

# NORTHWEST EMC

**APDM, Inc.**

**AP**

**FCC 15.207:2016**

**FCC 15.247:2016**

**2.4 GHz DTS Radio**

**Report # APDM0009.3**



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	ANSI C63.10:2013
FCC 15.247:2016	

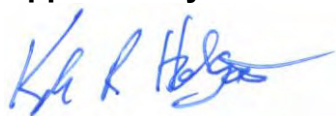
### Results

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

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## 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

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## Canada

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

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## 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.

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## Australia/New Zealand

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

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## Korea

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

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## Japan

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

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## 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.

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## Singapore

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

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## Israel

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

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## Hong Kong

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

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## Vietnam

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

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## 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

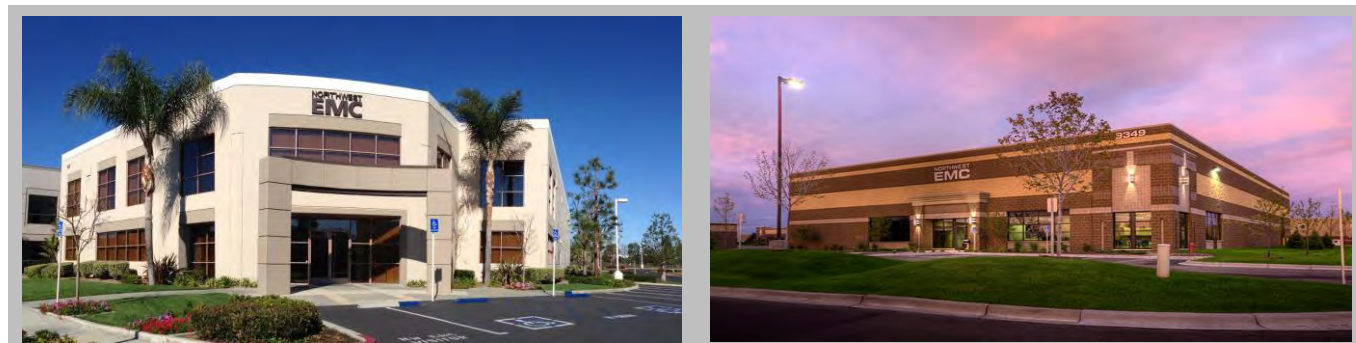
When a measurement is made, the result will be different from the true or theoretically correct value. The difference is the result of tolerances in the measurement system that cannot be completely eliminated. To the extent that technology allows us, it has been our aim to minimize this error. Measurement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

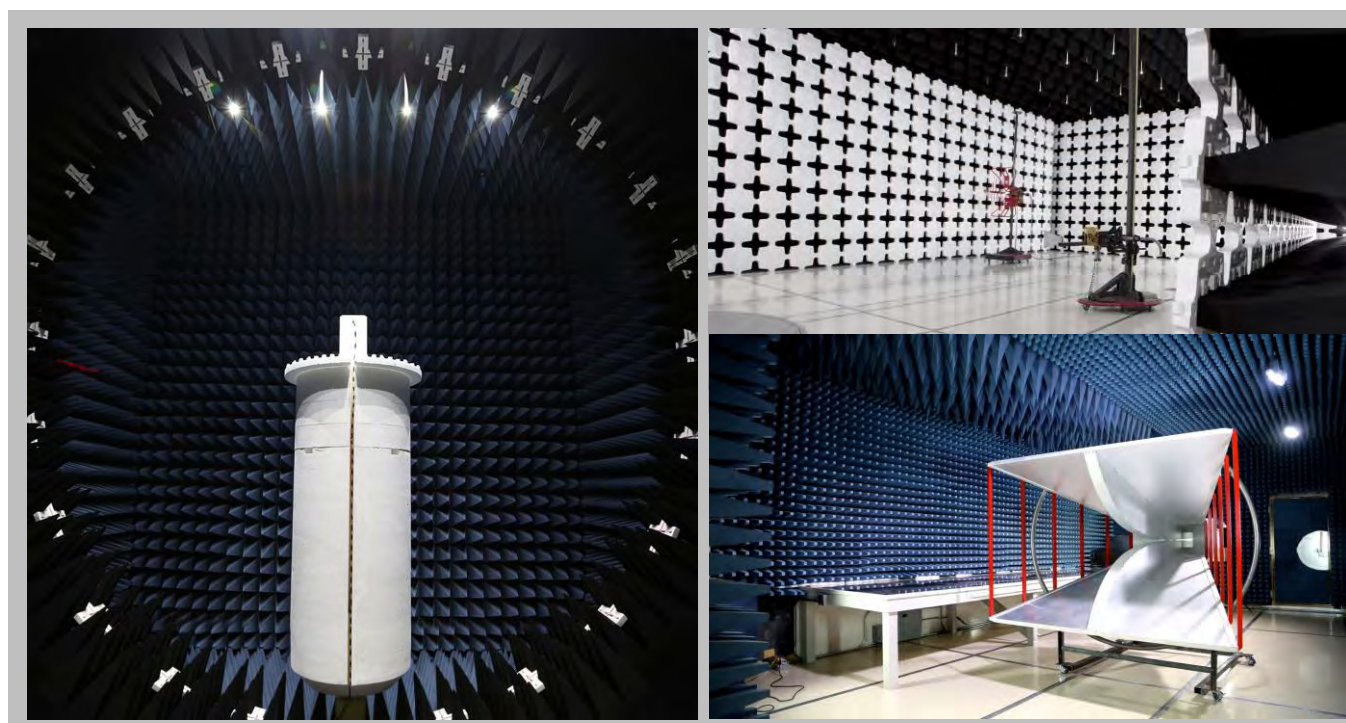
The following table represents the Measurement Uncertainty (MU) budgets for each of the tests that may be contained in this report.

<b>Test</b>	<b>+ MU</b>	<b>- MU</b>
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



<b>California</b> Labs OC01-13 41 Tesla Irvine, CA 92618 (949) 861-8918	<b>Minnesota</b> Labs MN01-08, MN10 9349 W Broadway Ave. Brooklyn Park, MN 55445 (612)-638-5136	<b>New York</b> Labs NY01-04 4939 Jordan Rd. Elbridge, NY 13060 (315) 554-8214	<b>Oregon</b> Labs EV01-12 22975 NW Evergreen Pkwy Hillsboro, OR 97124 (503) 844-4066	<b>Texas</b> Labs TX01-09 3801 E Plano Pkwy Plano, TX 75074 (469) 304-5255	<b>Washington</b> Labs NC01-05 19201 120 <sup>th</sup> Ave NE Bothell, WA 98011 (425)984-6600
<b>NVLAP</b>					
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
<b>Industry Canada</b>					
2834B-1, 2834B-3	2834E-1	N/A	2834D-1, 2834D-2	2834G-1	2834F-1
<b>BSMI</b>					
SL2-IN-E-1154R	SL2-IN-E-1152R	N/A	SL2-IN-E-1017	SL2-IN-E-1158R	SL2-IN-E-1153R
<b>VCCI</b>					
A-0029	A-0109	N/A	A-0108	A-0201	A-0110
<b>Recognized Phase I CAB for ACMA, BSMI, IDA, KCC/RRR, MIC, MOC, NCC, OFCA</b>					
US0158	US0175	N/A	US0017	US0191	US0157



# PRODUCT DESCRIPTION

## Client and Equipment Under Test (EUT) Information

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

## Information Provided by the Party Requesting the Test

<b>Functional Description of the EUT:</b>
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.
<b>Testing Objective:</b>
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	WASGU0AEXQDVL
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	Omegatette	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.

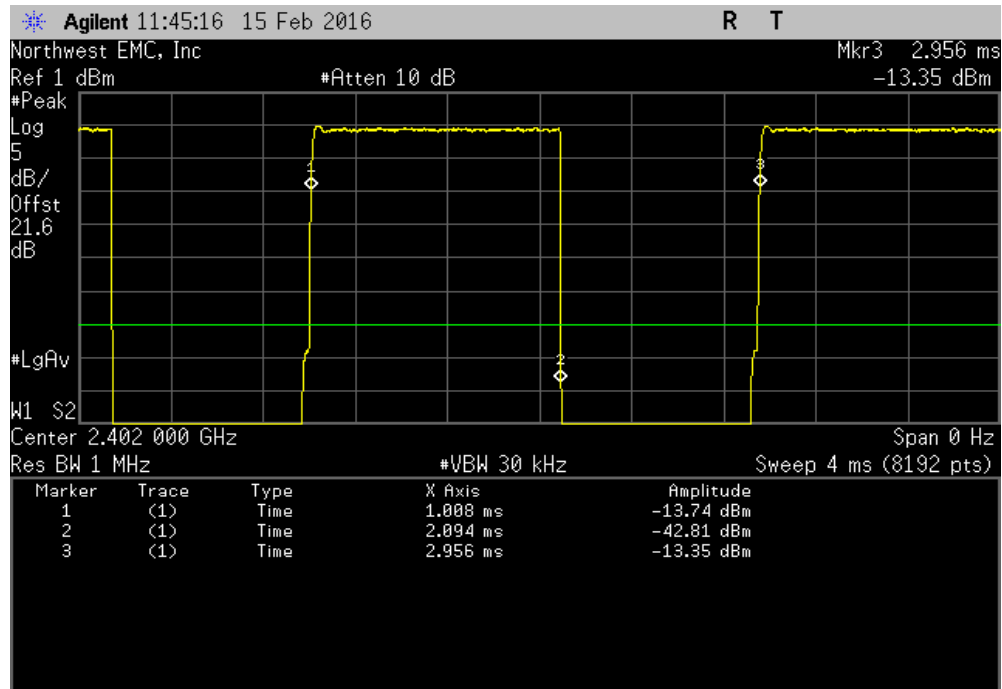
If the transmit duty cycle < 98 percent, burst gating may have been used during some of the other tests in this report to only take the measurement during the burst duration.

# DUTY CYCLE

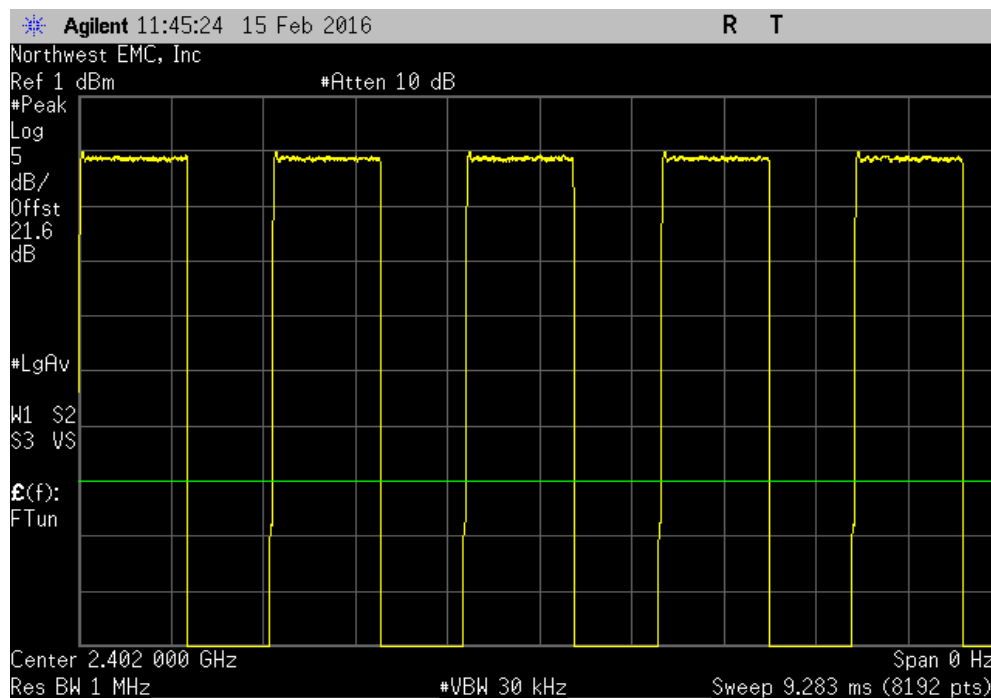
EUT: AP		Work Order: APDM0009	
Serial Number: SMTc1630754		Date: 02/15/16	
Customer: APDM, Inc.		Temperature: 22.5°C	
Attendees: Andrew Greenberg		Humidity: 48%	
Project: None		Barometric Pres.: 1022.6	
Tested by: Brandon Hobbs	Power: 5VDC	Job Site: EV06	
TEST SPECIFICATIONS		Test Method	
FCC 15.247:2016		ANSI C63.10:2013	
COMMENTS			
Continuous Broadcast modes were provided by the client.			
DEVIATIONS FROM TEST STANDARD			
Configuration #	2	Signature 	
		Pulse Width	Period
		Number of Pulses	Value (%)
		Limit (%)	Results
Normal Temperature Conditions			
Zigbee GFSK			
	Low Channel, 2, 2402 MHz	1.086 ms	1.948 ms
	Low Channel, 2, 2402 MHz	N/A	N/A
	Mid Channel, 40, 2440 MHz	1.087 ms	1.95 ms
	Mid Channel, 40, 2440 MHz	N/A	N/A
	High Channel, 81, 2481 MHz	1.087 ms	1.948 ms
	High Channel, 81, 2481 MHz	N/A	N/A
		5	55.8
		5	N/A
		1	55.7
		5	N/A
		1	55.8
		5	N/A
			N/A
			N/A
			N/A
			N/A

# 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

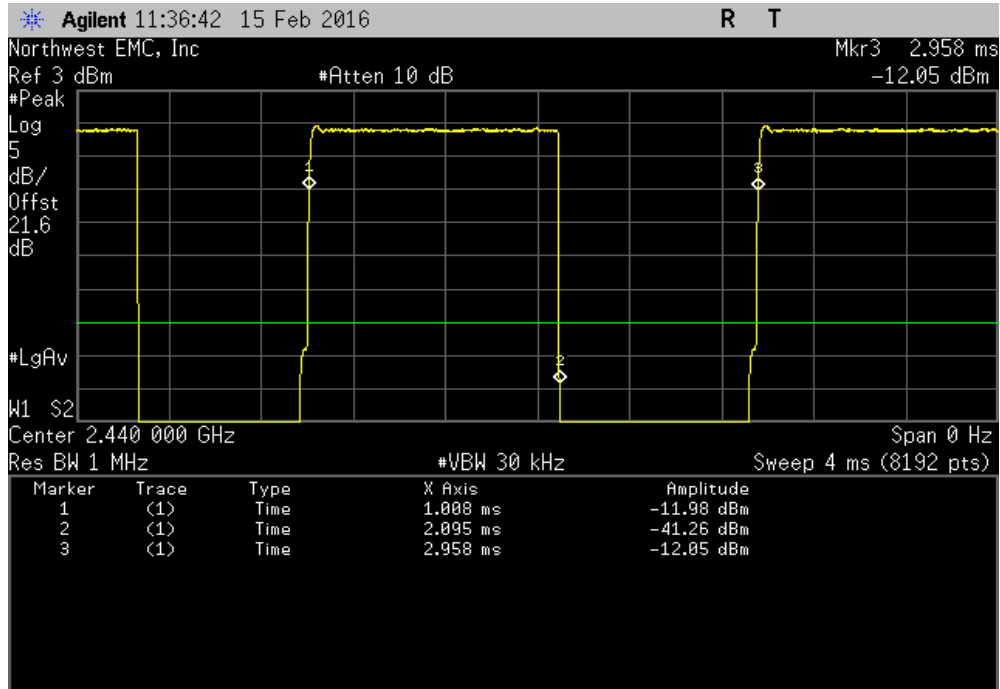


Normal Temperature Conditions, Zigbee GFSK, Low Channel, 2, 2402 MHz						
	Pulse Width	Period	Number of Pulses	Value (%)	Limit (%)	Results
	N/A	N/A	5	N/A	N/A	N/A

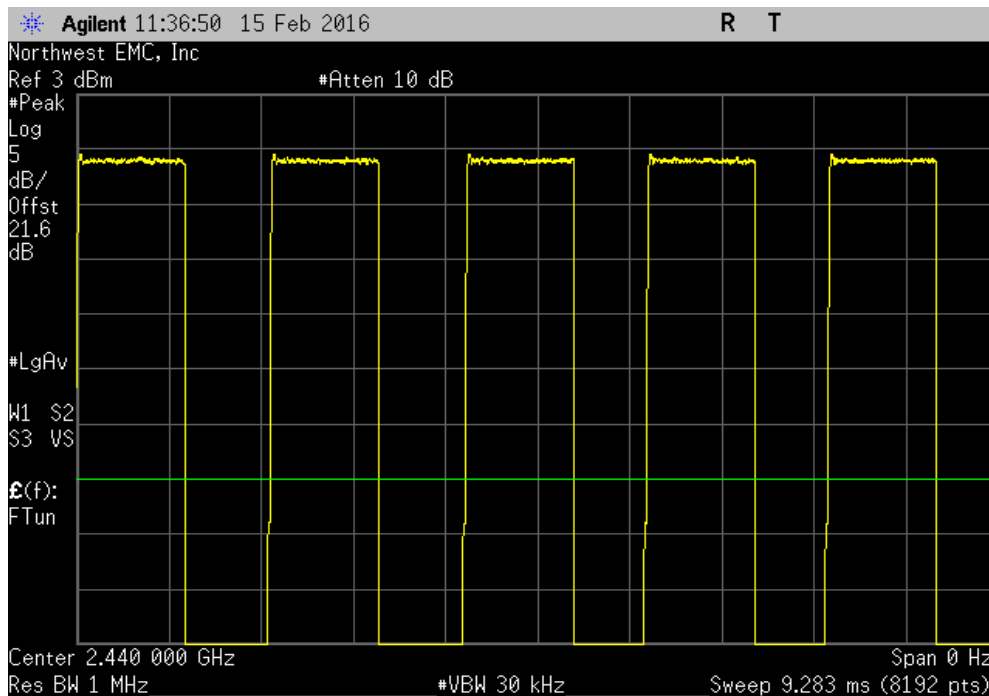


# DUTY CYCLE

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

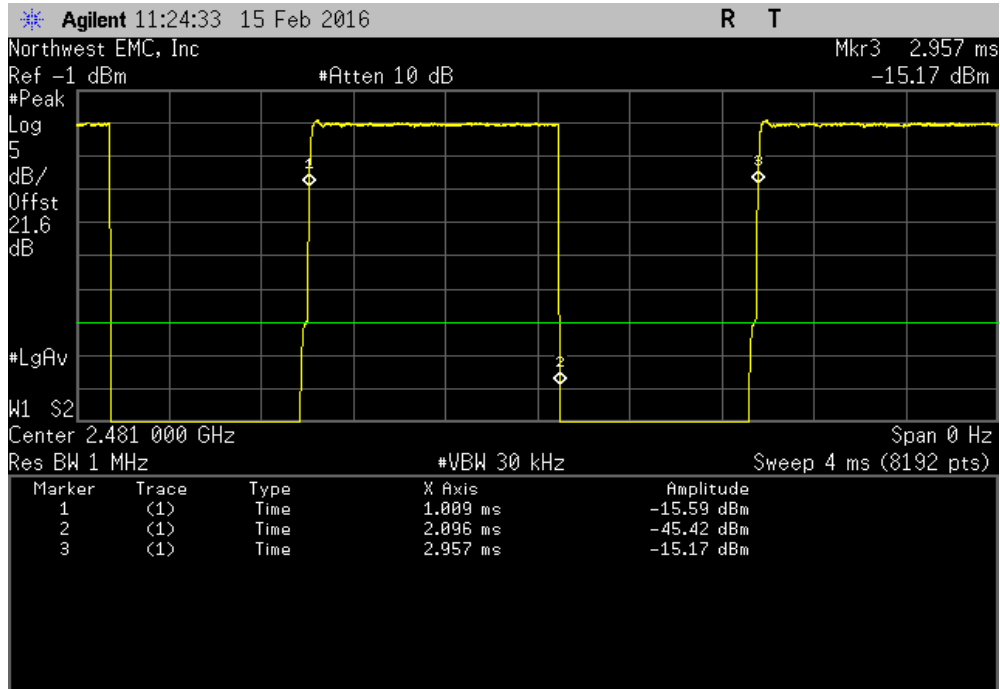


Normal Temperature Conditions, Zigbee GFSK, Mid Channel, 40, 2440 MHz						
	Pulse Width	Period	Number of Pulses	Value (%)	Limit (%)	Results
	N/A	N/A	5	N/A	N/A	N/A

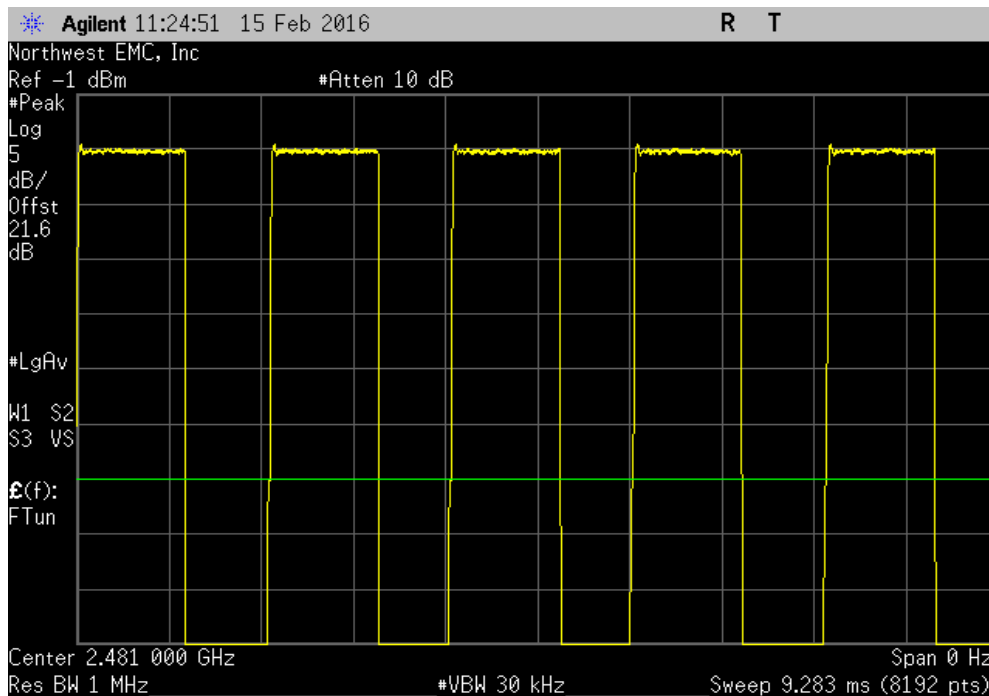


# DUTY CYCLE

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



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





# 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.

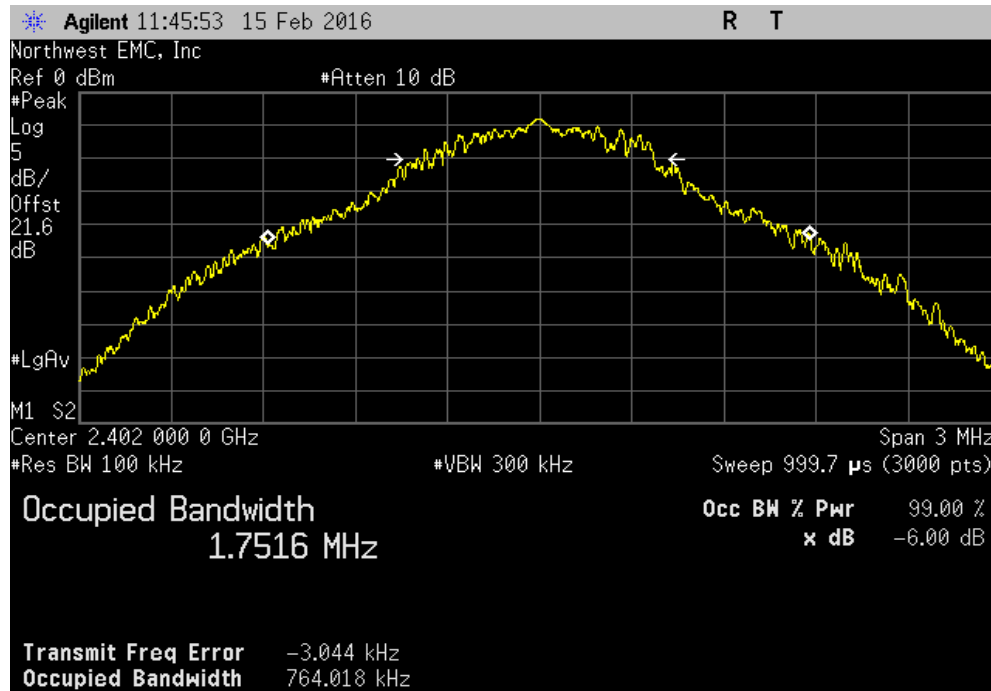
# OCCUPIED BANDWIDTH

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 mbr	
Tested by: Brandon Hobbs	Power: 5VDC	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			
None			
Configuration #	2	Signature 	
		Value	Limit (>) Result
Normal Temperature Conditions			
Zigbee GFSK			
Low Channel, 2, 2402 MHz		764.018 kHz	500 kHz Pass
Mid Channel, 40, 2440 MHz		776.175 kHz	500 kHz Pass
High Channel, 81, 2481 MHz		789.317 kHz	500 kHz Pass

# OCCUPIED BANDWIDTH

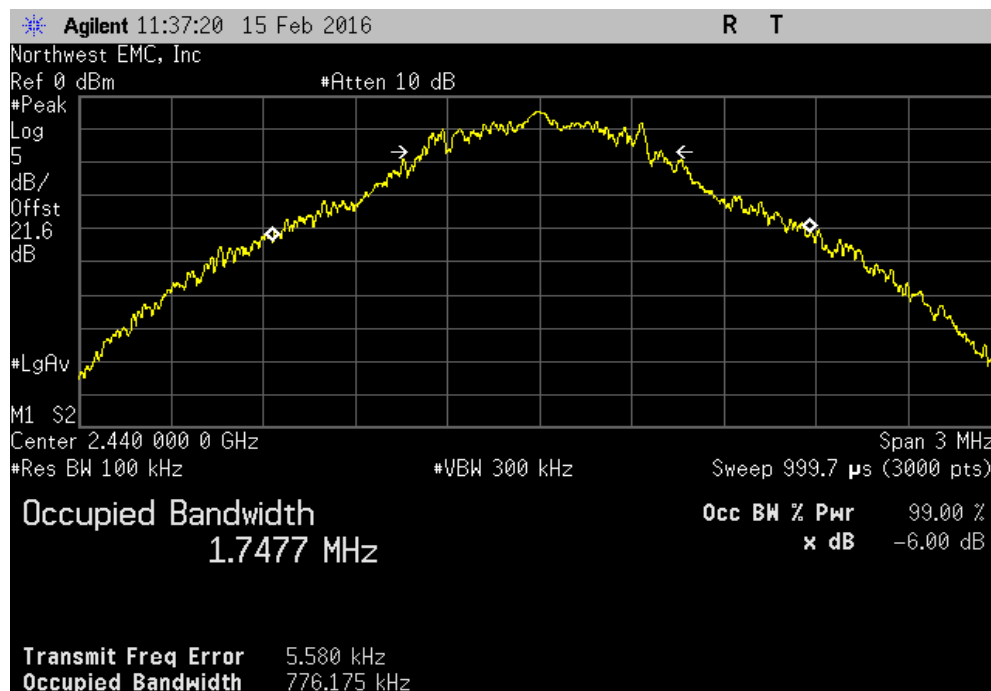
Normal Temperature Conditions, Zigbee GFSK, Low Channel, 2, 2402 MHz

				Value	Limit (>)	Result
				764.018 kHz	500 kHz	Pass



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

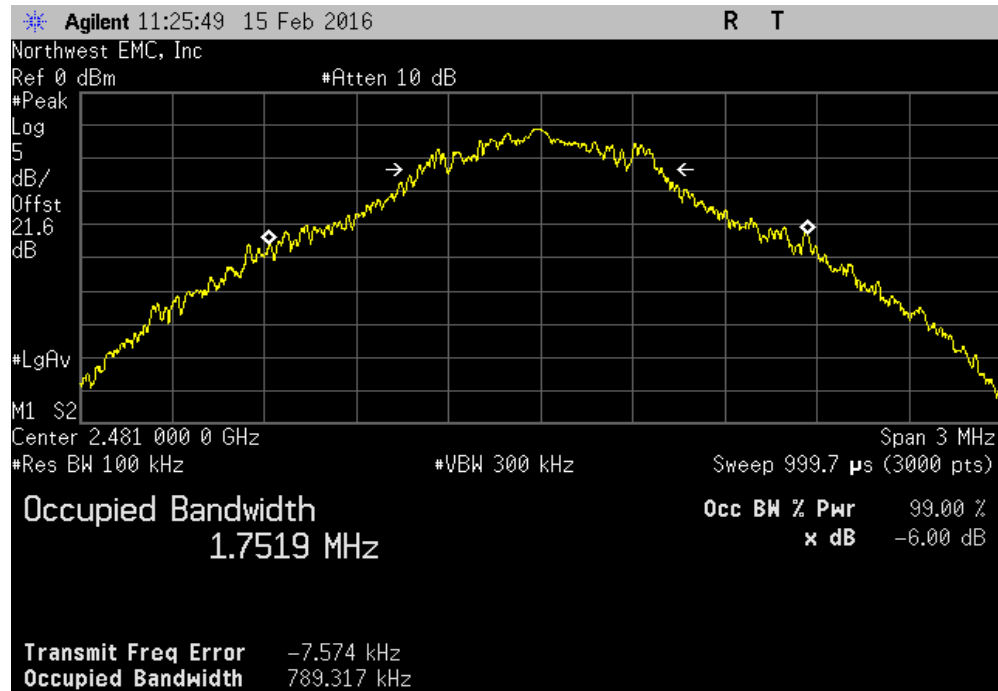
				Value	Limit (>)	Result
				776.175 kHz	500 kHz	Pass



# OCCUPIED BANDWIDTH

Normal Temperature Conditions, Zigbee GFSK, High Channel, 81, 2481 MHz

				Value	Limit	Result
				789.317 kHz	500 kHz	Pass



# 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	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 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.

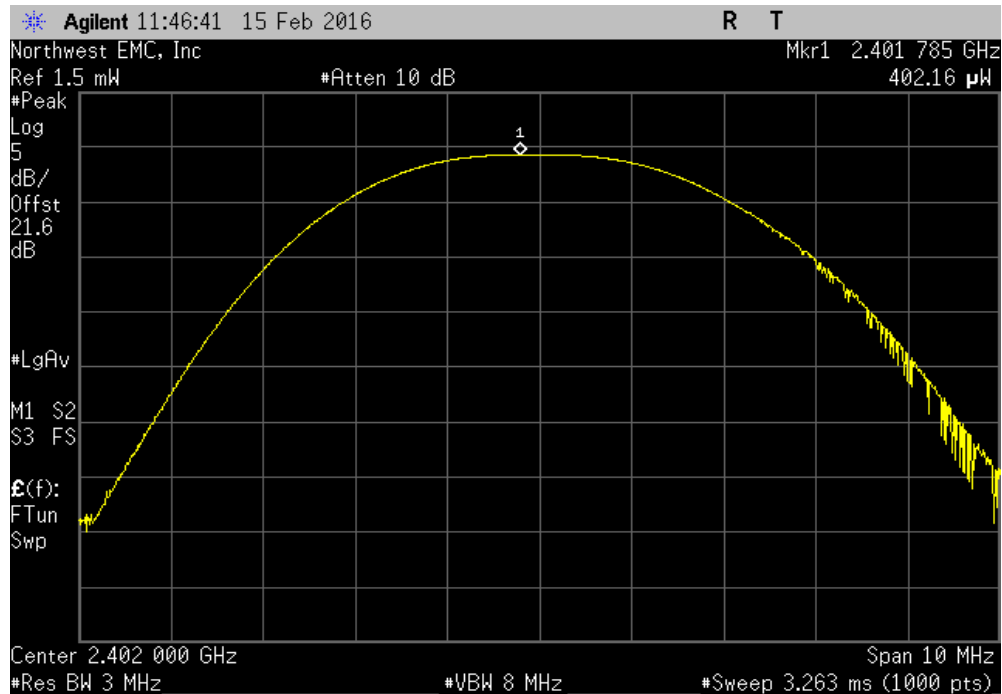
# OUTPUT POWER

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 mbr	
Tested by: Brandon Hobbs	Power: 5VDC	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 	
		Value	Limit (<) Result
Normal Temperature Conditions			
Zigbee GFSK			
Low Channel, 2, 2402 MHz		402.161 uW	1 W Pass
Mid Channel, 40, 2440 MHz		586.273 uW	1 W Pass
High Channel, 81, 2481 MHz		283.4 uW	1 W Pass

# OUTPUT POWER

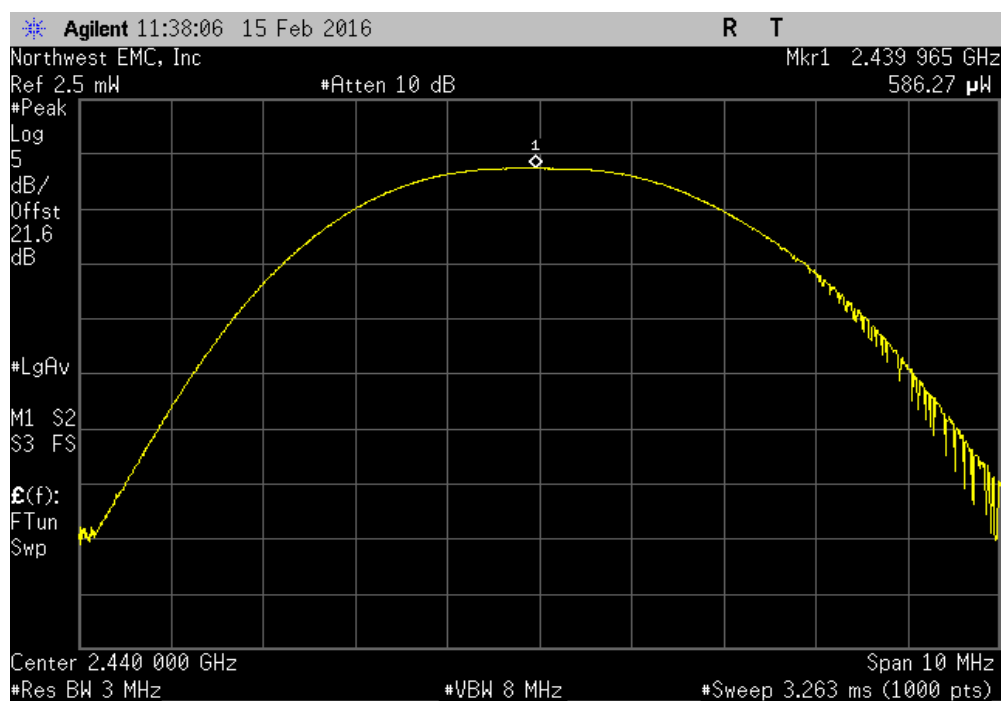
Normal Temperature Conditions, Zigbee GFSK, Low Channel, 2, 2402 MHz

	Value	Limit (<)	Result
	402.161 uW	1 W	Pass



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

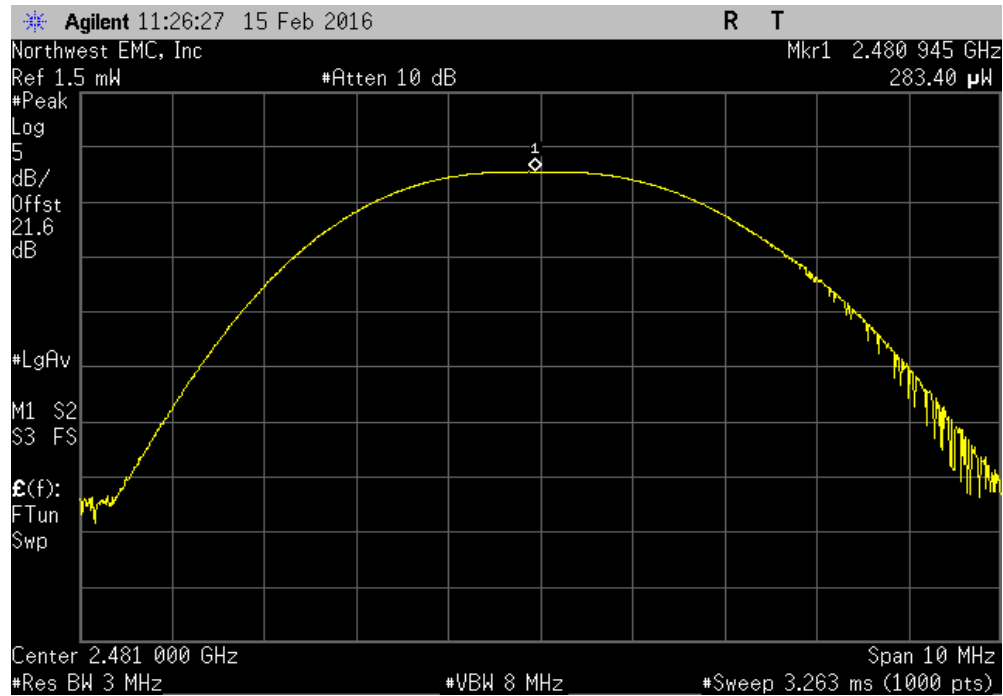
	Value	Limit (<)	Result
	586.273 uW	1 W	Pass





# OUTPUT POWER

Normal Temperature Conditions, Zigbee GFSK, High Channel, 81, 2481 MHz						
				Value	Limit	Result
				283.4 $\mu$ 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	Omegaette	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.

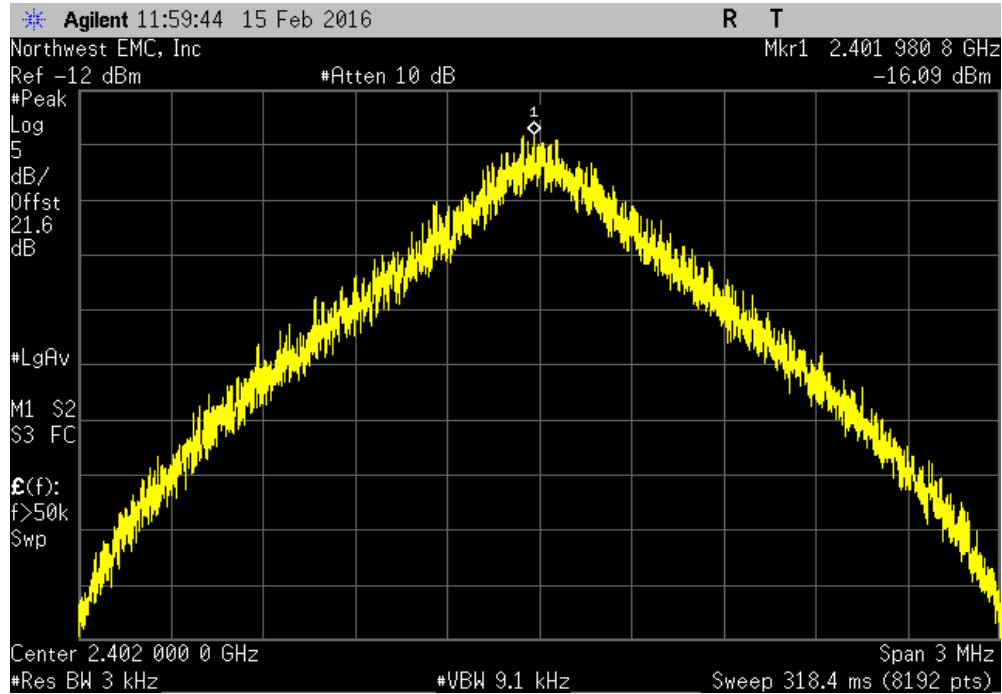
Per the procedure outlined in ANSI C63.10 the peak power spectral density was measured in a 3 kHz RBW.

# POWER SPECTRAL DENSITY

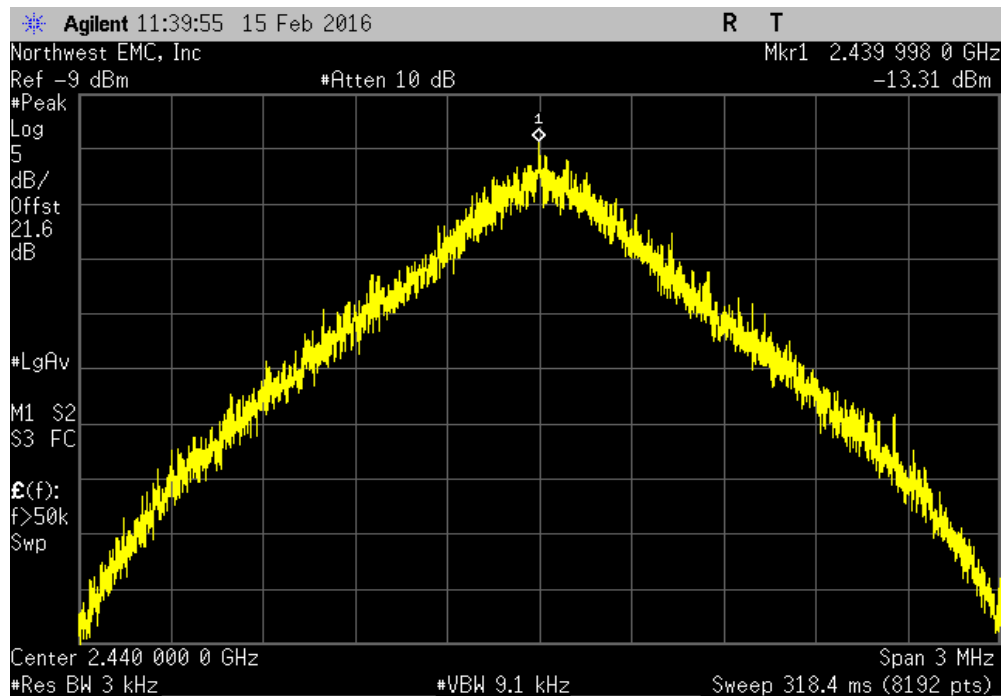
EUT: AP		Work Order: APDM0009	
Serial Number: SMTc1630754		Date: 02/15/16	
Customer: APDM, Inc.		Temperature: 22.6°C	
Attendees: Andrew Greenberg		Humidity: 47%	
Project: None		Barometric Pres.: 1022.6 mbr	
Tested by: Brandon Hobbs	Power: 5VDC	Job Site: EV01	
TEST SPECIFICATIONS		Test Method	
FCC 15.247:2016		ANSI C63.10:2013	
COMMENTS			
Continuous Broadcast modes were provided by the client.			
DEVIATIONS FROM TEST STANDARD			
Configuration #	2	Signature 	
		Value dBm/3kHz	Limit < dBm/3kHz
Normal Temperature Conditions			Results
Zigbee GFSK			
Low Channel, 2, 2402 MHz		-16.091	8 Pass
Mid Channel, 40, 2440 MHz		-13.312	8 Pass
High Channel, 81, 2481 MHz		-15.703	8 Pass

# POWER SPECTRAL DENSITY

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



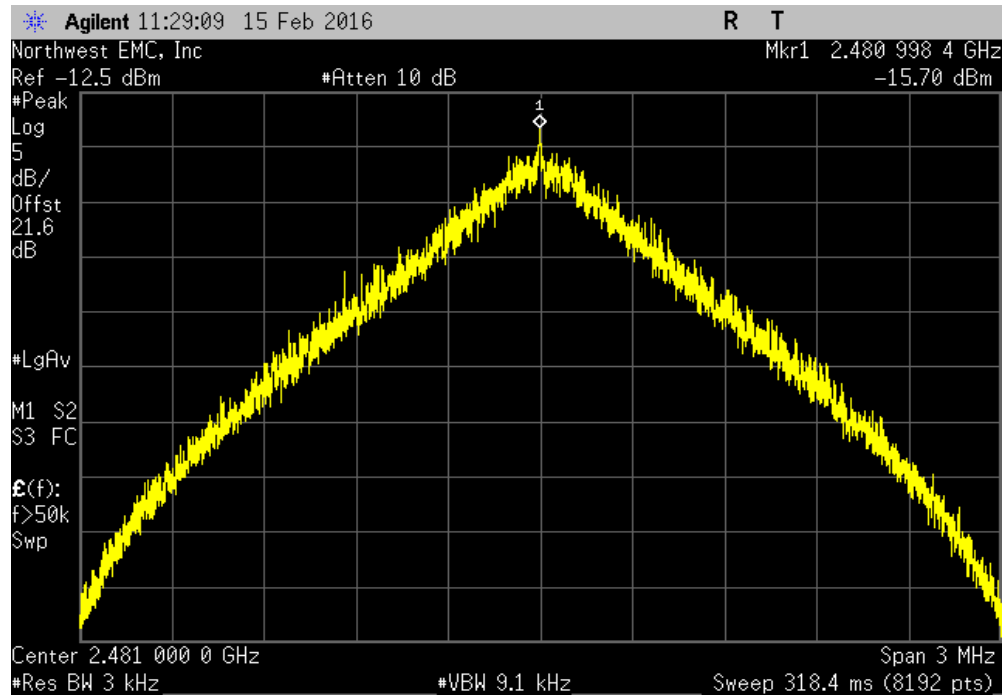
Normal Temperature Conditions, Zigbee GFSK, Mid Channel, 40, 2440 MHz						
	Value	Limit				
	dBm/3kHz	< dBm/3kHz	Results			
	-13.312	8	Pass			



# POWER SPECTRAL DENSITY

Normal Temperature Conditions, Zigbee GFSK, High Channel, 81, 2481 MHz

				Value	Limit	Results
				dBm/3kHz	< dBm/3kHz	
				-15.703	8	Pass



# 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

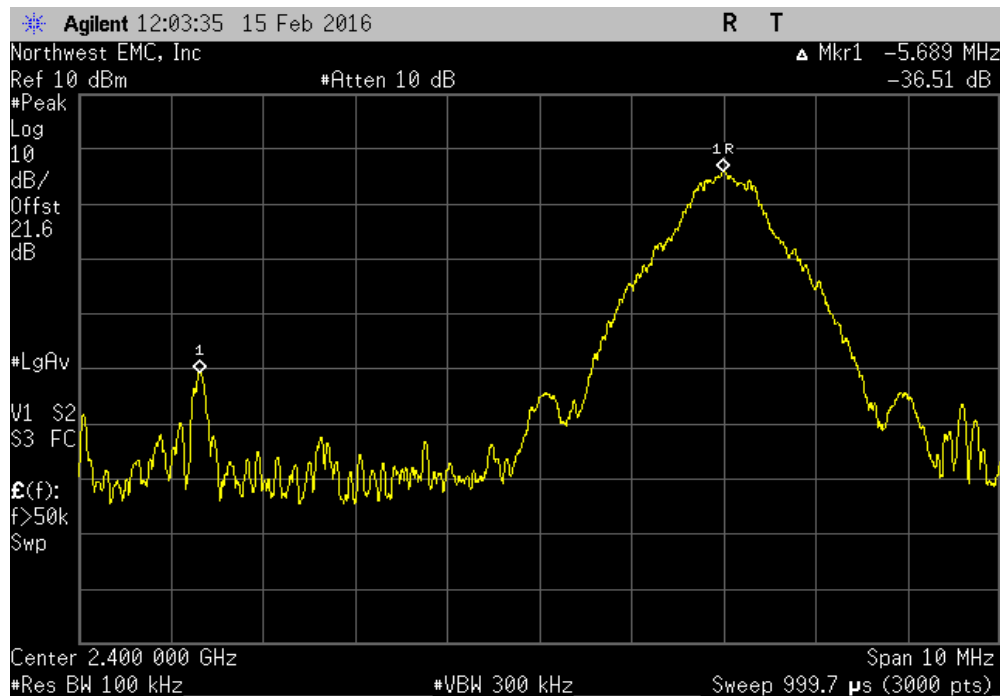
EUT: AP		Work Order: APDM0009	
Serial Number: SMTc1630754		Date: 02/15/16	
Customer: APDM, Inc.		Temperature: 22.6°C	
Attendees: Andrew Greenberg		Humidity: 47%	
Project: None		Barometric Pres.: 1022.6 mbr	
Tested by: Brandon Hobbs	Power: 5VDC	Job Site: EV01	
TEST SPECIFICATIONS		Test Method	
FCC 15.247:2016		ANSI C63.10:2013	
COMMENTS			
Continuous Broadcast modes were provided by the client.			
DEVIATIONS FROM TEST STANDARD			
Configuration #	2	Signature 	
		Value (dBc)	Limit ≤ (dBc) Result
Normal Temperature Conditions			
Zigbee GFSK			
Low Channel, 2, 2402 MHz		-36.51	-20 Pass
High Channel, 81, 2481 MHz		-31.09	-20 Pass



# BAND EDGE COMPLIANCE

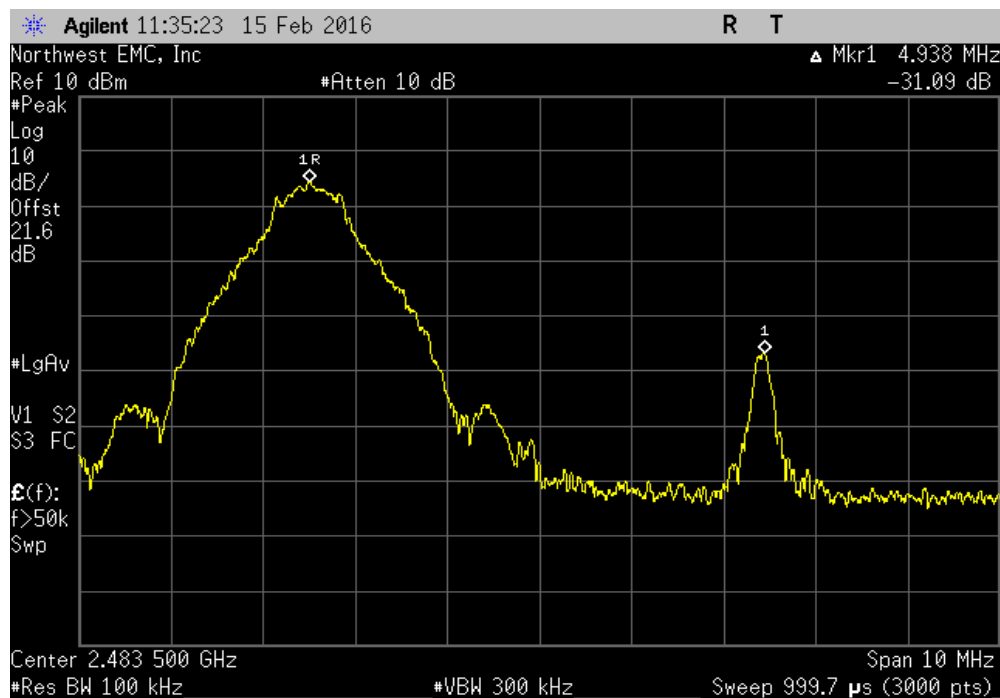
Normal Temperature Conditions, Zigbee GFSK, Low Channel, 2, 2402 MHz

	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	Omegatette	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

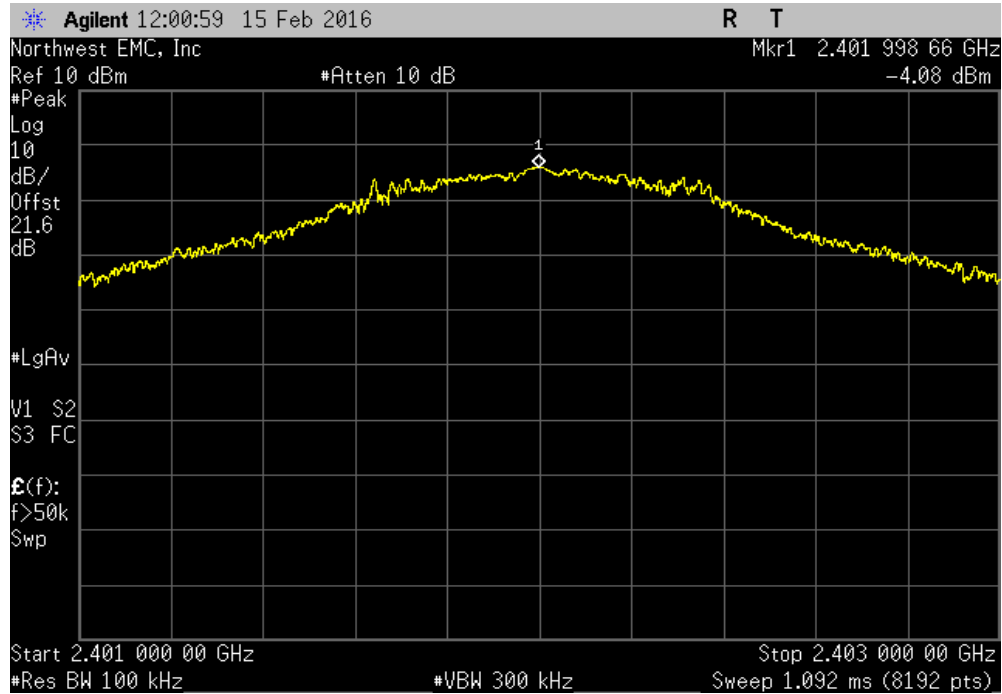
The spurious RF conducted emissions were measured with the EUT set to low, medium and high transmit frequencies. The measurements were made using a direct connection between the RF output of the EUT and the spectrum analyzer. The EUT was transmitting on the mode listed in the datasheet. For each transmit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

# SPURIOUS CONDUCTED EMISSIONS

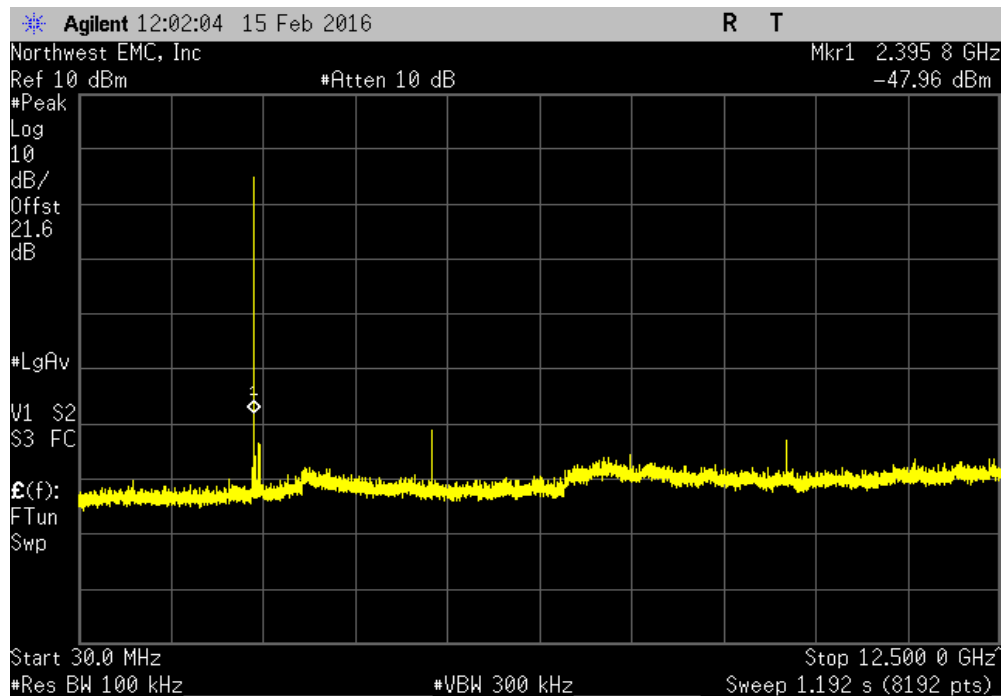
EUT: AP		Work Order: APDM0009	
Serial Number: SMTc1630754		Date: 02/15/16	
Customer: APDM, Inc.		Temperature: 22.5°C	
Attendees: Andrew Greenberg		Humidity: 47%	
Project: None		Barometric Pres.: 1022.6	
Tested by: Brandon Hobbs		Power: 5VDC	
Job Site: EV01			
TEST SPECIFICATIONS		Test Method	
FCC 15.247:2016		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
	Low Channel, 2, 2402 MHz	30 MHz - 12.5 GHz	-43.88 -20 Pass
	Low Channel, 2, 2402 MHz	12.5 GHz - 25 GHz	-45.68 -20 Pass
	Mid Channel, 40, 2440 MHz	Fundamental	N/A N/A N/A
	Mid Channel, 40, 2440 MHz	30 MHz - 12.5 GHz	-45.67 -20 Pass
	Mid Channel, 40, 2440 MHz	12.5 GHz - 25 GHz	-48.53 -20 Pass
	High Channel, 81, 2481 MHz	Fundamental	N/A N/A N/A
	High Channel, 81, 2481 MHz	30 MHz - 12.5 GHz	-40.56 -20 Pass
	High Channel, 81, 2481 MHz	12.5 GHz - 25 GHz	-44.79 -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	

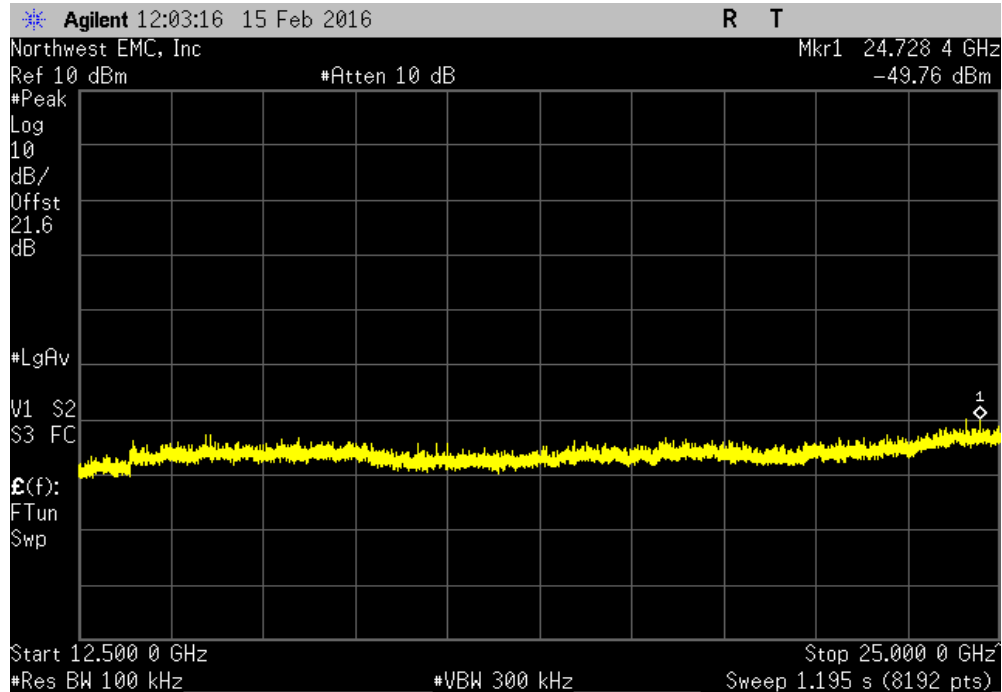


Normal Temperature Conditions, Zigbee GFSK, Low Channel, 2, 2402 MHz						
Frequency Range		Max Value (dBc)		Limit ≤ (dBc)	Result	
30 MHz - 12.5 GHz		-43.88		-20	Pass	

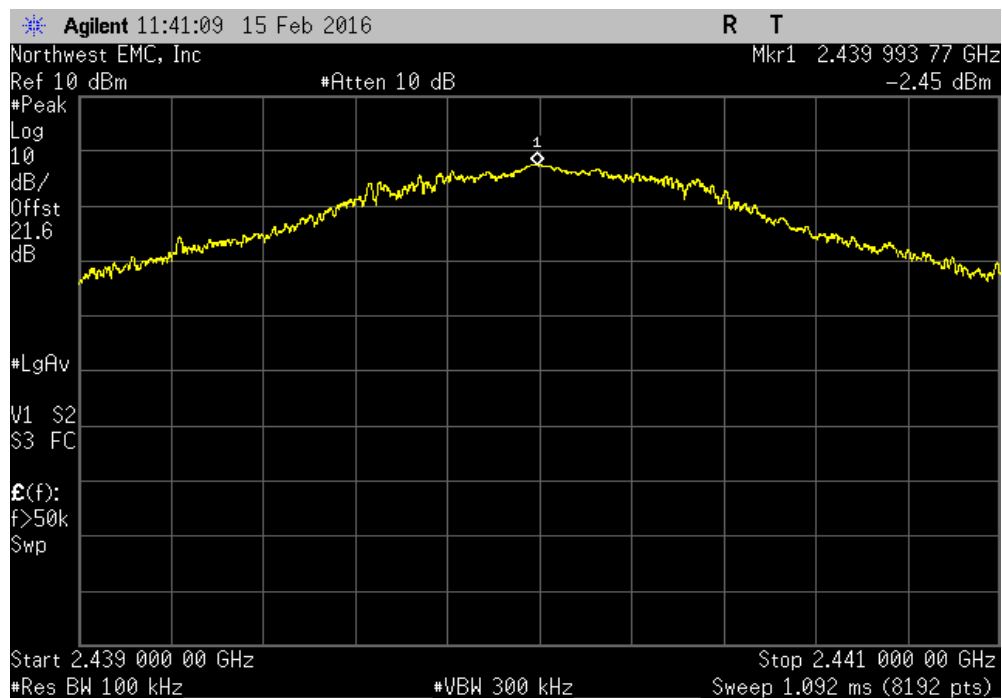


# SPURIOUS CONDUCTED EMISSIONS

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	

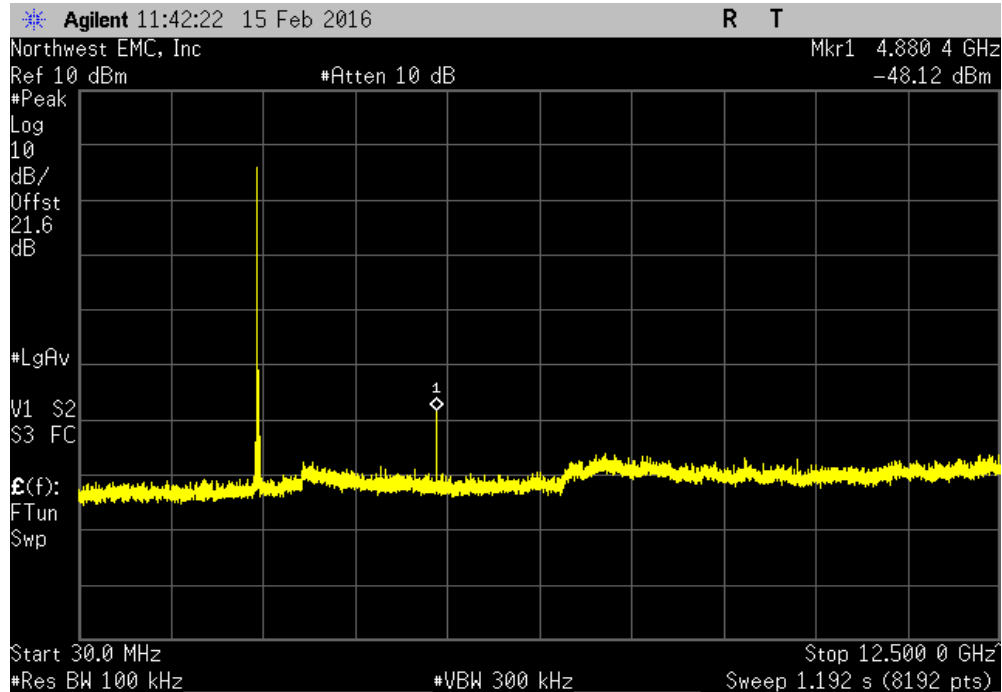


Normal Temperature Conditions, Zigbee GFSK, Mid Channel, 40, 2440 MHz				
Frequency Range	Max Value (dBc)	Limit ≤ (dBc)	Result	
Fundamental	N/A	N/A	N/A	

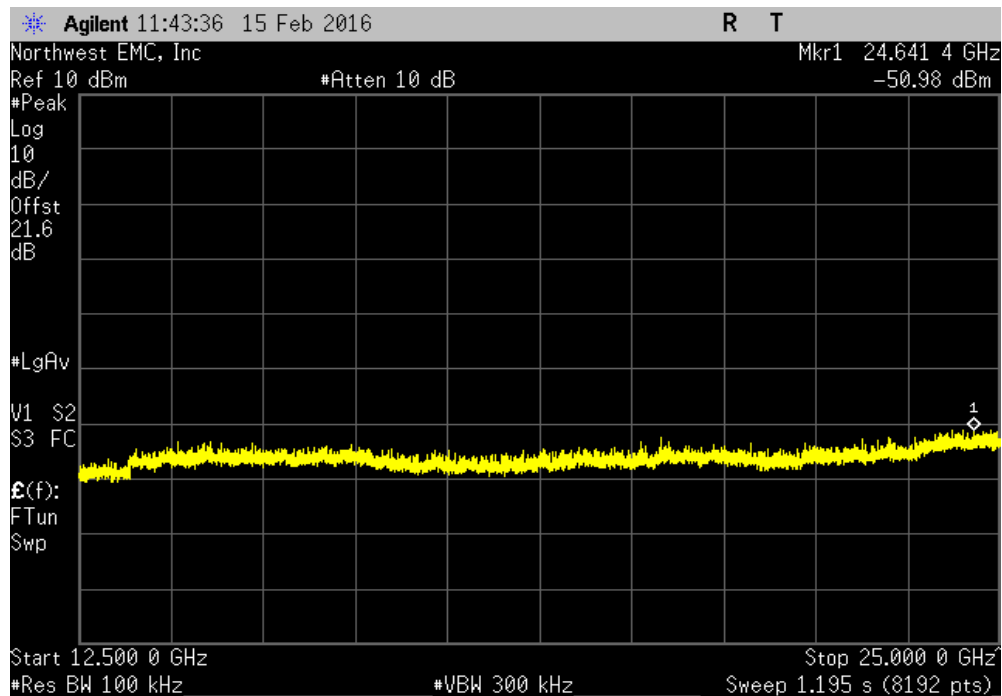


# SPURIOUS CONDUCTED EMISSIONS

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	

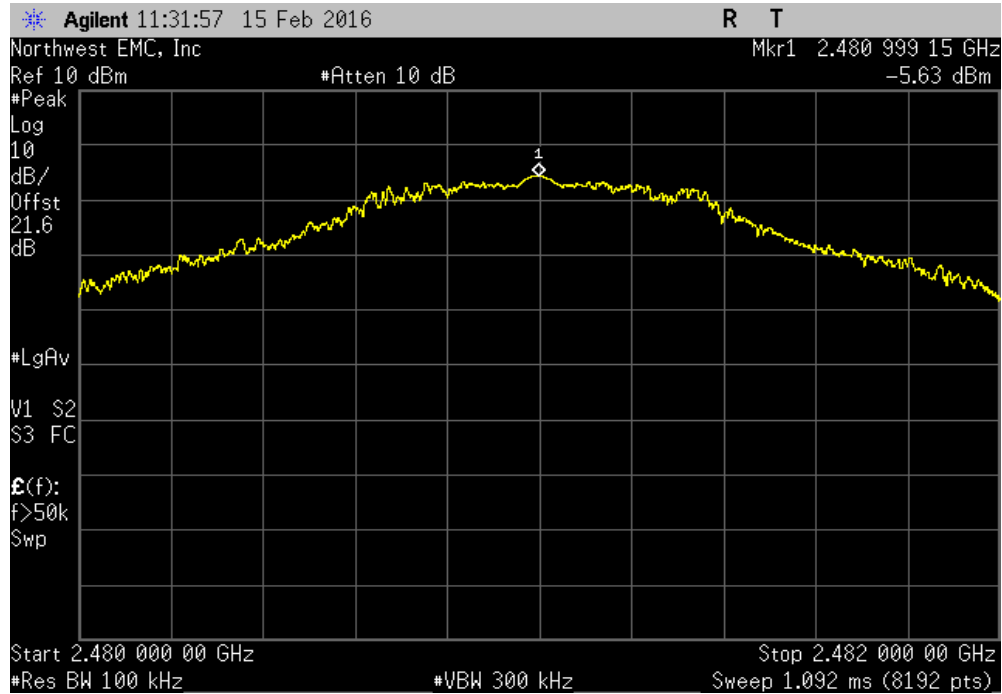


Normal Temperature Conditions, Zigbee GFSK, Mid Channel, 40, 2440 MHz				
Frequency Range	Max Value (dBc)	Limit ≤ (dBc)	Result	
12.5 GHz - 25 GHz	-48.53	-20	Pass	

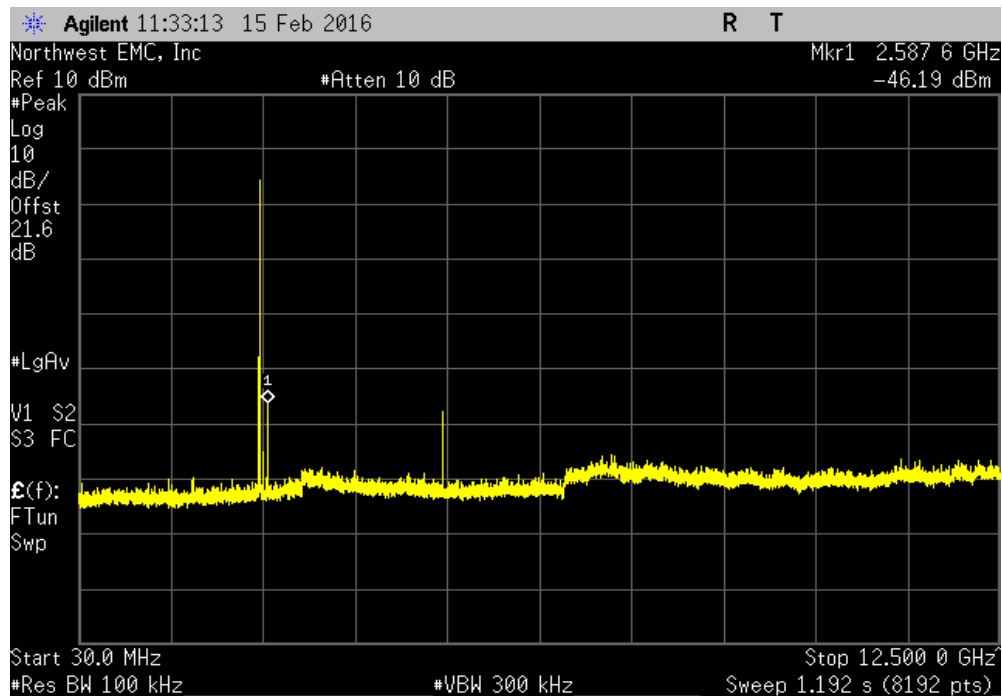


# SPURIOUS CONDUCTED EMISSIONS

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	



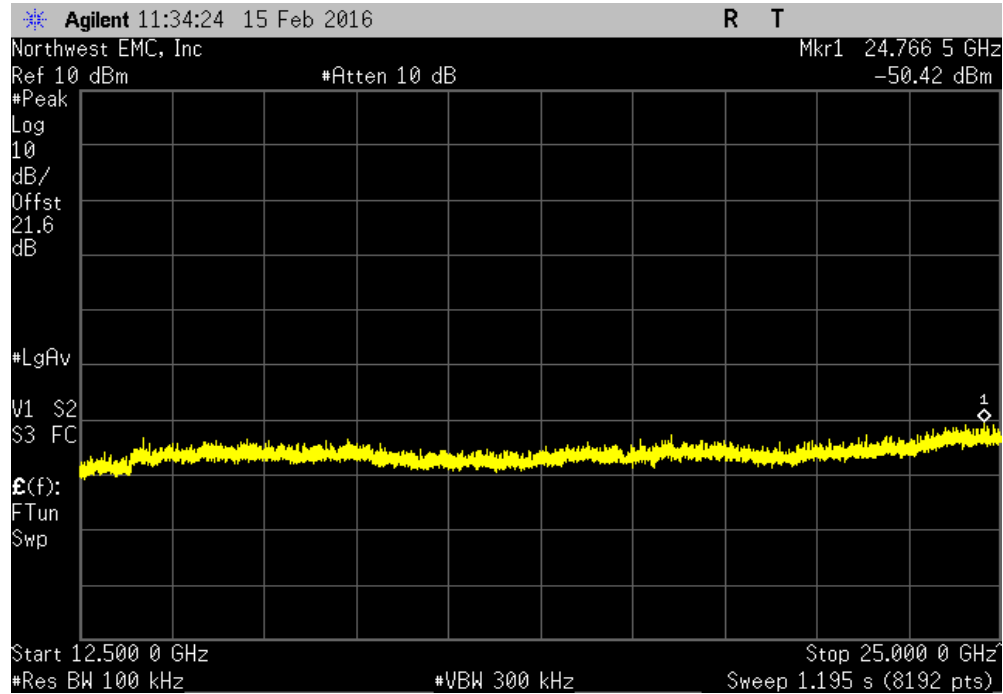
Normal Temperature Conditions, Zigbee GFSK, High Channel, 81, 2481 MHz						
Frequency Range		Max Value (dBc)		Limit ≤ (dBc)	Result	
30 MHz - 12.5 GHz		-40.56		-20	Pass	





# 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	AIV	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

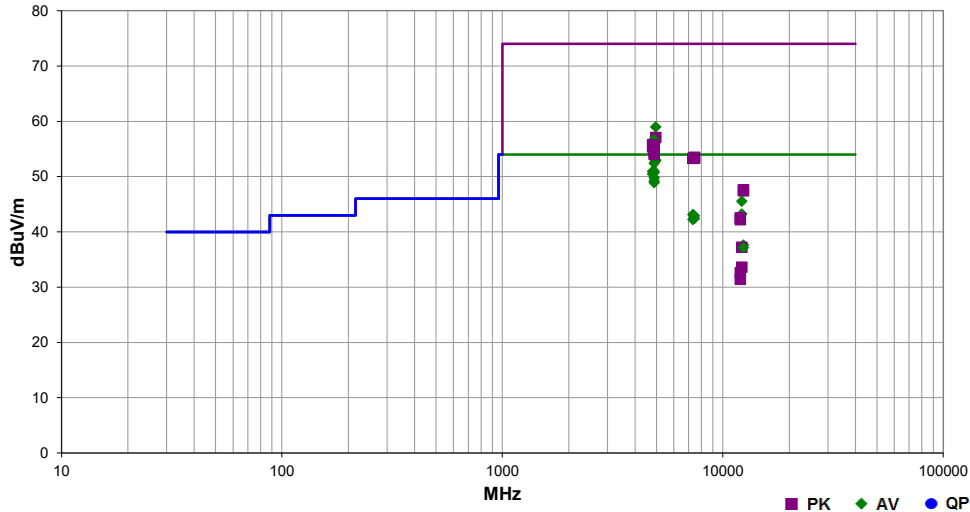
## TEST DESCRIPTION

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:	SMTCT630754	Barometric Pres.:	1030.2 mbar	
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	FCC 15.247:2016	Test Method	ANSI C63.10:2013
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Run #	12	Test Distance (m)	3	Antenna Height(s)	1 to 4(m)	Results	Pass
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Freq (MHz)	Amplitude (dBuV)	Factor (dB)	Antenna Height (meters)	Azimuth (degrees)	Test Distance (meters)	External Attenuation (dB)	Polarity/ Transducer Type	Detector	Distance Adjustment (dB)	Adjusted (dBuV/m)	Spec. Limit (dBuV/m)	Compared to Spec. (dB)	Comments
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



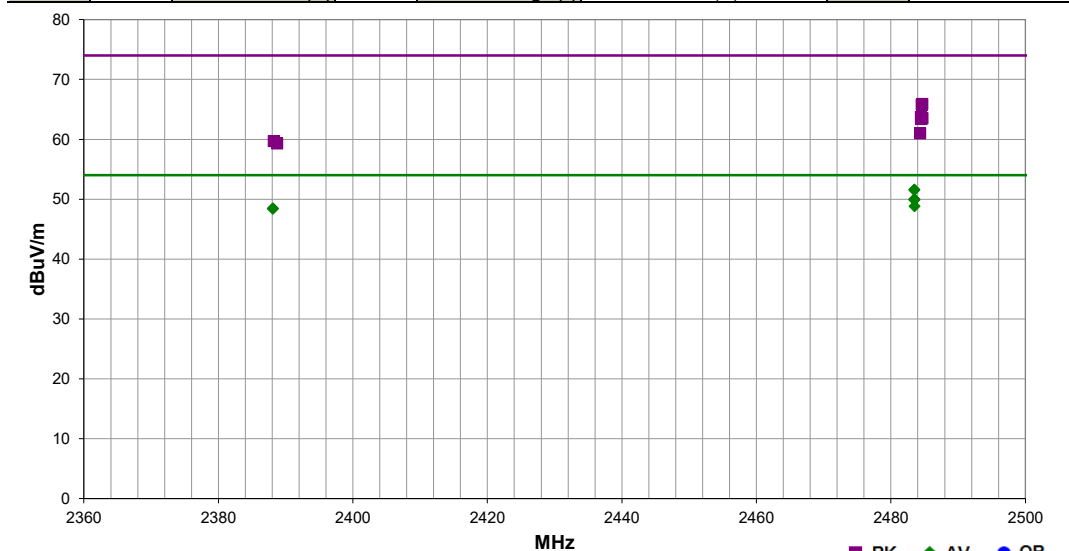
# SPURIOUS RADIATED EMISSIONS

PSA-ESCI 2015.07.01  
EmiR5 2015.11.06

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		
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

Run #	17	Test Distance (m)	3	Antenna Height(s)	1 to 4(m)	Results	Pass
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Freq (MHz)	Amplitude (dBuV)	Factor (dB)	Antenna Height (meters)	Azimuth (degrees)	Test Distance (meters)	External Attenuation (dB)	Polarity/ Transducer Type	Detector	Distance Adjustment (dB)	Adjusted (dBuV/m)	Spec. Limit (dBuV/m)	Compared to Spec. (dB)	Comments
2483.503	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 Alcock	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

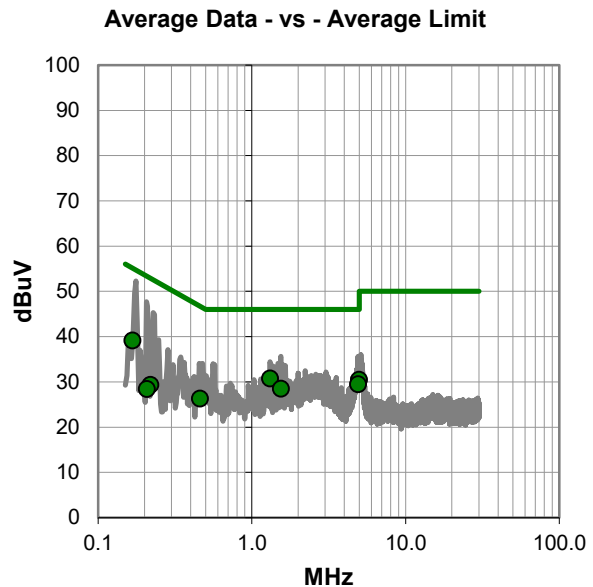
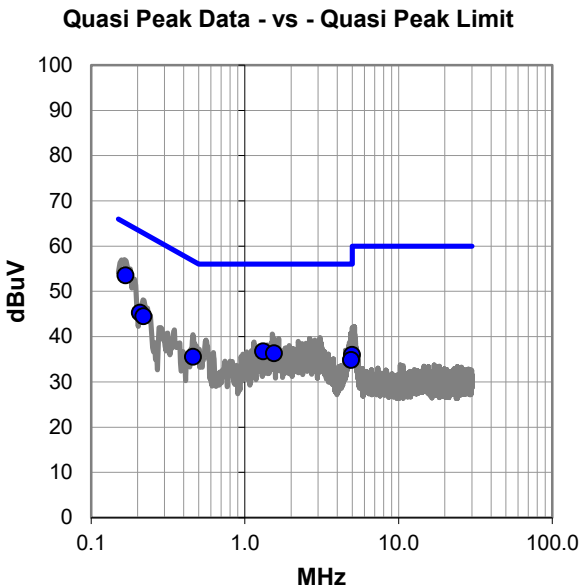
None

## 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 Alcock	Job Site:	EV07
Power:	5VDC	Configuration:	APDM0009-4

## TEST SPECIFICATIONS

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

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

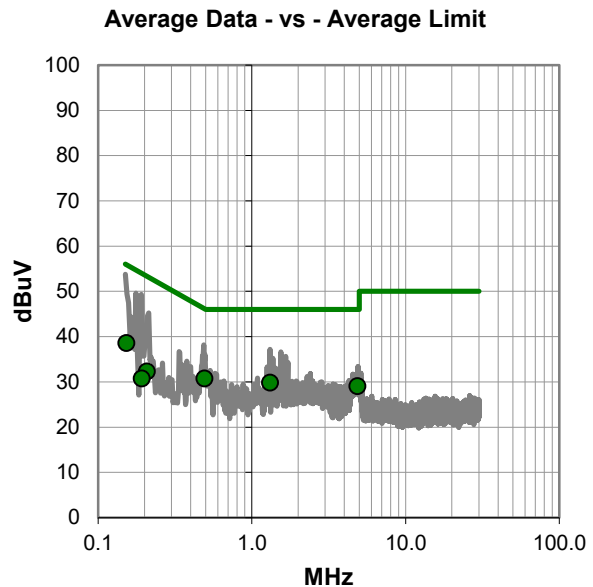
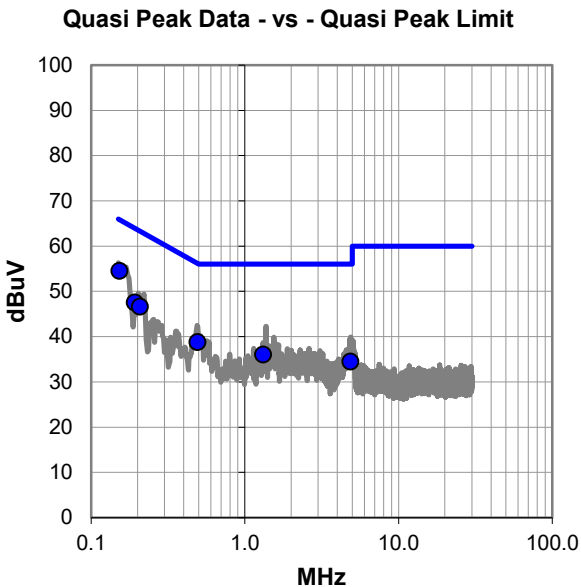
None

## 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 Alcock	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

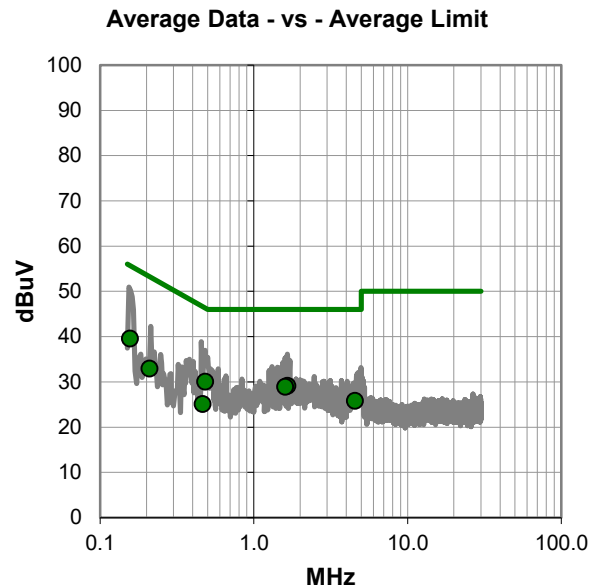
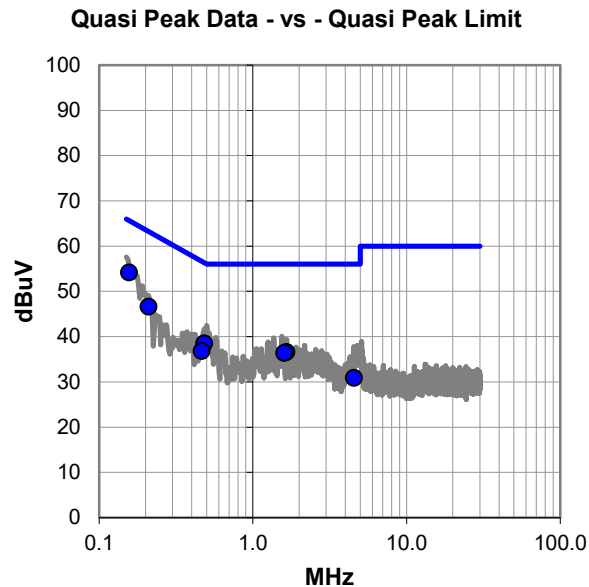
None

## 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 Alcock	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

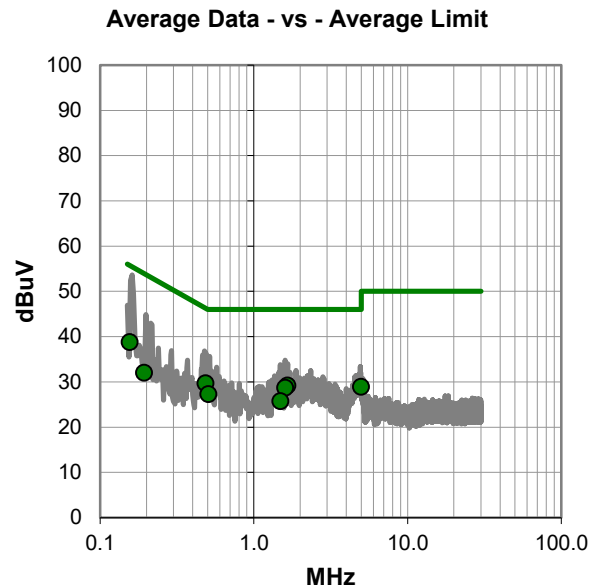
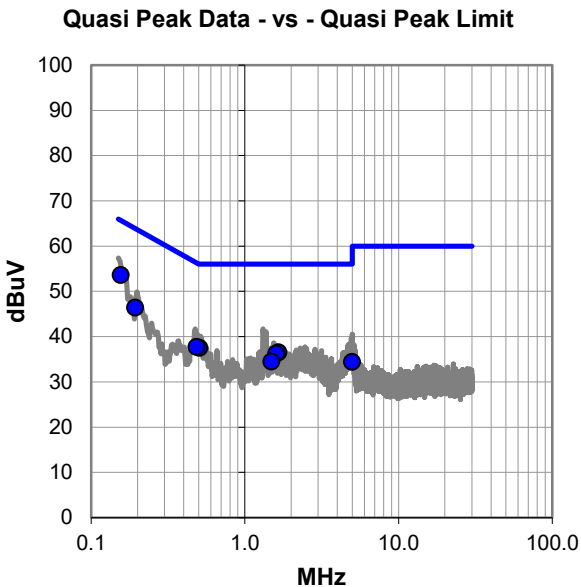
None

## 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 Alcock	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

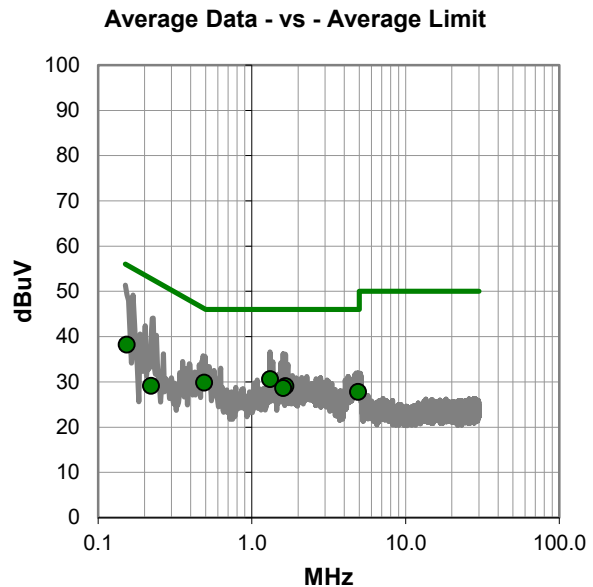
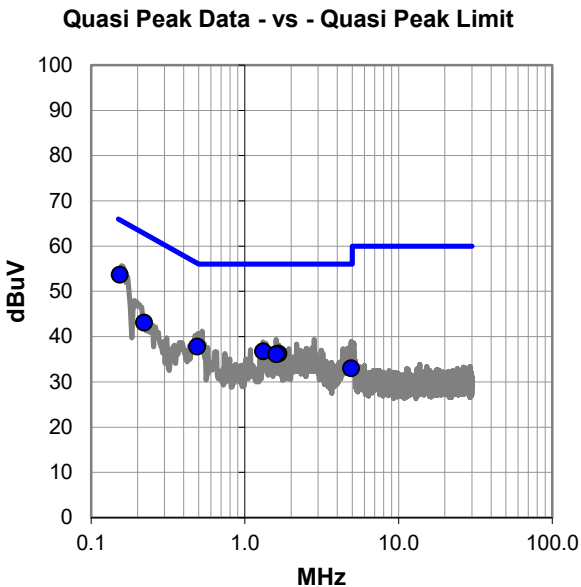
None

## 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 Alcock	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

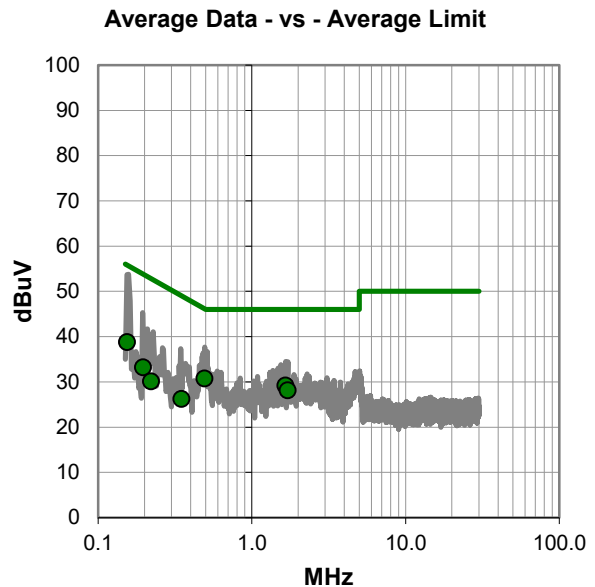
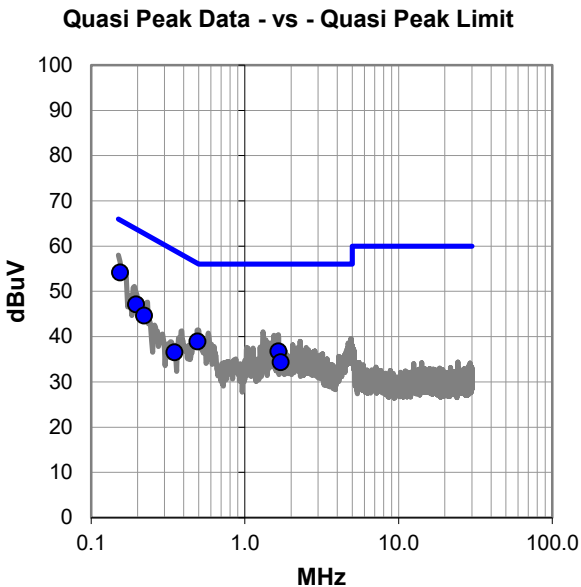
None

## 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