XLR PRO®

Radio Frequency (RF) Module

User Guide

PRELIMINARY DRAFT

XLR PRO Radio Frequency Module User Guide

Part Number 90001407

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About the XLR PRO Radio Frequency (RF) Module

The XLR PRO Application Name is a high performance, industrial grade long-range RF solution using Chirp Spread Spectrum (CSS) technology to maximize range and significantly increase immunity to interference.

XLR PRO Application Name Technical Specifications

Specification	Description
Transmit Power (Software Selectable)	30 dBm (highest power level)
Receiver Sensitivity	Up to -120 dBm (see XLR PRO RF Module Receiver Sensitivity on page 6)
Throughput Data Rate (Software Selectable)	TBD
RF Data Rate	9 kbps to 3.1 Mbps
Networking and Security	
Transmission	Chirp Spread Spectrum (CSS)
Modulation	Quadrature Phase Shift Keying (*QPSK*)
Supported Network Topologies	Point-to-point, Point-to-multipoint, Broadcast repeater
Interface	Serial CMOS UART and I/O lines
Encryption	128bit AES
Power Requirements	
Supply Voltage	3.8 to 5.5VDC Note Operation below 4.5V may reduce radio transmit power performance and LNA sensitivity.

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Specification	Description
Receive Current	295 mA at 5 V
Transmit Current	1.5 A at 5 V
Shutdown Mode Power Down	3 µA
Environmental	
Operating Temperature	-40 C to 70 C
Certifications	
FCC ID	MCQ-XLRP (pending)
IC	1846A-XLRP (pending)
Hazardous Locations	C1D2 (pending)

XLR PRO RF Module Receiver Sensitivity

Data Rate	Receiver Sensitivity (25°C) (dBm)
9 kbps	-120
28 kbps	-119
65 kbps	-116
140 kbps	-113
290 kbps	-109
590 kbps	-106
1.1 Mbps	-104
2.3 Mbps	-100
3.1 Mbps	-98

XLR PRO Application Name Pin Signals

Pin #	Name	Description
1	Reserved	Do not connect
2	Reserved	Do not connect
3	Reserved	Do not connect

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Pin #	Name	Description
4	Reserved	Do not connect
5	GND	Ground
6	VDD-5V	Power Supply
7	Reserved	Do not connect
8	Reserved	Do not connect
9	Reserved	Do not connect
10	Reserved	Do not connect
11	VDD-5V	Power Supply
12	GND	Ground
13	3.3V_OUT	Regulated Output Voltage from VDD_5V. Controlled by nSHUTDOWN.
14	3.3V_IN	Voltage Supply for the Primary Processor and the I/O Voltages
15	3.3V_ADJUST	Voltage Control of 3.3V_OUT
16	nRESET	Module Reset
17	Reserved	Do not connect
18	DIO0/AD0/CommBtn	GPIO/Analog Input/Commissioning Button
19	Reserved	Do not connect
20	DIO1/AD1	GPIO/Analog Input
21	Reserved	Do not connect
22	DIO2/AD2	GPIO/Analog Input
23	Reserved	Do not connect
24	DIO1/AD1	GPIO/Analog Input
25	Reserved	Do not connect
26	DIO4	GPIO
27	Reserved	Do not connect
28	DIO5/ASSOC	GPIO/Associate Indicator
29	DIO19/SPI_nATTN	GPIO/SPI Attention

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Pin #	Name	Description
30	DIO8/nDTR/SLP_RQ	GPIO/Pin Sleep Control Line
31	DIO17/SPI_nSSEL	GPIO/SPI Slave Select
32	DIO9/ON_nSLEEP	GPIO/Module Status Indicator
33	DIO16/SPI_SI	GPIO/SPI Slave In
34	VREF	Used internally used for programmable secondary processor. For compatibility with other XLR modules, we recommend connecting this pin to the voltage reference if Analog Sampling is desired. Otherwise, connect to GND.
35	DIO15/SPI_SO	GPIO/SPI Slave Out
36	DIO10/PWM0/RSSI/DAC0	GPIO/RX Signal Strength Indicator
37	DIO18/SPI_CLK	GPIO/SPI Clock
38	DIO11/PWM1/DAC1	GPIO/Pulse Witdh Modulator
39	DIO7/nCTS	GPIO/Clear-to-Send Flow Control
40	DIO12/CD/PWM2/ADTRG	GPIO/Pulse Width Modulator
41	DIO6/nRTS	GPIO/Request-to-Send Flow Control
42	GND	Ground
43	DIO13/DOUT	UART Data out
44	Reserved	Do not connect
45	DIO14/DIN/nConfig	UART Data in
46	nSHUTDOWN	Module Shutdown
47	GND	Ground
48	VDD_5V	Power Supply
49	Reserved	Do not connect
50	Reserved	Do not connect
51	Reserved	Do not connect
52	Reserved	Do not connect

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XLR PRO Application Name Data Rates

RF Baud Rate Setting	Raw Data Rate 9605 Mhz BW (Kbps)
0x00	9.380
0x01	12.50
0x02	28.14
0x03	37.52
0x04	65.66
0x05	87.55
0x06	140.7
0x07	187.6
0x08	290.8
0x09	387.7
0x0A	590.9
0x0B	787.8
0x0C	1191
0x0D	1588
0x0E	2392
0x0F	3189

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XLR PRO Certifications

The XLR PRO radio frequency (RF) module, when used with approved antennas, complies with the FCC and IC certifications detailed in this section. For a list of antennas approved for use with XLR PRO, see XLR PRO Approved Antennas on page 15.

FCC (United States) Certification

The XLR PRO RF module complies with Part 15 of the FCC rules and regulations. Compliance with the labeling requirements, FCC notices, and antenna usage guidelines is required. To operate under Digi International FCC Certification, RF modules/integrators must comply with the following regulations:

1. The system integrator must ensure that the text provided with this device (see *FCC-Required Label Text* on page 11) is placed on the outside of the final product and within the final product operation manual.
2. The XLR PRO RF module may be used only with antennas that have been tested and approved for use with this module refer to *XLR PRO Approved Antennas* on page 15.

FCC Labeling Requirements

WARNING: The Original Equipment Manufacturer (OEM) must ensure that FCC labeling requirements are met. This includes a clearly visible label on the outside of the final product enclosure that displays the text shown in *FCC-Required Label Text* on page 11.

FCC-Required Label Text

Contains FCC ID: MCQ-XLRP

The enclosed device complies with Part 15 of the FCC Rules. Operation is subject to the following two conditions: (i.) this device may not cause harmful interference and (ii.) this device must accept any interference received, including interference that may cause undesired operation.

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FCC Notices

IMPORTANT: The XLR PRO OEM RF Module has been certified by the FCC for use with other products without any further certification (as per FCC section 2.1091). Modifications not expressly approved by Digi International could void the user's authority to operate the equipment.

IMPORTANT: The RF module has been certified for remote and base radio applications. If the module will be used for portable applications, the device must undergo SAR testing.

This equipment has been tested and found to comply with the limits for a Class B digital device, pursuant to Part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference in a residential installation. This equipment generates, uses and can radiate radio frequency energy and, if not installed and used in accordance with the instructions, may cause harmful interference to radio communications. However, there is no guarantee that interference will not occur in a particular installation.

If this equipment does cause harmful interference to radio or television reception, which can be determined by turning the equipment off and on, the user is encouraged to try to correct the interference by one or more of the following measures: Re-orient or relocate the receiving antenna, Increase the separation between the equipment and receiver, Connect equipment and receiver to outlets on different circuits, or Consult the dealer or an experienced radio/TV technician for help.

FCC Limited Modular Approval

This is an RF module approved for Limited Modular use operating as a mobile transmitting device with respect to section 2.1091 and is limited to OEM installation for Mobile and Fixed applications only. During final installation, end-users are prohibited from access to any programming parameters. Professional installation adjustment is required for setting module power and antenna gain to meet EIRP compliance for high gain antenna(s).

Final antenna installation and operating configurations of this transmitter including antenna gain and cable loss must not exceed the EIRP of the configuration used for calculating MPE. Grantee (Digi) must coordinate with OEM integrators to ensure the end-users and installers of products operating with the module are provided with operating instructions to satisfy RF exposure requirements.

The FCC grant is valid only when the device is sold to OEM integrators. Integrators are instructed to ensure the end-user has no manual instructions to remove, adjust or install the device.

FCC-Approved Antennas

WARNING: This device has been tested with Reverse Polarity SMA connectors with the antennas listed in *XLR PRO Approved Antennas* on page 15. When integrated into OEM products, fixed antennas require installation preventing end-users from replacing them with non-approved antennas. Antennas not listed in the *XLR PRO Approved Antennas* on page 15 must be tested to comply with FCC Section 15.203 (unique antenna connectors) and Section 15.247 (emissions).

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WARNING: The FCC requires that all spread spectrum devices operating within the Unlicensed radio frequency bands must limit themselves to a maximum radiated power of 4 Watts EIRP. Failure to observe this limit is a violation of our warranty terms, and shall void the user's authority to operate the equipment. This can be stated as follows:

RF power - cable loss + antenna gain <= 36 dBm eirp

Fixed Base Station and Mobile Applications

Digi RF Modules are pre-FCC approved for use in fixed base station and mobile applications. When the antenna is mounted at least 20cm (8") from nearby persons, the application is considered a mobile application.

Portable Applications and SAR Testing

If the module will be used at distances closer than 20cm to all persons, the device may be required to undergo SAR testing. Co-location with other transmitting antennas closer than 20cm should be avoided.

RF Exposure

The following statement must be included as a CAUTION statement in OEM product manuals.

CAUTION: This equipment is approved for mobile and base station transmitting devices only. Antenna(s) used for this transmitter must be installed to provide a separation distance of at least 20 cm from all persons and must not be co-located or operating in conjunction with any other antenna or transmitter.

IC (Industry Canada) Certification

This device complies with Industry Canada licence-exempt RSS standard(s). Operation is subject to the following two conditions: (1) this device may not cause interference, and (2) this device must accept any interference, including interference that may cause undesired operation of the device.

Le présent appareil est conforme aux CNR d'Industrie Canada applicables aux appareils radio exempts de licence. L'exploitation est autorisée aux deux conditions suivantes: (1) l'appareil ne doit pas produire de brouillage, et (2) l'utilisateur de l'appareil doit accepter tout brouillage radioélectrique subi, même si le brouillage est susceptible d'en compromettre le fonctionnement.

IC Labeling Requirements

Labeling requirements for Industry Canada are similar to those of the FCC. A clearly visible label on the outside of the final product enclosure must display the following text.

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IC-Required Text

Contains IC:1846A-XLRP

The integrator is responsible for its product to comply with IC ICES-003 & FCC Part 15, Sub. B-Unintentional Radiators. ICES-003 is the same as FCC Part 15 Sub. B and Industry Canada accepts FCC test report or CISPR 22 test report for compliance with ICES-003.

Transmitters with Detachable Antennas

This radio transmitter (IC: 1846A-XLRP) has been approved by Industry Canada to operate with the antenna types listed in *XLR PRO Approved Antennas* on page 15 with the maximum permissible gain and required antenna impedance for each antenna type indicated. Antenna types not included in this list, having a gain greater than the maximum gain indicated for that type, are strictly prohibited for use with this device.

Le présent émetteur radio (IC: 1846A-XLRP) a été approuvé par Industrie Canada pour fonctionner avec les types d'antenne énumérés ci?dessous et ayant un gain admissible maximal et l'impédance requise pour chaque type d'antenne. Les types d'antenne non inclus dans cette liste, ou dont le gain est supérieur au gain maximal indiqué, sont strictement interdits pour l'exploitation de l'émetteur.

Detachable Antenna

Under Industry Canada regulations, this radio transmitter may operate using only an antenna of a type and maximum (or lesser) gain approved for the transmitter by Industry Canada. To reduce potential radio interference to other users, the antenna type and its gain should be so chosen that the equivalent isotropically radiated power (e.i.r.p.) is not more than that necessary for successful communication.

Conformément à la réglementation d'Industrie Canada, le présent émetteur radio peutfonctionner avec une antenne d'un type et d'un gain maximal (ou inférieur) approuvépour l'émetteur par Industrie Canada. Dans le but de réduire les risques de brouillageradioélectrique à l'intention des autres utilisateurs, il faut choisir le type d'antenne etson gain de sorte que la puissance isotrope rayonnée équivalente (p.i.r.e.) ne dépassepas l'intensité nécessaire àl'établissement d'une communication satisfaisante.

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XLR PRO Approved Antennas

Omni-Directional Antennas

Part Number	Type	Connector	Gain (dBi)	Application	Minimum Cable Loss or TX Power Reduction Required in dB
A09-F0	OMNI	RPN	0.0	Fixed	0
A09-F1	OMNI	RPN	1.0	Fixed	0
A09-F2	OMNI	RPN	2.1	Fixed	0
A09-F3	OMNI	RPN	3.1	Fixed	0
A09-F4	OMNI	RPN	4.1	Fixed	0
A09-F5	OMNI	RPN	5.1	Fixed	0
A09-F6	OMNI	RPN	6.1	Fixed	0.1
A09-F7	OMNI	RPN	7.1	Fixed	1.1
A09-F8	OMNI	RPN	8.1	Fixed	2.1
A09-W7	OMNI	RPN	7.1	Fixed	1.1
A09-F0	OMNI	RPSMA	0.0	Fixed	0
A09-F1	OMNI	RPSMA	1.0	Fixed	0
A09-F2	OMNI	RPSMA	2.1	Fixed	0
A09-F3	OMNI	RPSMA	3.1	Fixed	0
A09-F4	OMNI	RPSMA	4.1	Fixed	0
A09-F5	OMNI	RPSMA	5.1	Fixed	0
A09-F6	OMNI	RPSMA	6.1	Fixed	0.1
A09-F7	OMNI	RPSMA	7.1	Fixed	1.1
A09-F8	OMNI	RPSMA	8.1	Fixed	2.1
A09-M7	OMNI	RPSMAF	7.2	Fixed	1.2
A09-W7SM	OMNI	RPSMA	7.1	Fixed	1.1
A09-F0TM	OMNI	RPTNC	0.0	Fixed	0
A09-F1TM	OMNI	RPTNC	1.0	Fixed	0
A09-F2TM	OMNI	RPTNC	2.1	Fixed	0
A09-F3TM	OMNI	RPTNC	3.1	Fixed	0

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Part Number	Type	Connector	Gain (dBi)	Application	Minimum Cable Loss or TX Power Reduction Required in dB
A09-F4TM	OMNI	RPTNC	4.1	Fixed	0
A09-F5TM	OMNI	RPTNC	5.1	Fixed	0
A09-F6TM	OMNI	RPTNC	6.1	Fixed	0.1
A09-F7TM	OMNI	RPTNC	7.1	Fixed	1.1
A09-F8TM	OMNI	RPTNC	8.1	Fixed	2.1
A09-W7TM	OMNI	RPTNC	7.1	Fixed	1.1
A09-HSM-7	OMNI	RPSMA	3.0	Fixed/Mobile	0
A09-HASM-675	OMNI	RPSMA	2.1	Fixed/Mobile	0
A09-HABMM-P61	OMNI	MMCX	2.1	Fixed/Mobile	0
A09-HABMM-6-P61	OMNI	MMCX	2.1	Fixed/Mobile	0
A09-HBMM-P61	OMNI	MMCX	2.1	Fixed/Mobile	0
A09-HRSM	OMNI	RPSMA	2.1	Fixed	0
A09-HASM-7	OMNI	RPSMA	2.1	Fixed	0
A09-HG	OMNI	RPSMA	2.1	Fixed	0
A09-HATM	OMNI	RPTNC	2.1	Fixed	0
A09-HATM-10	OMNI	RPTNC	2.1	Fixed/Mobile	0
A09-H	OMNI	RPSMA	2.1	Fixed	0
A09-HBMMP61	OMNI	MMCX	2.1	Fixed/Mobile	0
A09-QBMMP61	OMNI	MMCX	1.9	Fixed/Mobile	0
A09-QSM-3	OMNI	RPSMA	1.9	Fixed/Mobile	0
A09-QSM-3H	OMNI	RPSMA	1.9	Fixed/Mobile	0
A09-QBMM-P61	OMNI	MMCX	1.9	Fixed/Mobile	0
		Max Gain	8.1		

Yagi Antennas

Part Number	Type	Connector	Gain (dBi)	Application	Minimum Cable Loss or TX Power Reduction Required in dB
A09-Y6	2-Element Yagi	RPN	6.1	Fixed/Mobile	0.1
A09-Y7	3-Element Yagi	RPN	7.1	Fixed/Mobile	1.1
A09-Y8	4-Element Yagi	RPN	8.1	Fixed/Mobile	2.2
A09-Y9	4-Element Yagi	RPN	9.1	Fixed/Mobile	3.1
A09-Y10	5-Element Yagi	RPN	10.1	Fixed/Mobile	4.1
A09-Y11	6-Element Yagi	RPN	11.1	Fixed/Mobile	5.1

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Part Number	Type	Connector	Gain (dBi)	Application	Minimum Cable Loss or TX Power Reduction Required in dB
A09-Y12	7-Element Yagi	RPN	12.1	Fixed/Mobile	6.1
A09-Y13	9-Element Yagi	RPN	13.1	Fixed/Mobile	7.1
A09-Y14	10-Element Yagi	RPN	14.1	Fixed/Mobile	8.1
A09-Y14	12-Element Yagi	RPN	14.1	Fixed/Mobile	8.1
A09-Y15	13-Element Yagi	RPN	15.1	Fixed/Mobile	9.1
A09-Y15	15-Element Yagi	RPN	15.1	Fixed/Mobile	9.1
A09-Y6TM	2-Element Yagi	RPTNC	6.1	Fixed/Mobile	0.1
A09-Y7TM	3-Element Yagi	RPTNC	7.1	Fixed/Mobile	1.1
A09-Y8TM	4-Element Yagi	RPTNC	8.1	Fixed/Mobile	2.1
A09-Y9TM	4-Element Yagi	RPTNC	9.1	Fixed/Mobile	3.1
A09-Y10TM	5-Element Yagi	RPTNC	10.1	Fixed/Mobile	4.1
A09-Y11TM	6-Element Yagi	RPTNC	11.1	Fixed/Mobile	5.1
A09-Y12TM	7-Element Yagi	RPTNC	12.1	Fixed/Mobile	6.1
A09-Y13TM	9-Element Yagi	RPTNC	13.1	Fixed/Mobile	7.1
A09-Y14TM	10-Element Yagi	RPTNC	14.1	Fixed/Mobile	8.1
A09-Y14TM	12-Element Yagi	RPTNC	14.1	Fixed/Mobile	8.1
A09-Y15TM	13-Element Yagi	RPTNC	15.1	Fixed/Mobile	9.1
A09-Y15TM	15-Element Yagi	RPTNC	15.1	Fixed/Mobile	9.1
		Max Gain	15.1		

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