FCC and IC
Electromagnetic Compatibility
Test Report

For

3M™ Detection System
Model 9100

FCC ID: DGFTTS9100
IC: 458A-TTS9100

3M™ Track and Trace Solutions Division

St. Paul, MN

February 2, 2011

Report Number: F0810001

Prepared By:
3M Regulatory Engineering and Quality
EMC Laboratory
410 Fillmore Avenue, Building 76
St. Paul, Minnesota 55144-1000

CERTIFICATE OF COMPLIANCE

MANUFACTURER'S NAME:	3M™ Company
NAME OF EQUIPMENT:	3M™ Detection System
MODEL NUMBER:	9100
FCC ID	DGFTTS9100
IC	IC: 458A-TTS9100
TEST REPORT NUMBER:	F0810001
DATE OF ISSUE:	February 2, 2011

USA (FCC) - Title 47, Code of Federal Regulations

Industry Canada (IC) – ICES, RSS

EMISSIONS:

Radiated / Conducted	**(FCC Part 15, Subpart B, Class A)**
	(IC, ICES-003)
Radiated / Conducted	**(FCC Part 15, Subpart C)**
	(IC, RSS-210, RSS-GEN)
RF Exposure	**(FCC - Exempt)**
	(IC - Exempt)

As the responsible EMC Project Engineer, I hereby declare that the equipment tested, as specified in the test report, at the 3M Product Safety EMC Laboratory is in compliance with 47 CFR, Part 15, Subpart B and Subpart C, and Industry Canada RSS & ICES Standards. It is the manufacturer's responsibility to assure that additional production units of this model are manufactured with identical electrical and mechanical characteristics.

Robert E. Heller

Digitally signed by Robert E. Heller
DN: cn=Robert E. Heller, c=US, o=EMC Lab, ou=SEMS, email=reheller@mmm.com
Date: 2011.02.23 13:06:56 -06'00'

Robert E. Heller
Senior EMC Engineer

NVLAP Lab Code 200033

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1.0 TEST SUMMARY

Test Report Number:	F0810001
Requester:	Seth Lieffort
Company:	3M™ Company TTS Division St. Paul, MN 55144
Telephone Number:	651-736-6939
Equipment Under Test:	3M™ Detection System Model 9100
Date Of Receipt:	January 21, 2011
Condition upon receipt	Device was in good working condition
Test Results:	Passed the following tests: Radiated Emissions: FCC Part 15 Subpart B, ICES-003 IC RSS-210, RSS-Gen Radiated Emissions: FCC Part 15 Subpart C, IC RSS-210, RSS-Gen IC RSS-102
Modifications:	See section 8.0
Test Location:	3M Product Safety EMC Laboratory Building 76-1-01 410 Fillmore Ave. St. Paul, MN 55144-1000

2.0 INTRODUCTION

2.1 Scope

This report contains results describing the conformance of the Equipment Under Test (EUT) to FCC Part 15, Subpart B and IC ICES-003 rules for unintentional radiators and FCC Part 15, Subpart C and IC RSS rules for intentional radiators.

This report is the confidential property of the client and applies only to the specific item tested under the stated test conditions. It is the manufacturer's responsibility to assure that additional production units of this model are manufactured with identical electrical and mechanical characteristics. This report shall not be reproduced except in full without the written approval of the testing laboratory.

Subsequent tests are necessary from time to time on equipment taken at random from production. Retesting of the EUT is also required when the EMC profile has been changed or is suspected of being changed.

The 3M Regulatory Engineering and Quality EMC Laboratory is recognized under the United States Department of Commerce National Institute of Standards and Technology's National Voluntary Laboratory Accreditation Program (NVLAP) for satisfactory compliance with criteria established in Title 15, Part 285 Code of Federal Regulations. These criteria encompass the requirements of ISO/IEC Guide 17025 and the relevant requirements of ISO 9002 (ANSI/ASQC Q92-1987) as suppliers of test results. Accreditation by the National Voluntary Laboratory Accreditation Program is awarded for specific services, listed on the Scope of Accreditation for: Electromagnetic Compatibility and Telecommunications FCC under Lab Code 200033. A complete copy of the Scope of Accreditation is available upon request.

The FCC Site Registration Number is 93334. The Industry Canada (IC) Site Registration Number is 458A-1.

The NVLAP accreditation or this test report does not in any way constitute or imply product certification, approval, or endorsement by NVLAP, NIST, or any agency of the U.S. Government.

2.2 EUT Description and Operation

The Equipment Under Test (EUT) was the 3M™ Detection System Model 9100. The 9100 is intended for use in detecting books and other media items marked using RFID tags that have not been checked out by library patrons. The system is typically placed at the exit point of a library such that patrons must walk through it when exiting the building or facility and provides an audio and visual alarm if unchecked materials are detected The system must be installed as specified in the *3M™ Detection System Model 9100 Series Architect's/Contractor's Information Package* and is intended for use in an indoor library environment. It has not been evaluated for other uses or locations.

The RFID System in the 3M Model 9100 consists of a 10W 3M RFID Reader with either a four-port or an eight-port multiplexer. The outputs of the multiplexer connect to between two and eight lattices, which each contain one figure-eight antenna, to create between one and seven detection corridors. At any given time, only one of the up to eight antennas is powered with RF. The reader has a transmit frequency of 13.5602 MHz. The EUT was tested while exercising all functions and at an input power of 120 VAC, 60 Hz.

Model 9100 Detection System

2.3 Measurement Uncertainty

The data and test results referenced in this report are true and accurate. However, there may be deviations within the calibration limits of the test equipment and facilities that can account for deviations. The following table lists the measurement uncertainty for the emissions testing. Furthermore, EUT component and manufacturing process variables may result in additional deviation.

Emission test	Confidence (95%)	Measurement Uncertainty	CISPR Limit
Radiated Emissions (30 MHz – 5 GHz)	k=2.0	4.11 dB	5.20 dB
Conducted Emissions (150 kHz – 30 MHz)	k=2.0	3.29 dB	3.60 dB

3.0 APPLICABLE DOCUMENTS

The following documents were used as references. The dates that are referenced are the dates of the latest amendments. All 3M Test Procedures can be found in the Document Center of the SEMS QDS System.

CFR 47: 2009	Part 15 Radio Frequency Devices, Subpart B Unintentional Radiators.	
CISPR 16-1	Specification for radio disturbance and immunity measuring apparatus and methods	
	-1 Measuring Apparatus	2006
	-2 Ancillary Equipment – Conducted Disturbance	2004
	-3 Ancillary Equipment – Disturbance Power	2004
	-4 Ancillary Equipment – Radiated Disturbance	2004
CISPR 16-2	Specification for radio disturbance and immunity measuring apparatus and methods	
	-1 Conducted Disturbance Measurements	2003
	-2 Measurements of Disturbance Power	2004
	-3 Radiated Disturbance Measurements	2003
	-4 Immunity Measurements	2003
CISPR 16-4	-1 Uncertainties in Standardized EMC Tests	2005
	-2 Uncertainty in EMC Measurements	2003
ANSI C63.4:2009	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.	
ANSI C63.10:2009	Unlicensened Transmitters	
ICES-003	Industry Canada, Interference-Causing Equipment Standard, Issue 4, February 2004	
RSS-GEN	Industry Canada, Radio Standards Specification Issue 3, December 2010	
RSS-210	Industry Canada, Radio Standards Specification Issue 8, December 2010	
RSS-102	Industry Canada, Radio Frequency Exposure Compliance, Issue 4, March 2010	

3M Test Procedure: Radiated Emissions Test (30 MHz – 1 GHz), PBLI-6SHLK2
3M Test Procedure: Radiated Emissions Test (1 GHz – 5 GHz), PBLI-6SNHFY
3M Test Procedure: Conducted Emissions Test (0.15 MHz – 30 MHz), PBLI-6S8LR2
3M Test Procedure: 13.56 MHz RFID Emissions Test, PBLI-6WHLEM
3M Test Procedure: 99% Power Bandwidth Test, PBLI-7C9JVN
3M Test Procedure: Frequency Stability Test, PBLI-7REHQV
3M Test Procedure: EMF Test w/EMR-300, PBLI-7FAM2G

4.0 Radiated Emissions Testing

The EUT was placed in an anechoic chamber and radiated emissions testing was performed in accordance with FCC Part 15, ICES-003, and 3M Test Procedures: Radiated Emissions Test (30 MHz – 1 GHz), PBLI-6SHLK2, Radiated Emissions Test (1 GHz – 5 GHz), PBLI-6SNHFY, and 13.56 MHz RFID Emissions Test, PBLI-6WHLEM. Radiated emissions measurements were made to determine the level of electromagnetic energy radiating from the EUT.

4.1 Frequency Stability

The Frequency Stability testing was preformed in accordance with RSS-210, ANSI C63.4, FCC Part 15.225(e), and 3M Test Procedure PBLI-7REHQV to insure that the intentional radiator carrier frequency stability was within the allowable limits for input power and temperature variations.

4.1.1 Test Procedure

The frequency stability was measured using the radiated signals from the EUT so that the measurement equipment would not load the radio frequency circuits. A frequency counter was used for the frequency stability measurements. A close field probe was attached to the counter and placed near the antenna of the reader for measurement. The frequency was measured while the input voltage was varied over the required voltage range and the ambient air temperature was varied over the required ambient temperature range. Measurements were taken at startup and at 2, 5, and 10 minutes after startup at each test condition.

4.1.2 Test Criteria

The IC/FCC Part 15, Subpart C for Frequency Stability Limits versus Supply Voltage are given as:

Carrier Frequency (MHz)	Voltage Range % of Nominal Supply (85 % and 115 %)	Max. Frequency Change (%)
13.56	102 and 138 VAC	+/- 0.01 %

The IC/FCC Part 15, Subpart C for Frequency Stability Limits versus Temperature is given as:

Carrier Frequency (MHz)	Temperature Range (degrees C)	Max. Frequency Change (%)
13.5602	-20 to +50	+/- 0.01 %

4.1.3 Test Results

The EUT met all FCC Part 15, Subpart C frequency stability requirements.

3M

Frequency Stability

SEMS EMC Laboratory

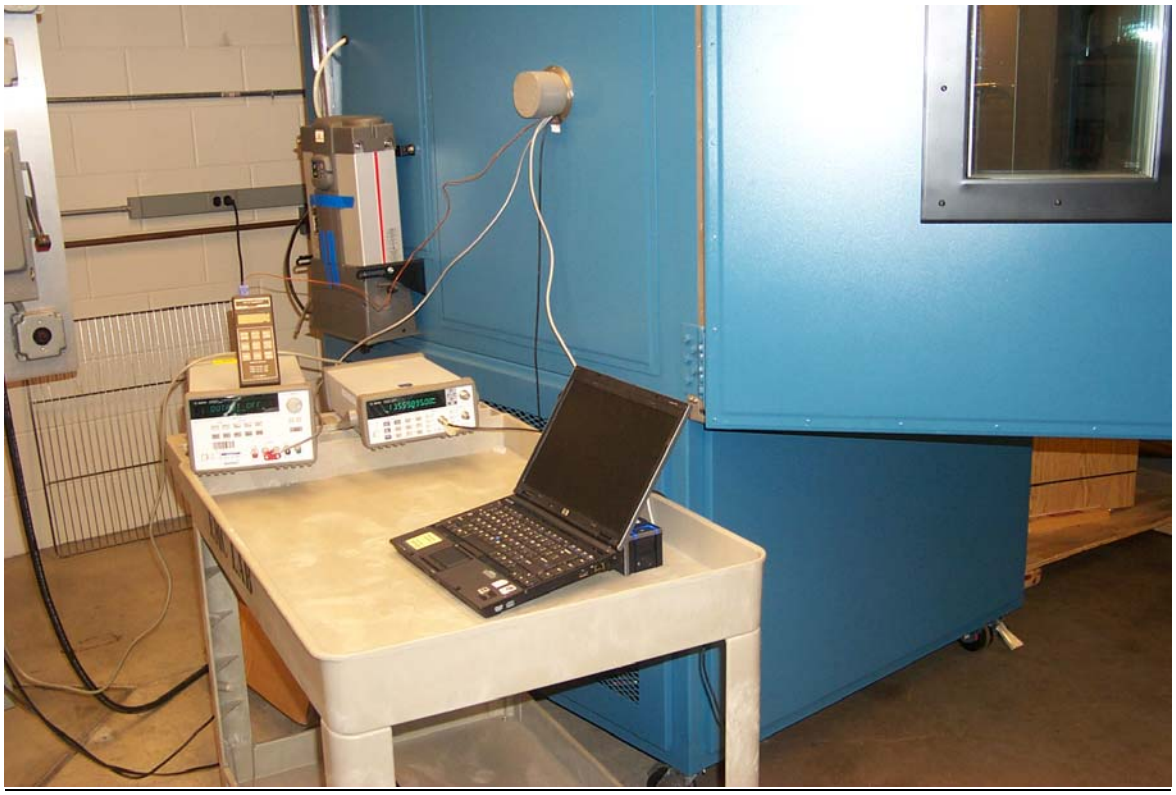
Report Number	F0810001	**Date**	25 January 2011
EUT Name	3M RFID Detection System Model 9100	**EUT Power**	see data
EUT Model	9100	**Test Std**	FCC
EUT Serial #		**Temperature (°C)**	see data
EUT Description	The Model 9100 is an RFID based detection system.	**Humidity (%)**	see data
		Air Pressure (kPa)	NA

Measurement	Startup	2 Minutes	5 Minutes	10 Minutes
24 V (+20ºC)	13.5598	13.5598	13.5599	13.5599
20.4 V (+20ºC)	13.5598	13.5598	13.5599	13.5600
27.6 V (+20ºC)	13.5598	13.5598	13.5598	13.5599
+50ºC (24 V)	13.5598	13.5599	13.5600	13.5602
-20ºC (24 V)	13.5598	13.5599	13.5598	13.5599

Note: For 13.56 MHz RFID transmitters, the carrier signal shall be maintained within ±0.01% of the operating frequency (±135.6 kHz)(13.4244 – 13.6956 MHz).

Test Engineer: Mike Schultz	Date: 25 January 2011

4.1.3 Test Setup Photos



4.2 Emission Bandwidth

The EUT was placed in a semi-anechoic chamber and the Emission Bandwidth testing was performed in accordance with ANSI C63.4, FCC Part 15.225 and 3M Test Procedure: 13.56 MHz RFID Emissions Test, PBLI-6WHLEM The Emission Bandwidth measurements were made to determine the intentional radiator frequency and determine the level of electromagnetic energy radiated at that frequency and at the band edges from the EUT.

4.2.1 Test Procedure

A loop measurement antenna was positioned at a distance of 5 meters from the center of the EUT (to insure far field measurements). An EMI receiver was used for the emissions measurements. Initial sweep measurements were taken with the receiver in continuous frequency overview mode utilizing peak level signal detection. The intentional radiator frequency and band edge frequencies utilizing quasi-peak detection were then maximized. Then the antenna, which was fixed at 1 meter height, was rotated until the highest emissions levels found. Measurement results were automatically calculated via software running the EMI receiver. The final quasi-peak measurements recorded were determined by the following formula: Result (dBµV/m) = receiver level (µV) + antenna factor (dB/m) + cable loss (dB) - preamp gain (dB) + lineal conversion (dB).

4.2.2 Test Criteria

The FCC Part 15 Subpart C, Paragraph 15.225 Carrier Frequency Limits and the FCC Part 15, Subpart C radiated limits are given as:

Lower Band Edge: 13.553 MHz
Upper Band Edge: 13.567 MHz

Frequency (MHz)	Distance (Meters)	Field Strength (dBµV/m)
1.705 to 13.110	10	48.62
13.110 to 13.410	10	59.58
13.410 to 13.553	10	69.55
13.553 to 13.567	10	103.00
13.567 to 13.710	10	69.55
13.710 to 14.010	10	59.58
14.010 to 30.000	10	48.62

Note: 40 dB/decade extrapolation factor was used per 15.31.

4.2.3 Test Results

The EUT met the FCC Part 15, Subpart C Emission Bandwidth requirements. The intentional radiator frequencies were within the allowed band and all maximized quasi-peak measurements for the EUT were below the quasi-peak limits.

Product Model: **9100** Report Number: F**0810001**

Carrier Frequency	13.56018	Turntable Degrees	232
Output Power	39.8 dBm	Loop Angle	Y -10º

PLOTS

Frequency Range	B/W	Type	Filename
13.00 - 14.10 MHz	9 kHz	Modulation Sweep	**9100 1/19/11 13_14**
13.55 - 13.57 MHz	9 kHz	QP Modulation Scan	**9100 1/19/11 9kHz**
13.55 – 13.57 MHz	1 kHz	QP Modulation Scan	**9100 1/19/11 1kHz**
12.00 – 30.00 MHz	9 kHz	Spurious Below 30 MHz	**9100 1/19/11 SELO**
9.00 kHz – 30.00 MHz	Multiple		
30 – 1000 MHz	120 kHz	with RFID	
30 – 1000 MHz	120 kHz	without RFID	
1.00 - ?? GHz	1 MHz	with RFID	
1.00 - ?? GHz	1 MHz	without RFID	
150 kHz – 30 MHz	9 kHz	AC line, with RFID	

MODULATION SPECTRUM MASK

Frequency	B/W	QP H-Field FCC and EU Limits @ 10 m		QP Level
13.5603 MHz	9 kHz	FCC 103 dBµV/m	EU 60 dBµA/m or111.5 dBµV/m	**96.18**
13.553 MHz	1 kHz	FCC 69.6 dBµV/m	EU 9 dBµA/m or 60.5 dBµV/m	**51.73**
13.567 MHz	1 kHz	FCC 69.6 dBµV/m	EU 9 dBµA/m or 60.5 dBµV/m	**51.54**
13.5485 MHz	9 kHz	FCC 69.6 dBµV/m	EU 9 dBµA/m or 60.5 dBµV/m	**59.12 Alt 1kHz**
13.5715 MHz	9 kHz	FCC 69.6 dBµV/m	EU 9 dBµA/m or 60.5 dBµV/m	**60.61 Alt 1kHz**
13.41 MHz	1 kHz	FCC 59.6 dBµV/m	EU -3.5 dBµA/m or 48 dBµV/m	**28.78**
13.71 MHz	1 kHz	FCC 59.6 dBµV/m	EU -3.5 dBµA/m or 48 dBµV/m	**34.65**
13.4055 MHz	9 kHz	FCC 59.6 dBµV/m	EU -3.5 dBµA/m or 48 dBµV/m	**46.30**
13.7141 MHz	9 kHz	FCC 59.6 dBµV/m	EU -3.5 dBµA/m or 48 dBµV/m	**51.60**
13.11 MHz	1 kHz	FCC 48.6 dBµV/m		**10.47**
14.01 MHz	1 kHz	FCC 48.6 dBµV/m		**16.85**
13.1055 MHz	9 kHz	FCC 48.6 dBµV/m		**31.17**
14.0145 MHz	9 kHz	FCC 48.6 dBµV/m		**35.19**

HARMONICS

		Measured Frequency	Limit	QP Level
2nd	27.12 MHz	**27.1214**	EU -3.5 dBµA/m or 48 dBµV/m	**32.35**
3rd	40.68 MHz	-	250 nW or 52.8 dBµV/m	-
4th	52.24 MHz	-	4 nW or 34.8 dBµV/m	-
5th	67.80 MHz	-	4 nW or 34.8 dBµV/m	-
7th	94.92 MHz	-	4 nW or 34.8 dBµV/m	-
8th	108.48 MHz	-	4 nW or 34.8 dBµV/m	-
9th	122.04 MHz	-	250 nW or 52.8 dBµV/m	-
10th	135.60 MHz	-	250 nW or 52.8 dBµV/m	-

OTHER SPURIOUS EMISSIONS

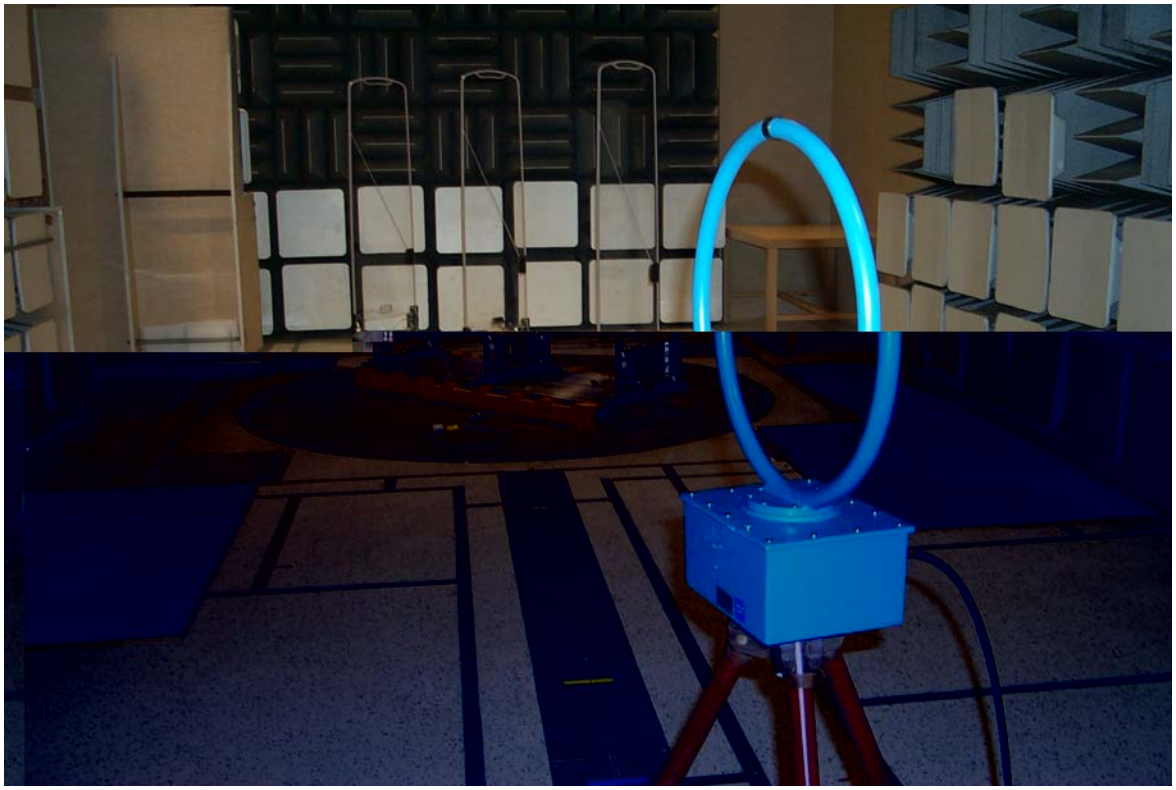
Frequency		Limit	QP Level
13.5785	**RBW 9kHz**	**FCC 69.6 dBµV/m**	**66.00**
13.5415	**RBW 9kHz**	**FCC 69.6 dBµV/m**	**65.55**

Notes:

99 % BW = 74.549 kHz

Test Engineer: Mike Schultz **Date: 19 January 2011**

4.2.4 Test Setup Photo

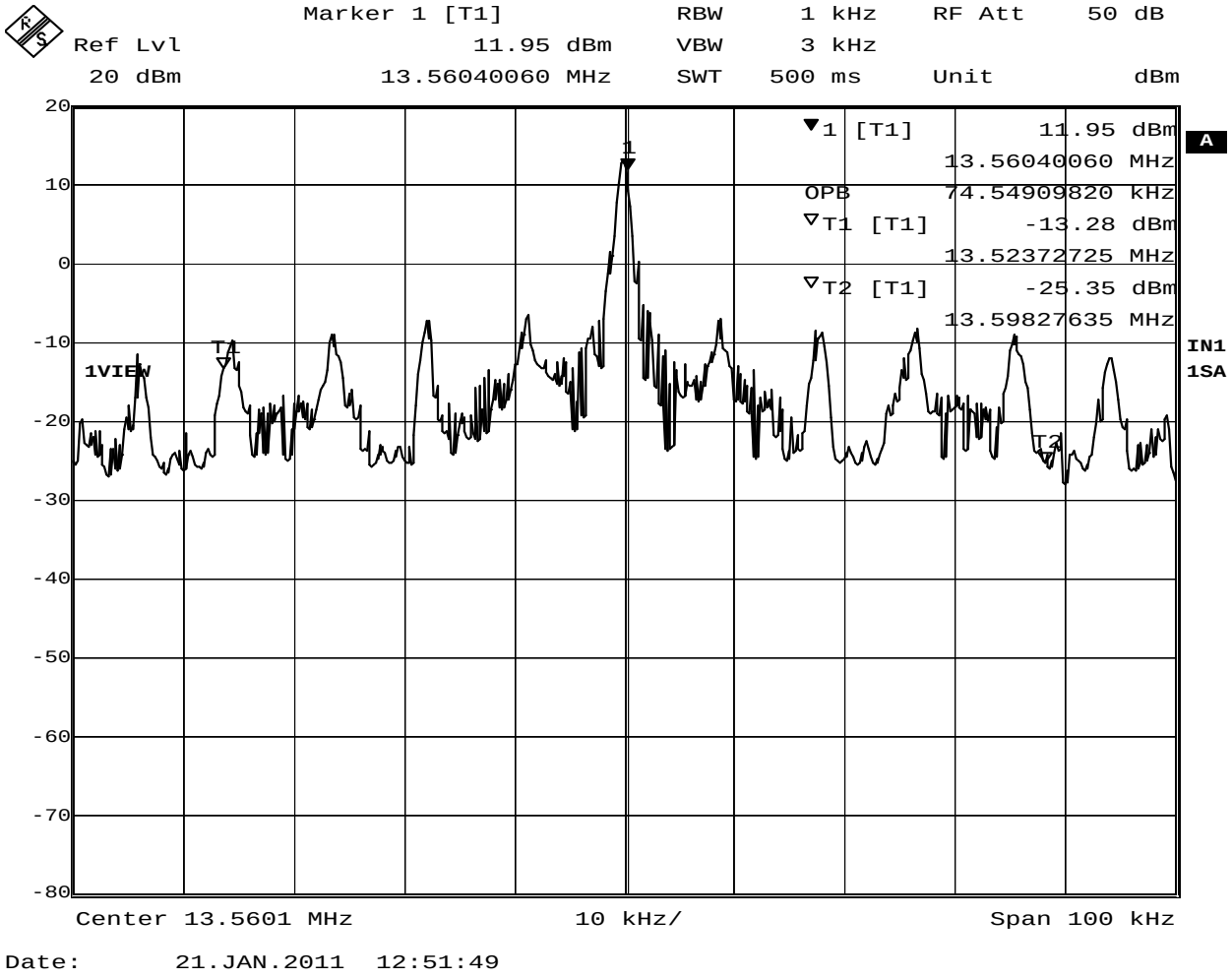


Carrier Frequency / Emissions Bandwidth / Spurious Emissions 9KHz to 30 MHz

4.2.5 Power Bandwidth Test Procedure (99%)

The EUT was placed in a shielded room and connected to the input of an EMI Receiver. The receiver was operated in the analyzer mode with a center frequency of 13.56 MHz. The transmitter was operated at its maximum carrier output with modulation applied under normal test conditions. The receiver's span and bandwidths were set in accordance with Industry Canada RSS-GEN (section 4.6.1). The receiver has an internal function that can be selected for the measurement of the 99% Bandwidth, and automatic placement of the markers. 3M Test Procedure: 99% Bandwidth Test, PBLI-7C9JVN contains the procedure for selecting the bandwidth function and output of the resultant plot.

The EUT has a measured occupied bandwidth of: **74.549 kHz.**



4.3 Spurious Emissions (9 kHz to 30 MHz.)

The EUT was placed in a semi-anechoic chamber and the Spurious Emissions testing was preformed in accordance with ANSI C63.4, FCC Part 15, Subpart C, and 3M Test Procedure: 13.56 MHz RFID Emissions Test, PBLI-6WHLEM.The Spurious Emission measurements were made to determine the level of spurious electromagnetic energy radiated from the EUT.

4.3.1 Test Procedure

A measurement antenna (loop) was positioned at a distance of 5 meters from the center of the EUT (to insure far field measurements). An EMI receiver was used for the emissions measurements. Initial sweep measurements were taken with the receiver in continuous frequency overview mode utilizing peak level signal detection. Acceptance analysis of these sweeps was used to determine which discrete frequencies, other than the intentional radiator frequency and band edge frequencies were to be maximized. Maximizing a frequency involves finding the angle of the highest emission levels by rotating the EUT 360 degrees (sampling at least every 4 degrees). Then the antenna, which was fixed at 1 meter height, was rotated until the highest emissions levels found. Final measurements were taken utilizing quasi-peak detection. Measurement results were automatically calculated via software running the EMI receiver. The final measurements recorded were determined by the following formula:

Result (dBμV/m) = receiver level (μV) + antenna factor (dB/m) + cable loss (dB) - preamp gain (dB) + lineal conversion (dB).

4.3.2 Test Criteria

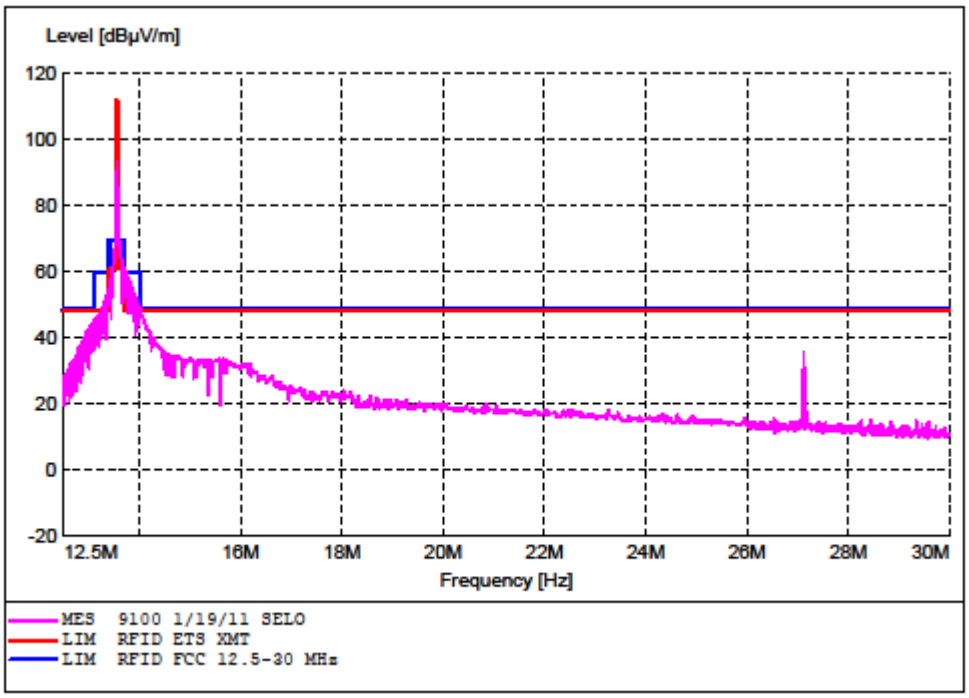
The FCC Part 15, Subpart C radiated limits are given below.

Frequency (MHz)	Distance (Meters)	Field Strength (dBμV/m)
12.000 to 13.110	10	48.62
13.110 to 13.410	10	59.58
13.410 to 13.553	10	69.55
13.553 to 13.567	10	103.00
13.567 to 13.710	10	69.55
13.710 to 14.010	10	59.58
14.010 to 30.000	10	48.62

Note: A 40 dB/decade extrapolation factor was used per 15.31.

4.3.3 Test Results

The EUT met the FCC Part 15, Subpart C Spurious Emissions (12 kHz to 30 MHz.) requirements. No measurable spurious emissions were detected below 12.5MHz.



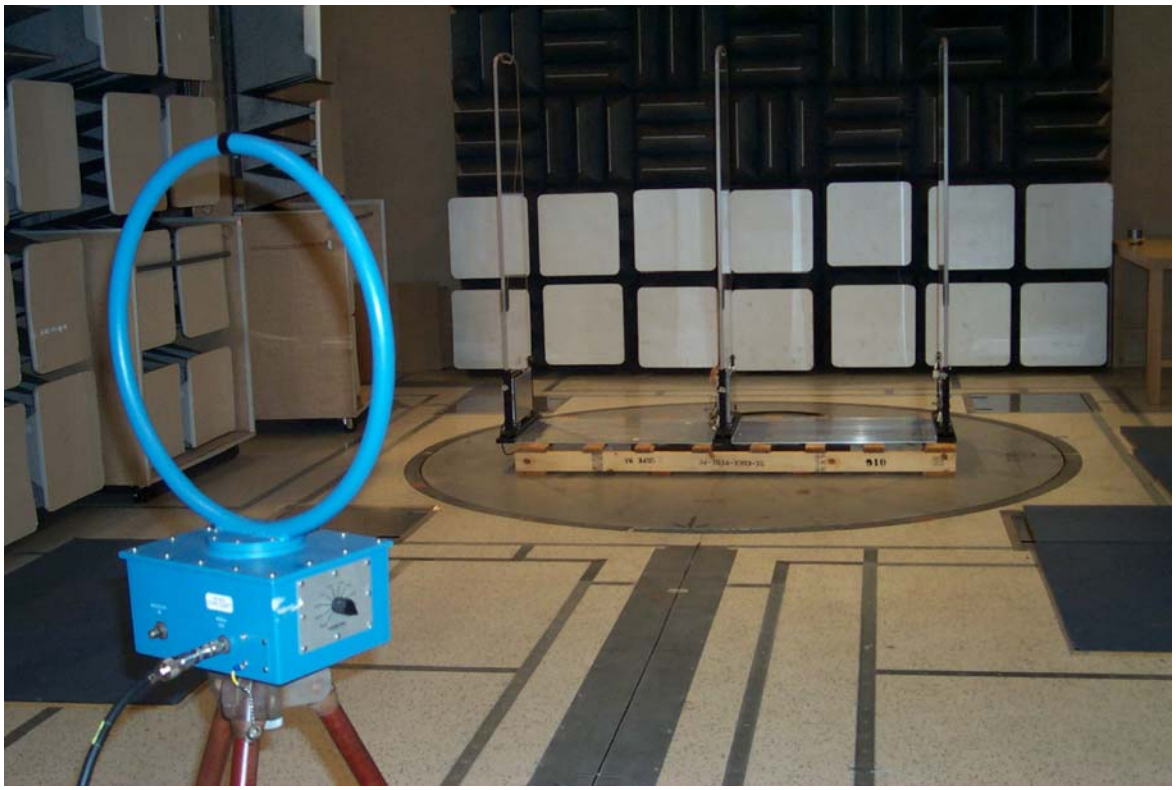
Report Number	F0810001	**Date**	19 Jan 2011
EUT Name	RFID Detection System	**EUT Power**	120 VAC / 60 Hz
EUT Model	9100	**Test Std**	FCC
EUT Serial #	-	**Temperature (°C)**	23
EUT Description	RFID Detection	**Humidity (%)**	30
		Air Pressure (kPa)	98.7

	MAXIMIZED QP SIGNAL		LIMIT LINE	PASSING MARGIN	MAXIMIZED POSITION		
FREQ (MHz)	X/Y/Z	dBµV	dBµV	dBµV	TURNTABLE (˚)	ANTENNA (M)	REMARKS
13.542	Y-10	66.00	69.60	3.60	232	1.0	
13.579	Y-10	65.55	69.60	4.05	232	1.0	
27.121	Y-10	32.35	48.00	15.65	232	1.0	

* - All readings have the correction factors applied.

Test Engineer: Mike Schultz	Date: 19 January 2011

5.3.4 Test Setup Photo



Spurious emissions below 30 MHz

4.4 Spurious Emissions (30 to 1000 MHz.)

The EUT was placed in a semi-anechoic chamber for spurious emissions testing in accordance with ANSI C63.4, FCC Part 15, Subpart C and 3M Test Procedures: 13.56 MHz RFID Emissions Test, PBLI-6WHLEM and Radiated Emissions Test (30 MHz – 1 GHz), PBLI-6SHLK2. The Spurious Emission measurements were made to determine the level of spurious electromagnetic energy radiated from the EUT while in the transmit mode.

4.4.1 Test Procedure

The EUT was placed in the center of a turntable. An EMI receiver was used for the emissions measurements in the range of 30MHz to 1000MHz. Initial measurements were taken with the receiver in continuous frequency overview mode utilizing peak level signal detection. Peak results were maximized at discrete frequencies utilizing quasi-peak detection. Maximizing a frequency involves finding the angle of the highest emission levels by rotating the EUT 360 degrees (sampling every 4 degrees) and varying the antenna height between 1 and 4 meters at the angles of the highest emissions levels found. Measurements were taken in both vertical and horizontal antenna polarization. The final measurements recorded were determined by the following formula:

Result (dBμV /m) = receiver level (μV) + antenna factor (dB/m) + cable loss (dB) - preamp gain (dB) + lineal conversion (dB)

4.4.2 Test Criteria

The FCC Part 15, Subpart C radiated limits are given below.

Frequency (MHz)	Distance (Meters)	Field Strength (dBμV/m)
30 - 88	10	29.54
88 - 216	10	33.06
216 - 960	10	35.56
960 and higher	10	43.52

4.4.3 Test Results

The EUT met the FCC Part 15, Subpart C Spurious Emissions (30 to 1000 MHz.) requirements.

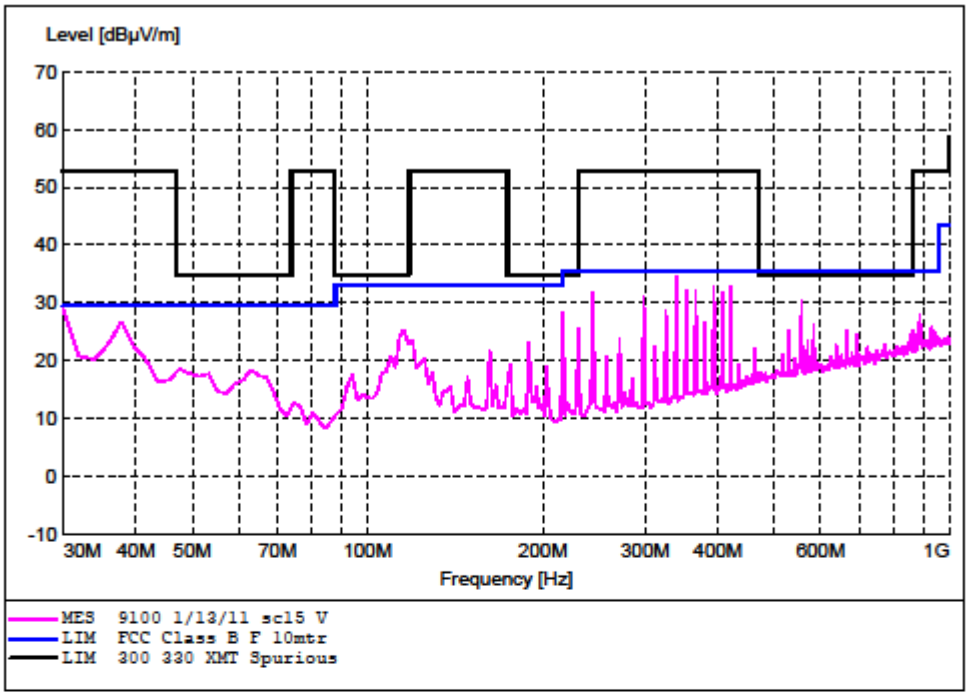
Report Number	F0810001	**Date**	13 January 2011
EUT Name	3M RFID Detection System	**EUT Power**	120 VAC / 60 Hz
EUT Model	9100	**Test Std**	FCC B
EUT Serial #	-	**Temperature (°C)**	23
EUT Description	The Model 9100 is an RFID based detection system.	**Humidity (%)**	23
		Air Pressure (kPa)	99.9

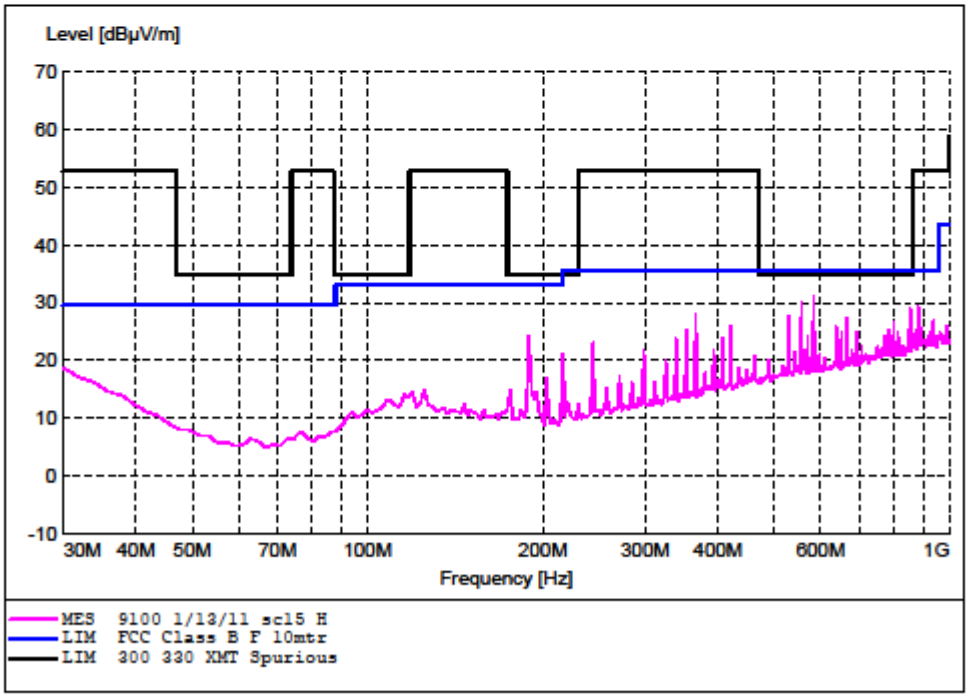
MAXIMIZED FILES 9100 1/13/11 sc15 V-H

FREQ. (MHz)	MAXIMIZED QP SIGNAL H/V	MAXIMIZED QP SIGNAL dBµV	LIMIT LINE dBµV	PASSING MARGIN dBµV	MAXIMIZED POSITION TURNTABLE (°)	MAXIMIZED POSITION ANTENNA (M)	REMARKS
216.965	V	29.83	35.56	5.73	280	1.0	
244.080	V	31.81	35.56	3.75	0	1.0	
298.320	V	30.94	35.56	4.62	60	1.0	
339.000	V	34.75	35.56	0.81	60	1.0	
352.555	V	32.19	35.56	3.37	280	1.0	
366.115	V	32.67	35.56	2.89	270	1.0	
393.225	V	32.95	35.56	2.61	277	1.0	
406.800	V	31.57	35.56	3.99	277	1.0	
420.350	V	30.85	35.56	4.71	100	1.0	
583.080	H	33.58	35.56	1.98	230	2.5	

* - All readings have the correction factors applied.

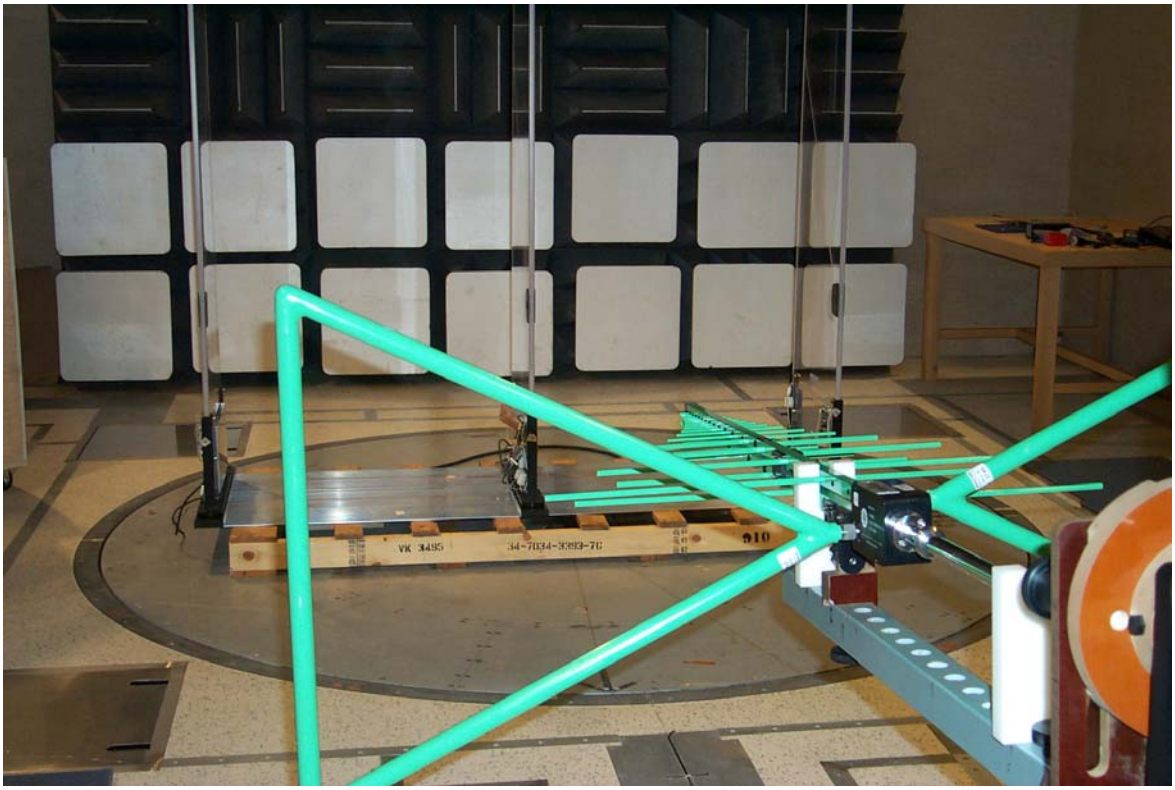
Test Engineer: Mike Schultz	Date: 13 January 2011





FCC = Blue, EN = Black

4.4.4 Test Setup Photo



Spurious Emissions 30 - 1000 MHz

4.5 Digital Radiated Emissions (30 MHz - 18000 MHz)

The EUT was placed in an anechoic chamber and radiated emissions testing was performed in accordance with ANSI C63.4, FCC Part 15 and 3M Test Procedures: Radiated Emissions Test (30 MHz – 1 GHz), PBLI-6SHLK2, and Radiated Emissions Test (1 GHz – 5 GHz), PBLI-6SNHFY. Radiated emissions measurements were made to determine the level of electromagnetic energy radiating from the EUT.

4.5.1 Test Procedure

The EUT was placed in the center of a turntable. An EMI receiver was used for the emissions measurements in the range of 30MHz to 40GHz (the upper limit of measurement is determined by the 5^{th} harmonic of the highest frequency generated in the device or 40 GHz whichever is lower). Initial measurements were taken with the receiver in continuous frequency overview mode utilizing peak level signal detection. Peak results were maximized at discrete frequencies utilizing quasi-peak detection. Maximizing a frequency involves finding the angle of the highest emission levels by rotating the EUT 360 degrees (sampling every 4 degrees) and varying the antenna height between 1 and 4 meters at the angles of the highest emissions levels found. Measurements were taken in both vertical and horizontal antenna polarization. The final quasi-peak measurements recorded were determined by the following (the detector used above 1000 MHz is both average and peak): Result (dBμV /m) = receiver level (μV) + antenna factor (dB/m) + cable loss (dB) - preamp gain (dB) + lineal conversion (dB).

4.5.2 Test Criteria

The FCC Class ‘A’ radiated limits are given below. The lower limit shall apply at the transition frequency.

Frequency (MHz)	Distance (Meters)	Field Strength (dBμV/m)
30 - 88	10	39.08
88 - 216	10	43.52
216 - 960	10	46.44
960 - 1000	10	49.50
1000 – 40000	10	49.50 AVG 69.50 PEAK

4.5.3 Test Results

The EUT met the FCC Class ‘A’ radiated emission requirements. All maximized quasi-peak measurements for the EUT were below the quasi-peak limit.

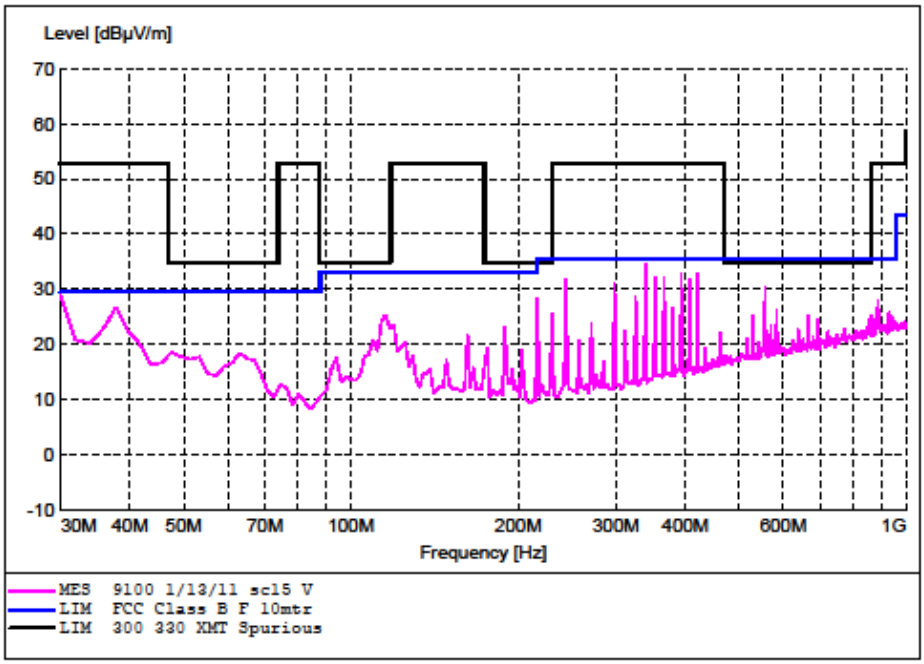
Report Number	F0810001	**Date**	13 January 2011
EUT Name	3M RFID Detection System Model 9100	**EUT Power**	120 VAC / 60 Hz
EUT Model	9100	**Test Std**	FCC
EUT Serial #	-	**Temperature (°C)**	23
EUT Description	The Model 9100 is an RFID based detection system.	**Humidity (%)**	23
		Air Pressure (kPa)	99.9

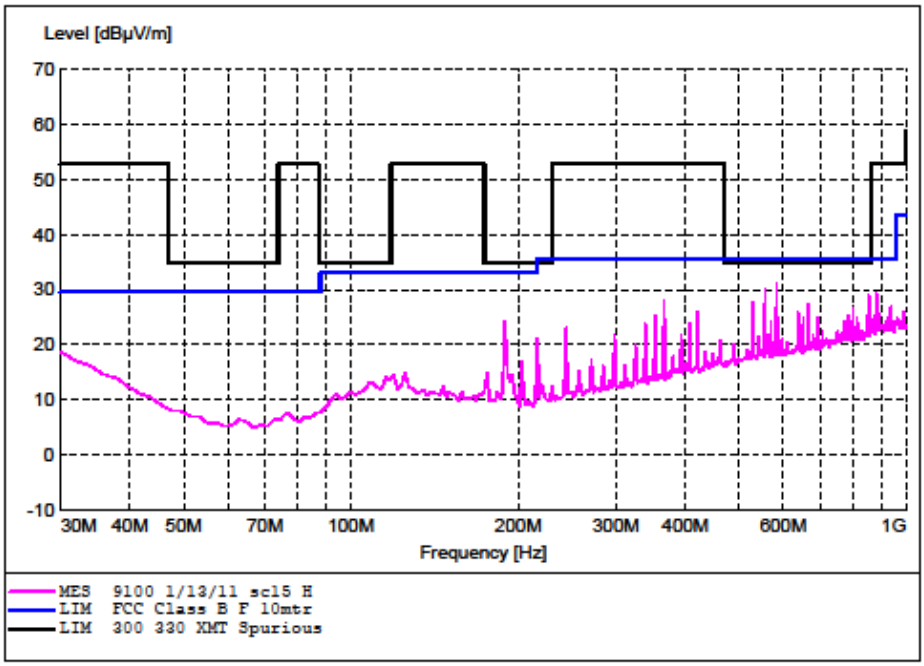
MAXIMIZED FILES 9100 1/13/11 sc 15 V-H

FREQ. (MHz)	MAXIMIZED QP SIGNAL H/V	MAXIMIZED QP SIGNAL dBµV	LIMIT LINE dBµV	PASSING MARGIN dBµV	MAXIMIZED POSITION TURNTABLE (°)	MAXIMIZED POSITION ANTENNA (M)	REMARKS
30.420	V	20.81	52.80	31.99	200	1.0	
38.635	V	11.20	52.80	41.60	280	1.0	
555.960	H	27.85	34.80	6.95	250	2.5	

* - All readings have the correction factors applied.

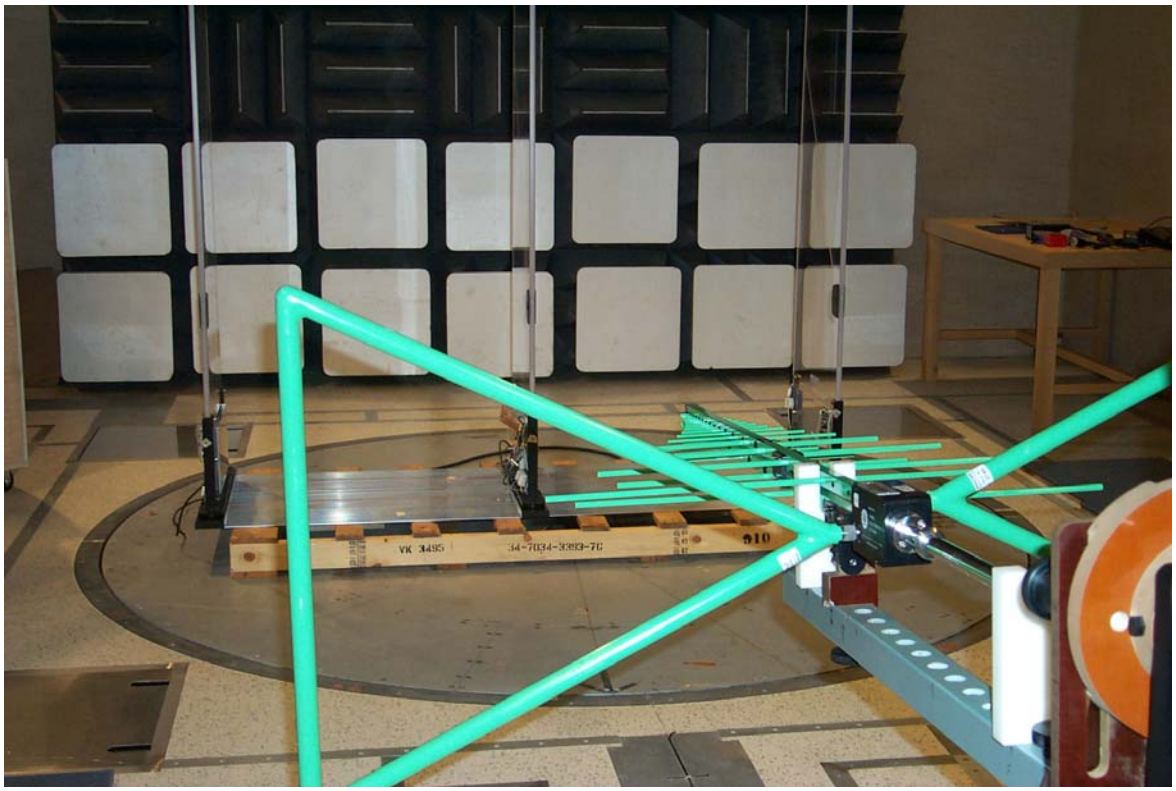
Test Engineer: Mike Schultz	Date: 13 January 2011





FCC = Blue, EN = Black

4.5.4 Test Setup Photo



Radiated Digital Emissions 30 to 1000 MHz

5.0 CONDUCTED EMISSIONS TESTING

Conducted emissions testing was performed in accordance with ANSI C63.4 and FCC Part 15 and 3M Test Procedure: Conducted Emissions Test (150 kHz – 30 MHz), PBLI-6S8LR2. Conducted emissions tests were made to determine the level of electromagnetic noise that is conducted onto the power mains from the EUT.

5.0.1 Test Procedure:

A Line Impedance Stabilization Network (LISN) with 50Ω / 50μH characteristic was used to isolate the EUT and give accurate and repeatable readings. An EMI test receiver was used for the emissions measurements in the range from 150 KHz to 30 MHz. Initial measurements were taken with the receiver in continuous frequency overview mode utilizing peak level signal detection. Initial results were measured at discrete frequencies utilizing quasi-peak detection. Measurement results were automatically calculated via software running the EMI receiver. The final quasi-peak and average measurements recorded were determined by the following:

Result (dBμV) = receiver reading (μV) + LISN (dB) + cable loss (dB)

5.0.2 Test Criteria:

The FCC Class 'B' conducted limits are given below. The lower limit shall apply at the transition frequency.

Mains Terminal Disturbance Limits		
Frequency (MHz)	Quasi-Peak (dBμV)	Average (dBμV)
0.15 to 0.50	66 to 56 *[1]	56 to 46 *[1]
0.50 to 5.0	56	46
5.0 to 30.0	60	50

*1 – decreasing with the log of the frequency

5.0.3 Test Results

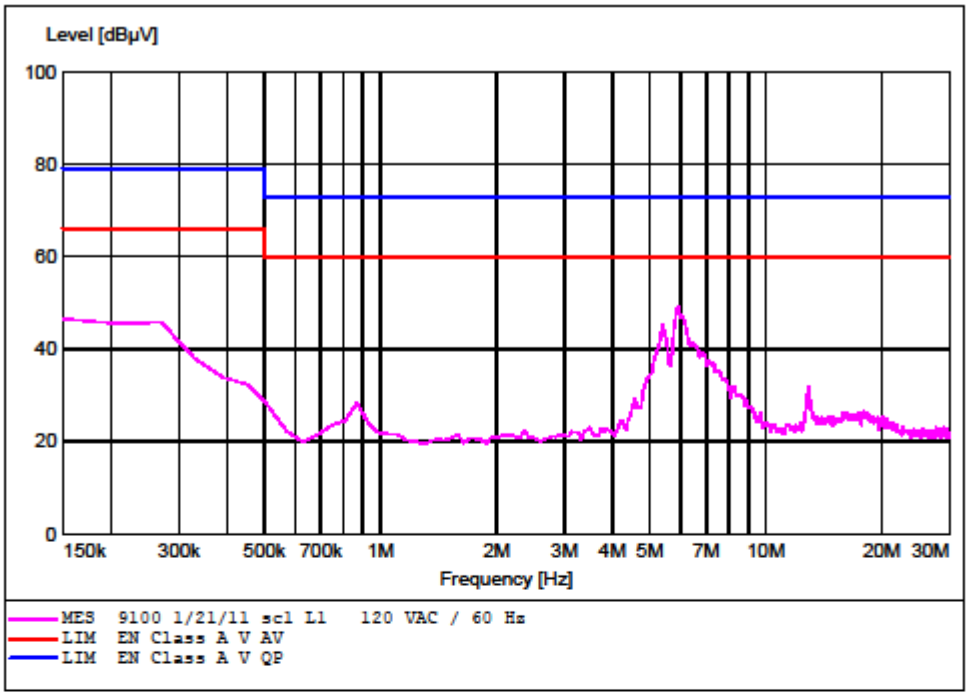
The EUT met the conducted emission and discontinuous requirements.

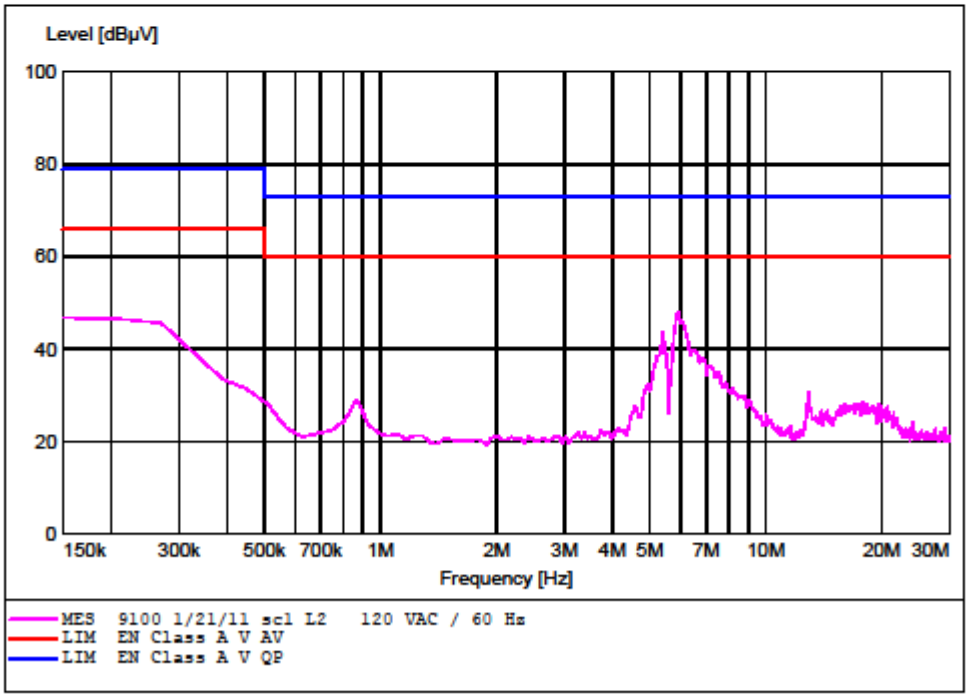
Report Number	F0810001	**Date**	21 January 2011
EUT Name	3M RFID Detection System	**EUT Power**	120 VAC / 60 Hz
EUT Model	9100	**Test Std**	FCC A
EUT Serial #	-	**Temperature (°C)**	23
EUT Description	The Model 9100 is an RFID based detection system.	**Humidity (%)**	23
		Air Pressure (kPa)	98.7

MAXIMIZED FILES 9100 1/21/11 sc1 L1 L2

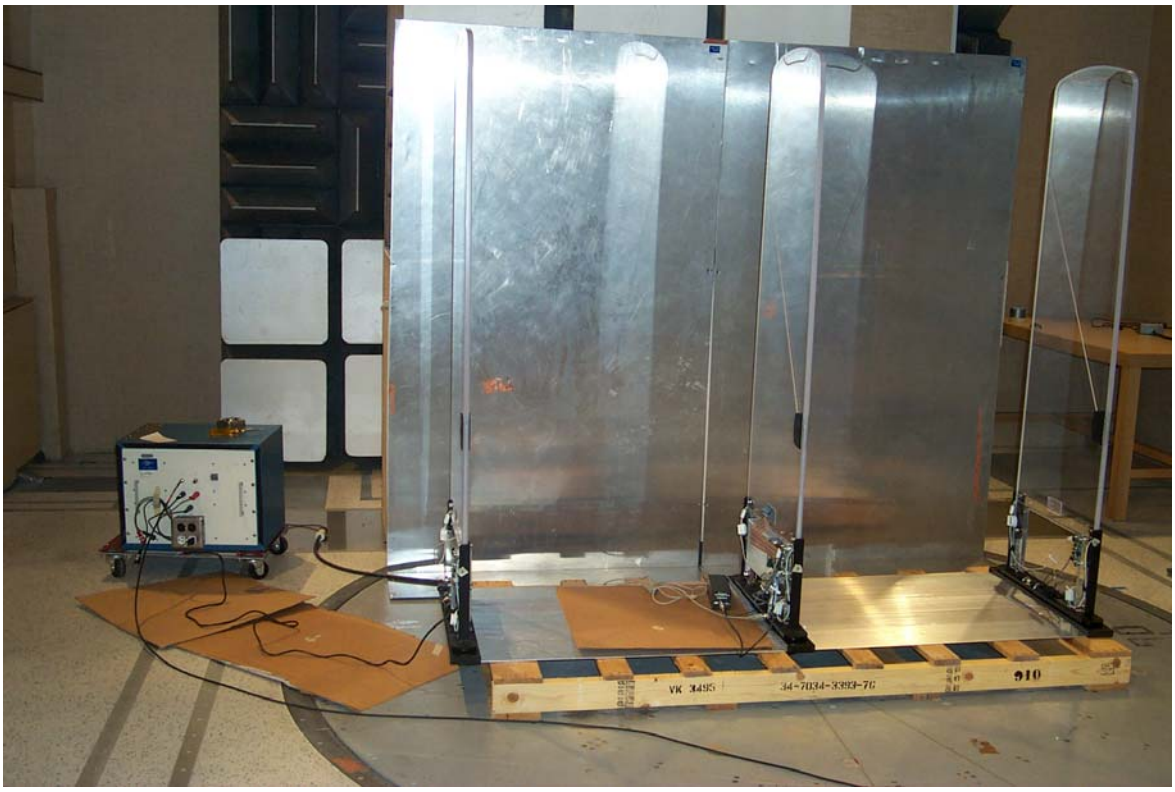
	PEAK (dBµV)		QUASI-PEAK (dBµV)				AVERAGE (dBµV)			
FREQUENCY (MHz)	L1 Line	L2 N	L1 Line	L2 N	Limit	Passing Margin	L1 Line	L2 N	Limit	Passing Margin
.192	X	X	45.6	45.6	79	33.4	36.3	36.7	66	29.3
.255	X	X	43.9	43.9	79	35.1	39.1	39.3	66	26.7
.320	X	X	44.7	44.5	79	34.3	38.7	38.5	66	27.3
.450	X	X	29.6	29.1	79	49.4	25.9	25.4	66	40.1
5.454	X	X	45.0	43.1	73	28.0	36.0	34.4	63	24.0
5.965	X	X	48.8	46.8	73	26.2	40.2	37.9	63	19.8

Test Engineer: Mike Schultz	Date: 21 January 2011


Level [dBµV]
100
80
60
40
20
0
150k
300k
500k
700k
1M
2M
3M
4M
5M
7M
10M
20M
30M
Frequency [Hz]
MES 9100 1/21/11 scl L1 120 VAC / 60 Hz
LIM EN Class A V AV
LIM EN Class A V QP


Level [dBµV]
100
80
60
40
20
0
150k
300k
500k
700k
1M
2M
3M
4M
5M
7M
10M
20M
30M
Frequency [Hz]
MES 9100 1/21/11 scl L2 120 VAC / 60 Hz
LIM EN Class A V AV
LIM EN Class A V QP

5.0.4 Test Setup Photograph



Conducted Emissions Test Setup

6.0 LIST OF TEST EQUIPMENT

The following test equipment was used to perform the indicated tests. All test equipment was calibrated by an accredited calibration laboratory or by the manufacturer. All calibration intervals are one year. All equipment calibrations, test procedures, and test facility are traceable to the standards of the National Institute of Standards and Technology (NIST). The test facility site attenuation verification results fall within the normalized site attenuation (NSA) criteria for open area test sites using volumetric measurements.

RADIATED EMISSIONS

Electro Metrics Large Loop Antenna, Model ALR25M, Serial No. 603 (cal due date: 20 Oct 11)
Schaffner Biconilog Antenna, Model CBL6112B, Serial No. 27491 (cal due date: 21 Oct 11)
A. H Systems Horn Antenna, Model SAS_200/571 Serial No: 234 (cal due date: 22 Oct 11)
HP Pre-Amplifier, Model 8447D, Serial No. 1937A03090 (cal due date: 21Oct 11)
HP Pre-Amplifier, Model 83017A, Serial No. 3123A00259 (cal due date: 20 Oct 11)
Rohde & Schwarz EMI Receiver, Model ESIB 40, S/N 100235 (cal due date: 23 Oct 11)
Rohde & Schwarz ESIB 40 Firmware Version 4.34.3

CONDUCTED EMISSIONS

EMCO LISN, Model 3825-2, Serial No. 1039 (cal due date: 20 Oct 11)
Solar High Pass Filter, Model 8130 - 5.0 (cal due date: 30 Aug 11)
Rohde & Schwarz EMI Receiver, Model ESIB 40, S/N 100235 (cal due date: 23 Oct 11)
Rohde & Schwarz ESIB 40 Firmware Version 4.34.3

FREQUENCY STABILITY / POWER OUTPUT

Agilent Freq. Counter Model 53131A, Serial No. MY40012264 (cal due date: 12 Oct 11)
Envirotronics Environ. Chamber, EH16-1-1.5AC, SN:10066639 (cal due date: 30 Sep 11)

OCCUPIED BANDWIDTH

Rohde & Schwarz EMI Receiver, Model ESIB 40, S/N 100235 (cal due date: 23 Oct 11)
Rohde & Schwarz ESIB 40 Firmware Version 4.34.3

TEST FACILITY

Lindgren Semi-Anechoic Chamber, (verification due date: 30 Oct 11)
FCC Site Registration Number: 93334
Canadian Site Registration Number: 458A-1

7.0 LABELING INFORMATION

The following labeling information is required by the FCC (Federal Communications Commission) and IC (Industry Canada) for Class A digital devices. Since the equipment contains both intentional and unintentional radiators, it must be labeled as a digital device and as an intentional radiator.

Labels on the Product

The following statements shall be placed in a conspicuous location on the device:

This device complies with Part 15 of the FCC Rules. Operation is subject to the following two conditions: (1) this device may not cause harmful interference, and (2) this device must accept any interference received, including interference that may cause undesired operation.

FCC ID: DGFTTS9100
IC ID: 458A-TTS9100

"This Class A digital apparatus complies with Canadian ICES-003."

"Cet appareil numérique de la classe A est conforme à la norme NMB-003 du Canada."

Statements in the Manuals

The following statement shall be placed in a prominent location in the text of the user manual:

NOTE: This equipment has been tested and found to comply with the limits for a Class A digital device, pursuant to Part 15 of the FCC Rules. These limits are designed to provide a reasonable protection against harmful interference when the equipment is operated in a commercial environment. This equipment generates, uses, and can radiate radio frequency energy and, if not installed and used in accordance with the instruction manual, may cause harmful interference to radio communications. Operation of this equipment in a residential area is likely to cause harmful interference in which case the user will be required to correct the interference at his/her own expense.

FCC ID: DGFTTS9100

NO MODIFICATIONS. Modifications to this device shall not be made without the written consent of 3M, Company. Unauthorized modifications may void the authority granted under Federal Communications Commission and Industry Canada Rules permitting the operation of this device.

"This Class A digital apparatus complies with Canadian ICES-003."

"Cet appareil numérique de la classe A est conforme à la norme NMB-003 du Canada."

IC ID: 458A-TTS9100

8.0 MODIFICATIONS to EUT

The following modifications were made to the EUT:

Report Number	0810001	**Date**	19 January 2011
EUT Name	3M RFID Detection System	**EUT Power**	120 VAC / 60 Hz
EUT Model	9100	**Test Std**	FCC A
EUT Serial #		**Temperature (°C)**	23
EUT Description	The Model 9100 is an RFID based detection system.	**Humidity (%)**	23
		Air Pressure (kPa)	98.7

Sheet 1 of 2

*Mod No. 1	Photo Taken: Yes	Initial: MS	Date: 19 JANUARY 2011
Description: Steward 28A0392-0A2 1-turn on **LED Cable** as it exits the lattice. Use on each lattice.			

*Mod No. 2	Photo Taken: Yes	Initial: MS	Date: 19 JANUARY 2011
Description: Steward 28B2029-0A0 4-turns on **LED Cable** as it exits the lattice. Use on each lattice.			

*Mod No. 3	Photo Taken: Yes	Initial: MS	Date: 19 JANUARY 2011
Description: Steward 28A0392-0A2 1-turn on **LED cable at the Sensor Board** end near J5.			

*Mod No. 4	Photo Taken: Yes	Initial: MS	Date: 19 JANUARY 2011
Description: Steward 28A2025-0A2 1-turn on 6-conductor cable J1 of the sensor board on power supply lattice only.			

*Mod No. 5	Photo Taken: Yes	Initial: MS	Date: 19 JANUARY 2011
Description: Steward 28A0392-0A2 1-turn on the 24 Vdc output to the reader on Power Supply Lattice only.			

*Mod No. 6	Photo Taken: Yes	Initial: MS	Date: 19 JANUARY 2011
Description: Steward 28A0392-0A2 2-turns on the antenna coax cable at the output of the low pass filter. Use on each lattice.			

Sheet 2 of 2

*Mod No. 7 Photo Taken: Yes	Initial: MS	Date: 19 JANUARY 2011
Description: 28A0392-0A2 1-turn on the **Buzzer Cable** at the sensor board end near J3.		

*Mod No. 8 Photo Taken: Yes	Initial: MS	Date: 19 JANUARY 2011
Description: 28A2029-0A2 1-turn on the **Serial Cable** from the Controller Board to the Reader.		

*Mod No. 9 Photo Taken: Yes	Initial: MS	Date: 19 JANUARY 2011
Description: 28A2029-0A2 2-turns on the **Serial Cable** from the Controller Board to the Reader		

*Mod No. 10 Photo Taken: Yes	Initial: MS	Date: 19 JANUARY 2011
Description: HFA259131-0A2 2-turn on the **DC Power Supply cable** to the Reader at the Reader end.		

*Mod No. 11 Photo Taken: Yes	Initial: MS	Date: 19 JANUARY 2011
Description: HFA150066-0A2 1-turn on the 24 Vdc Power supply cable to the Reader on the power supply lattice.		

This is the last page of the Test Report