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Observe precautions! Electrostatic sensitive devices!

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1 MODULE VARIANTS AND RELATED DOCUMENTS

This document describes operation of LTCM 310U/LTCM 300U modules available in variations for following frequencies:

- LTCM 300U: 902.875 MHz
- LTCM 310U: 902.875 MHz

In addition we recommend following our [application notes](#), in particular

- AN101: Power Supply Layout – Layout considerations for Line-Power
- AN102: Antenna Basics – Basic Antenna Design Considerations for EnOcean based Products
- AN105: 315 MHZ Internal Antenna Design – Considerations for EnOcean based Products

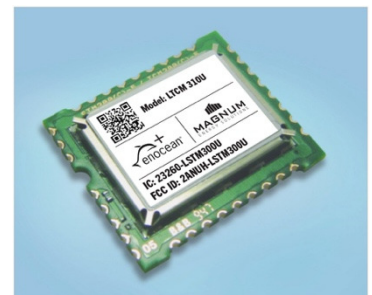
The specification of the serial protocol ESP3 can be found here:

http://www.enocean.com/en/enocean_modules/tcm-310/

2 GENERAL DESCRIPTION

2.1 Basic functionality

LTCM 300U is a SMD mountable radio transmitter module enabling the realization of gateways for 902 MHz radio systems. It provides a bi-directional radio interface and a bi-directional serial interface. Radio messages are sent transparently through the serial interface in both directions from and to an externally connected host processor or host PC. In addition control commands can be sent from the host, e.g. to configure the repeater functionality or to manage Smart Ack functions. TCM 300U can act as postmaster for up to 20 bi-directional sensors using Smart Ack technology.



Features

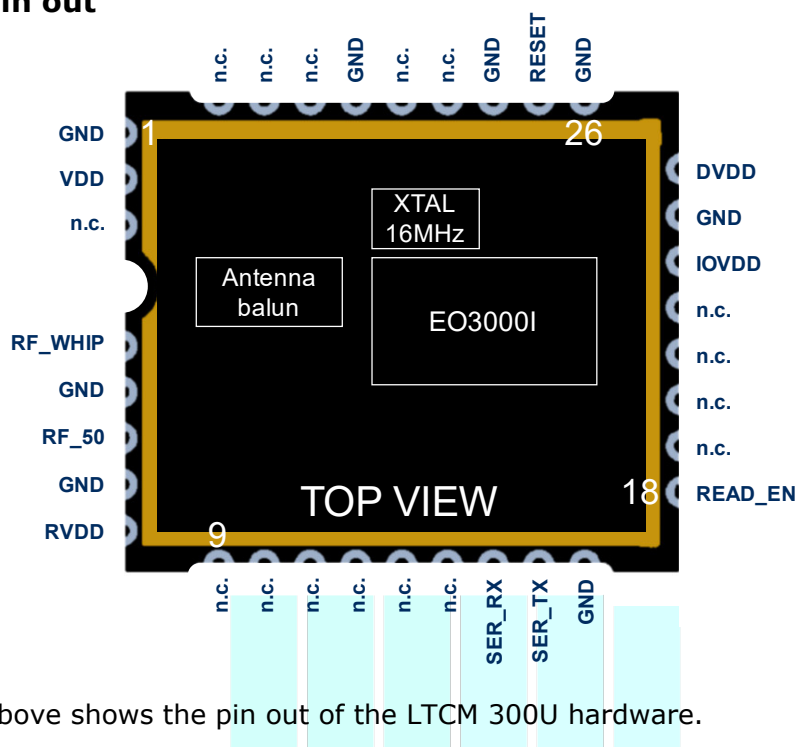
- Smart Ack controller functionality
- Transparent radio channel
- Programmable repeater functionality (1 / 2 Level)
- ESP3 support (EnOcean Serial Protocol V3)
- Not API programmable!

2.2 Technical data

Antenna	LTCM 310 U : external whip or 50 Ω antenna mountable
	LTCM 300U: external whip or Helical antenna
Frequency	LTCM 300U: 902.875 MHz (FSK) LTCM 310U: 902.875 MHz (FSK)
Data rate/Modulation type	125 kbps
Receiver Sensitivity (at 25 °C)	typ. -98 dBm (902.875 MHz) ¹⁾
Conducted Output Power	7 dBm @ 902.875 MHz
Power Supply	2.6V ... 3.5 V
Start-up Time	<500ms
Serial Interface	UART
Current Consumption	Receive mode: 33 mA Transmit mode: 24 mA
Dimensions of PCB	22x19x3 mm
Operating temperature	0 to +65 °C
Radio Regulations	FCC CFR-47 Part 15 (LTCM 310U / LTCM 300U)

3 FUNCTIONAL DESCRIPTION

3.1 Pin out



The figure above shows the pin out of the LTCM 300U hardware.

3.2 Pin description and operational characteristics

HW Symbol	Pin #	Function	Characteristics
GND	1, 5, 7, 17, 24, 26, 28, 31	Ground connection	Must be connected to GND; see 4.3
VDD	2	Supply voltage	2.6 V ... 3.5 V
RVDD	8	RF supply voltage regulator output	Leave open
DVDD	25	Digital supply voltage regulator output	1.8 V Output current: max. 5 mA
IOVDD	23	GPIO supply voltage	Must be connected to desired interface supply voltage (see 3.4) See also 3.2.1.
RESET	27	Reset input	External 10 kΩ pull-down parallel to >10nF capacitor recommended.
READ_EN	18	In read mode, the firmware version and configuration area can be read from the module	HIGH: read mode active LOW: operating mode Digital input, external 10 kΩ pull-down parallel to >10nF capacitor recommended.
SER_RX	15	UART input	See 3.6

SER_TX	16	UART output	See 3.6
RF_WHIP	4	RF output	Output for whip antenna
RF_50	6	RF output	50 Ohm output for external antenna
n.c.	3, 9-14, 19-22, 29,30, 32-34	Not connected	Do not connect!

3.2.1 GPIO supply voltage - IOVDD

For digital communication with other circuitry the pins of the serial interface UART may be operated from supply voltages different from DVDD. Therefore an interface voltage supply pin IOVDD is available which must be connected either to DVDD or to an external supply within the tolerated voltage range of IOVDD.



If DVDD=0 V (e.g. in any sleep mode or if $VDD < V_{OFF}$) and IOVDD is supplied, there may be unpredictable and varying current from IOVDD caused by internal floating nodes. It must be taken care that the current into IOVDD does not exceed 10 mA while DVDD=0 V.

If DVDD=0 V and IOVDD is not supplied, do not apply voltage to any above mentioned pin. This may lead to unpredictable malfunction of the device.



IOVDD voltage must not exceed VDD voltage! A malfunction of the module may be caused by such inverse supply!

3.3 Absolute maximum ratings (non operating)

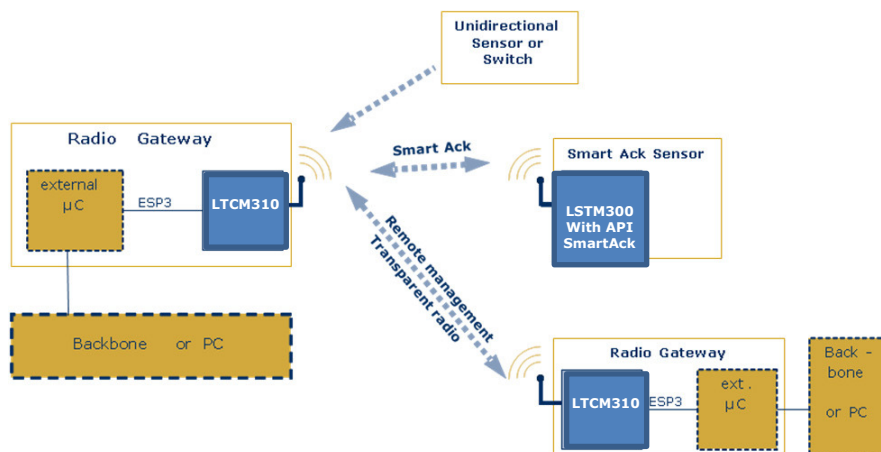
Symbol	Parameter	Min	Max	Units
VDD	Supply voltage at VDD	-0.5	5.5	V
IOVDD	GPIO supply voltage	-0.5	3.6	V
GND	Ground connection	0	0	V
VIND1	Voltage at RESET, and UART	-0.5	3.6	V

3.4 Maximum ratings (operating)

Symbol	Parameter	Min	Max	Units
VDD	Supply voltage at VDD LTCM 300U	2.6	3.6	V
IOVDD	GPIO supply voltage (see also 3.2.1)	1.7	3.6	V
GND	Ground connection	0	0	V
VIND1	Voltage at RESET, and UART	0	3.6	V
VDDR	Max. ripple at VDD		50	mVpp

3.5 System environment

In the figure below, LTCM 300U is shown in a typical system environment.



3.6 Serial Interface

LTCM 300U provides a bi-directional serial interface which conforms to the EnOcean ESP3 specification. For details regarding ESP3 please refer to the ESP3 specification¹. The data rate on the serial interface is 58.8 kbit/s which is usually interoperable with systems running at 57.6 kbit/s.

Direction	Nominal serial data rate	Tolerance
TX (sent by module)	58823 bit/s (=57600 bit/s + 2.1%)	< 50 ppm
RX (received by module)	58823 bit/s	< 5%

The following ESP3 commands are supported:

- Type 1 Radio command for transparent mode
- Type 2 Responses
- Type 4 Event
 - SA_CONFIRM_LEARN to confirm/discard learn in/out
 - CO_READY to indicate wake up from deep sleep initiated by CO_WR_SLEEP
 - CO_DUTYCYCLE_LIMIT to inform about a current limitation due to duty cycle
- Type 5 Common commands
 - CO_WR_SLEEP to enter energy saving mode (deep sleep mode)
 - CO_WR_RESET to reset the device
 - CO_RD_VERSION to read SW/HW versions, chip ID etc.
 - CO_RD_SYS_LOG to read system log from device data base
 - CO_WR_SYS_LOG to reset system log from device data base
 - CO_WR_BIST to perform flash BIST operation
 - CO_WR_IDBASE to write ID range base number
 - CO_RD_IDBASE to read ID range base number
 - CO_WR_REPEATER to configure repeater functionality
 - CO_RD_REPEATER to read repeater state

- CO_WR_FILTER_ADD to add filter to filter list or to selective repeating (up to 30 filters are supported)
- CO_WR_FILTER_DEL to delete filter from filter list or from selective repeating
- CO_WR_FILTER_DEL_ALL to delete all filter
- CO_WR_FILTER_ENABLE to enable/disable supplied filters
- CO_RD_FILTER to read supplied filters
- CO_WR_WAIT_MATURITY to wait maturity time before returning radio telegrams
- CO_WR_MEM for writing into memory
- CO_RD_MEM for reading memory
- CO_RD_MEM_ADDRESS to get addresses of special areas
- CO_RD_DUTYCYCLE_LIMIT to read information about current duty cycle limitations
- Type 6 Smart Acknowledge commands
 - SA_WR_LEARNMODE to set/reset Smart Acknowledge learn mode
 - SA_RD_LEARNMODE to get learn mode
 - SA_WR_LEARNCONFIRM to add or delete a mailbox of a client
 - SA_WR_RESET to send a reset command to a client
 - SA_RD_LEARNEDCLIENTS to get learned mailboxes/clients
 - SA_WR_POSTMASTER to activate/deactivate post master functionality
- Type 7 Remote Management messages up to 256 Bytes



All configuration values set via ESP3 commands are held in RAM and will therefore be lost after RESET or after a deep sleep phase. Only Smart Ack mailboxes are stored in FLASH and are available also after RESET or a deep sleep phase.



After sending a CO_WR_RESET command, the following CO_READY event indicates wake up reason 06 meaning "A memory request from the CPU core does not correspond to any valid memory location." This is caused by the real reset cause used when CO_WR_RESET will be performed. It is not a SW/HW malfunction.

3.7 Built-in Repeater

LTCM 300U provides the option to activate a one or two-level repeater for EnOcean radio telegrams.

1-level repeater: If a received telegram is a valid and original (not yet repeated), the telegram is repeated after a random delay. This delay will be chosen such that the maximum TX maturity time (as standardized in ISO 14543-3-10) of 40ms will not be exceeded.

2-level repeater: If a received telegram is valid and original or repeated once, the telegram is repeated after a random delay. This delay will be chosen such that the maximum TX maturity time (as standardized in ISO 14543-3-10) of 40ms will not be exceeded.

Repeated telegrams are marked as "repeated" by an increased repeater counter. Configuration of the repeater functionality is done via serial interface commands.



When using repeaters, care must be taken to ensure that regulatory transmitter duty cycle limits (if applicable) are not exceeded.



2-level repeating function should only be activated after careful study of the radio conditions! Otherwise the system function can be compromised by collisions of telegrams.

For detailed recommendations regarding the usage of repeaters please refer to our application note [EnOcean Wireless Systems - Installation Notes \(PDF\), 09/2010](#).

LTCM300U also provides selective repeating. It is possible to add filters and these will be applied during repeating. Selective repeating can be done based on:

- Sender ID
- Destination ID
- RORG
- dBm value

It is possible to define white lists or black lists for selective repeating and for filtering of received radio telegrams passed via ESP3 independently.



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3.8 Smart Acknowledge

LTCM 300U provides a post master function with 20 mailboxes for sensors using Smart Acknowledge technology. For more information on smart acknowledge please refer to the EnOcean End Equipment Profiles (EEP) 2.6 specification.



When teaching-in a device using Smart Acknowledge please take care to switch off all LTCM 300U devices which are not continuously powered. Otherwise these LTCM 300U modules could be declared postmaster.

If power supply to such postmaster will be switched off then Smart Acknowledge would not work due to the absence of the postmaster.



Smart Ack radio telegrams will be received and internally processed (post master, mailbox, etc.). There is no forwarding of such telegrams to the serial ESP3 interface.

3.9 Remote Management

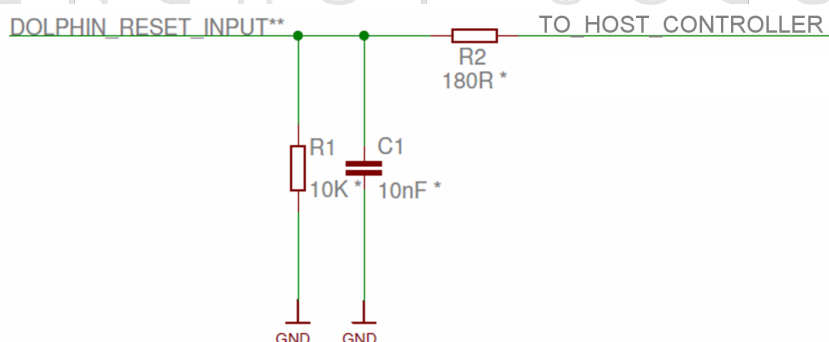
LTCM 300U provides a transparent radio channel also for remote management messages with a message length of up to 256 bytes. This enables an external micro controller connected to LTCM 300U to handle remote management request from external devices or to control other devices via remote management.

For more information on remote management please refer to the EnOcean End Equipment Profiles (EEP) 2.5 specification.

3.10 Suggested reset circuitry

In order to ensure reliable operation it is recommended to connect both the reset and the READ_EN input with a 10 k Ω resistor in parallel with a 10 nF capacitor to ground. This avoids spurious signal detection in very noisy environments.

The suggested circuit is shown below.



* values may be different depending on the application

** same circuit recommended for READ_EN input

4 APPLICATIONS INFORMATION



4.1 Antenna options

4.1.1 Overview

Several antenna types have been investigated by Magnum Energy Solutions. Please refer to our application notes AN102, and AN105 (EnOcean Website) which give an overview on our recommendations.

All LTCM 300U and LTCM310U modules have been approved with whip antenna, and LTCM 310U with helical antenna in addition.



902.875 MHz modules (LTCM 300U / LTCM 310U) please note that a full approval is needed if modules are used with antennas other than the specified antennas.

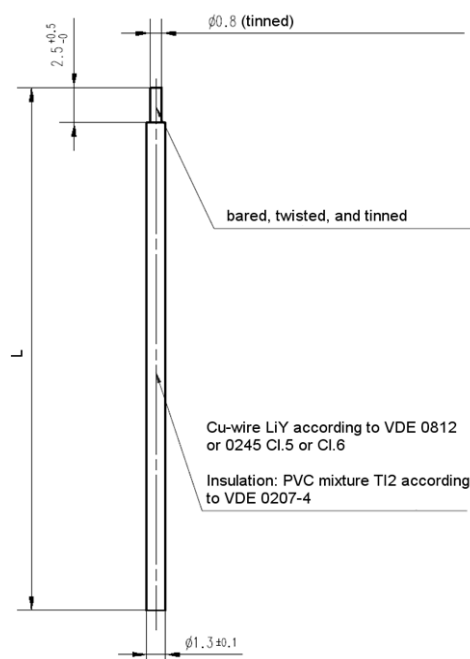
4.1.2 Whip antenna

902.875 MHz

Antenna: 64 mm wire, connect to RF_WHIP
Minimum GND plane: 50 mm x 50 mm
Minimum distance space: 10 mm

Antenna Test Procedure:

For production, the optimum antenna length 64mm should be used, two bridgeable (short, few mm optional soldering) in production fine tuning elements (e.g. $L \pm 5\%$) to increase the tolerances for the later mass production (different PCB materials or suppliers, specific device mounting undergrounds) can also be implemented like in the ex-ample shown below:



The inspection will be 5% of the production batch to make sure the length and the part number is correct.

4.1.3 External Antenna (ANT-916-CW-RCS, ANT-916-CW-HWR-RPS Linx Technologies)

The RCS Series is ideally suited for products requiring an attractive, yet compact, $\frac{1}{4}$ -wave antenna in a right-angle form factor. The antennas attach via a Part 15 compliant RP-SMA connector.

The HWR Series $\frac{1}{2}$ -wave center-fed dipole antennas deliver outstanding performance in a rugged and cosmetically attractive package. The articulating base allows the antenna to tilt 90 degrees and rotate 360 degrees. The antenna's internal counterpoise eliminates external ground plane dependence and maximizes performance. HWR Series antennas attach via a standard SMA or Part 15 compliant RP-SMA connector. Custom colors and connectors are available for volume OEM customers.

RCS Series Electrical Specifications	HWR Series Electrical Specifications
Center Frequency: 916MHz Recom. Freq. Range: 886–946MHz	Center Frequency: 916MHz Recom. Freq. Range: 900–930MHz Bandwidth: 30MHz
Wavelength: $\frac{1}{4}$ -wave VSWR: < 1.9 typical at center Peak Gain: 3.3dBi Impedance: 50-ohms Oper. Temp. Range: –20°C to +85°C Connector: RP-SMA	Wavelength: $\frac{1}{2}$ -wave VSWR: ≤ 2.0 typical Peak Gain: 1.2dBi Impedance: 50-ohms Connection: RP-SMA Oper. Temp. Range: –30°C to +80°C

Mounting 50 W antennas

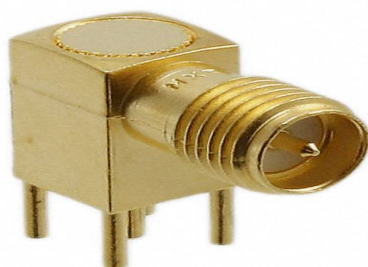
For mounting the receiver at bad RF locations (e.g. within a metal cabinet), an external 50W antenna may be connected. The whip antenna must be removed

Modification procedure:

- LTCM 300U: Remove whip antenna, then mount RP-SMA connector.
- LTCM 310U: Remove whip antenna, then mount RP-SMA connector.
- LSTM 300U: Remove whip antenna, then mount RP-SMA connector.

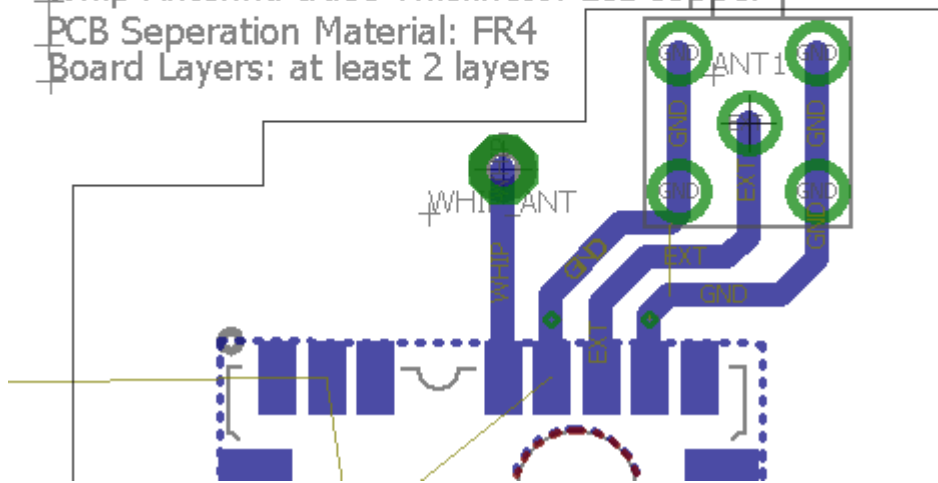
The module should provide soldering pads for an RP- SMA connector, e.g. from Molex, LLC:

Part number : 0733910320



4.2 Host PCB Trace Layout Considerations

- Gnd trace length: 10mm-20mm.
- EXT Trace length: 10mm-20mm
- EXT and GND trace Thickness: 1oz copper
- Whip Antenna Trace Width: 1mm
- Whip Antenna Trace Length to Module: 10 mm
- Whip Antenna trace Thickness: 1oz copper
- PCB Separation Material: FR4
- Board Layers: at least 2 layers



4.3 Positioning the whip antenna

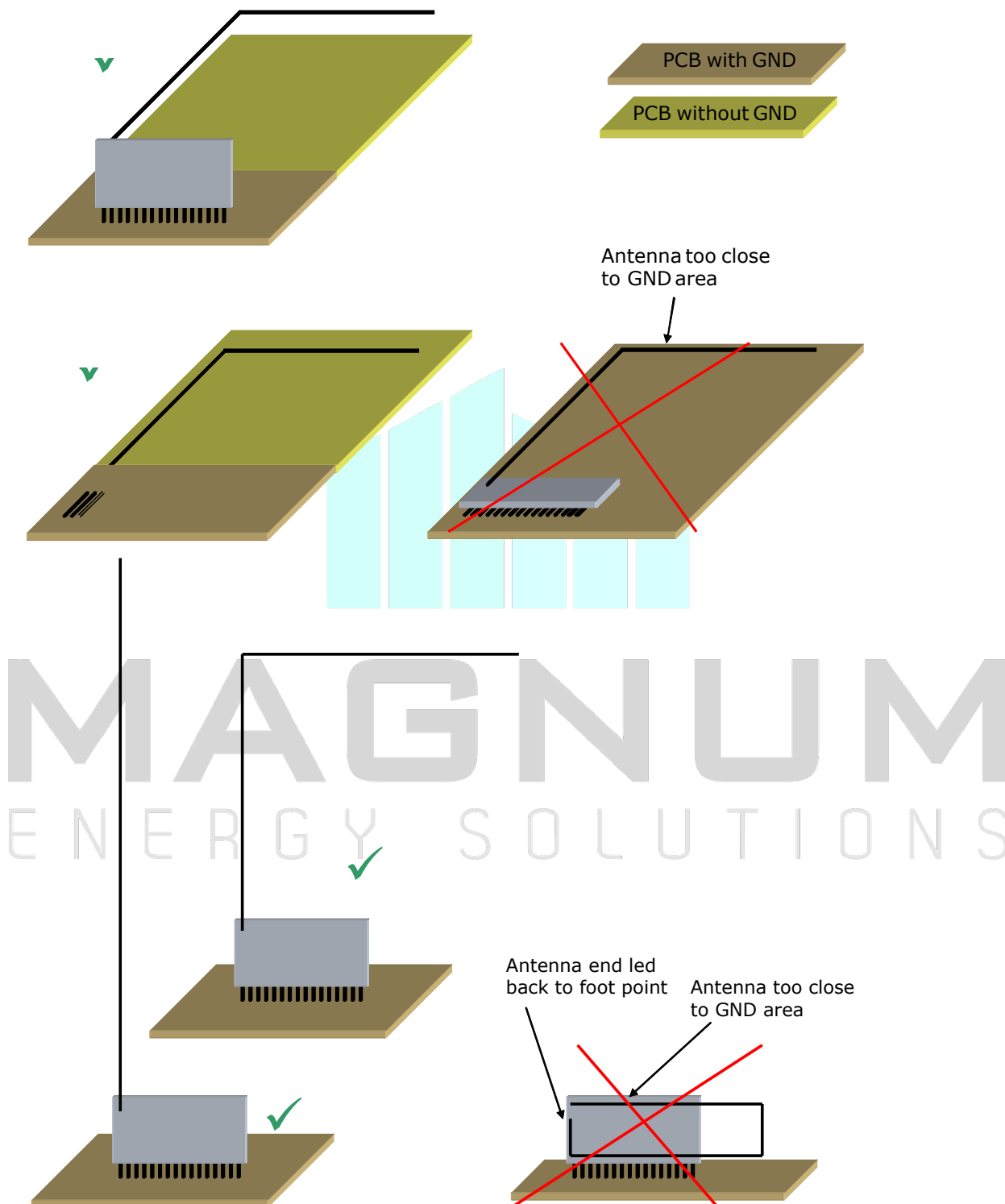
Positioning and choice of receiver and transmitter antennas are the most important factors in determining system transmission range.

For good receiver performance, great care must be taken about the space immediately around the antenna since this has a strong influence on screening and detuning the antenna. The antenna should be drawn out as far as possible and must never be cut off. Mainly the far end of the wire should be mounted as far away as possible (at least 15 mm) from all metal parts, ground planes, PCB strip lines and fast logic components (e.g. microprocessors). Do not roll up or twist the whip antenna!

Radio frequency hash from the motherboard desensitizes the receiver. Therefore:

- PCB strip lines on the user board should be designed as short as possible
- A PCB ground plane layer with sufficient ground via is strongly recommended
- Keep antenna away from noise generating parts of the circuit. Problems may especially occur with switching power supplies!

4.3.1 Recommendations for laying a whip antenna



4.4 Power supply requirements

In order to provide a good radio performance, great attention must be paid to the power supply and a correct layout and shielding. It is recommended to place a 22 μ F ceramic capacitor between VDD and GND close to the module (material: X5R, X7R, min 6.3 V to avoid derating effects).

In addition, an HF SMD EMI Suppression Ferrite Bead such as the Würth WE-CBF HF SMD EMI Suppression Ferrite Bead (Würth order number 742863160) shall be inserted in the power supply line.

For best performance it is recommended to keep the ripple on the power supply rail below 10 mVpp (see 3.4).



All GND pins must be connected to GND. Be careful not to create loops! The ground must be realized ideally on both sides of the PCB board with many vias. At least there must be a short star connection. Otherwise RF performance can be reduced!

4.5 Layout recommendations



The length of lines connected to I/Os should not exceed 5 cm.



It is recommended to have a complete GND layer in the application PCB, at least in the area below the module and directly connected components (e.g. mid-layer of your application PCB).

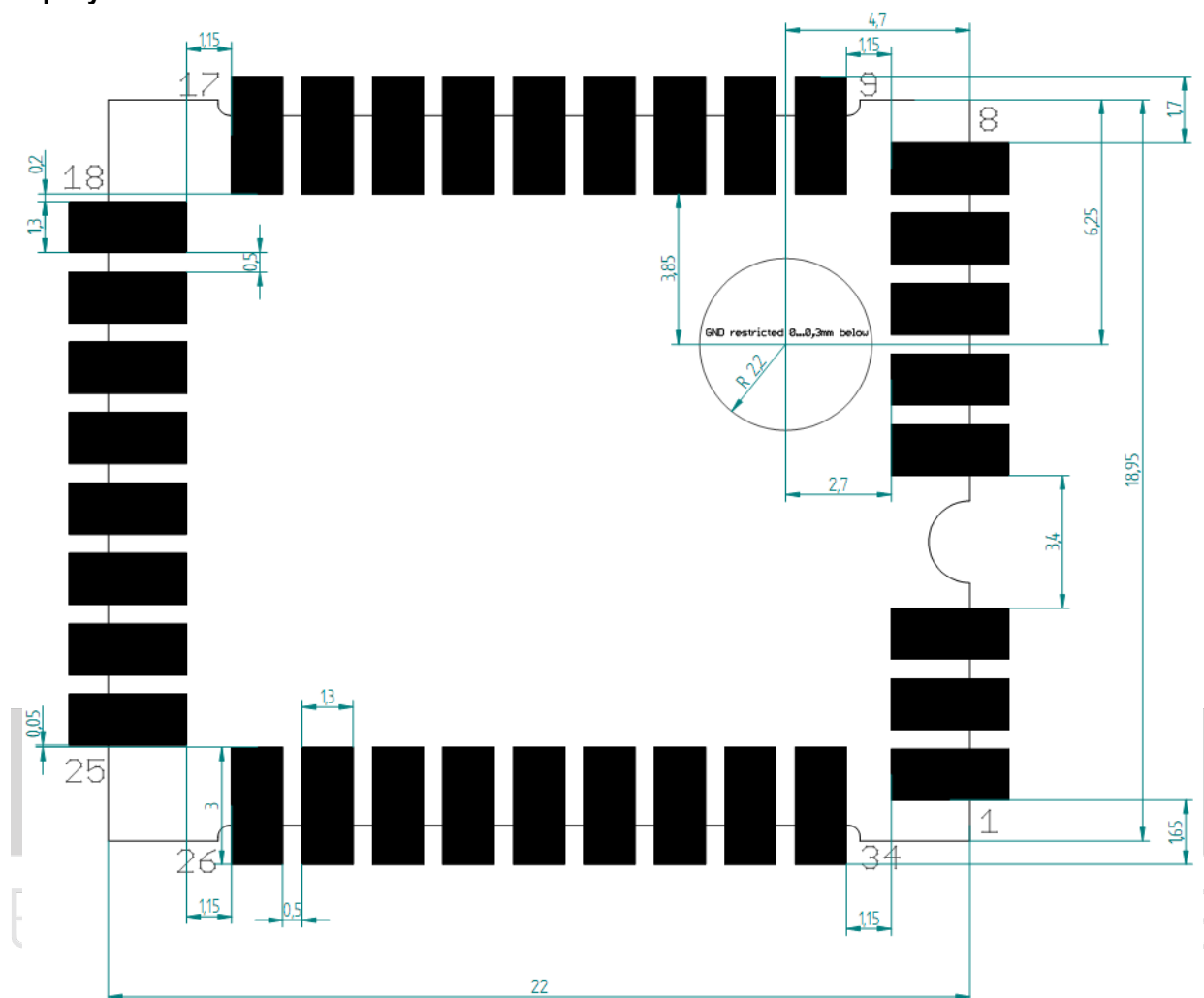
Due to unisolated test points there are live signals accessible on the bottom side of the module.

Please follow the following advices to prevent interference with your application circuit:

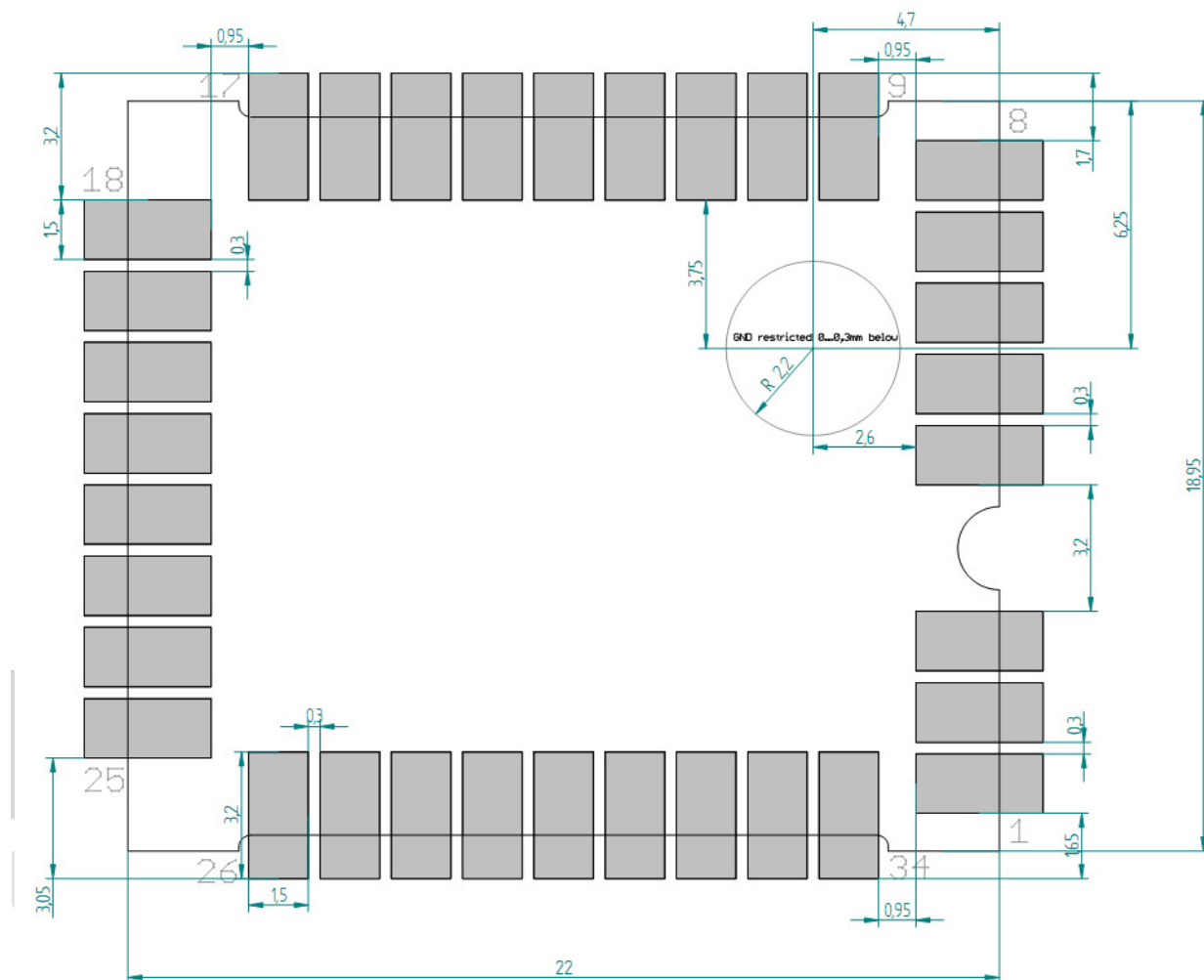
- We suggest avoiding any copper structure in the area directly underneath the module (top-layer layout of your application PCB). If this is not possible in your design, please provide coating on top of your PCB to prevent short circuits to the module. All bare metal surfaces including vias have to be covered (e.g. adequate layout of solder resist).
- It is mandatory that the area marked by the circle in the figure below is kept clear of any conductive structures in the top layer and 0.3 mm below. Otherwise RF performance will be degraded!

Furthermore, any distortive signals (e.g. bus signals or power lines) should not be routed underneath the module. If such signals are present in your design, we suggest separating them by using a ground plane between module and these signal lines.

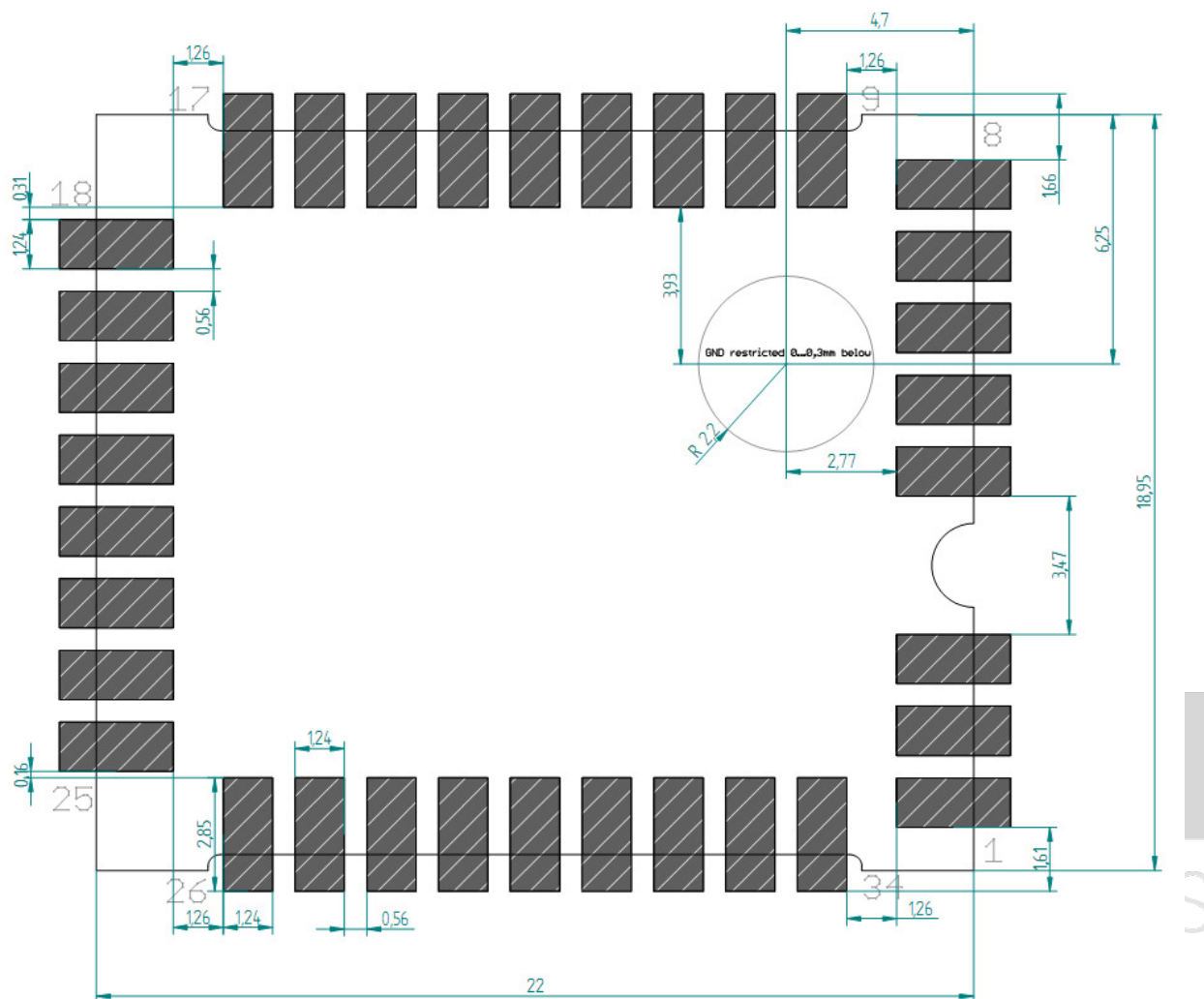
Top layer



Solder resist top layer



Solder paste top layer



The data above are also available as EAGLE library.

In order to ensure good solder quality a solder mask thickness of 150 μm is recommended.

In case a 120 μm solder mask is used, it is recommended to enlarge the solder print. The pads on the solder print should then be 0.1 mm larger than the pad dimensions of the module as specified in chapter 2.3. (not relative to the above drawing).

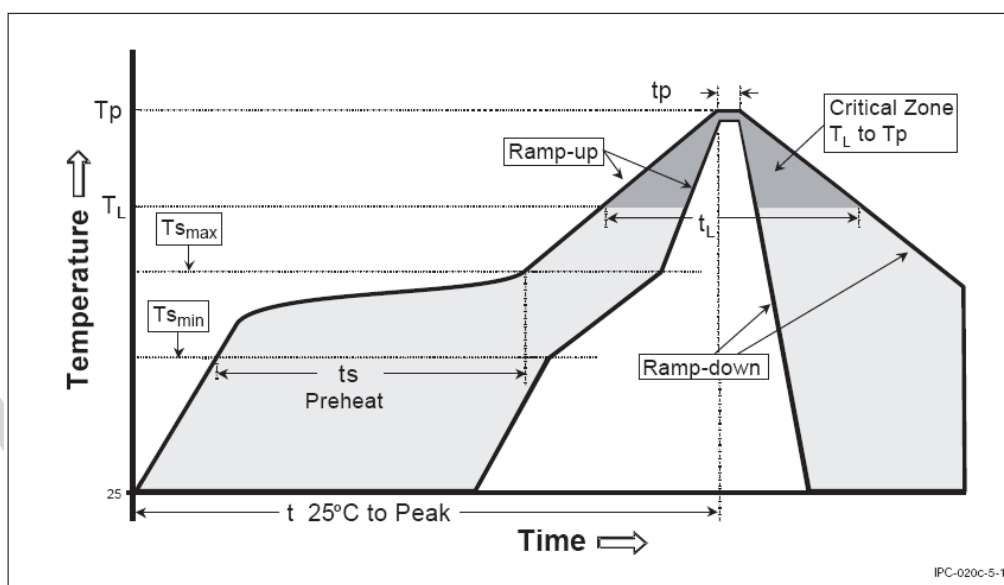
Nevertheless an application and production specific test regarding the amount of soldering paste should be performed to find optimum parameters.

4.6 Soldering information

LTCM 300U shall be soldered according to IPC/JEDEC J-STD-020C standard.

Profile Feature	Pb-Free Assembly
Average Ramp-Up Rate ($T_{s_{max}}$ to T_p)	3° C/second max.
Preheat	
– Temperature Min ($T_{s_{min}}$)	150 °C
– Temperature Max ($T_{s_{max}}$)	200 °C
– Time ($t_{s_{min}}$ to $t_{s_{max}}$)	60-180 seconds
Time maintained above:	
– Temperature (T_L)	217 °C
– Time (t_L)	60-150 seconds
Peak/Classification Temperature (T_p)	260 °C
Time within 5 °C of actual Peak Temperature (t_p)	20-40 seconds
Ramp-Down Rate	6 °C/second max.
Time 25 °C to Peak Temperature	8 minutes max.

Note 1: All temperatures refer to topside of the package, measured on the package body surface.



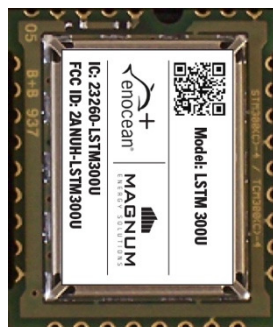
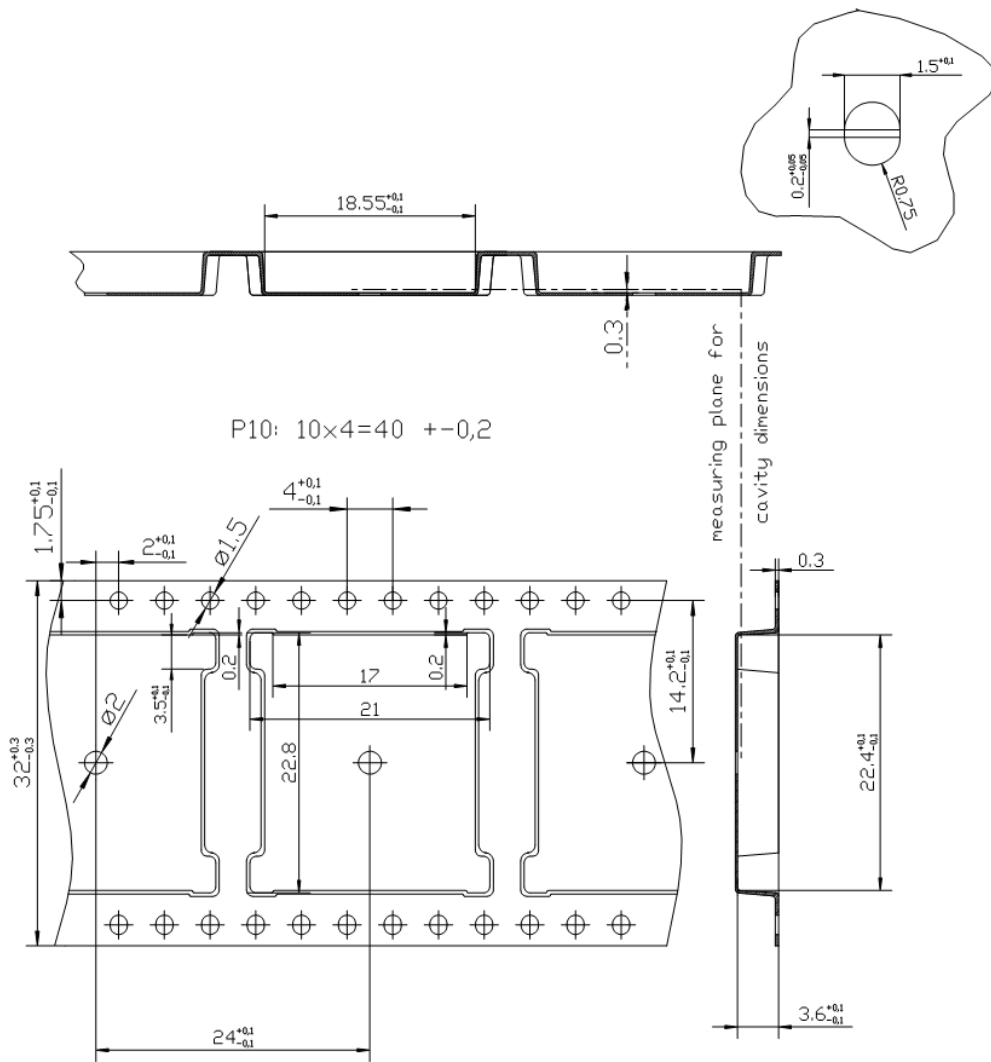
LTCM 300U shall be handled according to Moisture Sensitivity Level MSL4 which means a floor time of 72 h. LTCM 300U may be soldered only once, since one time is already consumed at production of the module itself.

Once the dry pack bag is opened, the desired quantity of units should be removed and the bag resealed within two hours. If the bag is left open longer than 30 minutes the desiccant should be replaced with dry desiccant. If devices have exceeded the specified floor life time of 72 h, they may be baked according IPC/JEDEC J-STD-033B at max. 90°C for less than 60 h.

Devices packaged in moisture-proof packaging should be stored in ambient conditions not exceeding temperatures of 40 °C or humidity levels of 90% r.H.

LTCM 300U modules shall be soldered within 6 months after delivery!

4.7 Tape & Reel specification



Tape running direction

4.8 Transmission range

The main factors that influence the system transmission range are type and location of the antennas of the receiver and the transmitter, type of terrain and degree of obstruction of the link path, sources of interference affecting the receiver, and "Dead" spots caused by signal reflections from nearby conductive objects. Since the expected transmission range strongly depends on this system conditions, range tests should categorically be performed before notification of a particular range that will be attainable by a certain application.

The angle at which the transmitted signal hits the wall is very important. The effective wall thickness – and with it the signal attenuation – varies according to this angle. Signals should be transmitted as directly as possible through the wall. Wall niches should be avoided. Other factors restricting transmission range:

- Switch mounted on metal surfaces (up to 30% loss of transmission range)
- Hollow lightweight walls filled with insulating wool on metal foil
- False ceilings with panels of metal or carbon fiber
- Lead glass or glass with metal coating, steel furniture

The distance between LSTM300U receivers and other transmitting devices such as computers, audio and video equipment that also emit high-frequency signals should be at least 0.5 m

5 AGENCY CERTIFICATIONS

The modules have been tested to fulfil the approval requirements for FCC/IC (LTCM 300U / LTCM 310U) based on the built-in firmware.

5.1 FCC (United States) Certification

LTCM 300U / LTCM 310U LIMITED MODULAR APPROVAL

This is an RF module approved for Limited Modular use operating as an intentional transmitting device with respect to 47 CFR 15.247(a-c) and is limited to OEM installation. The module is optimized to operate using small amounts of energy, and may be powered by a battery. The module transmits short radio packets comprised of control signals, (in some cases the control signal may be accompanied with data) such as those used with alarm systems, door openers, remote switches, and the like. The module does not support continuous streaming of voice, video, or any other forms of streaming data; it sends only short packets containing control signals and possibly data. The module is designed to comply with, has been tested according to 15.247(a-c), and has been found to comply with each requirement. Thus, a finished device containing the LTCM 300U / LTCM 310U radio module can be operated in the United States without additional Part 15 FCC approval (approval(s))

for unintentional radiators may be required for the OEM's finished product), under Magnum's FCC ID number. This greatly simplifies and shortens the design cycle and development costs for OEM integrators. The module can be triggered manually or automatically, which cases are described below.

Manual Activation

The radio module can be configured to transmit a short packetized control signal if triggered manually. The module can be triggered, by pressing a switch, for example. The packet contains one (or more) control signals that is(are) intended to control something at the receiving end. The packet may also contain data. Depending on how much energy is available from the energy source, subsequent manual triggers can initiate the transmission of additional control signals. This may be necessary if prior packet(s) was(were) lost to fading or interference. Subsequent triggers can also be initiated as a precaution if any doubt exists that the first packet didn't arrive at the receiver. Each packet that is transmitted, regardless of whether it was the first one or a subsequent one, will only be transmitted if enough energy is available from the energy source.

Automatic Activation

The radio module also can be configured to transmit a short packetized control signal if triggered automatically, by a relevant change of its inputs or in response to receiving a signal from another transmitter, for example. Again, the packet contains a control signal that is intended to control something at the receiving end and may also contain data. As above, it is possible for the packet to get lost and never reach the receiver. However, if enough energy is available from the energy source, and the module has been configured to do so, then another packet or packets containing the control signal may be transmitted at a later time.

The device is capable to operate as a repeater, which can receive signals from the following list of FCC/IC approved transmitters, and retransmit the signals.

LSTM 300U: (902.875 MHz)

■ LSTM 300U	FCC ID:2ANUH-LSTM300U	IC:23260-LSTM300U
■ LTCM 300U	FCC ID:2ANUH-LSTM300U	IC:23260-LSTM300U
■ LTCM 310U	FCC ID:2ANUH-LSTM300U	IC:23260-LSTM300U

OEM Requirements

In order to use Magnum's FCC ID number, the OEM must ensure that the following conditions are met:

- End users of products, which contain the module, must not have the ability to alter the firmware that governs the operation of the module. The agency grant is valid only when the module is incorporated into a final product by OEM integrators.
- The end-user must not be provided with instructions to remove, adjust or install the module.
- 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. Attaching a label to a removable portion of the final product, such as a battery cover, is not permitted. The label must include the following text:

LSTM 300U:

Contains FCC ID: 2ANUH-LSTM300U

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.

When the device is so small or for such use that it is not practicable to place the statement above on it, the information required by this paragraph shall be placed in a prominent location in the instruction manual or pamphlet supplied to the user or, alternatively, shall be placed on the container in which the device is marketed. However, the FCC identifier or the unique identifier, as appropriate, must be displayed on the device.

The user manual for the end product must also contain the text given above.

- Changes or modifications not expressly approved by Magnum could void the user's authority to operate the equipment.
- The module must be used with only the following approved antenna(s).

Part Number	Type	Gain
N.A.	Wire/Monopole	1.0 dBi
ANT-916-CW-RCS	RP-SMA Antenna	3.3 dBi
ANT-916-CW-HWR-RPS	RP-SMA Antenna	1.2 dBi

5.2 FCC Regulatory Statements

This device complies with part 15 of the FCC rules. Operation is subject to the following two conditions: (1) This device may not cause harmful interference, and (2) this device must accept any interference received, including interference that may cause undesired operation. Any changes or modifications not expressly approved by manufacturer could void the user's authority to operate the equipment.

IMPORTANT! Any changes or modifications not expressly approved by the party responsible for compliance could void the user's authority to operate this equipment.

NOTE: 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:

- Reorient or relocate the receiving antenna.
- Increase the separation between the equipment and receiver.
- Connect the equipment into an outlet on a circuit different from that to which the receiver is connected.
- Consult the dealer or an experienced radio/ TV technician for help.

5.3 IC (Industry Canada) Certification

In order to use Magnum's IC number, the OEM must ensure that the following conditions are met:

- Labeling requirements for Industry Canada are similar to those required by the FCC. The Original Equipment Manufacturer (OEM) must ensure that IC labeling requirements are met. A clearly visible label on the outside of a non-removable part of the final product must include the following text:

LTCM 300U:

Contains IC: 23260-LSTM300U

Contient le module d'émission IC: 23260-LSTM300U

LTCM 310U:

Contains IC: 23260-LSTM300U

Contient le module d'émission IC: 23260-LSTM300U

- The OEM must sign the OEM Limited Modular Approval Agreement with Magnum

Pour utiliser le numéro IC Magnum, le OEM doit s'assurer que les conditions suivantes sont remplies:

- Les exigences d'étiquetage pour Industrie Canada sont similaires à ceux exigés par la FCC. Le fabricant d'équipement d'origine (OEM) doit s'assurer que les exigences en matière d'étiquetage IC sont réunies. Une étiquette clairement visible à l'extérieur d'une partie non amovible du produit final doit contenir le texte suivant:

LTCM 300U:

Contains IC: 23260-LSTM300U

Contient le module d'émission IC: 23260-LSTM300U

LTCM 310U:

Contains IC: 23260-LSTM300U

Contient le module d'émission IC: 23260-LSTM300U

- L'OEM doit signer l'accord OEM limitée Approbation modulaire avec Magnum

5.4 Industry Canada Regulatory Statements

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.

IMPORTANT! Tous les changements ou modifications pas expressément approuvés par la partie responsable de la conformité ont pu vider l'autorité de l'utilisateur pour actionner cet équipement.

This Class B digital apparatus complies with Canadian ICES-003.

Cet appareil numérique de la classe B est conforme à la norme NMB-003 du Canada

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