Emissions Test Report

EUT Name: Form 16S A3 ALPHA Meter/Collector

EUT Model: ZA3300KD0xx

FCC Title 47, Part 15, SubpartC, RSS-210 Issue 5

Prepared for:

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Report/Issue Date: 11 July 2003
Report Number: 30361342.002

Statement of Compliance

Manufacturer: Elster Electricity, LLC
208 South Rogers Lane
Raleigh, NC 27610
919 212-4700
Requester / Applicant: Bob Mason
Name of Equipment: Form 16S A3 ALPHA Meter/Collector
Model No. ZA3300KD0xx
Type of Equipment: Intentional Radiator
Application of Regulations: FCC Title 47, Part 15, SubpartC, RSS-210 Issue 5
Test Dates: 19 June, 2003 to 10 July, 2003

Guidance Documents:

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

Test Methods:

Emissions: 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

11 July 2003
Date

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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, SubpartC, RSS-210 Issue 5 based on the results of testing performed on *19 June*, 2003 through *10 July*, 2003 on the *Form 16S A3 ALPHA Meter/Collector* Model No. *ZA3300KD0xx* manufactured by Elster Electricity, LLC. 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

Test	Test Method(s)	Test Parameters	Measurement	Result
Channel Separation	FCC Part 15.247(a)(1)	Greater of 25 kHz or 20 dB bandwidth	399.4 kHz	compliant
Pseudorandom Hopping Algorithm				compliant
Time of Occupancy	FCC Part 15.247(a)(1)(i)	=<0.4 sec in 10 sec.	0.39 sec in 10sec	compliant
Occupied Bandwidth	FCC Part 15.247(a)(1)(i)	=<500kHz	390 kHz	compliant
Peak Output Power	FCC Part 15.247(b)(2)	0.25 Watts	0.249 Watts	compliant
Spurious Emissions	FCC Part 15.247(C)	Table FCC Part 15.209	49.15 dBuV/m @ 3meters Average	compliant
Frequency Hopping Spread Spectrum Systems	FCC Part 15.247(g)			compliant
Incorporation of Intelligence	FCC Part 15.247(h)			compliant
Frequency Stability	FCC Part 15.215(c)	Containment of 20 dB bandwidth between 902 and 928	902.58 MHz 915.01 MHz	compliant
Conducted Emissions	47 CFR Part 15.207, ANSI C63.4:1992, RSS-210 Issue 5	Table FCC Part 15.207 Prior to September 27, 2002	44.28 dBuV Quasi-Peak	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 25 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 and C-1236).

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 25.

3 Product Information

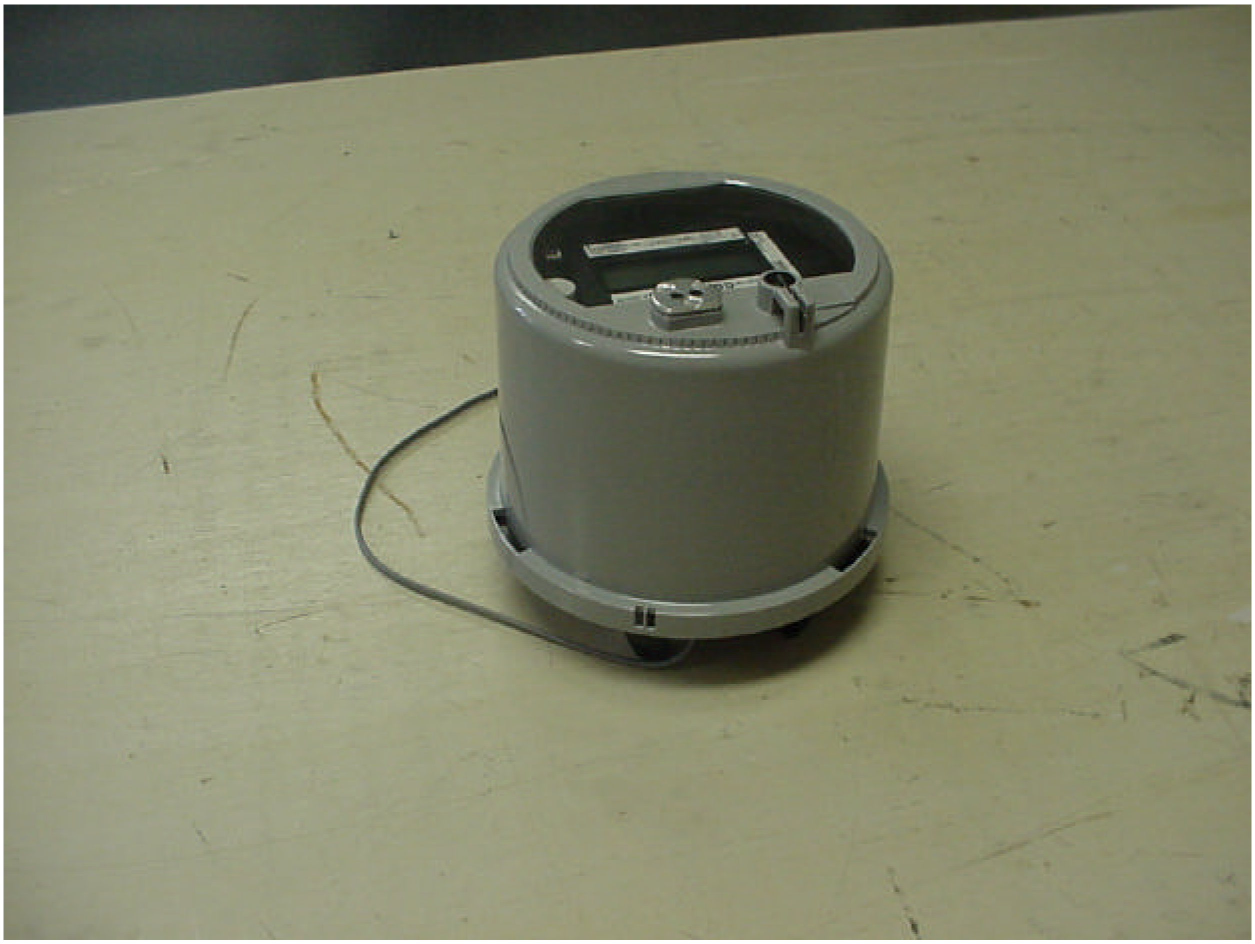


Figure 1 – Photo of EUT

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

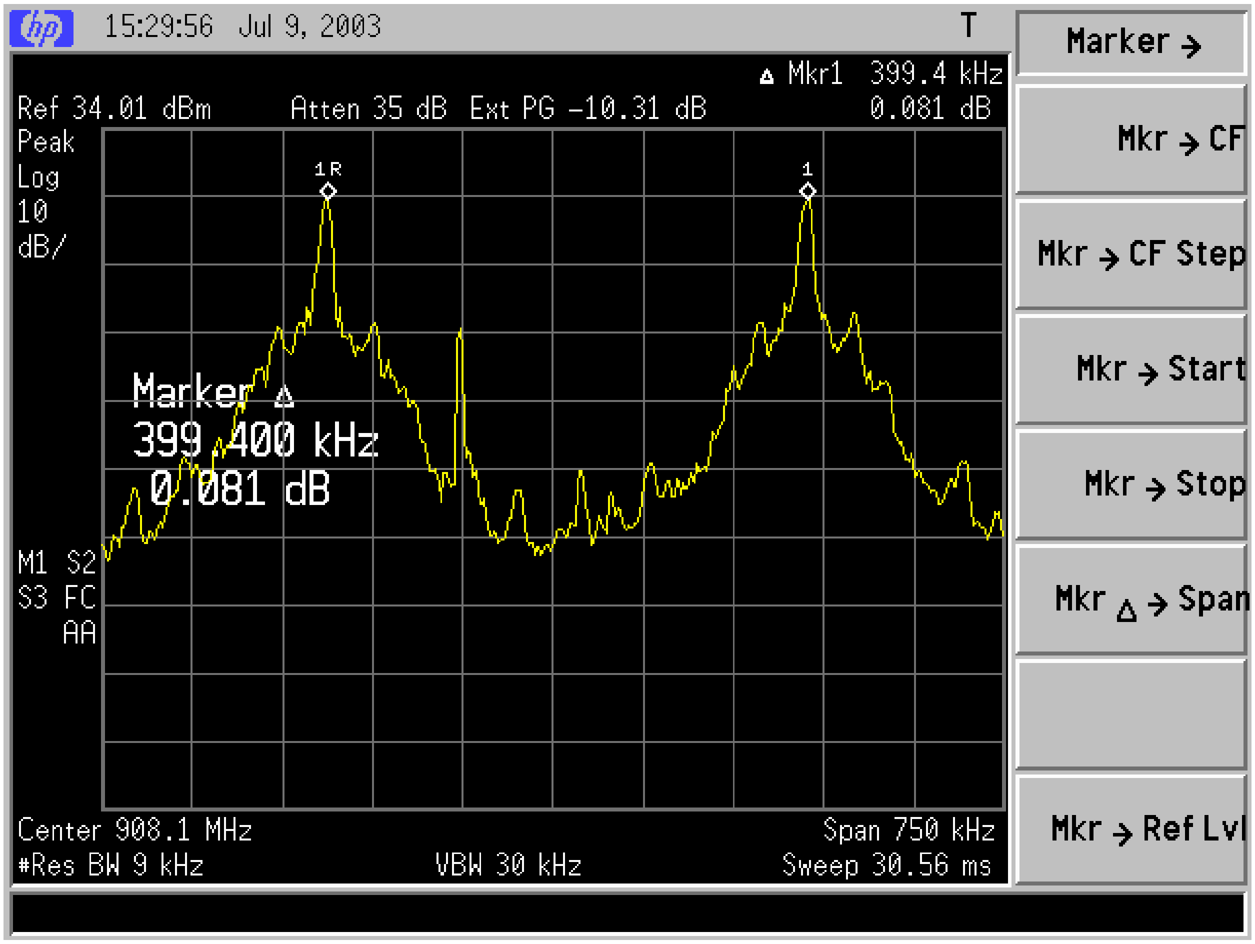
Testing was performed in accordance with 47 CFR Part 15, ANSI C63.4:1992, RSS-210 Issue 5. These test methods are listed under the laboratory's NVLAP Scope of Accreditation. This test measures the levels emanating from the EUT, thus evaluating the potential for the EUT to cause radio frequency interference to other electronic devices.

4.1 Channel Separation Part 15.247(a)(1)

Frequency hopping Systems shall have hopping channel carrier frequencies separated by a minimum of 25 kHz or the 20 dB bandwidth of the hopping channel, whichever is greater.

Bandwidth= 390 kHz

Channel Separation= 399.4 kHz



4.2 Pseudorandom Hopping Algorithm FCC Part 15.247(a)(1)

The system shall hop to channel frequencies that are selected from a pseudorandomly ordered list of hopping frequencies. Each frequency must be used equally on average by each transmitter. The system receivers shall have input bandwidths that match the hopping channel bandwidths of their transmitters and shall shift frequencies in synchronization with the transmitted signals.

The pseudo-random hop table is used to determine the transmitter's frequency hop sequence. The transmitter is slow hopping frequency system where the entire data packet is sent on a single channel. After sending a data packet, the transmitter uses the next channel in the pseudo-random hop table. Each frequency in the hop table is used before the transmitter will hop to a frequency already used. The receiver is a single IF system whose bandwidth is 330 kHz. When not synchronized to a transmitting device, the receiver is constantly hopping across the 25 channels scanning for a valid preamble from a transmitter. Once a valid preamble is detected, the receiver is synchronized to the transmitter and receives the data packet. After the transmission, the receiver returns to the scanning mode where it can look for another packet from either the same device or a different device.

Index	Channel	Center Frequency (MHz)
1	12	907.2
2	29	914
3	5	904.4
4	19	910
5	11	906.8
6	23	911.6
7	26	912.8
8	13	907.6
9	22	911.2
10	15	908.4
11	1	902.8
12	25	912.4
13	4	904
14	21	910.8
15	14	908
16	27	913.2
17	8	905.6
18	31	914.8
19	18	909.6
20	16	908.8
21	7	905.2
22	20	910.4
23	3	903.6
24	28	913.6
25	6	904.8

Sample hop table

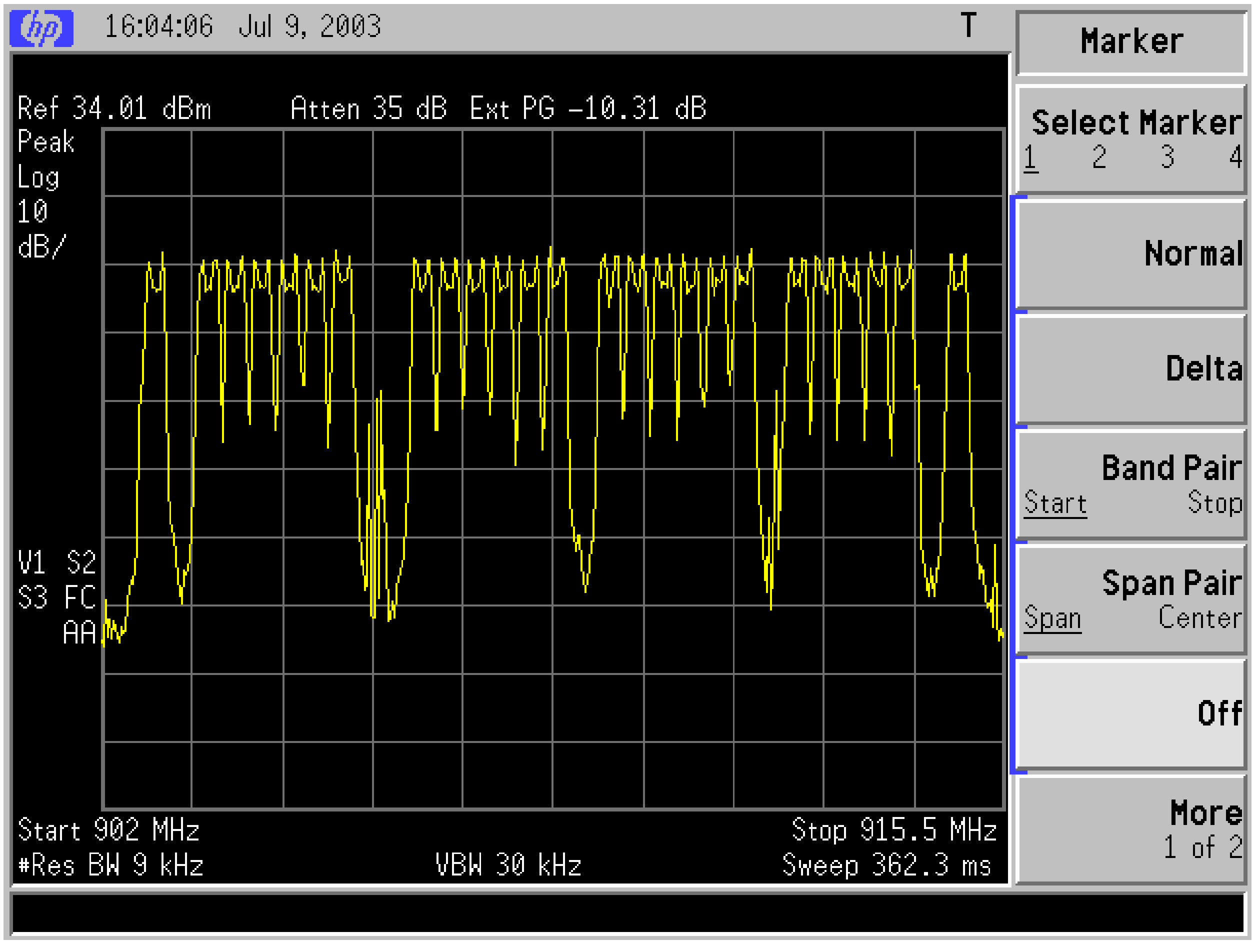


Figure 2 - Plot of hopping Channels

4.3 Time of Occupancy FCC Part 15.247(a)(1)(i)

Frequency Band (MHz)	20 dB Bandwidth	Number of Hopping Channels	Average Time of Occupancy
902-928	=>250 kHz	25	=<0.4 sec. In 10 sec.

The spectrum analyzer was set as follows:

RBW=1MHz

VBW=RBW

Span=0Hz

LOG dB/div.= 10dB

Sweep = 10 Sec.

Trigger Video

The occupancy time was measured as above. There were 4 hops at 97.5 msec per hop for any 10 sec. period. Time of occupancy equals number of hops multiplied by the duration of one hop.

Time of Occupancy = .39 seconds in any 10 second period.

4.4 Occupied Bandwidth FCC Part 15.247(a)(1)(i)

The maximum allowed 20 dB bandwidth of the hopping channel is 500 kHz.

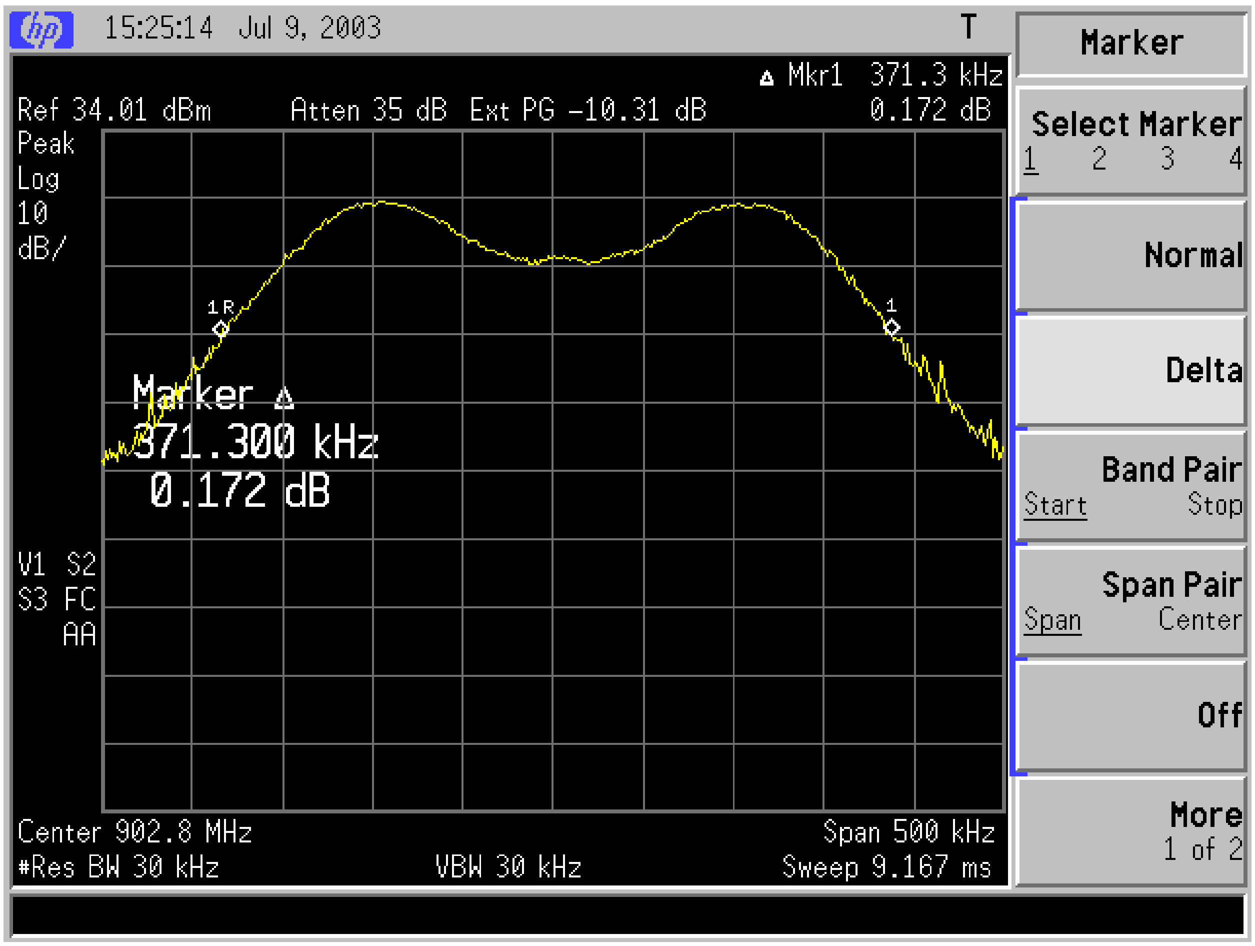


Figure 3 – CH1 Occupied Bandwidth

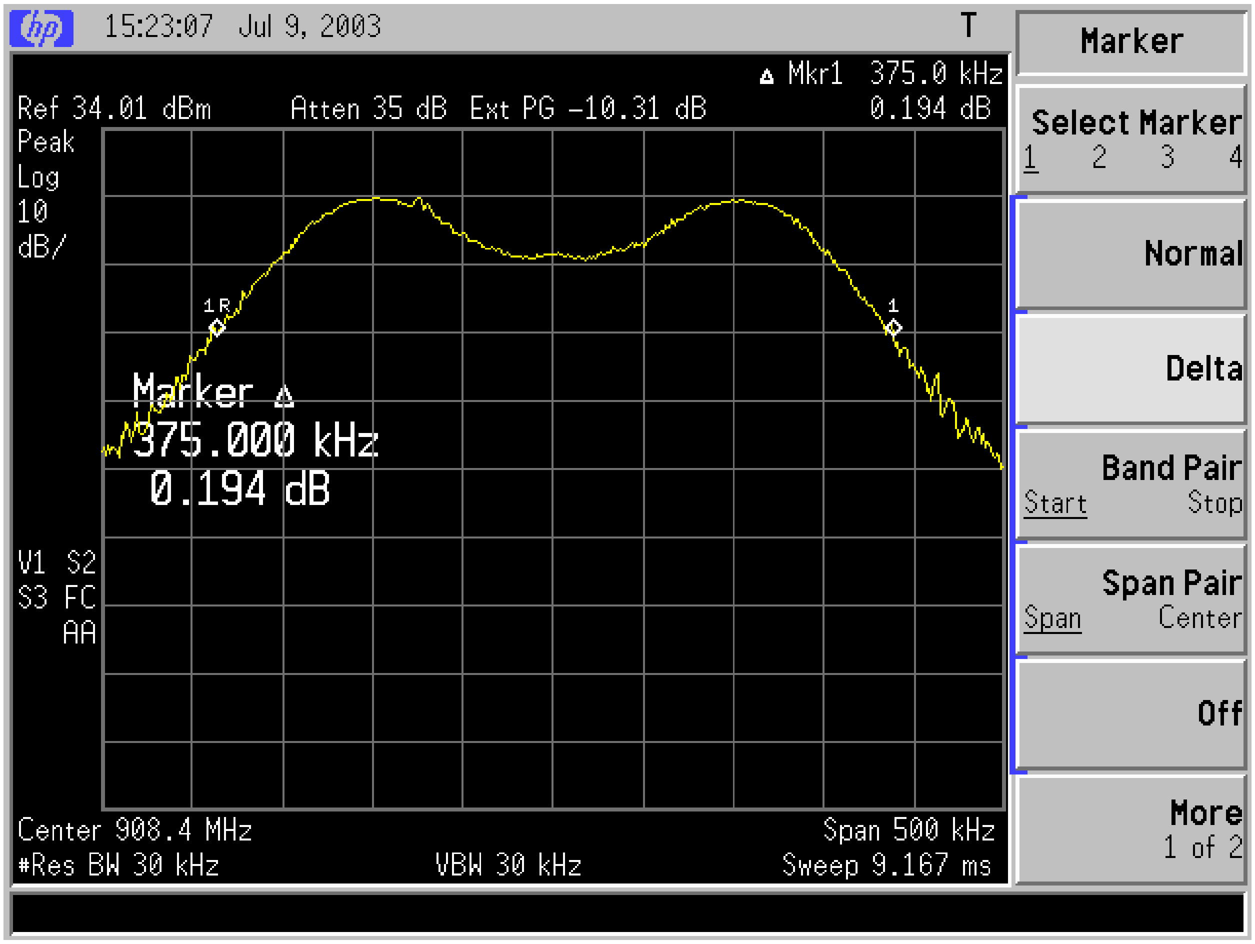


Figure 4 – CH15 Occupied Bandwidth

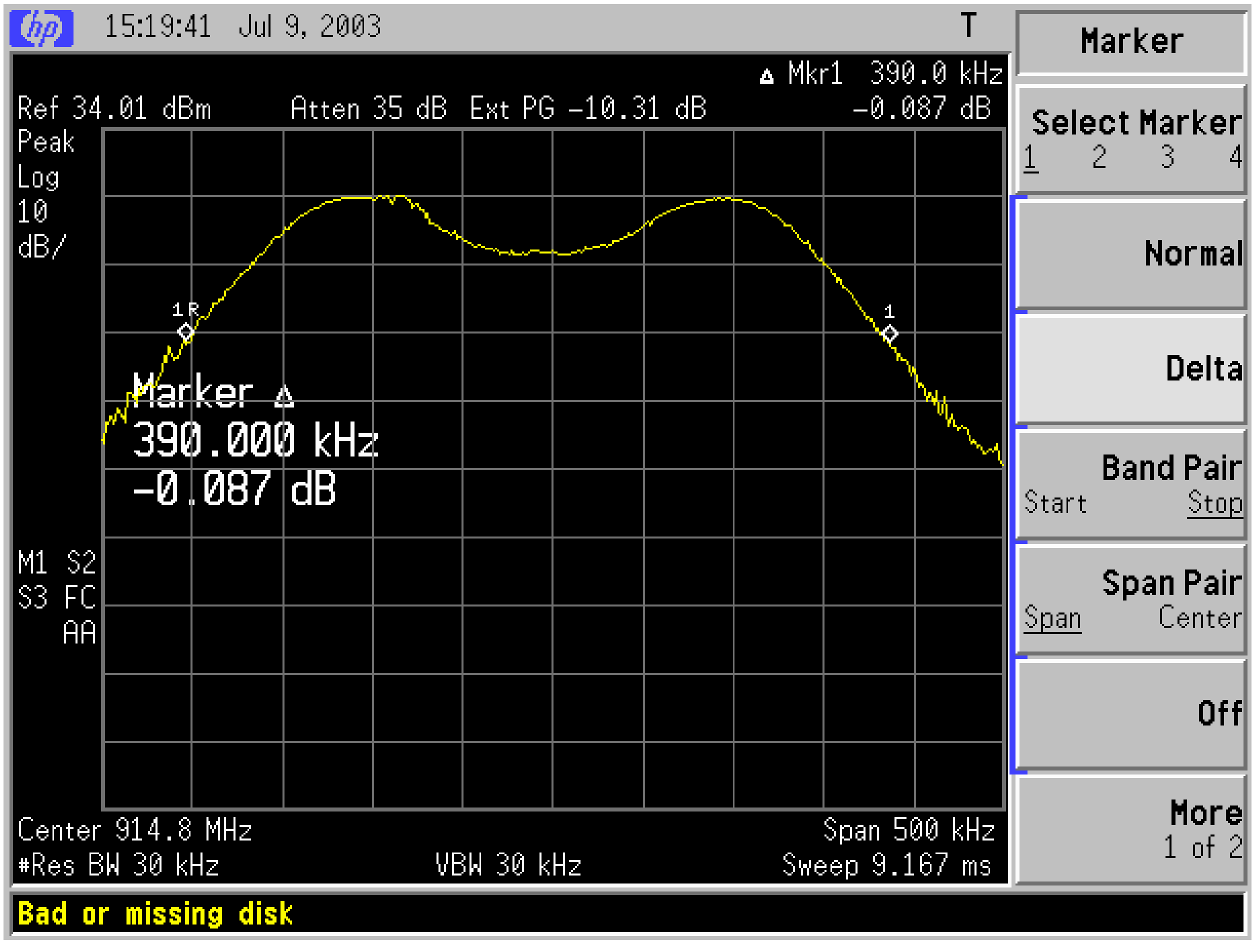


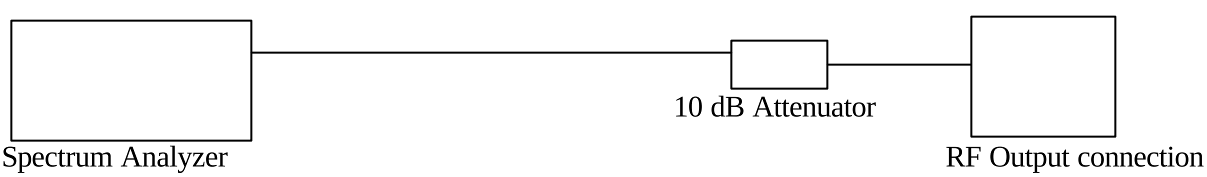
Figure 5 – CH31 Occupied Bandwidth

4.5 Peak Output Power FCC Part 15.247(b)(2)

The maximum peak output power of the intentional radiator shall not exceed 0.25 watts for systems employing less than 50 hopping channels, but at least 25 hopping channels. (Conducted Measurement)

The peak output power was measured at CH1, CH15, and at CH31. The measurement was made using a direct connection between the RF output of the EUT and the spectrum analyzer. After the measurement was made, the cable and the attenuator loss was added to the measurement. The spectrum analyzer's resolution bandwidth was greater than the 20dB bandwidth of the modulated carrier and the video bandwidth was equal to the resolution bandwidth.

Test Setup



Peak Power Output CH1 = .226 Watts

CH15 = .238 Watts

CH31 = .249 Watts

4.5.1 Antenna Gain

If peak power output was performed using the conducted method then the antenna gain will be stated.

The Substitution method was used.

The measurement was performed with out modulation. The transmitter under test was placed on a non-conductive table 80cm above the ground plane. The spectrum analyzer was tuned to the transmitter carrier frequency and the turntable was rotated 360 degrees about the vertical axis until the highest maximum signal was received. Then the receive antenna was raised and lowered 1 to 4 meters until the maximum signal was detected. Then the substitution dipole antenna and signal generator replaced the transmitter under test and both the receive and substitution dipole antennas were placed in the vertical polarization. The input signal to the substitution antenna was adjusted to the maximum signal received from the transmitter. The receive antenna was then raised and lowered to ensure the maximum signal was still received. The cable to the dipole was then removed and attached to a calibrated power meter to record the power level and added to the substitution dipole gain to obtain the EIRP level. Then the steps above were repeated for the horizontal polarization. The gain of the EUT antenna is the difference between the measured RF power at the RF port and the measured EIRP.

4.5.1.1 Results

Frequency	Polarization	Conducted Power Measurement	Measured EIRP	Antenna Gain
902.8 MHz	Vertical	23.55 dBm	21.86 dBm	-1.69 dBi
902.8 MHz	Horizontal	23.55 dBm	12.2 dBm	-11.35 dBi
908.4 MHz	Vertical	23.77 dBm	23.92 dBm	0.15 dBi
908.4 MHz	Horizontal	23.77 dBm	14.45 dBm	-9.32 dBi
914.8MHz	Vertical	23.96 dBm	24.95 dBm	0.99 dBi
914.8 MHz	Horizontal	23.96 dBm	14.67 dBm	-9.29 dBi

4.6 Spurious Emissions FCC Part 15.247(c)

4.6.1 Test Methodology

4.6.1.1 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 each 6° 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.

4.6.1.2 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.

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.

4.6.1.3 Deviations

There were no deviations from this test methodology.

4.6.2 Test Results

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

4.6.2.1 Radiated Emissions Outside the Frequency Band

In any 100kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20 dB below that in the 100 kHz bandwidth within the band that contains the highest level of desired power, based on radiated measurements.

SOP 1 Radiated Emissions **Tracking #** 30361342.002 Page 1 of 2

EUT Name	Form 16S A3 ALPHA Meter/Collector	**Date**	19 June 2003
EUT Model	ZA3300KD0xx	**Temp / Hum in**	73 deg. F / 48 %rh
EUT Serial	04578385	**Temp / Hum out**	N/A
Standard	FCC 47 CFR Part 15, RSS-210 Issue 5	**Line AC / Freq**	277 VAC / 60 Hz
Dist/Ant Used	3 meters / SAS-516 (200MHz to 1GHz) 3115-5770 (1GHz to 10 GHz)	**Performed by**	Randy Sherian

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)	20dB Below Fundamental (dBuV/m)	Spec Margin (dB)
X Plane (The fundamental of the EUT was tested in all three planes and X Plane was worse case.)										
Peak Measurements.										
Fundamental CH 31										
914.80	H	1.2	55	89.48	0.00	2.38	23.40	115.27	N/A	
955.80	H	1.2	236	28.49	0.00	2.44	23.12	54.05	95.27	-41.22
935.40	H	1.34	60	27.60	0.00	2.39	23.09	53.08	95.27	-42.19
873.90	H	1.22	60	31.54	0.00	2.34	22.42	56.30	95.27	-38.97
894.50	H	1.0	10	25.11	0.00	2.37	22.50	49.98	95.27	-45.29
1830.00	H	1.58	73	52.35	36.09	3.82	28.28	48.36	95.27	-46.91
914.80	V	1.59	359	98.16	0.00	2.38	21.79	122.34	N/A	
955.80	V	1.54	350	39.49	0.00	2.44	22.40	64.33	102.34	-38.01
935.40	V	1.54	346	37.65	0.00	2.39	22.31	62.35	102.34	-39.99
873.90	V	1.58	331	35.05	0.00	2.34	21.28	58.67	102.34	-43.67
894.50	V	1.69	350	32.97	0.00	2.37	21.13	56.47	102.34	-45.87
1830.00	V	1.0	32	49.81	36.09	3.82	28.28	45.82	102.34	-56.52
Fundamental CH 15										
908.40	H	1.13	55	89.60	0.00	2.37	23.50	115.47	N/A	
867.30	H	1.0	326	26.69	0.00	1.56	22.50	50.75	95.47	-44.72
888.00	H	1.0	350	23.48	0.00	1.62	22.50	47.60	95.47	-47.87
928.80	H	1.35	42	26.42	0.00	1.62	23.12	51.16	95.47	-44.31
949.30	H	1.76	87	31.38	0.00	1.64	22.99	56.00	95.47	-39.47
1817.00	H	1.2	64	44.08	36.08	3.79	28.22	40.01	95.47	-55.46

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:
RBW = 100kHz. VBW = 100kHz.

SOP 1 Radiated Emissions **Tracking #** 30361342.002 Page 2 of 2

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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)	20dB Below Fundamental (dBuV/m)	Spec Margin (dB)
X Plane (The fundamental of the EUT was tested in all three planes and X Plane was worse case.)										
Peak Measurements.										
Fundamental CH 15										
908.40	V	1.0	357	97.50	0.00	2.37	21.50	121.37	N/A	
867.50	V	1.67	332	34.26	0.00	1.56	21.30	57.12	101.37	-44.25
888.00	V	1.61	350	30.97	0.00	1.62	21.40	53.99	101.37	-47.38
928.80	V	1.57	10	35.21	0.00	1.62	22.23	59.06	101.37	-42.31
949.30	V	1.0	350	38.68	0.00	1.64	22.67	62.99	101.37	-38.38
1817.00	V	1.35	81	53.75	36.08	3.79	28.22	49.68	101.37	-51.69
Fundamental CH 1										
902.80	H	1.0	20	87.63	0.00	2.37	23.24	113.24	N/A	
861.80	H	1.24	51	29.51	0.00	2.30	22.56	54.37	93.24	-38.87
882.20	H	1.0	10	22.44	0.00	2.37	22.56	47.36	93.24	-45.88
943.90	H	1.0	246	29.73	0.00	2.41	22.92	55.06	93.24	-38.18
1805.00	H	1.28	72	53.30	36.07	3.75	28.16	49.14	93.24	-44.10
902.80	V	1.01	0	95.94	0.00	2.37	21.26	119.57	N/A	
861.80	V	1.17	10	36.53	0.00	2.30	21.46	60.29	99.57	-39.28
882.20	V	1.7	350	30.23	0.00	2.37	21.46	54.05	99.57	-45.52
943.90	V	1.0	10	39.11	0.00	2.41	22.48	64.00	99.57	-35.57
1805.00	V	1.38	10	56.52	36.07	3.75	28.16	52.36	99.57	-47.21

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:
RBW = 100kHz. VBW = 100kHz.

4.6.2.2 Restricted band measurements

Radiated emissions which fall in the restricted bands, as defined in 15.205(a), must also comply with the radiated emission limits specified in 15.209(a) (see 15.205(c)).

SOP 1 Radiated Emissions **Tracking #** 30361342.002 Page 1 of 6

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EUT Serial	04578385	**Temp / Hum out**	N/A
Standard	FCC 47 CFR Part 15, RSS-210 Issue 5	**Line AC / Freq**	277 VAC / 60 Hz
Dist/Ant Used	3 meters / SAS-516 (200MHz to 1GHz) 3115-5770 (1GHz to 10 GHz)	**Performed by**	Randy Sherian

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)
X Plane (The fundamental of the EUT was tested in all three planes and X Plane was worse case.)										
Fundamental CH 31										
Spurious Emissions, Peak Measurements										
2744.00	H	1.0	279	54.84	35.91	4.74	31.14	54.81	74.00	-19.19
3659.00	H	1.34	63	45.04	35.49	5.53	33.54	48.62	74.00	-25.38
4574.00	H	1.09	321	44.22	35.89	6.28	34.05	48.66	74.00	-25.34
Spurious Emissions, Average Measurements										
2744.00	H	1.0	279	49.18	35.91	4.74	31.14	49.15	54.00	-4.85
3659.00	H	1.34	63	37.27	35.49	5.53	33.54	40.85	54.00	-13.15
4574.00	H	1.09	321	37.09	35.89	6.28	34.05	41.53	54.00	-12.47

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:
RBW/VBW=1MHz/1MHz for frequencies between 1Ghz to 10 GHz for peak measurements.
RBW/VBW=1MHz/30Hz for frequencies between 1Ghz to 10 GHz for average measurements.

SOP 1 Radiated Emissions **Tracking #** 30361342.002 Page 2 of 6

EUT Name	Form 16S A3 ALPHA Meter/Collector	**Date**	19 June 2003
EUT Model	ZA3300KD0xx	**Temp / Hum in**	73 deg. F / 48 %rh
EUT Serial	04578385	**Temp / Hum out**	N/A
Standard	FCC 47 CFR Part 15, RSS-210 Issue 5	**Line AC / Freq**	277 VAC / 60 Hz
Dist/Ant Used	3 meters / SAS-516 (200MHz to 1GHz) 3115-5770 (1GHz to 10 GHz)	**Performed by**	Randy Sherian

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)
48 X Plane (The fundamental of the EUT was tested in all three planes and X Plane was worse case.)										
Fundamental CH 31										
Spurious Emissions, Peak Measurements										
2744.00	V	1.0	350	49.78	35.91	4.74	31.19	49.80	74.00	-24.20
3659.00	V	1.0	10	45.69	35.49	5.53	33.34	49.07	74.00	-24.93
4574.00	V	1.0	21	44.24	35.89	6.28	33.88	48.51	74.00	-25.49
Spurious Emissions, Average Measurements										
2744.00	V	1.0	350	45.14	35.91	4.74	31.19	45.16	54.00	-8.84
3659.00	V	1.0	10	39.34	35.49	5.53	33.34	42.72	54.00	-11.28
4574.00	V	1.0	21	37.91	35.89	6.28	33.88	42.18	54.00	-11.82

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:
RBW/VBW=1MHz/1MHz for frequencies between 1Ghz to 10 GHz for peak measurements.
RBW/VBW=1MHz/30Hz for frequencies between 1Ghz to 10 GHz for average measurements.

SOP 1 Radiated Emissions **Tracking #** 30361342.002 Page 3 of 6

EUT Name	Form 16S A3 ALPHA Meter/Collector	**Date**	19 June 2003
EUT Model	ZA3300KD0xx	**Temp / Hum in**	73 deg. F / 48 %rh
EUT Serial	04578385	**Temp / Hum out**	N/A
Standard	FCC 47 CFR Part 15, RSS-210 Issue 5	**Line AC / Freq**	277 VAC / 60 Hz
Dist/Ant Used	3 meters / SAS-516 (200MHz to 1GHz) 3115-5770 (1GHz to 10 GHz)	**Performed by**	Randy Sherian

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)
X Plane (The fundamental of the EUT was tested in all three planes and X Plane was worse case.)										
Fundamental CH 15										
Spurious Emissions, Peak Measurements										
2725.00	H	1.22	279	46.73	35.93	4.72	31.10	46.61	74.00	-27.39
3633.00	H	1.0	50	44.31	35.52	5.52	33.45	47.76	74.00	-26.24
4542.00	H	1.14	276	44.08	35.85	6.26	33.98	48.47	74.00	-25.53
9083.00	H	1.0	266	40.44	36.51	9.38	39.75	53.06	74.00	-20.94
Spurious Emissions, Average Measurements										
2725.00	H	1.22	279	39.40	35.93	4.72	31.10	39.28	54.00	-14.72
3633.00	H	1.0	50	35.38	35.52	5.52	33.45	38.83	54.00	-15.17
4542.00	H	1.14	276	35.35	35.85	6.26	33.98	39.74	54.00	-14.26
9083.00	H	1.0	266	31.36	36.51	9.38	39.75	43.98	54.00	-10.02

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:
RBW/VBW=1MHz/1MHz for frequencies between 1Ghz to 10 GHz for peak measurements.
RBW/VBW=1MHz/30Hz for frequencies between 1Ghz to 10 GHz for average measurements.

SOP 1 Radiated Emissions **Tracking #** 30361342.002 Page 4 of 6

EUT Name	Form 16S A3 ALPHA Meter/Collector	**Date**	19 June 2003
EUT Model	ZA3300KD0xx	**Temp / Hum in**	73 deg. F / 48 %rh
EUT Serial	04578385	**Temp / Hum out**	N/A
Standard	FCC 47 CFR Part 15, RSS-210 Issue 5	**Line AC / Freq**	277 VAC / 60 Hz
Dist/Ant Used	3 meters / SAS-516 (200MHz to 1GHz) 3115-5770 (1GHz to 10 GHz)	**Performed by**	Randy Sherian

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)
X Plane (The fundamental of the EUT was tested in all three planes and X Plane was worse case.)										
Fundamental CH 15										
Spurious Emissions, Peak Measurements										
2725.00	V	1.29	41	45.31	35.93	4.72	31.15	45.25	74.00	-28.75
3633.00	V	1.1	6	46.15	35.52	5.52	33.25	49.40	74.00	-24.60
4542.00	V	1.08	22	43.60	35.85	6.26	33.80	47.81	74.00	-26.19
9083.00	V	1.12	323	41.19	36.51	9.38	39.63	53.69	74.00	-20.31
Spurious Emissions, Average Measurements										
2725.00	V	1.29	41	39.59	35.93	4.72	31.15	39.53	54.00	-14.47
3633.00	V	1.1	6	38.76	35.52	5.52	33.25	42.01	54.00	-11.99
4542.00	V	1.08	22	34.12	35.85	6.26	33.80	38.33	54.00	-15.67
9083.00	V	1.21	323	32.51	36.51	9.38	39.63	45.01	54.00	-8.99

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:
RBW/VBW=1MHz/1MHz for frequencies between 1Ghz to 10 GHz for peak measurements.
RBW/VBW=1MHz/30Hz for frequencies between 1Ghz to 10 GHz for average measurements.

SOP 1 Radiated Emissions **Tracking #** 30361342.002 Page 5 of 6

EUT Name	Form 16S A3 ALPHA Meter/Collector	**Date**	19 June 2003
EUT Model	ZA3300KD0xx	**Temp / Hum in**	73 deg. F / 48 %rh
EUT Serial	04578385	**Temp / Hum out**	N/A
Standard	FCC 47 CFR Part 15, RSS-210 Issue 5	**Line AC / Freq**	277 VAC / 60 Hz
Dist/Ant Used	3 meters / SAS-516 (200MHz to 1GHz) 3115-5770 (1GHz to 10 GHz)	**Performed by**	Randy Sherian

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)
X Plane (The fundamental of the EUT was tested in all three planes and X Plane was worse case.)										
Fundamental CH 1										
Spurious Emissions, Peak Measurements										
2708.00	H	1.0	274	46.20	35.96	4.69	31.06	45.99	74.00	-28.01
3611.00	H	1.17	98	46.87	35.58	5.45	33.38	50.12	74.00	-23.88
4514.00	H	1.12	274	43.64	35.79	6.22	33.93	48.00	74.00	-26.00
5147.00	H	1.0	24	41.03	35.40	6.76	35.19	47.58	74.00	-26.42
9028.00	H	1.0	244	42.44	36.45	9.36	39.92	55.27	74.00	-18.73
Spurious Emissions, Average Measurements										
2708.00	H	1.0	274	39.20	35.96	4.69	31.06	38.99	54.00	-15.01
3611.00	H	1.17	98	39.15	35.58	5.45	33.38	42.40	54.00	-11.60
4514.00	H	1.12	274	35.26	35.79	6.22	33.93	39.62	54.00	-14.38
5147.00	H	1.0	24	31.03	35.40	6.76	35.19	37.58	54.00	-16.42
9028.00	H	1.0	244	32.34	36.45	9.36	39.92	45.17	54.00	-8.83

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:
RBW/VBW=1MHz/1MHz for frequencies between 1Ghz to 10 GHz for peak measurements.
RBW/VBW=1MHz/30Hz for frequencies between 1Ghz to 10 GHz for average measurements.

SOP 1 Radiated Emissions **Tracking #** 30361342.002 Page 6 of 6

EUT Name	Form 16S A3 ALPHA Meter/Collector	**Date**	19 June 2003
EUT Model	ZA3300KD0xx	**Temp / Hum in**	73 deg. F / 48 %rh
EUT Serial	04578385	**Temp / Hum out**	N/A
Standard	FCC 47 CFR Part 15, RSS-210 Issue 5	**Line AC / Freq**	277 VAC / 60 Hz
Dist/Ant Used	3 meters / SAS-516 (200MHz to 1GHz) 3115-5770 (1GHz to 10 GHz)	**Performed by**	Randy Sherian

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)
X Plane (The fundamental of the EUT was tested in all three planes and X Plane was worse case.)										
Fundamental CH 1										
2708.00	V	1.28	48	43.94	35.96	4.69	31.12	43.79	74.00	-30.21
3611.00	V	1.11	15	49.55	35.58	5.45	33.18	52.60	74.00	-21.40
4514.00	V	1.0	22	43.17	35.79	6.22	33.73	47.33	74.00	-26.67
5147.00	V	1.19	273	42.64	35.40	6.76	35.14	49.13	74.00	-24.87
9028.00	V	1.0	272	43.05	36.45	9.36	39.81	55.77	74.00	-18.23
Spurious Emissions, Average Measurements										
2708.00	V	1.28	48	34.90	35.96	4.69	31.12	34.75	54.00	-19.25
3611.00	V	1.11	15	42.73	35.58	5.45	33.18	45.78	54.00	-8.22
4514.00	V	1.0	22	35.66	35.79	6.22	33.73	39.82	54.00	-14.18
5147.00	V	1.19	273	33.56	35.40	6.76	35.14	40.05	54.00	-13.95
9028.00	V	1.0	272	32.74	36.45	9.36	39.81	45.46	54.00	-8.54

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:
RBW/VBW=1MHz/1MHz for frequencies between 1Ghz to 10 GHz for peak measurements.
RBW/VBW=1MHz/30Hz for frequencies between 1Ghz to 10 GHz for average measurements.

4.7 Frequency Hopping Spread Spectrum Systems FCC Part 15.247(g)

Frequency hopping spread spectrum systems are not required to employ all available hopping channels during each transmission. However, the system, consisting of both the transmitter and the receiver, must be designed to comply with all of the regulations in this section should the transmitter be presented with a continuous data (or information) stream. In addition, a system employing short transmission bursts must comply with the definition of a frequency hopping system and must distribute its transmissions over the minimum number of hopping channels specified in this section.

When the REX Meter is presented with a continuous data stream, each 97.3 msec packet transmitted by the meter will be sent on the next channel in the 25-channel pseudo random list. When presented with a continuous data stream, the REX meter adheres to the 0.4 second dwell time for each 10 second window requirement. The REX Meter always distributes its transmissions across all 25 channels, and does not re-use a channel again until a transmission has occurred on each of the other 24 channels.

4.8 Incorporation of Intelligence within a Frequency Hopping Spread Spectrum System FCC Part 15.247(h)

The incorporation of intelligence within a frequency hopping spread spectrum system that permits the system to recognize other users within the spectrum band so that it individually and independently chooses and adapts its hopsets to avoid hopping on occupied channels is permitted. The coordination of frequency hopping systems in any other manner for the express purpose of avoiding the simultaneous occupancy of individual hopping frequencies by multiple transmitters is not permitted.

The REX meter does not attempt to recognize other users or interferers within the spectrum band and then attempt to select which channels to use. The REX Meter always distributes its transmissions across the same 25 channels. A channel is not re-used until a transmission has occurred on each of the other 24 channels.

4.9 Frequency Stability FCC Part 15.215(c)

The requirement to contain the 20 dB bandwidth of the emission within the specified frequency band includes effects from frequency sweeping, frequency hopping and other modulation techniques that may be employed as well as the frequency stability of the transmitter over expected variations in temperature and supply voltage.

4.9.1 Containment of the Emission during Variations in Temperature

The EUT was placed in an environmental temperature test chamber, supplied with the normal AC voltage, and with an antenna attached to the output port. If the antenna is an adjustable length antenna, it will be fully extended. The monitoring device (ie. Spectrum analyzer) was then attached to a receive antenna placed 15 cm away from the EUT via coaxial cable.

The temperature inside the chamber is then raised to the highest temperature specified and allowed sufficient time for the temperature of the chamber to stabilize. While maintaining a constant temperature inside the environmental chamber, the carrier signal was then measured 40 min after temperature stabilization. Then the above process is repeated for the lowest temperature specified and 10 degree Centigrade increments between the extremes thereafter.

Results

Channel 1 (Modulated)

Temperature	Frequency in MHz measured 20dB below peak		Permitted Band in MHz	Results
-30° C	902.58	902.97	902 - 928	Pass
-20° C	902.59	902.97	902 - 928	Pass
-10° C	902.59	902.98	902 - 928	Pass
0° C	902.59	902.97	902 - 928	Pass
10° C	902.59	902.96	902 - 928	Pass
20° C	902.60	902.98	902 - 928	Pass
30° C	902.58	902.97	902 - 928	Pass
40° C	902.58	902.97	902 - 928	Pass
50° C	902.58	902.97	902 - 928	Pass

Channel 31 (Modulated)

Temperature	Frequency in MHz measured 20dB below peak		Permitted Band in MHz	Results
-30° C	914.62	915.00	902 - 928	Pass
-20° C	914.62	915.00	902 - 928	Pass
-10° C	914.62	915.00	902 - 928	Pass
0° C	914.62	915.00	902 - 928	Pass
10° C	914.62	915.00	902 - 928	Pass
20° C	914.62	915.01	902 - 928	Pass
30° C	914.62	915.01	902 - 928	Pass
40° C	914.63	915.01	902 - 928	Pass
50° C	914.63	915.01	902 - 928	Pass

Spectrum Analyzer Parameters:

RBW=30MHz

VBW=RBW

Span=1MHz

LOG dB/div.= 10dB

Sweep = 9.167 mS

Trigger Video

4.9.2 Containment of the Emission during Variations in Voltage

The setup was identical section 4.7.1 except the temperature inside of the chamber was set to 17 deg. C.

Channel 1 (Modulated)

Voltage	Frequency in MHz measured 20dB below peak		Permitted Band in MHz	Results
102	902.58	902.96	902 - 928	Pass
277	902.58	902.96	902 - 928	Pass
318	902.58	902.96	902 - 928	Pass

Channel 31 (Modulated)

Temperature	Frequency in MHz measured 20dB below peak		Permitted Band in MHz	Results
102	914.62	915	902 - 928	Pass
277	914.62	915	902 - 928	Pass
318	914.62	915	902 - 928	Pass

Spectrum Analyzer Parameters:

RBW=30MHz

VBW=RBW

Span=1MHz

LOG dB/div.= 10dB

Sweep = 9.167 mS

Trigger Video

4.9.3 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)

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

4.10 Conducted Emissions

Testing was performed in accordance with 47 CFR Part 15.207, ANSI C63.4:1992, RSS-210 Issue 5. 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.

4.10.1 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 4. 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.

4.10.1.1 Deviations

There were no deviations from this test methodology.

4.10.2 Test Results

Section 4.10.2.1 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).

4.10.2.1 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 # 30361342.002 Page 1 of 1

EUT Name	Form 16S A3 ALPHA Meter/Collector	**Date**	9 July 2003
EUT Model	ZA3300KD0xx	**Temperature**	73 deg. F
EUT Serial	04578385	**Humidity**	51 %rh
Standard	FCC 47 CFR Part 15, RSS-210 Issue 5	**Line AC/Freq**	277 VAC / 60 Hz
LISNs Used	987655, 987653	**Performed by**	Randy Sherian

Emission Freq (MHz)	Line ID (1,2,3,N)	FIM Quasi (dBuV)	FIM Ave (dBuV)	Cable Loss (dB)	LISN CF (dB)	-13dB For FCC BB Signal (Y/N)	FIM Value (dBuV)	Spec Limit (dB)	Spec Margin (dB)
.461	1	43.57		0.00	0.00	N	43.57	48.00	-4.43
2.62	1	32.53		0.00	0.00	N	32.53	48.00	-15.47
3.2	1	32.07		0.00	0.00	N	32.07	48.00	-15.93
.470	2	44.28		0.00	0.00	N	44.28	48.00	-3.72
.849	2	35.74		0.00	0.00	N	35.74	48.00	-12.26
24.57	2	25.18		0.00	0.00	N	25.18	48.00	-22.82

Spec Margin = FIM Value - Spec Limit ± Uncertainty
FIM Value = FIM Quasi + Cable Loss + LISN CF (if FIM Quasi - FIM Ave ≥ 6dB) then - 13dB

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

Notes:

4.10.3 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)

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

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	Hewlett Packard	8449B	3008A00268	7-Feb-03	7-Feb-04
Ant. Biconical	EMCO	3110B	3367	6-Jan-03	6-Jan-04
Ant. Log Periodic	AH Systems	SAS-516	133	3-Jan-03	3-Jan-04
Antenna Horn	EMCO	3115	2236	30-Sep-02	30-Sep-05
Ant. Dipole Set BL 1-4	EMCO	3121C	9302-914	16-Sep-02	16-Sep-03
Power Sensor	Boonton	51011-EMC	32203	12-Aug-02	12-Aug-03
Meter, RF Power	Boonton	4231A	66801	12-Aug-02	12-Aug-03
Cable, Coax	Andrew	FSJ1-50A	031	28-Jan-03	28-Jan-04
Cable, Coax	Andrew	FSJ1-50A	041	29-Jan-03	29-Jan-04
Cable, Coax	Andrew	FSJ1-50A	042	29-Jan-03	29-Jan-04
Cable, Coax	Andrew	FSJ1-50A	045	29-Jan-03	29-Jan-04
Chamber, Semi-Anechoic	Braden Shielding	5 meter	A67631	26-Mar-03	26-Mar-04
Data Table, EMCWin	TUV EMC	EMCWin.dll	002	6-Jan-02	6-Jan-06
Spectrum Analyzer	Agilent Tec.	E7405A	US39440161	5-Aug-02	5-Aug-03

SOP 2 - Conducted Emissions (AC/DC and Signal I/O)					
Cable, Coax	Andrew	FSJ1-50A	049	31-Jan-03	31-Jan-04
LISN 50uH/50A (Elster)	Solar Electronics	9247-50-TS-50-N	987655	12-Sept-02	12-Sept-03
LISN 50uH/50A (Elster)	Solar Electronics	9247-5-TS-50-N	987653	12-Sept-02	12-Sept-03
Spectrum Analyzer	Agilent Tec.	E7405A	US39440161	5-Aug-02	5-Aug-03

General Laboratory Equipment					
Filter, High Pass	Bonn	BHF1500	025155	11-Aug-02	11-Aug-03
Meter, Multi	Fluke	79-3	69200606	5-Aug-02	5-Aug-03
Meter, Temp/Humid/Barom	Fisher	02-400	01	21-Aug-02	21-Aug-03
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 Introduction

This manufacturer-supplied document provides a description of the Equipment Under Test (EUT), configuration(s), operating condition(s), and performance acceptance criteria. It is intended to provide the test laboratory with the essential information needed to perform the requested testing.

6.1 Customer

The information in the following tables is required, as it should appear in the final test report.

Table 2 – Manufacturer Information

Company Name:	Elster Electricity, LLC
Street Address:	208 South Rogers Lane
City, State, Zip Code:	Raleigh, NC 27610
Tel:	919-212-4700
Fax:	919-212-5108

Table 3 – Technical Contact Information

Contact Name	Telephone	Fax	Email address
Bob Mason	919-212-5086	919-250-5486	robert.t.mason@us.abb.com

6.2 Equipment Under Test (EUT)

The information provided in the following table is listed as it should appear in the final report. Note that the last two characters in the model number (style number) designate firmware functionality that may be enabled/disabled without hardware changes. Units submitted for test were shipped with all firmware functionality enabled. From this point forward, the A3 ALPHA Meter/Collector will be referred to as the A3 Collector.

Table 4 – EUT Designation

EUT	Model Name	Model Number (Elster Style Number)
Form 16S A3 ALPHA Meter/Collector	A3 ALPHA Meter/Collector	ZA3300KD0xx

6.2.1 Technical Description

6.2.1.1 Device Type

The A3 Collector is an intentional radiator and is classified as a Part 15.247 device. The critical specifications of the A3 Collector are listed in the following table:

Frequency Band	902 – 915 MHz
Classification	Frequency Hopping Spread Spectrum
Maximum Output Power	0.25W (+24 dBm)
Channel Spacing	400 kHz
Channel 20 dB Bandwidth	325 kHz
Number of Channels	25
Max channel dwell time within a 10 second period	< 0.4 seconds

6.2.1.2 Electronic Assembly Description

Refer to the document titled “A3 Collector Description.doc”

6.2.2 Configuration(s)

The meters to be tested are installed in meter sockets appropriate for measuring electricity consumption. The following standard meter forms have been provided for test:

Meter Form	Test Voltages
Form 16S	120 and 277V ac

All units have an internal antenna that is permanently affixed to the A3 ALPHA meter’s electronic housing. There are no other antenna options to be tested. The A3 Collector consists of an Internal LAN Controller (ILC) option board that has a 900 MHz 2-way radio. A second option board, the Internal Telephone Modem (ITM), is a 2400 baud analog telephone modem. To provide an interface for this modem, a telephone cable with an RJ11 connector is routed out of the base of the meter. Elster Electricity will provide a 600-ohm termination for the phone line.

Figure 6 – Picture of an A3 Collector without cover

6.2.3 Operating Conditions

The nominal line voltages typically seen by the REX meters to be tested are based on the meter form:

Meter Form	Test Voltage
Form 16S	240V ac

6.2.3.1 Firmware and Software

There are 3 sets of microprocessors in the A3 Collector. The A3 ALPHA meter has a 16-bit Mitsubishi M16C microprocessor and it will be labeled as firmware version 2.3. The ITM has a 16-bit Hitachi 3664 microprocessor and it will be labeled as firmware version 68. The ILC has a 16-bit Hitachi 2148B microprocessor and it will be labeled as firmware version 255.81.

A software program titled "Meter Explorer" will be used to exercise the A3 Collector and place the meter in various modes of operation required to test that the meters adhere to the FCC guidelines. Elster Electricity will provide the test lab with a laptop pc with the software and the interface hardware required to communicate to the REX meter.

6.2.3.2 Mode(s)

Refer to Section 6.2.3.6.

6.2.3.3 Testing the A3 Collector

6.2.3.3.1 Required Equipment

The following equipment is required to communicate to the A3 Collector to change the operating mode for test purposes:

1. A pc with a Windows NT or Windows 2000 operating system.
2. An Elster Electricity software program titled "MeterExplorer". This software tool can be used to place the A3 Collector (ILC) into the various test modes. The software on a CD or a laptop computer with the software loaded will be provided to the test lab. Version 3.0.9 or higher of MeterExplorer is required.
3. An optical probe and associated optical probe power supply.

Elster Electricity will provide the test lab with a laptop pc with the optical probe and power supply. The description of the test setup has already been done on this laptop, and the reader of this document can skip to Section 6.2.3.5.

6.2.3.4 Test Setup

To communicate to the A3 Collector, the optical probe must be plugged into a serial port on the pc and must also be plugged into the optical probe power supply. The optical probe is then hung on the optical hanger on the cover of the A3 Collector.

6.2.3.4.1 MeterExplorer Setup

By default, MeterExplorer is installed to the following directory:

C:\Program Files\ABB\MeterTools\

Assuming the default directory is not changed, the following step must be followed to allow MeterExplorer access to the proper meter definition file:

- Copy the files titled “REX_LANOB_255_81.MD” and “REX_NODE_LANOB_255_81.MD” to the following folder: C:\Program Files\ABB\MeterTools\MD\REX\

Note that the 255_81 suffixes on the end of the file names indicate the firmware release. The firmware release and the file names may change accordingly.

6.2.3.5 Running MeterExplorer

From the Start menu, open MeterExplorer as follows:

Start ▶ Programs ▶ MeterTools ▶ MeterExplorer

6.2.3.5.1 MeterExplorer Properties

At the top of the MeterExplorer window, there are 3 drop down menus that allow selection of the meter type, communication medium, and the communication protocol. To communicate to the ILC in the A3 Collector, these drop downs must be set to the following:

- REX.REX_LANOB_255_81
- OPTICAL_PROBE
- ANSI_C12_18

This MeterExplorer GUI configured for the A3 Collector is shown in Figure 7.

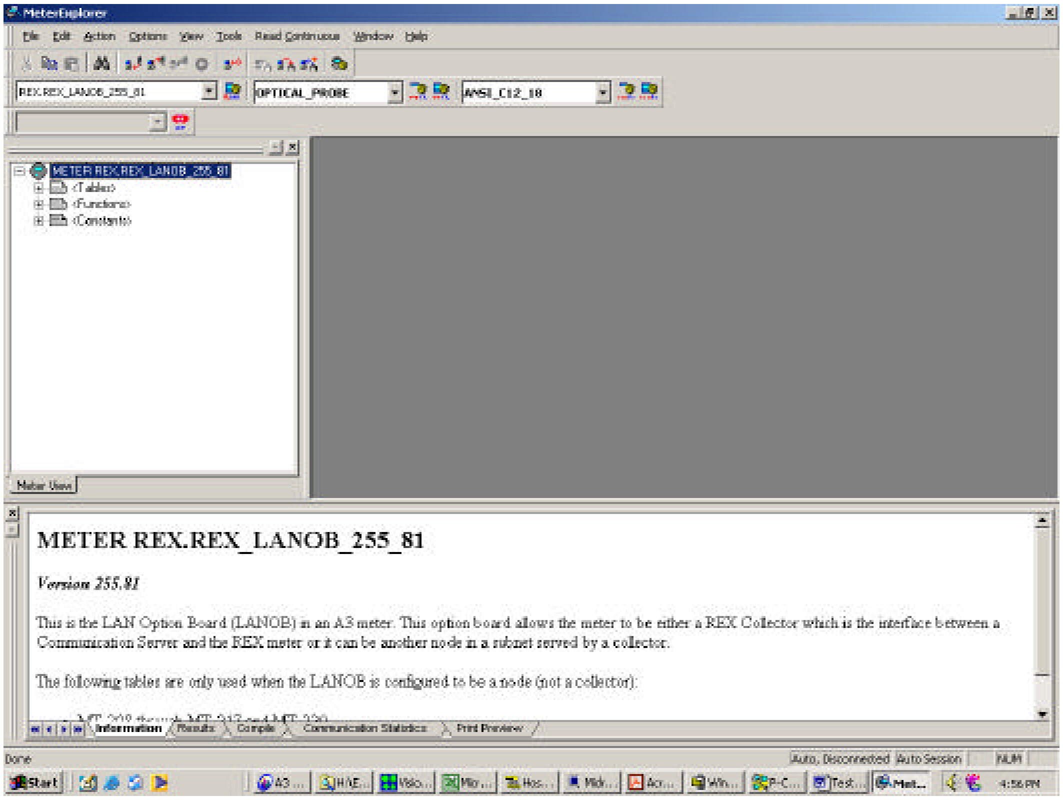

Figure 7: MeterExplorer GUI

To the immediate right of the communication medium (i.e. OPTICAL_PROBE) drop down menu is a tool button that allows the communication port and medium to be configured. By default, MeterExplorer uses Com Port 1 for communications. If you are using a different serial port on the pc, click the button and change the serial port to the port to which the optical probe is connected.

To the immediate right of the communication protocol (i.e. ANSI_C12_18) drop down menu is a tool button that allows the communication protocol to be configured. Click on this tool button to check that the following properties are set correctly:

- Session baud = 9600
- Under the Authentication tab, Password = 00000000000000000000 (twenty ASCII zeros)

6.2.3.5.2 Using MeterExplorer

MeterExplorer can be used to read or write tables to the ILC option board and to force the ILC option board in the meter to execute functions or commands. To read or write tables, expand the <Tables> item by clicking on the + box and then select the desired table by highlighting the table in the table list in the left-hand window. The table then can be accessed one of two ways:

1. From the main menu: **Action▶Read** or **Action▶Write**

   OR

2. Right click the mouse while it is over the highlighted table and click the right mouse button. From the pop-up menu, select **Read** or **Write**

To execute a function, expand the <Functions> item by clicking on the + box and then select the desired function by highlighting the function in the function list in the left-hand window. The function can then be executed one of two ways:

1. From the main menu: **Action▶Execute Function(s)**

   OR

2. Right click the mouse while it is over the highlighted function and click the right mouse button. From the pop-up menu, select **Execute Function(s)**

6.2.3.6 Description of Test Modes in the ILC

The ILC option board supports the following test modes of operation to facilitate FCC and manufacturing tests:

1. Test mode - Constant transmit, unmodulated data on a single channel
2. Test mode - Constant transmit – modulated data on a single channel
3. Test mode - Constant transmit – normal hopping, hopping between the 25 channels in the pseudo-random list of channels
4. Test mode - Constant receive mode on a single channel
5. Normal operation – Receive mode unless it is time for a scheduled transmit event to occur.

The following sections describe how the MeterExplorer software can be used to place the meter in the various modes.

For all the tests, the radio channel is specified as a number from 0 to 31, with the center frequency of the channel calculated from the following formula:

Center Frequency = 902.4 + Channel * 0.4 (MHz)

For example, channel 0 is:

Center Frequency = 902.4 + 0 * 0.4 (MHz) = 902.4 MHz

and channel 31 is:

Center Frequency = 902.4 + 31 * 0.4 (MHz) = 914.8 MHz

6.2.3.6.1 Test Modes Controlled by Parameters in MT-224

MT-224 is a configuration table that controls the operation of the 900 MHz radio. The table allows for the ILC to be placed in test modes of operation. The table will typically be read, the contents of the table modified, and then the table written back to the ILC.

To change the contents of MT-224, first read the table by doing the following:

1. Under the list of tables in the REX.REX_LANOB_255_81 highlight MT_224_LAN_CONFIGURATION.

2. With the table selected, right click on the mouse to bring up a pop-up menu and select **Read**

3. After reading the table, change the parameters necessary for the test (refer to Sections 6.2.3.6.1.1 and 6.2.3.6.1.4).

4. With the table selected, right click on the mouse to bring up a menu and select **Write**

After the table is written, the changes will only take affect if one of the following events occurs:

1. Power is cycled to the A3 Collector. After power is restored, the ILC delays 15 seconds prior to using the contents of MT-224.

2. MF_064_INITIATE_HEALTH_CHECK is sent to the ILC to tell it to reload configuration tables (i.e. MT-224) and immediately start using the reloaded configuration. To execute MF-064, highlight MF_064_INITIATE_HEALTH_CHECK in the functions items on the left side of the screen, right click on the mouse to bring up the pop-up menu, and select **Execute Function(s)**.

To take the unit out of test mode, the table must be written again with the parameters returned to the normal state. This can be done by reversing the procedure listed above or by following the procedures listed in Section 6.2.3.6.2 to put the unit back into the normal operating mode.

6.2.3.6.1.1 Constant Transmit – Unmodulated Data

When placed in this mode, the ILC will continually transmit an unmodulated signal on a specific channel (frequency). To place the ILC (A3 Collector) in this mode, the following MT-224 parameters must be changed from the normal MT-224 configuration:

MT_224_LAN_CONFIGURATION.RADIO_CONFIG.FLAGS.IS_IN_TEST_MODE = 1 {True}

MT_224_LAN_CONFIGURATION.RADIO_CONFIG.FLAGS.IS_SENDER = 1 {True}

MT_224_LAN_CONFIGURATION.RADIO_CONFIG.CONF.TRANSMIT_CONTINUOUSLY = 2 {continuous, unmodulated}

MT_224_LAN_CONFIGURATION.RADIO_TEST_MODE_PARAMETERS.CHANNEL_LIST[0] = 0 – 31 (selects the channel)

WARNING: Once MT-224 is set as shown above, the ILC will stay in this constant transmit mode until MT-224 is written with the parameters set for normal operation. After the test is completed, make sure to reverse the procedure to put the ILC back into the normal operating mode. To do this, the MT-224 parameters must be changed back to their default values:

MT_224_LAN_CONFIGURATION.RADIO_CONFIG.FLAGS.IS_IN_TEST_MODE = 0 {False}

MT_224_LAN_CONFIGURATION.RADIO_CONFIG.FLAGS.IS_SENDER = 0 {False}

MT_224_LAN_CONFIGURATION.RADIO_TEST_MODE_PARAMETERS.NUM_PACKETS = 0

MT_224_LAN_CONFIGURATION.RADIO_TEST_MODE_PARAMETERS.SEND_DELAY = 0

MT_224_LAN_CONFIGURATION.RADIO_TEST_MODE_PARAMETERS.TEST_PACKET.PACKET_LENGTH = 0

6.2.3.6.1.2 Constant Transmit – Modulated Data

When placed in this mode, the ILC will continually transmit a modulated signal on a specific channel (frequency). To place the ILC (A3 Collector) in this mode, the following MT-224 parameters must be changed from the normal MT-224 configuration:

MT_224_LAN_CONFIGURATION.RADIO_CONFIG.FLAGS.IS_IN_TEST_MODE = 1 {True}

MT_224_LAN_CONFIGURATION.RADIO_CONFIG.FLAGS.IS_SENDER = 1 {True}

MT_224_LAN_CONFIGURATION.RADIO_CONFIG.CONF.TRANSMIT_CONTINUOUSLY = 1 {continuous, modulated}

MT_224_LAN_CONFIGURATION.RADIO_TEST_MODE_PARAMETERS.CHANNEL_LIST[0] = 0 – 31 (selects the channel)

WARNING: Once MT-224 is set as shown above, the ILC will stay in this constant transmit mode until MT-224 is written with the parameters set for normal operation. After the test is completed, make sure to reverse the procedure to put the ILC back into the normal operating mode. To do this, the MT-224 parameters must be changed back to their default values:

MT_224_LAN_CONFIGURATION.RADIO_CONFIG.FLAGS.IS_IN_TEST_MODE = 0 {False}

MT_224_LAN_CONFIGURATION.RADIO_CONFIG.FLAGS.IS_SENDER = 0 {False}

MT_224_LAN_CONFIGURATION.RADIO_TEST_MODE_PARAMETERS.NUM_PACKETS = 0

MT_224_LAN_CONFIGURATION.RADIO_TEST_MODE_PARAMETERS.SEND_DELAY = 0

MT_224_LAN_CONFIGURATION.RADIO_TEST_MODE_PARAMETERS.TEST_PACKET.PACKET_LENGTH = 0

6.2.3.6.1.3 Constant Transmit – Channel Hopping

When placed in this mode, the ILC will continually transmit packets, with each packet being approximately 97.3 msec in duration and an 8 – 16 msec off time between packets. Each packet is sent on the next channel in the pseudo-random list of channels (refer to details in the document that describes the operation of the A3 Collector).

To place the ILC (A3 Collector) in this mode, the following MT-224 parameters must be changed from the normal MT-224 configuration:

MT_224_LAN_CONFIGURATION.RADIO_CONFIG.FLAGS.IS_IN_TEST_MODE = 1 {True}

MT_224_LAN_CONFIGURATION.RADIO_CONFIG.FLAGS.IS_SENDER = 1 {True}

MT_224_LAN_CONFIGURATION.RADIO_TEST_MODE_PARAMETERS.NUM_PACKETS = 65,000

MT_224_LAN_CONFIGURATION.RADIO_TEST_MODE_PARAMETERS.SEND_DELAY = 0

MT_224_LAN_CONFIGURATION.RADIO_TEST_MODE_PARAMETERS.TEST_PACKET.PACKET_LENGTH = 70

WARNING: Once MT-224 is set as shown above, the ILC will stay in this constant transmit mode until MT-224 is written with the parameters set for normal operation. After the test is completed, make sure to reverse the procedure to put the ILC back into the normal operating mode. To do this, the MT-224 parameters must be changed back to their default values:

MT_224_LAN_CONFIGURATION.RADIO_CONFIG.FLAGS.IS_IN_TEST_MODE = 0 {False}

MT_224_LAN_CONFIGURATION.RADIO_CONFIG.FLAGS.IS_SENDER = 0 {False}

MT_224_LAN_CONFIGURATION.RADIO_TEST_MODE_PARAMETERS.NUM_PACKETS = 0

MT_224_LAN_CONFIGURATION.RADIO_TEST_MODE_PARAMETERS.SEND_DELAY = 0

MT_224_LAN_CONFIGURATION.RADIO_TEST_MODE_PARAMETERS.TEST_PACKET.PACKET_LENGTH = 0

6.2.3.6.1.4 Constant Receive Mode

In test mode, the ILC can be configured to receive only on a specified channel. To place the ILC in this mode, the following MT-224 parameters must be changed from the normal MT-224 configuration:

MT_224_LAN_CONFIGURATION.RADIO_CONFIG.FLAGS.IS_IN_TEST_MODE = 1 {True}

MT_224_LAN_CONFIGURATION.RADIO_CONFIG.FLAGS.IS_SENDER = 0 {False}

MT_224_LAN_CONFIGURATION.RADIO_CONFIG.FLAGS.USE_CHANNEL_LIST = 1 {True}

MT_224_LAN_CONFIGURATION.RADIO_TEST_MODE_PARAMETERS.CHANNEL_LIST[0] = 0 – 31 (selects the channel)

WARNING: Once MT-224 is set as shown above, the ILC will stay in this mode of operation until MT-224 is written with the parameters set for normal operation. After the test is completed, make sure to reverse the procedure to put the ILC back into a normal mode of operation. To do this, the MT-224 parameters must be changed back to their default values:

MT_224_LAN_CONFIGURATION.RADIO_CONFIG.FLAGS.IS_IN_TEST_MODE = 0 {False}

MT_224_LAN_CONFIGURATION.RADIO_CONFIG.FLAGS.IS_SENDER = 0 {False}

MT_224_LAN_CONFIGURATION.RADIO_CONFIG.FLAGS.USE_CHANNEL_LIST = 0 {False}

MT_224_LAN_CONFIGURATION.RADIO_TEST_MODE_PARAMETERS.NUM_PACKETS = 0

MT_224_LAN_CONFIGURATION.RADIO_TEST_MODE_PARAMETERS.SEND_DELAY = 0

MT_224_LAN_CONFIGURATION.RADIO_TEST_MODE_PARAMETERS.TEST_PACKET.PACKET_LENGTH = 0

6.2.3.6.2 Normal Operation

In the normal operating mode, the ILC will only transmit if there is a scheduled event to be handled by the ILC. The scheduled events are described in the document titled "A3 Collector Description.doc" When not transmitting, the ILC is in receive mode scanning the 25 channels for a valid packet from another device.

To restore the ILC to the normal operating condition, use MeterExplorer to write the MT-224 base configuration to the meter. This is done as follows:

1. Under the list of tables in REX.REX_LANOB_255_81, highlight MT_224_LAN_CONFIGURATION.
2. With the table selected, right click on the mouse to bring up a menu and select **Read**
3. With the table selected, right click on the mouse to bring up a menu and select: **Load From File**
4. At the prompt, select and open the file named: "LANOBBaseConfig_255_81.mtd"
5. Under the list of tables in REX.REX_LANOB_255_81, highlight MT_224_LAN_CONFIGURATION.
6. With the table selected, right click on the mouse to bring up a menu and select **Write**. NOTE: The read followed by the write verifies that the information unique to a particular meter is maintained.

After the table is written, the changes will only take affect if one of the following events occurs:

1. Power is cycled to the A3 Collector. After power is restored, the ILC delays 15 seconds prior to using the contents of MT-224.
2. MF_064_INITIATE_HEALTH_CHECK is sent to the ILC to tell it to reload configuration tables (i.e. MT-224) and immediately start using the reloaded configuration. To execute MF-064, highlight MF_064_INITIATE_HEALTH_CHECK in the functions items on the left side of the screen, right click on the mouse to bring up the pop-up menu, and select **Execute Function(s)**.

6.3 Performance Criteria (Required for Immunity Testing Only)

Immunity testing on the A3 Collector is not required and this section is therefore not applicable.

6.3.1 Power Requirements

The A3 Collectors are powered by connecting 120-480Vac to the blades on the back of the meter. Power is typically brought to the meter blades via a meter socket and Elster Electricity has provided these sockets to the test lab.

Table 5 - Power Requirements

EUT	Input Voltage (as seen by A3 Collector power supply)	Input Frequency	Input Current (rated)	1ϕ, 3ϕ, or DC	Plug Type
Form 2S A3 Collector	120 to 480 Vac	60 Hz	200A	1ϕ	meter socket
Form 3S A3 Collector	120 to 480 Vac	60 Hz	20A	1ϕ	meter socket
Form 5S A3 Collector	120 to 480 Vac *1	60 Hz	20A	3ϕ	meter socket
Form 9S A3 Collector	120 to 277 Vac	60 Hz	20A	3ϕ	meter socket
Form 12S A3 Collector	120 to 480 Vac	60 Hz	200A	3ϕ	meter socket
Form 16S A3 Collector	120 to 277 Vac	60 Hz	200A	3ϕ	meter socket

***1** If the meter does not pass emissions at 480Vac, Elster Electricity would like it to be re-tested at 240Vac, and the meter will be marked as a 120 to 240V device.

6.3.2 Oscilltor / Microprocessor Frequencies

This section lists all oscillator frequencies used in the EUT. This is required for immunity testing (each frequency is dwelled upon during Radiated Immunity) and extremely helpful for mitigation during Radiated Emissions.

The 900 MHz radio in the ILC is a frequency-hopping spread sprectrum radio. The receiver is a single conversion, super-heterodyne receiver, with a 10.7 MHz IF. The receiver local oscillator is 10.7 MHz below the channel frequency.

Table 6 - Oscillator Frequency List

Source	Frequency
Crystal oscillator for A3 ALPHA metering engine	12.28608 MHz
Buffered clock from A3 ALPHA metering engine to drive A3 ALPHA processor	6.14304 MHz
Crystal oscillator for A3 ALPHA processor clock to support power down timekeeping	32.768 kHz
Crystal oscillator for ITM processor clock	14.7456 MHz
Crystal oscillator for ITM processor clock during power fail conditions.	32.768 kHz
Integral oscillator in the SI2400 modem ic.	78.643 MHz
Crystal oscillator for ILC processor clock and synthesizer reference.	20.48 MHz
ILC receiver IF (The receiver is a single-conversion, super-heterodyne receiver, with a 10.7 MHz IF)	10.7 MHz

6.4 Equivalent Models

Elster Electricity has provided samples of the various meters to be tested as listed in Section 6.2. The Elster style number consists of 11 ASCII characters. The eighth character indicates the type of internal modem in the meter. The eighth character is changed from a 'D" to a "G" to indicate that the A3 Collector contains a battery that allows the Internal Telephone Modem (ITM) to place calls to report power outages.

The last 2 characters in the Elster style number are related to firmware related features and they may be marked differently from the units tested.

6.4.1 Methods of Determining Equivalence

Either of the following methods can be used for including a list of equivalent models into the laboratory test report. Elster Electricity will provide a letter of attestation stating that the model listed above is equivalent to the model tested.

6.4.1.1 Manufacturer's Letter of Attestation

The manufacturer can provide a Letter of Attestation to the laboratory stating that the model(s) listed are equivalent to the one(s) tested. The laboratory will include this list in its final test report with the following statement:

> The manufacturer has provided this list of equivalent models and has been included in this report for the convenience of the customer. The laboratory has *not* performed an evaluation of these models and makes no statement regarding the validity of the list.

6.4.1.2 Laboratory Evaluation

The manufacturer can present the laboratory with a list of equivalent model(s) and the reason(s) why each model is equivalent to the one(s) tested. The laboratory will evaluate each model on the list and determine whether it is equivalent or not. Model(s) determined to be equivalent can be listed in the report with the following statement:

> The laboratory has performed an evaluation of this list of equivalent models and states that the test data contained within this report applies to the compliance of these models with the standards tested to. This statement is based on a test sample of one unit.