SMR

Smart Multichannel Relay

User Manual

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Sincerely,



Dr. Szymon Pustelny
CEO, DM Technologies

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SAFETY INSTRUCTIONS AND WARNINGS

Introduction

Before using the Smart Multichannel Relay (SMR), you must read and understand these safety instructions. They are designed to protect you, the device, and any connected equipment. Failure to adhere to these guidelines can result in equipment damage, data loss, chemical burns from batteries, or electric shock from external circuits, and will void the warranty.

!!! WARNING !!!

The SMR itself operates on low voltage. However, it is a relay designed to **switch external circuits that may carry hazardous voltages.** The primary risk of electric shock comes from the equipment you connect to the SMR's relay outputs. Because of that:

- Always ensure that any external circuit is completely de-energized before connecting it to or disconnecting it from the SMR.
- You are responsible for ensuring the safe design and implementation of any system connected to the SMR.

Power Source Safety

The SMR can be powered by AAA batteries or a USB connection. Each source has specific safety requirements.

AAA Battery Safety (Chemical and Fire Hazard)

Leakage: Regularly inspect batteries for any sign of leakage (e.g., white crystalline powder, moisture). If leakage is found, remove the batteries immediately using protective gloves. Clean the battery compartment thoroughly before installing new batteries.

Skin/Eye Contact: If battery acid comes into contact with skin or eyes, rinse immediately with plenty of clean water and seek medical attention.

Replacement:

- Always use the correct battery type (AAA).
- Replace all batteries at the same time. Do not mix old and new batteries, or batteries of different types or brands.
- Ensure correct polarity (+/-) is observed when installing. Incorrect installation can damage the SMR and cause batteries to leak.

NEVER attempt to recharge non-rechargeable batteries. Doing so can cause them to overheat, leak, or explode.

Handling: Avoid short-circuiting battery terminals (e.g., by letting them touch metal objects). This can cause rapid discharge, overheating, and leakage.

Disposal: Dispose of used batteries responsibly according to your local environmental regulations. Never dispose of batteries in a fire.

USB Connection (Equipment and Data Integrity Hazard)

Power Quality: For reliable operation, connect the SMR directly to a high-quality, mainboard USB port on a host computer.

AVOID using passive (unpowered), low-quality, or overloaded external USB hubs. These can provide unstable power, leading to erratic SMR behavior, data corruption, and potential permanent damage to both the SMR and the host computer's USB port.

General Operation and Maintenance

Enclosure: Never operate the device without its housing securely in place. It protects the internal electronics from damage and environmental factors.

Environment:

- Operate the device in a dry, indoor location, free from corrosive or explosive gases.
- Operate and store the device within the specified temperature range of 10°C to 40°C.

Ventilation: Ensure adequate airflow around the device to prevent overheating. Do not cover the ventilation openings.

Service and Modifications: All service or adjustments must be performed by qualified personnel. Any unauthorized modification or repair attempt will void the warranty and may compromise the device's safety and functionality.

SPECIFICATION AND PERFORMANCE

Crucial Features

- **Three Independent Channels:** Provides control over three separate devices or circuits simultaneously.
- **Flexible Multiplexer Configuration:** Channels can be combined to create a larger 1-of-3 or 1-of-4 multiplexer, allowing for advanced switching applications.
- **Dual Power Operation:** Features ultra-low power consumption for long-term operation on AAA batteries, fully independent of a computer. Alternatively, can be powered and controlled via USB.
- **Full Galvanic Isolation:** Utilizes mechanical relays to ensure a true physical air-gap disconnection, providing superior safety and signal integrity compared to solid-state solutions.
- **Plug-and-Play USB Control:** Offers straightforward computer-based control and configuration through a standard USB interface.

Specifications

Channels		
Number of channels	3 (2 x 1)	
Channel isolation	Galvanic	
Input-signal frequency range	(see Appendices)	
Maximum current	0.5 A	
Maximum voltage	30 V	
Contact resistance	<200 mΩ	
Transmission (see Appendix B for full transmission spectrum of all channels)	3 MHz 30 MHz 300 MHz 1.5 GHz	-0.07 dB -0.07 dB -0.82 dB -2.14 dB
Isolation (A ↔ B) (see Appendix B for full isolation spectrum of all channels)	3 MHz 30 MHz 300 MHz 1.5 GHz	-90.0 dB -71.6 dB -48.3 dB -12.6 dB

Remote interface	
Interface type	USB

General		
Dimensions (L x W x H)	80 x 170 x 35 mm	
Weight (g)	450 g	
Supply	2 Lithium/Iron Disulfide (Li/FeS2) Batteries (1.8 V)*	USB
Operating temperature	15-60°C	
Warranty	One year parts and labor on defects in materials and workmanship	

* Operation with alkaline batteries is possible, but may result in a significantly shorter operating time on batteries (no effect if operated using USB supply)

1. GETTING STARTED

1.1. HOW TO US THIS MANUAL

This manual is designed to suit your needs. For a comprehensive understanding of the Smart Multichannel Relay, including its features and step-by-step performance checks, we recommend reading from the beginning. If you are eager to start using the device right away, you can proceed directly to Section 2, which covers its core operation

1.2. IN THE BOX

The box contains following elements:

- Smart Multichannel Relay
- 2-m USB-C connection cable
- QR code with a link to the manual

1.3. OVERVIEW

Figure 1 shows the top and bottom, as well as two sides of the Smart Multichannel Relay with labels marking different elements.

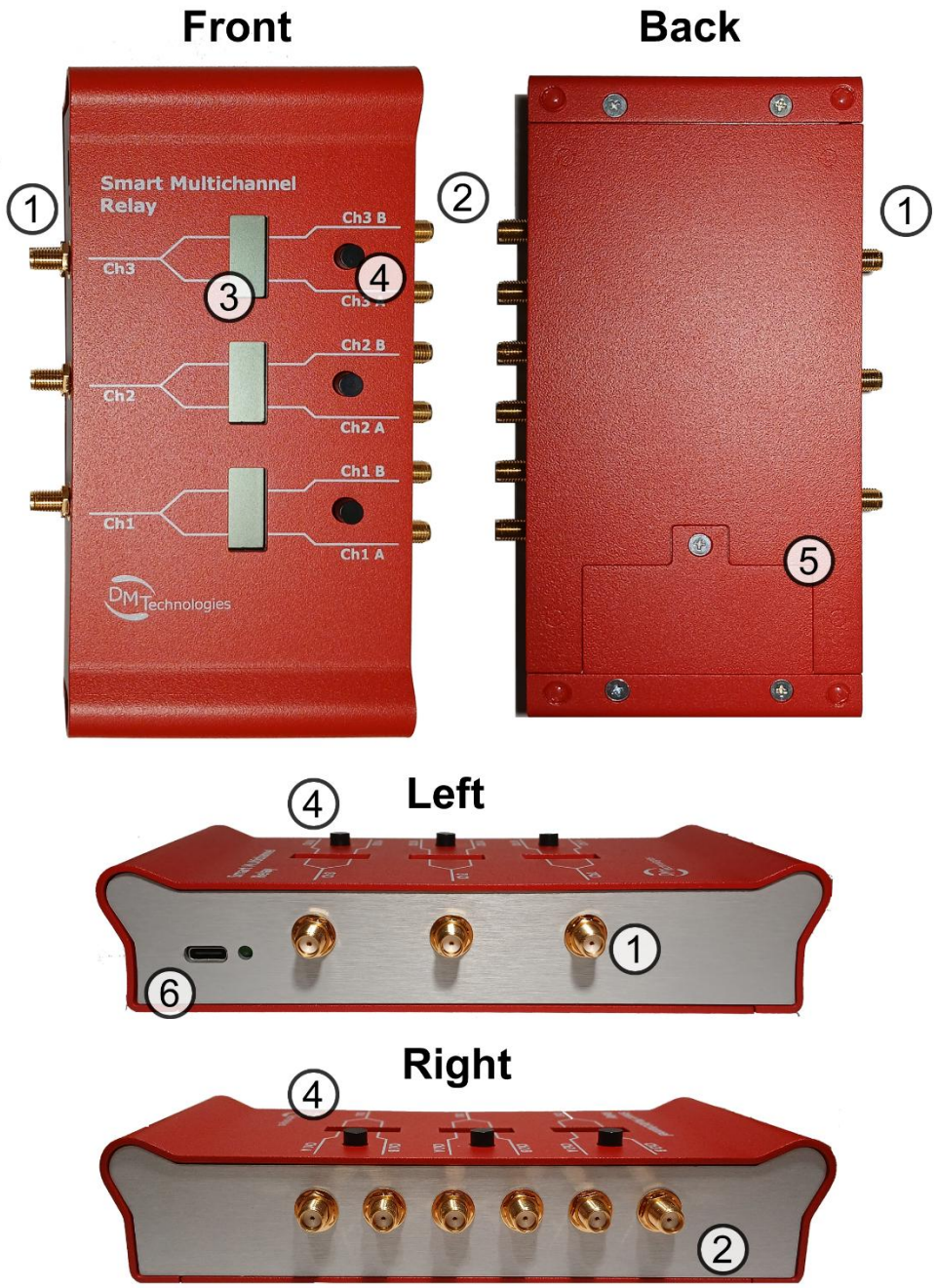


Figure 1. View of the top and bottom and two sides of the Smart Multichannel Relay with marked parts of the device related with its operation.

① **Common Terminal (Ch1, Ch2, Ch3)**
This is the common terminal for each channel. It will be connected to either terminal A or terminal B, depending on the selected state.

② **Switched Terminals (Ch1 A, Ch1 B, Ch2 A, Ch2 B, Ch3 A, Ch3 B)**
These are the two terminals for each channel that the Common terminal can connect to. For each channel, the relay will switch the connection between terminal A and terminal B.

③ **Status Screen**

This screen displays the current connection status for each channel, indicating whether the Common terminal is connected to terminal A or terminal B.

④ **Channel Control Button**

Press this button to switch the corresponding channel's connection between terminal A and terminal B.

⑤ **Battery Compartment Cover**

The cover for the battery compartment.

⑥ **USB-C Port**

This port is used for powering the device and for connecting to a computer for remote control and configuration.

3. OPERATION OF THE DEVICE

3.1. INITIALIZATION

If charged, either through the battery or USB the device is ready to be use.

3.2. REGULAR OPERATION

There are two modes of operation: manual and remote.

Manual Operation

You can change a channel's state at any time by pressing its associated button. You will hear a distinct click and see the display update as the physical relay switches.

While this works on both power sources, please be aware of a key difference in how the device handles multiple simultaneous button presses:

- **When on battery power:** The device ensures the required energy for physical switching the channels by switching them **sequentially**. If you press two or three buttons at once, they will activate one by one with an about 200-ms delay between them.
- **When powered by USB:** The device has full power available. Multiple channels will switch **instantly and simultaneously**, with no delay. This behavior also applies when sending remote commands to switch multiple channels.

Remote Operation

The Smart Multichannel Relay can also be operated remotely. By connecting it to a computer with a USB-C cable, the device can be fully controlled by sending text-based commands. The required communication settings and the complete command set are described in the following chapter.

3.3. LOW BATTERY INDICATION AND REPLACEMENT

The Smart Multichannel Relay is an ultra-low-power device designed for extended, long-term operation on batteries without any external power. The estimated battery life can exceed 1.5 years, though the actual duration depends on both the intensity of use and the quality of the batteries installed.

When the batteries are depleted to a level where reliable operation can no longer be guaranteed, the device will provide a clear visual warning: **the status indicators for all channels will begin to flash simultaneously.**

Upon seeing this indication, you should replace the batteries as soon as possible to ensure continued, reliable performance.

To replace the batteries, remove the screw securing the battery compartment cover, located on the underside of the device (as shown in Fig. 1**). For maximum operational life, it is highly recommended to use high-quality (Lithium/Iron Disulfide) AAA (1.8V) batteries.**

4. REMOTE INTERFACE

4.1. GENERAL SETTINGS

The Smart Multichannel Relay can be controlled remotely. Communication with a computer occurs through a USB C serial port.

Microsoft Windows

After connecting Multichannel current source with a computer, a new COM port should appear in Device manager. The communication settings are:

Baud rate: **115200**

Data bits: **8**

Parity: **None**

Stop bit: **1**

Row control: **Hardware**

4.2. COMMANDS

To control the device remotely, send one of the commands listed below. A command is only processed after the device receives a newline character (\n).

!idn	**Description:** Request identification of the device
Example:	**Command Sent**: • !idn **Successful Response:** • Smart Multichannel Relay ver. 2.0

!set;[CH1][CH2][CH3]	**Description:** Sets the state of all three channels simultaneously using a three-character string. Each character in the string corresponds to a channel (the first for Channel 1, the second for Channel 2, etc.). **Parameters:** The following characters can be used for each channel's state [CHx]: a sets channel x to position 'a' b sets channel x to position 'b' • t toggles the channel x current position (a ↔ b) • n leaves the channel x in its current state **Responses:** • **On Success:** Returns #set;[CH1][CH2][CH3] with the **new state** of all channels after the command has been executed. • **On Error:** Returns #set;wrong parameter if the command string is not exactly three characters long or contains invalid characters.

Example:	**Representative Initial State** • Channel 1 = a • Channel 2 = a • Channel 3 = b **Command Sent:** • !set;atn **Meaning:** • Channel 1 (a): Set to position 'a'. State remains a. • Channel 2 (t): Toggle position. State changes from a to b. • Channel 3 (n): No change. State remains b. **Successful Response:** • #set;abb

!get	**Description:** Gets the state of all three channels
Example:	**Command Sent:** • !get **Responses:** • **On Success:** Returns #get;[CH1][CH2][CH3]

!help	Query a full list of commends controlling the device
Example:	**Command Sent:** • !help **Successful Response:** Returns a string with all the comments along with their descriptions and examples.

4.3. SMR REMOTE CONTROL

There are several different means of the remote control of the Smart Multichannel Relay.

Dedicated Software (GUI Control)

For user-friendly operation, a dedicated software application is provided. The interface (shown in Fig. 2) simplifies device control.

Connecting to the Device:

1. Connect the SMR to your computer via the USB-C cable.
2. In the software, click the **Search** button. The device's COM port will appear in the "Ports" dropdown list.

3. Select the correct port from the list.
4. Click the **Connect** button. The software will establish communication and reflect the current state of the relays.

Using the Software:
The application offers two ways to control the device:

- **Graphical Switches:** Simply click the on-screen toggle switches for Channel 1, 2, or 3 to instantly change the state of the corresponding relay. The software automatically sends the correct !set command in the background.
- **Manual Command Entry:** For advanced control or testing, you can type any command from the reference list (Sec. 4.2) into the **Command** text field and click **Send**. The device's raw response will be displayed in the text area below.

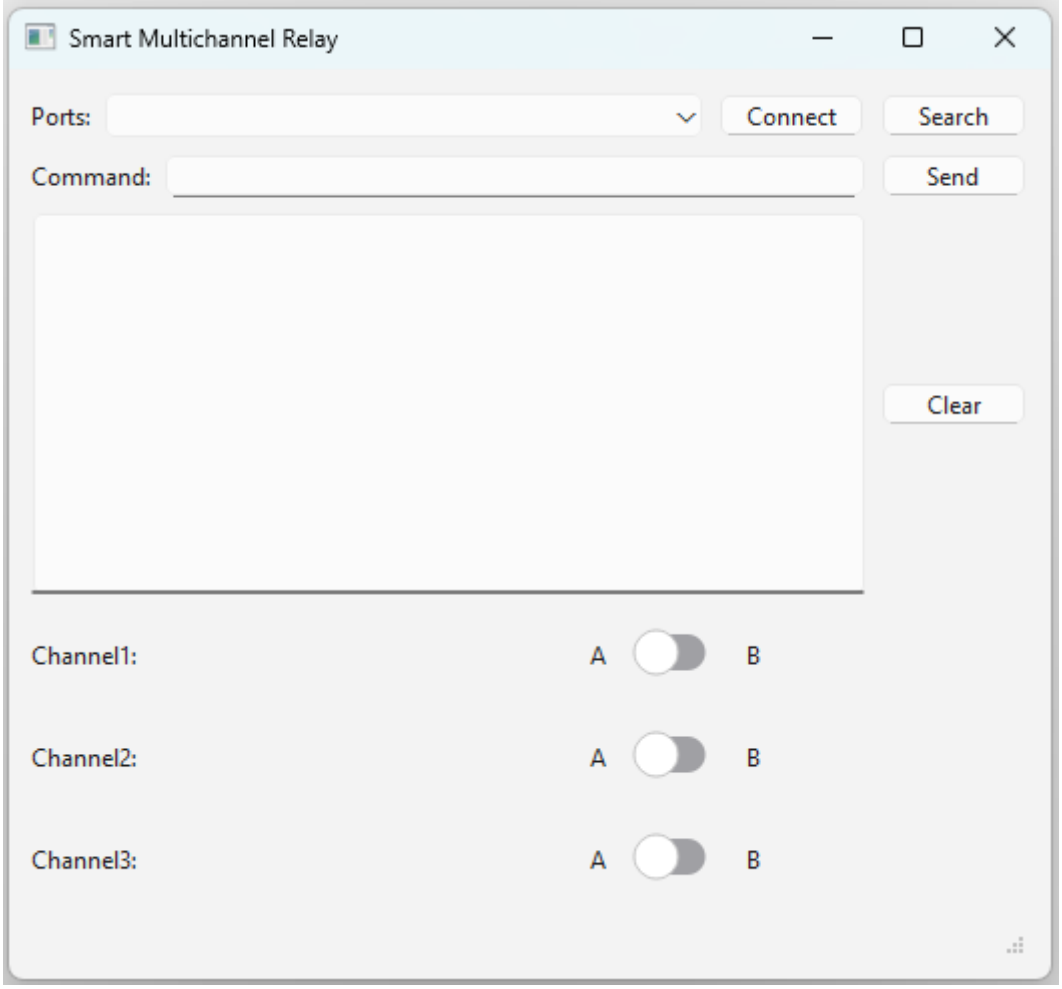


Figure 2. View of the Smart Multichannel Relay control software.

Dedicated Python Package

For programmatic control and automation, a dedicated Python package is available. This package provides a simple, high-level interface that wraps the serial commands detailed in Section 4.2.

Function Overview:

- InitializeSMR(port)
  - **Description:** Establishes a connection to the device. This must be called before any other function.
  - **Parameter port:** A string with the COM port name (e.g., 'COM3').
- setSMR(state_string)
  - **Description:** Sets the state of all three channels.
  - **Parameter state_string:** A 3-character string defining the action for each channel (e.g., 'atn'). The valid characters (a, b, t, n) are the same as in the command reference.
  - **Returns:** A string representing the **new state** of all three channels (e.g., 'abb').
- getSMR()
  - **Description:** Gets the current state of all three channels.
  - **Returns:** A 3-character string representing the current state (e.g., 'aab').
- identifySMR()
  - **Description:** Gets the device's identification string.
  - **Returns:** A string containing the manufacturer, model, and version.
- closeSMR()
  - **Description:** Closes the communication port to the device, releasing it for other applications.

An example Python script demonstrating the use of these functions for initialization, identification, and state manipulation is shown in Fig. 3.

Figure 3. Representative Python code enabling initialization, identification, getting the state of the device, changing the state of the device, successive getting the state of the device and closing the device.

Universal Serial Control

Beyond the provided software and Python package, the Smart Multichannel Relay can be controlled by **any application capable of serial port communication.** The device implements a transparent, text-based command protocol, offering maximum flexibility for custom integration.

This includes, but is not limited to:

- **Serial Terminal Applications:** You can directly control the device using common terminal programs like PuTTY, Tera Term, or the Arduino IDE's Serial Monitor. Simply configure the connection with the settings from Section 4.1 and type the commands manually.
- **Custom Programming:** You can integrate the SMR into your own applications using standard serial libraries available in virtually any programming language (e.g., pyserial for Python, SerialPort for C#, LabVIEW, MATLAB, etc.).

In all cases, communication is achieved by writing the command strings (e.g., !set;atn) followed by a newline character (\n) to the device's COM port, and then reading the ASCII response from the same port.

5. APPENDICES AND SUPPORT

This final chapter provides supplementary information, including a troubleshooting guide, full technical specifications, and warranty details to ensure you have a complete reference for your Smart Multichannel Relay.

5.1. TROUBLESHOOTING GUIDE

If you encounter issues with the device, please consult the table below before contacting support

Problem	Possible Cause & Solution
Device is unresponsive (manual or USB)	**On Battery Power:** Check that batteries are inserted with the correct polarity (+/-). Replace all batteries with a new, high-quality set. **On USB Power:** Ensure the USB-C cable is securely connected to both the device and the computer. Try a different USB port on your computer, preferably a mainboard port.
Cannot connect to the device via USB	Check the Windows Device Manager to confirm the device is visible and to identify its COM port number. Ensure the correct COM port is selected in your software. Restart the software or unplug and re-plug the device.
Commands are sent, but the device does not respond	**Most Common Cause:** Ensure that every command string is terminated with a newline character (\n). Communication will fail without it. Also, verify that your serial terminal settings (baud rate, etc.) match those specified in Section 4.1.
All channel indicators are flashing simultaneously	The batteries are depleted. Replace the batteries as instructed in Section 3.3 to ensure reliable operation.

5.2. WARRANTY INFORMATION

DM Technologies warrants this product to be free from defects in materials and workmanship for a period of one (1) year from the original date of purchase. This warranty does not cover damage resulting from improper use, accident, unauthorized modification, use contrary to the instructions, or damage caused by battery leakage. To make a warranty claim, please contact our support department with your proof of purchase.

5.3. CONTACT AND SUPPORT

For technical questions, suggestions, or support, please do not hesitate to contact us:

- **Website:** www.dmtechnologies.eu (Visit for the latest version of this manual, software downloads, and drivers.)
- **Email:** info@dmtechnologies.eu
- **Phone:** +48 609 413 923

5.4. REGULATORY COMPLIANCE

This product complies with the essential requirements of the applicable European directives and is eligible to bear the CE marking. The full Declaration of Conformity is available upon request or can be downloaded from our website.

APPENDIX A – TRANSMISSION SPECTRUM

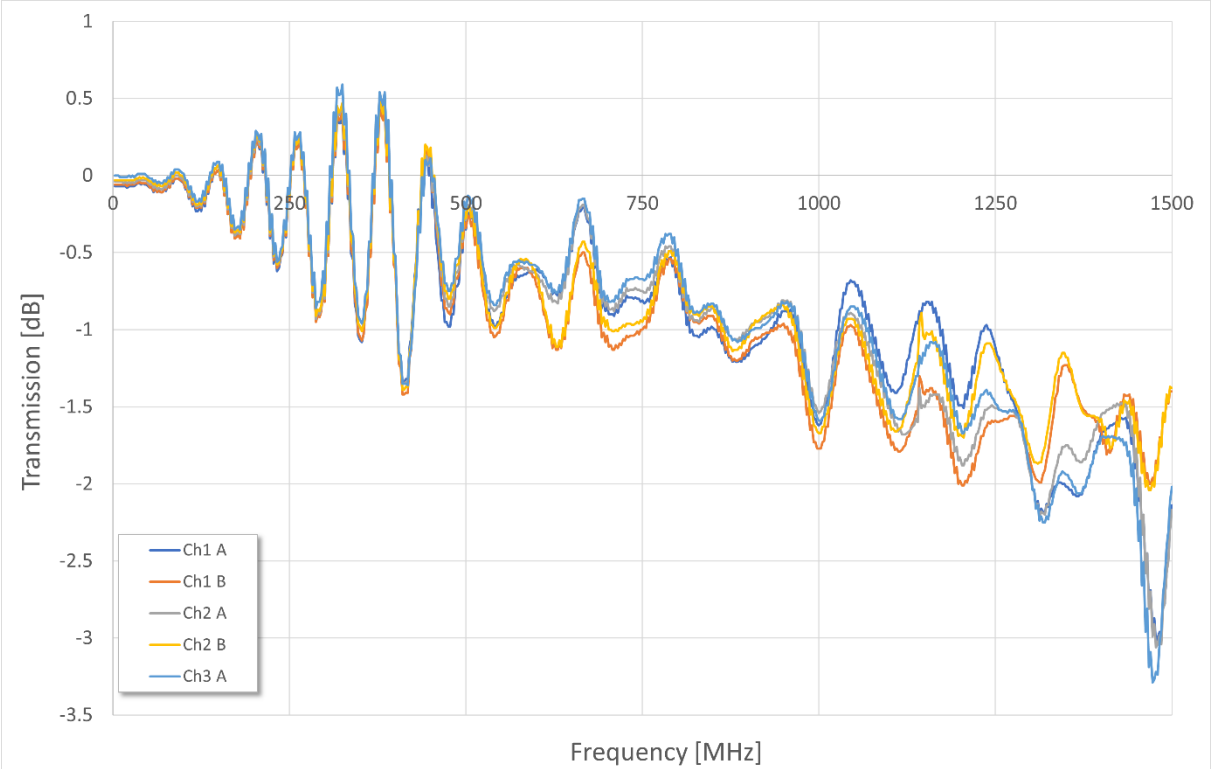


Figure 3. Transmission spectrum of all (linear scale).

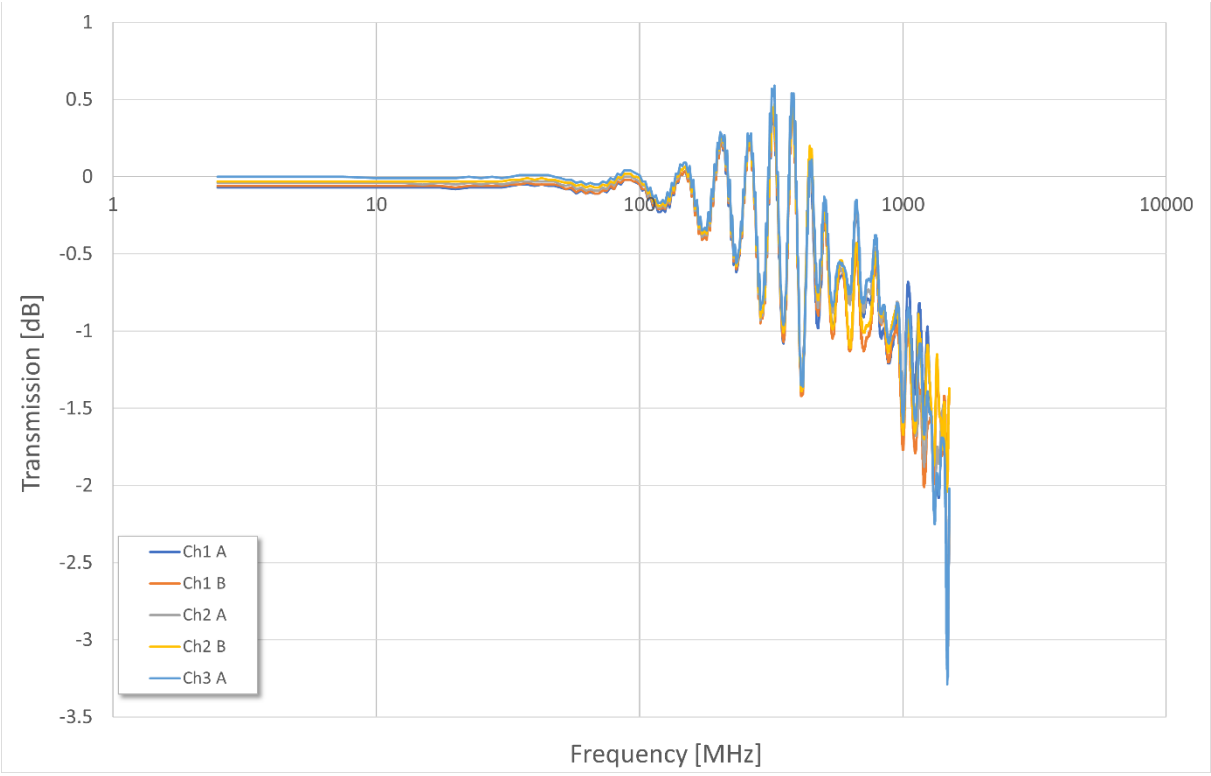


Figure 4. Transmission spectrum of all channels (logarithmic scale).

APPENDIX B – ISOLATION SPECTRUM

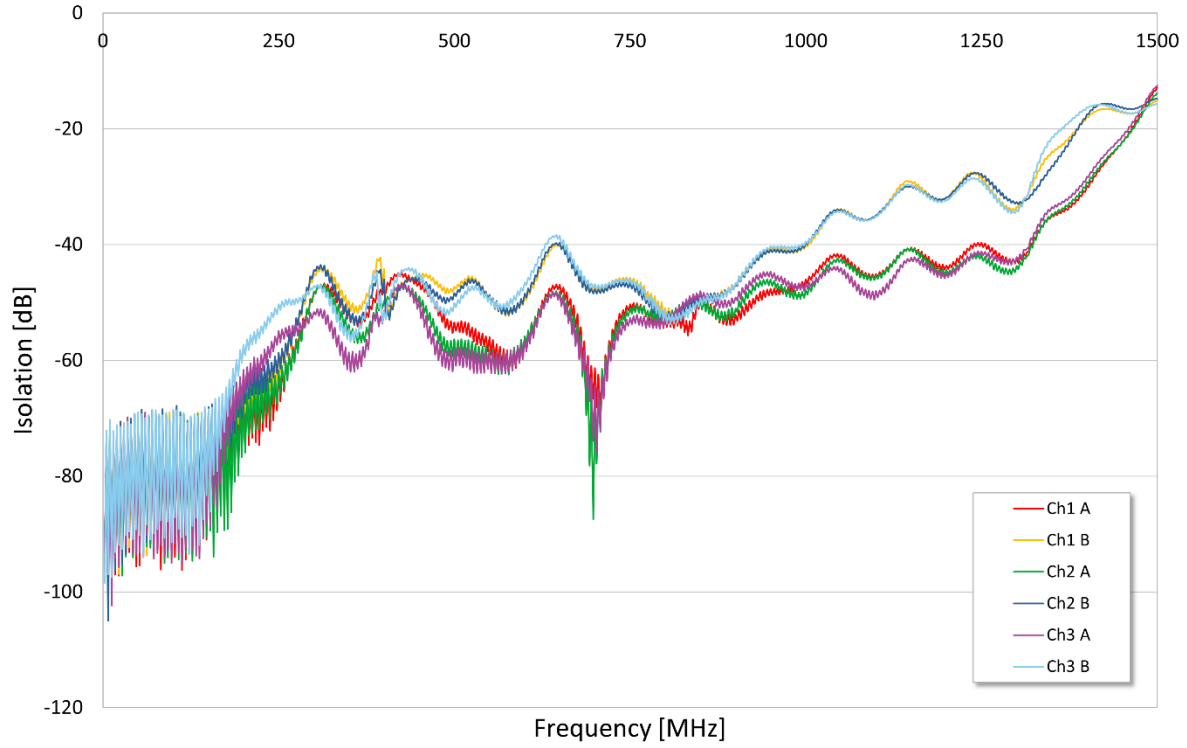


Figure 5. Isolation spectrum between the channels (linear scale).

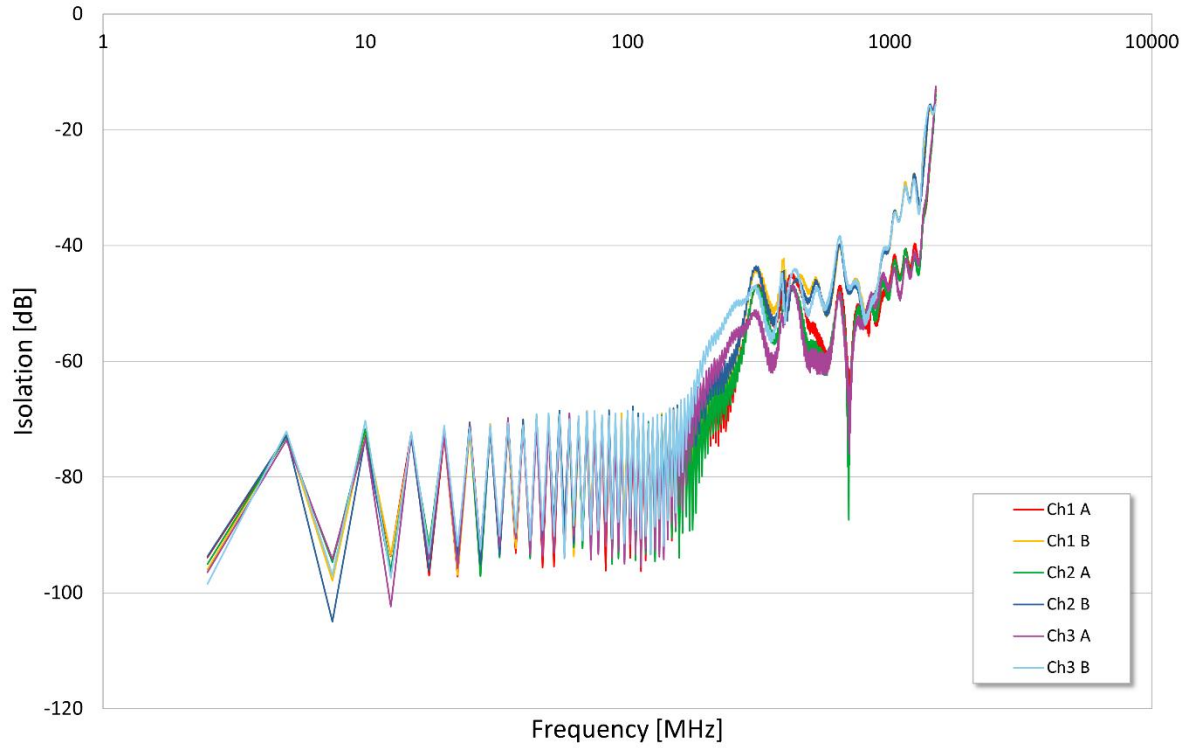


Figure 6. Isolation spectrum between the channels (logarithmic scale).