TUV Rheinland
of North America

Emissions
Test Report

EUT Name: TranspondIT Electric Centron (240V)

EUT Model: MS8EM915CV1

FCC Title 47, Part 15, Subpart C and RSS-210 Section 5

Prepared for:

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Report/Issue Date: 20 October 2004
Report Number: 30461431.001

Statement of Compliance

Manufacturer:	Advanced Technology / Ramar Ltd. P. O Box 110127 Research Triangle Park 27709 919-991-9924
Requester / Applicant:	Scott Seehoffer
Name of Equipment:	TranspondIT Electric Centron (240V) Model No. MS8EM915CV1
Type of Equipment:	RF Transmitter
Class of Equipment:	Class B
Application of Regulations:	FCC Title 47, Part 15, Subpart C and RSS-210 Section 5
Test Dates:	13 August 2004

Guidance Documents:

Emissions: FCC 47 CFR Part 15, RSS-210 Section 5

Test Methods:

Emissions: FCC 47 Part 15, ANSI C63.4:1992

The electromagnetic compatibility test and documented data described in this report has been performed and recorded by TUV Rheinland of North America, in accordance with the standards and procedures listed herein. As the responsible authorized agent of the EMC laboratory, I hereby declare that a sample of one, of the equipment described above, has been shown to be compliant with the EMC requirements of the stated regulations and standards based on these results. If any special accessories and/or modifications were required for compliance, they are listed in the Executive Summary of this report.

This report must not be used to claim product endorsement by NVLAP or any agency of the U.S. Government. This report contains data that are not covered by NVLAP accreditation. This report shall not be reproduced except in full, without the written authorization of the laboratory.

NVLAP Signatory

20 October 2004
Date

Table of Contents

1 Executive Summary

1.1 Scope

This report is intended to document the status of conformance with the requirements of the FCC Title 47, Part 15, Subpart C and RSS-210 Section 5 based on the results of testing performed on *13 August* 2004 on the *TranspondIT Electric Centron (240V)* Model No. *MS8EM915CV1* manufactured by Advanced Technology / Ramar Ltd.. This report only applies to the specific samples tested under the stated test conditions. It is the responsibility of the manufacturer to assure that additional production units of this model are manufactured with identical or EMI equivalent electrical and mechanical components. This report is further intended to document changes and modifications to the EUT throughout its life cycle. All documentation will be included as a supplement.

1.2 Purpose

Testing was performed to evaluate the EMC performance of the EUT in accordance with the applicable requirements, procedures, and criteria defined in the application of regulations and application of standards listed in this report.

1.3 Summary of Test Results

Table 1 - Summary of Test Results

Emission	Test Method(s)	Test Parameters	Result
Radiated Emissions	47 CFR 15.209 and 15.249, ANSI C63.4:1992	9 KHz to 1000 MHz, Class B	compliant
Conducted Emissions	47 CFR 15, ANSI C63.4:1992	150 kHz to 30 MHz, Class B	compliant
Variation of Fundamental Power with Voltage Variation	47 CFR 15.31e, ANSI C63.4:1992	Input Voltage varied between 85% to 115% of nominal input voltage	compliant

1.4 Special Accessories

No special accessories were necessary in order to achieve compliance.

1.5 Equipment Modifications

No modifications were found to be necessary in order to achieve compliance.

2 Laboratory Information

2.1 Accreditations & Endorsements

2.1.1 US Federal Communications Commission

TUV Rheinland of North America at the 762 Park Ave. Youngsville, N.C 27596 address is accredited by the commission for performing testing services for the general public on a fee basis. This laboratory test facilities have been fully described in reports submitted to and accepted by the FCC (Registration No 90552 and 100881). The laboratory scope of accreditation includes: Title 47 CFR Part 15, 18, and 90. The accreditation is updated every 3 years.

2.1.2 NIST / NVLAP

TUV Rheinland of North America is accredited by the National Voluntary Laboratory Accreditation Program, which is administered under the auspices of the National Institute of Standards and Technology. The laboratory has been assessed and accredited in accordance with ISO Guide 17025:1999 and ISO 9002 (Lab code 200094-0). The scope of laboratory accreditation includes emission and immunity testing. The accreditation is updated annually.

2.1.3 Japan - VCCI

The Voluntary Control Council for Interference by Information Technology Equipment (VCCI) is a group that consists of Information Technology Equipment (ITE) manufacturers and EMC test laboratories. The purpose of the Council is to take voluntary control measures against electromagnetic interference from Information Technology Equipment, and thereby contribute to the development of a socially beneficial and responsible state of affairs in the realm of Information Technology Equipment in Japan. TUV Rheinland of North America at the 762 Park Ave. Youngsville, N.C 27596 address has been assessed and approved in accordance with the Regulations for Voluntary Control Measures. (Registration No. R-1174, R-1679, C-1790 and C-1791).

2.1.4 Acceptance By Mutual Recognition Arrangement

The United States has an established agreement with specific countries under the Asia Pacific Laboratory Accreditation Corporation (APLAC) Mutual Recognition Arrangement. Under this agreement, all TUV Rheinland of North America at the 762 Park Ave. Youngsville, N.C 27596 address test results and test reports within the scope of the laboratory NIST / NVLAP accreditation will be accepted by each member country.

2.2 Test Facilities

All of the test facilities are located at 762 Park Ave., Youngsville, North Carolina 27596, USA.

2.2.1 Emission Test Facility

The Open Area Test Site and AC Line Conducted measurement facility used to collect the radiated and conducted data has been constructed in accordance with ANSI C63.7:1992. The site has been measured in accordance with and verified to comply with the theoretical normalized site attenuation requirements of ANSI C63.4:1992, at a test distance of 3 and 10 meters. This site has been described in reports dated May 12, 1997, submitted to the FCC, and accepted by letter dated June 25, 1997 (31040/SIT 1300F2). The site is listed with the FCC and accredited by NVLAP (code 200094-0). The 5m semi-anechoic chamber used to collect the radiated data has been verified to comply with the theoretical normalized site attenuation requirements of ANSI C63.4:1992, at a test distance of 3 meters. A report detailing this site can be obtained from TUV Rheinland of North America.

2.2.2 Immunity Test Facility

ESD, EFT, Surge, PQF: These tests are performed in an environmentally controlled room with a 3.7m x 3.7m x 3.175mm thick aluminum floor connected to PE ground. For ESD testing, tabletop equipment is placed on an insulated mat with a surface resistivity of 10^9 Ohms/square on a 1.6m x 0.8m x 0.8m high non-conductive table with a 3.175mm aluminum top (Horizontal Coupling Plane). The HCP is connected to the main ground plane via a low impedance ground strap through two 470 kΩ resistors. The Vertical Coupling Plane consists of an aluminum plate 50cm x 50cm x 3.175mm thick. The VCP is connected to the main ground plane via a low impedance ground strap through two 470 kΩ resistors. For each of the other tests, the HCP is removed.

RF Field Immunity testing is performed in a 7.3m x 3.7m x 3.2m anechoic chamber.

RF Conducted and Magnetic Field Immunity testing is performed on a 4.9m x 3.7m x 3.175mm thick aluminum ground plane which is connected to one end of the anechoic chamber.

All test areas allow a minimum distance of 1 meter from the EUT to walls or conducting objects.

2.3 Measurement Uncertainty

Two types of measurement uncertainty are expressed in this report, per *ISO Guide To The Expression Of Uncertainty In Measurement*, 1st addition, 1995.

The Combined Standard Uncertainty is the standard uncertainty of the result of a measurement when that result is obtained from the values of a number of other quantities, equal to the positive square root of a sum of terms, the terms being the variances or co-variances of these other quantities weighted according to how the measurement result varies with changes in these quantities. The term standard uncertainty is the result of a measurement expressed as a standard deviation.

The Expanded Uncertainty defines an interval about the result of a measurement that may be expected to encompass a large fraction of the distribution of values that could reasonably be attributed to the measurand. The fraction may be viewed as the coverage probability or level of confidence of the interval.

The test system for conducted emissions is defined as the LISN, spectrum analyzer, coaxial cables, and pads. The test system for radiated emissions is defined as the antenna, spectrum analyzer, pre-amplifier, coaxial cables, and pads. The conducted test system has a combined standard uncertainty of ± 1.2 dB. The radiated test system has a combined standard uncertainty of ± 1.6 dB. The expanded uncertainty at a level of 95% confidence is obtained by multiplying the combined standard uncertainty by a coverage factor of 2. Compliance criteria are not based on measurement uncertainty.

2.4 Calibration Traceability

All measurement instrumentation is traceable to the National Institute of Standards and Technology (NIST). Measurement method complies with ANSI/NCSL Z540-1-1994 and ISO Guide 17025:1999.

3 Product Information

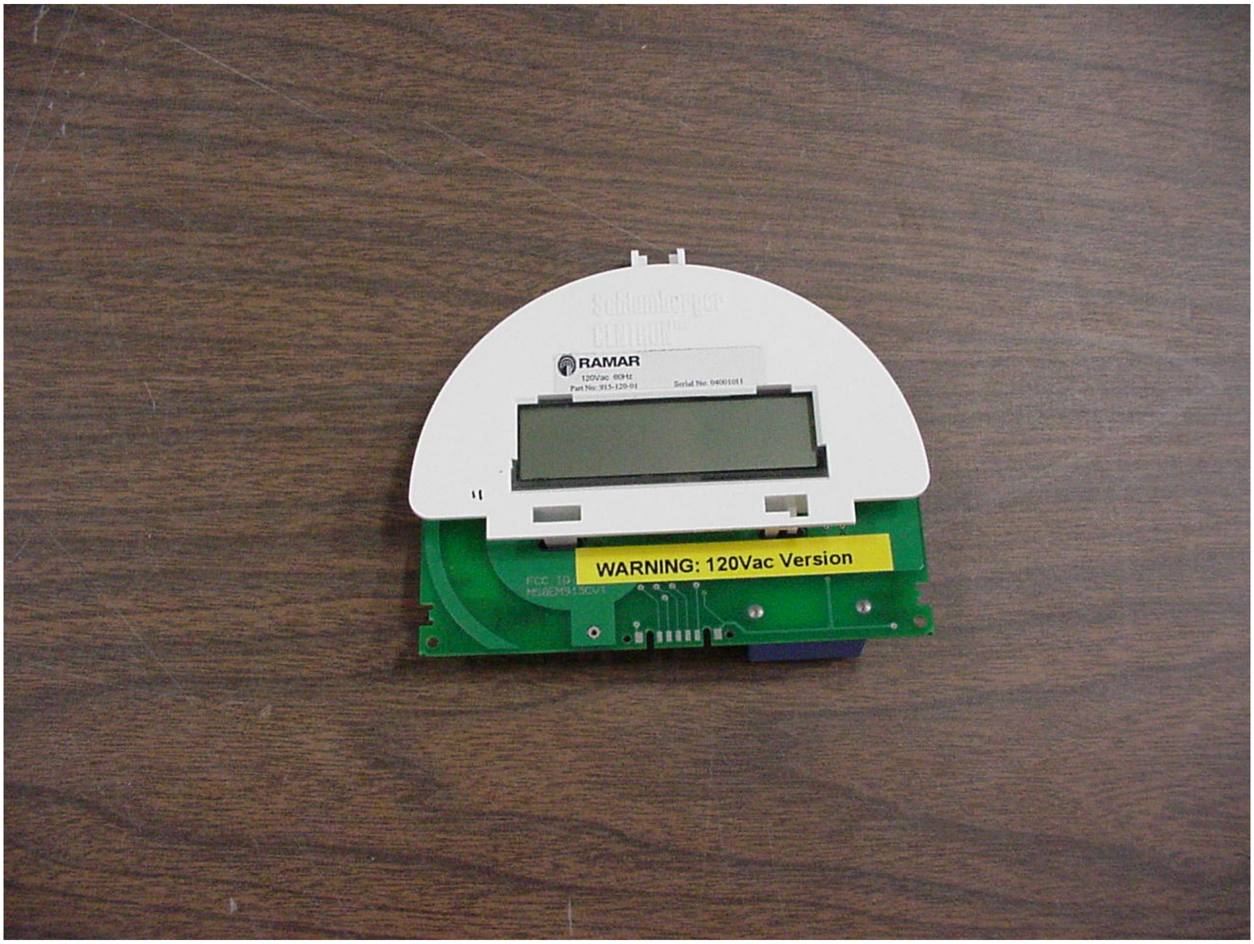


Figure 1 – Photo of EUT

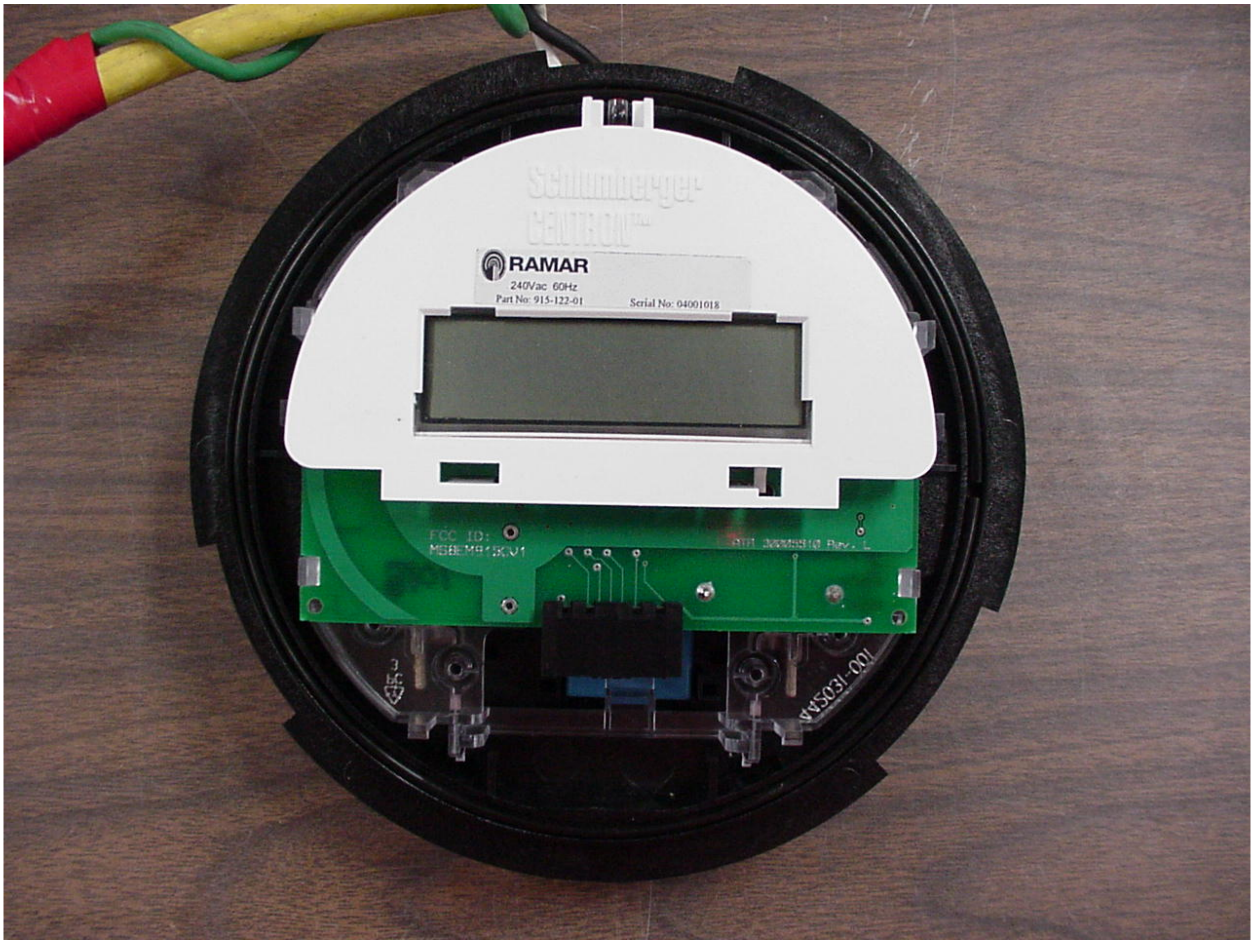


Figure 2 – Photo of EUT Installed in Meter

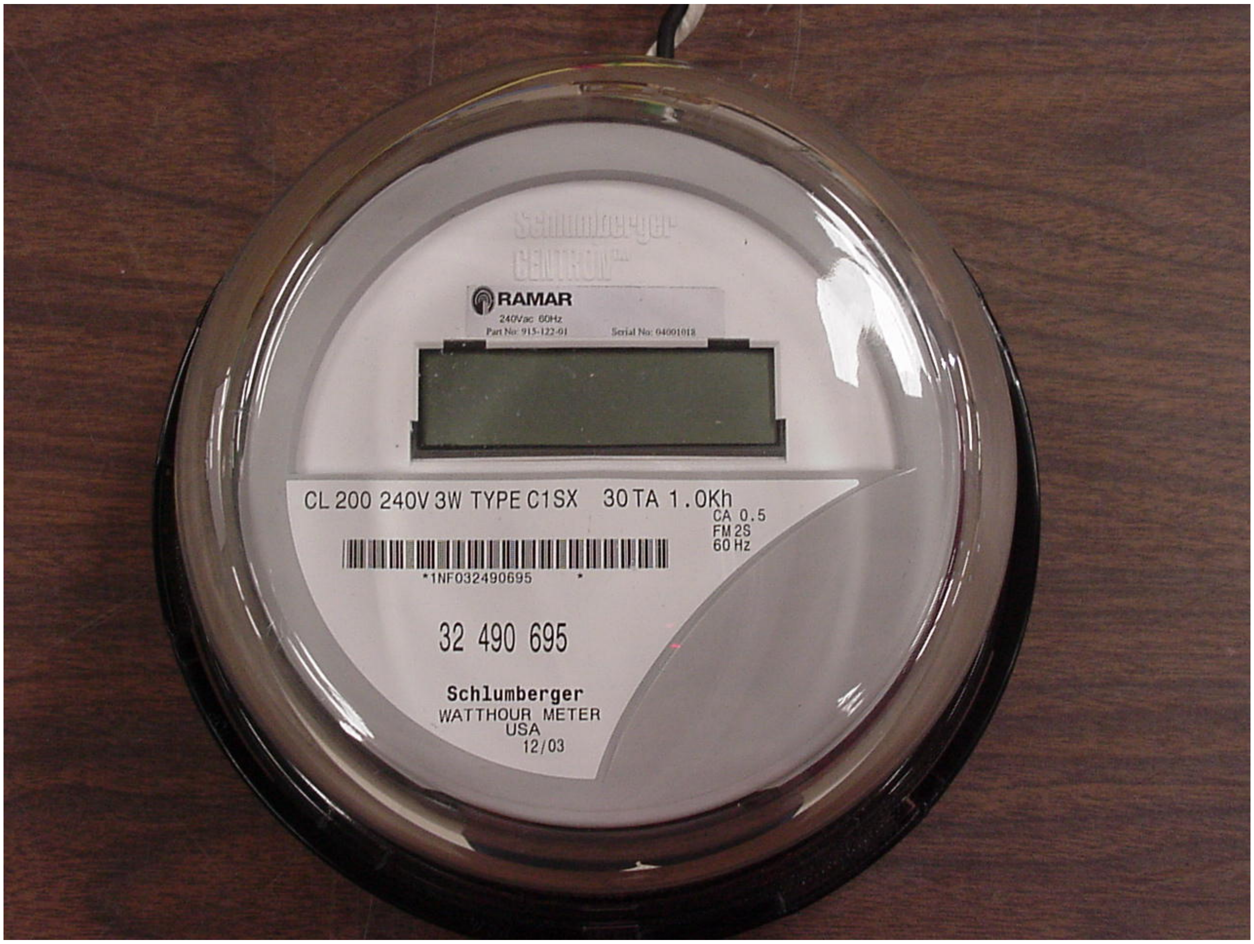


Figure 3 – Photo of EUT Installed in Meter

3.1 Product Description

The information for all equipment used in the tested system, including: descriptions of cables, clock and microprocessor frequencies, EMI critical components, and accessory equipment has been supplied by the manufacturer and is listed in the EMC Test Plan found in Section 6.

3.2 Equipment Configuration

A description and justification of the equipment configuration is given in the EMC Test Plan. The EUT was tested as described in the EMC Test Plan and was configured and operated in a manner consistent with its intended use. The EUT was connected to rated power and allowed to warm up to normal operating conditions. The placement of the EUT system components was guided by the test standard and selected to represent typical installation conditions.

In the case of an EUT that can operate in more than one configuration, preliminary testing was performed to determine the configuration that produced maximum radiation.

The final configuration was selected to produce worse case radiation and place the EUT in the most susceptible state. There were no deviations from the description of the Equipment Configuration given in the EMC Test Plan.

3.3 Operation Mode

A description and justification of the operation mode is given in the EMC Test Plan.

In the case of an EUT that can operate in more than one state, preliminary testing was performed to determine the operating mode that produced maximum radiation.

The final operating mode was selected to produce worse case radiation and place the EUT in the most susceptible state. There were no deviations from the description of the Operation Mode given in the EMC Test Plan.

4 Emissions

4.1 Radiated Emissions

Testing was performed in accordance with 47 CFR 15.209 and 15.249, ANSI C63.4:1992. These test methods are listed under the laboratory's NVLAP Scope of Accreditation. This test measures the levels emanating from the EUT, thus evaluating the potential for the EUT to cause radio frequency interference to other electronic devices.

4.1.1 Test Methodology

4.1.1.1 Preliminary Test

A test program that controls instrumentation and data logging was used to automate the preliminary RF emission test procedure. The frequency range of interest was divided into sub-ranges to yield a frequency resolution of approximately 300 kHz and provide a reading at each frequency for no more than 12° of turntable rotation. For each frequency sub-range the turntable was rotated 360° while peak emission data was recorded and plotted over the frequency range of interest in horizontal and vertical antenna polarization's.

Preliminary emission profile testing was performed inside the anechoic chamber. The EUT was placed on a 1.0m x 1.5m non-conductive table 80cm above the floor. The EUT was positioned as shown in the setup photographs. The receiving antenna was placed at a distance of 3m at a fixed height of 1m. Measurement equipment was located outside of the chamber. A video camera was placed inside the chamber to view the EUT.

4.1.1.2 Final Test

For each frequency measured, the peak emission was maximized by manipulating the receiving antenna from 1 to 4 meters above the ground plane and placing it at the position that produced the maximum signal strength reading. The turntable was then rotated through 360° while observing the peak signal and placing the EUT at the position that produced maximum radiation. The six highest emissions relative to the limit were measured unless such emissions were more than 20 dB below the limit. If less than six emissions are within 20 dB of the limit, than the noise level of the receiver is measured at frequencies where emissions are expected. Multiples of all oscillator and microprocessor frequencies were also checked.

Final testing was performed on an NSA compliant test site. The EUT was placed on a 1.0m x 1.5m non-conductive table 80cm above the ground plane. The placement of EUT and cables were the same as for preliminary testing and is shown in the setup photographs.

4.1.1.3 Deviations

There were no deviations from this test methodology.

4.1.2 Test Results

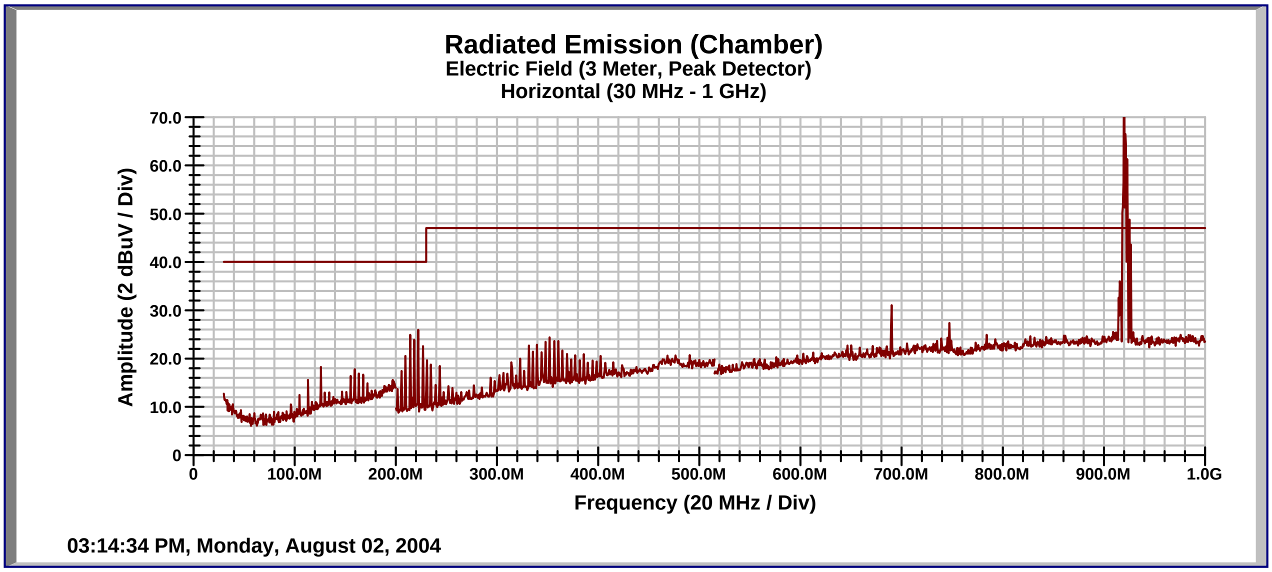
Section 4.1.2.1 lists the final measurement data under the worst case operating modes, configurations, and/or cable positions. It also reflects the results including any modifications and/or special accessories listed in Sections 1.4 and 1.5.

As originally tested, the EUT was found to be compliant to the requirements of the test standard(s).

4.1.2.1 Final Data

The data recorded in this section contains the final results under the worst-case conditions and with any modifications or special accessories implemented as the manufacturer intends.

SOP 1 Radiated Emissions		Tracking # 30461431.001 Page 1 of 7	
EUT Name	TranspondIT Electric Centron (240V)	**Date**	2 August 2004
EUT Model	MS8EM915CV1	**Temp / Hum in**	75 Deg. F / 50% RH
EUT Serial	None	**Temp / Hum out**	N/A
Standard	FCC 47 CFR Part 15, RSS-210 Section 5	**Line AC / Freq.**	240 VAC / 60 Hz
		RBW / VBW	120 KHz / 300 KHz
Dist/Ant Used	3M / 3110B, SAS-516	**Performed by**	Eugene Moses
Configuration	04001018 Transmitter. All measurements made with Quasi-peak detector.		



Emission Freq (MHz)	ANT Polar (H/V)	ANT Pos (m)	Table Pos (deg)	FIM Value (dBuV)	Amp Gain (dB)	Cable Loss (dB)	ANT Factor (dB/m)	E-Field Value (dBuV/m)	Spec Limit (dBuV/m)	Spec Margin (dB)
Measurements made with sas-516 log periodic, RBW=120 KHz, VBW 300 KHz. 3m from eut.										
919.80	H	2.26	3 q-p	64.14	0.00	2.47	23.40	90.01	94.00	-3.99
Dipole EMCO 3121C-DB4										
919.90	H	1	11 q-p	59.88	0.00	2.47	29.18	91.53	94.00	-2.47
Measurements made with sas-516 log periodic.										
222.30	H	1.44	268	14.47	0.00	1.17	11.50	27.14	40.00	-12.86
Measurements made with unit on side. Using dipole										
919.90	H	1	198	50.88	0.00	2.47	29.18	82.53	94.00	-11.47
Measurements made with unit on back. With dipole										
919.90	H	1	178q-p	59.21	0.00	2.47	29.18	90.86	94.00	-3.14

Spec Margin = E-Field Value - Limit, E-Field Value = FIM Value - Amp Gain + Cable Loss + ANT Factor ± Uncertainty

Combined Standard Uncertainty $u_c(y) = \pm 1.6$dB Expanded Uncertainty $U = ku_c(y)$ $k = 2$ for 95% confidence

SOP 1 Radiated Emissions

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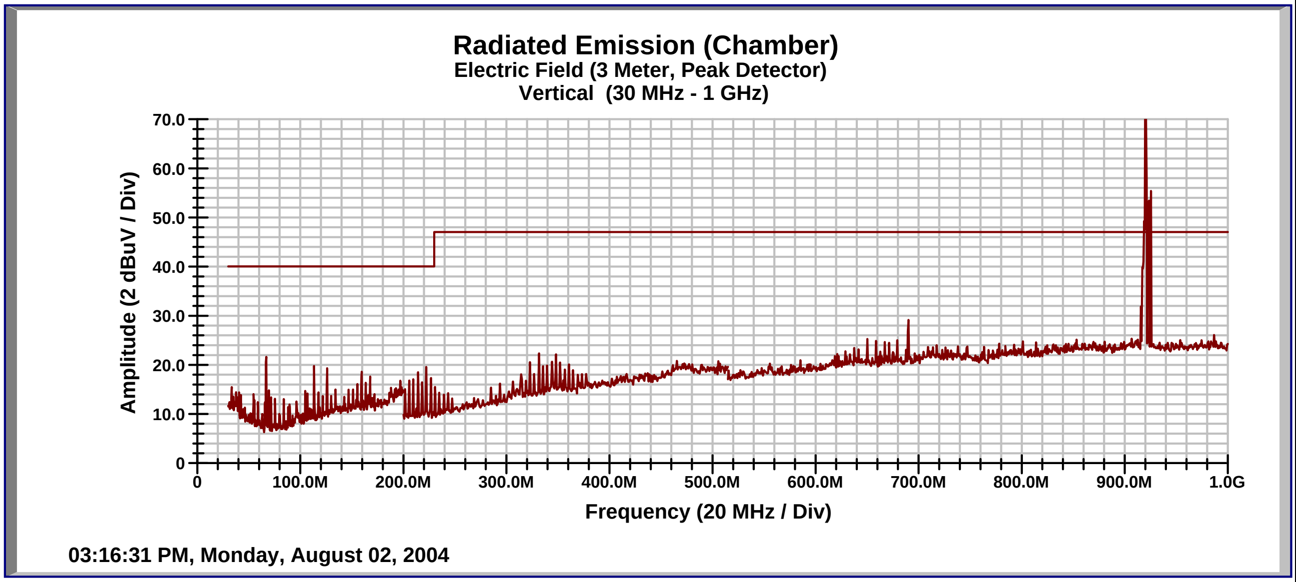
EUT Name	TranspondIT Electric Centron (240V)	**Date**	2 August 2004
EUT Model	MS8EM915CV1	**Temp / Hum in**	75 Deg. F / 50% RH
EUT Serial	None	**Temp / Hum out**	N/A
Standard	FCC 47 CFR Part 15, RSS-210 Section 5	**Line AC / Freq.**	240 VAC / 60 Hz
		RBW / VBW	120 KHz / 300 KHz
Dist/Ant Used	3M / 3110B, SAS-516	**Performed by**	Eugene Moses
Configuration	04001018 Transmitter. All measurements made with Quasi-peak detector.		



Emission Freq (MHz)	ANT Polar (H/V)	ANT Pos (m)	Table Pos (deg)	FIM Value (dBuV)	Amp Gain (dB)	Cable Loss (dB)	ANT Factor (dB/m)	E-Field Value (dBuV/m)	Spec Limit (dBuV/m)	Spec Margin (dB)
Measurements made with sas-516 log periodic, RBW=120 KHz, VBW 300 KHz. 3m from eut.										
919.90	V	1.1	133	61.48	0.00	2.47	21.90	85.85	94.00	-8.15
Dipole EMCO 3123C-DB4										
919.90	V	2.38 q-p	58	52.90	0.00	2.47	29.18	84.55	94.00	-9.45
Measurements made with sas-516 log periodic.										
67.11	V	1	0	1.76	0.00	0.62	8.60	10.98	40.00	-29.02
Measurements made with unit on side. With dipole										
919.90	V	1.14	18	61.43	0.00	2.47	29.18	93.08	94.00	-0.92
Measurements made with unit on back. With dipole.										
919.90	V	1q-p	49.76	49.76	0.00	2.47	29.18	81.41	94.00	-12.59
Spec Margin = E-Field Value - Limit, E-Field Value = FIM Value - Amp Gain + Cable Loss + ANT Factor ± Uncertainty										
Combined Standard Uncertainty $u_c(y)$ = ± 1.6dB Expanded Uncertainty $U = ku_c(y)$ k = 2 for 95% confidence										

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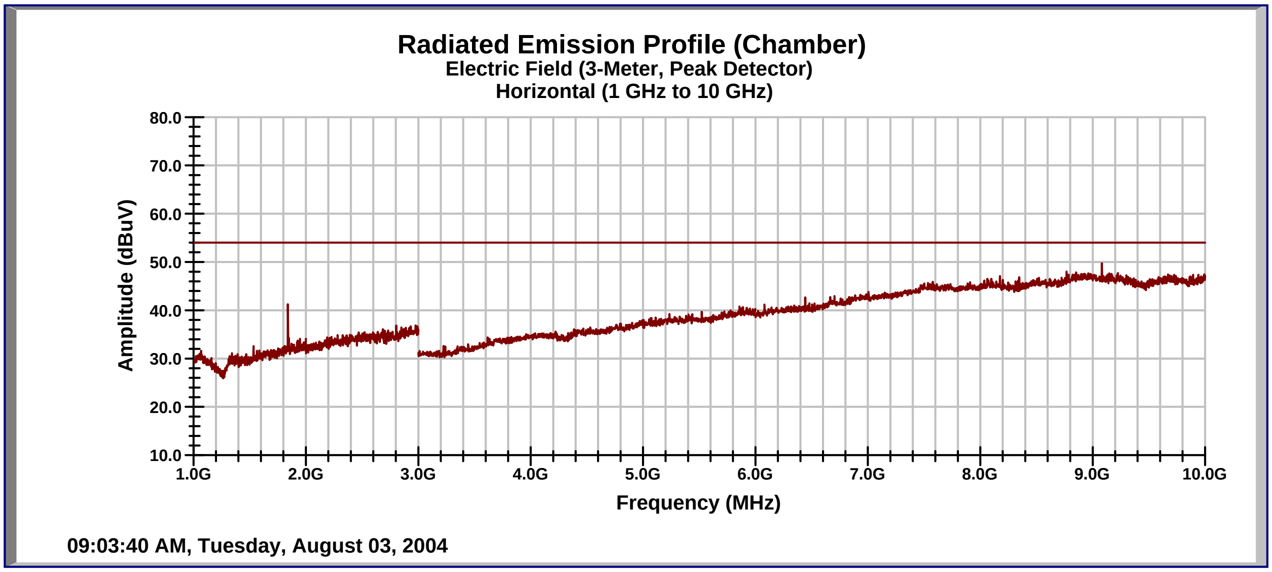
EUT Name	TranspondIT Electric Centron (240V)	**Date**	2 August 2004
EUT Model	MS8EM915CV1	**Temp / Hum in**	75 Deg. F / 50% RH
EUT Serial	None	**Temp / Hum out**	N/A
Standard	FCC 47 CFR Part 15, RSS-210 Section 5	**Line AC / Freq.**	240 VAC / 60 Hz
		RBW / VBW	1 MHz / 3 MHz
Dist/Ant Used	3M / 3115-5770	**Performed by**	Eugene Moses
Configuration	04001018 Transmitter		



Emission Freq (MHz)	ANT Polar (H/V)	ANT Pos (m)	Table Pos (deg)	FIM Value (dBuV)	Amp Gain (dB)	Cable Loss (dB)	ANT Factor (dB/m)	E-Field Value (dBuV/m)	Spec Limit (dBuV/m)	Spec Margin (dB)
Peak Value										
1840.00	H	1.76	95	49.01	35.41	4.99	27.78	46.38	74.00	-27.62
Average Value										
1840.00	H	1.76	95	32.70	35.41	4.99	27.78	30.07	54.00	-23.93

Spec Margin = E-Field Value - Limit, E-Field Value = FIM Value - Amp Gain + Cable Loss + ANT Factor $\pm$ Uncertainty

Combined Standard Uncertainty $u_c(y) = \pm 1.6$dB Expanded Uncertainty $U = ku_c(y)$ $k = 2$ for 95% confidence

Notes:

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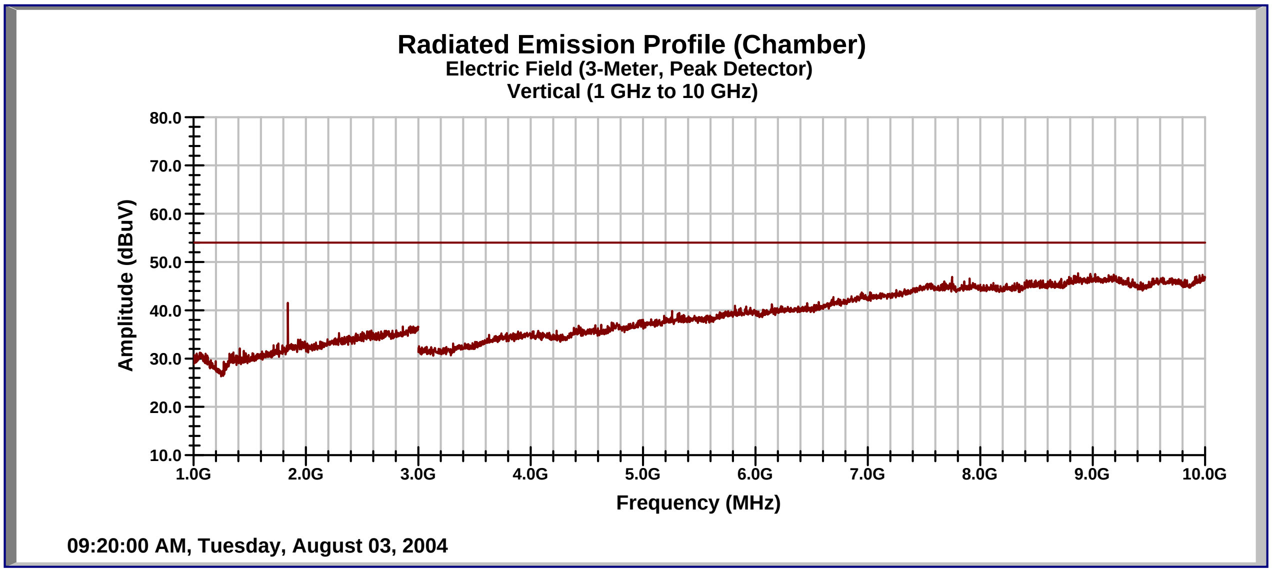
EUT Name	TranspondIT Electric Centron (240V)	**Date**	2 August 2004
EUT Model	MS8EM915CV1	**Temp / Hum in**	75 Deg. F / 50% RH
EUT Serial	None	**Temp / Hum out**	N/A
Standard	FCC 47 CFR Part 15, RSS-210 Section 5	**Line AC / Freq.**	240 VAC / 60 Hz
		RBW / VBW	1 MHz / 3 MHz
Dist/Ant Used	3M / 3115-5770	**Performed by**	Eugene Moses
Configuration	04001018 Transmitter		



Emission Freq (MHz)	ANT Polar (H/V)	ANT Pos (m)	Table Pos (deg)	FIM Value (dBuV)	Amp Gain (dB)	Cable Loss (dB)	ANT Factor (dB/m)	E-Field Value (dBuV/m)	Spec Limit (dBuV/m)	Spec Margin (dB)
Peak Value										
1840.00	V	1.41	68	50.14	35.41	4.99	27.86	47.58	74.00	-26.42
Average value										
1840.00	V	1.41	68	33.50	35.41	4.99	27.86	30.94	54.00	-23.06

Spec Margin = E-Field Value - Limit, E-Field Value = FIM Value - Amp Gain + Cable Loss + ANT Factor ± Uncertainty

Combined Standard Uncertainty $u_c(y)$ = ± 1.6dB Expanded Uncertainty $U = ku_c(y)$ k = 2 for 95% confidence

Notes:

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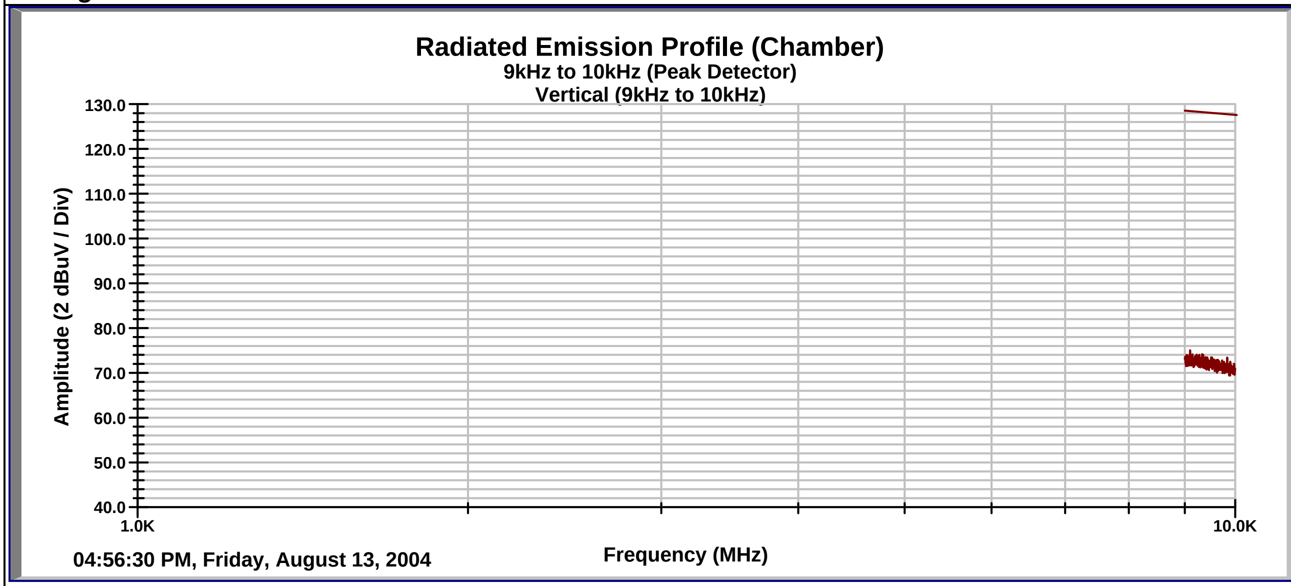
EUT Name	TranspondIT Electric Centron (240V)	**Date**	2 August 2004
EUT Model	MS8EM915CV1	**Temp / Hum in**	75 Deg. F / 50% RH
EUT Serial	None	**Temp / Hum out**	N/A
Standard	FCC 47 CFR Part 15, RSS-210 Section 5	**Line AC / Freq.**	240 VAC / 60 Hz
		RBW / VBW	9 KHz / 30 KHz
Dist/Ant Used	3M / 6511	**Performed by**	Eugene Moses
Configuration	04001018 Transmitter		



Emission Freq (MHz)	ANT Polar (H/V)	ANT Pos (m)	Table Pos (deg)	FIM Value (dBuV)	Amp Gain (dB)	Cable Loss (dB)	ANT Factor (dB/m)	E-Field Value (dBuV/m)	Spec Limit (dBuV/m)	Spec Margin (dB)

Spec Margin = E-Field Value - Limit, E-Field Value = FIM Value - Amp Gain + Cable Loss + ANT Factor ± Uncertainty

Combined Standard Uncertainty $u_c(y)$ = ± 1.6dB Expanded Uncertainty $U = ku_c(y)$ k = 2 for 95% confidence

Notes:

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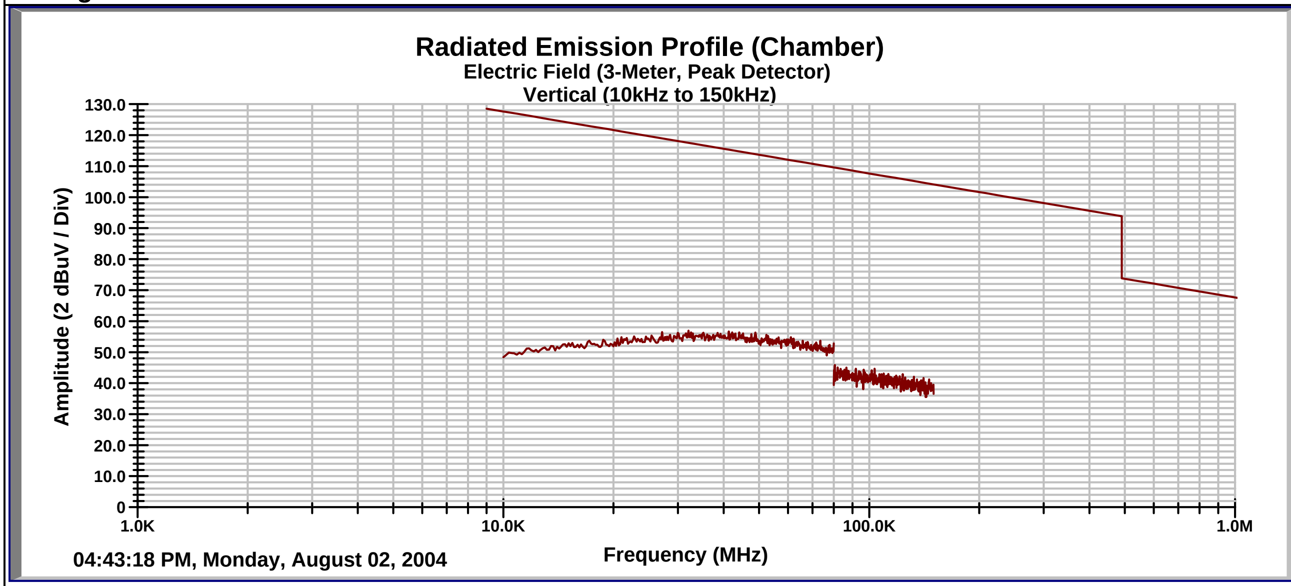
EUT Name	TranspondIT Electric Centron (240V)	**Date**	2 August 2004
EUT Model	MS8EM915CV1	**Temp / Hum in**	75 Deg. F / 50% RH
EUT Serial	None	**Temp / Hum out**	N/A
Standard	FCC 47 CFR Part 15, RSS-210 Section 5	**Line AC / Freq.**	240 VAC / 60 Hz
Deg/sweep	12	**RBW / VBW**	9 KHz / 30 KHz
Dist/Ant Used	3M / 6502	**Performed by**	Eugene Moses
Configuration	04001018 Transmitter		



Emission Freq (MHz)	ANT Polar (H/V)	ANT Pos (m)	Table Pos (deg)	FIM Value (dBuV)	Amp Gain (dB)	Cable Loss (dB)	ANT Factor (dB/m)	E-Field Value (dBuV/m)	Spec Limit (dBuV/m)	Spec Margin (dB)

Spec Margin = E-Field Value - Limit, E-Field Value = FIM Value - Amp Gain + Cable Loss + ANT Factor ± Uncertainty

Combined Standard Uncertainty $u_c(y)$ = ± 1.6dB Expanded Uncertainty $U = ku_c(y)$ k = 2 for 95% confidence

Notes:

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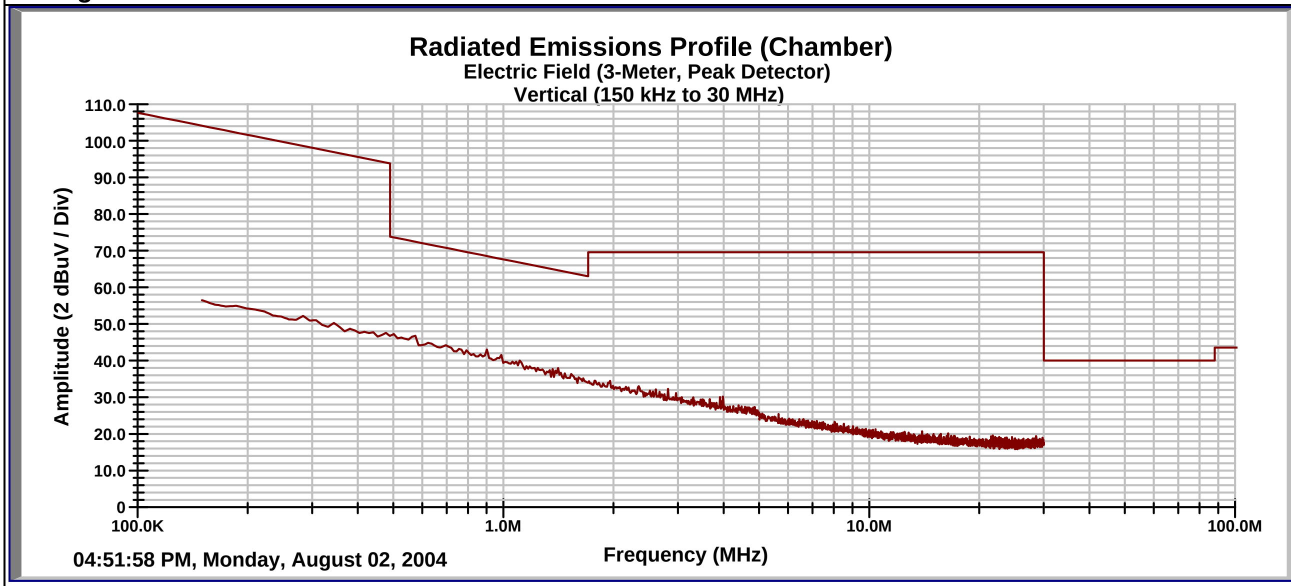
EUT Name	TranspondIT Electric Centron (240V)	**Date**	2 August 2004
EUT Model	MS8EM915CV1	**Temp / Hum in**	75 Deg. F / 50% RH
EUT Serial	None	**Temp / Hum out**	N/A
Standard	FCC 47 CFR Part 15, RSS-210 Section 5	**Line AC / Freq.**	240 VAC / 60 Hz
		RBW / VBW	9 KHz / 30 KHz
Dist/Ant Used	3M / 6502	**Performed by**	Eugene Moses
Configuration	04001018 Transmitter		



Emission Freq (MHz)	ANT Polar (H/V)	ANT Pos (m)	Table Pos (deg)	FIM Value (dBuV)	Amp Gain (dB)	Cable Loss (dB)	ANT Factor (dB/m)	E-Field Value (dBuV/m)	Spec Limit (dBuV/m)	Spec Margin (dB)

Spec Margin = E-Field Value - Limit, E-Field Value = FIM Value - Amp Gain + Cable Loss + ANT Factor ± Uncertainty

Combined Standard Uncertainty $u_c(y)$ = ± 1.6dB Expanded Uncertainty $U = ku_c(y)$ k = 2 for 95% confidence

Notes:

4.1.3 Photos

Figure 4 - Radiated Emissions Test Setup (Chamber - Front)

Figure 5 - Radiated Emissions Test Setup (Chamber - Back)

4.1.4 Sample Calculation

The field strength is calculated by subtracting the Amplifier Gain and adding the Cable Loss and Antenna Correction Factor to the measured reading. The basic equation is as follows:

Field Strength (dBμV/m) = FIM - AMP + CBL + ACF

Where: FIM = Field Intensity Meter (dBμV)
AMP = Amplifier Gain (dB)
CBL = Cable Loss (dB)
ACF = Antenna Correction Factor (dB/m)

$$\mu V/m = 10^{\frac{dB\mu V/m}{20}}$$

4.2 Conducted Emissions

Testing was performed in accordance with 47 CFR 15, ANSI C63.4:1992. These test methods are listed under the laboratory's NVLAP Scope of Accreditation.

This test measures the levels emanating from the EUT, thus evaluating the potential for the EUT to cause radio frequency interference to other electronic devices.

4.2.1 Test Methodology

A test program that controls instrumentation and data logging was used to automate the AC Power Line Conducted emission test procedure. The frequency range of interest was divided into sub-ranges such as to yield a frequency resolution of 9 kHz. For each frequency sub-range, each phase and neutral of the AC power line were measured with respect to ground. Measurements were performed using a set of 50μH / 50Ω LISNs.

Testing is either performed in the anechoic chamber or on PLC Site 2. The setup photographs clearly identify which site was used. The vertical ground plane used in the anechoic chamber is a 2m x 2m wooden frame that is covered with ¼ inch hardware cloth and is bonded to the horizontal ground plane.

In the case of tabletop equipment, the EUT is placed on a 1.0m x 1.5m non-conductive table 80cm above the ground plane and 40cm from a vertical ground reference plane. The rear of the EUT was positioned flush with the backside of the table and directly over the LISNs. The power and I/O cables were routed over the edge of the table and bundled approximately 40cm from the ground plane. Support equipment was powered from a separate LISN. Floor-standing equipment is placed directly on the ground plane.

4.2.1.1 Deviations

There were no deviations from this test methodology.

4.2.2 Test Results

Section 4.2.2.1 lists the final measurement data under the worst case operating modes, configurations, and/or cable positions. It also reflects the results including any modifications and/or special accessories listed in Sections 1.4 and 1.5.

As originally tested, the EUT was found to be compliant to the requirements of the test standard(s).

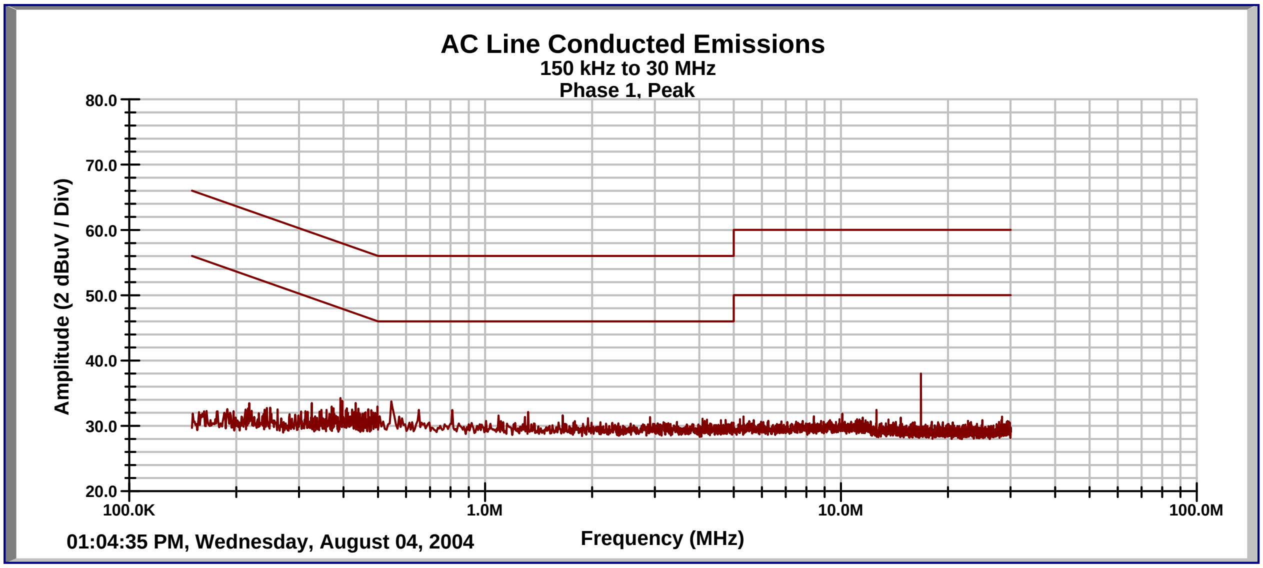
Plots of the EUT's AC Line Conducted emissions are contained in the following sections. The plots show peak and/or average emissions and the corresponding peak and/or average limits. If the peak emissions are below the average limit, then the EUT is considered to pass and no average measurements are made. If the peak emissions are below the quasi-peak limit and the average emissions are below the average limit, then the EUT is considered to pass and no further measurements are made. Otherwise, individual frequencies are measured and compared to the corresponding limit for the detector used (quasi-peak or average).

4.2.2.1 Final Data

The data recorded in this section contains the final results under the worst-case conditions and with any modifications or special accessories implemented as the manufacturer intends.

SOP 2 Conducted Emissions   Tracking # 30461431.001 Page 1 of 2

EUT Name	TranspondIT Electric Centron (240V)	**Date**	4 August 2004
EUT Model	MS8EM915CV1	**Temperature**	75 Deg. F
EUT Serial	None	**Humidity**	50% RH
Standard	FCC 47 CFR Part 15, RSS-210 Section 5	**Line AC / Freq**	240 VAC / 60 Hz
LISNs Used	7, 8	**Performed by**	Eugene Moses
Configuration	Original		



Emission Freq (MHz)	Line ID (1,2,3,N)	FIM Quasi (dBuV)	FIM Ave (dBuV)	Cable Loss (dB)	LISN + T Limiter (dB)	Quasi Limit (dBuV)	Ave Limit (dBuV)	Quasi Spec Margin (dB)	Ave Spec Margin (dB)
16.78	1	24.91	15.66	0.15	10.49	60.00	50.00	-24.45	-23.70

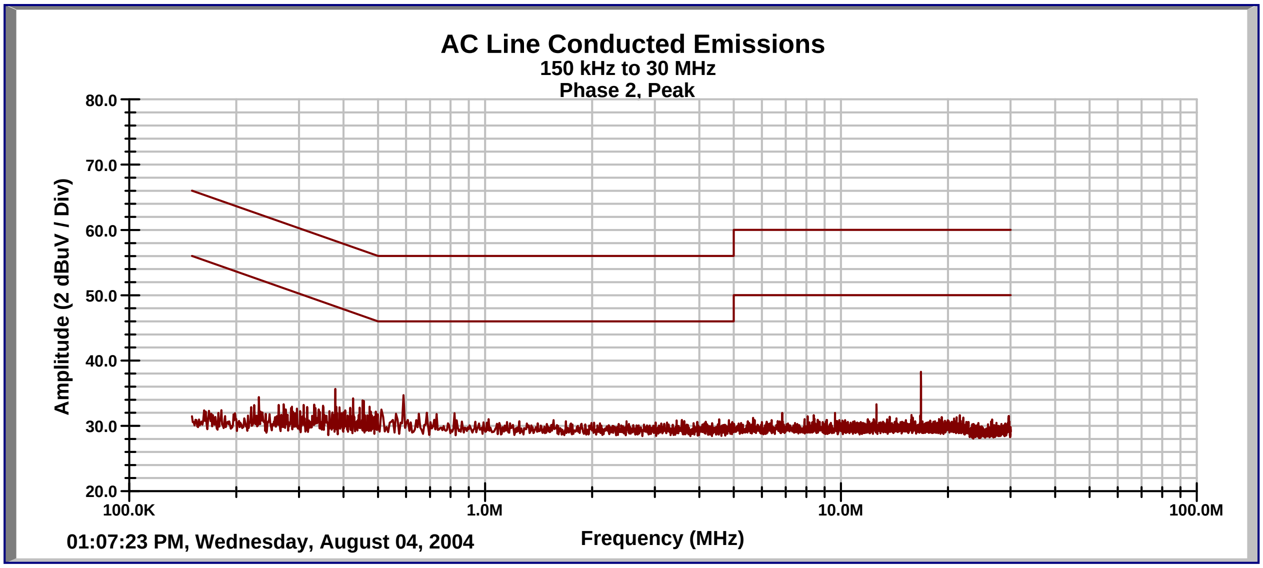
Quasi Spec Margin = Quasi FIM + Cable Loss + LISN CF - Quasi Limit ± Uncertainty
Ave Spec Margin = Ave FIM + Cable Loss + LISN CF - Ave Limit ± Uncertainty

Combined Standard Uncertainty $u_c(y) = \pm 1.2$dB   Expanded Uncertainty $U = ku_c(y)$ $k = 2$ for 95% confidence

Notes:

SOP 2 Conducted Emissions | Tracking # 30461431.001 Page 2 of 2

EUT Name	TranspondIT Electric Centron (240V)	**Date**	4 August 2004
EUT Model	MS8EM915CV1	**Temperature**	75 Deg. F
EUT Serial	None	**Humidity**	50% RH
Standard	FCC 47 CFR Part 15, RSS-210 Section 5	**Line AC / Freq**	240 VAC / 60 Hz
LISNs Used	7, 8	**Performed by**	Eugene Moses
Configuration	Original		



Emission Freq (MHz)	Line ID (1,2,3,N)	FIM Quasi (dBuV)	FIM Ave (dBuV)	Cable Loss (dB)	LISN + T Limiter (dB)	Quasi Limit (dBuV)	Ave Limit (dBuV)	Quasi Spec Margin (dB)	Ave Spec Margin (dB)
16.78	2	24.54	14.73	0.15	10.61	60.00	50.00	-24.70	-24.51

Quasi Spec Margin = Quasi FIM + Cable Loss + LISN CF - Quasi Limit ± Uncertainty
Ave Spec Margin = Ave FIM + Cable Loss + LISN CF - Ave Limit ± Uncertainty

Combined Standard Uncertainty $u_c(y)$ = ± 1.2dB Expanded Uncertainty $U = ku_c(y)$ k = 2 for 95% confidence

Notes:

4.2.3 Photos

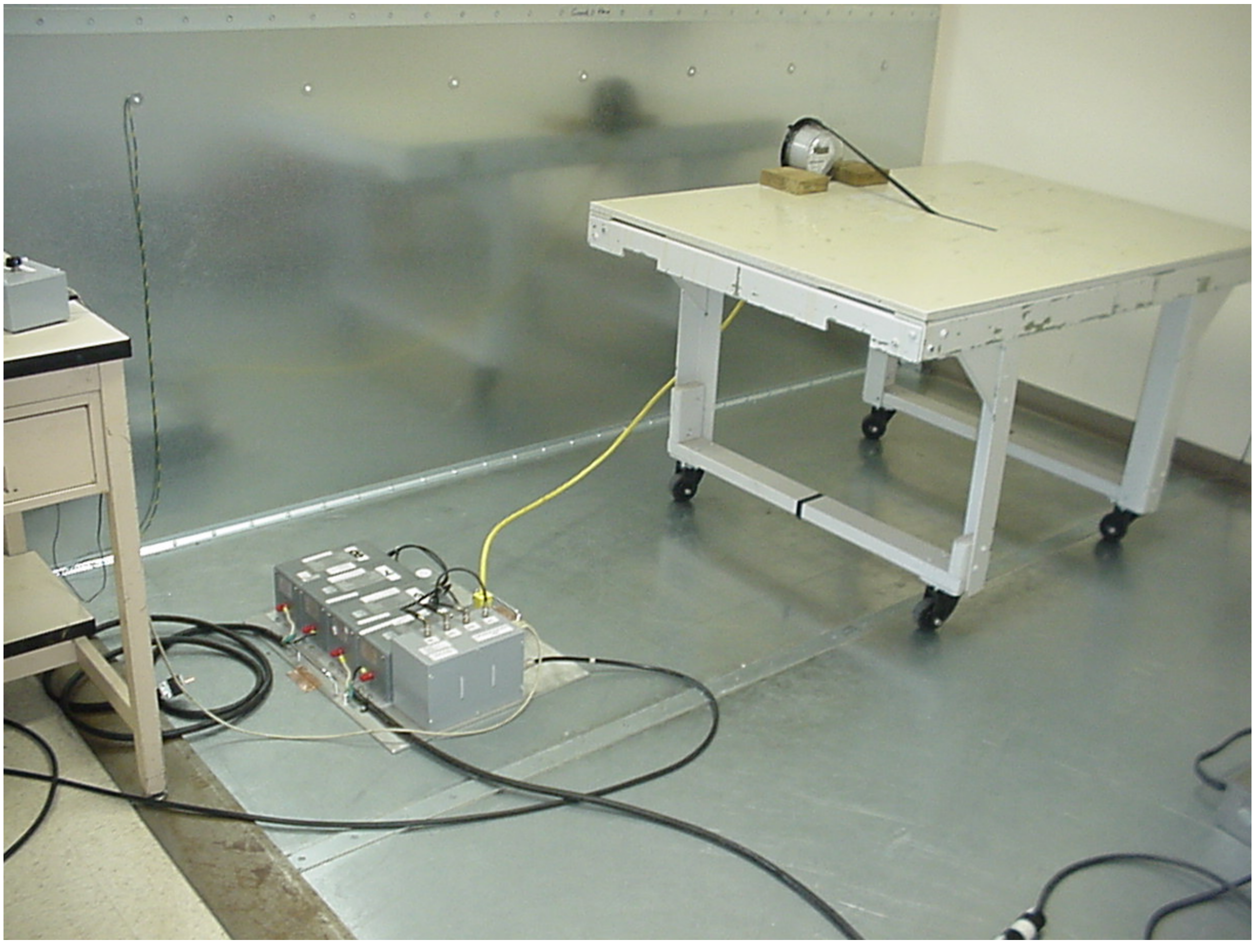


Figure 6 - Conducted Emissions Test Setup (Front)

4.2.4 Sample Calculation

The signal strength is calculated by adding the LISN Correction Factor and Cable Loss to the measured reading. The basic equation is as follows:

Field Strength (dBμV/m) = FIM + CBL + LCF

Where: FIM = Field Intensity Meter (dBμV)
CBL = Cable Loss (dB)
LCF = LISN Loss (dB)

$$\mu V/m = 10^{\frac{dB\mu V/m}{20}}$$

4.3 Variation of Fundamental Power with Voltage Variation (CFR 47, Part 15.31e)

Testing was performed in accordance with 47 CFR 15.209 and 15.249, ANSI C63.4:1992. These test methods are listed under the laboratory's NVLAP Scope of Accreditation. Test Methodology.

This test measures the variation in RF power output when the applied input voltage is varied between 85% and 115% of nominal voltage.

4.3.1.1 Final Test

For each frequency measured, the peak emission was maximized by manipulating the receiving antenna from 1 to 4 meters above the ground plane and placing it at the position that produced the maximum signal strength reading. The turntable was then rotated through 360° while observing the peak signal and placing the EUT at the position that produced maximum radiation.

Final testing was performed on an NSA compliant test site. The EUT was placed on a 1.0m x 1.5m non-conductive table 80cm above the ground plane.

4.3.1.2 Deviations

There were no deviations from this test methodology.

4.3.2 Test Results

Section 4.1.2.1 lists the final measurement data under the worst case operating modes, configurations, and/or cable positions. It also reflects the results including any modifications and/or special accessories listed in Sections 1.4 and 1.5.

As originally tested, the EUT was found to be compliant to the requirements of the test standard(s).

4.3.2.1 Final Data

The data recorded in this section contains the final results under the worst-case conditions and with any modifications or special accessories implemented as the manufacturer intends.

Radiated Emissions

Tracking # 30461431.001 Page 1 of 1

EUT Name	TranspondIT Electric Centron (240V)	**Date**	2 August 2004
EUT Model	MS8EM915CV1	**Temp / Hum in**	75 Deg. F / 50% RH
EUT Serial	None	**Temp / Hum out**	N/A
Standard	FCC 47 CFR Part 15, RSS-210 Section 5	**Line AC / Freq**	204,240,276 / 60 Hz
Dist/Ant Used	3M / EMCO 3123C-DB4 Dipole	**Performed by**	Eugene Moses

Configuration: 04001018 Transmitter. Unit on side. All measurements are Quasi-Peak. RBW = 120 KHz VBW = 300 KHz

Emission Freq (MHz)	ANT Polar (H/V)	ANT Pos (m)	Table Pos (deg)	FIM Value (dBuV)	Amp Gain (dB)	Cable Loss (dB)	ANT Factor (dB/m)	E-Field Value (dBuV/m)	Spec Limit (dBuV/m)	Spec Margin (dB)
Measurements made with unit on side. Using dipole. 240 VAC										
919.90	H	1	198	50.88	0.00	2.47	29.18	82.53	94.00	-11.47
Measurements made with unit on side. With dipole. 204 VAC										
919.90	H	1	10	49.67	0.00	2.47	29.18	81.32	94.00	-12.68
Measurements made with unit on side. With dipole. 276 VAC										
919.90	H	1	10	48.35	0.00	2.47	29.18	80.00	94.00	-14.00
Measurements made with unit on side. With dipole. 240 VAC										
919.90	V	1.14	18	61.43	0.00	2.47	29.18	93.08	94.00	-0.92
Measurements made with unit on side. With dipole. 204 VAC										
919.90	V	1.13	18	62.01	0.00	2.47	29.18	93.66	94.00	-0.34
Measurements made with unit on side. With dipole. 276 VAC										
919.90	V	1.14	18	61.90	0.00	2.47	29.18	93.55	94.00	-0.45

Spec Margin = E-Field Value - Limit, E-Field Value = FIM Value - Amp Gain + Cable Loss + ANT Factor ± Uncertainty

Combined Standard Uncertainty $u_c(y) = \pm 1.6$dB Expanded Uncertainty $U = ku_c(y)$ $k = 2$ for 95% confidence

Notes: The orientation for highest radiated power is on the side. This was previously measured in the radiated emission section, above.

4.3.3 Photos

Figure 7 - Radiated Emissions Test Setup (Chamber - Front)

Figure 8 - Radiated Emissions Test Setup (Chamber - Back)

5 Test Equipment Use List

Equipment	Manufacturer	Model #	Serial/Inst #	Last Cal dd/mm/yy	Next Cal dd/mm/yy
SOP 1 - Radiated Emissions (5 Meter Chamber)					
Amplifier, preamp	Agilent Technologies	8449B	3008A01480	10-May-04	10-May-05
Ant. Biconical	EMCO	3110B	3367	4-Feb-04	4-Feb-05
Ant. Log Periodic	AH Systems	SAS-516	133	19-Jan-04	19-Jan-05
Antenna Horn	EMCO	3115	5770	14-Oct-03	14-Oct-04
Cable, Coax	Andrew	FSJ1-50A	003	15-Jan-04	15-Jan-05
Cable, Coax	Andrew	FSJ1-50A	042	15-Jan-04	15-Jan-05
Cable, Coax	Andrew	FSJ1-50A	045	15-Jan-04	15-Jan-05
Chamber, Semi-Anechoic	Braden Shielding	5 meter	A67631	27-Jan-04	27-Jan-05
Data Table, EMCWin	TUV Rheinland	EMCWin.dll	002	6-Jan-02	6-Jan-06
Spectrum Analyzer	Agilent Tec.	E7405A	US39440157	11-Aug-03	11-Aug-04

SOP 2 - Conducted Emissions (AC/DC and Signal I/O)					
Cable, Coax	Belden	RG-213	004	19-Jan-04	19-Jan-05
LISN (5) 50mH/50Ω	Solar Electronics	8028-50-TS-24	990441	6-Aug-03	6-Aug-04
LISN (6) 50mH/50Ω	Solar Electronics	8028-50-TS-24	990442	6-Aug-03	6-Aug-04
LISN Selection Box	TUV Rheinland	CFL-9206	1650	11-May-04	11-May-05
Spectrum Analyzer	Agilent Tec.	E7405A	US39440161	11-Aug-03	11-Aug-04
Variation of Fundamental Power with Voltage Variation (CFR 47, Part 15.31e) (5 Meter Chamber)					
Amplifier, preamp	Agilent Technologies	8449B	3008A01480	10-May-04	10-May-05
Ant. Biconical	EMCO	3110B	3367	4-Feb-04	4-Feb-05
Ant. Log Periodic	AH Systems	SAS-516	133	19-Jan-04	19-Jan-05
Antenna Horn	EMCO	3115	5770	14-Oct-03	14-Oct-04
Cable, Coax	Andrew	FSJ1-50A	003	15-Jan-04	15-Jan-05
Cable, Coax	Andrew	FSJ1-50A	042	15-Jan-04	15-Jan-05
Cable, Coax	Andrew	FSJ1-50A	045	15-Jan-04	15-Jan-05
Chamber, Semi-Anechoic	Braden Shielding	5 meter	A67631	27-Jan-04	27-Jan-05
Data Table, EMCWin	TUV Rheinland	EMCWin.dll	002	6-Jan-02	6-Jan-06
Spectrum Analyzer	Agilent Tec.	E7405A	US39440157	11-Aug-03	11-Aug-04

General Laboratory Equipment					
Ant. Dipole Set BL 1-4	EMCO	3121C	9302-914	20-Oct-03	20-Oct-04
Filter, 1.5 GHz High Pass	Bonn Elektronik	BHF 1500	025155	07/22/03	07/22/04
Meter, Multi	Fluke	79-3	69200606	6-Aug-03	6-Aug-04
Meter, Temp/Humid/Barom	Fisher	02-400	01	13-Aug-03	13-Aug-04
Power Supply, AC	California Instruments	1251P	L06429	CNR II	CNR II

* Calibration of equipment past due for re-calibration will be performed expeditiously. If any equipment is found to be out of tolerance at that time, affected customers will be notified accordingly.

6 EMC Test Plan

A test plan was not provided by the manufacturer for this testing. EUT operation and configuration was based on the applicable test standards and actual application of the EUT.

1. OUTLINE FCC TEST PLAN

The test set up is shown in Fig 1
Use test procedures as defined by ANSI C63.4-1992

1.1. Equipment Under Test (EUT)

TransPondIT Serial Number	Meter Serial Number	Capacitor Value (C1)
04001018	324090695	330nF

All units are to be tested in Form 2S meters (as supplied).

For FCC testing all 4 links (see figure 2 below) need to be fitted. Units have been dispatched with these links fitted.

Note: The normal pulse repetition rate of 0.2Hz is below the minimum rate of 20Hz permitted by the FCC for use with quasi peak detectors. Therefore, the maximum transmitted field strength will be measured by setting the unit to a 20.833Hz PRF and using quasi-peak detector.

1.2. Radiated Emissions

Limits as set in section 15.249:
Fundamental (field strength) = 50mV/m @ 3m = 93.98dBuV (based on quasi-peak detector).

***Therefore the FCC limit of the fundamental is:* 93.98dBuV-Antenna factor (dB/m)-Cable loss (dB)…**……………Equation 1

Harmonics (field strength) = 500uV/m @ 3m (based on average detector) -Convert to dBuV = $20\text{Log}_{10}(500) = 53.98$

FCC limit = 53.98 dBuV – Antenna factor (dB/m) – cable loss (dB) (based on peak detector)……………………………………………...Equation 2

Measurement detector functions:
The field strength of fundamental frequency will be measured using a quasi-peak detector function.
The field strength of the harmonics will be measured using a peak detector function.

Note: Emissions radiated outside the band (902MHz to 928MHz), except for harmonics, shall be attenuated by at least 50dB below the level of the fundamental or 200uV/m @ 3m, which ever is the lesser attenuation.

1. 1. Ensure ALL links are fitted as shown in figure 2: this sets the EUT to transmit an RF packet (128 bits) that modulates the RF carrier. PRF is 20.833Hz.
2. 2. Setup the measurement equipment with the following settings:

Centre frequency = 919.8976MHz

RBW = 120KHz: VBW = 300KHz

1. 3. Set the antenna for horizontal polarization. Using a ***peak*** detector adjust the antennas height so as to determine the maximum field strength. Note the antennas height and maximum field strength.
2. 4. Repeat step 2 and determine the maximum field strength with the antenna vertically polarized. Note the antennas height and maximum field strength.
3. 5. From the results of 2 & 3, set the antenna height that gave the maximum field strength.
4. 6. Set up the measurement equipment to perform a ***quasi-peak*** measurement.
5. 7. Determine the maximum field strength.
6. 8. Use equation 1 to determine the EUT maximum radiated emission of the fundamental (919.8976MHz).

Harmonics

Setup the measurement equipment to record using an ***average*** detector function.

1. 9. Ensure ALL links are fitted as shown in figure 2 in the EUT. This sets the EUT to transmit RF packets at a 20.833 Hz PRF
2. 10. Set the antenna height to that obtained in step 5.
3. 11. Using both vertical and horizontal polarization measure the 2^{nd} to 10^{th} harmonic field strengths.
4. 12. Use equation 2 to determine the maximum field strengths of the harmonics.
5. 13. Generate test reports.

1.3. Conducted Emissions

Refer to section 15.207: Conducted limit is 250uV (based on quasi-peak detector)

Measure the conducted emissions amplitudes between 150kHz to 30MHz on the live and neutral sides of the ac power lines of the EUT. Compliance shall be based on the measurement of the radio frequency voltage between each power line and ground at the power terminals.

Method of measurement
1) Set detection mode to peak detection with 10kHz bandwidth
2) Scan the receiver from 150kHz to 30MHz
3) Record the peak emission amplitude for each frequency
4) Set detection mode to CISPR quasi-peak detection with 9kHz bandwidth.
5) Record the quasi-peak amplitude value for each frequency with a PEAK
margin of less than 10dB
6) Set detection mode to Average detection with a 10kHz bandwidth
7) Record Average amplitude values for each frequency with a CISPR
margin of less than 6dB
8) Generate test report.

This completes the FCC testing strategy.

Fig 1: The Test set up

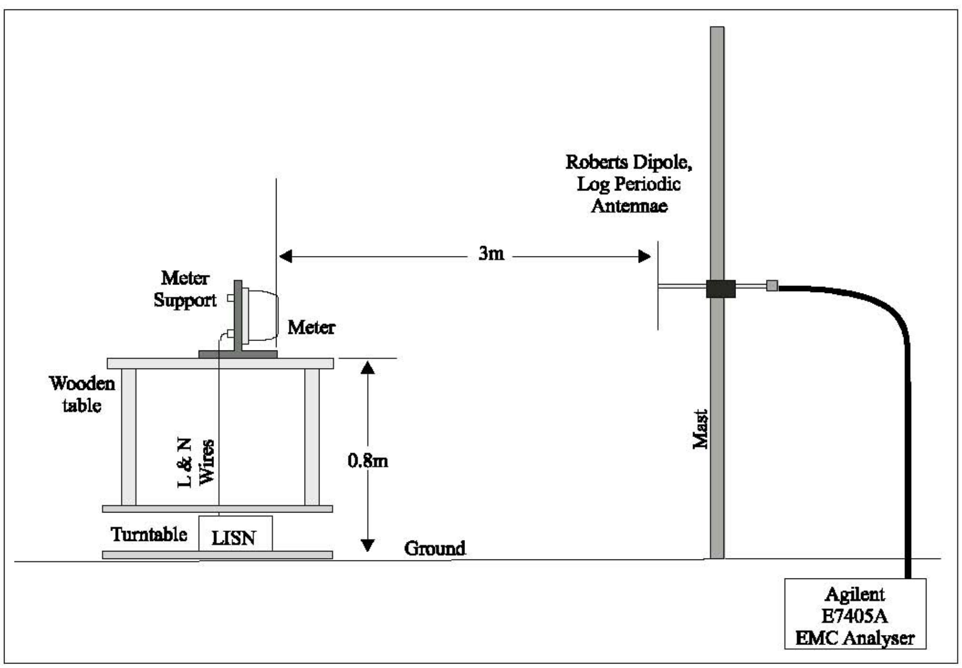
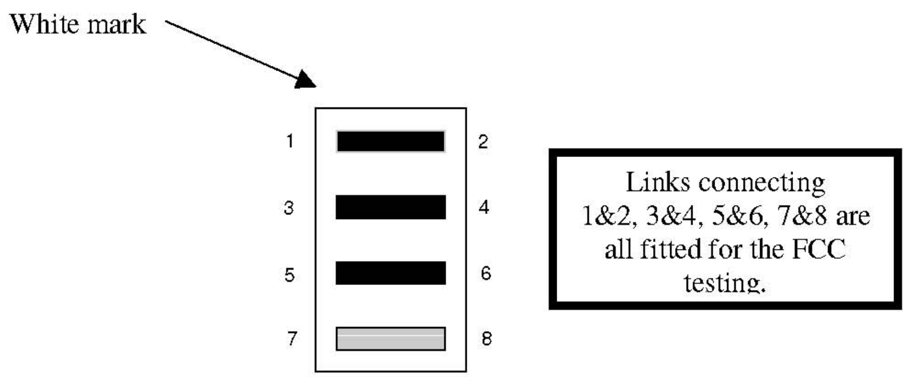


Figure 2: FCC Link Settings – rear view of PCB



Note: Normal operation has links 1&2, 3&4, 7&8 fitted only.