

TEST RESULT SUMMARY

FCC Part 15 Subpart C Section 15.207
FCC Part 15 Subpart C Section 15.225
Industry Canada RSS-210 Issue 7
Industry Canada RSS-Gen Issue 2

MANUFACTURER 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 WC1003842.1 Rev B

TEST DATE(S) 20 - 25 May and 05 August 2010

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", and Industry Canada RSS-210 and RSS-Gen.

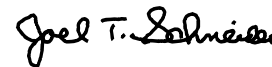
It is the manufacturer's responsibility to assure that additional production units of this model are manufactured with identical electrical and mechanical characteristics. Any modifications necessary for compliance made during testing on the above mentioned date(s) must be implemented in all production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

Date: 21 September 2010

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. WC1003842.1 Rev B Date of issue: 21 September 2010

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**

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.

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REVISION RECORD

REVISION	TOTAL NUMBER OF PAGES	DATE	DESCRIPTION
	41	17 June 2010	Initial Release
A	43	06 August 2010	Added Industry Canada data per Industry Canada RSS-210 Issue 7 and Industry Canada RSS-Gen Issue 2
B	43	21 September 2010	Added power supply statement, rbw for radiated emissions below 30 MHz, antenna height below 30 MHz, removed block diagram



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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)

RSS-210 Section A2.6

RSS-Gen Section 7.2.2

ENVIRONMENTAL CONDITIONS IN THE LAB

	<u>Actual</u>
Temperature:	: -20 - 50°C
Atmospheric pressure	: 98.8-99kPa
Relative Humidity	: 32.4-55%

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)

RSS-210 Section A2.6

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 36.0 dB μ V/m or 63.1 μ V/m at 30 meters

Minimum margin of compliance of the fundamental is 48.0 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

- 0.3 meters

- 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	29-Jul-11
WRLE02534	ESHS-20	Rhode & Schwarz	EMI Receiver	837055/003	29-Mar-11

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, peak and average measurements with a 9 kHz rbw, 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.

In the frequency range of 9 kHz to 30 MHz, magnetic field measurements may be performed. This method is applicable for radiated radio noise from all units, cables, power cords, and interconnect cabling or wiring. A calibrated loop antenna as specified shall be positioned with its plane vertical at the specified distance from the EUT and rotated about its vertical axis for maximum response at each azimuth about the EUT. For certain applications, the loop antenna may also need to be positioned horizontally at the specified distance from the EUT. The center of the loop shall be 1 m above the ground.

Test limit

15,848 μ V/m or 84 dB μ V/m at 30 meters

Test data

See following page

Radiated Emissions < 30 MHz per FCC 15.225



Test Report #: WC1003842 Test area: STS
Customer: Cubic Transportation Date: 5/20/2010
EUT Description: 13.56 MHz card reader Temperature: 25 C
EUT Model: TriReader 3 Air pressure: 98.8 kPa
EUT Serial: n/a Relative humidity: 32.4 %
Notes: extrapolated using 40 dB per decade

Freq. kHz	0.3m			1.0m			3.0m			10m			30m			100m			300m			limit dBuV/m	det	m	delta dB		
	Pk	QP	Avg	Pk	QP	Avg	Pk	QP	Avg	Pk	QP	Avg	Pk	QP	Avg	Pk	QP	Avg	Pk	QP	Avg						
13560	na	123.7	na	103.2	102.2	na	na	79	na	na	60.1	na	na	36	na	na	na	na	na	na	na	na	na	84.00	qp	30	-48.00
27120	na	72.5	na	na	36	na	na	nf	na	na	...	na	na	-24	na	na	na	na	na	na	na	na	na	29.50	qp	30	-53.50

Tested by: Greg S Jakubowski
print

sign

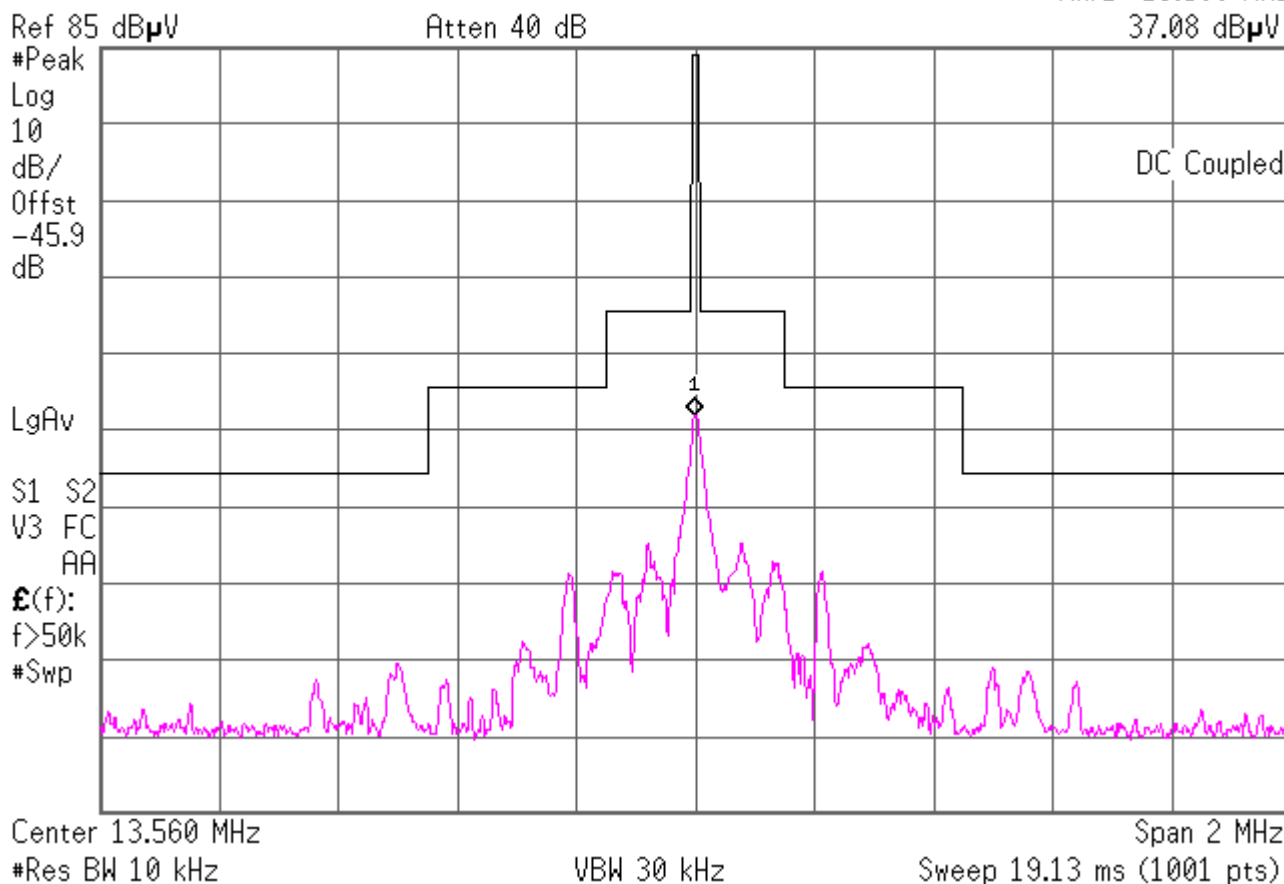
Reviewed by: Joel T Schneider
print

sign

Bandedge compliance
 Offset used to correct Y axis from dB μ V to dB μ V/m at 30 meters

Agilent 12:59:38 May 20, 2010

Mkr1 13.560 MHz
 37.08 dB μ V



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)



America

Emissions 13.410–13.553 MHz & 13.567–13.710 MHz

FCC 15.225(b)

RSS-210 Section A2.6

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	29-Jul-11
WRLE02534	ESHS-20	Rhode & Schwarz	EMI Receiver	837055/003	29-Mar-11

Test limit

334 μ V/m or 50.5 dB μ V/m at 30 meters

Emissions 13.110–13.410 MHz and 13.710–14.010 MHz

FCC 15.225(c)

RSS-210 Section A2.6

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	29-Jul-11
WRLE02534	ESHS-20	Rhode & Schwarz	EMI Receiver	837055/003	29-Mar-11

Test limit

106 μ V/m or 40.5 dB μ V/m at 30 meters

Emissions < 30 MHz, outside the band 13.110-14.010 MHz

FCC 15.225(d)

RSS-210 Section A2.6

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 -24.0 dB μ V/m* or 0.063 μ V/m at 30 meters at 27.120 MHz.

Minimum margin of compliance is 53.5 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	29-Jul-11
WRLE02534	ESHS-20	Rhode & Schwarz	EMI Receiver	837055/003	29-Mar-11

Test limit

Frequency (MHz)	Field strength μ V/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 27.12 MHz, the limit is 29.5 dB μ V/m at 30 meters

Test data

See page (page with 13.56 MHz fundamental data, "FCC 15.225 below 30 MHz.xls")

Radiated Emissions \geq 30 MHz

FCC 15.225(d)

RSS-210 Section A2.6

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 \geq 30 MHz is at 691.554 MHz, 36.05 dB μ V/m at 3 meters

Margin of compliance is 9.95 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
WRLE03204	EM-6917B	Electro-Metrics	Biconicalog Periodic	102	22-Mar-11
WRLE10617	ZHL-1042J	Mini-Circuits	Preamplifier 30 MHz-5 GHz	QA0746004	Code B 25-Sep-10
NBLE03196	8566B	Hewlett-Packard	Spectrum Analyzer	2240A01856	21-Jul-10
NBLE03195	85662A	Hewlett-Packard	Analyzer Display	2648A13518	21-Jul-10
WRLE02680	85650A	Hewlett-Packard	Quasi-Peak Adapter	2043A00343	15-Jun-11

Cal Code B = Calibration verification performed internally.

Test limits

Frequency (MHz)	Field strength (μ V/m)	Field strength (dB μ V/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

RADIATED EMISSIONS




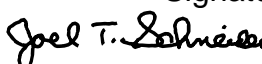
Test Report #: WC1003842 Run 1 Test Area: STS
 EUT Model #: Tri-Reader 3 Date: 5/20/2010
 EUT Serial #: _____ EUT Power: 12 VDC Temperature: 25.0 °C
 Test Method: FCC 15.225, 15.209 Air Pressure: 99.0 kPa
 Customer: Cubic Transportation Rel. Humidity: 35.0 %

EUT Description: 13.56 MHz Transmitter
RFID transmitter on
 Notes: _____

Data File Name: 3842.dat Page: 1 of 6

List of measurements for run #: 1

FREQ	LEVEL (dBuV)	CABLE / ANT / PREAMP / ATTN (dB)	FINAL (dBuV / m)	POL / HGT / AZ (m)(DEG)	DELTA1 FCC 15.209 3m	DELTA2
40.674 MHz	36.4 Qp	0.45 / 17.06 / 29.61 / 0.0	24.3	V / 1.00 / 0	-15.7	n/a
135.594 MHz	45.35 Qp	1.04 / 8.59 / 29.51 / 0.0	25.48	V / 1.00 / 0	-18.02	n/a
176.274 MHz	38.45 Qp	1.21 / 9.82 / 29.58 / 0.0	19.9	V / 1.00 / 0	-23.6	n/a
189.834 MHz	43.45 Qp	1.26 / 10.68 / 29.53 / 0.0	25.85	V / 1.00 / 0	-17.65	n/a
230.514 MHz	38.25 Qp	1.39 / 11.49 / 29.41 / 0.0	21.72	V / 1.00 / 0	-24.28	n/a
244.074 MHz	45.25 Qp	1.43 / 12.0 / 29.44 / 0.0	29.24	V / 1.00 / 0	-16.76	n/a
257.634 MHz	46.65 Qp	1.47 / 12.52 / 29.48 / 0.0	31.16	V / 1.00 / 0	-14.84	n/a
284.754 MHz	48.35 Qp	1.55 / 12.79 / 29.42 / 0.0	33.27	V / 1.00 / 0	-12.73	n/a
298.314 MHz	41.05 Qp	1.59 / 13.2 / 29.37 / 0.0	26.48	V / 1.00 / 0	-19.52	n/a
311.874 MHz	41.15 Qp	1.64 / 13.61 / 29.31 / 0.0	27.08	V / 1.00 / 0	-18.92	n/a
338.994 MHz	37.65 Qp	1.72 / 14.42 / 29.43 / 0.0	24.36	V / 1.00 / 0	-21.64	n/a
366.114 MHz	35.3 Qp	1.8 / 15.23 / 29.45 / 0.0	22.88	V / 1.00 / 0	-23.12	n/a
366.114 MHz	37.15 Qp	1.8 / 15.23 / 29.45 / 0.0	24.73	V / 1.00 / 0	-21.27	n/a
393.234 MHz	33.45 Qp	1.88 / 15.73 / 29.35 / 0.0	21.71	V / 1.00 / 0	-24.29	n/a
420.354 MHz	31.85 Qp	1.95 / 16.45 / 29.37 / 0.0	20.88	V / 1.00 / 0	-25.12	n/a
447.474 MHz	36.4 Qp	2.02 / 16.51 / 29.49 / 0.0	25.44	V / 1.00 / 0	-20.56	n/a
474.594 MHz	36.7 Qp	2.09 / 17.19 / 29.32 / 0.0	26.65	V / 1.00 / 0	-19.35	n/a
501.714 MHz	37.3 Qp	2.15 / 17.22 / 29.37 / 0.0	27.31	V / 1.00 / 0	-18.69	n/a
528.834 MHz	35.8 Qp	2.22 / 17.96 / 29.45 / 0.0	26.53	V / 1.00 / 0	-19.47	n/a
555.954 MHz	37.9 Qp	2.29 / 18.36 / 29.47 / 0.0	29.08	V / 1.00 / 0	-16.92	n/a
583.074 MHz	38.7 Qp	2.36 / 18.96 / 29.41 / 0.0	30.6	V / 1.00 / 0	-15.4	n/a
610.194 MHz	36.75 Qp	2.43 / 19.17 / 29.56 / 0.0	28.78	V / 1.00 / 0	-17.22	n/a
637.314 MHz	38.25 Qp	2.49 / 19.37 / 29.53 / 0.0	30.59	V / 1.00 / 0	-15.41	n/a
664.434 MHz	38.95 Qp	2.56 / 19.61 / 29.43 / 0.0	31.69	V / 1.00 / 0	-14.31	n/a
691.554 MHz	42.1 Qp	2.63 / 20.1 / 29.5 / 0.0	35.32	V / 1.00 / 0	-10.68	n/a
718.674 MHz	39.95 Qp	2.7 / 20.6 / 29.57 / 0.0	33.67	V / 1.00 / 0	-12.33	n/a
745.794 MHz	38.5 Qp	2.76 / 20.91 / 29.49 / 0.0	32.68	V / 1.00 / 0	-13.32	n/a
962.754 MHz	33.65 Qp	3.17 / 22.89 / 29.23 / 0.0	30.47	V / 1.00 / 0	-23.53	n/a

Tested by: Greg Jakubowski 
 Printed Signature
 Reviewed by: Joel T Schneider 
 Printed Signature

RADIATED EMISSIONS



Test Report #: WC1003842 Run 1 Test Area: STS
 EUT Model #: Tri-Reader 3 Date: 5/20/2010
 EUT Serial #: _____ EUT Power: 12 VDC Temperature: 25.0 °C
 Test Method: FCC 15.225, 15.209 Air Pressure: 99.0 kPa
 Customer: Cubic Transportation Rel. Humidity: 35.0 %

EUT Description: 13.56 MHz Transmitter
RFID transmitter on
 Notes: _____
 Data File Name: 3842.dat Page: 2 of 6

List of measurements for run #: 1

FREQ	LEVEL (dBuV)	CABLE / ANT / PREAMP / ATTEN (dB)	FINAL (dBuV / m)	POL / HGT / AZ (m)(DEG)	DELTA1 FCC 15.209 3m	DELTA2
989.874 MHz	33.0 Qp	3.21 / 23.49 / 29.23 / 0.0	30.46	V / 1.00 / 0	-23.54	n/a
184.313 MHz	38.69 Qp	1.24 / 10.33 / 29.55 / 0.0	20.7	V / 1.00 / 0	-22.8	n/a
221.189 MHz	35.8 Qp	1.36 / 11.14 / 29.42 / 0.0	18.88	V / 1.00 / 0	-27.12	n/a
258.052 MHz	40.2 Qp	1.47 / 12.54 / 29.48 / 0.0	24.73	V / 1.00 / 0	-21.27	n/a
294.91 MHz	44.0 Qp	1.58 / 13.1 / 29.38 / 0.0	29.3	V / 1.00 / 0	-16.7	n/a
40.674 MHz	38.75 Qp	0.45 / 17.06 / 29.61 / 0.0	26.65	V / 1.00 / 90	-13.35	n/a
230.514 MHz	38.9 Qp	1.39 / 11.49 / 29.41 / 0.0	22.37	V / 1.00 / 90	-23.63	n/a
176.274 MHz	39.9 Qp	1.21 / 9.82 / 29.58 / 0.0	21.35	V / 1.00 / 180	-22.15	n/a
184.313 MHz	38.85 Qp	1.24 / 10.33 / 29.55 / 0.0	20.86	V / 1.00 / 180	-22.64	n/a
189.834 MHz	44.45 Qp	1.26 / 10.68 / 29.53 / 0.0	26.85	V / 1.00 / 180	-16.65	n/a
420.354 MHz	35.1 Qp	1.95 / 16.45 / 29.37 / 0.0	24.13	V / 1.00 / 180	-21.87	n/a
447.474 MHz	36.8 Qp	2.02 / 16.51 / 29.49 / 0.0	25.84	V / 1.00 / 180	-20.16	n/a
474.594 MHz	37.65 Qp	2.09 / 17.19 / 29.32 / 0.0	27.6	V / 1.00 / 180	-18.4	n/a
528.834 MHz	37.25 Qp	2.22 / 17.96 / 29.45 / 0.0	27.98	V / 1.00 / 180	-18.02	n/a
610.194 MHz	39.2 Qp	2.43 / 19.17 / 29.56 / 0.0	31.23	V / 1.00 / 180	-14.77	n/a
393.234 MHz	38.7 Qp	1.88 / 15.73 / 29.35 / 0.0	26.96	V / 1.00 / 270	-19.04	n/a
221.189 MHz	35.95 Qp	1.36 / 11.14 / 29.42 / 0.0	19.03	H / 1.00 / 270	-26.97	n/a
338.994 MHz	41.85 Qp	1.72 / 14.42 / 29.43 / 0.0	28.56	H / 1.00 / 270	-17.44	n/a
366.114 MHz	40.4 Qp	1.8 / 15.23 / 29.45 / 0.0	27.98	H / 1.00 / 270	-18.02	n/a
184.313 MHz	39.4 Qp	1.24 / 10.33 / 29.55 / 0.0	21.41	H / 1.00 / 90	-22.09	n/a
189.834 MHz	44.45 Qp	1.26 / 10.68 / 29.53 / 0.0	26.85	H / 1.00 / 90	-16.65	n/a
230.514 MHz	41.7 Qp	1.39 / 11.49 / 29.41 / 0.0	25.17	H / 1.00 / 90	-20.83	n/a
294.91 MHz	46.4 Qp	1.58 / 13.1 / 29.38 / 0.0	31.7	H / 1.00 / 90	-14.3	n/a

Tested by: Greg Jakubowski *Greg Jakubowski*
 Printed Signature
 Reviewed by: Joel T Schneider *Joel T. Schneider*
 Printed Signature

RADIATED EMISSIONS




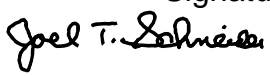
Test Report #: WC1003842 Run 1 Test Area: STS
EUT Model #: Tri-Reader 3 Date: 5/20/2010
EUT Serial #: _____ EUT Power: 12 VDC Temperature: 25.0 °C
Test Method: FCC 15.225, 15.209 Air Pressure: 99.0 kPa
Customer: Cubic Transportation Rel. Humidity: 35.0 %

EUT Description: 13.56 MHz Transmitter
RFID transmitter on
Notes: _____

Data File Name: 3842.dat Page: 3 of 6

List of measurements for run #: 1

FREQ	LEVEL (dBuV)	CABLE / ANT / PREAMP / ATTEN (dB)	FINAL (dBuV / m)	POL / HGT / AZ (m)(DEG)	DELTA1 FCC 15.209 3m	DELTA2
366.114 MHz	41.65 Qp	1.8 / 15.23 / 29.45 / 0.0	29.23	H / 1.00 / 0	-16.77	n/a
184.313 MHz	39.5 Qp	1.24 / 10.33 / 29.55 / 0.0	21.51	H / 2.00 / 90	-21.99	n/a
230.514 MHz	43.5 Qp	1.39 / 11.49 / 29.41 / 0.0	26.97	H / 2.00 / 90	-19.03	n/a
221.189 MHz	38.3 Qp	1.36 / 11.14 / 29.42 / 0.0	21.38	H / 2.00 / 270	-24.62	n/a
311.874 MHz	44.9 Qp	1.64 / 13.61 / 29.31 / 0.0	30.83	H / 2.00 / 270	-15.17	n/a
maximized						
691.554 MHz	42.83 Qp	2.63 / 20.1 / 29.5 / 0.0	36.05	V / 1.00 / 0	-9.95	n/a
718.674 MHz	41.29 Qp	2.7 / 20.6 / 29.57 / 0.0	35.01	V / 1.00 / 0	-10.99	n/a
284.754 MHz	49.59 Qp	1.55 / 12.79 / 29.42 / 0.0	34.51	V / 1.40 / 30	-11.49	n/a
end scan 30 - 1000 MHz						

Tested by: Greg Jakubowski 
Printed Signature
Reviewed by: Joel T Schneider 
Printed Signature

RADIATED EMISSIONS



Test Report #: WC1003842 Run 1 Test Area: STS
 EUT Model #: Tri-Reader 3 Date: 5/20/2010
 EUT Serial #: _____ EUT Power: 12 VDC Temperature: 25.0 °C
 Test Method: FCC 15.225, 15.209 Air Pressure: 99.0 kPa
 Customer: Cubic Transportation Rel. Humidity: 35.0 %

EUT Description: 13.56 MHz Transmitter
RFID transmitter on

Notes: _____

Data File Name: 3842.dat Page: 4 of 6

Measurement summary for limit1: FCC 15.209 3m (Qp)

FREQ	LEVEL (dBuV)	CABLE / ANT / PREAMP / ATTEN (dB)	FINAL (dBuV / m)	POL / HGT / AZ (m)(DEG)	DELTA1 FCC 15.209 3m
691.554 MHz	42.83 Qp	2.63 / 20.1 / 29.5 / 0.0	36.05	V / 1.00 / 0	-9.95
718.674 MHz	41.29 Qp	2.7 / 20.6 / 29.57 / 0.0	35.01	V / 1.00 / 0	-10.99
284.754 MHz	49.59 Qp	1.55 / 12.79 / 29.42 / 0.0	34.51	V / 1.40 / 30	-11.49
745.794 MHz	38.5 Qp	2.76 / 20.91 / 29.49 / 0.0	32.68	V / 1.00 / 0	-13.32
40.674 MHz	38.75 Qp	0.45 / 17.06 / 29.61 / 0.0	26.65	V / 1.00 / 90	-13.35
294.91 MHz	46.4 Qp	1.58 / 13.1 / 29.38 / 0.0	31.7	H / 1.00 / 90	-14.3
664.434 MHz	38.95 Qp	2.56 / 19.61 / 29.43 / 0.0	31.69	V / 1.00 / 0	-14.31
610.194 MHz	39.2 Qp	2.43 / 19.17 / 29.56 / 0.0	31.23	V / 1.00 / 180	-14.77
257.634 MHz	46.65 Qp	1.47 / 12.52 / 29.48 / 0.0	31.16	V / 1.00 / 0	-14.84
311.874 MHz	44.9 Qp	1.64 / 13.61 / 29.31 / 0.0	30.83	H / 2.00 / 270	-15.17
583.074 MHz	38.7 Qp	2.36 / 18.96 / 29.41 / 0.0	30.6	V / 1.00 / 0	-15.4
637.314 MHz	38.25 Qp	2.49 / 19.37 / 29.53 / 0.0	30.59	V / 1.00 / 0	-15.41
189.834 MHz	44.45 Qp	1.26 / 10.68 / 29.53 / 0.0	26.85	V / 1.00 / 180	-16.65
244.074 MHz	45.25 Qp	1.43 / 12.0 / 29.44 / 0.0	29.24	V / 1.00 / 0	-16.76
366.114 MHz	41.65 Qp	1.8 / 15.23 / 29.45 / 0.0	29.23	H / 1.00 / 0	-16.77
555.954 MHz	37.9 Qp	2.29 / 18.36 / 29.47 / 0.0	29.08	V / 1.00 / 0	-16.92
338.994 MHz	41.85 Qp	1.72 / 14.42 / 29.43 / 0.0	28.56	H / 1.00 / 270	-17.44
135.594 MHz	45.35 Qp	1.04 / 8.59 / 29.51 / 0.0	25.48	V / 1.00 / 0	-18.02
528.834 MHz	37.25 Qp	2.22 / 17.96 / 29.45 / 0.0	27.98	V / 1.00 / 180	-18.02
474.594 MHz	37.65 Qp	2.09 / 17.19 / 29.32 / 0.0	27.6	V / 1.00 / 180	-18.4
501.714 MHz	37.3 Qp	2.15 / 17.22 / 29.37 / 0.0	27.31	V / 1.00 / 0	-18.69
230.514 MHz	43.5 Qp	1.39 / 11.49 / 29.41 / 0.0	26.97	H / 2.00 / 90	-19.03
393.234 MHz	38.7 Qp	1.88 / 15.73 / 29.35 / 0.0	26.96	V / 1.00 / 270	-19.04
298.314 MHz	41.05 Qp	1.59 / 13.2 / 29.37 / 0.0	26.48	V / 1.00 / 0	-19.52
447.474 MHz	36.8 Qp	2.02 / 16.51 / 29.49 / 0.0	25.84	V / 1.00 / 180	-20.16
258.052 MHz	40.2 Qp	1.47 / 12.54 / 29.48 / 0.0	24.73	V / 1.00 / 0	-21.27
420.354 MHz	35.1 Qp	1.95 / 16.45 / 29.37 / 0.0	24.13	V / 1.00 / 180	-21.87

Tested by: Greg Jakubowski
 Printed

Greg Jakubowski
 Signature

Reviewed by: Joel T Schneider
 Printed

Joel T. Schneider
 Signature

RADIATED EMISSIONS



Test Report #: WC1003842 Run 1 Test Area: STS
EUT Model #: Tri-Reader 3 Date: 5/20/2010
EUT Serial #: _____ EUT Power: 12 VDC Temperature: 25.0 °C
Test Method: FCC 15.225, 15.209 Air Pressure: 99.0 kPa
Customer: Cubic Transportation Rel. Humidity: 35.0 %

EUT Description: 13.56 MHz Transmitter

RFID transmitter on

Notes: _____

Data File Name: 3842.dat

Page: 5 of 6

Measurement summary for limit1: FCC 15.209 3m (Qp)

FREQ	LEVEL (dBuV)	CABLE / ANT / PREAMP / ATTEN (dB)	FINAL (dBuV / m)	POL / HGT / AZ (m)(DEG)	DELTA1 FCC 15.209 3m
184.313 MHz	39.5 Qp	1.24 / 10.33 / 29.55 / 0.0	21.51	H / 2.00 / 90	-21.99
176.274 MHz	39.9 Qp	1.21 / 9.82 / 29.58 / 0.0	21.35	V / 1.00 / 180	-22.15
962.754 MHz	33.65 Qp	3.17 / 22.89 / 29.23 / 0.0	30.47	V / 1.00 / 0	-23.53
989.874 MHz	33.0 Qp	3.21 / 23.49 / 29.23 / 0.0	30.46	V / 1.00 / 0	-23.54
221.189 MHz	38.3 Qp	1.36 / 11.14 / 29.42 / 0.0	21.38	H / 2.00 / 270	-24.62

Tested by: Greg Jakubowski

Printed

Signature

Reviewed by: Joel T Schneider

by:

Printed

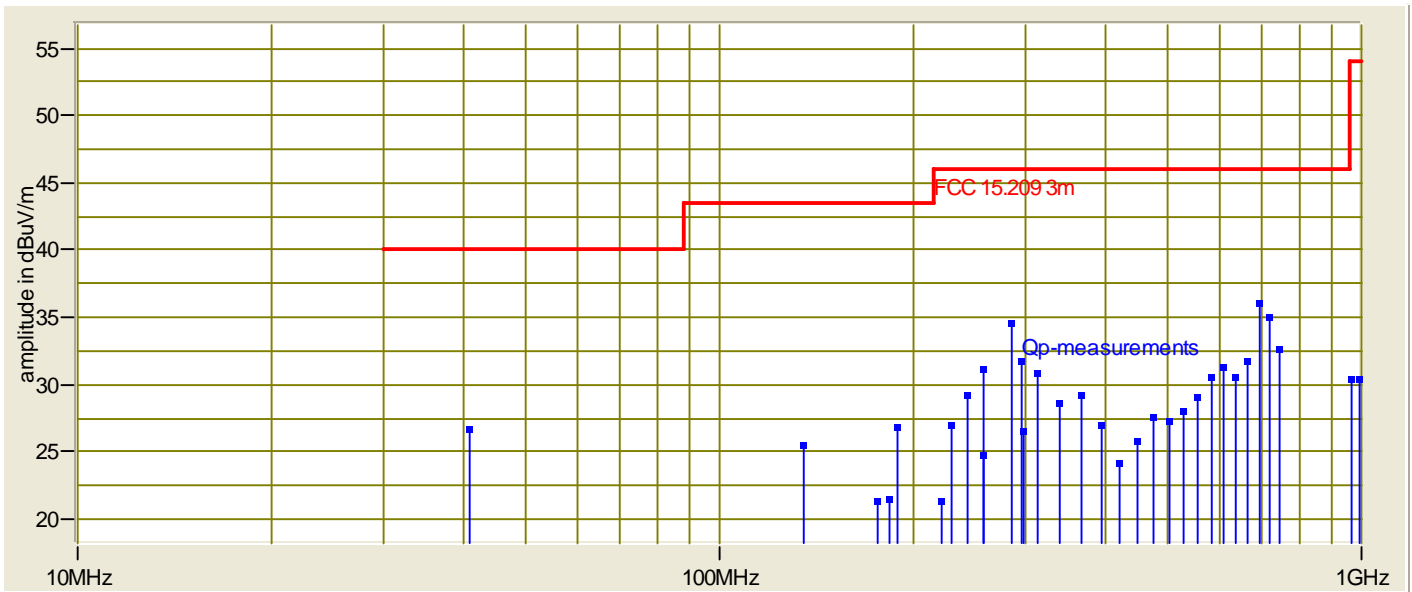
Signature

RADIATED EMISSIONS



Test Report #: WC1003842 Run 1 Test Area: STS
 EUT Model #: Tri-Reader 3 Date: 5/20/2010
 EUT Serial #: _____ EUT Power: 12 VDC Temperature: 25.0 °C
 Test Method: FCC 15.225, 15.209 Air Pressure: 99.0 kPa
 Customer: Cubic Transportation Rel. Humidity: 35.0 %
 EUT Description: 13.56 MHz Transmitter
 RFID transmitter on
 Notes: _____
 Data File Name: 3842.dat Page: 6 of 6

Graph:

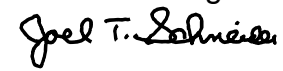


Tested by: Greg Jakubowski
 Printed



 Signature

Reviewed by: Joel T Schneider
 Printed



 Signature

Frequency tolerance

FCC 15.225(e)

RSS-210 Section A2.6

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 $\pm 0.01\%$ 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 21-Jul-10
NBLE10435	E4440A	Agilent	Spectrum Analyzer	MY44304483	28 Jul 10
NBLE02435	LP-105A	SG	Magnetic Field Probe	1	Code Y

Cal Code B = Calibration verification performed internally.

Test limits

Frequency tolerance maintained within $\pm 0.01\%$ of the operating frequency.

Test data

Cubic transmitter

5/24/2010

Degrees C	Frequency MHz	Frequency tolerance ($\pm 0.01\%$, or 1.356 kHz)
-20	13.5602	+ 200 Hz (.0014%)
-10	13.5602	+ 200 Hz (.0014%)
0	13.5602	+ 200 Hz (.0014%)
10	13.5602	+ 200 Hz (.0014%)
20	13.5602	+ 200 Hz (.0014%)
30	13.5600	0 Hz
40	13.5600	0 Hz
50	13.5600	0 Hz
85% Vin	13.5600	0 Hz
115% Vin	13.5600	0 Hz

Conducted limits - AC Power Lines

FCC 15.207(a)

RSS Gen Section 7.2.2

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

Used a BK Precision 1646 off the shelf power supply for this test – it has no additional line filtering, a photo of the inside of the supply is attached.

Minimum margin of compliance is 23 dB at 23.04 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
WRLE02416	3825/2	Electro-Mechanics (EMCO)	50 Ω LISN	8812-1437	Code B 06-Jan-11
WRLE02534	ESHS-20	Rohde & Schwarz	EMI Receiver	837055/003	29-Mar-11

Cal Code B = Calibration verification performed internally.

Test limits, dB μ V

Frequency (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 #: WC1003842 Run 2 Test Area: SR2
 EUT Model #: Tri-Reader 3 Date: 5/25/2010
 EUT Serial #: _____ EUT Power: 110V / 60Hz Temperature: 22.0 °C
 Test Method: FCC 15.207 Air Pressure: 99.0 kPa
 Customer: Cubic Transportation Rel. Humidity: 55.0 %
 EUT Description: 13.56 MHz Transmitter

Notes: _____

Data File Name: 3842.dat

Page: 1 of 4

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)						
150.0 kHz	-2.63 Qp	0.01 / 0.3 / 0.0 / 0.0	-2.32	L1	-68.32	n/a
400.0 kHz	10.66 Qp	0.03 / 0.1 / 0.0 / 0.0	10.79	L1	-47.07	n/a
4.605 MHz	1.43 Qp	0.18 / 0.0 / 0.0 / 0.0	1.61	L1	-54.39	n/a
11.895 MHz	0.41 Qp	0.28 / 0.22 / 0.0 / 0.0	0.91	L1	-59.09	n/a
13.56 MHz	13.59 Qp	0.3 / 0.24 / 0.0 / 0.0	14.13	L1	-45.87	n/a
21.345 MHz	11.96 Qp	0.38 / 0.41 / 0.0 / 0.0	12.75	L1	-47.25	n/a
23.04 MHz	25.96 Qp	0.4 / 0.54 / 0.0 / 0.0	26.9	L1	-33.1	n/a
28.52 MHz	9.53 Qp	0.42 / 0.98 / 0.0 / 0.0	10.93	L1	-49.07	n/a
150.0 kHz	-7.53 Av	0.01 / 0.3 / 0.0 / 0.0	-7.22	L1	n/a	-63.22
400.0 kHz	9.42 Av	0.03 / 0.1 / 0.0 / 0.0	9.55	L1	n/a	-38.31
4.605 MHz	-1.23 Av	0.18 / 0.0 / 0.0 / 0.0	-1.05	L1	n/a	-47.05
11.895 MHz	-2.84 Av	0.28 / 0.22 / 0.0 / 0.0	-2.34	L1	n/a	-52.34
13.56 MHz	12.37 Av	0.3 / 0.24 / 0.0 / 0.0	12.91	L1	n/a	-37.09
21.345 MHz	12.98 Av	0.38 / 0.41 / 0.0 / 0.0	13.77	L1	n/a	-36.23
23.04 MHz	25.58 Av	0.4 / 0.54 / 0.0 / 0.0	26.52	L1	n/a	-23.48
28.52 MHz	10.36 Av	0.42 / 0.98 / 0.0 / 0.0	11.76	L1	n/a	-38.24
150.0 kHz	-2.71 Qp	0.01 / 0.3 / 0.0 / 0.0	-2.4	N	-68.4	n/a
400.0 kHz	6.95 Qp	0.03 / 0.1 / 0.0 / 0.0	7.08	N	-50.78	n/a
4.605 MHz	2.64 Qp	0.18 / 0.0 / 0.0 / 0.0	2.82	N	-53.18	n/a
11.895 MHz	8.31 Qp	0.28 / 0.22 / 0.0 / 0.0	8.81	N	-51.19	n/a
13.56 MHz	19.43 Qp	0.3 / 0.24 / 0.0 / 0.0	19.97	N	-40.03	n/a
21.345 MHz	12.69 Qp	0.38 / 0.41 / 0.0 / 0.0	13.48	N	-46.52	n/a
23.04 MHz	26.75 Qp	0.4 / 0.54 / 0.0 / 0.0	27.69	N	-32.31	n/a
28.52 MHz	10.52 Qp	0.42 / 0.98 / 0.0 / 0.0	11.92	N	-48.08	n/a

Tested by: Greg Jakubowski
Printed

Greg Jakubowski

Signature

Reviewed by: Joel T Schneider
Printed

Joel T. Schneider

Signature

CONDUCTED EMISSIONS



Test Report #: WC1003842 Run 2 Test Area: SR2
 EUT Model #: Tri-Reader 3 Date: 5/25/2010
 EUT Serial #: _____ EUT Power: 110V / 60Hz Temperature: 22.0 °C
 Test Method: FCC 15.207 Air Pressure: 99.0 kPa
 Customer: Cubic Transportation Rel. Humidity: 55.0 %

EUT Description: 13.56 MHz Transmitter

Notes: _____

Data File Name: 3842.dat Page: 2 of 4

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
150.0 kHz	-7.42 Av	0.01 / 0.3 / 0.0 / 0.0	-7.11	N	n/a	-63.11
400.0 kHz	5.1 Av	0.03 / 0.1 / 0.0 / 0.0	5.23	N	n/a	-42.63
4.605 MHz	0.08 Av	0.18 / 0.0 / 0.0 / 0.0	0.26	N	n/a	-45.74
11.895 MHz	3.97 Av	0.28 / 0.22 / 0.0 / 0.0	4.47	N	n/a	-45.53
13.56 MHz	18.82 Av	0.3 / 0.24 / 0.0 / 0.0	19.36	N	n/a	-30.64
21.345 MHz	14.4 Av	0.38 / 0.41 / 0.0 / 0.0	15.19	N	n/a	-34.81
23.04 MHz	26.02 Av	0.4 / 0.54 / 0.0 / 0.0	26.96	N	n/a	-23.04
28.52 MHz	9.92 Av	0.42 / 0.98 / 0.0 / 0.0	11.32	N	n/a	-38.68

Tested by: Greg Jakubowski
 Printed

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Reviewed by: Joel T Schneider
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CONDUCTED EMISSIONS



Test Report #: WC1003842 Run 2 Test Area: SR2
 EUT Model #: Tri-Reader 3 Date: 5/25/2010
 EUT Serial #: _____ EUT Power: 110V / 60Hz Temperature: 22.0 °C
 Test Method: FCC 15.207 Air Pressure: 99.0 kPa
 Customer: Cubic Transportation Rel. Humidity: 55.0 %
 EUT Description: 13.56 MHz Transmitter

Notes: _____

Data File Name: 3842.dat

Page: 3 of 4

Measurement summary for limit1: FCC 15.207 qp (Qp)

FREQ	LEVEL (dBuV)	CABLE / ANT / PREAMP / ATTEN (dB)	FINAL (dBuV)	EUT Lead	DELTA1 FCC 15.207 qp
23.04 MHz	26.75 Qp	0.4 / 0.54 / 0.0 / 0.0	27.69	N	-32.31
13.56 MHz	19.43 Qp	0.3 / 0.24 / 0.0 / 0.0	19.97	N	-40.03
21.345 MHz	12.69 Qp	0.38 / 0.41 / 0.0 / 0.0	13.48	N	-46.52
400.0 kHz	10.66 Qp	0.03 / 0.1 / 0.0 / 0.0	10.79	L1	-47.07
28.52 MHz	10.52 Qp	0.42 / 0.98 / 0.0 / 0.0	11.92	N	-48.08
11.895 MHz	8.31 Qp	0.28 / 0.22 / 0.0 / 0.0	8.81	N	-51.19
4.605 MHz	2.64 Qp	0.18 / 0.0 / 0.0 / 0.0	2.82	N	-53.18
150.0 kHz	-2.63 Qp	0.01 / 0.3 / 0.0 / 0.0	-2.32	L1	-68.32

Measurement summary for limit2: FCC 15.207 avg (Av)

FREQ	LEVEL (dBuV)	CABLE / ANT / PREAMP / ATTEN (dB)	FINAL (dBuV)	EUT Lead	DELTA2 FCC 15.207 avg
23.04 MHz	26.02 Av	0.4 / 0.54 / 0.0 / 0.0	26.96	N	-23.04
13.56 MHz	18.82 Av	0.3 / 0.24 / 0.0 / 0.0	19.36	N	-30.64
21.345 MHz	14.4 Av	0.38 / 0.41 / 0.0 / 0.0	15.19	N	-34.81
28.52 MHz	10.36 Av	0.42 / 0.98 / 0.0 / 0.0	11.76	L1	-38.24
400.0 kHz	9.42 Av	0.03 / 0.1 / 0.0 / 0.0	9.55	L1	-38.31
11.895 MHz	3.97 Av	0.28 / 0.22 / 0.0 / 0.0	4.47	N	-45.53
4.605 MHz	0.08 Av	0.18 / 0.0 / 0.0 / 0.0	0.26	N	-45.74
150.0 kHz	-7.42 Av	0.01 / 0.3 / 0.0 / 0.0	-7.11	N	-63.11

Tested by: Greg Jakubowski
 Printed

Signature

Reviewed by: Joel T Schneider
 Printed

Signature

CONDUCTED EMISSIONS



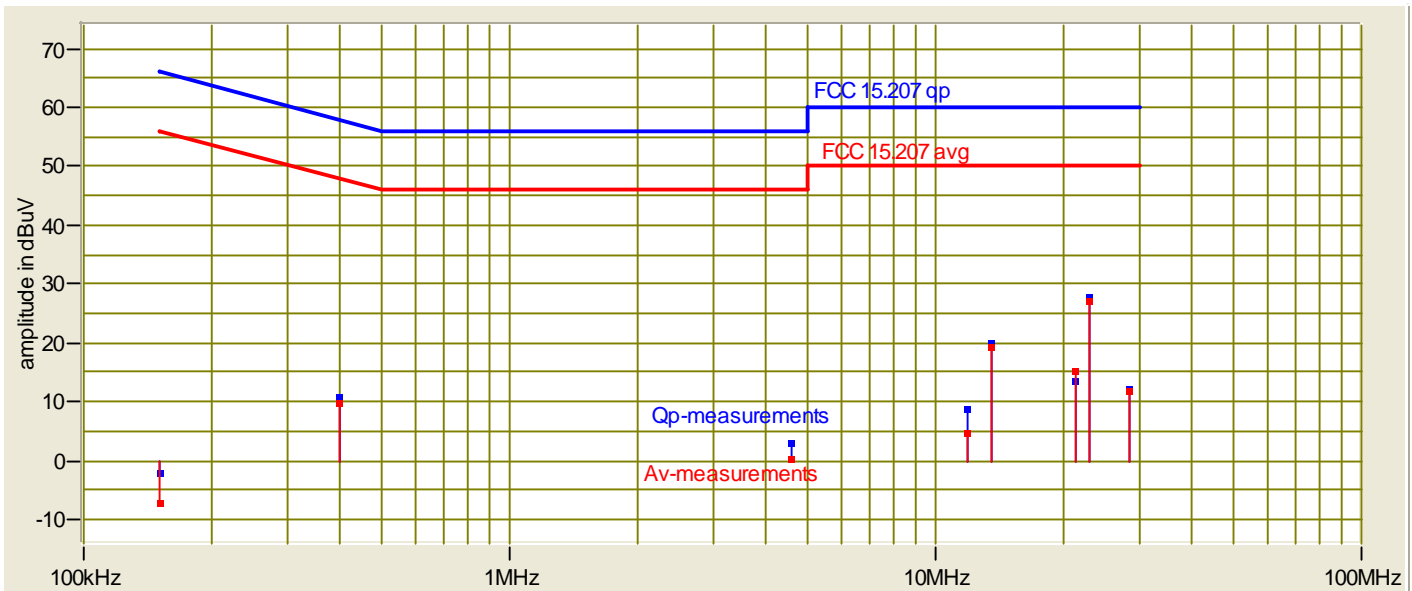
Test Report #: WC1003842 Run 2 Test Area: SR2
 EUT Model #: Tri-Reader 3 Date: 5/25/2010
 EUT Serial #: _____ EUT Power: 110V / 60Hz Temperature: 22.0 °C
 Test Method: FCC 15.207 Air Pressure: 99.0 kPa
 Customer: Cubic Transportation Rel. Humidity: 55.0 %
 EUT Description: 13.56 MHz Transmitter

Notes: _____

Data File Name: 3842.dat

Page: 4 of 4

Graph:



Tested by: Greg Jakubowski
Printed

Greg Jakubowski

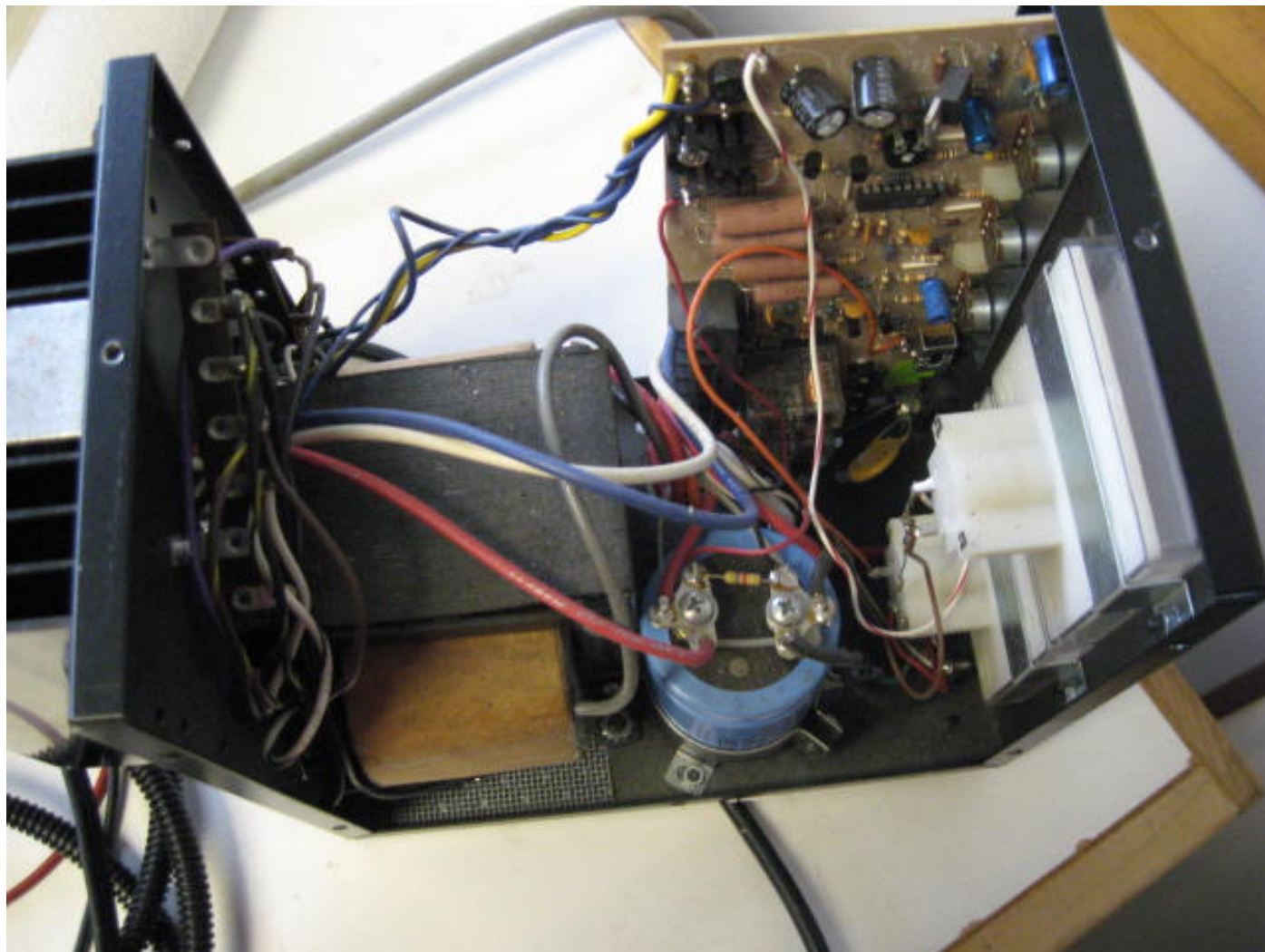
Signature

Reviewed by: Joel T Schneider
Printed

Joel T. Schneider

Signature

BK Precision 1646 power supply



Occupied bandwidth

RSS-Gen 4.6.1

Test summary

The requirements are: - MET - NOT MET

Test was performed in accordance with the article "The Measurement of Occupied Bandwidth" by Industry Canada's certification bureau.

Occupied bandwidth = 900 Hz

Test location

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

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

Test equipment

TUV ID	Model Number	Manufacturer	Description	Serial Number	Cal Due
WRLE03367	E4440A	Agilent	Spectrum Analyzer	MY42510439	04-Feb-2011

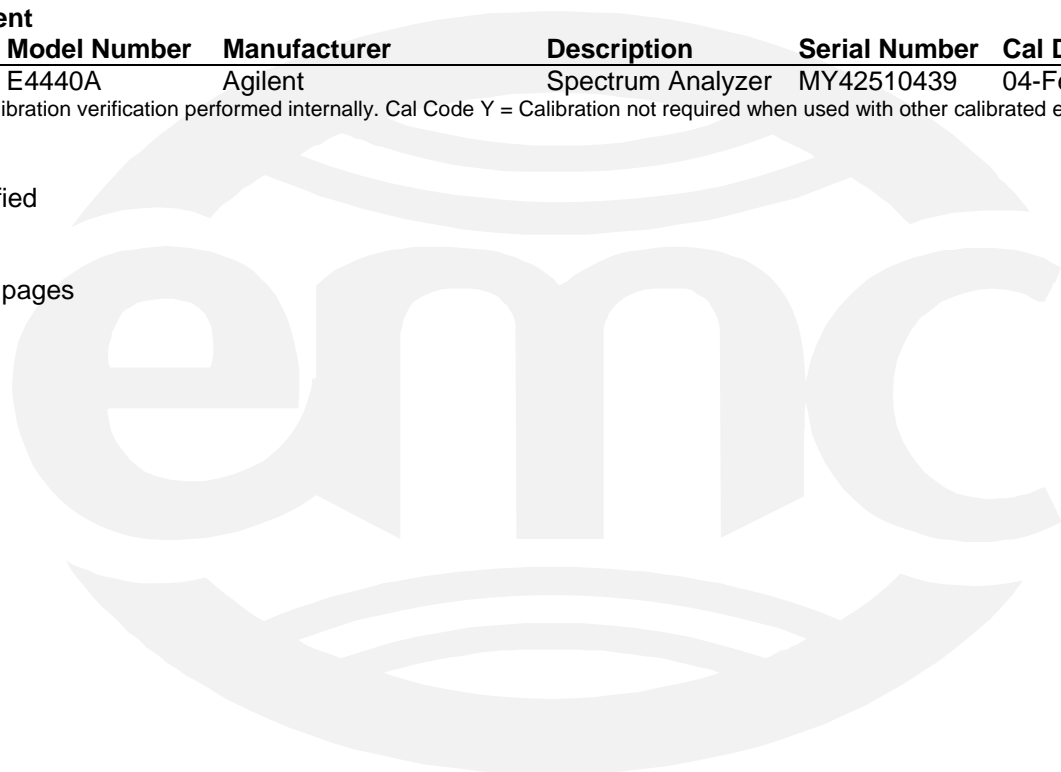
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Test limit

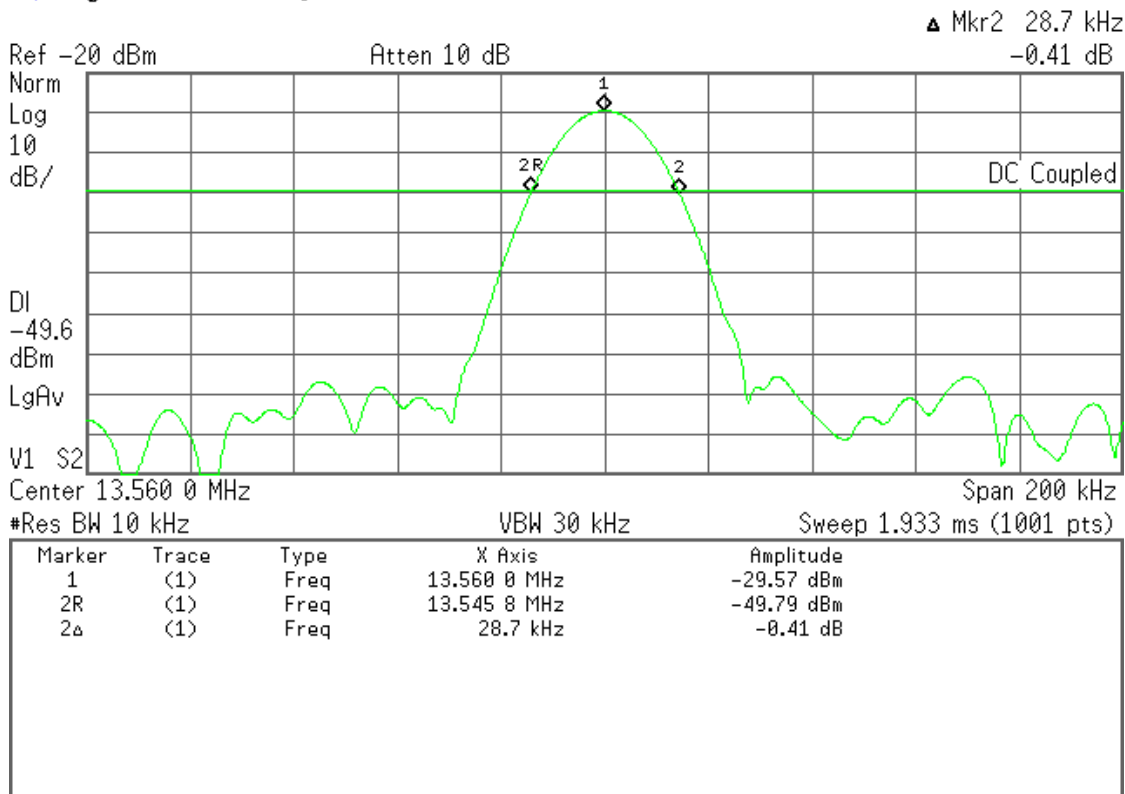
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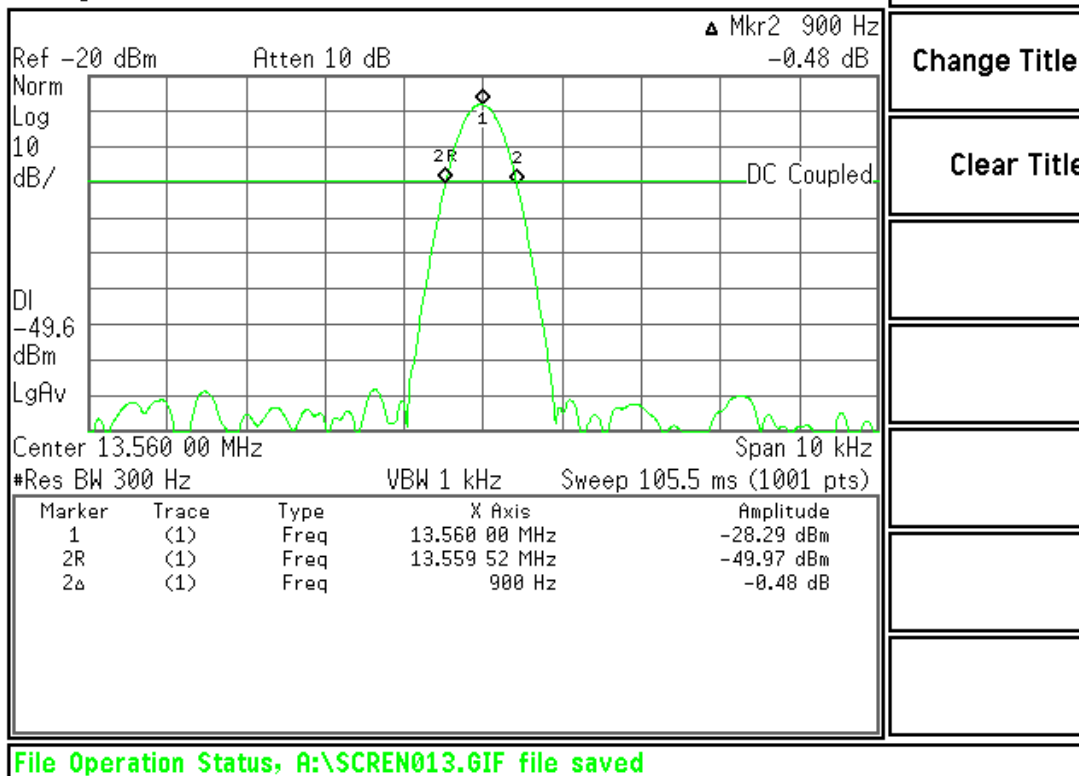
See following pages



Agilent 13:31:26 Aug 5, 2010

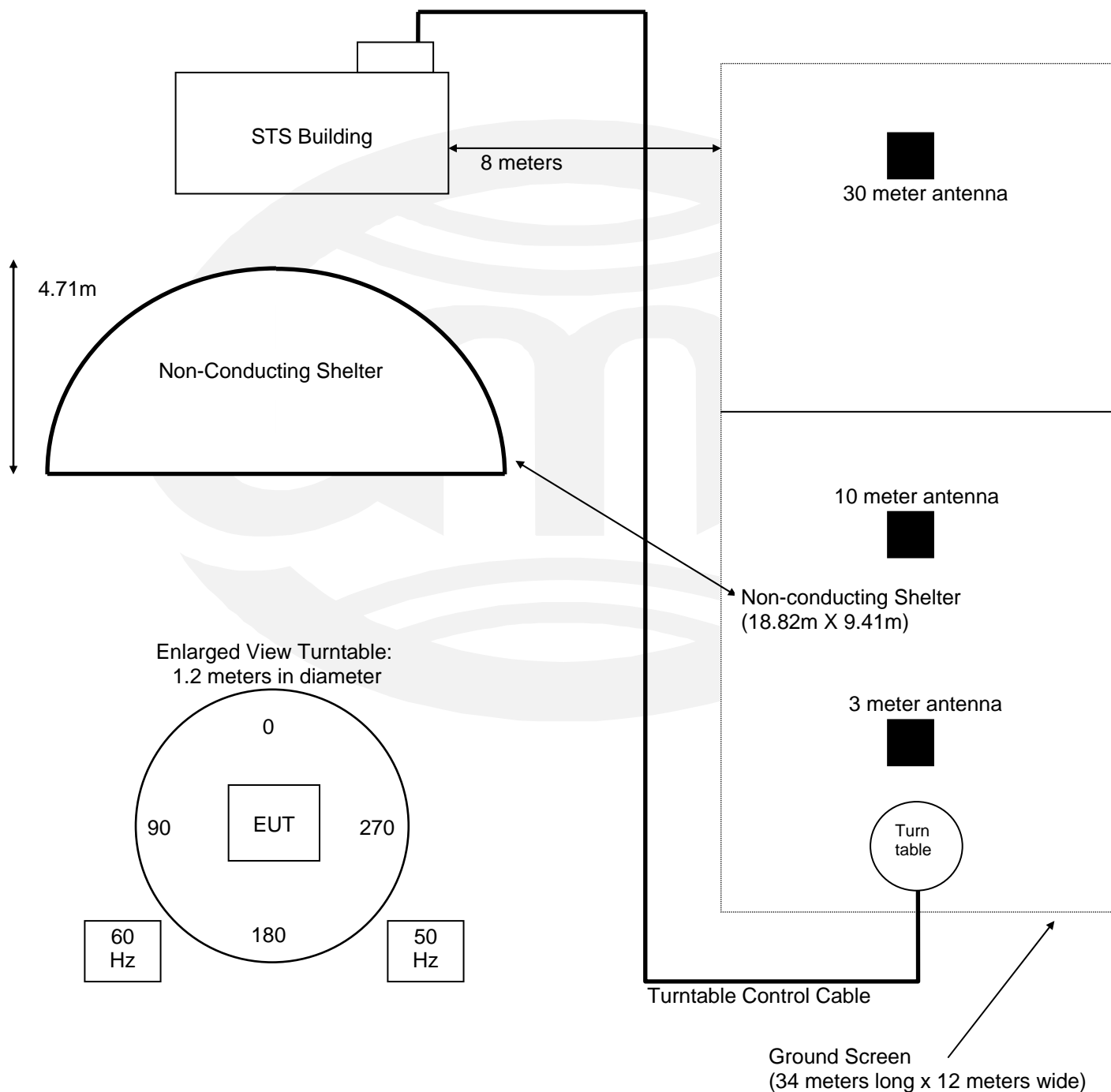


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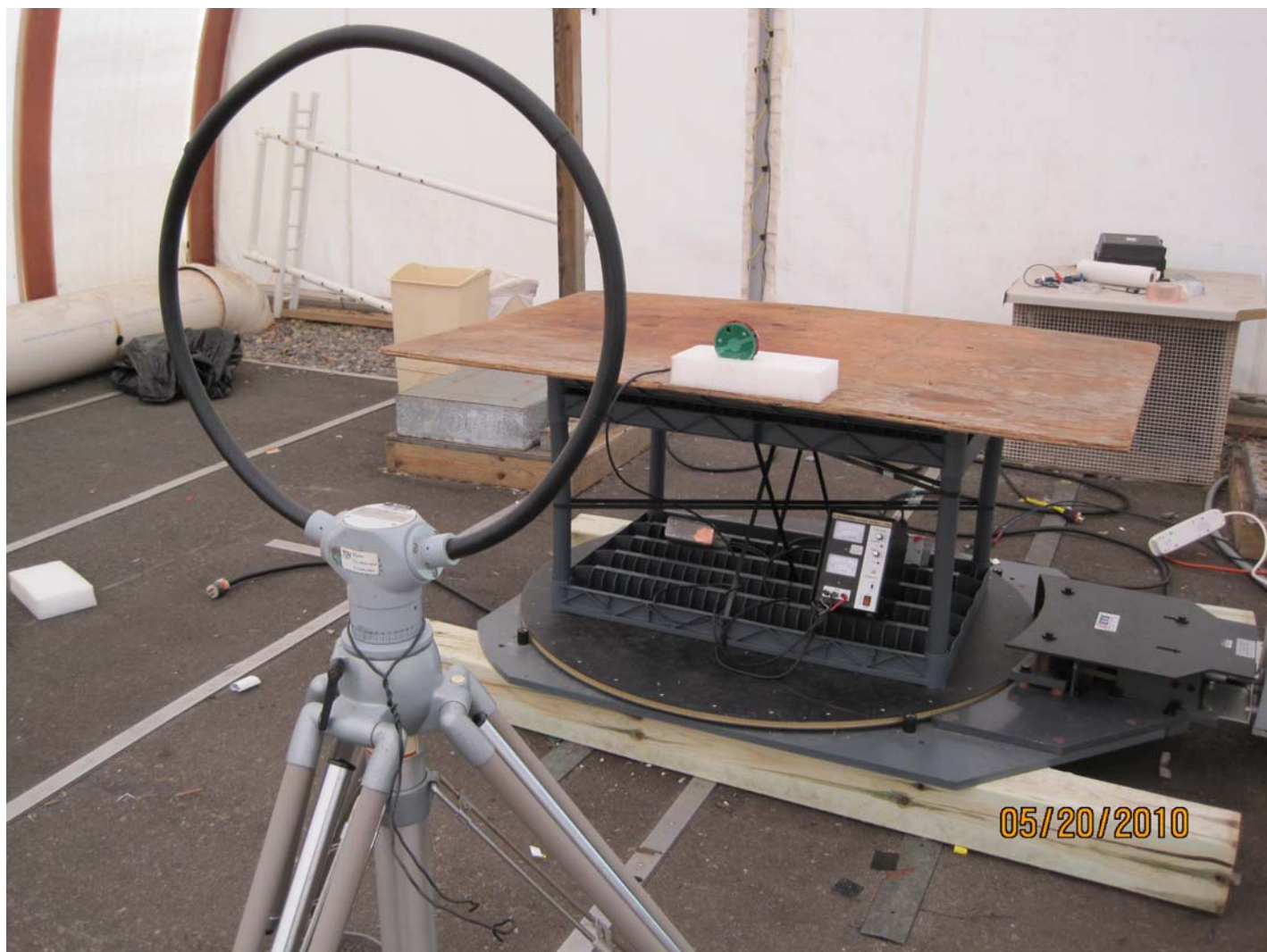


TEST SETUP FOR EMISSIONS TESTING

WILD RIVER LAB
Small Test Site (STS)



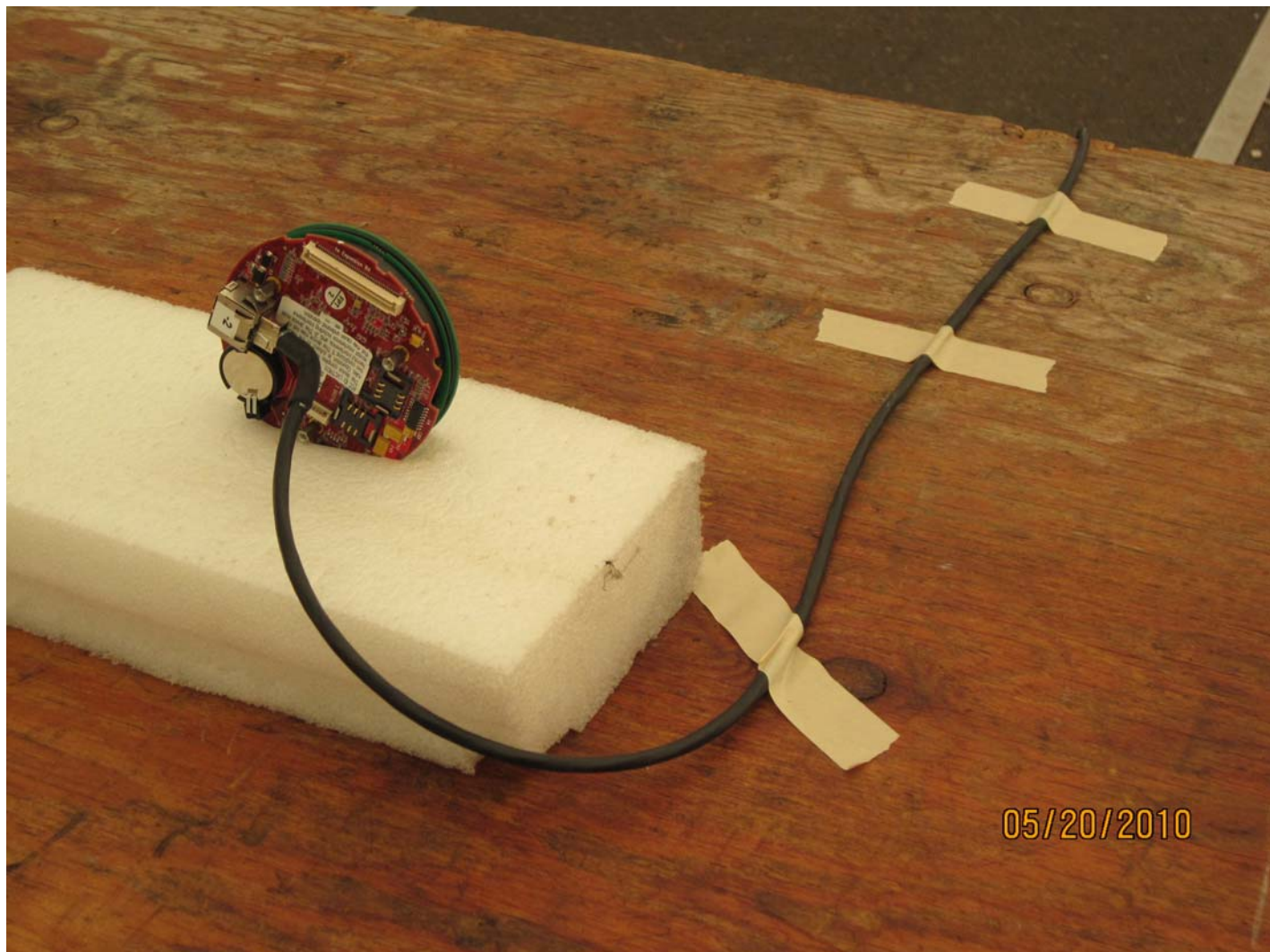
Test-setup photo(s):
General Field Strength Limits 0.009 – 30 MHz



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

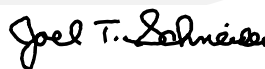
- met and the device under test does fulfill the general approval requirements.
- **not** met and the device under test does **not** fulfill the general approval requirements..

EUT Received Date: 20 May 2010Condition of EUT: NormalTesting Start Date: 20 May 2010Testing End Date: 05 August 2010

TÜV SÜD AMERICA INC



Greg S Jakubowski
Senior EMC Technician



Joel T Schneider
Senior EMC Engineer

Appendix A

Constructional Data 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.

- | | |
|---|--|
| <input checked="" type="checkbox"/> EMC Directive 2004/108/EC (EMC)
Std: <u>EN300330 + EN301489</u> | <input checked="" type="checkbox"/> FCC: Class <input type="checkbox"/> A <input checked="" type="checkbox"/> B Part <u>15</u> |
| <input type="checkbox"/> Machinery Directive 89/392/EEC (EMC)
Std: _____ | <input type="checkbox"/> VCCI: Class <input type="checkbox"/> A <input type="checkbox"/> B |
| <input type="checkbox"/> Medical Device Directive 93/42/EEC (EMC)
Std: _____ | <input type="checkbox"/> BSMI: Class <input type="checkbox"/> A <input type="checkbox"/> B (Separate Report) |
| <input type="checkbox"/> Vehicle Directive: <input type="checkbox"/> 2001/3/EC (EMC) <input type="checkbox"/> 2004/104/EC (EMC) | <input type="checkbox"/> Canada: Class <input type="checkbox"/> A <input type="checkbox"/> B |
| <input type="checkbox"/> FDA Reviewers Guidance for Premarket Notification Submissions (EMC) | <input type="checkbox"/> Australia: Class <input type="checkbox"/> A <input type="checkbox"/> B |
| | <input type="checkbox"/> Other: _____ |

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

- | | |
|--|---|
| <input type="checkbox"/> Attestation of Conformity (AoC)* | <input type="checkbox"/> EMC Certification (used with Octagon Mark)* |
| <input type="checkbox"/> Certificate of Conformity (CoC)*
Protection Class (N/A for vehicles) | <input type="checkbox"/> Compliance Document* |
| (Press F1 when field is selected to show additional information on Protection Class.) | <input type="checkbox"/> Class I <input type="checkbox"/> Class II <input type="checkbox"/> Class III |
| <input checked="" type="checkbox"/> FCC / TCB Certification | <input type="checkbox"/> Industry Canada / FCB Certification |
| <input type="checkbox"/> E-Mark Certification | <input type="checkbox"/> 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



EMC Test Plan and Constructional Data Form

EUT Interface Ports and Cables														
Type	Analog	Digital	During Test		Qty	Shielding		Termination	Connector Type	Port Termination	Length tested (in meters)	Removable	Permanent	
			Active	Passive		Yes	No							Type
EXAMPLE:														
RS232	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input 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	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	1	<input checked="" type="checkbox"/>	<input type="checkbox"/>	Foil	In cable	RJ45	120R	2	<input checked="" type="checkbox"/>	<input type="checkbox"/>
USB	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	1	<input checked="" type="checkbox"/>	<input type="checkbox"/>	Foil		USB mini	Debug port	N/A	<input checked="" type="checkbox"/>	<input type="checkbox"/>
Digital Expansion	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	1	<input type="checkbox"/>	<input checked="" type="checkbox"/>			Multipin	Expansion board	0	<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"/>	<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"/>	<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"/>
	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>		<input type="checkbox"/>	<input type="checkbox"/>						<input type="checkbox"/>	<input type="checkbox"/>



EMC Test Plan and Constructional Data Form

EUT Software.

Revision Level:

Description: Special software for environmental/EMC testing. Exercises 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	<input checked="" type="checkbox"/> Switched-mode: (Frequency) <u>145kHz</u> <input type="checkbox"/> Linear <input type="checkbox"/> Other: _____
			<input type="checkbox"/> Switched-mode: (Frequency) _____ <input type="checkbox"/> Linear <input type="checkbox"/> 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 in the 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 connection 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.	_____
Thomas Busch-Sorensen	10/31/08
_____	_____
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 $\text{dB}\mu\text{V}$, equals the EMI receiver level plus the cable loss and LISN factor.

Radiated Emissions

The final level, in $\text{dB}\mu\text{V}/\text{m}$, equals the reading from the spectrum analyzer (Level $\text{dB}\mu\text{V}$), 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 ($\text{dB}\mu\text{V}$)	CABLE/ANT/PREAMP (dB)	FINAL ($\text{dB}\mu\text{V}/\text{m}$)	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.

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 μ H (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.