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

for the

Mobile Data Platform Transceiver (UHF MDP)

With the

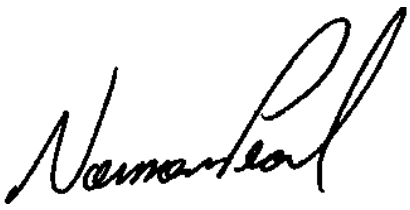
Dataradio Gemini Modem

FCC ID: EOTGPDA
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 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 original certificate has been granted for a 2-level FSK type of modulation scheme (DGMSK) with three emission designators 8K60, 15K0, 15K3F1D and 4-level FSK with four emission designators 15K6, 16K0, 8K17 and 8K67F1D. The change intends to add to the 4-FSK emission designator list a new value of 16K8F1D. This change involves the firmware only, with no change whatsoever occurring in the hardware.

EXISTING CONDITIONS

The unit utilized for these occupied bandwidth and mask-compliance measurements was a prototype built from production EOTGPDA with beta-level 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

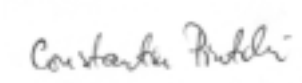
It is proposed to accept the request for the GEMINI/PD, 403-512 MHz Transceiver/Modem/GPS for operation in the band of frequencies previously outlined. The applicant anticipates marketing the device for use in wireless transmission of data.

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.2-154, Mar 15,2000. 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 29, 2001 and Nov 03, 2001

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 emission designators 16K8F1D to the existent list.



11/07/2001

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 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 original certificate has been granted for a 2-level FSK type of modulation scheme (DGMSK) with three emission designators 8K60, 15K0 , 15K3F1D and 4-level FSK with four emission designators 15K6,16K0, 8K17 and 8K67F1D

The change consists of the addition of a new speed for the 4-level FSK modulations with its emission designator 16K8 F1D. This modulation permits signaling at a higher baud rate when fitting the requirements of mask C 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. 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. Therefore a Class II Permissive Change request has been submitted.

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 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 installation manual that contains service-related information for 4 level FSK modulations is provided as appendix of the report.

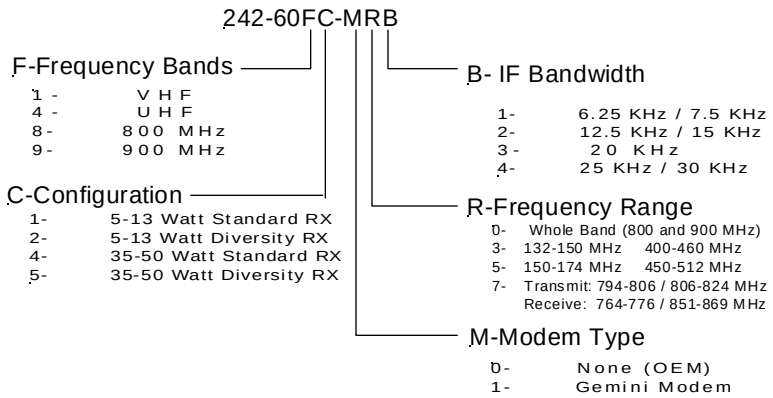
GENERAL INFORMATION ABOUT THE GRANTEE AND CERTIFICATED EQUIPMENT -2.1043 (b)(2)
(as perRule Part Number: 2.1033 (c).(1),(2),(5),(6),(7))

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- final assembly)
MODEL NUMBER:	GEMINI/PD
PART NUMBER:	GPDD-6045-xyz
SERIAL NUMBER (S):	AAAA-prototype 4-level FSK Gemini modem 6045- 11347 -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	Modem	050-03322-00x

DRL Part Number System for MDP:



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) (32000 bps /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.

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 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 4levelFSK 25kHz BW (16000baud, 4 FSK) **16K8F1D**

Previously granted for EOTGPDA
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**

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 EOTGPDA. 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	± 4.50 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 test report have been generated for Class II Permissive Change notification for EOTGPDA, Gemini/PD radio modem. Gemini/PD is comprised of the Dataradio COR Ltd. (DRL) Mobile Data Platform (MDP) UHF 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:

Bit rates (bps)	Baud rate (4FSK symbol rate)	Deviation	Occupied Bandwidth	Emission Designator	Authorised Bandwidth
32000	16000 bauds	± 4.50 KHz	16830 Hz	16K8F1D	20.00 kHz

The measurement theory and set-up explanations follow.

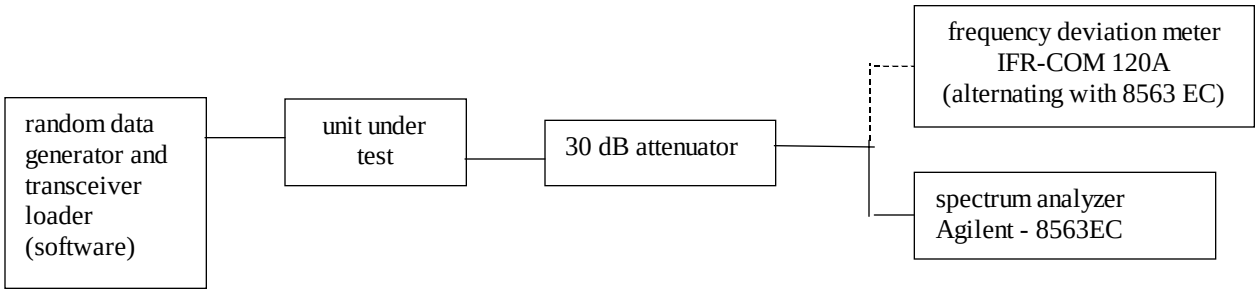
Occupied Bandwidth Measurement

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 RC4FSK

Mask compliance data in support of emission designator 16K8F1D

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

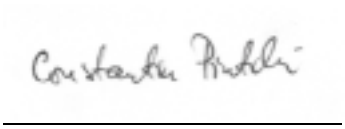
MINIMUM STANDARD: Mask C
Sidebands and Spurious [Rule 90.210 (C)]
Authorized Bandwidth = 20 kHz [Rule 90.209(b) (5)]

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

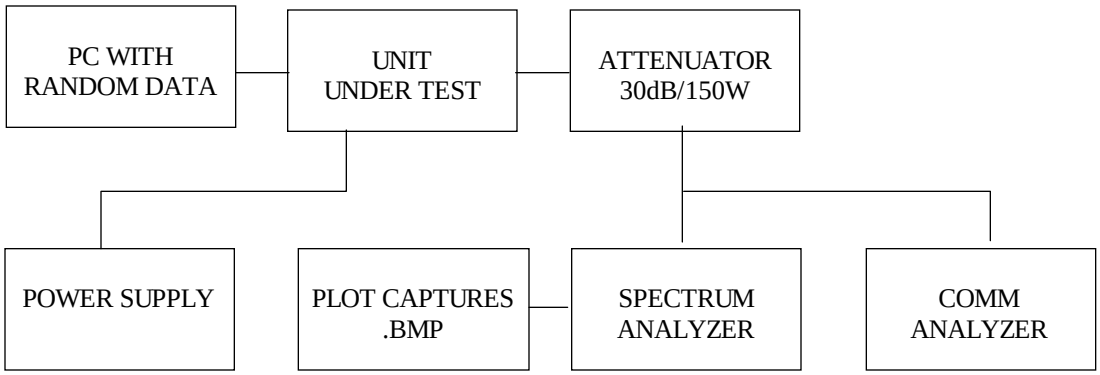
TEST EQUIPMENT: Attenuator, BIRD Model / 150-A-MFN-30 / 30 dB / 150 Watt
Splitter Minicircuits model ZFSC-2-4
DC Power Source, Model Astron VS 20M
Communication Analyzer, Model IFR COM120B (deviation meter)
Spectrum Analyzer, Model HP E4401



PERFORMED BY: _____ DATE: 11/02/2001
Constantin Pintilei

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

TEST SET-UP:



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 4.50kHz using a 1kHz tone to control the deviation level.

NECESSARY BANDWIDTH (Bn) CALCULATION

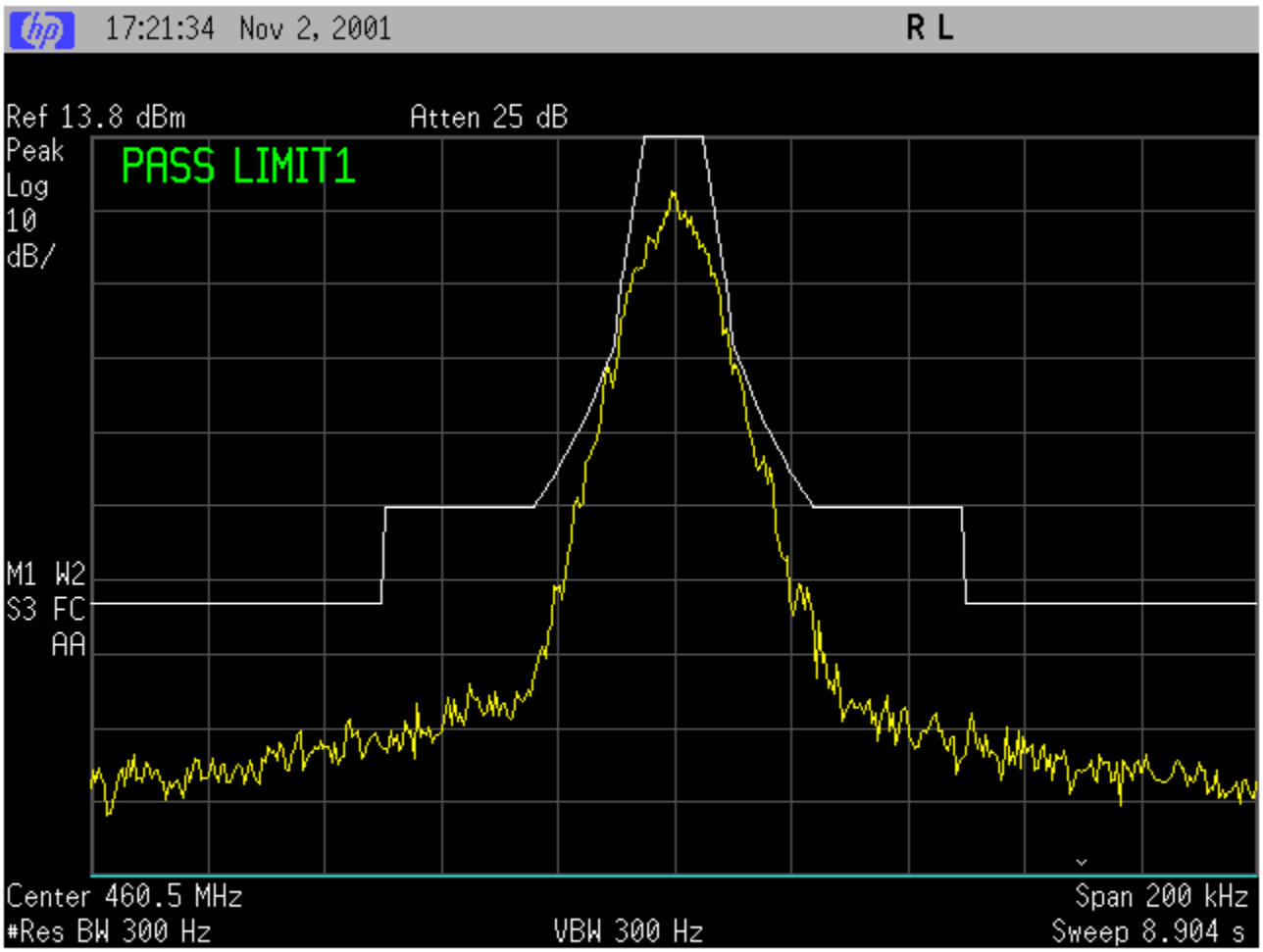
See Page 11 for emission designator determination.

The corresponding emission designator prefix for necessary bandwidth = **16K8F1D**

TEST DATA: Refer to the following graphs:

MASK: C, 50W

OUTPUT POWER: 50 Watts
32000 bps /16000 bauds 4 level FSK
Digital filters RC 0.4
PEAK DEVIATION = 4500 Hz
SPAN = 200 kHz



MASK: C, 10W

OUTPUT POWER: 10 Watts
32000 bps /16000 bauds 4 level FSK
Digital filter RC 0.4
PEAK DEVIATION = 4500 Hz
SPAN = 200 kHz