



element

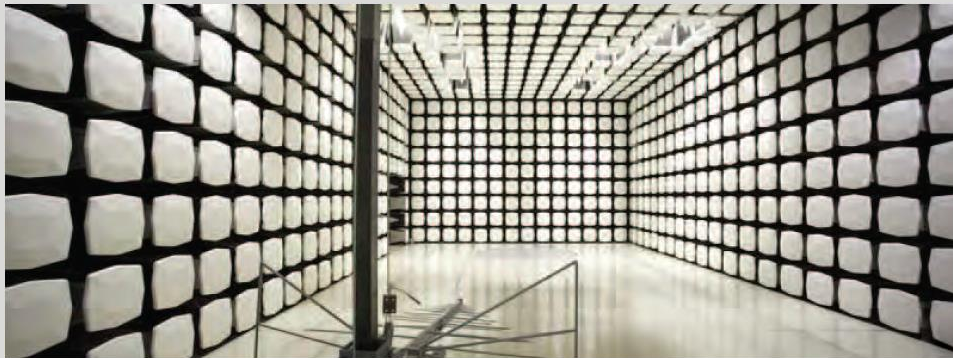
ESCO Corporation

GET Detect Bucket Module 4265507

FCC 15.247:2019

Bluetooth Low Energy (DTS) Radio

Report # ESCO0012.1



NVLAP LAB CODE: 200630-0



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More: <https://www.bis.doc.gov/index.php/forms-documents/regulations-docs/14-commerce-country-chart/fileT>

CERTIFICATE OF TEST

Last Date of Test: December 19, 2018
ESCO Corporation
Model: GET Detect Bucket Module 4265507

Radio Equipment Testing

Standards

Specification	Method
FCC 15.247:2019	ANSI C63.10:2013, KDB 558074

Results

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

Deviations From Test Standards

None

Approved By:



Kyle Holgate, Operations Manager

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

REVISION HISTORY



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

ACCREDITATIONS AND AUTHORIZATIONS



United States

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

A2LA - 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

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

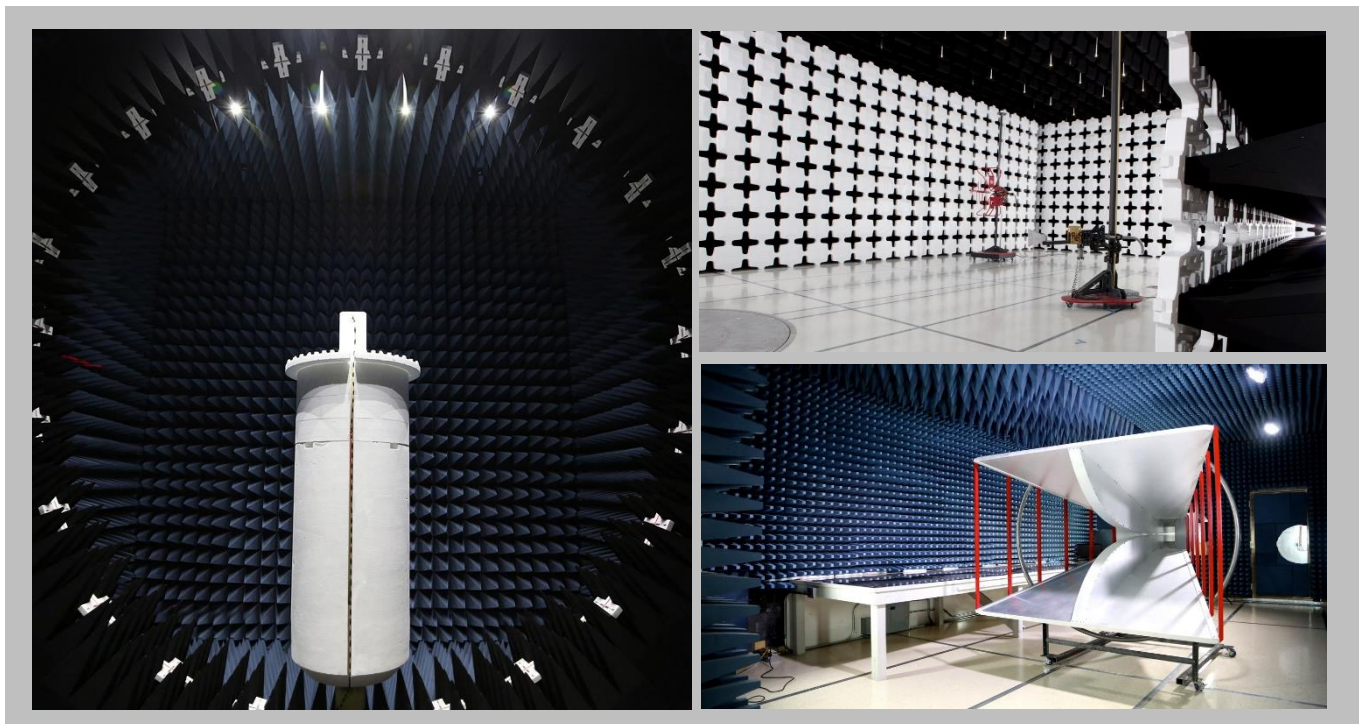
For details on the Scopes of our Accreditations, please visit:

<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	New York Labs NY01-04 4939 Jordan Rd. Elbridge, NY 13060 (315) 554-8214	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: 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	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/RRR, MIC, MOC, NCC, OFCA					
US0158	US0175	N/A	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 (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

Test Setup Block Diagrams

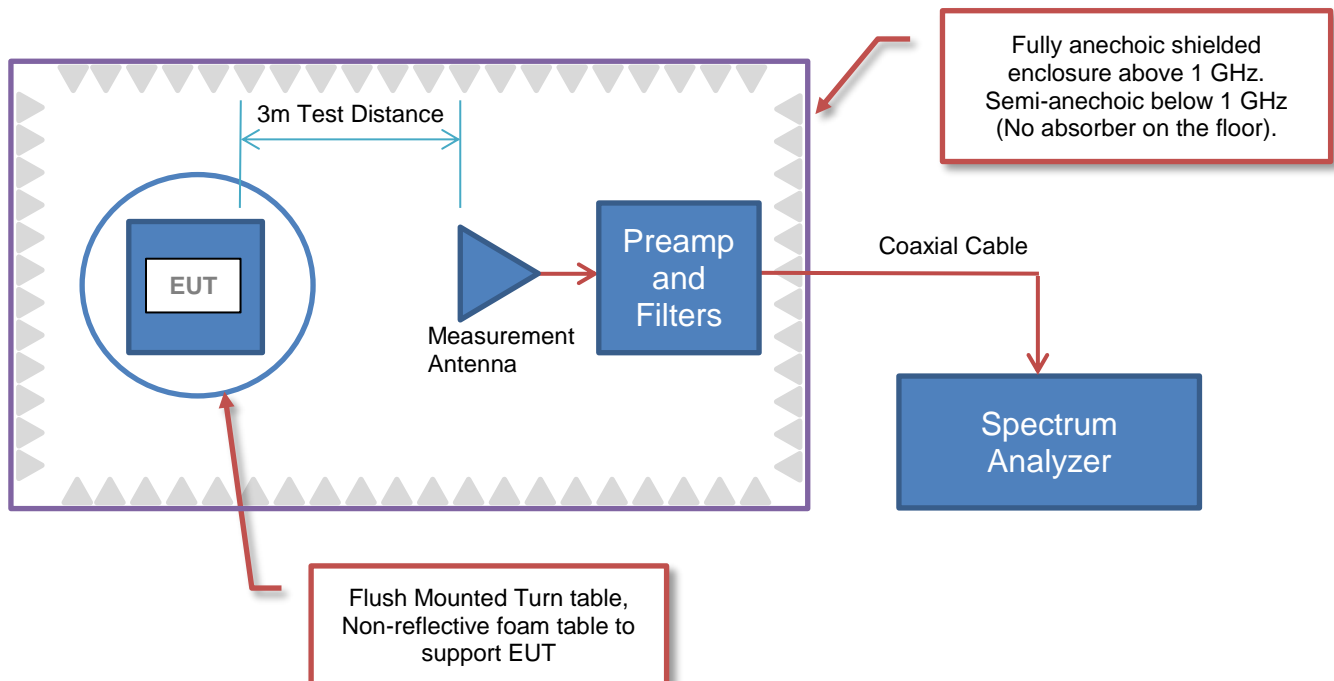
Antenna Port Conducted Measurements



Near Field Test Fixture Measurements



Spurious Radiated Emissions



PRODUCT DESCRIPTION



Client and Equipment Under Test (EUT) Information

Company Name:	ESCO Corporation
Address:	Building #3 2141 NW 25th Ave.
City, State, Zip:	Portland, OR 97210
Test Requested By:	Jason Betournay
Model:	GET Detect Bucket Module 4265507
First Date of Test:	December 18, 2018
Last Date of Test:	December 19, 2018
Receipt Date of Samples:	December 18, 2018
Equipment Design Stage:	Production
Equipment Condition:	No Damage
Purchase Authorization:	Verified

Information Provided by the Party Requesting the Test

Functional Description of the EUT:
Battery operated telemetry sensor (BTLE Radio)
Testing Objective:
To demonstrate compliance of the Bluetooth Low Energy (DTS) radio to FCC 15.247 requirements.

CONFIGURATIONS



Configuration ESCO0008- 1

Software/Firmware Running during test	
Description	Version
nRF Connect	4.22.1

EUT			
Description	Manufacturer	Model/Part Number	Serial Number
Battery operated telemetry sensor (BTLE Radio)	ESCO Corporation	GET Detect Bucket Module 4265507	None

MODIFICATIONS

Equipment Modifications

Item	Date	Test	Modification	Note	Disposition of EUT
1	2018-12-18	Spurious Radiated Emissions	Tested as delivered to Test Station.	No EMI suppression devices were added or modified during this test.	EUT remained at Element following the test.
2	2018-12-19	Occupied Bandwidth	Tested as delivered to Test Station.	No EMI suppression devices were added or modified during this test.	EUT remained at Element following the test.
3	2018-12-19	Output Power	Tested as delivered to Test Station.	No EMI suppression devices were added or modified during this test.	EUT remained at Element following the test.
4	2018-12-19	Equivalent Isotropic Radiated Power	Tested as delivered to Test Station.	No EMI suppression devices were added or modified during this test.	EUT remained at Element following the test.
5	2018-12-19	Power Spectral Density	Tested as delivered to Test Station.	No EMI suppression devices were added or modified during this test.	EUT remained at Element following the test.
6	2018-12-19	Band Edge Compliance	Tested as delivered to Test Station.	No EMI suppression devices were added or modified during this test.	EUT remained at Element following the test.
7	2018-12-19	Spurious Conducted Emissions	Tested as delivered to Test Station.	No EMI suppression devices were added or modified during this test.	Scheduled testing was completed.

POWER SETTINGS



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

SETTINGS FOR ALL TESTS IN THIS REPORT

Modulation Types / Data Rates	Type	Channel	Frequency (MHz)	Power Setting
BLE	DTS	0	2402	0
		20	2442	0
		39	2480	0

SPURIOUS RADIATED EMISSIONS



PSA-ESCI 2018.07.27

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

BTLE continuous TX, Low Channel = 2402 MHz, Mid Channel = 2442 MHz, High Channel = 2480 MHz, Software power setting = 0

POWER SETTINGS INVESTIGATED

Battery

CONFIGURATIONS INVESTIGATED

ESCO0008 - 2

FREQUENCY RANGE INVESTIGATED

Start Frequency	30 MHz	Stop Frequency	26.5 MHz
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SAMPLE CALCULATIONS

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

TEST EQUIPMENT

Description	Manufacturer	Model	ID	Last Cal.	Interval
Cable	ESM Cable Corp.	KMKM-72	EVY	24-Aug-2018	12 mo
Amplifier - Pre-Amplifier	Miteq	AMF-6F-18002650-25-10P	AVU	24-Aug-2018	12 mo
Antenna - Standard Gain	ETS Lindgren	3160-09	AIV	NCR	0 mo
Amplifier - Pre-Amplifier	Miteq	AMF-6F-12001800-30-10P	AVD	24-Nov-2018	12 mo
Antenna - Standard Gain	ETS Lindgren	3160-08	AHV	NCR	0 mo
Cable	None	Standard Gain Horns Cable	EVF	24-Nov-2018	12 mo
Amplifier - Pre-Amplifier	L-3 Narda-MITEQ	AMF-6F-08001200-30-10P	PAO	24-Nov-2018	12 mo
Antenna - Standard Gain	ETS Lindgren	3160-07	AHU	NCR	0 mo
Cable	N/A	Double Ridge Horn Cables	EVB	24-Nov-2018	12 mo
Amplifier - Pre-Amplifier	Miteq	AMF-3D-00100800-32-13P	PAG	24-Nov-2018	12 mo
Antenna - Double Ridge	ETS Lindgren	3115	AIZ	7-Feb-2018	24 mo
Attenuator	Coaxicom	3910-20	AXZ	28-Feb-2018	12 mo
Filter - Low Pass	Micro-Tronics	LPM50004	LFD	28-Feb-2018	12 mo
Cable	N/A	Bilog Cables	EVA	24-Nov-2018	12 mo
Amplifier - Pre-Amplifier	Miteq	AM-1616-1000	AOL	24-Nov-2018	12 mo
Antenna - Biconilog	Teseq	CBL 6141B	AXR	2-Oct-2018	24 mo
Analyzer - Spectrum Analyzer	Agilent	E4446A	AAQ	18-Mar-2018	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.

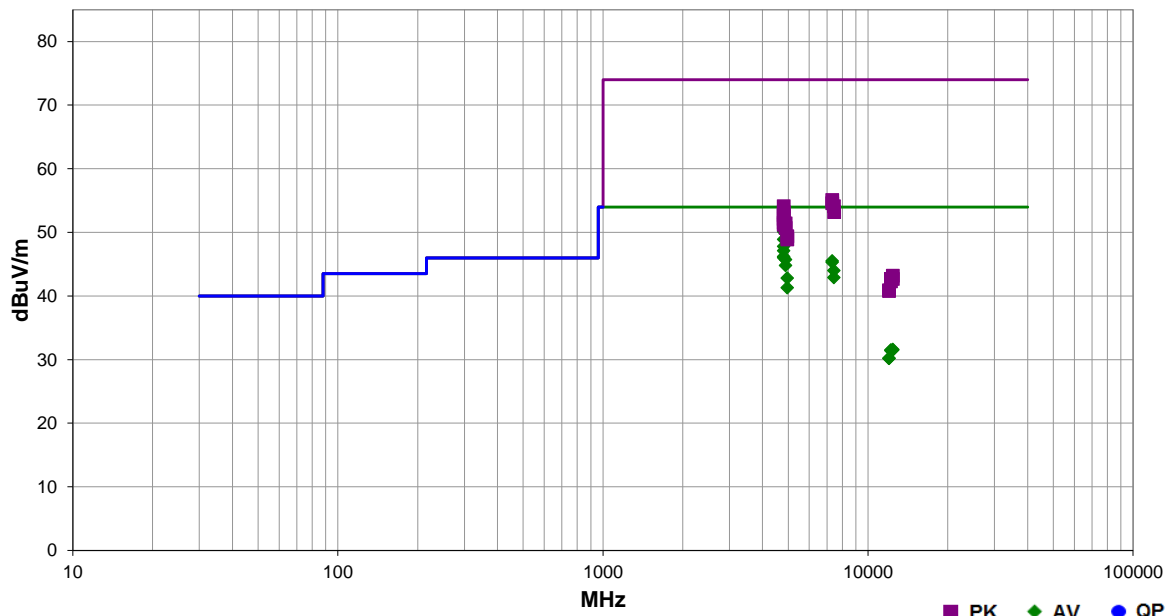
SPURIOUS RADIATED EMISSIONS



Work Order:	ESCO0008	Date:	18-Dec-2018	
Project:	None	Temperature:	20 °C	
Job Site:	EV01	Humidity:	46.3% RH	
Serial Number:	None	Barometric Pres.:	1011 mbar	
EUT:	GET Detect Bucket Module 4265507			Tested by: Jeff Alcock
Configuration:	2			
Customer:	ESCO Corporation			
Attendees:	Jason Betournay			
EUT Power:	Battery			
Operating Mode:	BTLE continuous TX, Low Channel = 2402 MHz, Mid Channel = 2442 MHz, High Channel = 2480 MHz, Software power setting = 0			
Deviations:	None			
Comments:	See comments below for Channel, EUT, and EUT orientation.			

Test Specifications	Test Method
FCC 15.247:2018	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)
4803.850	45.6	4.5	1.1	200.0	3.0	0.0	Vert	AV	0.0	50.1	54.0	-3.9
4803.808	44.4	4.5	1.0	48.0	3.0	0.0	Horz	AV	0.0	48.9	54.0	-5.1
4803.833	43.3	4.5	3.5	169.0	3.0	0.0	Horz	AV	0.0	47.8	54.0	-6.2
4803.900	42.6	4.5	1.9	36.0	3.0	0.0	Vert	AV	0.0	47.1	54.0	-6.9
4803.867	41.7	4.5	1.8	271.0	3.0	0.0	Horz	AV	0.0	46.2	54.0	-7.8
4803.842	41.5	4.5	1.0	271.0	3.0	0.0	Vert	AV	0.0	46.0	54.0	-8.0
4883.867	40.3	5.4	2.8	120.0	3.0	0.0	Horz	AV	0.0	45.7	54.0	-8.3
7325.220	32.3	13.2	1.4	107.0	3.0	0.0	Horz	AV	0.0	45.5	54.0	-8.5
7325.137	32.1	13.2	2.1	203.0	3.0	0.0	Vert	AV	0.0	45.3	54.0	-8.7
4883.790	39.4	5.4	2.2	153.0	3.0	0.0	Vert	AV	0.0	44.8	54.0	-9.2
7439.267	29.8	14.2	1.6	229.0	3.0	0.0	Horz	AV	0.0	44.0	54.0	-10.0
7440.367	28.7	14.2	1.4	245.0	3.0	0.0	Vert	AV	0.0	42.9	54.0	-11.1
4959.817	37.2	5.6	2.4	296.0	3.0	0.0	Vert	AV	0.0	42.8	54.0	-11.2
4959.817	35.7	5.6	4.0	244.0	3.0	0.0	Horz	AV	0.0	41.3	54.0	-12.7
7326.290	41.9	13.2	2.1	203.0	3.0	0.0	Vert	PK	0.0	55.1	74.0	-18.9
7325.563	41.4	13.2	1.4	107.0	3.0	0.0	Horz	PK	0.0	54.6	74.0	-19.4
4803.500	49.6	4.5	1.1	200.0	3.0	0.0	Vert	PK	0.0	54.1	74.0	-19.9
7438.917	39.9	14.2	1.6	229.0	3.0	0.0	Horz	PK	0.0	54.1	74.0	-19.9
4803.792	48.7	4.5	1.0	48.0	3.0	0.0	Horz	PK	0.0	53.2	74.0	-20.8
7442.242	39.0	14.2	1.4	245.0	3.0	0.0	Vert	PK	0.0	53.2	74.0	-20.8

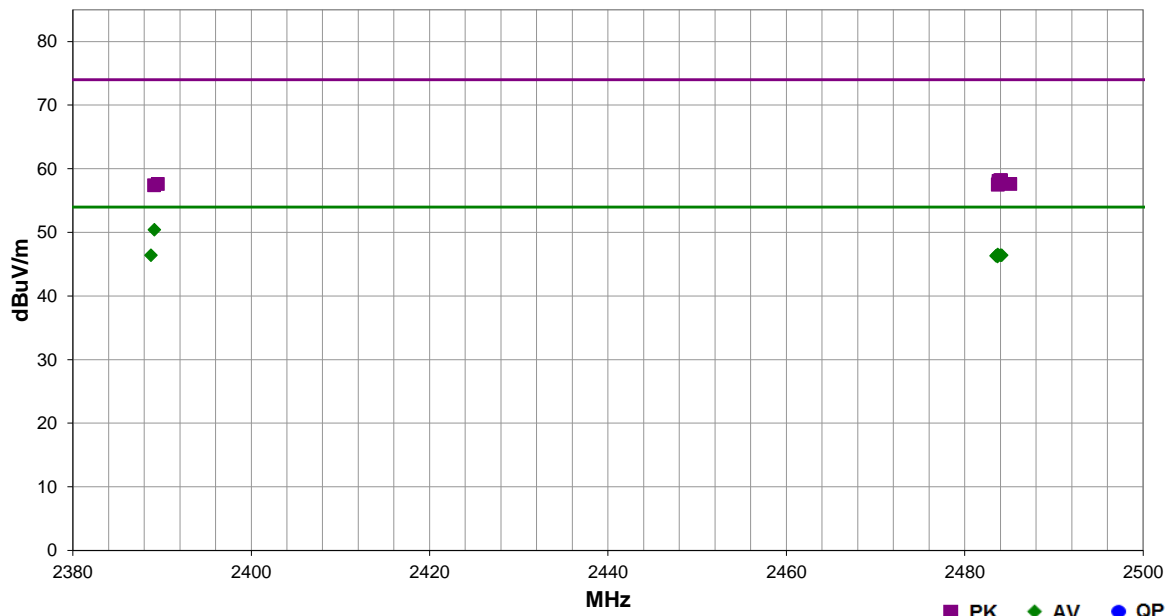
SPURIOUS RADIATED EMISSIONS



Work Order:	ESCO0008	Date:	18-Dec-2018	<small>EmiR5 2018.09.26</small> <small>PSA-ESCI 2018.07.27</small>
Project:	None	Temperature:	20 °C	
Job Site:	EV01	Humidity:	46.3% RH	
Serial Number:	None	Barometric Pres.:	1011 mbar	
EUT:	GET Detect Bucket Module 4265507			Tested by: Jeff Alcock
Configuration:	2			
Customer:	ESCO Corporation			
Attendees:	Jason Betournay			
EUT Power:	Battery			
Operating Mode:	BTLE continuous TX, Low Channel = 2402 MHz, Mid Channel = 2442 MHz, High Channel = 2480 MHz, Software power setting = 0			
Deviations:	None			
Comments:	See comments below for Channel, EUT, and EUT orientation.			

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

Run #	21	Test Distance (m)	3	Antenna Height(s)	1 to 4(m)	Results	Pass
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Freq (MHz)	Amplitude (dBuV)	Factor (dB)	Antenna Height (meters)	Azimuth (degrees)	Test Distance (meters)	External Attenuation (dB)	Polarity/Transducer Type	Detector	Distance Adjustment (dB)	Adjusted (dBuV/m)	Spec. Limit (dBuV/m)	Compared to Spec. (dB)
2389.137	35.5	-5.1	1.0	196.0	3.0	20.0	Horz	AV	0.0	50.4	54.0	-3.6
2483.697	31.4	-4.9	1.0	59.0	3.0	20.0	Horz	AV	0.0	46.5	54.0	-7.5
2483.670	31.3	-4.9	1.0	252.0	3.0	20.0	Vert	AV	0.0	46.4	54.0	-7.6
2483.990	31.3	-4.9	1.3	187.0	3.0	20.0	Horz	AV	0.0	46.4	54.0	-7.6
2484.147	31.2	-4.8	1.0	360.0	3.0	20.0	Vert	AV	0.0	46.4	54.0	-7.6
2388.763	31.5	-5.1	1.0	31.0	3.0	20.0	Vert	AV	0.0	46.4	54.0	-7.6
2483.503	31.2	-4.9	1.0	114.0	3.0	20.0	Vert	AV	0.0	46.3	54.0	-7.7
2483.683	31.1	-4.9	3.2	189.0	3.0	20.0	Horz	AV	0.0	46.2	54.0	-7.8
2483.980	43.1	-4.9	1.0	252.0	3.0	20.0	Vert	PK	0.0	58.2	74.0	-15.8
2484.057	43.1	-4.9	1.3	187.0	3.0	20.0	Horz	PK	0.0	58.2	74.0	-15.8
2483.783	43.0	-4.9	1.0	59.0	3.0	20.0	Horz	PK	0.0	58.1	74.0	-15.9
2483.770	42.6	-4.9	1.0	360.0	3.0	20.0	Vert	PK	0.0	57.7	74.0	-16.3
2485.093	42.4	-4.8	3.2	189.0	3.0	20.0	Horz	PK	0.0	57.6	74.0	-16.4
2389.537	42.7	-5.1	1.0	31.0	3.0	20.0	Vert	PK	0.0	57.6	74.0	-16.4
2483.713	42.4	-4.9	1.0	114.0	3.0	20.0	Vert	PK	0.0	57.5	74.0	-16.5
2389.103	42.5	-5.1	1.0	196.0	3.0	20.0	Horz	PK	0.0	57.4	74.0	-16.6

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. A direct connection was made between the RF output of the EUT and a spectrum analyzer. Attenuation and a DC block were used

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

The EUT operates at 100% Duty Cycle.

OCCUPIED BANDWIDTH



XMIT 2017.12.13

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

TEST EQUIPMENT

Description	Manufacturer	Model	ID	Last Cal.	Cal. Due
Generator - Signal	Keysight	N5182B	TFU	5-Nov-18	5-Nov-21
Cable	Micro-Coax	UFD150A-1-0720-200200	EVH	23-Apr-18	23-Apr-19
Attenuator	S.M. Electronics	SA26B-20	AUY	16-Apr-18	16-Apr-19
Block - DC	Fairview Microwave	SD3379	AMW	23-Apr-18	23-Apr-19
Analyzer - Spectrum Analyzer	Agilent	N9010A	AFI	12-Jan-18	12-Jan-19

TEST DESCRIPTION


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

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

OCCUPIED BANDWIDTH



TbTx 2018.09.13 XMt 2017.12.13

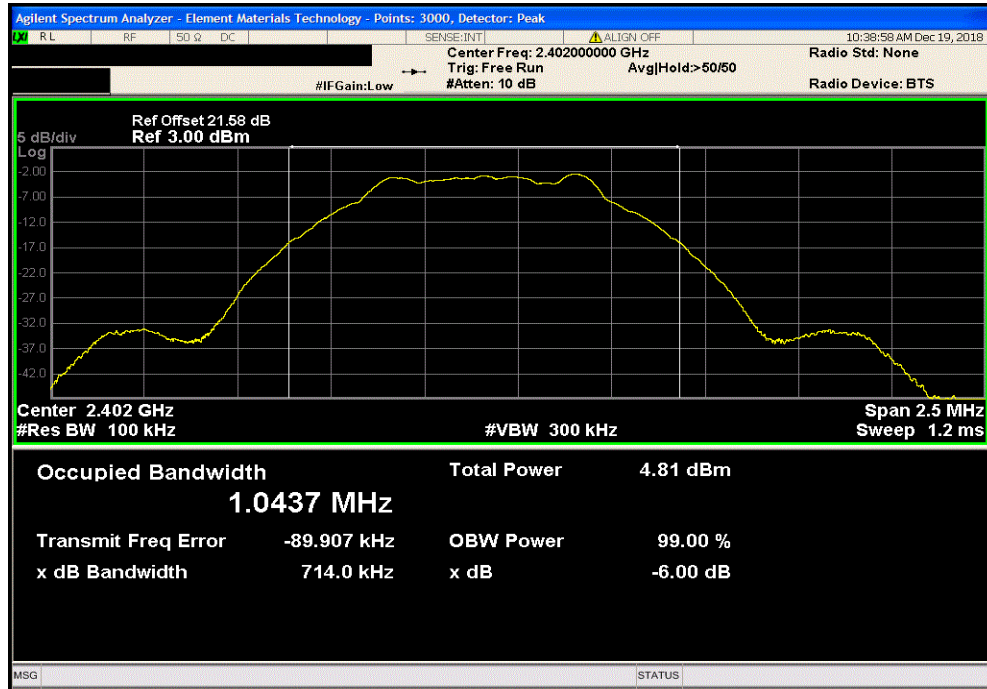
EUT: GET Detect Bucket Module 4265507		Work Order: ESCO0008	
Serial Number: None		Date: 19-Dec-18	
Customer: ESCO Corporation		Temperature: 21.2 °C	
Attendees: Jason Betournay		Humidity: 43.8% RH	
Project: None		Barometric Pres.: 1027 mbar	
Tested by: Jeff Alcock	Power: Battery	Job Site: EV06	
TEST SPECIFICATIONS		Test Method	
FCC 15.247:2018		ANSI C63.10:2013	
COMMENTS			
Reference level offset of 21.58 dB includes measurement cable and 20 dB attenuator. Software power setting = 0.			
DEVIATIONS FROM TEST STANDARD			
None			
Configuration #	1	Signature 	
		Value	Limit (±) Result
Bucket Module			
BLE/GFSK Low Channel, 2402 MHz		714.049 kHz	500 kHz Pass
BLE/GFSK Mid Channel, 2442 MHz		706.544 kHz	500 kHz Pass
BLE/GFSK High Channel, 2480 MHz		710.819 kHz	500 kHz Pass

OCCUPIED BANDWIDTH

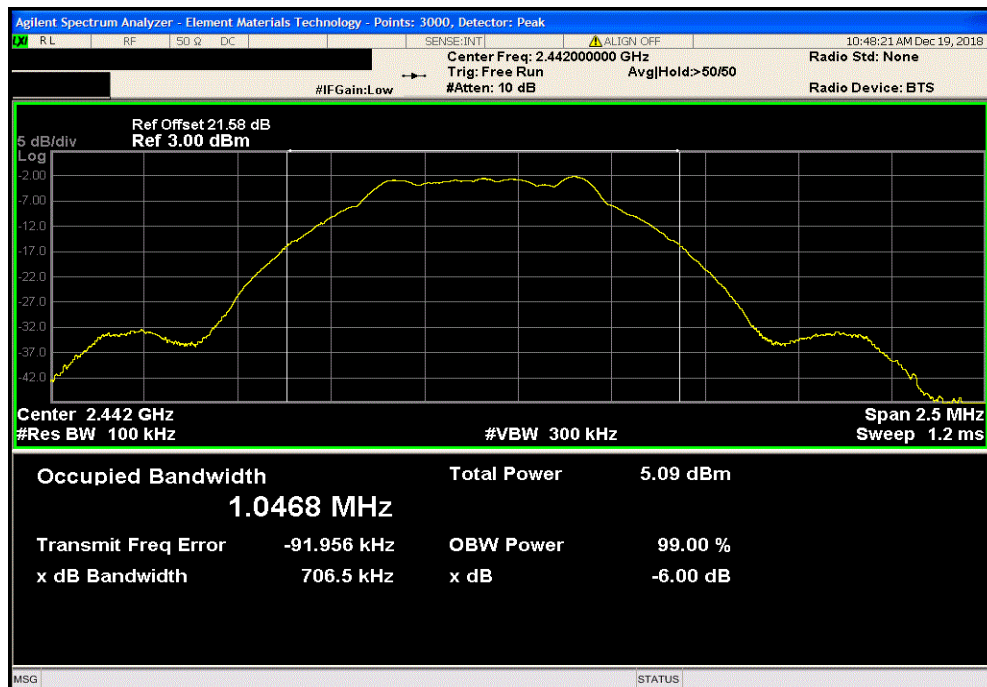


TMTx 2018.09.13 XMI 2017.12.13

Bucket Module, BLE/GFSK Low Channel, 2402 MHz						
	Value	Limit	Result			
	714.049 kHz	500 kHz	Pass			



Bucket Module, BLE/GFSK Mid Channel, 2442 MHz						
	Value	Limit	Result			
	706.544 kHz	500 kHz	Pass			

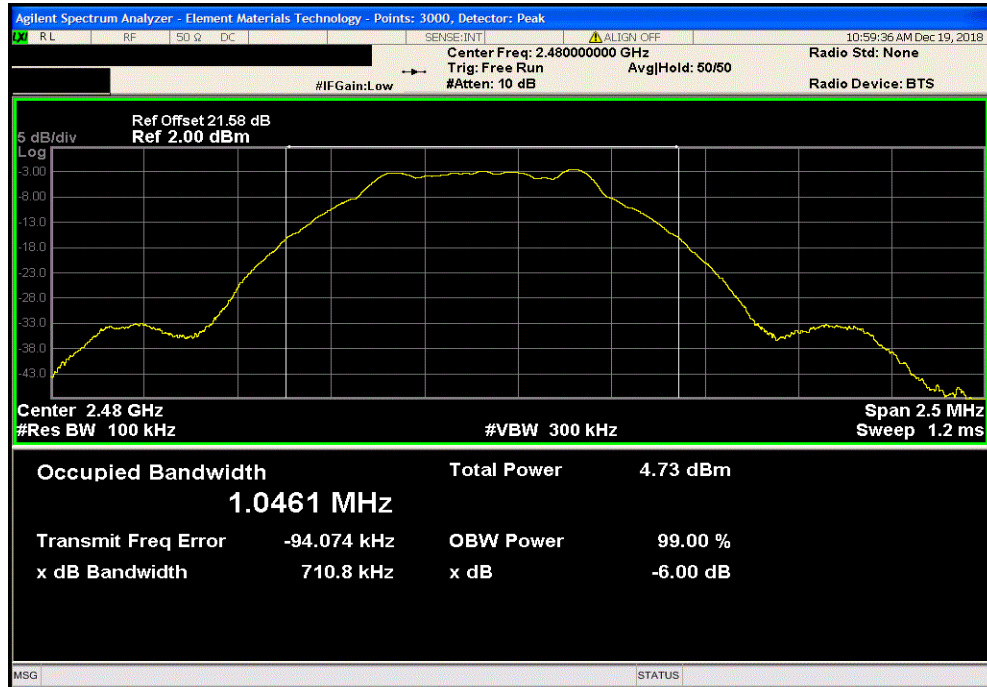


OCCUPIED BANDWIDTH

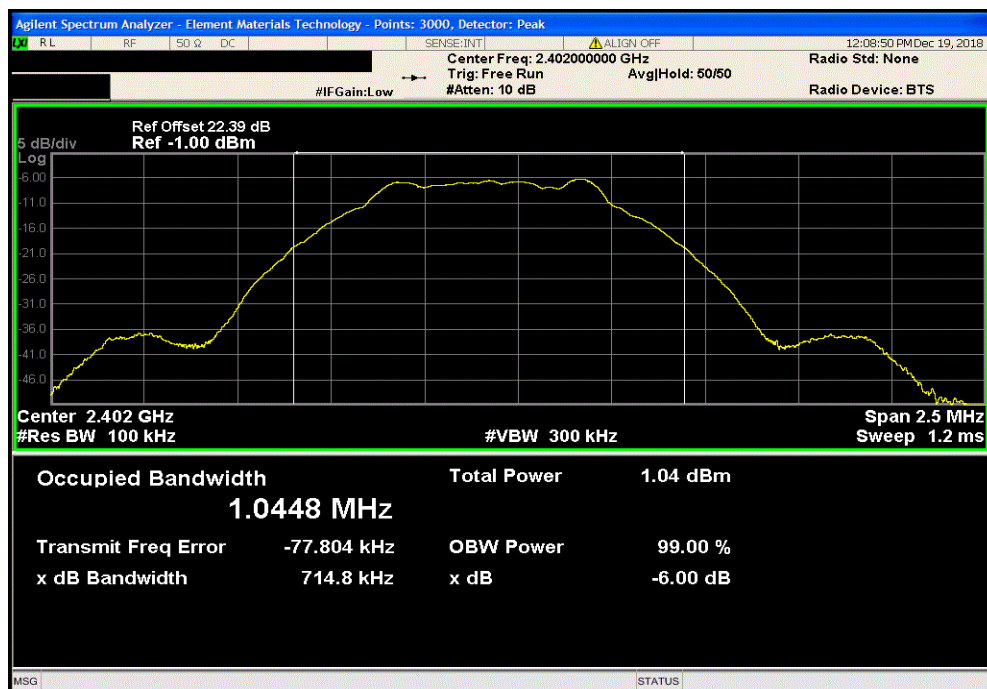


TMTx 2018.09.13 XMI 2017.12.13

Bucket Module, BLE/GFSK High Channel, 2480 MHz						
	Value	Limit	Result			
	710.819 kHz	500 kHz	Pass			



Point Sensor, BLE/GFSK Low Channel, 2402 MHz						
	Value	Limit	Result			
	714.835 kHz	500 kHz	Pass			

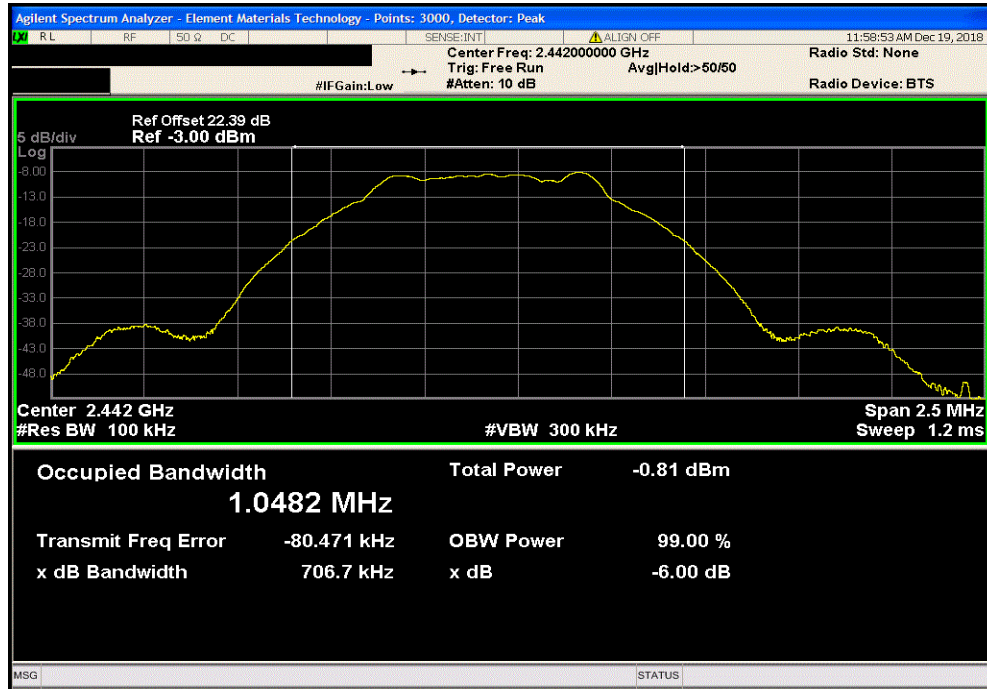


OCCUPIED BANDWIDTH

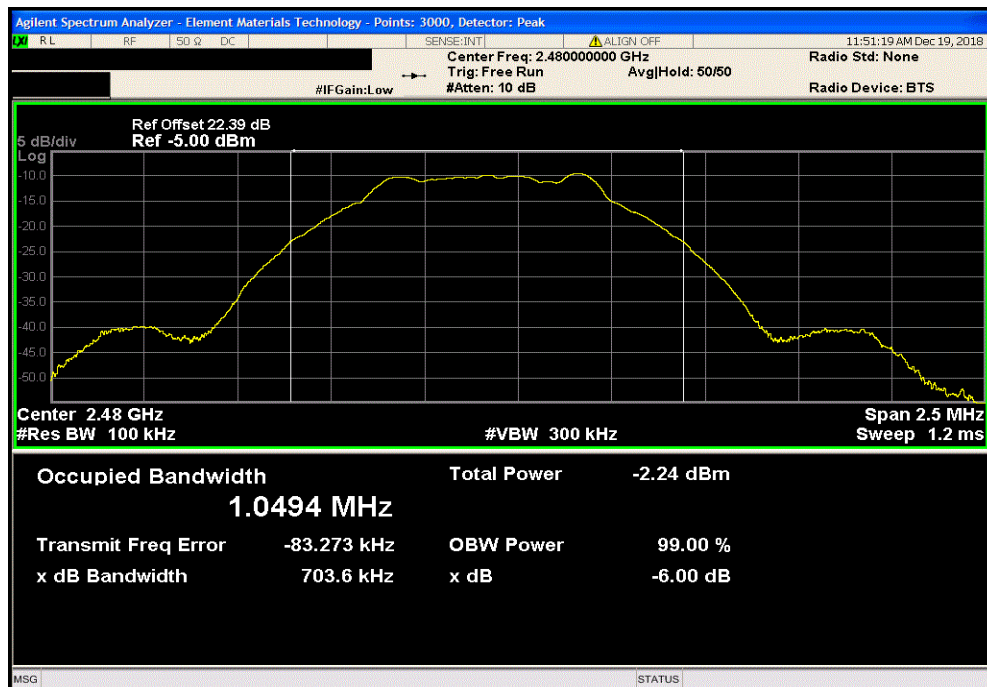


TMTx 2018.09.13 XMt 2017.12.13

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



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



OUTPUT POWER



XMIT 2017.12.13

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

TEST EQUIPMENT

Description	Manufacturer	Model	ID	Last Cal.	Cal. Due
Generator - Signal	Keysight	N5182B	TFU	5-Nov-18	5-Nov-21
Cable	Micro-Coax	UFD150A-1-0720-200200	EVH	23-Apr-18	23-Apr-19
Attenuator	S.M. Electronics	SA26B-20	AUY	16-Apr-18	16-Apr-19
Block - DC	Fairview Microwave	SD3379	AMW	23-Apr-18	23-Apr-19
Analyzer - Spectrum Analyzer	Agilent	N9010A	AFI	12-Jan-18	12-Jan-19

TEST DESCRIPTION

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


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

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

OUTPUT POWER



TbTx 2018.09.13 XMt 2017.12.13

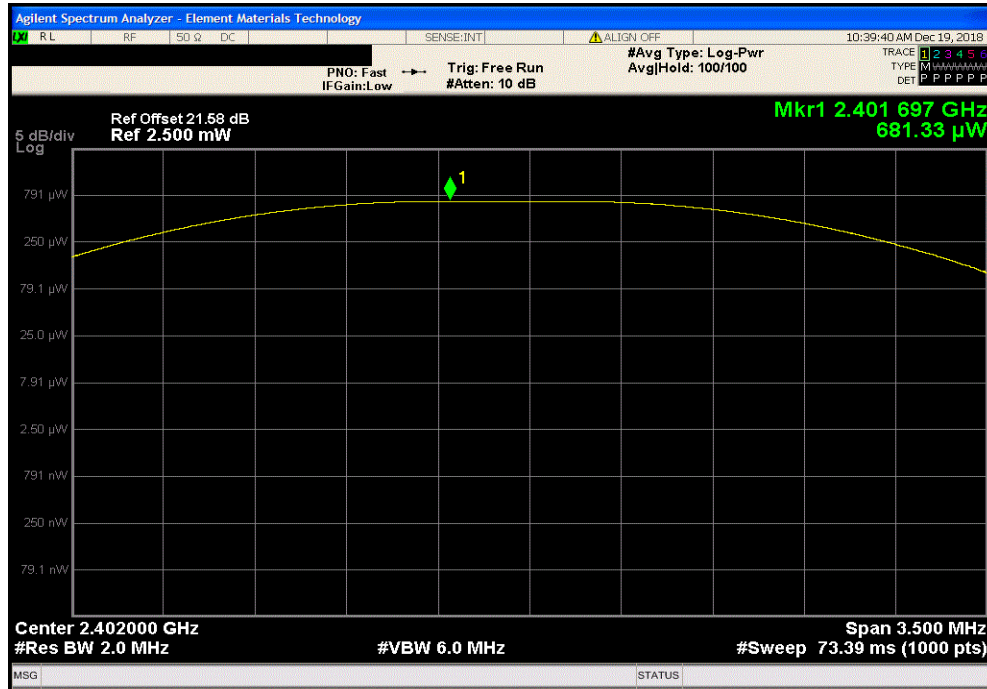
EUT: GET Detect Bucket Module 4265507		Work Order: ESCO0008	
Serial Number: None		Date: 19-Dec-18	
Customer: ESCO Corporation		Temperature: 21.2 °C	
Attendees: Jason Betournay		Humidity: 43.9% RH	
Project: None		Barometric Pres.: 1027 mbar	
Tested by: Jeff Alcock	Power: Battery	Job Site: EV06	
TEST SPECIFICATIONS		Test Method	
FCC 15.247:2018		ANSI C63.10:2013	
COMMENTS			
Reference level offset of 21.58 dB includes measurement cable and 20 dB attenuator. Software power setting = 0.			
DEVIATIONS FROM TEST STANDARD			
None			
Configuration #	1	Signature 	
		Value	Limit (<) Result
Bucket Module			
BLE/GFSK Low Channel, 2402 MHz		681.33 uW	1 W Pass
BLE/GFSK Mid Channel, 2442 MHz		725.06 uW	1 W Pass
BLE/GFSK High Channel, 2480 MHz		667.46 uW	1 W Pass

OUTPUT POWER

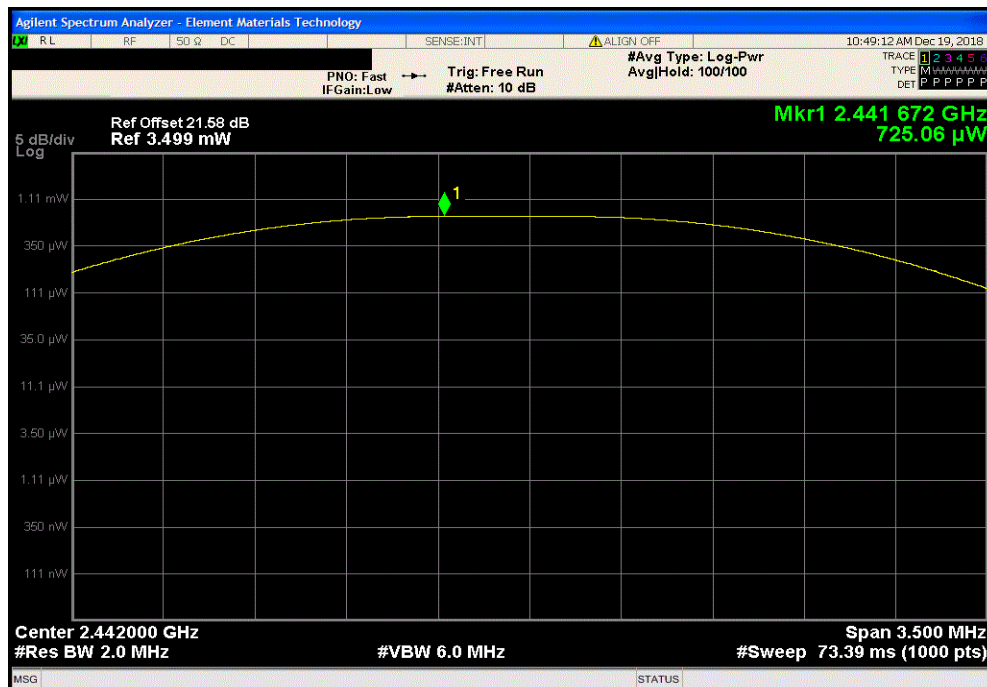


TbTx 2018.09.13 XMt 2017.12.13

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



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

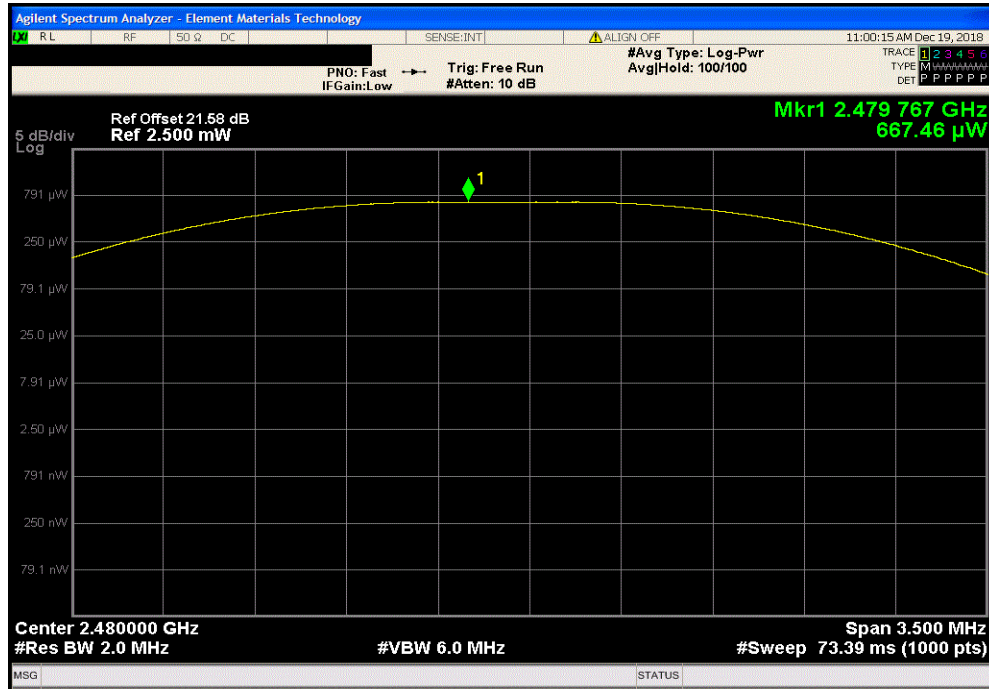


OUTPUT POWER



TbTx 2018.09.13 XMt 2017.12.13

Bucket Module, BLE/GFSK High Channel, 2480 MHz						
				Value	Limit	Result
				667.46 μ W	1 W	Pass



EQUIVALENT ISOTROPIC RADIATED POWER



XMIT 2017.12.13

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

TEST EQUIPMENT

Description	Manufacturer	Model	ID	Last Cal.	Cal. Due
Generator - Signal	Keysight	N5182B	TFU	5-Nov-18	5-Nov-21
Cable	Micro-Coax	UFD150A-1-0720-200200	EVH	23-Apr-18	23-Apr-19
Attenuator	S.M. Electronics	SA26B-20	AUY	16-Apr-18	16-Apr-19
Block - DC	Fairview Microwave	SD3379	AMW	23-Apr-18	23-Apr-19
Analyzer - Spectrum Analyzer	Agilent	N9010A	AFI	12-Jan-18	12-Jan-19

TEST DESCRIPTION

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

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

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

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

EQUIVALENT ISOTROPIC RADIATED POWER



TbTx 2018.09.13 XMt 2017.12.13

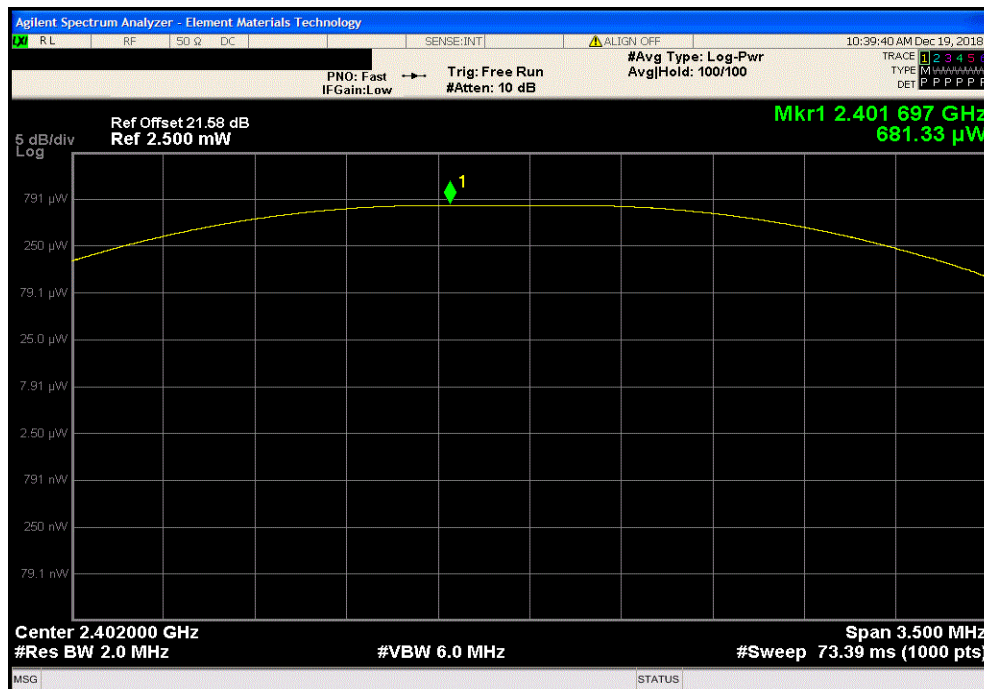
EUT: GET Detect Bucket Module 4265507		Work Order: ESCO0008	
Serial Number: None		Date: 19-Dec-18	
Customer: ESCO Corporation		Temperature: 21.2 °C	
Attendees: Jason Betournay		Humidity: 43.9% RH	
Project: None		Barometric Pres.: 1027 mbar	
Tested by: Jeff Alcock	Power: Battery	Job Site: EV06	
TEST SPECIFICATIONS		Test Method	
FCC 15.247:2018		ANSI C63.10:2013	
COMMENTS			
Reference level offset of 21.58 dB includes measurement cable and 20 dB attenuator. Software power setting = 0.			
DEVIATIONS FROM TEST STANDARD			
None			
Configuration #	1	Signature	
		Value (µW)	Value (dBm)
		Antenna Gain (dBi)	EIRP (dBm)
		Limit (< dBm)	Result
Bucket Module			
BLE/GFSK Low Channel, 2402 MHz		681.33	-1.67
BLE/GFSK Mid Channel, 2442 MHz		725.06	-1.40
BLE/GFSK High Channel, 2480 MHz		667.46	-1.76

EQUIVALENT ISOTROPIC RADIATED POWER

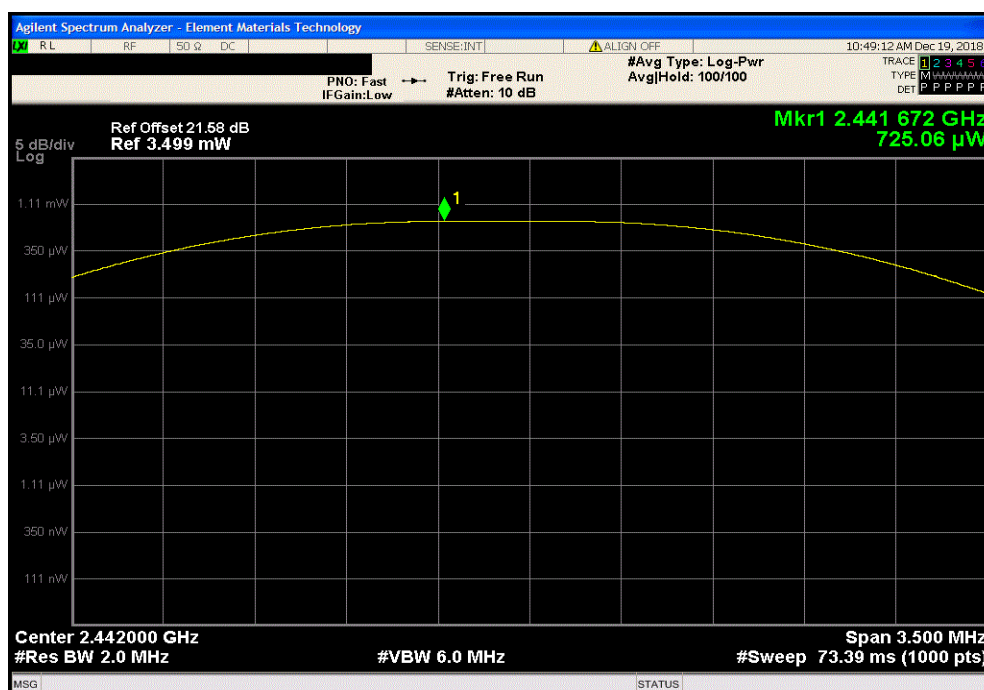


TbTx 2018.09.13 XMI 2017.12.13

Bucket Module, BLE/GFSK Low Channel, 2402 MHz						
Value (μ W)	Value (dBm)	Antenna Gain (dBi)	EIRP (dBm)	Limit (< dBm)	Result	
681.33	-1.67	2	0.33	36	Pass	



Bucket Module, BLE/GFSK Mid Channel, 2442 MHz						
Value (μ W)	Value (dBm)	Antenna Gain (dBi)	EIRP (dBm)	Limit (< dBm)	Result	
725.06	-1.40	2	0.60	36	Pass	

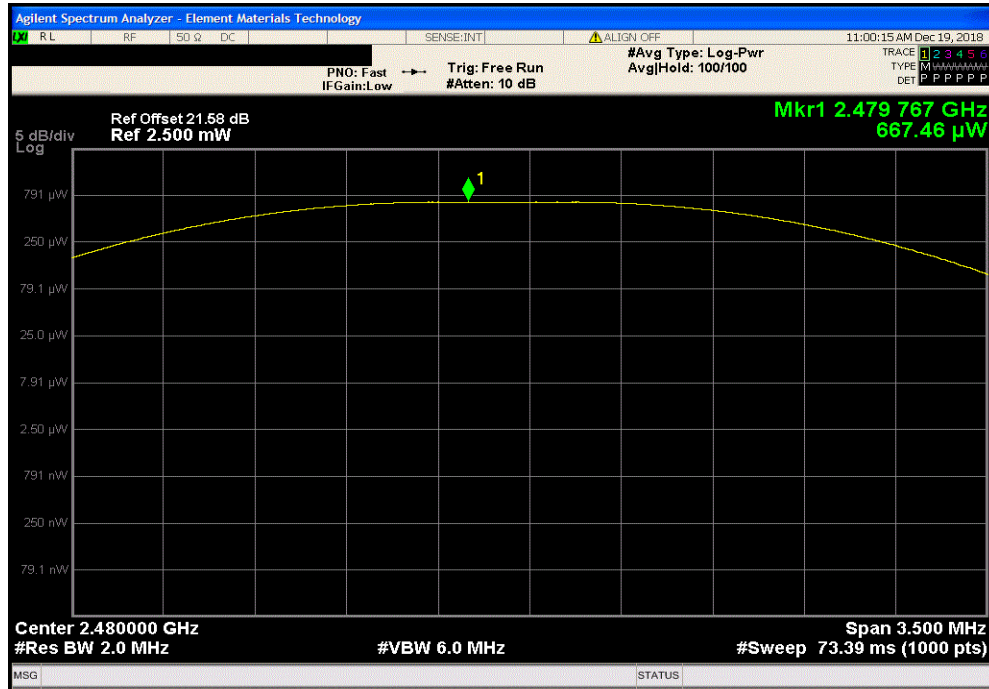


EQUIVALENT ISOTROPIC RADIATED POWER



TbTx 2018.09.13 XMt 2017.12.13

Bucket Module, BLE/GFSK High Channel, 2480 MHz						
Value (μ W)	Value (dBm)	Antenna Gain (dBi)	EIRP (dBm)	Limit (< dBm)	Result	
667.46	-1.76	2	0.24	36	Pass	



POWER SPECTRAL DENSITY



XMit 2017.12.13

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

TEST EQUIPMENT

Description	Manufacturer	Model	ID	Last Cal.	Cal. Due
Generator - Signal	Keysight	N5182B	TFU	5-Nov-18	5-Nov-21
Attenuator	S.M. Electronics	SA26B-20	AUY	16-Apr-18	16-Apr-19
Cable	Micro-Coax	UFD150A-1-0720-200200	EVH	23-Apr-18	23-Apr-19
Block - DC	Fairview Microwave	SD3379	AMW	23-Apr-18	23-Apr-19
Analyzer - Spectrum Analyzer	Agilent	N9010A	AFI	12-Jan-18	12-Jan-19

TEST DESCRIPTION


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

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

POWER SPECTRAL DENSITY



TbTx 2018.09.13 XMt 2017.12.13

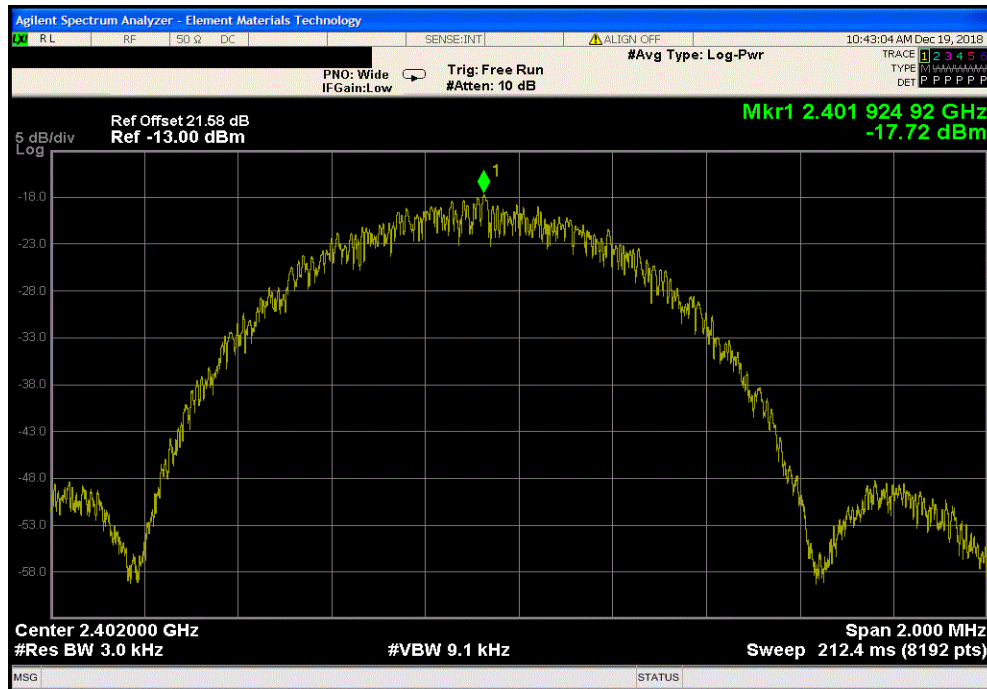
EUT: GET Detect Bucket Module 4265507		Work Order: ESCO0008	
Serial Number: None		Date: 19-Dec-18	
Customer: ESCO Corporation		Temperature: 21.2 °C	
Attendees: Jason Betournay		Humidity: 43.8% RH	
Project: None		Barometric Pres.: 1026 mbar	
Tested by: Jeff Alcock	Power: Battery	Job Site: EV06	
TEST SPECIFICATIONS		Test Method	
FCC 15.247:2018		ANSI C63.10:2013	
COMMENTS			
Reference level offset of 21.58 dB includes measurement cable and 20 dB attenuator. Software power setting = 0.			
DEVIATIONS FROM TEST STANDARD			
None			
Configuration #	1	Signature 	
		Value dBm/3kHz	Limit < dBm/3kHz
Bucket Module			Results
BLE/GFSK Low Channel, 2402 MHz		-17.723	8 Pass
BLE/GFSK Mid Channel, 2442 MHz		-17.404	8 Pass
BLE/GFSK High Channel, 2480 MHz		-17.819	8 Pass

POWER SPECTRAL DENSITY

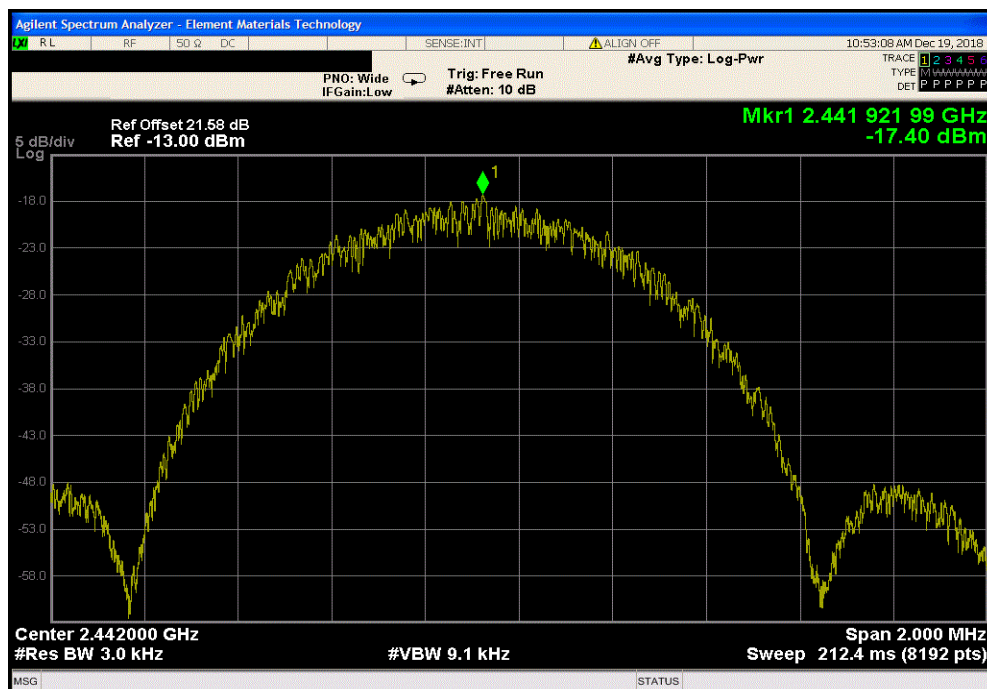


TMTx 2018.09.13 XMI 2017.12.13

Bucket Module, BLE/GFSK Low Channel, 2402 MHz						
	Value	Limit				
	dBm/3kHz	< dBm/3kHz	Results			
	-17.723	8	Pass			



Bucket Module, BLE/GFSK Mid Channel, 2442 MHz						
	Value	Limit				
	dBm/3kHz	< dBm/3kHz	Results			
	-17.404	8	Pass			

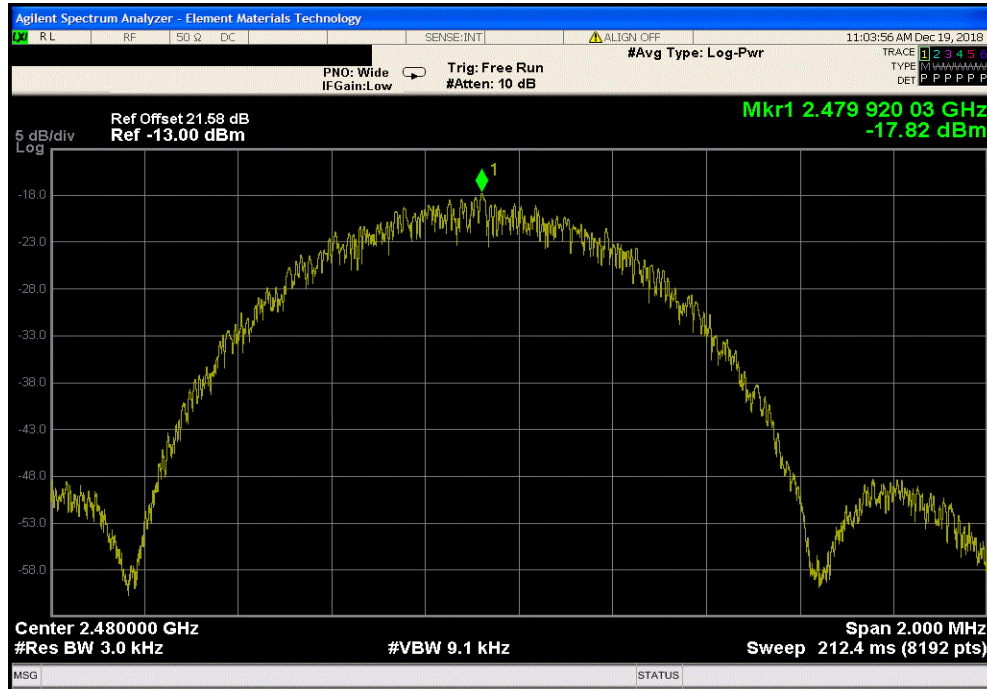


POWER SPECTRAL DENSITY



TbTx 2018.09.13 XMt 2017.12.13

Bucket Module, BLE/GFSK High Channel, 2480 MHz						
Value				Limit	Results	
dBm/3kHz				< dBm/3kHz		
-17.819				8	Pass	



BAND EDGE COMPLIANCE



XMI 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
Attenuator	S.M. Electronics	SA26B-20	AUY	16-Apr-18	16-Apr-19
Generator - Signal	Keysight	N5182B	TFU	5-Nov-18	5-Nov-21
Cable	Micro-Coax	UFD150A-1-0720-200200	EVH	23-Apr-18	23-Apr-19
Block - DC	Fairview Microwave	SD3379	AMW	23-Apr-18	23-Apr-19
Analyzer - Spectrum Analyzer	Agilent	N9010A	AFI	12-Jan-18	12-Jan-19

TEST DESCRIPTION


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

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

BAND EDGE COMPLIANCE



TbTx 2018.09.13 XMt 2017.12.13

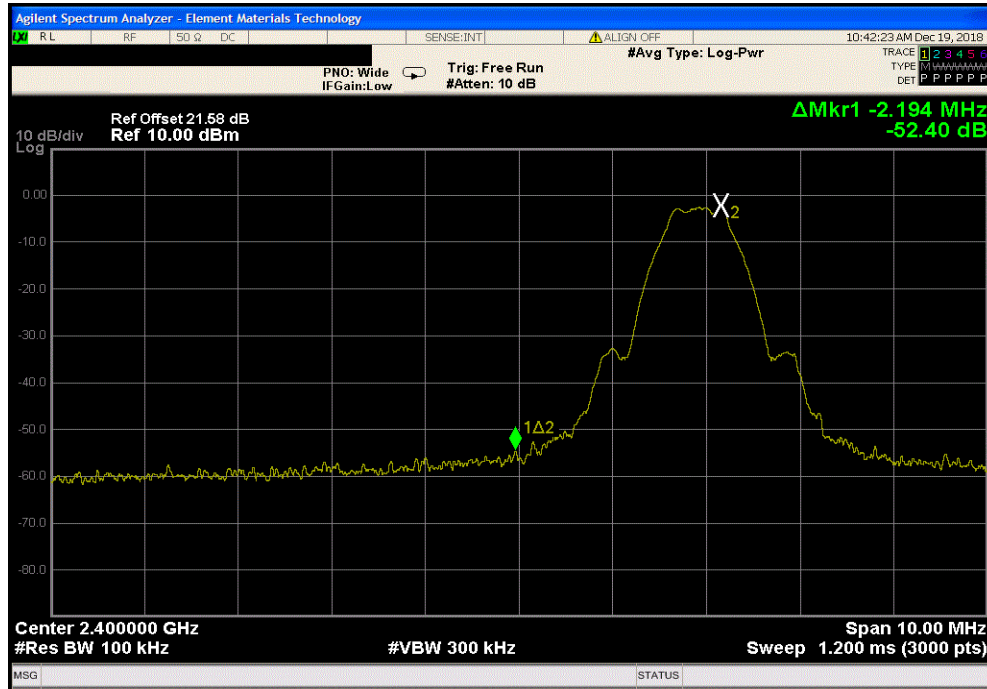
EUT: GET Detect Bucket Module 4265507		Work Order: ESCO0008	
Serial Number: None		Date: 19-Dec-18	
Customer: ESCO Corporation		Temperature: 21.2 °C	
Attendees: Jason Betournay		Humidity: 43.7% RH	
Project: None		Barometric Pres.: 1027 mbar	
Tested by: Jeff Alcock	Power: Battery	Job Site: EV06	
TEST SPECIFICATIONS		Test Method	
FCC 15.247:2018		ANSI C63.10:2013	
COMMENTS			
Reference level offset of 21.58 dB includes measurement cable and 20 dB attenuator. Software power setting = 0.			
DEVIATIONS FROM TEST STANDARD			
None			
Configuration #	1	Signature 	
		Value (dBc)	Limit ≤ (dBc) Result
Bucket Module			
BLE/GFSK Low Channel, 2402 MHz		-52.4	-20 Pass
BLE/GFSK High Channel, 2480 MHz		-53.81	-20 Pass

BAND EDGE COMPLIANCE

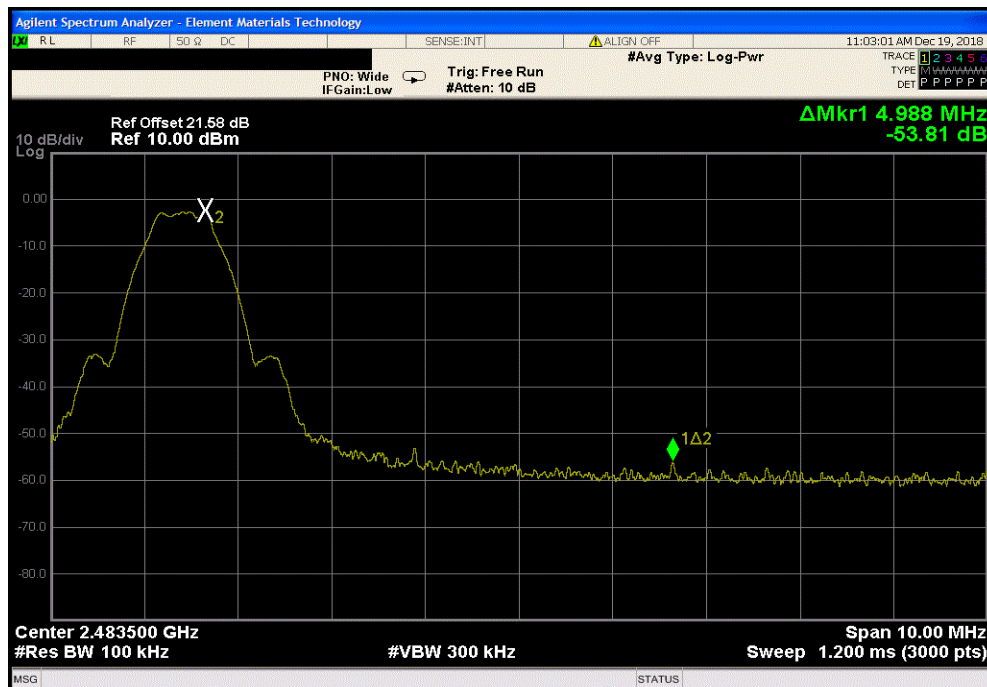


TbTx 2018.09.13 XMI 2017.12.13

Bucket Module, BLE/GFSK Low Channel, 2402 MHz						
				Value (dBc)	Limit ≤ (dBc)	Result
				-52.4	-20	Pass



Bucket Module, BLE/GFSK High Channel, 2480 MHz						
				Value (dBc)	Limit ≤ (dBc)	Result
				-53.81	-20	Pass



SPURIOUS CONDUCTED EMISSIONS



XMI 2017.12.13

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

TEST EQUIPMENT

Description	Manufacturer	Model	ID	Last Cal.	Cal. Due
Generator - Signal	Keysight	N5182B	TFU	5-Nov-18	5-Nov-21
Cable	Micro-Coax	UFD150A-1-0720-200200	EVH	23-Apr-18	23-Apr-19
Attenuator	S.M. Electronics	SA26B-20	AUY	16-Apr-18	16-Apr-19
Block - DC	Fairview Microwave	SD3379	AMW	23-Apr-18	23-Apr-19
Analyzer - Spectrum Analyzer	Agilent	N9010A	AFI	12-Jan-18	12-Jan-19

TEST DESCRIPTION

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

SPURIOUS CONDUCTED EMISSIONS



TbTx 2018.09.13 XMt 2017.12.13

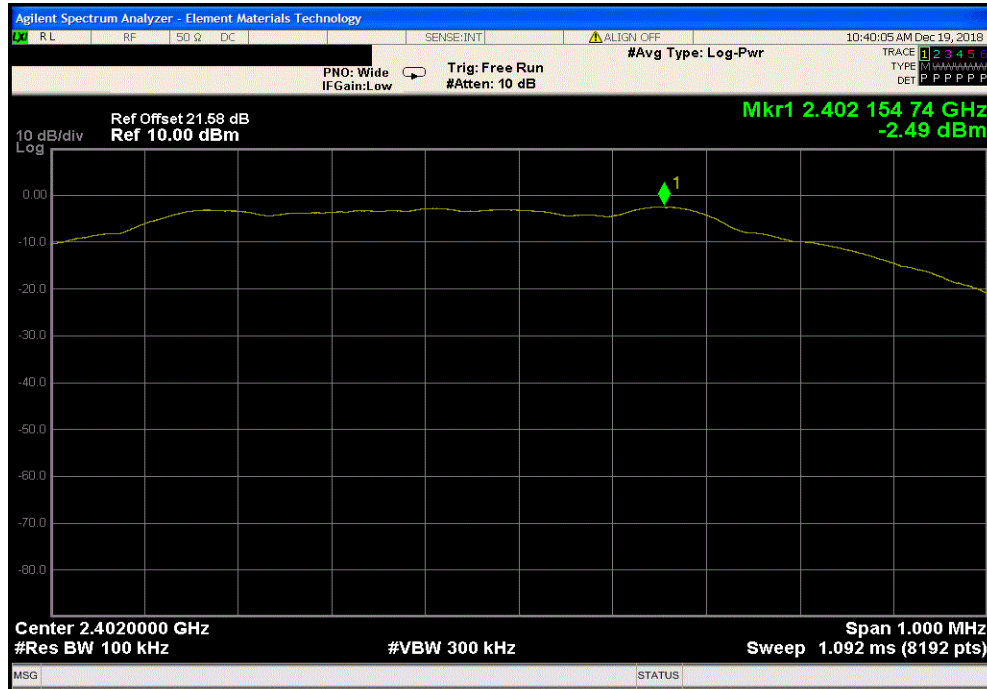
EUT: GET Detect Bucket Module 4265507		Work Order: ESCO0008				
Serial Number: None		Date: 19-Dec-18				
Customer: ESCO Corporation		Temperature: 21.2 °C				
Attendees: Jason Betournay		Humidity: 43.9% RH				
Project: None		Barometric Pres.: 1026 mbar				
Tested by: Jeff Alcock	Power: Battery	Job Site: EV06				
TEST SPECIFICATIONS		Test Method				
FCC 15.247:2018		ANSI C63.10:2013				
COMMENTS						
Reference level offset of 21.58 dB includes measurement cable and 20 dB attenuator. Software power setting = 0.						
DEVIATIONS FROM TEST STANDARD						
None						
Configuration #	1	Signature				
	Frequency Range	Measured Freq (MHz)	Max Value (dBc)	Limit ≤ (dBc)	Result	
Bucket Module	BLE/GFSK Low Channel, 2402 MHz	Fundamental	2402.15	N/A	N/A	N/A
	BLE/GFSK Low Channel, 2402 MHz	30 MHz - 12.5 GHz	4804.25	-42.91	-20	Pass
	BLE/GFSK Low Channel, 2402 MHz	12.5 GHz - 25 GHz	23741	-48.42	-20	Pass
	BLE/GFSK Mid Channel, 2442 MHz	Fundamental	2442.15	N/A	N/A	N/A
	BLE/GFSK Mid Channel, 2442 MHz	30 MHz - 12.5 GHz	9767.29	-45.37	-20	Pass
	BLE/GFSK Mid Channel, 2442 MHz	12.5 GHz - 25 GHz	24971	-49.25	-20	Pass
	BLE/GFSK High Channel, 2480 MHz	Fundamental	2480.15	N/A	N/A	N/A
	BLE/GFSK High Channel, 2480 MHz	30 MHz - 12.5 GHz	9921.05	-46.65	-20	Pass
	BLE/GFSK High Channel, 2480 MHz	12.5 GHz - 25 GHz	25000	-49.25	-20	Pass

SPURIOUS CONDUCTED EMISSIONS

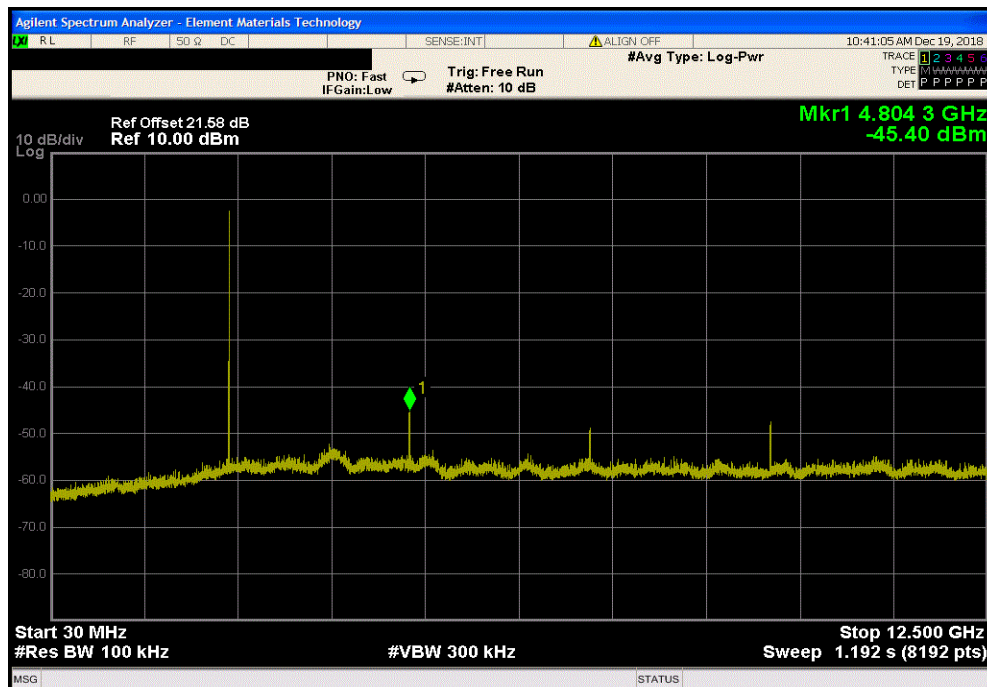


TMTx 2018.09.13 XMt 2017.12.13

Bucket Module, BLE/GFSK Low Channel, 2402 MHz						
Frequency Range	Measured Freq (MHz)	Max Value (dBc)	Limit ≤ (dBc)	Result		
Fundamental	2402.15	N/A	N/A	N/A		



Bucket Module, BLE/GFSK Low Channel, 2402 MHz						
Frequency Range	Measured Freq (MHz)	Max Value (dBc)	Limit ≤ (dBc)	Result		
30 MHz - 12.5 GHz	4804.25	-42.91	-20	Pass		

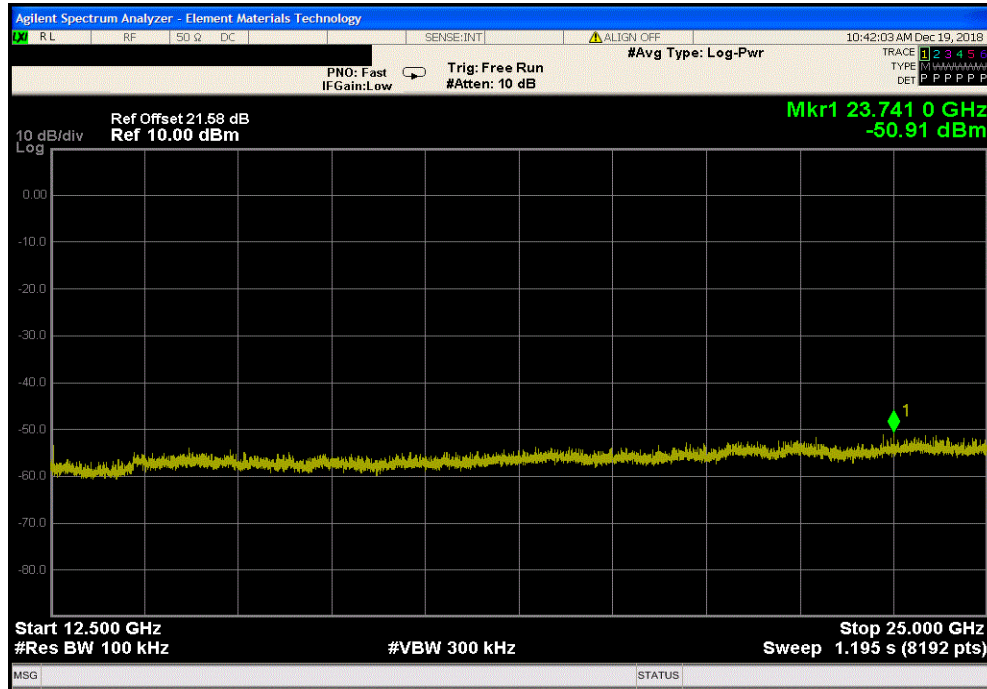


SPURIOUS CONDUCTED EMISSIONS

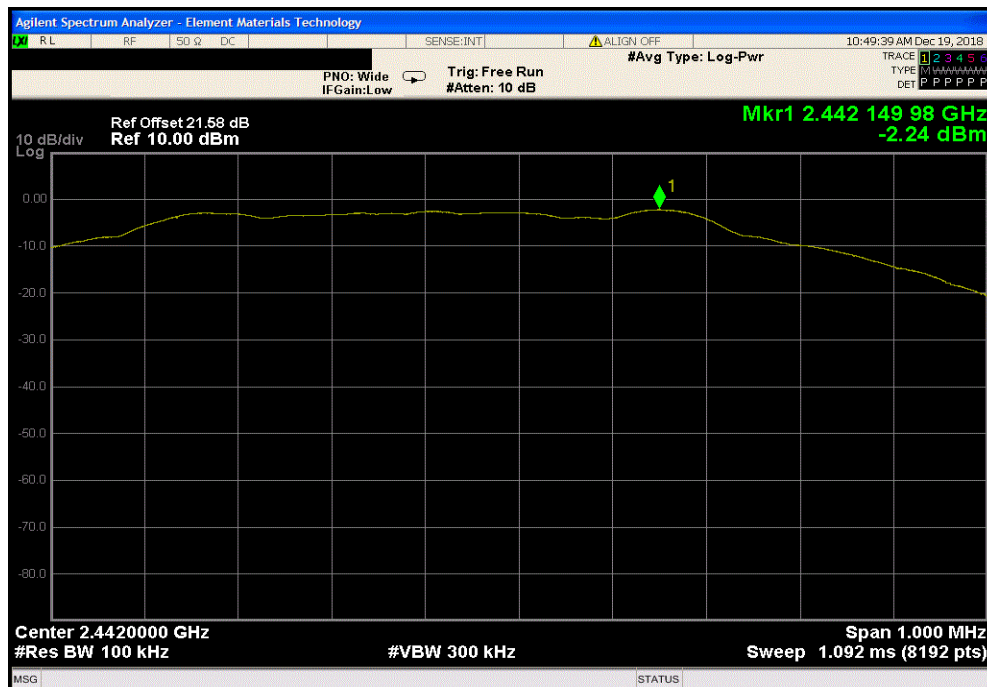


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Bucket Module, BLE/GFSK Low Channel, 2402 MHz					
Frequency Range	Measured Freq (MHz)	Max Value (dBc)	Limit ≤ (dBc)	Result	
12.5 GHz - 25 GHz	23741	-48.42	-20	Pass	



Bucket Module, BLE/GFSK Mid Channel, 2442 MHz					
Frequency Range	Measured Freq (MHz)	Max Value (dBc)	Limit ≤ (dBc)	Result	
Fundamental	2442.15	N/A	N/A	N/A	

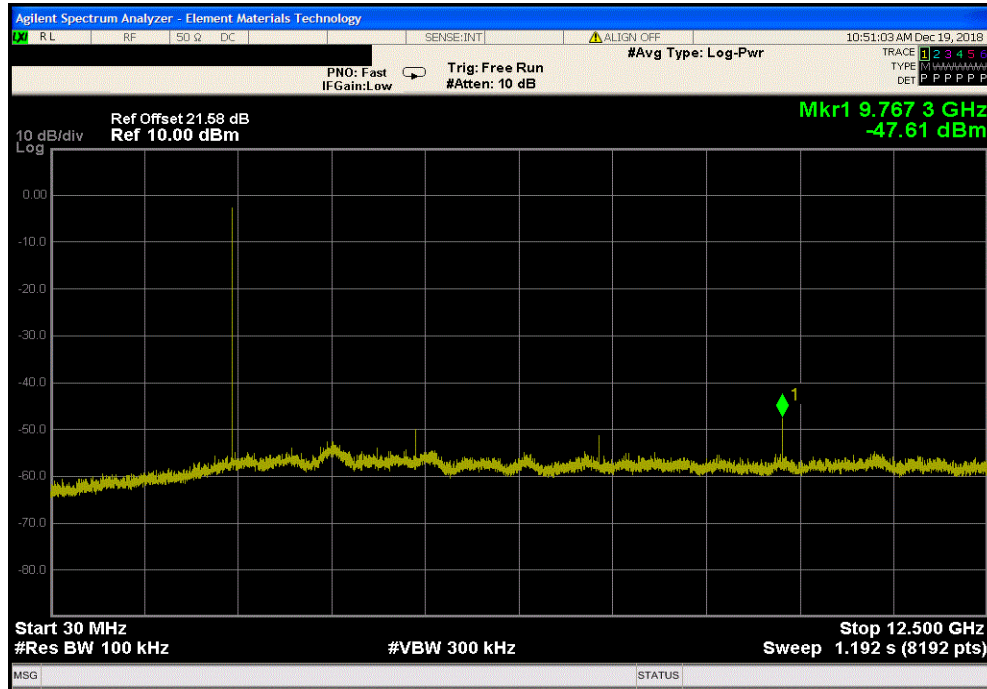


SPURIOUS CONDUCTED EMISSIONS

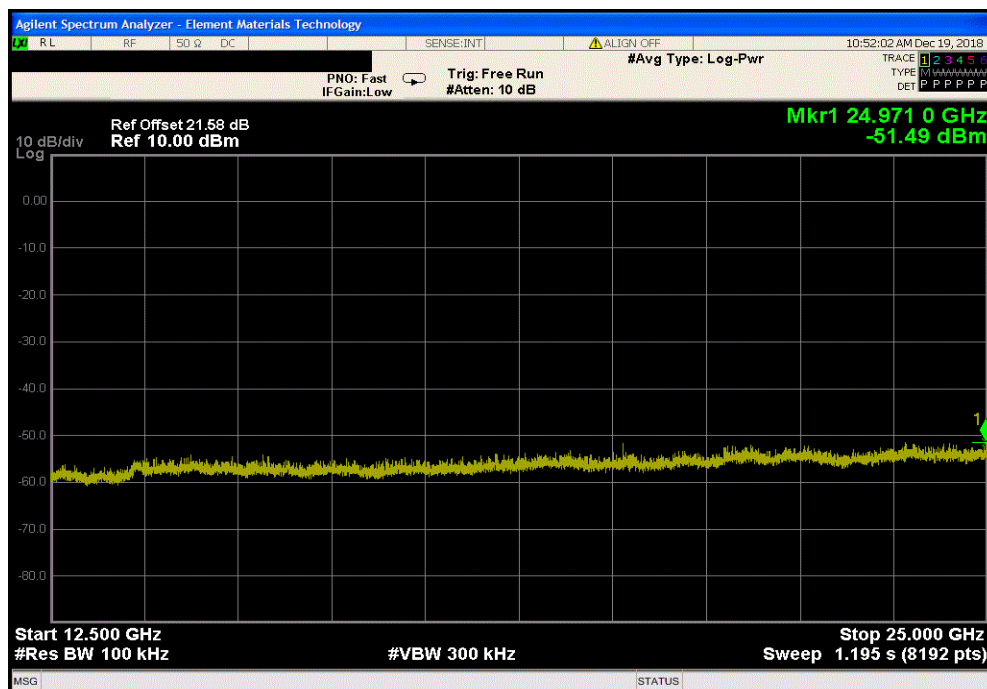


TMTx 2018.09.13 XMI 2017.12.13

Bucket Module, BLE/GFSK Mid Channel, 2442 MHz					
Frequency Range	Measured Freq (MHz)	Max Value (dBc)	Limit ≤ (dBc)	Result	
30 MHz - 12.5 GHz	9767.29	-45.37	-20	Pass	



Bucket Module, BLE/GFSK Mid Channel, 2442 MHz					
Frequency Range	Measured Freq (MHz)	Max Value (dBc)	Limit ≤ (dBc)	Result	
12.5 GHz - 25 GHz	24971	-49.25	-20	Pass	

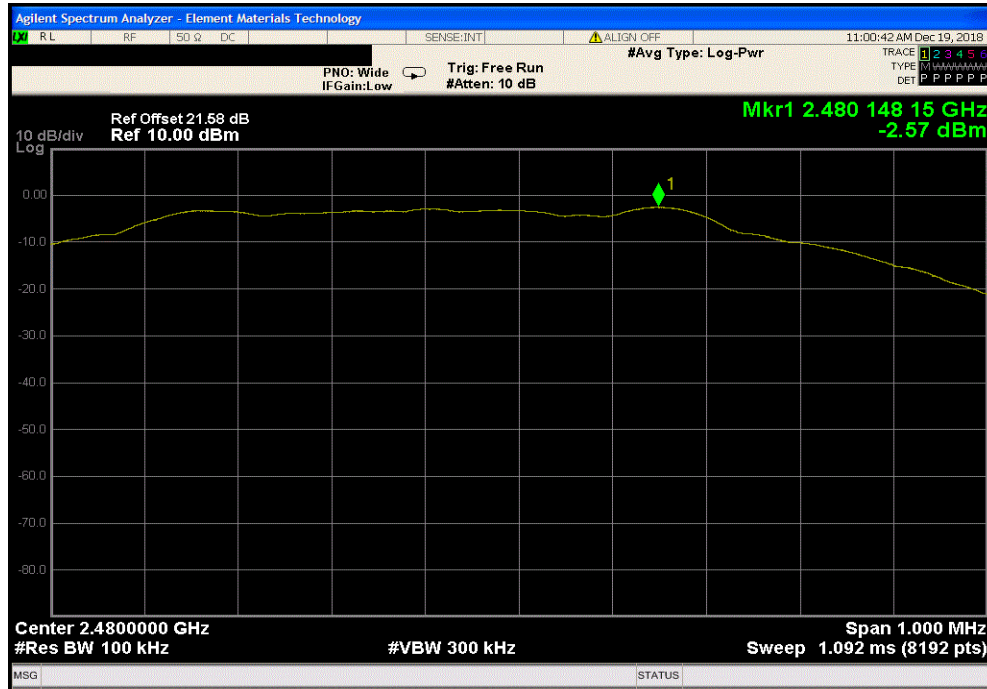


SPURIOUS CONDUCTED EMISSIONS

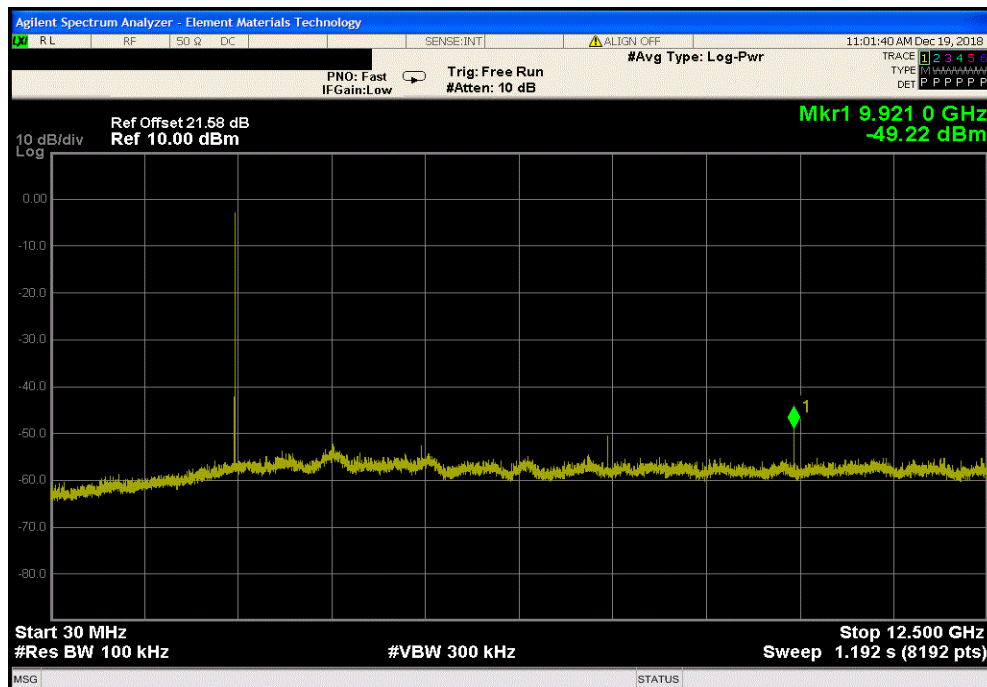


TbTx 2018.09.13 XMI 2017.12.13

Bucket Module, BLE/GFSK High Channel, 2480 MHz						
Frequency Range	Measured Freq (MHz)	Max Value (dBc)	Limit ≤ (dBc)	Result		
Fundamental	2480.15	N/A	N/A	N/A		



Bucket Module, BLE/GFSK High Channel, 2480 MHz						
Frequency Range	Measured Freq (MHz)	Max Value (dBc)	Limit ≤ (dBc)	Result		
30 MHz - 12.5 GHz	9921.05	-46.65	-20	Pass		



SPURIOUS CONDUCTED EMISSIONS



TbTx 2018.09.13 XMt 2017.12.13

Bucket Module, BLE/GFSK High Channel, 2480 MHz					
Frequency Range	Measured Freq (MHz)	Max Value (dBc)	Limit ≤ (dBc)	Result	
12.5 GHz - 25 GHz	25000	-49.25	-20	Pass	

