Supra, A Division of UTCFS

TRAC-Mini Controller

FCC 15.207:2018

FCC 15.247:2018

Bluetooth LE (DTS) Radio

Report # SUPR0237.1

NVLAP Lab Code: 200630-0

CERTIFICATE OF TEST

2017-1-25

Last Date of Test: January 25, 2018
Supra, A Division of UTCFS
Model: TRAC-Mini Controller

Radio Equipment Testing

Standards

Specification	Method
FCC 15.207:2018	ANSI C63.10:2013
FCC 15.247:2018	

Results

Method Clause	Test Description	Applied	Results	Comments
6.5, 6.6, 11.12.1, 11.13.2	Spurious Radiated Emissions	Yes	Pass	
6.2	Powerline Conducted Emissions	Yes	Pass	
11.6	Duty Cycle	Yes	Pass	
11.8.2	Occupied Bandwidth	Yes	Pass	
11.9.1.1	Output Power	Yes	Pass	
11.10.2	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.

REVISION HISTORY

Revision Number	Description	Date	Page Number
00	None		
01	Cover Page and Certificate of Test changed to reflect FCC 15.207:2018.	11-18-2018	1 & 2

ACCREDITATIONS AND AUTHORIZATIONS

2017.6.12

United States

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

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

NVLAP - Each laboratory is accredited by NVLAP to ISO 17025

Canada

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

European Union

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

Australia/New Zealand

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

Korea

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

Japan

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

Taiwan

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

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

Singapore

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

Israel

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

Hong Kong

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

Vietnam

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

SCOPE

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

MEASUREMENT UNCERTAINTY

TMU.2015.07.10

Measurement Uncertainty

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

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

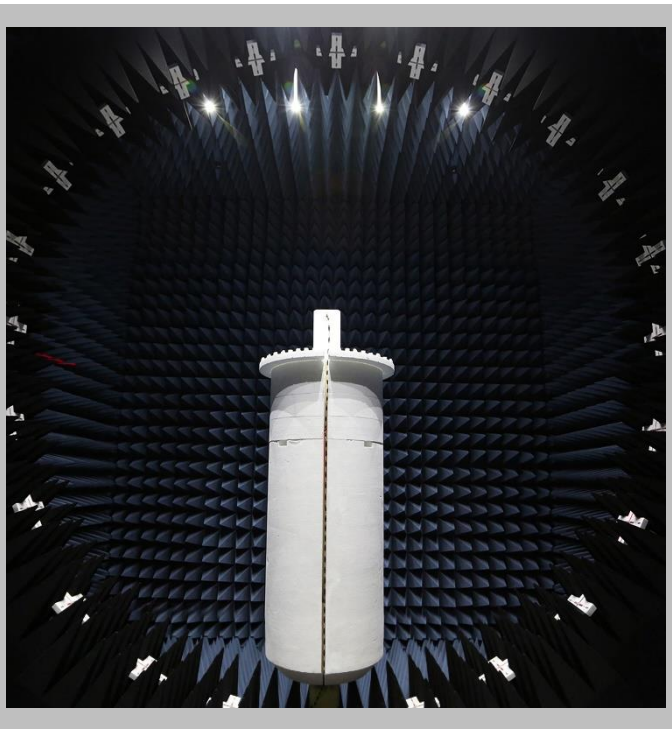
The following table represents the Measurement Uncertainty (MU) budgets for each of the tests that may be contained in this report.

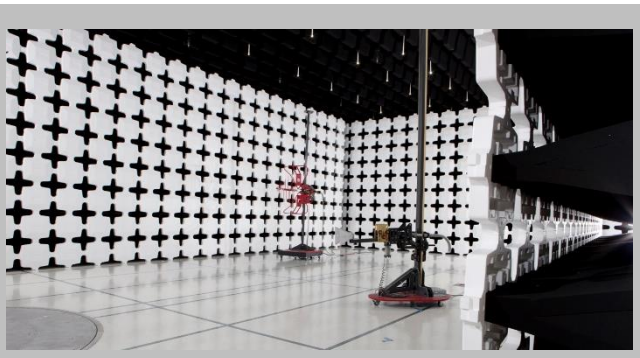
Test	+ MU	- MU
Frequency Accuracy (Hz)	0.0007%	-0.0007%
Amplitude Accuracy (dB)	1.2 dB	-1.2 dB
Conducted Power (dB)	0.3 dB	-0.3 dB
Radiated Power via Substitution (dB)	0.7 dB	-0.7 dB
Temperature (degrees C)	0.7°C	-0.7°C
Humidity (% RH)	2.5% RH	-2.5% RH
Voltage (AC)	1.0%	-1.0%
Voltage (DC)	0.7%	-0.7%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

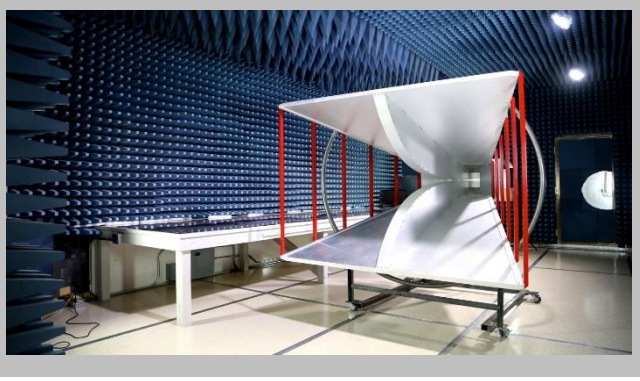
FACILITIES

2017.9.15

California	Minnesota	New York	Oregon	Texas	Washington
Labs OC01-17 41 Tesla Irvine, CA 92618 (949) 861-8918	Labs MN01-10 9349 W Broadway Ave. Brooklyn Park, MN 55445 (612)-638-5136	Labs NY01-04 4939 Jordan Rd. Elbridge, NY 13060 (315) 554-8214	Labs EV01-12 6775 NE Evergreen Pkwy #400 Hillsboro, OR 97124 (503) 844-4066	Labs TX01-09 3801 E Plano Pkwy Plano, TX 75074 (469) 304-5255	Labs NC01-05 19201 120th Ave NE Bothell, WA 98011 (425)984-6600
NVLAP					
NVLAP Lab Code: 200676-0	NVLAP Lab Code: 200881-0	NVLAP Lab Code: 200761-0	NVLAP Lab Code: 200630-0	NVLAP Lab Code:201049-0	NVLAP Lab Code: 200629-0
Innovation, Science and Economic Development Canada					
2834B-1, 2834B-3	2834E-1, 2834E-3	N/A	2834D-1, 2834D-*2*	2834G-1	2834F-1
BSMI					
SL2-IN-E-1154R	SL2-IN-E-1152R	N/A	SL2-IN-E-1017	SL2-IN-E-1158R	SL2-IN-E-1153R
VCCI					
A-0029	A-0109	N/A	A-0108	A-0201	A-0110
Recognized Phase I CAB for ACMA, BSMI, IDA, KCC/RRA, MIC, MOC, NCC, OFCA					
US0158	US0175	N/A	US0017	US0191	US0157

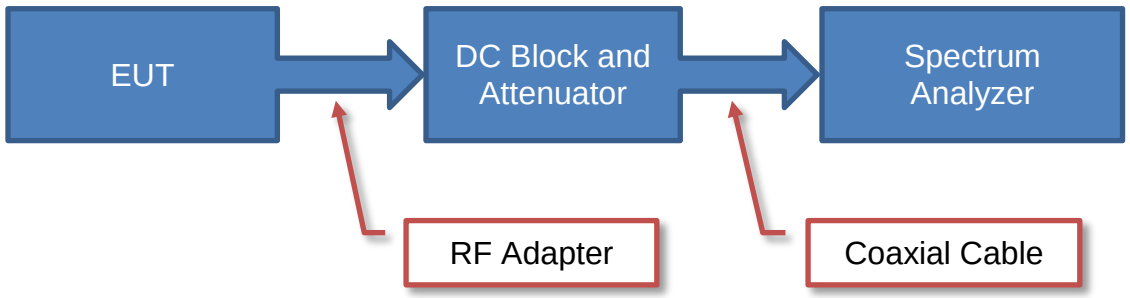




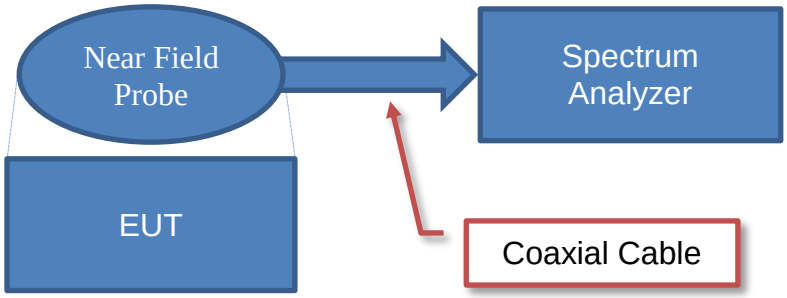


Test Setup Block Diagrams

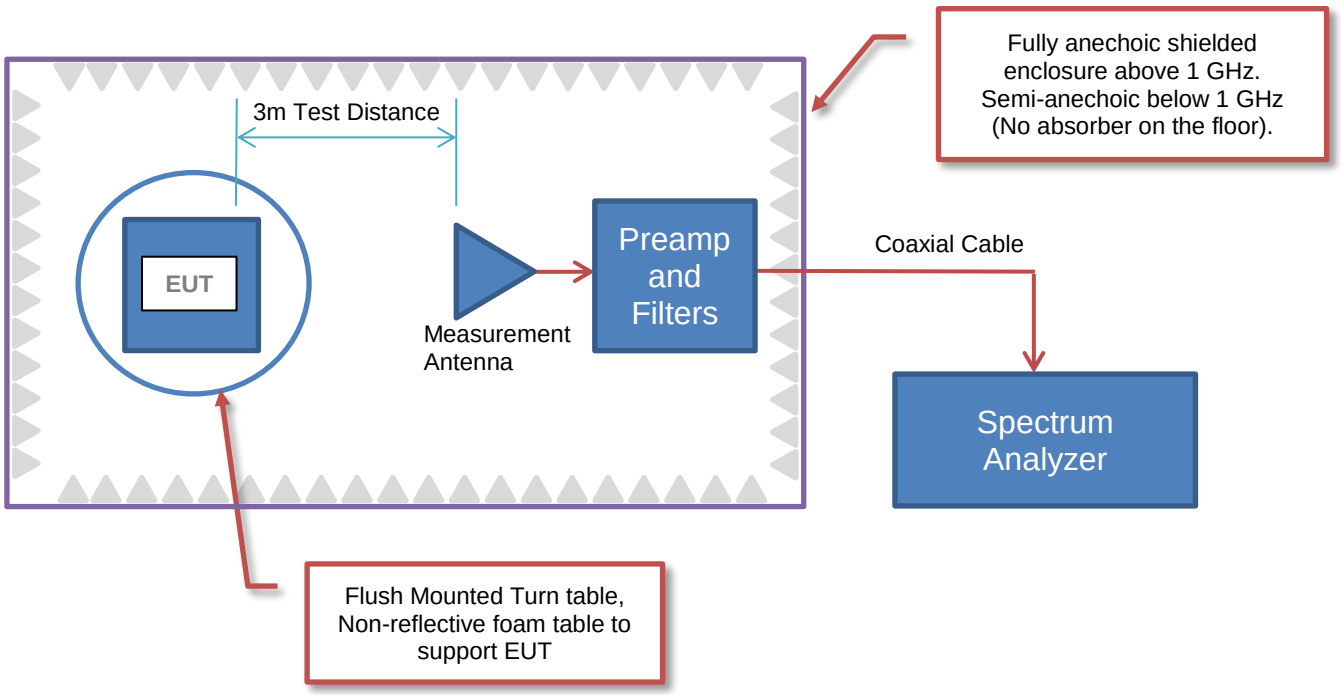
Antenna Port Conducted Measurements



Near Field Test Fixture Measurements



Spurious Radiated Emissions



PRODUCT DESCRIPTION

Client and Equipment Under Test (EUT) Information

Company Name:	Supra, A Division of UTCFS
Address:	4001 Fairview Industrial Dr SE
City, State, Zip:	Salem, OR 97302
Test Requested By:	Dean Sinn
Model:	TRAC-Mini Controller
First Date of Test:	September 9, 2017
Last Date of Test:	January 25, 2018
Receipt Date of Samples:	August 28, 2017
Equipment Design Stage:	Production
Equipment Condition:	No Damage
Purchase Authorization:	Verified

Information Provided by the Party Requesting the Test

Functional Description of the EUT:
TRACcess Bluetooth Controller

Testing Objective:
To demonstrate compliance of the Bluetooth Low Energy radio to FCC 15.247 requirements.

CONFIGURATIONS

Configuration SUPR0187- 2

Software/Firmware Running during test	
Description	**Version**
Murata BT Test Commands	None

EUT			
Description	**Manufacturer**	**Model/Part Number**	**Serial Number**
TRACcess Bluetooth Controller	Supra, A Division of UTCFS	TRAC-Mini Controller/ 10105244G1	7450

Remote Equipment Outside of Test Setup Boundary			
Description	**Manufacturer**	**Model/Part Number**	**Serial Number**
Laptop	Dell	Precision	Unknown
IR Programming Base	Supra, A Division of UTCFS	60703	60003369
Class 2 Power Supply	LEI	410905OO3CT	None
Linear DC Power Supply	Topward Electric Instruments Co., LTD.	TPS-2000	None

Cables					
Cable Type	**Shield**	**Length (m)**	**Ferrite**	**Connection 1**	**Connection 2**
DC Power	No	1.0 m	No	DC Power	TRACcess Bluetooth Controller
Switch	No	1.0 m	No	TRACcess Bluetooth Controller	Unterminated
I/O	No	1.0 m	No	TRACcess Bluetooth Controller	Unterminated
Serial to USB	Yes	1.0 m	No	Laptop	IR Programming Base
DC Power	No	1.5 m	No	IR Programming Base	Class 2 Power Supply
AC Power	No	1.8 m	No	AC Mains	Linear DC Power Supply

CONFIGURATIONS

Configuration SUPR0237- 2

Software/Firmware Running during test	
Description	**Version**
Excel - BLE Test Spreadsheet	None

EUT			
Description	**Manufacturer**	**Model/Part Number**	**Serial Number**
TRACcess Bluetooth Controller	Supra, A Division of UTCFS	TRAC-Mini Controller/ 10105244G1	45000000
TRACcess Bluetooth Controller Switch Plate	Supra, A Division of UTCFS	TRAC-Mini Controller/ 10105244G1	45000000

Remote Equipment Outside of Test Setup Boundary			
Description	**Manufacturer**	**Model/Part Number**	**Serial Number**
IR Programming Base	Supra, A Division of UTCFS	60703	60001657
Class 2 Power Supply	LEI	410905OO3CT	None
Laptop	Dell	Latitude E6410	17112572713

Cables					
Cable Type	**Shield**	**Length (m)**	**Ferrite**	**Connection 1**	**Connection 2**
I/O	No	0.9 m	No	TRACcess Bluetooth Controller	Unterminated
Switch	No	0.1 m	No	TRACcess Bluetooth Controller	TRACcess Bluetooth Controller Switch Plate
Serial to USB	Yes	1.0 m	No	Laptop	IR Programming Base
DC Power	No	1.5 m	No	IR Programming Base	Class 2 Power Supply

CONFIGURATIONS

Configuration SUPR0237- 3

Software/Firmware Running during test	
Description	**Version**
Excel - BLE Test Spreadsheet	None

EUT			
Description	**Manufacturer**	**Model/Part Number**	**Serial Number**
TRACcess Bluetooth Controller	Supra, A Division of UTCFS	TRAC-Mini Controller/ 10105244G1	6062

Remote Equipment Outside of Test Setup Boundary			
Description	**Manufacturer**	**Model/Part Number**	**Serial Number**
IR Programming Base	Supra, A Division of UTCFS	60703	60001657
Class 2 Power Supply	LEI	410905OO3CT	None
Laptop	Dell	Latitude E6410	17112572713

Cables					
Cable Type	**Shield**	**Length (m)**	**Ferrite**	**Connection 1**	**Connection 2**
Switch	No	0.1 m	No	TRACcess Bluetooth Controller	Unterminated
Serial to USB	Yes	1.0 m	No	Laptop	IR Programming Base
DC Power	No	1.5 m	No	IR Programming Base	Class 2 Power Supply

MODIFICATIONS

Equipment Modifications

Item	Date	Test	Modification	Note	Disposition of EUT
1	9/6/2017	Powerline 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.
2	1/19/2018	Spurious Radiated Emissions	Tested as delivered to Test Station.	No EMI suppression devices were added or modified during this test.	EUT remained at Element following the test.
3	1/25/2018	Duty Cycle	Tested as delivered to Test Station.	No EMI suppression devices were added or modified during this test.	EUT remained at Element following the test.
4	1/25/2018	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.
5	1/25/2018	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.
6	1/25/2018	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.
7	1/25/2018	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.
8	1/25/2018	Spurious Conducted Emissions	Tested as delivered to Test Station.	No EMI suppression devices were added or modified during this test.	Scheduled testing was completed.

SPURIOUS RADIATED EMISSIONS

PSA-ESCI 2017.09.18

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

Bluetooth Low Energy continuous Tx, Low channel = 2402 MHz, Mid channel = 2440 MHz, High channel = 2480 MHz., Power setting 0x0F.

POWER SETTINGS INVESTIGATED

Battery

CONFIGURATIONS INVESTIGATED

SUPR0237 - 2

FREQUENCY RANGE INVESTIGATED

Start Frequency	30 MHz	Stop Frequency	26500 MHz

SAMPLE CALCULATIONS

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

TEST EQUIPMENT

Description	Manufacturer	Model	ID	Last Cal.	Interval
Cable	ESM Cable Corp.	KNKN-72 SMA Cable	EVZ	10-Jun-2017	12 mo
Amplifier - Pre-Amplifier	Miteq	JSW45-26004000-40-5P	PAE	10-Jun-2017	12 mo
Antenna - Standard Gain	ETS Lindgren	3160-09	AIV	NCR	0 mo
Power Sensor	Gigatronics	80701A	SPL	26-Apr-2017	12 mo
Filter - Low Pass	Micro-Tronics	LPM50004	LFD	19-Apr-2017	12 mo
Attenuator	Coaxicom	3910-20	AXZ	19-Apr-2017	12 mo
Cable	None	Standard Gain Horns Cable	EVF	30-Nov-2017	12 mo
Cable	N/A	Double Ridge Horn Cables	EVB	29-Nov-2017	12 mo
Cable	N/A	Bilog Cables	EVA	30-Nov-2017	12 mo
Antenna - Double Ridge	EMCO	3115	AHC	23-Jun-2016	24 mo
Generator - Signal	Keysight	N5182B	TFU	27-Oct-2015	36 mo
Filter - High Pass	Micro-Tronics	HPM50111	HFO	6-Feb-2017	12 mo
Amplifier - Pre-Amplifier	Miteq	AMF-6F-12001800-30-10P	AVD	30-Nov-2017	12 mo
Amplifier - Pre-Amplifier	L-3 Narda-MITEQ	AMF-6F-08001200-30-10P	PAO	30-Nov-2017	12 mo
Amplifier - Pre-Amplifier	Miteq	AMF-3D-00100800-32-13P	PAG	29-Nov-2017	12 mo
Amplifier - Pre-Amplifier	Miteq	AM-1616-1000	AOL	30-Nov-2017	12 mo
Meter - Power	Gigatronics	8651A	SPM	19-Dec-2017	12 mo
Attenuator	S.M. Electronics	SA18N-06/SM4032	REE	6-Sep-2017	12 mo
Antenna - Standard Gain	ETS Lindgren	3160-08	AHV	NCR	0 mo
Antenna - Standard Gain	ETS Lindgren	3160-07	AHU	NCR	0 mo
Antenna - Double Ridge	ETS Lindgren	3115	AIZ	3-Feb-2016	24 mo
Antenna - Biconilog	Teseq	CBL 6141B	AXR	30-Jun-2016	24 mo
Analyzer - Spectrum Analyzer	Keysight	N9010A	AFN	13-Apr-2017	12 mo

TEST DESCRIPTION

The highest gain antenna of each type to be used with the EUT was tested. The EUT was configured for the required transmit frequencies and the modes as showed in the data sheets.

For each configuration, the spectrum was scanned throughout the specified range as part of the exploratory investigation of the emissions. These “pre-scans” are not included in the report. Final measurements on individual emissions were then made and included in this test report.

The individual emissions from the EUT were maximized by rotating the EUT on a turntable, adjusting the position of the EUT and EUT antenna in three orthogonal axis if required, and adjusting the measurement antenna height and polarization (per ANSI C63.10). A preamp and high pass filter (and notch filter) were used for this test in order to provide sufficient measurement sensitivity.

Measurements were made with the required detectors and annotated on the data for each individual point using the following annotation:

QP = Quasi-Peak Detector
PK = Peak Detector
AV = RMS Detector

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

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

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

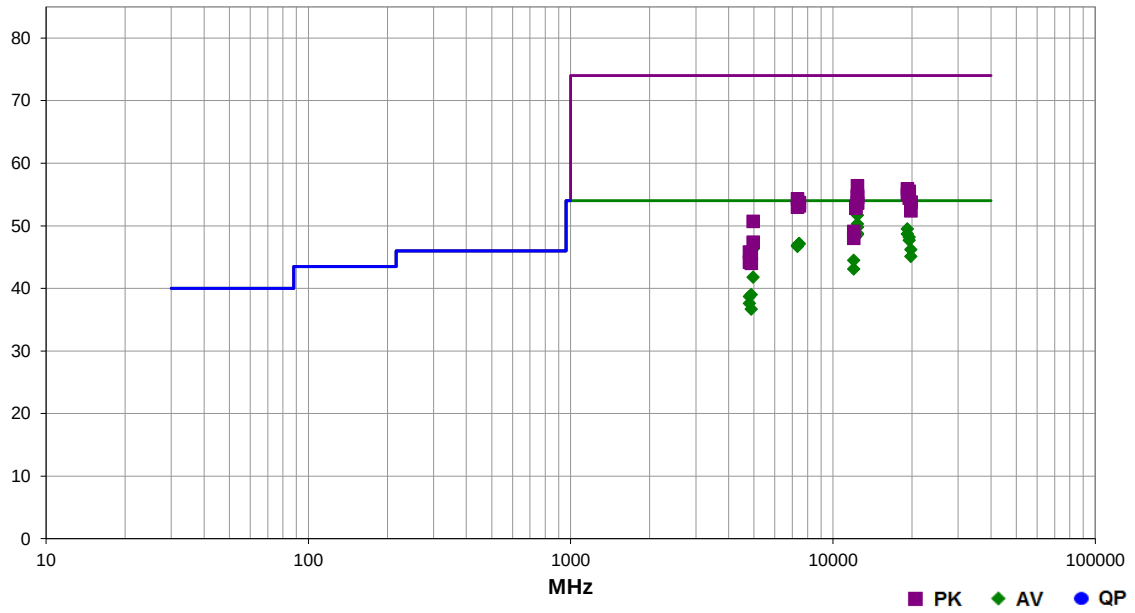
SPURIOUS RADIATED EMISSIONS

EmiR5 2017.09.18.2 PSA-ESCI 2017.09.18

Work Order:	SUPR0237	**Date:**	19-Jan-2018		
Project:	None	**Temperature:**	21.7 °C		
Job Site:	EV01	**Humidity:**	36.9% RH		
Serial Number:	None	**Barometric Pres.:**	1018 mbar	**Tested by:**	Jeff Alcoke & Jody House
EUT:	TRAC-Mini Controller				
Configuration:	2				
Customer:	Supra, A Division of UTCFS				
Attendees:	Dean Sinn				
EUT Power:	Battery				
Operating Mode:	Bluetooth Low Energy continuous Tx, Low channel = 2402 MHz, Mid channel = 2440 MHz, High channel = 2480 MHz., Power setting 0x0F.				
Deviations:	None				
Comments:	See comments below for channel and EUT orientation. The Radio was operating at a Duty Cycle (DC) of 51.3%. The Average data was corrected up by a Duty Cycle Correction Factor of 10*Log(DC) = 10*Log(0.513) = 2.9 dB				

Test Specifications	**Test Method**
FCC 15.247:2017	ANSI C63.10:2013

Run #	48	**Test Distance (m)**	3	**Antenna Height(s)**	1 to 4(m)	**Results**	Pass



Freq (MHz)	Amplitude (dBuV)	Factor (dB)	Antenna Height (meters)	Azimuth (degrees)	Duty Cycle Correction Factor (dB)	External Attenuation (dB)	Polarity/ Transducer Type	Detector	Distance Adjustment (dB)	Adjusted (dBuV/m)	Spec. Limit (dBuV/m)	Compared to Spec. (dB)	Comments
12398.910	47.6	1.2	1.0	160.0	2.9	0.0	Horz	AV	0.0	51.7	54.0	-2.3	High Channel, EUT Vertical
12398.900	46.2	1.2	1.0	219.0	2.9	0.0	Vert	AV	0.0	50.3	54.0	-3.7	High Channel, EUT on Side
12398.930	45.7	1.2	2.3	91.0	2.9	0.0	Vert	AV	0.0	49.8	54.0	-4.2	High Channel, EUT Horizontal
12398.940	45.7	1.2	2.7	43.0	2.9	0.0	Horz	AV	0.0	49.8	54.0	-4.2	High Channel, EUT Horizontal
19214.250	44.9	1.7	1.3	168.0	2.9	0.0	Horz	AV	0.0	49.5	54.0	-4.5	Low Channel, EUT Vertical
12398.920	44.7	1.2	1.0	46.0	2.9	0.0	Horz	AV	0.0	48.8	54.0	-5.2	High Channel, EUT on Side
19214.290	44.1	1.7	1.0	185.0	2.9	0.0	Vert	AV	0.0	48.7	54.0	-5.3	Low Channel, EUT on Side
12208.930	44.7	1.0	1.0	209.0	2.9	0.0	Vert	AV	0.0	48.6	54.0	-5.4	Mid Channel, EUT on Side
12398.910	44.5	1.2	1.0	43.0	2.9	0.0	Vert	AV	0.0	48.6	54.0	-5.4	High Channel, EUT Vertical
12208.880	44.4	1.0	1.0	173.0	2.9	0.0	Horz	AV	0.0	48.3	54.0	-5.7	Mid Channel, EUT Vertical
19534.220	43.5	1.8	1.3	172.0	2.9	0.0	Horz	AV	0.0	48.2	54.0	-5.8	Mid Channel, EUT Vertical
19534.300	43.0	1.8	1.0	180.0	2.9	0.0	Vert	AV	0.0	47.7	54.0	-6.3	Mid Channel, EUT on Side
7439.475	31.4	12.9	1.4	206.0	2.9	0.0	Horz	AV	0.0	47.2	54.0	-6.8	High Channel, EUT Vertical
7439.440	31.3	12.9	1.0	194.0	2.9	0.0	Vert	AV	0.0	47.1	54.0	-6.9	High Channel, EUT on Side
7325.510	31.8	12.2	1.2	206.0	2.9	0.0	Horz	AV	0.0	46.9	54.0	-7.1	Mid Channel, EUT Vertical
7325.358	31.6	12.2	1.0	206.0	2.9	0.0	Vert	AV	0.0	46.7	54.0	-7.3	Mid Channel, EUT on Side
4959.837	38.2	5.2	1.0	323.0	2.9	0.0	Vert	AV	0.0	46.3	54.0	-7.7	High Channel, EUT on Side
19838.250	41.4	1.9	1.3	170.0	2.9	0.0	Horz	AV	0.0	46.2	54.0	-7.8	High Channel, EUT Vertical
19838.280	40.3	1.9	1.0	180.0	2.9	0.0	Vert	AV	0.0	45.1	54.0	-8.9	High Channel, EUT on Side
12008.890	40.6	1.0	1.0	312.0	2.9	0.0	Vert	AV	0.0	44.5	54.0	-9.5	Low Channel, EUT on Side
12008.890	39.2	1.0	1.0	160.0	2.9	0.0	Horz	AV	0.0	43.1	54.0	-10.9	Low Channel, EUT Vertical
4959.813	33.7	5.2	1.1	227.0	2.9	0.0	Horz	AV	0.0	41.8	54.0	-12.2	High Channel, EUT Vertical

Freq (MHz)	Amplitude (dBuV)	Factor (dB)	Antenna Height (meters)	Azimuth (degrees)	Duty Cycle Correction Factor (dB)	External Attenuation (dB)	Polarity/ Transducer Type	Detector	Distance Adjustment (dB)	Adjusted (dBuV/m)	Spec. Limit (dBuV/m)	Compared to Spec. (dB)	Comments
4883.802	31.0	5.1	1.0	297.0	2.9	0.0	Vert	AV	0.0	39.0	54.0	-15.0	Mid Channel, EUT on Side
4803.720	32.0	3.8	1.0	325.0	2.9	0.0	Vert	AV	0.0	38.7	54.0	-15.3	Low Channel, EUT on Side
4803.720	30.9	3.8	3.8	15.0	2.9	0.0	Horz	AV	0.0	37.6	54.0	-16.4	Low Channel, EUT Vertical
4883.732	28.7	5.1	1.0	212.0	2.9	0.0	Horz	AV	0.0	36.7	54.0	-17.3	Mid Channel, EUT Vertical
12401.310	55.2	1.2	1.0	160.0	0.0	0.0	Horz	PK	0.0	56.4	74.0	-17.6	High Channel, EUT Vertical
19215.990	54.2	1.7	1.3	168.0	0.0	0.0	Horz	PK	0.0	55.9	74.0	-18.1	Low Channel, EUT Vertical
19534.100	53.7	1.8	1.3	172.0	0.0	0.0	Horz	PK	0.0	55.5	74.0	-18.5	Mid Channel, EUT Vertical
19218.130	53.3	1.7	1.0	185.0	0.0	0.0	Vert	PK	0.0	55.0	74.0	-19.0	Low Channel, EUT on Side
12398.790	53.7	1.2	1.0	219.0	0.0	0.0	Vert	PK	0.0	54.9	74.0	-19.1	High Channel, EUT on Side
12401.300	53.4	1.2	2.7	43.0	0.0	0.0	Horz	PK	0.0	54.6	74.0	-19.4	High Channel, EUT Horizontal
12398.830	53.3	1.2	2.3	91.0	0.0	0.0	Vert	PK	0.0	54.5	74.0	-19.5	High Channel, EUT Horizontal
19534.280	52.6	1.8	1.0	180.0	0.0	0.0	Vert	PK	0.0	54.4	74.0	-19.6	Mid Channel, EUT on Side
7325.312	42.1	12.2	1.2	206.0	0.0	0.0	Horz	PK	0.0	54.3	74.0	-19.7	Mid Channel, EUT Vertical
19842.210	51.9	1.9	1.3	170.0	0.0	0.0	Horz	PK	0.0	53.8	74.0	-20.2	High Channel, EUT Vertical
7440.152	40.8	12.9	1.4	206.0	0.0	0.0	Horz	PK	0.0	53.7	74.0	-20.3	High Channel, EUT Vertical
12398.820	52.5	1.2	1.0	46.0	0.0	0.0	Horz	PK	0.0	53.7	74.0	-20.3	High Channel, EUT on Side
12401.380	52.4	1.2	1.0	43.0	0.0	0.0	Vert	PK	0.0	53.6	74.0	-20.4	High Channel, EUT Vertical
7440.630	40.3	12.9	1.0	194.0	0.0	0.0	Vert	PK	0.0	53.2	74.0	-20.8	High Channel, EUT on Side
12210.250	52.1	1.0	1.0	173.0	0.0	0.0	Horz	PK	0.0	53.1	74.0	-20.9	Mid Channel, EUT Vertical
7325.300	40.8	12.2	1.0	206.0	0.0	0.0	Vert	PK	0.0	53.0	74.0	-21.0	Mid Channel, EUT on Side
12210.140	51.8	1.0	1.0	209.0	0.0	0.0	Vert	PK	0.0	52.8	74.0	-21.2	Mid Channel, EUT on Side
19838.200	50.5	1.9	1.0	180.0	0.0	0.0	Vert	PK	0.0	52.4	74.0	-21.6	High Channel, EUT on Side
4959.673	45.5	5.2	1.0	323.0	0.0	0.0	Vert	PK	0.0	50.7	74.0	-23.3	High Channel, EUT on Side
12008.790	48.1	1.0	1.0	312.0	0.0	0.0	Vert	PK	0.0	49.1	74.0	-24.9	Low Channel, EUT on Side
12008.830	47.0	1.0	1.0	160.0	0.0	0.0	Horz	PK	0.0	48.0	74.0	-26.0	Low Channel, EUT Vertical
4959.615	42.2	5.2	1.1	227.0	0.0	0.0	Horz	PK	0.0	47.4	74.0	-26.6	High Channel, EUT Vertical
4804.805	41.9	3.9	1.0	325.0	0.0	0.0	Vert	PK	0.0	45.8	74.0	-28.2	Low Channel, EUT on Side
4883.638	40.4	5.1	1.0	297.0	0.0	0.0	Vert	PK	0.0	45.5	74.0	-28.5	Mid Channel, EUT on Side
4803.487	40.4	3.8	3.8	15.0	0.0	0.0	Horz	PK	0.0	44.2	74.0	-29.8	Low Channel, EUT Vertical
4883.895	38.9	5.1	1.0	212.0	0.0	0.0	Horz	PK	0.0	44.0	74.0	-30.0	Mid Channel, EUT Vertical

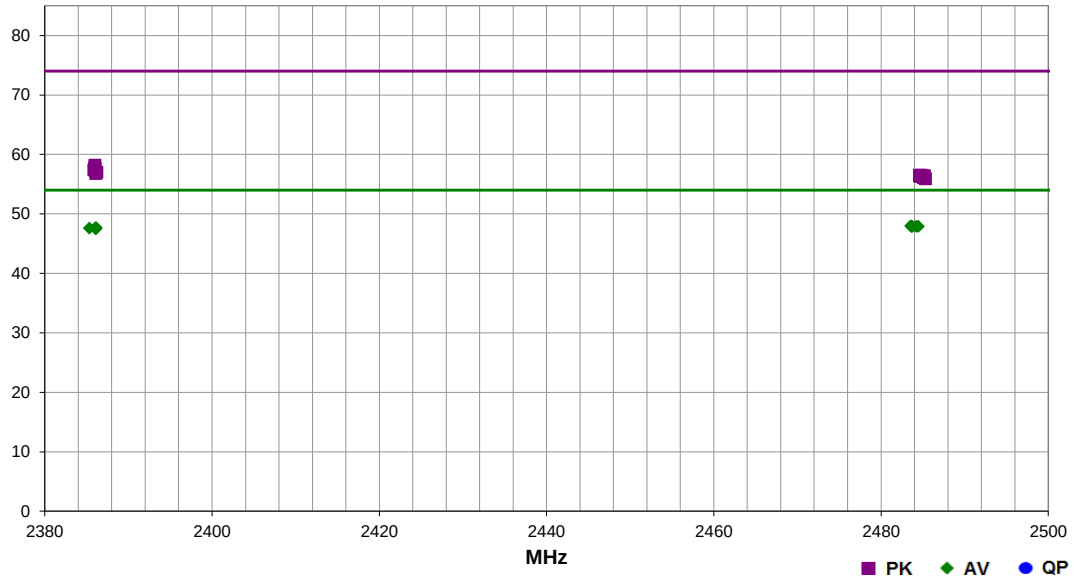
SPURIOUS RADIATED EMISSIONS

EmiR5 2017.09.18.2 PSA-ESCI 2017.09.18

Work Order:	SUPR0237	**Date:**	19-Jan-2018		
Project:	None	**Temperature:**	21.8 °C		
Job Site:	EV01	**Humidity:**	36.8% RH		
Serial Number:	None	**Barometric Pres.:**	1018 mbar	**Tested by:**	Jeff Alcoke & Jody House
EUT:	TRAC-Mini Controller				
Configuration:	2				
Customer:	Supra, A Division of UTCFS				
Attendees:	None				
EUT Power:	Battery				
Operating Mode:	Bluetooth Low Energy continuous Tx, Low channel = 2402 MHz, Mid channel = 2440 MHz, High channel = 2480 MHz, Power setting 0x0F.				
Deviations:	None				
Comments:	See comments below for channel and EUT orientation. The Radio was operating at a Duty Cycle (DC) of 51.3%. The Average data was corrected up by a Duty Cycle Correction Factor of 10*Log(DC) = 10*Log(0.513) = 2.9 dB				

Test Specifications	**Test Method**
FCC 15.247:2017	ANSI C63.10:2013

Run #	67	**Test Distance (m)**	3	**Antenna Height(s)**	1 to 4(m)	**Results**	Pass



Freq (MHz)	Amplitude (dBuV)	Factor (dB)	Antenna Height (meters)	Azimuth (degrees)	Duty Cycle Correction Factor (dB)	External Attenuation (dB)	Polarity/ Transducer Type	Detector	Distance Adjustment (dB)	Adjusted (dBuV/m)	Spec. Limit (dBuV/m)	Compared to Spec. (dB)	Comments
2483.563	29.5	-4.4	1.0	117.0	2.9	20.0	Horz	AV	0.0	48.0	54.0	-6.0	High Channel, EUT Horizontal
2484.210	29.4	-4.4	1.0	73.0	2.9	20.0	Horz	AV	0.0	47.9	54.0	-6.1	High Channel, EUT on Side
2483.623	29.4	-4.4	1.0	63.0	2.9	20.0	Vert	AV	0.0	47.9	54.0	-6.1	High Channel, EUT on Side
2484.460	29.4	-4.4	1.0	331.0	2.9	20.0	Horz	AV	0.0	47.9	54.0	-6.1	High Channel, EUT Vertical
2483.663	29.4	-4.4	1.0	97.0	2.9	20.0	Vert	AV	0.0	47.9	54.0	-6.1	High Channel, EUT Vertical
2483.730	29.4	-4.4	1.0	11.0	2.9	20.0	Vert	AV	0.0	47.9	54.0	-6.1	High Channel, EUT Horizontal
2386.120	29.8	-5.0	3.1	325.0	2.9	20.0	Vert	AV	0.0	47.7	54.0	-6.3	Low Channel, EUT on Side
2386.133	29.7	-5.0	2.3	312.0	2.9	20.0	Horz	AV	0.0	47.6	54.0	-6.4	Low Channel, EUT Vertical
2386.153	29.7	-5.0	1.0	233.0	2.9	20.0	Vert	AV	0.0	47.6	54.0	-6.4	Low Channel, EUT Vertical
2386.060	29.7	-5.0	1.0	233.0	2.9	20.0	Horz	AV	0.0	47.6	54.0	-6.4	Low Channel, EUT on Side
2385.333	29.7	-5.0	1.1	354.0	2.9	20.0	Horz	AV	0.0	47.6	54.0	-6.4	Low Channel, EUT Horizontal
2386.083	29.6	-5.0	1.3	58.0	2.9	20.0	Vert	AV	0.0	47.5	54.0	-6.5	Low Channel, EUT Horizontal
2385.987	43.2	-5.0	1.0	233.0	0.0	20.0	Horz	PK	0.0	58.2	74.0	-15.8	Low Channel, EUT on Side
2385.970	42.8	-5.0	3.1	325.0	0.0	20.0	Vert	PK	0.0	57.8	74.0	-16.2	Low Channel, EUT on Side
2386.017	42.6	-5.0	2.3	312.0	0.0	20.0	Horz	PK	0.0	57.6	74.0	-16.4	Low Channel, EUT Vertical
2385.857	42.4	-5.0	1.1	354.0	0.0	20.0	Horz	PK	0.0	57.4	74.0	-16.6	Low Channel, EUT Horizontal
2386.213	42.0	-5.0	1.0	41.0	0.0	20.0	Vert	PK	0.0	57.0	74.0	-17.0	Low Channel, EUT Horizontal
2386.100	41.8	-5.0	1.0	233.0	0.0	20.0	Vert	PK	0.0	56.8	74.0	-17.2	Low Channel, EUT Vertical
2484.833	40.9	-4.4	1.0	331.0	0.0	20.0	Horz	PK	0.0	56.5	74.0	-17.5	High Channel, EUT Vertical
2484.600	40.9	-4.4	1.0	11.0	0.0	20.0	Vert	PK	0.0	56.5	74.0	-17.5	High Channel, EUT Horizontal
2485.177	40.8	-4.4	1.0	117.0	0.0	20.0	Horz	PK	0.0	56.4	74.0	-17.6	High Channel, EUT Horizontal
2484.630	40.7	-4.4	1.0	97.0	0.0	20.0	Vert	PK	0.0	56.3	74.0	-17.7	High Channel, EUT Vertical
2485.067	40.5	-4.4	1.0	73.0	0.0	20.0	Horz	PK	0.0	56.1	74.0	-17.9	High Channel, EUT on Side
2485.320	40.3	-4.4	1.0	63.0	0.0	20.0	Vert	PK	0.0	55.9	74.0	-18.1	High Channel, EUT on Side

POWERLINE CONDUCTED EMISSIONS

WTD.2017.06.02.1

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
Receiver	Rohde & Schwarz	ESCI	ARH	3/27/2017	3/27/2018
Cable - Conducted Cable Assembly	Element	EVG, HHD, RKA	EVGA	4/13/2017	4/13/2018
LISN	Solar Electronics	9252-50-R-24-BNC	LIP	10/4/2016	10/4/2018

MEASUREMENT UNCERTAINTY

Description		
Expanded k=2	2.4 dB	-2.4 dB

CONFIGURATIONS INVESTIGATED

SUPR0187-2

MODES INVESTIGATED

BLE, Mid Channel, 2442 MHz

POWERLINE CONDUCTED EMISSIONS

WTD.2017.06.02.1

EUT:	TRAC-Mini Controller	Work Order:	SUPR0187
Serial Number:	7450	Date:	09/06/2017
Customer:	Supra, A Division of UTCFS	Temperature:	23.3°C
Attendees:	None	Relative Humidity:	45.6%
Customer Project:	None	Bar. Pressure:	1017 mb
Tested By:	Jeff Alcoke and Rod Peloquin	Job Site:	EV07
Power:	3.2 VDC via 110VAC/60Hz	Configuration:	SUPR0187-2

TEST SPECIFICATIONS

Specification:	Method:
FCC 15.207:2017	ANSI C63.10:2013

TEST PARAMETERS

Run #:	1	Line:	High Line	Add. Ext. Attenuation (dB):	0

COMMENTS

Measurements made on the AC input to a linear DC power supply.

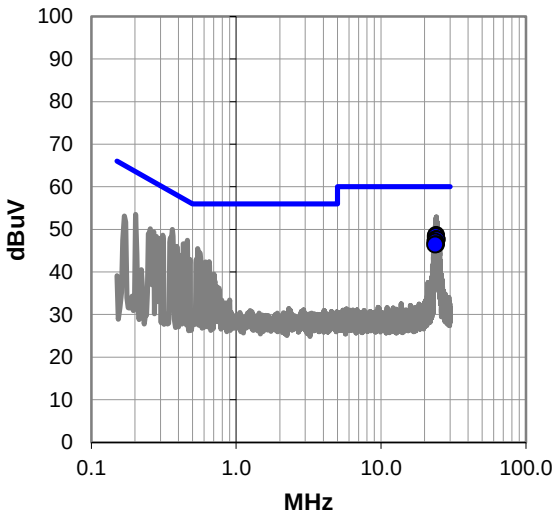
EUT OPERATING MODES

Bluetooth EDR, Mid Channel, 2440 MHz, DH5

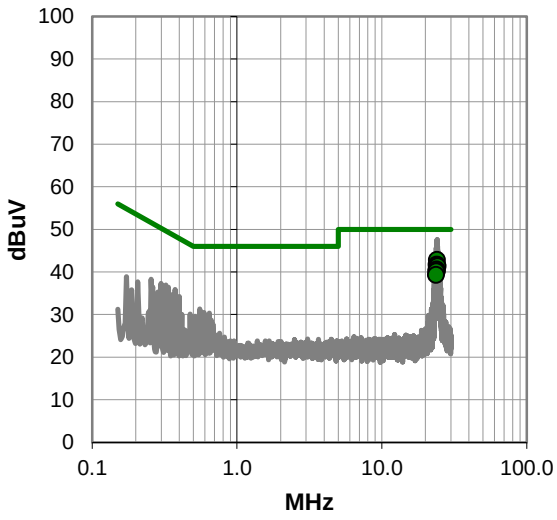
DEVIATIONS FROM TEST STANDARD

None

Quasi Peak Data - vs - Quasi Peak Limit



Average Data - vs - Average Limit



POWERLINE CONDUCTED EMISSIONS

WTD.2017.06.02.1

RESULTS - Run #1

Quasi Peak Data - vs - Quasi Peak Limit

Freq (MHz)	Amp. (dBuV)	Factor (dB)	Adjusted (dBuV)	Spec. Limit (dBuV)	Margin (dB)
24.041	27.9	20.8	48.7	60.0	-11.3
23.931	27.6	20.8	48.4	60.0	-11.6
24.160	26.9	20.8	47.7	60.0	-12.3
23.987	26.8	20.8	47.6	60.0	-12.4
24.286	26.8	20.8	47.6	60.0	-12.4
23.813	26.3	20.8	47.1	60.0	-12.9
24.101	25.7	20.8	46.5	60.0	-13.5
23.697	25.6	20.8	46.4	60.0	-13.6

Average Data - vs - Average Limit

Freq (MHz)	Amp. (dBuV)	Factor (dB)	Adjusted (dBuV)	Spec. Limit (dBuV)	Margin (dB)
24.041	22.0	20.8	42.8	50.0	-7.2
23.931	20.9	20.8	41.7	50.0	-8.3
24.160	20.8	20.8	41.6	50.0	-8.4
24.286	20.5	20.8	41.3	50.0	-8.7
23.987	19.8	20.8	40.6	50.0	-9.4
24.101	19.4	20.8	40.2	50.0	-9.8
23.813	19.3	20.8	40.1	50.0	-9.9
23.697	18.5	20.8	39.3	50.0	-10.7

CONCLUSION

Pass

Tested By

POWERLINE CONDUCTED EMISSIONS

EUT:	TRAC-Mini Controller	Work Order:	SUPR0187
Serial Number:	7450	Date:	09/06/2017
Customer:	Supra, A Division of UTCFS	Temperature:	23.3°C
Attendees:	None	Relative Humidity:	45.6%
Customer Project:	None	Bar. Pressure:	1017 mb
Tested By:	Jeff Alcoke and Rod Peloquin	Job Site:	EV07
Power:	3.2 VDC via 110VAC/60Hz	Configuration:	SUPR0187-2

TEST SPECIFICATIONS

Specification:	Method:
FCC 15.207:2017	ANSI C63.10:2013

TEST PARAMETERS

Run #:	2	Line:	Neutral	Add. Ext. Attenuation (dB):	0

COMMENTS

Measurements made on the AC input to a linear DC power supply.

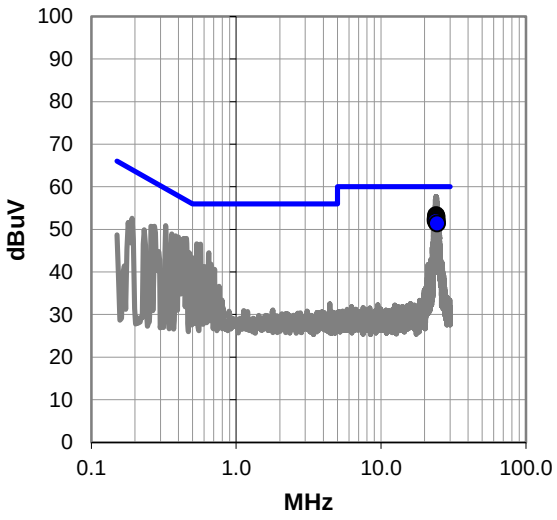
EUT OPERATING MODES

Bluetooth EDR, Mid Channel, 2440 MHz, DH5

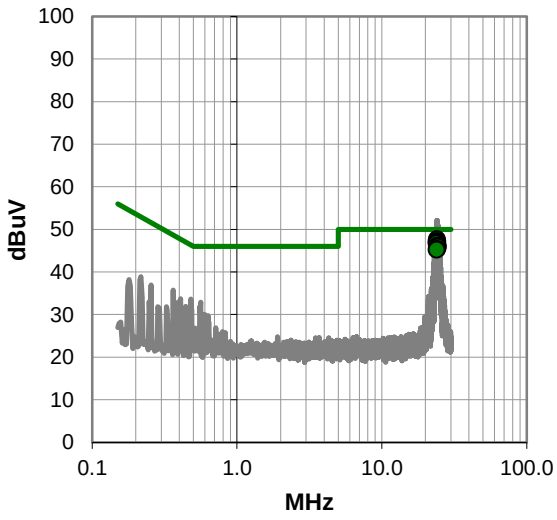
DEVIATIONS FROM TEST STANDARD

None

Quasi Peak Data - vs - Quasi Peak Limit



Average Data - vs - Average Limit



POWERLINE CONDUCTED EMISSIONS

WTD.2017.06.02.1

RESULTS - Run #2

Quasi Peak Data - vs - Quasi Peak Limit

Freq (MHz)	Amp. (dBuV)	Factor (dB)	Adjusted (dBuV)	Spec. Limit (dBuV)	Margin (dB)
24.015	32.5	20.8	53.3	60.0	-6.7
24.173	32.3	20.8	53.1	60.0	-6.9
24.143	32.0	20.8	52.8	60.0	-7.2
23.956	31.8	20.8	52.6	60.0	-7.4
24.067	31.8	20.8	52.6	60.0	-7.4
23.905	31.4	20.8	52.2	60.0	-7.8
24.224	31.4	20.8	52.2	60.0	-7.8
24.300	31.2	20.8	52.0	60.0	-8.0
23.871	31.1	20.8	51.9	60.0	-8.1
24.371	30.6	20.8	51.4	60.0	-8.6

Average Data - vs - Average Limit

Freq (MHz)	Amp. (dBuV)	Factor (dB)	Adjusted (dBuV)	Spec. Limit (dBuV)	Margin (dB)
24.015	26.9	20.8	47.7	50.0	-2.3
23.956	26.4	20.8	47.2	50.0	-2.8
24.173	26.4	20.8	47.2	50.0	-2.8
24.143	26.2	20.8	47.0	50.0	-3.0
24.067	26.1	20.8	46.9	50.0	-3.1
23.905	25.9	20.8	46.7	50.0	-3.3
24.300	25.4	20.8	46.2	50.0	-3.8
24.371	25.1	20.8	45.9	50.0	-4.1
24.224	24.6	20.8	45.4	50.0	-4.6
23.871	24.4	20.8	45.2	50.0	-4.8

CONCLUSION

Pass

Tested By

POWERLINE CONDUCTED EMISSIONS

WTD.2017.06.02.1

EUT:	TRAC-Mini Controller	Work Order:	SUPR0187
Serial Number:	7450	Date:	09/06/2017
Customer:	Supra, A Division of UTCFS	Temperature:	23.7°C
Attendees:	None	Relative Humidity:	44.9%
Customer Project:	None	Bar. Pressure:	1017 mb
Tested By:	Jeff Alcoke and Rod Peloquin	Job Site:	EV07
Power:	3.2 VDC via 110VAC/60Hz	Configuration:	SUPR0187-2

TEST SPECIFICATIONS

Specification:	Method:
FCC 15.207:2017	ANSI C63.10:2013

TEST PARAMETERS

Run #:	3	Line:	Neutral	Add. Ext. Attenuation (dB):	0

COMMENTS

Measurements made on the AC input to a linear DC power supply.

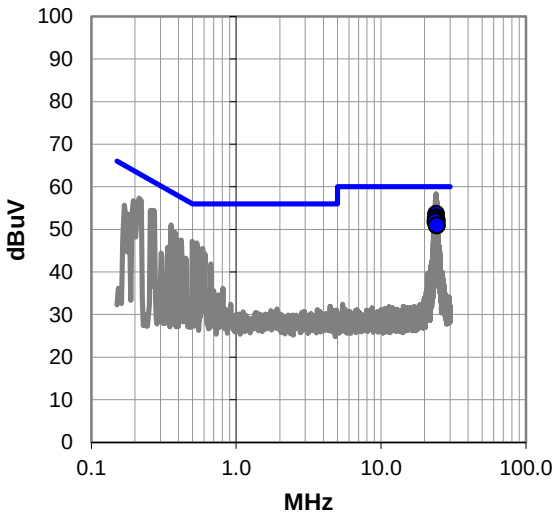
EUT OPERATING MODES

BLE, Mid Channel, 2442 MHz

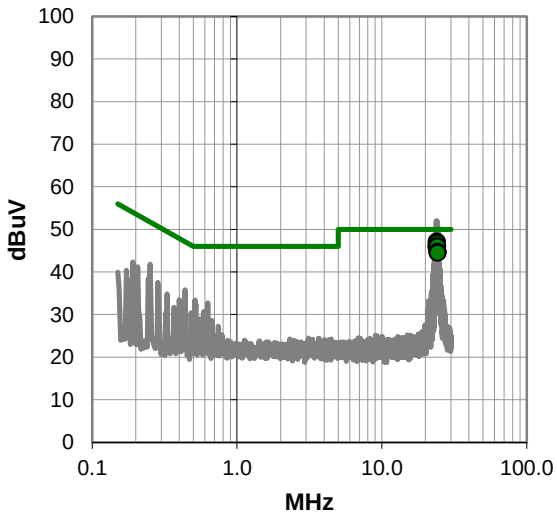
DEVIATIONS FROM TEST STANDARD

None

Quasi Peak Data - vs - Quasi Peak Limit



Average Data - vs - Average Limit



POWERLINE CONDUCTED EMISSIONS

WTD.2017.06.02.1

RESULTS - Run #3

Quasi Peak Data - vs - Quasi Peak Limit

Freq (MHz)	Amp. (dBuV)	Factor (dB)	Adjusted (dBuV)	Spec. Limit (dBuV)	Margin (dB)
24.051	32.8	20.8	53.6	60.0	-6.4
24.027	32.0	20.8	52.8	60.0	-7.2
23.944	31.9	20.8	52.7	60.0	-7.3
24.138	31.5	20.8	52.3	60.0	-7.7
24.283	31.2	20.8	52.0	60.0	-8.0
23.803	31.0	20.8	51.8	60.0	-8.2
24.249	30.1	20.8	50.9	60.0	-9.1
24.310	30.1	20.8	50.9	60.0	-9.1

Average Data - vs - Average Limit

Freq (MHz)	Amp. (dBuV)	Factor (dB)	Adjusted (dBuV)	Spec. Limit (dBuV)	Margin (dB)
24.027	26.3	20.8	47.1	50.0	-2.9
23.944	26.3	20.8	47.1	50.0	-2.9
24.051	25.9	20.8	46.7	50.0	-3.3
23.803	25.2	20.8	46.0	50.0	-4.0
24.138	25.2	20.8	46.0	50.0	-4.0
24.249	23.9	20.8	44.7	50.0	-5.3
24.310	23.9	20.8	44.7	50.0	-5.3
24.283	23.7	20.8	44.5	50.0	-5.5

CONCLUSION

Pass

Tested By

POWERLINE CONDUCTED EMISSIONS

EUT:	TRAC-Mini Controller	Work Order:	SUPR0187
Serial Number:	7450	Date:	09/06/2017
Customer:	Supra, A Division of UTCFS	Temperature:	23.7°C
Attendees:	None	Relative Humidity:	44.9%
Customer Project:	None	Bar. Pressure:	1017 mb
Tested By:	Jeff Alcoke and Rod Peloquin	Job Site:	EV07
Power:	3.2 VDC via 110VAC/60Hz	Configuration:	SUPR0187-2

TEST SPECIFICATIONS

Specification:	Method:
FCC 15.207:2017	ANSI C63.10:2013

TEST PARAMETERS

Run #:	4	Line:	High Line	Add. Ext. Attenuation (dB):	0

COMMENTS

Measurements made on the AC input to a linear DC power supply.

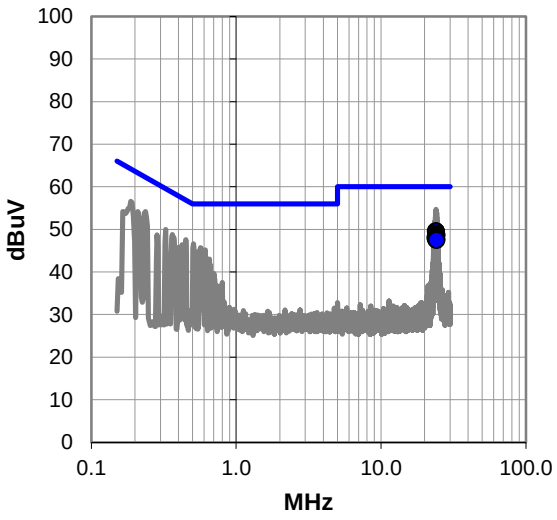
EUT OPERATING MODES

BLE, Mid Channel, 2442 MHz

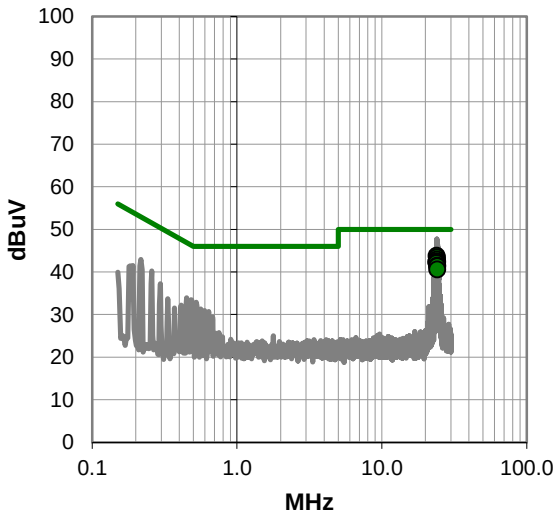
DEVIATIONS FROM TEST STANDARD

None

Quasi Peak Data - vs - Quasi Peak Limit



Average Data - vs - Average Limit



POWERLINE CONDUCTED EMISSIONS

WTD.2017.06.02.1

RESULTS - Run #4

Quasi Peak Data - vs - Quasi Peak Limit

Freq (MHz)	Amp. (dBuV)	Factor (dB)	Adjusted (dBuV)	Spec. Limit (dBuV)	Margin (dB)
23.944	28.8	20.8	49.6	60.0	-10.4
24.047	28.7	20.8	49.5	60.0	-10.5
24.015	28.2	20.8	49.0	60.0	-11.0
24.167	27.9	20.8	48.7	60.0	-11.3
24.129	27.9	20.8	48.7	60.0	-11.3
24.077	27.6	20.8	48.4	60.0	-11.6
23.850	27.3	20.8	48.1	60.0	-11.9
23.897	27.0	20.8	47.8	60.0	-12.2
24.191	26.8	20.8	47.6	60.0	-12.4
24.224	26.7	20.8	47.5	60.0	-12.5

Average Data - vs - Average Limit

Freq (MHz)	Amp. (dBuV)	Factor (dB)	Adjusted (dBuV)	Spec. Limit (dBuV)	Margin (dB)
23.944	23.0	20.8	43.8	50.0	-6.2
24.015	22.6	20.8	43.4	50.0	-6.6
24.047	22.1	20.8	42.9	50.0	-7.1
24.077	21.6	20.8	42.4	50.0	-7.6
23.850	21.6	20.8	42.4	50.0	-7.6
24.129	21.6	20.8	42.4	50.0	-7.6
23.897	21.3	20.8	42.1	50.0	-7.9
24.167	20.7	20.8	41.5	50.0	-8.5
24.191	20.5	20.8	41.3	50.0	-8.7
24.224	19.8	20.8	40.6	50.0	-9.4

CONCLUSION

Pass

Tested By

DUTY CYCLE

XMit 2017.12.13

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	TFU	27-Oct-15	27-Oct-18
Cable	Micro-Coax	UFD150A-1-0720-200200	EVH	30-May-17	30-May-18
Attenuator	S.M. Electronics	SA26B-20	AUY	30-May-17	30-May-18
Block - DC	Fairview Microwave	SD3379	AMW	5-Jun-17	5-Jun-18
Analyzer - Spectrum Analyzer	Keysight	N9010A	AFP	14-Aug-17	14-Aug-18

TEST DESCRIPTION

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

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

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

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

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

DUTY CYCLE

TbtTx 2017.12.14 XMit 2017.12.13

EUT:	**TRAC-Mini Controller**			**Work Order:**	**SUPR0237**
Serial Number:	**None**			**Date:**	**25-Jan-18**
Customer:	**Supra, A Division of UTCFS**			**Temperature:**	**22.4 °C**
Attendees:	**None**			**Humidity:**	**35.1% RH**
Project:	**None**			**Barometric Pres.:**	**1011 mbar**
Tested by:	**Jeff Alcoke & Jody House**	**Power:**	**Battery**	**Job Site:**	**EV06**

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

COMMENTS

Testing performed with output power setting set to 0x0F.

DEVIATIONS FROM TEST STANDARD

None

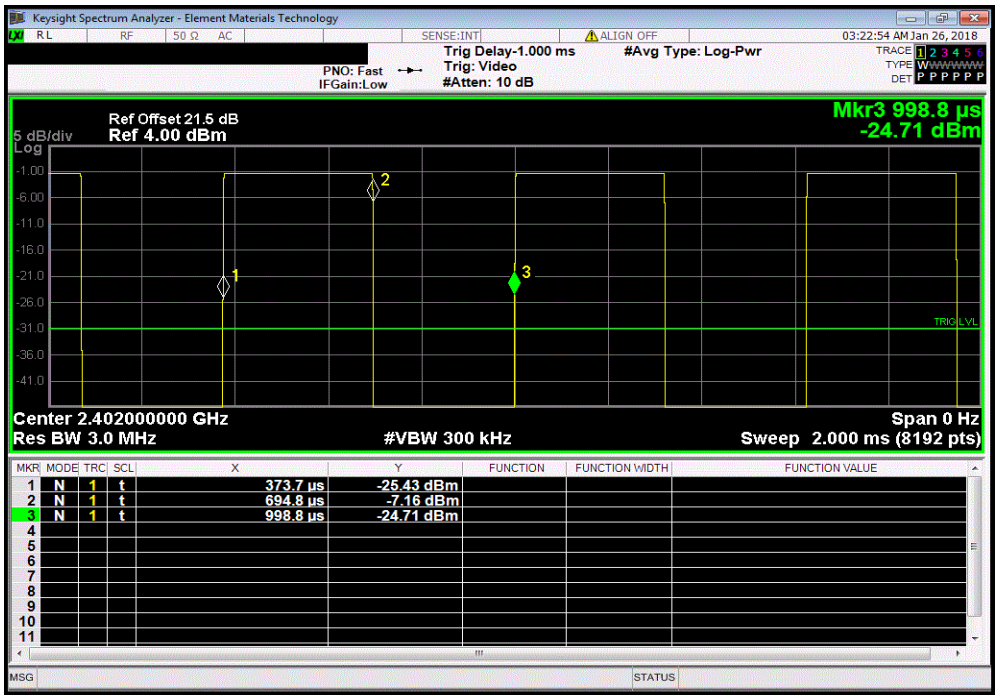
Configuration #	**3**	*Signature*

	Pulse Width	Period	Number of Pulses	Value (%)	Limit (%)	Results
BLE/GFSK Low Channel, 2402 MHz	321.1 us	625.1 us	1	51.4	N/A	N/A
BLE/GFSK Low Channel, 2402 MHz	N/A	N/A	5	N/A	N/A	N/A
BLE/GFSK Mid Channel, 2442 MHz	321.1 us	625.6 us	1	51.3	N/A	N/A
BLE/GFSK Mid Channel, 2442 MHz	N/A	N/A	5	N/A	N/A	N/A
BLE/GFSK High Channel, 2480 MHz	320.6 us	624.9 us	1	51.3	N/A	N/A
BLE/GFSK High Channel, 2480 MHz	N/A	N/A	5	N/A	N/A	N/A

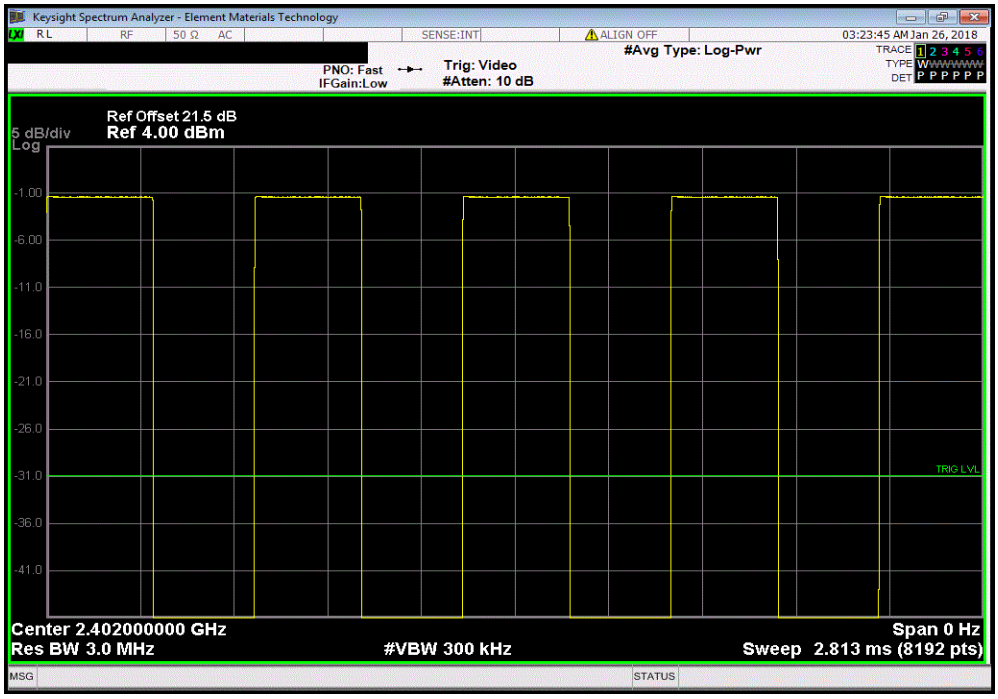
DUTY CYCLE

TbtTx 2017.12.14 XMit 2017.12.13

BLE/GFSK Low Channel, 2402 MHz						
	Pulse Width	Period	Number of Pulses	Value (%)	Limit (%)	Results
	321.1 us	625.1 us	1	51.4	N/A	N/A



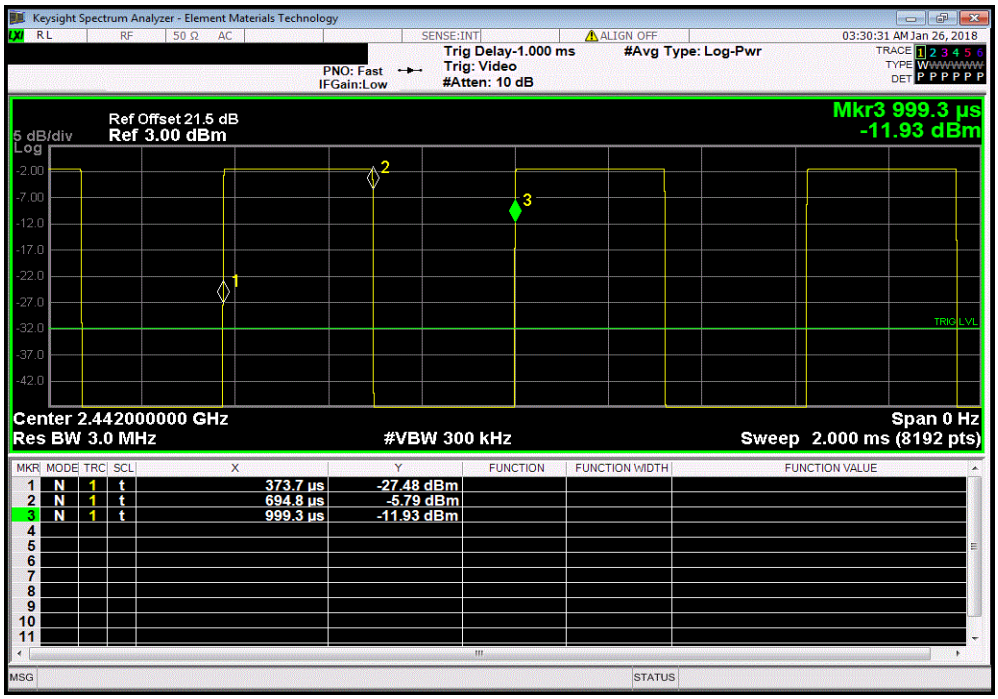
BLE/GFSK Low Channel, 2402 MHz						
	Pulse Width	Period	Number of Pulses	Value (%)	Limit (%)	Results
	N/A	N/A	5	N/A	N/A	N/A



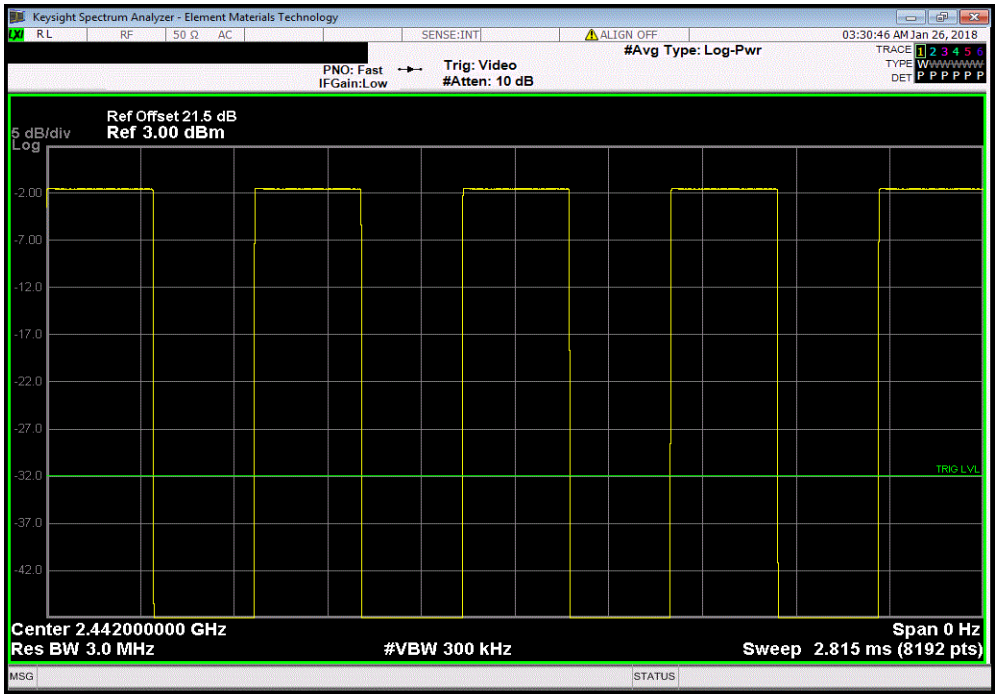
DUTY CYCLE

TbtTx 2017.12.14 XMit 2017.12.13

BLE/GFSK Mid Channel, 2442 MHz						
	Pulse Width	Period	Number of Pulses	Value (%)	Limit (%)	Results
	321.1 us	625.6 us	1	51.3	N/A	N/A



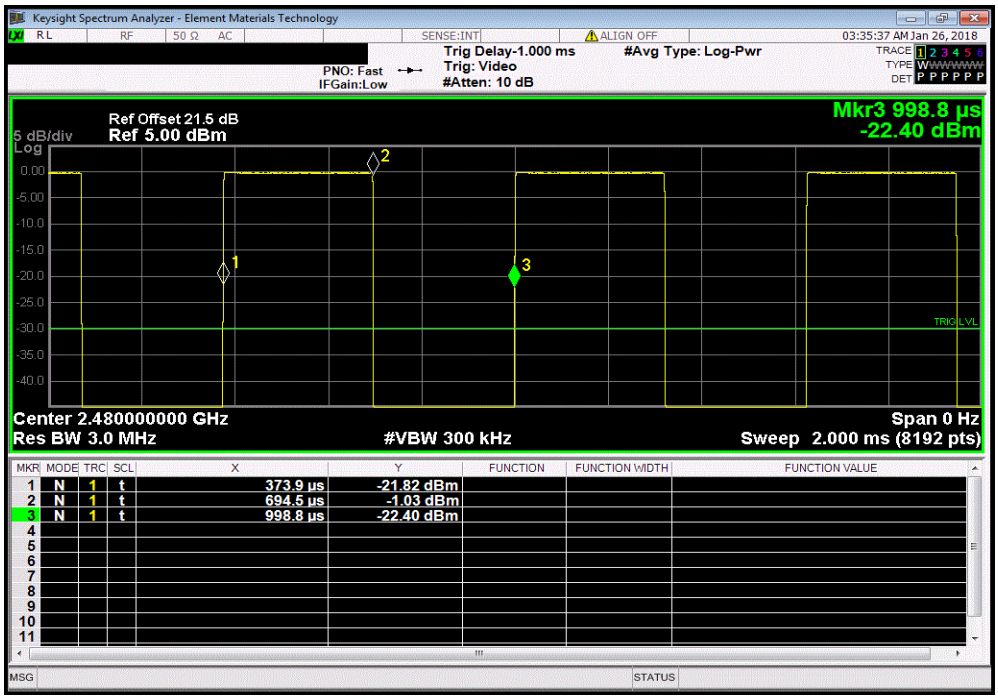
BLE/GFSK Mid Channel, 2442 MHz						
	Pulse Width	Period	Number of Pulses	Value (%)	Limit (%)	Results
	N/A	N/A	5	N/A	N/A	N/A



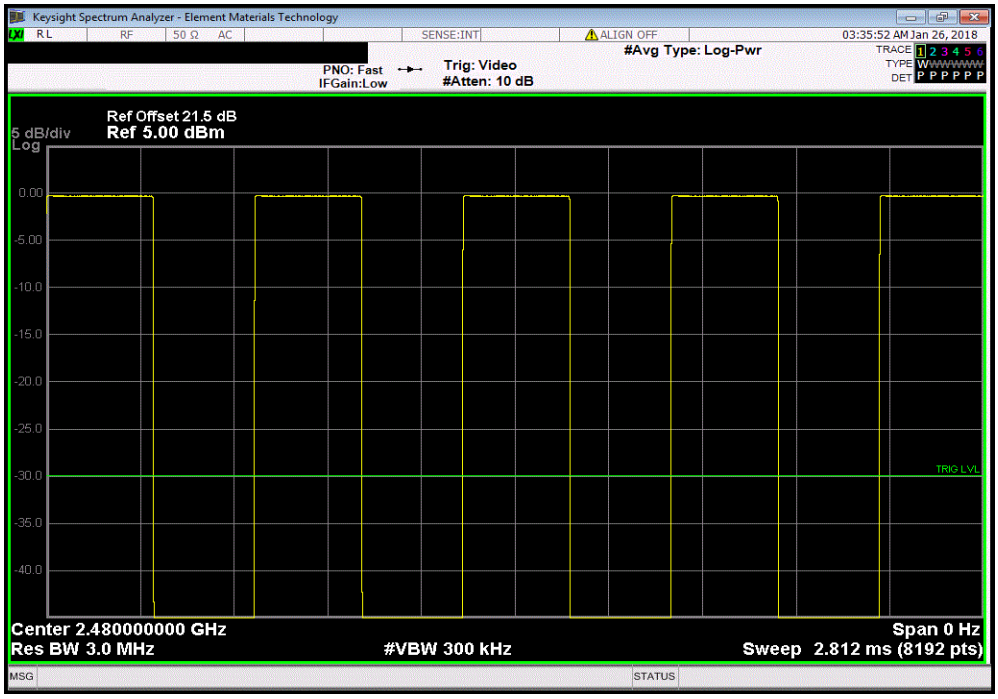
DUTY CYCLE

TbtTx 2017.12.14 XMit 2017.12.13

BLE/GFSK High Channel, 2480 MHz						
	Pulse Width	Period	Number of Pulses	Value (%)	Limit (%)	Results
	320.6 us	624.9 us	1	51.3	N/A	N/A



BLE/GFSK High Channel, 2480 MHz						
	Pulse Width	Period	Number of Pulses	Value (%)	Limit (%)	Results
	N/A	N/A	5	N/A	N/A	N/A



OCCUPIED BANDWIDTH

XMit 2017.12.13

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	TFU	27-Oct-15	27-Oct-18
Cable	Micro-Coax	UFD150A-1-0720-200200	EVH	30-May-17	30-May-18
Attenuator	S.M. Electronics	SA26B-20	AUY	30-May-17	30-May-18
Block - DC	Fairview Microwave	SD3379	AMW	5-Jun-17	5-Jun-18
Analyzer - Spectrum Analyzer	Keysight	N9010A	AFP	14-Aug-17	14-Aug-18

TEST DESCRIPTION

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

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

OCCUPIED BANDWIDTH

TbtTx 2017.12.14 XMit 2017.12.13

EUT:	**TRAC-Mini Controller**			**Work Order:**	**SUPR0237**
Serial Number:	**None**			**Date:**	**25-Jan-18**
Customer:	**Supra, A Division of UTCFS**			**Temperature:**	**25.7 °C**
Attendees:	**None**			**Humidity:**	**30.5% RH**
Project:	**None**			**Barometric Pres.:**	**1010 mbar**
Tested by:	**Jeff Alcoke & Jody House**	**Power:**	**Battery**	**Job Site:**	**EV06**

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

COMMENTS

Testing performed with output power setting set to 0x0F.

DEVIATIONS FROM TEST STANDARD

None

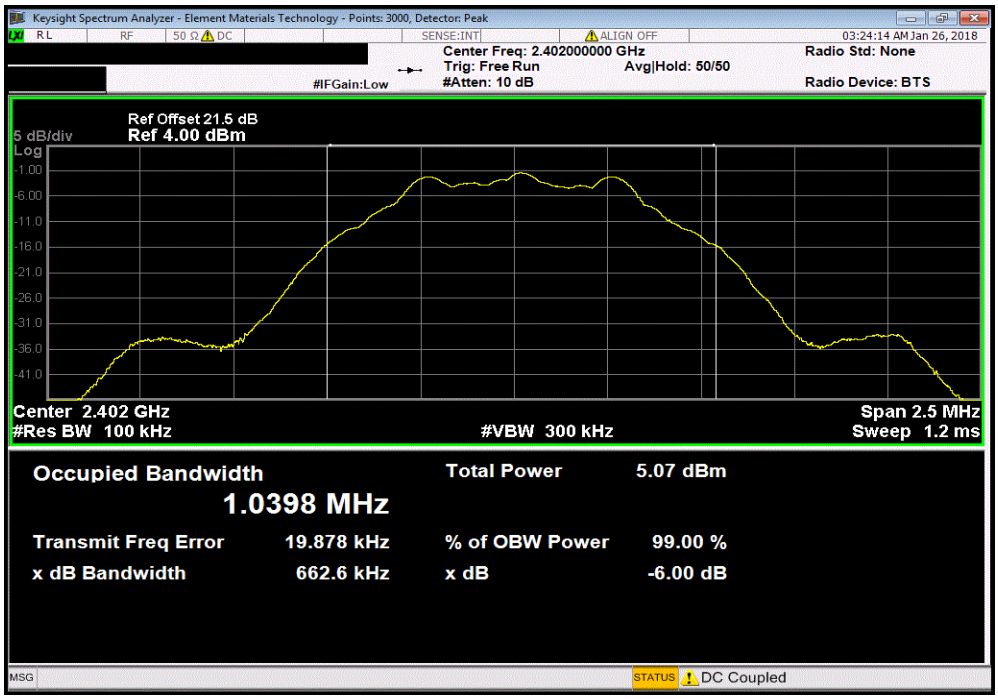
Configuration #	**3**	*Signature* 

	Value	**Limit (≥)**	**Result**
BLE/GFSK Low Channel, 2402 MHz	662.551 kHz	500 kHz	Pass
BLE/GFSK Mid Channel, 2442 MHz	660.427 kHz	500 kHz	Pass
BLE/GFSK High Channel, 2480 MHz	664.734 kHz	500 kHz	Pass

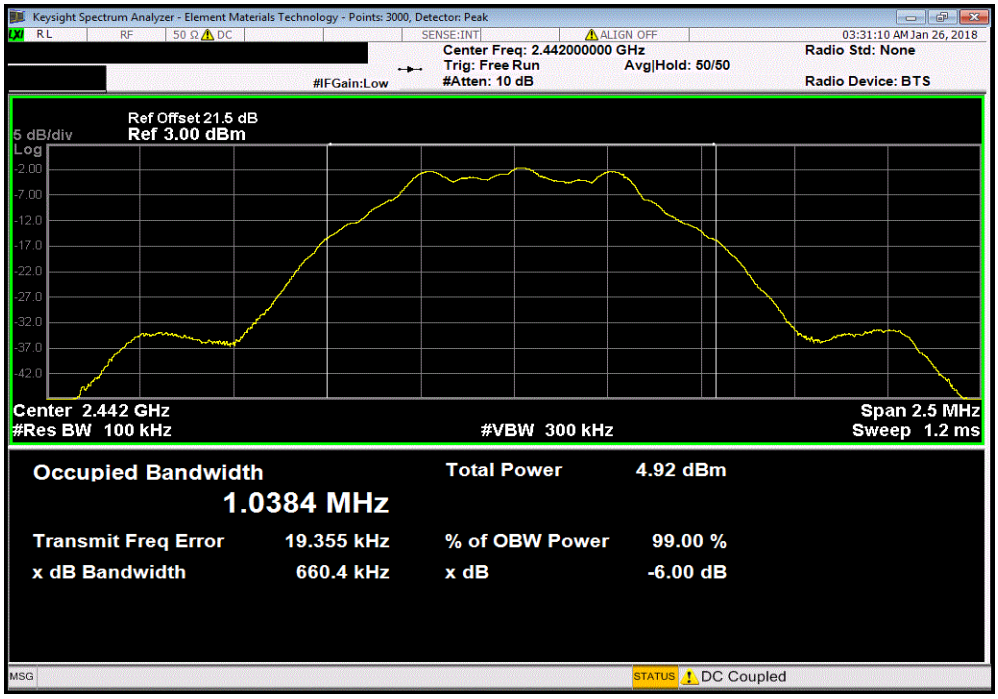
OCCUPIED BANDWIDTH

TbtTx 2017.12.14 XMit 2017.12.13

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



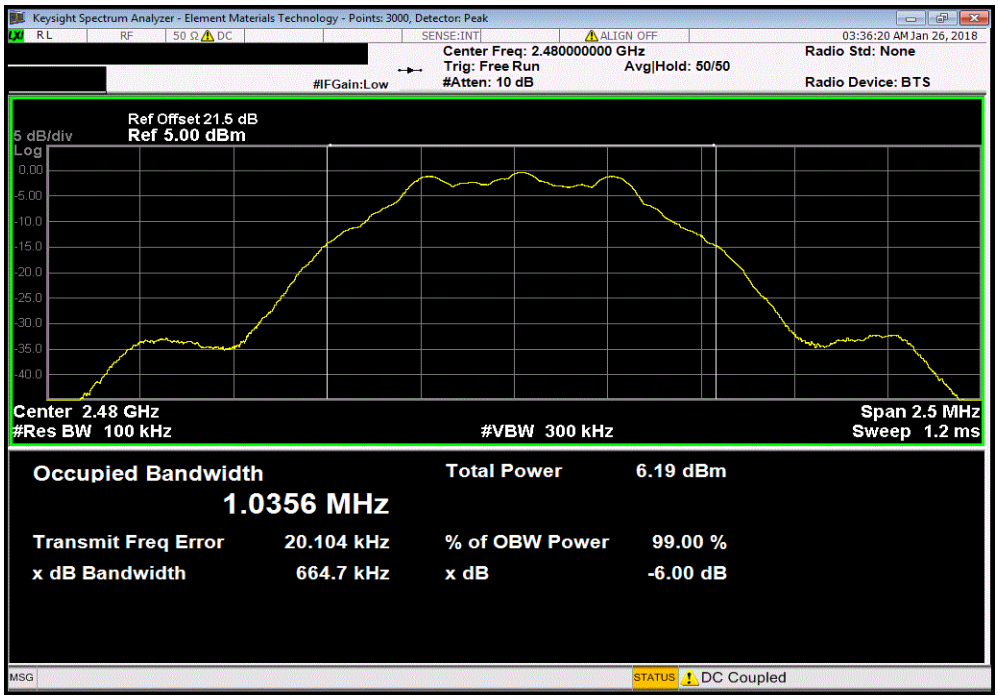
BLE/GFSK Mid Channel, 2442 MHz						
				Value	Limit (≥)	Result
				660.427 kHz	500 kHz	Pass



OCCUPIED BANDWIDTH

TbtTx 2017.12.14 XMit 2017.12.13

BLE/GFSK High Channel, 2480 MHz						
				Value	Limit (≥)	Result
				664.734 kHz	500 kHz	Pass



OUTPUT POWER

XMit 2017.12.13

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	TFU	27-Oct-15	27-Oct-18
Cable	Micro-Coax	UFD150A-1-0720-200200	EVH	30-May-17	30-May-18
Attenuator	S.M. Electronics	SA26B-20	AUY	30-May-17	30-May-18
Block - DC	Fairview Microwave	SD3379	AMW	5-Jun-17	5-Jun-18
Analyzer - Spectrum Analyzer	Keysight	N9010A	AFP	14-Aug-17	14-Aug-18

TEST DESCRIPTION

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

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

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

De Facto EIRP Limit: The EUT meets the de facto EIRP limit of +36 dBm.

OUTPUT POWER

TbtTx 2017.12.14 XMit 2017.12.13

EUT:	**TRAC-Mini Controller**			**Work Order:**	**SUPR0237**
Serial Number:	**None**			**Date:**	**25-Jan-18**
Customer:	**Supra, A Division of UTCFS**			**Temperature:**	**22.6 °C**
Attendees:	**None**			**Humidity:**	**34.8% RH**
Project:	**None**			**Barometric Pres.:**	**1011 mbar**
Tested by:	**Jeff Alcoke & Jody House**	**Power:**	**Battery**	**Job Site:**	**EV06**

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

COMMENTS

Testing performed with output power setting set to 0x0F.

DEVIATIONS FROM TEST STANDARD

None

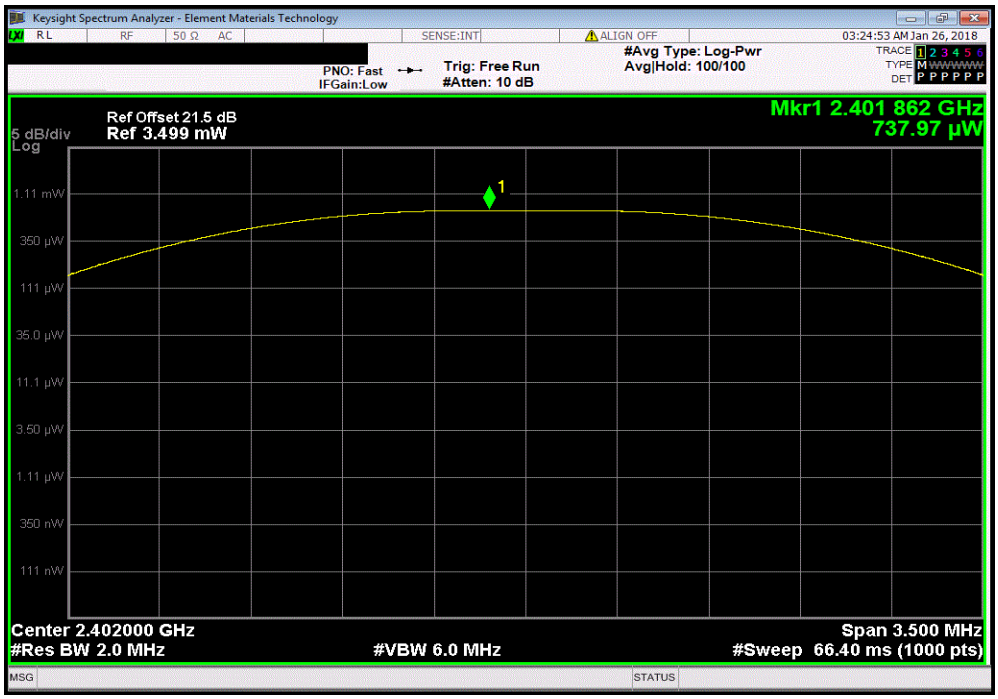
Configuration #	**3**	*Signature*

	Value	**Limit (<)**	**Result**
BLE/GFSK Low Channel, 2402 MHz	737.97 uW	1 W	Pass
BLE/GFSK Mid Channel, 2442 MHz	714.79 uW	1 W	Pass
BLE/GFSK High Channel, 2480 MHz	949.57 uW	1 W	Pass

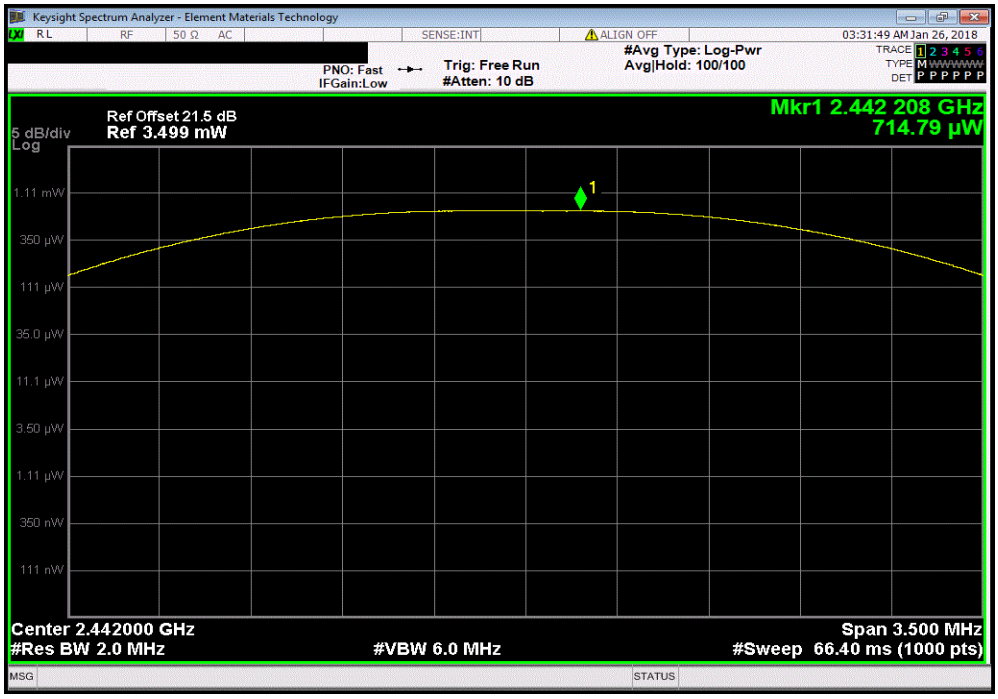
OUTPUT POWER

TbtTx 2017.12.14 XMit 2017.12.13

BLE/GFSK Low Channel, 2402 MHz						
				Value	Limit (<)	Result
				737.97 uW	1 W	Pass



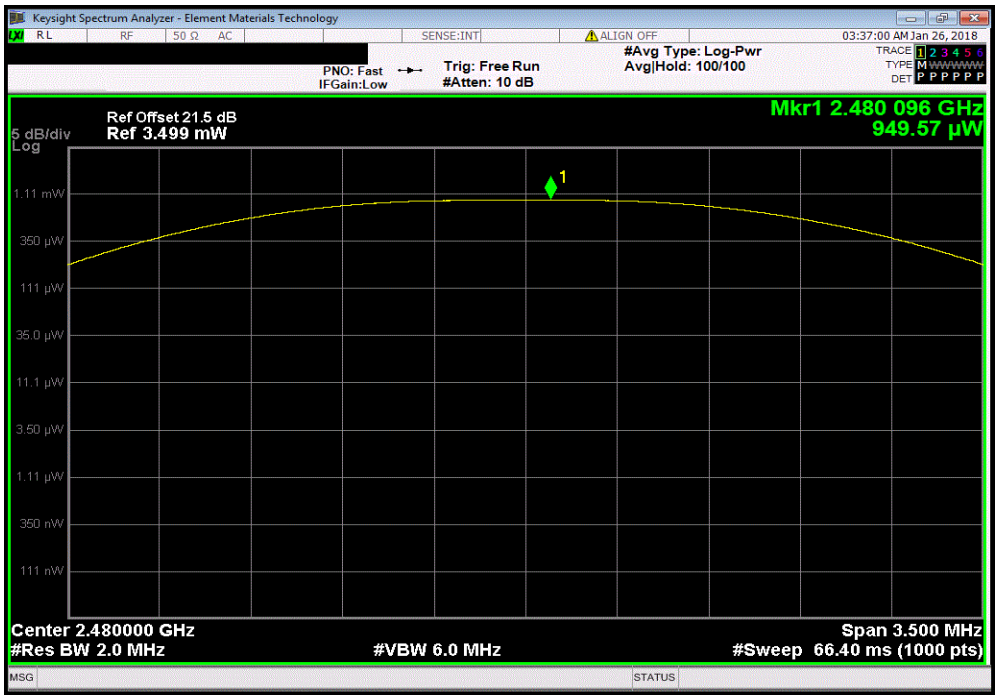
BLE/GFSK Mid Channel, 2442 MHz						
				Value	Limit (<)	Result
				714.79 uW	1 W	Pass



OUTPUT POWER

TbtTx 2017.12.14 XMit 2017.12.13

BLE/GFSK High Channel, 2480 MHz						
				Value	Limit (<)	Result
				949.57 uW	1 W	Pass



POWER SPECTRAL DENSITY

XMit 2017.12.13

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	TFU	27-Oct-15	27-Oct-18
Cable	Micro-Coax	UFD150A-1-0720-200200	EVH	30-May-17	30-May-18
Attenuator	S.M. Electronics	SA26B-20	AUY	30-May-17	30-May-18
Block - DC	Fairview Microwave	SD3379	AMW	5-Jun-17	5-Jun-18
Analyzer - Spectrum Analyzer	Keysight	N9010A	AFP	14-Aug-17	14-Aug-18

TEST DESCRIPTION

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

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

POWER SPECTRAL DENSITY

TbtTx 2017.12.14 XMit 2017.12.13

EUT:	**TRAC-Mini Controller**			**Work Order:**	**SUPR0237**
Serial Number:	**None**			**Date:**	**25-Jan-18**
Customer:	**Supra, A Division of UTCFS**			**Temperature:**	**22.4 °C**
Attendees:	**None**			**Humidity:**	**35% RH**
Project:	**None**			**Barometric Pres.:**	**1011 mbar**
Tested by:	**Jeff Alcoke & Jody House**	**Power:**	**Battery**	**Job Site:**	**EV06**

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

COMMENTS

Testing performed with output power setting set to 0x0F.

DEVIATIONS FROM TEST STANDARD

None

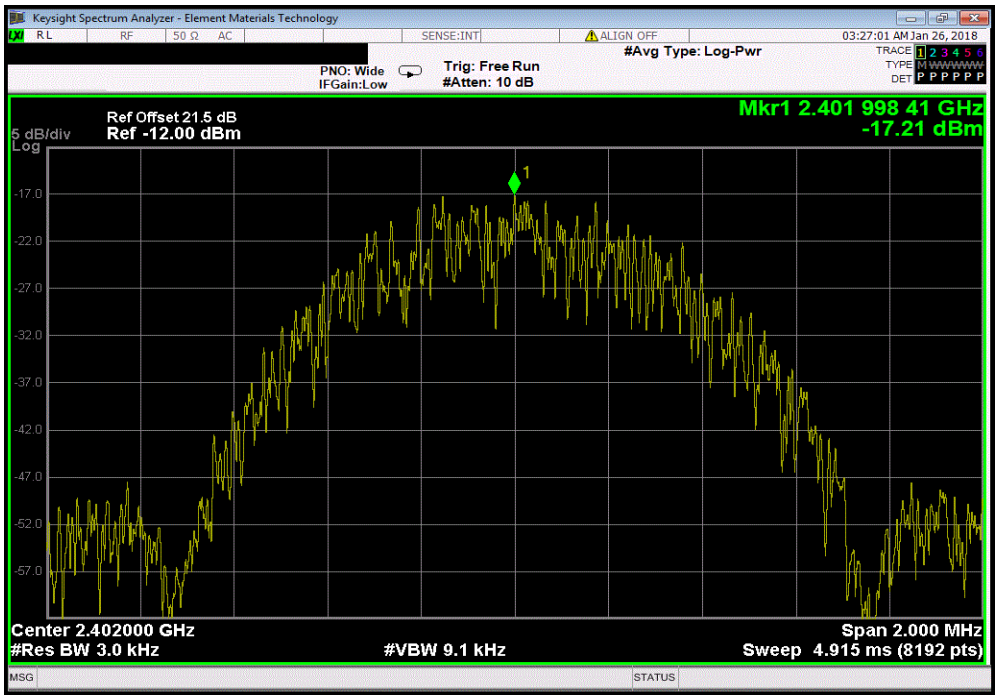
Configuration #	**3**	*Signature*

	Value dBm/3kHz	**Limit < dBm/3kHz**	**Results**
BLE/GFSK Low Channel, 2402 MHz	-17.207	8	Pass
BLE/GFSK Mid Channel, 2442 MHz	-17.321	8	Pass
BLE/GFSK High Channel, 2480 MHz	-16.013	8	Pass

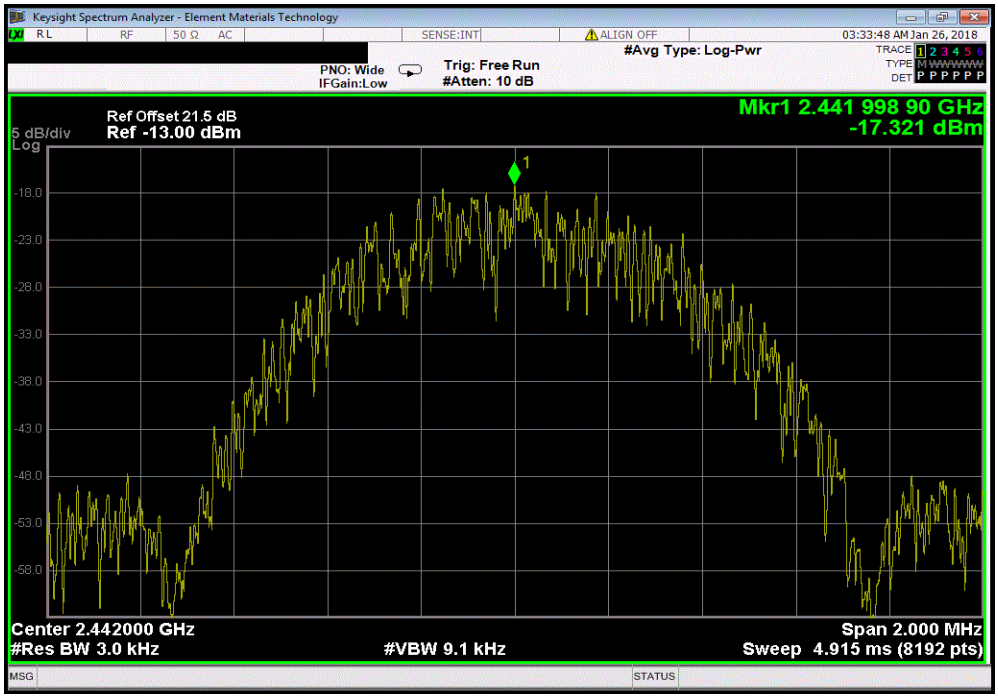
POWER SPECTRAL DENSITY

TbtTx 2017.12.14 XMit 2017.12.13

BLE/GFSK Low Channel, 2402 MHz						
				Value dBm/3kHz	Limit < dBm/3kHz	Results
				-17.207	8	Pass



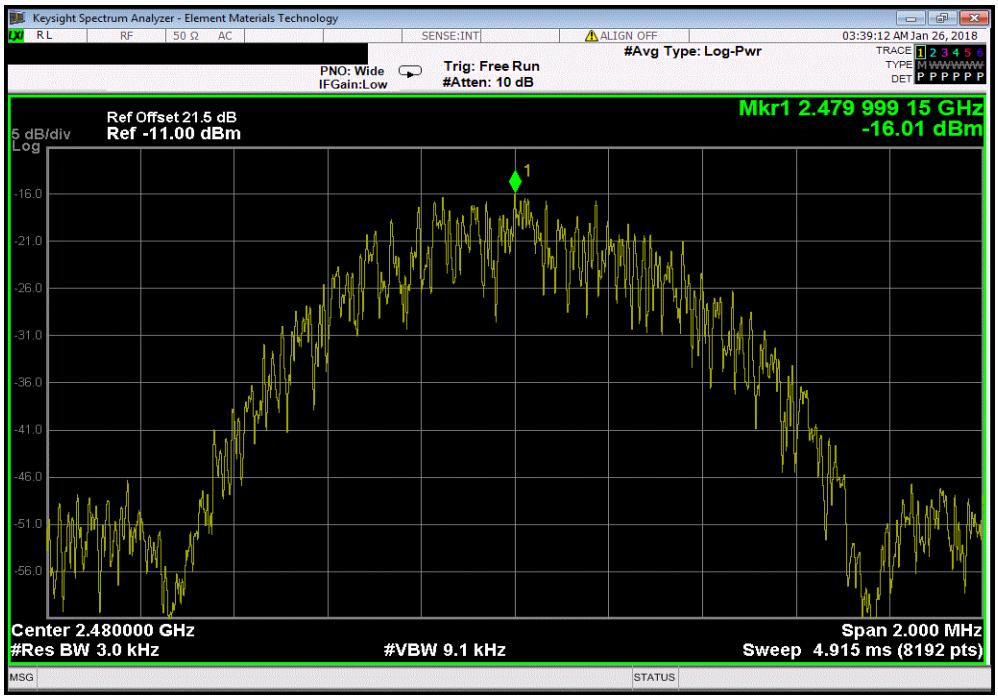
BLE/GFSK Mid Channel, 2442 MHz						
				Value dBm/3kHz	Limit < dBm/3kHz	Results
				-17.321	8	Pass



POWER SPECTRAL DENSITY

TbtTx 2017.12.14 XMit 2017.12.13

BLE/GFSK High Channel, 2480 MHz						
				Value dBm/3kHz	Limit < dBm/3kHz	Results
				-16.013	8	Pass



BAND EDGE COMPLIANCE

XMit 2017.12.13

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	TFU	27-Oct-15	27-Oct-18
Cable	Micro-Coax	UFD150A-1-0720-200200	EVH	30-May-17	30-May-18
Attenuator	S.M. Electronics	SA26B-20	AUY	30-May-17	30-May-18
Block - DC	Fairview Microwave	SD3379	AMW	5-Jun-17	5-Jun-18
Analyzer - Spectrum Analyzer	Keysight	N9010A	AFP	14-Aug-17	14-Aug-18

TEST DESCRIPTION

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

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

BAND EDGE COMPLIANCE

TbtTx 2017.12.14 XMit 2017.12.13

EUT:	**TRAC-Mini Controller**			**Work Order:**	**SUPR0237**
Serial Number:	**None**			**Date:**	**25-Jan-18**
Customer:	**Supra, A Division of UTCFS**			**Temperature:**	**25 °C**
Attendees:	**None**			**Humidity:**	**31.5% RH**
Project:	**None**			**Barometric Pres.:**	**1010 mbar**
Tested by:	**Jeff Alcoke & Jody House**	**Power:**	**Battery**	**Job Site:**	**EV06**

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

COMMENTS

Testing performed with output power setting set to 0x0F.

DEVIATIONS FROM TEST STANDARD

None

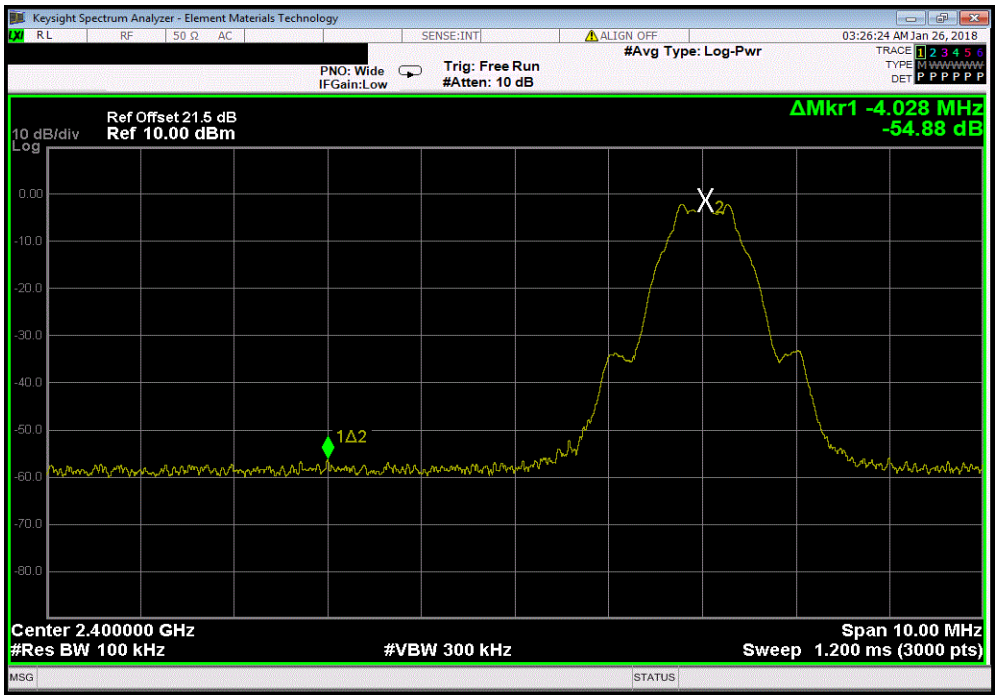
Configuration #	**3**	*Signature*

	Value (dBc)	**Limit ≤ (dBc)**	**Result**
BLE/GFSK Low Channel, 2402 MHz	-54.88	-20	Pass
BLE/GFSK High Channel, 2480 MHz	-55.37	-20	Pass

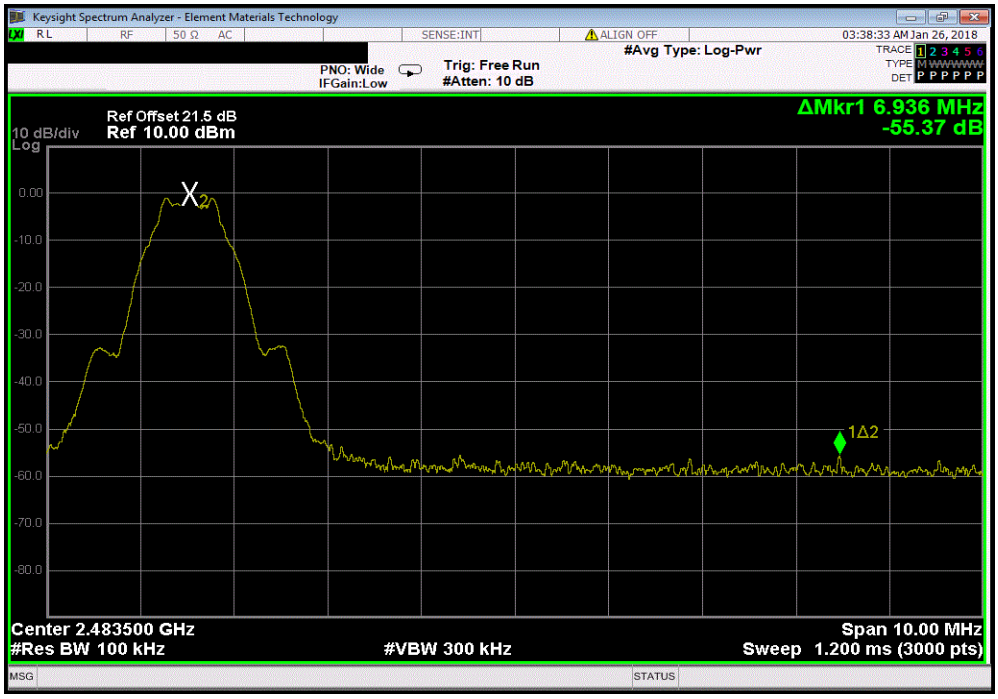
BAND EDGE COMPLIANCE

TbtTx 2017.12.14 XMit 2017.12.13

BLE/GFSK Low Channel, 2402 MHz						
				Value (dBc)	Limit ≤ (dBc)	Result
				-54.88	-20	Pass



BLE/GFSK High Channel, 2480 MHz						
				Value (dBc)	Limit ≤ (dBc)	Result
				-55.37	-20	Pass



SPURIOUS CONDUCTED EMISSIONS

XMit 2017.12.13

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	TFU	27-Oct-15	27-Oct-18
Cable	Micro-Coax	UFD150A-1-0720-200200	EVH	30-May-17	30-May-18
Attenuator	S.M. Electronics	SA26B-20	AUY	30-May-17	30-May-18
Block - DC	Fairview Microwave	SD3379	AMW	5-Jun-17	5-Jun-18
Analyzer - Spectrum Analyzer	Keysight	N9010A	AFP	14-Aug-17	14-Aug-18

TEST DESCRIPTION

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

SPURIOUS CONDUCTED EMISSIONS

TbtTx 2017.12.14 XMit 2017.12.13

EUT:	**TRAC-Mini Controller**			**Work Order:**	**SUPR0237**
Serial Number:	**None**			**Date:**	**25-Jan-18**
Customer:	**Supra, A Division of UTCFS**			**Temperature:**	**22.4 °C**
Attendees:	**None**			**Humidity:**	**35.1% RH**
Project:	**None**			**Barometric Pres.:**	**1011 mbar**
Tested by:	**Jeff Alcoke & Jody House**	**Power:**	**Battery**	**Job Site:**	**EV06**

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

COMMENTS

Testing performed with output power setting set to 0x0F.

DEVIATIONS FROM TEST STANDARD

None

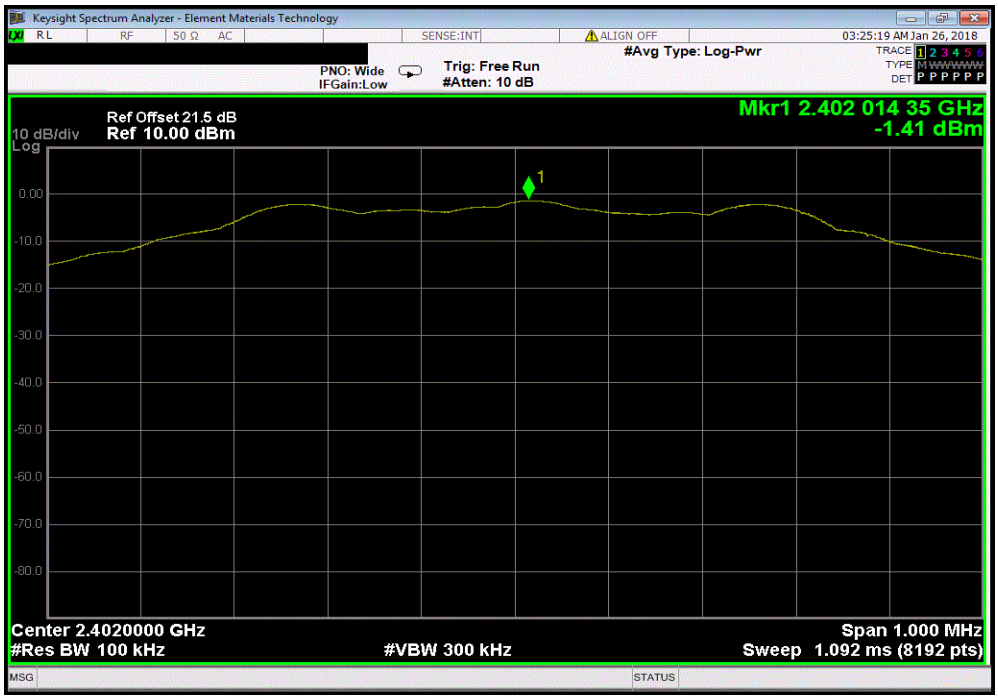
Configuration #	**3**	*Signature*

	Frequency Range	Max Value (dBc)	Limit ≤ (dBc)	Result
BLE/GFSK Low Channel, 2402 MHz	Fundamental	N/A	N/A	N/A
BLE/GFSK Low Channel, 2402 MHz	30 MHz - 12.5 GHz	-51.1	-20	Pass
BLE/GFSK Low Channel, 2402 MHz	12.5 GHz - 25 GHz	-36.75	-20	Pass
BLE/GFSK Mid Channel, 2442 MHz	Fundamental	N/A	N/A	N/A
BLE/GFSK Mid Channel, 2442 MHz	30 MHz - 12.5 GHz	-50.84	-20	Pass
BLE/GFSK Mid Channel, 2442 MHz	12.5 GHz - 25 GHz	-37.25	-20	Pass
BLE/GFSK High Channel, 2480 MHz	Fundamental	N/A	N/A	N/A
BLE/GFSK High Channel, 2480 MHz	30 MHz - 12.5 GHz	-52.09	-20	Pass
BLE/GFSK High Channel, 2480 MHz	12.5 GHz - 25 GHz	-38.22	-20	Pass

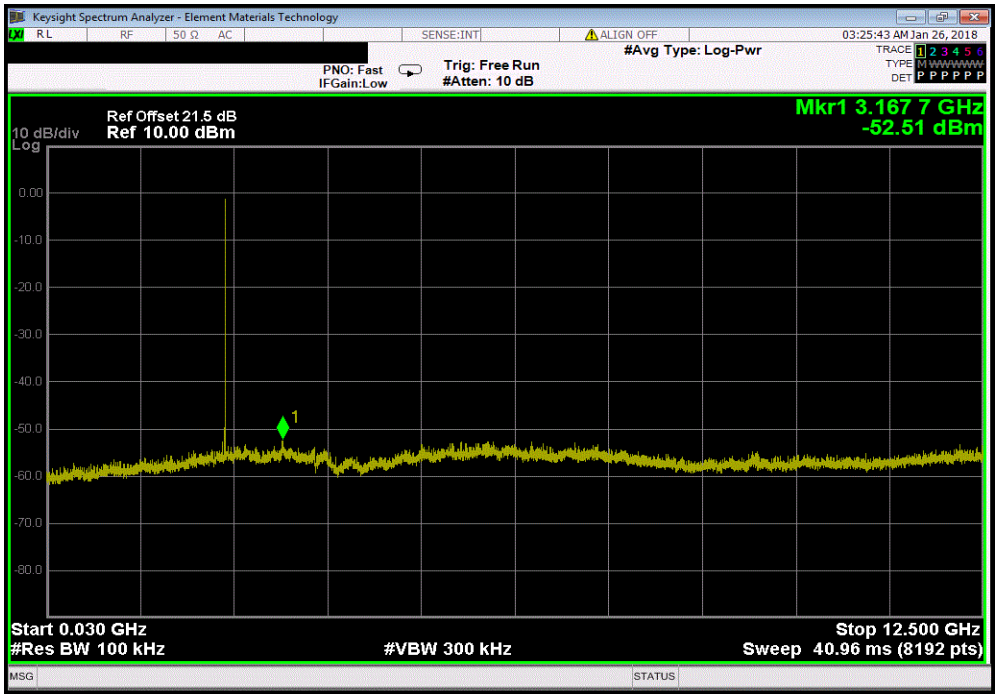
SPURIOUS CONDUCTED EMISSIONS

TbtTx 2017.12.14 XMit 2017.12.13

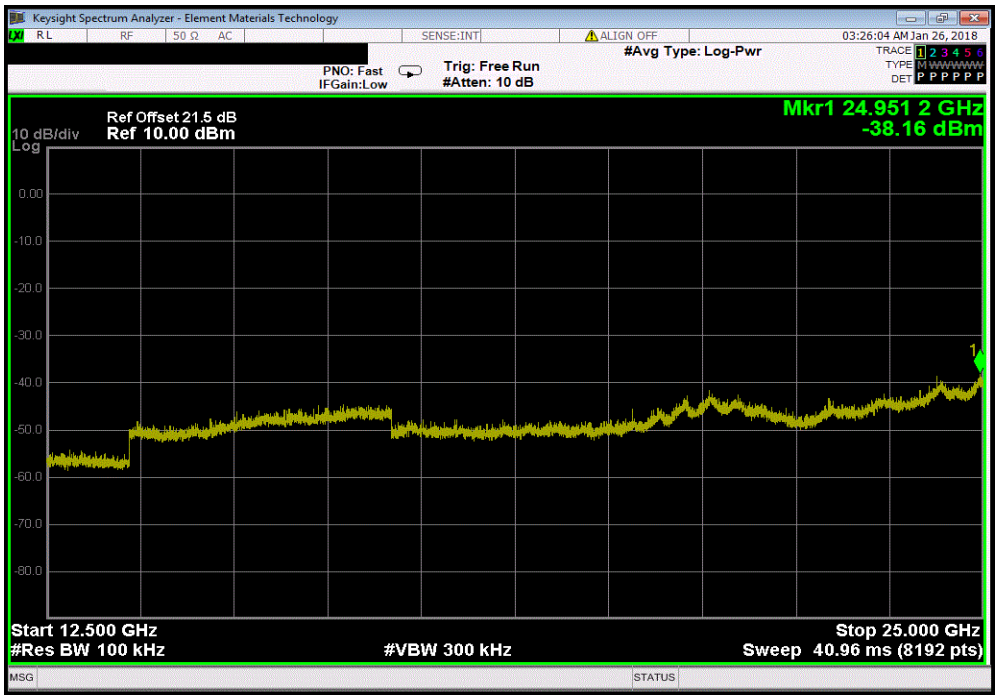
BLE/GFSK Low Channel, 2402 MHz						
	Frequency Range			Max Value (dBc)	Limit ≤ (dBc)	Result
	Fundamental			N/A	N/A	N/A



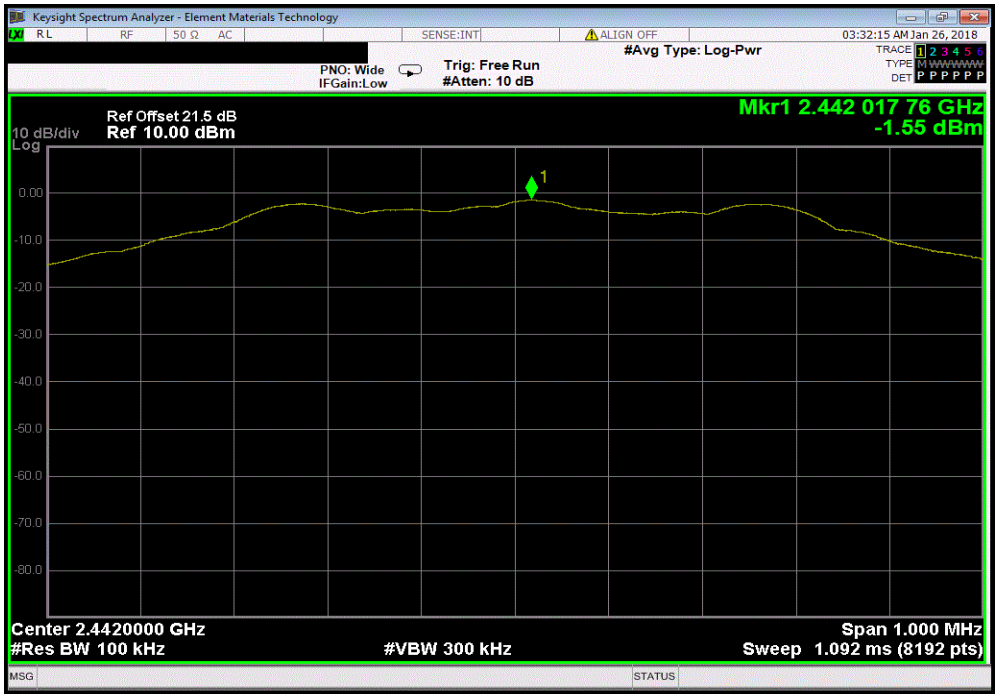
BLE/GFSK Low Channel, 2402 MHz					
Frequency Range			Max Value (dBc)	Limit ≤ (dBc)	Result
30 MHz - 12.5 GHz			-51.1	-20	Pass



BLE/GFSK Low Channel, 2402 MHz				
Frequency Range		Max Value (dBc)	Limit ≤ (dBc)	Result
12.5 GHz - 25 GHz		-36.75	-20	Pass



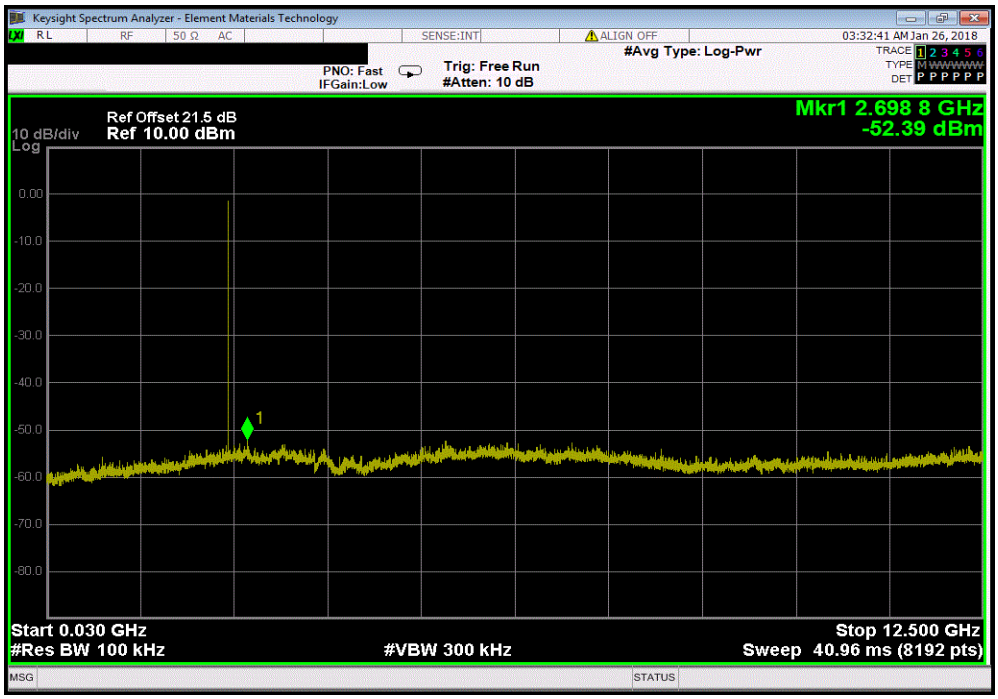
BLE/GFSK Mid Channel, 2442 MHz						
Frequency Range				Max Value (dBc)	Limit ≤ (dBc)	Result
	Fundamental			N/A	N/A	N/A



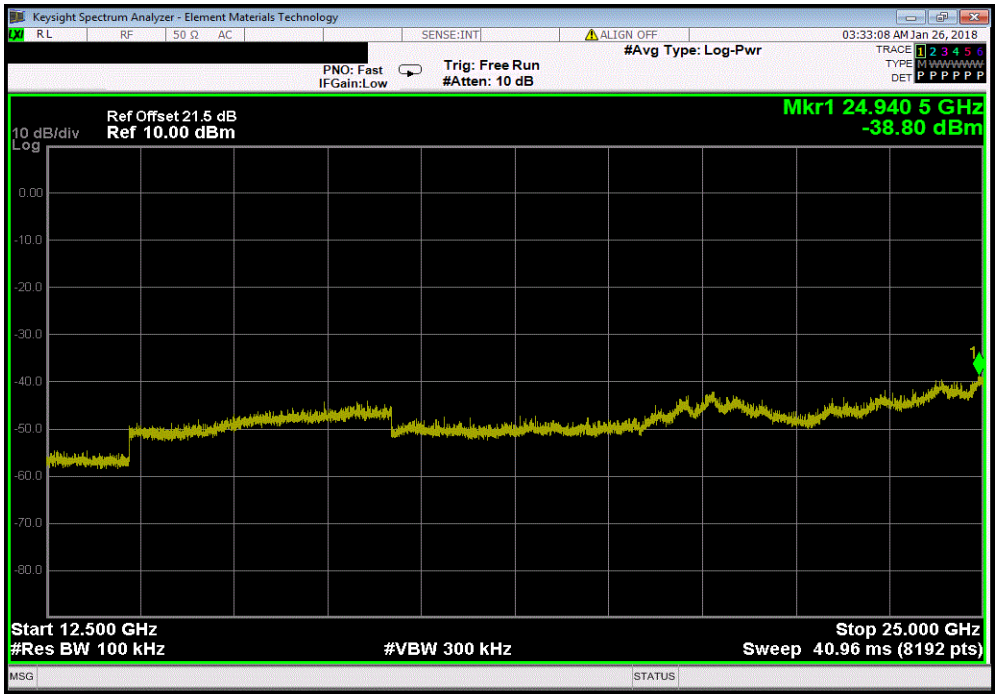
SPURIOUS CONDUCTED EMISSIONS

TbtTx 2017.12.14 XMit 2017.12.13

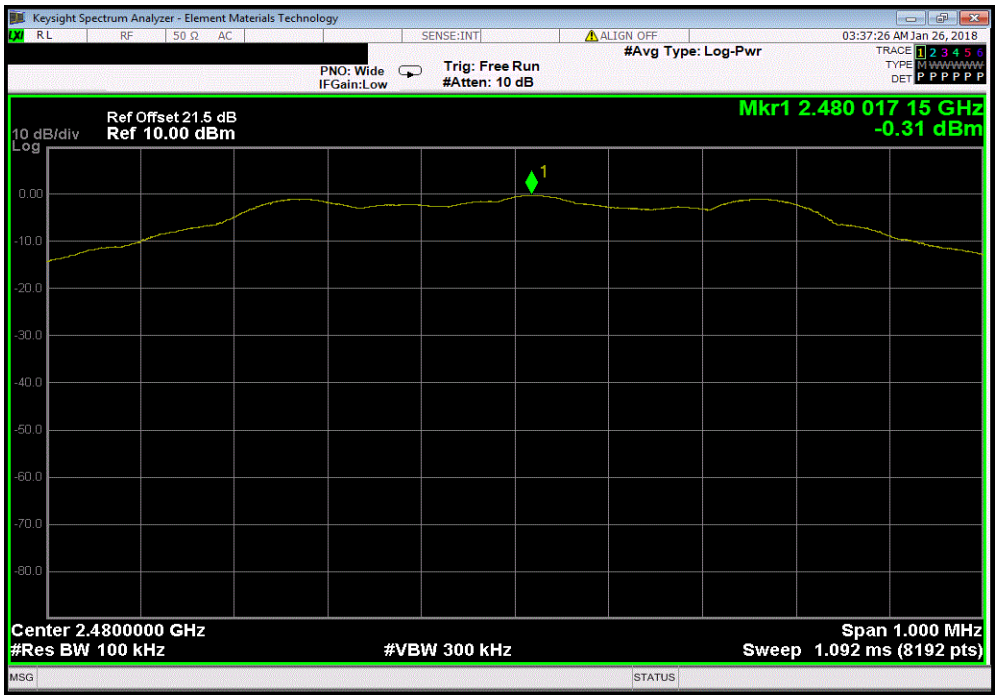
BLE/GFSK Mid Channel, 2442 MHz				
Frequency Range		Max Value (dBc)	Limit ≤ (dBc)	Result
30 MHz - 12.5 GHz		-50.84	-20	Pass



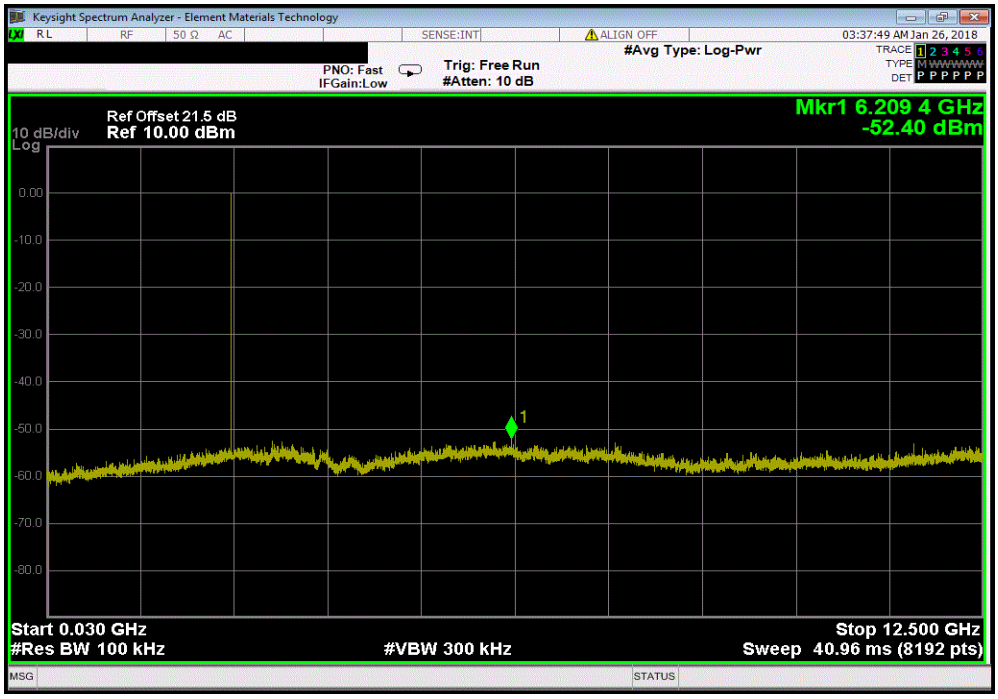
BLE/GFSK Mid Channel, 2442 MHz				
Frequency Range		Max Value (dBc)	Limit ≤ (dBc)	Result
12.5 GHz - 25 GHz		-37.25	-20	Pass



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



BLE/GFSK High Channel, 2480 MHz					
Frequency Range			Max Value (dBc)	Limit ≤ (dBc)	Result
30 MHz - 12.5 GHz			-52.09	-20	Pass



SPURIOUS CONDUCTED EMISSIONS

TbtTx 2017.12.14 XMit 2017.12.13

BLE/GFSK High Channel, 2480 MHz				
Frequency Range		Max Value (dBc)	Limit ≤ (dBc)	Result
12.5 GHz - 25 GHz		-38.22	-20	Pass