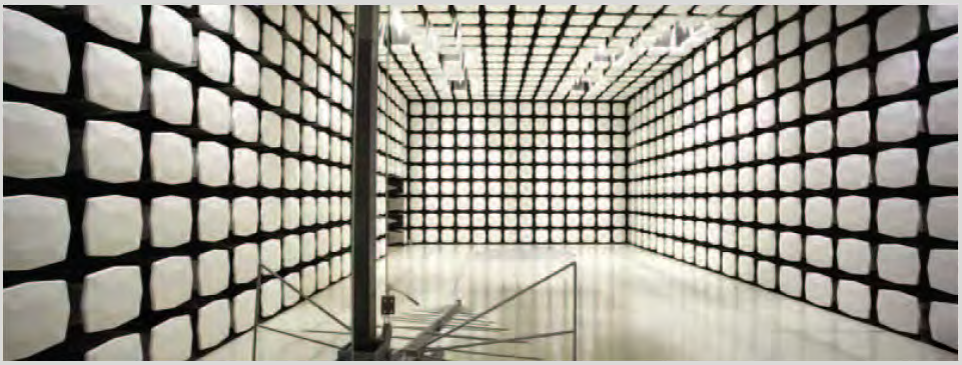
Dana Innovations

AM.2 Clear Connect Sleeve Top

FCC 15.231:2014

Report #: DANA0012.1



Report Prepared By Northwest EMC Inc.

NORTHWEST EMC – (888) 364-2378 – www.nwemc.com

California – Minnesota – Oregon – New York – Washington

CERTIFICATE OF TEST

WTD 12.5.23

Last Date of Test: July 01, 2014
Dana Innovations
Model: AM.2 Clear Connect Sleeve Top

Emissions

Test Description	Specification	Test Method	Pass/Fail
Duty Cycle	FCC 15.231:2014 Class B	ANSI C63.10:2009	Pass
Occupied Bandwidth	FCC 15.231:2014 Class B	ANSI C63.10:2009	Pass
Field Strength of Fundamental	FCC 15.231:2014 Class B	ANSI C63.10:2009	Pass
Spurious Radiated Emissions	FCC 15.231:2014 Class B	ANSI C63.10:2009	Pass

Deviations From Test Standards

None

Approved By:

Victor Ratinoff, Operations Manager

NVLAP Lab Code: 200676-0

This report must not be used to claim product certification, approval, or endorsement by NVLAP, NIST, or any agency of the federal government of the United States of America.

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. This Report may only be duplicated in its entirety. 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.

REVISION HISTORY

REV 2012.08.02

Revision Number	Description	Date	Page Number
00	None		

Barometric Pressure

The recorded barometric pressure has been normalized to sea level.

NORTHWEST EMC

REV 2012.05.24

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 Guide 65 as a product certifier. This allows Northwest EMC to certify transmitters to FCC and IC specifications.

NVLAP - Each laboratory is accredited by NVLAP to ISO 17025

Canada

IC - Recognized by Industry Canada as a Certification Body (CB). Certification chambers and Open Area Test Sites are filed with IC.

European Union

European Commission – Validated by the European Commission as a Conformity Assessment Body (CAB) under the EMC directive and as a Notified Body under the R&TTE Directive.

Australia/New Zealand

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

Korea

KCC / 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.

Hong Kong

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

Vietnam

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

Russia

GOST – Accredited by Certinform VNIINMASH, CERTINFO, SAMTES, and Federal CHEC to perform EMC and Hygienic testing for Information Technology products to GOST standards.

SCOPE

For details on the Scopes of our Accreditations, please visit:
http://www.nwemc.com/accreditations/

MEASUREMENT UNCERTAINTY

Measurement Uncertainty

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

A measurement uncertainty estimation has been performed for each test per our internal quality document WP 342. The estimation is used to compare the measured result with its "true" or theoretically correct value. The expanded measurement uncertainty (K=2) for each test is listed below. 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 16-4-1 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.

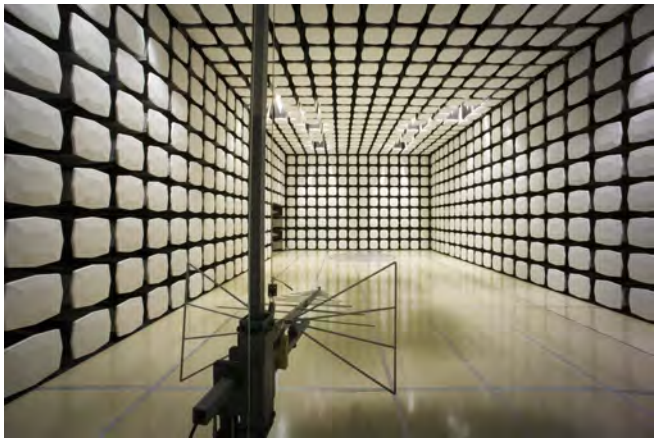
Test	+ MU	- MU
Frequency Accuracy (Hz)	0.12	-0.01
Amplitude Accuracy (dB)	0.49	-0.49
Conducted Power (dB)	0.41	-0.41
Radiated Power via Substitution (dB)	0.69	-0.68
Temperature (degrees C)	0.81	-0.81
Humidity (% RH)	2.89	-2.89
Field Strength (dB)	3.80	-3.80
AC Powerline Conducted Emissions (dB)	2.94	-2.94

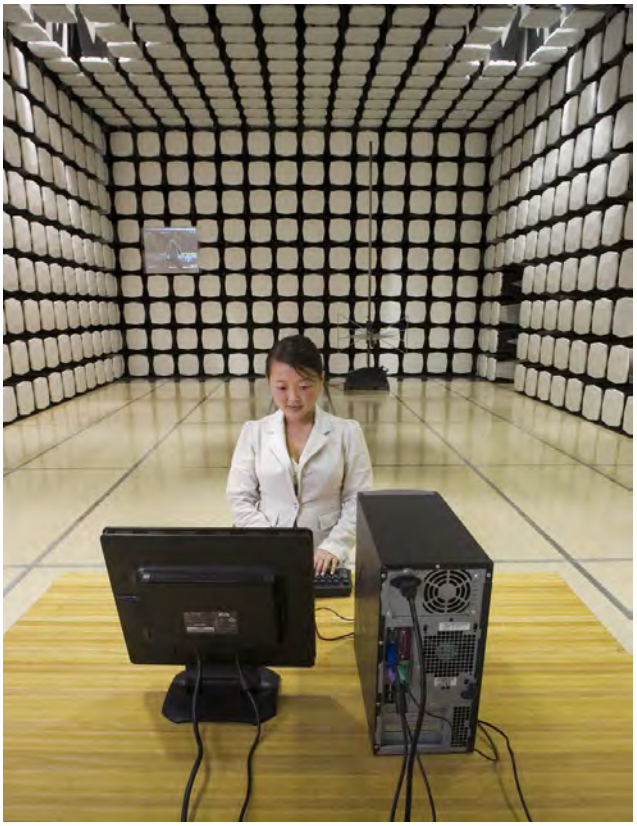
NORTHWEST EMC

REV 2013.06.28

FACILITIES

Oregon	California	New York	Minnesota	Washington
Labs EV01-12 22975 NW Evergreen Pkwy Hillsboro, OR 97124 (503) 844-4066	Labs OC01-13 41 Tesla Irvine, CA 92618 (949) 861-8918	Labs NY01-04 4939 Jordan Rd. Elbridge, NY 13060 (315) 685-0796	Labs MN01-08 9349 W Broadway Ave. Brooklyn Park, MN 55445 (763) 425-2281	Labs NC01-05,SU02,SU07 19201 120th Ave. NE Bothell, WA 98011 (425) 984-6600
VCCI				
A-0108	A-0029		A-0109	A-0110
Industry Canada				
2834D-1, 2834D-*2*	2834B-1, 2834B-2, 2834B-3		2834E-1	2834F-1
NVLAP				
NVLAP Lab Code: 200630-0	NVLAP Lab Code: 200676-0	NVLAP Lab Code: 200761-0	NVLAP Lab Code: 200881-0	NVLAP Lab Code: 200629-0





PRODUCT DESCRIPTION

WTD 12.5.23

Client and Equipment Under Test (EUT) Information

Company Name:	Dana Innovations
Address:	212 Avenida Fabricante
City, State, Zip:	San Clemente, CA 92672
Test Requested By:	Lucian Scripca
Model:	AM.2 Clear Connect Sleeve Top
First Date of Test:	July 01, 2014
Last Date of Test:	July 01, 2014
Receipt Date of Samples:	July 01, 2014
Equipment Design Stage:	Production
Equipment Condition:	No Damage

Information Provided by the Party Requesting the Test

Functional Description of the EUT (Equipment Under Test):
Sleeve accessory for iPad

Testing Objective:
To demonstrate compliance to FCC 15.231 specifications

CONFIGURATIONS

Configuration DANA0012- 2

EUT			
Description	**Manufacturer**	**Model/Part Number**	**Serial Number**
Sleeve accessory for iPad	Dana Innovations	AM.2 Clear Connect	US0001

Configuration DANA0012- 3

EUT			
Description	**Manufacturer**	**Model/Part Number**	**Serial Number**
Sleeve accessory for iPad	Dana Innovations	AM.2 Clear Connect	US0002

MODIFICATIONS

WTD 12.5.23

Equipment Modifications

Item	Date	Test	Modification	Note	Disposition of EUT
1	7/1/2014	Field Strength of Fundamental	Tested as delivered to Test Station.	No EMI suppression devices were added or modified during this test.	EUT remained at Northwest EMC following the test.
2	7/1/2014	Occupied Bandwidth	Tested as delivered to Test Station.	No EMI suppression devices were added or modified during this test.	EUT remained at Northwest EMC following the test.
3	7/1/2014	Duty Cycle	Tested as delivered to Test Station.	No EMI suppression devices were added or modified during this test.	EUT remained at Northwest EMC following the test.
4	7/1/2014	Spurious Radiated Emissions	Tested as delivered to Test Station.	No EMI suppression devices were added or modified during this test.	Scheduled testing was completed.

DUTY CYCLE

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.	Interval (mo.)
Near Field Probe Set	Com-Power	PS-400	IPF	NCR	0
OC13 Cables	Fairview Microwave	SCA1814-0101-120	OCZ	NCR	0
Spectrum Analyzer	Agilent	E4446A	AAY	2/22/2013	24

TEST DESCRIPTION

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 per 15.35(c) 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 = 74.98 mSec

Pulsewidth of Pulse= 5.43 mSec

Number of Pulses = 1

Duty Cycle = 20 log [(1)(5.43)/74.98]= -22.8 dB

The duty cycle correction factor of –22.8 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.

The field strength of the fundamental (transmit) frequency meets the limits as defined in 47 CFR 15.231(b). It also meets the provisions in 15.35 for averaging pulsed emissions and for limiting peak emissions.

DUTY CYCLE

EUT:	AM.2 Clear Connect Sleeve Top			**Work Order:**	DANA0012
Serial Number:	US0001			**Date:**	07/01/14
Customer:	Dana Innovations			**Temperature:**	26.3°C
Attendees:	Lucian Scripca			**Humidity:**	45%
Project:	None			**Barometric Pres.:**	1010
Tested by:	Johnny Candelas	**Power:**	Battery	**Job Site:**	OC10

TEST SPECIFICATIONS	Test Method
FCC 15.231:2014	ANSI C63.10:2009

COMMENTS

Period between bursts is less than 100ms.

DEVIATIONS FROM TEST STANDARD

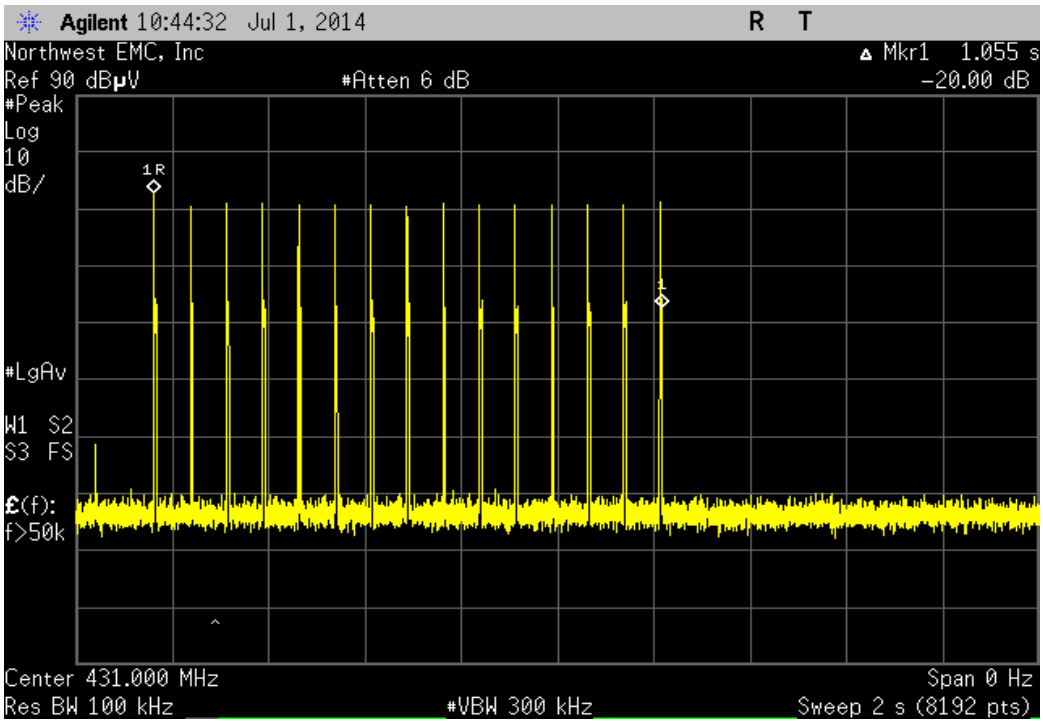
None

Configuration #	2	Signature

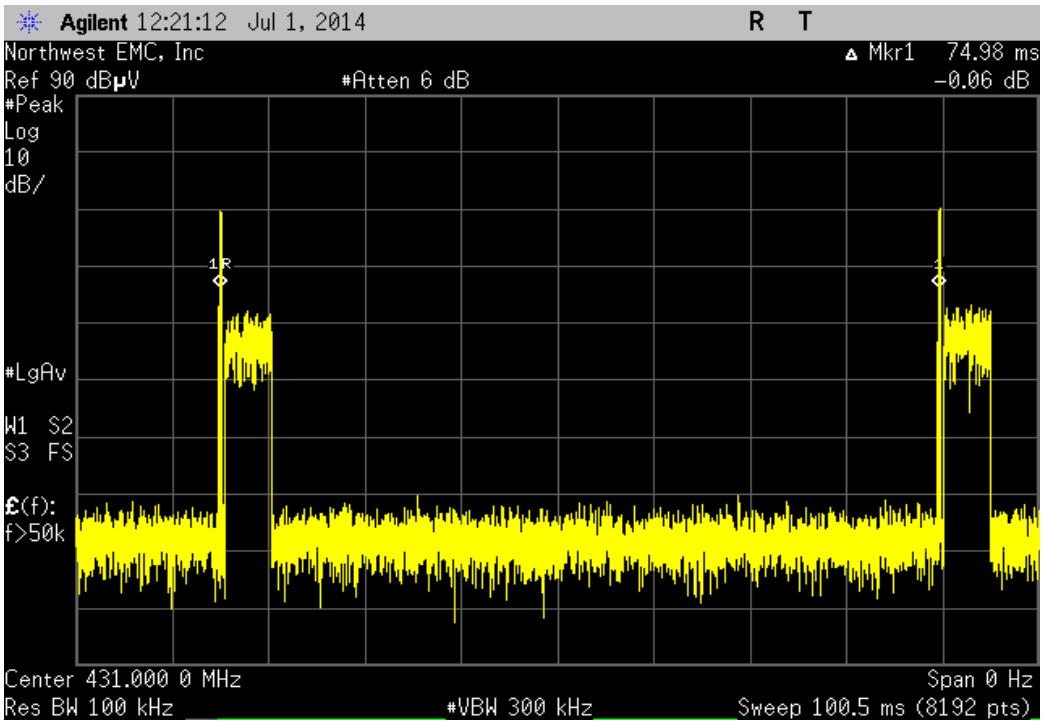
		Pulse Width (mS)	Period (mS)	Limit	Result
431 MHz					
	2 Second Interval	N/A	N/A	N/A	N/A
	100 mS Period	N/A	74.98	N/A	N/A
	20 mS Pulse Width	5.432	N/A	N/A	N/A
437 MHz					
	2 Second Interval	N/A	N/A	N/A	N/A
	100 mS Period	N/A	74.98	N/A	N/A
	20 mS Pulse Width	5.432	N/A	N/A	N/A

DUTY CYCLE

431 MHz, 2 Second Interval						
			Pulse Width (mS)	Period (mS)	Limit	Result
			N/A	N/A	N/A	N/A

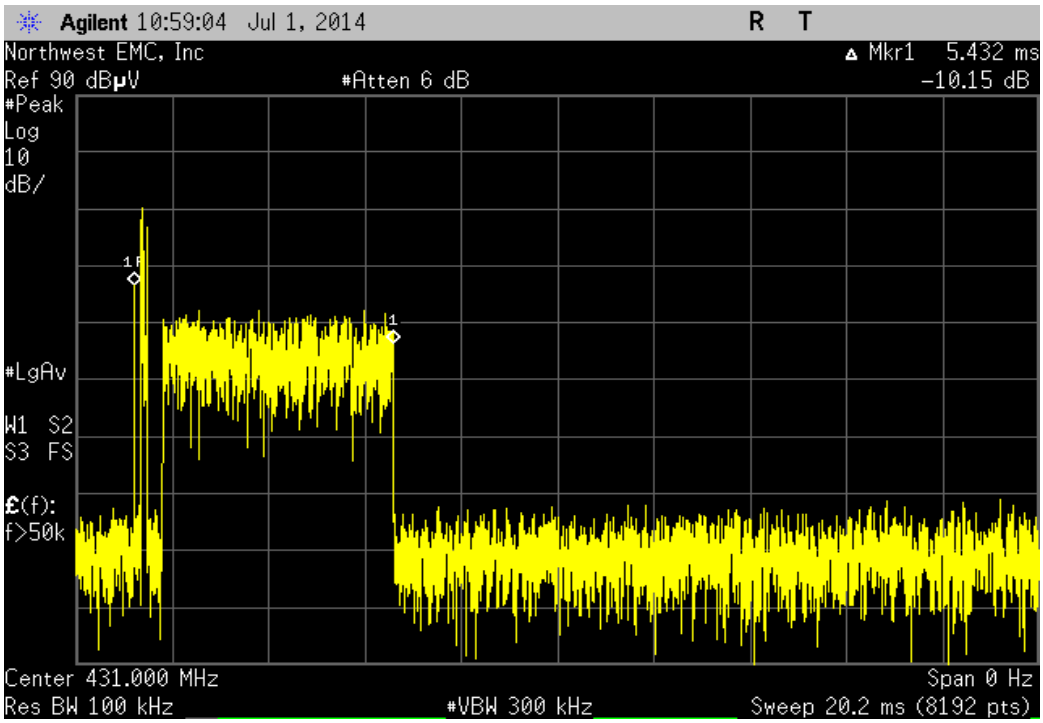


431 MHz, 100 mS Period						
			Pulse Width (mS)	Period (mS)	Limit	Result
			N/A	74.98	N/A	N/A

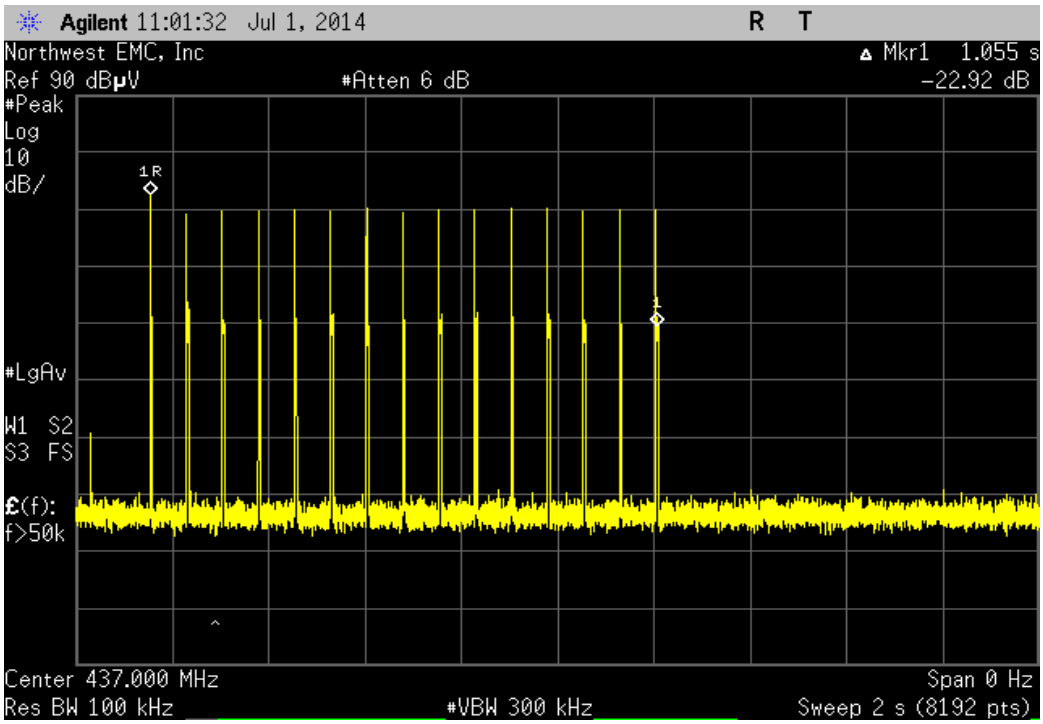


DUTY CYCLE

431 MHz, 20 mS Pulse Width						
			Pulse Width (mS)	Period (mS)	Limit	Result
			5.432	N/A	N/A	N/A

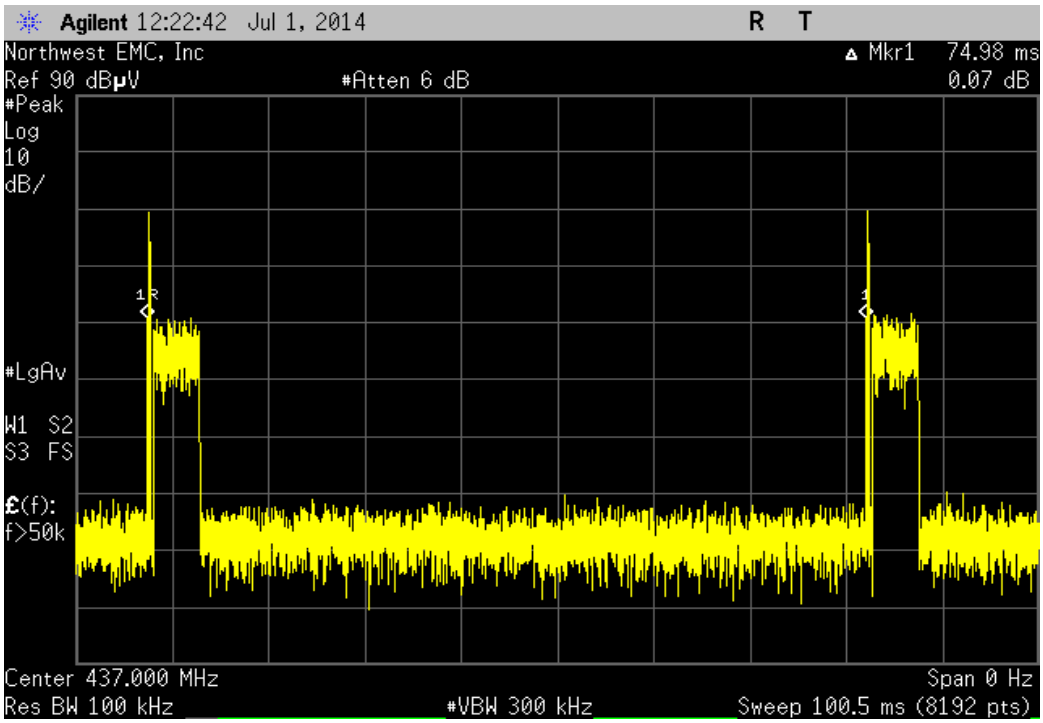


437 MHz, 2 Second Interval						
			Pulse Width (mS)	Period (mS)	Limit	Result
			N/A	N/A	N/A	N/A

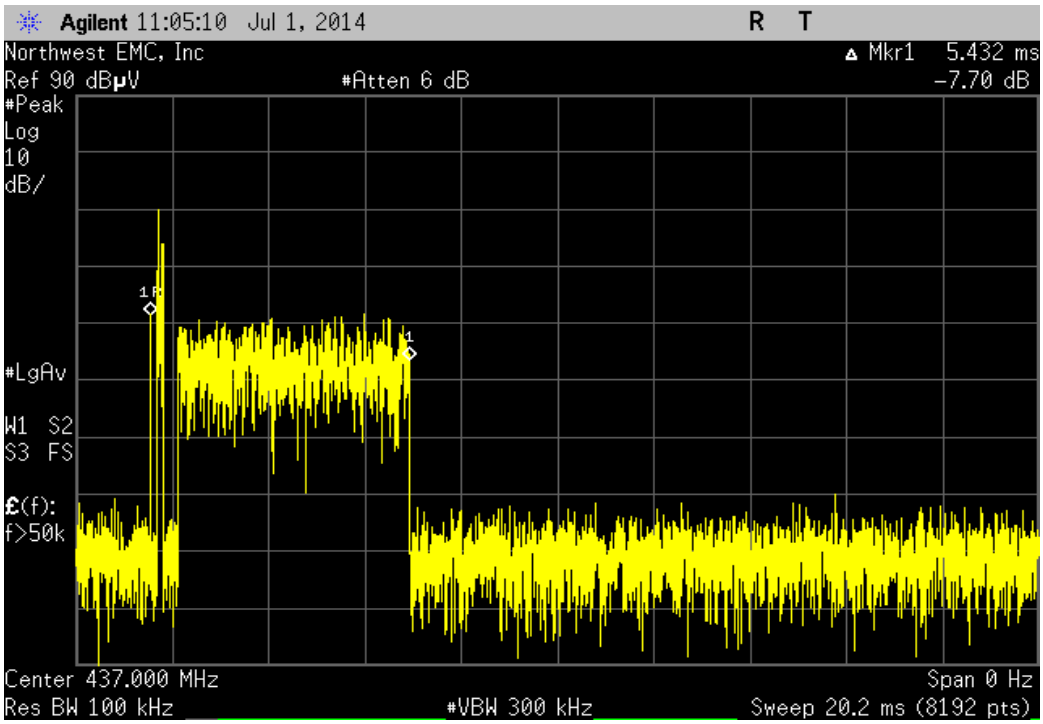


DUTY CYCLE

437 MHz, 100 mS Period						
			Pulse Width (mS)	Period (mS)	Limit	Result
			N/A	74.98	N/A	N/A



437 MHz, 20 mS Pulse Width						
			Pulse Width (mS)	Period (mS)	Limit	Result
			5.432	N/A	N/A	N/A



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.	Interval (mo.)
Near Field Probe Set	Com-Power	PS-400	IPF	NCR	0
OC13 Cables	Fairview Microwave	SCA1814-0101-120	OCZ	NCR	0
Spectrum Analyzer	Agilent	E4446A	AAY	2/22/2013	24

TEST DESCRIPTION

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

The measurement was made using near field probe near the integral antenna of the EUT to the input of the spectrum analyzer. The EUT was transmitting at its maximum data rate.

OCCUPIED BANDWIDTH

EUT:	AM.2 Clear Connect Sleeve Top			**Work Order:**	DANA0012
Serial Number:	US0002			**Date:**	07/01/14
Customer:	Dana Innovations			**Temperature:**	26.3°C
Attendees:	Lucian Scripca			**Humidity:**	45%
Project:	None			**Barometric Pres.:**	1010
Tested by:	Johnny Candelas	**Power:**	Battery	**Job Site:**	OC10

TEST SPECIFICATIONS	Test Method
FCC 15.231:2014	ANSI C63.10:2009

COMMENTS

Limit is based on center frequency: 431 MHz * 0.25% = 1.0775 MHz
437 MHz * 0.25% = 1.0925 MHz

DEVIATIONS FROM TEST STANDARD

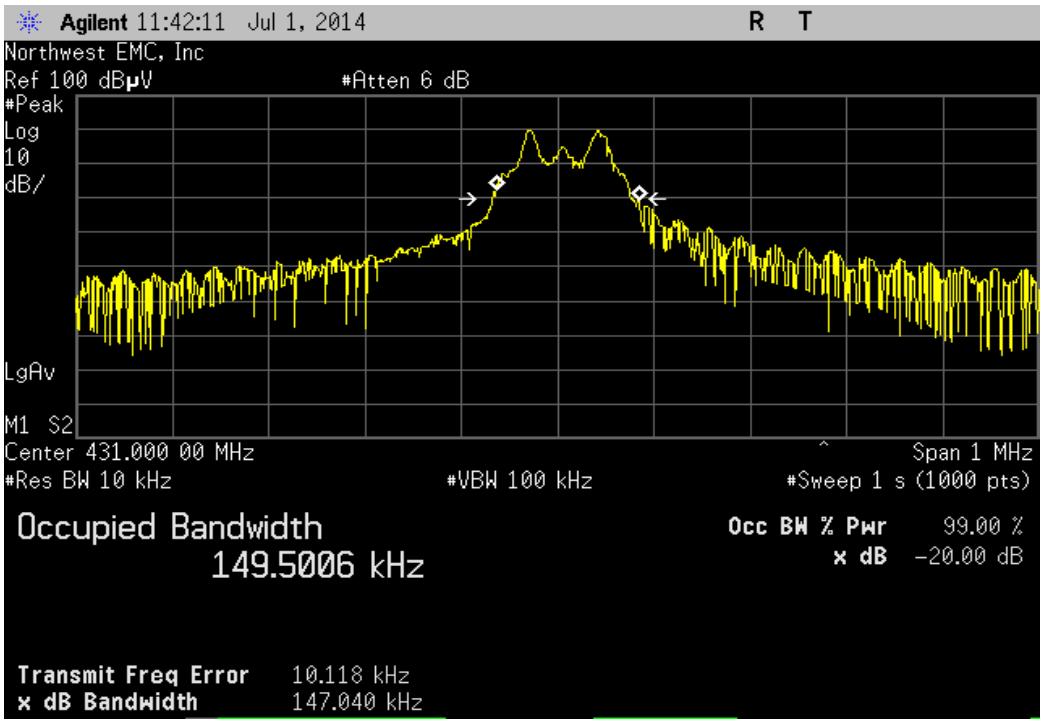
None

Configuration #	3	Signature

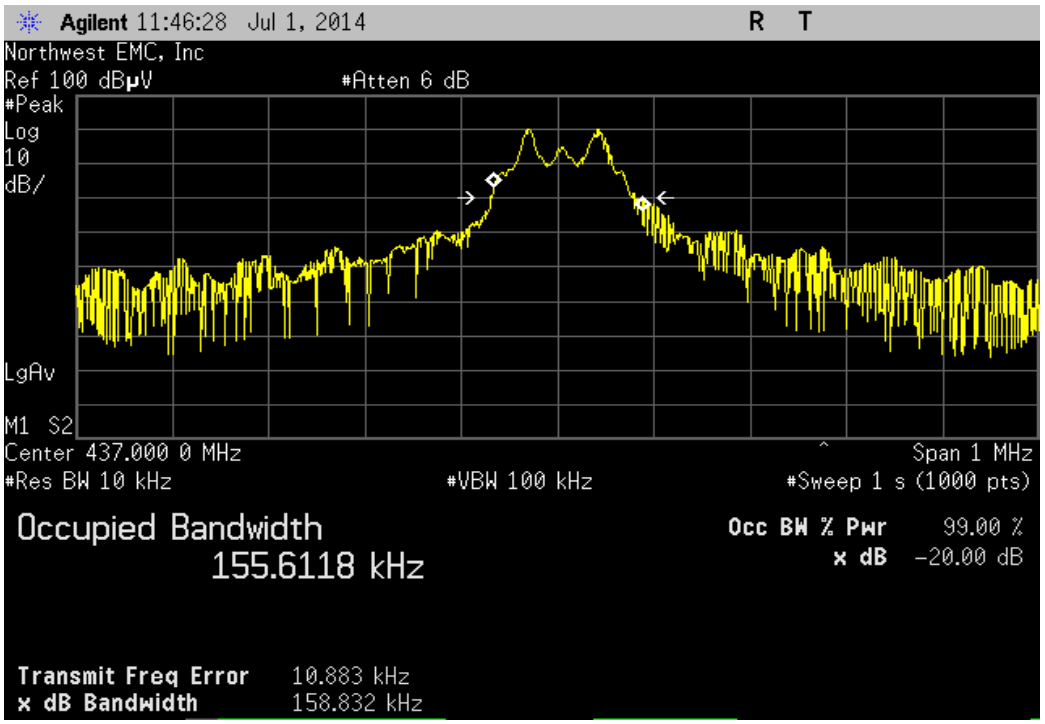
	Value (MHz)	Limit (MHz)	Result
431 MHz	0.14704	1.0775	Pass
437 MHz	0.15883	1.0925	Pass

OCCUPIED BANDWIDTH

431 MHz							
					Value (MHz)	Limit (MHz)	Result
					0.14704	1.0775	Pass



437 MHz							
					Value (MHz)	Limit (MHz)	Result
					0.15883	1.0925	Pass



FIELD STRENGTH OF FUNDAMENTAL

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 continuously in CW at 431 MHz
Transmitting continuously in CW at 437 MHz

POWER SETTINGS INVESTIGATED

Battery

CONFIGURATIONS INVESTIGATED

DANA0012 - 3

FREQUENCY RANGE INVESTIGATED

Start Frequency	430 MHz	Stop Frequency	438 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, Biconilog	EMCO	3142	AXB	6/2/2013	24 mo
OC10 Cables	N/A	10kHz-1GHz RE Cables	OCH	4/28/2014	12 mo
Spectrum Analyzer	Agilent	E4446A	AAY	2/22/2013	24 mo

TEST DESCRIPTION

The antennas to be used with the EUT were tested. The EUT was configured for continuous unmodulated 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 C63.10:2009).

To derive average emission measurements, a duty cycle correction factor per 15.35(c) 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 = 74.98 mSec

Pulsewidth of Pulse= 5.43 mSec

Number of Pulses = 1

Duty Cycle = 20 log [(1)(5.43)/74.98]= -22.8 dB

The duty cycle correction factor of –22.8 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.

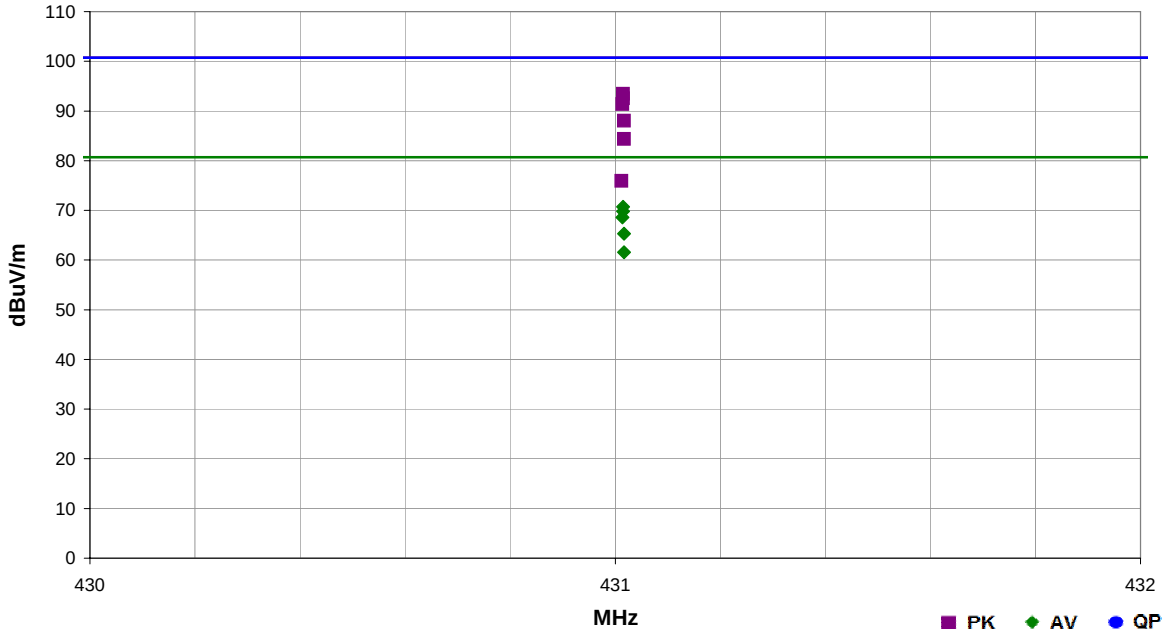
The field strength of the fundamental (transmit) frequency meets the limits as defined in 47 CFR 15.231(b). It also meets the provisions in 15.35 for averaging pulsed emissions and for limiting peak emissions.

FIELD STRENGTH OF FUNDAMENTAL

Work Order:	DANA0012	**Date:**	07/01/14		
Project:	None	**Temperature:**	24.2 °C		
Job Site:	OC10	**Humidity:**	49.3% RH		
Serial Number:	US0002	**Barometric Pres.:**	1012 mbar	**Tested by:**	Johnny Candelas
EUT:	AM.2 Clear Connect Sleeve Top				
Configuration:	3				
Customer:	Dana Innovations				
Attendees:	Lucian Scripca				
EUT Power:	Battery				
Operating Mode:	Transmitting continuously in CW at 431 MHz				
Deviations:	None				
Comments:	None				

Test Specifications	**Test Method**
FCC 15.231:2014	ANSI C63.10:2009

Run #	2	**Test Distance (m)**	3	**Antenna Height(s)**	1 to 4(m)	**Results**	Pass



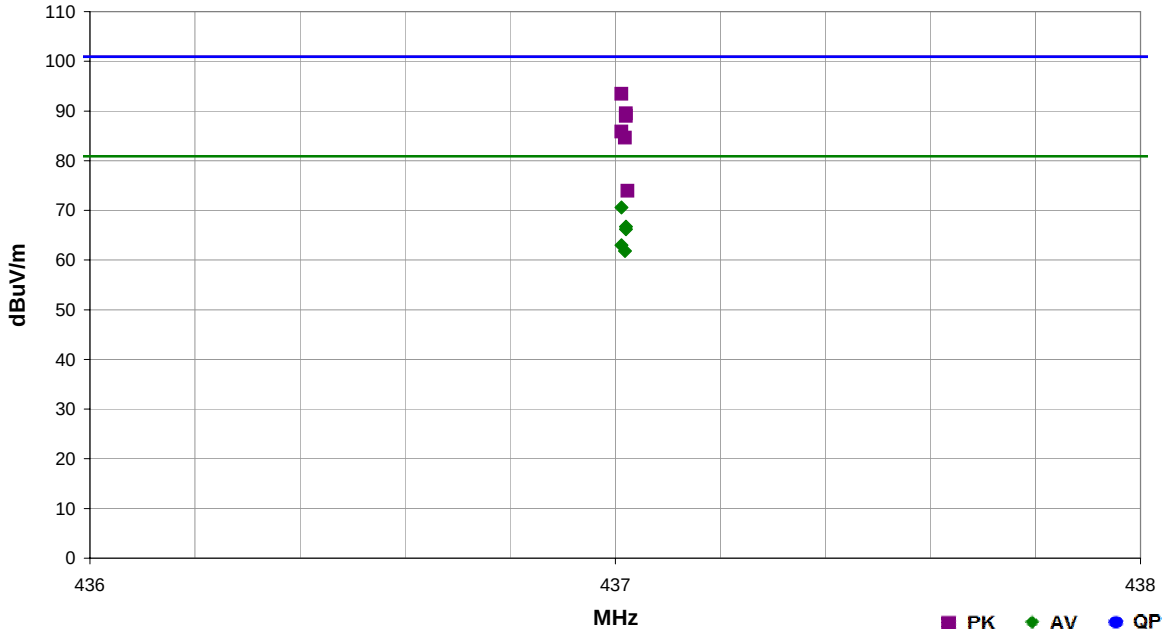
Freq (MHz)	Amplitude (dBuV)	Factor (dB)	Antenna Height (meters)	Azimuth (degrees)	Duty Cycle Correction Factor (dB)	External Attenuation (dB)	Polarity/ Transducer Type	Detector	Distance Adjustment (dB)	Adjusted (dBuV/m)	Spec. Limit (dBuV/m)	Compared to Spec. (dB)	Comments
431.015	71.5	22.0	1.0	289.0		0.0	Vert	PK	0.0	93.5	100.7	-7.2	EUT Vertical
431.015	70.6	22.0	1.0	103.0		0.0	Vert	PK	0.0	92.6	100.7	-8.1	EUT on Side
431.014	69.4	22.0	1.0	321.0		0.0	Horz	PK	0.0	91.4	100.7	-9.3	EUT Horizontal
431.015	71.5	22.0	1.0	289.0	-22.8	0.0	Vert	AV	0.0	70.7	80.7	-10.0	EUT Vertical
431.015	70.6	22.0	1.0	103.0	-22.8	0.0	Vert	AV	0.0	69.8	80.7	-10.9	EUT on Side
431.014	69.4	22.0	1.0	321.0	-22.8	0.0	Horz	AV	0.0	68.6	80.7	-12.1	EUT Horizontal
431.017	66.1	22.0	3.3	20.0		0.0	Horz	PK	0.0	88.1	100.7	-12.6	EUT on Side
431.017	66.1	22.0	3.3	20.0	-22.8	0.0	Horz	AV	0.0	65.3	80.7	-15.4	EUT on Side
431.017	62.4	22.0	4.0	17.0		0.0	Horz	PK	0.0	84.4	100.7	-16.3	EUT Vertical
431.017	62.4	22.0	4.0	17.0	-22.8	0.0	Horz	AV	0.0	61.6	80.7	-19.1	EUT Vertical
431.012	54.0	22.0	1.0	61.0		0.0	Vert	PK	0.0	76.0	100.7	-24.7	EUT Horizontal
431.012	54.0	22.0	1.0	61.0	-22.8	0.0	Vert	AV	0.0	53.2	80.7	-27.5	EUT Horizontal

FIELD STRENGTH OF FUNDAMENTAL

Work Order:	DANA0012	**Date:**	07/01/14		
Project:	None	**Temperature:**	24.2 °C		
Job Site:	OC10	**Humidity:**	49.3% RH		
Serial Number:	US0002	**Barometric Pres.:**	1012 mbar	**Tested by:**	Johnny Candelas
EUT:	AM.2 Clear Connect Sleeve Top				
Configuration:	3				
Customer:	Dana Innovations				
Attendees:	Lucian Scripca				
EUT Power:	Battery				
Operating Mode:	Transmitting continuously in CW at 437 MHz				
Deviations:	None				
Comments:	None				

Test Specifications	**Test Method**
FCC 15.231:2014	ANSI C63.10:2009

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
437.012	71.5	21.9	1.0	294.0		0.0	Vert	PK	0.0	93.4	100.9	-7.5	EUT Vertical
437.012	71.5	21.9	1.0	294.0	-22.8	0.0	Vert	AV	0.0	70.6	80.9	-10.3	EUT Vertical
437.020	67.6	21.9	1.0	105.0		0.0	Vert	PK	0.0	89.5	100.9	-11.4	EUT on Side
437.020	67.1	21.9	1.0	313.0		0.0	Horz	PK	0.0	89.0	100.9	-11.9	EUT Horizontal
437.020	67.6	21.9	1.0	105.0	-22.8	0.0	Vert	AV	0.0	66.7	80.9	-14.2	EUT on Side
437.020	67.1	21.9	1.0	313.0	-22.8	0.0	Horz	AV	0.0	66.2	80.9	-14.7	EUT Horizontal
437.012	63.9	21.9	4.0	19.0		0.0	Horz	PK	0.0	85.8	100.9	-15.1	EUT Vertical
437.019	62.7	21.9	3.5	20.0		0.0	Horz	PK	0.0	84.6	100.9	-16.3	EUT on Side
437.012	63.9	21.9	4.0	19.0	-22.8	0.0	Horz	AV	0.0	63.0	80.9	-17.9	EUT Vertical
437.019	62.7	21.9	3.5	20.0	-22.8	0.0	Horz	AV	0.0	61.8	80.9	-19.1	EUT on Side
437.024	52.0	21.9	2.9	202.0		0.0	Vert	PK	0.0	73.9	100.9	-27.0	EUT Horizontal
437.024	52.0	21.9	2.9	202.0	-22.8	0.0	Vert	AV	0.0	51.1	80.9	-29.8	EUT Horizontal

SPURIOUS RADIATED EMISSIONS

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 continuously in CW at 431 MHz
Transmitting continuously in CW at 437 MHz

POWER SETTINGS INVESTIGATED

Battery

CONFIGURATIONS INVESTIGATED

DANA0012 - 3

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
Pre-Amplifier	Miteq	AMF-4D-010120-30-10P-1	AOP	6/17/2014	12 mo
Antenna, Horn	EMCO	3115	AHB	3/10/2014	24 mo
OC10 Cables	N/A	1-8GHz RE Cables	OCJ	6/17/2014	12 mo
Attenuator	Coaxicom	66702 3910AF-10	TKG	4/28/2014	12 mo
Antenna, Biconilog	EMCO	3142	AXB	6/2/2013	24 mo
OC10 Cables	N/A	10kHz-1GHz RE Cables	OCH	4/28/2014	12 mo
Pre-Amplifier	Miteq	AM-1064-9079	AOO	4/28/2014	12 mo
Spectrum Analyzer	Agilent	E4446A	AAY	2/22/2013	24 mo

TEST DESCRIPTION

The single, integral antenna to be used with the EUT was tested. The EUT was configured for 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 C63.10:2009).

A preamp and high pass filter were used for this test in order to provide sufficient measurement sensitivity.

To derive average emission measurements, a duty cycle correction factor per 15.35(c) 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 = 74.98 mSec

Pulsewidth of Pulse= 5.43 mSec

Number of Pulses = 1

Duty Cycle = 20 log [(1)(5.43)/74.98]= -22.8 dB

The duty cycle correction factor of –22.8 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.

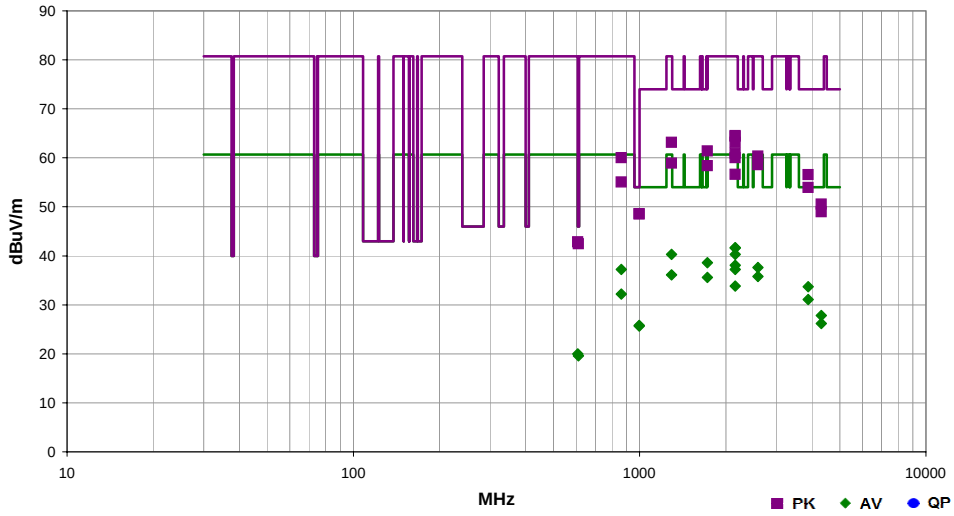
The field strength of the spurious emissions meet the limits as defined in 47 CFR 15.231(e). The spurious emissions also meet the provisions in 15.35 for averaging pulsed emissions and for limiting peak emissions. Further, spurious emissions meet the provisions of 15.205 using the measurement instrumentation specified in that section.

SPURIOUS RADIATED EMISSIONS

Work Order:	DANA0012	**Date:**	07/01/14		
Project:	None	**Temperature:**	24.2 °C		
Job Site:	OC10	**Humidity:**	49.3% RH		
Serial Number:	US0002	**Barometric Pres.:**	1012 mbar	**Tested by:**	Johnny Candelas
EUT:	AM.2 Clear Connect Sleeve Top				
Configuration:	3				
Customer:	Dana Innovations				
Attendees:	Lucian Scripca				
EUT Power:	Battery				
Operating Mode:	Transmitting continuously in CW at 431 MHz				
Deviations:	None				
Comments:	None				

Test Specifications	**Test Method**
FCC 15.231(b):2014	ANSI C63.10:2009

Run #	5	**Test Distance (m)**	3	**Antenna Height(s)**	1 to 4(m)	**Results**	Pass



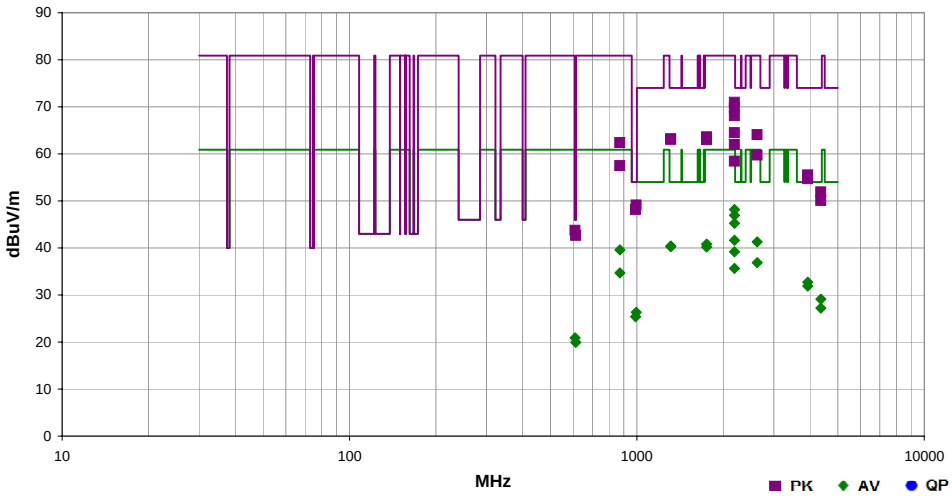
Freq (MHz)	Amplitude (dBuV)	Factor (dB)	Antenna Height (meters)	Azimuth (degrees)	Duty Cycle Correction Factor (meters)	External Attenuation (dB)	Polarity/ Transducer Type	Detector	Distance Adjustment (dB)	Adjusted (dBuV/m)	Spec. Limit (dBuV/m)	Compared to Spec. (dB)	Comments
608.341	27.1	5.7	1.5	241.0		10.0	Horz	PK	0.0	42.8	46.0	-3.2	EUT Horizontal
610.436	26.7	5.7	2.8	293.0		10.0	Vert	PK	0.0	42.4	46.0	-3.6	EUT on Side
2155.092	61.6	2.9	1.8	186.0		0.0	Horz	PK	0.0	64.5	80.7	-16.2	EUT Horizontal
2155.083	61.5	2.9	2.0	180.0		0.0	Horz	PK	0.0	64.4	80.7	-16.3	EUT Vertical
3879.075	49.1	7.4	1.6	229.0		0.0	Horz	PK	0.0	56.5	74.0	-17.5	EUT Horizontal
1293.042	65.5	-2.4	1.0	68.0		0.0	Vert	PK	0.0	63.1	80.7	-17.6	EUT on Side
2154.983	60.2	2.9	1.2	90.0		0.0	Vert	PK	0.0	63.1	80.7	-17.6	EUT on Side
2155.092	61.6	2.9	1.8	186.0	-22.8	0.0	Horz	AV	0.0	41.7	60.7	-19.0	EUT Horizontal
2155.083	61.5	2.9	2.0	180.0	-22.8	0.0	Horz	AV	0.0	41.6	60.7	-19.1	EUT Vertical
1724.058	60.6	0.8	1.7	275.0		0.0	Vert	PK	0.0	61.4	80.7	-19.3	EUT on Side
2155.133	58.0	2.9	2.8	277.0		0.0	Vert	PK	0.0	60.9	80.7	-19.8	EUT Horizontal
3879.025	46.5	7.4	1.2	171.0		0.0	Vert	PK	0.0	53.9	74.0	-20.1	EUT on Side
3879.075	49.1	7.4	1.6	229.0	-22.8	0.0	Horz	AV	0.0	33.7	54.0	-20.3	EUT Horizontal
2586.142	57.0	3.4	1.2	152.0		0.0	Vert	PK	0.0	60.4	80.7	-20.3	EUT on Side
1293.042	65.5	-2.4	1.0	68.0	-22.8	0.0	Vert	AV	0.0	40.3	60.7	-20.4	EUT on Side
2154.983	60.2	2.9	1.2	90.0	-22.8	0.0	Vert	AV	0.0	40.3	60.7	-20.4	EUT on Side
862.034	39.7	10.3	1.2	259.0		10.0	Vert	PK	0.0	60.0	80.7	-20.7	EUT on Side
2155.067	57.1	2.9	2.2	75.0		0.0	Vert	PK	0.0	60.0	80.7	-20.7	EUT Vertical
1293.050	61.3	-2.4	2.0	183.0		0.0	Horz	PK	0.0	58.9	80.7	-21.8	EUT Horizontal
1724.058	60.6	0.8	1.7	275.0	-22.8	0.0	Vert	AV	0.0	38.6	60.7	-22.1	EUT on Side
2586.150	55.2	3.4	2.2	188.0		0.0	Horz	PK	0.0	58.6	80.7	-22.1	EUT Horizontal
1724.092	57.6	0.8	1.0	354.0		0.0	Horz	PK	0.0	58.4	80.7	-22.3	EUT Horizontal
2155.133	58.0	2.9	2.8	277.0	-22.8	0.0	Vert	AV	0.0	38.1	60.7	-22.6	EUT Horizontal
3879.025	46.5	7.4	1.2	171.0	-22.8	0.0	Vert	AV	0.0	31.1	54.0	-22.9	EUT on Side
2586.142	57.0	3.4	1.2	152.0	-22.8	0.0	Vert	AV	0.0	37.6	60.7	-23.1	EUT on Side
4310.342	42.4	8.2	1.0	153.0		0.0	Vert	PK	0.0	50.6	74.0	-23.4	EUT on Side
2155.067	57.1	2.9	2.2	75.0	-22.8	0.0	Vert	AV	0.0	37.2	60.7	-23.5	EUT Vertical
862.034	39.7	10.3	1.2	259.0	-22.8	10.0	Vert	AV	0.0	37.2	60.7	-23.5	EUT on Side
2155.075	53.7	2.9	2.4	359.0		0.0	Horz	PK	0.0	56.6	80.7	-24.1	EUT on Side
1293.050	61.3	-2.4	2.0	183.0	-22.8	0.0	Horz	AV	0.0	36.1	60.7	-24.6	EUT Horizontal
2586.150	55.2	3.4	2.2	188.0	-22.8	0.0	Horz	AV	0.0	35.8	60.7	-24.9	EUT Horizontal
4310.725	40.8	8.2	1.2	314.0		0.0	Horz	PK	0.0	49.0	74.0	-25.0	EUT on Side
1724.092	57.6	0.8	1.0	354.0	-22.8	0.0	Horz	AV	0.0	35.6	60.7	-25.1	EUT Horizontal
997.782	26.9	11.7	1.0	0.0		10.0	Horz	PK	0.0	48.6	74.0	-25.4	EUT Horizontal
995.672	26.8	11.7	1.5	128.0		10.0	Vert	PK	0.0	48.5	74.0	-25.5	EUT on Side
862.010	34.7	10.3	1.0	51.0		10.0	Horz	PK	0.0	55.0	80.7	-25.7	EUT Horizontal
608.341	27.1	5.7	1.5	241.0	-22.8	10.0	Horz	AV	0.0	20.0	46.0	-26.0	EUT Horizontal
4310.342	42.4	8.2	1.0	153.0	-22.8	0.0	Vert	AV	0.0	27.8	54.0	-26.2	EUT on Side
610.436	26.7	5.7	2.8	293.0	-22.8	10.0	Vert	AV	0.0	19.6	46.0	-26.4	EUT on Side
2155.075	53.7	2.9	2.4	359.0	-22.8	0.0	Horz	AV	0.0	33.8	60.7	-26.9	EUT on Side
4310.725	40.8	8.2	1.2	314.0	-22.8	0.0	Horz	AV	0.0	26.2	54.0	-27.8	EUT on Side
997.782	26.9	11.7	1.0	0.0	-22.8	10.0	Horz	AV	0.0	25.8	54.0	-28.2	EUT Horizontal
995.672	26.8	11.7	1.5	128.0	-22.8	10.0	Vert	AV	0.0	25.7	54.0	-28.3	EUT on Side
862.010	34.7	10.3	1.0	51.0	-22.8	10.0	Horz	AV	0.0	32.2	60.7	-28.5	EUT Horizontal

SPURIOUS RADIATED EMISSIONS

Work Order:	DANA0012	**Date:**	07/01/14		
Project:	None	**Temperature:**	24.2 °C		
Job Site:	OC10	**Humidity:**	49.3% RH		
Serial Number:	US0002	**Barometric Pres.:**	1012 mbar	**Tested by:**	Johnny Candelas
EUT:	AM.2 Clear Connect Sleeve Top				
Configuration:	3				
Customer:	Dana Innovations				
Attendees:	Lucian Scripca				
EUT Power:	Battery				
Operating Mode:	Transmitting continuously in CW at 437 MHz				
Deviations:	None				
Comments:	None				

Test Specifications	**Test Method**
FCC 15.231(b):2014	ANSI C63.10:2009

Run #	7	**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
609.361	28.0	5.7	1.0	36.0		10.0	Vert	PK	0.0	43.7	46.0	-2.3	EUT on Side
612.523	26.9	5.8	2.8	183.0		10.0	Horz	PK	0.0	42.7	46.0	-3.3	EUT Vertical
2185.075	68.2	2.8	1.1	138.0		0.0	Vert	PK	0.0	71.0	80.9	-9.9	EUT on Side
1310.992	65.5	-2.3	1.0	9.0		0.0	Vert	PK	0.0	63.2	74.0	-10.8	EUT on Side
1311.000	65.4	-2.3	1.1	349.0		0.0	Horz	PK	0.0	63.1	74.0	-10.9	EUT Vertical
2185.042	67.0	2.8	2.2	171.0		0.0	Horz	PK	0.0	69.8	80.9	-11.1	EUT Vertical
2185.075	68.2	2.8	1.1	138.0	-22.8	0.0	Vert	AV	0.0	48.2	60.9	-12.7	EUT on Side
2185.092	65.3	2.8	2.8	155.0		0.0	Horz	PK	0.0	68.1	80.9	-12.8	EUT Horizontal
1310.992	65.5	-2.3	1.0	9.0	-22.8	0.0	Vert	AV	0.0	40.4	54.0	-13.6	EUT on Side
1311.000	65.4	-2.3	1.1	349.0	-22.8	0.0	Horz	AV	0.0	40.3	54.0	-13.7	EUT Vertical
2185.042	67.0	2.8	2.2	171.0	-22.8	0.0	Horz	AV	0.0	47.0	60.9	-13.9	EUT Vertical
2185.092	65.3	2.8	2.8	155.0	-22.8	0.0	Horz	AV	0.0	45.3	60.9	-15.6	EUT Horizontal
2185.017	61.7	2.8	1.2	91.0		0.0	Vert	PK	0.0	64.5	80.9	-16.4	EUT Vertical
2622.108	60.7	3.4	1.9	11.0		0.0	Horz	PK	0.0	64.1	80.9	-16.8	EUT Vertical
1748.083	62.6	1.0	1.2	302.0		0.0	Vert	PK	0.0	63.6	80.9	-17.3	EUT on Side
1748.075	62.0	1.0	2.8	160.0		0.0	Horz	PK	0.0	63.0	80.9	-17.9	EUT Vertical
3933.050	48.0	7.5	1.2	72.0		0.0	Vert	PK	0.0	55.5	74.0	-18.5	EUT on Side
874.031	42.4	10.0	1.2	283.0		10.0	Vert	PK	0.0	62.4	80.9	-18.5	EUT on Side
2185.092	59.2	2.8	2.6	18.0		0.0	Horz	PK	0.0	62.0	80.9	-18.9	EUT on Side
2185.017	61.7	2.8	1.2	91.0	-22.8	0.0	Vert	AV	0.0	41.7	60.9	-19.2	EUT Vertical
3933.192	47.2	7.5	1.2	167.0		0.0	Horz	PK	0.0	54.7	74.0	-19.3	EUT Vertical
2622.108	60.7	3.4	1.9	11.0	-22.8	0.0	Horz	AV	0.0	41.3	60.9	-19.6	EUT Vertical
1748.083	62.6	1.0	1.2	302.0	-22.8	0.0	Vert	AV	0.0	40.8	60.9	-20.1	EUT on Side
1748.075	62.0	1.0	2.8	160.0	-22.8	0.0	Horz	AV	0.0	40.2	60.9	-20.7	EUT Vertical
2622.050	56.3	3.4	1.7	99.0		0.0	Vert	PK	0.0	59.7	80.9	-21.2	EUT on Side
3933.050	48.0	7.5	1.2	72.0	-22.8	0.0	Vert	AV	0.0	32.7	54.0	-21.3	EUT on Side
874.031	42.4	10.0	1.2	283.0	-22.8	10.0	Vert	AV	0.0	39.6	60.9	-21.3	EUT on Side
2185.092	59.2	2.8	2.6	18.0	-22.8	0.0	Horz	AV	0.0	39.2	60.9	-21.7	EUT on Side
4369.892	43.5	8.4	1.2	181.0		0.0	Horz	PK	0.0	51.9	74.0	-22.1	EUT Vertical
3933.192	47.2	7.5	1.2	167.0	-22.8	0.0	Horz	AV	0.0	31.9	54.0	-22.1	EUT Vertical
2185.117	55.7	2.8	1.2	213.0		0.0	Vert	PK	0.0	58.5	80.9	-22.4	EUT Horizontal
874.038	37.5	10.0	1.0	56.0		10.0	Horz	PK	0.0	57.5	80.9	-23.4	EUT Vertical
4370.217	41.6	8.4	1.2	158.0		0.0	Vert	PK	0.0	50.0	74.0	-24.0	EUT on Side
2622.050	56.3	3.4	1.7	99.0	-22.8	0.0	Vert	AV	0.0	36.9	60.9	-24.0	EUT on Side
4369.892	43.5	8.4	1.2	181.0	-22.8	0.0	Horz	AV	0.0	29.1	54.0	-24.9	EUT Vertical
995.176	27.4	11.7	2.0	124.0		10.0	Vert	PK	0.0	49.1	74.0	-24.9	EUT on Side
609.361	28.0	5.7	1.0	36.0	-22.8	10.0	Vert	AV	0.0	20.9	46.0	-25.1	EUT on Side
2185.117	55.7	2.8	1.2	213.0	-22.8	0.0	Vert	AV	0.0	35.7	60.9	-25.2	EUT Horizontal
990.522	26.4	11.8	1.5	71.0		10.0	Horz	PK	0.0	48.2	74.0	-25.8	EUT Vertical
612.523	26.9	5.8	2.8	183.0	-22.8	10.0	Horz	AV	0.0	19.9	46.0	-26.1	EUT Vertical
874.038	37.5	10.0	1.0	56.0	-22.8	10.0	Horz	AV	0.0	34.7	60.9	-26.2	EUT Vertical
4370.217	41.6	8.4	1.2	158.0	-22.8	0.0	Vert	AV	0.0	27.2	54.0	-26.8	EUT on Side
995.176	27.4	11.7	2.0	124.0	-22.8	10.0	Vert	AV	0.0	26.3	54.0	-27.7	EUT on Side
990.522	26.4	11.8	1.5	71.0	-22.8	10.0	Horz	AV	0.0	25.4	54.0	-28.6	EUT Vertical