EMC TEST REPORT

NVLAP Lab Code 200033-0

Standard(s):

47 CFR FCC Part 15.225
FCC Parts 15.107 and 15.109
RSS 210, Issue 8, 2010
ICES 003, Issue 5, 2012

FCC ID: DGFTSSD5400
IC: 458F-TSSD5400

Product: 3M™ Double-Sided ID1 Reader
Model: CR5400
3M Division: TSSD

Report Number: RE1501030-3
Report Issue Date: April 8, 2015

Report Prepared By:

Signature: Yuriy Litvinov

Yuriy Litvinov
Lead EMC Engineer

Tested By:
3M EMC Laboratory
410 E. Fillmore Avenue, Building 76-01-1
St. Paul, Minnesota 55107-1000

TABLE OF CONTENTS

1.0 Test Summary

Based on the results of our investigation, we have concluded the product tested complies with the requirements of the standard(s) indicated. The results obtained in this test report pertain only to the item(s) tested.

No	Standard	Test Requirements	Result	Comments
4.1	15.107/15.207/RSS-Gen	Conducted Emissions	pass	
4.2	15.225(d)/15.209 RSS210	Radiated Emissions outside of the specified band	pass	
4.3	2.1049/RSS Gen	20dB Bandwidth	pass	
4.4	15.225(a)(b)(c)/RSS210	Field Strength of Fundamental	pass	
4.5	15.225(e)/RSS210	Frequency Stability	pass	

Note:	

1.1 Measurement Uncertainty

The measured value related to the corresponding limit will be used to decide whether the equipment meets the requirements. The measurement uncertainty figures were calculated and correspond to a coverage factor of k=2, providing a confidence level of respectively 95.45 % in the case where the distributions characterizing the actual measurement uncertainties are normal (Gaussian).

Radiated emissions	5.20 dB
Conducted emissions	3.60 dB
Harmonics and Flicker	3.32 dB

2.0 Equipment Description

2.1	Equipment Under Test	
Description:	The 3M CR5400 Double-sided ID1 Reader inspects and images government issued identity documents ID1 sized (85 x 54mm) in a variety of market segments like Retail, Financial and Hospitality.	
Model(s):	CR5400	
Serial number:	N/A	
Client Contact:	Stephen P. Bernard	
Phone:	613 722 2070 ext 1755	
3M Division:	TSSD	
Modifications:	n/a	
Frequency Range (MHz) :	13.56MHz	
Modulation Type:	ASK	
Channel No.:	1	
Maximum Output Power:	N/A	
Antenna:	Internal Loop Antenna	
Equipment Category:	☒ General ☐ Portable ☐ Indoor Use	
Rated Power:	Voltage: ☒ 120VAC ☐ 230VAC ☐ _____ VDC Frequency: ☒ 50Hz ☐ 60Hz Current: ☒ 1.0Amps	
Test Dates:	02/25-03/12/2015	
Received Date:	01/10/2015	
Received Conditions:	☐ Poor ☒ Good ☒ Prototype ☐ Production	

3.0 EUT Configuration

3.1 Support Equipment

No.	Product Type	Manufacturer	Model	Comments
1	Power Supply	DVE	DSA-12CA-05	
2	EMC Lab Laptop	HP	Elite Book 8540W	

3.2 Cables

No.	Name	Type	Length	Shielding	Comments
1	USB Cable		1m	Yes	Mini-B USB-USB 2.0 with molded ferrites on each end

3.3 Operating Condition of EUT

	Operation Modes
☐	Stand by
☐	Continuous Monitored Operation
☐	Continuous Unmonitored Operation
☒	Passport Reader was connected to the PC over USB cable to read the plastic card image using AutoCal SW00355 2.04 software

3.4 Exercising of EUT

No.	Description of EUT Exercising
1	Continues transmission of modulated signal at 13.56MHz
2	

4.0 Test Conditions and Results

4.1	**Conducted Emissions Data**
Method:	The AMN was placed 0.8 m from the boundary of the unit under test and bonded to a ground reference plane. This distance was between the closest points of the AMN and the EUT. All other units of the EUT and associated equipment were at least 0.8 m from the AMN. All power was connected to the system through Artificial Mains Network (AMN). Conducted voltage measurements on mains lines were made at the output of the AMN.

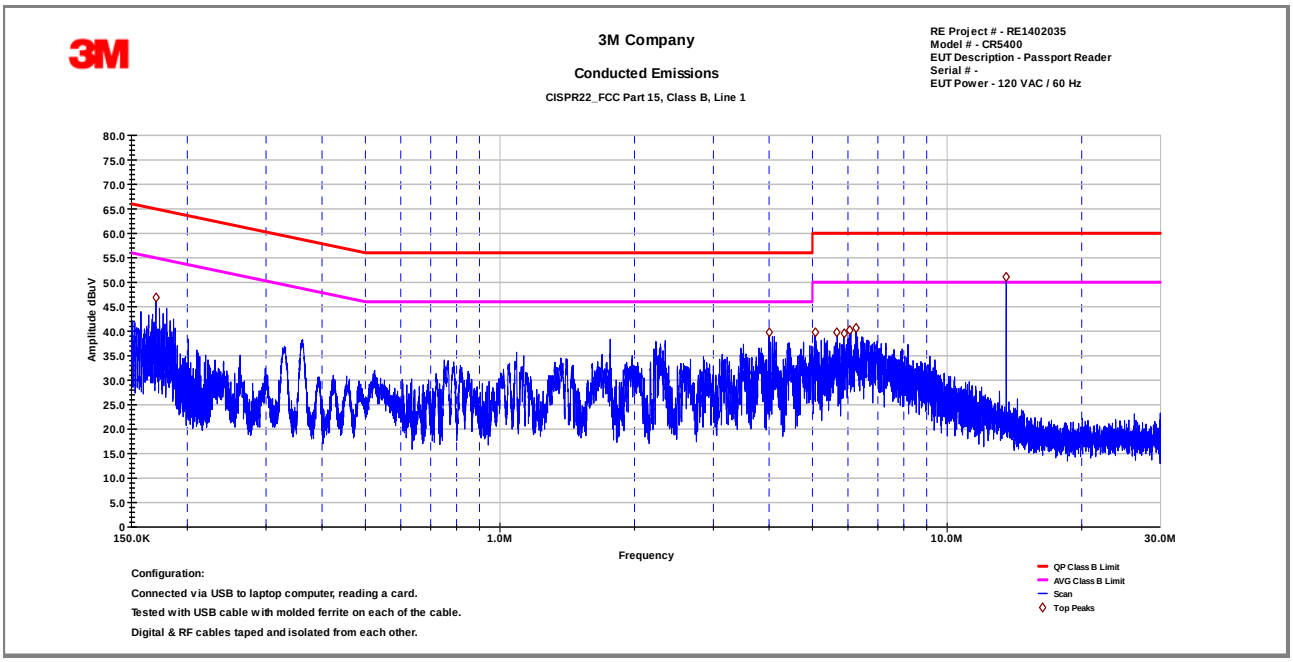
Test Verification: ☒	Laboratory Ambient Temperature	21°C
	Relative Humidity	35%
Reference Standard:	☒ ANSI C63.4:2009 ☐ ANSI C63.10:2009 ☒ FCC Part 15.207/RSS Gen ☐ FCC Part 15.247/RSS 210 ☐	**Measurement Point** ☒ Mains ☐ Telecommunication ports ☐
Frequency Range:	☒ 150KHz to 30KHz ☐	
Nominal Voltage:	☒ 120VAC ☐ 230VAC ☐	
Tested By:	Mike Schultz MS	**Date:** 02/26/2015

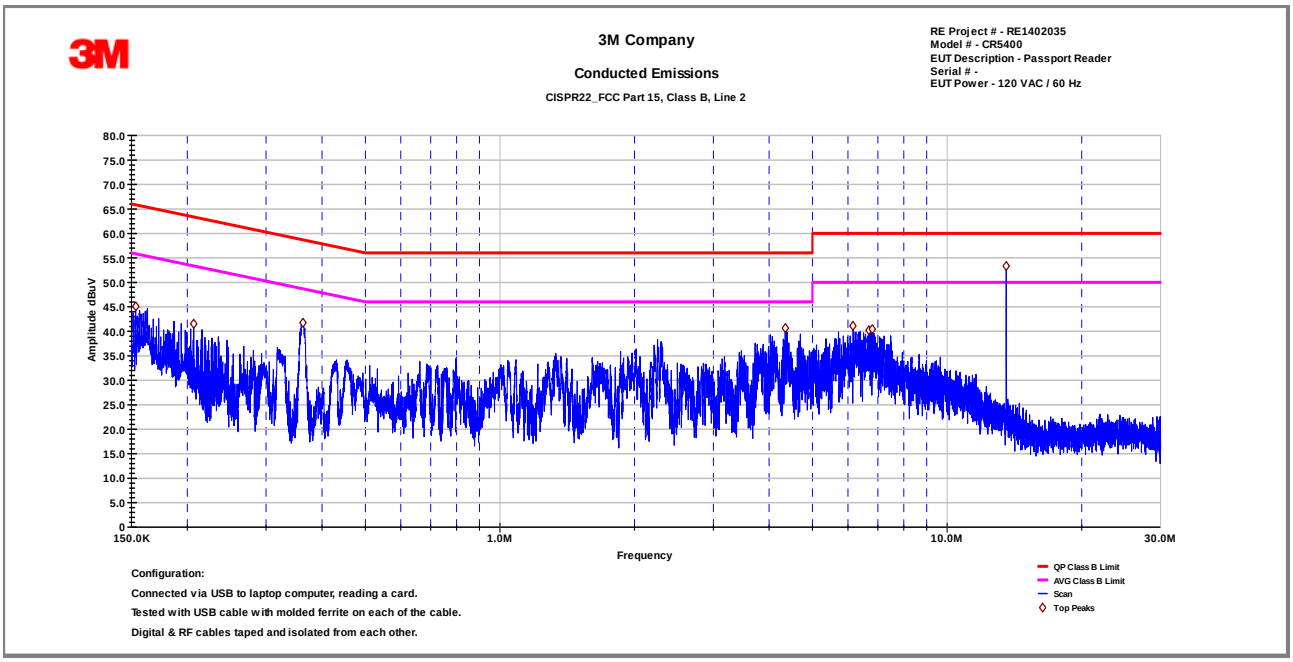
Limits

Frequency (MHz)	Limit dB (µV)			
	Quasi-Peak	Average	Result	Comments
0.15 to 0.50	66 to 56	56 to 46	**pass**	
0.50 to 5	56	46	**pass**	
5 to 30	60	50	**pass**	

Modifications:	
Note:	The RF exclusion 13.56MHz band applied to RFID

Frequency (MHz)	QP Line 1 dB (µV)	AVG Line 1 dB (µV)	QP Limit dB (µV)	AVG Limit dB (µV)	QP Margin dB	AVG Margin dB
0.168	37.3	28.39	65.04	55.04	-27.74	-26.65
3.976	34.66	26.17	56	46	-21.34	-19.83
5.073	34.94	26.36	60	50	-25.06	-23.64
5.67	38.45	29.74	60	50	-21.55	-20.26
5.946	37.87	30.75	60	50	-22.13	-19.25
6.004	36.8	29.25	60	50	-23.2	-20.75
6.27	38.2	28.79	60	50	-21.8	-21.21
Frequency (MHz)	**QP Line 2 dB (µV)**	**AVG Line 2 dB (µV)**	**QP Limit dB (µV)**	**AVG Limit dB (µV)**	**QP Margin dB**	**AVG Margin dB**
0.155	41.93	32.37	65.74	55.74	-23.81	-23.37
0.206	33.46	25.75	63.36	53.36	-29.91	-27.61
0.359	41.62	41	58.75	48.75	-17.13	-7.74
4.38	37.26	29.74	56	46	-18.74	-16.26
6.055	36.72	28.32	60	50	-23.28	-21.68
6.693	35.28	27.19	60	50	-24.72	-22.81
6.796	37.38	31.29	60	50	-22.62	-18.71
0.155	41.93	32.37	65.74	55.74	-23.81	-23.37
Voltage		☒ 120VAC ☐ 230VAC ☐				
Notes						


3M Company
Conducted Emissions
CISPR22_FCC Part 15, Class B, Line 1
RE Project # - RE1402035
Model # - CR5400
EUT Description - Passport Reader
Serial # -
EUT Power - 120 VAC / 60 Hz
Amplitude dBuV
80.0
75.0
70.0
65.0
60.0
55.0
50.0
45.0
40.0
35.0
30.0
25.0
20.0
15.0
10.0
5.0
0
150.0K
1.0M
10.0M
30.0M
Frequency
QP Class B Limit
AVG Class B Limit
Scan
Top Peaks
Configuration:
Connected via USB to laptop computer, reading a card.
Tested with USB cable with molded ferrite on each of the cable.
Digital & RF cables taped and isolated from each other.


3M Company
Conducted Emissions
CISPR22_FCC Part 15, Class B, Line 2
RE Project # - RE1402035
Model # - CR5400
EUT Description - Passport Reader
Serial # -
EUT Power - 120 VAC / 60 Hz
Amplitude dBuV
80.0
75.0
70.0
65.0
60.0
55.0
50.0
45.0
40.0
35.0
30.0
25.0
20.0
15.0
10.0
5.0
0
150.0K
1.0M
10.0M
30.0M
Frequency
QP Class B Limit
AVG Class B Limit
Scan
Top Peaks
Configuration:
Connected via USB to laptop computer, reading a card.
Tested with USB cable with molded ferrite on each of the cable.
Digital & RF cables taped and isolated from each other.

Test Set Up Photo

4.2	**Radiated Emissions Data**
Method:	Measurements were made in a 3-meter semi-anechoic chamber that complies to CISPR 16. The EUT was rotated 360° about its azimuth with the receive antenna located at various heights in horizontal and vertical polarities. Final measurements (quasi-peak) were then performed by rotating the EUT 360° and adjusting the receive antenna height from 1 to 4 m. All frequencies were investigated in both horizontal and vertical antenna polarity, where applicable.

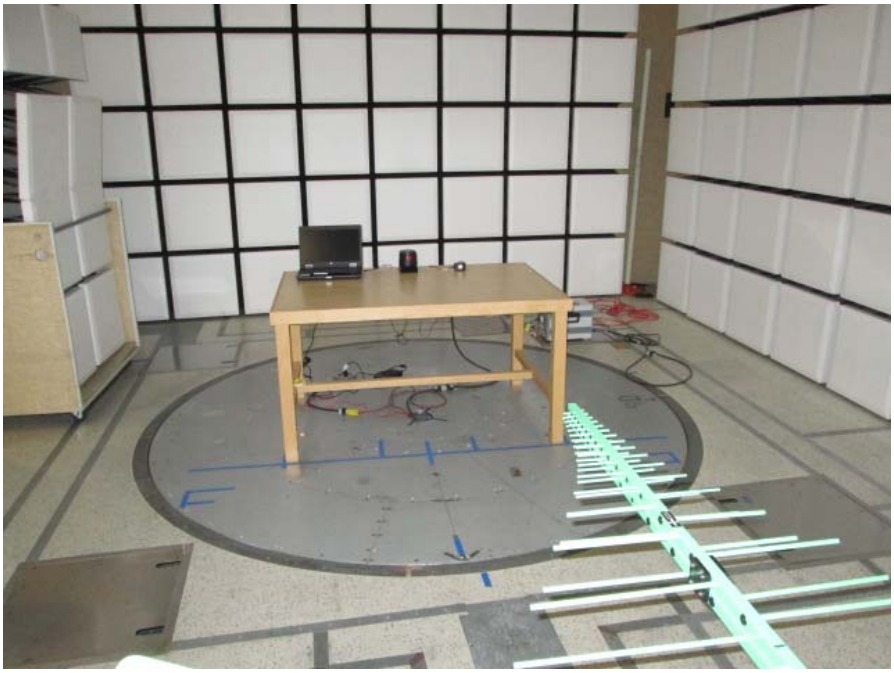
Test Verification: ☒	Laboratory Ambient Temperature	23°C
	Relative Humidity	35%
Reference Standard:	☒ ANSI C63.4:2009 ☐ ANSI C63.10:2009 ☒ FCC Part 15.109/ICES 003 ☐ FCC Part 15.247/RSS 210 ☒ FCC Part 15.209	**Measurement Distance** ☒ 3 Meters ☐
Frequency Range:	☒ 30 MHz TO 10GHz ☐	
Nominal Voltage:	☒ 120VAC ☐ 230VAC ☐	
Tested By:	Mike Schultz MS	**Date:** 02/27/2015

Limits

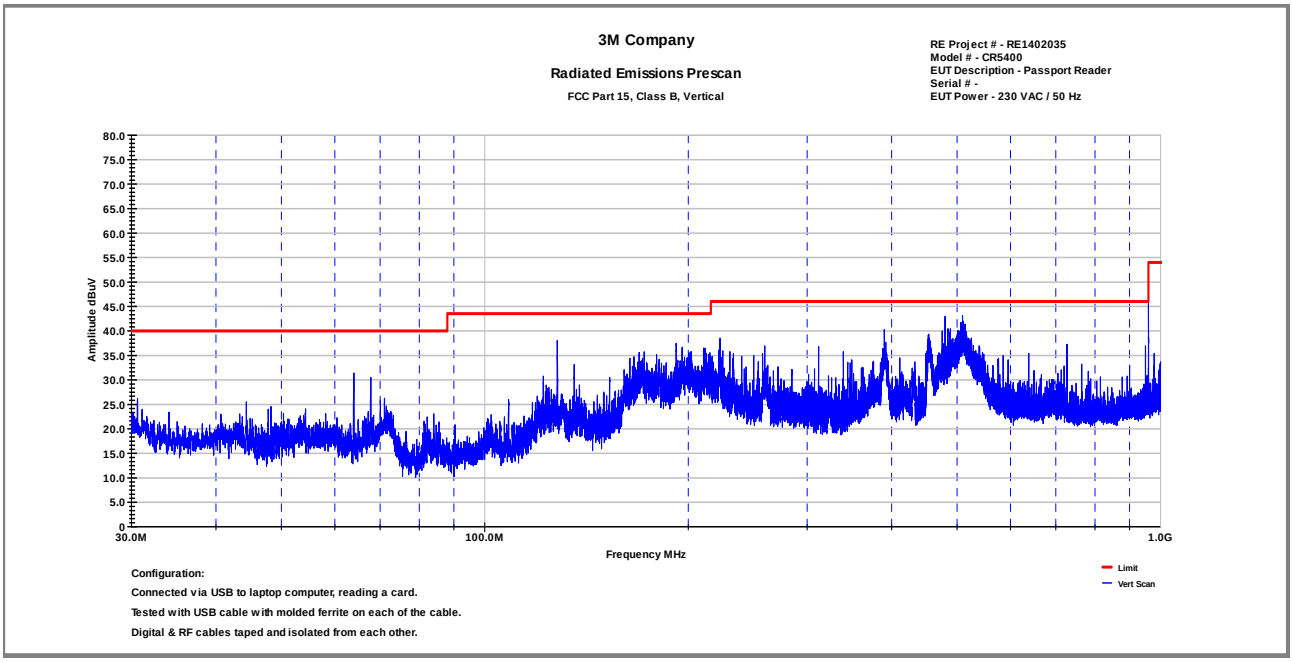
Frequency (MHz)	Limit dB (µV/m)			
	Quasi-Peak	Average	Distance	Results
0.009-0.490		2400/F(KHz)	300	**pass**
0.490-1.705	24000/F(KHz)		30	**pass**
1.705-30	29.5		30	**pass**
30 to 88	40		3	**pass**
88-216	43.5		3	**pass**
216-960	46		3	**pass**
Above 960		54	3	**N/A**

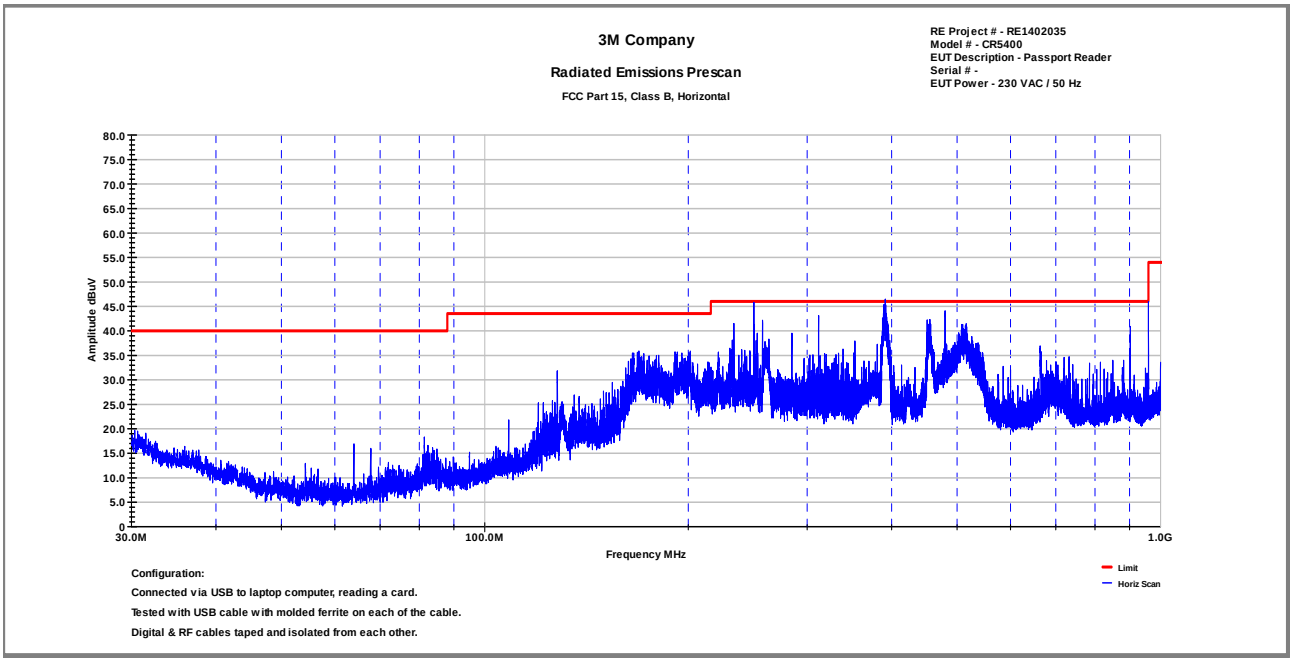
Modifications:	
Note:	For emission in the restricted bands, the limit of 15.209 was used.

Frequency (MHz)	Pol.	QP Reading dBµV/m	Total CF dB	Net at 3 m dBµV/m	Limit (dBµV/m)	Margin dB
16.59		-10.3	37.3	26.7	69.5	-42.8
27.12		-10.1	32.6	22.5	69.5	-47.0
128.005	V	5.11	15.67	20.78	43.52	-22.74
192.745	H	18.42	13.29	31.71	43.52	-11.81
222.111	H	21.85	13.29	35.14	46.02	-10.88
250.022	H	25.48	16.43	41.91	46.02	-4.11
311.901	H	26.45	17.68	44.13	46.02	-1.89
391.505	H	19.18	19.77	38.94	46.02	-7.08
475.529	V	12.33	21.6	33.93	46.02	-12.09
509.703	H	15.92	22.21	38.13	46.02	-7.89
959.915	H	13.23	26.06	39.28	46.02	-6.74
Notes		Total CF = Antenna Factor + Cable Factor - AMP Gain				



Test Set Up Photo

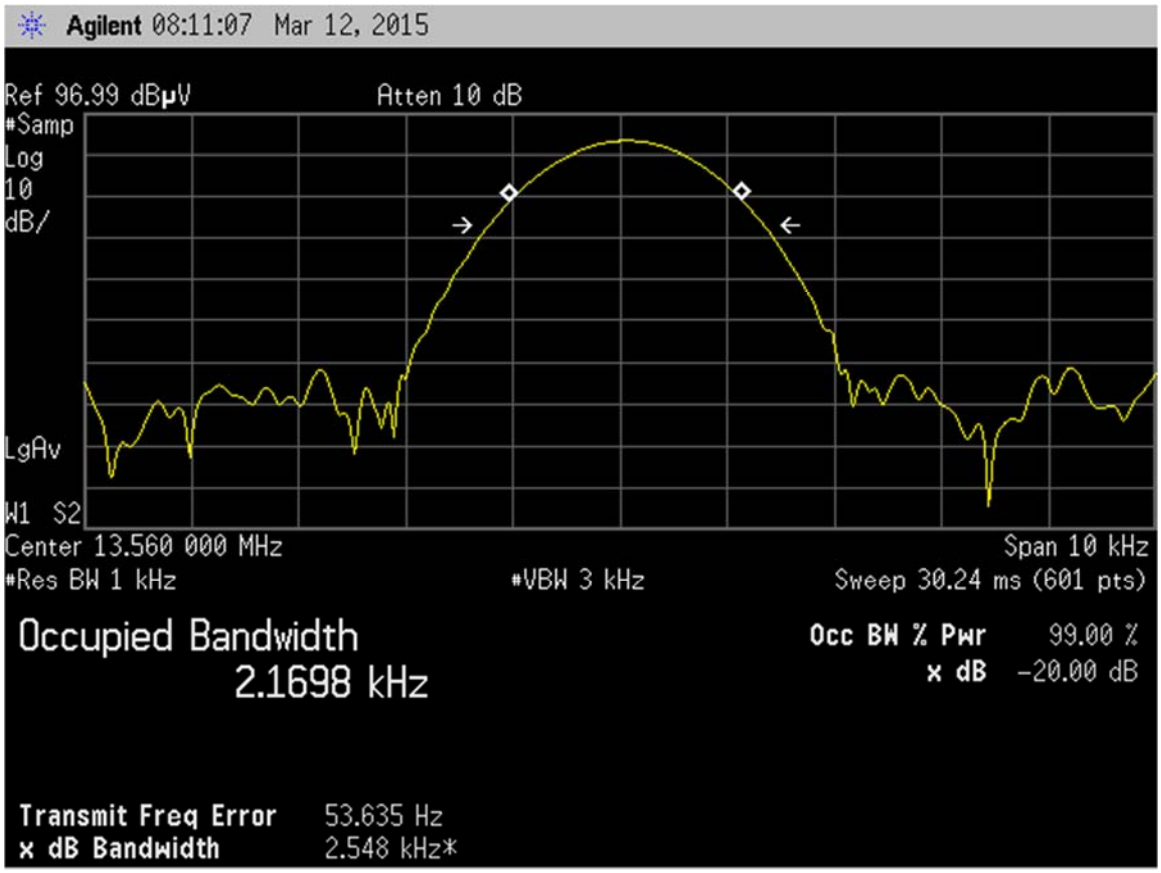

3M Company
Radiated Emissions Prescan
FCC Part 15, Class B, Vertical
RE Project # - RE1402035
Model # - CR5400
EUT Description - Passport Reader
Serial # -
EUT Power - 230 VAC / 50 Hz
Amplitude dBuV
80.0
75.0
70.0
65.0
60.0
55.0
50.0
45.0
40.0
35.0
30.0
25.0
20.0
15.0
10.0
5.0
0
30.0M
100.0M
1.0G
Frequency MHz
Limit
Vert Scan
Configuration:
Connected via USB to laptop computer, reading a card.
Tested with USB cable with molded ferrite on each of the cable.
Digital & RF cables taped and isolated from each other.


3M Company
Radiated Emissions Prescan
FCC Part 15, Class B, Horizontal
RE Project # - RE1402035
Model # - CR5400
EUT Description - Passport Reader
Serial # -
EUT Power - 230 VAC / 50 Hz
Amplitude dBuV
80.0
75.0
70.0
65.0
60.0
55.0
50.0
45.0
40.0
35.0
30.0
25.0
20.0
15.0
10.0
5.0
0
30.0M
100.0M
1.0G
Frequency MHz
Limit
Horiz Scan
Configuration:
Connected via USB to laptop computer, reading a card.
Tested with USB cable with molded ferrite on each of the cable.
Digital & RF cables taped and isolated from each other.

4.3	**20dB Bandwidth**	
Method:	The 20dB bandwidth was measured with a spectrum analyzer connected via Loop antenna placed near the EUT while the EUT is operating in transmissions mode	
	Laboratory Ambient Temperature	23°C
	Relative Humidity	35%
Reference Standard:	☒ ANSI C63.10:2013 ☐ FCC Part 15.109/ICES 003 ☐ FCC Part 15.247/RSS 210 ☐ FCC Part 15.209	**Measurement Point** ☐ Conducted ☒ Radiated ☐
Frequency Range:	☒ 13.553 MHz -13.567MHz	RBW ≥ 1% of the 20 dB bandwidth VBW ≥ RBW
Nominal Voltage:	☒ 120VAC ☐ VDC	
Tested By:	Mike Schultz MS	**Date:** 03/12/2015

Note:	

Frequency (MHz) (PR-ASK)	**20 dB Bandwidth (KHz)**	**99% Bandwidth (KHz)**	**Results**
13.553 MHZ -13.567	2.548	2.170	**pass**


Agilent 08:11:07 Mar 12, 2015
Ref 96.99 dBµV
Atten 10 dB
#Samp
Log
10
dB/
LgAv
W1 S2
Center 13.560 000 MHz
Span 10 kHz
#Res BW 1 kHz
#VBW 3 kHz
Sweep 30.24 ms (601 pts)
Occupied Bandwidth
2.1698 kHz
Occ BW % Pwr 99.00 %
x dB -20.00 dB
Transmit Freq Error 53.635 Hz
x dB Bandwidth 2.548 kHz*

4.4	**Field Strength of Fundamental**
Method:	Measurements was performed with modulated carrier at the highest power level at which the transmitter is intended to operate. The analyzer offset was adjusted to compensate for the attenuator and other losses.

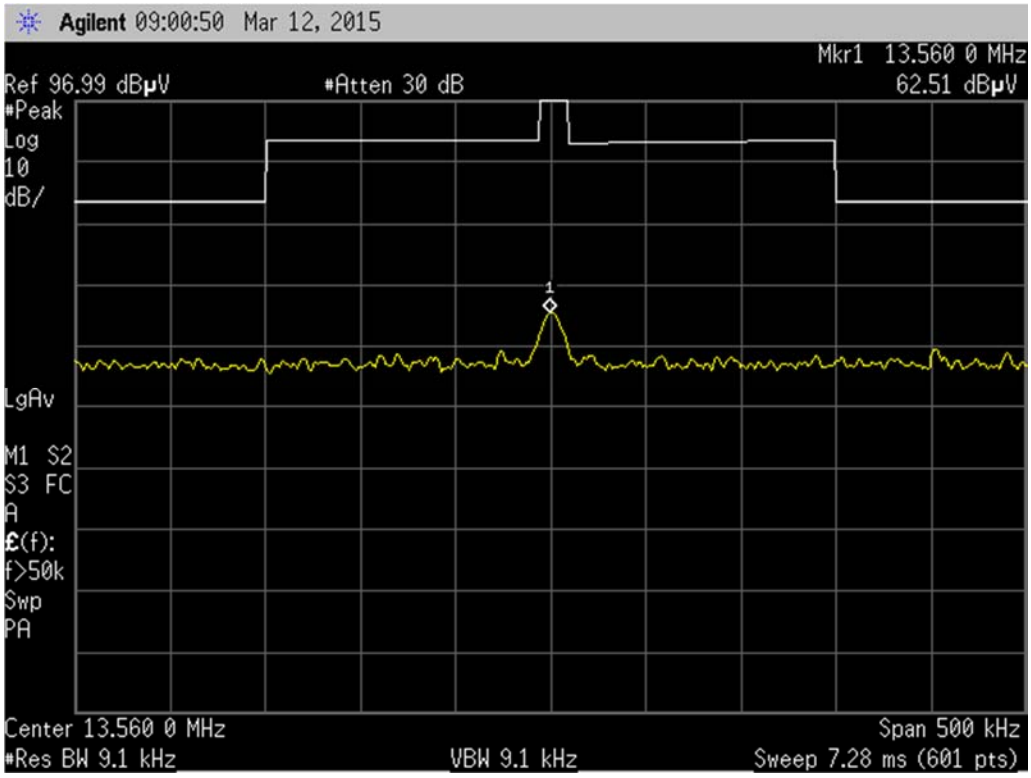
	Laboratory Ambient Temperature	21°C
	Relative Humidity	45%
Reference Standard:	☒ ANSI C63.10:2013 ☒ FCC Part 15.255/RSS210 ☐ FCC Part 15.109/ICES 003 ☐ FCC Part 15.209	**Measurement Point** ☐ Conducted ☒ Radiated at 3 meters
Frequency Range:	☒ 13.553 MHz -13.567MHz	

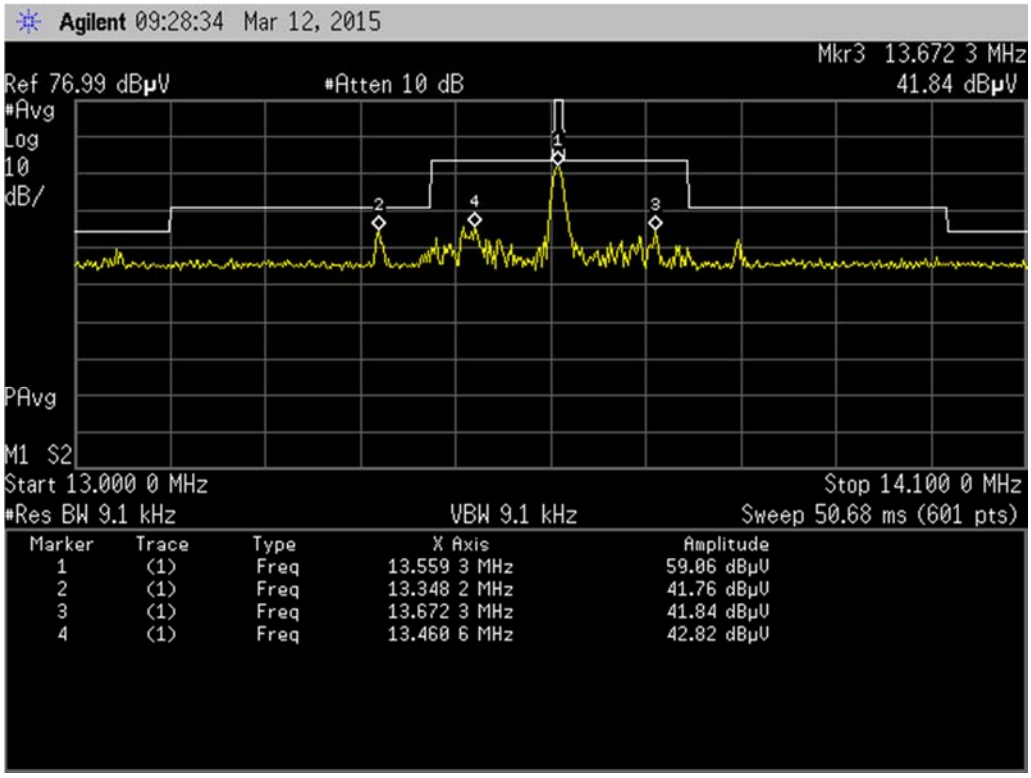
	Frequency (MHz)	**Field Strength uV/m at 30m**	**Field Strength dBuV/m at 3m**
Limit	1.705-13.110	30	69.5
	13.110-13.410	106	80.5
	13.410-13.553	334	90.5
	13.553-13.567	15848	124.0
	13.567-13.710	334	90.5
	13.710-14.010	106	80.5
	14.010-30.0	30	69.5

Nominal Voltage:	☐ 230VAC ☒ 120VAC	
Tested By:	Yuriy Litvinov	**Date:** 03/12/2015

Note:	

Frequency (MHz)	Pol (XYZ)	QP Reading dBµV/m	Limit (3m) (dBµV/m)	Margin dB	Antenna Height (m)
13.56	Y	62.5	124	-61.5	1.0


Agilent 09:00:50 Mar 12, 2015
Mkr1 13.560 0 MHz
Ref 96.99 dBµV
#Atten 30 dB
62.51 dBµV
#Peak
Log
10
dB/
LgAv
M1 S2
S3 FC
A
£(f):
f>50k
Swp
PA
Center 13.560 0 MHz
Span 500 kHz
#Res BW 9.1 kHz
VBW 9.1 kHz
Sweep 7.28 ms (601 pts)


Agilent 09:28:34 Mar 12, 2015
Mkr3 13.672 3 MHz
Ref 76.99 dBµV
#Atten 10 dB
41.84 dBµV
#Avg
Log
10
dB/
PAvg
M1 S2
Start 13.000 0 MHz
Stop 14.100 0 MHz
#Res BW 9.1 kHz
VBW 9.1 kHz
Sweep 50.68 ms (601 pts)
Marker Trace Type X Axis Amplitude
1 (1) Freq 13.559 3 MHz 59.06 dBµV
2 (1) Freq 13.348 2 MHz 41.76 dBµV
3 (1) Freq 13.672 3 MHz 41.84 dBµV
4 (1) Freq 13.460 6 MHz 42.82 dBµV

4.5	**Frequency Stability**		
Method:	Measurements was performed with modulated carrier at the highest power level at which the transmitter is intended to operate. The frequency was measured under normal and extreme test conditions test conditions. The analyzer offset was adjusted to compensate for the attenuator and other losses. During extreme test conditions, both extreme temperature and voltage apply simultaneously.		
	Laboratory Ambient Temperature		21°C
	Relative Humidity		35%
Reference Standard:	☒ Part 15.225 ☒ ANSI C63.10:2013		**Measurement Point** ☐ Conducted ☒ Radiated
Frequency Range:	☒ 13.553 MHz -13.567MHz		**Maximum Deviation**
Limit:	☒ ± 100ppm		7.5 ppm
Nominal Voltage:	☐ 230VAC ☒ 120VAC		
Extreme Temperature Ranges (C^0)	☒ General	☒ - 20.0 to +50.0	
	☐ Portable	☐	
	☐ Indoor Use	☐	
Extreme Test Voltages:	☒ Mains Voltage	☒ ± 15%	
	☐ Battery	☐ 0.85 ☐ 1.15	
Tested By:	Mike Schultz MS		Date:03/13/2015

Channels Frequency (MHz)	Temperature C^0	Voltage (VAC/50Hz)	Measured Frequency (MHz)	Frequency Deviation (MHz)	Result
13.56MHz	55	102	13.5603	0	**pass**
		120	13.5603	0	**pass**
		138	13.5603	0	**pass**
	30	102	13.5603	0	**pass**
		120	13.5603	0	**pass**
		138	13.5603	0	**pass**
	20	102	13.5603	0	**pass**
		120	13.5603	0	**pass**
		138	13.5603	0	**pass**
	10	102	13.5603	0	**pass**
		120	13.5603	0	**pass**
		138	13.5603	0	**pass**
	0	102	13.5603	0	**pass**
		120	13.5603	0	**pass**
		138	13.5603	0	**pass**
	-10	102	13.5604	0.0001	**pass**
		120	13.5604	0.0001	**pass**
		138	13.5604	0.0001	**pass**
	-20	102	13.5604	0.0001	**pass**
		120	13.5604	0.0001	**pass**
		138	13.5604	0.0001	**pass**

Test Set Up Photo

5.0 Test Equipment

Test Equipment Used

Description	Manufacturer	Model	Identifier	Cal. Due	Check
Biconilog Antenna	Schaffner	CBL6112B	27491	10/2015	☒
Horn Antenna	AH Systems	SAS 571	1010	10/2015	☐
Loop Antenna	EMCO	ALR25M	1011	10/2015	☒
EMI Receiver	Rohde & Schwarz	ESIB 40	100235	10/2015	☐
EMI Receiver	Agilent	E4448A	1530975	10/2015	☒
Signal Analyzer	Agilent	N9000A	MY53031040	10/2015	☒
LISN	TESEQ	NNB51	1130	10/2015	☒
Harmonic/Flicker Source	Cal. Instruments	C4-5001iX	57162	10/2015	☐
Amplifier	AR	250W1000AM	14354	10/2015	☐
Amplifier	AR	25S1G4A	4003	10/2015	☐
Signal Generator	HP	8656A	2326A05125	10/2015	☐
Signal Generator	Agilent	E8257D	160895	10/2015	☐
Field Probe	AR	FL7006	25019	10/2015	☐
Field Monitor	AR	FM2000	14292	10/2015	☐
AC CDN	Schaffner	M316,	21937	10/2015	☐
AC CDN	Teseq	M016,	26131	10/2015	☐
Current Injection Coil	A.H. Systems	ICP-200/521	149	10/2015	☐
RF Conducted System	TESEQ	NSG 4070-75	1141	10/2015	☐
ESD Generator	KeyTek	MZ-15/EC	609325	10/2015	☐
EFT/Surge Generator	ThermoFisher	EMC Pro Plus	1146	10/2015	☐
EMF Meter	NARDA	ELT400	1139	10/2015	☐
EMF Test Generator	FCC	F-1000-4-8-G	9940	10/2015	☐
AC Power System	Titan	MAC-03	6619921	10/2015	☐
EMC Software	ETS-Lindgren	TILE 6		10/2015	☒

6.0 Report revision history

Revision Level	Date	Report Number	Notes
0	04/08/2015	RE1501030-3	Original Issue

Certificate of Conformity

3M EMC Laboratory

SEMS Global Regulatory Engineering
Building 76-01-01
St. Paul, MN 55144-1000, USA

MANUFACTURER'S NAME	**3M COMPANY**
NAME OF EQUIPMENT	**3M™ Double-Sided ID1 Reader**
MODEL NUMBER(S)	**CR5400**
TEST REPORT NUMBER	**RE1501030-3**
DATE OF ISSUE	**April 8, 2015**

Referring to the performance criteria and operating mode during the tests specified in this report the equipment complies with the essential requirements herein specified:

47 CFR Part 15 – Subpart C – Intentional Radiator	**FCC Part 15.225**
License-exempt Radio Apparatus (All Frequency Bands): Category I Equipment	**RSS 210, Issue 8, 2010**
	47 CFR:2014, FCC Parts 15.107 and 15.109
	ICES-003, Issue 5, 2012

Comments:

NVLAP Lab Code 200033-0

Yuriy Litvinov

Yuriy Litvinov
Lead EMC Engineer