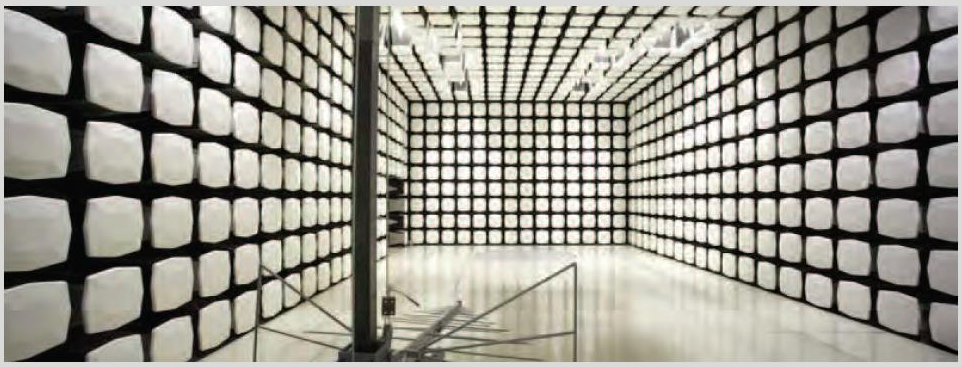
APDM, Inc.

V1 Opal

FCC 15.247:2019

2400 – 2483.5 MHz Other Wideband (DTS) Transceiver

Report # APDM0015.1



NVLAP LAB CODE: 200630-0

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CERTIFICATE OF TEST

Last Date of Test: February 11, 2019
APDM, Inc.
Model: V1 Opal

Radio Equipment Testing

Standards

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

Results

Method Clause	Test Description	Applied	Results	Comments
6.2	Powerline Conducted Emissions	No	N/A	Not required for a battery powered EUT.
6.5, 6.6, 11.12.1, 11.13.2	Spurious Radiated Emissions	Yes	Pass	
7.8.6	Band Edge Compliance - Hopping Mode	No	N/A	Not required for DTS devices.
7.8.2	Carrier Frequency Separation	No	N/A	Not required for DTS devices.
7.8.3	Number of Hopping Frequencies	No	N/A	Not required for DTS devices.
7.8.4	Dwell Time	No	N/A	Not required for DTS devices.
11.6	Duty Cycle	Yes	Pass	
11.8.2	Occupied Bandwidth	Yes	Pass	
11.9.1.1	Output Power	Yes	Pass	
11.9.1.1	Equivalent Isotropic Radiated Power	Yes	Pass	
11.10.2	Power Spectral Density	Yes	Pass	
11.11	Band Edge Compliance	Yes	Pass	
11.11	Spurious Conducted Emissions	Yes	Pass	

Deviations From Test Standards

None

Approved By:

Kyle Holgate, Operations Manager

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

REVISION HISTORY

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

ACCREDITATIONS AND AUTHORIZATIONS

United States

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

A2LA - 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

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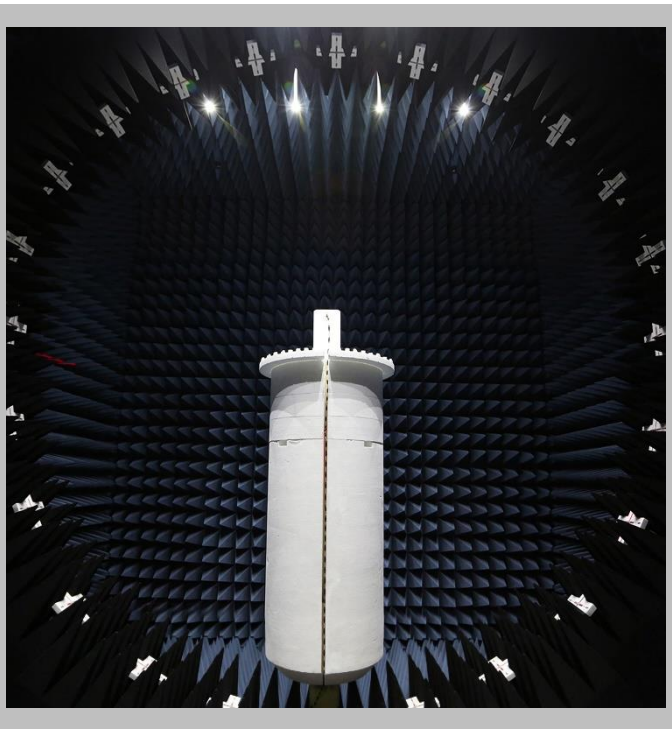
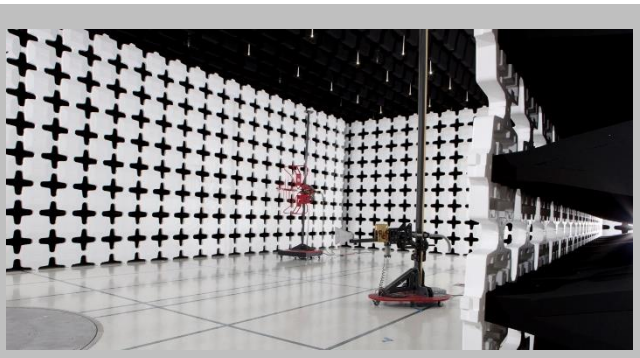
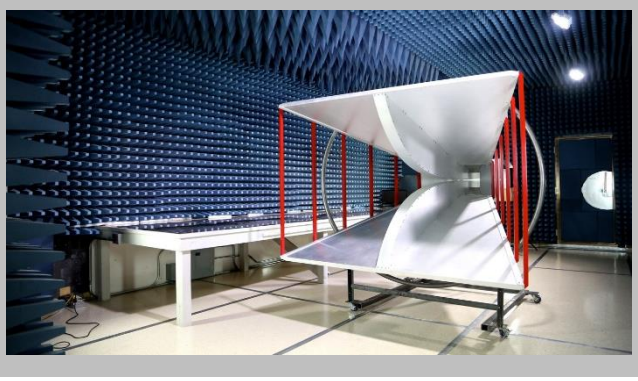
https://www.nwemc.com/emc-testing-accreditations

FACILITIES

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







MEASUREMENT UNCERTAINTY

element
TMU.2015.07.10

Measurement Uncertainty

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

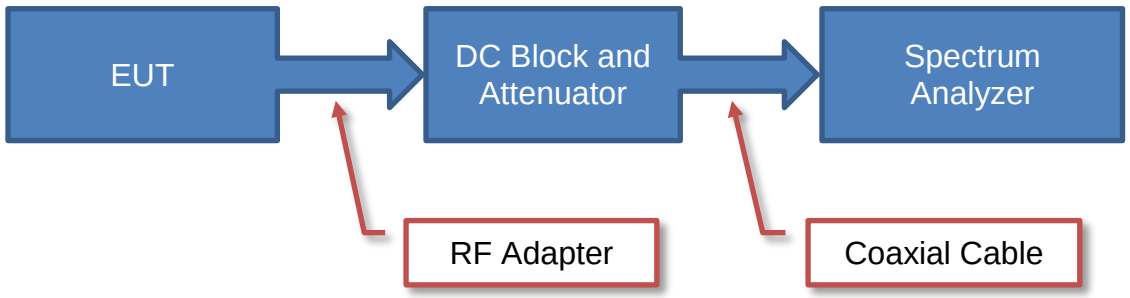
A measurement uncertainty estimation has been performed for each test per our internal quality document QM205.4.6. The estimation is used to compare the measured result with its "true" or theoretically correct value. The expanded measurement uncertainty (K=2) can be found included as part of the applicable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

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

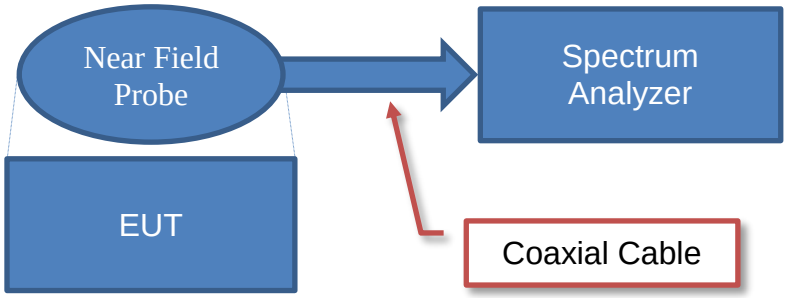
Test	+ MU	- MU
Frequency Accuracy (Hz)	0.0007%	-0.0007%
Amplitude Accuracy (dB)	1.2 dB	-1.2 dB
Conducted Power (dB)	0.3 dB	-0.3 dB
Radiated Power via Substitution (dB)	0.7 dB	-0.7 dB
Temperature (degrees C)	0.7°C	-0.7°C
Humidity (% RH)	2.5% RH	-2.5% RH
Voltage (AC)	1.0%	-1.0%
Voltage (DC)	0.7%	-0.7%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

Test Setup Block Diagrams

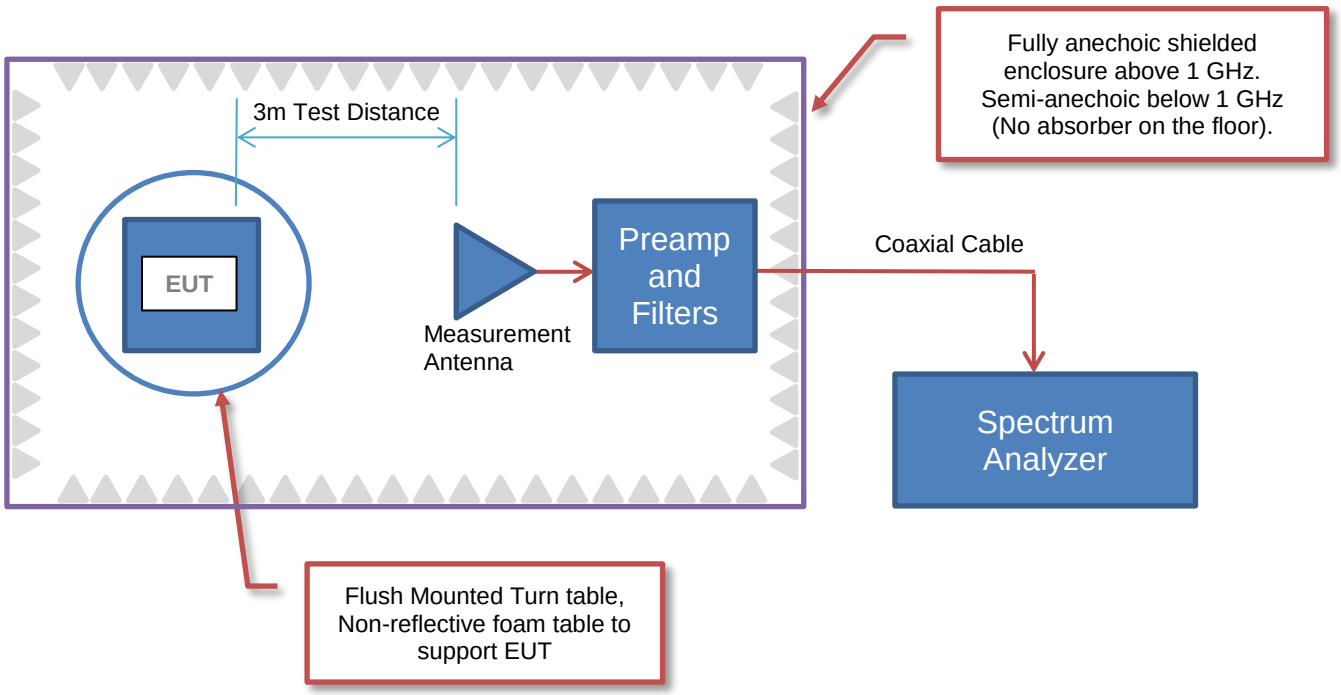
Antenna Port Conducted Measurements



Near Field Test Fixture Measurements



Spurious Radiated Emissions



PRODUCT DESCRIPTION

Client and Equipment Under Test (EUT) Information

Company Name:	APDM, Inc.
Address:	2828 S Corbett Ave. Suite 135
City, State, Zip:	Portland, OR 97201
Test Requested By:	Andrew Greenberg
Model:	V1 Opal
First Date of Test:	February 11, 2019
Last Date of Test:	February 11, 2019
Receipt Date of Samples:	February 11, 2019
Equipment Design Stage:	Production
Equipment Condition:	No Damage
Purchase Authorization:	Verified

Information Provided by the Party Requesting the Test

Functional Description of the EUT:
V1 Opal is a small body worn device which operates in the ISM band

Testing Objective:
Seeking to demonstrate compliance under FCC 15.247:2019 for operation in the 2400 - 2483.5 MHz Band.

CONFIGURATIONS

Configuration APDM0015- 1

EUT			
Description	**Manufacturer**	**Model/Part Number**	**Serial Number**
Wearable movement monitor	APDM, Inc.	V1 Opal	1380

Configuration APDM0015- 2

EUT			
Description	**Manufacturer**	**Model/Part Number**	**Serial Number**
Wearable movement monitor	APDM, Inc.	V1 Opal	2775

MODIFICATIONS

Equipment Modifications

Item	Date	Test	Modification	Note	Disposition of EUT
1	2019-02-11	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	2019-02-11	Duty Cycle	Tested as delivered to Test Station.	No EMI suppression devices were added or modified during this test.	EUT remained at Element following the test.
3	2019-02-11	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	2019-02-11	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	2019-02-11	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	2019-02-11	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	2019-02-11	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	2019-02-11	Spurious Conducted Emissions	Tested as delivered to Test Station.	No EMI suppression devices were added or modified during this test.	Scheduled testing was completed.

SPURIOUS RADIATED EMISSIONS

PSA-ESCI 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

Continuously transmitting. GFSK.2 MBps. Low channel = 2410 MHz, Mid channel = 2445 MHz , High channel = 2480 MHz. Maximum power setting.

POWER SETTINGS INVESTIGATED

Battery

CONFIGURATIONS INVESTIGATED

APDM0015 - 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
Analyzer - Spectrum Analyzer	Agilent	E4446A	AAQ	18-Mar-2018	12 mo
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
Filter - High Pass	Micro-Tronics	HPM50111	HFO	11-Dec-2018	12 mo
Attenuator	Coaxicom	3910-20	AXZ	28-Feb-2018	12 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
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

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.

Duty cycle during testing was DC = 13.7%. The RMS average measurements were upwardly correct by 10*log(1/DC) (per ANSI C63.10 Section 11.13.3.4). Additionally, the EUT has a protocol limited duty cycle of DC = 13.7%. The RMS average measurements were further corrected downward by 20*log(1/DC) (per ANSI C63.10 Section 7.5). The total correction was thus: -10*log(1/0.137) + 20*log(1/0.137) = 8.6 dB.

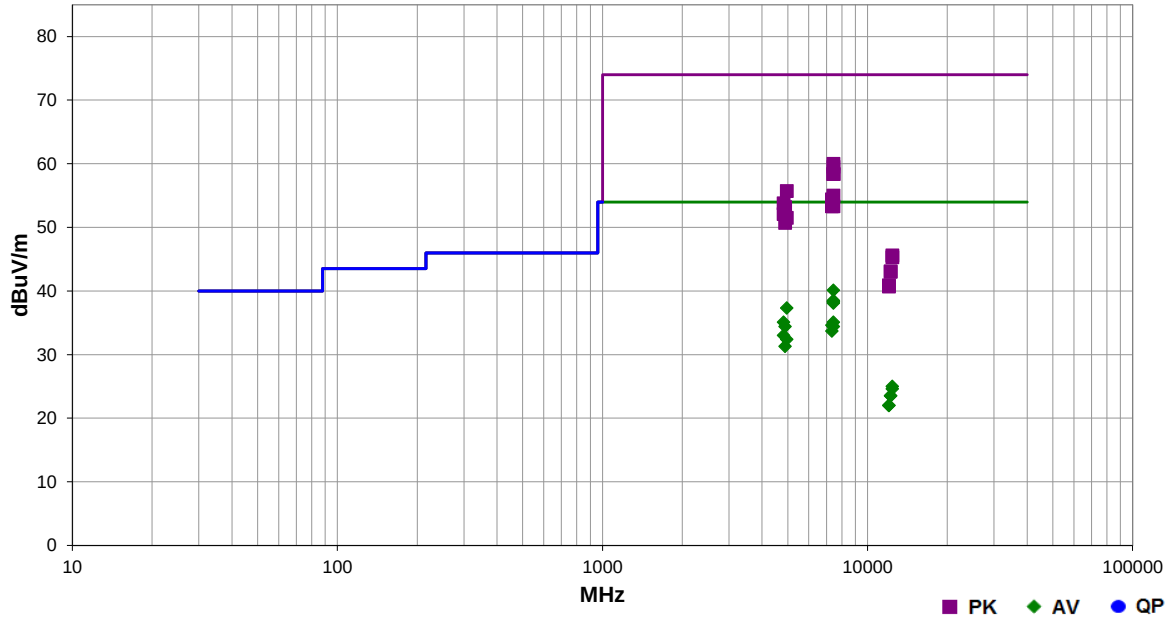
SPURIOUS RADIATED EMISSIONS

EmiR5 2018.09.26 PSA-ESCI 2018.07.27

Work Order:	APDM0015	**Date:**	11-Feb-2019		
Project:	None	**Temperature:**	18.3 °C		
Job Site:	EV01	**Humidity:**	35.2% RH		
Serial Number:	1380	**Barometric Pres.:**	1010 mbar	**Tested by:**	Jody House & Jeff Alcoke
EUT:	V1 Opal				
Configuration:	1				
Customer:	APDM, Inc.				
Attendees:	Andrew Greenberg, David Camarillo, Gavin Gallino, Timothy Brandon, Christopher Andrews.				
EUT Power:	Battery				
Operating Mode:	Continuously transmitting. GFSK.2 MBps. Low channel = 2410 MHz, Mid channel = 2445 MHz , High channel = 2480 MHz. Maximum power setting.				
Deviations:	None				
Comments:	EUT cannot transmit if port is populated. See comments for EUT serial number, orientation, and channel.				

Test Specifications	**Test Method**
FCC 15.247:2019	ANSI C63.10:2013

Run #	15	**Test Distance (m)**	3	**Antenna Height(s)**	1 to 4(m)	**Results**	Pass



Freq (MHz)	Amplitude (dBuV)	Factor (dB)	Antenna Height (meters)	Azimuth (degrees)	Duty Cycle Correction Factor (dB)	External Attenuation (dB)	Polarity/ Transducer Type	Detector	Distance Adjustment (dB)	Adjusted (dBuV/m)	Spec. Limit (dBuV/m)	Compared to Spec. (dB)	Comments
7439.175	34.5	14.2	1.0	92.0	-8.6	0.0	Vert	AV	0.0	40.1	54.0	-13.9	466, EUT Horz, High Ch
7439.092	45.8	14.2	1.0	92.0	0.0	0.0	Vert	PK	0.0	60.0	74.0	-14.0	466, EUT Horz, High Ch
7438.983	45.3	14.2	1.0	92.0	0.0	0.0	Horz	PK	0.0	59.5	74.0	-14.5	1380, EUT Vert, High Ch
7439.233	32.9	14.2	3.0	11.0	-8.6	0.0	Vert	AV	0.0	38.5	54.0	-15.5	1380, EUT On Side, High Ch
7439.242	44.2	14.2	3.0	360.0	0.0	0.0	Horz	PK	0.0	58.4	74.0	-15.6	1380, EUT Horz, High Ch
7439.850	44.2	14.2	1.0	309.0	0.0	0.0	Vert	PK	0.0	58.4	74.0	-15.6	1380, EUT Horz, High Ch
7440.275	44.2	14.2	3.0	11.0	0.0	0.0	Vert	PK	0.0	58.4	74.0	-15.6	1380, EUT On Side, High Ch
7439.500	32.7	14.2	1.0	309.0	-8.6	0.0	Vert	AV	0.0	38.3	54.0	-15.7	1380, EUT Horz, High Ch
7439.242	32.7	14.2	1.0	92.0	-8.6	0.0	Horz	AV	0.0	38.3	54.0	-15.7	1380, EUT Horz, High Ch
7439.233	32.5	14.2	3.0	360.0	-8.6	0.0	Horz	AV	0.0	38.1	54.0	-15.9	1380, EUT Vert, High Ch
4959.850	40.3	5.6	1.0	146.0	-8.6	0.0	Vert	AV	0.0	37.3	54.0	-16.7	1380, EUT Horz, High Ch
4959.500	50.1	5.6	1.0	146.0	0.0	0.0	Vert	PK	0.0	55.7	74.0	-18.3	1380, EUT Horz, High Ch
4819.817	38.9	4.8	1.0	149.0	-8.6	0.0	Vert	AV	0.0	35.1	54.0	-18.9	EUT Horz, Low Ch
7439.208	29.5	14.2	3.8	295.0	-8.6	0.0	Horz	AV	0.0	35.1	54.0	-18.9	1380, EUT On Side, High Ch
7440.075	40.8	14.2	3.8	295.0	0.0	0.0	Horz	PK	0.0	55.0	74.0	-19.0	1380, EUT On Side, High Ch
7334.367	30.1	13.1	1.6	359.0	-8.6	0.0	Horz	AV	0.0	34.6	54.0	-19.4	EUT Horz, Mid Ch
7334.158	41.3	13.1	1.6	359.0	0.0	0.0	Horz	PK	0.0	54.4	74.0	-19.6	EUT Horz, Mid Ch
7439.158	28.8	14.2	1.0	337.0	-8.6	0.0	Vert	AV	0.0	34.4	54.0	-19.6	1380, EUT Vert, High Ch
4889.808	37.6	5.4	1.0	337.0	-8.6	0.0	Vert	AV	0.0	34.4	54.0	-19.6	EUT Horz, Mid Ch
4819.408	49.0	4.8	1.0	149.0	0.0	0.0	Vert	PK	0.0	53.8	74.0	-20.2	EUT Horz, Low Ch

Freq (MHz)	Amplitude (dBuV)	Factor (dB)	Antenna Height (meters)	Azimuth (degrees)	Duty Cycle Correction Factor (dB)	External Attenuation (dB)	Polarity/ Transducer Type	Detector	Distance Adjustment (dB)	Adjusted (dBuV/m)	Spec. Limit (dBuV/m)	Compared to Spec. (dB)	Comments
7334.200	29.2	13.1	1.0	255.0	-8.6	0.0	Vert	AV	0.0	33.7	54.0	-20.3	EUT Horz, Mid Ch
7439.192	39.1	14.2	1.0	337.0	0.0	0.0	Vert	PK	0.0	53.3	74.0	-20.7	1380, EUT Vert, High Ch
7335.567	40.1	13.2	1.0	255.0	0.0	0.0	Vert	PK	0.0	53.3	74.0	-20.7	EUT Horz, Mid Ch
4889.575	47.8	5.4	1.0	337.0	0.0	0.0	Vert	PK	0.0	53.2	74.0	-20.8	EUT Horz, Mid Ch
4819.742	36.8	4.8	1.7	202.0	-8.6	0.0	Horz	AV	0.0	33.0	54.0	-21.0	EUT Horz, Low Ch
4959.808	35.4	5.6	1.0	78.0	-8.6	0.0	Horz	AV	0.0	32.4	54.0	-21.6	1380, EUT Horz, High Ch
4819.458	47.3	4.8	1.7	202.0	0.0	0.0	Horz	PK	0.0	52.1	74.0	-21.9	EUT Horz, Low Ch
4960.150	45.9	5.6	1.0	78.0	0.0	0.0	Horz	PK	0.0	51.5	74.0	-22.5	1380, EUT Horz, High Ch
4889.733	34.5	5.4	1.0	20.0	-8.6	0.0	Horz	AV	0.0	31.3	54.0	-22.7	EUT Horz, Mid Ch
4889.308	45.3	5.4	1.0	20.0	0.0	0.0	Horz	PK	0.0	50.7	74.0	-23.3	EUT Horz, Mid Ch
12399.980	43.6	2.0	1.0	144.0	0.0	0.0	Vert	PK	0.0	45.6	74.0	-28.4	EUT Horz, High Ch
12398.370	43.3	2.0	1.0	238.0	0.0	0.0	Horz	PK	0.0	45.3	74.0	-28.7	EUT Horz, High Ch
12398.580	31.6	2.0	1.0	144.0	-8.6	0.0	Vert	AV	0.0	25.0	54.0	-29.0	EUT Horz, High Ch
12398.650	31.2	2.0	1.0	238.0	-8.6	0.0	Horz	AV	0.0	24.6	54.0	-29.4	EUT Horz, High Ch
12223.430	30.3	1.8	1.0	225.0	-8.6	0.0	Horz	AV	0.0	23.5	54.0	-30.5	EUT Horz, Mid Ch
12223.630	30.3	1.8	1.0	182.0	-8.6	0.0	Vert	AV	0.0	23.5	54.0	-30.5	EUT Horz, Mid Ch
12223.680	41.3	1.8	1.0	182.0	0.0	0.0	Vert	PK	0.0	43.1	74.0	-30.9	EUT Horz, Mid Ch
12224.110	41.2	1.8	1.0	225.0	0.0	0.0	Horz	PK	0.0	43.0	74.0	-31.0	EUT Horz, Mid Ch
12051.360	29.6	1.0	1.0	245.0	-8.6	0.0	Horz	AV	0.0	22.0	54.0	-32.0	EUT Horz, Low Ch
12052.480	29.6	1.0	1.0	278.0	-8.6	0.0	Vert	AV	0.0	22.0	54.0	-32.0	EUT Horz, Low Ch
12048.790	39.9	1.0	1.0	245.0	0.0	0.0	Horz	PK	0.0	40.9	74.0	-33.1	EUT Horz, Low Ch
12050.330	39.7	1.0	1.0	278.0	0.0	0.0	Vert	PK	0.0	40.7	74.0	-33.3	EUT Horz, Low Ch

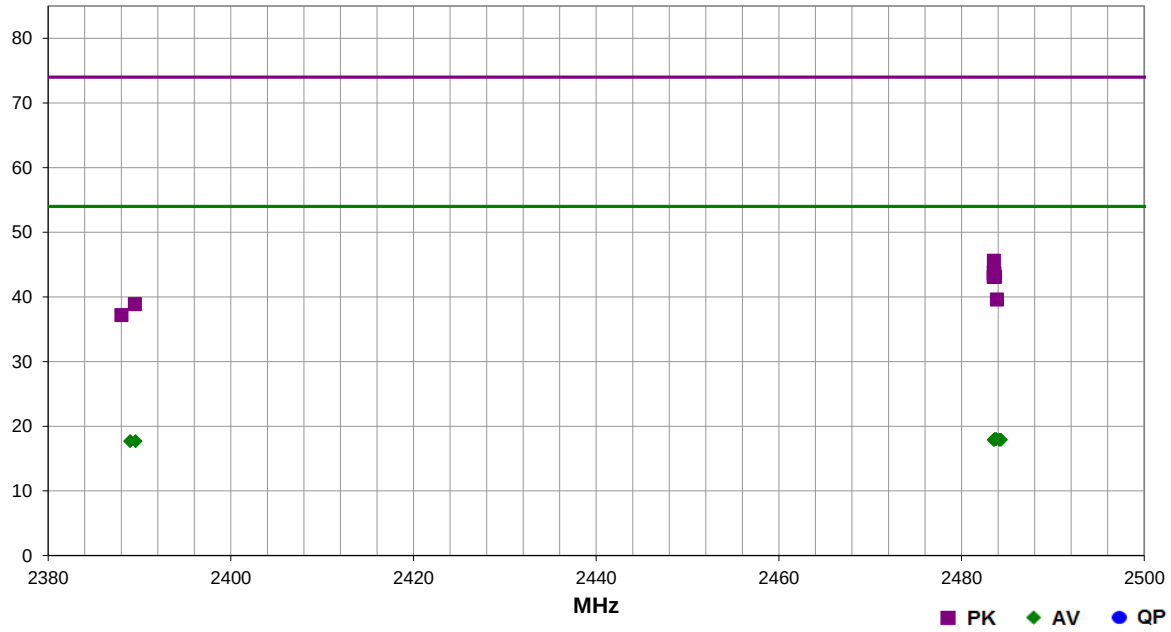
SPURIOUS RADIATED EMISSIONS

EmiR5 2018.09.26 PSA-ESCI 2018.07.27

Work Order:	APDM0015	**Date:**	11-Feb-2019		
Project:	None	**Temperature:**	19.5 °C		
Job Site:	EV01	**Humidity:**	35.6% RH		
Serial Number:	1380	**Barometric Pres.:**	1010 mbar	**Tested by:**	Jody House & Jeff Alcoke
EUT:	V1 Opal				
Configuration:	1				
Customer:	APDM, Inc.				
Attendees:	Andrew Greenberg,				
EUT Power:	Battery				
Operating Mode:	Continuously transmitting. GFSK.2 MBps. Low channel = 2410 MHz, Mid channel = 2445 MHz , High channel = 2480 MHz. Maximum power setting.				
Deviations:	None				
Comments:	See comments for EUT orientation and channel.				

Test Specifications	**Test Method**
FCC 15.247:2019	ANSI C63.10:2013

Run #	17	**Test Distance (m)**	3	**Antenna Height(s)**	1 to 4(m)	**Results**	Pass



Freq (MHz)	Amplitude (dBuV)	Factor (dB)	Antenna Height (meters)	Azimuth (degrees)	Duty Cycle Correction Factor (dB)	External Attenuation (dB)	Polarity/ Transducer Type	Detector	Distance Adjustment (dB)	Adjusted (dBuV/m)	Spec. Limit (dBuV/m)	Compared to Spec. (dB)	Comments
2483.543	50.5	-4.9	2.7	57.0	0.0	20.0	Vert	PK	0.0	45.6	74.0	-28.4	EUT On Side, High Ch
2483.523	48.6	-4.9	1.0	67.0	0.0	20.0	Horz	PK	0.0	43.7	74.0	-30.3	EUT Vert, High Ch
2483.593	48.5	-4.9	1.0	302.0	0.0	20.0	Vert	PK	0.0	43.6	74.0	-30.4	EUT Horz, High Ch
2483.660	48.0	-4.9	2.7	163.0	0.0	20.0	Horz	PK	0.0	43.1	74.0	-30.9	EUT Horz, High Ch
2483.523	48.0	-4.9	1.0	4.0	0.0	20.0	Horz	PK	0.0	43.1	74.0	-30.9	EUT On Side, High Ch
2483.877	44.5	-4.9	1.0	201.0	0.0	20.0	Vert	PK	0.0	39.6	74.0	-34.4	EUT Vert, High Ch
2389.497	44.0	-5.1	1.0	337.0	0.0	20.0	Vert	PK	0.0	38.9	74.0	-35.1	EUT Horz, Low Ch
2483.807	31.5	-4.9	2.7	163.0	-8.6	20.0	Horz	AV	0.0	18.0	54.0	-36.0	EUT Horz, High Ch
2483.660	31.5	-4.9	1.0	67.0	-8.6	20.0	Horz	AV	0.0	18.0	54.0	-36.0	EUT Vert, High Ch
2484.320	31.3	-4.8	1.0	201.0	-8.6	20.0	Vert	AV	0.0	17.9	54.0	-36.1	EUT Vert, High Ch
2484.150	31.3	-4.8	1.0	4.0	-8.6	20.0	Horz	AV	0.0	17.9	54.0	-36.1	EUT On Side, High Ch
2483.587	31.4	-4.9	1.0	302.0	-8.6	20.0	Vert	AV	0.0	17.9	54.0	-36.1	EUT Horz, High Ch
2483.530	31.4	-4.9	2.7	57.0	-8.6	20.0	Vert	AV	0.0	17.9	54.0	-36.1	EUT On Side, High Ch
2389.567	31.4	-5.1	1.0	337.0	-8.6	20.0	Horz	AV	0.0	17.7	54.0	-36.3	EUT Horz, Low Ch
2388.990	31.4	-5.1	1.0	337.0	-8.6	20.0	Vert	AV	0.0	17.7	54.0	-36.3	EUT Horz, Low Ch
2388.010	42.3	-5.1	1.0	337.0	0.0	20.0	Horz	PK	0.0	37.2	74.0	-36.8	EUT Horz, Low Ch

DUTY CYCLE

XMit 2017.12.13

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

TEST EQUIPMENT

Description	Manufacturer	Model	ID	Last Cal.	Cal. Due
Attenuator	S.M. Electronics	SA26B-20	AUY	16-Apr-18	16-Apr-19
Generator - Signal	Keysight	N5182B	TFU	5-Nov-18	5-Nov-21
Analyzer - Spectrum Analyzer	Agilent	N9010A	AFI	1-Feb-19	1-Feb-20
Cable, 40GHz	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

TEST DESCRIPTION

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

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

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

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

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

DUTY CYCLE

element

TbtTx 2018.09.13 XMit 2017.12.13

EUT:	V1 Opal			**Work Order:**	APDM0015
Serial Number:	2775			**Date:**	11-Feb-19
Customer:	APDM, Inc.			**Temperature:**	19.4 °C
Attendees:	Andrew Greenberg, David Camarillo, Gavin Gallino, Timothy Brandon, Christopher Andrews.			**Humidity:**	37.7% RH
Project:	None			**Barometric Pres.:**	1010 mbar
Tested by:	Jody House & Jeff Alcoke	**Power:**	Battery	**Job Site:**	EV06

TEST SPECIFICATIONS	**Test Method**
FCC 15.247:2019	ANSI C63.10:2013

COMMENTS

Continously transmitting. GFSK. 2 MBps. Maximum power setting.

DEVIATIONS FROM TEST STANDARD

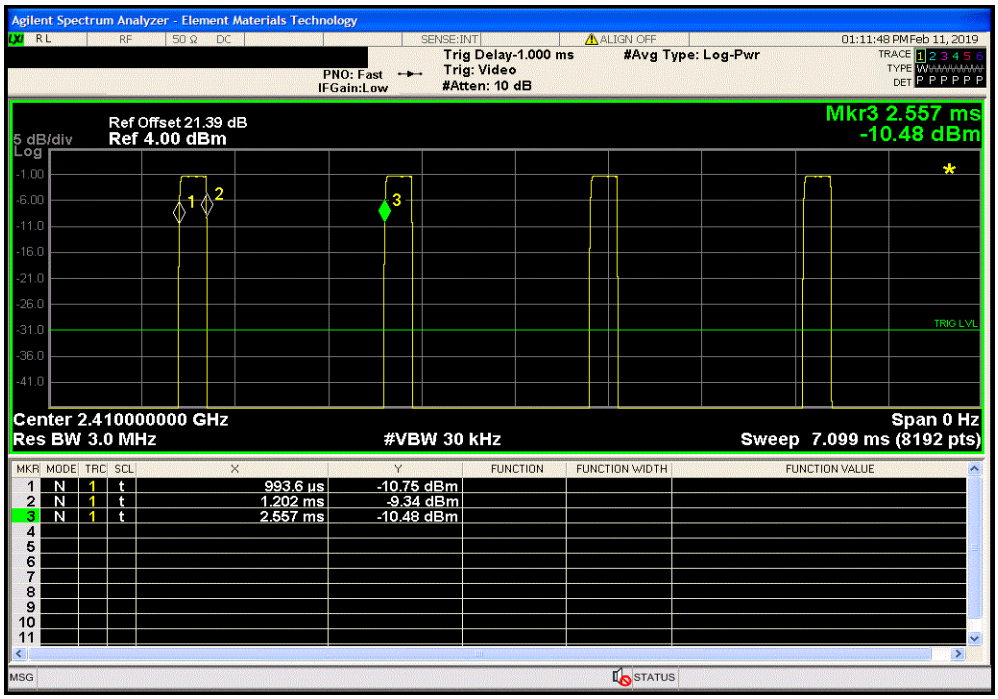
None

Configuration #	2	*Signature*

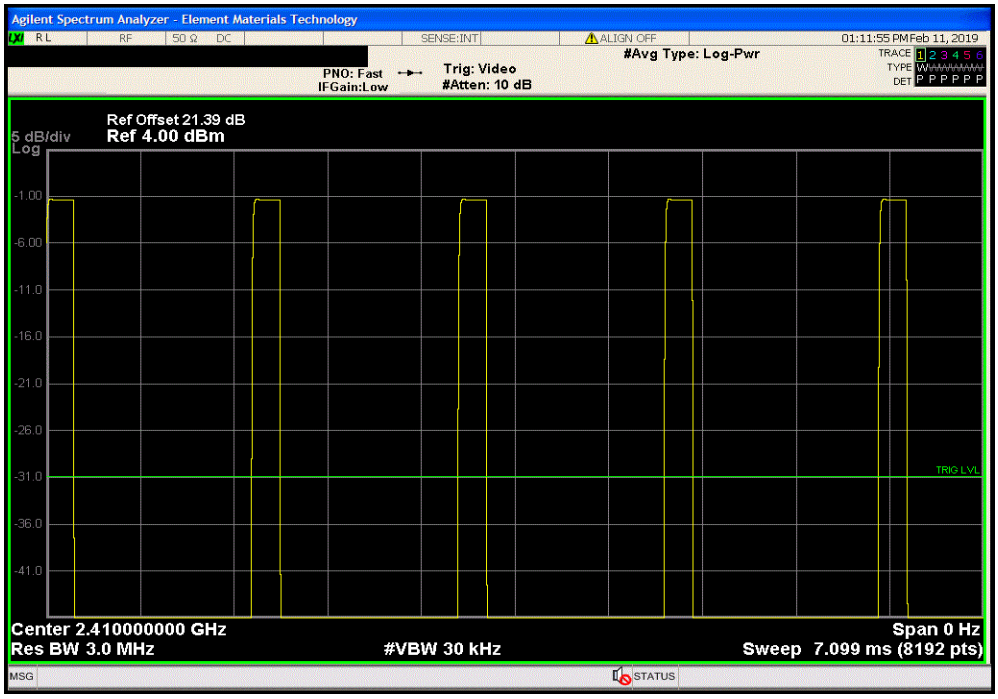
	Pulse Width	Period	Number of Pulses	Value (%)	Limit (%)	Results
GFSK Low Channel, 2410 MHz	208 us	1.563 ms	1	13.3	N/A	N/A
GFSK Low Channel, 2410 MHz	N/A	N/A	5	N/A	N/A	N/A
GFSK Mid Channel, 2445 MHz	206.9 us	1.564 ms	1	13.2	N/A	N/A
GFSK Mid Channel, 2445 MHz	N/A	N/A	5	N/A	N/A	N/A
GFSK High Channel, 2480 MHz	207.3 us	1.561 ms	1	13.3	N/A	N/A
GFSK High Channel, 2480 MHz	N/A	N/A	5	N/A	N/A	N/A

DUTY CYCLE

GFSK Low Channel, 2410 MHz						
	Pulse Width	Period	Number of Pulses	Value (%)	Limit (%)	Results
	208 us	1.563 ms	1	13.3	N/A	N/A

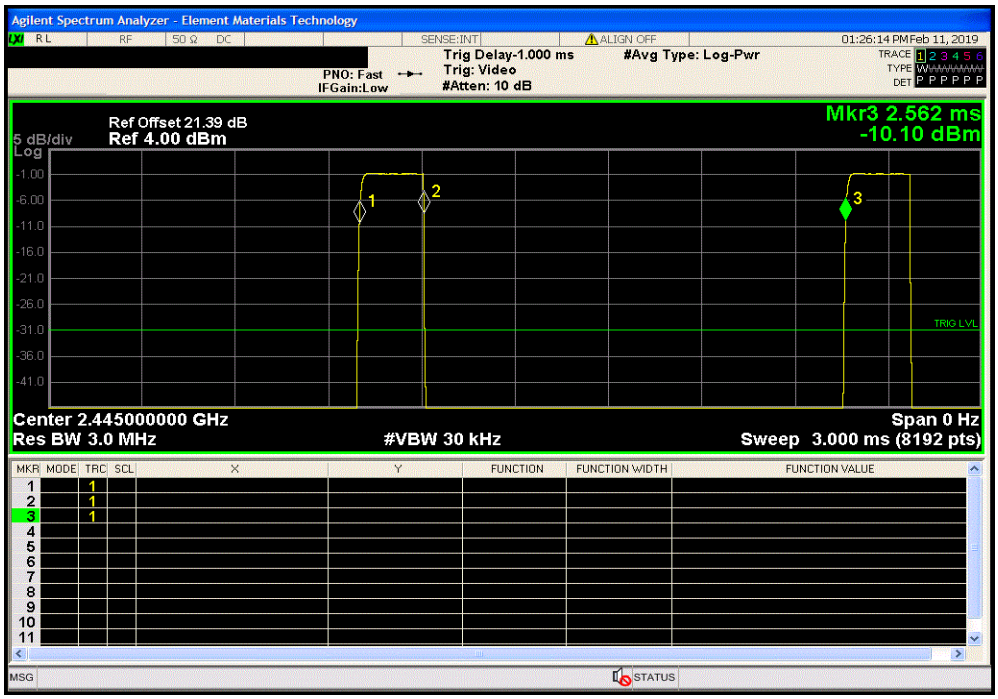


GFSK Low Channel, 2410 MHz						
	Pulse Width	Period	Number of Pulses	Value (%)	Limit (%)	Results
	N/A	N/A	5	N/A	N/A	N/A

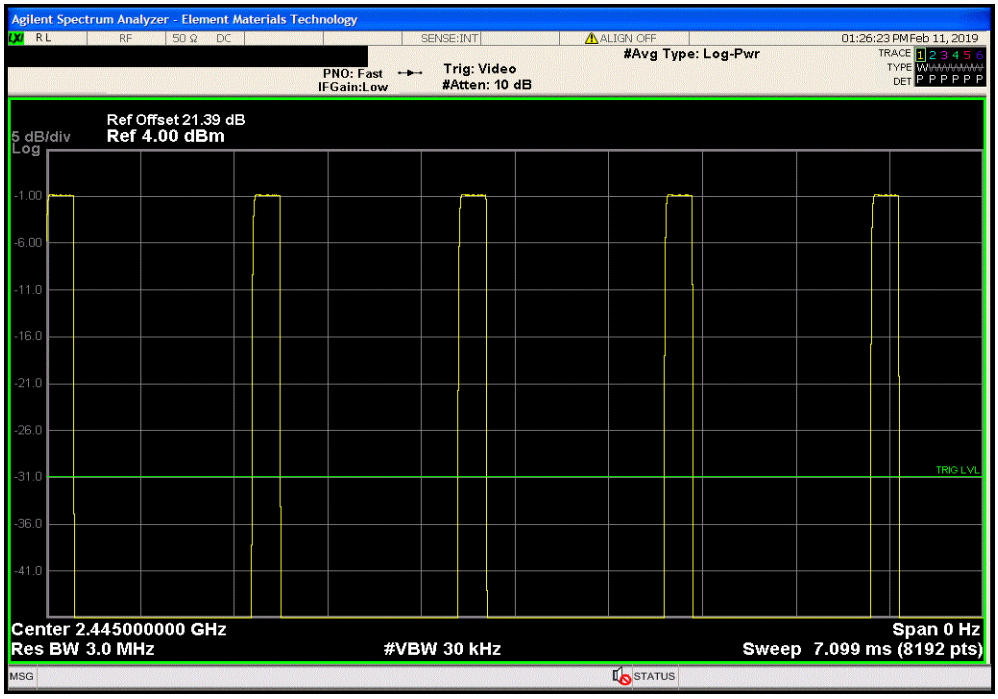


DUTY CYCLE

GFSK Mid Channel, 2445 MHz						
	Pulse Width	Period	Number of Pulses	Value (%)	Limit (%)	Results
	206.9 us	1.564 ms	1	13.2	N/A	N/A

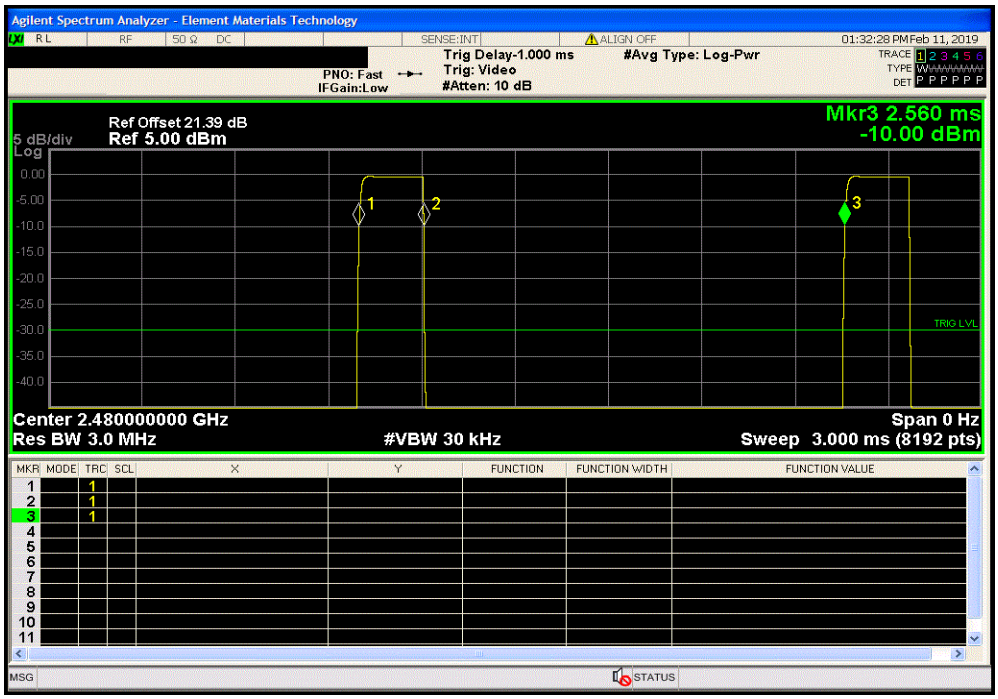


GFSK Mid Channel, 2445 MHz						
	Pulse Width	Period	Number of Pulses	Value (%)	Limit (%)	Results
	N/A	N/A	5	N/A	N/A	N/A

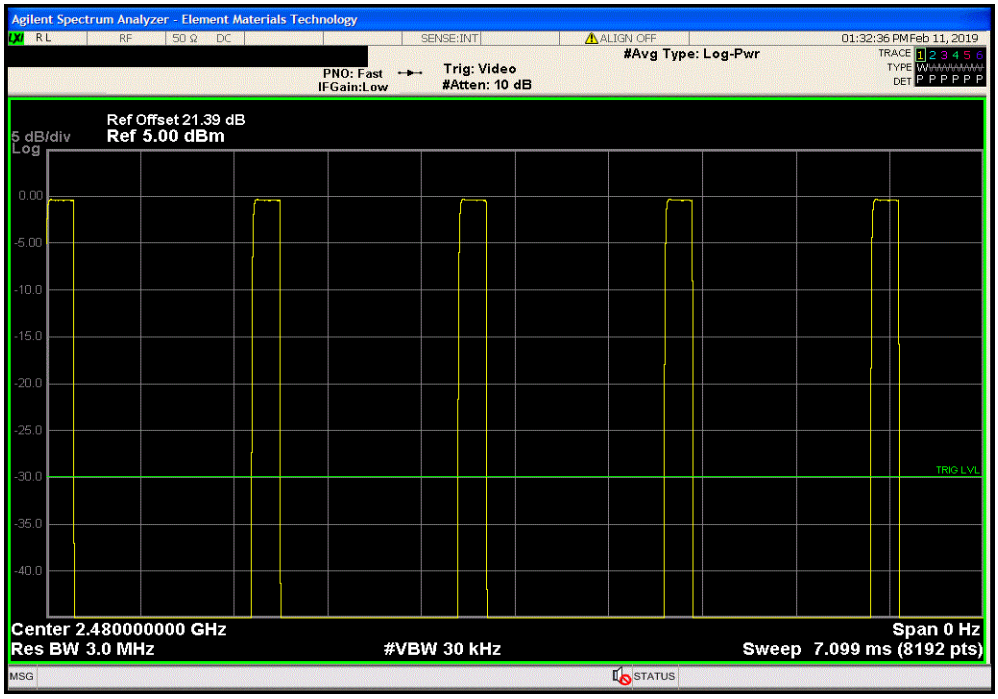


DUTY CYCLE

GFSK High Channel, 2480 MHz						
	Pulse Width	Period	Number of Pulses	Value (%)	Limit (%)	Results
	207.3 us	1.561 ms	1	13.3	N/A	N/A



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



OCCUPIED BANDWIDTH

XMit 2017.12.13

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

TEST EQUIPMENT

Description	Manufacturer	Model	ID	Last Cal.	Cal. Due
Generator - Signal	Keysight	N5182B	TFU	5-Nov-18	5-Nov-21
Cable, 40GHz	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
Attenuator	S.M. Electronics	SA26B-20	AUY	16-Apr-18	16-Apr-19
Analyzer - Spectrum Analyzer	Agilent	N9010A	AFI	1-Feb-19	1-Feb-20

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

element

TbtTx 2018.09.13 XMit 2017.12.13

EUT:	V1 Opal			**Work Order:**	APDM0015
Serial Number:	2775			**Date:**	11-Feb-19
Customer:	APDM, Inc.			**Temperature:**	19.4 °C
Attendees:	Andrew Greenberg, David Camarillo, Gavin Gallino, Timothy Brandon, Christopher Andrews.			**Humidity:**	37.7% RH
Project:	None			**Barometric Pres.:**	1010 mbar
Tested by:	Jody House & Jeff Alcoke	**Power:**	Battery	**Job Site:**	EV06

TEST SPECIFICATIONS	**Test Method**
FCC 15.247:2019	ANSI C63.10:2013

COMMENTS

Continously transmitting. GFSK. 2 MBps. Maximum power setting.

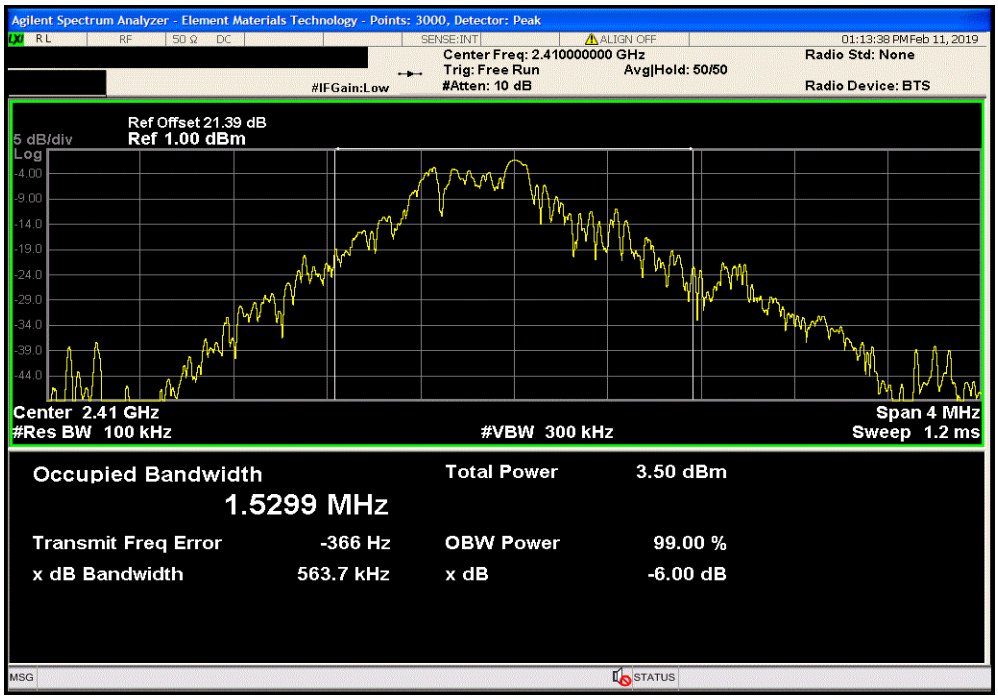
DEVIATIONS FROM TEST STANDARD

None

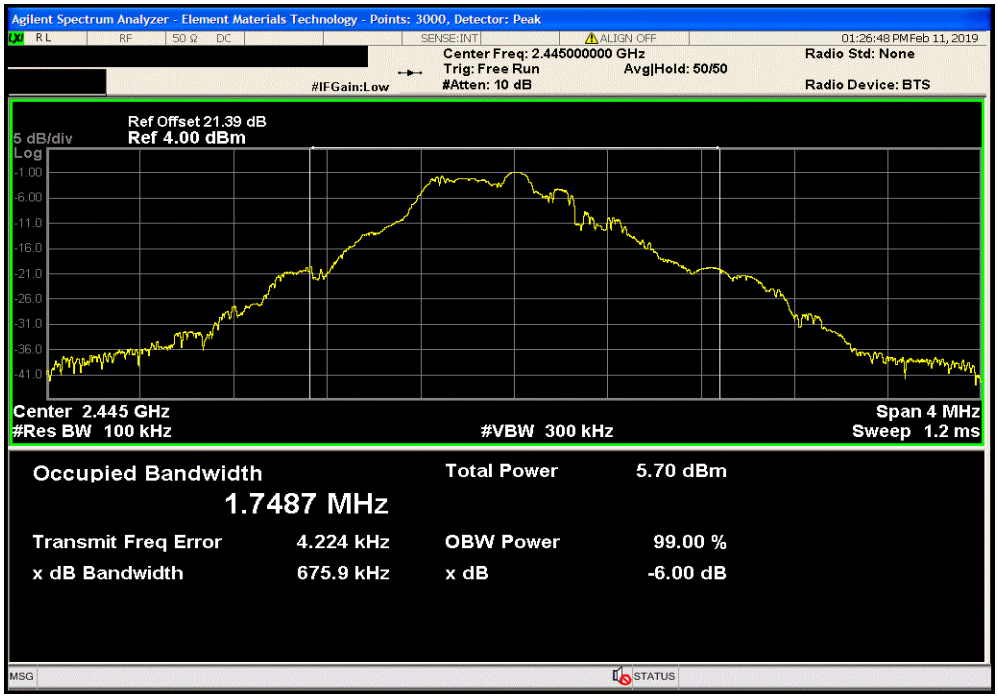
Configuration #	**2**	*Signature*

	Value	Limit (≥)	Result
GFSK Low Channel, 2410 MHz	563.693 kHz	500 kHz	Pass
GFSK Mid Channel, 2445 MHz	675.866 kHz	500 kHz	Pass
GFSK High Channel, 2480 MHz	690.128 kHz	500 kHz	Pass

GFSK Low Channel, 2410 MHz						
				Value	Limit (≥)	Result
				563.693 kHz	500 kHz	Pass

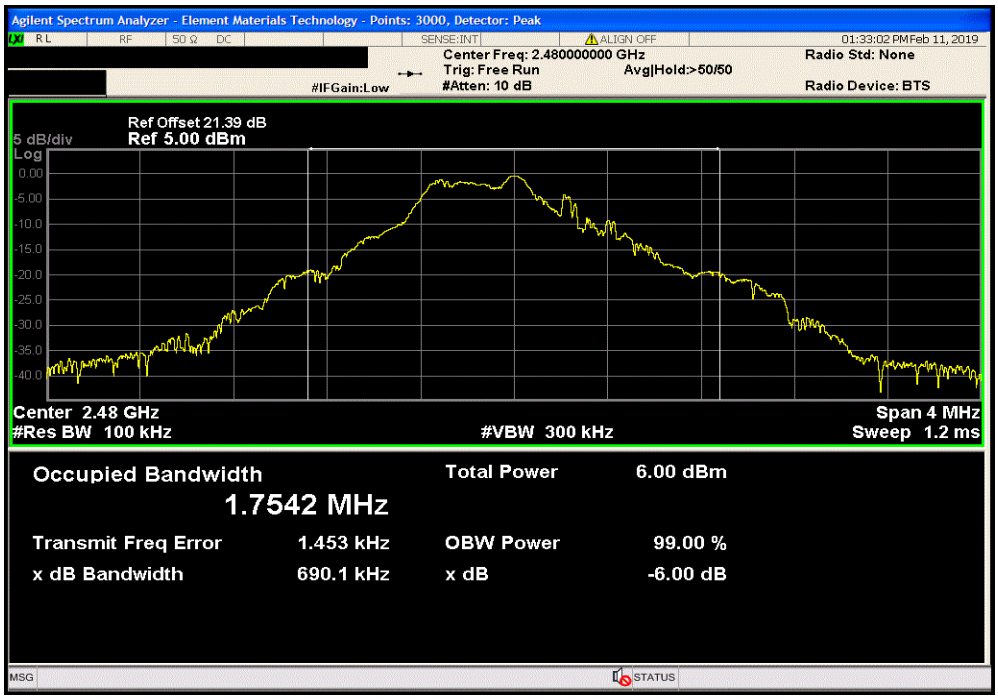


GFSK Mid Channel, 2445 MHz						
				Value	Limit (≥)	Result
				675.866 kHz	500 kHz	Pass



OCCUPIED BANDWIDTH

GFSK High Channel, 2480 MHz						
				Value	Limit (≥)	Result
				690.128 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
Analyzer - Spectrum Analyzer	Agilent	N9010A	AFI	1-Feb-19	1-Feb-20
Cable, 40GHz	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
Attenuator	S.M. Electronics	SA26B-20	AUY	16-Apr-18	16-Apr-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

TbtTx 2018.09.13 XMit 2017.12.13

EUT:	V1 Opal			**Work Order:**	APDM0015
Serial Number:	2775			**Date:**	11-Feb-19
Customer:	APDM, Inc.			**Temperature:**	19.4 °C
Attendees:	Andrew Greenberg, David Camarillo, Gavin Gallino, Timothy Brandon, Christopher Andrews.			**Humidity:**	37.6% RH
Project:	None			**Barometric Pres.:**	1010 mbar
Tested by:	Jody House & Jeff Alcoke	**Power:**	Battery	**Job Site:**	EV06

TEST SPECIFICATIONS	**Test Method**
FCC 15.247:2019	ANSI C63.10:2013

COMMENTS

Continously transmitting. GFSK. 2 MBps. Maximum power setting.

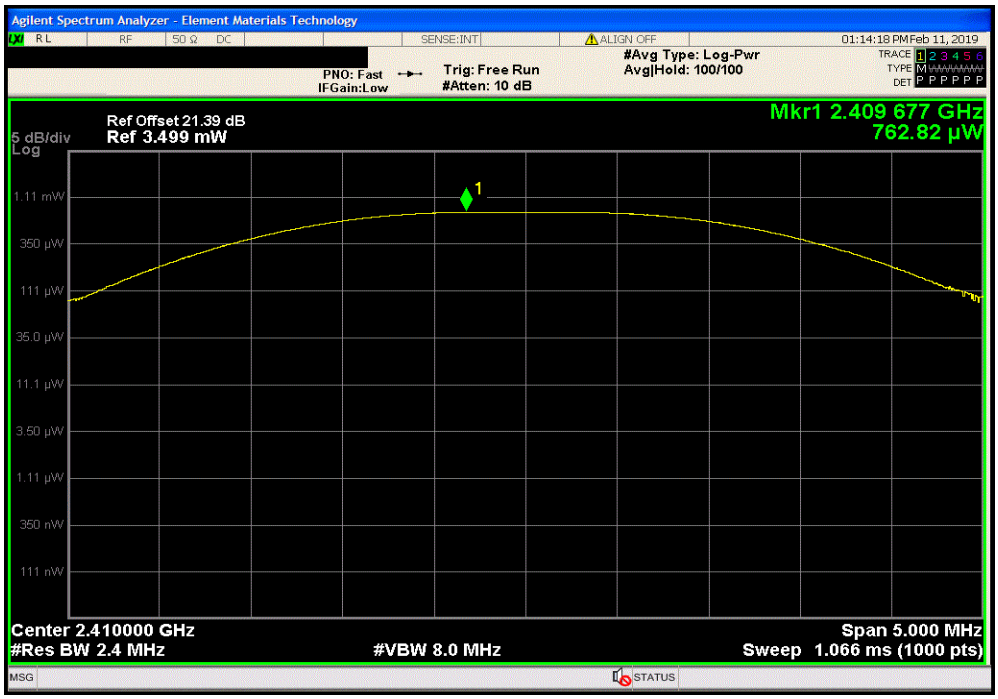
DEVIATIONS FROM TEST STANDARD

None

Configuration #	**2**	*Signature*

	Out Pwr (µW)	**Limit (W)**	**Result**
GFSK Low Channel, 2410 MHz	762.82	<1	Pass
GFSK Mid Channel, 2445 MHz	847.29	<1	Pass
GFSK High Channel, 2480 MHz	942.14	<1	Pass

GFSK Low Channel, 2410 MHz						
				Out Pwr (µW)	Limit (W)	Result
				762.82	<1	Pass



GFSK Mid Channel, 2445 MHz						
				Out Pwr (µW)	Limit (W)	Result
				847.29	<1	Pass

OUTPUT POWER

GFSK High Channel, 2480 MHz						
				Out Pwr (µW)	Limit (W)	Result
				942.14	<1	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
Analyzer - Spectrum Analyzer	Agilent	N9010A	AFI	1-Feb-19	1-Feb-20
Cable, 40GHz	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
Attenuator	S.M. Electronics	SA26B-20	AUY	16-Apr-18	16-Apr-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 actual antenna gain of hte EUT was added to the conducted output power to derive the EIRP values.

EQUIVALENT ISOTROPIC RADIATED POWER

element

TbtTx 2018.09.13 XMit 2017.12.13

EUT:	V1 Opal			**Work Order:**	APDM0015
Serial Number:	2775			**Date:**	11-Feb-19
Customer:	APDM, Inc.			**Temperature:**	19.5 °C
Attendees:	Andrew Greenberg, David Camarillo, Gavin Gallino, Timothy Brandon, Christopher Andrews.			**Humidity:**	37.5% RH
Project:	None			**Barometric Pres.:**	1010 mbar
Tested by:	Jody House & Jeff Alcoke	**Power:**	Battery	**Job Site:**	EV06

TEST SPECIFICATIONS	**Test Method**
FCC 15.247:2019	ANSI C63.10:2013

COMMENTS

Continously transmitting. GFSK. 2 MBps. Maximum power setting.

DEVIATIONS FROM TEST STANDARD

None

Configuration #	2	*Signature*

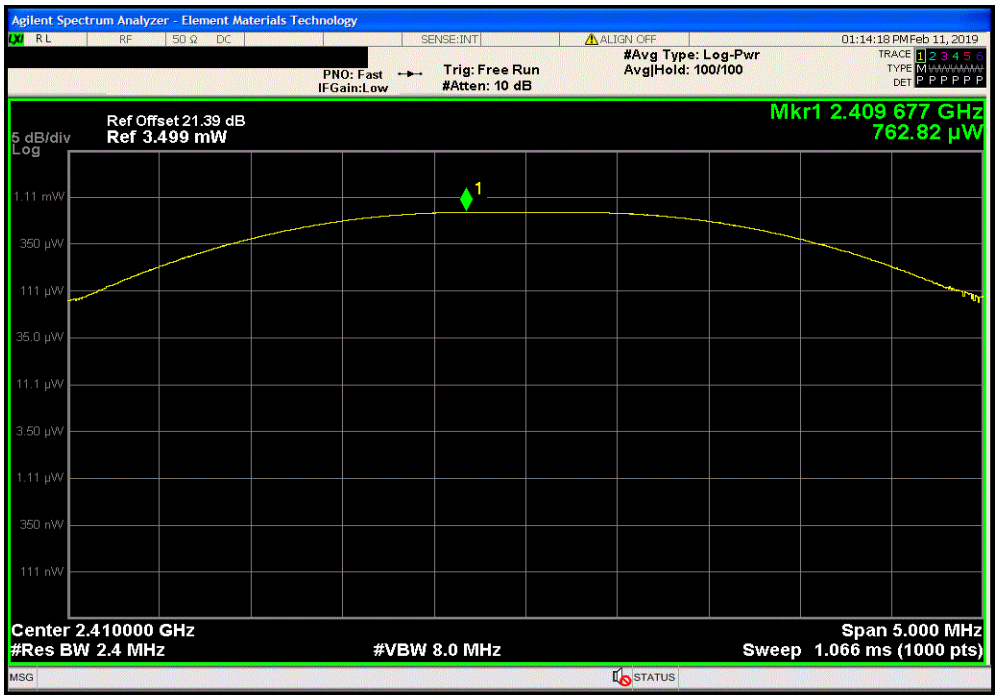
	Avg Cond Pwr (uW)	Out Pwr (dBm)	Antenna Gain (dBi)	EIRP (dBi)	EIRP Limit (dBi)	Result
GFSK Low Channel, 2410 MHz	762.82	-1	3	2	<36	Pass
GFSK Mid Channel, 2445 MHz	847.29	-1	3	2	<36	Pass
GFSK High Channel, 2480 MHz	942.14	0	3	3	<36	Pass

EQUIVALENT ISOTROPIC RADIATED POWER

element

TbtTx 2018.09.13 XMit 2017.12.13

GFSK Low Channel, 2410 MHz						
Avg Cond Pwr (uW)		Out Pwr (dBm)	Antenna Gain (dBi)	EIRP (dBi)	EIRP Limit (dBi)	Result
762.82		-1.18	3	1.82	<36	Pass



GFSK Mid Channel, 2445 MHz						
Avg Cond Pwr (uW)		Out Pwr (dBm)	Antenna Gain (dBi)	EIRP (dBi)	EIRP Limit (dBi)	Result
847.29		-0.72	3	2.28	<36	Pass

EQUIVALENT ISOTROPIC RADIATED POWER

element

TbtTx 2018.09.13 XMit 2017.12.13

GFSK High Channel, 2480 MHz						
Avg Cond Pwr (uW)		Out Pwr (dBm)	Antenna Gain (dBi)	EIRP (dBi)	EIRP Limit (dBi)	Result
942.14		-0.26	3	2.74	<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
Analyzer - Spectrum Analyzer	Agilent	N9010A	AFI	1-Feb-19	1-Feb-20
Generator - Signal	Keysight	N5182B	TFU	5-Nov-18	5-Nov-21
Cable, 40GHz	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

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

element

TbtTx 2018.09.13 XMit 2017.12.13

EUT:	V1 Opal			**Work Order:**	APDM0015
Serial Number:	2775			**Date:**	11-Feb-19
Customer:	APDM, Inc.			**Temperature:**	19.4 °C
Attendees:	Andrew Greenberg, David Camarillo, Gavin Gallino, Timothy Brandon, Christopher Andrews.			**Humidity:**	37.8% RH
Project:	None			**Barometric Pres.:**	1010 mbar
Tested by:	Jody House & Jeff Alcoke	**Power:**	Battery	**Job Site:**	EV06

TEST SPECIFICATIONS	**Test Method**
FCC 15.247:2019	ANSI C63.10:2013

COMMENTS

Continously transmitting. GFSK. 2 MBps. Maximum power setting.

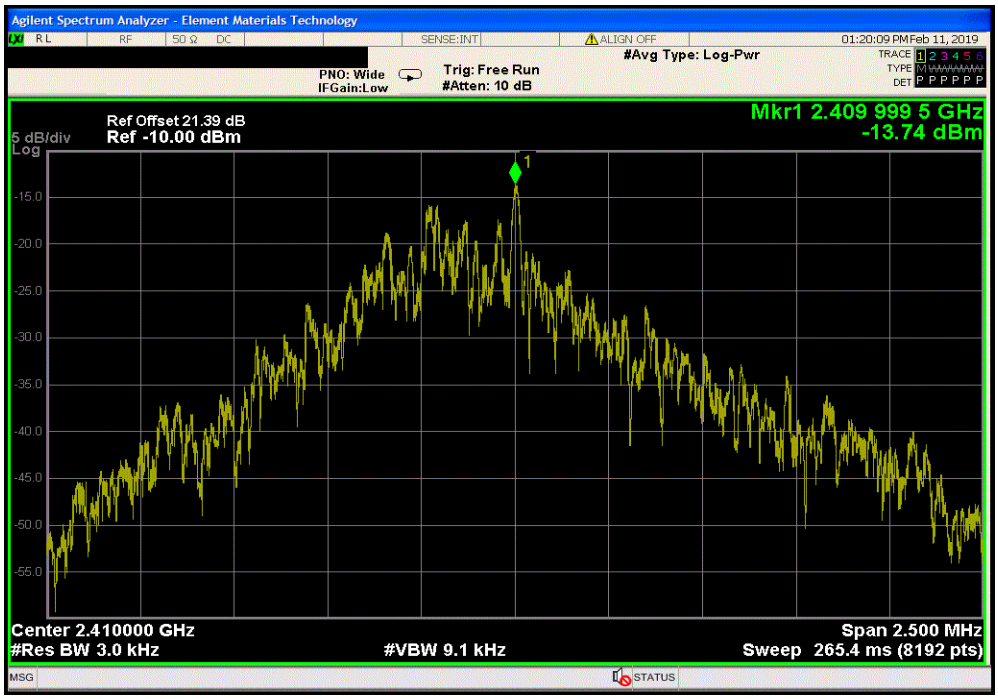
DEVIATIONS FROM TEST STANDARD

None

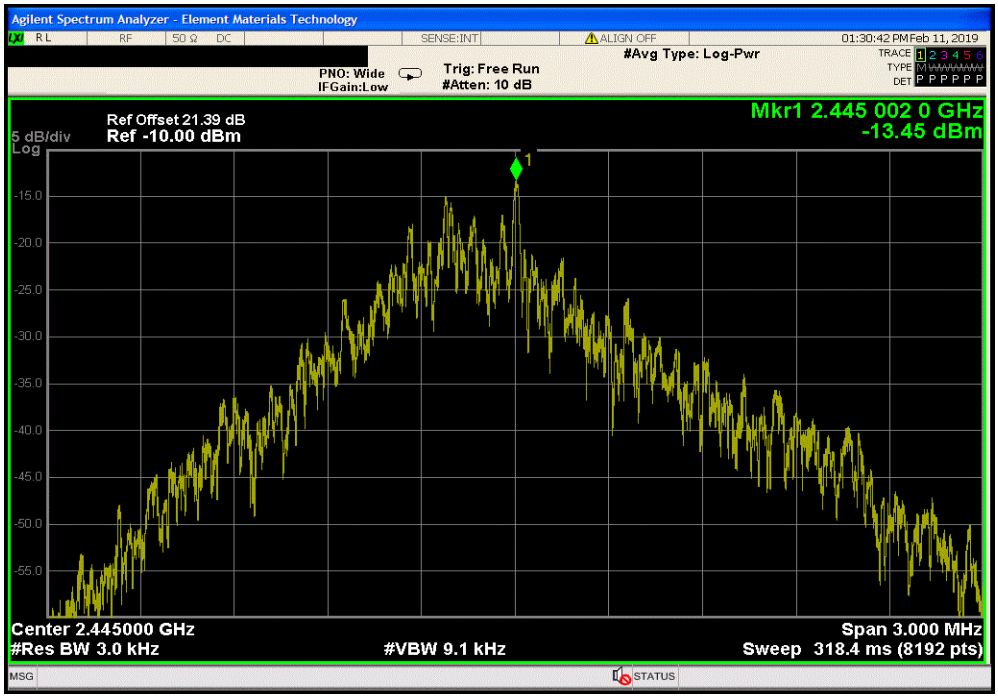
Configuration #	**2**	*Signature*

	Value dBm/3kHz	**Limit < dBm/3kHz**	**Results**
GFSK Low Channel, 2410 MHz	-13.739	8	Pass
GFSK Mid Channel, 2445 MHz	-13.45	8	Pass
GFSK High Channel, 2480 MHz	-12.794	8	Pass

GFSK Low Channel, 2410 MHz						
				Value dBm/3kHz	Limit < dBm/3kHz	Results
				-13.739	8	Pass



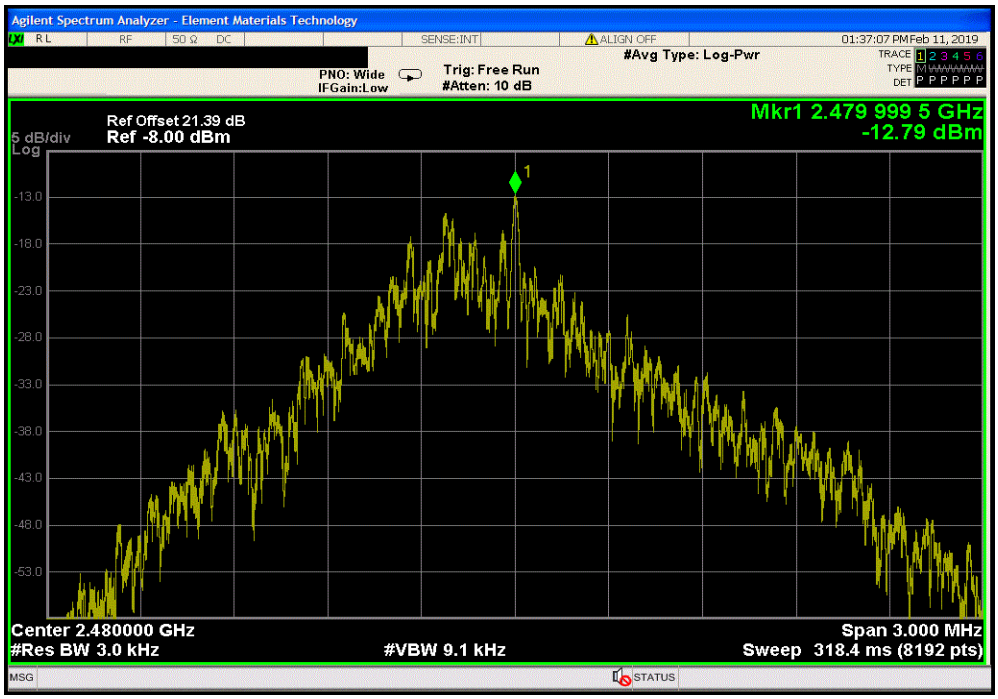
GFSK Mid Channel, 2445 MHz						
				Value dBm/3kHz	Limit < dBm/3kHz	Results
				-13.45	8	Pass



POWER SPECTRAL DENSITY

TbtTx 2018.09.13 XMit 2017.12.13

GFSK High Channel, 2480 MHz						
				Value dBm/3kHz	Limit < dBm/3kHz	Results
				-12.794	8	Pass



BAND EDGE COMPLIANCE

XMit 2017.12.13

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

TEST EQUIPMENT

Description	Manufacturer	Model	ID	Last Cal.	Cal. Due
Analyzer - Spectrum Analyzer	Agilent	N9010A	AFI	1-Feb-19	1-Feb-20
Cable, 40GHz	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
Generator - Signal	Keysight	N5182B	TFU	5-Nov-18	5-Nov-21

TEST DESCRIPTION

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

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

BAND EDGE COMPLIANCE

TbtTx 2018.09.13 XMit 2017.12.13

EUT:	V1 Opal			**Work Order:**	APDM0015
Serial Number:	2775			**Date:**	11-Feb-19
Customer:	APDM, Inc.			**Temperature:**	19.4
Attendees:	Andrew Greenberg, David Camarillo, Gavin Gallino, Timothy Brandon, Christopher Andrews.			**Humidity:**	38%
Project:	None			**Barometric Pres.:**	29.74
Tested by:	Jody House & Jeff Alcoke	**Power:**	Battery	**Job Site:**	EV06

TEST SPECIFICATIONS	**Test Method**
FCC 15.247:2019	ANSI C63.10:2013

COMMENTS

GFSK. 2 MBps. Maximum power setting.

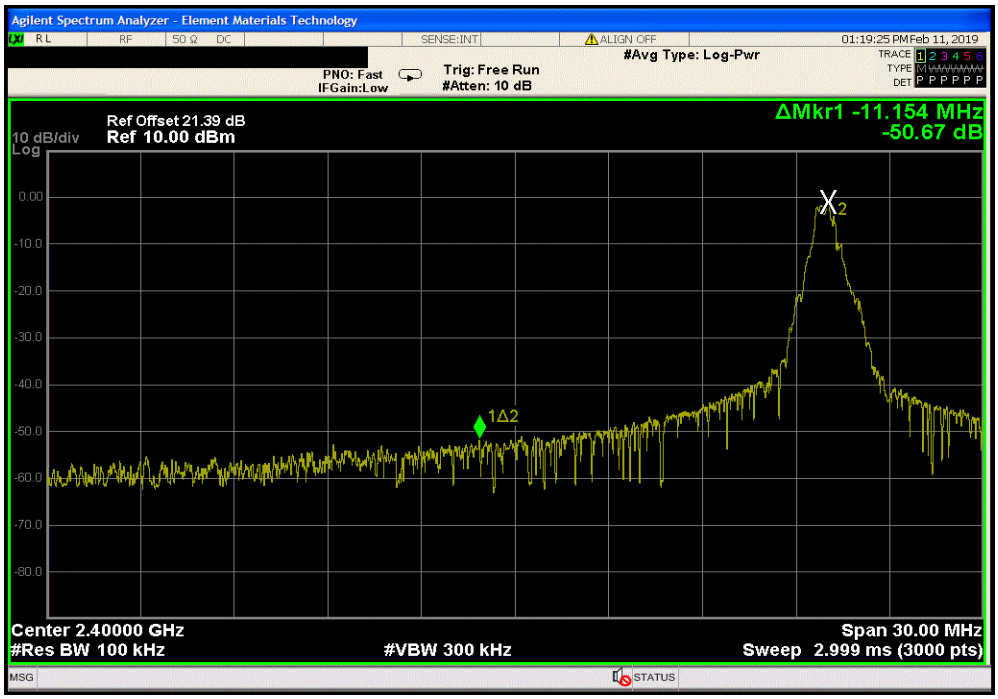
DEVIATIONS FROM TEST STANDARD

None

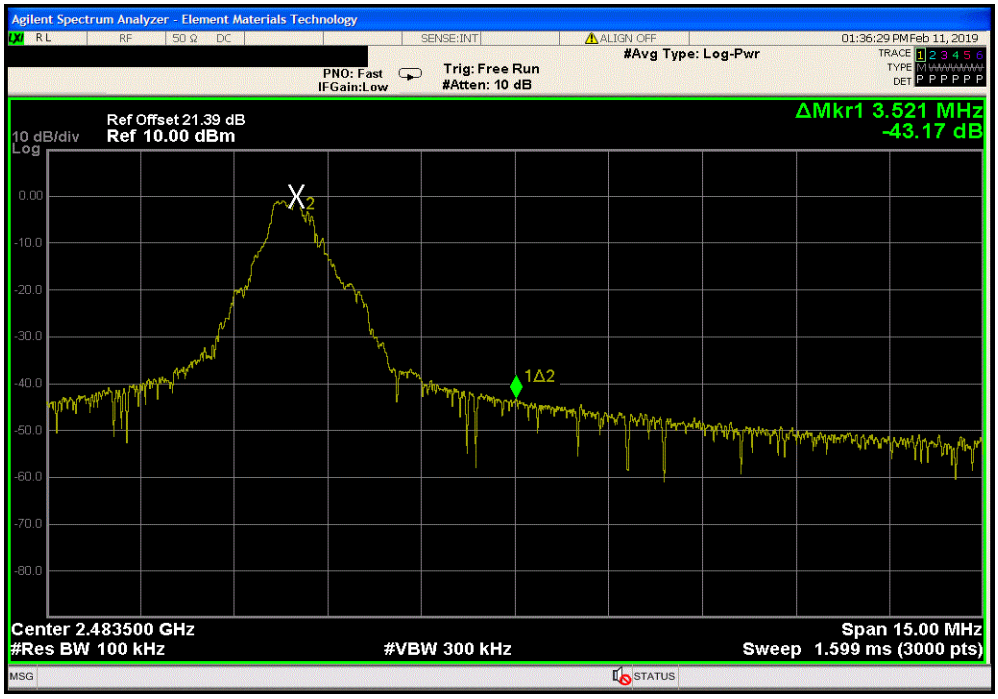
Configuration #	**2**	*Signature*

	Value (dBc)	**Limit ≤ (dBc)**	**Result**
GFSK Low Channel, 2410 MHz	-50.67	-20	Pass
GFSK High Channel, 2480 MHz	-43.17	-20	Pass

GFSK Low Channel, 2410 MHz						
				Value (dBc)	Limit ≤ (dBc)	Result
				-50.67	-20	Pass



GFSK High Channel, 2480 MHz						
				Value (dBc)	Limit ≤ (dBc)	Result
				-43.17	-20	Pass



SPURIOUS CONDUCTED EMISSIONS

XMit 2017.12.13

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

TEST EQUIPMENT

Description	Manufacturer	Model	ID	Last Cal.	Cal. Due
Generator - Signal	Keysight	N5182B	TFU	5-Nov-18	5-Nov-21
Cable, 40GHz	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
Attenuator	S.M. Electronics	SA26B-20	AUY	16-Apr-18	16-Apr-19
Analyzer - Spectrum Analyzer	Agilent	N9010A	AFI	1-Feb-19	1-Feb-20

TEST DESCRIPTION

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

SPURIOUS CONDUCTED EMISSIONS

TbtTx 2018.09.13 XMit 2017.12.13

EUT:	V1 Opal			**Work Order:**	APDM0015
Serial Number:	2775			**Date:**	11-Feb-19
Customer:	APDM, Inc.			**Temperature:**	19.4 °C
Attendees:	Andrew Greenberg, David Camarillo, Gavin Gallino, Timothy Brandon, Christopher Andrews.			**Humidity:**	37.8% RH
Project:	None			**Barometric Pres.:**	1010 mbar
Tested by:	Jody House & Jeff Alcoke	**Power:**	Battery	**Job Site:**	EV06

TEST SPECIFICATIONS	**Test Method**
FCC 15.247:2019	ANSI C63.10:2013

COMMENTS

Continously transmitting. GFSK. 2 MBps. Maximum power setting.

DEVIATIONS FROM TEST STANDARD

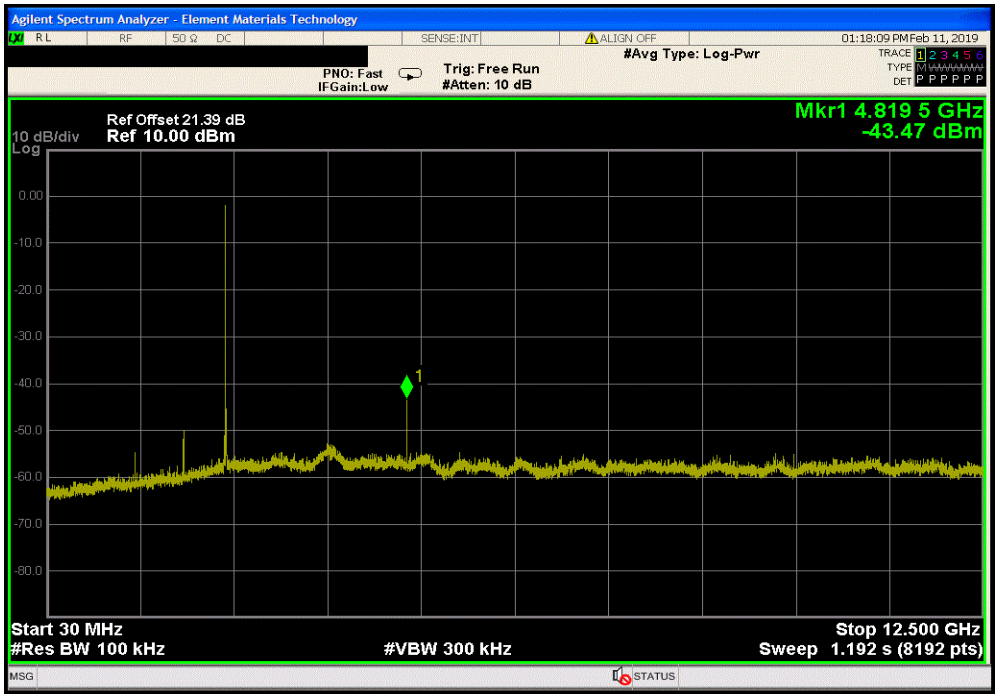
None

Configuration #	2	*Signature*

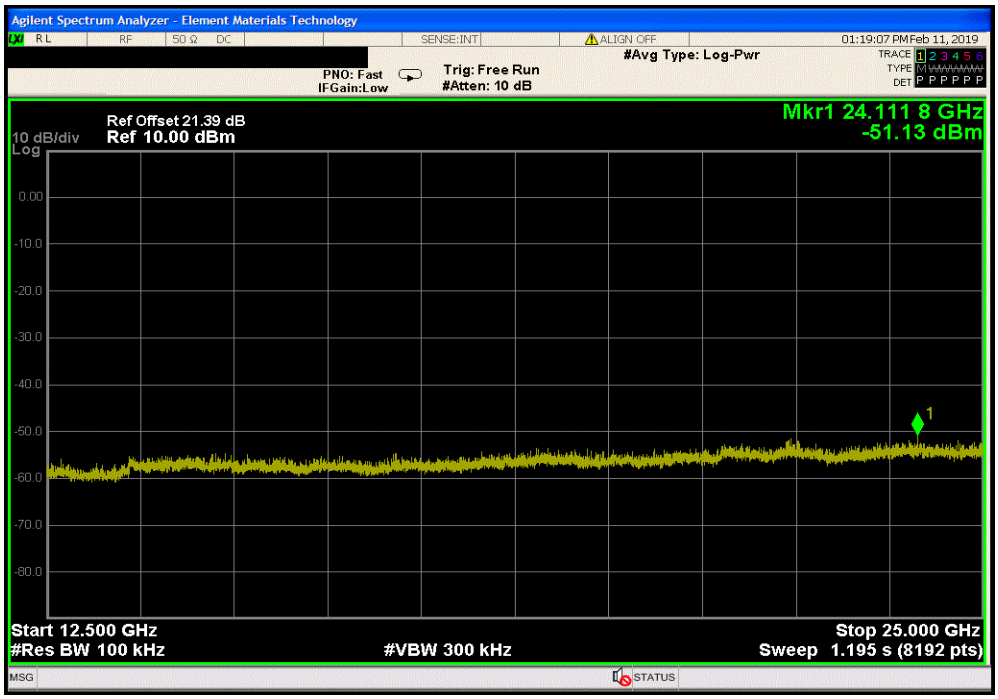
	Frequency Range	Measured Freq (MHz)	Max Value (dBc)	Limit ≤ (dBc)	Result
GFSK Low Channel, 2410 MHz	Fundamental	2410	N/A	N/A	N/A
GFSK Low Channel, 2410 MHz	30 MHz - 12.5 GHz	4819.48	-42.25	-20	Pass
GFSK Low Channel, 2410 MHz	12.5 GHz - 25 GHz	24111.83	-49.91	-20	Pass
GFSK Mid Channel, 2445 MHz	Fundamental	2445	N/A	N/A	N/A
GFSK Mid Channel, 2445 MHz	30 MHz - 12.5 GHz	4889.51	-42.17	-20	Pass
GFSK Mid Channel, 2445 MHz	12.5 GHz - 25 GHz	24938.96	-50.57	-20	Pass
GFSK High Channel, 2480 MHz	Fundamental	2480	N/A	N/A	N/A
GFSK High Channel, 2480 MHz	30 MHz - 12.5 GHz	4959.54	-42.35	-20	Pass
GFSK High Channel, 2480 MHz	12.5 GHz - 25 GHz	23988.22	-50.76	-20	Pass

GFSK Low Channel, 2410 MHz					
Frequency Range		Measured Freq (MHz)	Max Value (dBc)	Limit ≤ (dBc)	Result
	Fundamental	2410	N/A	N/A	N/A

GFSK Low Channel, 2410 MHz				
Frequency Range	Measured Freq (MHz)	Max Value (dBc)	Limit ≤ (dBc)	Result
30 MHz - 12.5 GHz	4819.48	-42.25	-20	Pass

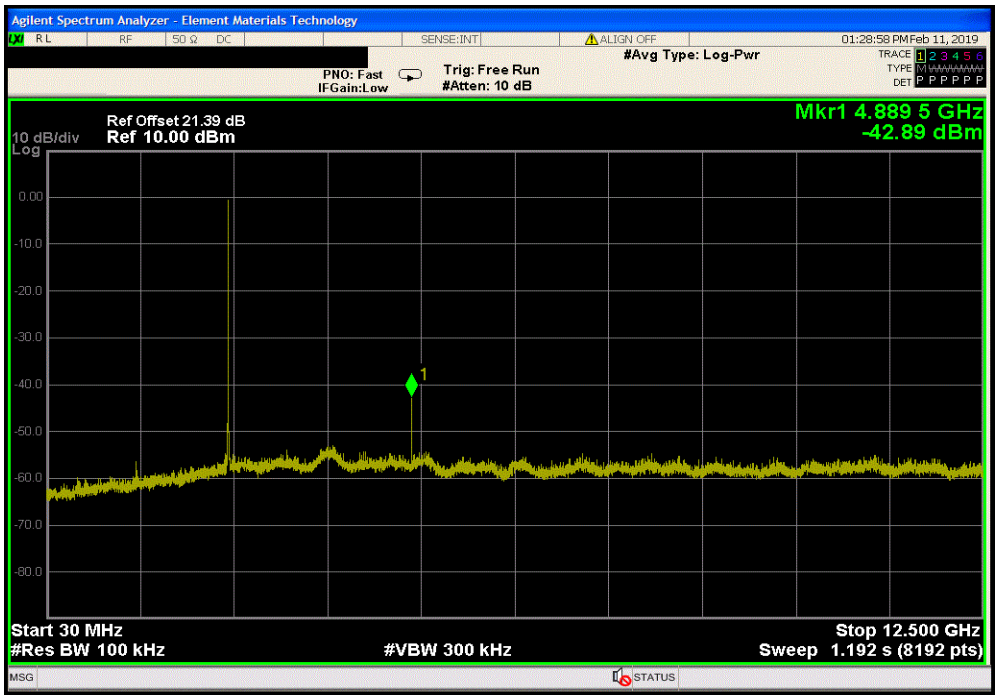


GFSK Low Channel, 2410 MHz				
Frequency Range	Measured Freq (MHz)	Max Value (dBc)	Limit ≤ (dBc)	Result
12.5 GHz - 25 GHz	24111.83	-49.91	-20	Pass

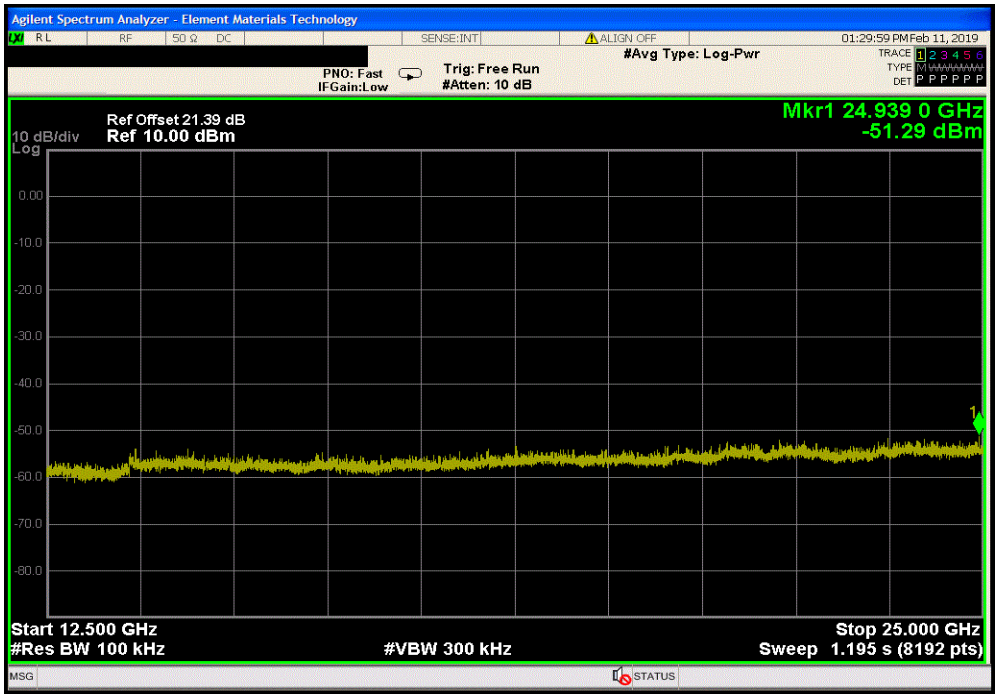


GFSK Mid Channel, 2445 MHz				
Frequency Range	Measured Freq (MHz)	Max Value (dBc)	Limit ≤ (dBc)	Result
Fundamental	2445	N/A	N/A	N/A

GFSK Mid Channel, 2445 MHz				
Frequency Range	Measured Freq (MHz)	Max Value (dBc)	Limit ≤ (dBc)	Result
30 MHz - 12.5 GHz	4889.51	-42.17	-20	Pass

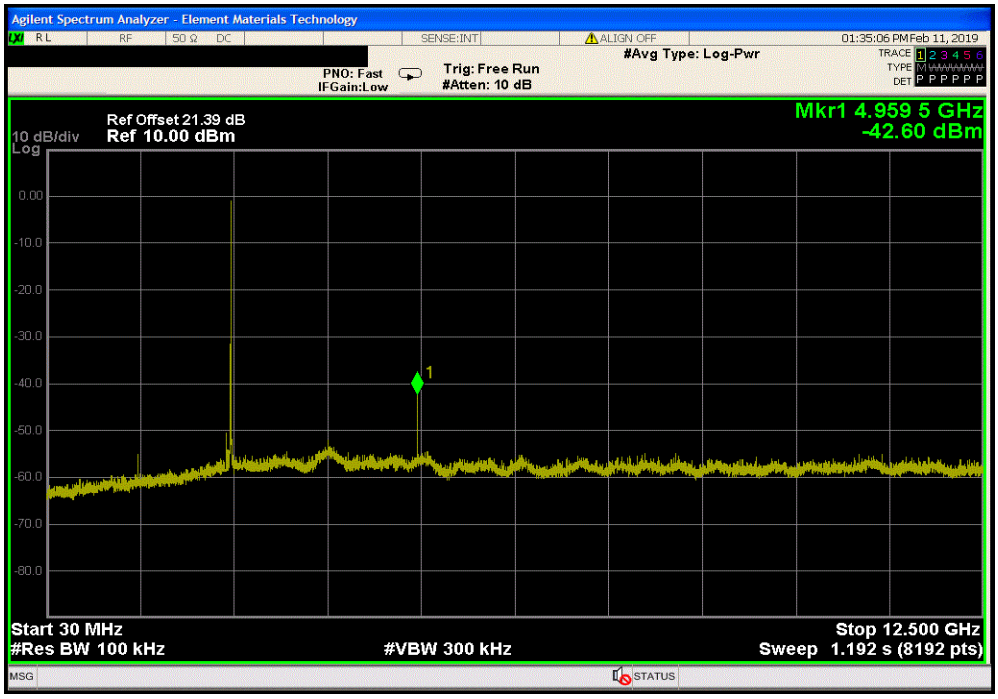


GFSK Mid Channel, 2445 MHz				
Frequency Range	Measured Freq (MHz)	Max Value (dBc)	Limit ≤ (dBc)	Result
12.5 GHz - 25 GHz	24938.96	-50.57	-20	Pass



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

GFSK High Channel, 2480 MHz				
Frequency Range	Measured Freq (MHz)	Max Value (dBc)	Limit ≤ (dBc)	Result
30 MHz - 12.5 GHz	4959.54	-42.35	-20	Pass



GFSK High Channel, 2480 MHz				
Frequency Range	Measured Freq (MHz)	Max Value (dBc)	Limit ≤ (dBc)	Result
12.5 GHz - 25 GHz	23988.22	-50.76	-20	Pass