Documents for TCB submission for FCC approval:

	Description of document	Filetype
7.	Userguide or manual	pdf
9.	Operational description	pdf
13.	User's guide	pdf

All three documents is covered by this module specification.

Module specification, MC-PLL-440C

Document number

SP-01-007

This page is not a part of the customer manual
and shall not be distributed!

	1	2	3	4	5
Date	2001-05-10	2001-11-12	2001-11-14	2003-05-07	2004-11-12
Written by	PB	PB	LdB	TOB	TOB
Checked by	JL	TOB	TOB	PB	JL
Approved by	PB	PB	TOB	PB	TOB

Revision	6	7	8	9	10
Date	2005-06-12				
Written by	PB				
Checked by	JL				
Approved by	AB				

File name	G:\01\SP\SP-01-007-06 Module specification MC-PLL-440C.doc

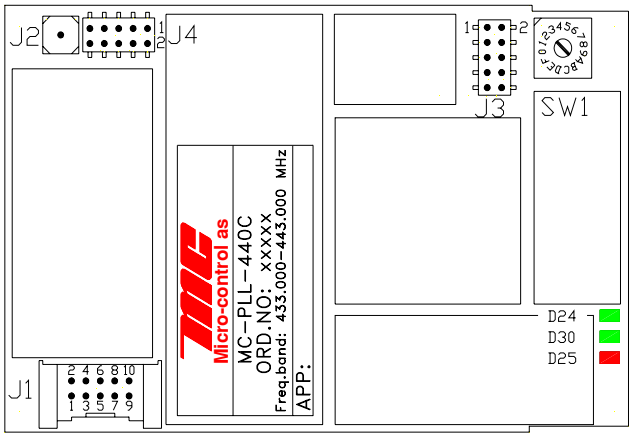
Revision history

Revision	Changes
1	First revision - based on the Norwegian version of the document
2	Second revision - New frequency tables and ordering numbers, added new versions.
3	Minor language changes & altered table 2 s.t. the output powers are identical to those listed in the Specification section (Laurens de Bruijn).
4	Replaced part numbers for all versions with new ones. Removed sentence about aging in chapter “Tuning”. Removed reference to system specification for MC-3000/MC-3-5.
5	Corrected frequencies in some rotary switch positions for LFB-, STD-, FCC0-, FCC1- and FCC2 variants.
6	Added information about FCC approved models, with information about modulation, channel spacing and ordering numbers. Changed order numbers according to iScala according to change 1.st of July 2005.

Module specification, MC-PLL-440C

Module

This module specification refers to the MC-PLL-440C. The module looks like this:



Ref.	Name	See chapter
J1	TX-bus	Connections
J2	Antenna connector	Connections
J3	Test connections	Connections
J4	Test connections	Connections
SW1	Rotary switch	Configuration
D24	RX-LED Green	Indicators
D25	TX-LED Red	Indicators
D30	RSSI-LED Green	Indicators

Versions

The PLL-440C exists in several versions with various properties. Refer to the label at the module top in the field "ORD.NO". The format is changed from XXXXX to M5-1012-XXXX. The following text may be found:

Order no.	Explanation	Frequency [MHz]	Channel separation [kHz]	Output power [mW]		
				Min	Nom.	Max.
M5-1012-4407	LFB (Low Frequency Band)	418 - 428	12.5	10	50	85
M5-1012-4405	Default version STD	433 - 443	25	10	50	85
M5-1012-4400	Version 0 FCC	440 - 450	12.5	10	50	85
M5-1012-4401	Version 1 with FCC approval.	450 - 460	12.5	10	50	85
M5-1012-4402	Version 2 with FCC approval.	460 - 470	12.5	10	50	85
M5-1012-4403	Version 3 FCC	470 - 474	12.5	10	50	85
M5-1012-4408	Version approved for ISM (Industry, Science and Medicine) band use.	428 – 438*	12.5	3	7	10

*The ISM band is limited to 433.075 - 434.775 MHz.

In addition to these differences the various versions have different frequencies that may be chosen using the rotary switch, refer to chapter “Configuration”.

Terms

PLL-440C	Short for MC-PLL-440C
LED	Light emitting diode

Functionality

PLL-440C is a multi-channel synthesized radio transmitter and receiver. The radio has a high sensitivity and an especially good performance in terms of adjacent channel noise and suppression of spurii. Data transfer speed is set by software to either 2400bps or 9600bps. Order numbers for the MC series

MC-PLL-440C, LFB	12.5 kHz channel separation	418-428 MHz	M5-1012-4407
MC-PLL-440C, ISM	12.5 kHz channel separation	428-438 MHz	M5-1012-4408
MC-PLL-440C, STD	25 kHz channel separation	433-443 MHz	M5-1012-4405
MC-PLL-440C, FCC0	12.5 kHz channel separation	440-450 MHz	M5-1012-4400
MC-PLL-440C, FCC1 *	12.5 kHz channel separation	450-460 MHz	M5-1012-4401
MC-PLL-440C, FCC2 *	12.5 kHz channel separation	460-470 MHz	M5-1012-4402
MC-PLL-440C, FCC3	12.5 kHz channel separation	470-474 MHz	M5-1012-4403

* FCC approved models

Order according to measurements

Antenna cable for terminal internal antenna	M5-1112-3000
Antenna cable for cabinet, 25cm	M5-1111-0100
Antenna cable for cabinet, 45cm	M5-1111-0200
Antenna cable for cabinet, 90cm	M5-1111-0000

Connections

J1 TX-bus

To be connected to the processor module TX-bus connection. This supplies the TX-bus of the PLL-440C with:

-Power supply. (Does not apply to the EX-version.)

-HPDN-signal. Sets the radio to active or power saving mode.

-Signals from the processor module, which controls transmission and reception.

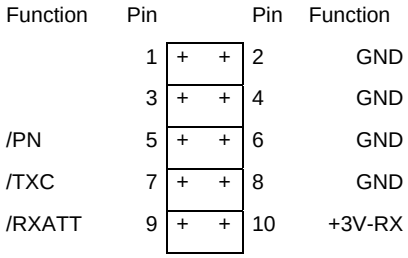
J2 Antenna connector

The antenna should have nominal impedance of 50Ω in the frequency band used. The connector is a SMB type.

Test connections

The PLL-440C is equipped with two 10 pin test connectors ("Test conn." in the diagram). Select the appropriate function at J3 by placing a strap ("jumper") between the required function pin and ground. This does not apply to J3-9, where the function is chosen by placing a strap between that function pin and +3V_RX.

Refer to the figure for the jumper placement (pins 1 and 2 are closest to the edge of the PCB):



J3 has the following functions:

J3-5 /PN

Function to transmit PN (Pseudo Noise)-sequence for testing of the radio according to EN 300-220. Normally not used except for the purpose of approval testing.

J3-7 /TXC

Function to transmit unmodulated carrier signal. This function can be used to check for frequency deviation between the transmitter and the receiver as follows: set an unmodulated carrier at the transmitter and measure the voltage at the receiver's J4-3 RXDA with a DC-voltmeter. If the frequency is set correctly at both the transmitter and the receiver, then the measured DC-voltage should be 2,5 Volt.

J3-9 RXATT

This sets an attenuator at the RX/receiver, in order to prevent overload in the presence of strong input signals.

J3-2, J3-4, J3-6 and J3-8

Ground pins.

J3-10

3,0 V_RX pin.

J4 has the following test signals:

J4-1 RSSI.

RSSI (Received Signal Strength Indication), output level from 0-3Volt. The output may be used to setup the antenna location and orientation.

J4-3 RXDA

Buffered receiver audio signal output, DC-coupled. This output can also be used to check if the transmitter and receiver are using the same frequency.

J4-5 Audio

Buffered receiver audio signal output, AC-coupled. This output can connected to earphones to check if other users are broadcasting on the channel.

J4-7 SDA2

SDA2 = SDA, serial data from the PM interface.

J4-9 SCL2

SCL2 = SCL, clock from the PM interface.

J4-2, J4-4, J4-6, J4-8 and J4-10

Ground pins.

Indicators

RX-LED (D24)

Lights green when the radio receives data.

TX-LED (D25)

Lights red when the radio transmits data.

RSSI-LED (D30)

Signal strength indication: Lights green when a signal is received on the selected channel with a signal strength >-115dBm.

Tuning

Note that the tuning of MC-PLL-440C requires advanced test equipment. Do not attempt to tune the PLL-440C without the necessary equipment and competence. The method of tuning PLL-440C is described in "TP-01-004 Procedure for mounting, testing and tuning MC-PLL-440C".

Configuration

Configure the PLL-440C by setting the rotary switch to the correct position. Normally position 0 is used, which enables the frequency to be set by the processor module (via the TX-bus). In position 0, the data transfer rate may be set to either 2400bps or 9600bps. All rotary switch positions other than 0 set the PLL-440C to a transfer rate of 2400bps. The other positions select a fixed frequency according to the table below:

Rotary switch position	PLL-LFB	PLL-ISM	PLL-STD	FCC0	FCC1	FCC2	FCC3
0	Frequency and data transmission rate is set by the processor						
1	418.075	433.075	441.325	443.8875	453.8875	463.8875	472.8875
2	418.225	433.225	441.550	443.9125	453.9125	463.9125	472.9125
3	418.500	433.375	441.575	443.9375	453.9375	463.9375	472.9375
4	418.975	433.525	441.600	443.9625	453.9625	463.9625	472.9625
5	419.500	433.675	441.625	443.9875	453.9875	463.9875	472.9875
6	420.000	433.825	441.725	444.0125	454.0125	464.0125	473.0125
7	421.000	433.875	439.700	444.0375	454.0375	464.0375	473.0375
8	422.000	433.925	439.750	444.0625	454.0625	464.0625	473.0625
9	424.000	433.975	439.800	444.0875	454.0875	464.0875	473.0875
A	425.000	434.025	439.850	444.1125	454.1125	464.1125	473.1125
B	426.000	434.175	439.900	444.1375	454.1375	464.1375	473.1375
C	427.000	434.325	442.950	444.1625	454.1625	464.1625	473.1625
D	418.050	434.475	439.975	444.1750	454.1750	464.1750	473.1750
E	423.000	434.625	433.050	444.2125	454.2125	464.2125	473.2125
F	427.950	434.775	438.050	444.2375	454.2375	464.2375	473.2375

Specifications

Supply voltage:

Via cable from the processor module (TX-bus): 6.9V - 9.0V (Nominal 7.2V)

Limited for the ISM version (M5-1012-4408): 6.5V +/- 5%

MC-PLL-440C works from a supply voltage of minimum 6.3V, but the output voltage/power is then reduced.

Current consumption:

During transmission:	Max 130 mA
During reception:	Max 80 mA
If deactivated (HPDN is turned off):	Max 10 mA

Radio specification:

Approval:	According to EN 300 220 V1.3.1 (2000-09)
Approval:	According to FCC Part 90 (FCC1, FCC2 with 12.5 kHz channel spacing)
Modulation:	FM-modulation, 2 FSK +/- 4.7 kHz @2400 bps
Modulation:	FM-modulation, 4 FSK 9600 bps
Data speed	Max 2400 bps/9600bps
Sensitivity:	Better than -110 dBm @2400 bps
Sensitivity:	Better than -105 dBm @9600 bps
Radiated power Nominal:	50 mW (7 mW for ISM version)
Radiated power Minimum:	10 mW (3 mW for ISM version)
Radiated power Maximum:	100 mW (<10 mW for ISM version)