



FCC Certification Test Report
for
Mine Safety Appliances
FCC ID: P9R-10058545

February 16, 2006
Revision 1, February 24, 2006

Prepared for:

Mine Safety Appliances, Instrument Division
1000 Cranberry Woods Drive
Pittsburgh, PA 16066

Prepared By:

Washington Laboratories, Ltd.
7560 Lindbergh Drive
Gaithersburg, Maryland 20879



**FCC Certification Test Report
for the
Mine Safety Appliances
RFID Tag (ICM System)
FCC ID: P9R-10058545**

February 16, 2006

Revision 1, February 24, 2006

WLL JOB# 8486

Prepared by: Brian J. Dettling
Documentation Specialist

Reviewed by: Gregory M. Snyder
Chief EMC Engineer

Abstract

This report has been prepared on behalf of Mine Safety Appliances, Instrument Division to support the attached Application for Equipment Authorization. The test report and application are submitted for an Intentional Radiator under Part 15.209 of the FCC Rules and Regulations. This Federal Communication Commission (FCC) Certification Test Report documents the test configuration and test results for a Mine Safety Appliances RFID Tag (ICM System).

Testing was performed on an Open Area Test Site (OATS) of Washington Laboratories, Ltd, 7560 Lindbergh Drive, Gaithersburg, MD 20879. Site description and site attenuation data have been placed on file with the FCC's Sampling and Measurements Branch at the FCC laboratory in Columbia, MD. Washington Laboratories, Ltd. has been accepted by the FCC and approved by NIST NVLAP (NVLAP Lab Code: 200066-0) as an independent FCC test laboratory.

The Mine Safety Appliances RFID Tag (ICM System) complies with the limits for an Intentional Radiator device under Part 15.209 of the FCC Rules and Regulations.

Table of Contents

Abstract	ii
1 Introduction.....	1
1.1 Compliance Statement	1
1.2 Test Scope	1
1.3 Contract Information.....	1
1.4 Test Dates	1
1.5 Test and Support Personnel	1
1.6 Abbreviations.....	2
2 Equipment Under Test	3
2.1 EUT Identification & Description	3
2.2 Test Configuration	3
2.3 Testing Algorithm.....	3
2.4 Test Location	4
2.5 Measurements	4
2.5.1 References.....	4
2.6 Measurement Uncertainty	4
3 Test Equipment	5
4 Test Results.....	6
4.1 Occupied Bandwidth: (FCC Part §2.1049).....	6
4.2 Radiated Spurious Emissions: (FCC Part §15.209).....	7
4.2.1 Test Procedure	7

List of Tables

Table 1: Device Summary	3
Table 2: Test Equipment List.....	5
Table 3: Radiated Emissions Limits	7
Table 4: Radiated Emissions Test Data	10

List of Figures

Figure 1. Occupied Bandwidth	6
Figure 2. Radiated Emissions Test Data, Ambient	8
Figure 3. Radiated Emissions Test Data, 0 meters	8
Figure 4. Radiated Emissions Test Data, 3 meters	9

1 Introduction

1.1 Compliance Statement

The Mine Safety Appliances RFID Tag (ICM System) complies with the limits for a Intentional Radiator device under Part 15.209 of the FCC Rules and Regulations.

1.2 Test Scope

Tests for radiated emissions were performed. All measurements were performed according to the 2003 version of ANSI C63.4. The measurement equipment conforms to ANSI C63.2 Specifications for Electromagnetic Noise and Field Strength Instrumentation.

1.3 Contract Information

Customer: Mine Safety Appliances, Instrument Division
1000 Cranberry Woods Drive
Pittsburgh, PA 16066

Quotation Number: 62079

1.4 Test Dates

Testing was performed on December 13, 2004.

1.5 Test and Support Personnel

Washington Laboratories, LTD

John Rapella

Customer

David Kodrin

1.6 Abbreviations

A	Ampere
Ac	alternating current
AM	Amplitude Modulation
Amps	Amperes
b/s	bits per second
BW	Bandwidth
CE	Conducted Emission
cm	centimeter
CW	Continuous Wave
dB	decibel
dc	direct current
EMI	Electromagnetic Interference
EUT	Equipment Under Test
FM	Frequency Modulation
G	giga - prefix for 10^9 multiplier
Hz	Hertz
IF	Intermediate Frequency
k	kilo - prefix for 10^3 multiplier
M	Mega - prefix for 10^6 multiplier
m	Meter
μ	micro - prefix for 10^{-6} multiplier
NB	Narrowband
LISN	Line Impedance Stabilization Network
RE	Radiated Emissions
RF	Radio Frequency
rms	root-mean-square
SN	Serial Number
S/A	Spectrum Analyzer
V	Volt

2 Equipment Under Test

2.1 EUT Identification & Description

The Mine Safety Appliances RFID Tag (ICM System) is an accessory of the Integrated Control Module (ICM). The control module / transmitter is mounted in the same location as the pneumatic pressure gage on a Self Contained Breathing Apparatus (SCBA). It contains a numeric display an integral electronic pressure transducer that measures the pressure in the gage line. The receiver (also known as the Heads Up Display (HUD)) is mounted to the face piece in the user's lower right hand corner of the lens. The HUD incorporates numerous LEDs to indicate various functions, primarily remaining tank capacity. This product uses magnetic induction to couple the transmitter to the receiver over a distance of up to eighteen (18) inches.

The RF ID Tag uses the same magnetic induction coupling to transmit user ID to the control module. The ID Tag is activated by swiping it by a magnet housed in the control unit. The ID Tag is powered by a single coin cell battery.

Table 1: Device Summary

ITEM	DESCRIPTION
Manufacturer:	Mine Safety Appliances
FCC ID Number	P9R-10058545
EUT Name:	Tag (ICM System)
Model:	RFID Tag
FCC Rule Parts:	§15.209
Frequency Range:	30.82kHz
Occupied Bandwidth:	5.52 kHz
Keying:	Automatic
Type of Information:	Data
Number of Channels:	1
Power Output Level	Fixed
Antenna Type	Integral
Interface Cables:	None
Power Source & Voltage:	Battery

2.2 Test Configuration

The RFID Tag was tested in a stand-alone configuration.

2.3 Testing Algorithm

The RFID Tag was operated continuously by being placed into a continuous transmit mode. Emissions were checked with the device placed in all three orthogonal planes with the worst case data being reported.

Worst case emission levels are provided in the test results data.

2.4 Test Location

All measurements herein were performed at Washington Laboratories, Ltd. test center in Gaithersburg, MD. Site description and site attenuation data have been placed on file with the FCC's Sampling and Measurements Branch at the FCC laboratory in Columbia, MD. Washington Laboratories, Ltd. has been accepted by the FCC and approved by NIST NVLAP (NVLAP Lab Code: 200066-0) as an independent FCC test laboratory.

2.5 Measurements

2.5.1 References

ANSI C63.2 Specifications for Electromagnetic Noise and Field Strength Instrumentation

ANSI C63.4 American National Standard for Methods of Measurement of Radio-Noise Emissions from Low-Voltage Electrical and Electronic Equipment in the Range of 9 kHz to 40 GHz

Land Mobile FM or PM Communications Equipment Measurement and Performance Standards (ANSI/TIA/EIA-603-93)

2.6 Measurement Uncertainty

All results reported herein relate only to the equipment tested. For the purposes of the measurements performed by Washington Laboratories, the measurement uncertainty is ± 2.3 dB. This has been calculated for a *worst-case situation* (radiated emissions measurements performed on an open area test site).

The following measurement uncertainty calculation is provided:

$$\text{Total Uncertainty} = (A^2 + B^2 + C^2)^{1/2}/(n-1)$$

where:

A = Antenna calibration uncertainty, in dB = 2 dB

B = Spectrum Analyzer uncertainty, in dB = 1 dB

C = Site uncertainty, in dB = 4 dB

n = number of factors in uncertainty calculation = 3

Thus, Total Uncertainty = $0.5 (2^2 + 1^2 + 4^2)^{1/2} = \pm 2.3$ dB.

3 Test Equipment

Table 2 shows a list of the test equipment used for measurements along with the calibration information.

Table 2: Test Equipment List

Equipment	WLL Asset #	Calibration Due
Hewlett-Packard 8568B Spectrum Analyzer	0073	7/08/05
Hewlett-Packard 85650A Quasi-Peak Adapter	0069	7/08/05
Hewlett-Packard 8593A Spectrum Analyzer	0074	8/17/05
Solar Electronics 8012-50-R-24BNC LISN	0125	10/01/05
ARA LPB-2520 BiconiLog Antenna	0007	9/14/05
Hewlett-Packard 85685A RF Preselector	0071	7/08/05
EMCO 6502 Active Loop Antenna	0032	1/10/05
EMCO 6511 Loop Antenna	0031	1/14/05

4 Test Results

4.1 Occupied Bandwidth: (FCC Part §2.1049)

Occupied bandwidth was performed by setting the EUT near the loop antenna to allow for sufficient pickup of the signal.

At full modulation, the occupied bandwidth (20dB) was measured at 5.62 kHz as shown in the following plot:

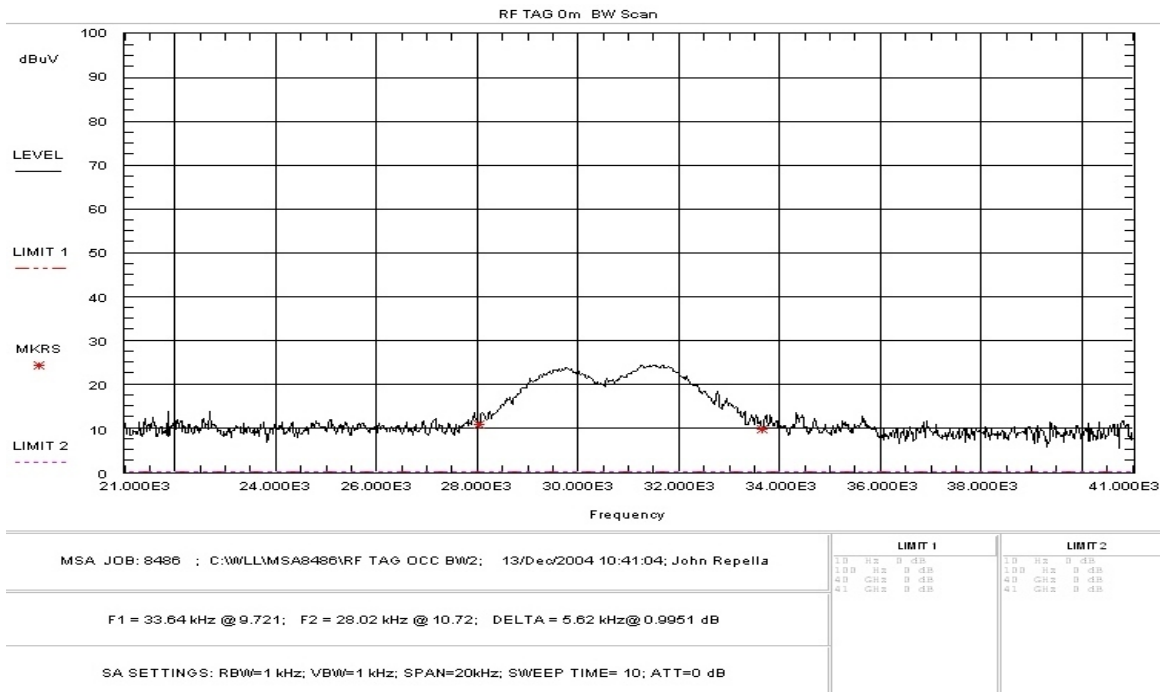


Figure 1. Occupied Bandwidth

4.2 Radiated Spurious Emissions: (FCC Part §15.209)

Transmitters operating under §15.209 must comply with the radiated emissions listed in the following table:

Table 3: Radiated Emissions Limits

Frequency (MHz)	Field Strength (microvolts/meter)	Measurement Distance (meters)
0.009 - 0.490	2400/F(kHz)	300
0.490 - 1.705	24000/F(kHz)	30
1.705 - 30.0	30	30
30 - 88	100	3
88 - 216	150	3
216 - 960	200	3
Above 960	500	3

4.2.1 Test Procedure

The EUT was placed on motorized turntable for radiated testing on a 3-meter open field test site. The emissions from the EUT were measured continuously at every azimuth by rotating the turntable. The receiving loop antenna was rotated about its vertical axis to determine the maximum emissions.

The EUT was scanned to 30MHz. No emissions were detectable at 3 meters test distance. Emission plots to 400kHz showing the ambient and with the unit on are included in Figure 2.

A 0 meter scan was then performed to 400kHz to verify the fundamental and other spurious emissions. A plot showing the 0 meter scan emissions is shown in Figure 3. Figure 4 is a list of ambient signals measured at 3 meters. The limit has been interpolated to 3m.

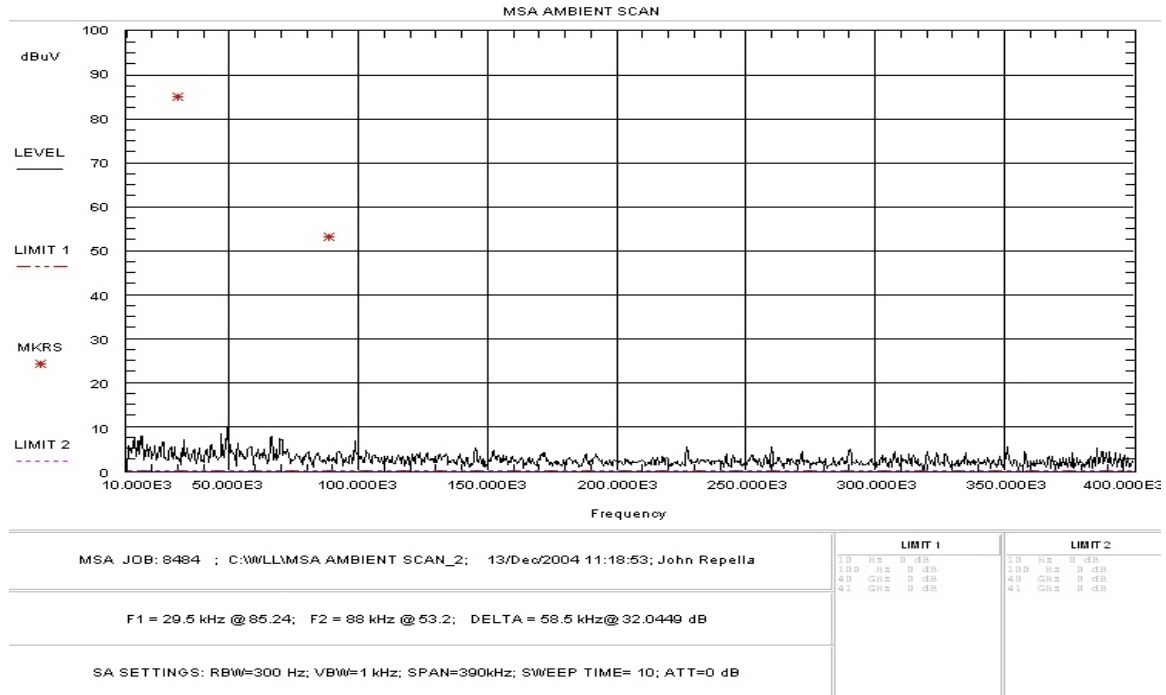


Figure 2. Radiated Emissions Test Data, Ambient

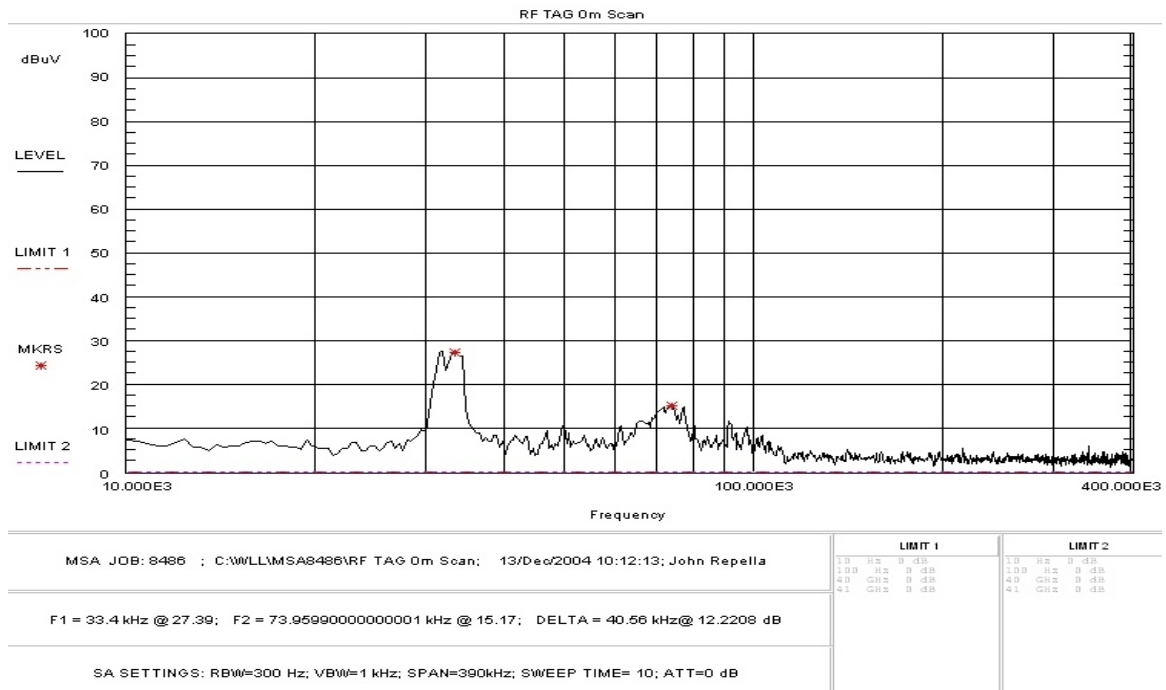


Figure 3. Radiated Emissions Test Data, 0 meters

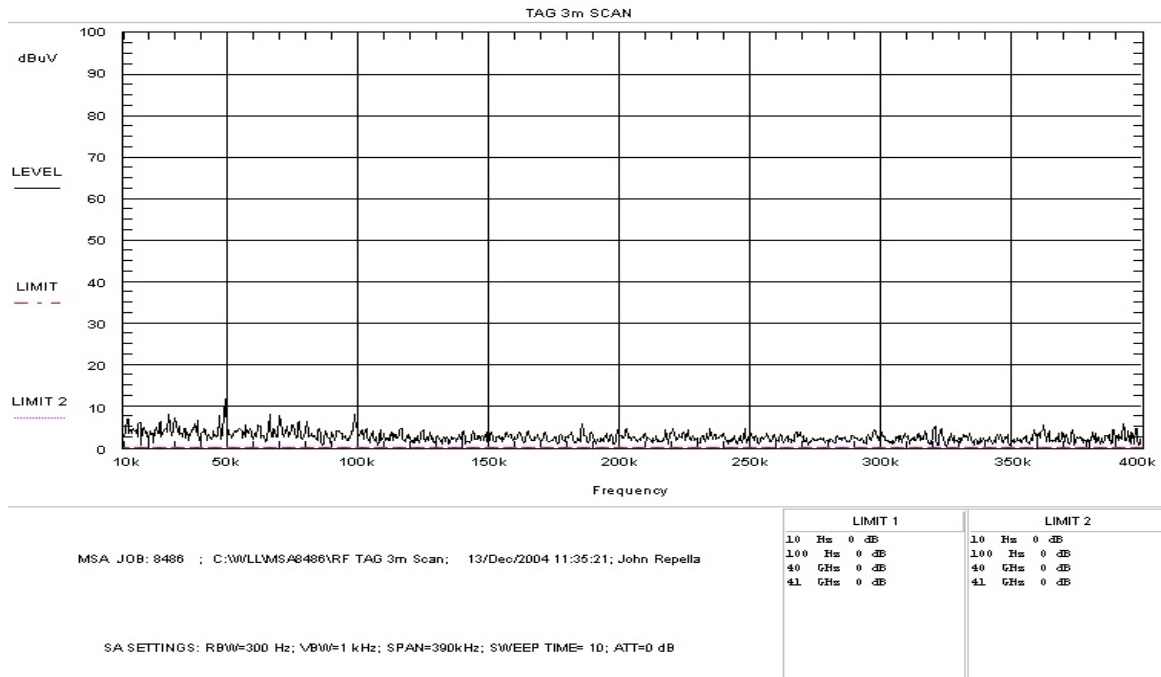


Figure 4. Radiated Emissions Test Data, 3 meters

Table 4: Radiated Emissions Test Data

CLIENT:	MSA	DATE:	12/13/2004
TESTER:	John Repella	JOB #:	8486
<u>EUT Information:</u>		<u>Test Requirements:</u>	
EUT:	RF Tag	TEST STANDARD:	FCC Part 15.209
Tx Frequency:	30.82 kHz	DISTANCE:	3m
<u>Test Equipment/Limit:</u>			
ANTENNA:	#00032	LIMIT:	FCC 15.209
CABLE:	CSITE2_3m	AMPLIFIER (dB)	None

Freq. (MHz)	Az Deg	Ant. Hght (m)	SA Level Peak (dBµV)	Ant. Corr. (dB/m)	Cable Corr. (dB)	Corr. Level (dBµV/m)	Corr. Level (µV/m)	Limit (µV/m)	Margin dB	Notes
0.03082	0.0	1.0	4.2	58.8	0.6	63.6	1513.6	7787.2	-14.2	amb
0.06164	0.0	1.0	5.4	54.0	0.6	60.0	1000.0	7787.2	-17.8	amb
0.09246	0.0	1.0	4.0	51.2	0.7	55.9	623.7	7787.2	-21.9	amb
0.12328	0.0	1.0	2.7	49.5	0.7	52.9	441.6	7787.2	-24.9	amb
0.15410	0.0	1.0	2.2	49.1	0.7	52.0	398.1	7787.2	-25.8	amb
0.18492	0.0	1.0	4.6	49.0	0.7	54.3	518.8	7787.2	-23.5	amb