



FloLogic Inc.

FloLogic Wireless Flowmeter Control System

FCC 15.247:2021

Bluetooth Low Energy (DTS) Radio

Report: DESO0001.1, Issue Date: May 18, 2021



NVLAP LAB CODE: 200881-0



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CERTIFICATE OF TEST



Last Date of Test: March 22, 2021

FloLogic Inc.

EUT: FloLogic Wireless Flowmeter Control System

Radio Equipment Testing

Standards

Specification	Method
FCC 15.207:2021	ANSI C63.10:2013, KDB 558074
FCC 15.247:2021	

Results

Method Clause	Test Description	Applied	Results	Comments
6.2	Powerline Conducted Emissions	Yes	Pass	
11.12.1, 11.13.2, 6.5, 6.6	Spurious Radiated Emissions	Yes	Pass	
11.6	Duty Cycle	Yes	N/A	Characterization of radio operation.
11.8.2	Occupied Bandwidth	Yes	Pass	
11.9.2.2.4	Output Power	Yes	Pass	
11.9.2.2.4	Equivalent Isotropic Radiated Power	Yes	Pass	
11.10.2	Power Spectral Density	Yes	Pass	
11.11	Band Edge Compliance	Yes	Pass	
11.11	Spurious Conducted Emissions	Yes	Pass	

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
00	None		

ACCREDITATIONS AND AUTHORIZATIONS



United States

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

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

NVLAP - Each laboratory is accredited by NVLAP to ISO 17025

Canada

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

European Union

European Commission – 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.

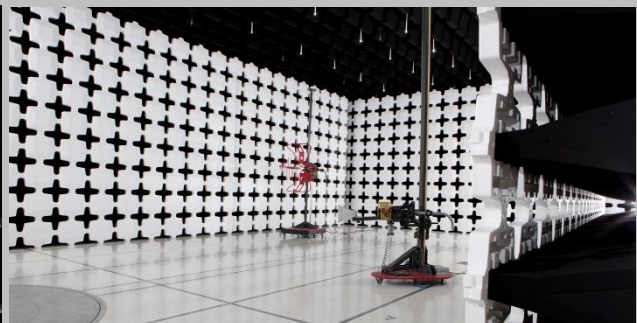
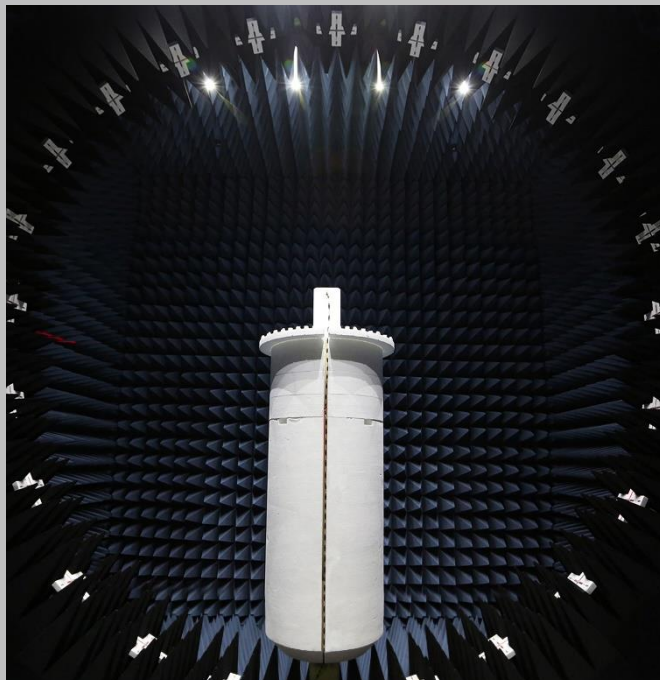
SCOPE

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

FACILITIES



California Labs OC01-17 41 Tesla Irvine, CA 92618 (949) 861-8918	Minnesota Labs MN01-11 9349 W Broadway Ave. Brooklyn Park, MN 55445 (612)-638-5136	Oregon Labs EV01-12 6775 NE Evergreen Pkwy #400 Hillsboro, OR 97124 (503) 844-4066	Texas Labs TX01-09 3801 E Plano Pkwy Plano, TX 75074 (469) 304-5255	Washington Labs NC01-05 19201 120 th Ave NE Bothell, WA 98011 (425)984-6600
NVLAP				
NVLAP Lab Code: 200676-0	NVLAP Lab Code: 200881-0	NVLAP Lab Code: 200630-0	NVLAP Lab Code:201049-0	NVLAP Lab Code: 200629-0
Innovation, Science and Economic Development Canada				
2834B-1, 2834B-3	2834E-1, 2834E-3	2834D-1	2834G-1	2834F-1
BSMI				
SL2-IN-E-1154R	SL2-IN-E-1152R	SL2-IN-E-1017	SL2-IN-E-1158R	SL2-IN-E-1153R
VCCI				
A-0029	A-0109	A-0108	A-0201	A-0110
Recognized Phase I CAB for ISED, ACMA, BSMI, IDA, KCC/RRA, MIC, MOC, NCC, OFCA				
US0158	US0175	US0017	US0191	US0157



MEASUREMENT UNCERTAINTY



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.

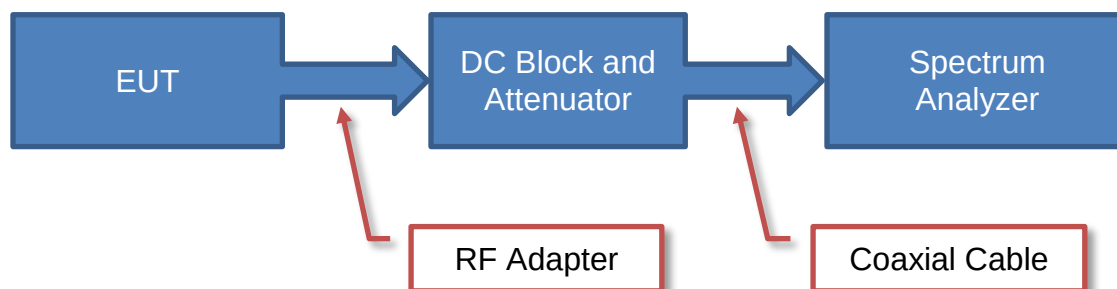
A measurement uncertainty estimation has been performed for each test per our internal quality document QM205.4.6. The estimation is used to compare the measured result with its "true" or theoretically correct value. The expanded measurement uncertainty (K=2) can be found in the table below. A lab specific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

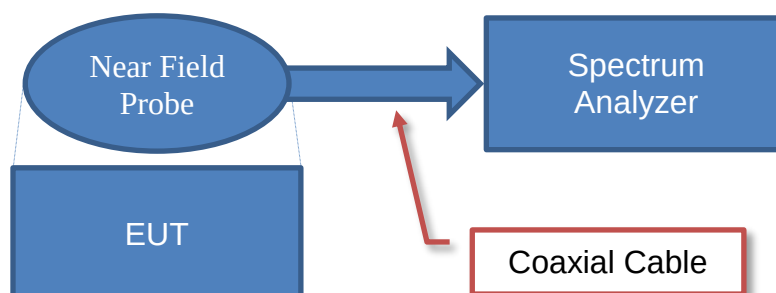
Test	+ MU	- MU
Frequency Accuracy	0.0007%	-0.0007%
Amplitude Accuracy (dB)	1.2 dB	-1.2 dB
Conducted Power (dB)	1.2 dB	-1.2 dB
Radiated Power via Substitution (dB)	0.7 dB	-0.7 dB
Temperature (degrees C)	0.7°C	-0.7°C
Humidity (% RH)	2.5% RH	-2.5% RH
Voltage (AC)	1.0%	-1.0%
Voltage (DC)	0.7%	-0.7%
Field Strength (dB)	5.2 dB	-5.2 dB
AC Powerline Conducted Emissions (dB)	2.6 dB	-2.6 dB

Test Setup Block Diagrams

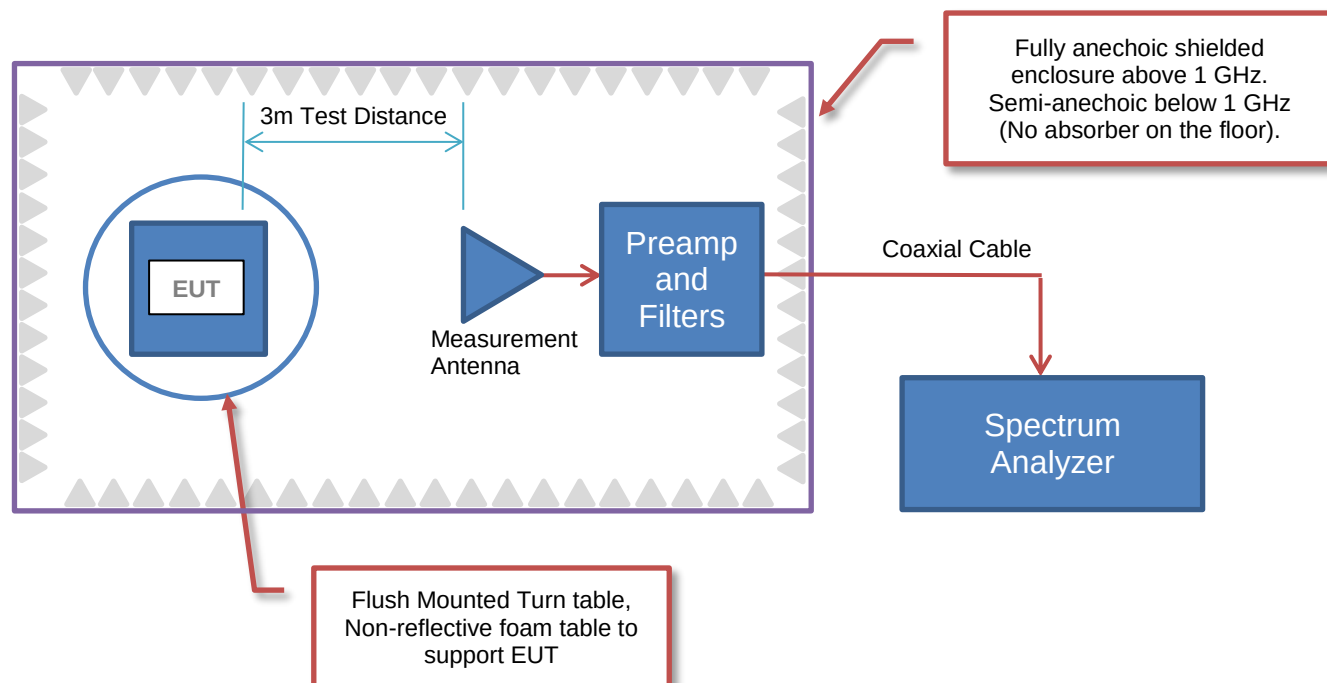
Antenna Port Conducted Measurements



Near Field Test Fixture Measurements



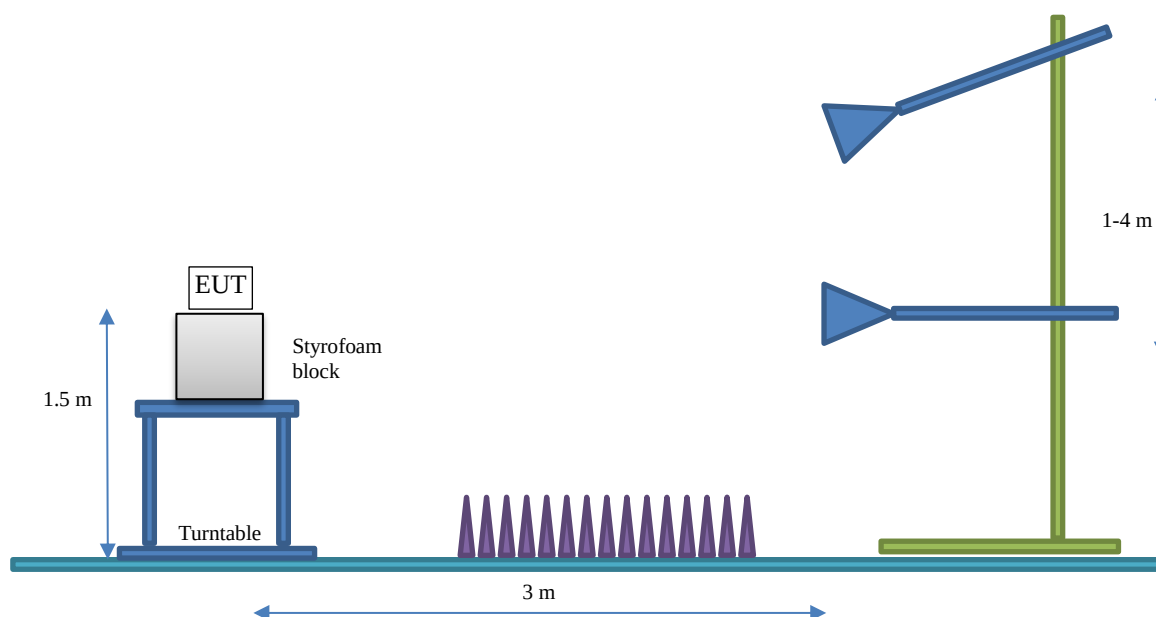
Spurious Radiated Emissions



Test Setup Block Diagrams

Bore Siting (>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:	FloLogic Inc.
Address:	1015 Aviation Parkway, Suite 900
City, State, Zip:	Morrisville, NC 27560
Test Requested By:	Bruce Gibson
EUT:	FloLogic Wireless Flowmeter Control System
First Date of Test:	February 3, 2021
Last Date of Test:	March 22, 2021
Receipt Date of Samples:	February 3, 2021
Equipment Design Stage:	Production
Equipment Condition:	No Damage
Purchase Authorization:	Verified

Information Provided by the Party Requesting the Test

Functional Description of the EUT:

Wireless Flowmeter Control System. Contains a Wifi radio that can transmit at the same time as a 915 MHz. Also contains a BLE radio that will not transmit at the same time.

Testing Objective:

To demonstrate compliance of the Bluetooth Low Energy (DTS) radio to FCC 15.247 requirements.

CONFIGURATIONS



Configuration DESO0001- 3

EUT			
Description	Manufacturer	Model/Part Number	Serial Number
Flowmeter Control System	FloLogic, Inc.	None	2001966

Peripherals in test setup boundary			
Description	Manufacturer	Model/Part Number	Serial Number
12V Battery	Leoch	None	None

Cables					
Cable Type	Shield	Length (m)	Ferrite	Connection 1	Connection 2
RJ11 Cable	No	1.5m	No	Flowmeter Control System	Unterminated
Power Leads	No	0.4m	No	12V Battery	Flowmeter Control System

Configuration DESO0001- 4

EUT			
Description	Manufacturer	Model/Part Number	Serial Number
Flowmeter Control System	FloLogic, Inc.	None	FL-40F5BF

Peripherals in test setup boundary			
Description	Manufacturer	Model/Part Number	Serial Number
12V Battery	Universal Power Group	UB1250	04IJE222A
Laptop	Lenovo	ThinkPad X201	3249ERU
AC/DC Adapter (Laptop)	Lenovo	92P1109	11S92P1109Z1ZBT9729GV

Cables					
Cable Type	Shield	Length (m)	Ferrite	Connection 1	Connection 2
Power Leads	No	0.4m	No	12V Battery	Flowmeter Control System
USB-TTL Cable	Yes	1.9m	No	Laptop	Flowmeter Control System
DC to RJ11 Cable	No	1.0m	No	12V Battery	Flowmeter Control System
AC Cable (Laptop)	No	1.0m	No	AC Mains	AC/DC Adapter (Laptop)
DC Cable (Laptop)	No	1.8m	Yes	AC/DC Adapter (Laptop)	Laptop

CONFIGURATIONS



Configuration DESO0002- 1

EUT			
Description	Manufacturer	Model/Part Number	Serial Number
Flowmeter Control System	FloLogic, Inc.	None	2001966

Peripherals in test setup boundary			
Description	Manufacturer	Model/Part Number	Serial Number
12V Battery	Leoch	None	None
Control Panel	FloLogic, Inc.	None	None
Water Valve	FloLogic, Inc.	FLS0035_1.5	7424F
Class 2 Power Supply	FloLogic, Inc.	XA005AN1380030	None

Cables					
Cable Type	Shield	Length (m)	Ferrite	Connection 1	Connection 2
RJ11 Cable 1	No	16.4m	No	Flowmeter Control System	Control Panel
RJ11 Cable 2	No	15.2m	No	Flowmeter Control System	Water Valve
DC Cable (Water Valve)	No	3.9m	No	AC/DC Adapter/Charger	Water Valve
Battery Leads (x2)	No	1.7m	No	AC/DC Adapter/Charger	12V Battery
AC Cable	No	1.8m	No	AC/DC Adapter/Charger	AC Mains

MODIFICATIONS

Equipment Modifications

Item	Date	Test	Modification	Note	Disposition of EUT
1	2021-02-03	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	2021-03-18	Occupied Bandwidth	Tested as delivered to Test Station.	No EMI suppression devices were added or modified during this test.	EUT remained at Element following the test.
3	2021-03-18	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.
4	2021-03-18	Equivalent Isotropic Radiated Power	Tested as delivered to Test Station.	No EMI suppression devices were added or modified during this test.	EUT remained at Element following the test.
5	2021-03-18	Power Spectral Density	Tested as delivered to Test Station.	No EMI suppression devices were added or modified during this test.	EUT remained at Element following the test.
6	2021-03-18	Band Edge Compliance	Tested as delivered to Test Station.	No EMI suppression devices were added or modified during this test.	EUT remained at Element following the test.
7	2021-03-18	Spurious Conducted Emissions	Tested as delivered to Test Station.	No EMI suppression devices were added or modified during this test.	EUT remained at Element following the test.
8	2021-03-22	Powerline Conducted Emissions	Tested as delivered to Test Station.	No EMI suppression devices were added or modified during this test.	Scheduled testing was completed.

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.

ANTENNA GAIN (dBi)

Type	Provided by:	Frequency Range (MHz)	Gain (dBi)
2.45 GHz SMD Chip Antenna	Johanson Technologies	2400-2500	2

No adjustable power settings were provided. The EUT was tested using power settings pre-defined by the manufacturer.

POWERLINE CONDUCTED EMISSIONS

TEST DESCRIPTION

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

TEST EQUIPMENT

Description	Manufacturer	Model	ID	Last Cal.	Cal. Due
LISN	Solar Electronics	9252-50-R-24-BNC	LIY	2021-03-15	2022-03-15
Cable - Conducted Cable Assembly	Northwest EMC	MNC, HGN, TYK	MNCA	2021-03-10	2022-03-10
Receiver	Gauss Instruments	TDEMI 30M	ARK	2020-10-27	2021-10-27

MEASUREMENT UNCERTAINTY

Description		
Expanded k=2	2.6 dB	-2.6 dB

CONFIGURATIONS INVESTIGATED

DESO0002-1

MODES INVESTIGATED

Bluetooth Radio continuous transmit CW mode, Mid ch.2440MHz.

POWERLINE CONDUCTED EMISSIONS

EUT:	FloLogic Wireless Flowmeter Control System	Work Order:	DESO0002
Serial Number:	2001966	Date:	2021-03-22
Customer:	FloLogic Inc.	Temperature:	22.3°C
Attendees:	None	Relative Humidity:	23.2%
Customer Project:	None	Bar. Pressure:	1017 mb
Tested By:	Dan Haas	Job Site:	MN03
Power:	120VAC/60Hz	Configuration:	DESO0002-1

TEST SPECIFICATIONS

Specification:	Method:
FCC 15.207:2021	ANSI C63.10:2013

TEST PARAMETERS

Run #:	5	Line:	High Line	Add. Ext. Attenuation (dB):	0
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COMMENTS

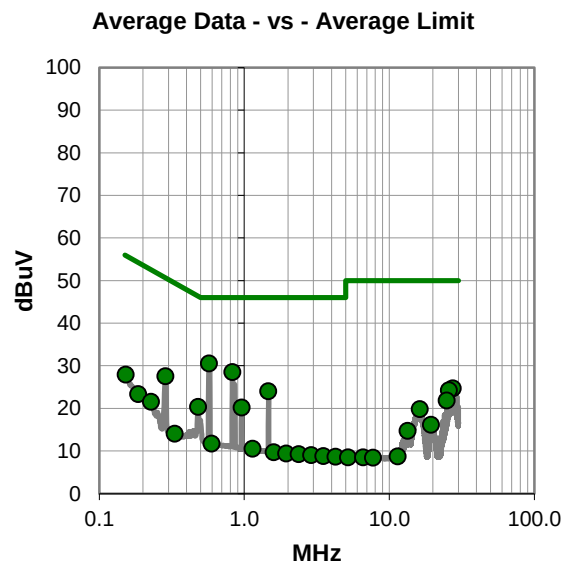
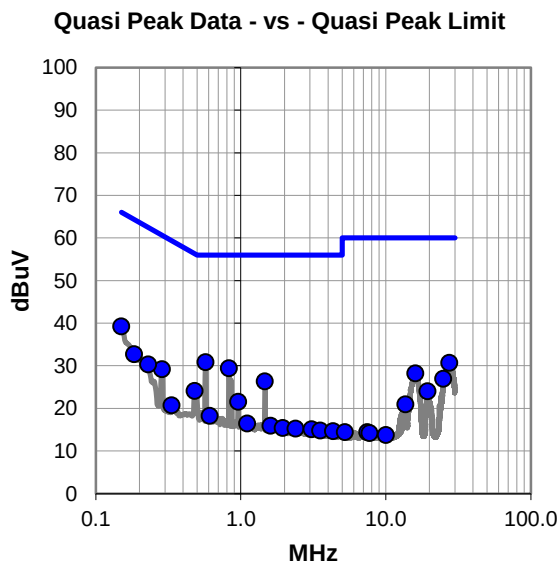
None

EUT OPERATING MODES

Bluetooth Radio continuous transmit CW mode, Mid ch.2440MHz.

DEVIATIONS FROM TEST STANDARD

None



POWERLINE CONDUCTED EMISSIONS



WTD, 2020.12.03.1
EmiR5 2021.01.08.0, PSA-ESCI
2021.03.17.0

RESULTS - Run #5

Quasi Peak Data - vs - Quasi Peak Limit

Freq (MHz)	Amp. (dBuV)	Factor (dB)	Adjusted (dBuV)	Spec. Limit (dBuV)	Margin (dB)
0.571	10.4	20.4	30.8	56.0	-25.2
0.830	8.9	20.5	29.4	56.0	-26.6
0.150	18.2	21.0	39.2	66.0	-26.8
27.438	9.3	21.4	30.7	60.0	-29.3
1.468	5.8	20.5	26.3	56.0	-29.7
0.286	8.7	20.5	29.2	60.7	-31.5
0.183	11.9	20.8	32.7	64.3	-31.6
16.001	7.1	21.1	28.2	60.0	-31.8
0.480	3.6	20.5	24.1	56.3	-32.2
0.229	9.7	20.6	30.3	62.5	-32.2
24.946	5.6	21.3	26.9	60.0	-33.1
0.959	1.0	20.5	21.5	56.0	-34.5
19.468	2.9	21.1	24.0	60.0	-36.0
0.611	-2.2	20.4	18.2	56.0	-37.8
0.334	0.2	20.5	20.7	59.4	-38.7
13.688	0.0	20.9	20.9	60.0	-39.1
1.105	-4.1	20.5	16.4	56.0	-39.6
1.606	-4.6	20.5	15.9	56.0	-40.1
1.946	-5.1	20.5	15.4	56.0	-40.6
2.392	-5.4	20.6	15.2	56.0	-40.8
3.074	-5.5	20.6	15.1	56.0	-40.9
3.525	-5.8	20.6	14.8	56.0	-41.2
4.328	-6.0	20.6	14.6	56.0	-41.4
5.215	-6.2	20.6	14.4	60.0	-45.6
7.449	-6.4	20.8	14.4	60.0	-45.6

Average Data - vs - Average Limit

Freq (MHz)	Amp. (dBuV)	Factor (dB)	Adjusted (dBuV)	Spec. Limit (dBuV)	Margin (dB)
0.571	10.1	20.4	30.5	46.0	-15.5
0.830	8.0	20.5	28.5	46.0	-17.5
1.468	3.5	20.5	24.0	46.0	-22.0
0.286	7.0	20.5	27.5	50.7	-23.2
27.438	3.3	21.4	24.7	50.0	-25.3
25.880	2.8	21.4	24.2	50.0	-25.8
0.959	-0.3	20.5	20.2	46.0	-25.8
0.480	-0.2	20.5	20.3	46.3	-26.0
0.152	7.0	20.9	27.9	55.9	-28.0
24.946	0.5	21.3	21.8	50.0	-28.2
16.214	-1.3	21.1	19.8	50.0	-30.2
0.185	2.5	20.8	23.3	54.2	-30.9
0.227	0.9	20.6	21.5	52.6	-31.1
19.426	-5.0	21.1	16.1	50.0	-33.9
0.596	-8.7	20.4	11.7	46.0	-34.3
13.408	-6.2	20.9	14.7	50.0	-35.3
0.331	-6.5	20.5	14.0	49.4	-35.4
1.141	-10.0	20.5	10.5	46.0	-35.5
1.596	-10.8	20.5	9.7	46.0	-36.3
1.948	-11.1	20.5	9.4	46.0	-36.6
2.372	-11.4	20.6	9.2	46.0	-36.8
2.891	-11.6	20.6	9.0	46.0	-37.0
3.510	-11.8	20.6	8.8	46.0	-37.2
4.272	-12.0	20.6	8.6	46.0	-37.4
11.418	-12.2	20.9	8.7	50.0	-41.3

CONCLUSION

Pass

Tested By

POWERLINE CONDUCTED EMISSIONS

EUT:	FloLogic Wireless Flowmeter Control System	Work Order:	DESO0002
Serial Number:	2001966	Date:	2021-03-22
Customer:	FloLogic Inc.	Temperature:	22.3°C
Attendees:	None	Relative Humidity:	23.2%
Customer Project:	None	Bar. Pressure:	1017 mb
Tested By:	Dan Haas	Job Site:	MN03
Power:	120VAC/60Hz	Configuration:	DESO0002-1

TEST SPECIFICATIONS

Specification:	Method:
FCC 15.207:2021	ANSI C63.10:2013

TEST PARAMETERS

Run #:	6	Line:	Neutral	Add. Ext. Attenuation (dB):	0
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COMMENTS

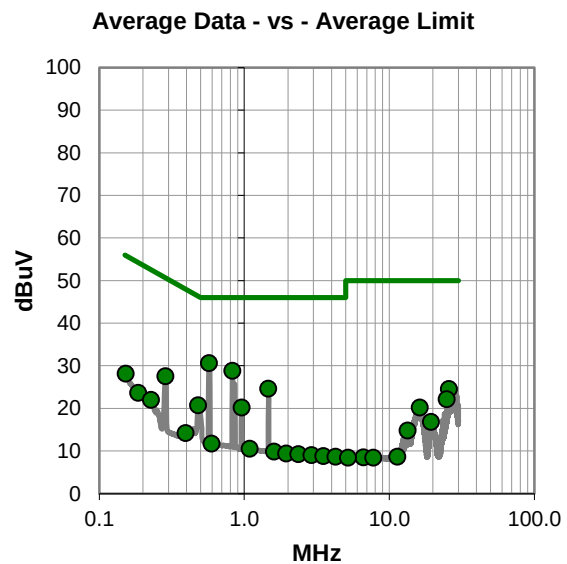
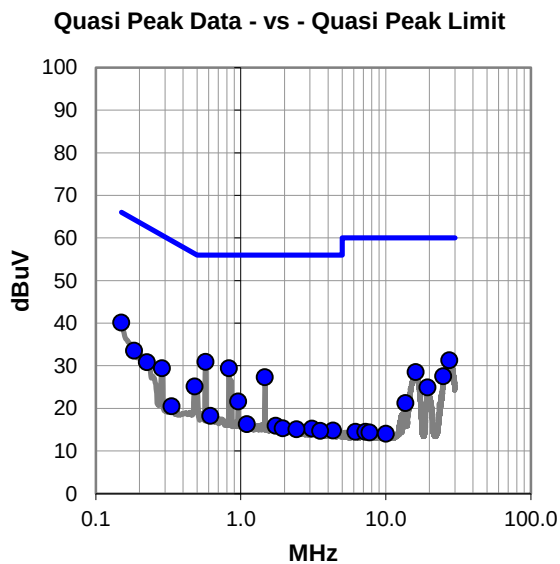
None

EUT OPERATING MODES

Bluetooth Radio continuous transmit CW mode, Mid ch.2440MHz.

DEVIATIONS FROM TEST STANDARD

None



POWERLINE CONDUCTED EMISSIONS

RESULTS - Run #6

Quasi Peak Data - vs - Quasi Peak Limit

Freq (MHz)	Amp. (dBuV)	Factor (dB)	Adjusted (dBuV)	Spec. Limit (dBuV)	Margin (dB)
0.571	10.5	20.4	30.9	56.0	-25.1
0.150	19.1	21.0	40.1	66.0	-25.9
0.830	8.9	20.5	29.4	56.0	-26.6
1.468	6.8	20.5	27.3	56.0	-28.7
27.440	9.9	21.4	31.3	60.0	-28.7
0.183	12.7	20.8	33.5	64.3	-30.8
0.480	4.6	20.5	25.1	56.3	-31.2
0.286	8.9	20.5	29.4	60.7	-31.3
16.070	7.4	21.1	28.5	60.0	-31.5
0.225	10.2	20.6	30.8	62.6	-31.8
24.946	6.2	21.3	27.5	60.0	-32.5
0.959	1.1	20.5	21.6	56.0	-34.4
19.439	3.8	21.1	24.9	60.0	-35.1
0.615	-2.2	20.4	18.2	56.0	-37.8
13.690	0.3	20.9	21.2	60.0	-38.8
0.334	0.0	20.5	20.5	59.4	-38.9
1.101	-4.2	20.5	16.3	56.0	-39.7
1.742	-4.6	20.5	15.9	56.0	-40.1
1.944	-5.2	20.5	15.3	56.0	-40.7
3.095	-5.4	20.6	15.2	56.0	-40.8
2.430	-5.5	20.6	15.1	56.0	-40.9
4.320	-5.8	20.6	14.8	56.0	-41.2
3.525	-5.9	20.6	14.7	56.0	-41.3
6.178	-6.2	20.7	14.5	60.0	-45.5
7.253	-6.3	20.8	14.5	60.0	-45.5

Average Data - vs - Average Limit

Freq (MHz)	Amp. (dBuV)	Factor (dB)	Adjusted (dBuV)	Spec. Limit (dBuV)	Margin (dB)
0.571	10.2	20.4	30.6	46.0	-15.4
0.830	8.3	20.5	28.8	46.0	-17.2
1.468	4.1	20.5	24.6	46.0	-21.4
0.286	7.0	20.5	27.5	50.7	-23.2
25.880	3.1	21.4	24.5	50.0	-25.5
0.480	0.2	20.5	20.7	46.3	-25.6
0.959	-0.3	20.5	20.2	46.0	-25.8
0.152	7.2	20.9	28.1	55.9	-27.8
24.946	0.8	21.3	22.1	50.0	-27.9
16.214	-0.9	21.1	20.2	50.0	-29.8
0.185	2.8	20.8	23.6	54.2	-30.6
0.227	1.4	20.6	22.0	52.6	-30.6
19.434	-4.3	21.1	16.8	50.0	-33.2
0.394	-6.3	20.5	14.2	48.0	-33.8
0.596	-8.7	20.4	11.7	46.0	-34.3
13.408	-6.1	20.9	14.8	50.0	-35.2
1.093	-10.0	20.5	10.5	46.0	-35.5
1.606	-10.7	20.5	9.8	46.0	-36.2
1.944	-11.1	20.5	9.4	46.0	-36.6
2.367	-11.4	20.6	9.2	46.0	-36.8
2.918	-11.6	20.6	9.0	46.0	-37.0
3.508	-11.8	20.6	8.8	46.0	-37.2
4.272	-12.0	20.6	8.6	46.0	-37.4
11.358	-12.3	20.9	8.6	50.0	-41.4
6.631	-12.3	20.8	8.5	50.0	-41.5

CONCLUSION

Pass



Tested By

SPURIOUS RADIATED EMISSIONS - BLE



PSA-ESCI 2021.01.22.0

Testing was performed using the mode(s) of operation and configuration(s) noted within the report. The individuals and/or the organization requesting the test provided the modes, configurations and settings used to complete the evaluation. The actual test parameters are specified in the test data, this includes items such as investigated frequency range (scanned) and test levels. The testing methods and performance specifications, as well as the test site used for the evaluation are indicated in the test data. The test data represents the configuration / operating mode/ model that produced the highest emission levels as compared to the specification limit.

MODES OF OPERATION

Transmitting BLE. High Ch. 39 (2480 MHz), Mid Ch. 20 (2442 MHz), Low Ch. 0 (2402 MHz), 1 Mbps

POWER SETTINGS INVESTIGATED

Battery 12VDC

CONFIGURATIONS INVESTIGATED

DESO0001 - 3

FREQUENCY RANGE INVESTIGATED

Start Frequency	30 MHz	Stop Frequency	26500 MHz
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SAMPLE CALCULATIONS

Radiated Emissions: Field Strength = Measured Level + Antenna Factor + Cable Factor - Amplifier Gain + Distance Adjustment Factor + External Attenuation

TEST EQUIPMENT

Description	Manufacturer	Model	ID	Last Cal.	Cal. Due
Cable	ESM Cable Corp.	TTBJ141 KMKM-72	MNP	2020-09-11	2021-09-11
Cable	ESM Cable Corp.	Double Ridge Guide Horn Cables	MNI	2021-01-15	2022-01-15
Attenuator	Fairview Microwave	SA18E-10	TYA	2020-09-14	2021-09-14
Attenuator	Fairview Microwave	SA18E-20	TWZ	2020-09-14	2021-09-14
Attenuator	JFW Industries	50FH-006-300	TWX	NCR	NCR
Cable	ESM Cable Corp.	Standard Gain Horn Cables	MNJ	2020-03-10	2021-03-10
Cable	ESM Cable Corp.	Bilog Cables	MNH	2020-10-06	2021-10-06
Cable	Fairview Microwave	FMCA1975-200CM	MN1	2020-08-10	2021-08-10
Filter - High Pass	Micro-Tronics	HPM50111	LFN	2020-09-14	2021-09-14
Filter - Low Pass	Micro-Tronics	LPM50004	LFK	2020-09-24	2021-09-24
Antenna - Standard Gain	ETS Lindgren	3160-07	AXP	NCR	NCR
Antenna - Biconilog	ETS Lindgren	3142D	AXO	2019-09-03	2021-09-03
Amplifier - Pre-Amplifier	Miteq	JSW45-26004000-40-5P	AVR	2020-08-10	2021-08-10
Amplifier - Pre-Amplifier	Miteq	AM-1616-1000	AVO	2020-10-06	2021-10-06
Antenna - Standard Gain	ETS Lindgren	3160-08	AIQ	NCR	NCR
Amplifier - Pre-Amplifier	Miteq	JSD4-18002600-26-8P	APU	2020-09-11	2021-09-11
Antenna - Standard Gain	ETS Lindgren	3160-09	AHG	NCR	NCR
Amplifier - Pre-Amplifier	Miteq	AMF-6F-12001800-30-10P	AVW	2021-01-15	2022-01-15
Amplifier - Pre-Amplifier	Miteq	AMF-6F-08001200-30-10P	AVV	2021-01-15	2022-01-15
Amplifier - Pre-Amplifier	Miteq	AMF-3D-00100800-32-13P	AVT	2021-01-15	2022-01-15
Antenna - Double Ridge	ETS-Lindgren	3115	AJQ	2021-01-25	2023-01-25

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

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 $10 \cdot \log(1/dc)$.

SPURIOUS RADIATED EMISSIONS - BLE



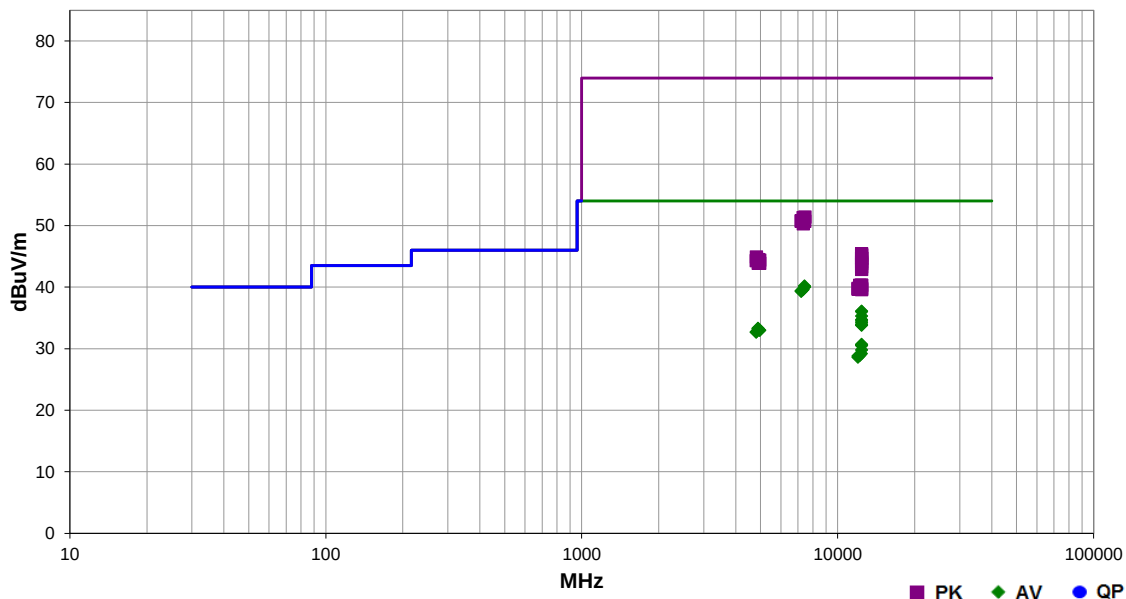
EmiR5 2020.12.09.0

PSA-ESCI 2021.01.22.0

Work Order:	DESO0001	Date:	2021-02-03		
Project:	None	Temperature:	22.2 °C		
Job Site:	MN05	Humidity:	21.7% RH		
Serial Number:	2001966	Barometric Pres.:	1016 mbar		
		Tested by:			Christopher Heintzelman, Chris Patterson
EUT:	FloLogic Wireless Flowmeter Control System				
Configuration:	3				
Customer:	FloLogic Inc.				
Attendees:	None				
EUT Power:	Battery 12VDC				
Operating Mode:	Transmitting BLE. High Ch. 39 (2480 MHz), Mid Ch. 20 (2442 MHz), Low Ch. 0 (2402 MHz), 1 Mbps				
Deviations:	None				
Comments:	None				

Test Specifications	FCC 15.247:2021	Test Method	ANSI C63.10:2013
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Run #	16	Test Distance (m)	3	Antenna Height(s)	1 to 4(m)	Results	Pass
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Freq (MHz)	Amplitude (dBuV)	Factor (dB)	Antenna Height (meters)	Azimuth (degrees)	Test Distance (meters)	External Attenuation (dB)	Polarity/Transducer Type	Detector	Distance Adjustment (dB)	Adjusted (dBuV/m)	Spec. Limit (dBuV/m)	Compared to Spec. (dB)	Comments
7429.875	31.0	9.2	1.5	0.0	3.0	0.0	Horz	AV	0.0	40.2	54.0	-13.8	EUT Horz, High Ch, 1 Mbps
7441.533	30.8	9.2	1.5	99.0	3.0	0.0	Vert	AV	0.0	40.0	54.0	-14.0	EUT Vert, High Ch, 1 Mbps
7328.242	30.5	9.1	1.5	204.9	3.0	0.0	Vert	AV	0.0	39.6	54.0	-14.4	EUT Vert, Mid Ch, 1 Mbps
7315.208	30.5	9.1	1.5	257.9	3.0	0.0	Horz	AV	0.0	39.6	54.0	-14.4	EUT Horz, Mid Ch, 1 Mbps
7194.417	30.1	9.3	1.5	54.0	3.0	0.0	Horz	AV	0.0	39.4	54.0	-14.6	EUT Horz, Low Ch, 1 Mbps
7206.133	30.1	9.2	1.5	103.9	3.0	0.0	Vert	AV	0.0	39.3	54.0	-14.7	EUT Vert, Low Ch, 1 Mbps
12398.880	35.3	0.8	2.0	311.0	3.0	0.0	Horz	AV	0.0	36.1	54.0	-17.9	EUT Horz, High Ch, 1 Mbps
12401.130	30.2	5.8	2.3	318.9	3.0	0.0	Horz	AV	0.0	36.0	54.0	-18.0	EUT Horz, High Ch, 1 Mbps
12398.880	34.5	0.8	1.1	41.9	3.0	0.0	Vert	AV	0.0	35.3	54.0	-18.7	EUT Vert, High Ch, 1 Mbps
12401.190	28.9	5.8	1.5	203.0	3.0	0.0	Vert	AV	0.0	34.7	54.0	-19.3	EUT Vert, High Ch, 1 Mbps
12401.100	28.7	5.8	3.6	297.0	3.0	0.0	Horz	AV	0.0	34.5	54.0	-19.5	EUT Vert, High Ch, 1 Mbps
12405.690	28.4	5.8	1.0	256.0	3.0	0.0	Vert	AV	0.0	34.2	54.0	-19.8	EUT On Side, High Ch, 1 Mbps
12405.380	28.1	5.8	1.5	66.0	3.0	0.0	Horz	AV	0.0	33.9	54.0	-20.1	EUT On Side, High Ch, 1 Mbps
12405.420	28.0	5.8	1.5	96.9	3.0	0.0	Vert	AV	0.0	33.8	54.0	-20.2	EUT Vert, High Ch, 1 Mbps
4885.858	31.0	2.3	1.5	103.9	3.0	0.0	Vert	AV	0.0	33.3	54.0	-20.7	EUT Vert, Mid Ch, 1 Mbps
4885.125	30.9	2.3	1.5	160.9	3.0	0.0	Horz	AV	0.0	33.2	54.0	-20.8	EUT Horz, Mid Ch, 1 Mbps
4963.875	30.6	2.4	1.1	188.0	3.0	0.0	Horz	AV	0.0	33.0	54.0	-21.0	EUT Horz, High Ch, 1 Mbps
4961.833	30.6	2.4	4.0	23.0	3.0	0.0	Vert	AV	0.0	33.0	54.0	-21.0	EUT Horz, High Ch, 1 Mbps
4804.333	30.6	2.1	1.5	318.0	3.0	0.0	Horz	AV	0.0	32.7	54.0	-21.3	EUT Horz, Low Ch, 1 Mbps
4803.883	30.6	2.1	4.0	336.0	3.0	0.0	Vert	AV	0.0	32.7	54.0	-21.3	EUT Vert, Low Ch, 1 Mbps
7442.483	42.2	9.2	1.5	99.0	3.0	0.0	Vert	PK	0.0	51.4	74.0	-22.6	EUT Vert, High Ch, 1 Mbps
7326.658	42.2	9.1	1.5	204.9	3.0	0.0	Vert	PK	0.0	51.3	74.0	-22.7	EUT Vert, Mid Ch, 1 Mbps
7207.875	41.6	9.2	1.5	103.9	3.0	0.0	Vert	PK	0.0	50.8	74.0	-23.2	EUT Vert, Low Ch, 1 Mbps

Freq (MHz)	Amplitude (dBuV)	Factor (dB)	Antenna Height (meters)	Azimuth (degrees)	Test Distance (meters)	External Attenuation (dB)	Polarity/ Transducer Type	Detector	Distance Adjustment (dB)	Adjusted (dBuV/m)	Spec. Limit (dBuV/m)	Compared to Spec. (dB)	Comments
7441.792	41.5	9.2	1.5	0.0	3.0	0.0	Horz	PK	0.0	50.7	74.0	-23.3	EUT Horz, High Ch, 1 Mbps
7207.125	41.5	9.2	1.5	54.0	3.0	0.0	Horz	PK	0.0	50.7	74.0	-23.3	EUT Horz, Low Ch, 1 Mbps
12405.460	24.9	5.8	1.5	96.9	3.0	0.0	Vert	AV	0.0	30.7	54.0	-23.3	EUT Horz, High Ch, 1Mbps
12398.730	29.8	0.8	2.0	249.0	3.0	0.0	Horz	AV	0.0	30.6	54.0	-23.4	EUT Vert, High Ch, 1 Mbps
12398.920	29.7	0.8	2.2	247.9	3.0	0.0	Vert	AV	0.0	30.5	54.0	-23.5	EUT On Side, High ch, 1 Mbps
7337.958	41.2	9.1	1.5	257.9	3.0	0.0	Horz	PK	0.0	50.3	74.0	-23.7	EUT Horz, Mid Ch, 1 Mbps
12398.710	29.0	0.8	1.5	311.0	3.0	0.0	Horz	AV	0.0	29.8	54.0	-24.2	EUT On Side, High ch, 1 Mbps
12393.290	28.4	0.8	1.5	0.0	3.0	0.0	Vert	AV	0.0	29.2	54.0	-24.8	EUT Horz, High Ch, 1 Mbps
12212.180	28.9	0.1	1.5	351.9	3.0	0.0	Horz	AV	0.0	29.0	54.0	-25.0	EUT Horz, Mid Ch, 1 Mbps
12208.420	28.8	0.1	1.5	153.9	3.0	0.0	Vert	AV	0.0	28.9	54.0	-25.1	EUT Vert, Mid Ch, 1 Mbps
11998.170	29.4	-0.6	1.5	264.9	3.0	0.0	Vert	AV	0.0	28.8	54.0	-25.2	EUT Vert, Low Ch, 1 Mbps
12010.090	29.2	-0.6	3.0	357.0	3.0	0.0	Horz	AV	0.0	28.6	54.0	-25.4	EUT Horz, Low Ch, 1 Mbps
12406.710	39.6	5.8	1.0	256.0	3.0	0.0	Vert	PK	0.0	45.4	74.0	-28.6	EUT On Side, High Ch, 1 Mbps
12405.790	39.4	5.8	3.6	297.0	3.0	0.0	Horz	PK	0.0	45.2	74.0	-28.8	EUT Vert, High Ch, 1 Mbps
4812.167	42.7	2.2	1.5	318.0	3.0	0.0	Horz	PK	0.0	44.9	74.0	-29.1	EUT Horz, Low Ch, 1 Mbps
12401.830	38.9	5.8	2.3	318.9	3.0	0.0	Horz	PK	0.0	44.7	74.0	-29.3	EUT Horz, High Ch, 1Mbps
12401.060	38.9	5.8	1.5	203.0	3.0	0.0	Vert	PK	0.0	44.7	74.0	-29.3	EUT Vert, High Ch, 1 Mbps
4884.792	42.2	2.3	1.5	103.9	3.0	0.0	Vert	PK	0.0	44.5	74.0	-29.5	EUT Vert, Mid Ch, 1 Mbps
4958.817	42.0	2.4	4.0	23.0	3.0	0.0	Vert	PK	0.0	44.4	74.0	-29.6	EUT Vert, High Ch, 1 Mbps
4804.558	42.2	2.1	4.0	336.0	3.0	0.0	Vert	PK	0.0	44.3	74.0	-29.7	EUT Vert, Low Ch, 1 Mbps
12400.210	38.3	5.8	1.5	96.9	3.0	0.0	Vert	PK	0.0	44.1	74.0	-29.9	EUT Horz, High Ch, 1Mbps
4958.083	41.6	2.3	1.1	188.0	3.0	0.0	Horz	PK	0.0	43.9	74.0	-30.1	EUT Horz, High Ch, 1 Mbps
4895.958	41.6	2.3	1.5	160.9	3.0	0.0	Horz	PK	0.0	43.9	74.0	-30.1	EUT Horz, Mid Ch, 1 Mbps
12408.940	38.0	5.8	1.5	66.0	3.0	0.0	Horz	PK	0.0	43.8	74.0	-30.2	EUT On Side, High Ch, 1 Mbps
12398.980	42.5	0.8	2.0	311.0	3.0	0.0	Horz	PK	0.0	43.3	74.0	-30.7	EUT Horz, High Ch, 1 Mbps
12398.770	42.1	0.8	1.1	41.9	3.0	0.0	Vert	PK	0.0	42.9	74.0	-31.1	EUT Vert, High Ch, 1 Mbps
12399.400	39.5	0.8	2.0	249.0	3.0	0.0	Horz	PK	0.0	40.3	74.0	-33.7	EUT Vert, High Ch, 1 Mbps
12387.690	39.5	0.8	1.5	0.0	3.0	0.0	Vert	PK	0.0	40.3	74.0	-33.7	EUT Horz, High Ch, 1 Mbps
12207.760	40.2	0.1	1.5	153.9	3.0	0.0	Vert	PK	0.0	40.3	74.0	-33.7	EUT Vert, Mid Ch, 1 Mbps
12207.990	40.1	0.1	1.5	351.9	3.0	0.0	Horz	PK	0.0	40.2	74.0	-33.8	EUT Horz, Mid Ch, 1 Mbps
12398.440	39.0	0.8	1.5	311.0	3.0	0.0	Horz	PK	0.0	39.8	74.0	-34.2	EUT On Side, High ch, 1 Mbps
12008.600	40.4	-0.6	3.0	357.0	3.0	0.0	Horz	PK	0.0	39.8	74.0	-34.2	EUT Horz, Low Ch, 1 Mbps
12010.790	40.3	-0.6	1.5	264.9	3.0	0.0	Vert	PK	0.0	39.7	74.0	-34.3	EUT Vert, Low Ch, 1 Mbps
12399.420	38.8	0.8	2.2	247.9	3.0	0.0	Vert	PK	0.0	39.6	74.0	-34.4	EUT On Side, High ch, 1 Mbps

SPURIOUS RADIATED EMISSIONS - BAND EDGE



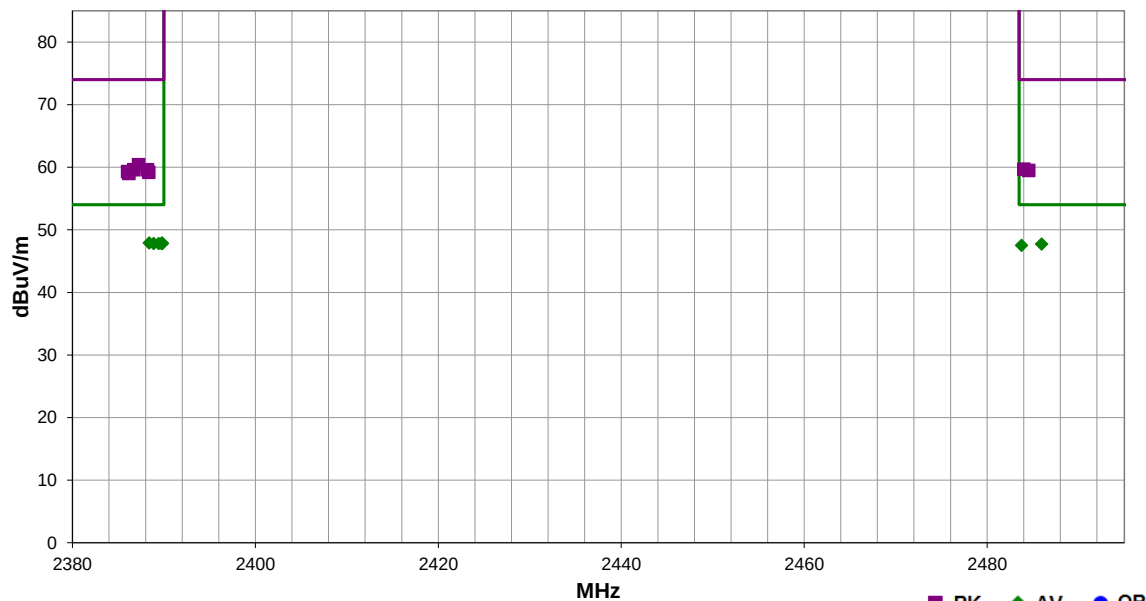
EmiR5 2020.12.09.0

PSA-ESCI 2021.01.22.0

Work Order:	DESO0001	Date:	2021-02-03	
Project:	None	Temperature:	22.2 °C	
Job Site:	MN05	Humidity:	21.7% RH	
Serial Number:	2001966	Barometric Pres.:	1016 mbar	
		Tested by:	Christopher Heintzelman, Chris Patterson	
EUT:	FloLogic Wireless Flowmeter Control System			
Configuration:	3			
Customer:	FloLogic Inc.			
Attendees:	None			
EUT Power:	Battery 12VDC			
Operating Mode:	Transmitting BLE: High Ch. 39 (2480 MHz), Mid Ch. 20 (2442 MHz), Low Ch. 0 (2402 MHz), 1 Mbps			
Deviations:	None			
Comments:	Band Edge low channel			

Test Specifications	Test Method
FCC 15.247:2021	ANSI C63.10:2013

Run #	21	Test Distance (m)	3	Antenna Height(s)	1 to 4(m)	Results	Pass
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Freq (MHz)	Amplitude (dBuV)	Factor (dB)	Antenna Height (meters)	Azimuth (degrees)	Test Distance (meters)	External Attenuation (dB)	Polarity/Transducer Type	Detector	Distance Adjustment (dB)	Adjusted (dBuV/m)	Spec. Limit (dBuV/m)	Compared to Spec. (dB)	Comments
2388.408	32.4	-4.5	2.8	240.9	3.0	20.0	Vert	AV	0.0	47.9	54.0	-6.1	EUT Vert. Low Ch. 1 Mbps
2389.800	32.4	-4.5	1.6	19.9	3.0	20.0	Vert	AV	0.0	47.9	54.0	-6.1	EUT On Side, Low Ch. 1 Mbps
2389.850	32.3	-4.5	4.0	59.9	3.0	20.0	Horz	AV	0.0	47.8	54.0	-6.2	EUT Vert. Low Ch. 1 Mbps
2389.750	32.3	-4.5	1.5	117.0	3.0	20.0	Horz	AV	0.0	47.8	54.0	-6.2	EUT Horz, Low Ch. 1 Mbps
2388.892	32.3	-4.5	1.5	159.0	3.0	20.0	Vert	AV	0.0	47.8	54.0	-6.2	EUT Horz, Low Ch. 1 Mbps
2389.442	32.3	-4.5	1.5	48.9	3.0	20.0	Horz	AV	0.0	47.8	54.0	-6.2	EUT On Side, Low Ch. 1 Mbps
2485.967	32.7	-5.0	1.5	181.0	3.0	20.0	Vert	AV	0.0	47.7	54.0	-6.3	EUT Vert. High Ch. 1 Mbps
2483.767	32.5	-5.0	2.9	196.0	3.0	20.0	Horz	AV	0.0	47.5	54.0	-6.5	EUT Vert. High Ch. 1 Mbps
2387.217	44.9	-4.5	1.5	159.0	3.0	20.0	Vert	PK	0.0	60.4	74.0	-13.6	EUT Horz, Low Ch. 1 Mbps
2484.008	44.7	-5.0	1.5	181.0	3.0	20.0	Vert	PK	0.0	59.7	74.0	-14.3	EUT Vert. High Ch. 1 Mbps
2388.200	44.1	-4.5	2.8	240.9	3.0	20.0	Vert	PK	0.0	59.6	74.0	-14.4	EUT Vert. Low Ch. 1 Mbps
2386.717	44.1	-4.5	1.5	117.0	3.0	20.0	Horz	PK	0.0	59.6	74.0	-14.4	EUT Horz, Low Ch. 1 Mbps

DUTY CYCLE



TEST DESCRIPTION

The Duty Cycle (x) were measured for each of the EUT operating modes. 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.

The EUT operates at 100% Duty Cycle.

OCCUPIED BANDWIDTH



XMIT 2020.12.30.0

Testing was performed using the mode(s) of operation and configuration(s) noted within the report. The individuals and/or the organization requesting the test provided the modes, configurations and settings used to complete the evaluation. The actual test parameters are specified in the test data, this includes items such as investigated frequency range (scanned) and test levels. The testing methods and performance specifications, as well as the test site used for the evaluation are indicated in the test data.

TEST EQUIPMENT

Description	Manufacturer	Model	ID	Last Cal.	Cal. Due
Generator - Signal	Keysight	N5182B	TFX	2020-04-28	2023-04-28
Cable	Micro-Coax	UFD150A-1-0720-200200	MNL	2020-09-14	2021-09-14
Attenuator	S.M. Electronics	SA26B-20	RFW	2021-02-05	2022-02-05
Block - DC	Fairview Microwave	SD3379	AMI	2020-08-05	2021-08-05
Analyzer - Spectrum Analyzer	Agilent	E4446A	AAQ	2020-05-07	2021-05-07

TEST DESCRIPTION

The EUT was set to the channels and modes listed in the datasheet.

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

OCCUPIED BANDWIDTH



TSMTx 2019.08.30.0 XMR 2020.12.30.0

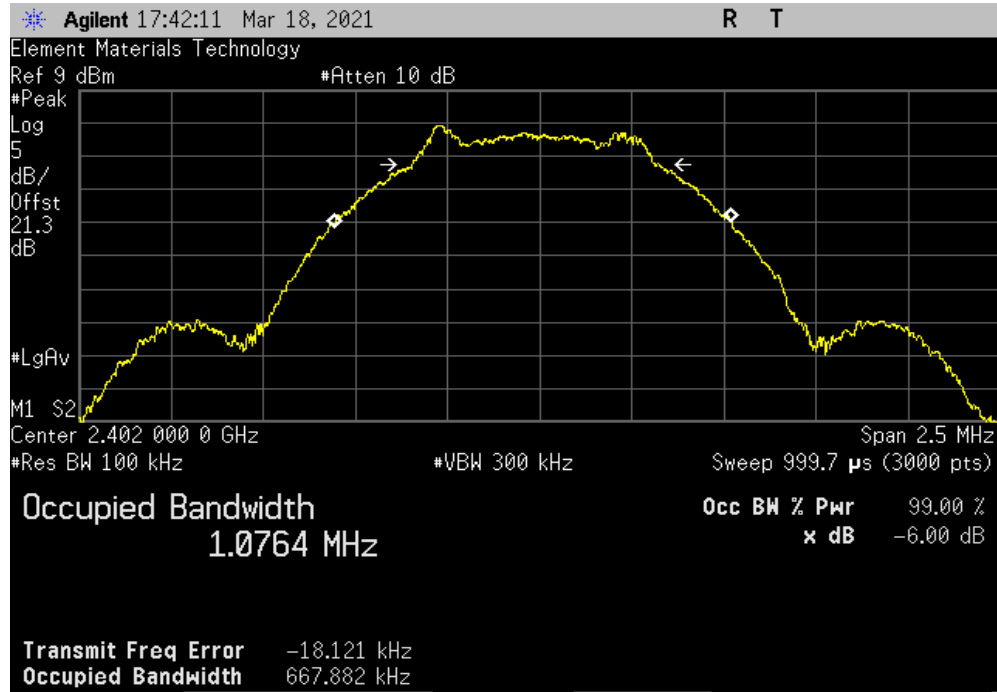
EUT: FloLogic Wireless Flowmeter Control System		Work Order: DESO0001	
Serial Number: FL-40F5BF		Date: 18-Mar-21	
Customer: FloLogic Inc.		Temperature: 24.3 °C	
Attendees: None		Humidity: 25.4% RH	
Project: None		Barometric Pres.: 1030 mbar	
Tested by: Dustin Sparks		Power: Battery	
		Job Site: MN08	
TEST SPECIFICATIONS		Test Method	
FCC 15.247:2021		ANSI C63.10:2013	
COMMENTS			
Reference level offset includes 20 dB attenuator, measurement cable, and DC block.			
DEVIATIONS FROM TEST STANDARD			
None			
Configuration #	4	Signature <i>Dustin Sparks</i>	
		Value	Limit (±) Result
BLE/GFSK 1 Mbps Low Channel, 2402 MHz		667.882 kHz	500 kHz Pass
BLE/GFSK 1 Mbps Mid Channel, 2442 MHz		697.565 kHz	500 kHz Pass
BLE/GFSK 1 Mbps High Channel, 2480 MHz		704.035 kHz	500 kHz Pass

OCCUPIED BANDWIDTH

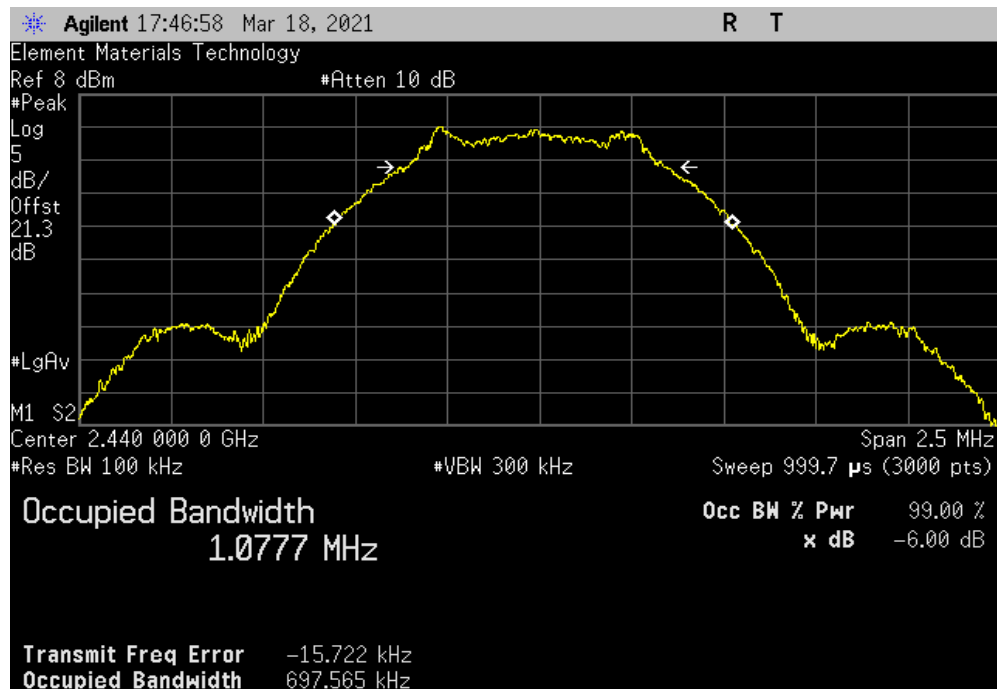


TIMTx 2019.08.30.0 XMR 2020.12.30.0

BLE/GFSK 1 Mbps Low Channel, 2402 MHz						
Value				Limit (≥)	Result	
667.882 kHz				500 kHz	Pass	



BLE/GFSK 1 Mbps Mid Channel, 2442 MHz						
Value				Limit (≥)	Result	
697.565 kHz				500 kHz	Pass	

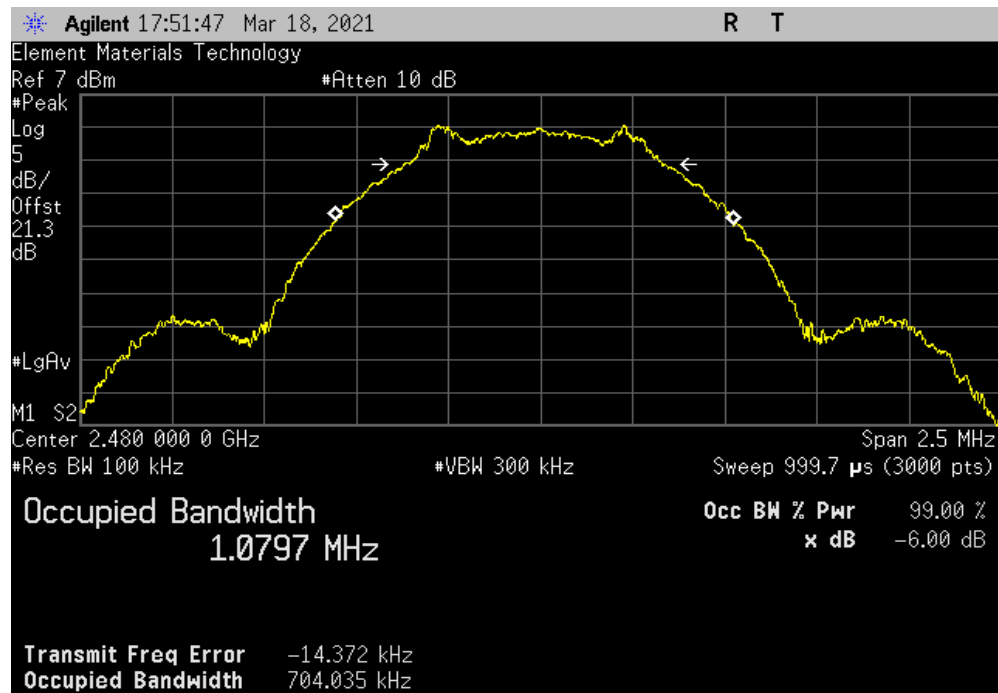


OCCUPIED BANDWIDTH



TbTx 2019.08.30.0 XMR 2020.12.30.0

BLE/GFSK 1 Mbps High Channel, 2480 MHz						
				Value	Limit	Result
				704.035 kHz	500 kHz	Pass



OUTPUT POWER



XMIT 2020.12.30.0

Testing was performed using the mode(s) of operation and configuration(s) noted within the report. The individuals and/or the organization requesting the test provided the modes, configurations and settings used to complete the evaluation. The actual test parameters are specified in the test data, this includes items such as investigated frequency range (scanned) and test levels. The testing methods and performance specifications, as well as the test site used for the evaluation are indicated in the test data.

TEST EQUIPMENT

Description	Manufacturer	Model	ID	Last Cal.	Cal. Due
Generator - Signal	Keysight	N5182B	TFX	2020-04-28	2023-04-28
Cable	Micro-Coax	UFD150A-1-0720-200200	MNL	2020-09-14	2021-09-14
Attenuator	S.M. Electronics	SA26B-20	RFW	2021-02-05	2022-02-05
Block - DC	Fairview Microwave	SD3379	AMI	2020-08-05	2021-08-05
Analyzer - Spectrum Analyzer	Agilent	E4446A	AAQ	2020-05-07	2021-05-07

TEST DESCRIPTION

The transmit frequency was set to the required channels in each band. The transmit power was set to its default maximum.

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

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

OUTPUT POWER



TSTx 2019.08.30.0 XMR 2020.12.30.0

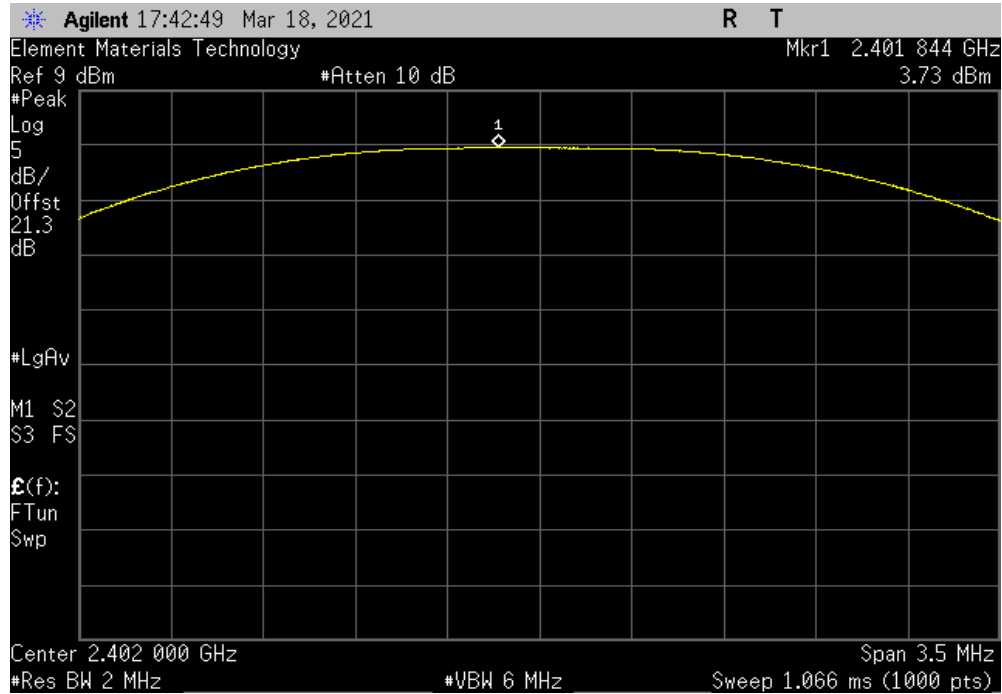
EUT: FloLogic Wireless Flowmeter Control System		Work Order: DESO0001	
Serial Number: FL-40F5BF		Date: 18-Mar-21	
Customer: FloLogic Inc.		Temperature: 24.3 °C	
Attendees: None		Humidity: 25.5% RH	
Project: None		Barometric Pres.: 1030 mbar	
Tested by: Dustin Sparks	Power: Battery	Job Site: MN08	
TEST SPECIFICATIONS		Test Method	
FCC 15.247:2021		ANSI C63.10:2013	
COMMENTS			
Reference level offset includes 20 dB attenuator, measurement cable, and DC block.			
DEVIATIONS FROM TEST STANDARD			
None			
Configuration #	4	Signature <i>Dustin Sparks</i>	
		Out Pwr (dBm)	Limit (dBm)
BLE/GFSK 1 Mbps Low Channel, 2402 MHz		3.728	30
BLE/GFSK 1 Mbps Mid Channel, 2442 MHz		3.436	30
BLE/GFSK 1 Mbps High Channel, 2480 MHz		2.74	30
			Result
			Pass
			Pass
			Pass

OUTPUT POWER

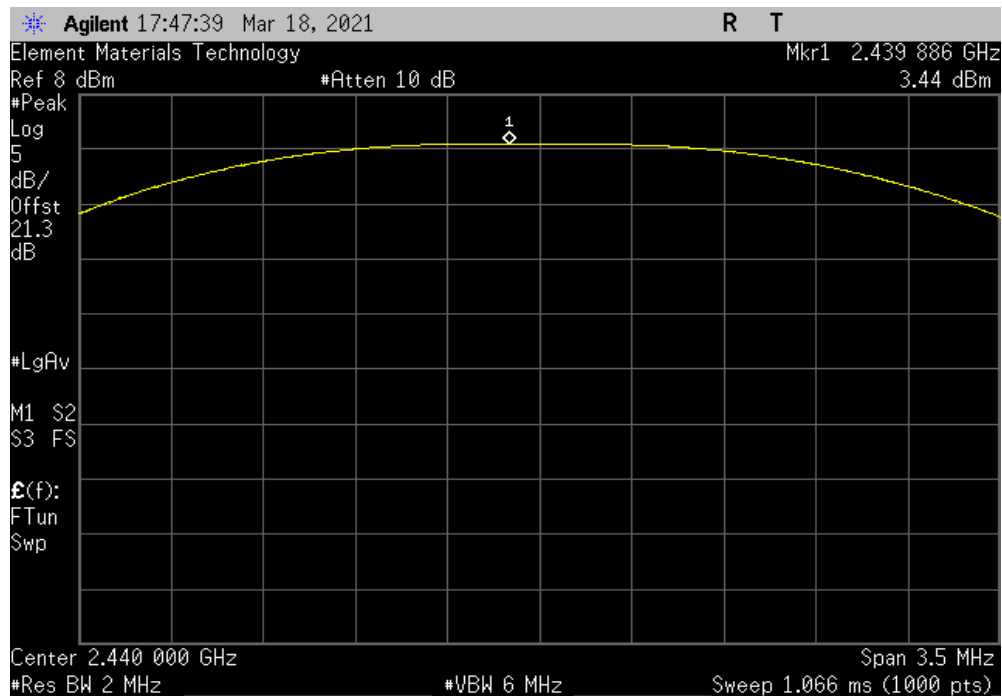


TbTx 2019.08.30.0 XMR 2020.12.30.0

BLE/GFSK 1 Mbps Low Channel, 2402 MHz						
				Out Pwr (dBm)	Limit (dBm)	Result
				3.728	30	Pass



BLE/GFSK 1 Mbps Mid Channel, 2442 MHz						
				Out Pwr (dBm)	Limit (dBm)	Result
				3.436	30	Pass

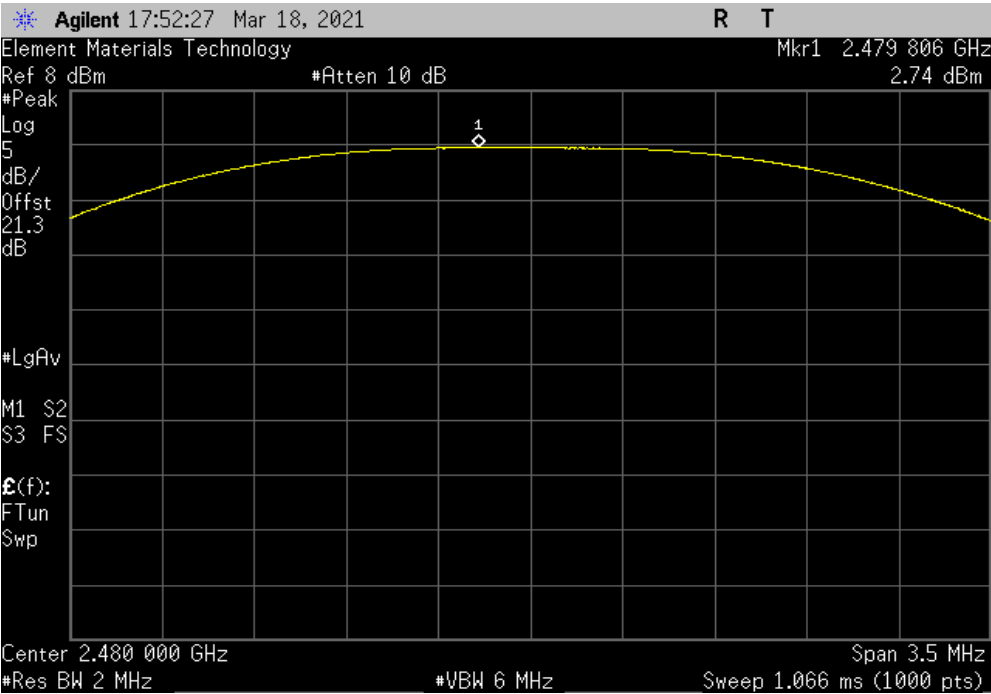


OUTPUT POWER



TbTx 2019.08.30.0 XMR 2020.12.30.0

BLE/GFSK 1 Mbps High Channel, 2480 MHz						
				Out Pwr (dBm)	Limit (dBm)	Result
				2.74	30	Pass



EQUIVALENT ISOTROPIC RADIATED POWER (EIRP)



XMIT 2020.12.30.0

Testing was performed using the mode(s) of operation and configuration(s) noted within the report. The individuals and/or the organization requesting the test provided the modes, configurations and settings used to complete the evaluation. The actual test parameters are specified in the test data, this includes items such as investigated frequency range (scanned) and test levels. The testing methods and performance specifications, as well as the test site used for the evaluation are indicated in the test data.

TEST EQUIPMENT

Description	Manufacturer	Model	ID	Last Cal.	Cal. Due
Generator - Signal	Keysight	N5182B	TFX	2020-04-28	2023-04-28
Cable	Micro-Coax	UFD150A-1-0720-200200	MNL	2020-09-14	2021-09-14
Attenuator	S.M. Electronics	SA26B-20	RFW	2021-02-05	2022-02-05
Block - DC	Fairview Microwave	SD3379	AMI	2020-08-05	2021-08-05
Analyzer - Spectrum Analyzer	Agilent	E4446A	AAQ	2020-05-07	2021-05-07

TEST DESCRIPTION

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)

EQUIVALENT ISOTROPIC RADIATED POWER (EIRP)



TSTx 2019.08.30.0 XMR 2020.12.30.0

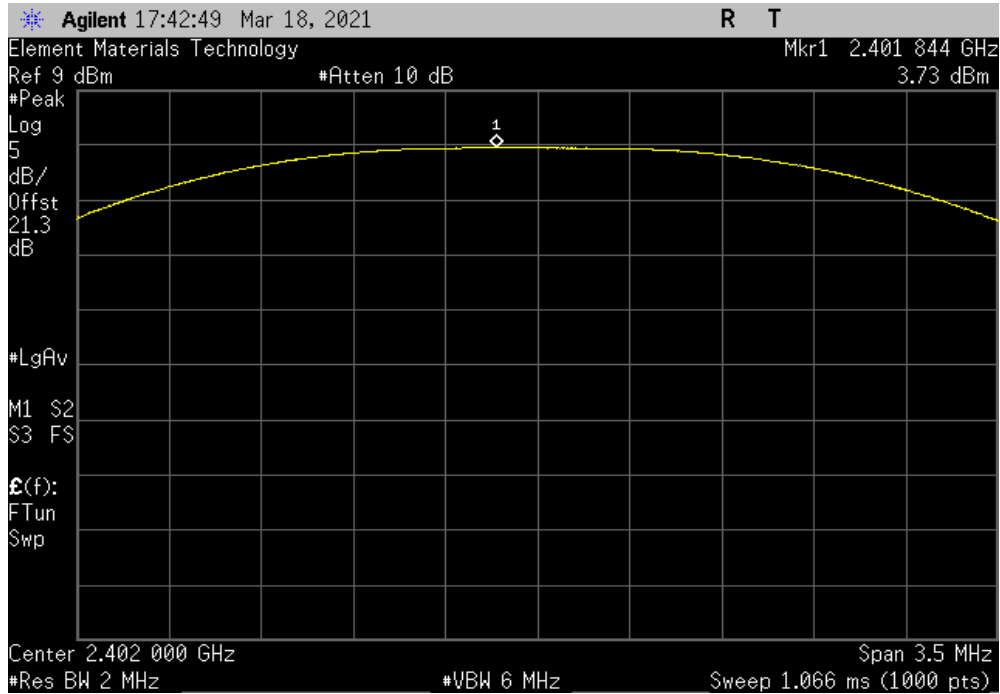
EUT: FloLogic Wireless Flowmeter Control System		Work Order: DESO0001	
Serial Number: FL-40F5BF		Date: 18-Mar-21	
Customer: FloLogic Inc.		Temperature: 24.3 °C	
Attendees: None		Humidity: 25.5% RH	
Project: None		Barometric Pres.: 1030 mbar	
Tested by: Dustin Sparks	Power: Battery	Job Site: MN08	
TEST SPECIFICATIONS		Test Method	
FCC 15.247:2021		ANSI C63.10:2013	
COMMENTS			
Reference level offset includes 20 dB attenuator, measurement cable, and DC block.			
DEVIATIONS FROM TEST STANDARD			
None			
Configuration #	4	Signature <i>Dustin Sparks</i>	
		Out Pwr (dBm)	Antenna Gain (dBi)
BLE/GFSK 1 Mbps Low Channel, 2402 MHz		3.728	2
BLE/GFSK 1 Mbps Mid Channel, 2442 MHz		3.436	2
BLE/GFSK 1 Mbps High Channel, 2480 MHz		2.74	2
		EIRP (dBm)	EIRP Limit (dBm)
		5.728	36
		5.436	36
		4.74	36
			Result
			Pass
			Pass
			Pass

EQUIVALENT ISOTROPIC RADIATED POWER (EIRP)

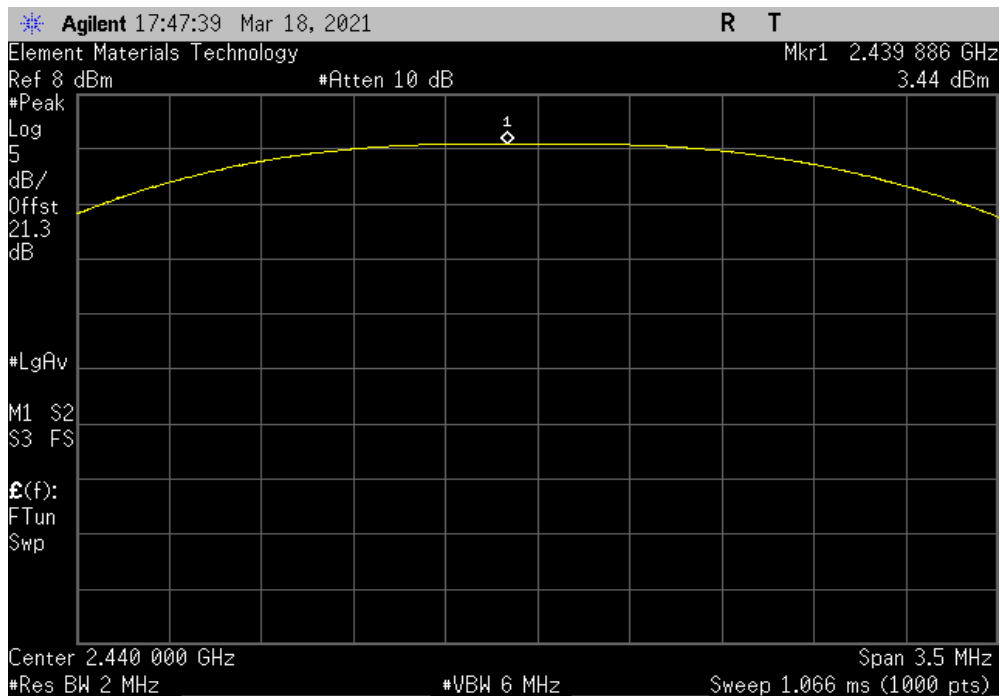


TbTx 2019.08.30.0 XMR 2020.12.30.0

BLE/GFSK 1 Mbps Low Channel, 2402 MHz						
	Out Pwr (dBm)	Antenna Gain (dBi)	EIRP (dBm)	EIRP Limit (dBm)	Result	
	3.728	2	5.728	36	Pass	



BLE/GFSK 1 Mbps Mid Channel, 2442 MHz						
	Out Pwr (dBm)	Antenna Gain (dBi)	EIRP (dBm)	EIRP Limit (dBm)	Result	
	3.436	2	5.436	36	Pass	

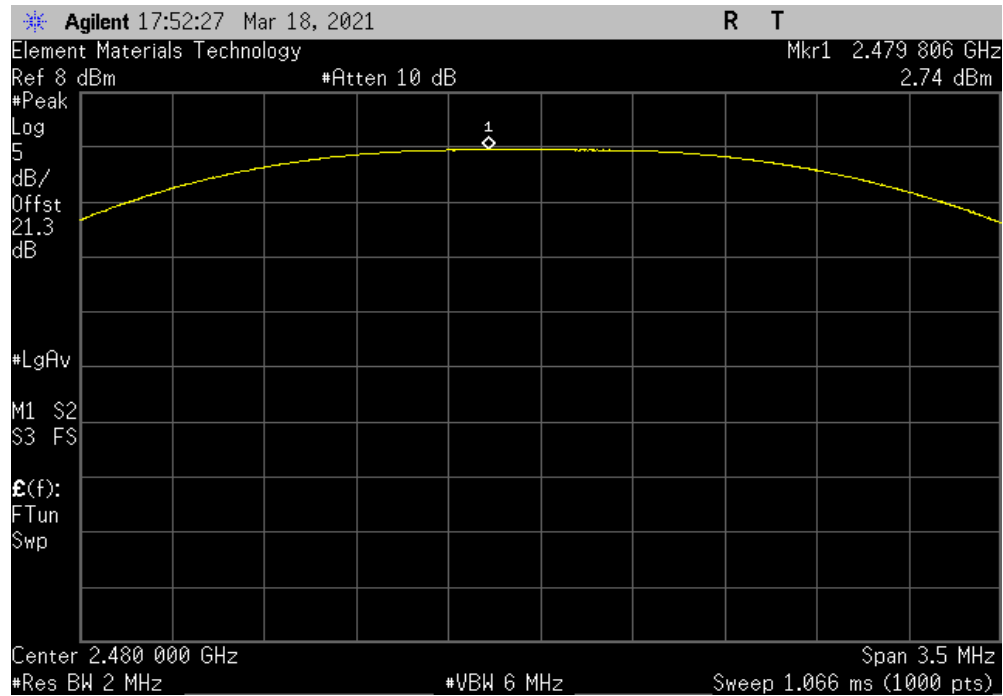


EQUIVALENT ISOTROPIC RADIATED POWER (EIRP)



TbTx 2019.08.30.0 XMt 2020.12.30.0

BLE/GFSK 1 Mbps High Channel, 2480 MHz						
	Out Pwr (dBm)	Antenna Gain (dBi)	EIRP (dBm)	EIRP Limit (dBm)	Result	
	2.74	2	4.74	36	Pass	



POWER SPECTRAL DENSITY



XMIT 2020.12.30.0

Testing was performed using the mode(s) of operation and configuration(s) noted within the report. The individuals and/or the organization requesting the test provided the modes, configurations and settings used to complete the evaluation. The actual test parameters are specified in the test data, this includes items such as investigated frequency range (scanned) and test levels. The testing methods and performance specifications, as well as the test site used for the evaluation are indicated in the test data.

TEST EQUIPMENT

Description	Manufacturer	Model	ID	Last Cal.	Cal. Due
Generator - Signal	Keysight	N5182B	TFX	2020-04-28	2023-04-28
Cable	Micro-Coax	UFD150A-1-0720-200200	MNL	2020-09-14	2021-09-14
Attenuator	S.M. Electronics	SA26B-20	RFW	2021-02-05	2022-02-05
Block - DC	Fairview Microwave	SD3379	AMI	2020-08-05	2021-08-05
Analyzer - Spectrum Analyzer	Agilent	E4446A	AAQ	2020-05-07	2021-05-07

TEST DESCRIPTION

The maximum power spectral density measurements was measured using the channels and modes as called out on the following data sheets.

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

POWER SPECTRAL DENSITY



TSTx 2019.08.30.0 XMR 2020.12.30.0

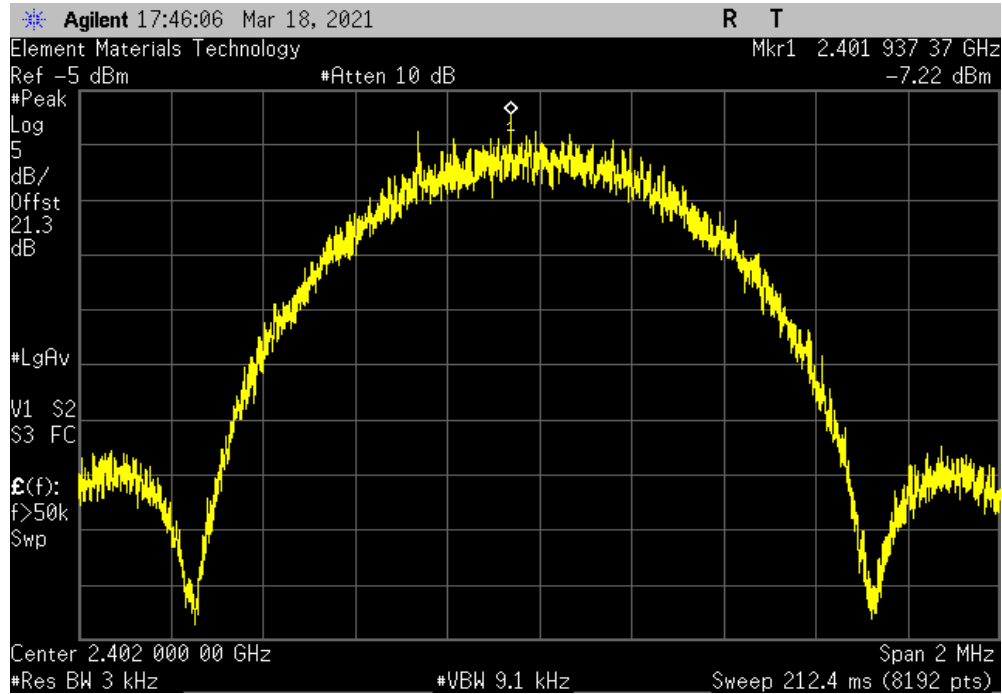
EUT: FloLogic Wireless Flowmeter Control System		Work Order: DESO0001	
Serial Number: FL-40F5BF		Date: 18-Mar-21	
Customer: FloLogic Inc.		Temperature: 24.3 °C	
Attendees: None		Humidity: 25.7% RH	
Project: None		Barometric Pres.: 1030 mbar	
Tested by: Dustin Sparks		Power: Battery	
		Job Site: MN08	
TEST SPECIFICATIONS		Test Method	
FCC 15.247:2021		ANSI C63.10:2013	
COMMENTS			
Reference level offset includes 20 dB attenuator, measurement cable, and DC block.			
DEVIATIONS FROM TEST STANDARD			
None			
Configuration #	4	Signature <i>Dustin Sparks</i>	
		Value dBm/3kHz	Limit < dBm/3kHz
BLE/GFSK 1 Mbps Low Channel, 2402 MHz		-7.225	8
BLE/GFSK 1 Mbps Mid Channel, 2442 MHz		-8.59	8
BLE/GFSK 1 Mbps High Channel, 2480 MHz		-9.761	8
			Results
			Pass
			Pass
			Pass

POWER SPECTRAL DENSITY

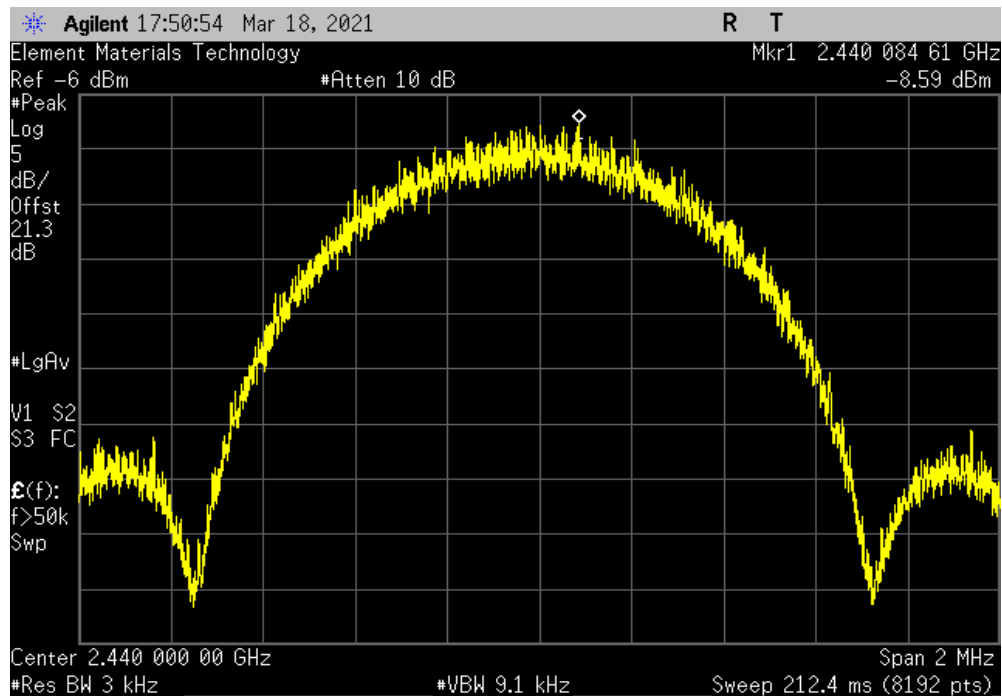


TbTx 2019.08.30.0 XMR 2020.12.30.0

BLE/GFSK 1 Mbps Low Channel, 2402 MHz						
	Value	Limit	Results			
	dBm/3kHz	< dBm/3kHz				
	-7.225	8	Pass			



BLE/GFSK 1 Mbps Mid Channel, 2442 MHz						
	Value	Limit	Results			
	dBm/3kHz	< dBm/3kHz				
	-8.59	8	Pass			

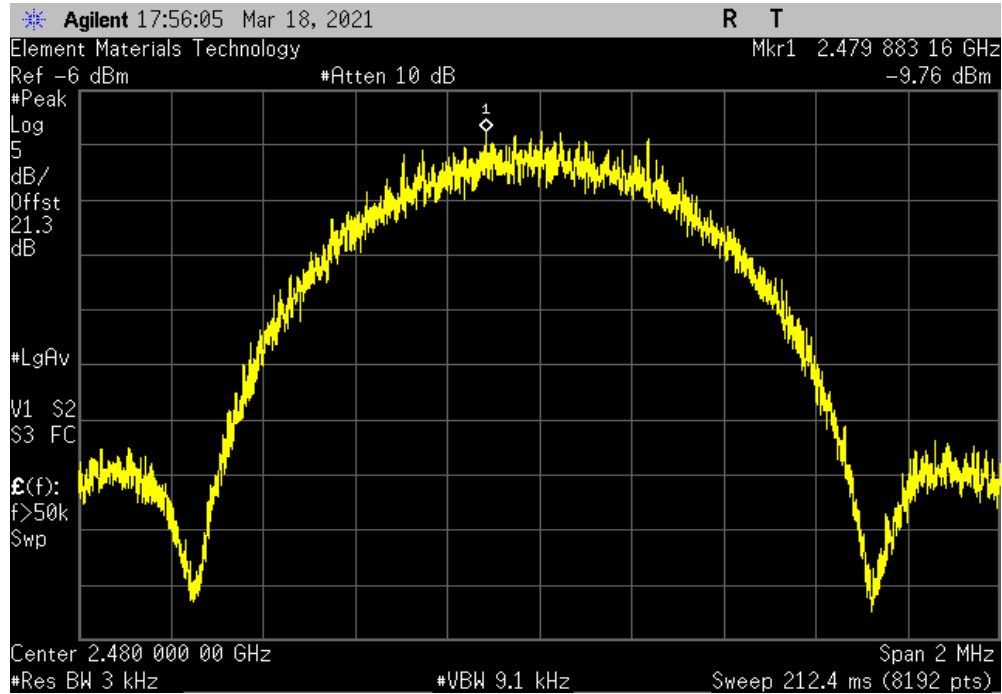


POWER SPECTRAL DENSITY



TbTx 2019.08.30.0 XMR 2020.12.30.0

BLE/GFSK 1 Mbps High Channel, 2480 MHz						
				Value	Limit	Results
				dBm/3kHz	< dBm/3kHz	
				-9.761	8	Pass



BAND EDGE COMPLIANCE



XMit 2020.12.30.0

Testing was performed using the mode(s) of operation and configuration(s) noted within the report. The individuals and/or the organization requesting the test provided the modes, configurations and settings used to complete the evaluation. The actual test parameters are specified in the test data, this includes items such as investigated frequency range (scanned) and test levels. The testing methods and performance specifications, as well as the test site used for the evaluation are indicated in the test data.

TEST EQUIPMENT

Description	Manufacturer	Model	ID	Last Cal.	Cal. Due
Generator - Signal	Keysight	N5182B	TFX	2020-04-28	2023-04-28
Cable	Micro-Coax	UFD150A-1-0720-200200	MNL	2020-09-14	2021-09-14
Attenuator	S.M. Electronics	SA26B-20	RFW	2021-02-05	2022-02-05
Block - DC	Fairview Microwave	SD3379	AMI	2020-08-05	2021-08-05
Analyzer - Spectrum Analyzer	Agilent	E4446A	AAQ	2020-05-07	2021-05-07

TEST DESCRIPTION

The spurious RF conducted emissions at the edges of the authorized bands were measured with the EUT set to low and high transmit frequencies in each available band. The channels closest to the band edges were selected. The EUT was transmitting at the data rate(s) listed in the datasheet.

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

BAND EDGE COMPLIANCE



TSTx 2019.08.30.0 XMR 2020.12.30.0

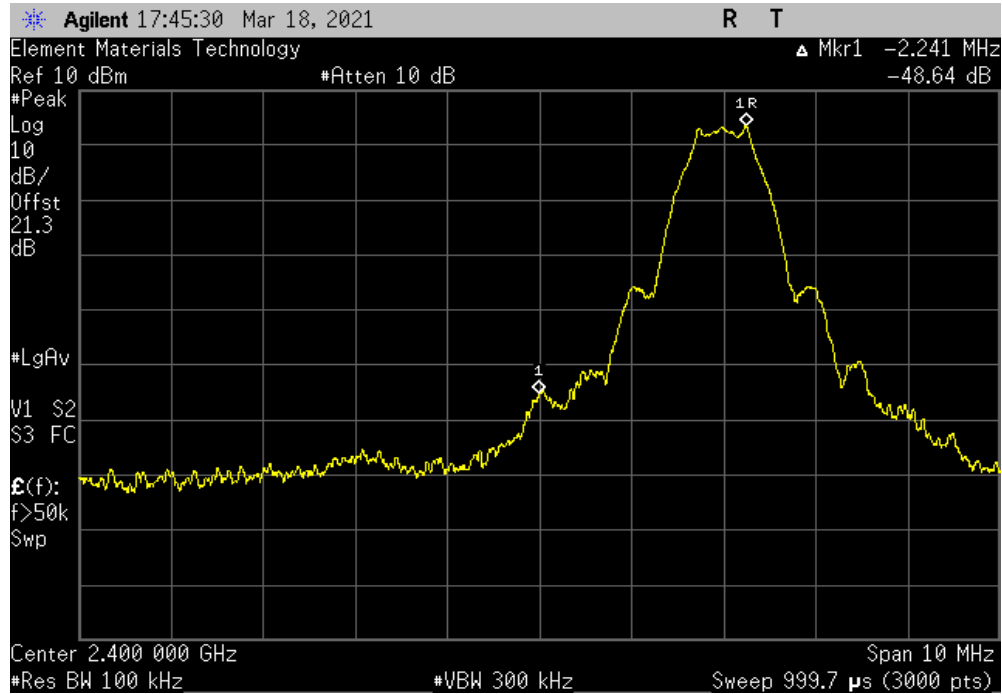
EUT: FloLogic Wireless Flowmeter Control System		Work Order: DESO0001	
Serial Number: FL-40F5BF		Date: 18-Mar-21	
Customer: FloLogic Inc.		Temperature: 24.3 °C	
Attendees: None		Humidity: 25.6% RH	
Project: None		Barometric Pres.: 1030 mbar	
Tested by: Dustin Sparks	Power: Battery	Job Site: MN08	
TEST SPECIFICATIONS		Test Method	
FCC 15.247:2021		ANSI C63.10:2013	
COMMENTS			
Reference level offset includes 20 dB attenuator, measurement cable, and DC block.			
DEVIATIONS FROM TEST STANDARD			
None			
Configuration #	4	Signature <i>Dustin Sparks</i>	
		Value (dBc)	Limit ≤ (dBc) Result
BLE/GFSK 1 Mbps Low Channel, 2402 MHz		-48.64	-20 Pass
BLE/GFSK 1 Mbps High Channel, 2480 MHz		-59.6	-20 Pass

BAND EDGE COMPLIANCE

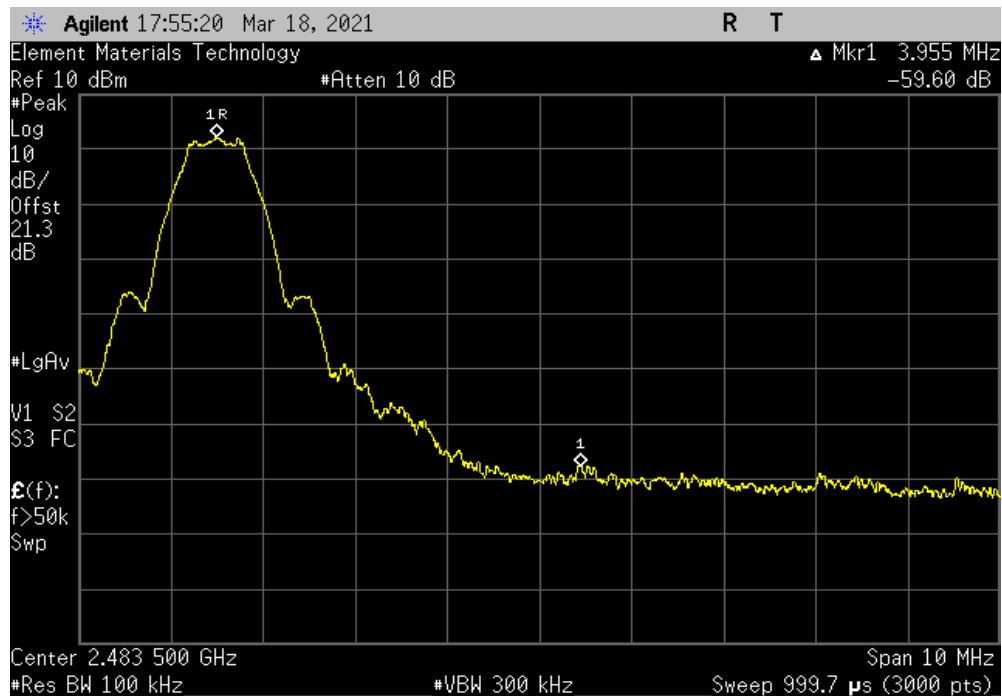


TMTx 2019.08.30.0 XMR 2020.12.30.0

BLE/GFSK 1 Mbps Low Channel, 2402 MHz						
				Value (dBc)	Limit ≤ (dBc)	Result
				-48.64	-20	Pass



BLE/GFSK 1 Mbps High Channel, 2480 MHz						
				Value (dBc)	Limit ≤ (dBc)	Result
				-59.6	-20	Pass



SPURIOUS CONDUCTED EMISSIONS



XMit 2020.12.30.0

Testing was performed using the mode(s) of operation and configuration(s) noted within the report. The individuals and/or the organization requesting the test provided the modes, configurations and settings used to complete the evaluation. The actual test parameters are specified in the test data, this includes items such as investigated frequency range (scanned) and test levels. The testing methods and performance specifications, as well as the test site used for the evaluation are indicated in the test data.

TEST EQUIPMENT

Description	Manufacturer	Model	ID	Last Cal.	Cal. Due
Generator - Signal	Keysight	N5182B	TFX	2020-04-28	2023-04-28
Cable	Micro-Coax	UFD150A-1-0720-200200	MNL	2020-09-14	2021-09-14
Attenuator	S.M. Electronics	SA26B-20	RFW	2021-02-05	2022-02-05
Block - DC	Fairview Microwave	SD3379	AMI	2020-08-05	2021-08-05
Analyzer - Spectrum Analyzer	Agilent	E4446A	AAQ	2020-05-07	2021-05-07

TEST DESCRIPTION

The spurious RF conducted emissions were measured with the EUT set to low, medium and high transmit frequencies. The EUT was transmitting at the data rate(s) listed in the datasheet. For each transmit frequency, the spectrum was scanned throughout the specified frequency range.

SPURIOUS CONDUCTED EMISSIONS



TSTx 2019.08.30.0 XMR 2020.12.30.0

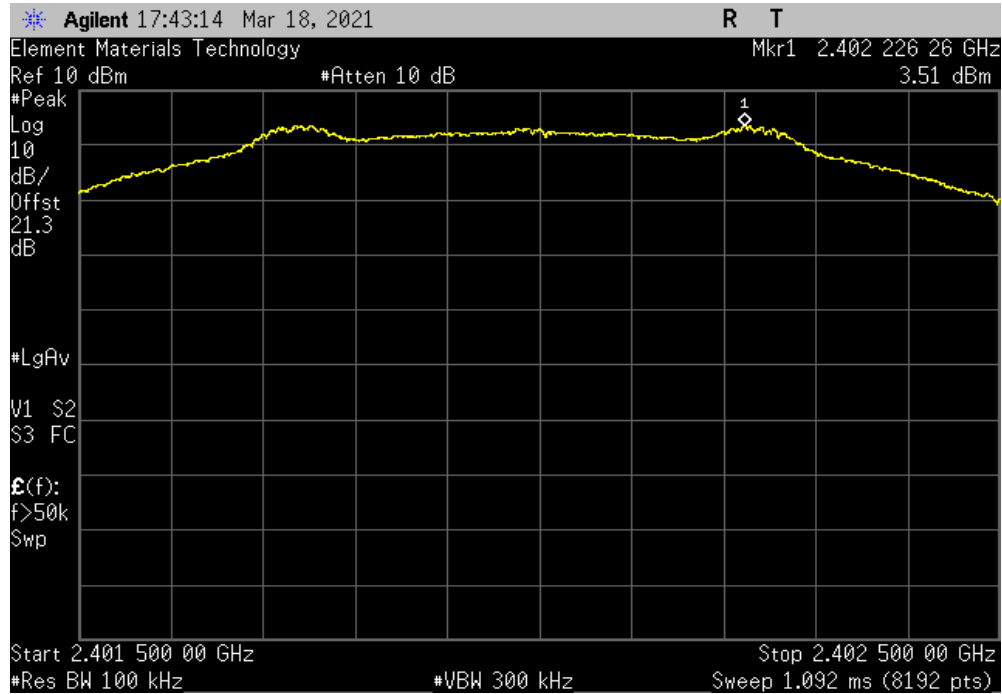
EUT: FloLogic Wireless Flowmeter Control System		Work Order: DESO0001			
Serial Number: FL-40F5BF		Date: 18-Mar-21			
Customer: FloLogic Inc.		Temperature: 24.2 °C			
Attendees: None		Humidity: 25.4% RH			
Project: None		Barometric Pres.: 1030 mbar			
Tested by: Dustin Sparks		Power: Battery			
		Job Site: MN08			
TEST SPECIFICATIONS		Test Method			
FCC 15.247:2021		ANSI C63.10:2013			
COMMENTS					
Reference level offset includes 20 dB attenuator, measurement cable, and DC block.					
DEVIATIONS FROM TEST STANDARD					
None					
Configuration #	4	Signature <i>Dustin Sparks</i>			
		Frequency Range	Measured Freq (MHz)		
			Max Value (dBc)		
			Limit ≤ (dBc)		
			Result		
BLE/GFSK 1 Mbps Low Channel, 2402 MHz		Fundamental	2402.23	N/A	N/A
BLE/GFSK 1 Mbps Low Channel, 2402 MHz		30 MHz - 12.5 GHz	4802.7	-49.11	-20
BLE/GFSK 1 Mbps Low Channel, 2402 MHz		12.5 GHz - 25 GHz	24955.7	-52.66	-20
BLE/GFSK 1 Mbps Mid Channel, 2442 MHz		Fundamental	2440.23	N/A	N/A
BLE/GFSK 1 Mbps Mid Channel, 2442 MHz		30 MHz - 12.5 GHz	4880.4	-48.9	-20
BLE/GFSK 1 Mbps Mid Channel, 2442 MHz		12.5 GHz - 25 GHz	24940.5	-51.89	-20
BLE/GFSK 1 Mbps High Channel, 2480 MHz		Fundamental	2480.23	N/A	N/A
BLE/GFSK 1 Mbps High Channel, 2480 MHz		30 MHz - 12.5 GHz	4959.5	-46.89	-20
BLE/GFSK 1 Mbps High Channel, 2480 MHz		12.5 GHz - 25 GHz	24807.7	-50.86	-20

SPURIOUS CONDUCTED EMISSIONS

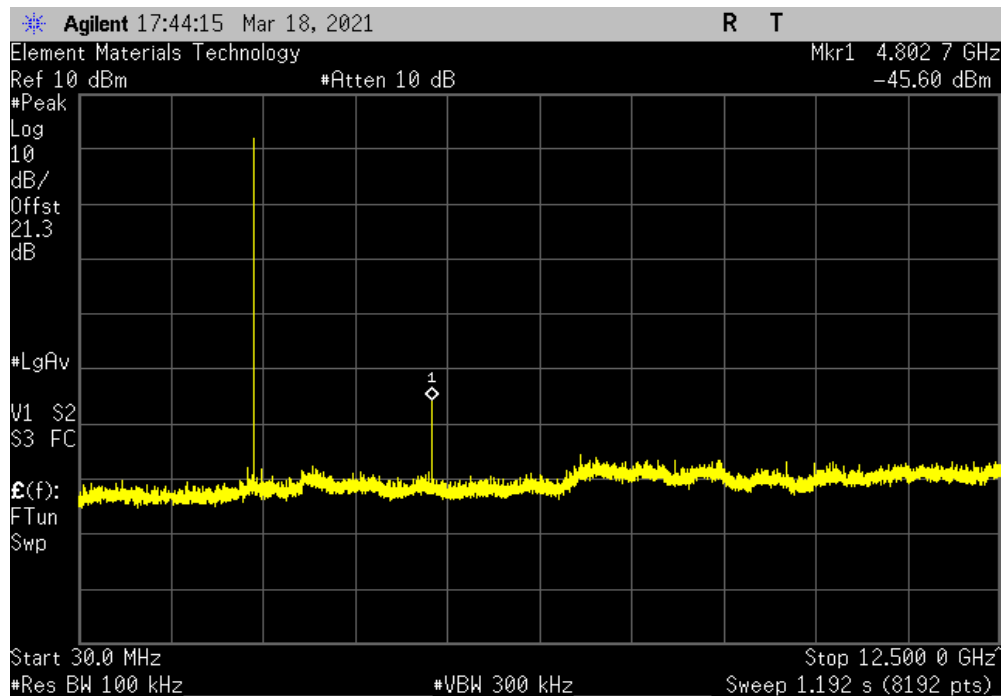


TbTx 2019.08.30.0 XMR 2020.12.30.0

BLE/GFSK 1 Mbps Low Channel, 2402 MHz						
Frequency Range	Measured Freq (MHz)	Max Value (dBc)	Limit ≤ (dBc)	Result		
Fundamental	2402.23	N/A	N/A	N/A		



BLE/GFSK 1 Mbps Low Channel, 2402 MHz						
Frequency Range	Measured Freq (MHz)	Max Value (dBc)	Limit ≤ (dBc)	Result		
30 MHz - 12.5 GHz	4802.7	-49.11	-20	Pass		

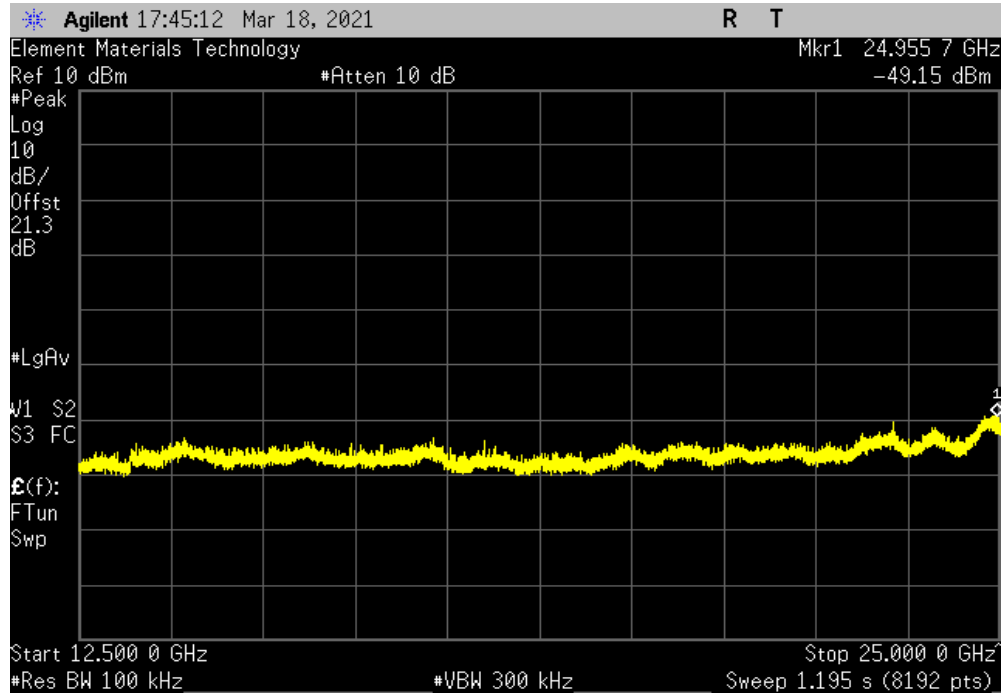


SPURIOUS CONDUCTED EMISSIONS

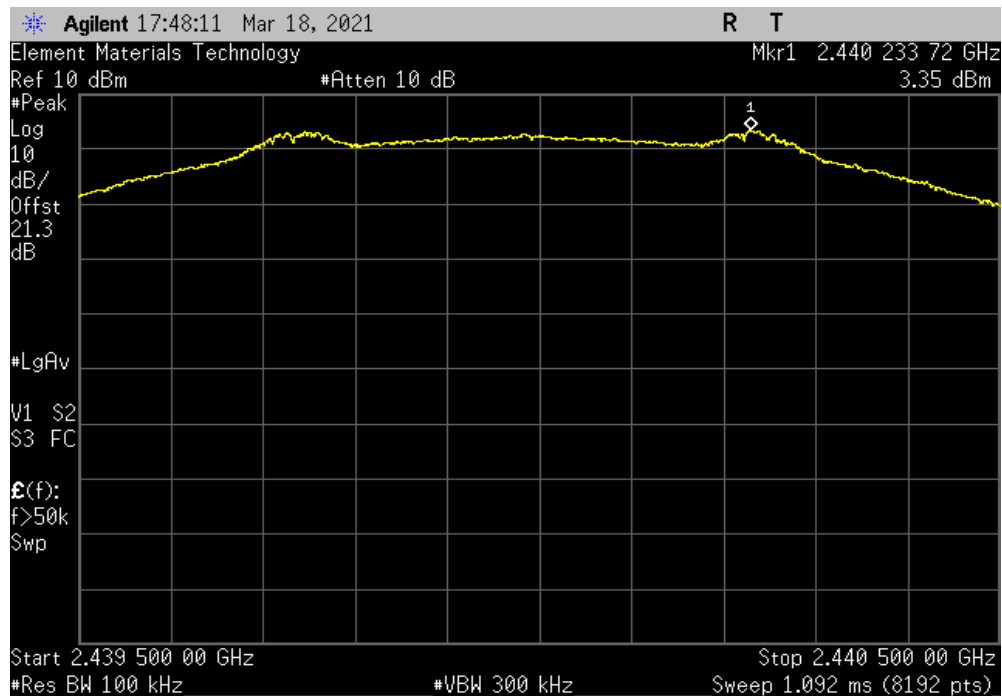


TbTx 2019.08.30.0 XMR 2020.12.30.0

BLE/GFSK 1 Mbps Low Channel, 2402 MHz					
Frequency Range	Measured Freq (MHz)	Max Value (dBc)	Limit ≤ (dBc)	Result	
12.5 GHz - 25 GHz	24955.7	-52.66	-20	Pass	



BLE/GFSK 1 Mbps Mid Channel, 2442 MHz					
Frequency Range	Measured Freq (MHz)	Max Value (dBc)	Limit ≤ (dBc)	Result	
Fundamental	2440.23	N/A	N/A	N/A	

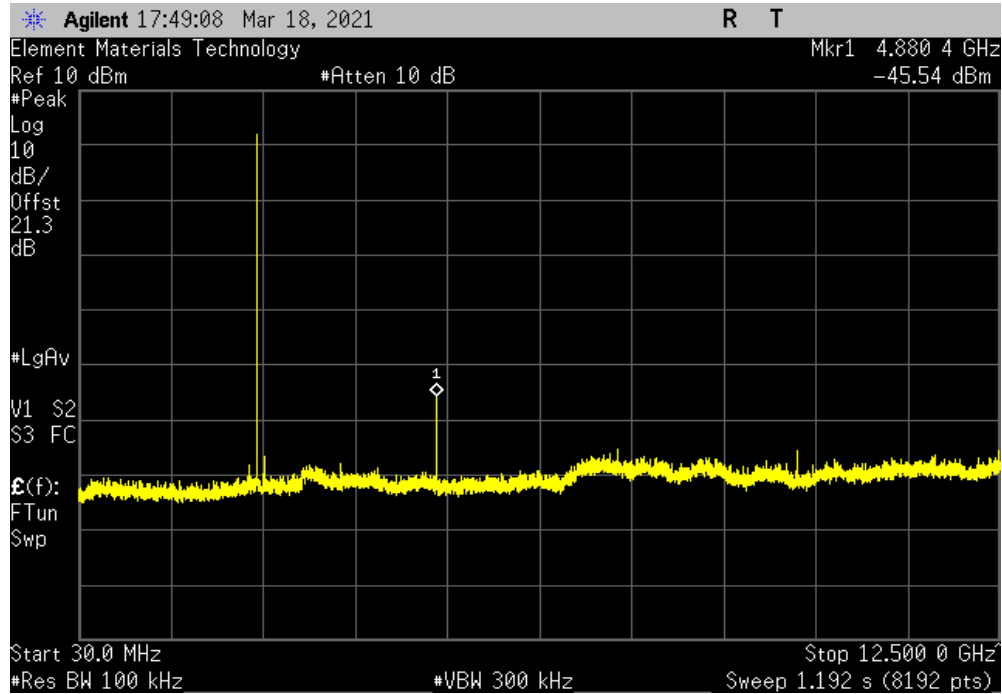


SPURIOUS CONDUCTED EMISSIONS

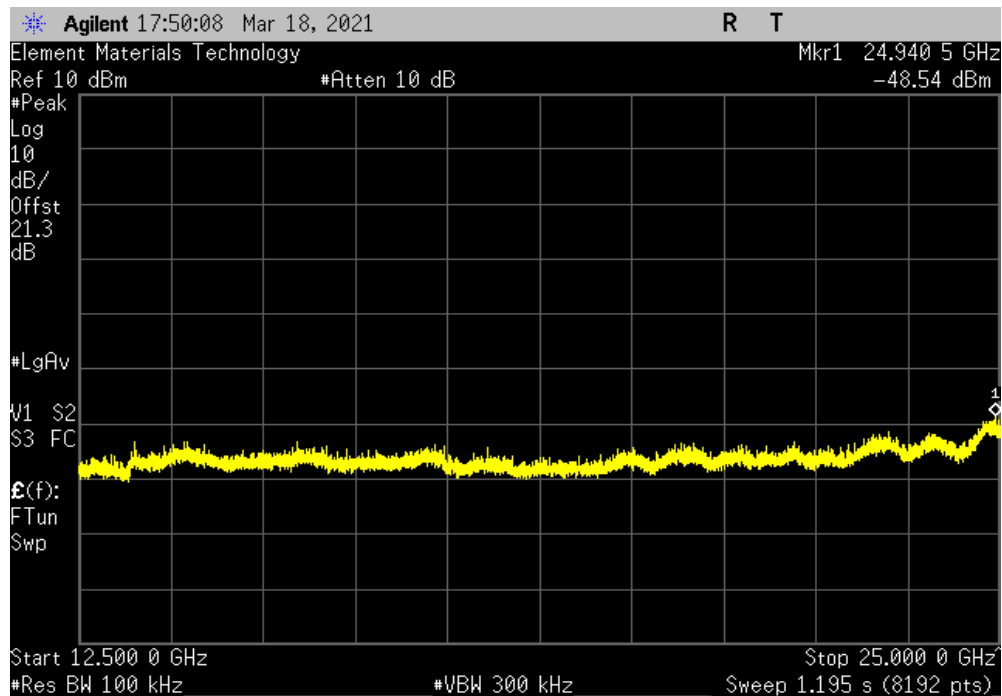


TbTx 2019.08.30.0 XMR 2020.12.30.0

BLE/GFSK 1 Mbps Mid Channel, 2442 MHz					
Frequency Range	Measured Freq (MHz)	Max Value (dBc)	Limit ≤ (dBc)	Result	
30 MHz - 12.5 GHz	4880.4	-48.9	-20	Pass	



BLE/GFSK 1 Mbps Mid Channel, 2442 MHz					
Frequency Range	Measured Freq (MHz)	Max Value (dBc)	Limit ≤ (dBc)	Result	
12.5 GHz - 25 GHz	24940.5	-51.89	-20	Pass	

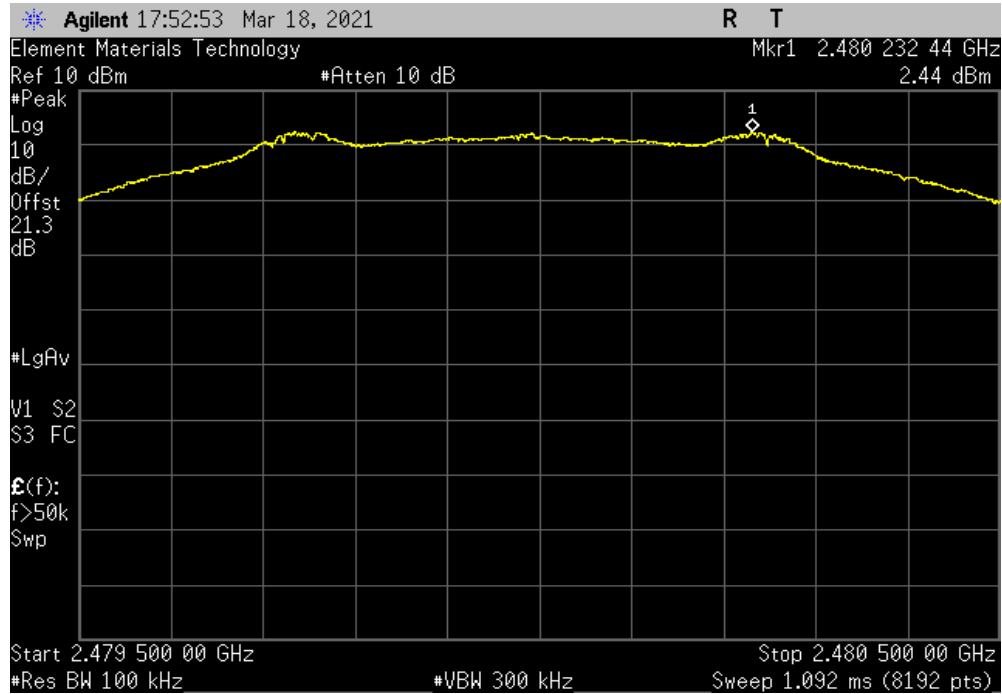


SPURIOUS CONDUCTED EMISSIONS

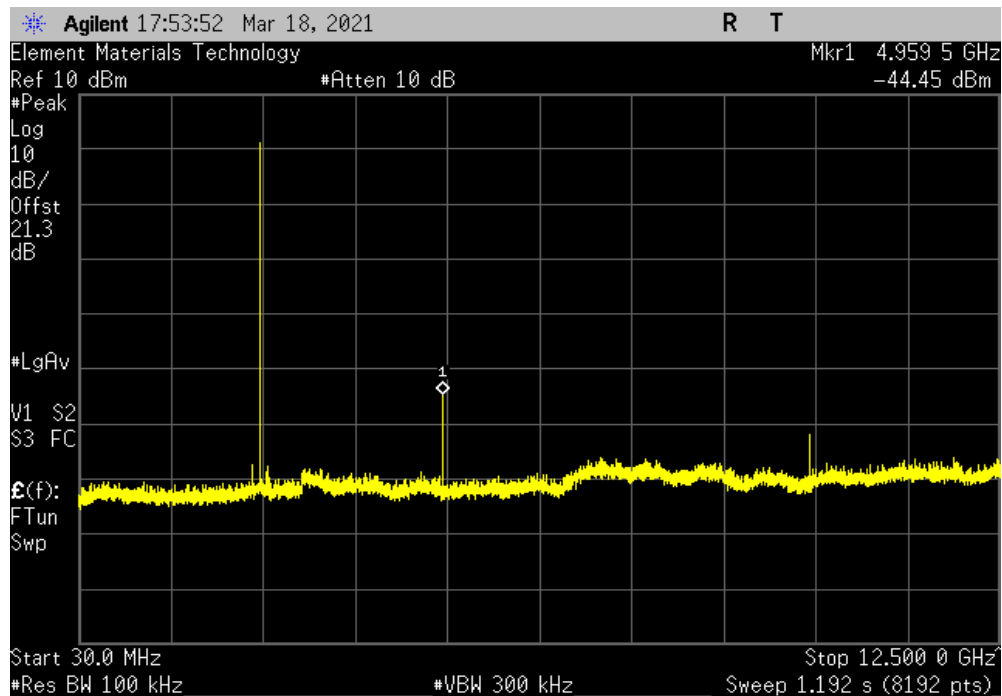


TbTx 2019.08.30.0 XMR 2020.12.30.0

BLE/GFSK 1 Mbps High Channel, 2480 MHz						
Frequency Range	Measured Freq (MHz)	Max Value (dBc)	Limit ≤ (dBc)	Result		
Fundamental	2480.23	N/A	N/A	N/A		



BLE/GFSK 1 Mbps High Channel, 2480 MHz						
Frequency Range	Measured Freq (MHz)	Max Value (dBc)	Limit ≤ (dBc)	Result		
30 MHz - 12.5 GHz	4959.5	-46.89	-20	Pass		

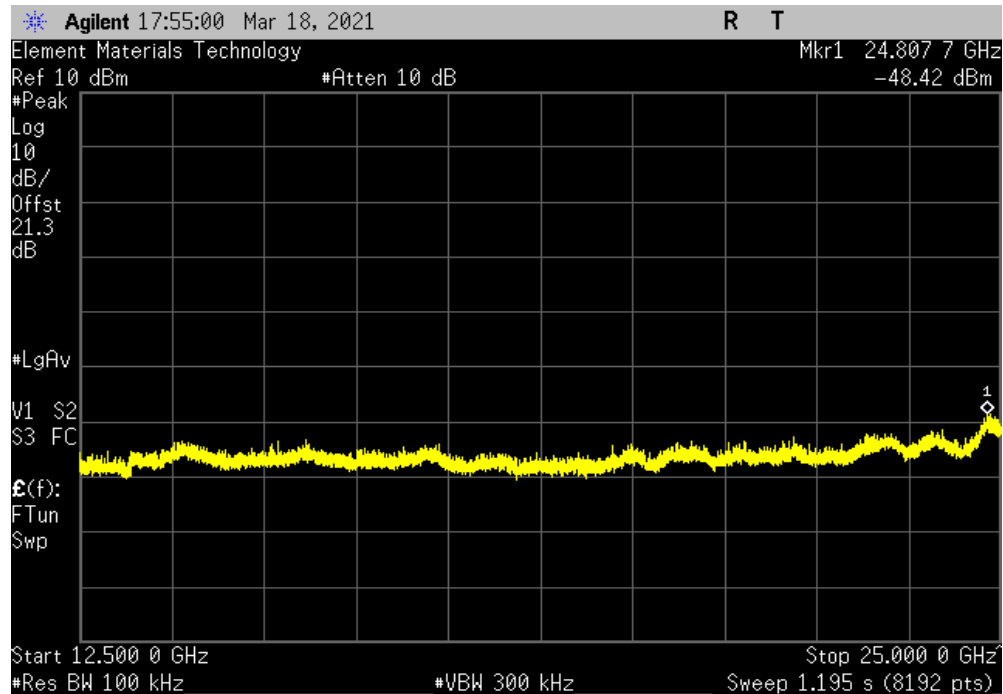


SPURIOUS CONDUCTED EMISSIONS



TbTx 2019.08.30.0 XbTx 2020.12.30.0

BLE/GFSK 1 Mbps High Channel, 2480 MHz					
Frequency Range	Measured Freq (MHz)	Max Value (dBc)	Limit ≤ (dBc)	Result	
12.5 GHz - 25 GHz	24807.7	-50.86	-20	Pass	



End of Test Report