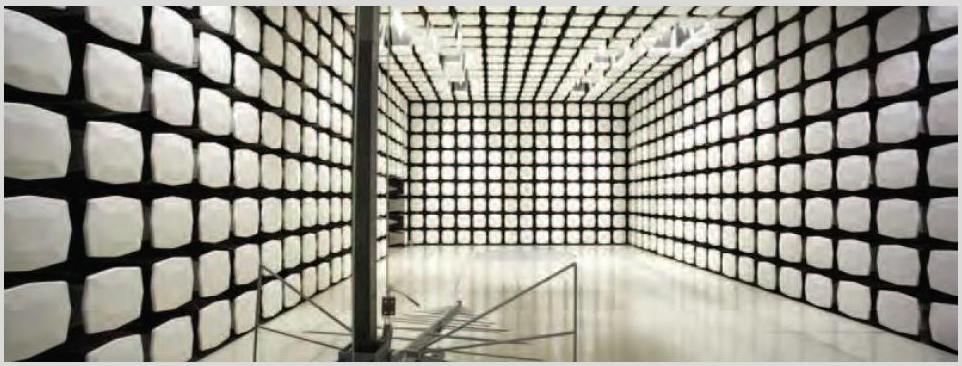
Schweitzer Engineering Laboratories, Inc.

Wireless Current Sensor

FCC 15.247:2019

902 - 928 MHz Other Wideband (DTS) Transceiver

Report # SCHW0244 Rev. 1



NVLAP LAB CODE: 200630-0

CERTIFICATE OF TEST

Last Date of Test: August 26, 2019
Schweitzer Engineering Laboratories, Inc.
Model: Wireless Current Sensor

Radio Equipment Testing

Standards

Specification	Method
FCC 15.247:2019	ANSI C63.10:2013, KDB 558074

Results

Method Clause	Test Description	Applied	Results	Comments
6.2	Powerline Conducted Emissions	No	N/A	Not required - EUT is not considered to be AC powered.
6.5, 6.6, 11.12.1, 11.13.2	Spurious Radiated Emissions	Yes	Pass	
11.6	Duty Cycle	Yes	N/A	Characterization of radio operation.
7.8.2	Carrier Frequency Separation	No	N/A	Not required for DTS devices.
7.8.3	Number of Hopping Frequencies	No	N/A	Not required for DTS devices.
7.8.4	Dwell Time	No	N/A	Not required for DTS devices.
11.9.1.1	Output Power	Yes	Pass	
11.9.1.1	Equivalent Isotropic Radiated Power	Yes	Pass	
11.11	Band Edge Compliance	Yes	Pass	
7.8.6	Band Edge Compliance - Hopping Mode	No	N/A	Not required for DTS devices.
11.8.2	Occupied Bandwidth	Yes	Pass	
11.11	Spurious Conducted Emissions	Yes	Pass	
11.10.2	Power Spectral Density	Yes	Pass	

Deviations From Test Standards

None

Approved By:

Kyle Holgate, 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
01	The calculation for the protocol limited duty cycle was added to the spurious radiated emissions header block.	2019-10-09	13

ACCREDITATIONS AND AUTHORIZATIONS

United States

FCC - Designated by the FCC as a Telecommunications Certification Body (TCB). Certification chambers, Open Area Test Sites, and conducted measurement facilities are listed with the FCC.

A2LA - Accredited by A2LA to ISO / IEC 17065 as a product certifier. This allows Element to certify transmitters to FCC and IC specifications.

NVLAP - Each laboratory is accredited by NVLAP to ISO 17025

Canada

ISED - Recognized by Innovation, Science and Economic Development Canada as a Certification Body (CB) and as a CAB for the acceptance of test data.

European Union

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

Australia/New Zealand

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

Korea

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

Japan

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

Taiwan

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

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

Singapore

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

Israel

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

Hong Kong

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

Vietnam

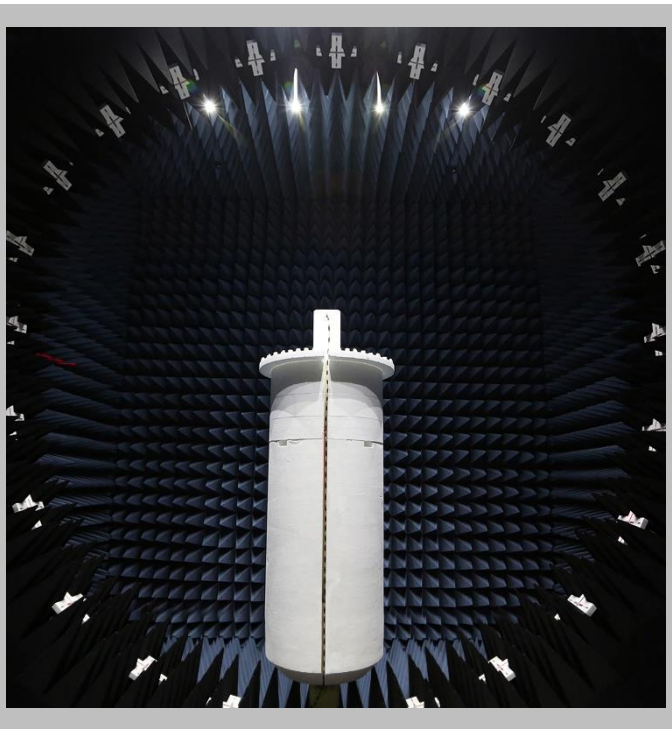
MIC – Recognized by MIC as a CAB for the acceptance of test data.

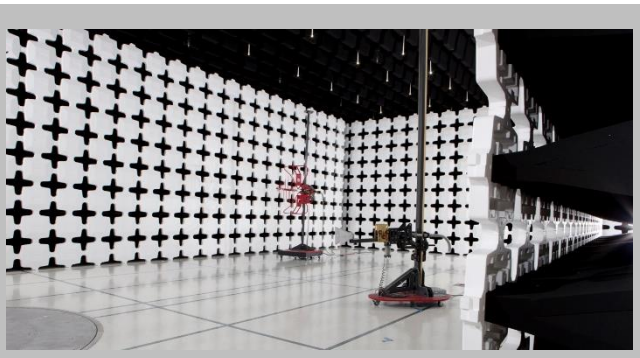
SCOPE

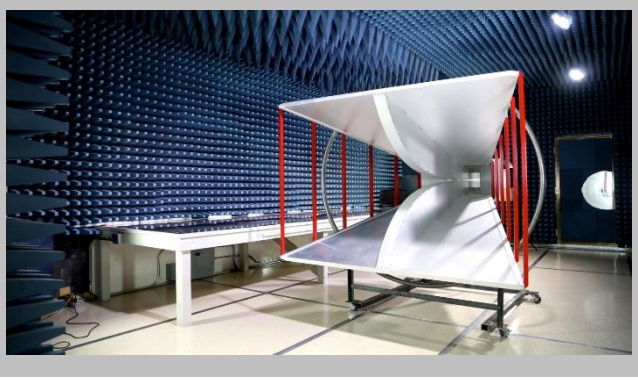
For details on the Scopes of our Accreditations, please visit:
https://www.nwemc.com/emc-testing-accreditations

FACILITIES

California	Minnesota	Oregon	Texas	Washington
Labs OC01-17 41 Tesla Irvine, CA 92618 (949) 861-8918	Labs MN01-10 9349 W Broadway Ave. Brooklyn Park, MN 55445 (612)-638-5136	Labs EV01-12 6775 NE Evergreen Pkwy #400 Hillsboro, OR 97124 (503) 844-4066	Labs TX01-09 3801 E Plano Pkwy Plano, TX 75074 (469) 304-5255	Labs NC01-05 19201 120th Ave NE Bothell, WA 98011 (425)984-6600
NVLAP				
NVLAP Lab Code: 200676-0	NVLAP Lab Code: 200881-0	NVLAP Lab Code: 200630-0	NVLAP Lab Code:201049-0	NVLAP Lab Code: 200629-0
Innovation, Science and Economic Development Canada				
2834B-1, 2834B-3	2834E-1, 2834E-3	2834D-1	2834G-1	2834F-1
BSMI				
SL2-IN-E-1154R	SL2-IN-E-1152R	SL2-IN-E-1017	SL2-IN-E-1158R	SL2-IN-E-1153R
VCCI				
A-0029	A-0109	A-0108	A-0201	A-0110
Recognized Phase I CAB for ISED, ACMA, BSMI, IDA, KCC/RRA, MIC, MOC, NCC, OFCA				
US0158	US0175	US0017	US0191	US0157







MEASUREMENT UNCERTAINTY

element
TMU.2015.07.10

Measurement Uncertainty

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

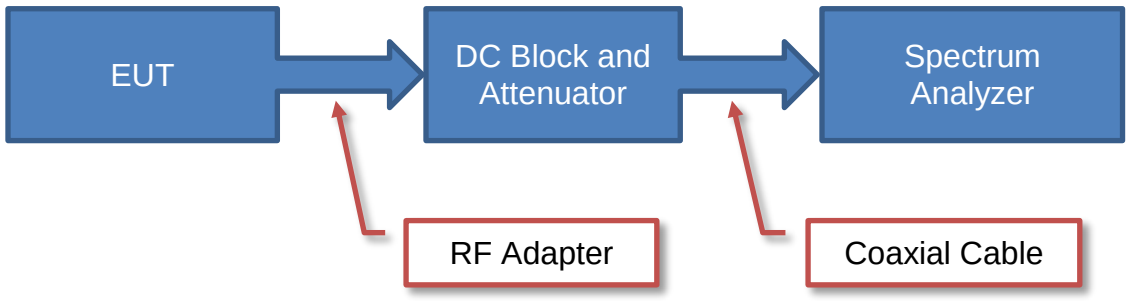
A measurement uncertainty estimation has been performed for each test per our internal quality document QM205.4.6. The estimation is used to compare the measured result with its "true" or theoretically correct value. The expanded measurement uncertainty (K=2) can be found included as part of the applicable test description page. Our measurement data meets or exceeds the measurement uncertainty requirements of the applicable specification; therefore, the test data can be compared directly to the specification limit to determine compliance. The calculations for estimating measurement uncertainty are based upon ETSI TR 100 028 (or CISPR 16-4-2 as applicable), and are available upon request.

The following table represents the Measurement Uncertainty (MU) budgets for each of the tests that may be contained in this report.

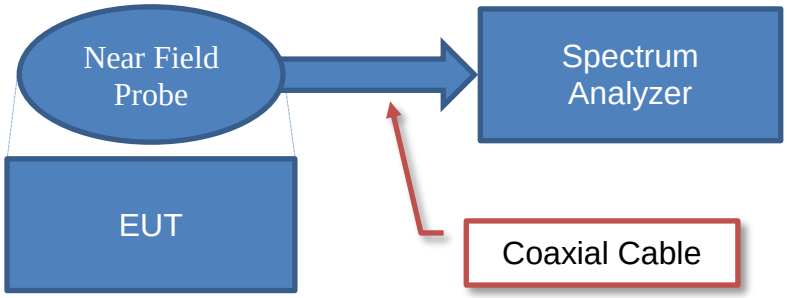
Test	+ MU	- MU
Frequency Accuracy	0.0007%	-0.0007%
Amplitude Accuracy (dB)	1.2 dB	-1.2 dB
Conducted Power (dB)	1.2 dB	-1.2 dB
Radiated Power via Substitution (dB)	0.7 dB	-0.7 dB
Temperature (degrees C)	0.7°C	-0.7°C
Humidity (% RH)	2.5% RH	-2.5% RH
Voltage (AC)	1.0%	-1.0%
Voltage (DC)	0.7%	-0.7%
Field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

Test Setup Block Diagrams

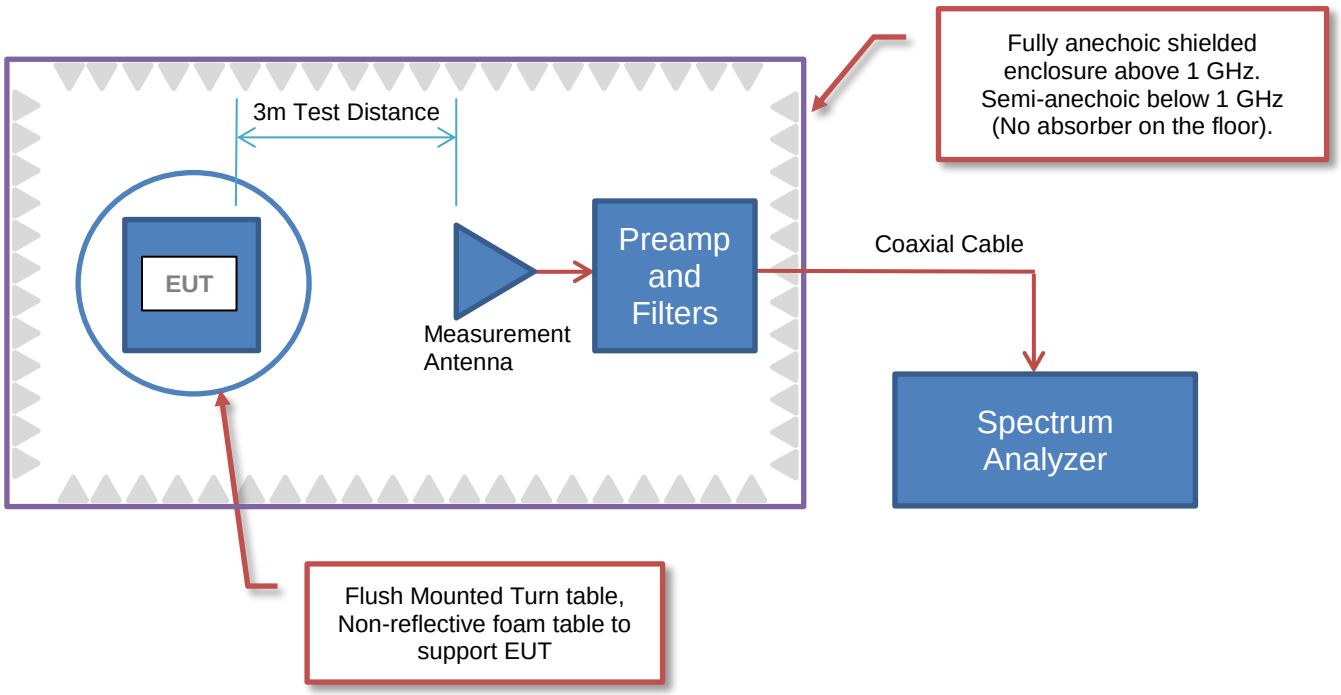
Antenna Port Conducted Measurements



Near Field Test Fixture Measurements



Spurious Radiated Emissions



PRODUCT DESCRIPTION

Client and Equipment Under Test (EUT) Information

Company Name:	Schweitzer Engineering Laboratories, Inc.
Address:	2350 NE Hopkins Court
City, State, Zip:	Pullman, WA 99163
Test Requested By:	Miralem Cosic
Model:	Wireless Current Sensor
First Date of Test:	August 26, 2019
Last Date of Test:	August 26, 2019
Receipt Date of Samples:	August 26, 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:
Wireless Current Sensor with Power Supply

Testing Objective:
Seeking to demonstrate compliance under FCC 15.247:2019 for operation in the 902 - 928 MHz Band.

CONFIGURATIONS

Configuration SCHW0244- 1

EUT			
Description	**Manufacturer**	**Model/Part Number**	**Serial Number**
Wireless Current Sensor	Schweitzer Engineering Laboratories, Inc.	SEL-WCS	808598516
Power Supply	Schweitzer Engineering Laboratories, Inc.	SEL-9322	EUT-MV01

Cables					
Cable Type	**Shield**	**Length (m)**	**Ferrite**	**Connection 1**	**Connection 2**
DC Power Cable	No	1.5m	No	DC Power Supply	Wireless Current Sensor

Configuration SCHW0244- 2

EUT			
Description	**Manufacturer**	**Model/Part Number**	**Serial Number**
Wireless Current Sensor	Schweitzer Engineering Laboratories, Inc.	SEL-WCS	808598542
Power Supply	Schweitzer Engineering Laboratories, Inc.	SEL-9322	EUT-MV01

Cables					
Cable Type	**Shield**	**Length (m)**	**Ferrite**	**Connection 1**	**Connection 2**
DC Power Cable	No	1.5m	No	DC Power Supply	Wireless Current Sensor

MODIFICATIONS

Equipment Modifications

Item	Date	Test	Modification	Note	Disposition of EUT
1	2019-08-26	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.
2	2019-08-26	Output Power	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	2019-08-26	Equivalent Isotropic Radiated Power	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	2019-08-26	Band Edge Compliance	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	2019-08-26	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.
6	2019-08-26	Spurious 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.
7	2019-08-26	Power Spectral Density	Tested as delivered to Test Station.	No EMI suppression devices were added or modified during this test.	Scheduled testing was completed.

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

Continuous Tx 300kbs set at Highest output power 17 dBm

CHANNELS OF OPERATION

Low Ch. 906 MHz
Mid Ch. 915 MHz
High Ch. 927 MHz

POWER SETTINGS INVESTIGATED

24VDC

CONFIGURATIONS INVESTIGATED

SCHW0244 - 1

FREQUENCY RANGE INVESTIGATED

Start Frequency	30 MHz	Stop Frequency	18 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
Amplifier - Pre-Amplifier	Miteq	AMF-6F-12001800-30-10P	AVD	24-Nov-2018	12 mo
Antenna - Standard Gain	ETS Lindgren	3160-08	AHV	NCR	0 mo
Cable	None	Standard Gain Horns Cable	EVF	24-Nov-2018	12 mo
Amplifier - Pre-Amplifier	L-3 Narda-MITEQ	AMF-6F-08001200-30-10P	PAO	24-Nov-2018	12 mo
Antenna - Standard Gain	ETS Lindgren	3160-07	AHU	NCR	0 mo
Filter - High Pass	Micro-Tronics	HPM50108	HFV	11-Dec-2018	12 mo
Analyzer - Spectrum Analyzer	Agilent	E4446A	AAQ	24-Mar-2019	12 mo
Cable	N/A	Double Ridge Horn Cables	EVB	24-Nov-2018	12 mo
Amplifier - Pre-Amplifier	Miteq	AMF-3D-00100800-32-13P	PAG	24-Nov-2018	12 mo
Antenna - Double Ridge	ETS Lindgren	3115	AIZ	7-Feb-2018	24 mo
Filter - Band Pass/Notch	K&L Microwave	3TNF-500/1000-N/N	HFT	5-Dec-2018	12 mo
Filter - Low Pass	Micro-Tronics	LPM50004	LFD	15-Feb-2019	12 mo
Cable	N/A	Bilog Cables	EVA	24-Nov-2018	12 mo
Amplifier - Pre-Amplifier	Miteq	AM-1616-1000	AOL	24-Nov-2018	12 mo
Antenna - Biconilog	Teseq	CBL 6141B	AXR	2-Oct-2018	24 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 frequencies 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 if required, 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

Measurements were made to satisfy the specific requirements of the test specification for out of band emissions as well as the restricted band requirements.

If there are no detectable emissions above the noise floor, the data included may show noise floor measurements for reference only.

Measurements at the edges of the allowable band may be presented in an alternative method as provided for in the ANSI C63.10 Marker-Delta method. This method involves performing an in-band fundamental measurement followed by a screen capture of the fundamental and out-of-band emission using reduced measurement instrumentation bandwidths. The amplitude delta measured on this screen capture is applied to the fundamental emission value to show the out-of-band emission level as applied to the limit.

Where the radio test software does not provide for a duty cycle at continuous transmit conditions (> 98%) and the RMS (power average) measurements were made across the on and off times of the EUT transmissions, a duty cycle correction is added to the measurements using the formula of 10*LOG(dc).

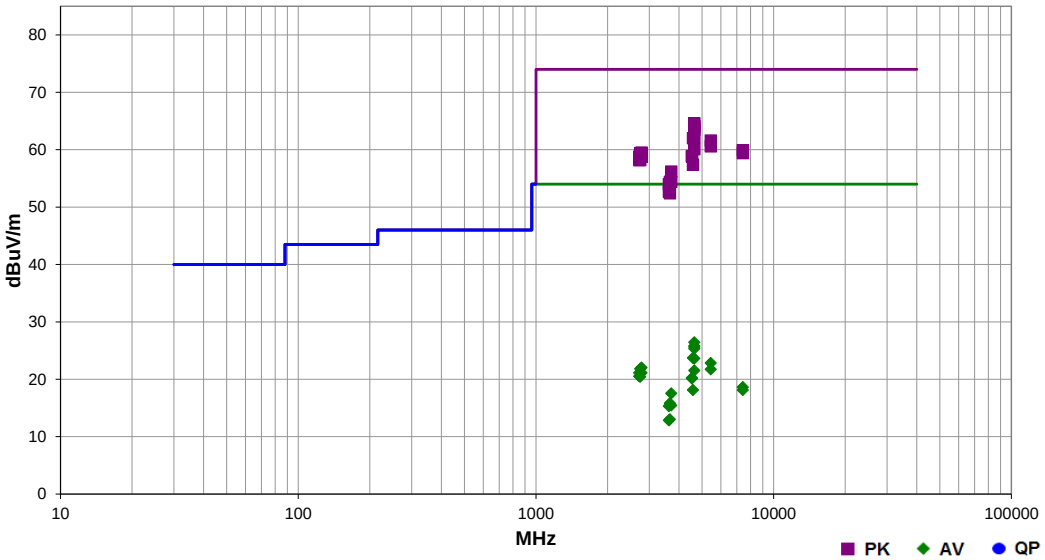
SPURIOUS RADIATED EMISSIONS

EmiR5 2019.08.01 PSA-ESCI 2019.05.10

Work Order:	SCHW0244	**Date:**	26-Aug-2019		
Project:	None	**Temperature:**	22.4 °C		
Job Site:	EV01	**Humidity:**	45.3% RH		
Serial Number:	808598516	**Barometric Pres.:**	1024 mbar	**Tested by:**	Brandon Hobbs, Jeff Alcoke
EUT:	Wireless Current Sensor				
Configuration:	1				
Customer:	Schweitzer Engineering Laboratories, Inc.				
Attendees:	Miralem Cosic				
EUT Power:	24VDC				
Operating Mode:	Continuous Tx 300kbs set at Highest output power 17 dBm at 100% duty cycle				
Deviations:	None				
Comments:	A protocol-limited duty cycle correction was applied to the average measurements per KDB 558074 Section 11 Q&A 3 method c for DTS radios certified under part 15.247 of the CFR. The correction was made using the 20Log(On Time/T) where T is defined as a 100ms period. 20*Log(2/100)= -33.979 dB				

Test Specifications	**Test Method**
FCC 15.247:2019	ANSI C63.10:2013

Run #	12	**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
4636.100	60.6	4.0	3.8	320.0	0.0	0.0	Vert	PK	0.0	64.6	74.0	-9.4	High Ch.927 Mhz, EUT On Side
4636.317	60.1	4.0	1.0	253.0	0.0	0.0	Vert	PK	0.0	64.1	74.0	-9.9	High Ch.927 MHz, EUT Horz
4636.067	60.0	4.0	1.2	238.0	0.0	0.0	Horz	PK	0.0	64.0	74.0	-10.0	High Ch.927 MHz, EUT Horz
4636.017	59.5	4.0	3.3	245.0	0.0	0.0	Horz	PK	0.0	63.5	74.0	-10.5	High Ch.927 Mhz, EUT On Side
4633.958	58.1	4.0	1.0	268.0	0.0	0.0	Vert	PK	0.0	62.1	74.0	-11.9	High Ch.927 Mhz, EUT Vert
4576.067	58.1	3.9	1.1	237.0	0.0	0.0	Horz	PK	0.0	62.0	74.0	-12.0	Mid Ch.915 MHz, EUT Horz
5437.708	55.5	6.1	3.2	224.0	0.0	0.0	Horz	PK	0.0	61.6	74.0	-12.4	Low Ch.906 MHz, EUT Horz
5434.900	54.5	6.1	2.6	340.0	0.0	0.0	Vert	PK	0.0	60.6	74.0	-13.4	Low Ch.906 MHz, EUT On Side
4636.075	56.1	4.0	1.2	181.0	0.0	0.0	Horz	PK	0.0	60.1	74.0	-13.9	High Ch.927 Mhz, EUT Vert
7413.900	45.6	14.3	1.0	323.0	0.0	0.0	Vert	PK	0.0	59.9	74.0	-14.1	High Ch.927 Mhz, EUT On Side
2780.325	62.7	-3.2	1.0	42.0	0.0	0.0	Vert	PK	0.0	59.5	74.0	-14.5	High Ch.927 MHz, EUT On Side
7417.580	45.1	14.3	2.6	340.0	0.0	0.0	Horz	PK	0.0	59.4	74.0	-14.6	High Ch.927 MHz, EUT Horz
2745.675	62.8	-3.4	1.0	45.0	0.0	0.0	Vert	PK	0.0	59.4	74.0	-14.6	Mid Ch.915 MHz, EUT On Side
4531.017	55.0	3.9	1.0	239.0	0.0	0.0	Vert	PK	0.0	58.9	74.0	-15.1	Low Ch.906 MHz, EUT On Side
2780.242	62.0	-3.2	1.7	249.0	0.0	0.0	Horz	PK	0.0	58.8	74.0	-15.2	High Ch.927 MHz, EUT Horz
2718.700	62.2	-3.4	1.1	325.0	0.0	0.0	Vert	PK	0.0	58.8	74.0	-15.2	Low Ch.906 MHz, EUT On Side
4531.192	54.9	3.9	3.5	201.0	0.0	0.0	Horz	PK	0.0	58.8	74.0	-15.2	Low Ch.906 MHz, EUT Horz
2745.650	61.6	-3.4	1.5	247.0	0.0	0.0	Horz	PK	0.0	58.2	74.0	-15.8	Mid Ch.915 MHz, EUT Horz
2718.717	61.6	-3.4	1.9	334.0	0.0	0.0	Horz	PK	0.0	58.2	74.0	-15.8	Low Ch.906 MHz, EUT Horz
4576.067	53.5	3.9	1.5	196.0	0.0	0.0	Vert	PK	0.0	57.4	74.0	-16.6	Mid Ch.915 MHz, EUT On Side
3707.108	54.0	2.2	1.1	222.0	0.0	0.0	Horz	PK	0.0	56.2	74.0	-17.8	High Ch.927 MHz, EUT Horz
3707.908	52.2	2.2	1.2	238.0	0.0	0.0	Vert	PK	0.0	54.4	74.0	-19.6	High Ch.927 Mhz, EUT On Side
3660.775	52.3	2.1	3.2	249.0	0.0	0.0	Horz	PK	0.0	54.4	74.0	-19.6	Mid Ch.915 MHz, EUT Horz
3622.850	52.2	1.8	1.1	238.0	0.0	0.0	Vert	PK	0.0	54.0	74.0	-20.0	Low Ch.906 MHz, EUT On Side
3623.142	50.9	1.8	3.2	277.0	0.0	0.0	Horz	PK	0.0	52.7	74.0	-21.3	Low Ch.906 MHz, EUT Horz
3660.800	50.3	2.1	2.6	46.0	0.0	0.0	Vert	PK	0.0	52.4	74.0	-21.6	Mid Ch.915 MHz, EUT On Side
4636.050	56.4	4.0	3.8	320.0	-34.0	0.0	Vert	AV	0.0	26.4	54.0	-27.6	High Ch.927 Mhz, EUT On Side
4636.025	55.8	4.0	1.0	253.0	-34.0	0.0	Vert	AV	0.0	25.8	54.0	-28.2	High Ch.927 MHz, EUT Horz
4636.008	55.6	4.0	1.2	238.0	-34.0	0.0	Horz	AV	0.0	25.6	54.0	-28.4	High Ch.927 MHz, EUT Horz
4636.083	55.3	4.0	3.3	245.0	-34.0	0.0	Horz	AV	0.0	25.3	54.0	-28.7	High Ch.927 Mhz, EUT On Side
4576.067	53.8	3.9	1.1	237.0	-34.0	0.0	Horz	AV	0.0	23.7	54.0	-30.3	Mid Ch.915 MHz, EUT Horz

Freq (MHz)	Amplitude (dBuV)	Factor (dB)	Antenna Height (meters)	Azimuth (degrees)	Duty Cycle Correction Factor (dB)	External Attenuation (dB)	Polarity/ Transducer Type	Detector	Distance Adjustment (dB)	Adjusted (dBuV/m)	Spec. Limit (dBuV/m)	Compared to Spec. (dB)	Comments
4636.067	53.6	4.0	1.0	268.0	-34.0	0.0	Vert	AV	0.0	23.6	54.0	-30.4	High Ch.927 Mhz, EUT Vert
5437.283	50.7	6.1	3.2	224.0	-34.0	0.0	Horz	AV	0.0	22.8	54.0	-31.2	Low Ch.906 MHz, EUT Horz
2780.433	59.2	-3.2	1.0	42.0	-34.0	0.0	Vert	AV	0.0	22.0	54.0	-32.0	High Ch.927 Mhz, EUT On Side
2745.558	59.2	-3.4	1.0	45.0	-34.0	0.0	Vert	AV	0.0	21.8	54.0	-32.2	Mid Ch.915 MHz, EUT On Side
5437.275	49.6	6.1	2.6	340.0	-34.0	0.0	Vert	AV	0.0	21.7	54.0	-32.3	Low Ch.906 MHz, EUT On Side
4636.033	51.5	4.0	1.2	181.0	-34.0	0.0	Horz	AV	0.0	21.5	54.0	-32.5	High Ch.927 Mhz, EUT Vert
2780.433	58.3	-3.2	1.7	249.0	-34.0	0.0	Horz	AV	0.0	21.1	54.0	-32.9	High Ch.927 MHz, EUT Horz
2718.558	58.5	-3.4	1.1	325.0	-34.0	0.0	Vert	AV	0.0	21.1	54.0	-32.9	Low Ch.906 MHz, EUT On Side
2718.558	57.9	-3.4	1.9	334.0	-34.0	0.0	Horz	AV	0.0	20.5	54.0	-33.5	Low Ch.906 MHz, EUT Horz
2745.600	57.8	-3.4	1.5	247.0	-34.0	0.0	Horz	AV	0.0	20.4	54.0	-33.6	Mid Ch.915 MHz, EUT Horz
4531.017	50.3	3.9	1.0	239.0	-34.0	0.0	Vert	AV	0.0	20.2	54.0	-33.8	Low Ch.906 MHz, EUT On Side
4528.950	50.2	3.9	3.5	201.0	-34.0	0.0	Horz	AV	0.0	20.1	54.0	-33.9	Low Ch.906 MHz, EUT Horz
7414.283	38.3	14.3	1.0	323.0	-34.0	0.0	Vert	AV	0.0	18.6	54.0	-35.4	High Ch.927 Mhz, EUT On Side
7417.710	37.8	14.3	2.6	340.0	-34.0	0.0	Horz	AV	0.0	18.1	54.0	-35.9	High Ch.927 MHz, EUT Horz
4576.008	48.2	3.9	1.5	196.0	-34.0	0.0	Vert	AV	0.0	18.1	54.0	-35.9	Mid Ch.915 MHz, EUT On Side
3708.825	49.3	2.2	1.1	222.0	-34.0	0.0	Horz	AV	0.0	17.5	54.0	-36.5	High Ch.927 MHz, EUT Horz
3660.858	47.7	2.1	3.2	249.0	-34.0	0.0	Horz	AV	0.0	15.8	54.0	-38.2	Mid Ch.915 MHz, EUT Horz
3708.833	47.2	2.2	1.2	238.0	-34.0	0.0	Vert	AV	0.0	15.4	54.0	-38.6	High Ch.927 Mhz, EUT On Side
3623.200	47.5	1.8	1.1	238.0	-34.0	0.0	Vert	AV	0.0	15.3	54.0	-38.7	Low Ch.906 MHz, EUT On Side
3660.792	44.9	2.1	2.6	46.0	-34.0	0.0	Vert	AV	0.0	13.0	54.0	-41.0	Mid Ch.915 MHz, EUT On Side
3624.850	45.0	1.8	3.2	277.0	-34.0	0.0	Horz	AV	0.0	12.8	54.0	-41.2	Low Ch.906 MHz, EUT Horz

DUTY CYCLE

XMit 2019.06.11

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 DESCRIPTION

The measurement was made using a direct connection between the RF output of the EUT and a spectrum analyzer. The Duty Cycle (x) of the single channel operation of the radio as controlled by the provided test software was measured for each of the EUT operating modes.

There is no compliance requirement to be met by this test, so therefore no Pass / Fail criteria.

The measurements were made using a zero span on the spectrum analyzer to see the pulses in the time domain. The transmit power was set to its default maximum.

The test software provided for operation in a fixed, single channel mode allows the EUT to operate continuously at 100% Duty Cycle.

OUTPUT POWER

XMit 2019.06.11

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	N9010A	AFI	7-Jun-19	7-Jun-20
Generator - Signal	Agilent	N5182A	TIF	23-Aug-17	23-Aug-20
Cable	Micro-Coax	UFD150A-1-0720-200200	EVH	28-Mar-19	28-Mar-20
Attenuator	S.M. Electronics	SA26B-20	AUY	28-Mar-19	28-Mar-20
Block - DC	Fairview Microwave	SD3379	AMX	29-Mar-19	29-Mar-20

TEST DESCRIPTION

The measurement was made using a direct connection between the RF output of the EUT and a spectrum analyzer. The transmit frequency was set to the required channels in each band. The transmit power was set to its default maximum.

Prior to measuring peak transmit power the DTS bandwidth (B) was measured.

The method found in ANSI C63.10:2013 Section 11.9.1.1 was used because the RBW on the analyzer was greater than the DTS Bandwidth of the radio.

OUTPUT POWER

TbtTx 2019.08.02 XMit 2019.06.11

EUT:	**Wireless Current Sensor**			**Work Order:**	**SCHW0244**
Serial Number:	**808598542**			**Date:**	**26-Aug-19**
Customer:	**Schweitzer Engineering Laboratories, Inc.**			**Temperature:**	**24 °C**
Attendees:	**Miralem Cosic**			**Humidity:**	**44.8% RH**
Project:	**None**			**Barometric Pres.:**	**1020 mbar**
Tested by:	**Brandon Hobbs, Jeff Alcoke**	**Power:**	**24VDC**	**Job Site:**	**EV06**

TEST SPECIFICATIONS	**Test Method**
FCC 15.247:2019	ANSI C63.10:2013

COMMENTS

The DC block, attenuator and cable were all accounted for during testing.

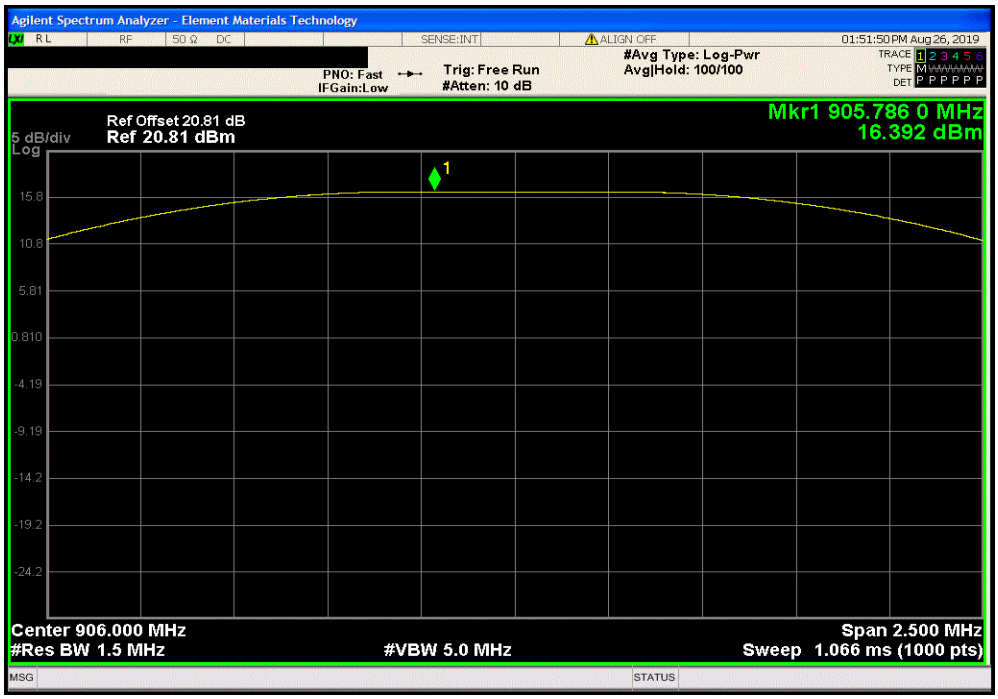
DEVIATIONS FROM TEST STANDARD

None

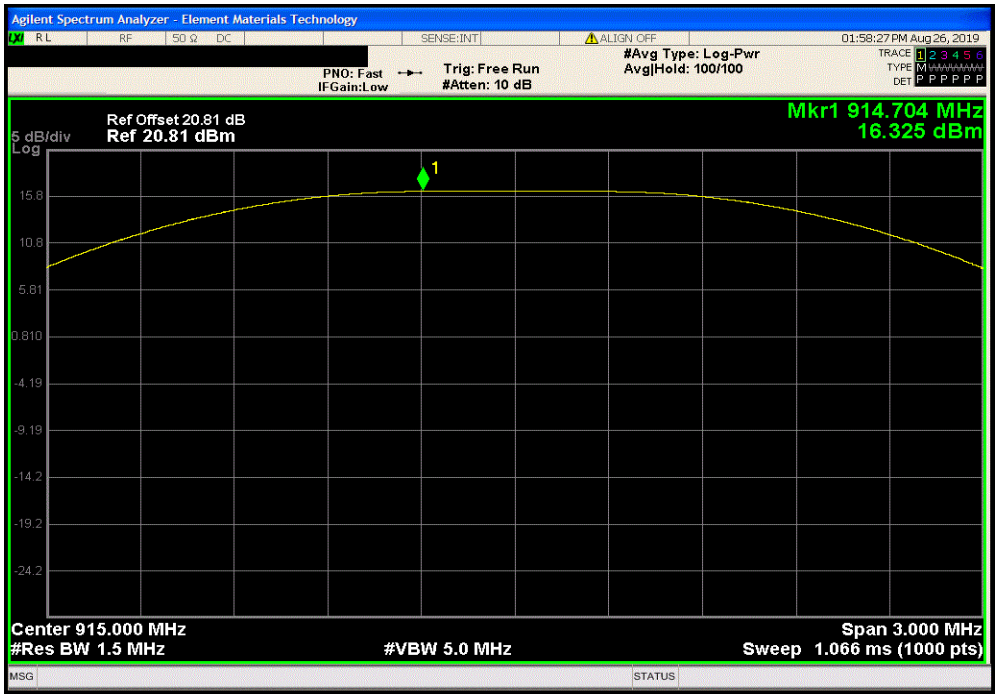
Configuration #	**2**	*Signature*

	Out Pwr (dBm)	**Limit (dBm)**	**Result**
DTS 300 kbs Low Channel, 906 MHz	16.392	30	Pass
DTS 300 kbs Mid Channel, 915 MHz	16.325	30	Pass
DTS 300 kbs High Channel, 927 MHz	16.098	30	Pass

DTS 300 kbs Low Channel, 906 MHz						
				Out Pwr (dBm)	Limit (dBm)	Result
				16.392	30	Pass

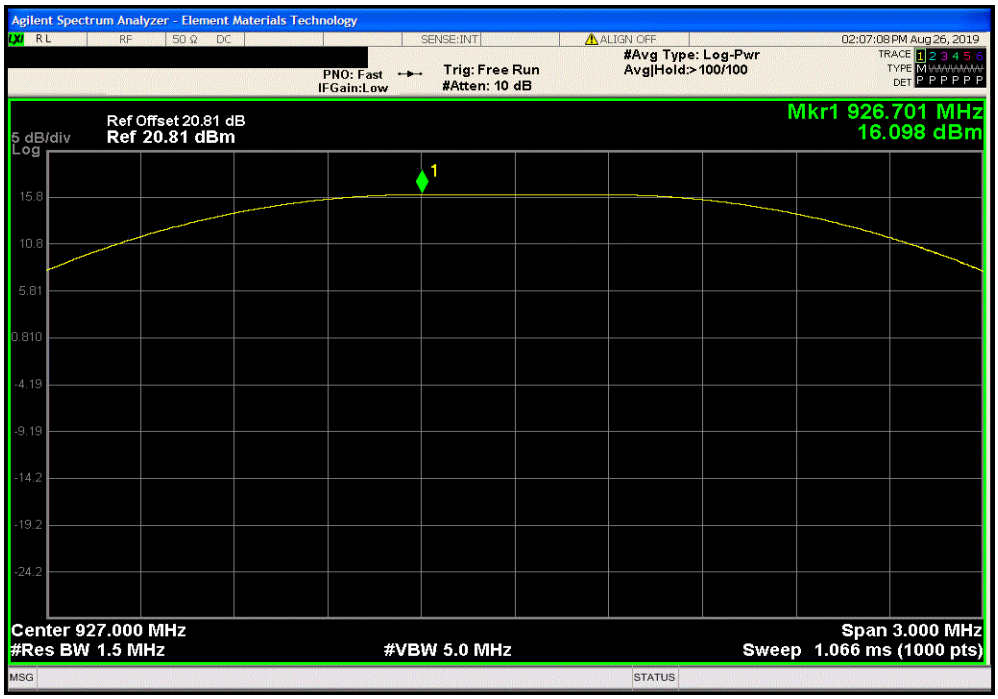


DTS 300 kbs Mid Channel, 915 MHz						
				Out Pwr (dBm)	Limit (dBm)	Result
				16.325	30	Pass



OUTPUT POWER

DTS 300 kbs High Channel, 927 MHz						
				Out Pwr (dBm)	Limit (dBm)	Result
				16.098	30	Pass



EQUIVALENT ISOTROPIC RADIATED POWER (EIRP)

XMit 2019.06.11

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
Generator - Signal	Agilent	N5182A	TIF	23-Aug-17	23-Aug-20
Cable	Micro-Coax	UFD150A-1-0720-200200	EVH	28-Mar-19	28-Mar-20
Analyzer - Spectrum Analyzer	Agilent	N9010A	AFI	7-Jun-19	7-Jun-20
Attenuator	S.M. Electronics	SA26B-20	AUY	28-Mar-19	28-Mar-20
Block - DC	Fairview Microwave	SD3379	AMX	29-Mar-19	29-Mar-20

TEST DESCRIPTION

The measurement was made using a direct connection between the RF output of the EUT and a spectrum analyzer. The transmit frequency was set to the required channels in each band. The transmit power was set to its default maximum.

Prior to measuring peak transmit power the DTS bandwidth (B) was measured.

The method found in ANSI C63.10:2013 Section 11.9.1.1 was used because the RBW on the analyzer was greater than the DTS Bandwidth of the radio.

EQUIVALENT ISOTROPIC RADIATED POWER (EIRP)

TbtTx 2019.08.02 XMit 2019.06.11

EUT:	Wireless Current Sensor			**Work Order:**	SCHW0244
Serial Number:	808598542			**Date:**	26-Aug-19
Customer:	Schweitzer Engineering Laboratories, Inc.			**Temperature:**	24 °C
Attendees:	Miralem Cosic			**Humidity:**	44.8% RH
Project:	None			**Barometric Pres.:**	1021 mbar
Tested by:	Brandon Hobbs, Jeff Alcoke	**Power:**	24VDC	**Job Site:**	EV06

TEST SPECIFICATIONS	Test Method
FCC 15.247:2019	ANSI C63.10:2013

COMMENTS

The DC block, attenuator and cable were all accounted for during testing.

DEVIATIONS FROM TEST STANDARD

None

Configuration #	2	Signature

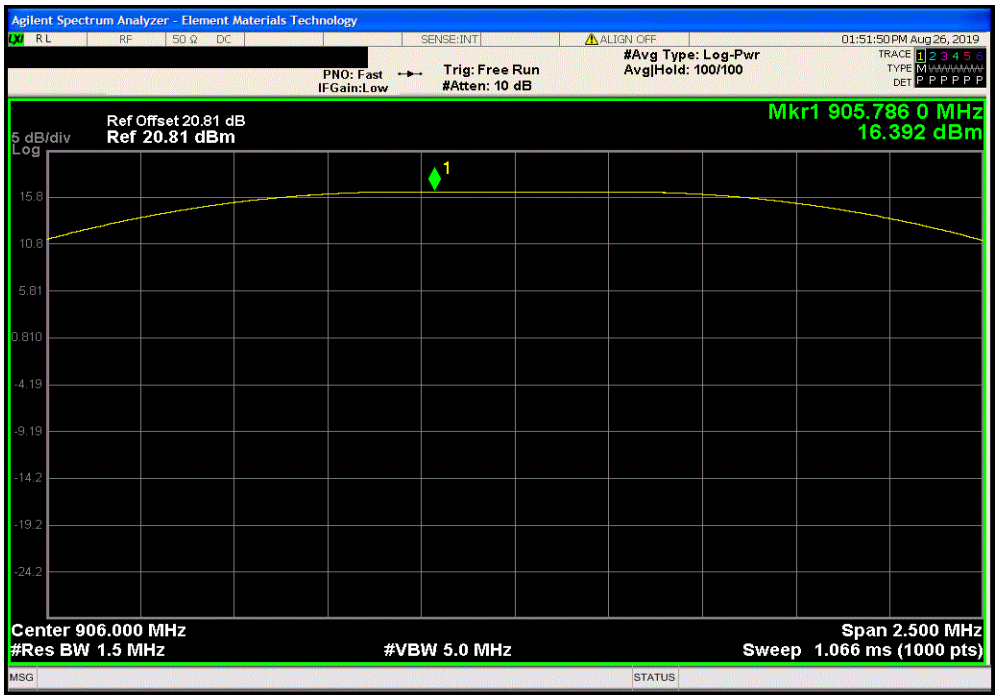
	Out Pwr (dBm)	Antenna Gain (dBi)	EIRP (dBm)	EIRP Limit (dBm)	Result
DTS 300 kbs Low Channel, 906 MHz	16.392	-5	11.392	36	Pass
DTS 300 kbs Mid Channel, 915 MHz	16.325	-5	11.325	36	Pass
DTS 300 kbs High Channel, 927 MHz	16.098	-5	11.098	36	Pass

EQUIVALENT ISOTROPIC RADIATED POWER (EIRP)

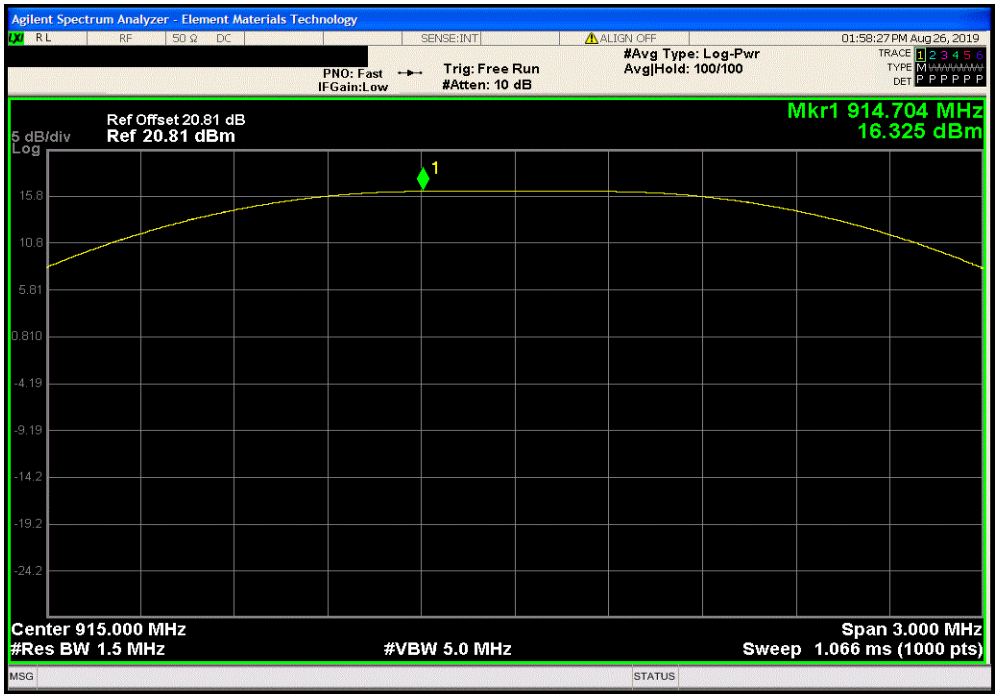
element

TbtTx 2019.08.02 XMit 2019.06.11

DTS 300 kbs Low Channel, 906 MHz						
		Out Pwr (dBm)	Antenna Gain (dBi)	EIRP (dBm)	EIRP Limit (dBm)	Result
		16.392	-5	11.392	36	Pass

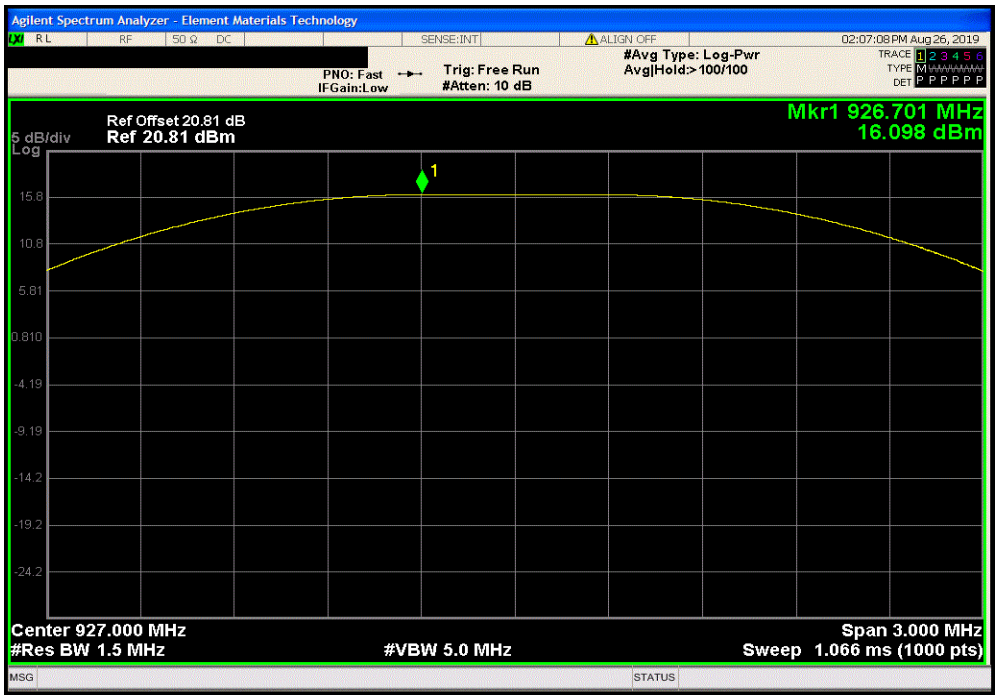


DTS 300 kbs Mid Channel, 915 MHz						
		Out Pwr (dBm)	Antenna Gain (dBi)	EIRP (dBm)	EIRP Limit (dBm)	Result
		16.325	-5	11.325	36	Pass



EQUIVALENT ISOTROPIC RADIATED POWER (EIRP)

DTS 300 kbs High Channel, 927 MHz						
		Out Pwr (dBm)	Antenna Gain (dBi)	EIRP (dBm)	EIRP Limit (dBm)	Result
		16.098	-5	11.098	36	Pass



BAND EDGE COMPLIANCE

XMit 2019.06.11

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	N9010A	AFI	7-Jun-19	7-Jun-20
Block - DC	Fairview Microwave	SD3379	AMX	29-Mar-19	29-Mar-20
Cable	Micro-Coax	UFD150A-1-0720-200200	EVH	28-Mar-19	28-Mar-20
Attenuator	S.M. Electronics	SA26B-20	AUY	28-Mar-19	28-Mar-20
Generator - Signal	Agilent	N5182A	TIF	23-Aug-17	23-Aug-20

TEST DESCRIPTION

The measurement was made using a direct connection between the RF output of the EUT and a spectrum analyzer. The spurious RF conducted emissions at the edges of the authorized bands were measured with the EUT set to low and high transmit frequencies in each available band. The channels closest to the band edges were selected. The EUT was transmitting at the data rate(s) listed in the datasheet.

The spectrum was scanned below the lower band edge and above the higher band edge.

BAND EDGE COMPLIANCE

TbtTx 2019.08.02 XMit 2019.06.11

EUT:	**Wireless Current Sensor**			**Work Order:**	**SCHW0244**
Serial Number:	**808598542**			**Date:**	**26-Aug-19**
Customer:	**Schweitzer Engineering Laboratories, Inc.**			**Temperature:**	**24 °C**
Attendees:	**Miralem Cosic**			**Humidity:**	**44.8% RH**
Project:	**None**			**Barometric Pres.:**	**1021 mbar**
Tested by:	**Brandon Hobbs, Jeff Alcoke**	**Power:**	**24VDC**	**Job Site:**	**EV06**

TEST SPECIFICATIONS	**Test Method**
FCC 15.247:2019	ANSI C63.10:2013

COMMENTS

The DC block, attenuator and cable were all accounted for during testing.

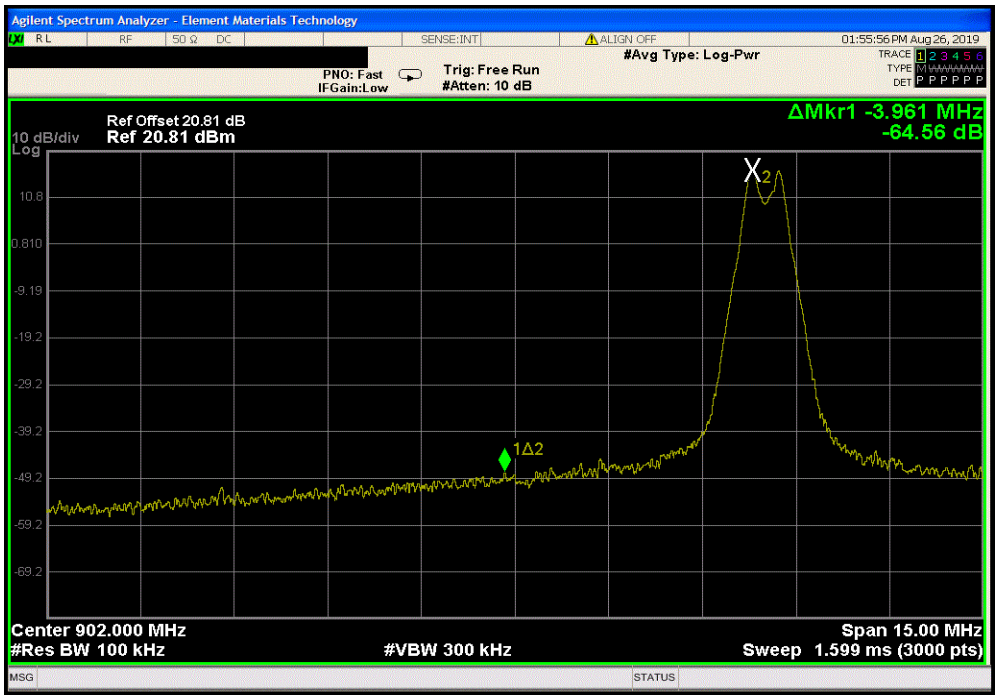
DEVIATIONS FROM TEST STANDARD

None

Configuration #	**2**	*Signature*

	Value (dBc)	**Limit ≤ (dBc)**	**Result**
DTS 300 kbs Low Channel, 906 MHz	-64.56	-20	Pass
DTS 300 kbs High Channel, 927 MHz	-48.01	-20	Pass

DTS 300 kbs Low Channel, 906 MHz						
				Value (dBc)	Limit ≤ (dBc)	Result
				-64.56	-20	Pass



DTS 300 kbs High Channel, 927 MHz						
				Value (dBc)	Limit ≤ (dBc)	Result
				-48.01	-20	Pass

OCCUPIED BANDWIDTH

XMit 2019.06.11

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	Micro-Coax	UFD150A-1-0720-200200	EVH	28-Mar-19	28-Mar-20
Generator - Signal	Agilent	N5182A	TIF	23-Aug-17	23-Aug-20
Attenuator	S.M. Electronics	SA26B-20	AUY	28-Mar-19	28-Mar-20
Analyzer - Spectrum Analyzer	Agilent	N9010A	AFI	7-Jun-19	7-Jun-20
Block - DC	Fairview Microwave	SD3379	AMX	29-Mar-19	29-Mar-20

TEST DESCRIPTION

The measurement was made using a direct connection between the RF output of the EUT and a spectrum analyzer. The EUT was set to the channels and modes listed in the datasheet.

The 6dB occupied bandwidth was measured using 100 kHz resolution bandwidth and 300 kHz video bandwidth. The 99.0% occupied bandwidth was also measured at the same time which can be needed during Output Power depending on the applicable method.

OCCUPIED BANDWIDTH

TbtTx 2019.08.02 XMit 2019.06.11

EUT:	**Wireless Current Sensor**			**Work Order:**	**SCHW0244**
Serial Number:	**808598542**			**Date:**	**26-Aug-19**
Customer:	**Schweitzer Engineering Laboratories, Inc.**			**Temperature:**	**24 °C**
Attendees:	**Miralem Cosic**			**Humidity:**	**44.9% RH**
Project:	**None**			**Barometric Pres.:**	**1021 mbar**
Tested by:	**Brandon Hobbs, Jeff Alcoke**	**Power:**	**24VDC**	**Job Site:**	**EV06**

TEST SPECIFICATIONS	**Test Method**
FCC 15.247:2019	ANSI C63.10:2013

COMMENTS

The DC block, attenuator and cable were all accounted for during testing.

DEVIATIONS FROM TEST STANDARD

None

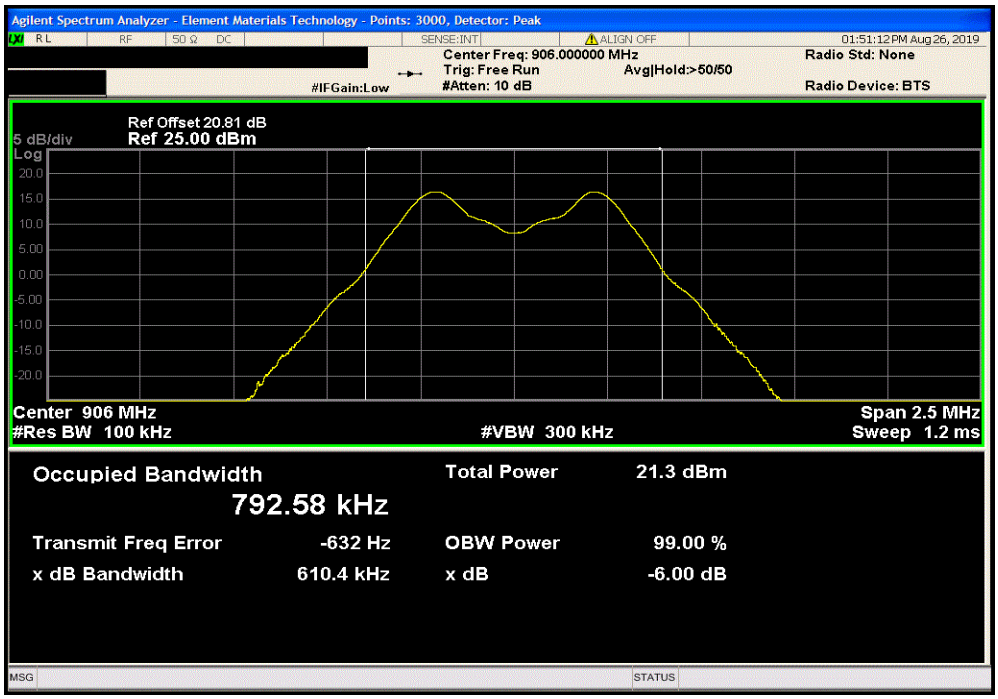
Configuration #	**2**	*Signature*

	Value	**Limit (>)**	**Result**
DTS 300 kbs Low Channel, 906 MHz	610.377 kHz	500 kHz	Pass
DTS 300 kbs Mid Channel, 915 MHz	606.357 kHz	500 kHz	Pass
DTS 300 kbs High Channel, 927 MHz	605.886 kHz	500 kHz	Pass

OCCUPIED BANDWIDTH

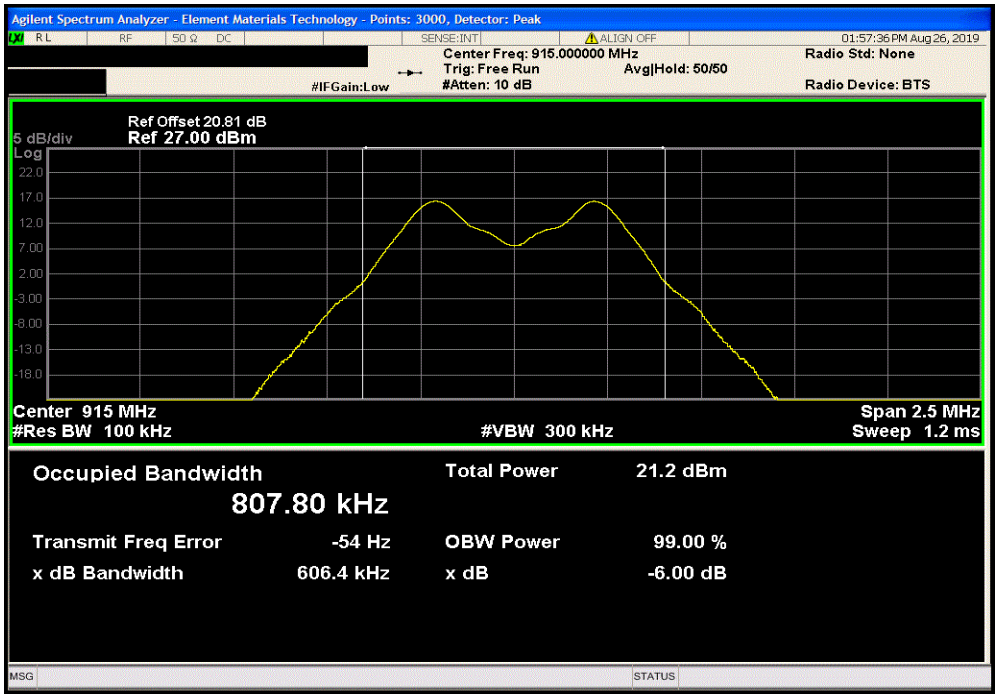
DTS 300 kbs Low Channel, 906 MHz

				Value	Limit (>)	Result
				610.377 kHz	500 kHz	Pass



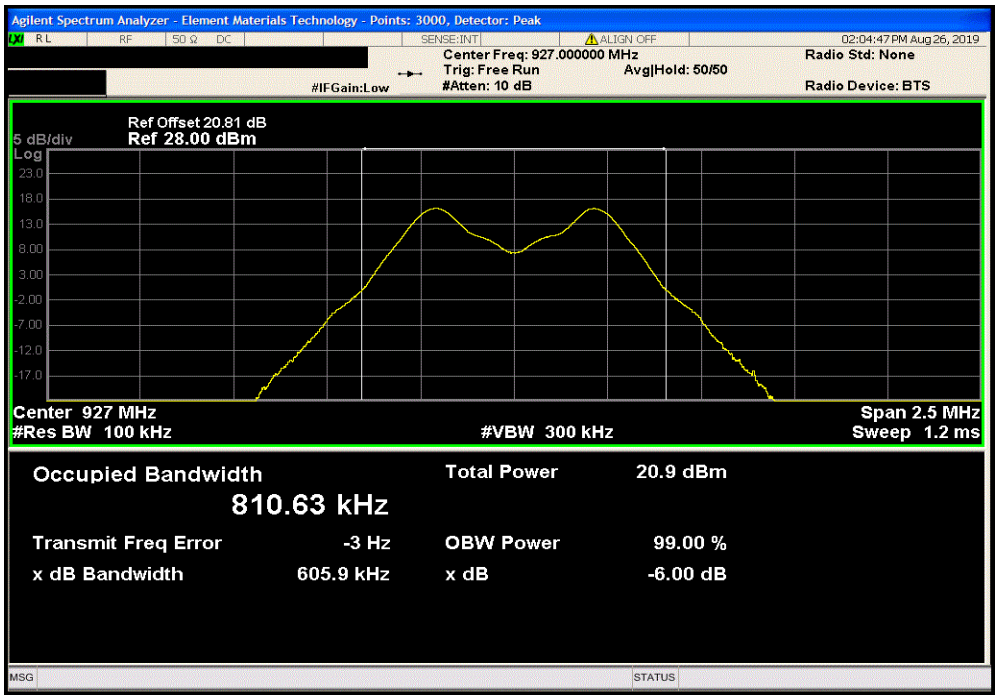
DTS 300 kbs Mid Channel, 915 MHz

				Value	Limit (>)	Result
				606.357 kHz	500 kHz	Pass



OCCUPIED BANDWIDTH

DTS 300 kbs High Channel, 927 MHz						
				Value	Limit (>)	Result
				605.886 kHz	500 kHz	Pass



SPURIOUS CONDUCTED EMISSIONS

XMit 2019.06.11

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	N9010A	AFI	7-Jun-19	7-Jun-20
Generator - Signal	Agilent	N5182A	TIF	23-Aug-17	23-Aug-20
Cable	Micro-Coax	UFD150A-1-0720-200200	EVH	28-Mar-19	28-Mar-20
Block - DC	Fairview Microwave	SD3379	AMX	29-Mar-19	29-Mar-20
Attenuator	S.M. Electronics	SA26B-20	AUY	28-Mar-19	28-Mar-20

TEST DESCRIPTION

The measurement was made using a direct connection between the RF output of the EUT and a spectrum analyzer. The spurious RF conducted emissions were measured with the EUT set to low, medium and high transmit frequencies. The EUT was transmitting at the data rate(s) listed in the datasheet. For each transmit frequency, the spectrum was scanned throughout the specified frequency range.

SPURIOUS CONDUCTED EMISSIONS

TbtTx 2019.08.02 XMit 2019.06.11

EUT:	**Wireless Current Sensor**			**Work Order:**	**SCHW0244**
Serial Number:	**808598542**			**Date:**	**26-Aug-19**
Customer:	**Schweitzer Engineering Laboratories, Inc.**			**Temperature:**	**24.1 °C**
Attendees:	**Miralem Cosic**			**Humidity:**	**44.8% RH**
Project:	**None**			**Barometric Pres.:**	**1020 mbar**
Tested by:	**Brandon Hobbs, Jeff Alcoke**	**Power:**	**24VDC**	**Job Site:**	**EV06**

TEST SPECIFICATIONS	**Test Method**
FCC 15.247:2019	ANSI C63.10:2013

COMMENTS

The DC block, attenuator and cable were all accounted for during testing.

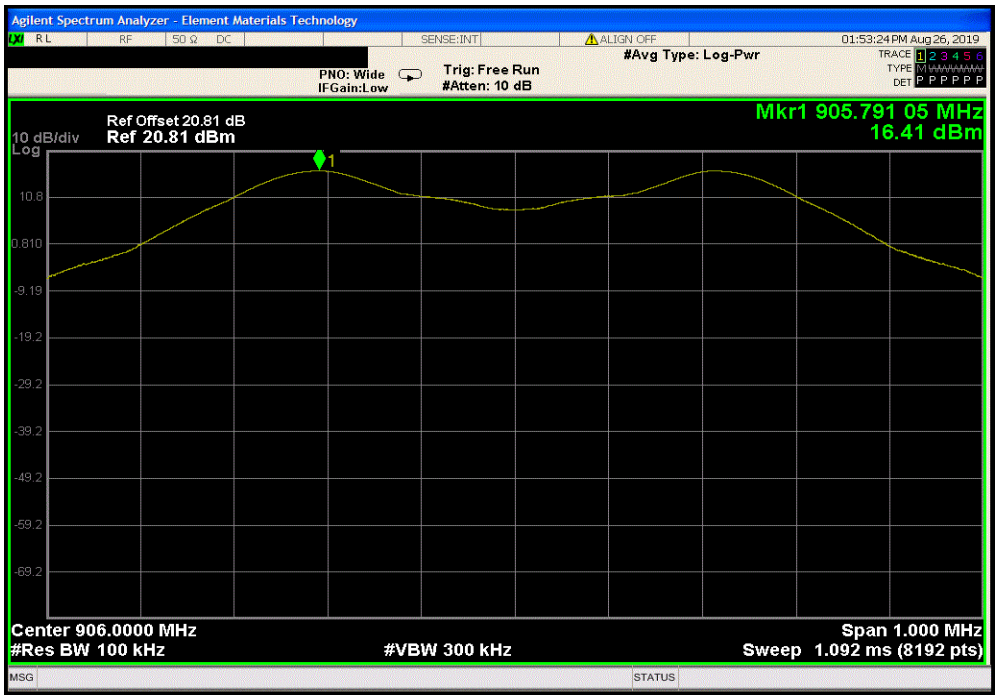
DEVIATIONS FROM TEST STANDARD

None

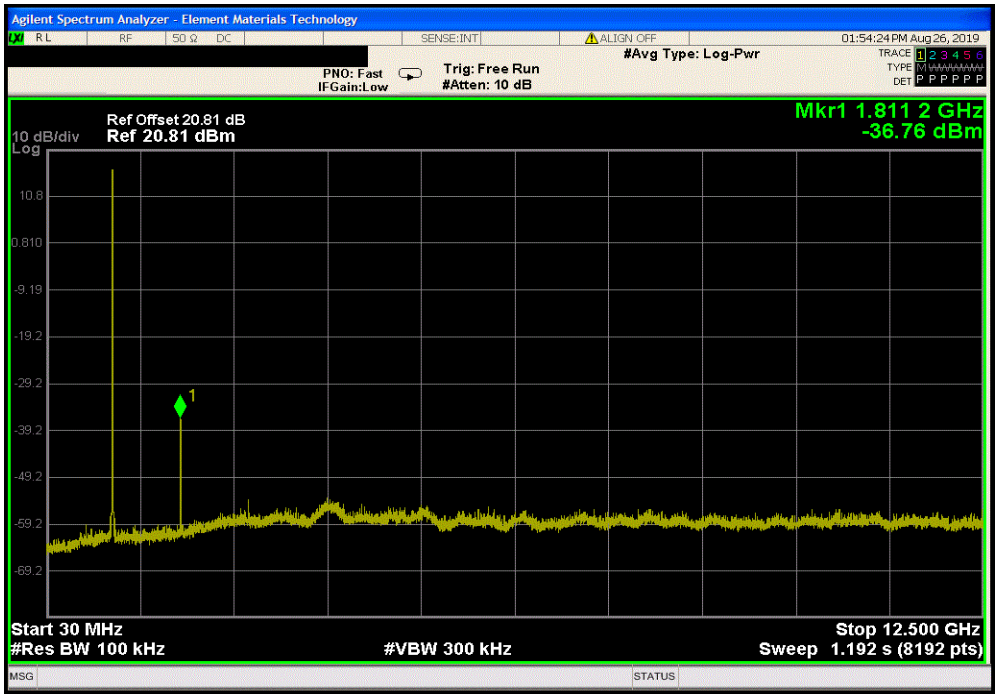
Configuration #	**2**	*Signature*

	Frequency Range	Measured Freq (MHz)	Max Value (dBc)	Limit ≤ (dBc)	Result
DTS 300 kbs Low Channel, 906 MHz	Fundamental	905.79	N/A	N/A	N/A
DTS 300 kbs Low Channel, 906 MHz	30 MHz - 12.5 GHz	1811.21	-53.17	-20	Pass
DTS 300 kbs Low Channel, 906 MHz	12.5 GHz - 25 GHz	24177.45	-67.96	-20	Pass
DTS 300 kbs Mid Channel, 915 MHz	Fundamental	914.79	N/A	N/A	N/A
DTS 300 kbs Mid Channel, 915 MHz	30 MHz - 12.5 GHz	1829.48	-53.38	-20	Pass
DTS 300 kbs Mid Channel, 915 MHz	12.5 GHz - 25 GHz	24287.33	-68.81	-20	Pass
DTS 300 kbs High Channel, 927 MHz	Fundamental	926.79	N/A	N/A	N/A
DTS 300 kbs High Channel, 927 MHz	30 MHz - 12.5 GHz	1853.84	-54.48	-20	Pass
DTS 300 kbs High Channel, 927 MHz	12.5 GHz - 25 GHz	24084.36	-68.27	-20	Pass

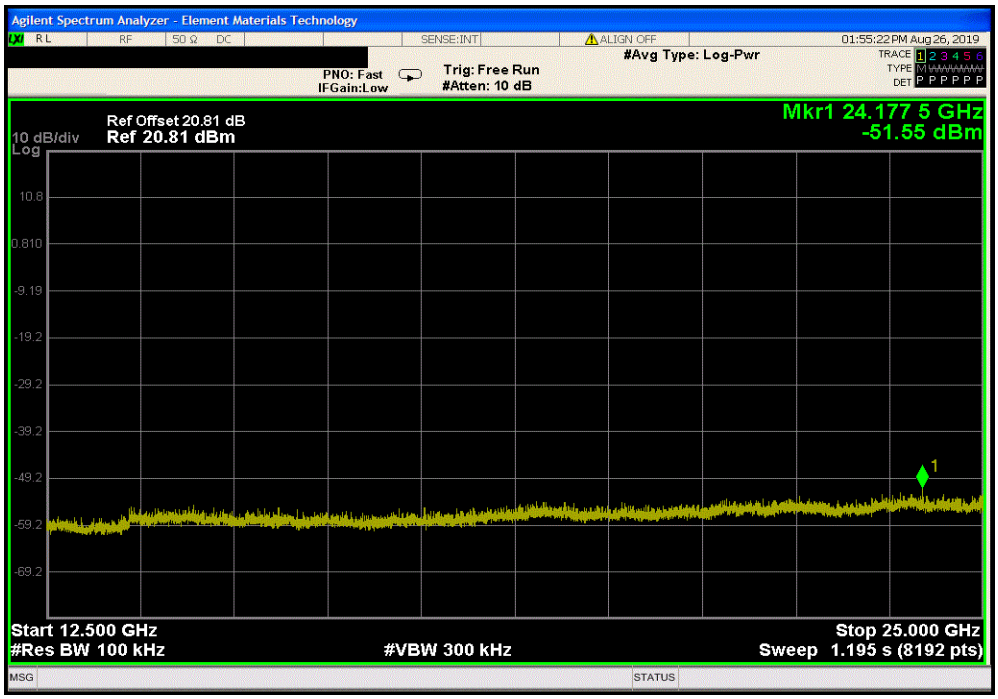
DTS 300 kbs Low Channel, 906 MHz					
Frequency Range		Measured Freq (MHz)	Max Value (dBc)	Limit ≤ (dBc)	Result
	Fundamental	905.79	N/A	N/A	N/A



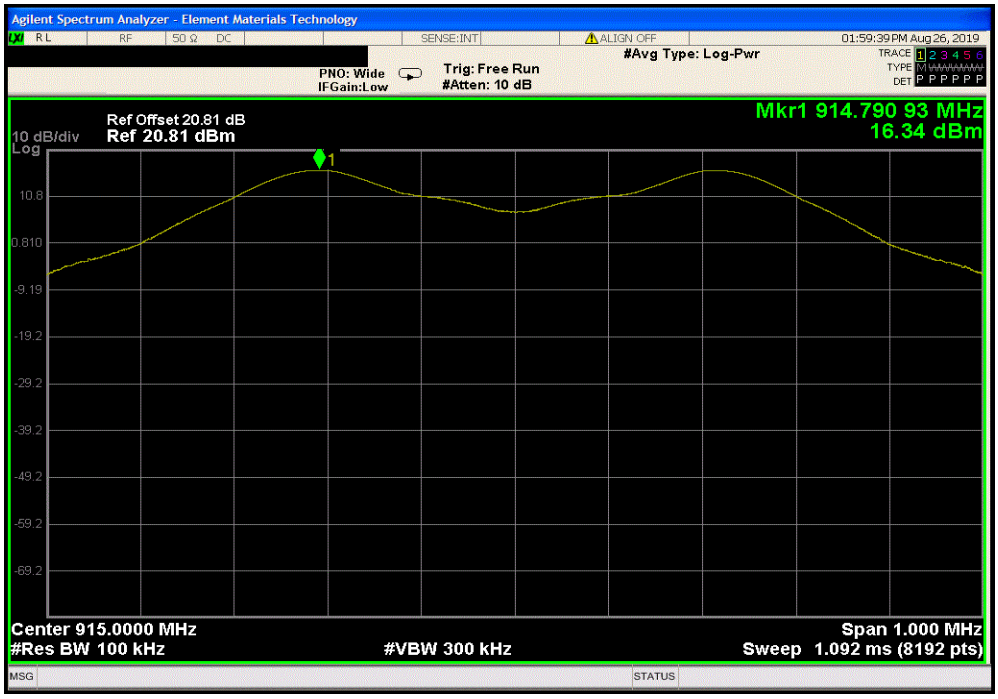
DTS 300 kbs Low Channel, 906 MHz				
Frequency Range	Measured Freq (MHz)	Max Value (dBc)	Limit ≤ (dBc)	Result
30 MHz - 12.5 GHz	1811.21	-53.17	-20	Pass



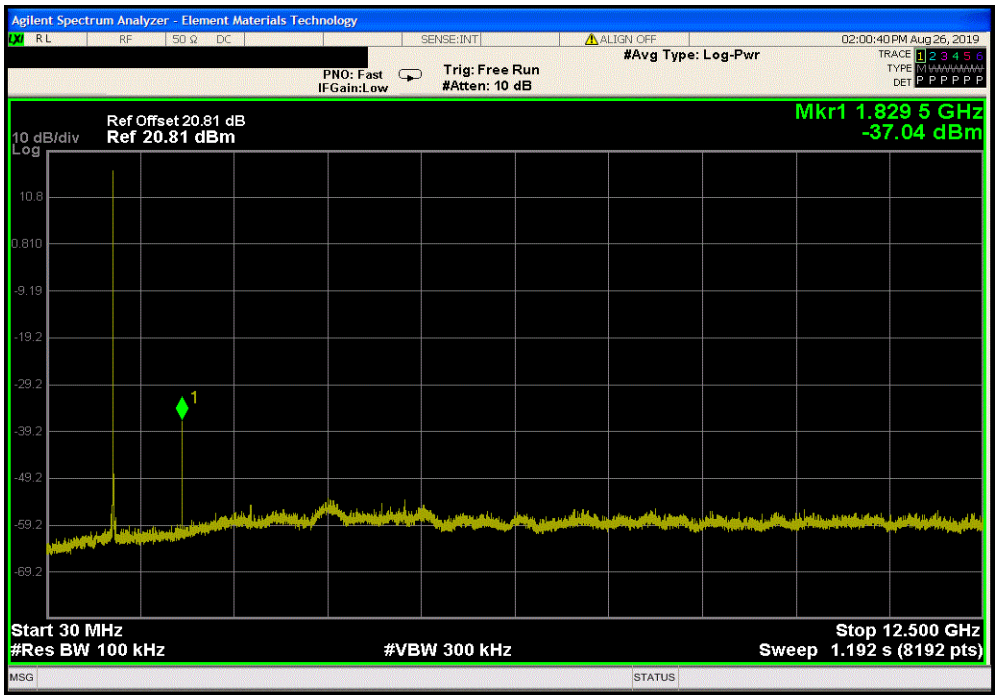
DTS 300 kbs Low Channel, 906 MHz				
Frequency Range	Measured Freq (MHz)	Max Value (dBc)	Limit ≤ (dBc)	Result
12.5 GHz - 25 GHz	24177.45	-67.96	-20	Pass



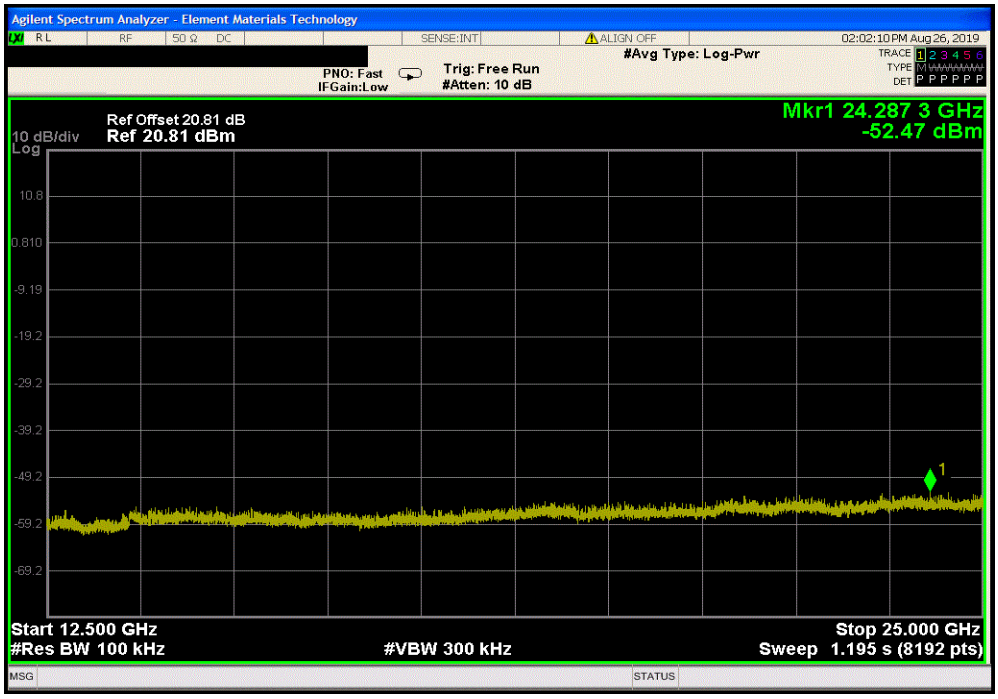
DTS 300 kbs Mid Channel, 915 MHz				
Frequency Range	Measured Freq (MHz)	Max Value (dBc)	Limit ≤ (dBc)	Result
Fundamental	914.79	N/A	N/A	N/A



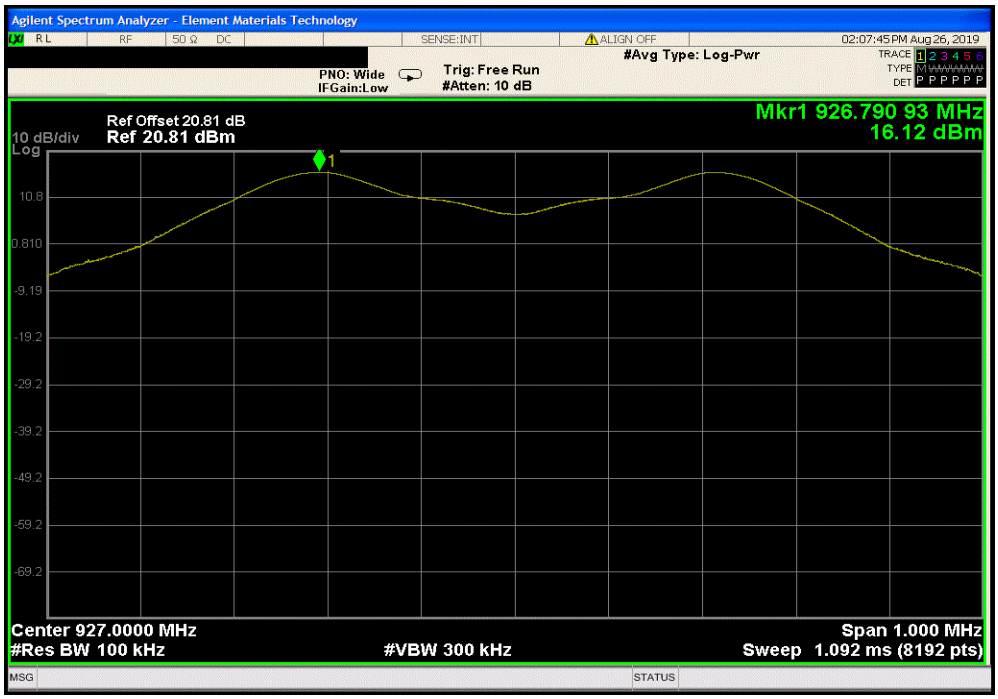
DTS 300 kbs Mid Channel, 915 MHz				
Frequency Range	Measured Freq (MHz)	Max Value (dBc)	Limit ≤ (dBc)	Result
30 MHz - 12.5 GHz	1829.48	-53.38	-20	Pass



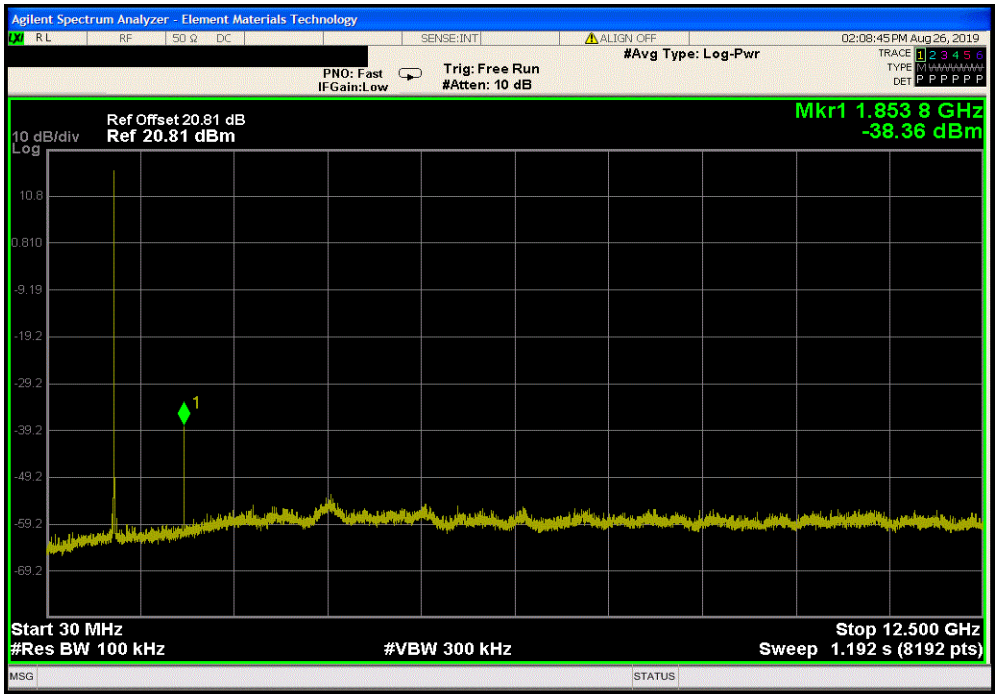
DTS 300 kbs Mid Channel, 915 MHz				
Frequency Range	Measured Freq (MHz)	Max Value (dBc)	Limit ≤ (dBc)	Result
12.5 GHz - 25 GHz	24287.33	-68.81	-20	Pass



DTS 300 kbs High Channel, 927 MHz					
Frequency Range		Measured Freq (MHz)	Max Value (dBc)	Limit ≤ (dBc)	Result
	Fundamental	926.79	N/A	N/A	N/A

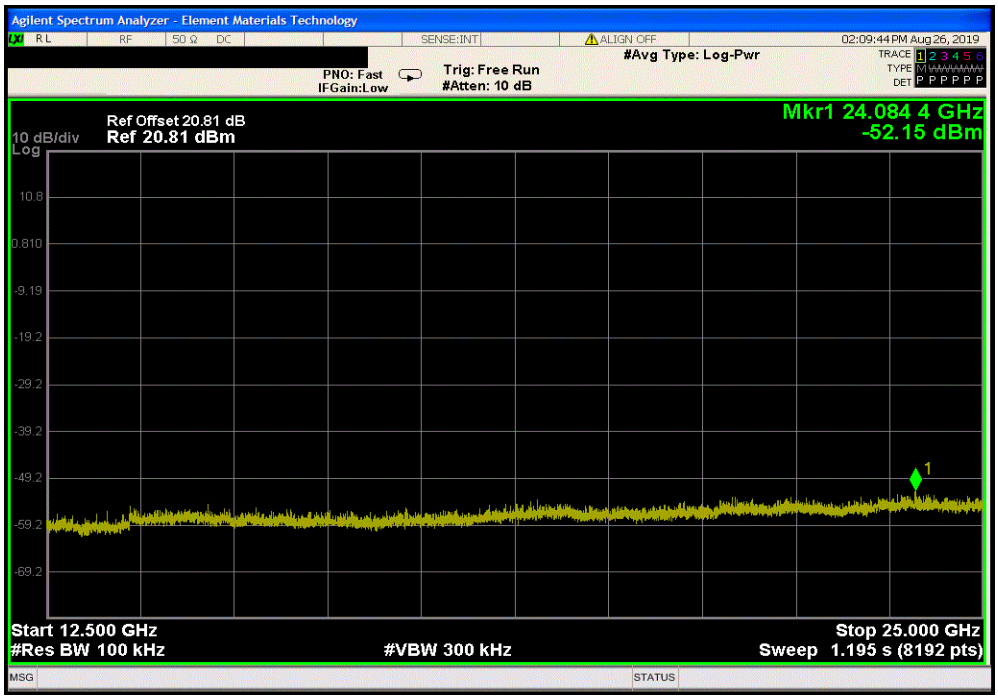


DTS 300 kbs High Channel, 927 MHz				
Frequency Range	Measured Freq (MHz)	Max Value (dBc)	Limit ≤ (dBc)	Result
30 MHz - 12.5 GHz	1853.84	-54.48	-20	Pass



DTS 300 kbs High Channel, 927 MHz

Frequency Range	Measured Freq (MHz)	Max Value (dBc)	Limit ≤ (dBc)	Result
12.5 GHz - 25 GHz	24084.36	-68.27	-20	Pass



POWER SPECTRAL DENSITY

XMit 2019.06.11

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	N9010A	AFI	7-Jun-19	7-Jun-20
Cable	Micro-Coax	UFD150A-1-0720-200200	EVH	28-Mar-19	28-Mar-20
Generator - Signal	Agilent	N5182A	TIF	23-Aug-17	23-Aug-20
Block - DC	Fairview Microwave	SD3379	AMX	29-Mar-19	29-Mar-20
Attenuator	S.M. Electronics	SA26B-20	AUY	28-Mar-19	28-Mar-20

TEST DESCRIPTION

The measurement was made using a direct connection between the RF output of the EUT and a spectrum analyzer. The maximum power spectral density measurements was measured using the channels and modes as called out on the following data sheets.

Per the procedure outlined in ANSI C63.10 the peak power spectral density was measured in a 3 kHz RBW.

POWER SPECTRAL DENSITY

element

TbtTx 2019.08.02 XMit 2019.06.11

EUT:	**Wireless Current Sensor**			**Work Order:**	**SCHW0244**
Serial Number:	**808598542**			**Date:**	**26-Aug-19**
Customer:	**Schweitzer Engineering Laboratories, Inc.**			**Temperature:**	**24.1 °C**
Attendees:	**Miralem Cosic**			**Humidity:**	**44.8% RH**
Project:	**None**			**Barometric Pres.:**	**1020 mbar**
Tested by:	**Brandon Hobbs, Jeff Alcoke**	**Power:**	**24VDC**	**Job Site:**	**EV06**

TEST SPECIFICATIONS	**Test Method**
FCC 15.247:2019	ANSI C63.10:2013

COMMENTS

The DC block, attenuator and cable were all accounted for during testing.

DEVIATIONS FROM TEST STANDARD

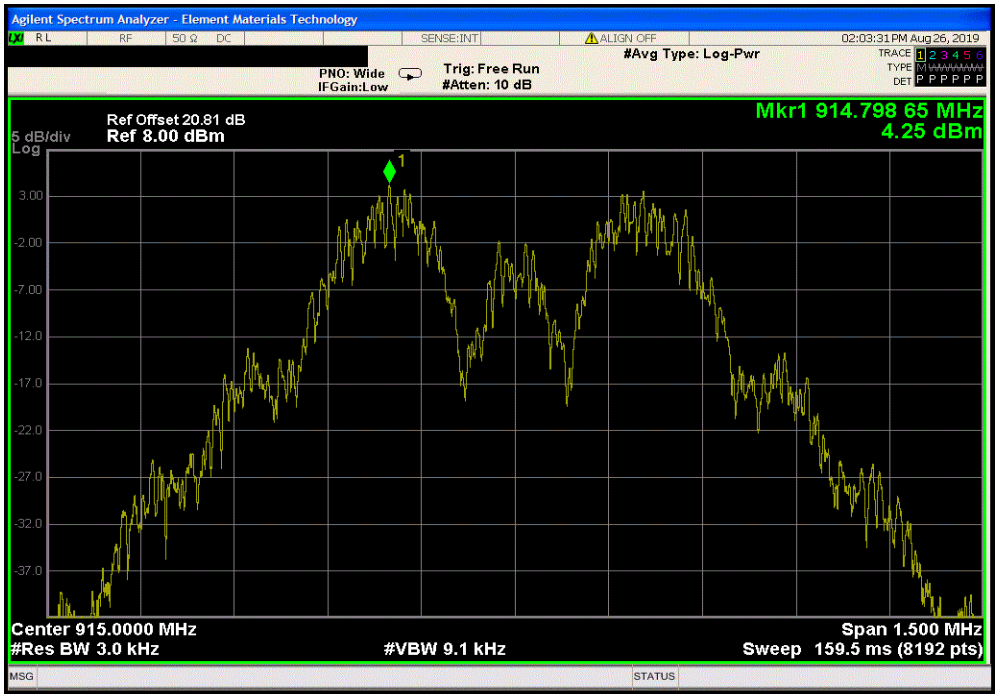
None

Configuration #	**2**	*Signature*

	Value dBm/3kHz	**Limit < dBm/3kHz**	**Results**
DTS 300 kbs Low Channel, 906 MHz	4.278	8	Pass
DTS 300 kbs Mid Channel, 915 MHz	4.246	8	Pass
DTS 300 kbs High Channel, 927 MHz	4.033	8	Pass

DTS 300 kbs Low Channel, 906 MHz						
				Value dBm/3kHz	Limit < dBm/3kHz	Results
				4.278	8	Pass

DTS 300 kbs Mid Channel, 915 MHz						
				Value dBm/3kHz	Limit < dBm/3kHz	Results
				4.246	8	Pass



POWER SPECTRAL DENSITY

DTS 300 kbs High Channel, 927 MHz						
				Value dBm/3kHz	Limit < dBm/3kHz	Results
				4.033	8	Pass