

NORTHWEST EMC

APDM, Inc.

AP

FCC 15.207:2016

FCC 15.247:2016

2.4 GHz DTS Radio

Report # APDM0009.3



NVLAP®

NVLAP Lab Code: 200630-0

This report must not be used to claim product certification, approval, or endorsement by NVLAP, NIST, or any agency of the federal government of the United States of America.

CERTIFICATE OF TEST

Last Date of Test: February 18, 2016

APDM, Inc.

Model: AP

Radio Equipment Testing

Standards

Specification	Method
FCC 15.207:2016	
FCC 15.247:2016	ANSI C63.10:2013

Results

Method Clause	Test Description	Applied	Results	Comments
6.2	AC – Powerline Conducted Emissions	Yes	Pass	
6.5, 6.6	Spurious Radiated Emissions	Yes	Pass	
6.10.4	Band Edge Compliance	Yes	Pass	
11.6	Duty Cycle	Yes	Pass	
11.8.2	Occupied Bandwidth	Yes	Pass	
11.9	Output Power	Yes	Pass	
11.10	Power Spectral Density	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.

REVISION HISTORY

Revision Number	Description	Date	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 Northwest EMC to certify transmitters to FCC and IC specifications.

NVLAP - Each laboratory is accredited by NVLAP to ISO 17025

Canada

IC - Recognized by Industry Canada as a Certification Body (CB). Certification chambers and Open Area Test Sites are filed with IC.

European Union

European Commission - Validated by the European Commission as a Conformity Assessment Body (CAB) under the EMC directive and as a Notified Body under the R&TTE Directive.

Australia/New Zealand

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

Korea

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

Japan

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

Taiwan

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

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

Singapore

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

Israel

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

Hong Kong

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

Vietnam

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

SCOPE

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

<http://www.nwemc.com/accreditations/>

<http://gsi.nist.gov/global/docs/cabs/designations.html>

MEASUREMENT UNCERTAINTY

Measurement Uncertainty

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

A measurement uncertainty estimation has been performed for each test per our internal quality document WP 342. The estimation is used to compare the measured result with its "true" or theoretically correct value. The expanded measurement uncertainty (K=2) for each test is on each data sheet. Our measurement data meets or exceeds the measurement uncertainty requirements of the applicable specification; therefore, the test data can be compared directly to the specification limit to determine compliance. The calculations for estimating measurement uncertainty are based upon ETSI TR 100 028 (or CISPR 16-4-2 as applicable), and are available upon request.

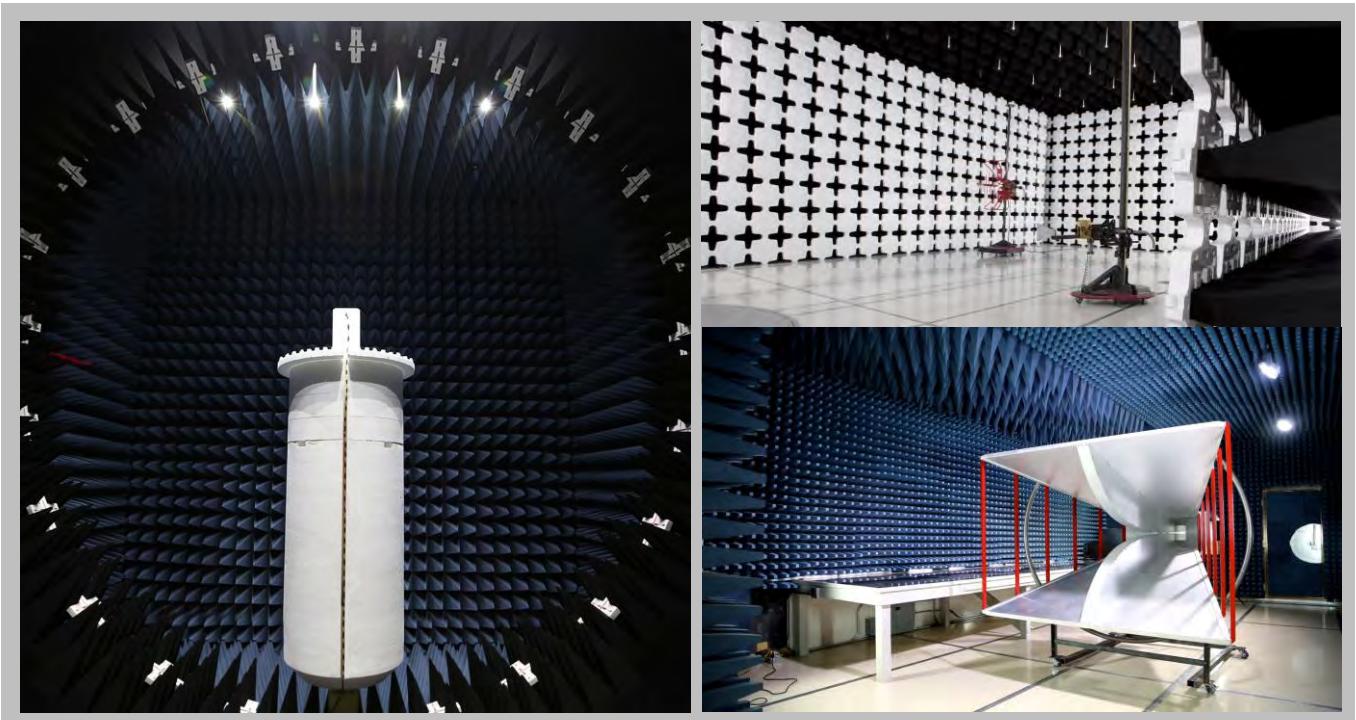
The following table represents the Measurement Uncertainty (MU) budgets for each of the tests that may be contained in this report.

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

FACILITIES



California	Minnesota	New York	Oregon	Texas	Washington
Labs OC01-13 41 Tesla Irvine, CA 92618 (949) 861-8918	Labs MN01-08, MN10 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 22975 NW Evergreen Pkwy Hillsboro, OR 97124 (503) 844-4066	Labs TX01-09 3801 E Plano Pkwy Plano, TX 75074 (469) 304-5255	Labs NC01-05 19201 120 th Ave NE Bothell, WA 98011 (425)984-6600
NVLAP					
NVLAP Lab Code: 200676-0	NVLAP Lab Code: 200881-0	NVLAP Lab Code: 200761-0	NVLAP Lab Code: 200630-0	NVLAP Lab Code: 201049-0	NVLAP Lab Code: 200629-0
Industry Canada					
2834B-1, 2834B-3	2834E-1	N/A	2834D-1, 2834D-2	2834G-1	2834F-1
BSMI					
SL2-IN-E-1154R	SL2-IN-E-1152R	N/A	SL2-IN-E-1017	SL2-IN-E-1158R	SL2-IN-E-1153R
VCCI					
A-0029	A-0109	N/A	A-0108	A-0201	A-0110
Recognized Phase I CAB for ACMA, BSMI, IDA, KCC/RRA, MIC, MOC, NCC, OFCA					
US0158	US0175	N/A	US0017	US0191	US0157



PRODUCT DESCRIPTION

Client and Equipment Under Test (EUT) Information

Company Name:	APDM, Inc.
Address:	2828 SW Corbett Ave. Suite 135
City, State, Zip:	Portland, OR 97201
Test Requested By:	Jennifer Guyot
Model:	AP
First Date of Test:	February 05, 2016
Last Date of Test:	February 18, 2016
Receipt Date of Samples:	February 02, 2016
Equipment Design Stage:	Production
Equipment Condition:	No Damage

Information Provided by the Party Requesting the Test

Functional Description of the EUT:

The AP contains a proprietary 2.4 GHz GFSK radio that communicates with body worn patient monitor. The AP is wired via USB to a Dock that provides an interface via USB to a PC. The Dock is powered by an AC-DC wall bug adapter.

Testing Objective:

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

CONFIGURATIONS

Configuration APDM0009- 1

Software/Firmware Running during test	
Description	Version
sd-read.sh	None

EUT			
Description	Manufacturer	Model/Part Number	Serial Number
Access Point	APDM Inc.	None	SMTC1630754

Remote Equipment Outside of Test Setup Boundary			
Description	Manufacturer	Model/Part Number	Serial Number
Laptop (Dell)	Dell	HP-2140	CNU9312N8C
AC/DC Power Supply (Dell)	Dell	None	None

Cables					
Cable Type	Shield	Length (m)	Ferrite	Connection 1	Connection 2
USB	Yes	2.0m	No	Access Point	Laptop
Audio Cable	No	1.2m	No	Access Point	Unterminated

Configuration APDM0009- 2

Software/Firmware Running during test	
Description	Version
sd-read.sh	None

EUT			
Description	Manufacturer	Model/Part Number	Serial Number
Access Point	APDM Inc.	None	SMTC1630754

Peripherals in test setup boundary			
Description	Manufacturer	Model/Part Number	Serial Number
AC/DC Adapter (HP)	Hewlett-Packard	519329-001	WASGU0AEXQDV
Laptop (HP)	Hewlett-Packard	KS148UT#ABA	CNU9312N8C

Cables					
Cable Type	Shield	Length (m)	Ferrite	Connection 1	Connection 2
USB	Yes	2.0m	No	Access Point	Laptop
AC Power	No	2.0m	No	AC mains	AC/DC Adapter (HP)
DC Power	Unknown	1.8m	No	AC/DC Adapter (HP)	Laptop (HP)

CONFIGURATIONS

Configuration APDM0009- 4

Software/Firmware Running during test	
Description	Version
sd-read.sh	None
Firmware	20140103114632-795-G30DFFBE
AP_Help_Loop	None

EUT			
Description	Manufacturer	Model/Part Number	Serial Number
Dock	APDM Inc.	None	D39
Access Point	APDM Inc.	None	SMTC1630754

Peripherals in test setup boundary				
Description	Manufacturer	Model/Part Number	Serial Number	
AC/DC Adapter (Lenovo)	Lenovo	42T4418	11S42T4418Z1Z6W616FFB0	
Laptop (Lenovo)	Lenovo	Edge/0578-A25	LR-XVYX2	
Wearable wirelessly synchronized human movement monitor	APDM Inc.	Opal v2.6	STMC1630738	
AC Adapter (Dock)	Volgen	KTPS24-12020WA	None	

Cables					
Cable Type	Shield	Length (m)	Ferrite	Connection 1	Connection 2
DC Power	No	1.8m	Yes	AC/DC Adapter (Lenovo)	Laptop (Lenovo)
AC Power	No	1.0	No	AC Mains	AC/DC Adapter (Lenovo)
Synchronization interface cable	Unknown	1.8m	No	Access Point	Unterminated
USB	Yes	2.0m	Yes	Access Point	Dock
USB	Yes	2.0m	Yes	Dock	Laptop (Lenovo)
DC Power	No	1.5m	No	AC Adapter (Dock)	Dock

MODIFICATIONS

Equipment Modifications

Item	Date	Test	Modification	Note	Disposition of EUT
1	2/5/2016	Spurious Radiated Emissions	Tested as delivered to Test Station.	No EMI suppression devices were added or modified during this test.	EUT remained at Northwest EMC following the test.
2	2/15/2016	Duty Cycle	Tested as delivered to Test Station.	No EMI suppression devices were added or modified during this test.	EUT remained at Northwest EMC following the test.
3	2/15/2016	Occupied Bandwidth	Tested as delivered to Test Station.	No EMI suppression devices were added or modified during this test.	EUT remained at Northwest EMC following the test.
4	2/15/2016	Output Power	Tested as delivered to Test Station.	No EMI suppression devices were added or modified during this test.	EUT remained at Northwest EMC following the test.
5	2/15/2016	Power Spectral Density	Tested as delivered to Test Station.	No EMI suppression devices were added or modified during this test.	EUT remained at Northwest EMC following the test.
6	2/15/2016	Band Edge Compliance	Tested as delivered to Test Station.	No EMI suppression devices were added or modified during this test.	EUT remained at Northwest EMC following the test.
7	2/15/2016	Spurious Conducted Emissions	Tested as delivered to Test Station.	No EMI suppression devices were added or modified during this test.	EUT remained at Northwest EMC following the test.
8	2/18/2016	AC – Powerline Conducted Emissions	Tested as delivered to Test Station.	No EMI suppression devices were added or modified during this test.	Scheduled testing was completed.

DUTY CYCLE

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.	Interval (mo)
Generator - Signal	Keysight	5182B	TFU	NCR	0
Chamber - Temperature/Humidity	Cincinnati Sub Zero (CSZ)	ZPH-8-2-SCT/AC	TBI	NCR	0
Thermometer	Omegalette	HH311	DTY	1/21/2015	36
Cable	ESM Cable Corp.	TT	EV1	NCR	0
Attenuator	S.M. Electronics	SA26B-20	AWU	NCR	0
Block - DC	Fairview Microwave	SD3379	AMQ	6/18/2015	12
Analyzer - Spectrum Analyzer	Agilent	E4440A	AAW	12/1/2014	24

TEST DESCRIPTION

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. 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.

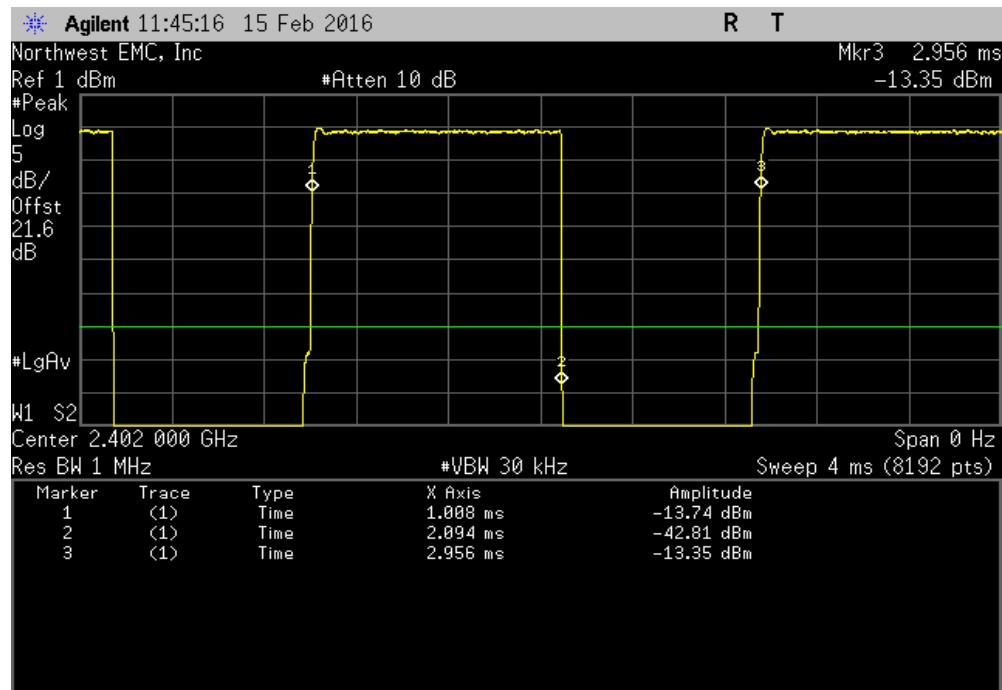
If the transmit duty cycle < 98 percent, burst gating may have been used during some of the other tests in this report to only take the measurement during the burst duration.

DUTY CYCLE

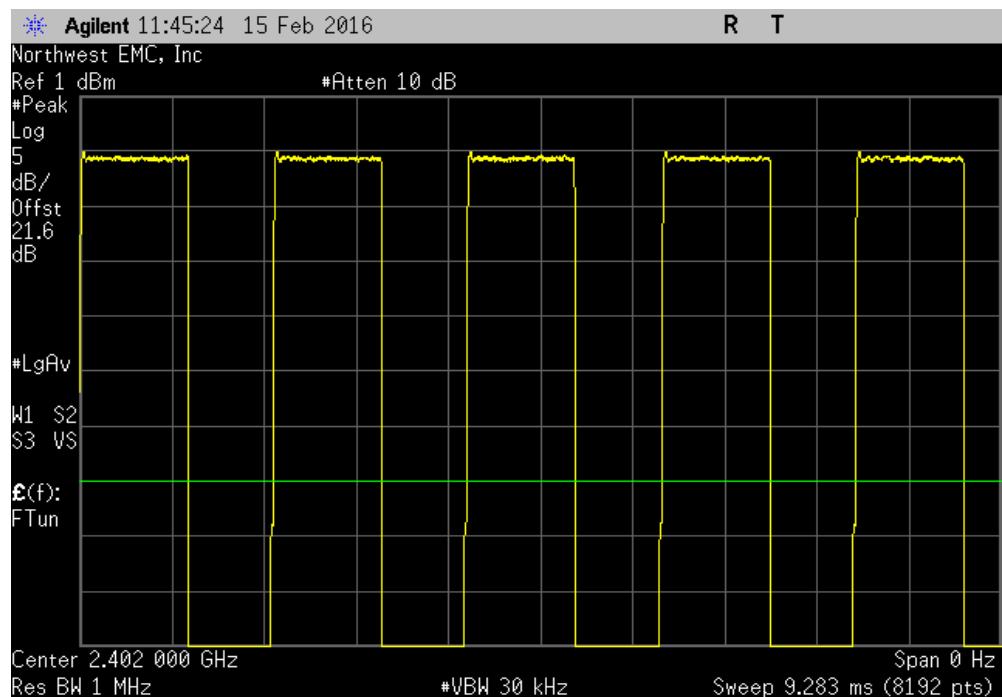
EUT:	AP	Work Order:	APDM0009				
Serial Number:	SMTC1630754	Date:	02/15/16				
Customer:	APDM, Inc.	Temperature:	22.5°C				
Attendees:	Andrew Greenberg	Humidity:	48%				
Project:	None	Barometric Pres.:	1022.6				
Tested by:	Brandon Hobbs	Job Site:	EV06				
TEST SPECIFICATIONS		Test Method					
FCC 15.247:2016		ANSI C63.10:2013					
COMMENTS							
Continuous Broadcast modes were provided by the client.							
DEVIATIONS FROM TEST STANDARD							
Configuration #	2	Signature: 			Value (%)	Limit (%)	Results
Normal Temperature Conditions		Pulse Width	Period	Number of Pulses			
Zigbee GFSK		1.086 ms	1.948 ms	1	55.8	N/A	N/A
Low Channel, 2, 2402 MHz		N/A	N/A	5	N/A	N/A	N/A
Low Channel, 2, 2402 MHz		1.087 ms	1.95 ms	1	55.7	N/A	N/A
Mid Channel, 40, 2440 MHz		N/A	N/A	5	N/A	N/A	N/A
Mid Channel, 40, 2440 MHz		1.087 ms	1.948 ms	1	55.8	N/A	N/A
High Channel, 81, 2481 MHz		N/A	N/A	5	N/A	N/A	N/A
High Channel, 81, 2481 MHz							

DUTY CYCLE

Normal Temperature Conditions, Zigbee GFSK, Low Channel, 2, 2402 MHz						
Pulse Width	Period	Number of Pulses	Value (%)	Limit (%)	Results	
1.086 ms	1.948 ms	1	55.8	N/A	N/A	N/A

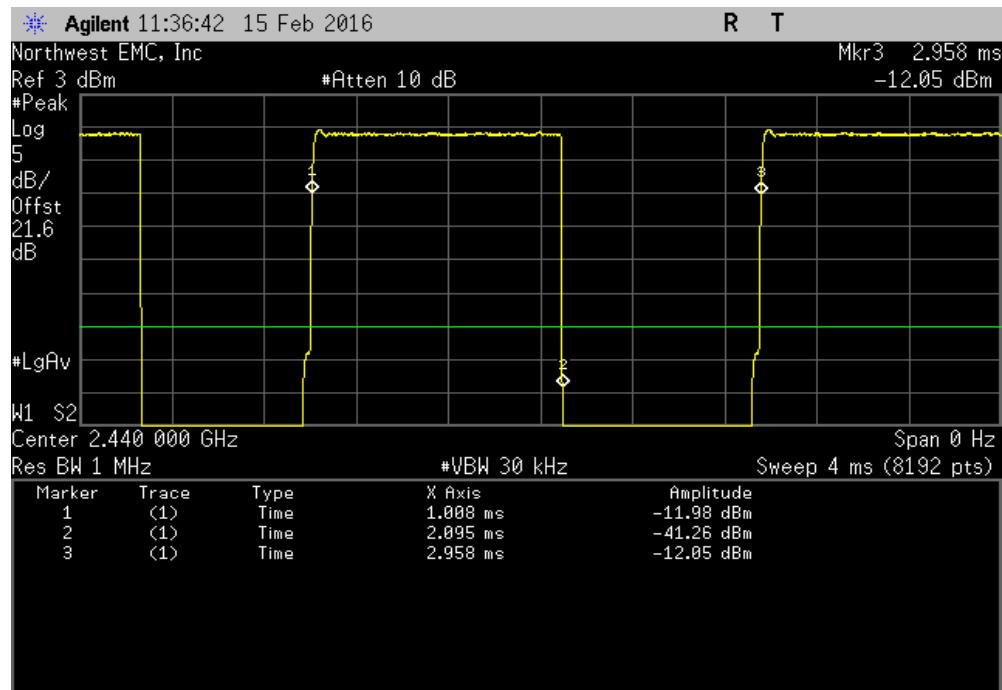


Normal Temperature Conditions, Zigbee GFSK, Low Channel, 2, 2402 MHz						
Pulse Width	Period	Number of Pulses	Value (%)	Limit (%)	Results	
N/A	N/A	5	N/A	N/A	N/A	N/A

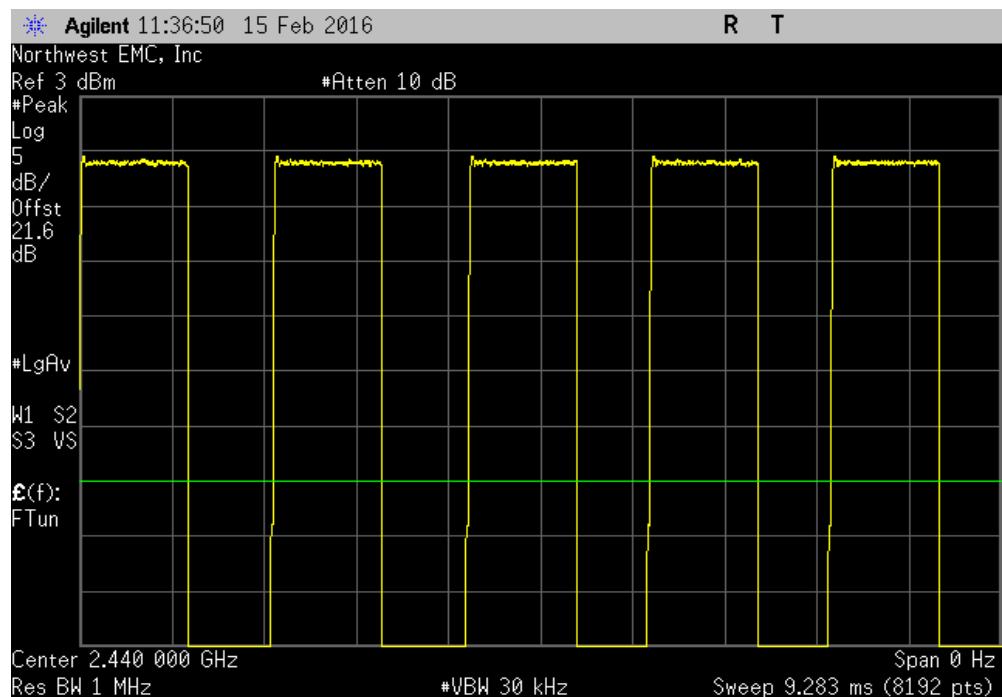


DUTY CYCLE

Normal Temperature Conditions, Zigbee GFSK, Mid Channel, 40, 2440 MHz						
Pulse Width	Period	Number of Pulses	Value (%)	Limit (%)	Results	
1.087 ms	1.95 ms	1	55.7	N/A	N/A	N/A

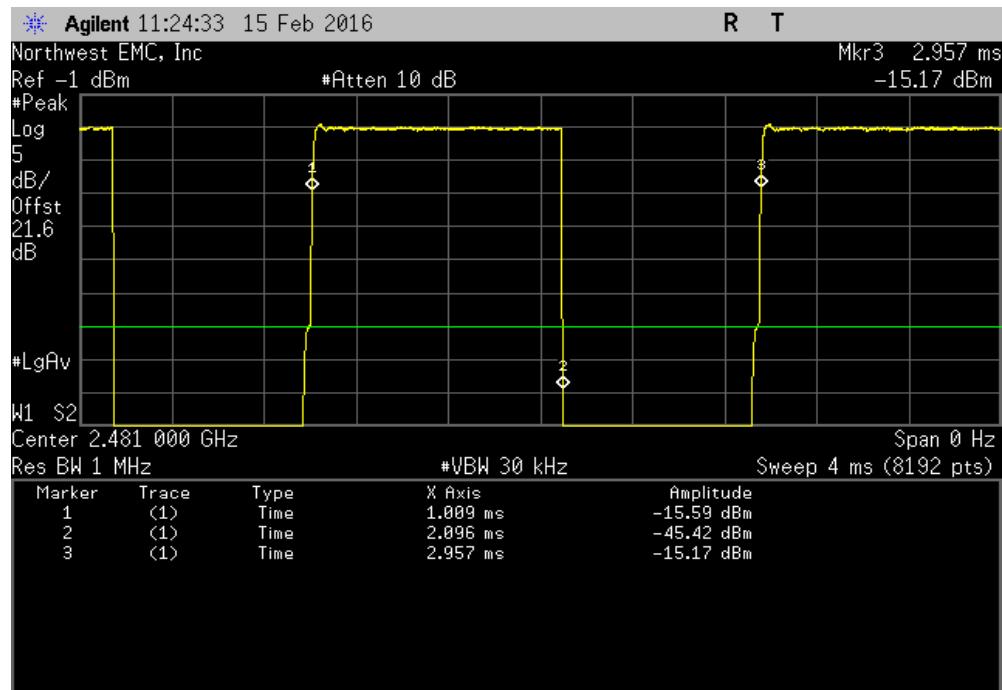


Normal Temperature Conditions, Zigbee GFSK, Mid Channel, 40, 2440 MHz						
Pulse Width	Period	Number of Pulses	Value (%)	Limit (%)	Results	
N/A	N/A	5	N/A	N/A	N/A	N/A

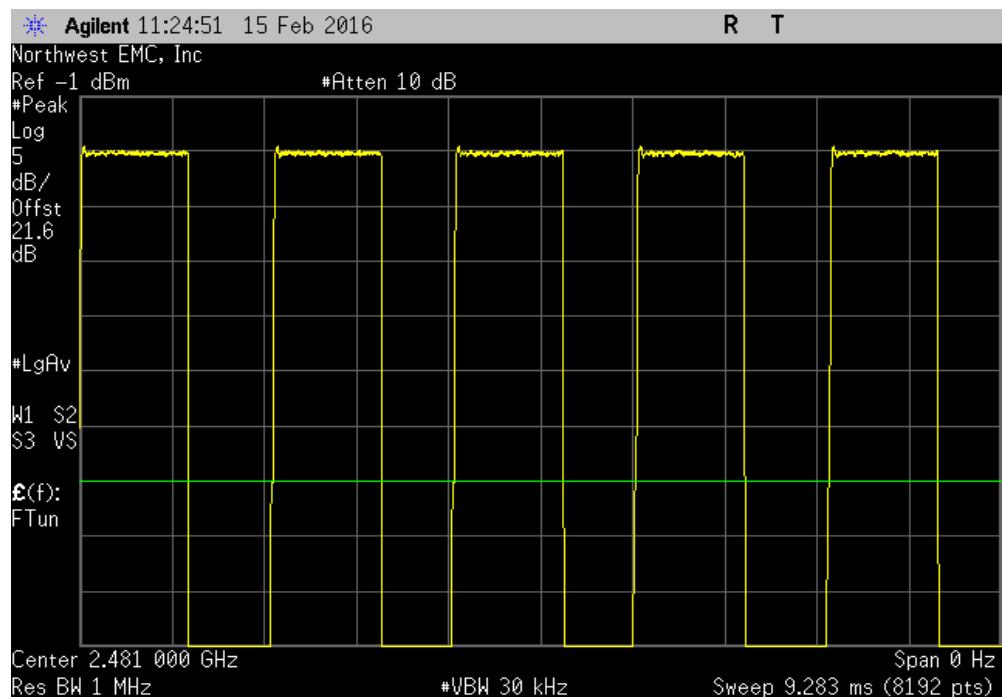


DUTY CYCLE

Normal Temperature Conditions, Zigbee GFSK, High Channel, 81, 2481 MHz						
Pulse Width	Period	Number of Pulses	Value (%)	Limit (%)	Results	
1.087 ms	1.948 ms	1	55.8	N/A	N/A	N/A



Normal Temperature Conditions, Zigbee GFSK, High Channel, 81, 2481 MHz						
Pulse Width	Period	Number of Pulses	Value (%)	Limit (%)	Results	
N/A	N/A	5	N/A	N/A	N/A	N/A



OCCUPIED BANDWIDTH

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

TEST EQUIPMENT

Description	Manufacturer	Model	ID	Last Cal.	Interval (mo)
Chamber - Temperature/Humidity	Cincinnati Sub Zero (CSZ)	ZPH-8-2-SCT/AC	TBI	NCR	0
Generator - Signal	Keysight	5182B	TFU	NCR	0
Thermometer	Omegaette	HH311	DTY	1/21/2015	36
Cable	ESM Cable Corp.	TT	EV1	NCR	0
Attenuator	S.M. Electronics	SA26B-20	AWU	NCR	0
Block - DC	Fairview Microwave	SD3379	AMQ	6/18/2015	12
Analyzer - Spectrum Analyzer	Agilent	E4440A	AAW	12/1/2014	24

TEST DESCRIPTION

The 6dB occupied bandwidth was measured using 100 kHz resolution bandwidth and 300 kHz video bandwidth. The 99% emission bandwidth (EBW) was also measured at the the same time.

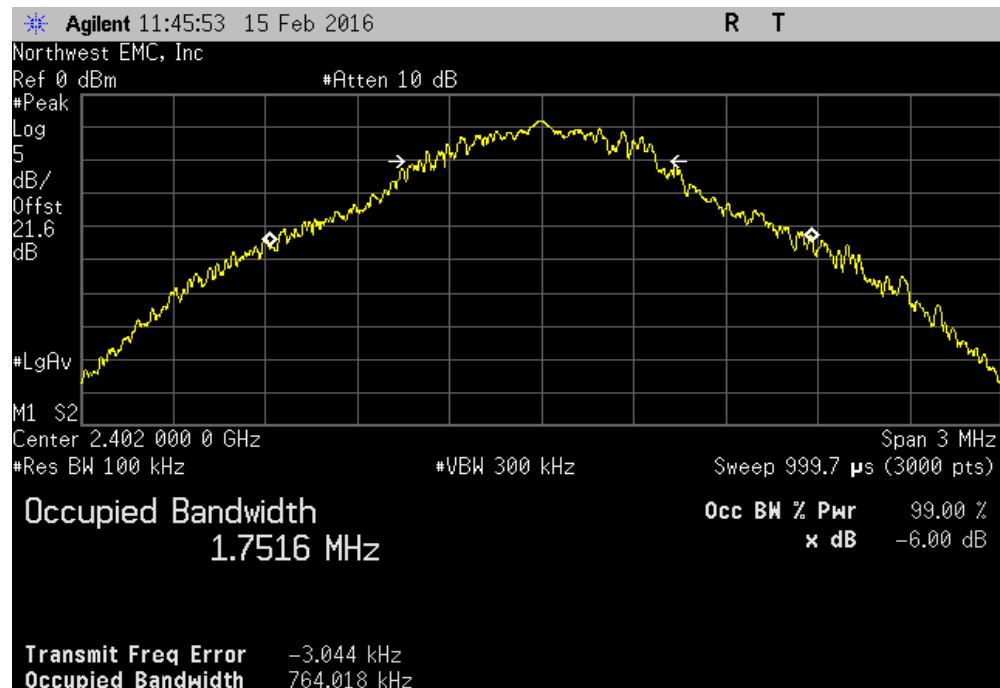
The EUT was set to the channels and modes listed in the datasheet. The measurement was made using a direct connection between the RF output of the EUT and the spectrum analyzer.

OCCUPIED BANDWIDTH

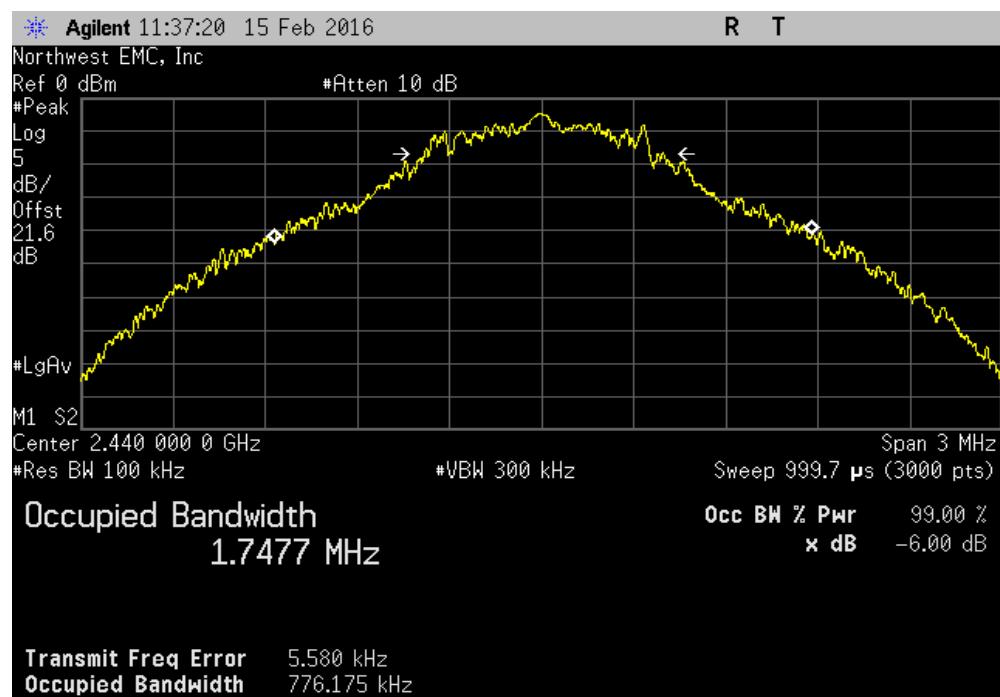
EUT:	AP	Work Order:	APDM0009
Serial Number:	SMTC1630754	Date:	02/15/16
Customer:	APDM, Inc.	Temperature:	22.6°C
Attendees:	Andrew Greenberg	Humidity:	47%
Project:	None	Barometric Pres.:	1022.6 mbar
Tested by:	Brandon Hobbs	Job Site:	EV01
TEST SPECIFICATIONS		Power:	5VDC
FCC 15.247:2016		Test Method	ANSI C63.10:2013
COMMENTS			
Continuous Broadcast modes were provided by the client.			
DEVIATIONS FROM TEST STANDARD			
None			
Configuration #	2	Signature	
			Value
			Limit (>)
			Result
Normal Temperature Conditions			
Zigbee GFSK			
Low Channel, 2, 2402 MHz Mid Channel, 40, 2440 MHz High Channel, 81, 2481 MHz			
764.018 kHz 500 kHz Pass 776.175 kHz 500 kHz Pass 789.317 kHz 500 kHz Pass			

OCCUPIED BANDWIDTH

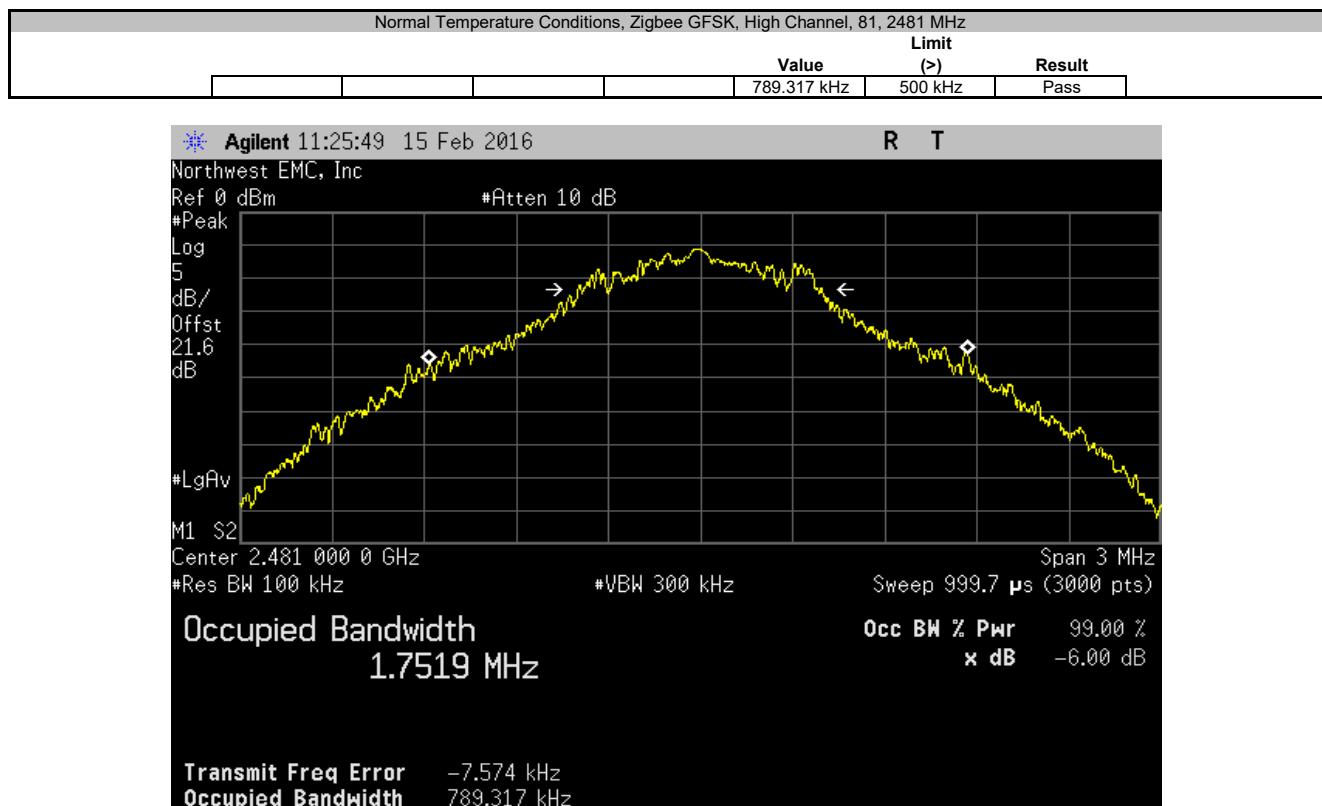
Normal Temperature Conditions, Zigbee GFSK, Low Channel, 2, 2402 MHz			Limit
Value	(>)	Result	
764.018 kHz	500 kHz	Pass	



Normal Temperature Conditions, Zigbee GFSK, Mid Channel, 40, 2440 MHz			Limit
Value	(>)	Result	
776.175 kHz	500 kHz	Pass	



OCCUPIED BANDWIDTH



OUTPUT POWER

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.	Interval (mo)
Generator - Signal	Keysight	5182B	TFU	NCR	0
Chamber - Temperature/Humidity	Cincinnati Sub Zero (CSZ)	ZPH-8-2-SCT/AC	TBI	NCR	0
Thermometer	Omegalette	HH311	DTY	1/21/2015	36
Cable	ESM Cable Corp.	TT	EV1	NCR	0
Attenuator	S.M. Electronics	SA26B-20	AWU	NCR	0
Block - DC	Fairview Microwave	SD3379	AMQ	6/18/2015	12
Analyzer - Spectrum Analyzer	Agilent	E4440A	AAW	12/1/2014	24

TEST DESCRIPTION

The transmit frequency was set to the required channels in each band. 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 reference level offset on the spectrum analyzer was adjusted to compensate for cable loss and the external attenuation used between the RF output and the spectrum analyzer input.

Prior to measuring peak transmit power the DTS bandwidth (B) and the transmission pulse duration (T) were measured. Both are required to determine the method of measuring Maximum Conducted Output Power. The transmission pulse duration (T) was measured using a zero span on the spectrum analyzer to see the pulses in the time domain.

The method found in ANSI C63.10:2013 Section 11.10.2 was used because the RBW on the analyzer was greater than the DTS Bandwidth of the radio.

De Facto EIRP Limit: Per 47 CFR 15.247 (b)(1-3), the EUT meets the de facto EIRP limit of +36 dBm.

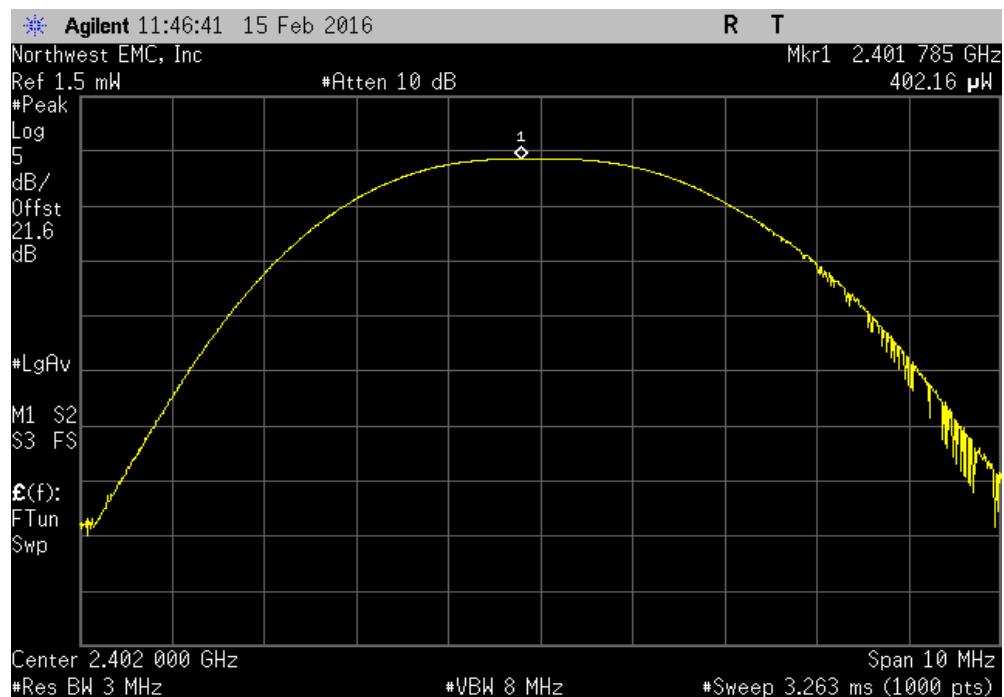
OUTPUT POWER

EUT:	AP	Work Order:	APDM0009
Serial Number:	SMTC1630754	Date:	02/15/16
Customer:	APDM, Inc.	Temperature:	22.6°C
Attendees:	Andrew Greenberg	Humidity:	47%
Project:	None	Barometric Pres.:	1022.6 mbar
Tested by:	Brandon Hobbs	Job Site:	EV01
TEST SPECIFICATIONS		Power:	5VDC
FCC 15.247:2016		Test Method	ANSI C63.10:2013
COMMENTS			
Continuous Broadcast modes were provided by the client.			
DEVIATIONS FROM TEST STANDARD			
Configuration #	2	Signature	
		Value	Limit (≤)
		402.161 uW	1 W
		586.273 uW	1 W
		283.4 uW	1 W
Normal Temperature Conditions			
Zigbee GFSK			
Low Channel, 2, 2402 MHz			
Mid Channel, 40, 2440 MHz			
High Channel, 81, 2481 MHz			

OUTPUT POWER

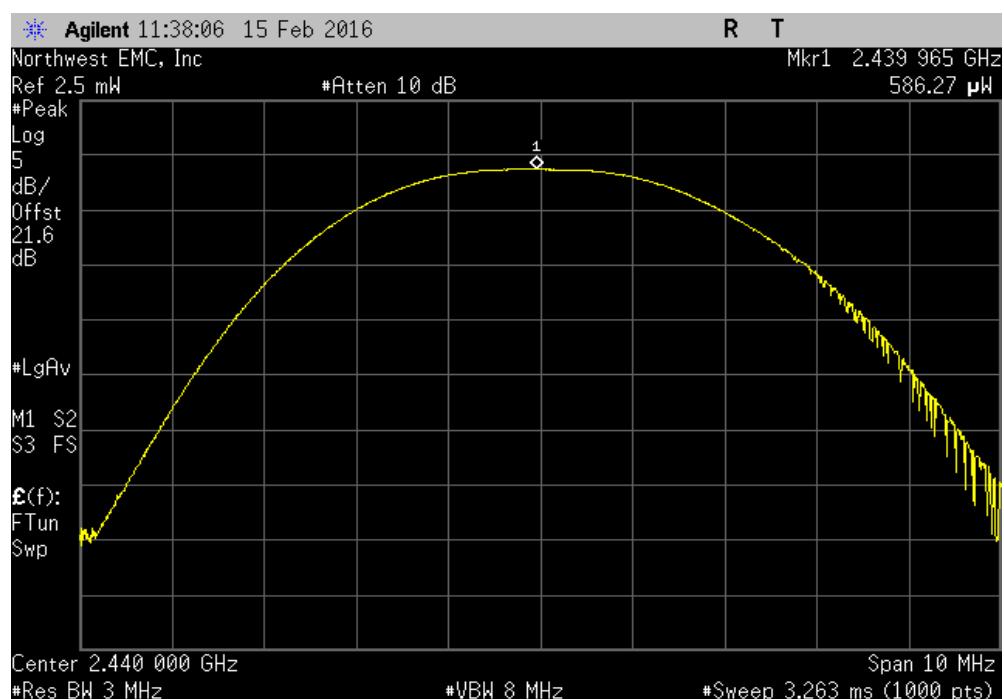
Normal Temperature Conditions, Zigbee GFSK, Low Channel, 2, 2402 MHz

Value	Limit	Result
402.161 uW	(<) 1 W	Pass



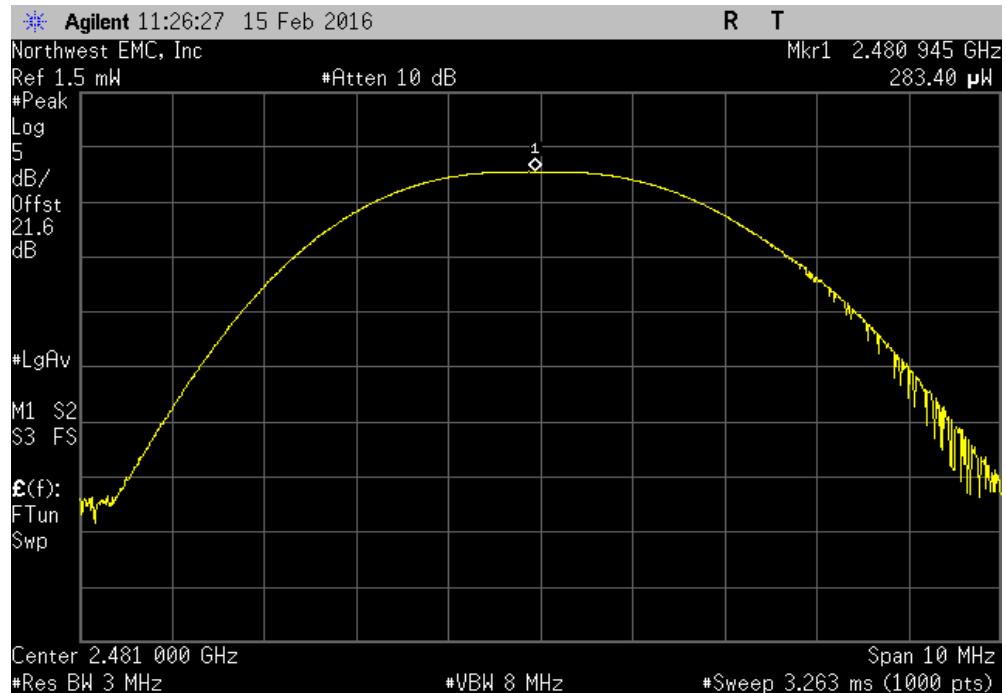
Normal Temperature Conditions, Zigbee GFSK, Mid Channel, 40, 2440 MHz

Value	Limit	Result
586.273 uW	(<) 1 W	Pass



OUTPUT POWER

Normal Temperature Conditions, Zigbee GFSK, High Channel, 81, 2481 MHz			
	Value	Limit	Result
	283.4 μ W	1 W	Pass



POWER SPECTRAL DENSITY

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

TEST EQUIPMENT

Description	Manufacturer	Model	ID	Last Cal.	Interval (mo)
Chamber - Temperature/Humidity	Cincinnati Sub Zero (CSZ)	ZPH-8-2-SCT/AC	TBI	NCR	0
Thermometer	Omegalette	HH311	DTY	1/21/2015	36
Generator - Signal	Rohde & Schwarz	SMC100A	TIB	3/26/2015	36
Cable	ESM Cable Corp.	TT	EV1	NCR	0
Attenuator	S.M. Electronics	SA26B-20	AWU	NCR	0
Block - DC	Fairview Microwave	SD3379	AMQ	6/18/2015	12
Analyzer - Spectrum Analyzer	Agilent	E4440A	AAW	12/1/2014	24

TEST DESCRIPTION

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

A direct connection was made between the RF output of the EUT and a spectrum analyzer. External attenuation and a DC block were used. The reference level offset on the spectrum analyzer was adjusted to compensate for cable loss and the external attenuation used between the RF output and the spectrum analyzer input.

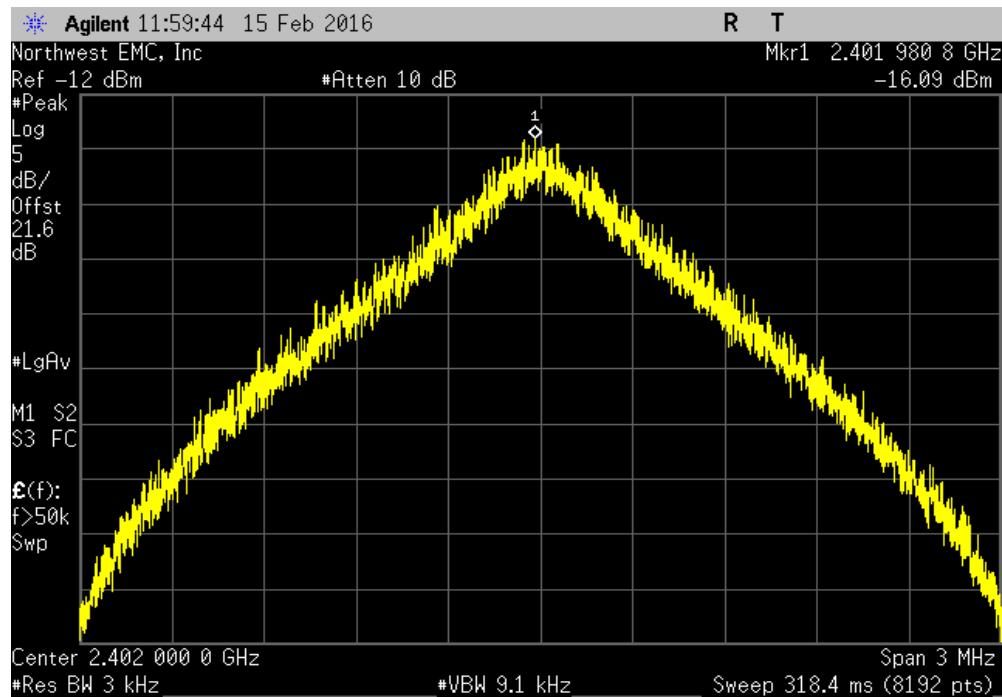
Per the procedure outlined in ANSI C63.10 the peak power spectral density was measured in a 3 kHz RBW.

POWER SPECTRAL DENSITY

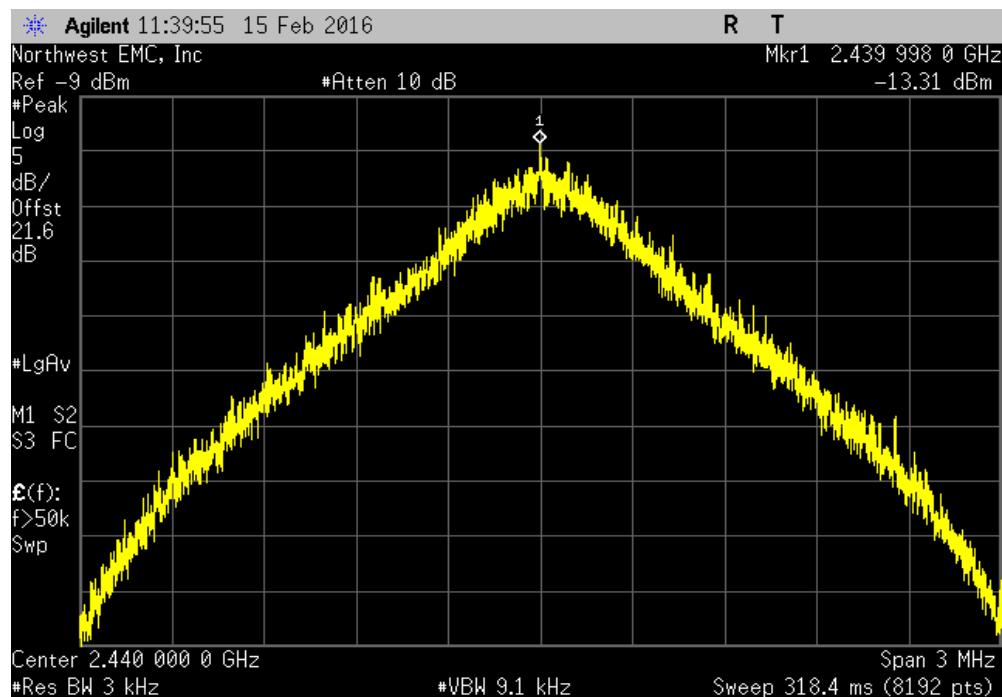
EUT:	AP	Work Order:	APDM0009	
Serial Number:	SMTC1630754	Date:	02/15/16	
Customer:	APDM, Inc.	Temperature:	22.6°C	
Attendees:	Andrew Greenberg	Humidity:	47%	
Project:	None	Barometric Pres.:	1022.6 mbr	
Tested by:	Brandon Hobbs	Job Site:	EV01	
TEST SPECIFICATIONS		Power:	5VDC	
FCC 15.247:2016		Test Method	ANSI C63.10:2013	
COMMENTS				
Continuous Broadcast modes were provided by the client.				
DEVIATIONS FROM TEST STANDARD				
Configuration #	2	Signature		
		Value dBm/3kHz	Limit < dBm/3kHz	Results
Normal Temperature Conditions Zigbee GFSK		-16.091	8	Pass
Low Channel, 2, 2402 MHz		-13.312	8	Pass
Mid Channel, 40, 2440 MHz		-15.703	8	Pass
High Channel, 81, 2481 MHz				

POWER SPECTRAL DENSITY

Normal Temperature Conditions, Zigbee GFSK, Low Channel, 2, 2402 MHz			
Value	Limit	Results	
dBm/3kHz	< dBm/3kHz	Pass	
-16.091	8		

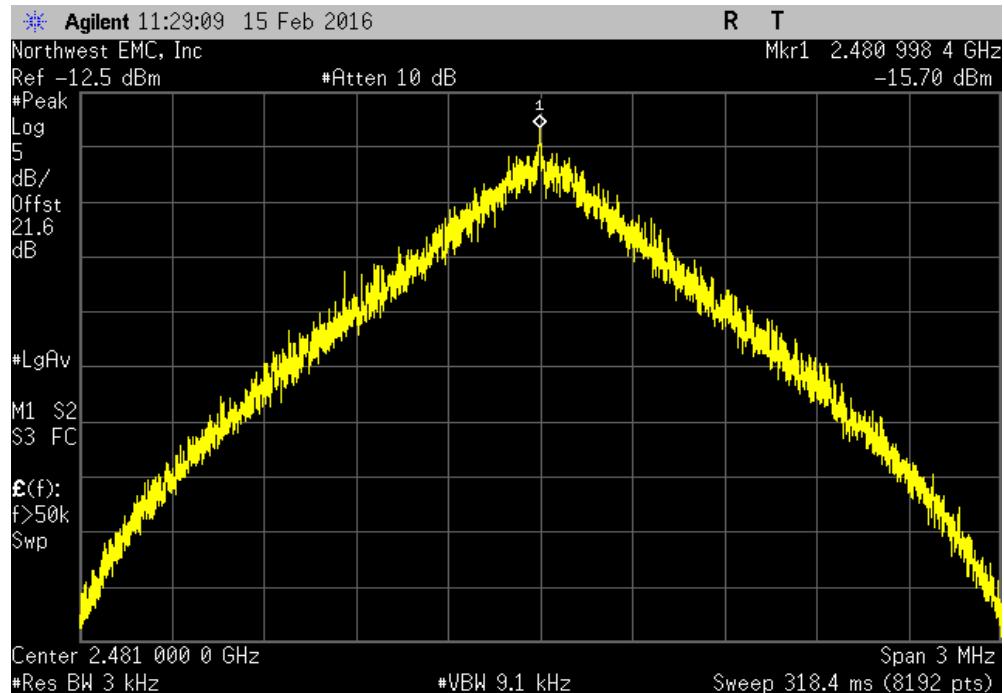


Normal Temperature Conditions, Zigbee GFSK, Mid Channel, 40, 2440 MHz			
Value	Limit	Results	
dBm/3kHz	< dBm/3kHz	Pass	
-13.312	8		



POWER SPECTRAL DENSITY

Normal Temperature Conditions, Zigbee GFSK, High Channel, 81, 2481 MHz			
Value	Limit	Results	
dBm/3kHz	< dBm/3kHz	Pass	
-15.703	8		



BAND EDGE COMPLIANCE

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.	Interval (mo)
Chamber - Temperature/Humidity	Cincinnati Sub Zero (CSZ)	ZPH-8-2-SCT/AC	TBI	NCR	0
Generator - Signal	Keysight	5182B	TFU	NCR	0
Thermometer	Omegaette	HH311	DTY	1/21/2015	36
Cable	ESM Cable Corp.	TT	EV1	NCR	0
Attenuator	S.M. Electronics	SA26B-20	AWU	NCR	0
Block - DC	Fairview Microwave	SD3379	AMQ	6/18/2015	12
Analyzer - Spectrum Analyzer	Agilent	E4440A	AAW	12/1/2014	24

TEST DESCRIPTION

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

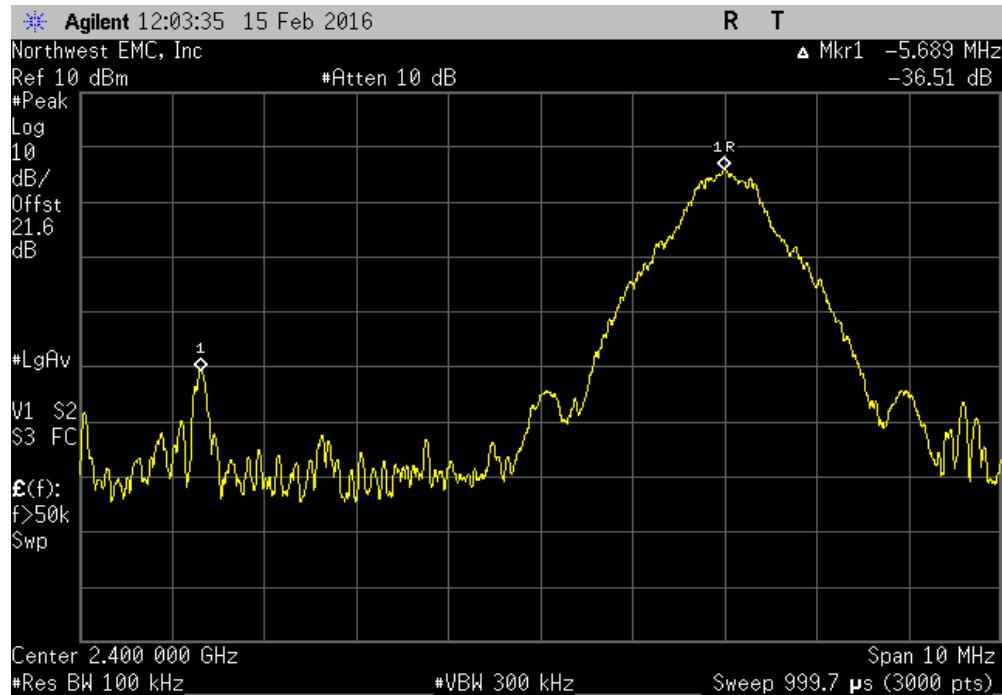
The spectrum was scanned below the lower band edge and above the higher band edge.

BAND EDGE COMPLIANCE

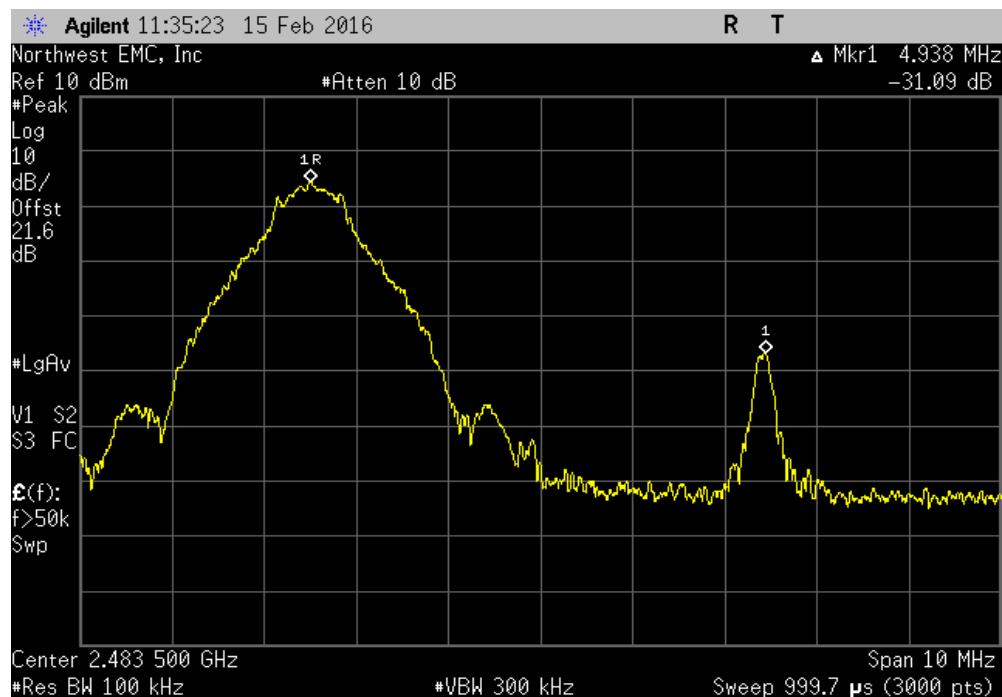
EUT:	AP	Work Order:	APDM0009		
Serial Number:	SMTC1630754	Date:	02/15/16		
Customer:	APDM, Inc.	Temperature:	22.6°C		
Attendees:	Andrew Greenberg	Humidity:	47%		
Project:	None	Barometric Pres.:	1022.6 mbr		
Tested by:	Brandon Hobbs	Job Site:	EV01		
TEST SPECIFICATIONS		Power:	5VDC		
FCC 15.247:2016		Test Method	ANSI C63.10:2013		
COMMENTS					
Continuous Broadcast modes were provided by the client.					
DEVIATIONS FROM TEST STANDARD					
Configuration #	2	Signature			
			Value (dBc)	Limit ≤ (dBc)	Result
Normal Temperature Conditions Zigbee GFSK		Low Channel, 2, 2402 MHz High Channel, 81, 2481 MHz	-36.51 -31.09	-20 -20	Pass Pass

BAND EDGE COMPLIANCE

Normal Temperature Conditions, Zigbee GFSK, Low Channel, 2, 2402 MHz			
Value (dBc)	Limit ≤ (dBc)	Result	
-36.51	-20	Pass	



Normal Temperature Conditions, Zigbee GFSK, High Channel, 81, 2481 MHz			
Value (dBc)	Limit ≤ (dBc)	Result	
-31.09	-20	Pass	



SPURIOUS CONDUCTED EMISSIONS

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.	Interval (mo)
Chamber - Temperature/Humidity	Cincinnati Sub Zero (CSZ)	ZPH-8-2-SCT/AC	TBI	NCR	0
Cable	ESM Cable Corp.	TT	EV1	NCR	0
Generator - Signal	Keysight	5182B	TFU	NCR	0
Thermometer	Omegaette	HH311	DTY	1/21/2015	36
Attenuator	S.M. Electronics	SA26B-20	AWU	NCR	0
Block - DC	Fairview Microwave	SD3379	AMQ	6/18/2015	12
Analyzer - Spectrum Analyzer	Agilent	E4440A	AAW	12/1/2014	24

TEST DESCRIPTION

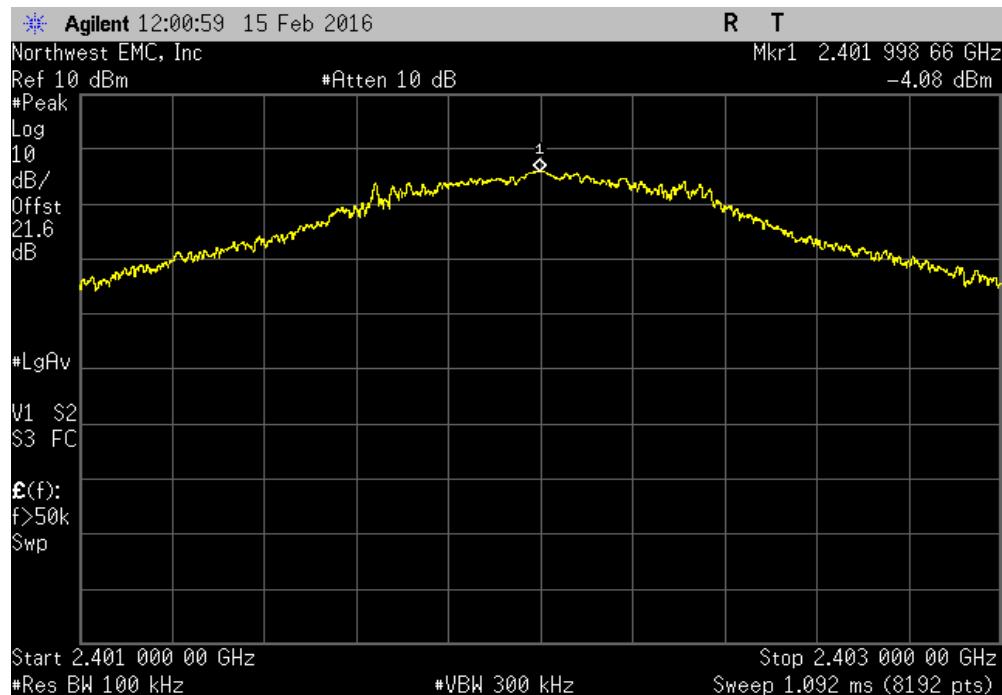
The spurious RF conducted emissions were measured with the EUT set to low, medium and high transmit frequencies. The measurements were made using a direct connection between the RF output of the EUT and the spectrum analyzer. The EUT was transmitting on the mode listed in the datasheet. For each transmit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

SPURIOUS CONDUCTED EMISSIONS

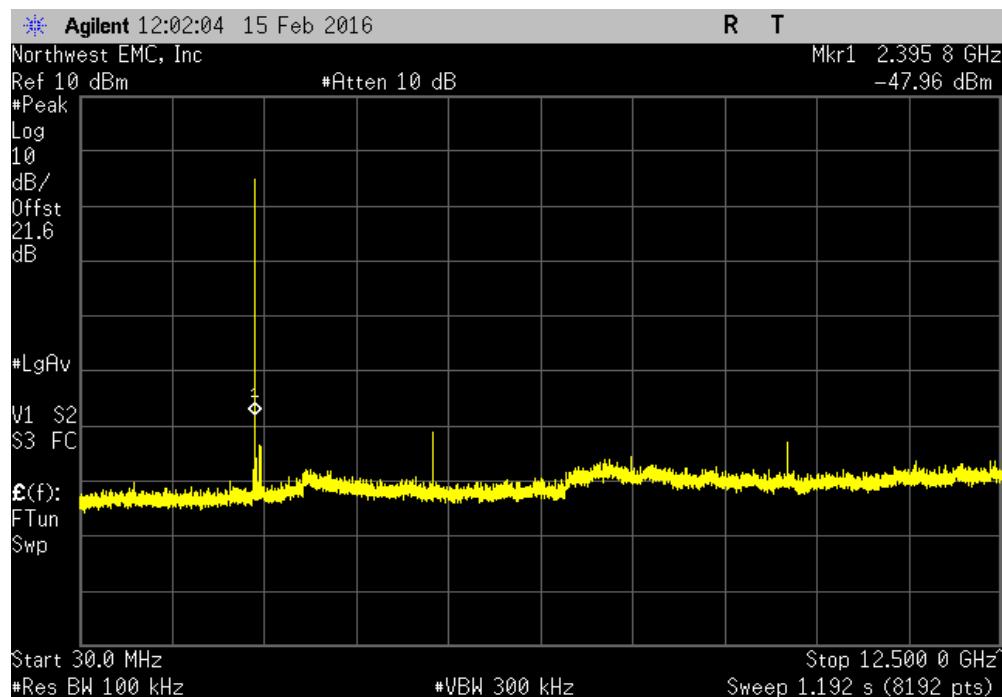
EUT:	AP	Work Order:	APDM0009		
Serial Number:	SMTC1630754	Date:	02/15/16		
Customer:	APDM, Inc.	Temperature:	22.5°C		
Attendees:	Andrew Greenberg	Humidity:	47%		
Project:	None	Barometric Pres.:	1022.6		
Tested by:	Brandon Hobbs	Job Site:	EV01		
TEST SPECIFICATIONS		Test Method			
FCC 15.247:2016		ANSI C63.10:2013			
COMMENTS					
Continuous Broadcast modes were provided by the client.					
DEVIATIONS FROM TEST STANDARD					
Configuration #	2	Signature			
		Frequency Range	Max Value (dBc)	Limit ≤ (dBc)	Result
Normal Temperature Conditions					
Zigbee GFSK					
Low Channel, 2, 2402 MHz	Fundamental	N/A	N/A	N/A	Pass
Low Channel, 2, 2402 MHz	30 MHz - 12.5 GHz	-43.88	-20	-20	Pass
Low Channel, 2, 2402 MHz	12.5 GHz - 25 GHz	-45.68	-20	-20	Pass
Mid Channel, 40, 2440 MHz	Fundamental	N/A	N/A	N/A	Pass
Mid Channel, 40, 2440 MHz	30 MHz - 12.5 GHz	-45.67	-20	-20	Pass
Mid Channel, 40, 2440 MHz	12.5 GHz - 25 GHz	-48.53	-20	-20	Pass
High Channel, 81, 2481 MHz	Fundamental	N/A	N/A	N/A	Pass
High Channel, 81, 2481 MHz	30 MHz - 12.5 GHz	-40.56	-20	-20	Pass
High Channel, 81, 2481 MHz	12.5 GHz - 25 GHz	-44.79	-20	-20	Pass

SPURIOUS CONDUCTED EMISSIONS

Normal Temperature Conditions, Zigbee GFSK, Low Channel, 2, 2402 MHz					
Frequency Range	Max Value (dBc)	Limit ≤ (dBc)	Result		
Fundamental	N/A	N/A	N/A		



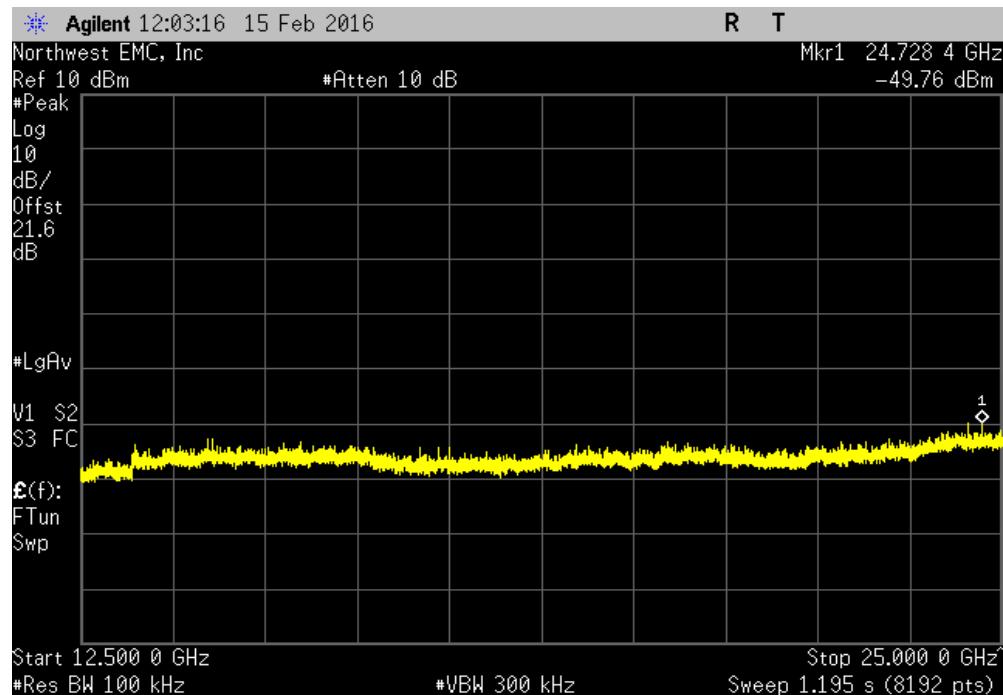
Normal Temperature Conditions, Zigbee GFSK, Low Channel, 2, 2402 MHz					
Frequency Range	Max Value (dBc)	Limit ≤ (dBc)	Result		
30 MHz - 12.5 GHz	-43.88	-20	Pass		



SPURIOUS CONDUCTED EMISSIONS

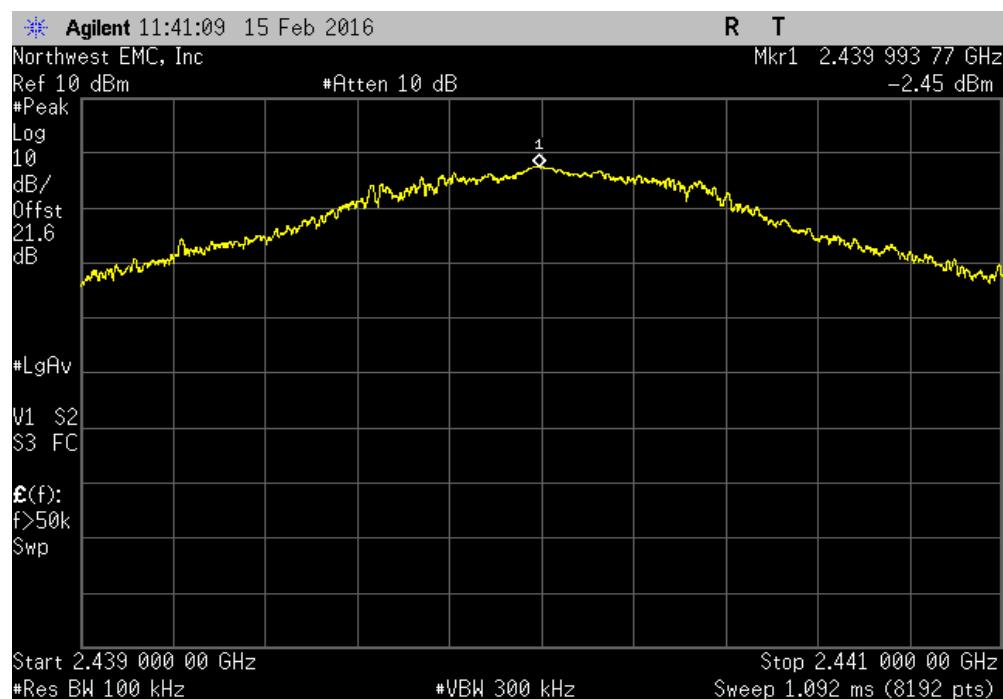
Normal Temperature Conditions, Zigbee GFSK, Low Channel, 2, 2402 MHz

Frequency Range	Max Value (dBc)	Limit ≤ (dBc)	Result
12.5 GHz - 25 GHz	-45.68	-20	Pass



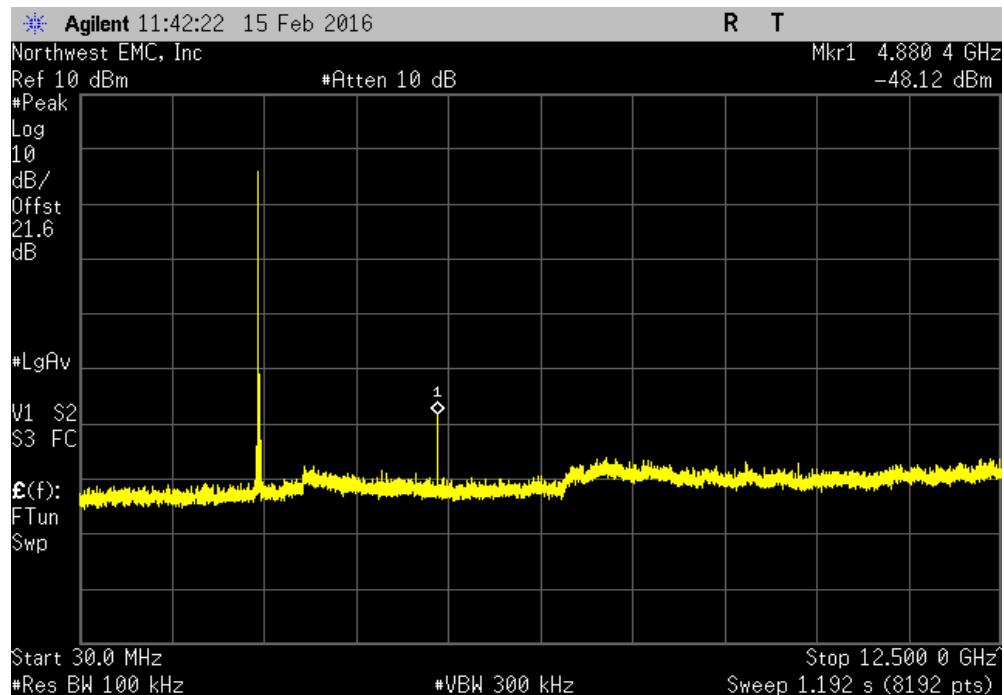
Normal Temperature Conditions, Zigbee GFSK, Mid Channel, 40, 2440 MHz

Frequency Range	Max Value (dBc)	Limit ≤ (dBc)	Result
Fundamental	N/A	N/A	N/A

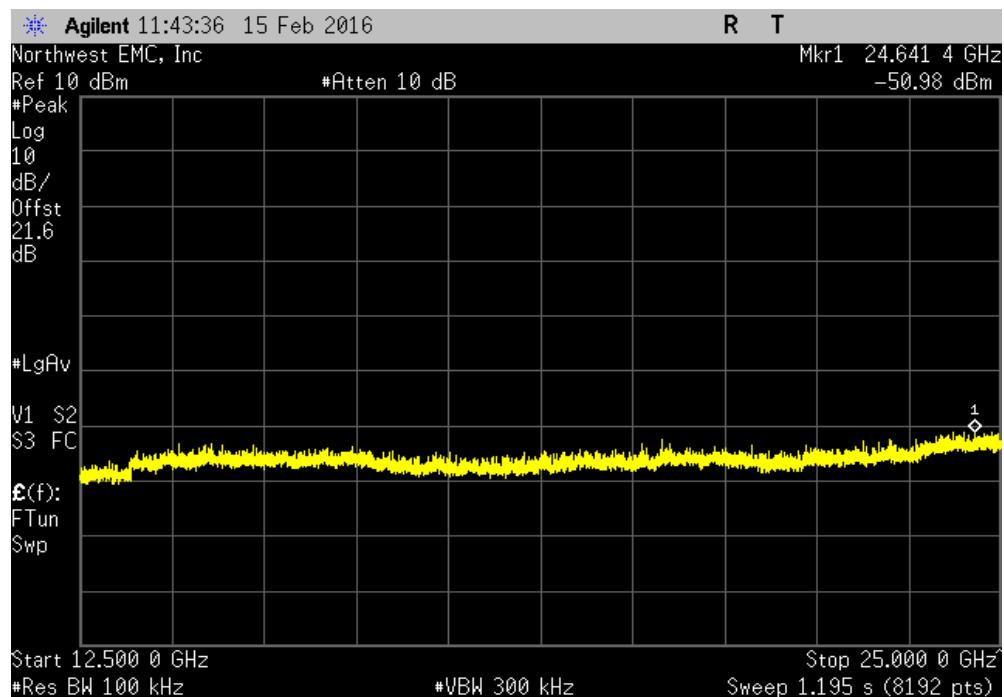


SPURIOUS CONDUCTED EMISSIONS

Normal Temperature Conditions, Zigbee GFSK, Mid Channel, 40, 2440 MHz				
Frequency Range	Max Value (dBc)	Limit ≤ (dBc)	Result	
30 MHz - 12.5 GHz	-45.67	-20	Pass	

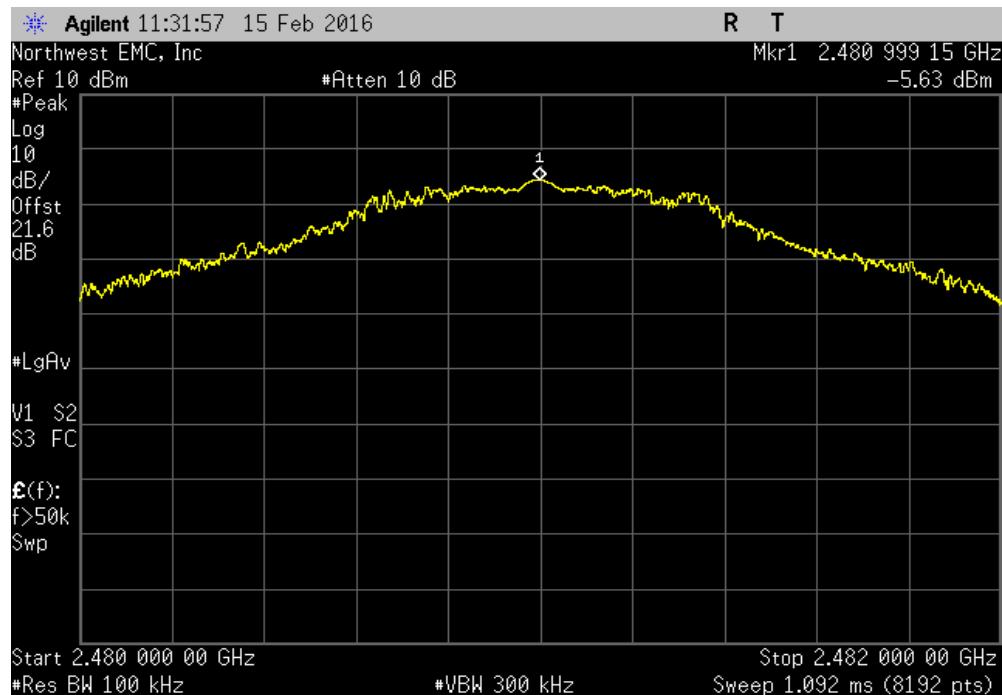


Normal Temperature Conditions, Zigbee GFSK, Mid Channel, 40, 2440 MHz				
Frequency Range	Max Value (dBc)	Limit ≤ (dBc)	Result	
12.5 GHz - 25 GHz	-48.53	-20	Pass	

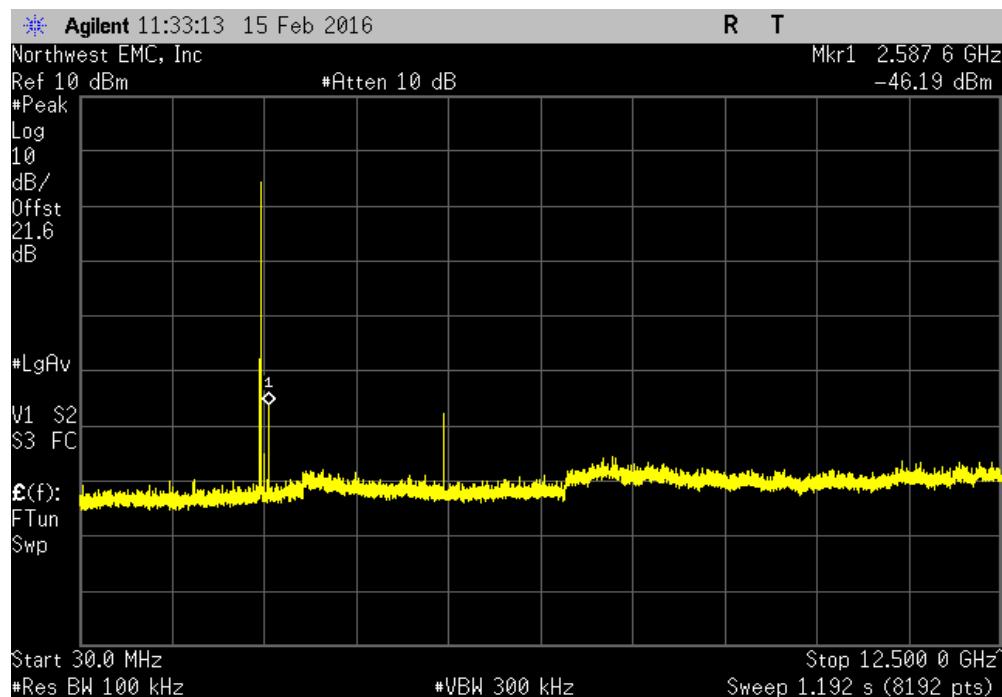


SPURIOUS CONDUCTED EMISSIONS

Normal Temperature Conditions, Zigbee GFSK, High Channel, 81, 2481 MHz					
Frequency Range	Max Value (dBc)	Limit ≤ (dBc)	Result		
Fundamental	N/A	N/A	N/A		

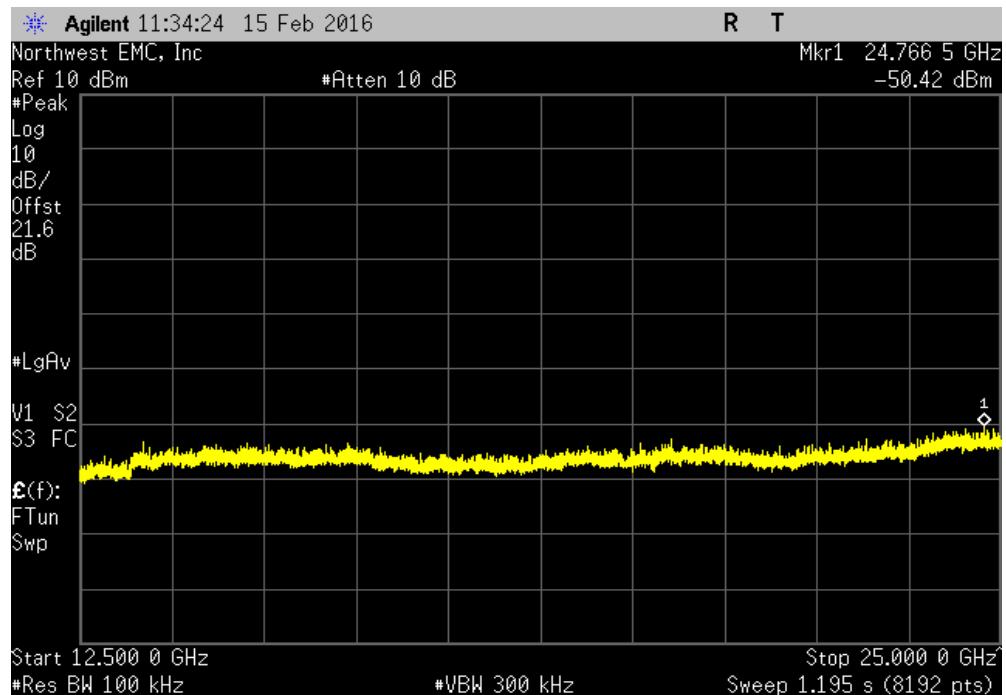


Normal Temperature Conditions, Zigbee GFSK, High Channel, 81, 2481 MHz					
Frequency Range	Max Value (dBc)	Limit ≤ (dBc)	Result		
30 MHz - 12.5 GHz	-40.56	-20	Pass		



SPURIOUS CONDUCTED EMISSIONS

Normal Temperature Conditions, Zigbee GFSK, High Channel, 81, 2481 MHz			
Frequency Range	Max Value (dBc)	Limit ≤ (dBc)	Result
12.5 GHz - 25 GHz	-44.79	-20	Pass



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

MODES OF OPERATION

Continuous Tx, Low Ch.2, 2402 MHz GFSK

Continuous Tx, Mid Ch.40, 2440 MHz GFSK

Continuous Tx, High Ch.81, 2481 MHz GFSK

POWER SETTINGS INVESTIGATED

5VDC

CONFIGURATIONS INVESTIGATED

APDM0009 - 1

FREQUENCY RANGE INVESTIGATED

Start Frequency	30 MHz	Stop Frequency	26500 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

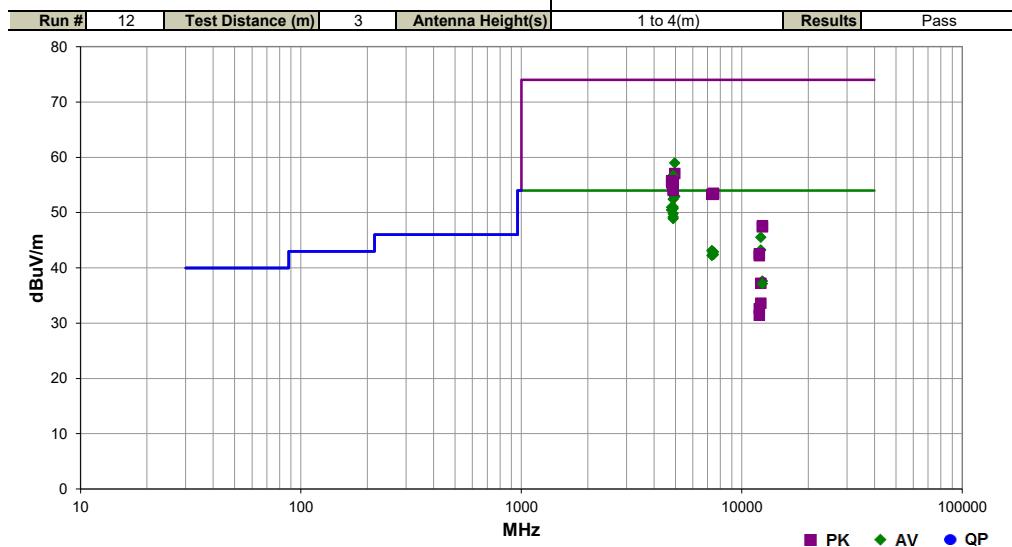
Description	Manufacturer	Model	ID	Last Cal.	Interval (mo)
Cable	ESM Cable Corp.	KMKM-72	EVY	11/4/2015	12
Amplifier - Pre-Amplifier	Miteq	AMF-6F-18002650-25-10P	AVU	11/4/2015	12
Antenna - Standard Gain	ETS Lindgren	3160-09	AVI	NCR	0
Amplifier - Pre-Amplifier	Miteq	AMF-6F-12001800-30-10P	AVD	4/16/2015	12
Antenna - Standard Gain	ETS Lindgren	3160-08	AHV	NCR	0
Cable	None	Standard Gain Horns Cable	EVF	4/20/2015	12
Amplifier - Pre-Amplifier	Miteq	AMF-6F-08001200-30-10P	AVC	4/20/2015	12
Antenna - Standard Gain	ETS Lindgren	3160-07	AHU	NCR	0
Cable	N/A	Double Ridge Horn Cables	EVB	4/16/2015	12
Amplifier - Pre-Amplifier	Miteq	AMF-3D-00100800-32-13P	PAG	4/16/2015	12
Antenna - Double Ridge	EMCO	3115	AHC	6/13/2014	24
Attenuator	Coaxicom	3910-20	AXZ	5/24/2015	12
Cable	N/A	Bilog Cables	EVA	1/29/2016	12
Amplifier - Pre-Amplifier	Miteq	AM-1616-1000	AOL	1/29/2016	12
Antenna - Biconilog	EMCO	3141	AXE	8/29/2014	24
Analyzer - Spectrum Analyzer	Agilent	E4446A	AAQ	3/10/2015	12
Filter - High Pass	Micro-Tronics	HPM50111	HFO	3/31/2015	12
Filter - Low Pass	Micro-Tronics	LPM50004	LFD	5/24/2015	12

TEST DESCRIPTION

The highest gain of each type of antenna to be used with the EUT was tested. The EUT was configured for low, mid, and high band transmit frequencies. For each configuration, the spectrum was scanned throughout the specified range. In addition, measurements were made in the restricted bands to verify compliance. While scanning, emissions from the EUT were maximized by rotating the EUT on a turntable, adjusting the position of the EUT and the EUT antenna in three orthogonal axis, and adjusting measurement antenna height and polarization. A preamp and high pass filter were used for this test in order to provide sufficient measurement sensitivity.

Work Order:	APDM0009	Date:	02/05/16	
Project:	None	Temperature:	20.9 °C	
Job Site:	EV01	Humidity:	39.6% RH	
Serial Number:	SMTc1630754	Barometric Pres.:	1030.2 mbar	
EUT:	AP	Tested by:	Brandon Hobbs	
Configuration:	1			
Customer:	APDM, Inc.			
Attendees:	Andrew Greenberg			
EUT Power:	5VDC			
Operating Mode:	Continuous Tx, GFSK, reference data comments for further information			
Deviations:	None			
Comments:	Please reference the data comments for EUT orientation, channel and frequency.			

Test Specifications	Test Method
FCC 15.247:2016	ANSI C63.10:2013

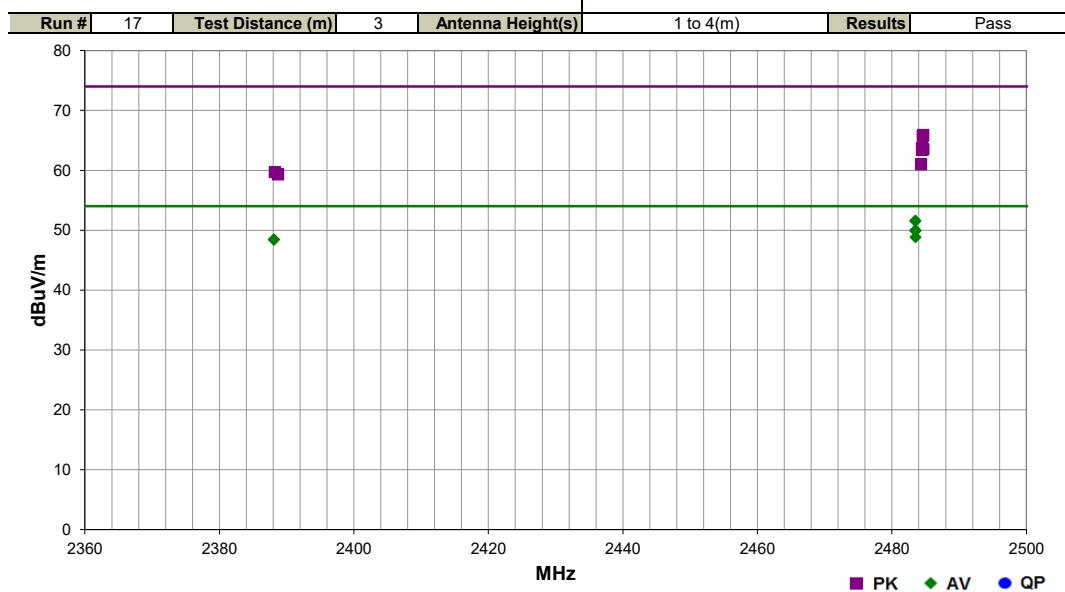


Freq (MHz)	Amplitude (dBuV)	Factor (dB)	Antenna Height (meters)	Azimuth (degrees)	Test Distance (meters)	External Attenuation (dB)	Polarity/Transducer Type	Detector	Distance Adjustment (dB)	Adjusted (dBuV/m)	Spec. Limit (dBuV/m)	Compared to Spec. (dB)	Comments
4961.920	45.2	7.8	2.1	340.0	3.0	0.0	Horz	AV	0.0	53.0	54.0	-1.0	High Ch.81. 2481MHz, -4dBm Pwr Level, EUT Vert
4962.065	45.1	7.8	1.0	0.0	3.0	0.0	Vert	AV	0.0	52.9	54.0	-1.1	High Ch.81. 2481MHz, 0dBm Pwr Level, EUT Vert
4879.990	44.7	7.7	2.0	343.0	3.0	0.0	Horz	AV	0.0	52.4	54.0	-1.6	Mid Ch.40. 2440MHz, 0dBm Pwr Level, EUT Vert
4880.065	43.3	7.7	1.2	0.0	3.0	0.0	Vert	AV	0.0	51.0	54.0	-3.0	Mid Ch.40. 2440MHz, 0dBm Pwr Level, EUT Vert
4804.085	43.4	7.5	1.7	333.0	3.0	0.0	Horz	AV	0.0	50.9	54.0	-3.1	Low Ch.2. 2402MHz, 0dBm Pwr Level, EUT Vert
4880.055	43.0	7.7	1.0	340.0	3.0	0.0	Vert	AV	0.0	50.7	54.0	-3.3	Mid Ch.40. 2440MHz, 0dBm Pwr Level, EUT Horz
4803.995	42.9	7.5	1.1	340.0	3.0	0.0	Vert	AV	0.0	50.4	54.0	-3.6	Low Ch.2. 2402MHz, 0dBm Pwr Level, EUT Vert
4880.145	42.1	7.7	2.1	243.0	3.0	0.0	Horz	AV	0.0	49.8	54.0	-4.2	Mid Ch.40. 2440MHz, 0dBm Pwr Level, EUT On Side
4880.100	41.5	7.7	1.0	334.0	3.0	0.0	Vert	AV	0.0	49.2	54.0	-4.8	Mid Ch.40. 2440MHz, 0dBm Pwr Level, EUT On Side
4880.045	41.2	7.7	1.0	73.0	3.0	0.0	Horz	AV	0.0	48.9	54.0	-5.1	Mid Ch.40. 2440MHz, 0dBm Pwr Level, EUT Horz
7320.800	28.8	14.3	1.7	20.0	3.0	0.0	Horz	AV	0.0	43.1	54.0	-10.9	Mid Ch.40. 2440MHz, 0dBm Pwr Level, EUT Vert
7442.265	28.3	14.6	1.6	18.0	3.0	0.0	Horz	AV	0.0	42.9	54.0	-11.1	High Ch.81. 2481MHz, 0dBm Pwr Level, EUT Vert
7441.990	27.8	14.6	1.0	227.0	3.0	0.0	Vert	AV	0.0	42.4	54.0	-11.6	High Ch.81. 2481MHz, 0dBm Pwr Level, EUT Vert
7319.570	27.9	14.3	1.0	10.0	3.0	0.0	Vert	AV	0.0	42.2	54.0	-11.8	Mid Ch.40. 2440MHz, 0dBm Pwr Level, EUT Vert
4962.640	51.2	7.8	2.0	345.0	3.0	0.0	Horz	PK	0.0	59.0	74.0	-15.0	High Ch.81. 2481MHz, 0dBm Pwr Level, EUT Vert
12403.750	28.8	8.8	1.0	234.0	3.0	0.0	Vert	AV	0.0	37.6	54.0	-16.4	High Ch.81. 2481MHz, -4dBm Pwr Level, EUT Vert
12198.690	36.1	1.1	2.0	215.0	3.0	0.0	Vert	AV	0.0	37.2	54.0	-16.8	Mid Ch.40. 2440MHz, 0dBm Pwr Level, EUT Vert
4961.505	49.4	7.8	2.1	340.0	3.0	0.0	Horz	PK	0.0	57.2	74.0	-16.8	High Ch.81. 2481MHz, -4dBm Pwr Level, EUT Vert
12403.570	28.3	8.8	1.8	301.0	3.0	0.0	Horz	AV	0.0	37.1	54.0	-16.9	High Ch.81. 2481MHz, -4dBm Pwr Level, EUT Vert
4962.705	49.3	7.8	1.0	0.0	3.0	0.0	Vert	PK	0.0	57.1	74.0	-16.9	High Ch.81. 2481MHz, 0dBm Pwr Level, EUT Vert
4879.215	49.0	7.7	2.0	343.0	3.0	0.0	Horz	PK	0.0	56.7	74.0	-17.3	Mid Ch.40. 2440MHz, 0dBm Pwr Level, EUT Vert
4804.600	48.2	7.5	1.7	333.0	3.0	0.0	Horz	PK	0.0	55.7	74.0	-18.3	Low Ch.2. 2402MHz, 0dBm Pwr Level, EUT Vert
4803.995	47.8	7.5	1.1	340.0	3.0	0.0	Vert	PK	0.0	55.3	74.0	-18.7	Low Ch.2. 2402MHz, 0dBm Pwr Level, EUT Vert
4880.820	47.6	7.7	1.0	340.0	3.0	0.0	Vert	PK	0.0	55.3	74.0	-18.7	Mid Ch.40. 2440MHz, 0dBm Pwr Level, EUT Horz
4880.820	47.6	7.7	1.2	0.0	3.0	0.0	Vert	PK	0.0	55.3	74.0	-18.7	Mid Ch.40. 2440MHz, 0dBm Pwr Level, EUT Vert
4879.590	47.1	7.7	2.1	243.0	3.0	0.0	Horz	PK	0.0	54.8	74.0	-19.2	Mid Ch.40. 2440MHz, 0dBm Pwr Level, EUT On Side
4880.060	46.5	7.7	1.0	334.0	3.0	0.0	Vert	PK	0.0	54.2	74.0	-19.8	Mid Ch.40. 2440MHz, 0dBm Pwr Level, EUT On Side
4880.690	46.3	7.7	1.0	73.0	3.0	0.0	Horz	PK	0.0	54.0	74.0	-20.0	Mid Ch.40. 2440MHz, 0dBm Pwr Level, EUT Horz
12198.710	32.5	1.1	1.4	296.0	3.0	0.0	Horz	AV	0.0	33.6	54.0	-20.4	Mid Ch.40. 2440MHz, 0dBm Pwr Level, EUT Vert
7442.465	38.9	14.6	1.6	18.0	3.0	0.0	Horz	PK	0.0	53.5	74.0	-20.5	High Ch.81. 2481MHz, 0dBm Pwr Level, EUT Vert
7320.215	39.0	14.3	1.7	20.0	3.0	0.0	Horz	PK	0.0	53.3	74.0	-20.7	Mid Ch.40. 2440MHz, 0dBm Pwr Level, EUT Vert
7319.280	39.0	14.3	1.0	10.0	3.0	0.0	Vert	PK	0.0	53.3	74.0	-20.7	Mid Ch.40. 2440MHz, 0dBm Pwr Level, EUT Vert
7443.250	38.7	14.6	1.0	227.0	3.0	0.0	Vert	PK	0.0	53.3	74.0	-20.7	High Ch.81. 2481MHz, 0dBm Pwr Level, EUT Vert
12011.420	32.5	0.1	2.3	198.0	3.0	0.0	Vert	AV	0.0	32.6	54.0	-21.4	Low Ch.2. 2402MHz, 0dBm Pwr Level, EUT Vert
12011.300	31.3	0.1	1.5	160.0	3.0	0.0	Horz	AV	0.0	31.4	54.0	-22.6	Low Ch.2. 2402MHz, 0dBm Pwr Level, EUT Vert
12405.810	38.8	8.8	1.0	234.0	3.0	0.0	Vert	PK	0.0	47.6	74.0	-26.4	High Ch.81. 2481MHz, -4dBm Pwr Level, EUT Vert
12405.140	38.6	8.8	1.8	301.0	3.0	0.0	Horz	PK	0.0	47.4	74.0	-26.6	High Ch.81. 2481MHz, -4dBm Pwr Level, EUT Vert
12198.580	44.4	1.1	2.0	215.0	3.0	0.0	Vert	PK	0.0	45.5	74.0	-28.5	Mid Ch.40. 2440MHz, 0dBm Pwr Level, EUT Vert
12198.650	42.1	1.1	1.4	296.0	3.0	0.0	Horz	PK	0.0	43.2	74.0	-30.8	Mid Ch.40. 2440MHz, 0dBm Pwr Level, EUT Vert
12011.260	42.4	0.1	2.3	198.0	3.0	0.0	Vert	PK	0.0	42.5	74.0	-31.5	Low Ch.2. 2402MHz, 0dBm Pwr Level, EUT Vert
12008.580	42.1	0.1	1.5	160.0	3.0	0.0	Horz	PK	0.0	42.2	74.0	-31.8	Low Ch.2. 2402MHz, 0dBm Pwr Level, EUT Vert

SPURIOUS RADIATED EMISSIONS

Work Order:	APDM0009	Date:	02/05/16	
Project:	None	Temperature:	20.9 °C	
Job Site:	EV01	Humidity:	39.6% RH	
Serial Number:	SMTC1630754	Barometric Pres.:	1030.2 mbar	
Tested by: Brandon Hobbs				
EUT:	AP			
Configuration:	1			
Customer:	APDM, Inc.			
Attendees:	Andrew Greenberg			
EUT Power:	5VDC			
Operating Mode:	Continuous Tx, GFSK, reference data comments for further information			
Deviations:	None			
Comments:	Please reference the data comments for EUT orientation, channel and frequency.			

Test Specifications	Test Method
FCC 15.247.2016	ANSI C63.10:2013



Freq (MHz)	Amplitude (dBuV)	Factor (dB)	Antenna Height (meters)	Azimuth (degrees)	Test Distance (meters)	External Attenuation (dB)	Polarity/Transducer Type	Detector	Distance Adjustment (dB)	Adjusted (dBuV/m)	Spec. Limit (dBuV/m)	Compared to Spec. (dB)	Comments
2483.503	34.1	-2.5	1.0	26.0	3.0	20.0	Horz	AV	0.0	51.6	54.0	-2.4	High Ch.81, 2481MHz, -4dBm Pwr Level, EUT Vert
2483.503	34.0	-2.5	1.0	6.0	3.0	20.0	Vert	AV	0.0	51.5	54.0	-2.5	High Ch.81, 2481MHz, -4dBm Pwr Level, EUT On Side
2483.500	32.5	-2.5	1.0	0.0	3.0	20.0	Horz	AV	0.0	50.0	54.0	-4.0	High Ch.81, 2481MHz, -4dBm Pwr Level, EUT On Side
2483.500	32.4	-2.5	3.9	157.0	3.0	20.0	Horz	AV	0.0	49.9	54.0	-4.1	High Ch.81, 2481MHz, -4dBm Pwr Level, EUT Horz
2483.500	32.4	-2.5	1.0	4.0	3.0	20.0	Vert	AV	0.0	49.9	54.0	-4.1	High Ch.81, 2481MHz, -4dBm Pwr Level, EUT Vert
2483.533	31.3	-2.5	1.0	131.0	3.0	20.0	Vert	AV	0.0	48.8	54.0	-5.2	High Ch.81, 2481MHz, -4dBm Pwr Level, EUT Horz
2388.127	31.1	-2.7	1.0	49.0	3.0	20.0	Horz	AV	0.0	48.4	54.0	-5.6	Low Ch.2, 2402MHz, 0dBm Pwr Level, EUT Vert
2388.087	31.1	-2.7	1.0	103.0	3.0	20.0	Vert	AV	0.0	48.4	54.0	-5.6	Low Ch.2, 2402MHz, 0dBm Pwr Level, EUT On Side
2484.660	48.4	-2.5	1.0	26.0	3.0	20.0	Horz	PK	0.0	65.9	74.0	-8.1	High Ch.81, 2481MHz, -4dBm Pwr Level, EUT Vert
2484.583	48.3	-2.5	1.0	6.0	3.0	20.0	Vert	PK	0.0	65.8	74.0	-8.2	High Ch.81, 2481MHz, -4dBm Pwr Level, EUT On Side
2484.467	46.2	-2.5	1.0	0.0	3.0	20.0	Horz	PK	0.0	63.7	74.0	-10.3	High Ch.81, 2481MHz, -4dBm Pwr Level, EUT On Side
2484.693	46.0	-2.5	1.0	4.0	3.0	20.0	Vert	PK	0.0	63.5	74.0	-10.5	High Ch.81, 2481MHz, -4dBm Pwr Level, EUT Vert
2484.503	45.9	-2.5	3.9	157.0	3.0	20.0	Horz	PK	0.0	63.4	74.0	-10.6	High Ch.81, 2481MHz, -4dBm Pwr Level, EUT Horz
2484.327	43.5	-2.5	1.0	131.0	3.0	20.0	Vert	PK	0.0	61.0	74.0	-13.0	High Ch.81, 2481MHz, -4dBm Pwr Level, EUT Horz
2388.237	42.4	-2.7	1.0	49.0	3.0	20.0	Horz	PK	0.0	59.7	74.0	-14.3	Low Ch.2, 2402MHz, 0dBm Pwr Level, EUT Vert
2388.730	42.0	-2.7	1.0	103.0	3.0	20.0	Vert	PK	0.0	59.3	74.0	-14.7	Low Ch.2, 2402MHz, 0dBm Pwr Level, EUT On Side

AC – POWERLINE CONDUCTED EMISSIONS

TEST DESCRIPTION

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

TEST EQUIPMENT

Description	Manufacturer	Model	ID	Last Cal.	Cal. Due
Receiver	Rohde & Schwarz	ESCI	ARH	3/11/2015	3/11/2016
Cable - Conducted Cable Assembly	Northwest EMC	EVG, HHD, RKA	EVGA	5/12/2015	5/12/2016
LISN	Solar Electronics	9252-50-R-24-BNC	LIP	1/27/2015	1/27/2017
LISN	Solar Electronics	9252-50-R-24-BNC	LIN	1/15/2016	1/15/2017

MEASUREMENT UNCERTAINTY

Description		
Expanded k=2	2.4 dB	-2.4 dB

CONFIGURATIONS INVESTIGATED

APDM0009-4

MODES INVESTIGATED

Laptop powered at 110VAC/60Hz Continuous data transfer from Opal to Laptop. Continuous ping from laptop to Access Point. Access point radio set to High Channel.

Laptop powered at 110VAC/60Hz. Continuous data transfer from Opal to Laptop. Continuous ping from laptop to Access Point. Access point radio set to Low Channel.

Laptop powered at 110VAC/60Hz. Continuous data transfer from Opal to Laptop. Continuous ping from laptop to Access Point. Access point radio set to Mid Channel.

AC – POWERLINE CONDUCTED EMISSIONS

EUT:	AP	Work Order:	APDM0009
Serial Number:	SMTC1630754	Date:	02/18/2016
Customer:	APDM, Inc.	Temperature:	22.8°C
Attendees:	Gavin Gallino	Relative Humidity:	39.5%
Customer Project:	None	Bar. Pressure:	995.7 mb
Tested By:	Jeff Alcocke	Job Site:	EV07
Power:	5VDC	Configuration:	APDM0009-4

TEST SPECIFICATIONS

Specification:	Method:
FCC 15.207:2016	ANSI C63.10:2013

TEST PARAMETERS

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

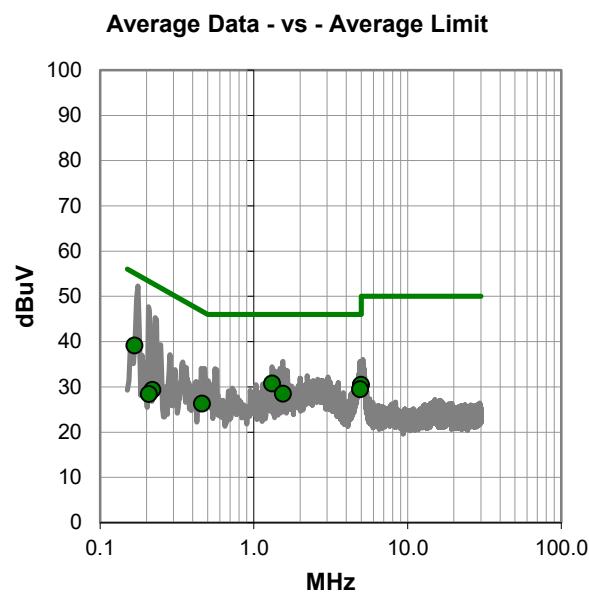
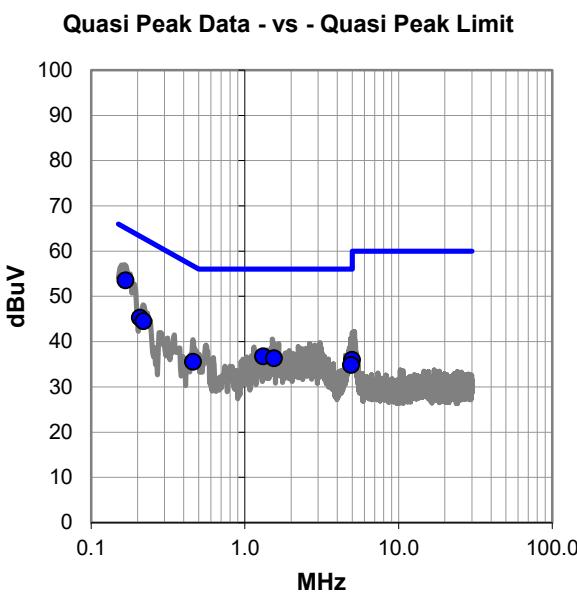
None

EUT OPERATING MODES

Laptop powered at 110VAC/60Hz. Continuous data transfer from Opal to Laptop. Continuous ping from laptop to Access Point. Access point radio set to Mid Channel.

DEVIATIONS FROM TEST STANDARD

None



AC – POWERLINE CONDUCTED EMISSIONS

RESULTS - Run #1

Quasi Peak Data - vs - Quasi Peak Limit

Freq (MHz)	Amp. (dBuV)	Factor (dB)	Adjusted (dBuV)	Spec. Limit (dBuV)	Margin (dB)
0.167	33.4	20.1	53.5	65.1	-11.6
0.208	25.2	20.1	45.3	63.3	-18.0
0.219	24.4	20.1	44.5	62.9	-18.4
1.315	16.6	20.1	36.7	56.0	-19.3
1.545	16.2	20.1	36.3	56.0	-19.7
4.984	15.7	20.3	36.0	56.0	-20.0
4.913	14.6	20.3	34.9	56.0	-21.1
0.461	15.5	20.0	35.5	56.7	-21.2

Average Data - vs - Average Limit

Freq (MHz)	Amp. (dBuV)	Factor (dB)	Adjusted (dBuV)	Spec. Limit (dBuV)	Margin (dB)
1.315	10.6	20.1	30.7	46.0	-15.3
4.984	10.2	20.3	30.5	46.0	-15.5
0.167	19.0	20.1	39.1	55.1	-16.0
4.913	9.2	20.3	29.5	46.0	-16.5
1.545	8.4	20.1	28.5	46.0	-17.5
0.461	6.3	20.0	26.3	46.7	-20.4
0.219	9.2	20.1	29.3	52.9	-23.6
0.208	8.3	20.1	28.4	53.3	-24.9

CONCLUSION

Pass



Tested By

AC – POWERLINE CONDUCTED EMISSIONS

EUT:	AP	Work Order:	APDM0009
Serial Number:	SMTC1630754	Date:	02/18/2016
Customer:	APDM, Inc.	Temperature:	22.8°C
Attendees:	Gavin Gallino	Relative Humidity:	39.5%
Customer Project:	None	Bar. Pressure:	995.7 mb
Tested By:	Jeff Alcocke	Job Site:	EV07
Power:	5VDC	Configuration:	APDM0009-4

TEST SPECIFICATIONS

Specification: Equipment Class B	Method:
FCC 15.207:2016	ANSI C63.10:2013

TEST PARAMETERS

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

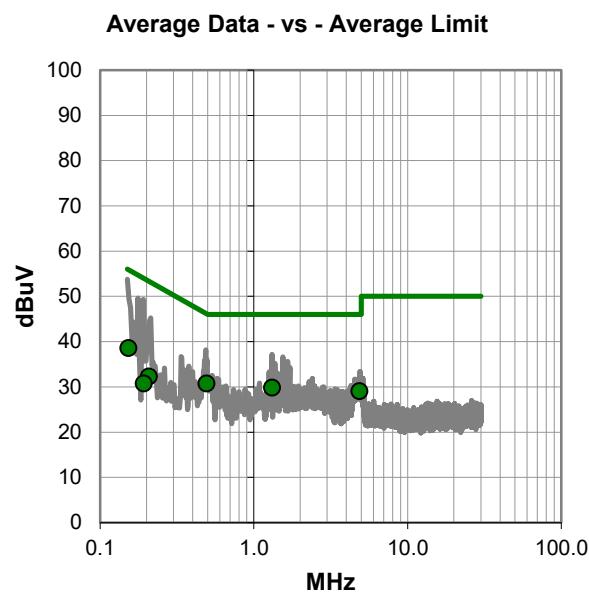
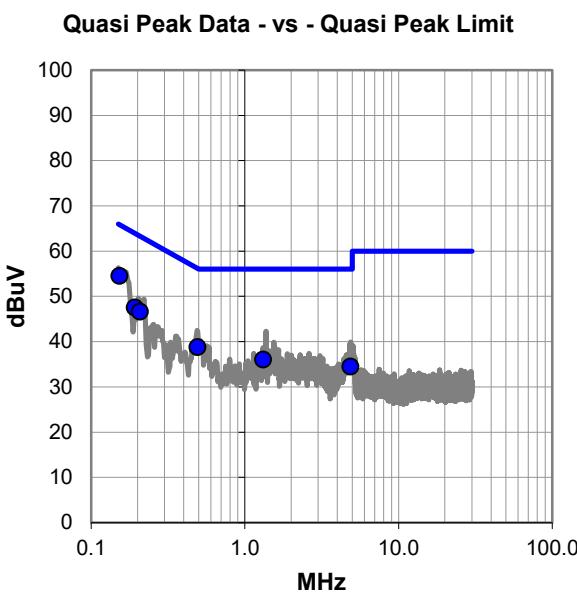
None

EUT OPERATING MODES

Laptop powered at 110VAC/60Hz. Continuous data transfer from Opal to Laptop. Continuous ping from laptop to Access Point. Access point radio set to Mid Channel.

DEVIATIONS FROM TEST STANDARD

None



AC – POWERLINE CONDUCTED EMISSIONS

RESULTS - Run #2

Quasi Peak Data - vs - Quasi Peak Limit

Freq (MHz)	Amp. (dBuV)	Factor (dB)	Adjusted (dBuV)	Spec. Limit (dBuV)	Margin (dB)
0.153	34.3	20.2	54.5	65.8	-11.3
0.193	27.4	20.1	47.5	63.9	-16.4
0.208	26.5	20.1	46.6	63.3	-16.7
0.493	18.8	20.0	38.8	56.1	-17.3
1.313	15.9	20.1	36.0	56.0	-20.0
4.861	14.2	20.2	34.4	56.0	-21.6

Average Data - vs - Average Limit

Freq (MHz)	Amp. (dBuV)	Factor (dB)	Adjusted (dBuV)	Spec. Limit (dBuV)	Margin (dB)
0.493	10.7	20.0	30.7	46.1	-15.4
1.313	9.7	20.1	29.8	46.0	-16.2
4.861	8.8	20.2	29.0	46.0	-17.0
0.153	18.4	20.2	38.6	55.8	-17.2
0.208	12.2	20.1	32.3	53.3	-21.0
0.193	10.6	20.1	30.7	53.9	-23.2

CONCLUSION

Pass



Tested By

AC – POWERLINE CONDUCTED EMISSIONS

EUT:	AP	Work Order:	APDM0009
Serial Number:	SMTC1630754	Date:	02/18/2016
Customer:	APDM, Inc.	Temperature:	22.8°C
Attendees:	Gavin Gallino	Relative Humidity:	39.5%
Customer Project:	None	Bar. Pressure:	995.7 mb
Tested By:	Jeff Alcocke	Job Site:	EV07
Power:	5VDC	Configuration:	APDM0009-4

TEST SPECIFICATIONS

Specification:	Method:
FCC 15.207:2016	ANSI C63.10:2013

TEST PARAMETERS

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

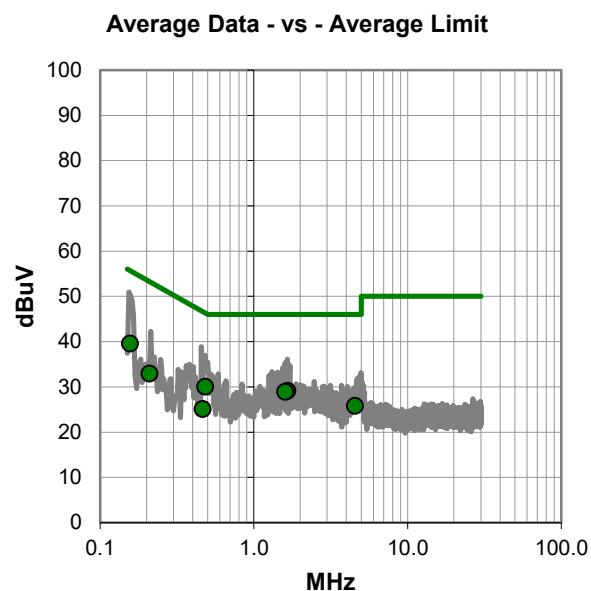
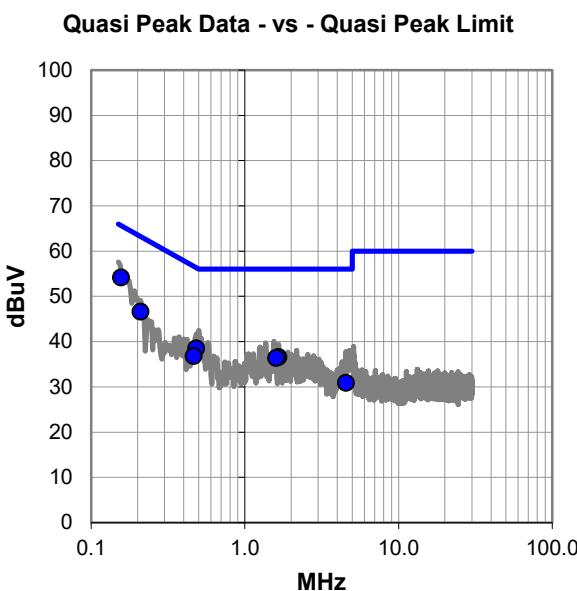
None

EUT OPERATING MODES

Laptop powered at 110VAC/60Hz Continuous data transfer from Opal to Laptop. Continuous ping from laptop to Access Point. Access point radio set to High Channel.

DEVIATIONS FROM TEST STANDARD

None



AC – POWERLINE CONDUCTED EMISSIONS

RESULTS - Run #3

Quasi Peak Data - vs - Quasi Peak Limit

Freq (MHz)	Amp. (dBuV)	Factor (dB)	Adjusted (dBuV)	Spec. Limit (dBuV)	Margin (dB)
0.157	34.0	20.2	54.2	65.6	-11.5
0.210	26.5	20.1	46.6	63.2	-16.6
0.482	18.5	20.0	38.5	56.3	-17.8
1.658	16.5	20.1	36.6	56.0	-19.4
1.601	16.3	20.1	36.4	56.0	-19.6
0.466	16.8	20.0	36.8	56.6	-19.8
4.543	10.7	20.2	30.9	56.0	-25.1

Average Data - vs - Average Limit

Freq (MHz)	Amp. (dBuV)	Factor (dB)	Adjusted (dBuV)	Spec. Limit (dBuV)	Margin (dB)
0.157	19.4	20.2	39.6	55.6	-16.1
0.482	10.0	20.0	30.0	46.3	-16.3
1.658	9.0	20.1	29.1	46.0	-16.9
1.601	8.8	20.1	28.9	46.0	-17.1
4.543	5.6	20.2	25.8	46.0	-20.2
0.210	12.8	20.1	32.9	53.2	-20.3
0.466	5.1	20.0	25.1	46.6	-21.5

CONCLUSION

Pass



Tested By

AC – POWERLINE CONDUCTED EMISSIONS

EUT:	AP	Work Order:	APDM0009
Serial Number:	SMTC1630754	Date:	02/18/2016
Customer:	APDM, Inc.	Temperature:	22.8°C
Attendees:	Gavin Gallino	Relative Humidity:	39.5%
Customer Project:	None	Bar. Pressure:	995.7 mb
Tested By:	Jeff Alcocke	Job Site:	EV07
Power:	5VDC	Configuration:	APDM0009-4

TEST SPECIFICATIONS

Specification:	Method:
FCC 15.207:2016	ANSI C63.10:2013

TEST PARAMETERS

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

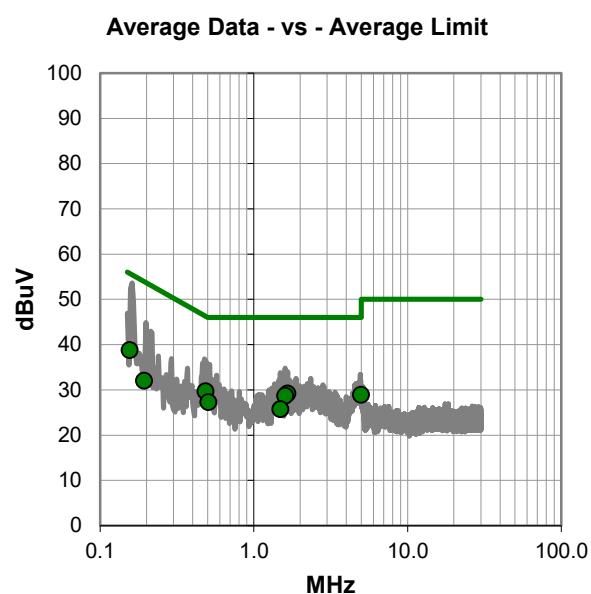
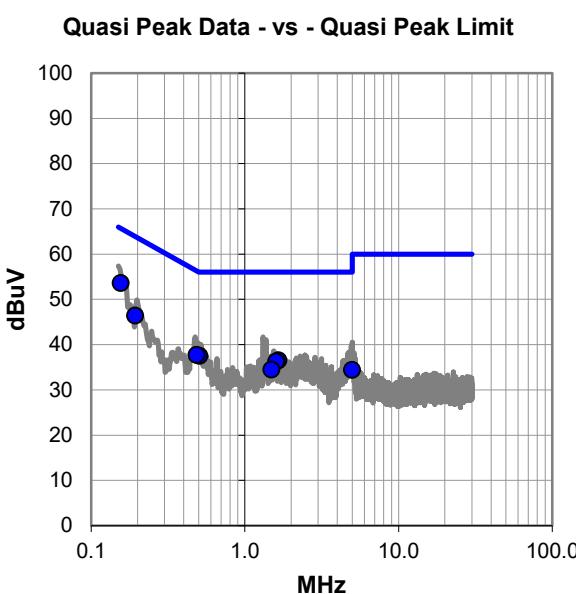
None

EUT OPERATING MODES

Laptop powered at 110VAC/60Hz Continuous data transfer from Opal to Laptop. Continuous ping from laptop to Access Point. Access point radio set to High Channel.

DEVIATIONS FROM TEST STANDARD

None



AC – POWERLINE CONDUCTED EMISSIONS

RESULTS - Run #4

Quasi Peak Data - vs - Quasi Peak Limit

Freq (MHz)	Amp. (dBuV)	Factor (dB)	Adjusted (dBuV)	Spec. Limit (dBuV)	Margin (dB)
0.156	33.4	20.2	53.6	65.7	-12.1
0.194	26.3	20.1	46.4	63.9	-17.5
0.507	17.5	20.0	37.5	56.0	-18.5
0.484	17.7	20.0	37.7	56.3	-18.6
1.658	16.4	20.1	36.5	56.0	-19.5
1.600	16.1	20.1	36.2	56.0	-19.8
1.487	14.4	20.1	34.5	56.0	-21.5
4.985	14.1	20.3	34.4	56.0	-21.6

Average Data - vs - Average Limit

Freq (MHz)	Amp. (dBuV)	Factor (dB)	Adjusted (dBuV)	Spec. Limit (dBuV)	Margin (dB)
0.484	9.7	20.0	29.7	46.3	-16.6
1.658	9.1	20.1	29.2	46.0	-16.8
0.156	18.6	20.2	38.8	55.7	-16.9
4.985	8.6	20.3	28.9	46.0	-17.1
1.600	8.6	20.1	28.7	46.0	-17.3
0.507	7.3	20.0	27.3	46.0	-18.7
1.487	5.6	20.1	25.7	46.0	-20.3
0.194	11.9	20.1	32.0	53.9	-21.9

CONCLUSION

Pass



Tested By

AC – POWERLINE CONDUCTED EMISSIONS

EUT:	AP	Work Order:	APDM0009
Serial Number:	SMTC1630754	Date:	02/18/2016
Customer:	APDM, Inc.	Temperature:	22.8°C
Attendees:	Gavin Gallino	Relative Humidity:	39.5%
Customer Project:	None	Bar. Pressure:	995.7 mb
Tested By:	Jeff Alcocke	Job Site:	EV07
Power:	5VDC	Configuration:	APDM0009-4

TEST SPECIFICATIONS

Specification:	Method:
FCC 15.207:2016	ANSI C63.10:2013

TEST PARAMETERS

Run #:	5	Line:	Neutral	Add. Ext. Attenuation (dB):	0
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COMMENTS

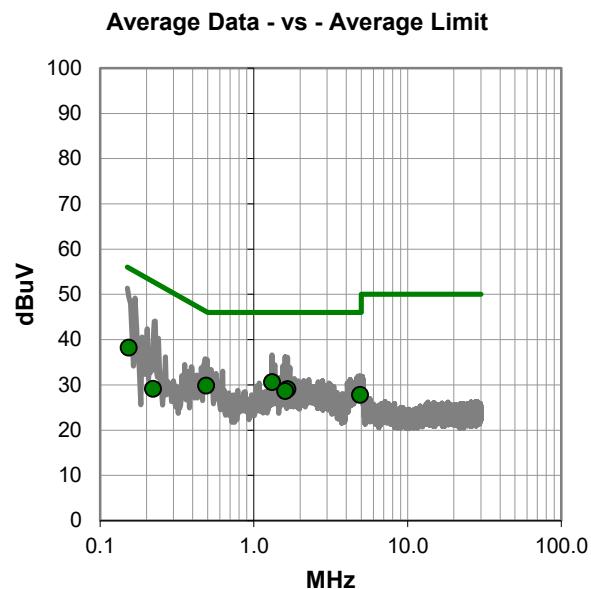
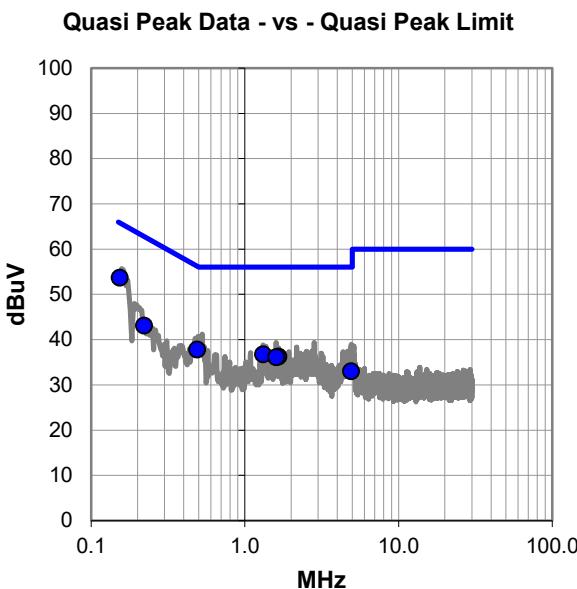
None

EUT OPERATING MODES

Laptop powered at 110VAC/60Hz. Continuous data transfer from Opal to Laptop. Continuous ping from laptop to Access Point. Access point radio set to Low Channel.

DEVIATIONS FROM TEST STANDARD

None



AC – POWERLINE CONDUCTED EMISSIONS

RESULTS - Run #5

Quasi Peak Data - vs - Quasi Peak Limit

Freq (MHz)	Amp. (dBuV)	Factor (dB)	Adjusted (dBuV)	Spec. Limit (dBuV)	Margin (dB)
0.154	33.5	20.2	53.7	65.8	-12.1
0.490	17.8	20.0	37.8	56.2	-18.4
1.315	16.6	20.1	36.7	56.0	-19.3
0.221	23.0	20.1	43.1	62.8	-19.7
1.657	16.1	20.1	36.2	56.0	-19.8
1.601	16.0	20.1	36.1	56.0	-19.9
4.919	12.7	20.3	33.0	56.0	-23.0

Average Data - vs - Average Limit

Freq (MHz)	Amp. (dBuV)	Factor (dB)	Adjusted (dBuV)	Spec. Limit (dBuV)	Margin (dB)
1.315	10.5	20.1	30.6	46.0	-15.4
0.490	9.8	20.0	29.8	46.2	-16.4
1.657	8.9	20.1	29.0	46.0	-17.0
1.601	8.5	20.1	28.6	46.0	-17.4
0.154	18.0	20.2	38.2	55.8	-17.6
4.919	7.5	20.3	27.8	46.0	-18.2
0.221	9.0	20.1	29.1	52.8	-23.7

CONCLUSION

Pass



Tested By

AC – POWERLINE CONDUCTED EMISSIONS

EUT:	AP	Work Order:	APDM0009
Serial Number:	SMTC1630754	Date:	02/18/2016
Customer:	APDM, Inc.	Temperature:	22.8°C
Attendees:	Gavin Gallino	Relative Humidity:	39.5%
Customer Project:	None	Bar. Pressure:	995.7 mb
Tested By:	Jeff Alcocke	Job Site:	EV07
Power:	5VDC	Configuration:	APDM0009-4

TEST SPECIFICATIONS

Specification:	Method:
FCC 15.207:2016	ANSI C63.10:2013

TEST PARAMETERS

Run #:	6	Line:	High Line	Add. Ext. Attenuation (dB):	0
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COMMENTS

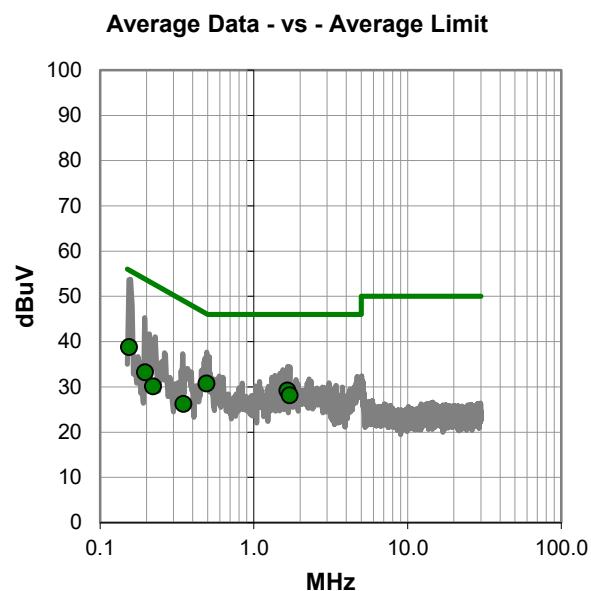
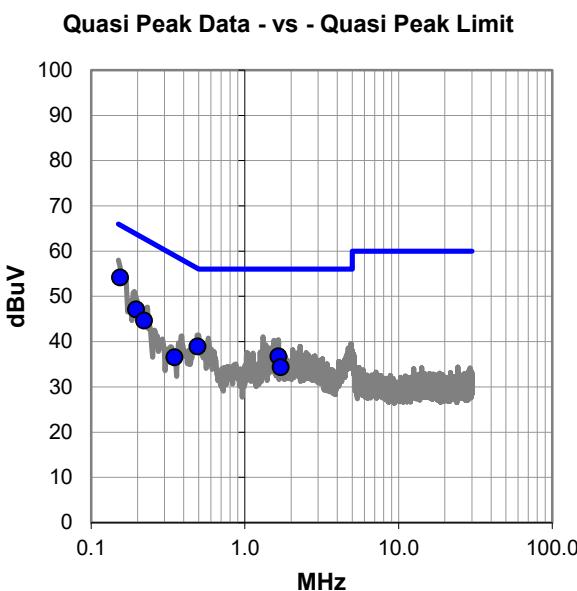
None

EUT OPERATING MODES

Laptop powered at 110VAC/60Hz. Continuous data transfer from Opal to Laptop. Continuous ping from laptop to Access Point. Access point radio set to Low Channel.

DEVIATIONS FROM TEST STANDARD

None



AC – POWERLINE CONDUCTED EMISSIONS

RESULTS - Run #6

Quasi Peak Data - vs - Quasi Peak Limit

Freq (MHz)	Amp. (dBuV)	Factor (dB)	Adjusted (dBuV)	Spec. Limit (dBuV)	Margin (dB)
0.155	34.0	20.2	54.2	65.7	-11.6
0.196	27.0	20.1	47.1	63.8	-16.7
0.491	18.9	20.0	38.9	56.1	-17.2
0.221	24.5	20.1	44.6	62.8	-18.2
1.659	16.6	20.1	36.7	56.0	-19.3
1.716	14.2	20.1	34.3	56.0	-21.7
0.349	16.5	20.0	36.5	59.0	-22.5

Average Data - vs - Average Limit

Freq (MHz)	Amp. (dBuV)	Factor (dB)	Adjusted (dBuV)	Spec. Limit (dBuV)	Margin (dB)
0.491	10.7	20.0	30.7	46.1	-15.4
1.659	9.1	20.1	29.2	46.0	-16.8
0.155	18.6	20.2	38.8	55.7	-17.0
1.716	8.0	20.1	28.1	46.0	-17.9
0.196	13.1	20.1	33.2	53.8	-20.6
0.221	10.0	20.1	30.1	52.8	-22.7
0.349	6.2	20.0	26.2	49.0	-22.8

CONCLUSION

Pass



Tested By