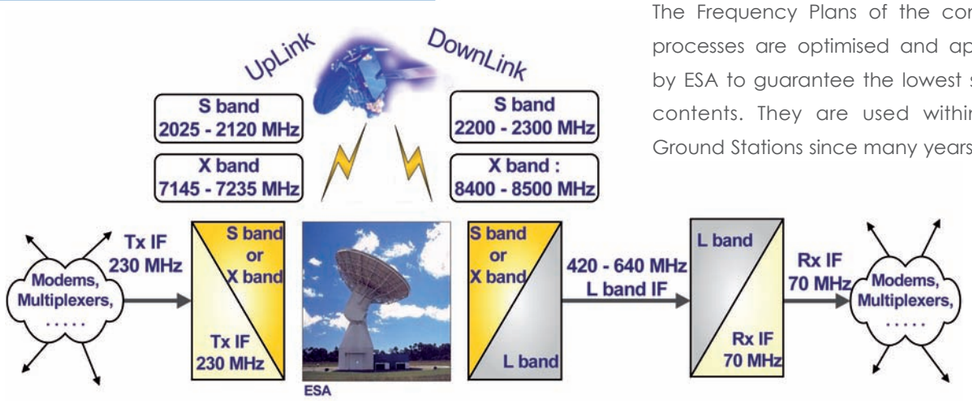
Model Table

X-band DC	SM52063801A
X-band UC	SM52063401A
S-band DC	SM52063701A
S-band UC	SM52063501A
L-band DC	SM52063601A
Reflective Converter	SM01006522A

S-band & X-band Frequency Converters

Frequency plans



The Frequency Plans of the conversion processes are optimised and approved by ESA to guarantee the lowest spurious contents. They are used within ESA's Ground Stations since many years.

Example of Ground Station

A typical example of Ground Station using this set of frequency converters is shown opposite. It illustrates the operating mode of the Reflective Converter.

The Reflective Converter is used for Ranging Calibration.

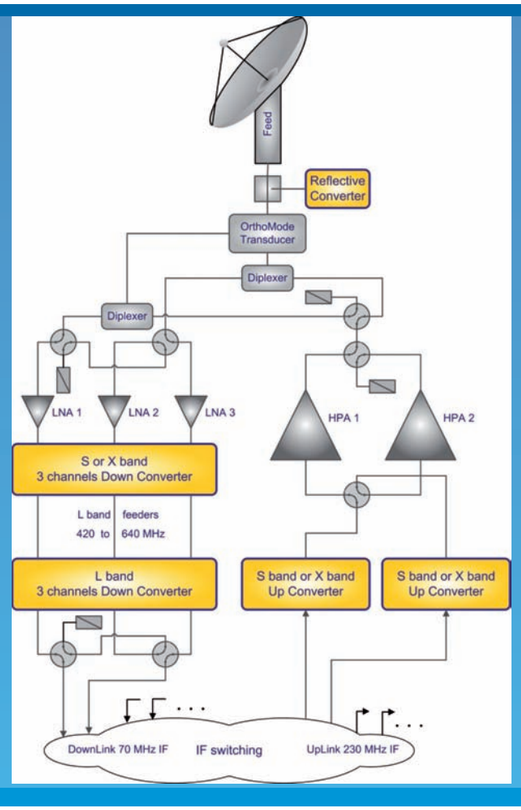
It is a Single Port Device dedicated to acquire the UpLink signal thru a probe located on the antenna sub-system, to translate it into a DownLink signal, and to inject it into the reception chain via the same probe.

An input switch allows two operating modes :

- Frequency conversion mode as described above.
- Injection mode, in which the conversion functions are bypassed, allowing the injection of a dedicated test signal in the antenna sub-system.

A switchable internal "cleaning loop" allows the cancellation of the modulation.

In order to maintain the very high phase stability, the internal frequency synthesizer is designed on the same way than the converter' LO and is synchronized on the UpLink signal.



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MASTERING THE ELEMENTS

ZODIAC AEROSPACE

Frequency Converters

IN-SNEC®

3rd generation of Frequency Converters developed by Zodiac Data Systems for Space Agencies.

These equipments are currently deployed within the Deep Space Network of the European Space Agency (ESA) for TT&C and communications with Deep Space Spacecrafts.

Proprietary Frequency Synthesis techniques are used to achieve very High Phase Stability and drastically Low Phase Noise required by Deep Space Missions.

Down Converters are 3-channels units with Gain & Phase Matching, for TT&C applications.

Local Oscillators and Power Supply Redundancy ensures missions' reliability.

Monitoring and Control can be performed locally via pull down menus thru the Front Panel or remotely under TCP/IP thru the user's LAN.

Ranging calibration is performed thanks to the Reflective Converter, which can be used to translate the UpLink signal within the DownLink RF chain, or to inject a dedicated test signal in the chains, for specific test purpose.

S-band & X-band

Up-link & Down-link

Main applications

- Telemetry, Tracking and Control
- Deep Space Networks

Main features

- Performance and reliability
  - Field proven Frequency Plan
  - Field proven performances : Rosetta, Mars Express, ...
  - High MTBF
  - Extensive built-in testability
- Designed for Deep Space applications :
  - Very Low Phase Noise
  - Very High Phase Stability
  - Very High Dynamic Range
- Highly configurable
  - 3 channels Down Converters with gain & phase matching for tracking applications
  - High level of built-in redundancy
  - High performances 100 MHz frequency reference
  - Lockable on external 5, 10 or 100 MHz station's reference
- Performing Monitoring & Control
  - Remote M&C thru LAN / TCP-IP
  - Local M&C thru pull down menus on large LCD display
  - Versatile Primary Power adaptability

ZODIAC DATA SYSTEMS

AEROSAFETY & TECHNOLOGY
Telemetry & Telecommunications

ZODIAC AEROSPACE

CONVERTERS

Up & Down - S-band & X-band

Specifications

	DOWN CONVERTERS			UP CONVERTERS	
	X-band	**S-band**	**L-band**	**X-band UC**	**S-band UC**
Configuration	3 channels, inverting, fixed	3 channels, inverting, fixed	3 channels, inverting, agile	1 channel, non inverting, agile	1 channel, non inverting, agile
N° of outputs per channel	2 outputs + 1 test	2 outputs + 1 test	2 outputs + 1 test	1 output + 1 test	1 output + 1 test
RF band	8400 - 8500 MHz	2200 - 2300 MHz	420 - 640 MHz	230 MHz ±15 MHz	230 MHz ±15 MHz
IF band	540 - 640 MHz	420 - 520 MHz	70 MHz +/- 10MHz	7145 - 7235 MHz	2025 - 2120 MHz
Gain	20 to 30 dB	20 to 30 dB	0 to 30 dB	15 to 25 dB	10 to 20 dB
Gain step	1 dB	1 dB	1 dB	1 dB	1 dB
Gain continuous variation	± 0.5 dB	± 0.5 dB	± 0.5 dB	-	-
Noise Figure @ max gain	8.5 dB	8.5 dB	16 dB	16 dB	16 dB
Output power	10 dBm	12 dBm	12 dBm	12 dBm	12 dBm
Output IP3	20 dBm	25 dBm	27 dBm	25 dBm	25 dBm
Gain tracking between channels	1dBpp	1dBpp	1dBpp	-	-
Crosstalk between channels	60 dB	60 dB	60 dB	-	-
Phase tracking between channels	5°	5°	5°	-	-
Phase stability vs temperature	10°/°C	6°/°C	6°/°C	8°/°C	6°/°C
Output spurious within IF band	- 60 dBc	- 90 dBm	- 30 dBc	- 60 dBc	- 60 dBm
Output spurious outside IF band	- 60 dBc	- 90 dBm	- 30 dBc	- 90 dBc	- 90 dBm
Output spurious IF harmonics	- 60 dBc	- 90 dBm	- 30 dBc	- 120 dBc	- 120 dBm
Frequency step	N/A	N/A	1 kHz	1kHz	1kHz
Phase noise (locked on external reference)	- 54 - 10log (ΔfHz)	- 54 - 10log (ΔfHz)	- 54 - 10log (ΔfHz)	- 54 - 10log (ΔfHz)	- 54 - 10log (ΔfHz)
External reference frequencies	5, 10 or 100 MHz	5, 10 or 100 MHz	5, 10 or 100 MHz	5, 10 or 100 MHz	5, 10 or 100 MHz
LO redundancy	Yes	Yes	No	No	No
Power supply redundancy	Yes	Yes	No	No	No
Mechanical Characteristics					
Dimensions	19" x 4U x 23.4" (595mm)	19" x 4U x 23.4" (595mm)	19" x 4U x 23.4" (595mm)	19" x 4U x 23.4" (595mm)	19" x 4U x 23.4" (595mm)
Weight	70.54 lb (32kg)	72.75 lb (33kg)	68.34 lb (31kg)	63.93 lb (29kg)	55. lb (25kg)
Primary Power					
Frequency	47 to 440Hz	47 to 440Hz	47 to 440Hz	47 to 440Hz	47 to 440Hz
Voltage	90 to 132V and 180 to 264V with automatic selection			90 to 132V and 180 to 264V with automatic selection	
Power consumption	200VA	220VA	140VA	130VA	120VA

Interfaces

RF/IF	N(f)
Unbalanced 5/10MHz ext ref	N(f)
Balanced 5/10MHz ext ref	BRZ
Unbalanced 100MHz ext ref	N(f)
Balanced 100MHz ext ref	Twinax (f)
Remote M&C	RJ45
Test Outputs on front panel	SMA (f)

Environmental conditions

Operating temperature	+5° to 45°C 23° ± 3°C for gain phase stability on channel matching performances
Storage temperature	-20° to 70°C
Humidity	up to 90% without condensation
EMC	compliant to EN50081-1 and EN50081-2
Marked	CE

REFLECTIVE CONVERTERS

Configuration	1 port, broadband S band / X band
Conversion plans (Coherency ratio)	S/S : 2025 - 2120 to 2200 - 2300 MHz (221/240) S/X : 2110 - 2120 to 8400 - 8500 MHz (221/880) X/S (OS) : 7145 - 7180 to 2280 - 2300 MHz (749/240) X/S (NE): 7190 - 7235 to 2250 - 2270 MHz (765/240) X/X : 7150 - 7190 to 8400 - 8450 MHz (749/880)
Conversion losses	<35 dB
Stability	Slope / flatness (no filter to insure Group Delay)
LO phase noise (typical)	S/S : - 54-10log(Δf) dBc/Hz S/X : - 44-10log(Δf) dBc/Hz X/S : - 44-10log(Δf) dBc/Hz X/X : - 54-10log(Δf) dBc/Hz
Noise floor :	-114dBc/Hz
Modulation suppression	15+20log(ΔfkHz) , from 100kHz to 1MHz
LO spurious	Main related (50Hz) : -55dBc Other main related : -55dBc Other spurious : -60dBc
Phase stability	S/S : 2°/°C (from 20 to 30°C) S/X : 12°/°C (from 20 to 30°C) S : 3°/dB (from 0 to 10dBm input level) X/S : 10°/°C (from 20 to 30°C) X/X : 3°/°C (from 20 to 30°C) X : 6°/dB (from 0 to 10dBm input level)

Mechanical Characteristics

Dimensions	19" x 1U x 18.11" (460 mm)
Weight	18.7 lb (8.5 kg)

Primary Power

Frequency	47 to 440Hz
Voltage	220VAC
Power consumption	33VA

Interfaces

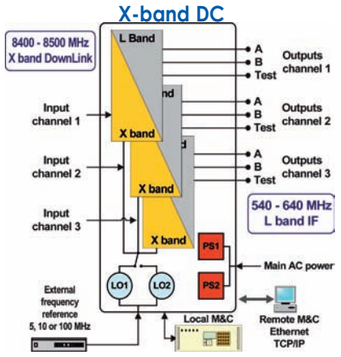
RF/IF	N(f)
Ext LO In	N(f)
Remote M&C	RJ45

Environmental conditions

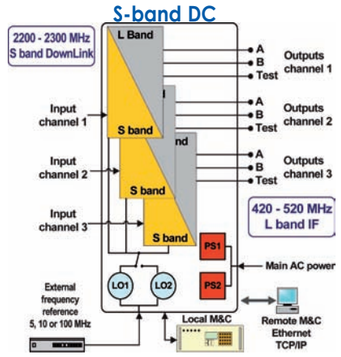
Operating temperature	0° to 40°C
Storage temperature	-20° to +70°C
Humidity	up to 90% without condensation
EMC	compliant to EN50081-1 and EN50081-2
Marked	CE

Block diagrams

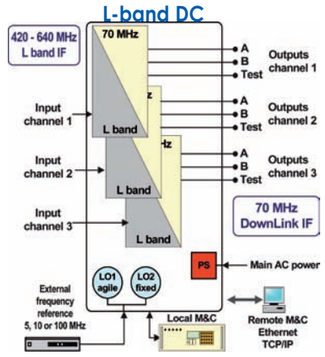
X-band DC



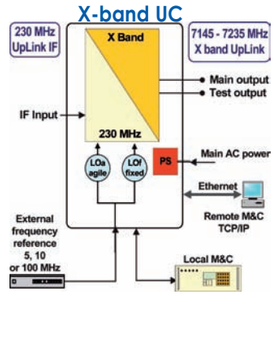
S-band DC



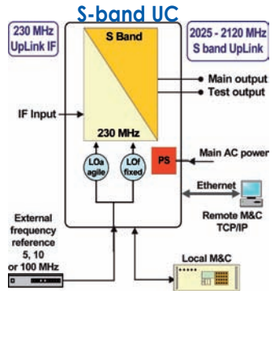
L-band DC



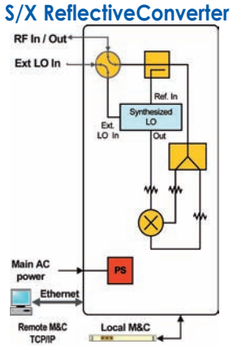
X-band UC



S-band UC



S/X ReflectiveConverter



Phase noise