UHF Narrow band radio transceiver
STD-302 434MHz/869MHz

Operation Guide

Version 1.4 (Sept 2003)

CIRCUIT DESIGN, INC.,

7557-1 Hotaka, Hotaka-machi,
Minamiazumi, Nagano 399-8303 JAPAN
Tel: + +81-(0)263-82-1024
Fax: + +81-(0)263-82-1016

e-mail: cdint@circuitdesign.jp
http://www.circuitdesign.jp

CONTENTS

GENERAL DESCRIPTION & FEATURES

General Description

The UHF FM narrow band semi-duplex radio data module STD-302 is an EN 300 220 compliant, high performance transceiver designed for use in industrial applications requiring long range, high performance and reliability.

The operating frequencies are available in the 434 MHz ISM band and 869 MHz European harmonized band.

All high frequency circuits are enclosed inside a robust housing to provide superior resistance against shock and vibration. A narrow band technique enables high interference rejection and concurrent operation with multiple modules.

STD-302, a narrowband module with 25 kHz channel steps, achieves high TX/RX switching speed, making it an ideal RF unit for inclusion in feedback systems.

Features

- 10 mW (434 MHz) / 5 mW (869 MHz) RF power, 3.0 V operation
- Programmable RF channel
- Fast TX/RX switching time (5 ms)
- High sensitivity -119 dBm (434 MHz) / -116 dBm (869 MHz)
- Excellent mechanical durability, high vibration & shock resistance
- EN 300 220 / EN 301 489 compliant

Applications

- Telemetry

  Water level monitor for rivers, dams, etc.

  Monitoring systems for environmental data such as temperature, humidity, etc.

  Transmission of measurement data (pressure, revolution, current, etc) to PC

  Security alarm monitoring
- Telecontrol

  Industrial remote control systems

  Remote control systems for factory automation machines

  Control of various driving motors
- Data transmission

  RS232/RS485 serial data transmission

SPECIFICATIONS

STD-302 434 MHz

All ratings at 25°C unless otherwise noted

Parameter	Rating	Conditions
General characteristics		
Communication method	Semi-duplex	
Oscillation type	PLL Controlled VCO	
Operating frequency range	433.05 - 434.775 MHz	
Channel step	Programmable	
Frequency stability	+/- 4 ppm	-10 to +55 °C
	+/- 8 ppm	-20 to +65 °C
Data rate	9600 bps max.	Input data pulse width: Min104 µs, Max 5 ms
PLL reference frequency	21.25 MHz	
Operating temperature range	- 10 to + 55 °C	
	- 20 to + 65 °C	*A
Operating voltage range	3 - 5.5 V	
Dimensions	30 x 50 x 9 mm	
Transmitter part		
RF output power	9.0 +/- 1 mW	At 434.0MHz / Antenna impedance 50 Ω
Deviation	2.5 kHz +/-0.3 kHz	PN9, 9600 bps, LPF 20 kHz
Deviation frequency characteristics	+/- 3 dB	50 - 4800 Hz
Residual FM noise	0.17 kHz	LPF 20 kHz
TX S/N	-30 dB	1 kHz, Dev.= +/-2.4 kHz CCITT filter
Spurious emission	-60 dBm	< 1 GHz
	-43 dBm	≥ 1 GHz
Adjacent channel leakage power	-37 dBm	CH 25 kHz, BW 16 kHz, PN9, 9600 bps
Total distortion and noise	30 dB	1 kHz, Dev.+/-2.4 kHz, CCITT filter
Consumption current	40 mA	
Switching time RX to TX	5 - 10 ms	RX -> TX *1
Lock time	30 - 40 ms	Free Run -> TX *2
	10 - 20 ms	25 kHz channel shift *3
Receiver part		
Reception method	Double superheterodyne	
Sensitivity	-119 dBm (AF OUT)	1 kHz, Dev.+/-2.4 kHz, CCITT filter
Bit error rate	-110 dBm (Data Out)	9600 bps, PN9 (1556 bit), Internal synchronous
AF output	150+/-35 mVrms	fmod.+/- 2.4 kHz, fm+/-1.2 kHz (RF level -30 dBm)
	140+/-35 mVrms	fmod.+/- 2.4 kHz, fm+/-2.4 kHz (RF level -30 dBm)
	120+/-45 mVrms	fmod.+/- 2.4 kHz, fm+/-4.8 kHz (RF level -30 dBm)
RX S/N	35 dB	1 kHz, Dev.+/-2.4 kHz, CCITT filter
Distortion	-30 dB	1 kHz, Dev.+/-2.4 kHz, CCITT filter
Spurious emission	-60 dBm	
Spurious sensitivity	45 dB	Two signal method, Jamming signal = FM
Intermodulation	45 dB	Two signal method
Adjacent channel selectivity	45 dB	Two signal method, CH 25 kHz, Jamming signal = FM
Consumption current	26 mA	
Switching time TX to RX	5 - 10 ms	TX -> RX *1
Lock Time	30 - 40 ms	Free Run -> RX *2
	10 - 20 ms	25 kHz channel shift *3

*A Under -10°C, the time required till effective data is output from DO is longer than that at normal temperature. It is recommended to use a preamble which is twice the length of the usual preamble. Please refer to page 13.

*1 Time required for the TX frequency or 1st local frequency to reach within +/-1.5 ppm of a stable frequency.

*2 Time required for the TX frequency or 1st local frequency to reach within +/-1.5 ppm of a stable frequency after PLL setting data is output.

*3 Time required for the TX frequency or 1st local frequency to reach within +/-1.5 ppm of a stable frequency after PLL setting data for 25kHz shift is output.

SPECIFICATIONS

STD-302 869 MHz

All ratings at 25°C unless otherwise noted

Parameter	Rating	Conditions
General characteristics		
Communication method	Semi-duplex	
Oscillation type	PLL Controlled VCO	
Operating frequency range	868 – 870 MHz	
Channel step	Programmable	
Frequency stability	+/- 3.4 ppm	-10 to +55 °C
	+/- 5 ppm	-15 to +60 °C
Data rate	9600 bps max.	
PLL reference frequency	21.25 MHz	
Operating temperature range	- 10 to + 55 °C	
	- 15 to + 60 °C	*A
Operating voltage range	3 - 5.5 V	
Dimensions	30 x 50 x 9 mm	
Transmitter part		
RF output power	4.0 +/- 1 mW	At 869.725MHz / Antenna impedance 50 Ω
Deviation	2.5 kHz +/-0.3 kHz	PN9, 9600 bps, LPF 20 kHz
Deviation frequency characteristics	+/- 3 dB	50 - 4800 Hz
Residual FM noise	0.35 kHz	LPF 20 kHz
TX S/N	-30 dB	1 kHz, Dev.= +/-2.4 kHz CCITT filter
Spurious emission	-60 dBm	< 1 GHz
	-43 dBm	≥ 1 GHz
Adjacent channel leakage power	-37 dBm	CH 25 kHz, BW 16 kHz, PN9, 9600 bps
Total distortion and noise	30 dB	1 kHz, Dev.+/-2.4 kHz, CCITT filter
Consumption current	40 mA	
Switching time RX to TX	5 - 10 ms	RX -> TX *1
Lock time	30 - 40 ms	Free Run -> TX *2
	10 - 20 ms	25 kHz channel shift *3
Receiver part		
Reception method	Double superheterodyne	
Sensitivity	-116 dBm (AF OUT)	1 kHz, Dev.+/-2.4 kHz, CCITT filter
Bit error rate	-107 dBm (Data Out)	9600 bps, PN9 (2556bit), Internal synchronous
AF output	150+/-35 mVrms	fmod.+/- 2.4 kHz, fm+/-1.2 kHz (RF level -30 dBm)
	140+/-35 mVrms	fmod.+/- 2.4 kHz, fm+/-2.4 kHz (RF level -30 dBm)
	120+/-45 mVrms	fmod.+/- 2.4 kHz, fm+/-4.8 kHz (RF level -30 dBm)
RX S/N	35 dB	1 kHz, Dev.+/-2.4 kHz, CCITT filter
Distortion	-30 dB	1 kHz, Dev.+/-2.4 kHz, CCITT filter
Spurious emission	-60 dBm	
Spurious sensitivity	45 dB	Two signal method, Jamming signal = FM
Intermodulation	45 dB	Two signal method
Adjacent channel selectivity	45 dB	Two signal method, CH 25 kHz, Jamming signal = FM
Consumption current	26 mA	
Switching time TX to RX	5 - 10 ms	TX -> RX *1
Lock Time	30 - 40 ms	Free Run -> RX *2
	10 - 20 ms	25 kHz channel shift *3

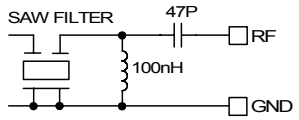
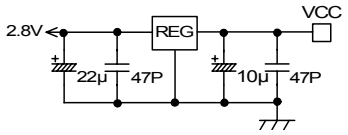
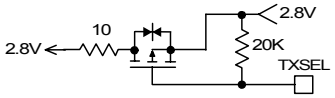
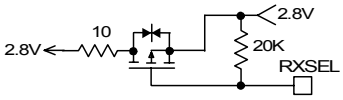
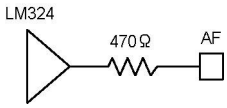
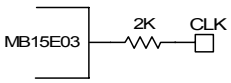
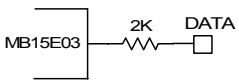
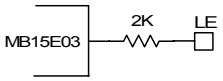
*A Under -10°C, the time required till effective data is output from DO is longer than that at normal temperature. It is recommended to use a preamble which is twice the length of the usual preamble. Please refer to page 13.

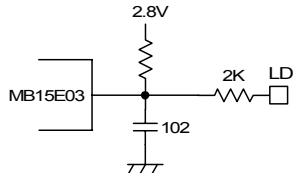
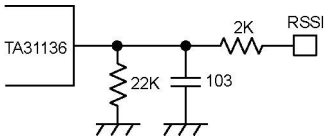
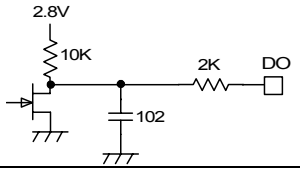
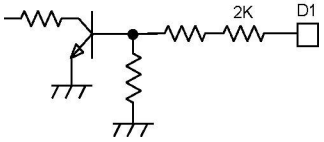
*1 Time required for the TX frequency or 1st local frequency to reach within +/-1.5 ppm of a stable frequency.

*2 Time required for the TX frequency or 1st local frequency to reach within +/-1.5 ppm of a stable frequency after PLL setting data is output.

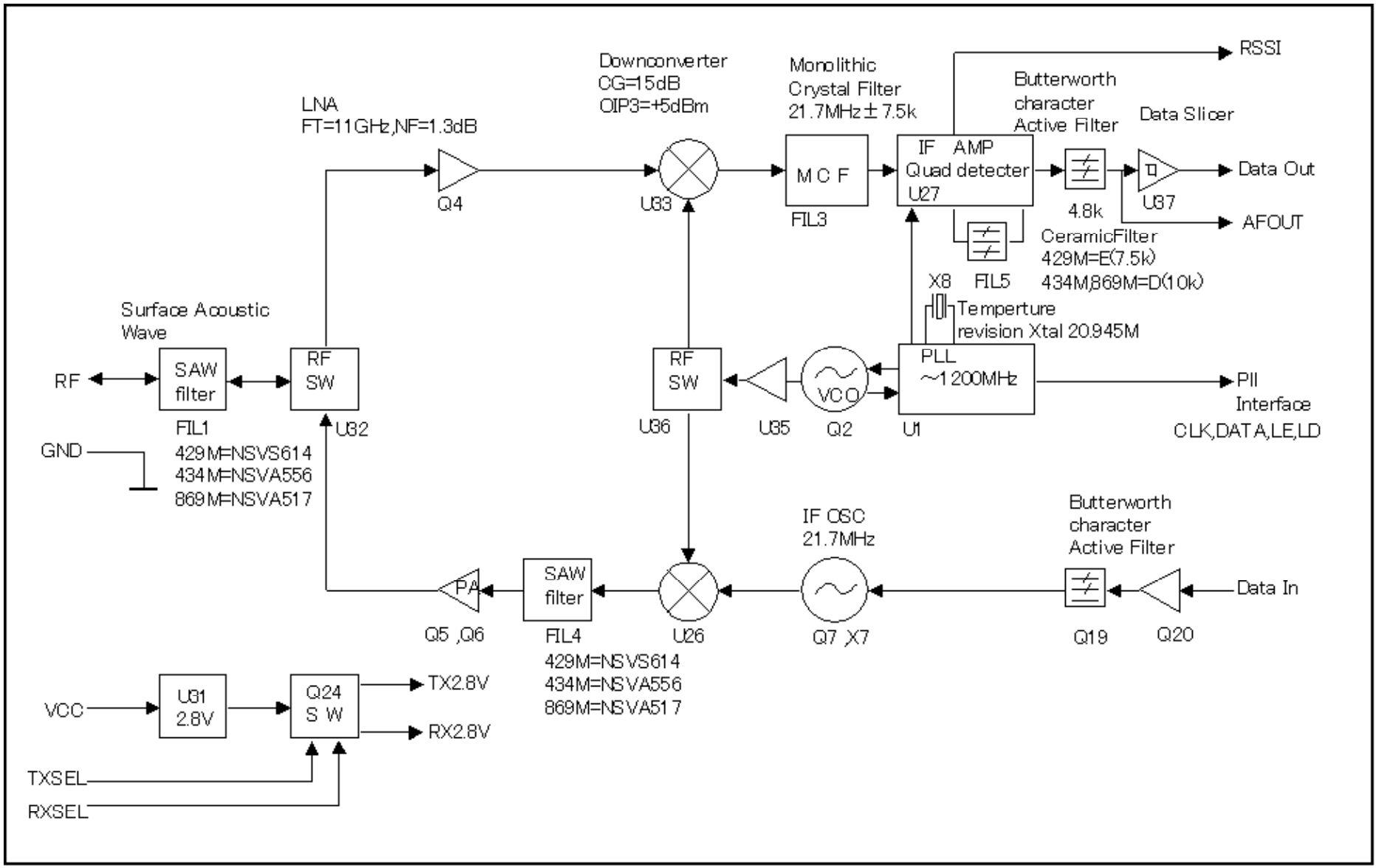
*3 Time required for the TX frequency or 1st local frequency to reach within +/-1.5 ppm of a stable frequency after PLL setting data for 25kHz shift is output.

PIN DESCRIPTION

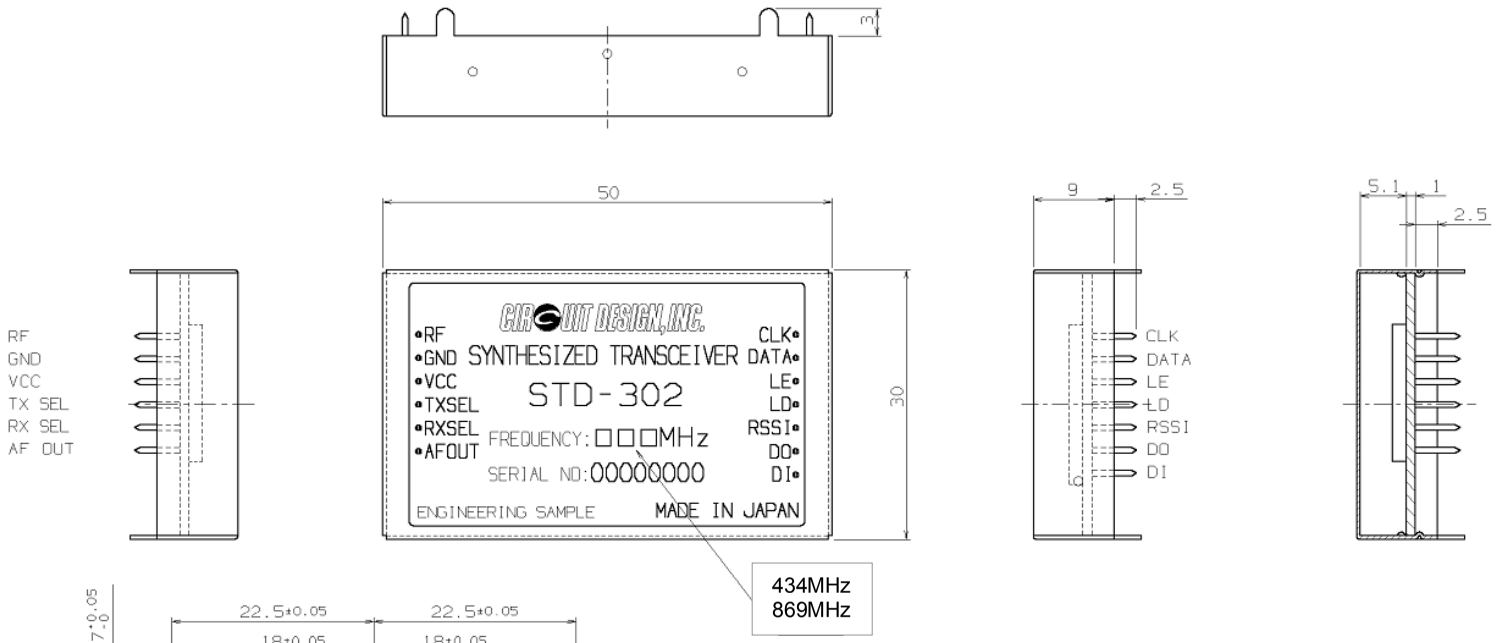
Pin name	I/O	Description	Equivalent circuit
RF	I/O	RF input terminal Antenna impedance nominal 50 **Ω**	
GND	I	GROUND terminal The GND pins and the feet of the shield case shoud be connected to the wide GND pattern.	
VCC	I	Power supply terminal DC 3.0 to 5.5 V	
TXSEL	I	TX select terminal GND = TXSEL active To enable the transmitter circuits, connect TXSEL to GND and RXSEL to OPEN or 2.8 V.	
RXSEL	I	RX select terminal GND= RXSEL active To enable the receiver circuits, connect RXSEL to GND and TXSEL to OPEN or 2.8 V.	
AF	I	Analogue output terminal There is DC offset of approx. 1 V. Refer to the specification table for amplitude level.	
CLK	I	PLL data setting input terminal Interface voltage H = 2.8 V, L = 0 V	
DATA	I	PLL data setting input terminal Interface voltage H = 2.8 V, L = 0 V	
LE	I	PLL data setting input terminal Interface voltage H = 2.8 V, L = 0 V	

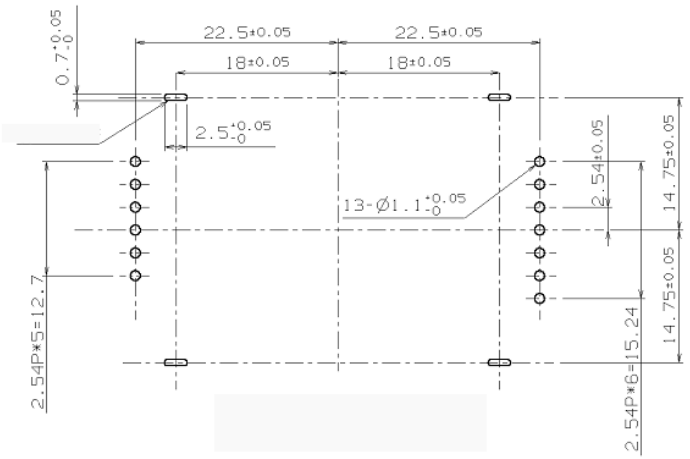
LD	O	PLL lock/unlock monitor terminal Lock = H (2.8 V), Unlock = L (0 V)	
RSSI	O	Received Signal Strength Indicator terminal	
DO	O	Data output terminal Interface voltage: H=2.8V, L=0V	
DI	I	Data input terminal Interface voltage: H=Vcc, L=0V Input data pulse width Min.104 µs Max.5 ms	

BLOCK DIAGRAM <STD-302 434MHz / 869MHz>



DIMENSIONS



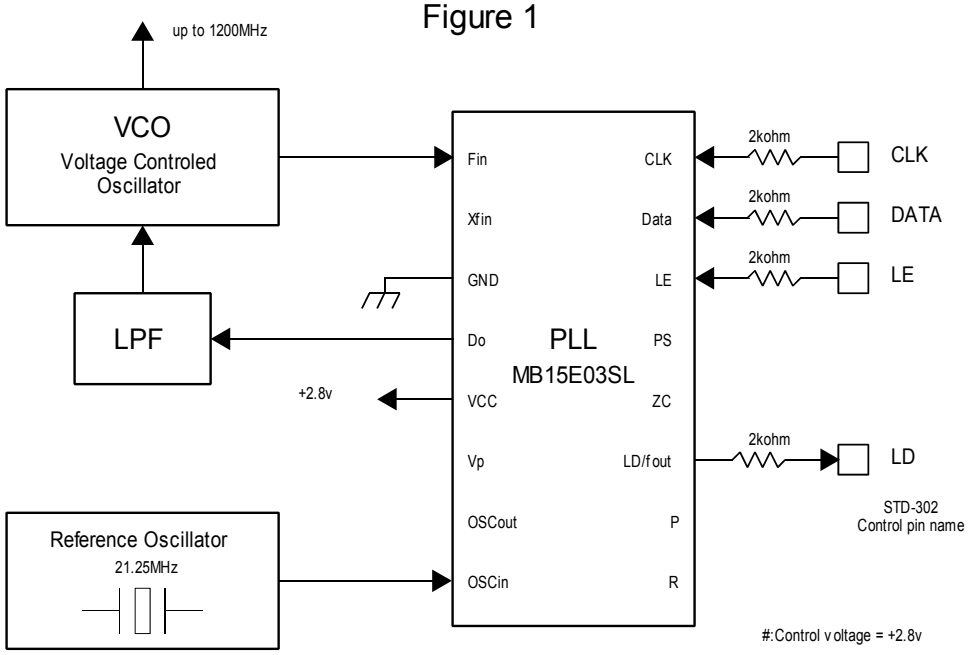


Reference hole position for PCB mounting (Bottom view)

PLL IC CONTROL

- **PLL IC control**

Figure 1



STD-302 is equipped with an internal PLL frequency synthesizer as shown in Figure 1. The operation of the PLL circuit enables the VCO to oscillate at a stable frequency. Transmission frequency is set externally by the controlling IC. STD-302 has control terminals (CLK, LE, DATA) for the PLL IC and the setting data is sent to the internal register serially via the data line. Also STD-302 has a Lock Detect (LD) terminal that shows the lock status of the frequency. These signal lines are connected directly to the PLL IC through a 2 kΩ resistor.

The interface voltage of STD-302 is 2.8 V, so the control voltage must be the same.
STD-302 comes equipped with a Fujitsu MB15E03SL PLL IC. Please refer to the manual of the PLL IC.

The following is a supplementary description related to operation with STD-302. In this description, the same names and terminology as in the PLL IC manual are used, so please read the manual beforehand.

- **How to calculate the setting values for the PLL register**

The PLL IC manual shows that the PLL frequency setting value is obtained with the following equation.

$f_{vco} = [(M \times N)+A] \times f_{osc} / R$ -- Equation 1

f_{vco} : Output frequency of external VCO
M: Preset divide ratio of the prescaler (64 or 128)
N: Preset divide ratio of binary 11-bit programmable counter (3 to 2,047)
A: Preset divide ratio of binary 7-bit swallow counter ($0 \le A \le 127$ A<N))
f_{osc}: Output frequency of the reference frequency oscillator
R: Preset divide ratio of binary 14-bit programmable reference counter (3 to 16,383)

With STD-302, there is an offset frequency (f_{offset}) 21.7 MHz for the transmission RF channel frequency f_{ch}. Therefore the expected value of the frequency generated at VCO (f_{expect}) is as below.

$f_{vco} = f_{expect} = f_{ch} - f_{offset}$ ---- Equation 2

The PLL internal circuit compares the phase to the oscillation frequency $f_{vco.}$ This phase comparison frequency (f_{comp}) must be decided. f_{comp} is made by dividing the frequency input to the PLL from the reference frequency oscillator by reference counter R. STD-302 uses 21.25 MHz for the reference clock $f_{osc.}$ f_{comp} is one of 6.25 kHz, 12.5 kHz or 25 kHz.

The above equation 1 results in the following with n = M x N + A, where “n” is the number for division.

$f_{vco}=n*f_{comp}$ ---- Equation 3 $n = f_{vco}/f_{comp}$ ---- Equation 4 note: $f_{comp} = f_{osc}/R$

Also, this PLL IC operates with the following R, N, A and M relational expressions.

$R=f_{osc}/f_{comp}$ ---- Equation 5 N = INT (n / M) ---- Equation 6 A = n - (M x N) ---- Equation 7
INT: integer portion of a division.

As an example, the setting value of RF channel frequency f_{ch} 869.725 MHz can be calculated as below.
The constant values depend on the electronic circuits of STD-302.

Conditions: Channel center frequency: f_{ch} = 869.725 MHz
Constant: Offset frequency: f_{offset}=21.7 MHz
Constant: Reference frequency: f_{osc}=21.25 MHz
Set 25 kHz for Phase comparison frequency and 64 for Prescaler value M

The frequency of VCO will be

$f_{vco} = f_{expect} = f_{ch} - f_{offset}$ = 869.725 –21.7 = 848.025MHz

Dividing value “n” is derived from Equation 4

$n = f_{vco} / f_{comp}$ = 848.025MHz/25kHz = 33921

Value “R” of the reference counter is derived from Equation 5.

$R = f_{osc}/f_{comp}$ = 21.25MHz/25kHz = 850

Value “N” of the programmable counter is derived from Equation 6.

N = INT (n/M) = INT(33921/64) = 530

Value “A“ of the swallow counter is derived from Equation 7.

A = n – (M x N) = 33921 – 64 x 530 = 1

The frequency of STD-302 is locked at a center frequency f_{ch} by inputting the PLL setting values N, A and R obtained with the above equations as serial data. The above calculations are the same for the other frequencies.
Excel sheets that contain automatic calculations for the above equations can be found on our web site (www.circuitdesign.jp/eng/).

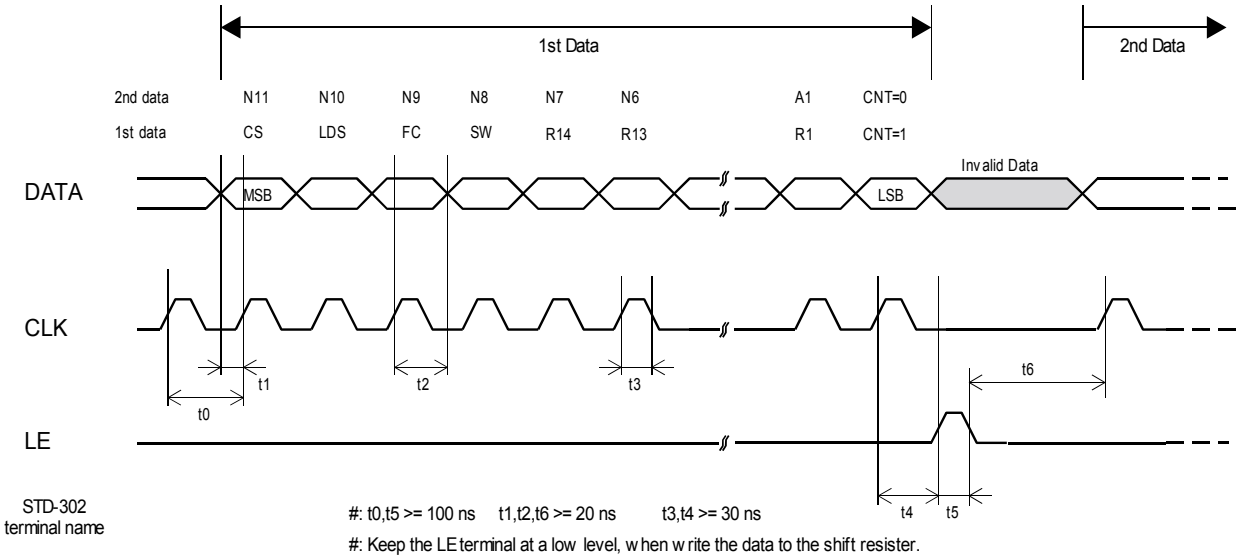
The result of the calculations is arranged as a table in the CPU ROM. The table is read by the channel change routine each time the channel is changed, and the data is sent to the PLL.

- **Method of serial data input to the PLL**

After the RF channel table plan is decided, the data needs to be allocated to the ROM table and read from there or calculated with the software.
Together with this setting data, operation bits that decide operation of the PLL must be sent to the PLL.
The operation bits for setting the PLL are as follows. These values are placed at the head of the reference counter value and are sent to the PLL.

1. CS: Charge pump current select bit
   CS = 0 +/-1.5 mA select VCO is optimized to +/-1.5 mA
2. LDS: LD/fout output setting bit
   LDS = 0 LD select Hardware is set to LD output
3. FC: Phase control bit for the phase comparator
   FC = 1 Hardware operates at this phase

Figure 2



The PLL IC, which operates as shown in the block diagram in the manual, shifts the data to the 19-bit shift register and then transfers it to the respective latch (counter, register) by judging the CNT control bit value input at the end.

1. CLK [Clock]: Data is shifted into the shift register on the rising edge of this clock.
2. LE [Load Enable]: Data in the 19-bit shift register is transferred to respective latches on the rising edge of the clock. The data is transferred to a latch according to the control bit CNT value.
3. Data [Serial Data]: You can perform either reference counter setup or programmable counter setup first.

TIMING CHART

Control timing in a typical application is shown in Figure 3.
Initial setting of the port connected to the radio module is performed when power is supplied by the CPU and reset is completed. MOS-FET for supply voltage control of the radio module, RXSEL and TXSEL are set to inactive to avoid unwanted emissions. The power supply of the radio module is then turned on. When the radio module is turned on, the PLL internal resistor is not yet set and the peripheral VCO circuit is unstable. Therefore data transmission and reception is possible 40 ms after the setting data is sent to the PLL at the first change of channel, however from the second change of channel, the circuit stabilizes within 20 ms and is able to handle the data.
Changing channels must be carried out in the receive mode. If switching is performed in transmission mode, unwanted emission occurs.

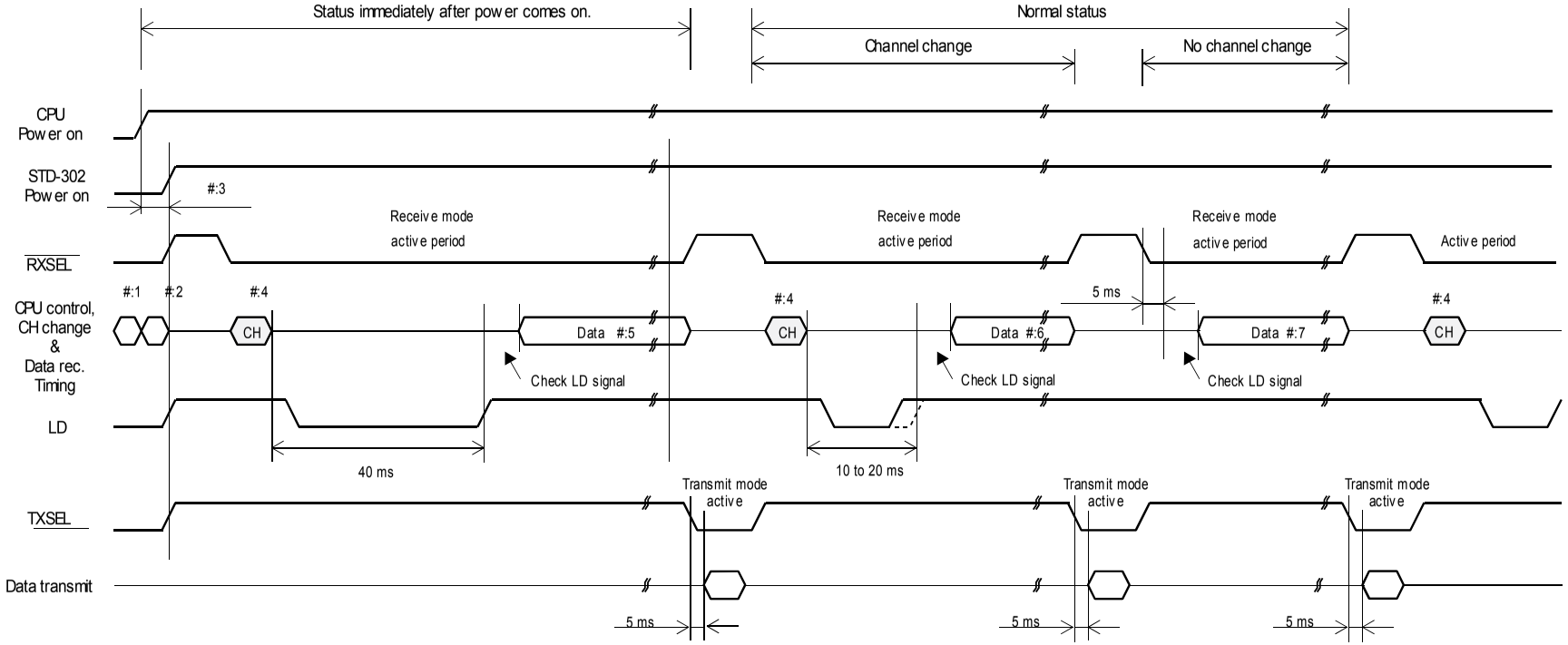
If the module is switched to the receive mode when operating in the same channel, (a new PLL setting is not necessary) it can receive data within 5 ms of switching[*1]. For data transmission, if the RF channel to be used for transmission is set while still in receiving mode, data can be sent at 5 ms after the radio module is switched from reception to transmission[*2].
Check that the Lock Detect signal is “high” 20 ms after the channel is changed. In some cases the Lock Detect signal becomes unstable before the lock is correctly detected, so it is necessary to note if processing of the signal is interrupted. It is recommended to observe the actual waveform before writing the process program.

[*1] DC offset may occur due to frequency drift caused by ambient temperature change. Under conditions below -10 °C, 10 to 20 ms delay of DO output is estimated. The customer is urged to verify operation at low temperature and optimize the timing.

[*2] Sending ‘10101…..’ preamble just after switching to transmission mode enables smoother operation of the binarization circuit of the receiver. For 9600 bps, a preamble of ‘11001100’ is effective.
Recommended preamble length:
-10 °C - +55°C: 7 ms (434 MHz), 15 ms (869 MHz)
-20 °C - +65 °C (for operation exceeding the above range): 15 ms (434 MHz)
-15 °C - +60 °C (for operation exceeding the above range): 40 ms (869 MHz)

Remark
For details about PLL control and the sample programs, see our technical document ‘STD-302 interface method’

Figure 3: Timing diagram for STD-302



#:1 Reset control CPU
#:2 Initialize the port connected to the module.
#:3 Supply power to the module after initializing CPU.
#:4 RFchannel change must be performed in receiving mode.

#:5 40 ms later, the receiver can receive the data after changing the channel..
#:6 10 to 20 ms later, the receiver can receive the data after changing the channel.
#:7 5 ms later, the data can be received if the RF channel is not changed.

PLL FREQUENCY SETTING DATA REFERENCE

434 MHz ISM band (433.050 - 434.790 MHz)

Parameter name	Value
Phase Comparing Frequency F_{comp} [kHz]	25
Start Channel Frequency F_{ch} [MHz]	433.0750
Channel Step Frequency [kHz]	25
Number of Channel	69
Prescaler M	64

: For data input
: Result of calculation
: Fixed value

Parameter name	Value
Reference Frequency F_{osc} [MHz]	21.25
Offset Frequency F_{offset} [MHz]	21.7

Parameter name	Value
Reference Counter R	850
Programmable Counter N Min. Value	257
Programmable Counter N Max. Value	258
Swallow Counter A Min. Value	0
Swallow Counter A Max. Value	63

No.	Channel Frequency F_{ch}	Expect Frequency F_{expect}	Lock Frequency F_{vco}	Number of Division n	Programmable Counter N	Swallow Counter A
	(MHz)	(MHz)	(MHz)			
0	433.0750	411.3750	411.3750	16455	257	7
1	433.1000	411.4000	411.4000	16456	257	8
2	433.1250	411.4250	411.4250	16457	257	9
3	433.1500	411.4500	411.4500	16458	257	10
4	433.1750	411.4750	411.4750	16459	257	11
5	433.2000	411.5000	411.5000	16460	257	12
6	433.2250	411.5250	411.5250	16461	257	13
7	433.2500	411.5500	411.5500	16462	257	14
8	433.2750	411.5750	411.5750	16463	257	15
9	433.3000	411.6000	411.6000	16464	257	16
10	433.3250	411.6250	411.6250	16465	257	17
11	433.3500	411.6500	411.6500	16466	257	18
12	433.3750	411.6750	411.6750	16467	257	19
13	433.4000	411.7000	411.7000	16468	257	20
14	433.4250	411.7250	411.7250	16469	257	21
15	433.4500	411.7500	411.7500	16470	257	22
16	433.4750	411.7750	411.7750	16471	257	23
17	433.5000	411.8000	411.8000	16472	257	24
18	433.5250	411.8250	411.8250	16473	257	25
19	433.5500	411.8500	411.8500	16474	257	26
20	433.5750	411.8750	411.8750	16475	257	27
21	433.6000	411.9000	411.9000	16476	257	28
22	433.6250	411.9250	411.9250	16477	257	29
23	433.6500	411.9500	411.9500	16478	257	30
24	433.6750	411.9750	411.9750	16479	257	31
25	433.7000	412.0000	412.0000	16480	257	32
26	433.7250	412.0250	412.0250	16481	257	33
27	433.7500	412.0500	412.0500	16482	257	34
28	433.7750	412.0750	412.0750	16483	257	35
29	433.8000	412.1000	412.1000	16484	257	36
30	433.8250	412.1250	412.1250	16485	257	37
31	433.8500	412.1500	412.1500	16486	257	38
32	433.8750	412.1750	412.1750	16487	257	39

33	433.9000	412.2000	412.2000	16488	257	40
34	433.9250	412.2250	412.2250	16489	257	41
35	433.9500	412.2500	412.2500	16490	257	42
36	433.9750	412.2750	412.2750	16491	257	43
37	434.0000	412.3000	412.3000	16492	257	44
38	434.0250	412.3250	412.3250	16493	257	45
39	434.0500	412.3500	412.3500	16494	257	46
40	434.0750	412.3750	412.3750	16495	257	47
41	434.1000	412.4000	412.4000	16496	257	48
42	434.1250	412.4250	412.4250	16497	257	49
43	434.1500	412.4500	412.4500	16498	257	50
44	434.1750	412.4750	412.4750	16499	257	51
45	434.2000	412.5000	412.5000	16500	257	52
46	434.2250	412.5250	412.5250	16501	257	53
47	434.2500	412.5500	412.5500	16502	257	54
48	434.2750	412.5750	412.5750	16503	257	55
49	434.3000	412.6000	412.6000	16504	257	56
50	434.3250	412.6250	412.6250	16505	257	57
51	434.3500	412.6500	412.6500	16506	257	58
52	434.3750	412.6750	412.6750	16507	257	59
53	434.4000	412.7000	412.7000	16508	257	60
54	434.4250	412.7250	412.7250	16509	257	61
55	434.4500	412.7500	412.7500	16510	257	62
56	434.4750	412.7750	412.7750	16511	257	63
57	434.5000	412.8000	412.8000	16512	258	0
58	434.5250	412.8250	412.8250	16513	258	1
59	434.5500	412.8500	412.8500	16514	258	2
60	434.5750	412.8750	412.8750	16515	258	3
61	434.6000	412.9000	412.9000	16516	258	4
62	434.6250	412.9250	412.9250	16517	258	5
63	434.6500	412.9500	412.9500	16518	258	6
64	434.6750	412.9750	412.9750	16519	258	7
65	434.7000	413.0000	413.0000	16520	258	8
66	434.7250	413.0250	413.0250	16521	258	9
67	434.7500	413.0500	413.0500	16522	258	10
68	434.7750	413.0750	413.0750	16523	258	11

869 MHz band (868 - 870 MHz)

Parameter name	Value
Phase Comparing Frequency F_{comp} [kHz]	25
Start Channel Frequency F_{ch} [MHz]	868.025
Channel Step Frequency [kHz]	25
Number of Channel	79
Prescaler M	64

: For data input
: Result of calculation
: Fixed value

Parameter name	Value
Reference Frequency F_{osc} [MHz]	21.25
Offset Frequency F_{offset} [MHz]	21.7

Parameter name	Value
Reference Counter R	850
Programmable Counter N Min. Value	528
Programmable Counter N Max. Value	530
Swallow Counter A Min. Value	0
Swallow Counter A Max. Value	63

No.	Channel Frequency F_{ch} (MHz)	Expect Frequency F_{expect} (MHz)	Lock Frequency F_{vco} (MHz)	Number of Division n	Programmable Counter N	Swallow Counter A
0	868.0250	846.3250	846.3250	33853	528	61
1	868.0500	846.3500	846.3500	33854	528	62
2	868.0750	846.3750	846.3750	33855	528	63
3	868.1000	846.4000	846.4000	33856	529	0
4	868.1250	846.4250	846.4250	33857	529	1
5	868.1500	846.4500	846.4500	33858	529	2
6	868.1750	846.4750	846.4750	33859	529	3
7	868.2000	846.5000	846.5000	33860	529	4
8	868.2250	846.5250	846.5250	33861	529	5
9	868.2500	846.5500	846.5500	33862	529	6
10	868.2750	846.5750	846.5750	33863	529	7
11	868.3000	846.6000	846.6000	33864	529	8
12	868.3250	846.6250	846.6250	33865	529	9
13	868.3500	846.6500	846.6500	33866	529	10
14	868.3750	846.6750	846.6750	33867	529	11
15	868.4000	846.7000	846.7000	33868	529	12
16	868.4250	846.7250	846.7250	33869	529	13
17	868.4500	846.7500	846.7500	33870	529	14
18	868.4750	846.7750	846.7750	33871	529	15
19	868.5000	846.8000	846.8000	33872	529	16
20	868.5250	846.8250	846.8250	33873	529	17
21	868.5500	846.8500	846.8500	33874	529	18
22	868.5750	846.8750	846.8750	33875	529	19
23	868.6000	846.9000	846.9000	33876	529	20
24	868.6250	846.9250	846.9250	33877	529	21
25	868.6500	846.9500	846.9500	33878	529	22
26	868.6750	846.9750	846.9750	33879	529	23
27	868.7000	847.0000	847.0000	33880	529	24
28	868.7250	847.0250	847.0250	33881	529	25
29	868.7500	847.0500	847.0500	33882	529	26
30	868.7750	847.0750	847.0750	33883	529	27
31	868.8000	847.1000	847.1000	33884	529	28
32	868.8250	847.1250	847.1250	33885	529	29

33	868.8500	847.1500	847.1500	33886	529	30
34	868.8750	847.1750	847.1750	33887	529	31
35	868.9000	847.2000	847.2000	33888	529	32
36	868.9250	847.2250	847.2250	33889	529	33
37	868.9500	847.2500	847.2500	33890	529	34
38	868.9750	847.2750	847.2750	33891	529	35
39	869.0000	847.3000	847.3000	33892	529	36
40	869.0250	847.3250	847.3250	33893	529	37
41	869.0500	847.3500	847.3500	33894	529	38
42	869.0750	847.3750	847.3750	33895	529	39
43	869.1000	847.4000	847.4000	33896	529	40
44	869.1250	847.4250	847.4250	33897	529	41
45	869.1500	847.4500	847.4500	33898	529	42
46	869.1750	847.4750	847.4750	33899	529	43
47	869.2000	847.5000	847.5000	33900	529	44
48	869.2250	847.5250	847.5250	33901	529	45
49	869.2500	847.5500	847.5500	33902	529	46
50	869.2750	847.5750	847.5750	33903	529	47
51	869.3000	847.6000	847.6000	33904	529	48
52	869.3250	847.6250	847.6250	33905	529	49
53	869.3500	847.6500	847.6500	33906	529	50
54	869.3750	847.6750	847.6750	33907	529	51
55	869.4000	847.7000	847.7000	33908	529	52
56	869.4250	847.7250	847.7250	33909	529	53
57	869.4500	847.7500	847.7500	33910	529	54
58	869.4750	847.7750	847.7750	33911	529	55
59	869.5000	847.8000	847.8000	33912	529	56
60	869.5250	847.8250	847.8250	33913	529	57
61	869.5500	847.8500	847.8500	33914	529	58
62	869.5750	847.8750	847.8750	33915	529	59
63	869.6000	847.9000	847.9000	33916	529	60
64	869.6250	847.9250	847.9250	33917	529	61
65	869.6500	847.9500	847.9500	33918	529	62
66	869.6750	847.9750	847.9750	33919	529	63
67	869.7000	848.0000	848.0000	33920	530	0
68	869.7250	848.0250	848.0250	33921	530	1
69	869.7500	848.0500	848.0500	33922	530	2
0	869.7750	848.0750	848.0750	33923	530	3
71	869.8000	848.1000	848.1000	33924	530	4
72	869.8250	848.1250	848.1250	33925	530	5
73	869.8500	848.1500	848.1500	33926	530	6
74	869.8750	848.1750	848.1750	33927	530	7
75	869.9000	848.2000	848.2000	33928	530	8
76	869.9250	848.2250	848.2250	33929	530	9
77	869.9500	848.2500	848.2500	33930	530	10
78	869.9750	848.2750	848.2750	33931	530	11

Regulatory compliance information

Assessment

Circuit Design, Inc. hereby declares that STD-302 (hereinafter referred to as 'RF modules') is in compliance with the essential requirements and other relevant provisions of Directive 1999/5/EC.

STD-302 has been assessed to the following
European harmonized standards.

EN 300 220-3 V1.1.1 (2000 Sept.)
EN 301 489-3 V1.4.1 (2002 Apr.)
ICE60950:2000(3rd Edition)

The assessment was carried out in accordance with Annex IV of the R&TTE Directive. RF module STD-302 is marked with the Notified Body's identification number '0499'. The Declaration of Conformity is attached in this Operation Guide.

Caution

STD-302 module is intended to be integrated into the host equipment. The host equipment in which the modules are installed should be assessed for compliance with the essential requirements and other relevant provisions of Directive 1999/5/EC.

The STD-302 emits carrier signals continuously when power is supplied. The user must design the host equipment of the STD-302 to ensure that the duty cycle of the host equipment is within the requirements of the radio regulations in the country where the equipment is to be used.

Make sure that the STD-302 is used within the specified supply vltage (3-5.5 V). Applying voltage over/under the rated range may cause malfunction.

To fulfill the requirements of EMC, make sure that the STD-302 is mounted on your PCB and enclosed in the case of the host equipment. Any surface of the module should not be exposed

Antenna and conformity assessment of STD-302
STD-302 is supplied without a dedicated antenna. It has a pin-type antenna connection and the user is required to prepare an antenna. However please pay attention, as far as we know, use of an external antenna is allowed only in UK and Germany (the external antenna must be a passive antenna, that means the gain of the antenna has to be zero). In other countries, use of an antenna dedicated to the unit will be required. With this point in view, the STD-302 has also been assessed using Circuit Design's standard antenna ANT-LEA-01/02 (1/4 lambda). We can recommend you to use this antenna or antennas with equivalent performance as a dedicated antenna. For information about our standard antenna, please see our URL or contact us. If you use an antenna other than we recommend, further conformity assessment may be required. Please consult the authorities in the relevant country for more details.

Specific instructions regarding the design of the host equipment relating to: Article 3.2 'Radio EN 300 220-3 v1.1.1: 2000-09'

It is stated in the Technical Guidance Note TGN01 issued by the R&TTE Compliance Association, that the assessed RF modules installed in the final products which are in compliance with the manufacturer's installation instructions require no further evaluation under Article 3.2 (radio) of the R&TTE Directive.

Therefore manufacturers of the final products, who use the assessed RF modules, are responsible for

Safety & EMC requirements only.

Notification for placing on the market under article 6.4 of R&TTE directive has been notified to the following countries;
(For operation with 10% duty cycle in the range from 433.05MHz to 434.790MHz, notification is no longer required.)

434MHz (434.04MHz to 434.790MHz Duty cycle up to 100%)
Germany, Austria, Belgium, Finland, France, Italy, Liechtenstein, Netherlands, Spain, Sweden, Switzerland, UK, Luxemburg, Norway, Denmark

869MHz
Germany, Austria, Belgium, Finland, France, Italy, Liechtenstein, Netherlands, Spain, Sweden, Switzerland, UK, Luxemburg, Norway, Denmark

For the latest information about notification, please see Circuit Design's URL www.circuitdesign.jp

If you have any inquiries about regulatory compliance of this product, please contact Circuit Design, Inc. We also recommend you to consult the authorities in each country for detailed regulatory information.

DECLARATION OF CONFORMITY
Directive 99/5/EC

Supplier Name: Circuit Design, Inc.
Supplier Address: 7557-1, Hotaka, Hotaka-machi, Minamiazumi, Nagano

declares on our sole responsibility, that the following product :

Kind of equipment: Transceiver module

Type-designation: STD-302 (433.050-434.790 MHz)

is/are in compliance with the following norm(s) or document(s):

EN 300 220-3 V1.1.1 (2000 Sept.)
EN 301 489-3 V1.4.1 (2002 Apr.)
ICE60950:2000(3rd Edition)

Hotaka, Japan July 9 2003
Place and date of issue

Kazuo Matsuyama
Manufacturer/Authorized representative name and signature

Accredited test laboratory : MIKES BABT SERVICE GmbH, **Ohmstrasse 2-4 94342 Strasskirchen, Germany**

DECLARATION OF CONFORMITY
Directive 99/5/EC

Supplier Name: Circuit Design, Inc.
Supplier Address: 7557-1, Hotaka, Hotaka-machi, Minamiazumi, Nagano

declares on our sole responsibility, that the following product :

Kind of equipment: Transceiver module

Type-designation: STD-302 (868.00-870.00 MHz)

is/are in compliance with the following norm(s) or document(s):

EN 300 220-3 V1.1.1 (2000 Sept.)
EN 301 489-3 V1.4.1 (2002 Apr.)
ICE60950:2000(3rd Edition)

Hotaka, Japan July 9 2003
Place and date of issue

Kazuo Matsuyama
Manufacturer/Authorized representative name and signature

Accredited test laboratory : MIKES BABT SERVICE GmbH, **Ohmstrasse 2-4 94342 Strasskirchen, Germany**

Cautions

- As the radio module communicates using electronic radio waves, there are cases where transmission will be temporarily cut off due to the surrounding environment and method of usage. The manufacturer is exempt from all responsibility relating to resulting harm to personnel or equipment and other secondary damage.
- Do not use the equipment within the vicinity of devices that may malfunction as a result of electronic radio waves from the radio module.
- The manufacturer is exempt from all responsibility relating to secondary damage resulting from the operation, performance and reliability of equipment connected to the radio module.
- Communication performance will be affected by the surrounding environment, so communication tests should be carried out before actual use.
- Ensure that the power supply for the radio module is within the specified rating. Short circuits and reverse connections may result in overheating and damage and must be avoided at all costs.
- Ensure that the power supply has been switched off before attempting any wiring work.
- The case is connected to the GND terminal of the internal circuit, so do not make contact between the '+' side of the power supply terminal and the case.
- When batteries are used as the power source, avoid short circuits, recharging, dismantling, and pressure. Failure to observe this caution may result in the outbreak of fire, overheating and damage to the equipment. Remove the batteries when the equipment is not to be used for a long period of time. Failure to observe this caution may result in battery leaks and damage to the equipment.
- Do not use this equipment in vehicles with the windows closed, in locations where it is subject to direct sunlight, or in locations with extremely high humidity.
- The radio module is neither waterproof nor splash proof. Ensure that it is not splashed with soot or water. Do not use the equipment if water or other foreign matter has entered the case.
- Do not drop the radio module or otherwise subject it to strong shocks.
- Do not subject the equipment to condensation (including moving it from cold locations to locations with a significant increase in temperature.)
- Do not use the equipment in locations where it is likely to be affected by acid, alkalis, organic agents or corrosive gas.
- Do not bend or break the antenna. Metallic objects placed in the vicinity of the antenna will have a great effect on communication performance. As far as possible, ensure that the equipment is placed well away from metallic objects.
- The GND for the radio module will also affect communication performance. If possible, ensure that the case GND and the circuit GND are connected to a large GND pattern.

Warnings

- Do not take a part or modify the equipment.
- Do not remove the product label (the label attached to the upper surface of the module.) Using a module from which the label has been removed is prohibited.