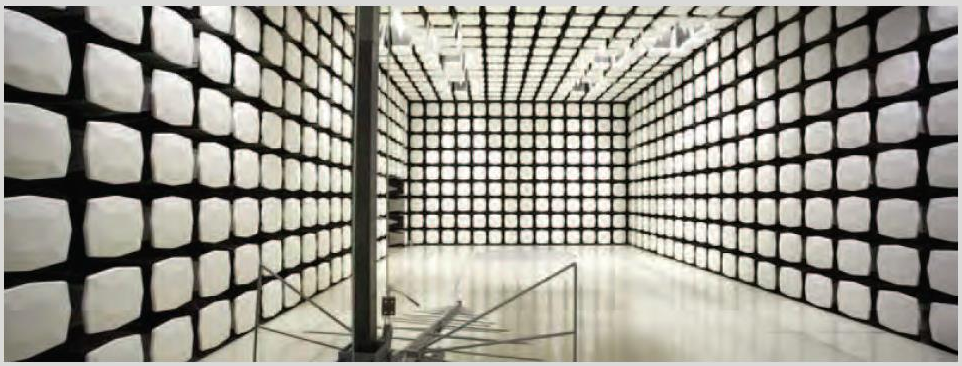
CINCH Systems

MIXRF319

FCC 15.231:2019

Low Power Periodic Radio

Report # CINC0040



NVLAP LAB CODE: 200881-0

CERTIFICATE OF TEST

Last Date of Test: July 5, 2019
CINCH Systems
Model: MIXRF319

Radio Equipment Testing

Standards

Specification	Method
FCC 15.207:2019	ANSI C63.4:2014
FCC 15.231:2019	ANSI C63.10:2013

Results

Method Clause	Test Description	Applied	Results	Comments
6.2	Powerline Conducted Emissions	Yes	Pass	
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:

Jeremiah Darden, 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) 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

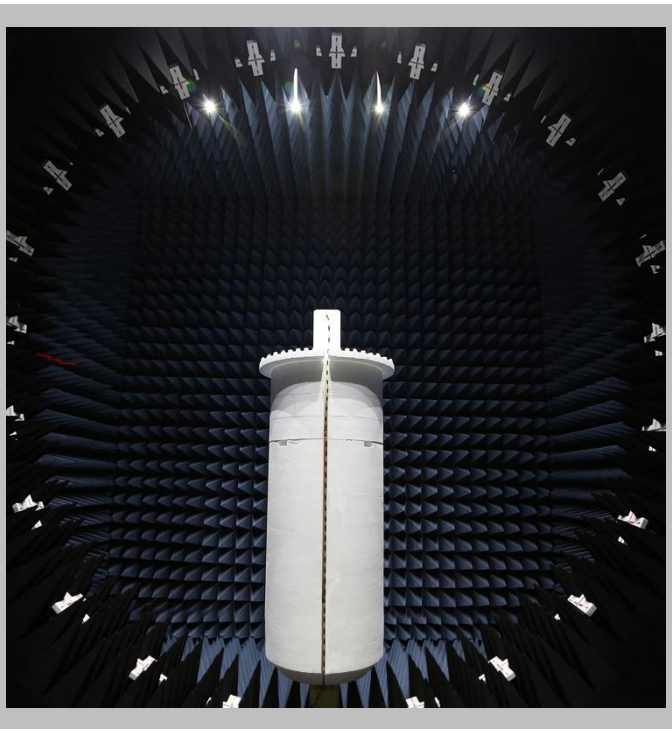
MIC – Recognized by MIC as a CAB for the acceptance of test data.

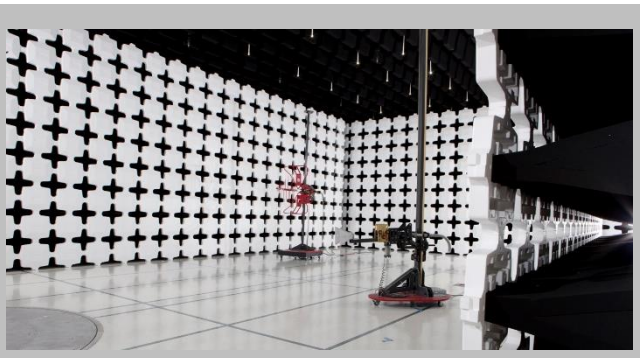
SCOPE

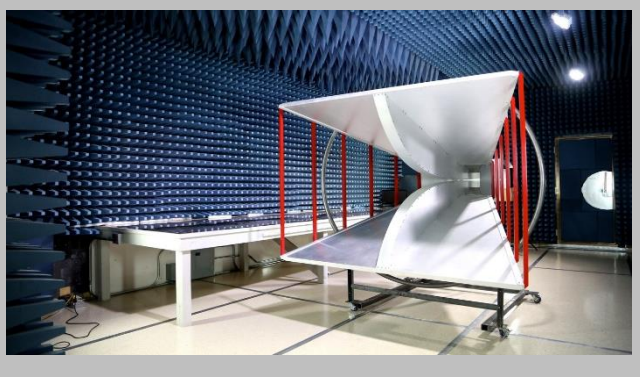
For details on the Scopes of our Accreditations, please visit:
https://www.nwemc.com/emc-testing-accreditations

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.

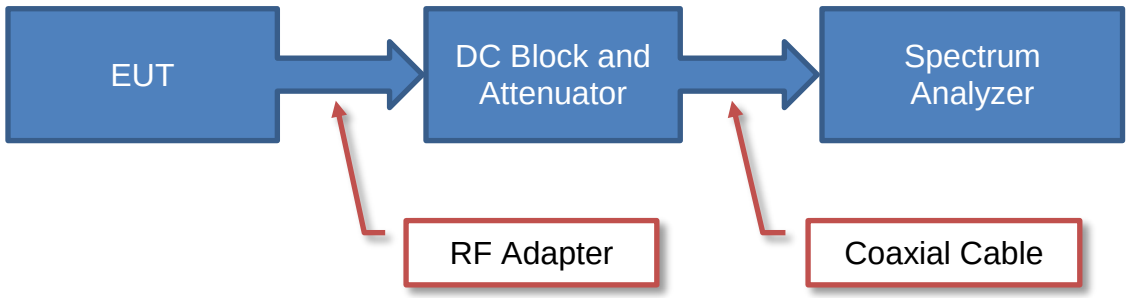
A measurement uncertainty estimation has been performed for each test per our internal quality document QM205.4.6. The estimation is used to compare the measured result with its "true" or theoretically correct value. The expanded measurement uncertainty (K=2) can be found included as part of the applicable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

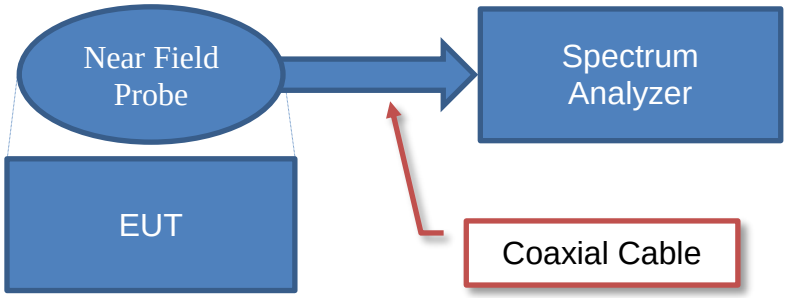
Test	+ MU	- MU
Frequency Accuracy (Hz)	0.0007%	-0.0007%
Amplitude Accuracy (dB)	1.2 dB	-1.2 dB
Conducted Power (dB)	1.2 dB	-1.2 dB
Radiated Power via Substitution (dB)	0.7 dB	-0.7 dB
Temperature (degrees C)	0.7°C	-0.7°C
Humidity (% RH)	2.5% RH	-2.5% RH
Voltage (AC)	1.0%	-1.0%
Voltage (DC)	0.7%	-0.7%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

Test Setup Block Diagrams

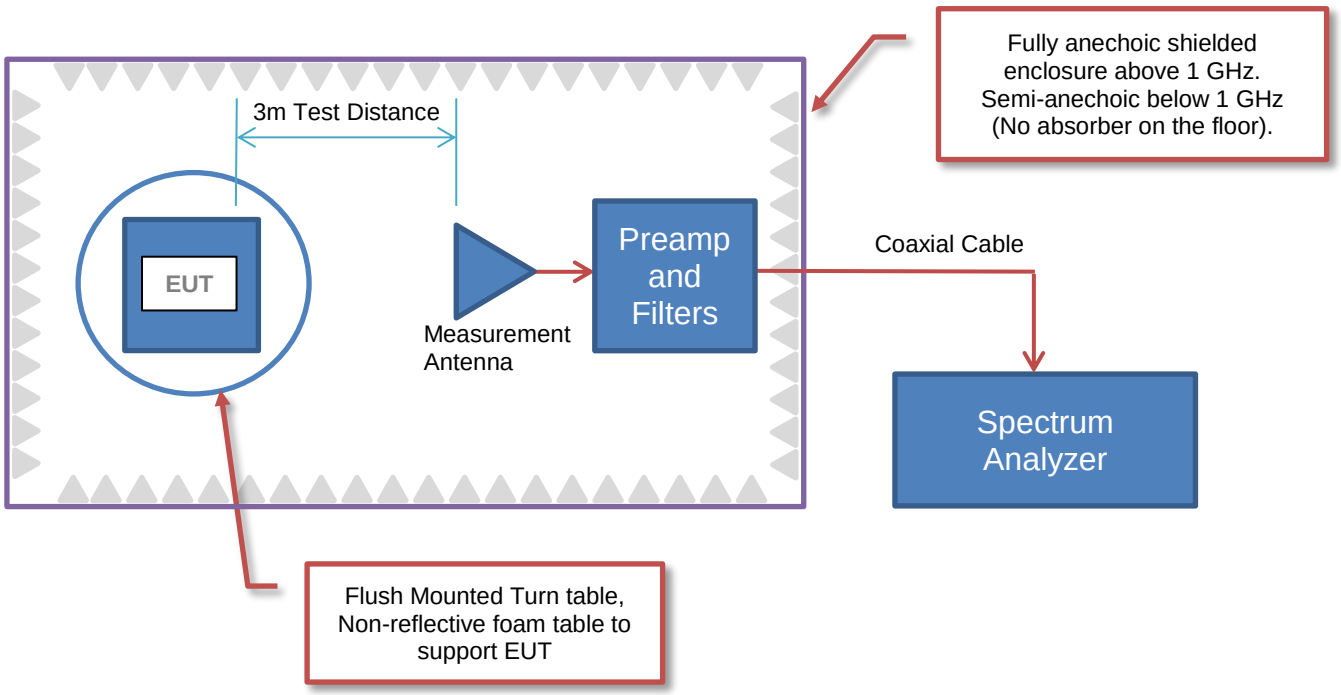
Antenna Port Conducted Measurements



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:	MIXRF319
First Date of Test:	July 5, 2019
Last Date of Test:	July 5, 2019
Receipt Date of Samples:	July 5, 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:
Transceiver radio

Testing Objective:
To demonstrate compliance to FCC 15.231 specifications.

CONFIGURATIONS

Configuration CINC0040- 1

EUT			
Description	**Manufacturer**	**Model/Part Number**	**Serial Number**
MIXRF319	CINCH Systems	MIXRF319	10B7

Peripherals in test setup boundary			
Description	**Manufacturer**	**Model/Part Number**	**Serial Number**
Power Supply (MIXRF319)	Sure-Power	SW-120200A	1113

Cables					
Cable Type	**Shield**	**Length (m)**	**Ferrite**	**Connection 1**	**Connection 2**
DC Cable	No	2.2 m	No	MIXRF319	Power Supply (MIXRF319)

Configuration CINC0040- 2

EUT			
Description	**Manufacturer**	**Model/Part Number**	**Serial Number**
MIXRF319	CINCH Systems	MIXRF319	10B8

Peripherals in test setup boundary			
Description	**Manufacturer**	**Model/Part Number**	**Serial Number**
Power Supply (MIXRF319)	Sure-Power	SW-120200A	1113

Cables					
Cable Type	**Shield**	**Length (m)**	**Ferrite**	**Connection 1**	**Connection 2**
DC Cable	No	2.2 m	No	MIXRF319	Power Supply (MIXRF319)

MODIFICATIONS

Equipment Modifications

Item	Date	Test	Modification	Note	Disposition of EUT
1	2019-07-05	Powerline Conducted 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.
2	2019-07-05	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	2019-07-05	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	2019-07-05	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.
5	2019-07-05	Duty Cycle	Tested as delivered to Test Station.	No EMI suppression devices were added or modified during this test.	Scheduled testing was completed.

POWERLINE CONDUCTED EMISSIONS

element
WTD.2019.1.24

TEST DESCRIPTION

Using the mode of operation and configuration noted within this report, conducted emissions tests were performed. The frequency range investigated (scanned), is also noted in this report. Conducted power line measurements are made, unless otherwise specified, over the frequency range from 150 kHz to 30 MHz to determine the line-to-ground radio-noise voltage that is conducted from the EUT power-input terminals that are directly (or indirectly via separate transformer or power supplies) connected to a public power network. Per the standard, an insulating material was also added to ground plane between the EUT's power and remote I/O cables. Equipment is tested with power cords that are normally used or that have electrical or shielding characteristics that are the same as those cords normally used. Typically those measurements are made using a LISN (Line Impedance Stabilization Network), the 50ohm measuring port is terminated by a 50ohm EMI meter or a 50ohm resistive load. All 50ohm measuring ports of the LISN are terminated by 50ohm. The test data represents the configuration/ operating mode/ model that produced the highest emission levels as compared to the specification limit.

TEST EQUIPMENT

Description	Manufacturer	Model	ID	Last Cal.	Cal. Due
Analyzer - Spectrum Analyzer	Agilent	E4443A	AAS	2019-03-08	2020-03-08
LISN	Solar Electronics	9252-50-R-24-BNC	LIY	2019-03-15	2020-03-15
Cable - Conducted Cable Assembly	Northwest EMC	MNC, HGN, TYK	MNCA	2019-03-13	2020-03-13

MEASUREMENT UNCERTAINTY

Description		
Expanded k=2	2.4 dB	-2.4 dB

CONFIGURATIONS INVESTIGATED

CINC0040-1
CINC0040-2

MODES INVESTIGATED

Rx at 319.5 MHz
Tx at 319.5 MHz, Modulated

POWERLINE CONDUCTED EMISSIONS

EUT:	MIXRF319	Work Order:	CINC0040
Serial Number:	10B7	Date:	2019-07-05
Customer:	CINCH Systems	Temperature:	21.7°C
Attendees:	Jibril Aga	Relative Humidity:	66.7%
Customer Project:	None	Bar. Pressure:	1019 mb
Tested By:	Andrew Rogstad	Job Site:	MN03
Power:	110VAC/60Hz	Configuration:	CINC0040-1

TEST SPECIFICATIONS

Specification:	Method:
FCC 15.207:2019	ANSI C63.10:2013

TEST PARAMETERS

Run #:	3	Line:	Neutral	Add. Ext. Attenuation (dB):	0

COMMENTS

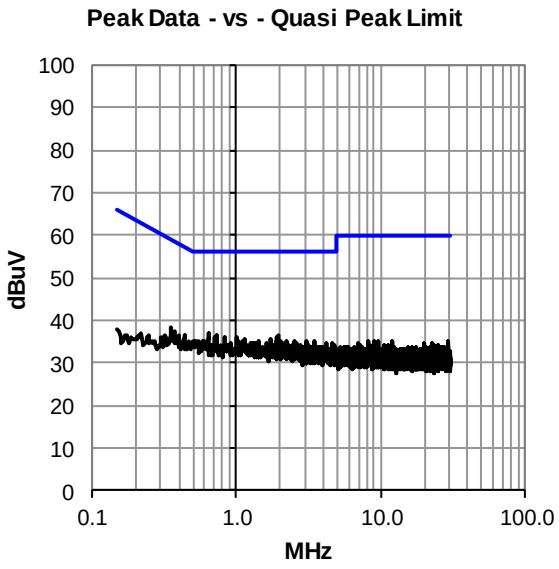
None

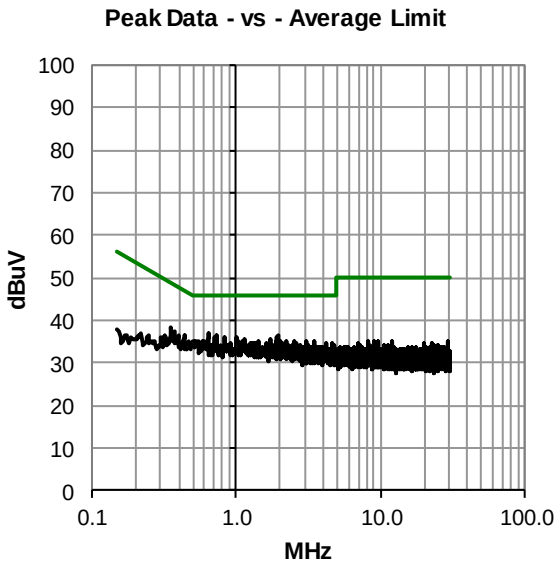
EUT OPERATING MODES

Rx at 319.5 MHz

DEVIATIONS FROM TEST STANDARD

None





POWERLINE CONDUCTED EMISSIONS

element
WTD.2019.1.24

RESULTS - Run #3

Peak Data - vs - Quasi Peak Limit

Freq (MHz)	Amp. (dBuV)	Factor (dB)	Adjusted (dBuV)	Spec. Limit (dBuV)	Margin (dB)
0.639	16.5	20.6	37.1	56.0	-18.9
0.732	15.8	20.6	36.4	56.0	-19.6
1.930	15.7	20.6	36.3	56.0	-19.7
0.825	15.5	20.6	36.1	56.0	-19.9
1.001	15.3	20.6	35.9	56.0	-20.1
0.355	17.9	20.6	38.5	58.8	-20.3
1.739	15.1	20.6	35.7	56.0	-20.3
1.146	14.9	20.6	35.5	56.0	-20.5
2.504	14.6	20.7	35.3	56.0	-20.7
0.437	15.7	20.6	36.3	57.1	-20.8
2.034	14.5	20.6	35.1	56.0	-20.9
1.441	14.4	20.6	35.0	56.0	-21.0
3.041	14.3	20.7	35.0	56.0	-21.0
3.485	14.2	20.8	35.0	56.0	-21.0
2.221	14.2	20.7	34.9	56.0	-21.1
1.359	14.2	20.6	34.8	56.0	-21.2
4.228	14.1	20.7	34.8	56.0	-21.2
2.071	14.1	20.6	34.7	56.0	-21.3
4.601	13.8	20.7	34.5	56.0	-21.5
2.541	13.7	20.7	34.4	56.0	-21.6
2.582	13.7	20.7	34.4	56.0	-21.6
3.127	13.6	20.7	34.3	56.0	-21.7
1.683	13.6	20.6	34.2	56.0	-21.8
2.754	13.5	20.7	34.2	56.0	-21.8
4.769	13.5	20.7	34.2	56.0	-21.8
3.004	13.2	20.7	33.9	56.0	-22.1

Peak Data - vs - Average Limit

Freq (MHz)	Amp. (dBuV)	Factor (dB)	Adjusted (dBuV)	Spec. Limit (dBuV)	Margin (dB)
0.639	16.5	20.6	37.1	46.0	-8.9
0.732	15.8	20.6	36.4	46.0	-9.6
1.930	15.7	20.6	36.3	46.0	-9.7
0.825	15.5	20.6	36.1	46.0	-9.9
1.001	15.3	20.6	35.9	46.0	-10.1
0.355	17.9	20.6	38.5	48.8	-10.3
1.739	15.1	20.6	35.7	46.0	-10.3
1.146	14.9	20.6	35.5	46.0	-10.5
2.504	14.6	20.7	35.3	46.0	-10.7
0.437	15.7	20.6	36.3	47.1	-10.8
2.034	14.5	20.6	35.1	46.0	-10.9
1.441	14.4	20.6	35.0	46.0	-11.0
3.041	14.3	20.7	35.0	46.0	-11.0
3.485	14.2	20.8	35.0	46.0	-11.0
2.221	14.2	20.7	34.9	46.0	-11.1
1.359	14.2	20.6	34.8	46.0	-11.2
4.228	14.1	20.7	34.8	46.0	-11.2
2.071	14.1	20.6	34.7	46.0	-11.3
4.601	13.8	20.7	34.5	46.0	-11.5
2.541	13.7	20.7	34.4	46.0	-11.6
2.582	13.7	20.7	34.4	46.0	-11.6
3.127	13.6	20.7	34.3	46.0	-11.7
1.683	13.6	20.6	34.2	46.0	-11.8
2.754	13.5	20.7	34.2	46.0	-11.8
4.769	13.5	20.7	34.2	46.0	-11.8
3.004	13.2	20.7	33.9	46.0	-12.1

CONCLUSION

Pass

Tested By

POWERLINE CONDUCTED EMISSIONS

EUT:	MIXRF319	Work Order:	CINC0040
Serial Number:	10B7	Date:	2019-07-05
Customer:	CINCH Systems	Temperature:	21.7°C
Attendees:	Jibril Aga	Relative Humidity:	66.7%
Customer Project:	None	Bar. Pressure:	1019 mb
Tested By:	Andrew Rogstad	Job Site:	MN03
Power:	110VAC/60Hz	Configuration:	CINC0040-1

TEST SPECIFICATIONS

Specification:	Method:
FCC 15.207:2019	ANSI C63.10:2013

TEST PARAMETERS

Run #:	4	Line:	High Line	Add. Ext. Attenuation (dB):	0

COMMENTS

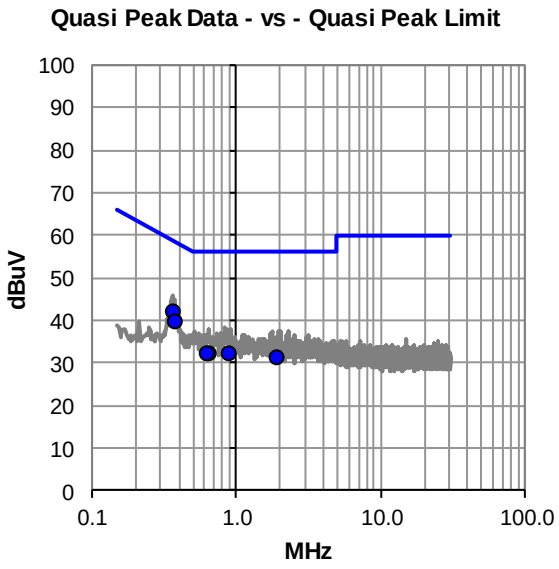
None

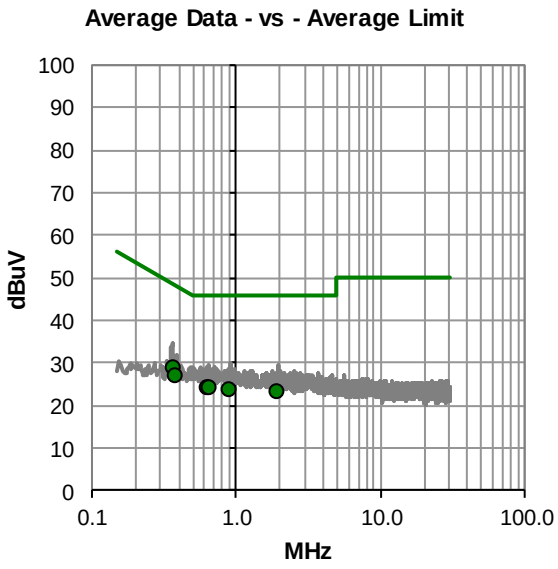
EUT OPERATING MODES

Rx at 319.5 MHz

DEVIATIONS FROM TEST STANDARD

None





POWERLINE CONDUCTED EMISSIONS

element
WTD.2019.1.24

RESULTS - Run #4

Quasi Peak Data - vs - Quasi Peak Limit

Freq (MHz)	Amp. (dBuV)	Factor (dB)	Adjusted (dBuV)	Spec. Limit (dBuV)	Margin (dB)
0.366	21.5	20.6	42.1	58.6	-16.5
0.376	18.7	20.6	39.3	58.4	-19.1
0.649	11.6	20.6	32.2	56.0	-23.8
0.913	11.5	20.6	32.1	56.0	-23.9
0.625	11.6	20.5	32.1	56.0	-23.9
1.953	10.4	20.6	31.0	56.0	-25.0

Average Data - vs - Average Limit

Freq (MHz)	Amp. (dBuV)	Factor (dB)	Adjusted (dBuV)	Spec. Limit (dBuV)	Margin (dB)
0.366	8.1	20.6	28.7	48.6	-19.9
0.376	6.2	20.6	26.8	48.4	-21.6
0.625	3.7	20.5	24.2	46.0	-21.8
0.649	3.3	20.6	23.9	46.0	-22.1
0.913	3.0	20.6	23.6	46.0	-22.4
1.953	2.3	20.6	22.9	46.0	-23.1

CONCLUSION

Pass

Tested By

POWERLINE CONDUCTED EMISSIONS

EUT:	MIXRF319	Work Order:	CINC0040
Serial Number:	10B8	Date:	2019-07-05
Customer:	CINCH Systems	Temperature:	21.7°C
Attendees:	Jibril Aga	Relative Humidity:	66.7%
Customer Project:	None	Bar. Pressure:	1019 mb
Tested By:	Andrew Rogstad	Job Site:	MN03
Power:	110VAC/60Hz	Configuration:	CINC0040-2

TEST SPECIFICATIONS

Specification:	Method:
FCC 15.207:2019	ANSI C63.10:2013

TEST PARAMETERS

Run #:	7	Line:	Neutral	Add. Ext. Attenuation (dB):	0

COMMENTS

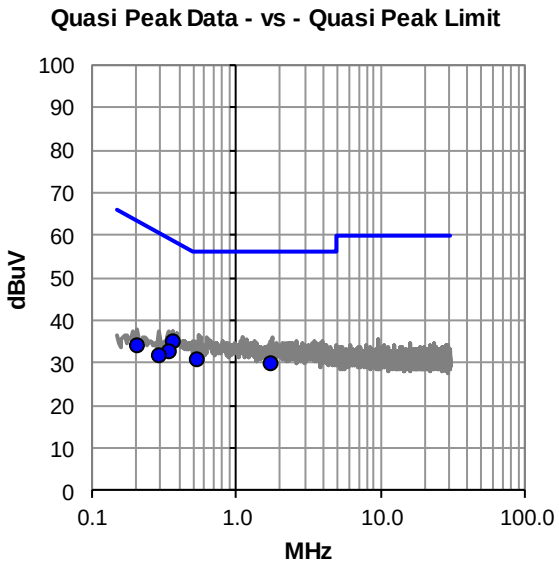
None

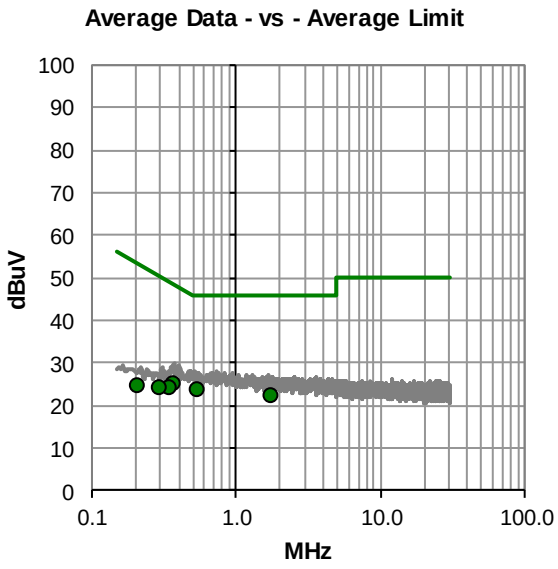
EUT OPERATING MODES

Tx at 319.5 MHz, Modulated

DEVIATIONS FROM TEST STANDARD

None





POWERLINE CONDUCTED EMISSIONS

element
WTD.2019.1.24

RESULTS - Run #7

Quasi Peak Data - vs - Quasi Peak Limit

Freq (MHz)	Amp. (dBuV)	Factor (dB)	Adjusted (dBuV)	Spec. Limit (dBuV)	Margin (dB)
0.365	14.3	20.6	34.9	58.6	-23.7
0.541	10.2	20.6	30.8	56.0	-25.2
1.762	8.9	20.6	29.5	56.0	-26.5
0.343	11.8	20.6	32.4	59.1	-26.7
0.295	10.9	20.6	31.5	60.4	-28.9
0.209	13.2	20.8	34.0	63.2	-29.2

Average Data - vs - Average Limit

Freq (MHz)	Amp. (dBuV)	Factor (dB)	Adjusted (dBuV)	Spec. Limit (dBuV)	Margin (dB)
0.541	3.0	20.6	23.6	46.0	-22.4
0.365	4.6	20.6	25.2	48.6	-23.4
1.762	1.5	20.6	22.1	46.0	-23.9
0.343	3.5	20.6	24.1	49.1	-25.0
0.295	3.3	20.6	23.9	50.4	-26.5
0.209	3.8	20.8	24.6	53.2	-28.6

CONCLUSION

Pass

Tested By

POWERLINE CONDUCTED EMISSIONS

element
WTD.2019.1.24

EUT:	MIXRF319	Work Order:	CINC0040
Serial Number:	10B8	Date:	2019-07-05
Customer:	CINCH Systems	Temperature:	21.7°C
Attendees:	Jibril Aga	Relative Humidity:	66.7%
Customer Project:	None	Bar. Pressure:	1019 mb
Tested By:	Andrew Rogstad	Job Site:	MN03
Power:	110VAC/60Hz	Configuration:	CINC0040-2

TEST SPECIFICATIONS

Specification:	Method:
FCC 15.207:2019	ANSI C63.10:2013

TEST PARAMETERS

Run #:	8	Line:	High Line	Add. Ext. Attenuation (dB):	0

COMMENTS

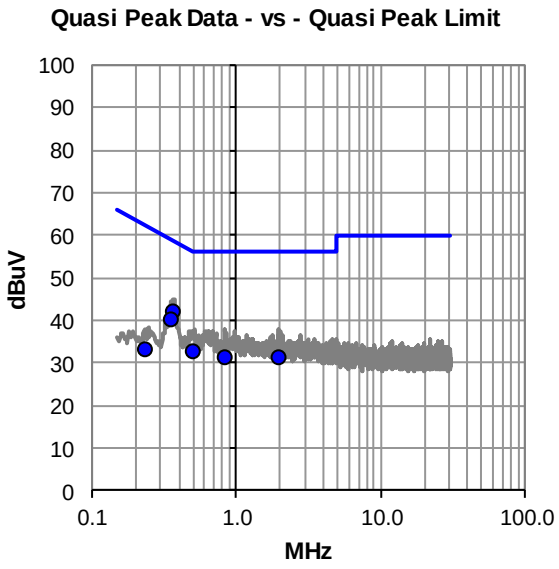
None

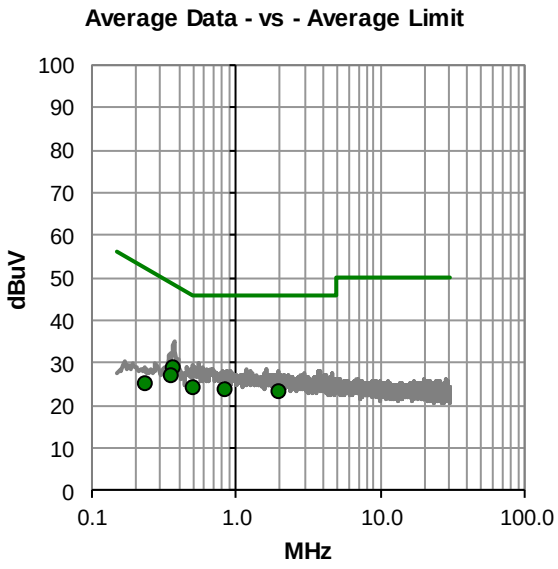
EUT OPERATING MODES

Tx at 319.5 MHz, Modulated

DEVIATIONS FROM TEST STANDARD

None





POWERLINE CONDUCTED EMISSIONS

element
WTD.2019.1.24

RESULTS - Run #8

Quasi Peak Data - vs - Quasi Peak Limit

Freq (MHz)	Amp. (dBuV)	Factor (dB)	Adjusted (dBuV)	Spec. Limit (dBuV)	Margin (dB)
0.367	21.4	20.6	42.0	58.6	-16.6
0.353	19.4	20.6	40.0	58.9	-18.9
0.503	11.8	20.6	32.4	56.0	-23.6
0.837	10.7	20.6	31.3	56.0	-24.7
1.977	10.5	20.6	31.1	56.0	-24.9
0.239	12.2	20.7	32.9	62.1	-29.2

Average Data - vs - Average Limit

Freq (MHz)	Amp. (dBuV)	Factor (dB)	Adjusted (dBuV)	Spec. Limit (dBuV)	Margin (dB)
0.367	8.0	20.6	28.6	48.6	-20.0
0.353	6.5	20.6	27.1	48.9	-21.8
0.503	3.5	20.6	24.1	46.0	-21.9
0.837	2.9	20.6	23.5	46.0	-22.5
1.977	2.3	20.6	22.9	46.0	-23.1
0.239	4.2	20.7	24.9	52.1	-27.2

CONCLUSION

Pass

Tested By

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 at 319.505 MHz, Modulated

POWER SETTINGS INVESTIGATED

110VAC/60Hz

CONFIGURATIONS INVESTIGATED

CINC0040 - 2

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	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	AFN	1-May-2019	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 = 0.1259 mSec
Pulsewidth of Type 2 Pulse = 0.3658 mSec
Pulsewidth of Type 3 Pulse = 0.2439 mSec
Number of Type 1 Pulses = 62
Number of Type 2 Pulses = 13
Number of Type 3 Pulses = 8

Duty Cycle = 20 log [((62)(0.1259) + (13)(0.3658) + (8)(0.2439))/100] = -16.77 dB

The duty cycle correction factor of -16.77 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.

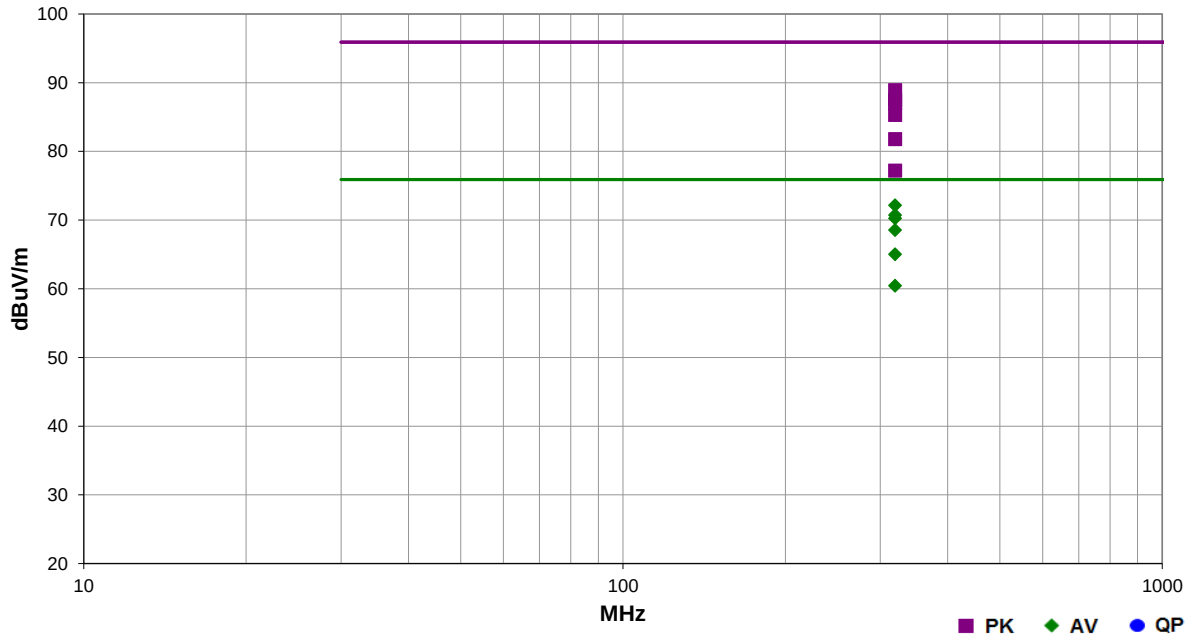
FIELD STRENGTH OF FUNDAMENTAL

EmiR5 2019.05.20 PSA-ESCI 2019.05.10

Work Order:	CINC0040	**Date:**	5-Jul-2019		
Project:	None	**Temperature:**	21.9 °C		
Job Site:	MN05	**Humidity:**	77.1% RH		
Serial Number:	10B8	**Barometric Pres.:**	1020 mbar	**Tested by:**	Andrew Rogstad
EUT:	MIXRF319				
Configuration:	2				
Customer:	CINCH Systems				
Attendees:	Jibril Aga				
EUT Power:	110VAC/60Hz				
Operating Mode:	Tx at 319.505 MHz, Modulated				
Deviations:	None				
Comments:	None				

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

Run #	6	**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	69.2	19.7	1.0	275.0	-16.8	0.0	Horz	AV	0.0	72.1	75.9	-3.8	EUT on side
319.505	67.8	19.7	1.01	214.0	-16.8	0.0	Horz	AV	0.0	70.7	75.9	-5.2	EUT horz
319.507	67.3	19.7	1.08	15.0	-16.8	0.0	Horz	AV	0.0	70.2	75.9	-5.7	EUT vert
319.507	69.2	19.7	1.0	275.0		0.0	Horz	PK	0.0	88.9	95.9	-7.0	EUT on side
319.505	65.6	19.7	1.7	261.0	-16.8	0.0	Vert	AV	0.0	68.5	75.9	-7.4	EUT vert
319.505	67.8	19.7	1.01	214.0		0.0	Horz	PK	0.0	87.5	95.9	-8.4	EUT horz
319.507	67.3	19.7	1.08	15.0		0.0	Horz	PK	0.0	87.0	95.9	-8.9	EUT vert
319.505	65.6	19.7	1.7	261.0		0.0	Vert	PK	0.0	85.3	95.9	-10.6	EUT vert
319.507	62.1	19.7	1.35	162.0	-16.8	0.0	Vert	AV	0.0	65.0	75.9	-10.9	EUT on side
319.507	62.1	19.7	1.35	162.0		0.0	Vert	PK	0.0	81.8	95.9	-14.1	EUT on side
319.507	57.5	19.7	1.25	173.0	-16.8	0.0	Vert	AV	0.0	60.4	75.9	-15.5	EUT horz
319.507	57.5	19.7	1.25	173.0		0.0	Vert	PK	0.0	77.2	95.9	-18.7	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 319.505 MHz, Modulated

POWER SETTINGS INVESTIGATED

110VAC/60Hz

CONFIGURATIONS INVESTIGATED

CINC0040 - 2

FREQUENCY RANGE INVESTIGATED

Start Frequency	30 MHz	Stop Frequency	4000 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
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
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	AFN	1-May-2019	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 = 0.1259 mSec
Pulsewidth of Type 2 Pulse = 0.3658 mSec
Pulsewidth of Type 3 Pulse = 0.2439 mSec
Number of Type 1 Pulses = 62
Number of Type 2 Pulses = 13

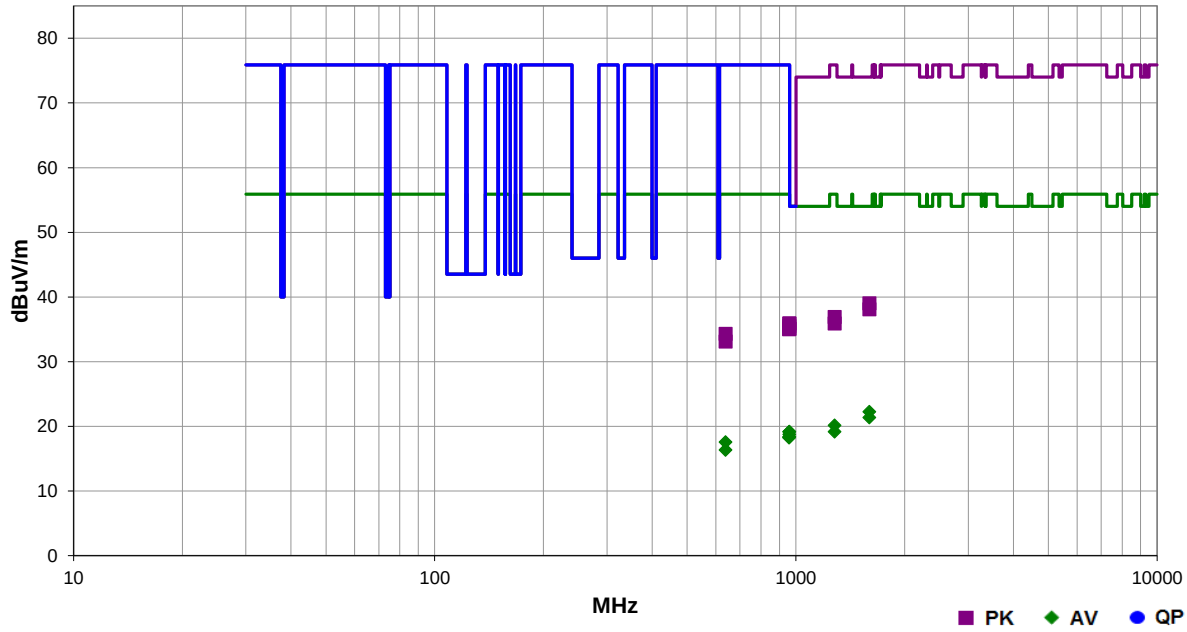
SPURIOUS RADIATED EMISSIONS

EmiR5 2019.05.20 PSA-ESCI 2019.05.10

Work Order:	CINC0040	**Date:**	5-Jul-2019		
Project:	None	**Temperature:**	21.9 °C		
Job Site:	MN05	**Humidity:**	77.1% RH		
Serial Number:	10B8	**Barometric Pres.:**	1020 mbar	**Tested by:**	Andrew Rogstad
EUT:	MIXRF319				
Configuration:	2				
Customer:	CINCH Systems				
Attendees:	Jibril Aga				
EUT Power:	110VAC/60Hz				
Operating Mode:	Tx at 319.505 MHz, Modulated				
Deviations:	None				
Comments:	None				

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

Run #	8	**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
1597.450	45.0	-6.0	1.5	156.0	-16.8	0.0	Horz	AV	0.0	22.2	54.0	-31.8	EUT on side
1597.625	44.1	-6.0	1.5	231.0	-16.8	0.0	Vert	AV	0.0	21.3	54.0	-32.7	EUT vert
1597.450	45.0	-6.0	1.5	156.0		0.0	Horz	PK	0.0	39.0	74.0	-35.0	EUT on side
1280.042	43.9	-7.0	1.5	149.9	-16.8	0.0	Horz	AV	0.0	20.1	55.9	-35.8	EUT on side
1597.625	44.1	-6.0	1.5	231.0		0.0	Vert	PK	0.0	38.1	74.0	-35.9	EUT vert
958.475	22.7	13.2	3.7	173.0	-16.8	0.0	Horz	AV	0.0	19.1	55.9	-36.8	EUT on side
958.905	22.7	13.2	1.0	184.0	-16.8	0.0	Vert	AV	0.0	19.1	55.9	-36.8	EUT horz
1279.283	42.9	-7.0	1.5	45.9	-16.8	0.0	Vert	AV	0.0	19.1	55.9	-36.8	EUT vert
958.568	22.3	13.2	1.0	36.0	-16.8	0.0	Vert	AV	0.0	18.7	55.9	-37.2	EUT vert
958.795	21.9	13.2	1.6	162.0	-16.8	0.0	Vert	AV	0.0	18.3	55.9	-37.6	EUT on side
958.248	21.9	13.2	1.0	48.0	-16.8	0.0	Horz	AV	0.0	18.3	55.9	-37.6	EUT horz
958.065	21.8	13.2	1.0	240.9	-16.8	0.0	Horz	AV	0.0	18.2	55.9	-37.7	EUT vert
639.017	27.5	6.8	1.0	95.0	-16.8	0.0	Horz	AV	0.0	17.5	55.9	-38.4	EUT on side
1280.042	43.9	-7.0	1.5	149.9		0.0	Horz	PK	0.0	36.9	75.9	-39.0	EUT on side
639.017	26.3	6.8	1.3	146.9	-16.8	0.0	Vert	AV	0.0	16.3	55.9	-39.6	EUT vert
958.475	22.7	13.2	3.7	173.0		0.0	Horz	PK	0.0	35.9	75.9	-40.0	EUT on side
958.905	22.7	13.2	1.0	184.0		0.0	Vert	PK	0.0	35.9	75.9	-40.0	EUT horz
1279.283	42.9	-7.0	1.5	45.9		0.0	Vert	PK	0.0	35.9	75.9	-40.0	EUT vert

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
958.568	22.3	13.2	1.0	36.0		0.0	Vert	PK	0.0	35.5	75.9	-40.4	EUT vert
958.795	21.9	13.2	1.6	162.0		0.0	Vert	PK	0.0	35.1	75.9	-40.8	EUT on side
958.248	21.9	13.2	1.0	48.0		0.0	Horz	PK	0.0	35.1	75.9	-40.8	EUT horz
958.065	21.8	13.2	1.0	240.9		0.0	Horz	PK	0.0	35.0	75.9	-40.9	EUT vert
639.017	27.5	6.8	1.0	95.0		0.0	Horz	PK	0.0	34.3	75.9	-41.6	EUT on side
639.017	26.3	6.8	1.3	146.9		0.0	Vert	PK	0.0	33.1	75.9	-42.8	EUT vert

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
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	Keysight	N9010A	AFN	1-May-2019	1-May-2020

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 2019.02.26

EUT:	MIXRF319			**Work Order:**	CINC0040
Serial Number:	10B8			**Date:**	5-Jul-19
Customer:	CINCH Systems			**Temperature:**	21.9 °C
Attendees:	Jibril Aga			**Humidity:**	77.1% RH
Project:	None			**Barometric Pres.:**	1020 mbar
Tested by:	Andrew Rogstad	**Power:**	110VAC/60Hz	**Job Site:**	MN05

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

COMMENTS

Tx at 319.505 MHz, modulated

DEVIATIONS FROM TEST STANDARD

None

Configuration #	2	*Signature*

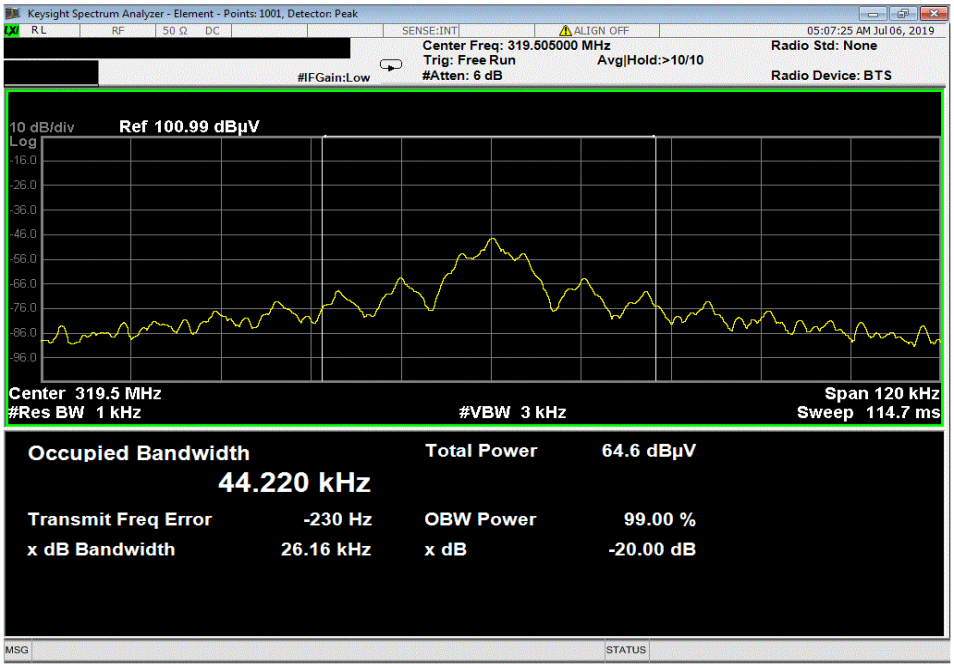
	Value (kHz)	**Limit (kHz)**	**Result**
319.505 MHz	26.16	798.77	Pass

OCCUPIED BANDWIDTH

element

XMit 2019.02.26

319.505 MHz						
				Value (kHz)	Limit (kHz)	Result
				26.16	798.77	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
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	Keysight	N9010A	AFN	1-May-2019	1-May-2020

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 = .1259 mSec
Pulsewidth of Type 2 Pulse = .3658 mSec
Pulsewidth of Type 3 Pulse = .2439 mSec
Number of Type 1 Pulses = 62
Number of Type 2 Pulses = 13
Number of Type 3 Pulses = 8

Duty Cycle = 20 log [((62)(.1259) + (13)(.3658) + (8)(.2439))/100] = -16.77 dB

The duty cycle correction factor of **–16.77 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

XMit 2017.12.13

EUT:	MIXRF319			**Work Order:**	CINC0040
Serial Number:	10B7			**Date:**	5-Jul-19
Customer:	CINCH Systems			**Temperature:**	21.9 °C
Attendees:	Jibril Aga			**Humidity:**	77.1% RH
Project:	None			**Barometric Pres.:**	1020 mbar
Tested by:	Andrew Rogstad	**Power:**	110VAC/60Hz	**Job Site:**	MN05

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

COMMENTS

Transmitting at 319.505 MHz

DEVIATIONS FROM TEST STANDARD

None

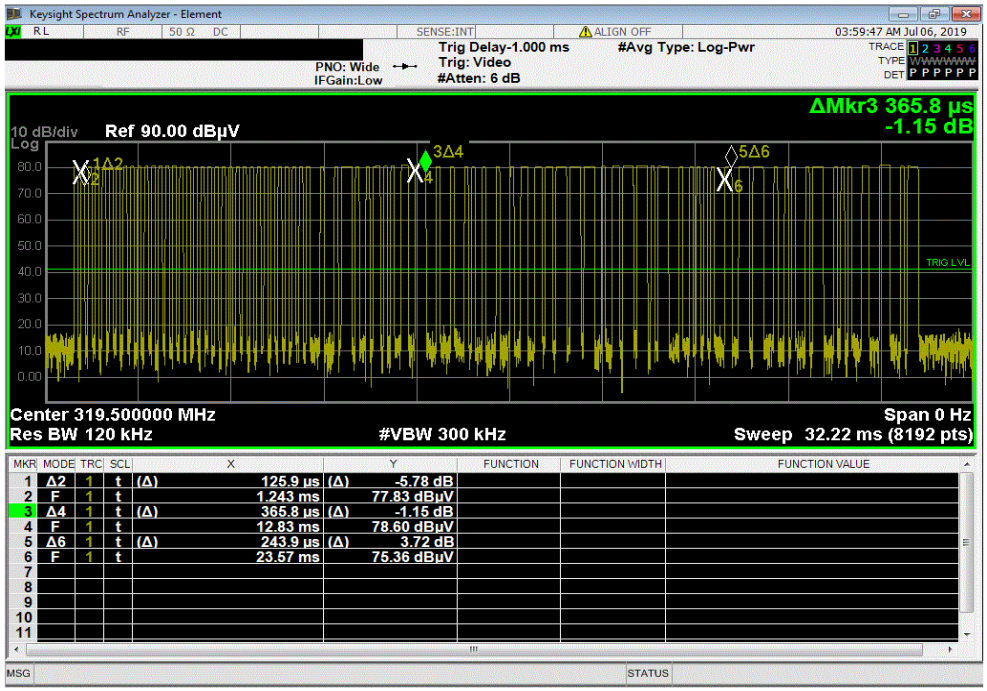
Configuration #	1	*Signature*

	Number of Type 1 Pulses	Type 1 Pulse length (ms)	Number of Type 2 Pulses	Type 2 Pulse length (ms)	Number of Type 3 Pulses	Type 2 Pulse length (ms)	DCCF	Result
32 ms	62	0.1259	13	0.3658	8	0.2439	-16.77	N/A
100 ms	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
5 s	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A

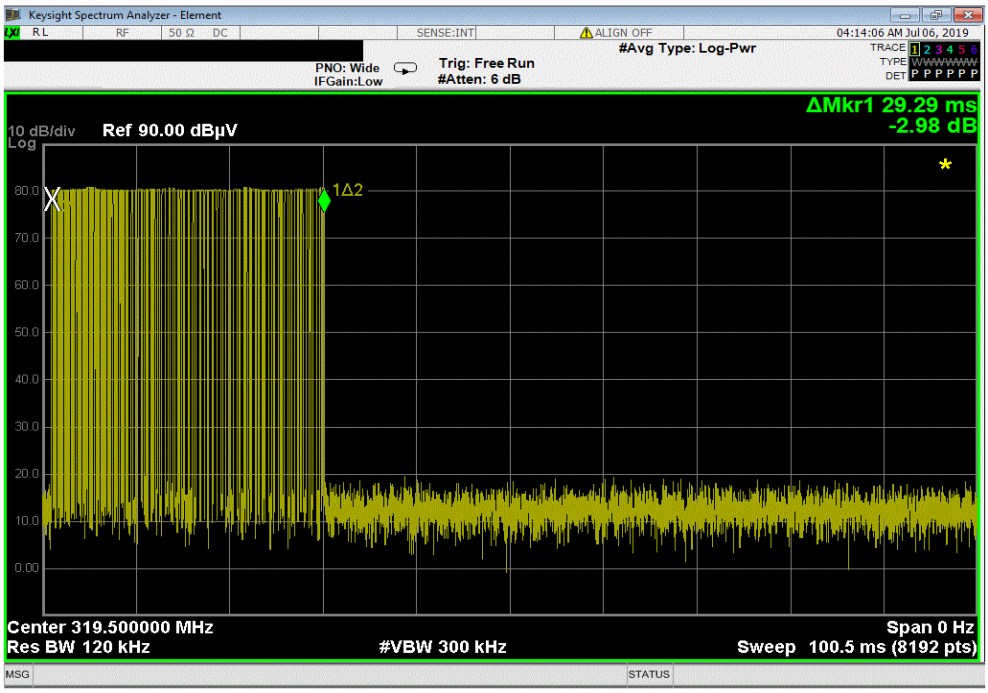
Duty Cycle

XMit 2017.12.13

32 ms						
Number of Type 1 Pulses	Type 1 Pulse length (ms)	Number of Type 2 Pulses	Type 2 Pulse length (ms)	Number of Type 3 Pulses	Type 2 Pulse length (ms)	DCCF
62	0.1259	13	0.3658	8	0.2439	-16.77



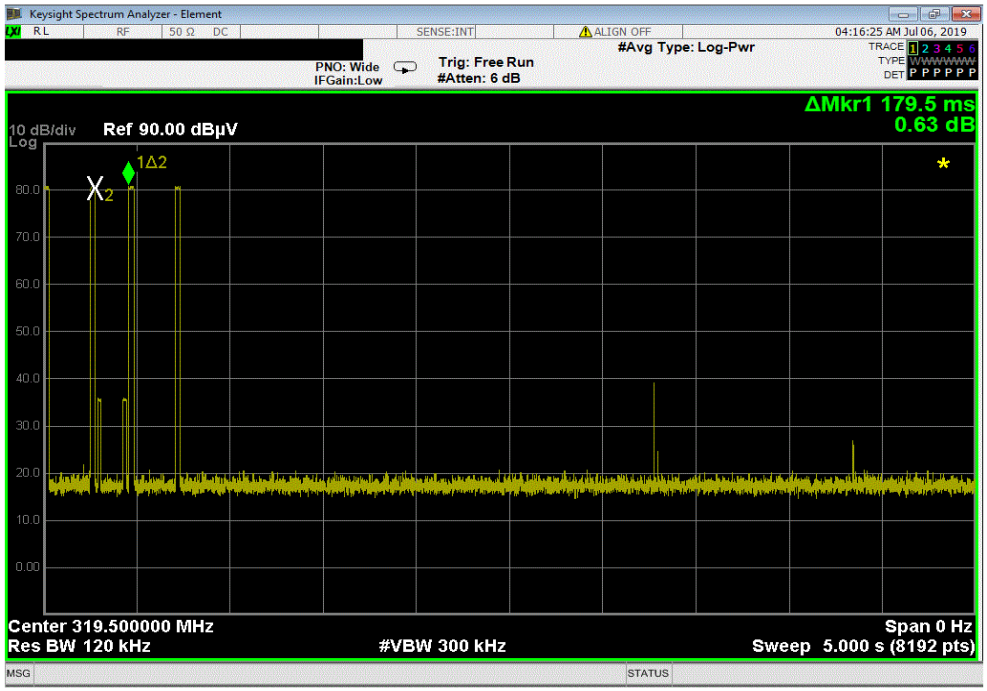
100 ms						
Number of Type 1 Pulses	Type 1 Pulse length (ms)	Number of Type 2 Pulses	Type 2 Pulse length (ms)	Number of Type 3 Pulses	Type 2 Pulse length (ms)	DCCF
N/A	N/A	N/A	N/A	N/A	N/A	N/A



Duty Cycle

XMit 2017.12.13

5 s						
Number of Type 1 Pulses	Type 1 Pulse length (ms)	Number of Type 2 Pulses	Type 2 Pulse length (ms)	Number of Type 3 Pulses	Type 2 Pulse length (ms)	DCCF
N/A	N/A	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)	Number of Type 3 Pulses	Type 2 Pulse length (ms)	DCCF
N/A	N/A	N/A	N/A	N/A	N/A	N/A