



FCC ID: LN4P-41-AOO818

SEPTEMBER 15, 1998

Federal Communications Commission  
Authorization and Evaluation Division  
7435 Oakland Mills Road Columbia, MD 21046

Attention: Applications Examiner

Applicant: LCC International, Inc.  
2300 Clarendon Blvd., Suite 800  
Arlington, VA 22201

Equipment: SpectraWave 1900 Base Station Transmitter  
FCC ID: LN4P-41-AOO818

Specification: 47 CFR 24 Type Acceptance

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Dear Examiner:

The following application for Grant of Equipment Authorization is presented on behalf of LCC International, Inc. For their SpectraWave 1900 Base Station Transmitter

Enclosed, please find a complete data and documentation package demonstrating that this device complies with the technical requirements of 47 CFR 24, for a Base Station Transmitter.

If you have any questions, please contact the undersigned, who is authorized to act as Agent.

Sincerely,

Chris Harvey  
Director, EMC Laboratory

**MET Laboratories, Inc.** *Safety Certification - EMI - Telecom Environmental Simulation*

914 WEST PATAPSCO AVENUE • BALTIMORE, MARYLAND 21230-3432 • PHONE (410) 354-3300 • FAX (410) 354-3313



# ENGINEERING TEST REPORT

in support of the  
Application for Grant of Equipment Authorization

**EQUIPMENT:** SpectraWave 1900 Base Station Transmitter

**FCC ID:** LN4P-41-AOO818

**Specification:** 47 CFR 24

**On Behalf of the Applicant:** LCCInternational, Inc.  
2300 Clarendon Blvd., Suite 800  
Arlington, VA 22201

**Manufacturer:** LCCInternational, Inc.  
2300 Clarendon Blvd., Suite 800  
Arlington, VA 22201

**Manufacturer's Representative** Mr. Mike Sciarrotta

**Test Date(s):** April 8 to September 18, 1998

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## ENGINEERING STATEMENT

**I ATTEST:** the measurements shown in this report were made in accordance with the procedures indicated, and that the emissions from this equipment were found to be within the limits applicable. I assume full responsibility for the accuracy and completeness of these measurements. On the basis of the measurements made, the equipment tested is capable of operation in accordance with the requirements of Part 24 of the FCC Rules under normal use and maintenance.

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Kenneth Bass  
EMI Engineer, MET Laboratories

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Supervised by:  
Chris Harvey  
Director, EMC Laboratory



**1.0 INTRODUCTION**

The following data is presented on behalf of the Applicant, LCC International, Inc., as verification of the compliance of LCC International's SpectraWave 1900 Transmitter to the requirements of 47CFR24.

**2.0 TEST SITE**

All testing was conducted at MET Laboratories, Inc., 914 West Patapsco Avenue, Baltimore, Maryland 21230-3493. Radiated emissions measurements were performed on a three-meter open area test site (OATS). A complete site description is on file with the FCC Laboratory Division as 31040/SIT/MET.

**3.0 TEST EQUIPMENT USED**

Manufacturer	Equipment	Calibration Due	Cal. Interval
Hewlett Packard	8591E Spectrum Analyzer	1/29/99	annual
EMCO	Biconical Antenna 3104	2/9/99	annual
EMCO	EMCO Log Periodic Antenna	3/20/99	annual
EMCO	Double Ridge Guided Horn	3/20/99	annual
Hewlett Packard	8563A Analyzer	5/27/99	annual
Solar	LISN	6/30/99	annual

**4.0 EQUIPMENT UNDER TEST CONFIGURATION**

The EUT was operated in a manner representative of the typical usage of the equipment. During all testing, system components were manipulated within the confines of typical usage to maximize each emission.

**5.0 TEST TYPE(S)**

- 5.1 47CFR2.993 Field Strength of Spurious Emissions from Cabinet of EUT
- 5.2 47CFR2.985,24.232(a),(b) RF Power Output Measurement
- 5.3 47CFR2.989,24.238 Occupied Bandwidth:NOT APPLICABLE:EUT uses no modulation
- 5.4 47CFR24.238 Measurement of Spurious Emission inside the 1MHz band adjacent to each frequency block (i.e.spurs+/- 1MHz)
- 5.5 47CFR2.991, 24.238(a) Measurement of Conducted Spurious Emissions. Limits =  $43+10\log(P)$ .
- 5.6 47CFR2.995(a)(1) Frequency Stability over -30degreesCto +50degrees C
- 5.7 47CFR 2.995(d)(1) Frequency Stability variationsof supply 85% to 115%
- 5.8 47CFR15.107 Line Conducted Emissions required



## 6.0 TEST RESULTS

Test results are presented in the order they appear in section 5.0. Associated plots, graphs, and photographs are referenced at the end of each results section as electronic file names. These files are provided as attachments to this electronic submission.

**6.1 TEST TYPE:** Field Strength of Spurious Emissions from Cabinet of EUT

**6.1.1 TECHNICAL SPECIFICATION:** 2.993; 24.238(a)

**6.1.2 TEST DATE(S):** 6 Aug 98

### 6.1.3 MEASUREMENT PROCEDURES:

As required by §2.993, *field strength of spurious radiation measurements* were made in accordance with the general procedures of ANSI C63.4-1992 "Methods of Measurement of Radio-Noise Emissions from Low-Voltage Electrical and Electronic Equipment in the Range of 9kHz to 40 GHz". Preliminary radiated emission measurements were performed inside a shielded chamber with all digital signal generators on and terminated. The frequency list from the preliminary measurements was used as a guide for making final measurements on an 10 meter open area test site. The unit was scanned over the frequency range of 9kHz to 20GHz. The Radiated Spurious Emissions *Limit* is obtained by the following:

The radiated spurious emissions limit is obtained by the following:

Based on an input power (as measured at the transmitter output) of 20 watts:

$$P_o = 20 \text{ W}$$

Install Equation Editor and double-click here to view equation.

Install Equation Editor and double-click here to view equation.

Install Equation Editor and double-click here to view equation.

Install Equation Editor and double-click here to view equation.

As per 2.993 (a), it is assumed this power is to be fed to a half-wave tuned dipole. Using a conversion formula for distance, the field strength at one meter can be derived: As per 24.238, the spurious emissions must be attenuated by  $43 + \log(P)$  which is: Therefore, the limit for spurious emissions is: At 3 meters measurement distance, the limit is;

Again, according to 24.238, all signals must be attenuated by 56 dB;



Install Equation Editor and double-click here to view equation.

Therefore, the limit for spurious emissions for a test distance of 10 meters is:

**SUBJECT:** Radiated Emissions  
Unmodulated Carrier  
FCC Part 24

**MET REPORT:** EMI1116  
**MFG:** LCC International, Inc.  
**TESTED BY:** Kenneth Bass  
**TEST DATE(S):** 6 Aug 1998

**EUT:** Base Station Transmitter  
**MODEL:** Spectrawave 1900  
**TECHNICAL SPECIFICATION:** 2.993; 24.238(a)

**Carrier Emission:** 20 Watts

FREQUENCY	EUT AZIMUTH	ANTENNA		EUT RADIATION	ANTENNA FACTOR	TEST DISTANCE	CABLE LOSS	AMP GAIN MINUS FILTER LOSS	FIELD STRENGTH	LIMITS
		POL (H/V)	HGT (m)							
(MHz)	(Degrees)			(dB $\mu$ V)	(dB/m)	(m)	(dB)	(dB $\mu$ V)	(dBuV/m)	(dBuV/m)
206.54	180	H	2.0	23.54	17.3	3	2.86		33.30	84.39
206.54	45	V	1.0	18.50	18.5	3	2.86		27.63	84.39
221.30	180	H	1.5	25.27	16.6	3	3.25		34.66	84.39
221.30	45	V	1.0	20.60	16.6	3	3.25		29.99	84.39
250.80	0	H	1.5	24.25	16.5	3	3.25		33.54	84.39
250.80	180	V	1.5	24.50	17.7	3	3.25		34.99	84.39
272.93	135	H	3.0	24.71	15.3	3	3.25		29.80	84.39
272.93	180	V	2.0	21.89	15.4	3	3.25		30.08	84.39
339.32	135	H	2.5	23.82	15.4	3	3.81		32.57	84.39
339.32	180	V	2.0	21.03	15.3	3	3.81		29.68	84.39
365.13	180	H	2.5	22.81	16.1	3	3.81		32.26	84.39
365.13	0	V	1.5	19.22	15.9	3	3.81		28.47	84.39



Equipment meets the specifications of 2.985; 2.993; 24.238(a)

**Photograph of Radiated Emissions Test Configuration**



**6.2 TEST TYPE:** RF Power Output Measurement

**6.2.1 TECHNICAL SPECIFICATION:** 47CFR2.985, 24.232(a)(b)

**6.2.2 TEST DATE(S):** 14 May 1996

**6.2.3 MEASUREMENT PROCEDURES:**

The transmitter power output was measured for Channels at the low, middle, and high end of the transmitter frequency range. The spectrum analyzer was replaced with an HP RF power meter for comparison. The levels obtained with the spectrum analyzer are displayed in the attached plots. The transmitter power shall not exceed 100W or 157dBuV) at the carrier frequency for forward link channels and 2W (140dBuV) for the reverse link channels.

**6.2.4 RESULTS:**

EUT complies with Section 2.985 and 24.232(a) and (b). Plots of the RF output Power level of the unmodulated carrier, as measured at the RF output terminal appear on the attached files:

UPLINK: Poup2.jpg, Poup3.jpg, and Poup4.jpg

DOWNLINK: Po.jpg, Po2.jpg, and Po3.jpg



**Photograph of Conducted Spurious Emissions and  
RF Power Output Test Configuration**



**6.3 TEST TYPE:** Occupied Bandwidth / Unmodulated Carrier

**6.3.1 TECHNICAL SPECIFICATION:** 47CFR2.989 and 24.238

**6.3.2 TEST DATE(S):** n/a

**6.3.3 MEASUREMENT PROCEDURES:** n/a

**6.3.4 RESULTS:** The equipment is classified as a NON modulated transmitter. Therefore, the modulation and bandwidth requirements of section 2.989 are not applicable.





**6.4 TEST TYPE:** Spurious Emissions at Antenna Terminals

**6.4.1 TECHNICAL SPECIFICATION:** 2.991 and 24.238(a)(b)

**6.4.2 TEST DATE(S):** 15 May 1996

**6.4.3 MEASUREMENT PROCEDURES:**

As required by §2.991 of CFR 47, *spurious emissions at antenna terminal measurements* were made at the RF output terminals using a 50 Ω attenuator and spectrum analyzer. The frequency spectrum was investigated from 9.0 KHz to 20.0 GHz. For measuring emissions above 2 GHz, a high-pass filter was used to eliminate the fundamental transmit frequency to prevent possible saturation effects on the front end of the spectrum analyzer. For Spurious Emissions at Antenna Terminals at Block Edges (24.238(b)), modulation products outside this band are attenuated at least 43 + 10 log (P) below the level of the modulated carrier. (Note: a RBW of 30KHz is allowed for measurement of spurious emissions at the band edges, though it is not necessary since all spurs are/were found to be greater than 20dB below the allowable limit.)

**6.4.4 RESULTS:**

Equipment complies with Section 2.991 and 24.238(a)(b)

**SUMMARY OF SPURIOUS EMISSIONS AT ANTENNA TERMINALS  
for Forward and Reverse Channels**

Frequency Range	Emission Frequency	Emission Level (dBm)	Limit (dBm)
30MHz - 20GHz	see plots	n/a	-13.1

Plots are attached to this application as:

FORWARD CHANNELS: Lccfwd1.jpg, Lccfwd2.jpg, Lccfwd3.jpg, Lccfwd4.jpg, Lccfwd5.jpg  
REVERSE CHANNELS: Lccrev1.jpg, Lccrev2.jpg, Lccrev3.jpg, Lccrev4.jpg, Lccrev5.jpg

**SPURIOUS EMISSION FREQUENCY BLOCKS**

Frequency Block (MHz)	Low Frequency (CH #)	Hi Frequency (CH #)
A (1930 - 1945)	513 (1930.2)	584 (1944.8)
B (1950 - 1965)	613 (1950.2)	684 (1964.8)
C (1975 - 1990)	738 (1975.2)	809 (1989.8)
D (1945 - 1950)	588 (1945.2)	609 (1949.8)
E (1965 - 1970)	688 (1965.2)	709 (1969.8)



F (1970 - 1975)	713 (1969.2)	734 (1974.8)
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Plots of the spurious emissions as measured at the extremes of each frequency block are attached as files:

blked12.jpg, blked13.jpg, blked14.jpg, blked16.jpg, blked17.jpg, blked18.jpg, blked19.jpg, blked20.jpg, blked21.jpg, blked22.jpg, blked23.jpg, blked24.jpg

**6.5 TEST TYPE:** Frequency Stability over -30 degrees C to +50 degrees C, and Power Supply variations of 85% to 115%

**6.5.1 TECHNICAL SPECIFICATION:** 2.995(a)(1),(d)(1) ; 24.235

**6.5.2 TEST DATE(S):** 13 May 1996

**6.5.3 MEASUREMENT PROCEDURES:**

Frequency tolerance of carrier signal: +/- 0.005% for a temperature variation from -30 degrees C to +50 degrees C at normal supply voltage, and for a variation in primary voltage from 85% to 115% of the rated supply voltage at 20 degrees C.

**6.5.4 RESULTS:**

Equipment complies with Section 2.995 and 24.235

**CARRIER FREQUENCY DEVIATIONS DUE TO POWER SUPPLY INSTABILITY**

% Deviation from Nominal Voltage	Supply Voltage	Channel Carrier Frequency (GHz) HIGH	Channel Carrier Frequency (Ghz) MID	Channel Carrier Frequency (Ghz) LOW	Max Δf (Hz)
85%	102VAC	1.989799598	1.959999589	-	24
100%	120VAC	1.989799603	1.959999565	1.930199108	0
115%	138VAC	1.989799414	1.959999590	1.930198942	166

Plots are attached as files:

fvolt.jpg, fvolt5.jpg, fvolt2.jpg, fvolt3.jpg, fvolt4.jpg, and fvolt6.jpg

**MAXIMUM CARRIER FREQUENCY DEVIATIONS DUE TO TEMPERATURE INSTABILITY**

Temp (°C)	$\Delta f$ High Power Mode	
	Carrier Frequency (GHz)	$\Delta f$ (Hz)
-30	1.930199513	262
-20	1.930199519	209
-10	1.930199513	157
0	1.930199513	99
+10	1.989799687	79
+20	1.930199513	5
+30	1.930199444	12
+40	1.930199444	11
+50	1.930199444	17

PLOTS are attached as files:

ftemp1.jpg, ftemp2.jpg, ftemp3.jpg, ftemp4.jpg, ftemp5.jpg,  
ftemp6.jpg, ftemp7.jpg, ftemp8.jpg, ftemp9.jpg, ftemp10.jpg, ftemp11.jpg, ftemp12.jpg,  
ftemp13.jpg, and ftemp14.jpg

Equipment meets the requirements of 2.995 and 24.235

**6.6 TEST TYPE:** Line Conducted Emissions**6.6.1 TECHNICAL SPECIFICATION:** 15.107**6.6.2 TEST DATE(S):** 10 April 1997**6.6.3 MEASUREMENT PROCEDURES:**

Line Conducted Measurements were performed according the 47CFR15.107 for Class A devices. The frequency range of 450kHz to 30MHz was tested and found compliant with the limits of 15.107.

**6.5.4 RESULTS:**

PHASE			NEUTRAL		
FREQ (MHz)	QP Amp (dBuV)	AV Amp (dBuV)	FREQ (MHz)	QP Amp (dBuV)	AV Amp (dBuV)
29.5	46.8	46.4	29.5	47.9	47.9
14.75	38.7	37.5	25.81	39.1	38.1
25.81	37.6	35.2	15.13	37.8	28.4

Plots are attached as files: ceneut.jpg, and cephs.jpg