Excellence in Compliance Testing

Certification Test Report

FCC ID: AJKPN822-2325

FCC Rule Part: CFR 47 Part 87

ACS Report Number: 10-0190.W03.11.A

Manufacturer: Rockwell Collins, Inc.
Model: DME-2100

Test Begin Date: June 23, 2010
Test End Date: July 8, 2010

Report Issue Date: July 9, 2010

FOR THE SCOPE OF ACCREDITATION UNDER LAB Code 200612-0

This report must not be used by the client to claim product certification, approval, or endorsement by NVLAP, NIST, or any agency of the Federal Government.

Reviewed by: _____
Kirby Munroe
Director, Wireless Certifications
ACS, Inc.

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This report contains 16 pages

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1 GENERAL

1.1 Purpose

The purpose of this report is to demonstrate compliance with Part 2 Subpart J and Part 87 of the FCC's Code of Federal Regulations.

1.2 Product description

The DME-2100 is distance measuring equipment designed to operate in the 960 MHz to 1215 MHz band, per paragraph 87.173 under 14 CFR part 87. This frequency band is designated for electronic aids to navigation under Part 87 for use in Aeronautical Radionavigation.

The DME-2100 provides the slant range (line-of-sight) distance from the aircraft to VOR/DME, LOC/DME, VORTAC, and TACAN ground stations. The unit provides continuous distance information for selected stations in directed scan mode or all stations within DME range in free scan mode to a flight management computer system for high accuracy position fixing. Units also provide cockpit display information and aural information for a selected station in the directed and free scan modes of operation.

The DME-2100 measures distance by transmitting coded interrogation signals (pulse pairs) to the ground station at a selected channel frequency. The ground station receives the interrogation signal and returns a coded reply signal (pulse pair) for each interrogation.

The DME-2100 transmits over the frequencies from 1025 MHz to 1150 MHz.

Manufacturer Information:
Rockwell Collins, Inc.
1100 W. Hibiscus Blvd.
Melbourne, FL 32901

Test Sample Serial Numbers: 33V1V

Test Sample Condition: The test samples were provided in good working order with no visible defects.

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

1.3 Test Methodology and Considerations

For radiated emissions the RF output ports were terminated in 50 Ohm non-radiated loads.

1.4 Emission Designator

Emissions Designator: 460KP0N

2 TEST FACILITIES

2.1 Location

The radiated and conducted emissions test sites are located at the following address:

Advanced Compliance Solutions
5015 B.U. Bowman Drive
Buford, GA 30518
Phone: (770) 831-8048
Fax: (770) 831-8598

2.2 Laboratory Accreditations/Recognitions/Certifications

ACS is accredited to ISO/IEC 17025 by the National Institute of Standards and Technology under their National Voluntary Laboratory Accreditation Program (NVLAP), Lab Code 200612-0. Unless otherwise specified, all tests methods described within this report are covered under the ISO/IEC 17025 scope of accreditation.

The Semi-Anechoic Chamber Test Site, 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.

FCC Registration Number: 894540
Industry Canada Lab Code: IC 4175A-1
VCCI Member Number: 1831

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

2.3 Radiated Emissions Test Site Description

2.3.1 Semi-Anechoic Chamber Test Site

The Semi-Anechoic Chamber Test Site consists of a 20' x 30' x 18' shielded enclosure. The chamber is lined with Toyo Ferrite Grid Absorber, model number FFG-1000. The ferrite tile grid is 101 x 101 x 19mm thick and weighs approximately 550 grams. These tiles are mounted on steel panels and installed directly on the inner walls of the chamber.

The turntable is 150cm in diameter and is located 160cm from the back wall of the chamber. The chamber is grounded via 1 - 8' copper ground rod, installed at the center of the back wall, it is bound to the ground plane using 3/4" stainless steel braided cable.

The turntable is all steel, flush mounted table installed in an all steel frame. The table is remotely operated from inside the control room located 25' 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.

Behind the turntable is a 3' x 6' x 4' deep shielded pit used for support equipment if necessary. The pit is equipped with 1 - 4" PVC chases from the turntable to the pit 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.

A diagram of the Semi-Anechoic Chamber Test Site is shown in Figure 2.3-1 below:

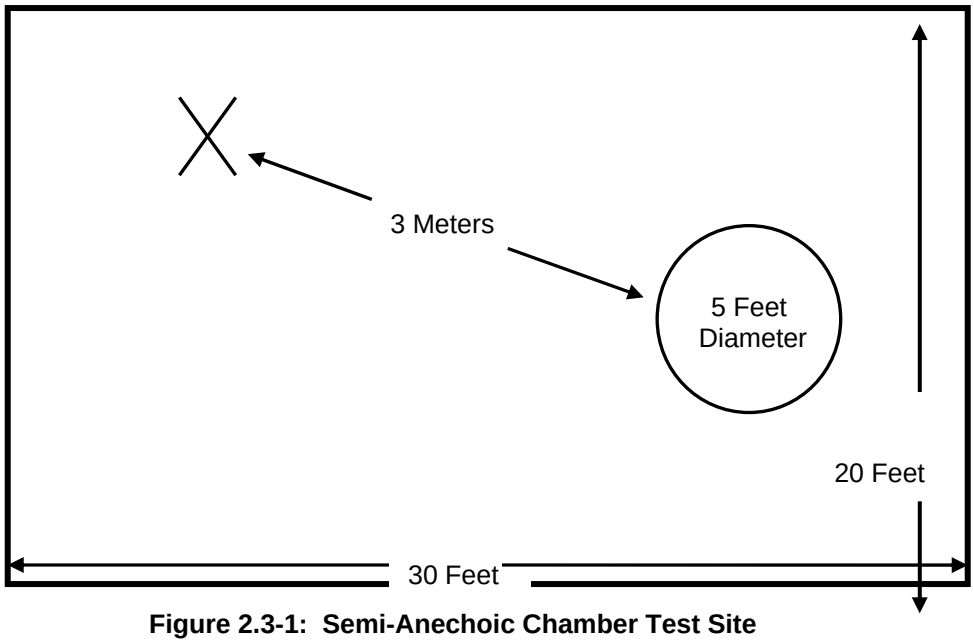

Figure 2.3-1: Semi-Anechoic Chamber Test Site

2.3.2 Open Area Tests Site (OATS)

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 2.3-2 below:

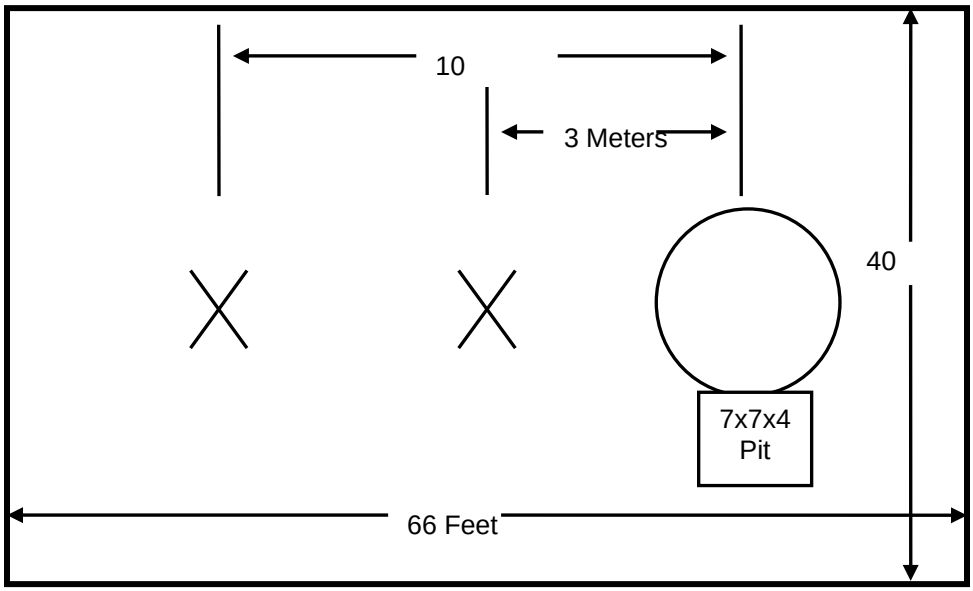

Figure 2.3-2: Open Area Test Site

3 APPLICABLE STANDARD REFERENCES

The following standards were used:

- ANSI C63.4-2003: Method of Measurements of Radio-Noise Emissions from Low-Voltage Electrical and Electronic Equipment in the 9KHz to 40GHz - 2003
- 2 -US Code of Federal Regulations (CFR): Title 47, Part 2, Subpart J: Equipment Authorization Procedures – 20010
- US Code of Federal Regulations (CFR): Title 47, Part 87, Aviation Services – 20010
- TIA-603-C: Land Mobile FM or PM - Communications Equipment - Measurement and Performance Standards – 2004

4 LIST OF TEST EQUIPMENT

The calibration interval of test equipment is annually or the manufacturer's recommendations. Where the calibration interval deviates from the annual cycle based on the instrument manufacturer's recommendations, it shall be stated below.

Table 4-1: Test Equipment

Equipment Calibration Information					
ACS#	**Mfg.**	**Eq. type**	**Model**	**S/N**	**Cal. Due**
1	Rohde & Schwarz	Spectrum Analyzers	ESMI - Display	833771/007	09-21-2010
2	Rohde & Schwarz	Spectrum Analyzers	ESMI-Receiver	839587/003	09-21-2010
25	Chase	Antennas	CBL6111	1043	09-02-2010
30	Spectrum Technologies	Antennas	DRH-0118	970102	05-08-2011
73	Agilent	Amplifiers	8447D	2727A05624	07-15-2010
167	ACS	Cable Set	Chamber EMI Cable Set	167	01-25-2011 (See Note1)
267	Agilent	Power Meter	N1911A	MY45100129	11/16/2010
268	Agilent	Power Sensor	N1921A	MY45240184	11/16/2010
283	Rohde & Schwarz	Spectrum Analyzers	FSP40	1000033	09-21-2010
291	Florida RF Cables	Cables	SMRE-200W-12.0-SMRE	None	11-24-2010 (See Note1)
292	Florida RF Cables	Cables	SMR-290AW-480.0-SMR	None	11-24-2010 (See Note1)
329	A.H.Systems	Antennas	SAS-571	721	08-04-2010
335	Suhner	Cables	SF-102A	882/2A	10-16-2010
338	Hewlett Packard	Amplifiers	8449B	3008A01111	10-16-2010
349	Weinschel	Attenuators	47-30-43	BU7390	12-07-2010 (See Note2)
422	Florida RF	Cables	SMS-200AW-72.0-SMR	805	01-26-2011 (See Note1)
RE35	Agilent	Signal Generator	E8257D	MY46521942	No Cal Req.

Note1: Items characterized on an annual cycle. The date shown indicates the next characterization due date.
Note2: Items verified on an annual cycle. The date shown indicates the next verification due date.

5 SUPPORT EQUIPMENT

Table 5-1: Support Equipment

Item #	Manufacturer	Equipment Type	Model Number	Serial Number
1	Bird Electronic	Termination	8085	13328
2	Rockwell	Wiring Harness	N/A	N/A
3	Elgar	Power Supply	CW1251M-LS	0036A1034
4	AeroFlex	Bus Analyzer	DT400H	N02202105
5 (ACS Asset #346)	Weinschel	Attenuator	54A-10	T1362

6 EQUIPMENT UNDER TEST SETUP BLOCK DIAGRAM

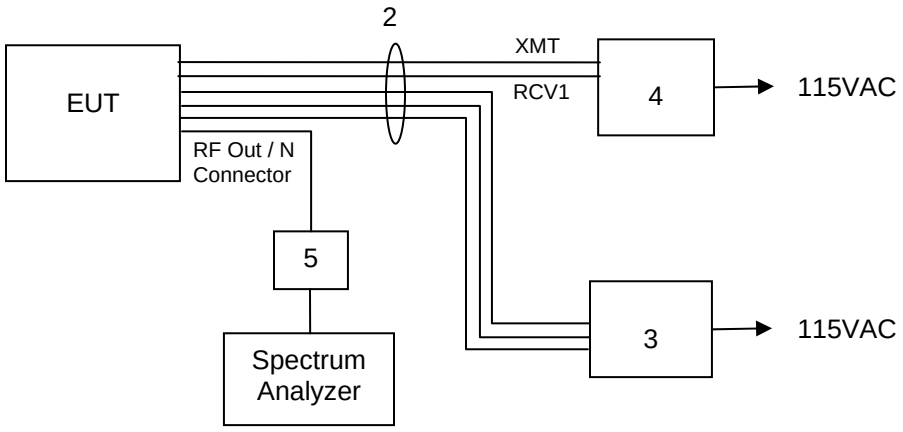

Figure 1: RF Conducted / Frequency Stability Test Setup

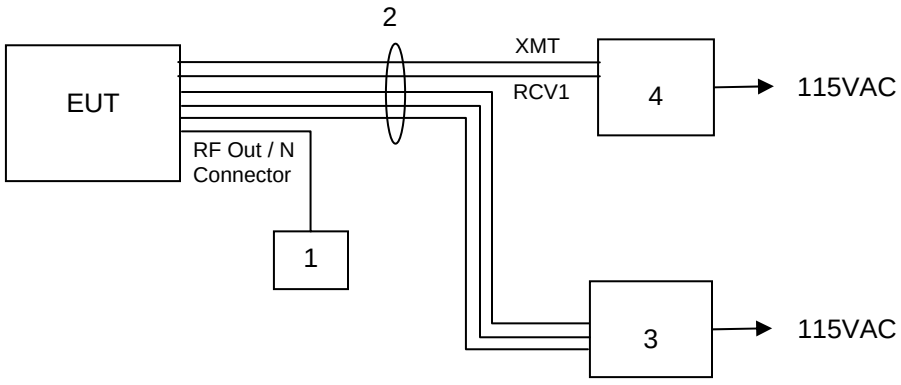

Figure 2: Radiated Emissions Test Setup

7 SUMMARY OF TESTS

Along with the tabular data shown below, plots were taken of all signals deemed important enough to document.

7.1 RF Power Output – FCC Part 87.131

7.1.1 Measurement Procedure

The RF output of the equipment under test was directly connected to the input of the power meter through a 40 dB of passive attenuation. The internal correction factors of the power meter were employed to correct for any cable or attenuator losses. Results are shown below.

7.1.2 Measurement Results

Table 7.1.2-1: Peak Output Power

Frequency (MHz)	Output Power (dBm)
1025	59.17
1087	58.67
1150	58.28

7.2 Occupied Bandwidth (Emission Limits) – FCC Part 87.135

7.2.1 Measurement Procedure

The RF output of the equipment under test was directly connected to the input of the Spectrum Analyzer through a 30 dB passive attenuator. The spectrum analyzer resolution and video bandwidths were set to 10 kHz and 30 kHz respectively. The internal correction factors of the spectrum analyzer were employed to correct for any cable or attenuator losses. The occupied bandwidth measurement function of the spectrum analyzer was used to measure the 99% occupied bandwidth. Results of the test are shown below.

7.2.2 Measurement Results

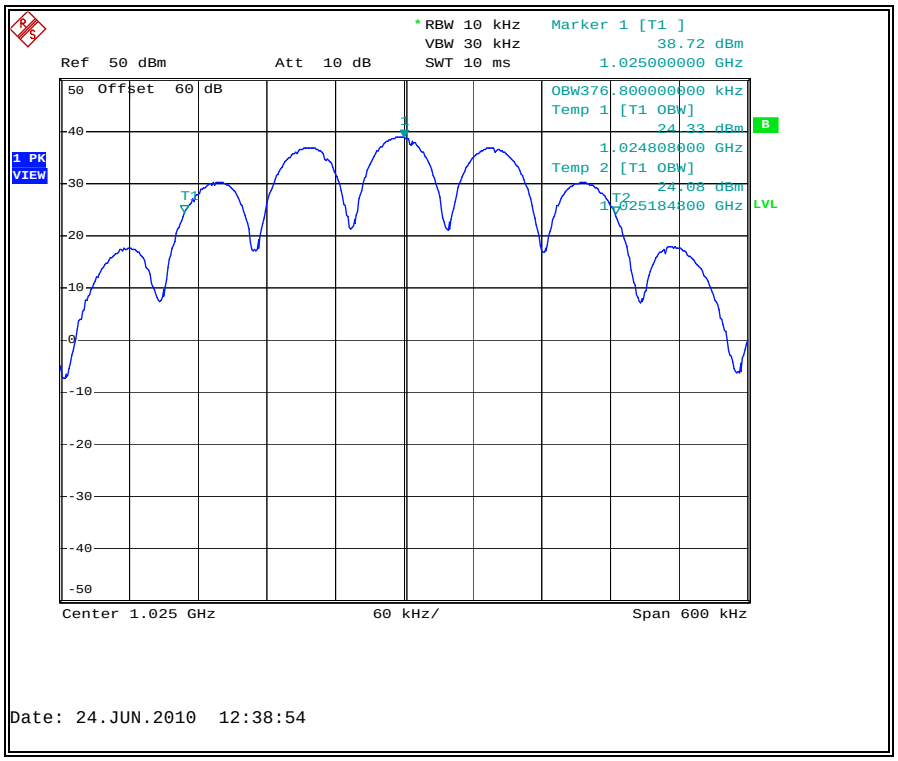

Figure 7.2.2-1: Occupied Bandwidth Low Channel

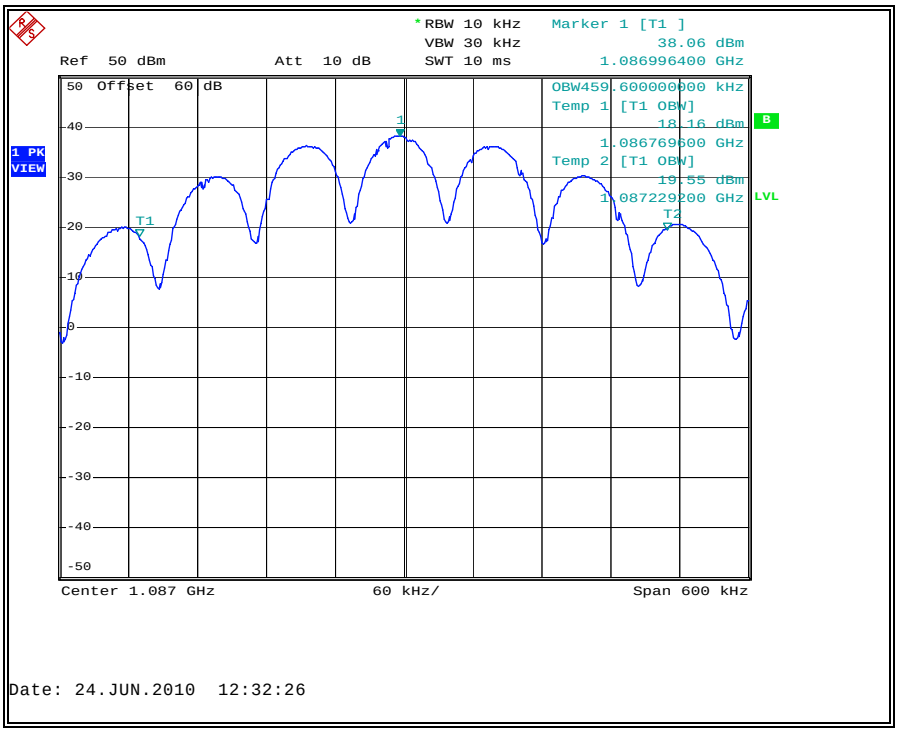

Figure 7.2.2-2: Occupied Bandwidth Mid Channel

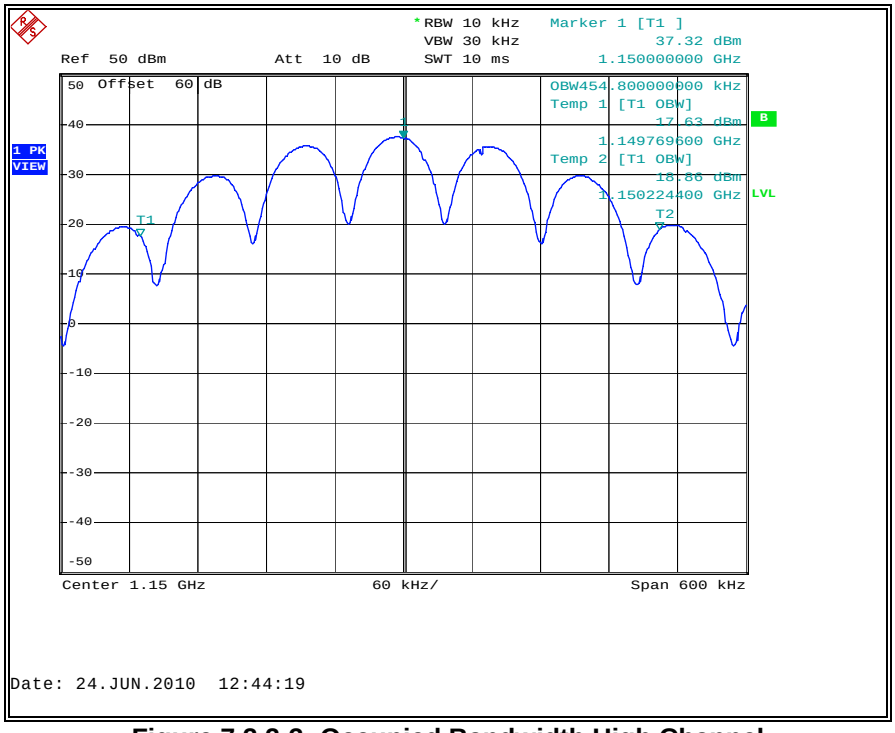

Figure 7.2.2-3: Occupied Bandwidth High Channel

7.3 Spurious Emissions at Antenna Terminals – FCC Part 87.139

7.3.1 Measurement Procedure

The RF output of the equipment under test was directly connected to the input of the Spectrum Analyzer through a 30 dB passive attenuator. The spectrum analyzer resolution bandwidth was set to 100 kHz for emissions <1000MHz and 1 MHz for emissions > 1000 MHz. The internal correction factors of the spectrum analyzer were employed to correct for any cable or attenuator losses. The spectrum was investigated in accordance to CFR 47 Part 2.1057. Results of the test are shown below.

The mean power of spurious emissions are reported below. The mean power of any emission must be attenuated 43 + 10 log10 (P)dB below the mean power of the transmitter. The mean power of the fundamental and spurious emissions was determined using the formula p=2*4us*150*0.5*pk, where 2 = two pulses per transmission, 4us = pulse width measured at the 50% point, 150 = max number of pulse pairs in search mode, 0.5 = half of power used for calculation since the DME-2100 uses cos2 pulses, pk = measured peak emission in mW.

7.3.2 Measurement Results

Table 7.3.2-1: Spurious Emissions at Antenna Terminal

Frequency (MHz)	Spectrum Analyzer Level (dBm)	Limit (dBm)	Margin (dB)
Low Channel			
2050	-37.19	-13.00	24.19
3075	-57.60	-13.00	44.60
7175	-66.46	-13.00	53.46
Mid Channel			
2174	-50.77	-13.00	37.77
3261	-55.75	-13.00	42.75
High Channel			
2300	-48.49	-13.00	35.49
3450	-57.55	-13.00	44.55

NOTE: Spurious emissions not reported were below the noise floor of the measurement system and therefore attenuated below the transmit power (P) in watts by 43 + 10 log10 (P) dB.

7.4 Field Strength of Spurious Emissions – FCC Part 87.139

7.4.1 Measurement Procedure

The equipment under test is placed in the Semi-Anechoic Chamber (described in section 2.3.1) on a wooden table at the turntable center. For each spurious emission, the antenna mast is raised and lowered from one (1) to four (4) meters and the turntable is rotated 360º and the maximum reading on the spectrum analyzer is recorded. This was repeated for both horizontal and vertical polarizations of the receive antenna.

The equipment under test is then replaced with a substitution antenna fed by a signal generator. The signal generator's frequency is set to that of the spurious emission recorded from the equipment under test. The antenna mast is raised and lowered from one (1) to four (4) meters to obtain a maximum reading on the spectrum analyzer. The output of the signal generator is then adjusted until the reading on the spectrum analyzer matches that obtained from the equipment under test. The signal generator level is recorded. The power in dBm of each spurious emission is calculated by correcting the signal generator level for the cable loss and gain of the substitution antenna referenced to a dipole. The spectrum was investigated in accordance to CFR 47 Part 2.1057. Results of the test are shown below.

7.4.2 Measurement Results

Table 7.4.2-1: Field Strength of Spurious Emissions

Frequency (MHz)	Spectrum Analyzer Level (dBm)	Generator Level (dBm)	Antenna Polarity (H/V)	Correction Factors (dB)	Corrected Level (dBm)	Limit (dBm)	Margin (dB)
Low Channel							
2050	-54.65	-54	H	2.56	-51.44	-13.00	38.44
2050	-59.5	-61	V	2.56	-58.44	-13.00	45.44
3075	-59.88	-57	V	3.60	-53.40	-13.00	40.40
Mid Channel							
2174	-61.23	-65	H	2.68	-62.32	-13.00	49.32
2174	-61.91	-64	V	2.68	-61.32	-13.00	48.32
3261	-59.86	-57	V	3.79	-53.21	-13.00	40.21
High Channel							
2300	-59.98	-60	H	2.80	-57.20	-13.00	44.20

NOTE: Spurious emissions not reported were below the noise floor of the measurement system and therefore attenuated below the transmit power (P) in watts by 43 + 10 log10 (P) dB.

7.5 Frequency Stability – FCC Part 87.133

7.5.1 Measurement Procedure

The equipment under test is placed inside an environmental chamber. The RF output is directly coupled to the input of the measurement equipment via a 30 dB attenuator with a power supply attached to the primary supply voltage.

Frequency measurements were made at the extremes of the of temperature range -20º C to +50º C and at intervals of 10º C at normal supply voltage. A period of time sufficient to stabilize all components of the equipment was allowed at each frequency measurement. At a temperature 20º C the supply voltage was varied to 85% and 115% of the nominal supply voltage. The maximum variation of frequency was recorded.

7.5.2 Measurement Results

Frequency Stability

Frequency (MHz): 1025

Temperature	Frequency	Frequency Error	Voltage	Voltage
C	MHz	(PPM)	(%)	(VAC)
-20 C	**1024.994845**	**-5.029**	100%	115.00
-10 C	**1024.994425**	**-5.439**	100%	115.00
0 C	**1024.995032**	**-4.847**	100%	115.00
10 C	**1024.994777**	**-5.096**	100%	115.00
20 C	**1024.996199**	**-3.708**	100%	115.00
30 C	**1024.995841**	**-4.058**	100%	115.00
40 C	**1024.996141**	**-3.765**	100%	115.00
50 C	**1024.996015**	**-3.888**	100%	115.00
20 C	**1024.996421**	**-3.492**	85%	97.75
20 C	**1024.996248**	**-3.660**	115%	132.25

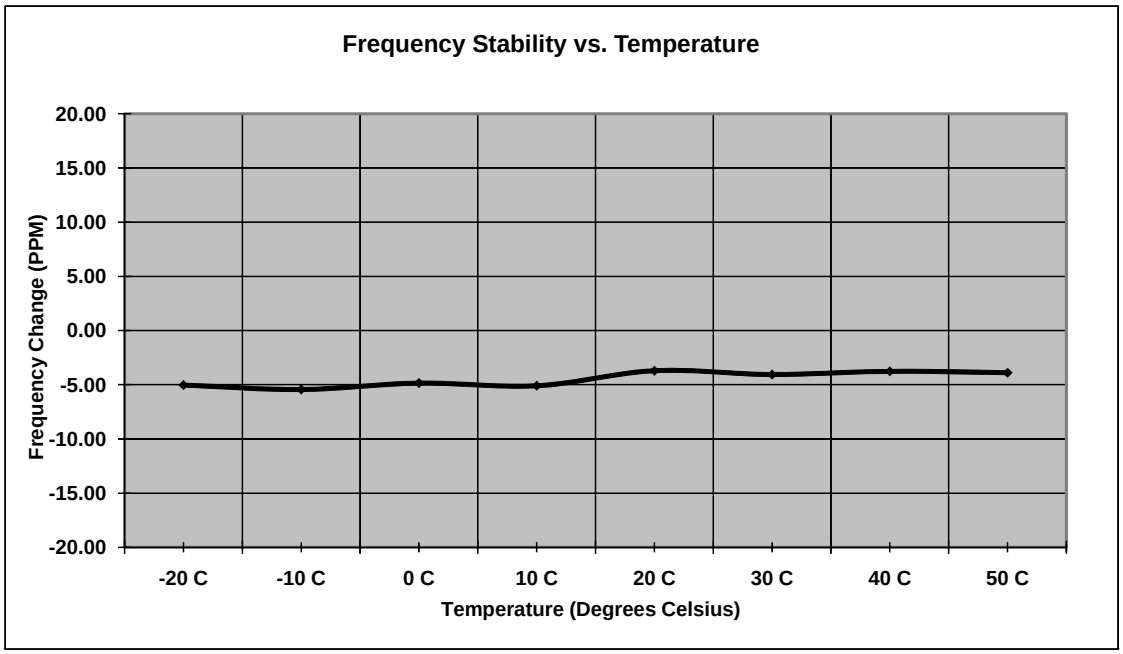

Figure 7.5.2-1: Frequency Stability – Low Channel

Frequency Stability

Frequency (MHz): 1087

Temperature	Frequency	Frequency Error	Voltage	Voltage
C	MHz	(PPM)	(%)	(VAC)
-20 C	**1086.994995**	**-4.604**	100%	115.00
-10 C	**1086.993659**	**-5.833**	100%	115.00
0 C	**1086.993822**	**-5.684**	100%	115.00
10 C	**1086.994371**	**-5.178**	100%	115.00
20 C	**1086.995502**	**-4.138**	100%	115.00
30 C	**1086.994912**	**-4.681**	100%	115.00
40 C	**1086.995210**	**-4.407**	100%	115.00
50 C	**1086.995030**	**-4.572**	100%	115.00
20 C	**1086.995413**	**-4.220**	85%	97.75
20 C	**1086.995571**	**-4.075**	115%	132.25

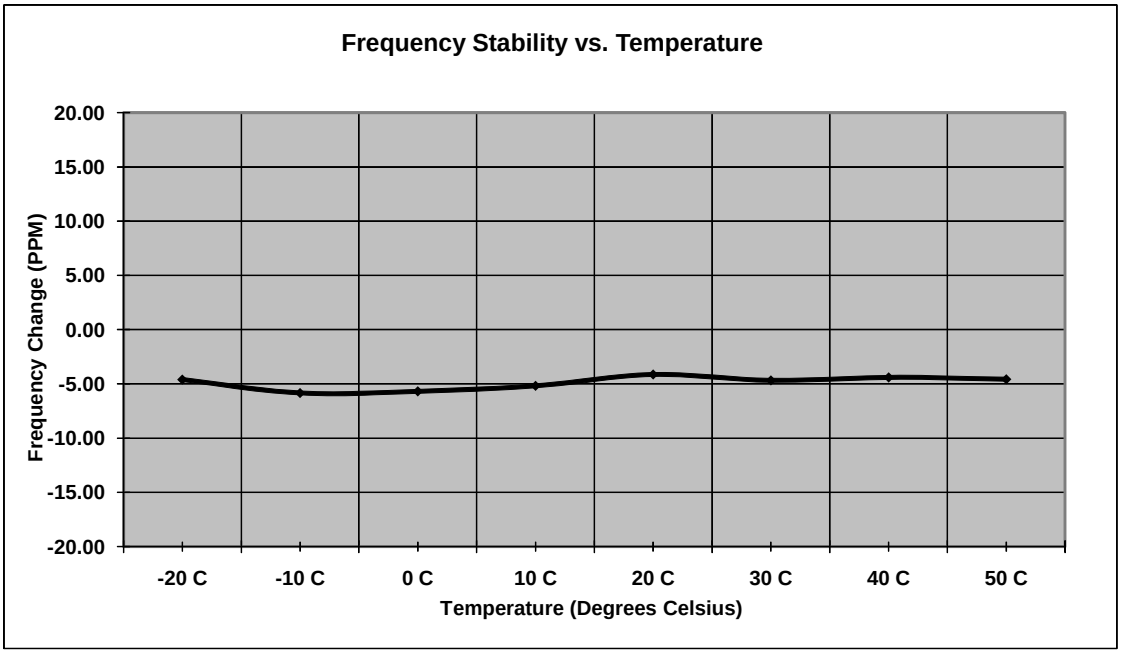

Figure 7.5.2-2: Frequency Stability – Mid Channel

Frequency Stability

Frequency (MHz): 1150

Temperature	Frequency	Frequency Error	Voltage	Voltage
C	MHz	(PPM)	(%)	(VAC)
-20 C	**1149.994208**	**-5.037**	100%	115.00
-10 C	**1149.994043**	**-5.180**	100%	115.00
0 C	**1149.994096**	**-5.134**	100%	115.00
10 C	**1149.994032**	**-5.190**	100%	115.00
20 C	**1149.995400**	**-4.000**	100%	115.00
30 C	**1149.995239**	**-4.140**	100%	115.00
40 C	**1149.995332**	**-4.059**	100%	115.00
50 C	**1149.995222**	**-4.155**	100%	115.00
20 C	**1149.994841**	**-4.486**	85%	97.75
20 C	**1149.995197**	**-4.177**	115%	132.25

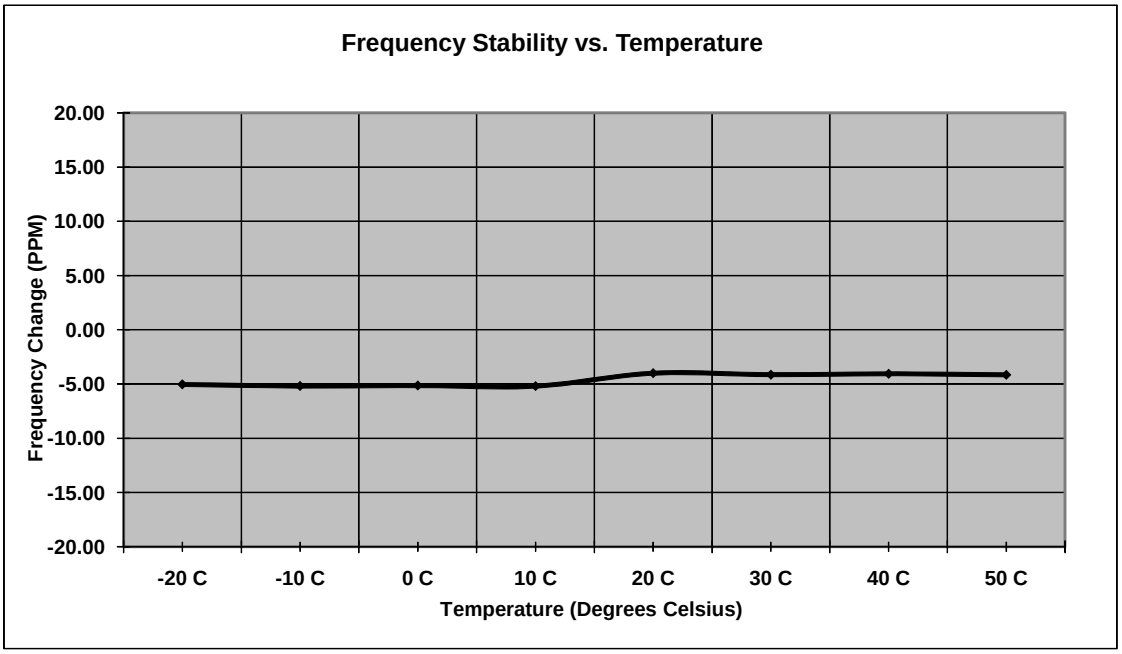

Figure 7.5.2-3: Frequency Stability – High Channel

8 CONCLUSION

In the opinion of ACS, Inc. the model DME-2100, manufactured by Rockwell Collins, Inc. meets all the requirements of FCC Part 87 as applicable.

End Report