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July 20, 2011

Vipin Malik Houston Radar, LLC 13814 Sherbun Manor Drive Cypress, TX 77095

# Dear Vipin:

Enclosed is the Wireless Test Report for the PD300 Radar by Houston Radar, LLC. This report can be used to demonstrate compliance with FCC requirements for wireless devices in the United States.

If you have any questions, please contact me.

Sincerely,

Jeffrey A. Lenk

President

Enclosure

Project 12538-10

# Houston Radar, LLC. PD300

# **Wireless Certification Report**

Prepared for: Houston Radar, LLC. 13814 Sherbun Manor Drive Cypress, TX 77095

By

Professional Testing (EMI), Inc. 1601 N. A.W. Grimes Blvd., Suite B Round Rock, Texas 78665

July 20, 2011

Reviewed by

Jeffrey A. Lenk President Written by

Layne Lueckemeyer Product Development Engineer

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# $THIS\ REPORT\ SHALL\ NOT\ BE\ REPRODUCED\ EXCEPT\ IN\ FULL,\ WITHOUT\ THE\ WRITTEN\ APPROVAL\ OF\ PROFESSIONAL\ TESTING\ (EMI),\ INC.$

NOTICE: (1) This Report must not be used to claim product endorsement, by NVLAP, NIST, the FCC or any other Agency. This report also does not warrant certification by NVLAP or NIST.

<sup>(2)</sup> This report shall not be reproduced except in full, without the written approval of Professional Testing (EMI), Inc.

<sup>(3)</sup> The significance of this report is dependent on the representative character of the test sample submitted for evaluation and the results apply only in reference to the sample tested. The manufacturer must continuously implement the changes shown herein to attain and maintain the required degree of compliance.



Applicant: Houston Radar, LLC.

Applicant's Address: 13814 Sherbun Manor Drive

Cypress, TX 77095

FCC ID: TIAPD300 Project Number: 12538-10

Test Dates: June 27 - 28, 2011

The **Houston Radar PD300** was tested to and found to be in compliance with FCC 47 CFR Part 15.

The highest emissions generated by the above equipment are listed below:

Parameter	Frequency (MHz)	Level	Limit	Margin (dB)	
Transmitter: Fundamental	24026	119.3 dBuV/m @ 1 m	137.5	-18.2	
Field Strength at 1m			dBuV/m		
Transmitter: Radiated Spurious	96356	94.0 dBμV/m @ .1 m	97.5 dBµV/m	-3.5	

# NOTE: Transmitter limits above reflect Peak limits. The EUT met both Peak and Average limits.

99% Occupied Bandwidth	Emission Designator
215.000 MHz	215MF0N

I, Layne Lueckemeyer, for Professional Testing (EMI), Inc., being familiar with the FCC rules and test procedures have reviewed the test setup, measured data, and this report. I believe them to be true and accurate.

Layne Lueckemeyer

**Product Development Engineer** 

This report has been reviewed and accepted by Houston Radar, LLC. The undersigned is responsible for ensuring that this device will continue to comply with the FCC and IC rules.

Representative of Houston Radar, LLC.

## 1.0 Introduction

# 1.1 Scope

This report describes the extent of the equipment under test (EUT) conformance to the intentional radiator requirements of the United States and Canada.

Professional Testing (EMI), Inc. (PTI), follows the guidelines of NIST for all uncertainty calculations, estimates, and expressions thereof for EMC testing. The procedure of ANSI C63.4: 2009 were utilized for making all emissions measurements.

# **1.2 EUT Description**

The PD300 Frequency Modulated Continuous-wave (FMCW) radar is nominally powered by a 12V DC supply but can operate from any 5.5V-18V DC source. The power input is protected from over-voltage, reverse voltage and over-current by a combination of a poly-fuse and a parallel uni-directional TVS diode. PD300 can monitor its own power consumption via a high side current sense circuit and input voltage through input divider that brings the voltage down to the level that can be safely measured by a microcontroller unit (MCU). Input voltage is further regulated down to 5V and 3.3V DC by two high-efficiency switching regulators operating at 250 KHz. The 5V DC rail is used to power a microwave sensor, audio frequency preamplifier and a varactor driver. The 3.3V DC regulator provides power to MCU and associated digital electronics such as RS232 transceiver and serial FLASH memory. The EUT continuously transmitted at maximum power. The system tested consisted of the following:

Manufacturer	Model	FCC ID Number
Houston Radar, LLC.	PD300	TIAPD300

The following rules apply to the operation of the EUT:

Guidelines	FCC Rules
Guidennes	Part 15
Transmitter Characteristics	15.249
Spurious Radiated Power	15.209
Antenna Requirement	15.203

## 1.3 Modifications

No modifications were made to the EUT during the performance of the test program.

#### 1.4 Test Site

Measurements were made at the PTI semi-anechoic facility designated Site 45 (FCC 459644, IC 3036B-1) in Austin, Texas. This site is registered with the FCC under Section 2.948 and Industry Canada per RS-212, and is subsequently confirmed by laboratory accreditation (NVLAP). The test site is located at 11400 Burnet Road, Austin, Texas, 78758, while the main office is located at 1601 N. A.W. Grimes Blvd., Suite B, Round Rock, Texas, 78665.

# 1.5 Applicable Documents

Document	Title	Release
ANSI C63.4	American National Standard for Methods of Measurement of Radio-	2009
	Noise Emissions from Low Voltage Electrical and Electronic	
	Equipment	
ANSI C63.10	American National Standard for Testing Unlicensed Wireless	2009
	Devices	
47 CFR	Part 15 – Radio Frequency Devices Subpart C -Intentional Radiators	

# 2.0 Fundamental Field Strength Measurements

Fundamental field strength measurements were made on the selected fundamental transmit frequency of the EUT.

Tests of the fundamental field strength of the EUT also determined the worse case polarization of the device. The emissions of the device were measured with the EUT in three orthogonal axes.

#### 2.1 Test Procedure

Radiated emission measurements were made of the fundamental field strength level for the EUT. The EUT was placed on a non-conductive table 0.8 meters above the ground plane. The table was centered on a motorized turntable that enables 360-degree rotation. For measurements of the fundamental signal, a measurement antenna was positioned at a distance of 1 meters, as measured from the closest point of the EUT. The field strength emissions were maximized by rotating the EUT. A diagram showing the test setup is given as Figure 2.1.1.

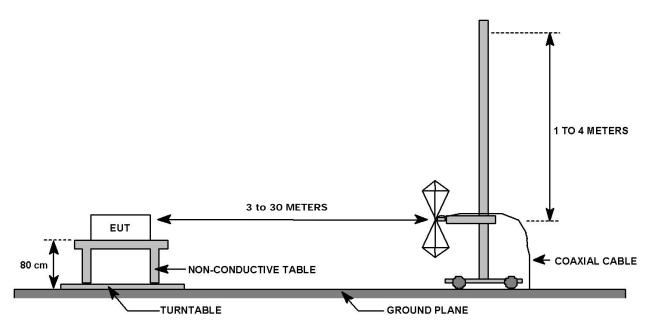


Figure 2.1.1: Radiated Emission Test Setup

# 2.2 Test Criteria

The maximum field strengths shall not exceed the following values:

Carrier (MHz)	Field Strength (mV/m)	Field Strength (dBµV)	Harmonic (μV/m)	Harmonic (dBµV)
902-928	50	94	500	54
2400-2483.5	50	94	500	54
5725-5875	50	94	500	54
24000-24250	250	108	2500	68

- (b) Field strength limits are specified at a distance of 3 meters.
- (c) Emissions radiated outside of the specified frequency bands, except for harmonics, shall be attenuated by at least 50 dB below the level of the fundamental or to the general radiated limits of 15.209 whichever is the less attenuation.
- (d) ...for frequencies above 1000 MHz, the above field strength limits are based on average limits. However, the peak field strength of any emission shall not exceed the maximum permitted average limits specified above by more than 20 dB under any condition of modulation.

Limits in the table below are at 1 meter. The limits are adjusted from the 3 meter limit by adding a factor of 9.5 dB from the formula:

$$20 \log(1/3) = -9.5 \text{ dB}$$

Peak limit is Avg. limit + 20 dB as described in 15.249(d).

# **Analyzer Settings:**

Peak Readings: RBW = 1 MHz, VBW = 10 MHz, Peak detector Average Readings: RBW = 1 MHz, VBW = 10 MHz, Average detector

The measurement was integrated over 215 MHz channel bandwidth to achieve the fundamental field strength.

#### 2.3 Test Results

Radiated emission measurements of the fundamental field strength level for the EUT were taken on June 27, 2011, and the EUT was found to be in compliance with applicable requirements.

Table 2.3.1: Radiated Emissions of the Fundamental Strength Test Equipment

Table 2.3.1. Radiated Emissions of the Fundamental Strength Test Equipment								
Professional Testing, EMI, Inc.								
Test Metho	d•			surement of Radio-Noise				
Electrical and Electronic Equipment in the Range of 9 kHz to 40 GHz" (incorporated by								
				Regulations Part 47, Subp	oart B - Unintention	nal Radiators,		
In accordan	ice with: Radia	ted Emissions Li	nits					
Section:	15.10	9						
Test Date(s)	): 6/27/2	2011		EUT Serial #:	1			
<b>Customer:</b>	Hous	ton Radar		EUT Part #:	PD300			
Project Nun	nber: 12538	3-10		Test Technician:	Layne Lueckemeyer			
Purchase Order #: 81126				Supervisor:	Jason Haley			
Equip. Und	er Test: FMC	W Microwave Ra	dar	Witness' Name:	Vipin Malik / Serg	gei Sharonov		
	Rac	diated Emissions Te	est Equipment	List	Page:	1 of 1		
T	ile! Software Versio	n: 3.4.K	.11, June 7, 20	006, 07:49:00 PM				
	Test Profile:	Radi	ated Emissions	s_updated_12-16-10.til				
Asset#	Manufacturer	Model	Equip	oment Nomenclature	Serial Number	Calibration Due Date		
ALN-077	Rohde & Schwarz	FSP30	Sı	pectrum Analyzer	100218	12/22/2012		
1542	A.H. Systems	SAS-572	Antenna, Ho	orn 18-26.5GHz, 20dB gain	225	NCR		
C117	Times Microwave	SLU18-SMSM- 05.00F	Cable, RF	, SMA-SMA, 60", Brown	none	9/22/2011		
1509B	Braden	N/A	TDK 10M	Chamber, VSWR > 1 GHz	DAC-012915-005	4/7/2012		

Table 2.3.2: Radiated Emissions of the Fundamental Strength Test Results

Table 2.5	Table 2.5.2: Radiated Emissions of the Fundamental Strength Test Results									
Professional Testing, EMI, Inc.										
Test Metho	d:							Noise Emiss Hz to 40 GH		ow-Voltage orated by
In accorda	ance with:	FCC	Part 1	5.249 Code	of Federal	Regulation	s Part 47			
Section:		15.24	9							
Test Date(s	):	6/27/2	2011			<b>EUT Seria</b>	l #:	1		
<b>Customer:</b>		Hous	ton R	adar		EUT Part	#:	PD300		
Project Nu	mber:	12538	3-10			Test Techn	iician:	Layne Lue	ckemeyer	
Purchase O	rder #:	81126	5			Supervisor	:	Jason Hale	y	
Equip. Und	ler Test:	<b>FMC</b>	W Mi	crowave Ra	adar	Witness' N	ame:	Vipin Mali	k / Sergei S	haronov
	Fund	damen	tal Fie	ld Strength	Test Results	Data Sheet		Pa	ge: 1	of 1
EUT L	ine Voltage:	:	1	2	VDC	EUT Li	ne Frequenc	y: N	/ <b>A</b>	Hz
	EUT N	Aode o	f Ope	ration:			Tran	smit Modula	tion On	
Frequency Measured (GHz)	Test Distance (Meters)	EUT Antenna Direction Height (Degrees) (Meters)  Detector Function		Recorded Amplitude (dBµV)	Corrected Level (dBµV/m)	Limit Level (dBµV/m)	Margin (dB)	Antenna Polarization		
24.026	1	18	30	1	Peak	81.8	119.3	137.5	-18.2	Vertical
24.026	1	18	30	1	Peak	65.6	103.1	137.5	-34.4	Horizontal
24.026	1	18	30	1	Average	73.9	111.4	117.5	-6.1	Vertical
24.026	1	18	30	1	Average	55.8	93.3	117.5	-24.2	Horizontal

Table 2.3.3: Radiated Emissions of the Fundamental Strength Test Setup Photos				
	<b>Professional To</b>	esting, EMI, Inc.		
Test Method:	Electrical and Electronic Equipmen	asurement of Radio-Noise Emissions from Low-Voltage at in the Range of 9 kHz to 40 GHz" (incorporated by		
		Regulations Part 47, Subpart B - Unintentional Radiators,		
In accordance with:	Radiated Emissions Limits			
Section:	15.109			
<b>Γest Date(s):</b>	6/27/2011	EUT Serial #: 1		
Customer:	Houston Radar	EUT Part #: PD300		
Project Number:	12538-10	Test Technician: Layne Lueckemeyer		
Purchase Order #:	81126	Supervisor: Jason Haley		
Equip. Under Test:	FMCW Microwave Radar	Witness' Name: Vipin Malik / Sergei Sharonov		
	Field Strength and Occupied Bandwidth P	Photographs Page: 1 of 1		
	PD300 Front	PD300		

# 3.0 Occupied Bandwidth

Occupied bandwidth measurements were performed on the EUT to determine compliance with FCC 15.249 and RSS-210.

#### 3.1 Test Procedure

The occupied bandwidth was measured with a spectrum analyzer connected to a double-ridged guide horn while the EUT was operating in continuous transmit mode at the appropriate center frequency. The analyzer center frequency was set to the EUT carrier frequency. The EUT was placed on a non-conductive table 0.8 meters above the floor. The table was rotated to an angle which presented the highest signal level. The occupied bandwidth was based on a 99% occupied bandwidth criteria. A drawing showing the test setup is given as Figure 1. A diagram showing the test setup is given as Figure 2.1.1.

## 3.2 Test Criteria

According to FCC Part 15.249, the emission must remain in the defined band.

#### 3.3 Test Results

Occupied bandwidth measurements were taken on June 27, 2011, and the EUT was found to be in compliance with applicable requirements. Test equipment used to perform this test is given in Table 2.3.1.

Table 3.3.1: Occupied Bandwidth Test Results, Data Sheet 1

n accordance with:	FCC Part 15.2 15.249	49 Code of Feder	ral Regulation	ns Part 47					
est Date(s): ustomer: roject Number: urchase Order #:	15,249 6/27/2011 Houston Rada 12538-10 81126 FMCW Micro		EUT Seria EUT Part Test Tech Superviso Witness' N	#: nician: r:	Jason	Lueckem		harono	OV
EUT Line Voltage:	Occupied Ba	andwidth Measure		Bandwidth		Page:	1	of MHz	
-100 -90 -80 -70 -50 -40 -30				Temp 2	76.1 023000 (T1 OB) 78.1	V] 53 dBµV 000 GHz	Α		
2.025 MHz									

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Table 3.3.2: Occupied Bandwidth Test Setup Photos						
	Professional Testing, EMI, Inc.					
Test Method:	Electrical and Electronic Equipmen	asurement of Radio-Noise Emissions from Low-Voltage t in the Range of 9 kHz to 40 GHz" (incorporated by				
		Regulations Part 47, Subpart B - Unintentional Radiators,				
In accordance with:	Radiated Emissions Limits					
Section:	15.109	I				
Test Date(s):	6/27/2011	EUT Serial #: 1				
Customer:	Houston Radar	EUT Part #: PD300				
Project Number:	12538-10	Test Technician: Layne Lueckemeyer				
Purchase Order #:	81126	Supervisor: Jason Haley				
Equip. Under Test:	FMCW Microwave Radar	Witness' Name: Vipin Malik / Sergei Sharonov				
	ield Strength and Occupied Bandwidth Pl	hotographs Page: 1 of 1				
	PD300 Front	PD300				

# 4.0 Out of Band Spurious Emissions

Out of band spurious/harmonic emissions measurements were performed on the EUT to determine compliance to FCC sections 15.249(c), 15.209 and RSS-210.

## **4.1** Test Procedure

The EUT was placed on a non-conductive table 0.8 meters above the ground plane. The table was centered on a rotating turntable at a distance of 10 meters from the measurement antenna.

For spurious emissions below 1 GHz, quasi-peak detection was used with a resolution bandwidth of 120 kHz. All measurements below 1 GHz were normalized to 3 meters using a 20 dB/decade distance extrapolation. The emissions were maximized by rotating the EUT and raising and lowering the measurement antenna from 1 to 4 meters.

Spurious/harmonic emissions above 1 GHz peak were measured with average and peak detection with a resolution bandwidth of 1 MHz and measured at a distance of 1 meter. Average detection was used to determine compliance of the EUT if the peak did not meet the average limit. Non-harmonic emissions must satisfy the average limit and the peak limit (20 dB above average). A diagram showing the test setup is given as Figure 2.1.1. Above 1 GHz, testing was completed at the transmit frequency to determine compliance.

From 24-100 GHz the measurement antenna was placed 0.1 meters from the EUT. The radiated emissions were maximized by rotating the EUT.

## 4.2 Test Criteria

The radiated limits of FCC 15.209 are shown below. The limits specified are at 3 meters. The limits are quasi-peak for emissions below 1 GHz and average for emissions above 1 GHz. Also above 1 GHz, the peak limit is 20 dB above the average limit.

Frequency MHz	Specification Distance (Meters)	Field Strength (dBuV/m)	Test Distance (Meters)	Field Strength (dBuV/m)
30 to 88	3	40.0	10	29.5
88 to 216	3	43.5	10	33.0
216 to 960	3	46.0	10	35.5
Above 960	3	54.0	3	54.0

#### 4.3 Test Results

Out of band spurious emissions measurements were taken on June 27 and 28, 2011, and the EUT was found to be in compliance with applicable requirements. There were no emissions detected above the carrier. The spectrum was searched from 30 MHz to 100 GHz. All emissions detected within 20 dB of the specification limit are reported per 15.31(o). Test equipment used to perform this test is given in Table 4.3.1, and 4.3.2.

Table 4.3.1: Out of Band Spurious Emissions Test Equipment List										
		Pro	ofess	ional Te	sting, EMI, Inc.					
Test Metho	a: metho	ods – Part 1-2	2: Rad	lio disturban	radio disturbance and ce and immunity measu	ring apparatus – A	ncillary			
In accordan	ce with: Radio	disturbance	e chara	acteristics —	ng corrigendum no. 1 In Limits and methods of	measurement	ogy equipment —			
Section: Test Date(s)			od of n		of radiated disturbance EUT Serial #:	1				
Customer:		ton Radar			EUT Part #:	PD300				
Project Nur		Layne Lueckemey	er							
Purchase Order #: 81126 Supervisor:					Jason Haley					
Equip. Under Test: FMCW Microwave Radar Witness' Name: Vipin Malik / Sergei Sharonov										
	Rac	liated Emissio	ons Tes	st Equipment l	List	Page:	1 of 1			
Т	ile! Software Versio	n:	3.4.K.	11, June 7, 200	06, 07:49:00 PM					
Test Profile: Radiated Emissions_updated_12-16-10.til										
Asset#	Manufacturer	Model		Equipment Nomenclature		Serial Number	Calibration Due Date			
1509A	Braden	N/A		TDK 10M Chamber, NSA < 1 GHz		DAC-012915-005	8/10/2011			
85	HP	85650A	Λ	Quasi-	Peak Adapter CISPR	3033A01458	7/28/2011			
1526	HP	85662A	١	Spec An	al Dsply for AN 1525	2403A07220	N/A			
1525	HP	8566B		Spectrum .	Spectrum Analyzer 100Hz-22GHz		6/7/2012			
238	HP	85685A	1	I	RF Preselector	2887A00841	7/27/2011			
1497	EMCO	3108		Antenna	, Bi Con, 30-300MHz	2121	8/4/2011			
1278	HP	85650A	Λ	Qu	asi Peak Adapter	2811A01147	7/28/2011			
1834	HP	85662A	Α.	S	pec Anal Dsply	2349A06182	N/A			
1145	HP	8568B		Spectrum A	Analyzer 100Hz-1.5GHz	2517A01821	7/28/2011			
1035	HP	85685A	Λ	I	RF Preselector	2901A00891	4/13/2012			
1486	EMCO	3147		Antenna,	Log Periodic, .2-5GHz	9112-1052	8/4/2011			
1497	EMCO	3108		Antenna	, Bi Con, 30-300MHz	2121	8/4/2011			
C026	N/A	RG214	ļ	Cabl	e Coax, N-N, 25m	none	8/10/2011			
C027	N/A	RG214	ļ	Cabl	e Coax, N-N, 25m	none	8/10/2011			
1414	HP	8447D			Preamp	1937A03403	7/15/2011			
1509B	Braden	N/A		TDK 10M C	Chamber, VSWR > 1 GHz	DAC-012915-005	4/7/2012			
1594	Miteq	AFS4-0100	1800	Amplif	er, 1-26.5GHz, 42dB	none	1/28/2012			
1529	Miteq	AFS4-0100	1800	Amplifi	er, 1-26.5GHz, 36dB	none	7/16/2011			
C030	N/A	0		Cabl	e Coax, N-N, 30m	none	3/21/2012			
1780	ETS-Lindgren	3117		Antenna,	DRG Horn, 1 - 18 GHz	1110313	1/14/2012			
<u> </u>	ļ <u> </u>					1				

NCR

NCR

NCR

NCR

none

none

none

none

Millitech / Pacific

Microwave Millitech / Pacific

Microwave Millitech / Pacific

Microwave

Tektronix

N/A

N/A

N/A

N/A

730

730

730

716

Table 4.3.2: Out of Band Spurious / Harmonic Emissions Test Equipment List											
	Professional Testing, EMI, Inc.										
Test Metho	ni•			surement of Radio-Noise t in the Range of 9 kHz to		O					
FCC Part 15.109 - Code of Federal Regulations Part 47, Subpart B - Unintentional Radiators, In accordance with: Radiated Emissions Limits  5 (15.109)											
Test Date(s)											
Customer:	· ·										
Project Number: 12538-10 Test Technician: Layne Lueckemeyer											
Purchase O	rder #: 81126			Supervisor:	Jason Haley						
Equip. Und	er Test: FMC	W Microwave Rad	ar	Witness' Name:	Vipin Malik / Serg	gei Sharonov					
Harmonic Emissions Test Equipment List											
	Har	monic Emissions Te	st Equipment	List							
Asset#	Har Manufacturer	monic Emissions Te Model		List ment Nomenclature	Serial Number	Calibration Due Date					
Asset#			Equip		Serial Number						
	Manufacturer	Model	<b>Equip</b> S <sub>I</sub>	ment Nomenclature		Date					
ALN-077	Manufacturer Rohde & Schwarz	Model FSP30	Equip S <sub>I</sub> Antenna, Ho	ment Nomenclature	100218	<b>Date</b> 12/22/2012					

Horn, Mixer 40 - 60 GHz

Horn, Mixer 60 - 90 GHz

Horn, Mixer 90 - 110 GHz

Diplexer / Mixer

**Table 4.3.3: Out of Band Spurious Emissions Test Results, 30 MHz to 1 GHz, Horizontal Polarization** 

Measured (MHz)         Distance (Meters)         Direction (Degrees)         Height (Meters)         Function (Meters)         Amplitude (dBμV)         Level (dBμV/m)         (dBμV/m)         (dB)         Result           34.86         10         1         1         Quasi-peak         22.5         10.1         29.5         -19.4         Pass           156.31         10         1         1         Quasi-peak         21.6         10.7         33.0         -22.3         Pass           199.83         10         1         1         Quasi-peak         21.4         12.1         33.0         -20.9         Pass	olarizati	ion									
Voltage Electrical and Electronic Equipment in the Range of 9 kHz to 40 GHz"				Professi	ional Te	sting, E	MI, Inc	•			
Voltage Electrical and Electronic Equipment in the Range of 9 kHz to 40 GHz?  In accordance with:  Radiators, Radiated Emissions Limits  rection:  15.109  Eust Date(s): 6/27/2011	est Metho	·d•									
Radiators, Radiated Emissions Limits    Supervisor:   Houston Radar   EUT Part #:   PD300	est Mictilo										
Sest Date(s): 6/27/2011   EUT Serial #: 1	In accorda	ance with:				_	ns Part 47,	Subpar	rt B -	Unintentio	nal
set Date(s): 6/27/2011  ustomer: Houston Radar  EUT Part #: PD300  Test Technician: Layne Lucckemeyer  urchase Order #: 81126  Supervisor: Jason Haley  quip. Under Test: FMCW Microwave Radar  Witness' Name: Vipin Malik / Sergei Sharonov  Radiated Emissions Test Results Data Sheet - Horizontal Antenna Polarity ≤ IGHz  EUT Line Voltage: 12 VDC  EUT Line Frequency: N/A Hz  EUT Mode of Operation:  Transmit Normal Operation  Transmit Normal Operation  Transmit Normal Operation  Transmit Normal Operation  Transmit Level (dBµV/m) (dBy/m) (dBy/m) (dBy/m) (dBy/m) (dBy/m) (dBy/m) (dBy/m)  156.31 10 1 1 Quasi-peak 22.5 10.1 29.5 -19.4 Pass 199.83 10 1 1 Quasi-peak 21.6 10.7 33.0 -22.3 Pass 199.83 10 1 1 Quasi-peak 21.6 10.7 33.0 -22.3 Pass 199.83 10 1 1 Quasi-peak 21.4 12.1 33.0 -20.9 Pass 566.4 10 1 1 Quasi-peak 26.8 25.0 35.5 -10.5 Pass 993.6 10 1 1 Quasi-peak 26.1 30.1 35.5 -5.4 Pass 993.6 10 1 1 Quasi-peak 26.5 31.8 43.5 -11.7 Pass 10 Meter Radiated Emissions 30-1000Metz Class B Horizontal Flot Project # - 12538-10 Description - FMCW Microwave Radar Project # - 12538-10 Description - FMCW Microwave Radar Project # - 12538-10 Description - FMCW Microwave Radar Project # - 12538-10 Description - FMCW Microwave Radar Project # - 12538-10 Description - FMCW Microwave Radar Project # - 12538-10 Description - FMCW Microwave Radar Project # - 12538-10 Description - FMCW Microwave Radar Project # - 12538-10 Description - FMCW Microwave Radar Project # - 12538-10 Description - FMCW Microwave Radar Project # - 12538-10 Description - FMCW Microwave Radar Project # - 12538-10 Description - FMCW Microwave Radar Project # - 12538-10 Description - FMCW Microwave Radar Project # - 12538-10 Description - FMCW Microwave Radar Project # - 12538-10 Description - FMCW Microwave Radar Project # - 12538-10 Description - FMCW Microwave Radar Project # - 12538-10 Description - FMCW Microwave Radar Project # - 12538-10 Description - FMCW Microwave Radar Project # - 12538-10 Description - FMCW Microwave Radar Project # - 12538-10 Description -	actions			, Radiated E	Emissions Li	mits					
Second   Houston Radar   Furth   Furtion   Test Technician   Layne Lueckemeyer   L		)·				FUT Sorial	I #•	1			
Test Technician: Layne Lueckemeyer   Jason Haley		/				)					
Supervisor: Jason Haley   Guipt Under Test: FMCW Microwave Radar   Witness' Name: Vipin Malik / Sergei Sharonos				· · · · · · · · · · · · · · · · · · ·						kemever	
Radiated Emissions Test Results Data Sheet - Horizontal Antenna Polarity ≤ 1GHz   Page: 1 of											
EUT Line Voltage: 12 VDC   EUT Line Frequency: N/A   Hz	quip. Und	ler Test:	FMCW M	licrowave R	adar	Witness' N	ame:				haronov
EUT Line Voltage: 12 VDC   EUT Line Frequency: N/A   Hz											
Tequency   Test Distance (Meters)   Detector Direction (Degrees)   (Meters)   (Meters)   Detector Height (Meters)   Detector (Meters)   (Met	Radiate	ed Emissions	Test Resul	ts Data Sheet	t - Horizontal	Antenna Po	larity≤1GF	Iz	Pag	ge: 1	of 1
Test   Distance (MHz)   Distance (MHz	EUT L	ine Voltage:		12	VDC	EUT Li	ne Frequenc	y:	<b>N</b> /A	A	Hz
Distance (MHz)   Distance (Meters)   Direction (		EUT N	Mode of Op	eration:			Transm	it Norm	ıal Op	eration	
156.31   10	Measured	Distance	Direction	Height		Amplitude	Level			_	Test Result
199.83 10 1 1 Quasi-peak 21.4 12.1 33.0 -20.9 Pass 566.4 10 1 1 Quasi-peak 26.8 25.0 35.5 -10.5 Pass 841.6 10 1 1 Quasi-peak 26.1 30.1 35.5 -5.4 Pass 993.6 10 1 1 Quasi-peak 26.5 31.8 43.5 -11.7 Pass 10 Meter Radiated Emissions 30-1000MHz Class B Horizontal Plot Project # - 12538-10 Voltage - 12 VDC	34.86	10	1	1	Quasi-peak	22.5	10.1	29.:	5	-19.4	Pass
100	156.31	10	1	1	Quasi-peak	21.6	10.7	33.	0	-22.3	Pass
841.6 10 1 1 Quasi-peak 26.1 30.1 35.5 -5.4 Pass 993.6 10 1 1 Quasi-peak 26.5 31.8 43.5 -11.7 Pass Professional Testing 10 Meter Radiated Emissions 30-1000MHz Class B Horizontal Plot Voltage - 12 VDC	199.83	10	1	1	Quasi-peak				_	-20.9	Pass
PROFESSIONAL  AND A STATE OF THE WARREN AND ASSETT OF THE WARREN AND A			_	-							Pass
Professional Testing 10 Meter Radiated Emissions 30-1000MHz Class B Horizontal Plot  PROFESSIONAL  Company - Houston Radar Model# - PD300 Description - FMCW Microwave Radar Project # - 12538-10 Voltage - 12 VDC		-									
10 Meter Radiated Emissions 30-1000MHz Class B Horizontal Plot Description - FMCW Microwave Radar Project # - 12538-10 Voltage - 12 VDC	993.0	10	1	1	Quasi-peak	20.5	31.8	43	5	-11./	Pass
20.0 10.0M 1.0G		PROFESSIONAL			10 Meter Radiate	ed Emissions		/lodel# - PD Description Project # - 1:	300 - FMCW 2538-10	Microwave Rad	lar
10.0 TOO MILES TO MILES TO TOO MILES TO MILES TO TOO MILES TO MILES	50.0										
200 100M 100M	1										ļ
200 100M 100M	€ 40.0 N										
10.0 10.0M	<b>9</b> 30.0 ₹									la de Albander	
10.0 10.0M	B			11.				Pales	فمسللهم	ALL THE STREET	
100M 1.0G	₹ 20.0			~		a contraction of the contraction	Marithus Committee of the Committee of t	and the same of the same of			
100M 1.0G	10.0			N. m. and and Mark Marketine	Managara de	Hall berger	Maran				
Fraguency (H=)	1										
Operator: Lavne Luckemeyer Frequency (Hz) — Horizontal Data	0 <del> </del> 10.0	DM			100.	ОМ				1.0	bG
09:19:32 A M, Monday, June 27, 2011 — FCC B 30M-1GHz — FCC A 30M-1GHz	-	-	-			cy (Hz)				— FC0	C B 30M-1GHz

**Table 4.3.4: Out of Band Spurious Emissions Test Results, 30 MHz to 1 GHz, Vertical Polarization** 

EUT Line Voltage: 12 VDC   EUT Line Frequency: N/A Hz	Polarizati	ion									
Voltage Electrical and Electronic Equipment in the Range of 9 kHz to 40 GHz"   FCC Part 15.109 - Code of Federal Regulations Part 47, Subpart B - Unintentional Radiators, Radiated Emissions Limits				Profess	sional Te	sting, E	MI, Inc	•			
Voltage Electrical and Electronic Equipment in the Range of 9 kHz to 40 GHz*  In accordance with:  Corpart 15.109  Statistics   Stati	Fost Moths	.d.	ANSI C	63.4–2003: "I	Methods of M	Ieasuremen	t of Radio-	Noise Er	nissions	from L	ow-
Test Housers Direction:    Test Tensions   Test Tensions   Test Tensions	est Metho	ou:									
Radiators, Radiated Emissions Limits	In accord	ance with:				_	ns Part 47,	Subpart	t <b>B</b> - Uni	intentio	nal
Set Date(s): 6/27/2011		unce with.		rs, Radiated	Emissions Li	mits					
Test Distance (MHz)  (Meters)  10  11  11  11  11  12  12  13  10  11  11  11  11  11  11  11  11		`				ELIE C	1 //				
Test Technician: Layne Lueckemeyer urchase Order #: 81126 Supervisor: Jason Haley quip. Under Test: FMCW Microwave Radar Witness' Name: Vipin Malik / Sergei Sharonov Radiated Emissions Test Results Data Sheet - Vertical Antenna Polarity ≤ 1GHz Page: 1 of EUT Line Voltage: 12 VDC EUT Line Frequency: N/A Hz  EUT Mode of Operation: Transmit Normal Operation  Trequency Distance (Meters) Direction (Meters) Punction (Meters) P		5):									
Supervisor:   Jason Haley   Witness' Name:   Vipin Malik   Sergei Sharonov		mhore					-		Lucalzar	22 OX OM	
Radiated Emissions Test Results Data Sheet - Vertical Antenna Polarity ≤ 1GHz   Page: 1 of				U						neyer	
Radiated Emissions Test Results Data Sheet - Vertical Antenna Polarity ≤ IGHz   Page: 1 of				Microwave F	Radar					Sergei S	haronov
EUT Line Voltage: 12	дир опс	201 1 0500	TME	Microwave	tada1	VVIENCSS IV	uiii.	v ipin i	Tank / c	ocigei o	nai ono v
Test   Distance (Meters)   Test   Direction (Meters)   Direction (Met	Radia	ted Emission	ns Test Ro	esults Data Sho	eet - Vertical A	Antenna Pola	arity ≤ 1GHz	z.	Page:	1	of 1
Test   Distance (MHz)   Distance (MHz	EUT I	Line Voltage	:	12	VDC	EUT Li	ne Frequenc	ey:	N/A		Hz
Distance (MHz)   Distance (Meters)   Direction (Degrees)   Height (Meters)   Function   Amplitude (dBμV/m) (dBμV/m) (dB)   Result		EUT N	Mode of C	Operation:			Transm	it Norma	al Opera	tion	
95.583	Frequency Measured (MHz)	Distance	Direction	on Height		Amplitude	Level			_	Test Results
199.83	43.1	10	1	1	Quasi-peak	22.8	9.4	29.5		-20.1	Pass
1	95.583	10	1	1	Quasi-peak	25.7	9.8	33.0	-	-23.2	Pass
841.6 10 1 1 Quasi-peak 26.1 30.1 35.5 -5.4 Pass 993.6 10 1 1 Quasi-peak 26.5 31.8 43.5 -11.7 Pass Professional Testing 10 Meter Radiated Emissions 30-1000MHz Class B Vertical Plot Voltage - 12 VDC	199.83	10	1	1	Quasi-peak	21.4	12.1	33.0		-20.9	Pass
Professional Testing 10 Meter Radiated Emissions 30-1000MHz Class B Vertical Plot  PROFESSIONAL  PROFESSIONAL  PROFESSIONAL  PROFESSIONAL  Company - Houston Radar Model# - PD300 Description - FMCW Microwave Radar Project # - 12538-10 Vokage - 12 VDC	566.4	_	1	1		26.8	25.0				Pass
Professional Testing 10 Meter Radiated Emissions 30-1000MHz Class B Vertical Plot  PROFESSIONAL  Company - Houston Radar Model# - PD300 Description - FMCW Microwave Radar Project # - 12538-10 Voltage - 12 VDC		-									
10 Meter Radiated Emissions 30-1000MHz Class B Vertical Plot Description - FMCW Microwave Radar Project # - 12538-10 Voltage - 12 VDC	993.6	10	1	1	Quasi-peak	26.5	31.8	43.5		-11.7	Pass
50.0 40.0 40.0 40.0 40.0 40.0 40.0 40.0	60.07	PROFESSIONAL T C S T I N G			10 Meter Radiate	ed Emissions	ig ,	Model # - PD3 Description - Project # - 12	800 FMCW Micr 538-10		ar
200 100M 100.0M 1.03											
20.0 10.0 10.0 10.0 10.0 10.0 10.0 10.0	50.0										
20.0 10.0 10.0 10.0 10.0 10.0 10.0 10.0	€ 40.0									$ \Gamma$	
20.0 10.0 10.0 10.0 10.0 10.0 10.0 10.0	Age I									linites	
10.0 100.0M	90.0 1								. La mara de Marales	And in contrast of the last	
10.0 100.0M	<b>5</b> 20.0 €			Hara Halle				- Marian Marian	Ind.		
100M				WHINNIP III	Managhana and a labor	والمتعادية والمتاب والمتاب والمتاب والمتابع	and which the same	-			
Francisco (Un)	10.0				and the first of the state of the stat						
Francisco (Un)	.]										
Operator: Layne Lueckemeyer Frequency (Hz) — Vertical Data			neyer	· • •			· '	•			G tical Data
09:24:43 AM, Monday, June 27, 2011 Transmit — FCC B 30M/1GHz — FCC A 30M/1GHz	-	-	-		Transmit					— FCC	B 30M-1GHz

**Table 4.3.5: Out of Band Spurious Emissions Test Results, 1 GHz to 18 GHz, Horizontal Polarization** 

Polarizat	ion									
			Professi	onal Te	sting, E	MI, Inc	•			
Fest Metho	d:		.4–2003: "M							ow-
t est ivictino	· <b>u</b> ·		ectrical and							,
In accorda	ance with:		15.109 - Coo Radiated E		_	ns Part 47,	Subpai	rt B -	Unintentio	nal
Section:		15.109	Kaulateu E	IIIISSIOIIS LI	IIIItS					
Test Date(s	):	6/27/2011			EUT Serial	l #:	1			
Customer:	/	<b>Houston R</b>	ladar		EUT Part #	<b>#:</b>	PD300	)		
Project Nu		12538-10			Test Techn	ician:			kemeyer	
Purchase C		81126		_	Supervisor		Jason			
Equip. Und	ler Test:	FMCW M	icrowave Ra	adar	Witness' N	ame:	Vipin	Malik	x / Sergei S	naronov
Radiate	ed Emissions	Test Result	s Data Sheet	- Horizontal	Antenna Po	larity > 1GH	Iz	Pag	e: 1	of 1
EUT I	ine Voltage	:	12	VDC	EUT Li	ne Frequenc	<b>y</b> :	<b>N</b> / <i>A</i>	A	Hz
	EUT N	Mode of Ope	eration:			Transm	it Norn	ıal Op	eration	
Frequency Measured (MHz)	Test Distance (Meters)	EUT Direction (Degrees)	Antenna Height (Meters)	Detector Function	Recorded Amplitude (dBµV)	Corrected Level (dBµV/m)	Limit 1 (dBµV		Margin (dB)	Test Results
3801	3	1	1	Average	42.7	13.8	54.	0	-40.1	Pass
4861	3	1	1	Average	43.4	16.6	54.	0	-37.4	Pass
5586	3	1	1	Average	42.6	15.4	54.	_	-38.5	Pass
8367	3	1	1	Average	45.5	23.8	54.	_	-30.2	Pass
12005 15474	3	1	1	Average Average	49.7 47	38.2 35.2	54. 54.		-15.7 -18.8	Pass Pass
	PROFESSIONAL T L S T I N G			rofessio 3 Meter Radiate 1-18GHz Class B	ed Emissions		Company - /lodel # - PE Description Project # - 1 /oltage - 12	0300 1 - FMCW 2538-10	Microwave Rad	
70.0 (Ê) 60.0										
So.o Finds					and the state of the	1	, ~~	V	·//	
	: Layne Lueckem		6.1G	7.8G 9.5 Frequen Transmit		12.9G	14.6G	1111111	— FCC	izontal Data C A 1-18GHz C B 1-18GHz
			1GHz	to 18GHz, H	Horizontal Po	olarity				

Table 4.3.6: Out of Band Spurious Emissions Test Results, 1 GHz to 18 GHz, Vertical Polarization

Polarizati	ion								
		-	Professi	onal Te	sting, E	MI, Inc	•		
Test Metho	d:							sions from L to 40 GHz"	ow-
In accordance with: FCC Part 15.109 - Code of Federal Regulations Part 47, Subpart B - Unintentional Radiators, Radiated Emissions Limits									
Section: 15.109									
Test Date(s	t Date(s): 6/27/2011 EUT Serial #: 1								
<b>Customer:</b>		<b>Houston R</b>	adar		<b>EUT Part</b> #	<b>#:</b>	PD300		
Project Nu	mber:	12538-10			Test Techn	ician:	Layne Lu	eckemeyer	
Purchase O		81126			Supervisor		Jason Hal		
Equip. Und	ler Test:	FMCW Mi	crowave Ra	ndar	Witness' N	ame:	Vipin Ma	lik / Sergei S	haronov
Radiated Emissions Test Results Data Sheet - Vertical Antenna Polarity > 1GHz Page: 1 of 1									
EUT Line Voltage: 12 VDC					EUT Li	ne Frequenc	y:	N/A	Hz
	EUT N	Aode of Ope	ration:			Transm	it Normal (	Operation	
Frequency Measured (MHz)	Test Distance (Meters)	EUT Direction (Degrees)	Antenna Height (Meters)	Detector Function	Recorded Amplitude (dBµV)	Corrected Level (dBµV/m)	Limit Leve (dBµV/m)	"	Test Results
3801	3	1	1	Average	42.7	13.8	54.0	-40.1	Pass
4861	3	1	1	Average	43.4	16.6	54.0	-37.4	Pass
5586	3	1	1	Average	42.6	15.4	54.0	-38.5	Pass
8367	3	1	1	Average	45.5	23.8	54.0	-30.2	Pass
12005	3	1	1	Average	49.7	38.2	54.0	-15.7	Pass
15474	3	1	1	Average	47	35.2	54.0	-18.8	Pass
80.0 7	PROFESSIONAL T E S T I N G			rofessio 3 Meter Radiate 1-18GHz Class		. E	Company - Hous Model# - PD300 Description - FM0 Project # - 12538 Voltage - 12 VDC	CW Microwave Rad	ar
70.0 60.0									
90.0 40.0 40.0						1-L-1-	, ~~		
	: Layne Lueckem	-	6.1G	7.8G 9.5 Frequen Transmit		12.9G	14.6G	— FC	og rtical Data C A 1-18GHz C B 1-18GHz
			1GH	z to 18GHz,	Vertical Pol	arity			

Table 4.3.7: Out of Band Spurious / Harmonic Emissions Test Results, 24 GHz to 100 GHz,

T tt bic iie	.,, Out o	or Duna S	purious	TIMI IIIOII	TC LIMISSI	ons rest	resures, 2	i Giiz to	TOU GIIZ,
			Profess	ional T	esting, I	EMI, Ind	<b>:</b> .		
Test Metho	od:				Aeasuremen				Low-Voltage orated by
In accorda	ance with:	FCC Part	15.209 Code	e of Federal	Regulation	s Part 47			
Section:		15.209							
Test Date(s): 6/27/2011					<b>EUT Seria</b>	l #:	1		
Customer: Houston Radar E						#:	PD300		
Project Number: 12538-10 Test Techn						ician:	Layne Lue	ckemeyer	
Purchase C	)rder #:	81126		Supervisor: Jason Haley					
Equip. Und	der Test:	FMCW M	icrowave Ra	adar	Witness' Name: Vipin Malik / Sergei Sharon				
	Fun	damental Fi	eld Strength	Test Results	Data Sheet		Pa	ge: 1	of 1
EUT I	Line Voltage	:	12	VDC	EUT Li	ne Frequenc	y: N	/A	Hz
	EUT I	Mode of Ope	ration:		Transmit Modulation On				
Frequency Measured (GHz)	Test Distance (Meters)	EUT Direction (Degrees)	Antenna Height (Meters)	Detector Function	Recorded Amplitude (dBµV)	Corrected Level (dBµV/m)	Limit Level (dBµV/m)	Margin (dB)	Antenna Polarization
48.178	0.1	180	1	Peak	53	92.9	97.5	-4.6	Vertical
72.267	0.1	180	1	Peak	47.4	90.8	97.5	-6.7	Vertical
96.356	0.1	180	1	Peak	48.1	94.0	97.5	-3.5	Vertical
48.178	0.1	180	1	Peak	42.9	82.8	97.5	-14.7	Horizontal
72.267	0.1	180	1	Peak	47.4	90.8	97.5	-6.7	Horizontal
96.356	0.1	180	1	Peak	48.1	94.0	97.5	-3.5	Horizontal

**Table 4.3.8 Radiated Emissions Test Setup Photos** 

Test Method:  ANSI C63.4–2003: "Methods of Methods of M	esting, EMI, Inc.  easurement of Radio-Noise Emissions from Low-Voltage int in the Range of 9 kHz to 40 GHz" (incorporated by Regulations Part 47, Subpart B - Unintentional Radiators,  EUT Serial #:  EUT Part #:  PD300  Test Technician:  Layne Lueckemeyer
I est Method:  Electrical and Electronic Equipme FCC Part 15.109 - Code of Federal In accordance with: Radiated Emissions Limits Section: 15.109 Test Date(s): 6/27/2011	nt in the Range of 9 kHz to 40 GHz" (incorporated by Regulations Part 47, Subpart B - Unintentional Radiators,  EUT Serial #: 1  EUT Part #: PD300
In accordance with: Radiated Emissions Limits Section: 15.109 Test Date(s): 6/27/2011	EUT Serial #: 1 EUT Part #: PD300
Section: 15.109 Test Date(s): 6/27/2011	EUT Part #: PD300
Test Date(s): 6/27/2011	EUT Part #: PD300
	EUT Part #: PD300
If 'listomer' Houston Voder	
Project Number: 12538-10 Purchase Order #: 81126	
Purchase Order #: 81126 Equip. Under Test: FMCW Microwave Radar	Supervisor: Jason Haley Witness' Name: Vipin Malik / Sergei Sharonov
Equip. Onder Test. FMC w Microwave Radar	withess Name. Vipin Mank/Sergel Sharonov
Radiated Emissions Photograp	hs Page: 1 of 1
PD300 Front	PD300 Close View
PD300 Rear	PD300 Side

# 5.0 Antenna Requirements

An antenna evaluation was performed on the EUT to determine compliance with FCC sections 15.203, 15.249(b) and RSS-210.

# **5.1** Evaluation Procedure

The design of the EUT antenna was evaluated for conformance to engineering requirements for gain and to prevent substitution of unapproved antennae. Gain of the antenna was assessed by reviewing the antenna manufacturer's data sheet.

#### **5.2** Evaluation Criteria

The antenna design must meet at least one of the following criteria:

- a) Antenna is permanently attached to the unit.
- b) Antenna must use a unique type of connector to attach to the EUT.
- c) Unit must be professionally installed. Installer shall be responsible for verifying that the correct antenna is employed with the unit.

## **5.3** Evaluation Results

The PD300 met the criteria of this rule by virtue of having an internal antenna inaccessible to the user. Therefore, the EUT is compliant.

End	of	Rei	D	or	t

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