



element

BIOTRONIK, Inc.
Neuro SCS Trial Stimulator

FCC 15.247:2021
Bluetooth LE Radio

Report: BIOT0085.2, Issue Date: August 30, 2021



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CERTIFICATE OF TEST



Last Date of Test: April 29, 2021
BIOTRONIK, Inc.
EUT: Neuro SCS Trial Stimulator

Radio Equipment Testing

Standards

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

Results

Method Clause	Test Description	Applied	Results	Comments
6.2	Powerline Conducted Emissions	No	N/A	Not required for a battery powered EUT.
6.5, 6.6, 11.12.1, 11.13.2	Spurious Radiated Emissions	Yes	Pass	
11.6	Duty Cycle	Yes	Pass	
11.8.2	Occupied Bandwidth	Yes	Pass	
11.9.1.1	Output Power	Yes	Pass	
11.9.1.1	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:

Kyle Holgate, Operations Manager

Product compliance is the responsibility of the client; therefore, the tests and equipment modes of operation represented in this report were agreed upon by the client, prior to testing. The results of this test pertain only to the sample(s) tested. The specific description is noted in each of the individual sections of the test report supporting this certificate of test. This report reflects only those tests from the referenced standards shown in the certificate of test. It does not include inspection or verification of labels, identification, marking or user information. As indicated in the Statement of Work sent with the quotation, Element's standard process is to always use the latest published version of the test methods even when earlier versions are cited in the test specification. Issuance of a purchase order was de facto acceptance of this approach. Otherwise, the client would have advised Element in writing of the specific version of the test methods they wanted applied to the subject testing.

REVISION HISTORY



Revision Number	Description	Date (yyyy-mm-dd)	Page Number
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 - 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

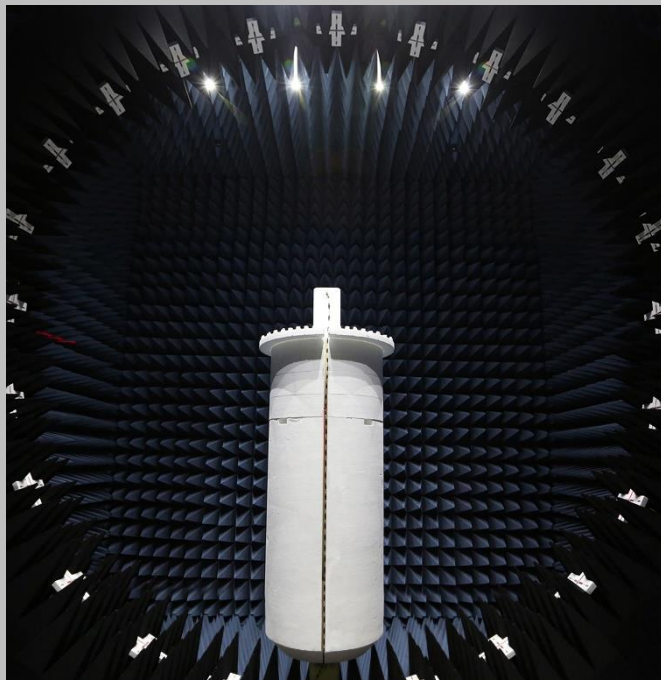
For details on the Scopes of our Accreditations, please visit:

<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
A2LA				
Lab Code: 3310.04	Lab Code: 3310.05	Lab Code: 3310.02	Lab Code: 3310.03	Lab Code: 3310.06
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/RRR, 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

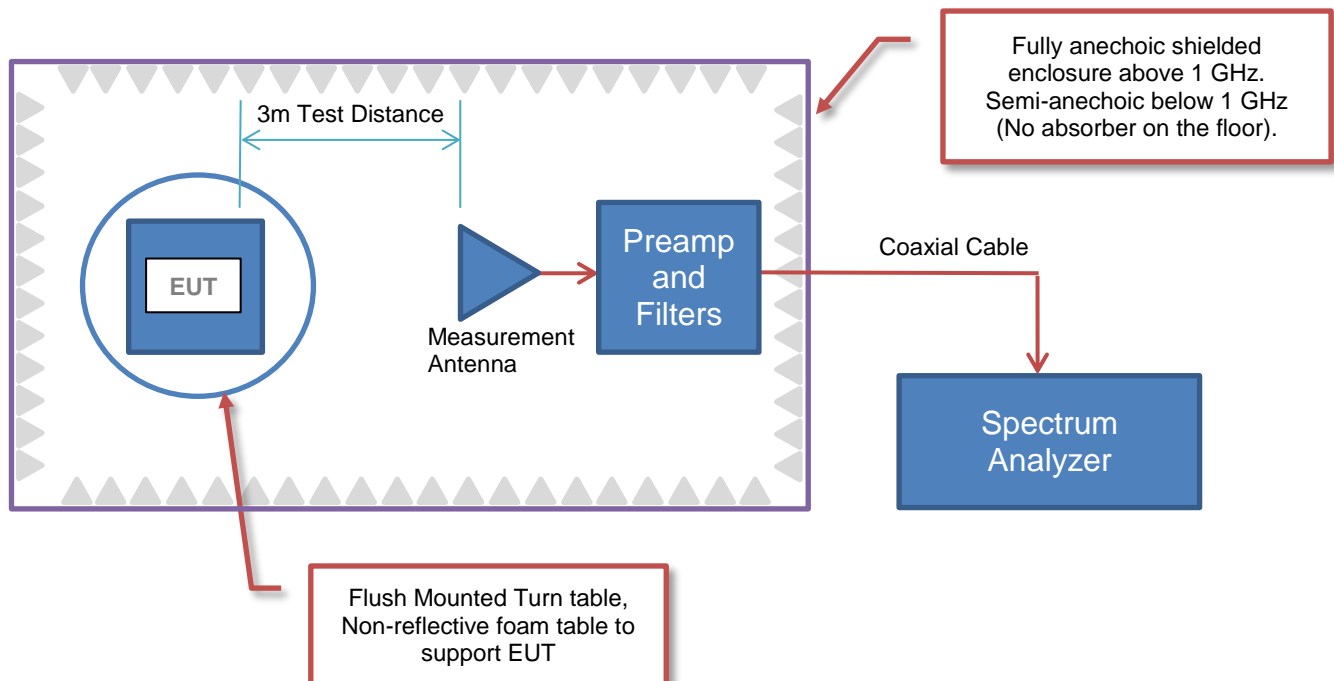
Antenna Port Conducted Measurements



Near Field Test Fixture Measurements



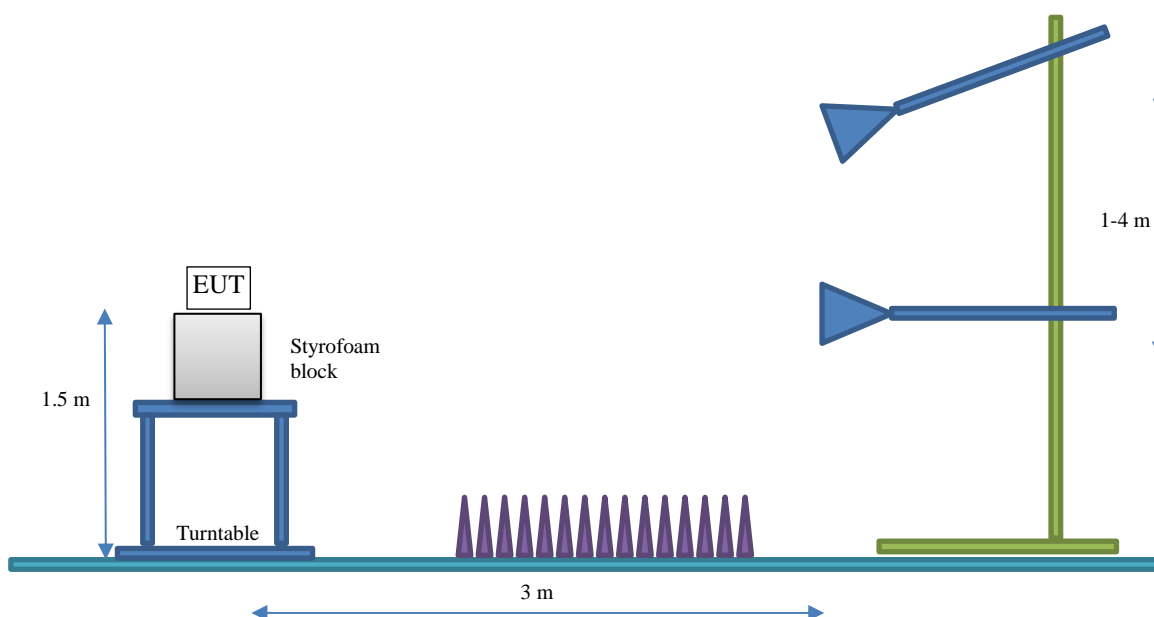
Spurious Radiated Emissions



Test Setup Block Diagrams

Bore 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:	BIOTRONIK, Inc.
Address:	6024 Jean Road, BLDG B
City, State, Zip:	Lake Oswego, OR 97035
Test Requested By:	Roy Wang
EUT:	Neuro SCS Trial Stimulator
First Date of Test:	April 28, 2021
Last Date of Test:	April 29, 2021
Receipt Date of Samples:	April 26, 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:
Body-worn Neurostimulator
Testing Objective:
To demonstrate compliance of the Bluetooth radio to FCC 15.247 requirements.

CONFIGURATIONS



Configuration BIOT0085- 5

EUT			
Description	Manufacturer	Model/Part Number	Serial Number
Neuro SCS Trial Stimulator	BIOTRONIK, Inc.	Neuro SCS Trial Stimulator	91820147

Remote Equipment Outside of Test Setup Boundary			
Description	Manufacturer	Model/Part Number	Serial Number
Smart Phone	Samsung	SM-A202F/DS	R58M949BWEV

Configuration BIOT0085- 6

EUT			
Description	Manufacturer	Model/Part Number	Serial Number
Neuro SCS Trial Stimulator	BIOTRONIK, Inc.	Neuro SCS Trial Stimulator	91820147

Remote Equipment Outside of Test Setup Boundary			
Description	Manufacturer	Model/Part Number	Serial Number
Smart Phone	Samsung	SM-A202F/DS	R58M949BWEV

Cables					
Cable Type	Shield	Length (m)	Ferrite	Connection 1	Connection 2
Patient Leads	No	0.8m	No	Neuro SCS Trial Stimulator	Water

MODIFICATIONS



Equipment Modifications

Item	Date	Test	Modification	Note	Disposition of EUT
1	2021-04-28	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.
2	2021-04-28	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	2021-04-28	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	2021-04-28	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.
5	2021-04-28	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.
6	2021-04-28	Spurious Conducted Emissions	Tested as delivered to Test Station.	No EMI suppression devices were added or modified during this test.	EUT remained at Element following the test.
7	2021-04-29	Spurious Radiated 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)
Ceramic Chip	Manufacturer	2400 - 2500	2.2

The EUT was tested using the power settings provided by the manufacturer:

SETTINGS FOR ALL TESTS IN THIS REPORT

		Power Setting
BLE	Low Channel – 2402 MHz	+4 dBm
	Mid Channel – 2442 MHz	+4 dBm
	High Channel – 2480 MHz	+4 dBm

SPURIOUS RADIATED EMISSIONS

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 = CISPR Average 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 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 $20 \cdot \log(1/dc)$.

TEST EQUIPMENT

Description	Manufacturer	Model	ID	Last Cal.	Cal. Due
Analyzer - Spectrum Analyzer	Keysight	N9010A	AFO	2020-06-25	2021-06-25
Antenna - Biconilog	EMCO	3141	AXG	2019-07-23	2021-07-23
Antenna - Double Ridge	EMCO	3115	AHC	2020-07-01	2022-07-01
Antenna - Standard Gain	ETS Lindgren	3160-07	AHU	NCR	NCR
Antenna - Standard Gain	ETS Lindgren	3160-08	AHV	NCR	NCR
Antenna - Standard Gain	ETS Lindgren	3160-09	AIV	NCR	NCR
Amplifier - Pre-Amplifier	Miteq	AM-1616-1000	AOL	2020-11-17	2021-11-17
Amplifier - Pre-Amplifier	Miteq	AMF-3D-00100800-32-13P	PAG	2020-11-17	2021-11-17
Amplifier - Pre-Amplifier	L-3 Narda-MITEQ	AMF-6F-08001200-30-10P	PAO	2020-11-18	2021-11-18
Amplifier - Pre-Amplifier	Miteq	AMF-6F-12001800-30-10P	AVD	2020-11-18	2021-11-18
Amplifier - Pre-Amplifier	Miteq	AMF-6F-18002650-25-10P	AVU	2020-07-25	2021-07-25
Cable	N/A	Bilog Cables	EVA	2020-11-17	2021-11-17
Cable	N/A	Double Ridge Horn Cables	EVB	2020-11-17	2021-11-17
Cable	None	Standard Gain Horns Cable	EVF	2020-11-18	2021-11-18
Cable	ESM Cable Corp.	TTBJ141-KMKM-72	EVY	2020-07-25	2021-07-25
Attenuator	Coaxicom	3910-20	AXZ	2021-02-15	2022-02-15
Filter - Low Pass	Micro-Tronics	LPM50004	LFD	2021-02-15	2022-02-15
Filter - High Pass	Micro-Tronics	HPM50111	HFO	2020-11-17	2021-11-17

SPURIOUS RADIATED EMISSIONS

MEASUREMENT UNCERTAINTY

Description		
Expanded k=2	5.2 dB	-5.2 dB

FREQUENCY RANGE INVESTIGATED

30 MHz TO 26.5 GHz

POWER INVESTIGATED

Battery

CONFIGURATIONS INVESTIGATED

BIOT0085-5
BIOT0085-6

MODES INVESTIGATED

Continuous Tx, BLE, 1 Mbps. Low Ch = 2402 MHz, Mid Ch = 2442 MHz, High Ch = 2480 MHz
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SPURIOUS RADIATED EMISSIONS

EUT:	Neuro SCS Trial Stimulator	Work Order:	BIOT0085
Serial Number:	91820147	Date:	2021-04-28
Customer:	BIOTRONIK, Inc.	Temperature:	23.4°C
Attendees:	Roy Wang	Relative Humidity:	37.5%
Customer Project:	None	Bar. Pressure:	1027 mb
Tested By:	Jeff Alcock	Job Site:	EV01
Power:	Battery	Configuration:	BIOT0085-5

TEST SPECIFICATIONS

Specification:	Method:
FCC 15.247:2021	ANSI C63.10:2013

TEST PARAMETERS

Run #:	12	Test Distance (m):	3	Ant. Height(s) (m):	1 to 4(m)
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COMMENTS

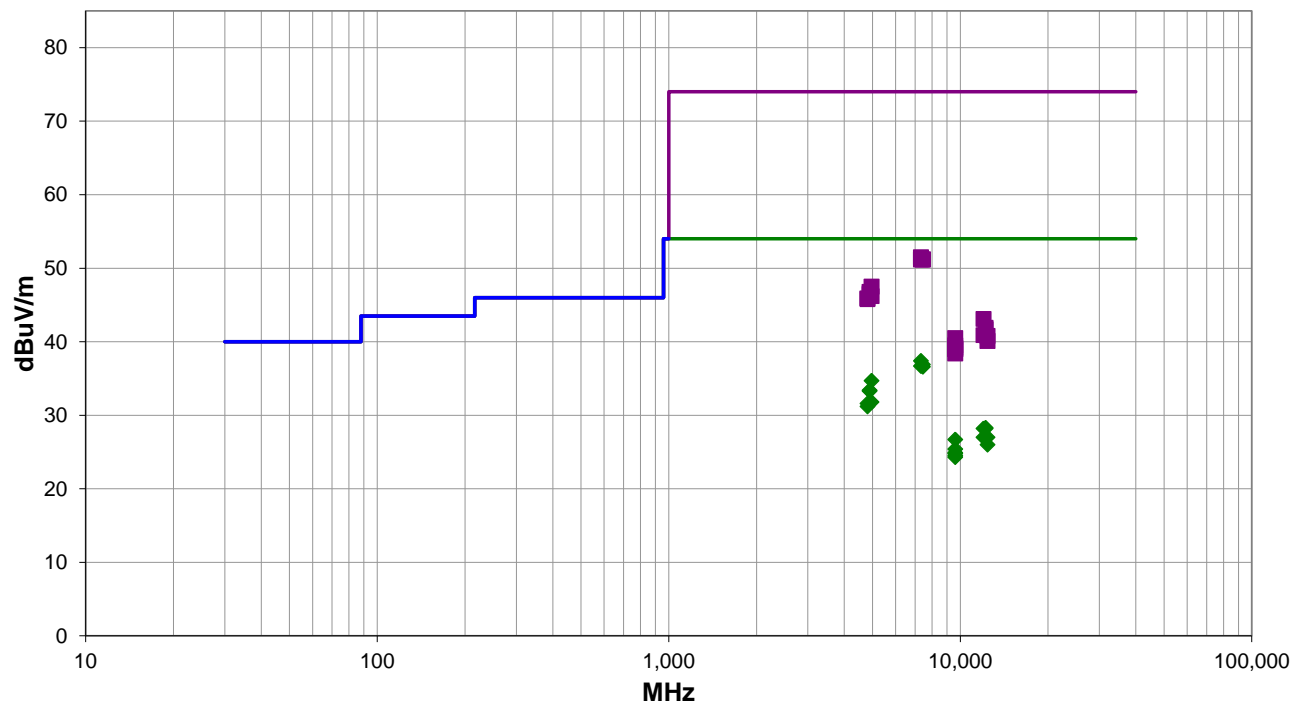
The only notable emission from pre-scans was the 4th harmonic for low channel. Measurements on the 4th harmonic were used to determine worst case orientation. The worst case orientation was used for other harmonics in the 15.205 restricted bands. Please reference data comments below for Channel and EUT orientation.

EUT OPERATING MODES

Continuous Tx, BLE, 1 Mbps. Low Ch = 2402 MHz, Mid Ch = 2442 MHz, High Ch = 2480 MHz

DEVIATIONS FROM TEST STANDARD

None



Run #: 12

■ PK ◆ AV ● QP

SPURIOUS RADIATED EMISSIONS

RESULTS - Run #12

Freq (MHz)	Amplitude (dBuV)	Preamplifier (dB)	Antenna Height (meters)	Transducer (dB/m)	Cable (dB)	External Attenuation (dB)	Polarity/Transducer Type	Detector	Distance Adjustment (dB)	Adjusted (dBuV/m)	Spec. Limit (dBuV/m)	Compared to Spec. (dB)	Comments
7326.800	25.7	11.7	2.92	105.0	3.0	0.0	Horz	AV	0.0	37.4	54.0	-16.6	Mid Ch, EUT on Side
7440.783	24.7	12.2	2.99	165.0	3.0	0.0	Vert	AV	0.0	36.9	54.0	-17.1	High Ch, EUT Horz
7326.775	25.0	11.7	1.5	230.0	3.0	0.0	Vert	AV	0.0	36.7	54.0	-17.3	Mid Ch, EUT Horz
7440.867	24.4	12.2	1.5	82.0	3.0	0.0	Horz	AV	0.0	36.6	54.0	-17.4	High Ch, EUT on Side
4960.392	28.8	5.9	2.38	117.0	3.0	0.0	Horz	AV	0.0	34.7	54.0	-19.3	High Ch, EUT on Side
4884.408	27.4	6.0	2.84	129.0	3.0	0.0	Horz	AV	0.0	33.4	54.0	-20.6	Mid Ch, EUT on Side
4884.367	27.3	6.0	3.31	174.0	3.0	0.0	Vert	AV	0.0	33.3	54.0	-20.7	Mid Ch, EUT Horz
4959.750	25.9	5.9	1.5	38.0	3.0	0.0	Vert	AV	0.0	31.8	54.0	-22.2	High Ch, EUT Horz
4803.808	26.5	5.1	1.5	160.0	3.0	0.0	Horz	AV	0.0	31.6	54.0	-22.4	Low Ch, EUT on Side
7325.217	39.8	11.7	2.92	105.0	3.0	0.0	Horz	PK	0.0	51.5	74.0	-22.5	Mid Ch, EUT on Side
7326.708	39.5	11.7	1.5	230.0	3.0	0.0	Vert	PK	0.0	51.2	74.0	-22.8	Mid Ch, EUT Horz
7439.825	39.0	12.2	2.99	165.0	3.0	0.0	Vert	PK	0.0	51.2	74.0	-22.8	High Ch, EUT Horz
7441.500	39.0	12.2	1.5	82.0	3.0	0.0	Horz	PK	0.0	51.2	74.0	-22.8	High Ch, EUT on Side
4804.483	26.0	5.2	1.5	0.0	3.0	0.0	Vert	AV	0.0	31.2	54.0	-22.8	Low Ch, EUT Horz
12211.380	27.3	1.0	2.16	175.0	3.0	0.0	Vert	AV	0.0	28.3	54.0	-25.7	Mid Ch, EUT Horz
12009.030	27.1	1.1	1.05	171.0	3.0	0.0	Horz	AV	0.0	28.2	54.0	-25.8	Low Ch, EUT on Side
12211.440	27.2	1.0	1.01	148.0	3.0	0.0	Horz	AV	0.0	28.2	54.0	-25.8	Mid Ch, EUT on Side
4959.442	41.6	5.9	2.38	117.0	3.0	0.0	Horz	PK	0.0	47.5	74.0	-26.5	High Ch, EUT on Side
12009.040	25.9	1.1	2.74	179.0	3.0	0.0	Vert	AV	0.0	27.0	54.0	-27.0	Low Ch, EUT Horz
12399.030	25.5	1.5	1.5	157.0	3.0	0.0	Horz	AV	0.0	27.0	54.0	-27.0	High Ch, EUT on Side
4884.492	40.8	6.0	3.31	174.0	3.0	0.0	Vert	PK	0.0	46.8	74.0	-27.2	Mid Ch, EUT Horz
9609.125	28.0	-1.3	1.15	360.0	3.0	0.0	Horz	AV	0.0	26.7	54.0	-27.3	Low Ch, EUT on Side
4884.408	40.5	6.0	2.84	129.0	3.0	0.0	Horz	PK	0.0	46.5	74.0	-27.5	Mid Ch, EUT on Side
4960.533	40.3	5.9	1.5	38.0	3.0	0.0	Vert	PK	0.0	46.2	74.0	-27.8	High Ch, EUT Horz
12399.090	24.5	1.5	1.5	262.0	3.0	0.0	Vert	AV	0.0	26.0	54.0	-28.0	High Ch, EUT Horz
4803.042	40.8	5.1	1.5	160.0	3.0	0.0	Horz	PK	0.0	45.9	74.0	-28.1	Low Ch, EUT on Side
4805.550	40.6	5.2	1.5	0.0	3.0	0.0	Vert	PK	0.0	45.8	74.0	-28.2	Low Ch, EUT Horz
9609.042	26.7	-1.3	1.05	132.0	3.0	0.0	Vert	AV	0.0	25.4	54.0	-28.6	Low Ch, EUT Horz
9605.942	26.2	-1.3	1.5	334.0	3.0	0.0	Vert	AV	0.0	24.9	54.0	-29.1	Low Ch, EUT Vert
9609.083	26.1	-1.3	1.5	142.0	3.0	0.0	Horz	AV	0.0	24.8	54.0	-29.2	Low Ch, EUT Horz
9609.125	25.8	-1.3	1.89	232.0	3.0	0.0	Vert	AV	0.0	24.5	54.0	-29.5	Low Ch, EUT on Side
9607.283	25.6	-1.3	2.92	37.0	3.0	0.0	Horz	AV	0.0	24.3	54.0	-29.7	Low Ch, EUT Vert
12009.210	42.0	1.1	1.05	171.0	3.0	0.0	Horz	PK	0.0	43.1	74.0	-30.9	Low Ch, EUT on Side
12211.160	40.9	1.0	1.01	148.0	3.0	0.0	Horz	PK	0.0	41.9	74.0	-32.1	Mid Ch, EUT on Side
12211.550	40.7	1.0	2.16	175.0	3.0	0.0	Vert	PK	0.0	41.7	74.0	-32.3	Mid Ch, EUT Horz
12008.820	39.8	1.1	2.74	179.0	3.0	0.0	Vert	PK	0.0	40.9	74.0	-33.1	Low Ch, EUT Horz
12399.530	39.3	1.5	1.5	157.0	3.0	0.0	Horz	PK	0.0	40.8	74.0	-33.2	High Ch, EUT on Side
9607.317	41.8	-1.3	1.15	360.0	3.0	0.0	Horz	PK	0.0	40.5	74.0	-33.5	Low Ch, EUT on Side
12399.300	38.6	1.5	1.5	262.0	3.0	0.0	Vert	PK	0.0	40.1	74.0	-33.9	High Ch, EUT Horz
9608.917	40.8	-1.3	1.05	132.0	3.0	0.0	Vert	PK	0.0	39.5	74.0	-34.5	Low Ch, EUT Horz

SPURIOUS RADIATED EMISSIONS

Freq (MHz)	Amplitude (dBuV)	Preamplifier (dB)	Antenna Height (meters)	Transducer (dB/m)	Cable (dB)	External Attenuation (dB)	Polarity/ Transducer Type	Detector	Distance Adjustment (dB)	Adjusted (dBuV/m)	Spec. Limit (dBuV/m)	Compared to Spec. (dB)	Comments
9607.858	40.5	-1.3	1.89	232.0	3.0	0.0	Vert	PK	0.0	39.2	74.0	-34.8	Low Ch, EUT on Side
9609.142	40.3	-1.3	1.5	334.0	3.0	0.0	Vert	PK	0.0	39.0	74.0	-35.0	Low Ch, EUT Vert
9606.342	40.3	-1.3	1.5	142.0	3.0	0.0	Horz	PK	0.0	39.0	74.0	-35.0	Low Ch, EUT Horz
9608.017	39.7	-1.3	2.92	37.0	3.0	0.0	Horz	PK	0.0	38.4	74.0	-35.6	Low Ch, EUT Vert

CONCLUSION

Pass



Tested By

SPURIOUS RADIATED EMISSIONS

EUT:	Neuro SCS Trial Stimulator	Work Order:	BIOT0085
Serial Number:	91820147	Date:	2021-04-28
Customer:	BIOTRONIK, Inc.	Temperature:	23.4°C
Attendees:	Roy Wang	Relative Humidity:	37.5%
Customer Project:	None	Bar. Pressure:	1027 mb
Tested By:	Jeff Alcock	Job Site:	EV01
Power:	Battery	Configuration:	BIOT0085-5

TEST SPECIFICATIONS

Specification:	Method:
FCC 15.247:2021	ANSI C63.10:2013

TEST PARAMETERS

Run #:	19	Test Distance (m):	3	Ant. Height(s) (m):	1 to 4(m)
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COMMENTS

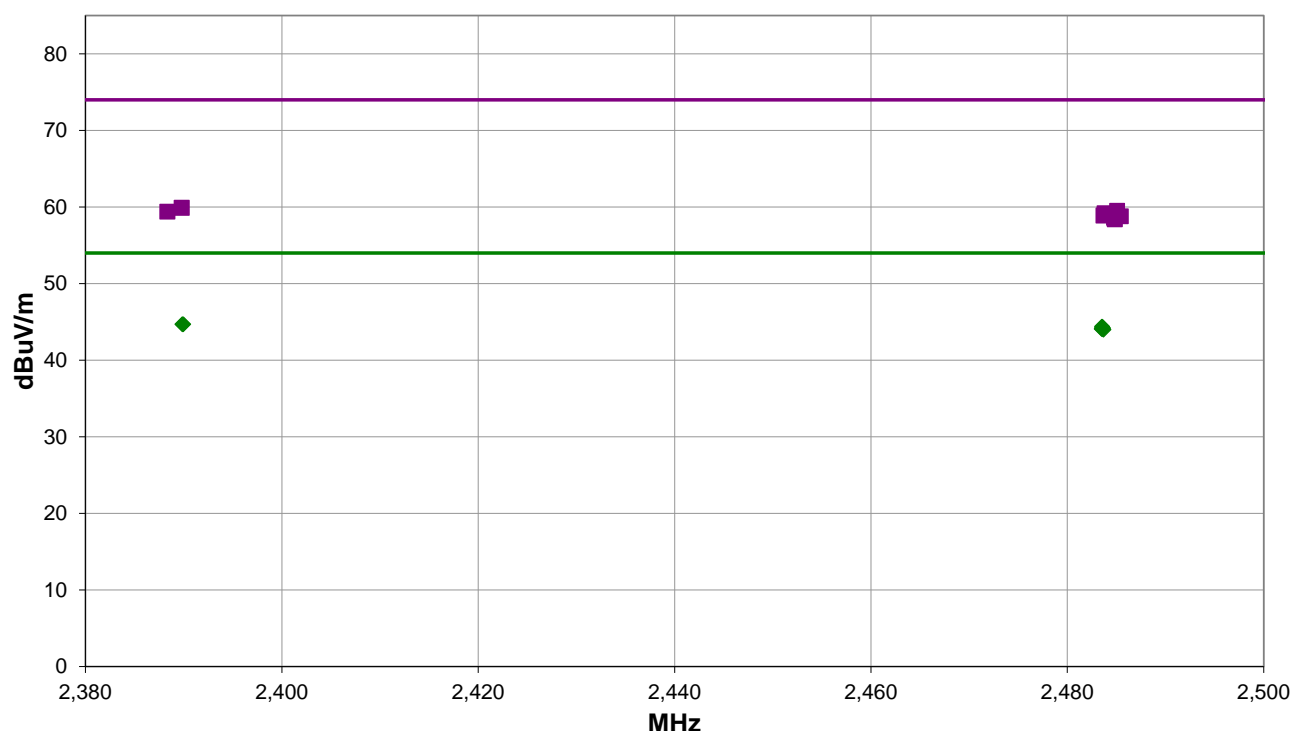
All reported emissions are noise floor. Please reference data comments below for Channel and EUT orientation.

EUT OPERATING MODES

Continuous Tx, BLE, 1 Mbps. Low Ch = 2402 MHz, Mid Ch = 2442 MHz, High Ch = 2480 MHz

DEVIATIONS FROM TEST STANDARD

None



Run #: 19

■ PK ◆ AV ● QP

SPURIOUS RADIATED EMISSIONS

RESULTS - Run #19

Freq (MHz)	Amplitude (dBuV)	Factor (dB/m)	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
2389.870	28.2	-3.5	1.0	360.0	3.0	20.0	Horz	AV	0.0	44.7	54.0	-9.3	Low Ch, EUT Horz
2389.947	28.2	-3.5	1.0	360.0	3.0	20.0	Vert	AV	0.0	44.7	54.0	-9.3	Low Ch, EUT Horz
2483.540	28.0	-3.6	1.42	230.0	3.0	20.0	Horz	AV	0.0	44.4	54.0	-9.6	High Ch, EUT Horz
2483.533	27.8	-3.6	1.5	1.0	3.0	20.0	Vert	AV	0.0	44.2	54.0	-9.8	High Ch, EUT on Side
2483.633	27.8	-3.6	1.5	50.0	3.0	20.0	Vert	AV	0.0	44.2	54.0	-9.8	High Ch, EUT Horz
2483.557	27.7	-3.6	1.5	142.0	3.0	20.0	Horz	AV	0.0	44.1	54.0	-9.9	High Ch, EUT Vert
2483.503	27.7	-3.6	1.5	190.0	3.0	20.0	Horz	AV	0.0	44.1	54.0	-9.9	High Ch, EUT on Side
2483.677	27.6	-3.6	3.99	190.0	3.0	20.0	Vert	AV	0.0	44.0	54.0	-10.0	High Ch, EUT Vert
2389.793	43.4	-3.5	1.0	360.0	3.0	20.0	Horz	PK	0.0	59.9	74.0	-14.1	Low Ch, EUT Horz
2485.067	43.0	-3.5	1.5	50.0	3.0	20.0	Vert	PK	0.0	59.5	74.0	-14.5	High Ch, EUT Horz
2388.343	42.9	-3.5	1.0	360.0	3.0	20.0	Vert	PK	0.0	59.4	74.0	-14.6	Low Ch, EUT Horz
2483.793	42.8	-3.6	3.99	190.0	3.0	20.0	Vert	PK	0.0	59.2	74.0	-14.8	High Ch, EUT Vert
2483.690	42.5	-3.6	1.5	190.0	3.0	20.0	Horz	PK	0.0	58.9	74.0	-15.1	High Ch, EUT on Side
2485.453	42.3	-3.5	1.42	230.0	3.0	20.0	Horz	PK	0.0	58.8	74.0	-15.2	High Ch, EUT Horz
2484.760	42.2	-3.6	1.5	142.0	3.0	20.0	Horz	PK	0.0	58.6	74.0	-15.4	High Ch, EUT Vert
2484.830	42.0	-3.6	1.5	1.0	3.0	20.0	Vert	PK	0.0	58.4	74.0	-15.6	High Ch, EUT on Side

CONCLUSION

Pass



Tested By

SPURIOUS RADIATED EMISSIONS

EUT:	Neuro SCS Trial Stimulator	Work Order:	BIOT0085
Serial Number:	91820147	Date:	2021-04-28
Customer:	BIOTRONIK, Inc.	Temperature:	23.4°C
Attendees:	Roy Wang	Relative Humidity:	37.5%
Customer Project:	None	Bar. Pressure:	1027 mb
Tested By:	Jeff Alcock	Job Site:	EV01
Power:	Battery	Configuration:	BIOT0085-6

TEST SPECIFICATIONS

Specification:	Method:
FCC 15.247:2021	ANSI C63.10:2013

TEST PARAMETERS

Run #:	30	Test Distance (m):	3	Ant. Height(s) (m):	1 to 4(m)
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COMMENTS

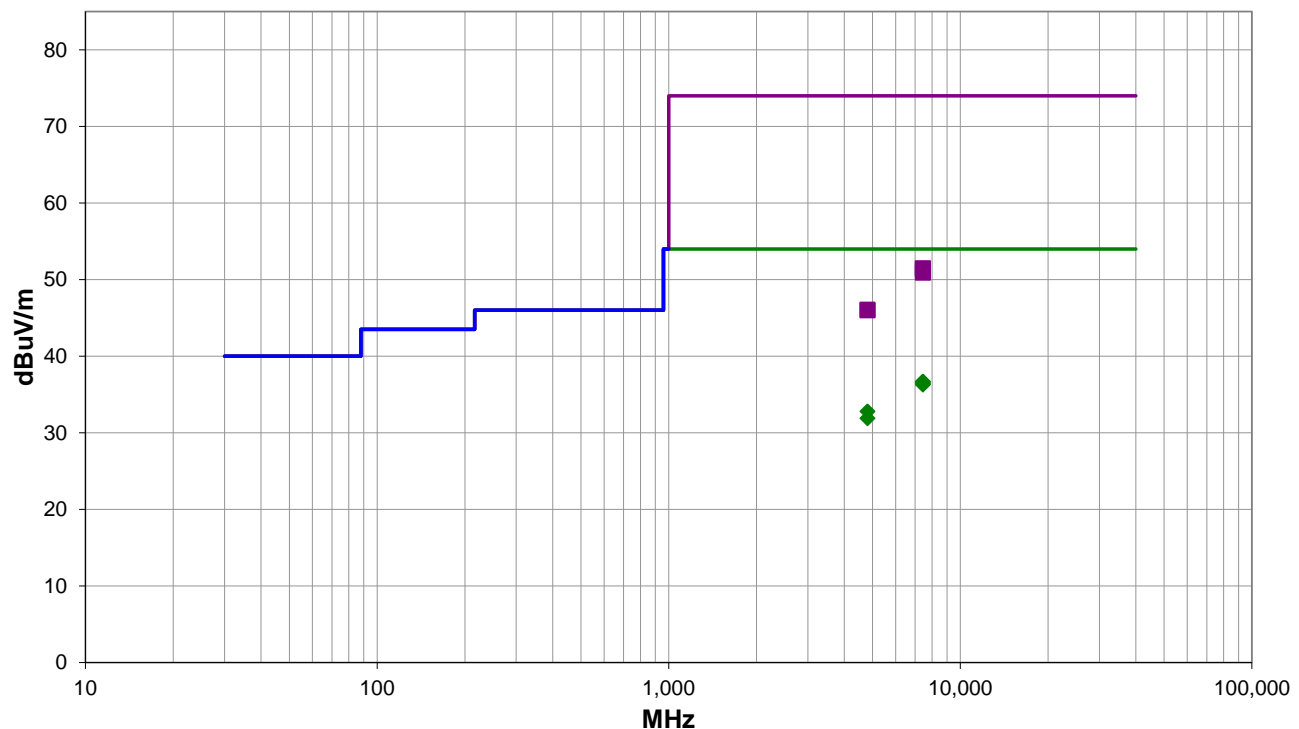
Please reference data comments below for Channel and EUT orientation.

EUT OPERATING MODES

Continuous Tx, BLE, 1 Mbps. Low Ch = 2402 MHz, Mid Ch = 2442 MHz, High Ch = 2480 MHz

DEVIATIONS FROM TEST STANDARD

None



Run #: 30

■ PK ◆ AV ● QP

SPURIOUS RADIATED EMISSIONS

RESULTS - Run #30

Freq (MHz)	Amplitude (dBuV)	Factor (dB/m)	Antenna Height (meters)	Azimuth (degrees)	Test Distance (meters)	External Attenuation (dB)	Polarity/Transducer Type	Detector	Distance Adjustment (dB)	Adjusted (dBuV/m)	Spec. Limit (dBuV/m)	Compared to Spec. (dB)	Comments
7439.458	24.5	12.2	1.5	246.0	3.0	0.0	Horz	AV	0.0	36.7	54.0	-17.3	High Ch, EUT on Side
7439.467	24.4	12.2	1.5	352.0	3.0	0.0	Vert	AV	0.0	36.6	54.0	-17.4	High Ch, EUT Horz
7442.308	24.2	12.2	1.5	108.0	3.0	0.0	Horz	AV	0.0	36.4	54.0	-17.6	Mid Ch, EUT on Side
7440.158	24.1	12.2	1.5	206.0	3.0	0.0	Vert	AV	0.0	36.3	54.0	-17.7	Mid Ch, EUT Horz
4803.892	27.7	5.1	1.5	216.0	3.0	0.0	Horz	AV	0.0	32.8	54.0	-21.2	Low Ch, EUT on Side
4803.875	26.8	5.1	1.5	23.0	3.0	0.0	Vert	AV	0.0	31.9	54.0	-22.1	Low Ch, EUT Horz
7440.133	39.3	12.2	1.5	246.0	3.0	0.0	Horz	PK	0.0	51.5	74.0	-22.5	High Ch, EUT on Side
7441.508	39.2	12.2	1.5	352.0	3.0	0.0	Vert	PK	0.0	51.4	74.0	-22.6	High Ch, EUT Horz
7438.500	39.2	12.2	1.5	206.0	3.0	0.0	Vert	PK	0.0	51.4	74.0	-22.6	Mid Ch, EUT Horz
7439.550	38.7	12.2	1.5	108.0	3.0	0.0	Horz	PK	0.0	50.9	74.0	-23.1	Mid Ch, EUT on Side
4803.067	41.0	5.1	1.5	216.0	3.0	0.0	Horz	PK	0.0	46.1	74.0	-27.9	Low Ch, EUT on Side
4804.658	40.8	5.2	1.5	23.0	3.0	0.0	Vert	PK	0.0	46.0	74.0	-28.0	Low Ch, EUT Horz

CONCLUSION

Pass



Tested By

SPURIOUS RADIATED EMISSIONS

EUT:	Neuro SCS Trial Stimulator	Work Order:	BIOT0085
Serial Number:	91820147	Date:	2021-04-29
Customer:	BIOTRONIK, Inc.	Temperature:	23.8°C
Attendees:	Roy Wang	Relative Humidity:	40.6%
Customer Project:	None	Bar. Pressure:	1025 mb
Tested By:	Jeff Alcock	Job Site:	EV01
Power:	Battery	Configuration:	BIOT0085-6

TEST SPECIFICATIONS

Specification:	Method:
FCC 15.247:2021	ANSI C63.10:2013

TEST PARAMETERS

Run #:	32	Test Distance (m):	3	Ant. Height(s) (m):	1 to 4(m)
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COMMENTS

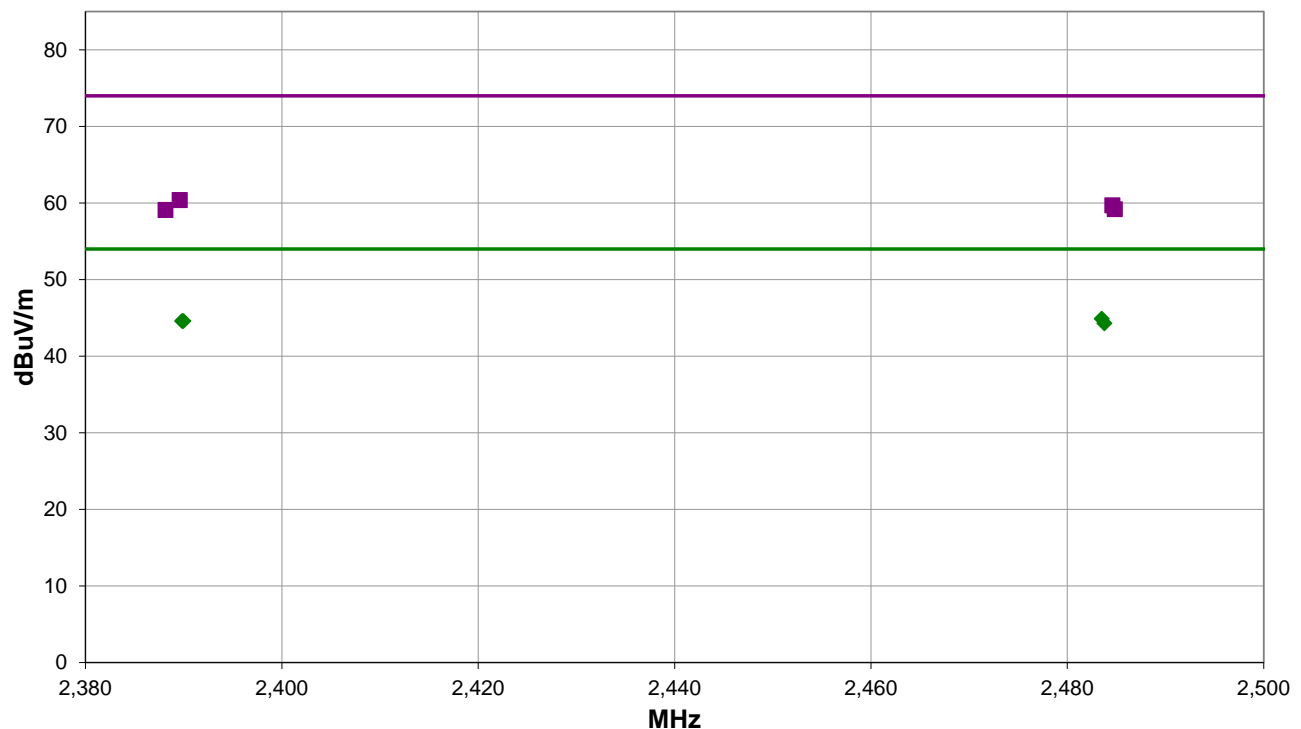
All reported emissions are noise floor. Please reference data comments below for Channel and EUT orientation.

EUT OPERATING MODES

Continuous Tx, BLE, 1 Mbps. Low Ch = 2402 MHz, Mid Ch = 2442 MHz, High Ch = 2480 MHz

DEVIATIONS FROM TEST STANDARD

None



Run #: 32

■ PK ◆ AV ● QP

SPURIOUS RADIATED EMISSIONS

RESULTS - Run #32

Freq (MHz)	Amplitude (dBuV)	Factor (dB/m)	Antenna Height (meters)	Azimuth (degrees)	Test Distance (meters)	External Attenuation (dB)	Polarity/Transducer Type	Detector	Distance Adjustment (dB)	Adjusted (dBuV/m)	Spec. Limit (dBuV/m)	Compared to Spec. (dB)	Comments
2483.503	28.5	-3.6	1.5	236.0	3.0	20.0	Horz	AV	0.0	44.9	54.0	-9.1	High Ch, EUT Horz
2389.840	28.1	-3.5	1.0	0.0	3.0	20.0	Vert	AV	0.0	44.6	54.0	-9.4	Low Ch, EUT Horz
2389.960	28.1	-3.5	1.0	0.0	3.0	20.0	Horz	AV	0.0	44.6	54.0	-9.4	Low Ch, EUT Horz
2483.773	27.9	-3.6	1.5	354.0	3.0	20.0	Vert	AV	0.0	44.3	54.0	-9.7	High Ch, EUT Horz
2389.590	43.9	-3.5	1.0	0.0	3.0	20.0	Horz	PK	0.0	60.4	74.0	-13.6	Low Ch, EUT Horz
2484.587	43.3	-3.6	1.5	354.0	3.0	20.0	Vert	PK	0.0	59.7	74.0	-14.3	High Ch, EUT Horz
2484.827	42.8	-3.6	1.5	236.0	3.0	20.0	Horz	PK	0.0	59.2	74.0	-14.8	High Ch, EUT Horz
2388.147	42.6	-3.5	1.0	0.0	3.0	20.0	Vert	PK	0.0	59.1	74.0	-14.9	Low Ch, EUT Horz

CONCLUSION

Pass



Tested By

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
Analyzer - Spectrum Analyzer	Agilent	E4440A	AFE	2021-04-08	2022-04-08
Cable	Micro-Coax	UFD150A-1-0720-200200	EVH	2021-03-14	2022-03-14
Attenuator	S.M. Electronics	SA26B-20	AUY	2021-03-14	2022-03-14
Block - DC	Fairview Microwave	SD3379	AMW	2021-03-14	2022-03-14
Generator - Signal	Keysight	N5182B	TFU	2020-11-20	2022-11-20

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



TstTx 2019.08.30.0 XMI 2020.12.30.0

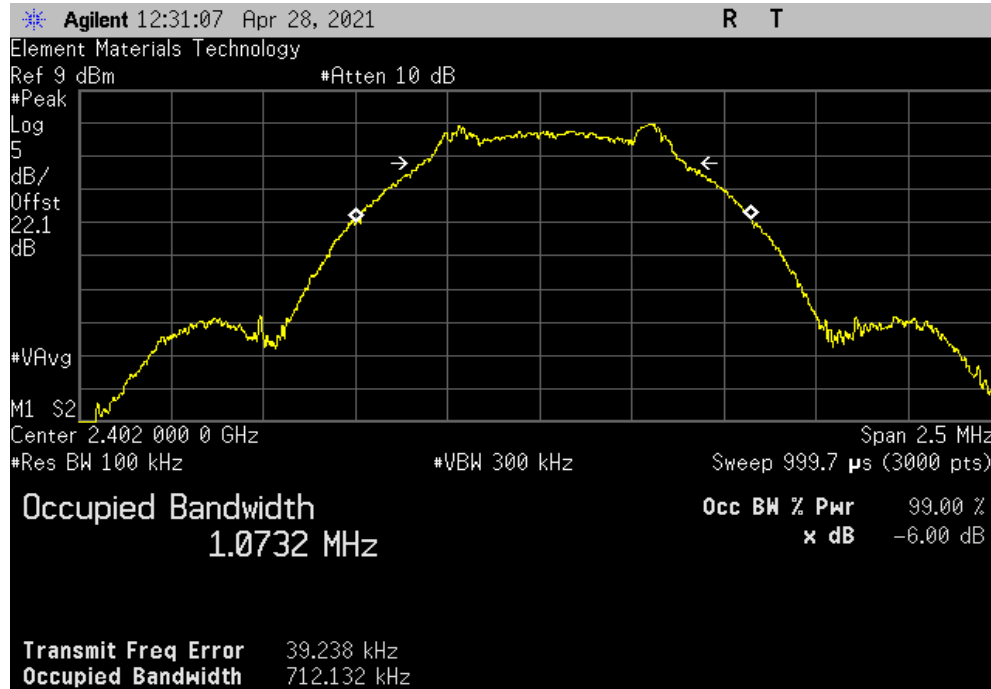
EUT: Neuro SCS Trial Stimulator		Work Order: BIOT0085	
Serial Number: 91820147		Date: 28-Apr-21	
Customer: BIOTRONIK, Inc.		Temperature: 23.3 °C	
Attendees: Roy Wang		Humidity: 37.3% RH	
Project: None		Barometric Pres.: 1028 mbar	
Tested by: Jeff Alcove	Power: Battery	Job Site: EV05	
TEST SPECIFICATIONS		Test Method	
FCC 15.247:2021		ANSI C63.10:2013	
COMMENTS			
Reference level offset includes: DC Block, 20 dB Attenuator, Measurement Cable and Manufacturers SMA to SWD patch cable.			
DEVIATIONS FROM TEST STANDARD			
None			
Configuration #	5	Signature 	
		Value	Limit (±) Result
BLE/GFSK 1 Mbps Low Channel, 2402 MHz		712.132 kHz	500 kHz Pass
BLE/GFSK 1 Mbps Mid Channel, 2442 MHz		702.566 kHz	500 kHz Pass
BLE/GFSK 1 Mbps High Channel, 2480 MHz		720.672 kHz	500 kHz Pass

OCCUPIED BANDWIDTH

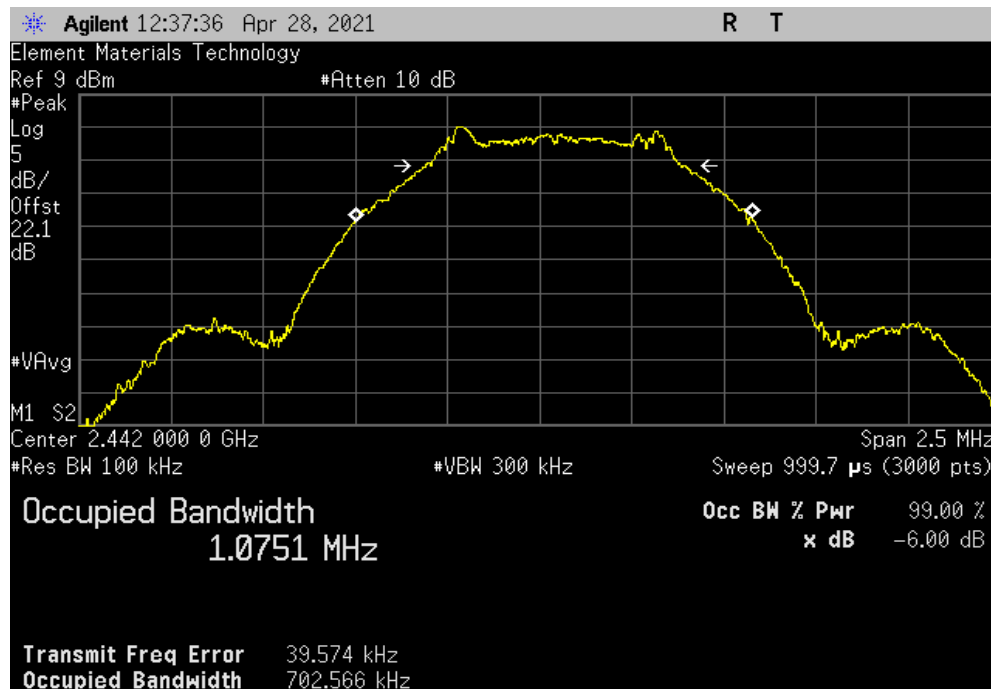


TuTx 2019.08.30.0 XMt 2020.12.30.0

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



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

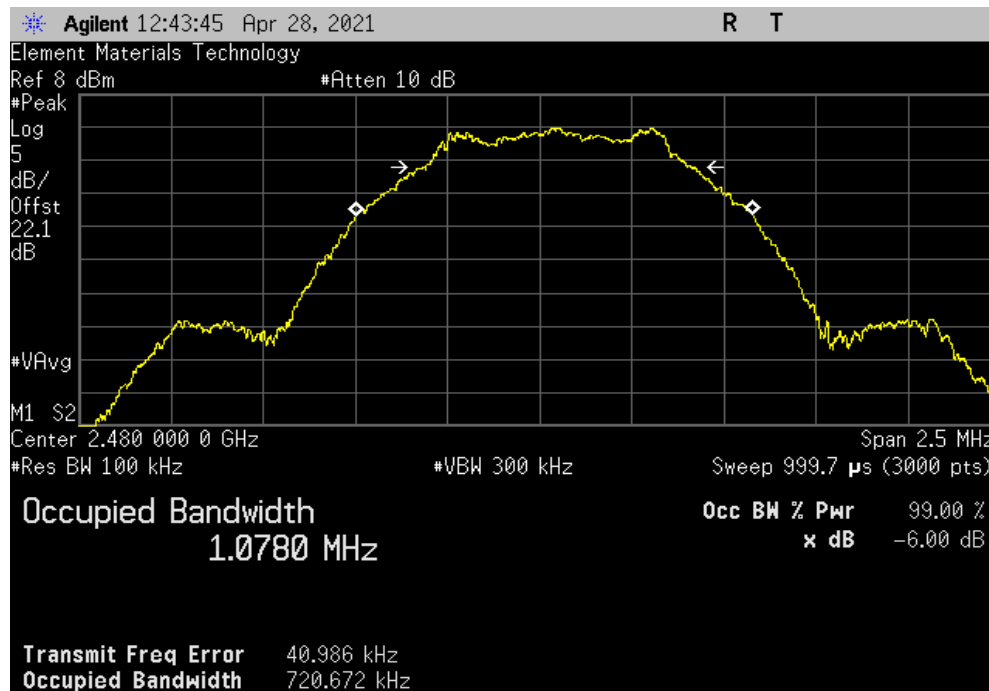


OCCUPIED BANDWIDTH



TbTx 2019.08.30.0 XMt 2020.12.30.0

BLE/GFSK 1 Mbps High Channel, 2480 MHz						
Value				Limit	Result	
				(≥)		
720.672 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
Analyzer - Spectrum Analyzer	Agilent	E4440A	AFE	2021-04-08	2022-04-08
Cable	Micro-Coax	UFD150A-1-0720-200200	EVH	2021-03-14	2022-03-14
Attenuator	S.M. Electronics	SA26B-20	AUY	2021-03-14	2022-03-14
Block - DC	Fairview Microwave	SD3379	AMW	2021-03-14	2022-03-14
Generator - Signal	Keysight	N5182B	TFU	2020-11-20	2022-11-20

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



TbTfx 2019.08.30.0 XMI 2020.12.30.0

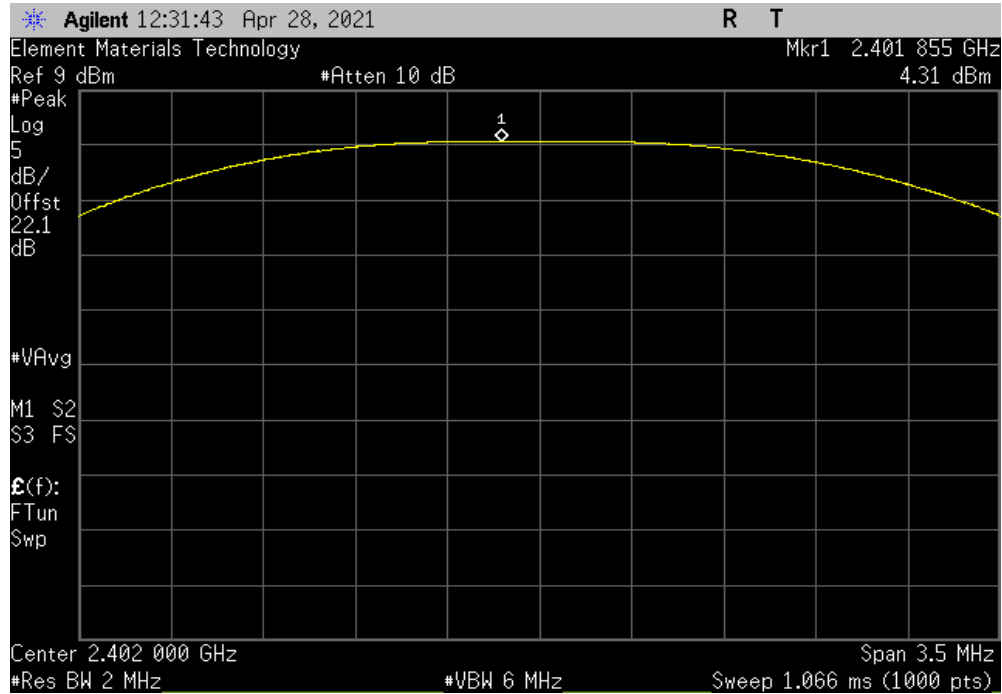
EUT: Neuro SCS Trial Stimulator		Work Order: BIOT0085	
Serial Number: 91820147		Date: 28-Apr-21	
Customer: BIOTRONIK, Inc.		Temperature: 23.3 °C	
Attendees: Roy Wang		Humidity: 37.3% RH	
Project: None		Barometric Pres.: 1028 mbar	
Tested by: Jeff Alcock	Power: Battery	Job Site: EV05	
TEST SPECIFICATIONS		Test Method	
FCC 15.247:2021		ANSI C63.10:2013	
COMMENTS			
Reference level offset includes: DC Block, 20 dB Attenuator, Measurement Cable and Manufacturers SMA to SWD patch cable.			
DEVIATIONS FROM TEST STANDARD			
None			
Configuration #	5	Signature 	
		Out Pwr (dBm)	Limit (dBm) Result
BLE/GFSK 1 Mbps Low Channel, 2402 MHz		4.312	30 Pass
BLE/GFSK 1 Mbps Mid Channel, 2442 MHz		4.178	30 Pass
BLE/GFSK 1 Mbps High Channel, 2480 MHz		3.655	30 Pass

OUTPUT POWER

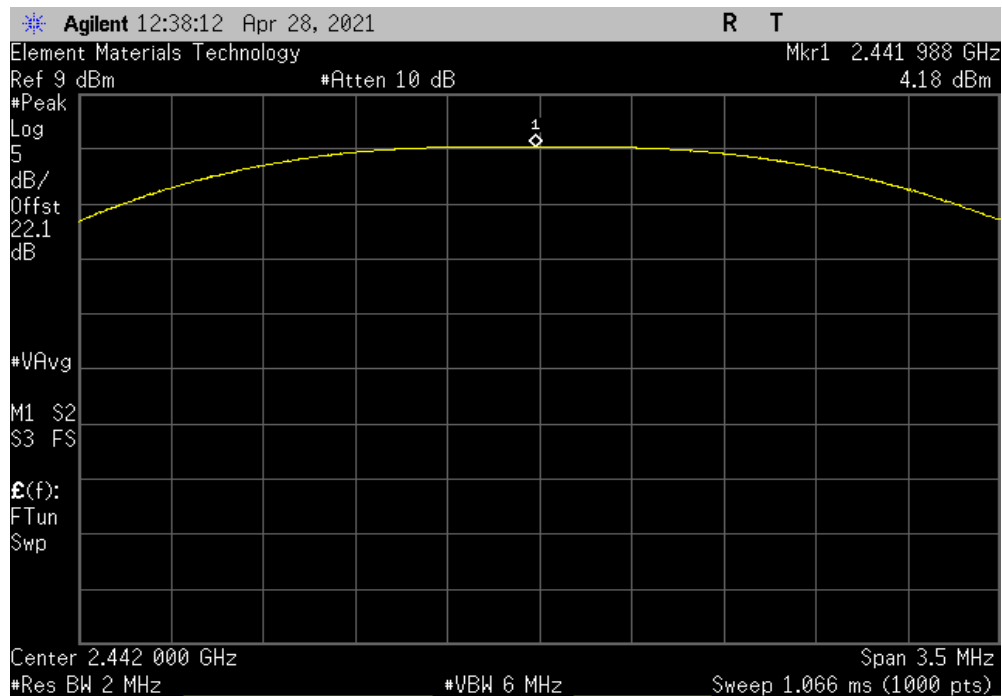


TbTx 2019.08.30.0 XMt 2020.12.30.0

BLE/GFSK 1 Mbps Low Channel, 2402 MHz						
				Out Pwr (dBm)	Limit (dBm)	Result
				4.312	30	Pass



BLE/GFSK 1 Mbps Mid Channel, 2442 MHz						
				Out Pwr (dBm)	Limit (dBm)	Result
				4.178	30	Pass

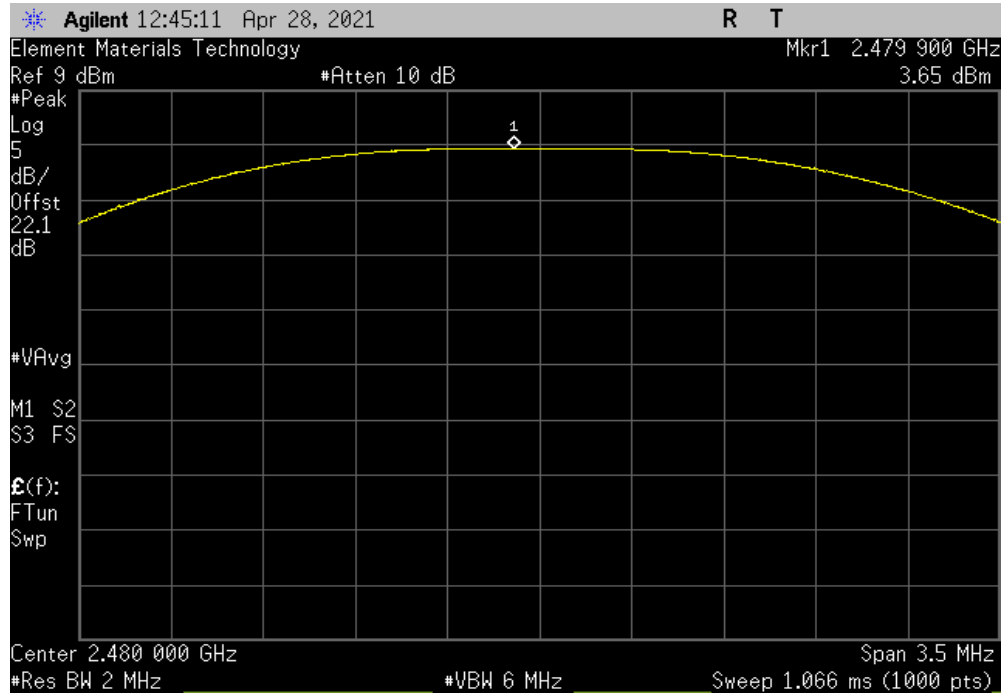


OUTPUT POWER



TbTx 2019.08.30.0 XMt 2020.12.30.0

BLE/GFSK 1 Mbps High Channel, 2480 MHz						
				Out Pwr (dBm)	Limit (dBm)	Result
				3.655	30	Pass



EQUIVALENT ISOTROPIC RADIATED POWER (EIRP)

TEST DESCRIPTION

The peak output power was measured with the EUT set to low, medium and high transmit frequencies. A field strength measurement was made of the fundamental with the carrier fully maximized for its highest radiated power.

The final data was converted from field strength to a radiated power value using equations found in ANSI C63.10:2013 Annex G.2

TEST EQUIPMENT

Description	Manufacturer	Model	ID	Last Cal.	Cal. Due
Analyzer - Spectrum Analyzer	Keysight	N9010A	AFO	2020-06-25	2021-06-25
Antenna - Double Ridge	EMCO	3115	AHC	2020-07-01	2022-07-01
Cable	N/A	Double Ridge Horn Cables	EVb	2020-11-17	2021-11-17

MEASUREMENT UNCERTAINTY

Description		
Expanded k=2	5.1 dB	-5.1 dB

FREQUENCY RANGE INVESTIGATED

2402 MHz TO 2480 MHz

POWER INVESTIGATED

Battery

CONFIGURATIONS INVESTIGATED

BIOT0085-5
BIOT0085-6

MODES INVESTIGATED

Continuous Tx, BLE, 1 Mbps. Low Ch = 2402 MHz, Mid Ch = 2442 MHz, High Ch = 2480 MHz

EQUIVALENT ISOTROPIC RADIATED POWER (EIRP)

EUT:	Neuro SCS Trial Stimulator	Work Order:	BIOT0085
Serial Number:	91820147	Date:	2021-04-28
Customer:	BIOTRONIK, Inc.	Temperature:	23.3°C
Attendees:	Roy Wang	Relative Humidity:	37.3%
Customer Project:	None	Bar. Pressure:	1028 mb
Tested By:	Jeff Alcock	Job Site:	EV01
Power:	Battery	Configuration:	BIOT0085-5

TEST SPECIFICATIONS

Specification:	Method:
FCC 15.247:2021	ANSI C63.10:2013

TEST PARAMETERS

Run #:	0	Test Distance (m):	3	Ant. Height(s) (m):	1 to 4(m)
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COMMENTS

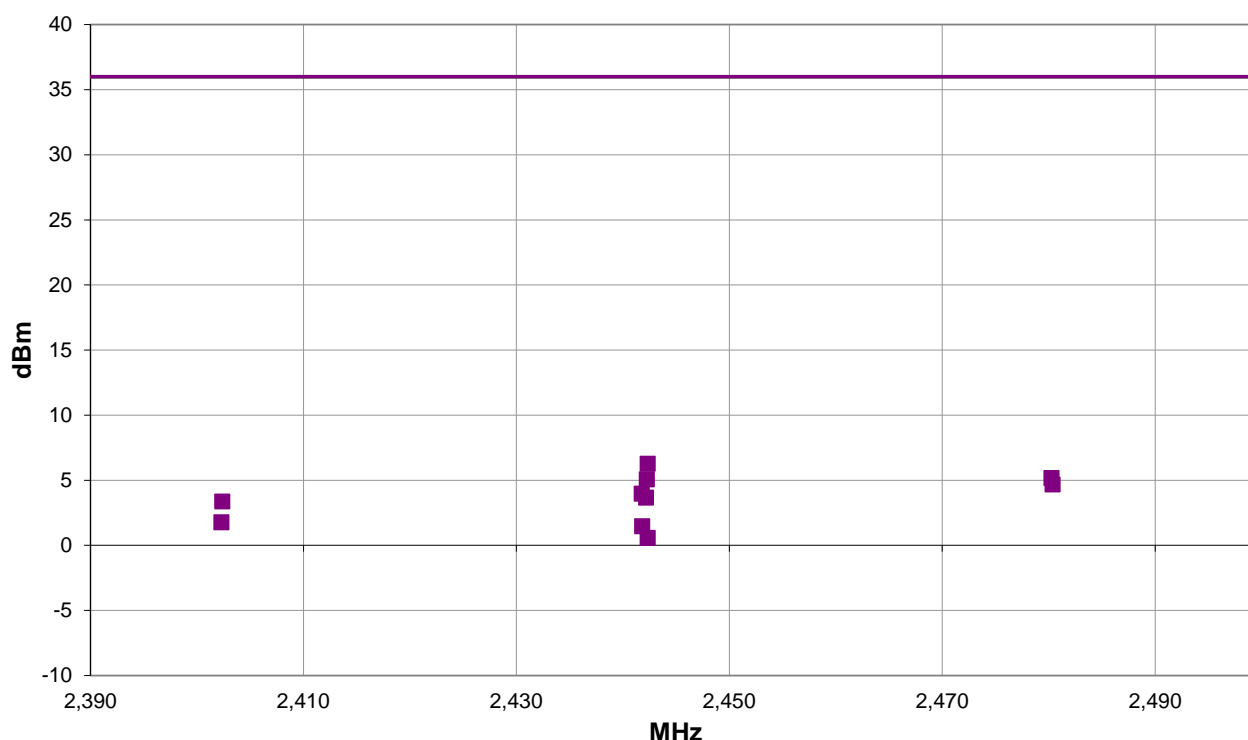
Please reference data comments below for Channel and EUT orientation.

EUT OPERATING MODES

Continuous Tx, BLE, 1 Mbps. Low Ch = 2402 MHz, Mid Ch = 2442 MHz, High Ch = 2480 MHz

DEVIATIONS FROM TEST STANDARD

None



Run #: 0

■ PK ◆ AV ● QP

EQUIVALENT ISOTROPIC RADIATED POWER (EIRP)

RESULTS - Run #0

Freq (MHz)	Antenna Height (meters)	Azimuth (degrees)	Polarity/Transducer Type	Detector	EIRP (Watts)	EIRP (dBm)	Spec. Limit (dBm)	Compared to Spec. (dB)	Comments
2442.333	1.0	303.0	Horz	PK	4.2E-3	6.3	36.0	-29.7	Mid Ch, EUT on Side
2480.250	1.1	161.0	Horz	PK	3.3E-3	5.2	36.0	-30.8	High Ch, EUT on Side
2442.250	1.13	146.0	Vert	PK	3.2E-3	5.1	36.0	-30.9	Mid Ch, EUT Vert
2480.358	1.0	143.0	Vert	PK	2.9E-3	4.7	36.0	-31.3	High Ch, EUT Vert
2441.775	1.38	242.0	Vert	PK	2.5E-3	4.0	36.0	-32.0	Mid Ch, EUT on Side
2442.175	3.24	124.0	Horz	PK	2.3E-3	3.7	36.0	-32.3	Mid Ch, EUT Horz
2402.367	1.26	299.0	Horz	PK	2.2E-3	3.4	36.0	-32.6	Low Ch, EUT on Side
2402.283	1.12	119.0	Vert	PK	1.5E-3	1.8	36.0	-34.2	Low Ch, EUT Vert
2441.817	3.95	177.0	Horz	PK	1.4E-3	1.5	36.0	-34.5	Mid Ch, EUT Vert
2442.333	3.78	166.0	Vert	PK	1.1E-3	0.6	36.0	-35.4	Mid Ch, EUT Horz

CONCLUSION

Pass



Tested By

EQUIVALENT ISOTROPIC RADIATED POWER (EIRP)

EUT:	Neuro SCS Trial Stimulator	Work Order:	BIOT0085
Serial Number:	91820147	Date:	2021-04-28
Customer:	BIOTRONIK, Inc.	Temperature:	23.4°C
Attendees:	Roy Wang	Relative Humidity:	37.5%
Customer Project:	None	Bar. Pressure:	1027 mb
Tested By:	Jeff Alcock	Job Site:	EV01
Power:	Battery	Configuration:	BIOT0085-6

TEST SPECIFICATIONS

Specification:	Method:
FCC 15.247:2021	ANSI C63.10:2013

TEST PARAMETERS

Run #:	28	Test Distance (m):	3	Ant. Height(s) (m):	1 to 4(m)
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COMMENTS

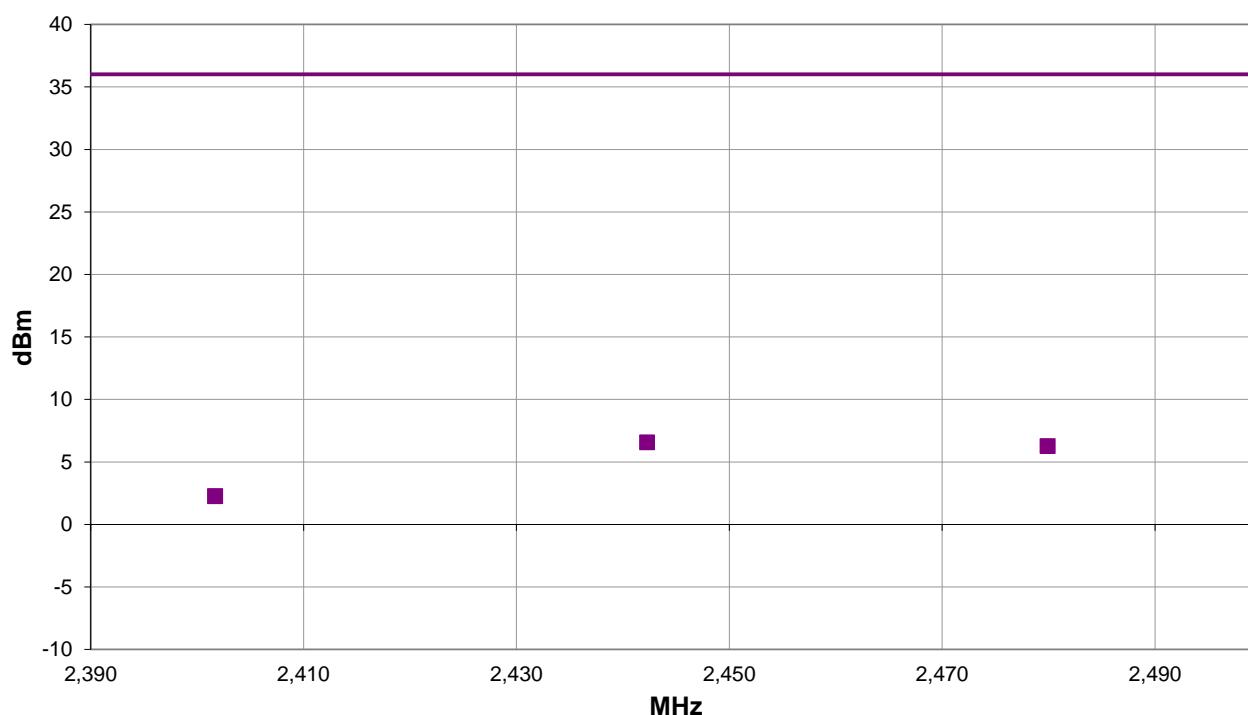
Please reference data comments below for Channel and EUT orientation.

EUT OPERATING MODES

Continuous Tx, BLE, 1 Mbps. Low Ch = 2402 MHz, Mid Ch = 2442 MHz, High Ch = 2480 MHz

DEVIATIONS FROM TEST STANDARD

None



Run #: 28

■ PK ◆ AV ● QP

EQUIVALENT ISOTROPIC RADIATED POWER (EIRP)

RESULTS - Run #28

Freq (MHz)	Antenna Height (meters)	Azimuth (degrees)	Polarity/ Transducer Type	Detector	EIRP (Watts)	EIRP (dBm)	Spec. Limit (dBm)	Compared to Spec. (dB)	Comments
2479.900	2.39	249.0	Horz	PK	4.2E-3	6.3	36.0	-29.7	High Ch, EUT on Side
2401.675	1.13	104.0	Horz	PK	1.7E-3	2.3	36.0	-33.7	Low Ch, EUT on Side
2442.267	2.41	95.0	Horz	PK	4.5E-3	6.6	36.0	-29.4	Mid Ch, EUT on Side

CONCLUSION

Pass



Tested By

POWER SPECTRAL DENSITY

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

TEST EQUIPMENT

Description	Manufacturer	Model	ID	Last Cal.	Cal. Due
Analyzer - Spectrum Analyzer	Agilent	E4440A	AFE	2021-04-08	2022-04-08
Cable	Micro-Coax	UFD150A-1-0720-200200	EVH	2021-03-14	2022-03-14
Attenuator	S.M. Electronics	SA26B-20	AUY	2021-03-14	2022-03-14
Block - DC	Fairview Microwave	SD3379	AMW	2021-03-14	2022-03-14
Generator - Signal	Keysight	N5182B	TFU	2020-11-20	2022-11-20

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



Test 2019.08.30.0 XML 2020.12.30.0

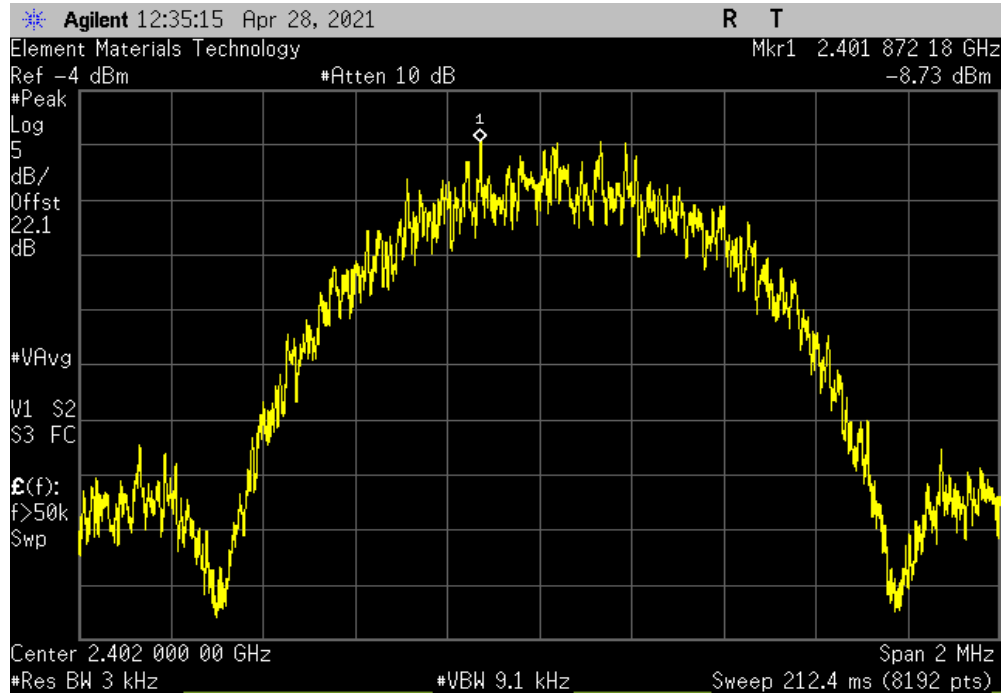
EUT: Neuro SCS Trial Stimulator		Work Order: BIOT0085	
Serial Number: 91820147		Date: 28-Apr-21	
Customer: BIOTRONIK, Inc.		Temperature: 23.3 °C	
Attendees: Roy Wang		Humidity: 37.3% RH	
Project: None		Barometric Pres.: 1028 mbar	
Tested by: Jeff Alcock		Power: Battery	
		Job Site: EV05	
TEST SPECIFICATIONS		Test Method	
FCC 15.247:2021		ANSI C63.10:2013	
COMMENTS			
Reference level offset includes: DC Block, 20 dB Attenuator, Measurement Cable and Manufacturers SMA to SWD patch cable.			
DEVIATIONS FROM TEST STANDARD			
None			
Configuration #	5	Signature 	
		Value dBm/3kHz	Limit < dBm/3kHz
BLE/GFSK 1 Mbps Low Channel, 2402 MHz		-8.734	8
BLE/GFSK 1 Mbps Mid Channel, 2442 MHz		-8.454	8
BLE/GFSK 1 Mbps High Channel, 2480 MHz		-8.576	8
			Results
			Pass
			Pass
			Pass

POWER SPECTRAL DENSITY

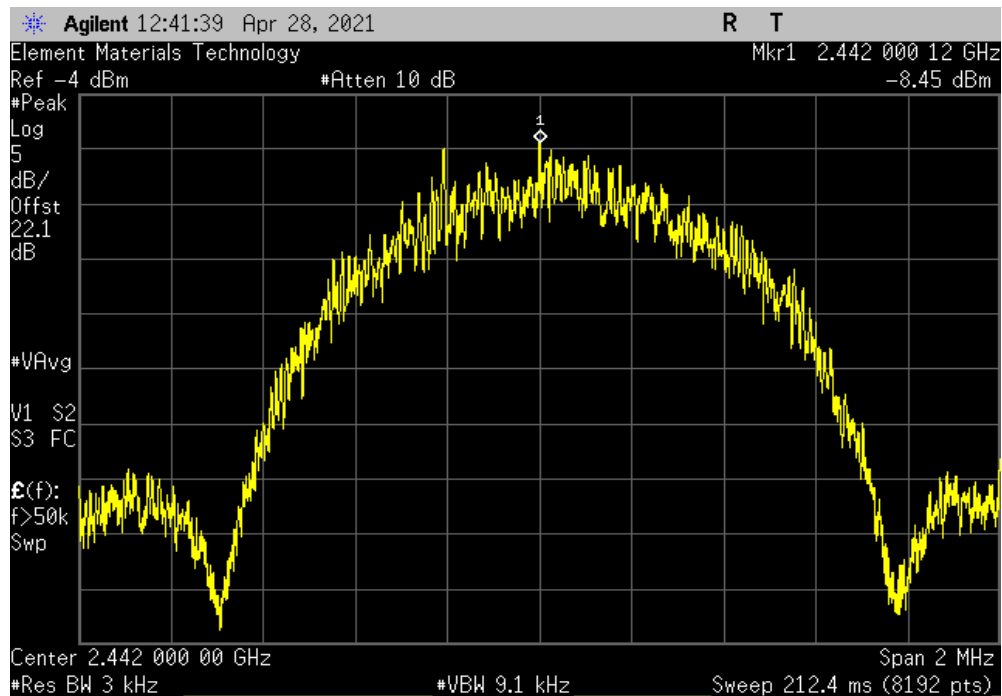


TbTx 2019.08.30.0 XMt 2020.12.30.0

BLE/GFSK 1 Mbps Low Channel, 2402 MHz						
	Value	Limit	Results			
	dBm/3kHz	< dBm/3kHz				
	-8.734	8	Pass			



BLE/GFSK 1 Mbps Mid Channel, 2442 MHz						
	Value	Limit	Results			
	dBm/3kHz	< dBm/3kHz				
	-8.454	8	Pass			

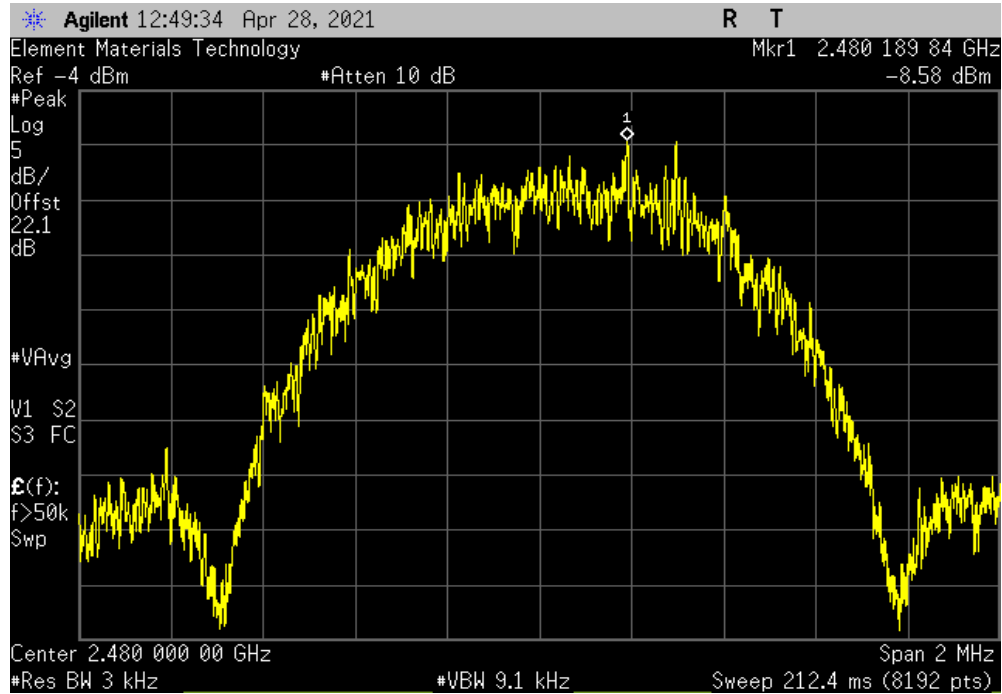


POWER SPECTRAL DENSITY



TbTx 2019.08.30.0 XMt 2020.12.30.0

BLE/GFSK 1 Mbps High Channel, 2480 MHz						
	Value	Limit	Results			
	dBm/3kHz	< dBm/3kHz				
	-8.576	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
Analyzer - Spectrum Analyzer	Agilent	E4440A	AFE	2021-04-08	2022-04-08
Cable	Micro-Coax	UFD150A-1-0720-200200	EVH	2021-03-14	2022-03-14
Attenuator	S.M. Electronics	SA26B-20	AUY	2021-03-14	2022-03-14
Block - DC	Fairview Microwave	SD3379	AMW	2021-03-14	2022-03-14
Generator - Signal	Keysight	N5182B	TFU	2020-11-20	2022-11-20

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



TbTx 2019.08.30.0 XMI 2020.12.30.0

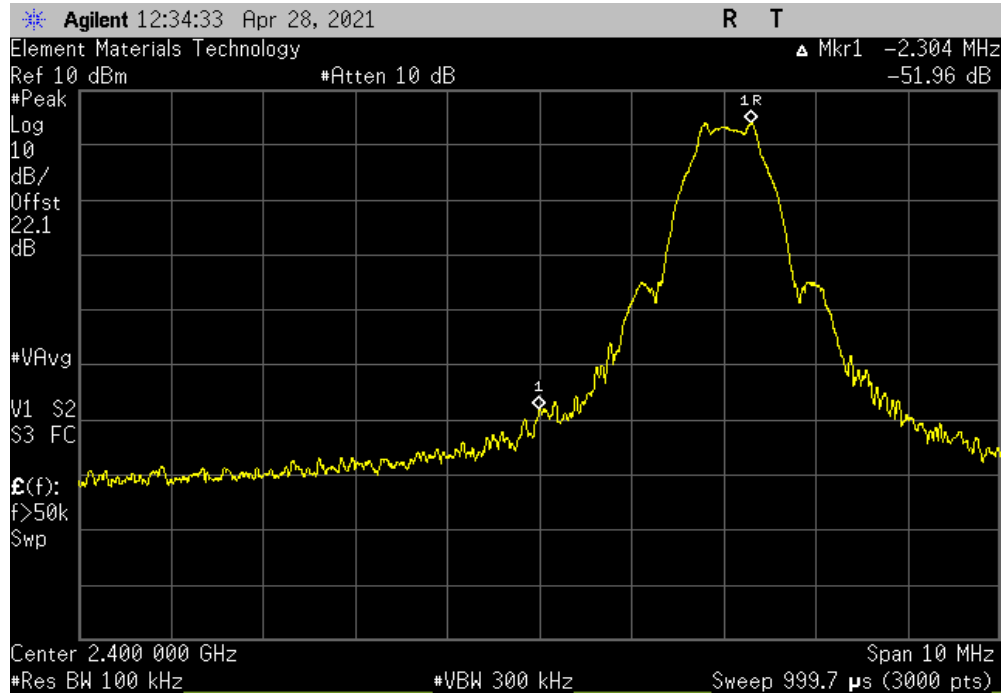
EUT: Neuro SCS Trial Stimulator		Work Order: BIOT0085	
Serial Number: 91820147		Date: 28-Apr-21	
Customer: BIOTRONIK, Inc.		Temperature: 23.3 °C	
Attendees: Roy Wang		Humidity: 37.3% RH	
Project: None		Barometric Pres.: 1028 mbar	
Tested by: Jeff Alcock		Power: Battery	
		Job Site: EV05	
TEST SPECIFICATIONS		Test Method	
FCC 15.247:2021		ANSI C63.10:2013	
COMMENTS			
Reference level offset includes: DC Block, 20 dB Attenuator, Measurement Cable and Manufacturers SMA to SWD patch cable.			
DEVIATIONS FROM TEST STANDARD			
None			
Configuration #	5	Signature 	
		Value (dBc)	Limit ≤ (dBc) Result
BLE/GFSK 1 Mbps Low Channel, 2402 MHz		-51.96	-20 Pass
BLE/GFSK 1 Mbps High Channel, 2480 MHz		-59.2	-20 Pass

BAND EDGE COMPLIANCE

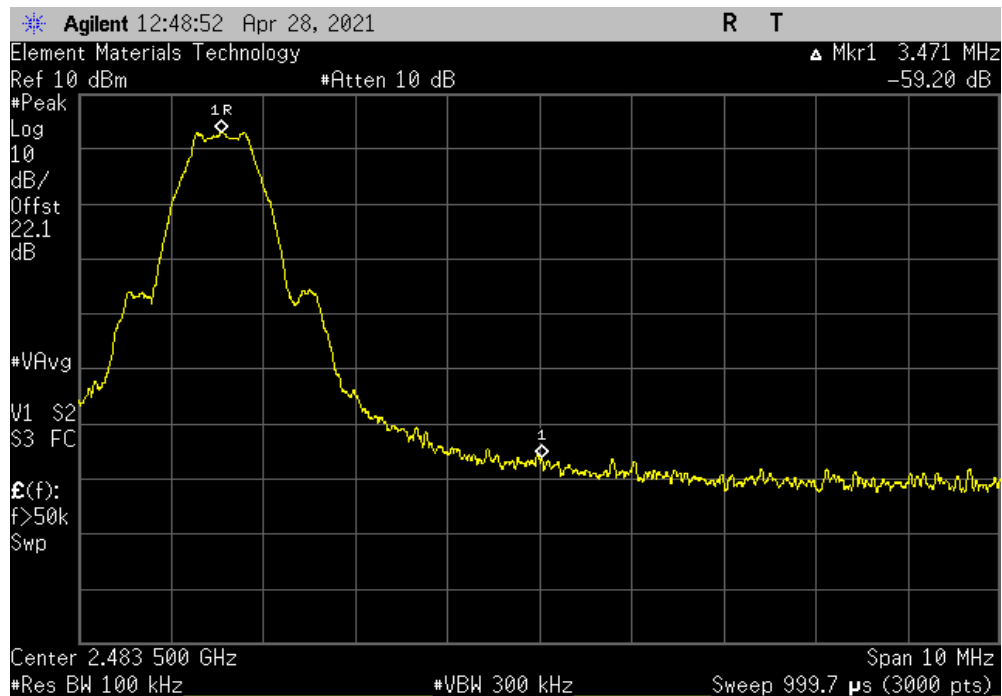


TuTt 2019.08.30.0 XMt 2020.12.30.0

BLE/GFSK 1 Mbps Low Channel, 2402 MHz						
				Value (dBc)	Limit ≤ (dBc)	Result
				-51.96	-20	Pass



BLE/GFSK 1 Mbps High Channel, 2480 MHz						
				Value (dBc)	Limit ≤ (dBc)	Result
				-59.2	-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
Analyzer - Spectrum Analyzer	Agilent	E4440A	AFE	2021-04-08	2022-04-08
Cable	Micro-Coax	UFD150A-1-0720-200200	EVH	2021-03-14	2022-03-14
Attenuator	S.M. Electronics	SA26B-20	AUY	2021-03-14	2022-03-14
Block - DC	Fairview Microwave	SD3379	AMW	2021-03-14	2022-03-14
Generator - Signal	Keysight	N5182B	TFU	2020-11-20	2022-11-20

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



TstTx 2019.08.30.0 XMI 2020.12.30.0

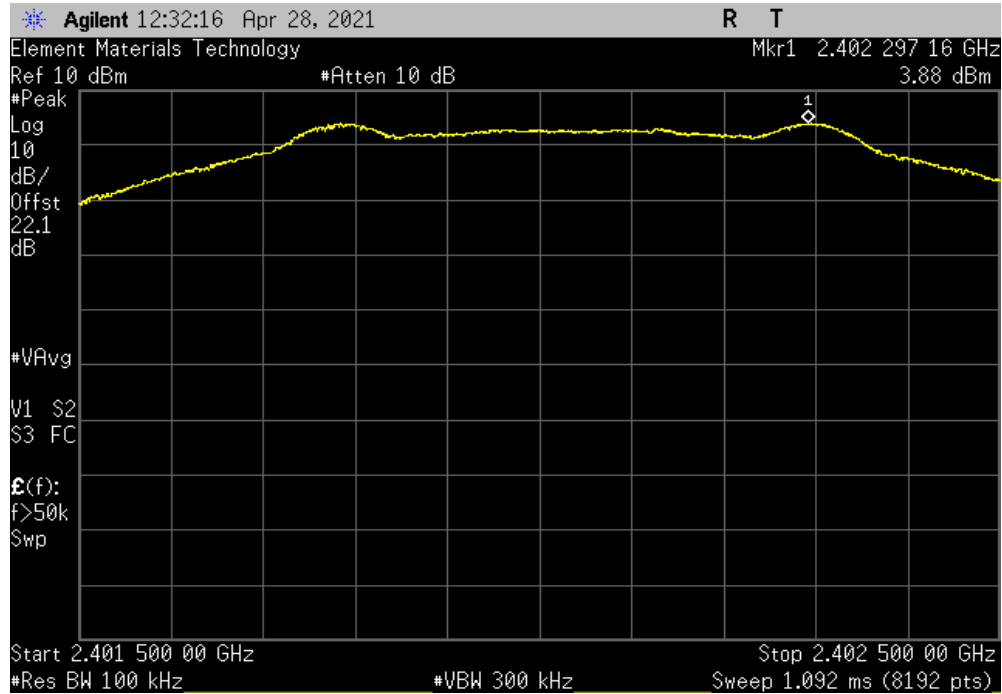
EUT: Neuro SCS Trial Stimulator		Work Order: BIOT0085	
Serial Number: 91820147		Date: 28-Apr-21	
Customer: BIOTRONIK, Inc.		Temperature: 23.3 °C	
Attendees: Roy Wang		Humidity: 37.3% RH	
Project: None		Barometric Pres.: 1028 mbar	
Tested by: Jeff Alcock		Power: Battery	
		Job Site: EV05	
TEST SPECIFICATIONS		Test Method	
FCC 15.247:2021		ANSI C63.10:2013	
COMMENTS			
Reference level offset includes: DC Block, 20 dB Attenuator, Measurement Cable and Manufacturers SMA to SWD patch cable.			
DEVIATIONS FROM TEST STANDARD			
None			
Configuration #	5	Signature	
		Frequency Range	Measured Freq (MHz)
BLE/GFSK 1 Mbps Low Channel, 2402 MHz		Fundamental	2402.3
BLE/GFSK 1 Mbps Low Channel, 2402 MHz		30 MHz - 12.5 GHz	7967.8
BLE/GFSK 1 Mbps Low Channel, 2402 MHz		12.5 GHz - 25 GHz	24943.5
BLE/GFSK 1 Mbps Mid Channel, 2442 MHz		Fundamental	2441.78
BLE/GFSK 1 Mbps Mid Channel, 2442 MHz		30 MHz - 12.5 GHz	7425.8
BLE/GFSK 1 Mbps Mid Channel, 2442 MHz		12.5 GHz - 25 GHz	24082.8
BLE/GFSK 1 Mbps High Channel, 2480 MHz		Fundamental	2480.04
BLE/GFSK 1 Mbps High Channel, 2480 MHz		30 MHz - 12.5 GHz	7441.1
BLE/GFSK 1 Mbps High Channel, 2480 MHz		12.5 GHz - 25 GHz	24861.1
		Max Value (dBc)	Limit ≤ (dBc)
		N/A	N/A
		-59.44	-20
		-56.27	-20
		N/A	N/A
		-60.17	-20
		-56.67	-20
		N/A	N/A
		-57.7	-20
		-55.56	-20
			Result
			N/A
			Pass
			Pass
			N/A
			Pass
			Pass
			Pass

SPURIOUS CONDUCTED EMISSIONS

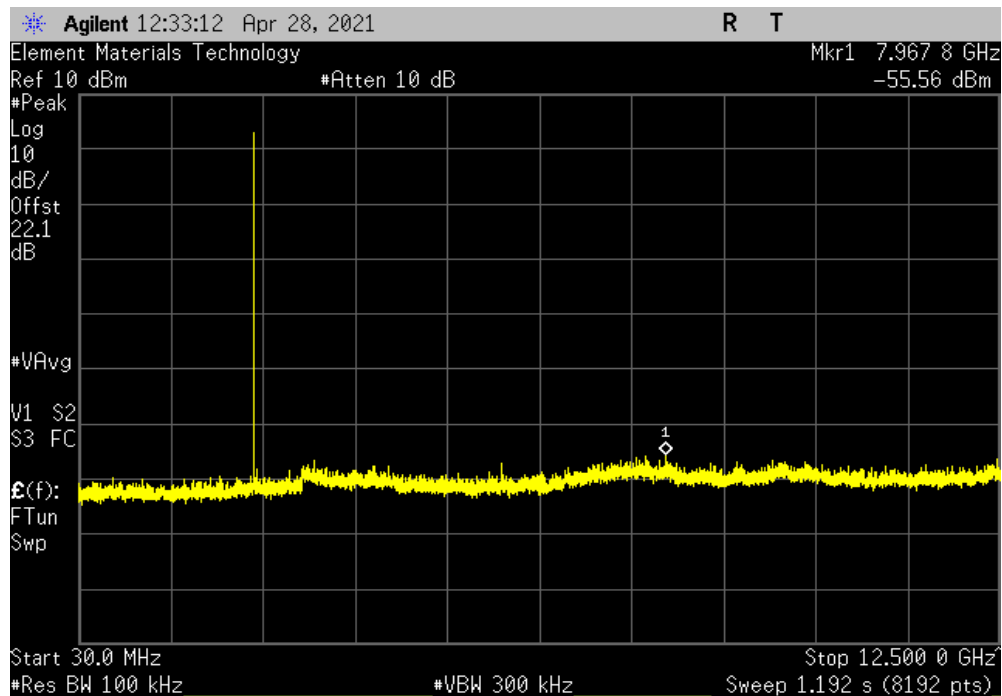


TbTx 2019.08.30.0 XMt 2020.12.30.0

BLE/GFSK 1 Mbps Low Channel, 2402 MHz						
Frequency Range		Measured Freq (MHz)	Max Value (dBc)	Limit ≤ (dBc)	Result	
Fundamental		2402.3	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		7967.8	-59.44	-20	Pass	

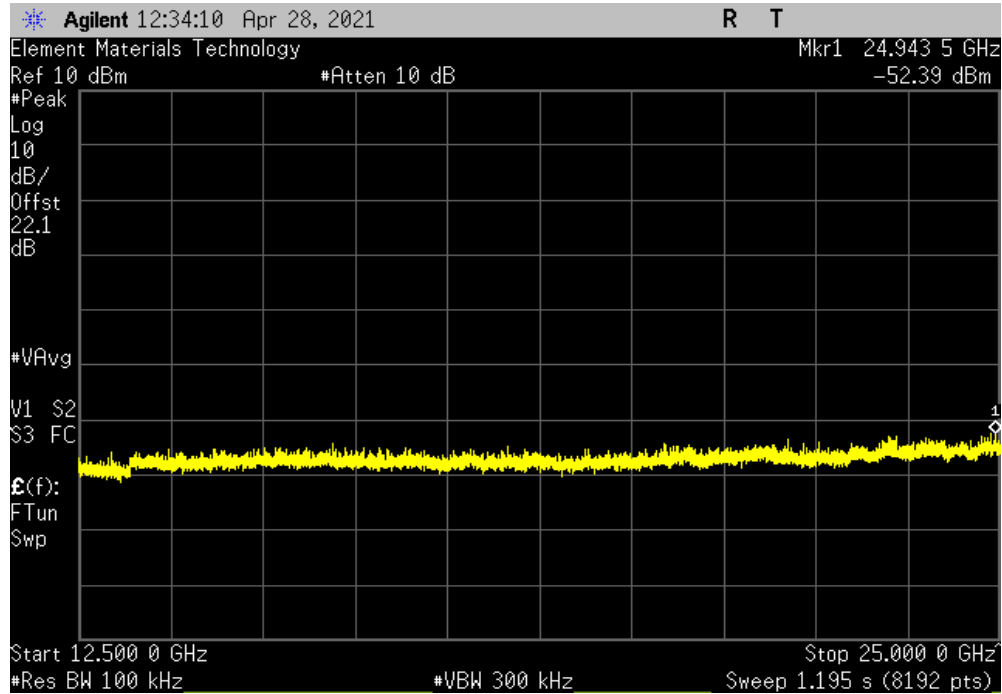


SPURIOUS CONDUCTED EMISSIONS

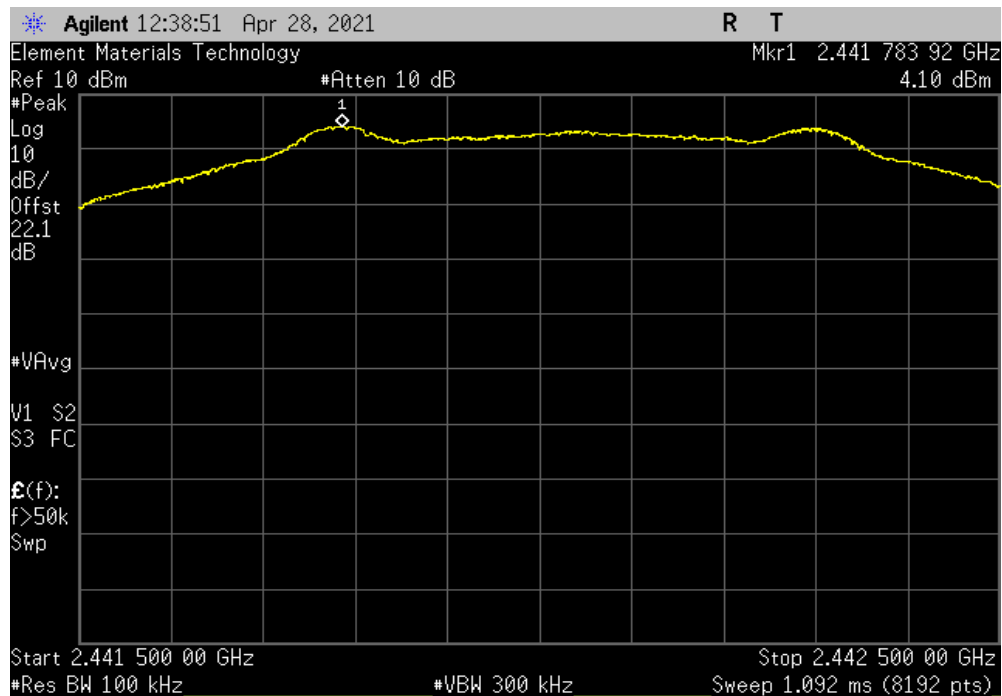


TuTx 2019.08.30.0 XMt 2020.12.30.0

BLE/GFSK 1 Mbps Low Channel, 2402 MHz					
Frequency Range	Measured Freq (MHz)	Max Value (dBc)	Limit ≤ (dBc)	Result	
12.5 GHz - 25 GHz	24943.5	-56.27	-20	Pass	



BLE/GFSK 1 Mbps Mid Channel, 2442 MHz					
Frequency Range	Measured Freq (MHz)	Max Value (dBc)	Limit ≤ (dBc)	Result	
Fundamental	2441.78	N/A	N/A	N/A	

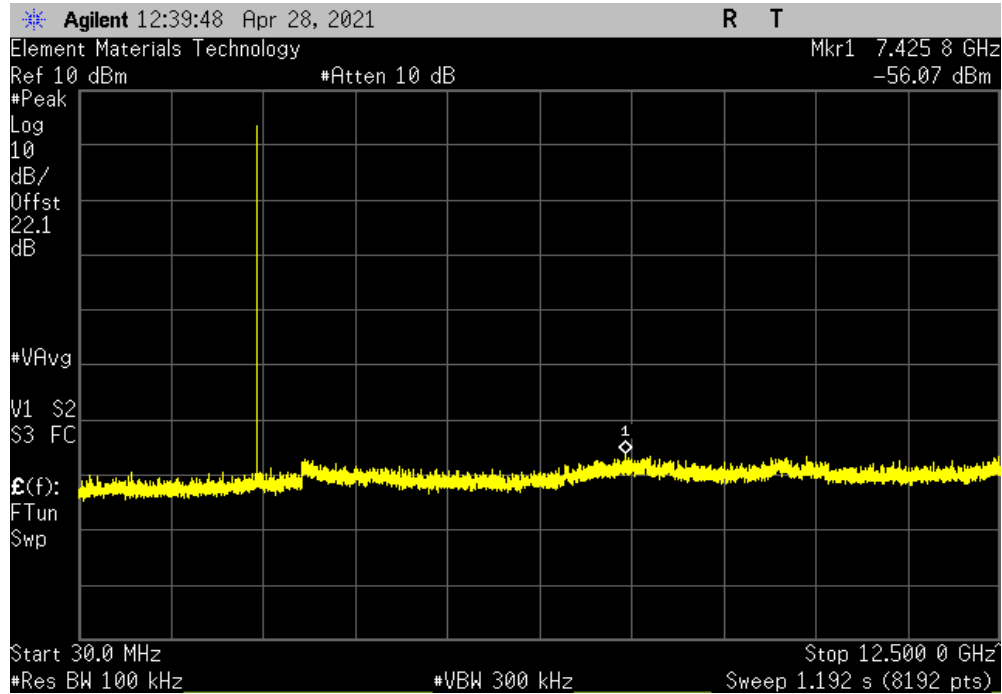


SPURIOUS CONDUCTED EMISSIONS

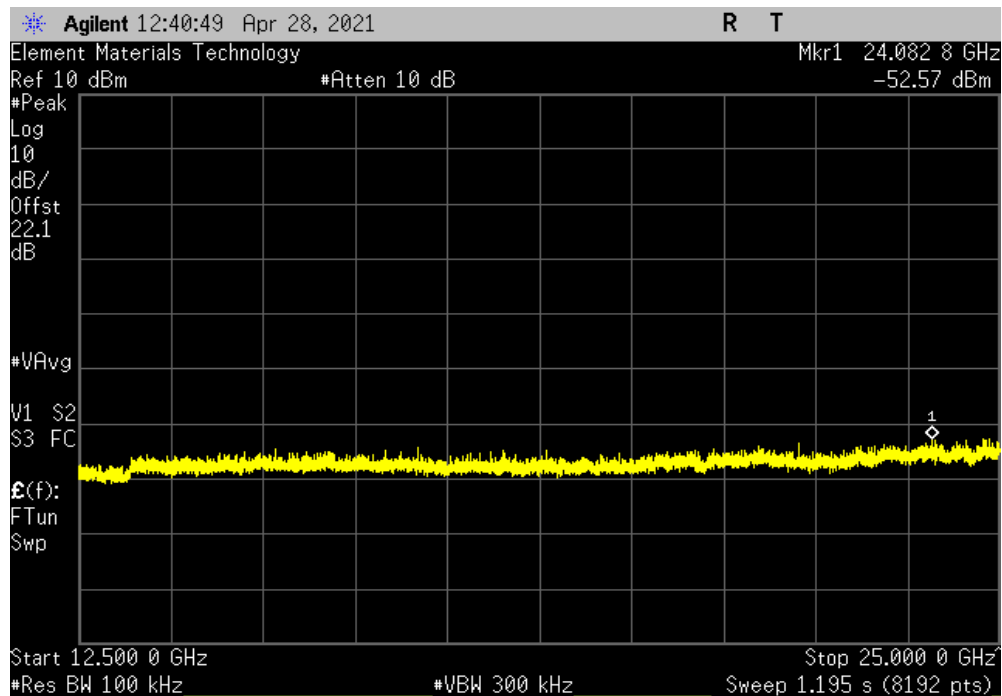


TbTx 2019.08.30.0 XMt 2020.12.30.0

BLE/GFSK 1 Mbps Mid Channel, 2442 MHz					
Frequency Range	Measured Freq (MHz)	Max Value (dBc)	Limit ≤ (dBc)	Result	
30 MHz - 12.5 GHz	7425.8	-60.17	-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	24082.8	-56.67	-20	Pass	

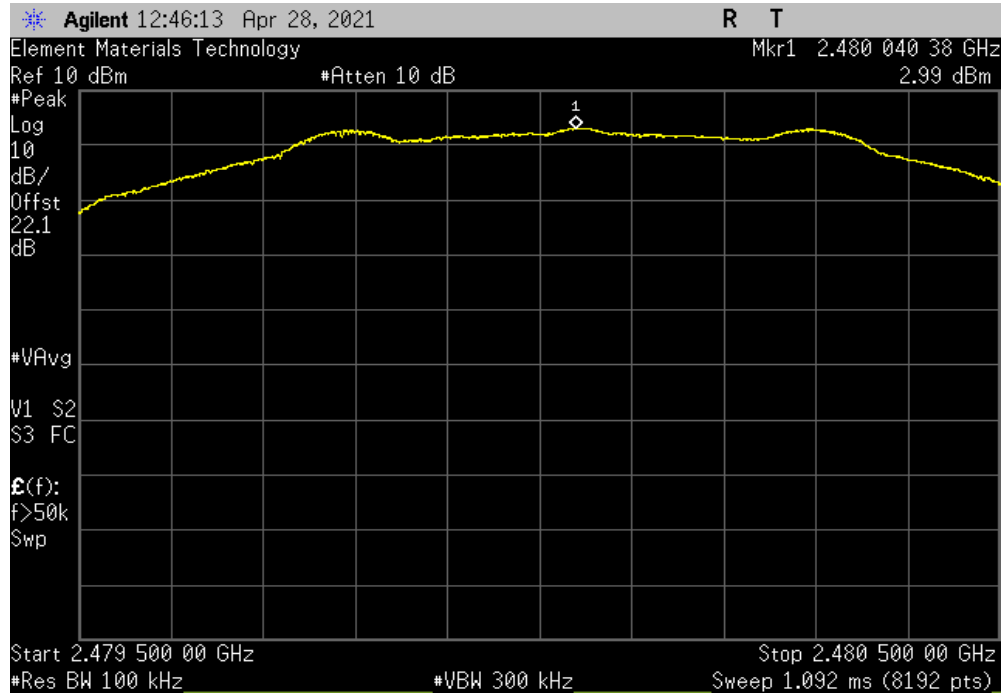


SPURIOUS CONDUCTED EMISSIONS

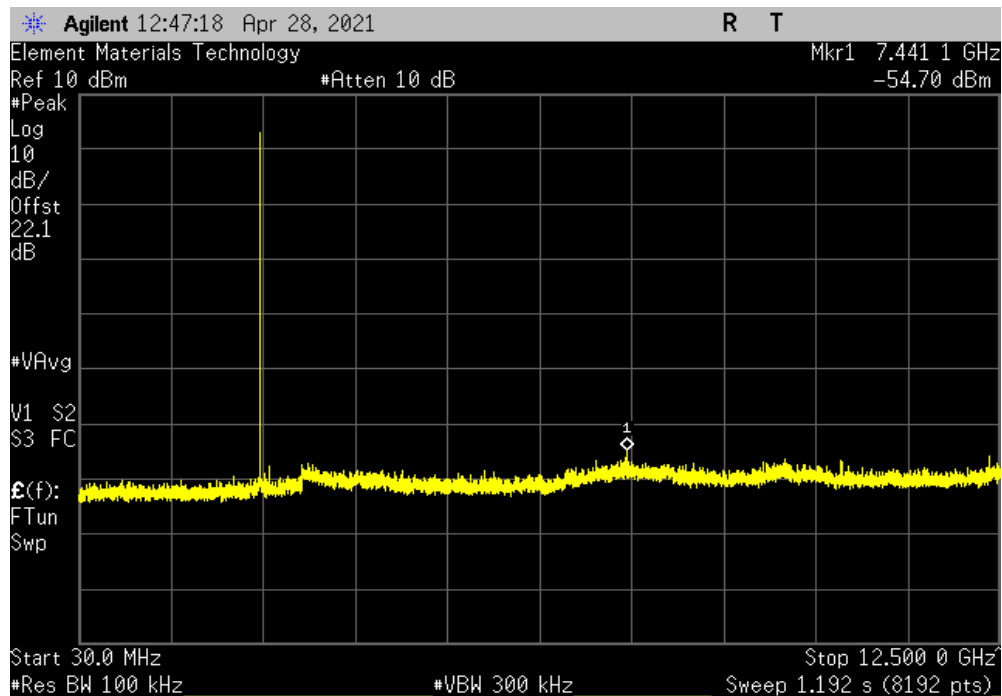


TbTx 2019.08.30.0 XMt 2020.12.30.0

BLE/GFSK 1 Mbps High Channel, 2480 MHz					
Frequency Range	Measured Freq (MHz)	Max Value (dBc)	Limit ≤ (dBc)	Result	
Fundamental	2480.04	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	7441.1	-57.7	-20	Pass	

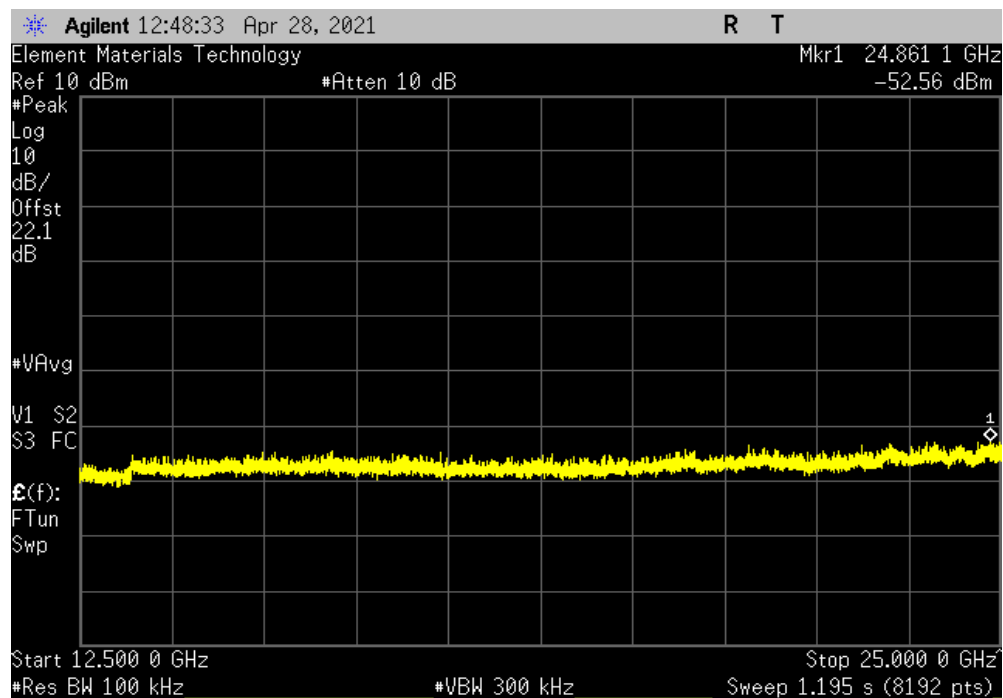


SPURIOUS CONDUCTED EMISSIONS



TuTx 2019.08.30.0 XMt 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	24861.1	-55.56	-20	Pass	



End of Test Report