Excellence in Compliance Testing

Certification Test Report

FCC ID: JEH2381GRPR
IC: 470B-2381GRPR

FCC Rule Part: 15.225
IC Radio Standards Specification: RSS-210

ACS Report Number: 10-0326.W06.11.A

Manufacturer: NCR Corporation
Model: 2381GRPR

Test Begin Date: September 20, 2010
Test End Date: September 27, 2010

Report Issue Date: October 18, 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.

Prepared by: _____

Kirby Munroe
Director, Wireless Certifications
ACS, Inc.

This report contains 17 pages

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1 GENERAL

1.1 Purpose

The purpose of this report is to demonstrate compliance with Part 15 Subpart C of the FCC's Code of Federal Regulations and Industry Canada's Radio Standards Specification RSS-210 for a single modular approval.

1.2 Product description

The 2381 RFID reader modules are HF RFID readers, and communicate with DVD hub labels for the purpose of identifying and tracking Digital Video Discs as they enter and exit the host machine, a DVD rental kiosk.

Technical Details:
Frequency Range: 13.56 MHz
Operating channels: 1
Modulation: ASK
Operating Voltage: 3.3V/5V dual DC

Manufacturer Information:
NCR Corporation
2651 Satellite Boulevard
Duluth, GA 30096

Test Sample Serial Number(s):
ACS#5

Test Sample Condition:
The test sample was provided in working order with no visible defects.

1.3 Test Methodology and Considerations

The EUT was tested in a configuration representative for worst case radiated emissions. No deviations from the test specifications were made.

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:

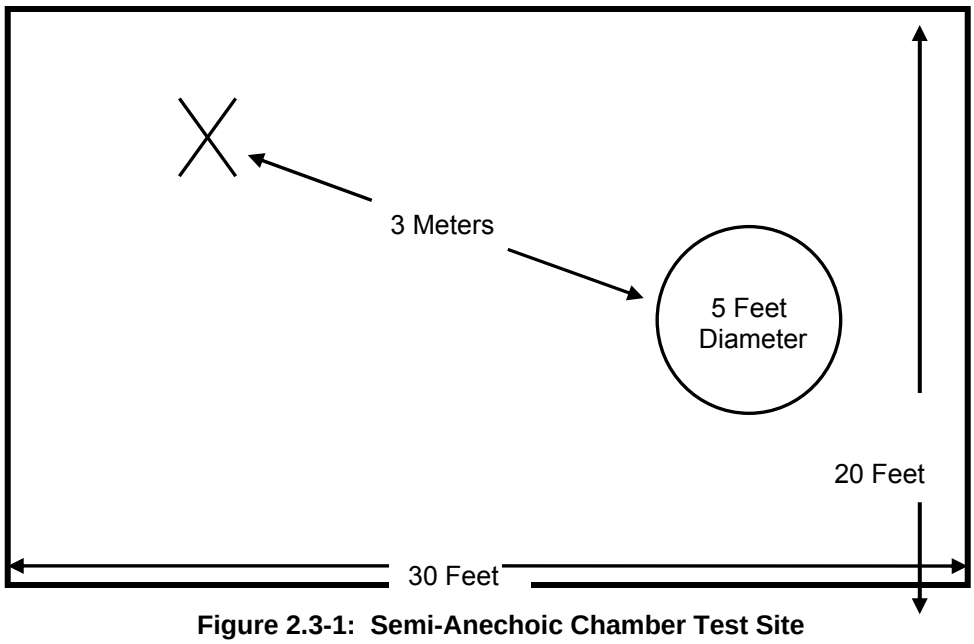

Figure 2.3-1: Semi-Anechoic Chamber Test Site

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:

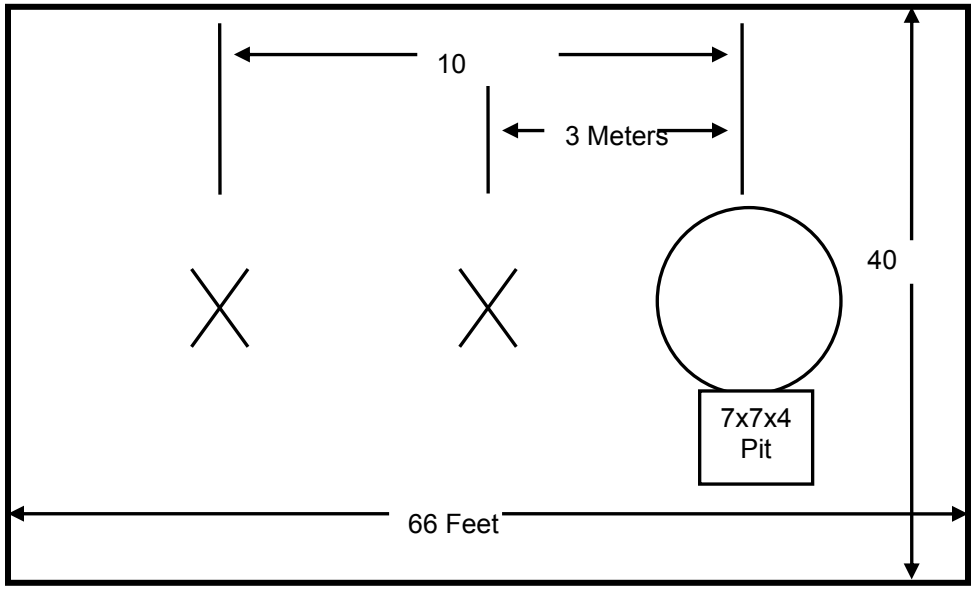

Figure 2.3-2: Open Area Test Site

2.4 Conducted Emissions Test Site Description

The AC mains conducted EMI site is located in the main EMC lab. It consists of an 8' x 8' solid aluminum horizontal group reference plane (GRP) bonded every 3" to an 8' X 8' vertical ground plane.

The site is of sufficient size to test table top and floor standing equipment in accordance with section 6.1.4 of ANSI C63.4.

A diagram of the room is shown below in figure 4.1.3-1:

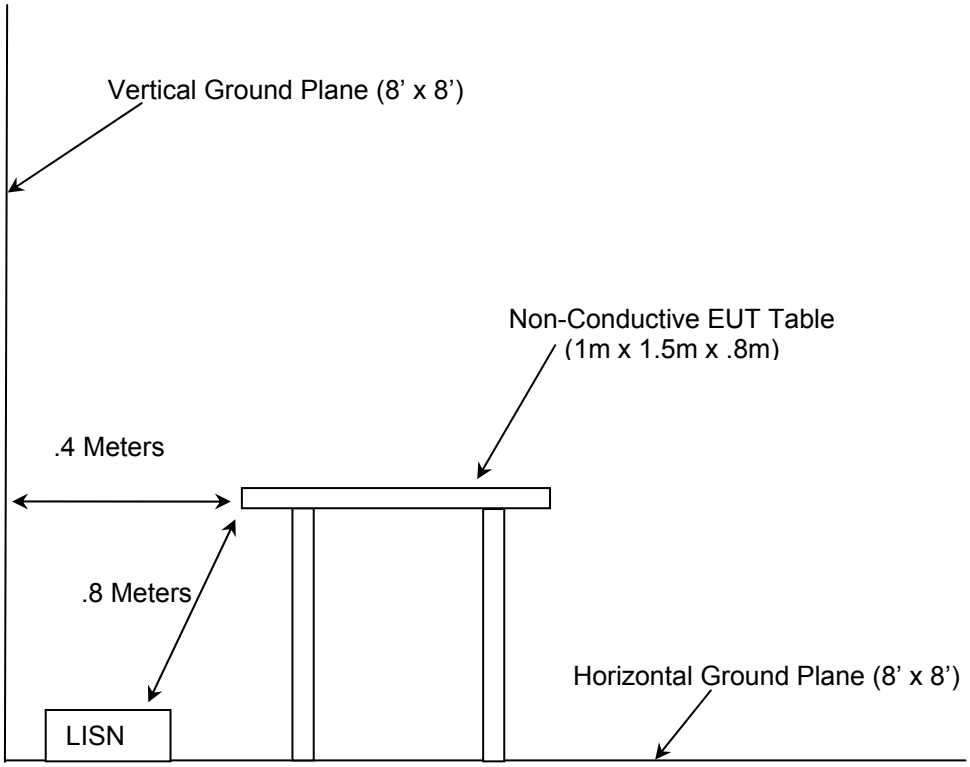

Figure 2.4-1: AC Mains Conducted EMI Site

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
- US Code of Federal Regulations (CFR): Title 47, Part 2, Subpart J: Equipment Authorization Procedures, 2010
- US Code of Federal Regulations (CFR): Title 47, Part 15, Subpart C: Radio Frequency Devices, Intentional Radiators, 2010
- Industry Canada Radio Standards Specification: RSS-210 - Low-power License-exempt Radiocommunication Devices (All Frequency Bands): Category I Equipment, Issue 7 June 2007
- Industry Canada Radio Standards Specification: RSS-GEN – General Requirements and Information for the Certification of Radiocommunication Equipment, Issue 2, June 2007.

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	09-23-2011
2	Rohde & Schwarz	Spectrum Analyzers	ESMI-Receiver	839587/003	09-23-2011
3	Rohde & Schwarz	Spectrum Analyzers	ESMI - Display	839379/011	02-02-2011
4	Rohde & Schwarz	Spectrum Analyzers	ESMI-Receiver	833827/003	02-02-2011
25	Chase	Antennas	CBL6111	1043	09-13-2012
73	Agilent	Amplifiers	8447D	2727A05624	05-26-2011
78	EMCO	Antennas	6502	9104-2608	01-11-2011
153	EMCO	LISN	3825/2	9411-2268	01-11-2011
167	ACS	Cable Set	Chamber EMI Cable Set	167	01-25-2011 (See Note1)
168	Hewlett Packard	Attenuators	11947A	44829	02-04-2011 (See Note2)
283	Rohde & Schwarz	Spectrum Analyzers	FSP40	1000033	08-31-2011
324	ACS	Cables	Belden	8214	07-09-2011

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	Equipment Type	Manufacturer	Model Number	Serial Number	FCC ID
1	Power Supply	Acopian	3.3J100D-5J200D	910	N/A

6 EQUIPMENT UNDER TEST SETUP BLOCK DIAGRAM

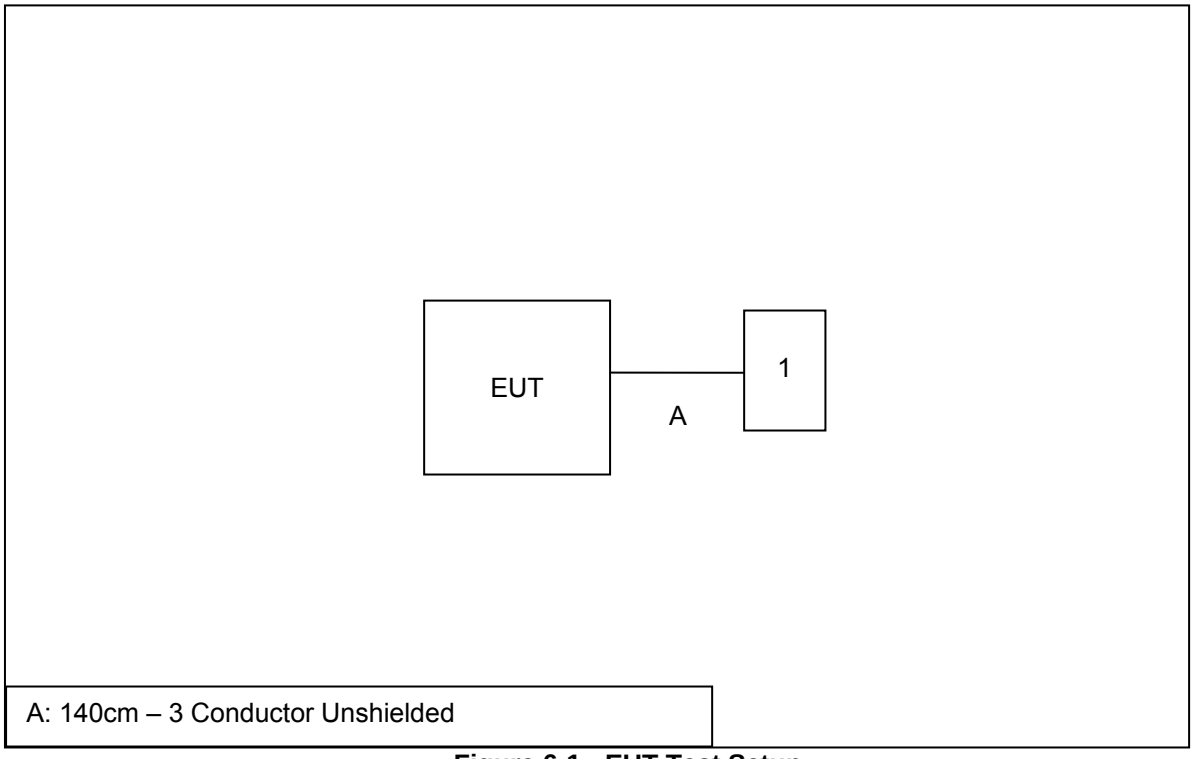

Figure 6-1: EUT Test Setup

*See Test Setup photographs for additional detail.

7 SUMMARY OF TESTS

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

7.1 Antenna Requirement – FCC: CFR 47 Part 15.203

The antenna is an integrated non-detachable loop antenna thus satisfying Part 15.203.

7.2 Power Line Conducted Emissions – FCC: CFR 47 Part 15.207/ IC RSS-GEN 7.2.2

7.2.1 Measurement Procedure

ANSI C63.4 sections 6 and 7 were the guiding documents for this evaluation. Conducted emissions were performed from 150kHz to 30MHz with the spectrum analyzer's resolution bandwidth set to 9kHz and the video bandwidth set to 30kHz. The calculation for the conducted emissions is as follows:

Corrected Reading = Analyzer Reading + LISN Loss + Cable Loss
Margin = Applicable Limit - Corrected Reading

7.2.2 Measurement Results

Results of the test are shown below in and Table 7.2.2-1 to 7.2.2.2.

Table 7.2.2-1: Line 1 Conducted EMI Results

Frequency (MHz)	Level (dBuV)	Transducer (dB)	Limit (dBuV)	Margin (dB)	Line	PE	Detector
0.192	30.5	9.9	64	33.5	L1	GND	QP
0.294	22.8	10	60	37.6	L1	GND	QP
0.486	17.3	10	56	39	L1	GND	QP
0.498	15.6	10	56	40.5	L1	GND	QP
0.576	17.4	10	56	38.6	L1	GND	QP
0.708	14.1	10.1	56	41.9	L1	GND	QP
0.9	10.2	10	56	45.8	L1	GND	QP
1.044	11.5	10	56	44.5	L1	GND	QP
1.986	9.8	10	56	46.2	L1	GND	QP
13.56	30.1	9.9	60	29.9	L1	GND	QP
0.198	12	9.9	54	41.7	L1	GND	AVG
0.294	8.4	10	50	42	L1	GND	AVG
0.486	7.4	10	46	38.8	L1	GND	AVG
0.54	7.3	10	46	38.7	L1	GND	AVG
0.552	7.3	10	46	38.7	L1	GND	AVG
0.708	7.2	10.1	46	38.8	L1	GND	AVG
0.99	7.1	10	46	39	L1	GND	AVG
1.098	7.1	10	46	38.9	L1	GND	AVG
1.968	7	10	46	39	L1	GND	AVG
13.632	7	9.9	50	43	L1	GND	AVG

Table 7.2.2-2: Line 2 Conducted EMI Results

Frequency (MHz)	Level (dBuV)	Transducer (dB)	Limit (dBuV)	Margin (dB)	Line	PE	Detector
0.156	33.1	9.9	66	32.6	L2	GND	QP
0.426	12	10	57	45.3	L2	GND	QP
0.522	10.5	10	56	45.5	L2	GND	QP
0.672	10	10	56	46	L2	GND	QP
0.9	9.9	10	56	46.1	L2	GND	QP
1.056	9.7	10	56	46.3	L2	GND	QP
3.3	9.4	9.9	56	46.6	L2	GND	QP
3.966	9.4	9.9	56	46.6	L2	GND	QP
13.65	9.4	9.9	60	50.6	L2	GND	QP
13.656	9.5	9.9	60	50.5	L2	GND	QP
0.228	8.2	9.9	53	44.4	L2	GND	AVG
0.42	7.6	10	47	39.9	L2	GND	AVG
0.498	7.3	10	46	38.8	L2	GND	AVG
0.654	7.3	10	46	38.7	L2	GND	AVG
0.93	7.1	10	46	39	L2	GND	AVG
1.044	7.1	10	46	38.9	L2	GND	AVG
3.366	6.6	9.9	46	39.4	L2	GND	AVG
3.936	6.6	9.9	46	39.4	L2	GND	AVG
13.5	6.8	9.9	50	43.3	L2	GND	AVG
13.566	15.9	9.9	50	34.2	L2	GND	AVG

7.3 Radiated Emissions – Intentional Radiation

7.3.1 In-Band Emissions Limitations – FCC Part 15.225(a),(b),(c) / IC RSS-210 A2.6

7.3.1.1 Test Methodology

Measurements below 30MHz were performed in a semi-anechoic chamber with a 3 meter separation distance between the EUT and measurement antenna. The EUT was rotated 360º and the loop antenna rotated about the vertical axis to maximize each emission. The magnetic loop receiving antenna was positioned with its center 1 meter above the ground.

The spectrum analyzer's resolution and video bandwidths were set to 9 kHz and 30 kHz respectively. A peak detector was used which shows worst case. The measurements were corrected by a distance correction factor, antenna correction factors, and cable loss for comparison to the limits. Sample correction factors and calculations can be found section 7.3.2.2 and 7.3.2.4.

7.3.1.2 Test Results

Compliance with the emissions levels are shown in figure 7.3.1-1 below. Only the worst case EUT orientation is shown.

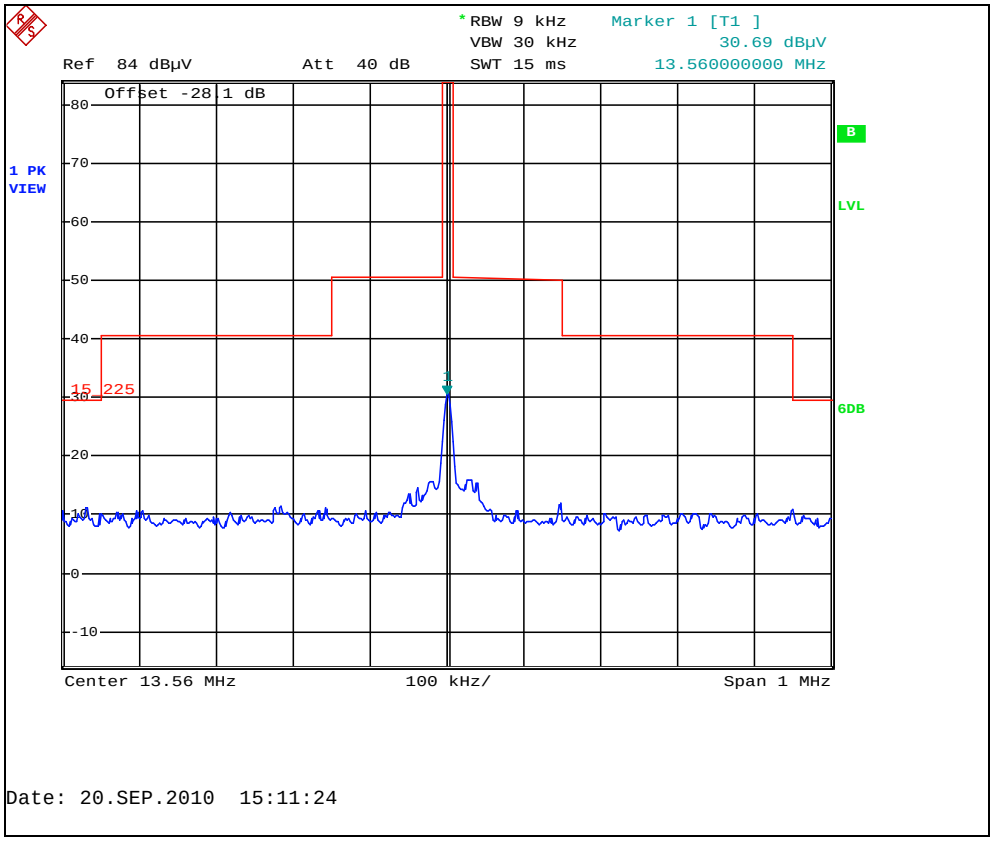

Figure 7.3.1-1: Emission Mask Plot

7.3.2 Out-of-Band Emissions – FCC Part 15.225(d), 15.209, 15.109 / IC RSS-210 2.6

7.3.2.1 Test Methodology

Section 15.33(a)(4) specifies, if the intentional radiator contains a digital device, regardless of whether this digital device controls the functions of the intentional radiator or the digital device is used for additional control or function purposes other than to enable the operation of the intentional radiator, the frequency range shall be investigated up to frequency specified in 15.33(b)(1) for unintentional radiators. The upper frequency range for the digital device is 1000MHz which greater than the 10th harmonic of the fundamental frequency. The upper frequency range measured was 1000MHz.

Measurements below 30MHz were performed in a semi-anechoic chamber with a 3 meter separation distance between the EUT and measurement antenna. The EUT was rotated 360º and the loop antenna rotated about the vertical axis to maximize each emission. The magnetic loop receiving antenna was positioned with its center 1 meter above the ground.

For measurements in the frequency bands 9-90 kHz and 110-490 kHz, an average detector was used. When average measurements are specified, the peak emissions were also compared to a limit corresponding to 20 dB above the maximum permitted average limit according to Part 15.35. All other emissions were measured using a Quasi-peak detector. The final measurements were then corrected by a distance correction factor, antenna correction factors, and cable loss for comparison to the limits.

Measurements above 30MHz were performed in a semi-anechoic chamber with a 3 meter separation distance between the EUT and measurement antenna. The EUT was rotated through 360° and the receive antenna height was varied from 1m to 4m so that the maximum radiated emissions level would be detected. For frequencies below 1000MHz, quasi-peak measurements were made.

The spectrum analyzer's resolution bandwidth was set to equal to or greater than 100 Hz from 9 kHz to 150 kHz, 9 kHz from 150 kHz to 30 MHz, 120 kHz from 30 MHz to 1000 MHz, and 1 MHz from 1 GHz to 40 GHz.

7.3.2.2 Distance Correction for Measurements Below 30 MHz – Part 15.31

Radiated measurements were performed at a distance closer than 30m as required according to Part 15.209. Therefore a correction factor was applied to account for propagation loss at the specified distance. The propagation loss was determined by using the square of an inverse linear distance extrapolation factor (40dB/decade) according to 15.31. A sample calculation of the distance correction factor is shown below for limits expressed at a 30m measurement distance.

Distance correction factor (30m Specified Test Distance) = 40*Log (Test Distance/30)
= 40*Log (3/30)
= - 40 dB

7.3.2.3 Test Results

Radiated spurious emissions found are reported in Tables 7.3.2-1.

Table 7.3.2-1: Radiated Spurious Emissions

Frequency (MHz)	Level (dBuV)		Antenna Polarity	Correction Factors	Corrected Level (dBuV/m)		Limit (dBuV/m)		Margin (dB)	
	pk	Qpk/Avg	(H/V)	(dB)	pk	Qpk/Avg	pk	Qpk/Avg	pk	Qpk/Avg
40.67	---------	37.08	V	-12.24	---------	24.85	--------	40.0	---------	15.20
257.63	---------	31.36	H	-11.04	---------	20.32	--------	46.0	---------	25.70
271.2	---------	27.22	H	-11.00	---------	16.22	--------	46.0	---------	29.80
298.32	---------	27.02	H	-11.02	---------	16.00	--------	46.0	---------	30.00
528.83	---------	40.84	V	-3.89	---------	36.95	--------	46.0	---------	9.00
900.84	---------	20.37	H	1.68	---------	22.05	--------	46.0	---------	23.90

Note: Spurious emissions associated with the transmitter that are not reported in the table above are below the noise floor of the measurement system.

7.3.2.4 Sample Calculation:

Example Calculation – Average/Quasi-Peak

Limit < 30MHz

Limit (dBuV/m) = 20*log(30) - Distance Correction Factor (Section 7.3.2.2)
Limit (dBuV/m) = 29.5 + 40
Limit (dBuV/m) = 69.5

$R_C = R_U + CF_T$

Where:

CF_T	=	Total Correction Factor (AF+CA+AG)
R_U	=	Uncorrected Reading
R_C	=	Corrected Level
AF	=	Antenna Factor
CA	=	Cable Attenuation
AG	=	Amplifier Gain

Corrected Level: 37.08 - 12.24 = 24.8dBuV
Margin: 40dBuV – 24.8dBuV = 15.2dB

7.4 Occupied Bandwidth – FCC Part 15.215(c) / IC RSS-Gen 4.6.1

7.4.1 Test Methodology

The spectrum analyzer span was set to 2 to 3 times the estimated bandwidth of the emission. The RBW was to ≥ 1% of the estimated bandwidth. The trace was set to max hold with a peak detector active. The measurement function of the analyzer was utilized to determine the 99% occupied bandwidth.

7.4.2 Test Results

The 20dB and 99% bandwidths were measured as 80.4 KHz and 134 KHz respectively. The results are shown in Figure 7.4.2-1 and 7.4.2-2.

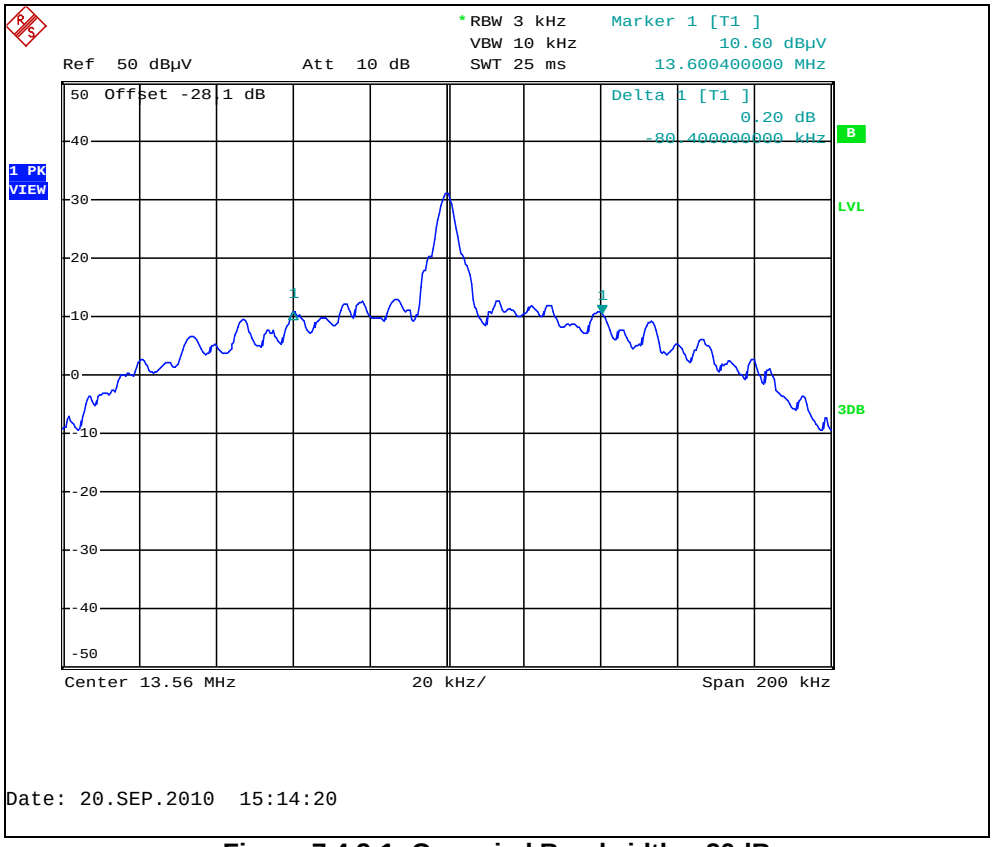

Figure 7.4.2-1: Occupied Bandwidth – 20dB

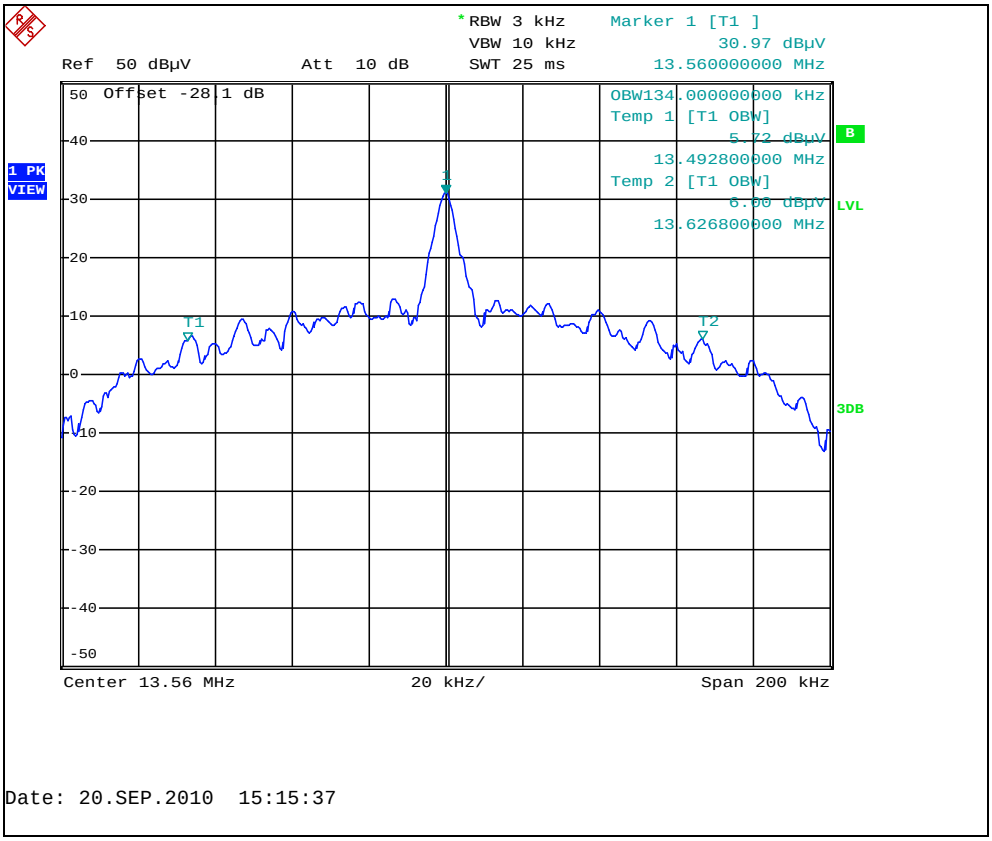

Figure 7.4.2-2: Occupied Bandwidth – 99%

7.5 Frequency Stability – FCC CFR 47 Part 15.225(e) / IC RSS-210 A2.6

7.5.1 Test Methodology

The equipment under test is placed inside an environmental chamber. The RF output is coupled to the input of the measurement equipment via a near field probe.

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 from 85% to 115% from the normal. The maximum variation of frequency was recorded.

The limit from rule part 15.225 is 0.01% or 100ppm.

7.5.2 Test Results

Results of the test are shown below in Figure 7.5.2-1.

Frequency Stability

Deviation Limit (PPM): 100ppm

Temperature	Frequency	Frequency Error	Voltage	Voltage
C	MHz	(PPM)	(%)	(VDC)
-20 C	**13.560105**	**7.743**	100%	5.00
-10 C	**13.560102**	**7.522**	100%	5.00
0 C	**13.560069**	**5.088**	100%	5.00
10 C	**13.560023**	**1.696**	100%	5.00
20 C	**13.559899**	**-7.448**	100%	5.00
30 C	**13.559857**	**-10.546**	100%	5.00
40 C	**13.559773**	**-16.740**	100%	5.00
50 C	**13.559702**	**-21.976**	100%	5.00
20 C	**13.559888**	**-8.260**	85%	4.25
20 C	**13.559894**	**-7.817**	100%	5.75

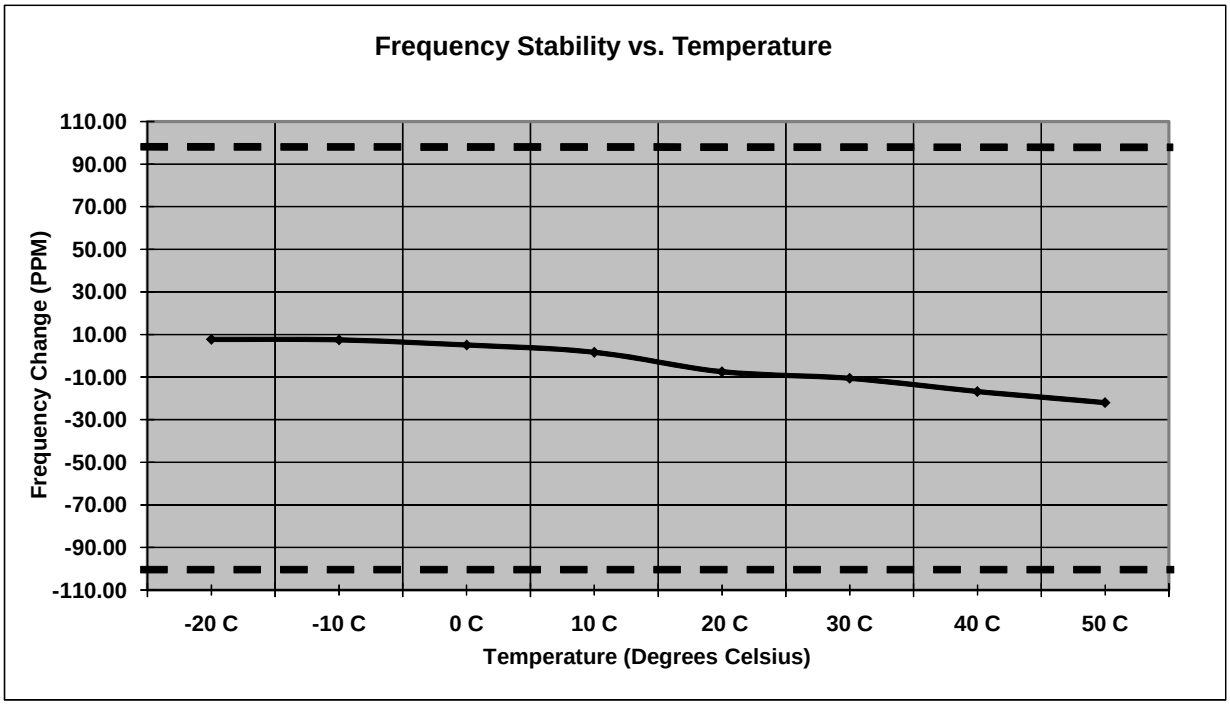

Figure 7.5.2-1: Frequency Stability

8 CONCLUSION

In the opinion of ACS, Inc. the 2381GRPR manufactured by NCR Corporation met the requirements of FCC Part 15 subpart C and Industry Canada's Radio Standards Specification RSS-210.

END REPORT