1601 North A.W. Grimes Blvd., Suite B
Round Rock, TX 78665
e-mail: info@ptitest.com
(512) 244-3371 Fax: (512) 244-1846

October 8, 2014

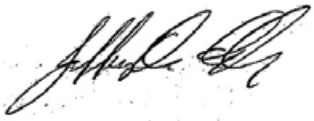
Vipin Malik
Houston Radar, LLC.
13814 Sherburn Manor Drive
Cypress, TX 77429

Dear: Vipin

Thank you for allowing Professional Testing (EMI), Inc. an opportunity to perform testing for Houston Radar, LLC. Enclosed is the Wireless Certification Report for the PD310. This report can be used to demonstrate compliance with the regulatory requirements for wireless devices in North America.

If you have any questions, please contact me.

Sincerely,



Jeffrey A. Lenk
President

Attachment

Project 16296-15

Houston Radar
Model
PD310

Wireless Test Report

Prepared for:

Houston Radar, LLC
13814 Sherburn Manor Drive
Cypress, TX 77429
By

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

October 8, 2014

Reviewed by

Larry Finn
Chief Technical Officer

Written by

Eric Lifsey
Test Engineer

Table of Contents

Revision History

Revision Number	Description	Date
00	Initial draft released	October 8, 2014
01	Revised per internal quality review.	October 8, 2014
02	Revised per client comments and released.	October 8, 2014

Compliance Certificate

Applicant	Device & Test Identification	
Houston Radar, LLC (Vipin Malik) 13814 Sherburn Manor Drive Cypress, TX 77429 Certificate Date: October 8, 2014	FCC ID: Industry Canada ID: Model(s): Laboratory Project ID:	TIAPD310 Canada 310 PD310 16296-15

The EUT(s) listed above were tested utilizing the following documents and found to be in compliance with the required criteria.

Standard	Reference	Detail
FCC 47 CFR Part 15 C	15.249, 15.209, 15.205, 15.212(a)(1)	Radiated Power Bandwidth Spurious Emissions Modular Construction
IC RSS-310 Issue 3	3.10	Radiated Power Bandwidth Spurious Emissions
IC RSS-Gen	3.2.2	Modular Construction

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

Eric Lifsey
EMC Engineer

This report has been reviewed and accepted by the Applicant**.** The undersigned is responsible for ensuring that this device will continue to comply with the rules listed above.

_____
Representative of Applicant

1.0 Introduction

1.1 Scope

Demonstrate conformance to the intentional wireless radiator requirements of North America.

1.2 EUT Description

The EUT is a linear frequency modulated (FMCW) 24 GHz K-band speed radar. It is powered by 12V DC nominal voltage which is typically provided by a battery. The emission consists of FM modulated waves centered on the 24 GHz band.

Table 1.2: EUT Essential Information

Manufacturer & Model	Identification	Description
Houston Radar, LLC: PD310	FCC ID: TIAPD310 Canada 310	24 GHz Linear FMCW Radar Module

1.3 EUT Operation

The EUT was operated in continuous transmit mode at maximum power with modulation.

There is no separate receive mode as this technology must transmit to be able to receive and does so on the same antenna in full duplex fashion.

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-GEN and is subsequently confirmed by laboratory accreditation (NVLAP). Site 45 is located at 11400 Burnett Rd., Austin, Texas, 78758. The main office is located at 1601 N. A.W. Grimes Blvd., Suite B, Round Rock, Texas, 78665.

1.5 Applicable Documents and Clauses

Table 1.5.1: Applicable Documents	
Document	**Title**
47 CFR	Part 15 – Radio Frequency Devices Subpart C -Intentional Radiators
RSS-310 Issue 3	Licence-exempt Radio Apparatus (All Frequency Bands): Category II Equipment
RSS-Gen Issue 3	General Requirements and Information for the Certification of Radio Apparatus
ANSI C63.4 2009	American National Standard for Methods of Measurement of Radio-Noise Emissions from Low Voltage Electrical and Electronic Equipment

Table 1.5.2: Applicable Clauses		
Parameter	**FCC Part 15 Rule Paragraphs**	**IC RSS References**
Transmitter Characteristics	15.249	RSS 310 3.10, RSS-Gen
Spurious Radiated Power	15.249, 15.209, 15.205	RSS 310 3.10
Antenna Requirement	15.203	RSS-Gen
Mains Conducted Emissions	15.207, 15.107	RSS-Gen
Modular Construction	15.212(a)(1)	RSS-Gen 3.2.2

2.0 Fundamental Emission Measurements

2.1 Test Procedure

For measurements of the fundamental signal, the EUT was positioned on a motorized turntable at a distance of 1 meter as measured from the closest point of the EUT and to the measurement antenna.

2.2 Test Criteria

Section Reference	Parameter	Date(s)
15.249 RSS-310 3.10	Radiated Field Strength, 250 mV/m @ 3 m Restated as 107.96 dBµV/m @ 3 m Or 117.5 dBµV/m @ 1 m	2014-09-25

2.3 Test Results

Table 2.3.1: Field Strength of Fundamental, 1 Meter Measurement Distance

Frequency GHz	Antenna Polarity	Antenna Height meters	Corrected Level* (Measured Peak Level) dBµV/m
24.157	H	1	115.1
24.129	V	1	94.7

*Resolution bandwidth 1 MHz, video bandwidth 3 MHz, using peak detection.

Table 2.3.2: Limit, Corrected Maximum Power and Margin

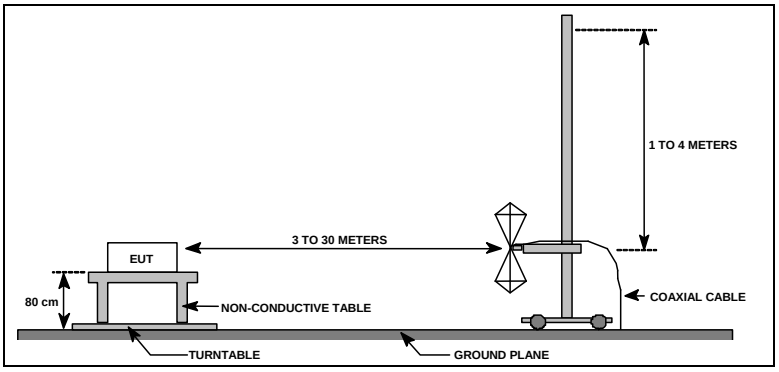
Limit at 1 meter dBµV/m	Maximum Corrected Level (Measured Peak Level) dBµV/m	Margin dB
117.5	115.1	-2.4

The EUT satisfies the criteria.

3.0 Radiated Spurious Emissions

3.1 Test Procedure

The EUT was placed on a non-conductive table 0.8 meters above the ground plane. The table was centered on a motorized turntable which allows 360 degree rotation.



Test Site Diagram

3.2 Test Criteria

The 3 m limits were extrapolated according to measurement distances in the table below.

Table 3.2.1 FCC/IC Emission Limits			
Frequency MHz	Test Distance (Meters)	Field Strength Limit (µV/m @ 3m)	(dBµV/m @ Test Distance)
30 to 88	10	100	29.5
88 to 216	10	150	33.0
216 to 960	10	200	35.5
960 to 1000	10	500	43.5
1000 to 18000	3	500	54.0
18000 to 26500	1	500	63.6
26500 to 100000	.1	500	83.5

Table 3.2.2 IC RSS-310 Clause 3.10 Emission Limits
Emissions radiated outside the specified frequency band shall be attenuated by at least 50 dB below the level of the fundamental or to the general field strength limits listed in RSS-Gen, whichever is the less stringent.

3.3 Test Results

Emissions were measured from 25 MHz to 100 GHz. Peak detection was used during the test for the fundamental and harmonics. Quasi-Peak detection was used for spurious emissions below 1 GHz. The correct signal level was determined by the following formula:

Corrected Level = Measured Level + Antenna Factor + Cable Loss – Amplifier Gain (if any)

The EUT satisfied the criteria.

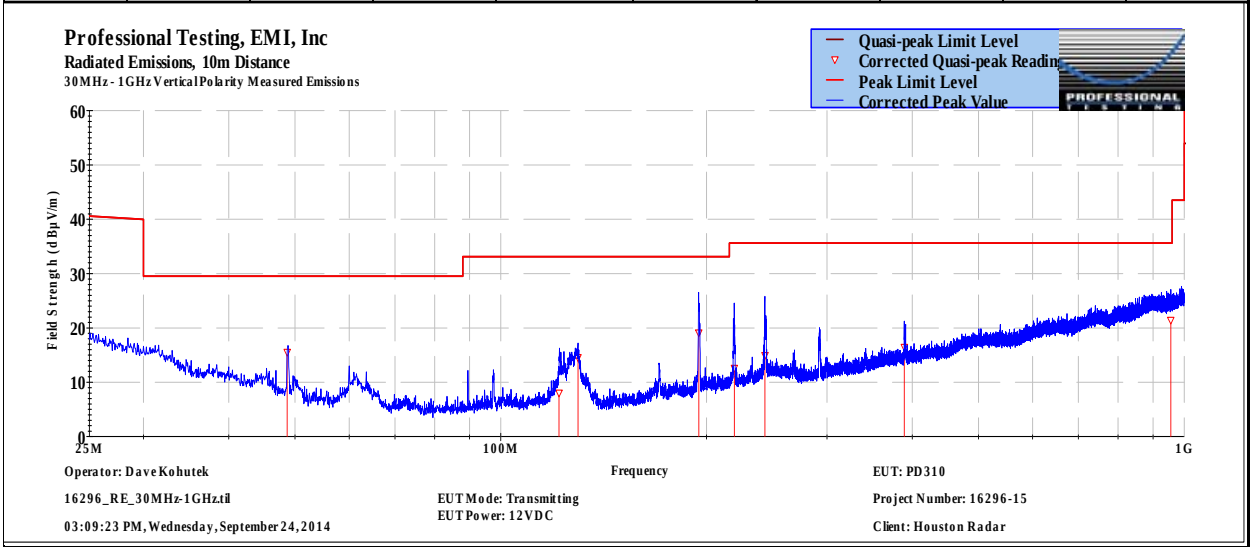
3.3.1 Emissions 25* MHz to 1 GHz

Professional Testing, EMI, Inc.			
Test Method:	ANSI C63.4–2003: "Methods of Measurement of Radio-Noise Emissions from Low-Voltage Electrical and Electronic Equipment in the Range of 9 kHz to 40 GHz" (incorporated by reference, see §15.38).		
In accordance with:	FCC Part 15.209 - Code of Federal Regulations Part 47, Subpart C - Intentional Radiators, Radiated Emissions Limits		
Section:	15.209		
Test Date(s):	9/24/2014	**EUT Serial #:**	000016cd2a50
Customer:	Houston Radar	**EUT Part #:**	None
Project Number:	16296-15	**Test Technician:**	Dave Kohutek
Purchase Order #:	81524	**Supervisor:**	Lisa Arndt
Equip. Under Test:	PD310	**Witness' Name:**	Vipin Malik

Radiated Emissions Test Results Data Sheet — **Page: 1 of 1**

EUT Line Voltage:	12 VDC	**EUT Power Frequency:**	N/A	N/A	
Antenna Orientation:	Vertical	**Frequency Range:**	30MHz to 1GHz		
EUT Mode of Operation:		Transmitting			

Frequency Measured (MHz)	Test Distance (Meters)	EUT Direction (Degrees)	Antenna Height (Meters)	Detector Function	Recorded Amplitude (dBµV)	Corrected Level (dBµV/m)	Limit Level (dBµV/m)	Margin (dB)	Test Results
48.6946	10	215	1.66	Quasi-peak	35.3	15.547	29.5	-14.0	Pass
121.673	10	146	2.29	Quasi-peak	29	8.023	33.1	-25.1	Pass
129.701	10	154	1.54	Quasi-peak	35.6	14.542	33.1	-18.6	Pass
194.853	10	114	1.47	Quasi-peak	36.4	19.093	33.1	-14.0	Pass
219.665	10	27	1.54	Quasi-peak	28.4	12.586	35.6	-23.0	Pass
243.532	10	102	3.3	Quasi-peak	28.9	14.939	35.6	-20.7	Pass
389.393	10	224	1.3	Quasi-peak	27.4	16.43	35.6	-19.2	Pass
955.826	10	242	1.45	Quasi-peak	21.1	21.437	35.6	-14.2	Pass



≤ 1GHz Vertical Antenna Polarity Measured Emissions

*25 to 30 MHz was measured as an overlap with an ETSI standard.

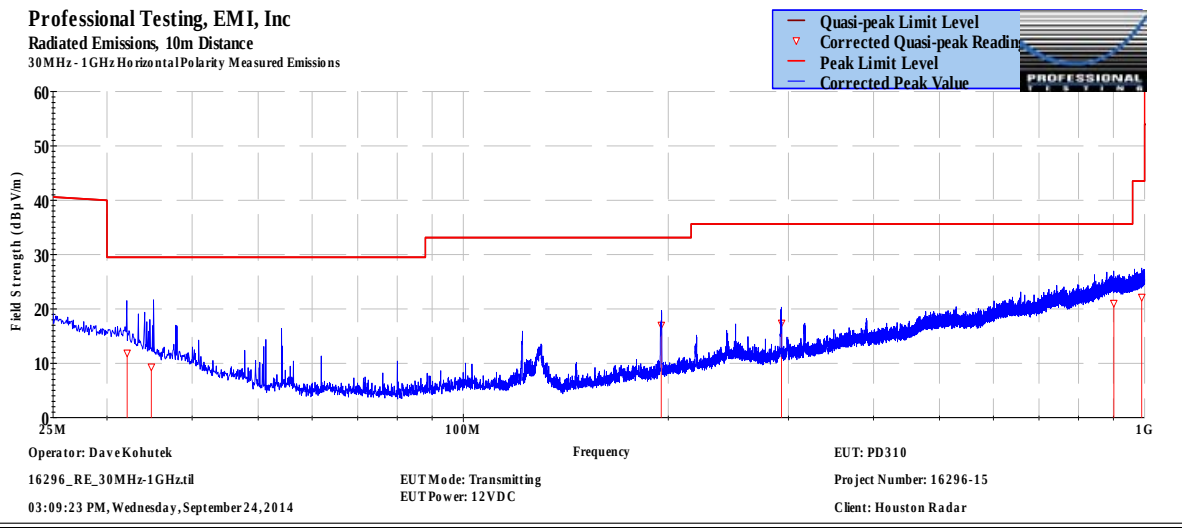
Professional Testing, EMI, Inc.

Test Method:	ANSI C63.4–2003: "Methods of Measurement of Radio-Noise Emissions from Low-Voltage Electrical and Electronic Equipment in the Range of 9 kHz to 40 GHz" (incorporated by reference, see §15.38).		
In accordance with:	FCC Part 15.209 - Code of Federal Regulations Part 47, Subpart C - Intentional Radiators, Radiated Emissions Limits		
Section:	15.209		
Test Date(s):	9/24/2014	**EUT Serial #:**	000016cd2a50
Customer:	Houston Radar	**EUT Part #:**	None
Project Number:	16296-15	**Test Technician:**	Dave Kohutek
Purchase Order #:	81524	**Supervisor:**	Lisa Arndt
Equip. Under Test:	PD310	**Witness' Name:**	Vipin Malik

Radiated Emissions Test Results Data Sheet — **Page: 1 of 1**

EUT Line Voltage:	12 VDC	**EUT Power Frequency:**	N/A N/A
Antenna Orientation:	Horizontal	**Frequency Range:**	30MHz to 1GHz
EUT Mode of Operation:		Transmitting	

Frequency Measured (MHz)	Test Distance (Meters)	EUT Direction (Degrees)	Antenna Height (Meters)	Detector Function	Recorded Amplitude (dBµV)	Corrected Level (dBµV/m)	Limit Level (dBµV/m)	Margin (dB)	Test Results
32.1108	10	27	2.11	Quasi-peak	24.1	11.88	29.5	-17.6	Pass
34.8546	10	47	3.62	Quasi-peak	23	9.33	29.5	-20.2	Pass
195.241	10	46	2.13	Quasi-peak	34.3	17.026	33.1	-16.1	Pass
293.237	10	83	3.68	Quasi-peak	31	17.394	35.6	-18.2	Pass
901.152	10	68	1.34	Quasi-peak	21.3	21.065	35.6	-14.5	Pass
990.53	10	67	3.77	Quasi-peak	21.1	22.169	43.5	-21.3	Pass



≤ 1GHz Horizontal Antenna Polarity Measured Emissions

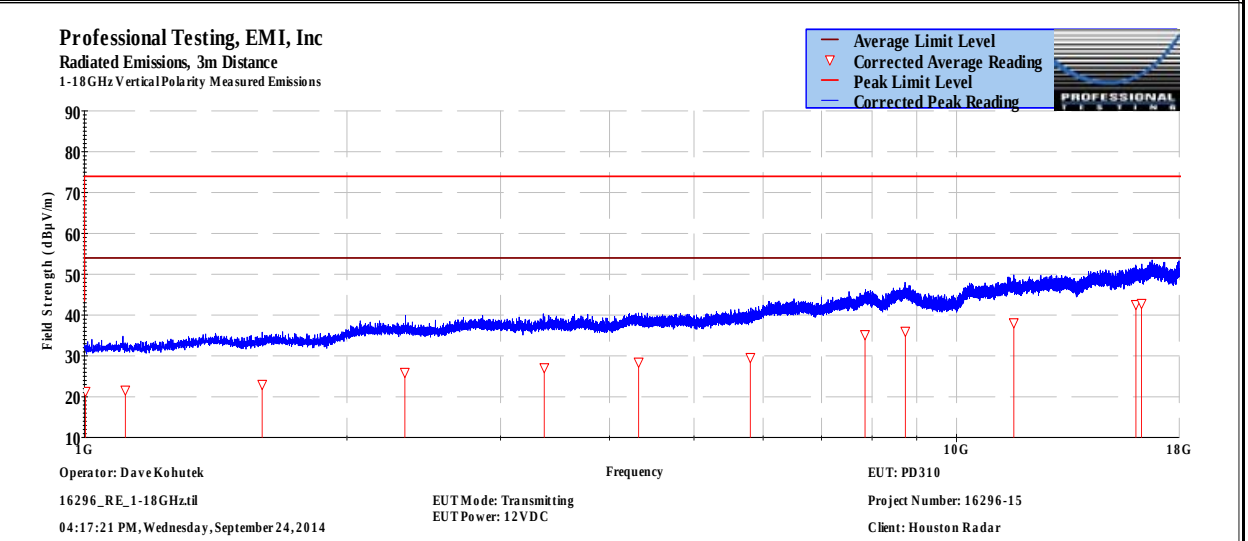
3.3.2 Emissions 1 GHz to 18 GHz

Professional Testing, EMI, Inc.			
Test Method:	ANSI C63.4–2003: "Methods of Measurement of Radio-Noise Emissions from Low-Voltage Electrical and Electronic Equipment in the Range of 9 kHz to 40 GHz" (incorporated by reference, see §15.38).		
In accordance with:	FCC Part 15.209 - Code of Federal Regulations Part 47, Subpart C - Intentional Radiators, Radiated Emissions Limits		
Section:	15.209		
Test Date(s):	9/24/2014	**EUT Serial #:**	000016cd2a50
Customer:	Houston Radar	**EUT Part #:**	None
Project Number:	16296-15	**Test Technician:**	Dave Kohutek
Purchase Order #:	81524	**Supervisor:**	Lisa Arndt
Equip. Under Test:	PD310	**Witness' Name:**	Vipin Malik

Radiated Emissions Test Results Data Sheet — **Page: 1 of 1**

EUT Line Voltage:	12 VDC		**EUT Power Frequency:**	N/A	N/A
Antenna Orientation:	Vertical		**Frequency Range:**	Above 1GHz	
EUT Mode of Operation:	Transmitting				

Frequency Measured (MHz)	Test Distance (Meters)	EUT Direction (Degrees)	Antenna Height (Meters)	Detector Function	Recorded Amplitude (dBµV)	Corrected Level (dBµV/m)	Limit Level (dBµV/m)	Margin (dB)	Test Results
1003.28	3	254	1	Average	35	21.346	54.0	-32.6	Pass
1114.34	3	286	1	Average	34.7	21.658	54.0	-32.3	Pass
1599.2	3	311	1	Average	35.2	23.046	54.0	-30.9	Pass
2330.17	3	318	1	Average	34.9	25.964	54.0	-28.0	Pass
3367.24	3	88	1	Average	34.7	27.138	54.0	-26.8	Pass
4320.38	3	71	1	Average	33.6	28.478	54.0	-25.5	Pass
5800.77	3	47	1	Average	31	29.63	54.0	-24.3	Pass
7852.17	3	247	1	Average	28.5	35.22	54.0	-18.7	Pass
8732.59	3	173	1	Average	27.6	36.07	54.0	-17.9	Pass
11631.5	3	248	1	Average	27.4	38.132	54.0	-15.8	Pass
16050.8	3	215	1	Average	27.5	42.613	54.0	-11.3	Pass
16297	3	78	1	Average	27.6	42.869	54.0	-11.1	Pass



> 1GHz Vertical Antenna Polarity Measured Emissions

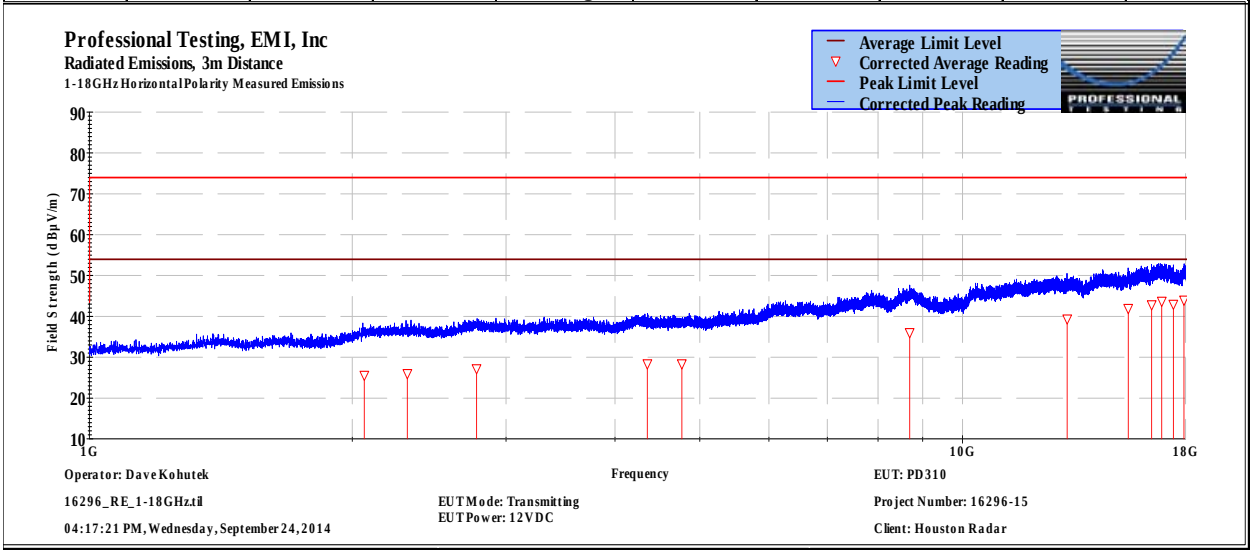
Professional Testing, EMI, Inc.

Test Method:	ANSI C63.4–2003: "Methods of Measurement of Radio-Noise Emissions from Low-Voltage Electrical and Electronic Equipment in the Range of 9 kHz to 40 GHz" (incorporated by reference, see §15.38).		
In accordance with:	FCC Part 15.209 - Code of Federal Regulations Part 47, Subpart C - Intentional Radiators, Radiated Emissions Limits		
Section:	15.209		
Test Date(s):	9/24/2014	**EUT Serial #:**	000016cd2a50
Customer:	Houston Radar	**EUT Part #:**	None
Project Number:	16296-15	**Test Technician:**	Dave Kohutek
Purchase Order #:	81524	**Supervisor:**	Lisa Arndt
Equip. Under Test:	PD310	**Witness' Name:**	Vipin Malik

Radiated Emissions Test Results Data Sheet — **Page: 1 of 1**

EUT Line Voltage:	12 VDC	**EUT Power Frequency:**	N/A N/A
Antenna Orientation:	Horizontal	**Frequency Range:**	Above 1GHz
EUT Mode of Operation:		Transmitting	

Frequency Measured (MHz)	Test Distance (Meters)	EUT Direction (Degrees)	Antenna Height (Meters)	Detector Function	Recorded Amplitude (dBµV)	Corrected Level (dBµV/m)	Limit Level (dBµV/m)	Margin (dB)	Test Results
2064.88	3	303	1	Average	35.3	25.588	54.0	-28.4	Pass
2312.98	3	20	1	Average	34.9	25.999	54.0	-28.0	Pass
2775.49	3	264	1	Average	34.8	27.201	54.0	-26.8	Pass
4355.58	3	126	1	Average	33.5	28.398	54.0	-25.6	Pass
4769.81	3	230	1	Average	33.1	28.401	54.0	-25.6	Pass
8698.85	3	224	1	Average	27.6	36.039	54.0	-17.9	Pass
13175.4	3	120	1	Average	27.7	39.373	54.0	-14.6	Pass
15477.2	3	129	1	Average	27.9	41.955	54.0	-12.0	Pass
16464.5	3	198	1	Average	27.2	42.824	54.0	-11.1	Pass
16909.2	3	160	1	Average	27.5	43.729	54.0	-10.2	Pass
17434.3	3	269	1	Average	26.8	42.982	54.0	-11.0	Pass
17930.8	3	87	1	Average	26.8	43.985	54.0	-10.0	Pass



> 1GHz Horizontal Antenna Polarity Measured Emissions

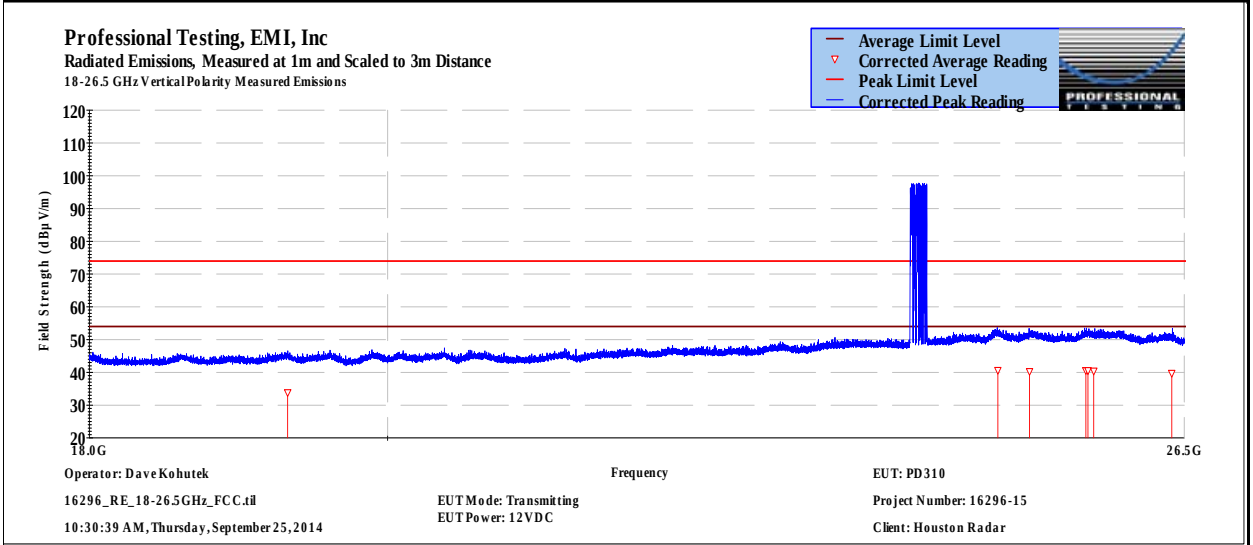
3.3.3 Emissions 18 GHz to 26.5 GHz

For this measurement the receive antenna was fixed in position on the spectrum analyzer. The EUT was rotated with the motorized turntable.

Professional Testing, EMI, Inc.			
Test Method:	CISPR 16-1-4:2004, Specification for radio disturbance and immunity measuring apparatus and methods – Part 1-4: Radio disturbance and immunity measuring apparatus – Ancillary equipment – Radiated disturbances		
In accordance with:	KN22:2009 Information technology equipment — Radio disturbance characteristics — Limits and methods of measurement		
Section:	Section 10 - Method of measurement of radiated disturbance		
Test Date(s):	9/24/2014	EUT Serial #:	000016cd2a50
Customer:	Houston Radar	EUT Part #:	None
Project Number:	16296-15	Test Technician:	Dave Kohutek
Purchase Order #:	81524	Supervisor:	Lisa Arndt
Equip. Under Test:	PD310	Witness' Name:	Vipin Malik

Radiated Emissions Test Results Data Sheet			Page:	1	of	1
EUT Line Voltage:	12	VDC	EUT Power Frequency:	N/A	N/A	
Antenna Orientation:	Vertical		Frequency Range:	Above 1GHz		
EUT Mode of Operation:			Transmitting			

Frequency Measured (MHz)	Test Distance (Meters)	EUT Direction (Degrees)	Antenna Height (Meters)	Detector Function	Recorded Amplitude (dBµV)	Corrected Level (dBµV/m)	Limit Level (dBµV/m)	Margin (dB)	Test Results
19306.2	3	96	1	Average	37.7	33.811	54.0	-20.2	Pass
24811.2	3	243	1	Average	40.3	40.618	54.0	-13.4	Pass
25090.5	3	329	1	Average	39.9	40.282	54.0	-13.7	Pass
25594.5	3	189	1	Average	40.2	40.56	54.0	-13.4	Pass
25614.7	3	227	1	Average	40.1	40.547	54.0	-13.5	Pass
25666.2	3	169	1	Average	39.9	40.388	54.0	-13.6	Pass
26383.7	3	257	1	Average	39.2	39.693	54.0	-14.3	Pass



> 1GHz Vertical Antenna Polarity Measured Emissions

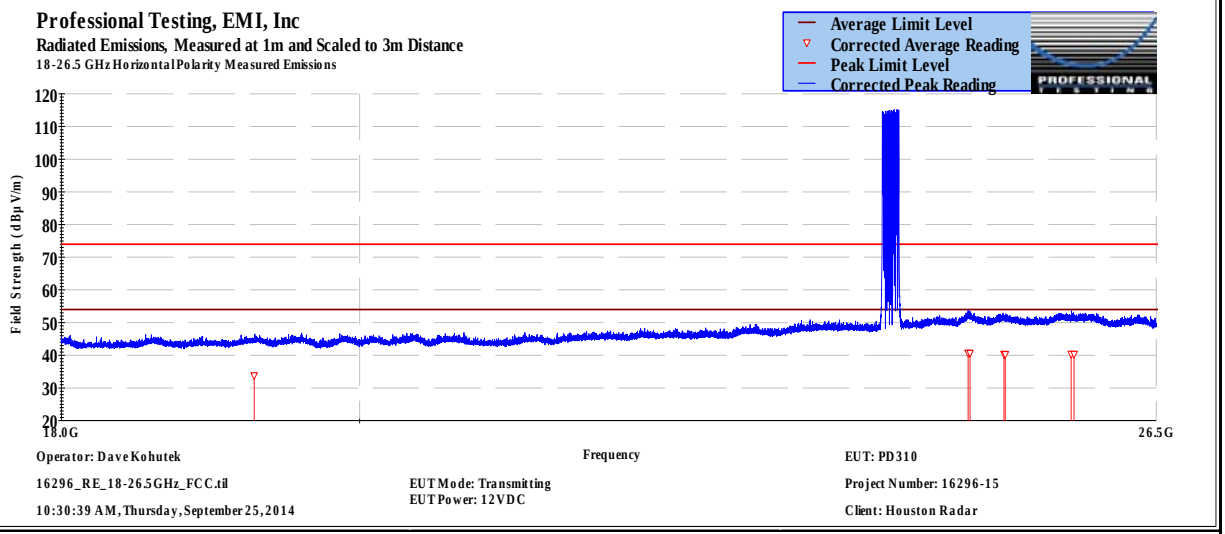
Professional Testing, EMI, Inc.

Test Method:	CISPR 16-1-4:2004, Specification for radio disturbance and immunity measuring apparatus and methods – Part 1-4: Radio disturbance and immunity measuring apparatus – Ancillary equipment – Radiated disturbances		
In accordance with:	KN22:2009 Information technology equipment — Radio disturbance characteristics — Limits and methods of measurement		
Section:	Section 10 - Method of measurement of radiated disturbance		
Test Date(s):	9/24/2014	**EUT Serial #:**	000016cd2a50
Customer:	Houston Radar	**EUT Part #:**	None
Project Number:	16296-15	**Test Technician:**	Dave Kohutek
Purchase Order #:	81524	**Supervisor:**	Lisa Arndt
Equip. Under Test:	PD310	**Witness' Name:**	Vipin Malik

Radiated Emissions Test Results Data Sheet — **Page: 1 of 1**

EUT Line Voltage:	12 VDC	**EUT Power Frequency:**	N/A N/A
Antenna Orientation:	Horizontal	**Frequency Range:**	Above 1GHz
EUT Mode of Operation:		Transmitting	

Frequency Measured (MHz)	Test Distance (Meters)	EUT Direction (Degrees)	Antenna Height (Meters)	Detector Function	Recorded Amplitude (dBµV)	Corrected Level (dBµV/m)	Limit Level (dBµV/m)	Margin (dB)	Test Results
19268.6	3	277	1	Average	37.7	33.793	54.0	-20.2	Pass
24795	3	181	1	Average	40.3	40.693	54.0	-13.3	Pass
24812.9	3	93	1	Average	40.3	40.63	54.0	-13.4	Pass
25112.1	3	191	1	Average	40	40.314	54.0	-13.7	Pass
25123.8	3	304	1	Average	40.1	40.262	54.0	-13.7	Pass
25715.5	3	105	1	Average	39.8	40.316	54.0	-13.7	Pass
25741.5	3	21	1	Average	39.8	40.31	54.0	-13.7	Pass



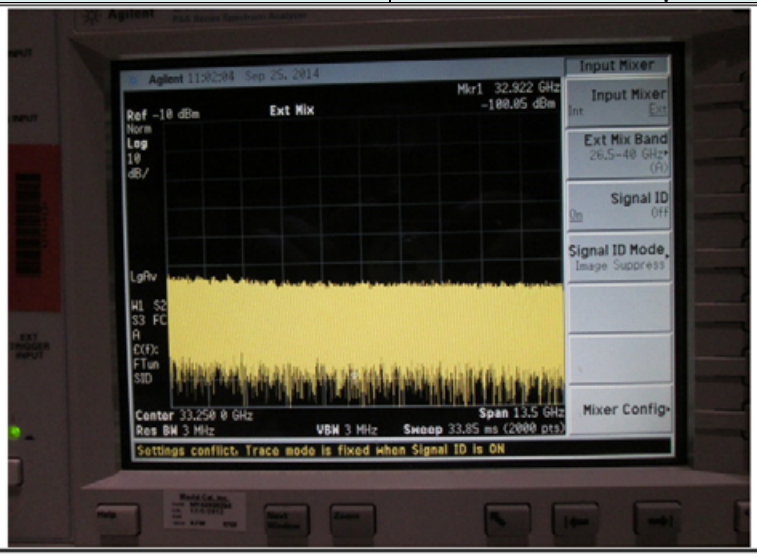
> 1GHz Horizontal Antenna Polarity Measured Emissions

3.3.4 Emissions 26.5 GHz to 100 GHz

For this measurement the receive antenna was manually brought to within 10 cm of the EUT and a search for emissions of both polarities was conducted. The analyzer Signal Ident feature was used to identify valid signals; the display was recorded photographically.

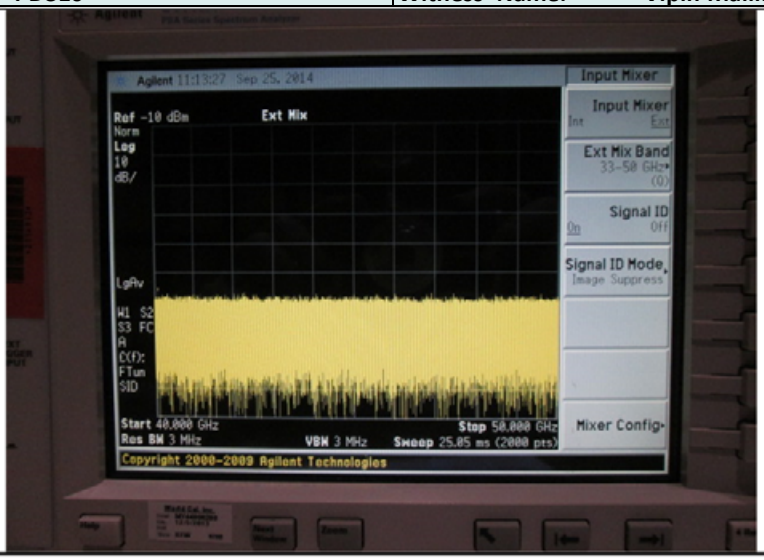
No signals were detected above the fundamental band.

Professional Testing, EMI, Inc.			
Test Method:	**ANSI C63.4–2003: "Methods of Measurement of Radio-Noise Emissions from Low-Voltage Electrical and Electronic Equipment in the Range of 9 kHz to 40 GHz" (incorporated by reference, see §15.38).**		
In accordance with:	**FCC Part 15.209 - Code of Federal Regulations Part 47, Subpart C - Intentional Radiators, Radiated Emissions Limits**		
Section:	**15.209**		
Test Date(s):	**9/24/2014**	**EUT Serial #:**	**000016cd2a50**
Customer:	**Houston Radar**	**EUT Part #:**	**None**
Project Number:	**16296-15**	**Test Technician:**	**Dave Kohutek**
Purchase Order #:	**81524**	**Supervisor:**	**Lisa Arndt**
Equip. Under Test:	**PD310**	**Witness' Name:**	**Vipin Malik**



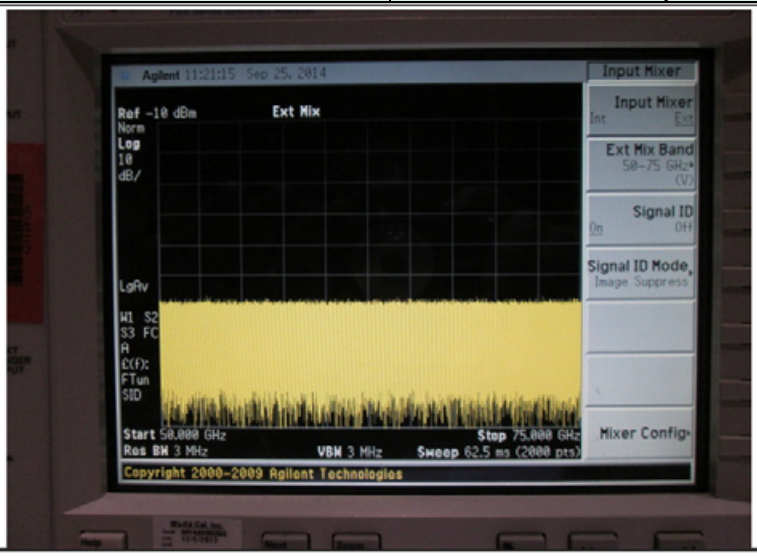
26.5GHz to 40GHz, Composite V & H

Professional Testing, EMI, Inc.			
Test Method:	**ANSI C63.4–2003: "Methods of Measurement of Radio-Noise Emissions from Low-Voltage Electrical and Electronic Equipment in the Range of 9 kHz to 40 GHz" (incorporated by reference, see §15.38).**		
In accordance with:	**FCC Part 15.209 - Code of Federal Regulations Part 47, Subpart C - Intentional Radiators, Radiated Emissions Limits**		
Section:	**15.209**		
Test Date(s):	**9/24/2014**	**EUT Serial #:**	**000016cd2a50**
Customer:	**Houston Radar**	**EUT Part #:**	**None**
Project Number:	**16296-15**	**Test Technician:**	**Dave Kohutek**
Purchase Order #:	**81524**	**Supervisor:**	**Lisa Arndt**
Equip. Under Test:	**PD310**	**Witness' Name:**	**Vipin Malik**



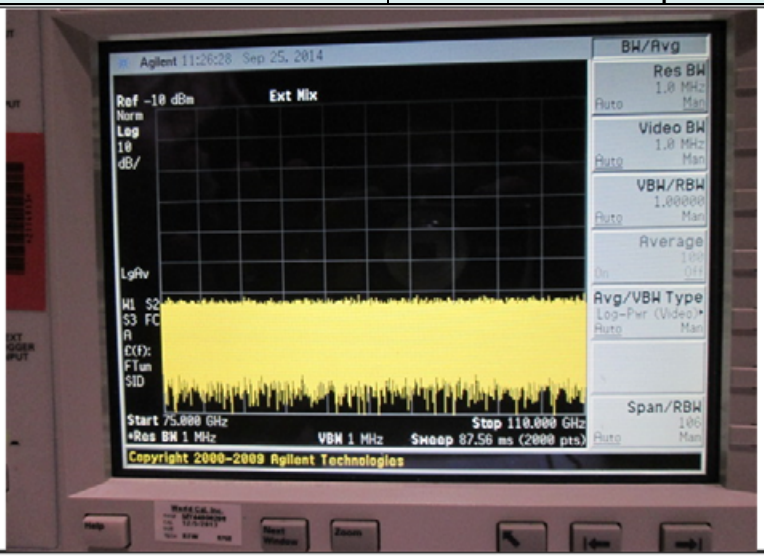
40GHz to 50GHz, Composite of V & H

Professional Testing, EMI, Inc.			
Test Method:	**ANSI C63.4–2003: "Methods of Measurement of Radio-Noise Emissions from Low-Voltage Electrical and Electronic Equipment in the Range of 9 kHz to 40 GHz" (incorporated by reference, see §15.38).**		
In accordance with:	**FCC Part 15.209 - Code of Federal Regulations Part 47, Subpart C - Intentional Radiators, Radiated Emissions Limits**		
Section:	**15.209**		
Test Date(s):	**9/24/2014**	**EUT Serial #:**	**000016cd2a50**
Customer:	**Houston Radar**	**EUT Part #:**	**None**
Project Number:	**16296-15**	**Test Technician:**	**Dave Kohutek**
Purchase Order #:	**81524**	**Supervisor:**	**Lisa Arndt**
Equip. Under Test:	**PD310**	**Witness' Name:**	**Vipin Malik**



50GHz to 75GHz, Composite of V & H

Professional Testing, EMI, Inc.			
Test Method:	**ANSI C63.4–2003: "Methods of Measurement of Radio-Noise Emissions from Low-Voltage Electrical and Electronic Equipment in the Range of 9 kHz to 40 GHz" (incorporated by reference, see §15.38).**		
In accordance with:	**FCC Part 15.209 - Code of Federal Regulations Part 47, Subpart C - Intentional Radiators, Radiated Emissions Limits**		
Section:	**15.209**		
Test Date(s):	**9/24/2014**	**EUT Serial #:**	**000016cd2a50**
Customer:	**Houston Radar**	**EUT Part #:**	**None**
Project Number:	**16296-15**	**Test Technician:**	**Dave Kohutek**
Purchase Order #:	**81524**	**Supervisor:**	**Lisa Arndt**
Equip. Under Test:	**PD310**	**Witness' Name:**	**Vipin Malik**

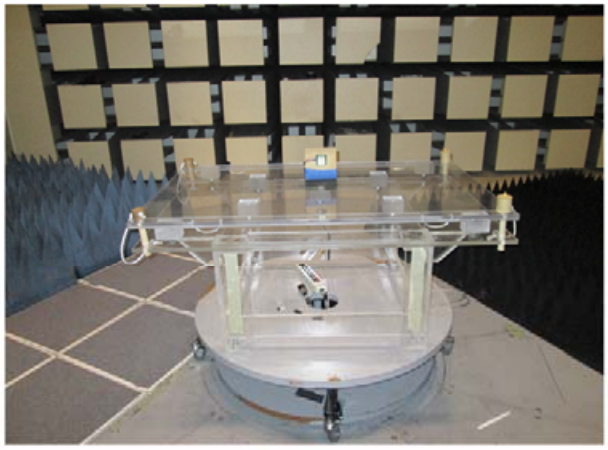


75GHz to 110GHz, Composite of V & H

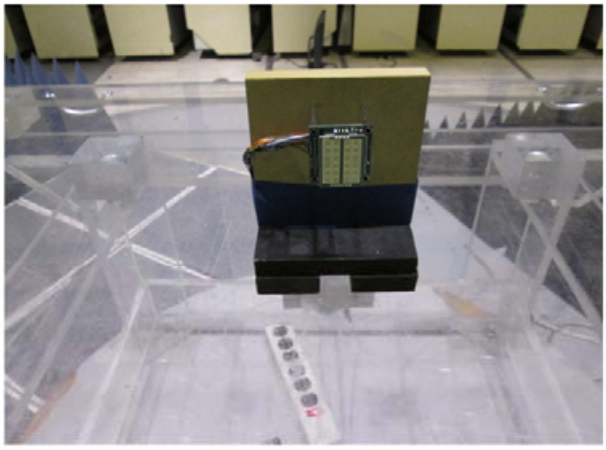
3.4 Setup Photographs

Professional Testing, EMI, Inc.			
Test Method:	ANSI C63.4–2003: "Methods of Measurement of Radio-Noise Emissions from Low-Voltage Electrical and Electronic Equipment in the Range of 9 kHz to 40 GHz" (incorporated by reference,		
In accordance with:	FCC Part 15.209 - Code of Federal Regulations Part 47, Subpart C - Intentional Radiators, Radiated Emissions Limits		
Section:	15.209		
Test Date(s):	9/24/2014	EUT Serial #:	000016cd2a50
Customer:	Houston Radar	EUT Part #:	None
Project Number:	16296-15	Test Technician:	Dave Kohutek
Purchase Order #:	81524	Supervisor:	Lisa Arndt
Equip. Under Test:	PD310	Witness' Name:	Vipin Malik

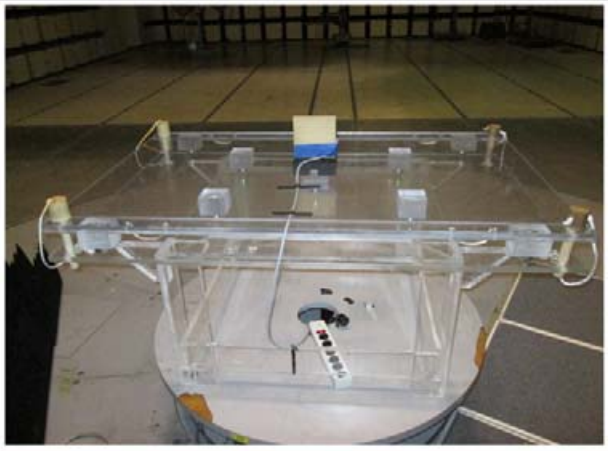
Radiated Emissions Photographs Page: 1 of 2



Front View



EUT Front Close Up View



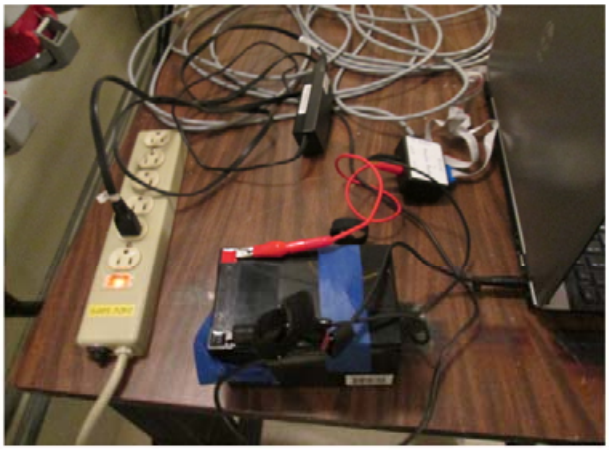
Rear View

Support Computer View

Professional Testing, EMI, Inc.

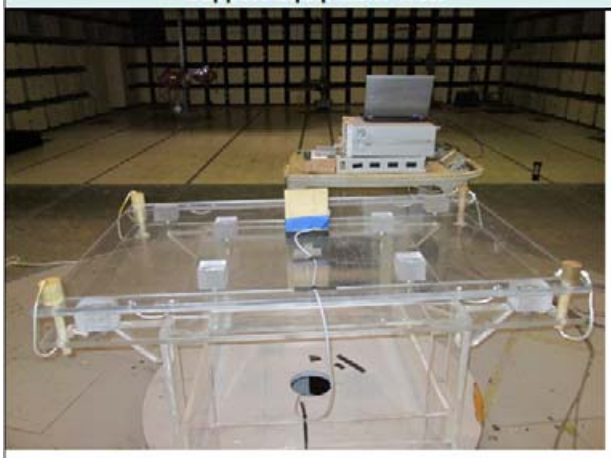
Test Method:	ANSI C63.4–2003: "Methods of Measurement of Radio-Noise Emissions from Low-Voltage Electrical and Electronic Equipment in the Range of 9 kHz to 40 GHz" (incorporated by reference,		
In accordance with:	FCC Part 15.209 - Code of Federal Regulations Part 47, Subpart C - Intentional Radiators, Radiated Emissions Limits		
Section:	15.209		
Test Date(s):	9/24/2014	EUT Serial #:	000016cd2a50
Customer:	Houston Radar	EUT Part #:	None
Project Number:	16296-15	Test Technician:	Dave Kohutek
Purchase Order #:	81524	Supervisor:	Lisa Arndt
Equip. Under Test:	PD310	Witness' Name:	Vipin Malik

Radiated Emissions Photographs Page: 2 of 4

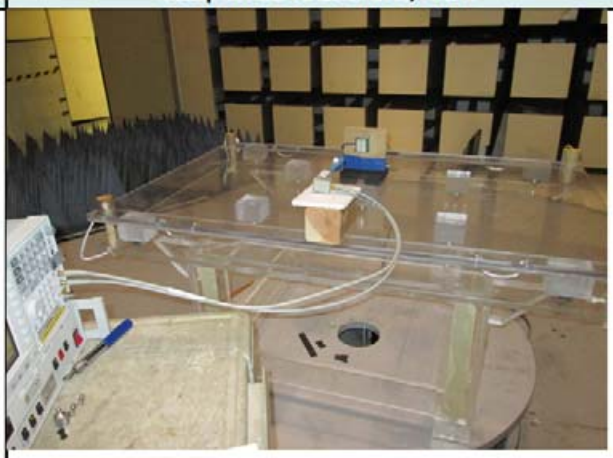


Support Equipment View

Setup for 18 to 26.5 GHz, Front



Setup for 18 to 26.5 GHz, Back

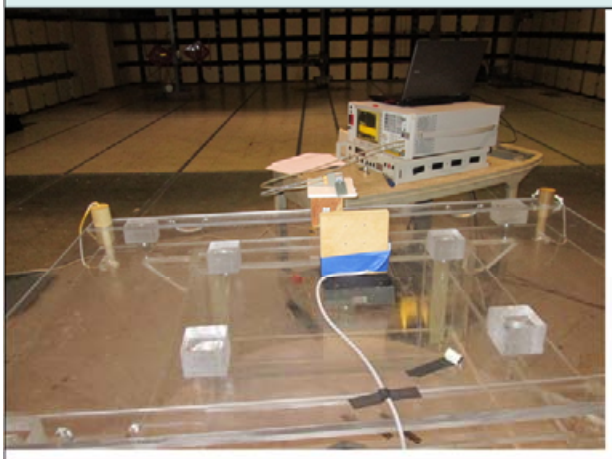


Setup for 26.5 to 40 GHz, Front

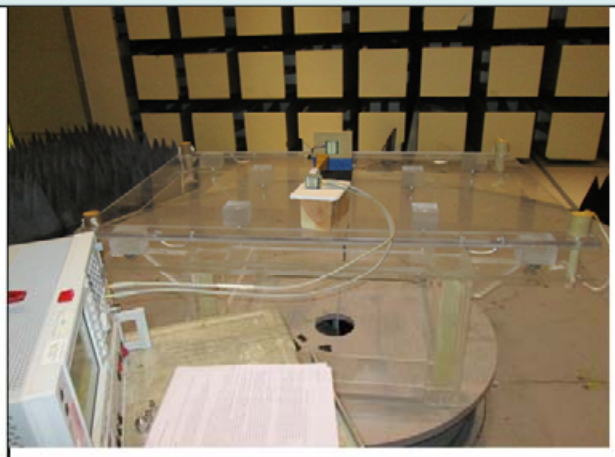
Professional Testing, EMI, Inc.

Test Method:	ANSI C63.4–2003: "Methods of Measurement of Radio-Noise Emissions from Low-Voltage Electrical and Electronic Equipment in the Range of 9 kHz to 40 GHz" (incorporated by reference,		
In accordance with:	FCC Part 15.209 - Code of Federal Regulations Part 47, Subpart C - Intentional Radiators, Radiated Emissions Limits		
Section:	15.209		
Test Date(s):	9/24/2014	EUT Serial #:	000016cd2a50
Customer:	Houston Radar	EUT Part #:	None
Project Number:	16296-15	Test Technician:	Dave Kohutek
Purchase Order #:	81524	Supervisor:	Lisa Arndt
Equip. Under Test:	PD310	Witness' Name:	Vipin Malik

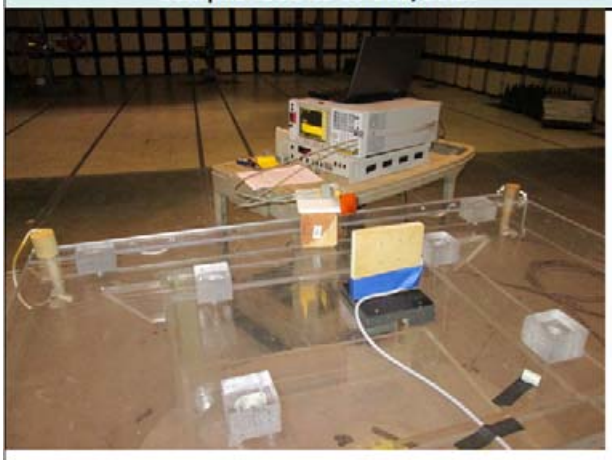
Radiated Emissions Photographs — Page: 3 of 4



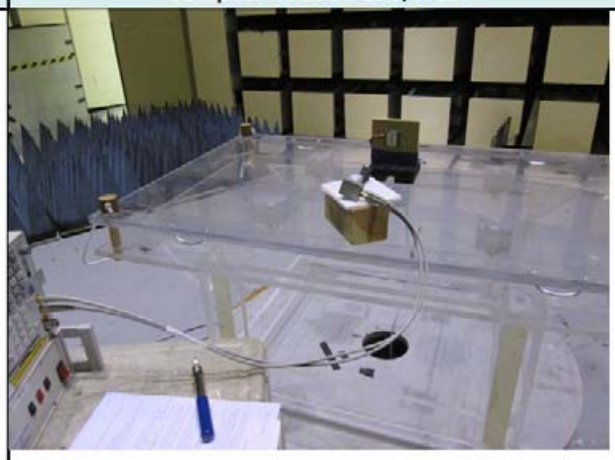
Setup for 26.5 to 40 GHz, Back



Setup for 40 to 50 GHz, Front



Setup for 40 to 50 GHz, Back

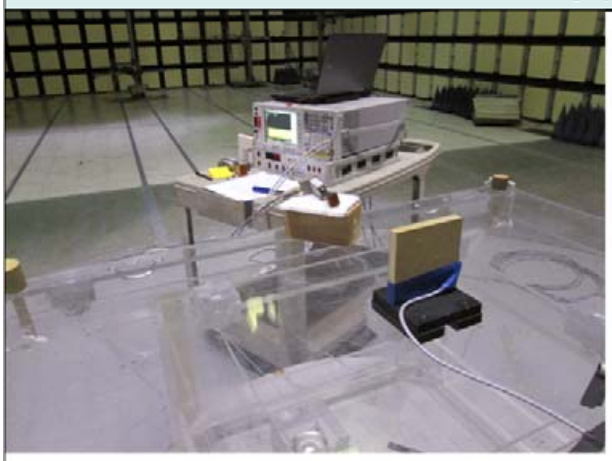


Setup for 75 to 110 GHz, Front

Professional Testing, EMI, Inc.

Test Method:	ANSI C63.4–2003: "Methods of Measurement of Radio-Noise Emissions from Low-Voltage Electrical and Electronic Equipment in the Range of 9 kHz to 40 GHz" (incorporated by reference,		
In accordance with:	FCC Part 15.209 - Code of Federal Regulations Part 47, Subpart C - Intentional Radiators, Radiated Emissions Limits		
Section:	15.209		
Test Date(s):	9/24/2014	EUT Serial #:	000016cd2a50
Customer:	Houston Radar	EUT Part #:	None
Project Number:	16296-15	Test Technician:	Dave Kohutek
Purchase Order #:	81524	Supervisor:	Lisa Arndt
Equip. Under Test:	PD310	Witness' Name:	Vipin Malik

Radiated Emissions Photographs Page: 4 of 4



Setup for 75 to 100 GHz, Front	No photos for 50 to 75 GHz, setup is same as others.

4.0 Occupied Bandwidth Measurements

Bandwidth is measured for reporting purposes and to verify emissions are contained within the allocated band.

4.1 Test Procedure

Measure 20 dB bandwidth in 1 to 3 percent of actual bandwidth.

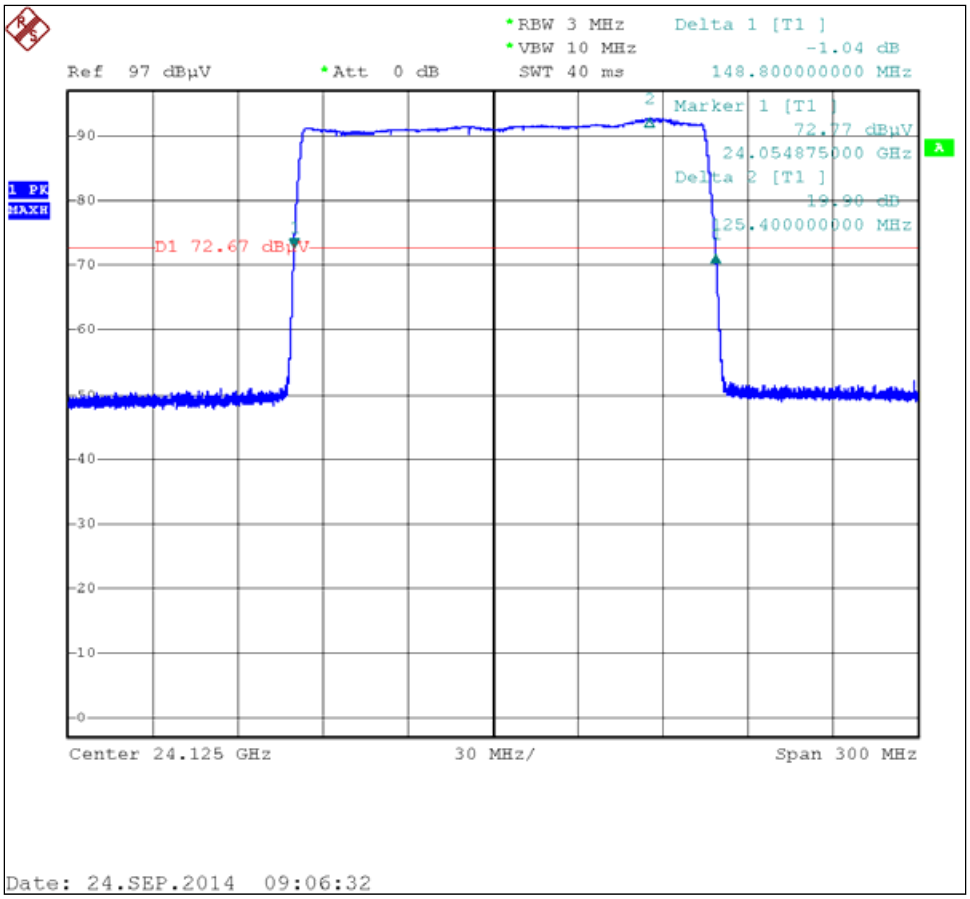
4.2 Test Criteria

The 20 dB or 99% of the power of the emission shall not fall outside of the specified band of 24000 - 24250 MHz.

4.3 Test Results

Table 4.3.1: Frequency and Bandwidth

Frequency GHz	Bandwidth 20 dB MHz
24.125	148.80



5.0 Antenna Requirement

5.1 Procedure

Examine the EUT design and compare to rule requirements for a modular approval.

5.2 Criteria & Results

Table 5.2.1: Modular Construction Criteria and Results		
Criteria	**Evaluation**	**Pass/Fail**
Antenna must be permanently attached to the unit.	The antenna is a permanent integral antenna (a printed circuit patch array).	Pass
Antenna must use a unique type of connector to attach to the EUT.	There is no antenna connector.	Pass
Unit must be professionally installed. Installer shall be responsible for verifying that the correct antenna is employed with the unit.	The antenna is not subject to replacement or modification by the user; there is no auxiliary antenna connector.	Pass
Optional criteria for confidentiality of user manual.	The circuitry is potted which prevents field repair or tampering. Only the printed antenna surface is exposed.	Pass

6.0 Mains AC Conducted Emissions

Measurements of the mains conducted emissions were taken.

6.1 Test Procedure

The EUT was placed on a non-conductive table 0.8 meters above the floor and 0.4 meters from the conductive reference plane (wall). The EUT is powered through a line impedance stabilization network (LISN) that provides a measurement tap and a termination approximating 50 Ohms in the measurement range of 150 kHz to 30 MHz. A spectrum analyzer is connected, in turn, to each mains line measurement tap and software is employed to measure the radio frequency noise generated by the EUT.

6.2 Test Criteria

Clause Subject	Section Number	Date
Mains Conducted Emissions, Class B	15.107	2014-09-26

6.3 Test Results

The measurement results are included below.

Table 6.3.1 – Mains Conducted Emissions, Measurement Bandwidth Table

Conducted Emissions Spectrum Analyzer Bandwidth and Measurement Time				
Frequency Band Start (MHz)	**Frequency Band Stop (MHz)**	**6 dB Bandwidth (kHz)**	**Number of Ranges Used**	**Measurement Time per Range**
0.01	0.15	0.3	7	Five 1 second sweeps
0.15	30	9	20	Five 1 second sweeps

*Notes:
1. The settings above are specifically calculated for the HP856X series of spectrum analyzers, which have 1,000 data points per range.
2. The measurement receiver resolution bandwidth setting is 300 Hz for quasi-peak measurements from 10-150 kHz.
3. The measurement receiver resolution bandwidth setting is 9 kHz for quasi-peak measurements from 0.15-30 MHz.

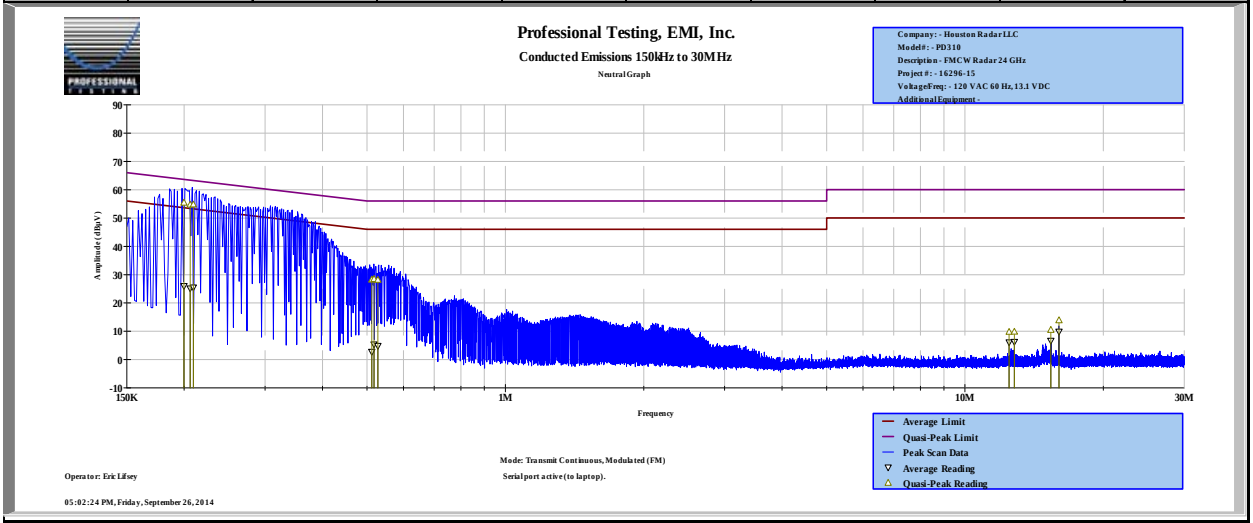
Table 6.3.2 – Mains Conducted Emissions, Neutral Line

Professional Testing, EMI, Inc.			
Test Method:	ANSI C63.4–2009: Methods of Measurement of Radio-Noise Emissions from Low-Voltage Electrical and Electronic Equipment in the Range of 9 kHz to 40 GHz (incorporated by reference, see §15.38).		
In accordance with:	FCC Part 15.207 - Code of Federal Regulations Part 47, Subpart C - Intentional Radiators, Conducted Emissions Limits		
Section:	15.207		
Test Date(s):	9/26/2014	**EUT Serial #:**	000016cd2a50
Customer:	Houston Radar	**EUT Part #:**	PD310
Project Number:	16296-15	**Test Technician:**	Eric Lifsey
Purchase Order #:	NA	**Supervisor:**	Lisa Arndt
Equip. Under Test:	FMCW Radar	**Witness' Name:**	Vipin Malik

Conducted Emissions Test Results Data Sheet - Neutral Lead **Page: 1 of 2**

EUT Line Voltage:	120	VAC	EUT Line Frequency:	60	Hz

Frequency Measured (MHz)	Peak Detector Reading (dBµV)	Quasi-peak Detector Reading (dBµV)	Quasi-peak Detector Limit (dBµV)	Quasi-peak Detector Margin (dB)	Quasi-peak Detector Test Results	Average Detector Reading (dBµV)	Average Detector Limit (dBµV)	Average Detector Margin (dB)	Average Detector Test Results
0.19976	61.4	55.4	63.6	-8.2	PASS	26	53.6	-27.7	PASS
0.20607	61	54.7	63.4	-8.7	PASS	25.1	53.4	-28.2	PASS
0.20938	61	54.8	63.2	-8.5	PASS	25.5	53.2	-27.8	PASS
0.5121	34.8	28.2	56	-27.8	PASS	2.7	46	-43.3	PASS
0.51779	35.2	28.5	56	-27.5	PASS	5.3	46	-40.7	PASS
0.52775	35	28.1	56	-27.9	PASS	4.8	46	-41.2	PASS
12.4804	19	9.8	60	-50.2	PASS	6.1	50	-43.9	PASS
12.8099	19	9.8	60	-50.2	PASS	6.3	50	-43.7	PASS
15.3813	20.3	10.5	60	-49.5	PASS	6.6	50	-43.4	PASS
16.0186	20.4	13.9	60	-46.1	PASS	9.9	50	-40.1	PASS



Measured Conducted Emissions - Neutral Lead

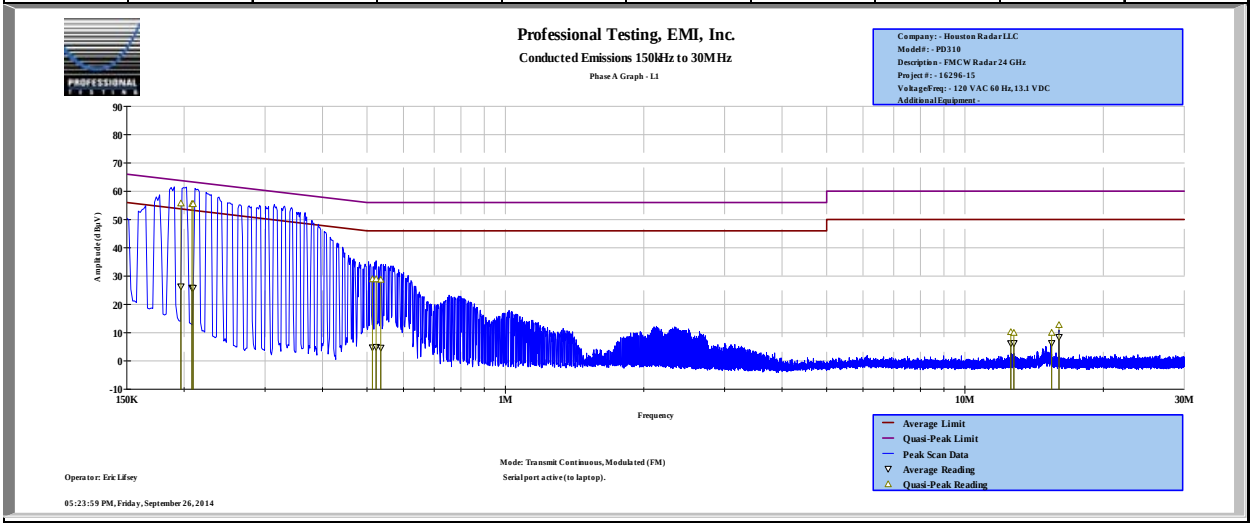
Table 6.3.3 – Mains Conducted Emissions, Phase Line

Professional Testing, EMI, Inc.			
Test Method:	ANSI C63.4–2009: Methods of Measurement of Radio-Noise Emissions from Low-Voltage Electrical and Electronic Equipment in the Range of 9 kHz to 40 GHz (incorporated by reference, see §15.38).		
In accordance with:	FCC Part 15.207 - Code of Federal Regulations Part 47, Subpart C - Intentional Radiators, Conducted Emissions Limits		
Section:	15.207		
Test Date(s):	9/26/2014	**EUT Serial #:**	000016cd2a50
Customer:	Houston Radar	**EUT Part #:**	PD310
Project Number:	16296-15	**Test Technician:**	Eric Lifsey
Purchase Order #:	NA	**Supervisor:**	Lisa Arndt
Equip. Under Test:	FMCW Radar	**Witness' Name:**	Vipin Malik

Conducted Emissions Test Results Data Sheet - Phase Lead (Line 1) **Page: 2 of 2**

EUT Line Voltage: 120 VAC **EUT Line Frequency:** 60 Hz

Frequency Measured (MHz)	Peak Detector Reading (dBµV)	Quasi-peak Detector Reading (dBµV)	Quasi-peak Detector Limit (dBµV)	Quasi-peak Detector Margin (dB)	Quasi-peak Detector Test Results	Average Detector Reading (dBµV)	Average Detector Limit (dBµV)	Average Detector Margin (dB)	Average Detector Test Results
0.1967	61.9	55.7	63.7	-8.1	PASS	26.3	53.7	-27.4	PASS
0.20794	61.2	55.4	63.3	-7.9	PASS	25.9	53.3	-27.4	PASS
0.20905	61.1	55.5	63.2	-7.8	PASS	25.8	53.2	-27.4	PASS
0.51363	35.7	28.9	56	-27.1	PASS	4.8	46	-41.2	PASS
0.52316	35.2	28.9	56	-27.1	PASS	5	46	-41	PASS
0.53575	35.6	28.7	56	-27.3	PASS	4.7	46	-41.3	PASS
12.5836	19.4	10.2	60	-49.8	PASS	6.3	50	-43.7	PASS
12.7784	19.2	9.9	60	-50.1	PASS	6.3	50	-43.7	PASS
15.4475	19.2	9.9	60	-50.1	PASS	6.3	50	-43.7	PASS
16.0225	19.6	12.7	60	-47.3	PASS	8.5	50	-41.5	PASS

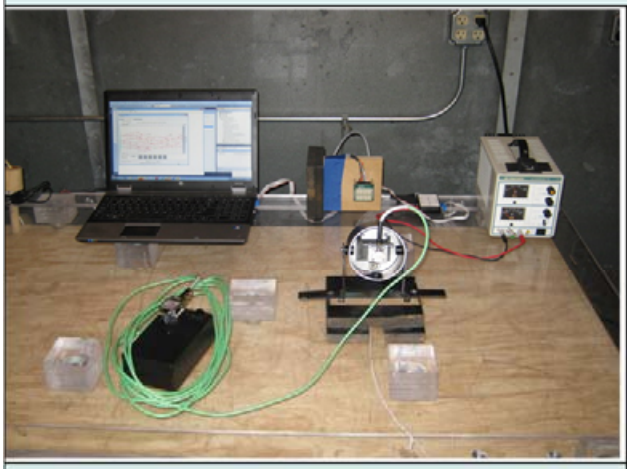


Measured Conducted Emissions - Phase Lead (Line 1)

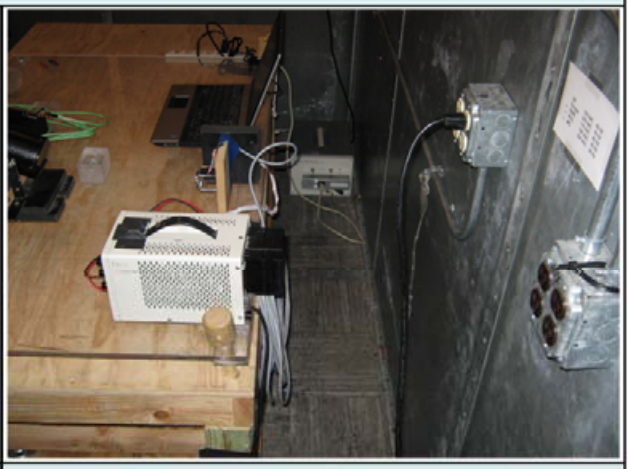
6.4 Setup Photographs

Professional Testing, EMI, Inc.			
Test Method:	ANSI C63.4–2009: Methods of Measurement of Radio-Noise Emissions from Low-Voltage Electrical and Electronic Equipment in the Range of 9 kHz to 40 GHz (incorporated by reference,		
In accordance with:	FCC Part 15.207 - Code of Federal Regulations Part 47, Subpart C - Intentional Radiators, Conducted Emissions Limits		
Section:	15.207		
Test Date(s):	9/26/2014	EUT Serial #:	000016cd2a50
Customer:	Houston Radar	EUT Part #:	PD310
Project Number:	16296-15	Test Technician:	Eric Lifsey
Purchase Order #:	NA	Supervisor:	Lisa Arndt
Equip. Under Test:	FMCW Radar	Witness' Name:	Vipin Malik

Conducted Emissions Photographs Page: 1 of 1



Front



Back

Power Cable

7.0 List of Test Equipment

Table 7.0.1 – Radiated Emissions 30 MHz to 1000 MHz, 1 GHz to 18 GHz, 18 to 26.5 GHz

Professional Testing, EMI, Inc.			
Test Method:	**ANSI C63.4–2003: "Methods of Measurement of Radio-Noise Emissions from Low-Voltage Electrical and Electronic Equipment in the Range of 9 kHz to 40 GHz" (incorporated by reference,**		
In accordance with:	**FCC Part 15.209 - Code of Federal Regulations Part 47, Subpart C - Intentional Radiators, Radiated Emissions Limits**		
Section:	**15.209**		
Test Date(s):	**9/24/2014**	**EUT Serial #:**	**000016cd2a50**
Customer:	**Houston Radar**	**EUT Part #:**	**None**
Project Number:	**16296-15**	**Test Technician:**	**Dave Kohutek**
Purchase Order #:	**81524**	**Supervisor:**	**Lisa Arndt**
Equip. Under Test:	**PD310**	**Witness' Name:**	**Vipin Malik**

Radiated Emissions Test Equipment List	
Tile! Software Version:	**4.2.A, May 23, 2010, 08:38:52 AM**
Test Profile:	**Radiated Emissions_Profile Version October 12, 2011**

Asset #	Manufacturer	Model	Equipment Nomenclature	Serial Number	Calibration Due Date
1509A	Braden	N/A	TDK 10M Chamber, NSA < 1 GHz	DAC-012915-005	9/29/2014
1890	HP	8447F	Preamp/Amp, 9kHz-1300MHz, 28/25dB	3313A05298	1/22/2015
1937	Agilent	E4440A	Spectrum Analyzer, 3 Hz - 26.5 GHz	MY44303298	12/2/2015
1926	ETS-Lindgren	3142D	Antenna, Biconilog, 26 MHz - 6 GHz	00135454	9/29/2014
C027	N/A	RG214	Cable Coax, N-N, 25m	none	9/26/2014
1327	EMCO	1050	Controller, Antenna Mast	none	N/A
0942	EMCO	11968D	Turntable, 4ft.	9510-1835	N/A
1969	HP	11713A	Attenuator/Switch Driver	3748A04113	N/A
1509B	Braden	N/A	TDK 10M Chamber, VSWR > 1 GHz	DAC-012915-005	10/16/2014
2004	Miteq	AFS44-00101800-2S-10P-44	Amplifier, 40dB, .1-18GHz	0	11/19/2014
C030	N/A	0	Cable Coax, N-N, 30m	none	9/26/2014
1325	EMCO	1050	Controller, Antenna Mast	9003-1461	N/A
1780	ETS-Lindgren	3117	Antenna, Double Ridged Guide Horn, 1 - 18 GHz	00110313	1/21/2015
1977	Agilent	87421A	Power Supply	MY44350145	N/A
1973	Agilent	83017A	Amplifier, Microwave 0.5-26.5 GHz	MY39500497	1/16/2015
1542	A.H. Systems	SAS-572	Antenna, Horn 18-26.5GHz, 20dB gain	225	N/A

Table 7.0.2 – Radiated Emissions 26.5 GHz to 100 GHz

Asset #	Manufacturer	Model #	Description	Calibration Due
1937	Agilent	E4440A	Spectrum Analyzer SN MY44303298	2015-12-02
None	Agilent	5061-5458	Agilent harmonic mixer cable 1: IF/LO SN none	NCR
None	Agilent	5061-5458	Agilent harmonic mixer cable 2: IF/LO SN none	NCR
2063	Agilent	11970A	Mixer, Harmonic, 26.5 - 40 GHz SN 3003A08717	NCR
2062	Agilent	11970Q	Mixer, Harmonic, 33 - 50 GHz SN 3003A03234	NCR
2064	Agilent	11970V	Mixer, Harmonic, 50 - 75 GHz SN MY30033017	NCR
2061	Agilent	11970W	Mixer, Harmonic, 75 - 110 GHz SN 2521A00784	NCR
0730	Millitech	SGH-19	Standard Gain Horn (no mixer) SN B020598	NCR
0730	Millitech	SGH-12	Standard Gain Horn (no mixer) SN 035-8344	NCR
0730	Millitech	SGH-10	Standard Gain Horn (no mixer) SN 085-8344	NCR
0730	Millitech	SGH-08	Standard Gain Horn (no mixer) SN 012-8344	NCR

Table 7.0.4 – Mains AC Conducted Emissions

Professional Testing, EMI, Inc.			
Test Method:	**ANSI C63.4–2009: Methods of Measurement of Radio-Noise Emissions from Low-Voltage Electrical and Electronic Equipment in the Range of 9 kHz to 40 GHz (incorporated by reference,**		
In accordance with:	**FCC Part 15.207 - Code of Federal Regulations Part 47, Subpart C - Intentional Radiators, Conducted Emissions Limits**		
Section:	**15.207**		
Test Date(s):	**9/26/2014**	**EUT Serial #:**	**000016cd2a50**
Customer:	**Houston Radar**	**EUT Part #:**	**PD310**
Project Number:	**16296-15**	**Test Technician:**	**Eric Lifsey**
Purchase Order #:	**NA**	**Supervisor:**	**Lisa Arndt**
Equip. Under Test:	**FMCW Radar**	**Witness' Name:**	**Vipin Malik**

Conducted Emissions Test Equipment List	
Tile! Software Version:	**4.1.A.0, April 14, 2009, 11:01:00PM**
Test Profile:	**Profile#: CE_2014_R3.TIL, dated May 1, 2014**

Asset #	Manufacturer	Model	Equipment Nomenclature	Serial Number	Calibration Due Date
1145	HP	8568B	Spectrum Analyzer 100Hz-1.5GHz	2517A01821	5/22/2015
0045	HP	85662A	Spec Anal Dsply for AN1842	2816A16413	N/A
0238	HP	85685A	RF Preselector	2887A00841	5/22/2015
0085	HP	85650A	Quasi-Peak Adapter CISPR	3033A01458	5/22/2015
1173	PTI	100k HPF	Filter, High Pass, 100kHz	none	10/30/2014
1086	PTI	PTI-ALF2	Attenuator Limiter Filter	none	5/7/2015
C107	Pomona	RG-223	Cable 9 ft BNC RG-223 (black)	none	8/11/2015
C108	HP	11170 C	Cable 5 ft BNC (Grey)	none	8/11/2015
C109	HP	none	Cable 19 inch BNC (grey)	none	8/11/2015
1185	EMCO	3825/2	LISN, 10kHz-100MHz	1235	10/31/2014
1132	AilTech	91550-1M	Probe, Current, 10kHz-100MHz	1856	1/8/2015
0936	FCC	FCC-TLISN-T2	TLISN-T2, 9kHz-30MHz, CISPR 22	20152	2/12/2015
0935	FCC	FCC-TLISN-T4	TLISN-T4, 9kHz-30MHz, CISPR 22	20153	2/12/2015
1683	Teseq	ISN T800	ISN-T8, Impedance Stabilization Network	27091	4/16/2015
0027	EMCO	3825/2	LISN, 10kHz-100MHz	9010-1708	10/23/2014

Table 7.0.5 –Supporting Equipment

Used for mains conducted emissions.

Asset #	Manufacturer	Model #	Description	Calibration Due
None	B&K	1710	Adjustable Bench Power Supply	CIU

Appendix: Policy, Rationale, and Evaluation of EMC Measurement Uncertainty

All uncertainty calculations, estimates and expressions thereof shall be in accordance with NIST policy. Since PTI operates in accordance with NIST (NVLAP) Handbook 150-11: 2007, all instrumentation having an effect on the accuracy or validity of tests shall be periodically calibrated or verified traceable to national standards by a competent calibration laboratory. The certificates of calibration or verification on this instrumentation shall include estimates of uncertainty as required by NIST Handbook 150-11.

1. Rationale and Summary of Expanded Uncertainty.

Each piece of instrumentation at PTI that is used in making measurements for determining conformance to a standard (or limit), shall be assessed to evaluate its contribution to the overall uncertainty of the measurement in which it is used. The assessment of each item will be based on either a type A evaluation or a type B evaluation. Most of the evaluations will be type B, since they will be based on the manufacturer's statements or specifications of the calibration tolerances, or uncertainty will be stated along with a brief rationale for the type of evaluation and the resulting stated uncertainties.

The individual uncertainties included in the combined standard uncertainty for a specific test result will depend on the configuration in which the item of instrumentation is used. The combination will always be based on the law of propagation of uncertainty. Any systematic effects will be accommodated by including their uncertainties, in the calculation of the combined standard uncertainty; except that if the direction and amount of the systematic effect cannot be determined and separated from its uncertainty, the whole effect will be treated as uncertainty and combined along with the other elements of the test setup.

Type A evaluations of standard uncertainty will usually be based on calculating the standard deviation of the mean of a series of independent observations, but may be based on a least-squares curve fit or the analysis of variance for unusual situations. Type B evaluations of standard uncertainty will usually be based on manufacturer's specifications, data provided in calibration reports, and experience. The type of probability distribution used (normal, rectangular, a priori, or u-shaped) will be stated for each Type B evaluation.

In the evaluation of the uncertainty of each type of measurement, the uncertainty caused by the operator will be estimated. One notable operator contribution to measurement uncertainty is the manipulation of cables to maximize the measured values of radiated emissions. The operator contribution to measurement uncertainty is evaluated by having several operators independently repeat the same test. This results in a Type A evaluation of operator-contributed measurement uncertainty.

A summary of the expanded uncertainties of PTI measurements is shown as Table 1. These are the worst-case uncertainties considering all operative influence factors.

Table 1: Summary of Measurement Uncertainties for Site 45

Type of Measurement	Frequency Range	Meas. Dist.	Expanded Uncertainty U, dB (k=2)
Mains Conducted Emissions	150 kHz to 30 MHz	N/A	2.9
Telecom Conducted Emissions	150 kHz to 30 MHz	N/A	2.8
Radiated Emissions	30 to 1,000 MHz	10 m	4.8
	1 to 18 GHz	3 m	5.7

END OF REPORT

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