

**EMC EMISSIONS - TEST REPORT (In Part)**

Test Report No.	<b>3188269DEN-003</b>		Issue Date:	<b>August 31, 2009</b>
Model / Serial No.	<b>MN: DFR200 /SN: DFR-090006833</b>			
Product Type	<b>Dual Fixed RFID Reader</b>			
Client	<b>DVM Systems, LCC</b>			
Manufacturer	<b>Phase IV Engineering, Inc.</b>			
License holder	<b>Phase IV Engineering, Inc.</b>			
Address	<b>2820 Wilderness Place, Unit C</b>			
	<b>Boulder CO 80301</b>			
Test Criteria Applied	<b>FCC 47 CFR Part 15.209 RSS-210 issue 7</b>		Title 47 CFR 15: RADIO FREQUENCY DEVICES Subpart C – Intentional Radiators	
Test Result	<b>PASS</b>		Low-power License-exempt Radio Communication Devices (All Frequency Bands): Category I Equipment	
Test Project Number	3188269			
References				
Total Pages	28			
Including Appendices:				
				
Tested By: Michael Spataro	 Reviewed By : Richard Georgerian			

**REVISION SUMMARY** - The following changes have been made to this Report:

Rev.	Revision Statement	Author	Revision Date	Reviewer
	<b>Initial Release of Document</b>	See above	See above	
A	Changed Model Number to DFR200	Michael Spataro	4/28/2010	RGeorgerian 

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## **STATEMENT OF MEASUREMENT UNCERTAINTY**

The data and results referenced in this document are true and accurate. The measurement uncertainty for Conducted Emissions in the frequency range of 150kHz – 30MHz is calculated to be  $\pm 3.14$ dB and for Radiated Emissions is calculated to be  $\pm 4.4$ dB in the frequency range of 10kHz – 1000MHz at 3m and  $\pm 4.9$ dB in the frequency range of 1 – 18GHz at 3m. For testing at 10m  $\pm 4.8$ dB in the frequency range of 30 – 1000MHz. For Disturbance Power,  $\pm 3.3$ dB in the frequency range of 30 – 1000MHz. For Flicker and Harmonics testing the equipment used is calibrated by the manufacturer and is within the tolerances specified in 61000-3-2/3. These uncertainties have been calculated using CISPR 16-4-2:2003 and represent a 95% confidence level (k=2).

EUT Received Date: 24-Aug-2009

Testing Start Date: 24-Aug-2009

Testing End Date: 25-Aug-2009

**The tests were performed according to following regulations:**

1. FCC CFR47 Part 15 subpart C
2. IC RSS-210:2007
3. IC RSS-GEN:2007
4. FCC CFR47 Part 15 subpart C
5. ICES-003

## Emission Test Results:

Conducted Emissions 15.207 - **PASS**

## Test Result

Minimum limit margin -10.6 dB at 0.268 MHz

Remarks: Covers RSS-Gen section 7.2.2 table 2

Radiated Unintentional and Spurious Emissions 15.109/15.205/209 - PASS

## Test Result

Minimum limit margin -2.6 dB at 44.40 MHz

Remarks: Covers RSS-Gen Section 6 table 1

Field Strength of the Fundamental 15.209/RSS-210 - **PASS**

## Test Result

Minimum limit margin **-5.4 dB** at **0.134 MHz**

Remarks: Covers RSS-210 section 2.7 table 3

**GENERAL REMARKS:**

The following remarks are to be considered as "where applicable" and are taken into account while completing any FCC/IC/ETSI radio tests at Intertek.

**FCC CFR47 Part 15.31: Measurement Standards:** In any case where the device is powered off a battery, a fresh battery was used during test. In cases where the device is powered off an AC supply, voltage was varied per Part 15.31 to find worst case emissions.

**FCC CFR47 Part 15.35: Measurement Detector Functions and Bandwidths:** FCC Part 15.35 was utilized when performing the measurements within this report.

Sample:

Production     Prototype     See Appendix B

Modifications required to pass: None

Test Specification Deviations: Additions to or Exclusions from: None

Test-setup photo(s):

Radiated Emissions:



Test-setup photo(s):  
Radiated Emissions:



Test-setup photo(s):  
Conducted Emissions:



Test-setup photo(s):  
Conducted Emissions:



## **Appendix A**

Test Data Sheets

and

Test Equipment Used

## **Conducted Emissions**

**FCC 15.207**

**RSS-GEN 7.2.2**

# Conducted Electromagnetic Emissions

Test Report #:	3188269	Test Area:	Pinewood Site 1 Cond	Temperature:	27.7	°C
Test Method:	FCC Part 15.107 Class B	Test Date:	25-Aug-2009	Relative Humidity:	53	%
EUT Model #:	DFR200	EUT Power:	120VAC 60Hz	Air Pressure:	100	kPa
EUT Serial #:	DFR-090006833					
Manufacturer:	Phase IV					
EUT Description:	Dual Fixed Reader					
Notes:						

Level Key

Pk – Peak	Nb – Narrow Band
Qp – QuasiPeak	Bb – Broad Band
Av - Average	

FREQ	LEVEL	CABLE / LISN / ATTEN	FINAL	TEST POINT	DELTA1 (dB)	DELTA2 (dB)
(MHz)	(dBuV)	(dB)	(dBuV)		QP15.107B	AV15.107B
0.268	30.5 Av	0.1 / 0.3 / -9.7	40.6	Neutral	N/A	-10.6
0.538	21.3 Qp	0.1 / 0.3 / -9.7	31.4	Neutral	-24.6	N/A
0.538	14.5 Av	0.1 / 0.3 / -9.7	24.6	Neutral	N/A	-21.4
4.03	23.0 Qp	0.3 / 0.3 / -9.7	33.3	Neutral	-22.7	N/A
4.03	22.0 Av	0.3 / 0.3 / -9.7	32.3	Neutral	N/A	-13.7
6.44	30.2 Qp	0.6 / 0.3 / -9.7	40.8	Neutral	-19.2	N/A
6.44	26.4 Av	0.6 / 0.3 / -9.7	37.0	Neutral	N/A	-13.0
8.86	23.2 Qp	0.6 / 0.3 / -9.7	33.8	Neutral	-26.2	N/A
29.93	15.7 Qp	1.2 / 2.4 / -9.7	29.0	Neutral	-31.0	N/A
0.268	37.5 Qp	0.1 / 0.3 / -9.7	47.6	Line 1	-13.6	N/A
0.268	30.4 Av	0.1 / 0.3 / -9.7	40.5	Line 1	N/A	-10.7
0.538	21.5 Qp	0.1 / 0.3 / -9.7	31.6	Line 1	-24.4	N/A
0.538	14.8 Av	0.1 / 0.3 / -9.7	24.9	Line 1	N/A	-21.1
4.03	22.8 Qp	0.3 / 0.3 / -9.7	33.1	Line 1	-22.9	N/A
4.03	21.8 Av	0.3 / 0.3 / -9.7	32.1	Line 1	N/A	-13.9
6.44	28.7 Qp	0.6 / 0.3 / -9.7	39.3	Line 1	-20.7	N/A
6.44	26.1 Av	0.6 / 0.3 / -9.7	36.7	Line 1	N/A	-13.3
8.86	22.0 Qp	0.6 / 0.3 / -9.7	32.6	Line 1	-27.4	N/A
17.04	25.7 Qp	0.9 / 0.7 / -9.7	36.9	Line 1	-23.1	N/A
17.04	25.6 Pk	0.9 / 0.7 / -9.7	36.8	Line 1	-23.2	-13.2
17.58	25.8 Qp	0.9 / 0.8 / -9.7	37.2	Line 1	-22.8	N/A
17.58	24.1 Av	0.9 / 0.8 / -9.7	35.5	Line 1	N/A	-14.5
17.58	25.9 Qp	0.9 / 0.8 / -9.7	37.3	Neutral	-22.7	N/A
17.58	24.3 Av	0.9 / 0.8 / -9.7	35.7	Neutral	N/A	-14.3
17.04	25.8 Pk	0.9 / 0.7 / -9.7	37.0	Neutral	-23.0	-13.0
17.04	25.7 Qp	0.9 / 0.7 / -9.7	36.9	Neutral	-23.1	N/A
17.04	24.1 Av	0.9 / 0.7 / -9.7	35.3	Neutral	N/A	-14.7

FREQ (MHz)	LEVEL (dBuV)	CABLE / LISN / ATTEN (dB)	FINAL (dBuV)	TEST POINT	DELTA1 (dB) QP15.107B	DELTA2 (dB) AV15.107B
<b>***** Measurement Summary *****</b>						
0.268	30.5 Av	0.1 / 0.3 / -9.7	40.6	Neutral	N/A	-10.6
6.44	26.4 Av	0.6 / 0.3 / -9.7	37.0	Neutral	N/A	-13.0
4.03	22.0 Av	0.3 / 0.3 / -9.7	32.3	Neutral	N/A	-13.7
17.58	24.3 Av	0.9 / 0.8 / -9.7	35.7	Neutral	N/A	-14.3
17.04	24.1 Av	0.9 / 0.7 / -9.7	35.3	Neutral	N/A	-14.7
0.538	14.8 Av	0.1 / 0.3 / -9.7	24.9	Line 1	N/A	-21.1
8.86	23.2 Qp	0.6 / 0.3 / -9.7	33.8	Neutral	-26.2	N/A
29.93	15.7 Qp	1.2 / 2.4 / -9.7	29.0	Neutral	-31.0	N/A

**Spurious Emissions  
And  
Unintentional Emissions**

**FCC 15.205/209/109**

**RSS-Gen Section 6**

# Radiated Electromagnetic Emissions

Test Report #:	3188269	Test Area:	Pinewood Site 1 (10m)		Temperature:	25.8	°C
Test Method:	FCC Part 15.209	Test Date:	24-Aug-2009		Relative Humidity:	53.7	%
EUT Model #:	DFR200	EUT Power:	120VAC 60Hz		Air Pressure:	100	kPa
EUT Serial #:	DFR-090006833						
Manufacturer:	Phase IV						Level Key
EUT Description:	Dual Fixed Reader					Pk – Peak	Nb – Narrow Band
Notes:						Qp – QuasiPeak	Bb – Broad Band
						Av - Average	

FREQ (MHz)	LEVEL (dBuV)	CABLE / ANT / PREAMP (dB)	FINAL (dBuV)	POL / HGT / AZ (m) (DEG)	DELTA1 (dB) 15.209 <1GHz 10m	DELTA2 (dB) N/A
Ferrites added to internal cables for multiple emissions between 30 and 80MHz. See Modifications datasheet.						
44.40	42.3 Qp	1.8 / 11.3 / 28.1	27.4	V / 1.0 / 0.0	-2.6	N/A
198.33	38.4 Qp	3.8 / 12.0 / 27.5	26.7	V / 1.0 / 0.0	-6.8	N/A
208.39	40.3 Qp	3.9 / 10.6 / 27.5	27.3	V / 1.0 / 0.0	-6.2	N/A
325.44	30.1 Qp	4.9 / 14.2 / 27.3	21.9	V / 1.0 / 0.0	-14.1	N/A
401.87	32.5 Qp	5.5 / 15.6 / 27.8	25.7	V / 1.0 / 0.0	-10.3	N/A
198.33	39.4 Qp	3.8 / 12.0 / 27.5	27.7	V / 1.0 / 90.0	-5.8	N/A
208.39	40.0 Qp	3.9 / 10.6 / 27.5	27.1	V / 1.0 / 90.0	-6.4	N/A
33.91	33.5 Qp	1.7 / 18.4 / 28.1	25.5	V / 1.0 / 180.0	-4.5	N/A
68.41	42.1 Qp	2.2 / 7.9 / 28.0	24.3	V / 1.0 / 180.0	-5.7	N/A
219.53	35.1 Qp	4.0 / 10.7 / 27.4	22.4	V / 1.0 / 180.0	-13.6	N/A
249.98	33.0 Qp	4.2 / 11.7 / 27.3	21.6	V / 1.0 / 180.0	-14.4	N/A
33.91	33.6 Qp	1.7 / 18.4 / 28.1	25.5	V / 1.0 / 270.0	-4.5	N/A
The following were maximized between 30 and 1000 MHz.						
33.91	35.1 Qp	1.7 / 18.4 / 28.1	27.1	V / 1.0 / 238.0	-2.9	N/A
44.4MHz did not maximize any higher.						
68.41	42.7 Qp	2.2 / 7.9 / 28.0	24.8	V / 1.0 / 195.0	-5.2	N/A
198.33	39.0 Qp	3.8 / 12.0 / 27.5	27.3	V / 1.5 / 125.0	-6.2	N/A
No higher emissions found: 30 to 1000MHz Vertical.						
The following are noise floor.						
500.00	26.9 Qp	6.1 / 17.8 / 28.3	22.5	V / 1.0 / 0.0	-13.5	N/A
995.00	25.8 Qp	9.3 / 22.5 / 27.3	30.2	V / 1.0 / 0.0	-13.8	N/A
70.05	33.0 Qp	2.2 / 8.0 / 28.0	15.2	H / 2.5 / 0.0	-14.8	N/A
68.99	41.9 Qp	2.2 / 7.9 / 28.0	24.0	H / 1.6 / 90.0	-6.0	N/A
193.27	30.6 Qp	3.8 / 11.3 / 27.5	18.2	H / 1.6 / 90.0	-15.3	N/A

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FREQ (MHz)	LEVEL (dBuV)	CABLE / ANT / PREAMP (dB)	FINAL (dBuV)	POL / HGT / AZ (m) (DEG)	DELTA1 (dB) 15.209 <1GHz 10m	DELTA2 (dB) N/A
No higher emissions found: 180Deg Horizontal.						
70.05	35.6 Qp	2.2 / 8.0 / 28.0	17.8	H / 1.6 / 270.0	-12.2	N/A
68.99	37.4 Qp	2.2 / 7.9 / 28.0	19.5	H / 2.5 / 270.0	-10.5	N/A
70.05	37.5 Qp	2.2 / 8.0 / 28.0	19.7	H / 2.5 / 270.0	-10.3	N/A
The following were maximized between 30 and 1000 MHz.						
68.99	43.7 Qp	2.2 / 7.9 / 28.0	25.8	H / 3.2 / 75.0	-4.2	N/A
70.05	42.5 Qp	2.2 / 8.0 / 28.0	24.7	H / 3.2 / 110.0	-5.3	N/A

FREQ (MHz)	LEVEL (dBuV)	CABLE / ANT / PREAMP (dB) (dB\m) (dB)	FINAL (dBuV)	POL / HGT / AZ (m) (DEG)	DELTA1 (dB) 15.209 <1GHz 10m	DELTA2 (dB) N/A
<b>***** Measurement Summary *****</b>						
44.40	42.3 Qp	1.8 / 11.3 / 28.1	27.4	V / 1.0 / 0.0	-2.6	N/A
33.91	35.1 Qp	1.7 / 18.4 / 28.1	27.1	V / 1.0 / 238.0	-2.9	N/A
68.99	43.7 Qp	2.2 / 7.9 / 28.0	25.8	H / 3.2 / 75.0	-4.2	N/A
68.41	42.7 Qp	2.2 / 7.9 / 28.0	24.8	V / 1.0 / 195.0	-5.2	N/A
70.05	42.5 Qp	2.2 / 8.0 / 28.0	24.7	H / 3.2 / 110.0	-5.3	N/A
198.33	39.4 Qp	3.8 / 12.0 / 27.5	27.7	V / 1.0 / 90.0	-5.8	N/A
208.39	40.3 Qp	3.9 / 10.6 / 27.5	27.3	V / 1.0 / 0.0	-6.2	N/A
29.39	30.2 Qp	1.5 / 8.2 / 0.0	39.9	V / 1.0 / 187.0	-7.6	N/A
28.85	29.9 Qp	1.5 / 8.3 / 0.0	39.7	V / 1.0 / 150.0	-7.8	N/A
28.58	29.4 Qp	1.5 / 8.4 / 0.0	39.3	V / 1.0 / 150.0	-8.2	N/A
29.93	29.2 Qp	1.5 / 8.1 / 0.0	38.9	V / 1.0 / 0.0	-8.6	N/A
28.05	28.4 Qp	1.5 / 8.5 / 0.0	38.3	V / 1.0 / 150.0	-9.2	N/A
401.87	32.5 Qp	5.5 / 15.6 / 27.8	25.7	V / 1.0 / 0.0	-10.3	N/A
500.00	26.9 Qp	6.1 / 17.8 / 28.3	22.5	V / 1.0 / 0.0	-13.5	N/A
219.53	35.1 Qp	4.0 / 10.7 / 27.4	22.4	V / 1.0 / 180.0	-13.6	N/A
995.00	25.8 Qp	9.3 / 22.5 / 27.3	30.2	V / 1.0 / 0.0	-13.8	N/A
325.44	30.1 Qp	4.9 / 14.2 / 27.3	21.9	V / 1.0 / 0.0	-14.1	N/A
249.98	33.0 Qp	4.2 / 11.7 / 27.3	21.6	V / 1.0 / 180.0	-14.4	N/A
193.27	30.6 Qp	3.8 / 11.3 / 27.5	18.2	H / 1.6 / 90.0	-15.3	N/A

**Fundamental field strength  
Harmonics of the Fundamental  
And  
All other emissions Below 30MHz**

**FCC 15.209**

**RSS-210 Section 2.7**

# Field Strength Measurements

## Fundamental and Spurious of the Transmitter

Test Report #:	3188269	Test Area:	Pinewood Site 1 (10m)		Temperature:	25.8	°C	
Test Method:	15.209	Test Date:	24/25-Aug-2009		Relative Humidity:	53.7	%	
EUT Model #:	DFR200	EUT Power:	120VAC 60Hz		Air Pressure:	100	kPa	
EUT Serial #:	DFR-090006833						Page:	
Manufacturer:	Phase IV						Level Key	
EUT Description:	Dual Fixed Reader					Pk – Peak	Nb – Narrow Band	
Notes:						Qp – QuasiPeak	Bb – Broad Band	
						Av - Average		

FREQ	LEVEL	CABLE / ANT / PREAMP	FINAL	POL / HGT / AZ	Near Field Correction	Final Corrected	Limit	DELTA
(MHz)	(dBuV)	(dB) (dBm) (dB)	(dBuV)	(m) (DEG)	(dB)	(dBuV/m)	(dBuV/m)	(dB)

### Near Field Correction

Per 15.31(f)(2) the final measurements were corrected for the test distance used of 10 meters. For the fundamental frequency at 134kHz the correction factor was derived from multiple measurements made at Intertek's OATS site at 40 Meadow Rd in Pinewood Springs CO. Annex B contains the report and data for justification of this correction factor. For all other measurement below 30MHz the correction factor used was calculated using 40dB/decade from 15.31(f)(2).

### Part 15.209

Loop antenna is parallel to the EUT antenna.

0.134	106.2 Qp	0.0 / 10.8 / 0.0	117	V / 1.0 / 10.0	104.6	12.4	25.1	-12.7
0.268	37.1 Qp	0.1 / 10.7 / 0.0	47.9	V / 1.0 / 5.0	59	-11.1	19.0	-30.1
0.401	43.5 Av	0.1 / 10.6 / 0.0	54.3	V / 1.0 / 10.0	59	-4.7	15.5	-20.2
0.538	38.5 Qp	0.2 / 10.6 / 0.0	49.3	V / 1.0 / 0.0	19	30.3	33.0	-2.7
0.671	28.3 Qp	0.2 / 10.6 / 0.0	39.2	V / 1.0 / 0.0	19	20.2	31.1	-10.9
0.806	30.9 Qp	0.3 / 10.6 / 0.0	41.7	V / 1.0 / 15.0	19	22.7	29.5	-6.8
0.94	26.4 Qp	0.3 / 10.6 / 0.0	37.3	V / 1.0 / 15.0	19	18.3	28.2	-9.9
1.07	21.9 Qp	0.4 / 10.6 / 0.0	32.8	V / 1.0 / 15.0	19	13.8	27.0	-13.2
1.21	25.3 Qp	0.4 / 10.6 / 0.0	36.3	V / 1.0 / 10.0	19	17.3	25.9	-8.6
1.34	11.3 Qp	0.4 / 10.6 / 0.0	22.3	V / 1.0 / 0.0	19	3.3	25.1	-21.8

Antenna is perpendicular to the EUT antenna.

0.134	113.5 Qp	0.0 / 10.8 / 0.0	124.3	H / 1.0 / 280.0	104.6	19.7	25.1	-5.4
0.268	48.5 Qp	0.1 / 10.7 / 0.0	59.3	H / 1.0 / 288.0	59	0.3	19.0	-18.7
0.402	53.6 Av	0.1 / 10.6 / 0.0	64.3	H / 1.0 / 270.0	59	5.3	15.5	-10.2
0.537	30.2 Qp	0.2 / 10.6 / 0.0	41.1	H / 1.0 / 270.0	19	22.1	33.0	-10.9
0.671	36.3 Qp	0.2 / 10.6 / 0.0	47.2	H / 1.0 / 280.0	19	28.2	31.1	-2.9
0.805	21.1 Qp	0.3 / 10.6 / 0.0	32	H / 1.0 / 280.0	19	13	29.5	-16.5
0.939	25.2 Qp	0.3 / 10.6 / 0.0	36.1	H / 1.0 / 265.0	19	17.1	28.2	-11.1
1.07	18.9 Qp	0.4 / 10.6 / 0.0	29.9	H / 1.0 / 265.0	19	10.9	27.0	-16.1
1.21	19.4 Qp	0.4 / 10.6 / 0.0	30.4	H / 1.0 / 0.0	19	11.4	25.9	-14.5
1.34	18.0 Qp	0.4 / 10.6 / 0.0	29	H / 1.0 / 0.0	19	10	25.1	-15.1

All other emissions found between 9kHz and 30MHz, maximized.

29.93	29.2 Qp	1.5 / 8.1 / 0.0	38.9	V / 1.0 / 0.0	19	19.9	29.5	-9.6
29.39	30.2 Qp	1.5 / 8.2 / 0.0	39.9	V / 1.0 / 187.0	19	20.9	29.5	-8.6
28.85	29.9 Qp	1.5 / 8.3 / 0.0	39.7	V / 1.0 / 150.0	19	20.7	29.5	-8.8
28.58	29.4 Qp	1.5 / 8.4 / 0.0	39.3	V / 1.0 / 150.0	19	20.3	29.5	-9.2
28.05	28.4 Qp	1.5 / 8.5 / 0.0	38.3	V / 1.0 / 150.0	19	19.3	29.5	-10.2

No other emissions found: 9kHz to 30 MHz.

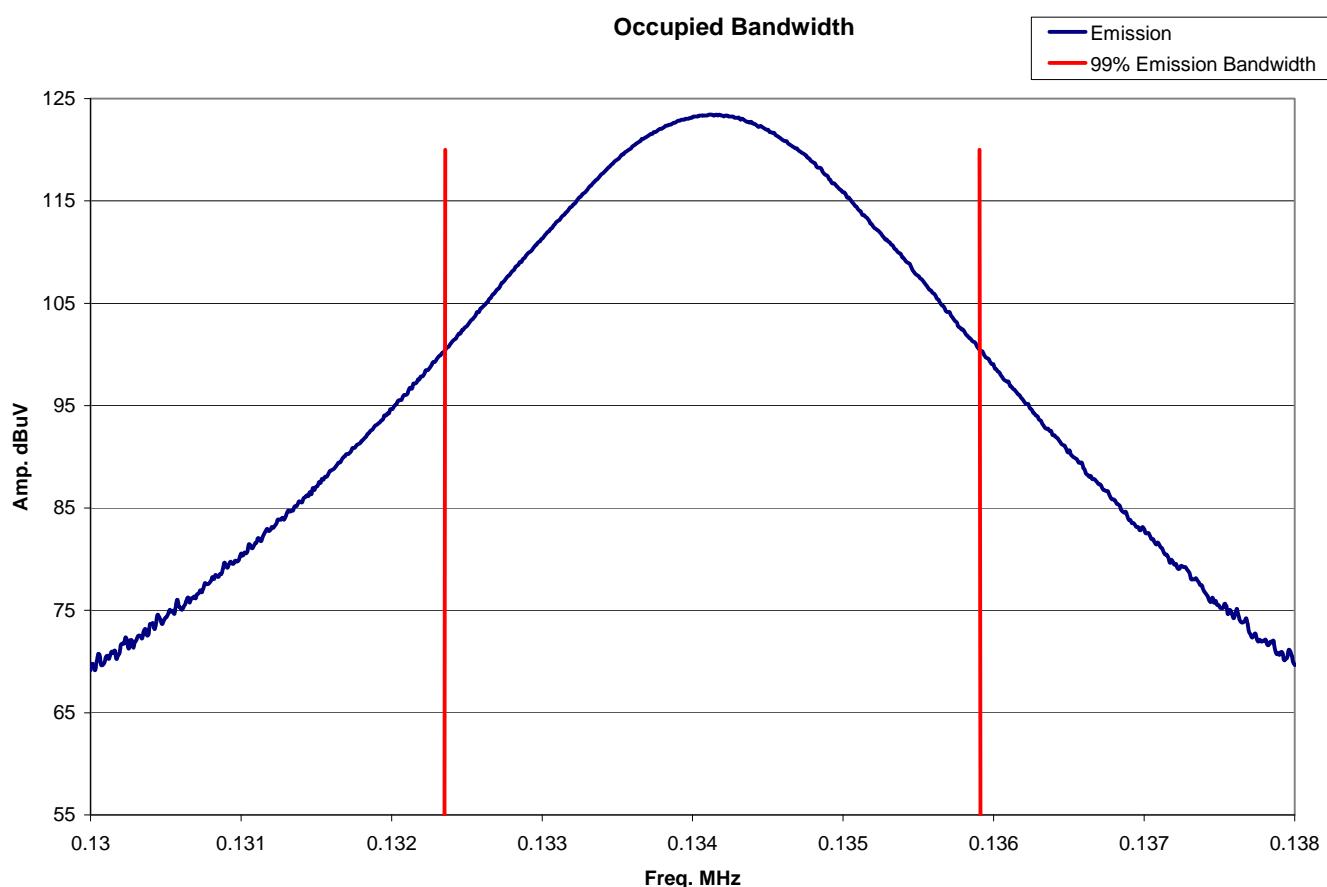
# Bandwidth

Test Report #: **3188269**  
 Test Method: RSS-Gen  
 EUT Model #: DFR200  
 EUT Serial #: DFR-090006833  
 Manufacturer: Phase IV  
 EUT Description: Dual Fixed Reader  
 Notes: The Occupied Bandwidth is 3.5kHz.

Test Area: Pinewood Site 1 (3m)  
 Test Date: 28-May-2009  
 EUT Power: 120VAC 60Hz

Temperature: 22.7 °C  
 Relative Humidity: 41 %  
 Air Pressure: 80 kPa

Level Key	
Pk – Peak	Nb – Narrow Band
Qp – QuasiPeak	Bb – Broad Band
Av - Average	



## **List of Equipment Utilized for Final Test**

## Equipment List

Project: 3185269  
 Test Engineer: Michael Spataro

Start Date: 8/24/2009  
 End Date: 8/25/2009

<u>Asset ID:</u>	<u>Description:</u>	<u>Manufacturer</u>	<u>Model:</u>	<u>Serial:</u>	<u>Cal Due:</u>
<u>Radiated Emissions</u>					
18882	Spectrum Analyzer (dc-22 GHz)	Hewlett-Packard	8566B	2410A00154	12/10/2009
18880	Q.P Adapter	Hewlett-Packard	85650A	2811A01300	12/11/2009
18889	Biconical Antenna 30-300MHz	EMC TEST SYSTEMS	3109	3142	02/22/2010
18888	Log Periodic Antenna (200-1000MHz)	EMCO	3146	9402-3775	10/21/2009
18912	9 kHz- 1.3GHz Pre Amp (9kHz – 1000 MHz)	Hewlett-Packard	8447F	3113A05545	05/12/2010
18897	Active loop antenna	EMCO	6502	9205-2738	10/02/2009
<u>Conducted Emissions</u>					
18909	EMI Test Receiver	RHODE & SCHWARZ	ESHS 30	842806/001	04/08/2010
18729	Transient Limiter	Hewlett-Packard	11947A	3107A01975	04/14/2010
18890	LISN 50 ohm/50uH 3 line (1kHz - 30 MHz)	RHODE & SCHWARZ	ESH2-Z5	830364/002	04/09/2010

## **Appendix B**

Test Plan

and

Constructional Data Form



## 10 Meter to 300 Meter Measured Roll-Off

### Scope:

Measurements were performed to determine the roll-off or site attenuation of a transmitted signal between 10 meters and 300 meters. The radiating loop antenna was centered on the turntable at Intertek, Pinewood Springs, Colorado, Open Area Test Site (OATS) facility. The frequency of the transmitter was set to 134.2 kHz and a receiving loop antenna was located at 10, 30, 100 and 300 Meters in a single radial. This investigation was performed in accordance with the Code of Federal Regulations 47, Part 15.31.f paragraph 2 through 4.

### Test Methodology:

The following extraction from CFR 47, Part 15.31 is shown herein for clarification:

"At frequencies below 30 MHz, measurements may be performed at a distance closer than the specified in the regulations; however, an attempt should be made to avoid making the measurements in the near field. Pending the development of an appropriate measurement procedure for measurements performed below 30 MHz, when performing measurements at a closer distance than specified, the results shall be extrapolated to the specified distance by either making measurements at a minimum of two distances on at least one radial to determine the proper extrapolation factor or by using the square of an inverse linear distance extrapolation factor (40 dB per decade). The applicant for a grant of certification shall specify the extrapolation method used in application filed with the Commission. For equipment subject to Declaration of Conformity or Verification, this information shall be retained with the measurement data. When measurement distances of 30 meters or less are specified in the regulation, the Commission will test the equipment at the distance specified unless measurements at the distance results in measurements being performed in the near field. When measurement distances of greater than 30 meters are specified in the regulations, the Commission will test the equipment at a closer distance, usually 30 meters, extrapolating the measured field strength to the specified distance using the methods shown in this section."

As shown above in Red Print, the FCC does allow for a measured extrapolation.

### Results:

The measured magnetic field extrapolation was determined to be 104.6 dB as shown in Figure 1. This value will be used to extrapolate the measured final test data, expressed in terms of dBuV/m, from the measured 10 meters position, to a final distance of 300 Meters.

David Schram, is a TCB reviewer of Intertek, and has agreed that this extrapolation method is acceptable for both the TCB and FCC and has signed this document to show his agreement.

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# HIGHTEC

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Product compliance engineering preparing you for the world's markets.

## 10 Meter to 300 Meter Magnetic Field Site Roll-Off: 104.6 dB Measured At Intertek, Pinewood Spring Colorado

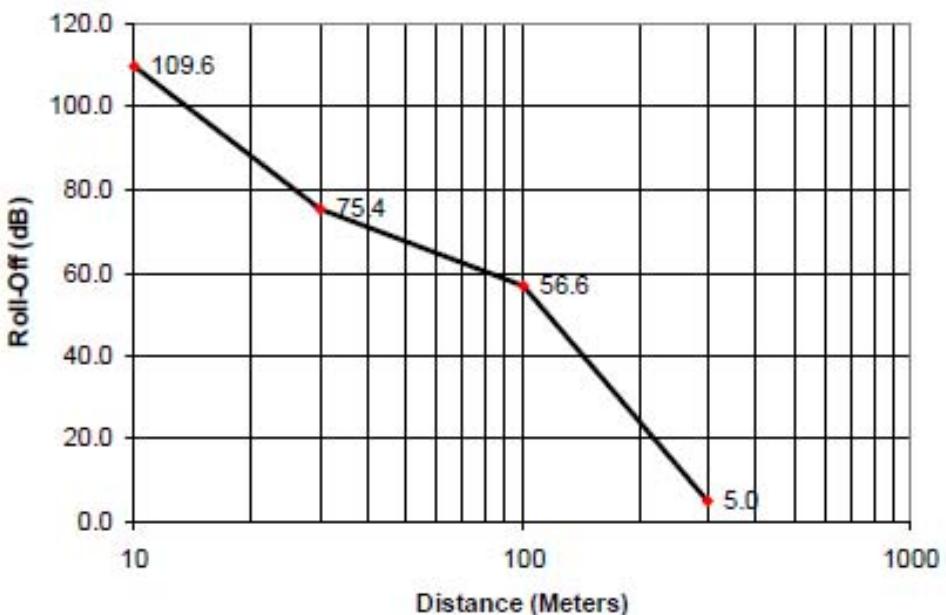


Figure 1. Magnetic Field Roll-Off at 134.2 kHz, 10 Meters to 300 Meters Measurement Distance.

Please feel free to contact me if you should have any questions about the data or comments contained in this report.

Thank you,

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## **Appendix C**

Measurement Protocol

And

Test Procedures

## MEASUREMENT PROTOCOL

### GENERAL INFORMATION

Intertek Testing Services NA, Inc. facilities located in Boulder CO and Pinewood Springs CO are ISO 17025:2005 accredited for EMC/EMI testing. See scope of accreditation for standards and restrictions.

#### Test Methodology

Conducted and radiated emission testing is performed according to the procedures in ANSI C63.4 & CNS13438.

#### 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 $\mu$ V, is arrived at by taking the reading directly from the EMI receiver. This level is compared directly to the applicable limit.

To convert between dB $\mu$ V and  $\mu$ 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 $\mu$ V/m, is arrived at by taking the reading from the spectrum analyzer (Level dB $\mu$ V) and adding the antenna correction factor and cable loss factor (Factor dB) to it. This result then has the applicable limit subtracted from it to provide the Delta which gives the tabular data as shown in the data sheets in Attachment B.

*Example: At a Test Frequency of 30 MHz, with a peak reading on the spectrum analyzer or measuring receiver of 14 dB $\mu$ V:*

Measured Level (dB $\mu$ V)	+	Transducer & Cable Loss factor (dB)	=	Corrected Reading (dB $\mu$ V/m)	Specification Limit (dB $\mu$ V/m)	-	Corrected Reading (dB $\mu$ V/m)	=	Delta Specification -11.1
14.0		14.9		28.9	40.0		28.9		

## DETAILS OF TEST PROCEDURES

### *General Standard Information*

The test methods used comply with ANSI C63.4-2003 - "Methods of Measurement of Radio-Noise Emissions from Low-Voltage Electrical and Electronic Equipment in the Range of 9 kHz to 40 GHz."

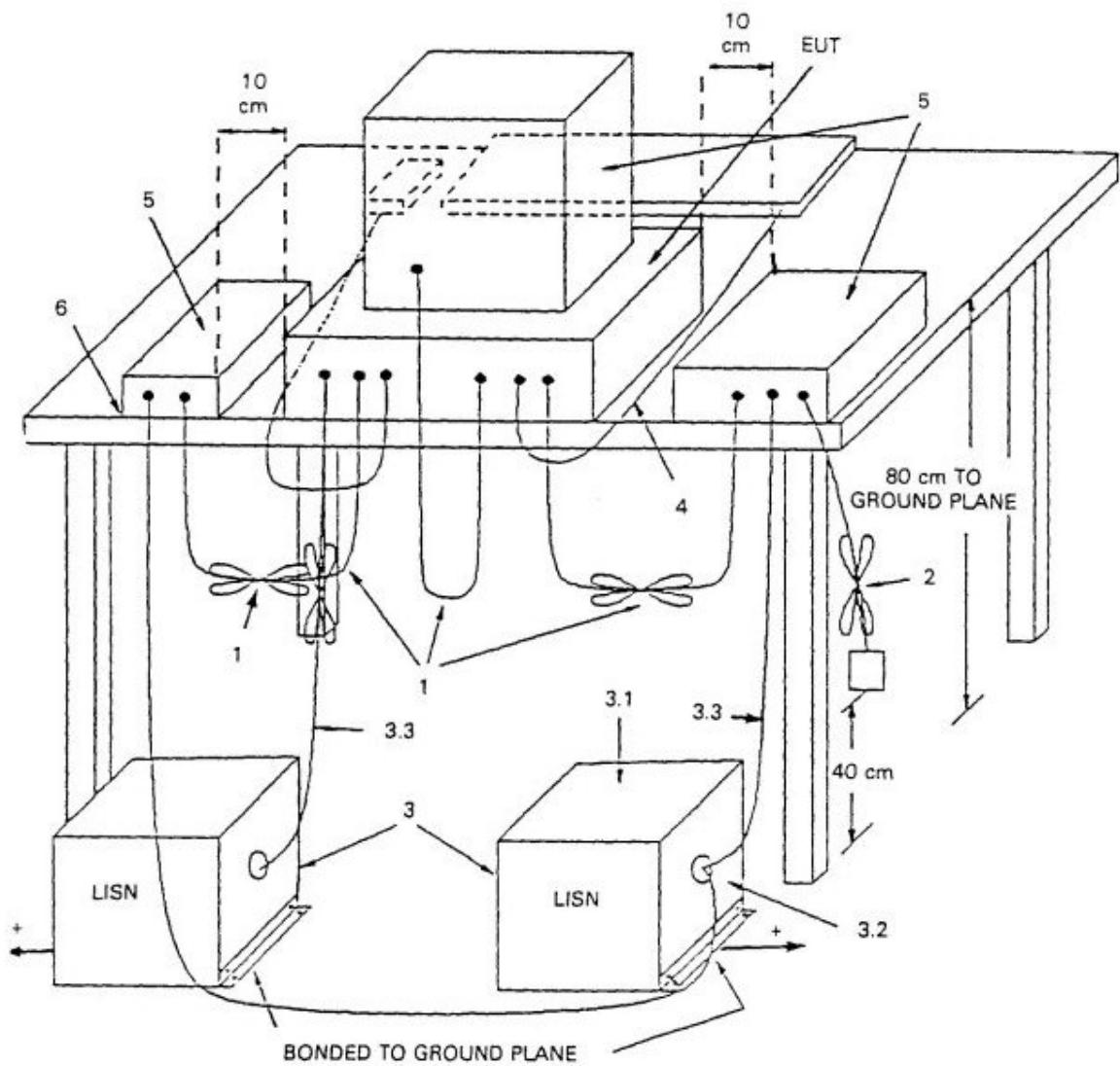
### **Conducted Emissions**

Conducted emissions on the 50 Hz and/or 60 Hz 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  $50\ \Omega/50\ \mu\text{H}$  (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 22GHz 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, 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.

## Conducted Emissions Diagram:



**Radiated Emissions Diagram:**

