ENGINEERING TEST REPORT

WAVENET RF/ID READER TRANSMITTER
MODEL NO.: WN900BST

FCC ID: MTHWN900BST

FCC PART 2 & PART 90
Location and Monitoring Service (LMS),
Non-multilateration Transmitters

UltraTech's FILE NO.: WTI-014FCC90

Tested for:

WAVENET INTERNATIONAL INC.
5825 Kennedy Road
Mississauga, Ontario
Canada, L4Z 2G3

Tested by:

UltraTech - Group of Labs
4181 Sladeview Crescent, Unit 33
Mississauga, Ontario
Canada L5L 5R2

Report Prepared by: Mr. Tri M. Luu, P.Eng.

DATE: Aug. 31, 1998

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1. EXHIBIT 1 - SUMMARY OF TEST RESULTS & GENERAL STATEMENT OF CERTIFICATION

FCC PARAGRAPH.	TEST REQUIREMENTS	COMPLIANCE (YES/NO)
2.9859(a) & 90.205	RF Power Output	Yes
2.995 & 90.213	Frequency Stability	Yes
2.987(d) & 90.211	Modulation Requirements	Not applicable. No modulation
2.989 & 90.209(b)	Occupied Bandwidth	Yes
2.987(a) & 90.242(b)(8)	Audio Frequency Response	Not applicable. No modulation
2.987(b) & 90.210	Modulation Limiting	Not applicable. No modulation
2.989 & 90.210	Emission Masks	Not applicable. No modulation
2.991 & 90.210	Emission Limits - Spurious Emissions at Antenna Terminal	Yes
2.993 & 90.210	Emission Limits - Field Strength of Spurious Emissions	Yes

WAVENET RF/ID READER TRANSMITTER, Model No.: WN900BST, by **WAVENET INTERNATIONAL INC.** has also been tested and found to comply with **FCC Part 15, Subpart B - Radio Receivers and Class A Digital Devices.** The engineering test report has been documented and kept in file and it is available anytime upon FCC request.

TESTIMONIAL AND STATEMENT OF CERTIFICATION

THIS IS TO CERTIFY:

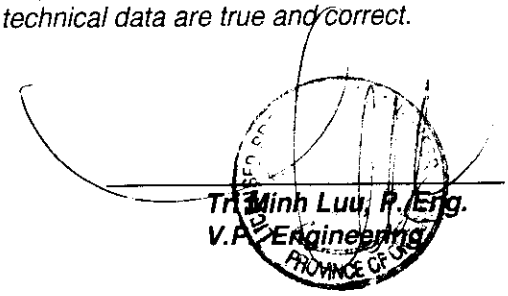
1) *THAT the application was prepared either by, or under the direct supervision of the undersigned.*

2) *THAT the measurement data supplied with the application was taken under my direction and supervision.*

3) *THAT the data was obtained on representative production units, representative.*

4) *THAT, to the best of my knowledge and belief, the facts set forth in the application and accompanying technical data are true and correct.*

Certified by:



Tri Minh Luu, P.Eng.
V.P. Engineering

DATE: Aug. 31, 1998

2. EXHIBIT 2 - GENERAL INFORMATION

2.1. APPLICANT

WAVENET INTERNATIONAL INC.
5825 Kennedy Road
Mississauga, Ontario
Canada, L4Z 2G3

Applicant's Representative: Mr. Vik Sodhi

2.2. MANUFACTURER

WAVENET INTERNATIONAL INC.
5825 Kennedy Road
Mississauga, Ontario
Canada, L4Z 2G3

2.3. DESCRIPTION OF EQUIPMENT UNDER TESTS

PRODUCT NAME:	WAVENET RF/ID READER TRANSMITTER
MODEL NO.:	WN900BST
SERIAL NUMBER:	80003
TYPE OF EQUIPMENT:	Location and Monitoring Service (LMS) – Non-Multilateral
OPERATION TYPE:	Intermittent (automatically turned off after 1 second)
SERVICES AREAS:	Commercial/Industrial
OPERATING FREQ.:	909.75 – 919.75 MHz
OSCILLATOR FREQUENCIES:	32.768 kHz, 20 MHz
CHANNEL SPACINGS	Single channel output
POWER RATING:	2.0 Watts
OUTPUT IMPEDANCE:	50 Ohms
DUTY CYCLE:	Continuous
99% BANDWIDTH (26dB BW):	4.6 kHz
BAUD RATES:	No modulation

EMISSION DESIGNATION:	4K6N0N
INPUT SUPPLY:	7.5 Vdc Battery
ASSOCIATED DEVICES:	N/A
FCC ID:	MTHWN900BST
INTERFACE PORTS:	Console (RS-232) for Technical Services only

2.4. RELATED SUBMITTALS)/GRANT

Not applicable

2.5. TEST METHODOLOGY

These tests were conducted on a sample of the equipment for the purpose of certification compliance with Code of Federal Regulations, Parts 2 & 90, Sec. 90.351 - Location and Monitoring Service (LMS), Non-multilateration Transmitters operating in the frequency bands 902 - 928 MHz.

Both conducted and radiated emissions measurements were conducted in accordance with American National Standards Institute ANSI C63.4 - American National Standard for Methods of Measurement of Radio-Noise Emissions from Low-Voltage Electrical and Electronic Equipment in the Range of 9 kHz to 40 GHz.

2.6. TEST FACILITY

AC Powerline Conducted Emissions were performed in UltraTech's shielded room, 16'(L) by 12'(W) by 12'(H).

Radiated Emissions were performed at the Ultratech's 3 Meter Open Field Test Site (OFTS) situated in the Town of Oakville, province of Ontario.

The above sites have been calibrated in accordance with ANSI C63.4, and found to be in compliance with the requirements of Sec. 2.948 of the FCC Rules. The descriptions and site measurement data of the Oakville Open Field Test Site has been filed with FCC office (FCC File No.: 31040/SIT 1300B3) and Industry Canada office (Industry Canada File No.: IC2049). Last Date of Site Calibration: July 16, 1997.

The above test site is also filed with Interference Technology International Ltd (ITI - An EC Directive on EMC).

2.7. UNITS OF MEASUREMENTS

Measurements of conducted emissions are reported in units of dB referenced to one microvolt [dB(uV)].

Measurements of radiated emissions are reported in units of dB referenced to one microvolt per meter [dB(uV)/m] at the distance specified in the report, wherever it is applicable.

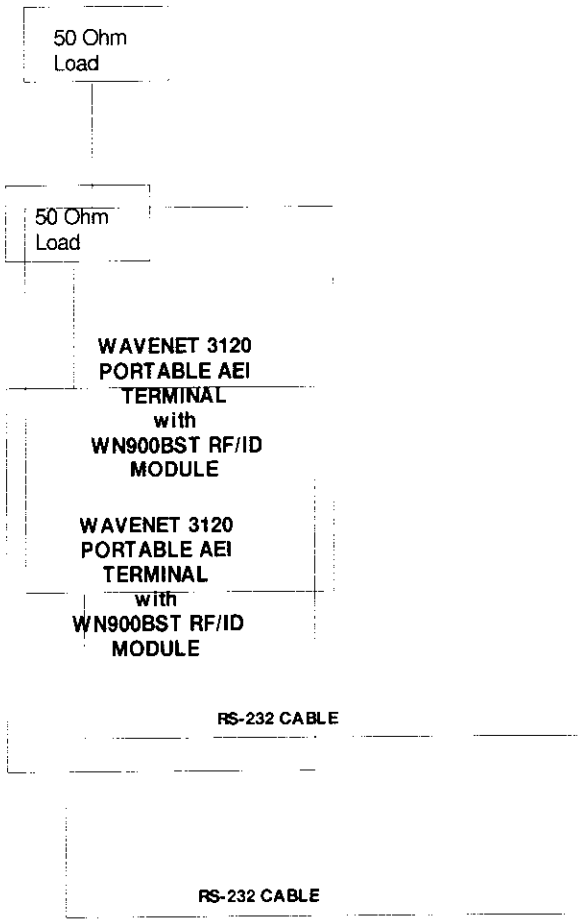
3. EXHIBIT 3 - SYSTEM TEST CONFIGURATION

3.1. TEST SYSTEM DETAILS

The following peripherals, FCC identifiers and types interconnecting cables were used with the EUT for testing:

(1) **EUT**: WAVENET INTERNATIONAL INC., WAVENET RF/ID READER TRANSMITTER, Model : WN900BST, S/N: 80003. The Wavenet RF/ID Reader Module was installed inside the Wavenet 3120 Terminal for all tests in this report.
I/O Cable: All I/O cables were shielded
Power Supply Cable: Non-shielded

3.2. BLOCK DIAGRAMS OF TEST SET-UP



3.4. JUSTIFICATION

No deviation, in both configuration and operation manners, different from normal operation were required.

3.5. EUT OPERATING CONDITION

Transmitter was program to be turn on longer than normal operating duration (1.5 second) to 10 seconds for convenience of testing.

3.6. SPECIAL ACCESSORIES

No special accessories were required.

3.7. EQUIPMENT MODIFICATIONS

Not required.

4. EXHIBIT 4 - TEST DATA

4.1. POWER AND ANTENNA HEIGHT @ FCC 2.985(A) & 90.205

PRODUCT NAME: **WAVENET RF/ID READER TRANSMITTER, Model No.: WN900BST**

FCC REQUIREMENTS:

FCC Part 2.985(A) & 90.205:- Please refer to FCC CFR 47, 2.985(a) and 90.205 for specification details.

CLIMATE CONDITION:

Standard Temperature and Humidity:

- Ambient temperature: 21 °C
- Relative humidity: 43%

POWER INPUT:

7.5 Vdc Battery.

TEST EQUIPMENT:

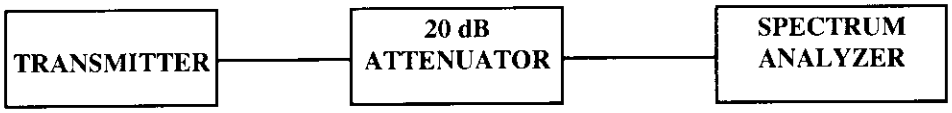
- Advantest Spectrum Analyzer, Model R3271, S/N: 15050203
- Bird Attenuator, 50 Ohm IN/OUT

METHOD OF MEASUREMENTS:

Refer to FCC @ 2.985

(a) For transmitter other than single sideband, independent sideband and controlled carrier radiotelephone, power rf output shall be measured at the RF output terminals when the transmitter is adjusted in accordance with the tune-up procedure to give the values of the current and voltage on the circuit elements specified in 2.983(d)(5). The electrical characteristics of the radio frequency load attached to the output terminals when this test is made shall be stated.

TEST ARRANGEMENT



TEST RESULTS: Conforms.

TESTED PERSONNEL: Mr. Hung Trinh, EMI/EMC Technician

DATE: Aug. 27, 1998

MEASUREMENT DATA

PEAK POWER MEASUREMENT AT THE ANTENNA TERMINAL

TEST CONFIGURATION

- *The transmitter terminal was coupled to the Spectrum Analyzer through a 20 dB attenuator*
- *Power of the transmitter channel near the lowest, middle and highest of each frequency block/band were measured using the power meter, and the reading was corrected by added the calibrated attenuator's attenuation value and cable loss.*
- *The RF Output was turned on with no modulation.*

TRANSMITTER CHANNEL OUTPUT	FUNDAMENTAL FREQUENCY (MHz)	MEASURED PEAK POWER (Watts)	PEAK POWER RATING (Watts)
Single	915	2.0	2.0

ERP Measurements: - Appropriate antenna type, and adjustment of power output for effective radiated power (ERP) to meet FCC limits will be performed by the manufacturer at location of installation.

4.2. FREQUENCY STABILITY @ FCC 2.995(A)(1), 2.995(B), 2.995(1) AND 90.213

PRODUCT NAME: **WAVENET RF/ID READER TRANSMITTER, Model No.: WN900BST**

FCC REQUIREMENTS:

FCC Part 90, Sub. I, Para. 90.213, Note 13

Fixed Non-multilateration transmitters with an authorized bandwidth is more than 40 kHz from the band edge, intermittently handheld readers, and mobile transponders are not subject to frequency tolerance restriction.

CLIMATE CONDITION:

Standard Temperature and Humidity: Please refer to Measurement Data

POWER INPUT:

7.5 Vdc Battery.

TEST EQUIPMENT:

- Advantest Spectrum Analyzer, Model R3271, S/N: 15050203
- Tenney Temp. & Humidity Chamber, Model T5, S/N: 9723B
- Bird Attenuator, 50 Ohm IN/OUT

METHOD OF MEASUREMENTS:

Refer to FCC @ 2.995

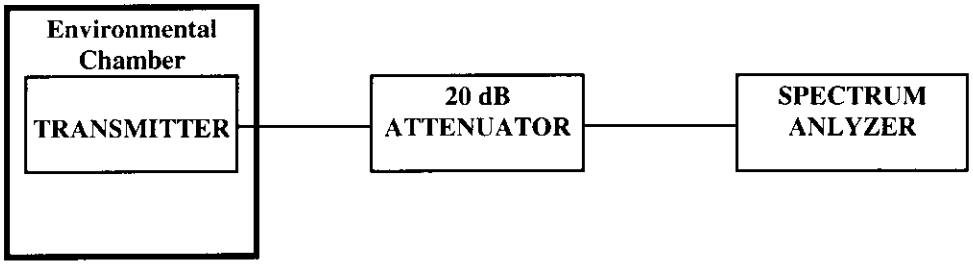
(a) The frequency stability shall be measured with variation of ambient temperature as follows:

- From -30 to +50 centigrade except that specified in subparagraph (2) & (3) of this paragraph.

(b) Frequency measurements shall be made at extremes of the specified temperature range and at intervals of not more than 10 centigrade through the range. A period of time sufficient to stabilize all of the components of the oscillator circuit at each temperature level shall be allowed prior to frequency measurement. The short term transient effects on the frequency of the transmitter due to keying (except for broadcast transmitters) and any heating element cycling normally occurring at each ambient temperature level also shall be shown. Only the portion or portions of the transmitter containing the frequency determining and stability circuitry need be subjected to the temperature variation test.

(e) When deemed necessary, the Commission may require tests of frequency stability under conditions in addition to those specifically set out in paragraphs (a), (b), (c) and (d) of this section. (For example, measurements showing the effect of proximity to large metal objects, or of various types of antennas, may be required for portable equipment).

TEST ARRANGEMENT



TEST RESULTS: Conforms.

TESTED PERSONNEL: Mr. Hung Trinh, EMI/EMC Technician

DATE: Aug. 27, 1998

MEASUREMENT DATA

FREQUENCY STABILITY

TEST CONFIGURATION

- *The transmitter was placed inside the environmental chamber, and its output terminal was coupled to the Spectrum Analyzer through a 20 dB attenuator.*
- *One transmitter channel frequency was tested.*
- *The DUT was supplied by a variable power supply.*
- *The environmental chamber was cycled down to -30° C. When the chamber reaches -30° C, the EUT was powered on with the nominal voltage level, with the transmitter keyed off. The terminal remained in the chamber at -30°C for a period of 1 hour. After 1 hour the transmitter was continuously keyed on, at **full power**. The transmitter frequency of the terminal was measured from the spectrum analyzer every minute for a period of 10 minutes.*
- *When the measurement complete, the transmitter was keyed off and the chamber was cycled up to 10° C steps. The EUT remained powered up (unkeyed) at -20° C for a minimum period of 1 hour, after which the measurements will be made as outlined above.*
- *The above was repeated for -10, 0, 20, 30, 40 and 50 degrees Celsius.*

Product Name **Model No.**	**WAVENET RF/ID READER TRANSMITTER** **MODEL NO.: WN900BST**
Centre Frequency	915 MHz
Full Power Level	2 Watts
Frequency Tolerance Limit	The transmitter shall stayed within 902 – 928 MHz Band.
Max. Frequency Tolerance Measured	+950 kHz max
Base/Mobile/Portable	-30 to +50 degree C, 85% to 115%

		CENTRE FREQUENCY & RF POWER OUTPUT VARIATION					
AMBIENT TEMP.	**KEYED-ON TIME**	**Supply Voltage (Nominal) 7.5 Volts**		**Supply Voltage (85% of Nominal) Volts**		**Supply Voltage (115% of Nominal) Volts**	
(°C)	**(Seconds)**	**KHz**	**dB**	**KHz**	**dB**	**KHz**	**dB**
-30	**Within 20 s**	**839**	**N/A**	**N/A**	**N/A**	**N/A**	**N/A**
-20	**Within 20 s**	**864**	**N/A**	**N/A**	**N/A**	**N/A**	**N/A**
-10	**Within 20 s**	**857**	**N/A**	**N/A**	**N/A**	**N/A**	**N/A**
0	**Within 20 s**	**950**	**N/A**	**N/A**	**N/A**	**N/A**	**N/A**
+10	**Within 20 s**	**531**	**N/A**	**N/A**	**N/A**	**N/A**	**N/A**
+20	**Within 20 s**	**0**	**N/A**	**N/A**	**N/A**	**N/A**	**N/A**
+30	**Within 20 s**	**247**	**N/A**	**N/A**	**N/A**	**N/A**	**N/A**
+40	**Within 20 s**	**-49**	**N/A**	**N/A**	**N/A**	**N/A**	**N/A**
+50	**Within 20 s**	**159**	**N/A**	**N/A**	**N/A**	**N/A**	**N/A**

Note: The transmitter is specially program to transmit longer (20 seconds) than its normal operating duration time (1.5 second) for convenient of testing.

4.3. MODULATION REQUIREMENTS @ FCC 2.987(D) & 90.211

None system operates, the transmitter operates CW with no modulation. The requirements are met.

4.4. OCCUPIED BANDWITH @ FCC 2.989 & 90.209(B)(10)

None system operates, the transmitter operates CW with no modulation. The requirements are met as shown in the attached plot.

4.5. AUDIO FREQUENCY RESPONSE @ FCC 2.987(A) & 90.242(B)(8)

None system operates, the transmitter operates CW with no modulation; therefore, tests are not applicable.

4.6. MODULATION LIMITING @ FCC 2.987(B) & 90.210

None system operates, the transmitter operates CW with no modulation; therefore, tests are not applicable.

4.7. EMISSION MASKS @ FCC 90.210

None system operates, the transmitter operates CW with no modulation; therefore, tests are not applicable.

4.8. TRANSMITTER ANTENNA POWER SPURIOUS/HARMONIC CONDUCTED EMISSIONS @ FCC 2.991 & 90.210

PRODUCT NAME: **WAVENET RF/ID READER TRANSMITTER, Model No.: WN900BST**

FCC REQUIREMENTS:

FCC Part 90, Sub. I, Para. 90.210

Emissions shall be attenuated below the mean output power of the transmitter as follows:

FCC RULES	FREQUENCY RANGE	ATTENUATION LIMIT (dBc)
90.210(k)(3) – Other transmitters	Lowest frequency generated from the transmitter circuit to 10^{th} harmonic of the fundamental frequency	$55 + 10\log_{10}(P)$ or –25 dBm

CLIMATE CONDITION:

Standard Temperature and Humidity:

- Ambient temperature: 21 °C
- Relative humidity: 43%

POWER INPUT:

7.5 Vdc Battery.

TEST EQUIPMENT:

- Advantest Spectrum Analyzer, Model R3271, S/N: 15050203
- Bird Attenuator, 50 Ohm IN/OUT
- Hihpass Filter, Microphase, P/N: CR220HIB, S/N: IITI11000AB, cut-off freq.: 600 MHz.
- Audio Oscillator, HP, Model 204C, SN: 0989A08798, Output: 0-1.2 MHz, 5 Vrms.

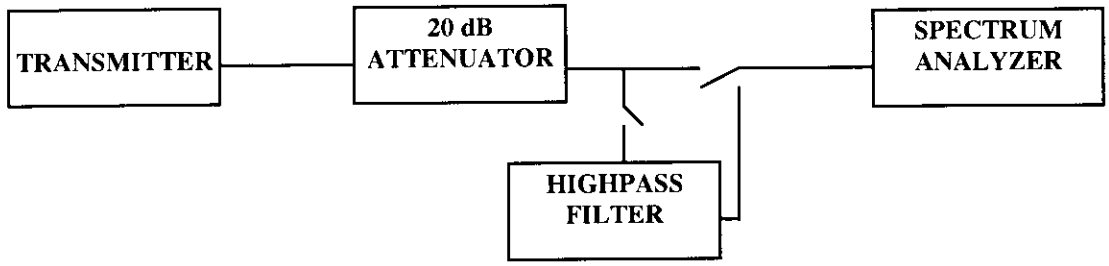
METHOD OF MEASUREMENTS:

With transmitter modulation characteristics described in Out-of-Band Emissions measurements @ 2.989, the transmitter spurious and harmonic emissions were scanned. The spurious and harmonic emissions were measured with the Spectrum Analyzer controls set as RBW = 100 kHz, VBW = 100 kHz and SWEEP TIME = AUTO). The transmitter was operated at a full rated power output, and modulated as follows:

FCC CFR 47, Para. 2.997 - Frequency spectrum to be investigated:- The spectrum was investigated from the lowest radio generated in the equipment up to at least the 10th harmonic of the carrier frequency or to the highest frequency practicable in the present state of the art of measuring techniques, whichever is lower. Particular attention should be paid to harmonics and subharmonics of the carrier frequency. Radiation at the frequencies of multiplier stages should be checked. The
amplitude of spurious emissions which are attenuated more than 20 dB below the permissible value need not be reported.

FCC CFR 47, Para. 2.991 - Spurious Emissions at Antenna Terminal:- The radio frequency voltage or powers generated within the equipment and appearing on a spurious frequency shall be checked at the equipment output terminals when properly loaded with a suitable artificial antenna. Curves or equivalent data shall show the magnitude of the harmonic and other spurious emission that can be detected when the equipment is operated under the conditions specified in 2.989 as appropriate. The magnitude of spurious emissions which are attenuated more than 20 dB below the permissible value need not be specified.

TEST ARRANGEMENT



TEST RESULTS: Conforms.

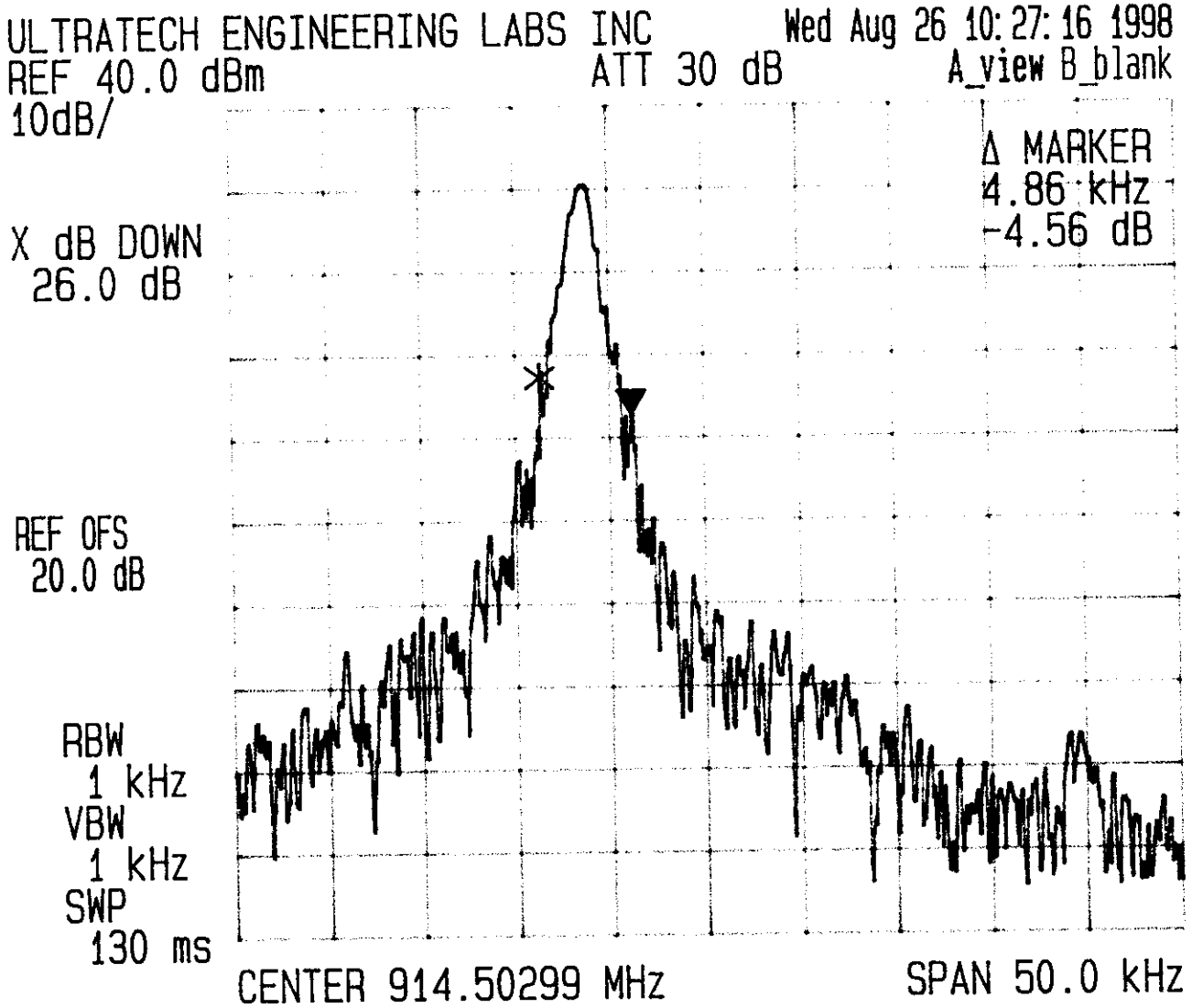
TESTED PERSONNEL: Mr. Hung Trinh, EMI/EMC Technician

DATE: Aug. 27, 1998

UltraTech
Engineering Labs Inc.

WAVENET INTERNATIONAL INC.
PORTABLE AEI TERMINAL, MODEL 3100/3120
Tx Frequency: 915 MHz
NO MODULATION
26 dB BW

Date: August 27 1998
Tested by: Hung Trinh



MEASUREMENT DATA

SPURIOUS & HARMONIC EMISSIONS AT THE TRANSMITTER ANTENNA TERMINAL

TEST CONFIGURATION

- *The transmitter was coupled to the Spectrum Analyzer through a 20 dB attenuator.*
- *The insertion loss between the transmitter output terminal and the spectrum analyzer was measured to be 20 dB*

Please see attached plots for detailed measurements.

Fundamental Frequency: 915 MHz
RF Output Power: 2.0 Watts
Modulation: No modulation

FREQUENCY (MHz)	RF LEVEL (dBm)	LIMIT (dBm)	MARGIN (dB)	PASS/ FAIL
No significant rf emissions were found in the frequency range from 1 MHz to 10 GHz when they scanned at the transmitter antenna terminal.				

4.9. TRANSMITTER SPURIOUS/HARMONIC RADIATED EMISSIONS @ FCC 2.993 & 90.210

PRODUCT NAME: **WAVENET RF/ID READER TRANSMITTER, Model No.: WN900BST**

FCC REQUIREMENTS:

FCC Part 90, Sub. I, Para. 90.210

Emissions shall be attenuated below the mean output power of the transmitter as follows:

FCC RULES	FREQUENCY RANGE	ATTENUATION LIMIT (dBc)
90.210(k)(3) – Other transmitters	Lowest frequency generated from the transmitter circuit to 10th harmonic of the fundamental frequency	$55 + 10\log_{10}(P)$ or –25 dBm

CLIMATE CONDITION:

Standard Temperature and Humidity:

- Ambient temperature: 21 °C
- Relative humidity: 43%

POWER INPUT:

7.5 Vdc Battery.

TEST EQUIPMENT:

1. EMI Receiver System/Spectrum Analyzer, Hewlett Packard, Model 8546A, Input +25dBm max., 9KHz-5.6GHz, 50 Ohms, built-in Peak, Quasi-Peak & Average Detectors, Pre-Amplifier and Tracking Signal Generator. This System includes: (1) HP 85460A RF Filter Section, S/N: 3448A00236 and (2) HP 85462A Receiver RF Section/Display, S/N: 3520A00248.
2. Spectrum Analyzer, Advantest, Model R3271, S/N: 15050203, 100 Hz to 32 GHz)
3. Microwave Amplifier, HP, Model 83017A, Frequency Range 1 to 22GHz, 30dB gain nominal, low noise floor type.
4. Active Loop Antenna, Emco, Model 6502, SN 9104-2611, Frequency Range 1 KHz - 30 MHz, @ 50 Ohms.
5. BiconiLog Antenna, Emco, Model 3142, SN 10005, 30-2000 MHz @ 50 Ohms.
6. Log Periodic Antenna, AH System, Model SAS-200/518, SN: 343, Frequency Range: 1GHz-18GHz.
7. FCC Listed Open Field Test Site.
8. Audio Oscillator, HP, Model 204C, SN: 0989A08798, Output: 0-1.2 MHz, 5 Vrms.

METHOD OF MEASUREMENTS:

Refer to **ANSI 63.4**, Para. 8 for detailed radiated emissions measurement procedures.

With transmitter modulation characteristics described in Out-of-Band Emissions measurements @ 2.989, the transmitter spurious and harmonic emissions were scanned. The spurious and harmonic emissions were measured with the Spectrum Analyzer controls set as RBW = 100 kHz, VBW = 100 kHz and SWEEP TIME = AUTO). The transmitter was operated at a full rated power output, and modulated as follows:

FCC CFR 47, Para. 2.997 - Frequency spectrum to be investigated

The spectrum was investigated from the lowest radio generated in the equipment up to at least the 10^{th} harmonic of the carrier frequency or to the highest frequency practicable in the present state of the art of measuring techniques, whichever is lower. Particular attention should be paid to harmonics and subharmonics of the carrier frequency. Radiation at the frequencies of multiplier stages should be checked. The amplitude of spurious emissions which are attenuated more than 20 dB below the permissible value need not be reported.

FCC CFR 47, Para. 2.993 - Field Strength Spurious Emissions

(a) Measurements was made to detect spurious emissions radiated directly from the cabinet, control circuits, power leads, or intermediate circuit elements under normal conditions of installation and operation. Curves or equivalent data were supplied showing the magnitude of each harmonic and other spurious emission. For this test, single sideband, independent sideband, and controlled carrier transmitters shall be modulated under the conditions specified in paragraph 2.989(c) as appropriate. For equipment operating on frequencies below 1 GHz , an Open Field Test is normally required, with the measuring instrument antenna located in the far field at all test frequencies. In event it is either impractical or impossible to make open field measurements (e.g. a broadcast transmitter installed in a building) measurement will be accepted of the equipment as installed. Such measurements must be accompanied by a description of the site where the measurements were made showing the location of any possible source of reflections which might distort the field strength measurements. Information submitted shall include the relative radiated power of each spurious emission with the reference to the rated power output of the transmitter, assuming all emissions are radiated from half-wave dipole antennas.

(b) Measurements specified in paragraph (a) of this section shall be made for the following equipment:

(1) Those in which the spurious emission are required to be 60 dB or more below the mean power of the transmitter.
(2) All equipment operating on frequencies higher than 25 MHz
(3) All equipment where the antenna is an integral part of, and attached directly to the transmitter.
(4) Other types of equipment as required, when deemed necessary by the Commission.

METHOD OF CALCULATION FOR TRANSMITTED POWER (P) FROM THE MEASURED FIELD STRENGTH LEVEL (E):

According to IEC 801-3, the power density can be calculated as follows:

$S = P / (4xPIxD^2)$ Where: S: Power density in watts per square feet
P: Transmitted power in watts
PI: 13.1415
D: Distance in meters

The power density S (W/m^2) and electric field E (V/m) is related by:

$$S = E^2/(120xPI)$$

Accordingly, the field intensity of isotropic radiator in free space can be expressed as follows:

$$E = (30xP)^{1/2}/D = 5.5x(P)^{1/2}/D$$

For Halfwave dipole antenna or other antennas correlated to dipole in direction of maximum radiation:

$$S = (1.64xP)/(4xPIxD^2)$$
$$E = (49.2xP)^{1/2}xD = 7.01x(P)^{1/2}/D$$

$$P = (ExD/7.01)^2$$

Calculation of transmitted power P (dBM) given a measured field intensity E (dBuV/m):

$P(W) = [E(V/m)xD/7.01]^2$
$P(mW) = P(W)x1000$
=> $P(dBm) = 10logP(mW)$
$= 20logE(V/m) + 20log(D) - 20log(7.01) + 10log1000$
$= E(dBV/m) + 20logD + 13$
$= E(dBuV/m) - 120 + 20log(D) + 13$
$= E(dBuV/m) + 20log(D) - 107$

The Transmitted Power @ D = 3 Meters

P(dBm) = E(dBuV/m) - 97.5

TEST RESULTS: Conforms.

TESTED PERSONNEL: Mr. Hung Trinh, EMI/EMC Technician

DATE: Aug. 27, 1998

MEASUREMENT DATA

RADIATED EMISSIONS MEASUREMENTS @ 3 METERS

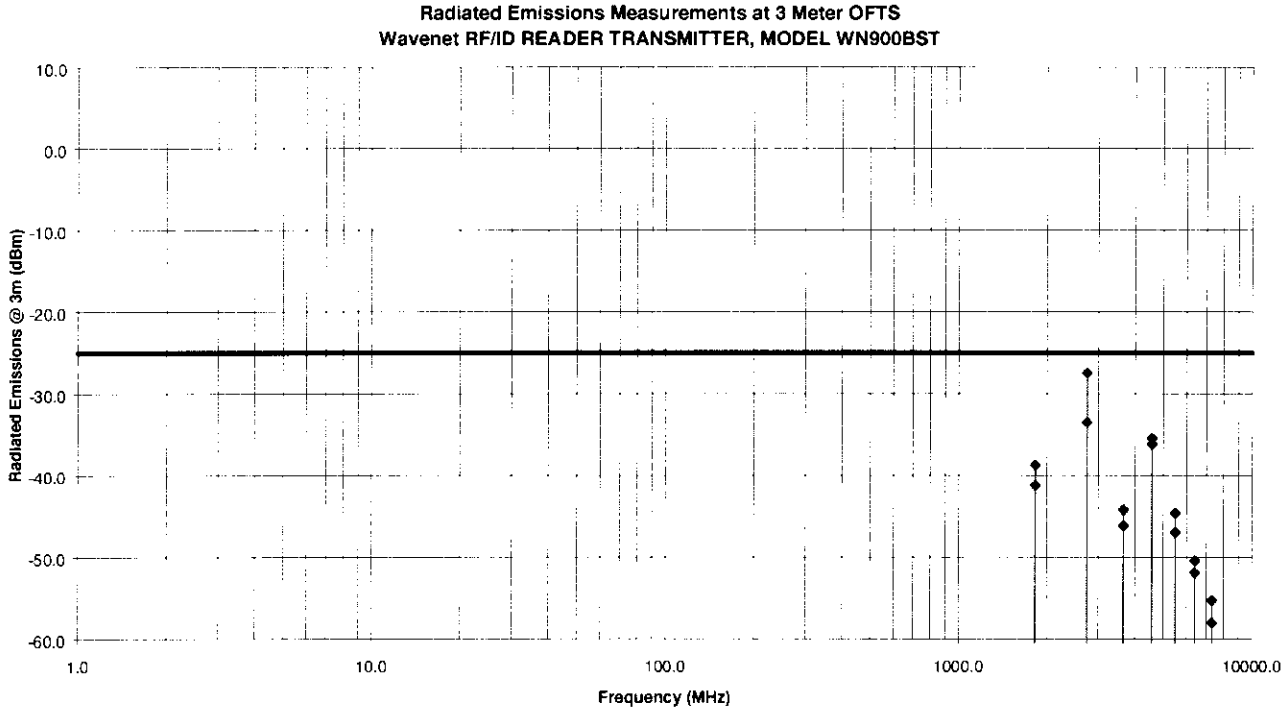
TEST CONFIGURATION

- *For measuring radiated emissions at frequencies below 1 GHz, the Spectrum Analyzer was set as 100 kHz RBW, 100 KHz VBW, SWEEP TIME: AUTO, PEAK DETECTOR.*
- *For measuring radiated emissions at frequencies above 1 GHz, the Spectrum Analyzer was set as 1 MHz RBW, 1 MHz VBW, SWEEP TIME: AUTO, PEAK DETECTOR.*
- *All rf emissions from the lowest frequency generated by the transmitter (...) upto the 10^{th} harmonic of fundamental were scanned, and only emissions less than 20 dB below the limits (-25 dBm) were recorded.*
- *The handheld terminal was sit in three different orthogonal positions to find the maximum signal level.*

Fundamental Frequency: 915 MHz
RF Output Power: 2 Watts
Modulation: No modulation

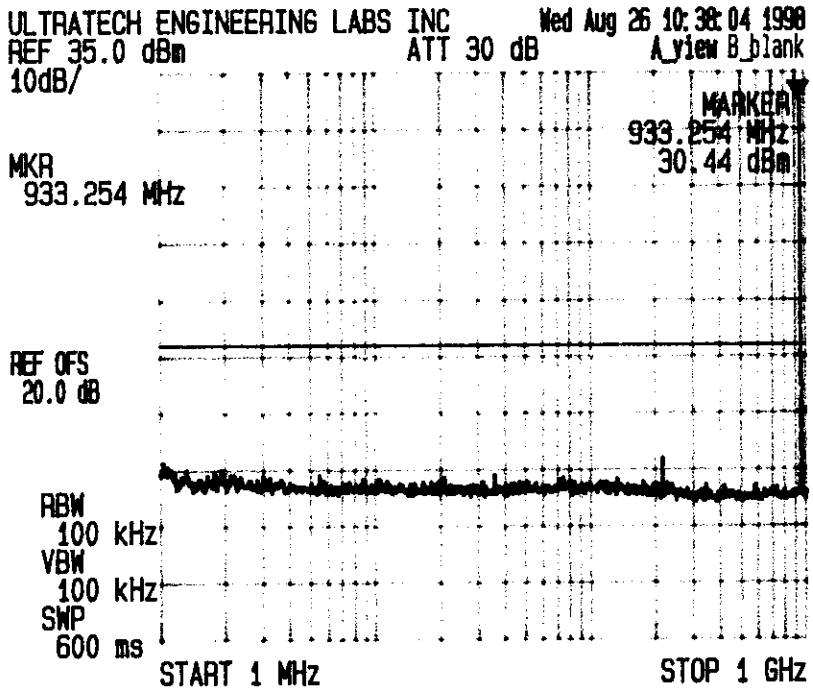
FREQUENCY (MHz)	RF Field Strength Level (dBuV/m)	RF Power Level (dBm)	DETECTOR USED (PEAK/QP)	ANTENNA PLANE (H/V)	LIMIT (dBm)	MARGIN (dB)	PASS/ FAIL
1830.00	56.3	-41.2	PEAK	V	-25.0	-16.2	PASS
2745.00	70.0	-27.5	PEAK	V	-25.0	-2.5	PASS
3660.00	51.4	-46.1	PEAK	V	-25.0	-21.1	PASS
4575.00	62.0	-35.5	PEAK	V	-25.0	-10.5	PASS
5490.00	52.9	-44.6	PEAK	V	-25.0	-19.6	PASS
6405.00	45.6	-51.9	PEAK	V	-25.0	-26.9	PASS
7320.00	39.5	-58.0	PEAK	V	-25.0	-33.0	PASS
1830.00	58.8	-38.7	PEAK	V	-25.0	-13.7	PASS
2745.00	64.0	-33.5	PEAK	H	-25.0	-8.5	PASS
3660.00	53.3	-44.2	PEAK	H	-25.0	-19.2	PASS
4575.00	61.3	-36.2	PEAK	H	-25.0	-11.2	PASS
5490.00	50.6	-46.9	PEAK	H	-25.0	-21.9	PASS
6405.00	47.1	-50.4	PEAK	H	-25.0	-25.4	PASS
7320.00	42.3	-55.2	PEAK	H	-25.0	-30.2	PASS

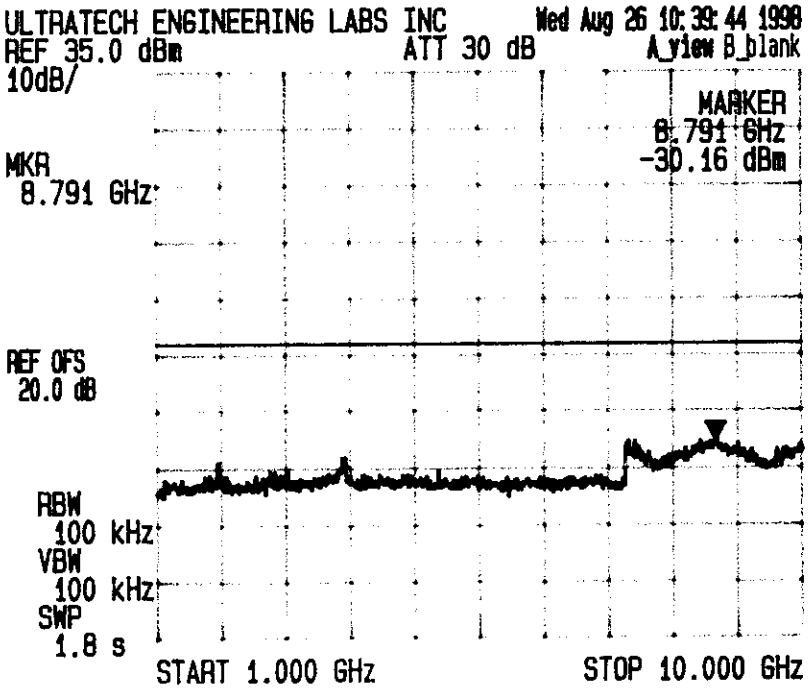
No other significant rf emissions were found in the frequency range from 1 MHz to 10 GHz when they scanned at 3 meter distances.


Radiated Emissions Measurements at 3 Meter OFTS
Wavenet RF/ID READER TRANSMITTER, MODEL WN900BST
Radiated Emissions @ 3m (dBm)
10.0
0.0
-10.0
-20.0
-30.0
-40.0
-50.0
-60.0
1.0
10.0
100.0
1000.0
10000.0
Frequency (MHz)

Date: August 27 1998
Tested by: Hung Trinh

WAVENET INTERNATIONAL INC.
PORTABLE AEI TERMINAL, MODEL 3100/3120
Tx Frequency: 915 MHz
NO MODULATION
BATTERY / CHARGING EMISSIONS



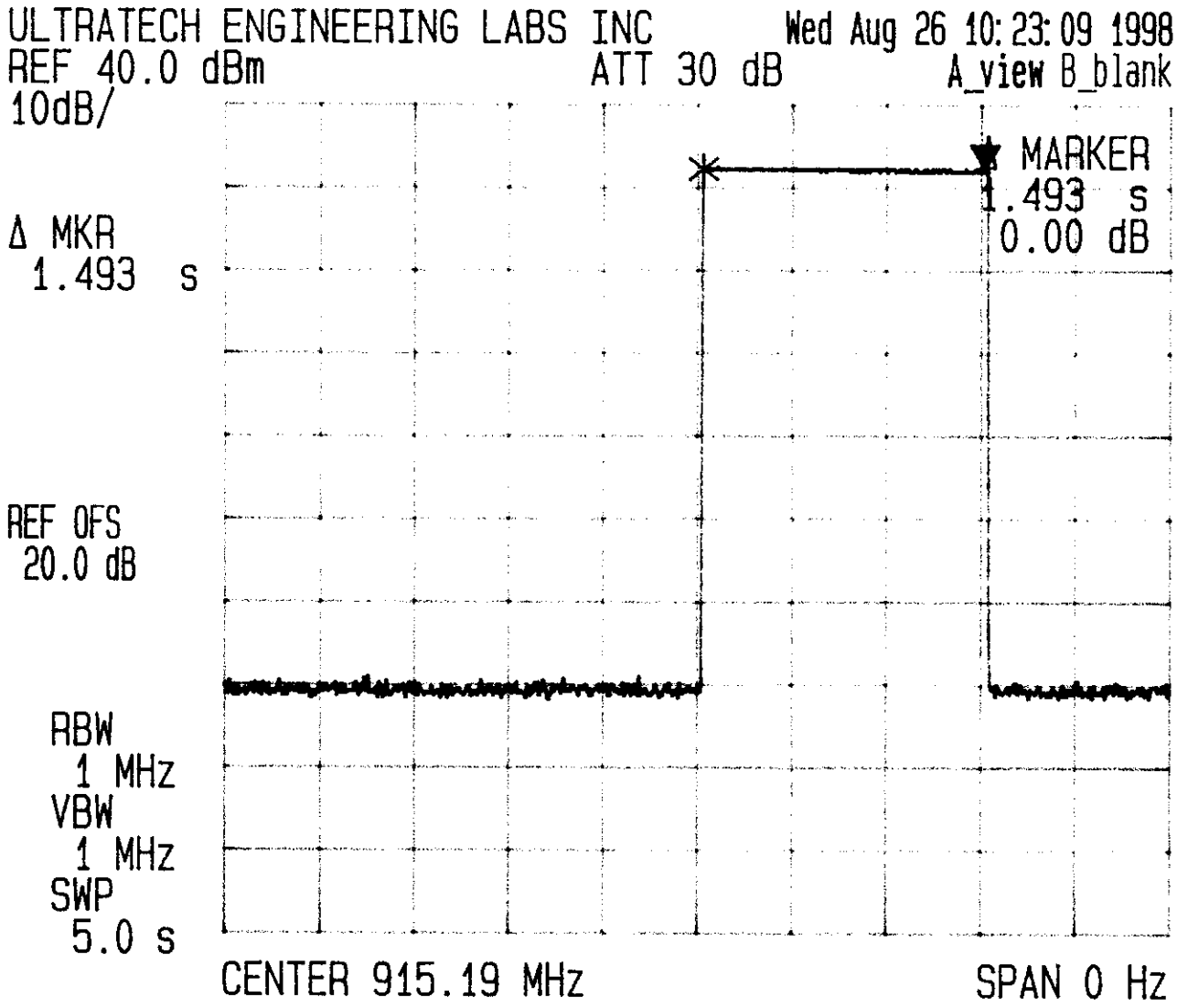


UltraTech
Engineering Labs Inc.

UltraTech Engineering Labs Inc.

WAVENET INTERNATIONAL INC.
PORTABLE AEI TERMINAL, MODEL 3100/3120
Tx Frequency: 915 MHz
NO MODULATION
DURATION OF TRANSMISSION

Date: August 27 1998
Tested by: Hung Trinh



5. EXHIBIT 5 - GENERAL TEST PROCEDURES

5.1. ELECTRICAL FIELD RADIATED EMISSIONS MEASUREMENTS - GENERAL TEST METHOD

- The radiated emission measurements were performed at the Ultratech's 3 Meter Open Field Test Site (OFTS) situated in the Town of Oakville, province of Ontario. The Attenuation Characteristics of OFTS have been filed to FCC.

- Radiated emissions measurements were made using the following test instruments:

  1. Calibrated EMCO biconilogl antenna in the frequency range from 30 MHz to 2000 MHz.
  2. Calibrated A.H. Systems log periodic antenna in the frequency range above 1000 MHz (1GHz - 18 GHz).
  3. Calibrated EMI receiver or spectrum analyzer and pre-selector. In general, the spectrum analyzer would be used as follows:

     – The rf electric field levels were measured with the spectrum analyzer set to PEAK detector (100 KHz RBW and 100 KHz VBW).

     – If any rf emission was observed to be a broadband noise, the spectrum analyzer's CISPR QUASI-PEAK detector (120 KHz RBW and 1MHz VBW) was then set to measure the signal level.

     – If the signal being measured was narrowband and the ambient field was broadband, the bandwidth of the spectrum analyzer was reduced.

- The EUT was set-up in its typical configuration and operated in its various modes as described in 3.2 of the test report.

- The frequencies of emissions was first detected. Then the amplitude of the emissions was measured at the specified measurement distance using required antenna height, polarization, and detector characteristics.

- During this process, cables and peripheral devices were manipulated within the range of likely configuration.

- For each mode of operation required to be tested, the frequency spectrum was monitored. Variations in antenna heights (from 1 meter to 4 meters above the ground plane), antenna polarization (horizontal plane and vertical plane), cable placement and peripheral placement (each variable within bounds specified elsewhere) were explored to produce the highest amplitude signal relative to the limit.

  The maximum radiated emission for a given mode of operation was found by using the following step-by-step procedure:

  Step1: Monitor the frequency range of interest at a fixed antenna height and EUT azimuth.

  Step2: Manipulate the system cables to produce highest amplitude signal relative to the limit. Note the amplitude and frequency of the suspect signal.

  Step3: Rotate the EUT 360 degrees to maximize the suspected highest amplitude signal. If the signal or another at a different frequency is observed to exceed the previously noted highest amplitude signal by 1 dB or more, go back to the azimuth and repeat Step 2. Otherwise, orient the EUT azimuth to repeat the highest amplitude observation and proceed.

Step4: Move the antenna over its full allowed range of travel (1 to 4 meters) to maximize the suspected highest amplitude signal. If the signal or another at a different frequency is observed to exceed the previously noted highest amplitude signal by 1 dB or more, return to Step 2 with the highest amplitude observation and proceed.

Step5: Change the polarization of the antenna and repeat Step 2 through 4. Compare the resulting suspected highest amplitude signal with that found for the other polarization. Select and note the higher of the two signals. This signal is termed the highest observed signal with respect to the limit for this EUT operational mode.

Step6: The effects of various modes of operation is examined. This is done by varying the equipment modes as steps 2 through 5 are being performed.

Step7: After completing steps 1 through 6, record the final highest emission level, frequency, antenna polarization and detector mode of the measuring instrument.

Calculation of Field Strength:

The field strength is calculated by adding the calibrated antenna factor and cable factor, and subtracting the Amplifier gain (if any) from the measured reading. The basic equation with a sample calculation is as follows:

$$\mathbf{FS = RA + AF + CF - AG}$$

Where	FS	=	Field Strength
	RA	=	Receiver/Analyzer Reading
	AF	=	Antenna Factor
	CF	=	Cable Attenuation Factor
	AG	=	Amplifier Gain

Example: If a receiver reading of 60.0 dBuV is obtained, the antenna factor of 7.0 dB/m and cable factor of 1.0 dB are added, and the amplifier gain of 30 dB is subtracted. The actual field strength will be:.

Field Level = 60 + 7.0 + 1.0 - 30 = 38.0 dBuV/m.

Field Level = $10^{(38/20)}$ = 79.43 uV/m.

Notes: The frequency and amplitude of at least six highest conducted emissions relative to the limit are recorded unless such emissions are more than 20 dB below the limit. If less than six emissions are within 20dB of the limit, the background or receiver noise level shall be reported at representative frequencies.

6. EXHIBIT 6 - INFORMATION RELATED TO EQUIPMENT UNDER TESTS

6.1. FCC ID LABELLING AND SKETCH OF FCC LABEL LOCATION

Refer to the attached sheets

6.2. PHOTOGRAPHS OF EQUIPMENT UNDER TEST

Refer to the attached photographs

6.3. SYSTEM BLOCK DIAGRAM(S)

Refer to the attached sheets

6.4. SCHEMATIC DIAGRAMS

Refer to the attached sheets

6.5. USER'S MANUAL WITH "FCC INFORMATION TO USER STATEMENTS"

Refer to the attached Users' manual

Regulations and Approvals

This equipment has been tested and found to comply with the limits for a Class A digital device, pursuant to Part 15 of the ***FCC*** rules. These limits are designed to provide reasonable protection against harmful interference when the equipment is operated in a commercial environment. The equipment generates, uses, and can radiate radio frequency energy and, if not installed and used in accordance with the instruction manual, may cause harmful interference to radio communications.

Operation of this equipment in a residential area is likely to cause harmful interference in which case the user will be required to correct the interference at his own expense. All external cables must be shielded to ensure compliance with the ***Class A FCC*** limits.

******WARNING****** Changes or modifications not expressly approved by ***WaveNet International Inc.*** could void the user's authority to operate the equipment and void the warranty.