



element

Preco, Inc.

PRECOlink

FCC 15.247:2020

2.4GHz DTS

Report: PRCO0113, Issue Date: April 15, 2020



NVLAP LAB CODE: 200630-0



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CERTIFICATE OF TEST

Last Date of Test: March 30, 2020

Preco, Inc.

EUT: PRECOLink

Radio Equipment Testing

Standards

Specification	Method
FCC 15.247:2020	ANSI C63.10:2013, KDB 558074

Results

Method Clause	Test Description	Applied	Results	Comments
6.2	Powerline Conducted Emissions	No	N/A	Not required for a product intended for vehicular use
11.6	Duty Cycle	Yes	Pass	
11.8.2	Occupied Bandwidth	Yes	Pass	
11.9.1.1	Output Power	Yes	Pass	
11.9.1.1	Equivalent Isotropic Radiated Power	Yes	Pass	
11.10.2	Power Spectral Density	Yes	Pass	
11.11	Band Edge Compliance	Yes	Pass	
11.11	Spurious Conducted Emissions	Yes	Pass	
11.12.1, 11.13.2, 6.5, 6.6	Spurious Radiated Emissions	Yes	Pass	
11.12.1, 11.13.2, 6.5, 6.6	Spurious Radiated Emissions	Yes	Pass	

Deviations From Test Standards

None

Approved By:



Kyle Holgate, Operations Manager

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

REVISION HISTORY



Revision Number	Description	Date (yyyy-mm-dd)	Page Number
00	None		

ACCREDITATIONS AND AUTHORIZATIONS



United States

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

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

NVLAP - Each laboratory is accredited by NVLAP to ISO 17025

Canada

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

European Union

European Commission – 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

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

Japan

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

Taiwan

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

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

Singapore

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

Israel

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

Hong Kong

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

Vietnam

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

SCOPE

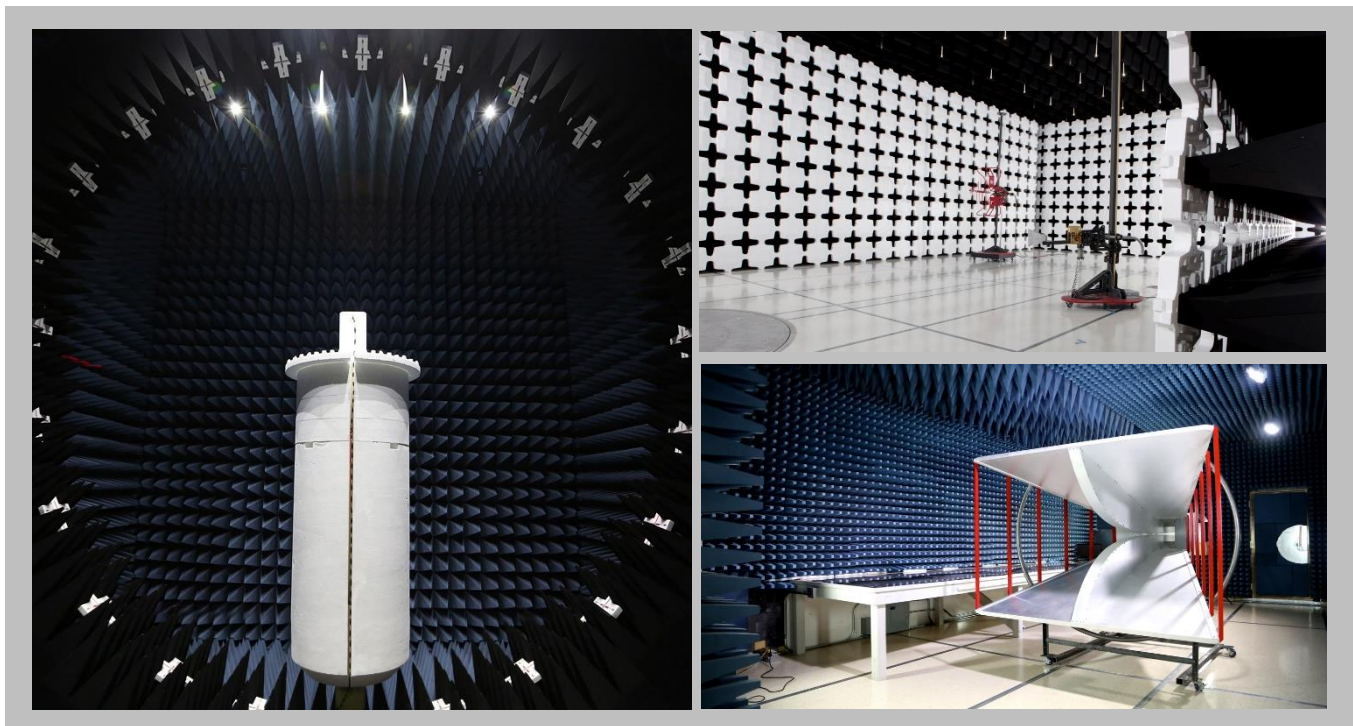
For details on the Scopes of our Accreditations, please visit:

<https://www.nwemc.com/emc-testing-accreditations>

FACILITIES



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



MEASUREMENT UNCERTAINTY



Measurement Uncertainty

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

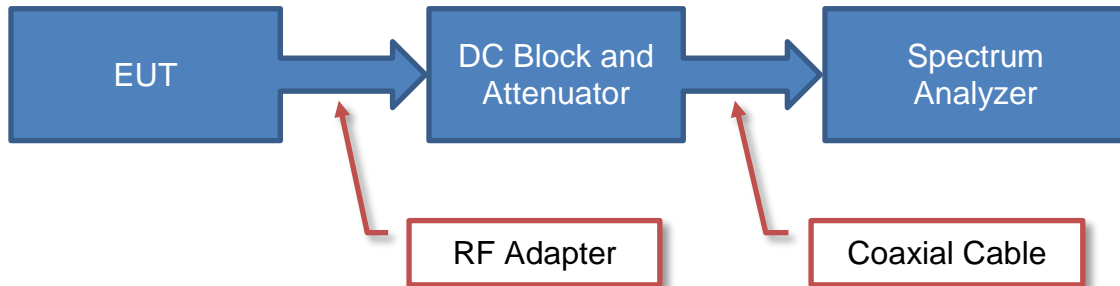
A measurement uncertainty estimation has been performed for each test per our internal quality document QM205.4.6. The estimation is used to compare the measured result with its "true" or theoretically correct value. The expanded measurement uncertainty (K=2) can be found included as part of the applicable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

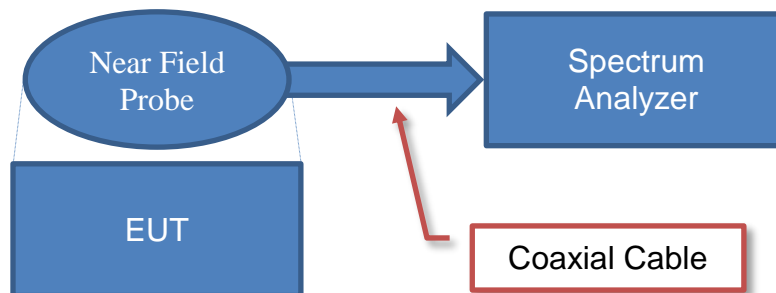
Test	+ MU	- MU
Frequency Accuracy	0.0007%	-0.0007%
Amplitude Accuracy (dB)	1.2 dB	-1.2 dB
Conducted Power (dB)	1.2 dB	-1.2 dB
Radiated Power via Substitution (dB)	0.7 dB	-0.7 dB
Temperature (degrees C)	0.7°C	-0.7°C
Humidity (% RH)	2.5% RH	-2.5% RH
Voltage (AC)	1.0%	-1.0%
Voltage (DC)	0.7%	-0.7%
Field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

Test Setup Block Diagrams

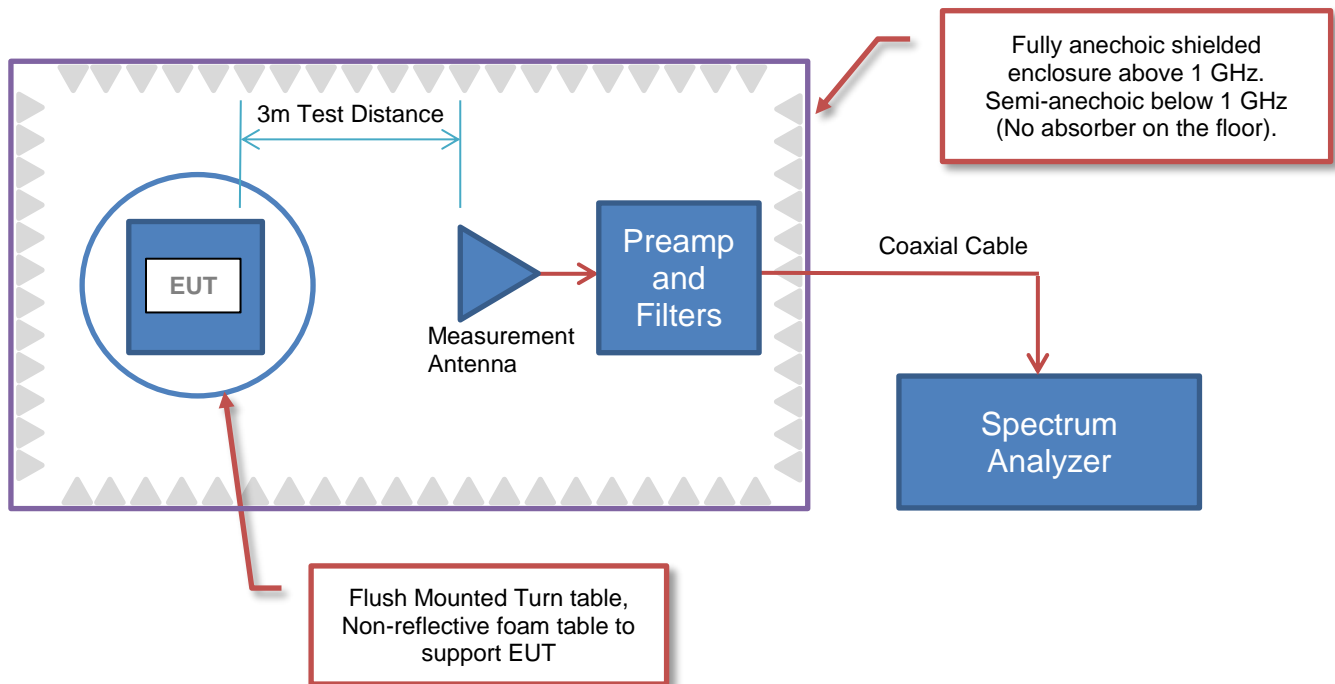
Antenna Port Conducted Measurements



Near Field Test Fixture Measurements



Spurious Radiated Emissions



PRODUCT DESCRIPTION

Client and Equipment Under Test (EUT) Information

Company Name:	Preco, Inc.
Address:	10335 West Emerald Street
City, State, Zip:	Boise, ID 83704
Test Requested By:	Bryan Holloway
EUT:	PRECOLink
First Date of Test:	February 11, 2020
Last Date of Test:	March 30, 2020
Receipt Date of Samples:	February 11, 2020
Equipment Design Stage:	Production
Equipment Condition:	No Damage
Purchase Authorization:	Verified

Information Provided by the Party Requesting the Test

Functional Description of the EUT:

This product is a wireless CAN bus for vehicles. It's an after-market accessory. It uses the 2.4 GHz unlicensed band. The lowest channel used has a center frequency of 2.405 GHz. The highest channel center frequency is 2.475 GHz. The modulation is DSSS O-QPSK. Channel bandwidth is about 2 MHz. It does not use frequency hopping. The product has 3 different antennas (for diversity). 2 are on-board PCB trace antennas. The third antenna path is to an SMA port for connection to an external antenna. For conducted measurements, a unit is provided with U.FL connectors at the antenna feed points. Another sample without the U.FL connectors is provided for radiated measurements.

Testing Objective:

To demonstrate compliance of the 2.4 GHz DTS radio to FCC 15.247 requirements.

CONFIGURATIONS



Configuration PRCO0111- 1

Software/Firmware Running during test	
Description	Version
Tera Term	4.100

EUT			
Description	Manufacturer	Model/Part Number	Serial Number
Dipole	Linx	ANT-2.4-ID/ANT-2.4-ID-2000-SMA	None
PRECOLink	Preco, Inc.	PRECOLink	B8

Remote Equipment Outside of Test Setup Boundary			
Description	Manufacturer	Model/Part Number	Serial Number
Remote Laptop	HP	Elitebook 820	5GG63636KL

Cables					
Cable Type	Shield	Length (m)	Ferrite	Connection 1	Connection 2
RG58/U Coax	Yes	2.0 m	No	Dipole	PRECOLink
Main Cable Harness	No	3.8m	No	PRECOLink	DC Power Cable
DC Power Cable	No	1.0 m	No	Main Cable Harness	DC Linear Power Supply
AC Mains	No	1.8 m	No	AC Mains	DC Linear Power Supply

CONFIGURATIONS



Configuration PRCO0113- 1

Software/Firmware Running during test	
Description	Version
Tera Term	4.100

EUT			
Description	Manufacturer	Model/Part Number	Serial Number
Dipole	Linx	ANT-2.4-ID/ANT-2.4-ID-2000-SMA	None
PRECOlink	Preco, Inc.	PRECOlink	B7

Peripherals in test setup boundary			
Description	Manufacturer	Model/Part Number	Serial Number
DC Linear Power Supply	Topward Electronic Instruments	TPS 2000	TPD

Remote Equipment Outside of Test Setup Boundary			
Description	Manufacturer	Model/Part Number	Serial Number
Laptop	HP	Elitebook 820	5GG63636KL

Cables					
Cable Type	Shield	Length (m)	Ferrite	Connection 1	Connection 2
AC Mains	No	1.8 m	No	AC Mains	DC Linear Power Supply
RG58/U Coax	Yes	2.0 m	No	PRECOlink	Dipole
Main Cable Harness	No	3.8 m	No	DC Power	PRECOlink
DC Power	No	1.0 m	No	Main Cable Harness	DC Linear Power Supply

CONFIGURATIONS



Configuration PRCO0113- 3

Software/Firmware Running during test	
Description	Version
Tera Term	4.100

EUT			
Description	Manufacturer	Model/Part Number	Serial Number
PRECOlink	Preco, Inc.	PRECOlink	B2

Peripherals in test setup boundary			
Description	Manufacturer	Model/Part Number	Serial Number
DC Linear Power Supply	Topward Electronic Instruments	TPS 2000	TPD
JTAG programming PCB	Preco, Inc.	None	None

Remote Equipment Outside of Test Setup Boundary			
Description	Manufacturer	Model/Part Number	Serial Number
Laptop	HP	Elitebook 820	5GG63636KL

Cables					
Cable Type	Shield	Length (m)	Ferrite	Connection 1	Connection 2
AC Mains	No	1.8 m	No	AC Mains	DC Linear Power Supply
DC Power	No	1.0 m	No	PRECOlink	DC Linear Power Supply
USB	Yes	0.9 m	No	JTAG programming PCB	Laptop

MODIFICATIONS



Equipment Modifications

Item	Date	Test	Modification	Note	Disposition of EUT
1	2020-02-11	Spurious Radiated Emissions	Tested as delivered to Test Station.	No EMI suppression devices were added or modified during this test.	Scheduled testing was completed.
2	2020-03-27	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	2020-03-30	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.
4	2020-03-30	Output Power	Tested as delivered to Test Station.	No EMI suppression devices were added or modified during this test.	EUT remained at Element following the test.
5	2020-03-30	Equivalent Isotropic Radiated Power	Tested as delivered to Test Station.	No EMI suppression devices were added or modified during this test.	EUT remained at Element following the test.
6	2020-03-30	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	2020-03-30	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	2020-03-30	Spurious Conducted Emissions	Tested as delivered to Test Station.	No EMI suppression devices were added or modified during this test.	Scheduled testing was completed.

DUTY CYCLE



TEST DESCRIPTION

The Duty Cycle (x) were measured for each of the EUT operating modes. The measurements were made using a zero span on the spectrum analyzer to see the pulses in the time domain. The transmit power was set to its default maximum.

The duty cycle was calculated by dividing the transmission pulse duration (T) by the total period of a single on and total off time. The EUT operates at 100% Duty Cycle.



OCCUPIED BANDWIDTH

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	5-Nov-18	5-Nov-20
Cable	Micro-Coax	UFD150A-1-0720-200200	EVH	13-Mar-20	13-Mar-21
Attenuator	S.M. Electronics	SA26B-20	AUY	13-Mar-20	13-Mar-21
Block - DC	Fairview Microwave	SD3379	AMW	13-Mar-20	13-Mar-21
Analyzer - Spectrum Analyzer	Agilent	E4440A	AFA	28-Feb-20	28-Feb-21

TEST DESCRIPTION

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

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

OCCUPIED BANDWIDTH



Tel: 2019.08.30.0 XM: 2020.03.25.0

EUT: PRECOlink		Work Order: PRCO0113	
Serial Number: B2		Date: 30-Mar-20	
Customer: Preco, Inc.		Temperature: 22.6 °C	
Attendees: None		Humidity: 37.4% RH	
Project: None		Barometric Pres.: 1017 mbar	
Tested by: Kam Robertson, Jeff Alcock		Power: 12 VDC	
		Job Site: EV06	
TEST SPECIFICATIONS		Test Method	
FCC 15.247:2020		ANSI C63.10:2013	
COMMENTS			
The reference level offset includes: DC block, 20dB attenuator, measurement cable. Software power setting = 0x32.			
DEVIATIONS FROM TEST STANDARD			
None			
Configuration #	3	Signature	

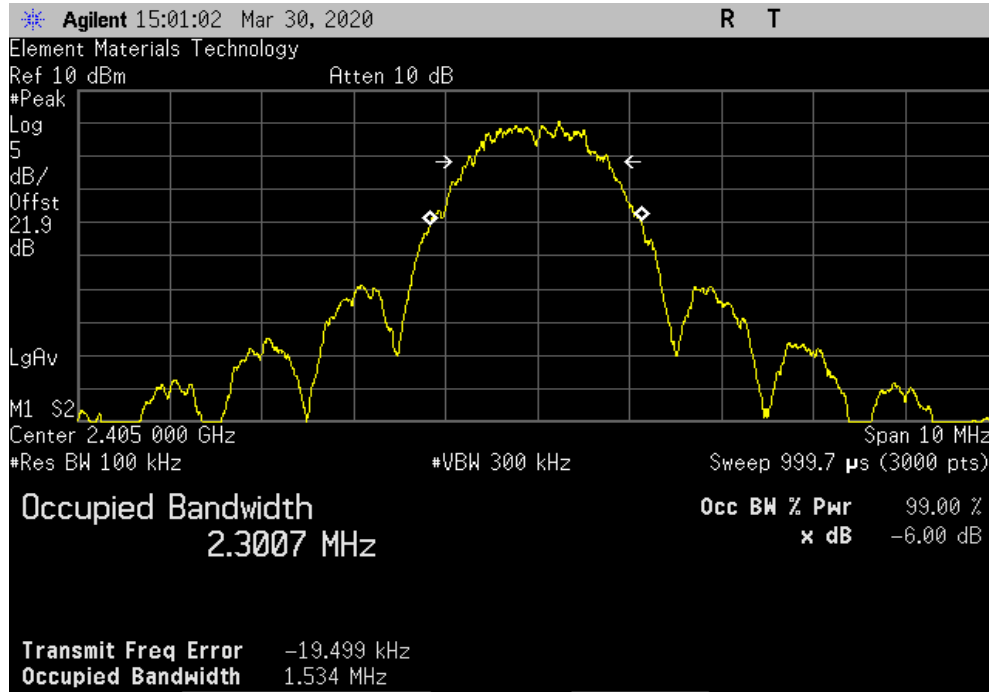
	Value	Limit (>)	Result
802.15.4, O-PQSK			
Antenna 1			
Low Ch. 2405 MHz	1.534 MHz	500 kHz	Pass
Mid Ch. 2440 MHz	1.575 MHz	500 kHz	Pass
High Ch. 2475 MHz	1.561 MHz	500 kHz	Pass
Antenna 2			
Low Ch. 2405 MHz	1.559 MHz	500 kHz	Pass
Mid Ch. 2440 MHz	1.609 MHz	500 kHz	Pass
High Ch. 2475 MHz	1.536 MHz	500 kHz	Pass
External Antenna			
Low Ch. 2405 MHz	1.434 MHz	500 kHz	Pass
Mid Ch. 2440 MHz	1.58 MHz	500 kHz	Pass
High Ch. 2475 MHz	1.605 MHz	500 kHz	Pass

OCCUPIED BANDWIDTH

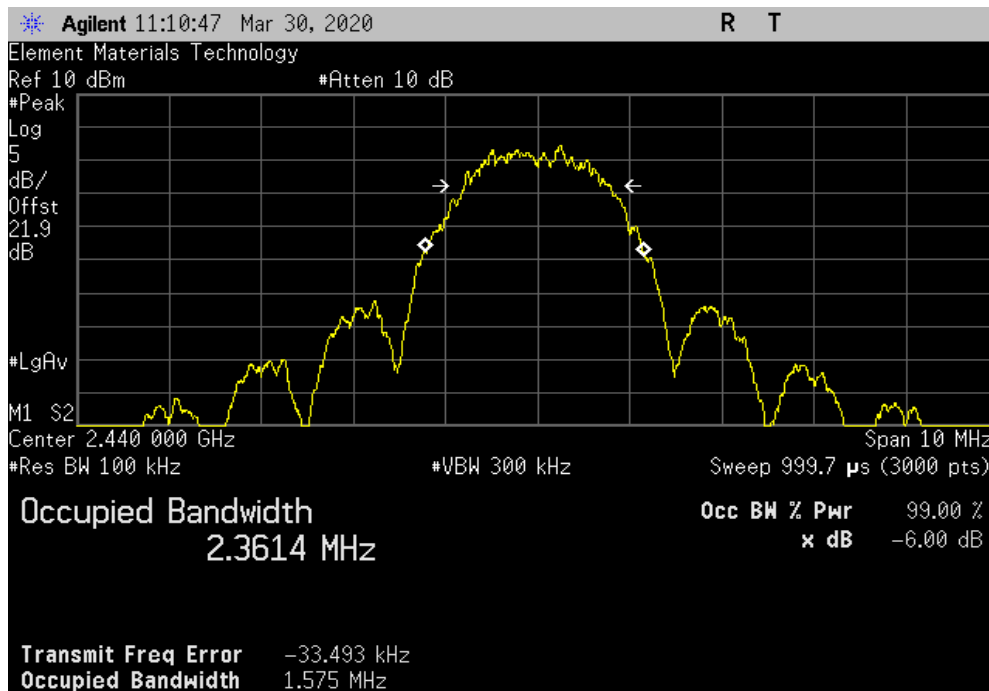


TuTx 2019.08.30.0 XMt 2020.03.25.0

802.15.4, O-PQSK, Antenna 1, Low Ch. 2405 MHz			
	Value	Limit (>)	Result
	1.534 MHz	500 kHz	Pass



802.15.4, O-PQSK, Antenna 1, Mid Ch. 2440 MHz			
	Value	Limit (>)	Result
	1.575 MHz	500 kHz	Pass

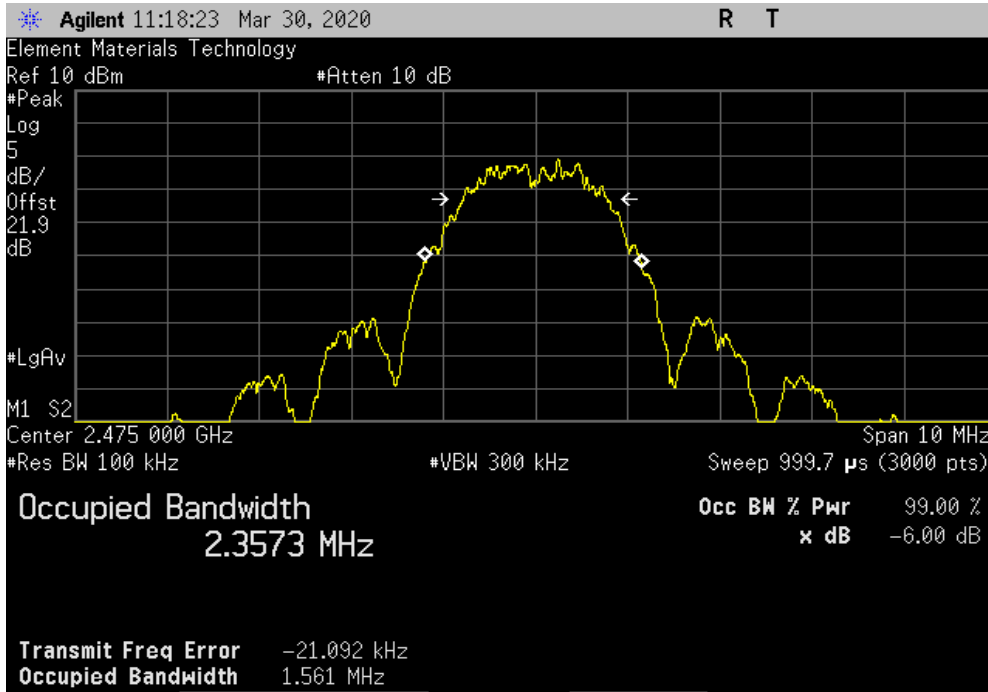


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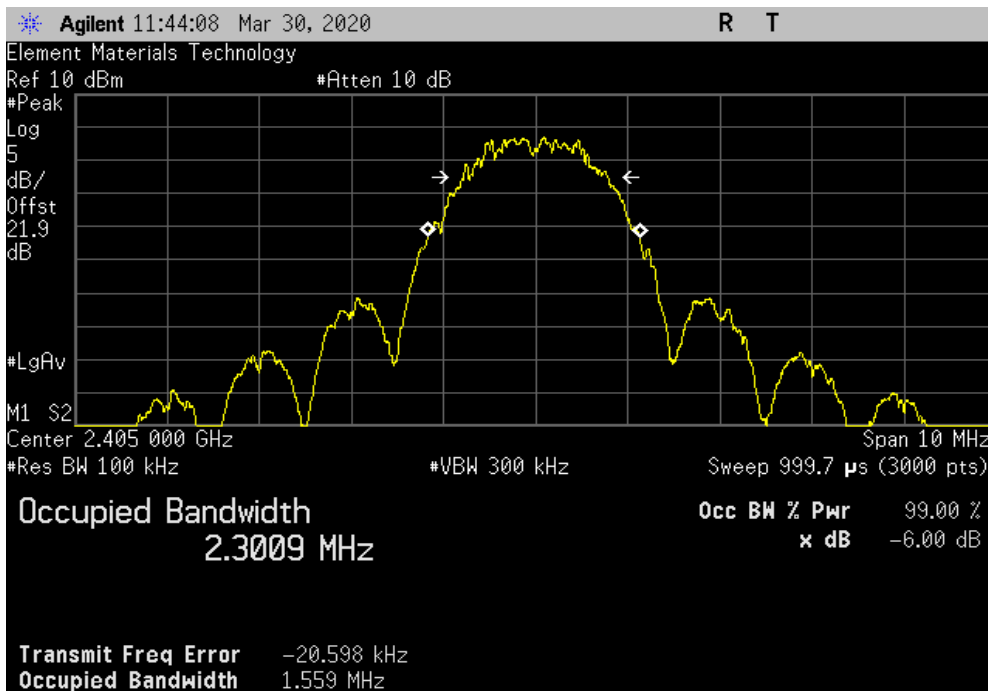


TuTx 2019.08.30.0 XMt 2020.03.25.0

802.15.4, O-PQSK, Antenna 1, High Ch. 2475 MHz						
				Value	Limit (>)	Result
				1.561 MHz	500 kHz	Pass



802.15.4, O-PQSK, Antenna 2, Low Ch. 2405 MHz						
				Value	Limit (>)	Result
				1.559 MHz	500 kHz	Pass

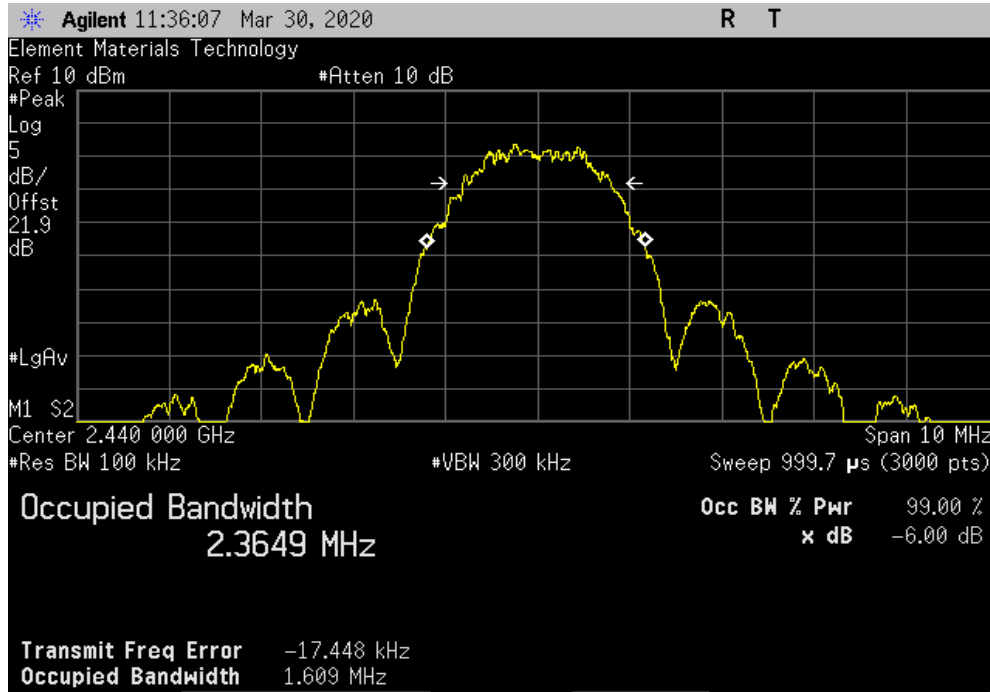


OCCUPIED BANDWIDTH

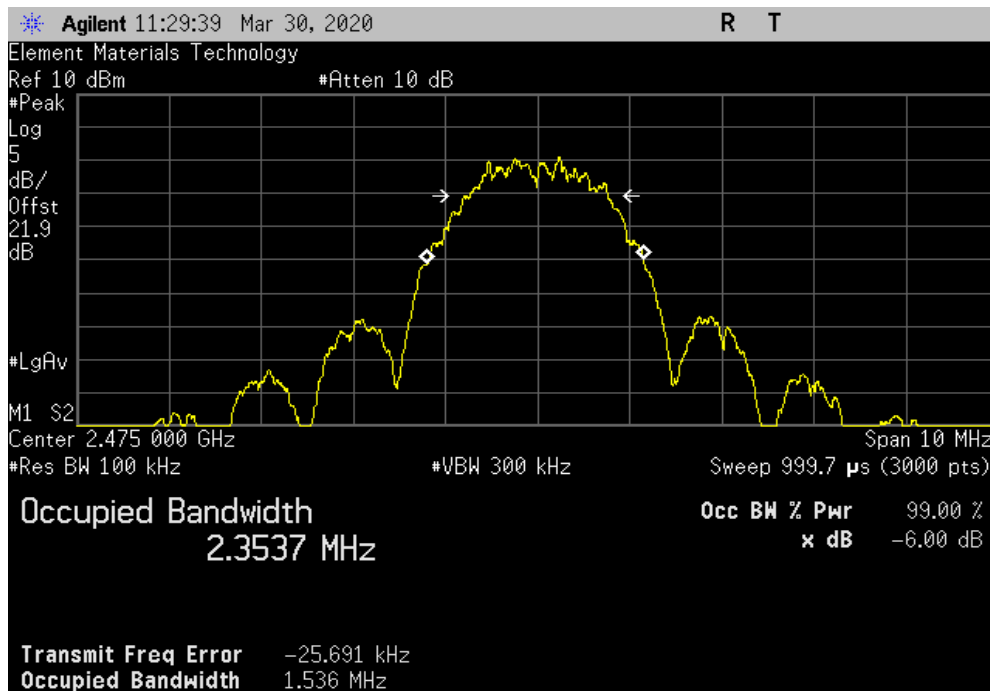


TuTx 2019.08.30.0 XMt 2020.03.25.0

802.15.4, O-PQSK, Antenna 2, Mid Ch. 2440 MHz			
	Value	Limit (>)	Result
	1.609 MHz	500 kHz	Pass



802.15.4, O-PQSK, Antenna 2, High Ch. 2475 MHz			
	Value	Limit (>)	Result
	1.536 MHz	500 kHz	Pass

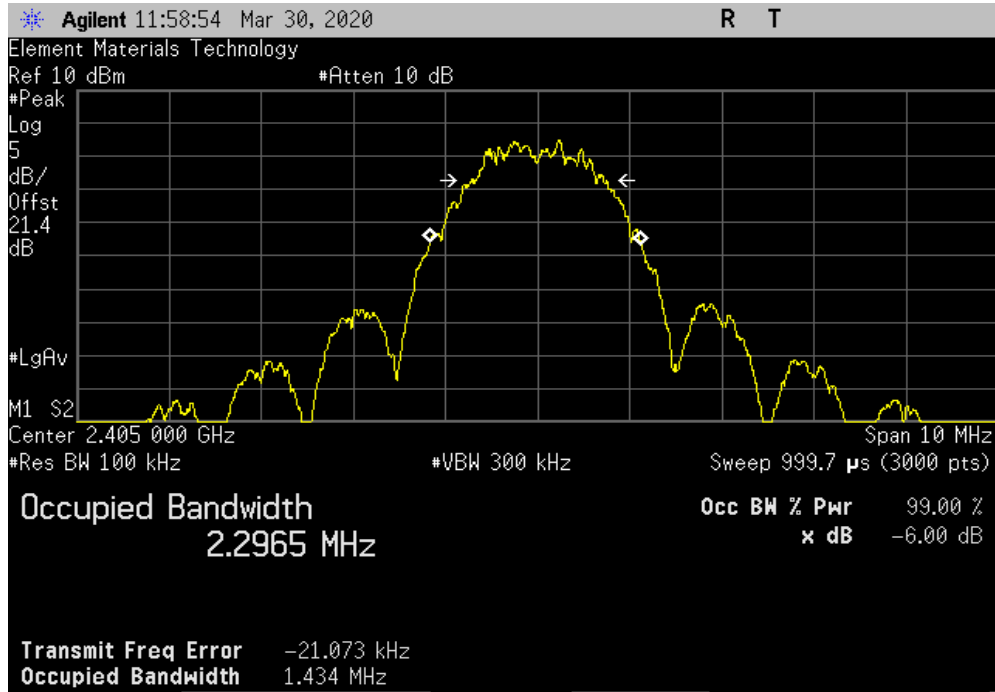


OCCUPIED BANDWIDTH

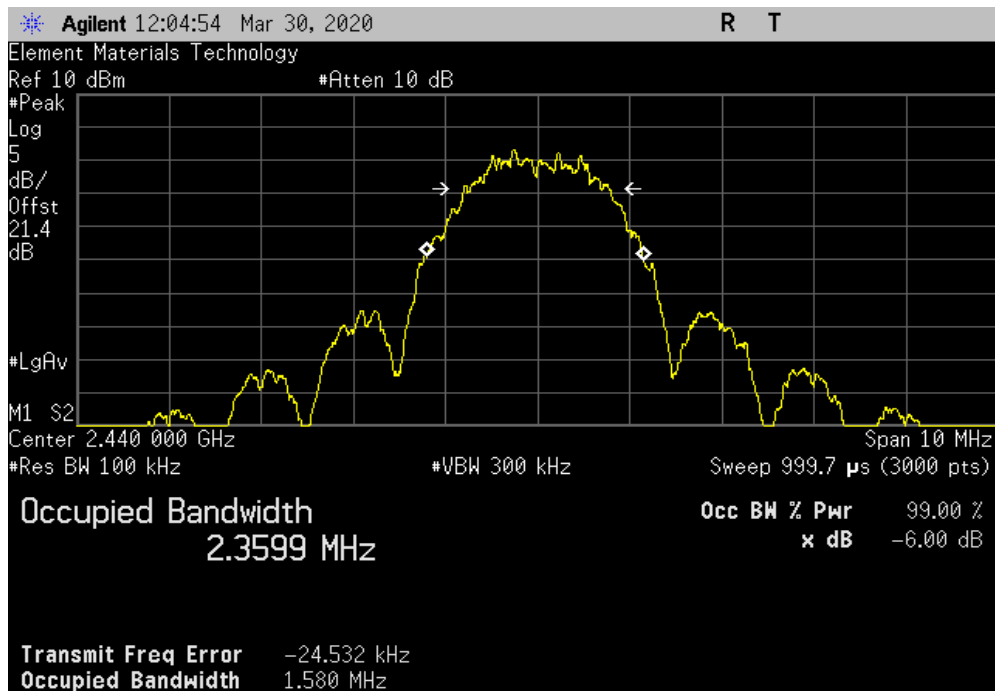


TuTx 2019.08.30.0 XMI 2020.03.25.0

802.15.4, O-PQSK, External Antenna, Low Ch. 2405 MHz						
				Value	Limit (>)	Result
				1.434 MHz	500 kHz	Pass



802.15.4, O-PQSK, External Antenna, Mid Ch. 2440 MHz						
				Value	Limit (>)	Result
				1.58 MHz	500 kHz	Pass

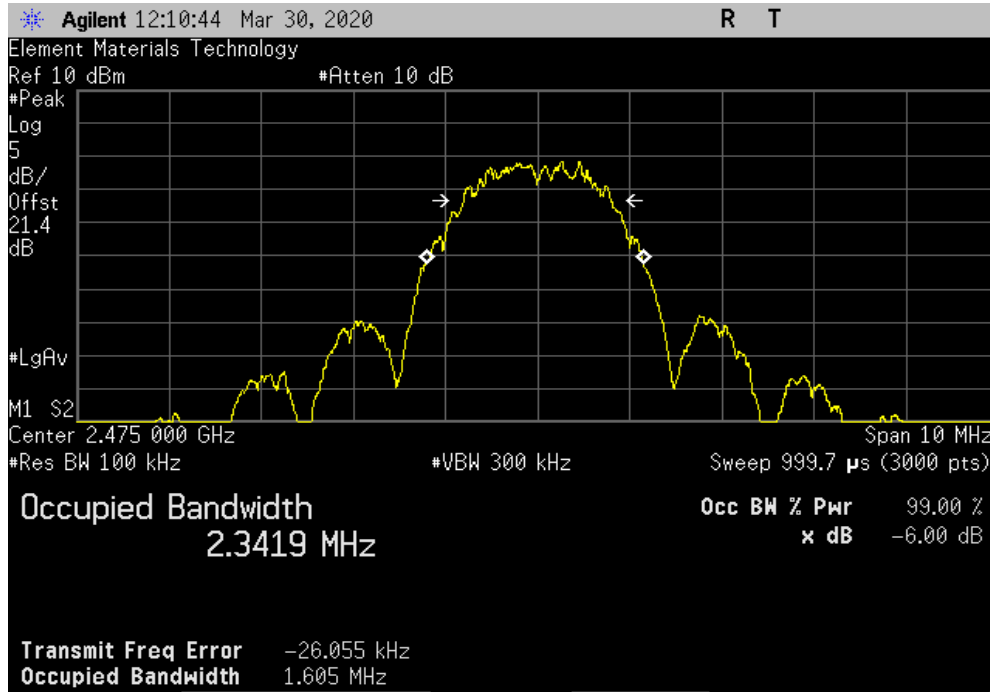


OCCUPIED BANDWIDTH



TbTx 2019.08.30.0 XMI 2020.03.25.0

802.15.4, O-PQSK, External Antenna, High Ch. 2475 MHz			
	Value	Limit	Result
	1.605 MHz	500 kHz	Pass



OUTPUT POWER



XMit 2020.03.25.0

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

TEST EQUIPMENT

Description	Manufacturer	Model	ID	Last Cal.	Cal. Due
Generator - Signal	Keysight	N5182B	TFU	5-Nov-18	5-Nov-20
Cable	Micro-Coax	UFD150A-1-0720-200200	EVH	13-Mar-20	13-Mar-21
Attenuator	S.M. Electronics	SA26B-20	AUY	13-Mar-20	13-Mar-21
Block - DC	Fairview Microwave	SD3379	AMW	13-Mar-20	13-Mar-21
Analyzer - Spectrum Analyzer	Agilent	E4440A	AFA	28-Feb-20	28-Feb-21

TEST DESCRIPTION

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

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

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

OUTPUT POWER



TelTx 2019.08.30.0 XMt 2020.03.25.0

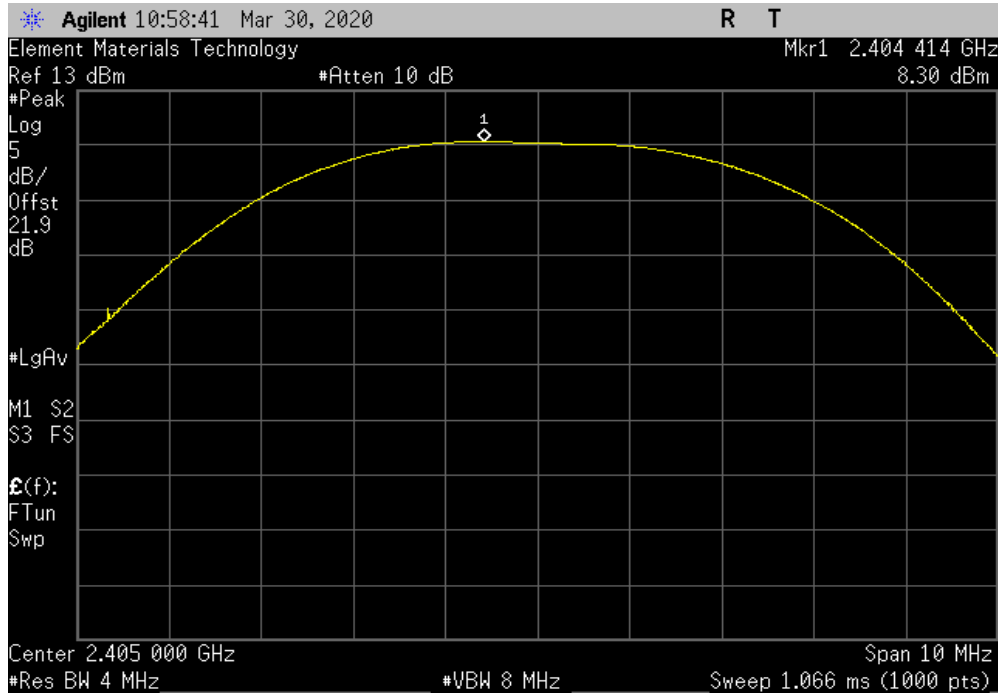
EUT: PRECOlink		Work Order: PRCO0113	
Serial Number: B2		Date: 30-Mar-20	
Customer: Preco, Inc.		Temperature: 22.7 °C	
Attendees: None		Humidity: 37.2% RH	
Project: None		Barometric Pres.: 1017 mbar	
Tested by: Kam Robertson, Jeff Alcock		Power: 12 VDC	
		Job Site: EV06	
TEST SPECIFICATIONS		Test Method	
FCC 15.247:2020		ANSI C63.10:2013	
COMMENTS			
The reference level offset includes: DC block, 20dB attenuator, measurement cable. Software power setting = 0x32.			
DEVIATIONS FROM TEST STANDARD			
None			
Configuration #	3	Signature	
		Out Pwr (dBm)	Limit (dBm) Result
802.15.4, O-PQSK			
Antenna 1			
	Low Ch. 2405 MHz	8.296	30 Pass
	Mid Ch. 2440 MHz	5.554	30 Pass
	High Ch. 2475 MHz	2.797	30 Pass
Antenna 2			
	Low Ch. 2405 MHz	7.256	30 Pass
	Mid Ch. 2440 MHz	5.502	30 Pass
	High Ch. 2475 MHz	3.746	30 Pass
External Antenna			
	Low Ch. 2405 MHz	5.515	30 Pass
	Mid Ch. 2440 MHz	4.605	30 Pass
	High Ch. 2475 MHz	3.016	30 Pass

OUTPUT POWER

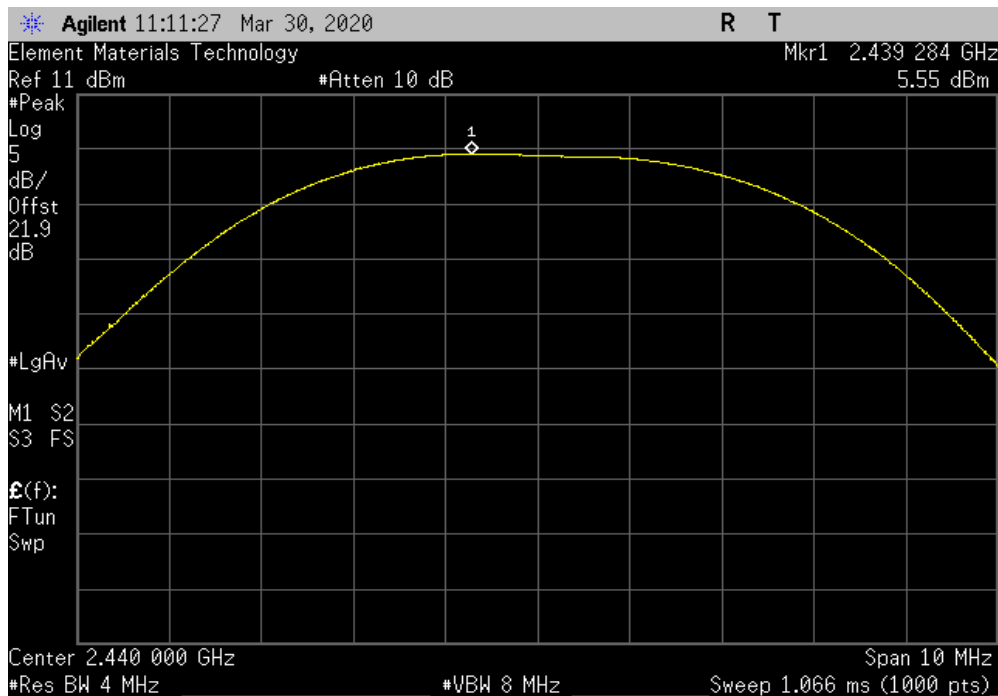


TuTx 2019.08.30.0 XMt 2020.03.25.0

802.15.4, O-PQSK, Antenna 1, Low Ch. 2405 MHz						
				Out Pwr (dBm)	Limit (dBm)	Result
				8.296	30	Pass



802.15.4, O-PQSK, Antenna 1, Mid Ch. 2440 MHz						
				Out Pwr (dBm)	Limit (dBm)	Result
				5.554	30	Pass

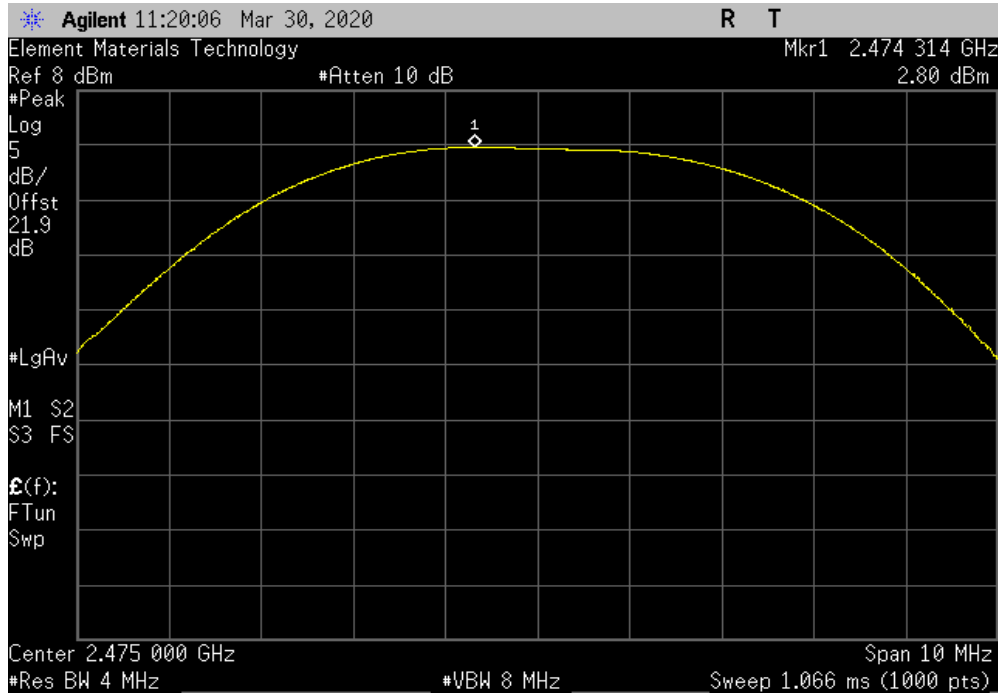


OUTPUT POWER

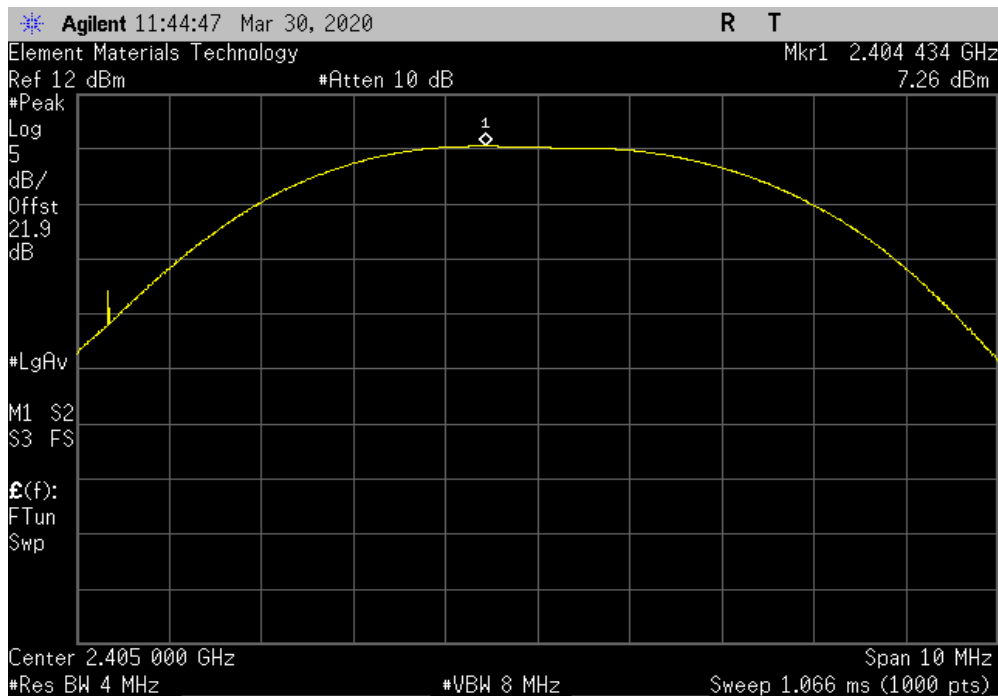


TuTx 2019.08.30.0 XMt 2020.03.25.0

802.15.4, O-PQSK, Antenna 1, High Ch. 2475 MHz						
				Out Pwr (dBm)	Limit (dBm)	Result
				2.797	30	Pass



802.15.4, O-PQSK, Antenna 2, Low Ch. 2405 MHz						
				Out Pwr (dBm)	Limit (dBm)	Result
				7.256	30	Pass

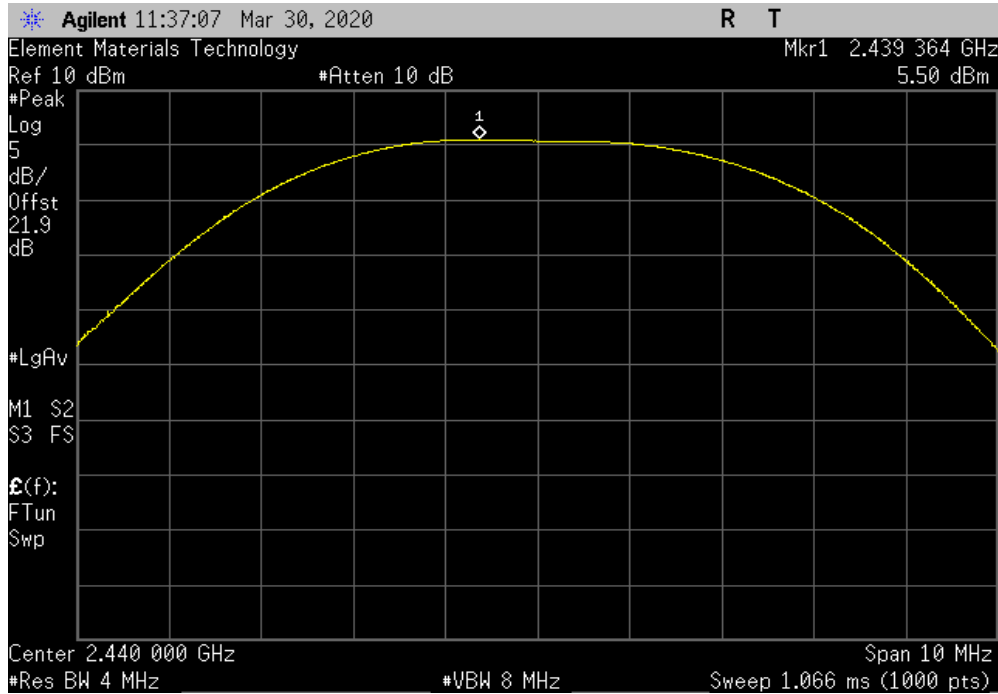


OUTPUT POWER

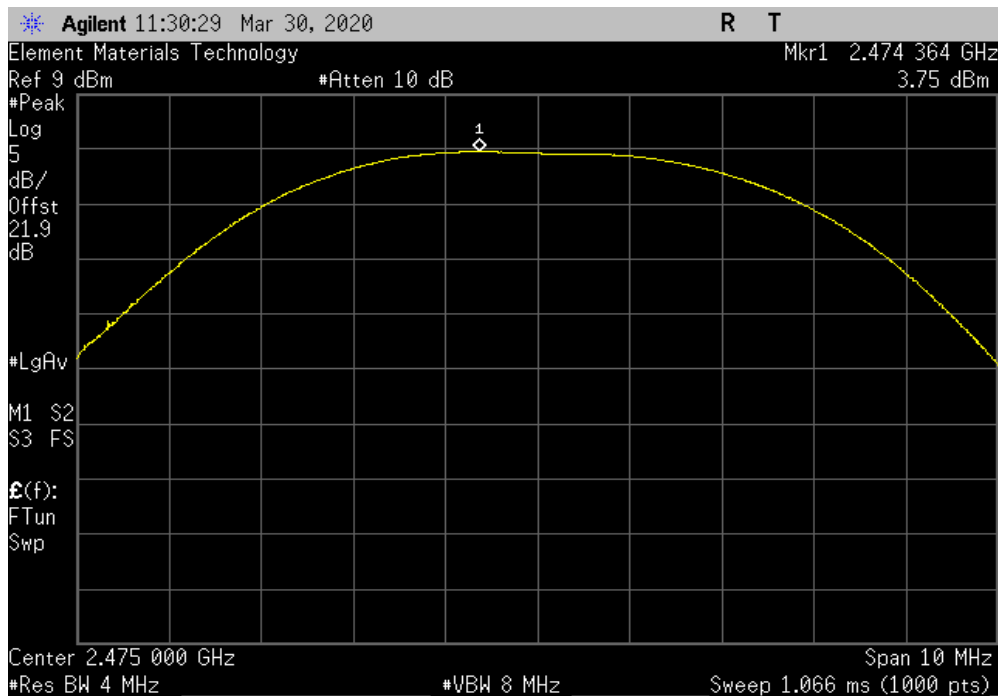


TuTx 2019.08.30.0 XMt 2020.03.25.0

802.15.4, O-PQSK, Antenna 2, Mid Ch. 2440 MHz						
				Out Pwr (dBm)	Limit (dBm)	Result
				5.502	30	Pass



802.15.4, O-PQSK, Antenna 2, High Ch. 2475 MHz						
				Out Pwr (dBm)	Limit (dBm)	Result
				3.746	30	Pass

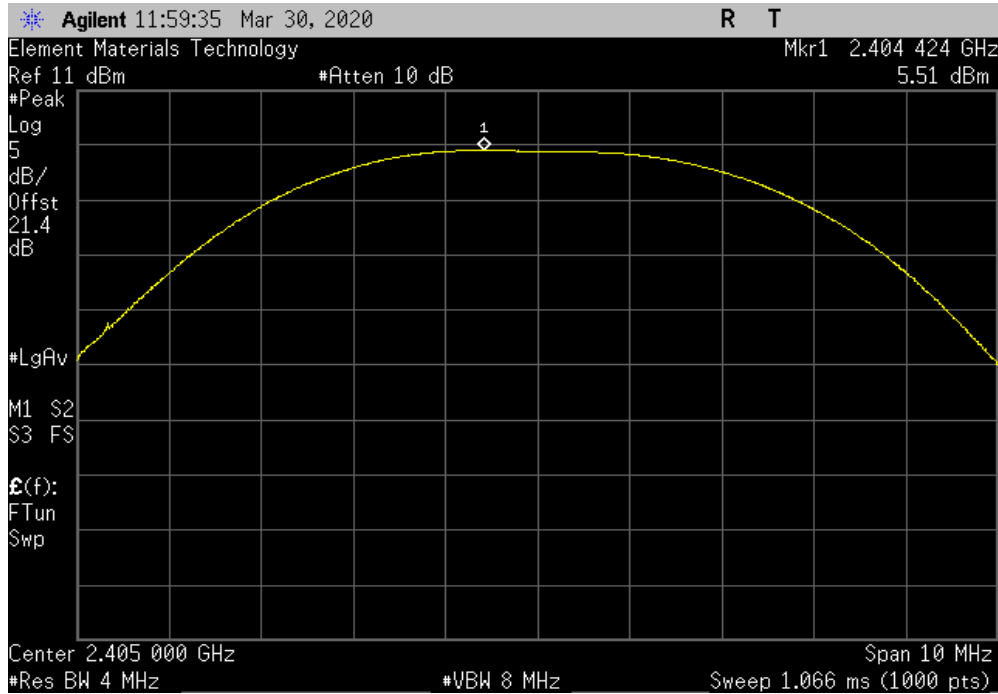


OUTPUT POWER

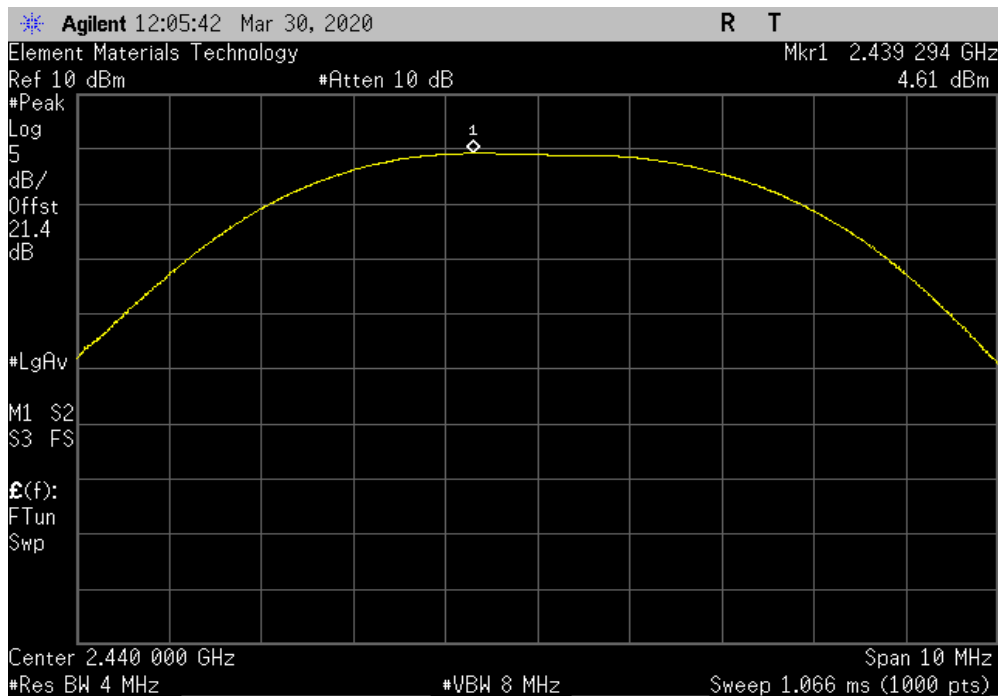


TuTx 2019.08.30.0 XMI 2020.03.25.0

802.15.4, O-PQSK, External Antenna, Low Ch. 2405 MHz						
				Out Pwr (dBm)	Limit (dBm)	Result
				5.515	30	Pass



802.15.4, O-PQSK, External Antenna, Mid Ch. 2440 MHz						
				Out Pwr (dBm)	Limit (dBm)	Result
				4.605	30	Pass

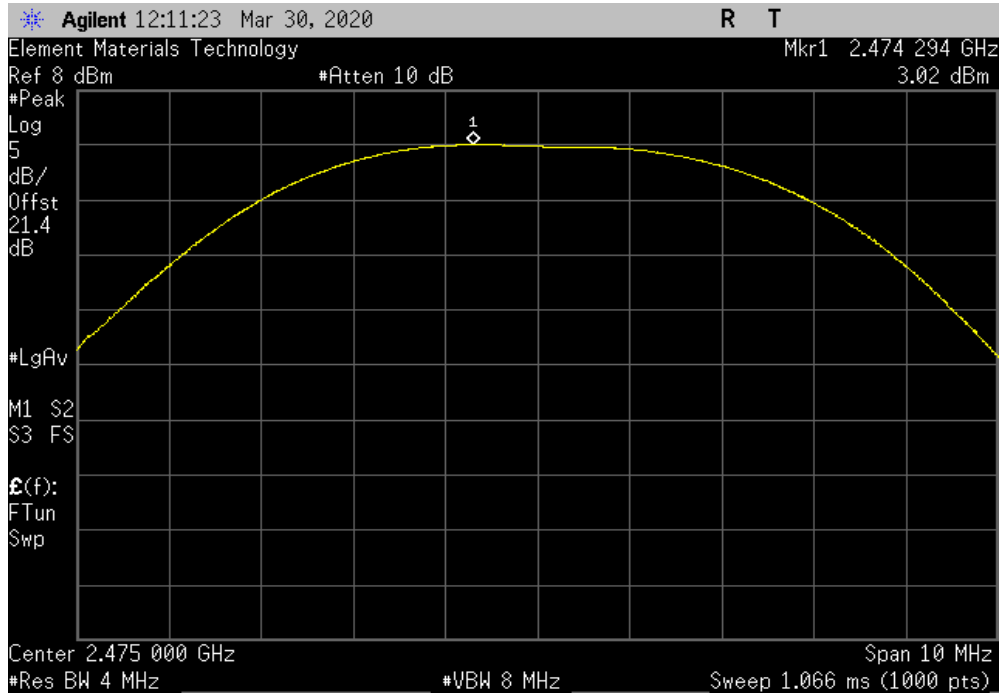


OUTPUT POWER



TbTx 2019.08.30.0 XMI 2020.03.25.0

802.15.4, O-PQSK, External Antenna, High Ch. 2475 MHz						
				Out Pwr (dBm)	Limit (dBm)	Result
				3.016	30	Pass



EQUIVALENT ISOTROPIC RADIATED POWER (EIRP)



element

XMIT 2020.03.25.0

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

TEST EQUIPMENT

Description	Manufacturer	Model	ID	Last Cal.	Cal. Due
Generator - Signal	Keysight	N5182B	TFU	5-Nov-18	5-Nov-20
Block - DC	Fairview Microwave	SD3379	AMW	13-Mar-20	13-Mar-21
Cable	Micro-Coax	UFD150A-1-0720-200200	EVH	13-Mar-20	13-Mar-21
Attenuator	S.M. Electronics	SA26B-20	AUY	13-Mar-20	13-Mar-21
Analyzer - Spectrum Analyzer	Agilent	E4440A	AFA	28-Feb-20	28-Feb-21

TEST DESCRIPTION

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

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

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

The antenna gain of the EUT was added to the conducted output power to derive the EIRP value.

EQUIVALENT ISOTROPIC RADIATED POWER (EIRP)



Tel: 2019.08.30.0 XM: 2020.03.25.0

EUT: PRECOlink		Work Order: PRCO0113	
Serial Number: B2		Date: 30-Mar-20	
Customer: Preco, Inc.		Temperature: 22.5 °C	
Attendees: None		Humidity: 37.5% RH	
Project: None		Barometric Pres.: 1017 mbar	
Tested by: Kam Robertson, Jeff Alcock		Power: 12 VDC	
Job Site: EV06		Test Method	
FCC 15.247:2020		ANSI C63.10:2013	
COMMENTS			
The reference level offset includes: DC block, 20dB attenuator, measurement cable. Software power setting = 0x32.			
DEVIATIONS FROM TEST STANDARD			
None			
Configuration #	3	Signature	

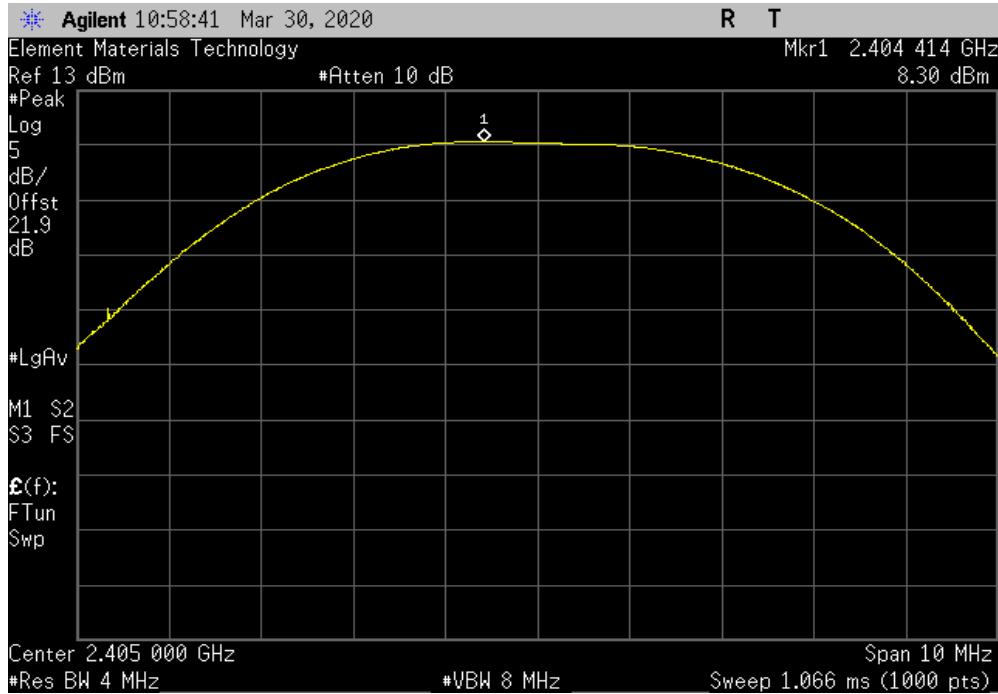
	Out Pwr (dBm)	Antenna Gain (dBi)	EIRP (dBm)	EIRP Limit (dBm)	Result
802.15.4, O-PQSK					
Antenna 1					
Low Ch. 2405 MHz	8.296	2.7	11.0	36	Pass
Mid Ch. 2440 MHz	5.554	2.7	8.3	36	Pass
High Ch. 2475 MHz	2.797	2.7	5.5	36	Pass
Antenna 2					
Low Ch. 2405 MHz	7.256	4.6	11.9	36	Pass
Mid Ch. 2440 MHz	5.502	4.6	10.1	36	Pass
High Ch. 2475 MHz	3.746	4.6	8.3	36	Pass
External Antenna					
Low Ch. 2405 MHz	5.515	3.0	8.5	36	Pass
Mid Ch. 2440 MHz	4.605	3.0	7.6	36	Pass
High Ch. 2475 MHz	3.016	3.0	6.0	36	Pass

EQUIVALENT ISOTROPIC RADIATED POWER (EIRP)

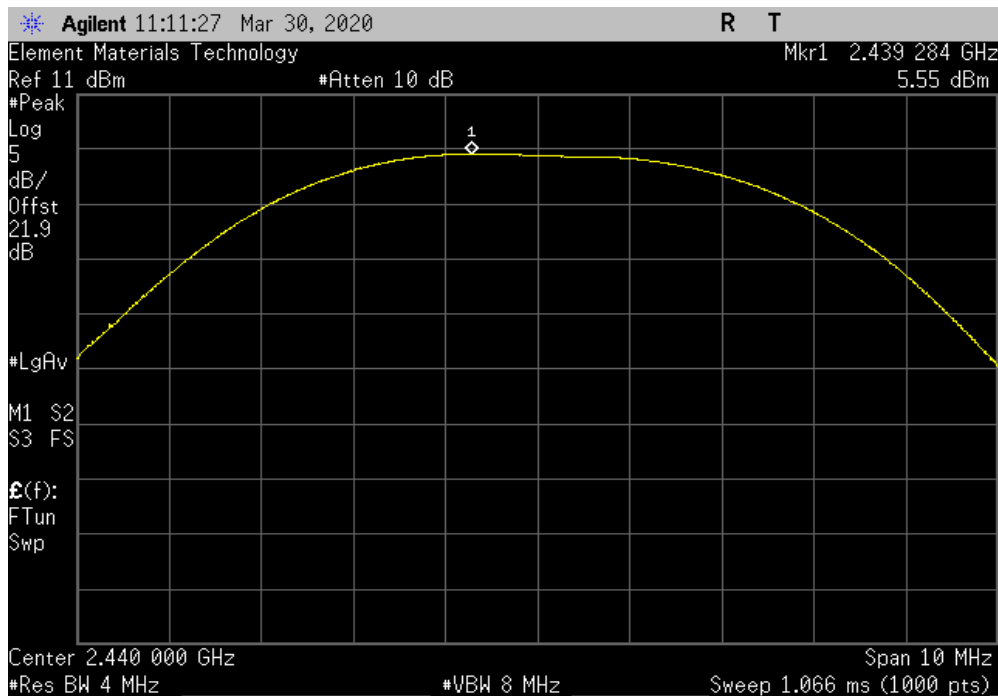


TuTx 2019.08.30.0 XMI 2020.03.25.0

802.15.4, O-PQSK, Antenna 1, Low Ch. 2405 MHz						
	Out Pwr (dBm)	Antenna Gain (dBi)	EIRP (dBm)	EIRP Limit (dBm)	Result	
	8.296	2.7	10.996	36	Pass	



802.15.4, O-PQSK, Antenna 1, Mid Ch. 2440 MHz						
	Out Pwr (dBm)	Antenna Gain (dBi)	EIRP (dBm)	EIRP Limit (dBm)	Result	
	5.554	2.7	8.254	36	Pass	

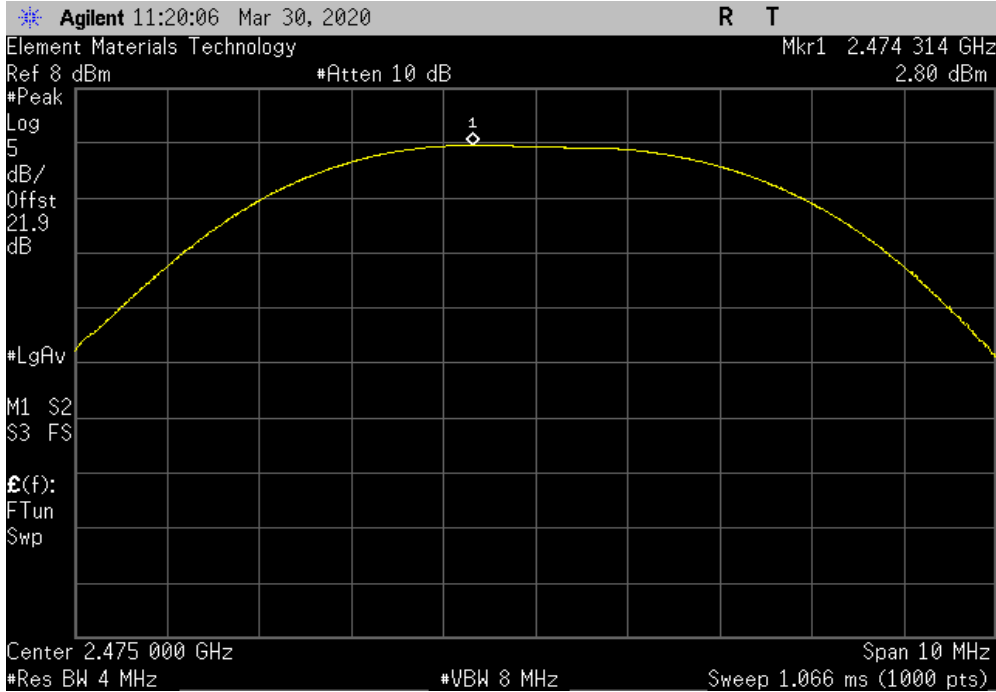


EQUIVALENT ISOTROPIC RADIATED POWER (EIRP)

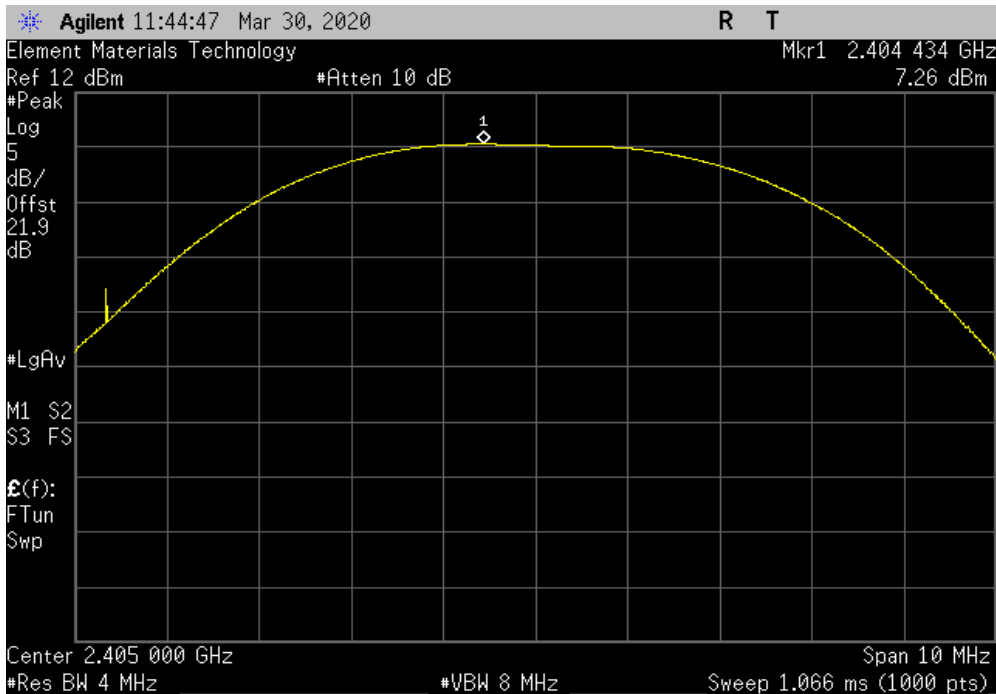


TbTx 2019.08.30.0 XMI 2020.03.25.0

802.15.4, O-PQSK, Antenna 1, High Ch. 2475 MHz						
	Out Pwr (dBm)	Antenna Gain (dBi)	EIRP (dBm)	EIRP Limit (dBm)	Result	
	2.797	2.7	5.497	36	Pass	



802.15.4, O-PQSK, Antenna 2, Low Ch. 2405 MHz						
	Out Pwr (dBm)	Antenna Gain (dBi)	EIRP (dBm)	EIRP Limit (dBm)	Result	
	7.256	4.6	11.856	36	Pass	

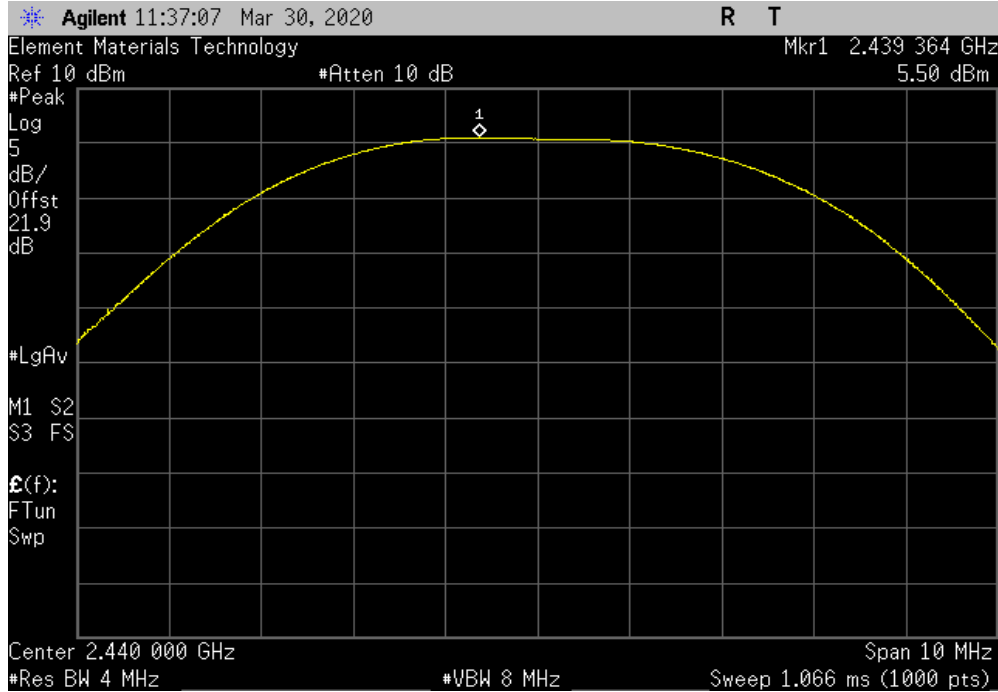


EQUIVALENT ISOTROPIC RADIATED POWER (EIRP)

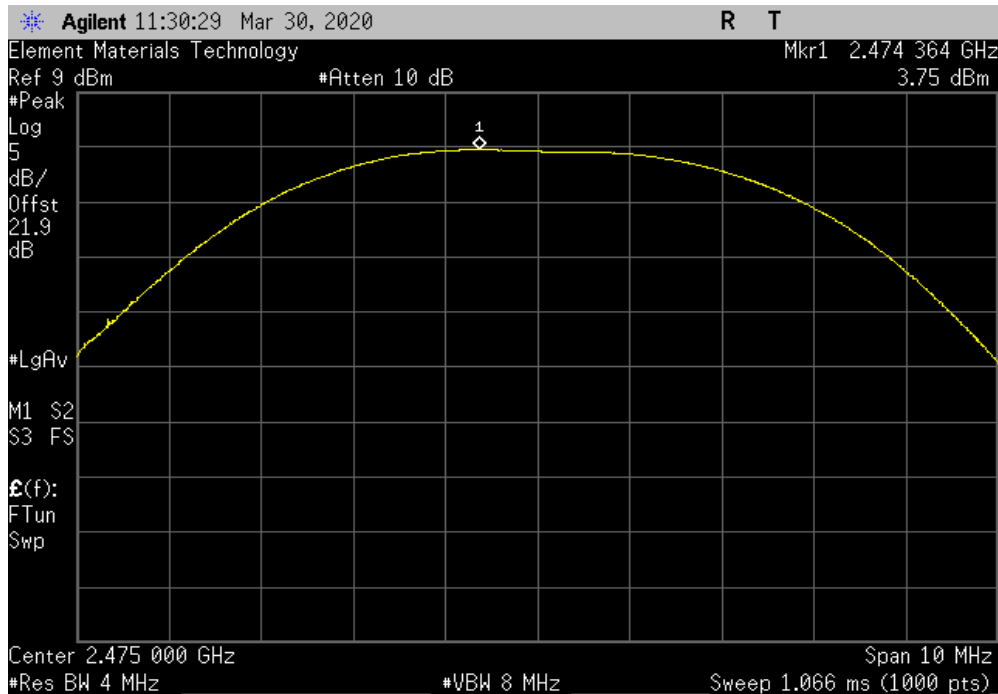


TuTx 2019.08.30.0 XMI 2020.03.25.0

802.15.4, O-PQSK, Antenna 2, Mid Ch. 2440 MHz						
	Out Pwr (dBm)	Antenna Gain (dBi)	EIRP (dBm)	EIRP Limit (dBm)	Result	
	5.502	4.6	10.102	36	Pass	



802.15.4, O-PQSK, Antenna 2, High Ch. 2475 MHz						
	Out Pwr (dBm)	Antenna Gain (dBi)	EIRP (dBm)	EIRP Limit (dBm)	Result	
	3.746	4.6	8.346	36	Pass	

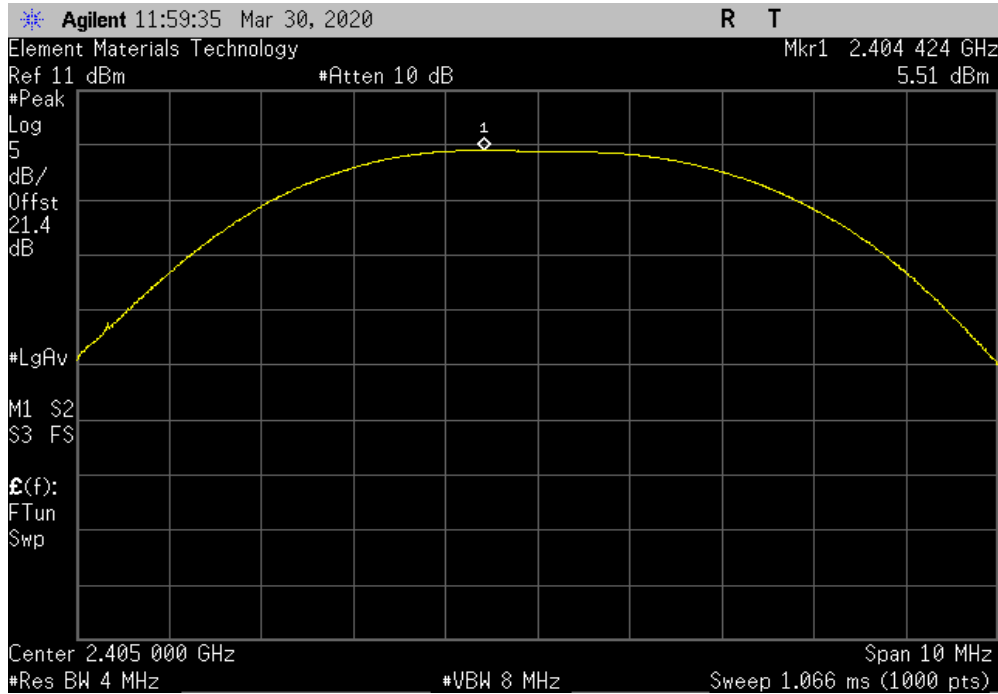


EQUIVALENT ISOTROPIC RADIATED POWER (EIRP)

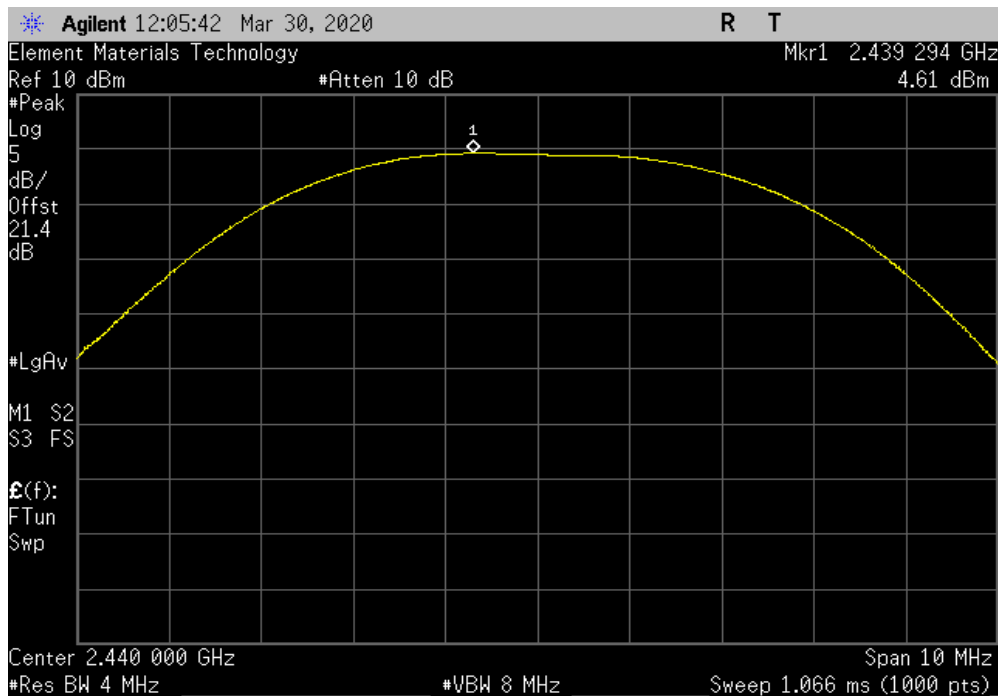


TbTx 2019.08.30.0 XMI 2020.03.25.0

802.15.4, O-PQSK, External Antenna, Low Ch. 2405 MHz						
	Out Pwr (dBm)	Antenna Gain (dBi)	EIRP (dBm)	EIRP Limit (dBm)	Result	
	5.515	3	8.515	36	Pass	



802.15.4, O-PQSK, External Antenna, Mid Ch. 2440 MHz						
	Out Pwr (dBm)	Antenna Gain (dBi)	EIRP (dBm)	EIRP Limit (dBm)	Result	
	4.605	3	7.605	36	Pass	

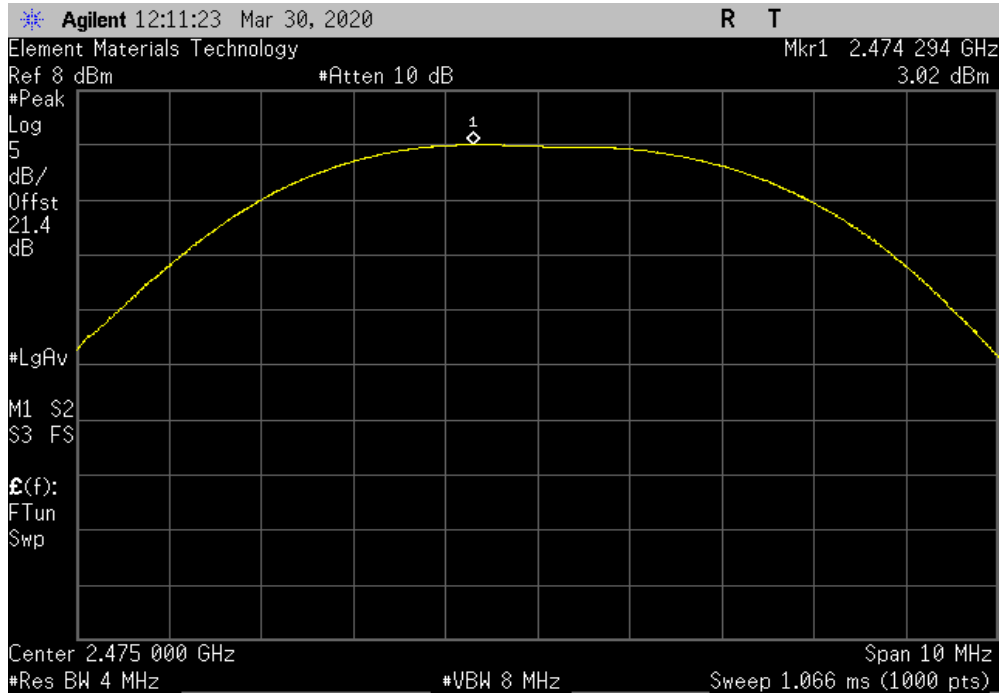


EQUIVALENT ISOTROPIC RADIATED POWER (EIRP)



TbTx 2019.08.30.0 XMI 2020.03.25.0

802.15.4, O-PQSK, External Antenna, High Ch. 2475 MHz						
	Out Pwr (dBm)	Antenna Gain (dBi)	EIRP (dBm)	EIRP Limit (dBm)	Result	
	3.016	3	6.016	36	Pass	





POWER SPECTRAL DENSITY

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

TEST EQUIPMENT

Description	Manufacturer	Model	ID	Last Cal.	Cal. Due
Generator - Signal	Keysight	N5182B	TFU	5-Nov-18	5-Nov-20
Cable	Micro-Coax	UFD150A-1-0720-200200	EVH	13-Mar-20	13-Mar-21
Attenuator	S.M. Electronics	SA26B-20	AUY	13-Mar-20	13-Mar-21
Block - DC	Fairview Microwave	SD3379	AMW	13-Mar-20	13-Mar-21
Analyzer - Spectrum Analyzer	Agilent	E4440A	AFA	28-Feb-20	28-Feb-21

TEST DESCRIPTION

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

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

POWER SPECTRAL DENSITY



TelTx 2019.08.30.0 XMt 2020.03.25.0

EUT: PRECOlink		Work Order: PRCO0113	
Serial Number: B2		Date: 30-Mar-20	
Customer: Preco, Inc.		Temperature: 22.7 °C	
Attendees: None		Humidity: 36.6% RH	
Project: None		Barometric Pres.: 1017 mbar	
Tested by: Kam Robertson, Jeff Alcoke		Power: 12 VDC	
		Job Site: EV06	
TEST SPECIFICATIONS		Test Method	
FCC 15.247:2020		ANSI C63.10:2013	
COMMENTS			
The reference level offset includes: DC block, 20dB attenuator, measurement cable. Software power setting = 0x32.			
DEVIATIONS FROM TEST STANDARD			
None			
Configuration #	3	Signature	

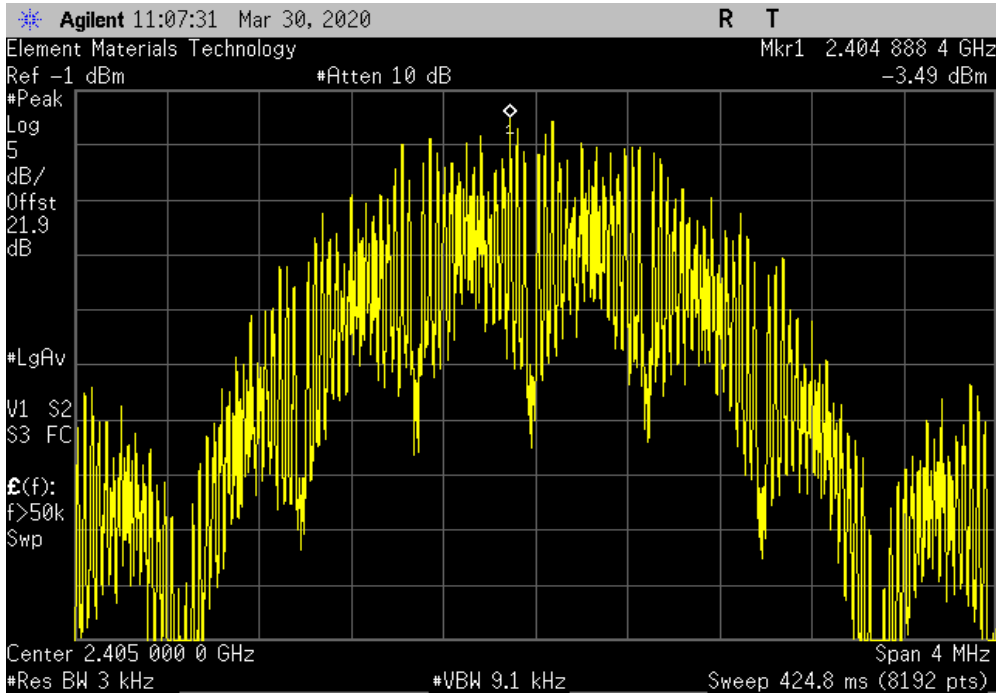
	Value dBm/3kHz	Limit < dBm/3kHz	Results
802.15.4, O-PQSK			
Antenna 1			
Low Ch. 2405 MHz	-3.488	8	Pass
Mid Ch. 2440 MHz	-6.843	8	Pass
High Ch. 2475 MHz	-9.502	8	Pass
Antenna 2			
Low Ch. 2405 MHz	-4.504	8	Pass
Mid Ch. 2440 MHz	-6.752	8	Pass
High Ch. 2475 MHz	-8.533	8	Pass
External Antenna			
Low Ch. 2405 MHz	-6.179	8	Pass
Mid Ch. 2440 MHz	-7.604	8	Pass
High Ch. 2475 MHz	-9.228	8	Pass

POWER SPECTRAL DENSITY

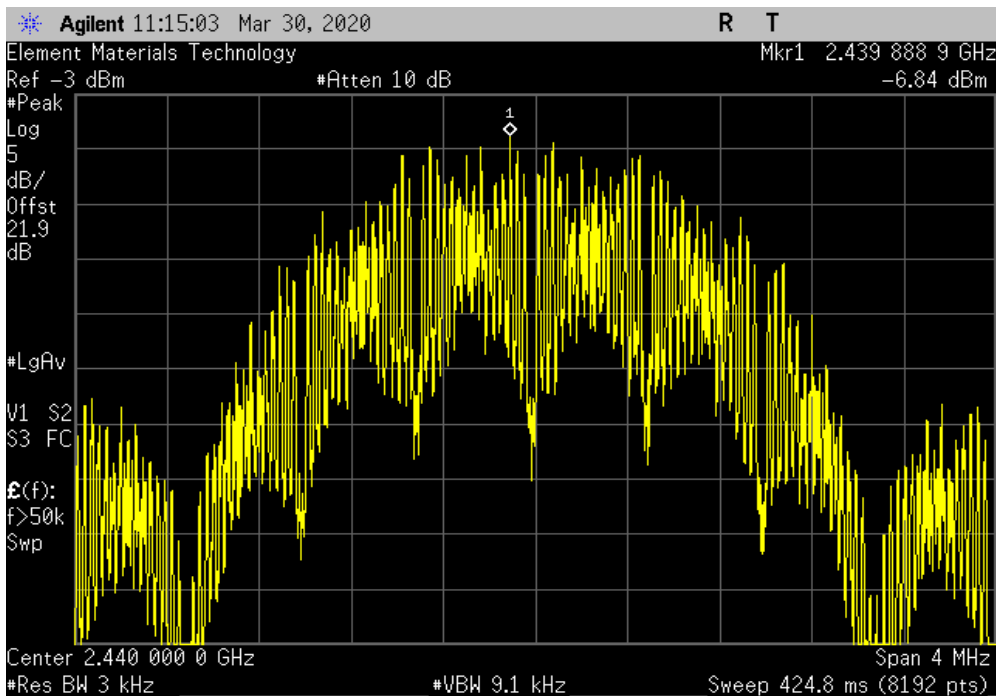


TuTx 2019.08.30.0 XMI 2020.03.25.0

802.15.4, O-PQSK, Antenna 1, Low Ch. 2405 MHz			
	Value	Limit	Results
	dBm/3kHz	< dBm/3kHz	
	-3.488	8	Pass



802.15.4, O-PQSK, Antenna 1, Mid Ch. 2440 MHz			
	Value	Limit	Results
	dBm/3kHz	< dBm/3kHz	
	-6.843	8	Pass

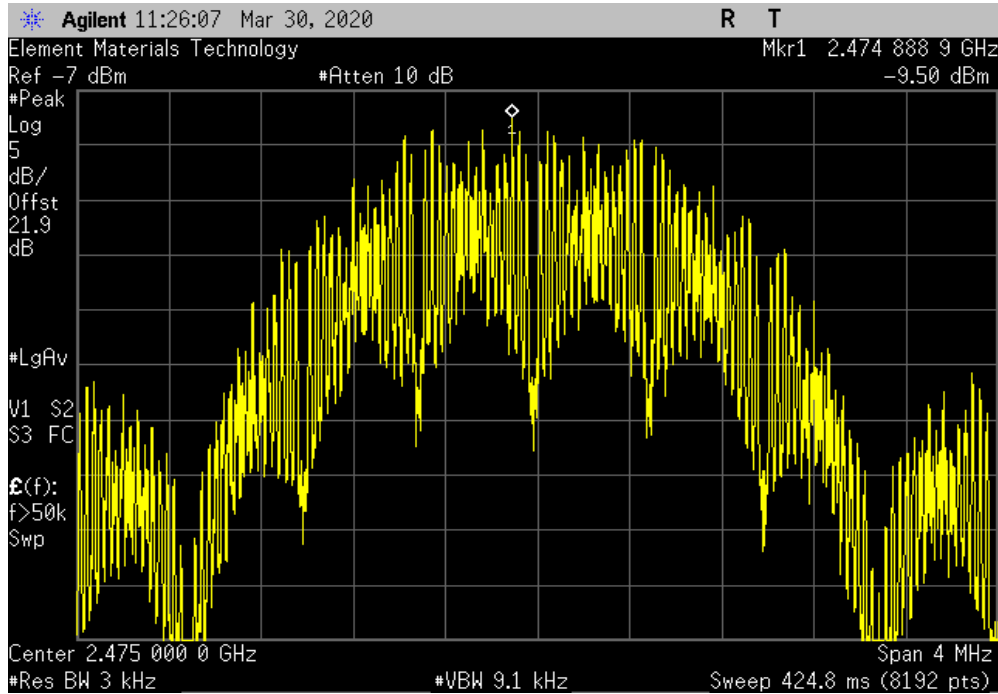


POWER SPECTRAL DENSITY

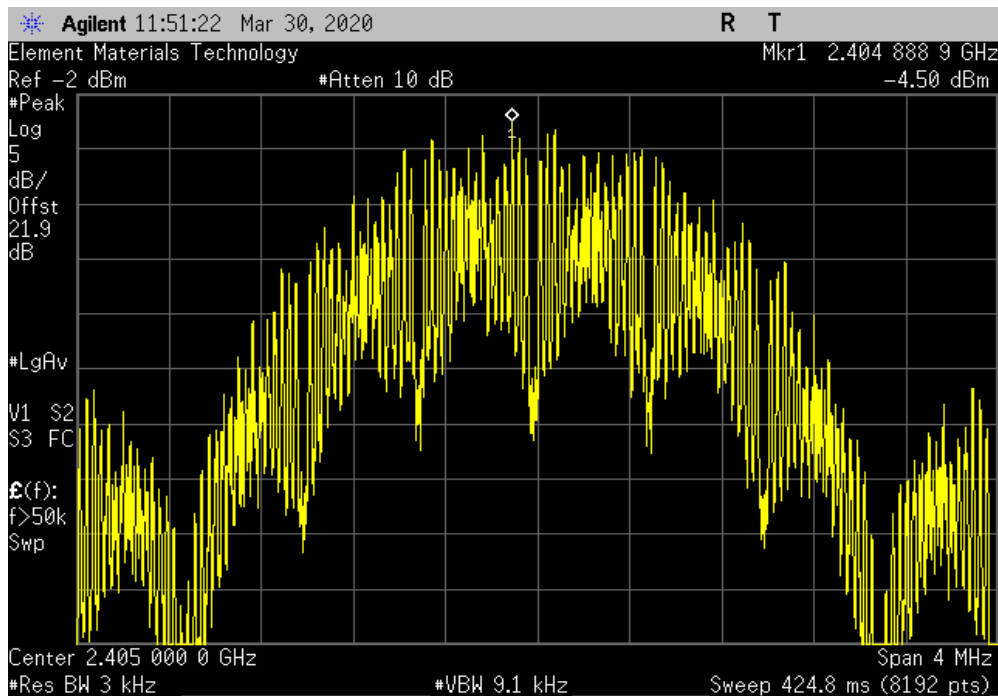


TuTx 2019.08.30.0 XMI 2020.03.25.0

802.15.4, O-PQSK, Antenna 1, High Ch. 2475 MHz			
	Value	Limit	Results
	dBm/3kHz	< dBm/3kHz	
	-9.502	8	Pass



802.15.4, O-PQSK, Antenna 2, Low Ch. 2405 MHz			
	Value	Limit	Results
	dBm/3kHz	< dBm/3kHz	
	-4.504	8	Pass

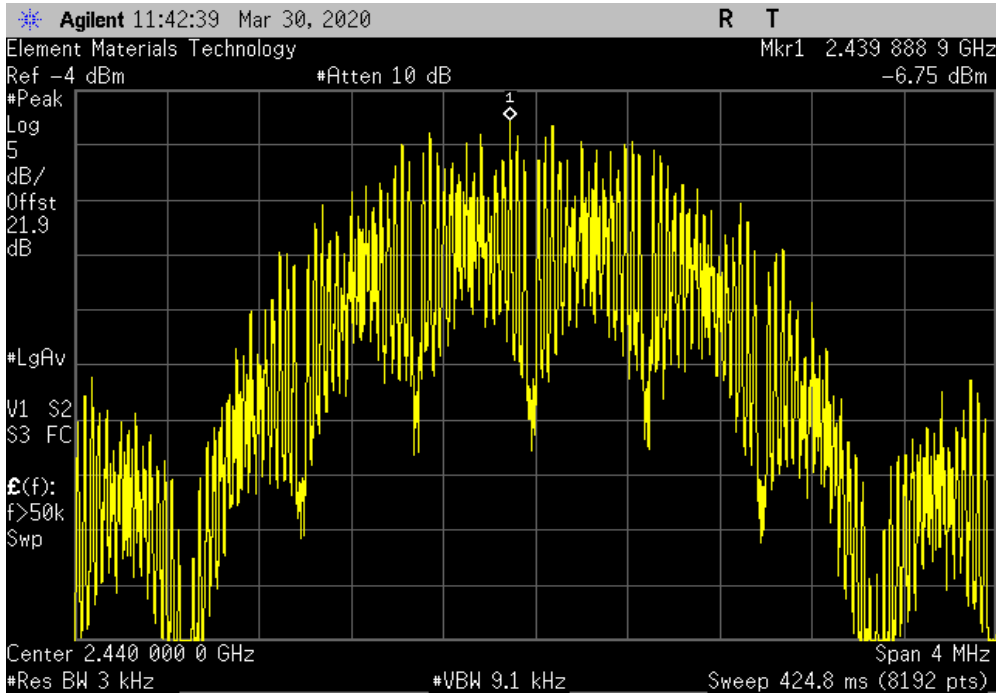


POWER SPECTRAL DENSITY

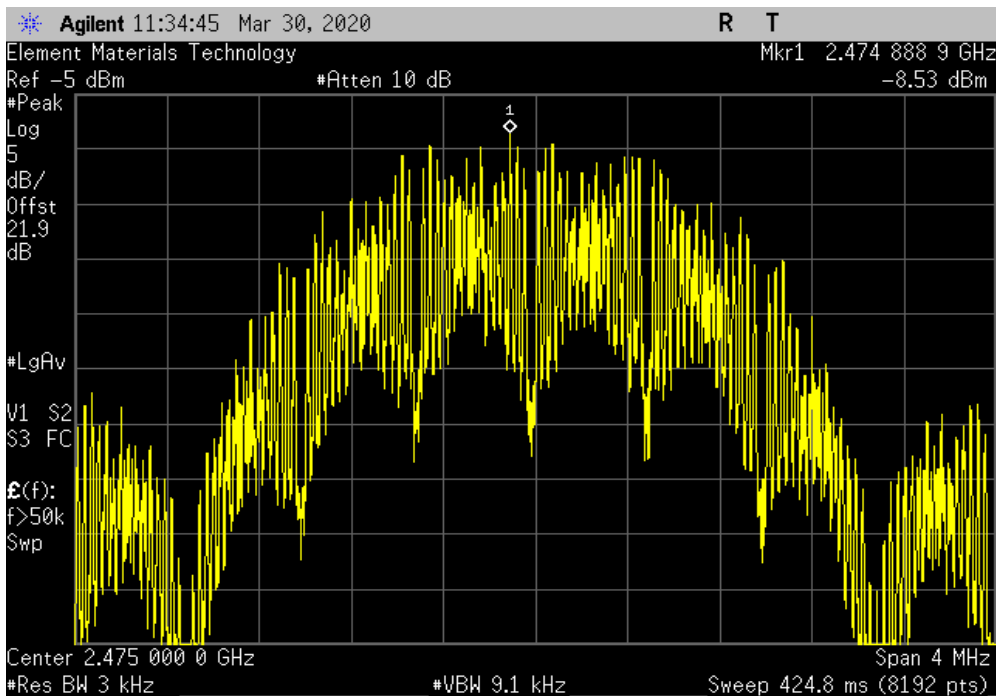


TuTx 2019.08.30.0 XMit 2020.03.25.0

802.15.4, O-PQSK, Antenna 2, Mid Ch. 2440 MHz			
	Value	Limit	Results
	dBm/3kHz	< dBm/3kHz	
	-6.752	8	Pass



802.15.4, O-PQSK, Antenna 2, High Ch. 2475 MHz			
	Value	Limit	Results
	dBm/3kHz	< dBm/3kHz	
	-8.533	8	Pass

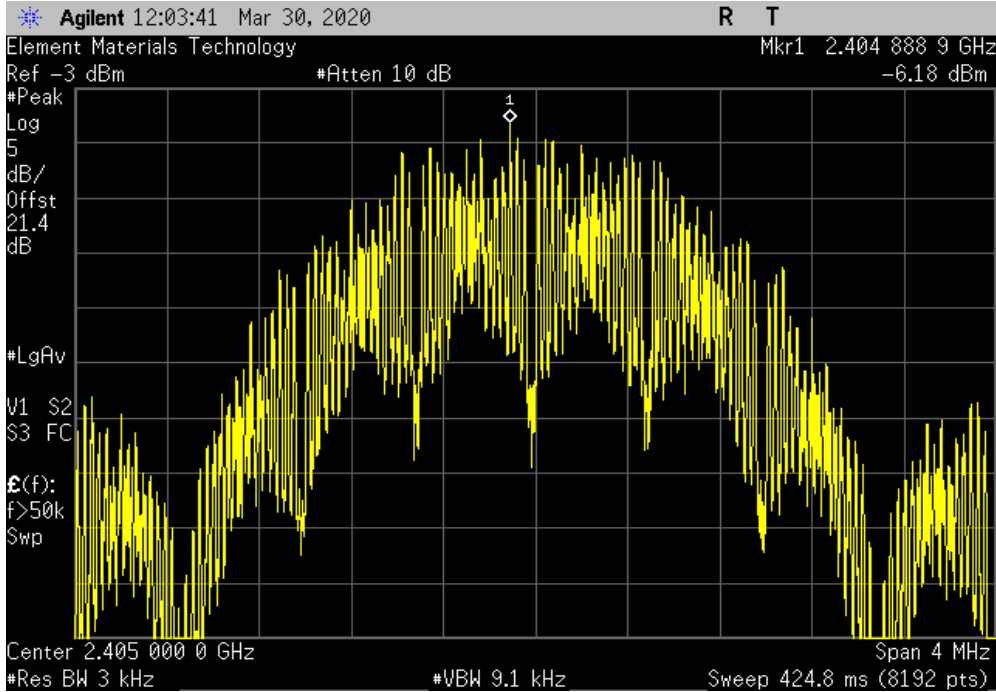


POWER SPECTRAL DENSITY

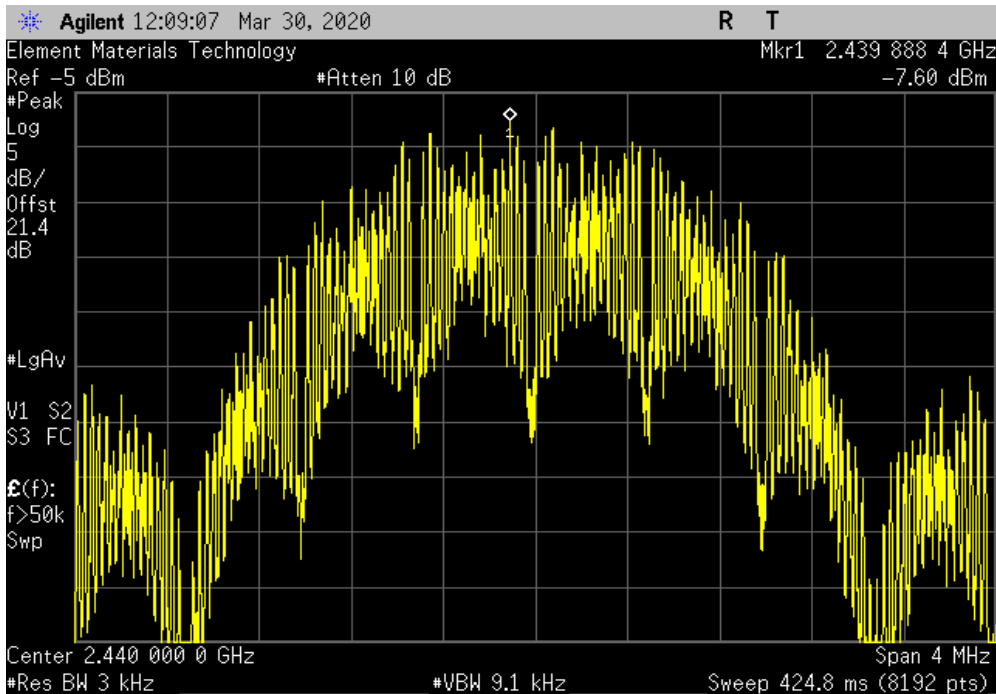


TuTx 2019.08.30.0 XMI 2020.03.25.0

802.15.4, O-PQSK, External Antenna, Low Ch. 2405 MHz			
	Value	Limit	Results
	dBm/3kHz	< dBm/3kHz	
	-6.179	8	Pass



802.15.4, O-PQSK, External Antenna, Mid Ch. 2440 MHz			
	Value	Limit	Results
	dBm/3kHz	< dBm/3kHz	
	-7.604	8	Pass

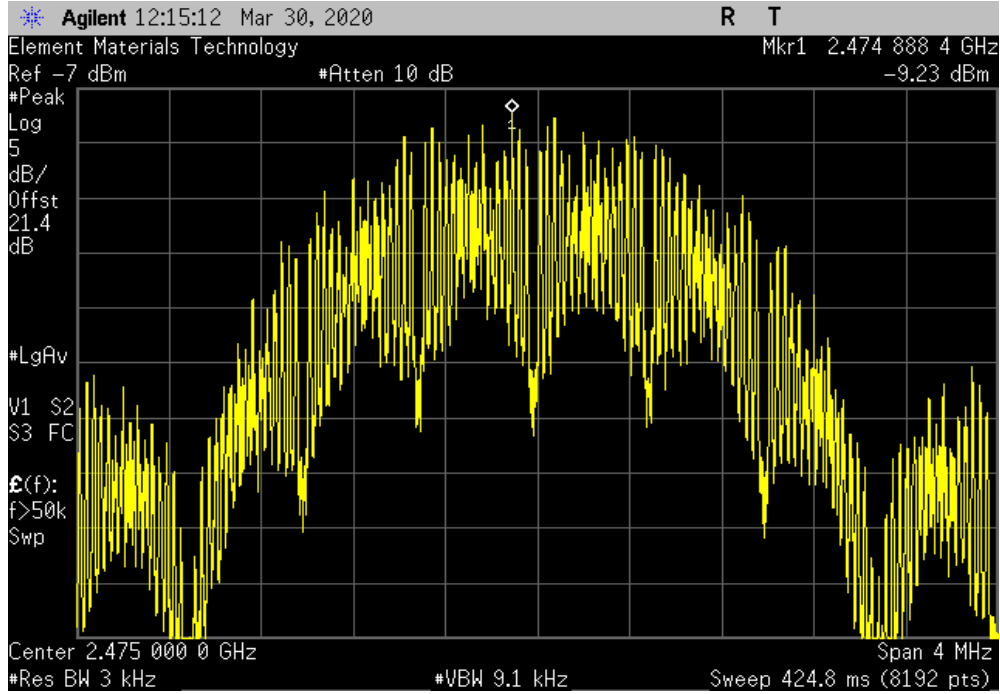


POWER SPECTRAL DENSITY



TuTx 2019.08.30.0 XMI 2020.03.25.0

802.15.4, O-PQSK, External Antenna, High Ch. 2475 MHz			
	Value	Limit	Results
	dBm/3kHz	< dBm/3kHz	
	-9.228	8	Pass



BAND EDGE COMPLIANCE



XMIT 2020.03.25.0

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

TEST EQUIPMENT

Description	Manufacturer	Model	ID	Last Cal.	Cal. Due
Generator - Signal	Keysight	N5182B	TFU	5-Nov-18	5-Nov-20
Cable	Micro-Coax	UFD150A-1-0720-200200	EVH	13-Mar-20	13-Mar-21
Attenuator	S.M. Electronics	SA26B-20	AUY	13-Mar-20	13-Mar-21
Block - DC	Fairview Microwave	SD3379	AMW	13-Mar-20	13-Mar-21
Analyzer - Spectrum Analyzer	Agilent	E4440A	AFA	28-Feb-20	28-Feb-21

TEST DESCRIPTION

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

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

BAND EDGE COMPLIANCE



Tel: 2019.08.30.0 XMI: 2020.03.25.0

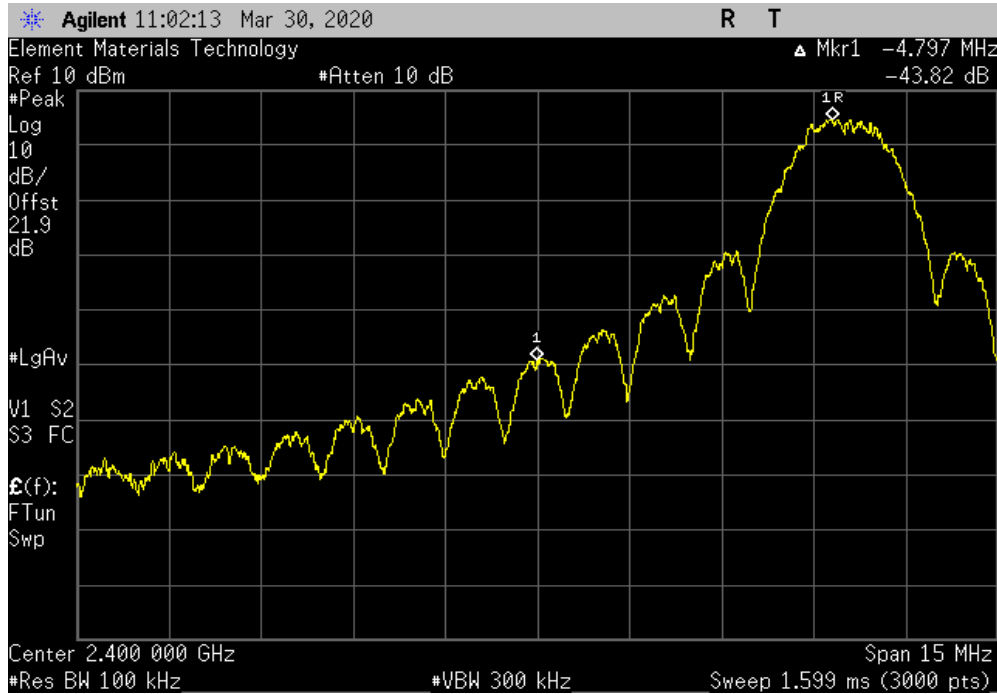
EUT: PRECOlink		Work Order: PRCO0113	
Serial Number: B2		Date: 30-Mar-20	
Customer: Preco, Inc.		Temperature: 22.2 °C	
Attendees: None		Humidity: 37.8% RH	
Project: None		Barometric Pres.: 1017 mbar	
Tested by: Kam Robertson, Jeff Alcoke		Power: 12 VDC	
		Job Site: EV06	
TEST SPECIFICATIONS		Test Method	
FCC 15.247:2020		ANSI C63.10:2013	
COMMENTS			
The reference level offset includes: DC block, 20dB attenuator, measurement cable. Software power setting = 0x32.			
DEVIATIONS FROM TEST STANDARD			
None			
Configuration #	3	Signature	
		Value (dBc)	Limit ≤ (dBc) Result
802.15.4, O-PQSK			
Antenna 1			
	Low Ch. 2405 MHz	-43.82	-20 Pass
	High Ch. 2475 MHz	-56.25	-20 Pass
Antenna 2			
	Low Ch. 2405 MHz	-44.87	-20 Pass
	High Ch. 2475 MHz	-56.7	-20 Pass
External Antenna			
	Low Ch. 2405 MHz	-44.63	-20 Pass
	High Ch. 2475 MHz	-56.04	-20 Pass

BAND EDGE COMPLIANCE

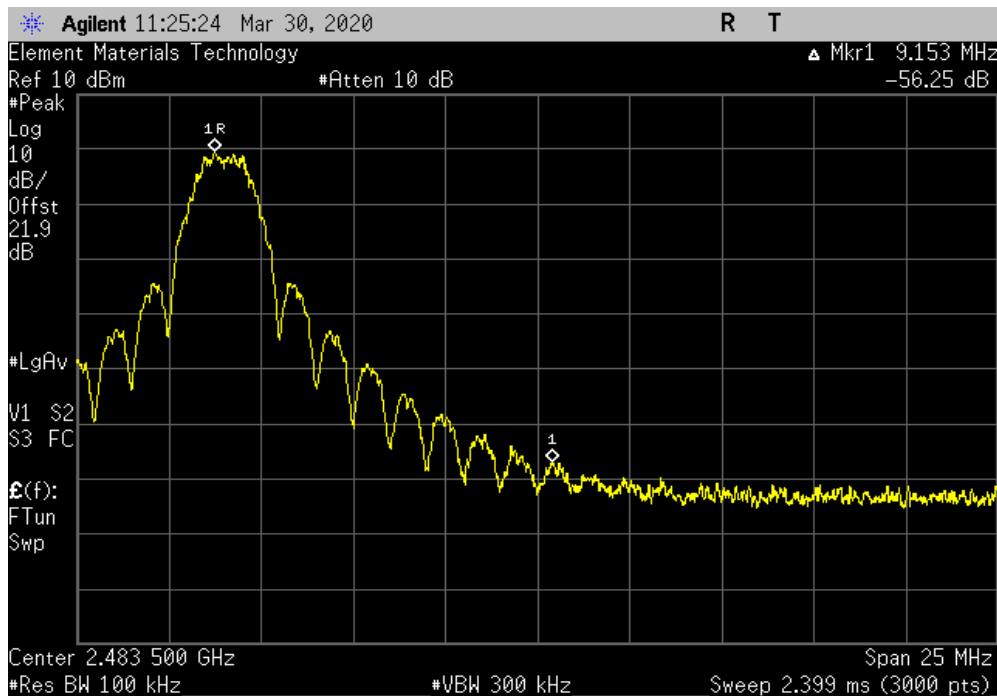


TuTx 2019.08.30.0 XMI 2020.03.25.0

802.15.4, O-PQSK, Antenna 1, Low Ch. 2405 MHz				Value	Limit	Result
				(dBc)	≤ (dBc)	
				-43.82	-20	Pass



802.15.4, O-PQSK, Antenna 1, High Ch. 2475 MHz				Value	Limit	Result
				(dBc)	≤ (dBc)	
				-56.25	-20	Pass

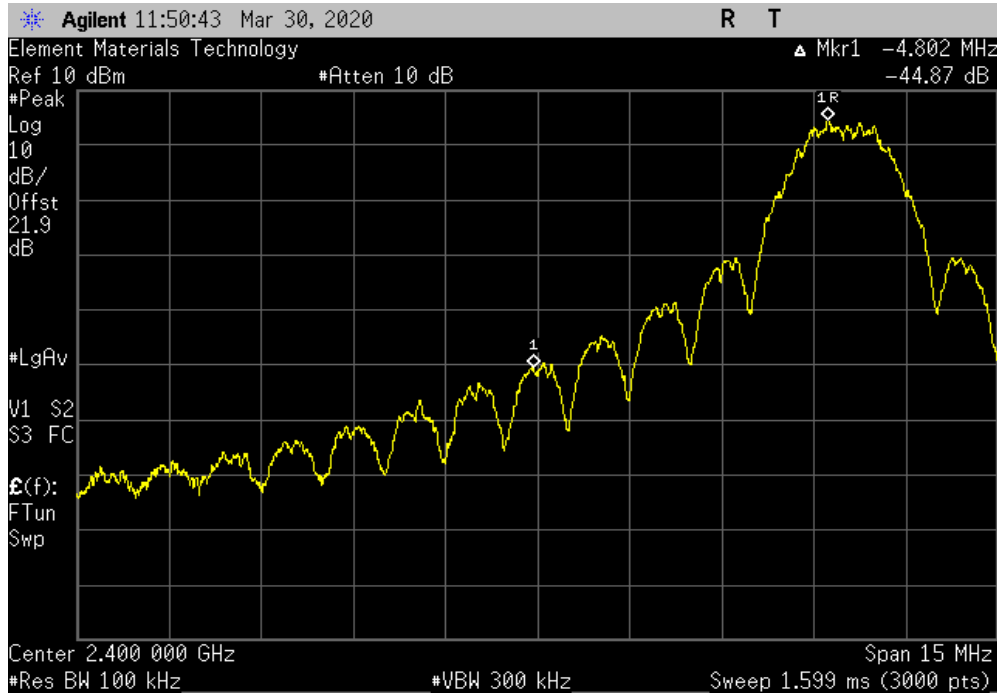


BAND EDGE COMPLIANCE

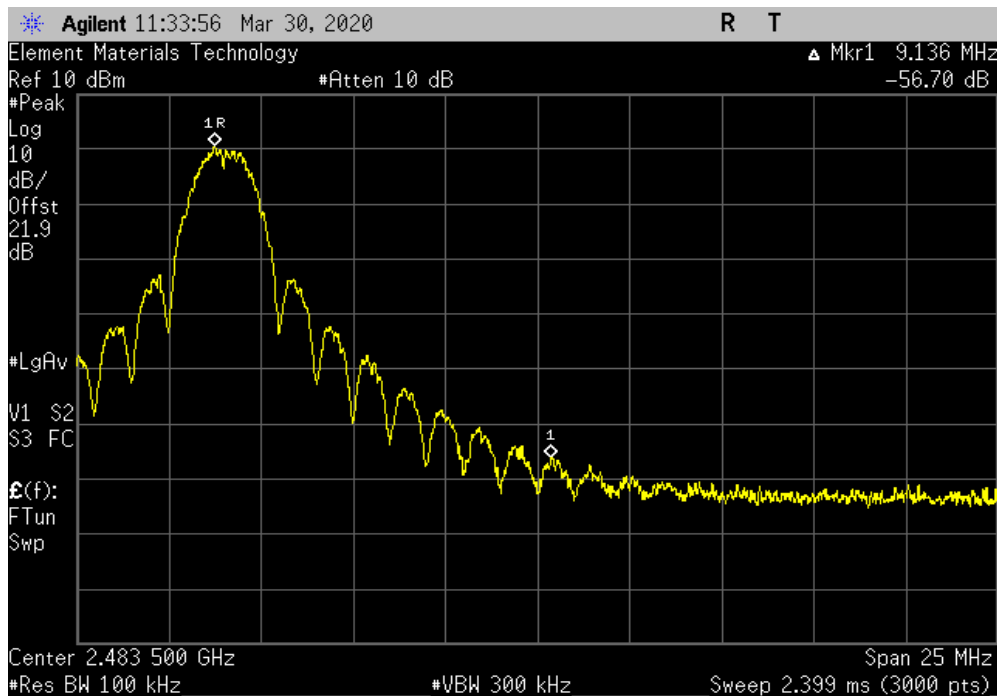


TuTx 2019.08.30.0 XMI 2020.03.25.0

802.15.4, O-PQSK, Antenna 2, Low Ch. 2405 MHz				Value	Limit	Result
				(dBc)	≤ (dBc)	
				-44.87	-20	Pass



802.15.4, O-PQSK, Antenna 2, High Ch. 2475 MHz				Value	Limit	Result
				(dBc)	≤ (dBc)	
				-56.7	-20	Pass

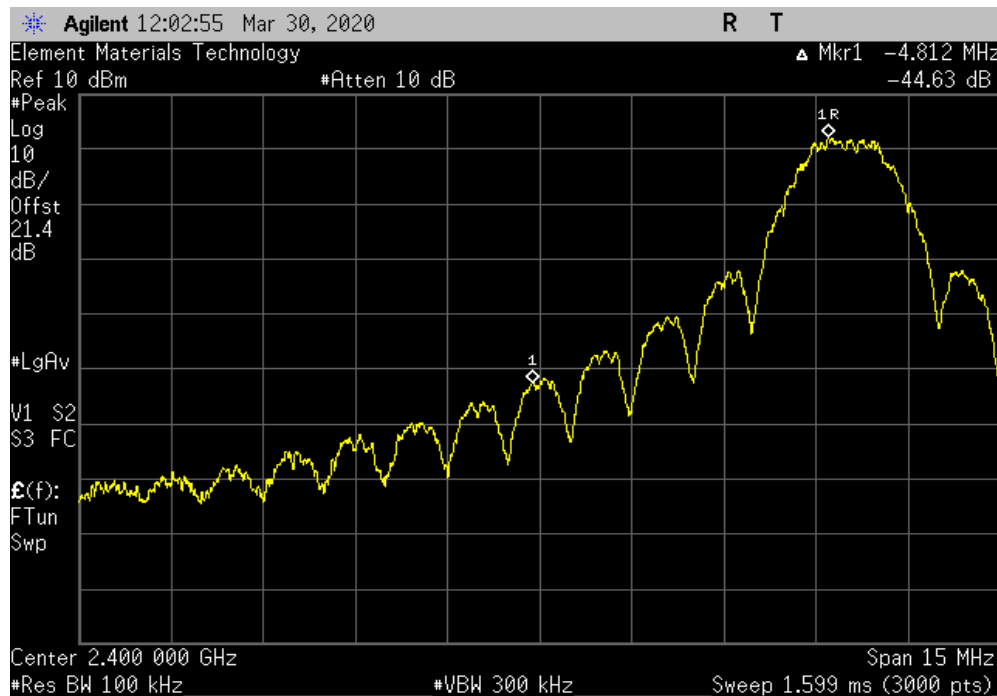


BAND EDGE COMPLIANCE

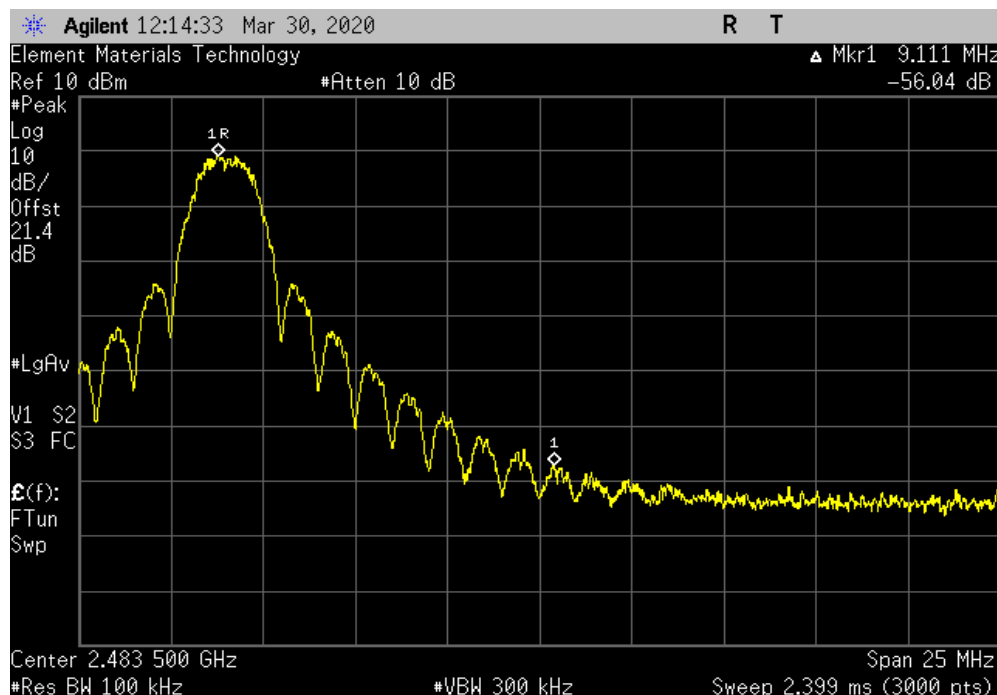


TuTx 2019.08.30.0 XMt 2020.03.25.0

802.15.4, O-PQSK, External Antenna, Low Ch. 2405 MHz				Value	Limit	Result
				(dBc)	≤ (dBc)	
				-44.63	-20	Pass



802.15.4, O-PQSK, External Antenna, High Ch. 2475 MHz				Value	Limit	Result
				(dBc)	≤ (dBc)	
				-56.04	-20	Pass



SPURIOUS CONDUCTED EMISSIONS



XMI 2020.03.25.0

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

TEST EQUIPMENT

Description	Manufacturer	Model	ID	Last Cal.	Cal. Due
Generator - Signal	Keysight	N5182B	TFU	5-Nov-18	5-Nov-20
Cable	Micro-Coax	UFD150A-1-0720-200200	EVH	13-Mar-20	13-Mar-21
Attenuator	S.M. Electronics	SA26B-20	AUY	13-Mar-20	13-Mar-21
Block - DC	Fairview Microwave	SD3379	AMW	13-Mar-20	13-Mar-21
Analyzer - Spectrum Analyzer	Agilent	E4440A	AFA	28-Feb-20	28-Feb-21

TEST DESCRIPTION

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

SPURIOUS CONDUCTED EMISSIONS



Tel: 2019.08.30.0 XM: 2020.03.25.0

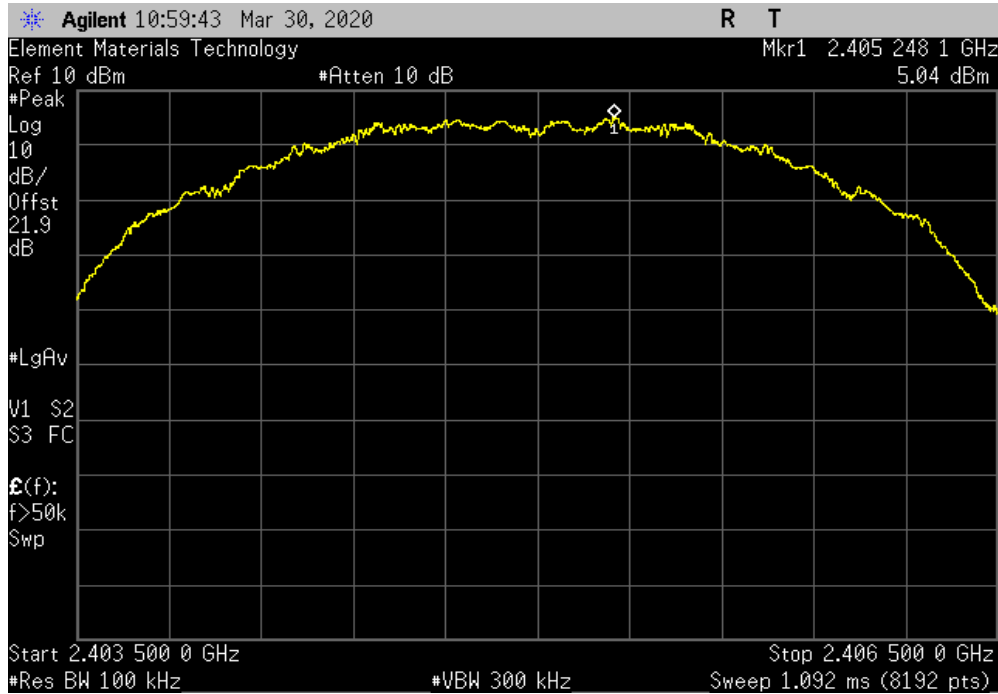
EUT: PRECOlink		Work Order: PRCO0113			
Serial Number: B2		Date: 30-Mar-20			
Customer: Preco, Inc.		Temperature: 22.7 °C			
Attendees: None		Humidity: 36.9% RH			
Project: None		Barometric Pres.: 1017 mbar			
Tested by: Kam Robertson, Jeff Alcoke		Power: 12 VDC			
Job Site: EV06					
TEST SPECIFICATIONS		Test Method			
FCC 15.247:2020		ANSI C63.10:2013			
COMMENTS					
The reference level offset includes: DC block, 20dB attenuator, measurement cable. Software power setting = 0x32.					
DEVIATIONS FROM TEST STANDARD					
None					
Configuration #	3	Signature			
	Frequency Range	Measured Freq (MHz)	Max Value (dBc)	Limit ≤ (dBc)	Result
802.15.4, O-PQSK					
Antenna 1					
Low Ch. 2405 MHz	Fundamental	2405.25	N/A	N/A	N/A
Low Ch. 2405 MHz	30 MHz - 12.5 GHz	2373	-59.63	-20	Pass
Low Ch. 2405 MHz	12.5 GHz - 25 GHz	23417.5	-59.01	-20	Pass
Mid Ch. 2440 MHz	Fundamental	2440.24	N/A	N/A	N/A
Mid Ch. 2440 MHz	30 MHz - 12.5 GHz	10321.4	-58.98	-20	Pass
Mid Ch. 2440 MHz	12.5 GHz - 25 GHz	24456.7	-55.91	-20	Pass
High Ch. 2475 MHz	Fundamental	2474.71	N/A	N/A	N/A
High Ch. 2475 MHz	30 MHz - 12.5 GHz	6888.4	-56.51	-20	Pass
High Ch. 2475 MHz	12.5 GHz - 25 GHz	24037.1	-52.95	-20	Pass
Antenna 2					
Low Ch. 2405 MHz	Fundamental	2404.72	N/A	N/A	N/A
Low Ch. 2405 MHz	30 MHz - 12.5 GHz	2373	-60.27	-20	Pass
Low Ch. 2405 MHz	12.5 GHz - 25 GHz	24127.1	-57.8	-20	Pass
Mid Ch. 2440 MHz	Fundamental	2440.23	N/A	N/A	N/A
Mid Ch. 2440 MHz	30 MHz - 12.5 GHz	6676.8	-59.11	-20	Pass
Mid Ch. 2440 MHz	12.5 GHz - 25 GHz	13592.7	-55.84	-20	Pass
High Ch. 2475 MHz	Fundamental	2475.24	N/A	N/A	N/A
High Ch. 2475 MHz	30 MHz - 12.5 GHz	6969.1	-57.64	-20	Pass
High Ch. 2475 MHz	12.5 GHz - 25 GHz	20701.1	-53.7	-20	Pass
External Antenna					
Low Ch. 2405 MHz	Fundamental	2405.22	N/A	N/A	N/A
Low Ch. 2405 MHz	30 MHz - 12.5 GHz	10303.2	-58.92	-20	Pass
Low Ch. 2405 MHz	12.5 GHz - 25 GHz	24713.1	-56.66	-20	Pass
Mid Ch. 2440 MHz	Fundamental	2440.24	N/A	N/A	N/A
Mid Ch. 2440 MHz	30 MHz - 12.5 GHz	10453.9	-58.93	-20	Pass
Mid Ch. 2440 MHz	12.5 GHz - 25 GHz	24249.2	-54.8	-20	Pass
High Ch. 2475 MHz	Fundamental	2474.71	N/A	N/A	N/A
High Ch. 2475 MHz	30 MHz - 12.5 GHz	10423.4	-57.1	-20	Pass
High Ch. 2475 MHz	12.5 GHz - 25 GHz	24978.6	-53.79	-20	Pass

SPURIOUS CONDUCTED EMISSIONS

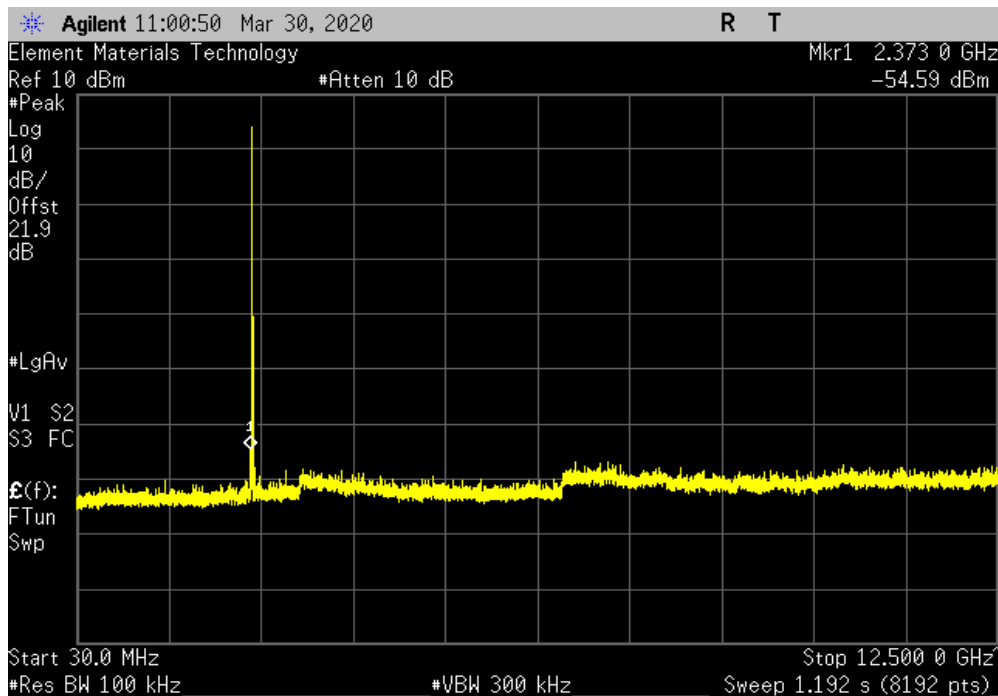


TuTx 2019.08.30.0 XMI 2020.03.25.0

802.15.4, O-PQSK, Antenna 1, Low Ch. 2405 MHz					
Frequency Range	Measured Freq (MHz)	Max Value (dBc)	Limit ≤ (dBc)	Result	
Fundamental	2405.25	N/A	N/A	N/A	



802.15.4, O-PQSK, Antenna 1, Low Ch. 2405 MHz					
Frequency Range	Measured Freq (MHz)	Max Value (dBc)	Limit ≤ (dBc)	Result	
30 MHz - 12.5 GHz	2373	-59.63	-20	Pass	

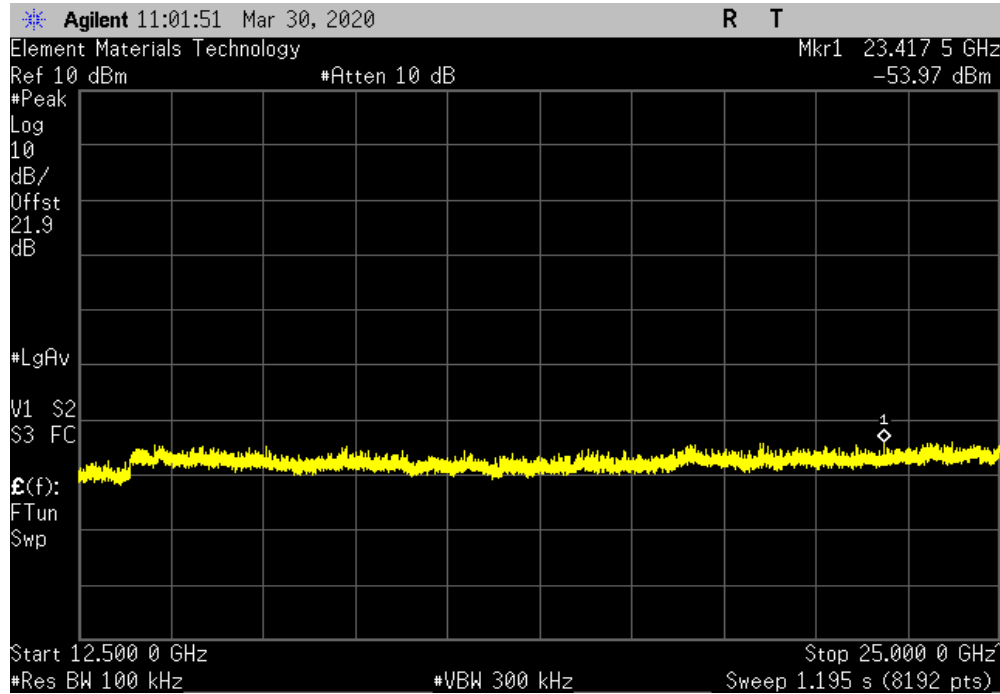


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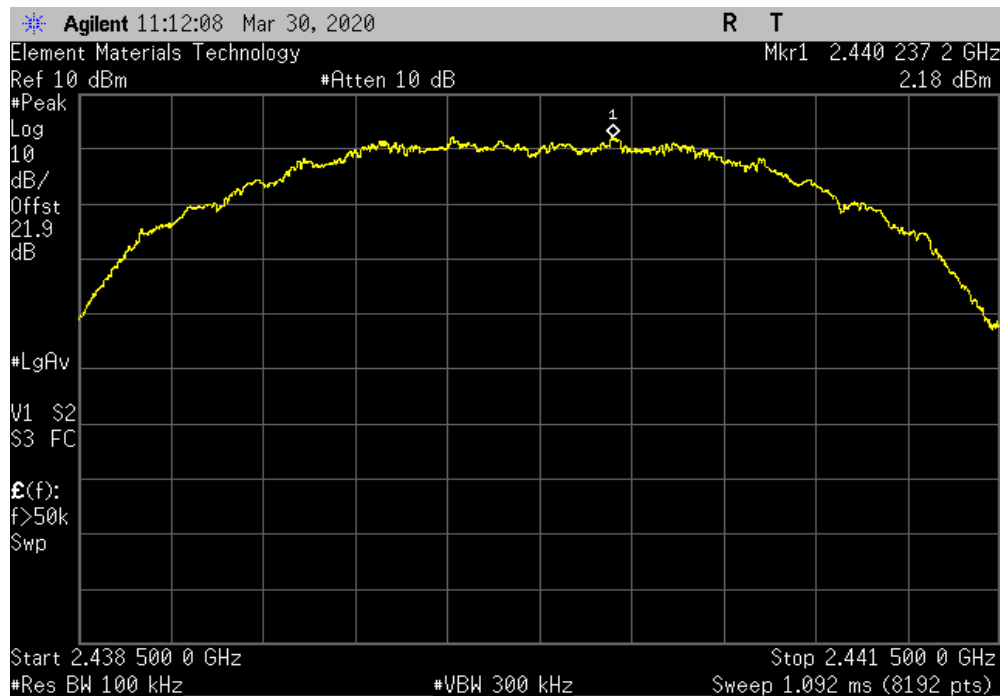


TuTx 2019.08.30.0 XMI 2020.03.25.0

802.15.4, O-PQSK, Antenna 1, Low Ch. 2405 MHz					
Frequency Range	Measured Freq (MHz)	Max Value (dBc)	Limit ≤ (dBc)	Result	
12.5 GHz - 25 GHz	23417.5	-59.01	-20	Pass	



802.15.4, O-PQSK, Antenna 1, Mid Ch. 2440 MHz					
Frequency Range	Measured Freq (MHz)	Max Value (dBc)	Limit ≤ (dBc)	Result	
Fundamental	2440.24	N/A	N/A	N/A	

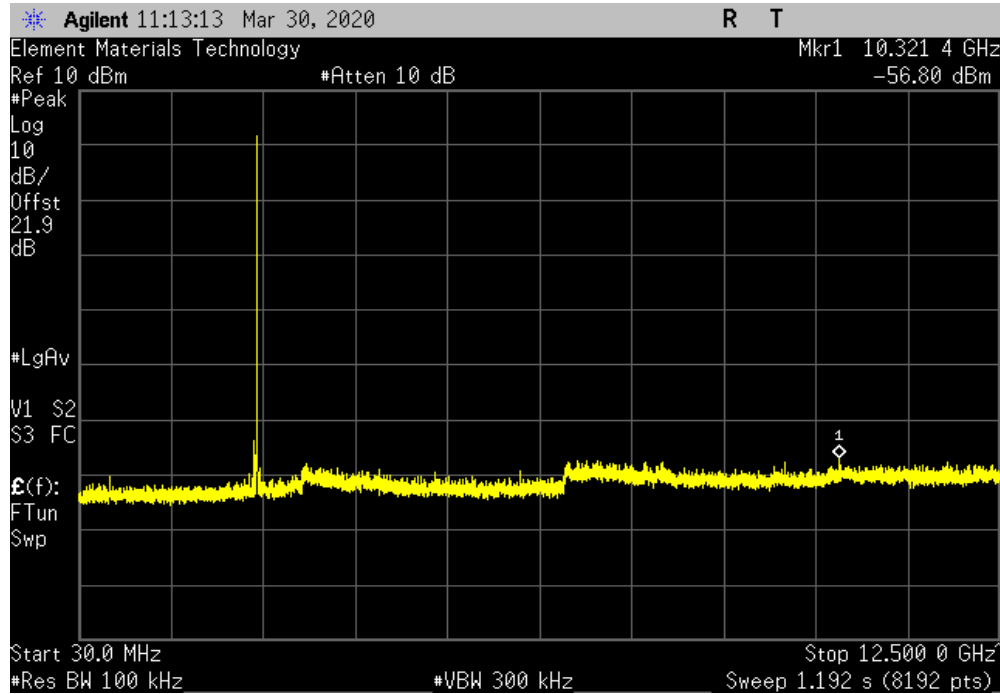


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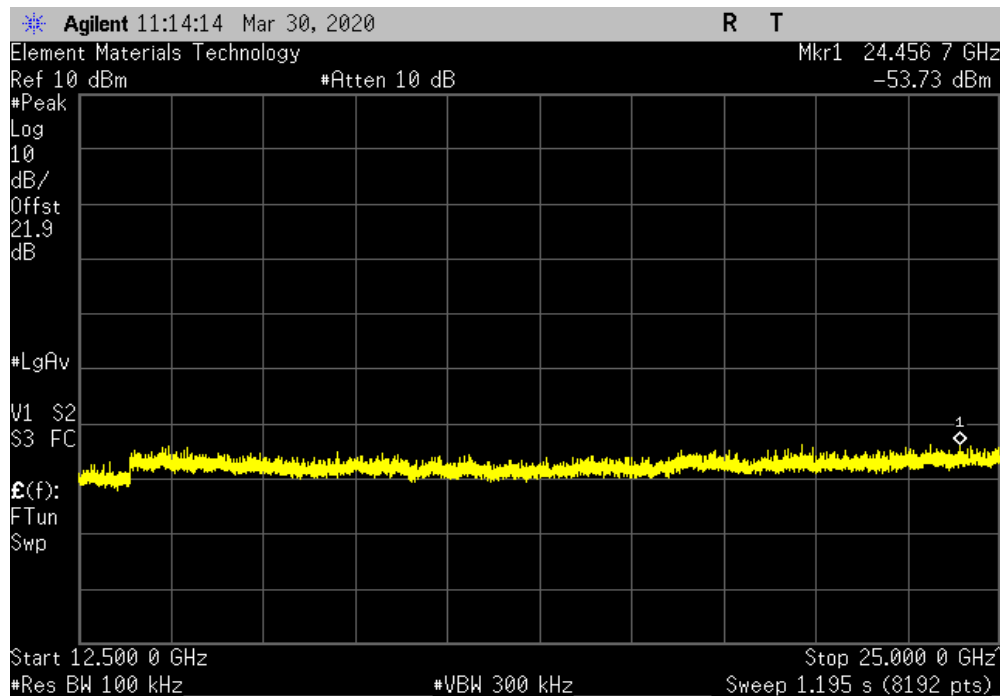


TuTx 2019.08.30.0 XMI 2020.03.25.0

802.15.4, O-PQSK, Antenna 1, Mid Ch. 2440 MHz				
Frequency Range	Measured Freq (MHz)	Max Value (dBc)	Limit ≤ (dBc)	Result
30 MHz - 12.5 GHz	10321.4	-58.98	-20	Pass



802.15.4, O-PQSK, Antenna 1, Mid Ch. 2440 MHz				
Frequency Range	Measured Freq (MHz)	Max Value (dBc)	Limit ≤ (dBc)	Result
12.5 GHz - 25 GHz	24456.7	-55.91	-20	Pass

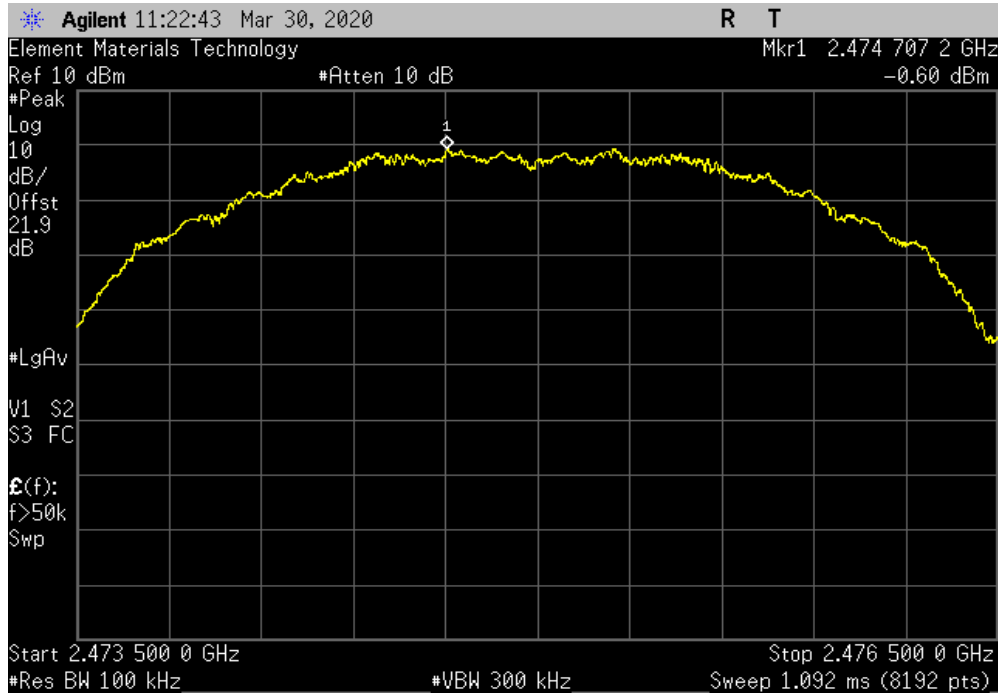


SPURIOUS CONDUCTED EMISSIONS

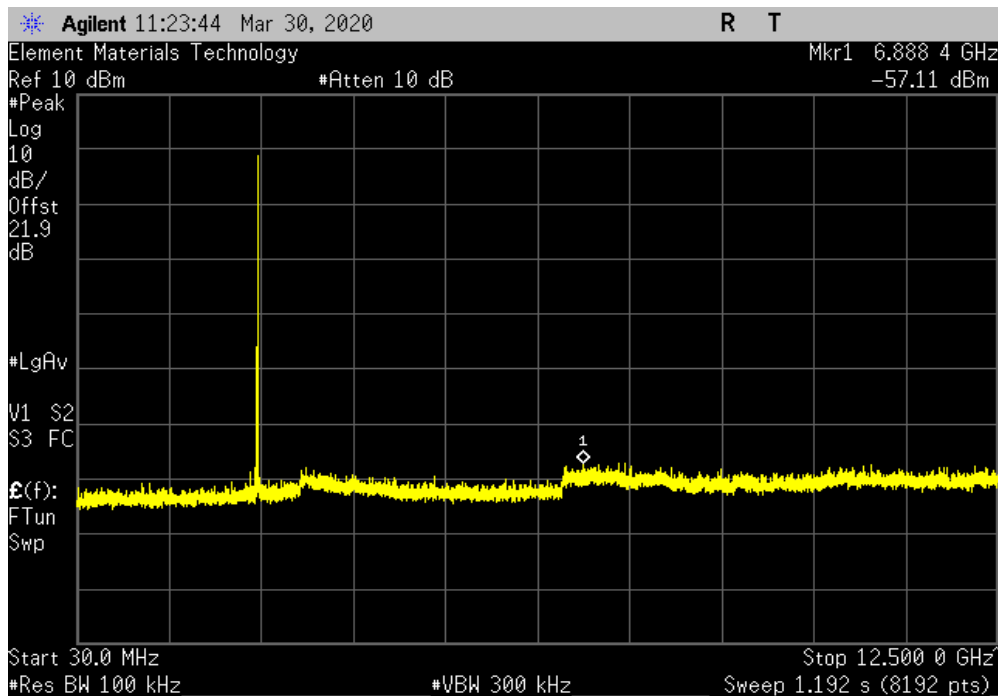


TuTx 2019.08.30.0 XMt 2020.03.25.0

802.15.4, O-PQSK, Antenna 1, High Ch. 2475 MHz					
Frequency Range	Measured Freq (MHz)	Max Value (dBc)	Limit ≤ (dBc)	Result	
Fundamental	2474.71	N/A	N/A	N/A	



802.15.4, O-PQSK, Antenna 1, High Ch. 2475 MHz					
Frequency Range	Measured Freq (MHz)	Max Value (dBc)	Limit ≤ (dBc)	Result	
30 MHz - 12.5 GHz	6888.4	-56.51	-20	Pass	

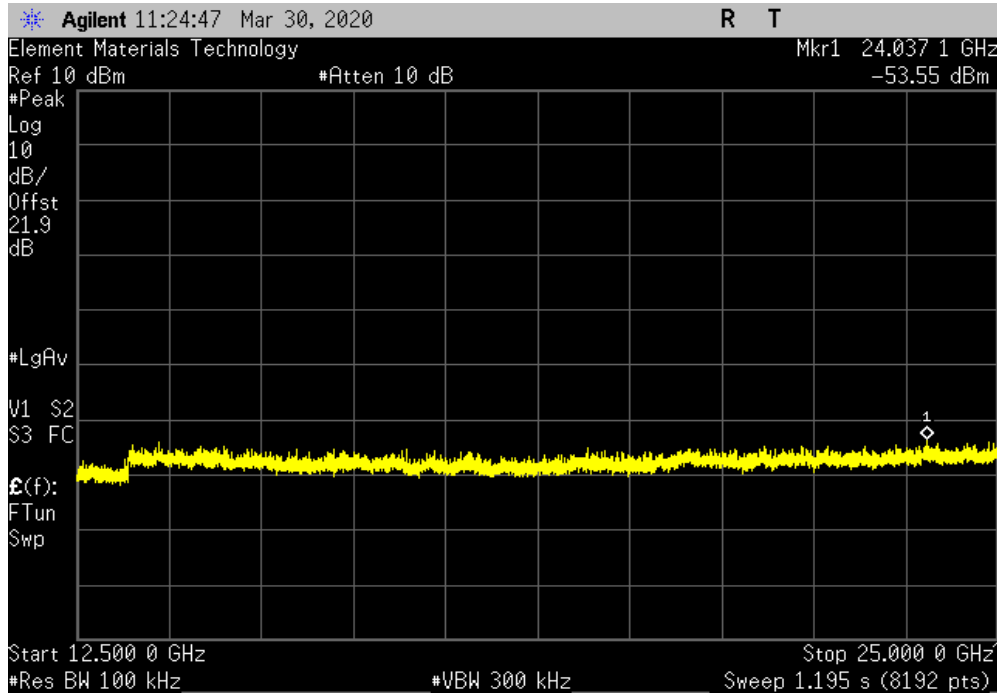


SPURIOUS CONDUCTED EMISSIONS

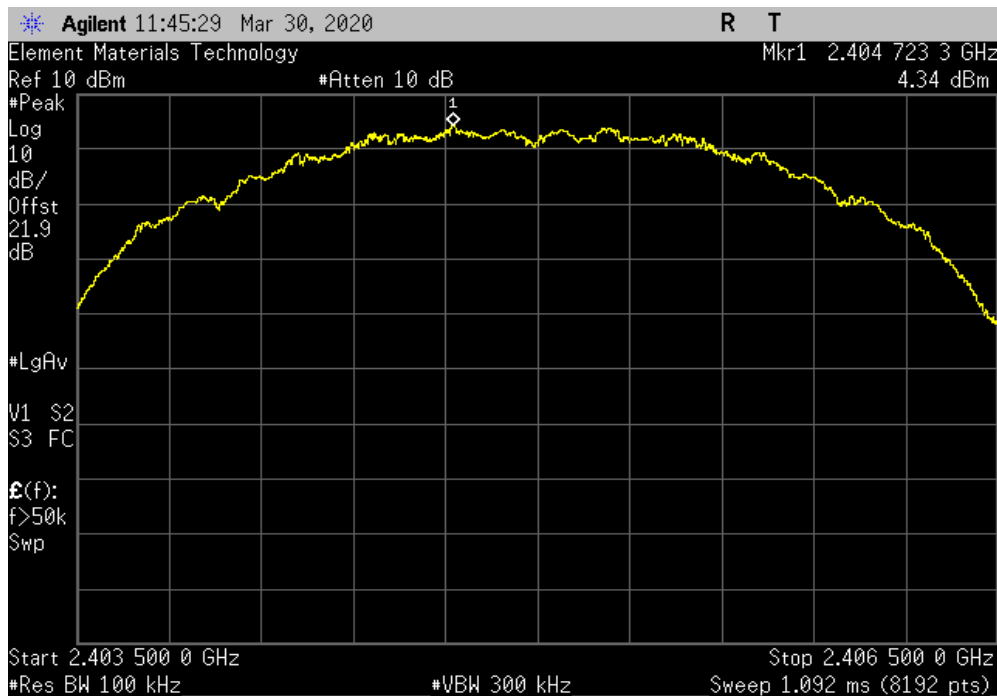


TuTx 2019.08.30.0 XMI 2020.03.25.0

802.15.4, O-PQSK, Antenna 1, High Ch. 2475 MHz					
Frequency Range	Measured Freq (MHz)	Max Value (dBc)	Limit ≤ (dBc)	Result	
12.5 GHz - 25 GHz	24037.1	-52.95	-20	Pass	



802.15.4, O-PQSK, Antenna 2, Low Ch. 2405 MHz					
Frequency Range	Measured Freq (MHz)	Max Value (dBc)	Limit ≤ (dBc)	Result	
Fundamental	2404.72	N/A	N/A	N/A	

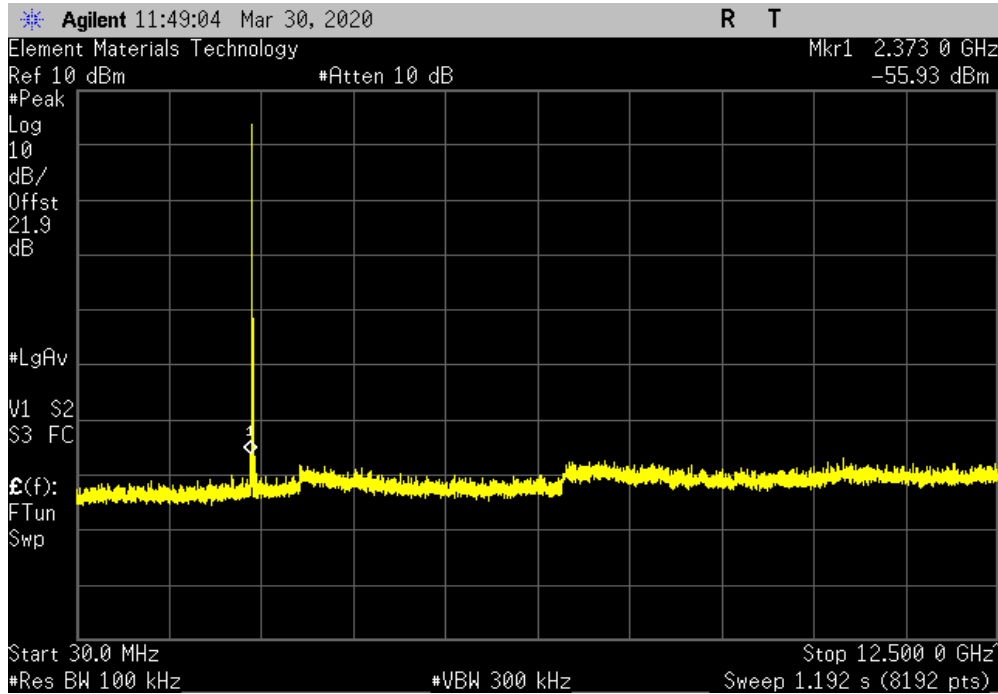


SPURIOUS CONDUCTED EMISSIONS

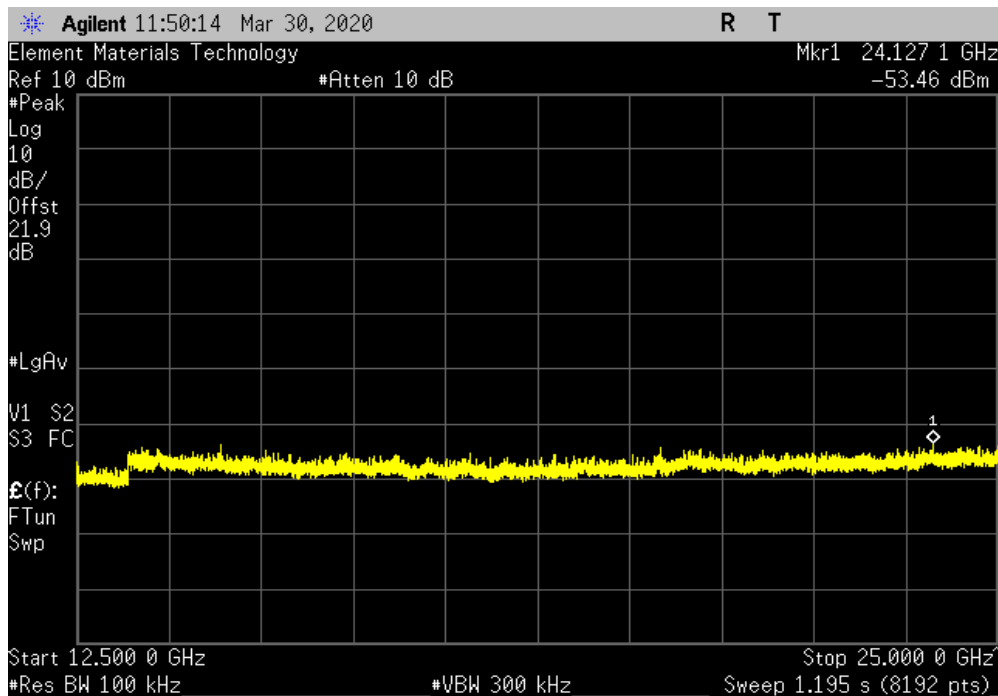


TuTx 2019.08.30.0 XMt 2020.03.25.0

802.15.4, O-PQSK, Antenna 2, Low Ch. 2405 MHz				
Frequency Range	Measured Freq (MHz)	Max Value (dBc)	Limit ≤ (dBc)	Result
30 MHz - 12.5 GHz	2373	-60.27	-20	Pass



802.15.4, O-PQSK, Antenna 2, Low Ch. 2405 MHz				
Frequency Range	Measured Freq (MHz)	Max Value (dBc)	Limit ≤ (dBc)	Result
12.5 GHz - 25 GHz	24127.1	-57.8	-20	Pass

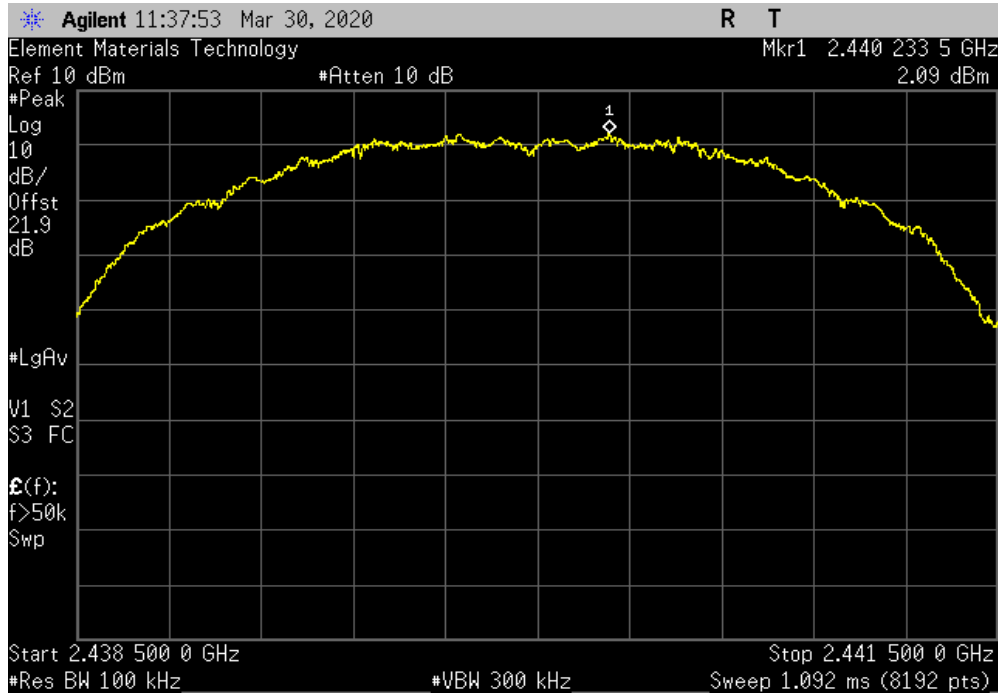


SPURIOUS CONDUCTED EMISSIONS

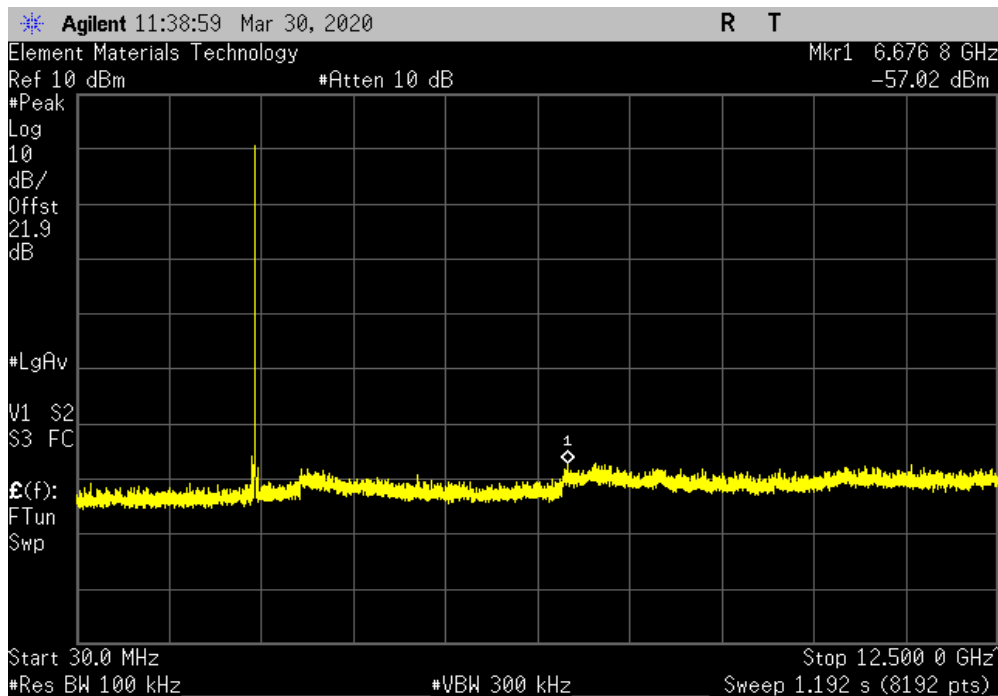


TuTx 2019.08.30.0 XMI 2020.03.25.0

802.15.4, O-PQSK, Antenna 2, Mid Ch. 2440 MHz					
Frequency Range	Measured Freq (MHz)	Max Value (dBc)	Limit ≤ (dBc)	Result	
Fundamental	2440.23	N/A	N/A	N/A	



802.15.4, O-PQSK, Antenna 2, Mid Ch. 2440 MHz					
Frequency Range	Measured Freq (MHz)	Max Value (dBc)	Limit ≤ (dBc)	Result	
30 MHz - 12.5 GHz	6676.8	-59.11	-20	Pass	

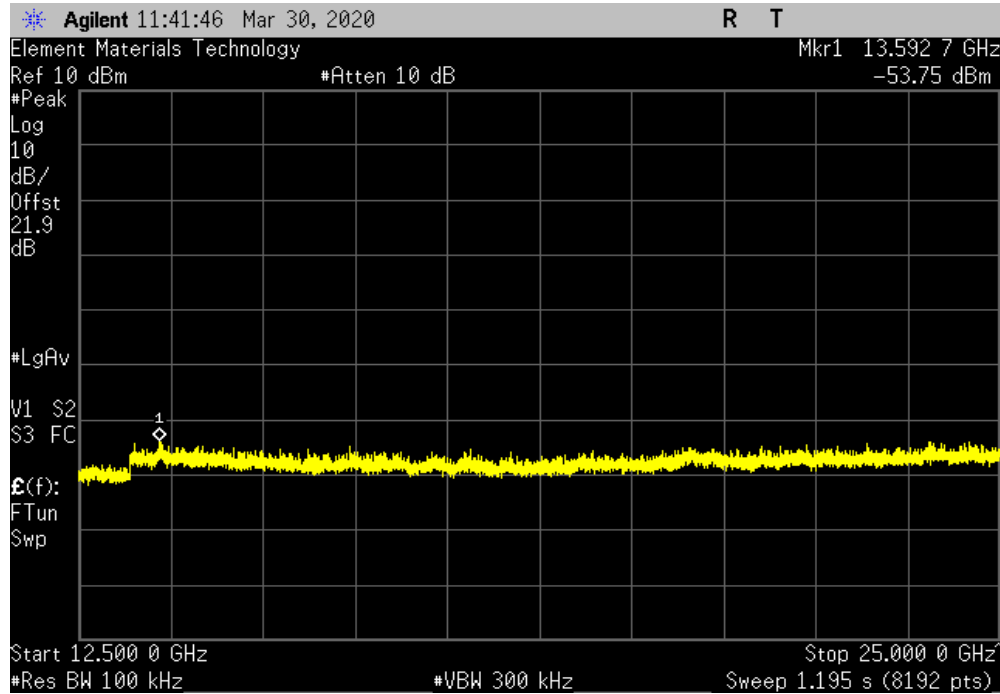


SPURIOUS CONDUCTED EMISSIONS

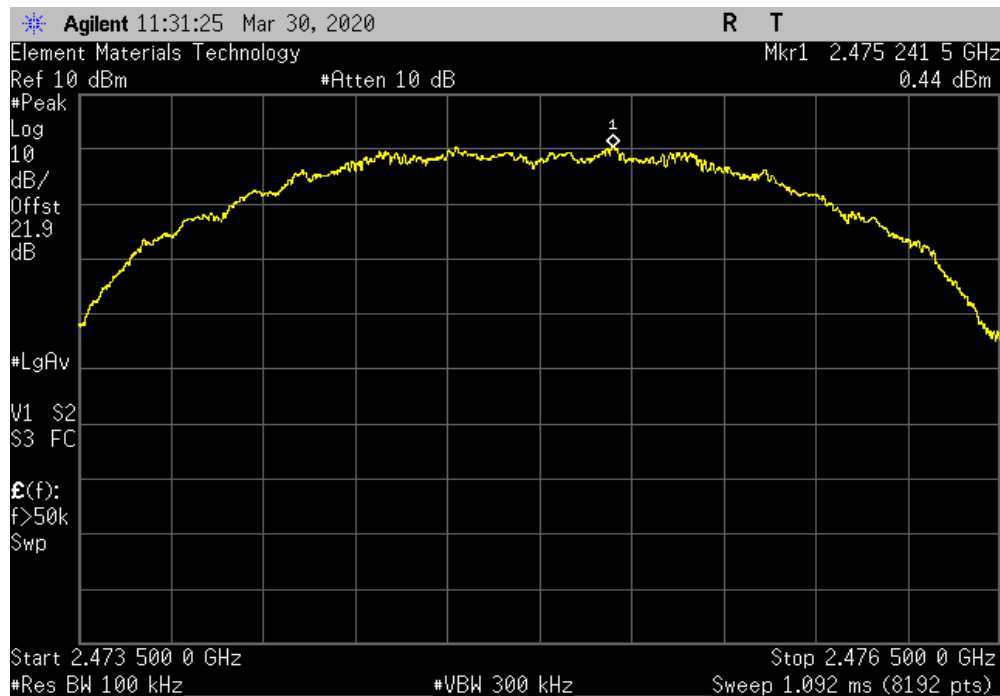


TuTx 2019.08.30.0 XMI 2020.03.25.0

802.15.4, O-PQSK, Antenna 2, Mid Ch. 2440 MHz					
Frequency Range	Measured Freq (MHz)	Max Value (dBc)	Limit ≤ (dBc)	Result	
12.5 GHz - 25 GHz	13592.7	-55.84	-20	Pass	



802.15.4, O-PQSK, Antenna 2, High Ch. 2475 MHz					
Frequency Range	Measured Freq (MHz)	Max Value (dBc)	Limit ≤ (dBc)	Result	
Fundamental	2475.24	N/A	N/A	N/A	

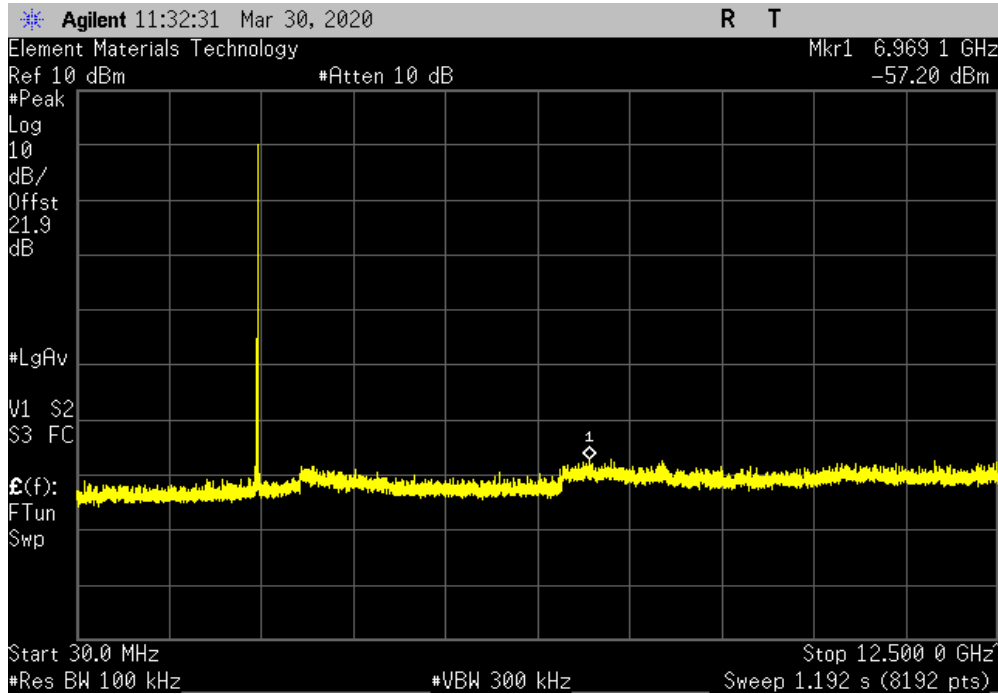


SPURIOUS CONDUCTED EMISSIONS

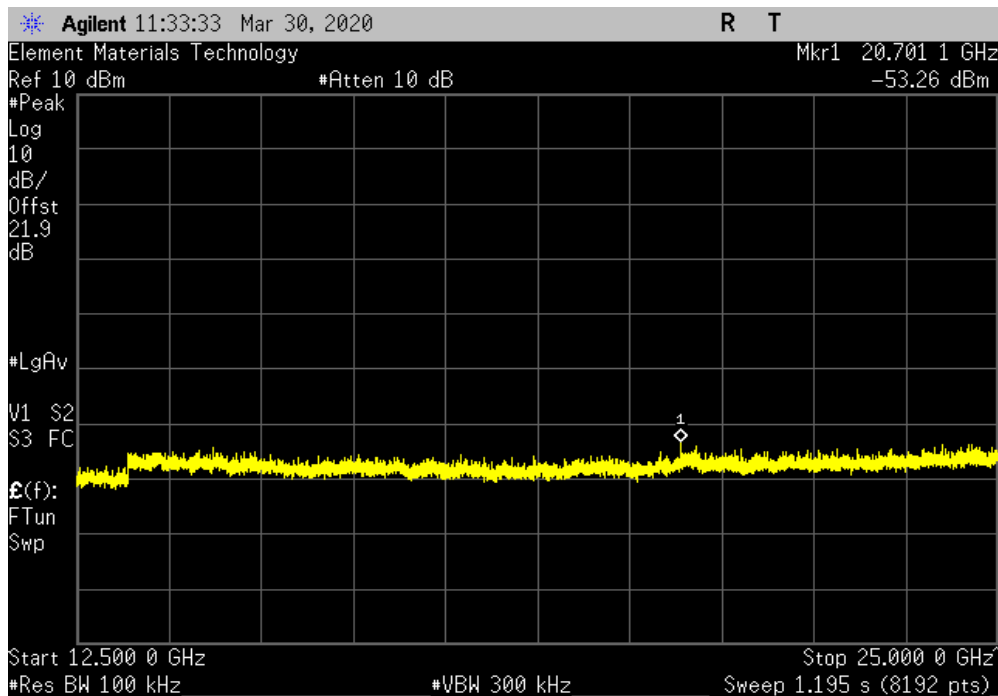


TuTx 2019.08.30.0 XMt 2020.03.25.0

802.15.4, O-PQSK, Antenna 2, High Ch. 2475 MHz				
Frequency Range	Measured Freq (MHz)	Max Value (dBc)	Limit ≤ (dBc)	Result
30 MHz - 12.5 GHz	6969.1	-57.64	-20	Pass



802.15.4, O-PQSK, Antenna 2, High Ch. 2475 MHz				
Frequency Range	Measured Freq (MHz)	Max Value (dBc)	Limit ≤ (dBc)	Result
12.5 GHz - 25 GHz	20701.1	-53.7	-20	Pass

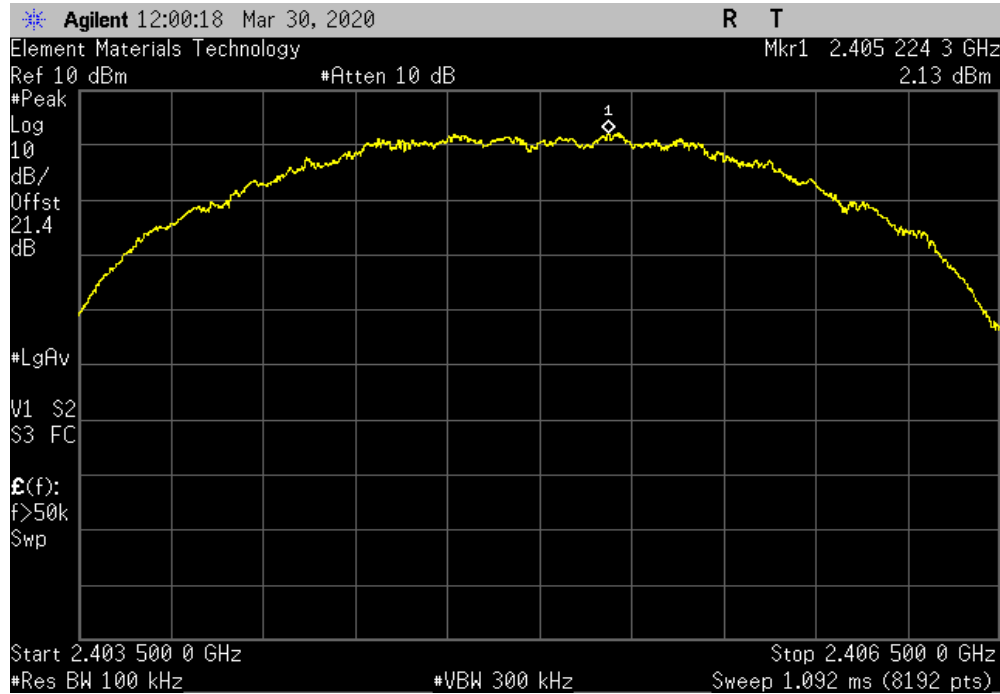


SPURIOUS CONDUCTED EMISSIONS

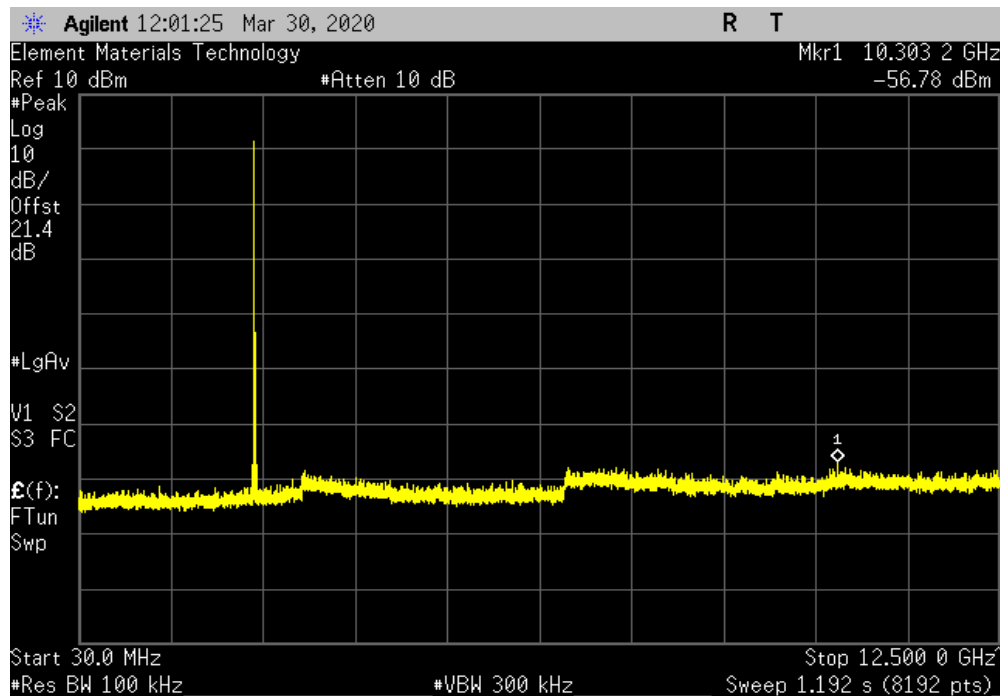


TuTx 2019.08.30.0 XMI 2020.03.25.0

802.15.4, O-PQSK, External Antenna, Low Ch. 2405 MHz					
Frequency Range	Measured Freq (MHz)	Max Value (dBc)	Limit ≤ (dBc)	Result	
Fundamental	2405.22	N/A	N/A	N/A	



802.15.4, O-PQSK, External Antenna, Low Ch. 2405 MHz					
Frequency Range	Measured Freq (MHz)	Max Value (dBc)	Limit ≤ (dBc)	Result	
30 MHz - 12.5 GHz	10303.2	-58.92	-20	Pass	

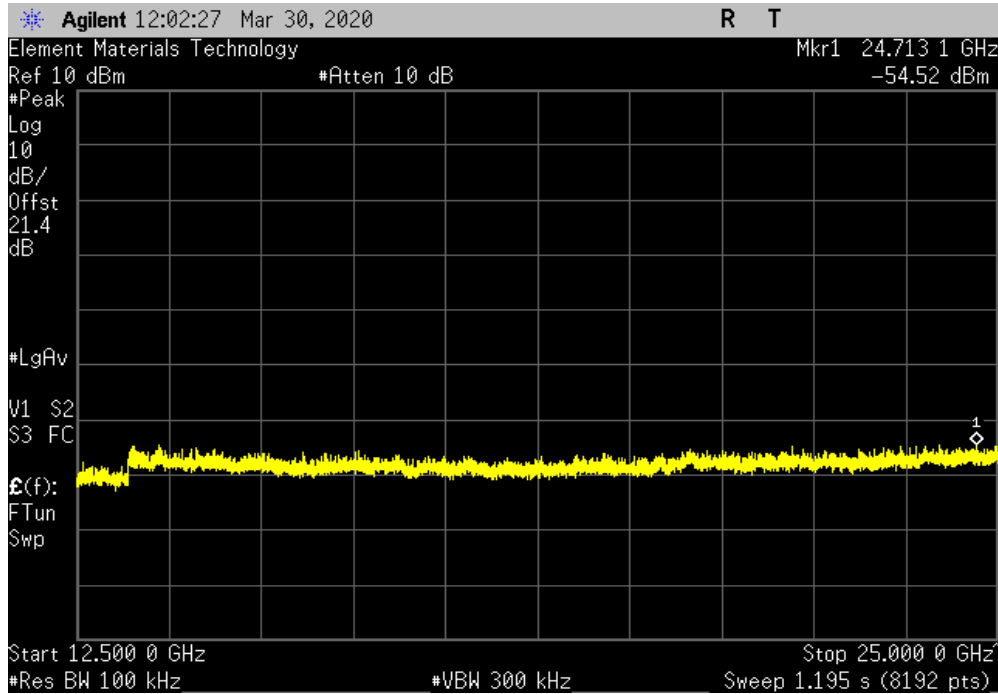


SPURIOUS CONDUCTED EMISSIONS

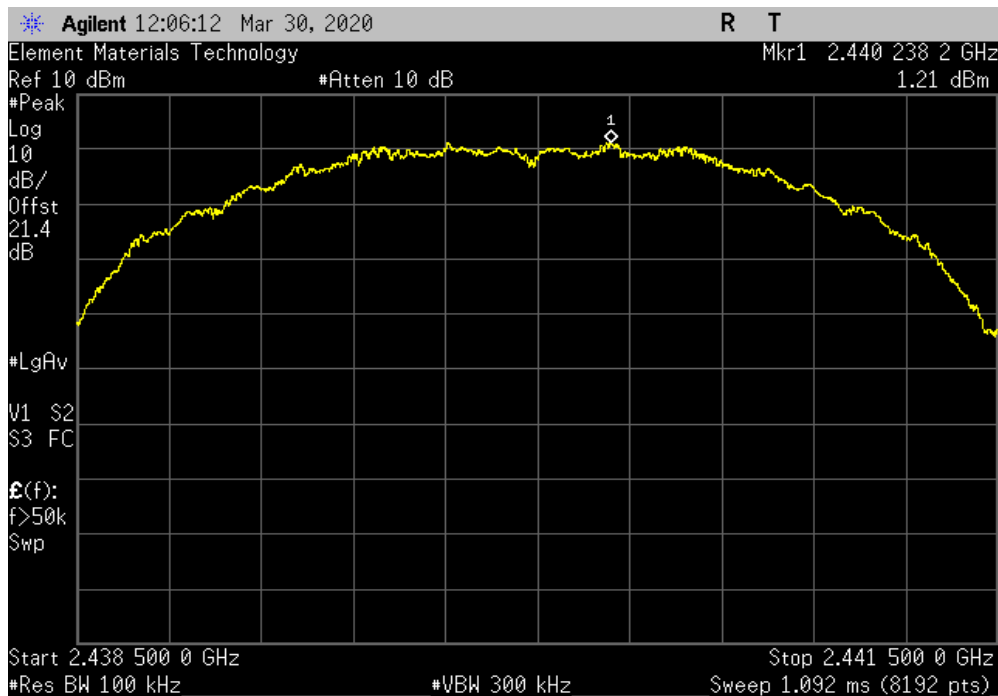


TuTx 2019.08.30.0 XMI 2020.03.25.0

802.15.4, O-PQSK, External Antenna, Low Ch. 2405 MHz					
Frequency Range	Measured Freq (MHz)	Max Value (dBc)	Limit ≤ (dBc)	Result	
12.5 GHz - 25 GHz	24713.1	-56.66	-20	Pass	



802.15.4, O-PQSK, External Antenna, Mid Ch. 2440 MHz					
Frequency Range	Measured Freq (MHz)	Max Value (dBc)	Limit ≤ (dBc)	Result	
Fundamental	2440.24	N/A	N/A	N/A	

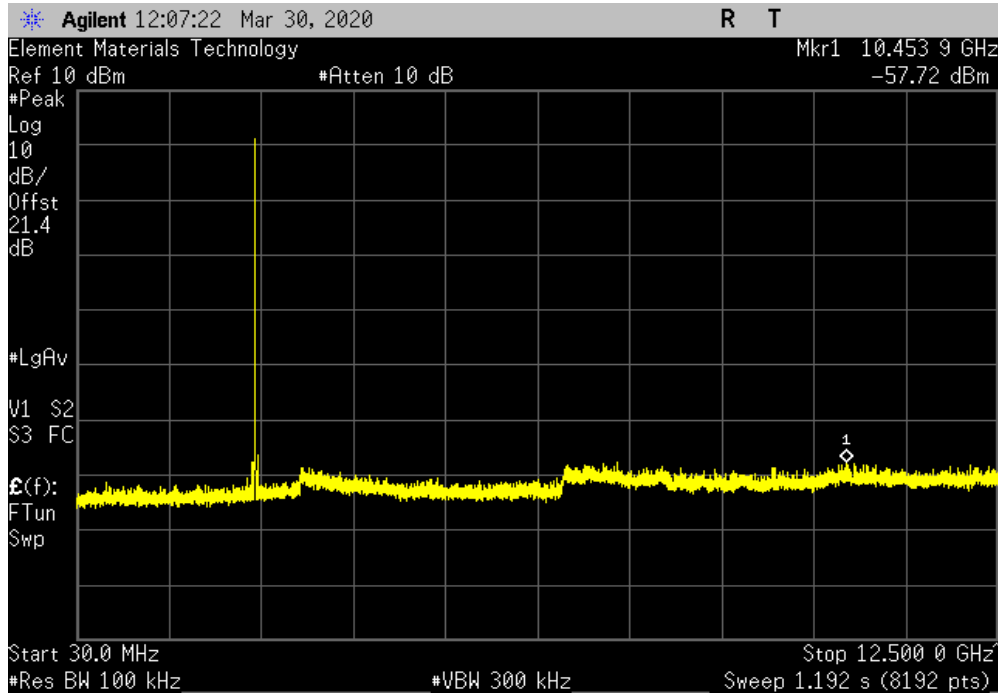


SPURIOUS CONDUCTED EMISSIONS

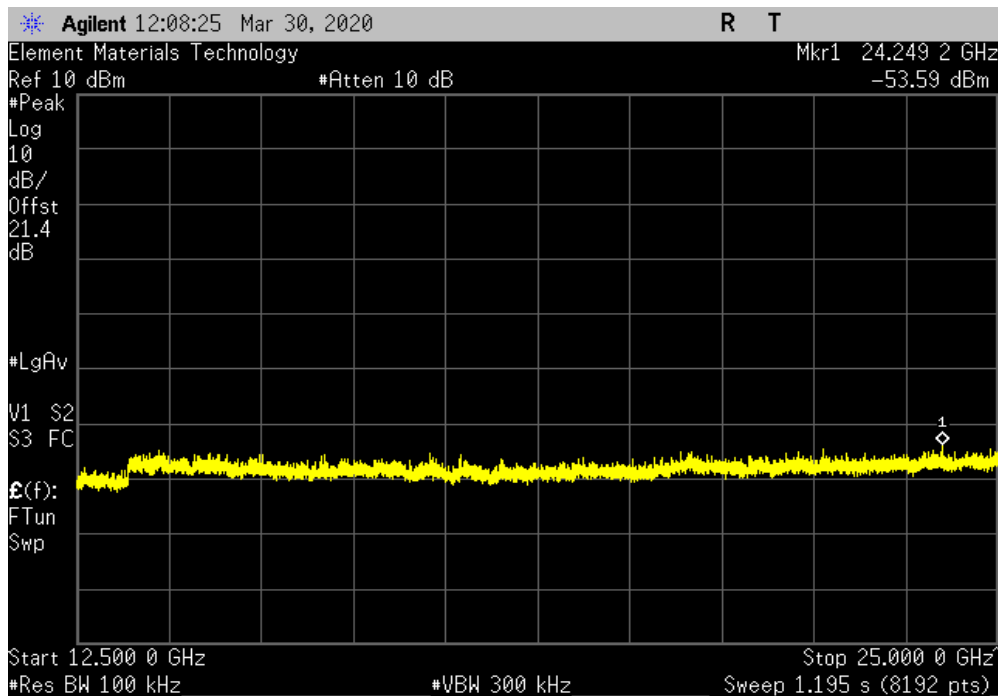


TuTx 2019.08.30.0 XMI 2020.03.25.0

802.15.4, O-PQSK, External Antenna, Mid Ch. 2440 MHz				
Frequency Range	Measured Freq (MHz)	Max Value (dBc)	Limit ≤ (dBc)	Result
30 MHz - 12.5 GHz	10453.9	-58.93	-20	Pass



802.15.4, O-PQSK, External Antenna, Mid Ch. 2440 MHz				
Frequency Range	Measured Freq (MHz)	Max Value (dBc)	Limit ≤ (dBc)	Result
12.5 GHz - 25 GHz	24249.2	-54.8	-20	Pass

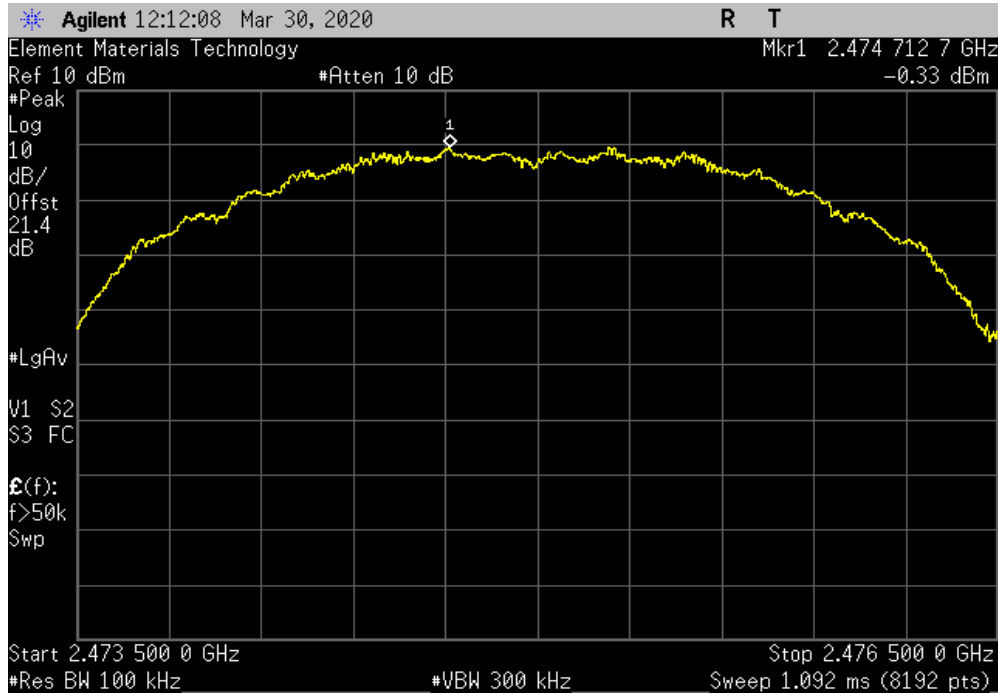


SPURIOUS CONDUCTED EMISSIONS

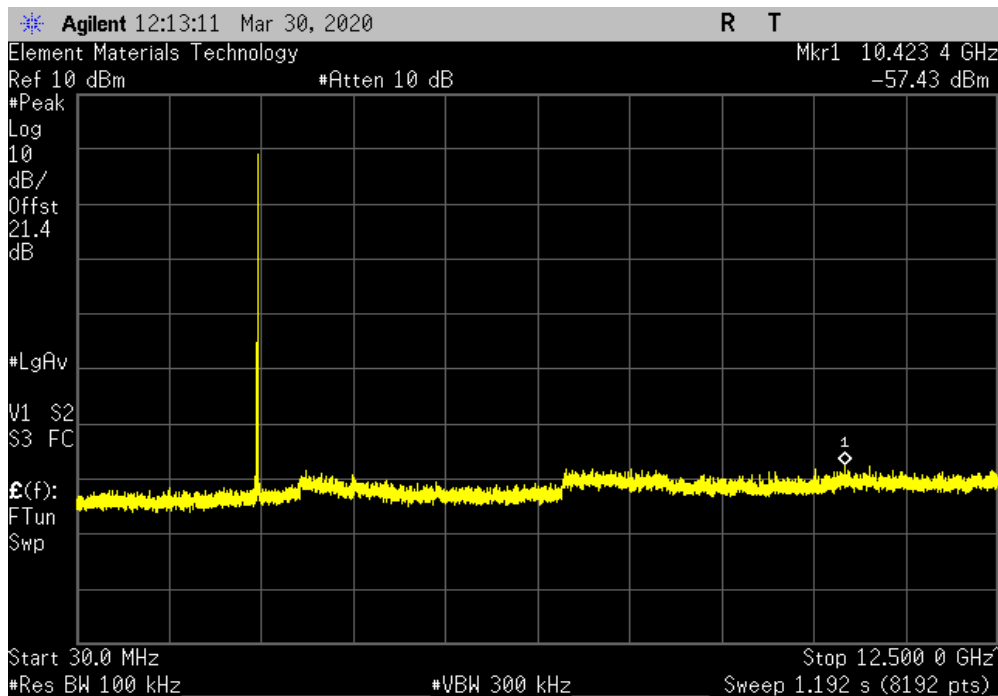


TuTx 2019.08.30.0 XMI 2020.03.25.0

802.15.4, O-PQSK, External Antenna, High Ch. 2475 MHz					
Frequency Range	Measured Freq (MHz)	Max Value (dBc)	Limit ≤ (dBc)	Result	
Fundamental	2474.71	N/A	N/A	N/A	



802.15.4, O-PQSK, External Antenna, High Ch. 2475 MHz					
Frequency Range	Measured Freq (MHz)	Max Value (dBc)	Limit ≤ (dBc)	Result	
30 MHz - 12.5 GHz	10423.4	-57.1	-20	Pass	

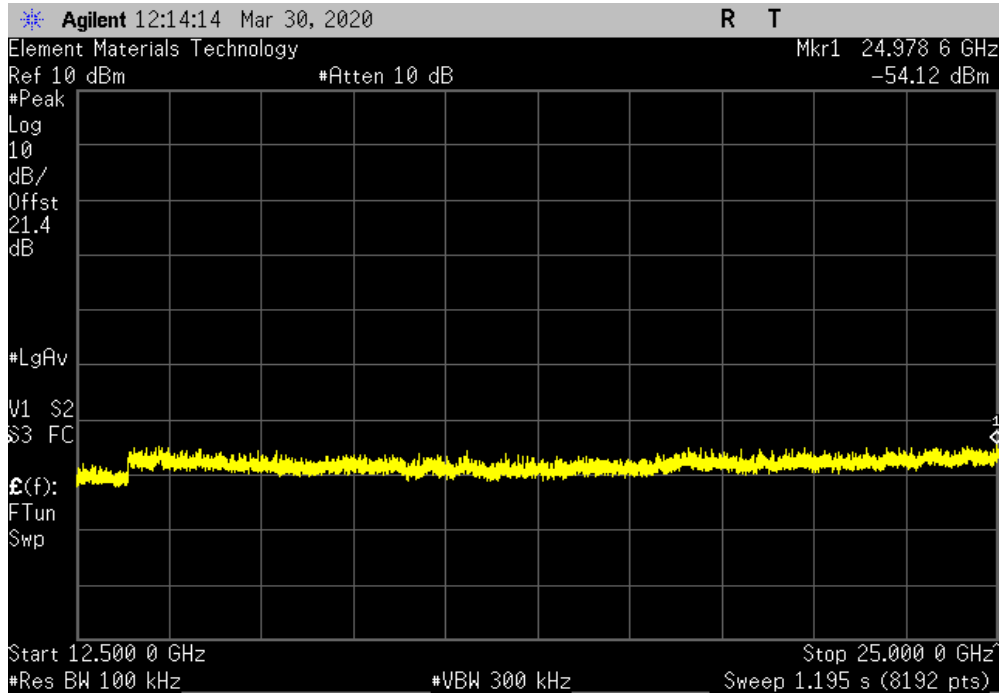


SPURIOUS CONDUCTED EMISSIONS



TbTx 2019.08.30.0 XMI 2020.03.25.0

802.15.4, O-PQSK, External Antenna, High Ch. 2475 MHz				
Frequency Range	Measured Freq (MHz)	Max Value (dBc)	Limit ≤ (dBc)	Result
12.5 GHz - 25 GHz	24978.6	-53.79	-20	Pass



SPURIOUS RADIATED EMISSIONS



PSA-ESCI 2019.11.08.1

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

Continuous Tx, O-QPSK, External Antenna, Low Ch. 11 = 2405 MHz, Mid Ch. 18 = 2440 MHz, High Ch. 25 = 2475 MHz, Power Setting = 0x32
 Continuous Tx, O-QPSK, Antenna 2, Low Ch. 11 = 2405 MHz, Mid Ch. 18 = 2440 MHz, High Ch. 25 = 2475 MHz, Power Setting = 0x32
 Continuous Tx, O-QPSK, Antenna 1, Low Ch. 11 = 2405 MHz, Mid Ch. 18 = 2440 MHz, High Ch. 25 = 2475 MHz, Power Setting = 0x32

POWER SETTINGS INVESTIGATED

12 VDC

CONFIGURATIONS INVESTIGATED

PRCO0113 - 1
 PRCO0111 - 1

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
Filter - High Pass	Micro-Tronics	HPM50111	HFO	2019-11-18	12 mo
Filter - Low Pass	Micro-Tronics	LPM50004	LFD	2020-02-15	12 mo
Attenuator	Coaxicom	3910-20	AXZ	2020-02-15	12 mo
Cable	ESM Cable Corp.	TTBJ141-KMKM-72	EYV	2019-07-31	12 mo
Cable	None	Standard Gain Horns Cable	EVF	2019-11-19	12 mo
Cable	N/A	Double Ridge Horn Cables	EVB	2019-11-18	12 mo
Cable	N/A	Bilog Cables	EVA	2019-11-18	12 mo
Amplifier - Pre-Amplifier	Miteq	AMF-6F-18002650-25-10P	AVU	2019-07-31	12 mo
Amplifier - Pre-Amplifier	Miteq	AMF-6F-12001800-30-10P	AVD	2019-11-19	12 mo
Amplifier - Pre-Amplifier	L-3 Narda-MITEQ	AMF-6F-08001200-30-10P	PAO	2019-11-19	12 mo
Amplifier - Pre-Amplifier	Miteq	AMF-3D-00100800-32-13P	PAG	2019-11-18	12 mo
Amplifier - Pre-Amplifier	Miteq	AM-1616-1000	AOL	2019-11-18	12 mo
Antenna - Standard Gain	ETS Lindgren	3160-09	AIV	NCR	0 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	EMCO	3115	AHC	2018-07-02	24 mo
Antenna - Biconilog	Teseq	CBL 6141B	AXR	2018-10-02	24 mo
Analyzer - Spectrum Analyzer	Agilent	E4446A	AAQ	2019-03-24	12 mo
Analyzer - Spectrum Analyzer	Agilent	N9010A	AFI	2019-12-13	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.

Where the radio test software does not provide for a duty cycle at continuous transmit conditions (> 98%) and the RMS (power average) measurements were made across the on and off times of the EUT transmissions, a duty cycle correction is added to the measurements using the formula of 10*LOG(dc).

SPURIOUS RADIATED EMISSIONS

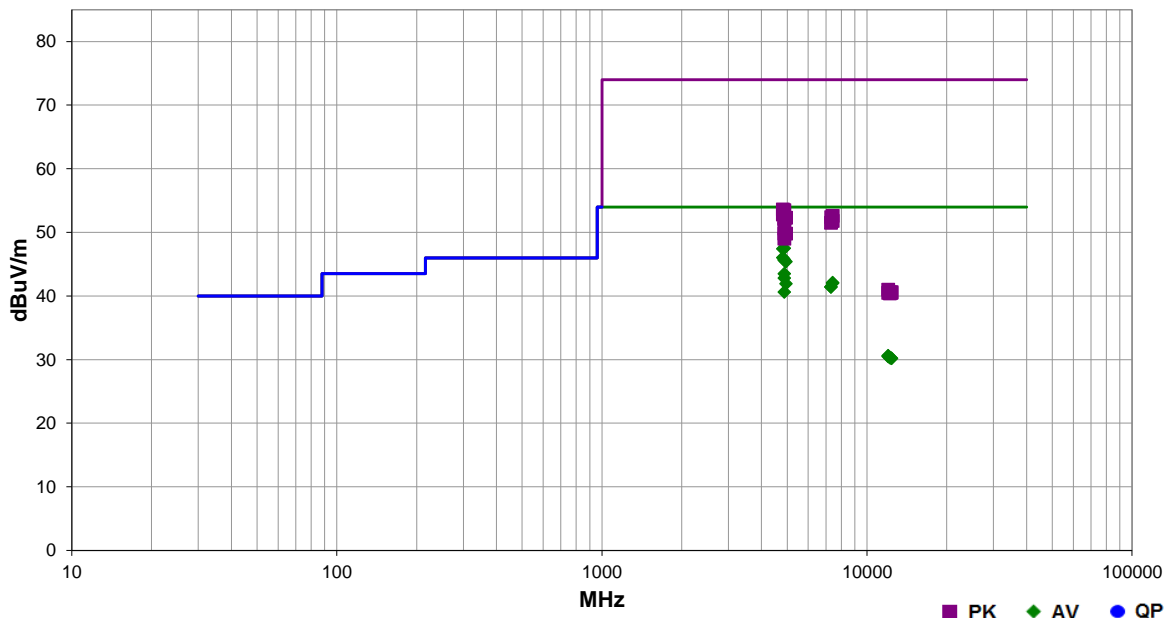


EmiRS 2019.08.15.1 PSA-ESCI2019.11.08.1

Work Order:	PRCO0111	Date:	2020-02-11	
Project:	None	Temperature:	21.9 °C	
Job Site:	EV01	Humidity:	34.6% RH	
Serial Number:	B8	Barometric Pres.:	1031 mbar	
EUT:	PRECOlink			
Configuration:	1			
Customer:	Preco, Inc.			
Attendees:	Brian Holloway			
EUT Power:	12 VDC			
Operating Mode:	Continuous Tx, O-QPSK, Antenna 1, Low Ch. 11 = 2405 MHz, Mid Ch. 18 = 2440 MHz, High Ch. 25 = 2475 MHz, Power Setting = 0x32			
Deviations:	None			
Comments:	See comments below for Channel, EUT orientation, and Antenna Port			

Test Specifications	Test Method
FCC 15.247:2020	ANSI C63.10:2013

Run #	24	Test Distance (m)	3	Antenna Height(s)	1 to 4(m)	Results	Pass
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Freq (MHz)	Amplitude (dBuV)	Factor (dB)	Antenna Height (meters)	Azimuth (degrees)	Test Distance (meters)	External Attenuation (dB)	Polarity/Transducer Type	Detector	Distance Adjustment (dB)	Adjusted (dBuV/m)	Spec. Limit (dBuV/m)	Compared to Spec. (dB)	Comments
4880.933	40.9	6.6	1.0	55.0	3.0	0.0	Vert	AV	0.0	47.5	54.0	-6.5	Mid Ch, EUT Vert, Ant 1
4810.883	41.7	5.7	2.87	319.0	3.0	0.0	Horz	AV	0.0	47.4	54.0	-6.6	Low Ch, EUT on Side, Ant 1
4810.883	40.3	5.7	1.03	119.0	3.0	0.0	Vert	AV	0.0	46.0	54.0	-8.0	Low Ch, EUT Vert, Ant 1
4880.917	39.1	6.6	2.81	99.0	3.0	0.0	Horz	AV	0.0	45.7	54.0	-8.3	Mid Ch, EUT on Side, Ant 1
4878.967	39.0	6.6	2.81	349.0	3.0	0.0	Vert	AV	0.0	45.6	54.0	-8.4	Mid Ch, EUT Horz, Ant 1
4950.967	38.7	6.7	2.22	30.0	3.0	0.0	Horz	AV	0.0	45.4	54.0	-8.6	High Ch, EUT on Side, Ant 1
4880.883	36.9	6.6	3.33	87.0	3.0	0.0	Horz	AV	0.0	43.5	54.0	-10.5	Mid Ch, EUT Horz, Ant 1
4879.000	36.2	6.6	1.12	214.0	3.0	0.0	Vert	AV	0.0	42.8	54.0	-11.2	Mid Ch, EUT on Side, Ant 1
7421.267	28.2	13.9	1.5	79.0	3.0	0.0	Horz	AV	0.0	42.1	54.0	-11.9	High Ch, EUT on Side, Ant 1
7421.700	28.1	13.9	3.17	0.0	3.0	0.0	Vert	AV	0.0	42.0	54.0	-12.0	High Ch, EUT Vert, Ant 1
4950.950	35.2	6.7	2.7	144.0	3.0	0.0	Vert	AV	0.0	41.9	54.0	-12.1	High Ch, EUT Vert, Ant 1
7315.033	28.4	13.0	2.99	6.0	3.0	0.0	Vert	AV	0.0	41.4	54.0	-12.6	Mid Ch, EUT Horz, Ant 1
7317.400	28.4	13.0	1.0	119.0	3.0	0.0	Horz	AV	0.0	41.4	54.0	-12.6	Mid Ch, EUT Vert, Ant 1
4880.983	34.0	6.6	1.3	189.0	3.0	0.0	Horz	AV	0.0	40.6	54.0	-13.4	Mid Ch, EUT Vert, Ant 1
4810.900	47.9	5.7	2.87	319.0	3.0	0.0	Horz	PK	0.0	53.6	74.0	-20.4	Low Ch, EUT on Side, Ant 1
4880.983	46.9	6.6	1.0	55.0	3.0	0.0	Vert	PK	0.0	53.5	74.0	-20.5	Mid Ch, EUT Vert, Ant 1
4810.733	47.1	5.7	1.03	119.0	3.0	0.0	Vert	PK	0.0	52.8	74.0	-21.2	Low Ch, EUT Vert, Ant 1
7421.633	38.7	13.9	1.5	79.0	3.0	0.0	Horz	PK	0.0	52.6	74.0	-21.4	High Ch, EUT on Side, Ant 1
7323.400	39.3	13.1	2.99	6.0	3.0	0.0	Vert	PK	0.0	52.4	74.0	-21.6	Mid Ch, EUT Vert, Ant 1
4950.933	45.6	6.7	2.22	30.0	3.0	0.0	Horz	PK	0.0	52.3	74.0	-21.7	High Ch, EUT on Side, Ant 1

Freq (MHz)	Amplitude (dBuV)	Factor (dB)	Antenna Height (meters)	Azimuth (degrees)	Test Distance (meters)	External Attenuation (dB)	Polarity/ Transducer Type	Detector	Distance Adjustment (dB)	Adjusted (dBuV/m)	Spec. Limit (dBuV/m)	Compared to Spec. (dB)	Comments
4879.000	45.6	6.6	2.81	349.0	3.0	0.0	Vert	PK	0.0	52.2	74.0	-21.8	Mid Ch, EUT Horz, Ant 1
4880.917	45.5	6.6	2.81	99.0	3.0	0.0	Horz	PK	0.0	52.1	74.0	-21.9	Mid Ch, EUT on Side, Ant 1
7425.967	38.0	13.8	3.17	0.0	3.0	0.0	Vert	PK	0.0	51.8	74.0	-22.2	High Ch, EUT Vert, Ant 1
7320.400	38.4	13.1	1.0	119.0	3.0	0.0	Horz	PK	0.0	51.5	74.0	-22.5	Mid Ch, EUT Vert, Ant 1
12021.070	29.6	1.0	2.09	138.0	3.0	0.0	Horz	AV	0.0	30.6	54.0	-23.4	Low Ch, EUT on Side, Ant 1
4881.450	44.0	6.6	3.33	87.0	3.0	0.0	Horz	PK	0.0	50.6	74.0	-23.4	Mid Ch, EUT Horz, Ant 1
12020.470	29.5	1.0	2.24	233.0	3.0	0.0	Vert	AV	0.0	30.5	54.0	-23.5	Low Ch, EUT Vert, Ant 1
12197.590	29.5	0.8	1.0	320.0	3.0	0.0	Horz	AV	0.0	30.3	54.0	-23.7	Mid Ch, EUT on Side, Ant 1
12195.880	29.5	0.8	1.45	288.0	3.0	0.0	Vert	AV	0.0	30.3	54.0	-23.7	Mid Ch, EUT Vert, Ant 1
12374.120	29.2	1.0	1.5	43.0	3.0	0.0	Vert	AV	0.0	30.2	54.0	-23.8	High Ch, EUT Vert, Ant 1
12371.870	29.2	1.0	2.6	60.0	3.0	0.0	Horz	AV	0.0	30.2	54.0	-23.8	High CH, EUT on Side, Ant 1
4881.333	43.2	6.6	1.12	214.0	3.0	0.0	Vert	PK	0.0	49.8	74.0	-24.2	Mid Ch, EUT on Side, Ant 1
4950.867	43.1	6.7	2.7	144.0	3.0	0.0	Vert	PK	0.0	49.8	74.0	-24.2	High Ch, EUT Vert, Ant 1
4879.033	42.4	6.6	1.3	189.0	3.0	0.0	Horz	PK	0.0	49.0	74.0	-25.0	Mid Ch, EUT Vert, Ant 1
12027.480	40.0	1.0	2.24	233.0	3.0	0.0	Vert	PK	0.0	41.0	74.0	-33.0	Low Ch, EUT Vert, Ant 1
12199.120	39.8	0.8	1.0	320.0	3.0	0.0	Horz	PK	0.0	40.6	74.0	-33.4	Mid Ch, EUT on Side, Ant 1
12375.720	39.6	1.0	2.6	60.0	3.0	0.0	Horz	PK	0.0	40.6	74.0	-33.4	High CH, EUT on Side, Ant 1
12025.180	39.5	1.0	2.09	138.0	3.0	0.0	Horz	PK	0.0	40.5	74.0	-33.5	Low Ch, EUT on Side, Ant 1
12370.400	39.5	1.0	1.5	43.0	3.0	0.0	Vert	PK	0.0	40.5	74.0	-33.5	High Ch, EUT Vert, Ant 1
12195.550	39.6	0.8	1.45	288.0	3.0	0.0	Vert	PK	0.0	40.4	74.0	-33.6	Mid Ch, EUT Vert, Ant 1

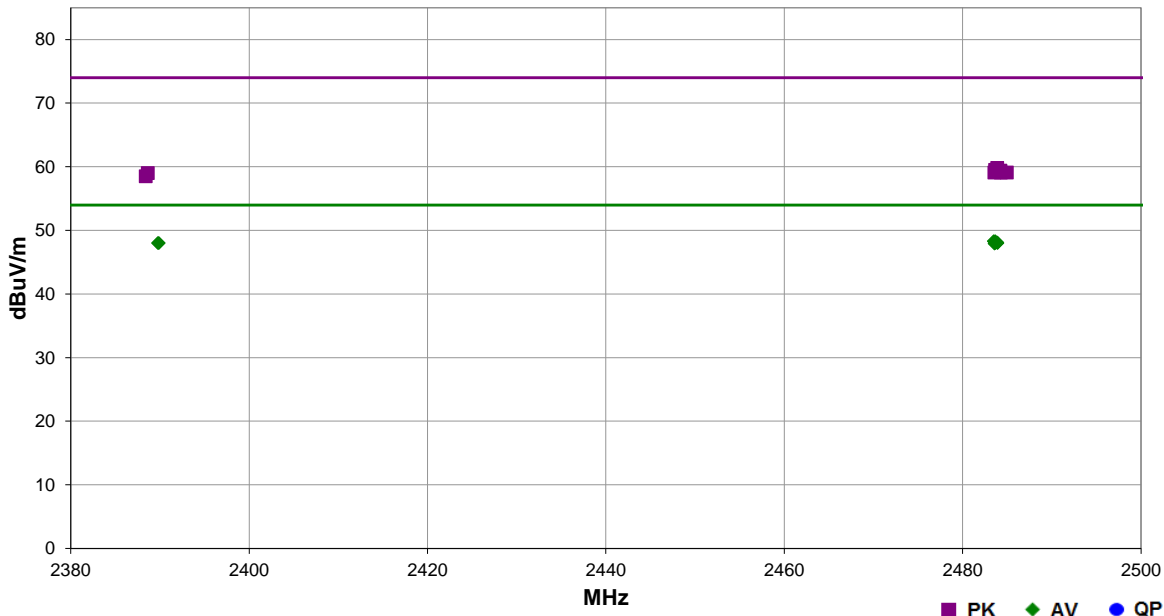
SPURIOUS RADIATED EMISSIONS



EmiRS 2019.08.15.1 PSA-ESCI 2019.11.08.1

Work Order:	PRCO0113	Date:	2020-02-11	
Project:	None	Temperature:	21.8 °C	
Job Site:	EV01	Humidity:	38.3% RH	
Serial Number:	B7	Barometric Pres.:	1018 mbar	
Tested by:	Jeff Alcoke			
EUT:	PRECOlink			
Configuration:	1			
Customer:	Preco, Inc.			
Attendees:	None			
EUT Power:	12 VDC			
Operating Mode:	Continuous Tx, O-QPSK, Antenna 1, Low Ch. 11 = 2405 MHz, Mid Ch. 18 = 2440 MHz, High Ch. 25 = 2475 MHz, Power Setting = 0x32			
Deviations:	None			
Comments:	See comments below for Channel, EUT orientation, and Antenna Port			

Test Specifications	Test Method						
FCC 15.247:2020	ANSI C63.10:2013						
Run #	36	Test Distance (m)	3	Antenna Height(s)	1 to 4(m)	Results	Pass



Freq (MHz)	Amplitude (dBuV)	Factor (dB)	Antenna Height (meters)	Azimuth (degrees)	Test Distance (meters)	External Attenuation (dB)	Polarity/Transducer Type	Detector	Distance Adjustment (dB)	Adjusted (dBuV/m)	Spec. Limit (dBuV/m)	Compared to Spec. (dB)	Comments
2483.500	31.6	-3.3	1.5	308.0	3.0	20.0	Horz	AV	0.0	48.3	54.0	-5.7	High Ch, EUT Horz, Ant 1
2483.653	31.6	-3.3	1.5	327.0	3.0	20.0	Vert	AV	0.0	48.3	54.0	-5.7	High Ch, EUT Vert, Ant 1
2483.897	31.4	-3.3	1.14	286.0	3.0	20.0	Vert	AV	0.0	48.1	54.0	-5.9	High Ch, EUT on Side, Ant 1
2483.907	31.3	-3.3	1.5	221.0	3.0	20.0	Horz	AV	0.0	48.0	54.0	-6.0	High Ch, EUT on Side, Ant 1
2483.657	31.3	-3.3	1.5	187.0	3.0	20.0	Horz	AV	0.0	48.0	54.0	-6.0	High Ch, EUT Vert, Ant 1
2389.783	31.4	-3.4	3.47	211.0	3.0	20.0	Vert	AV	0.0	48.0	54.0	-6.0	Low Ch, EUT Vert, Ant 1
2389.880	31.4	-3.4	1.84	286.0	3.0	20.0	Horz	AV	0.0	48.0	54.0	-6.0	Low Ch, EUT Horz, Ant 1
2483.570	31.2	-3.3	1.5	63.0	3.0	20.0	Vert	AV	0.0	47.9	54.0	-6.1	High Ch, EUT Horz, Ant 1
2483.870	43.1	-3.3	1.14	286.0	3.0	20.0	Vert	PK	0.0	59.8	74.0	-14.2	High Ch, EUT on Side, Ant 1
2483.630	42.8	-3.3	1.5	63.0	3.0	20.0	Vert	PK	0.0	59.5	74.0	-14.5	High Ch, EUT Horz, Ant 1
2484.233	42.7	-3.3	1.5	187.0	3.0	20.0	Horz	PK	0.0	59.4	74.0	-14.6	High Ch, EUT Vert, Ant 1
2483.553	42.4	-3.3	1.5	308.0	3.0	20.0	Horz	PK	0.0	59.1	74.0	-14.9	High Ch, EUT Horz, Ant 1
2484.273	42.4	-3.3	1.5	221.0	3.0	20.0	Horz	PK	0.0	59.1	74.0	-14.9	High Ch, EUT on Side, Ant 1
2484.960	42.4	-3.3	1.5	327.0	3.0	20.0	Vert	PK	0.0	59.1	74.0	-14.9	High Ch, EUT Vert, Ant 1
2388.640	42.4	-3.4	1.84	286.0	3.0	20.0	Horz	PK	0.0	59.0	74.0	-15.0	Low Ch, EUT Horz, Ant 1
2388.410	41.9	-3.4	3.47	211.0	3.0	20.0	Vert	PK	0.0	58.5	74.0	-15.5	Low Ch, EUT Vert, Ant 1

SPURIOUS RADIATED EMISSIONS

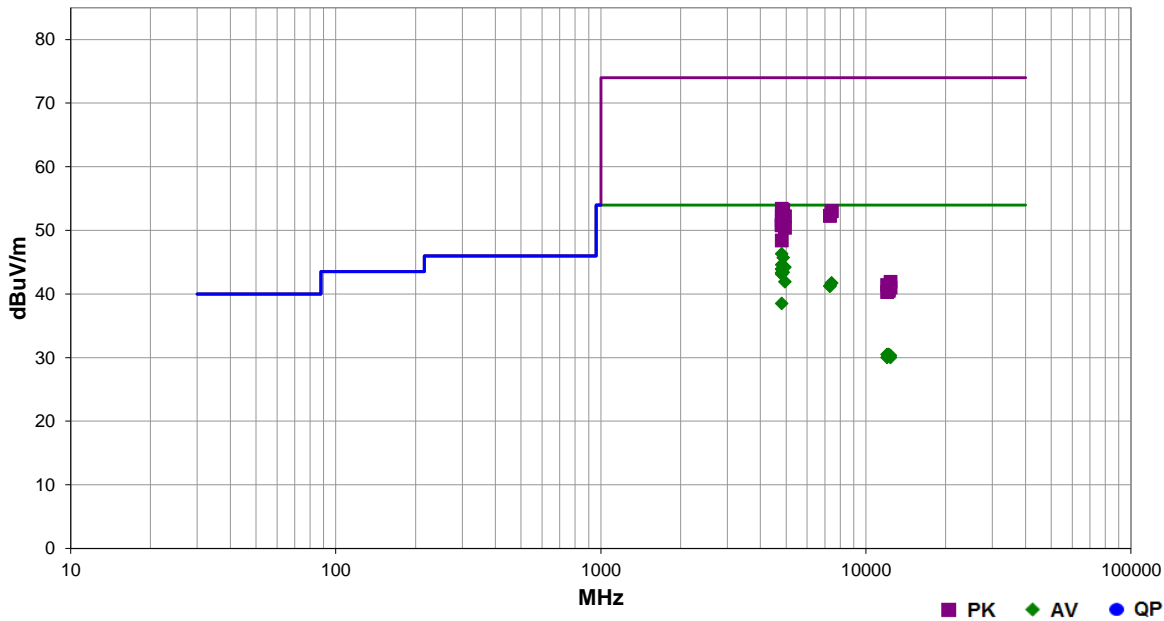


EmiRS 2019.08.15.1 PSA-ESCI 2019.11.08.1

Work Order:	PRCO0113	Date:	2020-03-27	
Project:	None	Temperature:	21.9 °C	
Job Site:	EV01	Humidity:	34.7% RH	
Serial Number:	B7	Barometric Pres.:	1017 mbar	
EUT:	PRECOlink			
Configuration:	1			
Customer:	Preco, Inc.			
Attendees:	None			
EUT Power:	12 VDC			
Operating Mode:	Continuous Tx, O-QPSK, Antenna 2, Low Ch. 11 = 2405 MHz, Mid Ch. 18 = 2440 MHz, High Ch. 25 = 2475 MHz, Power Setting = 0x32			
Deviations:	None			
Comments:	See comments below for Channel, EUT orientation, and Antenna Port			

Test Specifications	Test Method
FCC 15.247:2020	ANSI C63.10:2013

Run #	12	Test Distance (m)	3	Antenna Height(s)	1 to 4(m)	Results	Pass
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Freq (MHz)	Amplitude (dBuV)	Factor (dB)	Antenna Height (meters)	Azimuth (degrees)	Test Distance (meters)	External Attenuation (dB)	Polarity/Transducer Type	Detector	Distance Adjustment (dB)	Adjusted (dBuV/m)	Spec. Limit (dBuV/m)	Compared to Spec. (dB)	Comments
4810.917	40.6	5.7	2.23	42.0	3.0	0.0	Horz	AV	0.0	46.3	54.0	-7.7	Low Ch, EUT on Side, Ant 2
4880.917	39.1	6.6	2.22	37.0	3.0	0.0	Horz	AV	0.0	45.7	54.0	-8.3	Mid Ch, EUT on Side, Ant 2
4810.900	38.9	5.7	2.2	296.0	3.0	0.0	Horz	AV	0.0	44.6	54.0	-9.4	Low Ch, EUT Horz, Ant 2
4950.933	37.5	6.7	2.16	32.0	3.0	0.0	Horz	AV	0.0	44.2	54.0	-9.8	High Ch, EUT on Side, Ant 2
4809.083	38.2	5.7	3.05	323.0	3.0	0.0	Horz	AV	0.0	43.9	54.0	-10.1	Low Ch, EUT Vert, Ant 2
4880.933	36.8	6.6	3.88	360.0	3.0	0.0	Vert	AV	0.0	43.4	54.0	-10.6	Mid Ch, EUT Horz, Ant 2
4808.983	37.6	5.7	1.51	156.0	3.0	0.0	Vert	AV	0.0	43.3	54.0	-10.7	Low Ch, EUT Vert, Ant 2
4810.867	37.4	5.7	2.33	268.0	3.0	0.0	Vert	AV	0.0	43.1	54.0	-10.9	Low Ch, EUT Horz, Ant 2
4950.925	35.2	6.7	3.81	343.0	3.0	0.0	Vert	AV	0.0	41.9	54.0	-12.1	High Ch, EUT Horz, Ant 2
7422.800	27.8	13.9	1.5	64.0	3.0	0.0	Horz	AV	0.0	41.7	54.0	-12.3	High Ch, EUT on Side, Ant 2
7423.650	27.8	13.9	1.5	274.0	3.0	0.0	Vert	AV	0.0	41.7	54.0	-12.3	High Ch, EUT Horz, Ant 2
7322.150	28.2	13.1	1.5	242.0	3.0	0.0	Vert	AV	0.0	41.3	54.0	-12.7	Mid Ch, EUT Horz, Ant 2
7320.542	28.1	13.1	1.5	280.0	3.0	0.0	Horz	AV	0.0	41.2	54.0	-12.8	Mid Ch, EUT on Side, Ant 2
4810.842	32.8	5.7	1.5	255.0	3.0	0.0	Vert	AV	0.0	38.5	54.0	-15.5	Low Ch, EUT on Side, Ant 2
4810.842	47.7	5.7	2.23	42.0	3.0	0.0	Horz	PK	0.0	53.4	74.0	-20.6	Low Ch, EUT on Side, Ant 2
4878.825	46.6	6.6	2.22	37.0	3.0	0.0	Horz	PK	0.0	53.2	74.0	-20.8	Mid Ch, EUT on Side, Ant 2
7424.617	39.1	13.9	1.5	64.0	3.0	0.0	Horz	PK	0.0	53.0	74.0	-21.0	High Ch, EUT on Side, Ant 2
7422.908	39.1	13.9	1.5	274.0	3.0	0.0	Vert	PK	0.0	53.0	74.0	-21.0	High Ch, EUT Horz, Ant 2
4810.967	46.6	5.7	2.2	296.0	3.0	0.0	Horz	PK	0.0	52.3	74.0	-21.7	Low Ch, EUT Horz, Ant 2
7317.567	39.3	13.0	1.5	242.0	3.0	0.0	Vert	PK	0.0	52.3	74.0	-21.7	Mid Ch, EUT Horz, Ant 2

Freq (MHz)	Amplitude (dBuV)	Factor (dB)	Antenna Height (meters)	Azimuth (degrees)	Test Distance (meters)	External Attenuation (dB)	Polarity/ Transducer Type	Detector	Distance Adjustment (dB)	Adjusted (dBuV/m)	Spec. Limit (dBuV/m)	Compared to Spec. (dB)	Comments
7317.942	39.3	13.0	1.5	280.0	3.0	0.0	Horz	PK	0.0	52.3	74.0	-21.7	Mid Ch, EUT on Side, Ant 2
4950.842	45.5	6.7	2.16	32.0	3.0	0.0	Horz	PK	0.0	52.2	74.0	-21.8	High Ch, EUT on Side, Ant 2
4880.792	45.4	6.6	3.88	360.0	3.0	0.0	Vert	PK	0.0	52.0	74.0	-22.0	Mid Ch, EUT Horz, Ant 2
4811.075	45.8	5.7	3.05	323.0	3.0	0.0	Horz	PK	0.0	51.5	74.0	-22.5	Low Ch, EUT Vert, Ant 2
4811.083	45.3	5.7	1.51	156.0	3.0	0.0	Vert	PK	0.0	51.0	74.0	-23.0	Low Ch, EUT Vert, Ant 2
4808.950	45.1	5.7	2.33	268.0	3.0	0.0	Vert	PK	0.0	50.8	74.0	-23.2	Low Ch, EUT Horz, Ant 2
12020.150	29.5	1.0	1.5	360.0	3.0	0.0	Horz	AV	0.0	30.5	54.0	-23.5	Low Ch, EUT on Side, Ant 2
12202.900	29.7	0.8	1.5	309.0	3.0	0.0	Horz	AV	0.0	30.5	54.0	-23.5	Mid Ch, EUT on Side, Ant 2
12196.070	29.6	0.8	1.5	359.0	3.0	0.0	Vert	AV	0.0	30.4	54.0	-23.6	Mid Ch, EUT Horz, Ant 2
4948.817	43.7	6.7	3.81	343.0	3.0	0.0	Vert	PK	0.0	50.4	74.0	-23.6	High Ch, EUT Horz, Ant 2
12376.040	29.3	1.0	1.2	189.0	3.0	0.0	Vert	AV	0.0	30.3	54.0	-23.7	High Ch, EUT Horz, Ant 2
12021.700	29.0	1.0	3.78	115.0	3.0	0.0	Vert	AV	0.0	30.0	54.0	-24.0	Low Ch, EUT Horz, Ant 2
12374.970	29.0	1.0	3.74	255.0	3.0	0.0	Horz	AV	0.0	30.0	54.0	-24.0	High Ch, EUT on Side, Ant 2
4811.192	42.7	5.7	1.5	255.0	3.0	0.0	Vert	PK	0.0	48.4	74.0	-25.6	Low Ch, EUT on Side, Ant 2
12373.900	40.9	1.0	1.2	189.0	3.0	0.0	Vert	PK	0.0	41.9	74.0	-32.1	High Ch, EUT Horz, Ant 2
12022.470	40.4	1.0	1.5	360.0	3.0	0.0	Horz	PK	0.0	41.4	74.0	-32.6	Low Ch, EUT on Side, Ant 2
12375.990	40.0	1.0	3.74	255.0	3.0	0.0	Horz	PK	0.0	41.0	74.0	-33.0	High Ch, EUT on Side, Ant 2
12201.180	40.0	0.8	1.5	359.0	3.0	0.0	Vert	PK	0.0	40.8	74.0	-33.2	Mid Ch, EUT Horz, Ant 2
12202.280	39.7	0.8	1.5	309.0	3.0	0.0	Horz	PK	0.0	40.5	74.0	-33.5	Mid Ch, EUT on Side, Ant 2
12028.170	39.3	1.0	3.78	115.0	3.0	0.0	Vert	PK	0.0	40.3	74.0	-33.7	Low Ch, EUT Horz, Ant 2

SPURIOUS RADIATED EMISSIONS

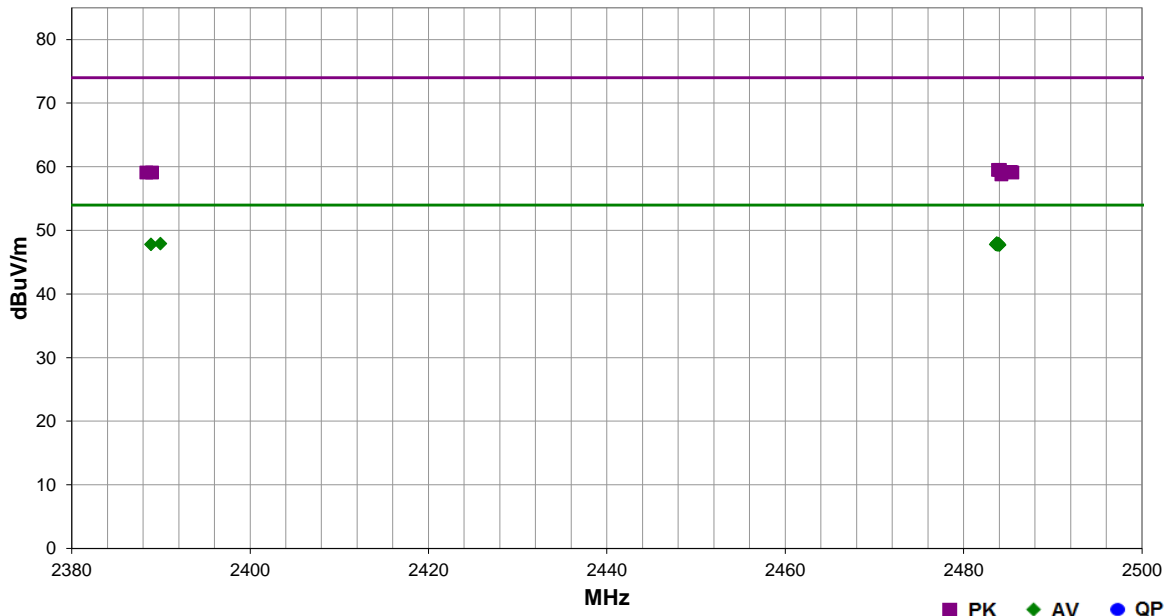


EmiRS 2019.08.15.1 PSA-ESCI2019.11.08.1

Work Order:	PRCO0113	Date:	2020-03-27	
Project:	None	Temperature:	21.9 °C	
Job Site:	EV01	Humidity:	34.7% RH	
Serial Number:	B7	Barometric Pres.:	1017 mbar	
EUT:	PRECOlink			
Configuration:	1			
Customer:	Preco, Inc.			
Attendees:	None			
EUT Power:	12 VDC			
Operating Mode:	Continuous Tx, O-QPSK, Antenna 2, Low Ch. 11 = 2405 MHz, Mid Ch. 18 = 2440 MHz, High Ch. 25 = 2475 MHz, Power Setting = 0x32			
Deviations:	None			
Comments:	See comments below for Channel, EUT orientation, and Antenna Port			

Test Specifications	Test Method
FCC 15.247:2020	ANSI C63.10:2013

Run #	17	Test Distance (m)	3	Antenna Height(s)	1 to 4(m)	Results	Pass
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Freq (MHz)	Amplitude (dBuV)	Factor (dB)	Antenna Height (meters)	Azimuth (degrees)	Test Distance (meters)	External Attenuation (dB)	Polarity/Transducer Type	Detector	Distance Adjustment (dB)	Adjusted (dBuV/m)	Spec. Limit (dBuV/m)	Compared to Spec. (dB)	Comments
2483.727	31.3	-3.3	2.66	38.0	3.0	20.0	Horz	AV	0.0	48.0	54.0	-6.0	High Ch, EUT Vert, Ant 2
2483.937	31.2	-3.3	1.5	184.0	3.0	20.0	Horz	AV	0.0	47.9	54.0	-6.1	High Ch, EUT on Side, Ant 2
2389.943	31.3	-3.4	1.5	112.0	3.0	20.0	Horz	AV	0.0	47.9	54.0	-6.1	Low Ch, EUT Vert, Ant 2
2483.600	31.1	-3.3	1.5	147.0	3.0	20.0	Horz	AV	0.0	47.8	54.0	-6.2	High Ch, EUT Horz, Ant 2
2388.903	31.2	-3.4	3.43	213.0	3.0	20.0	Vert	AV	0.0	47.8	54.0	-6.2	Low Ch, EUT Vert, Ant 2
2483.763	31.0	-3.3	1.5	110.0	3.0	20.0	Vert	AV	0.0	47.7	54.0	-6.3	High Ch, EUT Horz, Ant 2
2483.960	31.0	-3.3	1.5	324.0	3.0	20.0	Vert	AV	0.0	47.7	54.0	-6.3	High Ch, EUT on Side, Ant 2
2484.043	31.0	-3.3	1.89	52.0	3.0	20.0	Vert	AV	0.0	47.7	54.0	-6.3	High Ch, EUT Vert, Ant 2
2484.070	42.8	-3.3	1.5	147.0	3.0	20.0	Horz	PK	0.0	59.5	74.0	-14.5	High Ch, EUT Horz, Ant 2
2483.847	42.8	-3.3	2.66	38.0	3.0	20.0	Horz	PK	0.0	59.5	74.0	-14.5	High Ch, EUT Vert, Ant 2
2484.950	42.5	-3.3	1.5	110.0	3.0	20.0	Vert	PK	0.0	59.2	74.0	-14.8	High Ch, EUT Horz, Ant 2
2485.287	42.5	-3.3	1.5	184.0	3.0	20.0	Horz	PK	0.0	59.2	74.0	-14.8	High Ch, EUT on Side, Ant 2
2485.470	42.4	-3.3	1.89	52.0	3.0	20.0	Vert	PK	0.0	59.1	74.0	-14.9	High Ch, EUT Vert, Ant 2
2388.370	42.5	-3.4	1.5	112.0	3.0	20.0	Horz	PK	0.0	59.1	74.0	-14.9	Low Ch, EUT Vert, Ant 2
2389.003	42.5	-3.4	3.43	213.0	3.0	20.0	Vert	PK	0.0	59.1	74.0	-14.9	Low Ch, EUT Vert, Ant 2
2484.240	42.1	-3.3	1.5	324.0	3.0	20.0	Vert	PK	0.0	58.8	74.0	-15.2	High Ch, EUT on Side, Ant 2

SPURIOUS RADIATED EMISSIONS

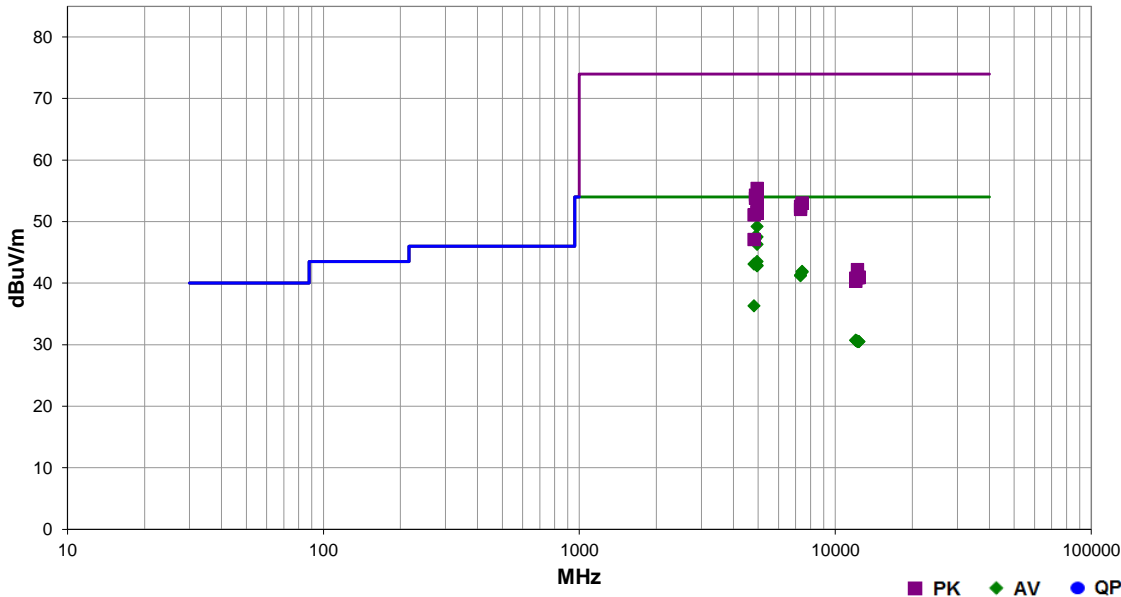


EmiRS 2019.08.15.1 PSA-ESCI 2019.11.08.1

Work Order:	PRCO0113	Date:	2020-03-27	
Project:	None	Temperature:	21.9 °C	
Job Site:	EV01	Humidity:	34.7% RH	
Serial Number:	B7	Barometric Pres.:	1017 mbar	
EUT:	PRECOlink			
Configuration:	1			
Customer:	Preco, Inc.			
Attendees:	None			
EUT Power:	12 VDC			
Operating Mode:	Continuous Tx, O-QPSK, Externl Antenna, Low Ch. 11 = 2405 MHz, Mid Ch. 18 = 2440 MHz, High Ch. 25 = 2475 MHz, Power Setting = 0x32			
Deviations:	None			
Comments:	See comments below for Channel, EUT orientation, and Antenna Port			

Test Specifications	Test Method
FCC 15.247:2020	ANSI C63.10:2013

Run #	29	Test Distance (m)	3	Antenna Height(s)	1 to 4(m)	Results	Pass
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Freq (MHz)	Amplitude (dBuV)	Factor (dB)	Antenna Height (meters)	Azimuth (degrees)	Test Distance (meters)	External Attenuation (dB)	Polarity/Transducer Type	Detector	Distance Adjustment (dB)	Adjusted (dBuV/m)	Spec. Limit (dBuV/m)	Compared to Spec. (dB)	Comments
4950.875	42.5	6.7	2.2	36.0	3.0	0.0	Horz	AV	0.0	49.2	54.0	-4.8	High Ch, EUT on Side, External Ant
4879.017	41.0	6.6	2.97	34.0	3.0	0.0	Horz	AV	0.0	47.6	54.0	-6.4	Mid Ch, EUT on Side, External Ant
4950.992	40.8	6.7	3.16	0.0	3.0	0.0	Vert	AV	0.0	47.5	54.0	-6.5	High Ch, EUT Horz, External Ant
4880.933	40.6	6.6	2.84	353.0	3.0	0.0	Vert	AV	0.0	47.2	54.0	-6.8	Mid Ch, EUT Horz, External Ant
4949.058	39.6	6.7	1.06	341.0	3.0	0.0	Vert	AV	0.0	46.3	54.0	-7.7	High Ch, EUT Vert, External Ant
4950.917	36.8	6.7	2.15	138.0	3.0	0.0	Horz	AV	0.0	43.5	54.0	-10.5	High Ch, EUT Horz, External Ant
4810.958	37.4	5.7	2.66	344.0	3.0	0.0	Vert	AV	0.0	43.1	54.0	-10.9	Low Ch, EUT Horz, External Ant
4950.892	36.2	6.7	1.21	354.0	3.0	0.0	Vert	AV	0.0	42.9	54.0	-11.1	High Ch, EUT on Side, External Ant
4950.850	36.1	6.7	1.78	117.0	3.0	0.0	Horz	AV	0.0	42.8	54.0	-11.2	High Ch, EUT Vert, External Ant
7424.275	28.0	13.9	1.5	208.0	3.0	0.0	Horz	AV	0.0	41.9	54.0	-12.1	High Ch, EUT on Side, External Ant
7427.150	28.0	13.8	1.16	45.0	3.0	0.0	Vert	AV	0.0	41.8	54.0	-12.2	High Ch, EUT Horz, External Ant
7317.692	28.3	13.0	1.5	203.0	3.0	0.0	Horz	AV	0.0	41.3	54.0	-12.7	Mid Ch, EUT on Side, External Ant
7317.942	28.2	13.0	1.5	6.0	3.0	0.0	Vert	AV	0.0	41.2	54.0	-12.8	Mid Ch, EUT Horz, External Ant
4810.867	30.6	5.7	1.5	56.0	3.0	0.0	Horz	AV	0.0	36.3	54.0	-17.7	Low Ch, EUT on Side, External Ant
4948.875	48.7	6.7	2.2	36.0	3.0	0.0	Horz	PK	0.0	55.4	74.0	-18.6	High Ch, EUT on Side, External Ant
4881.083	47.7	6.6	2.97	34.0	3.0	0.0	Horz	PK	0.0	54.3	74.0	-19.7	Mid Ch, EUT on Side, External Ant
4950.833	47.3	6.7	3.16	0.0	3.0	0.0	Vert	PK	0.0	54.0	74.0	-20.0	High Ch, EUT Horz, External Ant
4878.967	47.2	6.6	2.84	353.0	3.0	0.0	Vert	PK	0.0	53.8	74.0	-20.2	Mid Ch, EUT Horz, External Ant
4951.092	46.7	6.7	1.06	341.0	3.0	0.0	Vert	PK	0.0	53.4	74.0	-20.6	High Ch, EUT Vert, External Ant
7423.842	39.1	13.9	1.5	208.0	3.0	0.0	Horz	PK	0.0	53.0	74.0	-21.0	High Ch, EUT on Side, External Ant
7424.775	39.1	13.9	1.16	45.0	3.0	0.0	Vert	PK	0.0	53.0	74.0	-21.0	High Ch, EUT Horz, External Ant
7319.717	39.4	13.1	1.5	203.0	3.0	0.0	Horz	PK	0.0	52.5	74.0	-21.5	Mid Ch, EUT on Side, External Ant
7321.125	38.9	13.1	1.5	6.0	3.0	0.0	Vert	PK	0.0	52.0	74.0	-22.0	Mid Ch, EUT Horz, External Ant

Freq (MHz)	Amplitude (dBuV)	Factor (dB)	Antenna Height (meters)	Azimuth (degrees)	Test Distance (meters)	External Attenuation (dB)	Polarity/ Transducer Type	Detector	Distance Adjustment (dB)	Adjusted (dBuV/m)	Spec. Limit (dBuV/m)	Compared to Spec. (dB)	Comments
4950.975	45.3	6.7	2.15	138.0	3.0	0.0	Horz	PK	0.0	52.0	74.0	-22.0	High Ch, EUT Horz, External Ant
4950.892	44.8	6.7	1.78	117.0	3.0	0.0	Horz	PK	0.0	51.5	74.0	-22.5	High Ch, EUT Vert, External Ant
4950.908	44.7	6.7	1.21	354.0	3.0	0.0	Vert	PK	0.0	51.4	74.0	-22.6	High Ch, EUT on Side, External Ant
4810.975	45.4	5.7	2.66	344.0	3.0	0.0	Vert	PK	0.0	51.1	74.0	-22.9	Low Ch, EUT Horz, External Ant
12021.520	29.7	1.0	1.5	204.0	3.0	0.0	Horz	AV	0.0	30.7	54.0	-23.3	Low Ch, EUT on Side, External Ant
12020.200	29.7	1.0	1.5	204.0	3.0	0.0	Vert	AV	0.0	30.7	54.0	-23.3	Low Ch, EUT Horz, External Ant
12203.080	29.8	0.8	1.5	356.0	3.0	0.0	Horz	AV	0.0	30.6	54.0	-23.4	Mid Ch, EUT on Side, External Ant
12202.870	29.7	0.8	1.5	51.0	3.0	0.0	Vert	AV	0.0	30.5	54.0	-23.5	Mid Ch, EUT Horz, External Ant
12376.680	29.5	1.0	1.5	313.0	3.0	0.0	Horz	AV	0.0	30.5	54.0	-23.5	High Ch, EUT on Side, External Ant
12375.620	29.5	1.0	1.5	110.0	3.0	0.0	Vert	AV	0.0	30.5	54.0	-23.5	High Ch, EUT Horz, External Ant
4811.133	41.4	5.7	1.5	56.0	3.0	0.0	Horz	PK	0.0	47.1	74.0	-26.9	Low Ch, EUT on Side, External Ant
12202.700	41.4	0.8	1.5	356.0	3.0	0.0	Horz	PK	0.0	42.2	74.0	-31.8	Mid Ch, EUT on Side, External Ant
12377.980	40.0	1.0	1.5	110.0	3.0	0.0	Vert	PK	0.0	41.0	74.0	-33.0	High Ch, EUT Horz, External Ant
12200.080	40.1	0.8	1.5	51.0	3.0	0.0	Vert	PK	0.0	40.9	74.0	-33.1	Mid Ch, EUT Horz, External Ant
12373.050	39.9	1.0	1.5	313.0	3.0	0.0	Horz	PK	0.0	40.9	74.0	-33.1	High Ch, EUT on Side, External Ant
12026.650	39.8	1.0	1.5	204.0	3.0	0.0	Horz	PK	0.0	40.8	74.0	-33.2	Low Ch, EUT on Side, External Ant
12026.880	39.3	1.0	1.5	204.0	3.0	0.0	Vert	PK	0.0	40.3	74.0	-33.7	Low Ch, EUT Horz, External Ant

SPURIOUS RADIATED EMISSIONS

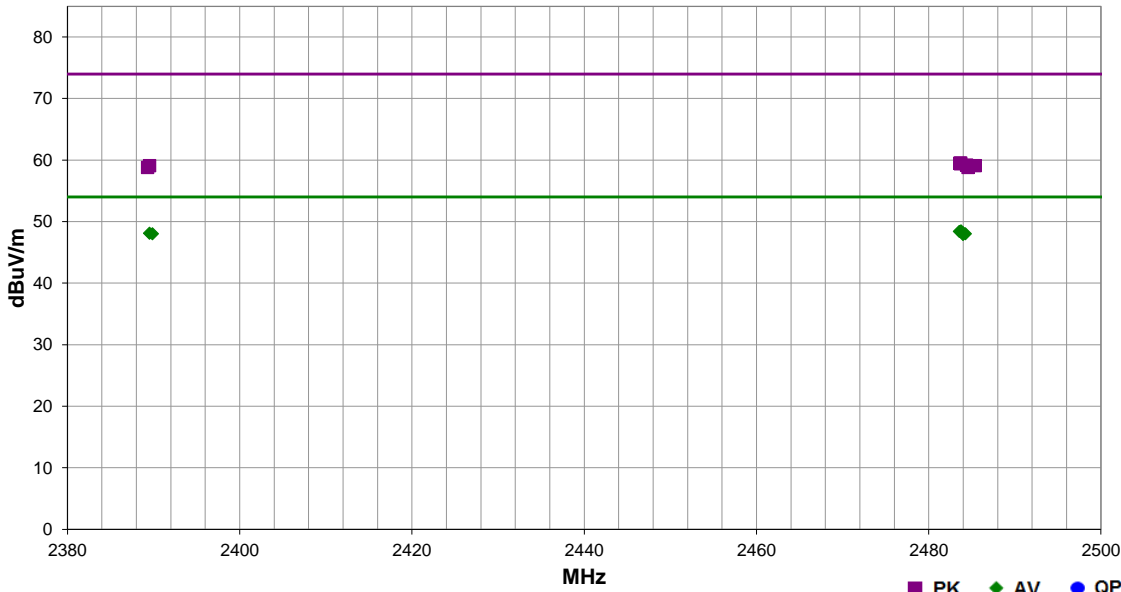


EmiRS 2019.08.15.1 PSA-ESCI 2019.11.08.1

Work Order:	PRCO0113	Date:	2020-03-27	
Project:	None	Temperature:	21.9 °C	
Job Site:	EV01	Humidity:	34.7% RH	
Serial Number:	B7	Barometric Pres.:	1017 mbar	
EUT:	PRECOlink			
Configuration:	1			
Customer:	Preco, Inc.			
Attendees:	None			
EUT Power:	12 VDC			
Operating Mode:	Continuous Tx, O-QPSK, Externl Antenna, Low Ch. 11 = 2405 MHz, Mid Ch. 18 = 2440 MHz, High Ch. 25 = 2475 MHz, Power Setting = 0x32			
Deviations:	None			
Comments:	See comments below for Channel, EUT orientation, and Antenna Port			

Test Specifications	Test Method
FCC 15.247:2020	ANSI C63.10:2013

Run #	31	Test Distance (m)	3	Antenna Height(s)	1 to 4(m)	Results	Pass
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Freq (MHz)	Amplitude (dBuV)	Factor (dB)	Antenna Height (meters)	Azimuth (degrees)	Test Distance (meters)	External Attenuation (dB)	Polarity/ Transducer Type	Detector	Distance Adjustment (dB)	Adjusted (dBuV/m)	Spec. Limit (dBuV/m)	Compared to Spec. (dB)	Comments
2483.747	31.8	-3.3	1.2	299.0	3.0	20.0	Horz	AV	0.0	48.5	54.0	-5.5	High Ch, EUT on Side, External Ant
2483.570	31.7	-3.3	1.5	212.0	3.0	20.0	Vert	AV	0.0	48.4	54.0	-5.6	High Ch, EUT Vert, External Ant
2483.957	31.5	-3.3	1.5	191.0	3.0	20.0	Horz	AV	0.0	48.2	54.0	-5.8	High Ch, EUT Horz, External Ant
2484.000	31.4	-3.3	1.5	298.0	3.0	20.0	Vert	AV	0.0	48.1	54.0	-5.9	High Ch, EUT Horz, External Ant
2389.523	31.5	-3.4	1.4	230.0	3.0	20.0	Vert	AV	0.0	48.1	54.0	-5.9	Low Ch, EUT Vert, External Ant
2484.263	31.3	-3.3	1.5	135.0	3.0	20.0	Horz	AV	0.0	48.0	54.0	-6.0	High Ch, EUT Vert, External Ant
2389.880	31.4	-3.4	1.5	286.0	3.0	20.0	Horz	AV	0.0	48.0	54.0	-6.0	Low Ch, EUT on Side, External Ant
2483.987	31.2	-3.3	1.22	122.0	3.0	20.0	Vert	AV	0.0	47.9	54.0	-6.1	High Ch, EUT on Side, External Ant
2483.723	42.8	-3.3	1.5	298.0	3.0	20.0	Vert	PK	0.0	59.5	74.0	-14.5	High Ch, EUT Horz, External Ant
2483.637	42.8	-3.3	1.2	299.0	3.0	20.0	Horz	PK	0.0	59.5	74.0	-14.5	High Ch, EUT on Side, External Ant
2483.690	42.7	-3.3	1.5	212.0	3.0	20.0	Vert	PK	0.0	59.4	74.0	-14.6	High Ch, EUT Vert, External Ant
2484.383	42.5	-3.3	1.5	191.0	3.0	20.0	Horz	PK	0.0	59.2	74.0	-14.8	High Ch, EUT Horz, External Ant
2485.383	42.4	-3.3	1.22	122.0	3.0	20.0	Vert	PK	0.0	59.1	74.0	-14.9	High Ch, EUT on Side, External Ant
2389.530	42.5	-3.4	1.4	230.0	3.0	20.0	Vert	PK	0.0	59.1	74.0	-14.9	Low Ch, EUT Vert, External Ant
2484.570	42.1	-3.3	1.5	135.0	3.0	20.0	Horz	PK	0.0	58.8	74.0	-15.2	High Ch, EUT Vert, External Ant
2389.303	42.2	-3.4	1.5	286.0	3.0	20.0	Horz	PK	0.0	58.8	74.0	-15.2	Low Ch, EUT on Side, External Ant