KOSMINIS VYTIS

NT1069x8_FMC

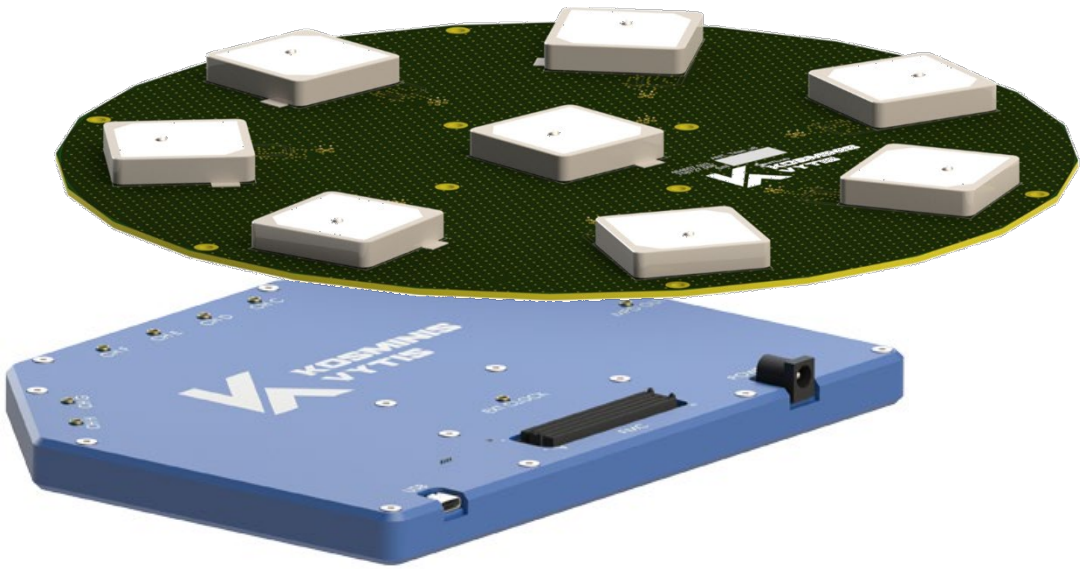
HIGH-PERFORMANCE EVALUATION KIT

WITH

KV-8AJA1

8-ELEMENT SINGLE BAND ANTENNA ARRAY

SPECIFICATION



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CONTENTS

1 GENERAL INFORMATION

NT1069x8_FMC is a single enclosure evaluation kit that features interference-resistant single channel NT1069 RF ICs. This Evaluation Kit is able to accept GPS, GLONASS, Galileo, BeiDou, NavIC (IRNSS), QZSS GNSS signals in L1, L2, L3, L5, S bands.

Only one frequency band at the time is available. The default frequency band assembly option is "L1". For the L2, L3, L5, S frequency bands, evaluation kit implementation is provided by request.

NT1069x8_FMC allows to process up to 8 RF channels: amplify, down-convert to a fixed Intermediate Frequency (IF) with subsequent additional filtering and digitization by 12 (or 14) bit ADC @100 MHz. Each RF channel has individual RF input with active antenna supply option.

NT1069x8_FMC features the FMC connector, which works as a compact electro-mechanical expansion interface for a daughter card to an FPGA board. Such flexibility with FMC is essential to enable developers to accelerate the development of their applications: Anti-jammer algorithms, Spoof-proof algorithms and others, and check it with the real-time GNSS signals.

NT1069x8_FMC has embedded GNSS receivers, which provide the navigation solution in autonomous mode, as well as up-converter (modulator) which provides connection to the external (third-party) GNSS receiver.

Key Features and Assignment:

- Interference resistant NT1069 RF Front-End ICs
- High noise immunity and high linearity of the NT1069 RF Front-End IC channel
- 8 RF channels
- 12/14-bit @100 MHz ADC
- External Gain Control of NT1069 LNA and IFA
- Flexibility with FMC connector
- Internal GNSS receiver
- Ability to connect the external GNSS receiver
- Ability to debug and test own algorithms developed on FPGA board
- Demonstration of the NT1069 RF ICs performance

2 PACKAGE CONTENTS

List of shipped products:

- NT1069x8_FMC high performance evaluation kit – 1 pc.;
- Power cable – 1 pc.;
- USB Mini-B Interface cable – 1 pc.;
- SMA female to MMCX male RF cables – 9 pcs.;
- 8AJA1 8-element single band OEM antenna array (enclosureless) – 1pcs (active or passive type of antenna).

3 SPECIFICATION

Table 3.1 – NT1069x8_FMC Specification

№	Parameter	Description	Note
1	Supported GNSS constellations	▪ GPS + Galileo ▪ GLONASS ▪ BeiDou ▪ NavIC (IRNSS) ▪ QZSS	- C/A and P-code; - Only one frequency band variant with bandwidth 30 MHz is possible (optional)
2	Frequency band	L1 (1550 MHz - 1609 MHz), L2/L3/L5 (1164 MHz - 1300 MHz), S (2482 MHz-2500 MHz)	- L1 – default frequency band; - L2/L3/L5/S –frequency bands by request; - Only one frequency band variant with bandwidth 30 MHz is possible
3	IF bandwidth	30 MHz	
4	Noise figure	5.8 dB	- RF AGC and IF AGC = max gain; - 1575.42 MHz test frequency
5	1 dB compression point	-13 dBm	1575.42 MHz test frequency
6	Total Gain	53 dB	
7	Channel Isolation	> 65 dB	
8	Input VSWR	< 2	
9	RF AGC Range	10.5 dB	
10	IF AGC Range	46 dB	
11	Number of receiver RF channels	up to 8	
12	Output interfaces	UART	
13	On-board GNSS receiver	Yes	u-blox MAX-M8W-0
14	On-board up-converter	L1 (1550 MHz - 1609 MHz), L2/L3/L5 (1164 MHz - 1300 MHz)	Only one frequency band variant with bandwidth 30 MHz is possible
15	Supply voltage	15 V	typical
16	Power consumption:	15.5 W	typical
17	Dimensions	227 mm × 182 mm × 21 mm	
18	Weight	1150 g	
19	Operating temperature	-40 °C ...+ 65 °C	
20	Connectors:		
	RF (IN+DC Antenna out, RF OUT)	MMCX	
	Interface connectors	FMC / USB type C	to FPGA board / to PC
	Power	Jack PJ-002A	
21	GNSS External Active Antenna Requirements:		
	Antenna voltage supply	5 V	
	Maximum current	100 mA	
	LNA Gain Range (minus signal loss)	20 dB ...35 dB	

Table 3.2 – KV-8AJA1.a 8-element single band active antenna array Specification

№	Parameter	Description	Note
1	Frequency band	1559 MHz - 1609 MHz (L1)	L1 – default frequency band. L2/L3/L5/S –frequency bands by request
2	Number of antenna elements	8 pcs	
3	VSWR	< 1.8	
4	Ellipticity	< 3 dB	
5	Gain	28 dB	
6	Isolation between antenna elements	> 25 dB	
7	Power supply	5 V	
8	Current consumption	1.6 W	
9	Dimensions (Ø x H)	250 mm × 14 mm	
10	Weight	440 g	
11	Type of RF connector	MMCX	

Note:
The GNSS antenna array must have a clear line of sight to the sky during operation. Roofs free from other structures or geographic overhead elements, with a direct view of the horizon, usually make good places to install. This clear view allows antenna to track the maximum number of satellites during the day. Don't install GNSS antenna array near the window of the building or indoors. Incorrect antenna placement can influence on navigation solution.
GNSS antenna installation is key to achieve good performance of the module.

Table 3.3 – KV-8AJA1.p 8-element single band passive antenna array Specification

№	Parameter	Description	Note
1	Frequency band	1559 MHz - 1609 MHz (L1)	L1 – default frequency band. L2/L3/L5/S –frequency bands by request
2	Number of antenna elements	8 pcs	
3	Dimensions (Ø x H)	250 mm × 14 mm	
4	Weight	440 g	
5	Type of RF connector	MMCX	

Note:
The GNSS antenna array must have a clear line of sight to the sky during operation. Roofs free from other structures or geographic overhead elements, with a direct view of the horizon, usually make good places to install. This clear view allows antenna to track the maximum number of satellites during the day. Don't install GNSS antenna array near the window of the building or indoors. Incorrect antenna placement can influence on navigation solution.
GNSS antenna installation is key to achieve good performance of the module.

4 BLOCK DIAGRAM

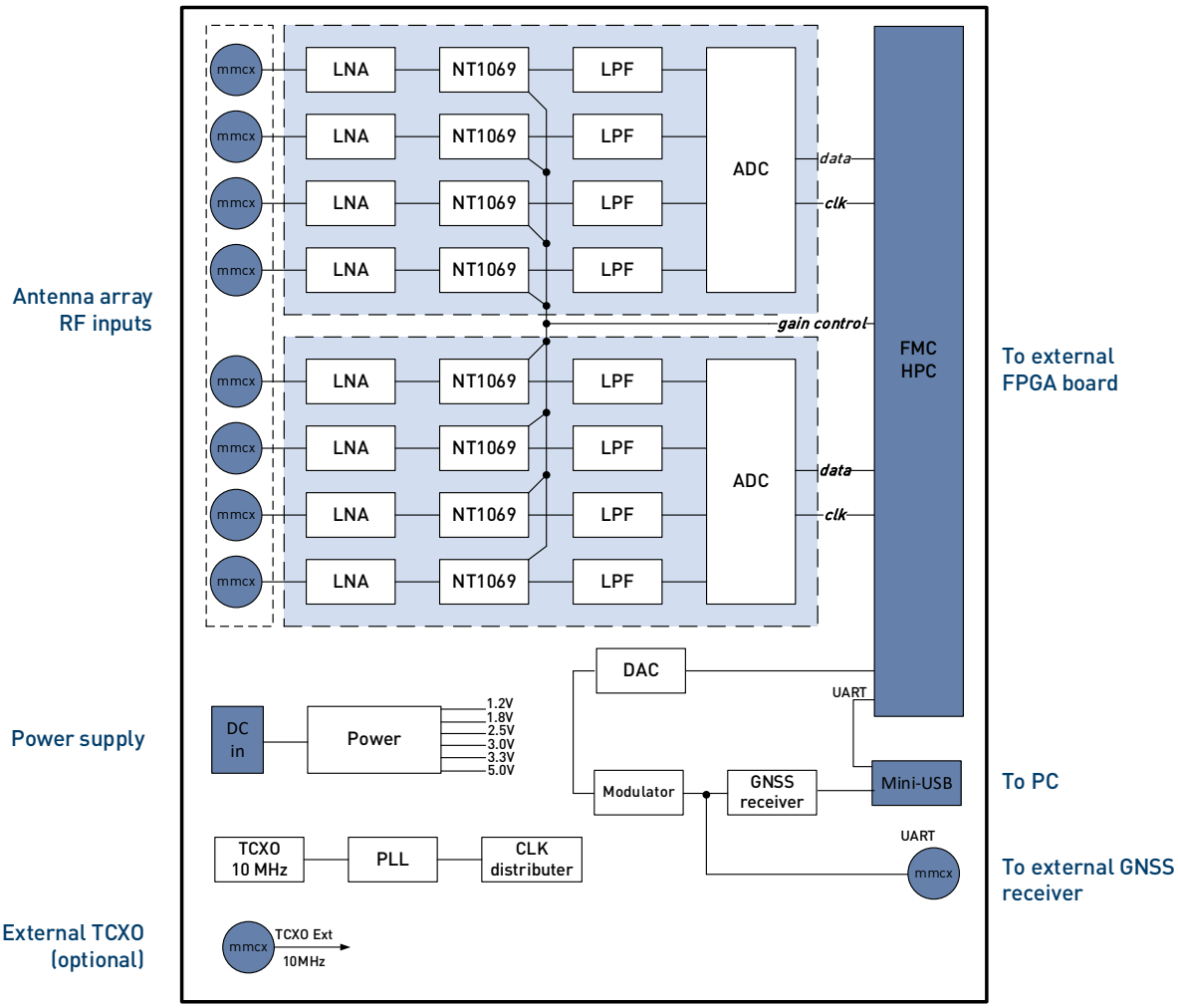

Figure 4.1 - The NT1069x8_FMC simplified block diagram

The device is based on NTLab chipset:

- NT1069 is an interference resistant RF Front-End IC which is intended for reception of all existing Global Navigational Satellite Systems (GNSS) signals such as* GPS, GLONASS, Galileo, BeiDou, NavIC (IRNSS), QZSS in L1, L2, L3, L5, E1, E5a, E5b, E6, B1, B2, B3, S bands. The distinctive feature of NT1069 is high noise immunity, which is achieved by high linearity of the channel. The receiving channel consists of LNA, highly linear mixer, 2-stage IFA and output linear buffer. Gain of LNA and IFA can be controlled externally. Two-stage RF frequency filtration is performed on external components with the aim of noise immunity improvement. For better filtration all external components should be specially selected for each GNSS.

* Default settings are specified in the Specification (see Table 3.1, №1)

5 DIMENSIONS

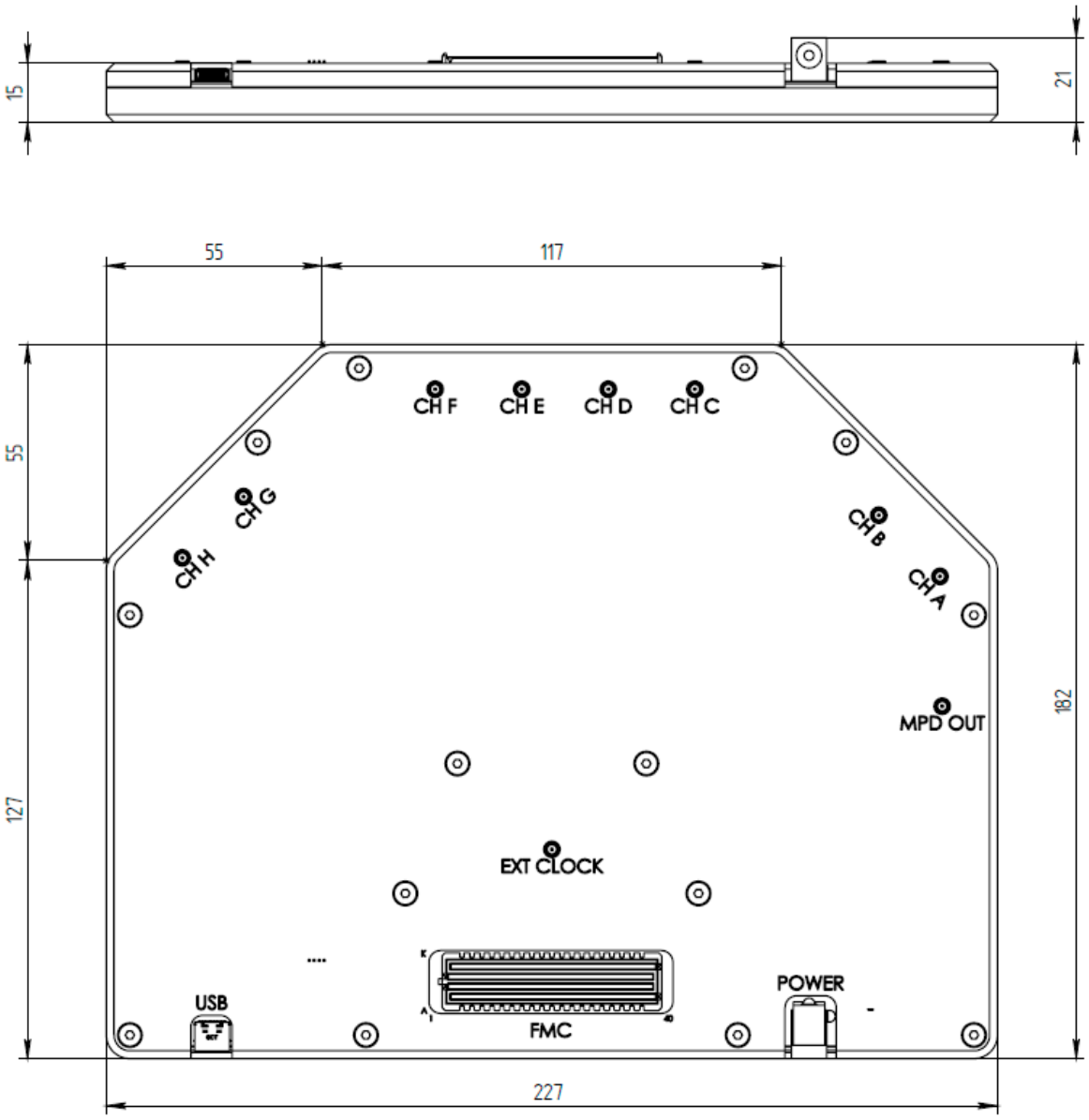

Figure 5.1 – The NT1069x8_FMC Dimensions

6 GRAPHICAL USER INTERFACE

Graphical user interface allows to setup and control NT1069x8_FMC. Spectrum and the Time diagram of the signals can be visualized by GUI.

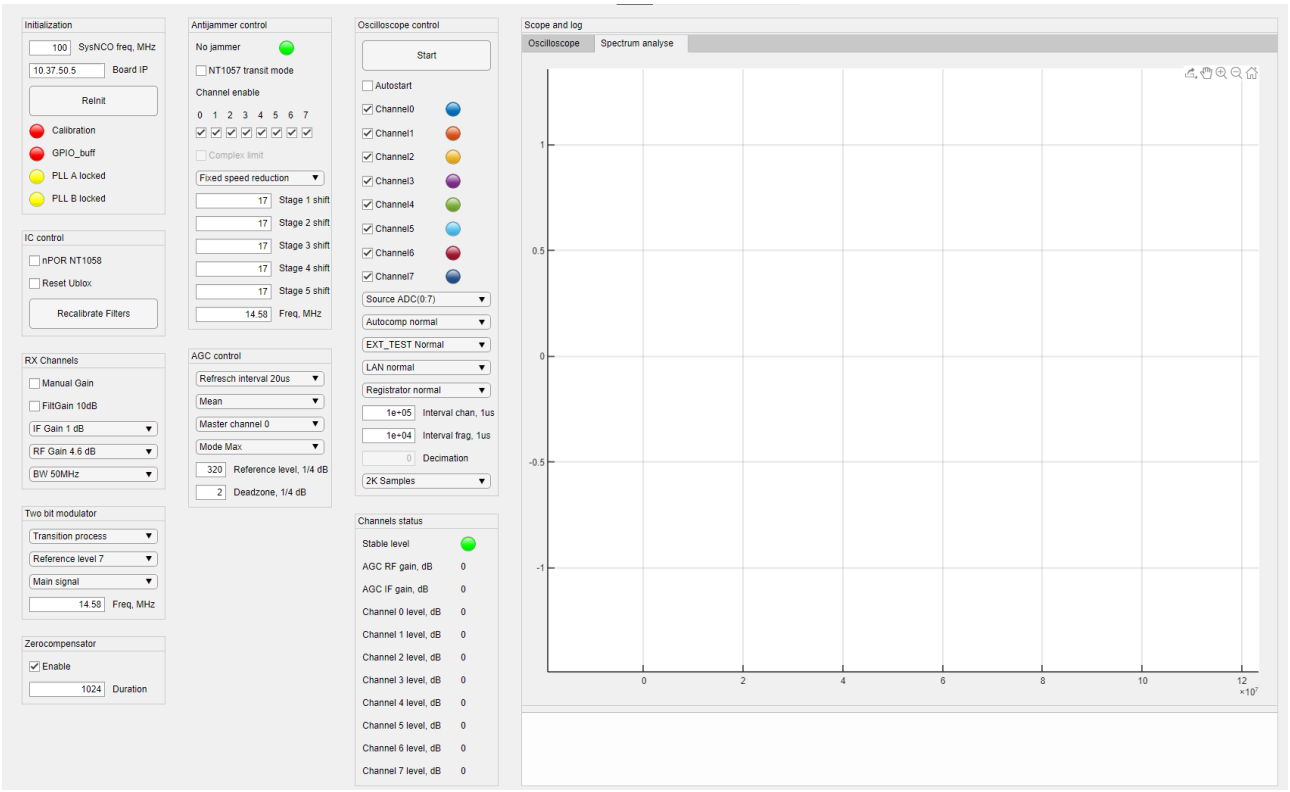

Figure 6.1 – The NT1069x8_FMC GUI Main screen

The *Figure A.1* shows the practical use of the NT1069x8_FMC to develop and test own FPGA-based implementation (Xilinx VC709 FPGA board) of the Anti-jamming algorithm.

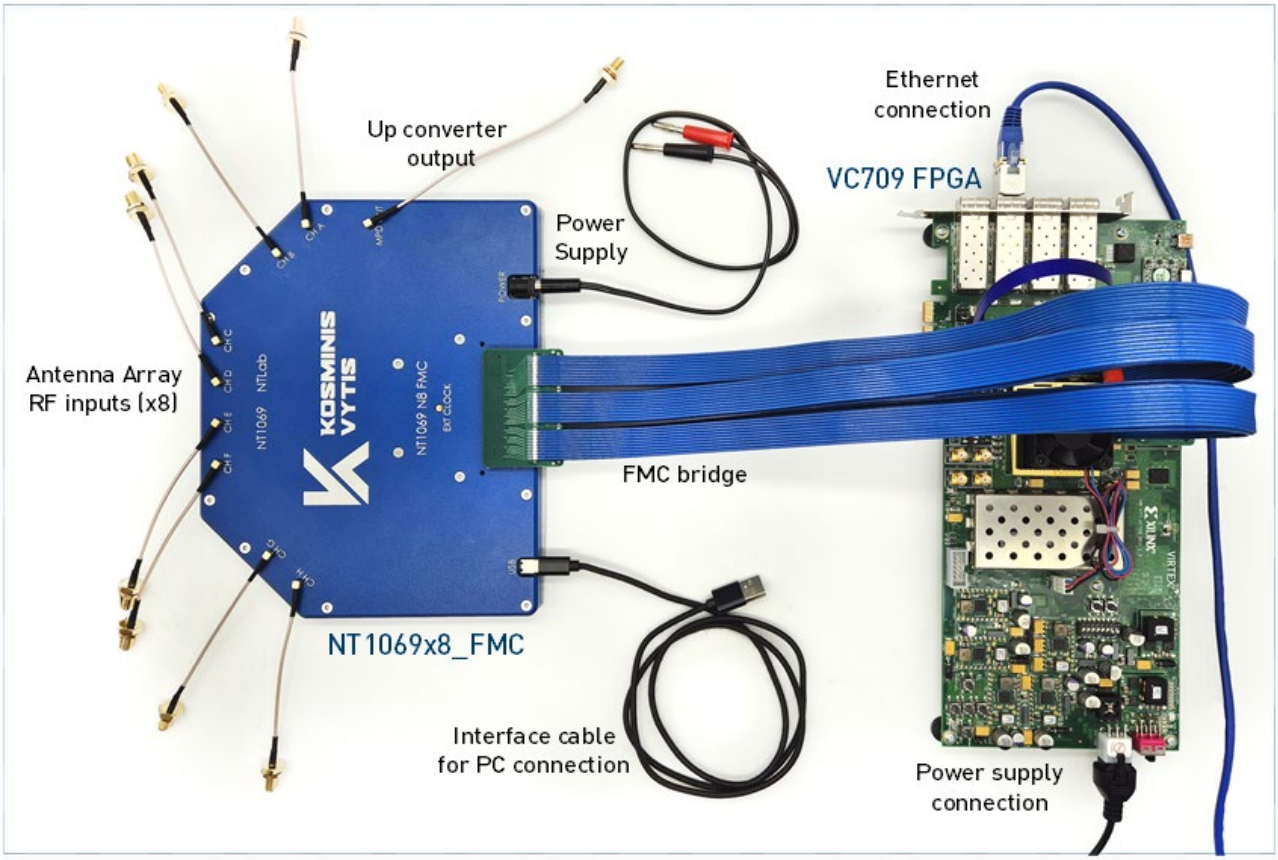

Figure A.1 – The NT1069x8_FMC with FPGA Evaluation Board

Table A.1 – Jamming resistance with NTLab's Anti-jamming algorithm on FPGA Mezzanine Card

Jamming	Jamming conditions	J/S, dB
Single jammer interference resistance	- one CW signal centered at 1575.42 MHz; - one FM signals centered at 1575.42 MHz; - bandwidth 3 MHz; - deviation rate 500 Hz	up to 117 *
Note: * - Result is obtained for passive antenna with cables (MMCX - to– MMCX) length 50 cm.		

APPENDIX B REFERENCE DESIGN

The *Figure D.1* shows the practical use of the NT1069x8_FMC to develop and test own FPGA-based implementation (Trenz adapter with Trenz TE0808-05 [Zync Ultrascale+ MPSoC] module) of the Anti-jamming algorithm.

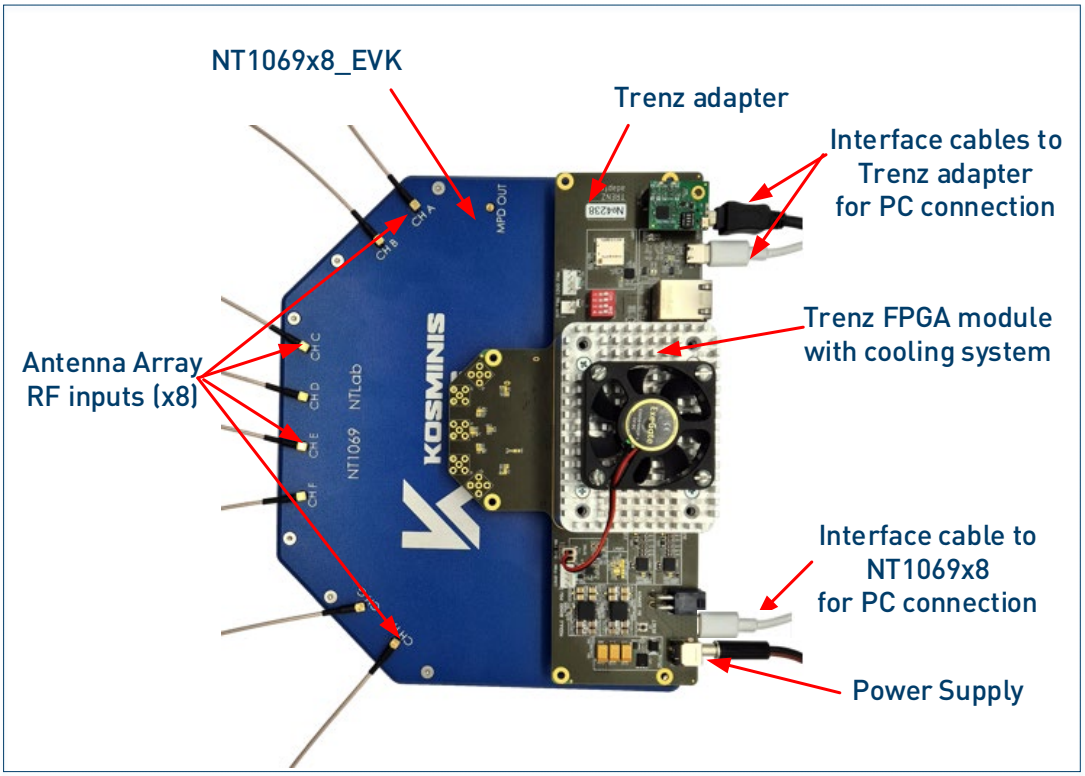

Figure B.1 – The NT1069x8_FMC with Trenz Adapter + Trenz FPGA EVK

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