

FCC ID: PQS-BM28001

Exhibit 2c

Engineering Report on

Bandwidth (2.1049) Modulation Characteristics (2.1047)



Assessment of Compliance

for

**Measurement of Modulation Characteristics/Occupied Bandwidth in
accordance with the FCC Rules & Regulations Part 2.1047/49 and
90**

Wireless OEM Modem Module Boomer II

Wavenet Technologies Pty Ltd.



August 2002

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

51 Spectrum Way Nepean ON K2R 1E6
Tel: (613) 820-2730 Fax: (613) 820-4161
email: info@aprel.com

Engineering Report

Subject: Measurements of Modulation Characteristics/
Occupied Bandwidth in accordance with the
FCC Rules & Regulations Part 2.1047/49 and 90

FCC ID: PQS-BM28001

Equipment: Wireless OEM Modem Module

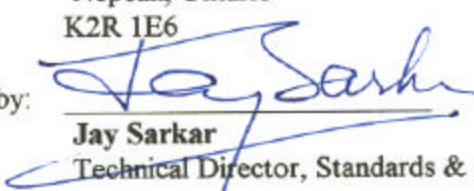
Model: BOOMER-II

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

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

Prepared By: APREL Laboratories,
Regulatory Compliance Division
51 Spectrum Way
Nepean, Ontario
K2R 1E6

Approved by:

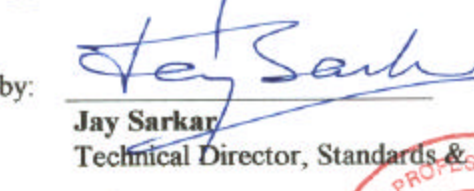

Jay Sarkar

Technical Director, Standards & Certification

Date:

Sept. 12, 2002

Submitted by:

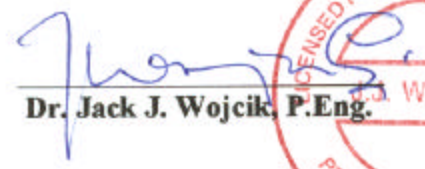

Jay Sarkar

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 2.1047/49 and 90

ENGINEERING SUMMARY

This report contains the results of the Occupied Bandwidth/Bandwidth Limitation 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 Part 2.1049. The product was evaluated for bandwidth 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).

Modulation Characteristics (FCC Rule PART 2.1047): This test is not applicable, as the device is not capable of voice transmission.

This modem has two different profiles type with appropriate settings for data rate, deviation, modulation shaping set for 806-821 MHz G Spectral Mask (MDC 48003, RDLAP 9.6 and RDLAP 19.2) and 821-824 MHz H Spectral mask (RDLAP 9.6).

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
Bandwidth/bandwidth Limitation Ref. Paragraph 2.1049 and 90	8	1	Passed

INTRODUCTION

General

This report describes the results of the occupied bandwidth measurement conducted on a Wavenet Wireless OEM Modem Module, model BOOMER-II.

Test Facility

The tests were 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.

Standard

The evaluation and analysis were conducted in accordance with FCC Rules and Regulations Parts 2.1049/47.

Personnel: The equipment was tested by Roman Kuleba, EMC Engineer. Methodology was developed and the report 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.

Environmental Conditions

Measurements were conducted in the EMC Laboratory.

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

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
Burswood, Perth, WA 6100
AUSTRALIA

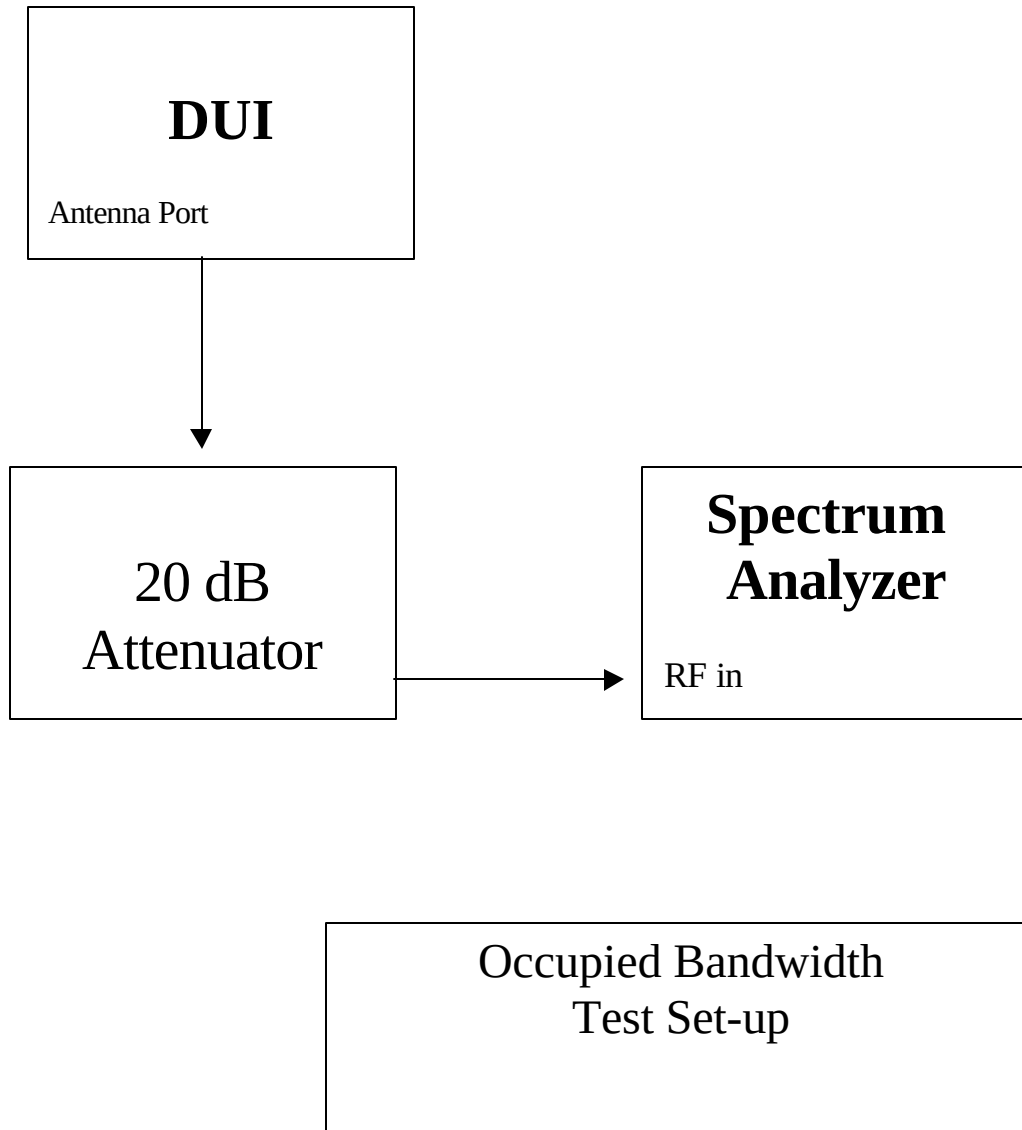
Evaluated by: **APREL Laboratories**
51 Spectrum Way
Nepean, Ontario
Canada K2R 1E6

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
Power Source:	3.6 (nominal) VDC, Lithium Battery
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: Occupied Bandwidth, Emission Mask G, 806 –821 MHz

Ref: FCC Part 90.210 (g) and 2.1049

Criteria: **806 –821 MHz**, Emission Mask G. For transmitters that are not equipped with an audio low-pass filter pursuant to 90.211(b), the power of any emission must be attenuated below the unmodulated carrier power (P) as follows:

- (1) On any frequency removed from the centre of the authorized bandwidth by displacement frequency (f_d in kHz) of more than 5 kHz, but no more than 10 kHz: At least $83 \log (f_d/5)$ dB.
- (2) On any frequency removed from the centre of the authorized bandwidth by a displacement frequency (f_d in kHz) of more than 10 kHz, but no more than 250 percent of the authorized bandwidth: At least $116 \log f_d/6.1$ dB, or $50 + 10 \log (P)$ dB, or 70 dB, whichever is the lesser attenuation.
- (3) On any frequency removed from the centre of the authorized bandwidth by more than 250 percent of the authorized bandwidth: At least $43 + 10 \log (P)$ dB.

Below is the description of the mask for band 806-821 MHz: 1.828 Watts ERP transmitter ($P = 1.828 \text{ W ERP}$)

Frequency (MHz)	Formula	Limit (dB)
-26500	$43+10 \log (P)$	45
-0.050	$43+10 \log (P)$	45
-0.050	$50+10 \log (P)$	52
-0.0175	$116 \log (f_d / 6.1)$	53
-0.010	$116 \log (f_d / 6.1)$ or $83 \log(f_d/5)$	25
-0.005	$83 \log(f_d/5)$	0
0.005	$83 \log(f_d/5)$	0
0.010	$116 \log (f_d / 6.1)$ or $83 \log(f_d/5)$	25
0.0175	$116 \log (f_d / 6.1)$	53
0.050	$50+10 \log (P)$	52
0.050	$43+10 \log (P)$	45
26500	$43+10 \log (P)$	45

Test: Occupied Bandwidth, Emission Mask H, 821 –824 MHz

Ref: FCC Part 90.210 (h) and 2.1049

Criteria: **821 –824 MHz**, Emission Mask H. For transmitters that are not equipped with an audio low-pass filter pursuant to 90.211(b), the power of any emission must be attenuated below the unmodulated carrier power (P) as follows:

- (1) On any frequency removed from the centre of the authorized bandwidth by a displacement frequency (f_d in kHz) of 4 kHz or less: Zero dB.
- (2) On any frequency removed from the centre of the authorized bandwidth by a displacement frequency (f_d in kHz) of more than 4 kHz, but no more than 8.5 kHz: At least $107 \cdot \log(f_d/4)$ dB.
- (3) On any frequency removed from the centre of the authorized bandwidth by a displacement frequency (f_d in kHz) of more than 8.5 kHz, but no more than 15 kHz: At least $40.5 \cdot \log(f_d/1.16)$ dB.
- (4) On any frequency removed from the centre of the authorized bandwidth by a displacement frequency (f_d in kHz) of more than 15 kHz, but no more than 25 kHz: At least $116 \cdot \log(f_d/6.1)$ dB.
- (5) On any frequency removed from the centre of the authorized bandwidth by more than 25 kHz: At least $43 + 10 \cdot \log(P)$ dB.

Below is the description of the mask for band 821-824 MHz: 1.496 Watts ERP transmitter (P= 1.496 W ERP)

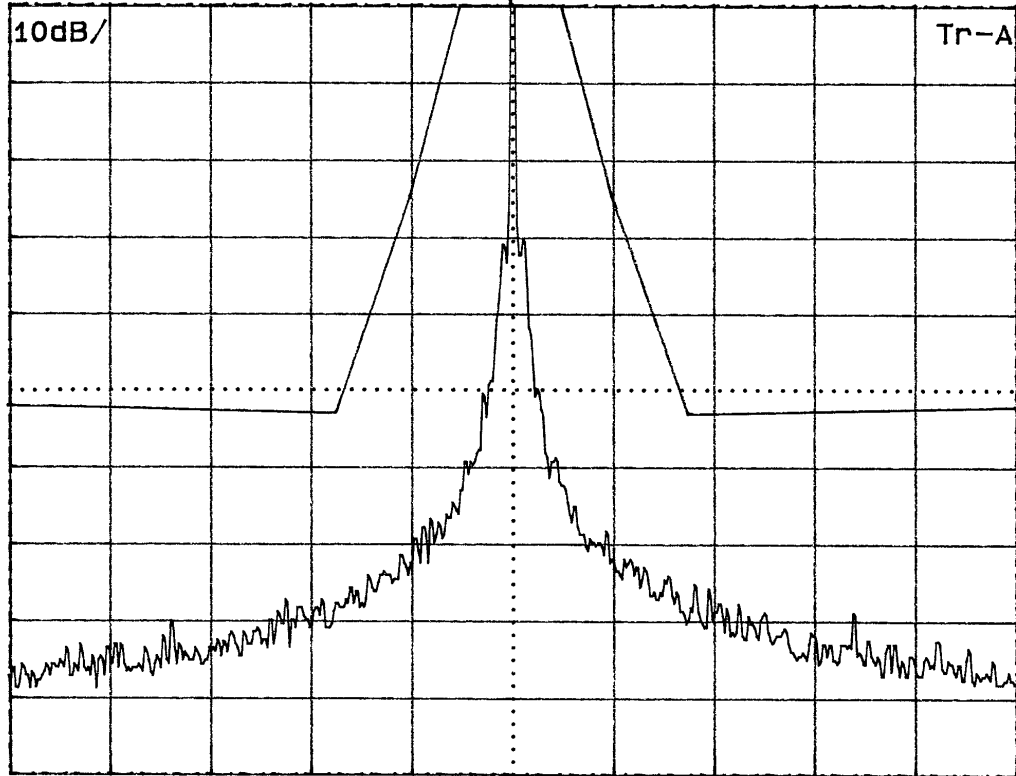
Frequency (MHz)	Formula	Limit (dB)
-26500	$43+10 \log(P)$	71
-0.0250	$116 \log(f_d / 6.1)$	71
-0.0150	$40.5 \log(f_d / 1.16)$ or $116 \log(f_d / 6.1)$	45
-0.0085	$107 \log(f_d / 4)$ or $40.5 \log(f_d / 1.16)$	35
-0.0040	$107 \log(f_d / 4)$	0
0.0000	0	0
0.0040	$107 \log(f_d / 4)$	0
0.0085	$107 \log(f_d / 4)$ or $40.5 \log(f_d / 1.16)$	35
0.0150	$40.5 \log(f_d / 1.16)$ or $116 \log(f_d / 6.1)$	45
0.0250	$116 \log(f_d / 6.1)$	71
26500	$43+10 \log(P)$	71

Occupied Bandwidth – Test Results

Wireless OEM Modem Module WaveNet BOOMER-II

806 – 821 MHz Frequency Band Mask G

MKR: 806.0002MHz WaweNet Boomer II
12.69dBm RB 100Hz# AT 30dB Band auto
RLV: 12.70dBm VB 3kHz# ST 30s

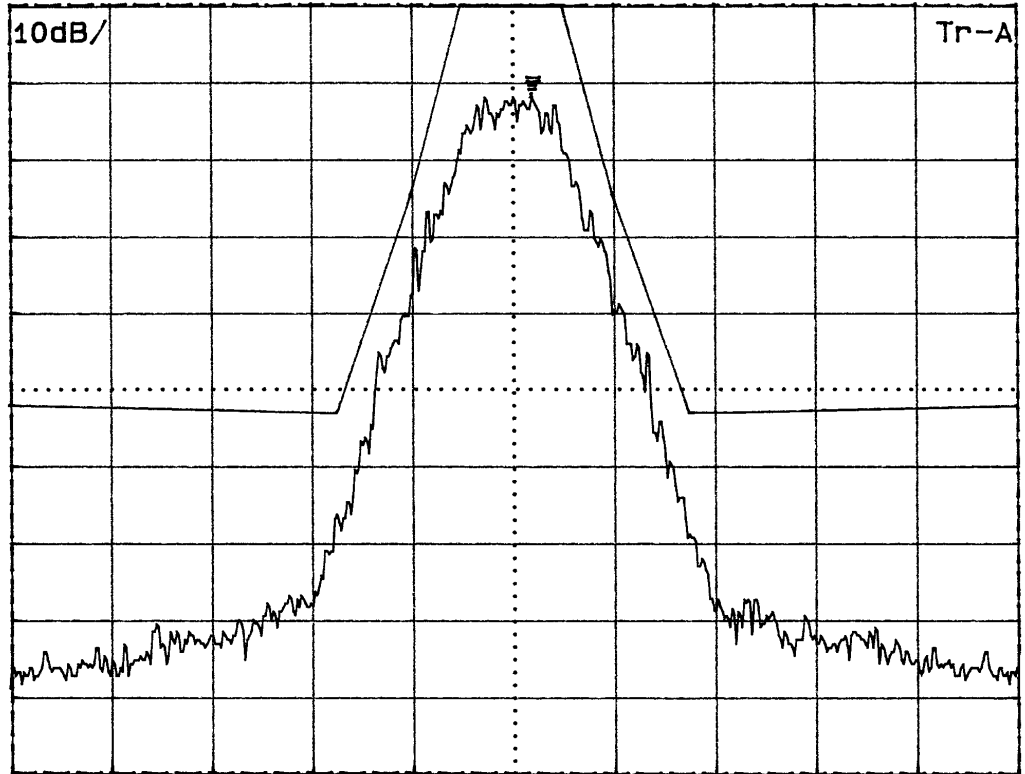


CF: 806.0000MHz

Span: 100kHz

Occupied Bandwidth
Unmodulated Carrier
Mask G
Transmitting Frequency: 806 MHz

MKR: 806.0020MHz WaweNet Boomer II
0.48dBm RB 100Hz# AT 30dB Band auto
RLV: 12.70dBm VB 3kHz# ST 30s

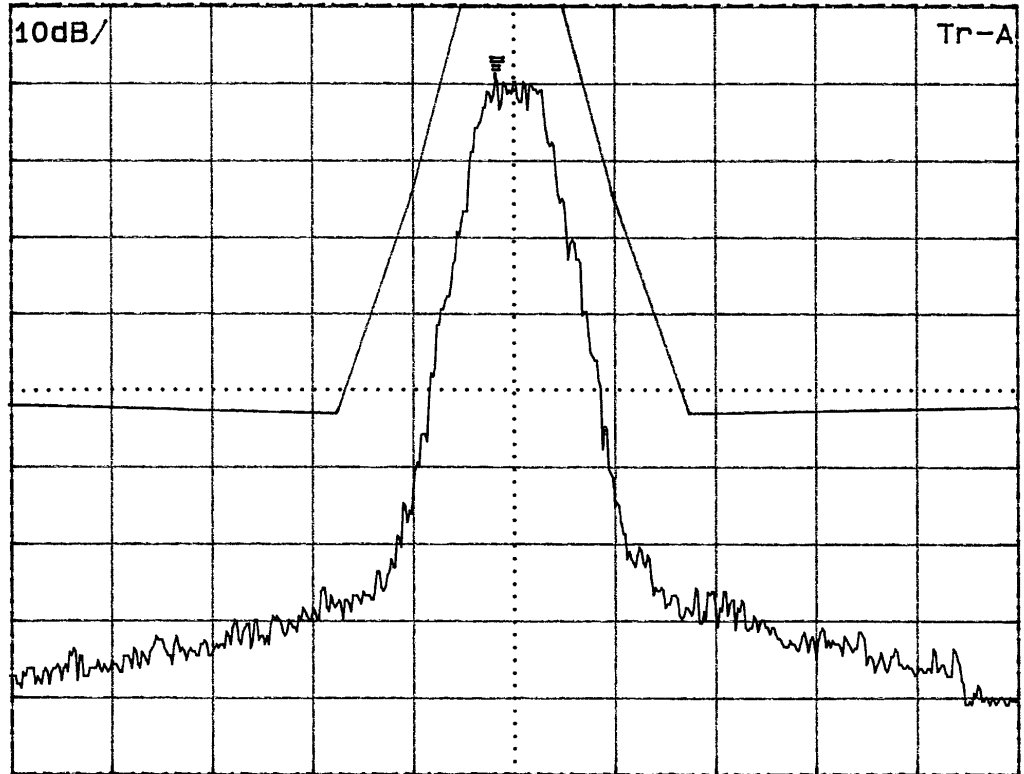


CF: 806.0000MHz

Span: 100kHz

Occupied Bandwidth
Modulated Carrier: RD-LAP 19.2 kbps
Mask G
Transmitting Frequency: 806 MHz

MKR: 805.9984MHz WaweNet Boomer II
2.87dBm RB 100Hz# AT 30dB Band auto
RLV: 12.70dBm VB 3kHz# ST 30s

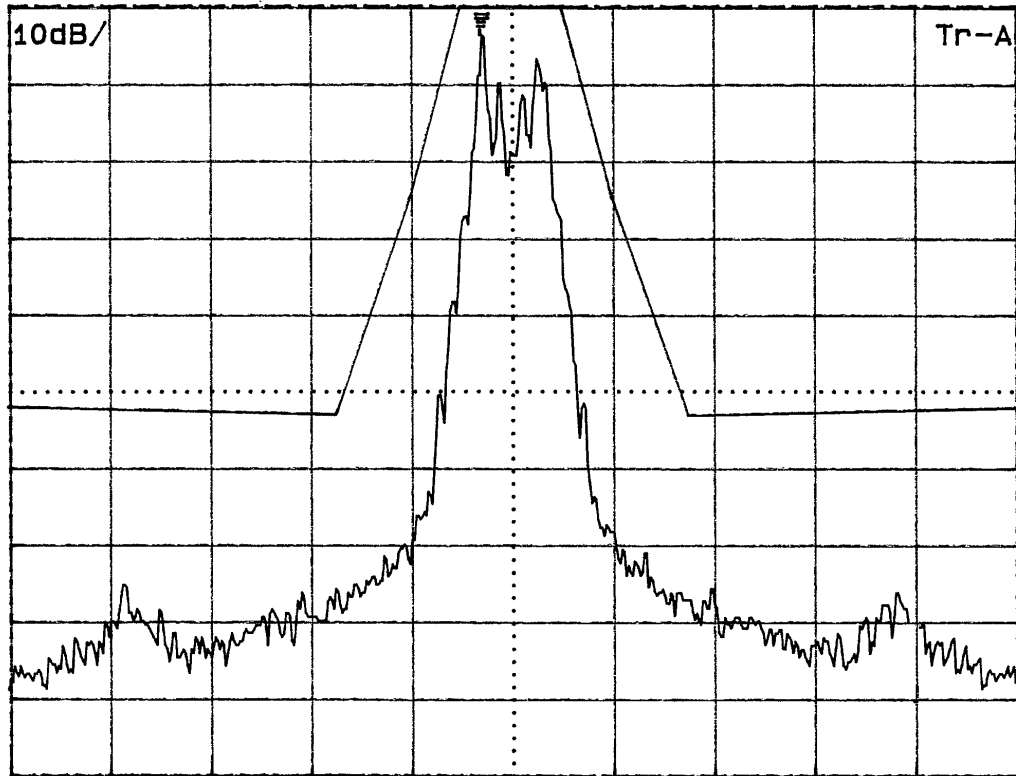


CF: 806.0000MHz

Span: 100kHz

Occupied Bandwidth
Modulated Carrier: RD-LAP 9.6 kbps
Mask G
Transmitting Frequency: 806 MHz

MKR: 805.9972MHz WaweNet Boomer II
8.72dBm RB 100Hz# AT 30dB Band auto
RLV: 12.70dBm VB 3kHz# ST 30s

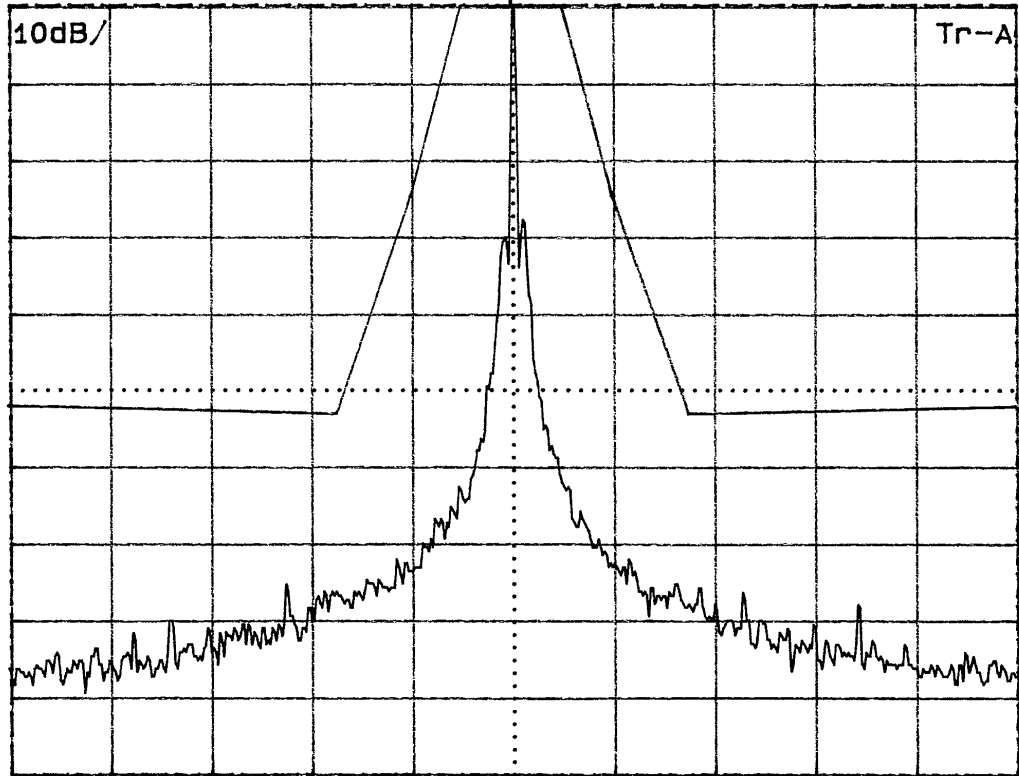


CF: 806.0000MHz

Span: 100kHz

Occupied Bandwidth
Modulated Carrier: MDC 4.8 kbps
Mask G
Transmitting Frequency: 806 MHz

MKR: 815.0002MHz WaweNet Boomer II
12.50dBm RB 100Hz# AT 30dB Band auto
RLV: 12.50dBm VB 3kHz# ST 30s

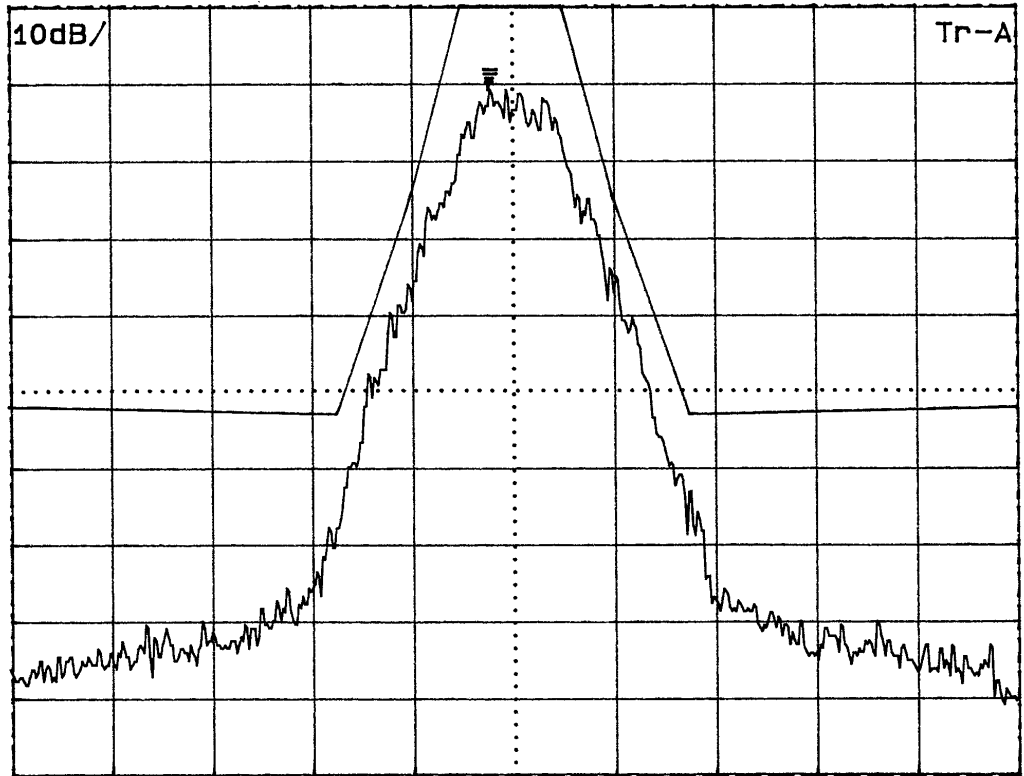


CF: 815.0000MHz

Span: 100kHz

Occupied Bandwidth
Unmodulated Carrier
Mask G
Transmitting Frequency: 815 MHz

MKR: 814.9980MHz WaweNet Boomer II
1.17dBm RB 100Hz# AT 30dB Band auto
RLV: 12.50dBm VB 3kHz# ST 30s

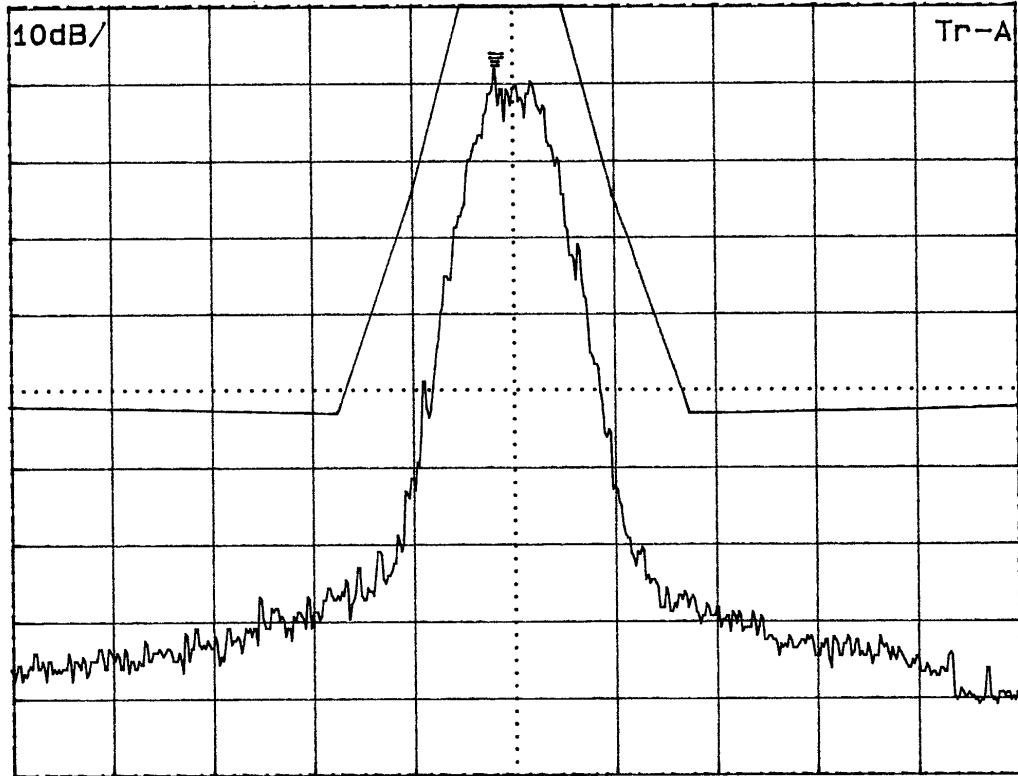


CF: 815.0000MHz

Span: 100kHz

Occupied Bandwidth
Modulated Carrier: RD-LAP 19.2 kbps
Mask G
Transmitting Frequency: 815 MHz

MKR: 814.9984MHz WaweNet Boomer II
3.28dBm RB 100Hz# AT 30dB Band auto
RLV: 12.50dBm VB 3kHz# ST 30s

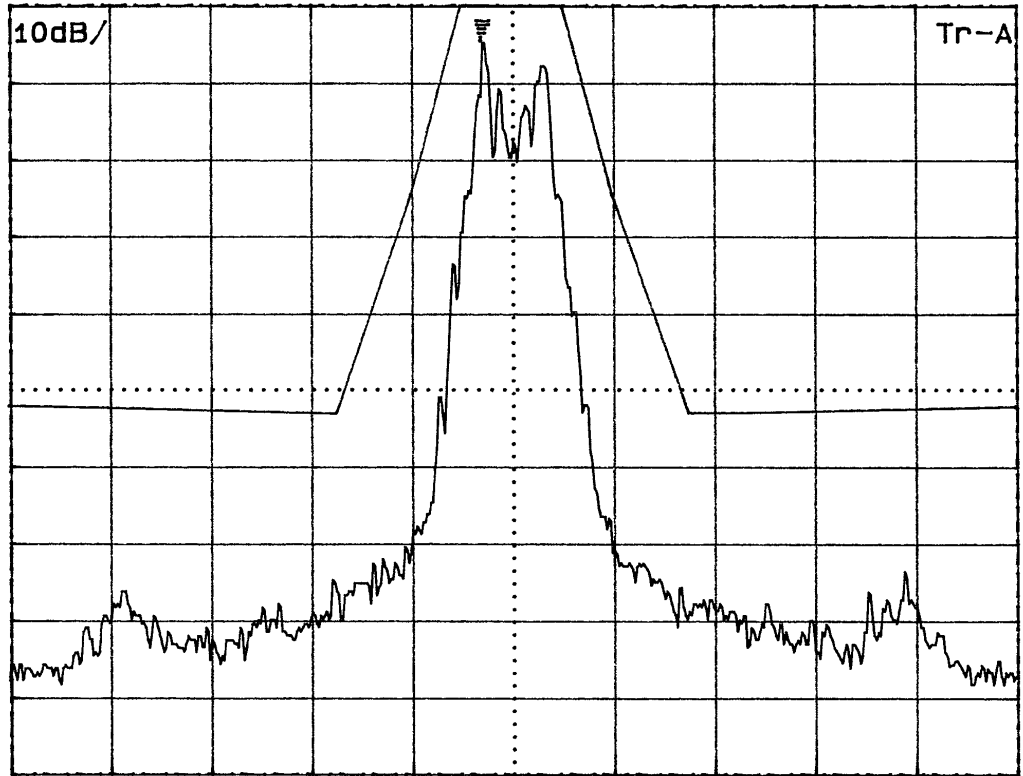


CF: 815.0000MHz

Span: 100kHz

Occupied Bandwidth
Modulated Carrier: RD-LAP 9.6 kbps
Mask G
Transmitting Frequency: 815 MHz

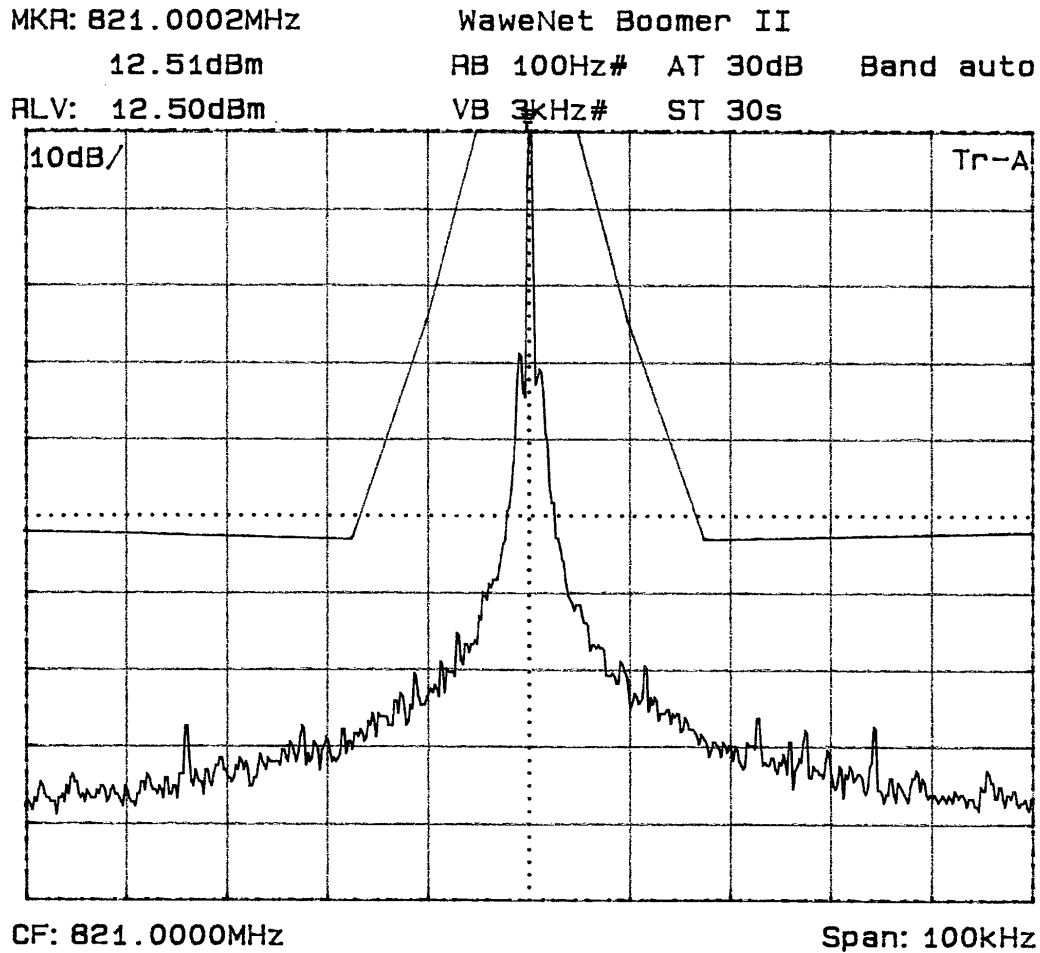
MKR: 814.9972MHz WaweNet Boomer II
7.33dBm RB 100Hz# AT 30dB Band auto
RLV: 12.50dBm VB 3kHz# ST 30s



CF: 815.0000MHz

Span: 100kHz

Occupied Bandwidth
Modulated Carrier: MDC 4.8 kbps
Mask G
Transmitting Frequency: 815 MHz



Occupied Bandwidth
Unmodulated Carrier
Transmitting Frequency: 821 MHz
Mask G

MKR: 821.0034MHz

WaveNet Boomer II

1.79dBm

RB 100Hz#

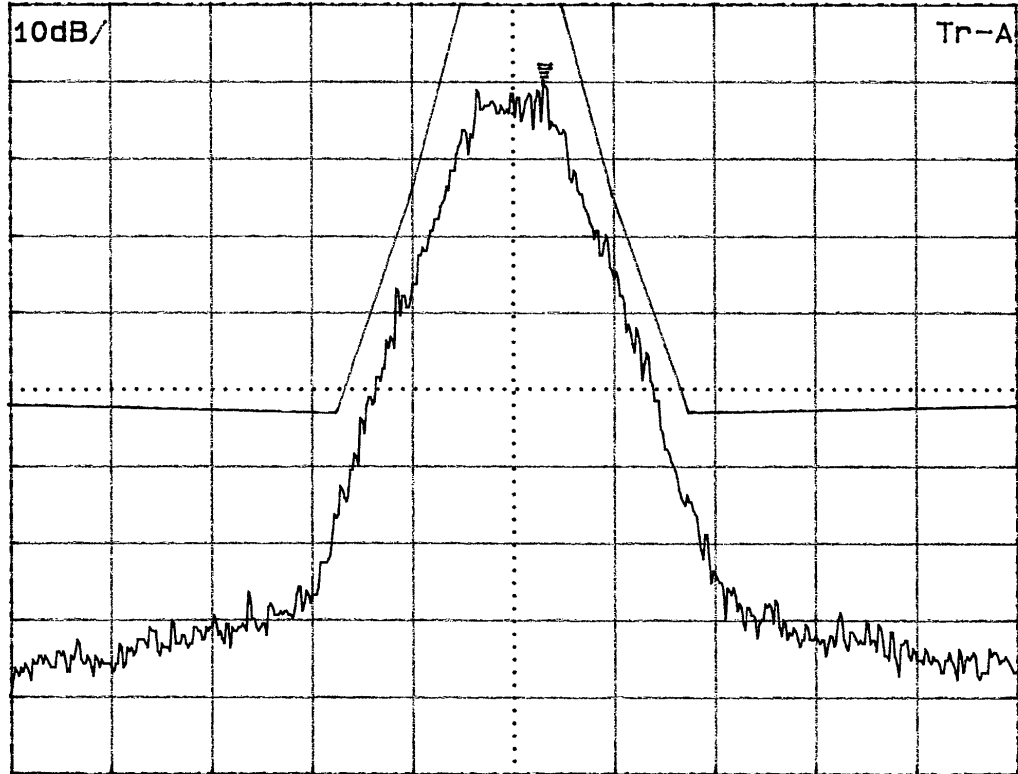
AT 30dB

Band auto

RLV: 12.50dBm

VB 3kHz#

ST 30s

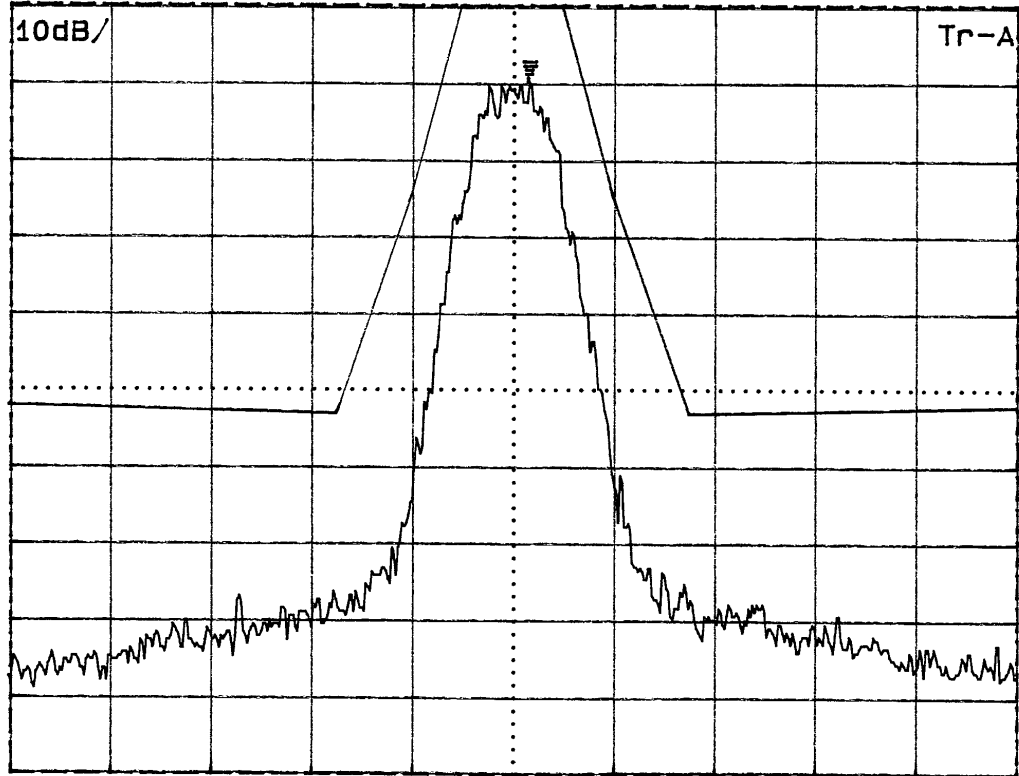


CF: 821.0000MHz

Span: 100kHz

Occupied Bandwidth
Modulated Carrier: RD-LAP 19.2 kbps
Transmitting Frequency: 821 MHz
Mask G

MKR: 821.0018MHz WaweNet Boomer II
2.20dBm RB 100Hz# AT 30dB Band auto
RLV: 12.50dBm VB 3kHz# ST 30s

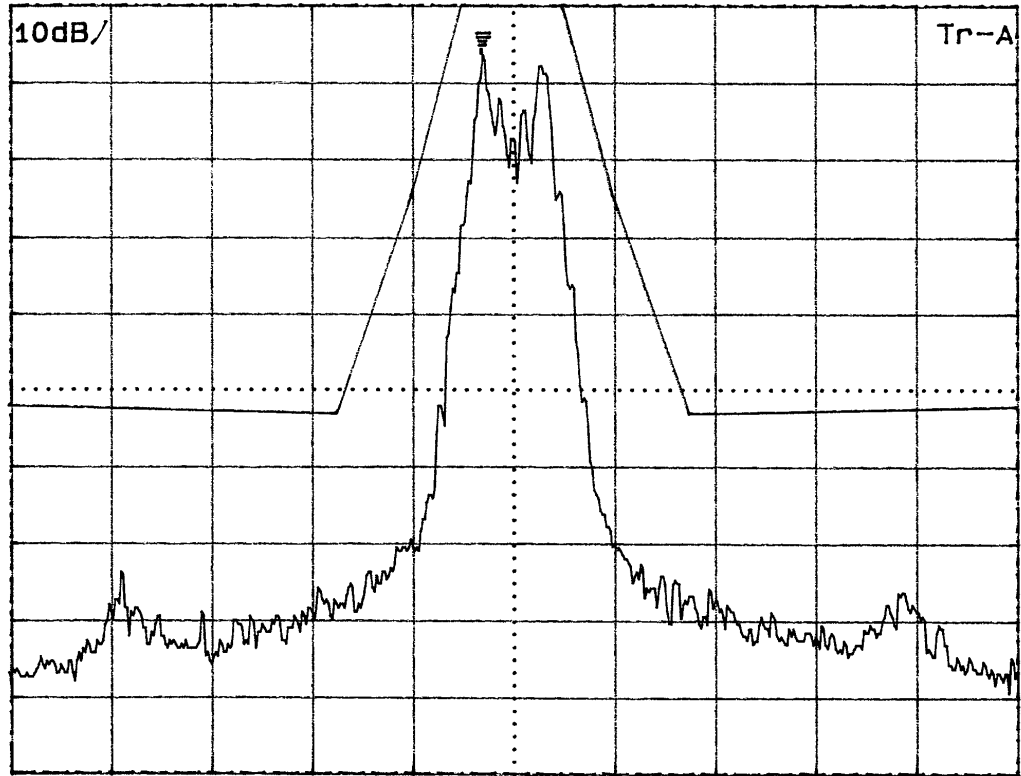


CF: 821.0000MHz

Span: 100kHz

Occupied Bandwidth
Modulated Carrier: RD-LAP 9.6 kbps
Transmitting Frequency: 821 MHz
Mask G

MKR: 820.9972MHz WaweNet Boomer II
5.86dBm RB 100Hz# AT 30dB Band auto
RLV: 12.50dBm VB 3kHz# ST 30s



CF: 821.0000MHz

Span: 100kHz

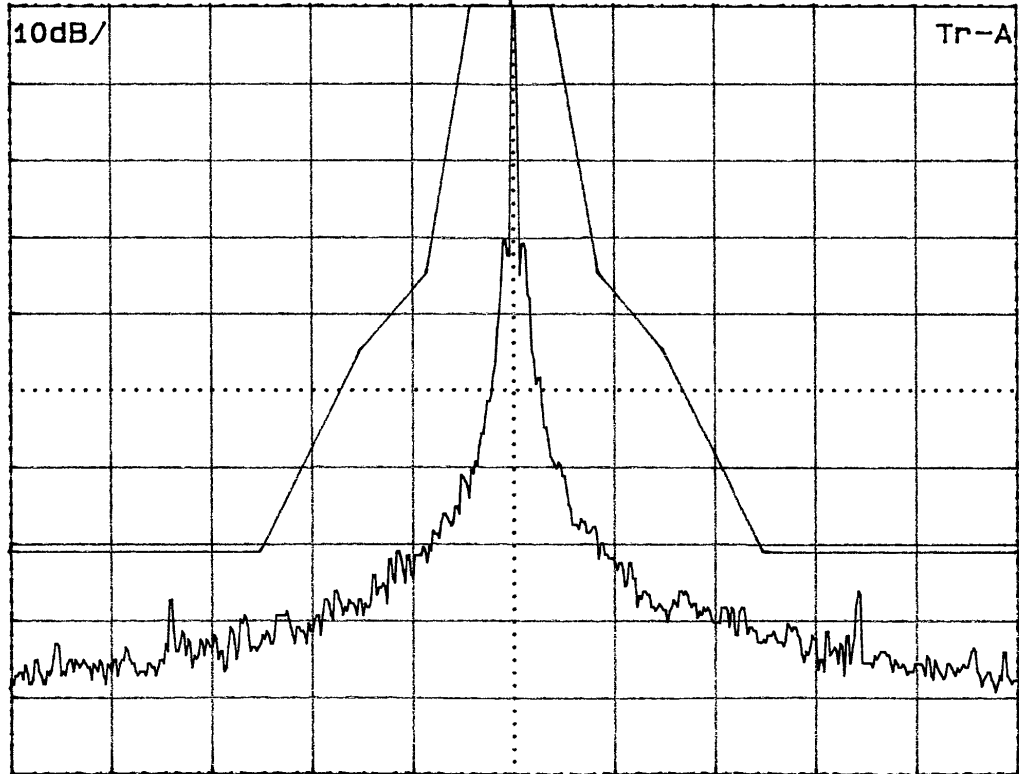
Occupied Bandwidth
Modulated Carrier: MDC 4.8 kbps
Transmitting Frequency: 821 MHz
Mask G

Occupied Bandwidth – Test Results

Wireless OEM Modem Module WaveNet BOOMER-II

821 – 824 MHz Frequency Band Mask H

MKR: 821.0002MHz WaweNet Boomer II
12.51dBm RB 100Hz# AT 30dB Band auto
RLV: 12.50dBm VB 3kHz# ST 30s



CF: 821.0000MHz

Span: 100kHz

Occupied Bandwidth
Unmodulated Carrier
Transmitting Frequency: 821 MHz
Mask H

MKR: 821.0018MHz

WaveNet Boomer II

2.20dBm

RB 100Hz#

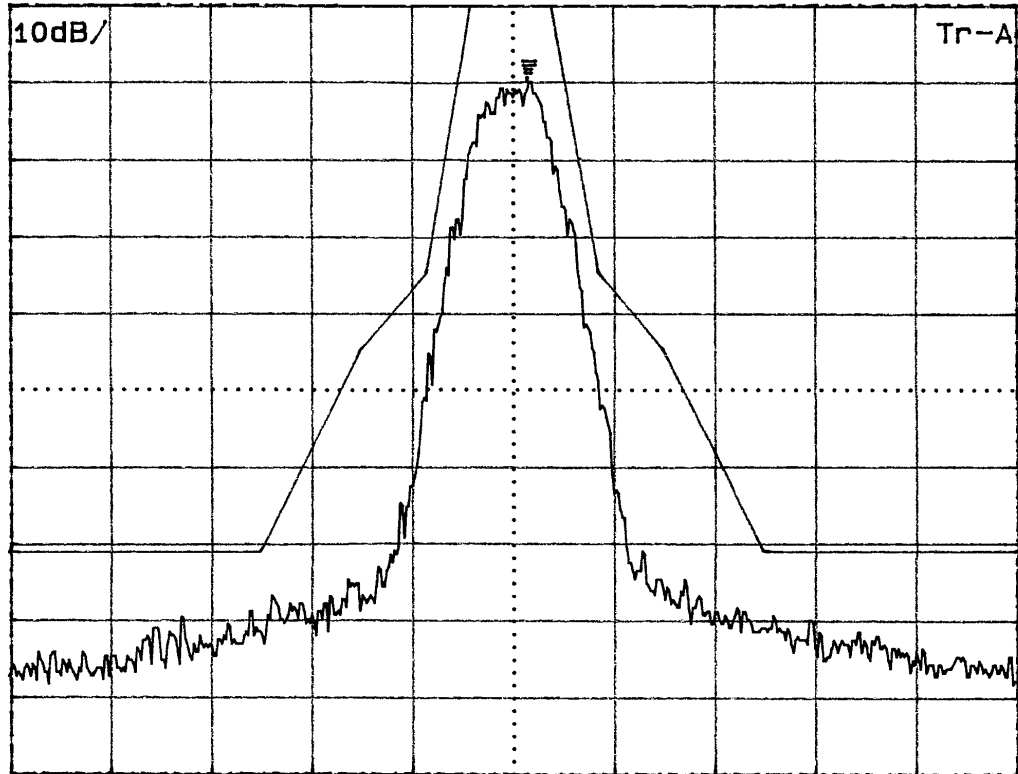
AT 30dB

Band auto

RLV: 1 .50dBm

VB 3kHz#

ST 30s

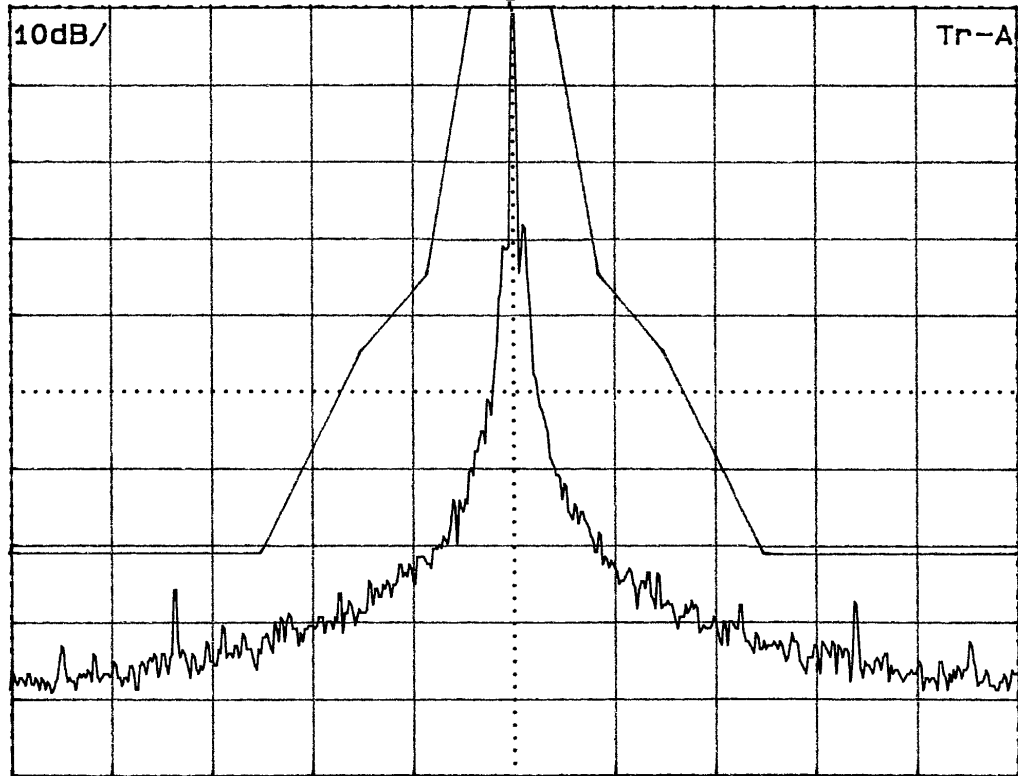


CF: 821.0000MHz

Span: 100kHz

Occupied Bandwidth
Modulated Carrier: RD-LAP 9.6 kbps
Transmitting Frequency: 821 MHz
Mask H

MKR: 822.5002MHz WaweNet Boomer II
12.51dBm RB 100Hz# AT 30dB Band auto
RLV: 12.50dBm VB 3kHz# ST 30s

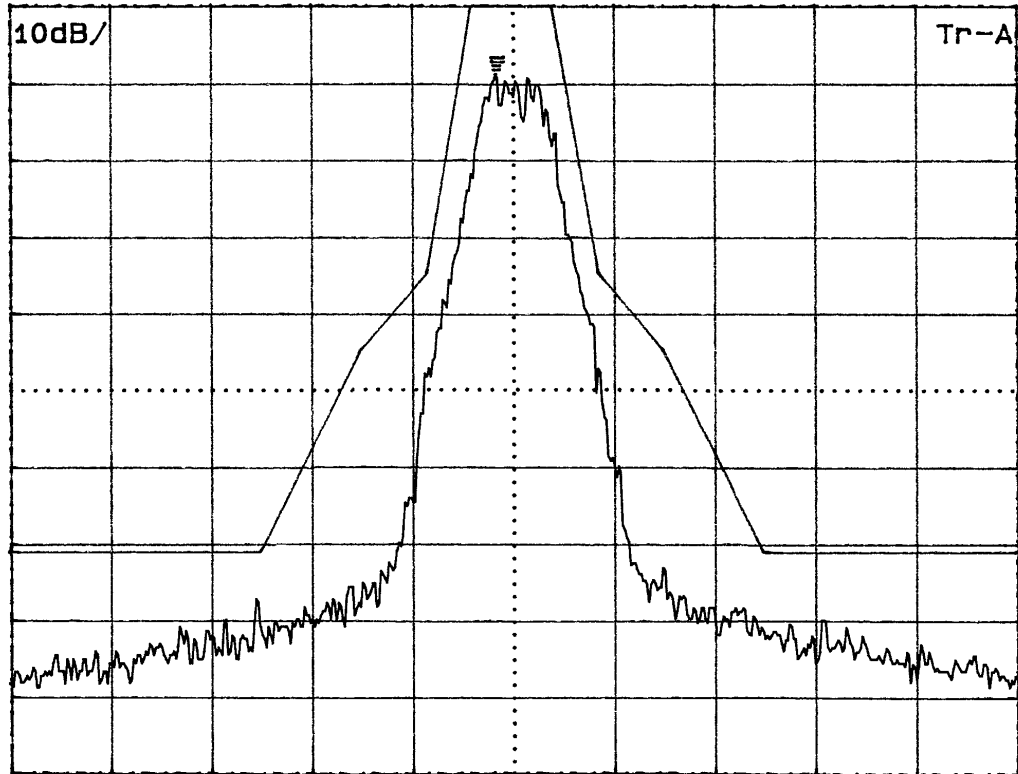


CF: 822.5000MHz

Span: 100kHz

Occupied Bandwidth
Unmodulated Carrier
Transmitting Frequency: 822.5 MHz
Mask H

MKR: 822.4984MHz WaweNet Boomer II
2.94dBm RB 100Hz# AT 30dB Band auto
RLV: 12.50dBm VB 3kHz# ST 30s

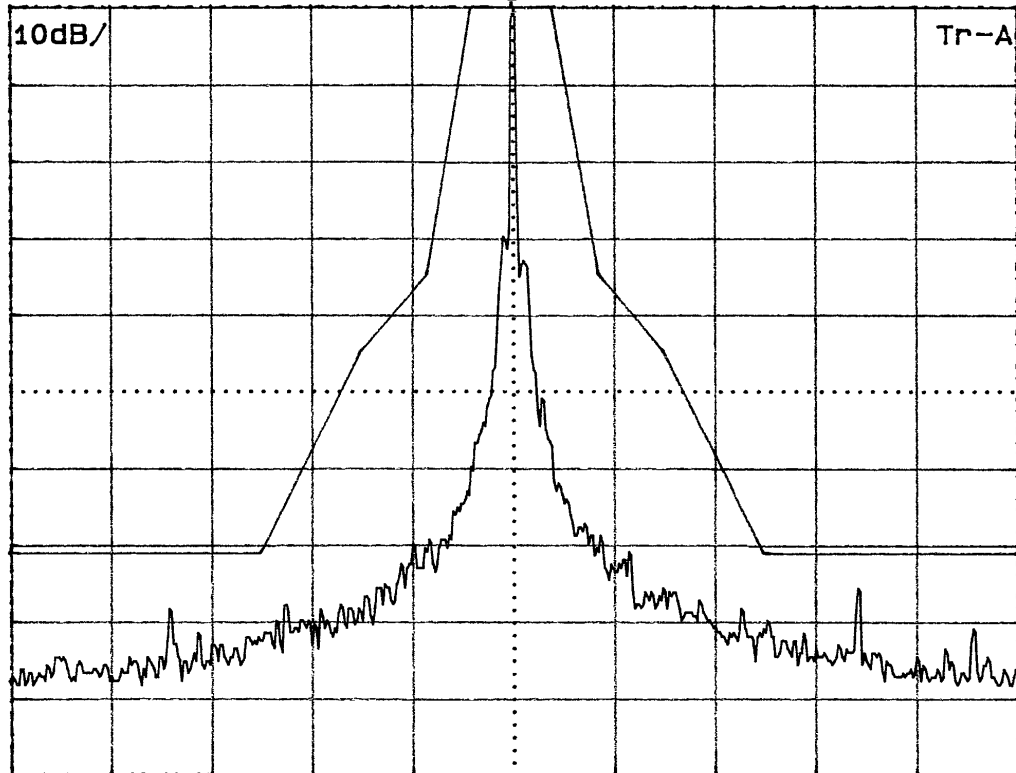


CF: 822.5000MHz

Span: 100kHz

Occupied Bandwidth
Modulated Carrier: RD-LAP 9.6 kbps
Transmitting Frequency: 822.5 MHz
Mask H

MKR: 824.0002MHz WaweNet Boomer II
12.48dBm RB 100Hz# AT 30dB Band auto
RLV: 12.50dBm VB 3kHz# ST 30s



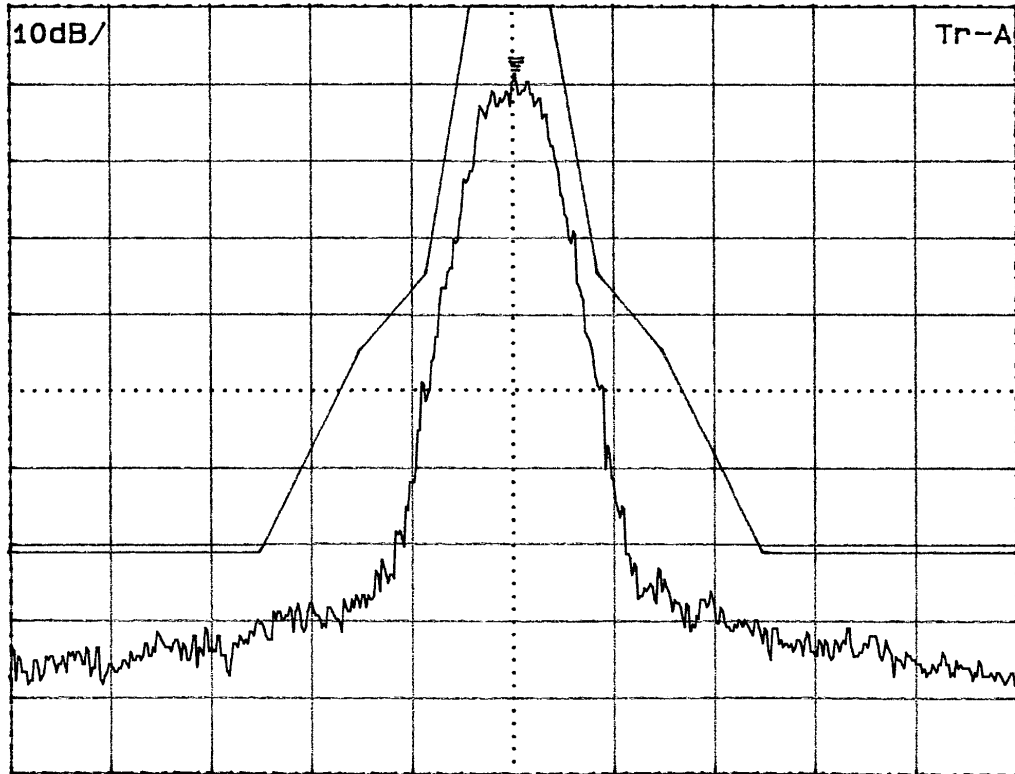
CF: 824.0000MHz

Span: 100kHz

Occupied Bandwidth

Unmodulated Carrier
Transmitting Frequency: 824 MHz
Mask H

MKR: 824.0004MHz WaweNet Boomer II
2.60dBm RB 100Hz# AT 30dB Band auto
RLV: 12.50dBm VB 3kHz# ST 30s



CF: 824.0000MHz

Span: 100kHz

Occupied Bandwidth
Modulated Carrier: RD-LAP 9.6 kbps
Transmitting Frequency: 824 MHz
Mask H

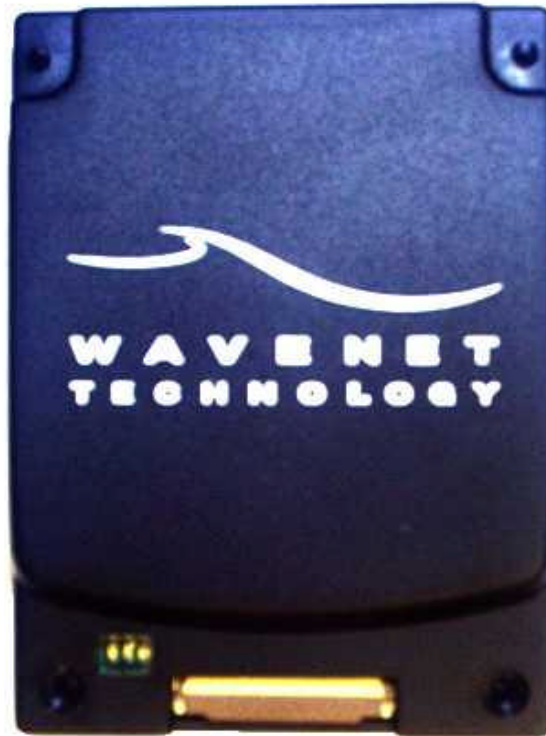
Test Equipment

List of Equipment used

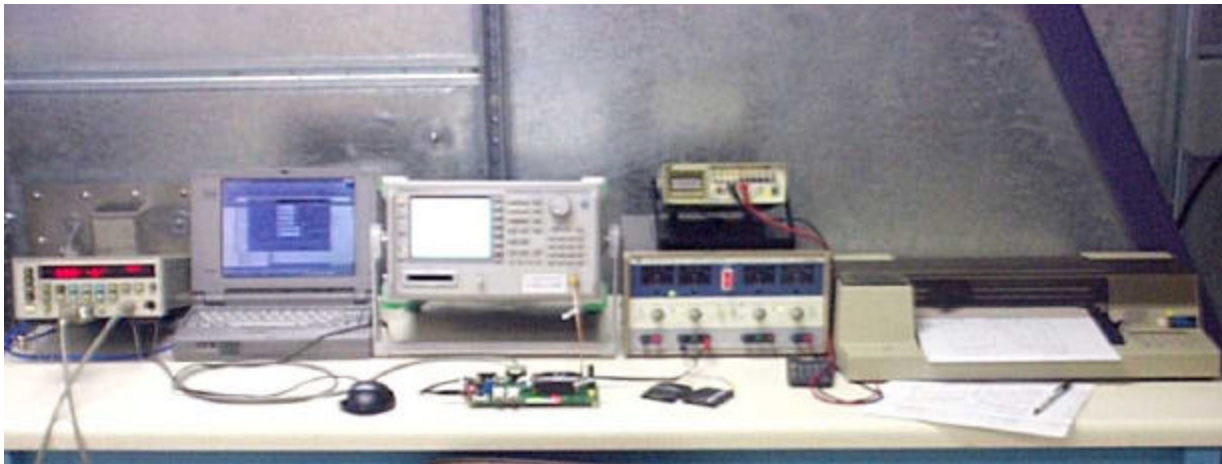
Description	Manufacturer	Model #	Asset #	Calibration Due Data
Spectrum Analyzer	Anritsu	MS2667C	301436	Sep, 2002
Power Meter	Rhode & Schwarz	NRVS	100851	Oct, 2002
20 dB Attenuator	Narda	4774-20	301533	CBT

Appendix

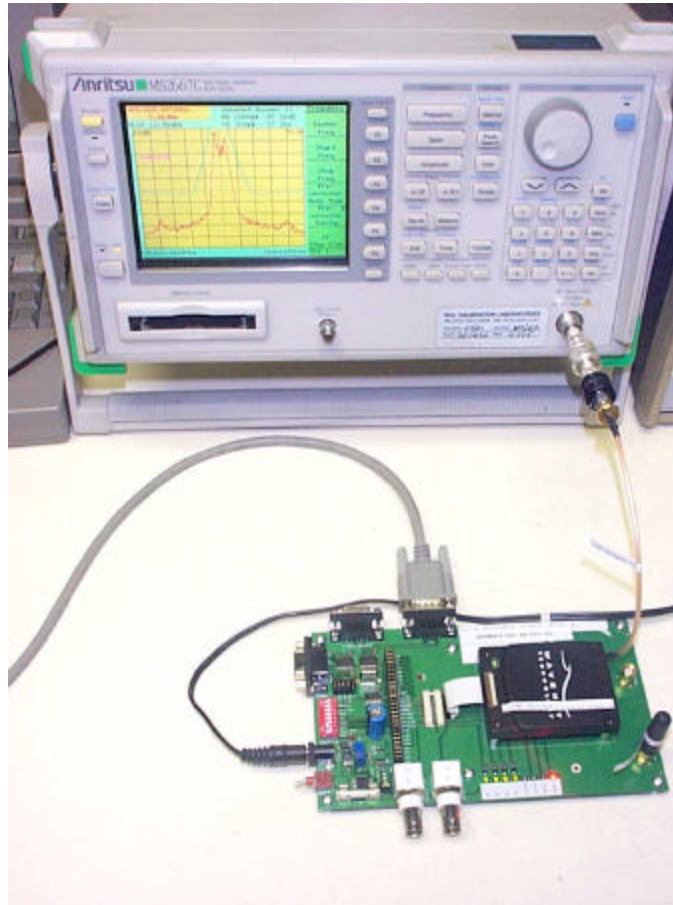
Photographs



**Wireless OEM Modem Module
WaveNet BOOMER-II**



Occupied Bandwidth – Testing Setup



**Testing Occupied Bandwidth on
Wireless OEM Modem Module
WaveNet BOOMER-II**