Key Features

- RF to 40GHz
- Minimum Phase Noise
- Low Conversion Loss
- Harmonic-filtered LO
- Standalone Operation
- Front Panel OLED Display
- USB Control & Power
- Ultra Compact
- Extremely Affordable
- External Reference Source Input
- Audio & Visual Feedback

DS Instruments

MX-SERIES INTEGRATED-LO MICROWAVE MIXERS

Wideband Mixers with Integrated Programmable Local Oscillators

Eliminate the need for an expensive external signal source when up and down converting!

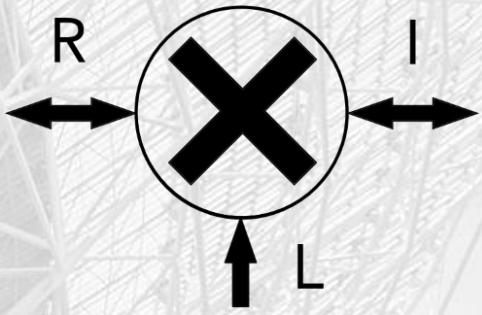
The MX family of integrated mixers combines a wideband RF mixer with a high performance programmable signal source to act as the local oscillator. This saves the user on setup time, equipment space, total cost, and system complexity for many microwave applications.

This device family covers all the most common communications bands up to 40GHz, and provides and extremely wideband IF coverage making applications like down converting easier.

Remote Operation

Industry standard SCPI commands allow the MX Family devices to be controlled by any PC with a USB interface.

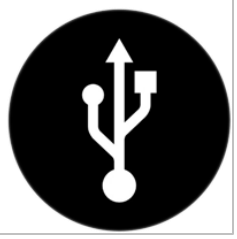
The USB port is configured as a standard virtual COM port so that no additional custom drivers or setup is required.



MX SERIES Integrated Mixers

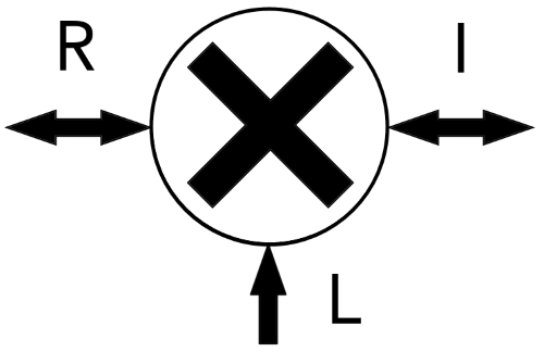
Common Device Features

- Premium Microwave SMA RF & IF Connectors
- Standard USB Power Input & Virtual COM Port Interface
- Crisp & Bright OLED Front User Display
- Front Control Buttons with Audio Feedback
- Remote automated programmable
- Compact Aluminum Enclosure
- Internal / External Reference Frequency MCX ports
- Extreme space and cost savings
- Ethernet on select models



Typical Device Applications

- General RF lab testing applications
- Receiver development
- Communications applications
- Satellite uplink and downlinks
- Radar systems
- Defense applications
- Wideband transponders
- Military end-use
- Test & measurement
- Cellular base station test
- Block conversion



MX SERIES Integrated Mixers

Device Feature Matrix

	MX2500	MX6000	MX12000	MX20000	MX30000	MX40000
LO Frequency	35-2500M	1.5-6G	5-14G	10-22G	18-30G	25-40G
RF Frequency	25-2500M	1.5-6G	5-14G	10-22G	15-30G	20-40G
IF Frequency	5-1000M	10-2000M	10-6000M	10-6000M	10-8000M	25-15000M
Conversion Loss (dB)	<8	6-8	6-10	8-12	9-14	10-16
Power Connector	USB-C	USB-C	USB-C	USB-C	USB-C	USB-C
Harmonic Filtering	X	X	X	X	X	X
Mid Band Phase Noise @ 10Khz	-90dBc	-72dBc	-98dBc	-94dBc	-90dBc	-90dBc
LO Frequency Step	1.25KHz	2.5KHz	2Hz	2Hz	2Hz	3Hz
Reference Frequency (MHz)	10	10	10/100	10/100	10/100	10/100
Ethernet Port			X	X	X	X

MX Integrated Mixer Family

Device Specifications

Band 1

MX2500L

- Local oscillator range: **35–3000MHz**
- Mixer RF frequency range: **25-2500MHz**
- Mixer IF frequency range: **5-1000MHz**
- Typical LO to RF isolation: 35dB
- Typical LO to IF isolation: 25dB
- Phase noise, 2.4GHz @ 10KHz: **-89dBc**
- Low conversion loss: < **8dB** typical
- Return loss: >12 dB
- Typical IP3: 20dBm
- Input P1dB: +5dBm
- Modes: Up and down-converting
- LO Harmonic level (Filtered): < **-30dBc**
- Max input power: +17dBm
- LO frequency step size (worst case): 2.4KHz
- RF/IF ports: SMA
- Power / data port: USB Type-C
- Reference frequency stability: ±2.5 PPM (10MHz)
- Current requirement: 0.50A typical (0.7A max)
- Mass: 140g
- Operating temp: 0 to 50C
- Voltage input range: 4.5V – 5.35V

Band 2

MX6000C

- Local oscillator range: **1000 – 6000 MHz**
- RF range: **1500 – 6000 MHz**
- IF range: **5 - 2000 MHz**
- Low conversion loss: **6-8 dB Typ.**
- LO-RF isolation: 30 dB typical
- LO-IF isolation: 20 dB typical
- RF P1dB : +1 dBm
- IP3: 10 dBm
- Min LO frequency step size: 5KHz
- LO phase noise at 6GHz -72dBc (10KHz offset)
- Reference frequency stability: ±2.5 PPM (10MHz)
- Return loss: 10 dB typical
- Max input power: **+15dBm**
- Modes: Up / Down Converting
- LO Harmonic level (Filtered): < -30dBc
- LO output port: Yes (MCX)
- RF port: SMA
- Power / data port: USB Type-C
- Current requirement: 0.40A to 0.65A
- Mass: 140g
- Operating temp: 0 to 50C
- Voltage input range: 4.5V – 5.4V

MX Integrated Mixer Family

Device Specifications

Band 3
MX12000

- Local oscillator range: **5GHz – 14GHz**
- RF range: **5GHz – 14GHz**
- IF range: **10MHz to 6000MHz**
- RF input P1dB > +10dBm
- LO phase noise at 12GHz: < **-98dBc** @ 10KHz
- Return loss > 10 dB
- Third-order intercept: 15-20 dBm
- Low conversion loss: **7-10dB** Typical
- Single-sideband noise figure: 7.5-10dB
- RF to IF isolation: 10-19dB
- LO to RF isolation: 30-45dB
- LO to IF isolation: 20-45dB
- Min LO frequency step size: 2Hz
- Modes: Up / Down Converting
- Max input power: **+23dBm**
- LO Reference frequency: 100MHz & 10MHz
- Reference Source: **±280 PPB** (10MHz)
- RF ports: Premium Gold SMA
- Power / data port: USB type-C
- Current requirement: ~1.25A

Band 4
MX20000

- Local oscillator range: **10GHz – 22GHz**
- RF range: **10 – 20 GHz+**
- IF range: 10MHz to 6GHz
- RF input P1dB: +11dBm
- Max input power: +23dBm
- Min LO frequency step size: 10Hz
- LO phase noise at 18GHz: < **-94dBc** (10KHz offset)
- Typical Return loss > 10dB
- Typical Conversion Loss: **8-12dB**
- Single-sideband noise figure: 7-11dB
- RF to IF isolation: 15-25dB
- LO to RF isolation: 40-46dB
- LO to IF isolation: 30-40dB
- Modes: **Up / Down** Converting
- 10MHz reference port - MCX
- LO Reference frequency: 100MHz & 10MHz
- Reference Source: **±280 PPB** (10MHz)
- RF port: Premium Gold SMA (26GHz rated)
- Power / data port: USB type-C
- Current requirement: ~1.50A
- Standard Ethernet port

MX Integrated Mixer Family

Device Specifications

Band 5
MX30000

- Integrated **18–30GHz** Local Oscillator
- Mixer RF frequency range: **15-30GHz**
- Mixer IF frequency range: **10-8000**MHz
- Conversion loss: **10-14dB** typical
- Typical IP3: 15-19dBm
- Input P1dB: **9-12dBm**
- Phase noise, 30GHz @ 10KHz: **-90dBc**
- Max RF input power: **+17dBm**
- Single-sideband noise figure: 10.5dB
- Typical LO to RF isolation: 46dB
- Typical LO to IF isolation: 28-40dB
- Typical RF to IF isolation: 22-38dB
- Up and down-converting supported
- Typical return loss: >7dB
- Min LO frequency step size: 2Hz
- LO Reference frequency: 100MHz & 10MHz
- Reference Source: **±10 PPB** (10MHz **Oven**)
- RF ports: **2.92mm**, SMA
- Power / data port: Dual USB type-C
- Current requirement: 2.0A
- **Ethernet** port

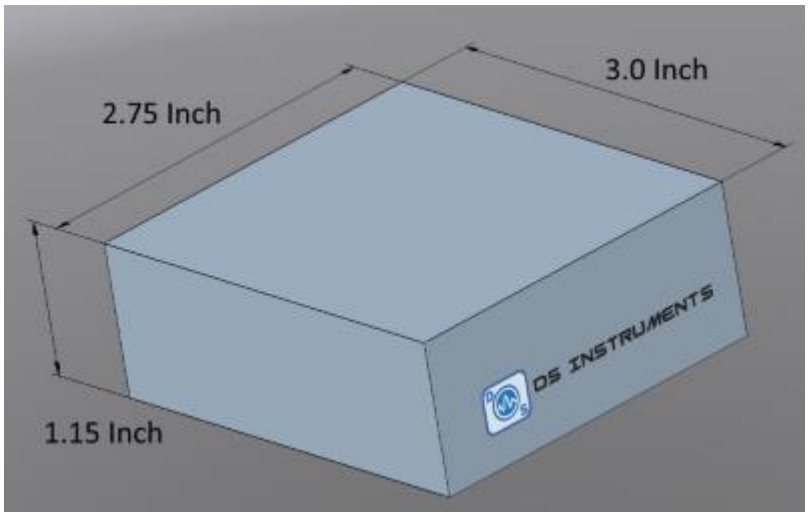
Band 6
MX40000

- Integrated local oscillator: **25–40GHz**
- Mixer RF frequency range: **20-40GHz**
- Mixer IF frequency range: **10MHz-15GHz**
- Conversion loss: **10-16dB** typical
- Typical IP3: **20dBm**
- Input P1dB: **+10dBm**
- Phase noise, 40GHz @ 10KHz: < **-90dBc**
- Max RF input power: **+20dBm**
- Typical LO to RF isolation: 35dB
- Typical LO to IF isolation: 25-45dB
- Typical RF to IF isolation: 10-30dB
- Up and down-converting supported
- Typical return loss: >6dB typical
- Min LO frequency step size: 3Hz
- LO Reference frequency: 100MHz & 10MHz
- Reference Source: **±10 PPB** (10MHz **Oven**)
- RF ports: **2.4mm**, SMA
- Power / data port: Dual USB type-C
- Current requirement: 2.40A
- Ethernet port

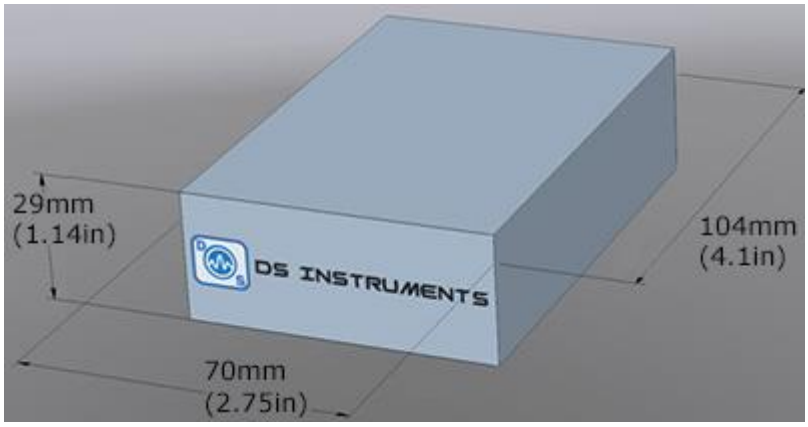
MX Integrated Mixer Family

Physical Features

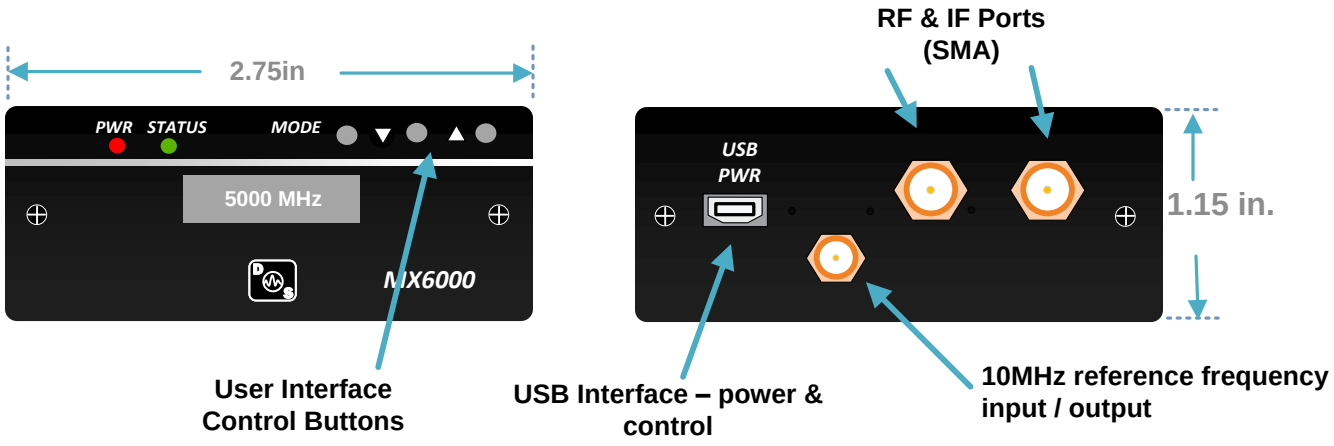
- MX2500L
- MX6000C



- MX12000
- MX20000

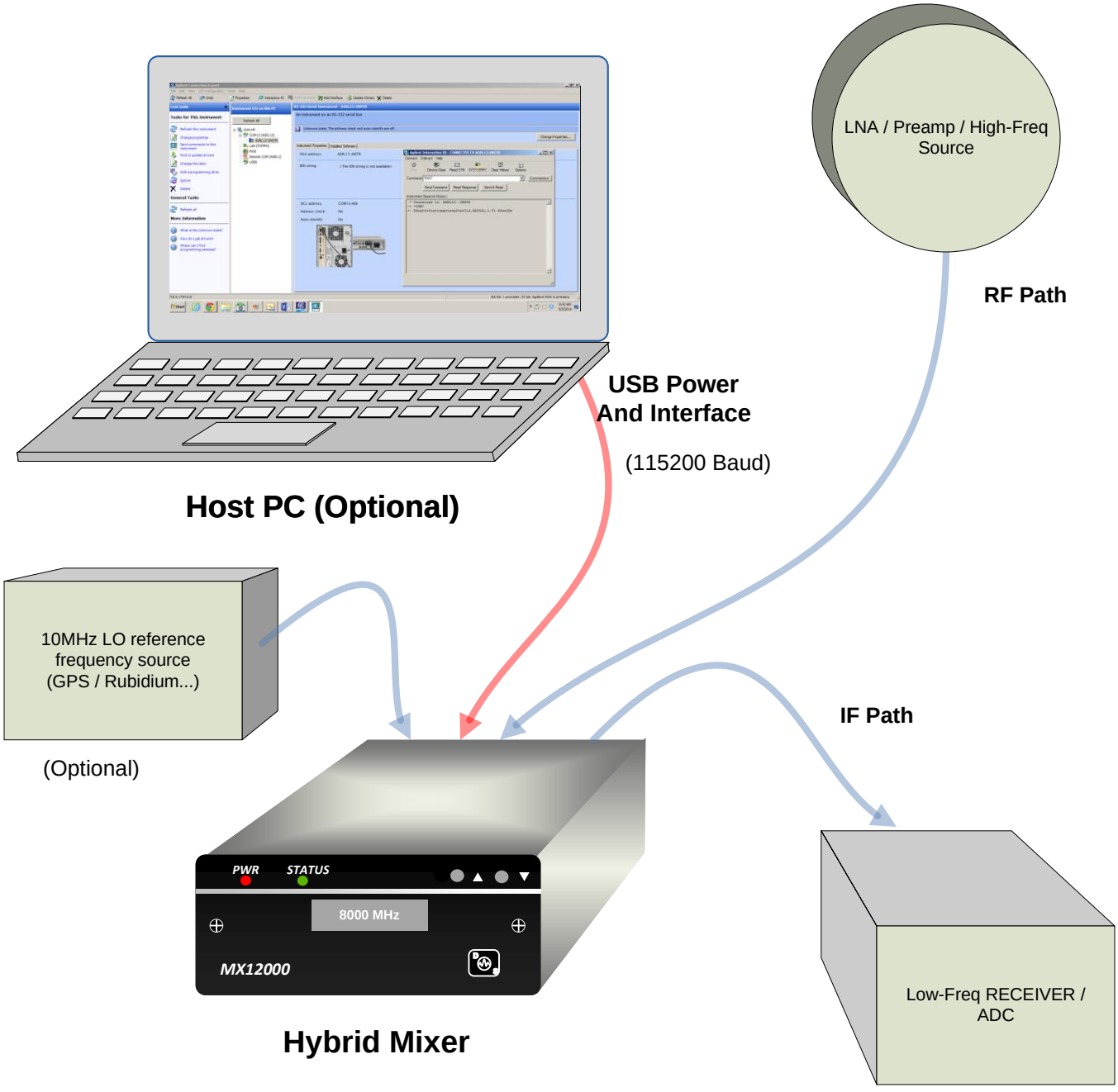


Common Front and Rear Panel Features



MX Integrated Mixer Family

Typical User Connections



MX Integrated Mixer Family

SCPI Command List – MX2500 / MX6000

DS Instruments - MX6000 Integrated-LO Mixer SCPI Command List (V4)

Command	Example 1	Example 2	Description
FREQ:CW	FREQ:CW 400MHZ	FREQ:CW 3.33GHZ	Set LO Frequency
FREQ:CW?			Return current LO Frequency
OUTP:STAT ON			Turn on the mixer output
OUTP:STAT OFF			Turn off the active mixer
OUTP:STAT?			Return status of the LO output
POWER	POWER 10	POWER -30	Fine tune the LO power (+-100)
POWER?			Return power tuning value - default 0
AUXLO:STAT	AUXLO:STAT ON	AUXLO:STAT OFF	Set LO output on devices with an external port
*IDN?			Return the SCPI identification string
*PING?			returns "PONG!" if device is responding
*REV?			Get the hardware revision number
*RST			Reset unit now
*CLS			Clear all errors
*INTREF?			Is the internal reference enabled?
*EXTREF?			Is an external reference signal detected?
*INTERNALREF 1			Set reference frequency to internal
*INTERNALREF 0			Set reference frequency to external
*INTERNALREF A			Default autodetect reference at power-on
*REFUPDATE			
SYST:ERR?			Return any pending error messages
SYST:DBG?			Return the last debug message
*SYSVOLTS?			Return system USB voltage
*DISPLAY	*DISPLAY OFF	*DISPLAY ON	Power on of off the display
*BUZZER	*BUZZER ON	*BUZZER OFF	Mute the buzzer
*BUTTONS ON			
*SAVESTATE			Save frequency & attenuation as boot defaults
*UNITNAME	*UNITNAME Bob	*UNITNAME DEV-34	Set a unique name in flash memory
*UNITNAME?			Return this device's name

Command terminator is LINEFEED ("\n")

(COM BAUD: 115200)

MX Integrated Mixer Family

SCPI Command List

DS Instruments - MX 12000/20000/30000 - SCPI Command List (V4)

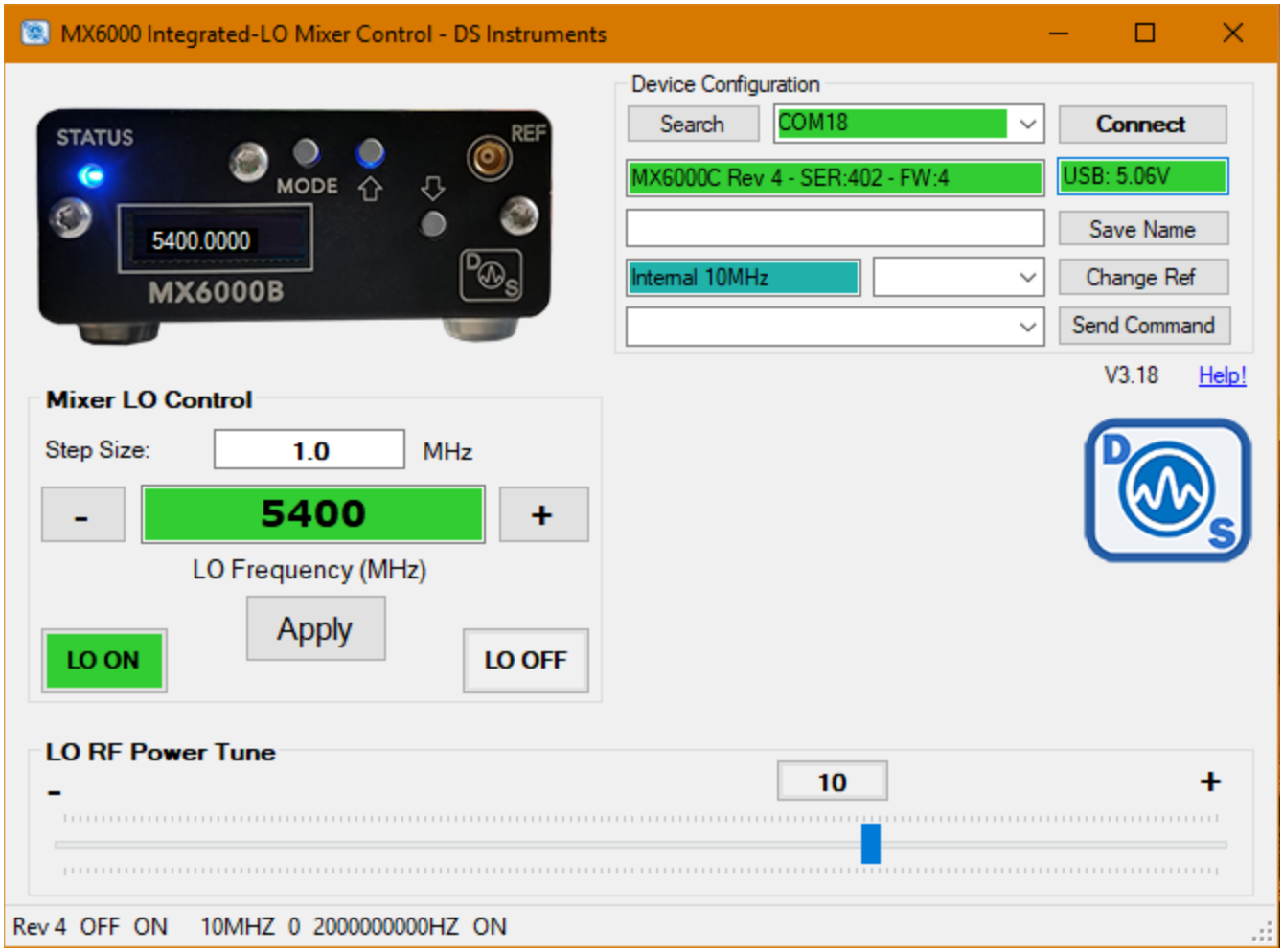
Command	Example 1	Example 2	Description
FREQ:CW	FREQ:CW 7GHZ	FREQ:CW 9.33GHZ	Set LO Frequency
FREQ:CW?			Return current LO Frequency
OUTP:STAT ON			Turn ON the mixer LO
OUTP:STAT OFF			Turn off the MIXER LO
OUTP:STAT?			Return status of the LO output
LOPOWER xx			Adjust the LO power level if available
LOPOWER?			Return the current setting, default is 0
SYSREF INT			VCXO locked to internal 10MHz TCXO
SYSREF EXT			VCXO locked to an external 10MHz
SYSREF FREE			VCXO not locked to 10MHZ - lowest noise
SYSREF AUTO			Automatic choice between internal and external
SYSREF?			Return the current source of the reference signal
SYSREF STATUS?			Returns the detected status of current reference
SYSREF UPDATE			After a reference change this will relock the source
SYSREF OFF			Internal sources disabled. Requires external 100MHz
SYSREF LOCK?			Check if the ref PLL is locked (100MHz to 10MHz)
*IDN?			Return the SCPI identification string
*PING?			returns "PONG!" if device is responding
*RST			Reset unit now
*REV?			Get hardware revision
*DATE?			Return the production test date string
*DISPLAY	*DISPLAY OFF	*DISPLAY ON	Power on of off the display
*BUZZER	*BUZZER ON	*BUZZER OFF	Mute the buzzer
*BUTTONS ON			Turn back on the front buttons
*SYSVOLTS?			Return measured system USB voltage
*SAVESTATE			Save frequency & attenuation as boot defaults
SYST:ERR?			Returns any pending error codes
SYST:DBG?			Returns the next debug message
*UNITNAME	*UNITNAME Bob	*UNITNAME DEV-34	Set a unique name in flash memory
*UNITNAME?			Return this device's name

Command terminator is LINEFEED ("\n")

(COM BAUD: 115200)

MX Integrated Mixer Family

Windows Mixer Control GUI – MX2500L & MX6000C

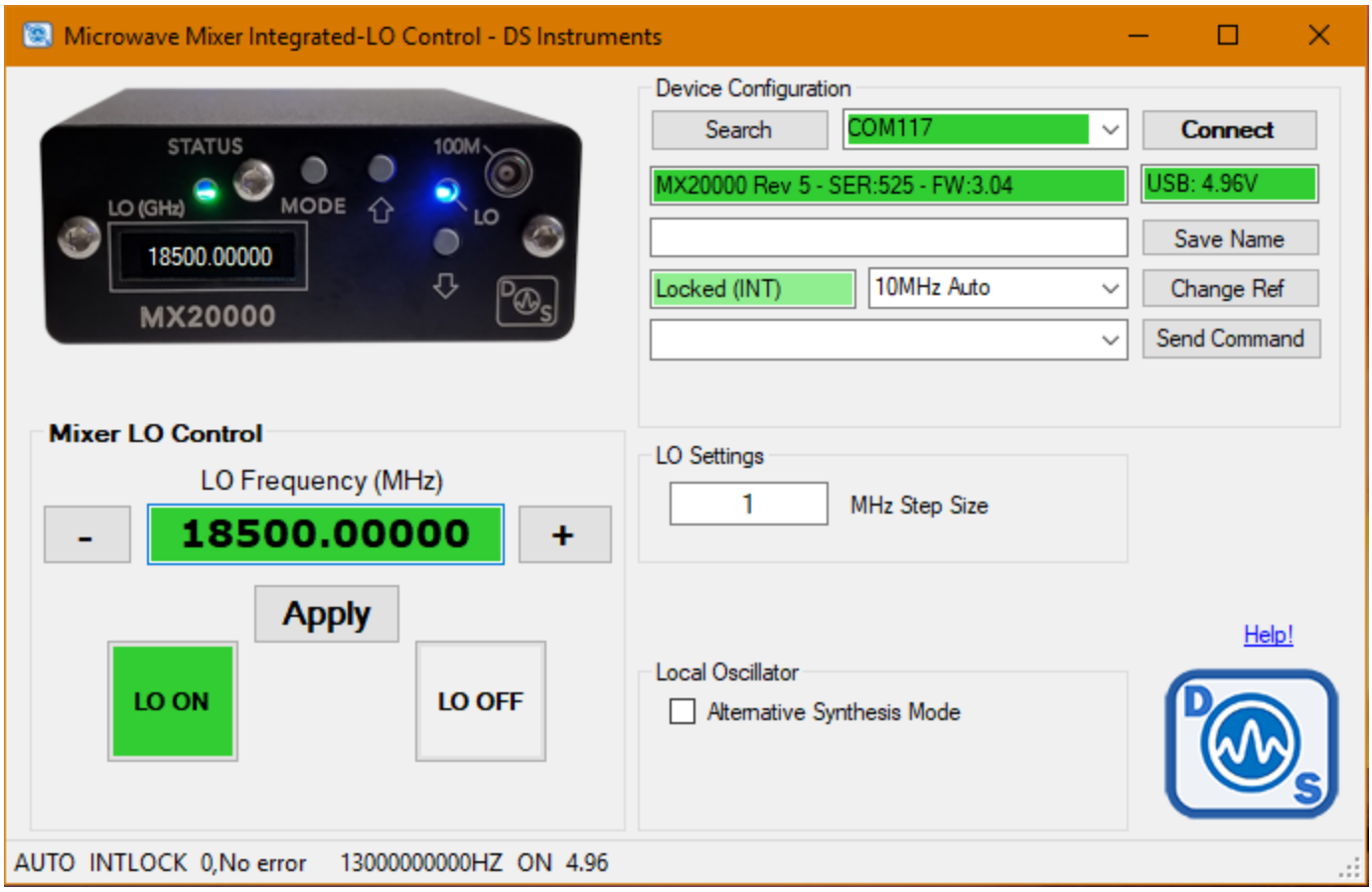


Usage Tips

- The MX2500L, MX6000C, and MX12000 allow the user to change the LO power level to optimize for minimal conversion loss or port isolation and spurs depending on project requirements.
- Apply an external 10MHz reference if desired **before** powering up the unit. The internal reference will automatically be disabled.
- To store a custom device name or ID tag into flash memory use the “save name” button and text field under the device info display box. This functionality can be found in all of our products.
- MX devices with a 100MHz MCX port also allow direct input of a 100MHz clock reference, or external access to the device’s own onboard low noise oscillator.

MX Integrated Mixer Family

PC Control Software – MX12000, MX20000, MX30000



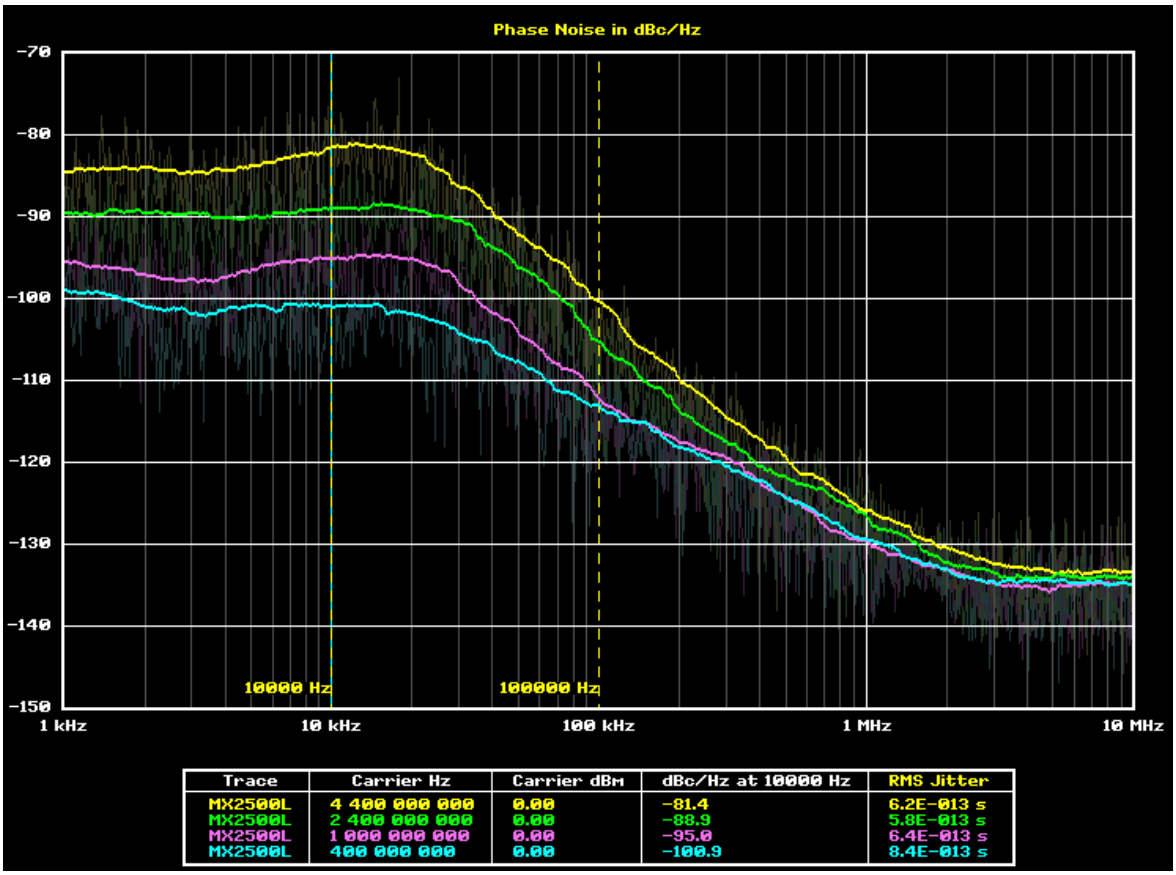
USB Remote SCPI Common Commands

FREQ:CW xxxxMHz	- Set the LO frequency
FREQ:CW?	- Return LO frequency
OUTP:STAT ON	- Turn on the LO signal
OUTP:STAT OFF	- Turn off the LO signal
OUTP:STAT?	- Return the state of the LO signal
*IDN?	- Return standard identification string
*RST	- Reset device
*BUZZER OFF	- Disable buzzer
*DISPLAY OFF	- Disable display to speed up remote command response
*SAVESTATE	- Save LO frequency and state to boot-up default memory

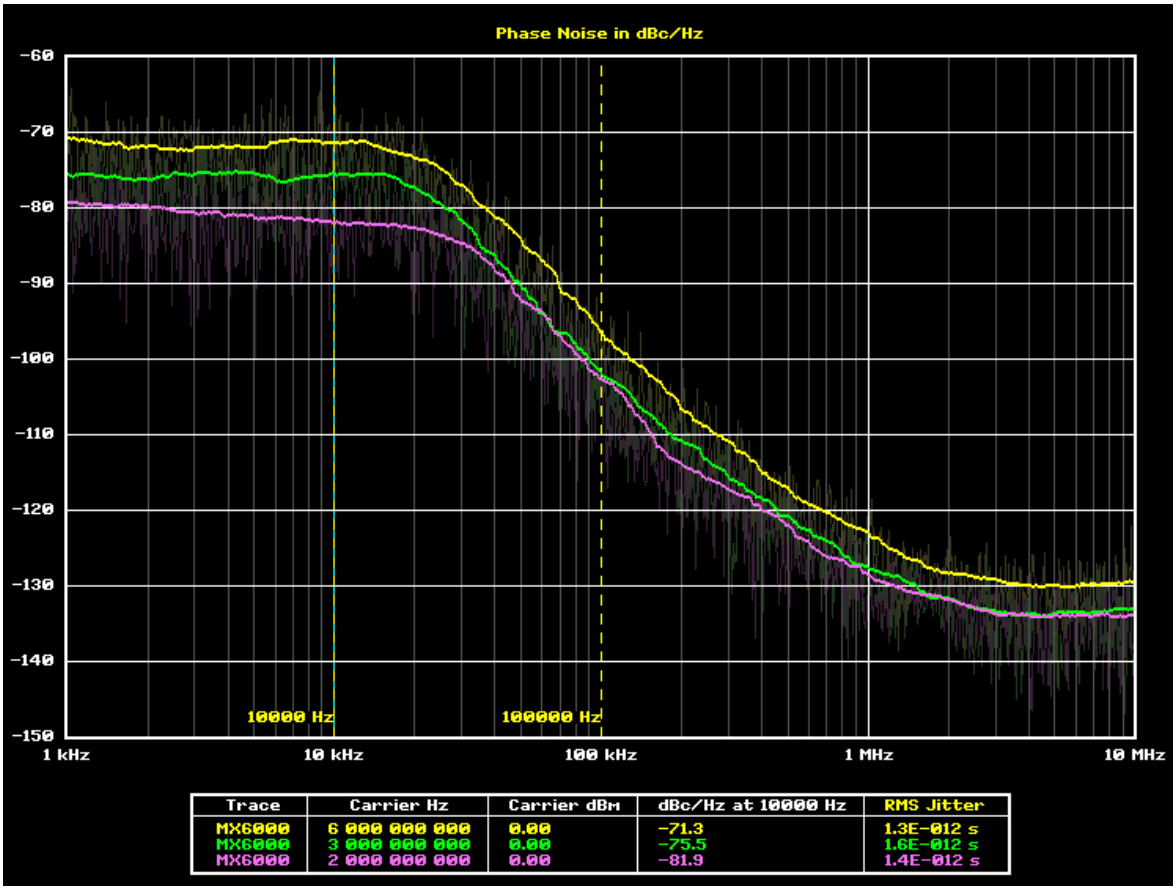
(115200 Baud – Virtual COM port serial connection)

MX2500 & MX6000

Typical Performance Data



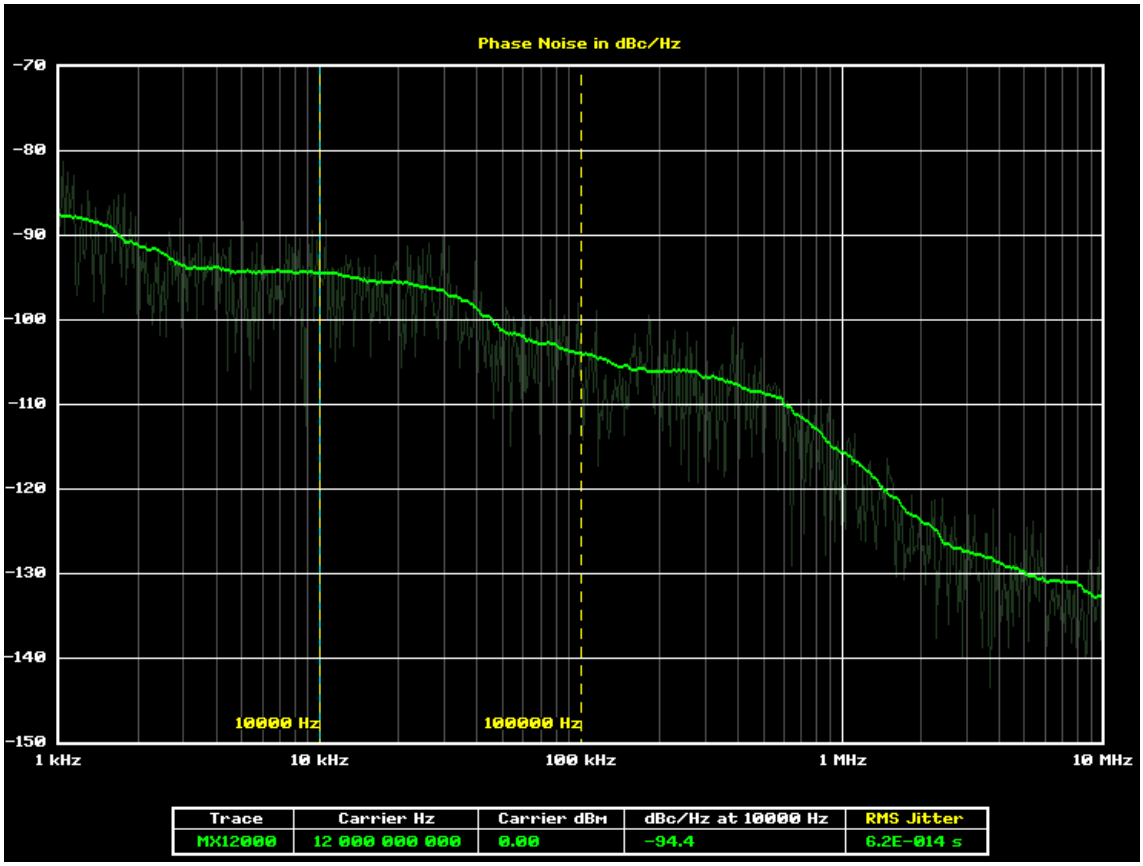
Trace	Carrier Hz	Carrier dBm	dBc/Hz at 10000 Hz	RMS Jitter
MX2500L	4 400 000 000	0.00	-81.4	6.2E-013 s
MX2500L	2 400 000 000	0.00	-88.9	5.8E-013 s
MX2500L	1 000 000 000	0.00	-95.0	6.4E-013 s
MX2500L	400 000 000	0.00	-100.9	8.4E-013 s



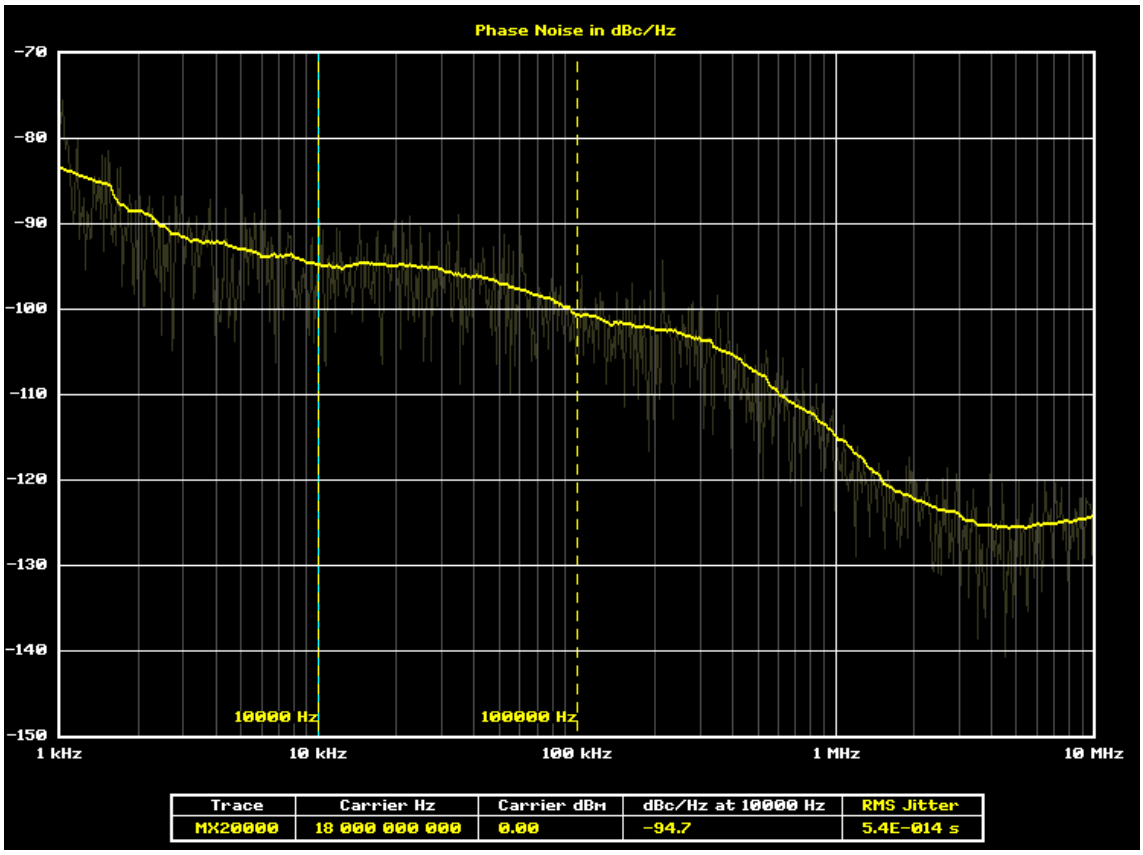
Trace	Carrier Hz	Carrier dBm	dBc/Hz at 10000 Hz	RMS Jitter
MX6000	6 000 000 000	0.00	-71.3	1.3E-012 s
MX6000	3 000 000 000	0.00	-75.5	1.6E-012 s
MX6000	2 000 000 000	0.00	-81.9	1.4E-012 s

MX12000 & MX20000

Phase Noise Plots



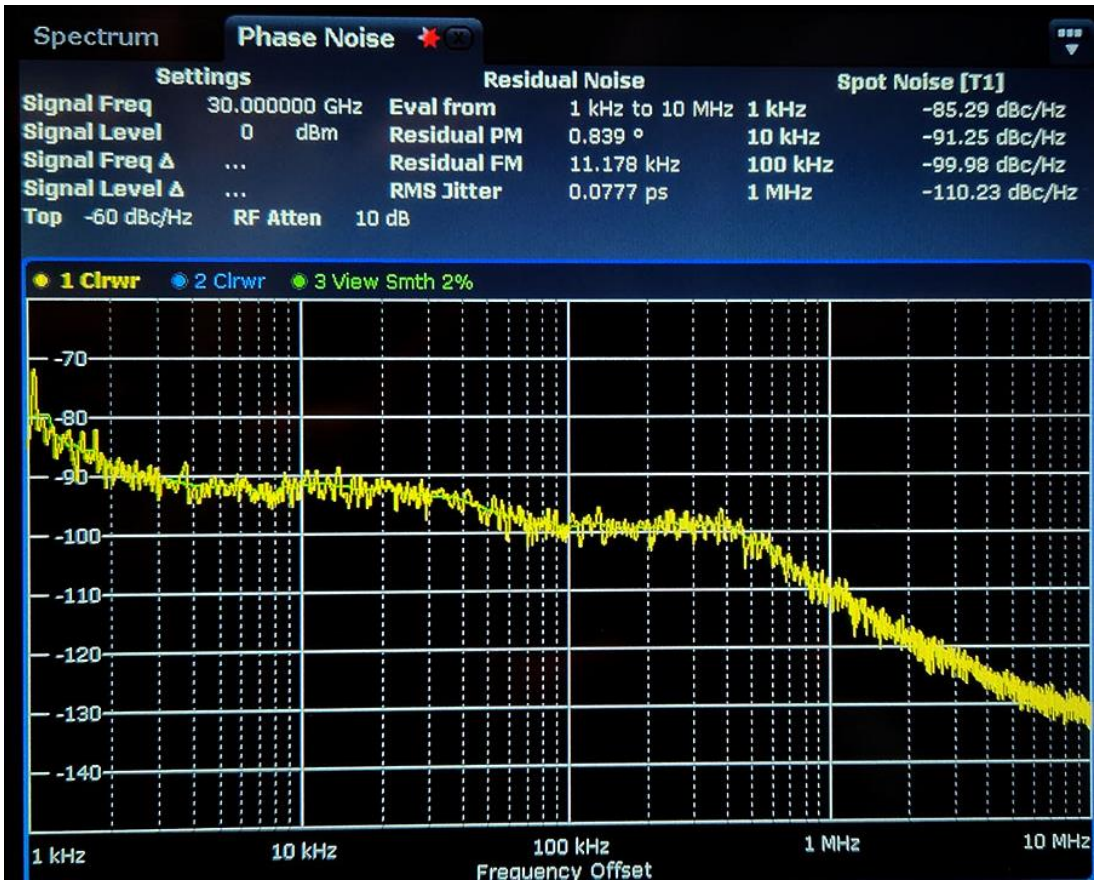
Trace	Carrier Hz	Carrier dBm	dBc/Hz at 10000 Hz	RMS Jitter
MX12000	12 000 000 000	0.00	-94.4	6.2E-014 s

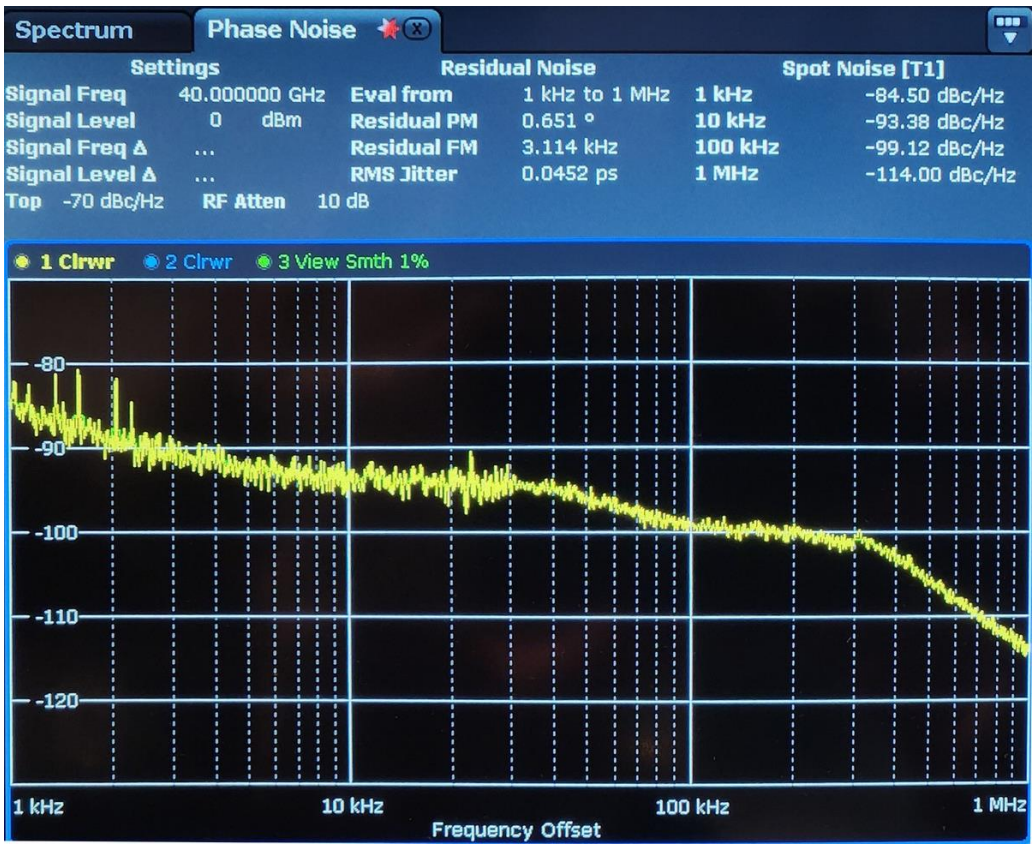


Trace	Carrier Hz	Carrier dBm	dBc/Hz at 10000 Hz	RMS Jitter
MX20000	18 000 000 000	0.00	-94.7	5.4E-014 s

MX30000 & MX40000

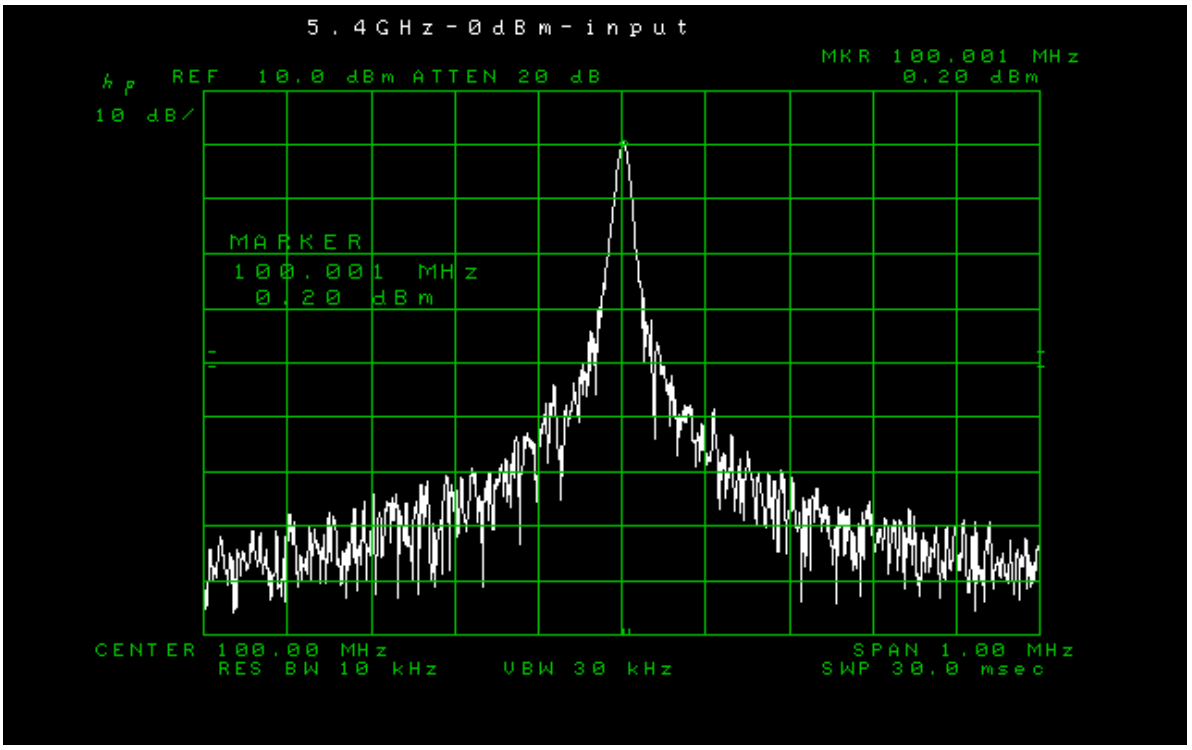
Phase Noise Plots



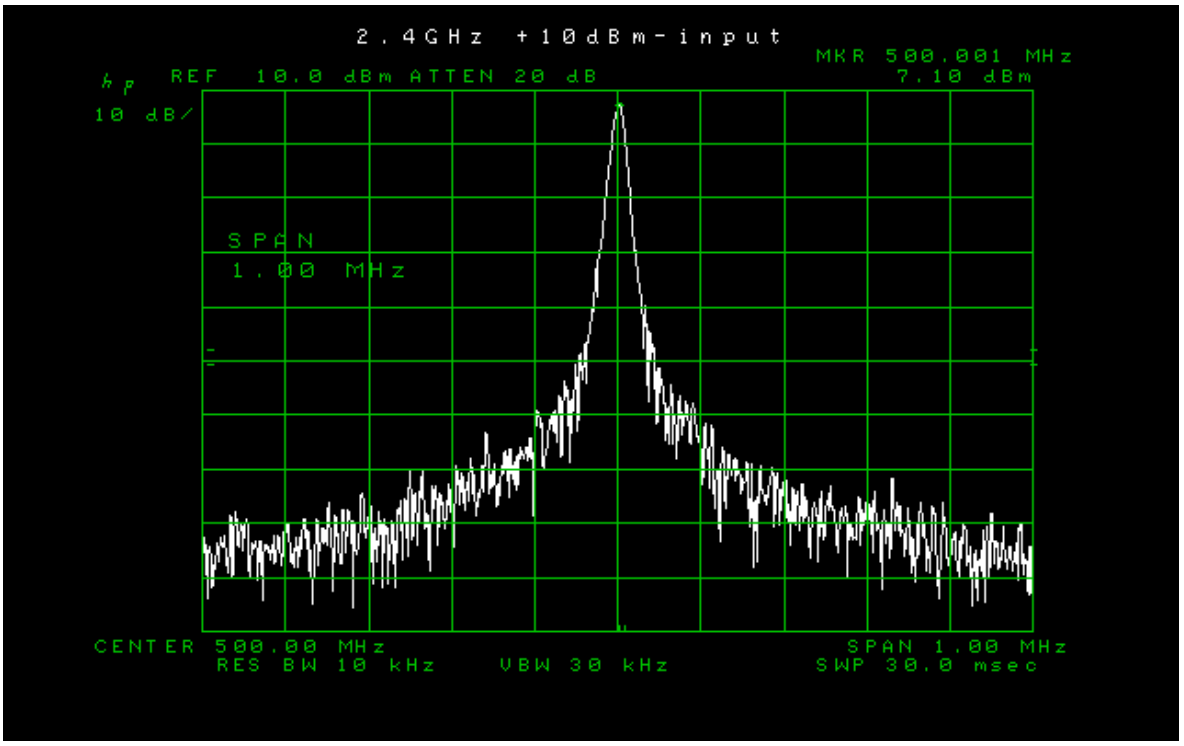


MX6000

Typical Performance Data



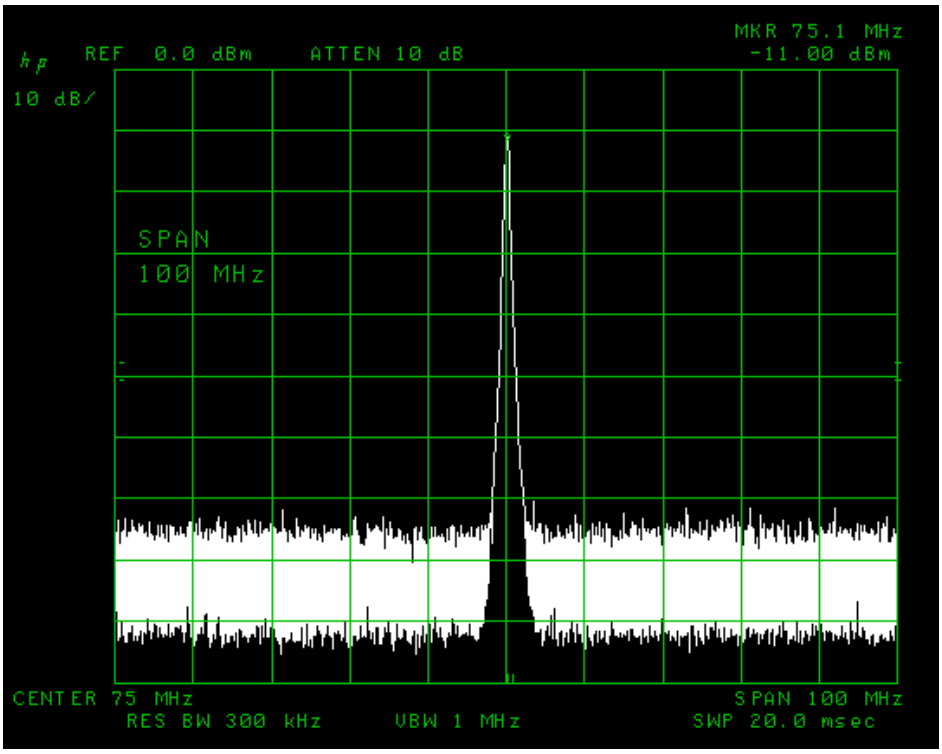
MX6000. Input signal 5.4GHz @ +0dBm, LO set to 5.3GHz, IF out = 100MHz.



MX6000. Input signal 2.4GHz @ +10dBm, LO set to 2.9GHz, IF out = 500MHz.

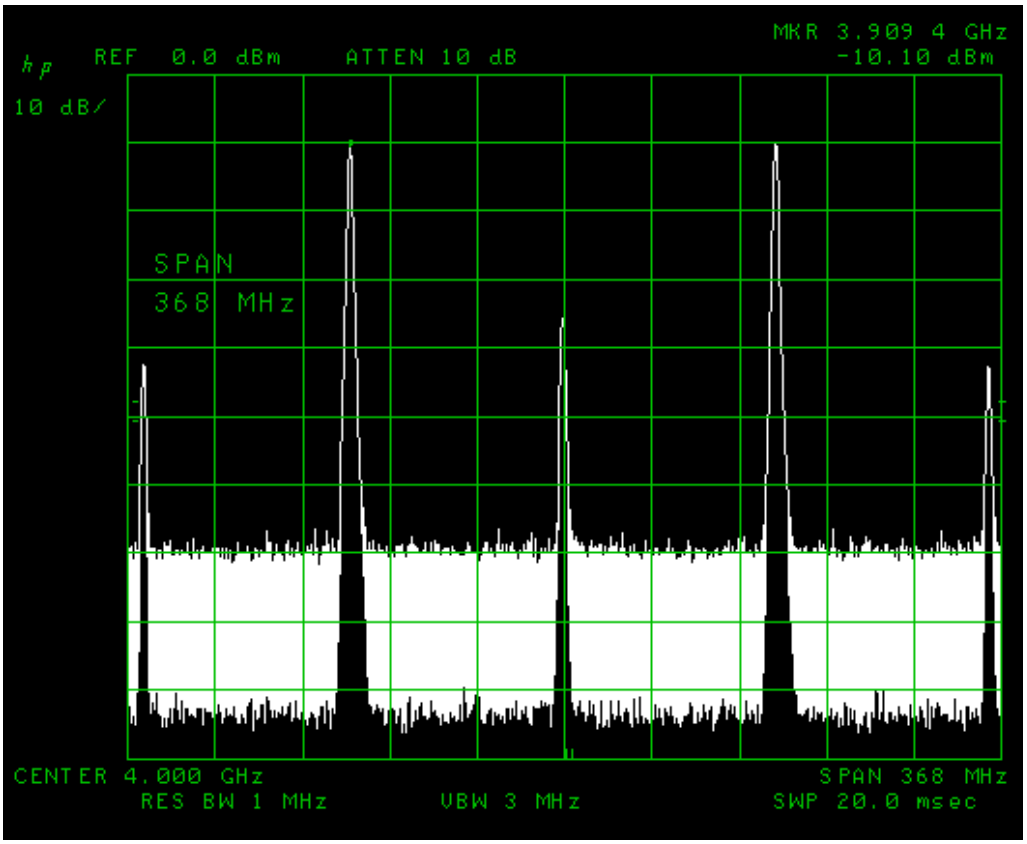
MX6000

Typical Performance Data



Down-convert

- Internal LO=5.125GHz
- RF=5.2GHz @ -5dBm
- IF Output=75MHz @ -11dBm



UP-convert

- Internal LO=4.0GHz
- IF=90MHz @ 0dBm

MX Integrated Mixer Family

Cables & Accessories

Cable required for power and PC host control of device. MX6000 and MX2500 use micro-USB, MX12000, MX20000, MX3000 use a **UCB-C** type. Included with purchase of integrated-LO mixer.

A high-current (1.5A+) USB host port is required, these include: Blue USB 3.0 ports, portable power banks, powered USB hubs, most smart-phone chargers.

The acceptable USB voltage range is 4.6 to 5.35V.

Low-loss **SMA** cables should be used on RF and IF ports. High-band devices like the MX30000 need a very high-frequency rated 2.92mm cable or excessive losses should be expected.

SMA cables should ***NOT*** be used on the delicate precision 2.92mm mixer RF ports!

Optional cable adapters for **MCX** reference frequency ports. Many 10MHz reference signals are typically output on BNC connectors. Due to size constraints, our products use 6GHz-rated MCX connectors. “Pigtail” type short adapter cables can be found very inexpensively online, or we can provide them with our products if requested.

The recommended reference input power is **-5 to +13dBm.**

MX Integrated Mixer Family

Ordering Information

MX2500L – (3.0GHz) – Mixer with Integrated harmonic-filtered LO	$699
MX6000C – (6.0GHz) – Mixer with integrated harmonic-filtered LO	$799
MX12000 – (14GHz) – Mixer with Integrated low-noise LO	$2499
MX20000 – (22GHz) - Mixer with Integrated low-noise LO	$3999
MX30000 – (30GHz) - Mixer with Integrated low-noise LO	$5999
MX40000PRO – (40GHz) - Mixer with Integrated low-noise LO	$6999

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