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

for the

Mobile Data Platform Transceiver (UHF (403 MHz-512MHz) MDP)
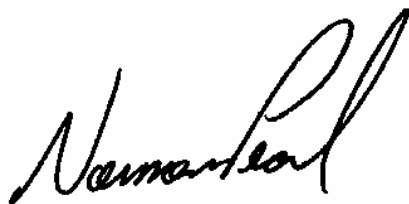
With the

Data Radio Gemini Modem

**FCC ID: EOTGPDA
Trade Name: GEMINI/PD**

April 5, 2004

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 EOTGPDA.

The certification EOTGPDA 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) UHF (403 MHz-512MHz) Transceiver with the Dataradio Inc Gemini Modem. Dataradio Inc does the final assembly and markets the Gemini/PD unit. The EOTGPDA certificate has been granted for several bit rates at 2, 4 and 8-level FSK type of modulation scheme with a total of 11 emission designators. The change intends to add a 16-FSK modulation scheme with two new bit rates of 64kbps and 57.6kbps along with their emission designators emission of 16K4F1D and 16K9F1D. This change involves the firmware only, with no change whatsoever occurring in the hardware of the MDP transceiver. A new modem board to generate the proposed modulation scheme is also presented in this report along with a notification about a Class I permissive change.

EXISTING CONDITIONS

The unit utilized for these occupied bandwidth and mask-compliance measurements was a prototype built from production EOTGPDA with variant modulation source (prototype board and firmware) used to create the modulation scheme. The transceiver operates on frequencies ranging from 403.000 MHz to 512.000 MHz. The frequency tolerance of the transceiver is .00015% or 1.5 parts per million as granted in EOTGPDA.

PROPOSED CONDITIONS

It is proposed to accept the request for the GEMINI/PD, 403-512 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.2-165, Mar 15,2003. 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 Apr 12, 2001 and Apr 23,2004

CONCLUSION

Given the results of the measurements contained herein, the applicant requests to be applied a Class II Permissive Change for the Certificate EOTGPDA to add the 16K9F1D to the existent list and to accept the use of the emission designators 16K4F1D for 64.0kbps data rate.

_____05/04/04

Constantin Pintilei
R&D Test Engineer, Dataradio Inc.

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ANNEXES:

Annex A: Instruction Manual

Annex B: External picture of the front panel

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 27 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 2001 10 Years experience in radio frequency measurements.

NAME:	**Dominic Lavoie**
TITLE:	R&D Technician
TECHNICAL EDUCATION:	College Diploma, Electrical Engineering Technician, Telecom option (1998), Technical College CEGEP du Vieux-Montreal, Montreal, Canada
TECHNICAL EXPERIENCE:	6 Years in telecom electronics, of which 4 as Dataradio R&D Technician

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

The certification EOTGPDA 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) UHF (403 MHz-512MHz) Transceiver with the Dataradio Inc Gemini GCU Modem. Dataradio Inc does the final assembly and markets the Gemini/PD unit. The original certificate has been granted for a 2, 4 and 8-level FSK type of modulation scheme with several emission designators as follow:

Proposed for Class II Permissive Change   25kHz BW (16000baud, 16 FSK) **16K4F1D** - already existent
                                            25kHz BW (14400baud, 16 FSK) **16K9F1D**

Previously granted for EOTGPDA   25kHz BW (16000baud, 8 FSK) **17K0F1D**
                                            25kHz BW (14400baud, 8 FSK) **16K4F1D**
                                            12.5kHz BW (8000baud, 8 FSK) **8K17F1D**
                                            12.5kHz BW (7200baud, 8 FSK) **9K67F1D**
                                            12.5KHz BW (9600bps)   **8K60F1D**
                                            25KHz BW (16.0Kbps)   **15K3F1D**
                                            25KHz BW (19.2Kbps)   **15K0F1D**
                                            25kHz BW (12800baud, 4 FSK) **15K6F1D**
                                            25kHz BW (9600baud, 4 FSK) **16K0F1D**
                                            12.5kHz BW (8000baud, 4 FSK) **8K17F1D**
                                            12.5kHz BW (7200baud, 4 FSK) **8K67F1D**
                                            25kHz BW (16000baud, 4 FSK) **16K8F1D**

The change consists of the addition of two new speeds for the 16-level FSK modulations with two new emission designators 16K4F1D and 16K9 F1D. This modulation permits signaling at a reduced baud rate when fitting the requirements of mask C with improved signal-to -noise (data sensitivity) performance. Only the modulation source is being changed to produce 16-level FSK modulator signal. There are no hardware changes involved in the radio circuitry. Also there are no changes in those modules of the MDP firmware that control the transceiver. Therefore a Class II Permissive Change request has been considered.

   The characteristics affected are :
Digital Modulation Techniques   - part 2.1033.(c)(13)
Type of emission and Emission designators list   - part 2.1033 (c)(4),90.209
Occupied bandwidth and mask compliance requirement - part 2.1049,90.210(c)
They are entirely documented with the current report.

   Because this change is implemented in the modulation source only, there are no changes whatsoever occurring in schematics, part list, mechanical assembly, shape, label or any other hardware of the transceiver. All the basic frequency determining and stabilizing circuitry (including clock or data rates), frequency multiplication stages, basic modulator circuit or maximum power or field strength ratings belong exclusively to the MDP transceiver and its firmware and undergo no changes. The modulation source consisting of a GCU modem board was redesigned and it has been considered to classify under a Class I Permissive Change. Although 2.1043 b.1 allows it without notification, details of this change are presented below.

DETAILS ABOUT CLASS I PERMISSIVE CHANGE INFORMATION - Rule part 2.1043 (a) and (b)(1)

As per 2.1043 (a) there are allowed variations in electrical or mechanical construction of the EOTGPDA.

In order to maximize the benefits of higher air transmission rates, the modem board (Gemini GCU) of the unit was redesigned (new Gemini controller unit GCU III) to add a USB port and a RJ45 Ethernet port along with two RS232 serial ports. The former modem offered three RS232 serial ports. Minor mechanical changes on the front plate of the unit were done to accomodate the change and the corresponding front plate external picture is attached as appendix of the report.

 A preliminary version of the manual that contains installation and service-related information for 16 level FSK modulations is provided as appendix of the report.

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 modem and final assembly)

MODEL NUMBER: GEMINI/PD
PART NUMBER: GPDD-6045-xyz

SERIAL NUMBER (S):   AAA-prototype 16-level FSK Gemini GCU III modem
                              6045- 13251 -154 production MDP transceiver

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

FREQUENCY RANGE: 403.000 MHz - 512.000 MHz (406-406.1 MHz software blocked)

MAXIMUM POWER RATING: 50.00 Watts (10-50 watts variable).

NUMBER OF CHANNELS: 16 Channel Modem

INPUT IMPEDANCE: 50 ohms, Nominal

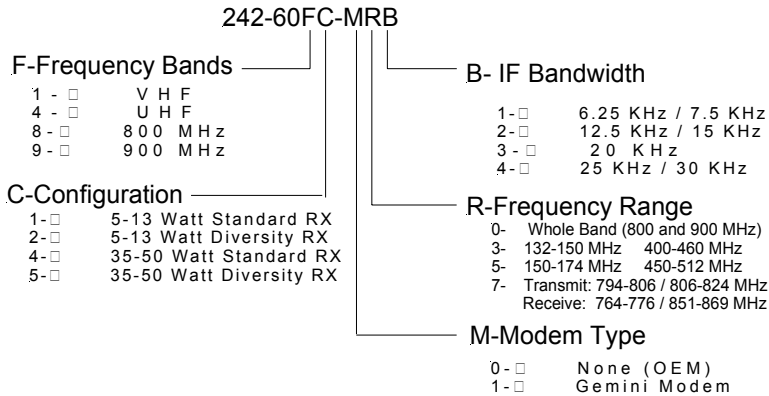VOLTAGE REQUIREMENTS: 10.9-16.3VDC (13.6 VDC Nominal)

EQUIPMENT IDENTIFICATION:

TRADE NAME	DESCRIPTION	DRI PART NUMBER
MDP6000	403-520 XCVR	242-604C-MRB
Gemini GCU III	Modem	255-03434-00x

DRL Part Number System for MDP:

242-60FC-MRB

F-Frequency Bands
1 -   V H F
4 -   U H F
8 -   8 0 0   M H z
9 -   9 0 0   M H z

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).(8),(9),(10),(11),(12) ,(15),(16)

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
Spectrum efficiency standard	90.203 (j) (64000 or 57600 bps /25kHz) is larger than 19200 bps required in 25kHz (4*4800 bps/4*6.25kHz)
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 and 90.214
  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
Transient Frequency Behavior	90.214

DATA AND CHARACTERISTICS AFFECTED BY THE CHANGE - Rule Part Number:2.1033(c) (3)(4)(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.

TYPE OF EMISSION: 2.1033(c)(4)

For Class II Permissive Change 16levelFSK 25kHz BW (16000baud, 16 FSK) **16K4F1D**   - already existent
                                                  25kHz BW (14400baud, 16 FSK) **16K9F1D**

Previously granted for EOTGPDA   25kHz BW (16000baud, 8 FSK) **17K0F1D**
                                                  25kHz BW (14400baud, 8 FSK) **16K4F1D**
                                                  12.5kHz BW (8000baud, 8 FSK) **8K17F1D**
                                                  12.5kHz BW (7200baud, 8 FSK) **9K67F1D**
                                                  12.5KHz BW (9600bps)   **8K60F1D**
                                                  25KHz BW (16.0Kbps)   **15K3F1D**
                                                  25KHz BW (19.2Kbps)   **15K0F1D**
                                                  25kHz BW (12800baud, 4 FSK) **15K6F1D**
                                                  25kHz BW (9600baud, 4 FSK) **16K0F1D**
                                                  12.5kHz BW (8000baud, 4 FSK) **8K17F1D**
                                                  12.5kHz BW (7200baud, 4 FSK) **8K67F1D**
                                                  25kHz BW (16000baud, 4 FSK) **16K8F1D**

DIGITAL MODULATION TECHNIQUES   2.1033(c).(13)

The Gemini/PD modem generates 16-level Squared Root Raised Cosine Frequency Shift Keying. (SRRC16FSK). Both modulations schemes have been granted with the certificate EOTGPDA. This measurement concerns only the new symbol rates that use16-level SRRC (squared root raised cosine) modulation, their description follows. Meantime, the modulation scheme SRRC16FSK remains the same.

The 16-level signaling transmits four information bits per symbol (baud) which yields a bit rate four times higher than the on-air baud rate, hence the 57.6 or 64 kbps references in the Installation Guide correspond to a transmitter baud rate of 14400 or 16000 baud. That digital signal is digitally filtered (Squared Root 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 SRRC16FSK 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 generated with a reference tone of 1000Hz 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	Square Root Raised Cosine filter's 3dB cut-off frequency	Deviation
64000 b/s	16000bauds	8.0 kHz	± 4.85 kHz
57600 b/s	14400bauds	7.2 KHz	± 4.70 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(c): 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 reports have been generated for Class II Permissive Change request for EOTGPDA ,Gemini/PD radio modem.
Gemini/PD is comprised of the Dataradio COR Ltd. (DRL) Mobile Data Platform (MDP) UHF (403-512 MHz) Transceiver with the
Dataradio Inc Gemini Modem. Dataradio Inc does the final assembly and markets the Gemini/PD unit

  Unless otherwise noted, all of 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 Squared Root Raised Cosine α=0.4 DSP implemented low-pass filter to an FM transceiver. The necessary bandwidth calculation for this type of modulation (SRRC16FSK) is not covered by paragraphs (1), (2) or (3) from 2.202(c), the result exceeding by far the real 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:

Bit rate	Baud rate	Plot of the record	Deviation on test tone of 1000 Hz txon7	Deviation of random data pattern Txon4	Occupied Bandwidth	Emission designator
64000	16000 bauds	10W	± 4.85 kHz	± 5.95 kHz	16351.9Hz	16K4F1D
57600	14400 bauds	10W	± 4.70 kHz	± 6.20 kHz	16837.6Hz	16K9F1D

The measurement theory and set-up explanations follow.

Occupied Bandwidth Measurement
         The Occupied Bandwidth measurement option of the instrument (E4401B 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 ***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 C, the value occurred was recorded as Occupied Bandwidth. The smallest deviation value yielded from the readings of Maximum Deviation tests was used for the record of the maximum deviation allowed and of the occupied bandwidth

         The measurement set-up is:
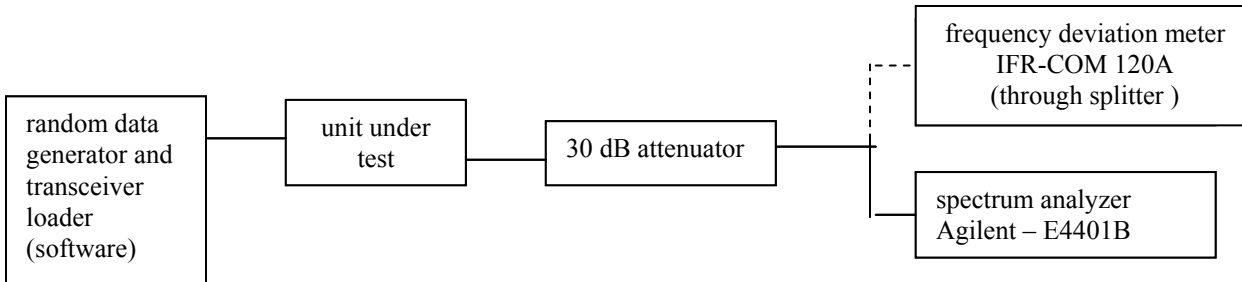
NAME OF TEST: Transmitter Occupied Bandwidth
                                 GEMINI Modem at SRRC16FSK

Mask compliance data in support of emission designators 16K4F1D and 16K9F1D

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

MINIMUM STANDARD: Mask C
                                 Sidebands and Spurious [Rule 90.210 (C)]
                                 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= $83*\log(f_d /5)$ dB
                                 >10.0 kHz to 250% Auth BW   Attenuation = Lesser of:
                                                                   $29*\log(f_d{}^2 /11)$ dB or 50dB
                                 >250% Auth BW $43 + 10*\log(P)$ dB
                                 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 20 kHz   Attenuation = 27.8 dB to 45.2 dB
                                 >20 kHz to 24 kHz   Attenuation =45.2 dB to 50 dB
                                 >24 kHz to 50kHz   Attenuation =50dB
                                 >250% Authorized BW   Attenuation = 63 dB


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

TEST CONDITIONS: Standard Test Conditions, 25 C

TEST EQUIPMENT: Attenuator, BIRD Model / 150-A-MFN-30 / 30 dB / 150 Watt
                                 Splitter Minicircuits model ZFSC-2-4
                                 DC Power Source, Model Astron VS 20M
                                 Communication Analyzer, Model IFR COM120B (deviation meter)
                                 Spectrum Analyzer, Model Agilent E4401B

PERFORMED BY: Dominic Lavoie   DATE: 31/03/2004

TEST SET-UP:
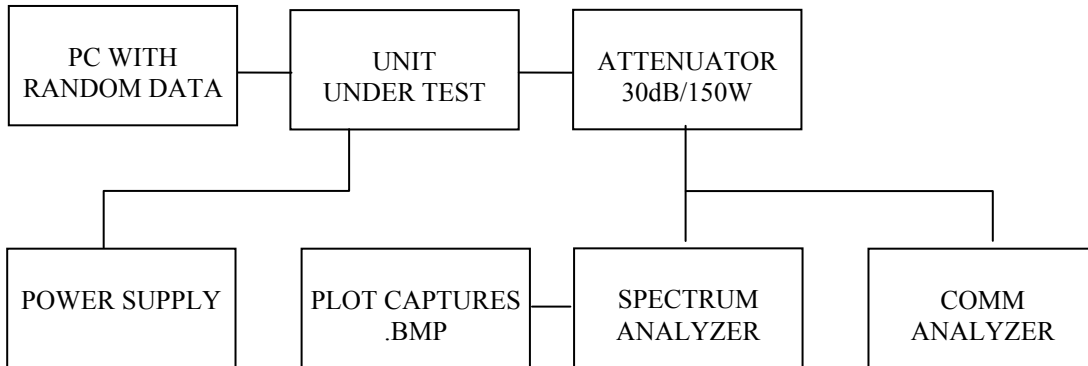
NAME OF TEST: Transmitter Occupied Bandwidth (Continued)

MODULATION SOURCE DESCRIPTION:

TX Data Test Pattern:

The transmit "test data" pattern command produces a 8,388,607 bit pseudo- random pattern. This pattern is generated by the DSP using the polynomial X23+X5+1 form and a 23-bit shift register. Initial value of the register is 1 (1 hex). The 8,388,607 bit sequence is repeated thereafter as long is necessary to complete the test duration, this sequence lasts 131 seconds at 64 kbps or 145seconds at 57.6kbps. Commonly this is longer than the test duration.

  This pattern is applied to the DSP modulator for mapping to 16-FSK and pulse shaping with SRRC a=0.4.

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 /64000 bit rate the deviation is set to 4.850kHz using a 1kHz tone to control the deviation level.
For 14400 baud rate /57600 bit rate the deviation is set to 4.700kHz using a 1kHz tone to control the deviation level.

NECESSARY BANDWIDTH (Bn) CALCULATION

See Page 11 for emission designator determination.

The corresponding emission designator prefix for necessary bandwidth = **16K4F1D** for 64.0kbps and **16K9F1D** for 57.6kbps

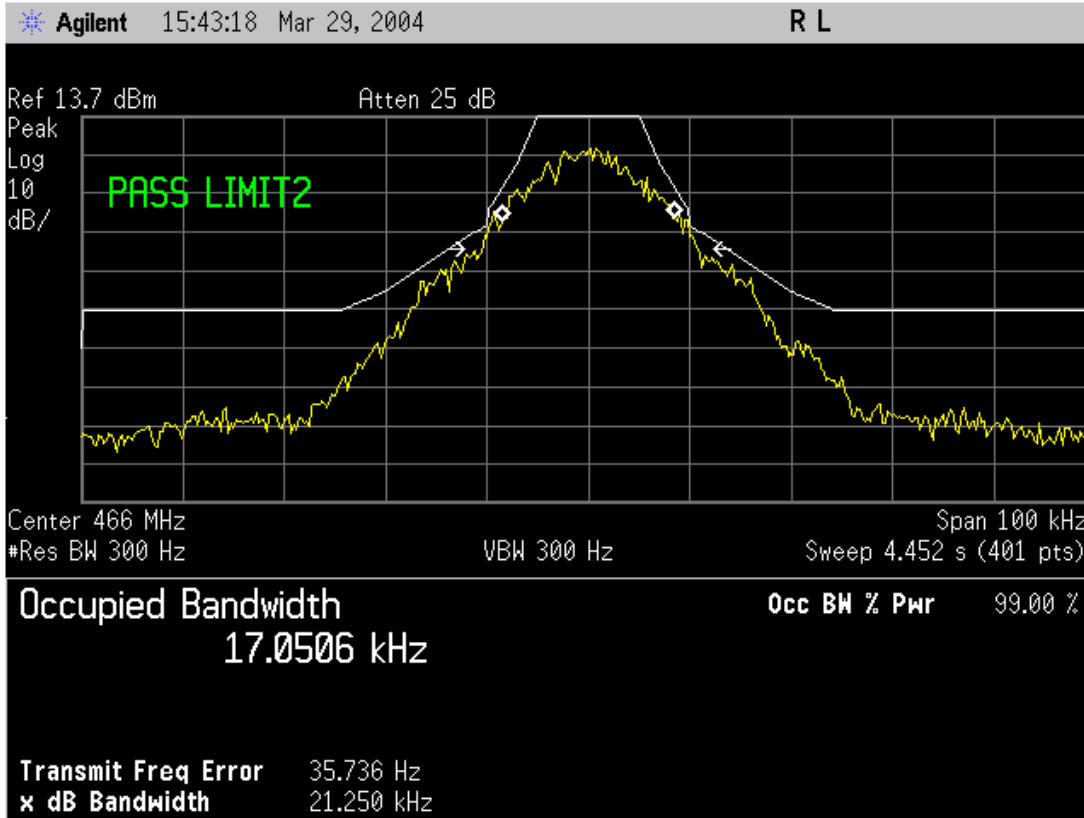TEST DATA: Refer to the following graphs:

MASK: C, 50W 64000 bps /16000 bauds 16 level FSK

OUTPUT POWER: 50 Watts
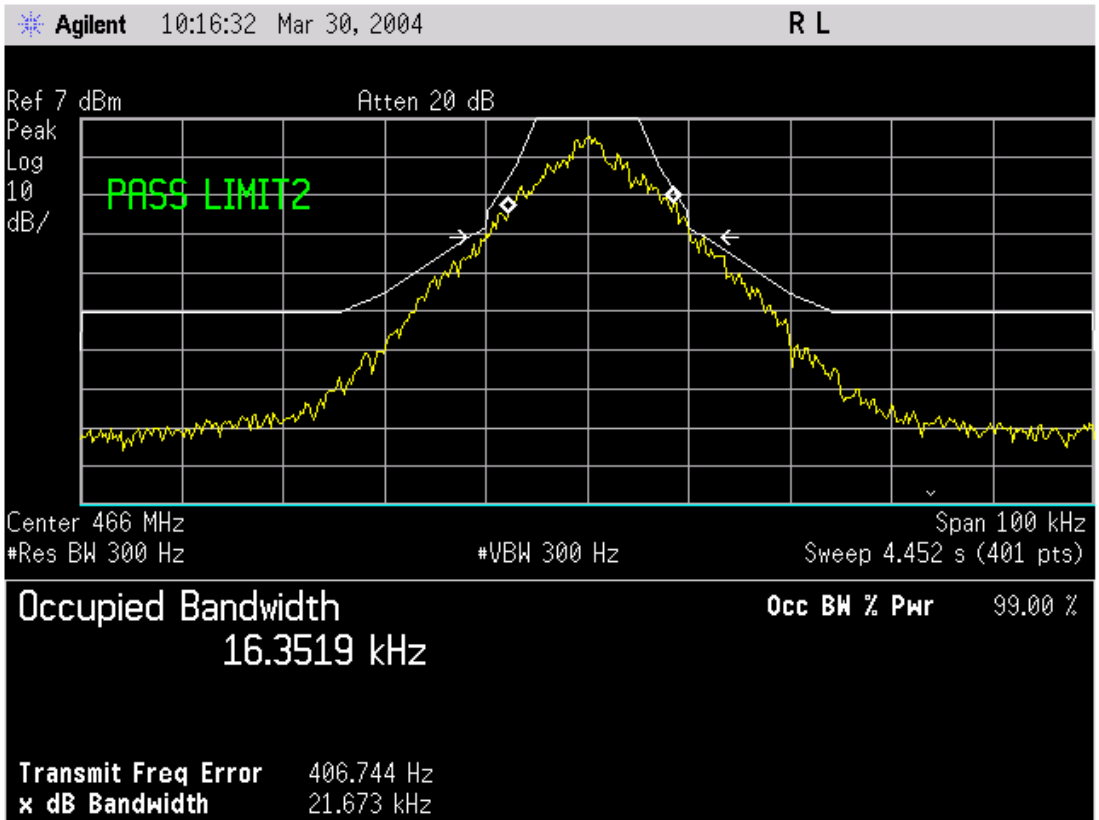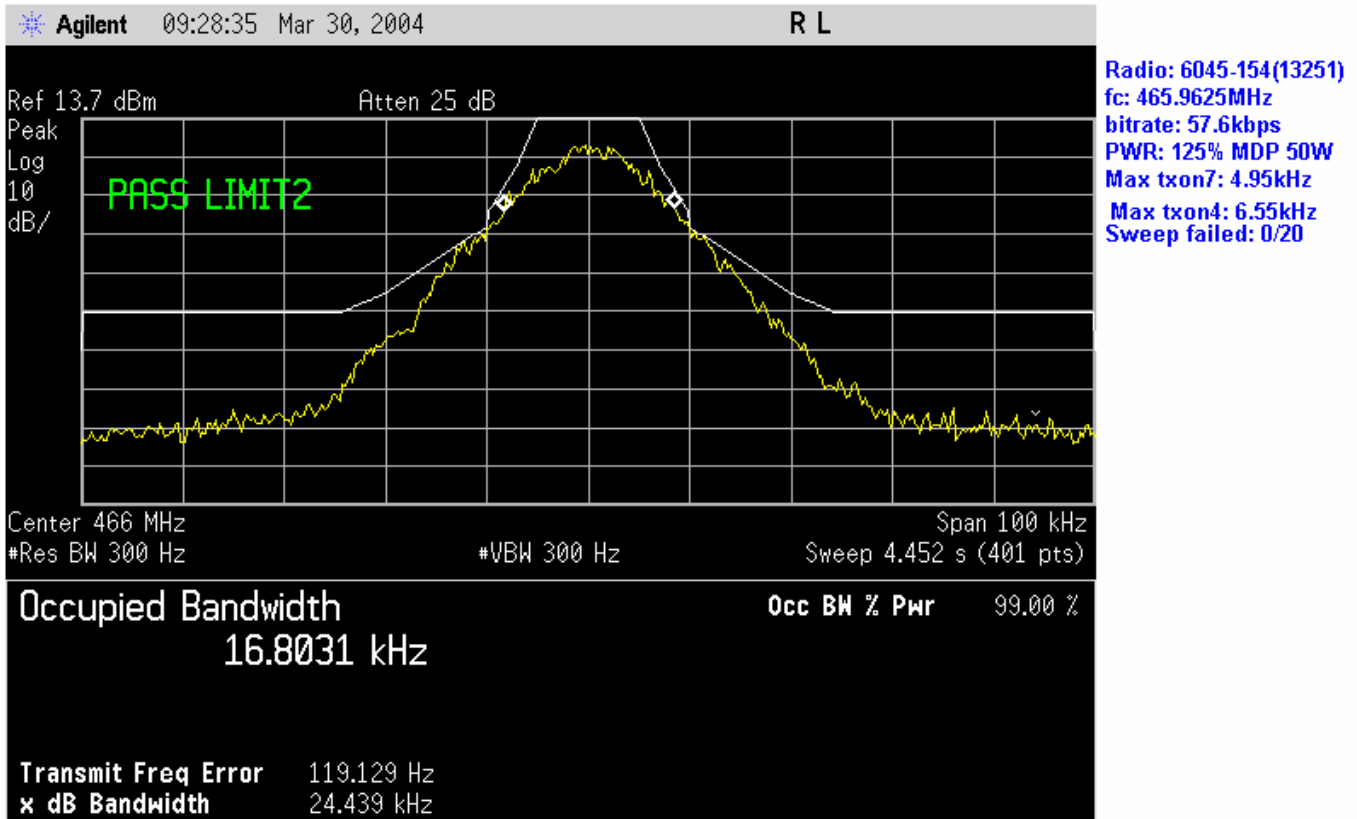Digital filters SRRC 0.4
PEAK DEVIATION = 4950 Hz
SPAN = 100 kHz

MASK: C, 10W, 64000 bps /16000 bauds 16 level FSK

OUTPUT POWER: 10 Watts
Digital filter RC 0.4
PEAK DEVIATION = 4850 Hz
SPAN = 100 kHz

MASK: C, 50W, 57600 bps /14400 bauds 16 level FSK

OUTPUT POWER: 50 Watts
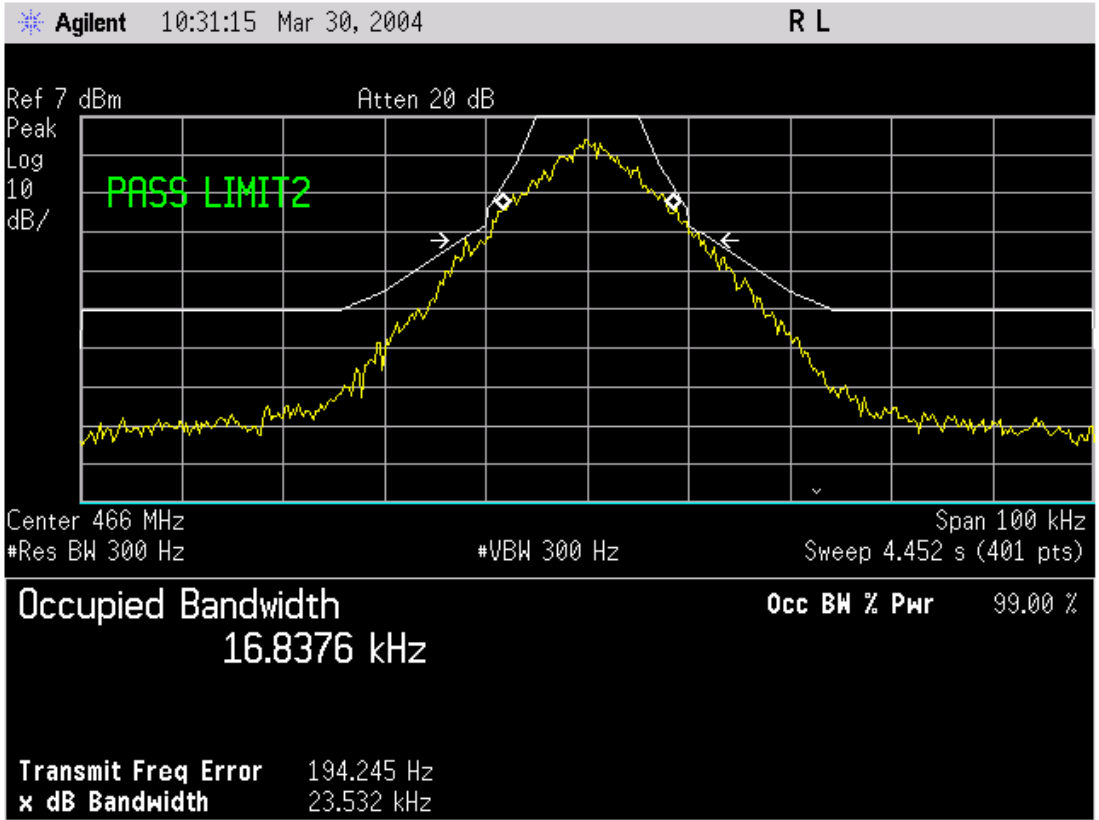Digital filters SRRC 0.4
PEAK DEVIATION = 4950 Hz
SPAN = 100 kHz

MASK: C, 10W,57600 bps /14400 bauds 16 level FSK

OUTPUT POWER: 10 Watts
Digital filter SRRC 0.4
PEAK DEVIATION = 4700 Hz
SPAN = 100 kHz