TEST RESULT SUMMARY

FCC Part 15 Subpart C Section 15.207
FCC Part 15 Subpart C Section 15.225

MANUFACTURER'S NAME	Cubic Transportation Systems 5650 Kearny Mesa Road San Diego CA 92111
PRODUCT NAME	Tri-Reader 3
MODEL NUMBER(S) TESTED	Tri-Reader 3
PRODUCT DESCRIPTION	Contactless Smartcard Reader with 13.56 MHz RFID
TEST REPORT NUMBER	WC808612.2
TEST DATE(S)	04 – 19 November 2008

TÜV SÜD America Inc, as an independent testing laboratory, declares that the equipment tested as specified above conforms to the applicable EMC requirements of FCC Part 15 Subpart C Sections 15.207 "*Conducted Limits*" and 15.225 "*Operation within the band 13.110–14.010 MHz"*

It is the manufacturer's responsibility to assure that additional production units of this model are manufactured with identical electrical and mechanical characteristics. Any modifications necessary for compliance made during testing on the above mentioned date(s) must be implemented in all production units for compliance to be maintained.

Date: 16 December 2008

Location: Taylors Falls MN
USA

Greg S Jakubowski
Senior EMC Technician

Joel T Schneider
Senior EMC Engineer

Not Transferable

EMC TEST REPORT

Test Report No.	**WC808612.2**	Date of issue:	16 December 2008
Product Name	Tri-Reader 3		
Model / Serial No(s) Tested	Tri-Reader 3 / ---		
Product Description	Contactless Smartcard Reader with 13.56 MHz RFID		
Manufacturer	Cubic Transportation Systems 5650 Kearny Mesa Road San Diego CA 92111		
Test Result	■ **Positive** ☐ **Negative**		
Total pages including Appendices	**50**		

TÜV SÜD America Inc reports apply only to the specific samples tested under stated test conditions. It is the manufacturer's responsibility to assure that additional production units of this model are manufactured with identical electrical and mechanical components. TÜV SÜD America Inc shall have no liability for any deductions, inferences or generalizations drawn by the client or others from TÜV SÜD America Inc issued reports.

TÜV SÜD America Inc and its professional staff hold government and professional organization certifications and are members of AAMI, ACIL, AEA, ANSI, IEEE, NARTE, and VCCI.

TÜV SÜD AMERICA INC 19333 Wild Mountain Road Taylors Falls MN 55084 Tel: (651) 638-0297 Fax: (651) 638-0298 Rev. 113006

REVISION RECORD

REVISION	TOTAL NUMBER OF PAGES	DATE	DESCRIPTION
	50	16 December 2008	Initial Release

TÜV SÜD AMERICA INC 19333 Wild Mountain Road Taylors Falls MN 55084 Tel: (651) 638-0297 Fax: (651) 638-0298 Rev. 113006

DIRECTORY

Contents

TÜV SÜD AMERICA INC 19333 Wild Mountain Road Taylors Falls MN 55084 Tel: (651) 638-0297 Fax: (651) 638-0298 Rev. 113006

EMC TEST REGULATIONS:
The tests were performed according to the following regulations:
FCC Part 15 Subpart C Section 15.207 Paragraph (a)
FCC Part 15 Subpart C Section 15.225 Paragraphs (a), (b), (c), (d), (e)

ENVIRONMENTAL CONDITIONS IN THE LAB

	Actual
Temperature:	: -20 - 50°C
Atmospheric pressure	: 99kPa
Relative Humidity	: 26 - 38%

POWER SUPPLY UTILIZED
Power supply system : 10.2 – 13.8 VDC

TEST EQUIPMENT
All measurement instrumentation is traceable to the National Institute of Standards and Technology and is calibrated according to internal procedure.

SIGN EXPLANATIONS
☐ - not applicable
■ - applicable

13.56 MHz Fundamental
FCC 15.225(a)

Test summary
The requirements are: ■ - MET ☐ - NOT MET
Testing was performed in accordance with the test procedure of ANSI C63.4 2003, clause 8.2.2
Maximum field strength of the 13.56 MHz fundamental is 36.4 dBμV/m* or 66.1 μV/m at 30 meters
Minimum margin of compliance of the fundamental is 47.6 dB
***Extrapolated level using a 40 dB/decade fall off as indicated by the measurements

Test location
■ - Wild River Lab Large Test Site (Open Area Test Site)
☐ - Wild River Lab Small Test Site (Open Area Test Site)

Test distance
■ - 1.0 meters
■ - 3 meters
■ - 10 meters
■ - 30 meters

Test equipment

TUV ID	Model	Manufacturer	Description	Serial	Cal Due
WRLE02517	HFH2-Z2	Polarad	Loop Antenna	879285/036	17-Jun-09
WRLE02534	ESHS-20	Rhode & Schwarz	EMI Receiver	837055/003	20-Mar-09

Test limit
15,848 μV/m or 84 dBμV/m at 30 meters

Test data
See following page

Radiated Emissions < 30 MHz per FCC 15.225

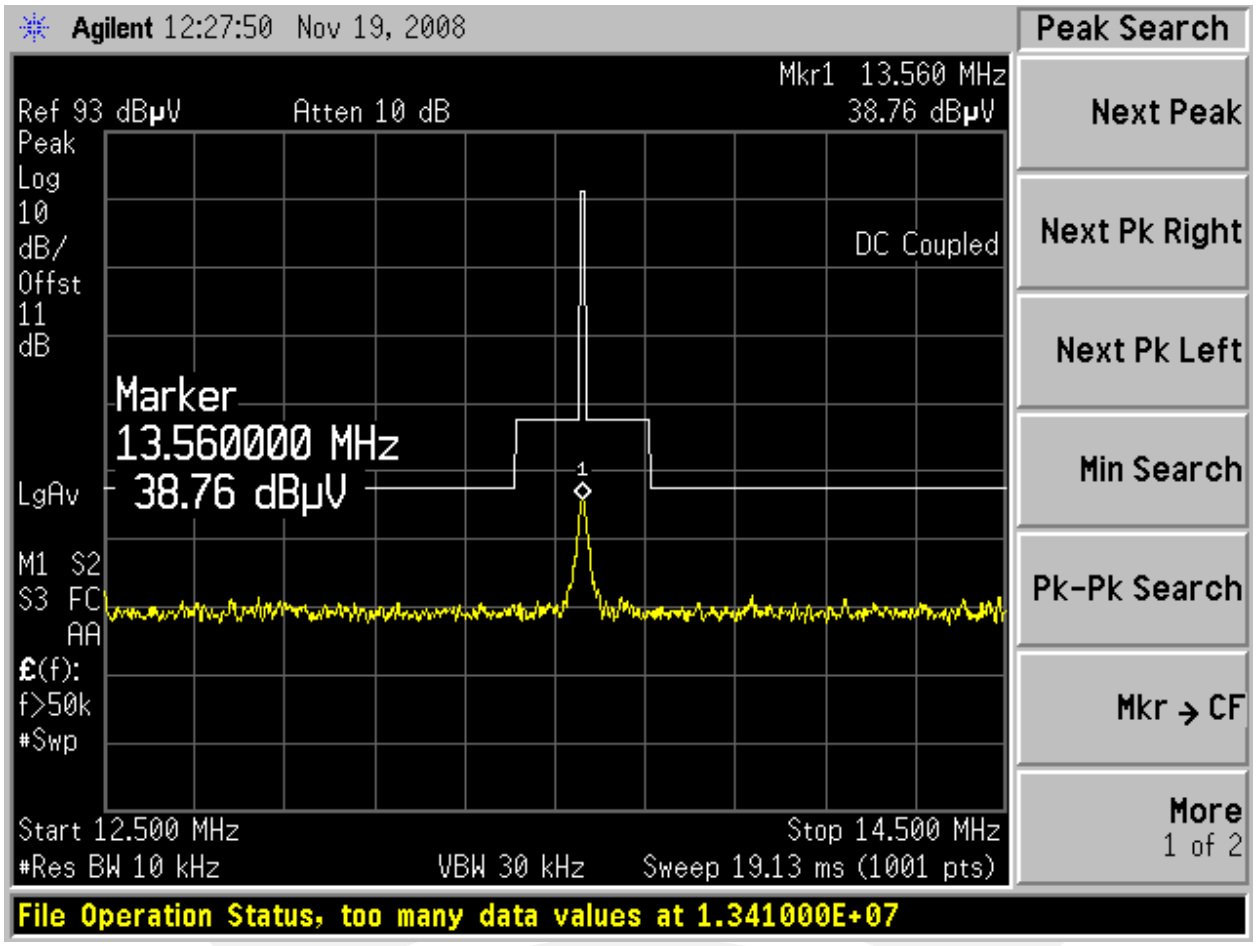
Test Report #:	WC808612	Test area:	LTS
Customer:	Cubic Transportation	Date:	14 Nov 08
EUT Description:	TriReader	Temperature:	21 C
EUT Model:	TriReader	Air pressure:	99.1 kPa
EUT Serial:	n/a	Relative humidity:	31 %
Notes:	extrapolated using 40 dB per decade		

Freq.	0.1m			0.3m			1.0m			3.0m			10m			30m			100m			300m			limit			delta
kHz	Pk	QP	Avg	Pk	QP	Avg	Pk	QP	Avg	Pk	QP	Avg	Pk	QP	Avg	Pk	QP	Avg	Pk	QP	Avg	Pk	QP	Avg	dBuV/m	det	m	dB
13560	na		na	na		na	na	100	na	na	76.4	na	na	57.4	na	na	36.4	na	na	na	na	na	na	na	84.00	qp	30	-47.60
27120	na		na	na		na	na	24	na	na	nf	na	na	nf	na	na	-36	na	na	na	na	na	na	na	29.50	qp	30	-65.50

Tested by: Greg S Jakubowski (print) — G Jakubowski (sign)

Reviewed by: Joel T Schneider (print) — Joel T. Schneider (sign)

Bandedge compliance
Offset used to correct Y axis from dBµV to dBµV/m at 30 meters



Frequency	Limit
13.110-13.410 MHz	106 uV/m (40.5 dBuV/m)
13.410-13.553 MHz	334 uV/m (50.5 dBuV/m)
13.553-13.567 MHz	15848 uV/m (84 dBuV/m)
13.567-13.710 MHz	334 uV/m (50.5 dBuV/m)
13.710-14.010 MHz	106 uV/m (40.5 dBuV/m)

Emissions 13.410–13.553 MHz & 13.567–13.710 MHz
FCC 15.225(b)

Test summary
The requirements are: ■ - MET ☐ - NOT MET
Testing was performed in accordance with the test procedure of ANSI C63.4 2003, clause 8.2.2
No significant emissions were detected in the frequency ranges 13.410–13.553 MHz or 13.567–13.710 MHz

Test location
■ - Wild River Lab Large Test Site (Open Area Test Site)
☐ - Wild River Lab Small Test Site (Open Area Test Site)

Test distance
■ - 1.0 meters
☐ - 3 meters
☐ - 10 meters
☐ - 30 meters

Test equipment

TUV ID	Model	Manufacturer	Description	Serial	Cal Due
WRLE02517	HFH2-Z2	Polarad	Loop Antenna	879285/036	17-Jun-09
WRLE02534	ESHS-20	Rhode & Schwarz	EMI Receiver	837055/003	20-Mar-09

Test limit
334 μV/m or 50.5 dBμV/m at 30 meters

Emissions 13.110–13.410 MHz and 13.710–14.010 MHz
FCC 15.225(c)

Test summary
The requirements are: ■ - MET ☐ - NOT MET
Testing was performed in accordance with the test procedure of ANSI C63.4 2003, clause 8.2.2
No significant emissions were detected in the frequency ranges 13.110–13.410 MHz or 13.710–14.010 MHz

Test location
■ - Wild River Lab Large Test Site (Open Area Test Site)
☐ - Wild River Lab Small Test Site (Open Area Test Site)

Test distance
■ - 1.0 meters
☐ - 3 meters
☐ - 10 meters
☐ - 30 meters

Test equipment

TUV ID	Model	Manufacturer	Description	Serial	Cal Due
WRLE02517	HFH2-Z2	Polarad	Loop Antenna	879285/036	17-Jun-09
WRLE02534	ESHS-20	Rhode & Schwarz	EMI Receiver	837055/003	20-Mar-09

Test limit
106 μV/m or 40.5 dBμV/m at 30 meters

Emissions < 30 MHz, outside the band 13.110-14.010 MHz
FCC 15.225(d)

Test summary
The requirements are: ■ - MET ☐ - NOT MET
Testing was performed in accordance with the test procedure of ANSI C63.4 2003, clause 8.2.2.
Maximum field strength of emissions < 30 MHz and outside the band 13.110-14.010 MHz is -36.0 dBμV/m* or 0.016 μV/m at 30 meters at 27.120 MHz.
Minimum margin of compliance is 65.5 dB.
***Extrapolated level using a 40 dB/decade fall off as indicated by the measurements

Test location
■ - Wild River Lab Large Test Site (Open Area Test Site)
☐ - Wild River Lab Small Test Site (Open Area Test Site)

Test distance
■ - 1.0 meters
■ - 3 meters
☐ - 10 meters
☐ - 30 meters

Test equipment

TUV ID	Model	Manufacturer	Description	Serial	Cal Due
WRLE02517	HFH2-Z2	Polarad	Loop Antenna	879285/036	17-Jun-09
WRLE02534	ESHS-20	Rhode & Schwarz	EMI Receiver	837055/003	20-Mar-09

Test limit

Frequency (MHz)	Field strength μV/m	Measurement distance (m)
0.009-0.490	2400/F(kHz)	300
0.490 - 1.705	24000/F(kHz)	30
1.705 - 30	30	30

At the 27.12 MHz, the limit is 29.5 dBμV/m at 30 meters

Test data
See page 6

Radiated Emissions ≥ 30 MHz

FCC 15.225(d)

Test summary

The requirements are: ■ - MET ☐ - NOT MET

Testing was performed in accordance with the test procedure of ANSI C63.4 2003, clause 8.3

The minimum margin of compliance of spurious emissions ≥ 30 MHz is at 40.68 MHz, 34.8 dBμV/m at 3 meters

Margin of compliance is 5.2 dB

Test location

■ - Wild River Lab Large Test Site (Open Area Test Site)

☐ - Wild River Lab Small Test Site (Open Area Test Site)

Test distance

■ - 3 meters

☐ - 10 meters

Test Equipment

TUV ID	Model	Manufacturer	Description	Serial	Cal Due
WRLE03995	EM-6917B	Electro-Metrics	Biconicalog Periodic	151	23-Apr-09
WRLE03847	ZHL-1042J	Mini-Circuits	Preamplifier 10 - 3000 MHz	0607	Code B 12-May-09
WRLE02681	85650A	Hewlett-Packard	Quasi-Peak Adapter	2430A00562	31-Mar-09
WRLE08052	8566B	Hewlett-Packard	Spectrum Analyzer	2115A00853	27-Mar-09
WRLE08051	85662A	Hewlett-Packard	Analyzer Display	2112A02220	27-Mar-09

Cal Code B = Calibration verification performed internally.

Test limits

Frequncy (MHz)	Field strength (μV/m)	Field strength (dBμV/m)	Measurement distance (m)
30 – 88	100	40	3
88 – 216	150	43.5	3
216 – 960	200	46	3
Above 960	500	54	3

Test data

See following pages

TÜV SÜD AMERICA INC 19333 Wild Mountain Road Taylors Falls MN 55084 Tel: (651) 638-0297 Fax: (651) 638-0298 Rev. 113006

RADIATED EMISSIONS

Test Report #:	WC808612 Run 1	Test Area:	LTS		
EUT Model #:	TriReader	Date:	10/29/2008		
EUT Serial #:		EUT Power:	12 VDC	Temperature:	24.0 °C
Test Method:	FCC 15.225			Air Pressure:	99.0 kPa
Customer:	Cubic Transportation			Rel. Humidity:	24.0 %
EUT Description:	TriReader				
Notes:					
Data File Name:	8612.dat			Page:	1 of 13

List of measurements for run #: 1

FREQ	LEVEL (dBuV)	CABLE / ANT / PREAMP / ATTEN (dB)	FINAL (dBuV / m)	POL / HGT / AZ (m)(DEG)	DELTA1	DELTA2 FCC-B <1GHz 3m
Start Spurious Emissions Scan 30 - 1000MHz						
Transmitter is Transmitting.						
40.68 MHz	42.2 Qp	0.74 / 16.53 / 29.8 / 0.0	29.67	V / 1.00 / 0	n/a	-10.33
54.24 MHz	35.45 Qp	0.84 / 13.09 / 29.7 / 0.0	19.69	V / 1.00 / 0	n/a	-20.31
67.8 MHz	34.5 Qp	0.94 / 9.49 / 29.6 / 0.0	15.32	V / 1.00 / 0	n/a	-24.68
81.36 MHz	37.6 Qp	1.01 / 7.69 / 29.7 / 0.0	16.6	V / 1.00 / 0	n/a	-23.4
108.48 MHz	34.3 Qp	1.14 / 9.17 / 29.7 / 0.0	14.92	V / 1.00 / 0	n/a	-28.58
122.04 MHz	31.75 Qp	1.21 / 8.94 / 29.7 / 0.0	12.2	V / 1.00 / 0	n/a	-31.3
135.6 MHz	35.45 Qp	1.33 / 8.2 / 29.7 / 0.0	15.28	V / 1.00 / 0	n/a	-28.22
149.16 MHz	34.9 Qp	1.4 / 9.57 / 29.8 / 0.0	16.07	V / 1.00 / 0	n/a	-27.43
162.72 MHz	32.4 Qp	1.51 / 8.83 / 29.8 / 0.0	12.93	V / 1.00 / 0	n/a	-30.57
176.28 MHz	30.05 Qp	1.54 / 9.65 / 29.8 / 0.0	11.44	V / 1.00 / 0	n/a	-32.06
189.84 MHz	31.85 Qp	1.58 / 10.79 / 29.8 / 0.0	14.42	V / 1.00 / 0	n/a	-29.08
203.4 MHz	38.4 Qp	1.62 / 10.53 / 29.8 / 0.0	20.75	V / 1.00 / 0	n/a	-22.75
216.96 MHz	30.55 Qp	1.67 / 10.92 / 29.8 / 0.0	13.34	V / 1.00 / 0	n/a	-32.66
230.52 MHz	39.95 Qp	1.73 / 11.39 / 29.76 / 0.0	23.31	V / 1.00 / 0	n/a	-22.69
244.08 MHz	37.0 Qp	1.8 / 11.87 / 29.72 / 0.0	20.95	V / 1.00 / 0	n/a	-25.05
257.64 MHz	38.55 Qp	1.84 / 12.34 / 29.8 / 0.0	22.93	V / 1.00 / 0	n/a	-23.07
284.76 MHz	32.7 Qp	1.93 / 12.7 / 29.85 / 0.0	17.48	V / 1.00 / 0	n/a	-28.52
298.32 MHz	36.9 Qp	2.0 / 13.12 / 29.9 / 0.0	22.11	V / 1.00 / 0	n/a	-23.89
311.88 MHz	35.55 Qp	2.06 / 13.53 / 29.9 / 0.0	21.24	V / 1.00 / 0	n/a	-24.76
325.44 MHz	31.05 Qp	2.11 / 13.95 / 29.94 / 0.0	17.17	V / 1.00 / 0	n/a	-28.83
339.0 MHz	36.7 Qp	2.14 / 14.36 / 30.0 / 0.0	23.2	V / 1.00 / 0	n/a	-22.8
352.56 MHz	33.9 Qp	2.17 / 14.65 / 30.0 / 0.0	20.72	V / 1.00 / 0	n/a	-25.28
366.12 MHz	32.7 Qp	2.2 / 15.04 / 30.0 / 0.0	19.94	V / 1.00 / 0	n/a	-26.06
379.68 MHz	28.85 Qp	2.25 / 15.37 / 30.0 / 0.0	16.46	V / 1.00 / 0	n/a	-29.54
393.24 MHz	32.6 Qp	2.3 / 15.46 / 30.0 / 0.0	20.36	V / 1.00 / 0	n/a	-25.64

Tested by: Robert J Behringer (Printed) — Signature

Reviewed by: Joel T Schneider (Printed) — Signature

RADIATED EMISSIONS

Test Report #:	WC808612 Run 1	Test Area:	LTS		
EUT Model #:	TriReader	Date:	10/29/2008		
EUT Serial #:		EUT Power:	12 VDC	Temperature:	24.0 °C
Test Method:	FCC 15.225			Air Pressure:	99.0 kPa
Customer:	Cubic Transportation			Rel. Humidity:	24.0 %
EUT Description:	TriReader				
Notes:					
Data File Name:	8612.dat			Page:	2 of 13

List of measurements for run #: 1

FREQ	LEVEL (dBuV)	CABLE / ANT / PREAMP / ATTEN (dB)	FINAL (dBuV / m)	POL / HGT / AZ (m)(DEG)	DELTA1	DELTA2 FCC-B <1GHz 3m
406.8 MHz	30.45 Qp	2.35 / 15.66 / 30.0 / 0.0	18.46	V / 1.00 / 0	n/a	-27.54
420.36 MHz	31.25 Qp	2.39 / 16.15 / 30.0 / 0.0	19.8	V / 1.00 / 0	n/a	-26.2
433.92 MHz	28.85 Qp	2.44 / 16.22 / 30.0 / 0.0	17.51	V / 1.00 / 0	n/a	-28.49
447.48 MHz	33.9 Qp	2.48 / 16.4 / 30.0 / 0.0	22.78	V / 1.00 / 0	n/a	-23.22
474.6 MHz	34.8 Qp	2.57 / 16.89 / 30.17 / 0.0	24.09	V / 1.00 / 0	n/a	-21.91
488.16 MHz	29.45 Qp	2.61 / 16.77 / 30.2 / 0.0	18.63	V / 1.00 / 0	n/a	-27.37
501.72 MHz	36.0 Qp	2.65 / 17.08 / 30.2 / 0.0	25.53	V / 1.00 / 0	n/a	-20.47
515.28 MHz	31.6 Qp	2.69 / 17.39 / 30.2 / 0.0	21.48	V / 1.00 / 0	n/a	-24.52
528.84 MHz	34.95 Qp	2.71 / 17.7 / 30.2 / 0.0	25.16	V / 1.00 / 0	n/a	-20.84
555.96 MHz	35.7 Qp	2.75 / 18.26 / 30.19 / 0.0	26.52	V / 1.00 / 0	n/a	-19.48
569.52 MHz	29.75 Qp	2.76 / 18.32 / 30.15 / 0.0	20.68	V / 1.00 / 0	n/a	-25.32
610.218 MHz	30.75 Qp	2.83 / 19.24 / 30.15 / 0.0	22.67	V / 1.00 / 0	n/a	-23.33
637.338 MHz	30.55 Qp	2.89 / 19.78 / 30.2 / 0.0	23.03	V / 1.00 / 0	n/a	-22.97
650.898 MHz	32.8 Qp	2.95 / 19.69 / 30.2 / 0.0	25.24	V / 1.00 / 0	n/a	-20.76
664.458 MHz	31.1 Qp	3.01 / 19.6 / 30.2 / 0.0	23.51	V / 1.00 / 0	n/a	-22.49
691.596 MHz	34.25 Qp	3.11 / 20.13 / 30.17 / 0.0	27.32	V / 1.00 / 0	n/a	-18.68
705.156 MHz	28.9 Qp	3.14 / 20.4 / 30.15 / 0.0	22.29	V / 1.00 / 0	n/a	-23.71
718.716 MHz	33.75 Qp	3.16 / 20.67 / 30.12 / 0.0	27.47	V / 1.00 / 0	n/a	-18.53
732.276 MHz	29.35 Qp	3.19 / 20.95 / 30.1 / 0.0	23.39	V / 1.00 / 0	n/a	-22.61
745.836 MHz	35.35 Qp	3.22 / 21.19 / 30.1 / 0.0	29.66	V / 1.00 / 0	n/a	-16.34
759.396 MHz	30.3 Qp	3.24 / 21.17 / 30.1 / 0.0	24.61	V / 1.00 / 0	n/a	-21.39
772.956 MHz	37.75 Qp	3.27 / 21.37 / 30.1 / 0.0	32.29	V / 1.00 / 0	n/a	-13.71
786.516 MHz	31.4 Qp	3.3 / 21.42 / 30.09 / 0.0	26.03	V / 1.00 / 0	n/a	-19.97
800.076 MHz	38.75 Qp	3.32 / 21.6 / 30.06 / 0.0	33.61	V / 1.00 / 0	n/a	-12.39
813.636 MHz	30.4 Qp	3.34 / 21.87 / 30.04 / 0.0	25.58	V / 1.00 / 0	n/a	-20.42
827.196 MHz	38.25 Qp	3.37 / 21.8 / 30.02 / 0.0	33.4	V / 1.00 / 0	n/a	-12.6
840.756 MHz	32.15 Qp	3.39 / 21.71 / 29.97 / 0.0	27.28	V / 1.00 / 0	n/a	-18.72
854.316 MHz	39.4 Qp	3.41 / 21.87 / 29.88 / 0.0	34.81	V / 1.00 / 0	n/a	-11.19

Tested by: Robert J Behringer (Printed) _____ (Signature)

Reviewed by: Joel T Schneider (Printed) _____ (Signature)

RADIATED EMISSIONS

Test Report #:	WC808612 Run 1	Test Area:	LTS		
EUT Model #:	TriReader	Date:	10/29/2008		
EUT Serial #:		EUT Power:	12 VDC	Temperature:	24.0 °C
Test Method:	FCC 15.225			Air Pressure:	99.0 kPa
Customer:	Cubic Transportation			Rel. Humidity:	24.0 %
EUT Description:	TriReader				
Notes:					
Data File Name:	8612.dat			Page:	3 of 13

List of measurements for run #: 1

FREQ	LEVEL (dBuV)	CABLE / ANT / PREAMP / ATTEN (dB)	FINAL (dBuV / m)	POL / HGT / AZ (m)(DEG)	DELTA1	DELTA2 FCC-B <1GHz 3m
867.876 MHz	31.85 Qp	3.44 / 22.03 / 29.79 / 0.0	27.53	V / 1.00 / 0	n/a	-18.47
881.436 MHz	39.45 Qp	3.46 / 22.19 / 29.7 / 0.0	35.4	V / 1.00 / 0	n/a	-10.6
894.996 MHz	32.6 Qp	3.48 / 22.35 / 29.6 / 0.0	28.83	V / 1.00 / 0	n/a	-17.17
908.556 MHz	38.0 Qp	3.51 / 22.51 / 29.62 / 0.0	34.4	V / 1.00 / 0	n/a	-11.6
922.116 MHz	31.05 Qp	3.55 / 22.67 / 29.64 / 0.0	27.63	V / 1.00 / 0	n/a	-18.37
935.676 MHz	38.45 Qp	3.59 / 22.83 / 29.66 / 0.0	35.21	V / 1.00 / 0	n/a	-10.79
949.236 MHz	30.75 Qp	3.64 / 22.99 / 29.68 / 0.0	27.69	V / 1.00 / 0	n/a	-18.31
962.796 MHz	36.65 Qp	3.68 / 22.91 / 29.7 / 0.0	33.54	V / 1.00 / 0	n/a	-20.46
976.356 MHz	28.45 Qp	3.72 / 23.13 / 29.72 / 0.0	25.57	V / 1.00 / 0	n/a	-28.43
989.916 MHz	34.85 Qp	3.76 / 23.15 / 29.74 / 0.0	32.02	V / 1.00 / 0	n/a	-21.98
36.87 MHz	39.3 Qp	0.71 / 17.89 / 29.9 / 0.0	28.0	V / 1.00 / 0	n/a	-12.0
80.01 MHz	38.9 Qp	1.0 / 7.83 / 29.7 / 0.0	18.03	V / 1.00 / 0	n/a	-21.97
86.01 MHz	34.95 Qp	1.03 / 7.44 / 29.7 / 0.0	13.72	V / 1.00 / 0	n/a	-26.28
108.821 MHz	33.7 Qp	1.15 / 9.18 / 29.7 / 0.0	14.33	V / 1.00 / 0	n/a	-29.17
110.609 MHz	36.5 Qp	1.15 / 9.25 / 29.7 / 0.0	17.2	V / 1.00 / 0	n/a	-26.3
147.48 MHz	38.95 Qp	1.39 / 9.66 / 29.8 / 0.0	20.21	V / 1.00 / 0	n/a	-23.29
172.039 MHz	33.75 Qp	1.53 / 9.29 / 29.8 / 0.0	14.77	V / 1.00 / 0	n/a	-28.73
200.01 MHz	30.95 Qp	1.61 / 10.6 / 29.8 / 0.0	13.36	V / 1.00 / 0	n/a	-30.14
208.891 MHz	33.45 Qp	1.64 / 10.64 / 29.8 / 0.0	15.93	V / 1.00 / 0	n/a	-27.57
221.192 MHz	40.7 Qp	1.68 / 11.07 / 29.8 / 0.0	23.65	V / 1.00 / 0	n/a	-22.35
258.064 MHz	37.55 Qp	1.84 / 12.36 / 29.8 / 0.0	21.95	V / 1.00 / 0	n/a	-24.05
264.22 MHz	37.3 Qp	1.86 / 12.57 / 29.8 / 0.0	21.93	V / 1.00 / 0	n/a	-24.07
270.345 MHz	32.65 Qp	1.88 / 12.49 / 29.8 / 0.0	17.22	V / 1.00 / 0	n/a	-28.78
284.788 MHz	33.2 Qp	1.93 / 12.7 / 29.85 / 0.0	17.99	V / 1.00 / 0	n/a	-28.01
294.927 MHz	38.2 Qp	1.98 / 13.01 / 29.9 / 0.0	23.3	V / 1.00 / 0	n/a	-22.7
366.142 MHz	32.9 Qp	2.2 / 15.05 / 30.0 / 0.0	20.14	V / 1.00 / 0	n/a	-25.86
393.262 MHz	32.65 Qp	2.3 / 15.46 / 30.0 / 0.0	20.41	V / 1.00 / 0	n/a	-25.59
405.524 MHz	32.7 Qp	2.34 / 15.69 / 30.0 / 0.0	20.73	V / 1.00 / 0	n/a	-25.27

Tested by: Robert J Behringer (Printed) _____ (Signature)

Reviewed by: Joel T Schneider (Printed) _____ (Signature)

RADIATED EMISSIONS

Test Report #:	WC808612 Run 1	Test Area:	LTS		
EUT Model #:	TriReader	Date:	10/29/2008		
EUT Serial #:		EUT Power:	12 VDC	Temperature:	24.0 °C
Test Method:	FCC 15.225			Air Pressure:	99.0 kPa
Customer:	Cubic Transportation			Rel. Humidity:	24.0 %
EUT Description:	TriReader				
Notes:					
Data File Name:	8612.dat			Page:	4 of 13

List of measurements for run #: 1

FREQ	LEVEL (dBuV)	CABLE / ANT / PREAMP / ATTEN (dB)	FINAL (dBuV / m)	POL / HGT / AZ (m)(DEG)	DELTA1	DELTA2 FCC-B <1GHz 3m
450.016 MHz	32.7 Qp	2.49 / 16.5 / 30.01 / 0.0	21.68	V / 1.00 / 0	n/a	-24.32
550.018 MHz	31.45 Qp	2.74 / 18.19 / 30.2 / 0.0	22.18	V / 1.00 / 0	n/a	-23.82
555.987 MHz	35.95 Qp	2.75 / 18.26 / 30.19 / 0.0	26.77	V / 1.00 / 0	n/a	-19.23
40.68 MHz	45.65 Qp	0.74 / 16.53 / 29.8 / 0.0	33.12	V / 1.00 / 90	n/a	-6.88
67.8 MHz	36.0 Qp	0.94 / 9.49 / 29.6 / 0.0	16.82	V / 1.00 / 90	n/a	-23.18
147.48 MHz	43.7 Qp	1.39 / 9.66 / 29.8 / 0.0	24.96	V / 1.00 / 90	n/a	-18.54
149.16 MHz	40.65 Qp	1.4 / 9.57 / 29.8 / 0.0	21.82	V / 1.00 / 90	n/a	-21.68
176.28 MHz	31.05 Qp	1.54 / 9.65 / 29.8 / 0.0	12.44	V / 1.00 / 90	n/a	-31.06
325.44 MHz	33.35 Qp	2.11 / 13.95 / 29.94 / 0.0	19.47	V / 1.00 / 90	n/a	-26.53
325.62 MHz	34.95 Qp	2.11 / 13.95 / 29.94 / 0.0	21.08	V / 1.00 / 90	n/a	-24.92
405.524 MHz	34.95 Qp	2.34 / 15.69 / 30.0 / 0.0	22.98	V / 1.00 / 90	n/a	-23.02
447.48 MHz	36.25 Qp	2.48 / 16.4 / 30.0 / 0.0	25.13	V / 1.00 / 90	n/a	-20.87
474.6 MHz	38.35 Qp	2.57 / 16.89 / 30.17 / 0.0	27.64	V / 1.00 / 90	n/a	-18.36
501.72 MHz	39.25 Qp	2.65 / 17.08 / 30.2 / 0.0	28.78	V / 1.00 / 90	n/a	-17.22
528.84 MHz	37.1 Qp	2.71 / 17.7 / 30.2 / 0.0	27.31	V / 1.00 / 90	n/a	-18.69
555.987 MHz	37.2 Qp	2.75 / 18.26 / 30.19 / 0.0	28.02	V / 1.00 / 90	n/a	-17.98
610.218 MHz	36.8 Qp	2.83 / 19.24 / 30.15 / 0.0	28.72	V / 1.00 / 90	n/a	-17.28
637.338 MHz	35.65 Qp	2.89 / 19.78 / 30.2 / 0.0	28.13	V / 1.00 / 90	n/a	-17.87
949.236 MHz	31.45 Qp	3.64 / 22.99 / 29.68 / 0.0	28.39	V / 1.00 / 90	n/a	-17.61
976.356 MHz	31.3 Qp	3.72 / 23.13 / 29.72 / 0.0	28.42	V / 1.00 / 90	n/a	-25.58
110.609 MHz	39.55 Qp	1.15 / 9.25 / 29.7 / 0.0	20.25	V / 1.00 / 180	n/a	-23.25
122.04 MHz	33.45 Qp	1.21 / 8.94 / 29.7 / 0.0	13.9	V / 1.00 / 180	n/a	-29.6
149.16 MHz	43.75 Qp	1.4 / 9.57 / 29.8 / 0.0	24.92	V / 1.00 / 180	n/a	-18.58
264.22 MHz	39.7 Qp	1.86 / 12.57 / 29.8 / 0.0	24.33	V / 1.00 / 180	n/a	-21.67
270.345 MHz	34.8 Qp	1.88 / 12.49 / 29.8 / 0.0	19.37	V / 1.00 / 180	n/a	-26.63
284.788 MHz	42.6 Qp	1.93 / 12.7 / 29.85 / 0.0	27.39	V / 1.00 / 180	n/a	-18.61

Tested by: Robert J Behringer (Printed) — Signature

Reviewed by: Joel T Schneider (Printed) — Signature

RADIATED EMISSIONS

Test Report #:	WC808612 Run 1	Test Area:	LTS		
EUT Model #:	TriReader	Date:	10/29/2008		
EUT Serial #:		EUT Power:	12 VDC	Temperature:	24.0 °C
Test Method:	FCC 15.225			Air Pressure:	99.0 kPa
Customer:	Cubic Transportation			Rel. Humidity:	24.0 %
EUT Description:	TriReader				
Notes:					
Data File Name:	8612.dat			Page:	5 of 13

List of measurements for run #: 1

FREQ	LEVEL (dBuV)	CABLE / ANT / PREAMP / ATTEN (dB)	FINAL (dBuV / m)	POL / HGT / AZ (m)(DEG)	DELTA1	DELTA2 FCC-B <1GHz 3m
298.32 MHz	39.35 Qp	2.0 / 13.12 / 29.9 / 0.0	24.56	V / 1.00 / 180	n/a	-21.44
311.88 MHz	43.1 Qp	2.06 / 13.53 / 29.9 / 0.0	28.79	V / 1.00 / 180	n/a	-17.21
325.44 MHz	36.4 Qp	2.11 / 13.95 / 29.94 / 0.0	22.52	V / 1.00 / 180	n/a	-23.48
339.0 MHz	40.55 Qp	2.14 / 14.36 / 30.0 / 0.0	27.05	V / 1.00 / 180	n/a	-18.95
352.56 MHz	37.9 Qp	2.17 / 14.65 / 30.0 / 0.0	24.72	V / 1.00 / 180	n/a	-21.28
366.142 MHz	37.35 Qp	2.2 / 15.05 / 30.0 / 0.0	24.59	V / 1.00 / 180	n/a	-21.41
374.792 MHz	31.0 Qp	2.23 / 15.39 / 30.0 / 0.0	18.62	V / 1.00 / 180	n/a	-27.38
393.262 MHz	40.0 Qp	2.3 / 15.46 / 30.0 / 0.0	27.76	V / 1.00 / 180	n/a	-18.24
405.524 MHz	36.45 Qp	2.34 / 15.69 / 30.0 / 0.0	24.48	V / 1.00 / 180	n/a	-21.52
406.8 MHz	32.7 Qp	2.35 / 15.66 / 30.0 / 0.0	20.71	V / 1.00 / 180	n/a	-25.29
420.384 MHz	36.7 Qp	2.39 / 16.15 / 30.0 / 0.0	25.25	V / 1.00 / 180	n/a	-20.75
555.987 MHz	39.1 Qp	2.75 / 18.26 / 30.19 / 0.0	29.92	V / 1.00 / 180	n/a	-16.08
610.218 MHz	37.55 Qp	2.83 / 19.24 / 30.15 / 0.0	29.47	V / 1.00 / 180	n/a	-16.53
637.338 MHz	38.35 Qp	2.89 / 19.78 / 30.2 / 0.0	30.83	V / 1.00 / 180	n/a	-15.17
664.458 MHz	38.95 Qp	3.01 / 19.6 / 30.2 / 0.0	31.36	V / 1.00 / 180	n/a	-14.64
691.596 MHz	38.0 Qp	3.11 / 20.13 / 30.17 / 0.0	31.07	V / 1.00 / 180	n/a	-14.93
894.996 MHz	35.5 Qp	3.48 / 22.35 / 29.6 / 0.0	31.73	V / 1.00 / 180	n/a	-14.27
922.116 MHz	33.6 Qp	3.55 / 22.67 / 29.64 / 0.0	30.18	V / 1.00 / 180	n/a	-15.82
949.236 MHz	32.95 Qp	3.64 / 22.99 / 29.68 / 0.0	29.89	V / 1.00 / 180	n/a	-16.11
962.796 MHz	38.85 Qp	3.68 / 22.91 / 29.7 / 0.0	35.74	V / 1.00 / 180	n/a	-18.26
976.356 MHz	33.15 Qp	3.72 / 23.13 / 29.72 / 0.0	30.27	V / 1.00 / 180	n/a	-23.73
989.916 MHz	38.8 Qp	3.76 / 23.15 / 29.74 / 0.0	35.97	V / 1.00 / 180	n/a	-18.03
251.884 MHz	35.1 Qp	1.83 / 12.14 / 29.77 / 0.0	19.3	V / 1.00 / 180	n/a	-26.7
331.799 MHz	36.4 Qp	2.12 / 14.14 / 29.97 / 0.0	22.7	V / 1.00 / 180	n/a	-23.3
368.652 MHz	37.85 Qp	2.2 / 15.15 / 30.0 / 0.0	25.2	V / 1.00 / 180	n/a	-20.8
411.684 MHz	40.05 Qp	2.36 / 15.69 / 30.0 / 0.0	28.1	V / 1.00 / 180	n/a	-17.9
479.252 MHz	32.95 Qp	2.58 / 16.81 / 30.2 / 0.0	22.15	V / 1.00 / 180	n/a	-23.85
632.872 MHz	33.25 Qp	2.88 / 19.75 / 30.2 / 0.0	25.69	V / 1.00 / 180	n/a	-20.31

Tested by: Robert J Behringer (Printed) _____ (Signature)

Reviewed by: Joel T Schneider (Printed) _____ (Signature)

RADIATED EMISSIONS

Test Report #:	WC808612 Run 1	Test Area:	LTS		
EUT Model #:	TriReader	Date:	10/29/2008		
EUT Serial #:		EUT Power:	12 VDC	Temperature:	24.0 °C
Test Method:	FCC 15.225			Air Pressure:	99.0 kPa
Customer:	Cubic Transportation			Rel. Humidity:	24.0 %
EUT Description:	TriReader				
Notes:					
Data File Name:	8612.dat			Page:	6 of 13

List of measurements for run #: 1

FREQ	LEVEL (dBuV)	CABLE / ANT / PREAMP / ATTEN (dB)	FINAL (dBuV / m)	POL / HGT / AZ (m)(DEG)	DELTA1	DELTA2 FCC-B <1GHz 3m
663.557 MHz	34.6 Qp	3.0 / 19.61 / 30.2 / 0.0	27.01	V / 1.00 / 180	n/a	-18.99
700.439 MHz	32.65 Qp	3.13 / 20.31 / 30.16 / 0.0	25.93	V / 1.00 / 180	n/a	-20.07
706.589 MHz	35.65 Qp	3.14 / 20.43 / 30.14 / 0.0	29.08	V / 1.00 / 180	n/a	-16.92
724.962 MHz	34.7 Qp	3.18 / 20.8 / 30.11 / 0.0	28.57	V / 1.00 / 180	n/a	-17.43
731.154 MHz	34.75 Qp	3.19 / 20.92 / 30.1 / 0.0	28.76	V / 1.00 / 180	n/a	-17.24
811.039 MHz	39.6 Qp	3.34 / 21.82 / 30.04 / 0.0	34.72	V / 1.00 / 180	n/a	-11.28
884.75 MHz	34.05 Qp	3.47 / 22.23 / 29.67 / 0.0	30.07	V / 1.00 / 180	n/a	-15.93
952.347 MHz	36.5 Qp	3.65 / 22.98 / 29.69 / 0.0	33.44	V / 1.00 / 180	n/a	-12.56
43.026 MHz	42.35 Qp	0.76 / 15.93 / 29.8 / 0.0	29.24	V / 1.00 / 270	n/a	-10.76
36.87 MHz	41.75 Qp	0.71 / 17.89 / 29.9 / 0.0	30.45	V / 1.00 / 270	n/a	-9.55
479.252 MHz	35.65 Qp	2.58 / 16.81 / 30.2 / 0.0	24.85	V / 1.00 / 270	n/a	-21.15
705.156 MHz	31.0 Qp	3.14 / 20.4 / 30.15 / 0.0	24.39	V / 1.00 / 315	n/a	-21.61
718.716 MHz	36.4 Qp	3.16 / 20.67 / 30.12 / 0.0	30.12	V / 1.00 / 315	n/a	-15.88
745.836 MHz	37.4 Qp	3.22 / 21.19 / 30.1 / 0.0	31.71	V / 1.00 / 315	n/a	-14.29
Start of Maximizing Vertically.						
854.316 MHz	40.93 Qp	3.41 / 21.87 / 29.88 / 0.0	36.34	V / 1.09 / 0	n/a	-9.66
811.039 MHz	42.01 Qp	3.34 / 21.82 / 30.04 / 0.0	37.13	V / 1.00 / 200	n/a	-8.87
40.68 MHz	47.33 Qp	0.74 / 16.53 / 29.8 / 0.0	34.8	V / 1.00 / 95	n/a	-5.2
800.076 MHz	41.04 Qp	3.32 / 21.6 / 30.06 / 0.0	35.9	V / 1.09 / 340	n/a	-10.1
827.196 MHz	39.8 Qp	3.37 / 21.8 / 30.02 / 0.0	34.95	V / 1.10 / 340	n/a	-11.05
772.956 MHz	40.37 Qp	3.27 / 21.37 / 30.1 / 0.0	34.91	V / 1.10 / 300	n/a	-11.09
745.836 MHz	41.74 Qp	3.22 / 21.19 / 30.1 / 0.0	36.05	V / 1.13 / 305	n/a	-9.95
36.846 MHz	39.77 Qp	0.71 / 17.9 / 29.9 / 0.0	28.48	V / 1.00 / 215	n/a	-11.52
664.458 MHz	39.41 Qp	3.01 / 19.6 / 30.2 / 0.0	31.82	V / 1.00 / 185	n/a	-14.18
End of Vertical Scan						

Tested by: Robert J Behringer (Printed) _____ (Signature)

Reviewed by: Joel T Schneider (Printed) _____ (Signature)

RADIATED EMISSIONS

Test Report #:	WC808612 Run 1	Test Area:	LTS		
EUT Model #:	TriReader	Date:	10/29/2008		
EUT Serial #:		EUT Power:	12 VDC	Temperature:	24.0 °C
Test Method:	FCC 15.225			Air Pressure:	99.0 kPa
Customer:	Cubic Transportation			Rel. Humidity:	24.0 %
EUT Description:	TriReader				
Notes:					
Data File Name:	8612.dat			Page:	7 of 13

List of measurements for run #: 1

FREQ	LEVEL (dBuV)	CABLE / ANT / PREAMP / ATTEN (dB)	FINAL (dBuV / m)	POL / HGT / AZ (m)(DEG)	DELTA1	DELTA2 FCC-B <1GHz 3m
Start of Horizontal Scan						
176.28 MHz	32.4 Qp	1.54 / 9.65 / 29.8 / 0.0	13.79	H / 3.00 / 0	n/a	-29.71
257.64 MHz	38.0 Qp	1.84 / 12.34 / 29.8 / 0.0	22.38	H / 3.00 / 0	n/a	-23.62
515.28 MHz	31.45 Qp	2.69 / 17.39 / 30.2 / 0.0	21.33	H / 3.00 / 0	n/a	-24.67
637.338 MHz	36.85 Qp	2.89 / 19.78 / 30.2 / 0.0	29.33	H / 3.00 / 0	n/a	-16.67
664.458 MHz	37.75 Qp	3.01 / 19.6 / 30.2 / 0.0	30.16	H / 3.00 / 0	n/a	-15.84
718.716 MHz	34.95 Qp	3.16 / 20.67 / 30.12 / 0.0	28.67	H / 3.00 / 0	n/a	-17.33
184.335 MHz	36.15 Qp	1.57 / 10.32 / 29.8 / 0.0	18.24	H / 3.00 / 0	n/a	-25.26
324.209 MHz	32.9 Qp	2.11 / 13.91 / 29.93 / 0.0	18.99	H / 3.00 / 0	n/a	-27.01
244.08 MHz	39.15 Qp	1.8 / 11.87 / 29.72 / 0.0	23.1	H / 3.00 / 90	n/a	-22.9
257.64 MHz	39.35 Qp	1.84 / 12.34 / 29.8 / 0.0	23.73	H / 3.00 / 90	n/a	-22.27
184.335 MHz	38.55 Qp	1.57 / 10.32 / 29.8 / 0.0	20.64	H / 3.00 / 180	n/a	-22.86
189.84 MHz	34.8 Qp	1.58 / 10.79 / 29.8 / 0.0	17.37	H / 3.00 / 180	n/a	-26.13
447.48 MHz	37.65 Qp	2.48 / 16.4 / 30.0 / 0.0	26.53	H / 3.00 / 180	n/a	-19.47
610.218 MHz	39.5 Qp	2.83 / 19.24 / 30.15 / 0.0	31.42	H / 3.00 / 180	n/a	-14.58
637.338 MHz	37.45 Qp	2.89 / 19.78 / 30.2 / 0.0	29.93	H / 3.00 / 180	n/a	-16.07
501.75 MHz	40.2 Qp	2.65 / 17.08 / 30.2 / 0.0	29.73	H / 3.00 / 270	n/a	-16.27
447.504 MHz	38.95 Qp	2.48 / 16.4 / 30.0 / 0.0	27.83	H / 3.00 / 270	n/a	-18.17
718.716 MHz	38.3 Qp	3.16 / 20.67 / 30.12 / 0.0	32.02	H / 3.00 / 315	n/a	-13.98
Start of Maximizing.						
718.716 MHz	43.51 Qp	3.16 / 20.67 / 30.12 / 0.0	37.23	H / 1.60 / 210	n/a	-8.77
610.218 MHz	42.59 Qp	2.83 / 19.24 / 30.15 / 0.0	34.51	H / 1.80 / 250	n/a	-11.49

Tested by: Robert J Behringer (Printed) _____ (Signature)

Reviewed by: Joel T Schneider (Printed) _____ (Signature)

RADIATED EMISSIONS

Test Report #:	WC808612 Run 1	Test Area:	LTS		
EUT Model #:	TriReader	Date:	10/29/2008		
EUT Serial #:		EUT Power:	12 VDC	Temperature:	24.0 °C
Test Method:	FCC 15.225			Air Pressure:	99.0 kPa
Customer:	Cubic Transportation			Rel. Humidity:	24.0 %
EUT Description:	TriReader				
Notes:					
Data File Name:	8612.dat			Page:	8 of 13

List of measurements for run #: 1

FREQ	LEVEL (dBuV)	CABLE / ANT / PREAMP / ATTEN (dB)	FINAL (dBuV / m)	POL / HGT / AZ (m)(DEG)	DELTA1	DELTA2 FCC-B <1GHz 3m
501.75 MHz	41.79 Qp	2.65 / 17.08 / 30.2 / 0.0	31.32	H / 3.00 / 255	n/a	-14.68
End of Horizontal Scan						
End of Spurious Scan 30 - 1000 MHz.						

Tested by: Robert J Behringer (Printed) _____ (Signature)

Reviewed by: Joel T Schneider (Printed) _____ (Signature)

RADIATED EMISSIONS

Test Report #:	WC808612 Run 1	Test Area:	LTS		
EUT Model #:	TriReader	Date:	10/29/2008		
EUT Serial #:		EUT Power:	12 VDC	Temperature:	24.0 °C
Test Method:	FCC 15.225			Air Pressure:	99.0 kPa
Customer:	Cubic Transportation			Rel. Humidity:	24.0 %
EUT Description:	TriReader				
Notes:					
Data File Name:	8612.dat			Page:	9 of 13

Measurement summary for limit2: FCC-B <1GHz 3m (Qp)

FREQ	LEVEL (dBuV)	CABLE / ANT / PREAMP / ATTEN (dB)	FINAL (dBuV / m)	POL / HGT / AZ (m)(DEG)	DELTA2 FCC-B <1GHz 3m
40.68 MHz	47.33 Qp	0.74 / 16.53 / 29.8 / 0.0	34.8	V / 1.00 / 95	-5.2
718.716 MHz	43.51 Qp	3.16 / 20.67 / 30.12 / 0.0	37.23	H / 1.60 / 210	-8.77
811.039 MHz	42.01 Qp	3.34 / 21.82 / 30.04 / 0.0	37.13	V / 1.00 / 200	-8.87
36.87 MHz	41.75 Qp	0.71 / 17.89 / 29.9 / 0.0	30.45	V / 1.00 / 270	-9.55
854.316 MHz	40.93 Qp	3.41 / 21.87 / 29.88 / 0.0	36.34	V / 1.09 / 0	-9.66
745.836 MHz	41.74 Qp	3.22 / 21.19 / 30.1 / 0.0	36.05	V / 1.13 / 305	-9.95
800.076 MHz	41.04 Qp	3.32 / 21.6 / 30.06 / 0.0	35.9	V / 1.09 / 340	-10.1
881.436 MHz	39.45 Qp	3.46 / 22.19 / 29.7 / 0.0	35.4	V / 1.00 / 0	-10.6
43.026 MHz	42.35 Qp	0.76 / 15.93 / 29.8 / 0.0	29.24	V / 1.00 / 270	-10.76
935.676 MHz	38.45 Qp	3.59 / 22.83 / 29.66 / 0.0	35.21	V / 1.00 / 0	-10.79
827.196 MHz	39.8 Qp	3.37 / 21.8 / 30.02 / 0.0	34.95	V / 1.10 / 340	-11.05
772.956 MHz	40.37 Qp	3.27 / 21.37 / 30.1 / 0.0	34.91	V / 1.10 / 300	-11.09
610.218 MHz	42.59 Qp	2.83 / 19.24 / 30.15 / 0.0	34.51	H / 1.80 / 250	-11.49
908.556 MHz	38.0 Qp	3.51 / 22.51 / 29.62 / 0.0	34.4	V / 1.00 / 0	-11.6
952.347 MHz	36.5 Qp	3.65 / 22.98 / 29.69 / 0.0	33.44	V / 1.00 / 180	-12.56
664.458 MHz	39.41 Qp	3.01 / 19.6 / 30.2 / 0.0	31.82	V / 1.00 / 185	-14.18
894.996 MHz	35.5 Qp	3.48 / 22.35 / 29.6 / 0.0	31.73	V / 1.00 / 180	-14.27
501.75 MHz	41.79 Qp	2.65 / 17.08 / 30.2 / 0.0	31.32	H / 3.00 / 255	-14.68
691.596 MHz	38.0 Qp	3.11 / 20.13 / 30.17 / 0.0	31.07	V / 1.00 / 180	-14.93
637.338 MHz	38.35 Qp	2.89 / 19.78 / 30.2 / 0.0	30.83	V / 1.00 / 180	-15.17
922.116 MHz	33.6 Qp	3.55 / 22.67 / 29.64 / 0.0	30.18	V / 1.00 / 180	-15.82
884.75 MHz	34.05 Qp	3.47 / 22.23 / 29.67 / 0.0	30.07	V / 1.00 / 180	-15.93
555.987 MHz	39.1 Qp	2.75 / 18.26 / 30.19 / 0.0	29.92	V / 1.00 / 180	-16.08
949.236 MHz	32.95 Qp	3.64 / 22.99 / 29.68 / 0.0	29.89	V / 1.00 / 180	-16.11
706.589 MHz	35.65 Qp	3.14 / 20.43 / 30.14 / 0.0	29.08	V / 1.00 / 180	-16.92
311.88 MHz	43.1 Qp	2.06 / 13.53 / 29.9 / 0.0	28.79	V / 1.00 / 180	-17.21
731.154 MHz	34.75 Qp	3.19 / 20.92 / 30.1 / 0.0	28.76	V / 1.00 / 180	-17.24

Tested by: Robert J Behringer (Printed) _____ (Signature)

Reviewed by: Joel T Schneider (Printed) _____ (Signature)

RADIATED EMISSIONS

Test Report #:	WC808612 Run 1	Test Area:	LTS		
EUT Model #:	TriReader	Date:	10/29/2008		
EUT Serial #:		EUT Power:	12 VDC	Temperature:	24.0 °C
Test Method:	FCC 15.225			Air Pressure:	99.0 kPa
Customer:	Cubic Transportation			Rel. Humidity:	24.0 %
EUT Description:	TriReader				
Notes:					
Data File Name:	8612.dat			Page:	10 of 13

Measurement summary for limit2: FCC-B <1GHz 3m (Qp)

FREQ	LEVEL (dBuV)	CABLE / ANT / PREAMP / ATTEN (dB)	FINAL (dBuV / m)	POL / HGT / AZ (m)(DEG)	DELTA2 FCC-B <1GHz 3m
724.962 MHz	34.7 Qp	3.18 / 20.8 / 30.11 / 0.0	28.57	V / 1.00 / 180	-17.43
411.684 MHz	40.05 Qp	2.36 / 15.69 / 30.0 / 0.0	28.1	V / 1.00 / 180	-17.9
989.916 MHz	38.8 Qp	3.76 / 23.15 / 29.74 / 0.0	35.97	V / 1.00 / 180	-18.03
447.504 MHz	38.95 Qp	2.48 / 16.4 / 30.0 / 0.0	27.83	H / 3.00 / 270	-18.17
393.262 MHz	40.0 Qp	2.3 / 15.46 / 30.0 / 0.0	27.76	V / 1.00 / 180	-18.24
962.796 MHz	38.85 Qp	3.68 / 22.91 / 29.7 / 0.0	35.74	V / 1.00 / 180	-18.26
474.6 MHz	38.35 Qp	2.57 / 16.89 / 30.17 / 0.0	27.64	V / 1.00 / 90	-18.36
867.876 MHz	31.85 Qp	3.44 / 22.03 / 29.79 / 0.0	27.53	V / 1.00 / 0	-18.47
147.48 MHz	43.7 Qp	1.39 / 9.66 / 29.8 / 0.0	24.96	V / 1.00 / 90	-18.54
149.16 MHz	43.75 Qp	1.4 / 9.57 / 29.8 / 0.0	24.92	V / 1.00 / 180	-18.58
284.788 MHz	42.6 Qp	1.93 / 12.7 / 29.85 / 0.0	27.39	V / 1.00 / 180	-18.61
528.84 MHz	37.1 Qp	2.71 / 17.7 / 30.2 / 0.0	27.31	V / 1.00 / 90	-18.69
840.756 MHz	32.15 Qp	3.39 / 21.71 / 29.97 / 0.0	27.28	V / 1.00 / 0	-18.72
339.0 MHz	40.55 Qp	2.14 / 14.36 / 30.0 / 0.0	27.05	V / 1.00 / 180	-18.95
663.557 MHz	34.6 Qp	3.0 / 19.61 / 30.2 / 0.0	27.01	V / 1.00 / 180	-18.99
786.516 MHz	31.4 Qp	3.3 / 21.42 / 30.09 / 0.0	26.03	V / 1.00 / 0	-19.97
700.439 MHz	32.65 Qp	3.13 / 20.31 / 30.16 / 0.0	25.93	V / 1.00 / 180	-20.07
54.24 MHz	35.45 Qp	0.84 / 13.09 / 29.7 / 0.0	19.69	V / 1.00 / 0	-20.31
632.872 MHz	33.25 Qp	2.88 / 19.75 / 30.2 / 0.0	25.69	V / 1.00 / 180	-20.31
813.636 MHz	30.4 Qp	3.34 / 21.87 / 30.04 / 0.0	25.58	V / 1.00 / 0	-20.42
420.384 MHz	36.7 Qp	2.39 / 16.15 / 30.0 / 0.0	25.25	V / 1.00 / 180	-20.75
650.898 MHz	32.8 Qp	2.95 / 19.69 / 30.2 / 0.0	25.24	V / 1.00 / 0	-20.76
368.652 MHz	37.85 Qp	2.2 / 15.15 / 30.0 / 0.0	25.2	V / 1.00 / 180	-20.8
479.252 MHz	35.65 Qp	2.58 / 16.81 / 30.2 / 0.0	24.85	V / 1.00 / 270	-21.15
352.56 MHz	37.9 Qp	2.17 / 14.65 / 30.0 / 0.0	24.72	V / 1.00 / 180	-21.28
759.396 MHz	30.3 Qp	3.24 / 21.17 / 30.1 / 0.0	24.61	V / 1.00 / 0	-21.39
366.142 MHz	37.35 Qp	2.2 / 15.05 / 30.0 / 0.0	24.59	V / 1.00 / 180	-21.41
298.32 MHz	39.35 Qp	2.0 / 13.12 / 29.9 / 0.0	24.56	V / 1.00 / 180	-21.44

Tested by: Robert J Behringer (Printed) _____ (Signature)

Reviewed by: Joel T Schneider (Printed) _____ (Signature)

RADIATED EMISSIONS

Test Report #:	WC808612 Run 1	Test Area:	LTS		
EUT Model #:	TriReader	Date:	10/29/2008		
EUT Serial #:		EUT Power:	12 VDC	Temperature:	24.0 °C
Test Method:	FCC 15.225			Air Pressure:	99.0 kPa
Customer:	Cubic Transportation			Rel. Humidity:	24.0 %
EUT Description:	TriReader				
Notes:					
Data File Name:	8612.dat			Page:	11 of 13

Measurement summary for limit2: FCC-B <1GHz 3m (Qp)

FREQ	LEVEL (dBuV)	CABLE / ANT / PREAMP / ATTEN (dB)	FINAL (dBuV / m)	POL / HGT / AZ (m)(DEG)	DELTA2 FCC-B <1GHz 3m
405.524 MHz	36.45 Qp	2.34 / 15.69 / 30.0 / 0.0	24.48	V / 1.00 / 180	-21.52
705.156 MHz	31.0 Qp	3.14 / 20.4 / 30.15 / 0.0	24.39	V / 1.00 / 315	-21.61
264.22 MHz	39.7 Qp	1.86 / 12.57 / 29.8 / 0.0	24.33	V / 1.00 / 180	-21.67
80.01 MHz	38.9 Qp	1.0 / 7.83 / 29.7 / 0.0	18.03	V / 1.00 / 0	-21.97
257.64 MHz	39.35 Qp	1.84 / 12.34 / 29.8 / 0.0	23.73	H / 3.00 / 90	-22.27
221.192 MHz	40.7 Qp	1.68 / 11.07 / 29.8 / 0.0	23.65	V / 1.00 / 0	-22.35
732.276 MHz	29.35 Qp	3.19 / 20.95 / 30.1 / 0.0	23.39	V / 1.00 / 0	-22.61
230.52 MHz	39.95 Qp	1.73 / 11.39 / 29.76 / 0.0	23.31	V / 1.00 / 0	-22.69
294.927 MHz	38.2 Qp	1.98 / 13.01 / 29.9 / 0.0	23.3	V / 1.00 / 0	-22.7
203.4 MHz	38.4 Qp	1.62 / 10.53 / 29.8 / 0.0	20.75	V / 1.00 / 0	-22.75
184.335 MHz	38.55 Qp	1.57 / 10.32 / 29.8 / 0.0	20.64	H / 3.00 / 180	-22.86
244.08 MHz	39.15 Qp	1.8 / 11.87 / 29.72 / 0.0	23.1	H / 3.00 / 90	-22.9
67.8 MHz	36.0 Qp	0.94 / 9.49 / 29.6 / 0.0	16.82	V / 1.00 / 90	-23.18
110.609 MHz	39.55 Qp	1.15 / 9.25 / 29.7 / 0.0	20.25	V / 1.00 / 180	-23.25
331.799 MHz	36.4 Qp	2.12 / 14.14 / 29.97 / 0.0	22.7	V / 1.00 / 180	-23.3
81.36 MHz	37.6 Qp	1.01 / 7.69 / 29.7 / 0.0	16.6	V / 1.00 / 0	-23.4
325.44 MHz	36.4 Qp	2.11 / 13.95 / 29.94 / 0.0	22.52	V / 1.00 / 180	-23.48
976.356 MHz	33.15 Qp	3.72 / 23.13 / 29.72 / 0.0	30.27	V / 1.00 / 180	-23.73
550.018 MHz	31.45 Qp	2.74 / 18.19 / 30.2 / 0.0	22.18	V / 1.00 / 0	-23.82
258.064 MHz	37.55 Qp	1.84 / 12.36 / 29.8 / 0.0	21.95	V / 1.00 / 0	-24.05
450.016 MHz	32.7 Qp	2.49 / 16.5 / 30.01 / 0.0	21.68	V / 1.00 / 0	-24.32
515.28 MHz	31.6 Qp	2.69 / 17.39 / 30.2 / 0.0	21.48	V / 1.00 / 0	-24.52
325.62 MHz	34.95 Qp	2.11 / 13.95 / 29.94 / 0.0	21.08	V / 1.00 / 90	-24.92
406.8 MHz	32.7 Qp	2.35 / 15.66 / 30.0 / 0.0	20.71	V / 1.00 / 180	-25.29
569.52 MHz	29.75 Qp	2.76 / 18.32 / 30.15 / 0.0	20.68	V / 1.00 / 0	-25.32
189.84 MHz	34.8 Qp	1.58 / 10.79 / 29.8 / 0.0	17.37	H / 3.00 / 180	-26.13
86.01 MHz	34.95 Qp	1.03 / 7.44 / 29.7 / 0.0	13.72	V / 1.00 / 0	-26.28
270.345 MHz	34.8 Qp	1.88 / 12.49 / 29.8 / 0.0	19.37	V / 1.00 / 180	-26.63

Tested by: Robert J Behringer (Printed) _____ (Signature)

Reviewed by: Joel T Schneider (Printed) _____ (Signature)

RADIATED EMISSIONS

Test Report #:	WC808612 Run 1	Test Area:	LTS		
EUT Model #:	TriReader	Date:	10/29/2008		
EUT Serial #:		EUT Power:	12 VDC	Temperature:	24.0 °C
Test Method:	FCC 15.225			Air Pressure:	99.0 kPa
Customer:	Cubic Transportation			Rel. Humidity:	24.0 %
EUT Description:	TriReader				
Notes:					
Data File Name:	8612.dat			Page:	12 of 13

Measurement summary for limit2: FCC-B <1GHz 3m (Qp)

FREQ	LEVEL (dBuV)	CABLE / ANT / PREAMP / ATTEN (dB)	FINAL (dBuV / m)	POL / HGT / AZ (m)(DEG)	DELTA2 FCC-B <1GHz 3m
251.884 MHz	35.1 Qp	1.83 / 12.14 / 29.77 / 0.0	19.3	V / 1.00 / 180	-26.7
324.209 MHz	32.9 Qp	2.11 / 13.91 / 29.93 / 0.0	18.99	H / 3.00 / 0	-27.01
488.16 MHz	29.45 Qp	2.61 / 16.77 / 30.2 / 0.0	18.63	V / 1.00 / 0	-27.37
374.792 MHz	31.0 Qp	2.23 / 15.39 / 30.0 / 0.0	18.62	V / 1.00 / 180	-27.38
208.891 MHz	33.45 Qp	1.64 / 10.64 / 29.8 / 0.0	15.93	V / 1.00 / 0	-27.57
135.6 MHz	35.45 Qp	1.33 / 8.2 / 29.7 / 0.0	15.28	V / 1.00 / 0	-28.22
433.92 MHz	28.85 Qp	2.44 / 16.22 / 30.0 / 0.0	17.51	V / 1.00 / 0	-28.49
108.48 MHz	34.3 Qp	1.14 / 9.17 / 29.7 / 0.0	14.92	V / 1.00 / 0	-28.58
172.039 MHz	33.75 Qp	1.53 / 9.29 / 29.8 / 0.0	14.77	V / 1.00 / 0	-28.73
108.821 MHz	33.7 Qp	1.15 / 9.18 / 29.7 / 0.0	14.33	V / 1.00 / 0	-29.17
379.68 MHz	28.85 Qp	2.25 / 15.37 / 30.0 / 0.0	16.46	V / 1.00 / 0	-29.54
122.04 MHz	33.45 Qp	1.21 / 8.94 / 29.7 / 0.0	13.9	V / 1.00 / 180	-29.6
176.28 MHz	32.4 Qp	1.54 / 9.65 / 29.8 / 0.0	13.79	H / 3.00 / 0	-29.71
200.01 MHz	30.95 Qp	1.61 / 10.6 / 29.8 / 0.0	13.36	V / 1.00 / 0	-30.14
162.72 MHz	32.4 Qp	1.51 / 8.83 / 29.8 / 0.0	12.93	V / 1.00 / 0	-30.57
216.96 MHz	30.55 Qp	1.67 / 10.92 / 29.8 / 0.0	13.34	V / 1.00 / 0	-32.66

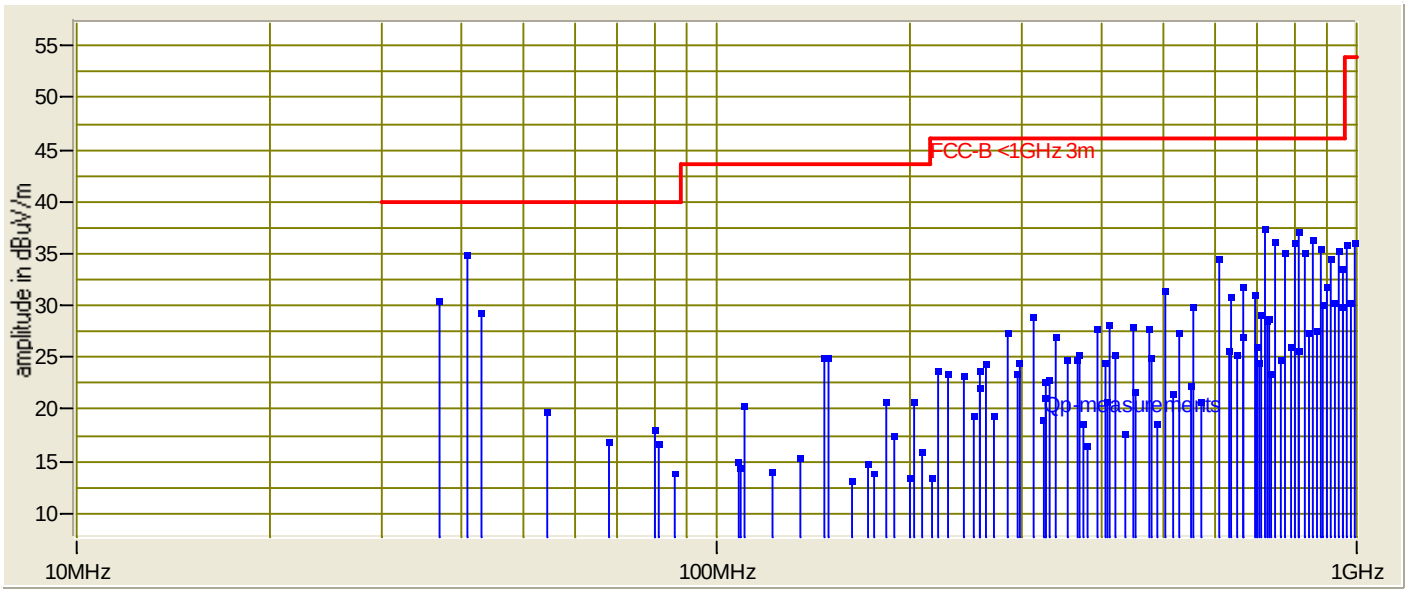
Tested by: Robert J Behringer (Printed) _____ (Signature)

Reviewed by: Joel T Schneider (Printed) _____ (Signature)

RADIATED EMISSIONS

Test Report #:	WC808612 Run 1	Test Area:	LTS		
EUT Model #:	TriReader	Date:	10/29/2008		
EUT Serial #:		EUT Power:	12 VDC	Temperature:	24.0 °C
Test Method:	FCC 15.225			Air Pressure:	99.0 kPa
Customer:	Cubic Transportation			Rel. Humidity:	24.0 %
EUT Description:	TriReader				
Notes:					
Data File Name:	8612.dat			Page:	13 of 13

Graph:



Tested by: Robert J Behringer (Printed) _____ (Signature)

Reviewed by: Joel T Schneider (Printed) _____ (Signature)

Frequency tolerance
FCC 15.225(e)

Test summary
The requirements are: ■ - MET ☐ - NOT MET
Testing was performed in accordance with the test procedure of ANSI C63.4 2003, clause H.5
The frequency tolerance of the carrier signal is maintained within ±0.01% of the operating frequency over temperature variations of -20 degrees to +50 degrees C at normal supply voltage, and for a variation in the primary supply voltage from 85% to 115% of the rated supply voltage at a temperature of 20 degrees C.

Test location
☐ - Wild River Lab Large Test Site (Open Area Test Site)
☐ - Wild River Lab Small Test Site (Open Area Test Site)
■ - New Brighton Facility, Environmental Lab

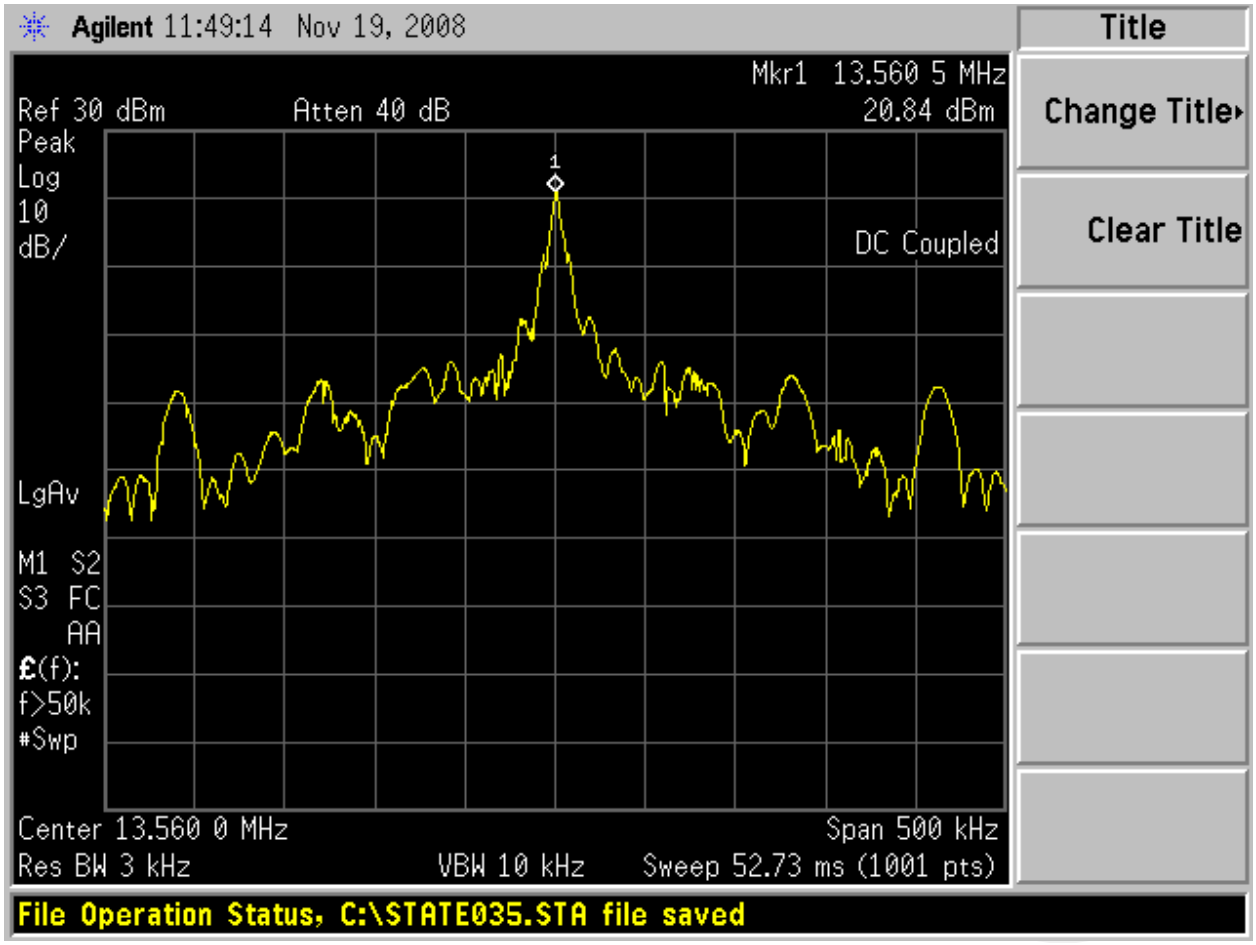
Test Equipment

TUV ID	Model	Manufacturer	Description	Serial	Cal Due
NBLE02238	SH27	ENVIRONTRONICS	27 Cu Ft T/H Chamber	09963482-5	Code Y 04-Aug-09
NBLE10435	E4440A	Agilent	Spectrum Analyzer	MY44304483	21-May-09
NBLE02435	LP-105A	SG	Magnetic Field Probe	1	Code Y

Cal Code B = Calibration verification performed internally.

Test limits
Frequency tolerance maintained within ±0.01% of the operating frequency.

Test data
See following page



Temperature/Voltage	Frequency	Spec	Result
-20 degrees C	13.5605 MHz	±.01% (1.356 kHz)	Pass
-10 degrees C	13.5605 MHz	±.01% (1.356 kHz)	Pass
0 degrees C	13.5605 MHz	±.01% (1.356 kHz)	Pass
10 degrees C	13.5605 MHz	±.01% (1.356 kHz)	Pass
20 degrees C	13.5605 MHz	±.01% (1.356 kHz)	Pass
30 degrees C	13.5605 MHz	±.01% (1.356 kHz)	Pass
40 degrees C	13.5605 MHz	±.01% (1.356 kHz)	Pass
50 degrees C	13.5605 MHz	±.01% (1.356 kHz)	Pass
10.2 VDC	13.5605 MHz	±.01% (1.356 kHz)	Pass
13.8 VDC	13.5605 MHz	±.01% (1.356 kHz)	Pass

Conducted limits - AC Power Lines
FCC 15.207(a)

Test summary
The requirements are: ■ - MET ☐ - NOT MET
Testing was performed in accordance with the test procedure of ANSI C63.4 2003, clause 7.2
Measured a representative AC – DC power supply
Minimum margin of compliance is 16.38 dB at 13.56 MHz

Test location
☐ - Wild River Lab Large Test Site (Open Area Test Site)
☐ - Wild River Lab Small Test Site (Open Area Test Site)
■ - Wild River Lab Shield Room 2

Test Equipment

TUV ID	Model	Manufacturer	Description	Serial	Cal Due
WRLE03990	3816/2	ETS Lindgren	50 Ω LISN	00035359	Code B 28-Jul-09
WRLE02534	ESHS-20	Rhode & Schwarz	EMI Receiver	837055/003	20-Mar-09

Cal Code B = Calibration verification performed internally.

Test limits, dBμV

Frequncy (MHz)	Quasi Peak	Average
0.15 - 0.5	66 - 56*	56 - 46*
0.5 - 5	56	46
5 - 30	60	50

*Decreases with the logarithm of the frequency

Test data
See following pages

CONDUCTED EMISSIONS

Test Report #:	WC808612 Run 2	Test Area:	SR2		
EUT Model #:	TriReader	Date:	11/12/2008		
EUT Serial #:		EUT Power:	110 VAC 60 Hz	Temperature:	22.0 °C
Test Method:	FCC 15.207			Air Pressure:	99.0 kPa
Customer:	Cubic Transportation			Rel. Humidity:	38.0 %
EUT Description:	TriReader				
Notes:					
Data File Name:	8612.dat			Page:	1 of 5

List of measurements for run #: 2

FREQ	LEVEL (dBuV)	CABLE / ANT / PREAMP / ATTEN (dB)	FINAL (dBuV)	EUT Lead	DELTA1 FCC 15.207 Qp	DELTA2 FCC 15.207 Avg
110 VAC 60 Hz to 12 VDC power supply (representative power supply)						
155.0 kHz	13.87 Qp	0.01 / 0.05 / 0.0 / 0.0	13.93	L1	-51.8	n/a
300.0 kHz	18.77 Qp	0.02 / 0.04 / 0.0 / 0.0	18.83	L1	-41.41	n/a
775.0 kHz	-3.83 Qp	0.05 / 0.04 / 0.0 / 0.0	-3.74	L1	-59.74	n/a
3.64 MHz	-2.99 Qp	0.15 / 0.08 / 0.0 / 0.0	-2.76	L1	-58.76	n/a
12.0 MHz	21.91 Qp	0.28 / 0.25 / 0.0 / 0.0	22.44	L1	-37.56	n/a
13.56 MHz	24.75 Qp	0.3 / 0.28 / 0.0 / 0.0	25.33	L1	-34.67	n/a
27.12 MHz	9.99 Qp	0.42 / 0.58 / 0.0 / 0.0	10.99	L1	-49.01	n/a
155.0 kHz	7.44 Av	0.01 / 0.05 / 0.0 / 0.0	7.5	L1	n/a	-48.23
300.0 kHz	18.14 Av	0.02 / 0.04 / 0.0 / 0.0	18.2	L1	n/a	-32.04
775.0 kHz	-7.75 Av	0.05 / 0.04 / 0.0 / 0.0	-7.66	L1	n/a	-53.66
3.64 MHz	-7.12 Av	0.15 / 0.08 / 0.0 / 0.0	-6.89	L1	n/a	-52.89
12.0 MHz	-5.39 Av	0.28 / 0.25 / 0.0 / 0.0	-4.86	L1	n/a	-54.86
13.56 MHz	29.63 Av	0.3 / 0.28 / 0.0 / 0.0	30.21	L1	n/a	-19.79
27.12 MHz	8.03 Av	0.42 / 0.58 / 0.0 / 0.0	9.03	L1	n/a	-40.97
155.0 kHz	8.05 Qp	0.01 / 0.05 / 0.0 / 0.0	8.11	N	-57.62	n/a
300.0 kHz	4.89 Qp	0.02 / 0.04 / 0.0 / 0.0	4.95	N	-55.29	n/a
775.0 kHz	-5.11 Qp	0.05 / 0.04 / 0.0 / 0.0	-5.02	N	-61.02	n/a
3.64 MHz	-3.13 Qp	0.15 / 0.08 / 0.0 / 0.0	-2.9	N	-58.9	n/a
12.0 MHz	-0.61 Qp	0.28 / 0.25 / 0.0 / 0.0	-0.08	N	-60.08	n/a
13.56 MHz	33.63 Qp	0.3 / 0.28 / 0.0 / 0.0	34.21	N	-25.79	n/a
27.12 MHz	10.51 Qp	0.42 / 0.58 / 0.0 / 0.0	11.51	N	-48.49	n/a
155.0 kHz	-3.8 Av	0.01 / 0.05 / 0.0 / 0.0	-3.74	N	n/a	-59.47
300.0 kHz	3.07 Av	0.02 / 0.04 / 0.0 / 0.0	3.13	N	n/a	-47.11
775.0 kHz	-8.72 Av	0.05 / 0.04 / 0.0 / 0.0	-8.63	N	n/a	-54.63

Tested by: Greg Jakubowski (Printed) — G Jakubowski (Signature)

Reviewed by: Joel T Schneider (Printed) — Joel T. Schneider (Signature)

CONDUCTED EMISSIONS

Test Report #:	WC808612 Run 2	Test Area:	SR2		
EUT Model #:	TriReader	Date:	11/12/2008		
EUT Serial #:		EUT Power:	110 VAC 60 Hz	Temperature:	22.0 °C
Test Method:	FCC 15.207			Air Pressure:	99.0 kPa
Customer:	Cubic Transportation			Rel. Humidity:	38.0 %
EUT Description:	TriReader				
Notes:					
Data File Name:	8612.dat			Page:	2 of 5

List of measurements for run #: 2

FREQ	LEVEL (dBuV)	CABLE / ANT / PREAMP / ATTEN (dB)	FINAL (dBuV)	EUT Lead	DELTA1 FCC 15.207 Qp	DELTA2 FCC 15.207 Avg
3.64 MHz	-7.07 Av	0.15 / 0.08 / 0.0 / 0.0	-6.84	N	n/a	-52.84
12.0 MHz	-6.03 Av	0.28 / 0.25 / 0.0 / 0.0	-5.5	N	n/a	-55.5
13.56 MHz	33.04 Av	0.3 / 0.28 / 0.0 / 0.0	33.62	N	n/a	-16.38
27.12 MHz	9.09 Av	0.42 / 0.58 / 0.0 / 0.0	10.09	N	n/a	-39.91

Tested by: Greg Jakubowski (Printed) _____ (Signature)

Reviewed by: Joel T Schneider (Printed) _____ (Signature)

CONDUCTED EMISSIONS

Test Report #:	WC808612 Run 2	Test Area:	SR2		
EUT Model #:	TriReader	Date:	11/12/2008		
EUT Serial #:		EUT Power:	110 VAC 60 Hz	Temperature:	22.0 °C
Test Method:	FCC 15.207			Air Pressure:	99.0 kPa
Customer:	Cubic Transportation			Rel. Humidity:	38.0 %
EUT Description:	TriReader				
Notes:					
Data File Name:	8612.dat			Page:	3 of 5

Measurement summary for limit1: EN55022 B Qp (Qp)

FREQ	LEVEL (dBuV)	CABLE / ANT / PREAMP / ATTEN (dB)	FINAL (dBuV)	EUT Lead	DELTA1 FCC 15.207 Qp
13.56 MHz	33.63 Qp	0.3 / 0.28 / 0.0 / 0.0	34.21	N	-25.79
12.0 MHz	21.91 Qp	0.28 / 0.25 / 0.0 / 0.0	22.44	L1	-37.56
300.0 kHz	18.77 Qp	0.02 / 0.04 / 0.0 / 0.0	18.83	L1	-41.41
27.12 MHz	10.51 Qp	0.42 / 0.58 / 0.0 / 0.0	11.51	N	-48.49
155.0 kHz	13.87 Qp	0.01 / 0.05 / 0.0 / 0.0	13.93	L1	-51.8
3.64 MHz	-2.99 Qp	0.15 / 0.08 / 0.0 / 0.0	-2.76	L1	-58.76
775.0 kHz	-3.83 Qp	0.05 / 0.04 / 0.0 / 0.0	-3.74	L1	-59.74

Tested by: Greg Jakubowski (Printed) — G Jakubowski (Signature)

Reviewed by: Joel T Schneider (Printed) — Joel T. Schneider (Signature)

CONDUCTED EMISSIONS

Test Report #:	WC808612 Run 2	Test Area:	SR2			
EUT Model #:	TriReader	Date:	11/12/2008			
EUT Serial #:		EUT Power:	110 VAC 60 Hz	Temperature:	22.0	°C
Test Method:	FCC 15.207			Air Pressure:	99.0	kPa
Customer:	Cubic Transportation			Rel. Humidity:	38.0	%
EUT Description:	TriReader					
Notes:						
Data File Name:	8612.dat			Page:	4 of 5	

Measurement summary for limit2: EN55022 B Avg (Av)

FREQ	LEVEL (dBuV)	CABLE / ANT / PREAMP / ATTEN (dB)	FINAL (dBuV)	EUT Lead	DELTA2 FCC 15.207 Avg
13.56 MHz	33.04 Av	0.3 / 0.28 / 0.0 / 0.0	33.62	N	-16.38
300.0 kHz	18.14 Av	0.02 / 0.04 / 0.0 / 0.0	18.2	L1	-32.04
27.12 MHz	9.09 Av	0.42 / 0.58 / 0.0 / 0.0	10.09	N	-39.91
155.0 kHz	7.44 Av	0.01 / 0.05 / 0.0 / 0.0	7.5	L1	-48.23
3.64 MHz	-7.07 Av	0.15 / 0.08 / 0.0 / 0.0	-6.84	N	-52.84
775.0 kHz	-7.75 Av	0.05 / 0.04 / 0.0 / 0.0	-7.66	L1	-53.66
12.0 MHz	-5.39 Av	0.28 / 0.25 / 0.0 / 0.0	-4.86	L1	-54.86

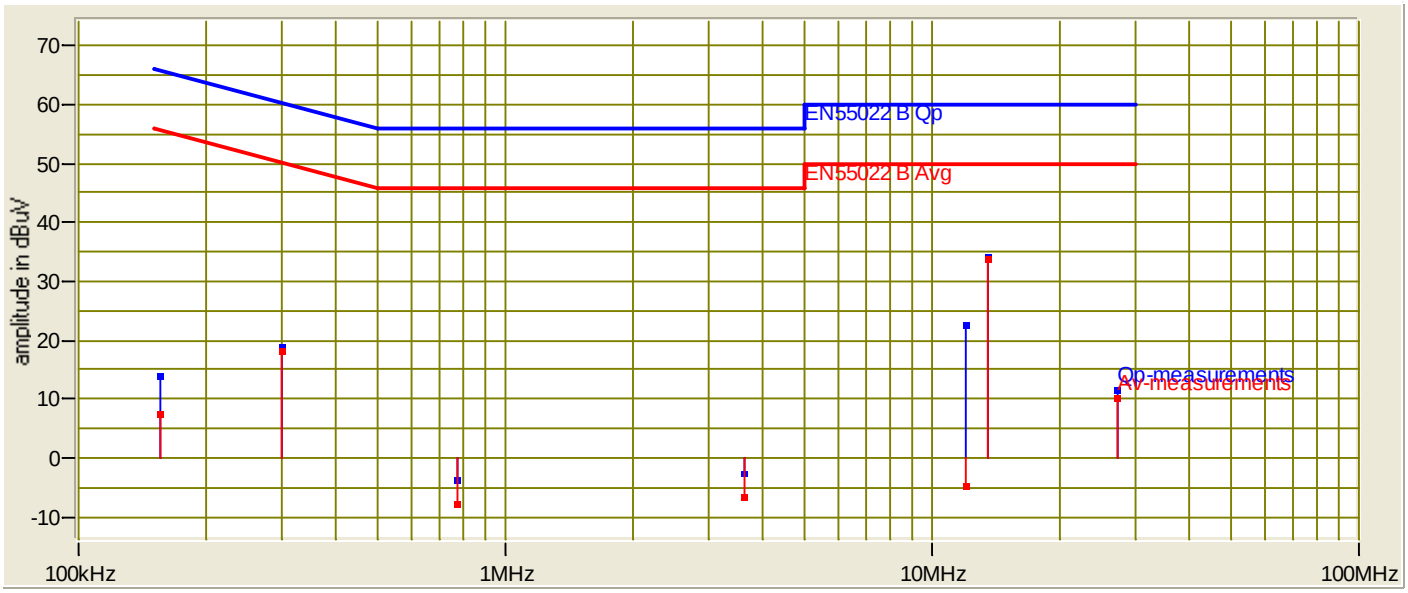
Tested by: Greg Jakubowski (Printed) — G Jakubowski (Signature)

Reviewed by: Joel T Schneider (Printed) — Joel T. Schneider (Signature)

CONDUCTED EMISSIONS

Test Report #:	WC808612 Run 2	Test Area:	SR2		
EUT Model #:	TriReader	Date:	11/12/2008		
EUT Serial #:		EUT Power:	110 VAC 60 Hz	Temperature:	22.0 °C
Test Method:	FCC 15.207			Air Pressure:	99.0 kPa
Customer:	Cubic Transportation			Rel. Humidity:	38.0 %
EUT Description:	TriReader				
Notes:					
Data File Name:	8612.dat			Page:	5 of 5

Graph:



Tested by: Greg Jakubowski (Printed) _____ (Signature)

Reviewed by: Joel T Schneider (Printed) _____ (Signature)

TEST SETUP FOR EMISSIONS TESTING

WILD RIVER LAB
Large Test Site

Notes:

1. Items shown in dotted lines are located on the floor below the test area. It is 5 meters vertically from the ground floor to the test area.

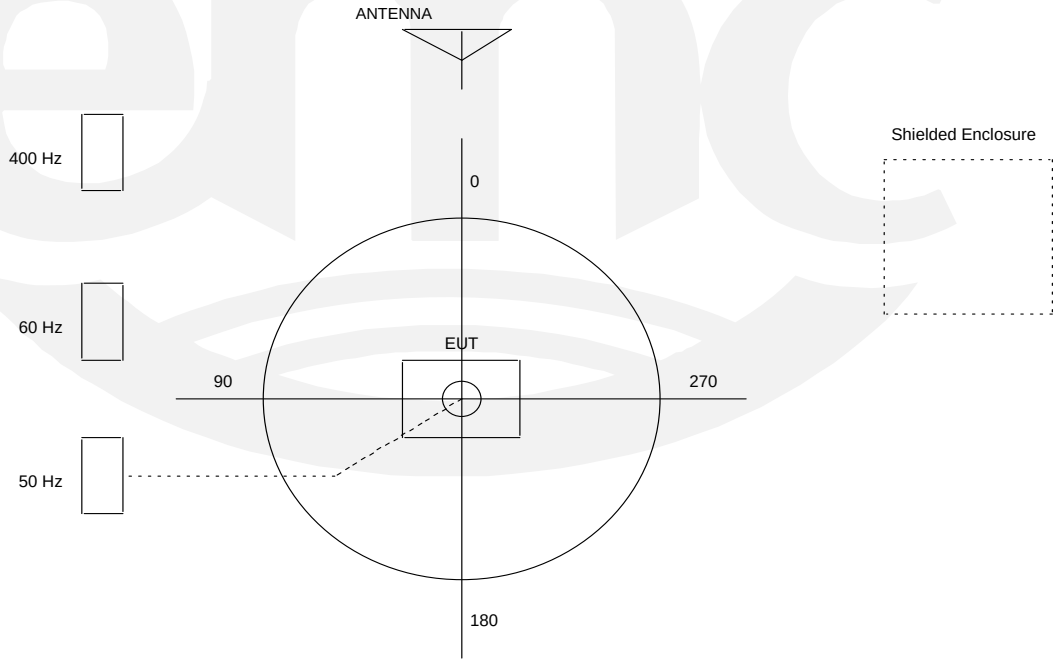
2. 50 Hz, 60 Hz, and 400 Hz are power panels for alternating current.

3. The antenna may be positioned horizontally 3, 10 or 30 meters from the center of the turntable.

4. The circle is a 6.7 meter diameter turntable.

5. A ground plane is in the plane of this sheet.

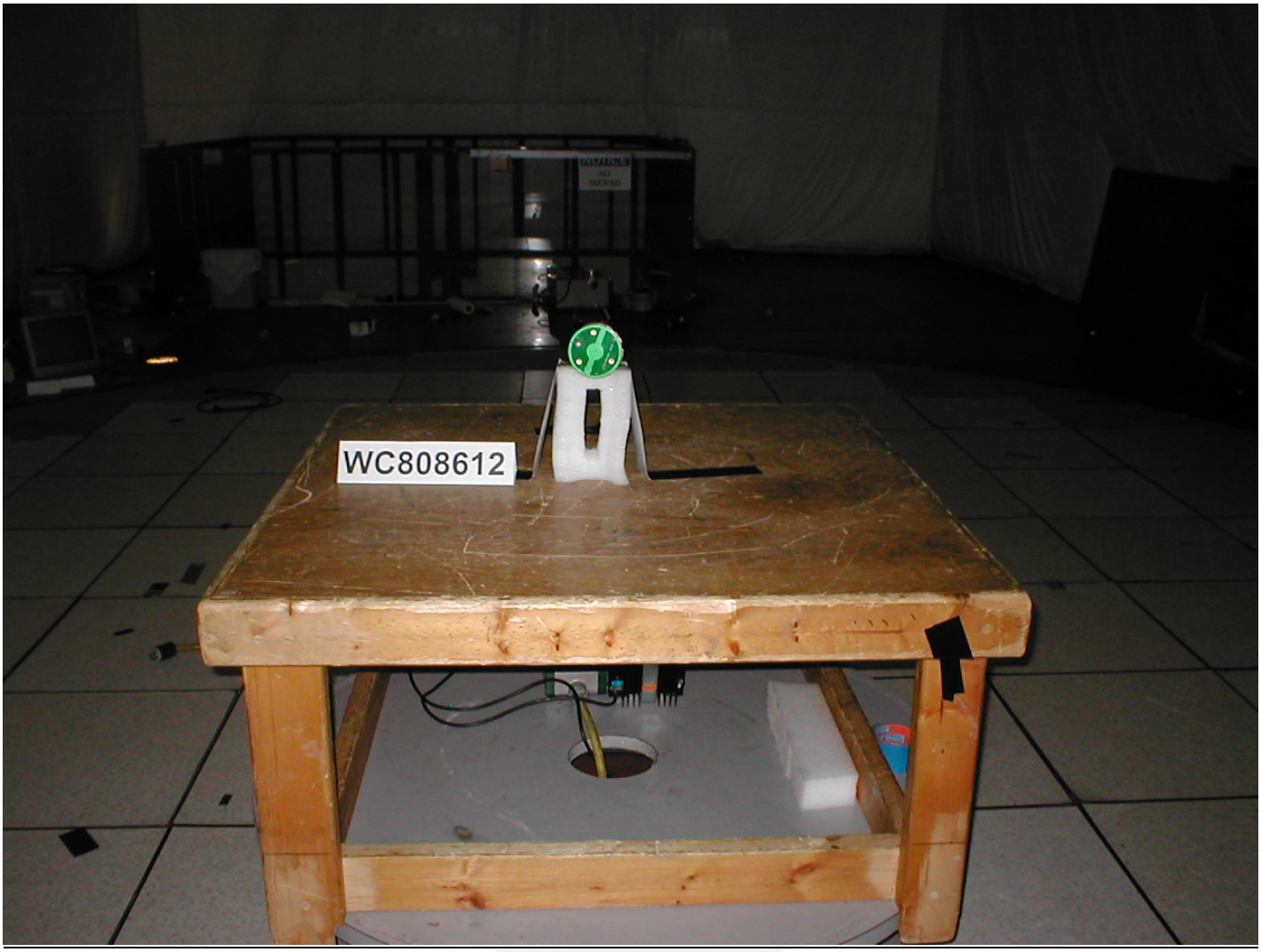
6. The test sample is shown in the azimuthal position representing zero degrees.



TÜV SÜD AMERICA INC 19333 Wild Mountain Road Taylors Falls MN 55084 Tel: (651) 638-0297 Fax: (651) 638-0298 Rev. 113006

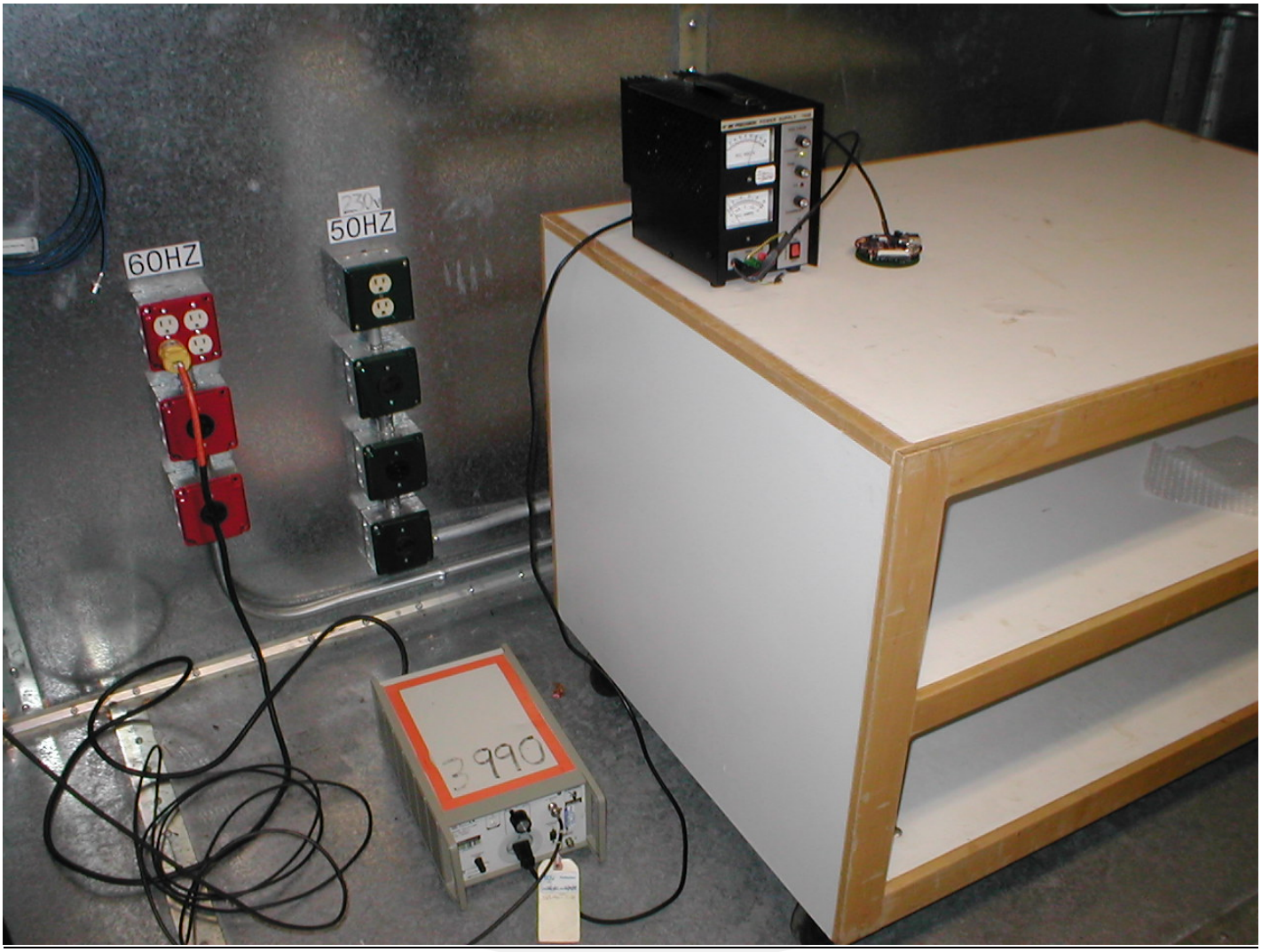
Test-setup photo(s):
General Field Strength Limits 0.009 – 30 MHz

Test-setup photo(s):
Radiated Emissions 30 - 1000 MHz



Test-setup photo(s):
Radiated Emissions 30 - 1000 MHz

Test-setup photo(s):
Conducted Emissions, AC lines, 150 kHz - 30 MHz



Equipment Under Test (EUT) Test Operation Mode:

The device under test was operated under the following conditions during immunity testing :

☐ - Standby

☐ - Test program (H - Pattern)

☐ - Test program (color bar)

☐ - Test program (customer specific)

☐ - Practice operation

☐ - Normal operating mode

■ - Active, polling for cards

Configuration of the device under test:

■ - See Appendix A and test setup photos

☐ - See Product Information Form(s) in Appendix B

DEVIATIONS FROM STANDARD:
None.

GENERAL REMARKS:
None

Modifications required to pass:
■ None
☐ As indicated on the data sheet(s)

Test Specification Deviations: Additions to or Exclusions from:
■ None
☐ As indicated in the Test Plan

SUMMARY:
The requirements according to the technical regulations are
■ - met and the device under test does fulfill the general approval requirements.
☐ - **not** met and the device under test does **not** fulfill the general approval requirements..

EUT Received Date: 04 November 2008

Condition of EUT: Normal

Testing Start Date: 04 November 2008

Testing End Date: 19 November 2008

TÜV SÜD AMERICA INC

Greg S Jakubowski
Senior EMC Technician

Joel T Schneider
Senior EMC Engineer

Appendix A

Constructional Data Form & Block Diagram

Form

EMC Test Plan and Constructional Data Form

PLEASE COMPLETE THIS DOCUMENT IN FULL, ENTERING N/A IF THE FIELD IS NOT APPLICABLE. IF TESTING RESULTS IN MODIFICATIONS TO THE EQUIPMENT, PLEASE SUBMIT A REVISED TP/CDF INDICATING THOSE MODIFICATIONS.
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 Transportaion Systems

Address: 5650 Kearny Mesa Road
San Diego, CA 92111

Contact: Tom Sorensen Position: Sr. Principal HW Engineer

Phone: 858 627 4534 Fax:

E-mail Address: tom.sorensen@cubic.com

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

EUT Description: Contactless Smartcard Reader, according to ISO 14443

EUT Name: Tri-Reader 3

Model No.: Serial No.:

Product Options: None

Configurations to be tested: Stand-alone, polling for cards

Equipment Modification (*If applicable, indicate modifications since EUT was last tested. If modifications are made during this testing, submit revised TP/CDF after testing is complete.)*

Modifications since last test: N/A

Modifications made during test: N/A

Test Objective(s): ***Please indicate the tests to be performed, entering the applicable standard(s) where noted.***

- ☒ EMC Directive 2004/108/EC (EMC) — Std: EN300330 + EN301489
- ☐ Machinery Directive 89/392/EEC (EMC) — Std:
- ☐ Medical Device Directive 93/42/EEC (EMC) — Std:
- ☐ Vehicle Directive: ☐ 2001/3/EC (EMC) ☐ 2004/104/EC (EMC) ☐ Other Vehicle Std:
- ☐ FDA Reviewers Guidance for Premarket Notification Submissions (EMC)

- ☒ FCC: Class ☐ A ☒ B Part 15
- ☐ VCCI: Class ☐ A ☐ B
- ☐ BSMI: Class ☐ A ☐ B (Separate Report)
- ☐ Canada: Class ☐ A ☐ B
- ☐ Australia: Class ☐ A ☐ B
- ☐ Other:

Third Party Certification, if applicable (*Signature on Page 6 Required)

- ☐ Attestation of Conformity (AoC)*
- ☐ Certificate of Conformity (CoC)*
- ☐ EMC Certification (used with Octagon Mark)*
- ☐ 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.)
- ☒ FCC / TCB Certification
- ☐ E-Mark Certification
- ☐ Industry Canada / FCB Certification
- ☐ Taiwan Certification

EMC Test Plan and Constructional Data Form

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 SÜD America should:

☒ Call contact listed above, if not available then stop testing. (After hrs phone): 619 223 7927
☐ Continue testing to complete test series.
☐ Continue testing to define corrective action.
☐ Stop testing.

EUT Specifications and Requirements

Length: 88mm Width: 88mm Height: 40mm Weight: 0.4kg

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: 12Vdc (If battery powered, make sure battery life is sufficient to complete testing.)

# of Phases: N/A

Current (Amps/phase(max)): 1A Current (Amps/phase(nominal)): 0.25A

Other DC operation

Other Special Requirements

Typical Installation and/or Operating Environment

(ie. Hospital, Small Business, Industrial/Factory, etc.)
Train Station, Bus, Tram...

EUT Power Cable

☐ Permanent OR ☒ Removable Length (in meters): 2
☒ Shielded OR ☐ Unshielded
☐ Not Applicable

Form

EMC Test Plan and Constructional Data Form

EUT Interface Ports and Cables

Type	Analog	Digital	During Test: Active	During Test: Passive	Qty	Shielding: Yes	Shielding: No	Shielding: Type	Termination	Connector Type	Port Termination	Length tested (in meters)	Removable	Permanent
EXAMPLE: *RS232*	☐	☒	☒	☐	*2*	☒	☐	*Foil over braid*	*Coaxial*	*Metallized 9-pin D-Sub*	*Characteristic Impedance*	*6*	☒	☐
RS422	☐	☒	☒	☐	1	☒	☐	Foil	In cable	RJ45	120R	2	☒	☐
USB	☐	☒	☐	☒	1	☒	☐	Foil		USB mini	Debug port	N/A	☒	☐
Digital Expansion	☐	☒	☐	☒	1	☐	☒			Multipin	Expansion board	0	☒	☐
	☐	☐	☐	☐		☐	☐						☐	☐
	☐	☐	☐	☐		☐	☐						☐	☐
	☐	☐	☐	☐		☐	☐						☐	☐
	☐	☐	☐	☐		☐	☐						☐	☐
	☐	☐	☐	☐		☐	☐						☐	☐
	☐	☐	☐	☐		☐	☐						☐	☐
	☐	☐	☐	☐		☐	☐						☐	☐
	☐	☐	☐	☐		☐	☐						☐	☐
	☐	☐	☐	☐		☐	☐						☐	☐
	☐	☐	☐	☐		☐	☐						☐	☐

EMC Test Plan and Constructional Data Form

EUT Software.

Revision Level:

Description: Special software for environmental/EMC testing. Exercses all memory chips and FPGA. Polls for cards and turns on green LED when a card is read OK. Reports card serial number on RS232/RS422 port.

Equipment Under Test (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. Active, polling for cards.

2.

3.

Equipment Under Test (EUT) System Components -- List and describe all components which are part of the EUT. For FCC & Taiwan testing a minimum configuration is required. (ie. Mouse, Printer, Monitor, External Disk Drive, Motherboard, etc)

Description	Model #	Serial #	FCC ID #
N/A			

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) This information is required for FCC & Taiwan testing.

Description	*Model #*	*Serial #*	*FCC ID #*
N/A			

Oscillator Frequencies

Manufacturer	*Frequency*	*Derived Frequency*	*Component # / Location*	*Description of Use*
Siward	27.120MHz	13.560MHz	Y1, Antenna Contr.	2x carrier frequency
Citizen	18.432MHz	N/A	Y3, Digital Board	CPU crystal
Citizen	32.768kHz	1Hz	Y2, Digital Board	RTC
Citizen	32.768kHz	N/A	Y1, Digital Board	CPU, sleep mode

Power Supply

Manufacturer	*Model #*	*Serial #*	*Type*
NS	LM3525	N/A	☒ Switched-mode: (Frequency) 145kHz ☐ Linear ☐ Other:
			☐ Switched-mode: (Frequency) _____ ☐ Linear ☐ Other: _____

Power Line Filters

Manufacturer	*Model #*	*Location in EUT*
N/A		

EMC Test Plan and Constructional Data Form

Critical EMI Components (Capacitors, ferrites, etc.)

Description	*Manufacturer*	*Part # or Value*	*Qty*	*Component # / Location*
N/A				

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

The device is designed with internal shielding int he PCBs, i.e. the noisier part of the circuit is contained in the volume between the digital board and the analog controller board. The ground planes in these two boards act as shields. Ground conenction between the two boards is improved by using grounded metal stand-offs. The antenna loop is completely shielded and backed by ferrite rubber.

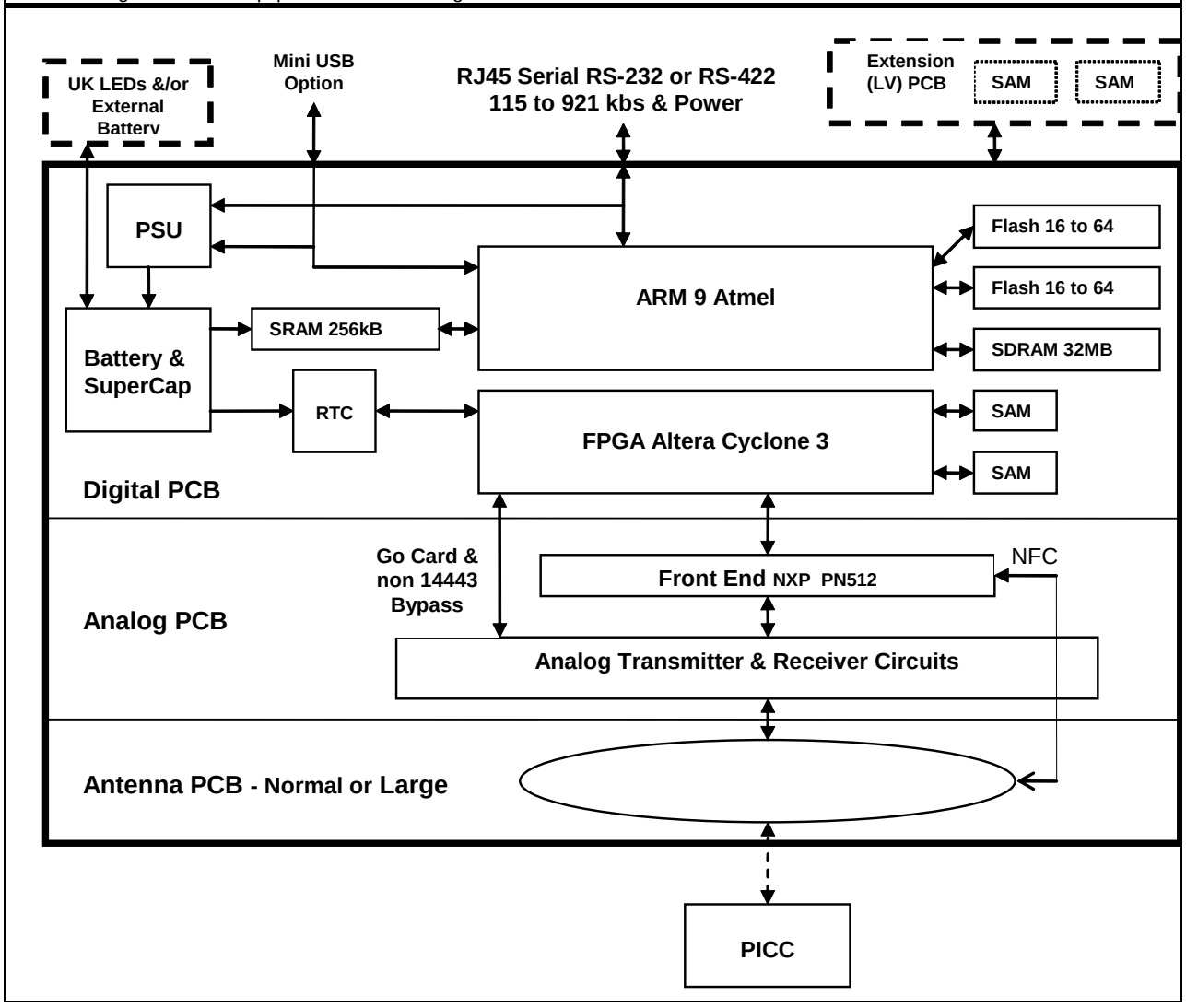
PLEASE ENTER NAMES BELOW (INSERT ELECTRONIC SIGNATURE IF POSSIBLE)

Authorization (Signature Required if a Third Party Certification is checked on pg 1)

	10/31/08
Customer authorization to perform tests according to this test plan.	Date
Thomas Busch-Sorensen	10/31/08
Test Plan/CDF Prepared By (please print)	Date

EMC Block Diagram Form

System Configuration Block Diagram -- Provide a line drawing identifying the EUT, simulators, support equipment, I/O cables, power cables, and any other pertinent components to be used during testing. Use a dashed line to separate the equipment in the testing field versus equipment outside testing field.



Authorization Signatures

Thomas Busch-Sorensen	11/26/08
Customer authorization to perform tests according to this test plan.	Date
	11/26/08
Test Plan/CDF Prepared By (please print)	Date

Appendix B

Measurement Protocol

MEASUREMENT PROTOCOL

GENERAL INFORMATION

Test Methodology

Emissions testing is performed according to the procedures in ANSI C63.4-2003

Measurement Uncertainty

The test system for conducted emissions is defined as the LISN, tuned receiver or spectrum analyzer, and coaxial cable. The test system has a measurement uncertainty of ±1.8 dB. The test system for radiated emissions is defined as the antenna, the pre-amplifier, the spectrum analyzer and the coaxial cable. The test system has a measurement uncertainty of ±4.8 dB. The equipment comprising the test systems is calibrated on an annual basis.

Justification

The Equipment Under Test (EUT) is configured in a typical user arrangement in accordance with the manufacturer's instructions. A cable is connected to each available port and either terminated with a peripheral into its characteristic impedance or left unterminated. When appropriate, the cables are manually manipulated with respect to each other to obtain maximum emissions from the unit.

Conducted Emissions

The final level, in dBμV, equals the EMI receiver level plus the cable loss and LISN factor.

Radiated Emissions

The final level, in dBμV/m, equals the reading from the spectrum analyzer (Level dBμV), adding the antenna correction factor and cable loss factor (Factor dB) to it, and subtracting the preamp gain (and duty cycle correction factor, if applicable). This result then has the limit subtracted from it to provide the Delta, which gives the tabular data as shown in the data sheets in Attachment A.

Example:

FREQ (MHz)	LEVEL (dBuV)		CABLE/ANT/PREAMP (dB) (dB/m) (dB)			FINAL (dBuV/m)	POL/HGT/AZ (m) (deg)			DELTA1
60.80	42.5Qp	+	1.2	+ 10.9	- 25.5 =	29.1	V	1.0	0.0	-10.9

Test Equipment

All measurement instrumentation is traceable to the National Institute of Standards and Technology and is calibrated according to internal procedure.

TÜV SÜD AMERICA INC 19333 Wild Mountain Road Taylors Falls MN 55084 Tel: (651) 638-0297 Fax: (651) 638-0298 Rev. 113006

DETAILS OF TEST PROCEDURES

Conducted Emissions

Conducted emissions on the 50 Hz and/or 60 Hz representative power interface of the EUT are measured in the frequency range of 150 kHz to 30 MHz. The measurements are performed using a receiver, which has CISPR characteristic bandwidth and quasi-peak detection, and a Line Impedance Stabilization Network (LISN), with 50 Ω/50 μH (CISPR 16) characteristics. Table top equipment is placed on a non-conducting table 80 centimeters above the floor and is positioned 40 centimeters from the vertical ground plane (wall) of the screen room. In some cases, a pre-scan using a spectrum analyzer is initially performed on the units comprising the system under test to locate the highest emissions.

Radiated Emissions

Radiated emissions in the frequency range of 10 kHz to 30 MHz, including the fundamental transmit signal, are measured using a receiver capable of quasi-peak and average measurements and a magnetic loop antenna. The transmitter is rotated through 3 orthogonal axes in order to determine the maximum emission levels. If the signal cannot be measured at the specified limit distance, measurements are recorded at multiple distances nearer to the device and the final level mathematically extrapolated. Radiated emissions from the EUT are measured in the frequency range of 30 to 1000 MHz using a spectrum analyzer and appropriate broadband linearly polarized antennas. Measurements between 30 MHz and 1000 MHz are made with 120 kHz/6 dB bandwidth and quasi-peak detection and measurements above 1000 MHz are made with a 1 MHz/6 dB bandwidth and peak detection. Table top equipment is placed on a 1.0 X 1.5 meter non-conducting table 80 centimeters above the ground plane. Interface cables that are closer than 40 centimeters to the ground plane are bundled in the center in a serpentine fashion so they are at least 40 centimeters from the ground plane. Cables to simulators/testers (if used in this test) are routed through the center of the table and to a screen room located outside the test area. The antenna is positioned 3, 10 or 30 meters horizontally from the EUT. To locate maximum emissions from the test sample the antenna is varied in height from 1 to 4 meters, measurement scans are made with both horizontal and vertical antenna polarizations and the EUT are rotated 360 degrees.