



Assessment of Compliance

for

Measurement of Field Strength of Spurious Radiation in accordance with the FCC Rules & Regulations Part 2.1053, 27.53 and 90.543

**700 MHz band base station
Model: T881-10**

Dataradio.



May 2004

APREL Project No.: DATB-T881-10-5018

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Engineering Report

Subject: Measurement of Field Strength of Spurious Radiation in accordance with the FCC Rules & Regulations Part 2.1053, 27.53 and 90.543

FCC ID: EOTBDP3-T881

Equipment: 700 MHz band base station

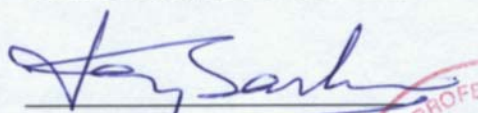
Model: T881-10

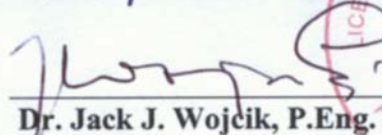
Client: Dataradio
Suite 200, 5500 Royalmount Ave.
Town of Mount Royal, Quebec
CANADA, H4P 1H7

Project #: DATB-T881-10-5018

Prepared By: APREL Laboratories,
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Jay Sarkar:
 Technical Director, Standards & Certification

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Released by:  Date: May 17/2004
Dr. Jack J. Wojcik, P.Eng.



FCC ID: EOTBDP3-T881
Applicant: Dataradio
Equipment: 700 MHz band base station
Model: T881-10
Standard: FCC Rules and Regulations Part 2.1053 and 90

ENGINEERING SUMMARY

This report contains the results of Field Strength of Spurious Radiation measurement performed on a Dataradio 700 MHz band base station model T881-10, in accordance with the FCC Rules and Regulations Part 2.1053 and 90. The measurements were carried out using substitution method as radiated.

The product was evaluated for spurious radiation when it was set at the highest power.

Test configuration: T881-10 was tested as a stand-alone unit.

This report presents test data for frequency band 767.025-772.975 MHz & 762.025-763.925 MHz

The results presented in this report relate only to the sample tested.

Summary of the Results

Test Description	Page No.	Test Set-up Figure No.	Results Summary
Field Strength of Spurious Radiation Ref. Paragraph 2.1053 and 90.543 (c), 27.53(d)(3)	8	1	Passed

INTRODUCTION

General

This report describes the results of the Field Strength of Spurious Radiation measurement conducted on a DATARADIO 700 MHz band base station, model T881-10.

Test Facility

The tests were performed for Dataradio by APREL Laboratories at APREL's EMI facility located in Nepean, Ontario, Canada. The laboratory operates an (3m and 10m) Open Area Test Site (OATS). The measurement facility is calibrated in accordance with ANSI C63.4-1992.

A description of the measurement facility in accordance with the radiated and AC line conducted test site criteria per ANSI C63.4-1992 is on file with the Federal Communications Commission and is in compliance with the requirements of Section 2.948 of the Commissions rules and regulations. **APREL's registration number is 90416.**

APREL is accredited by Standard Council of Canada. APREL is also accredited by Industry Canada and recognised by the Federal Communications Commissions (FCC).

Standard

The evaluation and analysis were conducted in accordance with FCC Rules and Regulations Parts 2.1053 and the appropriate limits (90).

Personnel: The equipment was tested by Roman Kuleba, EMC Engineer, methodology developed and the report was written by Jayanta (Jay) K. Sarkar, Technical Director, Standards and Certification.

Test Equipment

The test equipment used during the evaluation is listed in Appendix A with calibration due dates.

Environmental Conditions

Measurements were conducted in open area test site. Temperature: $24^{\circ}\text{C} \pm 2$,
Relative Humidity: 30 - 50 % , Air Pressure: $101 \text{ kPa} \pm 3$.

FCC SUBMISSION INFORMATION

FCC ID: EOTBDP3-T881

Equipment type: **700 MHz band base station**

Model: **T881-10**

For: Certification

Applicant: **Dataradio**
Suite 200, 5500 Royalmount Ave.
Town of Mount Royal, Quebec
CANADA, H4P 1H7

Manufacturer: **Dataradio**
Suite 200, 5500 Royalmount Ave.
Town of Mount Royal, Quebec
CANADA, H4P 1H7

Evaluated by: **APREL Laboratories**
51 Spectrum Way
Nepean, Ontario
Canada K2R 1E6

MANUFACTURER'S DATA

FCC ID: EOTBDP3-T881

Equipment Type: 700 MHz band base station

Model: T881-10

Reference: FCC Rules and Regulations Parts 2 and Part 90, Part 27

Manufacturer: Dataradio

Development Stage of Unit: Pre-Production

Test: Field Strength of Spurious Radiation

Ref: FCC Parts 2.1053 and 90.543 (c), 27.53(d)(3)

Frequency Band: 767-773MHz (Part 90.543) and 762-764MHz (Part 27.53(d))

Criteria: The radiated spurious emissions shall be attenuated below the maximum level of Emissions of the carrier frequency in accordance with the following formula.

Spurious attenuation in dB=43+10log₁₀(P). (Thus the effective limit is -13dBm)

Set-up: See Figure 1.a

Conditions: Voltage Supply: DC Battery

Equipment: See Appendix A.

Procedure:

Methodology: Measurement by Substitution Method:

The T881-10 was tested for spurious radiated emissions using the substitution method.

Test site: The radiated RF measurement was taken at APREL Laboratory's open area test site (OATS). This open area test site is calibrated to ANSI C63.4 document and a description of the measurement facility is on file with the Federal Communications Commission and is in compliance with the requirement of Section 2.948 of the Commissions rules and regulations. (FCC File No.: 90416)

The test was set-up as illustrated in Fig.1. The DUI was configured to operate at maximum power. The equipment under test was placed on a turntable positioned 3 m away from the calibrated receiving antenna, which in turn was connected to the spectrum analyzer.

A set of two reference dipoles, a horn antenna and a signal generator to duplicate the signal were used. Signals radiated from the T881-10 on the fundamental frequency as well as second and third harmonic were evaluated by comparing to the signals transmitted from the reference dipoles. For testing the higher frequencies, fourth to 8th harmonics, a calibrated horn antenna with known gain was used as a replacement source of radiation thus substituting the T881-10. The duplicated reading (taken in dBm designated as ERP) was then referenced to the dipole.

For each transmitter frequency, the received signal was **maximised** by rotating the turntable and adjusting the height of the receiving antenna. To obtain the actual ERP, the DUI was replaced by a vertically polarised half-wave dipole antenna resonant to that frequency and fed by a RF power amplifier and signal generator. The center of the dipole antenna was placed precisely in the same location as the DUI. It was ensured that the orientation of the rotating table and the height of the receiving antenna were unmoved. The signal generator level was adjusted until the peak reading on the spectrum analyzer was identical to that obtained when the DUI was on the turntable. The two signals were matched by superimposing one signal to the other on the spectrum analyzer screen. The output of power amplifier was disconnected from the substitute dipole antenna and connected to a RF power meter. **The effective radiated power was read directly from the power meter.**

Criteria: The criteria level using substitution method was calculated to be – 13.0 dBm in the frequency band 767.0-773.0 MHz.

This level was obtained by using the following expression:

$$\text{Criteria}_{\text{Limit (dBm)}} = \text{ERP}_{\text{Carrier (dBm)}} - [43 + 10 * \log_{10} \text{ERP}_{(W)}]$$

Example: $\text{Criteria}_{\text{Limit(dBm)}} = 37.7 \text{ dBm} - [43 + 10 * \log_{10} (5.888 \text{ W})]$
 $\text{Criteria}_{\text{Limit(dBm)}} = 37.7 \text{ dBm} - (43 + 7.7) \text{ dB} = -13.0 \text{ dBm}$

It can also be shown using the above calculation that the criteria level using substitution method is also –13.0 dBm in the frequency band 762.0 - 764.0MHz.

Results: Passed. See Tables 1 to 4 for substitution method

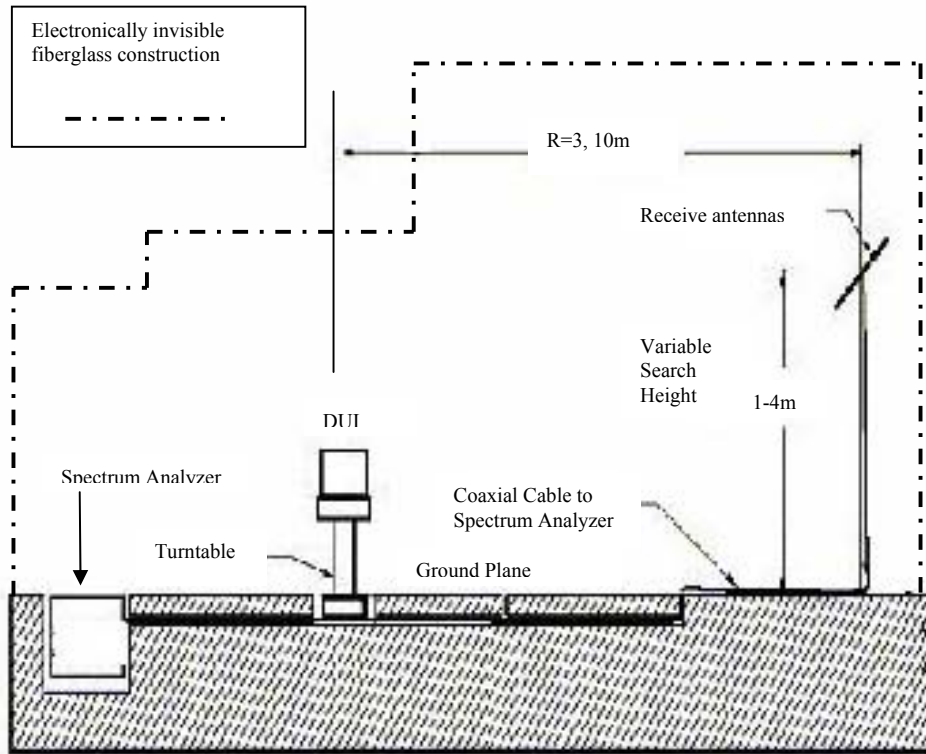


Figure 2.a: Test set up for the radiated emission measurement in OATS (not to scale)

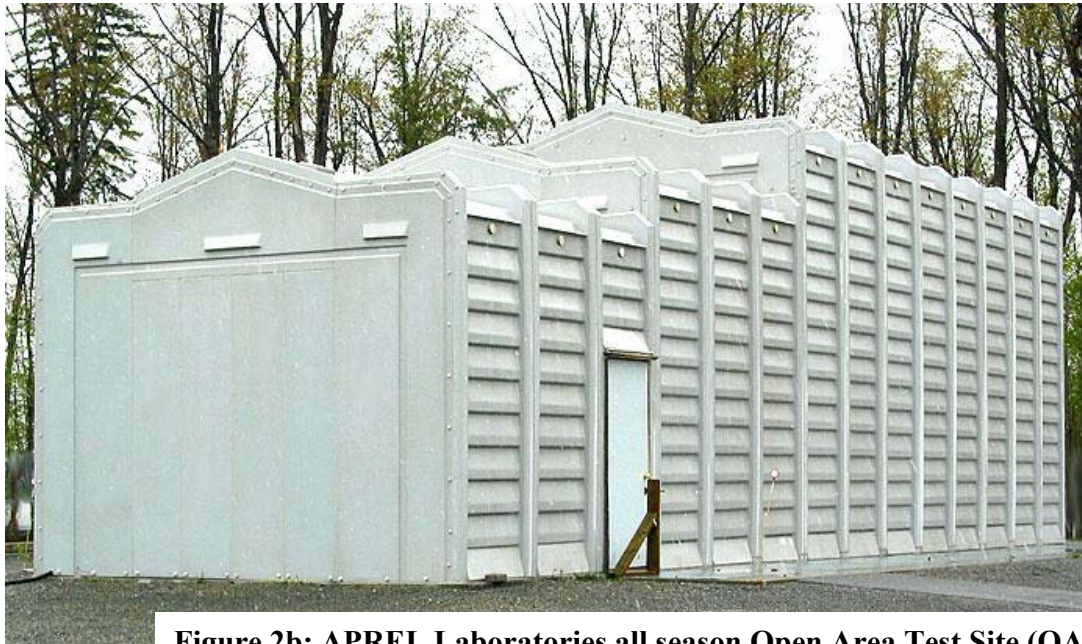


Figure 2b: APREL Laboratories all season Open Area Test Site (OATS)

Table 1
Field Strength of Spurious Radiation
 Antenna Polarization: **Vertical**
 Substitution Method as Radiated

Frequency MHz	ERP_v dBm	Limit dBm	Margin dB
Low Channel - Transmitting Frequency: 767.025 MHz			
767.025	42.2		
1534.050	-39.1	-13.0	26.1
2301.075	-48.2	-13.0	35.2
3068.100	-60.1 nf	-13.0	47.1
3835.125	-41.3	-13.0	28.3
4602.150	-63.4 nf	-13.0	50.4
5369.175	-59.8 nf	-13.0	46.8
6136.200	-62.1 nf	-13.0	49.1
6903.225	-62.8 nf	-13.0	49.8
7670.250	-60.6 nf	-13.0	47.6
Medium Channel - Transmitting Frequency: 770.025 MHz			
770.025	37.7		
1540.050	-49.1	-13.0	36.1
2310.075	-59.1	-13.0	46.1
3080.100	-63.3 nf	-13.0	50.3
3850.125	-52.3	-13.0	39.3
4620.150	-65.9 nf	-13.0	52.9
5390.175	-61.4 nf	-13.0	48.4
6160.200	-63.4 nf	-13.0	50.4
6930.225	-62.8 nf	-13.0	49.8
7700.250	-60.9 nf	-13.0	47.9
770.025	37.7		
High Channel - Transmitting Frequency: 772.975 MHz			
772.975	45.9		
1545.950	-31.9	-13.0	18.9
2318.925	-40.0	-13.0	27.0
3091.900	-62.5 nf	-13.0	49.5
3864.875	-40.8	-13.0	27.8
4637.850	-64.3 nf	-13.0	51.3
5410.825	-59.6 nf	-13.0	46.6
6183.800	-61.9 nf	-13.0	48.9
6956.775	-62.7 nf	-13.0	49.7
7729.750	-61.8 nf	-13.0	48.8

*nf – noise floor

Test performed by: Lucretia Roman Date: May, 2004

Table 2
Field Strength of Spurious Radiation
 Antenna Polarization: **Horizontal**
 Substitution Method as Radiated

Frequency MHz	ERP_v dBm	Limit dBm	Margin dB
Low Channel - Transmitting Frequency: 767.025 MHz			
767.025	10.6		
1534.050	-54.9	-13.0	41.9
2301.075	-62.1	-13.0	49.1
3068.100	-61.5 nf	-13.0	48.5
3835.125	-51.8	-13.0	38.8
4602.150	-60.9	-13.0	47.9
5369.175	-59.6	-13.0	46.6
6136.200	-62.0	-13.0	49.0
6903.225	-63.0 nf	-13.0	50.0
7670.250	-61.6 nf	-13.0	48.6
Medium Channel - Transmitting Frequency: 770.025 MHz			
770.025	14.6		
1540.050	-55.0	-13.0	42.0
2310.075	-61.5	-13.0	48.5
3080.100	-62.7 nf	-13.0	49.7
3850.125	-52.6	-13.0	39.6
4620.150	-62.1	-13.0	49.1
5390.175	-61.0	-13.0	48.0
6160.200	-63.3	-13.0	50.3
6930.225	-63.8 nf	-13.0	50.8
7700.250	-61.6 nf	-13.0	48.6
High Channel - Transmitting Frequency: 772.975 MHz			
772.975	21.0		
1545.950	-54.6	-13.0	41.6
2318.925	-60.1	-13.0	47.1
3091.900	-61.4 nf	-13.0	48.4
3864.875	-51.3	-13.0	38.3
4637.850	-59.9	-13.0	46.9
5410.825	-58.8	-13.0	45.8
6183.800	-61.6	-13.0	48.6
6956.775	-62.9 nf	-13.0	49.9
7729.750	-61.3 nf	-13.0	48.3

*nf – noise floor

Test performed by: Lucretia Roman Date: May, 2004

Table 3
Field Strength of Spurious Radiation
 Antenna Polarization: **Vertical**
 Substitution Method as Radiated

Frequency MHz	ERP_v dBm	Limit dBm	Margin dB
Low Channel - Transmitting Frequency: 762.025 MHz			
762.025	41.8		
1524.050	-37.4	-13.0	24.4
2286.075	-47.4	-13.0	34.4
3048.100	-55.8 nf	-13.0	42.8
3810.125	-41.5	-13.0	28.5
4572.150	-63.4	-13.0	50.4
5334.175	-60.0	-13.0	47.0
6096.200	-62.6 nf	-13.0	49.6
6858.225	-58.2 nf	-13.0	45.2
7620.250	-57.0 nf	-13.0	44.0
Medium Channel - Transmitting Frequency: 763.025 MHz			
763.025	41.7		
1526.050	-37.9	-13.0	24.9
2289.075	-42.7	-13.0	29.7
3052.100	-59.5 nf	-13.0	46.5
3815.125	-47.3	-13.0	34.3
4578.150	-59.3	-13.0	46.3
5341.175	-63.9	-13.0	50.9
6104.200	-58.6 nf	-13.0	45.6
6867.225	-63.2 nf	-13.0	50.2
7630.250	-61.7 nf	-13.0	48.7
763.025	41.7		
High Channel - Transmitting Frequency: 763.925 MHz			
763.925	41.8		
1527.850	-37.9	-13.0	24.9
2291.775	-47.7	-13.0	34.7
3055.700	-58.2 nf	-13.0	45.2
3819.625	-41.0	-13.0	28.0
4583.550	-64.3	-13.0	51.3
5347.475	-59.8	-13.0	46.8
6111.400	-62.6 nf	-13.0	49.6
6875.325	-59.0 nf	-13.0	46.0
7639.250	-57.5 nf	-13.0	44.5

*nf – noise floor

Test performed by: Lucretia Roman Date: May, 2004

Table 4
Field Strength of Spurious Radiation
 Antenna Polarization: **Horizontal**
 Substitution Method as Radiated

Frequency MHz	ERP_v dBm	Limit dBm	Margin dB
Low Channel - Transmitting Frequency: 762.025 MHz			
762.025	16.8		
1524.050	-50.6	-13.0	37.6
2286.075	-63.6 nf	-13.0	50.6
3048.100	-57.2	-13.0	44.2
3810.125	-52.0	-13.0	39.0
4572.150	-60.9	-13.0	47.9
5334.175	-59.8	-13.0	46.8
6096.200	-63.0	-13.0	50.0
6858.225	-63.2 nf	-13.0	50.2
7620.250	-61.2 nf	-13.0	48.2
Medium Channel - Transmitting Frequency: 763.025 MHz			
763.025	19.2		
1526.050	-49.6	-13.0	36.6
2289.075	-63.1 nf	-13.0	50.1
3052.100	-59.4	-13.0	46.4
3815.125	-51.1	-13.0	38.1
4578.150	-62.0	-13.0	49.0
5341.175	-64.7	-13.0	51.7
6104.200	-58.2	-13.0	45.2
6867.225	-63.2 nf	-13.0	50.2
7630.250	-61.2 nf	-13.0	48.2
763.025	19.2		
High Channel - Transmitting Frequency: 763.925 MHz			
763.925	19.8		
1527.850	-51.4	-13.0	38.4
2291.775	-63.1 nf	-13.0	50.1
3055.700	-57.1	-13.0	44.1
3819.625	-51.5	-13.0	38.5
4583.550	-59.9	-13.0	46.9
5347.475	-59.0	-13.0	46.0
6111.400	-62.6	-13.0	49.6
6875.325	-63.2 nf	-13.0	50.2
7639.250	-61.2 nf	-13.0	48.2

*nf – noise floor

Test performed by: Lu Chih Roman Date: May, 2004

APPENDIX A

List of Test Equipment

**Radiated Spurious Emissions
List of Equipment**

Description	Range	Manufacturer	Model #	APREL Asset #	Cal. Due Date
Spectrum Analyzer	9 kHz - 3 GHz	Anritsu	MS2661C	301330	March 25, 2005
Spectrum Analyzer	9 kHz - 30 GHz	Anritsu	MS2667C	301386	Sept. 5, 2004
RF Signal Generator	10 MHz – 26.5 GHz	Hewlett Packard	HP 8340 B	100955	Oct 5, 2004
Low Noise Antenna Pre-amplifier	30-1000 MHz	APREL Inc.	LNA-1	301415	August 27,2004
Attenuator	20 dB	NARDA	9779-20	301533	August 15, 2004
Notch Filter	DC - 6 GHz	Microwavefilter Co.	6367	301055	CBT
RF Power Meter	10 MHz - 18 GHz	Giga-tronics	8541C	301393	Oct.16, 2004
RF Power Sensor	10 MHz - 18 GHz	Giga-tronics	80601A	301394	Oct.16, 2004
Biconical Antenna	20 MHz - 200 MHz	Eaton	94455-1	100890	July 18, 2004
Log - Periodic Antenna	200 MHz -1.0 GHz	Eaton	ALP-1	100063	July 31, 2004
Horn Antenna	1 – 18 GHz	APREL Inc.	AA – 118	100400	June 17, 2004
Anechoic Shielded Room	10 kHz - 10 GHz	APREL Inc.	ALP-AnSh	301329	May 22, 2007
Reference Half -wave Dipole Antenna	770 MHz	APREL Inc.	ALP-DA1/2W	100157	July 3, 2004
Reference Half -wave Dipole Antenna	2300.00 MHz	APREL Inc.	ALP-DA1/2W	301550	July 3, 2004
OATS	30 MHz – 1 GHz	APREL Inc.	3 m & 10 m	N/A	March 20, 2006

APPENDIX B

PHOTOGRAPHS



**DataRadio T881-10 700 MHz band base station
tested for radiated spurious emissions**



**Dataradio T881-10 700 MHz band base station
tested for Spurious Emissions from Transmitter
Frequency Range: 30 MHz – 18 GHz**