National Technical Systems

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Certification Test Report

CFR 47 FCC Part 15, Subpart C Section 15.245

Model: ACMI005 Sport II speed sensor
FCC ID.: IBQACMI005

Report No.: W7194-1

Revision: 0

Prepared for:	Applied Concepts 2609 Technology Drive Plano, TX 75074
Author:	Tom Tidwell
Issued:	31 May, 2007

Report Summary
NTS Plano

Accreditation Numbers: FCC: 101741
IC: 46405-4319 File # IC-4319

Applicant: Applied Concepts

Customer Representative: Phil Wooldridge

EUT Description:

EUT Description	Manufacturer	Model	Revision	Serial Number
The EUT is a K-band speed sensor radar gun used for sporting events	Applied Concepts	ACMI005	-	001

Test Summary

Appendix	Test/Requirement Description	Deviations from:			Pass / Fail	Applicable Rule Parts
		Base Standard	Test Basis	NTS Procedure		
A	Field Strength of Fundamental Emission	No	No	No	PASS	15.245(b)
B	Field Strength of Harmonics	No	No	No	PASS	15.245(b)
C	Spurious Emissions in Restricted Bands	No	No	No	PASS	15.209
D	AC Power line Conducted Emissions	No	No	No	Not Applicable	15.207
E	Test Equipment List	No	No	No	PASS	NA

Test Result: The product presented for testing complied with test requirements as shown above.

This is to certify that the preceding report is true and correct to the best of my knowledge.

Robert Stevens,
Quality Assurance Manager

Tom Tidwell,
Wireless Test Engineer

Table of Contents

Register of revisions

Revision	Reason for Revision	Revision Date
0	Original	31 May, 2007

1.0 INTRODUCTION

1.1 PURPOSE

The purpose of this document is to describe the tests applied by NTS Plano to demonstrate compliance of the ACMI005 to FCC Part 15 Subpart C section 15.245 for Field Disturbance Sensors.

2.0 EUT DESCRIPTION

2.1 CONFIGURATION

Description of EUT

	Name	Model	Revision	Serial Number
EUT	Sport II	ACMI005	-	001
RF Exposure Classification	Mobile			
Frequency Range	24.125 GHz +/- 50 MHz			
Power	10 mW nominal			
Emission Type	CW signal (non-pulsed)			
Functional Description	The Sport II is a speed sensor radar gun for recreational use. Typical use would be measuring the speed of a pitched ball at a baseball game.			

2.1.1 EUT POWER

Voltage	7.5 Vdc
Number of Feeds	Battery

2.2 EUT CABLES

Quantity	Model/Type	Routing		Shielded / Unshielded	Description	Cable Length (m)
		From	To			
1	RS232	EUT	laptop computer	unshielded	Consumer-off-the-shelf	1.25

2.3 MODE OF OPERATION DURING TESTS

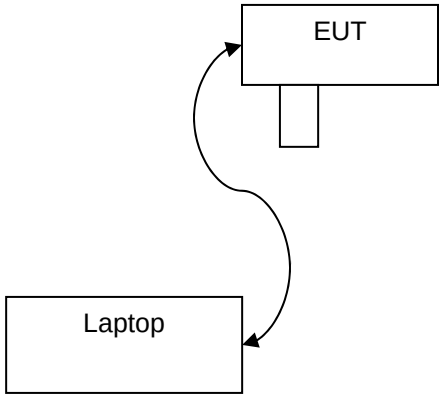
The ACMI005 was tested while in a continuous transmit mode. While transmitting the EUT was setup to operate at the intended maximum power output available to the end user. For all test cases pre-scans were completed in all modes to determine worst case levels.

3.0 SUPPORT EQUIPMENT

3.1 CONFIGURATION

NA

3.2 TEST BED/PERIPHERAL CABLES



APPENDICES

APPENDIX A: FIELD STRENGTH OF FUNDAMENTAL EMISSION

A.1. Base Standard & Test Basis

Base Standard	FCC 15.245
Test Basis	FCC 15.245
Test Method	TCB Council Millimeter Wave Test Procedure

A.2. Specifications

15.245(b) The field strength of emissions from intentional radiators operated within these frequency bands shall comply with the following:

Fundamental frequency (MHz)	Field strength of fundamental (millivolts/meter)
902-928	500
2435-2465	500
5785-5815	500
10500-10550	2500
24075-24175	2500

A.3. Measurement Uncertainty

Expanded Uncertainty (K=2)
+/- 3.7 dB (Below 18 GHz) +/-4.3 dB (Above 18 GHz)

A.4. Deviations

Deviation Number	Time & Date	Description and Justification of Deviation	Deviation Reference			Approval
			Base Standard	Test Basis	NTS Procedure	
none						

A.5. Test Method

TCB Council Millimeter Wave Test Procedure

A.6. Test Results

Compliant – The maximum field strength was 2,114 mV/m @ 3m. This is 1.5 dB below the specified limit.

A.7. Sample Calculation

FS(dBuV/m) = V + AF + CL
Where;

V = The measured voltage at the input to the measuring instrument in dBuV
AF = Antenna factor
CL = Cable losses

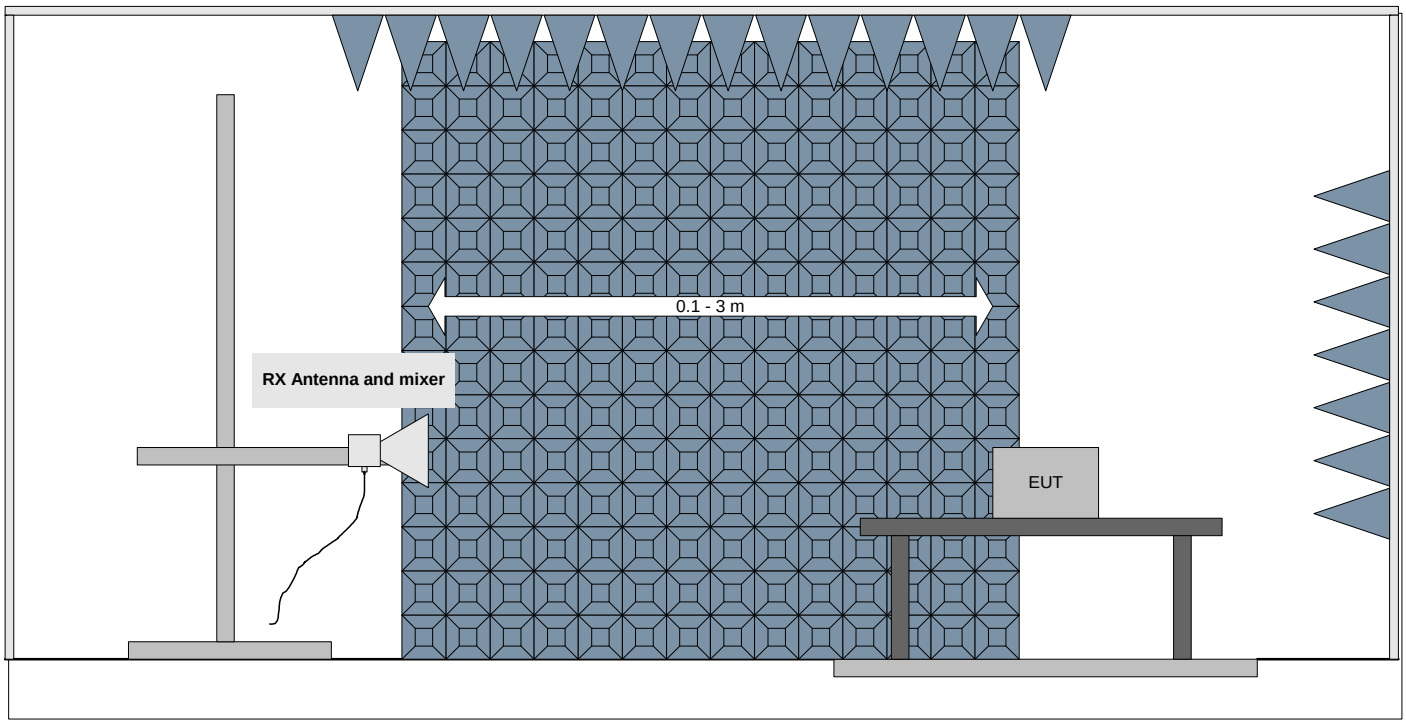
FS(uV/m) = 10^(FS(dBuV/m)/20)
FS(mV/m) = FS(uV/m)/1000

Test Data Summary

RX Ant. Pol. (V/H)	Measured Max. Voltage (dBuV)	Antenna Factor and cable loss (dB)	Measured Max. Field Strength (dBuV/m)	Measured Max. Radiated Field Strength (uV/m)	Measured Max. Radiated Field Strength (mV/m)	Margin (dB)	Measurement Distance (m)
H	80.5	46.0	126.5	2,113,489	2,114	1.46	3
V	79.4	46.0	125.4	1,862,087	1,862	2.56	3

Spectrum analyzer settings: RBW 1 MHz, VBW 1 MHz. The measured signal is a CW, non-pulsed signal so the signal level is not affected by variation of the RBW or VBW.

A.8. Test Setup



Note: The antenna is actually manipulated by hand as per the TCB Council Millimeter Wave Test Procedure document.

A.9. Tested By

Name: Tom Tidwell
Function: Manager of Wireless Services
Date: 24 April, 2007

APPENDIX B: FIELD STRENGTH OF HARMONIC EMISSIONS

B.1. Base Standard & Test Basis

Base Standard	FCC 15.245
Test Basis	FCC 15.245
Test Method	TCB Council Millimeter Wave Test Procedure

B.2. Specifications

15.245(b) The field strength of emissions from intentional radiators operated within these frequency bands shall comply with the following:

Fundamental frequency (MHz)	Field strength of fundamental (millivolts/meter)	Field strength of harmonics (millivolts/meter)
902-928	500	1.6
2435-2465	500	1.6
5785-5815	500	1.6
10500-10550	2500	25.0
24075-24175	2500	25.0

B.3. Measurement Uncertainty

Expanded Uncertainty (K=2)
+/- 3.7 dB (Below 18 GHz) +/-4.3 dB (Above 18 GHz)

B.4. Deviations

Deviation Number	Time & Date	Description and Justification of Deviation	Deviation Reference			Approval
			Base Standard	Test Basis	NTS Procedure	
none						

B.5. Test Method

TCB Council Millimeter Wave Test Procedure

B.6. Test Results

Compliant – The maximum field strength was 0.363 mV/m @ 3m. This is 36.7 dB below the specified limit.

B.7. Sample Calculation

FS(dBmV/m) = V + AF + CL – AG - DC
Where;

V = The measured voltage at the input to the measuring instrument in dBmV
AF = Antenna factor
CL = Cable losses
AG = Gain of the measurement preamplifier
DC = Distance correction factor

FS(mV/m) = 10^(FS(dBmV/m)/20)

Distance correction factor(dB) = 20 log(d2/d1)
Where;
d1 = 3 meters
d2 = measurement distance in meters

RX Ant. Pol. (V/H)	Freq. (GHz)	Meas. Max. Voltage (dBmV)	Antenna Factor and cable loss (dB)	Amp Gain (dB)	Meas. Dist. (m)	Dist. Corr. (dB)	Meas. Max. Field Strength (dBmV/m @3m)	Meas. Max. Field Strength (mV/m@3 m)	Margin (dB)
H	48,206	-25.1	40.6	18	1	9.5	-12.0	0.251	29.5
V	48,206	-14.9	40.6	18	1	9.5	-1.8	0.812	19.3
H	72.309	-15	43.4	-	.25	21.5	6.9	2.2	10.6
V	72.309	-15	43.4	-	.25	21.5	6.9	2.2	10.6
H	96.412	-15	45.9	-	.25	21.5	9.4	3.0	8.1
V	96.412	-15	45.9	-	.25	21.5	9.4	3.0	8.1
H	120.515	-15	47.8	-	.25	21.5	11.3	3.7	6.2
V	120.515	-15	47.8	-	.25	21.5	11.3	3.7	6.2
H	144.618	-13	49.4	-	.1	29.5	7.9	2.5	9.6
V	144.618	-13	49.4	-	.1	29.5	7.9	2.5	9.6
H	168.721	-13	50.8	-	.1	29.5	8.3	2.6	9.2
V	168.721	-13	50.8	-	.1	29.5	8.3	2.6	9.2
H	192.824	-12	51.9	-	.1	29.5	10.4	3.3	7.1
V	192.824	-12	51.9	-	.1	29.5	10.4	3.3	7.1
H	216.927	-9	52.9	-	.1	29.5	14.4	5.2	3.1
V	216.927	-9	52.9	-	.1	29.5	14.4	5.2	3.1

All measurements above 48.206 GHz are peak noise floor readings measurements.

Spectrum analyzer settings: RBW = 1 MHz, VBW = 1 MHz (for peak measurement) or
RBW = 1 MHz, VBW = 10 Hz (for peak measurement)

B.8. Tested By

Name: Tom Tidwell
Function: Manager of Wireless Services
Date: 24 April, 2007

APPENDIX C: RADIATED EMISSIONS IN RESTRICTED BANDS 30 MHz – 220 GHz

C.1. Base Standard & Test Basis

Base Standard	CFR Title 47 – Telecommunications, Chapter I - FCC Part 15.209 – Radio Frequency Devices
Test Basis	CFR Title 47 – Telecommunications, Chapter I - FCC Part 15.209 – Radio Frequency Devices
Test Method	TCB Council Millimeter Wave Test Procedure

Specifications

MHz	MHz	MHz	GHz
0.090-0.110	16.42-16.423	399.9-410	4.5-5.15
\1\ 0.495-0.505	16.69475-16.69525	608-614	5.35-5.46
2.1735-2.1905	16.80425-16.80475	960-1240	7.25-7.75
4.125-4.128	25.5-25.67	1300-1427	8.025-8.5
4.17725-4.17775	37.5-38.25	1435-1626.5	9.0-9.2
4.20725-4.20775	73-74.6	1645.5-1646.5	9.3-9.5
6.215-6.218	74.8-75.2	1660-1710	10.6-12.7
6.26775-6.26825	108-121.94	1718.8-1722.2	13.25-13.4
6.31175-6.31225	123-138	2200-2300	14.47-14.5
8.291-8.294	149.9-150.05	2310-2390	15.35-16.2
8.362-8.366	156.52475-156.52525	2483.5-2500	17.7-21.4
8.37625-8.38675	156.7-156.9	2690-2900	22.01-23.12
8.41425-8.41475	162.0125-167.17	3260-3267	23.6-24.0
12.29-12.293	167.72-173.2	3332-3339	31.2-31.8
12.51975-12.52025	240-285	3345.8-3358	36.43-36.5
12.57675-12.57725	322-335.4	3600-4400	(\2\)
13.36-13.41			

\1\ Until February 1, 1999, this restricted band shall be 0.490-0.510 MHz.
\2\ Above 38.6

(b) Except as provided in paragraphs (d) and (e) of this section, the field strength of emissions appearing within these frequency bands shall not exceed the limits shown in §15.209. At frequencies equal to or less than 1000 MHz, compliance with the limits in §15.209 shall be demonstrated using measurement instrumentation employing a CISPR quasi-peak detector. Above 1000 MHz, compliance with the emission limits in §15.209 shall be demonstrated based on the average value of the measured emissions. The provisions in §15.35 apply to these measurements.

C.2. Measurement Uncertainty

Radiated Emissions	Measurement Uncertainty	Expanded Uncertainty (K=2)
(dB)	3.7	4.3

C.3. Deviations

Deviation Number	Time & Date	Description and Justification of Deviation	Deviation Reference			Approval
			Base Standard	Test Basis	NTS Procedure	
none						

C.4. Test Results

Compliant.

C.5. Deviations from Normal Operating Mode During Test

None.

C.6. Test Data & Photographs

RX Ant. Pol. (V/H)	Freq. (GHz)	Meas. Max. Voltage (dBmV)	Antenna Factor and cable loss (dB)	Amp Gain (dB)	Meas. Dist. (m)	Dist. Corr. (dB)	Meas. Max. Field Strength (dBmV/m @3m)	Meas. Max. Field Strength (mV/m@3 m)	Margin (dB)
H	48,206	-25.1	40.6	18	1	9.5	-12.0	0.251	29.5
V	48,206	-14.9	40.6	18	1	9.5	-1.8	0.812	19.3
H	72.309	-15	43.4	-	.25	21.5	6.9	2.2	10.6
V	72.309	-15	43.4	-	.25	21.5	6.9	2.2	10.6
H	96.412	-15	45.9	-	.25	21.5	9.4	3.0	8.1
V	96.412	-15	45.9	-	.25	21.5	9.4	3.0	8.1
H	120.515	-15	47.8	-	.25	21.5	11.3	3.7	6.2
V	120.515	-15	47.8	-	.25	21.5	11.3	3.7	6.2
H	144.618	-13	49.4	-	.1	29.5	7.9	2.5	9.6
V	144.618	-13	49.4	-	.1	29.5	7.9	2.5	9.6
H	168.721	-13	50.8	-	.1	29.5	8.3	2.6	9.2
V	168.721	-13	50.8	-	.1	29.5	8.3	2.6	9.2
H	192.824	-12	51.9	-	.1	29.5	10.4	3.3	7.1
V	192.824	-12	51.9	-	.1	29.5	10.4	3.3	7.1
H	216.927	-9	52.9	-	.1	29.5	14.4	5.2	3.1
V	216.927	-9	52.9	-	.1	29.5	14.4	5.2	3.1

All measurements above 48.206 GHz are peak noise floor readings measurements.
No emissions were detected in the restricted bands below 17 GHz.
The spectrum was searched from 30 MHz to 220 GHz.

Spectrum analyzer settings: RBW = 1 MHz, VBW = 1 MHz (for peak measurement) or
RBW = 1 MHz, VBW = 10 Hz (for peak measurement)

C.7. Tested By

Name: Tom Tidwell
Function: Manager of Wireless Services
Date: 24 April, 2007

APPENDIX D: FCC PART 15.207 CONDUCTED VOLTAGE EMISSIONS 150 kHz – 30 MHz

D.1. Base Standard & Test Basis

Base Standard	CFR Title 47 – Telecommunications, Chapter I - FCC Part 15.207 – Radio Frequency Devices - Subpart C – Unintentional Radiators
Test Basis	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
Test Method	NTS Radiated Emissions Test Method E011R1

D.2. Specifications

Frequency	☐	**Class A**	☒	**Class B**
Limit	**Quasi-Peak**	**Average**	**Quasi-Peak**	**Average**
MHz	**dBµV**	**dBµV**	**dBµV**	**dBµV**
0.150 – 0.500	79.00	66.00	66 to 56[1]	56 to 46[1]
0.500 – 5.00	73.00	60.00	56	46
5.00 – 30.00	73.00	60.00	60	50

Note 1: decrease with the logarithm of the frequency.

D.3. Measurement Uncertainty

Conducted Current Emissions 150 kHz – 30 MHz	**Measurement Uncertainty**	**Expanded Uncertainty (K=2)**
(dB)		

D.4. Deviations

Deviation Number	**Time & Date**	**Description and Justification of Deviation**	**Deviation Reference**			**Approval**
			Base Standard	**Test Basis**	**NTS Procedure**	
none						

D.5. Special Considerations

None.

D.6. Test Results

Not applicable. The device is battery operated.

APPENDIX E: TEST EQUIPMENT LIST

E.1. Test Equipment

NTS Asset No.	Instrument	Manufacturer	Model	Calibration Frequency	Calibration Due
ANTENNA CONDUCTED EMISSIONS					
W1020P	Spectrum Analyzer	Rohde & Schwarz	FSQ 26	12 Months	10/1/07
E1289P	Bilog Antenna	ETS	3142C	12 Months	9/4/08
E1019P	Horn Antenna	ETS	3115	12 Months	2/28/08
W1025P	Low Noise Preamplifier	Miteq	JSW4-40006000	12 Months	1/15/08
W1026P	U-Band Horn Antenna	Oleson	M19RH	24 Months	1/15/09
W1027P	E-Band Horn Antenna	Oleson	M12RH	24 Months	1/15/09
W1028P	F-Band Horn Antenna	Oleson	M08RH	24 Months	1/15/09
W1029P	G-Band Horn Antenna	Oleson	M05RH	24 Months	1/15/09
W1030P	U-Band Mixer	Oleson	M19HWD	24 Months	1/15/09
W1031P	E-Band Mixer	Oleson	M12HWD	24 Months	1/15/09
W1032P	F-Band Mixer	Oleson	M08HWD	24 Months	1/15/09
W1033P	G-Band Mixer	Oleson	M05HWD	24 Months	1/15/09
E1068P	18 – 40 GHz horn	EMCO	3116	24 Months	10/1/07

END OF DOCUMENT