KOSMINIS VYTIS

NT1069X8_FMC

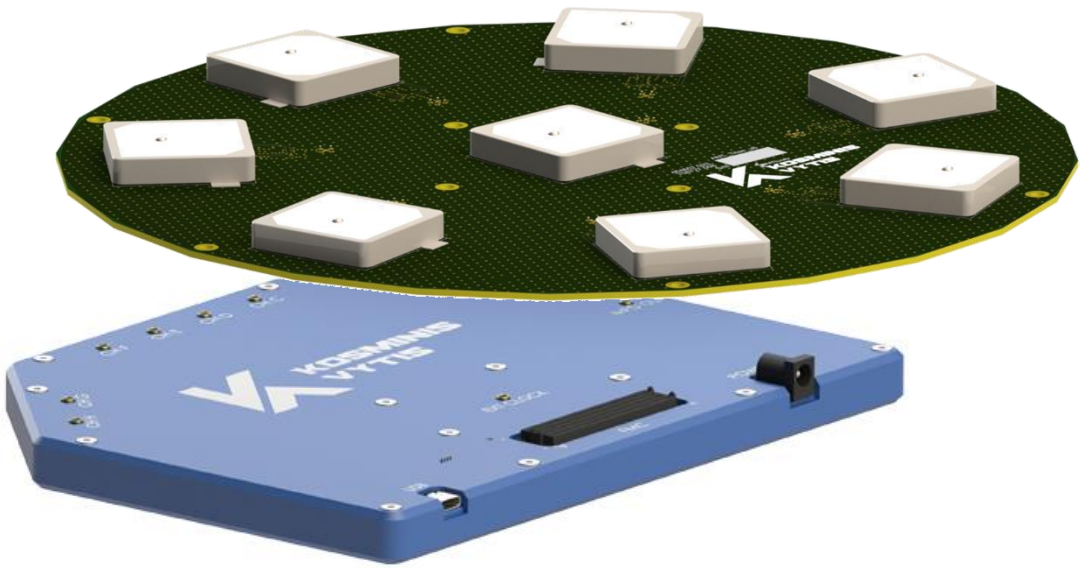
HIGH-PERFORMANCE EVALUATION KIT

WITH

AJA1X8

8-ELEMENT SINGLE BAND ANTENNA ARRAY

SPECIFICATION



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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.;
- AJA1X8 8-element single band OEM antenna array (enclosureless).

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 GNSS constellations variant is possible (optional)
2	Frequency band	L1 (1530 MHz - 1620 MHz), L2/L3/L5 (1150 MHz - 1300 MHz), S (2482 MHz-2502 MHz)	L1 – default frequency band. L2/L3/L5/S –frequency bands by request. Only one frequency band variant 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	Data interfaces	FMC HPC, USB	
13	On-board GNSS receiver	Yes	Ublox MAX-M8W-0
14	On-board up-converter	L1 (1530 MHz - 1620 MHz), L2/L3/L5 (1150 MHz - 1300 MHz)	Only one GNSS constellation is possible
15	Supply voltage	15 V	typical
16	Power consumption:	16 W	typical
17	Dimensions	227 mm × 182 mm × 21 mm	
18	Weight	1144 g	
19	Operating temperature	-40 °C ...+ 65 °C	
20	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 – AJA1X8 8-element single band 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. Only one frequency band variant is possible
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(s) array must have a clear line of sight to the sky during operation. Install the antenna array with a clear view of the sky and clear of obstructions such as building, trees etc.

Rooftops, free from other structures with a direct view of the horizon, usually make good places to install. This clear view allows antenna array to track the maximum number of satellites during the day.

Don't install GNSS antenna array near the windows of the building or indoors. When installing the GNSS antenna array, choose a location where the antenna array will not be covered by drifting snow or accumulated snow. It must not be covered with leaves or placed in a position where it could be blocked.

Avoid placing the GNSS antenna array in close proximity to broadcast antennas, metal surfaces or powerful transmitters. Try to choose a "lightning-protected zone".

When installing GNSS antennas arrays separate them by at least 1 m.

Poor visibility may result in a position shift or an increase in Time To First Fix (TTFF).

Incorrect antenna array placement can influence on navigation solution. Good visibility of the sky is an important condition for accurate positioning and confident reception.

4 BLOCK DIAGRAM

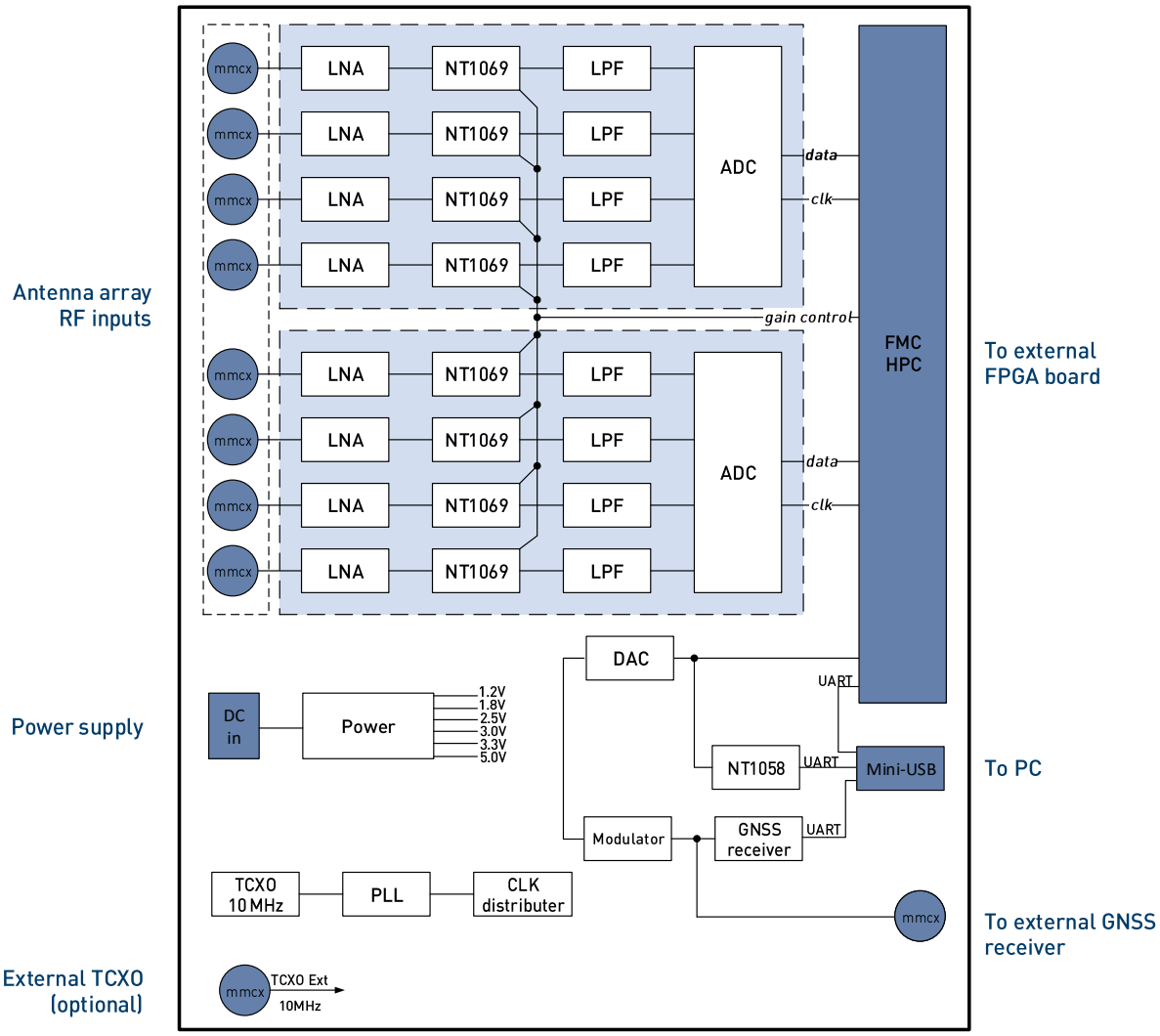

Figure 4.1 - The NT1069X8_FMC simplified block diagram

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.
- NT1058 is microcontroller which includes digital Baseband Processor and 128-channels hardware correlator (2x128) for signals tracking and primary processing of digital signals. NT1058 provides the navigation solution (PVT) in autonomous mode (standalone mode) based on supported GNSS signals (see Table 1, №1).

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

5 DIMENSIONS

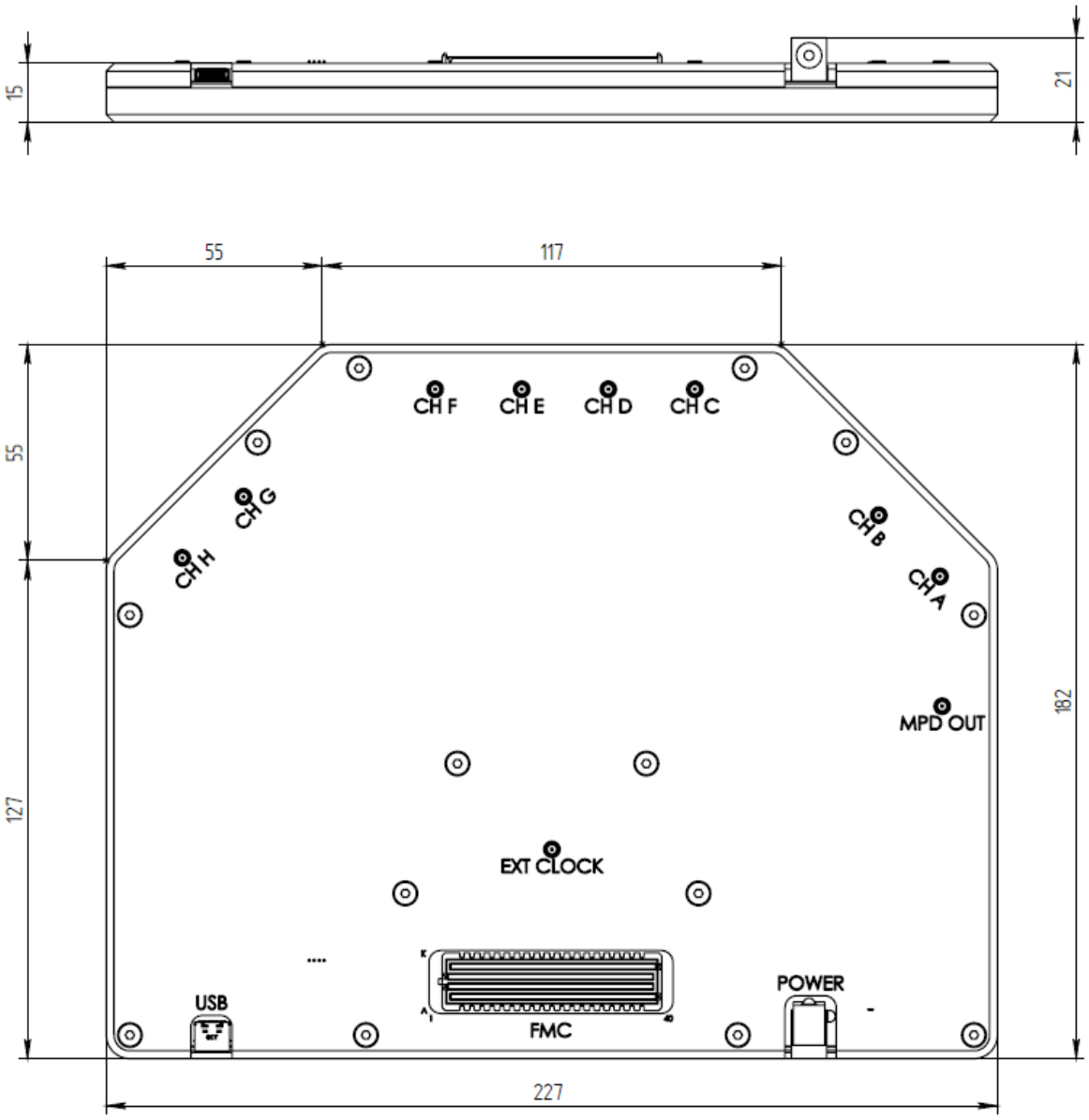

Figure 5.1 – The NT1069X8_FMC Dimensions

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.

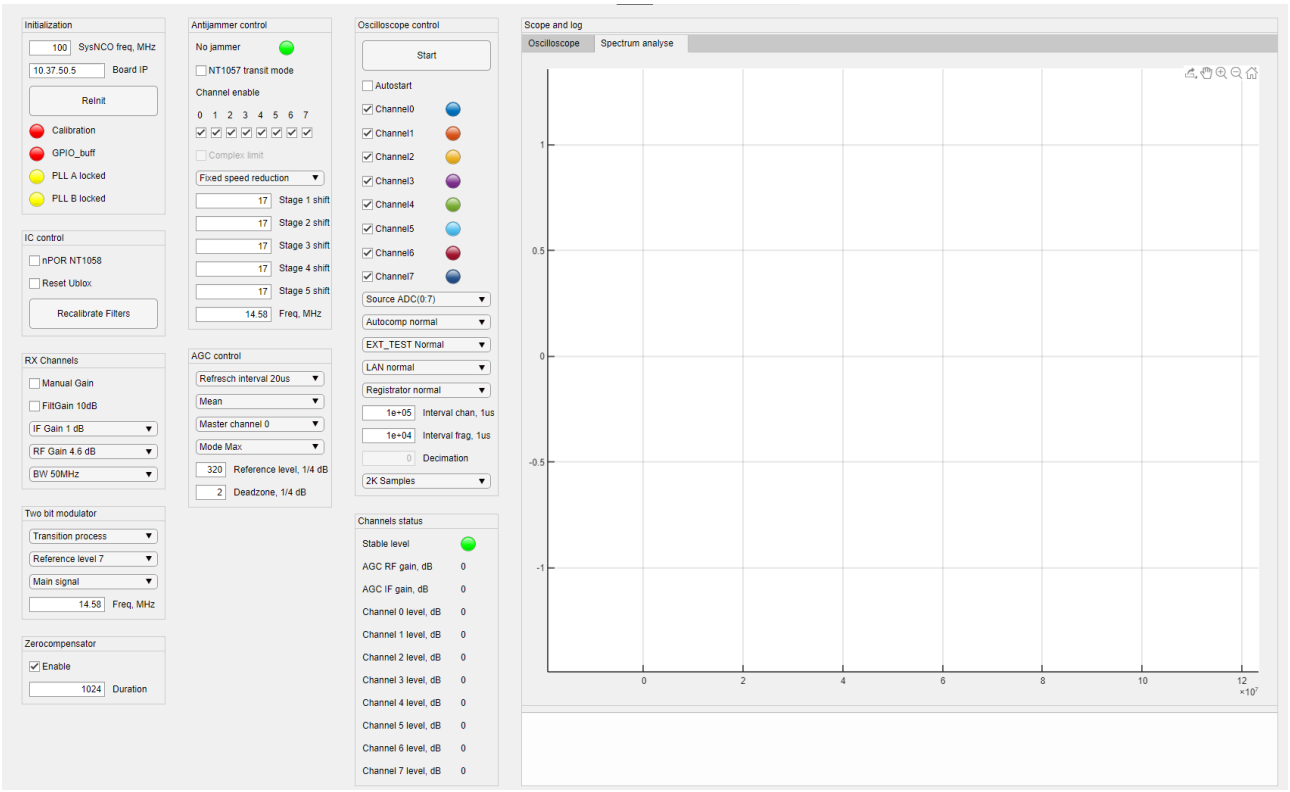

Figure 6.1 – The NT1069X8_FMC GUI Main screen

The *Figure A.1* shows the practical use of the NT1069X8_FMC to develop and test own FPGA-based implementation of the Anti-jamming algorithm.

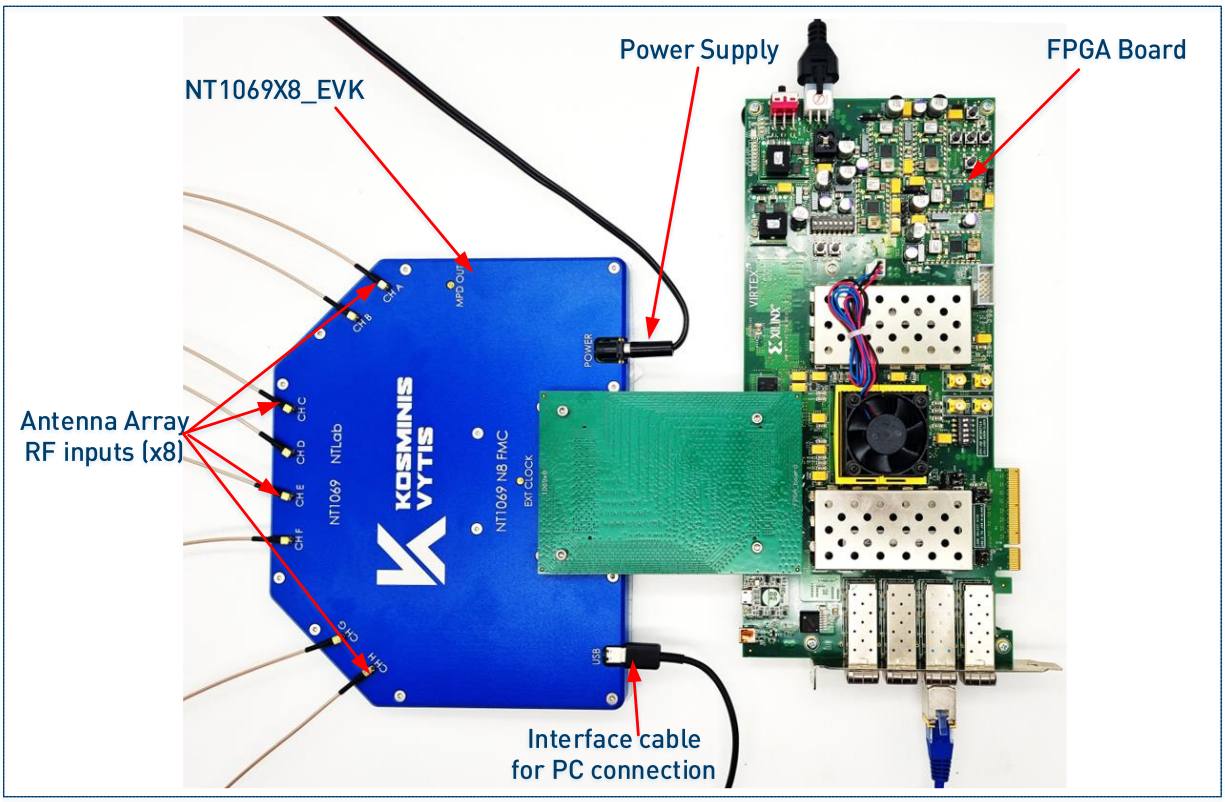

Figure A.1 – The NT1069X8_FMC with FPGA Evaluation Board

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 115

APPENDIX B REFERENCE DESIGN

The *Figure B.1* shows the 8-channel Anti-jamming Receiver's reference design, based on NT1069X8_FMC board and NTLab Anti-jamming processor NT1056.

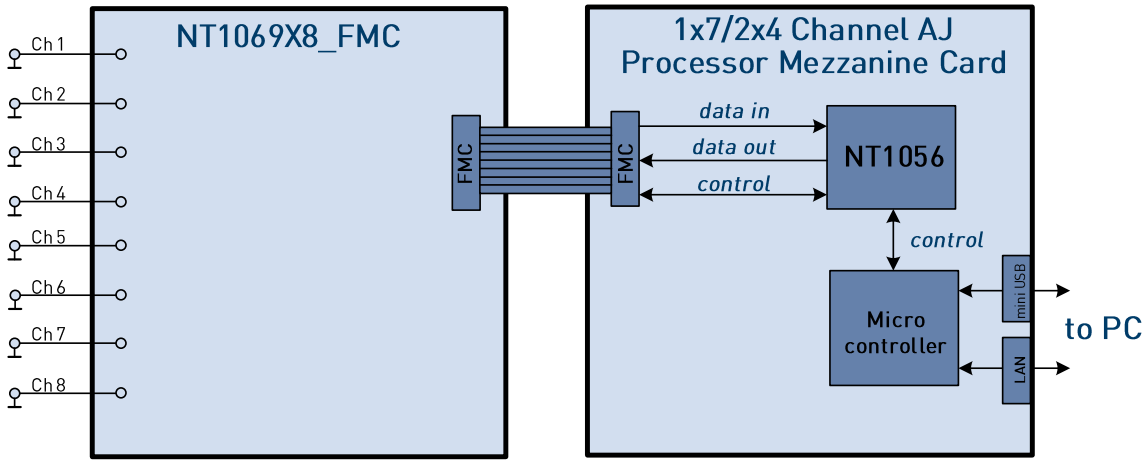

Figure B.1– The NT1069X8_FMC with 8-channel Anti-jamming Mezzanine Card simplified block diagram

NT1056 is the Anti-jamming GNSS processor for use with 8-element antenna array. The NT1056 implements the Null-Steering algorithm based on the classic auto-compensator architectures with equalization channels. It creates the dynamic nulls for protection GNSS module against narrowband and broadband interference sources.

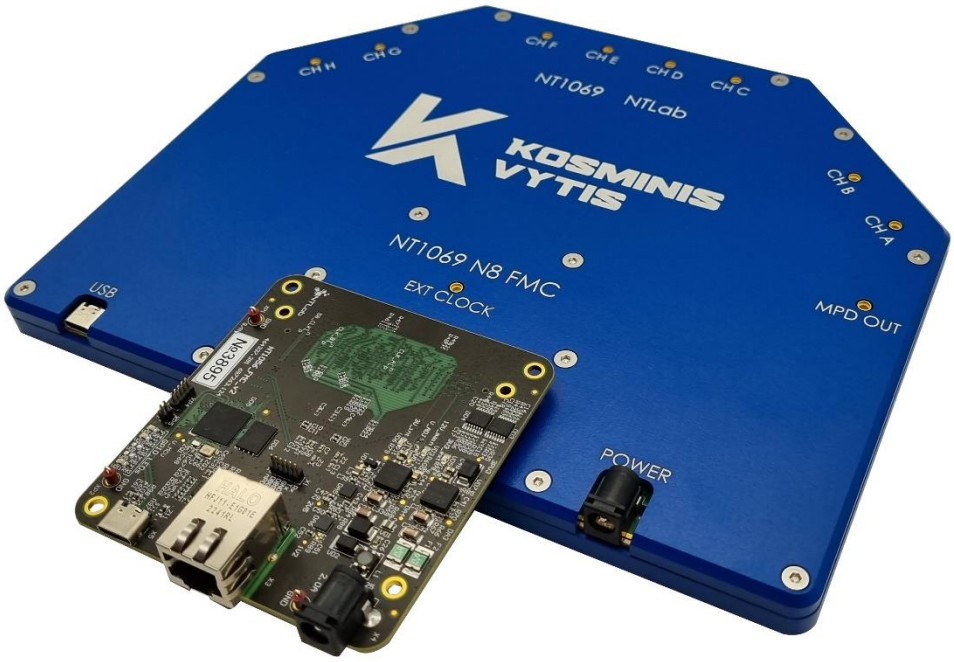

Figure B.2 – The NT1069X8_FMC with 1x7/2x4-channels NT1056 Anti-Jamming Processor Mezzanine Card

APPENDIX C REFERENCE DESIGN

The *Figure C.1* shows the 4-channel Anti-jamming Receiver's reference design, based on NT1069X8_FMC board and NTLab Anti-jamming processor NT1057.

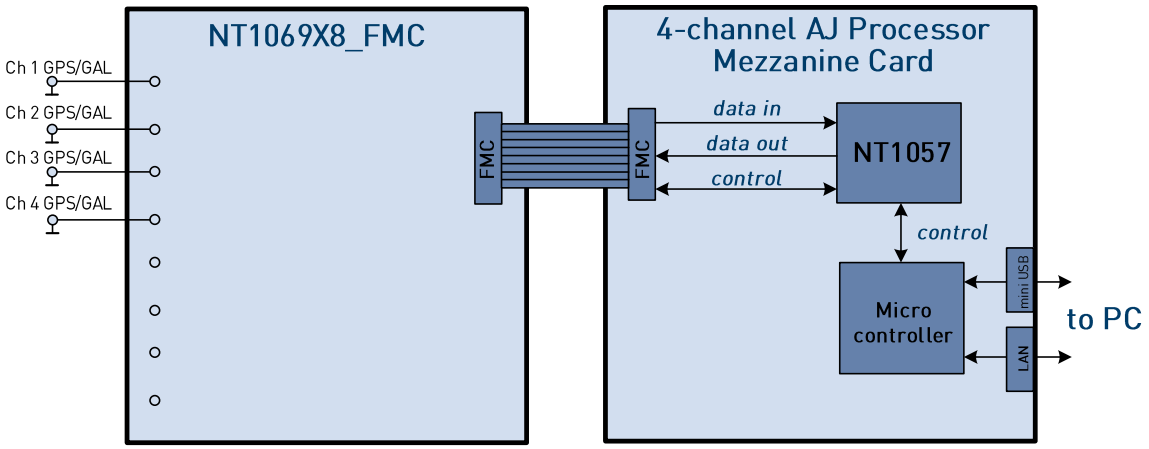

Figure C.1– The NT1069X8_FMC with 4-channel Anti-jamming Mezzanine Card simplified block diagram

NT1057 is the Anti-jamming GNSS processor for use with one 4-element antenna array. The NT1057 implements the Null-Steering algorithm based on the classic auto-compensator architectures with equalization channels. It creates the dynamic nulls for protection GNSS module against narrowband and broadband interference sources.

Figure C.2– The NT1069X8_FMC with 4-channels NT1057 Anti-Jamming Processor Mezzanine Card

CONTACTS

Kosminis Vytis, UAB
88 Zalgirio, LT-09303 Vilnius, Lithuania
e-mail: sales@kosminis-vytis.lt