MEASUREMENT AND TECHNICAL REPORT

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

DATE: 11 June 2002

This Report Concerns:	Original Grant: X	Class II Change:
Equipment Type:	Tri-Reader Contactless Smart Card Reader, Model 9801 7012	
Deferred grant requested per 47 CFR 0.457(d)(1)(ii)?	Yes: **Defer until:**	No: X
Company Name **agrees to notify the Commission by:** **of the intended date of announcement of the product so that the grant can be issued on that date.**	N/A	
Transition Rules Request per 15.37?	Yes:	*No: X

(*) FCC Part 2, Paragraphs 15.107(a); 15.209(a); 15.225(a), (c)

Report Prepared by:

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

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1 GENERAL INFORMATION

1.1 Product Description

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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

☐ EMC Directive 89/336/EEC (EMC)	☒	FCC:	Class	☒ A ☐ B Part 15B
Std:	☐	VCCI:	Class	☐ A ☐ B
☐ Machinery Directive 89/392/EEC (EMC	☐	BCIQ:	Class	☐ A ☐ B
Std:	☒	Canada:	Class	☒ A ☐ B
☐ Medical Device Directive 93/42/EEC (EMC)	☐	Australia:	Class	☐ A ☐ B
Std:	☒	Other:	FCC 15C (intentional radiator); Canada RSS-210	

☐ Vehicle Directive 72/245/EEC (EMC)
Std:

☐ 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) ☐ International EMC Mark (IEM)
☐ Certificate of Conformity (CoC) ☐ Compliance Document
Protection Class (N/A for vehicles) ☐ 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:	Width:	Height:	Weight:
AC: 17" DC: 7.3"	13" 6.3"	3" 13.4"	6.15 lbs 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 (Config1) 12 VDC (Config 2) (If battery powered, make sure battery life is sufficient to complete testing.)

# of Phases: Single

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

Current (Amps/phase(nominal)): AC: 130 mA RMS 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)

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

EUT Power Cable				
☐ Permanent	OR	☒ Removable	Length (in meters):	6 feet
☐ Shielded	OR	☒ Unshielded		
☐ Not Applicable				

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EUT Interface Ports and Cables

Interface Type	Analog	Digital	Qty	Shielding Yes	Shielding No	Type	Termination	Connector Type	Port Termination	Length (in meters)	Removable	Permanent
EXAMPLE: RS232	☐	☒	*2*	☒	☐	*Foil over braid*	*Coaxial*	*Metallized 9 pin D Sub*	*Characteristic Impedance*	*6*	☒	☐
RS422/485	☐	☒	0	☒	☐	Twisted shielded pair	RJ45	Metallized RJ45	120 ohms	0.5	☒	☐
	☐	☐		☐	☐						☐	☐
	☐	☐		☐	☐						☐	☐
	☐	☐		☐	☐						☐	☐
	☐	☐		☐	☐						☐	☐
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	☐	☐		☐	☐						☐	☐
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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. (ie. Mouse, Printer, Monitor, External Disk Drive, Motherboard, etc.)

Description	Model #	Serial #	FCC ID #

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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)	EY244R5U	5700171	Unknown
Corcom Line Filter (AC EUT)	F7302	None	None
Cubic-Designed Single Board Computer	Cubic PN 534-09007	AC EUT: 3630 DC EUT: 3611	None
Color 3.8" LCD by Planar (DC EUT)	Cubic PN 0001-0100	3100194	None
Proxim Wireless LAN OEM 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
			☐ Switched-mode: (Frequency) ☐ Linear ☐ Other:
			☐ Switched mode: (Frequency) ☐ Linear ☐ Other:

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Power Line Filters		
Manufacturer	*Model #*	*Location in EUT*

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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

Customer authorization to perform tests according to this test plan. — Date: 6/11/02

CHARLES R. BURNS — Test Plan/CDF Prepared By (please print) — Date: 6/11/02

Reviewed by TÜV Product Service Associate — Date

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Critical components

Description	Manufacturer	Part-#	Value	Qty	Component-#
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,
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, C
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

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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
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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.

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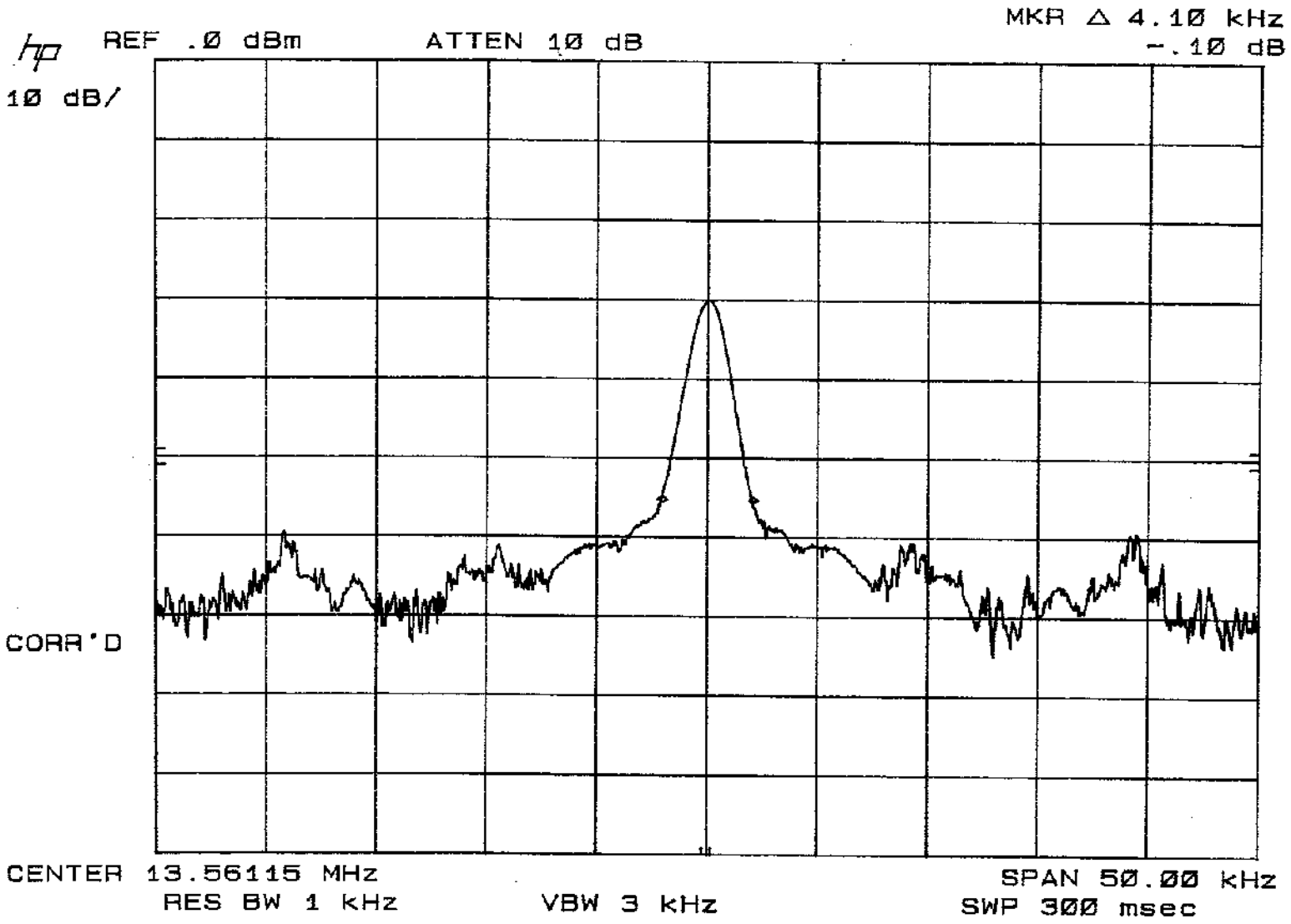
3 BANDWIDTH EQUIPMENT/DATA

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).

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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 (dBµV) = Measured Level + Antenna Correction Factor + Cable Loss - Amplifier Gain

FREQUENCY MHz	MEASURED LEVEL (dBµV) V	MEASURED LEVEL (dBµV) H	ANTENNA CORRECTION FACTOR (dB/m)	CABLE LOSS (dB)	AMPLIFIER GAIN (dB)	EMISSION LEVEL (dBµV/m) V	EMISSION LEVEL (dBµV/m) H	LIMIT	EUT MARGIN (dB)
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. LALDAN Printed — A. Laldan Signature

Reviewed by: JIM OWEN Printed — Jim Owen Signature

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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 Suplly	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

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FREQUENCY STABILITY

SHEET 1 OF 1

TÜV PRODUCT SERVICE

TEST REPORT # SC 203064

TEST AREA SR3

DATE 6-3-02 EUT MODEL # TRIREADER 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 MHz	Delta %	COMPLIES YES	COMPLIES NO	REMARKS
24 Vdc	2	15.561150		✓		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. Landani A. LANDANI

REVIEWED BY:

FREQUENCY STABILITY

SHEET 1 OF 1

TEST REPORT # SC203064

TEST AREA Temp. Chamber

DATE 6-10-02 EUT MODEL # TRIREADER 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 MHz	TEST LEVEL Duration Minutes	Frequency %	Temp. °C	COMPLIES YES	COMPLIES NO	Remarks
13.560871	60	Ref.	20	✓		Baseline measurement
13.560892	60	.000155	+50	✓		
13.560983	60	.000886	-20	✓		

NOTES:

TESTED BY: REVIEWED BY:

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

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TÜV PRODUCT SERVICE

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 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

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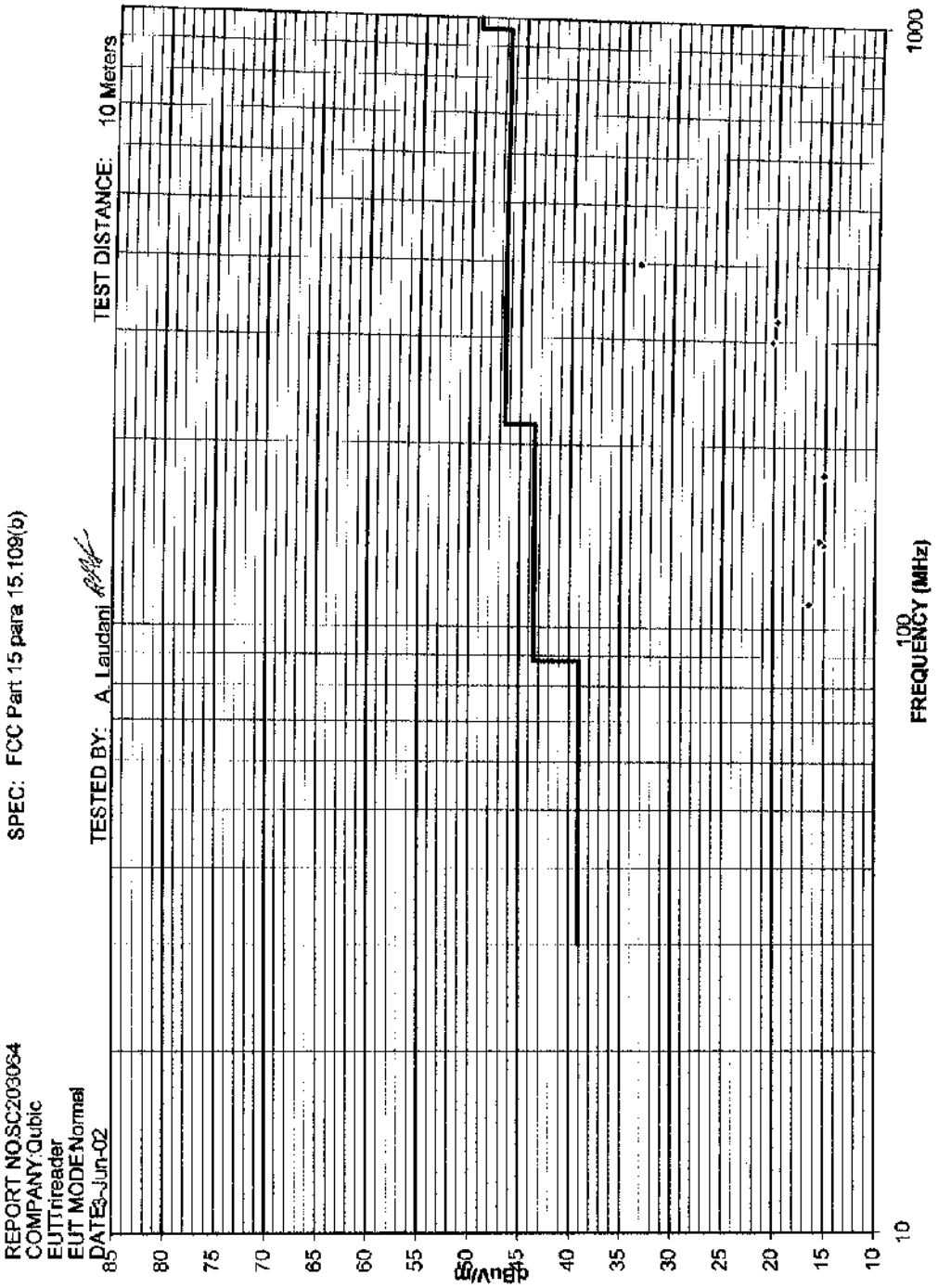
REPORT NO:SC203064
COMPANY:Qubic
EUT:Ireader
EUT MODE:Normal
DATE:5-Jun-02
SPEC: FCC Part 15 para 15.109(b)
TESTED BY: A. Laudani
TEST DISTANCE: 10 Meters
dBuV/m
85
80
75
70
65
60
55
50
45
40
35
30
25
20
15
10
10
100
1000
FREQUENCY (MHz)

REPORT No: SC203064 SPEC: FCC Part 15 para 15.109(b)

CUSTOMER: Qubic TEST DIST: 10 Meters

E U T: Trireader TEST SITE: 2

EUT MODE: Normal BICONICAL: 739 Cal Due 3/21/03

DATE: 3-Jun-02 TESTED BY: A. Laudani LOG PERIODIC: 739 3/21/03

NOTES: Quasi-Peak with 120 KHz measurement bandwidth. RCVR: 427 DUE CAL DATE 12/8/2001

120 Vac

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	**19.8**	46.5	-26.7	320	1
398.83	13	5.9	20.3	**33.3**	46.5	-13.2	55	1

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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:

Corrected Meter Reading Limit (CMRL) = SAR + AF + CL - AG - 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:

CMRL = 29.4 dBuV + 9.2dB = 1.4 dB - 20 dB/M - 0.0 dB

CMRL = 20.0 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.

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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
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

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

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TUV PRODUCT SERVICE
Conducted Emissions

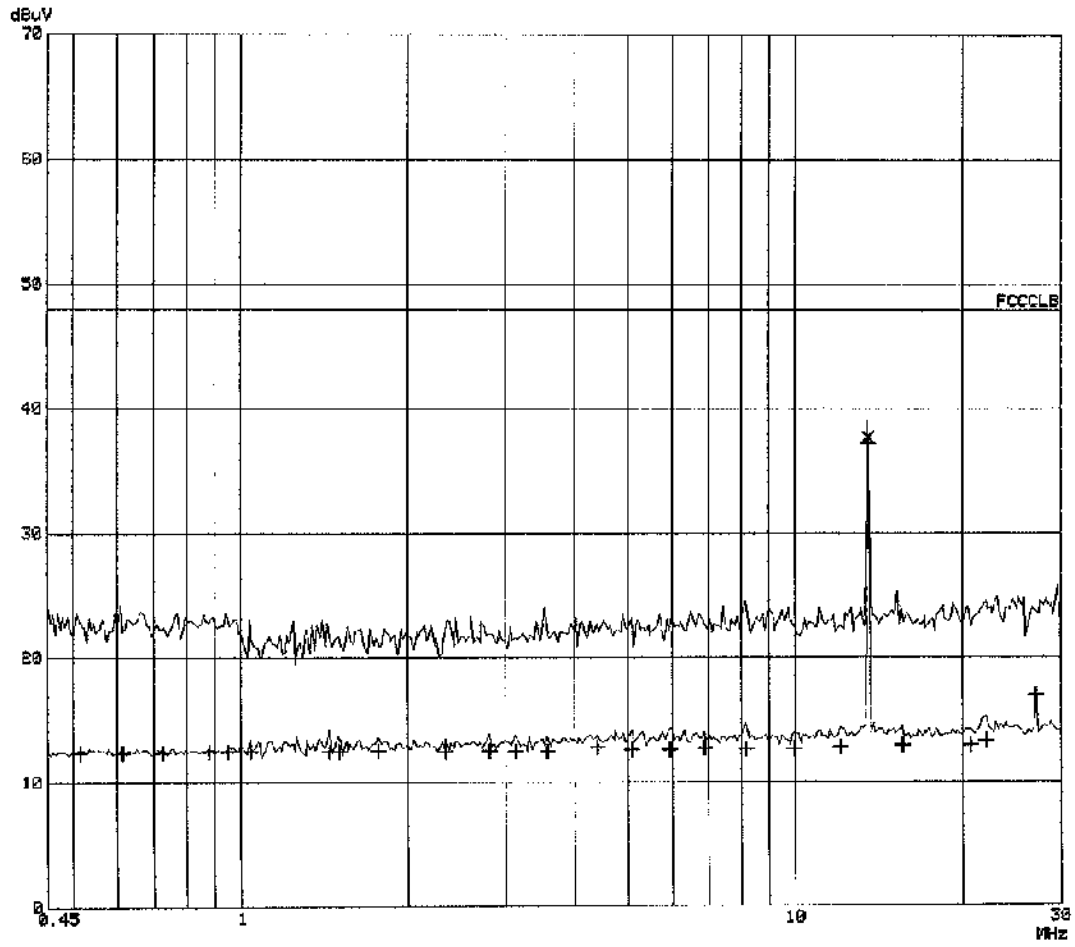
EUT: Trireader
Manuf: Qubic
Op Cond: Normal
Operator: A. Laudani
Test Spec: FCC Class B
Comment: 115 VAC 60 Hz Line 1
SC-203064
Date: 03. Jun 02 08:10

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
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

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

TÜV PRODUCT SERVICE

TUV PRODUCT SERVICE
Conducted Emissions

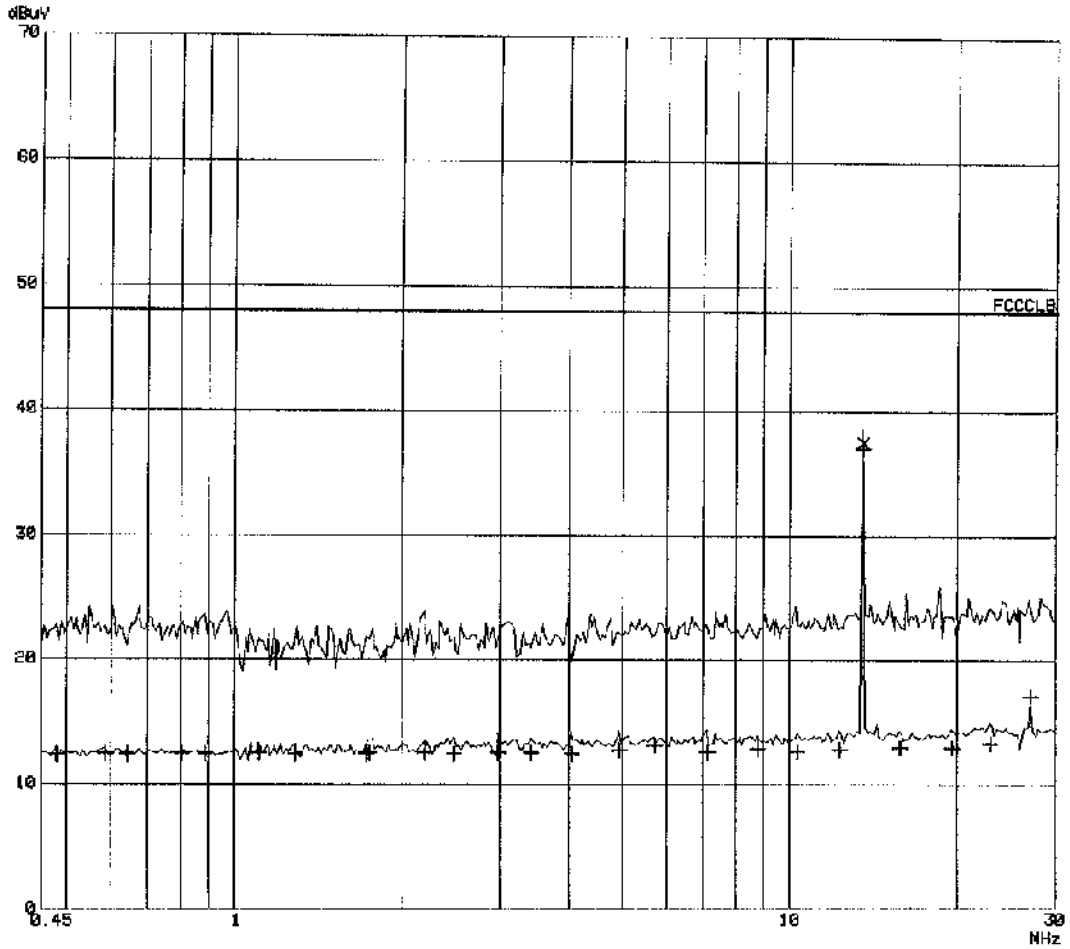
EUT: Trireader
Manuf: Qubic
Op Cond: Normal
Operator: A. Laudani
Test Spec: FCC Class B
Comment: 115 VAC 60 Hz Line 2
SC-203064
Date: 03. Jun 02 08:21

Scan Settings (2 Ranges)

Frequencies			Receiver Settings					
Start	Stop	Step	IF BW	Detector	M-Time	Atten	Preamp	Op
450k	1M	5k	10k	PK+AV	50ms	AUTO	LN OFF	6(
1M	30M	5k	10k	PK+AV	2ms	AUTO	LN OFF	6(

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 I 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, FC*C 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

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