Standards Council of Canada
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TM

Test Report:	5W56178 Issue 2
Applicant:	Canadian Bank Note Company 18 Auriga Drive, Ottawa, ON, K2E 7T9 Canada
Apparatus:	Travel Document Reader
FCC ID:	TT5 PDT02933
In Accordance With:	FCC Part 15 Subpart C, 15.207 and 15.209 Intentional Radiators
Tested By:	Nemko Canada Inc. 303 River Road Ottawa, Ontario K1V 1H2
Authorized By:	Sim Jagpal, Resource Manager
Date:	January 13, 2006
Total Number of Pages:	32

Report Summary

These tests were conducted on a sample of the equipment for the purpose of demonstrating compliance with Part 15, Subpart C. Radiated tests were conducted in accordance with ANSI C63.4-2003. Radiated emissions are made on an open area test site. A description of the test facility is on file with the FCC.

The assessment summary is as follows:

Apparatus Assessed:	Travel Document Reader
Specification:	FCC Part 15 Subpart C, 15.207 and 15.209
Compliance Status:	Complies
Exclusions:	None
Non-compliances:	None
Report Release History:	Original Release

Author: Roman Kuleba, EMC/Wireless Specialist

Note that the results contained in this report relate only to the items tested and were obtained in the period between the date of initial receipt of samples and the date of issue of the report.

This test report has been completed in accordance with the requirements of ISO/IEC 17025.

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Section 1 : Equipment Under Test

1.1 Product Identification

The Equipment Under Test was identified as follows: Travel Document Reader CM2510 and CM2511

1.2 Samples Submitted for Assessment

The following samples of the apparatus have been submitted for type assessment:

Sample No.	Description	Serial No.
1	Travel Document Reader CM2510	000016
2	Travel Document Reader CM2511	000008
3	100-240VAC/50-60Hz to 12VDC Power Adaptor GlobTek GT-21097-5012	006349 52/03
4	Host PC (Laptop)	N/A

The first samples were received on: November 21, 2005

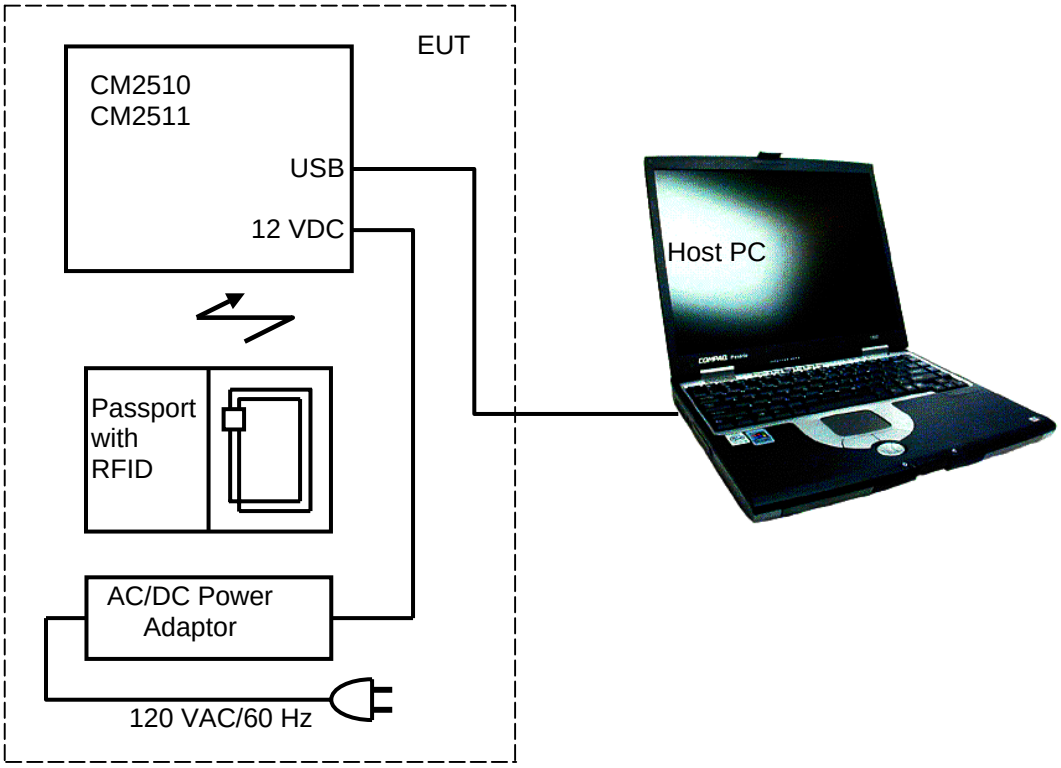
1.3 Theory of Operation

The CM2510/CM2511 is a travel document reader with optical and dual-antenna ePassport capabilities. Both models (CM2510 and CM2511) are identical except for the connectors added on the back panel of CM2510 (all available host interfaces are fitted on CM2510 and only USB 2.0 on CM2511).
The optical portion of the reader uses a high-resolution digital camera sensor to capture images of documents under several wavelengths of light. Document features are extracted and transferred to a host computer. An RFID interface (with two integral loop antennas) retrieves data from documents fitted with ICAO-compliant ePassport capability.
Local Oscillators and Clock: 0.032768, 12, 13.56, 20, 60, 80, 240 MHz

1.4 Technical Specifications of the EUT

Manufacturer:	Canadian Bank Note Company
Transmitter Frequency:	13.56 MHz
Modulation:	ASK, Data Rate: 424 kbps
Antenna Data:	Integral Loop
Antenna Connector:	SMB
Power Source:	100-240VAC/50-60Hz to 12VDC Power Adaptor

1.5 Block Diagram of the EUT



Section 2 : Test Conditions

2.1 Specifications

The apparatus was assessed against the following specifications:

FCC Part 15 Subpart C (Intentional Radiators)

2.2 Deviations From Laboratory Test Procedures

No deviations were made from laboratory test procedures.

2.3 Test Environment

All tests were performed under the following environmental conditions:

Temperature range	:	15 – 30 ^{o}C
Humidity range	:	20 - 75 %
Pressure range	:	86 - 106 kPa
Power supply range	:	+/- 5% of rated voltages

2.4 Test Equipment

Equipment	Manufacturer	Model No.	Asset/Serial No.	Last Cal.	Next Cal.
LISN	EMCO	4825/2	FA001545	Jan. 13/05	Jan. 13/06
Receiver	Rohde & Schwarz	ESHS 10	FA001918	Feb. 28/05	Feb. 28/06
Transient Limiter	Hewlett-Packard	1194 7A	FA000975	May 25/05	May 25/06
Spectrum Analyzer	Hewlett-Packard	8566B	FA001309	May 18/05	May 18/06
Spectrum Analyzer Display	Hewlett-Packard	85662A	FA001309	May 18/05	May 18/06
0.1 – 1300 MHz Amplifier	Hewlett Packard	8447D	FA001909	Jan. 13/05	Jan. 13/06
Bilog Antenna	Schaffner	CBL6112B	FA001504	NCR	NCR
Biconical (2) Antenna	EMCO	3109	FA000904	Aug. 26/05	Aug. 26/06
Log Periodic Antenna #1	EMCO	LPA-25	FA000477	Aug. 29/05	Aug. 29/06
Receiver	Rohde & Schwarz	ESVS-30	FA001437	July 27/05	July 27/06
Horn Antenna #2	EMCO	3115	FA000825	Dec. 14/04	Dec. 14/05
Active Loop Antenna	Rohde & Schwarz	HFH2-Z2	FA000631	May 20/05	May 20/06
Spectrum Analyzer	Rohde & Schwarz	FSP	FA001920	March 22/05	March 22/06

Section 3 : Observations

3.1 Modifications Performed During Assessment

No modifications were performed during assessment.

3.2 Record Of Technical Judgements

No technical judgements were made during the assessment.

3.3 EUT Parameters Affecting Compliance

The user of the apparatus could not alter parameters that would affect compliance.

3.4 Test Deleted

No Tests were deleted from this assessment.

3.5 Additional Observations

There were no additional observations made during this assessment.

Section 4 : Results Summary

This section contains the following:

FCC Part 15 Subpart C : Test Results

The column headed 'Required' indicates whether the associated clauses were invoked for the apparatus under test. The following abbreviations are used:

N	No : not applicable / not relevant.
Y	Yes : Mandatory i.e. the apparatus shall conform to these tests.
N/T	Not Tested, mandatory but not assessed. (See section 3.4 Test deleted)

The results contained in this section are representative of the operation of the apparatus as originally submitted.

4.1 FCC Part 15 Subpart C : Test Results

Part 15	Test Description	Required	Result
15.207(a)	Conducted Emission Limits	Y	PASS
15.209	Radiated Emission Limits, General Requirements	Y	PASS
15.225	Operation within the band 13.110-14.010 MHz	Y	PASS

Notes: None

Appendix A : Test Results

Clause §15.207(a) Conducted Emissions

Except as shown in paragraphs (b) and (c) of this section, for an intentional radiator that is designed to be connected to the public utility (AC) power line, the radio frequency voltage that is conducted back onto the AC power line on any frequency or frequencies, within the band 150 kHz to 30 MHz, shall not exceed the limits in the following table, as measured using a 50 mH/50 ohms line impedance stabilization network (LISN). Compliance with the provisions of this paragraph shall be based on the measurement of the radio frequency voltage between each power line and ground at the power terminal. The lower limit applies at the boundary between the frequency ranges.

Frequency of emission (MHz)	Conducted limit (dBmV) Quasi-peak	Average
0.15-0.5	66 to 56*	56 to 46*
0.5-5	56	46
5-30	60	50

* Decreases with the logarithm of the frequency.

Test Conditions:

Sample Number:	1	**Temperature:**	23 °C
Date:	Nov. 23 – Dec. 2, 2005	**Humidity:**	36 %
Modification State:	0	**Tester:**	Roman Kuleba
		Laboratory:	Ottawa

Test Results: See Attached Tables and Plots.

Note:

The EUT was tested in two different configurations:

1. In normal operation mode with the integral loop antennas connected to the transmitter, and
2. With the integral loop antennas disconnected from the transmitter and replaced with a 50 Ω load connected to the antenna terminal at the output of the transmitter.

This was done in order to demonstrate that the emissions exceeding the limits at 13.56 MHz that were measured at the AC-lines on the power adaptor originated from the radiated signal picked up by the power adaptor, and not from the emissions conducted from the EUT.

Conducted Emissions, continued

Tested with the integral antenna connected:

Test Date: November 23, 2005

Engineer's Name: Roman Kuleba

Tested as per: Table Top

Mains Input Voltage: 120 VAC | Mains Input Frequency: 60 Hz

Spectrum plots for each frequency band can be found at the back of this section. *All plots were generated with a peak detector and average limits were applied.

Port Investigation Data

Port under test: AC Mains

Results: Refer to plots of this section and tables.

Conductor	Frequency (MHz)	Detector	Emission Level (dBµV)	LISN Loss (dB)	Cable Loss (dB)	Result (dBµV)	Limit (dBµV)	Margin (dB)
Phase	2.8600	Quasi Peak	35.5	0.00	0.14	35.64	56.0	20.4
		Average	30.5	0.00	0.14	30.64	46.0	15.4
	13.5595	Quasi Peak	70.5	0.10	0.40	71.00	60.0	-11.0
		Average	70.0	0.10	0.40	70.50	50.0	-20.5
	14.4200	Quasi Peak	40.6	0.20	0.22	41.02	60.0	19.0
		Average	18.1	0.20	0.22	18.52	50.0	31.5
	16.1400	Quasi Peak	45.3	0.20	0.40	45.90	60.0	14.1
		Average	18.0	0.20	0.40	18.60	50.0	31.4
Neutral	1.5958	Quasi Peak	37.6	0.00	0.01	37.61	56.0	18.4
		Average	34.5	0.00	0.01	34.51	46.0	11.5
	13.6000	Quasi Peak	71.1	0.10	0.40	71.60	60.0	-11.6
		Average	70.6	0.10	0.40	71.10	50.0	-21.1
	14.4500	Quasi Peak	43.3	0.20	0.25	43.75	60.0	16.3
		Average	21.1	0.20	0.25	21.55	50.0	28.5
	16.1100	Quasi Peak	45.1	0.20	0.40	45.70	60.0	14.3
		Average	18.5	0.20	0.40	19.10	50.0	30.9

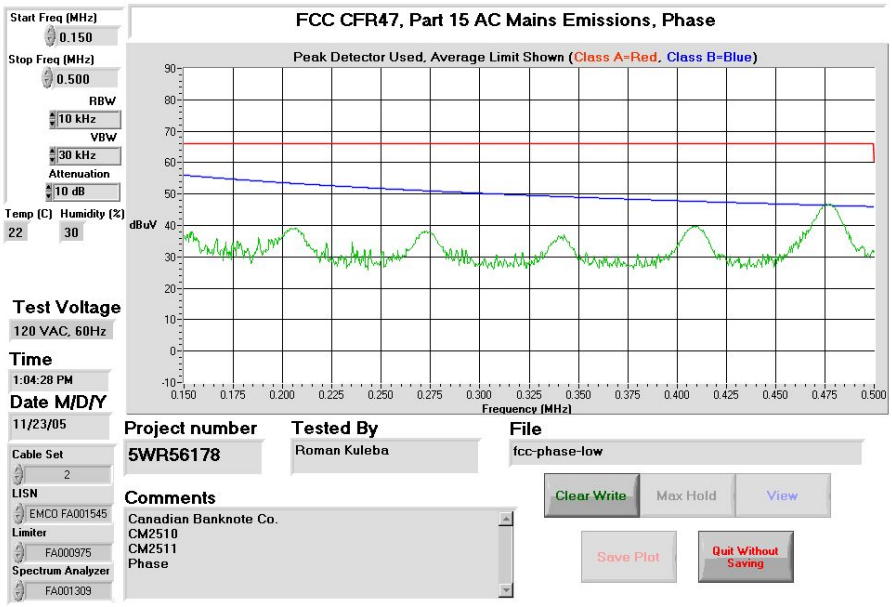
Notes

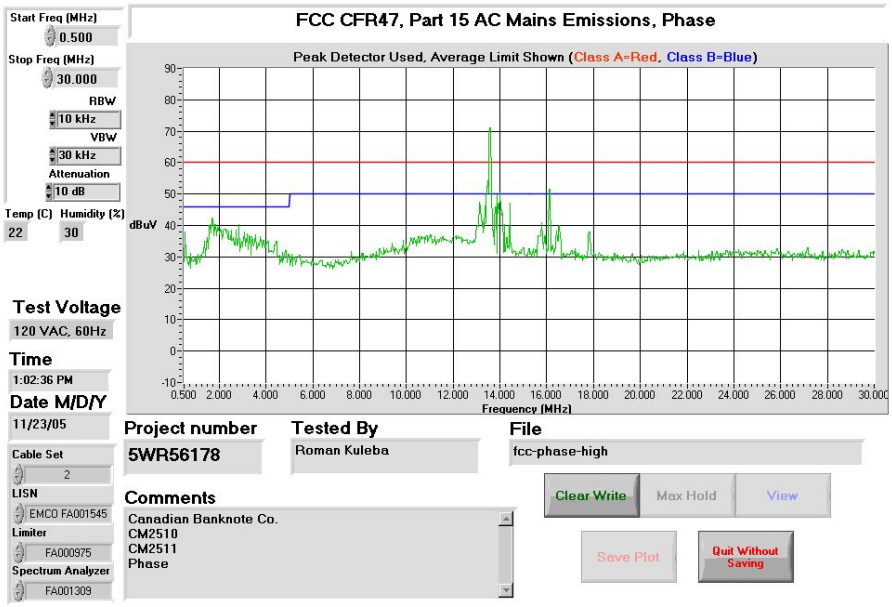
Tested in normal configuration with the integral loop antennas connected to the transmitter.

Conducted Emissions, continued

Tested with the integral antenna connected:

Conducted Disturbance at Mains Plots

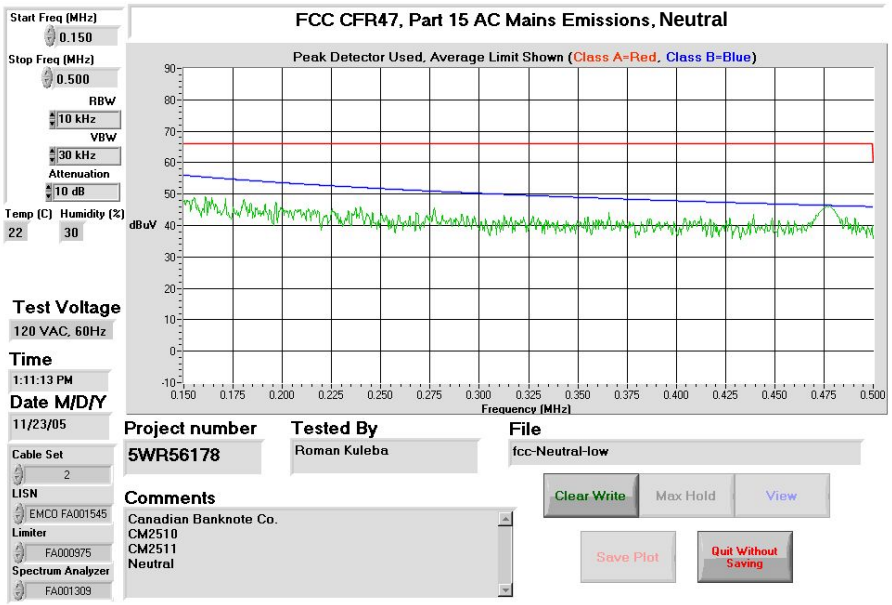


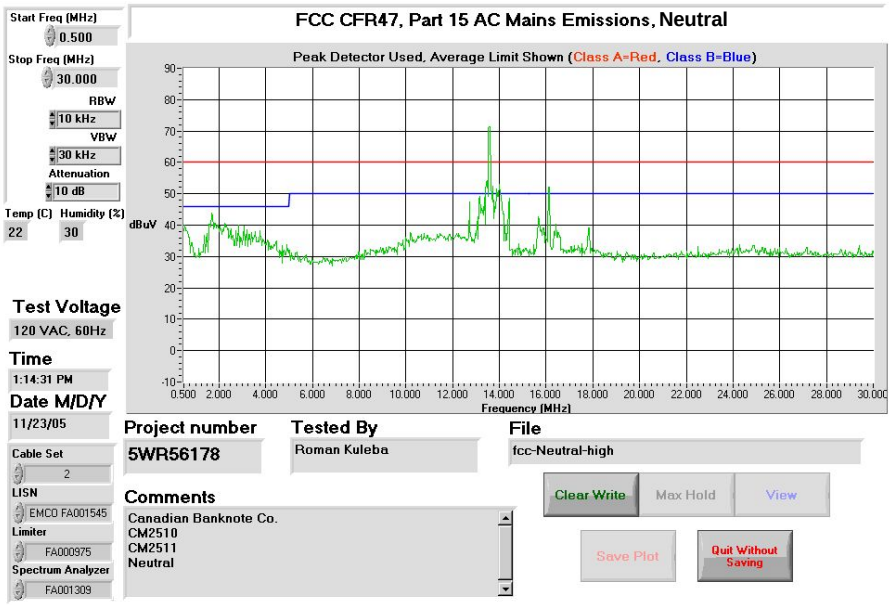


Conducted Emissions, continued

Tested with the integral antenna connected:

Conducted Disturbance at Mains Plots, continued





Conducted Emissions, continued

Tested with 50 Ω dummy load:

Test Date: December 2, 2005

Engineer's Name: Roman Kuleba

Tested as per: Table Top

Mains Input Voltage: 120 VAC | Mains Input Frequency: 60 Hz

Spectrum plots for each frequency band can be found at the back of this section. *All plots were generated with a peak detector and average limits were applied.

Port Investigation Data

Port under test: AC Mains

Results: Refer to plots of this section and tables.

Conductor	Frequency (MHz)	Detector	Emission Level (dBµV)	LISN Loss (dB)	Cable Loss (dB)	Result (dBµV)	Limit (dBµV)	Margin (dB)
Phase	0.4022	Quasi Peak	39.4	0.00	0.20	39.60	57.8	18.2
		Average	28.0	0.00	0.20	28.20	47.8	19.6
	0.4693	Quasi Peak	42.4	0.00	0.20	42.60	56.5	13.9
		Average	35.4	0.00	0.20	35.60	46.5	10.9
	1.6792	Quasi Peak	25.2	0.00	0.00	25.20	56.0	30.8
		Average	19.0	0.00	0.00	19.00	46.0	27.0
Neutral	0.4042	Quasi Peak	38.5	0.00	0.20	38.70	57.8	19.1
		Average	27.0	0.00	0.20	27.20	47.8	20.6
	0.4693	Quasi Peak	43.0	0.00	0.20	43.20	56.5	13.3
		Average	35.7	0.00	0.20	35.90	46.5	10.6
	1.9943	Quasi Peak	35.9	0.00	0.01	35.91	56.0	20.1
		Average	31.7	0.00	0.01	31.71	46.0	14.3

Notes

During the test the integral loop antennas were disconnected and the transmitter output (antenna terminal) was terminated with 50 Ω load.

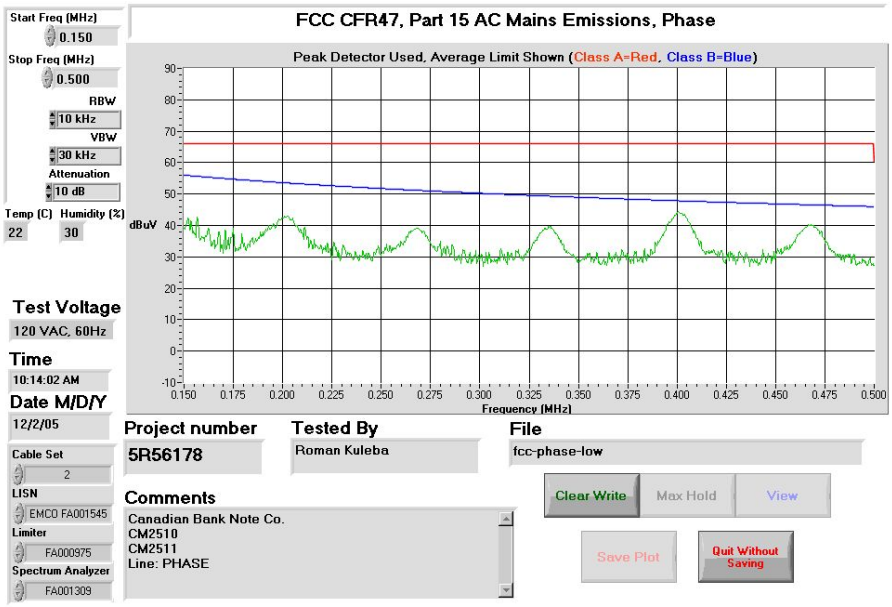
Test Result

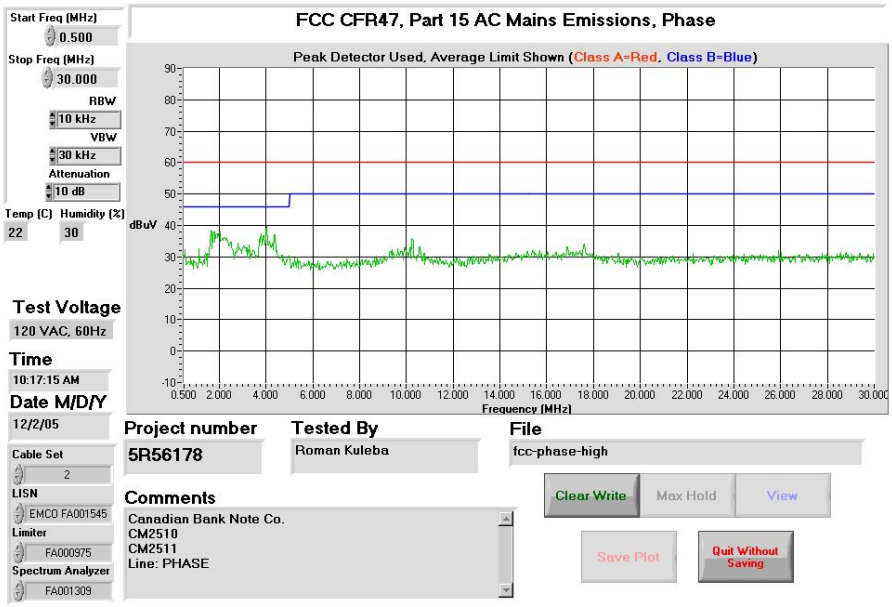
Final Test Result: Pass

Conducted Emissions, continued

Tested with 50 Ω dummy load:

Conducted Disturbance at Mains Plots

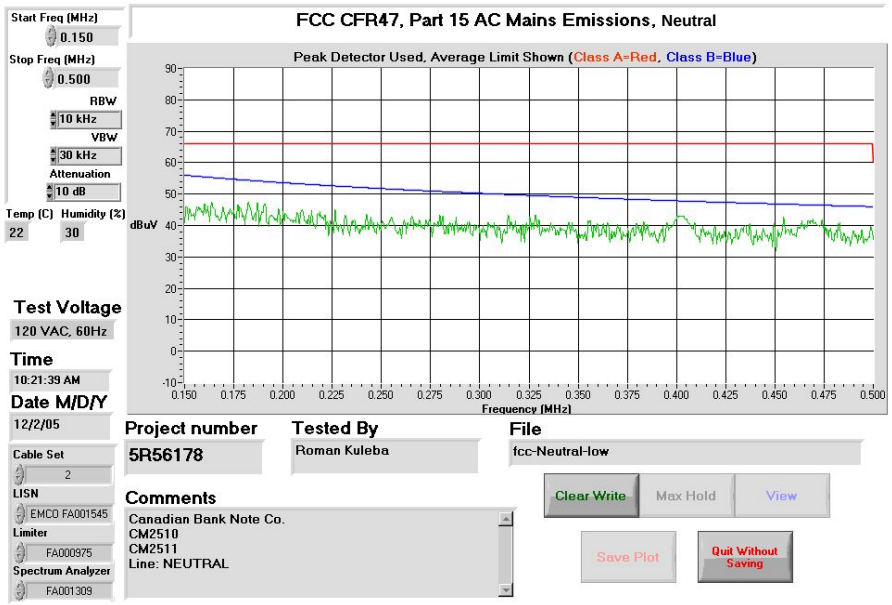


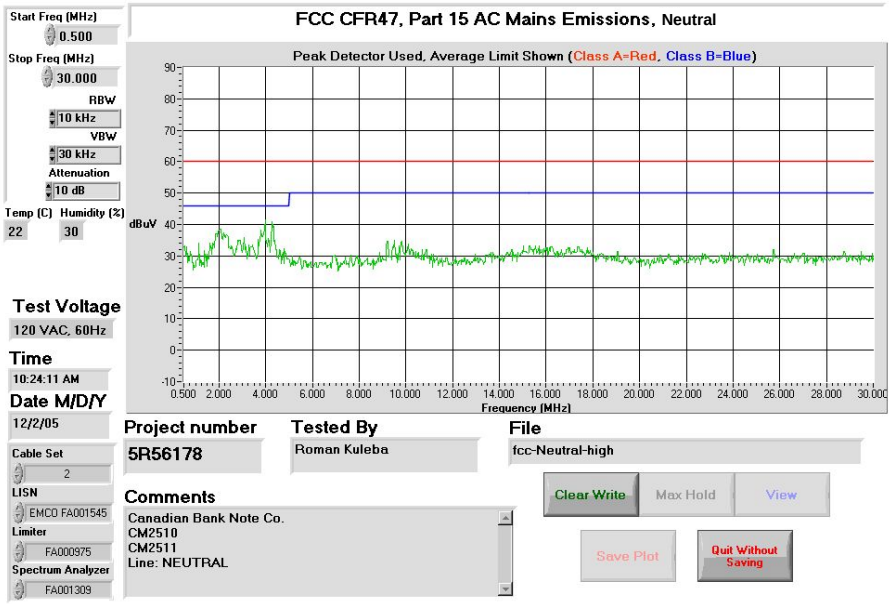


Conducted Emissions, continued

Tested with 50 Ω dummy load:

Conducted Disturbance at Mains Plots, continued





Clause §15.209 Radiated Emission Limits, General Requirements

§15.209(a) Except as provided elsewhere in this subpart, the emissions from an intentional radiator shall not exceed the field strength levels specified in the following table:

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

§15.209(e) The provisions in §15.31, 15.33, and 15.35 for measuring emissions at distances other than the distances specified in the above table, determining the frequency range over which radiated emissions are to be measured, and limiting peak emissions apply to all devices operated under this part.

Test Conditions:

Sample Number:	1	**Temperature:**	23 °C
Date:	December 8, 2005	**Humidity:**	36 %
Modification State:	0	**Tester:**	Roman Kuleba
		Laboratory:	Ottawa

Test Results:

See attached table.

Additional Observations:

The Spectrum was searched from 30 MHz to the 10th harmonic.

The EUT was tested on three orthogonal axes to find the maximum emissions.

Measurement equipment setup was 9 kHz Quasi-peak detector for frequencies below 30 MHz, 120kHz Quasi-peak detector for frequencies between 30 MHz and 1 GHz and 1MHz RBW/VBW Peak detector above 1GHz.

All measurements were performed at 3 meters.

Radiated Emission Limits, General Requirements, continued

Freq. (MHz)	Ant	Pol. V/H	RCVD Signal (dBμV)	Ant. Factor (dB)	Amp. Gain (dB)	Cable Loss (dB)	Field Str. Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)
40.0000	BC2	V	24.5	11.6	N/A	1.3	37.4	40.0	2.6
60.0000	BC2	V	29.8	8.5	N/A	1.4	39.7	40.0	0.3
120.0000	BC2	V	20.0	12.1	N/A	1.8	33.9	43.5	9.6
160.0000	BC2	V	25.0	13.5	N/A	1.9	40.4	43.5	3.1
180.0000	BC2	V	20.0	13.3	N/A	2.1	35.4	43.5	8.1
190.0000	BC2	V	24.1	14.2	N/A	2.0	40.3	43.5	3.2
240.0000	BC2	V	21.0	16.5	N/A	2.3	39.8	46.0	6.2
280.0000	BC2	V	21.5	17.2	N/A	2.4	41.1	46.0	4.9
300.0000	BC2	V	19.2	17.6	N/A	2.6	39.4	46.0	6.6
360.0000	LP1	V	23.7	15.1	N/A	2.8	41.6	46.0	4.4
420.0000	LP1	V	27.0	16.0	N/A	2.9	45.9	46.0	0.1
440.0000	LP1	V	25.3	16.3	N/A	3.1	44.7	46.0	1.3
40.0000	BC2	H	15.2	12.2	N/A	1.3	28.7	40.0	11.3
60.0000	BC2	H	20.2	9.1	N/A	1.4	30.7	40.0	9.3
120.0000	BC2	H	27.1	11.4	N/A	1.8	40.3	43.5	3.2
180.0000	BC2	H	25.3	12.7	N/A	2.1	40.1	43.5	3.4
240.0000	BC2	H	23.0	15.6	N/A	2.3	40.9	46.0	5.1
360.0000	LP1	H	24.2	15.2	N/A	2.8	42.2	46.0	3.8
420.0000	LP1	H	21.0	16.3	N/A	2.9	40.2	46.0	5.8
440.0000	LP1	H	21.0	16.9	N/A	3.1	41.0	46.0	5.0

Note 1: Antenna Legend: BC = Biconical, BL = Bilog, LP = Log-Periodic, Horn = Horn, ED = EMCO Dipole

Clause §15.225 (a)(b)(c)(d) Operation within the band 13.110-14.010 MHz, Field Strength of Emissions

§15.225 Operation within the band 13.110-14.010 MHz, Emission Mask:
(a) The field strength of any emissions within the band 13.553-13.567 MHz shall not exceed 15,848 microvolts/meter at 30 meters.
(b) Within the bands 13.410-13.553 MHz and 13.567-13.710 MHz, the field strength of any emissions shall not exceed 334 microvolts/meter at 30 meters.
(c) Within the bands 13.110-13.410 MHz and 13.710-14.010 MHz the field strength of any emissions shall not exceed 106 microvolts/meter at 30 meters.
(d) The field strength of any emissions appearing outside of the 13.110-14.010 MHz band shall not exceed the general radiated emission limits in §15.209.

§15.31(f) (2) At frequencies below 30 MHz, measurements may be performed at a distance closer than that specified in the regulations; however, an attempt should be made to avoid making measurements in the near field. Pending the development of an appropriate measurement procedure for measurements performed below 30 MHz, when performing measurements at a closer distance than specified, the results shall be extrapolated to the specified distance by either making measurements at a minimum of two distances on at least one radial to determine the proper extrapolation factor or by using the square of an inverse linear distance extrapolation factor (40 dB/decade).

Test Conditions:

Sample Number:	1	**Temperature:**	23 °C
Date:	November 30, 2005	**Humidity:**	36 %
Modification State:	0	**Tester:**	Roman Kuleba
		Laboratory:	Ottawa

Test Results:

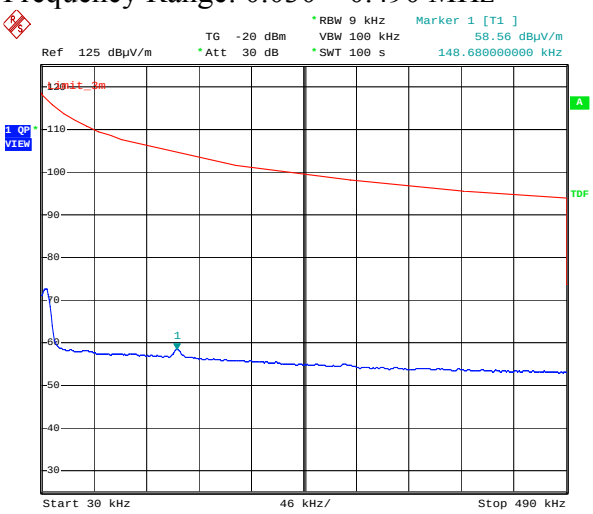
See attached table.

Additional Observations:

The Spectrum was searched from 30 kHz (the lowest frequency generated) to 30 MHz.
The EUT was tested on three orthogonal axes to find the maximum emissions.
Measurement equipment setup was 9 kHz Quasi-peak detector for frequencies below 30 MHz, 120kHz Quasi-peak detector for frequencies between 30 MHz and 1 GHz and 1MHz RBW/VBW Peak detector above 1GHz.
Measurements were performed at 3 meters distance.
The readings were obtained with the testing loop-antenna positioned in three orthogonal axes (x, y and z).
The readings were obtained directly in dBµV/m with transducer factors (antenna factor plus cable loss) pre-programmed in spectrum analyzer.
On frequencies below 30 MHz, limits for near-field measurement on 3m distance were determined from 30m distance limits by using the square of an inverse linear distance extrapolation factor (i.e. 40 dB/decade).

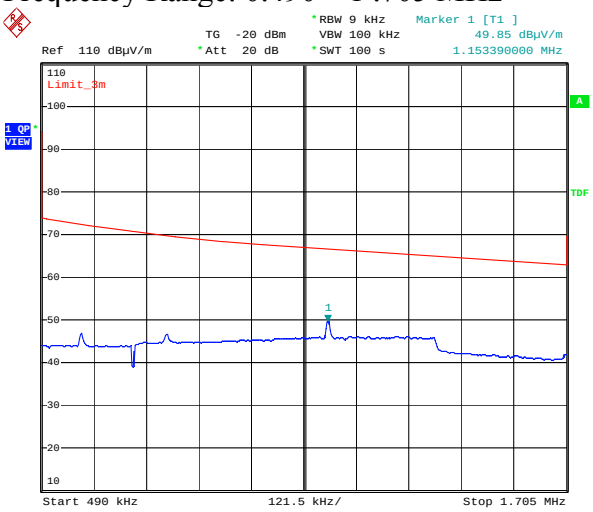
Operation within the band 13.110-14.010 MHz, Field Strength of Emissions, continued

Testing loop-antenna orientation: X-axis
Frequency Range: 0.030 – 0.490 MHz



Date: 30.NOV.2005 02:43:32

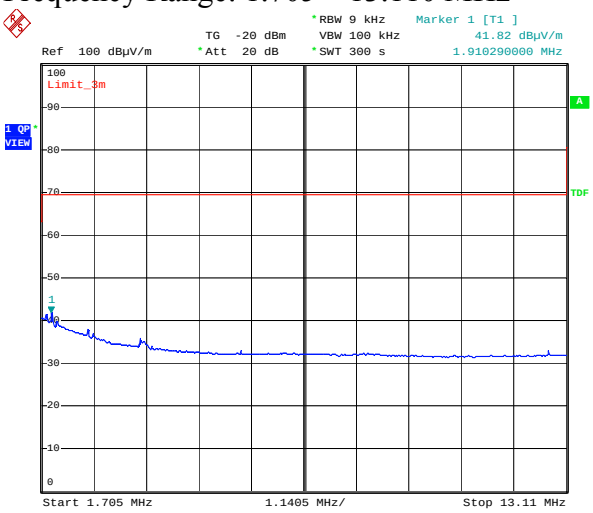
Testing loop-antenna orientation: X-axis
Frequency Range: 0.490 – 1 .705 MHz



Date: 30.NOV.2005 02:21:49

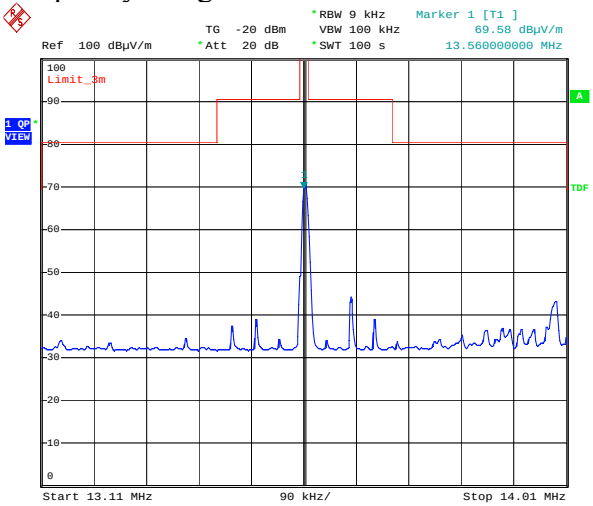
Operation within the band 13.110-14.010 MHz, Field Strength of Emissions, continued

Testing loop-antenna orientation: X-axis
Frequency Range: 1.705 – 13.110 MHz



Date: 30.NOV.2005 01:46:10

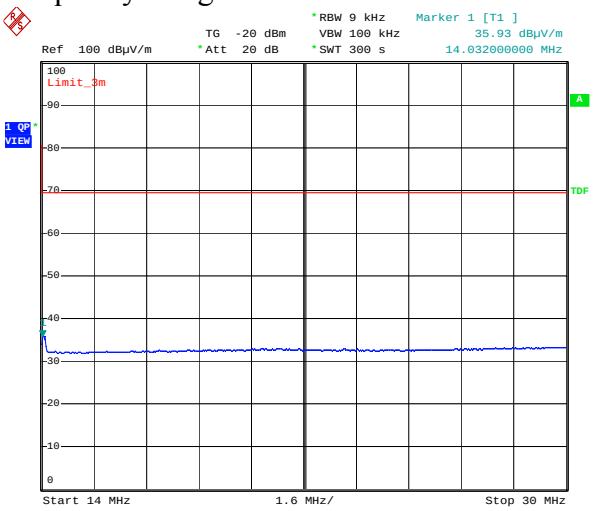
Testing loop-antenna orientation: X-axis
Frequency Range: 13.110 – 14.010 MHz



Date: 30.NOV.2005 00:08:00

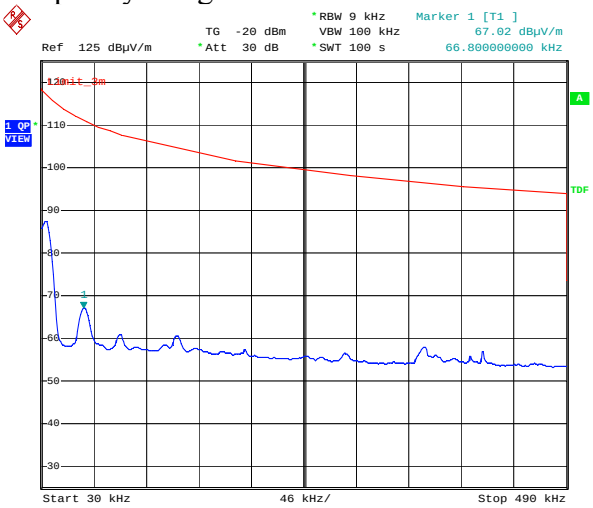
Operation within the band 13.110-14.010 MHz, Field Strength of Emissions, continued

Testing loop-antenna orientation: X-axis
Frequency Range: 14 – 30 MHz



Date: 30.NOV.2005 00:48:46

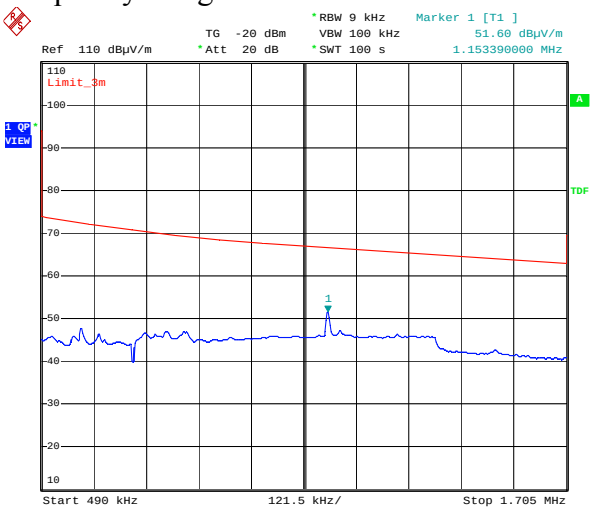
Testing loop-antenna orientation: Y-axis
Frequency Range: 0.030 – 0.490 MHz



Date: 30.NOV.2005 02:40:11

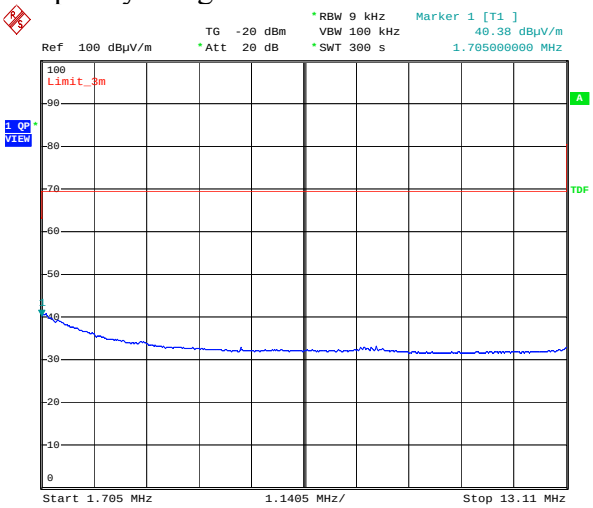
Operation within the band 13.110-14.010 MHz, Field Strength of Emissions, continued

Testing loop-antenna orientation: Y-axis
Frequency Range: 0.490 – 1 .705 MHz



Date: 30.NOV.2005 02:16:43

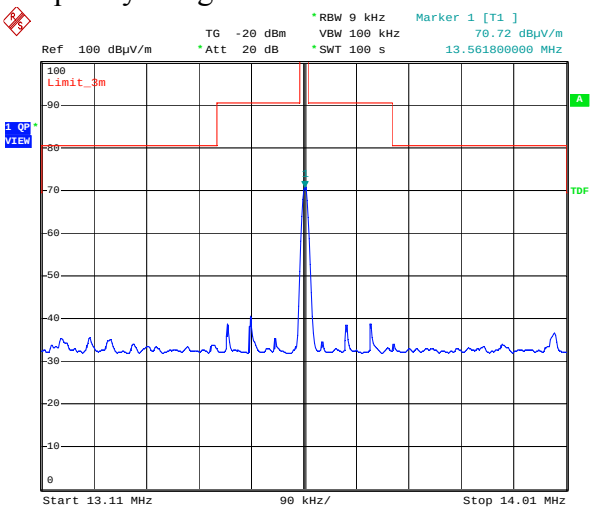
Testing loop-antenna orientation: Y-axis
Frequency Range: 1.705 – 13.110 MHz



Date: 30.NOV.2005 01:35:59

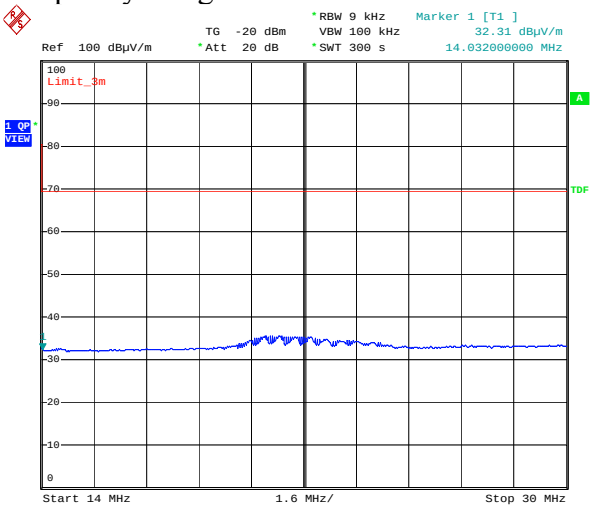
Operation within the band 13.110-14.010 MHz, Field Strength of Emissions, continued

Testing loop-antenna orientation: Y-axis
Frequency Range: 13.110 – 14.010 MHz



Date: 30.NOV.2005 00:33:48

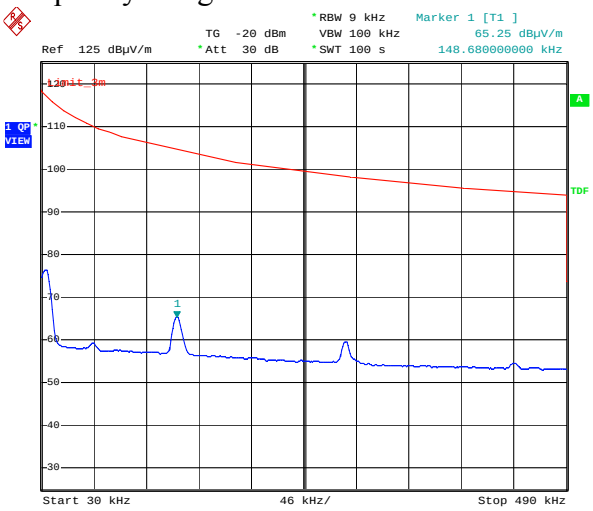
Testing loop-antenna orientation: Y-axis
Frequency Range: 14 – 30 MHz



Date: 30.NOV.2005 00:56:35

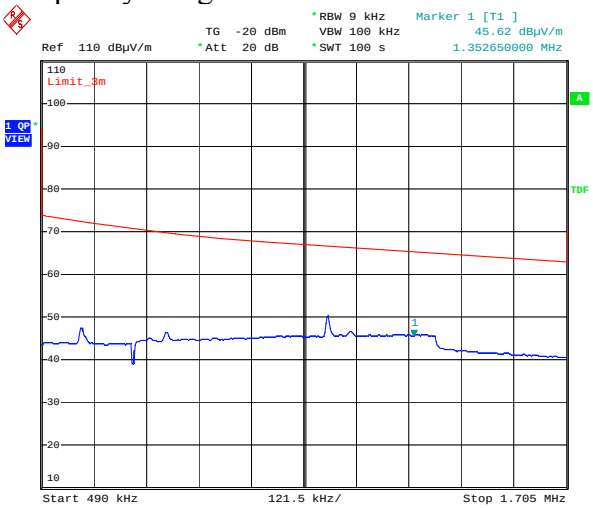
Operation within the band 13.110-14.010 MHz, Field Strength of Emissions, continued

Testing loop-antenna orientation: Z-axis
Frequency Range: 0.030 – 0.490 MHz



Date: 30.NOV.2005 03:07:58

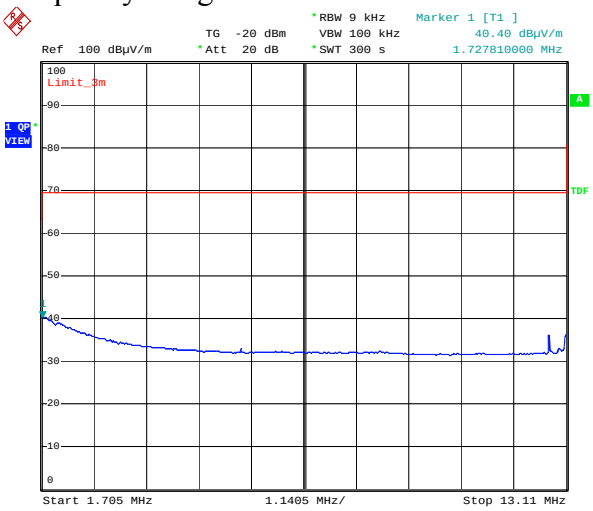
Testing loop-antenna orientation: Z-axis
Frequency Range: 0.490 – 1.705 MHz



Date: 30.NOV.2005 03:14:44

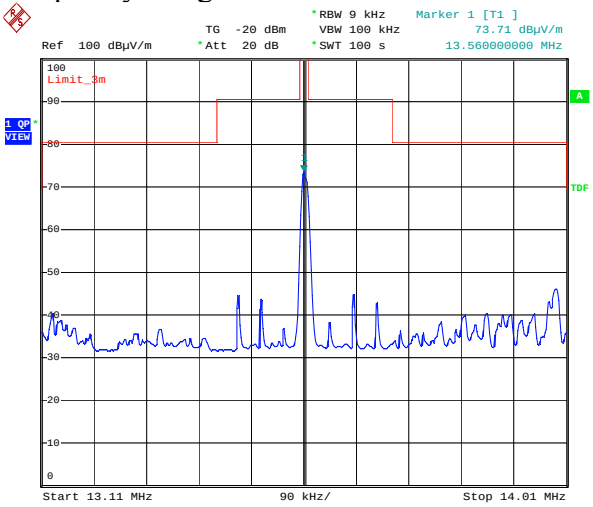
Operation within the band 13.110-14.010 MHz, Field Strength of Emissions, continued

Testing loop-antenna orientation: Z-axis
Frequency Range: 1.705 – 13.110 MHz



Date: 30.NOV.2005 03:28:23

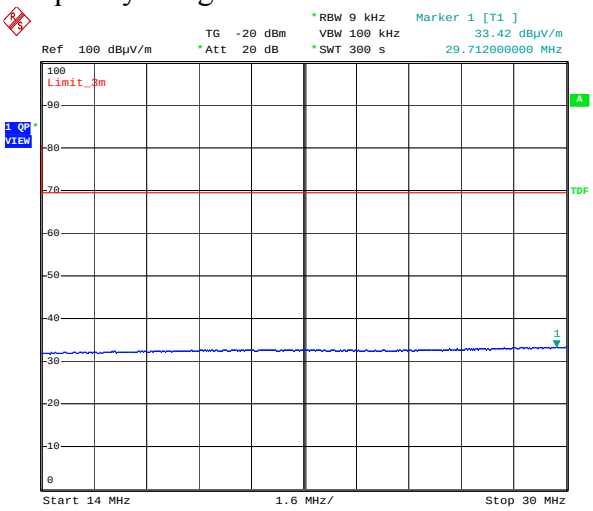
Testing loop-antenna orientation: Z-axis
Frequency Range: 13.110 – 14.010 MHz



Date: 30.NOV.2005 03:36:14

Operation within the band 13.110-14.010 MHz, Field Strength of Emissions, continued

Testing loop-antenna orientation: Z-axis
Frequency Range: 14 – 30 MHz



Date: 30.NOV.2005 03:51:28

Clause §15.225 (e) Operation within the band 13.110-14.010 MHz, Frequency Tolerance

§15.225 Operation within the band 13.110-14.010 MHz, Frequency Tolerance:

(e) The frequency tolerance of the carrier signal shall be maintained within ±0.01% (±100ppm) of the operating frequency over a temperature variation of -20 degrees to +50 degrees C at normal supply voltage, and for a variation in the primary supply voltage from 85% to 115% of the rated supply voltage at a temperature of 20 degrees C. For battery operated equipment, the equipment tests shall be performed using a new battery.

Test Conditions:

Sample Number:	1	**Temperature:**	23 °C
Date:	November 24, 2005	**Humidity:**	36 %
Modification State:	0	**Tester:**	Roman Kuleba
		Laboratory:	Ottawa

Test Results:

See attached tables.

Operation within the band 13.110-14.010 MHz, Frequency Tolerance, continued

Limit: ±0.01% (±100ppm)

Temperature: 20 °C

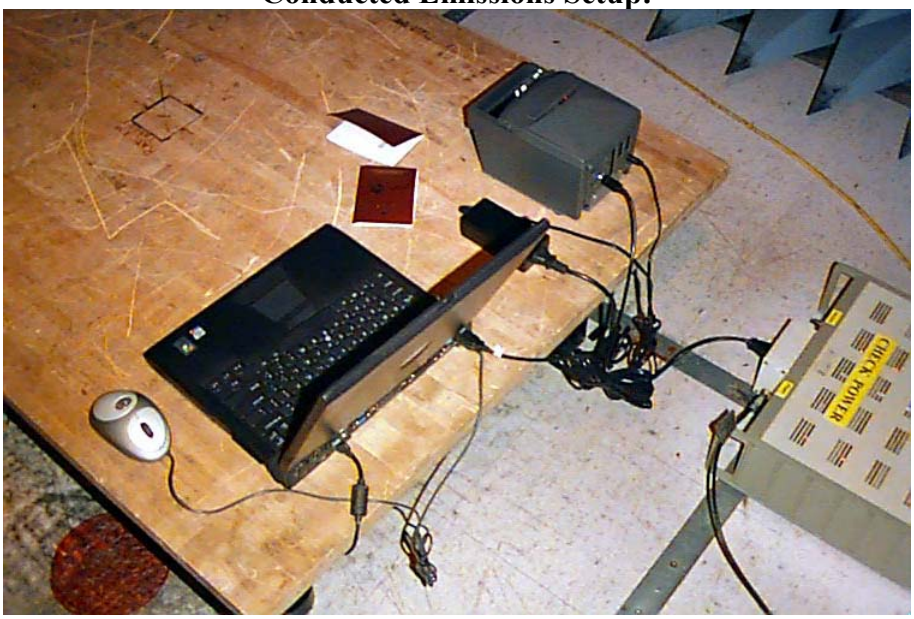
Voltage (VAC)	Voltage/Nom.Voltage (%)	Carrier Frequency (MHz)	Deviation (ppm)
102	85	13.559952	0.073747
120	**100**	**13.559951**	**0.000000**
138	115	13.559952	0.073747

Mains Voltage: 120 VAC

Temperature (°C)	Carrier Frequency (MHz)	Deviation (ppm)
-30	13.560024	5.383500
-20	13.560032	5.973473
-10	13.560032	5.973473
0	13.560020	5.088514
10	13.559988	2.728623
20	**13.559951**	**0.000000**
30	13.559932	-1.401185
40	13.559924	-1.991158
50	13.559920	-2.286144

Appendix B : Setup Photographs

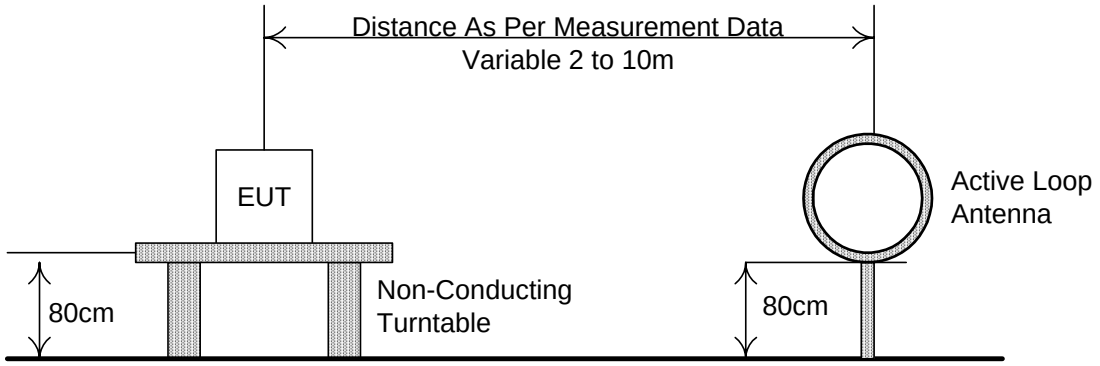
Conducted Emissions Setup:



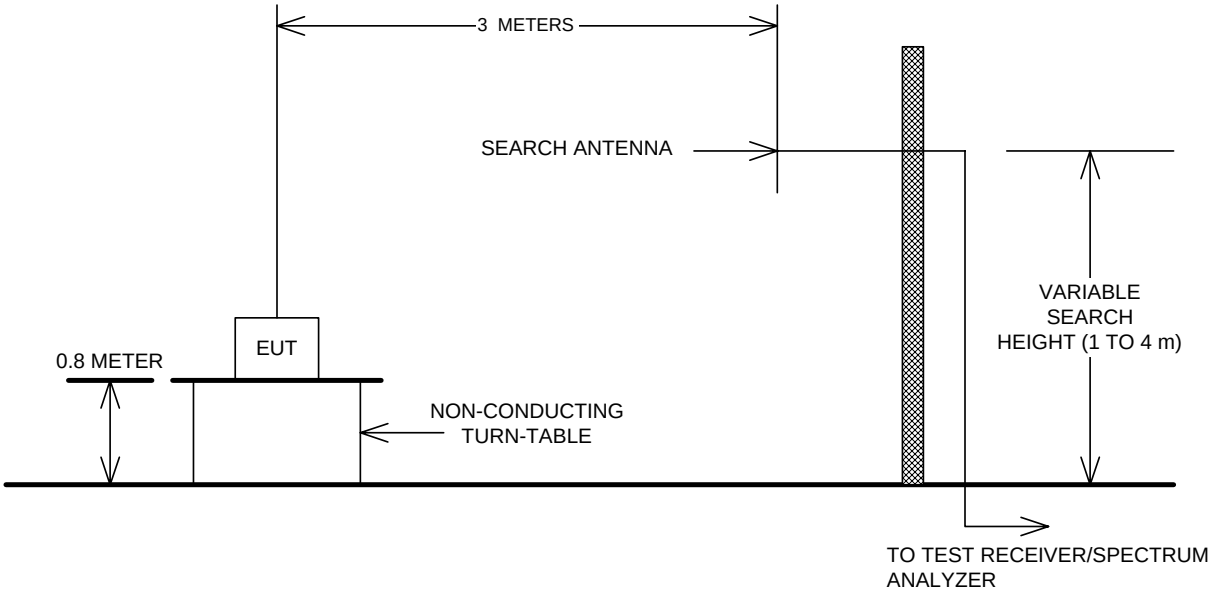
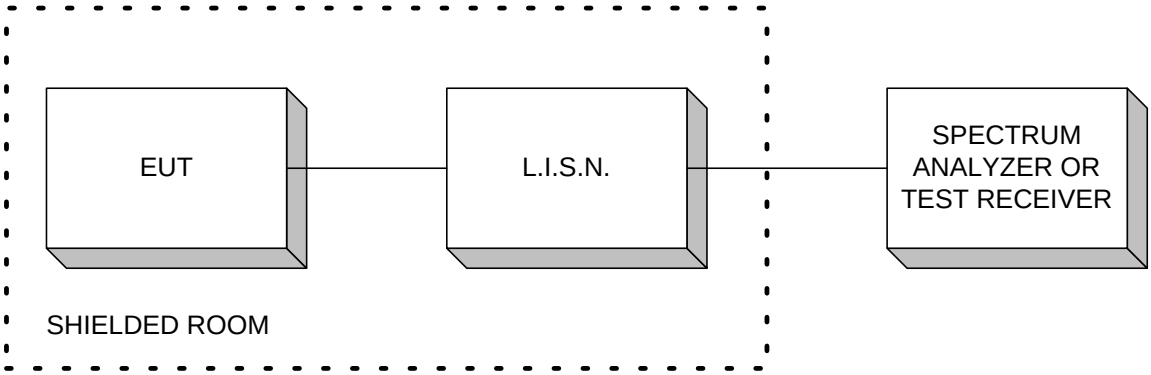
Radiated Emissions Setup:

Appendix C : Block Diagram of Test Setups

Test Site For Radiated Emissions Below 30MHz



Test Site For Radiated Emissions Above 30MHz



Test Setup for Conducted Emissions