Element Materials Technology

Zeno Lite with Clarity

FCC 15.247:2018

Bluetooth LE (DTS) Radio

Report # ELEM0063

NVLAP LAB CODE: 200630-0

CERTIFICATE OF TEST

Last Date of Test: 2018-05-01
Element Materials Technology
Model: Zeno Lite with Clarity

Radio Equipment Testing

Standards

Specification	Method
FCC 15.247:2018	ANSI C63.10:2013, KDB 558074

Results

Method Clause	Test Description	Applied	Results	Comments
6.2	Powerline Conducted Emissions	No	N/A	Not requested.
6.5, 6.6, 11.12.1, 11.13.2	Spurious Radiated Emissions	Yes	Pass	
11.6	Duty Cycle	No	N/A	Not requested.
11.8.2	Occupied Bandwidth	No	N/A	Not requested.
11.9.1.1	Output Power	No	N/A	Not requested.
11.10.2	Power Spectral Density	No	N/A	Not requested.
11.11	Band Edge Compliance	No	N/A	Not requested.
11.11	Spurious Conducted Emissions	No	N/A	Not requested.

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.

REVISION HISTORY

Revision Number	Description	Date	Page Number
00	None		

ACCREDITATIONS AND AUTHORIZATIONS

United States

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

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

NVLAP - Each laboratory is accredited by NVLAP to ISO 17025

Canada

ISED - Recognized by Innovation, Science and Economic Development Canada as a Certification Body (CB). Certification chambers and Open Area Test Sites are filed with ISED.

European Union

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

Australia/New Zealand

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

Korea

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

Japan

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

Taiwan

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

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

Singapore

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

Israel

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

Hong Kong

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

Vietnam

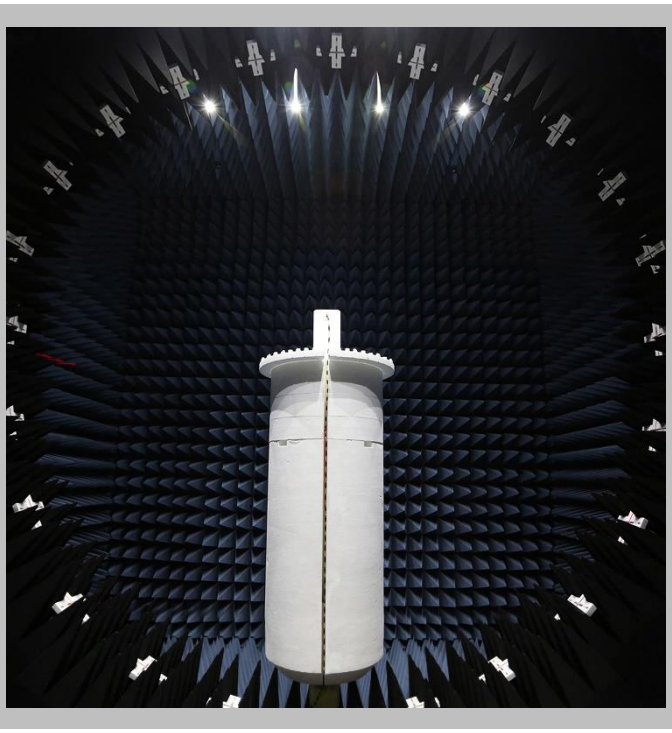
MIC – Recognized by MIC as a CAB for the acceptance of test data.

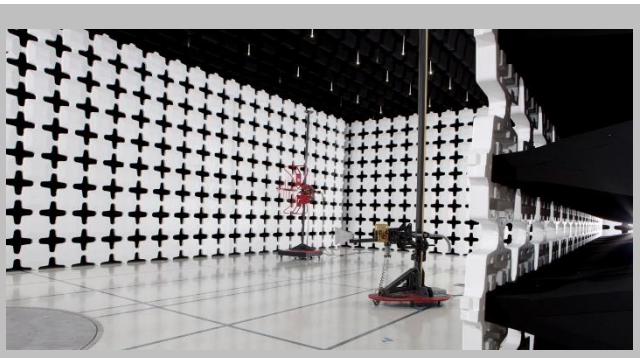
SCOPE

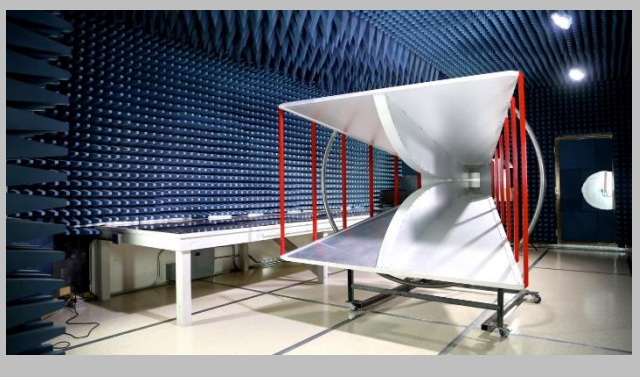
For details on the Scopes of our Accreditations, please visit:
http://portlandcustomer.element.com/ts/scope/scope.htm
http://gsi.nist.gov/global/docs/cabs/designations.html

FACILITIES

California	Minnesota	New York	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 NY01-04 4939 Jordan Rd. Elbridge, NY 13060 (315) 554-8214	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: 200761-0	NVLAP Lab Code: 200630-0	NVLAP Lab Code:201049-0	NVLAP Lab Code: 200629-0
Innovation, Science and Economic Development Canada					
2834B-1, 2834B-3	2834E-1, 2834E-3	N/A	2834D-1, 2834D-*2*	2834G-1	2834F-1
BSMI					
SL2-IN-E-1154R	SL2-IN-E-1152R	N/A	SL2-IN-E-1017	SL2-IN-E-1158R	SL2-IN-E-1153R
VCCI					
A-0029	A-0109	N/A	A-0108	A-0201	A-0110
Recognized Phase I CAB for ACMA, BSMI, IDA, KCC/RRA, MIC, MOC, NCC, OFCA					
US0158	US0175	N/A	US0017	US0191	US0157







MEASUREMENT UNCERTAINTY

TMU.2015.07.10

Measurement Uncertainty

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

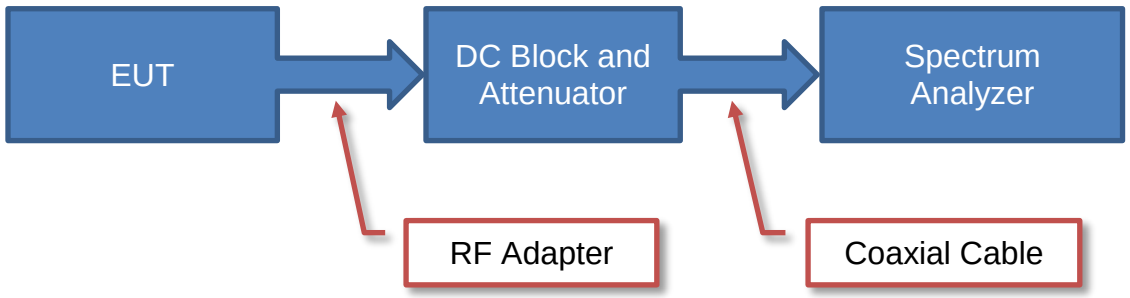
A measurement uncertainty estimation has been performed for each test per our internal quality document QM205.4.6. The estimation is used to compare the measured result with its "true" or theoretically correct value. The expanded measurement uncertainty (K=2) can be found included as part of the applicable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

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

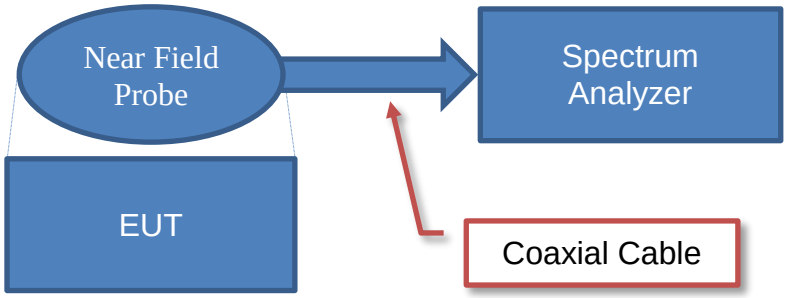
Test	+ MU	- MU
Frequency Accuracy (Hz)	0.0007%	-0.0007%
Amplitude Accuracy (dB)	1.2 dB	-1.2 dB
Conducted Power (dB)	0.3 dB	-0.3 dB
Radiated Power via Substitution (dB)	0.7 dB	-0.7 dB
Temperature (degrees C)	0.7°C	-0.7°C
Humidity (% RH)	2.5% RH	-2.5% RH
Voltage (AC)	1.0%	-1.0%
Voltage (DC)	0.7%	-0.7%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

Test Setup Block Diagrams

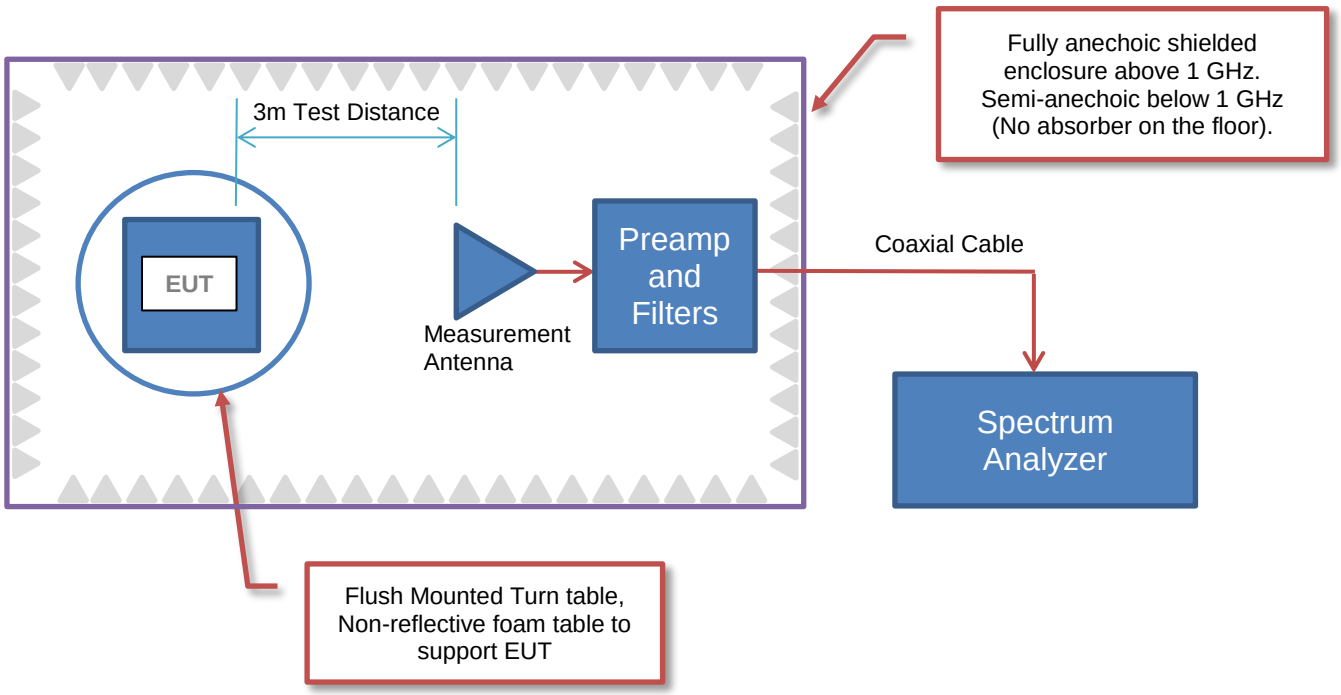
Antenna Port Conducted Measurements



Near Field Test Fixture Measurements



Spurious Radiated Emissions



PRODUCT DESCRIPTION

Client and Equipment Under Test (EUT) Information

Company Name:	Element Materials Technology
Address:	Unit E South Orbital Trading Park Hedon Road
City, State, Zip:	Hull, HU9 1NJ
Test Requested By:	Luke Hardy
Model:	Zeno Lite with Clarity
First Date of Test:	2018-04-26
Last Date of Test:	2018-05-01
Receipt Date of Samples:	2018-04-26
Equipment Design Stage:	Production
Equipment Condition:	No Damage
Purchase Authorization:	Verified

Information Provided by the Party Requesting the Test

Functional Description of the EUT:
Oxygen Concentrator

Testing Objective:
To provide Bluetooth low energy radio testing to FCC 15.247 as requested by the customer

CONFIGURATIONS

Configuration ELEM0063- 1

EUT			
Description	**Manufacturer**	**Model/Part Number**	**Serial Number**
Portable Oxygen Concentrator	Gas Control Equipment	RS-00500	ZE100966

MODIFICATIONS

Equipment Modifications

Item	Date	Test	Modification	Note	Disposition of EUT
1	4/26/2018	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	5/1/2018	Spurious Radiated Emissions	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 2017.12.19

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 BLE

POWER SETTINGS INVESTIGATED

110VAC/60Hz

CONFIGURATIONS INVESTIGATED

ELEM0063 - 1

FREQUENCY RANGE INVESTIGATED

Start Frequency	30 MHz	Stop Frequency	26 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
Cable	ESM Cable Corp.	KMKM-72	EVY	31-Aug-2017	12 mo
Amplifier - Pre-Amplifier	Miteq	AMF-6F-18002650-25-10P	AVU	31-Aug-2017	12 mo
Antenna - Standard Gain	ETS Lindgren	3160-09	AIV	NCR	0 mo
Amplifier - Pre-Amplifier	Miteq	AMF-6F-12001800-30-10P	AVD	30-Nov-2017	12 mo
Antenna - Standard Gain	ETS Lindgren	3160-08	AHV	NCR	0 mo
Cable	None	Standard Gain Horns Cable	EVF	30-Nov-2017	12 mo
Amplifier - Pre-Amplifier	L-3 Narda-MITEQ	AMF-6F-08001200-30-10P	PAO	30-Nov-2017	12 mo
Antenna - Standard Gain	ETS Lindgren	3160-07	AHU	NCR	0 mo
Filter - High Pass	Micro-Tronics	HPM50111	HFO	1-Feb-2018	12 mo
Attenuator	Coaxicom	3910-20	AXZ	28-Feb-2018	12 mo
Cable	N/A	Double Ridge Horn Cables	EVB	29-Nov-2017	12 mo
Amplifier - Pre-Amplifier	Miteq	AMF-3D-00100800-32-13P	PAG	29-Nov-2017	12 mo
Antenna - Double Ridge	ETS Lindgren	3115	AIZ	7-Feb-2018	24 mo
Cable	N/A	Bilog Cables	EVA	30-Nov-2017	12 mo
Amplifier - Pre-Amplifier	Miteq	AM-1616-1000	AOL	30-Nov-2017	12 mo
Antenna - Biconilog	Teseq	CBL 6141B	AXR	30-Jun-2016	24 mo
Analyzer - Spectrum Analyzer	Agilent	E4446A	AAQ	18-Mar-2018	12 mo

TEST DESCRIPTION

The highest gain antenna of each type to be used with the EUT was tested. The EUT was configured for the required transmit 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.

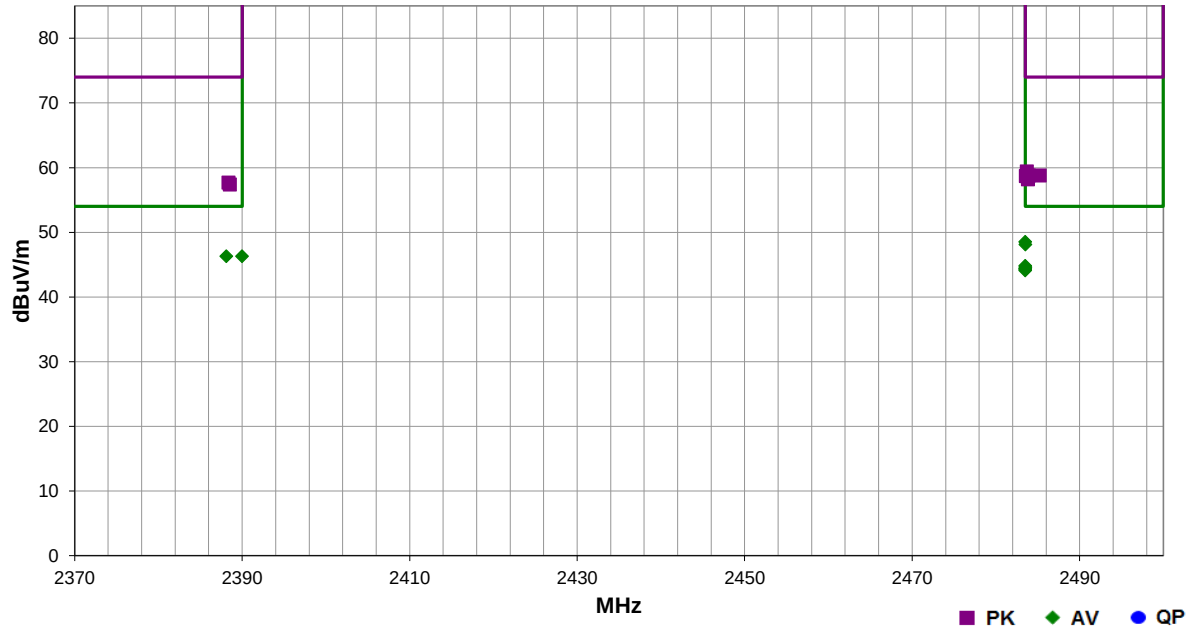
RADIATED EMISSIONS

EmiR5 2018.02.06 PSA-ESCI 2017.12.19

Work Order:	ELEM0063	**Date:**	26-Apr-2018		
Project:	None	**Temperature:**	22.2 °C		
Job Site:	EV01	**Humidity:**	41.4% RH		
Serial Number:	ZE100966	**Barometric Pres.:**	1017 mbar	**Tested by:**	Travis Pow and Rod Peloquin
EUT:	Zeno Lite with Clarity				
Configuration:	1				
Customer:	Element Materials Technology				
Attendees:	None				
EUT Power:	110VAC/60Hz				
Operating Mode:	Continuous Tx BLE				
Deviations:	None				
Comments:	See comments below for EUT orientation and Tx Channel				

Test Specifications	**Test Method**
FCC 15.247:2018	ANSI C63.10:2013

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



Freq (MHz)	Amplitude (dBuV)	Factor (dB)	Antenna Height (meters)	Azimuth (degrees)	Test Distance (meters)	External Attenuation (dB)	Polarity/ Transducer Type	Detector	Distance Adjustment (dB)	Adjusted (dBuV/m)	Spec. Limit (dBuV/m)	Compared to Spec. (dB)	Comments
2483.500	33.0	-4.5	1.5	206.0	3.0	20.0	Horz	AV	0.0	48.5	54.0	-5.5	EUT Horizontal
2483.527	32.6	-4.5	1.0	46.0	3.0	20.0	Vert	AV	0.0	48.1	54.0	-5.9	EUT Horizontal
2388.123	31.2	-4.9	1.0	43.0	3.0	20.0	Horz	AV	0.0	46.3	54.0	-7.7	EUT Horizontal
2390.000	31.2	-4.9	1.0	49.0	3.0	20.0	Vert	AV	0.0	46.3	54.0	-7.7	EUT Horizontal
2483.513	29.3	-4.5	1.0	46.0	3.0	20.0	Vert	AV	0.0	44.8	54.0	-9.2	EUT Horizontal
2483.537	29.1	-4.5	1.4	340.0	3.0	20.0	Horz	AV	0.0	44.6	54.0	-9.4	EUT on Side
2483.517	28.9	-4.5	1.0	207.0	3.0	20.0	Vert	AV	0.0	44.4	54.0	-9.6	EUT on Side
2483.500	28.8	-4.5	1.4	131.0	3.0	20.0	Horz	AV	0.0	44.3	54.0	-9.7	EUT Vertical
2483.513	28.6	-4.5	1.0	63.0	3.0	20.0	Vert	AV	0.0	44.1	54.0	-9.9	EUT Vertical
2483.690	43.9	-4.5	1.5	207.0	3.0	20.0	Horz	PK	0.0	59.4	74.0	-14.6	EUT Horizontal
2485.240	43.2	-4.4	1.0	63.0	3.0	20.0	Vert	PK	0.0	58.8	74.0	-15.2	EUT Vertical
2483.930	43.3	-4.5	1.0	207.0	3.0	20.0	Vert	PK	0.0	58.8	74.0	-15.2	EUT on Side
2483.583	43.2	-4.5	1.0	46.0	3.0	20.0	Vert	PK	0.0	58.7	74.0	-15.3	EUT Horizontal
2483.813	43.1	-4.5	1.4	340.0	3.0	20.0	Horz	PK	0.0	58.6	74.0	-15.4	EUT on Side
2483.833	42.7	-4.5	1.4	131.0	3.0	20.0	Horz	PK	0.0	58.2	74.0	-15.8	EUT Vertical
2388.357	42.6	-4.9	1.0	43.0	3.0	20.0	Horz	PK	0.0	57.7	74.0	-16.3	EUT Horizontal
2388.517	42.3	-4.9	1.0	49.0	3.0	20.0	Vert	PK	0.0	57.4	74.0	-16.6	EUT Horizontal

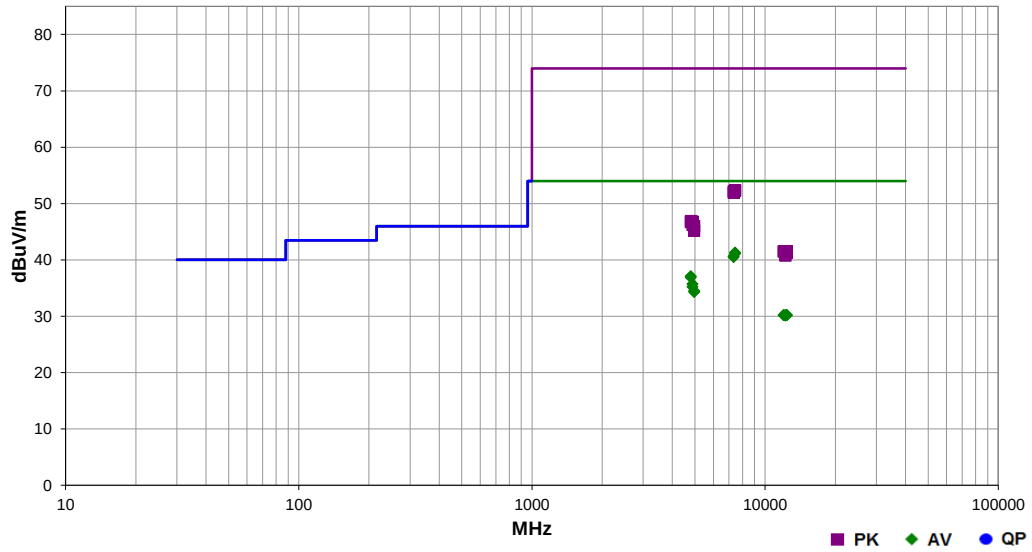
SPURIOUS RADIATED EMISSIONS

EmiR5 2018.02.06 PSA-ESCI 2017.12.19

Work Order:	ELEM0063	**Date:**	1-May-2018		
Project:	None	**Temperature:**	20.5 °C		
Job Site:	EV01	**Humidity:**	42.3% RH		
Serial Number:	ZE100966	**Barometric Pres.:**	1022 mbar	**Tested by:**	Travis Pow and Rod Peloquin
EUT:	Zeno Lite with Clarity				
Configuration:	1				
Customer:	Element Materials Technology				
Attendees:	None				
EUT Power:	110VAC/60Hz				
Operating Mode:	Continuous Tx BLE				
Deviations:	None				
Comments:	See Comments below for EUT orientation and Tx Channel				

Test Specifications	**Test Method**
FCC 15.247:2018	ANSI C63.10:2013

Run #	25	**Test Distance (m)**	3	**Antenna Height(s)**	1 to 4(m)	**Results**	Pass



Freq (MHz)	Amplitude (dBuV)	Factor (dB)	Antenna Height (meters)	Azimuth (degrees)	Test Distance (meters)	External Attenuation (dB)	Polarity/ Transducer Type	Detector	Distance Adjustment (dB)	Adjusted (dBuV/m)	Spec. Limit (dBuV/m)	Compared to Spec. (dB)	Comments
7439.193	28.3	13.0	1.6	49.0	3.0	0.0	Horz	AV	0.0	41.3	54.0	-12.7	EUT on Side, High Ch. 2480 MHz
7439.930	28.1	13.0	3.8	321.0	3.0	0.0	Vert	AV	0.0	41.1	54.0	-12.9	EUT Horizontal, High Ch. 2480 MHz
7319.010	28.4	12.2	1.0	5.0	3.0	0.0	Vert	AV	0.0	40.6	54.0	-13.4	EUT Horizontal, Mid Ch. 2442 MHz
7319.703	28.3	12.2	1.0	360.0	3.0	0.0	Horz	AV	0.0	40.5	54.0	-13.5	EUT on Side, Mid Ch. 2442 MHz
4803.995	33.3	3.8	2.7	176.0	3.0	0.0	Vert	AV	0.0	37.1	54.0	-16.9	EUT Horizontal, Low Ch. 2402 MHz
4803.737	33.1	3.8	1.0	206.0	3.0	0.0	Horz	AV	0.0	36.9	54.0	-17.1	EUT on Side, Low Ch. 2402 MHz
4883.903	30.6	5.1	1.1	184.0	3.0	0.0	Vert	AV	0.0	35.7	54.0	-18.3	EUT Horizontal, Mid Ch. 2442 MHz
4883.983	30.1	5.1	1.2	217.0	3.0	0.0	Horz	AV	0.0	35.2	54.0	-18.8	EUT on Side, Mid Ch. 2442 MHz
4959.950	29.3	5.2	1.0	188.0	3.0	0.0	Vert	AV	0.0	34.5	54.0	-19.5	EUT Horizontal, High Ch. 2480 MHz
4959.930	29.1	5.2	1.0	214.0	3.0	0.0	Horz	AV	0.0	34.3	54.0	-19.7	EUT on Side, High Ch. 2480 MHz
7439.333	39.4	13.0	3.8	321.0	3.0	0.0	Vert	PK	0.0	52.4	74.0	-21.6	EUT Horizontal, High Ch. 2480 MHz
7439.710	39.3	13.0	1.6	49.0	3.0	0.0	Horz	PK	0.0	52.3	74.0	-21.7	EUT on Side, High Ch. 2480 MHz
7321.000	40.0	12.2	1.0	360.0	3.0	0.0	Horz	PK	0.0	52.2	74.0	-21.8	EUT on Side, Mid Ch. 2442 MHz
7320.563	39.7	12.2	1.0	5.0	3.0	0.0	Vert	PK	0.0	51.9	74.0	-22.1	EUT Horizontal, Mid Ch. 2442 MHz
12009.550	29.2	1.0	1.0	224.0	3.0	0.0	Horz	AV	0.0	30.2	54.0	-23.8	EUT on Side, Low Ch. 2402 MHz
12009.800	29.2	1.0	1.9	258.0	3.0	0.0	Vert	AV	0.0	30.2	54.0	-23.8	EUT Horizontal, Low Ch. 2402 MHz
12209.530	29.2	1.0	1.6	57.0	3.0	0.0	Vert	AV	0.0	30.2	54.0	-23.8	EUT Horizontal, Mid Ch. 2442 MHz
12399.010	29.0	1.2	1.0	251.0	3.0	0.0	Vert	AV	0.0	30.2	54.0	-23.8	EUT Horizontal, High Ch. 2480 MHz
12399.240	29.0	1.2	1.0	72.0	3.0	0.0	Horz	AV	0.0	30.2	54.0	-23.8	EUT on Side, High Ch. 2480 MHz
12209.340	29.1	1.0	1.0	74.0	3.0	0.0	Horz	AV	0.0	30.1	54.0	-23.9	EUT on Side, Mid Ch. 2442 MHz
4804.273	43.1	3.8	1.0	206.0	3.0	0.0	Horz	PK	0.0	46.9	74.0	-27.1	EUT on Side, Low Ch. 2402 MHz
4884.610	41.7	5.1	1.1	184.0	3.0	0.0	Vert	PK	0.0	46.8	74.0	-27.2	EUT Horizontal, Mid Ch. 2442 MHz
4803.740	42.9	3.8	2.7	176.0	3.0	0.0	Vert	PK	0.0	46.7	74.0	-27.3	EUT Horizontal, Low Ch. 2402 MHz
4884.690	41.1	5.1	1.2	217.0	3.0	0.0	Horz	PK	0.0	46.2	74.0	-27.8	EUT on Side, Mid Ch. 2442 MHz
4960.433	40.8	5.2	1.0	188.0	3.0	0.0	Vert	PK	0.0	46.0	74.0	-28.0	EUT Horizontal, High Ch. 2480 MHz
4960.360	40.0	5.2	1.0	214.0	3.0	0.0	Horz	PK	0.0	45.2	74.0	-28.8	EUT on Side, High Ch. 2480 MHz
12010.210	40.5	1.0	1.0	224.0	3.0	0.0	Horz	PK	0.0	41.5	74.0	-32.5	EUT on Side, Low Ch. 2402 MHz
12010.500	40.5	1.0	1.9	258.0	3.0	0.0	Vert	PK	0.0	41.5	74.0	-32.5	EUT Horizontal, Low Ch. 2402 MHz
12399.760	40.3	1.2	1.0	72.0	3.0	0.0	Horz	PK	0.0	41.5	74.0	-32.5	EUT on Side, High Ch. 2480 MHz
12399.440	40.1	1.2	1.0	251.0	3.0	0.0	Vert	PK	0.0	41.3	74.0	-32.7	EUT Horizontal, High Ch. 2480 MHz
12209.480	39.8	1.0	1.0	74.0	3.0	0.0	Horz	PK	0.0	40.8	74.0	-33.2	EUT on Side, Mid Ch. 2442 MHz
12210.820	39.8	1.0	1.6	57.0	3.0	0.0	Vert	PK	0.0	40.8	74.0	-33.2	EUT Horizontal, Mid Ch. 2442 MHz