tele radio®
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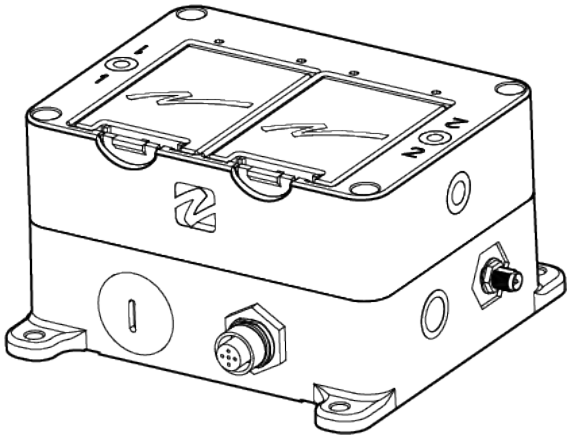
INSTALLATION INSTRUCTIONS

Repeater: D5-22



IM-ANC-DX102-EN-v02
Language: English (original)

D5

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CHAPTER 1: INTRODUCTION

Thank you for purchasing a Tele Radio AB product

Tele Radio AB's product range is composed of transmitters, receivers, and accessories intended for use together as a system.

Tele Radio AB systems are mainly intended for the industrial, lifting, hydraulic and mobile equipment markets.

READ ALL INSTRUCTIONS AND WARNINGS CAREFULLY BEFORE MOUNTING, INSTALLING, CONFIGURING AND OPERATING THE PRODUCTS.

These Installation instructions have been published by Tele Radio AB and are not subject to any guarantees. The Installation instructions may be withdrawn or revised by Tele Radio AB at any time and without further notice.

IMPORTANT! These instructions are intended for installers and authorized service and distribution centers. The instructions containing information about the installation and configuration of the radio remote control unit on the machine are NOT intended to be passed on to the end user. Only information that is needed to operate the machine correctly by radio remote control may be passed on to the end user.

Tele Radio AB remote controls are often built into wider applications. It is the responsibility of any such users or integrators to perform the appropriate and complete risk analysis, evaluation and testing of the products with respect to the relevant specific application or use. Tele Radio AB shall not be responsible or liable for misuse of the information contained herein.

Always refer to the applicable local regulations for installation and safety requirements relating to cranes, hoists, material handling applications, lifting equipment, industrial machinery, and/or mobile hydraulic applications using Tele Radio AB products, e.g.:

- applicable local and industrial standards and requirements,
- applicable occupational health and safety regulations,
- applicable safety rules and procedures for the factory where the equipment is being used,
- user and safety manuals or instructions of the manufacturer of the equipment where Tele Radio AB remote control systems are installed.

Tele Radio AB Installation instructions do not include or address the specific instructions and safety warnings of the end product manufacturer.

Tele Radio AB products are covered by a warranty against material, construction, or manufacturing faults. See "Chapter 8: Warranty, service, repairs, and maintenance".

1.1 About this document

Before installing or operating the product, read the corresponding documentation carefully.

Tele Radio AB's product range is composed of transmitters, receivers, and accessories intended for use together as a system.

These Installation instructions cover main technical specifications, standard installation, configuration and operating instructions, as well as general troubleshooting.

Please report any error or omission in this document, as well as any improvement or amendment suggestion to td@tele-radio.com.

1.1.1 COPYRIGHT

1.1.2 TERM AND SYMBOL DEFINITIONS

The capitalized terms and symbol used herein shall have the following meaning:

- WARNING: indicates a hazardous situation which, if not avoided, could result in death or serious injury.
- CAUTION: indicates a hazardous situation which, if not avoided, will result in minor or moderate injury.
- IMPORTANT: is used for information that requires special consideration.
- NOTE: is used to address practices not related to physical injury.

This symbol is used to call attention to safety messages that would be assigned the signal words "WARNING" or "CAUTION".

1.2 About D5 repeater & active antenna

Depending on the application and/or the environment, repeaters or active antennas can be installed in all Puma and Panther systems to optimize data transmission.

D5-22 is a combined repeater / active antenna that can be used to extend transmissions so that the signal can cover greater distances or be received on the other side of an obstruction.

D5-22 repeaters are configured by default for Puma systems but can easily be set for a Panther systems. Contact your representative for assistance.

An active antenna is recommended whenever strict control distances are required or when the receiver is mounted in close proximity to unintentional electronic emitters, e.g. a truck alternator, welding machine or a variable frequency drive. If needed, the active antenna can be used together with one or more repeaters. When used as an active antenna, D5-22 is connected to the receiver via a bus-cable.

Each repeater is independent and has a range depending on the environment. A Puma system can have up to fifteen repeaters simultaneously, a Panther system can have up to eight.

1.2.1 SYSTEM RADIO FREQUENCY

D5-22 repeaters operate on the frequency band 2.4 GHz. The frequency band has been divided into 16 channels (11 to 26). Once the channel has been selected on the transmitter, the receivers and repeaters will automatically detect and switch to the same channel.

CHAPTER 2: SAFETY

This product is to be used together with a Tele Radio AB radio system including one or more transmitters and receivers.

2.1 Warnings & restrictions

Carefully read through the following safety instructions before proceeding with the installation, configuration, operation, or maintenance of the product. Failure to follow these warnings could result in death or serious injury.

This product must not be operated without having read and understood the Installation instructions, the specific technical documentation (for customized systems), and having received the appropriate training. The purchaser of this product has been instructed how to handle the system safely. The following information is intended for use as a complement to applicable local regulations and standards.

IMPORTANT! Tele Radio AB remote controls are often built into wider applications. These systems should be equipped with:

- **a wired emergency stop where necessary**
- **a brake**
- **an audible or visual warning signal**

2.1.1 INSTALLATION AND COMMISSIONING

IMPORTANT! Only licensed or qualified personnel should be permitted to install the product.

This radio system must not be used in areas where there is a risk of explosion.

Always switch off all electrical power from the equipment before installation procedure.

RISK OF UNINTENDED EQUIPMENT OPERATION

Only transmitters that are intended for use should be registered in the receiver.

Failure to follow these instructions could result in death, serious injury, or equipment damage.

RISK OF ELECTRIC SHOCK

The repeater must only be opened by qualified installers or authorized personnel.

Make sure the power supply is switched off before opening the repeater.

Failure to follow these instructions could result in death, serious injury, or equipment damage.

- **The product must be securely attached and located where it will not be hit by e.g. any moving parts.**
- **Do not install the product in areas affected by strong vibrations**
- **Cable glands and vent plugs must face downwards to prevent water ingress.**
- **Ensure that the power supply is connected to the correct terminals.**
- **Ensure that flexible cords and cables are not damaged through friction or stress.**
- **Do not use damaged cables.**
- **Ensure cables and connectors do not hang loose.**

- The product is designed to withstand normal weather conditions but should be protected from extreme conditions.
- Mount the product in a location where the LED(s) are easily visible and the button accessible.
- Make sure to install available accessories inside or on the repeater before permanently installing the repeater . A permanent installation of the product must include fuse protection of the equipment and cables against short circuits.

2.1.2 OPERATION

The D5 repeaters are to be part of a system where operations are performed on the transmitter. The following warning and restrictions apply to a system.

- **Only qualified personnel should be permitted to access the transmitter and operate the equipment.**
- **Make sure that the user satisfies the age requirements in your country for operating the equipment.**
- **Make sure that the user is not under the influence of drugs, alcohol and medications.**

- **Make sure that the user knows and follows operating and maintenance instructions as well as all applicable safety procedures and requirements.**
- **The user should:**
  - **Never leave the transmitter unattended.**
  - **Always switch the transmitter off when not in use. Store in a safe place.**
  - **Keep a clear view of the work area at all times.**

2.1.3 MAINTENANCE

Before maintenance intervention on any remote controlled equipments:
• always remove all electrical power from the equipment.
• always follow lockout procedures.

- Keep the safety information for future reference. Always download the Installation instructions from our website, www.tele-radio.com, for the latest available version.
- If error messages are shown, it is very important to find out what caused them. Contact your representative for help.
- If the stop button is mechanically damaged, do not use the transmitter. Contact your supervisor or representative for service immediately.
- Keep contacts and antennas clean.
- Wipe off dust using a clean, slightly damp cloth.
- Never use cleaning solutions.
- Check the encapsulation, foils and cable for damages. If the encapsulation or foil is damaged, moisture can cause serious damage to the electronics.

CHAPTER 3: FUNCTIONAL SAFETY

NOTE: This section applies to repeaters used together with a Puma or Panther system with functional safety (safety-related stop function):

- R20, R21, T24, T26, T28 (Puma)
- R15, R23, T19, T25, T27 (Panther)

IMPORTANT! Adding one or more repeater(s) to a Tele Radio AB radio system (receiver + transmitter) does not modify the original safety level achieved by the system.

If the main radio system – receiver(s) + transmitter(s) – is configured to fulfill the safety level on the safety-related stop function, the safety level remains valid even when the radio protocol goes through the repeater.

If the main radio system – receiver(s) + transmitter(s) – is configured NOT to fulfill the safety level, there will be no safety level either when the radio protocol goes through the repeater.

NOTE: The safety level of the stop function on the complete end-user system depends on other subsystem(s) and needs to be calculated by the manufacturer of the complete system.

For more information about the safety-related stop function, please refer to the corresponding receiver or transmitter Installation instructions.

CHAPTER 4: TECHNICAL DATA

REPEATER	**D5-22**
Power supply	12 ... 24 VDC (-50% ... +35%)
Current consumption	Max. 600 mA (for more details, see "4.1 Current consumption ")
)Connector	M12 5-pin female
Frequency	2405 – 2480 MHz
Radio communication	Duplex
Radio frequency output power	EIRP: < 12.5 dBm (18 mW)
Antenna	Internal by default Two (2) PSMA connectors for external antenna (optional)
Range	100 m (328 ft), adjustable depending on configuration
IP code	IP66
Operating temperature	-20...+55 °C / -4...+130 °F
Charging temperature	+10...+35 °C / +50...+95°F
Dimension	138 x 119 x 68 mm (5.43 x 4.69 x 2.68 in)
Weight (typical)	~ 397 g / 14.0 oz (including batteries)

4.1 Current consumption

4.1.1 EXTERNAL POWER SOURCE

Input power	D5-22		
	Min.*	Max.1**	Max.2***
12 V DC	65 mA	110 mA	600 mA
24 V DC	40 mA	60 mA	360 mA

*Minimum current consumption = repeater powered[1], high power LED 'Off', no charging, no radio session established.

**Maximum current consumption 1 = repeater powered[1], high power LED always 'On', no charging, radio session established.

***Maximum current consumption 2 = repeater powered[1], high power LED 'On', charging , radio session established.

4.1.2 ON BATTERIES

Input power	D5-22	
	Min.*	Max.**
3.7 V / 1600 mAh battery	110 mA	120 mA

*Minimum current consumption = repeater powered, no radio session established.

**Maximum current consumption = repeater powered, radio session established.

NOTE: Two 3.7 V / 1600 mAh batteries can be installed in the unit.

[1]External power source.

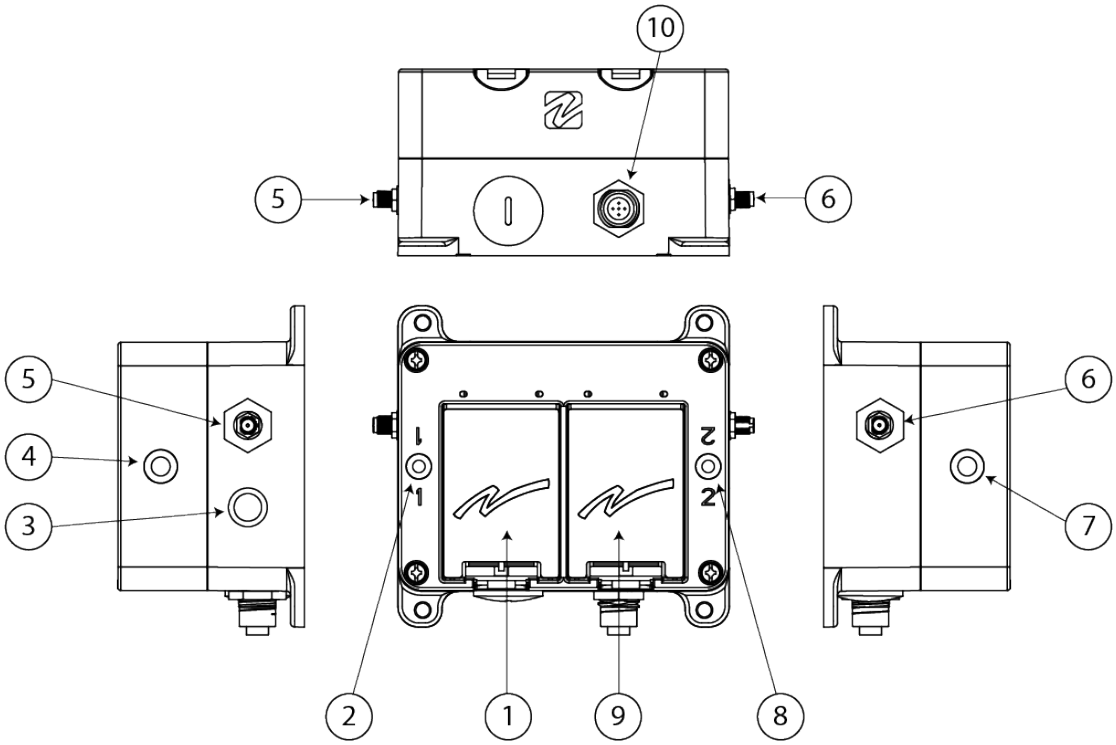
CHAPTER 4: SYSTEM RADIO FREQUENCY

D5-22 repeaters operate on the frequency band 2.4 GHz. The frequency band has been divided into 16 channels (11 to 26). Once the channel has been selected on the transmitter, the receivers and repeaters will automatically detect and switch to the same channel.

CHAPTER 5: PRODUCT GENERAL DESCRIPTION

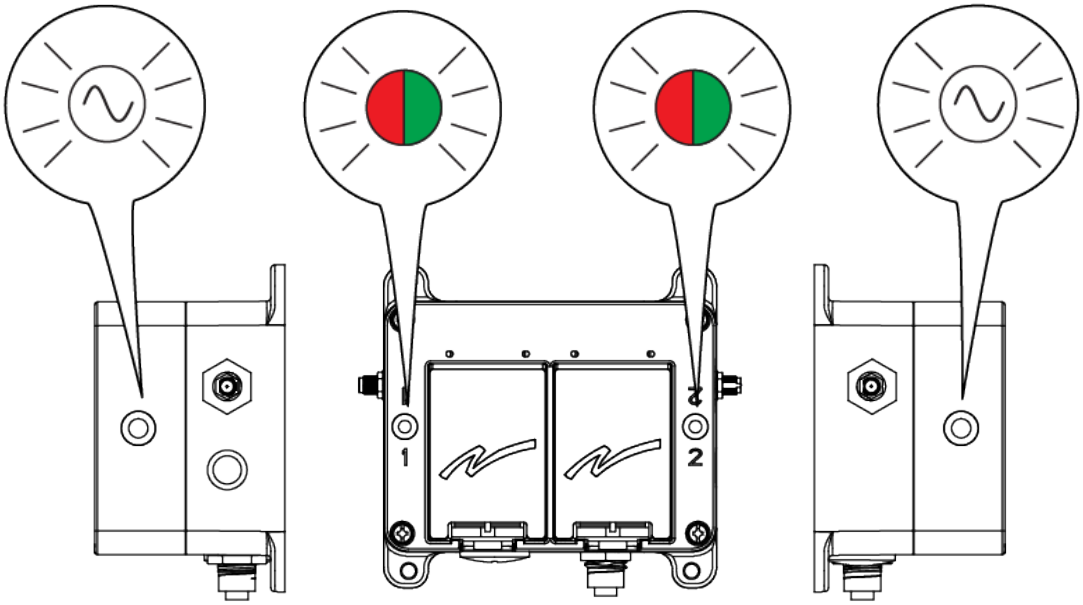
NOTE: The pictures shown in this chapter are for illustrative purposes only. Depending on the configuration, the actual product appearance may differ from the basic model used for reference.

5.1 Repeater description



1. Replaceable battery 1
2. Battery LED 1
3. **Cap sensor** button (**Function** button)
4. High power LED 1
5. Connector for external antenna 1
6. Connector for external antenna 2
7. High power LED 2
8. Battery LED 2
9. Replaceable battery 2
10. M12 connector

5.1.1 LED INDICATORS



High power LED | Battery LEDs | High power LED

The repeater is equipped with two high power LEDs and two dual-color LEDs.

High power LEDs

The high power LEDs are located one on each side of the repeater. These LEDs are used to give status and error indications about the repeater and operations (see "6.2 Indication of operation outcome").

Flashing type	Time LED is on	Time LED is off
Fast	200 ms	200 ms
Slow	700 ms	700 ms

Battery LEDs

The two dual-color LEDs on the top cover are for battery status indication (see "6.3 Charging and battery LED indications"). Fatal start-up errors are also indicated partly on the battery LEDs (see "6.4 Fatal start-up error indications ").

Flashing type	Time LED is on	Time LED is off
Fast	250 ms	250 ms
Slow	500 ms	500 ms

5.1.2 CAP SENSOR BUTTON ACTIONS

The repeater is equipped with one **Cap sensor** button with two possible user interfaces allowing for different actions, e.g. accessing the **registry management mode** and enable the registration, replace, and erase functions.

Tapping actions

Tap the function button …	**Action**
Once	Show the battery status on the battery LEDs for 10 seconds (if the unit is running on a battery as power source).
4 times within 10 s	Reset the charging overload error.
10 times within 10 s	Erase all registered receiver/ transmitter IDs from the repeater. See "7.4 Erase all"

Touch and hold actions

Touch and hold the function button for …	**LED indication**	**Action**
5 s < … < 12 s	**power LED**flashing slow	Enter **registry management mode**
≥ 12 s	**power LED** lit steady	Enter **configuration mode** via radio[1]

[1]Only for Puma systems.

5.2 M12 connector

The M12 connector is used for communication, and also for programming/flashing the unit when connected to a D2-17[1].

Male connector (cable)

Female connector (on the repeater)

Pin	Signal	Cable color[2]
1	RS485_SHLD	White-Brown
2	V+ (from power supply)	White-Blue
3	GND	Blue
4	RS485B	Brown
5	RS485A	Orange

5.3 Power sources

D5-22 repeaters can have different power sources:

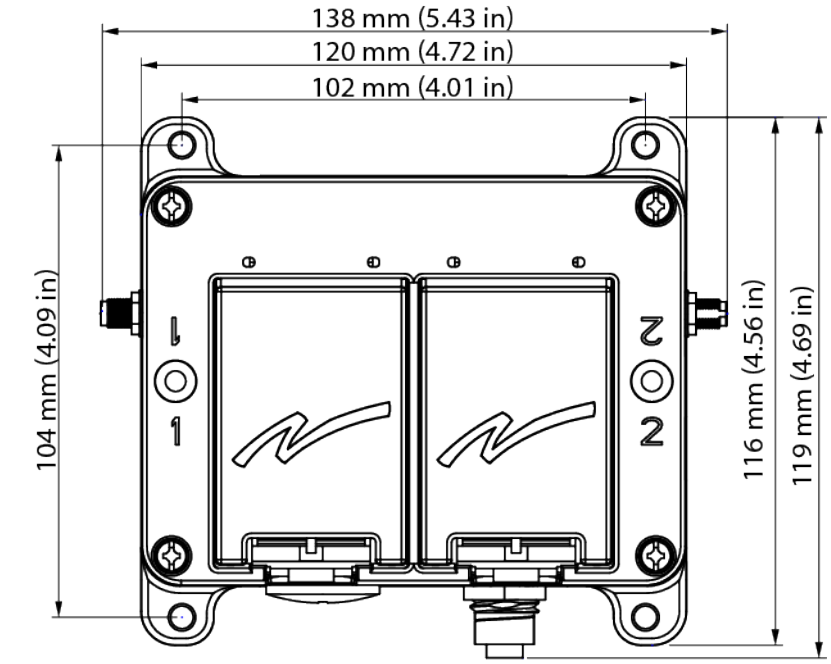
- The two replaceable, rechargeable lithium-ion batteries (hot swappable).
- An external charger/ power source.

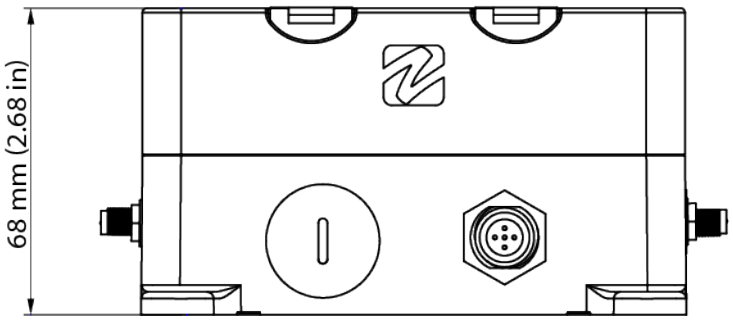
If D5-22 is powered by an external power supply, the batteries will be charged one at a time. If the two batteries are empty, one battery will be fully charged before starting to charge the other battery.

[1]Do not use a D2-11 module for programming/flashing the unit, it will brick the device. Contact your representative for assistance.

[2]Connector on the repeater

5.4 Mounting dimensions





5.4.1 PRECAUTIONS FOR THE INSTALLATION OF THE REPEATER/ ACTIVE ANTENNA

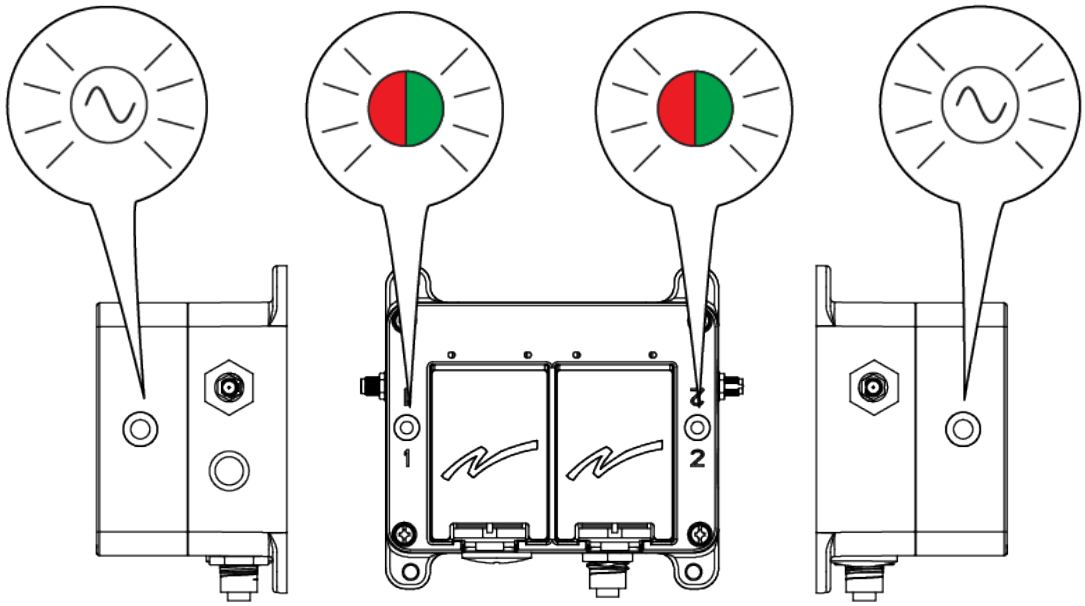
Before connecting the equipment, make sure that the power supply is switched off.

IMPORTANT! Only authorized personnel should install the product.

Only correct installation meets the safety levels for the product.

- Install the repeater/active antenna in a location where the LED and button can easily be seen and accessed.
- For optimum performance, place the repeater/ active antennas away from metal objects such as metal girders, high-voltage cables, and other antennas.
- Keep the longest distance possible between the repeater and e.g. engines, welding machines, power sources, inverters, x-ray devices and other radio transmitters.
- Any repeater that is mounted separately must be positioned in as open a space as possible. A hidden antenna significantly impairs the reception.
- Do not mount the repeater/ active antenna in a locker.
- Test the equipment before installing the repeater/ active antenna permanently.

CHAPTER 6: STATUS AND ERROR INDICATIONS



High power LED Battery LEDs High power LED

Repeater status and errors are indicated with the two high power LEDs and the battery LEDs.

6.1 Indication when in radio session

When the repeater is in session, the high power LEDs flash once, very briefly, for each packet received/sent.

6.2 Indication of operation outcome

Operation outcome ('Store success', 'Erase success' or failure) is indicated by the high power LED flashing according to following:

Designation	Description	High power LED indication	Comments
'Store success'	Something was successfully stored in settings	Ramping from lowest to highest intensity during one second, and letting it lit on highest intensity for one second.	Repeated three times.

Designation	Description	High power LED indication	Comments
'Erase success'	Something was successfully erased from settings	Ramping from highest to lowest intensity during one second, and letting it off for one second.	Repeated three times.
Failure	The procedure was not successful	7 fast flashes	The seven flashes may look like six flashes if the LED was previously lit.

6.3 Charging and battery LED indications

NOTE: It can take up to 15 seconds before an inserted battery is detected.

NOTE: When a battery is removed it will be indicated as bad for an half to one second after removal, this is normal. **Do not insert another battery while the LED is orange, it will not be properly detected.**

To see the battery status when the repeater is running on batteries, tap the **Cap sensor** button once. The battery LEDs will indicate the battery status for 10 seconds.

LED color	On	Flashing	Indication
Green	●		Battery contains sufficient energy or has completed charging, not charging, and not power source.
Red	●		Battery is almost empty, not charging, not power source.
Orange	●		Battery is considered bad. If this happens repeatedly for a specific battery, replace the battery.
Red		slow	Battery is charging
Green		slow	Battery is charging, charge soon completed.

LED color	On	Flashing	Indication
Orange		fast	Charging overload detected. NOTE: Could indicate that the battery consumes too much current during charging. This could be caused by water or something else that is in contact with the battery connections in the unit. This condition can be reset either by removing the battery or by performing the reset procedure described in the section "5.1.2 Cap sensor button actions".
Green/orange alternatively		slow	The battery is the main power source and has sufficient energy. NOTE: When the unit is running on batteries, the LEDs are in general not lit. This indication is only seen when the touch-button has recently been tapped (see "5.1.2 Cap sensor button actions").
Red/orange alternatively		slow	The battery is the main power source and is soon empty. NOTE: When the unit is running on batteries, the LEDs are in general not lit. This indication is only seen when the touch-button has recently been tapped (see "5.1.2 Cap sensor button actions").

6.4 Fatal start-up error indications

Fatal start-up errors are indicated by the high power LEDs ramping up and down from minimum to maximum intensity for one second.

The type of error is indicated by the battery LEDs:

Battery LED 1	Battery LED 2	Description
Green	Off	No production data
Red	Off	Failed to start radio chip(s)

CHAPTER 7: OPERATION

7.1 General information

To control a receiver, the transmitter must be registered and logged in to the receiver. If another transmitter is already logged in to the receiver, it must be logged out before a different transmitter can be logged in.

More than one transmitter can be registered in the receiver, but only one transmitter can be logged in at a time.

7.2 Registry management mode

In this mode the repeater will either register a receiver-id (Puma systems), or a transmitter-id (Panther systems), if it has not been previously stored, or erase it if it has already been stored.

When the repeater enters **registry management mode** it will remain in that mode for 30 seconds.

- **Puma systems:**

If no receiver has responded to the registration/erase packets within 30 s, the repeater will exit **registry management mode** and indicate failure.

- **Panther systems:**

If no transmitter registration packets have been received within 30 s, the repeater will exit **registry management mode** and indicate failure.

7.2.1 ENTER REGISTRY MANAGEMENT MODE

NOTE: The repeater must not be in a radio session for this procedure to succeed.

1. Touch and hold the **Function** button for 5 s or until the LED starts flashing slow.
2. Release the **Function** button.
   *The repeater enters **registry management mode** (if it is not in an active radio session). It will remain in that mode for 30 seconds.*

7.2.2 REGISTER / ERASE PUMA RECEIVERS IN THE REPEATER

NOTE: Only for Puma systems.

Register

IMPORTANT! For the registration procedure to be successful:

- **The receiver must not have been previously registered in the repeater.**
- **The receiver must be in registration mode.**
- **The repeater must be in registry management mode.**

If a receiver responds and is successfully stored, the repeater exits **registry management mode** and indicates 'Store success' (see "5.1.1 LED indicators"). If no receiver has responded within 30 s, the repeater will exit **registry management mode** and indicate failure.

NOTE: The configuration ID set in the repeater must match the configuration ID in the receiver. If not, the receiver will not respond and the repeater will indicate failure.

Erase

IMPORTANT! For the erase procedure to be successful:

- **The receiver must have been previously registered in the repeater.**
- **The receiver must be in registration mode.**
- **The repeater must be in registry management mode.**

If a receiver responds and is successfully erased, the repeater exits **registry management mode** and indicates 'Erase success'[1] (see "5.1.1 LED indicators"). If no receiver has responded within 30 s, the repeater will exit **registry management mode** and indicate failure.

NOTE: The configuration ID set in the repeater must match the configuration ID in the receiver. If not, the receiver will not respond and the repeater will indicate failure.

[1] If the receiver was not registered in the repeater, the indication will still be successful as the outcome is be the same: the receiver in question is not stored in the repeater.

7.2.3 REGISTER / ERASE PANTHER TRANSMITTERS IN THE REPEATER

NOTE: Only for Panther systems.

Register

IMPORTANT! For the registration procedure to be successful:

- **The transmitter must not have been previously registered in the repeater.**
- **The transmitter must send registration packets.**
- **The repeater must be in registry management mode.**

If transmitter registration packets are received and the transmitter is successfully stored, the repeater exits **registry management mode** and indicates 'Store success' (see "5.1.1 LED indicators"). If no transmitter registration packets have been received within 30 s, the repeater will exit **registry management mode** and indicate failure.

NOTE: If there are no free memory in the repeater to store more transmitters, the repeater will indicate a general failure when trying to enter **registry management mode**.

Erase

IMPORTANT! For the erase procedure to be successful:

- **The transmitter must have been previously registered in the repeater.**
- **The transmitter must send registration packets. [1]**
- **The repeater must be in registry management mode.**

If transmitter registration packets are received and the transmitter is successfully erased, the repeater exits **registry management mode** and indicates 'Erase success'[2] (see "5.1.1 LED indicators"). If no transmitter registration packets have been received within 30 s, the repeater will exit **registry management mode** and indicate failure.

[1] Panther transmitter with menu option are not yet available.

[2] If the transmitter was not registered in the repeater, the indication will still be successful as the outcome is be the same: the receiver in question is not stored in the repeater.

7.3 Replace transmitters in the repeater

NOTE: Only for Panther systems.

NOTE: This instruction is intented for repeaters with software version **SW0043-02v01pre7** or higher.

IMPORTANT! For the replace procedure to succeed:

- **The transmitter to be replaced must have been previously registered in the repeater.**

NOTE: The transmitter that will be replacing the old transmitter can either be already registered in the repeater or not.

If transmitter replace packets are received and the old transmitter is successfully replaced, the repeater indicates 'Store success' (see "5.1.1 LED indicators"). If no transmitter replace packets have been received within 30 s, the repeater will indicate failure.

7.4 Erase all

1. Quickly tap the **Function** button 10 times within 10 seconds.
   All registered receiver IDs (Puma)/ transmitter IDs (Panther) have been erased from the repeater.

7.5 Configuration mode via radio

NOTE: Only for Puma systems.

IMPORTANT! To be able to communicate with each other, the repeater, the receiver and the transmitter must have the same configuration ID. The configuration ID is set in SM (V or higher).

IMPORTANT! It is strongly recommended to have only one repeater powered up and in range of the transmitter when performing configuration via radio.

The configuration mode allows to set the **slot id** [1] via radio, from a Puma transmitter.

[1]Correspond to the position number (0–14) of the repeater when used in a chain of repeaters. Where 0 corresponds to the first repeater in the chain and 14 is the last one.

Once the repeater has entered the configuration mode via the **Function** button, it will remain in this mode for 30 seconds, or until a transmitter starts sending configuration packets, and if so, it will remain in configuration mode indefinitely or until the transmitter terminates the configuration session.

7.5.1 ENTER CONFIGURATION MODE VIA RADIO

NOTE: The repeater must not be in a radio session for this procedure to succeed.

When the repeater enters **configuration mode** via radio it will remain in that mode for 30 seconds.

1. Press and hold the **Function** button for 12 seconds or until the red LED stops flashing and stays lit.
2. Release the **Function** button.
   The repeater enters configuration mode .

For more details on how to change the **slot id**, please refer to the *Configure repeater slot ID* instruction in the corresponding transmitter installation instruction[1].

[1] IM-PM-TX101 (T24) or IM-PM-TX102 (T26).

CHAPTER 7: BATTERY

7.6 Battery precautions

Carefully read the following safety instructions and warnings before using or disposing of the batteries.

Batteries contain flammable substances such as lithium or other organic solvents, which may result in overheating, rupture or combustion. Failure to read and follow the below instructions may result in fire, personal injury and damage to property if charged or used improperly.

7.6.1 HANDLING AND STORAGE

- **Do not short-circuit, disassemble, deform or heat batteries.**
- **Do not use or charge the battery if it appears to be leaking, deformed or damaged in any way.**
- **Do not solder directly onto batteries.**
- **Store in a cool location. Keep batteries away from direct sunlight, high temperature, and high humidity.**
- **Keep batteries out of reach of small children. Should a child swallow a battery, consult a physician immediately.**

7.6.2 DISPOSAL

When discarding batteries, insulate the + and - terminals of batteries with insulating/ masking tape.

- **Do not place multiple batteries in the same plastic bag.**
- **Do not incinerate or dispose of batteries in fire.**
- **Do not place used batteries in the household waste. Dispose of used batteries in accordance with the applicable regulations and legal requirements.**
- **Batteries that have been disposed of incorrectly may short circuit, causing them to become hot, burst or ignite.**

7.7 Battery information

NOTE: Only batteries approved by Tele Radio AB should be used in D5-22 repeaters.

D5-22 repeaters are equipped with two batteries to allow hot swap: one battery is used at a time, which allows to replace a low level battery during operation. The battery compartments are marked 1 and 2 and correspond to the two battery LED indicators on the repeater's front (see "5.1.1 LED indicators").

The batteries can be recharged using a Tele Radio AB battery charger (e.g. table charger or car cigarette lighter adapter) or the AC main charger adapter.

BATTERY PACK	
Article number	M245060 (D4-02)
Battery type	Replaceable, rechargeable lithium-ion battery
Weight (typical)	47 g (1.66 oz)
Voltage	3.7 V / 1600 mAh
Operating time	~ 13 h with continuous usage per battery (~ 26 h total)
Charging time	~ 4 h with an empty battery
Charging cycle	600 cycles
Charging temperature	+10…+35 °C / +50…+95°F
Storage temperature	-20…+55 °C / -4…+130 °F
Functions	Hot swappable

CHARGER[1]	**M769755**	**M769780**	**M769746**
Description	Table/wall charger battery M245060	AC adapter to be used with M769755	DC adapter[2] to be used with M769755
Input/output power	5 V DC, 10 % (1A)	110 – 240 V AC / 5 V DC	12 – 24 V DC / 5 V DC
Weight (typical)	0.12 kg (0.26 lbs)	–	0.11 kg (0.25 lbs)
Dimensions	90 x 25 x 135 mm (3.5 x 1 x 5.3 in)	–	–

[1] Purchased separately.

[2] Car cigarette-lighter adapter

CHARGER[1]	M769755	M769780	M769746
Other	Can be wall-mounted	Supplied with multiple connector types	–

NOTE: M769755 must be purchased together with an adapter, either AC (M769780) or DC (M769746).

NOTE: Electronics and batteries must be physically separated before disposal. Make sure that electronics or batteries are not disposed of in household waste.

7.8 Charge the battery in the table charger

NOTE: When approximately 10 % of a battery capacity remains, the corresponding battery LED will light red.

1. Remove the battery from its compartment and place it in the Tele Radio AB battery charger.
2. The charger's LED lights red while the battery is charging.
3. The charger's LED turns green when the battery is fully charged.
4. Put the battery back into the repeater's corresponding compartment.

7.9 AC adapter

The AC adapter can be used for charging the batteries while they are being used. It can also power the repeater while the batteries are removed and charged in the battery charger.

[1] Purchased separately.

CHAPTER 8: WARRANTY, SERVICE, REPAIRS, AND MAINTENANCE

Tele Radio AB products are covered by a warranty against material, construction and manufacturing faults. During the warranty period, Tele Radio AB may replace the product or faulty parts. Work under warranty must be performed by Tele Radio AB or by an authorized service center specified by Tele Radio AB.

The following are **not** covered by the warranty:

- Faults resulting from normal wear and tear
- Parts of a consumable nature
- Products that have been subject to unauthorized modifications
- Faults resulting from incorrect installation and use
- Damp and water damage

Maintenance

Repairs and maintenance must be performed by qualified personnel

Only use spare parts from Tele Radio AB

Contact your representative for service or any other assistance

Keep contacts and antennas clean

Wipe off dust using a slightly damp, clean cloth

NOTE: Never use cleaning solutions or high-pressure washer.

CHAPTER 9: REGULATORY INFORMATION

9.1 Europe

Applies to:

D5-22

9.1.1 CE MARKING

Hereby, Tele Radio AB, declares that the radio equipment type(s) listed above is/ are in compliance with the Radio Equipment Directive 2014/53/EU.

The latest version of the complete EU Declaration of Conformity is available on the Tele Radio AB website, www.tele-radio.com.

9.1.2 WEEE DIRECTIVE

This symbol means that inoperative electrical and electronic products must not be mixed with household waste. The European Union has implemented a collection and recycling system for which producers are responsible. For proper treatment, recovery and recycling, please take this product to a designated collection point.

Tele Radio AB strives to minimize the use of hazardous materials, promotes reuse and recycling, and reduces emissions to air, soil and water. When a commercially viable alternative is available, Tele Radio AB strives to restrict or eliminate substances and materials that pose an environmental, health or safety risk.

9.2 North America

Applies to:

D5-22

9.2.1 FCC STATEMENT

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.

Changes or modifications not expressly approved by the party responsible for compliance could void the user’s authority to operate the equipment.

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.

To satisfy FCC RF exposure requirements, a separation distance of 20 cm or more should be maintained between the antenna of this device and persons during device operation. To ensure compliance, operations at closer than this distance is not recommended.

9.2.2 IC STATEMENT

This product complies with Industry Canada's licence-exempt RSSs. 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 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;

2) l’appareil doit accepter tout brouillage radioélectrique subi, même si le brouillage est susceptible d’en compromettre le fonctionnement.

This radio transmitter has been approved by Industry Canada to operate with the antenna types listed below with the maximum permissible gain and required antenna impedance for each antenna type indicated. Antenna types not included in

this list, having a gain greater than the maximum gain indicated for that type, are strictly prohibited for use with this device.

Gain of antenna: 3.0 dBi max.

Type of antenna: 50 ohm, Omni-directional

Le présent émetteur radio a été approuvé par Industrie Canada pour fonctionner avec les types d'antenne énumérés ci-dessous ayant le gain admissible maximal et l'impédance requise pour chaque type d'antenne indiqué. Les types d'antenne non inclus dans cette liste, ou dont le gain est supérieur au gain maximal indiqué, sont strictement interdits pour l'exploitation de l'émetteur.

Gain d'antenne: 3.0 dBi maximum

Type d'antenne: 50 ohm, omnidirectionnel

To satisfy IC RF exposure requirements, a separation distance of 20 cm or more should be maintained between the antenna of this device and persons during device operation. To ensure compliance, operation at closer than this distance is not recommended.

Afin d'assurer la conformité aux exigences de la IC en matière d'exposition aux RF, une distance de séparation d'au moins 20 cm doit être maintenue entre l'antenne de cet appareil et toute personne à proximité pendant le fonctionnement de l'appareil. Pour assurer le respect de ces exigences, il n'est pas recommandé d'utiliser l'appareil à une distance inférieure à celle-ci.

9.2.3 FCC/IC LABELS

The FCC ID and IC numbers can be found printed on the product label, as per below.

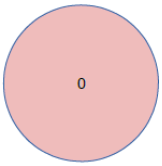
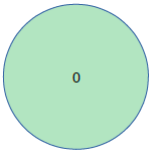
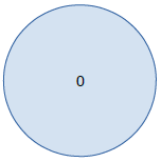
ANNEX A: DETAILED INFORMATION ABOUT REPEATERS AND REPEATER TECHNOLOGY

The diagrams used in this document are for illustrative purposes only.

A.1 Concepts used in this document

This chapter presents the different symbols used for transmitters, receivers and repeaters and explain how the diagrams used later on in this document should be interpreted.

A.1.1 SYMBOLS AND THEIR DESCRIPTIONS

			
Color	Red	Green	Blue
Description	Transmitter	Receiver	Repeater
The big circle represents	The coverage area of the transmitter when it's sending	The coverage area of the receiver feedback radio signal	The coverage area of the repeater radio signal.
The "0" in the center represents	the physical transmitter.	the physical receiver.	the physical repeater[1]

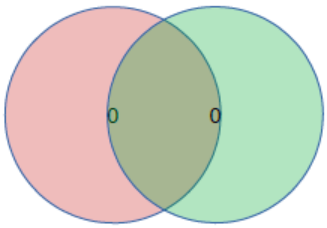
NOTE: All symbols presented above presume that there is balance between the transmission power of the transmitter, receiver and repeater.

A.1.2 BASIC COMMUNICATION DIAGRAMS

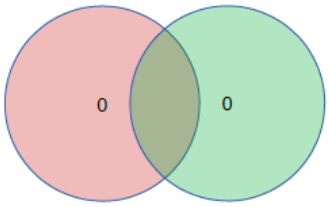
For a transmitter and receiver to be able to communicate, the red area of the transmitter must overlap the green area of the receiver and include the receiver itself.

[1]When there is another number than "Zero", it represents the repeater SlotID.

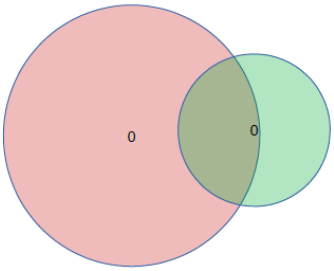
In the diagram below, the radio coverage is just enough to allow the two units to communicate.



In the following diagram however, the two units are unable to communicate, the red area does include the receiver, and vice versa.



The following diagram shows what happens if the transmission power of the transmitter and the receiver is not balanced. Here, the transmission power of the transmitter is superior to that of the receiver: the receiver will be able to hear the transmitter, but the feedback from the receiver (if any) cannot reach the transmitter.



NOTE: All the assumptions above are simplified. The area covered by an RF device is not only determined by the transmission power of the sending device, it also depends on the sensitivity of the receiving device. As an example, installing a better antenna on the receiver will allow to have the transmitter positioned further away, while keeping the same transmission power. But for the sake of simplicity, this is kept out of the scope of this document.

A.2 How to arrange repeaters physically

There are a few simple rules that repeaters follow:

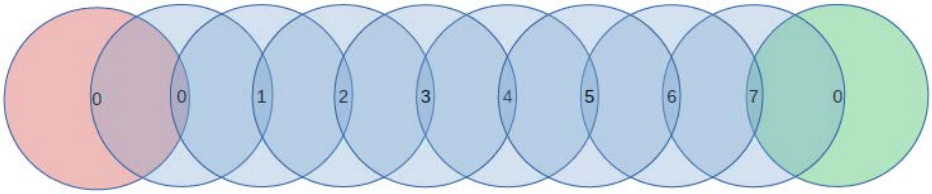
1. Each repeater will repeat packets in its own timeslot, and only in this particular timeslot.
2. Each repeater must have a unique timeslot.
3. The closer a repeaters is to the transmitter, the earlier its timeslot will be available and the closer a repeater is to the receiver, the later its timeslot will be available (counted from when the transmitter sends its packet).

The consequence of these rules is that repeaters must be arranged in a virtual line, from TX to RX, where the highest slot corresponds to the repeater closest to the receiver. When covering a large area rather than a physical line, repeaters must still be in a virtual line.

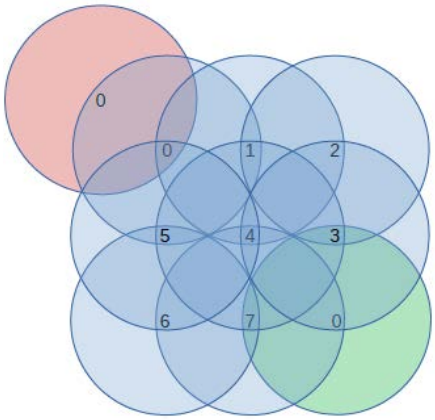
A.2.1 GOOD EXAMPLES OF HOW TO ARRANGE REPEATERS

Below are some good examples of how to arrange repeaters. Each repeater has its slotId written in the middle of the circle:

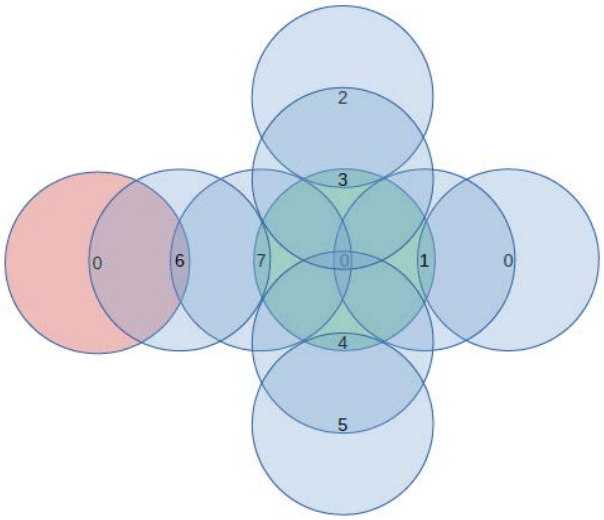
All repeaters in one line



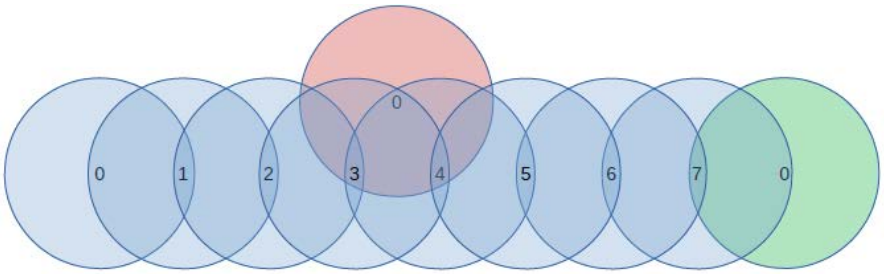
Covering an area



Covering four shorter lines from a receiver positioned in the middle

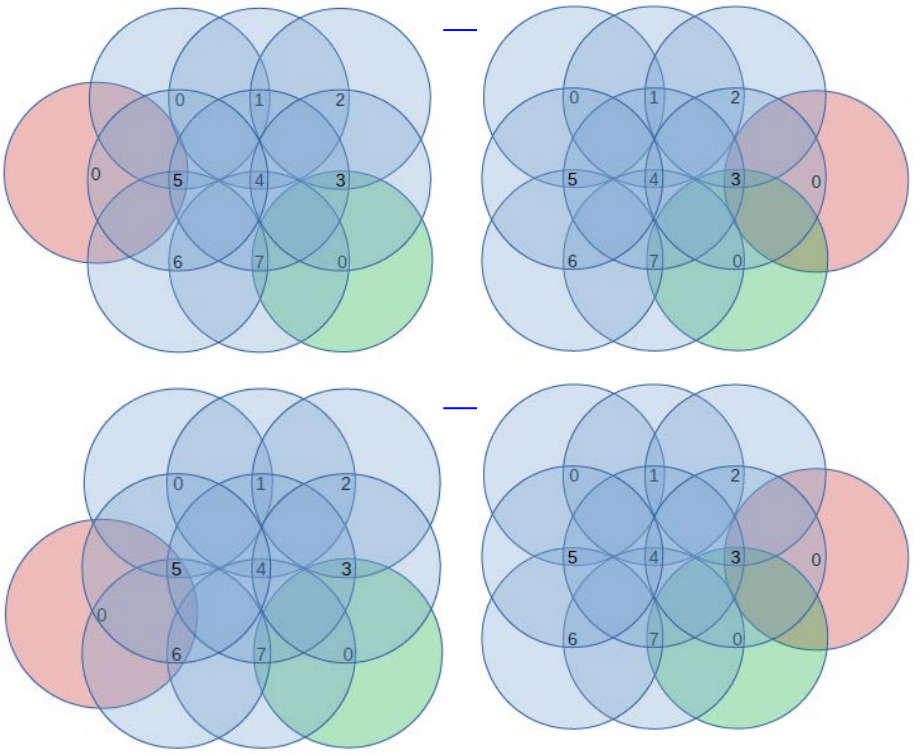


Covering a line with different transmitter positions

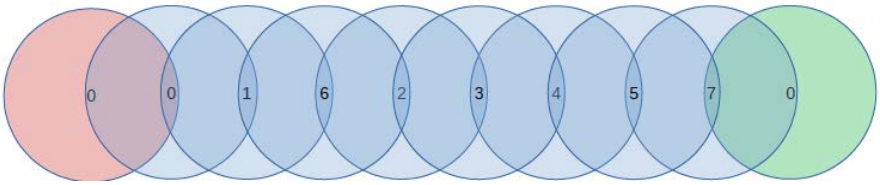


Good as well. Repeater 0, 1 and 2 will never send anything, but it does not matter, the packet is still repeated all the way from the transmitter to the receiver. (The reason for having 0,1 and 2 there, is of course to offer coverage when the transmitter is moved around).

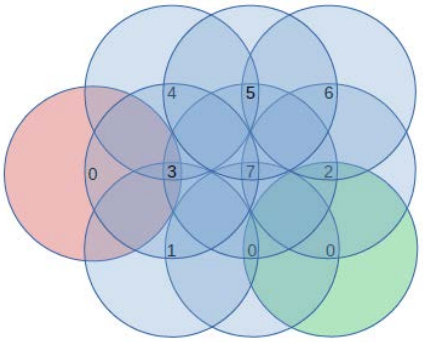
Covering areas with different Transmitter positions



A.2.2 BAD EXAMPLES OF HOW TO ARRANGE REPEATERS



In this example, the packet is repeated through repeater 0, 1 and 6 but when repeater 2 hears the packet from repeater 6 it cannot repeat it. The reason is that repeater slot 6 comes after repeater slot 2 and the timeslot of repeater 2 has already elapsed when repeater 2 will hear repeater 6.



In this arrangement, the packet will be repeated by repeater 3, 4, 5, 6 and 7, but not by repeaters 0, 1 and 2 so nothing will reach the receiver.

NOTE: If the receiver is also moving around, things become more difficult. The general rule is that **there must always be a virtual line of repeaters from the transmitter to the receiver**, where slotIds are decreasing as repeaters get closer to the transmitter and increasing as repeaters get closer to the receiver.

ANNEX B: INDEX

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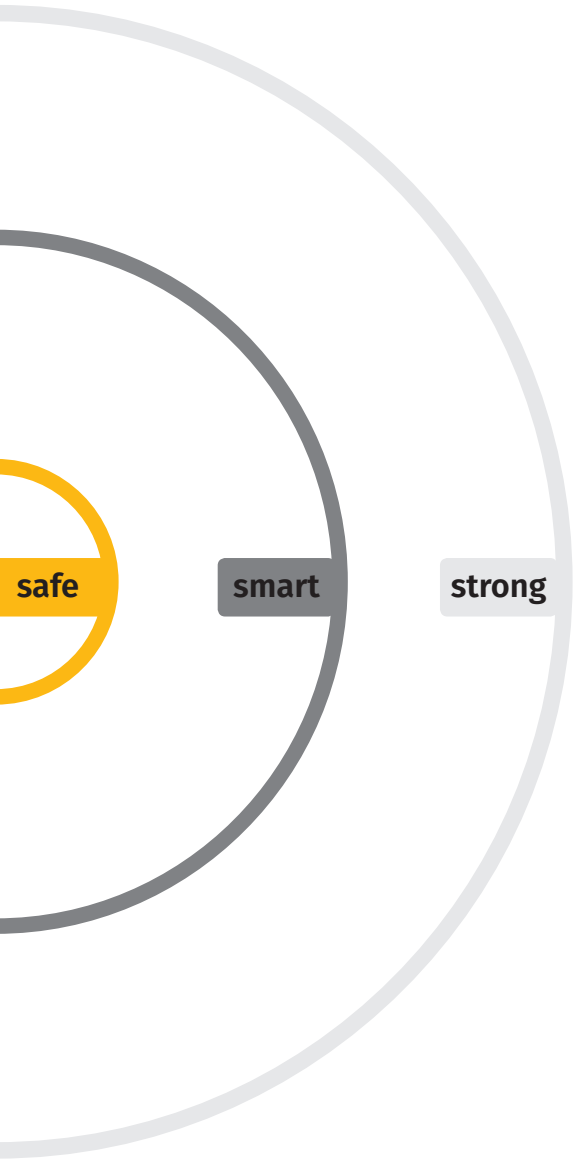

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