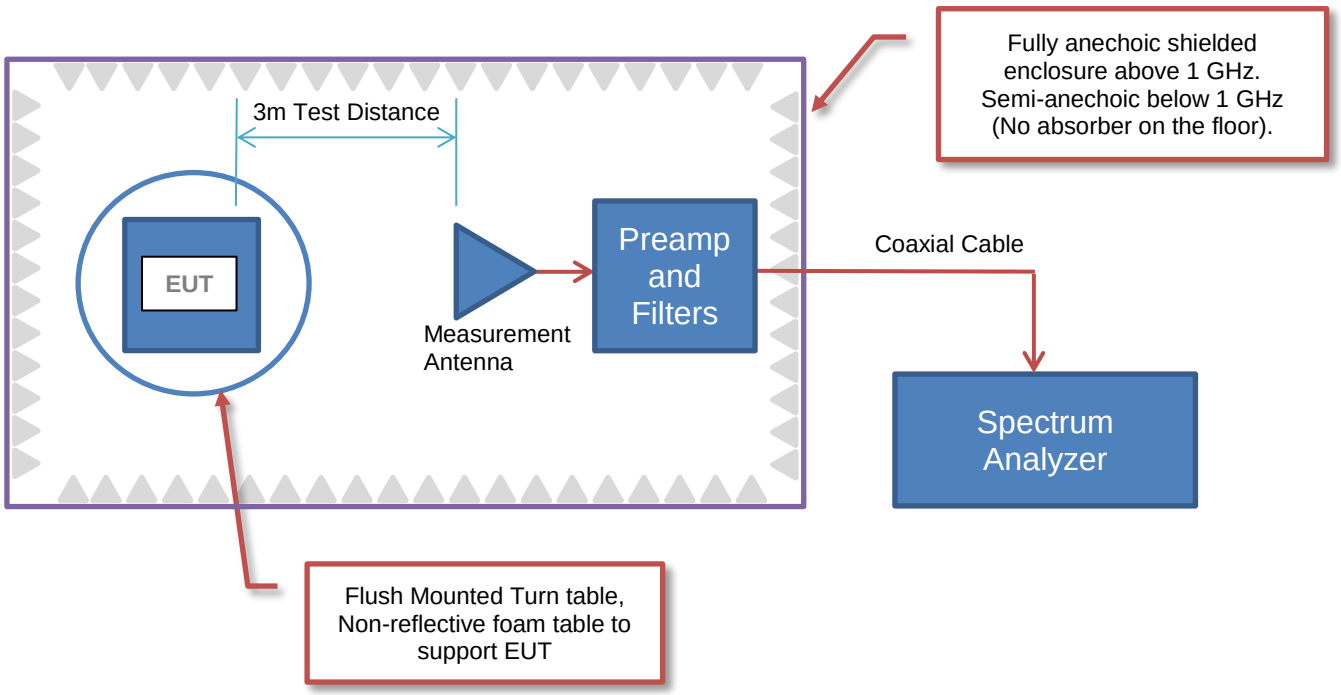
Antenna Port Conducted Measurements



Near Field Test Fixture Measurements



Spurious Radiated Emissions



PRODUCT DESCRIPTION

Client and Equipment Under Test (EUT) Information

Company Name:	CINCH Systems
Address:	Suite 300 12075 43rd Street NE
City, State, Zip:	St. Michael, MN 55376
Test Requested By:	Jibril Aga
EUT:	RF-CMDWS-433-CLR-W
First Date of Test:	March 3, 2020
Last Date of Test:	March 3, 2020
Receipt Date of Samples:	March 3, 2020
Equipment Design Stage:	Production
Equipment Condition:	No Damage
Purchase Authorization:	Verified

Information Provided by the Party Requesting the Test

Functional Description of the EUT:
Sensors containing periodic radio.

Testing Objective:
To demonstrate compliance to FCC 15.231 specifications.

CONFIGURATIONS

element
2018-07-17

Configuration CINC0049- 7

EUT			
Description	**Manufacturer**	**Model/Part Number**	**Serial Number**
RF-CMDWS-433-CLR-W	CINCH Systems	RF-CMDWS-433-CLR-W	0193411

Configuration CINC0049- 8

EUT			
Description	**Manufacturer**	**Model/Part Number**	**Serial Number**
RF-CMDWS-433-CLR-W	CINCH Systems	RF-CMDWS-433-CLR-W	F6FE0

Configuration CINC0049- 9

EUT			
Description	**Manufacturer**	**Model/Part Number**	**Serial Number**
RF-CMDWS-433-CLR-W	CINCH Systems	RF-CMDWS-433-CLR-W	0A815E9

MODIFICATIONS

Equipment Modifications

Item	Date	Test	Modification	Note	Disposition of EUT
1	2020-03-03	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.
2	2020-03-03	Spurious Radiated Emissions	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	2020-03-03	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.
4	2020-03-03	Duty Cycle	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 2019.11.08.1

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

Transmitting CW at 433.95 MHz.

POWER SETTINGS INVESTIGATED

Battery

CONFIGURATIONS INVESTIGATED

CINC0049 - 8

FREQUENCY RANGE INVESTIGATED

Start Frequency	433 MHz	Stop Frequency	435 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
Attenuator	Coaxicom	3910-10	AWZ	2019-09-17	12 mo
Cable	Element	Biconilog Cable	MNX	2020-02-18	12 mo
Amplifier - Pre-Amplifier	Miteq	AM-1064-9079 and SA18E-10	AOO	2020-02-18	12 mo
Antenna - Biconilog	Ametek	CBL 6141B	AYS	2019-03-19	24 mo
Analyzer - Spectrum Analyzer	Keysight	N9010A	AFN	2019-12-23	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 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 +….

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 +…)/100mS 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 = 0.110 mSec
Pulsewidth of Type 2 Pulse = 0.210 mSec
Number of Type 1 Pulses = 54
Number of Type 2 Pulses = 19

Duty Cycle = 20 log [((52)(0.101) + (19)(0.202))/100] = -20.1 dB

The duty cycle correction factor of -20.1 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.

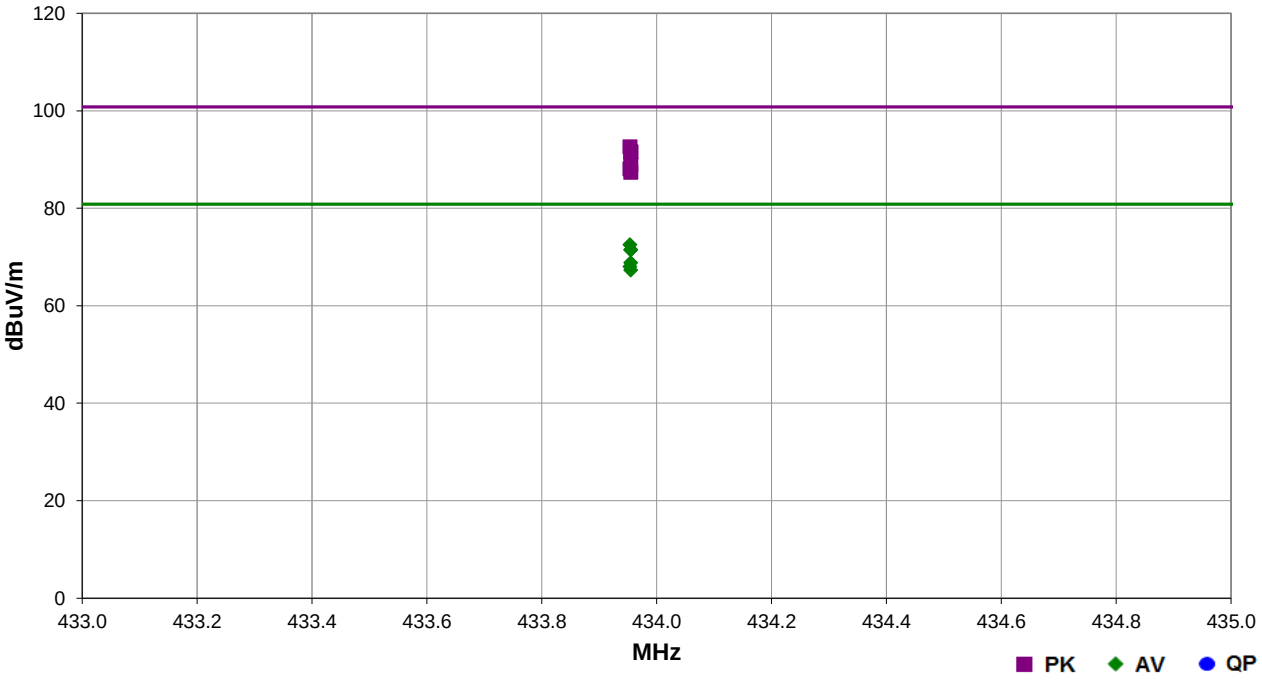
FIELD STRENGTH OF FUNDAMENTAL

EmiR5 2019.08.15.1 PSA-ESCI 2019.11.08.1

Work Order:	CINC0049	**Date:**	2020-03-03		
Project:	None	**Temperature:**	22.9 °C		
Job Site:	MN09	**Humidity:**	25.3% RH		
Serial Number:	F6FE0	**Barometric Pres.:**	1003 mbar	**Tested by:**	Kyle McMullan
EUT:	RF-CMDWS-433-CLR-W				
Configuration:	8				
Customer:	CINCH Systems				
Attendees:	Jibril Aga				
EUT Power:	Battery				
Operating Mode:	Transmitting CW at 433.95 MHz.				
Deviations:	None				
Comments:	None				

Test Specifications	**Test Method**
FCC 15.231:2020	ANSI C63.10:2013

Run #	16	**Test Distance (m)**	3	**Antenna Height(s)**	1 to 4(m)	**Results**	Pass



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
433.953	81.2	1.4	1.1	83.0		10.0	Vert	PK	0.0	92.6	100.8	-8.2	EUT On Side
433.953	81.2	1.4	1.1	83.0	-20.1	10.0	Vert	AV	0.0	72.5	80.8	-8.3	EUT On Side
433.955	80.2	1.4	1.2	87.0		10.0	Vert	PK	0.0	91.6	100.8	-9.2	EUT Vert
433.955	80.2	1.4	1.2	87.0	-20.1	10.0	Vert	AV	0.0	71.5	80.8	-9.3	EUT Vert
433.955	80.1	1.4	1.0	75.0		10.0	Horz	PK	0.0	91.5	100.8	-9.3	EUT Horz
433.955	80.1	1.4	1.0	75.0	-20.1	10.0	Horz	AV	0.0	71.4	80.8	-9.4	EUT Horz
433.955	77.5	1.4	1.9	216.0		10.0	Horz	PK	0.0	88.9	100.8	-11.9	EUT Vert
433.955	77.5	1.4	1.9	216.0	-20.1	10.0	Horz	AV	0.0	68.8	80.8	-12.0	EUT Vert
433.953	76.7	1.4	1.0	328.0		10.0	Horz	PK	0.0	88.1	100.8	-12.7	EUT On Side
433.953	76.7	1.4	1.0	328.0	-20.1	10.0	Horz	AV	0.0	68.0	80.8	-12.8	EUT On Side
433.955	76.0	1.4	1.2	282.0		10.0	Vert	PK	0.0	87.4	100.8	-13.4	EUT Horz
433.955	76.0	1.4	1.2	282.0	-20.1	10.0	Vert	AV	0.0	67.3	80.8	-13.5	EUT Horz

SPURIOUS RADIATED EMISSIONS

PSA-ESCI 2019.11.08.1

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

Transmitting CW at 433.95 MHz.

POWER SETTINGS INVESTIGATED

Battery

CONFIGURATIONS INVESTIGATED

CINC0049 - 8

FREQUENCY RANGE INVESTIGATED

Start Frequency	30 MHz	Stop Frequency	5000 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
Antenna - Double Ridge	ETS Lindgren	3115	AIB	2018-08-27	24 mo
Filter - High Pass	Micro-Tronics	HPM50108	HFW	2019-09-18	12 mo
Cable	Element	Double Ridge Guide Horn Cables	MNV	2020-02-18	12 mo
Attenuator	Coaxicom	3910-10	AWZ	2019-09-17	12 mo
Cable	Element	Biconilog Cable	MNX	2020-02-18	12 mo
Amplifier - Pre-Amplifier	Miteq	AM-1064-9079 and SA18E-10	AOO	2020-02-18	12 mo
Antenna - Biconilog	Ametek	CBL 6141B	AYS	2019-03-19	24 mo
Analyzer - Spectrum Analyzer	Keysight	N9010A	AFN	2019-12-23	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 +….

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 +…)/100mS 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 = 0.110 mSec
Pulsewidth of Type 2 Pulse = 0.210 mSec
Number of Type 1 Pulses = 54
Number of Type 2 Pulses = 19

Duty Cycle = 20 log [((52)(0.101) + (19)(0.202))/100] = -20.1 dB

The duty cycle correction factor of -20.1 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.

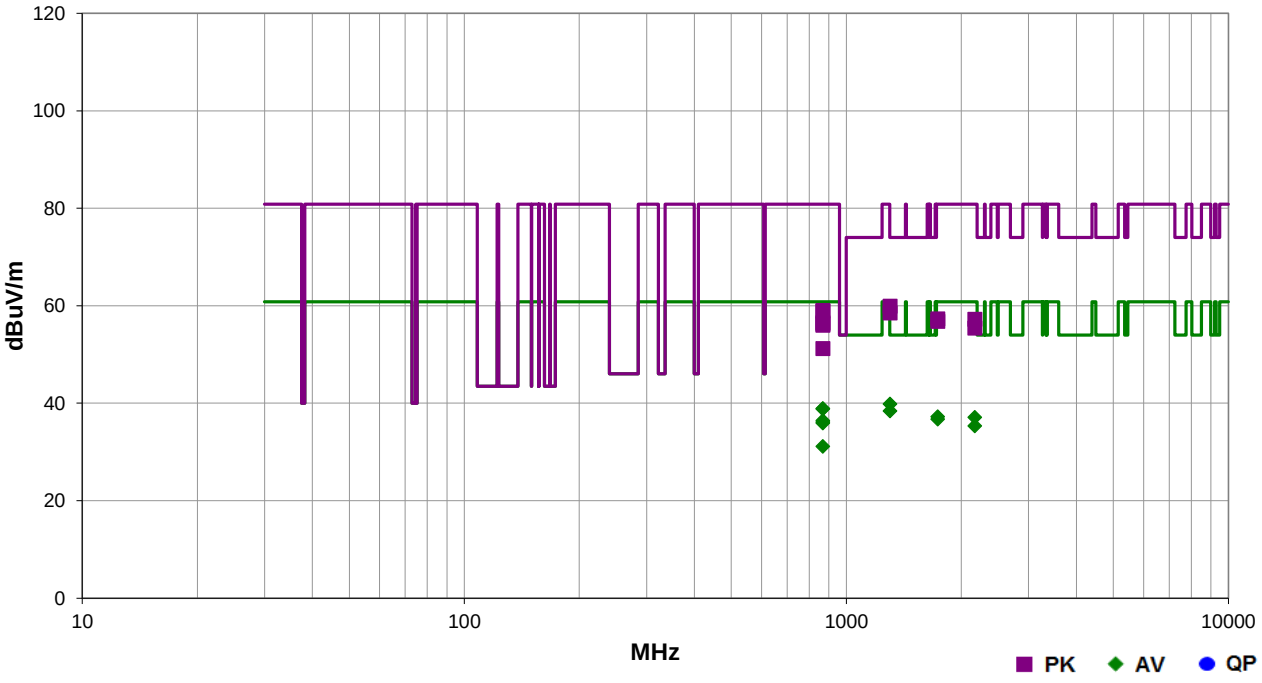
SPURIOUS RADIATED EMISSIONS

EmiR5 2019.08.15.1 PSA-ESCI 2019.11.08.1

Work Order:	CINC0049	**Date:**	2020-03-03		
Project:	None	**Temperature:**	22.9 °C		
Job Site:	MN09	**Humidity:**	25.3% RH		
Serial Number:	F6FE0	**Barometric Pres.:**	1003 mbar	**Tested by:**	Kyle McMullan, Dustin Sparks
EUT:	RF-CMDWS-433-CLR-W				
Configuration:	8				
Customer:	CINCH Systems				
Attendees:	Jibril Aga				
EUT Power:	Battery				
Operating Mode:	Transmitting CW at 433.95 MHz.				
Deviations:	None				
Comments:	None				

Test Specifications	**Test Method**
FCC 15.231:2020	ANSI C63.10:2013

Run #	17	**Test Distance (m)**	3	**Antenna Height(s)**	1 to 4(m)	**Results**	Pass



Freq (MHz)	Amplitude (dBuV)	Factor (dB)	Antenna Height (meters)	Azimuth (degrees)	Duty Cycle Correction Factor (meters)	External Attenuation (dB)	Polarity/ Transducer Type	Detector	Distance Adjustment (dB)	Adjusted (dBuV/m)	Spec. Limit (dBuV/m)	Compared to Spec. (dB)	Comments
1301.767	66.9	-7.0	4.0	247.0		0.0	Vert	PK	0.0	59.9	74.0	-14.1	EUT On Side
1301.767	66.9	-7.0	4.0	247.0	-20.1	0.0	Vert	AV	0.0	39.8	54.0	-14.2	EUT On Side
1301.950	65.5	-7.0	1.5	117.0		0.0	Horz	PK	0.0	58.5	74.0	-15.5	EUT Horz
1301.950	65.5	-7.0	1.5	117.0	-20.1	0.0	Horz	AV	0.0	38.4	54.0	-15.6	EUT Horz
867.910	38.3	10.7	1.1	91.0		10.0	Vert	PK	0.0	59.0	80.8	-21.8	EUT On Side
867.910	38.3	10.7	1.1	91.0	-20.1	10.0	Vert	AV	0.0	38.9	60.8	-21.9	EUT On Side
867.900	38.2	10.7	1.3	93.0		10.0	Vert	PK	0.0	58.9	80.8	-21.9	EUT Vert
867.900	38.2	10.7	1.3	93.0	-20.1	10.0	Vert	AV	0.0	38.8	60.8	-22.0	EUT Vert
1735.717	62.9	-5.6	1.0	228.0		0.0	Vert	PK	0.0	57.3	80.8	-23.5	EUT On Side
2169.833	59.6	-2.4	3.7	117.0		0.0	Horz	PK	0.0	57.2	80.8	-23.6	EUT Horz
1735.717	62.9	-5.6	1.0	228.0	-20.1	0.0	Vert	AV	0.0	37.2	60.8	-23.6	EUT On Side
2169.833	59.6	-2.4	3.7	117.0	-20.1	0.0	Horz	AV	0.0	37.1	60.8	-23.7	EUT Horz
1735.758	62.4	-5.6	1.5	118.0		0.0	Horz	PK	0.0	56.8	80.8	-24.0	EUT Horz

Freq (MHz)	Amplitude (dBuV)	Factor (dB)	Antenna Height (meters)	Azimuth (degrees)	Duty Cycle Correction Factor (meters)	External Attenuation (dB)	Polarity/ Transducer Type	Detector	Distance Adjustment (dB)	Adjusted (dBuV/m)	Spec. Limit (dBuV/m)	Compared to Spec. (dB)	Comments
1735.758	62.4	-5.6	1.5	118.0	-20.1	0.0	Horz	AV	0.0	36.7	60.8	-24.1	EUT Horz
867.905	35.8	10.7	1.0	344.0		10.0	Horz	PK	0.0	56.5	80.8	-24.3	EUT Horz
867.905	35.8	10.7	1.0	344.0	-20.1	10.0	Horz	AV	0.0	36.4	60.8	-24.4	EUT Horz
867.910	35.5	10.7	1.0	78.0		10.0	Horz	PK	0.0	56.2	80.8	-24.6	EUT On Side
867.910	35.5	10.7	1.0	78.0	-20.1	10.0	Horz	AV	0.0	36.1	60.8	-24.7	EUT On Side
867.910	35.3	10.7	1.0	272.0		10.0	Horz	PK	0.0	56.0	80.8	-24.8	EUT Vert
867.910	35.3	10.7	1.0	272.0	-20.1	10.0	Horz	AV	0.0	35.9	60.8	-24.9	EUT Vert
2169.667	57.8	-2.4	1.0	91.0		0.0	Vert	PK	0.0	55.4	80.8	-25.4	EUT On Side
2169.667	57.8	-2.4	1.0	91.0	-20.1	0.0	Vert	AV	0.0	35.3	60.8	-25.5	EUT On Side
867.895	30.5	10.7	1.1	277.0		10.0	Vert	PK	0.0	51.2	80.8	-29.6	EUT Horz
867.895	30.5	10.7	1.1	277.0	-20.1	10.0	Vert	AV	0.0	31.1	60.8	-29.7	EUT Horz

OCCUPIED BANDWIDTH

XMit 2019.09.05

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
Attenuator	Coaxicom	3910-10	AWZ	17-Sep-19	17-Sep-20
Amplifier - Pre-Amplifier	Miteq	AM-1064-9079 and SA18E-10	AOO	18-Feb-20	18-Feb-21
Cable	Element	Biconilog Cable	MNX	18-Feb-20	18-Feb-21
Antenna - Biconilog	Ametek	CBL 6141B	AYS	19-Mar-19	19-Mar-21
Analyzer - Spectrum Analyzer	Keysight	N9010A	AFN	23-Dec-19	23-Dec-20

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. 0.0025*433.950 MHz = 1085 kHz.

OCCUPIED BANDWIDTH

XMit 2019.09.05

EUT:	**RF-CMDWS-433-CLR-W**			**Work Order:**	**CINC0049**
Serial Number:	**0A815E9**			**Date:**	**3-Mar-20**
Customer:	**CINCH Systems**			**Temperature:**	**22.1 °C**
Attendees:	**Jibril Aga**			**Humidity:**	**26.7% RH**
Project:	**None**			**Barometric Pres.:**	**1004 mbar**
Tested by:	**Kyle McMullan**	**Power:**	**Battery**	**Job Site:**	**MN10**

TEST SPECIFICATIONS	**Test Method**
FCC 15.231:2020	ANSI C63.10:2013

COMMENTS

None

DEVIATIONS FROM TEST STANDARD

None

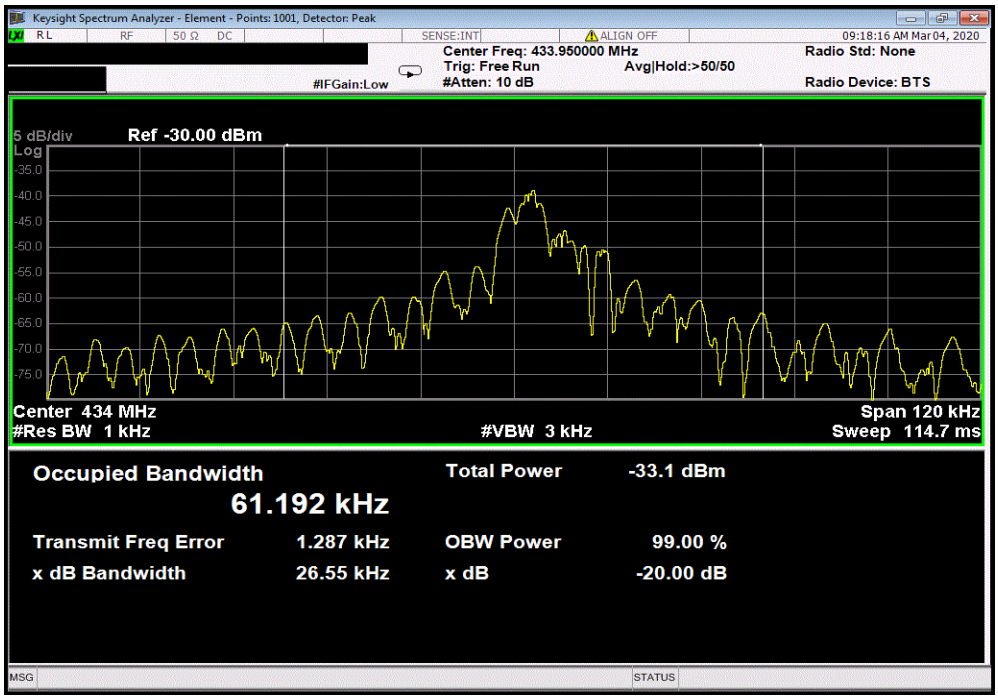
Configuration #	**9**	*Signature*

	Value	**Limit**	**Result**
Occupied Bandwidth	27 kHz	1085 kHz	Pass

OCCUPIED BANDWIDTH

XMit 2019.09.05

Occupied Bandwidth						
				Value	Limit	Result
				27 kHz	1085 kHz	Pass



DUTY CYCLE

XMit 2019.09.05

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	18-Feb-20	18-Feb-21
Attenuator	Coaxicom	3910-10	AWZ	17-Sep-19	17-Sep-20
Cable	Element	Biconilog Cable	MNX	18-Feb-20	18-Feb-21
Antenna - Biconilog	Ametek	CBL 6141B	AYS	19-Mar-19	19-Mar-21
Analyzer - Spectrum Analyzer	Keysight	N9010A	AFN	23-Dec-19	23-Dec-20

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 +….

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 +…)/100mS 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 = 0.110 mSec
Pulsewidth of Type 2 Pulse = 0.210 mSec
Number of Type 1 Pulses = 54
Number of Type 2 Pulses = 19

Duty Cycle = 20 log [((52)(0.101) + (19)(0.202))/100] = -20.1 dB

The duty cycle correction factor of -20.1 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 100kHz.

Additionally, it was ensured the automatic transmiter ceased transmission within 5 seconds of activation.

DUTY CYCLE

XMit 2019.09.05

EUT:	RF-CMDWS-433-CLR-W			Work Order:	CINC0049
Serial Number:	0193411			Date:	3-Mar-20
Customer:	CINCH Systems			Temperature:	22.8 °C
Attendees:	Jibril Aga			Humidity:	25.7% RH
Project:	None			Barometric Pres.:	1002 mbar
Tested by:	Kyle McMullan	Power:	Battery	Job Site:	MN02

TEST SPECIFICATIONS	Test Method
FCC 15.231:2020	ANSI C63.10:2013

COMMENTS

None

DEVIATIONS FROM TEST STANDARD

None

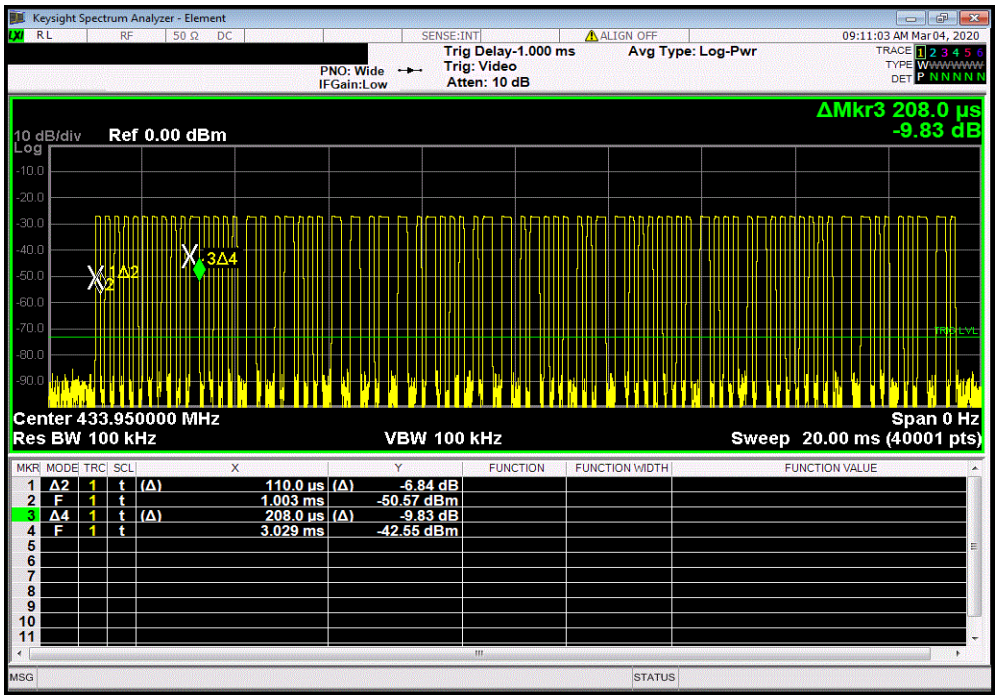
Configuration #	7	Signature

	Number Type 1 Pulses	Type 1 Pulse Length (ms)	Number Type 2 Pulses	Type 2 Pulse Length (ms)	DCCF (dB)	Result
20 ms	54	0.11	19	0.21	-20.1	N/A
100 ms	N/A	N/A	N/A	N/A	N/A	N/A
10 s	N/A	N/A	N/A	N/A	N/A	N/A

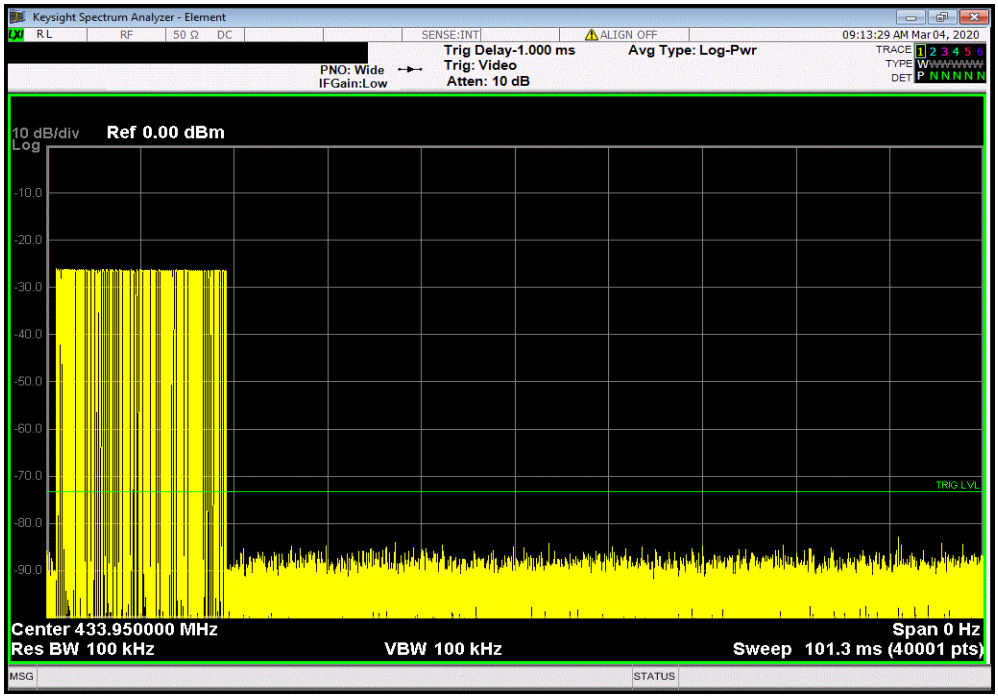
DUTY CYCLE

XMit 2019.09.05

20 ms						
	Number Type 1 Pulses	Type 1 Pulse Length (ms)	Number Type 2 Pulses	Type 2 Pulse Length (ms)	DCCF (dB)	Result
	54	0.11	19	0.21	-20.1	N/A



100 ms						
	Number Type 1 Pulses	Type 1 Pulse Length (ms)	Number Type 2 Pulses	Type 2 Pulse Length (ms)	DCCF (dB)	Result
	N/A	N/A	N/A	N/A	N/A	N/A



DUTY CYCLE

XMit 2019.09.05

10 s						
	Number Type 1 Pulses	Type 1 Pulse Length (ms)	Number Type 2 Pulses	Type 2 Pulse Length (ms)	DCCF (dB)	Result
	N/A	N/A	N/A	N/A	N/A	N/A