TSI, Incorporated

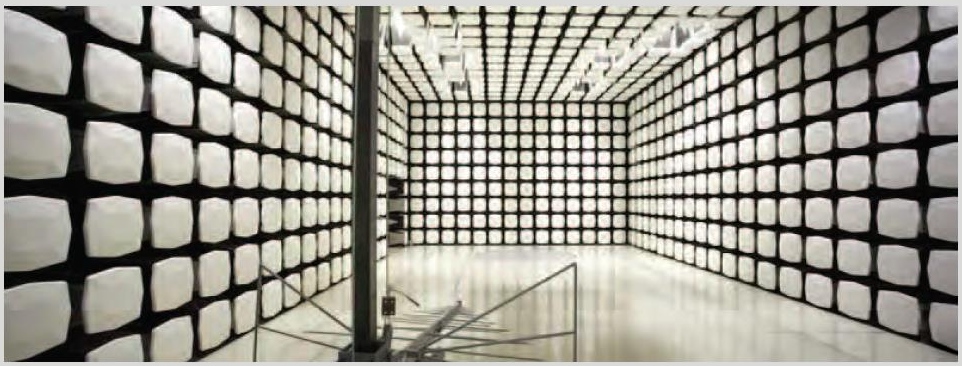
O3 Sensor; CO Sensor; TVOC Sensor

NH3 Sensor; CH2O Sensor; CL2 Sensor

Bluetooth Low Energy (DTS) Radio

FCC 15.247:2023, RSS-247 issue 3:2023
RSS-Gen Issue 5:2018+A1:2019+A2:2021

Report: TSIN0212.1 Rev. 1, Issue Date: February 5, 2024



CERT #3310.05

TABLE OF CONTENTS

element
2023.04.17

Section	Page Number

CERTIFICATE OF TEST

Last Date of Test: January 11, 2024
TSI, Incorporated
EUT: O3 Sensor; CO Sensor; TVOC Sensor
NH3 Sensor; CH2O Sensor; CL2 Sensor

Radio Equipment Testing

Standards

Specification	Method
FCC 15.247:2024	ANSI C63.10:2013
RSS-247 Issue 3:2023	
RSS-Gen Issue 5:2018+A1:2019+A2:2021	

Guidance

FCC KDB 558074 v05r02:2019
Notice 2021 - CEB0001

Results

Test Description	Result	FCC Section(s)	RSS Section(s)	ANSI C63.10 Section(s)	Comments
Powerline Conducted Emissions	N/A	15.207	RSS-Gen 8.8	6.2	Not included for a C2PC related to depopulation of components
Duty Cycle	Evaluated	KDB 558074 -6.0	RSS-Gen 3.2	11.6	No standard specified pass/fail criteria for this test
DTS Bandwidth (6 dB)	N/A	15.247(a)(2), KDB 558074 -8.2	RSS-247 5.2(a)	11.8.2	Not included for a C2PC related to depopulation of components
Occupied Bandwidth (99%)	Evaluated	KDB 558074 -2.1	RSS-Gen 6.7	6.9.3	No standard specified pass/fail criteria for this test
Output Power	Pass	15.247(b)(3), KDB 558074 -8.3.1	RSS-247 5.4(d, f), RSS-Gen 6.12	11.9.1.1	
Equivalent Isotropic Radiated Power	Pass	15.247(b)(3), KDB 558074 -8.3.1	RSS-247 5.4(d, f), RSS-Gen 6.12	11.9.1.1	
Power Spectral Density	N/A	15.247(e), KDB 558074 -8.4	RSS-247 5.2(b)	11.10.2	Not included for a C2PC related to depopulation of components
Band Edge Compliance	N/A	15.247(d), KDB 558074 -8.5	RSS-247 5.5	11.11	Not included for a C2PC related to depopulation of components
Spurious Conducted Emissions	N/A	15.247(d), KDB 558074 -8.5	RSS-247 5.5	11.11	Not included for a C2PC related to depopulation of components
Spurious Radiated Emissions	Pass	15.247(d), KDB 558074 - 8.6, 8.7	RSS-247 5.5, RSS-Gen 6.13, 8.10	11.12.1, 11.13.2, 6.5, 6.6	

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.

CERTIFICATE OF TEST

Spurious Radiated Emissions - Simultaneous Transmissions	Pass	15.247(d), KDB 558074 - 8.6, 8.7	11.12.1, 11.13.2, 6.5, 6.6	N/A	

Deviations From Test Standards

None

Approved By:

Eric Brandon, Department 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	Corrected antenna gain value	2024-02-05	
01	Added radio standard details to Cover Page	2024-02-05	1
01	Added ISED standard details to Spurious Radiated Emissions datasheets	2024-02-05	Various

ACCREDITATIONS AND AUTHORIZATIONS

element
2021.09.01

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 - Each laboratory is accredited by A2LA to ISO / IEC 17025, and as a product certifier to ISO / IEC 17065 which allows Element to certify transmitters to FCC and IC specifications.

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 – Recognized as an EU Notified Body validated for the EMCD and RED Directives.

United Kingdom

BEIS – Recognized by the UK as an Approved Body under the UK Radio Equipment and UK EMC Regulations.

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:

California Minnesota Oregon Texas Washington

FACILITIES

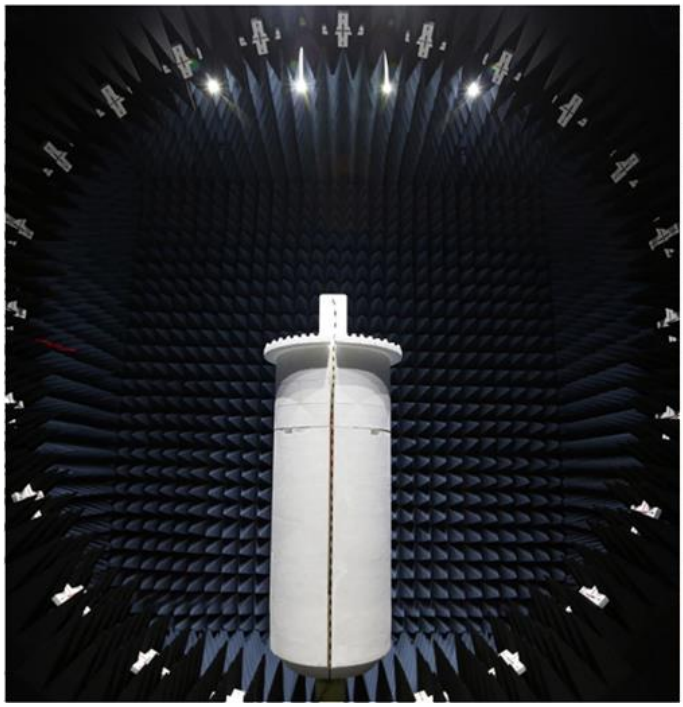
element
2023.09.21

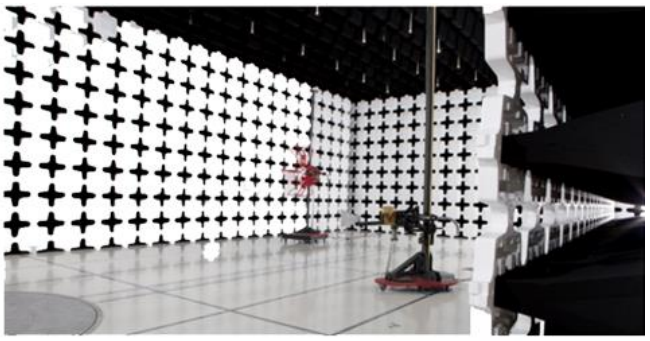
Testing was performed at the following location(s)

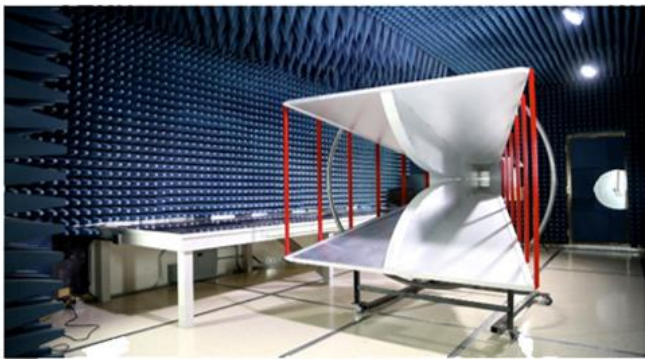
	Location	Labs (1)	Address	A2LA (2)	ISED (3)	BSMI (4)	VCCI (5)	CAB (6)	FDA (7)
☐	California	OC01-17	41 Tesla Irvine, CA 92618 (949) 861-8918	3310.04	2834B	SL2-IN-E-1154R	A-0029	US0158	TL-55
☒	Minnesota	MN01-11	9349 W Broadway Ave. Brooklyn Park, MN 55445 (612) 638-5136	3310.05	2834E	SL2-IN-E-1152R	A-0109	US0175	TL-57
☐	Oregon	EV01-12	6775 NE Evergreen Pkwy #400 Hillsboro, OR 97124 (503) 844-4066	3310.02	2834D	SL2-IN-E-1017	A-0108	US0017	TL-56
☐	Texas	TX01-09	3801 E Plano Pkwy Plano, TX 75074 (469) 304-5255	3310.03	2834G	SL2-IN-E-1158R	A-0201	US0191	TL-54
☐	Washington	NC01-05	19201 120th Ave NE Bothell, WA 98011 (425) 984-6600	3310.06	2834F	SL2-IN-E-1153R	A-0110	US0157	TL-67
☐	Offsite	N/A	See Product Description	N/A	N/A	N/A	N/A	N/A	N/A

See data sheets for specific labs

(1) The lab designations denote individual rooms within each location. (OC01, OC02, OC03, etc.)
(2) A2LA Certificate No.
(3) ISED Company No.
(4) BSMI No.
(5) VCCI Site Filing No.
(6) CAB Identifier. Recognized Phase I CAB for ISED, ACMA, BSMI, IDA, KCC/RRA, MIC, MOC, NCC, OFCA
(7) FDA ASCA No.







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 in the table below. A lab specific value may also be found in the applicable test description section. 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)	3.2 dB	-3.2 dB

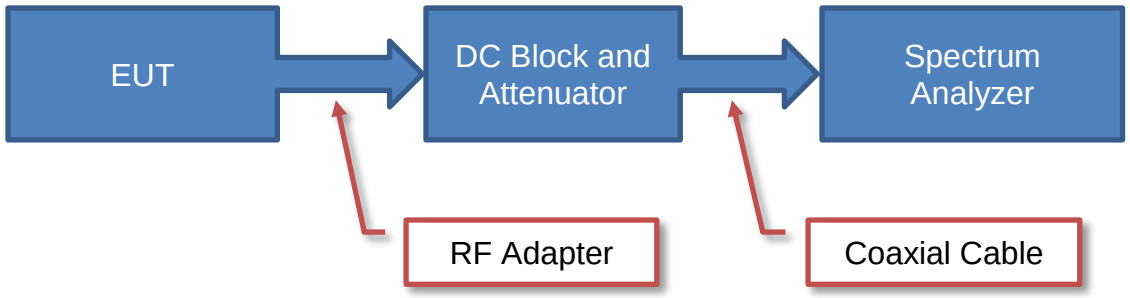
TEST SETUP BLOCK DIAGRAMS

Measurement Bandwidths

Frequency Range (MHz)	Peak Data (kHz)	Quasi-Peak Data (kHz)	Average Data (kHz)
0.01 - 0.15	1.0	0.2	0.2
0.15 - 30.0	10.0	9.0	9.0
30.0 - 1000	100.0	120.0	120.0
Above 1000	1000.0	N/A	1000.0

Unless otherwise stated, measurements were made using the bandwidths and detectors specified. No video filter was used.

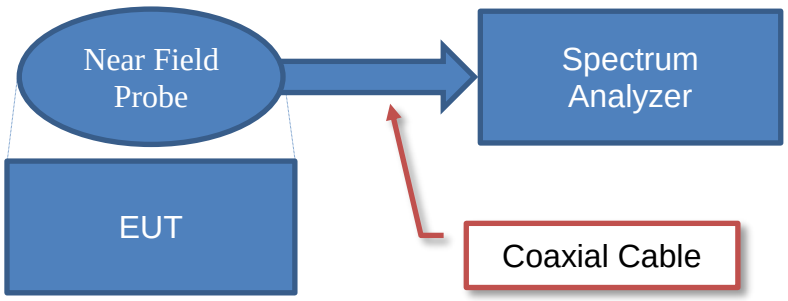
Antenna Port Conducted Measurements



Sample Calculation (logarithmic units)

Measured Value		Measured Level		Reference Level Offset
71.2	=	42.6	+	28.6

Near Field Test Fixture Measurements

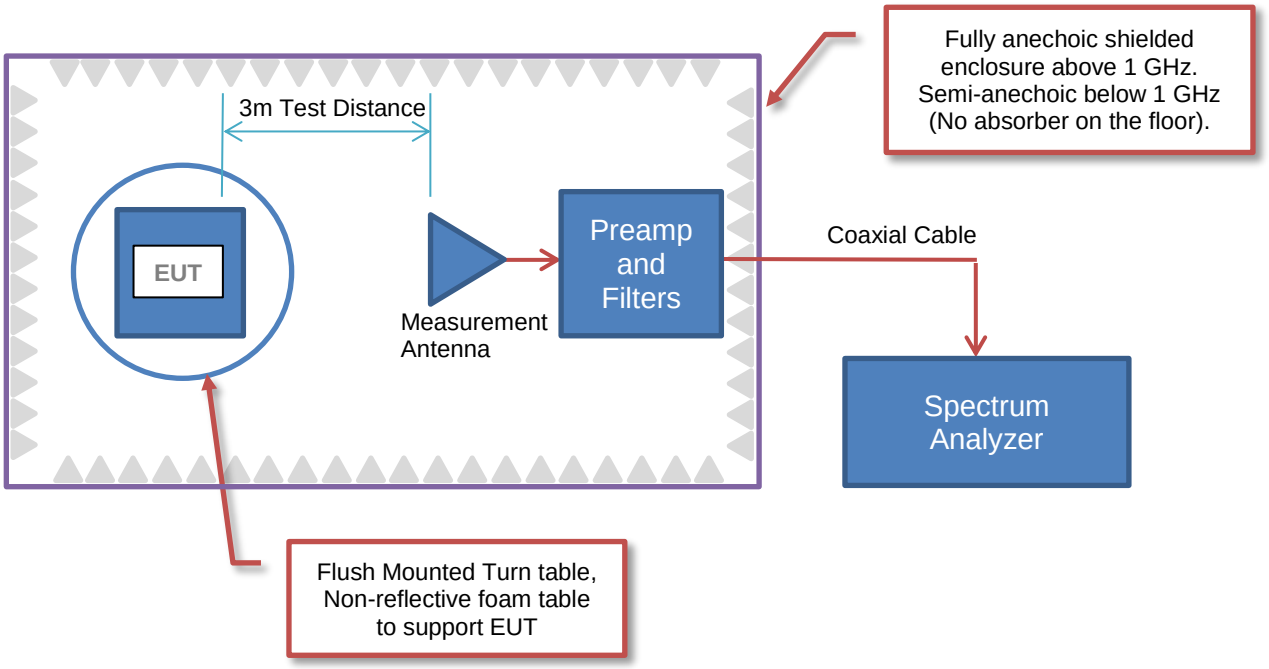


Sample Calculation (logarithmic units)

Measured Value		Measured Level		Reference Level Offset
71.2	=	42.6	+	28.6

TEST SETUP BLOCK DIAGRAMS

Emissions Measurements



Sample Calculation (logarithmic units)

Radiated Emissions:

Measured Level (Amplitude)		Factor: Antenna Factor		Factor: Cable Factor		Factor: Amplifier Gain		Distance Adjustment Factor		External Attenuation		Field Strength
42.6	+	28.6	+	3.1	-	40.8	+	0.0	+	0.0	=	**33.5**

Conducted Emissions:

Measured Level (Amplitude)		Factor: Transducer Factor		Factor: Cable Factor		External Attenuation		Adjusted Level
26.7	+	0.3	+	0.1	+	20.0	=	**47.1**

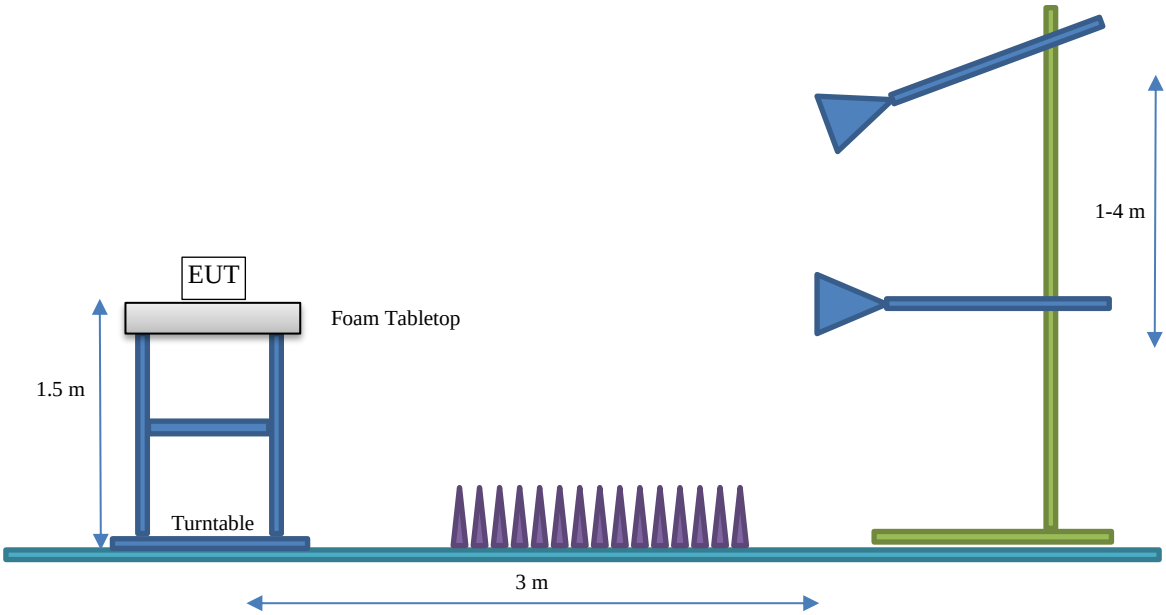
Radiated Power (ERP/EIRP) – Substitution Method:

Measured Level into Substitution Antenna (Amplitude dBm)		Substitution Antenna Factor (dBi)		EIRP to ERP (if applicable)		Measured power (dBm ERP/EIRP)
10.0	+	6.0	-	2.15	=	**13.9/16.0**

TEST SETUP BLOCK DIAGRAMS

Bore Sighting (>1GHz)

The diameter of the illumination area is the dimension of the line tangent to the EUT formed by 3 dB beamwidth of the measurement antenna at the measurement distance. At a 3 meter test distance, the diameter of the illumination area was 3.8 meters at 1 GHz and greater than 2.1 meters up to 6 GHz. Above 1 GHz, when required by the measurement standard, the antenna is pointed for both azimuth and elevation to maintain the receive antenna within the cone of radiation from the EUT. The specified measurement detectors were used for comparison of the emissions to the peak and average specification limits.



PRODUCT DESCRIPTION

Client and Equipment under Test (EUT) Information

Company Name:	TSI, Incorporated
Address:	500 Cardigan Road
City, State, Zip:	Shoreview, MN 55126
Test Requested By:	Jared Hansen
EUT:	O3 Sensor; CO Sensor; TVOC Sensor NH3 Sensor; CH2O Sensor; CL2 Sensor
First Date of Test:	November 30, 2023
Last Date of Test:	January 11, 2024
Receipt Date of Samples:	November 30, 2023
Equipment Design Stage:	Prototype
Equipment Condition:	No Damage
Purchase Authorization:	Verified

Information Provided by the Party Requesting the Test

Functional Description of the EUT:
This product is a survey instrument used by IAQ professionals to sample air quality inside buildings. The tVOC parts-per-billion (ppb) sensor measures the concentration of volatile hydrocarbons (benzene, alcohol, acetone, toluene, etc.) in the ambient air.

Testing Objective:
To demonstrate compliance of the Bluetooth radio to FCC 15.247/RSS-247 requirements.

POWER SETTINGS AND ANTENNAS

The power settings, antenna gain value(s) and cable loss (if applicable) used for the testing contained in this report were provided by the customer and will affect the validity of the results. Element assumes no responsibility for the accuracy of this information. The power settings below reflect the maximum power that the EUT is allowed to transmit at during normal operation.

ANTENNA GAIN (dBi)

Type	Provided by:	Frequency Range (MHz)	Gain (dBi)
PCB Trace on module	ProAnt	2400-2483.5	2.0

The EUT was tested using the power settings provided by the manufacturer which were based upon:

☐ Test software settings Test software/firmware installed on EUT: Direct Test Mode 1.0
☒ Rated power settings

SETTINGS FOR ALL TESTS IN THIS REPORT

Modulation Types / Data Rates	Channel Position	Frequency Range (MHz)	Power Setting
BLE/GFSK 1 Mbps, 2 Mbps, 125kbps, 500 kbps	Low, 2402 MHz Mid, 2442 MHz High, 2480 MHz	2400-2483.5	0 dBm (-4 dBm for Duty Cycle and Occupied Bandwidth)

CONFIGURATIONS

Configuration TSIN0212-7

EUT			
Description	**Manufacturer**	**Model/Part Number**	**Serial Number**
CO	TSI, Incorporated	7591-06	814012335009

Configuration TSIN0212-8

EUT			
Description	**Manufacturer**	**Model/Part Number**	**Serial Number**
O3	TSI, Incorporated	7591-08	8014062335005

Configuration TSIN0212-9

EUT			
Description	**Manufacturer**	**Model/Part Number**	**Serial Number**
CH2O	TSI, Incorporated	7591-07	14092342003

Peripherals in Test Setup Boundary			
Description	**Manufacturer**	**Model/Part Number**	**Serial Number**
Laptop	Dell	Lattitude 5400	GKJN2R2

Cables					
Cable Type	**Shield**	**Length (m)**	**Ferrite**	**Connection 1**	**Connection 2**
USB Cable	Yes	1.8 m	No	Laptop	Sensor

CONFIGURATIONS

Configuration TSIN0212-10

EUT			
Description	**Manufacturer**	**Model/Part Number**	**Serial Number**
TVOC sensor	TSI, Incorporated	7591-03	14082342004

Configuration TSIN0212-11

EUT			
Description	**Manufacturer**	**Model/Part Number**	**Serial Number**
NH3	TSI, Incorporated	7591-11	14032343008

Configuration TSIN0212-12

EUT			
Description	**Manufacturer**	**Model/Part Number**	**Serial Number**
CL2	TSI, Incorporated	7591-10	14002342002

Configuration TSIN0212-13

EUT			
Description	**Manufacturer**	**Model/Part Number**	**Serial Number**
CH2O	TSI, Incorporated	7591-07	8014092335005

CONFIGURATIONS

Configuration TSIN0220-1

EUT			
Description	**Manufacturer**	**Model/Part Number**	**Serial Number**
TVOC sensor	TSI, Incorporated	7591-03	Conducted #1

Peripherals in Test Setup Boundary			
Description	**Manufacturer**	**Model/Part Number**	**Serial Number**
Laptop	Dell	Precision 3561	G5LJML3

Cables					
Cable Type	**Shield**	**Length (m)**	**Ferrite**	**Connection 1**	**Connection 2**
USB Cable	Yes	1.85 m	No	Laptop	IAQ Module

MODIFICATIONS

Equipment Modifications

Item	Date	Test	Modification	Note	Disposition of EUT
1	2023-11-30	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	2023-12-01	Duty Cycle	Tested as delivered to test Station.	No EMI suppression devices were added or modified during this test.	EUT remained at Element following the test.
3	2023-12-01	Occupied Bandwidth (99%)	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	2024-01-11	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.
5	2024-01-11	Equivalent Isotropic Radiated Power	Tested as delivered to test Station.	No EMI suppression devices were added or modified during this test.	Scheduled testing was completed.

DUTY CYCLE

element
TbtTx 2023.11.29.0
WTD.2023.10.23.0

TEST DESCRIPTION

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 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 duty cycle was calculated by dividing the transmission pulse duration (T) by the total period of a single on and total off time.

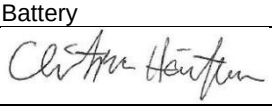
If the transmit duty cycle < 98 percent, burst gating may have been used during some of the other tests in this report to only take the measurement during the burst duration.

TEST EQUIPMENT

Description	Manufacturer	Model	ID	Last Cal.	Cal. Due
Analyzer - Spectrum Analyzer	Keysight	N9010A	AFM	2023-05-01	2024-05-01
Cable	Micro-Coax	UFD150A-1-0720-200200	MNL	2023-09-05	2024-09-05
Generator - Signal	Agilent	N5183A	TIK	2022-01-24	2025-01-24
Attenuator	Fairview Microwave	SA4014-20	AQI	2023-09-05	2024-09-05
Block - DC	Fairview Microwave	SD3379	ANH	2023-09-05	2024-09-05

DUTY CYCLE

element
TbtTx 2023.11.29.0
WTD.2023.10.23.0

EUT:	O3 Sensor	Work Order:	TSIN0212
Serial Number:	14092342003	Date:	2023-12-01
Customer:	TSI, Incorporated	Temperature:	22.8°C
Attendees:	Micah Larson	Relative Humidity:	24.2%
Customer Project:	None	Bar. Pressure (PMSL):	1014 mbar
Tested By:	Christopher Heintzelman	Job Site:	MN11
Power:	Battery	Configuration:	TSIN0212-9
Signature:			

TEST SPECIFICATIONS

Specification:	Method:
FCC 15.247:2023	ANSI C63.10:2013
RSS-247 Issue 3:2023	ANSI C63.10:2013

COMMENTS

Reference level offset includes measurement cable, attenuator, and DC block.
Power setting -4dBm.

DEVIATIONS FROM TEST STANDARD

None

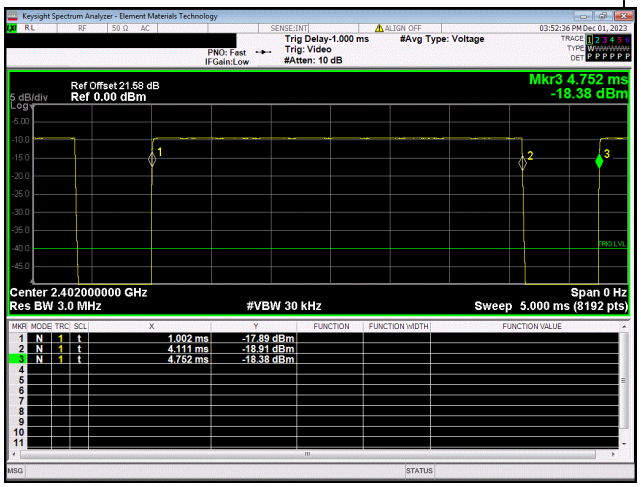
TEST RESULTS

	Pulse Width	Period	Number of Pulses	Value (%)	Limit N/A ()	Results
BLE/GFSK 125 kbps						
Low Channel, 2402 MHz	3.108 ms	3.75 ms	1	82.9	N/A	N/A
	N/A	N/A	5	N/A	N/A	N/A
Mid Channel, 2442 MHz	3.109 ms	3.75 ms	1	82.9	N/A	N/A
	N/A	N/A	5	N/A	N/A	N/A
High Channel, 2480 MHz	3.108 ms	3.75 ms	1	82.9	N/A	N/A
	N/A	N/A	5	N/A	N/A	N/A
BLE/GFSK 500 kbps						
Low Channel, 2402 MHz	1.08 ms	1.875 ms	1	57.6	N/A	N/A
	N/A	N/A	5	N/A	N/A	N/A
Mid Channel, 2442 MHz	1.075 ms	1.872 ms	1	57.4	N/A	N/A
	N/A	N/A	5	N/A	N/A	N/A
High Channel, 2480 MHz	1.08 ms	1.875 ms	1	57.6	N/A	N/A
	N/A	N/A	5	N/A	N/A	N/A
BLE/GFSK 1 Mbps						
Low Channel, 2402 MHz	413.8 us	625.1 us	1	66.2	N/A	N/A
	N/A	N/A	5	N/A	N/A	N/A
Mid Channel, 2442 MHz	413 us	625.1 us	1	66.1	N/A	N/A
	N/A	N/A	5	N/A	N/A	N/A
High Channel, 2480 MHz	413.1 us	625.1 us	1	66.1	N/A	N/A
	N/A	N/A	5	N/A	N/A	N/A
BLE/GFSK 2 Mbps						
Low Channel, 2402 MHz	228.8 us	625.1 us	1	36.6	N/A	N/A
	N/A	N/A	5	N/A	N/A	N/A

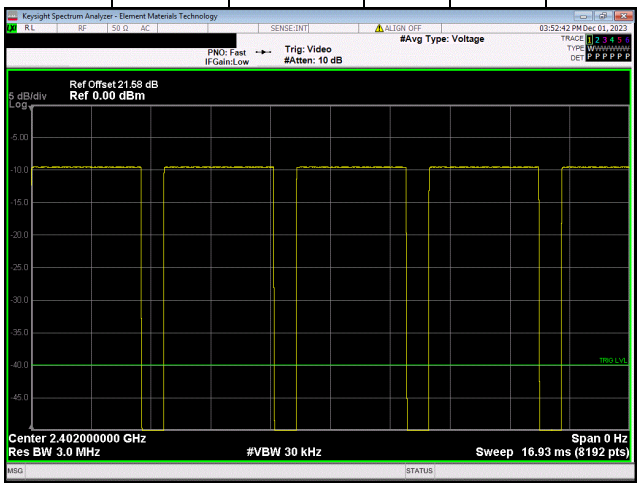
DUTY CYCLE

element
TbtTx 2023.11.29.0
WTD.2023.10.23.0

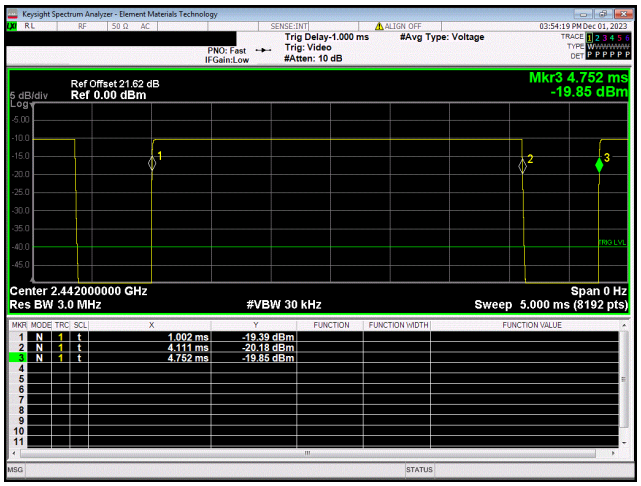
	Pulse Width	Period	Number of Pulses	Value (%)	Limit N/A ()	Results
Mid Channel, 2442 MHz	227.7 us	625 us	1	36.4	N/A	N/A
	N/A	N/A	5	N/A	N/A	N/A
High Channel, 2480 MHz	227.2 us	625.1 us	1	36.3	N/A	N/A
	N/A	N/A	5	N/A	N/A	N/A



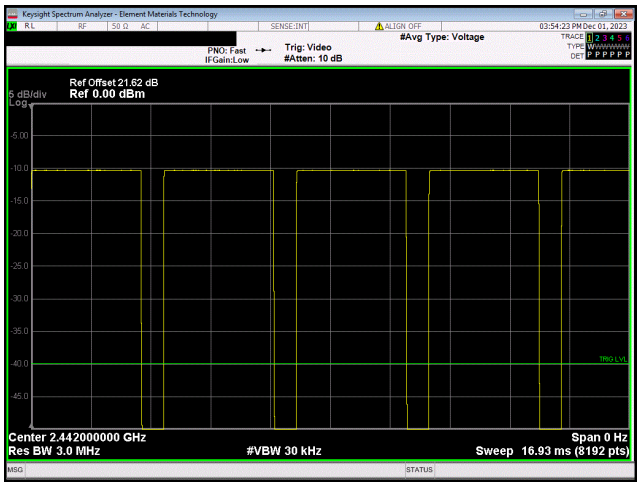
BLE/GFSK 125 kbps
Low Channel, 2402 MHz



BLE/GFSK 125 kbps
Low Channel, 2402 MHz



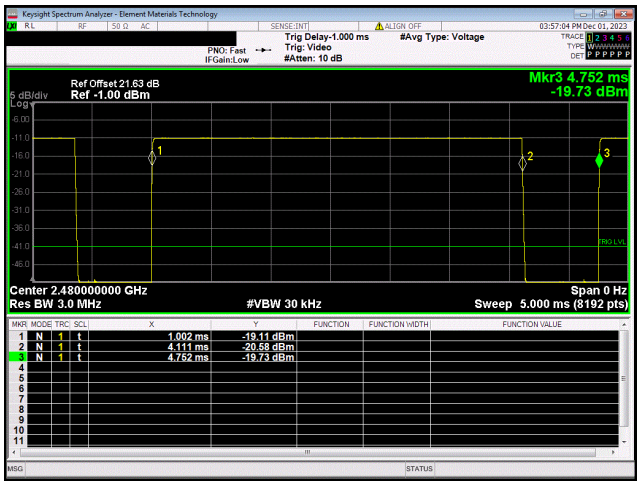
BLE/GFSK 125 kbps
Mid Channel, 2442 MHz



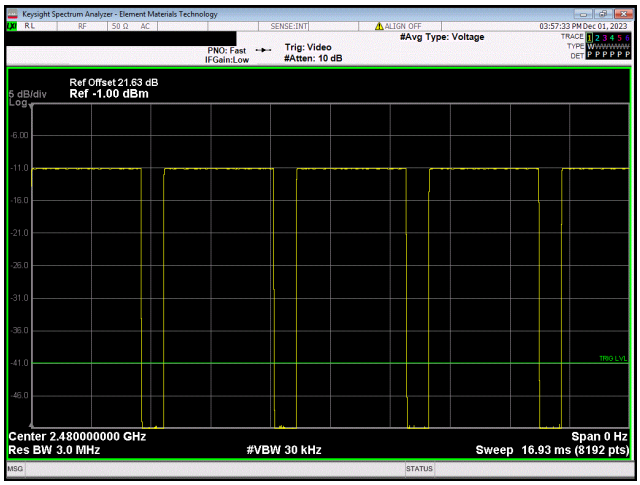
BLE/GFSK 125 kbps
Mid Channel, 2442 MHz

DUTY CYCLE

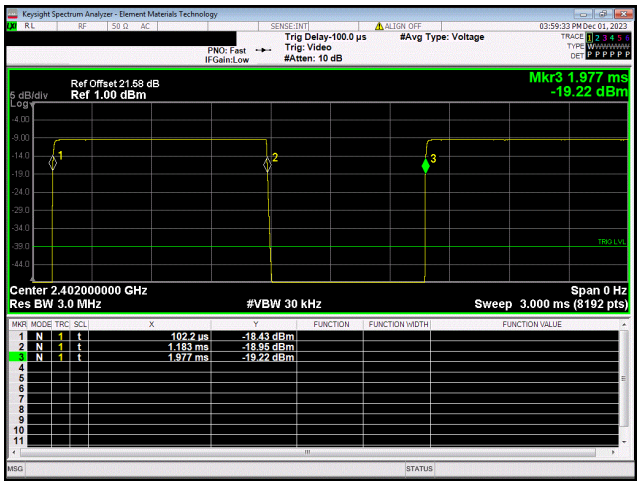
element
TbtTx 2023.11.29.0
WTD.2023.10.23.0



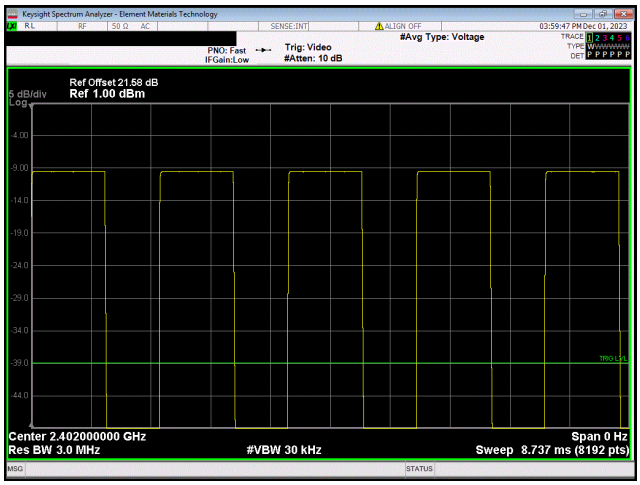
BLE/GFSK 125 kbps
High Channel, 2480 MHz



BLE/GFSK 125 kbps
High Channel, 2480 MHz



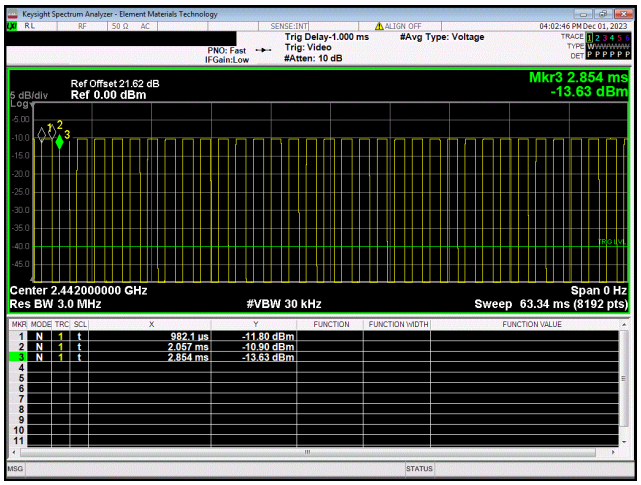
BLE/GFSK 500 kbps
Low Channel, 2402 MHz



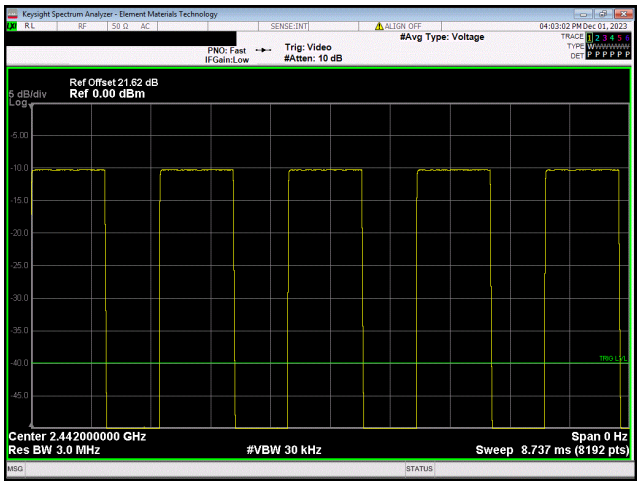
BLE/GFSK 500 kbps
Low Channel, 2402 MHz

DUTY CYCLE

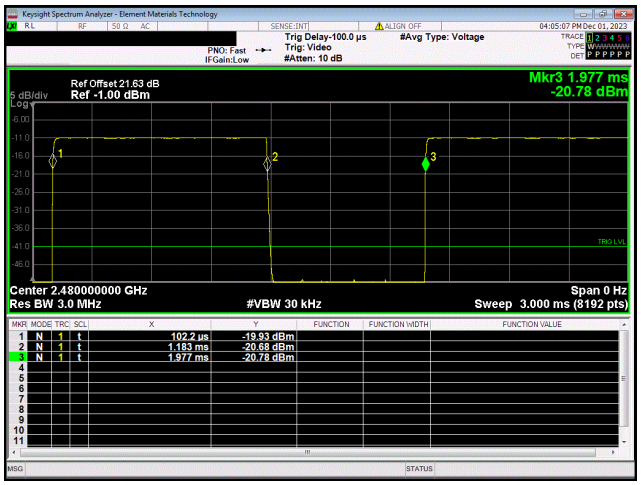
element
TbtTx 2023.11.29.0
WTD.2023.10.23.0



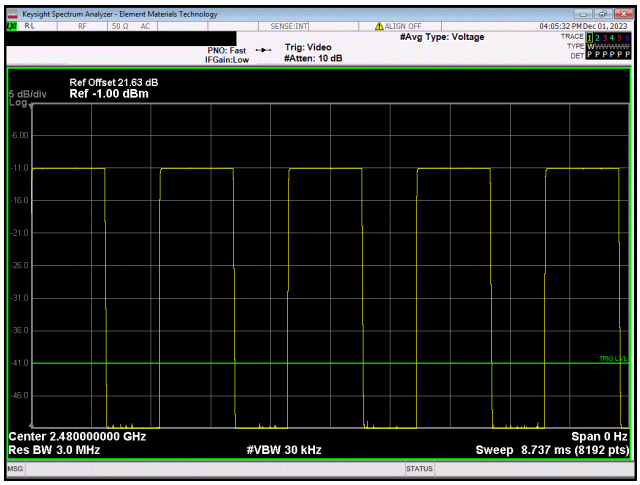
BLE/GFSK 500 kbps
Mid Channel, 2442 MHz



BLE/GFSK 500 kbps
Mid Channel, 2442 MHz



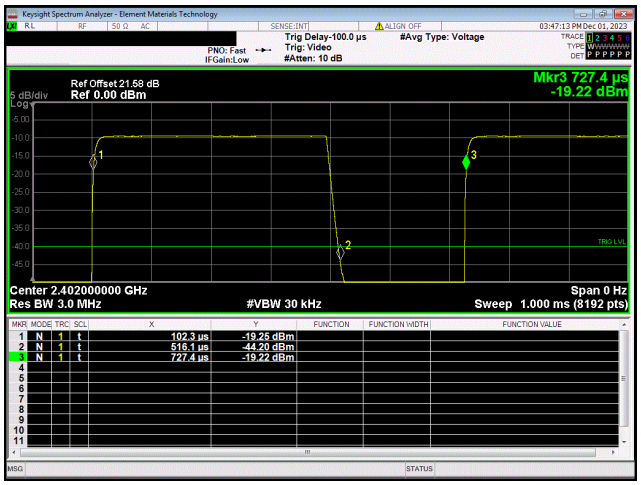
BLE/GFSK 500 kbps
High Channel, 2480 MHz



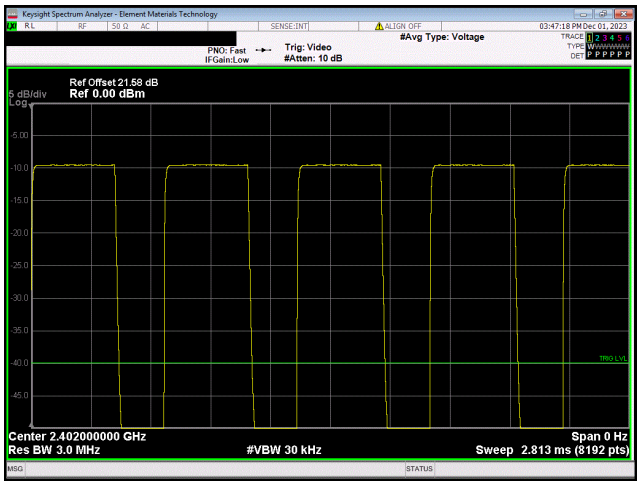
BLE/GFSK 500 kbps
High Channel, 2480 MHz

DUTY CYCLE

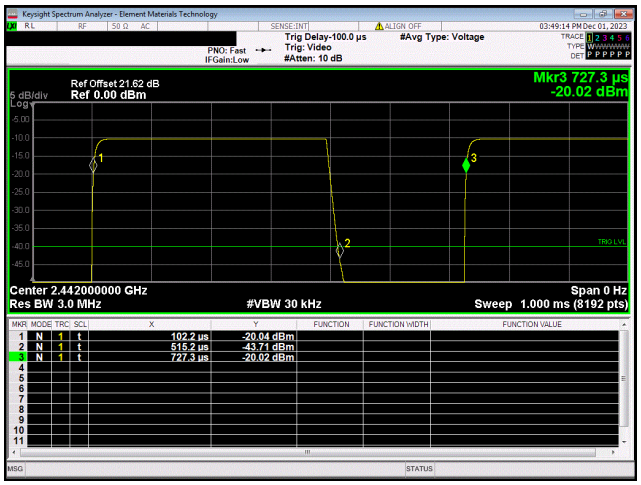
element
TbtTx 2023.11.29.0
WTD.2023.10.23.0



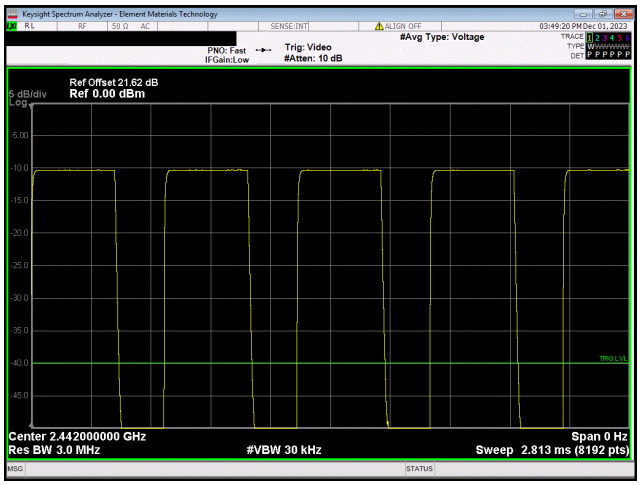
BLE/GFSK 1 Mbps
Low Channel, 2402 MHz



BLE/GFSK 1 Mbps
Low Channel, 2402 MHz



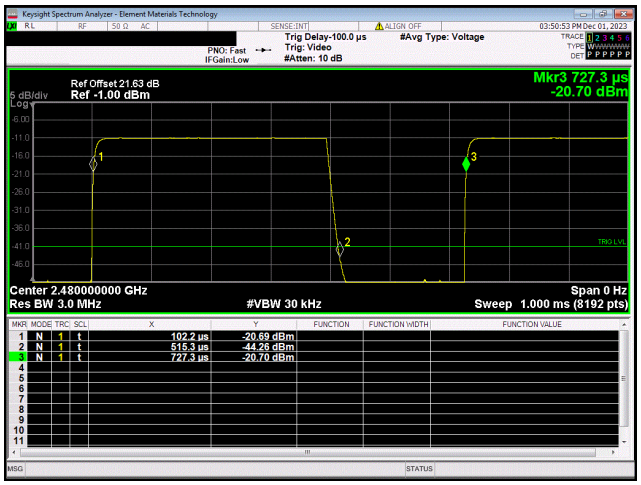
BLE/GFSK 1 Mbps
Mid Channel, 2442 MHz



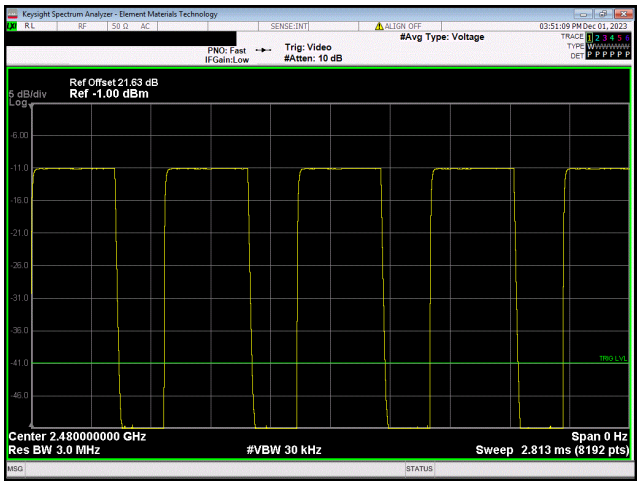
BLE/GFSK 1 Mbps
Mid Channel, 2442 MHz

DUTY CYCLE

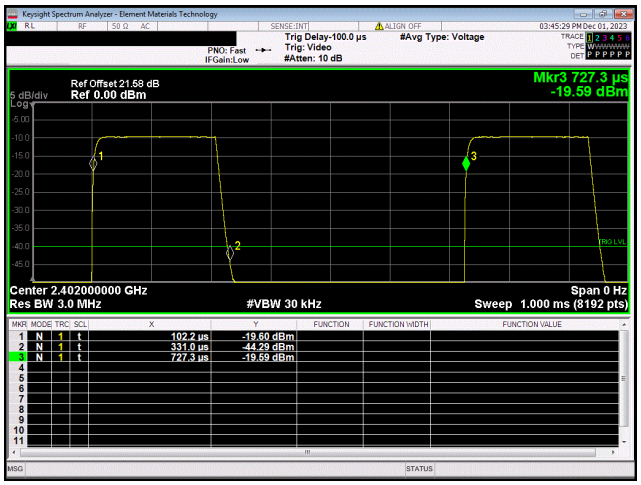
element
TbtTx 2023.11.29.0
WTD.2023.10.23.0



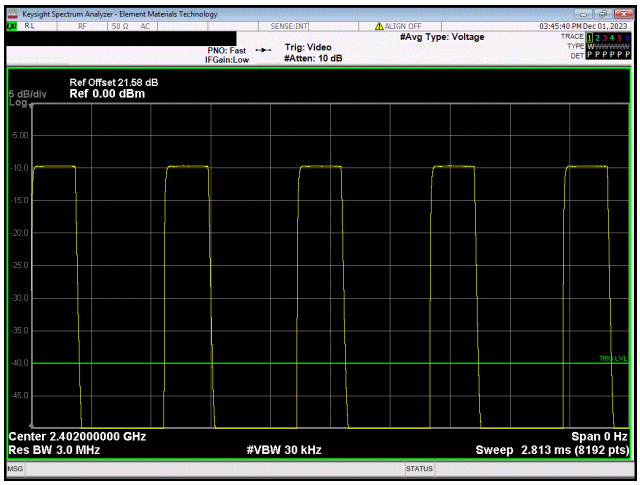
BLE/GFSK 1 Mbps
High Channel, 2480 MHz



BLE/GFSK 1 Mbps
High Channel, 2480 MHz



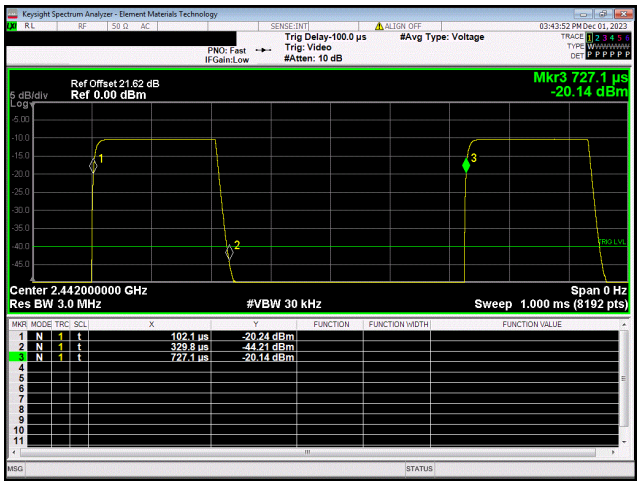
BLE/GFSK 2 Mbps
Low Channel, 2402 MHz



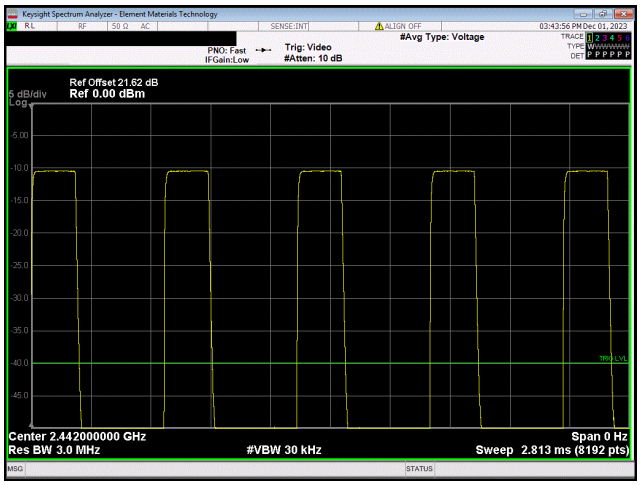
BLE/GFSK 2 Mbps
Low Channel, 2402 MHz

DUTY CYCLE

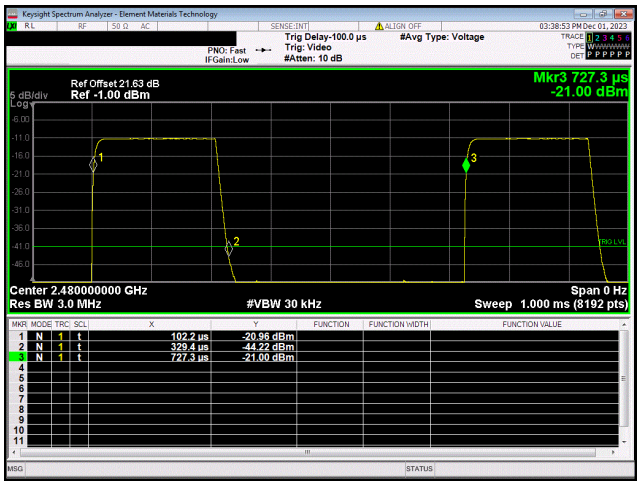
element
TbtTx 2023.11.29.0
WTD.2023.10.23.0



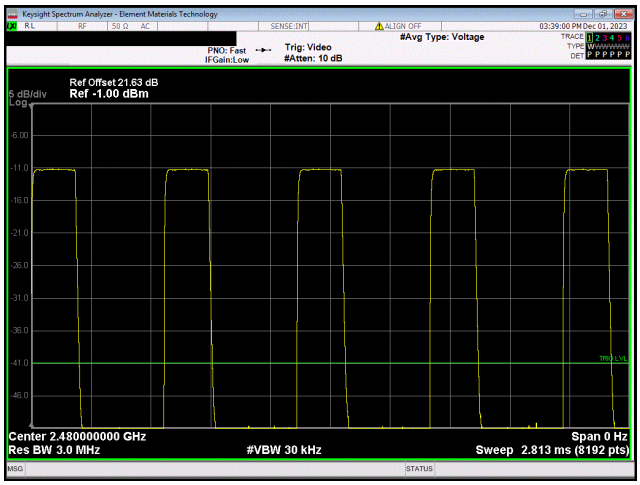
BLE/GFSK 2 Mbps
Mid Channel, 2442 MHz



BLE/GFSK 2 Mbps
Mid Channel, 2442 MHz



BLE/GFSK 2 Mbps
High Channel, 2480 MHz



BLE/GFSK 2 Mbps
High Channel, 2480 MHz

OCCUPIED BANDWIDTH (99%)

element
TbtTx 2023.11.29.0
WTD.2023.10.23.0

TEST DESCRIPTION

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 measurement was made using a direct connection between the RF output of the EUT and a spectrum analyzer.

The 99% occupied bandwidth was measured with the EUT configured for continuous modulated operation.

Per ANSI C63.10:2013, 6.9.3, the spectrum analyzer was configured as follows:

The span of the analyzer shall be set to capture all products of the modulation process, including the emission skirts.

The resolution bandwidth (RBW) of the spectrum analyzer was set to the range of 1% to 5% of the occupied bandwidth (OBW) and video bandwidth (VBW) bandwidth was set to at least 3 times the resolution bandwidth. The analyzer sweep time was set to auto to prevent video filtering or averaging. A sample detector was used unless the device was not able to be operated in a continuous transmit mode, in which case a peak detector was used.

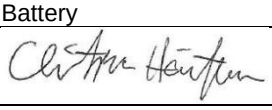
The spectrum analyzer occupied bandwidth measurement function was used to sum the power of the transmission in linear terms to obtain the 99% bandwidth.

TEST EQUIPMENT

Description	Manufacturer	Model	ID	Last Cal.	Cal. Due
Analyzer - Spectrum Analyzer	Keysight	N9010A	AFM	2023-05-01	2024-05-01
Cable	Micro-Coax	UFD150A-1-0720-200200	MNL	2023-09-05	2024-09-05
Generator - Signal	Agilent	N5183A	TIK	2022-01-24	2025-01-24
Attenuator	Fairview Microwave	SA4014-20	AQI	2023-09-05	2024-09-05
Block - DC	Fairview Microwave	SD3379	ANH	2023-09-05	2024-09-05

OCCUPIED BANDWIDTH (99%)

element
TbtTx 2023.11.29.0
WTD.2023.10.23.0

EUT:	O3 Sensor	Work Order:	TSIN0212
Serial Number:	14092342003	Date:	2023-12-01
Customer:	TSI, Incorporated	Temperature:	22.9°C
Attendees:	Micah Larson	Relative Humidity:	24.2%
Customer Project:	None	Bar. Pressure (PMSL):	1014 mbar
Tested By:	Christopher Heintzelman	Job Site:	MN11
Power:	Battery	Configuration:	TSIN0212-9
Signature:			

TEST SPECIFICATIONS

Specification:	Method:
FCC 15.247:2023	ANSI C63.10:2013
RSS-247 Issue 3:2023	ANSI C63.10:2013

COMMENTS

Reference level offset includes measurement cable, attenuator, and DC block.
Power setting -4dBm

DEVIATIONS FROM TEST STANDARD

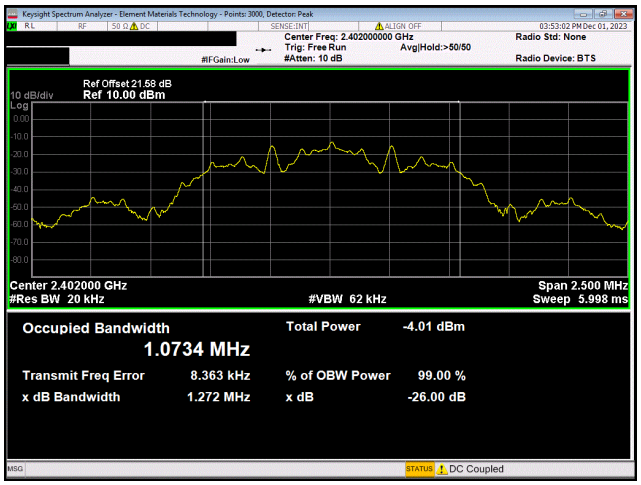
None

TEST RESULTS

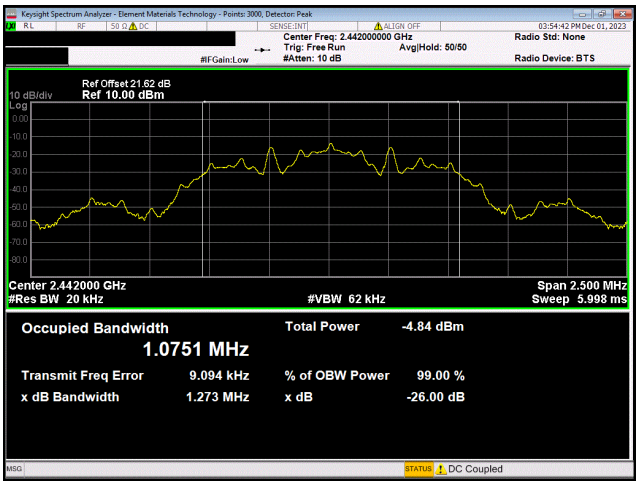
	Value	Limit	Result
BLE/GFSK 125 kbps			
Low Channel, 2402 MHz	1.073 MHz	N/A	N/A
Mid Channel, 2442 MHz	1.075 MHz	N/A	N/A
High Channel, 2480 MHz	1.077 MHz	N/A	N/A
BLE/GFSK 500 kbps			
Low Channel, 2402 MHz	1.041 MHz	N/A	N/A
Mid Channel, 2442 MHz	1.044 MHz	N/A	N/A
High Channel, 2480 MHz	1.047 MHz	N/A	N/A
BLE/GFSK 1 Mbps			
Low Channel, 2402 MHz	1.057 MHz	N/A	N/A
Mid Channel, 2442 MHz	1.06 MHz	N/A	N/A
High Channel, 2480 MHz	1.06 MHz	N/A	N/A
BLE/GFSK 2 Mbps			
Low Channel, 2402 MHz	2.054 MHz	N/A	N/A
Mid Channel, 2442 MHz	2.057 MHz	N/A	N/A
High Channel, 2480 MHz	2.062 MHz	N/A	N/A

OCCUPIED BANDWIDTH (99%)

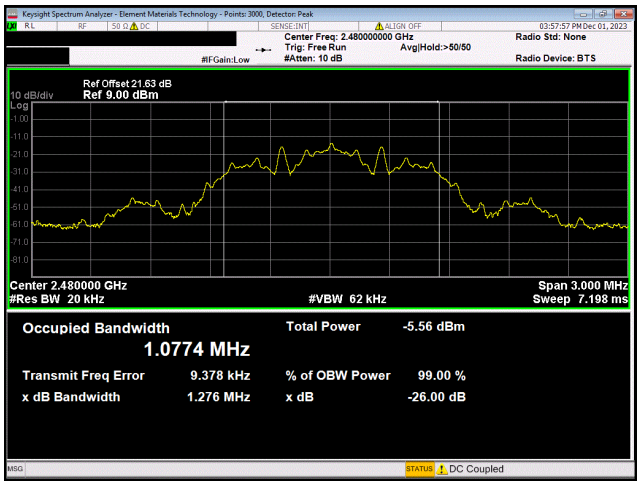
element
TbtTx 2023.11.29.0
WTD.2023.10.23.0



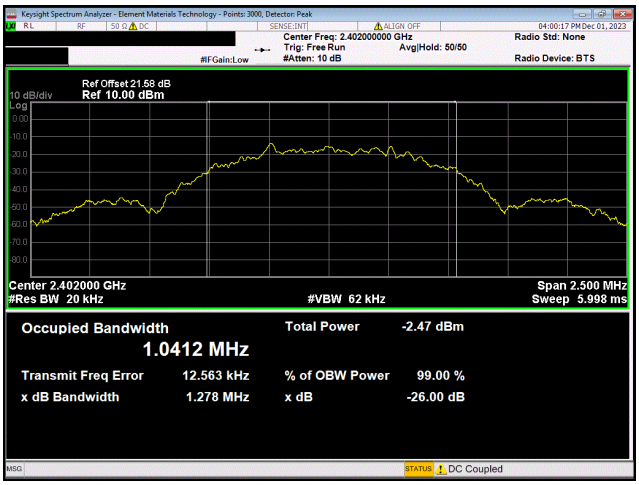
BLE/GFSK 125 kbps
Low Channel, 2402 MHz



BLE/GFSK 125 kbps
Mid Channel, 2442 MHz



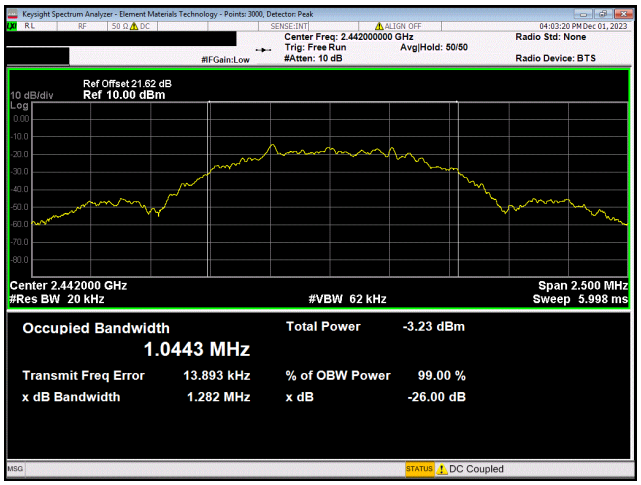
BLE/GFSK 125 kbps
High Channel, 2480 MHz



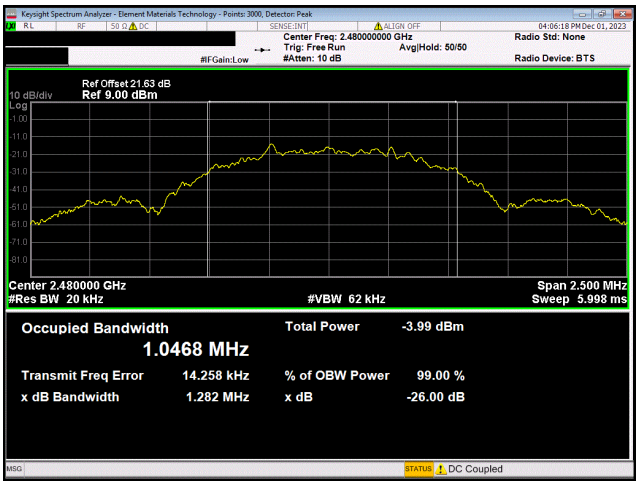
BLE/GFSK 500 kbps
Low Channel, 2402 MHz

OCCUPIED BANDWIDTH (99%)

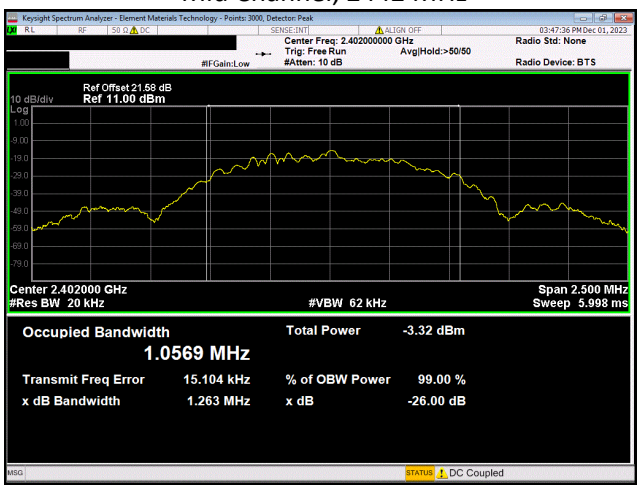
element
TbtTx 2023.11.29.0
WTD.2023.10.23.0



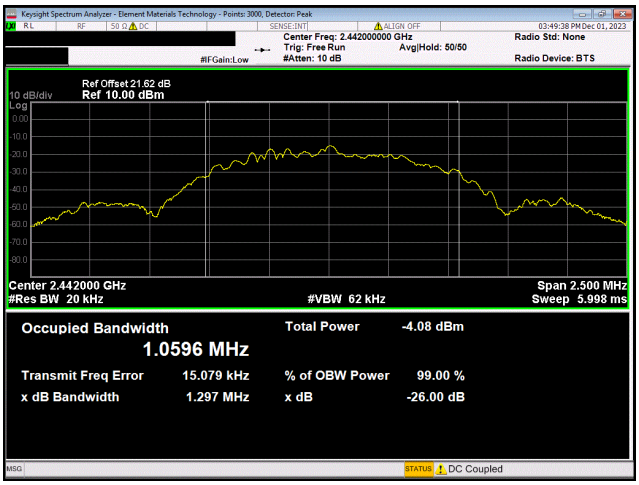
BLE/GFSK 500 kbps
Mid Channel, 2442 MHz



BLE/GFSK 500 kbps
High Channel, 2480 MHz



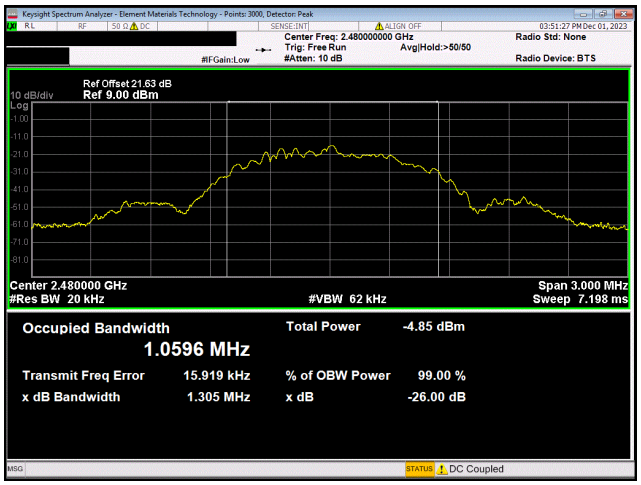
BLE/GFSK 1 Mbps
Low Channel, 2402 MHz



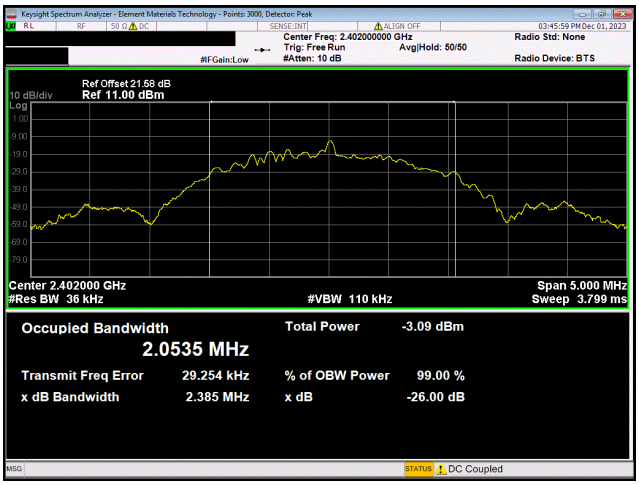
BLE/GFSK 1 Mbps
Mid Channel, 2442 MHz

OCCUPIED BANDWIDTH (99%)

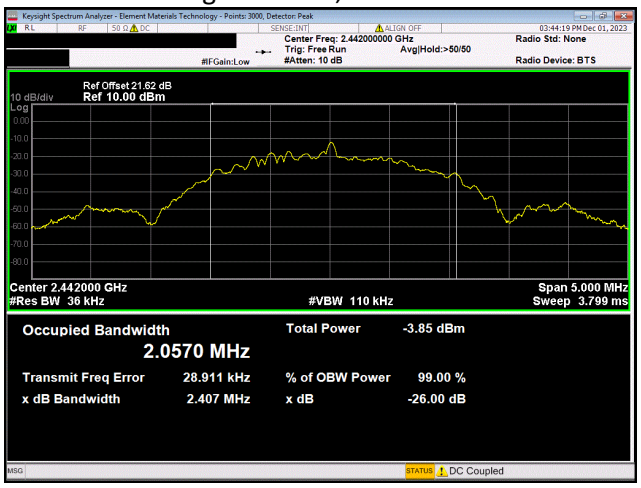
element
TbtTx 2023.11.29.0
WTD.2023.10.23.0



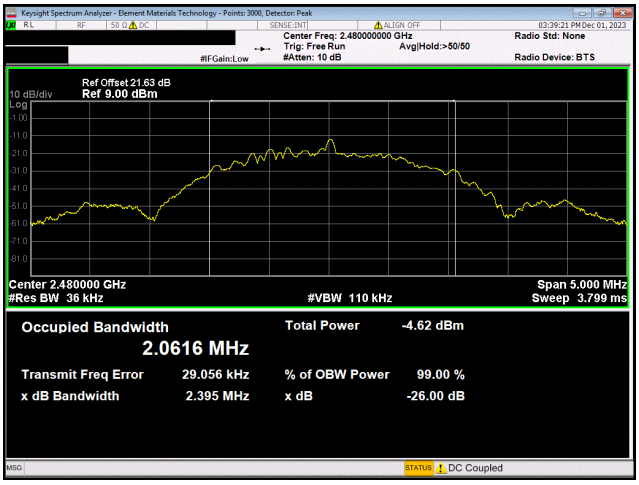
BLE/GFSK 1 Mbps
High Channel, 2480 MHz



BLE/GFSK 2 Mbps
Low Channel, 2402 MHz



BLE/GFSK 2 Mbps
Mid Channel, 2442 MHz



BLE/GFSK 2 Mbps
High Channel, 2480 MHz

OUTPUT POWER

element
TbtTx 2023.12.06.2
WTD.2023.10.23.0

TEST DESCRIPTION

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 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.

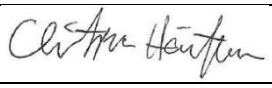
The method found in ANSI C63.10:2013 Section 11.9.1.1 was used because the RBW on the analyzer was greater than the DTS Bandwidth of the radio.

TEST EQUIPMENT

Description	Manufacturer	Model	ID	Last Cal.	Cal. Due
Analyzer - Spectrum Analyzer	Agilent	E4443A	AAS	2023-06-14	2024-06-14
Generator - Signal	Agilent	N5183A	TIK	2022-01-24	2025-01-24
Cable	Micro-Coax	UFD150A-1-0720-200200	MNL	2023-09-05	2024-09-05
Block - DC	Fairview Microwave	SD3379	ANH	2023-09-05	2024-09-05
Attenuator	S.M. Electronics	SA26B-20	RFW	2023-02-07	2024-02-07

OUTPUT POWER

element
TbtTx 2023.12.06.2
WTD.2023.10.23.0

EUT:	TVOC Sensor	Work Order:	TSIN0220
Serial Number:	Conducted #1	Date:	2024-01-11
Customer:	TSI, Incorporated	Temperature:	21.4°C
Attendees:	Micah Larson	Relative Humidity:	23.6%
Customer Project:	None	Bar. Pressure (PMSL):	1011 mbar
Tested By:	Christopher Heintzelman	Job Site:	MN11
Power:	5VDC via USB	Configuration:	TSIN0220-1
Signature:			

TEST SPECIFICATIONS

Specification:	Method:
FCC 15.247:2024	ANSI C63.10:2013
RSS-247 Issue 3:2023	ANSI C63.10:2013

COMMENTS

Reference level offset includes measurement cable, attenuator, and DC block. 0dBm power setting.

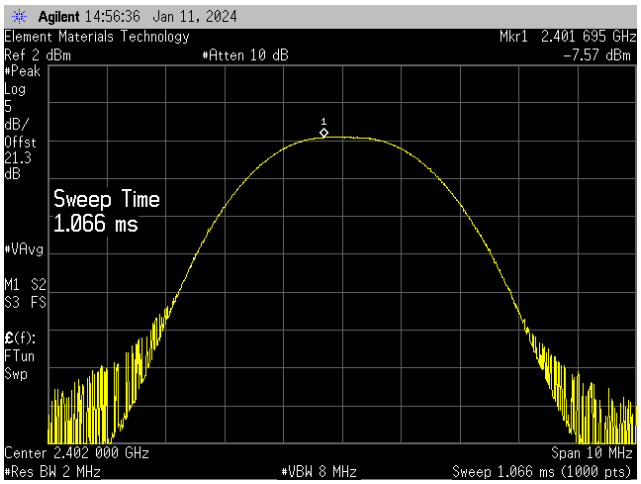
DEVIATIONS FROM TEST STANDARD

None

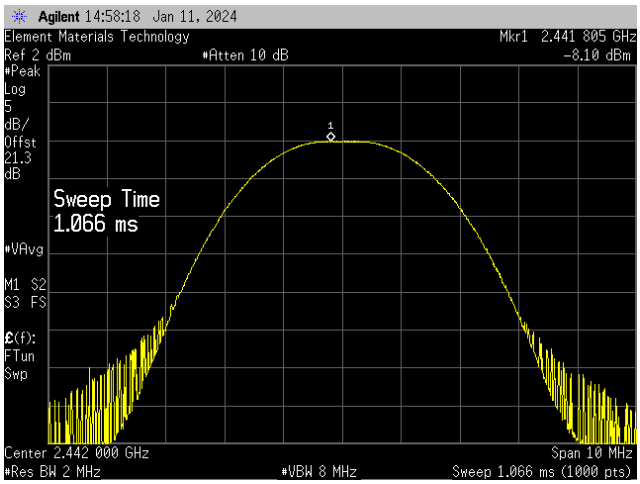
TEST RESULTS

	Out Pwr (dBm)	Limit (dBm)	Result
BLE/GFSK 125 kbps			
Low Channel, 2402 MHz	-7.568	30	Pass
Mid Channel, 2442 MHz	-8.096	30	Pass
High Channel, 2480 MHz	-8.931	30	Pass
BLE/GFSK 500 kbps			
Low Channel, 2402 MHz	-7.579	30	Pass
Mid Channel, 2442 MHz	-8.092	30	Pass
High Channel, 2480 MHz	-8.946	30	Pass
BLE/GFSK 1 Mbps			
Low Channel, 2402 MHz	-7.566	30	Pass
Mid Channel, 2442 MHz	-8.089	30	Pass
High Channel, 2480 MHz	-8.937	30	Pass
BLE/GFSK 2 Mbps			
Low Channel, 2402 MHz	-7.478	30	Pass
Mid Channel, 2442 MHz	-7.995	30	Pass
High Channel, 2480 MHz	-8.833	30	Pass

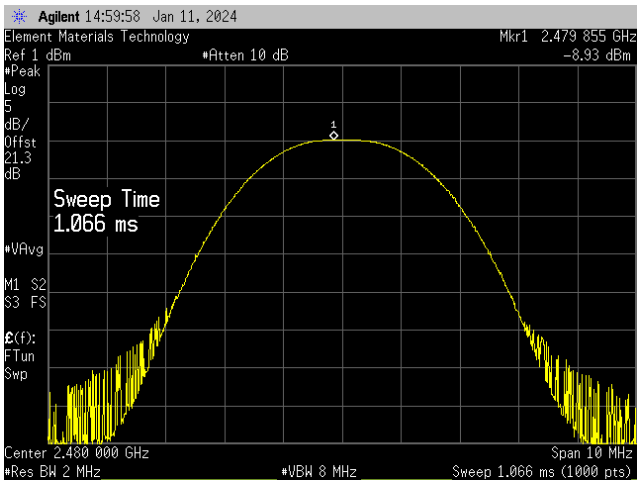
OUTPUT POWER



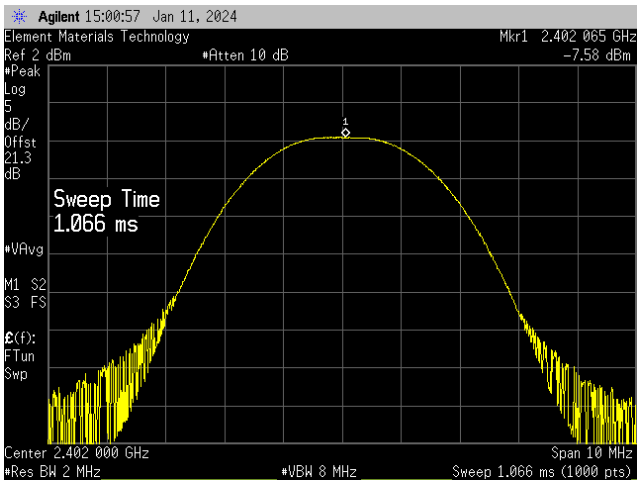
BLE/GFSK 125 kbps
Low Channel, 2402 MHz



BLE/GFSK 125 kbps
Mid Channel, 2442 MHz

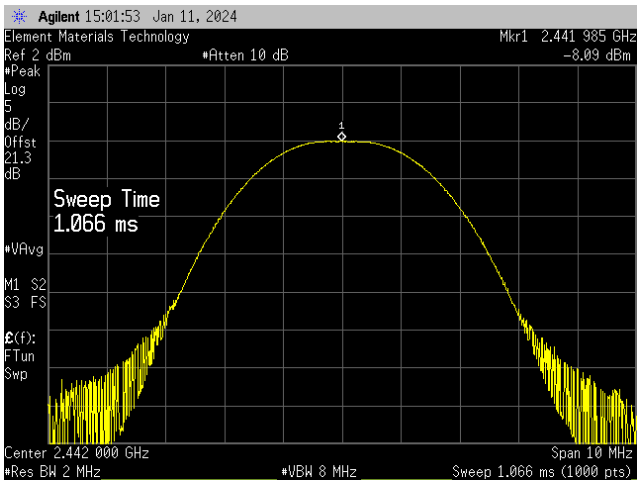


BLE/GFSK 125 kbps
High Channel, 2480 MHz

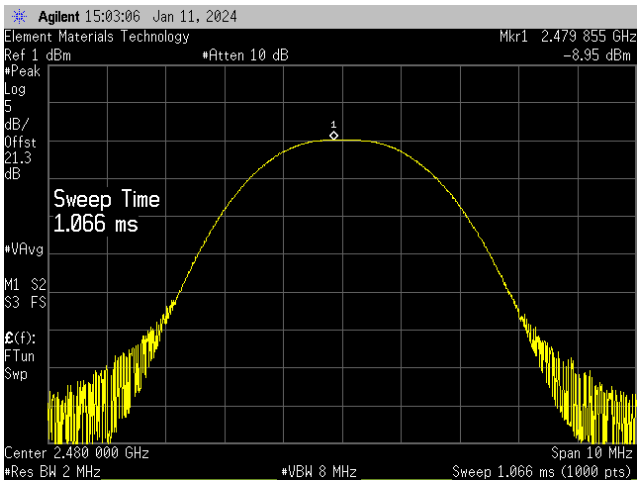


BLE/GFSK 500 kbps
Low Channel, 2402 MHz

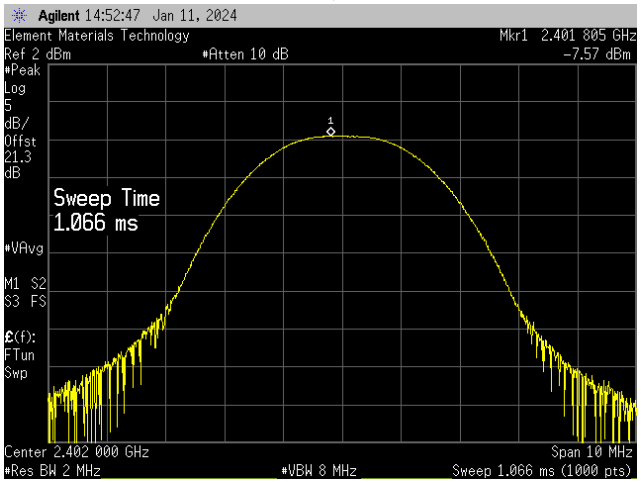
OUTPUT POWER



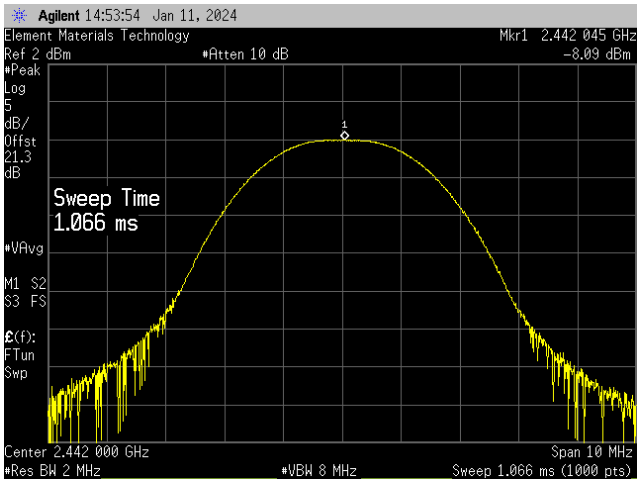
BLE/GFSK 500 kbps
Mid Channel, 2442 MHz



BLE/GFSK 500 kbps
High Channel, 2480 MHz

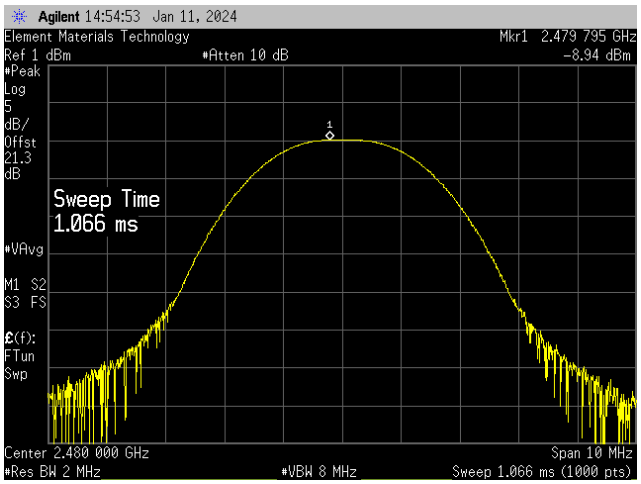


BLE/GFSK 1 Mbps
Low Channel, 2402 MHz

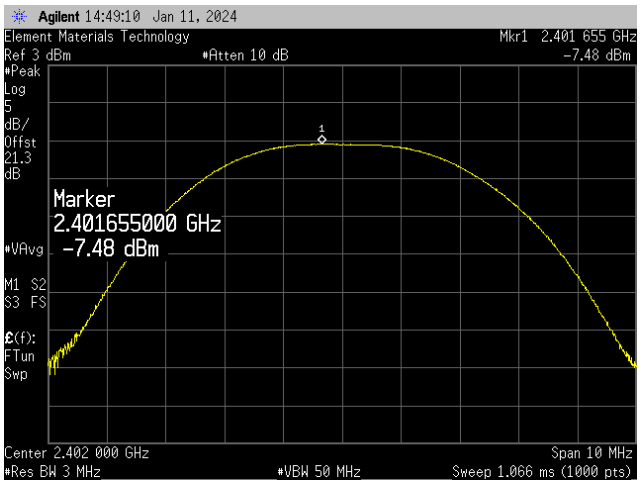


BLE/GFSK 1 Mbps
Mid Channel, 2442 MHz

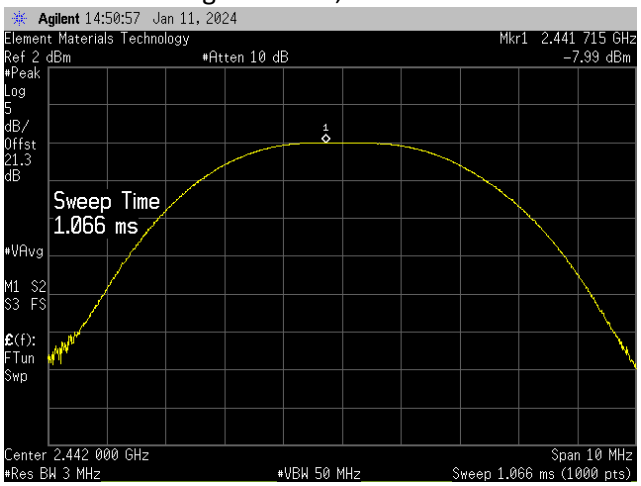
OUTPUT POWER



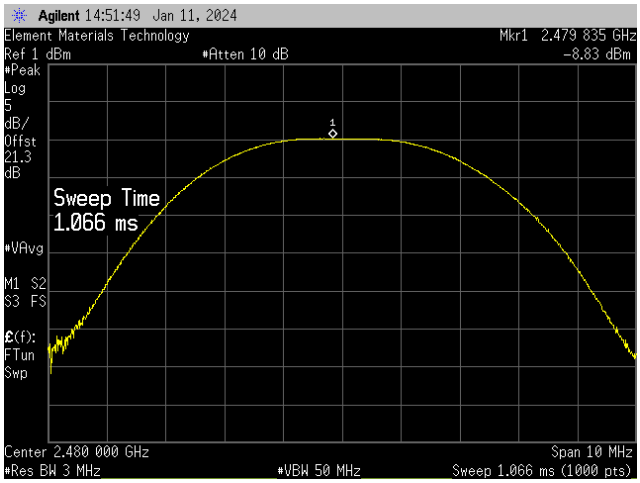
BLE/GFSK 1 Mbps
High Channel, 2480 MHz



BLE/GFSK 2 Mbps
Low Channel, 2402 MHz



BLE/GFSK 2 Mbps
Mid Channel, 2442 MHz



BLE/GFSK 2 Mbps
High Channel, 2480 MHz

EQUIVALENT ISOTROPIC RADIATED POWER (EIRP)

element
TbtTx 2023.12.06.2
WTD.2023.10.23.0

TEST DESCRIPTION

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 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.

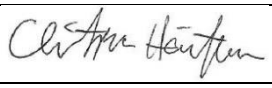
Equivalent Isotropic Radiated Power (EIRP) = Max Measured Power + Antenna gain (dBi)

TEST EQUIPMENT

Description	Manufacturer	Model	ID	Last Cal.	Cal. Due
Analyzer - Spectrum Analyzer	Agilent	E4443A	AAS	2023-06-14	2024-06-14
Generator - Signal	Agilent	N5183A	TIK	2022-01-24	2025-01-24
Cable	Micro-Coax	UFD150A-1-0720-200200	MNL	2023-09-05	2024-09-05
Block - DC	Fairview Microwave	SD3379	ANH	2023-09-05	2024-09-05
Attenuator	S.M. Electronics	SA26B-20	RFW	2023-02-07	2024-02-07

EQUIVALENT ISOTROPIC RADIATED POWER (EIRP)

element
TbtTx 2023.12.06.2
WTD.2023.10.23.0

EUT:	TVOC Sensor	Work Order:	TSIN0220
Serial Number:	Conducted #1	Date:	2024-01-11
Customer:	TSI, Incorporated	Temperature:	21.4°C
Attendees:	Micah Larson	Relative Humidity:	23.7%
Customer Project:	None	Bar. Pressure (PMSL):	1011 mbar
Tested By:	Christopher Heintzelman	Job Site:	MN11
Power:	5VDC via USB	Configuration:	TSIN0220-1
Signature:			

TEST SPECIFICATIONS

Specification:	Method:
FCC 15.247:2024	ANSI C63.10:2013
RSS-247 Issue 3:2023	ANSI C63.10:2013

COMMENTS

Reference level offset includes measurement cable, attenuator, and DC block. 0dBm power setting.

DEVIATIONS FROM TEST STANDARD

None

TEST RESULTS

	Out Pwr (dBm)	Antenna Gain (dBi)	EIRP (dBm)	EIRP Limit (dBm)	Result
BLE/GFSK 125 kbps					
Low Channel, 2402 MHz	-7.568	2	-5.568	36	Pass
Mid Channel, 2442 MHz	-8.096	2	-6.096	36	Pass
High Channel, 2480 MHz	-8.931	2	-6.931	36	Pass
BLE/GFSK 500 kbps					
Low Channel, 2402 MHz	-7.579	2	-5.579	36	Pass
Mid Channel, 2442 MHz	-8.092	2	-6.092	36	Pass
High Channel, 2480 MHz	-8.946	2	-6.946	36	Pass
BLE/GFSK 1 Mbps					
Low Channel, 2402 MHz	-7.566	2	-5.566	36	Pass
Mid Channel, 2442 MHz	-8.089	2	-6.089	36	Pass
High Channel, 2480 MHz	-8.937	2	-6.937	36	Pass
BLE/GFSK 2 Mbps					
Low Channel, 2402 MHz	-7.478	2	-5.478	36	Pass
Mid Channel, 2442 MHz	-7.995	2	-5.995	36	Pass
High Channel, 2480 MHz	-8.833	2	-6.833	36	Pass

SPURIOUS RADIATED EMISSIONS

element
WTD.2023.10.23.0
EmiR5 2022.07.06.0
PSA-ESCI 2023.04.25.0

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 within 2 MHz of the allowable band may have been taken using the integration method from ANSI C63.10 clause 11.13.3. This procedure uses the channel power feature of the spectrum analyzer to integrate the power of the emission within a 1 MHz bandwidth.

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(1/dc).

TEST EQUIPMENT

Description	Manufacturer	Model	ID	Last Cal.	Cal. Due
Antenna - Double Ridge	ETS Lindgren	3115	AIP	2022-07-20	2024-07-20
Cable	ESM Cable Corp.	Double Ridge Guide Horn Cables	MNI	2023-01-14	2024-01-14
Amplifier - Pre-Amplifier	Miteq	AMF-3D-00100800-32-13P	AVT	2023-01-14	2024-01-14
Analyzer - Spectrum Analyzer	Agilent	E4446A	AAQ	2023-02-06	2024-02-06
Antenna - Standard Gain	ETS Lindgren	3160-07	AXP	NCR	NCR
Cable	ESM Cable Corp.	Standard Gain Horn Cables	MNJ	2023-01-14	2024-01-14
Amplifier - Pre-Amplifier	Miteq	AMF-6F-08001200-30-10P	AVV	2023-01-14	2024-01-14
Antenna - Standard Gain	ETS Lindgren	3160-08	AIQ	NCR	NCR
Amplifier - Pre-Amplifier	Miteq	AMF-6F-12001800-30-10P	AVW	2023-01-14	2024-01-14
Antenna - Biconilog	Ametek	CBL 6141B	AYS	2023-03-28	2025-03-28
Cable	ESM Cable Corp.	Bilog Cables	MNH	2023-10-08	2024-10-08
Amplifier - Pre-Amplifier	Miteq	AM-1616-1000	AVO	2023-10-08	2024-10-08
Filter - Low Pass	Micro-Tronics	LPM50004	LFK	2023-08-23	2024-08-23

SPURIOUS RADIATED EMISSIONS

element
WTD.2023.10.23.0
EmiR5 2022.07.06.0
PSA-ESCI 2023.04.25.0

MEASUREMENT UNCERTAINTY

Description		
Expanded k=2	5.2 dB	-5.2 dB

FREQUENCY RANGE INVESTIGATED

30 MHz TO 26500 MHz

POWER INVESTIGATED

Battery

CONFIGURATIONS INVESTIGATED

TSIN0212-10
TSIN0212-11
TSIN0212-12
TSIN0212-13
TSIN0212-7
TSIN0212-8

MODES INVESTIGATED

Transmitting BLE Low and High Channels (2402 and 2480 MHz) 1 Mbps, 2 Mbps, 500 kbps, 125 kbps Modulated. PRBS9. Power 0 dBm
Transmitting BLE Low, Mid and High Channels (2402, 2442, 2480 MHz) 1 Mbps, 2 Mbps, 500 kbps, 125 kbps Modulated. PRBS9. Power 0 dBm

SPURIOUS RADIATED EMISSIONS

element
WTD.2023.10.23.0
EmiR5 2022.07.06.0
PSA-ESCI 2023.04.25.0

EUT:	CO Sensor	Work Order:	TSIN0212
Serial Number:	814012335009	Date:	2023-11-30
Customer:	TSI, Incorporated	Temperature:	22.6°C
Attendees:	Micah Larson	Relative Humidity:	25.7%
Customer Project:	None	Bar. Pressure (PMSL):	1007 mb
Tested By:	Marcelo Aguayo	Job Site:	MN05
Power:	Battery	Configuration:	TSIN0212-7

TEST SPECIFICATIONS

Specification:	Method:
FCC 15.247:2023	ANSI C63.10:2013
RSS-247 Issue 3:2023 RSS-Gen Issue 5:2018+A1:2019+A2:2021	ANSI C63.10:2013

TEST PARAMETERS

Run #:	54	Test Distance (m):	3	Ant. Height(s) (m):	1 to 4(m)

COMMENTS

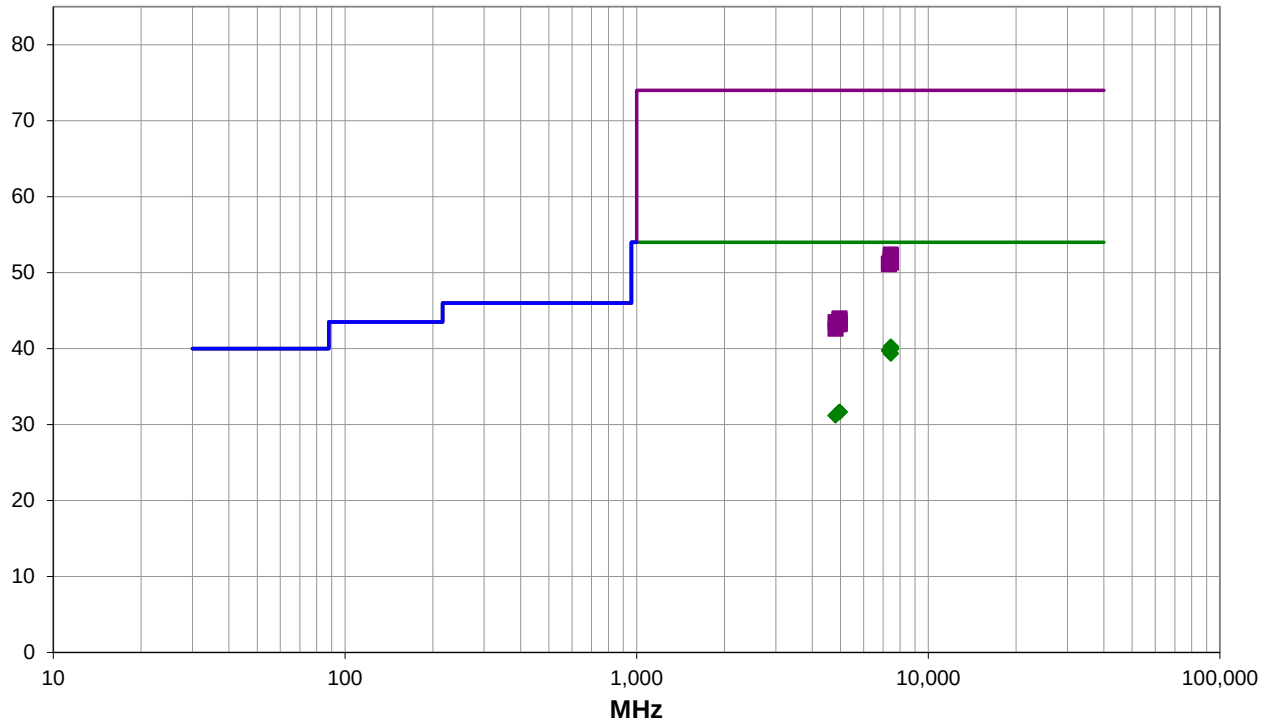
Tested with power 0dBm. Test mode duty cycle is 77.9% (1 Mbps), 79.9% (2 Mbps), 95.9% (125 kbps), 83.7% (500 kbps). Operational duty cycle is 60%. Duty cycle correction factor (DCCF) applied using DCCF=[10*log(1/test mode DC)]+[10*log(operational DC)]. Total correction applied: 1Mbps= -1.1 dB, 2Mbps=-1.3 Db, 125kbps=-2 dB, 500kbps= -1.4 dB

EUT OPERATING MODES

Transmitting BLE Low, Mid and High Channels (2402, 2442, 2480 MHz) 1 Mbps, 2 Mbps, 500 kbps, 125 kbps Modulated. PRBS9. Power 0 dBm

DEVIATIONS FROM TEST STANDARD

None



SPURIOUS RADIATED EMISSIONS

element
WTD.2023.10.23.0
EmiR5 2022.07.06.0
PSA-ESCI 2023.04.25.0

Run #: 54

■ PK ◆ AV ● QP

RESULTS - Run #54

Freq (MHz)	Amplitude (dBuV)	Factor (dB/m)	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
7440.133	29.5	11.9	1.5	66.9	-1.1	0.0	Horz	AV	0.0	40.3	54.0	-13.7	EUT Horz,High Ch 1Mbps
7440.733	29.5	11.9	1.5	191.0	-1.4	0.0	Vert	AV	0.0	40.0	54.0	-14.0	EUT Horz,High Ch 500kbps
7437.642	29.5	11.9	1.5	360.0	-2.0	0.0	Horz	AV	0.0	39.4	54.0	-14.6	EUT Horz,High Ch 125kbps
7439.292	29.4	11.9	1.5	174.0	-1.1	0.0	Vert	AV	0.0	40.2	54.0	-13.8	EUT Horz,High Ch 1Mbps
7440.433	29.4	11.9	1.5	23.0	-1.1	0.0	Horz	AV	0.0	40.2	54.0	-13.8	EUT Vert,High Ch 1Mbps
7438.392	29.4	11.9	2.3	1.0	-1.1	0.0	Vert	AV	0.0	40.2	54.0	-13.8	EUT Vert,High Ch 1Mbps
7440.158	29.4	11.9	3.7	358.9	-1.1	0.0	Horz	AV	0.0	40.2	54.0	-13.8	EUT On Side,High Ch 1Mbps
7439.158	29.4	11.9	1.5	360.0	-1.1	0.0	Vert	AV	0.0	40.2	54.0	-13.8	EUT On Side,High Ch 1Mbps
7438.633	29.4	11.9	1.4	160.9	-1.3	0.0	Horz	AV	0.0	40.0	54.0	-14.0	EUT Horz,High Ch 2Mbps
7438.092	29.4	11.9	3.7	116.0	-1.3	0.0	Vert	AV	0.0	40.0	54.0	-14.0	EUT Horz,High Ch 2Mbps
7438.092	29.4	11.9	1.5	335.0	-1.4	0.0	Horz	AV	0.0	39.9	54.0	-14.1	EUT Horz,High Ch 500kbps
7438.925	29.4	11.9	1.5	308.9	-2.0	0.0	Vert	AV	0.0	39.3	54.0	-14.7	EUT Horz,High Ch 125kbps
7325.033	29.2	11.7	1.5	54.0	-1.1	0.0	Horz	AV	0.0	39.8	54.0	-14.2	EUT Horz,Mid Ch 1Mbps
7323.783	29.1	11.7	1.5	60.9	-1.1	0.0	Vert	AV	0.0	39.7	54.0	-14.3	EUT Horz,Mid Ch 1Mbps
7437.658	40.5	11.9	1.5	66.9	0.0	0.0	Horz	PK	0.0	52.4	74.0	-21.6	EUT Horz,High Ch 1Mbps
7439.850	40.3	11.9	1.5	360.0	0.0	0.0	Vert	PK	0.0	52.2	74.0	-21.8	EUT On Side,High Ch 1Mbps
7442.267	40.3	11.9	1.5	335.0	0.0	0.0	Horz	PK	0.0	52.2	74.0	-21.8	EUT Horz,High Ch 500kbps
7438.750	40.2	11.9	1.5	174.0	0.0	0.0	Vert	PK	0.0	52.1	74.0	-21.9	EUT Horz,High Ch 1Mbps
7440.008	40.0	11.9	1.5	308.9	0.0	0.0	Vert	PK	0.0	51.9	74.0	-22.1	EUT Horz,High Ch 125kbps
7438.033	39.8	11.9	3.7	358.9	0.0	0.0	Horz	PK	0.0	51.7	74.0	-22.3	EUT On Side,High Ch 1Mbps
4959.525	29.2	3.6	2.0	335.0	-1.1	0.0	Vert	AV	0.0	31.7	54.0	-22.3	EUT Horz,High Ch 1Mbps
4960.850	29.2	3.6	1.5	16.9	-1.1	0.0	Horz	AV	0.0	31.7	54.0	-22.3	EUT Vert,High Ch 1Mbps
4960.358	29.2	3.6	1.1	70.9	-1.1	0.0	Vert	AV	0.0	31.7	54.0	-22.3	EUT Vert,High Ch 1Mbps
4960.658	29.2	3.6	1.5	142.0	-1.1	0.0	Horz	AV	0.0	31.7	54.0	-22.3	EUT On Side,High Ch 1Mbps
4959.858	29.2	3.6	1.5	311.9	-1.1	0.0	Vert	AV	0.0	31.7	54.0	-22.3	EUT On Side,High Ch 1Mbps
4960.292	29.1	3.6	4.0	81.9	-1.1	0.0	Horz	AV	0.0	31.6	54.0	-22.4	EUT Horz,High Ch 1Mbps
7437.508	39.7	11.9	1.4	160.9	0.0	0.0	Horz	PK	0.0	51.6	74.0	-22.4	EUT Horz,High Ch 2Mbps
7440.617	39.7	11.9	3.7	116.0	0.0	0.0	Vert	PK	0.0	51.6	74.0	-22.4	EUT Horz,High Ch 2Mbps
7441.092	39.6	11.9	2.3	1.0	0.0	0.0	Vert	PK	0.0	51.5	74.0	-22.5	EUT Vert,High Ch 1Mbps
7440.250	39.5	11.9	1.5	191.0	0.0	0.0	Vert	PK	0.0	51.4	74.0	-22.6	EUT Horz,High Ch 500kbps
7440.358	39.5	11.9	1.5	360.0	0.0	0.0	Horz	PK	0.0	51.4	74.0	-22.6	EUT Horz,High Ch 125kbps
7442.417	39.4	11.9	1.5	23.0	0.0	0.0	Horz	PK	0.0	51.3	74.0	-22.7	EUT Vert,High Ch 1Mbps
7327.358	39.5	11.7	1.5	54.0	0.0	0.0	Horz	PK	0.0	51.2	74.0	-22.8	EUT Horz,Mid Ch 1Mbps
4803.483	29.0	3.3	1.5	109.0	-1.1	0.0	Horz	AV	0.0	31.2	54.0	-22.8	EUT Horz,Low Ch 1Mbps
4805.775	29.0	3.3	1.5	109.0	-1.1	0.0	Vert	AV	0.0	31.2	54.0	-22.8	EUT Horz,Low Ch 1Mbps
7326.733	39.4	11.7	1.5	60.9	0.0	0.0	Vert	PK	0.0	51.1	74.0	-22.9	EUT Horz,Mid Ch 1Mbps
4961.650	40.4	3.6	1.1	70.9	0.0	0.0	Vert	PK	0.0	44.0	74.0	-30.0	EUT Vert,High Ch 1Mbps
4957.733	40.2	3.6	1.5	142.0	0.0	0.0	Horz	PK	0.0	43.8	74.0	-30.2	EUT On Side,High Ch 1Mbps

SPURIOUS RADIATED EMISSIONS

element
WTD.2023.10.23.0
EmiR5 2022.07.06.0
PSA-ESCI 2023.04.25.0

Freq (MHz)	Amplitude (dBuV)	Factor (dB/m)	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
4801.700	40.2	3.3	1.5	109.0	0.0	0.0	Vert	PK	0.0	43.5	74.0	-30.5	EUT Horz,Low Ch 1Mbps
4959.508	39.8	3.6	4.0	81.9	0.0	0.0	Horz	PK	0.0	43.4	74.0	-30.6	EUT Horz,High Ch 1Mbps
4961.858	39.8	3.6	1.5	311.9	0.0	0.0	Vert	PK	0.0	43.4	74.0	-30.6	EUT On Side,High Ch 1Mbps
4960.192	39.7	3.6	1.5	16.9	0.0	0.0	Horz	PK	0.0	43.3	74.0	-30.7	EUT Vert,High Ch 1Mbps
4958.050	39.6	3.6	2.0	335.0	0.0	0.0	Vert	PK	0.0	43.2	74.0	-30.8	EUT Horz,High Ch 1Mbps
4806.008	39.3	3.3	1.5	109.0	0.0	0.0	Horz	PK	0.0	42.6	74.0	-31.4	EUT Horz,Low Ch 1Mbps

CONCLUSION

Pass

Tested By

SPURIOUS RADIATED EMISSIONS

element
WTD.2023.10.23.0
EmiR5 2022.07.06.0
PSA-ESCI 2023.04.25.0

EUT:	CO Sensor	Work Order:	TSIN0212
Serial Number:	814012335009	Date:	2023-11-30
Customer:	TSI, Incorporated	Temperature:	22.7°C
Attendees:	Micah Larson	Relative Humidity:	25.5%
Customer Project:	None	Bar. Pressure (PMSL):	1007 mb
Tested By:	Marcelo Aguayo	Job Site:	MN05
Power:	Battery	Configuration:	TSIN0212-7

TEST SPECIFICATIONS

Specification:	Method:
FCC 15.247:2023	ANSI C63.10:2013
RSS-247 Issue 3:2023 RSS-Gen Issue 5:2018+A1:2019+A2:2021	ANSI C63.10:2013

TEST PARAMETERS

Run #:	57	Test Distance (m):	3	Ant. Height(s) (m):	1 to 4(m)

COMMENTS

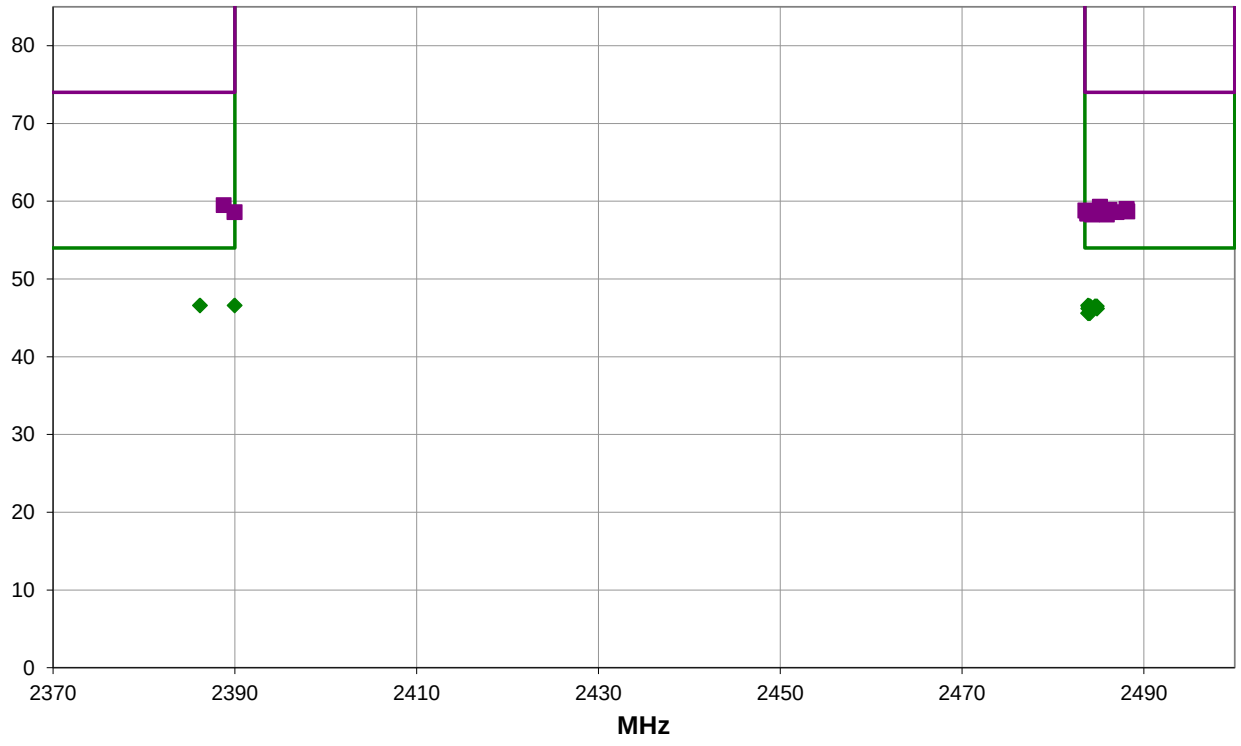
Tested with power 0dBm. Test mode duty cycle is 77.9% (1 Mbps), 79.9% (2 Mbps), 95.9% (125 kbps), 83.7% (500 kbps). Operational duty cycle is 60%. Duty cycle correction factor (DCCF) applied using DCCF=[10*log(1/test mode DC)]+[10*log(operational DC)]. Total correction applied: 1Mbps= -1.1 dB, 2Mbps=-1.3 Db, 125kbps=-2 dB, 500kbps= -1.4 dB

EUT OPERATING MODES

Transmitting BLE Low and High Channels (2402 and 2480 MHz) 1 Mbps, 2 Mbps, 500 kbps, 125 kbps Modulated. PRBS9. Power 0 dBm

DEVIATIONS FROM TEST STANDARD

None



SPURIOUS RADIATED EMISSIONS

element
WTD.2023.10.23.0
EmiR5 2022.07.06.0
PSA-ESCI 2023.04.25.0

Run #: 57

■ PK ◆ AV ● QP

RESULTS - Run #57

Freq (MHz)	Amplitude (dBuV)	Factor (dB/m)	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
2483.875	31.9	-4.2	1.5	249.0	-1.1	20.0	Horz	AV	0.0	46.6	54.0	-7.4	EUT On Side,High Ch 1Mbps
2389.967	32.0	-4.3	4.0	333.0	-1.1	20.0	Horz	AV	0.0	46.6	54.0	-7.4	EUT On Side,Low Ch 1Mbps
2386.150	32.0	-4.3	1.5	123.0	-1.1	20.0	Vert	AV	0.0	46.6	54.0	-7.4	EUT Horz,Low Ch 1Mbps
2484.083	31.8	-4.2	1.5	191.0	-1.1	20.0	Horz	AV	0.0	46.5	54.0	-7.5	EUT Horz,High Ch 1Mbps
2484.642	31.8	-4.2	1.5	281.0	-1.1	20.0	Vert	AV	0.0	46.5	54.0	-7.5	EUT Horz,High Ch 1Mbps
2483.925	31.8	-4.2	3.1	319.9	-1.1	20.0	Vert	AV	0.0	46.5	54.0	-7.5	EUT On Side,High Ch 1Mbps
2484.817	31.8	-4.2	1.5	245.0	-1.1	20.0	Horz	AV	0.0	46.5	54.0	-7.5	EUTVert,High Ch 1Mbps
2483.992	31.8	-4.2	1.5	40.0	-1.3	20.0	Vert	AV	0.0	46.3	54.0	-7.7	EUT Horz,High Ch 2Mbps
2484.375	31.8	-4.2	2.4	52.9	-1.4	20.0	Horz	AV	0.0	46.2	54.0	-7.8	EUT On Side,High Ch 500kbps
2483.883	31.8	-4.2	1.0	294.9	-1.4	20.0	Vert	AV	0.0	46.2	54.0	-7.8	EUT Horz,High Ch 500kbps
2484.058	31.8	-4.2	1.5	178.0	-2.0	20.0	Horz	AV	0.0	45.6	54.0	-8.4	EUT Horz,High Ch 125kbps
2483.867	31.8	-4.2	1.5	91.0	-2.0	20.0	Vert	AV	0.0	45.6	54.0	-8.4	EUT On Side,High Ch 125kbps
2484.108	31.7	-4.2	1.5	8.0	-1.1	20.0	Vert	AV	0.0	46.4	54.0	-7.6	EUTVert,High Ch 1Mbps
2484.842	31.7	-4.2	1.5	70.0	-1.3	20.0	Horz	AV	0.0	46.2	54.0	-7.8	EUT On Side,High Ch 2Mbps
2388.758	43.8	-4.3	4.0	333.0	0.0	20.0	Horz	PK	0.0	59.5	74.0	-14.5	EUT On Side,Low Ch 1Mbps
2485.175	43.5	-4.2	1.5	281.0	0.0	20.0	Vert	PK	0.0	59.3	74.0	-14.7	EUT Horz,High Ch 1Mbps
2488.092	43.1	-4.1	1.5	249.0	0.0	20.0	Horz	PK	0.0	59.0	74.0	-15.0	EUT On Side,High Ch 1Mbps
2486.208	43.1	-4.2	1.5	245.0	0.0	20.0	Horz	PK	0.0	58.9	74.0	-15.1	EUTVert,High Ch 1Mbps
2483.567	43.0	-4.2	2.4	52.9	0.0	20.0	Horz	PK	0.0	58.8	74.0	-15.2	EUT On Side,High Ch 500kbps
2488.183	42.8	-4.1	1.5	178.0	0.0	20.0	Horz	PK	0.0	58.7	74.0	-15.3	EUT Horz,High Ch 125kbps
2389.958	42.9	-4.3	1.5	123.0	0.0	20.0	Vert	PK	0.0	58.6	74.0	-15.4	EUT Horz,Low Ch 1Mbps
2486.983	42.8	-4.2	1.5	70.0	0.0	20.0	Horz	PK	0.0	58.6	74.0	-15.4	EUT On Side,High Ch 2Mbps
2485.317	42.7	-4.2	3.1	319.9	0.0	20.0	Vert	PK	0.0	58.5	74.0	-15.5	EUT On Side,High Ch 1Mbps
2485.192	42.7	-4.2	1.5	40.0	0.0	20.0	Vert	PK	0.0	58.5	74.0	-15.5	EUT Horz,High Ch 2Mbps
2483.792	42.7	-4.2	1.5	91.0	0.0	20.0	Vert	PK	0.0	58.5	74.0	-15.5	EUT On Side,High Ch 125kbps
2483.783	42.6	-4.2	1.5	8.0	0.0	20.0	Vert	PK	0.0	58.4	74.0	-15.6	EUTVert,High Ch 1Mbps
2485.925	42.5	-4.2	1.5	191.0	0.0	20.0	Horz	PK	0.0	58.3	74.0	-15.7	EUT Horz,High Ch 1Mbps
2484.283	42.5	-4.2	1.0	294.9	0.0	20.0	Vert	PK	0.0	58.3	74.0	-15.7	EUT Horz,High Ch 500kbps

CONCLUSION

Pass

Tested By

SPURIOUS RADIATED EMISSIONS

element
WTD.2023.10.23.0
EmiR5 2022.07.06.0
PSA-ESCI 2023.04.25.0

EUT:	O3 Sensor	Work Order:	TSIN0212
Serial Number:	8014062335005	Date:	2023-11-30
Customer:	TSI, Incorporated	Temperature:	22.7°C
Attendees:	Micah Larson	Relative Humidity:	25.5%
Customer Project:	None	Bar. Pressure (PMSL):	1007 mb
Tested By:	Marcelo Aguayo	Job Site:	MN05
Power:	Battery	Configuration:	TSIN0212-8

TEST SPECIFICATIONS

Specification:	Method:
FCC 15.247:2023	ANSI C63.10:2013
RSS-247 Issue 3:2023 RSS-Gen Issue 5:2018+A1:2019+A2:2021	ANSI C63.10:2013

TEST PARAMETERS

Run #:	80	Test Distance (m):	3	Ant. Height(s) (m):	1 to 4(m)

COMMENTS

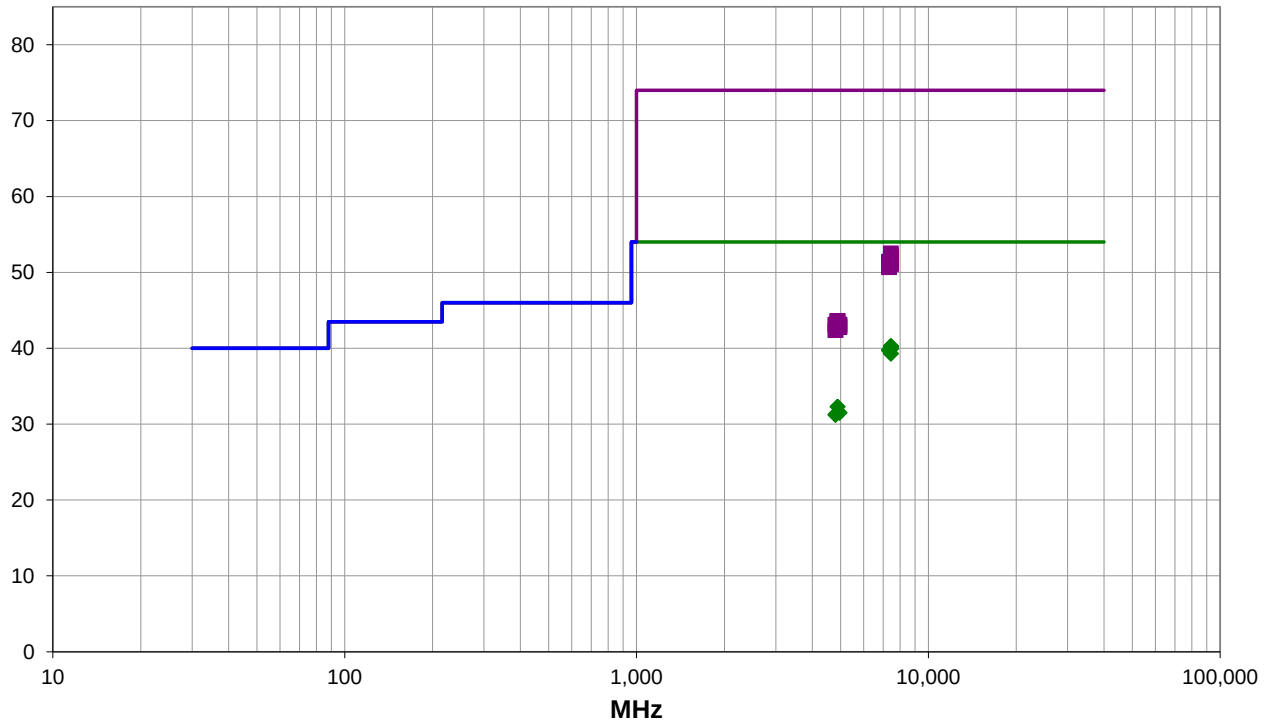
Tested with power 0dBm. Test mode duty cycle is 77.9% (1 Mbps), 79.9% (2 Mbps), 95.9% (125 kbps), 83.7% (500 kbps). Operational duty cycle is 60%. Duty cycle correction factor (DCCF) applied using DCCF=[10*log(1/test mode DC)]+[10*log(operational DC)]. Total correction applied: 1Mbps= -1.1 dB, 2Mbps=-1.3 Db, 125kbps=-2 dB, 500kbps= -1.4 dB

EUT OPERATING MODES

Transmitting BLE Low, Mid and High Channels (2402, 2442, 2480 MHz) 1 Mbps, 2 Mbps, 500 kbps, 125 kbps Modulated. PRBS9. Power 0 dBm

DEVIATIONS FROM TEST STANDARD

None



SPURIOUS RADIATED EMISSIONS

element
WTD.2023.10.23.0
EmiR5 2022.07.06.0
PSA-ESCI 2023.04.25.0

Run #: 80

■ PK ◆ AV ● QP

RESULTS - Run #80

Freq (MHz)	Amplitude (dBuV)	Factor (dB/m)	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
7439.183	29.5	11.9	1.5	84.9	-1.1	0.0	Horz	AV	0.0	40.3	54.0	-13.7	EUT Horz, High Ch, 1Mbps
7439.708	29.5	11.9	1.5	146.9	-1.1	0.0	Vert	AV	0.0	40.3	54.0	-13.7	EUT Horz, High Ch, 1Mbps
7441.025	29.5	11.9	1.3	52.0	-1.4	0.0	Horz	AV	0.0	40.0	54.0	-14.0	EUT Horz, High Ch, 500kbps
7438.450	29.4	11.9	1.5	346.0	-1.1	0.0	Horz	AV	0.0	40.2	54.0	-13.8	EUT On Side, High Ch, 1Mbps
7439.450	29.4	11.9	1.5	271.9	-1.1	0.0	Vert	AV	0.0	40.2	54.0	-13.8	EUT On Side, High Ch, 1Mbps
7437.992	29.4	11.9	1.5	141.0	-1.1	0.0	Horz	AV	0.0	40.2	54.0	-13.8	EUT Vert, High Ch, 1Mbps
7438.542	29.4	11.9	1.5	308.9	-1.1	0.0	Vert	AV	0.0	40.2	54.0	-13.8	EUT Vert, High Ch, 1Mbps
7438.408	29.4	11.9	1.5	52.0	-1.3	0.0	Horz	AV	0.0	40.0	54.0	-14.0	EUT Horz, High Ch, 2Mbps
7438.700	29.4	11.9	1.5	199.0	-1.3	0.0	Vert	AV	0.0	40.0	54.0	-14.0	EUT Horz, High Ch, 2Mbps
7439.958	29.4	11.9	1.2	15.0	-1.4	0.0	Vert	AV	0.0	39.9	54.0	-14.1	EUT Horz, High Ch, 500kbps
7438.125	29.4	11.9	1.5	336.0	-2.0	0.0	Horz	AV	0.0	39.3	54.0	-14.7	EUT Horz, High Ch, 125kbps
7439.850	29.4	11.9	1.5	329.0	-2.0	0.0	Vert	AV	0.0	39.3	54.0	-14.7	EUT Horz, High Ch, 125kbps
7323.717	29.2	11.7	1.4	149.0	-1.1	0.0	Vert	AV	0.0	39.8	54.0	-14.2	EUT Horz, Mid Ch, 1Mbps
7324.058	29.1	11.7	1.5	322.0	-1.1	0.0	Horz	AV	0.0	39.7	54.0	-14.3	EUT Horz, Mid Ch, 1Mbps
7439.342	40.6	11.9	1.5	141.0	0.0	0.0	Horz	PK	0.0	52.5	74.0	-21.5	EUT Vert, High Ch, 1Mbps
4884.617	30.0	3.4	1.5	300.0	-1.1	0.0	Horz	AV	0.0	32.3	54.0	-21.7	EUT Horz, Mid Ch, 1Mbps
4884.308	30.0	3.4	1.7	193.9	-1.1	0.0	Vert	AV	0.0	32.3	54.0	-21.7	EUT Horz, Mid Ch, 1Mbps
7442.400	40.2	11.9	1.5	329.0	0.0	0.0	Vert	PK	0.0	52.1	74.0	-21.9	EUT Horz, High Ch, 125kbps
7437.908	40.1	11.9	1.5	84.9	0.0	0.0	Horz	PK	0.0	52.0	74.0	-22.0	EUT Horz, High Ch, 1Mbps
7439.692	40.1	11.9	1.5	346.0	0.0	0.0	Horz	PK	0.0	52.0	74.0	-22.0	EUT On Side, High Ch, 1Mbps
7441.083	40.0	11.9	1.3	52.0	0.0	0.0	Horz	PK	0.0	51.9	74.0	-22.1	EUT Horz, High Ch, 500kbps
7439.792	39.9	11.9	1.5	271.9	0.0	0.0	Vert	PK	0.0	51.8	74.0	-22.2	EUT On Side, High Ch, 1Mbps
7439.192	39.9	11.9	1.2	15.0	0.0	0.0	Vert	PK	0.0	51.8	74.0	-22.2	EUT Horz, High Ch, 500kbps
7442.017	39.7	11.9	1.5	146.9	0.0	0.0	Vert	PK	0.0	51.6	74.0	-22.4	EUT Horz, High Ch, 1Mbps
4960.675	29.0	3.6	1.5	228.0	-1.1	0.0	Horz	AV	0.0	31.5	54.0	-22.5	EUT Horz, High Ch, 1Mbps
4959.558	29.0	3.6	1.6	296.0	-1.1	0.0	Vert	AV	0.0	31.5	54.0	-22.5	EUT Horz, High Ch, 1Mbps
7441.033	39.6	11.9	1.5	52.0	0.0	0.0	Horz	PK	0.0	51.5	74.0	-22.5	EUT Horz, High Ch, 2Mbps
7326.250	39.7	11.7	3.8	131.0	0.0	0.0	Vert	PK	0.0	51.4	74.0	-22.6	EUT Horz, Mid Ch, 1Mbps
4804.825	29.1	3.3	1.5	311.0	-1.1	0.0	Vert	AV	0.0	31.3	54.0	-22.7	EUT Horz, Low Ch, 1Mbps
7441.350	39.3	11.9	1.5	308.9	0.0	0.0	Vert	PK	0.0	51.2	74.0	-22.8	EUT Vert, High Ch, 1Mbps
7437.883	39.3	11.9	1.5	336.0	0.0	0.0	Horz	PK	0.0	51.2	74.0	-22.8	EUT Horz, High Ch, 125kbps
4803.792	29.0	3.3	1.5	102.9	-1.1	0.0	Horz	AV	0.0	31.2	54.0	-22.8	EUT Horz, Low Ch, 1Mbps
7441.167	39.2	11.9	1.5	199.0	0.0	0.0	Vert	PK	0.0	51.1	74.0	-22.9	EUT Horz, High Ch, 2Mbps
7327.975	38.9	11.8	1.5	322.0	0.0	0.0	Horz	PK	0.0	50.7	74.0	-23.3	EUT Horz, Mid Ch, 1Mbps
4884.092	40.2	3.4	1.5	300.0	0.0	0.0	Horz	PK	0.0	43.6	74.0	-30.4	EUT Horz, Mid Ch, 1Mbps
4882.058	40.2	3.4	1.7	193.9	0.0	0.0	Vert	PK	0.0	43.6	74.0	-30.4	EUT Horz, Mid Ch, 1Mbps
4959.775	39.5	3.6	1.6	296.0	0.0	0.0	Vert	PK	0.0	43.1	74.0	-30.9	EUT Horz, High Ch, 1Mbps
4803.992	39.8	3.3	1.5	102.9	0.0	0.0	Horz	PK	0.0	43.1	74.0	-30.9	EUT Horz, Low Ch, 1Mbps

SPURIOUS RADIATED EMISSIONS

element
WTD.2023.10.23.0
EmiR5 2022.07.06.0
PSA-ESCI 2023.04.25.0

Freq (MHz)	Amplitude (dBuV)	Factor (dB/m)	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
4961.000	39.2	3.6	1.5	228.0	0.0	0.0	Horz	PK	0.0	42.8	74.0	-31.2	EUT Horz, High Ch, 1Mbps
4804.958	39.1	3.3	1.5	311.0	0.0	0.0	Vert	PK	0.0	42.4	74.0	-31.6	EUT Horz, Low Ch, 1Mbps

CONCLUSION
Pass

Tested By

SPURIOUS RADIATED EMISSIONS

element
WTD.2023.10.23.0
EmiR5 2022.07.06.0
PSA-ESCI 2023.04.25.0

EUT:	O3 Sensor	Work Order:	TSIN0212
Serial Number:	8014062335005	Date:	2023-11-30
Customer:	TSI, Incorporated	Temperature:	22.7°C
Attendees:	Micah Larson	Relative Humidity:	25.5%
Customer Project:	None	Bar. Pressure (PMSL):	1007 mb
Tested By:	Marcelo Aguayo	Job Site:	MN05
Power:	Battery	Configuration:	TSIN0212-8

TEST SPECIFICATIONS

Specification:	Method:
FCC 15.247:2023	ANSI C63.10:2013
RSS-247 Issue 3:2023 RSS-Gen Issue 5:2018+A1:2019+A2:2021	ANSI C63.10:2013

TEST PARAMETERS

Run #:	81	Test Distance (m):	3	Ant. Height(s) (m):	1 to 4(m)

COMMENTS

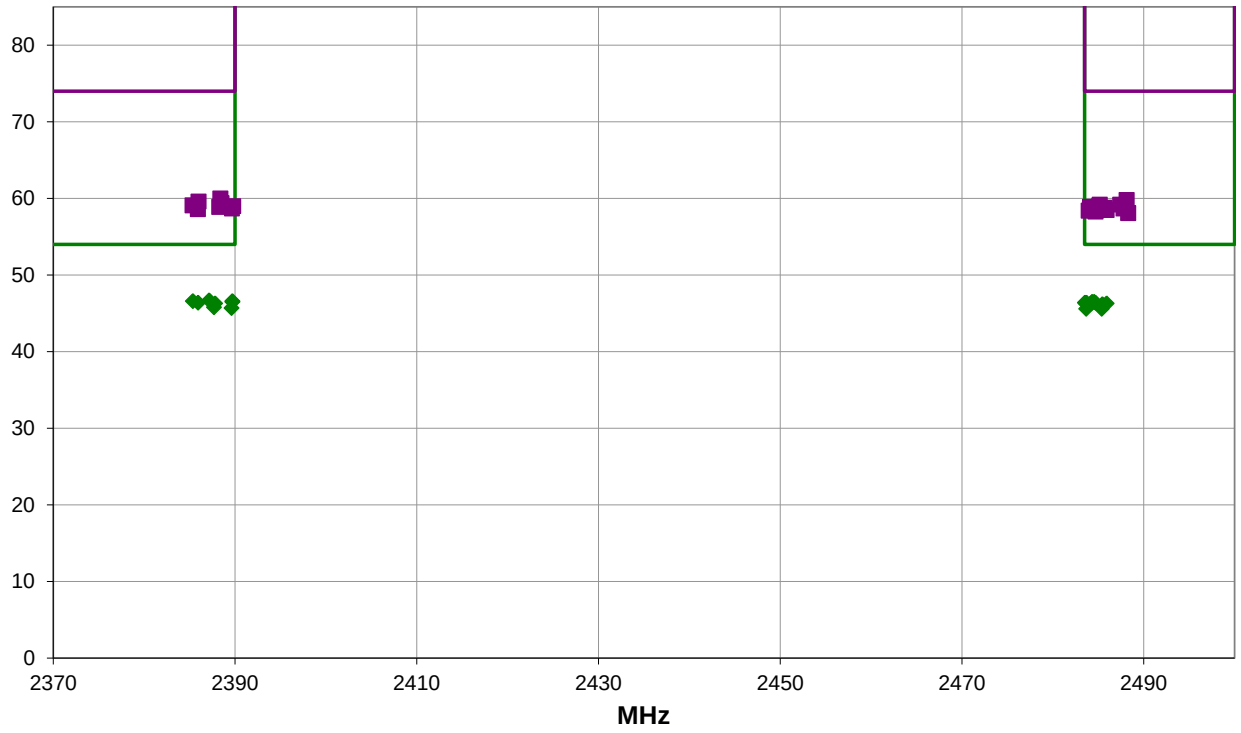
Tested with power 0dBm. Test mode duty cycle is 77.9% (1 Mbps), 79.9% (2 Mbps), 95.9% (125 kbps), 83.7% (500 kbps). Operational duty cycle is 60%. Duty cycle correction factor (DCCF) applied using DCCF=[10*log(1/test mode DC)]+[10*log(operational DC)]. Total correction applied: 1Mbps= -1.1 dB, 2Mbps=-1.3 Db, 125kbps=-2 dB, 500kbps= -1.4 dB

EUT OPERATING MODES

Transmitting BLE Low and High Channels (2402 and 2480 MHz) 1 Mbps, 2 Mbps, 500 kbps, 125 kbps Modulated. PRBS9. Power 0 dBm

DEVIATIONS FROM TEST STANDARD

None



SPURIOUS RADIATED EMISSIONS

element
WTD.2023.10.23.0
EmiR5 2022.07.06.0
PSA-ESCI 2023.04.25.0

Run #: 81

■ PK ◆ AV ● QP

RESULTS - Run #81

Freq (MHz)	Amplitude (dBuV)	Factor (dB/m)	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
2389.700	32.2	-4.3	1.5	343.9	-1.3	20.0	Vert	AV	0.0	46.6	54.0	-7.4	EUT Vert, Low Ch, 2Mbps
2387.142	32.1	-4.3	1.5	315.0	-1.1	20.0	Horz	AV	0.0	46.7	54.0	-7.3	EUT Vert, Low Ch, 1Mbps
2389.708	32.1	-4.3	1.5	267.0	-1.3	20.0	Horz	AV	0.0	46.5	54.0	-7.5	EUT Vert, Low Ch, 2Mbps
2387.675	32.1	-4.3	4.0	134.0	-2.0	20.0	Horz	AV	0.0	45.8	54.0	-8.2	EUT Vert, Low Ch, 125kbps
2385.925	32.1	-4.3	3.0	250.0	-1.4	20.0	Horz	AV	0.0	46.4	54.0	-7.6	EUT Vert, Low Ch, 500kbps
2385.350	32.0	-4.3	1.5	293.0	-1.1	20.0	Vert	AV	0.0	46.6	54.0	-7.4	EUT Vert, Low Ch, 1Mbps
2389.608	32.0	-4.3	1.5	220.0	-2.0	20.0	Vert	AV	0.0	45.7	54.0	-8.3	EUT Vert, Low Ch, 125kbps
2387.800	32.0	-4.3	1.5	333.9	-1.4	20.0	Vert	AV	0.0	46.3	54.0	-7.7	EUT Vert, Low Ch, 500kbps
2484.542	31.8	-4.2	1.5	211.9	-1.1	20.0	Horz	AV	0.0	46.5	54.0	-7.5	EUT Vert, High Ch, 1Mbps
2484.317	31.8	-4.2	3.8	337.9	-1.1	20.0	Vert	AV	0.0	46.5	54.0	-7.5	EUT Vert, High Ch, 1Mbps
2485.917	31.8	-4.2	1.5	52.9	-1.3	20.0	Horz	AV	0.0	46.3	54.0	-7.7	EUT Vert, High Ch, 2Mbps
2483.617	31.8	-4.2	1.5	222.9	-1.3	20.0	Vert	AV	0.0	46.3	54.0	-7.7	EUT Vert, High Ch, 2Mbps
2485.375	31.8	-4.2	1.5	112.0	-2.0	20.0	Horz	AV	0.0	45.6	54.0	-8.4	EUT Vert, High Ch, 125kbps
2483.667	31.8	-4.2	1.5	220.0	-2.0	20.0	Vert	AV	0.0	45.6	54.0	-8.4	EUT Vert, High Ch, 125kbps
2484.100	31.8	-4.2	1.5	49.9	-1.4	20.0	Horz	AV	0.0	46.2	54.0	-7.8	EUT Vert, High Ch, 500kbps
2485.450	31.8	-4.2	3.3	16.0	-1.4	20.0	Vert	AV	0.0	46.2	54.0	-7.8	EUT Vert, High Ch, 500kbps
2483.525	31.7	-4.2	1.5	117.9	-1.1	20.0	Vert	AV	0.0	46.4	54.0	-7.6	EUT Horz, High Ch, 1Mbps
2484.292	31.7	-4.2	1.5	27.9	-1.1	20.0	Horz	AV	0.0	46.4	54.0	-7.6	EUT On Side, High Ch, 1Mbps
2483.700	31.7	-4.2	1.5	16.9	-1.1	20.0	Vert	AV	0.0	46.4	54.0	-7.6	EUT On Side, High Ch, 1Mbps
2484.683	31.7	-4.2	1.5	307.9	-1.1	20.0	Horz	AV	0.0	46.4	54.0	-7.6	EUT Horz, High Ch, 1Mbps
2388.375	44.3	-4.3	1.5	343.9	0.0	20.0	Vert	PK	0.0	60.0	74.0	-14.0	EUT Vert, Low Ch, 2Mbps
2488.125	43.9	-4.1	1.5	16.9	0.0	20.0	Vert	PK	0.0	59.8	74.0	-14.2	EUT On Side, High Ch, 1Mbps
2385.983	43.9	-4.3	1.5	293.0	0.0	20.0	Vert	PK	0.0	59.6	74.0	-14.4	EUT Vert, Low Ch, 1Mbps
2388.492	43.7	-4.3	3.0	250.0	0.0	20.0	Horz	PK	0.0	59.4	74.0	-14.6	EUT Vert, Low Ch, 500kbps
2487.400	43.4	-4.2	1.5	52.9	0.0	20.0	Horz	PK	0.0	59.2	74.0	-14.8	EUT Vert, High Ch, 2Mbps
2485.158	43.4	-4.2	1.5	49.9	0.0	20.0	Horz	PK	0.0	59.2	74.0	-14.8	EUT Vert, High Ch, 500kbps
2385.325	43.4	-4.3	1.5	315.0	0.0	20.0	Horz	PK	0.0	59.1	74.0	-14.9	EUT Vert, Low Ch, 1Mbps
2485.075	43.2	-4.2	1.5	117.9	0.0	20.0	Vert	PK	0.0	59.0	74.0	-15.0	EUT Vert, High Ch, 1Mbps
2389.792	43.3	-4.3	1.5	333.9	0.0	20.0	Vert	PK	0.0	59.0	74.0	-15.0	EUT Vert, Low Ch, 500kbps
2484.075	43.1	-4.2	3.8	337.9	0.0	20.0	Vert	PK	0.0	58.9	74.0	-15.1	EUT Horz, High Ch, 1Mbps
2388.242	43.2	-4.3	4.0	134.0	0.0	20.0	Horz	PK	0.0	58.9	74.0	-15.1	EUT Vert, Low Ch, 125kbps
2485.692	43.0	-4.2	1.5	211.9	0.0	20.0	Horz	PK	0.0	58.8	74.0	-15.2	EUT Vert, High Ch, 1Mbps
2389.650	43.0	-4.3	1.5	267.0	0.0	20.0	Horz	PK	0.0	58.7	74.0	-15.3	EUT Vert, Low Ch, 2Mbps
2487.775	42.9	-4.2	1.5	220.0	0.0	20.0	Vert	PK	0.0	58.7	74.0	-15.3	EUT Vert, High Ch, 125kbps
2484.150	42.9	-4.2	3.3	16.0	0.0	20.0	Vert	PK	0.0	58.7	74.0	-15.3	EUT Vert, High Ch, 500kbps
2385.908	42.9	-4.3	1.5	220.0	0.0	20.0	Vert	PK	0.0	58.6	74.0	-15.4	EUT Vert, Low Ch, 125kbps
2485.917	42.7	-4.2	1.5	112.0	0.0	20.0	Horz	PK	0.0	58.5	74.0	-15.5	EUT Vert, High Ch, 125kbps
2483.933	42.6	-4.2	1.5	27.9	0.0	20.0	Horz	PK	0.0	58.4	74.0	-15.6	EUT On Side, High Ch, 1Mbps

SPURIOUS RADIATED EMISSIONS

element
WTD.2023.10.23.0
EmiR5 2022.07.06.0
PSA-ESCI 2023.04.25.0

Freq (MHz)	Amplitude (dBuV)	Factor (dB/m)	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
2484.700	42.5	-4.2	1.5	307.9	0.0	20.0	Horz	PK	0.0	58.3	74.0	-15.7	EUT Horz, High Ch, 1Mbps
2488.292	42.2	-4.1	1.5	222.9	0.0	20.0	Vert	PK	0.0	58.1	74.0	-15.9	EUT Vert, High Ch, 2Mbps

CONCLUSION
Pass

Tested By

SPURIOUS RADIATED EMISSIONS

element
WTD.2023.10.23.0
EmiR5 2022.07.06.0
PSA-ESCI 2023.04.25.0

EUT:	TVOC Sensor	Work Order:	TSIN0212
Serial Number:	14082342004	Date:	2023-12-04
Customer:	TSI, Incorporated	Temperature:	22°C
Attendees:	Micah Larson	Relative Humidity:	27%
Customer Project:	None	Bar. Pressure (PMSL):	1012 mb
Tested By:	Marcelo Aguayo	Job Site:	MN05
Power:	Battery	Configuration:	TSIN0212-10

TEST SPECIFICATIONS

Specification:	Method:
FCC 15.247:2023	ANSI C63.10:2013
RSS-247 Issue 3:2023 RSS-Gen Issue 5:2018+A1:2019+A2:2021	ANSI C63.10:2013

Run #:	100	Test Distance (m):	3	Ant. Height(s) (m):	1 to 4(m)

COMMENTS

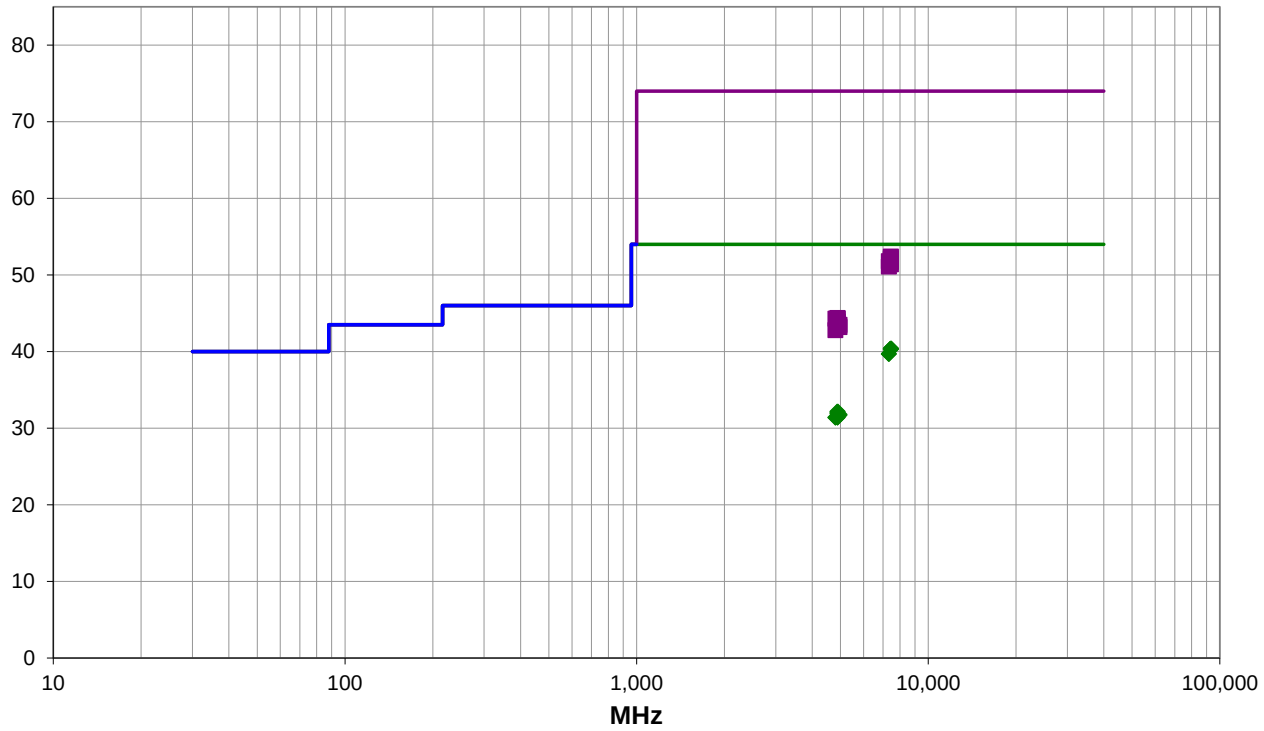
Tested with power 0dBm. Test mode duty cycle is 77.9% (1 Mbps), 79.9% (2 Mbps), 95.9% (125 kbps), 83.7% (500 kbps). Operational duty cycle is 60%. Duty cycle correction factor (DCCF) applied using DCCF=[10*log(1/test mode DC)]+[10*log(operational DC)]. Total correction applied: 1Mbps= -1.1 dB, 2Mbps=-1.3 Db, 125kbps=-2 dB, 500kbps= -1.4 dB

EUT OPERATING MODES

Transmitting BLE Low, Mid and High Channels (2402, 2442, 2480 MHz) 1 Mbps, 2 Mbps, 500 kbps, 125 kbps Modulated. PRBS9. Power 0 dBm

DEVIATIONS FROM TEST STANDARD

None



Run #: 100 ■ PK ◆ AV ● QP

SPURIOUS RADIATED EMISSIONS

element
WTD.2023.10.23.0
EmiR5 2022.07.06.0
PSA-ESCI 2023.04.25.0

RESULTS - Run #100

Freq (MHz)	Amplitude (dBuV)	Factor (dB/m)	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
4881.500	41.8	3.4	1.5	235.9	-1.1	0.0	Vert	AV	0.0	44.1	54.0	-9.9	EUT Horz, Mid Ch 1Mbps
7441.700	29.6	11.9	2.8	160.9	-1.1	0.0	Horz	AV	0.0	40.4	54.0	-13.6	EUT Horz, High Ch 1Mbps
7441.358	29.6	11.9	1.5	149.0	-1.1	0.0	Vert	AV	0.0	40.4	54.0	-13.6	EUT Horz, High Ch 1Mbps
7442.133	29.6	11.9	2.0	245.0	-1.1	0.0	Vert	AV	0.0	40.4	54.0	-13.6	EUT Vert, High Ch 1Mbps
7440.867	29.6	11.9	1.5	243.9	-1.1	0.0	Horz	AV	0.0	40.4	54.0	-13.6	EUT On Side, High Ch 1Mbps
7439.883	29.5	11.9	3.7	92.9	-1.1	0.0	Horz	AV	0.0	40.3	54.0	-13.7	EUT Vert, High Ch 1Mbps
7438.908	29.5	11.9	1.5	124.9	-1.1	0.0	Vert	AV	0.0	40.3	54.0	-13.7	EUT On Side, High Ch 1Mbps
7323.667	29.1	11.7	1.9	162.0	-1.1	0.0	Horz	AV	0.0	39.7	54.0	-14.3	EUT Horz, Mid Ch 1Mbps
7323.958	29.1	11.7	1.7	239.0	-1.1	0.0	Vert	AV	0.0	39.7	54.0	-14.3	EUT Horz, Mid Ch 1Mbps
7442.300	40.5	11.9	3.7	92.9	0.0	0.0	Horz	PK	0.0	52.4	74.0	-21.6	EUT Vert, High Ch 1Mbps
4883.908	30.0	3.4	3.7	332.0	-1.3	0.0	Horz	AV	0.0	32.1	54.0	-21.9	EUT Horz, Mid Ch 2Mbps
4884.750	30.0	3.4	3.2	293.0	-1.3	0.0	Vert	AV	0.0	32.1	54.0	-21.9	EUT Horz, Mid Ch 2Mbps
4884.408	30.0	3.4	3.6	270.0	-2.0	0.0	Horz	AV	0.0	31.4	54.0	-22.6	EUT Horz, Mid Ch 125kbps
4884.633	30.0	3.4	1.0	178.0	-2.0	0.0	Vert	AV	0.0	31.4	54.0	-22.6	EUT Horz, Mid Ch 125kbps
7442.000	40.3	11.9	1.5	149.0	0.0	0.0	Vert	PK	0.0	52.2	74.0	-21.8	EUT Horz, High Ch 1Mbps
4885.083	29.9	3.4	1.5	236.9	-1.1	0.0	Horz	AV	0.0	32.2	54.0	-21.8	EUT Horz, Mid Ch 1Mbps
4885.000	29.9	3.4	2.1	160.0	-1.4	0.0	Horz	AV	0.0	31.9	54.0	-22.1	EUT Horz, Mid Ch 500kbps
4886.200	29.9	3.4	1.5	318.0	-1.4	0.0	Vert	AV	0.0	31.9	54.0	-22.1	EUT Horz, Mid Ch 500kbps
7441.275	40.2	11.9	2.8	160.9	0.0	0.0	Horz	PK	0.0	52.1	74.0	-21.9	EUT Horz, High Ch 1Mbps
4961.967	29.3	3.6	1.5	141.0	-1.1	0.0	Vert	AV	0.0	31.8	54.0	-22.2	EUT Horz, High Ch 1Mbps
7441.883	39.9	11.9	2.0	245.0	0.0	0.0	Vert	PK	0.0	51.8	74.0	-22.2	EUT Vert, High Ch 1Mbps
7327.083	40.1	11.7	1.7	239.0	0.0	0.0	Vert	PK	0.0	51.8	74.0	-22.2	EUT Horz, Mid Ch 1Mbps
7438.058	39.8	11.9	1.5	243.9	0.0	0.0	Horz	PK	0.0	51.7	74.0	-22.3	EUT On Side, High Ch 1Mbps
4960.800	29.2	3.6	1.5	264.0	-1.1	0.0	Horz	AV	0.0	31.7	54.0	-22.3	EUT Horz, High Ch 1Mbps
4806.175	29.2	3.3	1.5	276.9	-1.1	0.0	Horz	AV	0.0	31.4	54.0	-22.6	EUT Horz, Low Ch 1Mbps
4801.975	29.2	3.3	1.5	62.0	-1.1	0.0	Vert	AV	0.0	31.4	54.0	-22.6	EUT Horz, Low Ch 1Mbps
7442.283	39.5	11.9	1.5	124.9	0.0	0.0	Vert	PK	0.0	51.4	74.0	-22.6	EUT On Side, High Ch 1Mbps
7325.742	39.4	11.7	1.9	162.0	0.0	0.0	Horz	PK	0.0	51.1	74.0	-22.9	EUT Horz, Mid Ch 1Mbps
4882.992	41.0	3.4	1.0	178.0	0.0	0.0	Vert	PK	0.0	44.4	74.0	-29.6	EUT Horz, Mid Ch 125kbps
4884.658	40.9	3.4	1.5	236.9	0.0	0.0	Horz	PK	0.0	44.3	74.0	-29.7	EUT Horz, Mid Ch 1Mbps
4885.508	40.9	3.4	1.5	235.9	0.0	0.0	Vert	PK	0.0	44.3	74.0	-29.7	EUT Horz, Mid Ch 1Mbps
4803.458	41.0	3.3	1.5	62.0	0.0	0.0	Vert	PK	0.0	44.3	74.0	-29.7	EUT Horz, Low Ch 1Mbps
4885.408	40.5	3.4	3.6	270.0	0.0	0.0	Horz	PK	0.0	43.9	74.0	-30.1	EUT Horz, Mid Ch 125kbps
4884.658	40.5	3.4	1.5	318.0	0.0	0.0	Vert	PK	0.0	43.9	74.0	-30.1	EUT Horz, Mid Ch 500kbps
4884.333	40.4	3.4	2.1	160.0	0.0	0.0	Horz	PK	0.0	43.8	74.0	-30.2	EUT Horz, Mid Ch 500kbps
4958.792	39.9	3.6	1.5	141.0	0.0	0.0	Vert	PK	0.0	43.5	74.0	-30.5	EUT Horz, High Ch 1Mbps
4883.458	40.1	3.4	3.7	332.0	0.0	0.0	Horz	PK	0.0	43.5	74.0	-30.5	EUT Horz, Mid Ch 2Mbps
4884.042	40.1	3.4	3.2	293.0	0.0	0.0	Vert	PK	0.0	43.5	74.0	-30.5	EUT Horz, Mid Ch 2Mbps
4960.992	39.6	3.6	1.5	264.0	0.0	0.0	Horz	PK	0.0	43.2	74.0	-30.8	EUT Horz, High Ch 1Mbps
4801.600	39.5	3.3	1.5	276.9	0.0	0.0	Horz	PK	0.0	42.8	74.0	-31.2	EUT Horz, Low Ch 1Mbps

SPURIOUS RADIATED EMISSIONS

element
WTD.2023.10.23.0
EmiR5 2022.07.06.0
PSA-ESCI 2023.04.25.0

CONCLUSION
Pass

Tested By

SPURIOUS RADIATED EMISSIONS

element
WTD.2023.10.23.0
EmiR5 2022.07.06.0
PSA-ESCI 2023.04.25.0

EUT:	TVOC Sensor	Work Order:	TSIN0212
Serial Number:	14082342004	Date:	2023-12-04
Customer:	TSI, Incorporated	Temperature:	22°C
Attendees:	Micah Larson	Relative Humidity:	27%
Customer Project:	None	Bar. Pressure (PMSL):	1012 mb
Tested By:	Marcelo Aguayo	Job Site:	MN05
Power:	Battery	Configuration:	TSIN0212-10

TEST SPECIFICATIONS

Specification:	Method:
FCC 15.247:2023	ANSI C63.10:2013
RSS-247 Issue 3:2023 RSS-Gen Issue 5:2018+A1:2019+A2:2021	ANSI C63.10:2013

TEST PARAMETERS

Run #:	101	Test Distance (m):	3	Ant. Height(s) (m):	1 to 4(m)

COMMENTS

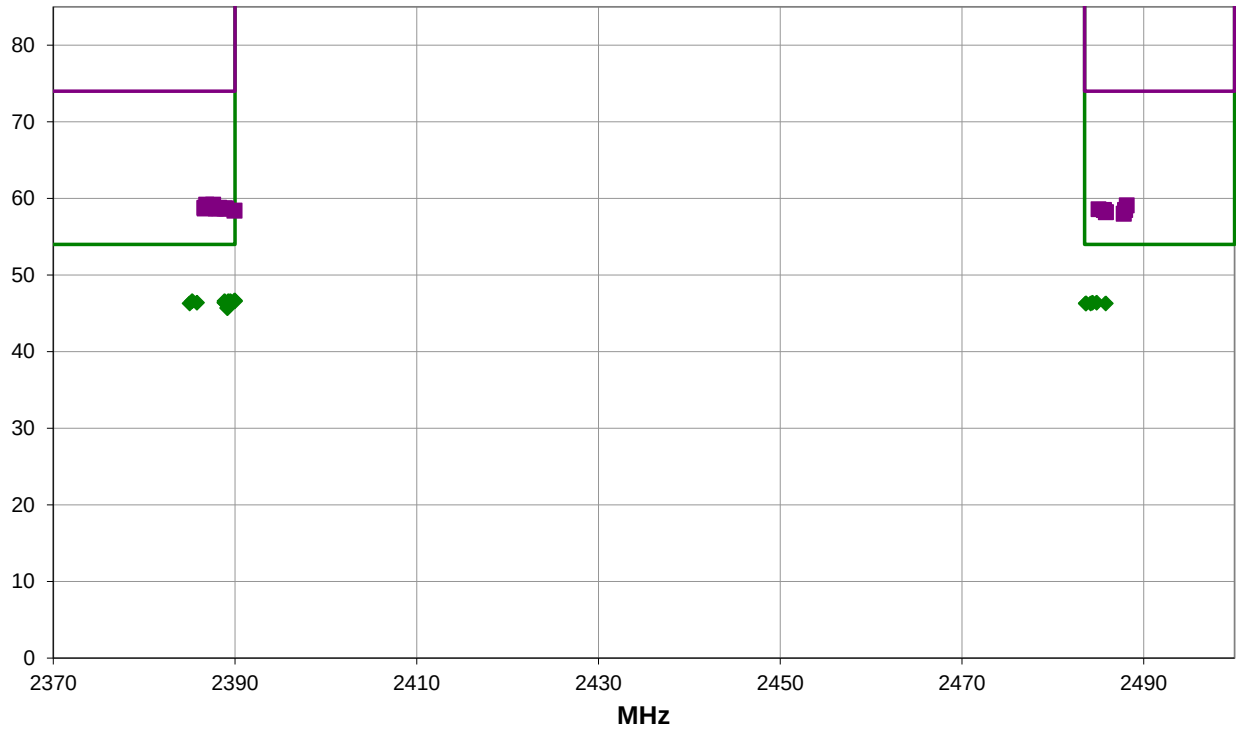
Tested with power 0dBm. Test mode duty cycle is 77.9% (1 Mbps), 79.9% (2 Mbps), 95.9% (125 kbps), 83.7% (500 kbps). Operational duty cycle is 60%. Duty cycle correction factor (DCCF) applied using DCCF=[10*log(1/test mode DC)]+[10*log(operational DC)]. Total correction applied: 1Mbps= -1.1 dB, 2Mbps=-1.3 Db, 125kbps=-2 dB, 500kbps= -1.4 dB

EUT OPERATING MODES

Transmitting BLE Low and High Channels (2402 and 2480 MHz) 1 Mbps, 2 Mbps, 500 kbps, 125 kbps Modulated. PRBS9. Power 0 dBm

DEVIATIONS FROM TEST STANDARD

None



SPURIOUS RADIATED EMISSIONS

element
WTD.2023.10.23.0
EmiR5 2022.07.06.0
PSA-ESCI 2023.04.25.0

Run #: 101

■ PK ◆ AV ● QP

RESULTS - Run #101

Freq (MHz)	Amplitude (dBuV)	Factor (dB/m)	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
2389.950	32.1	-4.3	2.2	149.9	-1.1	20.0	Horz	AV	0.0	46.7	54.0	-7.3	EUT Vert, Low Ch 1Mbps
2388.833	32.1	-4.3	1.5	65.0	-1.4	20.0	Horz	AV	0.0	46.4	54.0	-7.6	EUT Vert, Low Ch 500kbps
2388.842	32.0	-4.3	1.2	343.9	-1.1	20.0	Horz	AV	0.0	46.6	54.0	-7.4	EUT Horz, Low Ch 1Mbps
2385.275	32.0	-4.3	1.5	276.9	-1.1	20.0	Vert	AV	0.0	46.6	54.0	-7.4	EUT Vert, Low Ch 1Mbps
2389.483	32.0	-4.3	1.5	308.9	-1.1	20.0	Horz	AV	0.0	46.6	54.0	-7.4	EUT On Side, Low Ch 1Mbps
2389.258	32.0	-4.3	1.4	16.9	-1.1	20.0	Vert	AV	0.0	46.6	54.0	-7.4	EUT On Side, Low Ch 1Mbps
2389.992	32.0	-4.3	1.5	360.0	-1.1	20.0	Vert	AV	0.0	46.6	54.0	-7.4	EUT Horz, Low Ch 1Mbps
2385.800	32.0	-4.3	1.5	286.0	-1.3	20.0	Horz	AV	0.0	46.4	54.0	-7.6	EUT Vert, Low Ch 2Mbps
2388.867	32.0	-4.3	1.5	116.0	-1.3	20.0	Vert	AV	0.0	46.4	54.0	-7.6	EUT Vert, Low Ch 2Mbps
2389.150	32.0	-4.3	1.5	90.0	-2.0	20.0	Horz	AV	0.0	45.7	54.0	-8.3	EUT Vert, Low Ch 125kbps
2389.158	32.0	-4.3	1.1	336.9	-2.0	20.0	Vert	AV	0.0	45.7	54.0	-8.3	EUT Vert, Low Ch 125kbps
2385.000	32.0	-4.3	1.5	153.9	-1.4	20.0	Vert	AV	0.0	46.3	54.0	-7.7	EUT Vert, Low Ch 500kbps
2484.817	31.7	-4.2	1.5	217.0	-1.1	20.0	Horz	AV	0.0	46.4	54.0	-7.6	EUT On Side, High Ch 1Mbps
2484.358	31.7	-4.2	1.5	290.9	-1.1	20.0	Vert	AV	0.0	46.4	54.0	-7.6	EUT On Side, High Ch 1Mbps
2484.158	31.6	-4.2	1.5	263.0	-1.1	20.0	Horz	AV	0.0	46.3	54.0	-7.7	EUT Vert, High Ch 1Mbps
2483.642	31.6	-4.2	1.5	260.0	-1.1	20.0	Vert	AV	0.0	46.3	54.0	-7.7	EUT Vert, High Ch 1Mbps
2483.625	31.6	-4.2	1.6	80.0	-1.1	20.0	Horz	AV	0.0	46.3	54.0	-7.7	EUT Horz, High Ch 1Mbps
2485.817	31.6	-4.2	1.5	268.9	-1.1	20.0	Vert	AV	0.0	46.3	54.0	-7.7	EUT Horz, High Ch 1Mbps
2386.817	43.5	-4.3	1.1	336.9	0.0	20.0	Vert	PK	0.0	59.2	74.0	-14.8	EUT Vert, Low Ch 125kbps
2387.575	43.5	-4.3	1.5	153.9	0.0	20.0	Vert	PK	0.0	59.2	74.0	-14.8	EUT Vert, Low Ch 500kbps
2488.133	43.2	-4.1	1.5	290.9	0.0	20.0	Vert	PK	0.0	59.1	74.0	-14.9	EUT On Side, High Ch 1Mbps
2387.358	43.3	-4.3	1.5	116.0	0.0	20.0	Vert	PK	0.0	59.0	74.0	-15.0	EUT Vert, Low Ch 2Mbps
2388.225	43.1	-4.3	1.2	343.9	0.0	20.0	Horz	PK	0.0	58.8	74.0	-15.2	EUT Horz, Low Ch 1Mbps
2386.633	43.1	-4.3	1.5	286.0	0.0	20.0	Horz	PK	0.0	58.8	74.0	-15.2	EUT Vert, Low Ch 2Mbps
2386.925	43.1	-4.3	1.5	90.0	0.0	20.0	Horz	PK	0.0	58.8	74.0	-15.2	EUT Vert, Low Ch 125kbps
2387.875	43.0	-4.3	1.5	276.9	0.0	20.0	Vert	PK	0.0	58.7	74.0	-15.3	EUT Horz, Low Ch 1Mbps
2386.658	43.0	-4.3	1.5	308.9	0.0	20.0	Horz	PK	0.0	58.7	74.0	-15.3	EUT On Side, Low Ch 1Mbps
2389.025	43.0	-4.3	1.4	16.9	0.0	20.0	Vert	PK	0.0	58.7	74.0	-15.3	EUT On Side, Low Ch 1Mbps
2388.267	43.0	-4.3	1.5	360.0	0.0	20.0	Vert	PK	0.0	58.7	74.0	-15.3	EUT Vert, Low Ch 1Mbps
2388.825	43.0	-4.3	1.5	65.0	0.0	20.0	Horz	PK	0.0	58.7	74.0	-15.3	EUT Vert, Low Ch 500kbps
2485.025	42.8	-4.2	1.6	80.0	0.0	20.0	Horz	PK	0.0	58.6	74.0	-15.4	EUT Horz, High Ch 1Mbps
2487.942	42.7	-4.2	1.5	263.0	0.0	20.0	Horz	PK	0.0	58.5	74.0	-15.5	EUT Vert, High Ch 1Mbps
2485.617	42.7	-4.2	1.5	260.0	0.0	20.0	Vert	PK	0.0	58.5	74.0	-15.5	EUT Vert, High Ch 1Mbps
2389.933	42.7	-4.3	2.2	149.9	0.0	20.0	Horz	PK	0.0	58.4	74.0	-15.6	EUT Vert, Low Ch 1Mbps
2485.833	42.4	-4.2	1.5	217.0	0.0	20.0	Horz	PK	0.0	58.2	74.0	-15.8	EUT On Side, High Ch 1Mbps
2487.808	42.2	-4.2	1.5	268.9	0.0	20.0	Vert	PK	0.0	58.0	74.0	-16.0	EUT Horz, High Ch 1Mbps

CONCLUSION

SPURIOUS RADIATED EMISSIONS

element
WTD.2023.10.23.0
EmiR5 2022.07.06.0
PSA-ESCI 2023.04.25.0

Pass

Tested By

SPURIOUS RADIATED EMISSIONS

element
WTD.2023.10.23.0
EmiR5 2022.07.06.0
PSA-ESCI 2023.04.25.0

EUT:	NH3 Sensor	Work Order:	TSIN0212
Serial Number:	14032343008	Date:	2023-12-04
Customer:	TSI, Incorporated	Temperature:	22°C
Attendees:	Micah Larson	Relative Humidity:	27.2%
Customer Project:	None	Bar. Pressure (PMSL):	1010 mb
Tested By:	Marcelo Aguayo	Job Site:	MN05
Power:	Battery	Configuration:	TSIN0212-11

TEST SPECIFICATIONS

Specification:	Method:
FCC 15.247:2023	ANSI C63.10:2013
RSS-247 Issue 3:2023 RSS-Gen Issue 5:2018+A1:2019+A2:2021	ANSI C63.10:2013

TEST PARAMETERS

Run #:	117	Test Distance (m):	3	Ant. Height(s) (m):	1 to 4(m)

COMMENTS

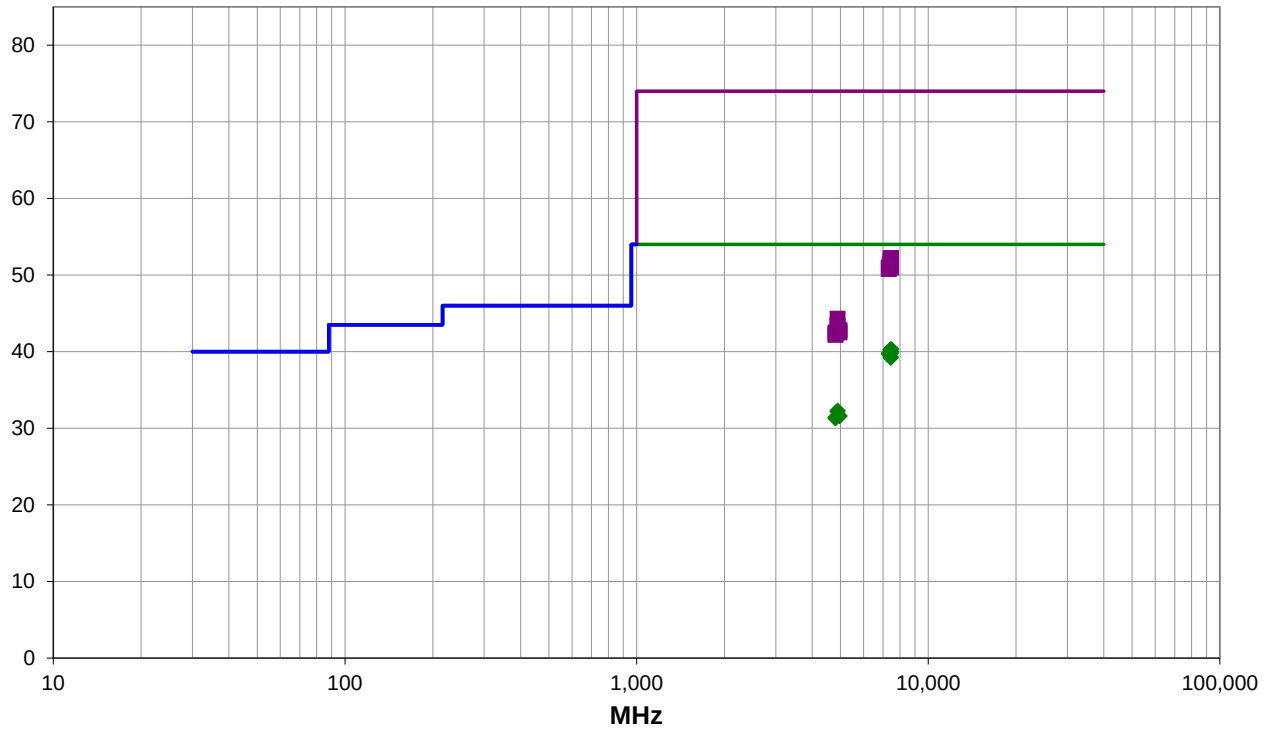
Tested with power 0dBm. Test mode duty cycle is 77.9% (1 Mbps), 79.9% (2 Mbps), 95.9% (125 kbps), 83.7% (500 kbps). Operational duty cycle is 60%. Duty cycle correction factor (DCCF) applied using DCCF=[10*log(1/test mode DC)]+[10*log(operational DC)]. Total correction applied: 1Mbps= -1.1 dB, 2Mbps=-1.3 Db, 125kbps=-2 dB, 500kbps= -1.4 dB

EUT OPERATING MODES

Transmitting BLE Low, Mid and High Channels (2402, 2442, 2480 MHz) 1 Mbps, 2 Mbps, 500 kbps, 125 kbps Modulated. PRBS9. Power 0 dBm

DEVIATIONS FROM TEST STANDARD

None



SPURIOUS RADIATED EMISSIONS

element
WTD.2023.10.23.0
EmiR5 2022.07.06.0
PSA-ESCI 2023.04.25.0

Run #: 117

■ PK ◆ AV ● QP

RESULTS - Run #117

Freq (MHz)	Amplitude (dBuV)	Factor (dB/m)	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
7440.208	29.5	11.9	2.5	235.9	-1.1	0.0	Horz	AV	0.0	40.3	54.0	-13.7	EUT Horz, High Ch, 1Mbps
7439.192	29.5	11.9	1.5	119.0	-1.1	0.0	Vert	AV	0.0	40.3	54.0	-13.7	EUT Horz, High Ch, 1Mbps
7439.858	29.5	11.9	3.3	83.0	-1.1	0.0	Horz	AV	0.0	40.3	54.0	-13.7	EUT Vert, High Ch, 1Mbps
7437.550	29.5	11.9	3.2	113.0	-1.1	0.0	Vert	AV	0.0	40.3	54.0	-13.7	EUT Vert, High Ch, 1Mbps
7439.292	29.5	11.9	1.5	290.9	-1.1	0.0	Horz	AV	0.0	40.3	54.0	-13.7	EUT On Side, High Ch, 1Mbps
7440.300	29.5	11.9	1.5	292.0	-1.1	0.0	Vert	AV	0.0	40.3	54.0	-13.7	EUT On Side, High Ch, 1Mbps
7439.200	29.4	11.9	1.5	99.0	-1.3	0.0	Horz	AV	0.0	40.0	54.0	-14.0	EUT Horz, High Ch, 2Mbps
7439.583	29.4	11.9	1.5	301.9	-1.3	0.0	Vert	AV	0.0	40.0	54.0	-14.0	EUT Horz, High Ch, 2Mbps
7440.050	29.4	11.9	1.5	83.0	-2.0	0.0	Horz	AV	0.0	39.3	54.0	-14.7	EUT Horz, High Ch, 125kbps
7439.242	29.4	11.9	1.5	357.0	-1.4	0.0	Horz	AV	0.0	39.9	54.0	-14.1	EUT Horz, High Ch, 500kbps
7437.783	29.3	11.9	3.0	318.0	-2.0	0.0	Vert	AV	0.0	39.2	54.0	-14.8	EUT Horz, High Ch, 125kbps
7441.958	29.3	11.9	1.5	294.9	-1.4	0.0	Vert	AV	0.0	39.8	54.0	-14.2	EUT Horz, High Ch, 500kbps
7323.792	29.2	11.7	1.5	16.9	-1.1	0.0	Horz	AV	0.0	39.8	54.0	-14.2	EUT Horz, Mid Ch, 1Mbps
7324.058	29.1	11.7	1.5	203.0	-1.1	0.0	Vert	AV	0.0	39.7	54.0	-14.3	EUT Horz, Mid Ch, 1Mbps
4885.475	30.0	3.4	1.4	59.9	-1.1	0.0	Horz	AV	0.0	32.3	54.0	-21.7	EUT Horz, Mid Ch, 1Mbps
7438.767	40.3	11.9	2.5	235.9	0.0	0.0	Horz	PK	0.0	52.2	74.0	-21.8	EUT Horz, High Ch, 1Mbps
7440.067	40.3	11.9	1.5	290.9	0.0	0.0	Horz	PK	0.0	52.2	74.0	-21.8	EUT On Side, High Ch, 1Mbps
4885.958	29.9	3.4	1.8	77.9	-1.1	0.0	Vert	AV	0.0	32.2	54.0	-21.8	EUT Horz, Mid Ch, 1Mbps
7441.450	40.2	11.9	3.0	318.0	0.0	0.0	Vert	PK	0.0	52.1	74.0	-21.9	EUT Horz, High Ch, 125kbps
7440.242	39.9	11.9	3.3	83.0	0.0	0.0	Horz	PK	0.0	51.8	74.0	-22.2	EUT Vert, High Ch, 1Mbps
7438.183	39.8	11.9	1.5	119.0	0.0	0.0	Vert	PK	0.0	51.7	74.0	-22.3	EUT Horz, High Ch, 1Mbps
4961.267	29.1	3.6	1.5	254.9	-1.1	0.0	Horz	AV	0.0	31.6	54.0	-22.4	EUT Horz, High Ch, 1Mbps
4959.217	29.1	3.6	1.5	330.9	-1.1	0.0	Vert	AV	0.0	31.6	54.0	-22.4	EUT Horz, High Ch, 1Mbps
7440.058	39.7	11.9	1.5	292.0	0.0	0.0	Vert	PK	0.0	51.6	74.0	-22.4	EUT On Side, High Ch, 1Mbps
7437.867	39.6	11.9	3.2	113.0	0.0	0.0	Vert	PK	0.0	51.5	74.0	-22.5	EUT Vert, High Ch, 1Mbps
4804.283	29.2	3.3	2.5	45.0	-1.1	0.0	Horz	AV	0.0	31.4	54.0	-22.6	EUT Horz, Low Ch, 1Mbps
4804.367	29.1	3.3	1.5	114.9	-1.1	0.0	Vert	AV	0.0	31.3	54.0	-22.7	EUT Horz, Low Ch, 1Mbps
7440.017	39.4	11.9	1.5	301.9	0.0	0.0	Vert	PK	0.0	51.3	74.0	-22.7	EUT Horz, High Ch, 2Mbps
7442.408	39.3	11.9	1.5	83.0	0.0	0.0	Horz	PK	0.0	51.2	74.0	-22.8	EUT Horz, High Ch, 125kbps
7442.292	39.3	11.9	1.5	357.0	0.0	0.0	Horz	PK	0.0	51.2	74.0	-22.8	EUT Horz, High Ch, 500kbps
7441.333	39.3	11.9	1.5	294.9	0.0	0.0	Vert	PK	0.0	51.2	74.0	-22.8	EUT Horz, High Ch, 500kbps
7328.192	39.2	11.8	1.5	203.0	0.0	0.0	Vert	PK	0.0	51.0	74.0	-23.0	EUT Horz, Mid Ch, 1Mbps
7441.283	39.1	11.9	1.5	99.0	0.0	0.0	Horz	PK	0.0	51.0	74.0	-23.0	EUT Horz, High Ch, 2Mbps
7323.783	39.1	11.7	1.5	16.9	0.0	0.0	Horz	PK	0.0	50.8	74.0	-23.2	EUT Horz, Mid Ch, 1Mbps
4886.425	40.9	3.4	1.4	59.9	0.0	0.0	Horz	PK	0.0	44.3	74.0	-29.7	EUT Horz, Mid Ch, 1Mbps
4884.517	40.0	3.4	1.8	77.9	0.0	0.0	Vert	PK	0.0	43.4	74.0	-30.6	EUT Horz, Mid Ch, 1Mbps
4958.783	39.2	3.6	1.5	330.9	0.0	0.0	Vert	PK	0.0	42.8	74.0	-31.2	EUT Horz, High Ch, 1Mbps
4961.625	38.9	3.6	1.5	254.9	0.0	0.0	Horz	PK	0.0	42.5	74.0	-31.5	EUT Horz, High Ch, 1Mbps

SPURIOUS RADIATED EMISSIONS

element
WTD.2023.10.23.0
EmiR5 2022.07.06.0
PSA-ESCI 2023.04.25.0

Freq (MHz)	Amplitude (dBuV)	Factor (dB/m)	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
4804.617	39.2	3.3	2.5	45.0	0.0	0.0	Horz	PK	0.0	42.5	74.0	-31.5	EUT Horz, Low Ch, 1Mbps
4806.350	38.9	3.3	1.5	114.9	0.0	0.0	Vert	PK	0.0	42.2	74.0	-31.8	EUT Horz, Low Ch, 1Mbps

CONCLUSION
Pass

Tested By

SPURIOUS RADIATED EMISSIONS

element
WTD.2023.10.23.0
EmiR5 2022.07.06.0
PSA-ESCI 2023.04.25.0

EUT:	NH3 Sensor	Work Order:	TSIN0212
Serial Number:	14032343008	Date:	2023-12-04
Customer:	TSI, Incorporated	Temperature:	22°C
Attendees:	Micah Larson	Relative Humidity:	27.2%
Customer Project:	None	Bar. Pressure (PMSL):	1010 mb
Tested By:	Marcelo Aguayo	Job Site:	MN05
Power:	Battery	Configuration:	TSIN0212-11

TEST SPECIFICATIONS

Specification:	Method:
FCC 15.247:2023	ANSI C63.10:2013
RSS-247 Issue 3:2023 RSS-Gen Issue 5:2018+A1:2019+A2:2021	ANSI C63.10:2013

TEST PARAMETERS

Run #:	118	Test Distance (m):	3	Ant. Height(s) (m):	1 to 4(m)

COMMENTS

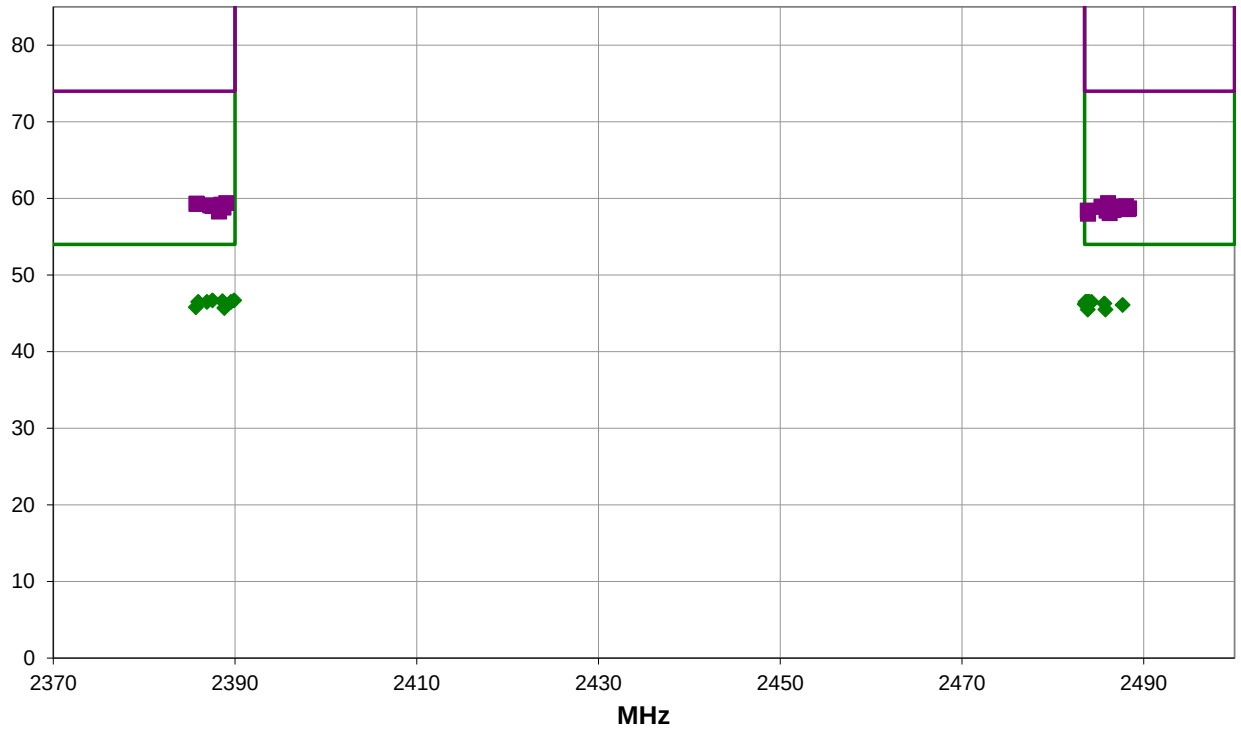
Tested with power 0dBm. Test mode duty cycle is 77.9% (1 Mbps), 79.9% (2 Mbps), 95.9% (125 kbps), 83.7% (500 kbps). Operational duty cycle is 60%. Duty cycle correction factor (DCCF) applied using DCCF=[10*log(1/test mode DC)]+[10*log(operational DC)]. Total correction applied: 1Mbps= -1.1 dB, 2Mbps=-1.3 Db, 125kbps=-2 dB, 500kbps= -1.4 dB

EUT OPERATING MODES

Transmitting BLE Low and High Channels (2402 and 2480 MHz) 1 Mbps, 2 Mbps, 500 kbps, 125 kbps Modulated. PRBS9. Power 0 dBm

DEVIATIONS FROM TEST STANDARD

None



SPURIOUS RADIATED EMISSIONS

element
WTD.2023.10.23.0
EmiR5 2022.07.06.0
PSA-ESCI 2023.04.25.0

Run #: 118

■ PK ◆ AV ● QP

RESULTS - Run #118

Freq (MHz)	Amplitude (dBuV)	Factor (dB/m)	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
2386.900	32.2	-4.3	2.4	225.9	-1.4	20.0	Horz	AV	0.0	46.5	54.0	-7.5	EUT Horz, Low Ch, 500kbps
2389.892	32.1	-4.3	1.5	48.9	-1.1	20.0	Vert	AV	0.0	46.7	54.0	-7.3	EUT Horz, Low Ch, 1Mbps
2389.542	32.1	-4.3	1.5	26.0	-1.3	20.0	Horz	AV	0.0	46.5	54.0	-7.5	EUT Horz, Low Ch, 2Mbps
2385.942	32.1	-4.3	1.5	184.0	-1.3	20.0	Vert	AV	0.0	46.5	54.0	-7.5	EUT Horz, Low Ch, 2Mbps
2387.508	32.1	-4.3	1.5	63.0	-1.1	20.0	Vert	AV	0.0	46.7	54.0	-7.3	EUT Horz, Low Ch, 125kbps
2385.683	32.1	-4.3	2.2	99.0	-2.0	20.0	Vert	AV	0.0	45.8	54.0	-8.2	EUT Horz, Low Ch, 500kbps
2388.608	32.0	-4.3	1.5	52.0	-1.1	20.0	Horz	AV	0.0	46.6	54.0	-7.4	EUT Horz, Low Ch, 1Mbps
2483.625	31.9	-4.2	1.5	1.9	-1.3	20.0	Horz	AV	0.0	46.4	54.0	-7.6	EUT Horz, High Ch, 2Mbps
2388.817	32.0	-4.3	2.9	116.0	-2.0	20.0	Horz	AV	0.0	45.7	54.0	-8.3	EUT Horz, Low Ch, 125kbps
2483.767	31.8	-4.2	1.5	357.0	-1.1	20.0	Horz	AV	0.0	46.5	54.0	-7.5	EUT Horz, High Ch, 1Mbps
2483.942	31.8	-4.2	1.5	315.0	-1.1	20.0	Vert	AV	0.0	46.5	54.0	-7.5	EUT Horz, High Ch, 1Mbps
2483.592	31.8	-4.2	1.5	314.0	-1.1	20.0	Horz	AV	0.0	46.5	54.0	-7.5	EUT Vert, High Ch, 1Mbps
2484.017	31.8	-4.2	1.2	155.0	-1.1	20.0	Vert	AV	0.0	46.5	54.0	-7.5	EUT Vert, High Ch, 1Mbps
2484.258	31.8	-4.2	1.5	279.0	-1.1	20.0	Horz	AV	0.0	46.5	54.0	-7.5	EUT On Side, High Ch, 1Mbps
2483.767	31.8	-4.2	3.6	42.9	-1.1	20.0	Vert	AV	0.0	46.5	54.0	-7.5	EUT On Side, High Ch, 1Mbps
2485.667	31.8	-4.2	2.7	189.0	-1.3	20.0	Vert	AV	0.0	46.3	54.0	-7.7	EUT Horz, High Ch, 2Mbps
2483.508	31.8	-4.2	1.5	210.0	-1.4	20.0	Vert	AV	0.0	46.2	54.0	-7.8	EUT Horz, High Ch, 500kbps
2483.842	31.7	-4.2	1.5	285.0	-2.0	20.0	Horz	AV	0.0	45.5	54.0	-8.5	EUT Horz, High Ch, 125kbps
2485.783	31.7	-4.2	1.5	0.0	-2.0	20.0	Vert	AV	0.0	45.5	54.0	-8.5	EUT Horz, High Ch, 125kbps
2487.675	31.7	-4.2	1.5	55.0	-1.4	20.0	Horz	AV	0.0	46.1	54.0	-7.9	EUT Horz, High Ch, 500kbps
2389.025	43.7	-4.3	1.5	48.9	0.0	20.0	Vert	PK	0.0	59.4	74.0	-14.6	EUT Horz, Low Ch, 1Mbps
2486.083	43.6	-4.2	1.5	55.0	0.0	20.0	Horz	PK	0.0	59.4	74.0	-14.6	EUT Horz, High Ch, 500kbps
2385.775	43.6	-4.3	1.5	63.0	0.0	20.0	Vert	PK	0.0	59.3	74.0	-14.7	EUT Horz, Low Ch, 125kbps
2385.742	43.6	-4.3	2.4	225.9	0.0	20.0	Horz	PK	0.0	59.3	74.0	-14.7	EUT Horz, Low Ch, 500kbps
2388.467	43.5	-4.3	1.5	26.0	0.0	20.0	Horz	PK	0.0	59.2	74.0	-14.8	EUT Horz, Low Ch, 2Mbps
2387.267	43.4	-4.3	2.9	116.0	0.0	20.0	Horz	PK	0.0	59.1	74.0	-14.9	EUT Horz, Low Ch, 125kbps
2488.042	43.1	-4.1	2.7	189.0	0.0	20.0	Vert	PK	0.0	59.0	74.0	-15.0	EUT Horz, High Ch, 2Mbps
2387.525	43.3	-4.3	2.2	99.0	0.0	20.0	Vert	PK	0.0	59.0	74.0	-15.0	EUT Horz, Low Ch, 500kbps
2486.983	43.1	-4.2	1.5	357.0	0.0	20.0	Horz	PK	0.0	58.9	74.0	-15.1	EUT Horz, High Ch, 1Mbps
2485.350	43.1	-4.2	2.0	37.0	0.0	20.0	Vert	PK	0.0	58.9	74.0	-15.1	EUT Horz, High Ch, 500kbps
2388.725	43.1	-4.3	1.5	52.0	0.0	20.0	Horz	PK	0.0	58.8	74.0	-15.2	EUT Horz, Low Ch, 1Mbps
2488.400	42.7	-4.0	1.5	314.0	0.0	20.0	Horz	PK	0.0	58.7	74.0	-15.3	EUT Vert, High Ch, 1Mbps
2488.258	42.7	-4.1	1.5	315.0	0.0	20.0	Vert	PK	0.0	58.6	74.0	-15.4	EUT Horz, High Ch, 1Mbps
2486.683	42.7	-4.2	1.5	279.0	0.0	20.0	Horz	PK	0.0	58.5	74.0	-15.5	EUT On Side, High Ch, 1Mbps
2486.533	42.7	-4.2	1.5	0.0	0.0	20.0	Vert	PK	0.0	58.5	74.0	-15.5	EUT Horz, High Ch, 125kbps
2483.842	42.6	-4.2	1.2	155.0	0.0	20.0	Vert	PK	0.0	58.4	74.0	-15.6	EUT Vert, High Ch, 1Mbps
2485.900	42.6	-4.2	1.5	1.9	0.0	20.0	Horz	PK	0.0	58.4	74.0	-15.6	EUT Horz, High Ch, 2Mbps
2388.225	42.6	-4.3	1.5	184.0	0.0	20.0	Vert	PK	0.0	58.3	74.0	-15.7	EUT Horz, Low Ch, 2Mbps

SPURIOUS RADIATED EMISSIONS

element
WTD.2023.10.23.0
EmiR5 2022.07.06.0
PSA-ESCI 2023.04.25.0

Freq (MHz)	Amplitude (dBuV)	Factor (dB/m)	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
2486.242	42.3	-4.2	3.6	42.9	0.0	20.0	Vert	PK	0.0	58.1	74.0	-15.9	EUT On Side, High Ch, 1Mbps
2483.875	42.2	-4.2	1.5	285.0	0.0	20.0	Horz	PK	0.0	58.0	74.0	-16.0	EUT Horz, High Ch, 125kbps

CONCLUSION
Pass

Tested By

SPURIOUS RADIATED EMISSIONS

element
WTD.2023.10.23.0
EmiR5 2022.07.06.0
PSA-ESCI 2023.04.25.0

EUT:	CH2O Sensor	Work Order:	TSIN0212
Serial Number:	8014092335005	Date:	2023-12-05
Customer:	TSI, Incorporated	Temperature:	22.3°C
Attendees:	Micah Larson	Relative Humidity:	28.1%
Customer Project:	None	Bar. Pressure (PMSL):	1022 mb
Tested By:	Marcelo Aguayo	Job Site:	MN05
Power:	Battery	Configuration:	TSIN0212-13

TEST SPECIFICATIONS

Specification:	Method:
FCC 15.247:2023	ANSI C63.10:2013
RSS-247 Issue 3:2023 RSS-Gen Issue 5:2018+A1:2019+A2:2021	ANSI C63.10:2013

TEST PARAMETERS

Run #:	133	Test Distance (m):	3	Ant. Height(s) (m):	1 to 4(m)

COMMENTS

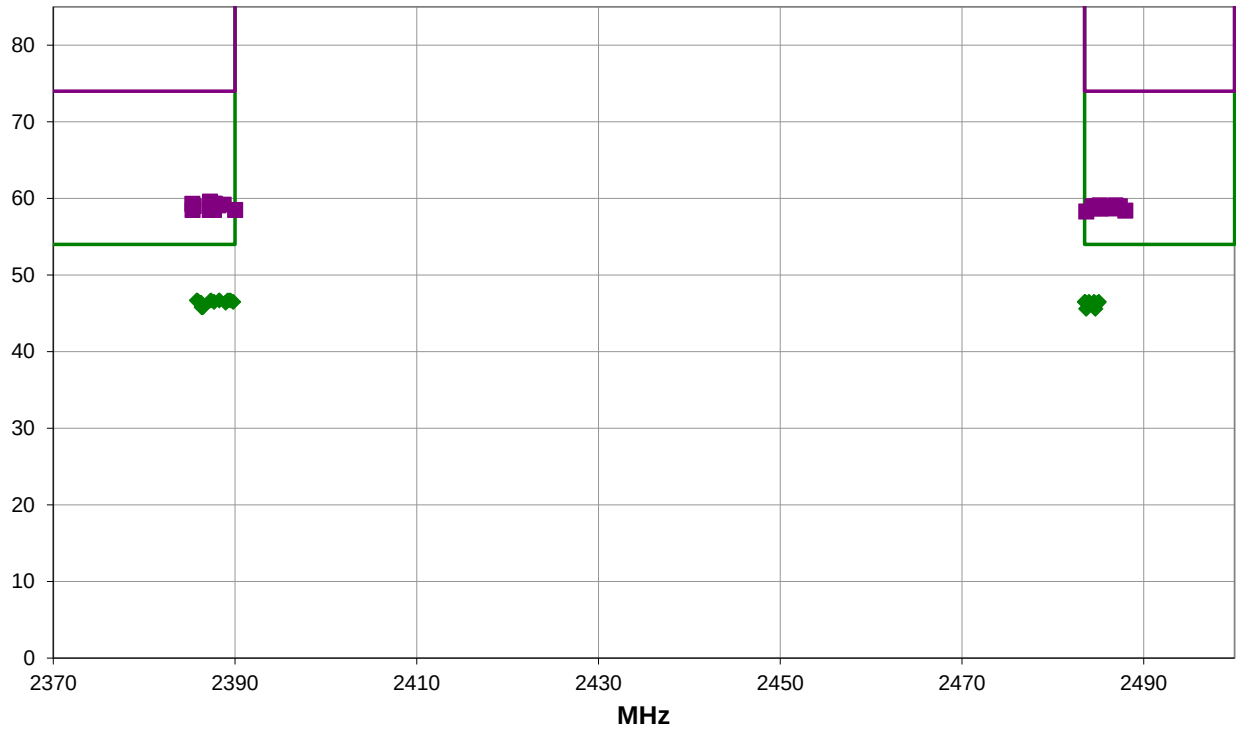
Tested with power 0dBm. Test mode duty cycle is 77.9% (1 Mbps), 79.9% (2 Mbps), 95.9% (125 kbps), 83.7% (500 kbps). Operational duty cycle is 60%. Duty cycle correction factor (DCCF) applied using DCCF=[10*log(1/test mode DC)]+[10*log(operational DC)]. Total correction applied: 1Mbps= -1.1 dB, 2Mbps=-1.3 Db, 125kbps=-2 dB, 500kbps= -1.4 dB

EUT OPERATING MODES

Transmitting BLE Low and High Channels (2402 and 2480 MHz) 1 Mbps, 2 Mbps, 500 kbps, 125 kbps Modulated. PRBS9. Power 0 dBm

DEVIATIONS FROM TEST STANDARD

None



SPURIOUS RADIATED EMISSIONS

element
WTD.2023.10.23.0
EmiR5 2022.07.06.0
PSA-ESCI 2023.04.25.0

Run #: 133

■ PK ◆ AV ● QP

RESULTS - Run #133

Freq (MHz)	Amplitude (dBuV)	Factor (dB/m)	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
2387.333	32.1	-4.3	1.5	290.9	-1.1	20.0	Horz	AV	0.0	46.7	54.0	-7.3	EUT On Side, Low Ch, 1Mbps
2389.200	32.1	-4.3	1.5	159.0	-1.1	20.0	Horz	AV	0.0	46.7	54.0	-7.3	EUT Horz, Low Ch, 1Mbps
2385.800	32.1	-4.3	1.5	138.9	-1.1	20.0	Vert	AV	0.0	46.7	54.0	-7.3	EUT On Side, Low Ch, 1Mbps
2388.258	32.1	-4.3	2.0	213.0	-1.1	20.0	Horz	AV	0.0	46.7	54.0	-7.3	EUT Vert, Low Ch, 1Mbps
2389.467	32.1	-4.3	3.0	73.9	-1.1	20.0	Vert	AV	0.0	46.7	54.0	-7.3	EUT Vert, Low Ch, 1Mbps
2387.683	32.1	-4.3	1.5	94.0	-1.3	20.0	Horz	AV	0.0	46.5	54.0	-7.5	EUT On Side, Low Ch, 2Mbps
2389.792	32.1	-4.3	1.5	6.9	-1.3	20.0	Vert	AV	0.0	46.5	54.0	-7.5	EUT On Side, Low Ch, 2Mbps
2386.442	32.1	-4.3	1.5	106.9	-2.0	20.0	Horz	AV	0.0	45.8	54.0	-8.2	EUT On Side, Low Ch, 125kbps
2386.325	32.1	-4.3	1.5	116.0	-2.0	20.0	Vert	AV	0.0	45.8	54.0	-8.2	EUT On Side, Low Ch, 125kbps
2386.233	32.1	-4.3	1.5	335.0	-1.4	20.0	Horz	AV	0.0	46.4	54.0	-7.6	EUT On Side, Low Ch, 500kbps
2388.958	32.1	-4.3	1.5	213.0	-1.4	20.0	Vert	AV	0.0	46.4	54.0	-7.6	EUT On Side, Low Ch, 500kbps
2385.892	32.0	-4.3	1.5	102.0	-1.1	20.0	Vert	AV	0.0	46.6	54.0	-7.4	EUT Horz, Low Ch, 1Mbps
2483.542	31.8	-4.2	4.0	112.0	-1.1	20.0	Horz	AV	0.0	46.5	54.0	-7.5	EUT Horz, High Ch, 1Mbps
2483.517	31.8	-4.2	1.5	279.0	-1.1	20.0	Horz	AV	0.0	46.5	54.0	-7.5	EUT Vert, High Ch, 1Mbps
2484.533	31.8	-4.2	1.8	343.0	-1.1	20.0	Vert	AV	0.0	46.5	54.0	-7.5	EUT Vert, High Ch, 1Mbps
2483.975	31.8	-4.2	1.6	322.9	-1.1	20.0	Horz	AV	0.0	46.5	54.0	-7.5	EUT On Side, High Ch, 1Mbps
2485.058	31.8	-4.2	1.5	348.9	-1.1	20.0	Vert	AV	0.0	46.5	54.0	-7.5	EUT On Side, High Ch, 1Mbps
2484.125	31.8	-4.2	1.5	20.9	-1.3	20.0	Horz	AV	0.0	46.3	54.0	-7.7	EUT On Side, High Ch, 2Mbps
2484.825	31.8	-4.2	1.5	92.9	-1.3	20.0	Vert	AV	0.0	46.3	54.0	-7.7	EUT On Side, High Ch, 2Mbps
2484.675	31.8	-4.2	1.5	99.0	-2.0	20.0	Horz	AV	0.0	45.6	54.0	-8.4	EUT On Side, High Ch, 125kbps
2483.667	31.8	-4.2	1.5	239.9	-2.0	20.0	Vert	AV	0.0	45.6	54.0	-8.4	EUT On Side, High Ch, 125kbps
2484.783	31.8	-4.2	1.5	5.9	-1.4	20.0	Horz	AV	0.0	46.2	54.0	-7.8	EUT On Side, High Ch, 500kbps
2484.683	31.8	-4.2	1.5	103.9	-1.4	20.0	Vert	AV	0.0	46.2	54.0	-7.8	EUT On Side, High Ch, 500kbps
2484.958	31.7	-4.2	3.0	310.0	-1.1	20.0	Vert	AV	0.0	46.4	54.0	-7.6	EUT Horz, High Ch, 1Mbps
2387.242	43.9	-4.3	1.5	116.0	0.0	20.0	Vert	PK	0.0	59.6	74.0	-14.4	EUT On Side, Low Ch, 125kbps
2387.700	43.6	-4.3	1.5	290.9	0.0	20.0	Horz	PK	0.0	59.3	74.0	-14.7	EUT On Side, Low Ch, 1Mbps
2385.292	43.6	-4.3	1.5	94.0	0.0	20.0	Horz	PK	0.0	59.3	74.0	-14.7	EUT On Side, Low Ch, 2Mbps
2387.783	43.6	-4.3	1.5	213.0	0.0	20.0	Vert	PK	0.0	59.3	74.0	-14.7	EUT On Side, Low Ch, 500kbps
2388.758	43.5	-4.3	1.5	335.0	0.0	20.0	Horz	PK	0.0	59.2	74.0	-14.8	EUT On Side, Low Ch, 500kbps
2486.883	43.3	-4.2	3.0	310.0	0.0	20.0	Vert	PK	0.0	59.1	74.0	-14.9	EUT Horz, High Ch, 1Mbps
2388.150	43.4	-4.3	1.5	159.0	0.0	20.0	Horz	PK	0.0	59.1	74.0	-14.9	EUT Horz, Low Ch, 1Mbps
2485.142	43.3	-4.2	1.5	239.9	0.0	20.0	Vert	PK	0.0	59.1	74.0	-14.9	EUT On Side, High Ch, 125kbps
2487.375	43.2	-4.2	4.0	112.0	0.0	20.0	Horz	PK	0.0	59.0	74.0	-15.0	EUT Horz, High Ch, 1Mbps
2385.450	43.3	-4.3	1.5	138.9	0.0	20.0	Vert	PK	0.0	59.0	74.0	-15.0	EUT Horz, Low Ch, 1Mbps
2387.508	43.3	-4.3	2.0	213.0	0.0	20.0	Horz	PK	0.0	59.0	74.0	-15.0	EUT Vert, Low Ch, 1Mbps
2484.358	43.2	-4.2	1.5	99.0	0.0	20.0	Horz	PK	0.0	59.0	74.0	-15.0	EUT On Side, High Ch, 125kbps
2484.850	43.2	-4.2	1.5	103.9	0.0	20.0	Vert	PK	0.0	59.0	74.0	-15.0	EUT On Side, High Ch, 500kbps
2485.608	43.1	-4.2	1.5	348.9	0.0	20.0	Vert	PK	0.0	58.9	74.0	-15.1	EUT On Side, High Ch, 1Mbps

SPURIOUS RADIATED EMISSIONS

element
WTD.2023.10.23.0
EmiR5 2022.07.06.0
PSA-ESCI 2023.04.25.0

Freq (MHz)	Amplitude (dBuV)	Factor (dB/m)	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
2486.700	43.1	-4.2	1.5	92.9	0.0	20.0	Vert	PK	0.0	58.9	74.0	-15.1	EUT On Side, High Ch, 2Mbps
2484.750	42.9	-4.2	1.8	343.0	0.0	20.0	Vert	PK	0.0	58.7	74.0	-15.3	EUT Vert, High Ch, 1Mbps
2485.275	42.9	-4.2	1.6	322.9	0.0	20.0	Horz	PK	0.0	58.7	74.0	-15.3	EUT On Side, High Ch, 1Mbps
2486.483	42.9	-4.2	1.5	5.9	0.0	20.0	Horz	PK	0.0	58.7	74.0	-15.3	EUT On Side, High Ch, 500kbps
2390.000	42.8	-4.3	1.5	102.0	0.0	20.0	Vert	PK	0.0	58.5	74.0	-15.5	EUT On Side, Low Ch, 1Mbps
2387.675	42.8	-4.3	3.0	73.9	0.0	20.0	Vert	PK	0.0	58.5	74.0	-15.5	EUT Vert, Low Ch, 1Mbps
2385.325	42.8	-4.3	1.5	6.9	0.0	20.0	Vert	PK	0.0	58.5	74.0	-15.5	EUT On Side, Low Ch, 2Mbps
2387.217	42.8	-4.3	1.5	106.9	0.0	20.0	Horz	PK	0.0	58.5	74.0	-15.5	EUT On Side, Low Ch, 125kbps
2487.975	42.5	-4.1	1.5	20.9	0.0	20.0	Horz	PK	0.0	58.4	74.0	-15.6	EUT On Side, High Ch, 2Mbps
2483.683	42.5	-4.2	1.5	279.0	0.0	20.0	Horz	PK	0.0	58.3	74.0	-15.7	EUT Vert, High Ch, 1Mbps

CONCLUSION

Pass

Tested By

SPURIOUS RADIATED EMISSIONS

element
WTD.2023.10.23.0
EmiR5 2022.07.06.0
PSA-ESCI 2023.04.25.0

EUT:	CH2O Sensor	Work Order:	TSIN0212
Serial Number:	8014092335005	Date:	2023-12-05
Customer:	TSI, Incorporated	Temperature:	22.3°C
Attendees:	Micah Larson	Relative Humidity:	28.1%
Customer Project:	None	Bar. Pressure (PMSL):	1022 mb
Tested By:	Marcelo Aguayo	Job Site:	MN05
Power:	Battery	Configuration:	TSIN0212-13

TEST SPECIFICATIONS

Specification:	Method:
FCC 15.247:2023	ANSI C63.10:2013
RSS-247 Issue 3:2023 RSS-Gen Issue 5:2018+A1:2019+A2:2021	ANSI C63.10:2013

TEST PARAMETERS

Run #:	132	Test Distance (m):	3	Ant. Height(s) (m):	1 to 4(m)

COMMENTS

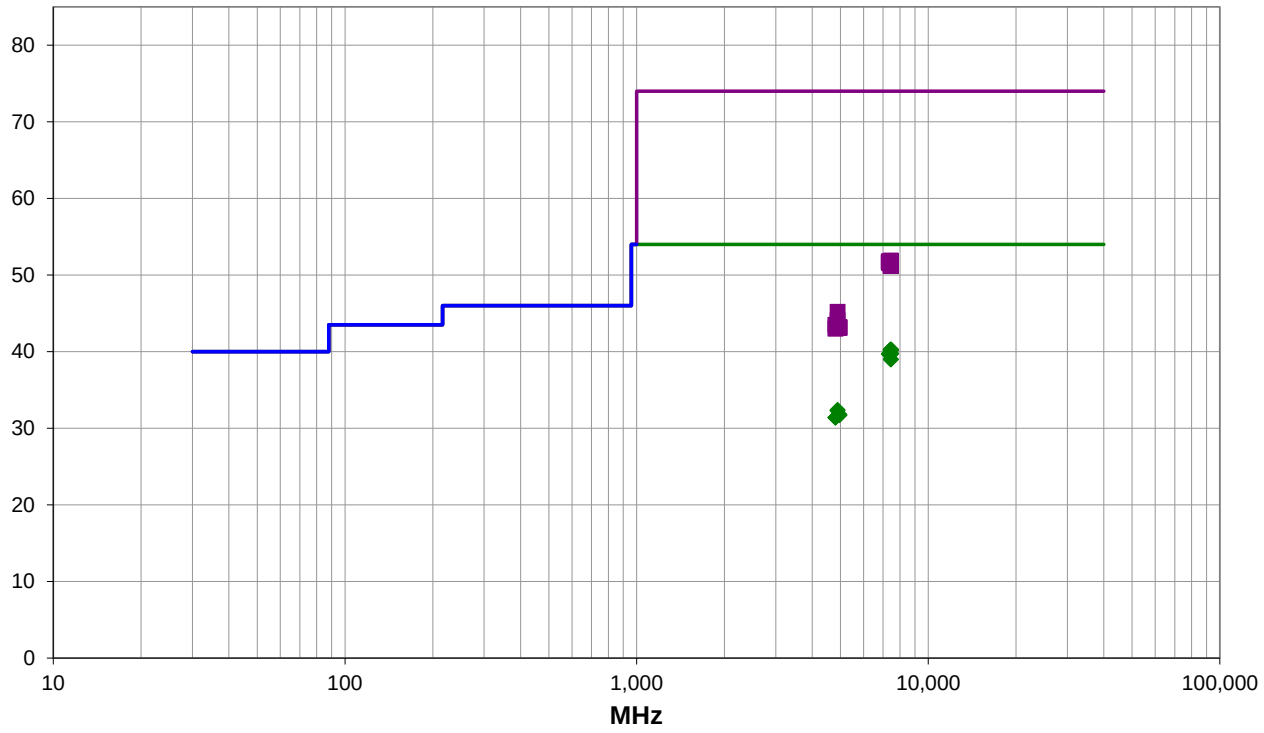
Tested with power 0dBm. Test mode duty cycle is 77.9% (1 Mbps), 79.9% (2 Mbps), 95.9% (125 kbps), 83.7% (500 kbps). Operational duty cycle is 60%. Duty cycle correction factor (DCCF) applied using DCCF=[10*log(1/test mode DC)]+[10*log(operational DC)]. Total correction applied: 1Mbps= -1.1 dB, 2Mbps=-1.3 Db, 125kbps=-2 dB, 500kbps= -1.4 dB

EUT OPERATING MODES

Transmitting BLE Low, Mid and High Channels (2402, 2442, 2480 MHz) 1 Mbps, 2 Mbps, 500 kbps, 125 kbps Modulated. PRBS9. Power 0 dBm

DEVIATIONS FROM TEST STANDARD

None



SPURIOUS RADIATED EMISSIONS

element
WTD.2023.10.23.0
EmiR5 2022.07.06.0
PSA-ESCI 2023.04.25.0

Run #: 132

■ PK ◆ AV ● QP

RESULTS - Run #132

Freq (MHz)	Amplitude (dBuV)	Factor (dB/m)	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
7441.100	29.5	11.9	1.5	78.9	-1.1	0.0	Horz	AV	0.0	40.3	54.0	-13.7	EUT Horz, High Ch, 1Mbps
7437.508	29.5	11.9	1.5	325.0	-1.1	0.0	Vert	AV	0.0	40.3	54.0	-13.7	EUT Horz, High Ch, 1Mbps
7437.658	29.4	11.9	1.5	257.9	-1.1	0.0	Vert	AV	0.0	40.2	54.0	-13.8	EUT On Side, High Ch, 1Mbps
7440.625	29.4	11.9	1.5	15.0	-1.1	0.0	Horz	AV	0.0	40.2	54.0	-13.8	EUT Vert, High Ch, 1Mbps
7439.550	29.4	11.9	1.5	231.0	-1.1	0.0	Vert	AV	0.0	40.2	54.0	-13.8	EUT Vert, High Ch, 1Mbps
7438.142	29.4	11.9	1.5	246.9	-1.1	0.0	Horz	AV	0.0	40.2	54.0	-13.8	EUT On Side, High Ch, 1Mbps
7439.108	29.2	11.9	1.5	16.9	-1.3	0.0	Horz	AV	0.0	39.8	54.0	-14.2	EUT Horz, High Ch, 2Mbps
7438.958	29.2	11.9	1.9	177.0	-1.3	0.0	Vert	AV	0.0	39.8	54.0	-14.2	EUT Horz, High Ch, 2Mbps
7439.833	29.2	11.9	1.5	131.0	-1.4	0.0	Horz	AV	0.0	39.7	54.0	-14.3	EUT Horz, High Ch, 500kbps
7439.033	29.2	11.9	1.5	214.0	-1.4	0.0	Vert	AV	0.0	39.7	54.0	-14.3	EUT Horz, High Ch, 500kbps
7440.992	29.1	11.9	3.7	44.0	-2.0	0.0	Horz	AV	0.0	39.0	54.0	-15.0	EUT Horz, High Ch, 125kbps
7439.592	29.1	11.9	4.0	192.0	-2.0	0.0	Vert	AV	0.0	39.0	54.0	-15.0	EUT Horz, High Ch, 125kbps
7325.650	29.1	11.7	2.4	175.9	-1.1	0.0	Horz	AV	0.0	39.7	54.0	-14.3	EUT Horz, Mid Ch, 1Mbps
7324.458	29.1	11.7	1.5	181.9	-1.1	0.0	Vert	AV	0.0	39.7	54.0	-14.3	EUT Horz, Mid Ch, 1Mbps
4885.592	30.1	3.4	1.5	225.0	-1.1	0.0	Horz	AV	0.0	32.4	54.0	-21.6	EUT Horz, Mid Ch, 1Mbps
4884.333	30.0	3.4	1.5	181.0	-1.1	0.0	Vert	AV	0.0	32.3	54.0	-21.7	EUT Horz, Mid Ch, 1Mbps
7437.800	40.0	11.9	1.5	78.9	0.0	0.0	Horz	PK	0.0	51.9	74.0	-22.1	EUT Horz, High Ch, 1Mbps
4959.492	29.3	3.6	1.5	103.9	-1.1	0.0	Horz	AV	0.0	31.8	54.0	-22.2	EUT Horz, High Ch, 1Mbps
7440.242	39.9	11.9	1.5	257.9	0.0	0.0	Vert	PK	0.0	51.8	74.0	-22.2	EUT Horz, High Ch, 1Mbps
7441.250	39.9	11.9	1.5	246.9	0.0	0.0	Horz	PK	0.0	51.8	74.0	-22.2	EUT On Side, High Ch, 1Mbps
7325.025	40.1	11.7	1.5	181.9	0.0	0.0	Vert	PK	0.0	51.8	74.0	-22.2	EUT Horz, Mid Ch, 1Mbps
7442.250	39.9	11.9	4.0	192.0	0.0	0.0	Vert	PK	0.0	51.8	74.0	-22.2	EUT Horz, High Ch, 125kbps
7439.258	39.8	11.9	1.5	15.0	0.0	0.0	Horz	PK	0.0	51.7	74.0	-22.3	EUT Vert, High Ch, 1Mbps
7441.300	39.8	11.9	1.5	16.9	0.0	0.0	Horz	PK	0.0	51.7	74.0	-22.3	EUT Horz, High Ch, 2Mbps
4958.375	29.2	3.6	1.4	185.9	-1.1	0.0	Vert	AV	0.0	31.7	54.0	-22.3	EUT Horz, High Ch, 1Mbps
7326.950	39.9	11.7	2.4	175.9	0.0	0.0	Horz	PK	0.0	51.6	74.0	-22.4	EUT Horz, Mid Ch, 1Mbps
7439.000	39.7	11.9	3.7	44.0	0.0	0.0	Horz	PK	0.0	51.6	74.0	-22.4	EUT Horz, High Ch, 125kbps
7441.650	39.6	11.9	1.5	325.0	0.0	0.0	Vert	PK	0.0	51.5	74.0	-22.5	EUT On Side, High Ch, 1Mbps
4803.675	29.2	3.3	1.5	76.0	-1.1	0.0	Horz	AV	0.0	31.4	54.0	-22.6	EUT Horz, Low Ch, 1Mbps
4805.233	29.2	3.3	1.5	217.9	-1.1	0.0	Vert	AV	0.0	31.4	54.0	-22.6	EUT Horz, Low Ch, 1Mbps
7439.083	39.5	11.9	1.5	131.0	0.0	0.0	Horz	PK	0.0	51.4	74.0	-22.6	EUT Horz, High Ch, 500kbps
7440.533	39.4	11.9	1.5	214.0	0.0	0.0	Vert	PK	0.0	51.3	74.0	-22.7	EUT Horz, High Ch, 500kbps
7439.967	39.3	11.9	1.5	231.0	0.0	0.0	Vert	PK	0.0	51.2	74.0	-22.8	EUT Vert, High Ch, 1Mbps
7438.950	39.3	11.9	1.9	177.0	0.0	0.0	Vert	PK	0.0	51.2	74.0	-22.8	EUT Horz, High Ch, 2Mbps
4885.858	41.8	3.4	1.5	181.0	0.0	0.0	Vert	PK	0.0	45.2	74.0	-28.8	EUT Horz, Mid Ch, 1Mbps
4886.300	40.7	3.4	1.5	225.0	0.0	0.0	Horz	PK	0.0	44.1	74.0	-29.9	EUT Horz, Mid Ch, 1Mbps
4805.467	40.2	3.3	1.5	76.0	0.0	0.0	Horz	PK	0.0	43.5	74.0	-30.5	EUT Horz, Low Ch, 1Mbps
4959.450	39.6	3.6	1.5	103.9	0.0	0.0	Horz	PK	0.0	43.2	74.0	-30.8	EUT Horz, High Ch, 1Mbps

SPURIOUS RADIATED EMISSIONS

element
WTD.2023.10.23.0
EmiR5 2022.07.06.0
PSA-ESCI 2023.04.25.0

Freq (MHz)	Amplitude (dBuV)	Factor (dB/m)	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
4957.800	39.5	3.6	1.4	185.9	0.0	0.0	Vert	PK	0.0	43.1	74.0	-30.9	EUT Horz, High Ch, 1Mbps
4804.992	39.7	3.3	1.5	217.9	0.0	0.0	Vert	PK	0.0	43.0	74.0	-31.0	EUT Horz, Low Ch, 1Mbps

CONCLUSION
Pass

Tested By

SPURIOUS RADIATED EMISSIONS

element
WTD.2023.10.23.0
EmiR5 2022.07.06.0
PSA-ESCI 2023.04.25.0

EUT:	CL2 Sensor	Work Order:	TSIN0212
Serial Number:	14002342002	Date:	2023-12-06
Customer:	TSI, Incorporated	Temperature:	22°C
Attendees:	Micah Larson	Relative Humidity:	25.5%
Customer Project:	None	Bar. Pressure (PMSL):	1017 mb
Tested By:	Marcelo Aguayo	Job Site:	MN05
Power:	Battery	Configuration:	TSIN0212-12

TEST SPECIFICATIONS

Specification:	Method:
FCC 15.247:2023	ANSI C63.10:2013
RSS-247 Issue 3:2023 RSS-Gen Issue 5:2018+A1:2019+A2:2021	ANSI C63.10:2013

TEST PARAMETERS

Run #:	147	Test Distance (m):	3	Ant. Height(s) (m):	1 to 4(m)

COMMENTS

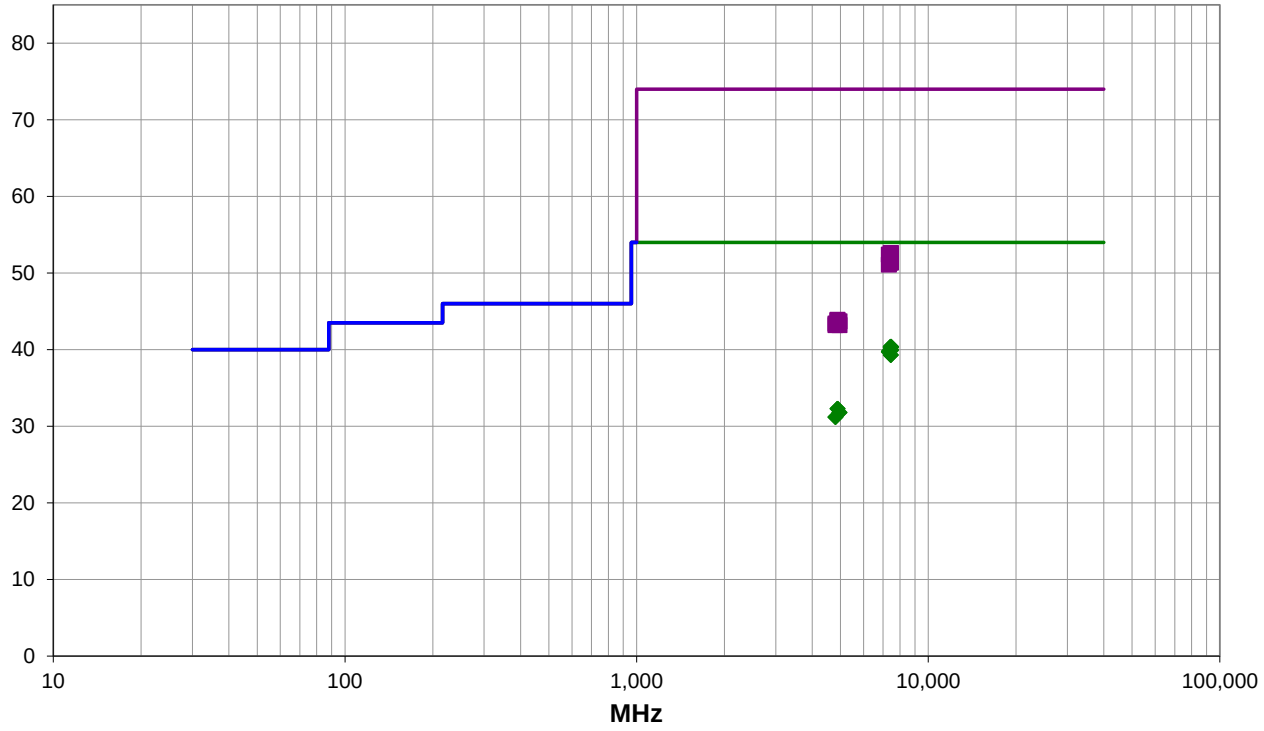
Tested with power 0dBm. Test mode duty cycle is 77.9% (1 Mbps), 79.9% (2 Mbps), 95.9% (125 kbps), 83.7% (500 kbps). Operational duty cycle is 60%. Duty cycle correction factor (DCCF) applied using DCCF=[10*log(1/test mode DC)]+[10*log(operational DC)]. Total correction applied: 1Mbps= -1.1 dB, 2Mbps=-1.3 Db, 125kbps=-2 dB, 500kbps= -1.4 dB

EUT OPERATING MODES

Transmitting BLE Low, Mid and High Channels (2402, 2442, 2480 MHz) 1 Mbps, 2 Mbps, 500 kbps, 125 kbps Modulated. PRBS9. Power 0 dBm

DEVIATIONS FROM TEST STANDARD

None



SPURIOUS RADIATED EMISSIONS

element
WTD.2023.10.23.0
EmiR5 2022.07.06.0
PSA-ESCI 2023.04.25.0

Run #: 147

■ PK ◆ AV ● QP

RESULTS - Run #147

Freq (MHz)	Amplitude (dBuV)	Factor (dB/m)	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
7439.008	29.6	11.9	1.5	325.0	-1.1	0.0	Horz	AV	0.0	40.4	54.0	-13.6	EUT Vert, High Ch, 1Mbps
7439.392	29.6	11.9	1.7	171.9	-1.1	0.0	Horz	AV	0.0	40.4	54.0	-13.6	EUT Horz, High Ch, 1Mbps
7439.883	29.6	11.9	2.5	149.0	-1.1	0.0	Vert	AV	0.0	40.4	54.0	-13.6	EUT Vert, High Ch, 1Mbps
7439.375	29.5	11.9	1.5	203.9	-1.1	0.0	Vert	AV	0.0	40.3	54.0	-13.7	EUT Horz, High Ch, 1Mbps
7438.642	29.5	11.9	1.5	333.9	-1.1	0.0	Horz	AV	0.0	40.3	54.0	-13.7	EUT On Side, High Ch, 1Mbps
7439.242	29.5	11.9	1.5	145.9	-1.1	0.0	Vert	AV	0.0	40.3	54.0	-13.7	EUT On Side, High Ch, 1Mbps
7439.217	29.4	11.9	3.9	182.9	-1.3	0.0	Horz	AV	0.0	40.0	54.0	-14.0	EUT Vert, High Ch, 2Mbps
7438.683	29.4	11.9	1.5	73.0	-1.3	0.0	Vert	AV	0.0	40.0	54.0	-14.0	EUT Vert, High Ch, 2Mbps
7439.275	29.4	11.9	1.5	282.9	-2.0	0.0	Horz	AV	0.0	39.3	54.0	-14.7	EUT Vert, High Ch, 125kbps
7439.125	29.4	11.9	1.5	264.0	-2.0	0.0	Vert	AV	0.0	39.3	54.0	-14.7	EUT Vert, High Ch, 125kbps
7440.217	29.4	11.9	1.5	221.9	-1.4	0.0	Horz	AV	0.0	39.9	54.0	-14.1	EUT Vert, High Ch, 500kbps
7441.000	29.4	11.9	1.5	113.0	-1.4	0.0	Vert	AV	0.0	39.9	54.0	-14.1	EUT Vert, High Ch, 500kbps
7326.283	29.2	11.7	1.5	300.9	-1.1	0.0	Vert	AV	0.0	39.8	54.0	-14.2	EUT Vert, Mid Ch, 1Mbps
7323.567	29.1	11.7	1.5	73.9	-1.1	0.0	Horz	AV	0.0	39.7	54.0	-14.3	EUT Vert, Mid Ch, 1Mbps
7437.900	40.7	11.9	1.5	325.0	0.0	0.0	Horz	PK	0.0	52.6	74.0	-21.4	EUT Horz, High Ch, 1Mbps
7439.700	40.7	11.9	1.5	203.9	0.0	0.0	Vert	PK	0.0	52.6	74.0	-21.4	EUT Horz, High Ch, 1Mbps
7325.050	40.7	11.7	1.5	73.9	0.0	0.0	Horz	PK	0.0	52.4	74.0	-21.6	EUT Vert, Mid Ch, 1Mbps
4884.575	30.0	3.4	1.7	135.0	-1.1	0.0	Horz	AV	0.0	32.3	54.0	-21.7	EUT Vert, Mid Ch, 1Mbps
4886.242	30.0	3.4	1.5	160.9	-1.1	0.0	Vert	AV	0.0	32.3	54.0	-21.7	EUT Vert, Mid Ch, 1Mbps
7439.025	40.4	11.9	1.5	333.9	0.0	0.0	Horz	PK	0.0	52.3	74.0	-21.7	EUT On Side, High Ch, 1Mbps
7440.408	40.0	11.9	2.5	149.0	0.0	0.0	Vert	PK	0.0	51.9	74.0	-22.1	EUT Vert, High Ch, 1Mbps
7439.542	40.0	11.9	3.9	182.9	0.0	0.0	Horz	PK	0.0	51.9	74.0	-22.1	EUT Vert, High Ch, 2Mbps
7440.958	40.0	11.9	1.5	282.9	0.0	0.0	Horz	PK	0.0	51.9	74.0	-22.1	EUT Vert, High Ch, 125kbps
4960.100	29.3	3.6	1.5	170.0	-1.1	0.0	Horz	AV	0.0	31.8	54.0	-22.2	EUT Vert, High Ch, 1Mbps
4961.158	29.3	3.6	1.5	261.9	-1.1	0.0	Vert	AV	0.0	31.8	54.0	-22.2	EUT Vert, High Ch, 1Mbps
7440.075	39.9	11.9	1.5	73.0	0.0	0.0	Vert	PK	0.0	51.8	74.0	-22.2	EUT Vert, High Ch, 2Mbps
7438.500	39.8	11.9	1.5	113.0	0.0	0.0	Vert	PK	0.0	51.7	74.0	-22.3	EUT Vert, High Ch, 500kbps
7441.992	39.7	11.9	1.5	221.9	0.0	0.0	Horz	PK	0.0	51.6	74.0	-22.4	EUT Vert, High Ch, 500kbps
7441.150	39.5	11.9	1.7	171.9	0.0	0.0	Horz	PK	0.0	51.4	74.0	-22.6	EUT Vert, High Ch, 1Mbps
7437.567	39.5	11.9	1.5	145.9	0.0	0.0	Vert	PK	0.0	51.4	74.0	-22.6	EUT On Side, High Ch, 1Mbps
7441.925	39.5	11.9	1.5	264.0	0.0	0.0	Vert	PK	0.0	51.4	74.0	-22.6	EUT Vert, High Ch, 125kbps
4805.750	29.0	3.3	1.5	175.9	-1.1	0.0	Horz	AV	0.0	31.2	54.0	-22.8	EUT Vert, Low Ch, 1Mbps
4804.950	29.0	3.3	1.5	120.9	-1.1	0.0	Vert	AV	0.0	31.2	54.0	-22.8	EUT Vert, Low Ch, 1Mbps
7326.000	39.4	11.7	1.5	300.9	0.0	0.0	Vert	PK	0.0	51.1	74.0	-22.9	EUT Vert, Mid Ch, 1Mbps
4881.992	40.5	3.4	1.5	160.9	0.0	0.0	Vert	PK	0.0	43.9	74.0	-30.1	EUT Vert, Mid Ch, 1Mbps
4885.758	40.4	3.4	1.7	135.0	0.0	0.0	Horz	PK	0.0	43.8	74.0	-30.2	EUT Vert, Mid Ch, 1Mbps
4958.933	40.1	3.6	1.5	261.9	0.0	0.0	Vert	PK	0.0	43.7	74.0	-30.3	EUT Vert, High Ch, 1Mbps
4806.283	40.1	3.3	1.5	175.9	0.0	0.0	Horz	PK	0.0	43.4	74.0	-30.6	EUT Vert, Low Ch, 1Mbps

SPURIOUS RADIATED EMISSIONS

element
WTD.2023.10.23.0
EmiR5 2022.07.06.0
PSA-ESCI 2023.04.25.0

Freq (MHz)	Amplitude (dBuV)	Factor (dB/m)	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
4961.800	39.6	3.6	1.5	170.0	0.0	0.0	Horz	PK	0.0	43.2	74.0	-30.8	EUT Vert, High Ch, 1Mbps
4803.017	39.9	3.3	1.5	120.9	0.0	0.0	Vert	PK	0.0	43.2	74.0	-30.8	EUT Vert, Low Ch, 1Mbps

CONCLUSION
Pass

Tested By

SPURIOUS RADIATED EMISSIONS

element
WTD.2023.10.23.0
EmiR5 2022.07.06.0
PSA-ESCI 2023.04.25.0

EUT:	CL2 Sensor	Work Order:	TSIN0212
Serial Number:	14002342002	Date:	2023-12-06
Customer:	TSI, Incorporated	Temperature:	22°C
Attendees:	Micah Larson	Relative Humidity:	25.5%
Customer Project:	None	Bar. Pressure (PMSL):	1017 mb
Tested By:	Marcelo Aguayo	Job Site:	MN05
Power:	Battery	Configuration:	TSIN0212-12

TEST SPECIFICATIONS

Specification:	Method:
FCC 15.247:2023	ANSI C63.10:2013
RSS-247 Issue 3:2023 RSS-Gen Issue 5:2018+A1:2019+A2:2021	ANSI C63.10:2013

TEST PARAMETERS

Run #:	148	Test Distance (m):	3	Ant. Height(s) (m):	1 to 4(m)

COMMENTS

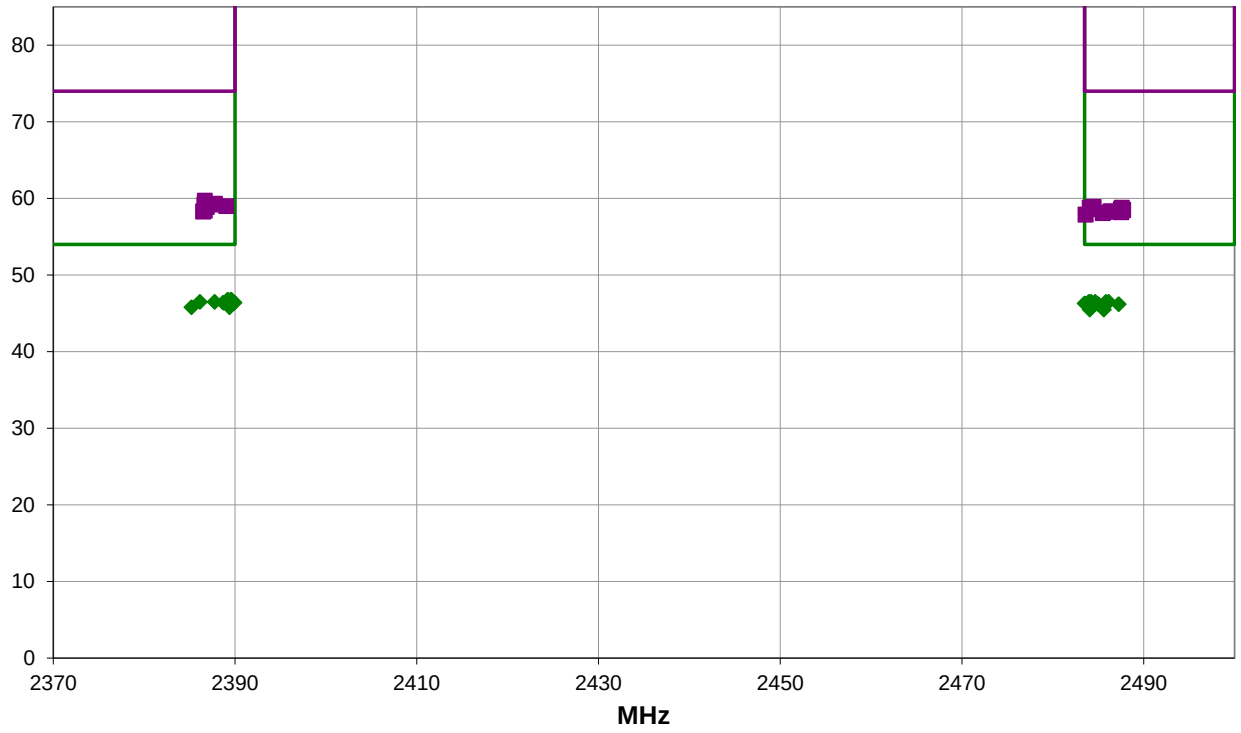
Tested with power 0dBm. Test mode duty cycle is 77.9% (1 Mbps), 79.9% (2 Mbps), 95.9% (125 kbps), 83.7% (500 kbps). Operational duty cycle is 60%. Duty cycle correction factor (DCCF) applied using DCCF=[10*log(1/test mode DC)]+[10*log(operational DC)]. Total correction applied: 1Mbps= -1.1 dB, 2Mbps=-1.3 Db, 125kbps=-2 dB, 500kbps= -1.4 dB

EUT OPERATING MODES

Transmitting BLE Low and High Channels (2402 and 2480 MHz) 1 Mbps, 2 Mbps, 500 kbps, 125 kbps Modulated. PRBS9. Power 0 dBm

DEVIATIONS FROM TEST STANDARD

None



SPURIOUS RADIATED EMISSIONS

element
WTD.2023.10.23.0
EmiR5 2022.07.06.0
PSA-ESCI 2023.04.25.0

Run #: 148

■ PK ◆ AV ● QP

RESULTS - Run #148

Freq (MHz)	Amplitude (dBuV)	Factor (dB/m)	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
2389.567	32.2	-4.3	1.5	335.0	-1.1	20.0	Horz	AV	0.0	46.8	54.0	-7.2	EUT Vert, High Ch 1Mbps
2389.192	32.2	-4.3	1.5	324.0	-1.1	20.0	Vert	AV	0.0	46.8	54.0	-7.2	EUT Vert, High Ch 1Mbps
2386.125	32.1	-4.3	2.9	81.0	-1.3	20.0	Horz	AV	0.0	46.5	54.0	-7.5	EUT Vert, High Ch 2Mbps
2387.750	32.1	-4.3	2.7	164.9	-1.3	20.0	Vert	AV	0.0	46.5	54.0	-7.5	EUT Vert, High Ch 2Mbps
2483.983	31.8	-4.2	1.5	258.9	-1.1	20.0	Horz	AV	0.0	46.5	54.0	-7.5	EUT Vert, High Ch 1Mbps
2484.658	31.8	-4.2	3.9	33.0	-1.1	20.0	Vert	AV	0.0	46.5	54.0	-7.5	EUT Vert, High Ch 1Mbps
2486.142	31.8	-4.2	1.5	55.9	-1.1	20.0	Horz	AV	0.0	46.5	54.0	-7.5	EUT Horz, High Ch 1Mbps
2484.217	31.8	-4.2	1.5	265.9	-1.1	20.0	Horz	AV	0.0	46.5	54.0	-7.5	EUT On Side, High Ch 1Mbps
2485.842	31.8	-4.2	1.5	319.9	-1.1	20.0	Vert	AV	0.0	46.5	54.0	-7.5	EUT On Side, High Ch 1Mbps
2388.692	32.1	-4.3	1.5	333.9	-1.4	20.0	Horz	AV	0.0	46.4	54.0	-7.6	EUT Vert, High Ch 500kbps
2389.933	32.1	-4.3	1.5	8.0	-1.4	20.0	Vert	AV	0.0	46.4	54.0	-7.6	EUT Vert, High Ch 500kbps
2483.875	31.7	-4.2	3.1	16.0	-1.1	20.0	Vert	AV	0.0	46.4	54.0	-7.6	EUT Horz, High Ch 1Mbps
2483.500	31.8	-4.2	1.5	73.9	-1.3	20.0	Horz	AV	0.0	46.3	54.0	-7.7	EUT Vert, High Ch 2Mbps
2483.717	31.8	-4.2	1.5	132.9	-1.4	20.0	Horz	AV	0.0	46.2	54.0	-7.8	EUT Vert, High Ch 500kbps
2485.000	31.8	-4.2	1.5	261.9	-1.4	20.0	Vert	AV	0.0	46.2	54.0	-7.8	EUT Vert, High Ch 500kbps
2487.242	31.7	-4.2	1.5	5.9	-1.3	20.0	Vert	AV	0.0	46.2	54.0	-7.8	EUT Vert, High Ch 2Mbps
2389.383	32.1	-4.3	3.3	297.0	-2.0	20.0	Horz	AV	0.0	45.8	54.0	-8.2	EUT Vert, High Ch 125kbps
2385.200	32.1	-4.3	1.5	360.0	-2.0	20.0	Vert	AV	0.0	45.8	54.0	-8.2	EUT Vert, High Ch 125kbps
2484.058	31.7	-4.2	1.5	110.9	-2.0	20.0	Horz	AV	0.0	45.5	54.0	-8.5	EUT Vert, High Ch 125kbps
2485.608	31.7	-4.2	2.8	357.0	-2.0	20.0	Vert	AV	0.0	45.5	54.0	-8.5	EUT Vert, High Ch 125kbps
2386.667	44.0	-4.3	1.5	360.0	0.0	20.0	Vert	PK	0.0	59.7	74.0	-14.3	EUT Vert, High Ch 125kbps
2387.783	43.6	-4.3	2.9	81.0	0.0	20.0	Horz	PK	0.0	59.3	74.0	-14.7	EUT Vert, High Ch 2Mbps
2387.667	43.5	-4.3	1.5	335.0	0.0	20.0	Horz	PK	0.0	59.2	74.0	-14.8	EUT Vert, High Ch 1Mbps
2386.625	43.5	-4.3	1.5	333.9	0.0	20.0	Horz	PK	0.0	59.2	74.0	-14.8	EUT Vert, High Ch 500kbps
2389.025	43.3	-4.3	1.5	324.0	0.0	20.0	Vert	PK	0.0	59.0	74.0	-15.0	EUT Vert, High Ch 1Mbps
2484.483	43.1	-4.2	1.5	73.9	0.0	20.0	Horz	PK	0.0	58.9	74.0	-15.1	EUT Vert, High Ch 2Mbps
2386.867	43.2	-4.3	2.7	164.9	0.0	20.0	Vert	PK	0.0	58.9	74.0	-15.1	EUT Vert, High Ch 2Mbps
2484.058	43.0	-4.2	1.5	132.9	0.0	20.0	Horz	PK	0.0	58.8	74.0	-15.2	EUT Vert, High Ch 500kbps
2487.583	43.0	-4.2	1.5	261.9	0.0	20.0	Vert	PK	0.0	58.8	74.0	-15.2	EUT Vert, High Ch 500kbps
2487.475	42.8	-4.2	3.1	16.0	0.0	20.0	Vert	PK	0.0	58.6	74.0	-15.4	EUT Horz, High Ch 1Mbps
2484.175	42.8	-4.2	1.5	110.9	0.0	20.0	Horz	PK	0.0	58.6	74.0	-15.4	EUT Vert, High Ch 125kbps
2487.733	42.7	-4.2	1.5	258.9	0.0	20.0	Horz	PK	0.0	58.5	74.0	-15.5	EUT Vert, High Ch 1Mbps
2386.650	42.7	-4.3	3.3	297.0	0.0	20.0	Horz	PK	0.0	58.4	74.0	-15.6	EUT Vert, High Ch 125kbps
2487.542	42.5	-4.2	3.9	33.0	0.0	20.0	Vert	PK	0.0	58.3	74.0	-15.7	EUT Vert, High Ch 1Mbps
2486.475	42.5	-4.2	1.5	265.9	0.0	20.0	Horz	PK	0.0	58.3	74.0	-15.7	EUT On Side, High Ch 1Mbps
2486.317	42.5	-4.2	2.8	357.0	0.0	20.0	Vert	PK	0.0	58.3	74.0	-15.7	EUT Vert, High Ch 125kbps
2386.483	42.6	-4.3	1.5	8.0	0.0	20.0	Vert	PK	0.0	58.3	74.0	-15.7	EUT Vert, High Ch 500kbps
2487.508	42.4	-4.2	1.5	5.9	0.0	20.0	Vert	PK	0.0	58.2	74.0	-15.8	EUT Vert, High Ch 2Mbps

SPURIOUS RADIATED EMISSIONS

element
WTD.2023.10.23.0
EmiR5 2022.07.06.0
PSA-ESCI 2023.04.25.0

Freq (MHz)	Amplitude (dBuV)	Factor (dB/m)	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
2485.492	42.3	-4.2	1.5	319.9	0.0	20.0	Vert	PK	0.0	58.1	74.0	-15.9	EUT On Side, High Ch 1Mbps
2483.608	42.1	-4.2	1.5	55.9	0.0	20.0	Horz	PK	0.0	57.9	74.0	-16.1	EUT Horz, High Ch 1Mbps

CONCLUSION
Pass

Tested By

End of Test Report