

MEASUREMENT AND TECHNICAL REPORT

CUBIC TRANSPORTATION SYSTEMS
 5650 Kearney Mesa Road
 San Diego, CA 92111

DATE: 11 June 2002

This Report Concerns:	Original Grant: <input checked="" type="checkbox"/>	Class II Change: <input type="checkbox"/>
Equipment Type:	Tri-Reader Contactless Smart Card Reader, Model 9801 7012	
Deferred grant requested per 47 CFR 0.457(d)(1)(ii)?	Yes: <input type="checkbox"/> Defer until:	No: <input checked="" type="checkbox"/>
Company Name agrees to notify the Commission by:	N/A	
of the intended date of announcement of the product so that the grant can be issued on that date.		
Transition Rules Request per 15.37?	Yes: <input type="checkbox"/>	*No: <input checked="" type="checkbox"/>
<i>(*) FCC Part 2, Paragraphs 15.107(a); 15.209(a); 15.225(a), (c)</i>		
<p>Report Prepared by:</p> <p>TÜV PRODUCT SERVICE 10040 Mesa Rim Road San Diego, CA 92121-2912 Phone: 858 546 3999 Fax: 858 546 0364</p>		

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1 GENERAL INFORMATION

1.1 Product Description

Form

EMC Test Plan and Constructional Data Form



PLEASE COMPLETE THIS DOCUMENT IN FULL, ENTERING N/A IF THE FIELD IS NOT APPLICABLE.
Applicant -- NOTE: This information will be input into your test report as shown below.
 Press the F1 key at any time to get HELP for the current field selected.

Company: Cubic Transportation Systems, Inc.
 Address: 5650 Kearny Mesa Road
San Diego, CA 92111
 Contact: Chuck Burns Position: Manager of Compliance
 Phone: 858 627 4562 Fax: 858 614-4462
 E-mail Address: chuck.burns@cubic.com

General Equipment Description -- NOTE: This information will be input into your test report as shown below.

EUT Description: RF Modem for Reading Contactless Smart Cards
 EUT Name: Tri Reader (tm)
 Model No.: 9801 7012 (Rev A3.1) Serial No.: 2072 (AC powered EUT)
1056 (DC powered EUT)
 Product Options: None
 Configurations to be tested: a) Battery powered equipment
b) AC voltage powered equipment

Test Objective

- | | |
|--|--|
| <input type="checkbox"/> EMC Directive 89/336/EEC (EMC) | <input checked="" type="checkbox"/> FCC: Class <input checked="" type="checkbox"/> A <input type="checkbox"/> B Part 15B |
| Std: | <input type="checkbox"/> VCCI: Class <input type="checkbox"/> A <input type="checkbox"/> B |
| <input type="checkbox"/> Machinery Directive 89/392/EEC (EMC) | <input type="checkbox"/> BCIS: Class <input type="checkbox"/> A <input type="checkbox"/> B |
| Std: | <input checked="" type="checkbox"/> Canada: Class <input checked="" type="checkbox"/> A <input type="checkbox"/> B |
| <input type="checkbox"/> Medical Device Directive 93/42/EEC (EMC) | <input type="checkbox"/> Australia: Class <input type="checkbox"/> A <input type="checkbox"/> B |
| Std: | <input checked="" type="checkbox"/> Other: <u>FCC 15C (intentional radiator); Canada HSS-210</u> |
| <input type="checkbox"/> Vehicle Directive 72/243/EEC (EMC) | |
| Std: | |
| <input type="checkbox"/> FDA Reviewers Guidance for Premarket Notification Submissions (EMC) | |

Form

EMC Test Plan and Constructional Data Form



TÜV Product Service Certification Requested

- Attestation of Conformity (AoC)
 - Certificate of Conformity (CoC)
 - Protection Class: (N/A for vehicles)
 - International EMC Mark (IEM)
 - Compliance Document
 - Class I
 - Class II
 - Class III
- (Press F1 when field is selected to show additional information on Protection Class.)

Attendance

Test will be: Attended by the customer Unattended by the customer

Failure - Complete this section if testing will not be attended by the customer.

- If a failure occurs, TÜV Product Service should:
- Call contact listed above, if not available then stop testing. (After hrs phone): _____
 - Continue testing to complete test series.
 - Continue testing to define corrective action.
 - Stop testing.

EUT Specifications and Requirements

Length: AC: 17" Width: 13" Height: 3" Weight: 6.15 lbs
 DC: 7.3" 6.3" 13.4" 4.5 lbs

Power Requirements

Regulations require testing to be performed at typical power ratings in the countries of intended use. (i.e., European power is typically 230 VAC 50 Hz or 400 VAC 50 Hz, single and three phase, respectively)

Voltage: 115VAC (Config 1) (If battery powered, make sure battery life is sufficient to complete testing.)
 12 VDC (Config 2)

of Phases: Single

Current (Amps/phase(max)): AC: 160 mA RMS Current (Amps/phase(nominal)): AC: 130 mA RMS
 12VDC: 1.5 A 12VDC: 1.25 A

Other _____

Other Special Requirements

Typical Installation and/or Operating Environment

(ie. Hospital, Small Business, Industrial/Factory, etc.)
 AC Powered Equipment: Mass Transit Stations (train/subway stations, bus depots, etc)

Form

EMC Test Plan and Constructional Data Form



DC Powered Equipment. Onboard public transportation vehicles (buses, trains, etc)

EUT Power Cable			
<input type="checkbox"/> Permanent	OR	<input checked="" type="checkbox"/> Removable	Length (in meters): <u>6 feet</u>
<input type="checkbox"/> Shielded	OR	<input checked="" type="checkbox"/> Unshielded	
<input type="checkbox"/> Not Applicable			

Form

EMC Test Plan and Constructional Data Form



EUT Interface Ports and Cables												
Interface				Shielding		Type	Termination	Connector Type	Port Termination	Length (in meters)	Removable	Permanent
Type	Analog	Digital	Qty	Yes	No							
<i>EXAMPLE:</i> RS232	<input type="checkbox"/>	<input checked="" type="checkbox"/>	2	<input checked="" type="checkbox"/>	<input type="checkbox"/>	Foil over braid	Coaxial	Metallized 9 pin D Sub	Characteristic Impedance	6	<input checked="" type="checkbox"/>	<input type="checkbox"/>
RS422/485	<input type="checkbox"/>	<input checked="" type="checkbox"/>	0	<input checked="" type="checkbox"/>	<input type="checkbox"/>	Twisted shielded pair	RJ45	Metallized RJ45	120 ohms	0.5	<input checked="" type="checkbox"/>	<input type="checkbox"/>
	<input type="checkbox"/>	<input type="checkbox"/>		<input type="checkbox"/>	<input type="checkbox"/>						<input type="checkbox"/>	<input type="checkbox"/>
	<input type="checkbox"/>	<input type="checkbox"/>		<input type="checkbox"/>	<input type="checkbox"/>						<input type="checkbox"/>	<input type="checkbox"/>
	<input type="checkbox"/>	<input type="checkbox"/>		<input type="checkbox"/>	<input type="checkbox"/>						<input type="checkbox"/>	<input type="checkbox"/>
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	<input type="checkbox"/>	<input type="checkbox"/>		<input type="checkbox"/>	<input type="checkbox"/>						<input type="checkbox"/>	<input type="checkbox"/>
	<input type="checkbox"/>	<input type="checkbox"/>		<input type="checkbox"/>	<input type="checkbox"/>						<input type="checkbox"/>	<input type="checkbox"/>
	<input type="checkbox"/>	<input type="checkbox"/>		<input type="checkbox"/>	<input type="checkbox"/>						<input type="checkbox"/>	<input type="checkbox"/>

Form

EMC Test Plan and Constructional Data Form



EUT Software

Revision Level: Tri-Reader Firmware:
 Flash File: FLS7p04.bin
 DSP Safe Code version : 7.65;
 DSP New Code version : 8.65;
 PIC Safe Code version : 7.44;
 PIC New Code version : 8.44

Description: Tri-Reader Firmware: Latest production firmware
 Application Code: Demonstration software that polls for three card types: ISO14443 Type A, ISO14443 Type B, and Cubic GO CARD

EUT Operating Modes to be Tested -- list the operating modes to be used during test. It is recommended the equipment be tested while operating in a typical operation mode. FCC testing of personal computers and/or peripherals requires that a simple program generate a complete line of upper case H's. Provide a general description of all software, firmware, and PLD algorithms used in the equipment. List all code modules as described above, with the revision level used during testing. Consult with your TÜV Product Service Representative if additional assistance is required.

1. Polling for cards. Typical scenario
- 2.
- 3.

EUT System Components -- list and describe all components which are part of the EUT. For FCC testing a minimum configuration is required. (i.e. Mouse, Printer, Monitor, External Disk Drive, Motherboard, etc.)

Description	Model #	Serial #	FCC ID #

Form

EMC Test Plan and Constructional Data Form



Support Equipment -- List and describe all support equipment which is not part of the EUT. (i.e. peripherals, simulators, etc)			
Description	Model #	Serial #	FCC ID #
Shindengen Power Supply Switching PS (AC EUT)	LY244H5U	5700171	Unknown
Corcom Line Filter (AC EUT)	F7302	None	None
Cubic-Designed Single Board Computer	Cubic PN 534-09007	AC EUI: 3630 DC EUT: 3611	None
Color 3.8" LCD by Planar (DC EUT)	Cubic PN 0001-0100	3100194	None
Proxim Wireless LAN OLM Module (2.4 GHz Carrier Frequency) (DC EUT)	6330	03100011	Unknown

Oscillator Frequencies			
Frequency	Derived Frequency	Component # / Location	Description of Use
27.120 MHz	13.56 MHz	Y1/Y2	2x Carrier Frequency
14.7456 MHz	N/A	U12	Microcontroller clock
20.000 MHz	N/A	U4	DSP Clock
150 KHz	N/A	U26	DC - DC Converter
500 KHz	N/A	U19	DC-DC Converter

Power Supply			
Manufacturer	Model #	Serial #	Type
			<input type="checkbox"/> Switched-mode: (Frequency) _____ <input type="checkbox"/> Linear <input type="checkbox"/> Other: _____
			<input type="checkbox"/> Switched mode: (Frequency) _____ <input type="checkbox"/> Linear <input type="checkbox"/> Other: _____

Form

EMC Test Plan and Constructional Data Form



Power Line Filters		
<i>Manufacturer</i>	<i>Model #</i>	<i>Location in EUT</i>

Form



EMC Test Plan and Constructional Data Form

Critical EMI Components (Capacitors, ferrites, etc.)				
Description	Manufacturer	Part # or Value	Qty	Component # / Location
SEE SEPARATE SHEET (tr critical components.xls)				

EMC Critical Detail -- Describe other EMC Design details used to reduce high frequency noise.

Ground plane designed carefully to minimize size of current loops

(PLEASE INSERT "ELECTRONIC SIGNATURE" BELOW IF POSSIBLE)

Authorization Signatures

John R. TR _____ Date 6/11/07
 Customer authorization to perform tests according to this test plan.

CHARLES R. BURNS _____ Date _____
 Test Plan/CDF Prepared By (please print)

 Reviewed by TÜV Product Service Associate Date _____

Description	Critical components		Value	Qty	Component-#
	Manufacturer	Part-#			
Conducted Emission Suppression (Switchmode PS)	Murata	GRM39Y5V104M050AD	0.1uF, 50V	1	C88
Conducted Emission Suppression (Switchmode PS)	Kemet	T495X106M035AS	10uF, 35V	1	C91
Conducted Emission Suppression (Switchmode PS)	Kemet	T495X226M035AS	22uF, 35V	1	C155, C156
Conducted Emission Suppression (Switchmode PS)	Sumida	CDRH6D38-101NC	100uH	1	L50
Conducted Emission Suppression (Switchmode PS)	ACT	IC1008-R47J	470nH 5%	1	L58
Antenna Tuning	Murata	GRM39C0G8R2C100AD	8.2pF +/-0.25	1	C117,C118, C119
Antenna Tuning	Murata	GRM39C0G2R0C100AD	2pF +/-0.25	1	C119, C120
Antenna Tuning	Murata	GRM39C0G200J050AD	20pF 5%	1	C121
Antenna Coil	CTS	9801-1404	4:4:1 Turn	1	L29
RF-drive Signal	Murata	GRM39C0G270G100AD	27pF 2%	1	C78
RF-drive Signal	Coilcraft	1008CS-332XGBC	3.3uH 2%	2	L14, L57
RF Output Stage	Murata	GRM39C0G271G050AD	270pF 2%	3	C75, C76, C77
RF Output Stage	Murata	GRM39X7R103K050AD	0.01uF, 50V	1	C79
RF Output Stage	Murata	GRM39C0G680G050AD	68pF 2%	2	C82, C85
RF Output Stage	ACT	IC1008-R47J	470nH 5%	2	L13, L16
RF Output Stage	Zetex	FZT491	NPN, SOT223	2	Q1,Q2

1 GENERAL INFORMATION (continued)

1.2 Related Submittal/Grant

None

1.3 Tested System Details

The FCC IDs for all equipment, plus descriptions of all cables used in the tested system are:

None

1.4 Test Methodology

Purpose of Test: To demonstrate compliance with the ANSI C63.4 setup.

TEST	FCC CFR 47 #	PASS/FAIL
Conducted Emissions	15.107(a)	Pass
Radiated Emissions	15.209(a)	Pass
Frequency Stability	15.225(c)	Pass
Output Power	15.225(a)	Pass
Bandwidth		Pass

Both Conducted and radiated testing were performed according to the procedures in FCC/ANSI C63.4 and CSA 108.8 - M1983. Radiated testing was performed at an antenna-to-EUT distance of 3 meters (1 - 25 GHz).

1.5 Test Facility

The open area test site and conducted measurement data were tested by:

TÜV PRODUCT SERVICE
 10040 Mesa Rim Road
 San Diego, CA 92121-2912
 Phone: 858 546 3999
 Fax: 858 546 0364

The Test Site Data and performance comply with ANSI 63.4 and are registered with the FCC, 7435 Oakland Mills Rd, Columbia Maryland 21046. All Measurement Data is acquired according to the content of FCC Measurement Procedure and ANSI C63.4, unless supplemented with additional requirements as noted in the test report.

2. SYSTEM TEST CONFIGURATION

2.1 Justification

The EUT was initially tested for FCC emission in the following configuration:

See Block Diagram.

2.2 EUT Exercise Software

None

2.3 Special Accessories

None

2.4 Modification

None

2.5 Configuration of Tested System

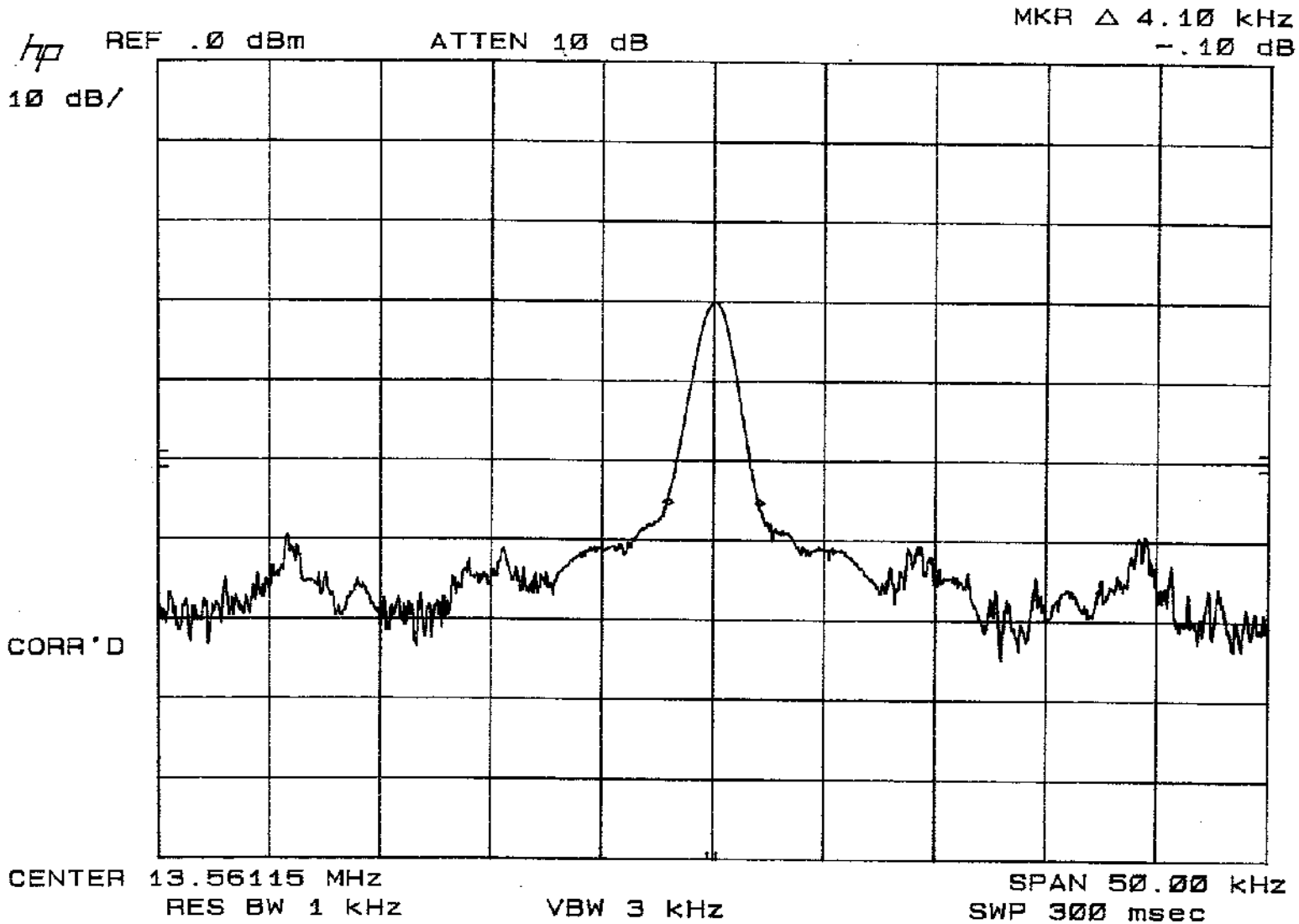
See Block Diagram.

3 BANDWIDTH EQUIPMENT/DATA

Test Equipment Used:

Model Number	Prop. #	Description	Manufacturer	Serial No.	Cal. Dates
Bandwidth					
hp8568B	6523	Spectrum Analyzer	Hewlett Packard	3503A00365	3/28/2003
7405	6437	Antenna, Probe Kit	EMC Test Systems	9812-4261	n.c.r.

Bandwidth
The bandwidth limit is 12.5 kHz. The EUT meets this limit with a -26 dB measurement of 4.1 KHz.



4 POWER OUTPUT FUNDAMENTAL EQUIPMENT/DATA

Test Equipment Used:

Model Number	Prop. #	Description	Manufacturer	Serial No.	Cal. Dates
Location: 30 Meter OATS -- Canyon 1					
For 15.225(a)					
Power Output Fundamental					
hp8594E	6504	Spectrum Analyzer	Hewlett Packard	3303A00365	6/29/2002
HFW-2-Z2	6628	Antenna, Loop	Rohde & Schwarz	880.458/25	

No emissions evident for 15.225(b).

Test Report #: SC203064 Power Output

Test Method: FCC 15.225(a) Date: 6-3-02

EUT Model #: TRIREADER EUT POWER: 230 Vac/50 Hz 120 Vac/60 Hz Other: 12 Vdc

EUT Description: CONTACTLESS SMART CARD Reader

NOTES: RBW = 100 ; VBW = 100 ; Receive antenna = HFW-2-72 ; Amplifier Gain: N/A

NO OTHER EMISSIONS EVIDENT FOR 15.225(b)

Emission level (dB μ V) = Measured Level + Antenna Correction Factor + Cable Loss - Amplifier Gain

FREQUENCY MHz	MEASURED LEVEL (dB μ V)		ANTENNA CORRECTION FACTOR (dB/m)	CABLE LOSS (dB)	AMPLIFIER GAIN (dB)	EMISSION LEVEL (dB μ V/m)		LIMIT	EUT MARGIN (dB)
	V	H				V	H		
13.56	13.8 X		20	0.3		34.1		80	-45.9
13.56	19.6 Y		20	0.3		39.9		80	-40.1
13.56	21.3 Z		20	0.3		41.6		80	-38.4
13.56	22.2 X		20	0.3		42.5		80	-37.5
13.56	34.8 Y		20	0.3		55.1		80	-24.9
13.56	33.8 Z		20	0.3		54.1		80	-25.9

Tested by: A. Laudani Printed _____ Signature A. Laudani

Reviewed by: JIM OWEN Printed _____ Signature J. Owen

5 FREQUENCY STABILITY, FCC Part 15, Paragraph 15.225(c)

See following page(s).

Test Equipment Used:

Model Number	Prop. #	Description	Manufacturer	Serial No.	Cal. Dates
For 15.225(c) Frequency Stability due to Variations of Voltage at Room Temperature					
hp8568B	6523	Spectrum Analyzer	Hewlett Packard	3503A00365	3/28/2003
7405	6437	Antenna, Probe Kit	EMC Test Systems	9812-4261	
W2041M	6006	Autotransformer	Variac Technipower		n.c.r.
hp6255A	6487	Dual Voltage Power Supply	Hewlett Packard		n.c.r.
DMM912		Multimeter	Tektronix		n.c.r.
For 15.225(c) Frequency Stability due to Temperature Variations					
hp8568B	6523	Spectrum Analyzer	Hewlett Packard	3503A00365	3/28/2003
AT-205 / URM-6	201	Antenna, Loop	Eaton	64090	12/2/2002



FREQUENCY STABILITY

SHEET 1 OF 1

TEST REPORT # SC 203064

TEST AREA SR3



DATE 6-3-02

EUT MODEL # TRI READER

TEMPERATURE 22 °C

SPECIFICATION(S):

EUT SERIAL # _____

HUMIDITY 45 %

FCC 15.225(c)

EUT DESCRIPTION CONTACTLESS SMART CARD READER

AIR PRESSURE 100.0 mBar

TEST LEVEL V	DURATION MINUTES	Frequency Hz	Delta %	COMPLIES		REMARKS
				YES	NO	
24 Vdc	2	15.561150	0	✓		BASELINE 12-24 Vdc
9 Vdc	2	15.561150	0	✓		< 85% of Nominal
30 Vdc	2	15.561150	0	✓		> 1.15% of Nominal
115 VAC	2	15.561150	0	✓		BASELINE
97 VAC	2	15.561150	0	✓		85% of Nominal
133 VAC	2	15.561150	0	✓		1.15% of Nominal

NOTES: _____

TESTED BY: A. Laudani
A. LAUDANI

REVIEWED BY: J. Olin



FREQUENCY STABILITY

SHEET 1 OF 1

TEST REPORT # SC203064

TEST AREA Temp. Chamber



DATE 6-10-02

EUT MODEL # TRI READER

TEMPERATURE 21 °C

SPECIFICATION(S):

EUT SERIAL # _____

HUMIDITY 47 %

FCC 15.225(b)

EUT DESCRIPTION CONTACTLESS SMART CARD READER

AIR PRESSURE 99.5 mBar

TEST LEVEL		Frequency %	Temp. °C	COMPLIES		REMARKS
Frequency MHz	DURATION MINUTES			YES	NO	
13.560871	60	Ref.	20	✓		Baseline measurement
13.560892	60	.00155	+50	✓		
13.560983	60	.00286	-20	✓		

NOTES: _____

TESTED BY: [Signature]

REVIEWED BY: [Signature]

6 RADIATED EMISSION EQUIPMENT/DATA, FCC Part 15, Paragraphs 15.209; 15.225(a)

Vdc and Vac data is included.

Test Equipment Used:

Model Number	Prop. #	Description	Manufacturer	Serial No.	Cal. Dates
Location: 10 Meter OATS -- Canyon 2					
For 15.109(b)					
LPB2520/A	739	Antenna, Biconical	Antenna Research	1170	3/21/2003
ESVS30	427	EMC Receiver	Rhode & Schwartz	830350/006	12/8/2002

REPORT No: SC203064

SPEC: FCC Part 15 para 15.109(b)

CUSTOMER: Cubic

TEST DIST: 10 Meters

E U T: Trireader

TEST SITE: 2

EUT MODE: Normal

BICONICAL: 739

*Cal Due Date
3/21/03*

DATE: 4-Jun-02

TESTED BY: A. Laudani *AKY*

LOG PERIODIC: 739

3/21/03

NOTES: Quasi-Peak with 120 KHz measurement bandwidth.

RCVR: 427

12/8/02

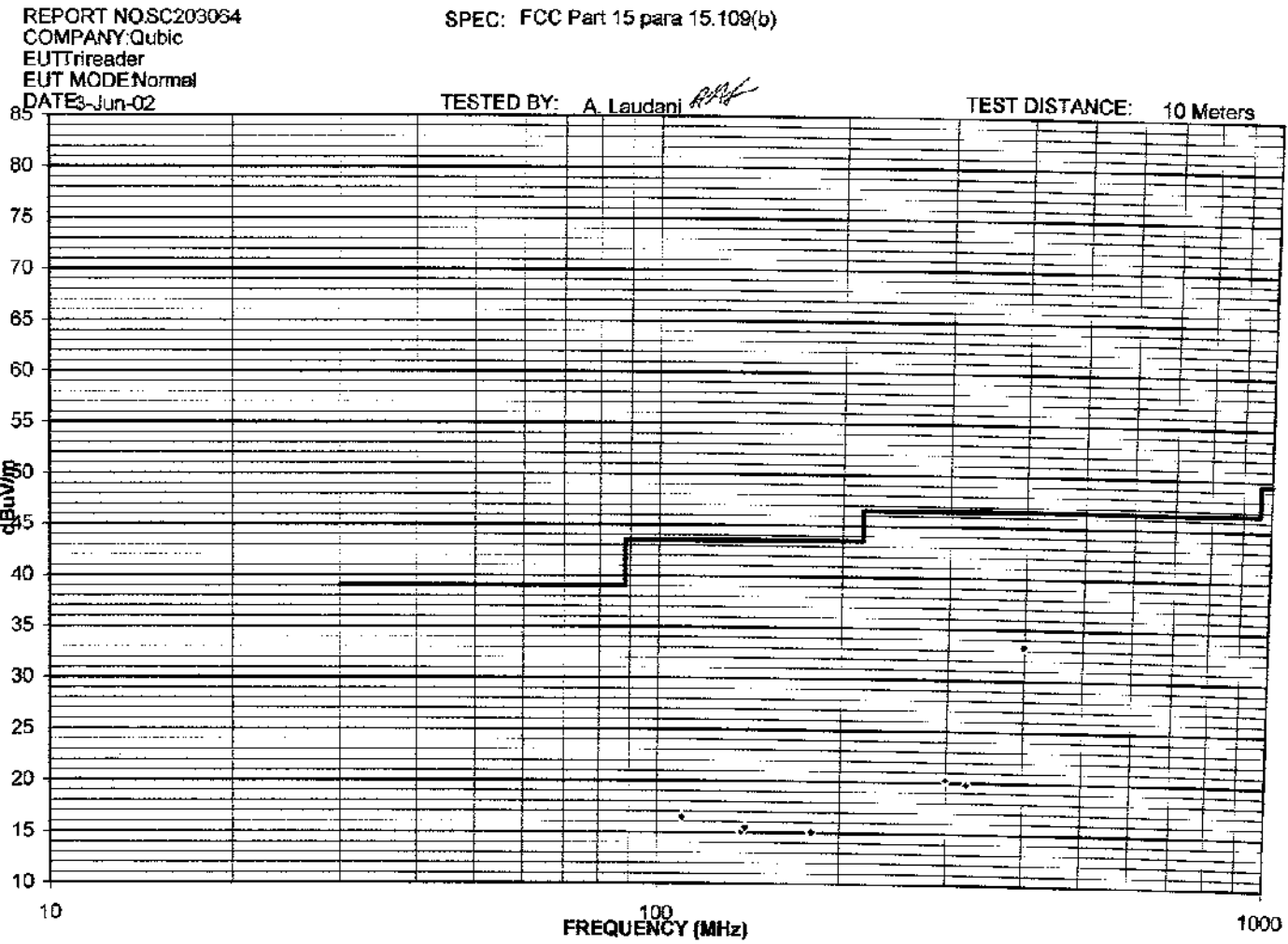
12 Vdc

With Eclipse Shielding PN BCF850394-B on both display and button cable on back of display board

Temperature: 22

Relative Humidity: 48

EUT MARGIN		-3.9 dB at 160 MHz				ver 1.8a		
FREQUENCY (MHz)	VERTICAL measured (dBuV)	HORIZONTAL measured (dBuV)	CORRECTION FACTOR (dB/m)	MAXIMUM CORRECTED (dBuV/m)	SPECIFIED LIMIT (dBuV/m)	EUT MARGIN (dB)	EUT ROTATION (degrees)	ANTENNA HEIGHT (meters)
40.00	2.4	-1.2	19.4	21.8	39	-17.2	100	1
80.00	7.8	3.2	10.2	18.0	39	-21.0	220	1
90.00	11	7	11.2	22.2	43.5	-21.3	55	2
110.00	5	3.4	13.6	18.6	43.5	-24.9	20	1
120.00	9	2.5	14.3	23.3	43.5	-20.2	30	1
128.00	10.9	3	13.5	24.4	43.5	-19.1	230	1
130.00	8.5	1	13.3	21.8	43.5	-21.7	65	1
140.00	16.3	11.5	12.0	28.3	43.5	-15.2	115	1
143.18	16.2	4	11.8	28.0	43.5	-15.5	70	1
144.00	27.4	22	11.7	39.1	43.5	-4.4	185	1
148.00	17.7	7.9	11.4	29.1	43.5	-14.4	140	1
150.00	16.4	8	11.3	27.7	43.5	-15.8	280	1
152.00	18.3	9.3	11.3	29.6	43.5	-13.9	260	1
160.00	28.1	19.2	11.5	39.6	43.5	-3.9	240	1
170.00	12.5	11.2	12.2	24.7	43.5	-18.8	70	1
180.00	17.5	7.9	12.8	30.3	43.5	-13.2	60	1
200.00	9.4	4	13.2	22.6	43.5	-20.9	120	1
210.00	5.6	2	14.1	19.7	43.5	-23.9	85	1
230.00	6.5	1.5	15.6	22.1	46.5	-24.4	165	1
244.10	13.8	5.5	16.4	30.2	46.5	-16.3	355	1
260.00	5.4	0.7	16.9	22.3	46.5	-24.2	50	2.5
264.00	3.7	0.3	16.9	20.6	46.5	-25.9	80	1
270.00	4.8	2.6	16.9	21.7	46.5	-24.8	40	1
280.00	7.2	7	16.9	24.1	46.5	-22.4	300	2.5
288.00	9.3	5	17.1	26.4	46.5	-20.1	180	1
330.00	2.7	3.2	18.5	21.7	46.5	-24.8	25	2



REPORT No: SC203064

SPEC: FCC Part 15 para 15.109(b)

CUSTOMER: Qubic

TEST DIST: 10 Meters

EUT: Trireader

TEST SITE: 2

EUT MODE: Normal

BICONICAL: 739

Cal Due 3/21/03

DATE: 3-Jun-02

TESTED BY: A. Laudani *AL*

LOG PERIODIC: 739

3/21/03

NOTES: Quasi-Peak with 120 KHz measurement bandwidth.
120 Vac

RCVR: 427

DOB CAL DATE 12/8/2002

Temperature: 25 Relative Humidity: 42

EUT MARGIN		-13.2 dB at 398.83 MHz				ver 1.8a		
FREQUENCY (MHz)	VERTICAL measured (dBuV)	HORIZONTAL measured (dBuV)	CORRECTION FACTOR (dB/m)	MAXIMUM CORRECTED (dBuV/m)	SPECIFIED LIMIT (dBuV/m)	EUT MARGIN (dB)	EUT ROTATION (degrees)	ANTENNA HEIGHT (meters)
110.00	2.9	2.5	13.6	16.5	43.5	-27.0	0	1
138.00	2	2.9	12.3	15.2	43.5	-28.3	70	4
140.00	3.5	2	12.0	15.5	43.5	-28.0	0	1
180.00	2.3	1	12.8	15.1	43.5	-28.4	0	1
299.12	3	0.2	17.3	20.3	46.5	-26.2	350	1
324.00	1.6	0.7	18.2	18.8	46.5	-28.7	320	1
398.83	13	5.9	20.3	33.3	46.5	-13.2	55	1

Field Strength Calculation

If a preamplifier was used during the Radiated Emission Testing, it is required that the amplifier gain must be subtracted from the Spectrum Analyzer (Meter) Reading. In addition, a correction factor for the antenna, cable used and a distance factor, if any, must be applied to the Meter Reading before a true field strength reading can be obtained. In the automatic measurement, these considerations are automatically presented as a part of the print out. In the case of manual measurements and for greater efficiency and convenience, instead of using these correlation factors for each meter reading, the specification limit was modified to reflect these correlation factors at each frequency value so that the meter readings can be compared directly to the modified specification limit. This modified specification limit is referred to as the "Corrected Meter Reading Limit" or simply the CMRL, which is the actual field strength present at the antenna. The quantity can be derived in the following manner:

$$\text{Corrected Meter Reading Limit (CMRL)} = \text{SAR} + \text{AF} + \text{CL} - \text{AG} - \text{DC}$$

Where, SAR = Spectrum Analyzer Reading
 AF = Antenna Factor
 CL = Cable Loss
 AG = Amplifier Gain (if any)
 DC = Distance Correction (if any)

Assume the following situation: A meter reading of 29.4 dBuV was obtained from a Class A computing device measured at 83 MHz. Assume an antenna factor of 9.2 dB, a cable loss of 1.4 dB and amplifier gain of 20.0 dB at 83 MHz. The final field strength would be determined as follows:

$$\text{CMRL} = 29.4 \text{ dBuV} + 9.2 \text{ dB} - 1.4 \text{ dB} - 20 \text{ dB/M} - 0.0 \text{ dB}$$

$$\text{CMRL} = 20.0 \text{ dBuV/M}$$

This result is well below the FCC and CSA Class A limit of 29.5 dbuV/m at 83 MHz.

For the manual mode of measurement, a table of corrected meter reading limit was used to permit immediate comparison of the meter reading to determine if the measure emission amplitude exceeded the specification limit at that specific frequency.

4 CONDUCTED EMISSION EQUIPMENT/DATA, FCC Part 15, Paragraph 15.107

Vac Conducted Data

See following page(s).

SR 3, Shielded Room, 12' x 20' x 8', Metal Chamber

Test Equipment Used:

Model Number	Prop. #	Description	Manufacturer	Serial No.	Cal. Due
ESHS 20	428	EMI Test Receiver	Rohde & Schwarz	837055/001	12/18/02
CAT-20	610	20 dB Attenuator	Mini-Circuits	--	NCR
9242-50-R-24-BNC	458	LISN	Solar Electronics	941720	2/11/03

**TUV PRODUCT SERVICE
Conducted Emissions**

EUT: Trireader
 Manuf: Qubic
 Op Cond: Normal
 Operator: A. Laudani *AKV*
 Test Spec: FCC Class B
 Comment: 115 VAC 60 Hz Line 1
 SC-203064
 Date: 03. Jun 02 08:10

Final Measurement Results:

Frequency MHz	QP Level dBuV	QP Limit dBuV
13.56000	37.7	48.0 ^A _(10³)

Frequency MHz	AV Level dBuV	AV Limit dBuV
0.51500	12.4	
0.61500	12.4	
0.72500	12.4	
0.87500	12.5	
0.95000	12.4	
1.04000	12.5	
1.44500	12.4	
1.50000	12.5	
1.76500	12.5	
2.34000	12.5	
2.81000	12.6	
3.13000	12.5	
3.57500	12.4	
4.40000	12.8	
5.08500	12.6	
5.94000	12.6	
6.86000	12.7	
8.14500	12.7	
9.98500	12.7	
12.05500	12.8	
13.56000	37.3	
15.61000	12.9	
20.72000	13.0	
22.06000	13.3	
27.12000	17.0	

* limit exceeded

**TUV PRODUCT SERVICE
Conducted Emissions**

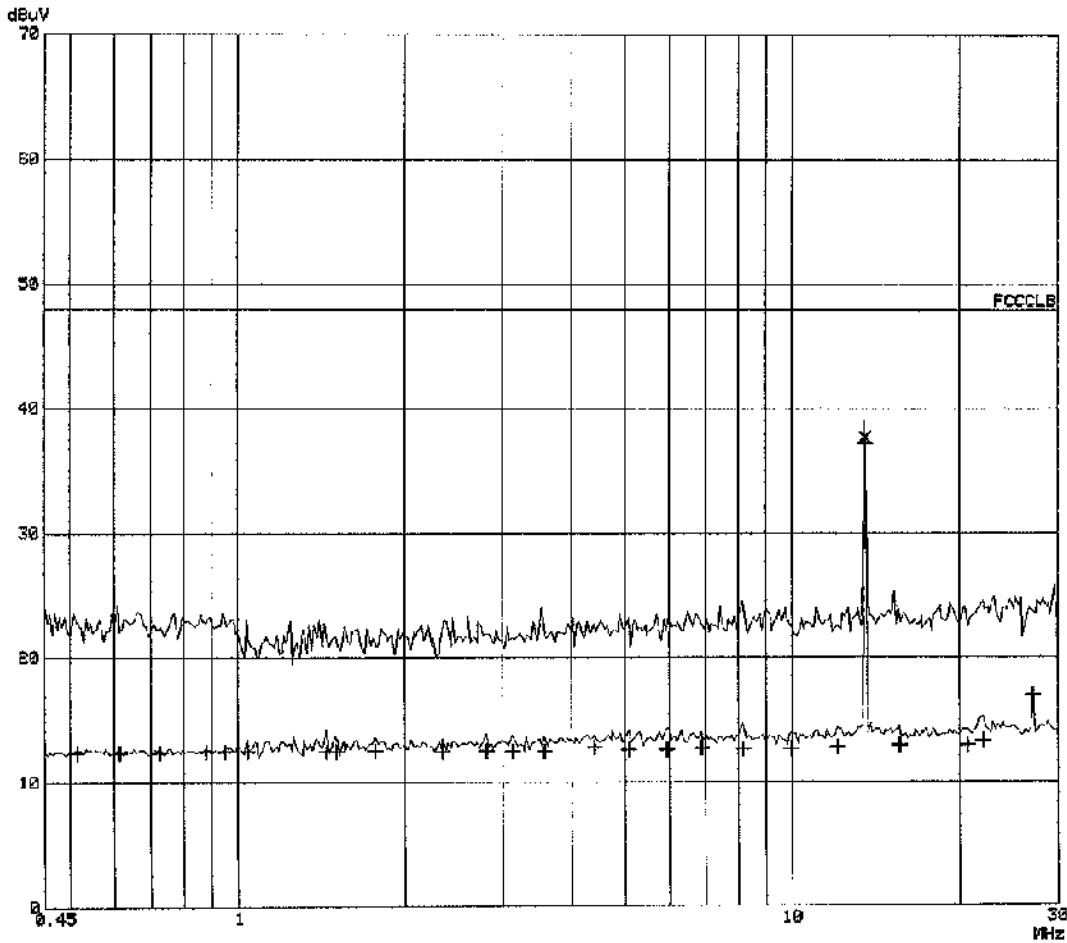
EUT: Trireader
 Manuf: Qubic
 Op Cond: Normal
 Operator: A. Laudani
 Test Spec: FCC Class B
 Comment: 115 VAC 60 Hz Line 1
 SC-203064
 Date: 03. Jun 02 08:10

Scan Settings (2 Ranges)

Frequencies			Receiver Settings			
Start	Stop	Step	IF BW	Detector	M-Time	Atten Preamp
450k	1M	5k	10k	PK+AV	50ms	AUTO LN OFF
1M	30M	5k	10k	PK+AV	2ms	AUTO LN OFF

Transducer No.	Start	Stop	Name
5	9k	30M	20dBLISN

Final Measurement: x QP / + AV
 Meas Time: 1 s
 Subranges: 25
 Acc Margin: 20dB



**TUV PRODUCT SERVICE
Conducted Emissions**

EUT: Trireader
 Manuf: Qubic
 Op Cond: Normal
 Operator: A. Laudani *ML*
 Test Spec: FCC Class B
 Comment: 115 VAC 60 Hz Line 2
 SC-203064
 Date: 03. Jun 02 08:21

Final Measurement Results:

Frequency MHz	QP Level dBuV	QP Limit dBuV
13.56000	37.5	48.0 <i>10.5</i>

Frequency MHz	AV Level dBuV	AV Limit dBuV
0.48000	12.4	
0.58500	12.5	
0.64000	12.4	
0.80500	12.5	
0.88500	12.4	
1.10500	12.5	
1.28500	12.5	
1.72500	12.5	
1.74500	12.5	
2.19500	12.5	
2.48500	12.4	
2.98000	12.5	
3.41500	12.5	
4.04500	12.5	
4.93500	12.7	
5.71000	13.1	
7.11000	12.6	
8.75500	12.9	
10.33500	12.7	
12.34000	12.8	
13.56000	37.0	
15.79500	12.9	
19.56500	12.9	
22.93000	13.3	
27.12000	17.1	

* limit exceeded

**TUV PRODUCT SERVICE
Conducted Emissions**

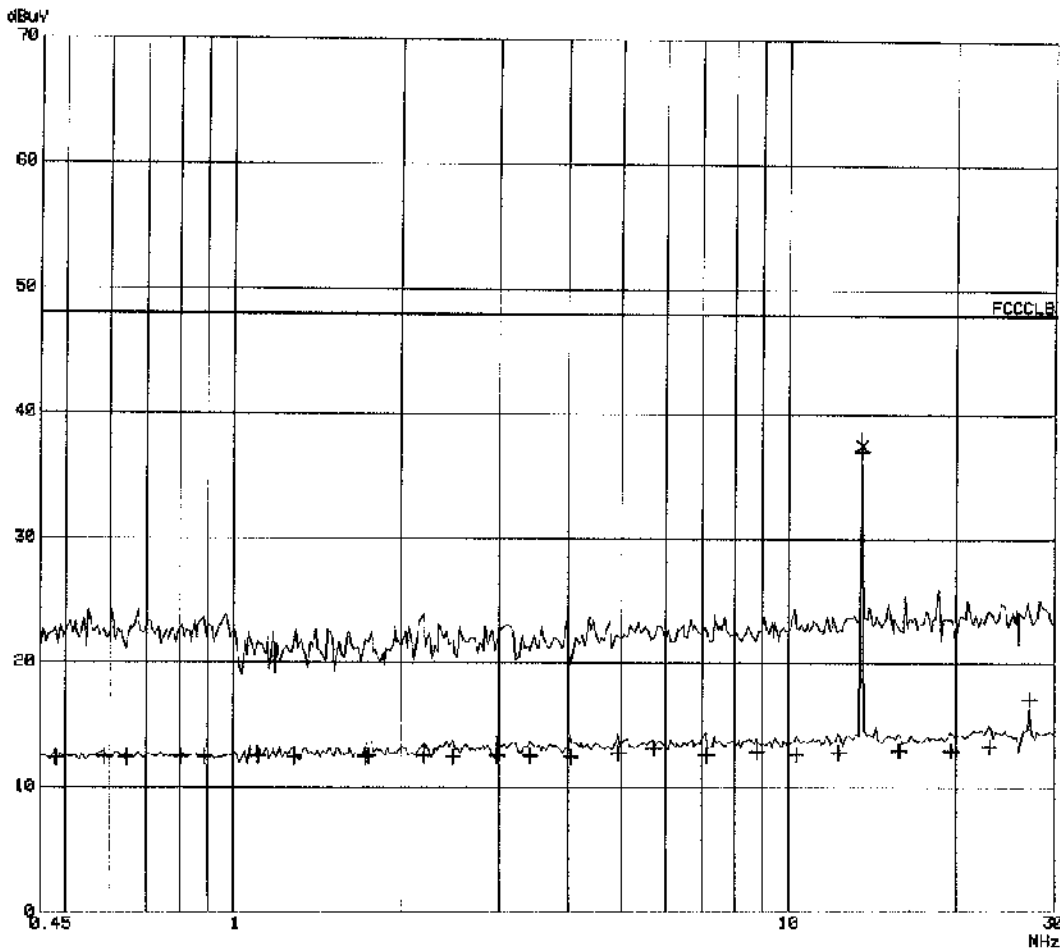
EUT: Trireader
 Manuf: Qubic
 Op Cond: Normal
 Operator: A. Laudani *ALY*
 Test Spec: FCC Class B
 Comment: 115 VAC 60 Hz Line 2
 SC-203064
 Date: 03. Jun 02 08:21

Scan Settings (2 Ranges)

Frequencies			Receiver Settings						
Start	Stop	Step	IF BW	Detector	M-Time	Atten	Preamp	Off	
450k	1M	5k	10k	PK+AV	50ms	AUTO	LN	OFF	60
1M	30M	5k	10k	PK+AV	2ms	AUTO	LN	OFF	60

Transducer No.	Start	Stop	Name
5	9k	30M	20dBLISN

Final Measurement: x QP / + AV
 Meas Time: 1 s
 Subranges: 25
 Acc Margin: 20dB



5 MODULAR APPROVAL INFORMATION

We hereby request modular approval under Part 15 of the FCC Rules for our Tri-Reader(tm) contactless smart card read/write device. The conditions set forth in Public Notice DA 00-1407 are addressed below:

1. "The modular device must have its own RF shielding." The device did not require any external shielding in order to comply with the radiated and conducted emissions requirements.
2. "The modular transmitter must have buffered modulation/data inputs..." All data inputs are sent to a microprocessor. The microprocessor formats the data and packetizes it before it is sent to the transmitter circuitry, under strict timing control.
3. The modular transmitter must have its own power supply regulation..." The transmitter has dc voltage regulators on-board.
4. The modular transmitter must comply with the antenna requirements of Section 15.203 and 15.204(c)..." The antenna is permanently attached at the factory. There are no antenna options in this design.
5. "The modular transmitter must be tested in stand-alone configuration..." The transmitter was tested in a "worst-case" configuration, within a plastic, non-shielding enclosure. Conducted emissions were tested successfully on the ac-powered variant. No ferrites were needed to comply with emission limits. All power and data cables used in testing were at least 1 meter in length. Support equipment was unmodified.
6. "The modular transmitter must be labeled with its own FCC ID number..." The device carries FCC markings on the PCB assembly and on the antenna support ring. These markings are visible from the back of the transmitter even after installation.
7. "The modular transmitter must comply with any specific rule or operating requirements applicable..." There are no specific rules or operating requirements for this type of device, operating under 15.225.
8. "The modular transmitter must comply with any applicable RF exposure requirements..." This device is categorically excluded from routine environmental evaluation for RF exposure by FCC Rules.

ATTESTATION STATEMENT

GENERAL REMARKS:

SUMMARY:

All tests were performed per CFR 47, FCC Part 2, Paragraphs 15.107(a); 15.209(a); 15.225(a), (c).

■ - Performed

The Equipment Under Test

■ - **Fulfills** the requirements of CFR 47, FCC Part 2, Paragraphs 15.107(a); 15.209(a); 15.225(a), (c).

- TÜV PRODUCT SERVICE, INC. -

Responsible Engineer:



Alan Laudani
(EMC Engineer)



Jim Owen
Chief Engineer