



Supra, A Division of UTCFS

TRAC-Mini Controller

FCC 15.207:2018

FCC 15.247:2018

Bluetooth Radio

Report # SUPR0237 Rev. 1



NVLAP Lab Code: 200630-0



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CERTIFICATE OF TEST



Last Date of Test: January 12, 2018
Supra, A Division of UTCFS
Model: TRAC-Mini Controller

Radio Equipment Testing

Standards

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

Results

Method Clause	Test Description	Applied	Results	Comments
6.2	Powerline Conducted Emissions	Yes	Pass	
6.5, 6.6	Spurious Radiated Emissions	Yes	Pass	
7.5	Duty Cycle	Yes	N/A	Characterization of radio operation.
7.8.2	Carrier Frequency Separation	Yes	Pass	
7.8.3	Number of Hopping Frequencies	Yes	Pass	
7.8.4	Dwell Time	Yes	Pass	
7.8.5	Output Power	Yes	Pass	
7.8.6	Band Edge Compliance	Yes	Pass	
7.8.6	Band Edge Compliance - Hopping Mode	Yes	Pass	
7.8.7	Occupied Bandwidth	Yes	Pass	
7.8.8	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	Updated Powerline Conducted Emissions specification date to FCC 15.207:2017 to reflect the year the testing was completed.	11-18-2018	14 & 16



ACCREDITATIONS AND AUTHORIZATIONS

United States

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

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

NVLAP - Each laboratory is accredited by NVLAP to ISO 17025

Canada

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

European Union

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

Australia/New Zealand

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

Korea

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

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.

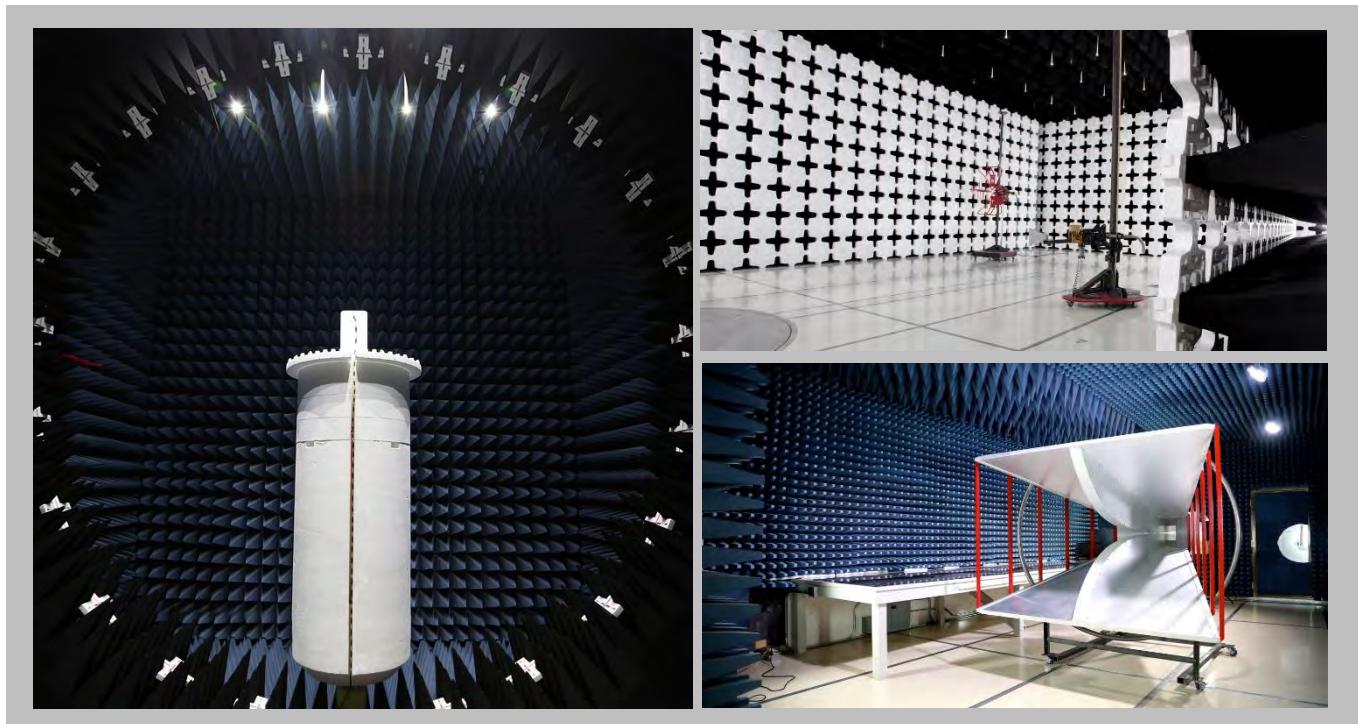
The following table represents the Measurement Uncertainty (MU) budgets for each of the tests that may be contained in this report.

<u>Test</u>	<u>+ MU</u>	<u>- MU</u>
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

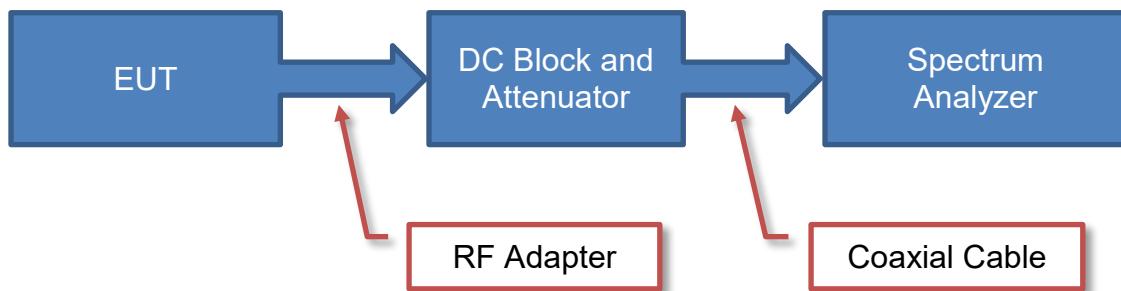


California	Minnesota	New York	Oregon	Texas	Washington
Labs OC01-17 41 Tesla Irvine, CA 92618 (949) 861-8918	Labs MN01-10 9349 W Broadway Ave. Brooklyn Park, MN 55445 (612)-638-5136	Labs NY01-04 4939 Jordan Rd. Elbridge, NY 13060 (315) 554-8214	Labs EV01-12 6775 NE Evergreen Pkwy #400 Hillsboro, OR 97124 (503) 844-4066	Labs TX01-09 3801 E Plano Pkwy Plano, TX 75074 (469) 304-5255	Labs NC01-05 19201 120 th 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

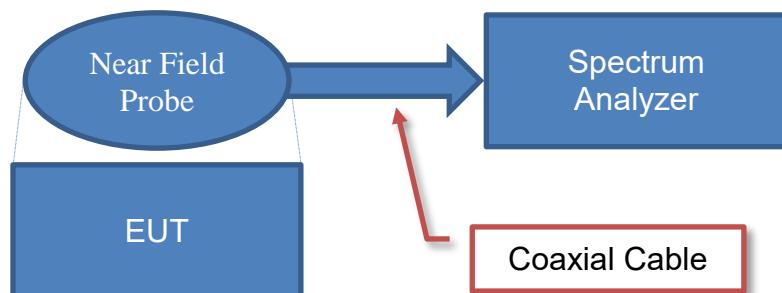


Test Setup Block Diagrams

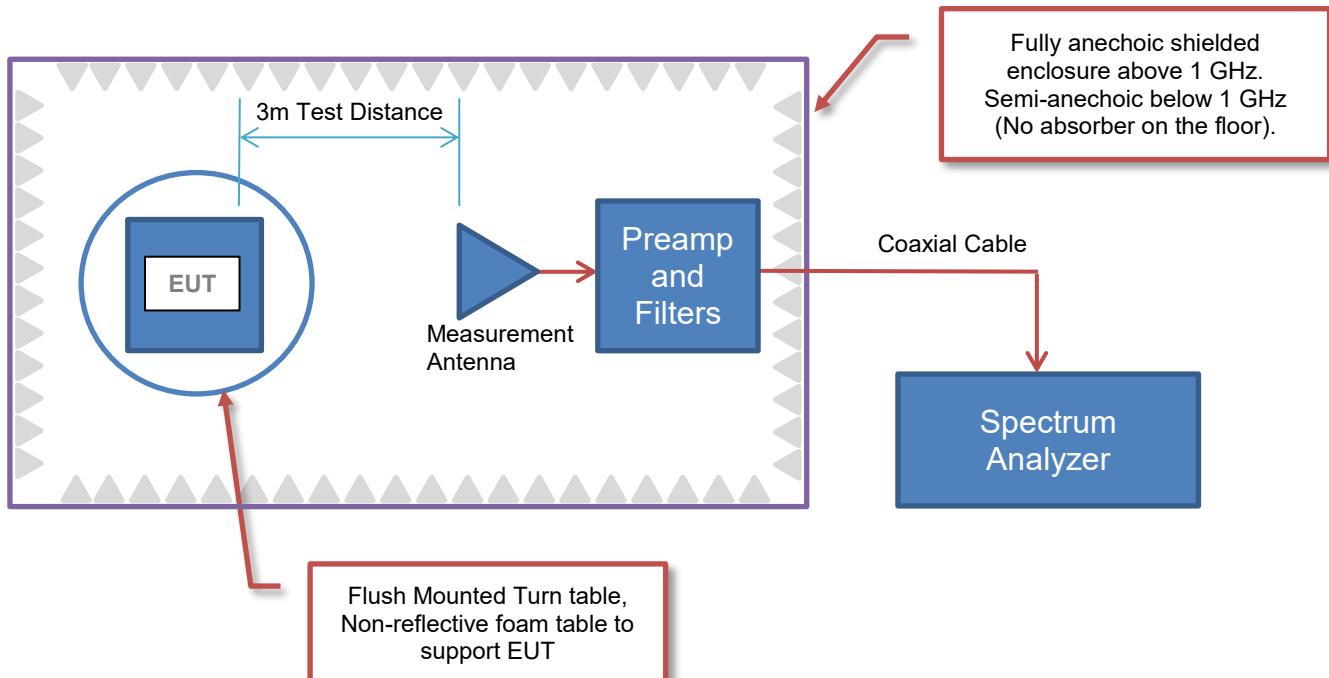
Antenna Port Conducted Measurements



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:	August 28, 2017
Last Date of Test:	January 12, 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 radio to FCC 15.247 and FCC 15.207 requirements.

CONFIGURATIONS



Configuration SUPR0187- 1

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

EUT	
Description	Manufacturer
TRACcess Bluetooth Controller	Supra, A Division of UTCFS

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

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- 1

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	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	410905003CT	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

MODIFICATIONS



Equipment Modifications

Item	Date	Test	Modification	Note	Disposition of EUT
1	8/28/2017	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.
2	8/28/2017	Band Edge Compliance – Hopping Mode	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	8/28/2017	Carrier Frequency Separation	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	8/28/2017	Number of Hopping Frequencies	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	8/28/2017	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.
6	8/28/2017	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.
7	8/28/2017	Spurious Conducted Emissions	Tested as delivered to Test Station.	No EMI suppression devices were added or modified during this test.	EUT remained at Element following the test.
8	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.
9	9/8/2017	Dwell Time	Tested as delivered to Test Station.	No EMI suppression devices were added or modified during this test.	EUT was taken home by the client following the test.
10	1/12/2018	Spurious Radiated Emissions	Modified from delivered configuration.	A shield was placed over the Radio IC. Modification authorized by Dean Sinn.	Scheduled testing was completed.



POWERLINE CONDUCTED EMISSIONS

TEST DESCRIPTION

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

TEST EQUIPMENT

Description	Manufacturer	Model	ID	Last Cal.	Cal. Due
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

Bluetooth EDR, Mid Channel, 2440 MHz, DH5



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 Alcocke 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
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COMMENTS

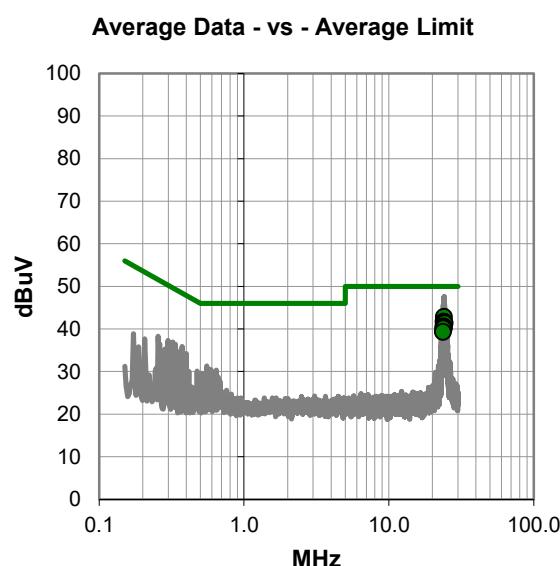
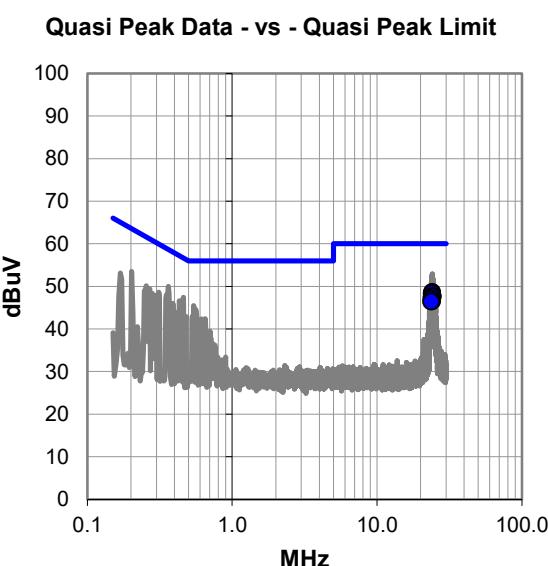
Measurements made on the AC input to a linear DC power supply.

EUT OPERATING MODES

Bluetooth EDR, Mid Channel, 2440 MHz, DH5

DEVIATIONS FROM TEST STANDARD

None





POWERLINE CONDUCTED EMISSIONS

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 Alcocke 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
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COMMENTS

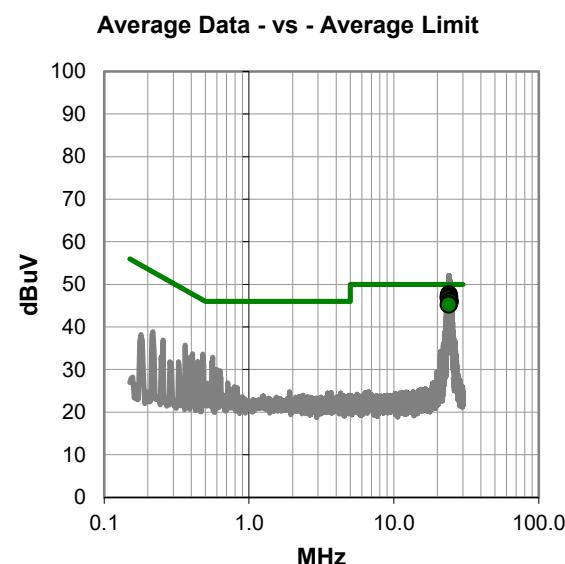
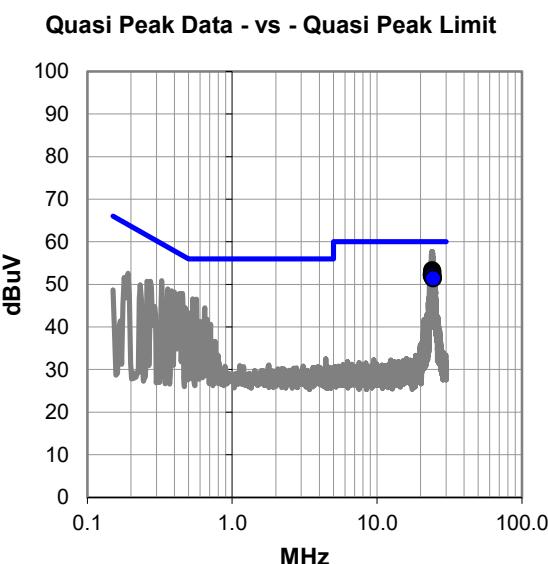
Measurements made on the AC input to a linear DC power supply.

EUT OPERATING MODES

Bluetooth EDR, Mid Channel, 2440 MHz, DH5

DEVIATIONS FROM TEST STANDARD

None





POWERLINE CONDUCTED EMISSIONS

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

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 continuous Tx, Low channel = 2402 MHz, Mid channel = 2440 MHz, High channel = 2480 MHz

POWER SETTINGS INVESTIGATED

Battery

CONFIGURATIONS INVESTIGATED

SUPR0237 - 1

FREQUENCY RANGE INVESTIGATED

Start Frequency	30 MHz	Stop Frequency	26.5 GHz
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SAMPLE CALCULATIONS

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

TEST EQUIPMENT

Description	Manufacturer	Model	ID	Last Cal.	Interval
Cable	ESM Cable Corp.	KNKN-72 SMA Cable	EVZ	10-Jun-2017	12 mo
Amplifier - Pre-Amplifier	Miteq	AMF-6F-18002650-25-10P	AVU	31-Aug-2017	12 mo
Antenna - Standard Gain	ETS Lindgren	3160-09	AIV	NCR	0 mo
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
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
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.



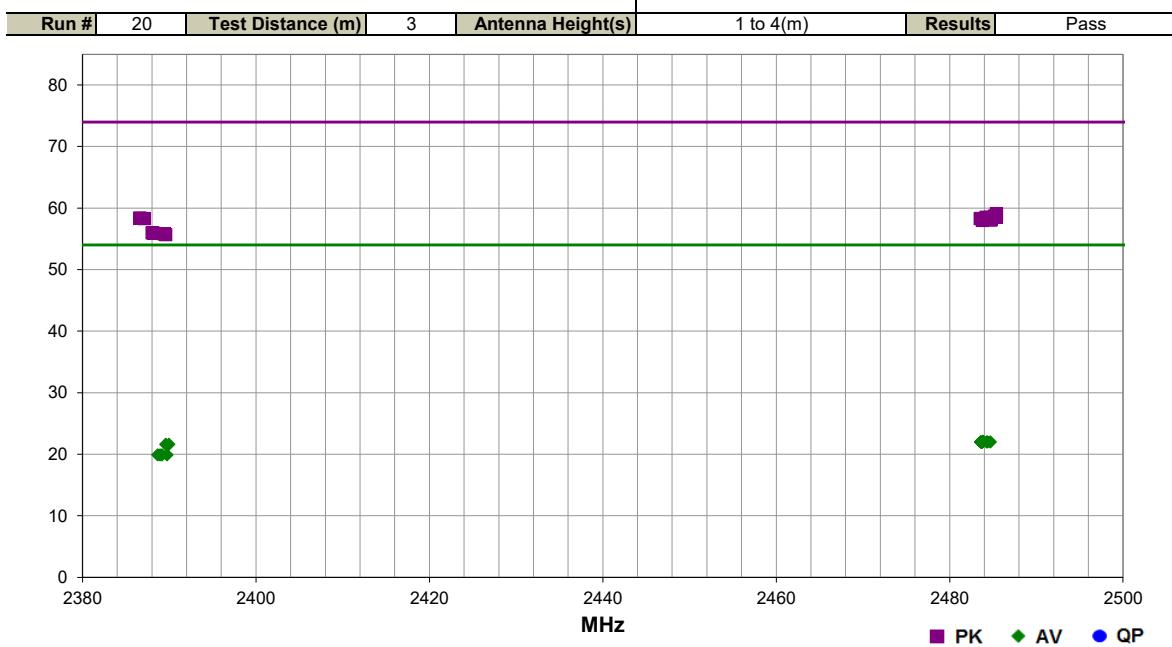
SPURIOUS RADIATED EMISSIONS

EmiRS 2017.09.18.2

PSA-ESCI 2017.09.18

Work Order:	SUPR0237	Date:	11-Jan-2018	
Project:	None	Temperature:	21.7 °C	
Job Site:	EV01	Humidity:	42.9% RH	
Serial Number:	45000000	Barometric Pres.:	1012 mbar	
EUT:	TRAC-Mini Controller	Tested by:	Jody House and Jeff Alcock	
Configuration:	1			
Customer:	Supra, A Division of UTCFS			
Attendees:	Dean Sinn			
EUT Power:	Battery			
Operating Mode:	Bluetooth continuous Tx, Low channel = 2402 MHz, Mid channel = 2440 MHz, High channel = 2480 MHz			
Deviations:	None			
Comments:	See comments below for channel, modulation type, and EUT orientation. A Duty Cycle Correction Factor (DCCF) was applied to the Average data. The Duty Cycle (D) in a 100 ms window was determined to be 5.8%. Using procedure 7.5 in ANSCI C63.10-2013 the DCCF is calculated using $20 \times \log(D)$, which gives a DCCF of -24.7 dB			

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



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
2485.403	43.5	-4.4	1.0	136.0	0.0	20.0	Horz	PK	0.0	59.1	74.0	-14.9	High channel, 3DH5, EUT vertical
2485.190	43.1	-4.4	1.0	16.0	0.0	20.0	Horz	PK	0.0	58.7	74.0	-15.3	High channel, 2DH5, EUT vertical
2484.203	42.9	-4.4	1.0	186.0	0.0	20.0	Vert	PK	0.0	58.5	74.0	-15.5	High channel, DH5, EUT vertical
2484.670	42.9	-4.4	1.0	116.0	0.0	20.0	Vert	PK	0.0	58.5	74.0	-15.5	High channel, 2DH5, EUT vertical
2485.377	42.9	-4.4	1.0	225.0	0.0	20.0	Horz	PK	0.0	58.5	74.0	-15.5	High channel, DH5, EUT vertical
2386.592	43.4	-5.0	1.0	183.0	0.0	20.0	Vert	PK	0.0	58.4	74.0	-15.6	Low channel, DH5, EUT vertical
2387.092	43.3	-5.0	1.0	300.0	0.0	20.0	Horz	PK	0.0	58.3	74.0	-15.7	Low channel, DH5, EUT vertical
2483.530	42.7	-4.4	1.0	58.0	0.0	20.0	Vert	PK	0.0	58.3	74.0	-15.7	High channel, DH5 EUT horizontal
2483.860	42.6	-4.4	1.0	16.0	0.0	20.0	Vert	PK	0.0	58.2	74.0	-15.8	High channel, DH5, EUT on side
2484.683	42.5	-4.4	1.0	321.0	0.0	20.0	Horz	PK	0.0	58.1	74.0	-15.9	High channel, DH5 EUT horizontal
2484.760	42.5	-4.4	1.0	36.0	0.0	20.0	Vert	PK	0.0	58.1	74.0	-15.9	High channel, 3DH5, EUT vertical
2483.787	42.4	-4.4	1.0	268.0	0.0	20.0	Horz	PK	0.0	58.0	74.0	-16.0	High channel, DH5, EUT on side
2388.020	41.0	-5.0	1.0	351.0	0.0	20.0	Horz	PK	0.0	56.0	74.0	-18.0	Low channel, 2DH5, EUT vertical
2388.203	40.9	-5.0	1.1	202.0	0.0	20.0	Horz	PK	0.0	55.9	74.0	-18.1	Low channel, 3DH5, EUT vertical
2389.400	40.8	-5.0	1.0	205.0	0.0	20.0	Vert	PK	0.0	55.8	74.0	-18.2	Low channel, 2DH5, EUT vertical
2389.577	40.7	-5.0	1.0	209.0	0.0	20.0	Vert	PK	0.0	55.7	74.0	-18.3	Low channel, 3DH5, EUT vertical
2483.850	31.2	-4.4	1.0	225.0	-24.7	20.0	Horz	AV	0.0	22.1	54.0	-31.9	High channel, DH5, EUT vertical
2483.570	31.1	-4.4	1.0	16.0	-24.7	20.0	Vert	AV	0.0	22.0	54.0	-32.0	High channel, DH5, EUT on side
2483.583	31.1	-4.4	1.0	186.0	-24.7	20.0	Vert	AV	0.0	22.0	54.0	-32.0	High channel, DH5, EUT vertical
2483.607	31.1	-4.4	1.0	58.0	-24.7	20.0	Vert	AV	0.0	22.0	54.0	-32.0	High channel, DH5 EUT horizontal
2483.770	31.1	-4.4	1.0	136.0	-24.7	20.0	Horz	AV	0.0	22.0	54.0	-32.0	High channel, 3DH5, EUT vertical
2484.267	31.1	-4.4	1.0	321.0	-24.7	20.0	Horz	AV	0.0	22.0	54.0	-32.0	High channel, DH5 EUT horizontal
2484.390	31.1	-4.4	1.0	36.0	-24.7	20.0	Vert	AV	0.0	22.0	54.0	-32.0	High channel, 3DH5, 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
2484.713	31.1	-4.4	1.0	16.0	-24.7	20.0	Horz	AV	0.0	22.0	54.0	-32.0	High channel, 2DH5, EUT vertical
2483.710	31.0	-4.4	1.0	268.0	-24.7	20.0	Horz	AV	0.0	21.9	54.0	-32.1	High channel, DH5, EUT on side
2483.727	31.0	-4.4	1.0	116.0	-24.7	20.0	Vert	AV	0.0	21.9	54.0	-32.1	High channel, 2DH5, EUT vertical
2389.608	31.3	-5.0	1.0	300.0	-24.7	20.0	Horz	AV	0.0	21.6	54.0	-32.4	Low channel, DH5, EUT vertical
2389.958	31.3	-5.0	1.0	183.0	-24.7	20.0	Vert	AV	0.0	21.6	54.0	-32.4	Low channel, DH5, EUT vertical
2389.183	29.6	-5.0	1.0	351.0	-24.7	20.0	Horz	AV	0.0	19.9	54.0	-34.1	Low channel, 2DH5, EUT vertical
2389.750	29.6	-5.0	1.0	205.0	-24.7	20.0	Vert	AV	0.0	19.9	54.0	-34.1	Low channel, 2DH5, EUT vertical
2388.960	29.6	-5.0	1.1	202.0	-24.7	20.0	Horz	AV	0.0	19.9	54.0	-34.1	Low channel, 3DH5, EUT vertical
2388.680	29.6	-5.0	1.0	209.0	-24.7	20.0	Vert	AV	0.0	19.9	54.0	-34.1	Low channel, 3DH5, EUT vertical

SPURIOUS RADIATED EMISSIONS

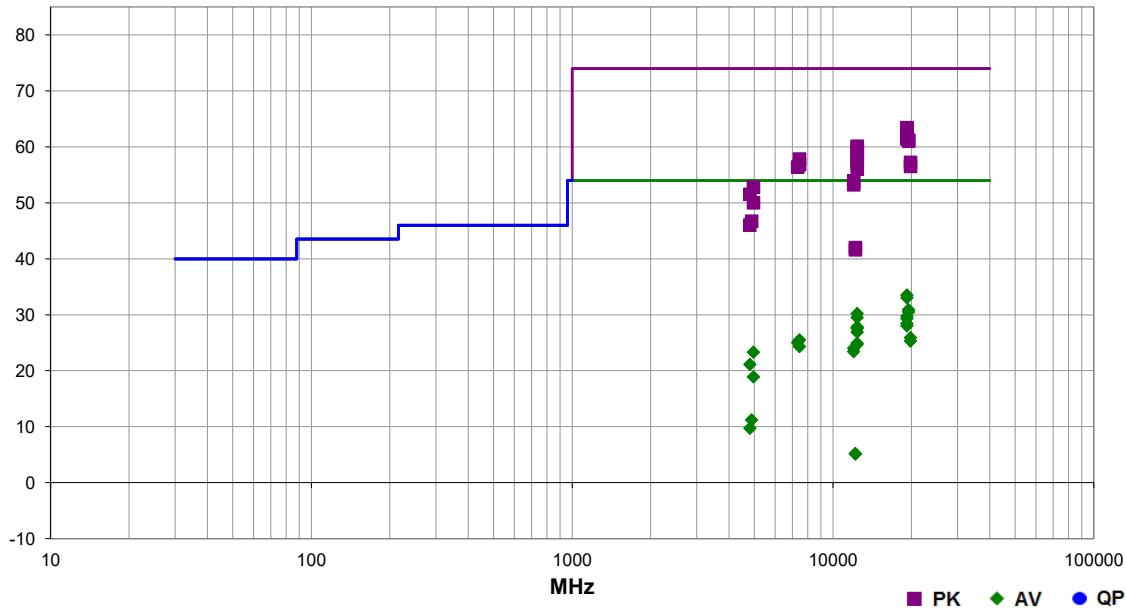


EmiR5 2017.09.18.2 PSA-ESCI 2017.09.18

Work Order:	SUPR0237	Date:	12-Jan-2018	
Project:	None	Temperature:	20.9 °C	
Job Site:	EV01	Humidity:	45.4% RH	
Serial Number:	45000000	Barometric Pres.:	1028 mbar	
EUT:	TRAC-Mini Controller	Tested by:	Jody House and Jeff Alcock	
Configuration:	1			
Customer:	Supra, A Division of UTCFS			
Attendees:	Dean Sinn			
EUT Power:	Battery			
Operating Mode:	Bluetooth continuous Tx, Low channel = 2402 MHz, Mid channel = 2440 MHz, High channel = 2480 MHz			
Deviations:	None			
Comments:	See comments below for channel, modulation type, and EUT orientation. A Duty Cycle Correction Factor (DCCF) was applied to the Average data. The Duty Cycle (D) in a 100 ms window was determined to be 5.8%. Using procedure 7.5 in ANSCI C63.10-2013 the DCCF is determined using $20 \log(D)$, which gives a DCCF of -24.7 dB			

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

Run #	27	Test Distance (m)	3	Antenna Height(s)	1 to 4(m)	Results	Pass
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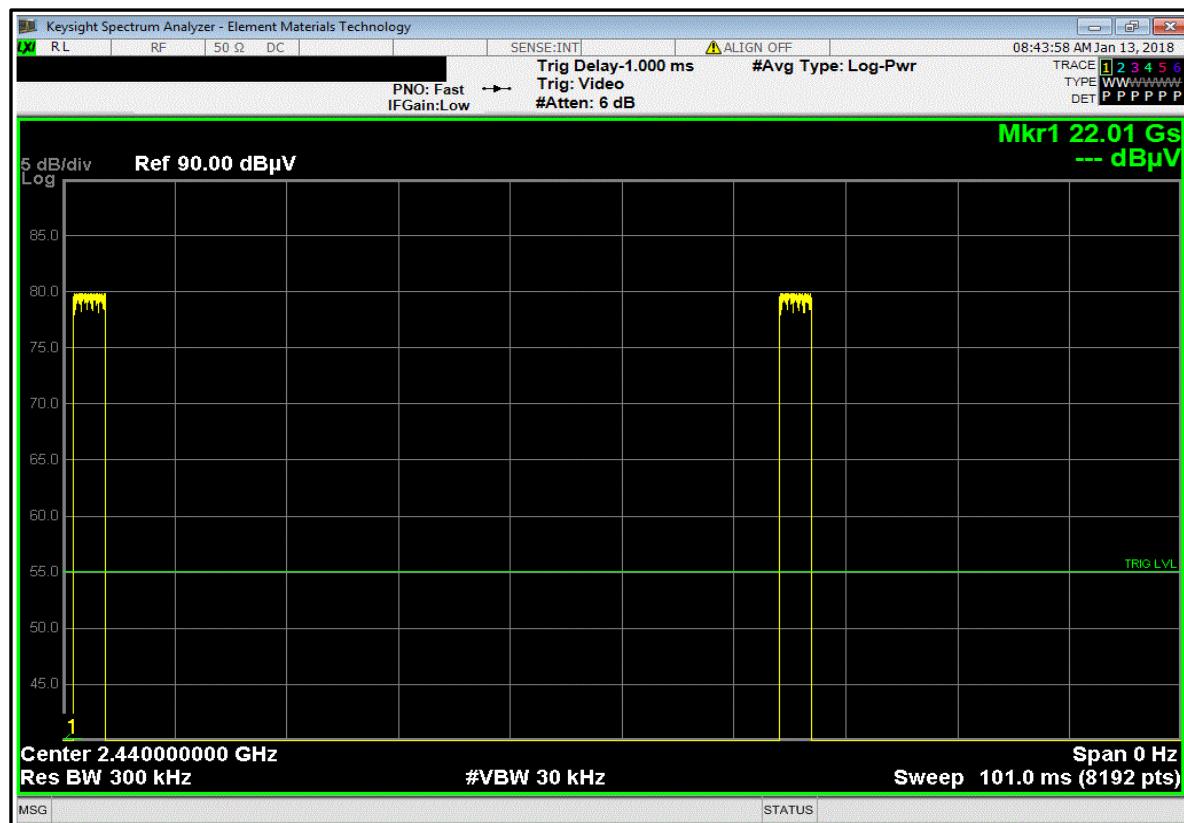
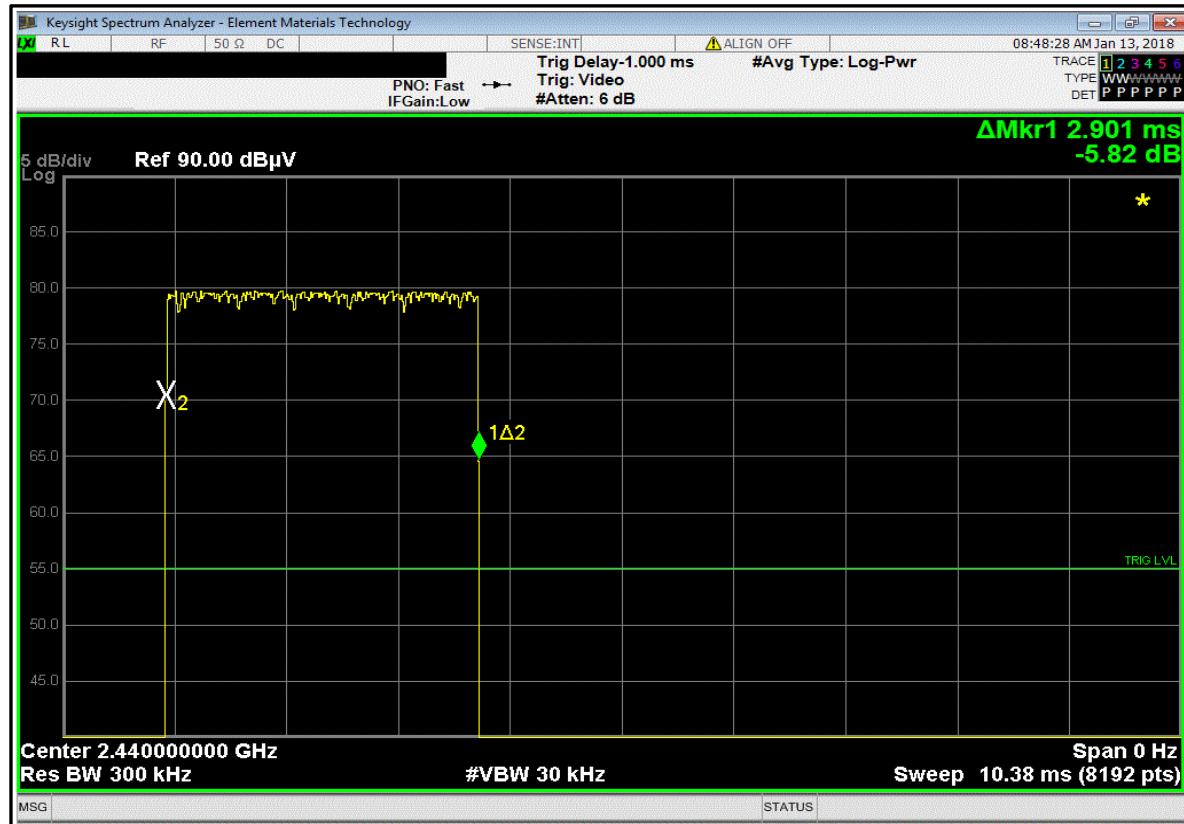
Freq (MHz)	Amplitude (dBuV)	Factor (dB)	Antenna Height (meters)	Azimuth (degrees)	Duty Cycle Correction Factor (dB)	External Attenuation (dB)	Polarity/Transducer Type	Detector	Distance Adjustment (dB)	Adjusted (dBuV/m)	Spec. Limit (dBuV/m)	Compared to Spec. (dB)	Comments
19214.950	61.7	1.7	1.4	357.0	0.0	0.0	Vert	PK	0.0	63.4	74.0	-10.6	Low channel, DH5, EUT on side
19217.300	61.5	1.7	1.4	350.0	0.0	0.0	Horz	PK	0.0	63.2	74.0	-10.8	Low channel, DH5, EUT vertical
19214.980	61.1	1.7	1.3	348.0	0.0	0.0	Horz	PK	0.0	62.8	74.0	-11.2	Low channel, 3DH5, EUT vertical
19214.750	60.9	1.7	1.4	348.0	0.0	0.0	Horz	PK	0.0	62.6	74.0	-11.4	Low channel, 2DH5, EUT vertical
19216.030	59.9	1.7	1.3	359.0	0.0	0.0	Vert	PK	0.0	61.6	74.0	-12.4	Low channel, 3DH5, EUT on side
19215.180	59.7	1.7	1.3	359.0	0.0	0.0	Vert	PK	0.0	61.4	74.0	-12.6	Low channel, 2DH5, EUT on side
19521.300	59.4	1.8	1.4	348.0	0.0	0.0	Horz	PK	0.0	61.2	74.0	-12.8	Mid channel, DH5, EUT vertical
19521.310	59.2	1.8	1.4	359.0	0.0	0.0	Vert	PK	0.0	61.0	74.0	-13.0	Mid channel, DH5, EUT on side
12400.820	50.2	9.9	1.1	347.0	0.0	0.0	Horz	PK	0.0	60.1	74.0	-13.9	High channel, DH5, EUT vertical
12400.750	50.1	9.9	1.1	219.0	0.0	0.0	Horz	PK	0.0	60.0	74.0	-14.0	High channel, 2DH5, EUT vertical
12400.920	49.6	9.9	1.0	227.0	0.0	0.0	Horz	PK	0.0	59.5	74.0	-14.5	High channel, DH5, EUT on side
12400.990	48.4	9.9	1.0	101.0	0.0	0.0	Vert	PK	0.0	58.3	74.0	-15.7	High channel, DH5, EUT on side
12400.860	48.2	9.9	1.1	217.0	0.0	0.0	Vert	PK	0.0	58.1	74.0	-15.9	High channel, DH5, EUT vertical
7439.458	44.9	12.9	1.3	249.0	0.0	0.0	Horz	PK	0.0	57.8	74.0	-16.2	High channel, DH5, EUT vertical
12400.910	47.6	9.9	2.1	282.0	0.0	0.0	Horz	PK	0.0	57.5	74.0	-16.5	High channel, DH5, EUT horizontal
19838.880	55.3	1.9	1.5	286.0	0.0	0.0	Vert	PK	0.0	57.2	74.0	-16.8	High channel, DH5, EUT on side
12400.810	47.2	9.9	1.0	90.0	0.0	0.0	Vert	PK	0.0	57.1	74.0	-16.9	High channel, 3DH5, EUT vertical
7440.158	43.9	12.9	2.3	265.0	0.0	0.0	Vert	PK	0.0	56.8	74.0	-17.2	High channel, DH5, EUT on side
19838.790	54.6	1.9	1.4	359.0	0.0	0.0	Horz	PK	0.0	56.5	74.0	-17.5	High channel, DH5, EUT vertical
7319.675	44.3	12.1	1.2	258.0	0.0	0.0	Horz	PK	0.0	56.4	74.0	-17.6	Mid channel, DH5 EUT vertical
12400.690	46.1	9.9	2.5	5.0	0.0	0.0	Vert	PK	0.0	56.0	74.0	-18.0	High channel, DH5, EUT horizontal
12010.880	52.9	1.0	1.0	221.0	0.0	0.0	Horz	PK	0.0	53.9	74.0	-20.1	Low channel, DH5, 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
19215.060	56.5	1.7	1.4	357.0	-24.7	0.0	Vert	AV	0.0	33.5	54.0	-20.5	Low channel, DH5, EUT on side
12010.750	52.2	1.0	1.2	260.0	0.0	0.0	Vert	PK	0.0	53.2	74.0	-20.8	Low channel, DH5, EUT on side
19214.980	56.0	1.7	1.4	350.0	-24.7	0.0	Horz	AV	0.0	33.0	54.0	-21.0	Low channel, DH5, EUT vertical
4960.108	47.6	5.2	2.6	125.0	0.0	0.0	Vert	PK	0.0	52.8	74.0	-21.2	High channel, DH5, EUT on side
4804.217	47.7	3.8	3.1	124.0	0.0	0.0	Vert	PK	0.0	51.5	74.0	-22.5	Low channel, DH5, EUT on side
19521.160	53.8	1.8	1.4	348.0	-24.7	0.0	Horz	AV	0.0	30.9	54.0	-23.1	Mid channel, DH5, EUT vertical
19521.110	53.4	1.8	1.4	359.0	-24.7	0.0	Vert	AV	0.0	30.5	54.0	-23.5	Mid channel, DH5, EUT on side
12400.580	45.0	9.9	1.1	347.0	-24.7	0.0	Horz	AV	0.0	30.2	54.0	-23.8	High channel, DH5, EUT vertical
4960.208	44.8	5.2	1.0	333.0	0.0	0.0	Horz	PK	0.0	50.0	74.0	-24.0	High channel, DH5, EUT vertical
19214.960	52.7	1.7	1.4	348.0	-24.7	0.0	Horz	AV	0.0	29.7	54.0	-24.3	Low channel, 2DH5, EUT vertical
12400.600	44.3	9.9	1.0	227.0	-24.7	0.0	Horz	AV	0.0	29.5	54.0	-24.5	High channel, DH5, EUT on side
19216.070	52.3	1.7	1.3	348.0	-24.7	0.0	Horz	AV	0.0	29.3	54.0	-24.7	Low channel, 3DH5, EUT vertical
19214.970	51.4	1.7	1.3	359.0	-24.7	0.0	Vert	AV	0.0	28.4	54.0	-25.6	Low channel, 2DH5, EUT on side
19216.080	51.0	1.7	1.3	359.0	-24.7	0.0	Vert	AV	0.0	28.0	54.0	-26.0	Low channel, 3DH5, EUT on side
12400.610	42.6	9.9	1.0	101.0	-24.7	0.0	Vert	AV	0.0	27.8	54.0	-26.2	High channel, DH5, EUT on side
12400.650	42.5	9.9	1.1	219.0	-24.7	0.0	Horz	AV	0.0	27.7	54.0	-26.3	High channel, 2DH5, EUT vertical
12400.640	42.3	9.9	1.1	217.0	-24.7	0.0	Vert	AV	0.0	27.5	54.0	-26.5	High channel, DH5, EUT vertical
12400.640	41.7	9.9	2.1	282.0	-24.7	0.0	Horz	AV	0.0	26.9	54.0	-27.1	High channel, DH5, EUT horizontal
4880.158	41.7	5.0	1.0	338.0	0.0	0.0	Horz	PK	0.0	46.7	74.0	-27.3	Mid channel, DH5 EUT vertical
4801.983	42.2	3.8	1.6	174.0	0.0	0.0	Horz	PK	0.0	46.0	74.0	-28.0	Low channel, DH5 EUT vertical
19841.130	48.7	1.9	1.5	286.0	-24.7	0.0	Vert	AV	0.0	25.9	54.0	-28.1	High channel, DH5, EUT on side
7439.975	37.3	12.9	1.3	249.0	-24.7	0.0	Horz	AV	0.0	25.5	54.0	-28.5	High channel, DH5, EUT vertical
19841.130	48.1	1.9	1.4	359.0	-24.7	0.0	Horz	AV	0.0	25.3	54.0	-28.7	High channel, DH5, EUT vertical
7320.025	37.6	12.1	1.2	258.0	-24.7	0.0	Horz	AV	0.0	25.0	54.0	-29.0	Middle channel, DH5 EUT vertical
12400.680	39.7	9.9	2.5	5.0	-24.7	0.0	Vert	AV	0.0	24.9	54.0	-29.1	High channel, DH5, EUT horizontal
12400.040	39.5	9.9	1.0	90.0	-24.7	0.0	Vert	AV	0.0	24.7	54.0	-29.3	High channel, 3DH5, EUT vertical
7439.992	36.1	12.9	2.3	265.0	-24.7	0.0	Vert	AV	0.0	24.3	54.0	-29.7	High channel, DH5, EUT on side
12010.580	47.7	1.0	1.0	221.0	-24.7	0.0	Horz	AV	0.0	24.0	54.0	-30.0	Low channel, DH5, EUT vertical
12010.610	47.1	1.0	1.2	260.0	-24.7	0.0	Vert	AV	0.0	23.4	54.0	-30.6	Low channel, DH5, EUT on side
4960.025	42.8	5.2	2.6	125.0	-24.7	0.0	Vert	AV	0.0	23.3	54.0	-30.7	High channel, DH5, EUT on side
12198.980	41.1	0.9	1.0	15.0	0.0	0.0	Horz	PK	0.0	42.0	74.0	-32.0	Mid channel, DH5, EUT vertical
12199.300	40.7	0.9	1.0	181.0	0.0	0.0	Vert	PK	0.0	41.6	74.0	-32.4	Mid channel, DH5, EUT on side
4804.042	42.0	3.8	3.1	124.0	-24.7	0.0	Vert	AV	0.0	21.1	54.0	-32.9	Low channel, DH5, EUT on side
4960.033	38.4	5.2	1.0	333.0	-24.7	0.0	Horz	AV	0.0	18.9	54.0	-35.1	High channel, DH5, EUT vertical
4880.108	30.9	5.0	1.0	338.0	-24.7	0.0	Horz	AV	0.0	11.2	54.0	-42.8	Mid channel, DH5 EUT vertical
4806.050	30.5	3.9	1.6	174.0	-24.7	0.0	Horz	AV	0.0	9.7	54.0	-44.3	Low channel, DH5 EUT vertical
12197.510	29.0	0.9	1.0	181.0	-24.7	0.0	Vert	AV	0.0	5.2	54.0	-48.8	Mid channel, DH5, EUT on side
12200.250	28.9	0.9	1.0	15.0	-24.7	0.0	Horz	AV	0.0	5.1	54.0	-48.9	Mid channel, DH5, EUT vertical

SPURIOUS RADIATED EMISSIONS



PSA-ESCI 2017.09.18



DUTY CYCLE



XMI: 2017.02.08

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 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 test software provided for operation in a fixed, single channel mode allows the EUT to operate continuously at 100% Duty Cycle.

CARRIER FREQUENCY SEPARATION



XMIT 2017.02.08

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	10/27/2015	10/27/2018
Meter - Multimeter	Tektronix	DMM912	MMH	2/17/2016	2/17/2019
Power Supply - DC	Topward	TPS-2000	TPD	NCR	NCR
Cable	Micro-Coax	UFD150A-1-0720-200200	EVH	5/30/2017	5/30/2018
Attenuator	S.M. Electronics	SA26B-20	AUY	5/30/2017	5/30/2018
Block - DC	Fairview Microwave	SD3379	AMW	6/5/2017	6/5/2018
Analyzer - Spectrum Analyzer	Keysight	N9010A	AFP	8/14/2017	8/14/2018

TEST DESCRIPTION

The measurement was made using a direct connection between the RF output of the EUT and a spectrum analyzer. The channel carrier frequencies in the 2400-2483.5MHz band must be separated by 25 kHz or the 20dB bandwidth of the hopping channel, whichever is greater. Or, if the output power is less than 125 mW, the channel separation can be 25 kHz or 2/3 of the 20dB bandwidth. The EUT was operated in pseudorandom hopping mode. The spectrum was scanned across two adjacent peaks. The separation between the peaks of these channels was measured.

CARRIER FREQUENCY SEPARATION



TbitTx 2017.07.11

XMMI 2017.02.08

EUT:	TRAC-Mini Controller		Work Order:	SUPR0187	
Serial Number:	0465		Date:	08/28/17	
Customer:	Supra, A Division of UTCFS		Temperature:	25 °C	
Attendees:	None		Humidity:	43.3% RH	
Project:	None		Barometric Pres.:	1012 mbar	
Tested by:	Jeff Alcock and Rod Peloquin		Power:	3.2 VDC	
TEST SPECIFICATIONS			Test Method	ANSI C63.10:2013	
FCC 15.247:2017					
COMMENTS					
Ref Offset includes SMA to u.fl cable.					
DEVIATIONS FROM TEST STANDARD					
None					
Configuration #	1	Signature			
			Value	Limit (±)	Results
Hopping Mode	3DH5, 8-DPSK	Mid Channel, 2440 MHz	1.0 MHz	1 MHz	Pass

CARRIER FREQUENCY SEPARATION



TbtTx 2017.07.11 XMT 2017.02.08

Hopping Mode, 3DH5, 8-DPSK, Mid Channel, 2440 MHz		Value	Limit (\geq)	Results
1.0 MHz	1 MHz			



NUMBER OF HOPPING FREQUENCIES



XMIT 2017.02.08

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	10/27/2015	10/27/2018
Meter - Multimeter	Tektronix	DMM912	MMH	2/17/2016	2/17/2019
Power Supply - DC	Topward	TPS-2000	TPD	NCR	NCR
Cable	Micro-Coax	UFD150A-1-0720-200200	EVH	5/30/2017	5/30/2018
Attenuator	S.M. Electronics	SA26B-20	AUY	5/30/2017	5/30/2018
Block - DC	Fairview Microwave	SD3379	AMW	6/5/2017	6/5/2018
Analyzer - Spectrum Analyzer	Keysight	N9010A	AFP	8/14/2017	8/14/2018

TEST DESCRIPTION

The measurement was made using a direct connection between the RF output of the EUT and a spectrum analyzer. The number of hopping frequencies was measured across the authorized band. The hopping function of the EUT was enabled.

NUMBER OF HOPPING FREQUENCIES



Tbitx 2017.07.11

XMI 2017.02.08

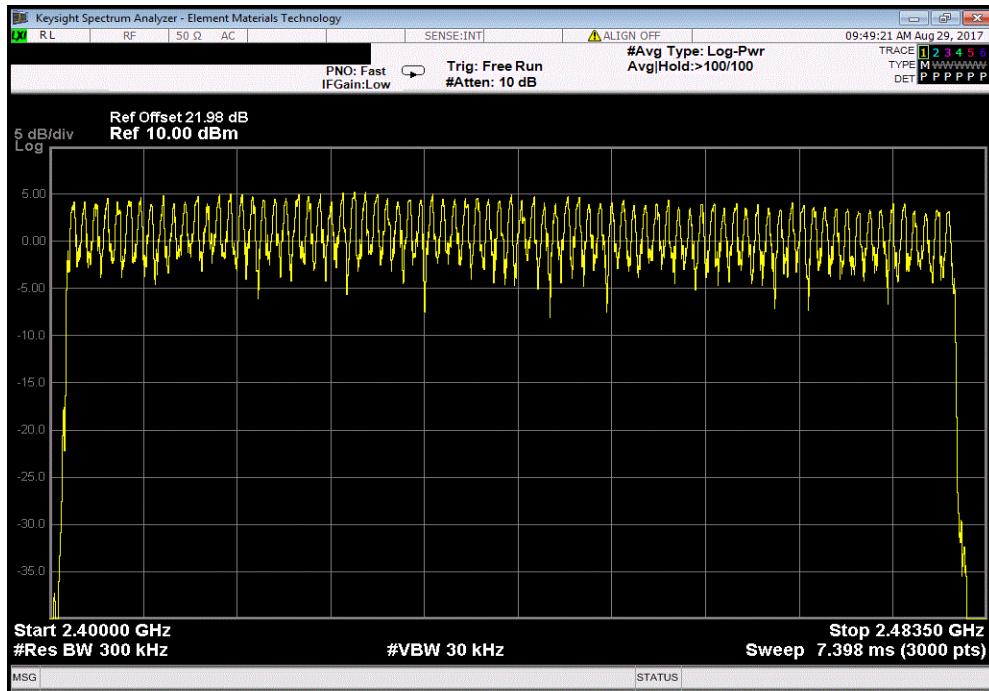
EUT:	TRAC-Mini Controller		Work Order:	SUPR0187	
Serial Number:	0465		Date:	08/28/17	
Customer:	Supra, A Division of UTCFS		Temperature:	25.1 °C	
Attendees:	None		Humidity:	43.2% RH	
Project:	None		Barometric Pres.:	1012 mbar	
Tested by:	Jeff Alcock and Rod Peloquin		Power:	3.2 VDC	
TEST SPECIFICATIONS			Test Method	ANSI C63.10:2013	
FCC 15.247:2017					
COMMENTS					
Ref Offset includes SMA to u.fl cable.					
DEVIATIONS FROM TEST STANDARD					
None					
Configuration #	1	Signature			
			Number of Channels	Limit (2)	Results
Hopping Mode			3DH5, 8-DPSK	79	15
			Mid Channel, 2440 MHz	Pass	

NUMBER OF HOPPING FREQUENCIES



TbtTx 2017.07.11 XMT 2017.02.08

Hopping Mode, 3DH5, 8-DPSK, Mid Channel, 2440 MHz			Number of Channels	Limit (≥)	Results
			79	15	Pass



DWELL TIME



XMIT 2017.02.08

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	Keysight	N9010A	AFP	8/14/2017	8/14/2018
Block - DC	Fairview Microwave	SD3379	AMW	6/5/2017	6/5/2018
Attenuator	S.M. Electronics	SA26B-20	AUY	5/30/2017	5/30/2018
Cable	Micro-Coax	UFD150A-1-0720-200200	EVH	5/30/2017	5/30/2018
Power Supply - DC	Topward	TPS-2000	TPD	NCR	NCR
Meter - Multimeter	Tektronix	DMM912	MMH	2/17/2016	2/17/2019
Generator - Signal	Keysight	N5182B	TFU	10/27/2015	10/27/2018

TEST DESCRIPTION

The measurement was made using a direct connection between the RF output of the EUT and a spectrum analyzer. The average dwell time per hopping channel was measured at one hopping channel in the middle of the authorized band. The hopping function of the EUT was enabled.

The dwell time limit is based on the Number of Hopping Channels * 400 mS. For Bluetooth this would be 79 Channels * 400mS = 31.6 Sec.

On Time During 31.6 Sec = Pulse Width * Average Number of Pulses * Scale Factor

➤Average Number of Pulses is based on 4 samples.

➤Scale Factor = 31.6 Sec / Screen Capture Sweep Time = 31.6 Sec / 6.32 Sec = 5

DWELL TIME



Tbitx 2017.07.11

XMI 2017.02.08

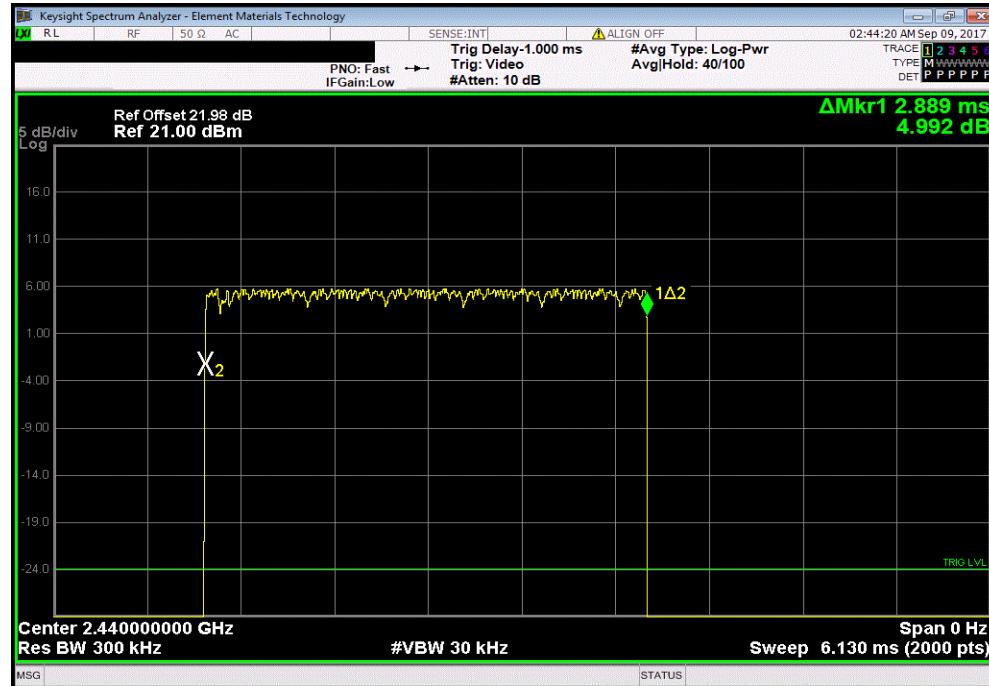
EUT:	TRAC-Mini Controller			Work Order:	SUPR0187		
Serial Number:	0465			Date:	09/08/17		
Customer:	Supra, A Division of UTCFS			Temperature:	24.1 °C		
Attendees:	None			Humidity:	45% RH		
Project:	None			Barometric Pres.:	1018 mbar		
Tested by:	Jeff Alcock and Rod Peloquin		Power:	3.2 VDC via 110VAC/60Hz		Job Site:	EV06
TEST SPECIFICATIONS				Test Method			
FCC 15.247:2017				ANSI C63.10:2013			
COMMENTS							
Ref Offset includes SMA to u.fl cable.							
DEVIATIONS FROM TEST STANDARD							
None							
Configuration #	1	Signature	<i>Rod Peloquin</i>				
			Pulse Width (ms)	Number of Pulses	Average No. of Pulses	Scale Factor	On Time (ms) During 31.6 s
Hopping Mode							
DH5, GFSK							
Mid Channel, 2440 MHz	2.889	N/A	N/A	N/A	N/A	N/A	N/A
Mid Channel, 2440 MHz	N/A	19	N/A	N/A	N/A	N/A	N/A
Mid Channel, 2440 MHz	N/A	26	N/A	N/A	N/A	N/A	N/A
Mid Channel, 2440 MHz	N/A	20	N/A	N/A	N/A	N/A	N/A
Mid Channel, 2440 MHz	N/A	17	N/A	N/A	N/A	N/A	N/A
Mid Channel, 2440 MHz	2.889	N/A	20.5	5	296.12	400	Pass
2DH5, pi/4-DQPSK							
Mid Channel, 2440 MHz	1.533	N/A	N/A	N/A	N/A	N/A	N/A
Mid Channel, 2440 MHz	N/A	22	N/A	N/A	N/A	N/A	N/A
Mid Channel, 2440 MHz	N/A	20	N/A	N/A	N/A	N/A	N/A
Mid Channel, 2440 MHz	N/A	25	N/A	N/A	N/A	N/A	N/A
Mid Channel, 2440 MHz	N/A	29	N/A	N/A	N/A	N/A	N/A
Mid Channel, 2440 MHz	1.533	N/A	24	5	183.96	400	Pass
3DH5, 8-DPSK							
Mid Channel, 2440 MHz	1.077	N/A	N/A	N/A	N/A	N/A	N/A
Mid Channel, 2440 MHz	N/A	21	N/A	N/A	N/A	N/A	N/A
Mid Channel, 2440 MHz	N/A	27	N/A	N/A	N/A	N/A	N/A
Mid Channel, 2440 MHz	N/A	19	N/A	N/A	N/A	N/A	N/A
Mid Channel, 2440 MHz	N/A	22	N/A	N/A	N/A	N/A	N/A
Mid Channel, 2440 MHz	1.077	N/A	22.25	5	119.82	400	Pass

DWELL TIME

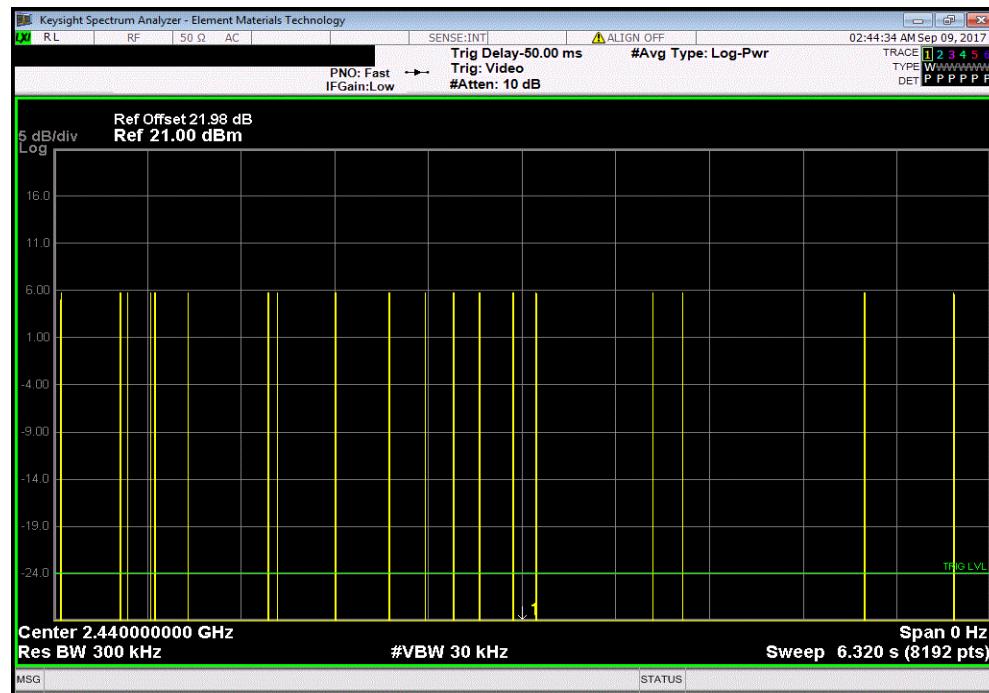


TbtTx 2017.07.11 XMT 2017.02.08

Hopping Mode, DH5, GFSK, Mid Channel, 2440 MHz						
Pulse Width (ms)	Number of Pulses	Average No. of Pulses	Scale Factor	On Time (ms) During 31.6 s	Limit (ms)	Results
2.889	N/A	N/A	N/A	N/A	N/A	N/A



Hopping Mode, DH5, GFSK, Mid Channel, 2440 MHz						
Pulse Width (ms)	Number of Pulses	Average No. of Pulses	Scale Factor	On Time (ms) During 31.6 s	Limit (ms)	Results
N/A	19	N/A	N/A	N/A	N/A	N/A

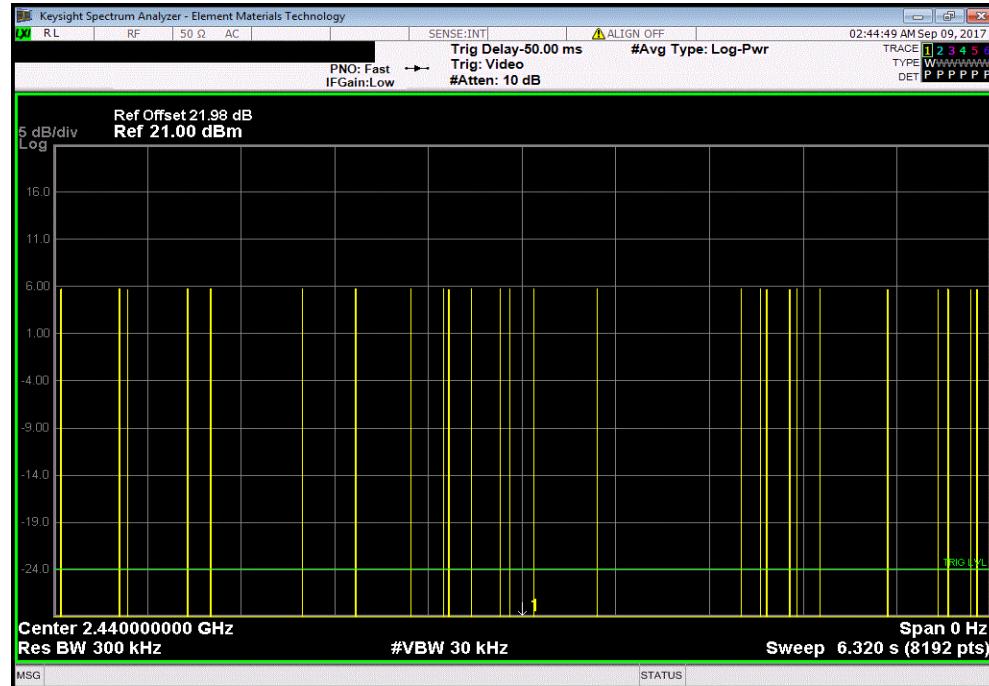


DWELL TIME

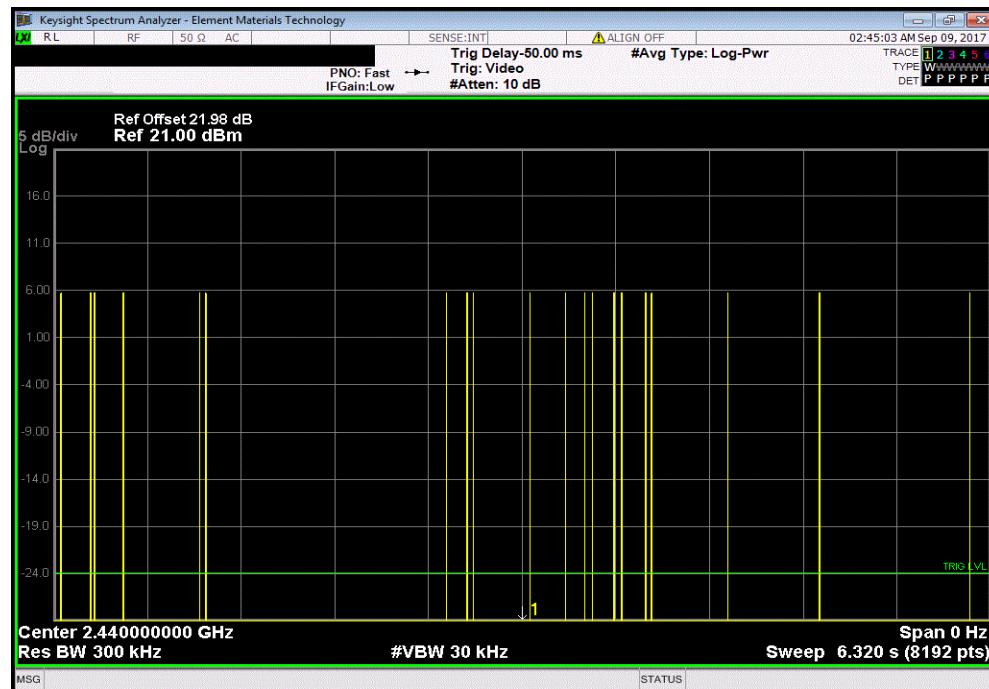


TbtTx 2017.07.11 XMT 2017.02.08

Hopping Mode, DH5, GFSK, Mid Channel, 2440 MHz						
Pulse Width (ms)	Number of Pulses	Average No. of Pulses	Scale Factor	On Time (ms) During 31.6 s	Limit (ms)	Results
N/A	26	N/A	N/A	N/A	N/A	N/A



Hopping Mode, DH5, GFSK, Mid Channel, 2440 MHz						
Pulse Width (ms)	Number of Pulses	Average No. of Pulses	Scale Factor	On Time (ms) During 31.6 s	Limit (ms)	Results
N/A	20	N/A	N/A	N/A	N/A	N/A

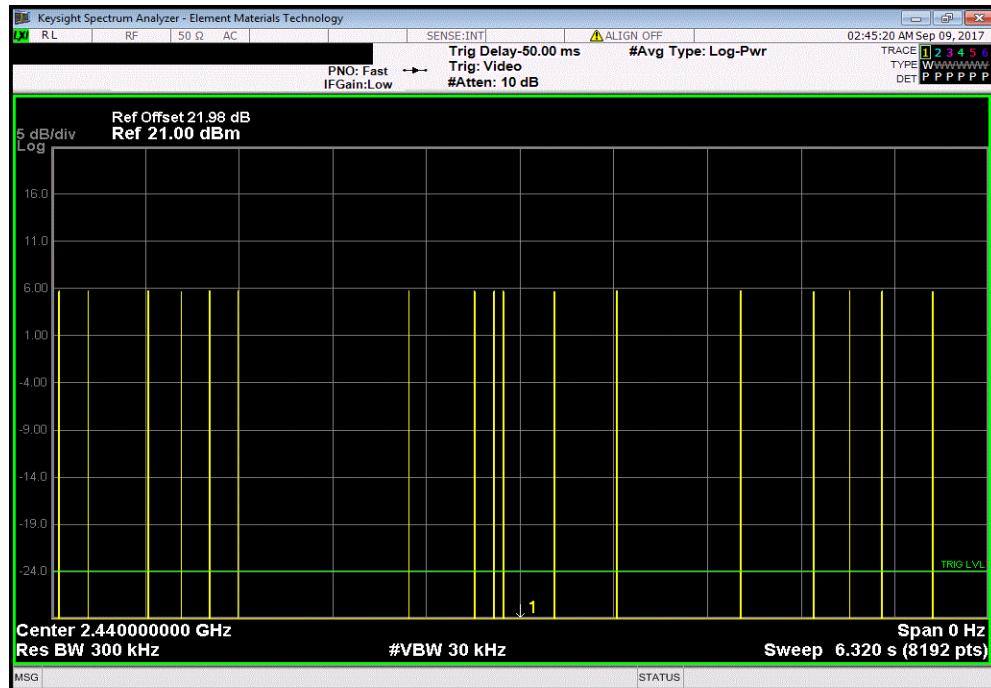


DWELL TIME



TbtTx 2017.07.11 XMT 2017.02.08

Hopping Mode, DH5, GFSK, Mid Channel, 2440 MHz						
Pulse Width (ms)	Number of Pulses	Average No. of Pulses	Scale Factor	On Time (ms) During 31.6 s	Limit (ms)	Results
N/A	17	N/A	N/A	N/A	N/A	N/A



Hopping Mode, DH5, GFSK, Mid Channel, 2440 MHz						
Pulse Width (ms)	Number of Pulses	Average No. of Pulses	Scale Factor	On Time (ms) During 31.6 s	Limit (ms)	Results
2.889	N/A	20.5	5	296.12	400	Pass

Calculation Only

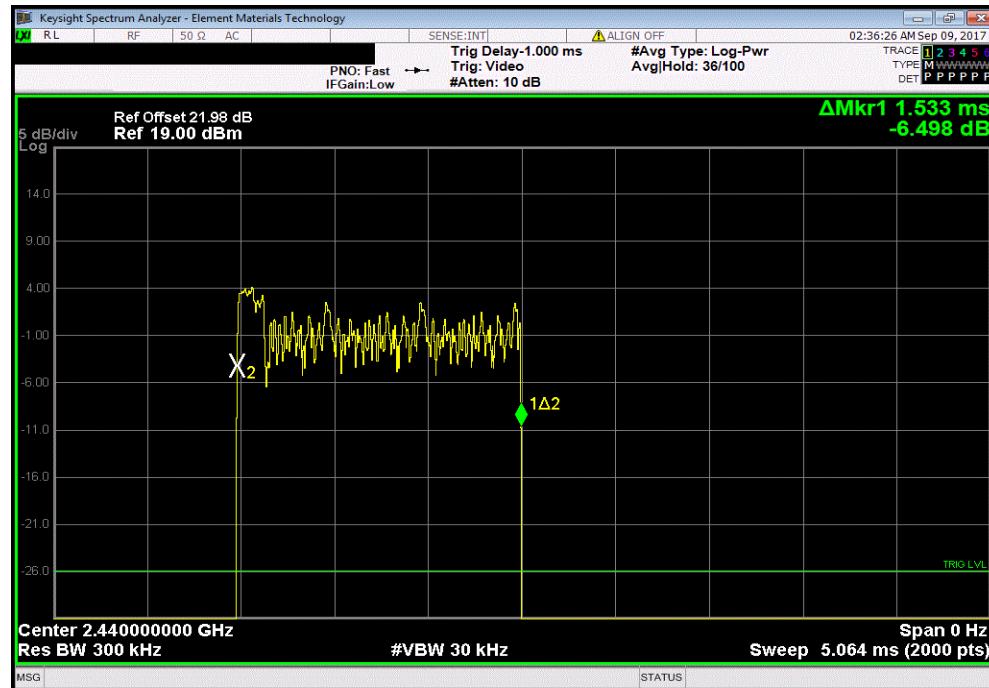
No Screen Capture Required

DWELL TIME

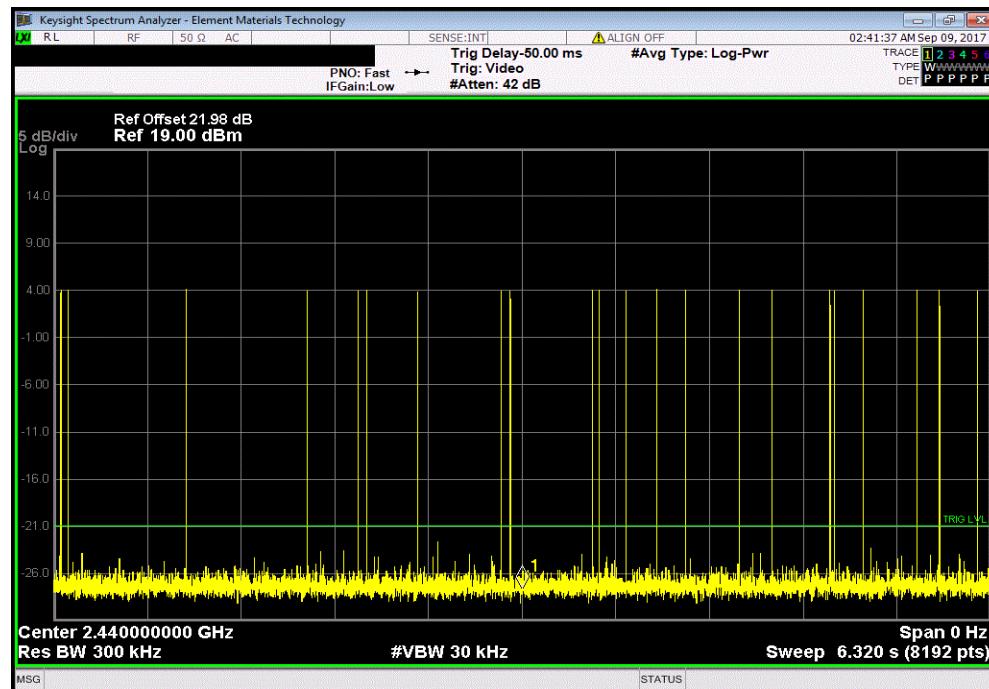


TbtTx 2017.07.11 XMT 2017.02.08

Hopping Mode, 2DH5, pi/4-DQPSK, Mid Channel, 2440 MHz						
Pulse Width (ms)	Number of Pulses	Average No. of Pulses	Scale Factor	On Time (ms) During 31.6 s	Limit (ms)	Results
1.533	N/A	N/A	N/A	N/A	N/A	N/A



Hopping Mode, 2DH5, pi/4-DQPSK, Mid Channel, 2440 MHz						
Pulse Width (ms)	Number of Pulses	Average No. of Pulses	Scale Factor	On Time (ms) During 31.6 s	Limit (ms)	Results
N/A	22	N/A	N/A	N/A	N/A	N/A

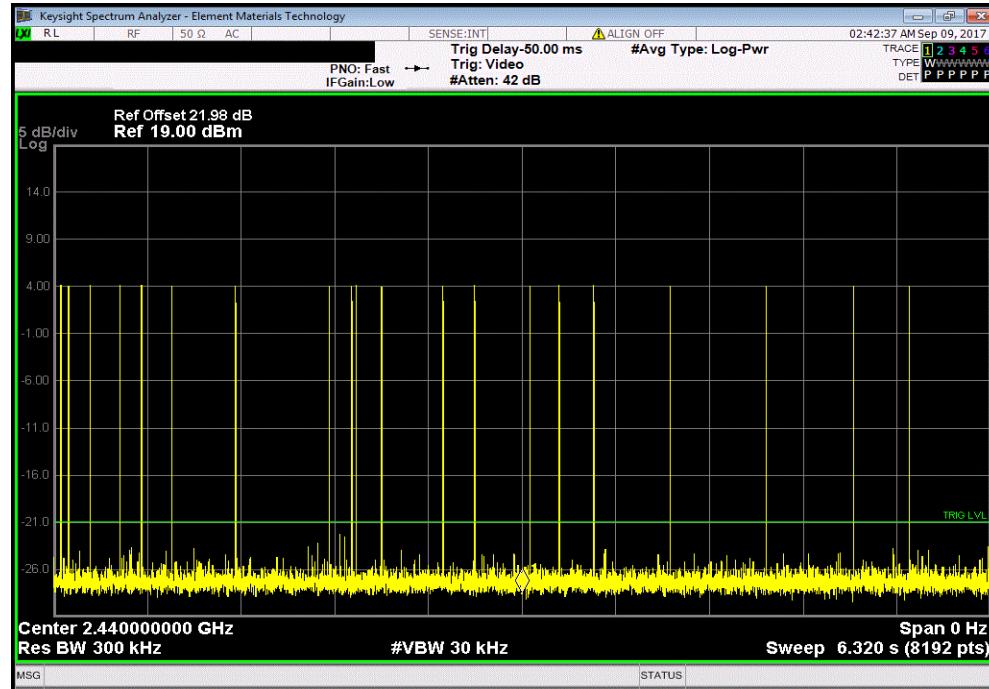


DWELL TIME

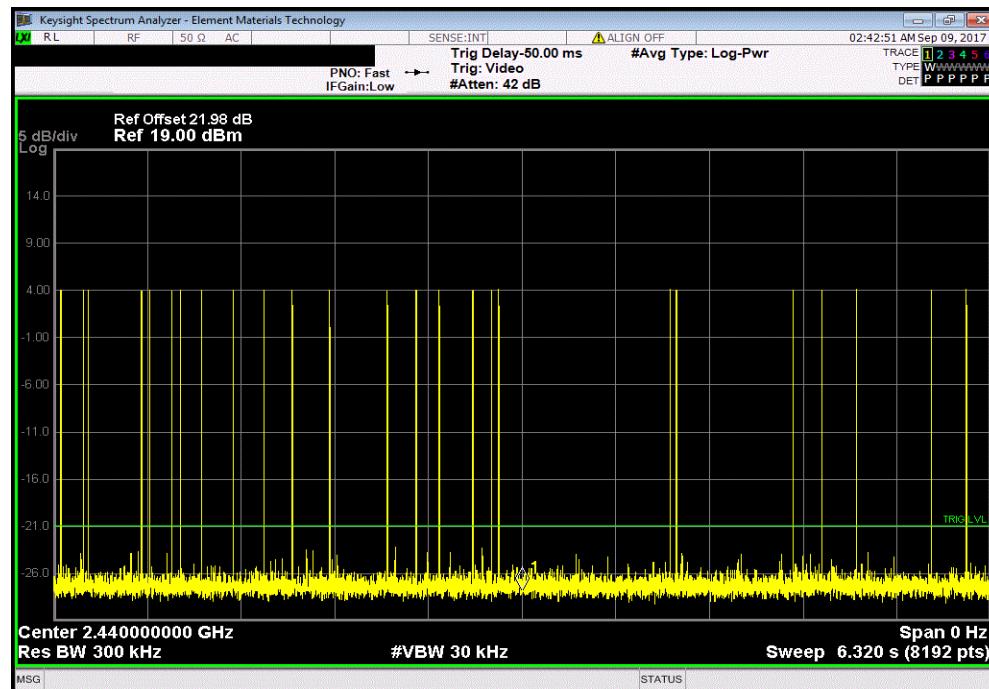


TbtTx 2017.07.11 XMT 2017.02.08

Hopping Mode, 2DH5, pi/4-DQPSK, Mid Channel, 2440 MHz						
Pulse Width (ms)	Number of Pulses	Average No. of Pulses	Scale Factor	On Time (ms) During 31.6 s	Limit (ms)	Results
N/A	20	N/A	N/A	N/A	N/A	N/A



Hopping Mode, 2DH5, pi/4-DQPSK, Mid Channel, 2440 MHz						
Pulse Width (ms)	Number of Pulses	Average No. of Pulses	Scale Factor	On Time (ms) During 31.6 s	Limit (ms)	Results
N/A	25	N/A	N/A	N/A	N/A	N/A



DWELL TIME



TbtTx 2017.07.11 XMT 2017.02.08

Hopping Mode, 2DH5, pi/4-DQPSK, Mid Channel, 2440 MHz						
Pulse Width (ms)	Number of Pulses	Average No. of Pulses	Scale Factor	On Time (ms) During 31.6 s	Limit (ms)	Results
N/A	29	N/A	N/A	N/A	N/A	N/A



Hopping Mode, 2DH5, pi/4-DQPSK, Mid Channel, 2440 MHz						
Pulse Width (ms)	Number of Pulses	Average No. of Pulses	Scale Factor	On Time (ms) During 31.6 s	Limit (ms)	Results
1.533	N/A	24	5	183.96	400	Pass

Calculation Only

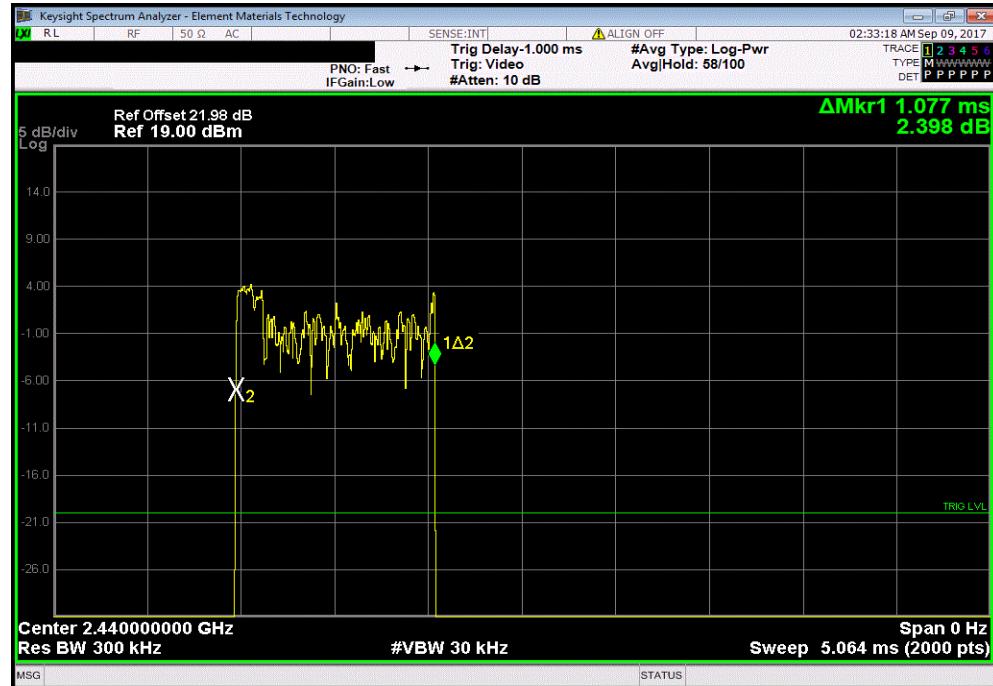
No Screen Capture Required

DWELL TIME

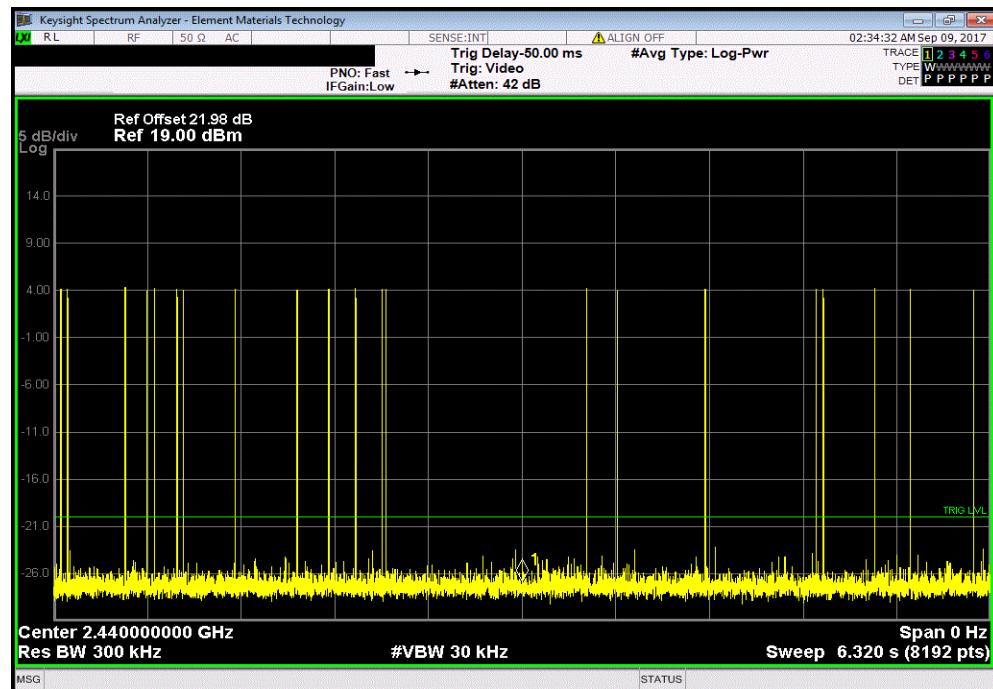


TbtTx 2017.07.11 XMT 2017.02.08

Hopping Mode, 3DH5, 8-DPSK, Mid Channel, 2440 MHz						
Pulse Width (ms)	Number of Pulses	Average No. of Pulses	Scale Factor	On Time (ms) During 31.6 s	Limit (ms)	Results
1.077	N/A	N/A	N/A	N/A	N/A	N/A



Hopping Mode, 3DH5, 8-DPSK, Mid Channel, 2440 MHz						
Pulse Width (ms)	Number of Pulses	Average No. of Pulses	Scale Factor	On Time (ms) During 31.6 s	Limit (ms)	Results
N/A	21	N/A	N/A	N/A	N/A	N/A

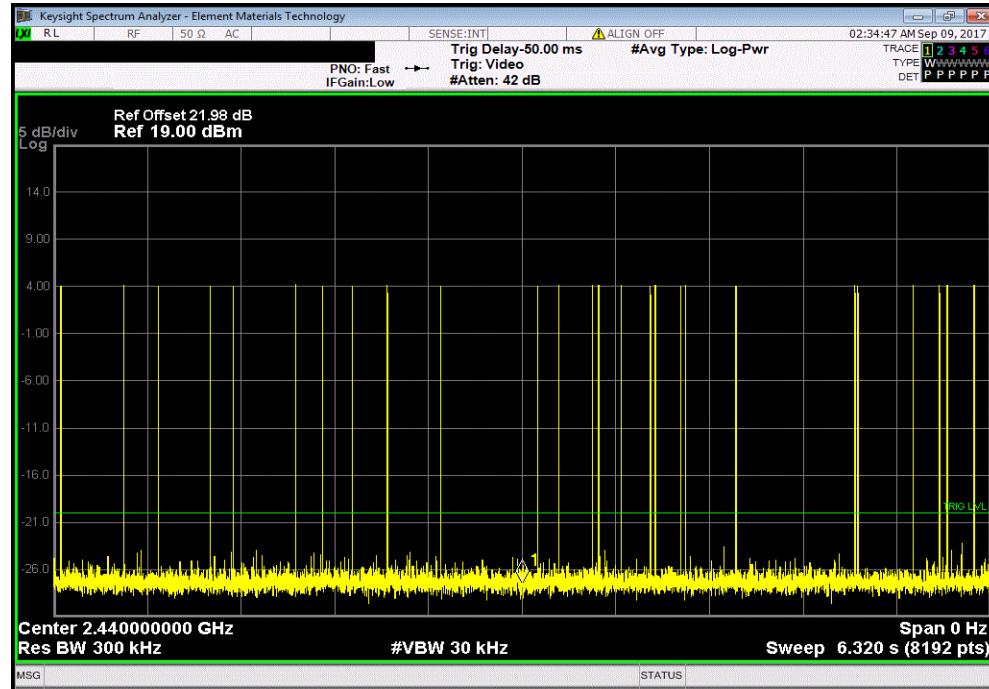


DWELL TIME

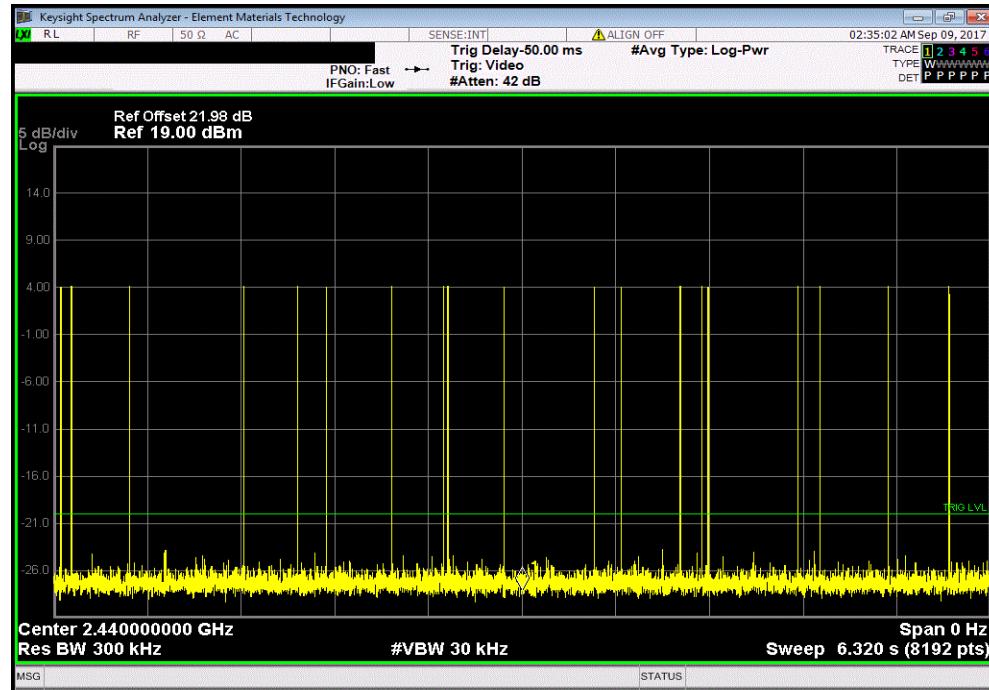


TbtTx 2017.07.11 XMT 2017.02.08

Hopping Mode, 3DH5, 8-DPSK, Mid Channel, 2440 MHz						
Pulse Width (ms)	Number of Pulses	Average No. of Pulses	Scale Factor	On Time (ms) During 31.6 s	Limit (ms)	Results
N/A	27	N/A	N/A	N/A	N/A	N/A



Hopping Mode, 3DH5, 8-DPSK, Mid Channel, 2440 MHz						
Pulse Width (ms)	Number of Pulses	Average No. of Pulses	Scale Factor	On Time (ms) During 31.6 s	Limit (ms)	Results
N/A	19	N/A	N/A	N/A	N/A	N/A

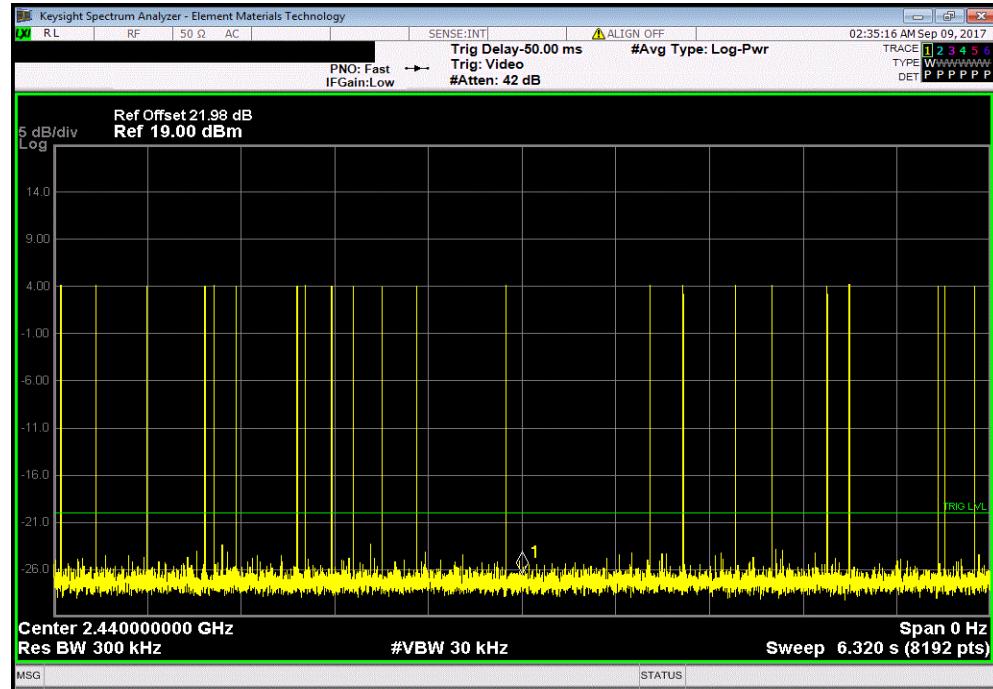


DWELL TIME



TbtTx 2017.07.11 XMT 2017.02.08

Hopping Mode, 3DH5, 8-DPSK, Mid Channel, 2440 MHz						
Pulse Width (ms)	Number of Pulses	Average No. of Pulses	Scale Factor	On Time (ms) During 31.6 s	Limit (ms)	Results
N/A	22	N/A	N/A	N/A	N/A	N/A



Hopping Mode, 3DH5, 8-DPSK, Mid Channel, 2440 MHz						
Pulse Width (ms)	Number of Pulses	Average No. of Pulses	Scale Factor	On Time (ms) During 31.6 s	Limit (ms)	Results
1.077	N/A	22.25	5	119.82	400	Pass

Calculation Only

No Screen Capture Required

OUTPUT POWER



XMit 2017.02.08

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	10/27/2015	10/27/2018
Meter - Multimeter	Tektronix	DMM912	MMH	2/17/2016	2/17/2019
Power Supply - DC	Topward	TPS-2000	TPD	NCR	NCR
Cable	Micro-Coax	UFD150A-1-0720-200200	EVH	5/30/2017	5/30/2018
Attenuator	S.M. Electronics	SA26B-20	AUY	5/30/2017	5/30/2018
Block - DC	Fairview Microwave	SD3379	AMW	6/5/2017	6/5/2018
Analyzer - Spectrum Analyzer	Keysight	N9010A	AFP	8/14/2017	8/14/2018

TEST DESCRIPTION

The measurement was made using a direct connection between the RF output of the EUT and a spectrum analyzer. The peak output power was measured with the EUT set to low, medium and high transmit frequencies. The EUT was transmitting in a no hop mode at the data rate(s) listed in the datasheet.

The method found in ANSI C63.10:2013 Section 7.8.5 was used for a FHSS radio.

De Facto EIRP Limit: The EUT meets the de facto EIRP limit of +27dBm.

OUTPUT POWER



TbTx 2017.07.11

XMI 2017.02.08

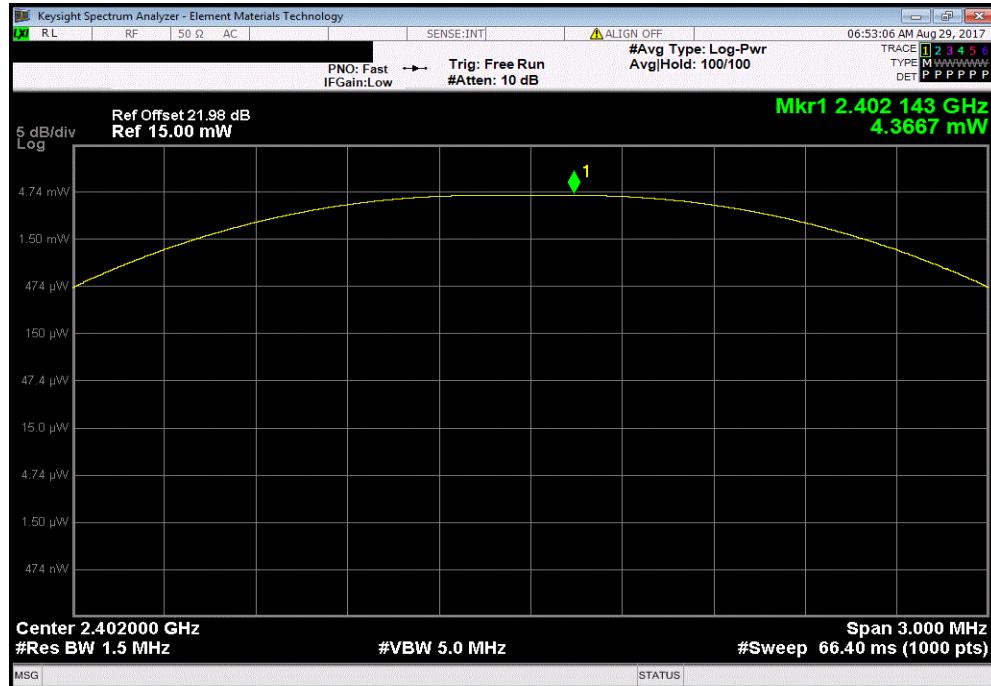
EUT:	TRAC-Mini Controller	Work Order:	SUPR0187			
Serial Number:	0465	Date:	08/28/17			
Customer:	Supra, A Division of UTCFS	Temperature:	24.6 °C			
Attendees:	None	Humidity:	44% RH			
Project:	None	Barometric Pres.:	1012 mbar			
Tested by:	Jeff Alcock and Rod Peloquin	Power:	3.2 VDC			
TEST SPECIFICATIONS		Test Method	ANSI C63.10:2013			
FCC 15.247:2017						
COMMENTS	Ref Offset includes SMA to u.fl cable.					
DEVIATIONS FROM TEST STANDARD						
None						
Configuration #	1	Signature				
		Value	Limit (<)			
DH5, GFSK			Result			
	Low Channel	4.367 mW	125 mW			
	Mid Channel	4.281 mW	125 mW			
	High Channel	3.398 mW	125 mW			
2DH5, pi/4-DQPSK	Low Channel	4.367 mW	125 mW			
	Mid Channel	4.255 mW	125 mW			
	High Channel	3.405 mW	125 mW			
3DH5, 8-DPSK	Low Channel	5.063 mW	125 mW			
	Mid Channel	4.725 mW	125 mW			
	High Channel	3.827 mW	125 mW			

OUTPUT POWER

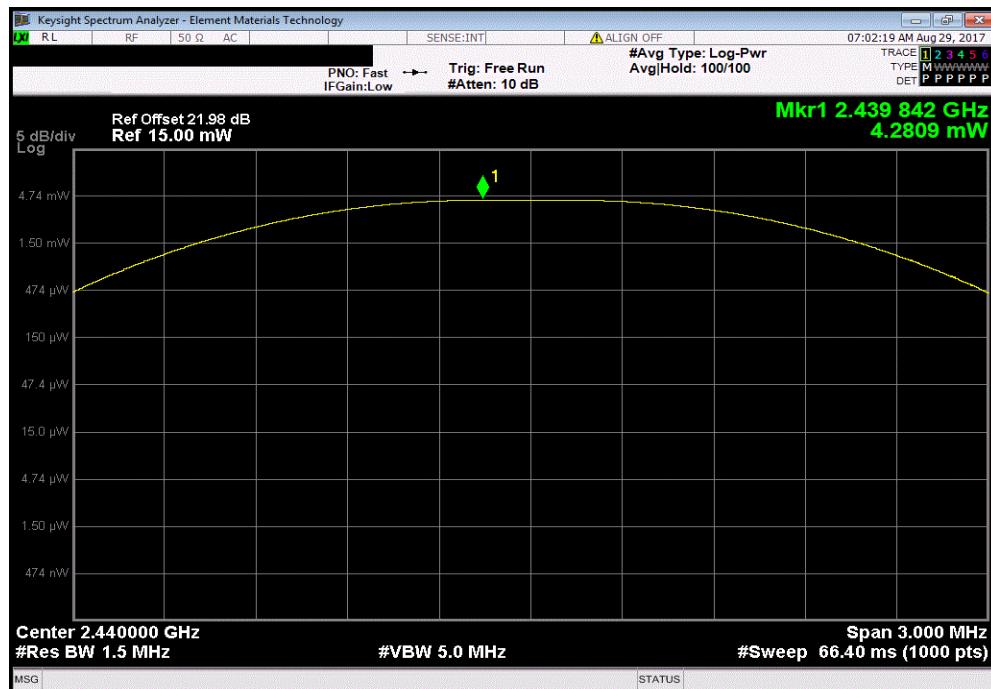


TbtTx 2017.07.11 XMT 2017.02.08

DH5, GFSK, Low Channel			Value	Limit	Result
			4.367 mW	125 mW	Pass



DH5, GFSK, Mid Channel			Value	Limit	Result
			4.281 mW	125 mW	Pass

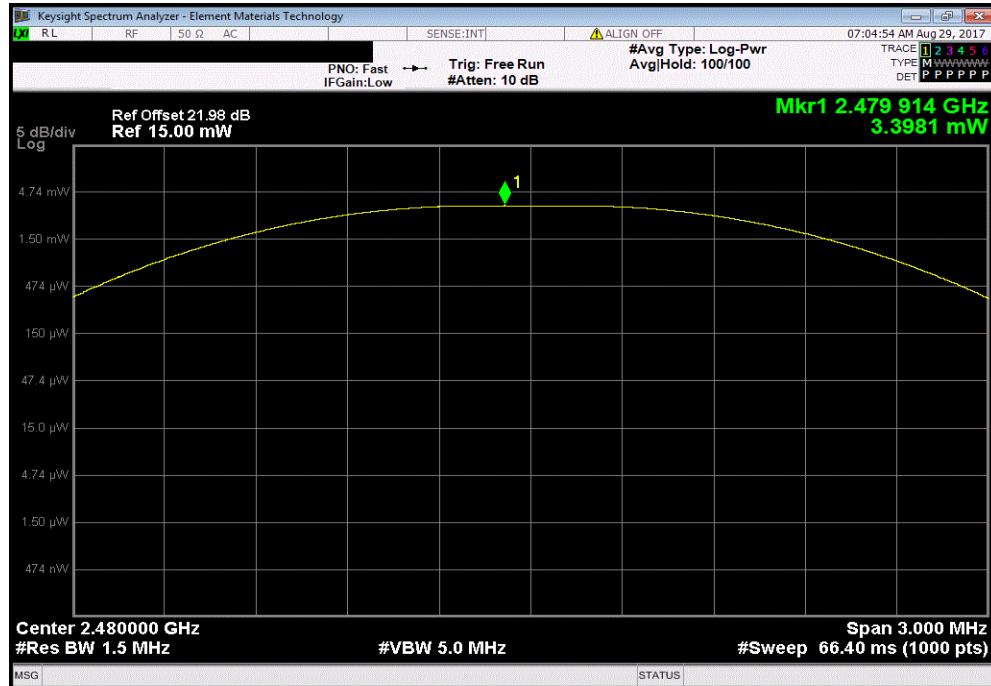


OUTPUT POWER

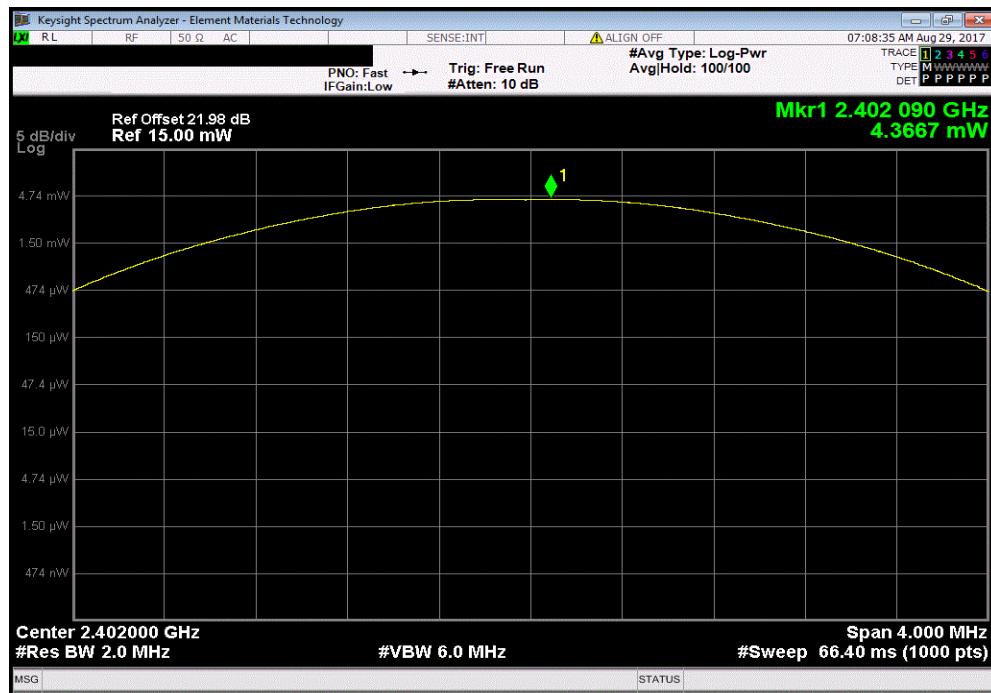


TbtTx 2017.07.11 XMT 2017.02.08

DH5, GFSK, High Channel			Value	Limit (≤)	Result
			3.398 mW	125 mW	Pass



2DH5, pi/4-DQPSK, Low Channel			Value	Limit (≤)	Result
			4.367 mW	125 mW	Pass

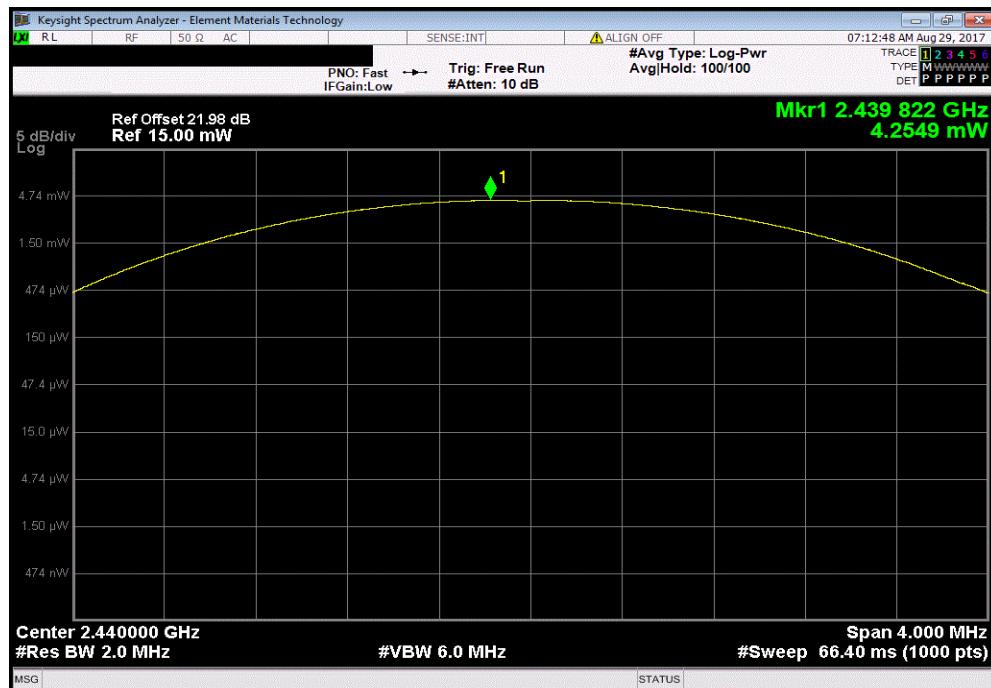


OUTPUT POWER

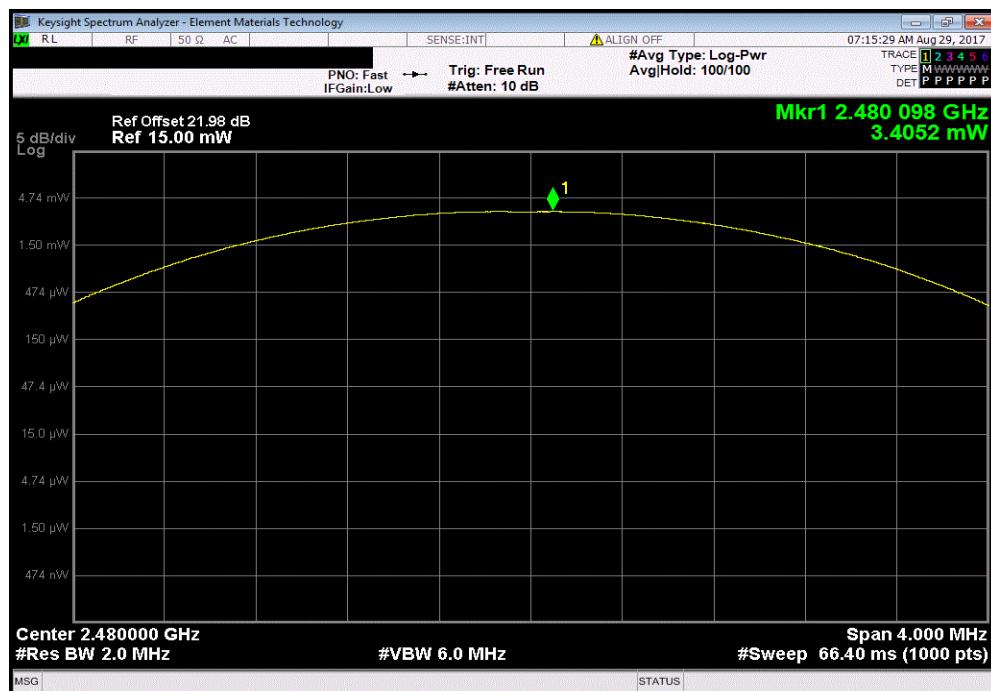


TbtTx 2017.07.11 XMT 2017.02.08

2DH5, pi/4-DQPSK, Mid Channel			Value	Limit (≤)	Result
			4.255 mW	125 mW	Pass



2DH5, pi/4-DQPSK, High Channel			Value	Limit (≤)	Result
			3.405 mW	125 mW	Pass

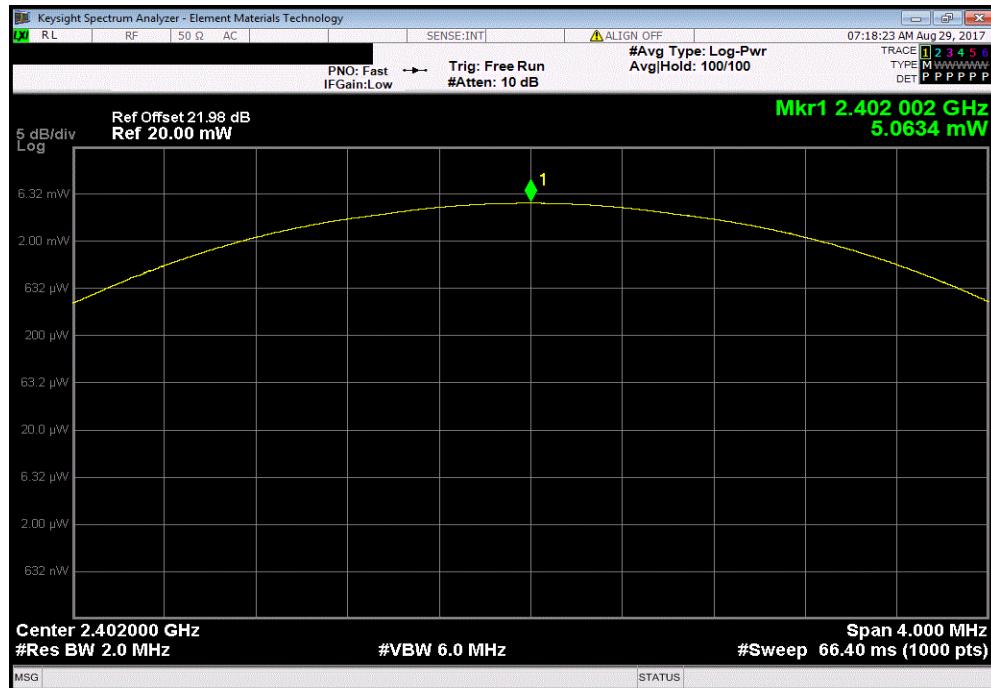


OUTPUT POWER

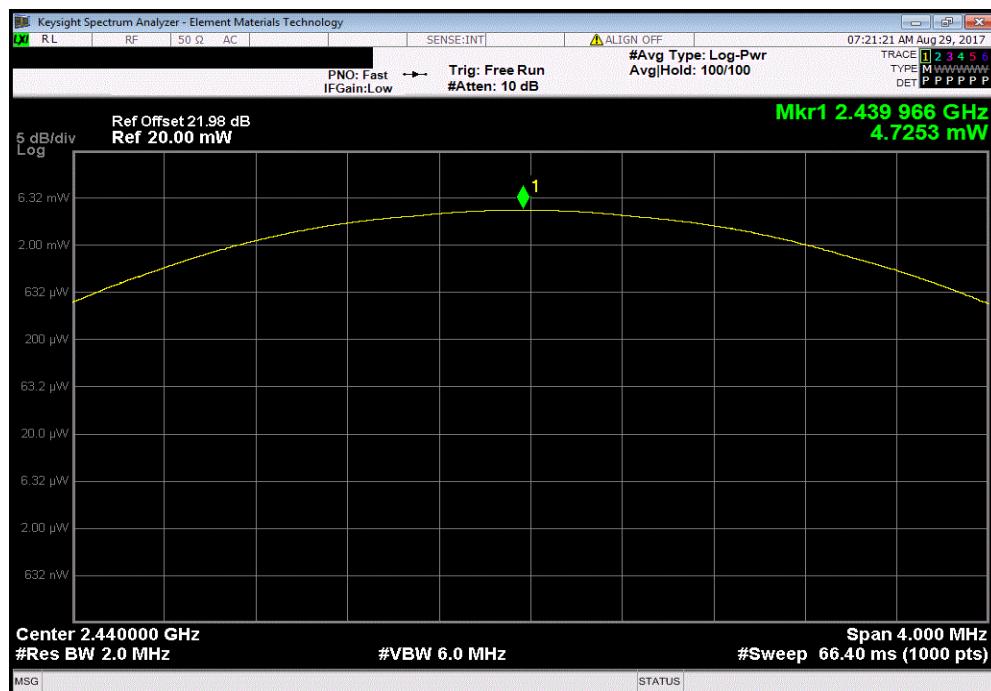


TbtTx 2017.07.11 XMT 2017.02.08

3DH5, 8-DPSK, Low Channel			Value	Limit	Result
			5.063 mW	125 mW	Pass



3DH5, 8-DPSK, Mid Channel			Value	Limit	Result
			4.725 mW	125 mW	Pass

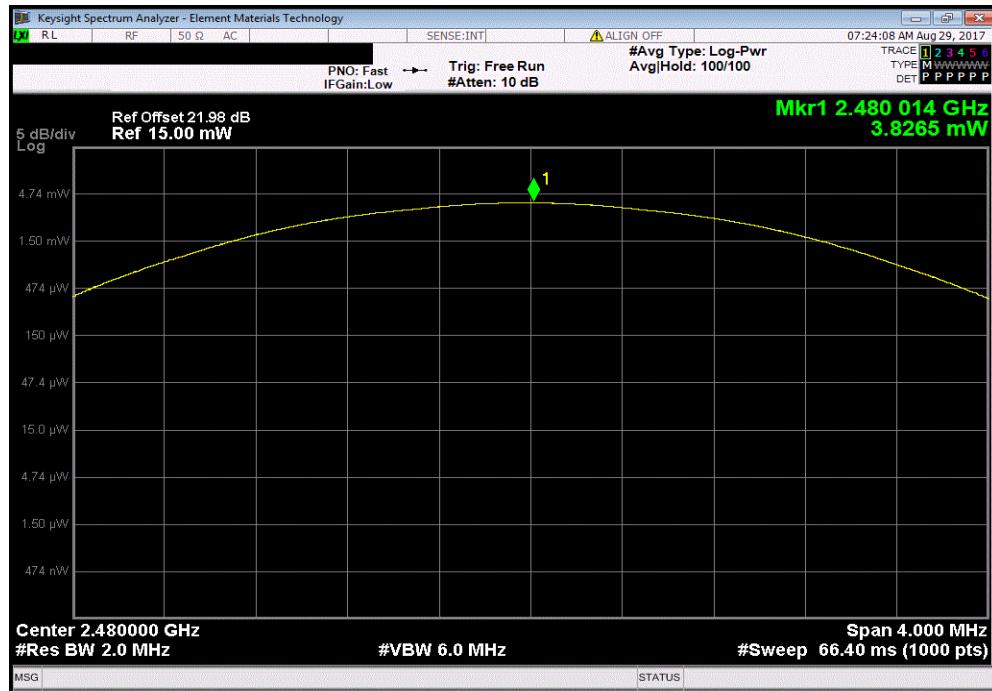




OUTPUT POWER

TbtTx 2017.07.11 XMT 2017.02.08

3DH5, 8-DPSK, High Channel			Value	Limit (<)	Result
			3.827 mW	125 mW	Pass



BAND EDGE COMPLIANCE



XMIT 2017.02.08

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	10/27/2015	10/27/2018
Meter - Multimeter	Tektronix	DMM912	MMH	2/17/2016	2/17/2019
Power Supply - DC	Topward	TPS-2000	TPD	NCR	NCR
Cable	Micro-Coax	UFD150A-1-0720-200200	EVH	5/30/2017	5/30/2018
Attenuator	S.M. Electronics	SA26B-20	AUY	5/30/2017	5/30/2018
Block - DC	Fairview Microwave	SD3379	AMW	6/5/2017	6/5/2018
Analyzer - Spectrum Analyzer	Keysight	N9010A	AFP	8/14/2017	8/14/2018

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 band were measured with the EUT set to low and high transmit frequencies. The EUT was transmitting at the data rate(s) listed in the datasheet in a no hop mode. The channels closest to the band edges were selected.

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

BAND EDGE COMPLIANCE



TbitTx 2017.07.11

XMMI 2017.02.08

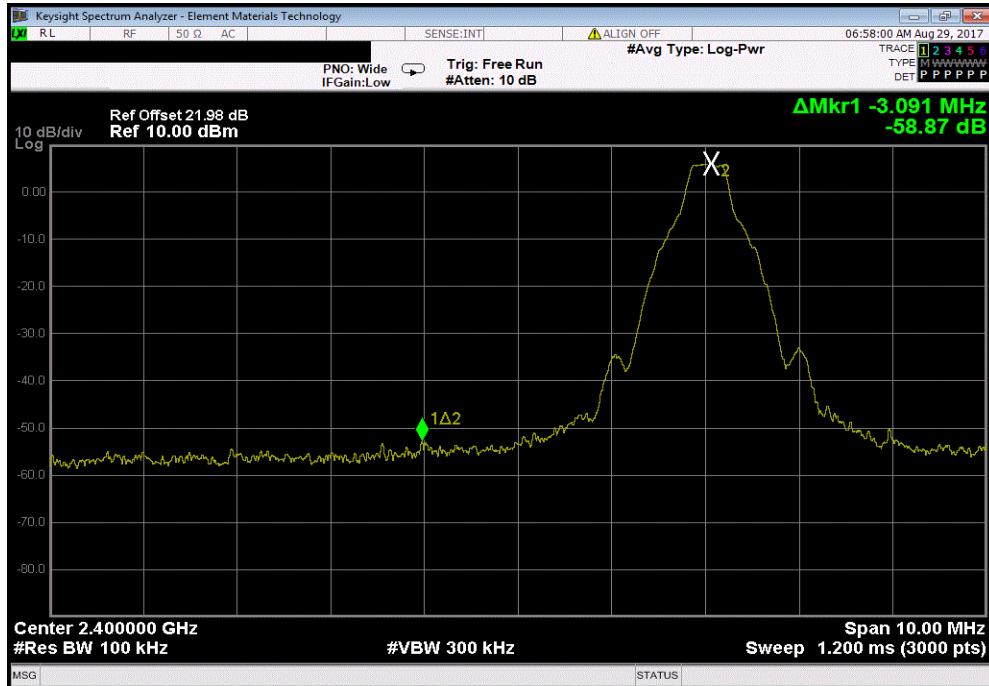
EUT:	TRAC-Mini Controller		Work Order:	SUPR0187	
Serial Number:	0465		Date:	08/28/17	
Customer:	Supra, A Division of UTCFS		Temperature:	25 °C	
Attendees:	None		Humidity:	43.1% RH	
Project:	None		Barometric Pres.:	1012 mbar	
Tested by:	Jeff Alcock and Rod Peloquin		Power:	3.2 VDC	
TEST SPECIFICATIONS			Test Method		
FCC 15.247:2017			ANSI C63.10:2013		
COMMENTS					
Ref Offset includes SMA to u.fl cable.					
DEVIATIONS FROM TEST STANDARD					
None					
Configuration #	1	Signature	<i>Rod Peloquin</i>	Value (dBc)	Limit ≤ (dBc)
DH5, GFSK					
Low Channel			-58.87	-20	Pass
High Channel			-59.17	-20	Pass
2DH5, π/4-DQPSK					
Low Channel			-48.06	-20	Pass
High Channel			-48.61	-20	Pass
3DH5, 8-DPSK					
Low Channel			-47.98	-20	Pass
High Channel			-46.33	-20	Pass

BAND EDGE COMPLIANCE

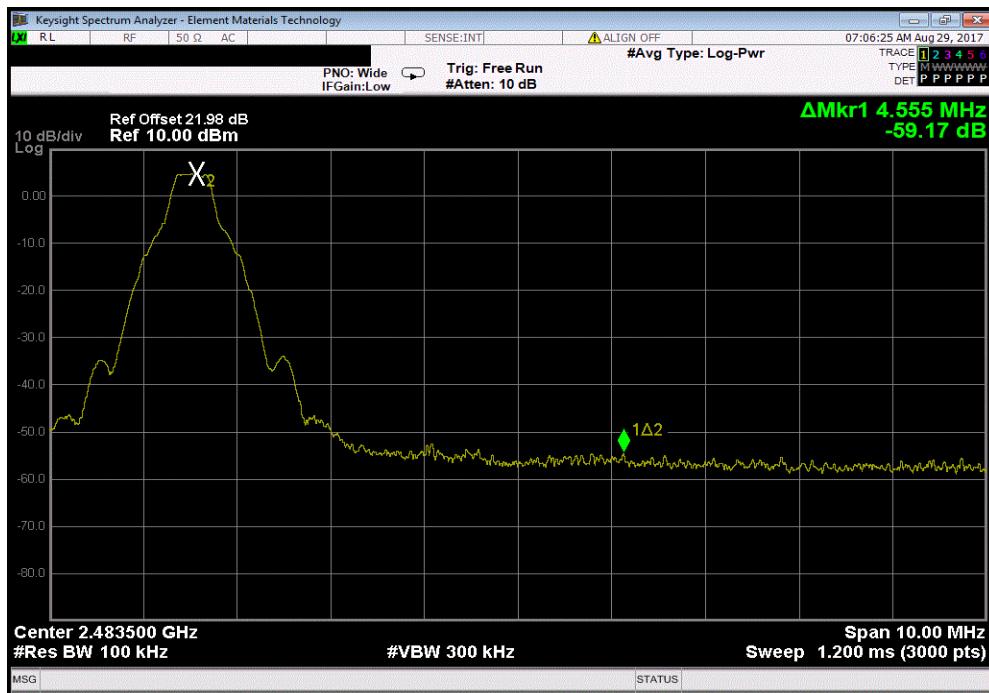


TbtTx 2017.07.11 XMT 2017.02.08

DH5, GFSK, Low Channel				Value (dBc)	Limit ≤ (dBc)	Result
				-58.87	-20	Pass



DH5, GFSK, High Channel				Value (dBc)	Limit ≤ (dBc)	Result
				-59.17	-20	Pass

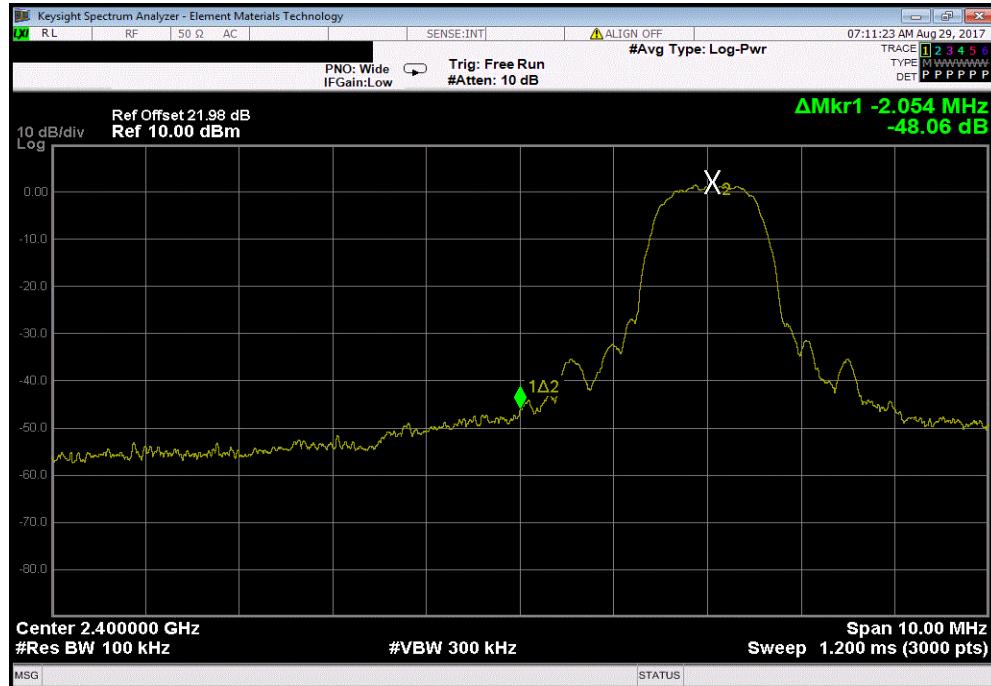


BAND EDGE COMPLIANCE

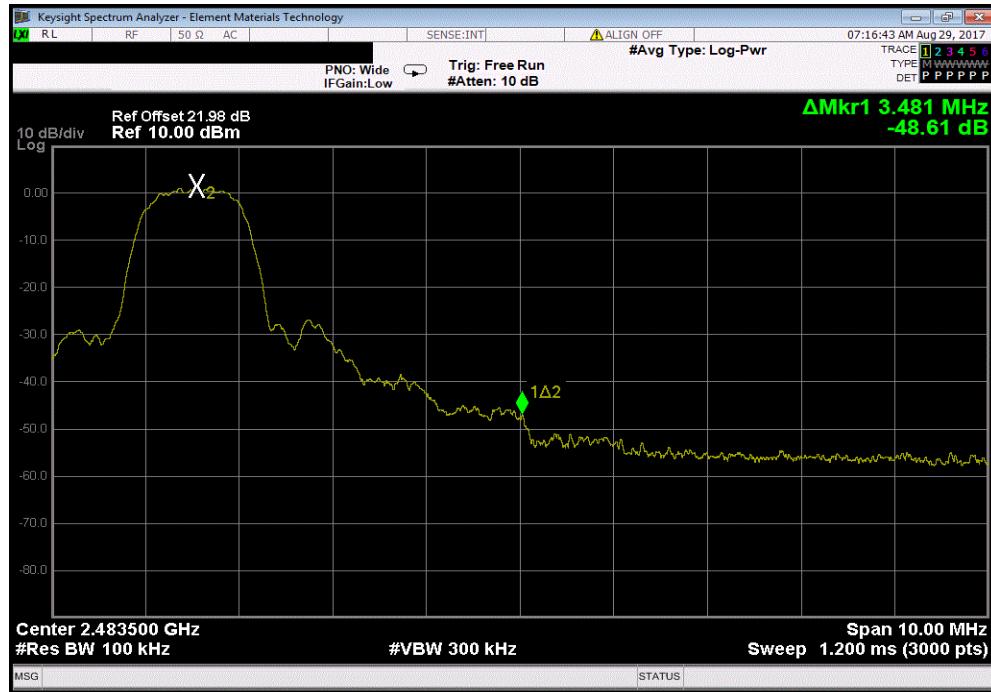


TbtTx 2017.07.11 XMT 2017.02.08

2DH5, pi/4-DQPSK, Low Channel				Value (dBc)	Limit ≤ (dBc)	Result
				-48.06	-20	Pass



2DH5, pi/4-DQPSK, High Channel				Value (dBc)	Limit ≤ (dBc)	Result
				-48.61	-20	Pass

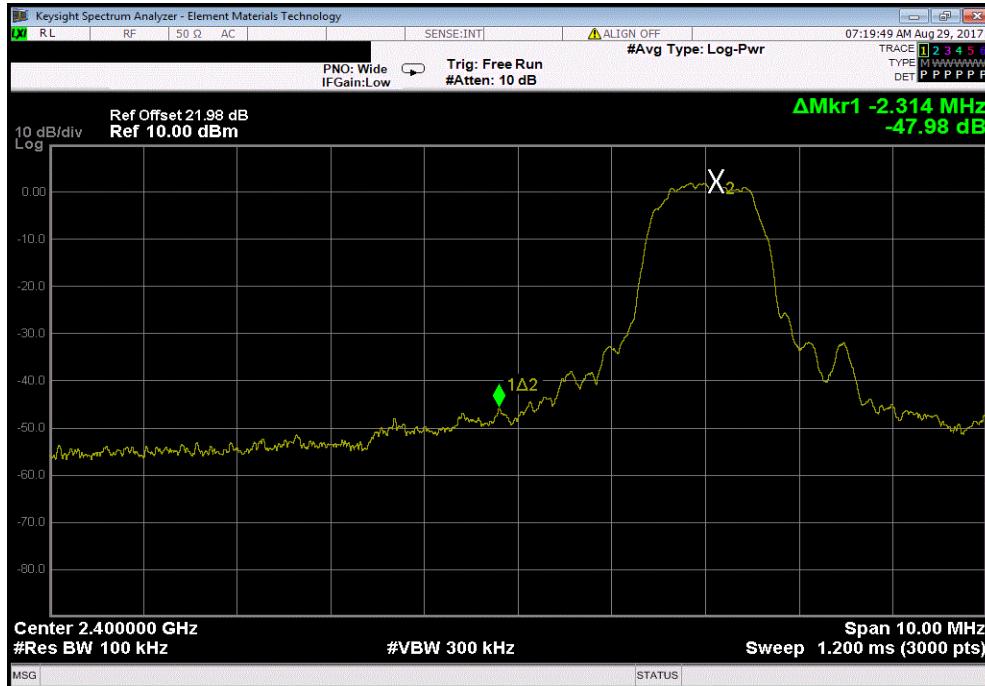


BAND EDGE COMPLIANCE

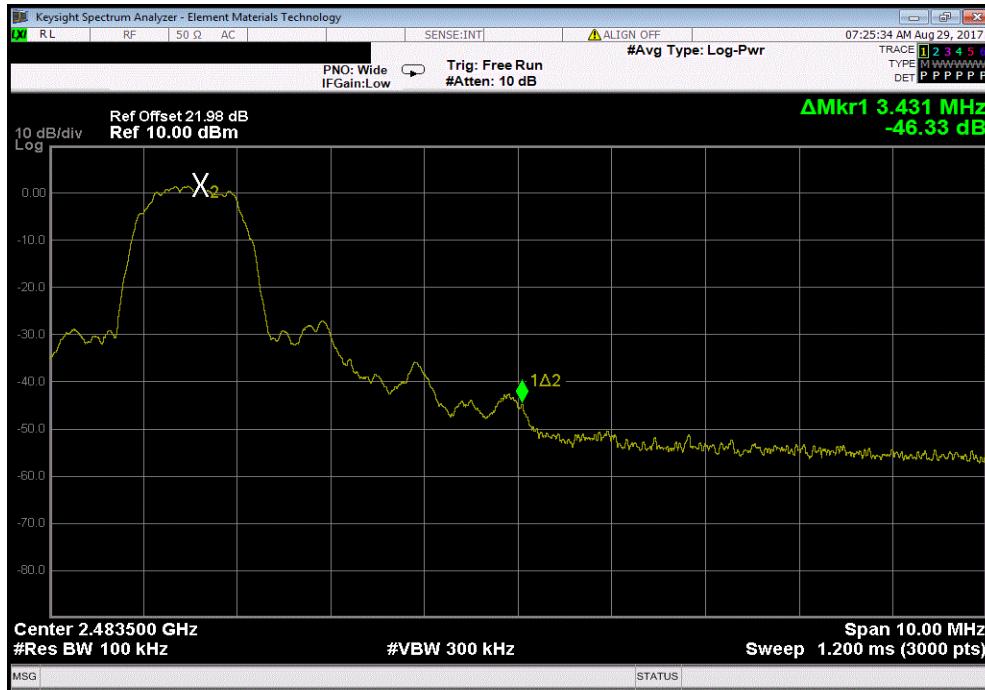


TbtTx 2017.07.11 XMT 2017.02.08

3DH5, 8-DPSK, Low Channel			
Value (dBc)	Limit ≤ (dBc)	Result	
-47.98	-20	Pass	



3DH5, 8-DPSK, High Channel			
Value (dBc)	Limit ≤ (dBc)	Result	
-46.33	-20	Pass	



BAND EDGE COMPLIANCE -HOPPING MODE



XMIT 2017.02.08

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
Meter - Multimeter	Tektronix	DMM912	MMH	2/17/2016	2/17/2019
Power Supply - DC	Topward	TPS-2000	TPD	NCR	NCR
Generator - Signal	Keysight	N5182B	TFU	10/27/2015	10/27/2018
Cable	Micro-Coax	UFD150A-1-0720-200200	EVH	5/30/2017	5/30/2018
Attenuator	S.M. Electronics	SA26B-20	AUY	5/30/2017	5/30/2018
Block - DC	Fairview Microwave	SD3379	AMW	6/5/2017	6/5/2018
Analyzer - Spectrum Analyzer	Keysight	N9010A	AFP	8/14/2017	8/14/2018

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 band were measured with the EUT set to its normal pseudo-random hopping sequence. 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 -HOPPING MODE



TbitTx 2017.07.11

XMMI 2017.02.08

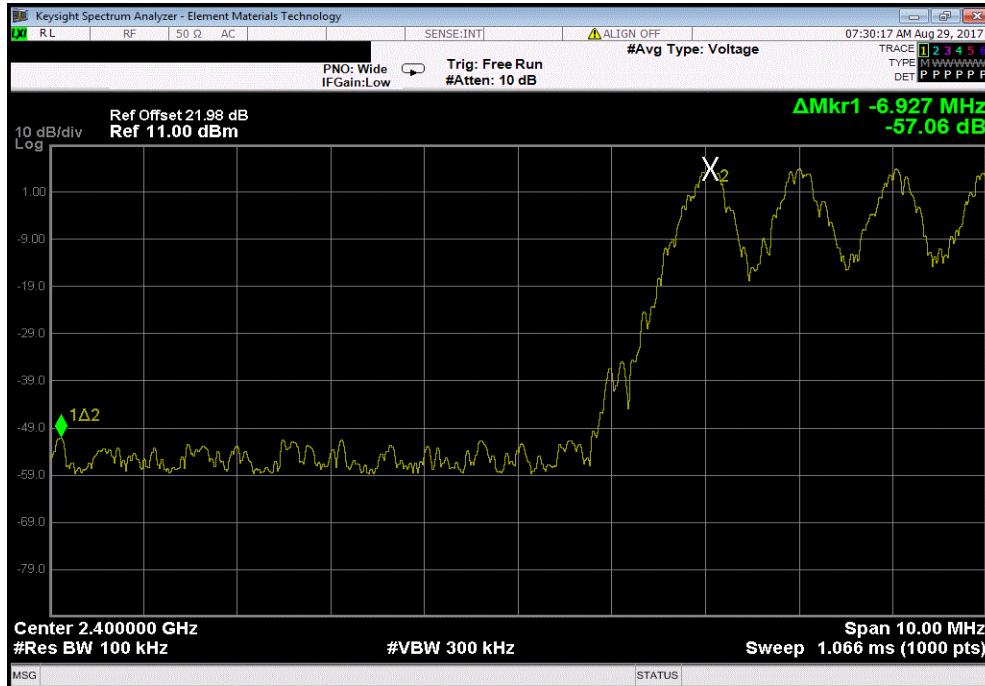
EUT:	TRAC-Mini Controller		Work Order:	SUPR0187		
Serial Number:	0465		Date:	08/28/17		
Customer:	Supra, A Division of UTCFS		Temperature:	24.6 °C		
Attendees:	None		Humidity:	43.7% RH		
Project:	None		Barometric Pres.:	1012 mbar		
Tested by:	Jeff Alcock and Rod Peloquin	Power:	3.2 VDC	Job Site:	EV06	
TEST SPECIFICATIONS		Test Method				
FCC 15.247:2017		ANSI C63.10:2013				
COMMENTS						
Ref Offset includes SMA to u.fl cable.						
DEVIATIONS FROM TEST STANDARD						
None						
Configuration #	1	Signature				
			Value (dBc)	Limit ≤ (dBc)	Result	
Hopping Mode						
DH5, GFSK						
Low Channel, 2402 MHz				-57.06	-20	Pass
High Channel, 2480 MHz				-56.05	-20	Pass
2DH5, pi/4-DQPSK						
Low Channel, 2402 MHz				-53.89	-20	Pass
High Channel, 2480 MHz				-53.47	-20	Pass
3DH5, 8-DPSK						
Low Channel, 2402 MHz				-55.62	-20	Pass
High Channel, 2480 MHz				-55.06	-20	Pass

BAND EDGE COMPLIANCE -HOPPING MODE

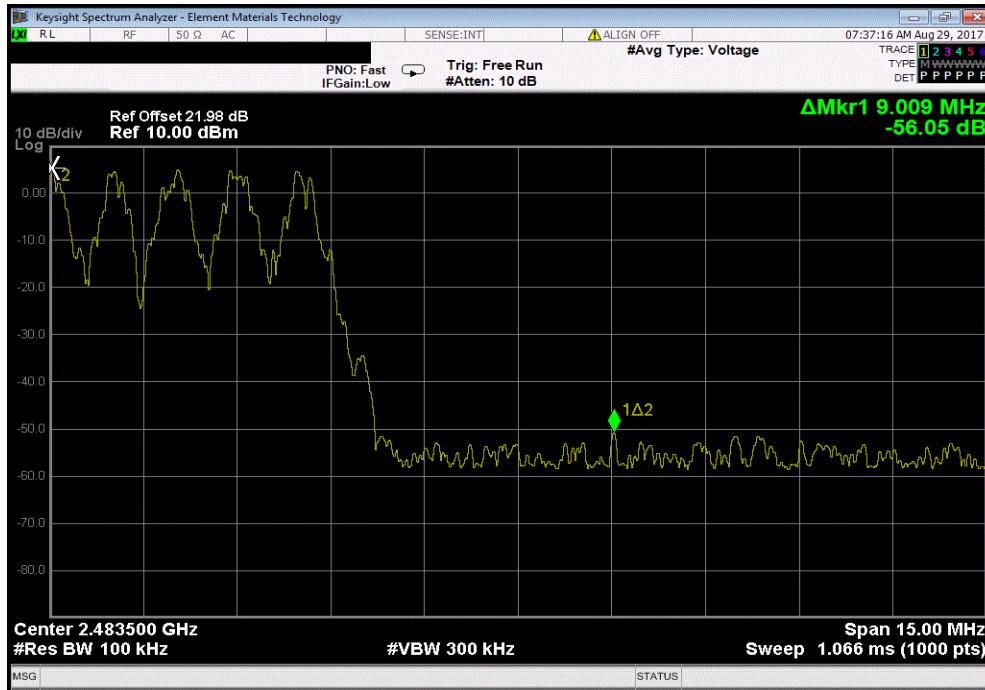


TbtTx 2017.07.11 XMT 2017.02.08

Hopping Mode, DH5, GFSK, Low Channel, 2402 MHz			
Value (dBc)	Limit ≤ (dBc)	Result	
-57.06	-20	Pass	



Hopping Mode, DH5, GFSK, High Channel, 2480 MHz			
Value (dBc)	Limit ≤ (dBc)	Result	
-56.05	-20	Pass	



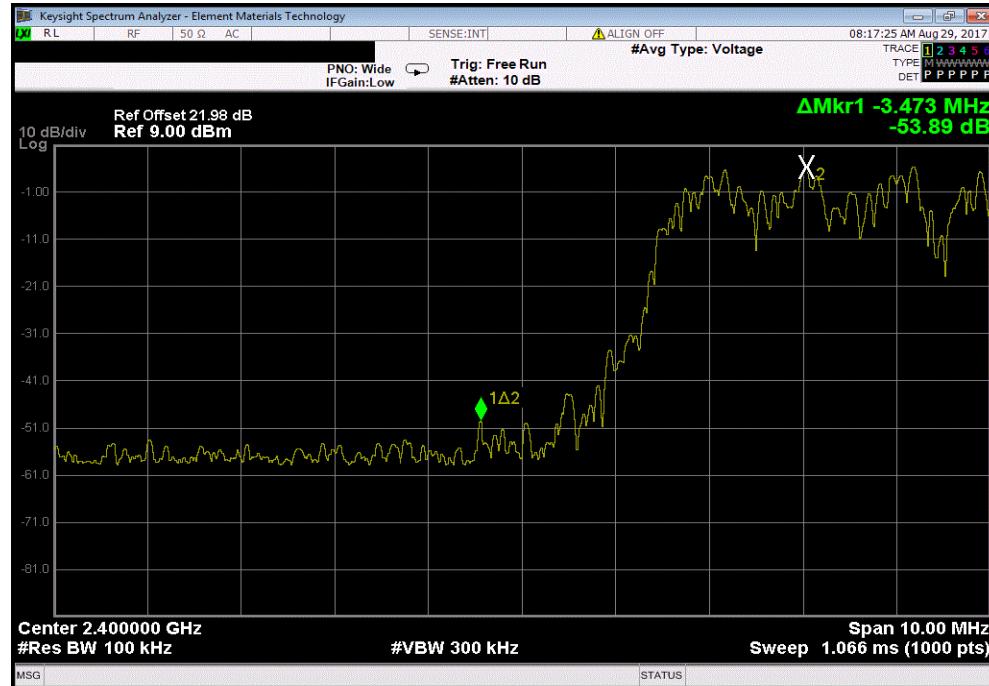
BAND EDGE COMPLIANCE -HOPPING MODE



TbtTx 2017.07.11 XMT 2017.02.08

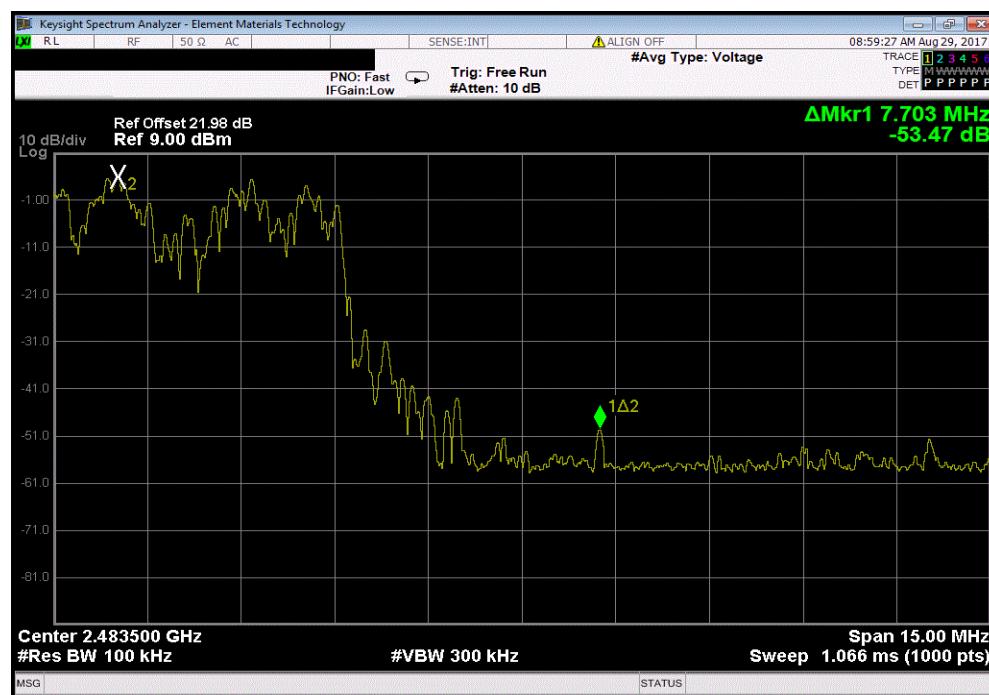
Hopping Mode, 2DH5, pi/4-DQPSK, Low Channel, 2402 MHz

	Value (dBc)	Limit ≤ (dBc)	Result
	-53.89	-20	Pass



Hopping Mode, 2DH5, pi/4-DQPSK, High Channel, 2480 MHz

	Value (dBc)	Limit ≤ (dBc)	Result
	-53.47	-20	Pass



BAND EDGE COMPLIANCE -HOPPING MODE



TbtTx 2017.07.11 XMT 2017.02.08

Hopping Mode, 3DH5, 8-DPSK, Low Channel, 2402 MHz			
Value (dBc)	Limit ≤ (dBc)	Result	
-55.62	-20	Pass	



Hopping Mode, 3DH5, 8-DPSK, High Channel, 2480 MHz			
Value (dBc)	Limit ≤ (dBc)	Result	
-55.06	-20	Pass	



OCCUPIED BANDWIDTH



XMIT 2017.02.08

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	10/27/2015	10/27/2018
Meter - Multimeter	Tektronix	DMM912	MMH	2/17/2016	2/17/2019
Power Supply - DC	Topward	TPS-2000	TPD	NCR	NCR
Cable	Micro-Coax	UFD150A-1-0720-200200	EVH	5/30/2017	5/30/2018
Attenuator	S.M. Electronics	SA26B-20	AUY	5/30/2017	5/30/2018
Block - DC	Fairview Microwave	SD3379	AMW	6/5/2017	6/5/2018
Analyzer - Spectrum Analyzer	Keysight	N9010A	AFP	8/14/2017	8/14/2018

TEST DESCRIPTION

The measurement was made using a direct connection between the RF output of the EUT and a spectrum analyzer. The 20 dB occupied bandwidth was measured with the EUT set to low, medium and high transmit frequencies in the band. The EUT was transmitting at the data rate(s) listed in the datasheet in a no-hop mode.

OCCUPIED BANDWIDTH



TbTx 2017.07.11

XMI 2017.02.08

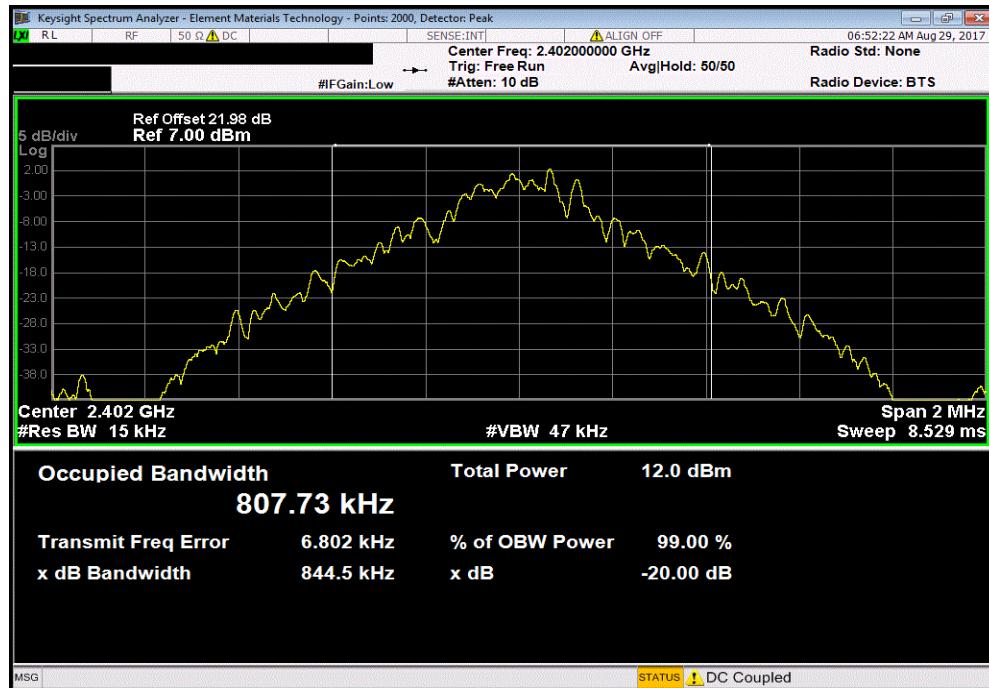
EUT:	TRAC-Mini Controller	Work Order:	SUPR0187			
Serial Number:	0465	Date:	08/28/17			
Customer:	Supra, A Division of UTCFS	Temperature:	25 °C			
Attendees:	None	Humidity:	43.2% RH			
Project:	None	Barometric Pres.:	1012 mbar			
Tested by:	Jeff Alcock and Rod Peloquin	Power:	3.2 VDC			
TEST SPECIFICATIONS		Test Method	ANSI C63.10:2013			
FCC 15.247:2017						
COMMENTS	Ref Offset includes SMA to u.fl cable.					
DEVIATIONS FROM TEST STANDARD						
None						
Configuration #	1	Signature	<i>Rod Peloquin</i>			
		Value	Limit (<)	Result		
DH5, GFSK						
	Low Channel	844.486 kHz	1.5 MHz	Pass		
	Mid Channel	848.324 kHz	1.5 MHz	Pass		
	High Channel	878.823 kHz	1.5 MHz	Pass		
2DH5, pi/4-DQPSK						
	Low Channel	1.366 MHz	1.5 MHz	Pass		
	Mid Channel	1.372 MHz	1.5 MHz	Pass		
	High Channel	1.371 MHz	1.5 MHz	Pass		
3DH5, 8-DPSK						
	Low Channel	1.355 MHz	1.5 MHz	Pass		
	Mid Channel	1.367 MHz	1.5 MHz	Pass		
	High Channel	1.357 MHz	1.5 MHz	Pass		

OCCUPIED BANDWIDTH

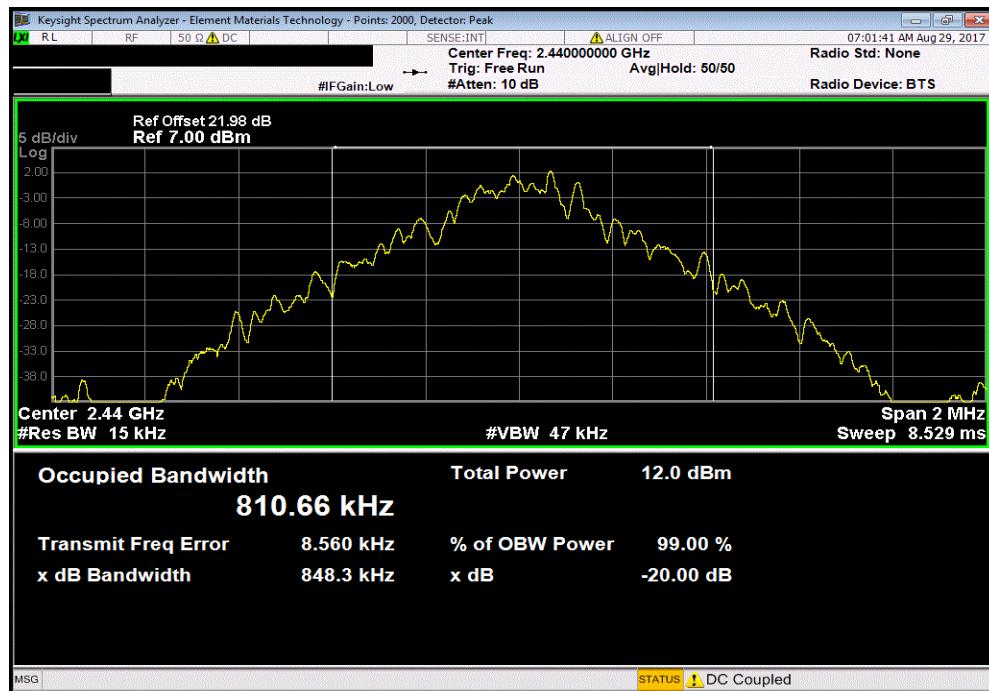


TbtTx 2017.07.11 XMT 2017.02.08

DH5, GFSK, Low Channel			Value	Limit	Result
			(<)		
	844.486 kHz	1.5 MHz			Pass



DH5, GFSK, Mid Channel			Value	Limit	Result
			(<)		
	848.324 kHz	1.5 MHz			Pass

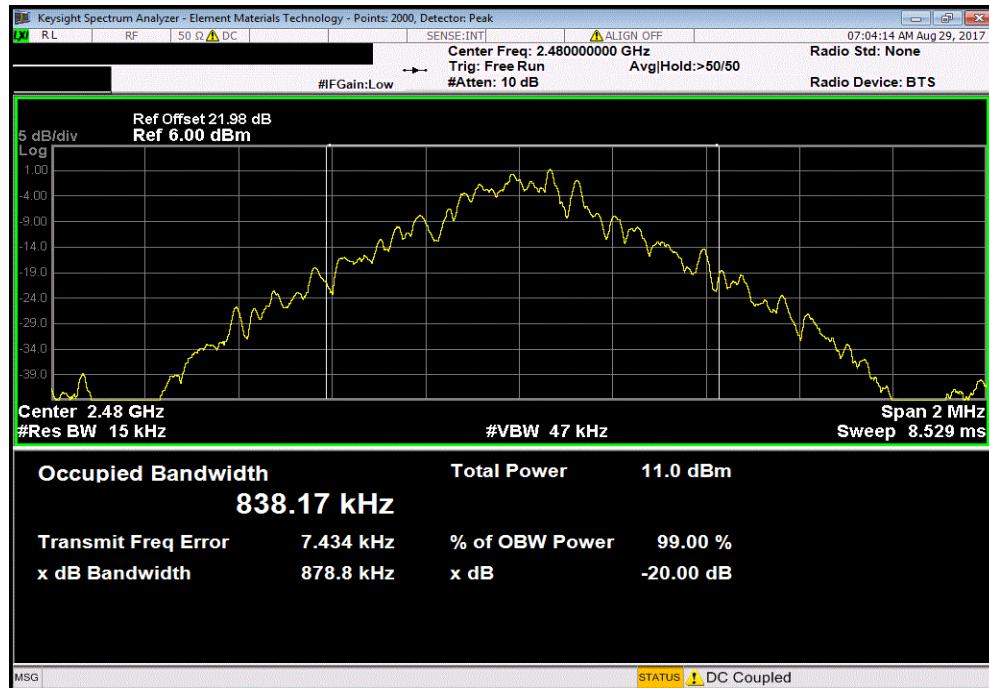


OCCUPIED BANDWIDTH

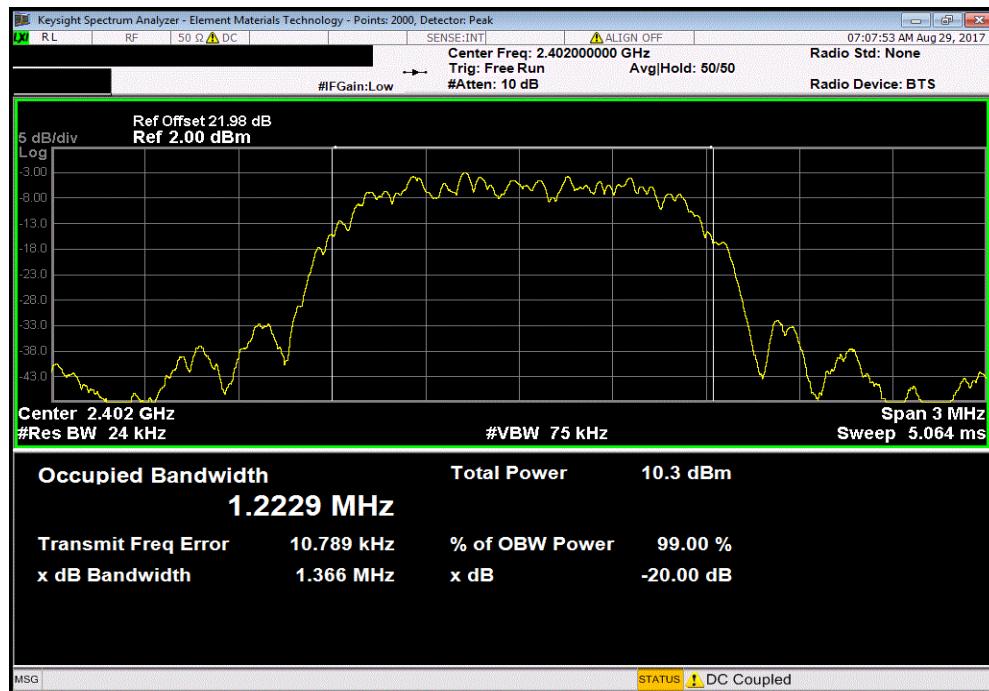


TbtTx 2017.07.11 XMT 2017.02.08

DH5, GFSK, High Channel			Value	Limit	Result
			(<)		
	878.823 kHz	1.5 MHz		Pass	



2DH5, pi/4-DQPSK, Low Channel			Value	Limit	Result
			(<)		
	1.366 MHz	1.5 MHz		Pass	

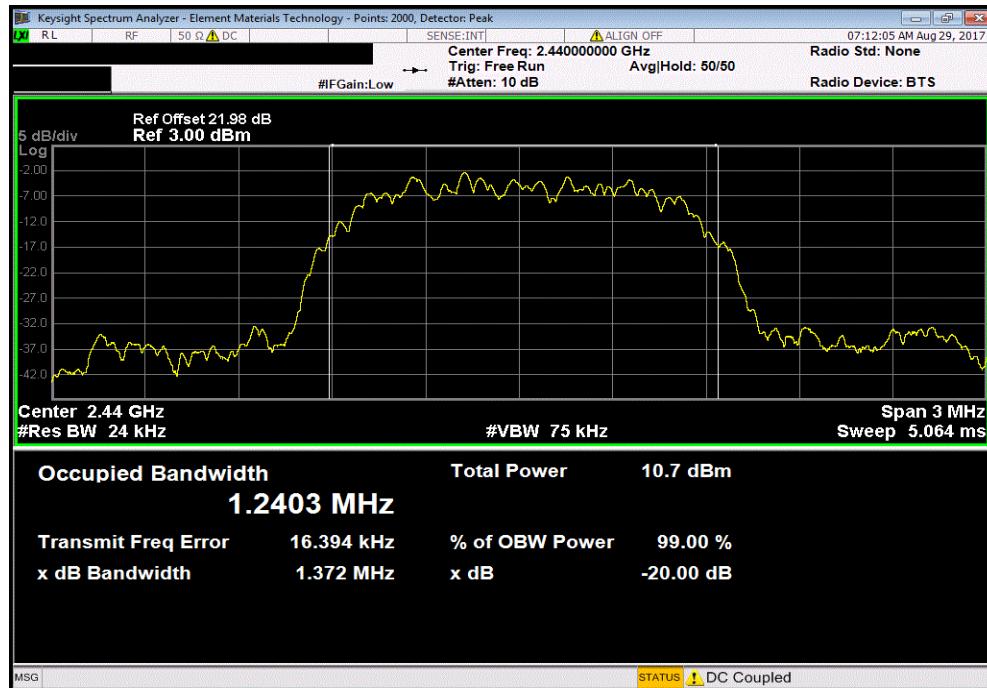


OCCUPIED BANDWIDTH

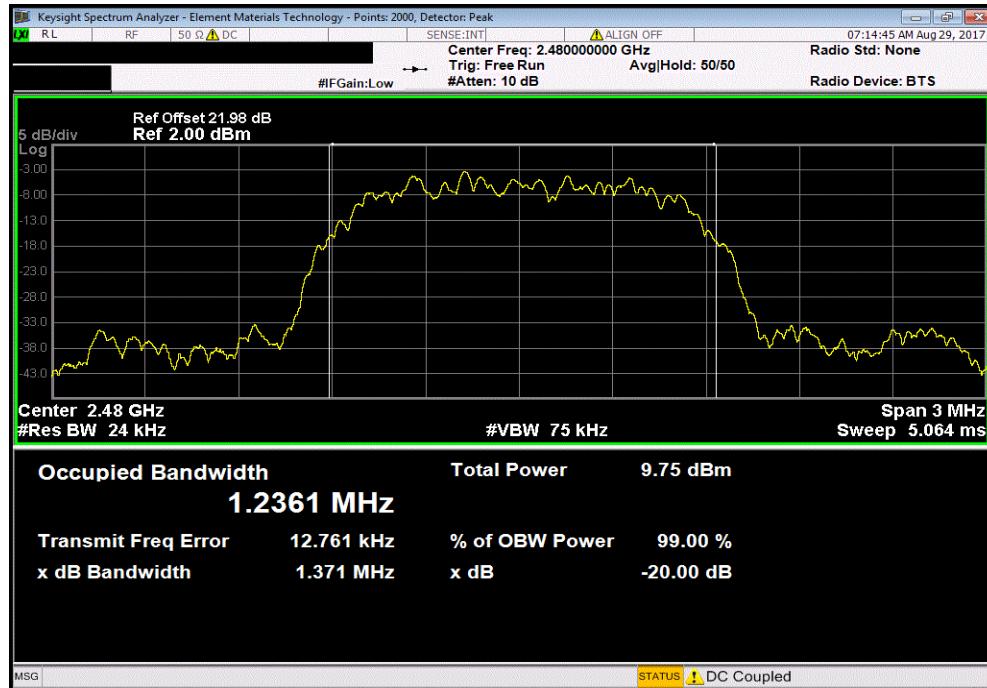


TbtTx 2017.07.11 XMT 2017.02.08

2DH5, pi/4-DQPSK, Mid Channel			Value	Limit	Result
			(<)		
	1.372 MHz	1.5 MHz			Pass



2DH5, pi/4-DQPSK, High Channel			Value	Limit	Result
			(<)		
	1.371 MHz	1.5 MHz			Pass

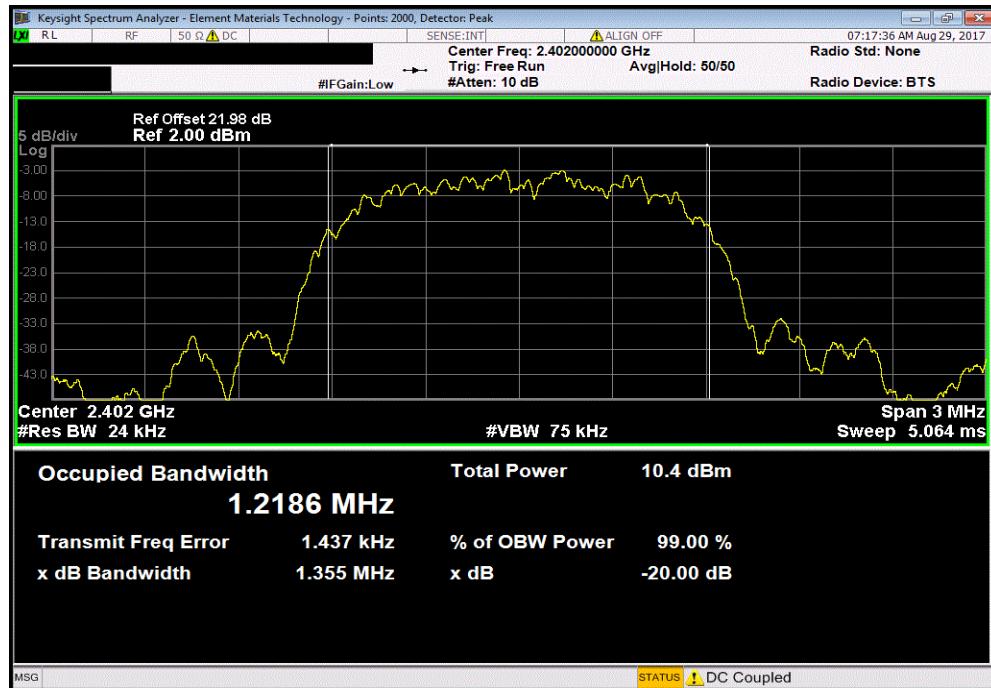


OCCUPIED BANDWIDTH

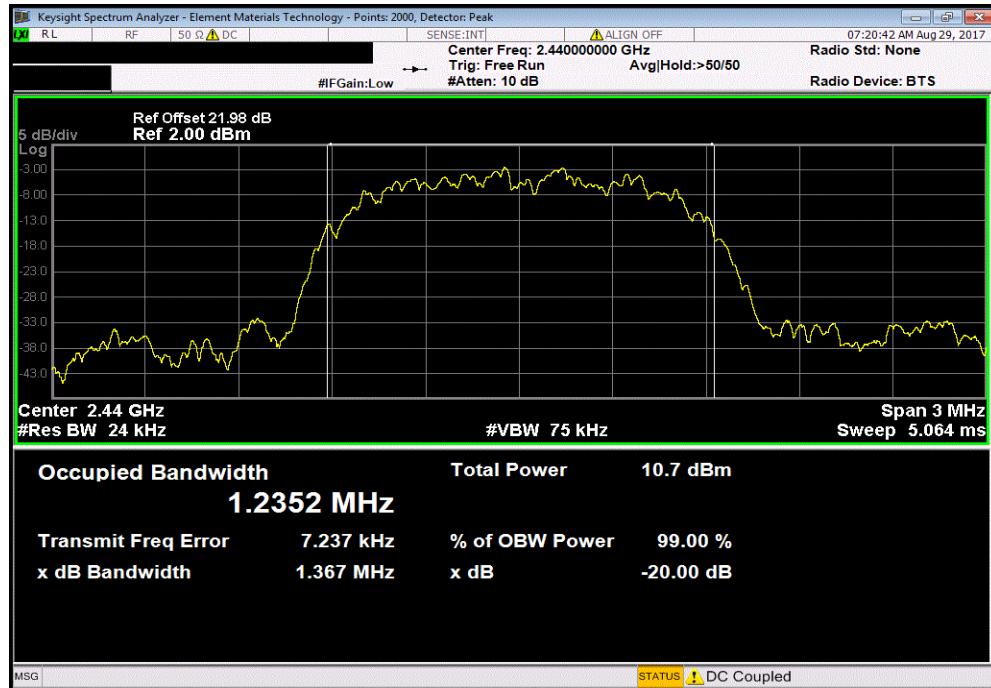


TbtTx 2017.07.11 XMT 2017.02.08

3DH5, 8-DPSK, Low Channel			Value	Limit	Result
			(<)		
	1.355 MHz	1.5 MHz		Pass	



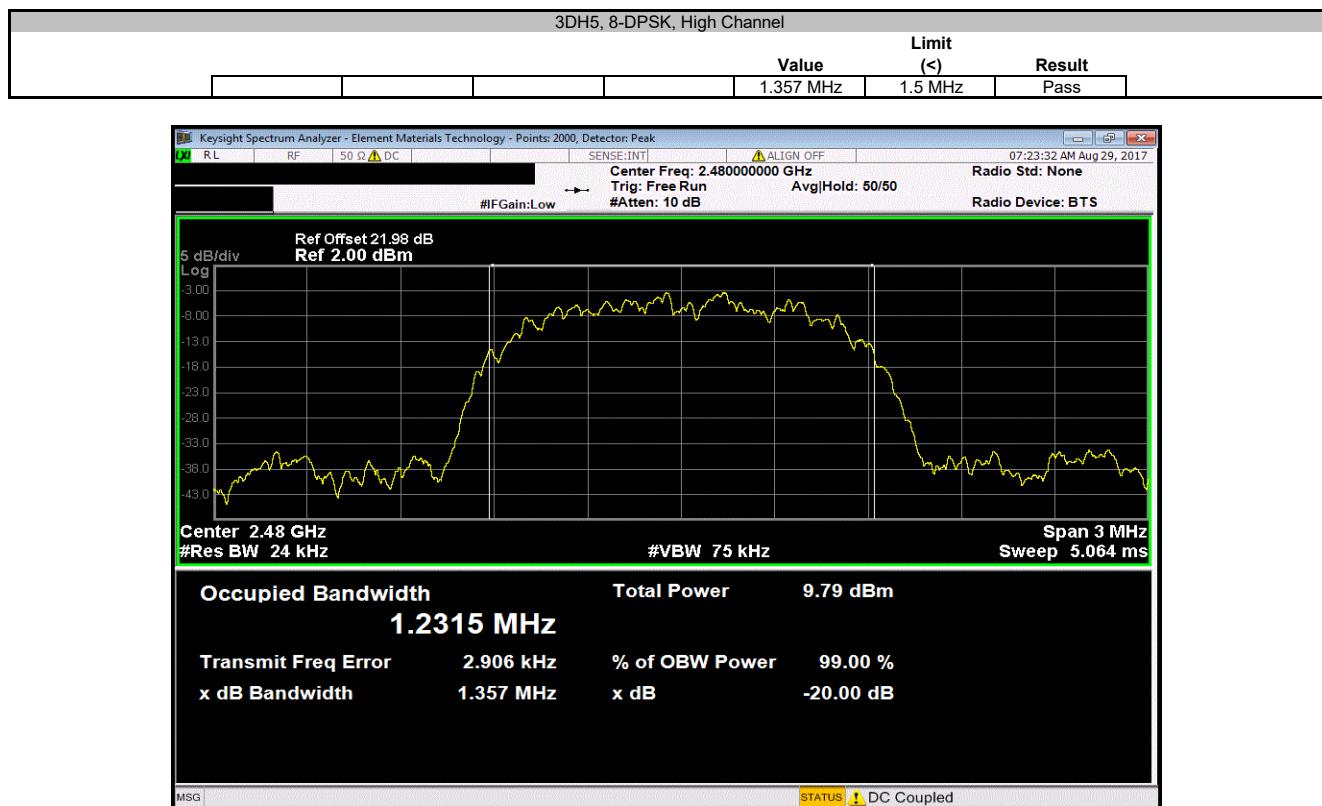
3DH5, 8-DPSK, Mid Channel			Value	Limit	Result
			(<)		
	1.367 MHz	1.5 MHz		Pass	





OCCUPIED BANDWIDTH

TbtTx 2017.07.11 XMT 2017.02.08



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
Meter - Multimeter	Tektronix	DMM912	MMH	17-Feb-16	17-Feb-19
Power Supply - DC	Topward	TPS-2000	TPD	NCR	NCR
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
Generator - Signal	Agilent	N5181A	TIG	6-Apr-17	6-Apr-20
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 in a no-hop mode. For each transmit frequency, the spectrum was scanned throughout the specified frequency range.

SPURIOUS CONDUCTED EMISSIONS



TbTx 2017.07.11

XMI 2017.02.08

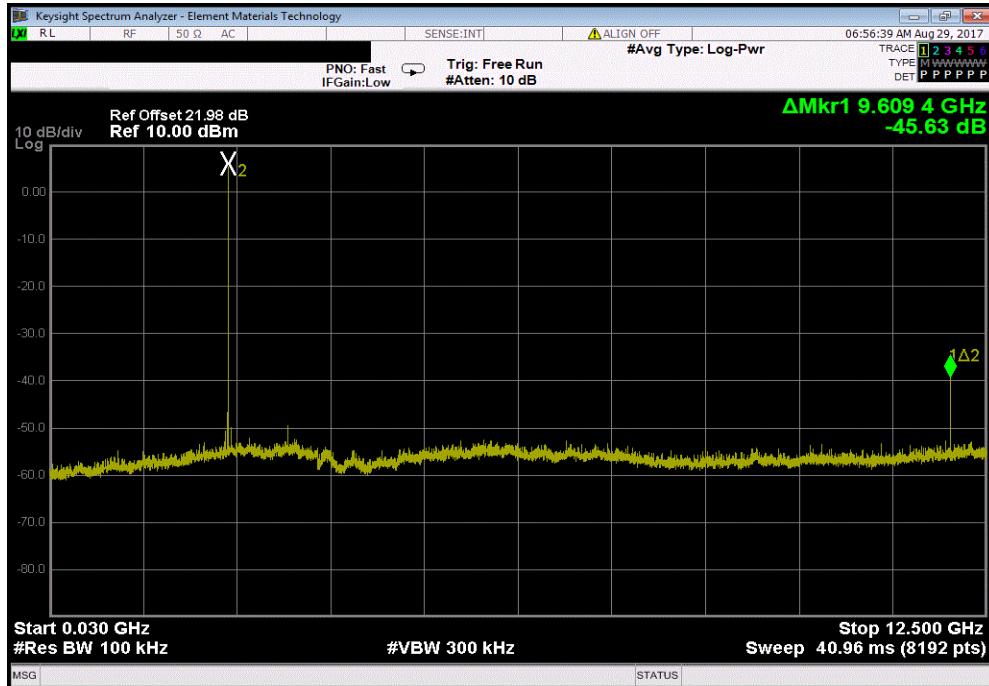
EUT:	TRAC-Mini Controller	Work Order:	SUPR0187		
Serial Number:	0465	Date:	08/28/17		
Customer:	Supra, A Division of UTCFS	Temperature:	25 °C		
Attendees:	None	Humidity:	43.2% RH		
Project:	None	Barometric Pres.:	1012 mbar		
Tested by:	Jeff Alcock and Rod Peloquin	Power:	3.2 VDC		
TEST SPECIFICATIONS		Test Method	ANSI C63.10:2013		
FCC 15.247:2017					
COMMENTS					
Ref Offset includes SMA to u.fl cable.					
DEVIATIONS FROM TEST STANDARD					
None					
Configuration #	1	Signature			
		<i>Rod Peloquin</i>			
		Frequency Range	Max Value (dBc)	Limit ≤ (dBc)	Result
DH5, GFSK					
Low Channel		30 MHz - 12.5 GHz	-45.63	-20	Pass
Low Channel		12.5 GHz - 25 GHz	-43.74	-20	Pass
Mid Channel		30 MHz - 12.5 GHz	-49.7	-20	Pass
Mid Channel		12.5 GHz - 25 GHz	-43.49	-20	Pass
High Channel		30 MHz - 12.5 GHz	-49.93	-20	Pass
High Channel		12.5 GHz - 25 GHz	-42.54	-20	Pass
2DH5, pi/4-DQPSK					
Low Channel		30 MHz - 12.5 GHz	-44.92	-20	Pass
Low Channel		12.5 GHz - 25 GHz	-39.83	-20	Pass
Mid Channel		30 MHz - 12.5 GHz	-50.04	-20	Pass
Mid Channel		12.5 GHz - 25 GHz	-39.73	-20	Pass
High Channel		30 MHz - 12.5 GHz	-52.37	-20	Pass
High Channel		12.5 GHz - 25 GHz	-37.88	-20	Pass
3DH5, 8-DPSK					
Low Channel		30 MHz - 12.5 GHz	-46.94	-20	Pass
Low Channel		12.5 GHz - 25 GHz	-40.1	-20	Pass
Mid Channel		30 MHz - 12.5 GHz	-53.04	-20	Pass
Mid Channel		12.5 GHz - 25 GHz	-40.45	-20	Pass
High Channel		30 MHz - 12.5 GHz	-52.86	-20	Pass
High Channel		12.5 GHz - 25 GHz	-39.5	-20	Pass

SPURIOUS CONDUCTED EMISSIONS

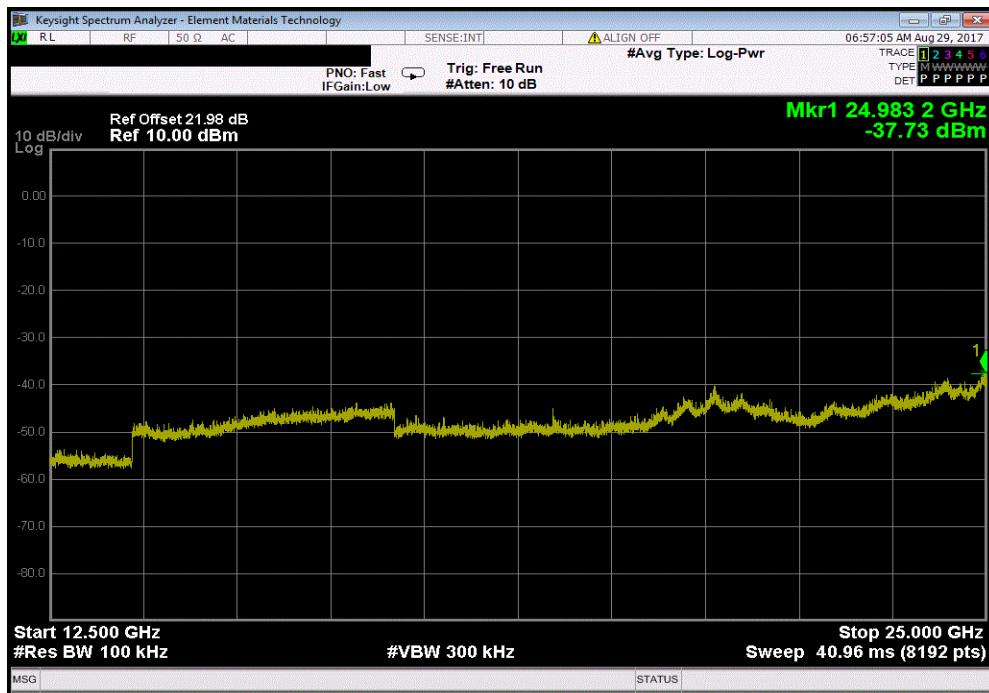


TbtTx 2017.07.11 XMT 2017.02.08

DH5, GFSK, Low Channel			
Frequency Range	Max Value (dBc)	Limit \leq (dBc)	Result
30 MHz - 12.5 GHz	-45.63	-20	Pass



DH5, GFSK, Low Channel			
Frequency Range	Max Value (dBc)	Limit \leq (dBc)	Result
12.5 GHz - 25 GHz	-43.74	-20	Pass

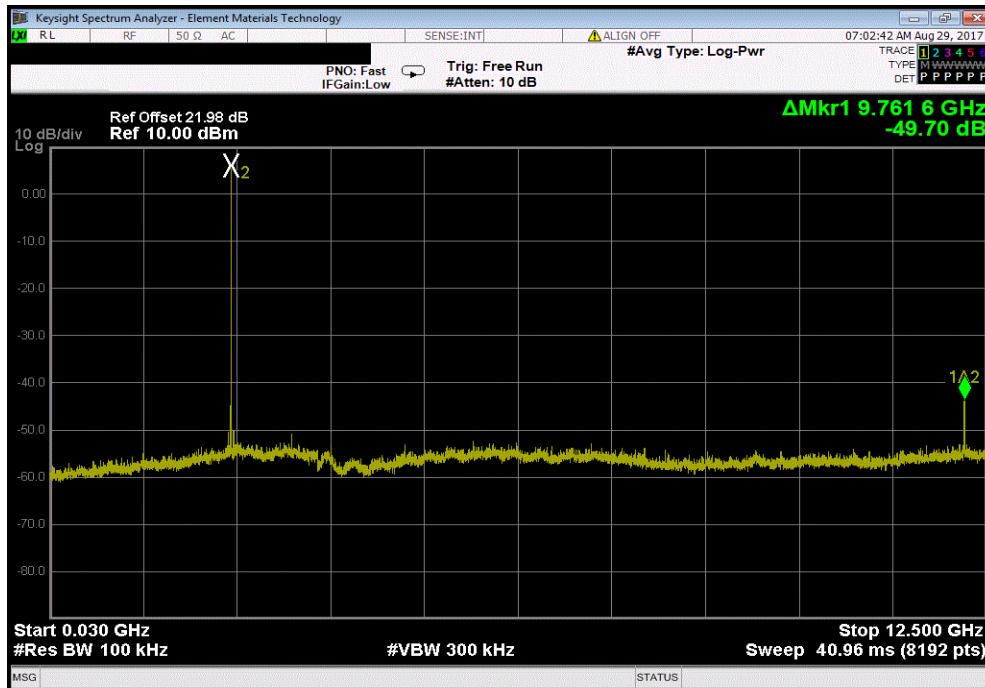


SPURIOUS CONDUCTED EMISSIONS

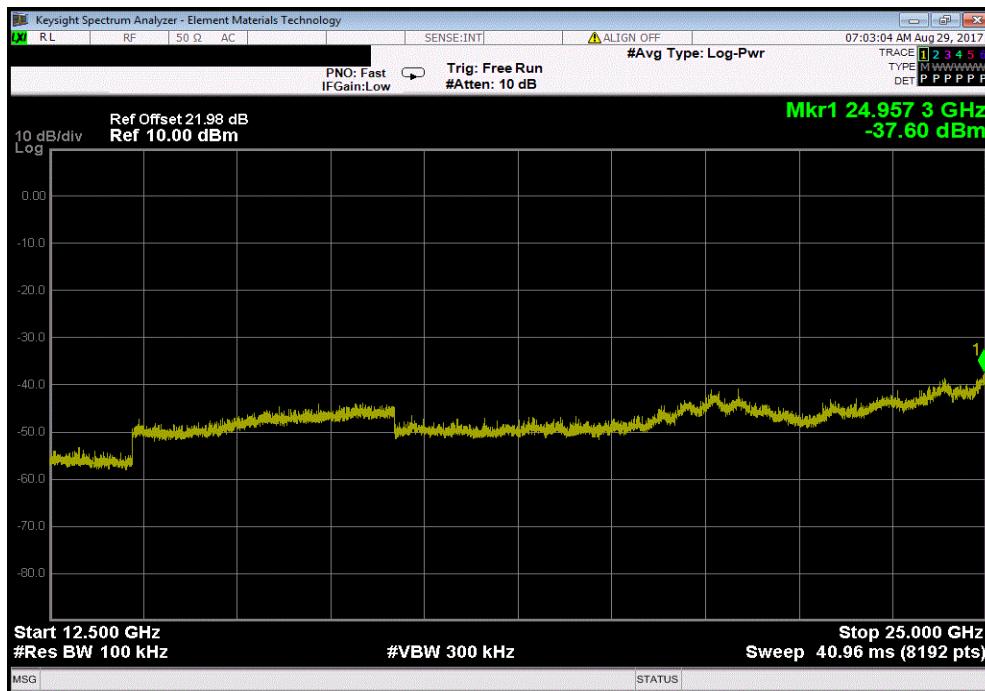


TbtTx 2017.07.11 XMT 2017.02.08

DH5, GFSK, Mid Channel			
Frequency Range	Max Value (dBc)	Limit \leq (dBc)	Result
30 MHz - 12.5 GHz	-49.7	-20	Pass



DH5, GFSK, Mid Channel			
Frequency Range	Max Value (dBc)	Limit \leq (dBc)	Result
12.5 GHz - 25 GHz	-43.49	-20	Pass

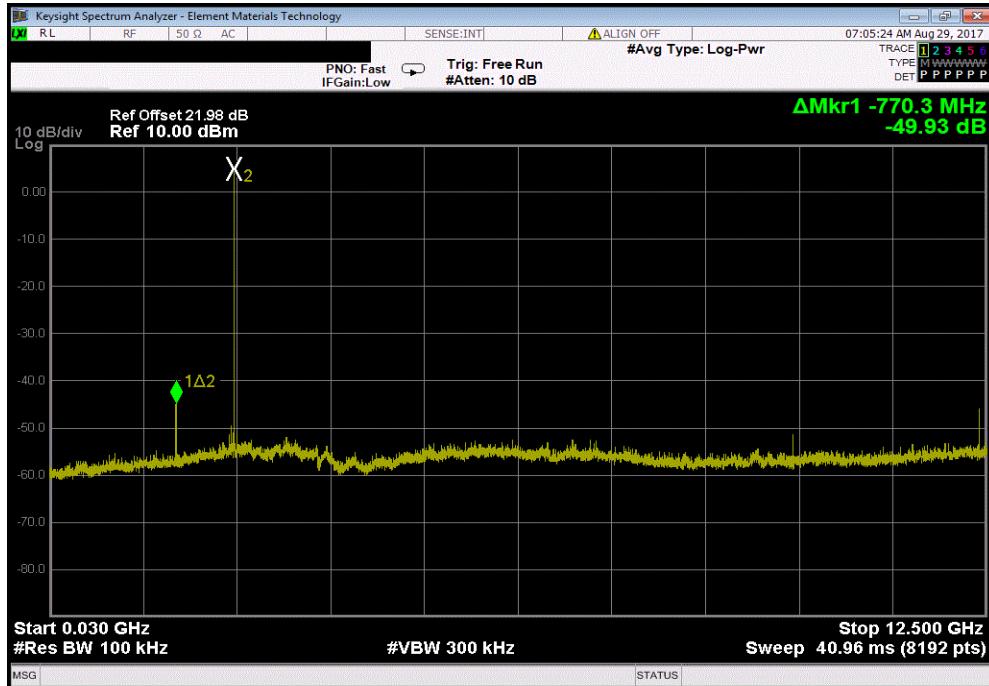


SPURIOUS CONDUCTED EMISSIONS

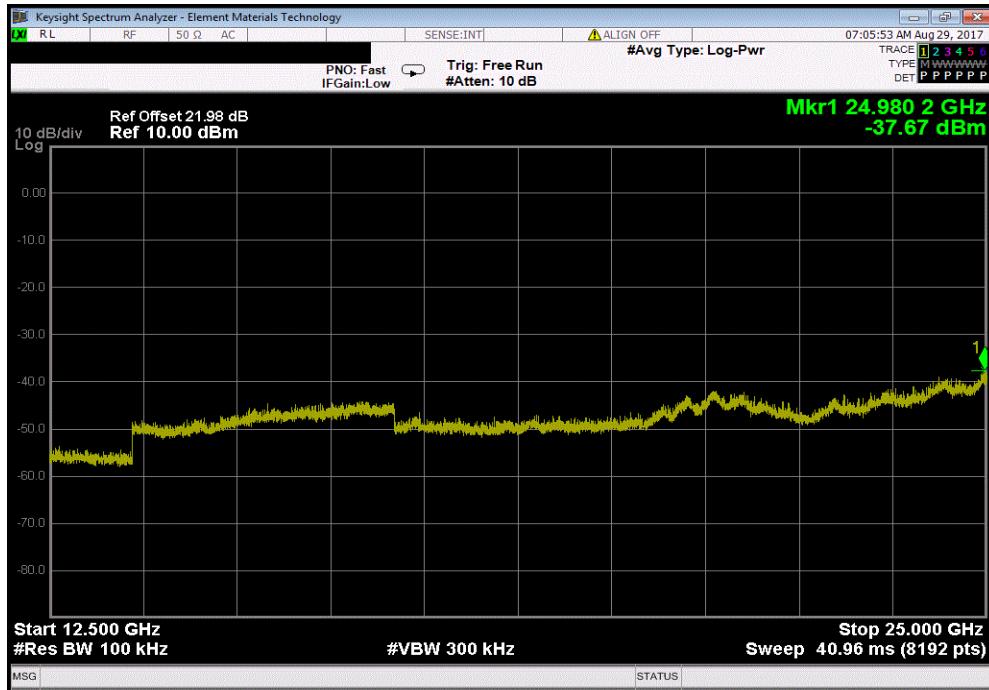


TbtTx 2017.07.11 XMT 2017.02.08

DH5, GFSK, High Channel			
Frequency Range	Max Value (dBc)	Limit \leq (dBc)	Result
30 MHz - 12.5 GHz	-49.93	-20	Pass



DH5, GFSK, High Channel			
Frequency Range	Max Value (dBc)	Limit \leq (dBc)	Result
12.5 GHz - 25 GHz	-42.54	-20	Pass

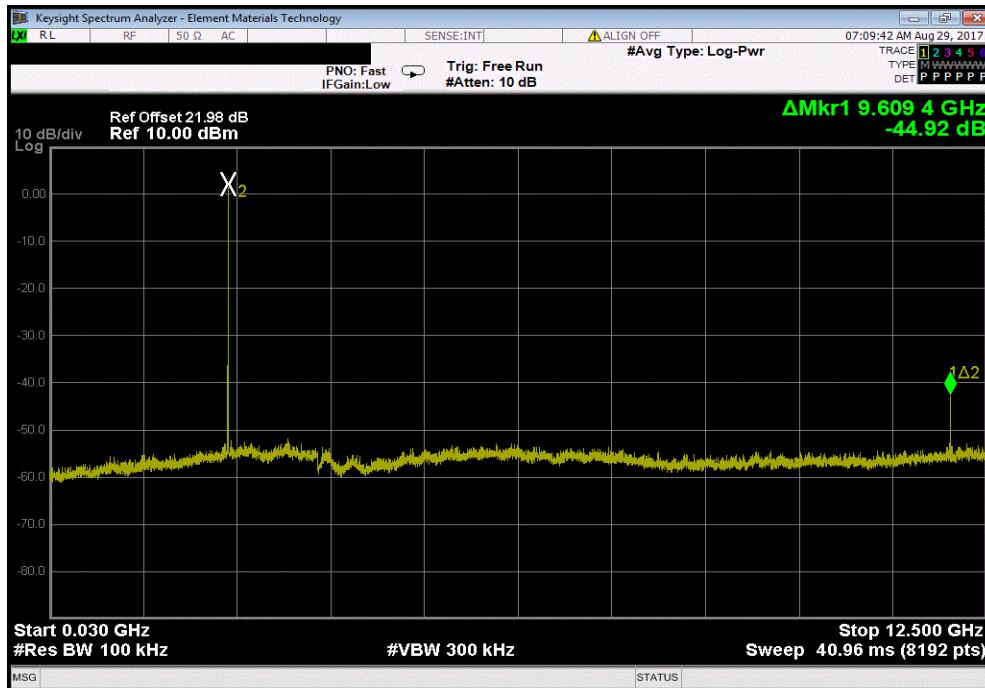


SPURIOUS CONDUCTED EMISSIONS

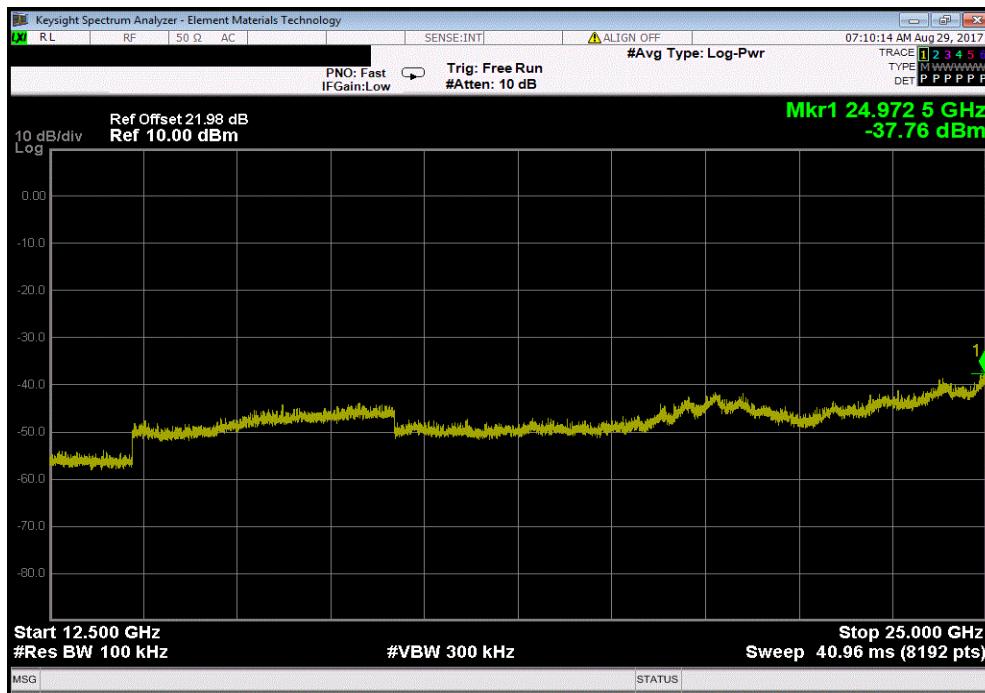


TbtTx 2017.07.11 XMT 2017.02.08

2DH5, pi/4-DQPSK, Low Channel			
Frequency Range	Max Value (dBc)	Limit \leq (dBc)	Result
30 MHz - 12.5 GHz	-44.92	-20	Pass



2DH5, pi/4-DQPSK, Low Channel			
Frequency Range	Max Value (dBc)	Limit \leq (dBc)	Result
12.5 GHz - 25 GHz	-39.83	-20	Pass

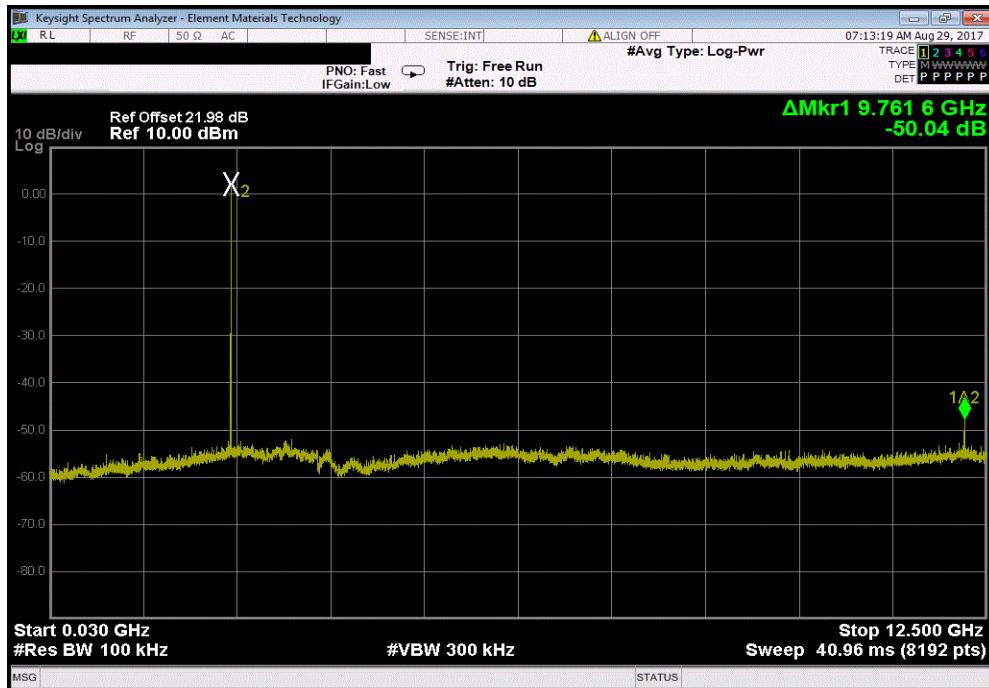


SPURIOUS CONDUCTED EMISSIONS

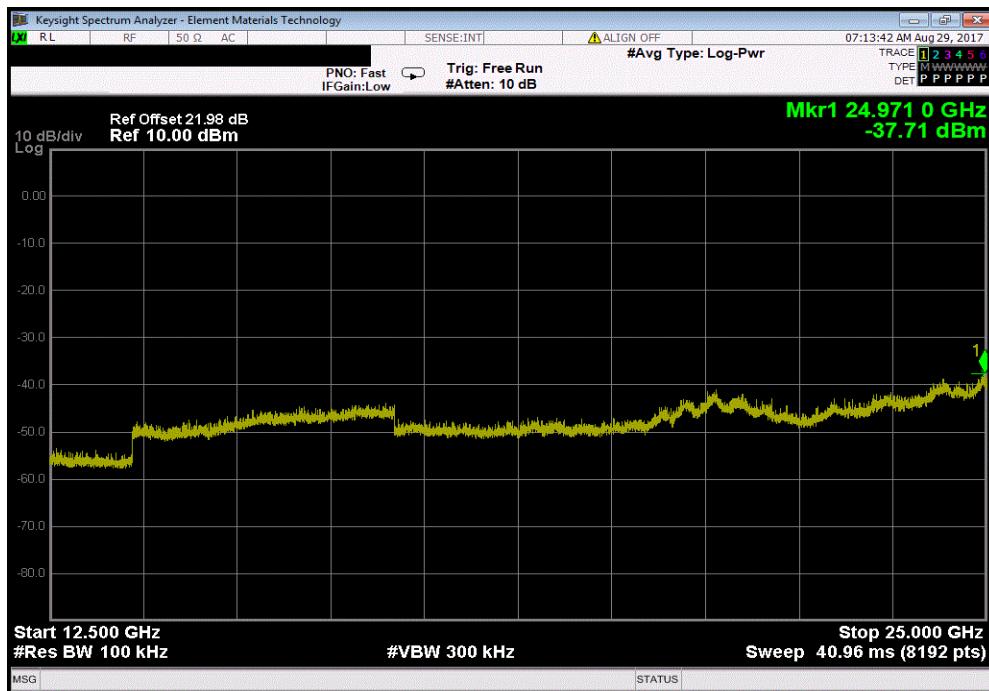


TbtTx 2017.07.11 XMT 2017.02.08

Frequency Range		Max Value (dBc)	Limit \leq (dBc)	Result
30 MHz - 12.5 GHz		-50.04	-20	Pass



Frequency Range		Max Value (dBc)	Limit \leq (dBc)	Result
12.5 GHz - 25 GHz		-39.73	-20	Pass

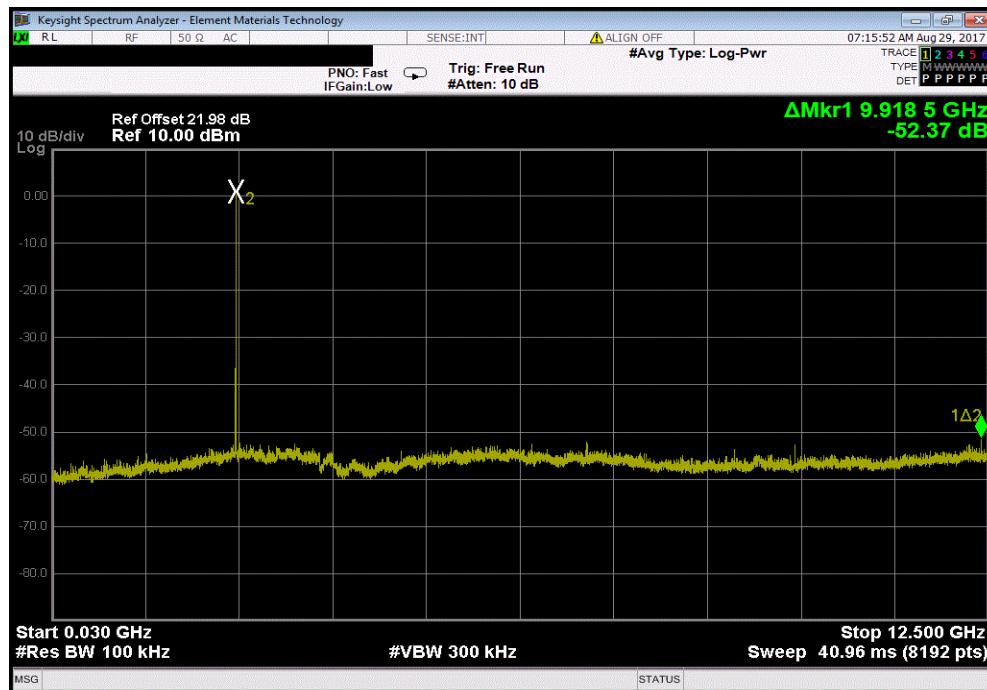


SPURIOUS CONDUCTED EMISSIONS

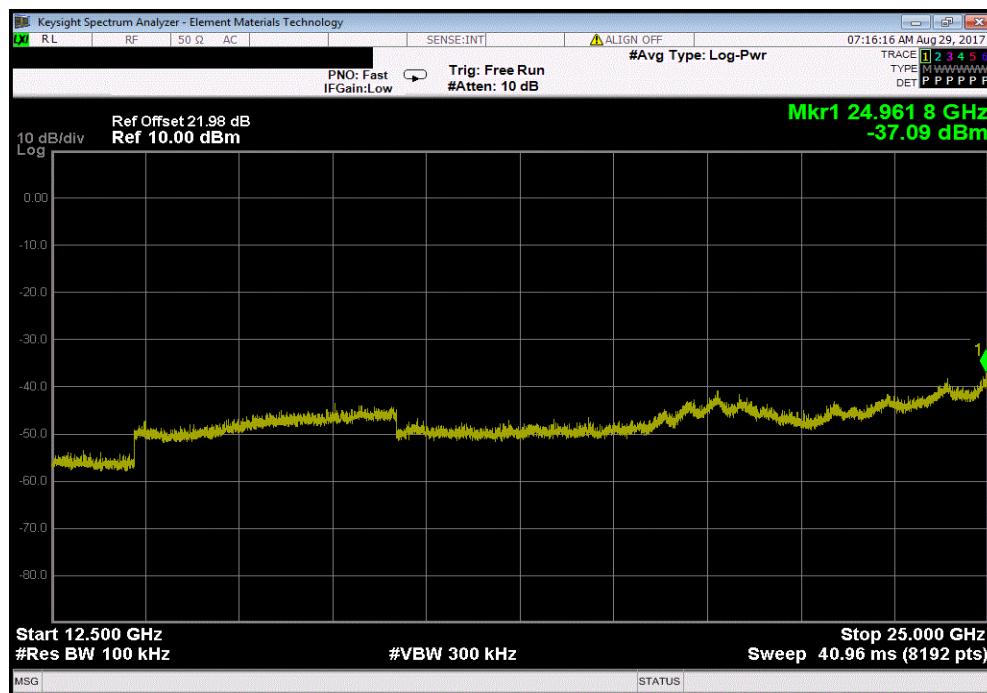


TbtTx 2017.07.11 XMT 2017.02.08

Frequency Range		Max Value (dBc)	Limit \leq (dBc)	Result
30 MHz - 12.5 GHz		-52.37	-20	Pass



Frequency Range		Max Value (dBc)	Limit \leq (dBc)	Result
12.5 GHz - 25 GHz		-37.88	-20	Pass

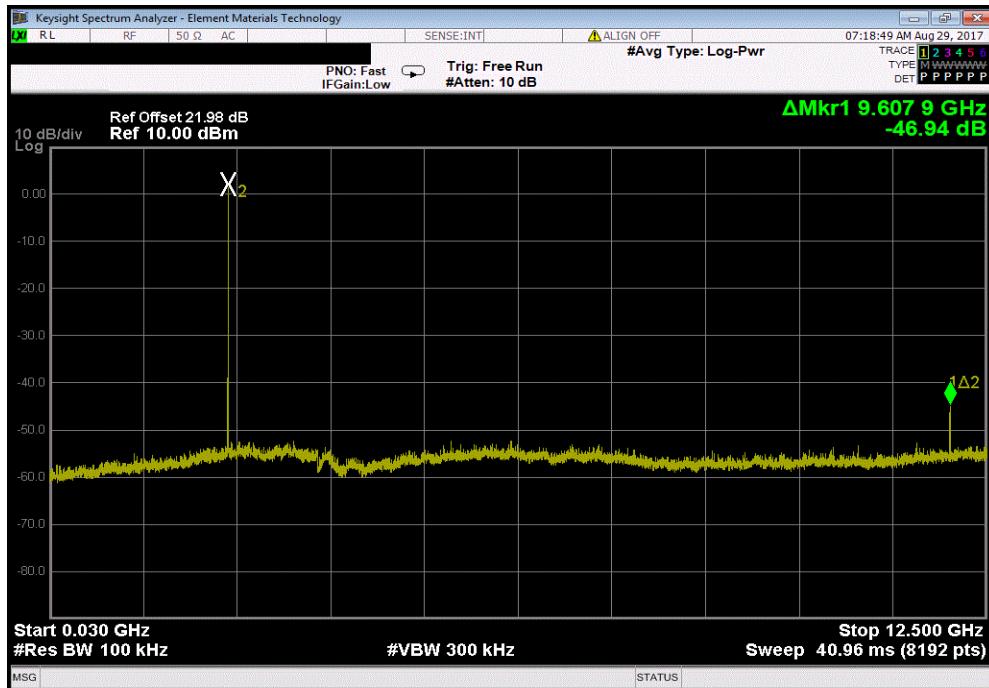


SPURIOUS CONDUCTED EMISSIONS

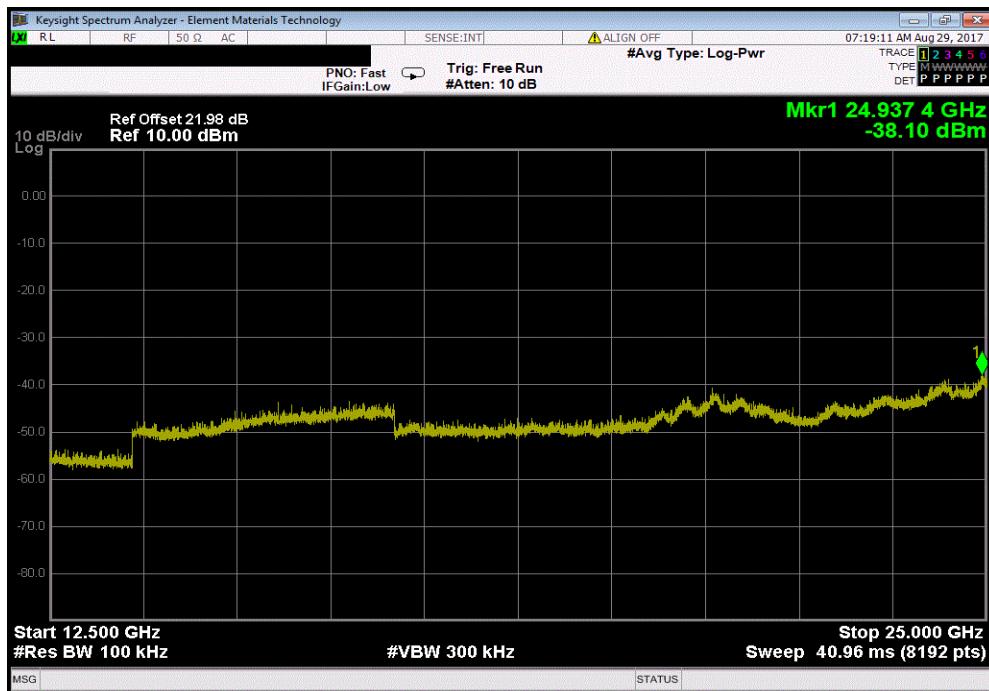


TbtTx 2017.07.11 XMT 2017.02.08

3DH5, 8-DPSK, Low Channel			
Frequency Range	Max Value (dBc)	Limit \leq (dBc)	Result
30 MHz - 12.5 GHz	-46.94	-20	Pass



3DH5, 8-DPSK, Low Channel			
Frequency Range	Max Value (dBc)	Limit \leq (dBc)	Result
12.5 GHz - 25 GHz	-40.1	-20	Pass

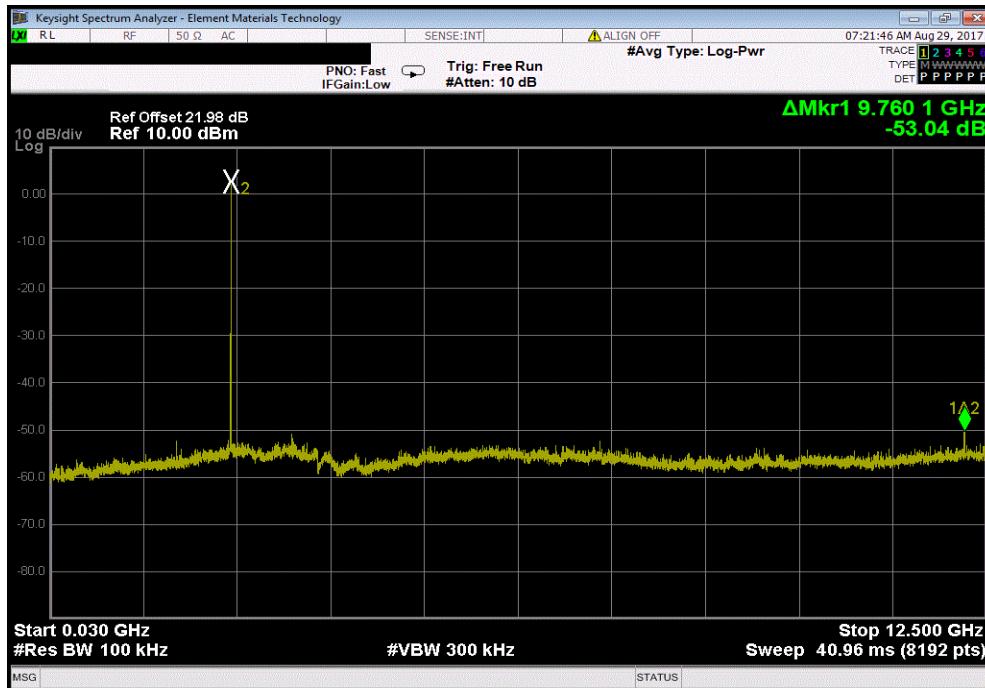


SPURIOUS CONDUCTED EMISSIONS

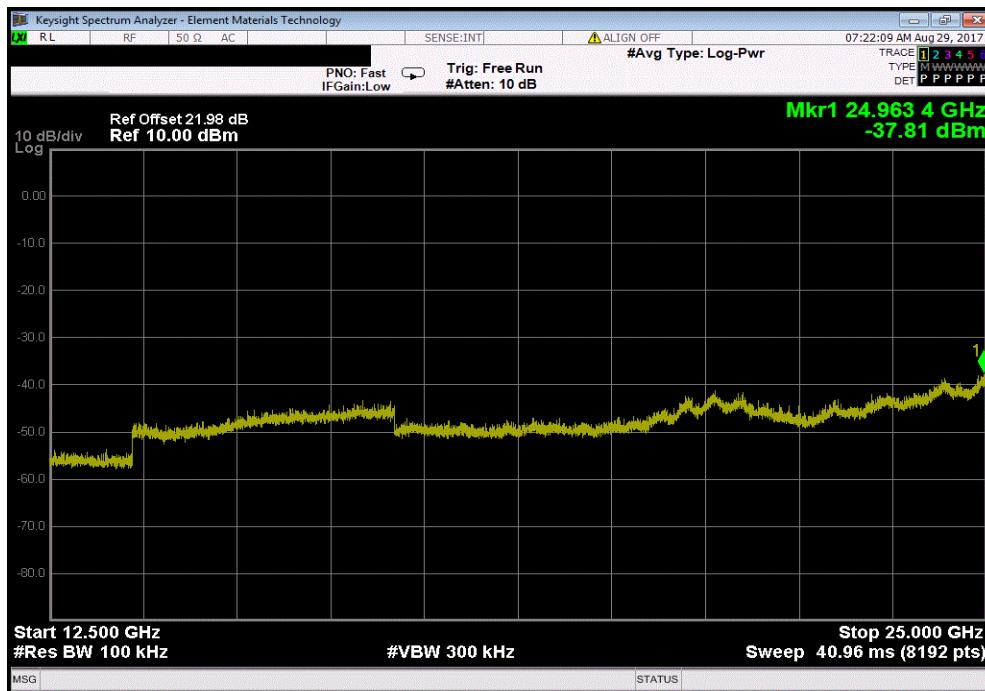


TbtTx 2017.07.11 XMT 2017.02.08

3DH5, 8-DPSK, Mid Channel			
Frequency Range	Max Value (dBc)	Limit ≤ (dBc)	Result
30 MHz - 12.5 GHz	-53.04	-20	Pass



3DH5, 8-DPSK, Mid Channel			
Frequency Range	Max Value (dBc)	Limit ≤ (dBc)	Result
12.5 GHz - 25 GHz	-40.45	-20	Pass

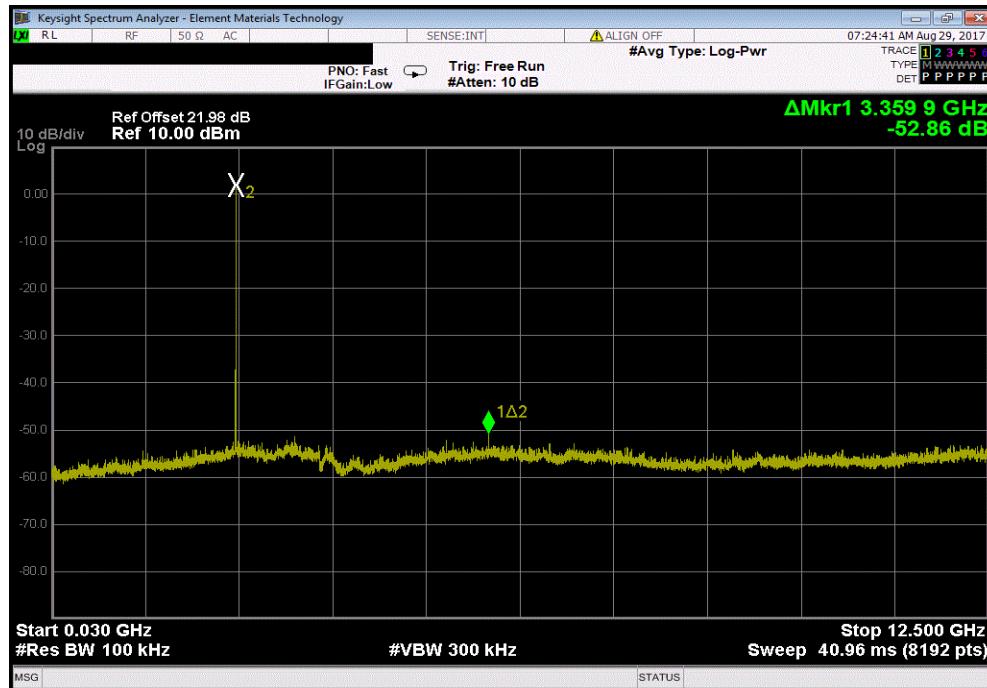


SPURIOUS CONDUCTED EMISSIONS



TbtTx 2017.07.11 XMT 2017.02.08

3DH5, 8-DPSK, High Channel			
Frequency Range	Max Value (dBc)	Limit \leq (dBc)	Result
30 MHz - 12.5 GHz	-52.86	-20	Pass



3DH5, 8-DPSK, High Channel			
Frequency Range	Max Value (dBc)	Limit \leq (dBc)	Result
12.5 GHz - 25 GHz	-39.5	-20	Pass

