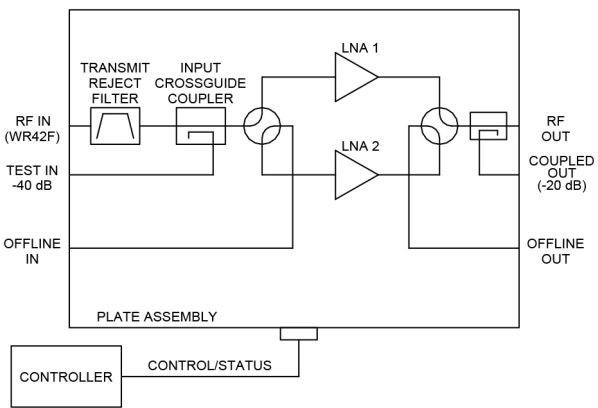
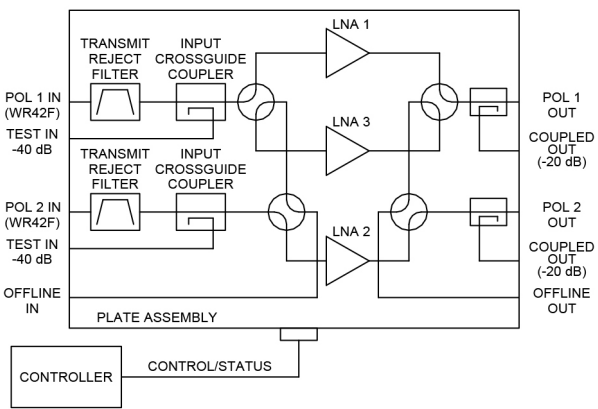


System Block Diagrams

1:1 System



1:2 System

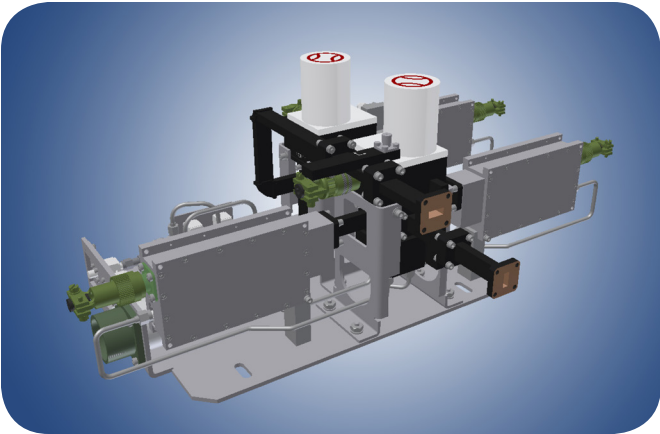


Other Products

- Solid-State Power Amplifiers and SSPA Systems
- Solid-State Power BUCs and SSPB Systems
- Low Noise Amplifiers and LNA Systems
- Low Noise Block Converters and LNB Systems
- Block Up and Block Down Converters
- Synthesized Converters
- Line Drive Amplifiers
- Power Supply Monitors
- Redundant Control Panels for SSPAs, SSPBs, and LNAs

Ka-Band Redundant LNA Systems

LRKA-1000 Series



Overview

Redundant LNA systems minimize system downtime due to LNA failure by providing a spare LNA and an automatic means of switching to the spare upon failure of a primary LNA. A 1:1 system provides one spare LNA for one primary LNA. A 1:2 system provides a spare LNA for either of two primary LNAs. The systems consist of an outdoor plate assembly which mounts at the antenna hub, an indoor control panel and interconnecting control cable.

Plate Assembly Features

- LK-20S000 Series Ka-band Low Noise Amplifiers (LNAs) High quality dual waveguide/coaxial switches
- Manual override
- Waveguide input flanges
- Output coaxial isolators standard
- Transmit reject filter(s), input crossguide coupler(s), output coax couplers, and offline I/O options available

Redundancy Controller Features

- 10/100 Base T Ethernet network interface
- Supports SNMP v1, v2c, and v3
- Manual or automatic operation
- Menu-driven user configuration of all options
- Front panel graphically depicts switch positions and unit status Worldwide universal AC input capability standard; consult factory for DC prime power
- Audible alarm
- CE certified and RoHS compliant; EAR 99

Monitors unit currents, external alarms, or both

Automatically switches RF path to standby unit when unit failure occurs

Rack-mount chassis, 19" wide, 1¾" (1 RU) high

Dual, redundant power supplies

User-selectable RS-232/-422/-485 serial I/O M&C interface
Parallel I/O M&C interface

Ka-Band Redundant LNA Systems

System Specifications *

Parameter	Notes	Min	Nom./Typ. [†]	Max.	Units
Frequency Range	Band “A” Band “B”	18.2 20.2		20.2 21.2	GHz GHz
Noise Temperature, System	At +23 °C Versus temperature	See Table 1 See Table 2			
Gain	Standard LNA LNA with Option 1	54 44	60 50		dB dB
Gain Flatness	Full band Per 40 MHz			±1.5 ±0.5	dB dB
Gain Stability (Constant Temp.)	Short term (10 min) Medium term (24 hrs) Long term (1 week)		±0.1 ±0.2 ±0.5		dB dB dB
Gain Stability	Vs. temperature (standard) Contact factory for improved stability LNA with Option 3	-0.06			dB per °C
VSWR	Input, standard Input, with System Option B, Tx filter Output		1.25 1.30 1.20		:1 :1 :1
Power Output at 1 dB Compression (P ₁ dB)	Standard LNA LNA with Option 2 LNA with Option 2 & System Option D, output couplers	+10 +18 +17	+19 +20 +28		dBm dBm dBm
Third Order Output Intercept Point (OIP ₃)	Standard LNA LNA with Option 2 LNA with Option 2 & System Option D, output couplers	+18 +26 +25	+20 +28 +27		dBm dBm dBm
AM/PM Conversion	At -5 dBm out			0.05	°/dB
Group Delay per 40 MHz	Linear Parabolic Ripple			0.02 0.002 0.2	ns/MHz ns/MHz ² ns p-p
Maximum Input Power	Without damage			0	dBm
Desensitization Threshold for 27.5–31.0 GHz in	Standard system With System Option B, Tx filter			-20 +30	dBm dBm
Connectors	RF Input RF Output Offline In/Out, Coupler In/Out		WR42F Waveguide Flange SMA Female A SMA Female A		
Temperature Range	Switch Plate Assy	-40		+60	°C

*System specifications depend on choice of LNA and various options. Specifications shown are for a typical system using LK-20S000 series LNAs (Specification 26926).

[†]When there is only one value on a line, the Nom./Typ. column is a nominal value; otherwise it is a typical value. Typical values are intended to illustrate typical performance, but are not guaranteed.

^AType N Female connectors available on request (custom option).

Part Number/Ordering Information

[illegible]

Examples:

1:1 system with 20.2-21.2 GHz, 110 K LNAs, no LNA options, commercial white LNAs, no system options, and 100 ft. cable:

Order Number	L	R	K	A	1	B	1	1	0	-	X	X	X	X	X	X	X	1
--------------	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---

1:1 system with 18.2-20.2 GHz, 120 K LNAs, with Tempco option, green LNAs, Tx Reject filter, CG coupler, and 200 ft. cable:

Order Number	L	R	K	A	1	A	1	2	0	-	X	X	3	5	B	C	X	X	3
--------------	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---

1:2 system with 20.2-21.2 GHz, 110 K LNAs with low gain option, tan LNAs, input CG coupler, output coax coupler, offline I/O, and 150 ft. cable:

Order Number	L	R	K	A	2	B	1	1	0	-	1	X	X	6	X	C	D	E	2
--------------	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---

1:2 system with 18.2-20.2 GHz, 130 K LNAs with low gain, high power, and Tempco output options, tan LNAs, Tx filter, input and output couplers, offline I/O, and 250 ft. cable:

Order Number	L	R	K	A	2	A	1	3	0	-	1	2	3	6	B	C	D	E	4
--------------	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---

Note:

Consult factory for custom configurations.

Table 1 — Typical System Noise Temperature with Various Options (Add to TLNA)

System	1:1	1:2		
Configuration:		<u>Pol. 1</u>	<u>Pol. 2</u>	<u>Standby</u>
Standard Configuration (Add to T _{LNA})	7 K	7 K	11 K	16 K
With 40 dB Crossguide Coupler(s)	9 K	9 K	13 K	18 K
With Transmit Reject Filter(s)	18 K	18 K	22 K	27 K
With Tx Filter(s) and Coupler(s)	20 K	20 K	24 K	29 K

Table 2 — Noise Temperature vs. Ambient Temperature

Noise temperature vs. ambient temperature can be found from the equation,

$$NT_2/NT_1 = (T_2/T_1)^n$$

where:

- NT₂ = Noise Temperature at T₂
- NT₁ = Noise Temperature at T₁
- T₂ = Temperature 2 in K
- T₁ = Temperature 1 in K
- n = 1.8 for the LNAs or = 1.0 for passive losses

For the case where T₁ = 296 K (+23 °C), the ratio NT₂/NT₁ is shown in the table below for both LNAs (n = 1.8) and for passive losses (n = 1.0):

Ambient Temperature T ₂ (°C)	n = 1.8 NT ₂ /NT ₁	n = 1.0 NT ₂ /NT ₁
0	0.86	0.92
+23	1.00	1.00
+40	1.11	1.06
+50	1.17	1.09
+60	1.24	1.13

Example: For a 1:1 system with Tx filter, crossguide coupler and 110 K LNAs, $T_{LNA} = 110\text{ K}$ at $+23\text{ }^{\circ}\text{C}$ and passive losses = 20 K at $+23\text{ }^{\circ}\text{C}$; thus, $T_{SYS} = 130\text{ K}$ at $+23\text{ }^{\circ}\text{C}$. What is T_{SYS} at $+50\text{ }^{\circ}\text{C}$?

From the table, NT_2/NT_1 at $50\text{ }^{\circ}\text{C}$ = 1.17 for the LNAs and 1.09 for the passive losses:
 $NT_2 = 1.17 \times (110\text{ K}) + 1.09 \times (20\text{ K}) = 129\text{ K} + 22\text{ K} = 151\text{ K}$ at $+50\text{ }^{\circ}\text{C}$.

Ka-Band Redundant LNA Systems

Redundant System Controller



1:2 Redundant System Controller, Model RSC12V1-AC

The RSC series redundant system controllers for 1:1 and 1:2 systems directly power the LNAs and monitor the output voltages and currents to detect faults. The RSC can also monitor external alarm signals or a combination of output currents and external alarm inputs. Upon detecting a fault, the RSC drives an RF transfer switch to activate the spare unit.

The RSC offers monitoring and control of auxiliary RF hardware; remote monitor and control via network, serial interface, or parallel I/O; flexible configuration of system behavior; remote disable of local controls for security; and the ability to detect and report certain failures within the controller itself.

A second RSC can be linked to a primary RSC to provide full system control from an alternate control site. When set up this way, the secondary RSC is referred to as a remote control panel, or RCP. The configuration and settings of the primary RSC are transferred to the RCP, which then mimics its controls and interfaces. This permits system operation from a location that is up to 4000 ft (1200 m) distant from the primary controller.

Controller Specifications

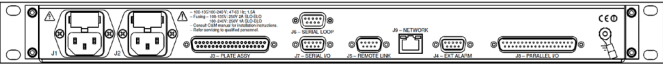
- **Unit Status Monitor Methods**
 - Controller monitors unit bias current; alarm is generated if current goes outside of allowed tolerance window (LNA or LNB systems). Controller also monitors external alarm inputs (SSPA and other systems) or combinations of both internal unit current and external alarm inputs.
- **Unit Current Window Width**
 - ±5% to ±25% of nominal; user selectable in 5% steps (applies to all monitored unit currents)
- **Switchover Time**
 - 100 ms maximum
- **Unit Power Outputs**
 - +14.3 to +15.0 Vdc, 700 mA maximum
- **Switch Drive Outputs**
 - -22 to -28 Vdc, 2 A maximum
- **External Alarm Inputs**
 - Optionally up to one per unit; require sinking 5 mA at 5 Vdc to negate alarm
- **Serial I/O Interface**
 - RS-232/RS-422/RS-485 2- or 4-wire; user selection

- **Parallel I/O Interface**
 - Control inputs: Contact closures to ground; require sinking 20 mA at 15 Vdc
 - Status outputs: Form 'C' dry contacts; 100 Vdc, 0.5 A, 3 W max (resistive load)
- **Controller Dimensions**
 - 19" (483 mm) W x 1.72" (43.7 mm) H x 17.5" (445 mm) D; 7.6 lb (3.4 kg)
- **Chassis Slides**
 - Standard. Radio relay rack-mount brackets available on request.
- **Cable Length to Plate Assy**
 - Order cable separately. 100 ft (30 m) to 250 ft (75 m) lengths in 50 ft (15 m) increments are standard; other lengths (up to 500 ft or 150 m) are available by special order.
- **AC Input (standard)**
 - 90-264 Vac, 47–63 Hz, 100 W; Dual AC inputs and dual redundant power supplies.
- **DC Input (option)**
 - Requires DC-AC inverter. Consult factory.
- **Temperature Range**
 - Operating: 0 to +50 °C (indoor equipment environment)
 - Storage: -40 to +70 °C
- **Relative Humidity**
 - Operating: 5% to 95% non-condensing
- **Altitude**
 - Up to 10,000 ft (3000 m) above mean sea level
- **Reliability**
 - MTBF: 48,200 hours; MTTR: less than 30 minutes with spares and proper technical person.

Controller Front Panel Controls and Indicators

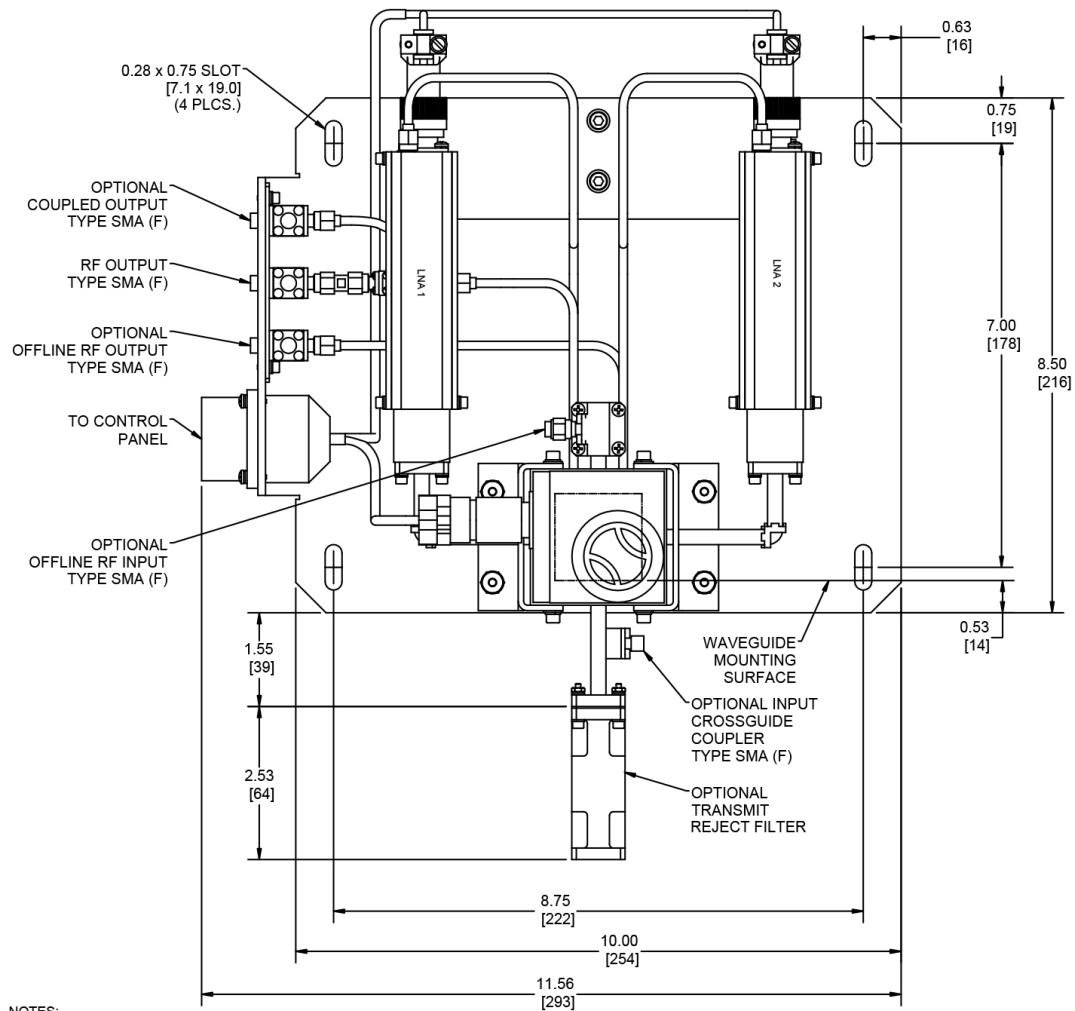
- **Unit Status Alarms**
 - LED Indicators glow green when OK, red when a fault is detected.
- **PS Indicator**
 - Glows red to show fault with either dual redundant power supply.
- **Panel Test**
 - Pushbutton lights all indicators & tests audible alarm.
- **RF Switch Pushbuttons and Indicators**
 - Pushbuttons are used to manually switch units. Front panel indicators show which units are on-line. Unit indicators light red to show faulted units.
 - In a typical 1:1 system, Unit 1 is the primary unit and Unit 2 is on standby. In a 1:2 system, Unit 1 is the primary unit for Pol 1 and Unit 2 is the primary unit for Pol 2. Unit 3 is on standby and can be selected for either Pol. In a dual 1:1 system, Unit 1 is the primary unit and Unit 2 is on standby for Pol 1; Unit 3 is the primary and Unit 4 is on standby for Pol 2.
- **Auto/Manual Switch and Indicators**
 - In Auto mode, a unit failure initiates automatic switchover to the standby unit. In manual mode, the on-line unit can be selected from the front panel or by serial I/O, parallel I/O or network command.
- **Remote/Local Switch and Indicators**
 - Selects local (front panel) control, or remote control from serial I/O, parallel I/O, or network.
 - An optional second RSC, configured as a Remote Control Panel, provides the means to operate the system from a physically distant, alternate location.

Controller Rear Panel Interfaces



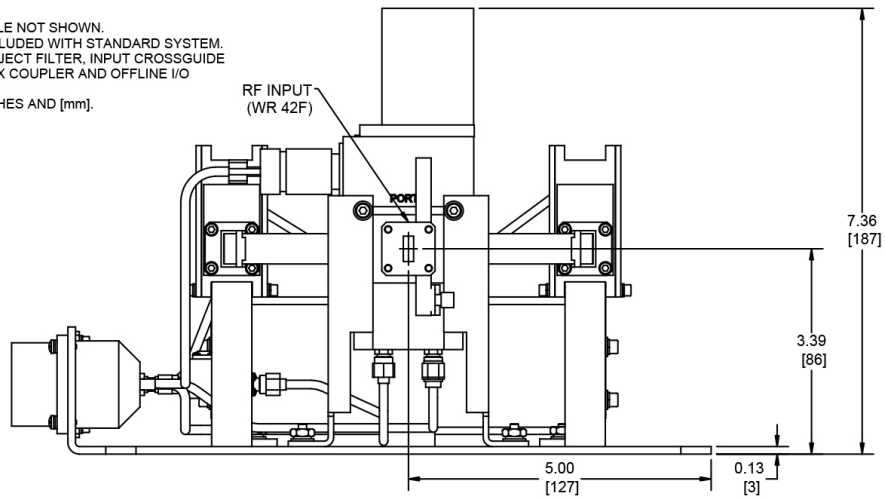
- **J1, J2 – LINE 1, LINE 2 (IEC 320-C14)**
 - Dual power entry modules contain the AC line input connectors. System can be powered from separate AC lines if desired. Either or both power supplies are capable of operating the system.
- **J3 – PLATE ASSY (37-pos D, Female)**
 - Cable to plate assembly carries unit power (for line drivers, LNAs or LNBs) and switch drive signals. Order cable separately. Standard lengths are 100' (30 m) to 250' (75 m) in 50' (15 m) increments; other lengths are special order. An adapter cable mates the controller to legacy system cables.
- **J6 – SERIAL I/O and J7 – SERIAL LOOP (9-pos D Female)**
 - RS-232/RS-422/RS-485 connector for user M&C System. Commands provide monitoring, controlling, and configuration. Interconnect cable lengths to 4000 ft (1200 m) with RS-422 or RS-485. A serial loop connector provides a convenient connection for daisy-chained systems.

1:1 Plate Assembly Outline Drawing, with Various Options Installed

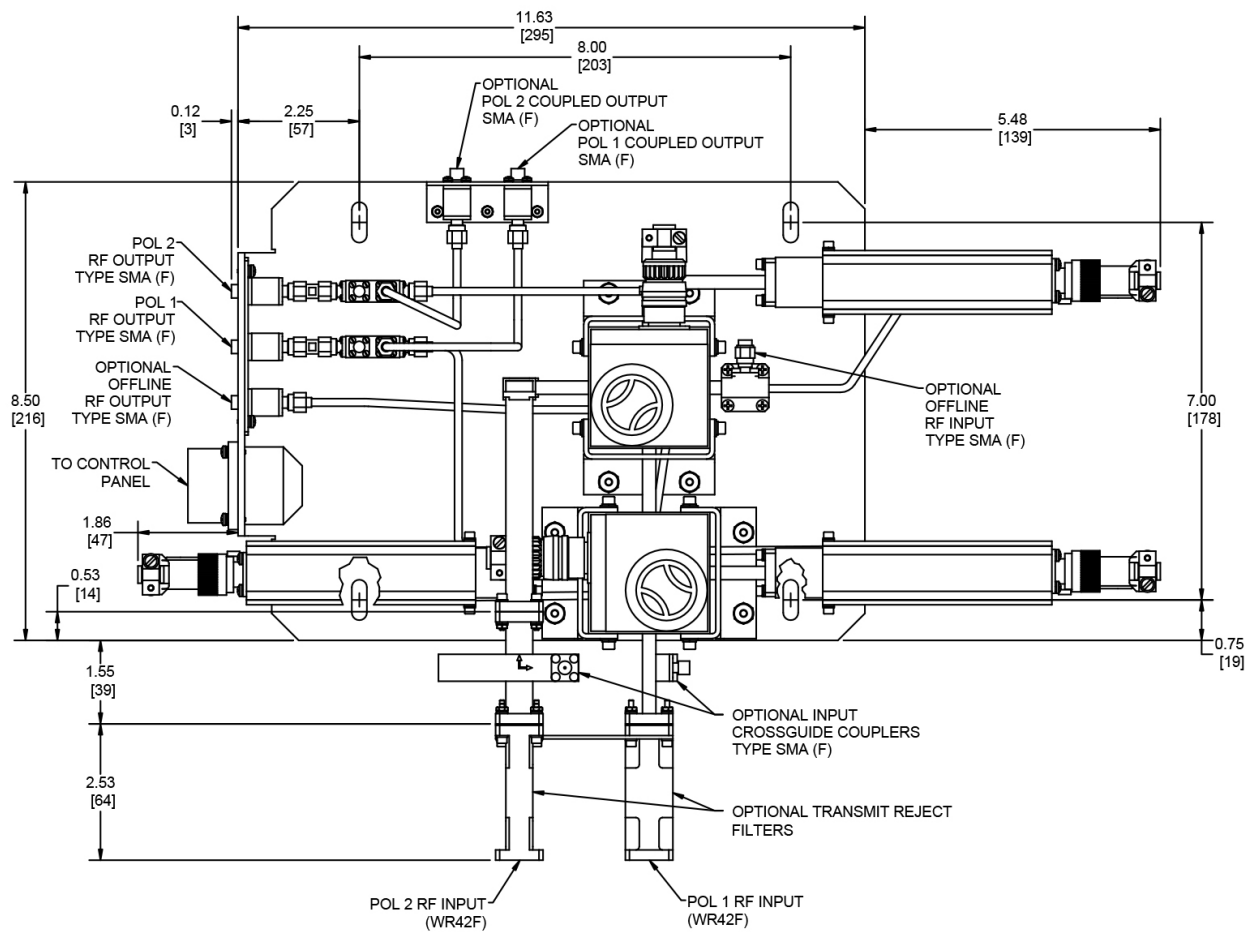


NOTES:

1. INTERCONNECTING CABLE NOT SHOWN.
2. OUTPUT ISOLATORS INCLUDED WITH STANDARD SYSTEM.
3. OPTIONAL TRANSMIT REJECT FILTER, INPUT CROSSGUIDE COUPLER, OUTPUT COAX COUPLER AND OFFLINE I/O SHOWN.
4. DIMENSIONS ARE IN INCHES AND [mm].



1:2 Plate Assembly Outline Drawing, with Various Options Installed



NOTES:

1. INTERCONNECTING CABLE NOT SHOWN.
2. OUTPUT ISOLATORS INCLUDED WITH STANDARD SYSTEM.
3. OPTIONAL TRANSMIT REJECT FILTERS, INPUT CROSSGUIDE COUPLERS, OUTPUT COAX COUPLERS, AND OFFLINE I/O SHOWN.
4. DIMENSIONS ARE IN INCHES AND [mm].

