

Type Acceptance Test Report

Wideband FM Audio/Video Transmit Module

FCC ID: QN41500

FCC Rule Part: 90

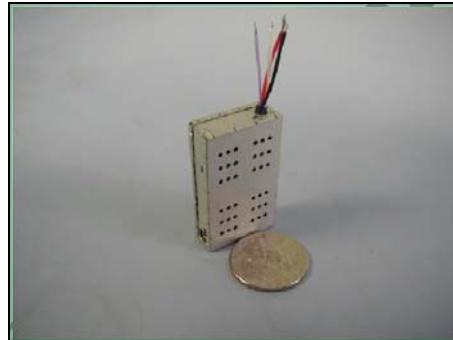
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Manufacturer: Datawave Technologies
Model: 1500-2467-33

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This report contains 13 pages

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1.0 GENERAL

1.1 Introduction

The purpose of this report is to demonstrate compliance with the relevant portions of Parts 2, 15 and 90 of the FCC's Code of Federal Regulations.

1.2 Product Description

The EUT is a 2.4GHz 300mW Part 90 Wideband FM Audio/Video Transmit Radio Module.

Detailed photographs of the EUT are filed separately with this filing.

1.2.1 Intended Use

The Datawave 1500-2467-33 module is intended to be marketed to Original Equipment Manufacturer's (OEM's) as an approved audio, video radio module for integration into their devices.

1.2.2 Technical Specifications

Table 1.2.2-1: Specifications

Parameter	Specification			Unit	Condition
	Min	Typ	Max		
Operating Voltage	4.85	5	5.15	Volts	Regulated
Current Consumption	485	510	535	mA	Pout=300mW
Max RF Output Power	285	300	315	m W	Carrier Power
RF Bandwidth	7.75	8	8.25	MHz	
First Harmonic Rej.	-57	-60	-65	dBc	Reference to Carrier Power
Frequency Range	2450		2483	MHz	
Channel 1		2458		MHz	
Channel 2		2474		MHz	
RF Power Output	1		300	m W	
Operating Temp.	-40		85	°C	
Modulation Type	Frequency Modulation				
Dimensions					
Antenna Interface	MMCX	**see approved antenna listing			
Weight	3 oz				
VSWR Antenna Port	2:1 @ 50?				

2.0 LOCATION OF TEST FACILITY

All testing was performed by qualified ACS personnel located at the following address:

ACS, Inc.
5015 B.U. Bowman Drive
Buford, GA 30518

2.1 DESCRIPTION OF TEST FACILITY

Both the Open Area Test Site(OATS) and Conducted Emissions site have been fully described, submitted to, and accepted by the FCC, Industry Canada and the Japanese Voluntary Control Council for Interference by information technology equipment.

The following certification numbers have been issued in recognition of these accreditations and certifications:

FCC Registration Number: 89450

Industry Canada Lab Code: IC 4175

VCCI Member Number: 1831

- VCCI OATS Registration Number R-1526
- VCCI Conducted Emissions Site Registration Number: C-1608

2.1.1 Open Area Test Site

The open area test site consists of a 40' x 66' concrete pad covered with a perforated electro-plated galvanized sheet metal. The perforations in the sheet metal are 1/8" holes that are staggered every 3/16". The individual sheets are placed to overlap each other by 1/4" and are riveted together to provide a continuous seam. Rivets are spaced every 3" in a 3 x 20 meter perimeter around the antenna mast and EUT area. Rivets in the remaining area are spaced as necessary to properly secure the ground plane and maintain the electrical continuity.

The entire ground plane extends 12' beyond the turntable edge and 16' beyond the antenna mast when set to a 10 meter measurement distance. The ground plane is grounded via 4 - 8' copper ground rods, each installed at a corner of the ground plane and bound to the ground plane using 3/4" stainless steel braided cable.

The turntable is an all aluminum 10' flush mounted table installed in an all aluminum frame. The table is remotely operated from inside the control room located 40' from the range. The turntable is electrically bonded to the surrounding ground plane via steel fingers installed on the edge of the turn table. The steel fingers make constant contact with the ground plane during operation.

Adjacent to the turntable is a 7' x 7' square and 4' deep concrete pit used for support equipment if necessary. The pit is equipped with 5 - 4" PVC chases from the pit to the control room that allow for cabling to the EUT if necessary. The underside of the turntable can be accessed from the pit so cables can be supplied to the EUT from the pit. The pit is covered with 2 sheets of 1/4" diamond style re-enforced steel sheets. The sheets are painted to match the perforated steel ground plane, however the underside edges have been masked off to maintain the electrical continuity of the ground plane. All reflecting objects are located outside of the ellipse defined in ANSI C63.4.

A diagram of the Open Area Test Site is shown in Figure 2.1-1 below:

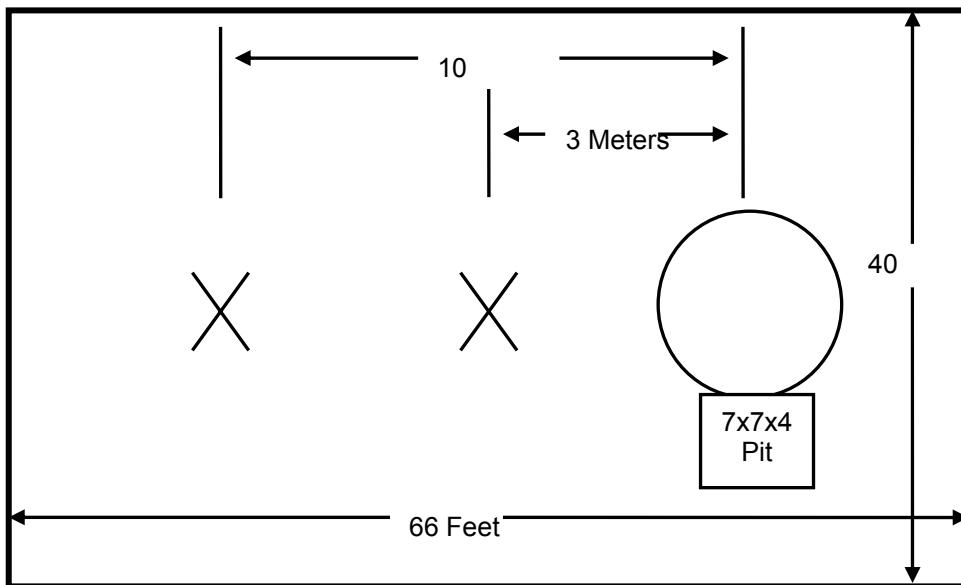


Figure 2.1-1: Open Area Test Site

2.1.2 Conducted Emissions Test Site Description

The AC mains conducted EMI site is a shielded room with the following dimensions:

- Height: 3.0 Meters
- Width: 3.6 Meters
- Length: 4.9 Meters

The room is manufactured by Rayproof Corporation and installed by Panashield, Inc. Earth ground is provided to the room via an 8' copper ground rod. Each panel of the room is connected electrically at intervals of 4".

Power to the room is filtered to prevent ambient noise from coupling to the EUT and measurement equipment. Filters are models 1B42-60P manufactured by Rayproof Corporation.

The room is of sufficient size to test table top and floor standing equipment in accordance with section 6.1.4 of ANSI C63.4.

A diagram of the room is shown below in figure 2.1.2-1:

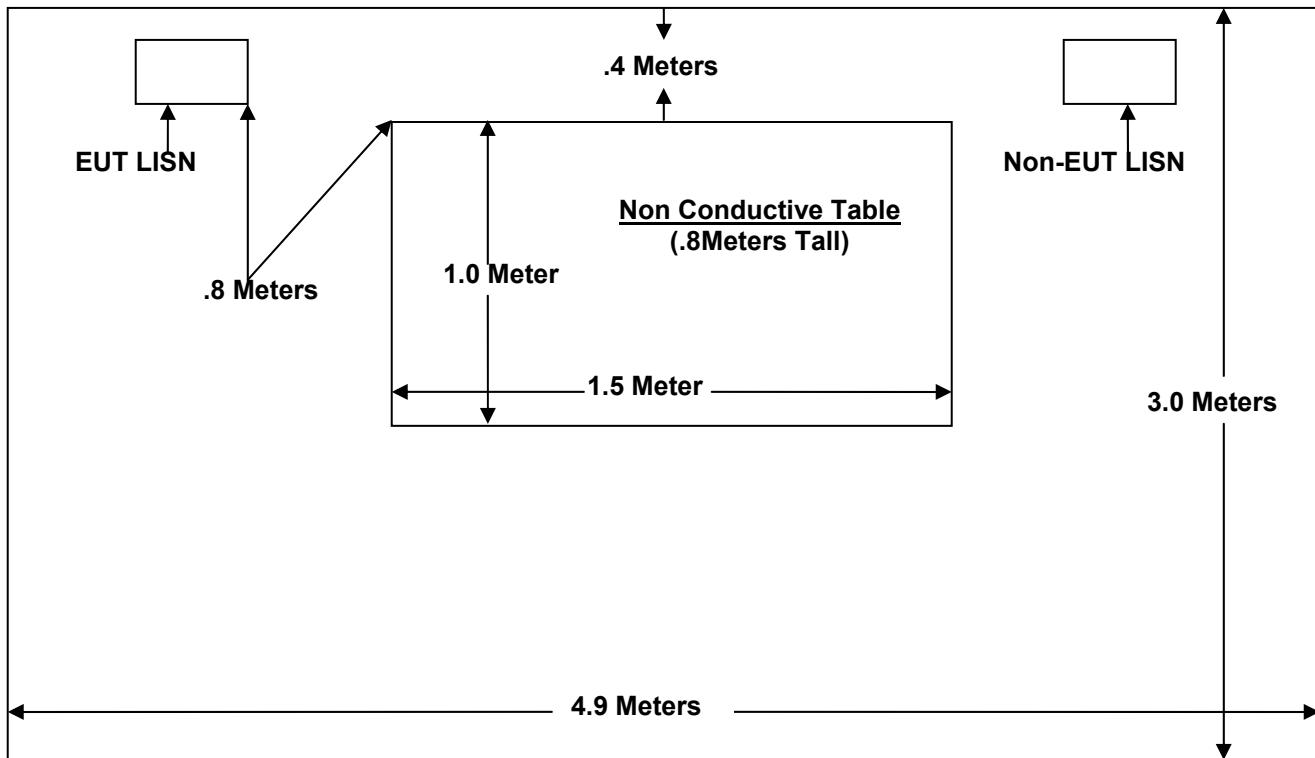


Figure 2.1.2-1: AC Mains Conducted EMI Site

3.0 APPLICABLE STANDARD REFERENCES

The following standards were used:

- ❖ ANSI C63.4-1992: Method of Measurements of Radio-Noise Emissions from Low-Voltage Electrical and Electronic Equipment in the 9KHz to 40GHz
- ❖ US Code of Federal Regulations (CFR): Title 47, Part 2, Subpart J: Equipment Authorization Procedures (October 2002)
- ❖ US Code of Federal Regulations (CFR): Title 47, Part 15, Subpart C: Radio Frequency Devices, Intentional Radiators (October 2002)
- ❖ US Code of Federal Regulations (CFR): Title 47, Part 90: Private Land Mobile Radio Services (October 2002)
- ❖ FCC OET Bulletin 65 Appendix C - Evaluating Compliance with FCC Guidelines for Human Exposure to Radiofrequency Electromagnetic Fields
- ❖ ANSI/TIA/EIA – 603 – A – 2001: Land Mobile or PM Communications Equipment and Performance Standards (August 15, 2001)

4.0 LIST OF TEST EQUIPMENT

All test equipment used for regulatory testing is calibrated yearly or according to manufacturer's specifications.

Table 4-1: Test Equipment

Equipment Calibration Information					
ACS #	Mfg.	Eq. type	Model	S/N	Cal. Due
4	Rohde & Schwarz	Spectrum Analyzer	ESMI	833827/003	8/16/03
3	Rohde & Schwarz	Display Unit	ESDI	839379/011	8/16/03
2	Rohde & Schwarz	Spectrum Analyzer	ESMI	839587/003	12/23/03
1	Rohde & Schwarz	Display Unit	ESDI	839379/011	12/26/03
26	Chase	Bi-Log Antenna	CBL6111	1044	8/26/03
25	Chase	Bi-Log Antenna	CBL6111	1043	9/19/03
71	Chase	LISN	ALN2070A	1028	8/23/03
152	EMCO	LISN	3825/2	9111-1905	12/11/03
153	EMCO	LISN	3825/2	9411-2268	12/11/03
30	Spectrum Technologies	Horn Antenna	DRH-0118	970102	9/17/03
16	ACS	Cable	RG8	16	9/17/03
23	ACS	Cable	RG8	23	1/3/04
24	ACS	Cable	Heliax	24	4/07/04
5	ACS	Cable	LL-335	None	7/31/03
6	ACS	Cable	LL-335	None	7/31/03
22	Agilent	Pre-Amplifier	8449B	3008A00526	9/21/03
73	Agilent	Pre-Amplifier	8447D	272A05624	4/15/04
30	Spectrum Technologies	Horn Antenna	DRH-0118	970102	9/17/03
105	Microwave Circuits	High Pass Filter	H1G810G1	2123-01 DC0225	6/19/03
---	BK Precision	NTSC Generator	1249A	155-03275	9/21/03
---	Wavetek	Function Generator	FG3B	707011	10/31/03
38	Agilent	Power Meter	436A/22	2446A21199 A	9/06/03
---	Agilent	Power Sensor	8482H	2704A03933	2/3/04

5.0 SYSTEM BLOCK DIAGRAM

Table 5.0: System Block Diagram

Diagram Number	Manufacturer	Equipment Type	Model Number	Serial Number	FCC ID
1	EUT	Radio Module	Datawave 1500-2467-33	None	Q4N1500
2	Centurion	Antenna	WXE	None	None
3	BK Precision	NTSC Generator	1249A	155-03275	None
4	Wavetek	Function Generator	FG3B	707011	None
5	OK Industries	DC Power Supply	PS732	36095	None

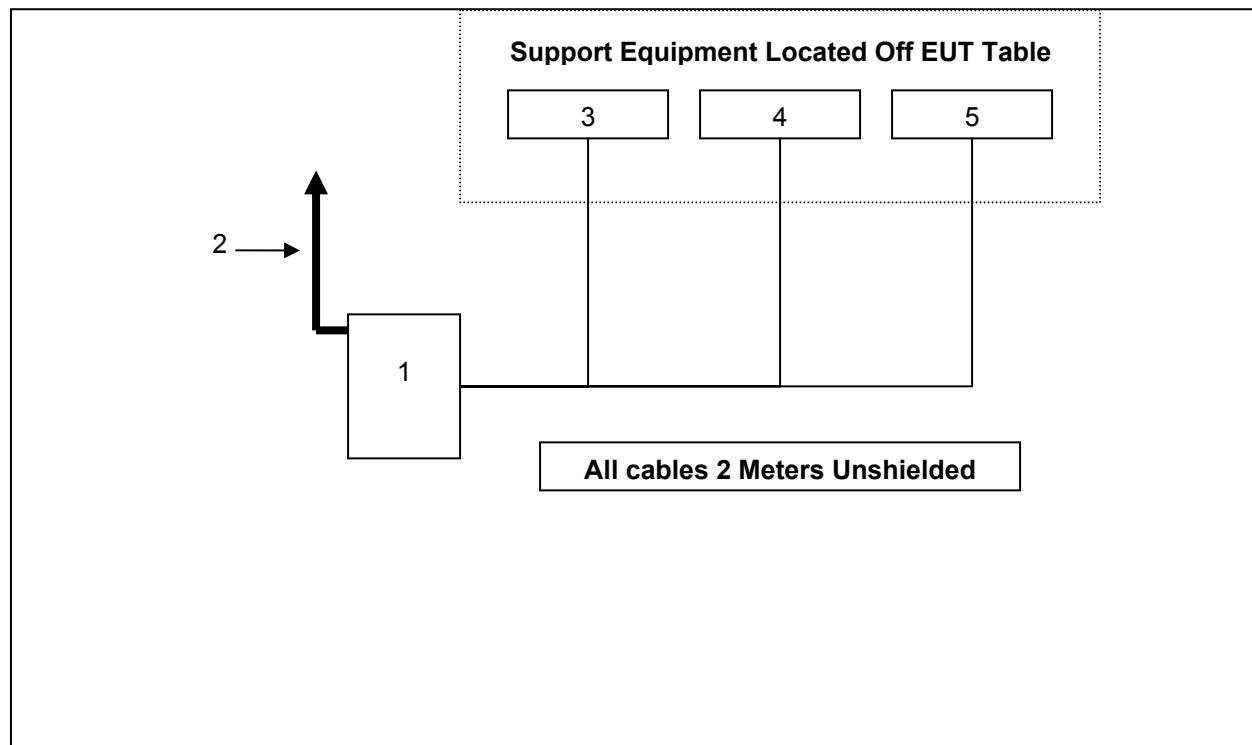


Figure 5.0-1: EUT Test Setup

6.0 SUMMARY OF TESTS

6.1 Power Line Conducted Emissions - FCC Section 15.207

6.1.1 Test Methodology

ANSI C63.4 sections 6 and 7 were the guiding documents for this evaluation. Conducted emissions were performed from 150kHz to 30MHz with the spectrum analyzer's resolution bandwidth set to 9kHz and the video bandwidth set to 30kHz.

6.1.2 Test Results

The EUT is powered from an external DC source supplied by the host device. There is no connection to the AC mains, therefore this requirement is not applicable to the EUT.

6.2 Radiated Emissions - FCC Section 15.209(Unintentional Radiation)

6.2.1 Test Methodology

ANSI C63.4 Sections 6 and 8 were the guiding documents for this evaluation. Radiated emissions tests were performed over the frequency range of 30MHz to 1000. Measurements of the radiated field strength were made at a distance of 3m from the boundary of the equipment under test (EUT) and the receiving antenna. The antenna height was varied from 1m to 4m so that the maximum radiated emissions level would be detected. Radiated measurements were made with the Spectrum Analyzer's resolution bandwidth set to 120KHz for measurements above 30MHz.

The EUT was caused to go into a "Standby" mode of operation for this test.

6.2.2 Test Results

Results of the test are given in Table 6.2.2-1 below:

Table 6.2.2-1: Radiated Emissions Tabulated Data(Unintentional Radiators)

Frequency (MHz)	Uncorrected Reading (dB μ V)	Antenna Polarity (H/V)	Antenna Height (cm)	Turntable Position (°)	Total Correction Factor (dB)	Corrected Reading (dB μ V)	Limit (dB μ V)	Margin (dB)	Results
31.078	13	V	100	0	19.54	32.54	40	7.5	Pass
42.933	14	V	100	0	13.51	27.51	40	12.5	Pass
82.81	14	V	100	0	9.61	23.61	40	16.4	Pass
115.144	13	V	100	0	13.41	26.41	43.5	17.1	Pass
153.944	24.35	H	200	270	13.50	37.85	43.5	5.7	Pass
230.467	24	H	200	270	13.26	37.26	46	8.7	Pass
308.067	37.1	H	100	143	-10.59	26.51	46	19.5	Pass
475.122	33.7	H	100	0	-5.36	28.34	46	17.7	Pass
702.533	28	H	100	0	-0.64	27.36	46	18.6	Pass
926.711	30	H	100	0	1.79	31.79	46	14.2	Pass

6.3 Peak Output Power Requirement - FCC Section 2.1046 & 90.205

6.3.1 Test Methodology

TIA/EIA-603-A, section 2.2.1 was the guiding document for this evaluation. The EUT was Modulated with a 2500Hz audio tone and an NTSC video signal on each channel in the band as shown below in figure 6.3.1-1.

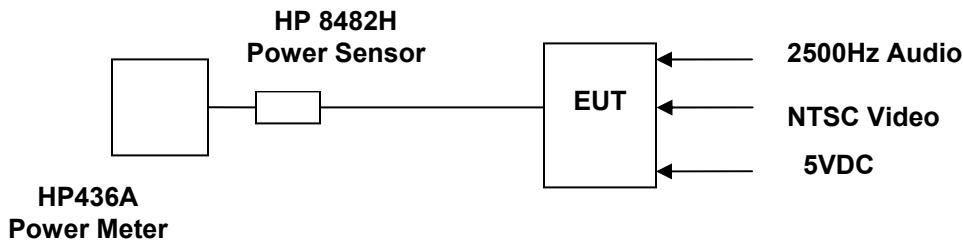


Figure 6.3.1-1: RF Output Power Test Setup

6.3.2 Test Results

Results are given in table's 6.3.2-1 and 6.3.2-2 below.

Table 6.3.2-1: RF Output Power

Frequency (MHz)	Power (dBm)
2458	26.20
2474	26.12

6.4 Occupied Bandwidth/Emission Mask – FCC Section 2.1049 & 90.210

6.4.1 Test Methodology

TIA/EIA-603-A section 2.2.11 was the guiding document for this evaluation.

6.4.2 Test Results

No emission mask is specified for the 2450-2483.5MHz band, therefore this requirement is not applicable to this device.

6.5 Spurious Emissions

6.5.1 RF Antenna Conducted Spurious Emissions – FCC Section 2.1051 & 90.210

6.5.1.1 Test Methodology

TIA/EIA-603-A section 2.2.13 was the guiding document for this evaluation. The EUT was investigated for conducted spurious emissions from 30MHz to 20GHz, 10 times the highest fundamental frequency. The EUT was Modulated with a 2500Hz audio tone and an NTSC video signal on each channel in the band as shown below in figure 6.5.1.1-1.

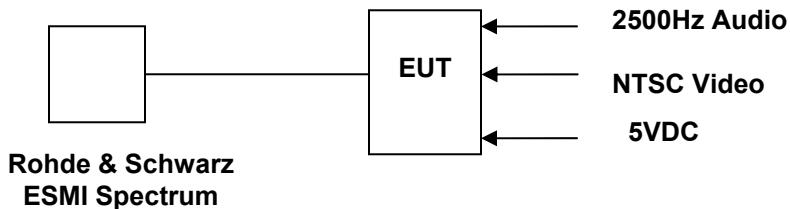


Figure 6.5.1.1-1

6.5.1.2 Test Results

Attenuation of $43 + \log(P_{\text{watts}})$ outside the permitted band is required.

Table 6.5.1.2-1: Antenna Conducted Spurious Emissions

Fundamental Frequency (MHz)	RF Output Power (dBm) Conducted	Frequency (MHz)	Conducted Power (dBm)	Conducted Power (dBc)	Limit (dBc)	Margin (dB)
2458	26.20	2450	-20.2	-46.4	-39.2	7.2
		5152.4	-28.02	-54.22	-39.2	15.02
		23800	-25.68	-51.88	-39.2	12.68
2474	26.12	2483.5	-21.16	-47.36	-39.2	8.16
		5579	-27.69	-53.89	-39.2	14.69
		23800	-25.18	-51.38	-39.2	12.18

Results: Pass

6.5.2 Radiated Spurious Emissions – FCC Section 2.1053 & 90.210

6.5.2.1 Test Methodology

TIA 603-A section 2.2.12 was the guiding document for this test.

6.5.2.2 Test Results

The limit for this test is determined by the formula $43 + \log(P_{\text{watts}})$.

Radiated spurious emissions found in the band of 30MHz to 20GHz are reported in Table 6.5.2.2-1. Plots of these emissions are also presented separately in Appendix D of this filing.

Table 6.5.2.2-1: Radiated Spurious Emissions

Fundamental Frequency (MHz):	2458	2474	<u>Sample Calculations</u>					
RF Output Power(dBm):	26.2	26.12	P_g	=	Output generator Level (dBm)	CL	=	Cable Loss(dB)
RF Output Power(Watts):	0.417	0.409	AG	=	Antenna Gain(dBi)	P_d	=	Corrected Level(dBm)
<u>Substitution Field Strength Calculation(dBm)</u> 10Log(TX power in watts/.001)- P_d								
Frequency (MHz)	P_g	CL	AG	P_d	Substitution Field Strength(dBm)	Substitution Field Strength(dBc)	Limit (dBc)	Margin (dB)
<u>2458MHz</u>								
4916	36.00	1.21	11.10	45.89	-19.69	-45.89	-39.20	6.69
7374	38.00	1.50	10.70	47.20	-21.00	-47.20	-39.20	8.00
9832	39.00	1.74	12.50	49.76	-23.56	-49.76	-39.20	10.56
<u>2474MHz</u>								
4948	36.00	1.21	11.10	45.89	-19.77	-45.89	-39.12	6.77
7422	38.00	1.50	10.70	47.20	-21.08	-47.20	-39.12	8.08
9896	40.00	1.21	12.50	51.29	-25.17	-51.29	-39.12	12.17

Results: Pass

6.6 Frequency Stability – FCC Sections 2.1055 & 90.213

6.6.1 Temperature

6.5.1.1 Test Methodology

TIA/EIA-603-A section 2.2.2 was the guiding document for this evaluation.

6.6.1.2 Test Results

No limits for frequency stability are given for the 2450-2483.5MHz band, therefore this requirement is not applicable to this EUT.

6.6.2 Voltage

6.6.2.1 Test Methodology

TIA/EIA-603-A section 2.2.2 was the guiding document for this evaluation.

6.6.2.2 Test Results

No limits for frequency stability are given for the 2450-2483.5MHz band, therefore this requirement is not applicable to this EUT.

7.0 CONCLUSION

In the opinion of ACS, Inc. the Datawave 1500-2467-33, manufactured by Datawave Technologies meets the relevant requirements of FCC Parts 2, 15 and 90 as required.