Engineering Exhibit in Support of
Class II Permissive Change Request
FCC Form 731

for the

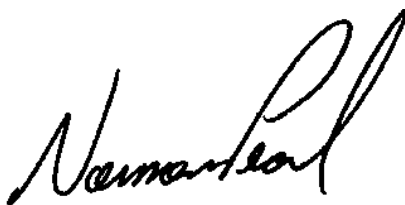**Mobile Data Platform Transceiver (800 MHz MDP)**

With the

Dataradio Gemini Modem

FCC ID: EOTGPDB
Trade Name: GEMINI/PD

November 9, 2001

AFFIDAVIT

The technical data included in this report has been accumulated through tests that were performed by me or by engineers under my direction. To the best of my knowledge, all of the data is true and correct.

_____

Norman D Pearl
Vice-president Engineering, Dataradio Inc.

Dataradio Inc.
Montreal, Canada

ENGINEERING STATEMENT
OF CONSTANTIN PINTILEI

The application consisting of the attached engineering exhibit and associated FCC form 731 has been prepared in support of a request for a Class II Permissive Change for EOTGPDB.

The certification EOTGPDB has been granted to Dataradio Inc for its Gemini/PD radio modem. Gemini/PD is comprised of the Dataradio COR Ltd. (DRL) Mobile Data Platform (MDP) 800 MHz Transceiver with the Dataradio Inc Gemini Modem. Dataradio Inc does the final assembly and markets the Gemini/PD unit. The EOTGPDB certificate has been granted for a 2-level FSK (DGMSK) and a 4-level FSK (SRRC4FSK) types of modulation scheme. The proposed digital filtering (RC4FSK) scheme will allow a 32kbps/16ksps data rate. This change involves the firmware only, with no change whatsoever occurring in the hardware. The opportunity will also be used to correct the text of the certification note.

EXISTING CONDITIONS

The unit utilized for these occupied bandwidth and mask-compliance measurements was a prototype built from production EOTGPDB with beta-level firmware used to create the modulation scheme. The transceiver operates on frequencies ranging from 806.000 MHz to 824.000 MHz. The frequency tolerance of the transceiver is .00015% or 1.5 parts per million as granted in EOTGPDB.
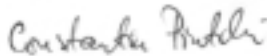
PROPOSED CONDITIONS

It is proposed to accept the request for the GEMINI/PD, 806-824 MHz Transceiver/Modem/GPS for operation in the band of frequencies previously outlined. The applicant anticipates marketing the device for use in wireless transmission of data.

PERFORMANCE MEASUREMENTS

All measurements for Occupied Bandwidth and mask compliance as per 2.1043 (b)(2) were conducted in accordance with the Rules and Regulations Section 2.1041and 2.1049 of Rules Service Co rev.2-158, Mar 15,2001. Equipment performance measurements were made in the engineering laboratory located at 5500 Royalmount ave, Montreal, Canada. All measurements were made and recorded by myself or under my direction. The performance measurements were made between Oct 19, 2001 and Oct 23,2001

CONCLUSION

Given the results of the measurements contained herein, the applicant requests to have accepted the Class II Permissive Change for the Certificate EOTGPDB, as per FCC part 2.1043(b)(2), in order to market the new digital speed of 32kbps. The note on the certificate should read "Device must operate with a maximum transmission duty factor not exceeding 25%, controlled by protocol firmware." to be correct.

_____10/24/01

Constantin Pintilei, Eng
R&D Test Engineer, Dataradio Inc.

TABLE OF CONTENTS

ANNEXES:

Annex A: Instruction Manual

QUALIFICATIONS OF ENGINEERING PERSONNEL

NAME:	**Norman Pearl**
TITLE:	Vice-president Engineering
TECHNICAL EDUCATION:	Bachelor of Engineering (Electrical) (1979) McGill University, Montreal, Canada.
TECHNICAL EXPERIENCE:	Professional engineer since 1979 25 Years experience in radio communications

NAME:	**Constantin Pintilei**
TITLE:	R&D Test Engineer
TECHNICAL EDUCATION:	Bachelor of Science Degree in Radiotechnique Electronic Engineering (1993) Technical University of Iasi, Romania.
TECHNICAL EXPERIENCE:	Professional Engineer since Sep, 2001 8 Years experience in radio frequency measurements.

CLASS II PERMISSIVE CHANGE INFORMATION REQUESTED BY GRANTEE - Rule part 2.1043 (b)(2)

The certification EOTGPDB has been granted to Dataradio Inc for its Gemini/PD radio modem. Gemini/PD is comprised of the Dataradio COR Ltd. (DRL) Mobile Data Platform (MDP) 800 MHz Transceiver with the Dataradio Inc Gemini Modem. Dataradio Inc does the final assembly and markets the Gemini/PD unit. The certificate, comprising its several Class II permissive changes already underwent, has been granted for a 2-level FSK , DGMSK – Differential Gaussian Minimum Shift Keying, with three emission designators 8K60, 15K0 , 15K3F1D and 4-level FSK, SRRC4FSK –Squared Root Raised Cosine 4-level Frequency Shift Keying, with four emission designators 10K0,11K0, 15K6 and 16K0 F1D.

The change consists of the addition of another digital filtering, RC4FSK Raised Cosine at 4FSK, used at a bit rate of 32kbps. This modulation permits signaling at a higher baud rate while fitting the requirements of Mask G with improved signal-to -noise (data sensitivity) performance. Only the operating firmware is being changed to produce both 2-level and 4 level FSK modulator signal with their appropriate digital filters. There are no hardware changes involved in either the radio or the modem/controller circuits. Also there are no changes in those modules of the firmware that control the transceiver.

Its emission designator, 15K3F1D does not need to be explicitly specified since 15K3 occupied bandwidth is already approved. Following the FCC part 2.1043(b)(2) rule, in order to market the proposed change we must obtain the acknowledgment of the Commission that the change is acceptable. Therefore a Class II Permissive Change request has been considered.

The characteristics affected are :
Digital Modulation Techniques   - part 2.1033.(c)(13)
Occupied bandwidth and mask compliance requirement - part 2.1049,90.210(h)

They are entirely documented with the current report.

Because this change is implemented in the operating firmware only, there are no change whatsoever occurring in schematics, part list, mechanical assembly, shape, label or any other hardware related issues. A preliminary version of the manual that contains service-related information for 4 level FSK modulation is provided as appendix of the report.

The proposed correction for the text of the note relates to the MPE assessment of the unit. A report demonstrating the MPE compliance of the unit issued by Aprel Laboratories in Feb 6, 2001was submitted on Mar 9,2001 as attachment to the application EA100290. This report supersedes the assumption of "categorical exclusion requirements of 2.1091" since it is the environmental evaluation for RF exposure as required by 2.1093(c). The proposed content of the second sentence of the note is: "Device must operate with a maximum transmission duty factor not exceeding 25%, controlled by protocol firmware," as it was written in the certificate granted in Apr 25,
 2001 following the application number EA100290.

GENERAL INFORMATION ABOUT THE GRANTEE AND CERTIFICATED EQUIPMENT -2.1043 (b)(2)
  (as perRule Part Number: 2.1033 (c).(1),(2),(5),(6),(7))

APPLICANT/GRANTEE   Dataradio Inc.,
                            5500 Royalmount Ave, suite 200,
                            Town of Mount Royal, Quebec, Canada, H4P 1H7

MANUFACTURER: Dataradio COR Ltd., Waseca, MN 56093 (MDP Transceiver)
                            DATARADIO Inc., Town of Mount Royal, Quebec, Canada, H4P 1H7
                                (Gemini- final assembly)

MODEL NUMBER: GEMINI/PD
PART NUMBER: GPDD-6085-xyz

SERIAL NUMBER (S):   ABC-prototype 32kbps RC4FSK code with 3322-002 Gemini modem
                            6085- 10460 - 104 production MDP transceiver

FCC ID NUMBER: EOTGPDB
FCC RULES AND REGS: FCC Part (s) 90

FREQUENCY RANGE: 806.000 MHz - 824.000 MHz
                            (806-821/851-866 and 821-824/866-869 MHz Bands)

MAXIMUM POWER RATING: 40.00 Watts (5-40 watts variable).

NUMBER OF CHANNELS: 16 Channel Modem

INPUT IMPEDANCE: 50 ohms, Nominal

VOLTAGE REQUIREMENTS: 10.9-16.3VDC (13.6 VDC Nominal)

EQUIPMENT IDENTIFICATION:

TRADE NAME	DESCRIPTION	DRI PART NUMBER
MDP6000	806-824/851-869MHz XCVR	242-608C-MRB
Gemini	Modem	050-03322-00x

DRL Part Number System for MDP:

242-60FC-MRB

F-Frequency Bands ─────────
    1 -   V H F
    4 -   U H F
    8 -   800 MHz
    9 -   900 MHz

C-Configuration ─────────
    1-   5-13 Watt Standard RX
    2-   5-13 Watt Diversity RX
    4-   35-50 Watt Standard RX
    5-   35-50 Watt Diversity RX

B- IF Bandwidth
    1-   6.25 KHz / 7.5 KHz
    2-   12.5 KHz / 15 KHz
    3 -   20 KHz
    4-   25 KHz / 30 KHz

R-Frequency Range
    0-   Whole Band (800 and 900 MHz)
    3-   132-150 MHz   400-460 MHz
    5-   150-174 MHz   450-512 MHz
    7-   Transmit: 794-806 / 806-824 MHz
          Receive: 764-776 / 851-869 MHz

M-Modem Type
    0-   None (OEM)
    1-   Gemini Modem

DATA AND CHARACTERISTICS NOT AFFECTED BY THE CHANGE - Rule Part Number: 2.1033 (c).(4),(8),(9),(10),(11),(12) ,(15),(16)

Type Of Emission:	2.1033(C)(4)
DC Voltages And Currents Into Final Amplifier	2.1033(C).(8)
Transmitter Tune Up Procedure	2.1033 C (9)
Description Of Circuitry	2.1033 (C)(10)
Schematics	2.1033 (C)(10)
Transistor, Diode, And IC Functions	2.1033 C (10)
FCC Label	2.1033 C (11)
Photographs	2.1033 C (12)
Data addressing Rule Part Number	2.1033(c) 15, 16: this unit is not designed for the mentioned purposes
MPE limits compliance	2.1091
Test results not affected by the change	2.1033C 14, 2.1041

Test data according to:
        Part 2: 2.1046, 2.1051, 2.1053, and 2.1055
        Part 90, Subpart I: 90.213.
  as follow:

Transmitter Rated Power Output	2.1046
Transmitter Spurious And Harmonic Outputs	2.1051
Field Strength Of Spurious Radiation	2.1053
Frequency Stability and Frequency Tolerance	2.1055,90.213

DATA AND CHARACTHERISTICS AFFECTED BY THE CHANGE - Rule Part Number:2.1033(c) (3)(13)(14)

INSTRUCTION BOOK   2.1033 (c) (3)

Annex A . The attached Installation Guide for the GEMINI/PD Transceiver/Modem/GPS is a preliminary version.

DIGITAL MODULATION TECHNIQUES   2.1033(c).(13)

The Gemini/PD modem generates 2 level Differential Gaussian Frequency Shift Keying (DGFSK) and 4 level Squared Root Raised Cosine Frequency Shift Keying. (SRRC 4FSK). Both modulations schemes have been granted with the certificate EOTGPDB. This measurement concerns only the new symbol rate of 32kbps/16ksps that use 4-level RC (raised cosine α=0.4) modulation, its description follows. Otherwise, except for the digital filtering, the modulation scheme 4FSK remains the same as certified.

   The 4-level signaling transmits two information bits per symbol (baud) which yields a bit rate of twice the on-air baud rate, hence the 32 kbps references in the Installation Guide correspond to a transmitter baud rate of 16000 baud. That digital signal is digitally filtered (Raised Cosine pulse shaping with α=0.4) by the DSP then fed to the CODEC for digital to analogue conversion as explained in previous submissions. This RC4FSK wave shape applied to the FM modulator will then produce a compact RF spectrum, when using proper frequency deviation, to fit inside the restrictive masks inherent to the intended channel bandwidth.

   The transmitter deviation level and digital filter cutoff frequency (which is based on the raised cosine filter equation) are set according to the bit rate selected and channel bandwidth as follows:

Bit rate	Baud rate	Raised Cosine filter's 3dB cut-off frequency	Deviation
32000 b/s	16000bauds	8.0 kHz	± 3.60 kHz

TEST DATA   **2.1033 (c)(14)**

Next section.

TEST DATA Section   Rule Part Number: 2.1033 (c)(14)

All applicable test data according to:
       -Part 2: 2.1043 (b)(2) ,2.1049
       -Part 90, Subpart I: 90.209 and 90.210
are provided in next section of this Engineering Report

Modulation Characteristic Part 2.1047 (d), 90.209 (b) 90.210(g): Other types of equipment: this equipment is not
    provided with hardware audio low-pass filters, the filtering is entirely result of DSP firmware.

The following test report have been generated for Class II Permissive Change notification for EOTGPDB ,Gemini/PD
radio modem. Gemini/PD is comprised of the Dataradio COR Ltd. (DRL) Mobile Data Platform (MDP) 800 MHz
Transceiver with the Dataradio Inc Gemini Modem. Dataradio Inc does the final assembly and markets the Gemini/PD
unit

 The measurements were conducted following the procedures set forth in the TIA/EIA-603 standards.

NAME OF TEST:
Transmitter Occupied Bandwidth

RULE PART NUMBER: 2.201, 2.202, 2.1033 c (14), 2.1049 (h), 2.1041

Emission Designator Determination

Necessary Bandwidth Measurement (90.209.(b))

This radiomodem uses digital modulation signals, passing through a Raised Cosine α=0.4 DSP implemented low-pass filter to an FM transceiver. The necessary bandwidth calculation for this type of modulation (RC4FSK) is not covered by paragraphs (1), (2) or (3) from 2.202(c), the result exceeding the real 99% necessary bandwidth obtained through simulations or measurement.

 Therefore, the approach outlined in (2.202(c)(4)) is applicable in this case.

The results of 99% Occupied Bandwidth measurement are:

Baud rate	Deviation	Occupied Bandwidth	Authorised Bandwidth
16000 bauds	± 3.60 KHz	15333 Hz	20000Hz

The Occupied Bandwidth being less than that, which is already approved with the 15K3,15K6 and 16K0F1D emission designators, there is no need to append a new emission designator to the list.

The measurement theory and set-up explanations follow.

Occupied Bandwidth Measurement
        The Occupied Bandwidth measurement option of the instrument (8563EC spectrum analyzer from Agilent) calculates and provides the values used above for the emission designator.
        The percentage setting of the measurement has been set to 99% following the definition of the ***Occupied Bandwidth*** "the frequency bandwidth such that, below its lower and above its upper frequency limits, the mean powers radiated are each equal to 0.5 percent of the total mean power radiated by a given emission" (FCC 2.202)
        The measurement has been performed during the tests for compliance with mask G, the resulting value was recorded as Occupied Bandwidth.

        The measurement set-up is:
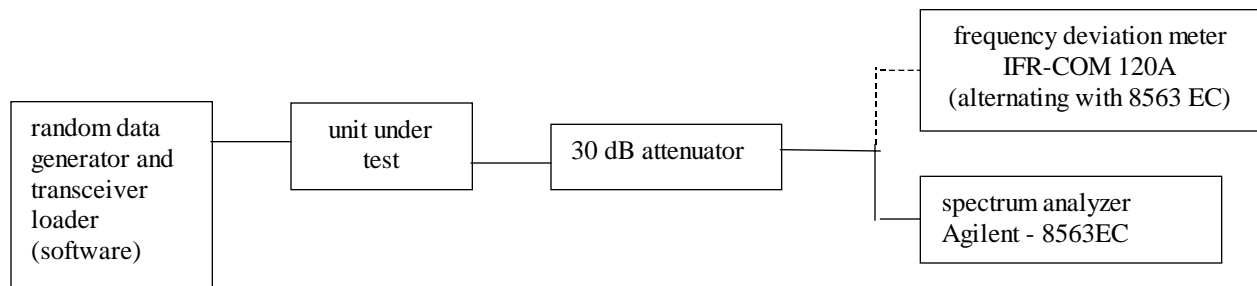
NAME OF TEST: Transmitter Occupied Bandwidth
GEMINI Modem at 16000bauds 4FSK

Mask compliance data in support of RC4FSK digital modulation at 32 kbps/16ksps

RULE PART NUMBER: 2.201, 2.202, 2.1033 c (14), 2.1041, 2.1049, 90.209 (b)(5), 90.210 (g)

MINIMUM STANDARD: Mask G
Sidebands and Spurious [Rule 90.210 (g)]
Authorized Bandwidth = 20 kHz [Rule 90.209(b) (5)]

Fo to 5.0 kHz	Attenuation = 0 dB
>5.0 kHz to 10.0 kHz	Attenuation= $83*\log(f_d \text{ KHz} /5)$ dB
>10.0 kHz to 250% Auth BW	Attenuation = Lesser of:

$$116*\log(f_d \text{ KHz} /6.1) \text{ dB},$$
$$50+10\log_{10}(P) \text{ or } 70\text{dB}$$

specifically:
10.0 kHz to 22.61 KHz Att = 24.9 dB to 66 dB (40W) then 66dB to ±50kHz
10.0 kHz to 18.91 KHz Att = 24.9 dB to 57 dB (5 W) then 57dB to ±50kHz

>250% Auth BW	$43+10*\log(P)$dB =59dB(40W) or 50dB(5W)

Corner Points:

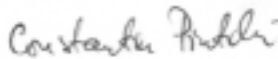|	
Fo to 5.0 kHz	Attenuation = 0 dB
>5.0 kHz to 10.0 kHz	Attenuation= 0 dB to 25 dB
>10.0 kHz to 15.0 KHz	Attenuation = 25 dB to 45 dB
>15 kHz to 25kHz	Attenuation =45dB to 70 dB
>25kHz to 50kHz	Attenuation =70dB
>250% Authorized BW	Attenuation = 53 dB

TEST RESULTS: Meets minimum standard (see data on the following pages)

TEST CONDITIONS: Standard Test Conditions, 25 C

TEST EQUIPMENT: Attenuator, BIRD Model / 100-A-MFN-30 / 30 dB / 100 Watt
Splitter Minicircuits model ZFSC-2-4
DC Power Source, Model Astron VS 20M
Communication Analyzer, Model IFR COM120B (deviation meter)
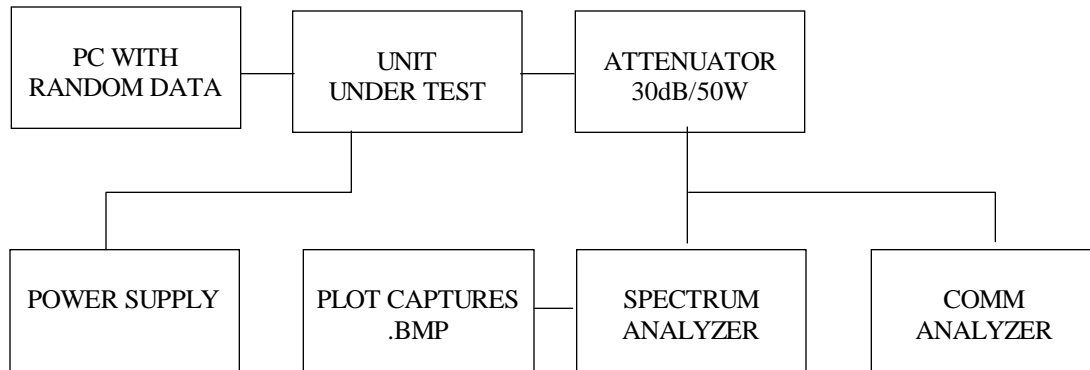Spectrum Analyzer, Model HP E4401

PERFORMED BY: _____   DATE: 10/23/01
                               Constantin Pintilei

NAME OF TEST: Transmitter Occupied Bandwidth (Continued)
                                 GEMINI Modem at 16000 bauds / RC4FSK

TEST SET-UP:

```
┌──────────────┐     ┌──────────────┐     ┌──────────────┐
│  PC WITH     │─────│    UNIT      │─────│  ATTENUATOR  │
│ RANDOM DATA  │     │ UNDER TEST   │     │   30dB/50W   │
└──────────────┘     └──────────────┘     └──────────────┘
                            │                    │
    ┌───────────────────────┴────┐       ┌───────┴──────────────┐
    │                            │        │                      │
┌──────────────┐   ┌──────────────┐   ┌──────────────┐   ┌──────────────┐
│POWER SUPPLY  │   │PLOT CAPTURES │───│  SPECTRUM    │   │    COMM      │
│              │   │    .BMP      │   │  ANALYZER    │   │   ANALYZER   │
└──────────────┘   └──────────────┘   └──────────────┘   └──────────────┘
```

MODULATION SOURCE DESCRIPTION:

TX Data Test Pattern:

The transmit "test data" pattern command produces a 2047 bit pseudo-random pattern. This pattern is generated by the internal software using the polynomial $X^{11}+X^{9}+1$ form and a 12-bit shift register. Initial value of the register is 111111111110 (FFE hex). The 2047 bit sequence is repeated thereafter as long is necessary to complete the test duration (55 sec). This pattern is applied to the DSP processor data input for encoding and 4 FSK RC α=0.4 pulse shaping .

This data follows same modulation process as described in Digital Modulation Techniques (page 9) and the resulting base band signal feeds the modulator's input of the transceiver.

For 16000 baud rate the deviation is set to 3.60kHz using a 1kHz tone to control the deviation level.

NECESSARY BANDWIDTH (Bn) COMPLIANCE

See Page 11 for Occupied Bandwidth. 15333Hz < 20000Hz , Authorized Bandwidth

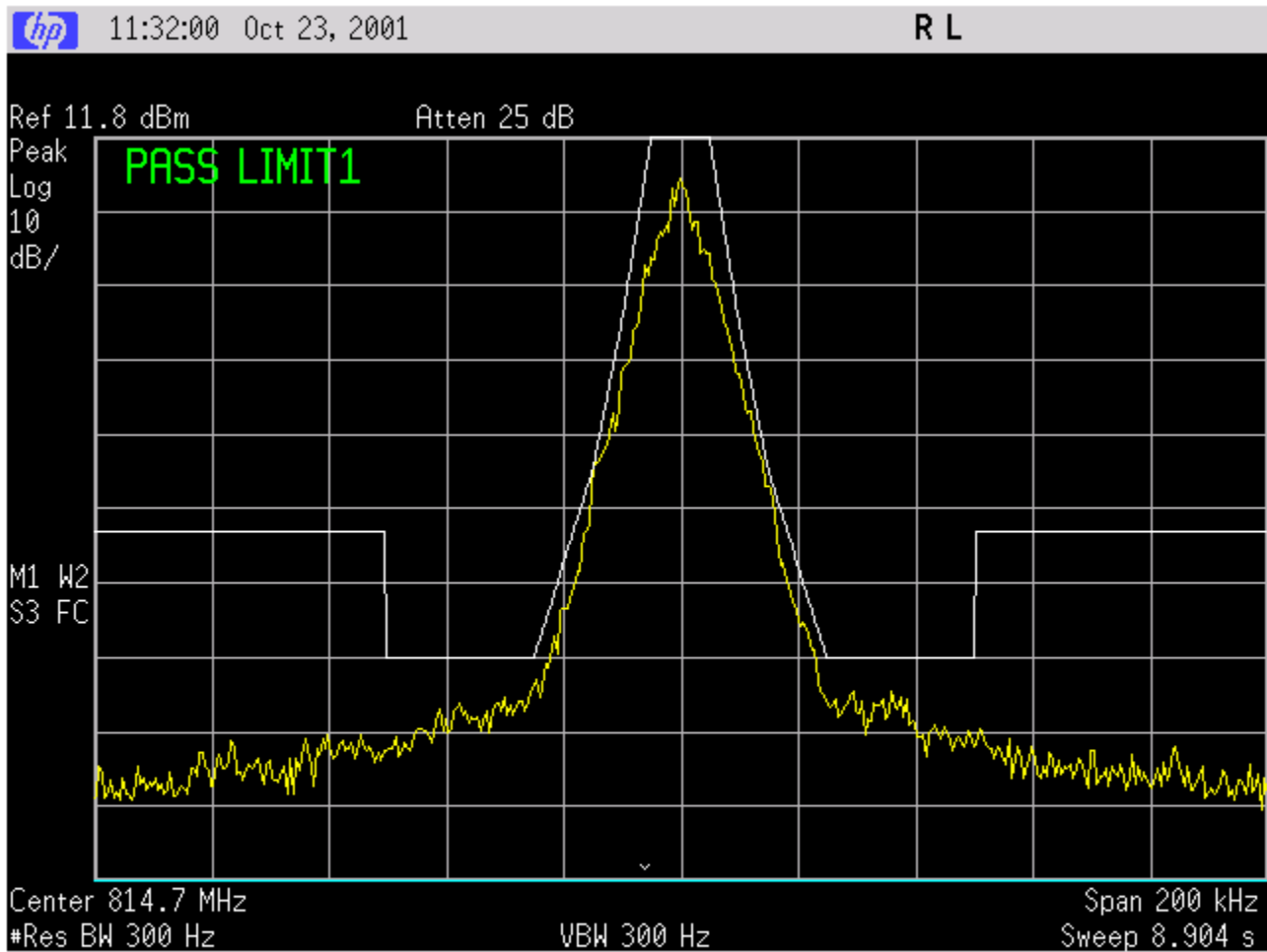TEST DATA: Refer to the following graphs:

MASK: G ,40W

OUTPUT POWER: 40 Watts
32000 bps /16000 bauds 4 level FSK
Digital filters RC 0.4
PEAK DEVIATION = 3600 Hz
SPAN = 200 kHz

MASK: G, 5W

OUTPUT POWER: 5 Watts
32000 bps /16000 bauds 4 level FSK
Digital filter RC 0.4
PEAK DEVIATION = 3600 Hz
SPAN = 200 kHz