SIGNAL CRAFT TECHNOLOGIES

Dual 6 to 26 GHz Microwave Front End Module for SDR

SC2470 | Microwave Converter

Product Brief

Summary

The SC2470 Microwave Converter delivers dual-channel, phase-aligned performance optimized for 6–26 GHz operation. Designed for seamless integration with software defined radios (SDRs), it interfaces effortlessly with platforms such as Analog Devices' Mixed-Signal Front End (MxFE), NI's USRP, and comparable SDR systems.

SC2470 – Microwave Converter

Description

The SC2470 architecture includes two converters (daughterboards), each providing one complete RF front end with independent transmit (Tx) and receive (Rx) paths. Each Tx path incorporates an upconverter, and each Rx path includes a downconverter, both operating from their own dedicated local oscillator (LO). The converters can be individually configured for either frequency division duplex (FDD) or time division duplex (TDD) operation. A built-in bypass path allows signals to route around the converters when frequency translation is unnecessary.

To address the challenges of MIMO systems, the SC2470 supports deterministic phase alignment across all channels and cascaded devices, ensuring repeatable and coherent performance in demanding applications such as beamforming, over-the-air testing, direction finding, and multi-antenna radar or communication system development.

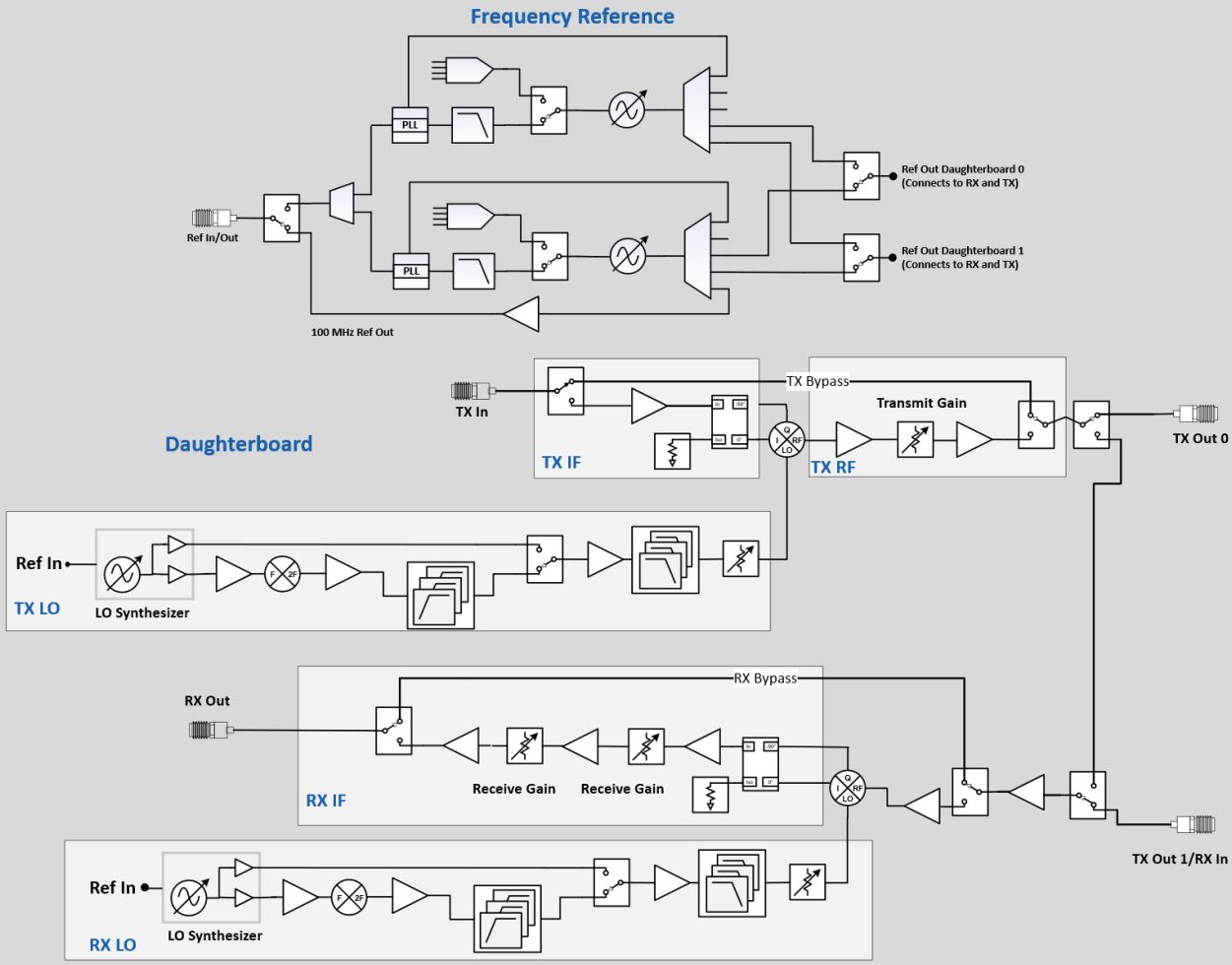
Adjustable gain control on both the upconverter and downconverter provides precise control over signal levels in the transmit and receive paths, ensuring optimal performance across varying input powers, link budgets, and noise environments. This flexible design allows the SC2470 to adapt easily to diverse deployment scenarios—from laboratory testing to field environments or integration into larger communication systems.

The SC2470 can also be configured as a UHD-compatible device and controlled using NI Ettus Research's USRP X4xx series SDRs, with full support through the UHD Extension.

Common Applications

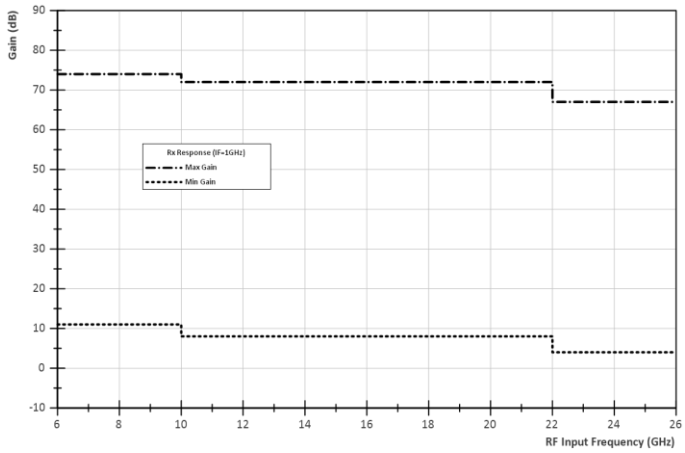
- 5G FR3 Research and Development
- Aerospace and Defense Application Prototyping
- Software Defined Radio Applications
- Advanced Wireless Communications Research

Radio Path – Simplified Block Diagram

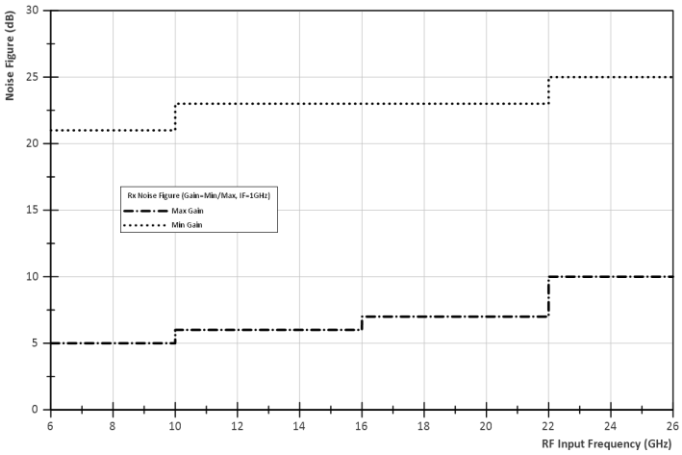


Downconverter Typical FDD Performance

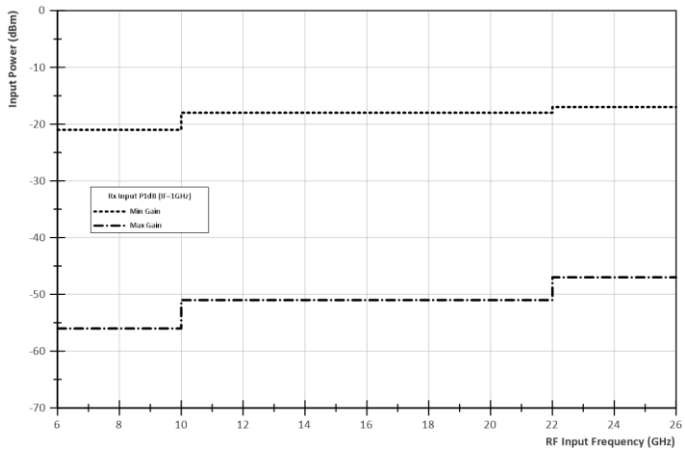
Gain Response



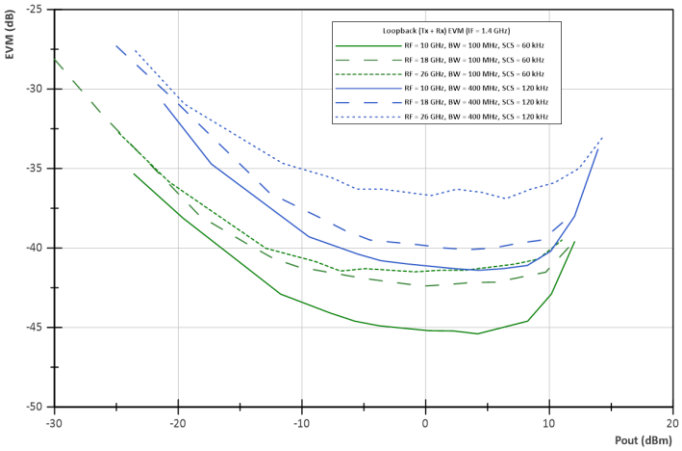
Noise Figure



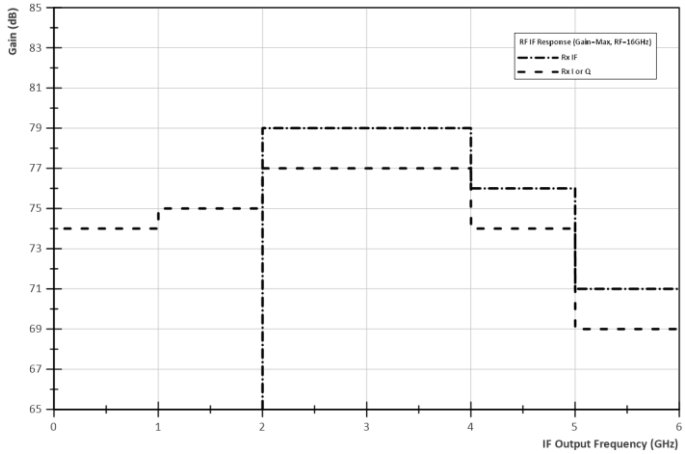
Input P1dB



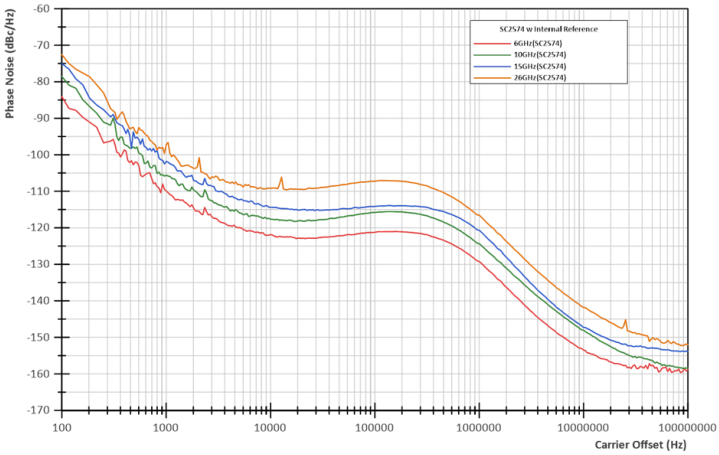
Loopback (Tx + Rx) EVM



Baseband Frequency Response

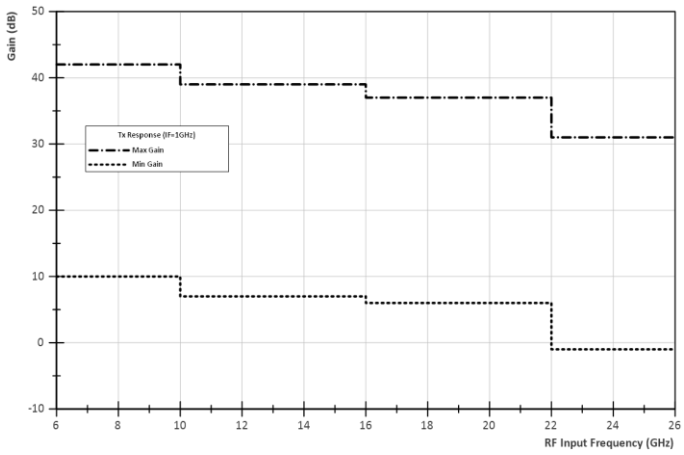


LO Phase Noise

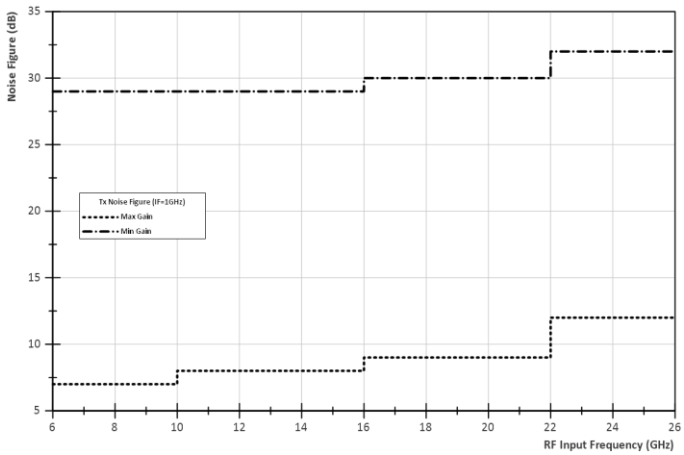


Upconverter Typical FDD Performance

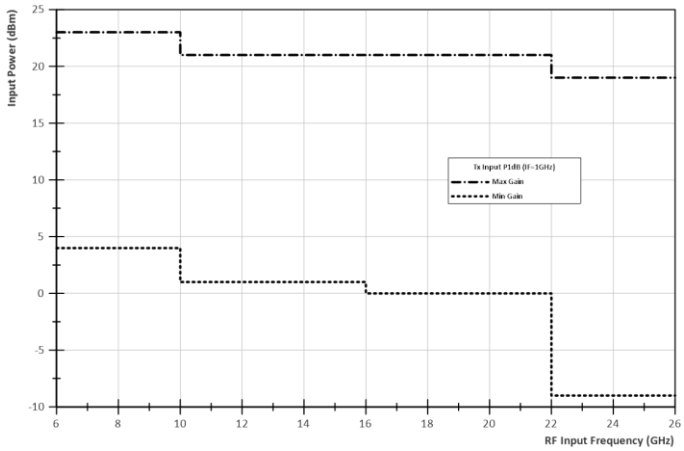
Frequency Response



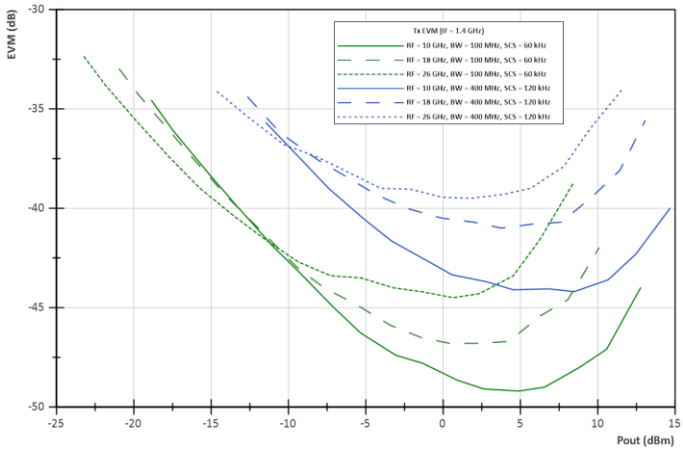
Noise Figure



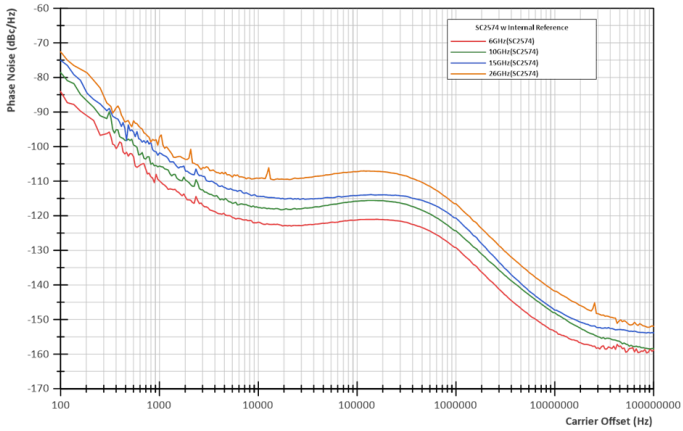
Output P1dB



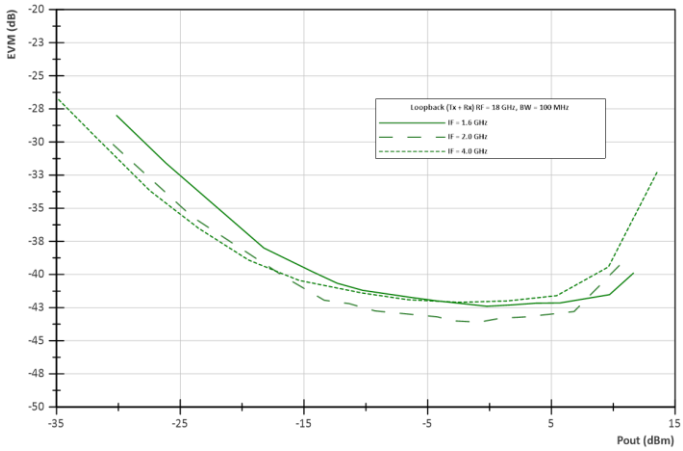
Transmit EVM



LO Phase Noise



Loopback (Tx + Rx) EVM vs IF



Typical RF Performance – Summary

Down Conversion (DC) Path

- Input Frequency Range: 0.1 to 26 GHz
- Maximum Input Power: 0 dBm
- IF Output Range: 0.6 to 6 GHz
- Internal LO: 0.8 to 25.6 GHz

Up Conversion (UC) Path

- IF Input Range: 0.6 to 6 GHz
- Maximum Input Power: +5 dBm
- Output Frequency Range: 0.1 to 26 GHz
- Internal LO: 0.8 to 25.6 GHz

DC FDD Mode – Maximum Gain

- Conversion Gain:
  - 74 dB @ 6 GHz
  - 72 dB @ 12 GHz
  - 72 dB @ 18 GHz
  - 67 dB @ 26 GHz
- Gain Control Range: 60 dB in 1.0 dB Steps
- Noise Figure:
  - 5 dB @ 6 GHz
  - 6 dB @ 12 GHz
  - 7 dB @ 18 GHz
  - 10 dB @ 26 GHz
- P1dB Input Compression Point
  - -56 dBm @ 6 GHz
  - -51 dB @ 12 GHz
  - -51 dB @ 18 GHz
  - -47 dB @ 26 GHz

UC FDD Mode – Maximum Gain

- Conversion Gain:
  - 42 dB @ 6 GHz
  - 39 dB @ 12 GHz
  - 37 dB @ 18 GHz
  - 31 dB @ 26 GHz
- Gain Control Range: 30 dB in 1.0 dB Steps
- Noise Figure:
  - 7 dB @ 6 GHz
  - 8 dB @ 12 GHz
  - 9 dB @ 18 GHz
  - 12 dB @ 26 GHz
- P1dB Output Compression Point
  - 23 dBm @ 6 GHz
  - 21 dB @ 12 GHz
  - 21 dB @ 18 GHz
  - 19 dB @ 26 GHz

DC FDD Mode – Minium Gain

- Conversion Gain:
  - 11 dB @ 6 GHz
  - 8 dB @ 12 GHz
  - 8 dB @ 18 GHz
  - 4 dB @ 26 GHz
- Noise Figure:
  - 21 dB @ 6 GHz
  - 23 dB @ 12 GHz
  - 23 dB @ 18 GHz
  - 25 dB @ 26 GHz
- P1dB Input Compression Point
  - -21 dBm @ 6 GHz
  - -18 dBm @ 12 GHz
  - -18 dBm @ 18 GHz
  - -17 dBm @ 26 GHz

UC FDD Mode – Minimum Gain

- Conversion Gain:
  - 10 dB @ 6 GHz
  - 7 dB @ 12 GHz
  - 6 dB @ 18 GHz
  - -1 dB @ 26 GHz
- Noise Figure:
  - 29 dB @ 6 GHz
  - 29 dB @ 12 GHz
  - 30 dB @ 18 GHz
  - 32 dB @ 26 GHz
- P1dB Output Compression Point
  - 4 dBm @ 6 GHz
  - 1 dBm @ 12 GHz
  - 0 dBm @ 18 GHz
  - -9 dBm @ 26 GHz

Feature Summary

General

- Dual Independent Synthesizers
- Supports Internal and External Frequency Reference
- Deterministic Phase Coherence across all channels and cascaded systems.
- List Mode
- Settling Time
  - Frequency Switching:
    - 150 us (typical)[1]
  - On/Off Switching (10/90%): [2]
    - On Time: 28 ns (typical)
    - Off Time: 36 ns (typical)
- Stability (Internal Reference):
  - Absolute/Time/Temperature: 25 ppm
- External Reference Input:
  - Selectable 10 or 100 MHz
  - 0.5 to 2.5 Vpp
  - 50% Duty Cycle
  - Min Slew Rate 1000V/uS
- Reference Output:
  - 100 MHz
  - 20 Vpp
  - 50% Duty Cycle
  - Sinusoidal
- Phase Noise
  - See Typical Performance plot above
- Power Consumption
  - 75W Typical

Environmental

- Operating
  - Temperature: 0 to 55 C
  - Humidity: 10 to 90% (non-condensing)
- Storage
  - Temperature: -40 to 70 C
  - Humidity: 10 to 90% (non-condensing)
- Mechanical Dimensions
  - 193 mm (l) x 130 mm (w) x 24.1 mm (h)
- Weight
  - 1100 g

Interfaces

- Front Panel
  - UHD Interface (labeled GPIO)
    - GPIO port
    - SPI Bus
    - Sync and Latch Control
    - TDD Control
  - Microwave Ports (per DB)
    - Tx IF Input
    - Tx RF Output
    - Rx IF Output
    - Rx RF Input
    - Tx/Rx Indicator
  - Power Switch w/ Power Indicator
- Rear Panel
  - Console Interface (USB-C)
  - 10/100 MHz REF Input
  - 100 MHz REF Output
  - Phase Sync Control Line
  - Expansion Ports (SPI and GPIO)
  - Status LEDs
  - Auto Start Control Switch

Control

- USRP Hardware Driver (UHD) for use with NI Ettus X410 and X440 series: SignalCraftTechnologies/SC2470-UHDExtension: The SC2470 UHD Extension Library
- Serial Drivers for standalone console access:
- SignalCraftTechnologies/fesd: Front End Serial Drivers (FESD) for Signal Craft products
- For non-standard applications, access to underlying raw ASCII and binary SPI protocols are available. See SC2470 API Specification for details.

[1] Frequency switching times are measured from start of the hardware latch trigger signal (Latch CH0/1 signal). Frequency Switching times will be extended if the LO frequency transitions from below 12.8GHz to above 12.8GHz or if phase adjustments are made as part of the frequency adjustment.

[2] On/Off switching times are measured from the start of the hardware trigger signal to switch between RX and TX in TDD mode (Automatic Transmit/Receive (ATR) CH0/1 signal). See SC2470 API Specification for more information.

Compliance and Certifications

The EU Declaration of Conformance (DoC) for this product can be obtained from the support section of our website, located at www.signalcraft.com/support/support-microwave/.

Electromagnetic Compatibility (EMC)

This product meets the requirements of the following EMC regulations for electrical equipment for measurement, control, and laboratory use:

EU: EMC Directive 2014/30/EU
US: FCC 47 CFR Part 15
Canada: ICES-003 Issue 7
Australia/New Zealand: Radiocommunications (EMC) Standard 2017 (RCM)
South Korea: Radio Waves Act (KC)

Conformity is assessed in accordance to the following standards:

EN IEC 61326-1:2021
EN 55032:2015/A11:2020
FCC 47 CFR Part 15 Subpart B
ICES-003 Issue 7
CISPR 32:2015/AMD1:2019
AS/NZS CISPR 32:2015 AMD1:2020
KS C 9610-6-4:2022
KS C 9610-6-2:2010
KS C 9811:2019

Environmental Management

SCT is committed to designing and manufacturing products in an environmentally responsible manner. We believe that eliminating hazardous substances from our products is beneficial to the environment and our customers.

At the end of the product's life cycle, customers are responsible for ensuring that all materials are disposed of according to local laws and regulations.

	RoHS Directive (EU) 2015/863 amending Annex II to Directive 2011/65/EU

Product Images

SC2470 Microwave Converter

Support

Technical support is available through our website, www.signalcraft.com/support, or by contacting us at support@signalcraft.com.

Warranty

Full one-year parts and labour when used under normal installation and operation conditions. Repair services are available for products no longer covered under warranty.

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Ordering Information

Send inquiries to support@signalcraft.com.