Frequency Converter up **NMVCH AXIe-0 Up**

The NMVCH AXIe-0 Up module is a carrier of mezzanine modules made in the AXIe-0 standard. The module ensures the functioning of various modules installed in it, made in the form of double mezzanines. The number of slots in the module is one.

Main function

- radio frequency spectrum Converter
- accumulates a large amount of information in the form of binary codes coming from the mezzanine at high input frequencies and a large number of channels, when it is not possible to process data in real time.

The NMVCH AXIe-0 Up module is used as part of information measurement systems based on the AXIe-0 backbone and is installed in the AXIe 0 standard chassis on the seats of the instrument modules.

A single mezzanine can be installed in the module, compatible with the module via the exchange and management interface, which can work for input, output, or data input and output simultaneously.

It is allowed to install different types of functional mezzanines with different clock frequencies in the module.

In the mode of information output to the mezzanine, the The NMVCH AXIe-0 Up provides output of data recorded in its internal memory at specified time intervals in a single time grid to the specified mezzanine.

The module performs batch buffering of data from heterogeneous mezzanines with data binding to a single time grid and provides access to the current (received at the last time) measurement results on any channel.

The exchange process with the mezzanine can be started:

- programmatically;
- by a programmatically selected signal (any of 12) of the trigger bus signals coming from the AXIe trunk (external trigger mode);
- by the signal “start NM” from the mezzanine (asynchronous operation mode).

The module supports exchange with the mezzanine via two interfaces:

- management interface - used for configuring and monitoring the state of the mezzanine;
- data interface - used for reading the measurement results of the mezzanine in RAM and output data arrays from RAM to the output mezzanine.

The module provides verification of the main technical characteristics in the self-monitoring mode.

Specifications

The parameters of the input “RF INPUT»: • connector type-SMA socket; • input impedance - 50 Ohms; • standing wave voltage coefficient (VSWR) no more than 1.5; • maximum non-destructive signal power of at least 20 dBm (100 mW)	Output parameters “RF OUTPUT”: • connector type-SMA socket; • input impedance – 50 Ohm; • maximum output power not exceeding 10 dBm (10 mW)
	Work in two program-defined modes: • “direct passage”; • “frequency transfer”
In the “frequency transfer” mode, the bandwidth level is -3 dB relative to the center frequency: • 50 to 9800 MHz at least 150 MHz; • 9800 to 10000 MHz at least 80 MHz	In the “forward pass” mode, the bandwidth level is -3 dB from 0.1 to 450 MHz
	The center frequency of the input signal is set in the range from 50 to 400 MHz in 25 MHz increments
The center frequency of the output signal is set in the range from 50 to 10,000 MHz in 50 MHz increments	The level of harmonic distortion when the input signal power is 0 dB and the transmission coefficient is 0 dB no more than minus 30 dB in the frequency range from 50 to 10000 MHz
The level of inharmonic distortion with an input signal power of 0 dB and a transmission coefficient of 0 dB no more than minus 40 DBN in the frequency range from 50 to 10000 MHz	Rated output power when the transmission coefficient is reduced by 1 dB (compression point R1db) at least 5 dBm
The intersection point of third-order intermodulation components (OIP3) is not less than 15 dBm	The spectral power density of the noise output of the module, measured in the range up to 10 GHz, no more than -120 dB / Hz. The transmission coefficient is set in the range from -63 to 0 dB in 0.5 dB increments.
Limits of permissible absolute error in setting the module transmission coefficient in the frequency range from 10 MHz to 10 GHz $A = \pm (15 \cdot 10\text{-}6 \cdot \lvert K \rvert \cdot F + 0{,}04 \cdot \lvert \Delta F \rvert + 1)$ дБ, where $\lvert K \rvert$ – absolute value of the programmed transmission coefficient in dB from 0 to 63 dB; F – value of the Central output frequency in MHz, in “forward pass” mode from 50 to 400 MHz in 25 MHz increments, in “frequency transfer” mode from 50 to 10000 MHz in 50 MHz increments; $\lvert \Delta F \rvert$ – absolute value of detuning from the Central output frequency F in MHz from 0 to 75 MHz.	Program selection of the 100 MHz reference source: • internal reference generator; • external oscillator; • external LVDS differential pair CLK100 of the AXIe trunk.
	Long-term relative frequency instability of the internal reference oscillator (without frequency adjustment): • per day-no more than ± ($2 \cdot 10^{-8}$); • per year-no more than ± ($2 \cdot 10^{-7}$).

<table>
<tr><td colspan="2">Note
The absolute error in setting the transmission coefficient is provided after the module is warmed up for 45 minutes
Frequency instability is provided after the module is warmed up for 45 minutes.</td></tr>
<tr><td>The internal reference generator of the module has the ability to programmatically adjust the reference frequency within ± ($5 \cdot 10^{-7}$)</td><td>Output of the reference frequency signal from the internal generator to the output connector “100 MHz OUT” at the program command</td></tr>
<tr><td>Parameters of the reference frequency output “100 MHz OUT”:
• connector type-SMB socket;
• output wave resistance – 50 Ohm;
• power – at least 4 dBm;
• the frequency of 100 MHz.</td><td>Input parameters of the reference frequency “100 MHz IN”:
• connector type-SMB socket;
• input impedance – 50 Ohm;
• power – not less than 0 dBm;
• frequency – (100 ± 1) MHz.</td></tr>
<tr><td colspan="2">Total spectral power density of the module phase noise at a carrier frequency of 1 GHz no more:
• -75 DBN / Hz on detuning from 100 Hz to 100 kHz;
• -100 DBN / Hz at 1 MHz tuning.</td></tr>
<tr><td rowspan="4">Characteristics of the mezzanine data interface:
• the number of bits of the data bus - 32;
• the number of words in the mezzanine is from 1 to 31. Data exchange between the module and the mezzanine occurs in the form of frames. Frame length from 1 to 31 words;
• the frame read / write frequency over the data bus is 16 MHz. The frame read/write TP period is set programmatically;
• the delay in reading/writing the first frame From the moment when the “START” signal appears on the data interface is set programmatically in the range from 125 ns to 1.0485760625 s with steps of 62.5 ns in the form of the number of time intervals with a duration of 62.5 ns;
• the delay of appearance of the signal “START” on the interface data from the signal “START” in the line of bus trigger signals coming from the AXIe of the highway, is in the range from 40 to 100 ns;
• the period TP of the treatment device to the mezzanine is set in the range from 187,5 ns to 1,0485759375 with steps of 62.5 ns as the number of time intervals having a duration of 62.5 ns</td><td>Characteristics of the mezzanine management interface:
• number of bits of the control bus - 16 bits;
• number of bits of the address bus – 5 bits;
• recording cycle duration - from 160 to 187 ns;
• the minimum reading cycle duration is 160 ns</td></tr>
<tr><td>Access to the mezzanine can be single or periodic (set programmatically)</td></tr>
<tr><td>The type of “START” signal on the data interface is selected programmatically - either a 190 ns pulse or a constant level during the entire exchange time</td></tr>
<tr><td>The module has two methods for monitoring exchange processes with mezzanines:
• control of the sequence of words coming from the mezzanine;
• control by “DATA_VALID” and “EMPTY” signals.</td></tr>
<tr><td>Control the structure of the mezzanine frame as follows: a bit (33rd) has been added to the data bus, the content of which is “1” for the first word of the frame and “0” for subsequent words of the frame.

If these conditions are not met, an error flag appears and an interrupt request may be issued</td></tr>
<tr><td>Control by the “DATA_VALID” and “EMPTY” signals as follows: the device’s mezzanine is a FIFO-type RAM, so when reading from the mezzanine, the presence of data in the mezzanine’s FIFO is monitored (the “DATA_VALID” signal = “0”), and when writing to the mezzanine, the absence of data is monitored (the EMPTY = “0”signal). If these conditions are not met, an error flag appears and an interrupt request may be issued</td><td>Synchronous and asynchronous exchange mode, in which the time of reading and writing information when exchanging with the mezzanine is determined by the mezzanine itself using service signals received by the module from the mezzanine</td></tr>
<tr><td>Ability to read current data (measurement results, survey) with timestamps at any time without interrupting the device operation (measurement, survey) and with a delay of no more than one measurement period</td><td>Exchange with the mezzanine using SDRAM</td></tr>
<tr><td rowspan="2">Program selection of the reference frequency source for its operation and the operation of the mezzanine from three possible options:
• internal signal generator;
• external reference frequency source;
• external LVDS differential pair CLK100 AXIe trunk</td><td>The base interface of the AXIe module trunk conforms to the IEEE 802.3 10/100 Base-t standard. IP address assignment modes – DHCP, AutoIP, static (default 192.168.1.100)</td></tr>
<tr><td>Module ID – «INFORMTEST, UNMBASE»</td></tr>
<tr><td rowspan="3">The module provides the following mezzanine supply voltages and limiting currents:
• 5 V; 2 A;
• -5,2 V; 0,7 A;
• 12 V; 0,5 A;
• -12 V; 0,375 A</td><td>Dimensions-30 × 350 × 318.9 mm</td></tr>
<tr><td>The power consumed by the module with the installed mezzanine does not exceed 50 W</td></tr>
<tr><td>Module supply voltage - from -53 to -45 V</td></tr>
<tr><td>Current consumed by the power supply circuit:
• maximum peak (Ipm) - no more than 1.1 A;
• maximum dynamic (Idm) – no more than 1 A</td><td>Module weight-3.2 kg</td></tr>
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