CINCH Systems

RF-CMDWS-UTC

FCC 15.231:2018
Low Power Radio

Report # CINC0028

NVLAP LAB CODE: 200881-0

CERTIFICATE OF TEST

Last Date of Test: February 28, 2019
CINCH Systems
Model: RF-CMDWS-UTC

Radio Equipment Testing

Standards

Specification	Method
FCC 15.231:2018	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

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). Certification chambers and Open Area Test Sites are filed with ISED.

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

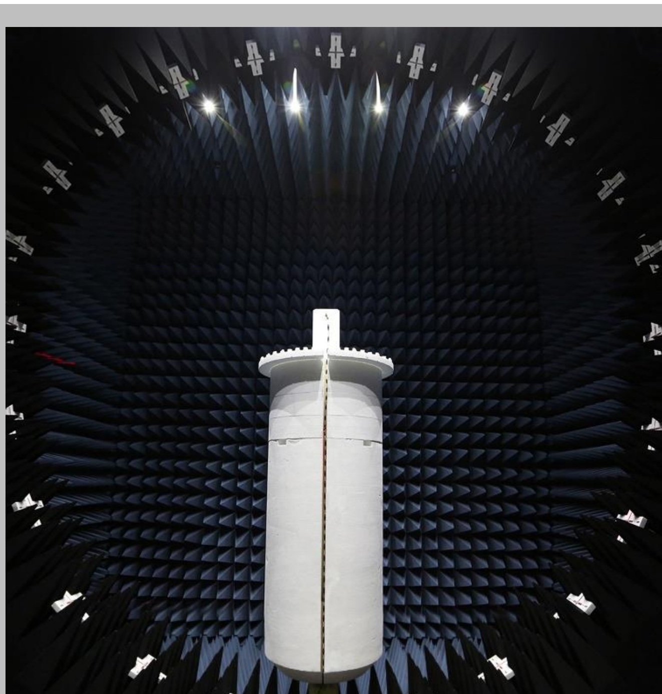
MIC – Recognized by MIC as a CAB for the acceptance of test data.

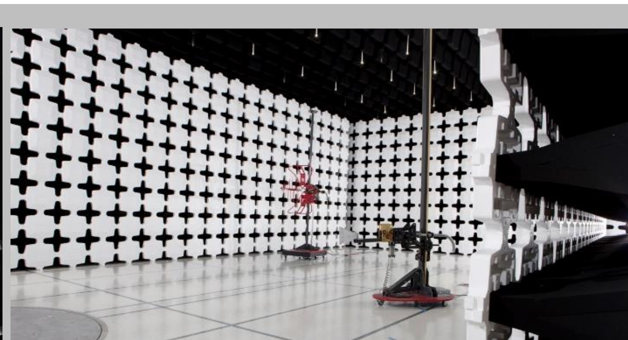
SCOPE

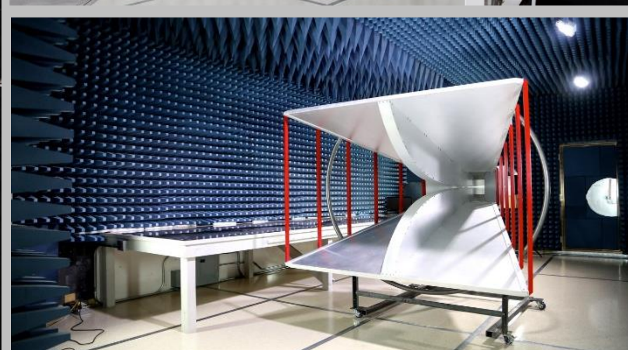
For details on the Scopes of our Accreditations, please visit:
https://www.nwemc.com/emc-testing-accreditations

FACILITIES

California Labs OC01-17 41 Tesla Irvine, CA 92618 (949) 861-8918	Minnesota Labs MN01-10 9349 W Broadway Ave. Brooklyn Park, MN 55445 (612)-638-5136	New York Labs NY01-04 4939 Jordan Rd. Elbridge, NY 13060 (315) 554-8214	Oregon Labs EV01-12 6775 NE Evergreen Pkwy #400 Hillsboro, OR 97124 (503) 844-4066	Texas Labs TX01-09 3801 E Plano Pkwy Plano, TX 75074 (469) 304-5255	Washington 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: 200761-0	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	N/A	2834D-1, 2834D-2	2834G-1	2834F-1
BSMI					
SL2-IN-E-1154R	SL2-IN-E-1152R	N/A	SL2-IN-E-1017	SL2-IN-E-1158R	SL2-IN-E-1153R
VCCI					
A-0029	A-0109	N/A	A-0108	A-0201	A-0110
Recognized Phase I CAB for ACMA, BSMI, IDA, KCC/RRA, MIC, MOC, NCC, OFCA					
US0158	US0175	N/A	US0017	US0191	US0157







MEASUREMENT UNCERTAINTY

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.

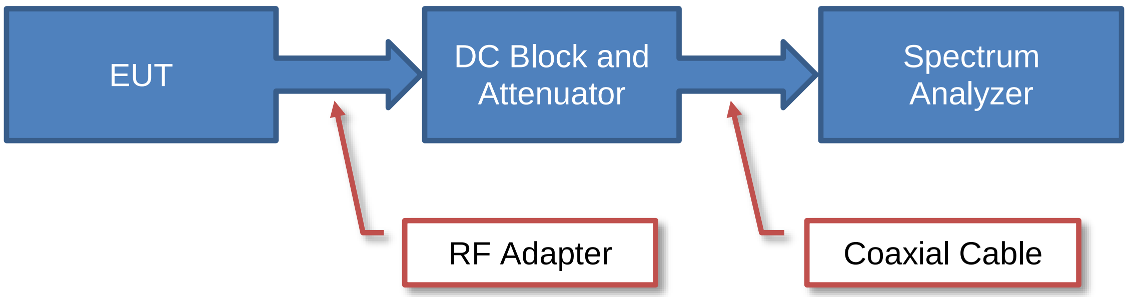
A measurement uncertainty estimation has been performed for each test per our internal quality document QM205.4.6. The estimation is used to compare the measured result with its "true" or theoretically correct value. The expanded measurement uncertainty (K=2) can be found included as part of the applicable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

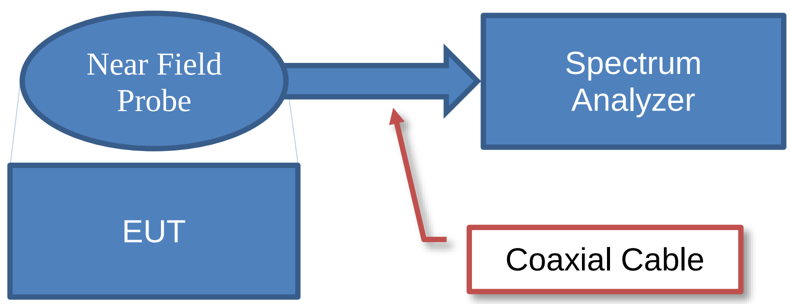
Test	+ MU	- MU
Frequency Accuracy (Hz)	0.0007%	-0.0007%
Amplitude Accuracy (dB)	1.2 dB	-1.2 dB
Conducted Power (dB)	0.3 dB	-0.3 dB
Radiated Power via Substitution (dB)	0.7 dB	-0.7 dB
Temperature (degrees C)	0.7°C	-0.7°C
Humidity (% RH)	2.5% RH	-2.5% RH
Voltage (AC)	1.0%	-1.0%
Voltage (DC)	0.7%	-0.7%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

Test Setup Block Diagrams

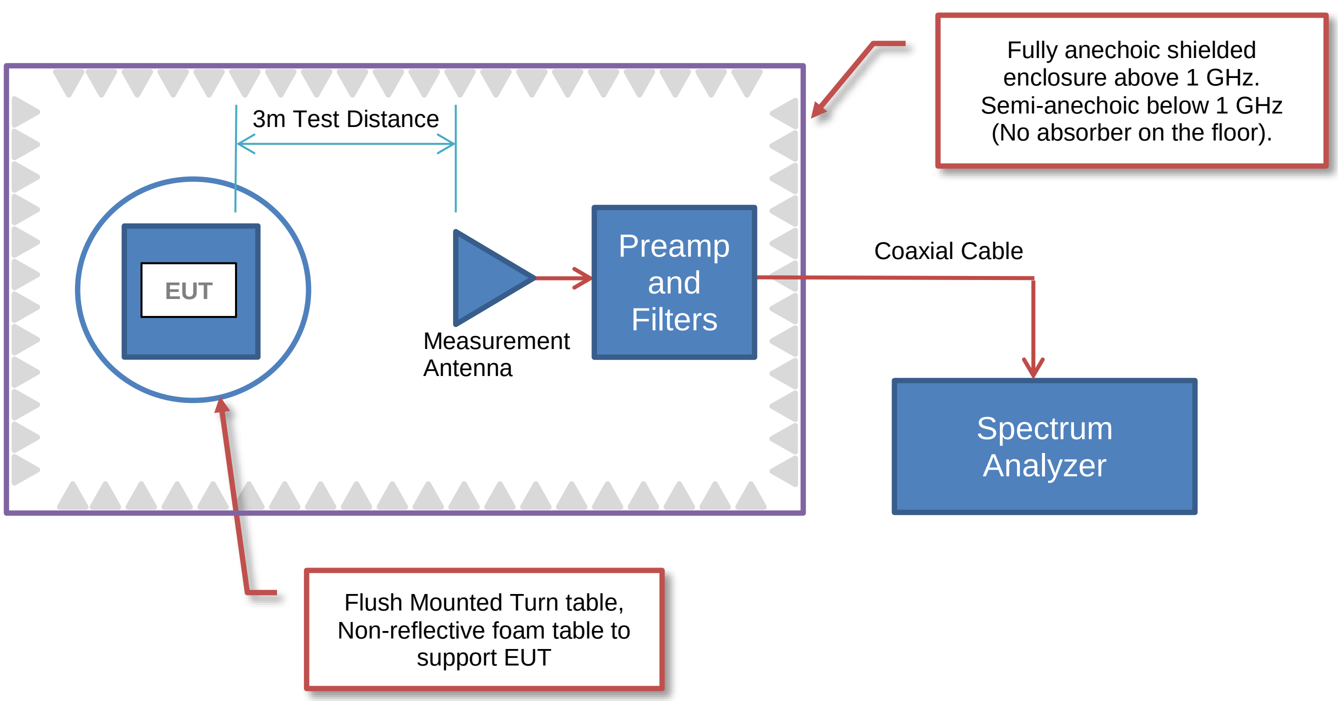
Antenna Port Conducted Measurements



Near Field Test Fixture Measurements



Spurious Radiated Emissions



PRODUCT DESCRIPTION

Client and Equipment Under Test (EUT) Information

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-CMDWS-UTC
First Date of Test:	October 12, 2018
Last Date of Test:	February 28, 2019
Receipt Date of Samples:	October 12, 2018
Equipment Design Stage:	Production
Equipment Condition:	No Damage
Purchase Authorization:	Verified

Information Provided by the Party Requesting the Test

Functional Description of the EUT:
Sensor containing a periodic radio

Testing Objective:
To demonstrate compliance to FCC 15.231 requirements.

CONFIGURATIONS

Configuration CINC0028- 1

EUT			
Description	**Manufacturer**	**Model/Part Number**	**Serial Number**
Window Sensor	CINCH Systems	RF-CMDWS-UTC	0A4165A

CONFIGURATIONS

element
2018-07-17

Configuration CINC0041- 1

EUT			
Description	**Manufacturer**	**Model/Part Number**	**Serial Number**
Window Sensor	CINCH Systems	RF-CMDWS-UTC	0A4165A

MODIFICATIONS

Equipment Modifications

Item	Date	Test	Modification	Note	Disposition of EUT
1	2018-10-12	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	2018-10-12	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.
3	2018-10-12	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.
4	2019-02-28	Occupied Bandwidth	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 2018.07.27

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 at 319.5 MHz, CW

POWER SETTINGS INVESTIGATED

Battery

CONFIGURATIONS INVESTIGATED

CINC0028 - 1

FREQUENCY RANGE INVESTIGATED

Start Frequency	30 MHz	Stop Frequency	1000 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
Cable	Element	Biconilog Cable	MNX	24-Feb-2018	12 mo
Antenna - Biconilog	ETS Lindgren	3142D	AXO	15-Dec-2017	24 mo
Analyzer - Spectrum Analyzer	Agilent	E4440A	AAX	26-Mar-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 +….

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 = 0.806 mSec
Pulsewidth of Type 2 Pulse = 0.3588 mSec
Pulsewidth of Type 3 Pulse = 0.2392 mSec
Pulsewidth of Type 4 Pulse = 0.1222 mSec
Number of Type 1 Pulses = 1
Number of Type 2 Pulses = 6
Number of Type 3 Pulses = 9
Number of Type 3 Pulses = 31

Duty Cycle = 20 log [((1)(0.806) + (6)(0.3588) + (9)(0.2392) + (31)(0.1222))/100] = -21.01 dB

The duty cycle correction factor of –21.01 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 2018.09.26 PSA-ESCI 2018.07.27

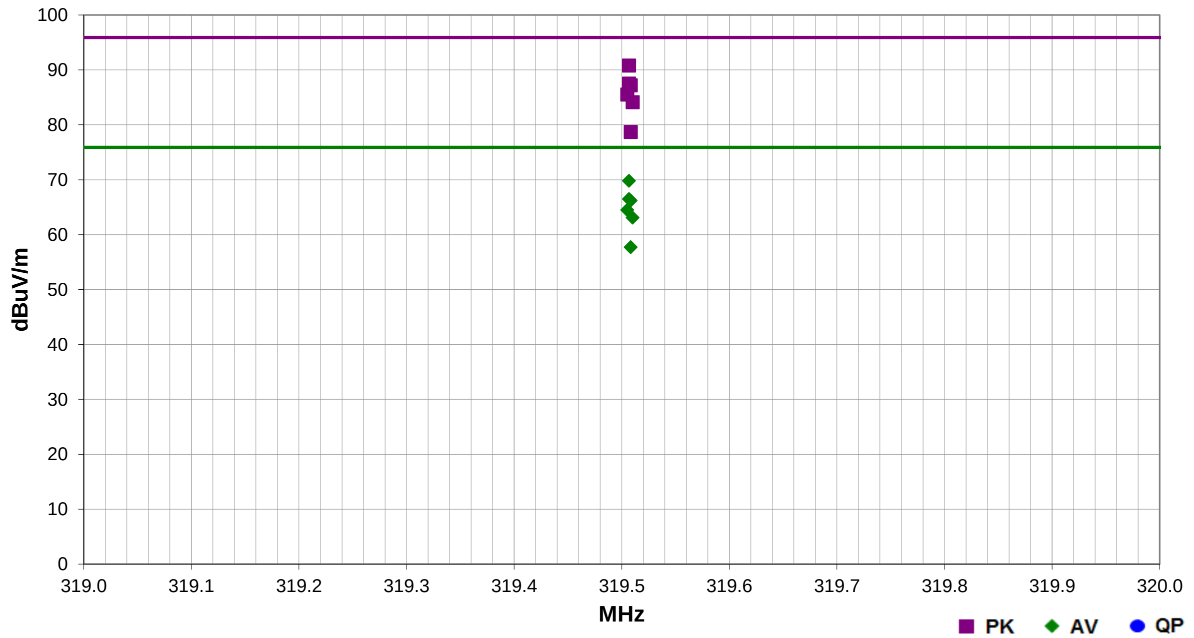
Work Order:	CINC0028	**Date:**	12-Oct-2018
Project:	None	**Temperature:**	20.1 °C
Job Site:	MN09	**Humidity:**	34.8% RH
Serial Number:	0A4165A	**Barometric Pres.:**	1020 mbar

Tested by: Andrew Rogstad, Trevor Buls

EUT:	RF-CMDWS-UTC
Configuration:	1
Customer:	CINCH Systems
Attendees:	Jibril Aga
EUT Power:	Battery
Operating Mode:	Transmitting at 319.5 MHz, CW
Deviations:	None
Comments:	None

Test Specifications	Test Method
FCC 15.231:2018	ANSI C63.10:2013

Run #	0	**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
319.507	71.3	19.5	1.0	321.0	0.0	0.0	Horz	PK	0.0	90.8	95.9	-5.1	EUT horz
319.507	71.3	19.5	1.0	321.0	-21.0	0.0	Horz	AV	0.0	69.8	75.9	-6.1	EUT horz
319.507	68.0	19.5	1.6	344.0	0.0	0.0	Vert	PK	0.0	87.5	95.9	-8.4	EUT on side
319.508	67.7	19.5	1.6	165.0	0.0	0.0	Vert	PK	0.0	87.2	95.9	-8.7	EUT vert
319.507	68.0	19.5	1.6	344.0	-21.0	0.0	Vert	AV	0.0	66.5	75.9	-9.4	EUT on side
319.508	67.7	19.5	1.6	165.0	-21.0	0.0	Vert	AV	0.0	66.2	75.9	-9.7	EUT vert
319.505	66.0	19.5	1.0	58.0	0.0	0.0	Horz	PK	0.0	85.5	95.9	-10.4	EUT vert
319.505	66.0	19.5	1.0	58.0	-21.0	0.0	Horz	AV	0.0	64.5	75.9	-11.4	EUT vert
319.510	64.6	19.5	1.3	220.0	0.0	0.0	Horz	PK	0.0	84.1	95.9	-11.8	EUT on side
319.510	64.6	19.5	1.3	220.0	-21.0	0.0	Horz	AV	0.0	63.1	75.9	-12.8	EUT on side
319.508	59.2	19.5	2.2	84.0	0.0	0.0	Vert	PK	0.0	78.7	95.9	-17.2	EUT horz
319.508	59.2	19.5	2.2	84.0	-21.0	0.0	Vert	AV	0.0	57.7	75.9	-18.2	EUT horz

SPURIOUS RADIATED EMISSIONS

PSA-ESCI 2018.07.27

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 at 319.5 MHz, CW

POWER SETTINGS INVESTIGATED

Battery

CONFIGURATIONS INVESTIGATED

CINC0028 - 1

FREQUENCY RANGE INVESTIGATED

Start Frequency	30 MHz	Stop Frequency	8.2 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	24-Feb-2018	12 mo
Cable	Element	Double Ridge Guide Horn Cables	MNV	24-Feb-2018	12 mo
Antenna - Double Ridge	ETS-Lindgren	3115	AJQ	14-Nov-2016	24 mo
Amplifier - Pre-Amplifier	Miteq	AM-1064-9079 and SA18E-10	AOO	24-Feb-2018	12 mo
Cable	Element	Biconilog Cable	MNX	24-Feb-2018	12 mo
Antenna - Biconilog	ETS Lindgren	3142D	AXO	15-Dec-2017	24 mo
Analyzer - Spectrum Analyzer	Agilent	E4440A	AAX	26-Mar-2018	12 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 +….

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 = 0.806 mSec
Pulsewidth of Type 2 Pulse = 0.3588 mSec
Pulsewidth of Type 3 Pulse = 0.2392 mSec
Pulsewidth of Type 3 Pulse = 0.1222 mSec
Number of Type 1 Pulses = 1
Number of Type 2 Pulses = 6
Number of Type 3 Pulses = 9
Number of Type 3 Pulses = 31

Duty Cycle = 20 log [((1)(0.806) + (6)(0.3588) + (9)(0.2392) + (31)(0.1222))/100] = -21.01 dB

The duty cycle correction factor of -21.01 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 2018.09.26 PSA-ESCI 2018.07.27

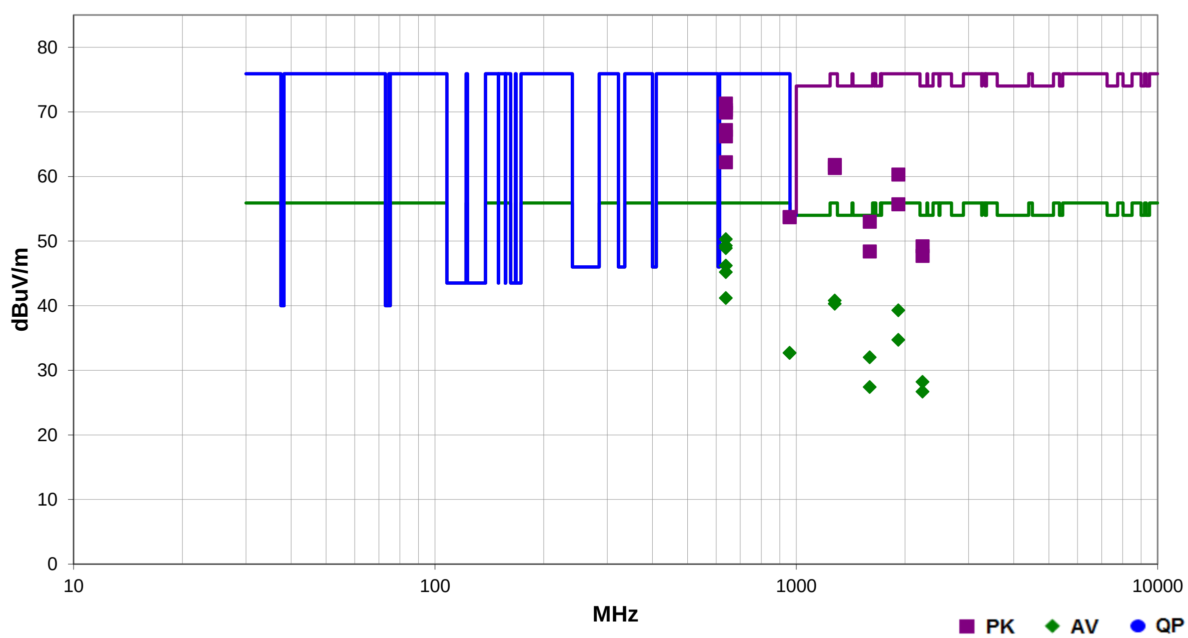
Work Order:	CINC0028	**Date:**	12-Oct-2018
Project:	None	**Temperature:**	20.1 °C
Job Site:	MN09	**Humidity:**	34.8% RH
Serial Number:	0A4165A	**Barometric Pres.:**	1020 mbar

Tested by: Andrew Rogstad, Trevor Buls

EUT:	RF-CMDWS-UTC
Configuration:	1
Customer:	CINCH Systems
Attendees:	Jibril Aga
EUT Power:	Battery
Operating Mode:	Transmitting at 319.5 MHz, CW
Deviations:	None
Comments:	None

Test Specifications	Test Method
FCC 15.231:2018	ANSI C63.10:2013

Run #	1	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
639.019	53.4	7.9	1.3	185.0	0.0	10.0	Horz	PK	0.0	71.3	75.9	-4.6	EUT on side
639.015	52.4	7.9	1.0	189.0	0.0	10.0	Vert	PK	0.0	70.3	75.9	-5.6	EUT horz
639.019	53.4	7.9	1.3	185.0	-21.0	10.0	Horz	AV	0.0	50.3	55.9	-5.6	EUT on side
639.010	52.0	7.9	1.2	178.0	0.0	10.0	Horz	PK	0.0	69.9	75.9	-6.0	EUT vert
639.015	52.4	7.9	1.0	189.0	-21.0	10.0	Vert	AV	0.0	49.3	55.9	-6.6	EUT horz
639.010	52.0	7.9	1.2	178.0	-21.0	10.0	Horz	AV	0.0	48.9	55.9	-7.0	EUT vert
639.014	49.3	7.9	1.0	243.0	0.0	10.0	Vert	PK	0.0	67.2	75.9	-8.7	EUT vert
639.015	48.3	7.9	1.3	262.0	0.0	10.0	Horz	PK	0.0	66.2	75.9	-9.7	EUT horz
639.014	49.3	7.9	1.0	243.0	-21.0	10.0	Vert	AV	0.0	46.2	55.9	-9.7	EUT vert
639.015	48.3	7.9	1.3	262.0	-21.0	10.0	Horz	AV	0.0	45.2	55.9	-10.7	EUT horz
639.015	44.3	7.9	3.1	131.0	0.0	10.0	Vert	PK	0.0	62.2	75.9	-13.7	EUT on side
1277.960	69.8	-8.0	1.0	223.0	0.0	0.0	Horz	PK	0.0	61.8	75.9	-14.1	EUT on side
1278.065	69.3	-8.0	1.6	220.0	0.0	0.0	Vert	PK	0.0	61.3	75.9	-14.6	EUT horz
639.015	44.3	7.9	3.1	131.0	-21.0	10.0	Vert	AV	0.0	41.2	55.9	-14.7	EUT on side
1277.960	69.8	-8.0	1.0	223.0	-21.0	0.0	Horz	AV	0.0	40.8	55.9	-15.1	EUT on side
1917.035	65.2	-4.9	2.7	59.0	0.0	0.0	Horz	PK	0.0	60.3	75.9	-15.6	EUT on side
1278.065	69.3	-8.0	1.6	220.0	-21.0	0.0	Vert	AV	0.0	40.3	55.9	-15.6	EUT horz
1917.035	65.2	-4.9	2.7	59.0	-21.0	0.0	Horz	AV	0.0	39.3	55.9	-16.6	EUT on side

1917.025	60.6	-4.9	1.0	271.0	0.0	0.0	Vert	PK	0.0	55.7	75.9	-20.2	EUT horz
1597.520	59.8	-6.8	1.0	258.0	0.0	0.0	Horz	PK	0.0	53.0	74.0	-21.0	EUT on side
1917.025	60.6	-4.9	1.0	271.0	-21.0	0.0	Vert	AV	0.0	34.7	55.9	-21.2	EUT horz
1597.520	59.8	-6.8	1.0	258.0	-21.0	0.0	Horz	AV	0.0	32.0	54.0	-22.0	EUT on side
958.530	30.5	13.2	1.5	321.0	0.0	10.0	Horz	PK	0.0	53.7	75.9	-22.2	EUT on side
958.515	30.5	13.2	1.1	359.0	0.0	10.0	Vert	PK	0.0	53.7	75.9	-22.2	EUT horz
958.530	30.5	13.2	1.5	321.0	-21.0	10.0	Horz	AV	0.0	32.7	55.9	-23.2	EUT on side
958.515	30.5	13.2	1.1	359.0	-21.0	10.0	Vert	AV	0.0	32.7	55.9	-23.2	EUT horz
2236.520	53.2	-4.0	1.0	69.0	0.0	0.0	Horz	PK	0.0	49.2	74.0	-24.8	EUT on side
1597.565	55.2	-6.8	1.0	122.0	0.0	0.0	Vert	PK	0.0	48.4	74.0	-25.6	EUT horz
2236.520	53.2	-4.0	1.0	69.0	-21.0	0.0	Horz	AV	0.0	28.2	54.0	-25.8	EUT on side
2236.555	51.7	-4.0	4.0	49.0	0.0	0.0	Vert	PK	0.0	47.7	74.0	-26.3	EUT horz
1597.565	55.2	-6.8	1.0	122.0	-21.0	0.0	Vert	AV	0.0	27.4	54.0	-26.6	EUT horz
2236.555	51.7	-4.0	4.0	49.0	-21.0	0.0	Vert	AV	0.0	26.7	54.0	-27.3	EUT horz

OCCUPIED BANDWIDTH

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-18	2-Nov-19
Cable	ESM Cable Corp.	Bilog Cables	MNH	2-Nov-18	2-Nov-19
Antenna - Biconilog	Teseq	CBL 6141B	AYD	25-Jan-18	25-Jan-20
Analyzer - Spectrum Analyzer	Keysight	N9010A	AFN	27-Apr-18	27-Apr-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

XMit 2017.12.13

EUT:	RF-CMDWS-UTC			Work Order:	CINC0041
Serial Number:	0A4165A			Date:	28-Feb-19
Customer:	CINCH Systems			Temperature:	22.3 °C
Attendees:	Jabril Aga			Humidity:	17.9% RH
Project:	None			Barometric Pres.:	1025 mbar
Tested by:	Andrew Rogstad	Power:	Battery	Job Site:	MN05

TEST SPECIFICATIONS	Test Method
FCC 15.231:2019	ANSI C63.10:2013

COMMENTS

None

DEVIATIONS FROM TEST STANDARD

None

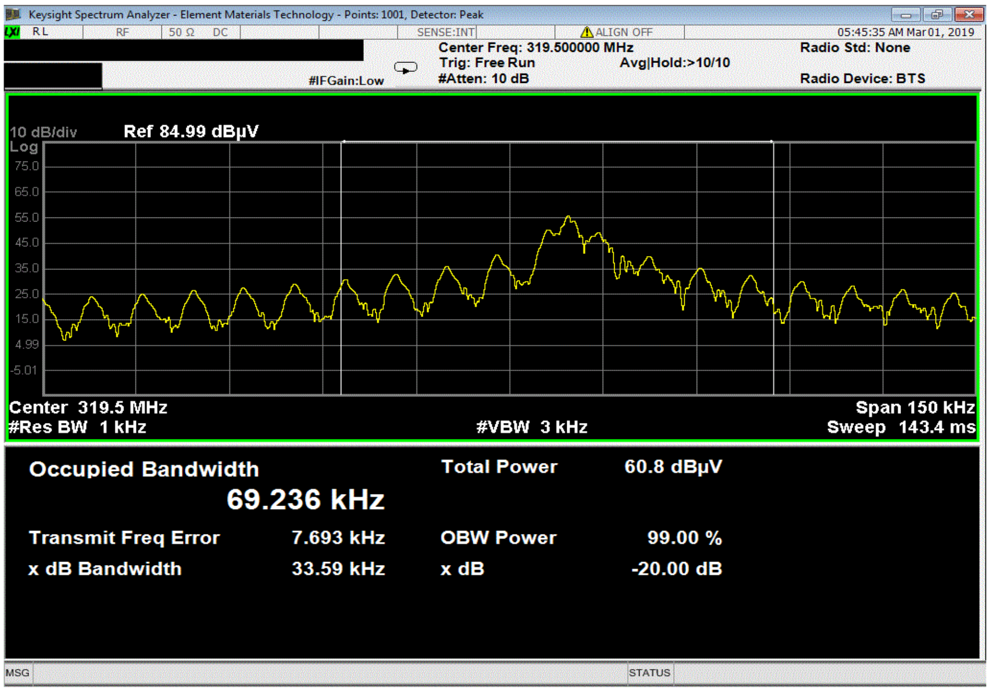
Configuration #	1	*Signature*

	Value (kHz)	Limit (kHz)	Result
319.5 MHz	33.59	798	PASS

OCCUPIED BANDWIDTH

XMit 2017.12.13

319.5 MHz						
				Value (kHz)	Limit (kHz)	Result
				33.59	798	PASS



Duty Cycle

XMit 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
Analyzer - Spectrum Analyzer	Agilent	E4440A	AAX	26-Mar-2018	26-Mar-2019
Cable	Element	Biconilog Cable	MNX	24-Feb-2018	24-Feb-2019
Antenna - Biconilog	ETS Lindgren	3142D	AXO	15-Dec-2017	15-Dec-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 +….

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 customer indicated that 2 protocols are used by the EUT, so the DCCF was found for both protocols.

The measured values for the EUT’s first protocol pulse train are as follows:

Period = 100 mSec
Pulsewidth of Type 1 Pulse = 0.806 mSec
Pulsewidth of Type 2 Pulse = 0.3588 mSec
Pulsewidth of Type 3 Pulse = 0.2392 mSec
Pulsewidth of Type 4 Pulse = 0.1222 mSec
Number of Type 1 Pulses = 1
Number of Type 2 Pulses = 6
Number of Type 3 Pulses = 9
Number of Type 4 Pulses = 31

Duty Cycle = 20 log [((1)(0.806) + (6)(0.3588) + (9)(0.2392) + (31)(0.1222))/100] = -21.01 dB

The measured values for the EUT’s second protocol pulse train are as follows:

Period = 100 mSec
Pulsewidth of Type 1 Pulse = 0.7904 mSec
Pulsewidth of Type 2 Pulse = 0.3536 mSec
Pulsewidth of Type 3 Pulse = 0.2366 mSec
Pulsewidth of Type 4 Pulse = 0.117 mSec
Number of Type 1 Pulses = 1
Number of Type 2 Pulses = 4
Number of Type 3 Pulses = 9
Number of Type 4 Pulses = 33

Duty Cycle = 20 log [((1)(0.806) + (6)(0.3588) + (9)(0.2392) + (31)(0.1222))/100] = -21.73 dB

Duty Cycle

XMit 2017.12.13

EUT:	**RF-CMDWS-UTC**	**Work Order:**	**CINC0028**
Serial Number:	**0A4165A**	**Date:**	**12-Oct-18**
Customer:	**CINCH Systems**	**Temperature:**	**21.4 °C**
Attendees:	**Jibril Aga**	**Humidity:**	**32.3% RH**
Project:	**None**	**Barometric Pres.:**	**1015 mbar**
Tested by:	**Andrew Rogstad, Trevor Buls** **Power:** **Battery**	**Job Site:**	**MN05**

TEST SPECIFICATIONS	**Test Method**
FCC 15.231:2018	ANSI C63.10:2013

COMMENTS

Transmitting at 319.5 MHz, Modulated

DEVIATIONS FROM TEST STANDARD

None

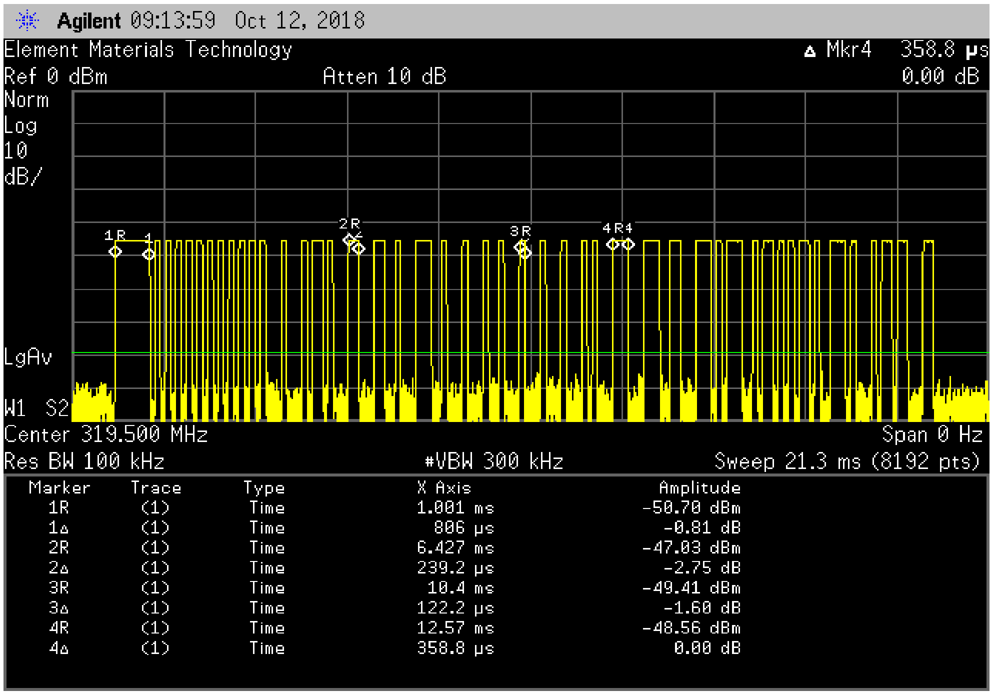
Configuration # **1** *Signature* Trevor Buls

	Number of Type 1	Type 1 Pulse length (ms)	Number of Type 2	Type 2 Pulse length (ms)	Number of Type 3 Pulses	Type 3 Pulse length (ms)	Number of Type 4 Pulses	Type 4 Pulse length (ms)	DCCF	Result
100 ms - 1st protocol	1	0.806	6	0.3588	9	0.2392	31	0.1222	-21.01	N/A
100 ms - 2nd protocol	1	0.7904	4	0.3536	9	0.2366	33	0.117	-21.73	N/A
5 s	N/A	N/A	N/A	N/A	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	N/A	N/A	N/A	N/A

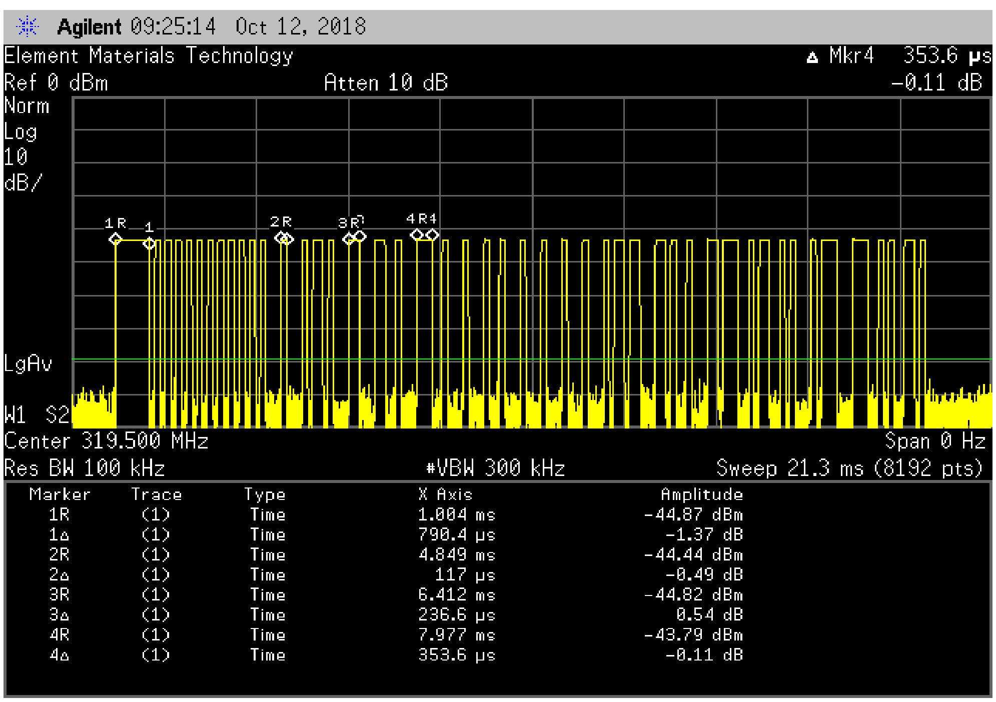
Duty Cycle

XMit 2017.12.13

100 ms - 1st protocol								
Number of Type 1	Type 1 Pulse length (ms)	Number of Type 2 Pulses	Type 2 Pulse length (ms)	Number of Type 3 Pulses	Type 3 Pulse length (ms)	Number of Type 4 Pulses	Type 4 Pulse length (ms)	DCCF
1	0.806	6	0.3588	9	0.2392	31	0.1222	-21.01



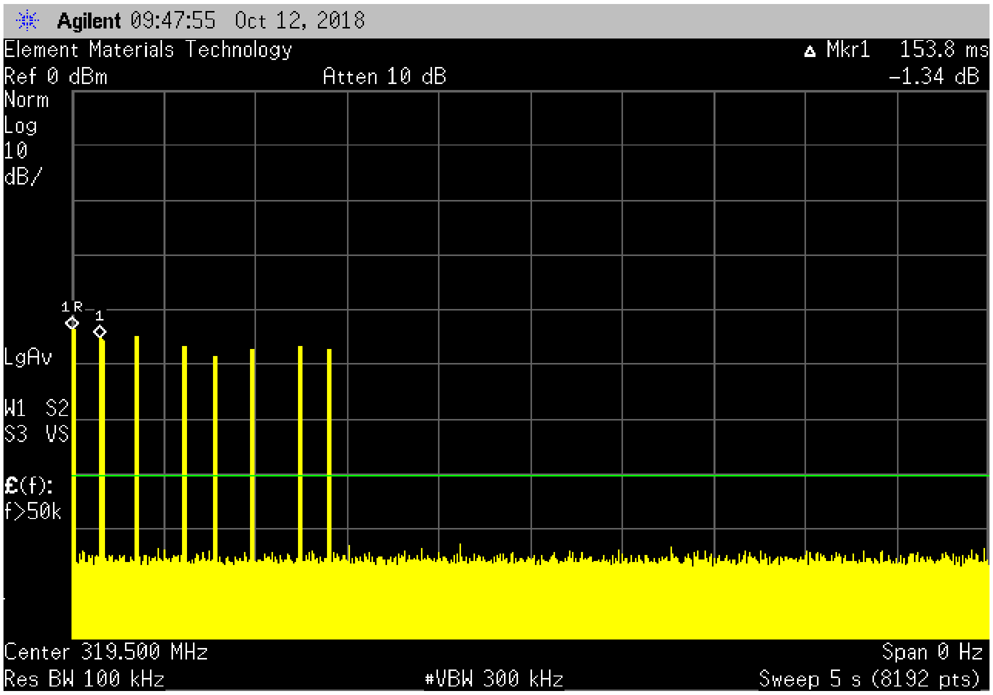
100 ms - 2nd protocol								
Number of Type 1	Type 1 Pulse length (ms)	Number of Type 2 Pulses	Type 2 Pulse length (ms)	Number of Type 3 Pulses	Type 3 Pulse length (ms)	Number of Type 4 Pulses	Type 4 Pulse length (ms)	DCCF
1	0.7904	4	0.3536	9	0.2366	33	0.117	-21.73



Duty Cycle

XMit 2017.12.13

5 s						
Number of Type 2 Pulses	Type 2 Pulse length (ms)	Number of Type 3 Pulses	Type 3 Pulse length (ms)	Number of Type 4 Pulses	Type 4 Pulse length (ms)	DCCF
N/A	N/A	N/A	N/A	N/A	N/A	N/A



10 s						
Number of Type 2 Pulses	Type 2 Pulse length (ms)	Number of Type 3 Pulses	Type 3 Pulse length (ms)	Number of Type 4 Pulses	Type 4 Pulse length (ms)	DCCF
N/A	N/A	N/A	N/A	N/A	N/A	N/A