

FCC ID: PQS-BM28001

Exhibit 2e

Engineering Report on

Frequency Stability (2.1055)



Assessment of Compliance

of

**Device Frequency Stability in accordance with the FCC Rules &
Regulations Parts 2.1055 and 90.213**

Wireless Modem BOOMER II

Wavenet Technologies Pty Ltd.



August 2002

APREL Project No.:WVTB-BoomerII-3922-1

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Engineering Report

Subject: Assessment of Compliance of Device Frequency Stability
In accordance with
FCC Rules & Regulations Parts 2.1055 and 90.213

FCC ID: PQS-BM28001

Equipment: Wireless OEM Modem Module

Model: BOOMER II

Client: Wavenet Technologies Pty Ltd.
140 Burswood Rd
Burswood, Perth, WA 6100
AUSTRALIA

Project #: WVTB-BoomerII-Modem-3922-1

Prepared By: APREL Laboratories,
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Approved by:


Jay Sarkar

Technical Director, Standards & Certification

Date:

Sept. 12, 2002

Submitted by:


Jay Sarkar

Technical Director, Standards & Certification

Date:

Sept. 12, 2002

Released by:


Dr. Jack J. Wojcik, P.Eng.

Date:

Sept 12/02



FCC ID: PQS-BM28001
Applicant: Wavenet Technologies Pty Ltd.
Equipment: Wireless OEM Modem Module
Model: BOOMER II
Standard: FCC Rules and Regulations Part 2.1055 and 90.213

ENGINEERING SUMMARY

This report contains the results of the Frequency Stability measurement performed on a **Wavenet Wireless OEM Modem Module model BOOMER II**. The measurements were carried out in accordance with the FCC Rules and Regulations Parts 2.1055 and 90.213. The product was evaluated for frequency stability when it was set at the maximum power level.

The Wireless OEM Modem Module is an 800 MHz OEM product for integration into customer end user equipment as an OEM modem and interfaces to it via the data interface port.

The modem provides two available bands: 806-821 MHz and 821-824 MHz. The bands are software controlled and can not be switched by user.

This report presents test data for both frequency bands, 806-821 MHz (Mask G) and 821-824 MHz (Mask H).

Frequency stability was measured at the nominal frequencies of 806 MHz, 815 MHz, 821 MHz, 822.5MHz and 824MHz

Frequency was measured with respect to voltage at 3.5 V, 3.8 V, and 4.1 V supply levels at 25°C at 806MHz, 815MHz, 821MHz, 822.5MHz and 824MHz.

Frequency was measured with respect to Temperature at 3.8 V supply with a temperature range of -30° to +60°.

(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
Ref. Paragraph 2.1055 and 90213	8	1	Passed

INTRODUCTION

General

This report describes the results of the frequency stability measurement conducted on a Wavenet Technologies Wireless OEM Modem Module model BOOMER II.

Test Facility

The evaluation for the compliance was performed for Wavenet Technologies Pty Ltd. 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 2.1055 and 90.213.

Test Equipment

The test equipment used during the evaluation is listed in Table 1 with calibration due dates.

Environmental Conditions

Measurements were conducted in open area test site.

- Temperature: 25 °C ± 2
- Relative Humidity: 30 - 50 %
- Air Pressure: 101 kPa ± 3

This report was written by Jayanta (Jay) Sarkar.

FCC SUBMISSION INFORMATION

FCC ID: PQS-BM28001

Equipment (type): Wireless OEM Modem Module
As Marketed

Model: BOOMER II

For: Certification

Applicant: Wavenet Technologies Pty Ltd.
140 Burswood Rd
Burswood, Perth, WA 6100
AUSTRALIA

Manufacturer: Wavenet Technologies Pty Ltd.
140 Burswood Rd
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AUSTRALIA

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

MANUFACTURER'S DATA

FCC ID No:	PQS-BM28001
Equipment Type:	Wireless OEM Modem Module
Model:	BOOMER II
Reference:	FCC Rules and Regulations Parts 2 and Part 90
Manufacturer:	Wavenet Technologies Pty Ltd
Development Stage of Unit:	Production

GENERAL SPECIFICATIONS

- Frequency Range:
 - 806.00 to 821.00 MHz (Transmitter)
 - 821.00 to 824.00 MHz (Transmitter)
- Measured ERP
 - 1.828 W (32.62 dBm) at frequency 806 MHz for band 806-821 MHz
 - 1.496 W (31.61 dBm) at frequency 821 MHz for band 821-824 MHz
- Emission Designators Per 47 CFR § 2.201 and §2.202
 - 806.00 to 821.00 MHz: 20K0F1D
 - 821.00 to 824.00 MHz: 12K6F1D
- Antenna Impedance: 50 Ohms

Test: Frequency Stability

Ref: FCC Part 2, Paragraph 2.995, and Part 90, Paragraph 90.213

Criteria: a) 2.5 ppm in 806 to 821 MHz Band
b) 1.5 ppm in 821 to 824 MHz Band

Description: Frequency stability is a measure of the frequency drift due to temperature and supply voltage variations, with reference to the frequency measured at + 25°C and rated supply voltage. The RF carrier frequency shall not depart from the reference frequency in excess of as described above in the criteria.

Set-up: See Figure 6

Conditions: See procedure

Equipment: See Table 1

Procedure: See Section 4

DEVICE FREQUENCY STABILITY

Test Data	Roger Lam	Date	12/07/02	DOC No.	
Approved	Ross Clark	Test unit	S/N #2	File No.	

1. Standards.

FCC CFR 47 Ch 1 rules.

Part 2 Required Measurements

Frequency Stability – Procedure, Temperature variation, Voltage variation.

Part 90 Subpart Technical standards.

90.213 Frequency Tolerance

- (a) Maintain carrier frequency within 2.5ppm of assigned frequency in 806 to 821 MHz band and within 1.5 ppm in 821 to 824 MHz band.
- (b) Verify Maximum Power output used for measurement.

Frequency and Output power are both measured at the same time.

These are measured at 806MHz, 815MHz, 821MHz, 822.5 MHz, and 824 MHz

Frequency is measured with respect to Voltage at 3.5V, 3.8V, 4.1V supply levels at 25°C.

Frequency is measured with respect to Temperature at 3.8V supply with a Temperature range of -30°C to +60°C.

2. Cable calibration

The N type cable and Narda directional coupler used from device port to HP8920 I/P

Loss was 0.8dB. for 806 ~ 824MHz.

A calibrated HP8920A and a stable signal generator were used to measure level change from extra insertion loss of cable assembly.

3. Power and Frequency Measurements

Place: Lab at Wavenet Technology, Perth.

Date: 12 07 02

Instruments

Table 1

Instrument Used	Serial Number	Calibrated on
DC Power Supply Agilent	MY40001704	Agilent 1 01 01
Universal Counter Agilent 53131A	US36134925	Agilent 1 02 01
10MHz OCXO Frequency Reference	Asset No.11112	Agilent 15 05 02
Communications analyser HP8920	3541U000513	Agilent 19 9 01
Signal Generator Marconi	119754/012	Agilent 15 05 02
Directional Coupler 0.3 ~ 1.0GHz Narda	38750	---
Temperature Chamber		
Heraeus Votsch VMT 07/35 Temp. chamber	33287	19/10/98
Temperature probe Fluke80TK	AA00094448	21/02/01
Digital Multimeter Agilent 34461A	US36134925	16/05/01

4. Procedure

The Wavenet Boomer II was placed in the Temperature chamber and connected to the instruments outside. Refer to fig 1. for details of test system.

The probe temperature was used to set the chamber exactly.

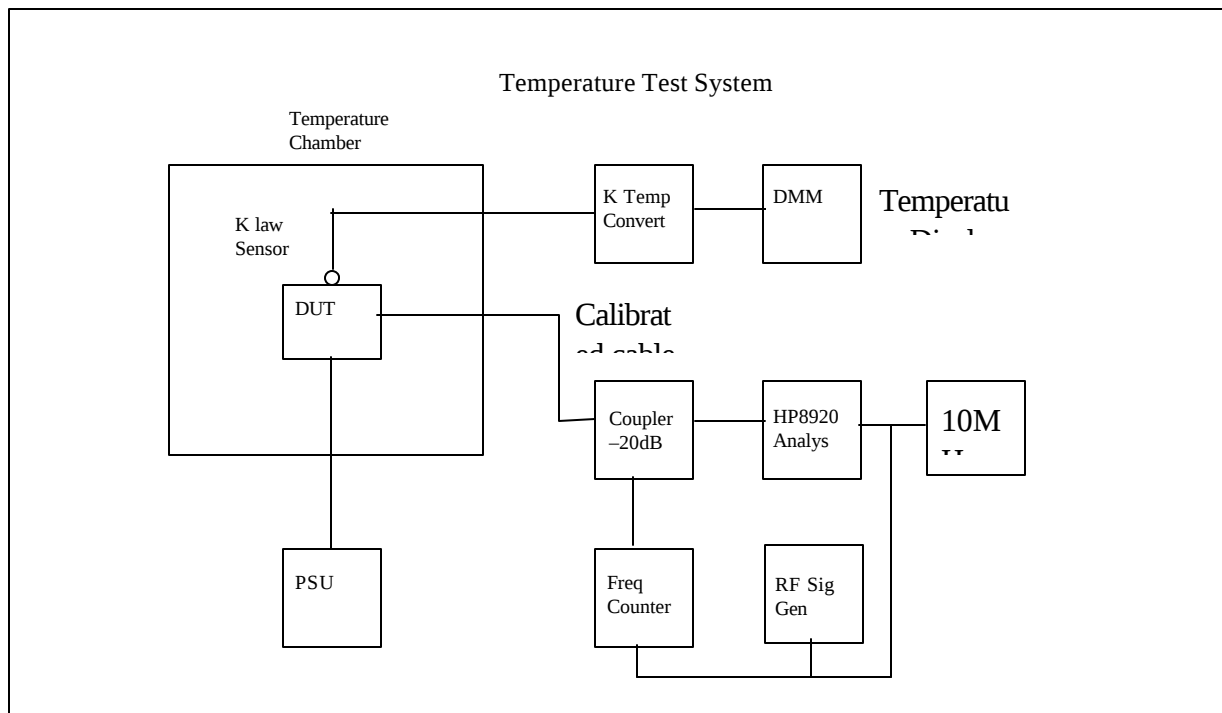
The tests were done once the chamber had stabilised as seen by the Temperature probe. This was 5minutes for the higher temperatures above 0°C and 8 minutes for below 0°C.

The Device was continuously transmitting with a 2 sec TX ON and 8 sec TX OFFcycle.

Modulation was set at RDLAP Symbol Sync (4.8kHz sine wave). (F8 – 6 setting)

The frequency was changed for each 3 frequencies and measurements done for Power and Frequency.

FIGURE 1



Test Set-up

5. Results

806MHz Nominal Frequency at 3.8V

PROBE TEMP	Freq Dev Hz	Freq Dev PPM	O/P Power
-30	682	0.85	33.2
-25	264	0.33	33.2
-20	174	0.33	33.2
-15	240	0.22	33.2
-10	186	0.30	33.2
-5	27	0.23	33.2
0	-58	0.03	33.2
5	-45	-0.07	33.2
10	22	-0.06	33.2
15	52	0.03	33.2
20	143	0.06	33.2
25	10	0.18	33.2
30	-42	0.01	33.2
35	-162	-0.05	33.2
40	-202	-0.20	33.2
45	-265	-0.25	32.1
50	-271	-0.33	33
55	-298	-0.34	33
60	-285	-0.37	32.9

815MHz Nominal Frequency at 3.8V

PROBE TEMP	Freq Dev Hz	Freq Dev PPM	O/P Power
-30	687	0.84	32
-25	265	0.33	32
-20	181	0.22	32
-15	227	0.28	32
-10	190	0.23	32
-5	31	0.04	32
0	-60	-0.07	32
5	-40	-0.05	32
10	27	0.03	32
15	54	0.07	32
20	145	0.18	32
25	8	0.01	32
30	-44	-0.05	32.1
35	-172	-0.21	32.1
40	-209	-0.26	32.1
45	-268	-0.33	32.1
50	-273	-0.33	32.1
55	-301	-0.37	32.1
60	-288	-0.35	32.1

821MHz Nominal Frequency at 3.8V

-30	690	0.84	32.9
-25	274	0.33	32.9
-20	203	0.25	32.9
-15	232	0.28	32.9
-10	204	0.25	32.9
-5	36	0.04	32.9
0	-54	-0.07	32.9
5	32	0.04	32.9
10	32	0.04	32.9
15	56	0.07	33
20	145	0.18	32.9
25	14	0.02	32.9
30	-45	-0.05	32.9
35	-177	-0.22	32.9
40	-205	-0.25	32.9
45	-275	-0.33	32.9
50	-277	-0.34	32.9
55	-304	-0.37	32.9
60	-288	-0.35	33

Output power given in dBm, conducted measurement.

822.5MHz Nominal Frequency at 3.8V

PROBE TEMP	Freq Dev Hz	Freq Dev PPM	O/P Power
-30	695	0.85	32.8
-25	267	0.33	32.8
-20	178	0.22	32.8
-15	242	0.29	32.8
-10	189	0.23	32.8
-5	42	0.05	32.8
0	-60	-0.07	32.8
5	-20	-0.02	32.8
10	20	0.02	32.8
15	58	0.07	32.9
20	145	0.18	32.8
25	8	0.01	32.8
30	-49	-0.06	32.9
35	-162	-0.20	32.9
40	-211	-0.26	32.9
45	-270	-0.33	32.9
50	-277	-0.34	32.9
55	-305	-0.37	32.9
60	-288	-0.35	32.9

824MHz Nominal Frequency at 3.8V

PROBE TEMP	Freq Dev Hz	Freq Dev PPM	O/P Power
-30	695	0.85	32.8
-25	266	0.32	32.8
-20	186	0.23	32.8
-15	250	0.30	32.8
-10	190	0.23	32.8
-5	52	0.06	32.8
0	-60	-0.07	32.8
5	-13	-0.02	32.8
10	25	0.03	32.8
15	60	0.07	32.8
20	143	0.17	32.8
25	12	0.01	32.8
30	-51	-0.06	32.8
35	-154	-0.19	32.8
40	-203	-0.25	32.9
45	-274	-0.33	32.9
50	-278	-0.34	32.9
55	-304	-0.37	32.9
60	-288	-0.35	32.9

Power Output Variation with Supply Voltage

806 to 821MHz band at 25°C

Supply Voltage	Frequency setting	Freq offset Hz	ppm
3.5	806	8	0.01
3.8	806	10	0.01
4.1	806	12	0.01
3.5	815	8	0.01
3.8	815	8	0.01
4.1	815	10	0.01
3.5	821	12	0.01
3.8	821	14	0.02
4.1	821	14	0.02

821 to 824MHz band at 25°C

Supply Voltage	Frequency setting	Freq offset Hz	ppm
3.5	821	12	0.01
3.8	821	14	0.02
4.1	821	14	0.02
3.5	822.5	20	0.02
3.8	822.5	18	0.02
4.1	822.5	18	0.02
3.5	824	14	0.02
3.8	824	12	0.01
4.1	824	13	0.02