

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

for the

Mobile Data Platform Transceiver (800MHz MDP)

With the

Dataradio Gemini Modem

**FCC ID: EOTGPDB
Trade Name: GEMINI**

May 10, 2007

Dataradio Inc.
Montreal, Quebec, Canada

ENGINEERING STATEMENT
OF Constantin Pintilei

This 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 certificate EOTGPDB has been granted to Dataradio Inc for its Gemini radio modem which is comprised of the Dataradio COR Ltd. (DRL) Mobile Data Platform (MDP) Transceiver and the Dataradio Inc Gemini Control Unit (GCU) Modem. Dataradio Inc does final assembly and markets the finished Gemini product. The EOTGPDB certificate has been granted for 806.000-824 MHz Tx and 851-869MHz Rx bands. Dataradio also manufactures a 700 MHz version of this product, certificated under FCCID EOTGPD7, which differs only in its receiver circuitry. We wish to extend the Tx frequency range from 806.000-824 MHz to 794-824.000 MHz and to add the range 764-776MHz to the receiver in order to manufacture a single model for both bands in future. This application documents this increase of the Tx frequency range and covers the related modulation restrictions and spurious emissions. This change involves a different programming firmware of the radio and some redesigning on the receiver side of the transceiver, with no change whatsoever occurring in the frequency determining circuitry or the maximum power rating of the MDP transmitter.

EXISTING CONDITIONS

The units utilized for these RF spurious measurements were prototypes built from pilot MDP dual band radios and pilot GCU modems used to create the modulation scheme.

PROPOSED CONDITIONS

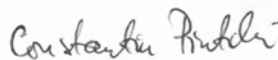
It is proposed to accept the request for the GEMINI. Gemini will be a Transceiver/Modem/GPS device for operation in the band of frequencies allowed by Part 90 subpart R (wideband 794-806MHz Tx and 764-776MHz Rx) and Part 90 subpart C (806-824MHz Tx and 851-869 MHz Rx). The applicant anticipates marketing the device for use in wireless data transmission for Public Safety services or other eligible users.

AFFIDAVIT

All measurements for Occupied Bandwidth and mask compliance as per 2.1043 (b)(2) were conducted in accordance with the Rules and Regulations Section 2.1041 and 2.1049 of Rules Service Co rev.2-172, Mar 15,2005. Equipment performance measurements were made in the R&D laboratory of Dataradio Inc and on the FCC certified Open Area Test Site of Dataradio COR located at 299 Johnson Avenue in Waseca, Minnesota. All measurements were made and recorded by myself or under my direction. The performance measurements were made between Mar 15-Mar 30, 2006 for spurious and conducted requirements and between May 1 and May 9, 2007 for modulation characteristics. To the best of my knowledge, all of the data is true and correct.

CONCLUSION

Given the results of the measurements contained herein, the applicant requests a Class II Permissive Change for the Certificate EOTGPDB to accept the extension of functional bands over 700MHz band.



05/10/2007

Constantin Pintilei, PE
Dataradio Inc

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QUALIFICATIONS OF ENGINEERING PERSONNEL

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
12 Years experience in radio frequency measurements.

NAME: **Daniel Hanson**

TITLE: Electrical Engineer I

TECHNICAL EDUCATION: Bachelor of Science Degree in Electrical Engineering (2005) from Minnesota State University, Mankato

TECHNICAL EXPERIENCE: 1 year experience in RF design.

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

The certificate EOTGPDB has been granted to Dataradio Inc for its Gemini radio modem which is comprised of a Mobile Data Platform (MDP) Transceiver manufactured by Dataradio COR Ltd. (Waseca, MN), and a Gemini Control Unit (GCU) Modem manufactured by Dataradio Inc (Montreal, Canada). Dataradio Inc does final assembly and markets the finished Gemini product.

Dataradio also manufactures a 700 MHz version of this product, certificated under FCCID EOTGPD7. The transmitter circuitry of both 700 MHz and 800 MHz models is the same.

The proposed change of the transceiver intends to combine two models into a single one by extending the Tx frequency range of EOTGPDB from 806.000-824.000 MHz to 794.000-824.000 MHz and to add an Rx operating range of 764-776MHz. This will extend the functionality of the Gemini radio modem to the 700MHz band, whose requirements are covered by Subpart R of the Part 90 of the FCC rules, and will allow us to manufacture a single model for both bands in future.

The change involves extending the transmit frequency range on the lower side by 12 MHz, from the 806-824 MHz band that the unit currently does to the 794-824 MHz band. This band covers mobile transmit frequencies for either 700MHz Public Safety services ruled by Subpart R (794-806MHz) or 800MHz mobile services ruled by Subpart I (806-809MHz and 809-824MHz). The transmitter exciter is a distinct section of the circuit board, separate from the receiver in the MDP, and the Power Amplifier is a separate assembly in its own compartment. There are no changes to the frequency determining and stabilizing circuitry (including clock or data rates), frequency multiplication stages, basic modulator circuit or RF power. The maximum power rating is preserved at 40W, as accepted at the certification. The transmitter was capable of operating across the whole range from the very beginning and the limitation in the tuning range came from the receiver side of the transceiver, as detailed below.

The change also involved redesigning the front-end of the receiver to handle both receive ranges. The 851-869MHz receive range was already functional; the 764-776MHz receive range (mobile receive band for the 700MHz band) was added. Specifically, the 3-pole pre-selector filter block in the front end and the 4-pole filter in the 1st IF block was redesigned to accommodate receiver's new requirements. Nevertheless, both bands are served by the same 1st LO into the 1st mixer to yield 55MHz at the first IF. For the 800MHz band low-side injection is used while for the 700MHz band high-side injection is used. Therefore 1st LO frequency ranges are 796-814MHz for 851-891 MHz receive band and 819-831MHz for 764-776MHz receive band. These LO frequencies were already in the working range of the VCO/synthesizer and no change occurred there. Filter block redesign added new passive components to the part list and the PCB and microstrip lines underwent slight modifications for better tuning range. These changes belong to the receiver part of the transceiver, do not concern any active components and, for the PCB itself, are of mechanical nature.

Therefore, considering the requirements of the rule parts 2.1043, 90.549 and 90.203, a Class II Permissive Change request has been considered to address the extension of the functional range to include the frequencies of Subpart R from Part 90.

The characteristics affected by this change concern:

- a new modulation scheme in the 700MHz band and Emission Limitations test data according to Subpart R of the Part 90.
- Transmitter Spurious And Harmonic Output at the antenna port according to the requirements of 2.1051
- Field strength of spurious radiation for the extended transmission (794-806 MHz) band according to the requirements of 2.1053

They are entirely documented within the current report.

GENERAL INFORMATION ABOUT THE GRANTEE AND CERTIFICATED EQUIPMENT -2.1043**(b)(2)**

(as per Rule 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

PART NUMBER: GPG3-6085-xyz

FCC ID NUMBER: EOTGPDB

FCC RULES AND REGS: FCC Part (s) 90 subparts I and R (R – added by this Class II
Permissive Change)

FREQUENCY RANGE: 794.000 MHz - 824.000 MHz Tx with 2 Rx bands 764-776MHz and
851-869MHz. (794-806/764-776 MHz, 806-809/851-854 MHz and
809-824/854-869 MHz Bands)

MAXIMUM POWER RATING: 40.00 Watts (10-40 watts variable). For the 700MHz band maximum
power is set at 30W by internal firmware (10-30W variable)

NUMBER OF CHANNELS: 32 Channel Modem

INPUT IMPEDANCE: 50 ohms, Nominal

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

EQUIPMENT IDENTIFICATION:

TRADE NAME

MDP6000

Gemini GCU III

DRL Part Number System for MDP:**DESCRIPTION**

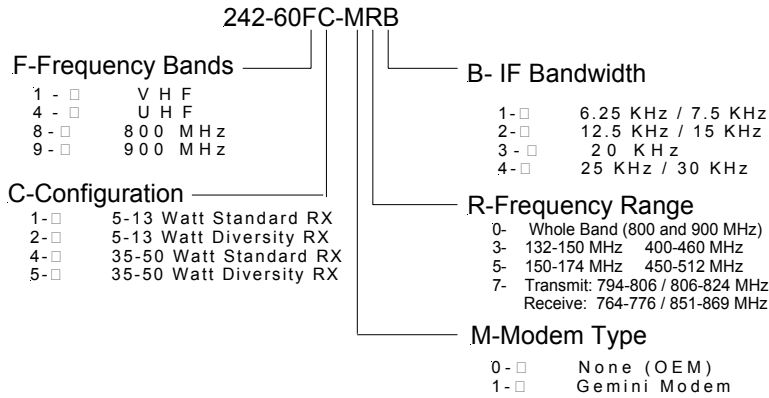
700/800 dual band XCVR

Modem

DRI PART NUMBER

242-608C-MR0 (new IF code 0)

255-03434-00x



DATA AND CHARACTERISTICS NOT AFFECTED BY THE CHANGE - Rule Part Number: 2.1033 (c). (3),(4),(11),(12),(13),(14),(15),(16)

Instruction book	2.1033 (c) (3)
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	2.1033(c) 14, 2.1041
Test data according to:	
Part 2:2.1047,2.1049 and 2.1055	
Part 90, Subpart I: 90.209, 90.210, 90.213 and 90.214	
as follow:	
Occupied Bandwidth and Emission designator	2.1047,2.1049, 90.209, 90.210
Frequency Stability and Frequency Tolerance	2.1055,90.213

DATA AND CHARACTERISTICS AFFECTED BY THE CHANGE - Rule Part Number:2.1033(c) (8)(9)(10)**Changes of characteristics supported by descriptions, relating to Subpart R – wideband channels:****Band plan****90.531**

Mobile unit: 794-806MHz transmit band paired with 764-776MHz receive band, 30MHz channel pairing supported. It uses 50kHz wide channels, without the possibility of combining channels in a single unit.

Digital Modulation Techniques**2.1033.(c) (13), 90.535 (a)**

The proposed change does not change modulation techniques in terms of pulse shape (Squared Root Raised Cosine) or modulation techniques (16FSK, 8FSK or 4FSK). The difference comes from the symbol rate that was increased to 32000bps to accommodate the spectral efficiency required for channels of 50kHz. 8FSK and 4FSK are subsets of the 16FSK. The highest bitrate of 128kbps is the default transmission rate speed for 700MHz band.

Overall the digital modulations proposed in 700 MHz band are:

Bit rate	levels FSK	Symbol rate	Pulse shape and modulation type	Acronyms/ factor / 3dB cutoff frequency	Deviation data/tone	Occupied Bandwidth
128 Kb/s	16	32000 baud	Squared Root Raised Cosine 16 Level Frequency Shift Keying	SRRC16FSK $\alpha=0.4$ 16000Hz	± 7.6 KHz ± 5.4 KHz	27446Hz
96 Kb/s	8	32000 baud	Squared Root Raised Cosine 16 Level Frequency Shift Keying	SRRC8FSK $\alpha=0.4$ 16000Hz	± 7.5 KHz ± 5.4 KHz	27671Hz
64 Kb/s	4	32000 baud	Squared Root Raised Cosine 16 LevelsFrequency Shift Keying	SRRC4FSK $\alpha=0.4$ 16000Hz	± 7.8 KHz ± 4.7 KHz	27671Hz

Spectrum Efficiency Standard**90.535 (c)**

In the proposed new range the unit employs only digital modulation as per 90.535 (a). The unit is designed for a channel size of 50 kHz as per 90.531(c) with a spectrum efficiency of 128kbps/50kHz. This equates to $128 \times 3\text{kbps} / 50 \times 3\text{kHz} = 384\text{kbps} / 150\text{kHz}$ as required by 90.535(c)

Frequency Stability**90.539(e)**

The frequency stability for 700MHz band is 1.25ppm, as previously certified under EOTGPD7. There is no AFC provided. Higher stability than required (better than 0.5 ppm) is typical for the product. In any case, the original EOTGPDB was only required to be 1.5ppm for the 800MHz band. Test results submitted in 2000 were 0.422ppm.

Output RF Power**2.1046, 90.541(b)**

The output power accepted is 40W, continuously adjustable down to 5W in the band of 806-824MHz. There are no RF power limitations for the mobile unit in this band.

Nevertheless, in the band of 794-806MHz requirements set in 90.541(b) ask for a power limitation of 30W for the mobile unit. The power of 30W is already in the range of adjustment for the unit and this maximum power is automatically set through the firmware. The power range in the 794-806MHz Tx band therefore becomes 30W continuously adjustable down to 10W.

Emission designator according to the Modulation Characteristic 2.1047 (d), 90.209 (b), 90.543 (e)

Emission designator according to 90.209(b) is 28K0F1D. A plot capture is provided in the test report.

Subpart R Requirements which do Not Apply to this certification:

90.523,90.525,90.527,90.529,90.533,90.537,90.545,90.547,90.548,90.551,90.553.

TEST DATA 2.1033 (c)(14)

All applicable test data as shown above are provided in next section of this Engineering Report

Test data supported by test reports relating to Subpart R – wideband channels:

Part 2: 2.1051, 2.1053 and 2.1057
 Part 90, Subpart R: 90.543
 are as follows:

Emission Limitations (ACP, OBW)	2.1046, 90.543
Transmitter's spurious emissions at antenna terminals	2.1051
Field strength of spurious radiation of the transmitter	2.1053

The following reports have been generated for Class II Permissive Change request for EOTGPDB ,Gemini/PD radio modem. Gemini is comprised of the Dataradio COR Ltd. (DRL) Mobile Data Platform (MDP) UHF (794-824 MHz Tx / 764-776 and 851-869MHz Rx) Transceiver with the Dataradio Inc Gemini G3 Modem. Dataradio Inc does the final assembly and markets the Gemini unit

Unless otherwise noted, all of the measurements were conducted following the procedures set forth in the TIA/EIA-603 standards.

Annex A doc # 156-9000-891 – Emission Limitations (ACP, OBW)	9.543
Annex B doc # 156-9000-892 - Transmitter's spurious emissions at antenna terminals	2.1051
Annex C doc # 156-9000-893 - Field strength of spurious radiation of the transmitter	2.1053

The three annexes are part of the current application.