

Radio solutions for industrial applications worldwide



# LOW-POWER RADIO MODULES

Product Data Sheets

Competence in radio solutions

**CIRCUIT DESIGN, INC.**

## Selection guide

Model Parameter	Data Transmitter / Receiver			Data Transceiver					Radio Modem		Telecommand			Audio	Model Parameter
	CDP-TX-02E/EP CDP-RX-02E/EP	CDP-TX-02F CDP-RX-02F	CDP-TX-07M/MP CDP-RX-07M/MP	STD-601 (434 MHz)	STD-601 (400 MHz)	STD-302Z	LMD-401	STD-503	SLR-434M	MU-4-434	NK-2.4Y	KST2.4S KSR2.4	CDT-TX-02M-R CDT-RX-03M	WA-TX-03S WA-RX-03S	
<b>Interface</b>															<b>Interface</b>
Serial data	●	●	●	●	●	●	●	●							Serial data
UART command									●	●					UART command
ON / OFF Level											●	●	●		ON / OFF Level
Audio														●	Audio
<b>Channel number</b>															<b>Channel number</b>
	32	128	4	137	137 *	Programmable	Programmable	77	137 *	127 *	–	–	4	15	
<b>Data rate</b>															<b>Data rate</b>
( bps )	4,800	4,800	4,800	4,800 / 9,600	1,200 - 19,200	9,600 *	4,800	19,200	4,800	4,800	250 k	250 k	1,200	–	
<b>Max. TX power</b>															<b>Max. TX power</b>
( mW )	10 ***	10 ***	10 *	10 ***	50 ***	10 *	10	10	10	10 ***	1.4	1.6	10 *	10 ***	
<b>Supply voltage</b>															<b>Supply voltage</b>
( V )	3.0 - 12.0	3.0 - 12.0	2.2 - 5.5 (TX) 3.0 - 14.0 (RX)	3.0 - 5.0	3.0 - 5.0	3.0 - 5.5	3.0 - 5.5	3.3 - 5.5	3.3 - 5.5	3.0 - 5.0	2.2 - 5.5	6.0 - 24.0	2.2 - 12.0 (TX) 3.0 - 12.0 (RX)	4.2 - 6.0 (TX) 3.0 - 5.0 (RX)	
<b>Supply current **</b>															<b>Supply current **</b>
TX ( mA )	43	43	20 *	26	58	44 *	46	48	29	42	3	30	27 *	60	
RX ( mA )	30	30	23	19	19	28	36	55	17	22	7	80	55	45	
<b>Page No.</b>	4	5	6 - 7	8	9	10	11	12	13	14	15	16	17	18	

\* Values vary by frequency band. Check product details.

\*\* Typical values at maximum RF output power unless otherwise noted.

\*\*\* Power selectable. Check product details.

Model Parameter	Data Transmitter / Receiver			Data Transceiver					Radio Modem		Telecommand			Audio	Model Regulation
	CDP-TX-02E/EP CDP-RX-02E/EP	CDP-TX-02F CDP-RX-02F	CDP-TX-07M/MP CDP-RX-07M/MP	STD-601 (434 MHz)	STD-601 (400 MHz)	STD-302Z	LMD-401	STD-503	SLR-434M	MU-4-434	NK-2.4Y	KST2.4S KSR2.4	CDT-TX-02M-R CDT-RX-03M	WA-TX-03S WA-RX-03S	
419 MHz						○									
426 MHz													●		ARIB STD-T67
429 MHz					○	○			●	●					ARIB STD-T67
434 MHz	●	●	●*	●	○	●			●	●			●		EN 300 220
447 MHz					○	○									
458 MHz					○	○									
458 - 462.5 MHz							●								FCC Part 90 ISED RSS-119
863 MHz														●	EN 301 357
869 MHz			●			●									EN 300 220
2.4 GHz								●			●	●**			EN 300 440 FCC Part15.247 ISED RSS-247 ARIB STD-T66

● : Pre-certified module ○ : Uncertified \* : Receiver category 1 compliance \*\* : FCC and ARIB compliance

32ch

# UHF Narrowband Multi Channel Transmitter and Receiver CDP-TX-02E, CDP-RX-02E 434 MHz

The unique and compact CDP-TX-02E and CDP-RX-02E are frequency selectable radio data modules for the 434 MHz ISM band. Both CDP-TX-02E and CDP-RX-02E are equipped with a frequency synthesizer system including a microcontroller. 32 RF channels are selectable using an onboard 4-bit DIP switch.

Its small size, low voltage operation and frequency selectability make it ideal for various applications in sites where many radio transmitters are operated.

The CDP-TX-02EP and CDP-RX-02EP are channel selectable using an 8 pin terminal allowing you to perform channel selection remotely.

## Features

- 32 RF channels
- 1 mW / 10 mW selectable
- Low voltage operation
- High sensitivity receiver
- FSK narrowband
- CE / UKCA marking

## Applications

- Industrial remote control
- Factory automation (Machine to machine)
- Security systems
- Alarms
- Telemetry systems



## General

Parameter	Specification (All ratings at 25 C unless otherwise noted)
Applicable standard	EN 300 220
Communication method	One way
Emission type	F1D (FSK narrow)
Frequency	433.875 to 434.650 MHz
Number of RF channels	32 ch (25 kHz step)
Channel spacing	25 kHz
Channel selection method	4 bit switch (CDP-TX-02E and CDP-RX-02E), 8 pin (CDP-TX-02EP and CDP-RX-02EP)
Frequency stability	+/-4.0 ppm or less (-20 to +60 C)
RF bit rate	300 to 4,800 bps (Min. pulse width 208 us, Max. pulse width 20 ms)
Operating temperature	-20 to +60 C (No dew condensation)

## CDP-TX-02E

Transmitter

Parameter	Specification
Oscillation system	PLL controlled VCO
RF output power	10 mW / 1 mW selectable
Transmitter start up time	50 ms (from power on)
Data input	Digital L = GND, H = Vcc
Deviation	+/-2.1 kHz (PN9 4,800 bps LPF 20 kHz)
Spurious emission	< -54 dBm (47 to 74, 87.5 to 118, 174 to 230, 470 to 862 MHz) < -36 dBm (Other frequencies below 1000 MHz) < -30 dBm (Frequencies above 1000 MHz)
Adjacent channel leakage power	< -37 dBm (CH 25 kHz / BW 16 kHz / PN9 4,800 bps)
Supply voltage	3.0 to 12 V
Supply current	43 mA typ. (10 mW), 33 mA typ. (1 mW)
Dimensions	26 x 36 x 10 mm (excluding protrusion)
Weight	14 g (without antenna)

## CDP-RX-02E

Receiver

Parameter	Specification
Receiver type	Double superheterodyne PLL synthesizer
Receiver category	1.5
Sensitivity (12 dB SINAD)	-120 dBm typ. at AF FM 1 kHz, Dev. +/-2.0 kHz, CCITT filter (-20 to +60 C)
Sensitivity (BER 1%)	-120 dBm typ. at DO PN9 4,800 bps (-20 to +60 C)
Adjacent channel selectivity	> -50 dBm (+/-25 kHz)
Blocking	> -20 dBm (+/-10 MHz), > -25 dBm (+/-2 MHz)
Spurious radiation	< -60 dBm (below 1 GHz), < -50 dBm (above 1 GHz)
Data output	Digital L = GND, H = Vcc
Supply voltage	3.0 to 12 V
Supply current	30 mA typ. (3 V), 33 mA typ. (12 V)
Dimensions	30 x 50 x 9 mm (excluding protrusion)
Weight	20 g

Specifications are subject to change without prior notice

**CIRCUIT DESIGN, INC.**

<https://www.circuitdesign.jp>  
CDP-TX/RX-02E ver. 1.2 Aug. 2022

## Sales Division

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128ch

# UHF Narrowband Multi Channel Transmitter and Receiver CDP-TX-02F, CDP-RX-02F 434 MHz

The unique and compact CDP-TX-02F and CDP-RX-02F are frequency selectable radio data modules for the 434 MHz ISM band. Both CDP-TX-02F and CDP-RX-02F are equipped with a frequency synthesizer system including a microcontroller. 128 RF channels are selectable using an onboard 7-bit DIP switch.

Its small size, low voltage operation and frequency selectability make it ideal for various applications in sites where many radio transmitters are operated.

## Features

- 128 RF channels
- 1 mW / 10 mW selectable
- Low voltage operation
- High sensitivity receiver
- FSK narrowband
- CE / UKCA marking

## Applications

- Industrial remote control
- Factory automation (Machine to machine)
- Security systems
- Alarms
- Telemetry systems



## General

Parameter	Specification (All ratings at 25 C unless otherwise noted)
Applicable standard	EN 300 220
Communication method	One way
Emission type	F1D (FSK narrow)
Frequency	433.1875 to 434.7750 MHz
Number of RF channels	128 ch (12.5 kHz step)
Channel spacing	25 kHz
Channel selection method	7 bit switch
Frequency stability	+/-4.0 ppm or less (-20 to +60 C)
RF bit rate	300 to 4,800 bps (Min. pulse width 208 us, Max. pulse width 20 ms)
Operating temperature	-20 to +60 C (No dew condensation)

## CDP-TX-02F

Transmitter

Parameter	Specification
Oscillation system	PLL controlled VCO
RF output power	10 mW / 1 mW selectable
Transmitter start up time	50 ms (from power on)
Data input	Digital L = GND, H = Vcc
Deviation	+/-2.1 kHz (PN9 4,800 bps LPF 20 kHz)
Spurious emission	< -54 dBm (47 to 74, 87.5 to 118, 174 to 230, 470 to 862 MHz) < -36 dBm (Other frequencies below 1000 MHz) < -30 dBm (Frequencies above 1000 MHz)
Adjacent channel leakage power	-37 dBm (CH 25 kHz / BW 16 kHz / PN9 4,800 bps)
Supply voltage	3.0 to 12 V
Supply current	43 mA typ. (10 mW), 33 mA typ. (1 mW)
Dimensions	26 x 36 x 10 mm (excluding protrusion)
Weight	14 g (without antenna)

## CDP-RX-02F

Receiver

Parameter	Specification
Receiver type	Double superheterodyne PLL synthesizer
Receiver category	1.5
Sensitivity (12 dB SINAD)	-120 dBm typ. at AF FM 1 kHz, Dev. +/-2.0 kHz, CCITT filter (-20 to +60 C)
Sensitivity (BER 1%)	-120 dBm typ. at DO PN9 4,800 bps (-20 to +60 C)
Adjacent channel selectivity	> -50 dBm (+/-25 kHz)
Blocking	> -20 dBm (+/-10 MHz), > -25 dBm (+/-2 MHz)
Spurious radiation	< -60 dBm (below 1 GHz), < -50 dBm (above 1 GHz)
Data output	Digital L = GND, H = Vcc
Supply voltage	3.0 to 12 V
Supply current	30 mA typ. (3 V), 33 mA typ. (12 V)
Dimensions	30 x 50 x 9 mm (excluding protrusion)
Weight	20 g

Specifications are subject to change without prior notice

**CIRCUIT DESIGN, INC.**

<https://www.circuitdesign.jp>  
CDP-TX/RX-02F ver. 1.2 Aug. 2022

## Sales Division

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# UHF Narrowband Transmitter and Receiver

## CDP-TX-07M, CDP-RX-07M 434 MHz

The CDP-TX-07M and CDP-RX-07M 434 MHz are low power narrowband FSK transmitter and receiver modules designed for industrial applications operating in the 434 MHz ISM band. The modules contain most of the components necessary for radio transmission in a compact housing. The RF channel can be selected from 4 preset channels using jumpers. The receiver is double superheterodyne and contains a SAW filter, ensuring high sensitivity and selectivity for stable long range communication.

The CDP-TX-07MP and CDP-RX-07MP 434 MHz are channel selectable using a 2 pin terminal allowing you to perform channel selection remotely. In addition, each of the 4 preset channels are reprogrammable using values in the range 433.075 to 434.700 MHz with 25 kHz step.

### Features

- Low power narrowband FSK
- 4 preset RF channels
- 600 m or more at line of sight.
- High reliability for industrial applications.
- Robust compact metal housing
- High selectivity and shock resistance
- CE / UKCA marking
- Receiver category 1

### Applications

- Industrial remote control
- Security / Alarms
- Telemetry / Monitoring systems
- Tracking systems



### General

Parameter	Specification
Applicable standard	EN 300 220
Communication method	One way
Emission type	F1D (FSK narrow)
Number of RF channels	4 ch
Frequency	434.0750* / 433.9200 / 434.6000 / 434.7000 MHz
RF bit rate	100 to 4,800 bps
Frequency stability	+/-2.5 ppm or less (-20 to +65 C)
Operating temperature	-20 to +65 C

### CDP-TX-07M

Transmitter

Parameter	Specification
RF output power	10 mW
Transmitter start up	< 20 ms
Deviation	+/-3 kHz
Supply voltage	2.2 to 5.5 V
Supply current	20 mA
Data input	Digital L = GND, H = Vcc
Spurious emission	< -54 dBm (below 862 MHz) < -36 dBm (862 to 1000 MHz) < -30 dBm (above 1000 MHz)
Adjacent channel leakage power	< -37 dBm (PN9 4,800 bps, CH = 25 kHz)
Dimensions	22 x 12 x 4.5 mm
Weight	2 g

### CDP-RX-07M

Receiver

Parameter	Specification
Receiver type	Double superheterodyne
Receiver category	1
IF frequency	21.7 MHz (1st), 450 kHz (2nd)
Sensitivity (12 dB SINAD)	-120 dBm
Sensitivity (BER 0.1%)	-115 dBm
Supply voltage	3 to 14 V
Supply current	23 mA typ.
Data output	Digital L = GND, H = Vcc
Adjacent channel selectivity	> 45 dB
Dimensions	36 x 26 x 8 mm
Weight	13 g

\* Factory default frequency channel setting  
Specifications are subject to change without prior notice

# UHF Narrowband Transmitter and Receiver

## CDP-TX-07M, CDP-RX-07M 869 MHz

The CDP-TX-07M and CDP-RX-07M 869 MHz are low power narrowband FSK transmitter and receiver modules designed for industrial applications operating in the 869 MHz ISM band. The modules contain most of the components necessary for radio transmission in a compact housing. The RF channel can be selected from 4 preset channels using jumpers. The receiver is double superheterodyne and contains a SAW filter, ensuring high sensitivity and selectivity for stable long range communication.

The CDP-TX-07MP and CDP-RX-07MP 869 MHz are channel selectable using a 2 pin terminal allowing you to perform channel selection remotely. In addition, each of the 4 preset channels are reprogrammable using values in the range 868.050 to 869.975 MHz with 12.5 kHz step.

### Features

- Low power narrowband FSK
- 4 preset RF channels
- 600 m or more at line of sight.
- High reliability for industrial applications.
- Robust compact metal housing
- High selectivity and shock resistance
- CE / UKCA marking

### Applications

- Industrial remote control
- Security / Alarms
- Telemetry / Monitoring systems
- Tracking systems



### General

Parameter	Specification
Applicable standard	EN 300 220
Communication method	One way
Emission type	F1D (FSK narrow)
Number of RF channels	4 ch
Frequency	869.7500* / 868.3000 / 869.8000 / 869.9250 MHz
RF bit rate	100 to 4,800 bps
Frequency stability	+/-2.5 ppm or less (-20 to +65 C)
Operating temperature	-20 to +65 C

### CDP-TX-07M

Transmitter

Parameter	Specification
RF output power	5 mW
Transmitter start up	< 20 ms
Deviation	+/-3 kHz
Supply voltage	2.2 to 5.5 V
Supply current	18 mA
Data input	Digital L = GND, H = Vcc
Spurious emission	< -54 dBm (below 790 MHz) < -36 dBm (790 to 1000 MHz) < -30 dBm (above 1000 MHz)
Adjacent channel leakage power	< -37 dBm (PN9 4,800 bps, CH = 25 kHz)
Dimensions	22 x 12 x 4.5 mm
Weight	2 g

### CDP-RX-07M

Receiver

Parameter	Specification
Receiver type	Double superheterodyne
Receiver category	1.5
IF frequency	21.7 MHz (1st), 450 kHz (2nd)
Sensitivity (12 dB SINAD)	-115 dBm
Sensitivity (BER 0.1%)	-110 dBm
Supply voltage	3 to 14 V
Supply current	23 mA typ.
Data output	Digital L = GND, H = Vcc
Adjacent channel selectivity	> 45 dB
Dimensions	36 x 26 x 8 mm
Weight	13 g

\*Factory default frequency channel setting  
Specifications are subject to change without prior notice

# Narrowband radio transceiver

## STD-601 434 MHz

The STD-601 434 MHz is a miniature 434 MHz band transceiver designed for industrial remote control applications. This module conforms to the EN 300 220 standard.

The STD-601 434 MHz has a simple serial interface and allows own communication protocol to be used. The RF power, data rate and channel can be set through the use of dedicated serial commands.

### Features

- Small 20 x 32 x 5 mm SMD
- Low current consumption
  - 26 mA (TX 10 mW)
  - 19 mA (RX)
- Transparent interface for data input and output
- CE / UKCA marking

### Applications

- Industrial telecontrol
- Telemetry systems



### General

Parameter	Specification
Applicable standard	EN 300 220
Communication method	Simplex, Half duplex
Emission type	F1D (2-GFSK)
Frequency	433.0750 to 434.7750 MHz
Number of RF channels	137 ch
Frequency stability	+/-3 ppm or less (-20 to +65 C)
RF bit rate	4,800 / 9,600 bps
Supply voltage	3.0 to 5.0 V
Supply current	26 mA typ. (TX 10 mW), 19 mA typ. (RX)
Operating temperature	-20 to +65 C (-30 to +75 C) *1
Dimensions	20 x 32 x 5 mm
Weight	4.5 g

### Transmitter part

Parameter	Specification
RF output power	10 / 5 / 1 mW at 50 ohm
Spurious emission	< -54 dBm (47 to 74, 87.5 to 118, 174 to 230, 470 to 862 MHz) < -37 dBm (Other frequencies below 1000 MHz) < -30 dBm (Frequencies above 1000 MHz)
Adjacent channel leakage power	< -37 dBm (CH 25 kHz / BW 16 kHz / PN9 9,600 bps)

### Receiver part

Parameter	Specification
Sensitivity (BER 1%)	-113 dBm (PN9 9,600 bps) -117 dBm (PN9 4,800 bps)
Adjacent channel selectivity	> 50 dB (+/-12.5 kHz 4,800 bps) > 50 dB (+/-25 kHz 9,600 bps)
Blocking	> 70 dB (+/-2 MHz, +/-10 MHz)

### Timing

Parameter	Specification
Power on to TX / RX	350 ms typ.
TX / RX switching time	10 ms typ.

### Interface

Parameter	Specification
Data interface (DI / DO)	Digital L = GND, H = Vcc (Asynchronous)
Command interface (TXD / RXD)	UART 9,600 / 19,200 / 38,400 bps Data length: 8 bit, Parity: None, Stop bit: 1

\* Unless otherwise specified, specifications are typical values obtained under 9,600 bps, 10 mW, 25 C, 434 MHz, 3 V  
\*1 Possible but operation in line with specifications cannot be guaranteed

Specifications are subject to change without prior notice

# Narrowband radio transceiver

## STD-601 400 MHz

The STD-601 400 MHz is a miniature transceiver designed for industrial applications. This module has selectable bands in a wide frequency range in the region of 400 MHz, conforming to the ISM bands in various countries.

The STD-601 400 MHz has a simple serial interface and allows own communication protocol to be used. The RF power, data rate and channel can be set through the use of dedicated serial commands.

### Features

- Small 20 x 32 x 5 mm SMD
- Selectable bands possible within wide frequency range.
  - 429 MHz (Japan) / 434 MHz (EU)
  - 447 MHz (Korea) / 458 MHz (UK)
- Maximum RF power 50 mW
- Transparent interface for data input and output

### Applications

- Industrial remote control systems
- Telemetry systems



### General

Parameter	Specification
Communication method	Simplex, Half duplex
Emission type	F1D (2-GFSK)
Frequency	429.1750 to 429.7375 MHz (429 MHz band 47 ch) 433.0750 to 434.7750 MHz (434 MHz band 137 ch) 447.2750 to 447.9875 MHz (447 MHz band 59 ch) 458.5000 to 459.1750 MHz (458 MHz band 28 ch)
Number of RF channels	137 ch
Frequency stability	+/-3 ppm or less (-20 to +65 C)
RF bit rate	1,200 / 2,400 / 4,800 / 9,600 / 19,200 bps
Supply voltage	3.0 to 5.0 V
Supply current	35 mA typ. (TX 10 mW), 58 mA typ. (TX 50 mW), 19 mA typ. (RX)
Operating temperature	-20 to +65 C (-30 to +75 C) *1
Dimensions	20 x 32 x 5 mm
Weight	4.5 g

### Transmitter part

Parameter	Specification
RF output power	50 / 25 / 20 / 10 / 5 / 1 mW at 50 ohm
Spurious emission	< -54 dBm (47 to 74, 87.5 to 118, 174 to 230, 470 to 862 MHz) < -37 dBm (Other frequencies below 1000 MHz) < -30 dBm (Frequencies above 1000 MHz)
Adjacent channel leakage power	< -37 dBm (CH 25 kHz / BW 16 kHz / PN9 9,600 bps)

### Receiver part

Parameter	Specification
Sensitivity (BER 1%)	-113 dBm (PN9 9,600 bps) -117 dBm (PN9 4,800 bps)
Adjacent channel selectivity	> 50 dB (+/-12.5 kHz 4,800 bps) > 50 dB (+/-25 kHz 9,600 bps)
Blocking	> 70 dB (+/-2 MHz, +/-10 MHz)

### Timing

Parameter	Specification
Power on to TX / RX	350 ms typ.
TX / RX switching time	10 ms typ.

### Interface

Parameter	Specification
Data interface (DI / DO)	Digital L = GND, H = Vcc (Asynchronous)
Command interface (TXD / RXD)	UART 9,600 / 19,200 / 38,400 bps Data length: 8 bit, Parity: None, Stop bit: 1

\* Unless otherwise specified, specifications are typical values obtained under 9,600 bps, 10 mW, 25 C, 434 MHz, 3 V

\*1 Possible but operation in line with specifications cannot be guaranteed  
Specifications are subject to change without prior notice



# UHF Narrowband Multi Channel Transceiver STD-302Z 434 MHz

The UHF FM narrowband semi-duplex radio module STD-302Z 434 MHz is suitable for industrial remote control and telemetry applications operating in the 434 MHz ISM band. The SAW filter and narrowband technique provides reliable data communication in industrial applications where interference rejection and practical distance range is required. Suitable for feedback systems.

## Features

- 10 mW RF power
- Programmable RF channel
- Receiver sensitivity -119 dBm
- Excellent vibration and shock resistance / Mechanical durability
- FSK narrowband
- CE / UKCA marking
- 419 MHz (China) / 429 MHz (Japan) / 447 MHz (Korea) / 458 MHz (UK) / 869 MHz (EU) available

## Applications

- Industrial remote control system
- Telemetry system
- Data transmission



## General

Parameter	Specification
Applicable standard	EN 300 220
Communication method	Simplex, Half duplex
Emission type	F1D (FSK narrow)
Frequency	433.075 to 434.775 MHz
Channel step	25 kHz (Programmable)
Frequency stability	+/- 3.5 ppm or less (-20 to +60 C)
RF bit rate	9,600 bps max (pulse width min. 100 us, max 15 ms)
PLL reference frequency	21.25 MHz
PLL response	30 ms typ. (from PLL setting to LD out)
PLL input method	PLL serial data with lock detect indicator output
Supply voltage	3.0 to 5.5 V
Supply current	44 mA (TX), 28 mA (RX)
Operating temperature	-20 to +60 C
TX / RX switching time	15 ms typ. (DI vs valid DO at the same frequency)
Dimensions	30 x 50 x 9 mm
Weight	25 g

## Transmitter part

Parameter	Specification
Oscillation system	PLL controlled VCO
RF output power	10 mW at 50 ohm
Deviation	+/- 2.75 kHz (PN9 9,600 bps)
Data input	Digital L = GND, H = 3 V to Vcc
Spurious emission	< -54 dBm (47 to 74, 87.5 to 118, 174 to 230, 470 to 790 MHz) < -36 dBm (Frequencies below 1000 MHz) < -30 dBm (Frequencies above 1000 MHz)
Adjacent channel leakage power	< -37 dBm (CH 25 kHz, BW 17.5 kHz, PN9 9,600 bps)

## Receiver part

Parameter	Specification
Receiver type	Double superheterodyne
Receiver category	1.5
IF frequency	21.7 MHz (1st), 450 kHz (2nd)
Maximum input level	+10 dBm
Sensitivity (12 dB SINAD)	-119 dBm
Sensitivity (BER 1%)	-116 dBm (PN9 9,600 bps)
Blocking	> -20 dBm (+/- 10 MHz), > -25 dBm (+/- 2 MHz)
Data output	Digital L = GND, H = 2.8 V
Adjacent channel selectivity	> -50 dBm (+/- 25 kHz)

Specifications are subject to change without prior notice

# UHF Narrowband Multi Channel Transceiver

## LMD-401 458 - 462.5 MHz

LMD-401 458 to 462.5 MHz is a synthesized multi channel transceiver module designed to meet FCC Part 90 and ISSED RSS-119 for the US market and Canada respectively. This small, highly integrated and fully shielded module is designed for embedding in user equipment. The module is suitable for various low power industrial telecontrol and telemetry applications.

### Features

- FCC and ISSED compliant
- 458.0 to 462.5 MHz band
- Programmable RF channel with 12.5 kHz channel space
- 10 mW, GFSK 4,800 bps
- Low power operation 3.0 to 5.5 V, 46 mA (TX), 36 mA (RX)
- Small size 50 x 30 x 9 mm
- Excellent vibration and shock resistance / Mechanical durability
- Wide operation range -20 to +65 C

### Applications

- Industrial remote control
- Remote monitoring / SCADA / Security
- Telemetry
- Data acquisition



### General

Parameter	Specification (All ratings at 25 C unless otherwise noted)
Applicable standard	FCC Part 90.217 / ISSED RSS-119
Communication method	Simplex, Half duplex
Emission type	F1D (GFSK narrow)
Frequency	458.0 to 462.5 MHz
Channel spacing	12.5 kHz (programmable)
Frequency stability	+/-2.5 ppm or less (-20 to +60 C)
RF bit rate	4,800 bps max. (Pulse width min. 200 us, max. 15 ms)
Operating temperature	-20 to +65 C
TX / RX switching time	15 ms typ. (DI vs DO)
Supply voltage	3.0 to 5.5 V
Supply current	46 mA (TX), 36 mA (RX)
Dimensions	50 x 30 x 9 mm
Weight	25 g

### Transmitter part

Parameter	Specification
Oscillation system	PLL controlled VCO
RF output power	10 mW at 50 ohm
Deviation	+/-2.4 kHz (PN9 4,800 bps)
Data input	Digital L = GND, H = 3 V to Vcc
Spurious emission	< -37 dBm (Frequencies below 1000 MHz) < -31 dBm (Frequencies above 1000 MHz)
Adjacent channel leakage power	< -20 dBm (+/-12.5 kHz, PN9 4,800 bps)

### Receiver part

Parameter	Specification
Receiver type	Double superheterodyne
IF frequency	21.7 MHz (1st), 450 kHz (2nd)
Maximum input level	10 dBm
Sensitivity (12 dB SINAD)	-116 dBm typ.
Sensitivity (BER 1%)	-116 dBm typ. (PN9 4,800 bps)
Co-channel rejection	-7 dB typ. (D / U ratio)
Spurious response rejection	> -44 dBm (1st mix, 2nd mix, 2 signal method)
Blocking	> -20 dBm (+/-2 MHz, +/-10 MHz, +/-5%, 2 signal method)
Data output	Digital L = GND, H = 2.8 V
Adjacent channel selectivity	> -50 dBm (+/-12.5 kHz, 2 signal method)

Specifications are subject to change without prior notice

# DSSS low power radio transceiver

## STD-503 2.4 GHz

The STD-503 is a 2.4 GHz transceiver enclosed in a small compact shield casing designed for industrial applications. The transceiver uses Direct Sequence Spread Spectrum (DSSS) modulation and true diversity circuit, enabling reliable communications even in the congested 2.4 GHz band.

The STD-503 complies with the European EN 300 440, U.S FCC Part 15.247, Canadian ISED RSS-210 and Japanese ARIB STD-T66 standard, making it ready for the global market.

The transceiver uses a transparent data interface to enable users to communicate using their own protocols.

The module's configuration can be set easily via the UART interface using dedicated commands.

\*Circuit Design developed an onboard ASIC containing SS correlator (a key part of spread spectrum communication). This ensures long term supply for industrial applications.

### Features

- CE, FCC, ISED and ARIB conformity
- Uses direct sequence spread spectrum (DSSS) modulation
- Channel stepping option controlled via CHC pin
- A true diversity receiver (two built-in receiver circuits)
- Module settings using dedicated commands
- Data communication using a transparent interface
- Low power operation
- 77 RF channels
- Communication range 300 m LOS
- Onboard temperature sensor



### Applications

- Industrial telecontrol
- Telemetry systems



### General

Parameter	Specification
Applicable standard	EN 300 440 / FCC Part 15.247 / ISED RSS-210 / ARIB STD-T66
Communication method	Simplex, Half duplex
Emission type	F1D (FSK)
Frequency	2402.5 to 2478.5 MHz
Number of RF channels	77 ch
Channel spacing	1 MHz
RF chip rate	288 kcps
Supply voltage	3.3 to 5.5 V
Supply current	48 mA typ. (TX), 55 mA typ. (RX)
RF output power	10 mW max. (EIRP)
Receiver sensitivity	-93 dBm (19,200 bps BER 0.1%)
Operating temperature	-20 to +65 C (No dew condensation)
Dimensions	40 x 29 x 5.5 mm (Not including connectors)
Weight	10 g
RF connectors	MHF x 2

### Interface

Parameter	Specification
Data interface (DI / DO / CLK)	19,200 bps (Synchronous)
Command interface (TXD / RXD)	UART 19,200 / 38,400 / 57,600 bps
	Data Length: 8 bit, Parity: None, Stop Bit: 1, Flow control: None

Specifications are subject to change without prior notice

# Low Power Radio Modem

## SLR-434M 434 MHz

The SLR-434M is a narrowband embedded radio modem for the 434 MHz ISM band. Compact and designed for ease of use, it incorporates LoRa® technology to achieve extremely long range at low power, albeit at low bit rate. Its superior sensitivity allows the possibility of communication into areas once considered difficult for RF to penetrate.

The SLR-434M uses a dedicated command system with a simple to use proprietary protocol. In addition to serial data transmission, the module also includes 8 x IO ports for switching signals allowing transmission of signals from sensors or for driving relays.

### Features

- Narrowband
- CE / UKCA marking
- Extremely long range operation achieved by LoRa mode.
- Higher resistance to urban noise, enabling long range operation
- Switchable between FSK mode and LoRa mode
- UART interface
- Transmission of up to 8 switching signals
- Low power consumption makes battery power operation possible
- Compact size
- 429 MHz (Japan) available

### Applications

- Data transmission, building air conditioning control
- Debris flow monitoring at mudslide control dams
- River water level / dam gate management
- Greenhouse temperature / humidity monitoring and control
- Monitoring of tunnels and bridges



### General

Parameter	Specification
Applicable standard	EN 300 220
Communication method	Simplex, Half duplex
Emission type	F1D
Modulation	2-FSK or LoRa
RF output power	10 mW (SMA / 50 ohm)
RF bit rate	4,800 bps (FSK) or 15 to 245 bps (LoRa)
Frequency	433.0750 to 434.7750 MHz
Operating temperature	-30 to +70 C
Number of RF channels	137 ch (Channel step: 12.5 kHz)
Channel spacing	12.5 kHz
Receiver sensitivity	-115 dBm (FSK), -133 dBm (LoRa 128 chip) (PER 1% with the user data of 45 bytes or less)
Supply voltage	3.5 to 5.0 V
Supply current	29 mA typ. (TX), 17 mA typ. (RX)
Dimensions	40 x 29 x 6.2 mm (Not including antenna connector)
Weight	13 g
Number of sw inputs	8

### Serial interface

Parameter	Specification
Communication method	Serial communication (RS232)
Synchronization	Asynchronous / UART
Data speed	19,200 bps
Flow control	Hardware: RTS / CTS pin Software: Xon / Xoff not used
Other parameters	Data length: 8 bit, Parity: None, Stop bit: 1

Specifications are subject to change without prior notice

The SLR-434M contains a Semtech's LoRa® wireless RFIC.  
The LoRa® Mark and LoRa Logo are trademarks of Semtech corporation.

# Embedded low power radio modem MU-4-434 434 MHz

The MU-4-434 is an embedded radio modem operating in the 434 MHz ISM band. Dedicated commands, specially designed for wireless applications are provided for building a range of wireless systems from simple control systems to wide network systems. Using the commands, the user can concentrate on designing the application without needing to be aware of the radio protocol and control aspects. Reed-Solomon code is used for forward error correction (FEC) to maintain data integrity and provide highly reliable wireless communication. The MU-4-434 meets the requirements of the European RE Directive and carries the CE and UKCA marking.

The relay feature allows you to extend the range by using additional units (up to 10 units).

## Features

- UART interface with simple command protocol
- 127 RF channels
- 10 mW / 1 mW power selectable
- Error correction with Reed-Solomon code
- Repeater and auto answer back function
- Target station receive signal and noise level acquisition
- Low power operation, 42 mA (TX)
- Optional transparent mode
- CE / UKCA marking



## Applications

- Environment monitoring, various measuring applications
- Remote control for industrial equipment
- Various alarm and monitoring systems



## General

Parameter	Specification
Applicable standard	EN 300 220
Communication method	Simplex, Half duplex
Emission type	F1D (FSK narrow)
RF output power	10 mW / 1 mW selectable (Nominal, Contact 50 ohm)
RF bit rate	4,800 bps
Frequency	433.2000 to 434.7750 MHz
Channel spacing	12.5 kHz
Number of RF channels	127 ch (Channel step 12.5 kHz)
Receiver sensitivity	-113 dBm (Transparent mode BER 0.1%)
Operating temperature	-20 to +65 C
Supply voltage	3.0 to 5.0 V (Absolute max. rate 5.5 V)
Supply current	42 mA (TX 10 mW), 22 mA (RX) 26 mA (TX 1 mW), 22 mA (RX)
Dimensions	36 x 26 x 8 mm
Weight	14.5 g (Not including antenna)

### Reference data

\* Effective radio communication speed: About 3,400 bps (Conditions: One-way communication, no error correction, 25 C)

\* Range: About 600 m (Conditions: One-way, no error correction, 25 C, line of sight distance, antenna height of 1.5 m, vertical antenna)

## Serial interface

Parameter	Specification
Communication method	Serial communication (RS232)
Synchronization	Asynchronous / UART
Data speed	1,200 / 2,400 / 4,800 / 9,600 / 19,200 / 38,400 / 57,600 bps
Flow control	RTS / CTS hardware flow control
Other parameters	Data length: 8 bit, Parity: (None, Odd, Even), Stop bit: 1 or 2

Specifications are subject to change without prior notice

# Telecommand radio module

## NK-2.4Y 2.4 GHz

The NK-2.4Y is an embedded input / output radio module which operates in the 2.4 GHz band. In spite of its small size and low power consumption, it achieves a communication range of 100 m (line of sight).

Our original frequency hopping protocol allows multiple modules to be used in one area simultaneously without concern about radio channels. With a fast input-output response time of 20 ms, a maximum of 8 switch inputs / outputs can be transmitted. Regarding an antenna, customers can select either internal PCB antenna or external antenna specified by Circuit Design.

Link signal output shows connection status, which helps the user to stay within the signal coverage area.

### Features

- FCC, ISED, CE, UKCA and ARIB conformity
- Module can be set to either input or output mode.
- CRC-16 error detection
- Achieves a Hamming distance of 6 to minimize malfunction
- Transmission of max 8 switching signals by connecting simple external circuitry
- Low current consumption
- Rapid two way communication for confirmation of communication link status.
- 1:1 communication only
- Frequency hopping allows multiple systems in one area without concern about channel management



### Applications

- Remote tail lifts on trucks.
- Remote control of care lifts on welfare vehicles
- Shutter open and close



### General

Parameter	Specification
Applicable standard	FCC Part 15 / ISED RSS-247 ARIB STD-T66 / EN 300 440
Communication method	Half duplex (for ACK purposes only)
Communication range	100 m (Line of sight)
Communication mode	1:1 (Input mode: Output mode)
Frequency	2403 to 2479 MHz (Frequency Hopping)
Operating temperature	-30 to +65 C
Antenna	Internal pattern antenna or specified external antennas
Supply voltage	2.2 to 5.5 V
Input / Output response	30 to 60 ms
Communication bit rate	250 kbps
Hamming distance	6
Dimensions	35.3 x 17.8 x 3.5 mm
Weight	3.2 g
Soldering conditions	Hand soldering (Soldering iron temp: 350 C within 3 sec)

### NK-2.4Y

Input mode

Parameter	Specification
RF output power	1.4 mW (+20%, -80%)
Supply current	3 mA ave.
Inputs	8 switch inputs
Input voltage range	-0.3 V to REG + 0.3 V (REG = Internal voltage 2.058 to 2.142 V)
Input voltage threshold	Low Level: 0.4 V (max) High Level: 1.7 V (min)

### NK-2.4Y

Output mode

Parameter	Specification
Supply current	When linked: 7 mA ave. During linking: 14 mA ave.
Outputs	8 switch outputs
Output voltage range	0.3 V to REG + 0.3 V (REG = Internal voltage 2.058 to 2.142 V)
Output voltage threshold	Low Level: 0.9 V (max) High Level: 1.1 V (min)
Output holding time when communication shutoff	400 ms typ.

Specifications are subject to change without prior notice

# 2.4 GHz Telecommand Unit

## KST2.4S, KSR2.4 2.4 GHz

The KST2.4S and KSR2.4 are telecommand units that allow the transmission and reception of upto 6 switching signals in the 2.4 GHz band.

The CRC-16 error detection achieving a Hamming distance of 6 allowing for reliable switching signal transmission. Frequency hopping minimises interference from other radio systems on the 2.4 GHz band. There is no need to manage any channels and multiple operation in the same area is possible. In addition, communication with separate NK-2.4Y telecommand radio module is possible.

Both KST2.4S and KSR2.4 display a LINK LED allowing the user to monitor communication status.

The units have a wide operating voltage range of 6 to 24 V.

### Features

- 6 inputs (KST2.4S) / 6 outputs (KSR2.4)
- 3 output operation modes (One-shot, Toggle, Momentary)
- 1:1 communication with KST2.4S and KSR2.4
- Includes a wiring harness to allow easy interface to user equipment.
- FCC and ARIB conformity RF module (NK-2.4Y) included.



### Applications

- Remote control applications
- Start / Stop control for motor operated equipment
- Monitor and alarm system with threshold level control for sensors

### General

Parameter	Specification
Applicable standard	FCC Part 15 / ARIB STD-T66 (NK-2.4Y included)
Communication method	Half duplex (for ACK purposes only)
Communication range	100 m (Line of sight)
Communication mode	1:1 (Input mode: Output mode)
Frequency	2403 to 2479 MHz (Frequency Hopping)
RF output power	< 1.6 mW
Communication bit rate	250 kbps
Hamming distance	6
Input / Output response	30 to 60 ms
RF connector	RP-SMA (Nominal 50 ohm)
Operating temperature	-20 to +60 C
Supply voltage	6 to 24 V
Dimensions	55 x 45 x 12.5 mm
Weight	26 g

### KST2.4S

Input Unit

Parameter	Specification
Number of Input / Output	Input 6, Link output 1
Input circuit	Input ON voltage : DC 6 to 35 V
Supply current	30 mA max

### KSR2.4

Output Unit

Parameter	Specification
Number of output	Output 6, Link output 1
Output relay	DC 35 V, 200 mA max
Supply current	80 mA max (All output ON, No load)

Specifications are subject to change without prior notice

# UHF Narrowband Telecommand Module

## CDT-TX-02M-R, CDT-RX-03M 434 MHz

CDT-TX-02M-R and CDT-RX-03M are telecommand transmitter and receiver modules which are specially designed for switching signal transmission. The RF channel is fixed but selectable from 4 preprogrammed channels. In addition to the RF part, the module includes photo MOS relays (RX) in its robust metal housing.

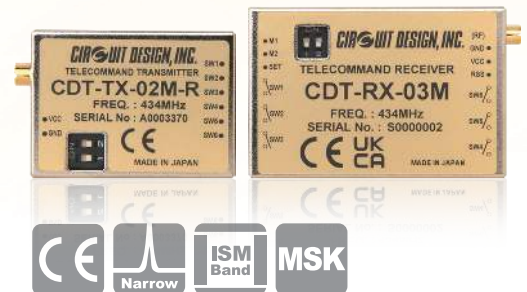
A handy transmitter can be easily made by only connecting switches to the CDT-TX-02M-R.

### Features

- 6 switch inputs and outputs
- Standby mode in TX
- 4 operation modes in RX
- Low voltage and consumption current
- Equipped with MSK modem
- Long range communication control
- CE marking

### Applications

- Remote control for motor operated shutter blinds, garage doors, gates etc.
- Industrial remote control
- Security / Alarms
- Paging system



### General

Parameter	Specification
Applicable standard	EN 300 220
Communication method	One way (MSK 1,200 bps)
Emission type	F2D (Sub-carrier MSK)
Communication range	500 to 1,000 m (Line of sight)
Number of RF channels	4 ch (Adjust using DIP switches)
Frequency*	434.075 / 433.920 / 434.600 / 434.700 MHz
Operating temperature	-20 to +60 C (No dew condensation)

### CDT-TX-02M-R Transmitter

Parameter	Specification
Oscillation system	PLL controlled VCO
RF output power	10 mW
Supply voltage	2.2 to 12 V (Max. rating 14.5 V)
Supply current	27 mA (TX), 1 uA (Stand-by)
Inputs	6 switch inputs (Negative logic)
Antenna	1/4 lambda whip antenna
Dimensions	36 x 26 x 8 mm (Excluding protrusion)
Weight	15 g

### CDT-RX-03M Receiver

Parameter	Specification
Sensitivity	-117 dBm (Level for stable operation)
Supply voltage	3.0 to 12 V (Max. rating 14.5 V)
Supply current	19 mA (6-output off), 55 mA (6-output on)
Operation mode	One-shot, Toggle, Switching, Continuous (Set by 3 input ports)
Outputs	6-photo MOS relay outputs
Output relay	Max switching voltage and current, 48 V 100 mA
Antenna	1/4 lambda whip antenna
Dimensions	53 x 35 x 12 mm (Excluding protrusion)
Weight	35 g

Specifications are subject to change without prior notice

\*Other frequency: Please contact Circuit Design, Inc.



# UHF Multi Channel Wireless Audio Transmitter and Receiver WA-TX-03S, WA-RX-03S 863 MHz

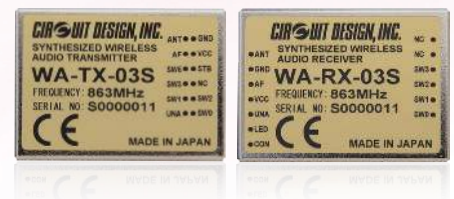
The WA-TX-03S and WA-RX-03S are 15 ch multichannel audio modules for analogue audio transmission. They operate in the European harmonized 863 to 865 MHz band with RF power selection of 5 and 10 mW. In addition to offering a frequency response range sufficient for voice transmission, the compander noise reduction system has a wide dynamic range, enabling transmission of clear audio signals. As embedded devices, they include nearly all the parts necessary for audio transmission in a small shielding case, making it possible to develop audio transmission equipment in a short time.

## Features

- 863 to 865 MHz European audio band
- Selectable RF output (5 mW and 10 mW)
- 15 RF channels with 125 kHz step
- Built in noise reduction systems
- Built in mute circuit
- Easy installation for user system
- CE / UKCA marking

## Applications

- Audio guiding at museum
- Tour guide system
- Wireless conference system
- Wireless microphone system for amateur users
- Various audio transmissions



## General

Parameter	Specification
Applicable standard	EN 301 357
Communication method	One way
Emission type	F3E (FM)
Number of RF channels	15 ch
Frequency	863.125 to 864.875 MHz
Communication range	50 m (Line of sight)
Dynamic range	90 dB or more (W/IHF-A Filter)
Audio frequency response	50 Hz to 13 kHz +/-3.5 dB
T.H.D	2% or less (@AF 1 kHz, Dev. = 20 kHz)
Emphasis	50 us
Operating temperature	0 to 50 C

## WA-TX-03S

Transmitter

Parameter	Specification
Oscillation system	Crystal based PLL oscillation
RF output power	5 mW, 10 mW (e.r.p)
Frequency stability	+/-15 kHz or less
Noise reduction type	Compander
Spurious emission	< 1 uW
Deviation	20 kHz (1 kHz @ -25 dBv)
Audio input level	-113 to -13 dBv (1 kHz)
Audio input impedance	12 kohm or more
Max. DC input to audio input	7 V DC max.
Supply voltage	4.2 to 6.0 V**
Supply current	50 mA (5 mW), 60 mA (10 mW), < 1 mA (Standby)
Dimensions	36 x 26 x 8 mm
Weight	13 g

## WA-RX-03S

Receiver

Parameter	Specification
Receiving method	Single superheterodyne
Local oscillation type	Crystal based PLL oscillation
IF frequency	10.7 MHz
Noise reduction type	Expander
Sensitivity	S/N 55 dB at 21 dBuV (-92 dBm)
Squelch sensitivity	Adjustable
Audio output level	-10 dBv (Dev. 20 kHz)
Audio output impedance	20 kohm or less
Supply voltage	3.0 to 5.0 V
Supply current	45 mA
Dimensions	36 x 26 x 8 mm
Weight	13 g

\*0 dBv = 0.775 V

\* Data of specification is measured at 25 C unless otherwise specified.

\*\* Supply voltage 3.6 to 7.0 V, possible operating range without meeting full specifications

Specifications are subject to change without prior notice

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