

Company: DOVEN LLC

Test of: DVD21-POE

To: FCC Part 15 Subpart F 15.517 - Indoor UWB Devices

Report No.: JANU02-U4 Rev A

TEST REPORT



COMBINED TEST REPORT



Test of: DOVEN LLC – DVD21-POE

To: FCC CFR 47 Part 15 Subpart F 15.517 – Indoor UWB Systems

Test Report Serial No.: JANU02-U4 Rev A

This report supersedes: NONE

Applicant: DOVEN LLC
2408 Timberloch PL Ste A6
The Woodlands TX 77380
USA

Product Function: Distance Measurement

Issue Date: 20th March 2019

This Test Report is Issued Under the Authority of:

MiCOM Labs, Inc.
575 Boulder Court
Pleasanton California 94566
USA
Phone: +1 (925) 462-0304
Fax: +1 (925) 462-0306
www.micomlabs.com



MiCOM Labs is an ISO 17025 Accredited Testing Laboratory

Table of Contents

1. ACCREDITATION, LISTINGS & RECOGNITION.....	4
1.1. Test Accreditation	4
1.2. Recognition	5
1.3. Product Certification	6
2. DOCUMENT HISTORY	7
3. TEST RESULT CERTIFICATE.....	8
4. REFERENCES AND MEASUREMENT UNCERTAINTY	9
4.1. Normative References	9
4.2. Test and Uncertainty Procedure	10
5. PRODUCT DETAILS AND TEST CONFIGURATIONS	11
5.1. Technical Details	11
5.2. Scope Of Test Program	12
5.3. Equipment Model(s) and Serial Number(s)	14
5.4. Antenna Details	14
5.5. Cabling and I/O Ports	14
5.6. Test Configurations.....	14
5.7. Equipment Modifications	14
5.8. Deviations from the Test Standard	14
6. TEST SUMMARY	15
7. TEST EQUIPMENT CONFIGURATION(S)	16
7.1. Radiated Emissions - 3m Chamber.....	16
8. MEASUREMENT AND PRESENTATION OF TEST DATA	19
9. TEST RESULTS	20
9.1. UWB Bandwidth.....	20
9.2. Peak Transmit Power	22
9.3. Peak Power Density	24
9.4. Radiated Spurious Emissions.....	26
9.4.1. <i>TX Spurious Band Emissions</i>	28
9.4.1.1. DVD21-POE	28
9.4.2. <i>GPS Band Emissions</i>	34
9.4.2.1. DVD21-POE	34
A. APPENDIX - GRAPHICAL IMAGES	36
A.1. UWB Bandwidth	37
A.2. Peak Power Density	38

1. ACCREDITATION, LISTINGS & RECOGNITION

1.1. Test Accreditation

MiCOM Labs, Inc. an accredited laboratory complies with the international standard EN ISO/IEC 17025. The company is accredited by the American Association for Laboratory Accreditation (A2LA) www.a2la.org test laboratory number 2381.01. MiCOM Labs test schedule is available at the following URL; <http://www.a2la.org/scopepdf/2381-01.pdf>



This test report may be reproduced in full only. The document may only be updated by MiCOM Labs personnel. All changes will be noted in the Document History section of the report.

1.2. Recognition

MiCOM Labs, Inc has widely recognized Electrical testing capabilities. Our international recognition includes Conformity Assessment Body designation by APEC MRA** countries. Our test reports are widely accepted for global type approvals.

Country	Recognition Body	Status	Phase	Identification No.
model	Federal Communications Commission (FCC)	TCB	-	US0159 Listing #: 102167
Canada	Industry Canada (IC)	FCB	APEC MRA 2	US0159 Listing #: 4143A-2 4143A-3
Japan	MIC (Ministry of Internal Affairs and Communication)	CAB	APEC MRA 2	RCB 210
	VCCI	--	--	A-0012
Europe	European Commission	NB	EU MRA	NB 2280
Australia	Australian Communications and Media Authority (ACMA)	CAB	APEC MRA 1	US0159
Hong Kong	Office of the Telecommunication Authority (OFTA)	CAB	APEC MRA 1	
Korea	Ministry of Information and Communication Radio Research Laboratory (RRL)	CAB	APEC MRA 1	
Singapore	Infocomm Development Authority (IDA)	CAB	APEC MRA 1	
Taiwan	National Communications Commission (NCC) Bureau of Standards, Metrology and Inspection (BSMI)	CAB	APEC MRA 1	
Vietnam	Ministry of Communication (MIC)	CAB	APEC MRA 1	

**APEC MRA – Asia Pacific Economic Community Mutual Recognition Agreement.

Is a recognition agreement under which test lab is accredited to regulatory standards of the APEC member countries

Phase I - recognition for product testing

Phase II – recognition for both product testing and certification

N/A – Not Applicable

**EU MRA – European Union Mutual Recognition Agreement.

Is a recognition agreement under which test lab is accredited to regulatory standards of the EU member countries

**NB – Notified Body

1.3. Product Certification

MiCOM Labs, Inc. is an accredited Product Certification Body per the international standard ISO/IEC 17065. The company is accredited by the American Association for Laboratory Accreditation (A2LA) www.a2la.org test laboratory number 2381.02. MiCOM Labs test schedule is available at the following URL; <http://www.a2la.org/scopepdf/2381-02.pdf>



United States of America – Telecommunication Certification Body (TCB)

TCB Identifier – US0159

Industry Canada – Certification Body

CAB Identifier – US0159

Europe – Notified Body

Notified Body Identifier - 2280

Japan – Recognized Certification Body (RCB)

RCB Identifier – 210

This test report may be reproduced in full only. The document may only be updated by MiCOM Labs personnel. All changes will be noted in the Document History section of the report.

2. DOCUMENT HISTORY

Document History		
Revision	Date	Comments
Draft	21 st January 2019	Draft for client review
Rev A	20 th March 2019	Initial Release

In the above table the latest report revision will replace all earlier versions.

3. TEST RESULT CERTIFICATE

Manufacturer: DOVEN LLC
2408 Timberloch PL Ste A6
The Woodlands TX 77380
USA

Tested By: MiCOM Labs, Inc.
575 Boulder Court
Pleasanton California 94566
USA

Model(s): DVD21-POE

Telephone: +1 925 462 0304
Fax: +1 925 462 0306

Equipment Type: Distance Measurement

S/N's: 19010901

Test Date(s): 9th – 14th January 2019

Website: www.micomlabs.com

STANDARD(S)

FCC CFR 47 Part 15 Subpart F
15.517

TEST RESULTS

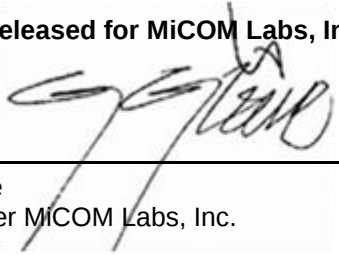
EQUIPMENT COMPLIES

MiCOM Labs, Inc. tested the equipment mentioned in accordance with the requirements set forth in the above standards. Test results indicate that the equipment tested is capable of demonstrating compliance with the requirements as documented within this report.

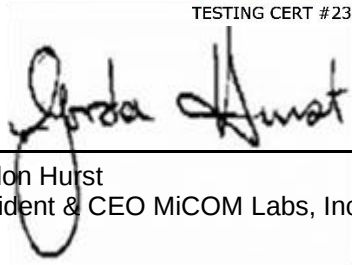
Notes:

1. This document reports conditions under which testing was conducted and the results of testing performed.
2. Details of test methods used have been recorded and kept on file by the laboratory.
3. Test results apply only to the item(s) tested.

Approved & Released for MiCOM Labs, Inc. by:



Graeme Grieve
Quality Manager MiCOM Labs, Inc.



Gordon Hurst
President & CEO MiCOM Labs, Inc.



This test report may be reproduced in full only. The document may only be updated by MiCOM Labs personnel. All changes will be noted in the Document History section of the report.

4. REFERENCES AND MEASUREMENT UNCERTAINTY

4.1. Normative References

REF.	PUBLICATION	YEAR	TITLE
I	FCC 47 CFR Part F	2018	Radio Frequency Devices; Subpart F – Ultra Wide Band Devices
II	A2LA	August 2017	R105 - Requirement's When Making Reference to A2LA Accreditation Status
III	ANSI C63.10	2013	American National Standard for Testing Unlicensed Wireless Devices
IV	ANSI C63.4	2014	American National Standards for Methods of Measurement of Radio-Noise Emissions from Low-Voltage Electrical and Electronic Equipment in the Range of 9 kHz to 40 GHz
V	ETSI TR 100 028	2001-12	Parts 1 and 2 Electromagnetic compatibility and Radio Spectrum Matters (ERM); Uncertainties in the measurement of mobile radio equipment characteristics
VI	M 3003	Edition 3 Nov.2012	Expression of Uncertainty and Confidence in Measurements
VII	FCC 47 CFR Part 2.1033	2016	FCC requirements and rules regarding photographs and test setup diagrams.
VIII	KDB 393764 D01 UWB FAQ v02	January 29, 2018	Ultra-Wideband (UWB) Devices frequently asked questions

4.2. Test and Uncertainty Procedure

Conducted and radiated emission measurements were conducted in accordance with American National Standards Institute ANSI C63.4, listed in the Normative References section of this report.

Measurement uncertainty figures are calculated in accordance with ETSI TR 100 028 Parts 1 and 2.

Measurement uncertainties stated are based on a standard uncertainty multiplied by a coverage factor $k = 2$, providing a level of confidence of approximately 95 % in accordance with UKAS document M 3003 listed in the Normative References section of this report.

5. PRODUCT DETAILS AND TEST CONFIGURATIONS

5.1. Technical Details

Details	Description
Purpose:	Test of the DOVEN DVD21-POE to FCC CFR 47 Part 15 Subpart F 15.517
Applicant:	DOVEN LLC 2408 Timberloch PL Ste A6 The Woodlands TX 77380 USA
Manufacturer:	As applicant
Laboratory performing the tests:	MiCOM Labs, Inc. 575 Boulder Court Pleasanton California 94566 USA
Test report reference number:	JANU01-U2
Date EUT received:	29 th January 2018
Standard(s) applied:	FCC CFR 47 Part 15 Subpart F 15.517
Dates of test (from - to):	9 th – 14 th January 2019
No of Units Tested:	4
Product Family Name:	DOVEN
Model(s):	DVD21-POE
Location for use:	No fixed location Primarily hand held
Declared Frequency Range(s):	3100-10600 MHz
Type of Modulation:	BPM/BPSK
EUT Modes of Operation:	500 MHz Bandwidth
Declared Nominal Output Power (dBm):	-41 dBm
Transmit/Receive Operation:	Transceiver
Rated Input Voltage and Current:	8-50 V _{DC} , 10W (POE Powered)
Operating Temperature Range:	-20 ~ +75°C
ITU Emission Designator:	500MX0D
Equipment Dimensions:	14 x 14 x 2 in
Weight:	DVD21-POE: 4 LB
Hardware Rev:	2.0.1
Software Rev:	2.0.5

This test report may be reproduced in full only. The document may only be updated by MiCOM Labs personnel. All changes will be noted in the Document History section of the report.

5.2. Scope Of Test Program

The scope of the test program was to test the Janus Automation DOVEN DVD21-POE configuration in the frequency ranges 3100 - 10600 MHz for compliance against the following specification:

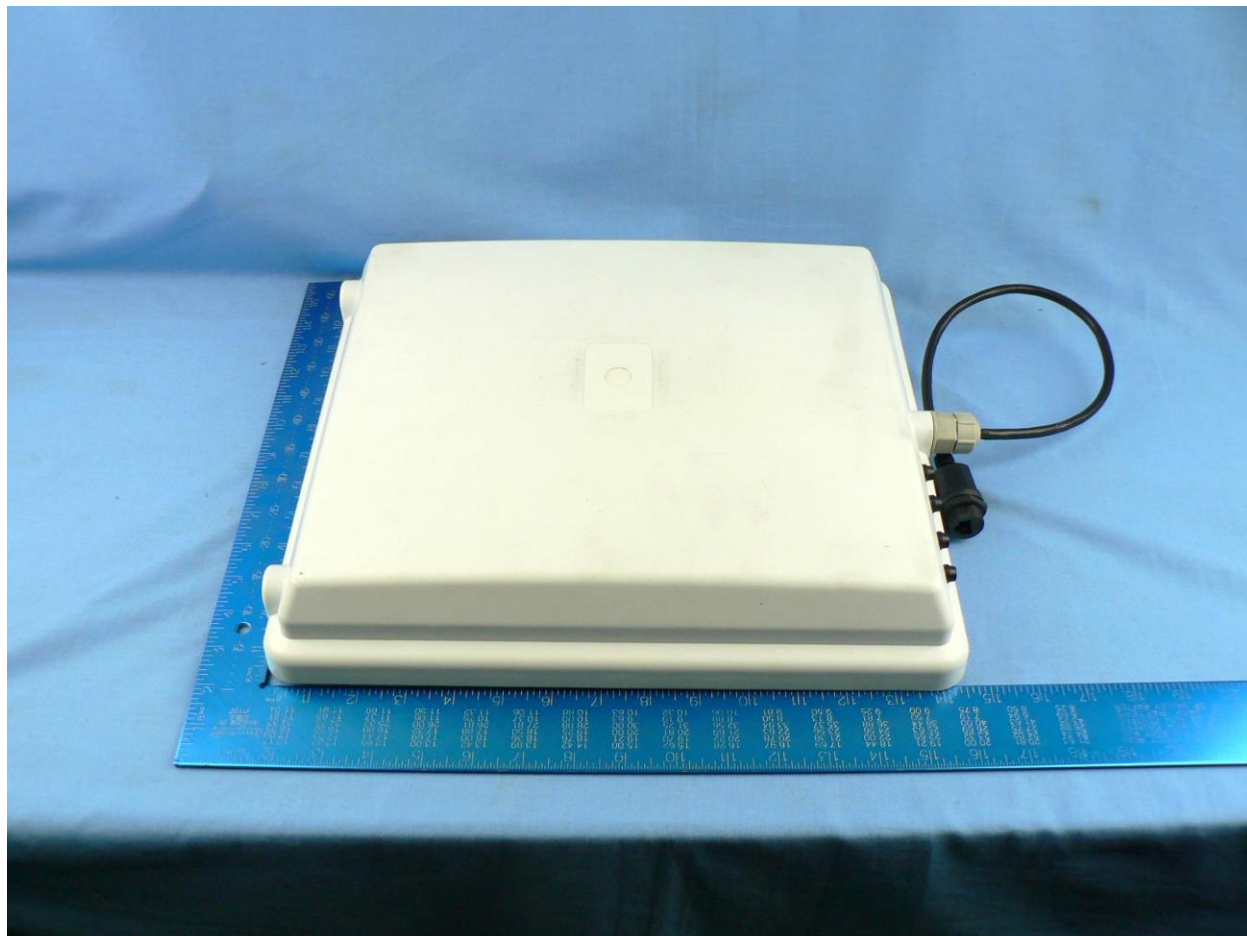
FCC CFR 47 Part 15 Subpart F – 15.517

Technical requirements for hand held UWB systems

.

DVD21-POE

Front View





5.3. Equipment Model(s) and Serial Number(s)

Type (EUT/Support)	Equipment Description (Including Brand Name)	Mfr.	Model No.	Serial No.
EUT	POE Unit with integrated directional antenna	DOVEN LLC	DVD21-POE	19010901

5.4. Antenna Details

Type	Manufacturer	Model	Family	Gain (dBi)	BF Gain	Dir BW	X-Pol	Frequency Band (MHz)
Integral	DOVEN LLC	DVD21-POE	Wide	9.28	--	--	No	3250 - 4250

BF Gain - Beamforming Gain
Dir BW - Directional BeamWidth
X-Pol - Cross Polarization

5.5. Cabling and I/O Ports

None

5.6. Test Configurations

Results for the following configurations are provided in this report:

Channel Bandwidth(s)	Transmission Rate	Channel Frequency (MHz)		
		Low	Mid	High
500MHz	6.8 Mbit/s	Single Frequency 3500.00		

5.7. Equipment Modifications

The following modifications were required to bring the equipment into compliance:

1. NONE

5.8. Deviations from the Test Standard

The following deviations from the test standard were required in order to complete the test program:

1. NONE



6. TEST SUMMARY

List of Measurements

Test Header	Result	Data Link
Radiated Test Methodology		
UWB Bandwidth	Complies	View Data
Radiated Power	Complies	View Data
Peak Power Density	Complies	View Data
Spurious Radiated Emissions 30 MHz - 1000 MHz	Complies	View Data
Spurious Radiated Emissions 1000 MHz - 18000 MHz	Complies	View Data
Spurious Radiated Emissions in GPS Bands	Complies	View Data
Comments: None		

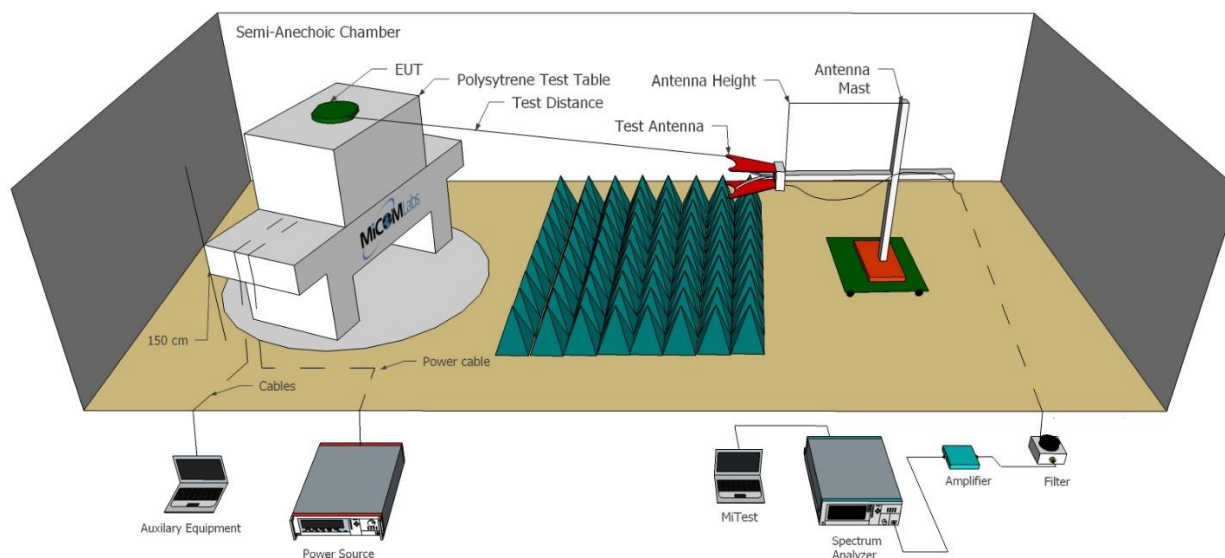
This test report may be reproduced in full only. The document may only be updated by MiCOM Labs personnel. All changes will be noted in the Document History section of the report.

7. TEST EQUIPMENT CONFIGURATION(S)

7.1. Radiated Emissions - 3m Chamber

The following tests were performed using the radiated test set-up shown in the diagram below. Radiated emissions above 1GHz.

Radiated Emissions Above 1GHz Test Setup



This test report may be reproduced in full only. The document may only be updated by MiCOM Labs personnel. All changes will be noted in the Document History section of the report.



A full system calibration was performed on the test station and any resulting system losses (or gains) were taken into account in the production of all final measurement data.

Asset#	Description	Manufacturer	Model#	Serial#	Calibration Due Date
170	Video System Controller for Semi Anechoic Chamber	Panasonic	WV-CU101	04R08507	Not Required
298	3M Radiated Emissions Chamber Maintenance Check	MiCOM	3M Chamber	298	21 Jan 2019
338	Sunol 30 to 3000 MHz Antenna	Sunol	JB3	A052907	4 Apr 2019
373	26III RMS Multimeter	Fluke	Fluke 26 series III	76080720	21 Sep 2019
377	Band Rejection Filter 5150 to 5880MHz	Microtronics	BRM50716	034	9 Oct 2019
378	Rohde & Schwarz 40 GHz Receiver with Generator	Rhode & Schwarz	ESIB40	100107/040	12 Oct 2019
397	Amp 10 - 2500MHz	MiCOM Labs	Amp 10 - 2500 MHz	NA	12 Feb 2019
399	ETS 1-18 GHz Horn Antenna	ETS	3117	00154575	12 Oct 2019
406	Amplifier for Radiated Emissions	MiCOM Labs	40dB 1 to 18GHz Amp	0406	12 Feb 2019
410	Desktop Computer	Dell	Inspiron 620	WS38	Not Required
411	Mast/Turntable Controller	Sunol Sciences	SC98V	060199-1D	Not Required
412	USB to GPIB Interface	National Instruments	GPIB-USB HS	11B8DC2	Not Required
413	Mast Controller	Sunol Science	TWR95-4	030801-3	Not Required
414	DC Power Supply 0-60V	HP	6274	1029A01285	Cal when used
415	Turntable Controller	Sunol Sciences	Turntable Controller	None	Not Required
447	MiTest Rad Emissions Test Software	MiCOM	Rad Emissions Test Software Version 1.0	447	Not Required
462	Schwarzbeck cable from Antenna to Amplifier.	Schwarzbeck	AK 9513	462	9 Oct 2019
463	Schwarzbeck cable from Amplifier to Bulkhead.	Schwarzbeck	AK 9513	463	9 Oct 2019
464	Schwarzbeck cable from Bulkhead to Receiver	Schwarzbeck	AK 9513	464	9 Oct 2019
465	Low Pass Filter DC-1000 MHz	Mini-Circuits	NLP-1200+	VUU01901402	9 Oct 2019
466	Low Pass Filter DC-1500 MHz	Mini-Circuits	NLP-1750+	VUU10401438	9 Oct 2019

This test report may be reproduced in full only. The document may only be updated by MiCOM Labs personnel. All changes will be noted in the Document History section of the report.



Title: DOVEN DVD21-POE

To: FCC Part 15.517

Serial #: JANU02-U4 Rev A

Issue Date: 20th March 2019

Page: 18 of 39

470	High Pass filter	Mini Circuits	SHP-700	None	9 Oct 2019
480	Cable - Bulkhead to Amp	SRC Haverhill	157-3050360	480	24 Aug 2019
481	Cable - Bulkhead to Receiver	SRC Haverhill	151-3050787	481	24 Aug 2019
510	Barometer/Thermometer	Control Company	68000-49	170871375	11 Dec 2019
518	Cable - Amp to Antenna	SRC Haverhill	157-3051574	518	24 Aug 2019
CC05	Confidence Check	MiCOM	CC05	None	21 Jan 2019

This test report may be reproduced in full only. The document may only be updated by MiCOM Labs personnel. All changes will be noted in the Document History section of the report.

8. MEASUREMENT AND PRESENTATION OF TEST DATA

The measurement and graphical data presented in this test report was generated automatically using state-of-the-art technology creating an easy to read report structure. Numerical measurement data is separated from supporting graphical data (plots) through hyperlinks. Numerical measurement data can be reviewed without scrolling through numerous graphical pages to arrive at the next data matrix.

Plots have been relegated into the Appendix 'Graphical Data'.

Test and report automation was performed by [MiTest](#). [MiTest](#) is an automated test system developed by MiCOM Labs. [MiTest](#) is the first cloud based modular test system enabling end-to-end automation of regulatory compliance testing for conducted RF testing.



The MiCOM Labs "[MiTest](#)" Automated Test System" (Patent Pending)

This test report may be reproduced in full only. The document may only be updated by MiCOM Labs personnel. All changes will be noted in the Document History section of the report.



9. TEST RESULTS

9.1. UWB Bandwidth

Conducted Test Conditions for 26 dB and 99% Bandwidth			
Standard:	FCC CFR 47:15.517	Ambient Temp. (°C):	24.0 - 27.5
Test Heading:	UWB Bandwidth	Rel. Humidity (%):	32 - 45
Standard Section(s):	ANSI C63.10 Section 10.1	Pressure (mBars):	999 - 1001
Reference Document(s):	See Normative References		
Test Procedure for UWB Bandwidth Measurement The UWB Bandwidth is measured radiated, at a 3-meter distance, while EUT is operating in transmission mode at the appropriate center frequency. The Resolution Bandwidth was set to 1MHz RBW IAW ANSI C63.10. Testing was performed under ambient conditions at nominal voltage. Test configuration and setup used for the measurement was per the Radiated Test Set-up section specified in this document.			



Title: DOVEN DVD21-POE
To: FCC Part 15.517
Serial #: JANU02-U4 Rev A
Issue Date: 20th March 2019
Page: 21 of 39

Equipment Configuration for UWB Bandwidth

Variant:	500 MHz Bandwidth	Duty Cycle (%):	100
Data Rate:	-	Antenna Gain (dBi):	9.28
Modulation:	BPM/BPSK	Beam Forming Gain (Y)(dB):	Not Applicable
TPC:	Not Applicable	Tested By:	JMH
Engineering Test Notes:			

DVD21-POE

Test Frequency MHz	Measured 10 dB Bandwidth (MHz) Port A	10 dB Bandwidth (MHz)			
		Highest	Lowest		
3500.00	501.97	501.97	501.97		

Traceability to Industry Recognized Test Methodologies

Work Instruction:	WI-03 MEASURING RF SPECTRUM MASK
Measurement Uncertainty:	±2.81 dB

Note: click the links in the above matrix to view the graphical image (plot).

The above values are representative of the worst case value between polarities and based on the power measurements.

This test report may be reproduced in full only. The document may only be updated by MiCOM Labs personnel. All changes will be noted in the Document History section of the report.



9.2. Peak Transmit Power

Conducted Test Conditions for Maximum Radiated Output Power			
Standard:	FCC CFR 47:15.517 (c)	Ambient Temp. (°C):	24.0 - 27.5
Test Heading:	Radiated Emissions UWB Transmission	Rel. Humidity (%):	32 - 45
Standard Section(s):	ANSI C63.10 Section 10.3.5	Pressure (mBars):	999 - 1001
Reference Document(s):	None		
Test Procedure for UWB Transmission Testing was performed under ambient conditions at nominal voltage. Test configuration and setup used for the measurement was per the Radiated Test Set-up section specified in this document. Supporting KDB's referenced below. Operating Frequency Band: 3100-10600 MHz Limits Maximum EIRP (dBm)			
Frequency (MHz)	EIRP Limit (dBm)	EIRP at 3 Meters (dBuv/m)	
3100 - 10600	-41.3	53.9	



Title: DOVEN DVD21-POE
To: FCC Part 15.517
Serial #: JANU02-U4 Rev A
Issue Date: 20th March 2019
Page: 23 of 39

Equipment Configuration for RF Output Power

Variant:	500 MHz Bandwidth	Duty Cycle (%):	99
Data Rate:	-	Antenna Gain (dBi):	9.28
Modulation:	BPM/BPSK	Beam Forming Gain (Y)(dB):	Not Applicable
TPC:	Not Applicable	Tested By:	JMH
Engineering Test Notes:			

Test Measurement Results

Test Frequency MHz	Measured Output Power (dBuv/m)	Calculated Total Power	Limit	Margin	EUT Power Setting
	Port A	dBuv/m	dBuv/m	Numeric	Numeric
DVD21-POE	49.7	49.7	53.9	-4.2	8

Traceability to Industry Recognized Test Methodologies

Work Instruction:	WI-01 MEASURING RF OUTPUT POWER
Uncertainty:	±1.33 dB

This test report may be reproduced in full only. The document may only be updated by MiCOM Labs personnel. All changes will be noted in the Document History section of the report.

9.3. Peak Power Density

Radiated Test Conditions for Maximum Peak Power Density			
Standard:	FCC CFR 47:15.517 (e)	Ambient Temp. (°C):	24.0 - 27.5
Test Heading:	Radiated Emissions UWB Transmission	Rel. Humidity (%):	32 - 45
Standard Section(s):	ANSI C63.10 Section 10.3.6	Pressure (mBars):	999 - 1001
Reference Document(s):	None		
Test Procedure for UWB Transmission			
Testing was performed under ambient conditions at nominal voltage.			
Test configuration and setup used for the measurement was per the Radiated Test Set-up section specified in this document. Supporting KDB's referenced below.			
Measurements were gathered with a RBW of 1MHz and converted to 50MHz using the following formula:			
$\text{EIRP}_{1\text{ MHz}} = \text{EIRP}_{50\text{ MHz}} + 20\log(1\text{MHz}/50\text{MHz}) = 0\text{dBm} + (-34\text{dBm}) = -34\text{dBm}$			
Operating Frequency Band: 3100-10600 MHz			
Limits Maximum EIRP (dBm)			
Frequency (MHz)	EIRP Limit (dBm/50MHz)	EIRP Limit (dBm/1MHz)	EIRP at 3 Meters (dBuv/m)
3100 - 10600	0	-34	61.23



Title: DOVEN DVD21-POE
To: FCC Part 15.517
Serial #: JANU02-U4 Rev A
Issue Date: 20th March 2019
Page: 25 of 39

Equipment Configuration for Peak Power Density			
--	--	--	--

Variant:	500 MHz Bandwidth	Duty Cycle (%):	99
Data Rate:	-	Antenna Gain (dBi):	9.28
Modulation:	BPM/BPSK	Beam Forming Gain (Y)(dB):	Not Applicable
TPC:	Not Applicable	Tested By:	JH
Engineering Test Notes:			

Test Measurement Results

Device	Measured Output Power	Limit	Margin	EUT Power Setting
	dBuv/m	dBuv/m	Numeric	Numeric
DVD21-POE	59.51	61.23	-1.72	8

Traceability to Industry Recognized Test Methodologies	
--	--

Work Instruction:	WI-01 MEASURING RF OUTPUT POWER
Uncertainty:	±1.33 dB

This test report may be reproduced in full only. The document may only be updated by MiCOM Labs personnel. All changes will be noted in the Document History section of the report.

9.4. Radiated Spurious Emissions

Radiated Test Conditions for Radiated Spurious and Band-Edge Emissions			
Standard:	FCC CFR 47 15.517	Ambient Temp. (°C):	20.0 - 24.5
Test Heading:	Radiated Spurious and Band-Edge Emissions	Rel. Humidity (%):	32 - 45
Standard Section(s):	ANSI C63.10 Section 10.2 + 10.3	Pressure (mBars):	999 - 1001
Reference Document(s):	See Normative References		
Test Procedure for Radiated Spurious and Band-Edge Emissions Radiated emissions for restricted bands above 1 GHz are measured in the anechoic chamber at a 3-meter distance on every azimuth in both horizontal and vertical polarities. The emissions are recorded and maximized as a function of azimuth by rotation through 360° with a spectrum analyzer in peak hold mode. Depending on the frequency band spanned a notch filter was used to remove the fundamental frequency. The highest emissions relative to the limit are listed for each frequency spanned. Measurements on any restricted band frequency or frequencies above 1 GHz are based on the use of measurement instrumentation employing peak and average detectors. All measurements were performed using a resolution bandwidth of 1 MHz.			
Limits for Restricted Bands (15.205, 15.209) Peak emission: 68.23 dBuV/m Average emission: 54 dBuV/m			
Field Strength Calculation The field strength is calculated by adding the Antenna Factor and Cable Loss, and subtracting Amplifier Gain from the measured reading. All factors are included in the reported data. FS = R + AF + CORR - FO where: FS = Field Strength R = Measured Spectrum analyzer Input Amplitude AF = Antenna Factor CORR = Correction Factor = CL – AG + NFL CL = Cable Loss AG = Amplifier Gain FO = Distance Falloff Factor NFL = Notch Filter Loss			
Frequency Range		Limit	
MHz	MHz	EIRP (dBm)	EIRP at 3 Meters (dBuV/m)
960	1610	-75.3	19.9
1610	1990	-63.3	41.9
1990	3100	-61.3	43.9
3100	10600	-41.3	53.9
10600	18000	-61.3	43.9

This test report may be reproduced in full only. The document may only be updated by MiCOM Labs personnel. All changes will be noted in the Document History section of the report.



Radiated Spurious Emissions in the GPS Bands 15.517 (d)

Frequency Range		Limit	
MHz	MHz	EIRP (dBm)	EIRP at 3 Meters (dBuV/m)
1164	1240	-85.3	9.9
1559	1610	-85.3	9.9

This test report may be reproduced in full only. The document may only be updated by MiCOM Labs personnel. All changes will be noted in the Document History section of the report.

9.4.1. TX Spurious Band Emissions

9.4.1.1. DVD21-POE

Note: M1-M4 are digital emissions, see next plot

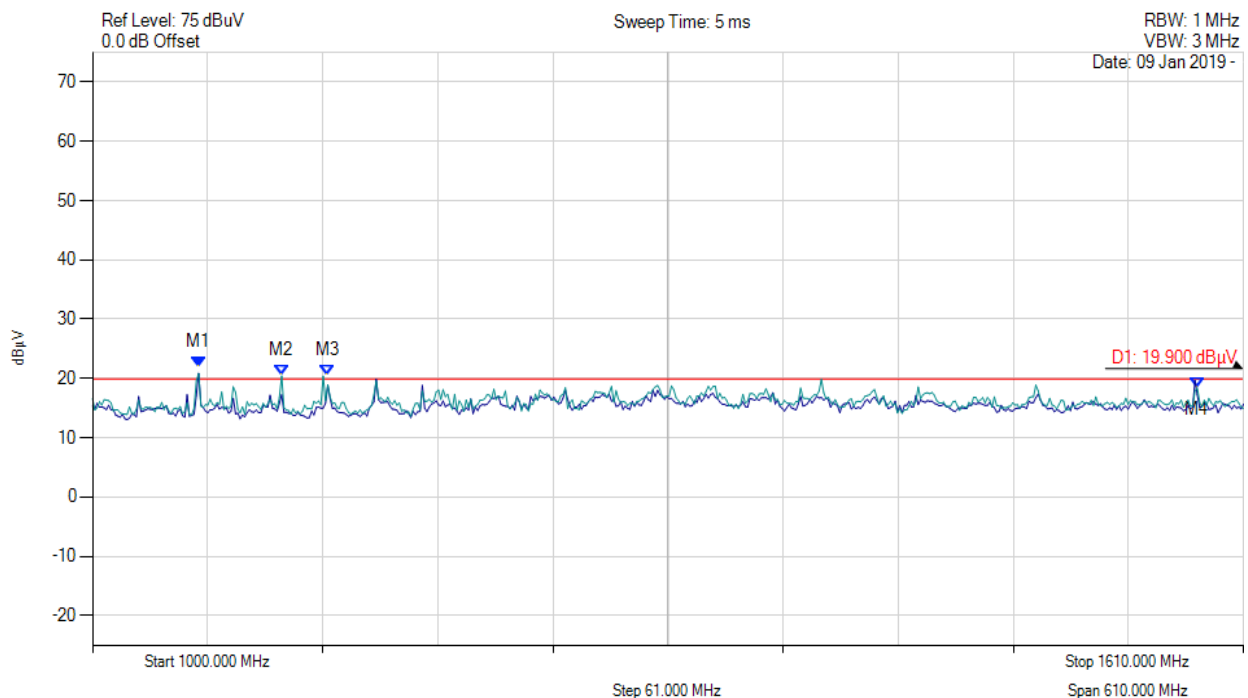
Equipment Configuration for Spurious Emissions

Antenna:	DVD21-POE	Variant:	500 MHz Bandwidth
Antenna Gain (dBi):	9.28	Modulation:	BPM/BPSK
Beam Forming Gain (Y):	Not Applicable	Duty Cycle (%):	99%
Channel Frequency (MHz):	3500.00	Data Rate:	
Power Setting:	8	Tested By:	JMH

Test Measurement Results

TX Spur 1.61 - 1.99 G

Variant: TX Spur 1-1.6, Channel: 3550.00 MHz, Chain a, Temp: 16, Voltage: 16 Vdc



Analyzer Setup	Marker:Frequency:Amplitude	Test Results
Sweep Count = 0 RF Atten (dB) = 10 TRACE 1: Detector = RMS Trace Mode = VIEW TRACE 2: Detector = RMS Trace Mode = VIEW	M1 : 1056.232 MHz : 21.838 dBuV M2 : 1100.241 MHz : 20.464 dBuV M3 : 1124.681 MHz : 20.571 dBuV M4 : 1585.551 MHz : 18.399 dBuV Notes: M1 – M4 are digital emissions, see next plot.	Channel Frequency: 3500.00 MHz

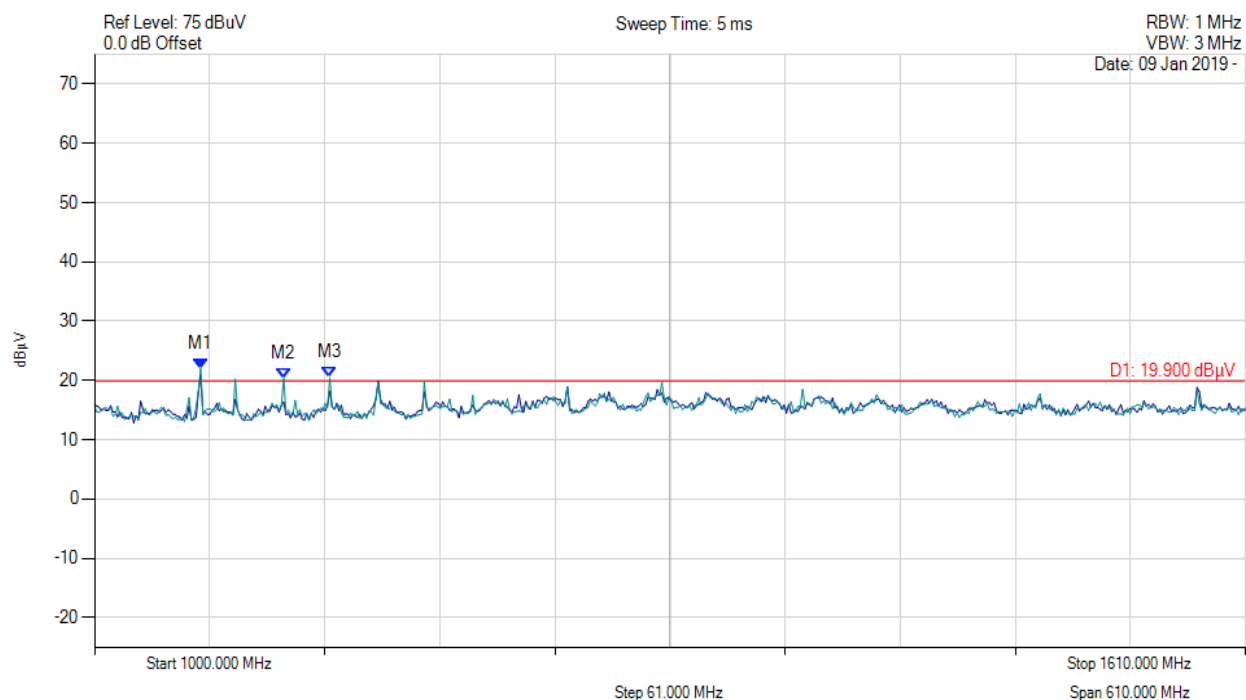
This test report may be reproduced in full only. The document may only be updated by MiCOM Labs personnel. All changes will be noted in the Document History section of the report.

Digital Emissions:

Digital 1.61 - 1.99 G



Variant: 1-1.6 Digital, Channel: 3500.00 MHz, Chain a, Temp: 16, Voltage: 16 Vdc



Analyzer Setup	Marker:Frequency:Amplitude	Test Results
Sweep Count = 0 RF Atten (dB) = 10 TRACE 1: Detector = RMS Trace Mode = VIEW TRACE 2: Detector = RMS Trace Mode = VIEW	M1 : 1056.232 MHz : 21.985 dBuV M2 : 1100.240 MHz : 20.340 dBuV M3 : 1124.689 MHz : 20.421 dBuV	Channel Frequency: 3550.00 MHz

This test report may be reproduced in full only. The document may only be updated by MiCOM Labs personnel. All changes will be noted in the Document History section of the report.

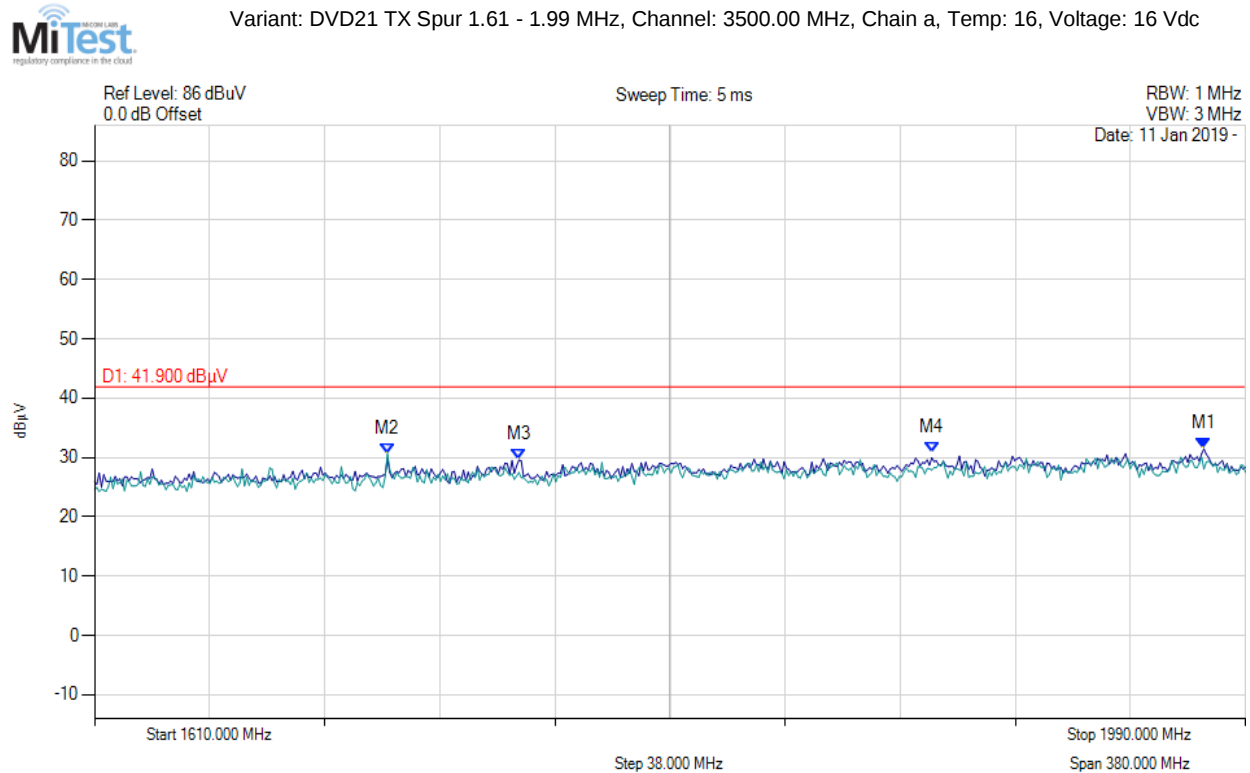
Equipment Configuration for Spurious Emissions

Antenna:	DVD21-POE	Variant:	500 MHz Bandwidth
Antenna Gain (dBi):	9.28	Modulation:	BPM/BPSK
Beam Forming Gain (Y):	Not Applicable	Duty Cycle (%):	99%
Channel Frequency (MHz):	3500.00	Data Rate:	
Power Setting:	8	Tested By:	JMH

Test Measurement Results

TX Spur 1.61 - 1.99 MHz

Variant: DVD21 TX Spur 1.61 - 1.99 MHz, Channel: 3500.00 MHz, Chain a, Temp: 16, Voltage: 16 Vdc



1610.00 - 1990.00 MHz

Num	Frequency MHz	Raw dBμV	Cable Loss dB	AF dB	Level dBμV/m	Measurement Type	Pol	Hgt cm	Azt Deg	Limit dBμV/m	Margin dB	Pass /Fail
1	1976.29	42.9	1.61	-13.06	31.45	RMS	Vertical	150	0	41.9	-10.45	Pass
2	1706.71	44.9	1.51	-15.8	30.61	RMS	Vertical	150	0	41.9	-11.29	Pass
3	1750.12	43.22	1.5	-15.15	29.57	RMS	Vertical	150	0	41.9	-12.33	Pass
4	1886.43	43.14	1.55	-13.78	30.91	RMS	Vertical	150	0	41.9	-10.99	Pass

This test report may be reproduced in full only. The document may only be updated by MiCOM Labs personnel. All changes will be noted in the Document History section of the report.



Title: DOVEN DVD21-POE
To: FCC Part 15.517
Serial #: JANU02-U4 Rev A
Issue Date: 20th March 2019
Page: 31 of 39

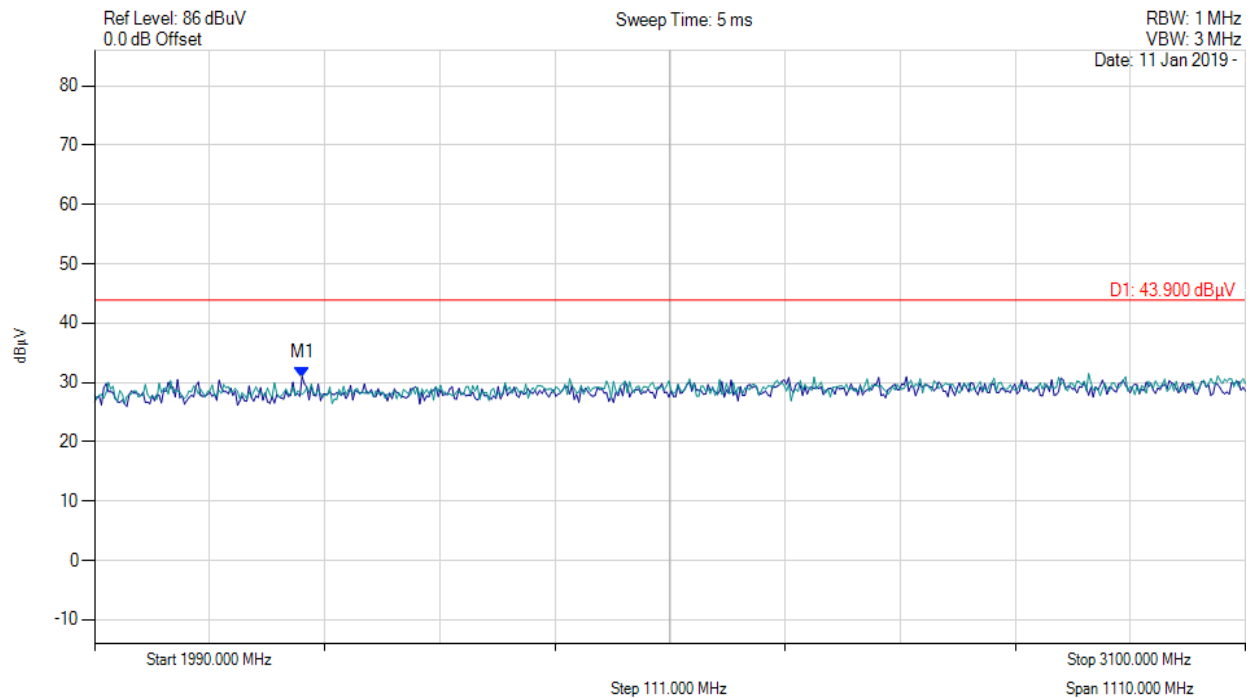
Equipment Configuration for Restricted Band Spurious Emissions

Antenna:	DVD21-POE	Variant:	500 MHz Bandwidth
Antenna Gain (dBi):	9.28	Modulation:	BPM/BPSK
Beam Forming Gain (Y):	Not Applicable	Duty Cycle (%):	99%
Channel Frequency (MHz):	3500.00	Data Rate:	
Power Setting:	8	Tested By:	JMH

Test Measurement Results

TX Spur 1.99-3.1 MHz

Variant: DVD21 TX Spur 1.99 - 3.1 MHz, Channel: 3500.00 MHz, Chain a, Temp: 16, Voltage: 16 Vdc



1990.00 – 3100.00 MHz												
Num	Frequency MHz	Raw dBuV	Cable Loss dB	AF dB	Level dBuV/m	Measurement Type	Pol	Hgt cm	Azt Deg	Limit dBuV/m	Margin dB	Pass /Fail
1	2190.2	41.92	1.69	-12.75	30.86	RMS	Vertical	150	0	43.9	-13.04	Pass

This test report may be reproduced in full only. The document may only be updated by MiCOM Labs personnel. All changes will be noted in the Document History section of the report.



Title: DOVEN DVD21-POE
To: FCC Part 15.517
Serial #: JANU02-U4 Rev A
Issue Date: 20th March 2019
Page: 32 of 39

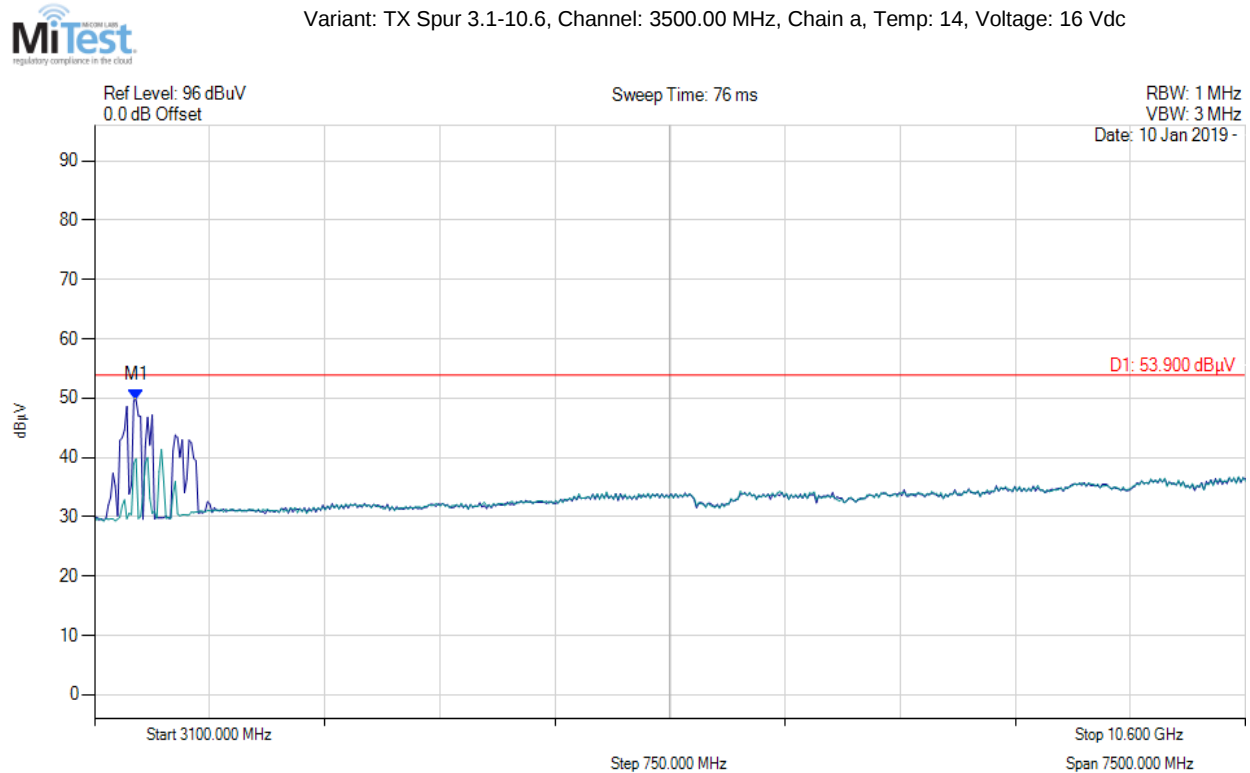
Equipment Configuration for Restricted Band Spurious Emissions

Antenna:	DVD21-POE	Variant:	500 MHz Bandwidth
Antenna Gain (dBi):	9.28	Modulation:	BPM/BPSK
Beam Forming Gain (Y):	Not Applicable	Duty Cycle (%):	99%
Channel Frequency (MHz):	3500.00	Data Rate:	
Power Setting:	8	Tested By:	JMH

Test Measurement Results

TX Spur 3.1-10.6 G

Variant: TX Spur 3.1-10.6, Channel: 3500.00 MHz, Chain a, Temp: 14, Voltage: 16 Vdc



1990.00 – 3100.00 MHz												
Num	Frequency MHz	Raw dBμV	Cable Loss dB	AF dB	Level dBμV/m	Measurement Type	Pol	Hgt cm	Azt Deg	Limit dBμV/m	Margin dB	Pass /Fail
1	3370.54	2.08	-1.61	-11.84	49.69	RMS	Vertical	150	0	53.9	-4.21	Pass

This test report may be reproduced in full only. The document may only be updated by MiCOM Labs personnel. All changes will be noted in the Document History section of the report.



Title: DOVEN DVD21-POE
To: FCC Part 15.517
Serial #: JANU02-U4 Rev A
Issue Date: 20th March 2019
Page: 33 of 39

Equipment Configuration for Restricted Band Spurious Emissions

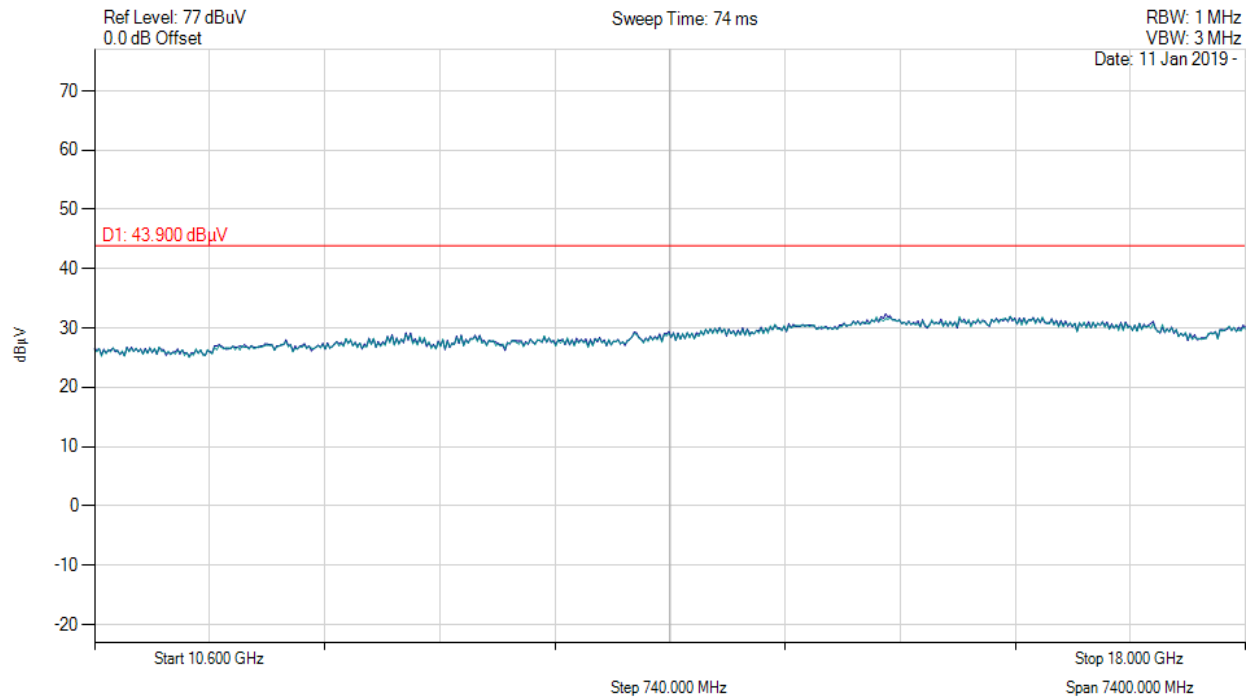
Antenna:	DVD21-POE	Variant:	500 MHz Bandwidth
Antenna Gain (dBi):	9.28	Modulation:	BPM/BPSK
Beam Forming Gain (Y):	Not Applicable	Duty Cycle (%):	99%
Channel Frequency (MHz):	3500.00	Data Rate:	
Power Setting:	8	Tested By:	JMH

Test Measurement Results

Tx Spur 10.6-18



Variant: DVD21 Tx Spur Tx Spur 10.6-18 PS 8, Channel: 3500.00 MHz, Chain a, Temp: 17, Voltage: 12 Vdc



There are no emissions found within 6dB of the limit line.

This test report may be reproduced in full only. The document may only be updated by MiCOM Labs personnel. All changes will be noted in the Document History section of the report.

9.4.2. GPS Band Emissions

9.4.2.1. DVD21-POE

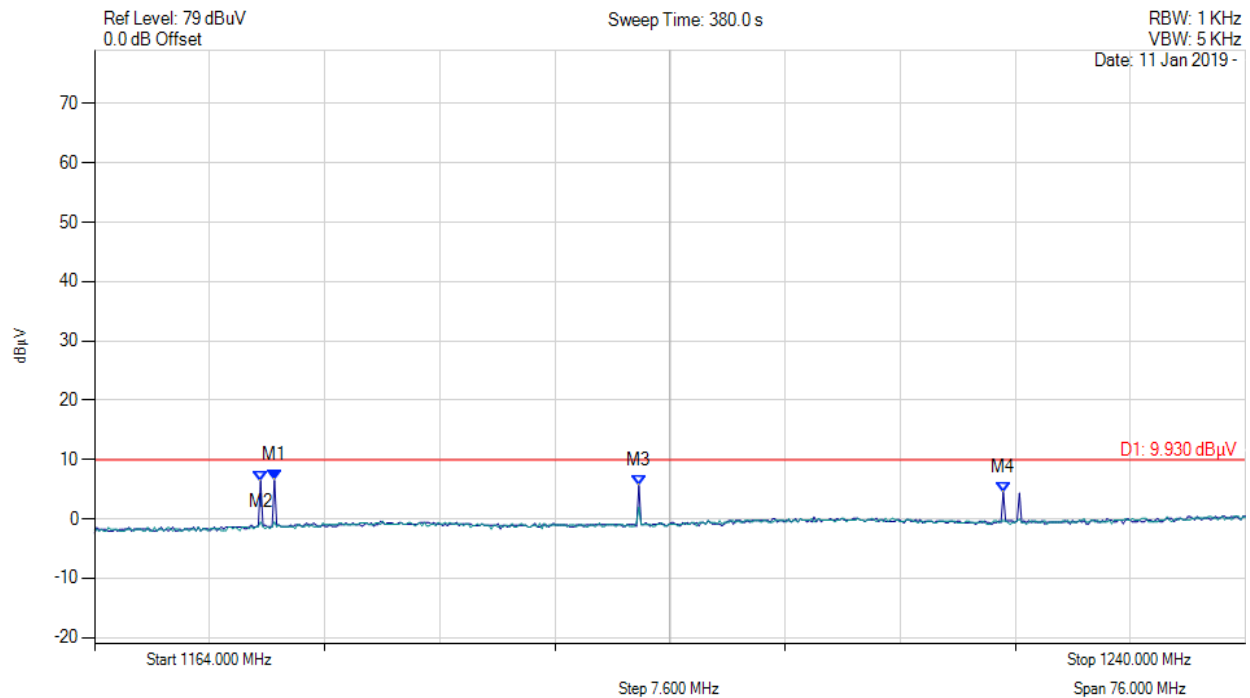
Equipment Configuration for GPS Spurious Emissions

Antenna:	DVD21-POE	Variant:	500 MHz Bandwidth
Antenna Gain (dBi):	9.28	Modulation:	BPM/BPSK
Beam Forming Gain (Y):	Not Applicable	Duty Cycle (%):	99%
Channel Frequency (MHz):	3500.00	Data Rate:	
Power Setting:	8	Tested By:	JMH

Test Measurement Results

GPS 1164-1240 MHz

Variant: DVD21 GPS 1164-1240 MHz, Channel: 3500.00 MHz, Chain a, Temp: 16, Voltage: 16 Vdc



GPS 1164.00 - 1240.00 MHz

Num	Frequency MHz	Raw dBuV	Cable Loss dB	AF dB	Level dBuV/m	Measurement Type	Pol	Hgt cm	Azt Deg	Limit dBuV/m	Margin dB	Pass /Fail
1	1175.88	22.28	1.25	-17.03	6.5	RMS	Vertical	150	0	9.9	-3.4	Pass
2	1174.97	22.14	1.25	-17.01	6.38	RMS	Vertical	150	0	9.9	-3.52	Pass
3	1199.94	21.84	1.21	-17.42	5.63	RMS	Vertical	150	0	9.9	-4.27	Pass
4	1224.01	19.76	1.26	-16.53	4.49	RMS	Vertical	150	0	9.9	-5.41	Pass

This test report may be reproduced in full only. The document may only be updated by MiCOM Labs personnel. All changes will be noted in the Document History section of the report.



Title: DOVEN DVD21-POE
To: FCC Part 15.517
Serial #: JANU02-U4 Rev A
Issue Date: 20th March 2019
Page: 35 of 39

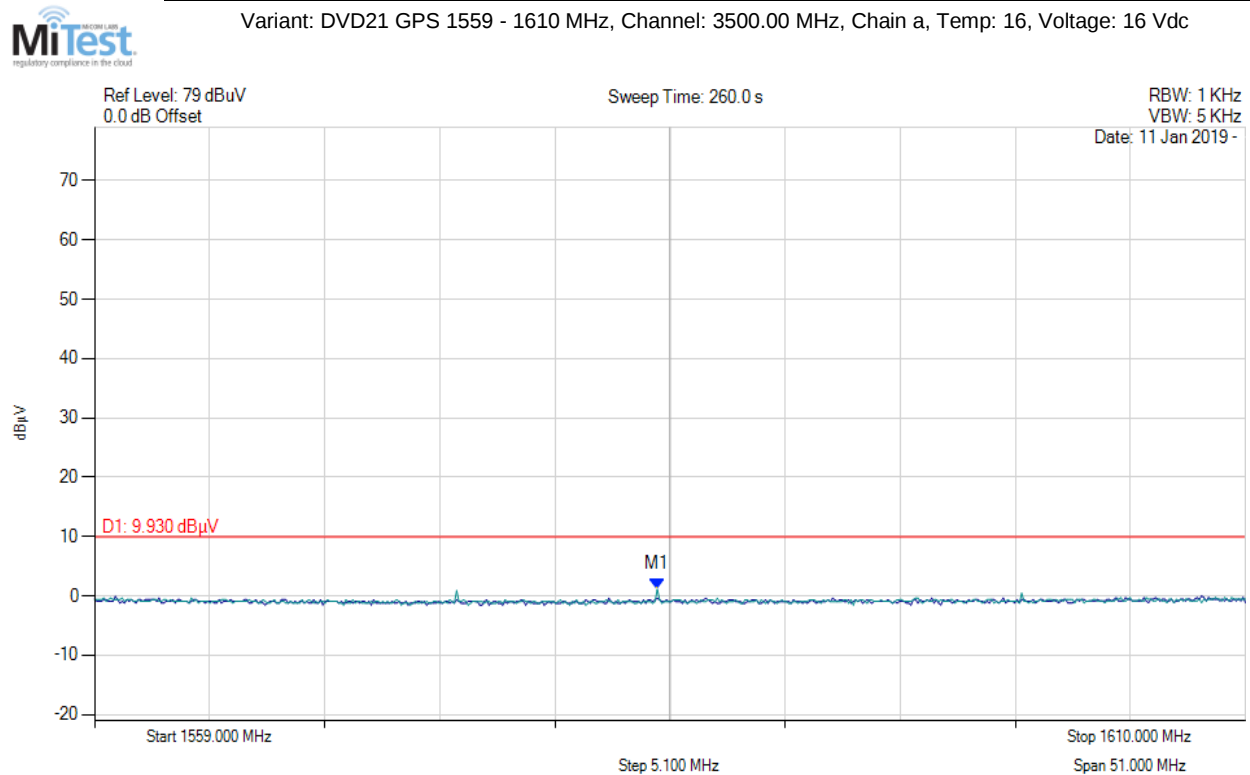
Equipment Configuration for GPS Spurious Emissions

Antenna:	DVD21-POE	Variant:	500 MHz Bandwidth
Antenna Gain (dBi):	9.28	Modulation:	BPM/BPSK
Beam Forming Gain (Y):	Not Applicable	Duty Cycle (%):	99%
Channel Frequency (MHz):	3500.00	Data Rate:	
Power Setting:	8	Tested By:	JMH

Test Measurement Results

GPS 1559 - 1610 MHz

Variant: DVD21 GPS 1559 - 1610 MHz, Channel: 3500.00 MHz, Chain a, Temp: 16, Voltage: 16 Vdc



GPS 1559.00 - 1610.00 MHz

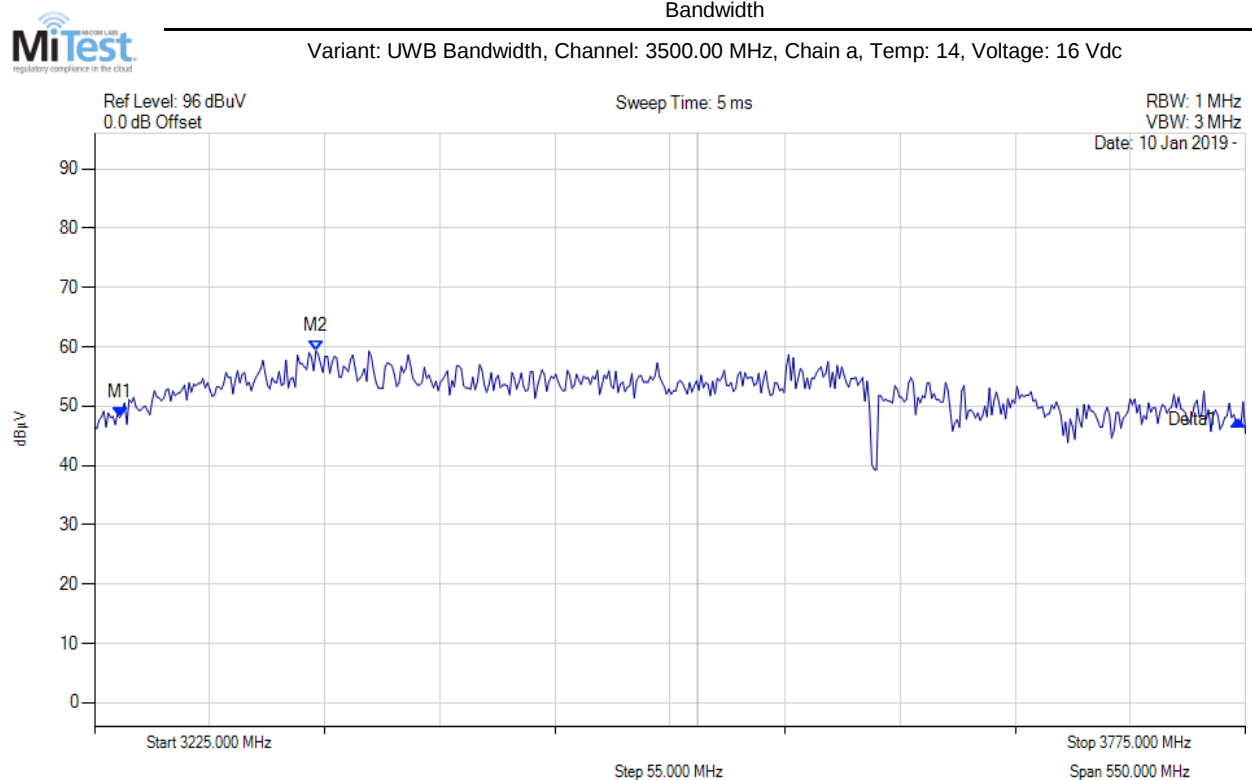
Num	Frequency MHz	Raw dBuV	Cable Loss dB	AF dB	Level dBuV/m	Measurement Type	Pol	Hgt cm	Azt Deg	Limit dBuV/m	Margin dB	Pass /Fail
1	1583.94	16.226	1.42	-16.55	1.096	RMS	Horizontal	150	0	9.9	-8.804	Pass

This test report may be reproduced in full only. The document may only be updated by MiCOM Labs personnel. All changes will be noted in the Document History section of the report.

A. APPENDIX - GRAPHICAL IMAGES

A.1. UWB Bandwidth

DVD21-POE



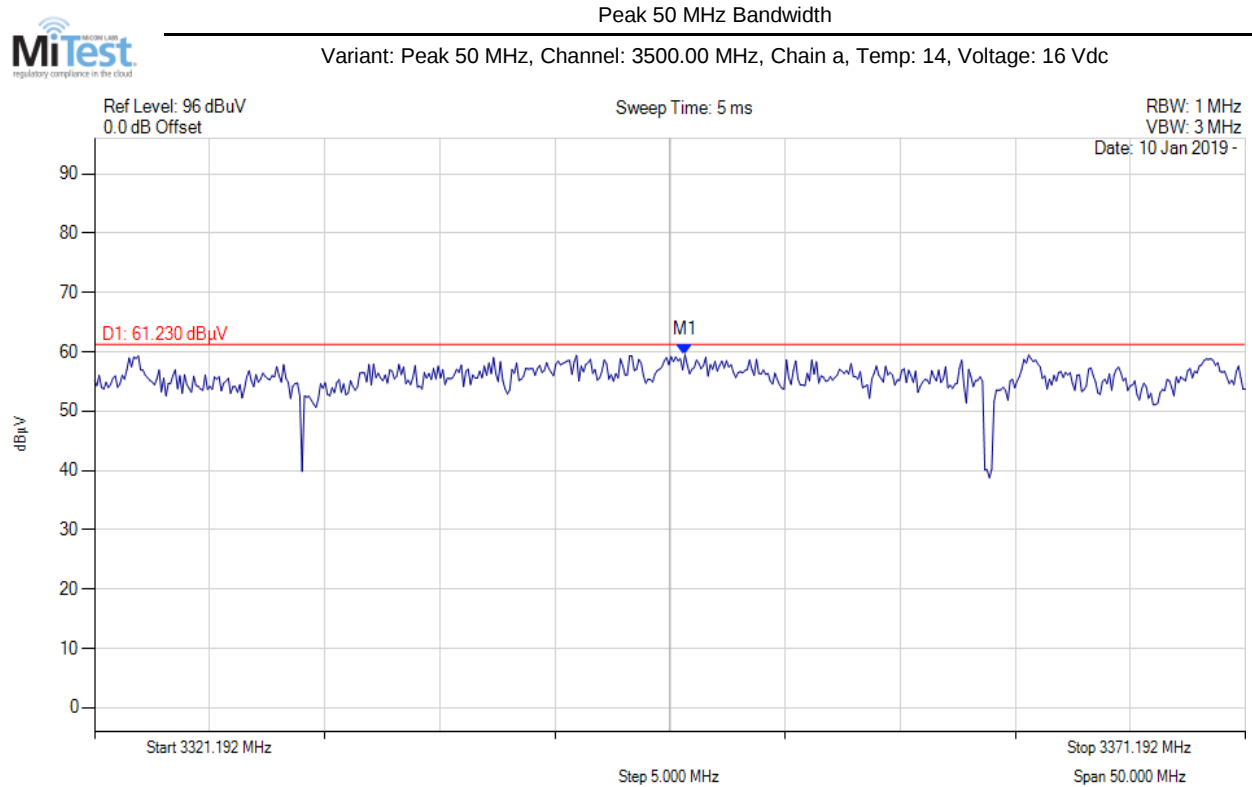
Analyzer Setup	Marker:Frequency:Amplitude	Test Results
Detector = MAX PEAK Sweep Count = 0 RF Atten (dB) = 10 Trace Mode = VIEW	M1 : 3261.022 MHz : 48.063 dBμV M2 : 3346.192 MHz : 59.343 dBμV Delta1 : 501.972 MHz : -0.401 dB	Channel Frequency: 3550.00 MHz

[back to matrix](#)

This test report may be reproduced in full only. The document may only be updated by MiCOM Labs personnel. All changes will be noted in the Document History section of the report.

A.2. Peak Power Density

DVD21-POE – 50MHz Span



Analyzer Setup	Marker:Frequency:Amplitude	Test Results
Detector = MAX PEAK Sweep Count = 0 RF Atten (dB) = 10 Trace Mode = VIEW	M1 : 3346.844 MHz : 59.505 dBµV	Channel Frequency: 3550.00 MHz

[back to matrix](#)

This test report may be reproduced in full only. The document may only be updated by MiCOM Labs personnel. All changes will be noted in the Document History section of the report.



575 Boulder Court
Pleasanton, California 94566, USA
Tel: +1 (925) 462 0304
Fax: +1 (925) 462 0306
www.micomlabs.com