

EMC EMISSION - TEST REPORT



Test Report No.	B835201	Issue Date	10 September 1998
Model / Serial No.	G3/xxAM / G3/021AM		
Product Type	Radio Frequency Identification Reader		
Client	Phase IV Engineering		
Manufacturer	Phase IV Engineering		
License holder	Phase IV Engineering		
Address	2820 Wilderness Place, Suite C Boulder, CO 80301		
Test Criteria Applied	FCC Part 15 15.209C		
Test Start Date:	31 July 1998		
Test End Date:	31 July 1998		
Test Result	☒ PASS ☐ FAIL		
Test Report Project No.	B241835201		
Total Pages including Appendices	41		

Reviewed By : Felix J. Chavez

Reviewed By : Shawn Singh

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EMISSIONS TEST REGULATIONS :

The tests were performed according to following regulations :

- | | | |
|---|-------------|-------------|
| ■ - Federal Communication Commission part 15 | ■ - Class A | □ - Class B |
| ■ - Federal Communication Commission part 15, Subpart C | ■ - 15.207 | ■ - 15.209 |
-

All tests performed according to ANSI C63.4

Emission Test Results:

Conducted emissions 150 kHz - 30 MHz

Test Result ☒ - PASS ☐ - FAIL ☐ - Not Applicable
Passing Margin _____ 2 dB at _____ 0.4 MHz
Remarks: EUT is battery operated.

Radiated emissions (electric field) 30 MHz - 1000 MHz (Unintentional Radiator)

Test Result ☒ - PASS ☐ - FAIL ☐ - Not Applicable
Passing Margin _____ 4.1 dB at _____ 66.5 MHz
Remarks: _____

Radiated emissions (magnetic field) 0.125 MHz - 1.250 MHz (Intentional Radiator)

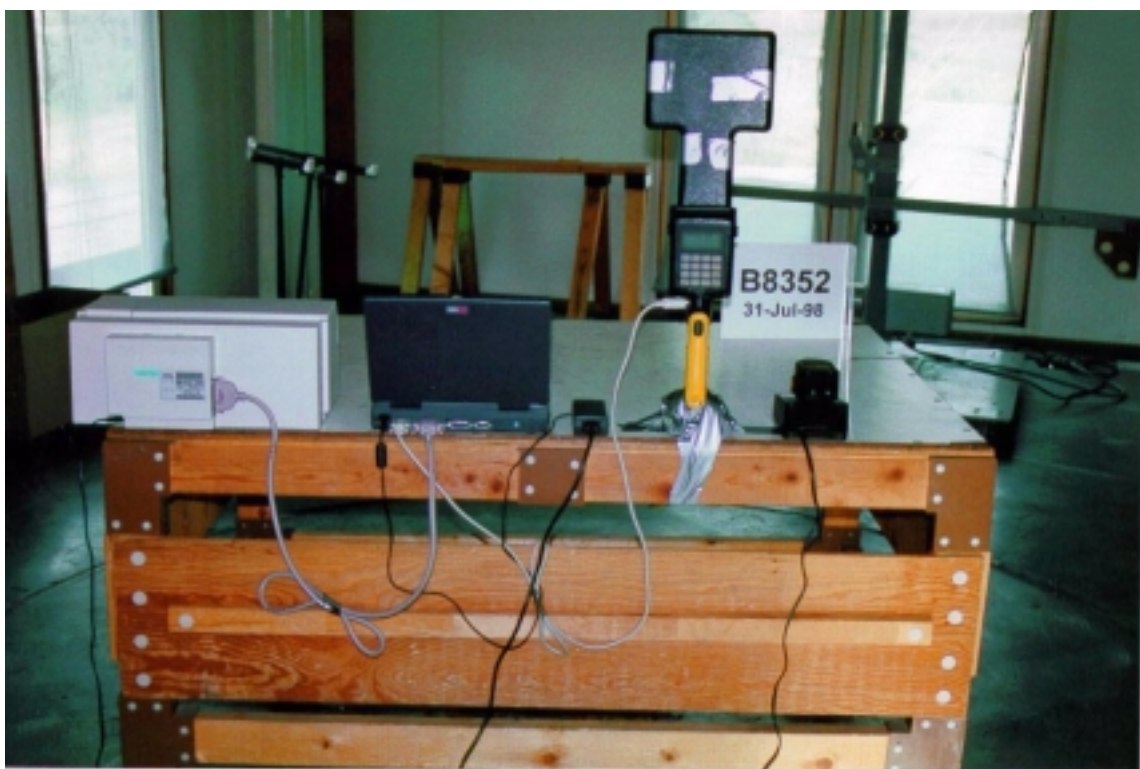
Test Result ☒ - PASS ☐ - FAIL ☐ - Not Applicable
Passing Margin _____ 19.4 dB at _____ 0.625 MHz
Remarks: _____

GENERAL REMARKS:

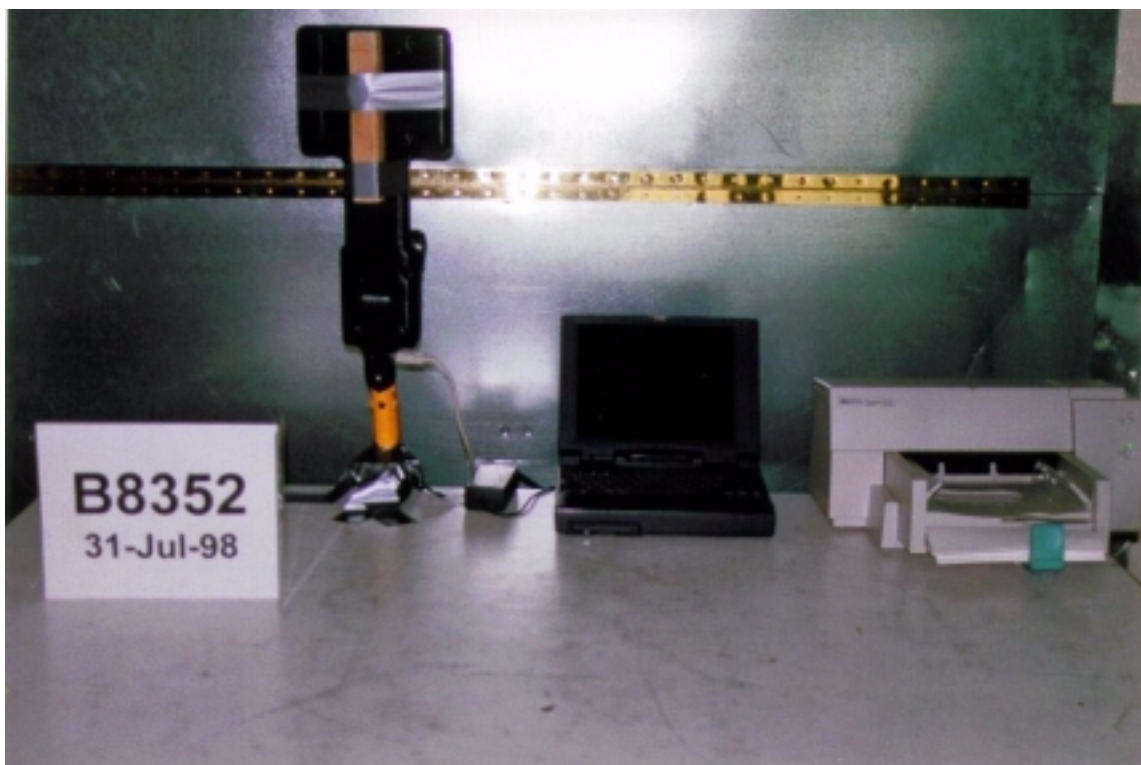
Modifications required to pass:

Test Specification Deviations: Additions to or Exclusions from: None

Test-setup photo(s)
Radiated Emissions



Test-setup photo(s):
Conducted Emissions



Test Equipment Used

Colorado Test Equipment

22-July-98

Report: B8352 Date: 31 July 1998 Signature: Shawn Singh
Temp: 20.8 deg. c Rel. Humd.: 66% Atmo. Pressure: 81.0 kPa

Location	Manufacturer	Model Number	Serial Number	Cal Date	Cal Due
PW	AH Systems	SAS-200/510	705	06-Jul-98	06-Jul-99
*PW	AH Systems	SAS-200/512	104	13-Jul-98	13-Jul-99
PW	AH Systems	SAS-200/542	256	03-Feb-98	03-Feb-99
PW	AvAntek	AFT97-8434-10	1007	18-Nov-97	18-Nov-98
PW	Avantek	AWT-18037	1002	18-Nov-97	18-Nov-98
PW	bird	4022	1825		
PW	bird	4024	1863		
PW	bird	4025	3702		
PW	Bird	4421-103	1254		
PW	California Instr.	850T	68458	08-Mar-98	08-Mar-99
PW	California Instr.	9000TCA/3-1	50666+		
PW	Compaq	470A	23605277		
PW	Compaq	575	g545HSY20483		
PW	Compliance Des.	RD-1		02-Mar-00	
PW	EMC Test Sys.	3142		27-Jan-98	27-Jan-99
PW	EMCO	1070-4	9206-1681		
PW	EMCO	1080/1081	9206-1636		
PW	EMCO	1090	1134		
*PW	EMCO	3108	2149	19-Jun-99	
PW	EMCO	3108	7059203-2457	06-Jul-99	
PW	EMCO	3115	3886	20-Feb-98	20-Feb-99
PW	EMCO	3146	9203-3376	18-Jun-98	18-Jun-99
PW	EMCO	3825/2	9202-1945	15-Jul-98	15-Jul-99
PW	EMCO	3825/2	9202-1946	08-Jul-97	08-Jul-98
PW	EMCO	3825/2	9202-1946	23-Jul-98	23-Jul-99
PW	EMCO	4610	9205-1199		
PW	EMCO	4620	9110-1015		
PW	EMCO	6502	2082		
*PW	EMCO	6502	9205-2738	30-Oct-97	29-Oct-00
PW	EMCO	7123	9205-1028		
PW	EMCO	7123	9205-1029	11-Dec-97	11-Dec-98
PW	EMCO	7405	9203-2175		
PW	Fischer	F-201	141	05-Mar-98	05-Mar-99
PW	Fischer	F-33-1	356	04-May-98	04-May-99
PW	Fischer Custom	F-61	274	17-Jun-97	17-Jun-98
*PW	Gishard	600-1040 mb	002		
PW	Hewlett Packard	11940A	2650A04527		
PW	Hewlett Packard	11940A	2650A04563		
PW	Hewlett Packard	11941A	2807A02957		
*PW	Hewlett Packard	11947A	2820A00277	18-Nov-97	18-Nov-98
PW	Hewlett Packard	11947A	3107A01975	17-Jun-98	17-Jun-99
PW	Hewlett Packard	8444A	2325A07899	18-Nov-97	18-Nov-98
PW	Hewlett Packard	8447D	2727A05399	18-Nov-97	18-Nov-98
PW	Hewlett Packard	8447F	3113A04923	21-Nov-97	21-Nov-98
PW	Hewlett Packard	85650A	2043A00256	17-Jun-98	17-Jun-99
*PW	Hewlett Packard	85650A	2811A01300	18-Nov-97	18-Nov-98
PW	Hewlett Packard	85662A	2112A02220	11-Mar-98	11-Mar-99
PW	Hewlett Packard	85662A	2318A04983	17-Jun-98	17-Jun-99
PW	Hewlett Packard	85662A	2403A06707	20-Nov-97	20-Nov-98
*PW	Hewlett Packard	85662A	2403A08749	01-Apr-98	30-Sep-98
*PW	Hewlett Packard	8566B	2410A00154	01-Apr-98	30-Sep-98
PW	Hewlett Packard	8566B	2410A00254	20-Nov-97	20-Nov-98

Location	Manufacturer	Model Number	Serial Number	Cal Date	Cal Due
PW	Hewlett Packard	8568B	2304A02508	17-Jun-99	
PW	Hewlett Packard	8590	2722A02036		
PW	Hewlett Packard	8594E	3223A00145	21-Nov-97	21-Nov-98
PW	HP	11947A	3107A01984	09-Jun-97	09-Jun-98
PW	JFW	50FH-003-100N	9825	18-Jun-98	18-Jun-99
PW	JFW	50FHB-003-5	00363	18-Nov-97	18-Nov-98
*PW	Mini-Circuits	ZHL-1042J	D020698-14	13-Feb-98	13-Feb-99
PW	Mini-Circuits	ZHL-1042J	N032698	11-May-98	11-May-99
PW	Polarad	ESH3-Z2	357.881J.32		
*PW	Radio Shack	63-867	005		
*PW	Rhode&Schwarz	ESH30	842806/001	07-Oct-97	07-Oct-98
PW	Rhode&Schwarz	ESH2-Z5	830364/002	23-Feb-99	
PW	Rhode & Schwarz	ESH3	872318/036	06-Aug-98	
PW	Rhode & Schwarz	HFH2-Z2	880665/042	08-Feb-98	08-Feb-99
PW	Schwarzbeck	NNLK 8129	8129126 LISN	20-Oct-97	20-Oct-98
PW	Schwarzbeck	TK 9416	TUV-600	04-Apr-99	
PW	Shaffner	NSG 431	1426		
*PW	Solar	8028-50-TS-24-B	8305121	23-Feb-98	23-Feb-99
*PW	Solar	8028-50-TS-24-B	8305122	23-Feb-98	23-Feb-99
PW	Tensor	4105	2020	11-Jun-98	11-Jun-99
PW	Transjonic	T-100	147		
PW	TUV PS	LPS-1	1		
PW	WaveTek	DM5XL	60206553		
PW	Weinschel	2-3dB	BC5530	18-Nov-97	18-Nov-98
PW	Weinschel	2-3dB	BC5539	18-Nov-97	18-Nov-98
PW	Weinschel	2-6B	BC6492	18-Nov-97	18-Nov-98
PW	Weinschel	2-6dB	BC6487	18-Nov-97	18-Nov-98

Appendix A

Transmitter Data Sheets

TUV PRODUCT SERVICE

RADIATED EMISSIONS SUMMARY

Report # 8352 Operator: Shawn Singh
Date of test: 31 Jul 98 Engineer: Shawn Singh
Model No.: G3/xxAM
Equipment tested: Radio Frequency Identification Reader
Requester: Phase IV Engineering
Representative: Rich Pollack

TEST EQUIPMENT

EMCO 6502 Loop Antenna
Rohde&Schwarz ESHS30 Receiver
Hewlett Packard 8566B Spectrum Analyzer

TEST DETAILS:

FCC Rules Section: 15.209
Fundamental Frequency: 0.125 MHz

Antenna description: Internal Small Diameter Loop
Modulation Method: None, continuous carrier

FCC Limit Distance: 300 meters
FCC Limit 19.2 uV/m 25.7 dBuV/m
FCC Default Falloff 40 dB/decade
Alternate Calculated Falloff 60 dB/decade
Falloff Used 60 dB/decade

MEASURED DATA:

Harmonic #	Freq. MHz	Readings dBuV/m					
		3 meters	Extrapolated Limit	Delta dB	30 meters	Extrapolated Limit	Delta dB
1	0.125	125.2	145.6	20.4	65.3	85.6	20.3
2	0.250	73	139.6	66.6	49.8	79.6	29.8
3	0.375	81.4	136	54.6	46.8	76	29.2
4	0.500	72.8	93.6	20.8	No emissions were found above the receiver's noise floor to 1.25 MHz.		
5	0.625	72.3	91.7	19.4			
6	0.750	62.8	90.1	27.3			
7	0.875	66.3	88.7	22.4			
8	1.000	61.4	87.6	26.2			
9	1.125	60.4	86.5	26.1			
10	1.250	41.4	85.7	44.3			

CONCLUSION: The device under test passed emissions requirements under Section 15.209 with a passing margin of 19.4 dB at test distance of 3 meters using alternate calculated falloff distance extrapolation of 60 dB per decade. No emissions were detected above the receiver's noise floor at 100 meters.

Appendix B

Detailed Test Data Sheets

TÜV Product Service
RADIATED EMISSIONS DATA SHEET

SHEET 1 OF 3

TEST DISTANCE 3 Meters
Test Area TT1-1
Test Standards FCC Pt 15 15.209C

TEST REPORT # B8352
DATE: 31-Jul-98
TESTED BY: Shawn Singh
REVIEWED BY: FJC

Manufacturer Phase IV Engineering
EUT Description Radio Frequency Identification Reader
EUT Model # G3/xxAM
EUT Serial # G3/021AM
Test Specification Deviations: Additions to or Exclusions from:

Representative Rich Pollack

FREQ. (MHz)	Reading (dBuV)	Factor (dB)	Condition		Azimuth (deg)	Polarization	Remarks: Rotated loop antenna for maximum emissions
			[1] (dBuV/m)	[2] (dBuV/m)			
0.125	115.4	9.8	125.2				
0.25	63.2	9.8	73				
0.375	71.6	9.8	81.4				
0.5	63	9.8	72.8				
0.625	62.5	9.8	72.3				
0.75	53	9.8	62.8				
0.875	56.5	9.8	66.3				
1	51	10.4	61.4				
1.125	50	10.4	60.4				
1.25	31	10.4	41.4				

Condition 1: Peak readings

Condition 2:

Modifications to EUT at time of test:

TÜV Product Service
RADIATED EMISSIONS DATA SHEET

SHEET 2 OF 3

TEST DISTANCE 30 Meters
Test Area TT1-1
Test Standards FCC Pt 15 15.209C

TEST REPORT # B8352
DATE: 31-Jul-98
TESTED BY: Shawn Singh
REVIEWED BY: FJC

Manufacturer Phase IV Engineering
EUT Description Radio Frequency Identification Reader
EUT Model # G3/xxAM
EUT Serial # G3/021AM
Test Specification Deviations: Additions to or Exclusions from:

Representative Rich Pollack

FREQ. (MHz)	Reading (dBuV)	Condition Factor (dB)	[1] (dBuV/m)	[2] (dBuV/m)	Azimuth (deg)	Polarization	Remarks: Rotated loop antenna for maximum emissions
0.125	55.5	9.8	65.3				
0.25	40	9.8	49.8				Noise floor reading
0.375	37	9.8	46.8				Noise floor reading
"							
1.25							No emissions were found above the receiver's noise floor to 1.25 MHz.

Condition 1: Peak readings

Condition 2:

Modifications to EUT at time of test:

TÜV Product Service
RADIATED EMISSIONS DATA SHEET

SHEET __3__ OF _3__

TEST DISTANCE 100 Meters
Test Area TT1-1
Test Standards FCC Pt 15 15.209C

TEST REPORT #B8352
DATE: 31-Jul-98
TESTED BY: Shawn Singh
REVIEWED BY:FJC

Manufacturer Phase IV Engineering
EUT Description Radio Frequency Identification Reader
EUT Model # G3/xxAM
EUT Serial # G3/021AM
Test Specification Deviations: Additions to or Exclusions from:

Representative Rich Pollack

FREQ. (MHz)	Reading (dBuV)	Factor (dB)	Condition		Azimuth (deg)	Polarization	Remarks: Rotated loop for maximum emissions
			[1] (dBuV/m)	[2] (dBuV/m)			
0.125	39.3	9.8	49.1				- Noise floor reading
"							
1.25							No emissions were found above the receiver's noise floor to 1.25 MHz.

Condition 1: Peak readings

Condition 2:

Modifications to EUT at time of test:

TUV PRODUCT SERVICE

Figure

NARROWBAND CONDUCTED EMISSIONS
PHASE IV ENGINEERING, M/N: G3/XXAM, S/N:G3/021AM
RF IDENTIFICATION READER, PC CONV. TO LISN, 120 VAC/60HZ

Report: B8352 Run A
Date: 31-AUG-98 Page 1
Engineer: Shawn Singh
Reviewed: FJC

Measurement Summary

Frequency (MHz)	Amplitude (dBuV)	DELTA FCC CLASS B
1.979	37.7	-10.3
3.00	43.5	-4.5
5.93	33.9	-14.1
6.08	42.8	-5.2
9.74	37.0	-11.0
14.93	42.7	-5.3

Minimum Passing Margin for FCC CLASS B is 4 dB at 3 MHz

File B8352 Run A

TUV PRODUCT SERVICE

Figure

NARROWBAND CONDUCTED EMISSIONS
PHASE IV ENGINEERING, M/N: DW9106, S/N: 1324567
DEWALT CHARGER, 120 VAC/60 HZ

Report: B8352
Date: 31-AUG-98
Engineer: Shawn Singh
Reviewed: FJC

Run B
Page 1

Measurement Summary

Frequency (MHz)	Amplitude (dBuV)	DELTA FCC CLASS A
0.450	57.6	-2.4
0.670	52.2	-7.8
1.000	45.2	-14.8
1.360	39.0	-21.0
2.650	21.8	-47.7
4.11	11.0	-58.5

Minimum Passing Margin for FCC CLASS A is 2 dB at .4499 MHz

File B8352 Run B

TUV PRODUCT SERVICE
RADIATED EMISSIONS

PW1 Test Site
10 Meter Antenna Distance
Equipment Under Test:
Phase IV Engineering
M/N: G3/XXAM, SIN: G3/021AM

Report B8352 Run 1
Date 07/31/98 Page 1
Engineer: FJC
Tech: S S
Requester:

Notes: Radio Frequency Identification Reader, Fresh 12 VDC battery

Frequency MHz	Level dBuV	Factor dB	Cable dB	Final dBuV/m	Az Polar\ deg Height	Delta FCC A	Delta CISPR B
w/DeWalt Charger DW9106, SIN: 1324567							
Bicon antenna, vertical polarization.							
0 degrees azimuth, initial antenna height 1 meter.							
33.744	7.45	14.1	.9	22.5	v	-16.6	-7.5
35.002	10.55	14	1	25.5	v	-13.6	-4.5
35.927	13.2	13.9	1	28	v	-11.1	-2
38.682	19.05	13.4	1	33.5	v	-5.6	3.5 *
39.557	13.85	13.3	1	28.2	v	-10.9	-1.8
42.484	15.9	12.9	1	29.8	v	-9.3	-.2
59.523	8.45	11.1	1.2	20.7	v	-18.4	-9.3
66.507	19.9	10	1.3	31.2	v	-7.9	1.2 *
67.772	18.85	9.8	1.3	30	v	-9.1	0 *
69.255	18.35	9.6	1.3	29.3	v	-9.8	-.7
74.157	13.8	9.1	1.3	24.2	v	-14.9	-5.8
84.93	12.25	8.5	1.4	22.2	v	-16.9	-7.8
85.974	14.2	8.5	1.5	24.2	v	-14.9	-5.8
88.069	14.45	8.5	1.5	24.4	v	-19.1	-5.6
99.195	11.85	9.8	1.6	23.3	v	-20.2	-6.7
103.03	11.6	10.3	1.6	23.5	v	-20	-6.5
104.05	14	10.4	1.6	26	v	-17.5	-4
105.43	13.7	10.5	1.6	25.9	v	-17.6	-4.1
106.15	15.65	10.6	1.6	27.9	v	-15.6	-2.1
109.26	19.4	10.9	1.7	32	v	-11.5	2 *
110.18	17.3	11	1.7	30	v	-13.5	0 *
111.79	15.75	11.2	1.7	28.6	v	-14.9	-1.4
112.37	15.8	11.2	1.7	28.7	v	-14.8	-1.3
115.24	17.2	11.5	1.7	30.4	v	-13.1	.4 *
117.99	17.3	11.6	1.7	30.7	v	-12.8	.7 *
119.04	15.8	11.7	1.7	29.2	v	-14.3	-.8
120.06	22	11.8	1.8	35.5	v	-8	5.5 *
120.43	15.7	11.8	1.8	29.2	v	-14.3	-.8
121.82	14.8	11.8	1.8	28.4	v	-15.1	-1.6
123.56	11.45	11.9	1.8	25.2	v	-18.3	-4.8
125.31	13.15	12	1.8	27	v	-16.5	-3
127.06	11.35	12.1	1.8	25.3	v	-18.2	-4.7
128.09	16.6	12.2	1.8	30.6	v	-12.9	.6 *
132.96	11.35	12.4	1.8	25.6	v	-17.9	-4.4

TUV PRODUCT SERVICE

RADIATED EMISSIONS

PW1 Test Site
10 Meter Antenna Distance
Equipment Under Test:
Phase IV Engineering
M/N: G3/XXAM, S/N: G3/021AM

Report B8352 Run 1
Date 07/31/98 Page 2
Engineer: FJC
Tech: S S
Requester:

Notes: Radio Frequency Identification Reader, Fresh 12 VDC battery

Frequency MHz	Level dBuV	Factor dB	Cable dB	Final dBuV/m	Az Polar\ deg Height	Delta FCC A	Delta CISPR B
136.1	13.35	12.6	1.9	27.8	v	-15.7	-2.2
144.12	11.5	13	1.9	26.4	v	-17.1	-3.6
155.21	7.45	13	2	22.5	v	-21	-7.5
160.10	14	13	2.1	29.1	v	-14.4	-.9
161.71	12.45	13	2.1	27.5	v	-16	-2.5
163.24	8.7	13	2.1	23.8	v	-19.7	-6.2
168.12	10.45	13	2.1	25.6	v	-17.9	-4.4
171.25	8.3	13	2.1	23.4	v	-20.1	-6.6
178.5	7.95	13.2	2.2	23.3	v	-20.2	-6.7
179.25	8.95	13.3	2.2	24.4	v	-19.1	-5.6
186.21	7.05	13.7	2.2	23	v	-20.5	-7
190.74	7.25	13.9	2.3	23.5	v	-20	-6.5
193.17	10.75	14.1	2.3	27.1	v	-16.4	-2.9
194.21	10.65	14.2	2.3	27.1	v	-16.4	-2.9
195.26	11.1	14.2	2.3	27.6	v	-15.9	-2.4
198.74	5.55	14.4	2.3	22.3	v	-21.2	-7.7
90 degrees azimuth							
59.517	16.25	11.1	1.2	28.5	v	-10.6	-1.5
66.447	20.85	10	1.3	32.1	v	-7	2.1 *
67.718	20.1	9.8	1.3	31.2	v	-7.9	1.2 *
69.327	18.95	9.6	1.3	29.8	v	-9.3	-.2
84.93	13.1	8.5	1.4	23	v	-16.1	-7
88.069	16.95	8.5	1.5	26.9	v	-16.6	-3.1
104.05	19.6	10.4	1.6	31.6	v	-11.9	1.6 *
111.72	18.45	11.2	1.7	31.3	v	-12.2	1.3 *
112.44	18	11.2	1.7	30.9	v	-12.6	.9 *
119.04	19	11.7	1.7	32.4	v	-11.1	2.4 *
120.06	22.95	11.8	1.8	36.5	v	-7	6.5 *
120.43	16.4	11.8	1.8	29.9	v	-13.6	-.1
121.82	15.7	11.8	1.8	29.3	v	-14.2	-.7
123.56	13.6	11.9	1.8	27.3	v	-16.2	-2.7
125.31	15.65	12	1.8	29.5	v	-14	-.5
128.09	22.05	12.2	1.8	36	v	-7.5	6 *
132.96	15.35	12.4	1.8	29.6	v	-13.9	-.4
144.12	14.2	13	1.9	29.1	v	-14.4	-.9
155.21	15.55	13	2	30.6	v	-12.9	.6 *
160.10	15.05	13	2.1	30.1	v	-13.4	.1 *
163.24	14.3	13	2.1	29.4	v	-14.1	-.6

TUV PRODUCT SERVICE

RADIATED EMISSIONS

PW1 Test Site
10 Meter Antenna Distance
Equipment Under Test:
Phase IV Engineering
M/N: G3/XXAM, SIN: G3/021AM

Report B8352 Run 1
Date 07/31/98 Page 3
Engineer: FJC
Tech: S S
Requester:

Notes: Radio Frequency Identification Reader, Fresh 12 VDC battery

Frequency MHz	Level dBuV	Factor dB	Cable dB	Final dBuV/m	Az deg	Polar Height	Delta FCC A	Delta CISPR B	
168.12	15.1	13		2.1	30.2	v	-13.3	.2	*
171.25	16.6	13		2.1	31.7	v	-11.8	1.7	*
178.5	10.4	13.2		2.2	25.8	v	-17.7	-4.2	
179.25	14.5	13.3		2.2	29.9	v	-13.6	-.1	
186.21	11.75	13.7		2.2	27.7	v	-15.8	-2.3	
190.74	8.05	13.9		2.3	24.3	v	-19.2	-5.7	
180 degrees azimuth									
66.447	23.1	10		1.3	34.4	v	-4.7	4.4	*
67.718	22.5	9.8		1.3	33.6	v	-5.5	3.6	*
69.327	21.45	9.6		1.3	32.3	v	-6.8	2.3	*
74.085	17.15	9.1		1.3	27.6	v	-11.5	-2.4	
84.93	15.1	8.5		1.4	25	v	-14.1	-5	
127.06	13.95	12.1		1.8	27.9	v	-15.6	-2.1	
128.09	23.05	12.2		1.8	37	v	-6.5	7	*
132.96	18	12.4		1.8	32.2	v	-11.3	2.2	*
160.10	19	13		2.1	34.1	v	-9.4	4.1	*
163.24	18.6	13		2.1	33.7	v	-9.8	3.7	*
168.12	18.35	13		2.1	33.5	v	-10	3.5	*
171.25	19.35	13		2.1	34.5	v	-9	4.5	*
178.5	12.4	13.2		2.2	27.8	v	-15.7	-2.2	
179.25	18.55	13.3		2.2	34	v	-9.5	4	*
186.21	17.35	13.7		2.2	33.3	v	-10.2	3.3	*
190.74	12.85	13.9		2.3	29.1	v	-14.4	-.9	
193.17	14.5	14.1		2.3	30.9	v	-12.6	.9	*
194.21	13.5	14.2		2.3	30	v	-13.5	0	*
195.26	12.6	14.2		2.3	29.1	v	-14.4	-.9	
198.74	7	14.4		2.3	23.8	v	-19.7	-6.2	
124.96	20.1	12		1.8	33.9	v	-9.6	3.9	*
126.73	17.65	12.1		1.8	31.5	v	-12	1.5	*
140.96	15.55	12.8		1.9	30.3	v	-13.2	.3	*
148.74	19.3	13		2	34.3	v	-9.2	4.3	*
156.97	17.45	13		2	32.5	v	-11	2.5	*
172.30	18	13		2.1	33.1	v	-10.4	3.1	*
172.98	19.5	13		2.1	34.6	v	-8.9	4.6	*
184.13	20.4	13.5		2.2	36.2	v	-7.3	6.2	*
185.16	16.55	13.6		2.2	32.4	v	-11.1	2.4	*
186.22	17.8	13.7		2.2	33.7	v	-9.8	3.7	*
186.90	17.85	13.7		2.3	33.8	v	-9.7	3.8	*

TUV PRODUCT SERVICE

RADIATED EMISSIONS

PW1 Test Site
 10 Meter Antenna Distance
 Equipment Under Test:
 Phase IV Engineering
 M/N: G3/XXAM, SIN: G3/021AM

Report B8352 Run 1
 Date 07/31/98 Page 4
 Engineer: FJC
 Tech: S S
 Requester

Notes: Radio Frequency Identification Reader, Fresh 12 VDC battery

Frequency MHz	Level dBuV	Factor dB	Cable dB	Final dBuV/m	Az Polar\ deg Height	Delta FCC A	Delta CISPR B
188.29	16.8	13.8	2.3	32.9	v	-10.6	2.9 *
270 degrees azimuth							
33.828	11.7	14.1	.9	26.8	v	-12.3	-3.2
34.918	13.75	14	.9	28.7	v	-10.4	-1.3
42.388	16.95	12.9	1	30.9	v	-8.2	.9 *
136.1	15.55	12.6	1.9	30	v	-13.5	0 *

maximized emissions 30 - 200MHz.

0 degrees azimuth, antenna height 1 meter.

38.706	19.7	13.4	1	34.1	v	-5	4.1 *
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163 degrees azimuth, antenna height 1 meter.

66.507	23.7	10	1.3	35	v	-4.1	5 *
67.784	23.3	9.8	1.3	34.4	v	-4.7	4.4 *

Bicon antenna, horizontal polarization.

0 degrees azimuth, initial antenna height 2.5 meters.

No higher emissions were found.

90 degrees azimuth

193.36	4.4	14.1	2.3	20.8	H	-22.7	-9.2
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90 degrees azimuth
 Disregard above note.
 180 degrees azimuth

TUV PRODUCT SERVICE

RADIATED EMISSIONS

PW1 Test Site
10 Meter Antenna Distance
Equipment Under Test:
Phase IV Engineering
M/N: G3/XxAM, SIN: G3/021AM

Report B8352 Run 1
Date 07/31/98 Page 5
Engineer: FJC
Tech: S S
Requester

Notes: Radio Frequency Identification Reader, Fresh 12 VDC battery

Frequency MHz	Level dBuV	Factor dB	Cable dB	Final dBuV/m	Az Polar\ deg Height	Delta FCC A	Delta CISPR B
No higher emissions were found.							
270 degrees azimuth							
193.36	10.9	14.1	2.3	27.3	H	-16.2	-2.7
Log periodic antenna, horizontal polarization.							
0 degrees azimuth, initial antenna height 2.5 meters.							
200.13	8.4	11.9	2.4	22.7	H	-20.8	-7.3
202.22	4.8	11.9	2.4	19.1	H	-24.4	-10.9
208.17	11.3	12.1	2.4	25.8	H	-17.7	-4.2
216.14	8.15	13	2.5	23.6	H	-22.8	-6.4
232.16	4.85	14.4	2.6	21.8	H	-24.6	-15.2
237.99	5.7	14.5	2.6	22.9	H	-23.5	-14.1
267.73	11.7	13.9	2.9	28.4	H	-18	-8.6
297.47	10.85	13.5	3.1	27.4	H	-19	-9.6
327.23	8.6	14.4	3.2	26.2	H	-20.2	-10.8
356.95	10.95	14.6	3.3	28.9	H	-17.5	-8.1
386.71	12.45	15.1	3.4	31	H	-15.4	-6
416.46	10.9	16.2	3.6	30.7	H	-15.7	-6.3
425.38	5.5	16.2	3.6	25.3	H	-21.1	-11.7
446.19	6.65	15.8	3.7	26.2	H	-20.2	-10.8
505.69	3.95	17.3	3.9	25.1	H	-21.3	-11.9
594.96	1.9	19.4	4.3	25.5	H	-20.9	-11.5
90 degrees azimuth							
200.13	8.7	11.9	2.4	23	H	-20.5	-7
208.21	17.2	12.1	2.4	31.7	H	-11.8	1.7 *
297.47	12.7	13.5	3.1	29.3	H	-17.1	-7.7
356.95	11.05	14.6	3.3	29	H	-17.4	-8
446.19	10.55	15.8	3.7	30.1	H	-16.3	-6.9
180 degrees azimuth							
297.47	14.5	13.5	3.1	31.1	H	-15.3	-5.9

TUV PRODUCT SERVICE

RADIATED EMISSIONS

PW1 Test Site
10 Meter Antenna Distance
Equipment Under Test:
Phase IV Engineering
M/N: G3/xxAM, SIN: G3/021AM

Report B8352 Run 1
Date 07/31/98 Page 6
Engineer: FJC
Tech: S S
Requester

Notes: Radio Frequency Identification Reader, Fresh 12 VDC battery

Frequency MHz	Level dBuV	Factor dB	Cable dB	Final dBuV/m	Az Polar\ deg Height	Delta FCC A	Delta CISPR B
270 degrees azimuth							
208.21	18.75	12.1	2.4	33.2	H	-10.3	3.2 *
237.99	9.4	14.5	2.6	26.6	H	-19.8	-10.4

maximized emissions 200 - 1000 MHz.

266 degrees azimuth, antenna height 2.6 meters.

208.17	19.1	12.1	2.4	33.6	H	-9.9	3.6 *
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Log periodic antenna, vertical polarization.

0 degrees azimuth, initial antenna height 1 meter.

Initial antenna height 1.2 meters.

No higher emissions were found.

90 degrees azimuth

No higher emissions were found.

180 degrees azimuth

No higher emissions were found.

270 degrees azimuth

Remeasured vertical polarization due to antenna not pointing toward EUT.

0 degrees azimuth

200.13	15.5	11.9	2.4	29.8	v	-13.7	-.2
202.22	10.9	11.9	2.4	25.2	v	-18.3	-4.8

TUV PRODUCT SERVICE

RADIATED EMISSIONS

PW1 Test Site
 10 Meter Antenna Distance
 Equipment Under Test:
 Phase IV Engineering
 M/N: G3/xxAM, SIN: G3/021AM

Report B8352 Run 1
 Date 07/31/98 Page 7
 Engineer: FJC
 Tech: S S
 Requester

Notes: Radio Frequency Identification Reader, Fresh 12 VDC battery

Frequency MHz	Level dBuV	Factor dB	Cable dB	Final dBuV/m	Az Polar\ deg Height	Delta FCC A	Delta CISPR B	
208.17	18.25	12.1	2.4	32.7	v	-10.8	2.7	*
216.14	11.75	13	2.5	27.2	v	-19.2	-2.8	
232.16	9.15	14.4	2.6	26.1	v	-20.3	-10.9	
237.99	9.7	14.5	2.6	26.9	v	-19.5	-10.1	
90 degrees azimuth								
208.17	19.4	12.1	2.4	33.9	v	-9.6	3.9	*
216.14	13.4	13	2.5	28.9	v	-17.5	-1.1	
232.16	9.85	14.4	2.6	26.8	v	-19.6	-10.2	
237.99	10.35	14.5	2.6	27.5	v	-18.9	-9.5	
180 degrees azimuth								
200.13	15.8	11.9	2.4	30.1	v	-13.4	.1	*
208.17	20.8	12.1	2.4	35.3	v	-8.2	5.3	*
270.7	18.3	13.8	2.9	25	v	-21.4	-12	
309.38	9.4	13.9	3.1	26.4	v	-20	-10.6	

270 degrees azimuth

No higher emissions were found.

Maximized emissions 200 - 1000 MHz.

180 degrees azimuth, antenna height 1 meter.

208.17	21.75	12.1	2.4	36.2	v	-7.3	6.2	*
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TUV PRODUCT SERVICE
RADIATED EMISSIONS

PW1 Test Site
10 Meter Antenna Distance
Equipment Under Test:
Phase IV Engineering
M/N: G3/xxAM, SIN: G3/021AM

Report B8352 Run 1
Date 07/31/98 Page 8
Engineer: FJC
Tech: S S
Requester

Notes: Radio Frequency Identification Reader, Fresh 12 VDC battery

Measurement Summary

Frequency MHz	----- dBuV/m	Final	UV/M	Azimuth deg	Polar\ Height	Delta FCC A	Delta CISPR B	
33.828	26.8		21.877		v	-12.3	-3.2	
34.918	28.7		27.227		v	-10.4	-1.3	
35.927	28		25.118		v	-11.1	-2	
38.706	34.1		50.699		v	-5	4.1	*
39.557	28.2		25.703		v	-10.9	-1.8	
42.388	30.9		35.075		v	-8.2	.9	*
59.517	28.5		26.607		v	-10.6	-1.5	
66.507	35		56.234		v	-4.1	5	*
67.784	34.4		52.480		v	-4.7	4.4	*
69.327	32.3		41.209		v	-6.8	2.3	*
74.085	27.6		23.988		v	-11.5	-2.4	
84.93	25		17.782		v	-14.1	-5	
85.974	24.2		16.218		v	-14.9	-5.8	
88.069	26.9		22.130		v	-16.6	-3.1	
99.195	23.3		14.621		v	-20.2	-6.7	
103.03	23.5		14.962		v	-20	-6.5	
104.05	31.6		38.018		v	-11.9	1.6	*
105.43	25.9		19.724		v	-17.6	-4.1	
106.15	27.9		24.831		v	-15.6	-2.1	
109.26	32		39.810		v	-11.5	2	*
110.18	30		31.622		v	-13.5	0	*
111.72	31.3		36.728		v	-12.2	1.3	*
112.44	30.9		35.075		v	-12.6	.9	*
115.24	30.4		33.113		v	-13.1	.4	*
117.99	30.7		34.276		v	-12.8	.7	*
119.04	32.4		41.686		v	-11.1	2.4	*
120.06	36.5		66.834		v	-7	6.5	*
120.43	29.9		31.260		v	-13.6	-.1	
121.82	29.3		29.174		v	-14.2	-.7	
123.56	27.3		23.173		v	-16.2	-2.7	
124.96	33.9		49.545		v	-9.6	3.9	*
125.31	29.5		29.853		v	-14	-.5	
126.73	31.5		37.583		v	-12	1.5	
127.06	27.9		24.831		v	-15.6	-2.1	
128.09	37		70.794		v	-6.5	7	*
132.96	32.2		40.738		v	-11.3	2.2	*
136.1	30		31.622		v	-13.5	0	*
140.96	30.3		32.734		v	-13.2	.3	*

TUV PRODUCT SERVICE

RADIATED EMISSIONS

PW1 Test Site
10 Meter Antenna Distance
Equipment Under Test:
Phase IV Engineering
M/N: G3/xxAM, SIN: G3/021AM

Report B8352 Run 1
Date 07/31/98 Page 9
Engineer : FJC
Tech: S S
Requester

Notes: Radio Frequency Identification Reader, Fresh 12 VDC battery

Measurement Summary (Cont'd)

Frequency MHz	----- dBuV/m	Final UV/M	Azimuth deg	Polar\ Height	Delta FCC A	Delta CISPR B
144.12	29.1	28.510		v	-14.4	-.9
148.74	34.3	51.88		v	-9.2	4.3 *
155.21	30.6	33.884		v	-12.9	.6 *
156.97	32.5	42.169		v	-11	2.5 *
160.10	34.1	50.699		v	-9.4	4.1 *
161.71	27.5	23.713		v	-16	-2.5
163.24	33.7	48.417		v	-9.8	3.7 *
168.12	33.5	47.315		v	-10	3.5 *
171.25	34.5	53.088		v	-9	4.5 *
172.30	33.1	45.185		v	-10.4	3.1 *
172.98	34.6	53.703		v	-8.9	4.6 *
178.5	27.8	24.547		v	-15.7	-2.2
179.25	34	50.118		v	-9.5	4 *
184.13	36.2	64.565		v	-7.3	6.2 *
185.16	32.4	41.686		v	-11.1	2.4 *
186.22	33.7	48.417		v	-9.8	3.7 *
186.90	33.8	48.977		v	-9.7	3.8 *
188.29	32.9	44.157		v	-10.6	2.9 *
190.74	29.1	28.510		v	-14.4	-.9
193.17	30.9	35.075		v	-12.6	.9 *
193.36	27.3	23.173		v	-16.2	-2.7
194.21	30	31.622		v	-13.5	0 *
195.26	29.1	28.510		v	-14.4	-.9
198.74	23.8	15.488		v	-19.7	-6.2
200.13	30.1	31.988		v	-13.4	.1 *
202.22	25.2	18.197		v	-18.3	-4.8
208.17	36.2	64.565		v	-7.3	6.2 *
216.14	28.9	27.861		v	-17.5	-1.1
232.16	26.8	21.877		v	-19.6	-10.2
237.99	27.5	23.713		v	-18.9	-9.5
267.73	28.4	26.302		v	-18	-8.6
270.71	25	17.782		v	-21.4	-12
297.47	31.1	35.892		v	-15.3	-5.9
309.38	26.4	20.892		v	-20	-10.6
327.23	26.2	20.417		v	-20.2	-10.8
356.95	29	28.183		v	-17.4	-8
386.71	31	35.481		v	-15.4	-6
416.46	30.7	34.276		v	-15.7	-6.3

TUV PRODUCT SERVICE

RADIATED EMISSIONS

PW1 Test Site
 10 Meter Antenna Distance
 Equipment Under Test:
 Phase IV Engineering
 M/N: G3/xxAM, SIN: G3/021AM

Report B8352 Run 1
 Date 07/31/98 Page 10
 Engineer : FJC
 Tech: S S
 Requester

Notes: Radio Frequency Identification Reader, Fresh 12 VDC battery

Measurement Summary (Cont'd)

Frequency MHz	Final dBuV/m	Azimuth UV/M	Polar\ deg	Delta Height	Delta FCC A	CISPR B
425.38	25.3	18.407		H	-21.1	-11.7
446.19	30.1	31.988		H	-16.3	-6.9
505.69	25.1	17.988		H	-21.3	-11.9
594.96	25.5	18.836		H	-20.9	-11.5
minimum Passing Margin		for FCC A is 4.1		dB	at	66.507 MHz
Maximum Failure Margin		for CISPR B is 7		dB	at	128.09 MHz

'File B8352 Run 1

Appendix C

Test Plan
and
Constructional Data Form

TÜV
PRODUCT SERVICE

Company:	<u>Phase IV Engineering</u>	Quote Number:	<u>1980728bd01</u>
Contact:	<u>Joe Letkomiller</u>	Phone: (business hrs)	<u>303 443-6611</u>
E-mail Address:	email@phaseivengr.com	Phone: (after hrs)	303 443-6611

Radio Frequency Identification Reader	
Description:	
Model Number:	G3/xxAM
Serial Number:	G3/021AM & G3/011AM

☐ EMC Directive 89/336/EEC (EMC)	☐ Vehicle Directive 72/245/EEC (EMC)
☐ Machinery Directive 89/392/EEC (EMC)	☐ FDA Reviewers Guidance for Premarket Notification Submissions (EMC)
☐ Medical Device Directive 93/42/EEC (EMC)	
☒ FCC ☒ Part 15 (list)	☒ Other: Supply report on emissions vs. U.K. & EEC regulations for this type of device

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

- ☐ Call contact listed above, if not available then stop testing.
- ☐ Continue testing to complete test series.
- ☒ Continue testing to define corrective action.
- ☐ Stop testing.

Customer authorization to perform tests according to this test plan.	July 30, 1998 Date
Joe Letkomiller and Rich Pollack Test Plan Prepared By (please print)	July 30, 1998 Date
Reviewed by TÜV Product Service Associate	Date

Test Plan

for Electromagnetic Compatibility Testing



Equipment Under Test Transportation

- ☒ Transportation between sites by customer.
☐ Other (consult your TÜV Product Service representative)

Dimensions and Weight

Length 27 Inches Width 8.5 Inches
Height 3.5 Inches Weight 4 pounds

Facilities

Power Requirements

- ☐ 230 VAC 50 Hz Single Phase _____ Amps
☐ 400 VAC 50 Hz Three Phase _____ Amps per phase
☐ 120 VAC 60 Hz Single Phase _____ Amps
☐ 208 VAC 60 Hz Three Phase _____ Amps per phase
☐ _____ VDC _____ Amps
☒ Battery 12 VDC Expected life 12 hours
☐ Other _____

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)

Other

- ☐ Air _____ cfm _____ psi ☐ Water _____ gpm _____ psi
☐ Other _____ (describe)

Test Plan Attachments

Constructional Data Form (CDF)
Applicable (attached)

* The CDF is required for all test plans.

Immunity Test Plan Details

- ☐ Applicable (attached) ☐ N/A

Emissions Test Plan Details

- ☐ Applicable (attached) ☐ N/A

On Site Test Plan Details

- ☐ Applicable (attached) ☐ N/A

Constructional Data Form for Electromagnetic Compatibility Testing



A completed form helps ensure that product testing will go smoothly. Add attachments as necessary for additional documentation. For additional help, please contact your TÜV Product Service Representative.

Applicant -- Enter company information pertaining to the location where the product is manufactured and for the manufacturer's contact soliciting the testing.

Company: Phase IV Engineering

Address: 2820 Wilderness Pl., Suite C, Boulder, CO 80301

Phone: 303 443-6611 Fax: 303 443-8379

Contact: Joe Letkomiller Position: Senior Electronics Technician

General Equipment Description -- Indicate which attachments you are providing with this document. It is recommended that you provide those listed.

Type of Equipment: RFID Reader Model No.: G3/xxAM

Serial No.: G3/021AM, G3/011AM FCC ID No.: _____

General description: Radio Frequency Reader for Interrogating and Reading Passive

Transponders that contain an ID number and that transmit pressure and temperature data.

The Reader emits a 125 kilohertz wave of about 250 milliseconds whenever manually actuated.

The device is intended to be used in truck fleet terminals for reading tires on the lot or in the

preventative maintenance area. The reader stores data in RAM which is later transferred to the

truck-fleet computer. The reader turns on when actuated and off after 2 minutes of non-use.

Product Variant/Options: The unit with serial number G3/011AM has internal conductive coating

intended to reduce radio emissions at higher frequencies.

Attachments: (only required for certification)

☐ External Photographs ☐ Product Literature ☐ High Level Bill of Materials

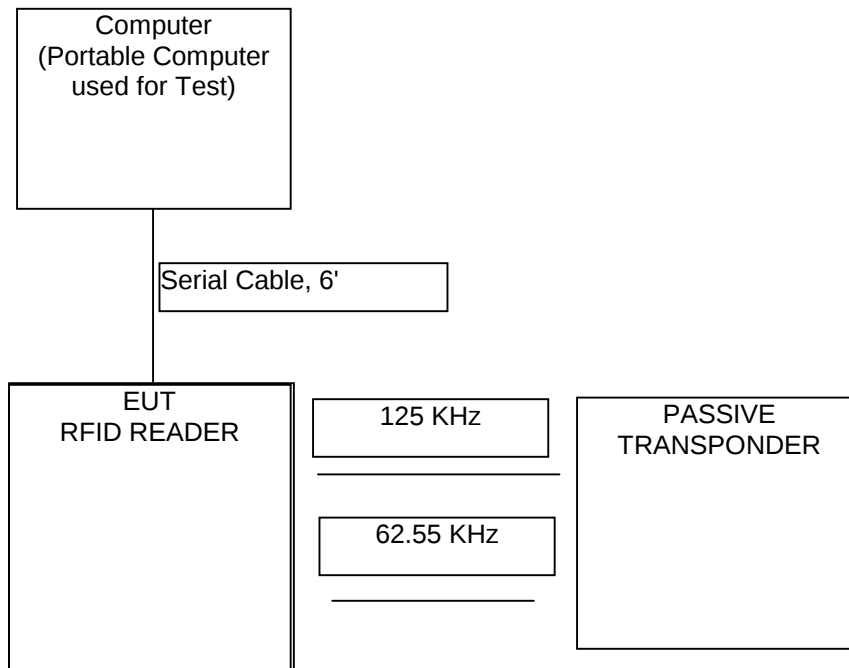
Date and sign each page of the CDF. Original signatures must be present on each page.

Date: _____ **Signature of Applicant:** _____

Constructional Data Form for Electromagnetic Compatibility Testing



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.



Date and sign each page of the CDF. Original signatures must be present on each page.

Date:

Signature of Applicant:

Constructional Data Form for Electromagnetic Compatibility Testing



Installation and Environmental Conditions (describe) -- Describe the intended installation. Include details such as power connection and system grounding approaches. Describe the intended operating environment, include details such as humidity, cooling, heating and hazardous environments. Attaching a copy of an Installation manual is recommended for proper documentation of your system. Please indicate.

This is a portable, battery powered device designed for indoor and outdoor use. The device will be used to read transponders installed in commercial truck tires at fleet terminals, either outdoors on the lot or in the preventative maintenance bays. There are some solvents and cleaners present in the preventative maintenance areas, but it is not a hazardous use area.

The battery used is a commercially available Dewalt 12 volt battery pack. The battery pack clips into the reader and is removed for recharging. The recharger is also a commercially available Dewalt product.

The reader can store the transponder information in RAM. Periodically the contents of the RAM can be transferred to a computer by attaching the reader to a computer and initiating a data transfer procedure from the computer.

The reader is specified to operate over a temperature range of -20 C. to +50 C. and over a humidity range of 0 to 95% RH.

☐ Installation manual/instructions (attached, only required for certification)

Power Requirements -- Indicate your system power requirements for the equipment to be tested.

Rated Voltage 12 Volts Rated Input Power 4.2 Watts

Protection Class -- Indicate your product's protection class. Contact your TÜV Product Service representative and is only required for certification.

Type: _____ Class: _____

Date and sign each page of the CDF. Original signatures must be present on each page.

Date: _____ **Signature of Applicant:** _____

Constructional Data Form for Electromagnetic Compatibility Testing



I/O Ports and Cables

Indicate all interface cables which can be attached to the equipment even if they are not sold as part of your system. Describe the port (e.g., Parallel, Serial, SCSI), list its type (e.g., AC, DC, Signal, Control) and number of ports/cables of type. Indicate if the I/O port is to be exercised during testing. List the type of transmission and if the cable is an EUT assembly-to-assembly interconnection cable (PC to printer, to modem). Indicate whether the cable is shielded or not, type of shield (e.g. Braid, Foil) and how terminated (e.g. 360 degree to conductive shell, pigtail) at both ends of the cable. If a cable can have a typical length of ≥ 3.0 meters, then it is required to test with a cable of at least 3.0 meters.

I/O Ports and Cables

Description: The reader contains one serial port with a DB-9 female connector.

Type of Port: RS-232

of ports/cables of type 1

Exercised during testing?

☒ Yes

☐ No

Assembly $\leftrightarrow$ Assembly Interconnect

☒ Yes

☐ No

Cable shielded:

☒ Yes

☐ No

Shield Type (describe)

Foil Braid

Termination: (describe)

Transmission Type:

☐ Analog

☒ Digital

Length of cable: 6'

Maximum: 6'

Tested: 6'

I/O Ports and Cables

Description: N/A

Type of Port:

of ports/cables of type

Exercised during testing?

☐ Yes

☐ No

Assembly $\leftrightarrow$ Assembly Interconnect

☐ Yes

☐ No

Cable shielded:

☐ Yes

☐ No

Shield Type (describe)

Termination: (describe)

Transmission Type:

☐ Analog

☐ Digital

Length of cable:

Maximum:

Tested:

I/O Ports and Cables

Description: N/A

Type of Port:

of ports/cables of type

Exercised during testing?

☐ Yes

☐ No

Assembly $\leftrightarrow$ Assembly Interconnect

☐ Yes

☐ No

Cable shielded:

☐ Yes

☐ No

Shield Type (describe)

Termination: (describe)

Transmission Type:

☐ Analog

☐ Digital

Length of cable:

Maximum:

Tested:

Date and sign each page of the CDF. Original signatures must be present on each page.

Date:

Signature of Applicant:

Constructional Data Form for Electromagnetic Compatibility Testing



EUT configurations -- Provide a technical description of all possible EUT configurations. Specify if more than one configuration is to be tested.

- 1) Plastic Housing not coated with RFI shielding paint.
- 2) Plastic Housing coated on the inside with RFI shielding paint.

EUT Software and Operation 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. Consult with your TÜV Product Service Representative when typical operating modes are not practical. FCC testing of personal computers and/or peripherals requires that a simple program generate a complete line of upper case H's. This pattern must be sent to the parallel port device, serial port device, and must be write/read/verified to each storage device. Monitors must display the H pattern, typically in white letters on a black background. 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.

General Description:
(describe) The reader has three separate modes of operation:

- 1) an on-mode where the microprocessor is on, data is displayed and the device is ready to interrogate when actuated;
- 2) the read push button is actuated at which time the reader emits a 125 kHz sine wave for approximately 250 millisecond;
- 3) the reader is attached to a computer and is transferring data.

Software Revision Level:
(list and describe) D0.91
Normal Operating Software that controls interrogation pulse, receives, decodes, stores and displays data from the transponder.
This software also supports data entry via the attached membrane keypad and data transfer to attached computer.

Operating modes to be tested: (list and describe)

- 1) On mode while not interrogating a transponder
- 2) Interrogation mode with a transponder placed 1.5" from the reader antenna.
- 3) Data upload mode attached to a laptop computer with a 6' serial cable.

☐ Operation manual/instructions (attached)

Date and sign each page of the CDF. Original signatures must be present on each page.

Date:

Signature of Applicant:

Constructional Data Form for Electromagnetic Compatibility Testing



System, Subsystem, Major Subassemblies or Internal Peripherals -- List and describe all system, subsystem, major subassemblies and all internal peripherals. This should include such things as an external monitor, parallel interface peripheral, serial interface peripheral, internal disk drives or internal circuit boards. It is recommended that circuit diagrams, assembly and subassembly drawings be attached. Please indicate.

<i>Description</i>	<i>Model #</i>	<i>Serial #</i>	<i>FCC ID #</i>
Motherboard	Gen. 3, Rev. B	2EO3000	
Receiver Circuit Board	Gen. 3, Rev. B		
Antenna Assembly, Aircore	O/U Mobius		
Display			
Enclosure	Gen. 3, ABS		
☐ Technical Drawings attached			

Interfacing Equipment and/or Simulators (which are not part of the EUT) -- List and Describe all equipment or peripherals that will be connected to the EUT. For FCC testing a minimum configuration is required. If you have questions about this minimum configuration contact your TÜV Product Service representative.

<i>Description</i>	<i>Model #</i>	<i>Serial #</i>	<i>FCC ID #</i>
Laptop Computer, 120 MHz	Green 753	GND963400807	DK4GREEN753
Serial Interface Cable, 6'			

Date and sign each page of the CDF. Original signatures must be present on each page.

Date:	Signature of Applicant:
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Constructional Data Form for Electromagnetic Compatibility Testing



EMC System Details -- List all frequencies and sub-harmonics which are 10kHz or above for such things as oscillators, horizontal line rate of monitors, and clock rates of incorporated OEM assemblies. List all power supplies. Indicate switching frequencies. List power line filters and indicate the manufacturer, model and location on EUT. Indicate all components used for high frequency noise reduction. (e.g., ceramic capacitor, 0.01µF, 1 ea. at C12 - C20).

Oscillator Frequencies

<i>Frequency</i>	<i>Sub-harmonics</i>	<i>EUT Location</i>	<i>Description of Use</i>
16 MHz		Motherboard, Y2	Microprocessor Clock
166 KHz		Motherboard, U2	DC-DC Converter
125 KHz	62.5 KHz from Transponder	Motherboard and Antenna Assembly	Transponder Interrogate
125 KHz	62.5 KHz	Receiver Board	Lock-in Amplifier, PLL
32.768 KHz		Motherboard, U4	Real-time Clock

Power Supply

<i>Frequency</i>	<i>Manufacturer</i>	<i>Model #</i>	<i>Serial #</i>	<i>Type (list frequency)</i>
166 KHz	Maxim	MAX744		DC-DC Converter

Power Line Filters

<i>Manufacturer</i>	<i>Model #</i>	<i>Qty</i>	<i>Location on EUT</i>

Critical EMI Components (Capacitors, ferrites, etc.)

<i>Description</i>	<i>Manufacturer</i>	<i>Part # or Value</i>	<i>Qty</i>	<i>Location on EUT</i>

Date and sign each page of the CDF. Original signatures must be present on each page.

Date:	Signature of Applicant:
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Constructional Data Form for Electromagnetic Compatibility Testing



Other EMI Critical Construction Detail -- Indicate any other measures taken to reduce high frequency noise, (e.g., grounding the circuit board on the right rear corner with 0.25" braid, 3 inches long to the chassis).

G3/011AM: Plastic Housing coated on the inside with RFI shielding paint. The case paint is grounded to a .125" braid 3" long to the negative battery input on the motherboard.

Description of Enclosure -- Describe the principle materials of the enclosure (e.g., plastic, plastic with shielding material, metal, metal with specific shielding contact points, metal with paint on all surfaces).

The enclosure is an ABS vacuum formed case that parts in the horizontal centerline. One version of the enclosure for testing is shielded on the inside with a RFI shielding paint. The unshielded version will be the type certified if it meets the FCC emissions requirements.

Date and sign each page of the CDF. Original signatures must be present on each page.

Date:

Signature of Applicant:

FCC Emissions
Test Plan Details
(ATTACHMENT)



Standards to be Applied

- ☐ CISPR 22

☐ Class A

☒ Class B
- ☐ FCC Part 15 (list) Class A (list)
- ☐ Other (list)

Description	Basic Document	Requirement
Radiated & Conducted Emissions	ANSI 63.4	Reference Basic Document or Applicable Standard

Engineering Justifications / Test Deviations

Appendix D

Measurement of Protocol

MEASUREMENT PROTOCOL FOR FCC

GENERAL INFORMATION

Measurement Uncertainty

The test system for conducted emissions is defined as the LISN, tuned receiver or spectrum analyzer, and coaxial cable. The test system for radiated emissions is defined as the antenna, the pre-amplifier, the spectrum analyzer and the coaxial cable. These test systems have a measurement uncertainty of ± 4.5 dB. The equipment comprising the test systems are 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, expressed in dB μ V, is arrived at by taking the reading directly from the EMI receiver. This level is compared directly to the FCC limit.

To convert between dB μ V and μ V, the following conversions apply:

$$\text{dB}\mu\text{V} = 20(\log \mu\text{V})$$

$$\mu\text{V} = \text{Inverse log}(\text{dB}\mu\text{V}/20)$$

RADIATED EMISSIONS

The final level, expressed in dB μ V/m, is arrived at by taking the reading from the spectrum analyzer (Level dB μ V) and adding the antenna correction factor and cable loss factor (Factor dB) to it. This result then has the FCC limit subtracted from it to provide the Delta which gives the tabular data as shown in the data sheets in Attachment B. The amplifier gain is automatically accounted for by using an analyzer offset.

Example:

Frequency (MHz)	Level (dB μ V)	+	Factor & Cable (dB)	=	Final (dB μ V/m)	-	FCC B Limit (dB μ V/m)	=	Delta FCC B (dB)
32.21	13.9	+	16.3	=	30.2	-	40.0	=	-9.8

DETAILS OF TEST PROCEDURES

General Standard Information

The test methods used comply with ANSI C63.4-1992 - "Methods of Measurement of Radio-Noise Emissions from Low-Voltage Electrical and Electronic Equipment in the Range of 9 kHz to 40 GHz."

Conducted Emissions

Conducted emissions on the 60 Hz power interface of the EUT are measured in the frequency range of 450 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. If the minimum passing margin appears to be less than 20 dB with a peak mode measurement, the emissions are re-measured using a tuned receiver or spectrum analyzer with quasi-peak and average detection and recorded on the data sheets.

Radiated Emissions

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. Floor standing equipment is placed directly on the turntable/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 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. Intentional radiators are rotated through three orthogonal axes to determine the attitude that maximizes the emissions.