BLAH10

Amplifier 200-600MHz
Operating & Service Manual

Version 001

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This manual describes the units as they are at the date of printing. On request, the manufacturer shall supply circuit diagrams, lists of components, descriptions, calibrating instructions and any other information for use by qualified personnel of the user, in charge of repairing the parts of the unit which have been stated by the manufacturer to be "repairable". Such supply shall in no event constitute permission to modify or repair the units or approval of the same.

This unit is not designed for any type of use which is not specifically described in this manual. Such use may be hazardous.

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General information 1

Introduction 1.1

"The BLAH10 Amplifier 200-600MHz (P/N:W1345041) is a single "^{1}H band" low power 10W amplifier including RF Output DPDT Switches, specifically suited for use with an external 100W-150W ^{1}H high power amplifier (such a BLAH100 Amplifier 200-600MHz (P/N: W1345060) or a H150 output from a BLAH1000 Amplifier) to obtain a BLARH100 RF topology.

This amplifier is fitted for ^{19}F decoupling during ^{1}H observe or ^{1}H decoupling during ^{19}F observe.

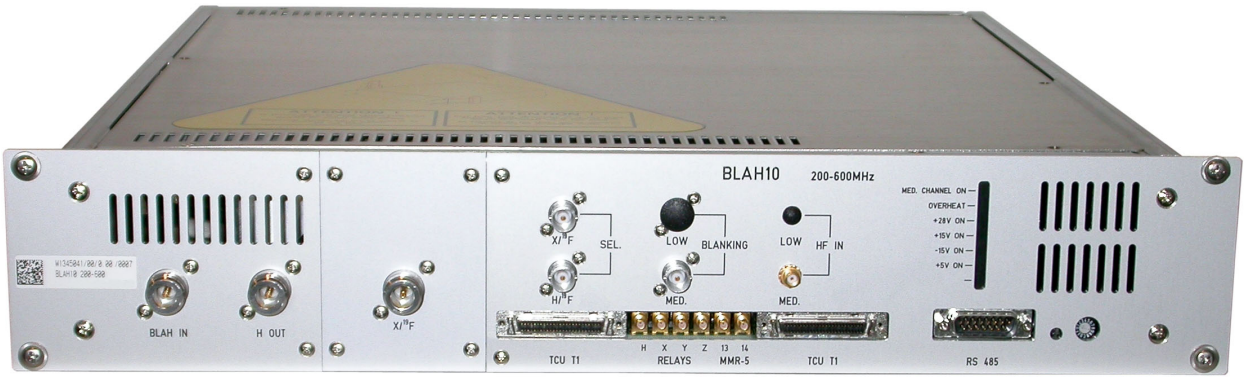
It includes "TCU-T1 Signal" accessory specially suited for the use with an old "solid equipment" (MSL or DSX) to dispatch real time "NMR5_13 & NMR5_14" and "relays" signals.

This accessory allows to dispatch the power of both channels (^{1}H amplifier channel & X amplifier channel) through three outputs: ^{1}H; ^{19}F and, XQNP in option.

Except main power supply, all sockets are coming through the front panel.

Two "BNC" sockets in front panel receive "real time" switching signals.

Figure 1.1. BLARH10 Amplifier 200-600MHz without XQNP accessory



Initial turn and procedure 1.2

Before inserting main power cord, be sure that all RF (HF in and HF out) channels, select signals (SEL. X/^{19}F & SEL. ^{1}H/^{19}F), Blanking and RS485 are correctly plugged.

Safety 2

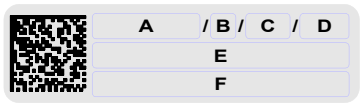
Labels 2.1

Labels are provided to alert operating and service personnel to conditions that may cause personal injury or damage to the equipment from misuse or abuse. Please read the labels and understand their meaning.

Identifying plate 2.1.1

The BLAH10 can be identified by an identifying plate at the front panel of the unit that has following information.

Figure 2.1. Identifying plate

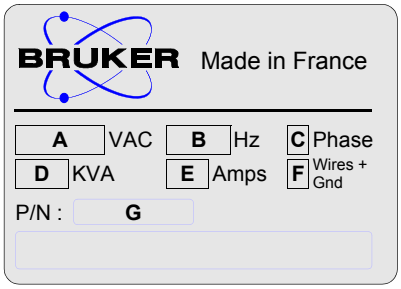


- **(A) Part Number**
  This field indicates the part number of the product.
- **(B) Variant**
  This field indicates the variant number that identifies the production category of the product. The default variant is 00.
- **(C) ECL**
  This field indicates the revision number that identifies the product configuration. The initial revision is 0.00.
- **(D) Serial Number**
  This field indicates the serial number of the product.
- **(E) Type**
  This field contains the designation of the product.
- **(F) Information**
  This field contains additional information about the product.

Manufacturer's nameplate *2.1.2*

The BLAH10 can be identified by a manufacturer's nameplate at the back panel of the unit that has following information:

Figure 2.2. Manufacturer's nameplate



- **(A) Voltage**
  This field indicates the input mains voltage of the product.
- **(B) Frequency**
  This field indicates the input mains frequency of the product.
- **(C) Phases**
  This field indicates the number of phases of the mains.
- **(D) Power**
  This field indicates the absorbed power of the product.
- **(E) Current**
  This field indicates the absorbed current of the product.
- **(F) Wires**
  This field indicates number of wires with the ground in the mains cord.
- **(G) Part Number**
  This field indicates the assembly number that identifies the part number of the product.

Safety labels and symbols 2.2

Dangerous area labels 2.2.1

WARNING! *Risk of electrical shocks when the device operates.*
This device is low voltage supplied (+28V), but high power RF transiting signals generate high voltage.

Figure 2.3. Electrical hazard symbol

Figure 2.4. General hazard symbol

Installation 3

Initial Inspection 3.1

Mechanical Check 3.1.1

If damage of the shipping carton is evident, request the carrier's agent be present when the instrument is unpacked. Check the equipment for damage and inspect the cabinet and panel surfaces for dents and scratches.

Claim for Damage 3.1.2

If the unit is mechanically damaged or fails to meet specifications upon receipt, notify BRUKER or our representative immediately. Retain the shipping carton and packing material for the carriers inspection as well as for subsequent use in returning the unit if necessary.

Reshipment and Repackaging Requirements 3.1.3

Whenever possible, the original carton and packing material should be used for reshipment. If the original packing material is not available, wrap the instrument in heavy paper or plastic. Use a strong shipping container. If a cardboard is used, it should be at least 200 lbs. test material.

Use shock absorbing material around all sides of the instrument to provide a firm cushion and to prevent movement inside the container wall on each side. Protect the front panel by means of cardboard spacers inserted between the front panel and the shipping carton. Make sure that the instrument cannot move in the container during shipping. Seal the carton with a good grade of shipping tape and mark the container:

FRAGILE ELECTRONIC INSTRUMENT

Auxiliary Kit 3.1.4

The BLARH10 Amplifier 200-600MHz is shipped with an accessories kit containing following items:

- Manual,
- Accessory, supply cord and RF wire cords set.

Installation Requirements 3.2

No special precautions are necessary. Mount the equipment in an area which is relatively free of vibration, and has sufficient room for cable connections.

Bench Operation 3.2.1

The units can be placed onto a secure flat surface.

Cooling and Ventilation 3.2.2

No specific cooling or ventilation is required. It should, however, be in an environment which conforms the 0° - 50°C (32°F - 158°F) specification, and in an area that does not obstruct the free flow into and out of the unit.

Power Requirements 3.3

BLAH10 Amplifier 200-600MHz is powered by the regular 230VAC main.
It taps to the maximum 400VA when it is switched on.
The connection to this power supply is realized via supply Cord.

System Check 3.4

Before applying RF power for the first time the following items should be checked:

- The RF output an RF input of the accessory must be wired.
- Two external "real time" signals must drive the both selection inputs (SEL. H/^{19}F & SEL. X/^{19}F) only one SEL. H/^{19}F if the "QNP accessory" is not present.
- Don't omit to wire the two RF outputs from the amplifier to the RF inputs of the accessory (use the two "N" ⇔ "N" auxiliary kit cords).

Initial Turn On Procedure 3.5

The following list describes how to turn on the BLAH10 Amplifier 200-600MHz and what should be seen as this occurs.

Before starting this procedure, make sure that you have properly followed instructions in the ***"System Check" on page 12***.

1. Connect the amplifier to the power supply and turn the circuit breaker, to ON.
2. Observe the indicators on the front panel of the amplifier:

- The +28V ON LED's will illuminate,
- The +15V, -15V and +5V ON LED's will illuminate.

System is now fully operational.

Operation 4

Front Panel description 4.1

The BLAH10 Amplifier 200-600MHz front panel is provided with:

- "BNC" selection and Blanking connectors,
- "N" RF power sockets and "SMA" RF input sockets,
- "Sub D15" socket for the RS485 communication,
- 6 "SMB" and 2 "SCSI" extra connectors used for TCU-T1 signal accessory,
- Status display.

Figure 4.1. BLAH10 Front Panel Design without QNP option

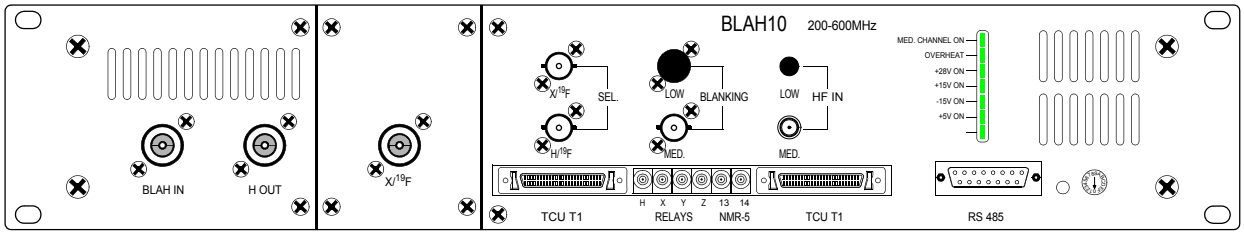
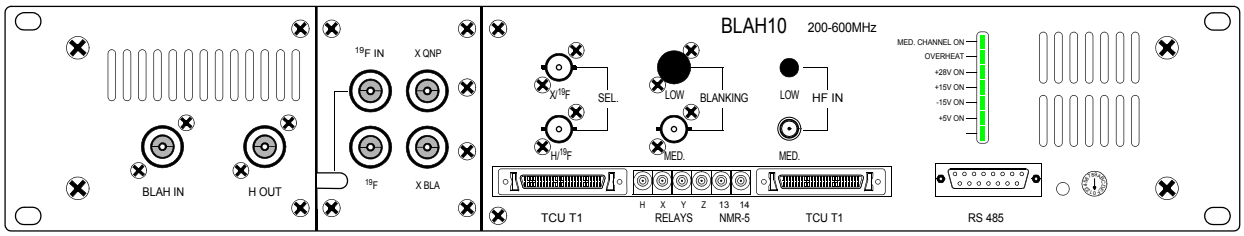


Figure 4.2. BLAH10 Front Panel Design with QNP option



Indicators 4.2

Table 4.1. LED's indicators assignment

MED CHANNEL ON	Indicates that "Med channel" (10W) is sending RF
OVERHEAT	Indicates an overheating or a fan default
+28V ON	Indicates that +28V power supply is ready
+15V ON	Indicates that +15V power supply is ready
-15V ON	Indicates that -15V power supply is ready
+5V ON	Indicates that +5V power supply is ready

Connectors 4.3

Table 4.2. RF Connectors assignment without QNP Relay Option

MED HF IN	RF in "SMA" Connector (female) 10W channel IN : nominal +4dBm
BLAH IN	RF in "N" Connector 100W ^{1}H input (for example : BLAH1000 200-400MHz)
H OUT	RF out "N" Connector ^{1}H out from Hin + 1W/10W amplifier via DPDT Pin Switch
X / ^{19}F	RF out "N" Connector ^{19}F out from Hin + 1W/10W amplifier via DPDT Pin Switch

Table 4.3. RF Connectors assignment with QNP Relay Option

MED HF IN	RF in «SMA" Connector (female) 10W channel IN : nominal +4dBm
BLAH IN	RF in "N" Connector 100W ^{1}H input (for exemple : BLAH1000 200-400MHz)
X BLA	RF in "N" Connector 300/500W X input coming from BLAX300 or BLAX500
^{19}F IN	RF in "N" Connector X/^{19}F out from Hin + 1W/10W amplifier via DPDT Pin Switch
H OUT	RF out "N" Connector ^{1}H out from Hin + 1W/10W amplifier via DPDT Pin Switch
^{19}F	RF out "N" Connector ^{19}F out from Hin + 1W/10W amplifier via DPDT Pin Switch and DPDT QNP Relay
X QNP	RF out "N" Connector 300/500W X input via DPDT QNP Relay

Table 4.4. Blanking Connectors assignment

MED BLANKING	TTL level in "BNC" Connector : 1 = blanked ; 0 = channel active

Table 4.5. RF Output Selection

X / ^{19}F	TTL level in "BNC" Connector : 1 = through ; 0 = crossed[a]
H / ^{19}F	TTL level in "BNC" Connector : 1 = through ; 0 = crossed

a. For DPDT QNP Relay only

True tables *4.3.1*

DPDT Pin Switch ^{1}H & ^{19}F outputs routes as a fonction of SEL H/^{19}F control signal.

Table 4.6. DPDT Pin Switch routing true table

SEL H/^{19}F	1W (LOW) + external Hin	10W (MED)
TTL Logic 1 (5V)	⇒ ^{1}H	⇒ ^{19}F
TTL Logic 0 (0V)	⇒ ^{19}F	⇒ ^{1}H

DPDT QNP Relay BLAH IN & X BLA inputs to ^{19}F & X QNP outputs routes as a fonction of SEL X/^{19}F control signal. For more details, see the chapter ***"Technical description" on page 21***

Table 4.7. DPDT QNP Relay routing true table

SEL X/^{19}F	Hin (if SEL H/^{19}F is LOW)	Xin
TTL Logic 1 (5V) in direct wire mode	supplied to ^{19}F	supplied to X QNP
TTL Logic 0 (0V) in reverse wire mode	supplied to X QNP	supplied to ^{19}F

TCU T1 Signal Accessory Connectors *4.4*

These connectors are defined to supply auxiliaries signals used with old "solid equipment" (MSL or DSX) : please, for more details refer to the Bruker Advanced Service Handbook (BASH : Dual bay > AQX > TCU T1) .

Table 4.8. TCU T1 Connectors assignment

Pin	Signal	Meaning	Pin	Signal	Meaning
1	word3_0	BLNK_TR1	26	GND	
2	NMR5_0	GAIN0_TR1	27	NMR5_1	GAIN1_TR1
3	NMR5_2	C/AB_TR1	28	GND	
4	word3_1	BLNK_TR2	29	GND	
5	NMR5_3	GAIN0_TR2	30	NMR5_4	GAIN1_TR2
6	NMR5_6	C/AB_TR2	31	GND	
7	word3_4	BLNK_TR5	32	GND	
8	NMR5_6	C/AB_TR5	33	GND	
9	word3_5	BLNK_TR6	34	GND	
10	NMR5_7	RELAY_H	35	NMR5_8	RELAY_X
11	TRIG3		36	GND	
12	NMR5_9	RELAY_Y	37	NMR5_10	RACK_ON/OFF
13	NMR5_11		38	GND	
14	NMR5_12	RELAY_Z	39	GND	
15	NMR5_13		40	GND	
16	NMR5_14		41	GND	
17	NMR5_15		42	GND	
18	NMR6_0	STP1_DIR	43	NMR6_1	LB_SEL
19	NMR6_2	DCM_STRT	44	GND	
20	NMR6_3	STP1_CLK	45	GND	
21	NMR6_4	SPTP2_CLK	46	GND	
22	NMR6_5	RES_STP1	47	GND	
23	NMR6_6	DCM_RES	48	GND	
24	NMR6_7	GO_POS	49	GND	
25	TRIG2		50	GND	

Table 4.9. Correspondance between TCU T1 and SMB Connectors

TCU T1 Connectors	SMB Connectors
NMR5_7 (Pin 10)	Relay H
NMR5_8 (Pin 35)	Relay X
NMR5_9 (Pin 12)	Relay Y
NMR5_12 (Pin 14)	Relay Z
NMR5_13 (Pin 15)	NMR5_13
NMR5_14 (Pin 16)	NMR5_14

Rear Panel *4.5*

The rear Panel of the BLARH1-10 Amplifier 200-600MHz is free of elements in exception of the three pole (2P + E) line socket.

- No power switch required. Power cord insertion will switch on the device.
- No fuse required. There are located in the power supply unit.

BLAH10 Amplifier 200-600MHz bloc diagrams 4.6

Figure 4.3. Amplifier block diagram without QNP option

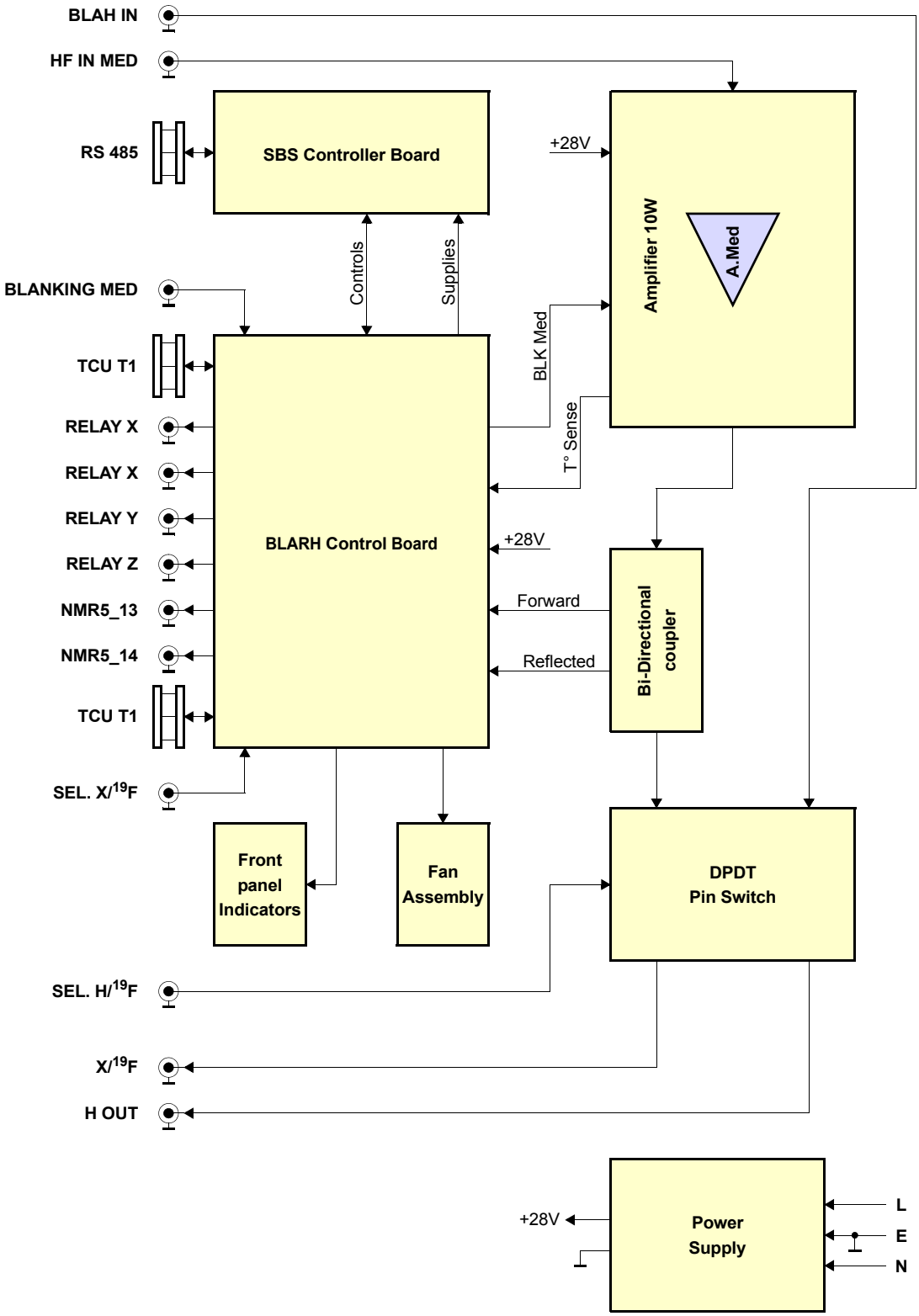
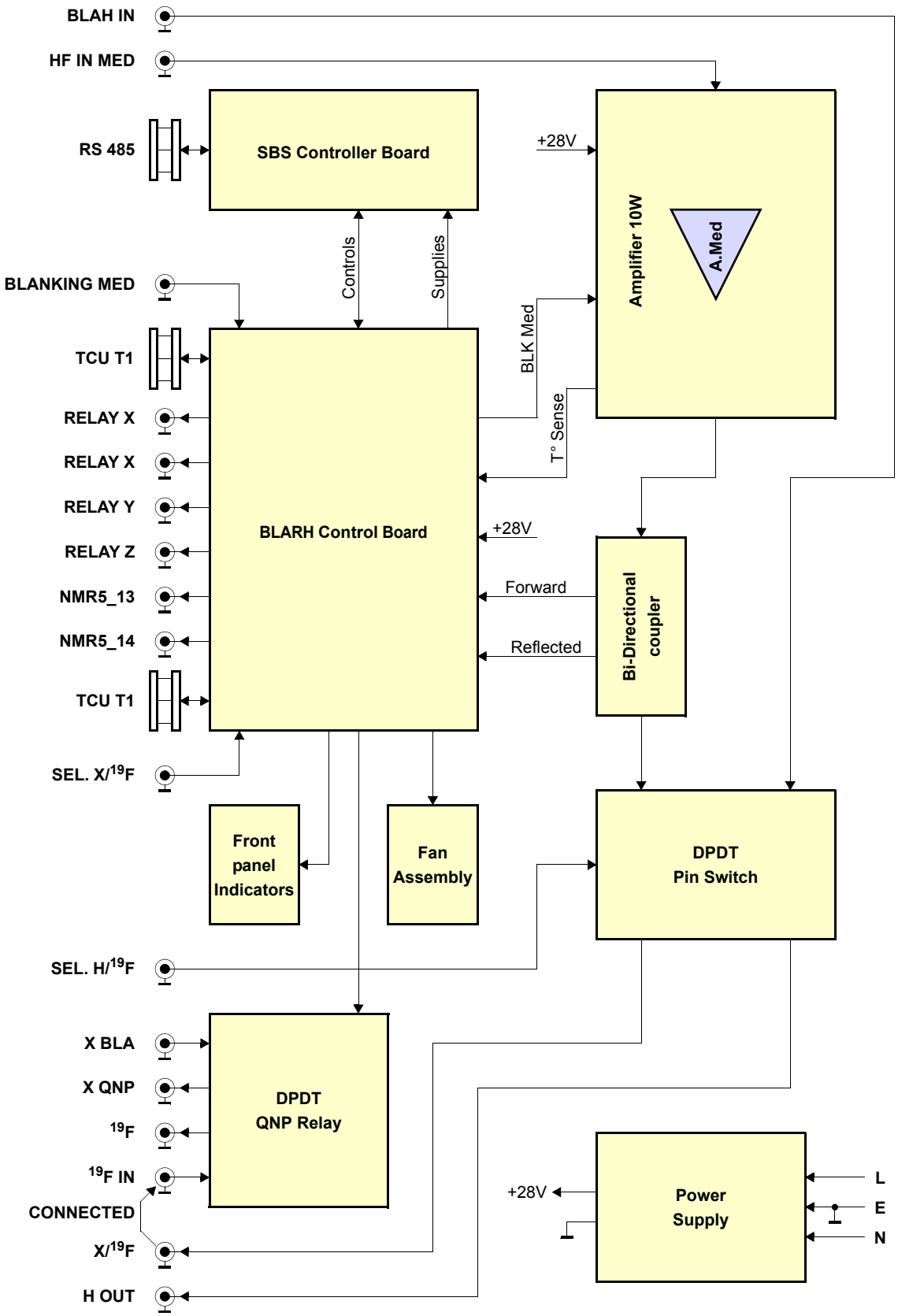


Figure 4.4. Amplifier block diagram with QNP option



Technical description

5

System overview 5.1

The BLAH10 Amplifier 200-600MHz provide a RF Output Power of 10W in the 200-600MHz frequency range, for 1H or 19F channels on two distinct ways which can be routed via a DPDT switch to reach the front panel through 1H and 19F Outputs.

A special 1H input "BLAH IN" channel of an 100W external 1H ,like a BLAH100, allows the routing with the 10W (MED) channel.

With the "QNP Relay Option", the user can route via an internal DPDT relay an external X source, issued from a BALX300 for example, and the 10W channel to supply the both 19F and X QNP Outputs.

The linear module BLMH10 includes a class AB power amplifiers.

The 10W channel is connected to the DPDT Pin Switch via a Bi-Directional coupler. Reflect and Forward Information is conveyed to the user via the RS485 Bus on front panel.

The entire system is tied together by a Digital Signal Interface send power level monitor and malfunctions (supply and temperature faults) to the spectrometer.

Circuits such, Fan Fault or RF Module Overheating, Supply Status and 10W MED Channel activity are displayed on the Front Panel.

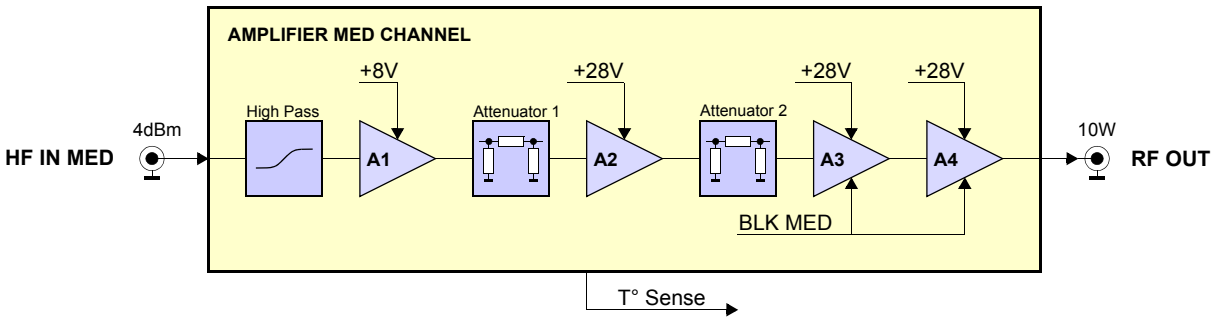
Theory of operation 5.2

RF Amplifier path 5.2.1

The BLAH10 Amplifier 200-600MHz (P/N: W1345041) consists of one Class AB power amplifier.

- A nominal input power level of +4dBm on RF «MED HF IN» produce a nominal output power of 10W peak or continuous power on MED channel.

Figure 5.1. Amplifier module block diagram



RF Outputs router without QNP Relay *5.2.2*

Figure 5.2. DPDT Pin Switch routes

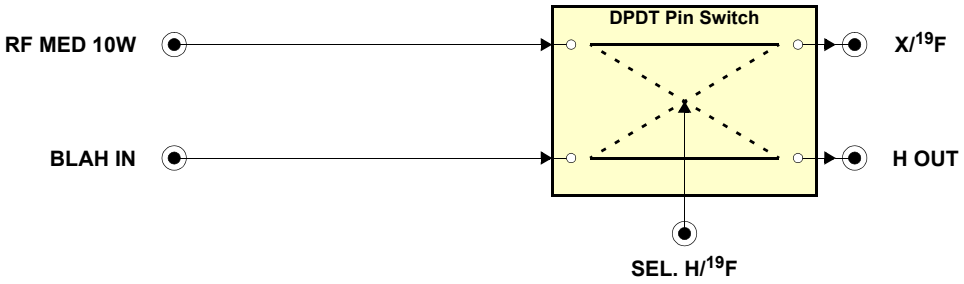
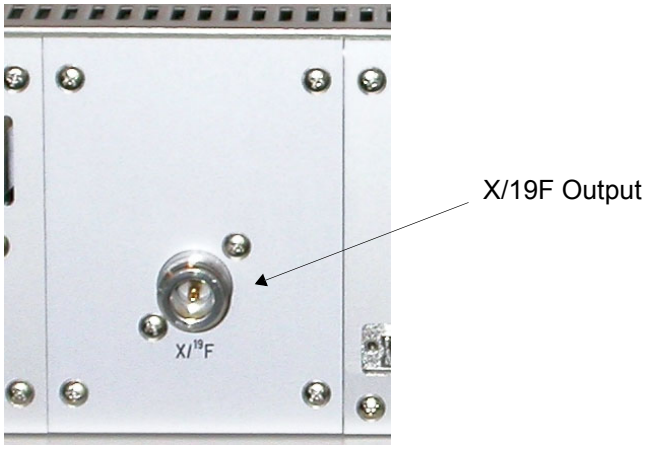


Table 5.1. DPDT Pin Switch True table

H/^{19}F[a]	DPDT Pin Switch
0	Crossed
1	Through

a. TTL Level in BNC Connector.

Figure 5.3. View of ^{19}F Output



RF Outputs router with QNP Relay *5.2.3*

Figure 5.4. DPDT Pin Switch and QNP Relay routes

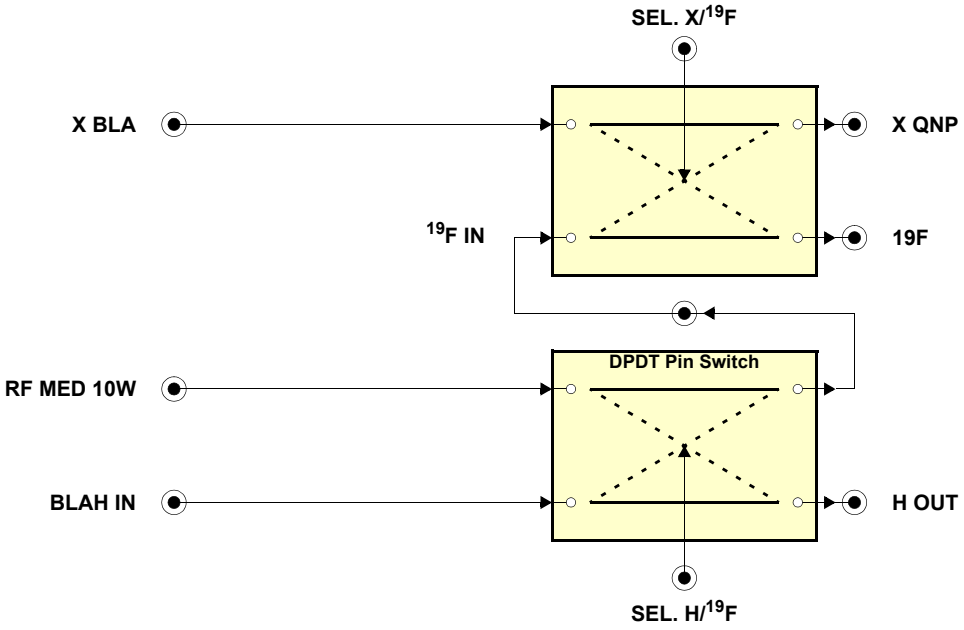


Table 5.2. DPDT Pin Switch

H/^{19}F[a]	DPDT Pin Switch
0	Crossed
1	Through

a. TTL Level in BNC Connector.

Table 5.3. DPDT QNP Relay True table

X/$^{19}F^{a}$	DPDT QNP Relay
0	Crossed
1	Through

a. TTL Level in BNC Connector.

Figure 5.5. View of QNP Relay Accessory before installation

Control Board *5.2.4*

The Control Board consists of circuitry to monitor the 10W output (MED Channel) RF power from the Bi-Directional coupler and to condition the input blanking (gating) signals and deliver there to the RF parts.

The Control Board also monitors the RF Path heatsink temperature and fans to protect against thermal overstress.

Information from supplies also being analyzed by the Control Board.

This Information are displayed on the front panel.

Status Board *5.2.5*

The Status Board on the front panel of the amplifier displays overstress functions, supply status and "MED channel" (10W) RF activity.

Specifications 6

General specifications 6.1

Table 6.1. HMED channel RF specifications

RF Specifications	Channel HMED
Frequency range	180 to 600MHz (3H on request)
Linear Gain	38dB ±1dB
Gain Flatness	±1dB max.
Minimum Pulsed Output Power	8W min.
CW Output Power	No limitation
Linear Output Power	5W min. @ 1dBm compression
Amplifier Biasing	Class AB Operation
Blanking Delay	< 1µs typ.
RF Rise Time	< 100ns
RF Fall Time	< 50ns
DC Ringing	200mV typ. (due to blanking signal)
Input Noise Figure	7dB max.
Output Noise Power (Unblanked)	-129dBm @ 1Hz
Output Noise Power (Blanked)	-174dBm @ 1Hz (Thermal Noise)
IN/OUT Impedance	50Ω
Input V.S.W.R.	1,5 max.
Output Harmonics	30dBc min. (full range)
Pulse Width (int. limitation)	No limitation
Duty Cycle (int. limitation)	No limitation
Amplitude Droop	< 4% @ 10W for 500ms Pulse Width

Table 6.2. External H150 channel RF specifications

RF Specifications	Channel H150
Frequency range	188 to 400MHz / 470 to 500MHz (3H on request)
Linear Gain	48dB ±1dB
Gain Flatness	±2dB max.
Minimum Pulsed Output Power	150W typ. (@ nominal input +4dBm)
CW Output Power	25W max. (internal limitation)
Linear Output Power	120W min. @ 1dBm compression
Amplifier Biasing	Class AB Operation
Blanking Delay	< 1µs typ.
RF Rise Time	< 70ns
RF Fall Time	< 50ns
Input Noise Figure	6dB max.
Output Noise Power (Unblanked)	-118dBm @ 1Hz
Output Noise Power (Blanked)	-174dBm @ 1Hz (Thermal Noise)
IN/OUT Impedance	50Ω
Input V.S.W.R.	1,5 max.
Output Harmonics	-30dBc min. @ 150W (full range)
Pulse Width (int. limitation)	250ms @ 200W (up to CW @ 50W)
Duty Cycle (int. limitation)	5% @ 200W (up to 100% @ 50W)
Amplitude Droop	< 6% @ 200W for 100ms Pulse Width
Dimensions	19" rack cabinet, 2U height, 460mm deph
Weight	12kg

RF signal coming from BLAH1000 (High Resolution output). Signal controlled on High Power "H" Amplifier (coupled under 50dB with HLOW channel). Internal insertion loss : 2dB.

Table 6.3. Common characteristics

RF Input	SMA (F)
RF Output	N (F)
Blanking Pulse Connector	BNC (F)
RF Switch Control Signal	BNC (F)

Figures

Figures

Tables

Tables