CERTIFICATION

Intentional Radiator

Under 47 CFR, Part 15.249

Measurement Systems International, Inc.

FCC ID: FJG-DL7200RFL

Dyna-Link Load Cell

July 17, 2000

Prepared By:

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209 Dayton Street
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CERTIFICATION

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TEST: FIELD STRENGTH OF RADIATED EMISSIONS

Grantee: Measurement Systems International, Inc.

FCC ID: FGJ-DL7200RFL   Model: Dyna-Link Load Cell

Setup:

The equipment under test (EUT) was configured and operated in accordance with the applicable provisions of ANSI C63.4-1992, Section 6, 13.   Measurements were made in accordance with applicable paragraphs of Section 8.2.3, 8.2.4, Section 13.1.1, 13.1.4 Appendix D, and I.

The EUT was placed on a 1 by 1.5 meter table located 40 cm above a 2 meter diameter non-metallic turntable that sits 40 cm above the 15 X 30-meter ground plane at Spectrum's Open Area Test Site. The bi-conical or log-periodic antenna was mounted on a tower spaced at a three meters distance, and arranged for adjustment in height (1-4 meters) and vertical/horizontal polarization to maximize the emissions levels when combined with turntable rotation of the EUT. The dual ridged guide antenna was mounted on a tripod at one-meter height and adjusted for vertical or horizontal antenna orientation. An HP 8562A spectrum analyzer with an HP 8447F, Option H64 amplifier and an HP 83006A pre-amplifier were used for the measuring instrumentation.

Discussion:

No modifications were required or made prior to the final radiated emissions measurements reported herein. Measurements of the transceiver were made from 30 to 9165.000 MHz.

The EUT is the Model: Dyna-Link 7200RFL, manufactured by Measurement Systems International, Inc. It is an Intentional Radiator, a transceiver, operating under Part 15.249. The Model: 7200RFH is a load or tension sensor that measures tension and then transmits the measured data by RF to a companion handheld the Model: Dyna-Link 7200RFH. Both of the systems transceivers are identical and operate on one channel at 916.500 MHz. The two units have different antenna types. The receiver and digital device emissions for Part 15.109 have been measured and found compliant under Verification.

The EUT would normally be handheld so the unit was tested in three mutually orthogonal planes. The EUT was carefully centered on the table to maintain a 3-meter EUT to receive antenna distance during rotation.   The horizontal position, flat on its back and also on its side, with a horizontal antenna were the worst case positions yielding the same level.

The transmitter was operated with test software that allowed the unit to transmit

continuously which made it easy to measure and maximize the emission level with turntable rotation and antenna height and polarization adjusted.

The unit is OOK so when keyed continuously runs about 50% duty cycle.

Preliminary measurements were made as described in Section 8.3.11 and 13.1.4.1 with the EUT operating as described.

The final set of measurements as specified in Section 8.3.1.2 and 13.1.4.2 were made as specified in Section 13.1.1. The transmitter was observed stand-alone in a horizontal positioned on the turntable three meters from the receive antenna. We rotated the turntable and varied antenna height and polarization endeavoring to maximize the signal being measured.   The EUT was powered with a fresh battery during all the measurements. RBW and VBW of 100 kHz were used for measurements below 1 GHz. Above 1 GHz peak measurements were made with a RBW and VBW of 1 MHz.

Only one of the harmonics were measurable at 3 meters during the final detailed radiated emissions measurements.   An HP pre-amplifier and a band pass filter were used to attenuated the 916.5 MHz signal to avoid overloading the front end of the spectrum analyzer when amplifying the input to be able to look for low level harmonics.

The EUT has an internal permanently attached antenna, which is not accessible to the end user. This internal antenna is referred to as the patch antenna and is not a very efficient radiator.

Conclusion:

The Measurement Systems International, Inc., FCC ID: FJG-DL7200RFL, when operated and measured as discussed above, meets the field strength of fundamental and spurious emissions requirements under Title 47, CFR Part 15.249.

FCC Part 15.249 Field Strength of Radiated Spurious Emissions

Grantee: Measurement Systems International, Inc.   06/13/00
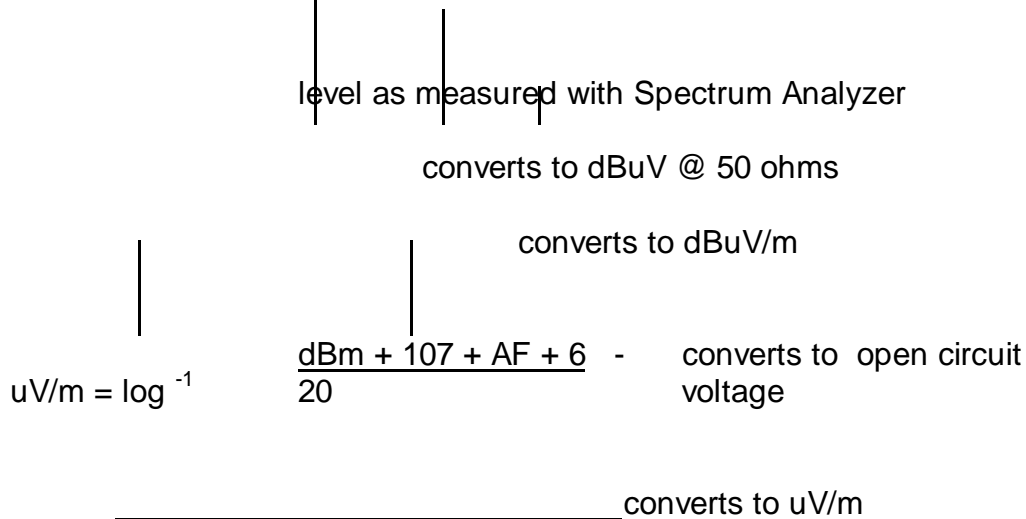
FCC ID: FJG-DL7200RFL

Worst case field strength reported having measured the only operating channel.   The limit under Part 15.249, for the 902 –928 band is 50 millivolts per meter for the fundamental and 500 microvolts per meter for the harmonics. Emissions outside of the specified band, except for harmonics shall be attenuated at least 50 dB below the level of the fundamental; or to the general radiated emissions limit in Section 15.209, which ever is the lessor.

FREQ MHz	VERT	HORZ	ANT-F	CABLE LOSS&BPF	AMP GAIN	DBuV/m	UV/m
916.500	60.33	62.67	27.8	2.67	0	93.14	45394
1833	39.5	42.67	27.15	1.22+.5	24.8	46.74	217.3
2749.5	*	*					
3666	*	*					
4582.5	*	*					
5499	*	*					
6415.5	*	*					
7332	*	*					
8248.5	*	*					
916.5	*	*					

Note: * denotes levels below the noise floor of the analyzer with preamp.

ANTENNA FACTORS FOR EMCO 3104 BICONICAL ANTENNA AND
EMCO 3146 LOG PERIODIC ANTENNA INCLUDING
CONVERSION TO OPEN CIRCUIT VOLTAGE.

Antenna Factor and Field Strength Formula

level as measured with Spectrum Analyzer

converts to dBuV @ 50 ohms

converts to dBuV/m

$$uV/m = \log^{-1} \frac{dBm + 107 + AF + 6}{20}$$ - converts to open circuit voltage

converts to uV/m

IF FREQ => 20	AND	FREQ =< 26.5	THEN ANTF = 12.5
IF FREQ => 26.6	AND	FREQ =< 28	THEN ANTF = 13.5
IF FREQ => 28.1	AND	FREQ =< 33	THEN ANTF = 14.5
IF FREQ => 33.1	AND	FREQ =< 35	THEN ANTF = 13.5
IF FREQ => 35.1	AND	FREQ =< 45	THEN ANTF = 13
IF FREQ => 45.	AND	FREQ =< 57	THEN ANTF = 12
IF FREQ => 57.1	AND	FREQ =< 63	THEN ANTF = 11
IF FREQ => 63.1	AND	FREQ =< 66	THEN ANTF = 10
IF FREQ => 66.1	AND	FREQ =< 75	THEN ANTF = 9
IF FREQ => 75.1	AND	FREQ =< 83	THEN ANTF = 8
IF FREQ => 83.1	AND	FREQ =< 86	THEN ANTF = 9
IF FREQ => 86.1	AND	FREQ =< 90	THEN ANTF = 10
IF FREQ => 90.1	AND	FREQ =< 95	THEN ANTF = 11
IF FREQ => 95.1	AND	FREQ =< 97.5	THEN ANTF = 12.5
IF FREQ => 97.6	AND	FREQ =< 101	THEN ANTF = 13.5
IF FREQ => 101.1	AND	FREQ =< 105	THEN ANTF = 14.5
IF FREQ => 105.1	AND	FREQ =< 108	THEN ANTF = 15.5
IF FREQ => 108.1	AND	FREQ =< 115	THEN ANTF = 16.5
IF FREQ => 115.1	AND	FREQ =< 123	THEN ANTF = 15.5
IF FREQ => 123.1	AND	FREQ =< 148	THEN ANTF = 14.5
IF FREQ => 148.1	AND	FREQ =< 151.5	THEN ANTF = 15.5
IF FREQ => 151.6	AND	FREQ =< 167.5	THEN ANTF = 17
IF FREQ => 167.6	AND	FREQ =< 182.5	THEN ANTF = 18
IF FREQ => 182.6	AND	FREQ =< 200	THEN ANTF = 19
IF FREQ => 200.1	AND	FREQ =< 202	THEN ANTF = 14.7
IF FREQ => 202	AND	FREQ =< 205	THEN ANTF = 14.5
IF FREQ => 205	AND	FREQ =< 215	THEN ANTF = 14.6
IF FREQ => 215	AND	FREQ =< 230	THEN ANTF = 14.55

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IF FREQ => 230        AND     FREQ =< 235      THEN ANTF = 14.5
IF FREQ => 235        AND     FREQ =< 240      THEN ANTF = 14.8
IF FREQ => 240        AND     FREQ =< 242.5    THEN ANTF = 14.9
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IF FREQ => 242.5      AND     FREQ =< 245      THEN ANTF = 15.1
IF FREQ => 245        AND     FREQ =< 247.5    THEN ANTF = 15.5
IF FREQ => 247.5      AND     FREQ =< 250      THEN ANTF = 15.7
IF FREQ => 250        AND     FREQ =< 252      THEN ANTF = 15.9
IF FREQ => 252        AND     FREQ =< 254      THEN ANTF = 16
IF FREQ => 254        AND     FREQ =< 256      THEN ANTF = 16.1
IF FREQ => 256        AND     FREQ =< 258      THEN ANTF = 16.2
IF FREQ => 258        AND     FREQ =< 260      THEN ANTF = 16.3
IF FREQ => 260        AND     FREQ =< 263.5    THEN ANTF = 16.4
IF FREQ => 263.5      AND     FREQ =< 265      THEN ANTF = 16.4
IF FREQ => 265        AND     FREQ =< 267.5    THEN ANTF = 16.6
IF FREQ => 267.5      AND     FREQ =< 271      THEN ANTF = 16.7
IF FREQ => 271        AND     FREQ =< 274      THEN ANTF = 16.8
IF FREQ => 274        AND     FREQ =< 276      THEN ANTF = 16.9
IF FREQ => 276        AND     FREQ =< 278      THEN ANTF = 17
IF FREQ => 278        AND     FREQ =< 280      THEN ANTF = 17.1
IF FREQ => 280        AND     FREQ =< 282      THEN ANTF = 17.3
IF FREQ => 282        AND     FREQ =< 284      THEN ANTF = 17.6
IF FREQ => 284        AND     FREQ =< 286      THEN ANTF = 18
IF FREQ => 286        AND     FREQ =< 288      THEN ANTF = 18.2
IF FREQ => 288        AND     FREQ =< 295      THEN ANTF = 18.4
IF FREQ => 290        AND     FREQ =< 295      THEN ANTF = 15.8
IF FREQ => 295        AND     FREQ =< 305      THEN ANTF = 18.6
IF FREQ => 305        AND     FREQ =< 310      THEN ANTF = 18.4
IF FREQ => 310        AND     FREQ =< 311      THEN ANTF = 18.3
IF FREQ => 311        AND     FREQ =< 312      THEN ANTF = 18.1
IF FREQ => 312        AND     FREQ =< 313      THEN ANTF = 18
IF FREQ => 313        AND     FREQ =< 340      THEN ANTF = 17.9
IF FREQ => 340        AND     FREQ =< 343      THEN ANTF = 18.1
IF FREQ => 343        AND     FREQ =< 350      THEN ANTF = 18.2
IF FREQ => 350        AND     FREQ =< 357      THEN ANTF = 18.3
IF FREQ => 357        AND     FREQ =< 360      THEN ANTF = 18.5
IF FREQ => 360        AND     FREQ =< 365      THEN ANTF = 18.6
IF FREQ => 365        AND     FREQ =< 375      THEN ANTF = 18.7
IF FREQ => 375        AND     FREQ =< 378      THEN ANTF = 19
IF FREQ => 378        AND     FREQ =< 381      THEN ANTF = 19.1
IF FREQ => 381        AND     FREQ =< 383      THEN ANTF = 19.2
IF FREQ => 383        AND     FREQ =< 385      THEN ANTF = 19.3
IF FREQ => 385        AND     FREQ =< 387.5    THEN ANTF = 19.4
IF FREQ => 387.5      AND     FREQ =< 390      THEN ANTF = 19.5
IF FREQ => 390        AND     FREQ =< 392      THEN ANTF = 19.7
IF FREQ => 392        AND     FREQ =< 394      THEN ANTF = 18.8
IF FREQ => 394        AND     FREQ =< 396      THEN ANTF = 19.9
IF FREQ => 396        AND     FREQ =< 398      THEN ANTF = 20
IF FREQ => 398        AND     FREQ =< 402      THEN ANTF = 20.1
IF FREQ => 402        AND     FREQ =< 405      THEN ANTF = 20.2
IF FREQ => 405        AND     FREQ =< 410      THEN ANTF = 20.3
IF FREQ => 410        AND     FREQ =< 415      THEN ANTF = 20.4
IF FREQ => 415        AND     FREQ =< 420      THEN ANTF = 20.6
IF FREQ => 420        AND     FREQ =< 425      THEN ANTF = 20.8
IF FREQ => 425        AND     FREQ =< 430      THEN ANTF = 21
IF FREQ => 430        AND     FREQ =< 435      THEN ANTF = 21.2
IF FREQ => 435        AND     FREQ =< 440      THEN ANTF = 21.3
IF FREQ => 440        AND     FREQ =< 445      THEN ANTF = 21.4
IF FREQ => 445        AND     FREQ =< 450      THEN ANTF = 21.5
IF FREQ => 450        AND     FREQ =< 455      THEN ANTF = 21.6
IF FREQ => 455        AND     FREQ =< 460      THEN ANTF = 21.8
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IF FREQ => 460      AND      FREQ =< 465      THEN ANTF = 21.9
IF FREQ => 465      AND      FREQ =< 470      THEN ANTF = 22
IF FREQ => 470      AND      FREQ =< 472.5    THEN ANTF = 22.1
IF FREQ => 472.5    AND      FREQ =< 475      THEN ANTF = 22.2
IF FREQ => 475      AND      FREQ =< 477      THEN ANTF = 22.4
IF FREQ => 477      AND      FREQ =< 478      THEN ANTF = 22.5
IF FREQ => 478      AND      FREQ =< 481      THEN ANTF = 22.6
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IF FREQ => 481      AND      FREQ =< 482.5    THEN ANTF = 22.7
IF FREQ => 482.5    AND      FREQ =< 485      THEN ANTF = 22.8
IF FREQ => 485      AND      FREQ =< 488      THEN ANTF = 22.9
IF FREQ => 488      AND      FREQ =< 515      THEN ANTF = 23.1
IF FREQ => 515      AND      FREQ =< 540      THEN ANTF = 23.3
IF FREQ => 540      AND      FREQ =< 560      THEN ANTF = 23.6
IF FREQ => 560      AND      FREQ =< 570      THEN ANTF = 23.7
IF FREQ => 570      AND      FREQ =< 580      THEN ANTF = 23.9
IF FREQ => 580      AND      FREQ =< 590      THEN ANTF = 24
IF FREQ => 590      AND      FREQ =< 610      THEN ANTF = 24.2
IF FREQ => 610      AND      FREQ =< 615      THEN ANTF = 24.4
IF FREQ => 615      AND      FREQ =< 620      THEN ANTF = 24.5
IF FREQ => 620      AND      FREQ =< 625      THEN ANTF = 24.6
IF FREQ => 625      AND      FREQ =< 630      THEN ANTF = 24.8
IF FREQ => 630      AND      FREQ =< 635      THEN ANTF = 24.9
IF FREQ => 635      AND      FREQ =< 640      THEN ANTF = 25
IF FREQ => 640      AND      FREQ =< 645      THEN ANTF = 25.1
IF FREQ => 645      AND      FREQ =< 647.5    THEN ANTF = 25.3
IF FREQ => 647.5    AND      FREQ =< 650      THEN ANTF = 25.4
IF FREQ => 650      AND      FREQ =< 652.5    THEN ANTF = 25.6
IF FREQ => 652.5    AND      FREQ =< 655      THEN ANTF = 25.7
IF FREQ => 655      AND      FREQ =< 660      THEN ANTF = 25.8
IF FREQ => 660      AND      FREQ =< 665      THEN ANTF = 26.1
IF FREQ => 665      AND      FREQ =< 670      THEN ANTF = 26.3
IF FREQ => 670      AND      FREQ =< 680      THEN ANTF = 26.6
IF FREQ => 680      AND      FREQ =< 690      THEN ANTF = 26.7
IF FREQ => 690      AND      FREQ =< 720      THEN ANTF = 26.9
IF FREQ => 720      AND      FREQ =< 760      THEN ANTF = 26.8
IF FREQ => 760      AND      FREQ =< 800      THEN ANTF = 27
IF FREQ => 800      AND      FREQ =< 802.5    THEN ANTF = 27.3
IF FREQ => 802.5    AND      FREQ =< 805      THEN ANTF = 27.5
IF FREQ => 805      AND      FREQ =< 807.5    THEN ANTF = 27.6
IF FREQ => 807.5    AND      FREQ =< 810      THEN ANTF = 27.7
IF FREQ => 810      AND      FREQ =< 815      THEN ANTF = 27.8
IF FREQ => 815      AND      FREQ =< 820      THEN ANTF = 27.9
IF FREQ => 820      AND      FREQ =< 840      THEN ANTF = 28.2
IF FREQ => 840      AND      FREQ =< 860      THEN ANTF = 28.4
IF FREQ => 860      AND      FREQ =< 870      THEN ANTF = 28.8
IF FREQ => 870      AND      FREQ =< 880      THEN ANTF = 29.3
IF FREQ => 880      AND      FREQ =< 890      THEN ANTF = 29.4
IF FREQ => 890      AND      FREQ =< 910      THEN ANTF = 29.6
IF FREQ => 910      AND      FREQ =< 920      THEN ANTF = 29.7
IF FREQ => 920      AND      FREQ =< 930      THEN ANTF = 29.9
IF FREQ => 930      AND      FREQ =< 940      THEN ANTF = 30
IF FREQ => 940      AND      FREQ =< 960      THEN ANTF = 30.2
IF FREQ => 960      AND      FREQ =< 970      THEN ANTF = 30.6
IF FREQ => 970      AND      FREQ =< 975      THEN ANTF = 30.8
IF FREQ => 975      AND      FREQ =< 980      THEN ANTF = 31
IF FREQ => 980      AND      FREQ =< 985      THEN ANTF = 31.1
IF FREQ => 985      AND      FREQ =< 990      THEN ANTF = 31.3
IF FREQ => 990      AND      FREQ =< 1000     THEN ANTF = 31.4
```

Serial Number 6225	ELECTO-METRICS GAIN AND ANTENNA FACTORS MODEL RGA-60	1 METER CALIBRATION

FREQUENCY MHz	14 FOOT CABLE LOSS FSJI-50A	ANTENNA FACTOR
1000	.84	23.21
1500	1.05	25.70
2000	1.22	27.15
2500	1.38	28.37
3000	1.53	29.93
3500	1.67	31.01
4000	1.80	32.45
4500	1.92	31.98
5000	2.04	33.33
5500	2.15	34.24
6000	2.27	34.48
6500	2.37	35.19
7000	2.48	36.05
7500	2.58	36.77
8000	2.68	37.33
8500	2.78	37.38
9000	2.87	37.14
9500	2.96	37.55
10000	3.06	38.33

Test Equipment A
SPECTRUM TECHNOLOGY, INC.

Equipment	Manufacturer	Serial Number	Cal Date/Due Date	
Spectrum Analyzer	Hewlett-Packard 8562A	08562-60062	11/04/99	11/04/00
Amplifier 9 kHz-1300 MHz	Hewlett-Packard 8447F OPT H64	2727A02208	11/04/99	11/04/00
Service Monitor	IFR FM/AM 500A	4103	---	
Oscilloscope	Kikusui C055060	6132295	---	
Power Supply	Astron VS35	8601266	---	
Voltmeter	Fluke 8020A	N2420658	---	
Multimeter	Fluke 25	3710310	---	
Wattmeter	Bird 43	56227	---	
RF Termination	Bird 8135	10004	---	
Dual Phase LISN 50 ohm/50 uH	STI per MP-4	02	1/8/00	1/9/01
Dual Phase LISN 50 ohm/50 uH	Compliance Design	8012-50R-24-BNC	1/8/00	1/9/01
Audio Generator	Hewlett-Packard 205-AG	8689	---	
Thermometer	Fluke 52	3965185	---	
Test Line	Simulator, Teltone TLS-2	none	---	
Turn Table, RC	EMCO 1060-2M	8912-1415	---	

Antenna Mast, RC   Compliance Design, Inc. M100   ---

Antennas:

Dipole Set	EMCO Model: 3121C	1335		reference only
Dipole Set	EMCO Model: 3121C	1336		reference only
Bi-Conical	EMCO 3104	3763		reference only
Bi-Conical	EMCO 3104C	9401-4635	01/25/00	1/25/01
Log-Periodic	EMCO 3146	1754	01/25/00	1/25/01
BiConiLog	EMCO 3141	1125	04/28/00	04/28/01
Active Loop	EMCO 6502	9107-2645		reference only

Rev. 05/00

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