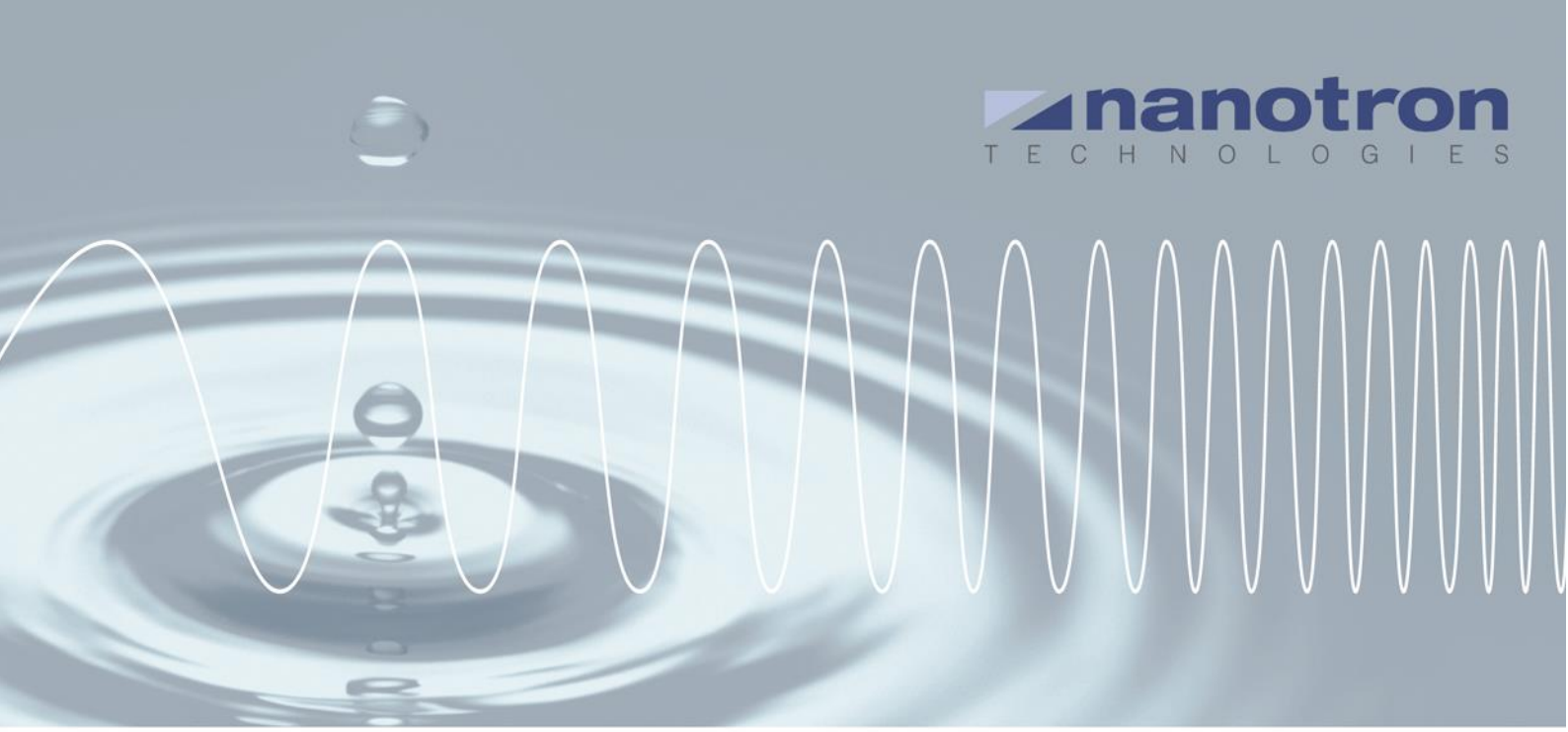

AN0509 *swarm* API Country Settings

1.0

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Document Information

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Contents

1. Scope

Nanotron's *swarm* products operate in the 2.4 GHz ISM band and use the chirp spread spectrum (CSS) technique complying with the standard ISO/IEC 24730-5:2010. Even though it complies with this communication standard, for each region extra regulations regarding electro-compatibility and radio spectrum apply. The compliance with this regional regulation is mandatory in order to sell and use the product for commercial purposes. Research and development are, however, excluded from its application.

The *swarm* bee LE module is delivered with integrated firmware, which can be accessed through the API. Using this it is possible to change its default settings and adapt the module to fulfill the different regional requirements.

This document shows users the specific requirements for each region and how the firmware parameters can be changed to fulfill them.

2. Overview of regional standards and requirements

The following table summarizes the standards that apply for radio certification in different regions and their main requirements. Only the requirements that may imply some modification in the swarm settings are included.

Country/Region	Standard	Requirements
Canada	IC, RSS - 210	Maximum radiated power 32.73 dBm
Europe (CE)	ETSI EN 300 328	Maximum radiated power (i.e.r.p.): 20 dBm
		CSMA in energy detection mode (when radiated power power >10 dBm)
Japan	ARIB STD-T66	Maximum density power 3.77 dBm/MHz
Mexico		Maximum radiated power 32.73 dBm
Russia	GOST	Maximum radiated power: 20 dBm Maximum density power: 10 dBm/MHz
USA	FCC, part 15	Maximum radiated power 32.73 dBm

Table 1 - Regional standards and main requirements

The user should note that the radiated power is the power at the RF port on the swarm plus the gain added by the antenna. In our documentation we refer to the power given at the RF port as the transmission power.

Disclaimer – For each standard the values in the table are those of the standard version enforced in May, 2015. The customer should always check the country regulations in order to make sure that requirements are fulfilled.

3. How to fulfill the requirements in each region

3.1. Canada

The requirements for Canada are similar to those in USA. However, being FCC certified does not mean that the product can also be sold for commercial used also in Canada. IC (Industry Canada) certification is required.

3.2. Europe (CE)

The maximum radiated power allowed by the EN 300 328 is 20 dBm. The maximum (and default) output power at the RF port on the swarm is 16 dBm; thus there is still budget for an antenna gain of up to 4 dB. In case of a higher antenna gain, the transmission power should be reduced. To do so an API command is provided: STXP <Power>.

Information on how to use this command can be found in [1]. [2] explains how to measure the actual power at the RF port.

The latest version (v1.8.1) of the standard includes also some requirements regarding the device functionality. When the radiated power is higher than 10 dBm, the device should perform listen before talk; more concretely, it should implement CSMA in energy mode. The back-off time should be random and the detection threshold should be (-50 dB – radiated_power).

An API command is provided that switches on the CSMA mechanism and selects its mode:

CSMA <m> <duration> <threshold>

<m> = 3 → energy detection mode on random seed

<duration> = 0… 255 used to generate the random number of backoff timeslots.

<threshold> = -50 – Ptxon → this is -70 dB when the radiated power is 20 dB

3.3. Japan

The CSS technique implemented by Nanotron can be considered some sort of very fast frequency hopping; the maximum bandwidth allowed for this product category is 83.5 MHz, with a radiated power density of maximum 3mW/MHz (which is 4.77 dBm/MHz)

The power density measured at the swarm's RF port when the transmission power is set to its maximum, 16 dBm, is -11 dBm/MHz. [2] explains how to measure it and shows the measurements results.

3.4. Mexico

The maximum transmission power in Mexico is similar to the one described by FCC. See chapter 3.6 for more information.

3.5. Russia and former USSR

The maximum radiated power allowed by GOST is 20 dBm; also the maximum radiated power density is specified as 10 dBm/MHz. The maximum transmitted power at the RF port on the swarms is 16 dBm, and the maximum radiated power density -1.1 dBm/MHz, [2]. Thus the user should be careful when adding the antenna that the limits are not exceeded.

More information on how to change the transmitted power and how to measure it can be found in [2].

3.6. USA

The maximum radiated power in USA is 2,500 mV/m measured at 3 meters from the antenna; this translates to 32.73 dBm of radiated power at the antenna. As the maximum transmitted power of the swarms is 16 dBm, there is quite some margin for the antenna.

4. References

[1] *API 2.1*, NA-13-0267-0003-2.1, Nanotron Technologies GmbH, Berlin 2015

[2] *AN0508 How to adjust and measure the RF power on swarm bee LE*, Nanotron Technologies GmbH, Berlin 2015

[3] ISO/IEC 24730-5:2010, *Information technology — Real-time locating systems (RTLS) — Part 5: Chirp spread spectrum (CSS) at 2.4 GHz air interface*. Similarly to the standard ISO/IEC 24730-

2:2012, *Information technology — Real Time Locating Systems (RTLS) — Part 2: Direct Sequence Spread Spectrum (DSSS) 2,4 GHz air interface protocol*.

End of Document

Document History

Date	Authors	Version	Description
2015-03-11	MLA	1.0	Initial version.

Life Support Policy

These products are not designed for use in life support appliances, devices, or systems where malfunction of these products can reasonably be expected to result in personal injury. Nanotron Technologies GmbH customers using or selling these products for use in such applications do so at their own risk and agree to fully indemnify Nanotron Technologies GmbH for any damages resulting from such improper use or sale.

Electromagnetic Interference / Compatibility
Nearly every electronic device is susceptible to electromagnetic interference (EMI) if inadequately shielded, designed, or otherwise configured for electromagnetic compatibility. To avoid electromagnetic interference and/or compatibility conflicts, do not use this device in any facility where posted notices instruct you to do so. In aircraft, use of any radio frequency devices must be in accordance with applicable regulations. Hospitals or health care facilities may be using equipment that is sensitive to external RF energy.
With medical devices, maintain a minimum separation of 15 cm (6 inches) between pacemakers and wireless devices and some wireless radios may interfere with some hearing aids. If other personal medical devices are being used in the vicinity of wireless devices, ensure that the device has been adequately shielded from RF energy. In a domestic environment this product may cause radio interference in which case the user may be required to take adequate measures.

CAUTION - Electrostatic Sensitive Device! Precaution should be used when handling the device in order to prevent permanent damage.

FCC User Information

Statement according to FCC part 15.19:
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.

Statement according to FCC part 15.21:
Modifications not expressly approved by this company could void the user's authority to operate the equipment.

RF exposure:
The internal / external antennas used for this mobile transmitter must provide a separation distance of at least 20 cm from all persons and must not be co-located or operating in conjunction with any other antenna or transmitter.

Statement according to FCC part 15.105:
This equipment has been tested and found to comply with the limits for a Class A and 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 and against harmful interference when the equipment is operated in a commercial environment.

This equipment generates, uses, and can radiate radio frequency energy and, if not installed and used in accordance with the instructions as provided in the user manual, may cause harmful interference to radio communications. However, there is no guarantee that interference will not occur in a particular installation. Operation of this equipment in a residential area is likely to cause harmful interference in which case the user will be required to correct the interference at his or her own expense.

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: (1) reorient or relocate the receiving antenna, (2) increase the separation between the equipment and receiver, (3) connect the equipment into an outlet on a circuit different from that to the connected equipment, and (4) consult the dealer or an experienced technician for help.

About Nanotron Technologies GmbH

Nanotron provides reliable loss protection technology and solutions that are used to protect people and animals. Energy efficient, battery-powered wireless nodes are the key building blocks. These small devices create a Virtual Safety Zone which protects tagged people and animals. Robust wireless Chirp technology underpins nanotron's offering of chips, modules and loss protection software for indoor and outdoor environments world wide.

Headquartered in Berlin, Germany, *Nanotron Technologies GmbH* was founded in 1991.

Further Information

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