



**Certelecum Laboratories Inc.**

*Safety - EMI - Telecom - ISO Guide 25*

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**ENGINEERING TEST REPORT**

**ON:  
HEADWATER LOW POWER TRANSMITTER**

**FCC ID: NKJHWRF01T1**

**IN ACCORDANCE WITH:  
FCC PART 15, SUBPART C  
FOR LOW POWER TRANSMITTERS  
OPERATING PERIODICALLY IN THE  
BAND 40.66 - 40.77 MHz AND ABOVE 70 MHz**

**PROJECT NO.: 7HE025-1C**

**TESTED FOR:**

**HEADWATER RESEARCH AND DEVELOPMENT INC.  
308 BILLING AVENUE  
OTTAWA, ONTARIO K1H 5L5**

**TESTED BY:**

**CERTELECOM LABORATORIES INC.  
3325 RIVER ROAD, R.R. 5  
OTTAWA, ONTARIO K1V 1H2**

**OCTOBER 1997**

This document contains 14 pages including this one.

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This report applies only to the items tested.

**KTL - Certelec Laboratories Inc.**FCC PART 15, SUBPART C  
FOR LOW POWER TRANSMITTERS  
PROJECT NO.: 7HE025-1C*EQUIPMENT: Headwater Low Power Transmitter*  
FCC ID: NKJHWR01T1

EQUIPMENT: The EUT is an electronic thermometer that transmits the temperature to a remote receiver via radio frequency fields.

MODEL NO.: T-100

SERIAL NO.: None

## GENERAL:

These tests were conducted on a sample of the equipment for the purpose of demonstrating compliance with Part 15, Subpart C, Paragraph 15.231. All tests were conducted using measurement procedure ANSI C63.4-1992. Radiated emissions are made on an open area test site. A description of the test facility is on file with the FCC.

## ABSTRACT:

NAME OF TEST	PARA. NO.	RESULTS
Transmission Requirements	15.231(a)	Complies
Radiated Emissions	15.231(e)	Complies
Occupied Bandwidth	15.231(c)	Complies

THIS TEST REPORT RELATES ONLY TO THE ITEM(S) TESTED.

THE FOLLOWING DEVIATIONS FROM, ADDITIONS TO, OR EXCLUSIONS FROM THE TEST  
SPECIFICATIONS HAVE BEEN MADE. - None

This unit was tested with both alkaline and lithium batteries.  
The worst case data results are presented in this report.

TESTED BY: Tom Tidwell  
Tom Tidwell, TechnologistDATE: 10 Oct. 1997APPROVED BY: G. Rae Dulmage  
G. Rae Dulmage, Vice-PresidentDATE: Oct. 10, 1997

*EQUIPMENT: Headwater Low Power Transmitter*  
*FCC ID: NKJHWRF01T1*

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GENERAL EQUIPMENT INFORMATION

EQUIPMENT:	RF Data transmitting Thermometer
MODEL NO.:	T-100
SERIAL NO.:	None
FREQUENCY RANGE:	315 MHz (Nominally fixed)
OPERATING FREQUENCY(IES) OF SAMPLE:	314.95 MHz
TYPE OF EMISSION:	On/Off keying (Manchester)
EMISSION DESIGNATOR:	5K1MOD
POWER REQUIREMENT:	2-AA Cells (Alkaline or Lithium) nominally 1.5 Vdc
DUTY CYCLE CALCULATION:	50 msec/100msec = 0.5 = 20Log (0.5) dB = 6 dB

EQUIPMENT: *Headwater Low Power Transmitter*  
FCC ID: *NKJHWR01T1*

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NAME OF TEST: Transmission Requirements	PARA. NO.: 15.231(a)
TESTED BY: Tom Tidwell	DATE: October 10, 1997

TEST CONDITIONS: Standard Temperature and Humidity  
Standard Test Voltage

MINIMUM STANDARD: 15.231(a) Continuous transmissions such as voice, video or data transmissions are not permitted.

15.231(a)(1) A manually operated transmitter shall employ a switch that will automatically deactivate the transmitter within not more than 5 seconds after being released.

15.231(a)(2) A transmitter activated automatically shall cease transmission within 5 seconds of activation.

15.231(a)(3) Periodic transmissions at regular pre-determined intervals are not permitted. However polling or supervisory transmissions to determine system integrity of transmitters used in security or safety applications are allowed if the periodic rate of transmission does not exceed one transmission of not more than one second duration per hour for each transmitter.

15.231(a)(4) Intentional radiators which are employed for radio control purposes during emergencies involving fire, security, and safety of life, when activated to signal an alarm, may operate during the pendency of the alarm.

TEST RESULTS: Complies. Though this transmitter operates a periodic rate of more than one transmission per hour, it is exempt from this requirement since it meets the limits of 15.231 (e)

MEASUREMENT DATA: Compliance was determined by verification of technical specifications and a functional test on the equipment.

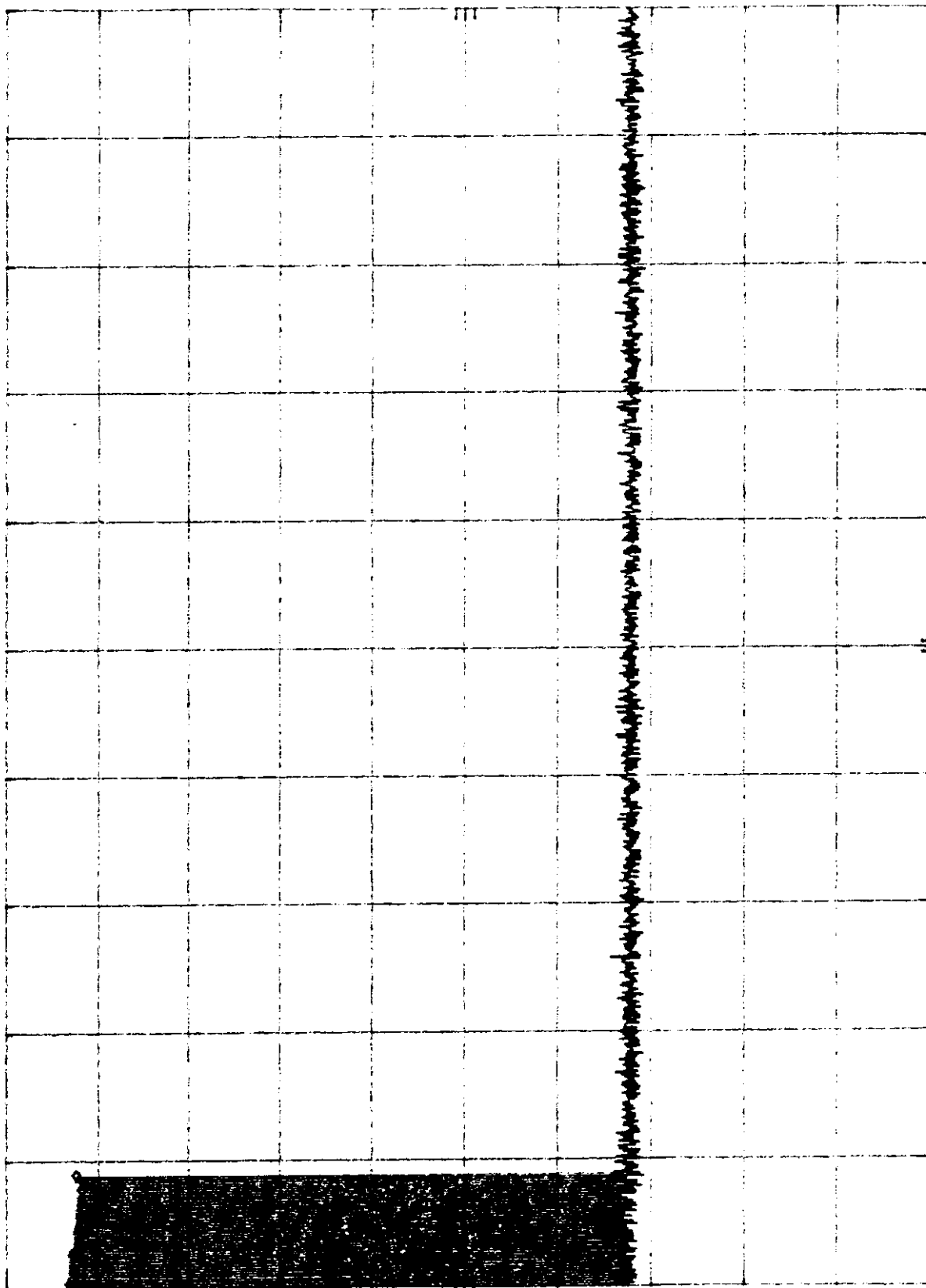
MKR  $\Delta$  880.0 msec  
-0.80 dB

REF -10.0 dBm

ATTEN 0 dB

hp

10 dB/



SPAN 0 Hz  
SWP 10.0 sec

VBW 3 MHz

CENTER 315.000 000 MHz  
RES BW 1 MHz

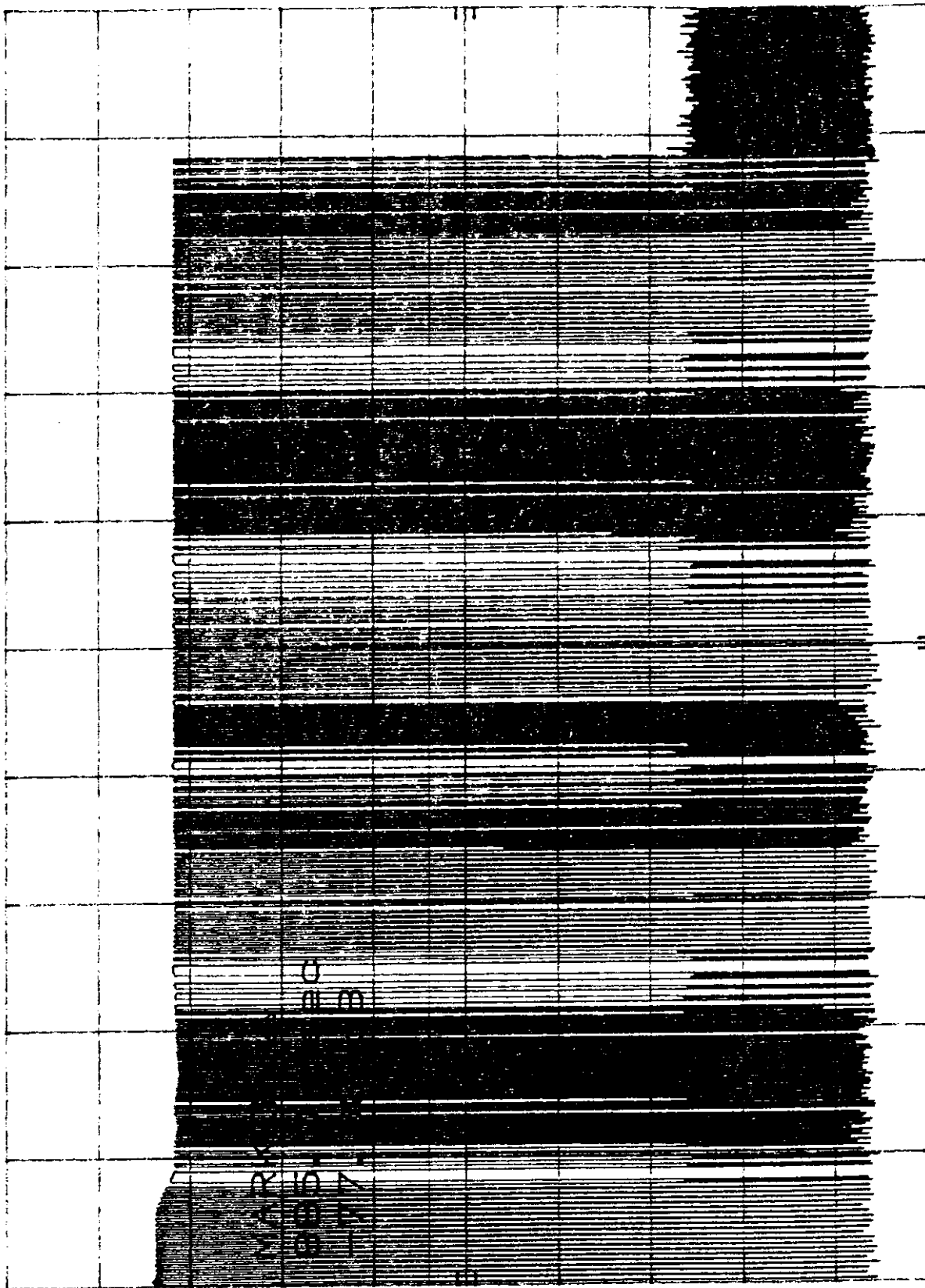
MKR  $\Delta$  885.0 msec  
-77.60 dB

ATTEN 0 dB

REF -10.0 dBm

HP

10 dB/



SPAN 0 Hz  
SWP 1.00 sec

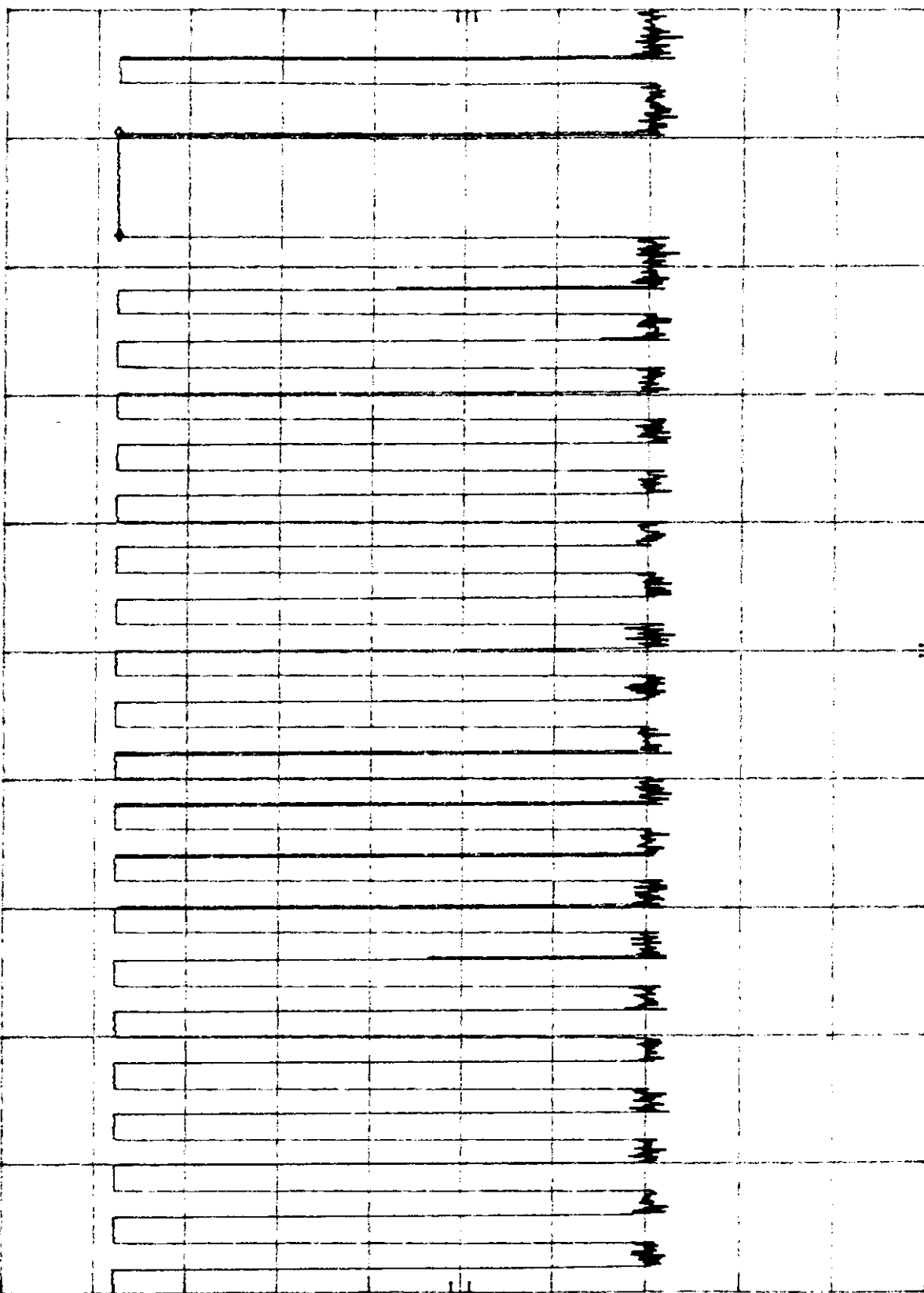
VBW 1 MHz

CENTER 315.000 000 MHz  
RES BW 300 kHz

MKR  $\Delta$  8.000 msec  
0.10 dB

REF -10.0 dBm ATTN 0 dB

10 dB/



SPAN 0 Hz  
SWP 100 msec

VBW 3 MHz

CENTER 315.000 000 MHz  
RES BW 1 MHz

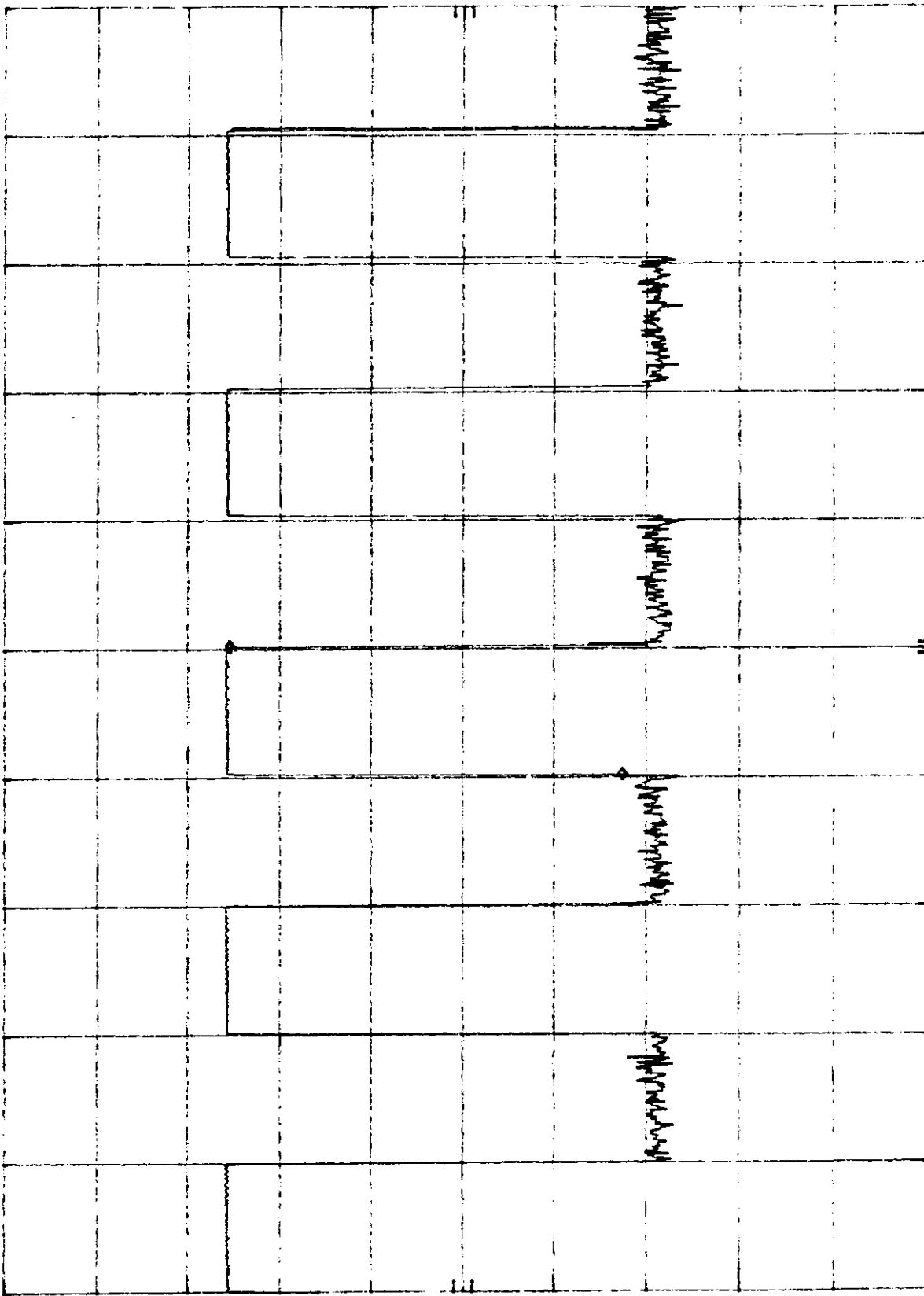
MKR  $\Delta$  2.000 msec  
42.90 dB

ATTEN 0 dB

REF -10.0 dBm

hp

10 dB/



CENTER 315.000 000 MHz  
RES BW 1 MHz  
VBW 3 MHz  
SPAN 0 Hz  
SWP 20.0 msec



EQUIPMENT: Headwater Low Power Transmitter  
FCC ID: NKJHWR01T1

NAME OF TEST: Radiated Emissions	PARA. NO.: 15.231(b)
TESTED BY: Tom Tidwell	DATE: October 10, 1997

TEST CONDITIONS: Standard Temperature and Humidity  
Standard Test Voltage (Fresh Lithium Batteries)  
Measured Voltage: 3.2 Vdc

## MINIMUM STANDARD:

Fundamental Frequency (MHz)	Field Strength of Fundamental ( $\mu\text{V/m @ 3m}$ )	Field Strength of Fundamental (dB $\mu\text{V/m @ 3m}$ )	Field Strength of Spurious ( $\mu\text{V/m @ 3m}$ )	Field Strength of Spurious (dB $\mu\text{V/m @ 3m}$ )
260 - 470	1500 - 5000	63.5 to 74.0	150 to 500	43.5 to 54.0

Any emissions that fall within the restricted bands of 15.205 shall not exceed the following limits:

Frequency (MHz)	Field Strength ( $\mu\text{V/m @ 3m}$ )	Field Strength (db @ 3m)
30 - 88	100	40.0
88 - 216	150	43.5
216 - 960	200	46.0
Above 960	500	54.0

TEST RESULTS: Complies. The worst-case emission level is 52.3 dB $\mu\text{V/m @ 3m}$  at 629.941 MHz. This is 1.4 dB below the specification limit.

MEASUREMENT DATA: See attached table.

Above 1 GHz a spectrum analyzer and low noise amplifier are used to measure emission levels. The spectrum analyzer resolution bandwidth was set to 1 MHz and video bandwidth was 3 MHz.

The E.U.T. is rotated in three planes to obtain worst-case results.

The temperature probe cable was fully extended for this test and oriented in two different planes to obtain worst-case results.



## CERTELECOM Laboratory

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# FAX

Date: 12/29/97

Number of pages including cover sheet: 2

To: Gregory Czumak

FCC

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REMARKS: ☐ Urgent ☐ For your review ☐ Reply ASAP ☐ Please comment

REF.FCC ID. NO. NKJHWR01T1

PROJECT NO. 7HE025-1C

Below is a response to your query Denial Notice dated December 10, 1997

I believe that the above equipment was denied based on a misinterpretation of the submitted data. When I spoke with you by phone on December 19, you indicated that you may be able to reverse the denial if the information presented had been misinterpreted or misrepresented. You asked that I review the returned submission package, add comments and forward it to your attention. The following are my comments:

1. The test report lists the limit on the fundamental emission as 73.7 dBuV/m. The note at the bottom of this table states that the specification limit was adjusted by 6 dB to compensate for a 6 dB duty cycle factor. The levels listed under the Field Strength column of this table are not adjusted for duty cycle. The error was in the header of the table which lists the detector function as "Average". The detector function was, in fact Peak, but was listed as Average to indicate the duty cycle compensation.



## CERTELECOM Laboratory

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2. The receiver bandwidth was listed as "10 kHz" in the table header when, in fact, the BW was 120 kHz. This apparently was a typographical error. As for emissions above 1 GHz, the test report states on page 9 of 15 that the RBW was 1 MHz and VBW was 3 MHz.

I trust that the above information is helpful in clearing this matter.

Best regards,

  
Tom Tidwell

# KTL - Certelec Laboratories Inc.

REvised  
PAGE

FCC PART 15, SUBPART C  
FOR LOW POWER TRANSMITTERS  
PROJECT NO.: 7HE025-1C

EQUIPMENT: Headwater Low Power Transmitter  
FCC ID: NKJHWR01T

STANDARD: FCC Part 15, Subpart C				E.U.T. S/N.: None		DETECTOR: PEAK				
TESTED BY: Tom Tidwell				TEST DISTANCE(metres): 3		ANTENNA:				
DATE: Oct. 10, 1997				TEST RECEIVER: 015		ANTENNA MODEL:				
E.U.T. MODEL NO.: T-100				RECEIVER BW: 120 kHz		ANTENNA S/N.:				
FREQ.	POL.	ANTENNA TYPE	TABLE AZIMUTH (Degrees)	RECEIVED SIGNAL (dBuV)	ANTENNA FACTOR (dB)	AMP GAIN (dB)**	DUTY CYCLE (dB)	FIELD STRENGTH (dBuV/m)	LIMIT * (dBuV/m)	MARGIN (dB)
(MHz)	(V/H)									
314.95	V	D/P		45.8	23.9			69.7	73.7	4.0
314.95	H	D/P		48.3	23.9			72.2	73.7	1.5
629.941	V	D/P		22.2	30.1			52.3	53.7	1.4
629.941	H	D/P		13.6	30.1			43.7	53.7	10.0
944.912	V	D/P		3.5	35.0			38.5	53.7	15.2
944.912	H	D/P		1.6	35.0			36.6	53.7	17.1
1575	V	H		40.7	28.1	-37.1		31.7	<del>53.7</del> 54	22.0
1575	H	H		44.0	28.1	-37.1		35.0	<del>53.7</del> 54	18.7
1890	V	H		35.3	29.2	-44.1		20.4	<del>53.7</del> 54	33.3
1890	H	H		35.0	29.2	-44.1		20.1	53.7	33.6
2205	V	H		41.5	30.0	-44.1		27.4	<del>53.7</del> 54	26.3
2205	H	H		44.3	30.0	-44.1		30.2	<del>53.7</del> 54	23.5
	V									
	H									
	V									
	H									
	V									
	H									
	V									
	H									
NOTES: * The above limit is adjusted by 6 dB to compensate for a 6 dB duty cycle. ✓										

NOTES: \* The above limit is adjusted by 6 dB to compensate for a 6 dB duty cycle. ✓

B/C = Biconical, B/L = Biconlog, L/P = Log-Periodic, H = Horn, D/P = Dipole

\*\* Includes cable loss when amplifier is not used.

\*\*\* Includes cable loss.

( ) Denotes failing emission level.

72.2-6 = 66.2 ✓  
15.231(e) Arc 67.7 dBuV/m @  
15  
3 m.

*EQUIPMENT: Headwater Low Power Transmitter*  
*FCC ID: NKJHWR01T1*

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NAME OF TEST: Occupied Bandwidth	PARA. NO.: 15.231(c)
TESTED BY: Tom Tidwell	DATE: October 10, 1997

TEST CONDITIONS:      Standard Temperature and Humidity  
                                 Standard Test Voltage

MINIMUM STANDARD:    The bandwidth of the emission shall be no wider than 0.25%  
                                 of the center frequency. Bandwidth is determined at the  
                                 points 20 dB down from the modulated carrier level.

TEST RESULTS:            Complies. See attached graph.  
                                  $0.0025 \times 314.95 \text{ MHz} = 0.787375 \text{ MHz}$   
                                 Measured bandwidth = 5.1 kHz

MEASUREMENT DATA:   See attached graph.

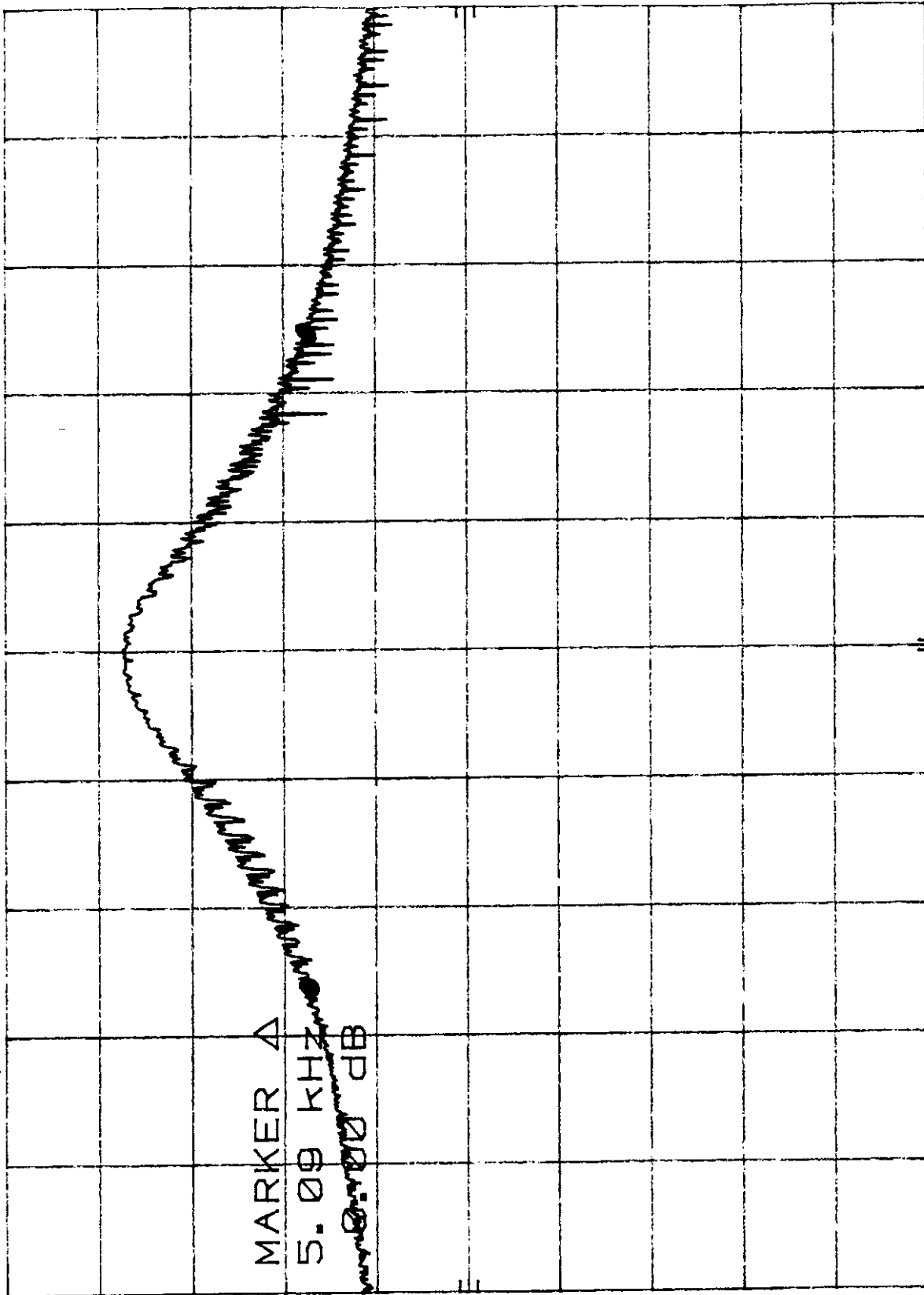
August 12, 1997

ATTEN 10 dB

REF 90.0 dBμV

hp

10 dB/



SPAN 10.0 KHz

SWP 300 msec

VBW 3 KHz

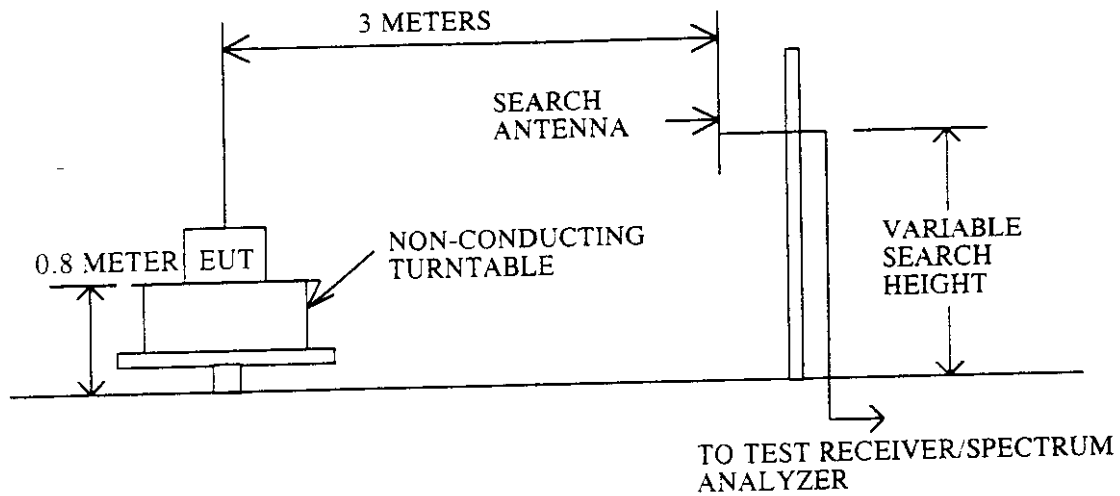
CENTER 314.889 5 MHz

RES BW 1 KHz

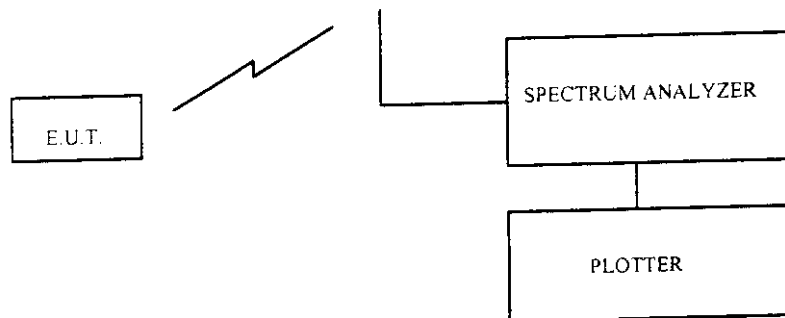
EQUIPMENT: Headwater Low Power Transmitter  
FCC ID: NKJHWR01T1

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TEST SITE FOR RADIATED EMISSIONS



OCCUPIED BANDWIDTH



EQUIPMENT: Headwater Low Power Transmitter  
FCC ID: NKJHWR01T1

## TEST EQUIPMENT LIST

### Equipment List - Radiated Emissions

Equipment	Manufacturer	Model #	Serial/Asset #	Last Cal.	Next Cal.
Biconilog Antenna	EMCO	3143	9404-1039	NCR	NCR
Dipole Antenna Set	EMCO	3121C	1029	June 2/97	Dec. 2/97
Receiver	Rohde & Schwarz	ESVP	892661/014	Mar. 25/97	Mar. 25/98
Spectrum Analyzer	Hewlett-Packard	8565E	FA000981	Jan. 3/97	Jan. 3/98
Spectrum Analyzer	Hewlett-Packard	8566B	2311A02238	Sept. 17/97	Sept. 17/98
Spectrum Analyzer Display	Hewlett-Packard	8566B	2314A04759	Sept. 17/97	Sept. 17/98
Quasi-Peak Adapter	Hewlett Packard	85650A	2043A00302	Sept. 17/97	Sept. 17/98
Plotter	Hewlett Packard	7470A	2210A08836	N/A	N/A
Biconical (1) Antenna	EMCO	3109	9204-2708	July 14/97	July 14/98
Horn Antenna	EMCO	3115	4336	Aug. 1/96	Aug. 1/98
Low Noise Amplifier	Avantek	AWT-8035	1005	July 24/97	July 24/98
Low Noise Amplifier	DBS Microwave	DWT-13035	9623	July 24/97	July 24/98

Note: N/A = Not Applicable  
NCR = No Cal Required