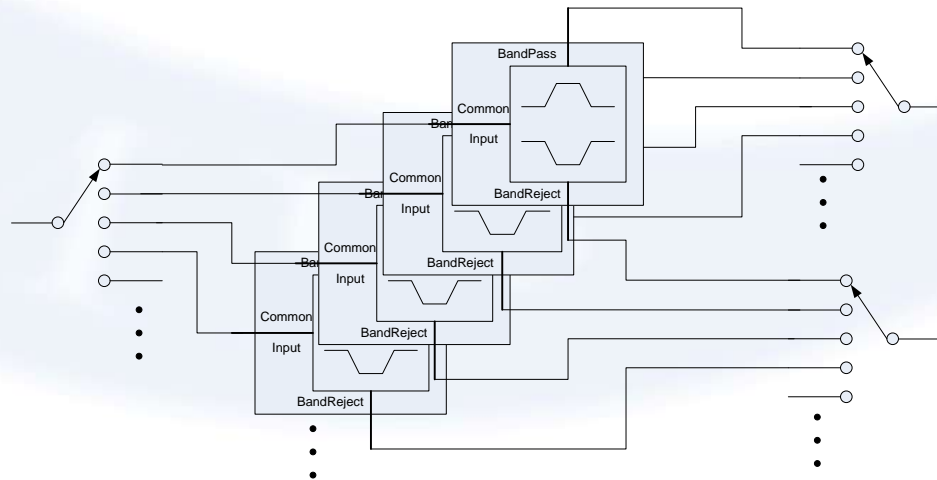


Overview of RF Solutions for Broad-Band Emission Monitoring



Market Applications

Separation of IM products from carriers while operating at full power.
Protecting devices from energy bouncing back.
Spurious Emission - Broad-Band
TX/RX Measurements
Interferer Tests
Interactions with Satellite Communication (GPS, Inmarsat, etc.)

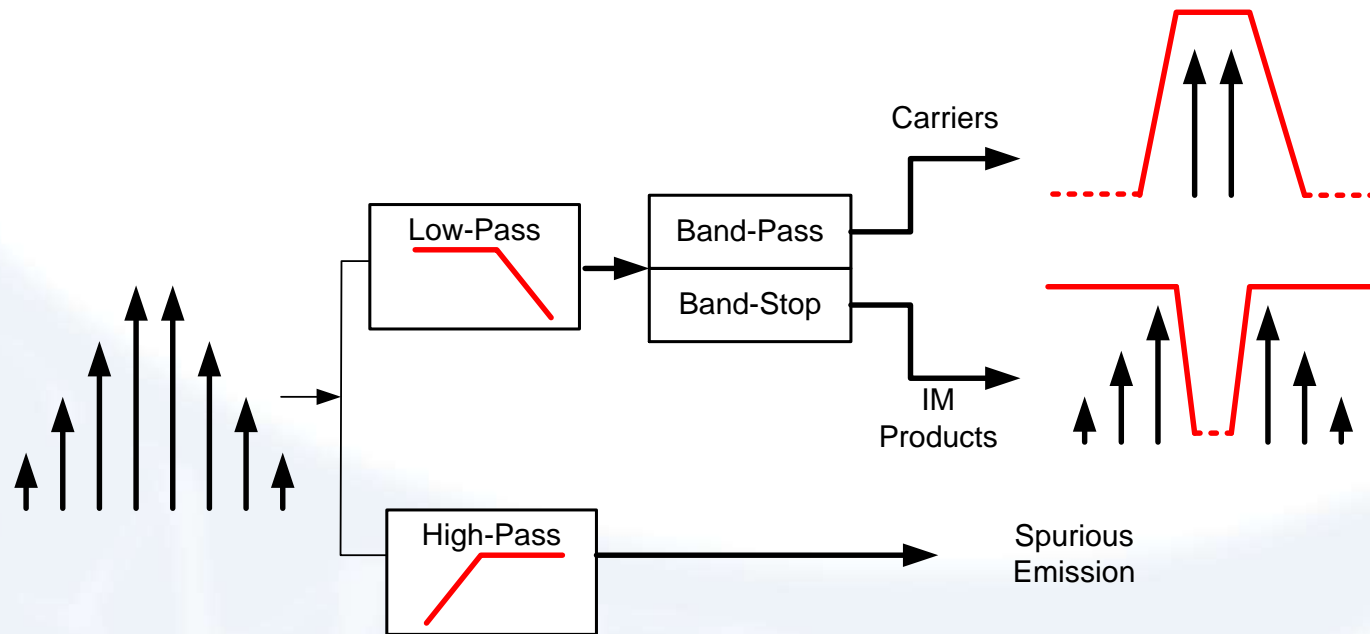
Low Power: Chip-Sets (OEM)
0.5W CW
IM: 100dBc for 2x+33dBm

Test Boxes:
LTE Bands

High Power: Base Stations (OEM)
100W CW, 1KW Peak
Low PIM: 156dBc for 2x+43dBm

Test Boxes:
3GPP Bands

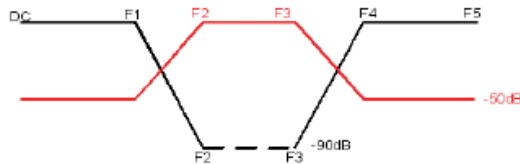
PIM Block Diagram



- Highpass/Lowpass Diplexer separates IM products and carriers (LP) from spurious emissions (HP).
- High Q Cavity Bandpass/Bandstop (BP/BS) Diplexer separates the IM products from the carriers.
- Low-PIM Requirements - The BP/BS Diplexer must meet stringent requirements, such as silver plating of 5 to 6 skin depths, avoidance of nickel and other ferromagnetic materials, surface finish, ridge pressure, etc.

BP/BS Diplexers

Low PIM, High-Power Filter Solutions for Monitoring Broadband Emissions
(Patent Pending)



PIM: The diplexers are available in two PIM levels: -130 dBc(-1) and -156 dBc(-2).

The third product is measured at the Bandreject port when two +43 dBm carriers are present at the common port in the passband of the Bandpass filter.

P/N	F1 MHz	F2 MHz	F3 MHz	F4 MHz	F5 MHz	BR- Insertion Loss (dB)	BP- Insertion Loss (dB)
WSD-00459	1995	2110	2170	2185	4000	-3	-3
WSD-00485	1915	1930	1990	2005	4000	-3	-3
WSD-00458	1790	1805	1880	1895	4000	-3	-3
WSD-00487	2095	2110	2155	2170	4000	-3	-3
WSD-00488	854	869	894	909	1650	-3	-3
WSD-00489	860	875	885	900	1650	-3	-3
WSD-00490	2605	2620	2690	2705	4000	-3	-3
WSD-00491	910	925	960	975	1650	-3	-3
WSD-00526	809	824	849	864	1650	-3	-3
WSD-00527	865	880	915	930	1650	-3	-3
WSD-00528	1695	1710	1785	1800	4000	-3	-3
WSD-00529	1835	1850	1910	1925	4000	-3	-3
WSD-00566	2060	2110	2170	2220	4000	-0.7	-1.5
WSD-00567	1880	1930	1990	2040	4000	-0.7	-1.5
WSD-00569	716	728	768	777	1400	-0.7	-1.5
WSD-00570	849	869	894	935	1650	-0.7	-1.5
WSD-00585*	849	869	894	930	2000	-0.7	-1.5
WSD-00599**	735	746	756	777	1400	-0.7	-1.5
WSD-00600	2570	2620	2690	2740	4000	-0.7	-1.5
WSD-00594	2060	2110	2155	2205	4000	-0.7	-1.5
WSD-00606	1910	1930	1990	2040	4000	-0.7	-1.5
WSD-00611	716	728	746	766	1400	-0.7	-1.5
WSD-00612	1463	1476	1511	1531	4000	-0.7	-1.5
WSD-00619	1463	1476	1486	1506	4000	-0.7	-1.5
WSD-00621	1785	1845	1880	1900	4000	-0.7	-1.5
WSD-00610	1910	1930	1990	2010	4000	-0.7	-1.5

BR- Return Loss: -10 dB

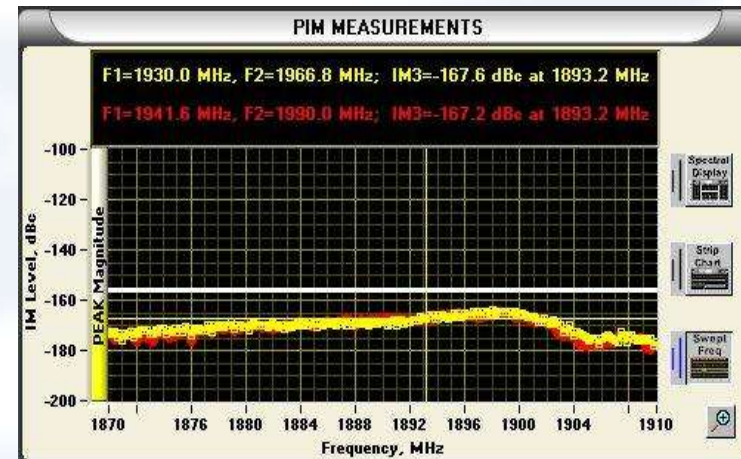
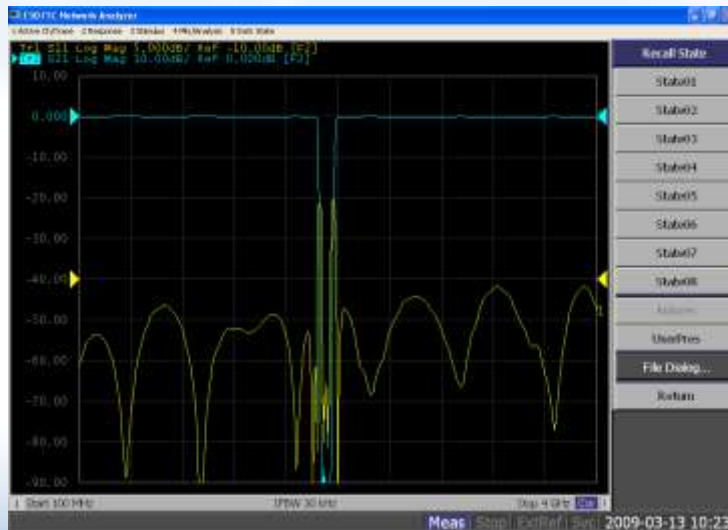
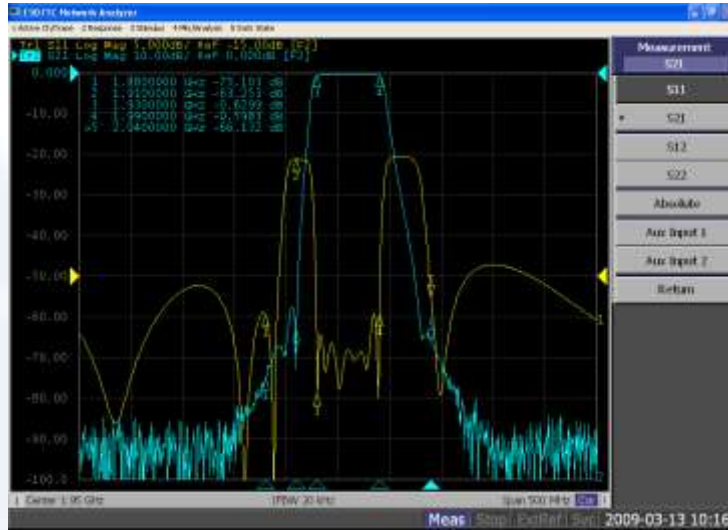
BP- Return Loss: -15 dB

* -100 dB Rejection instead of -90 dB

** -70 dB Rejection instead of -90 dB

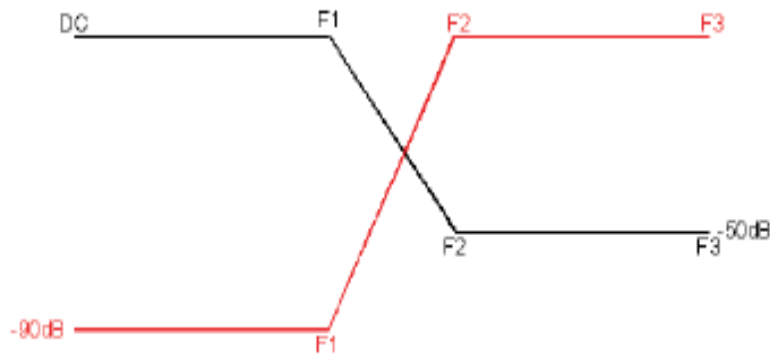


BP/BS Results



Highpass/Lowpass Diplexer

Low PIM, High-Power Filter Solutions for Monitoring Broadband Emissions
(Patent Pending)



PIM: The diplexers are available in three PIM levels: -110 dBc(-0), -130 dBc(-1) and -156 dBc(-2).

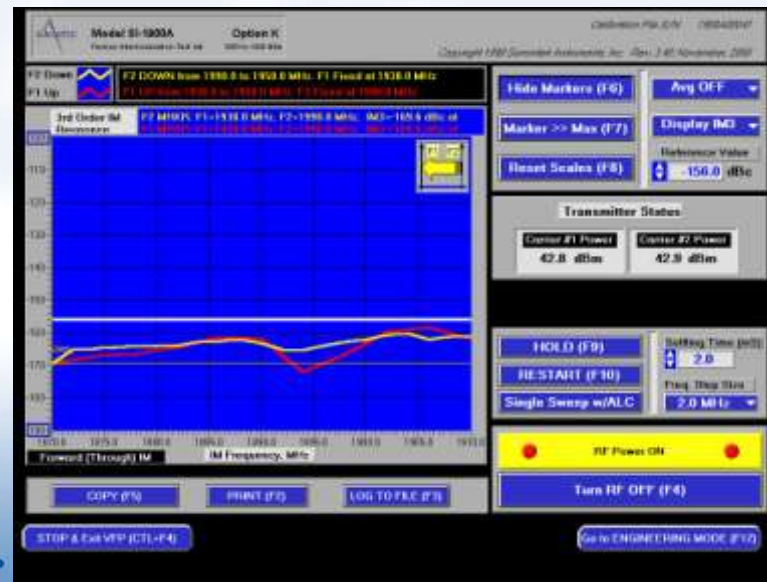
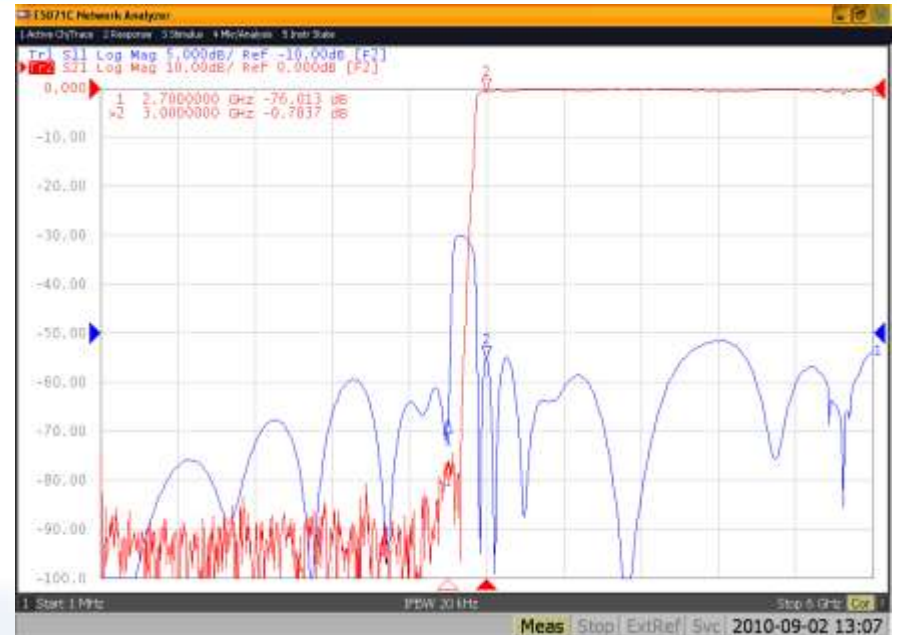
The third IM product is measured at the common port when two +43 dBm carriers are present at the Lowpass port and/or the Highpass port, with an adjacent port terminated.

P/N	F1 MHz	F2 MHz	F3 MHz	LP- Insertion Loss (dB)	LP- Return Loss (dB)	HP- Insertion Loss (dB)	HP- Return Loss (dB)
WSD-00568	960	1300	4000	-1.5	-15	-1	-10
WSD-00593	2700	4000	13000	-1.5	-15	-1	-10
WSD-00613*	2700	3000	6000	-1.5	-15	-1.5	-10
WSD-00618	1800	2400	6000	-1.5	-15	-0.7	-10

* -70 dB Rejection instead of -90 dB



Highpass/Lowpass Examples




Low-PIM Mechanical Switch

REVISIONS				
REV.	DESCRIPTION	DATE	APPROVED	
A	PRODUCTION RELEASE	2/23/10	K.R.	
B	REVISED PER ECO #9850	5/13/10	K.R.	

Nominal Coil Voltage	Part Number	
	SP7T	SP8T
12 Vdc	571JW-420823	581JW-420823
15 Vdc	571JW-490823	581JW-490823
24 Vdc	571JW-480823	581JW-480823
28 Vdc	571JW-430823	581JW-430823

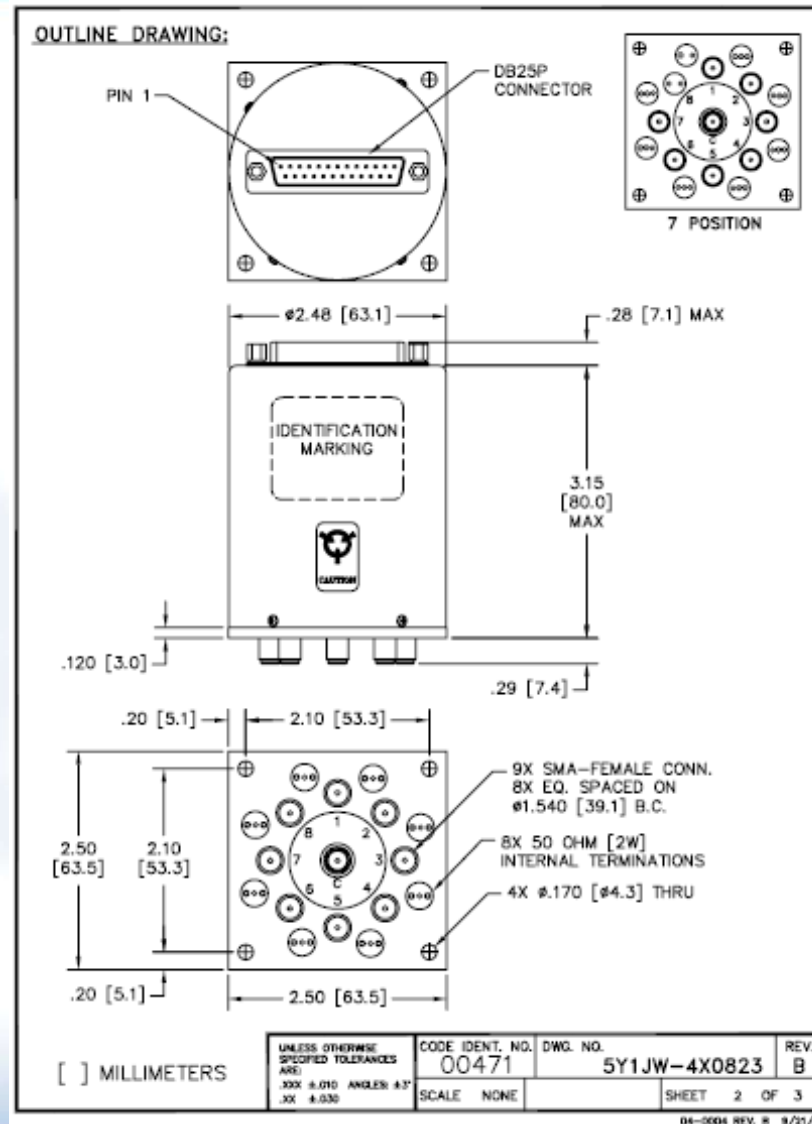
REVISIONS	B	B	B		
SHEET NO.	1	2	3		
APPROVALS			DATE		
DRWN	S. LEE	2/18/10			
ENG	S. LEE	2/18/10			
ENG. MGR.	G. NICKLAUS	2/20/10			
SALES MGR.	J. TRUJILLO	2/22/10			
Q.A. MGR.	S. LYNCH	2/23/10			
MFG. MGR.	S. WIGHTMAN	2/22/10			

 DowKey Microwave CORPORATION	4822 McGrath Street Ventura, CA. 93003-5641 PH: (805) 650-0280 FAX: (805) 650-1734	
	<small>A DOWKEY TECHNOLOGIES COMPANY</small>	
SWITCH, 7-8 POSITION, LATCHING SELF CUT-OFF SMA-FEMALE CONN., INDICATORS, 50 OHM [2W] TERM., DB25P CONN., LOW PASSIVE INTERMODULATION (PIM)		
CODE IDENT. NO.	DWG. NO.	
00471	5Y1JW-4X0823	
SCALE NONE	FINAL ASSY:	SHEET 1 OF 3

04-0004 REV. B 9/21/09



Low-PIM Mechanical Switch



Low-PIM Mechanical Switch

SPECIFICATIONS:

1. RF CHARACTERISTICS:

1.1 FREQUENCY (GHz):	DC-4	4-8	8-12.4	12.4-18
1.2 VSWR (RATIO MAX):	1.20:1	1.30:1	1.40:1	1.50:1
1.3 INSERTION LOSS (dB MAX):	0.20	0.30	0.40	0.50
1.4 ISOLATION (dB MIN):	80	75	70	60
1.5 RF POWER (WATTS CW MAX):	100	70	60	50

1.6 PASSIVE INTERMODULATION:

TEST SIGNALS: CARRIER FREQUENCY 1: 1930 MHz, APPROXIMATELY 43dBm (20W)
 CARRIER FREQUENCY 2: 1990 MHz, APPROXIMATELY 43dBm (20W)
 SPECIFICATION REQUIREMENT: 3rd ORDER PIM PERFORMANCE: BELOW -160 dBc
 3rd ORDER PIM FREQUENCY: 1870 MHz

2. ACTUATION DATA:

NOMINAL VOLTAGE	OPERATING VOLTAGE	CURRENT (TYP) @ NOMINAL VOLTAGE & 25°C
12	11-14	415mA
15	13-17	330mA
24	20-28	210mA
28	24-32	180mA

- 2.2 SWITCHING TIME: 15ms MAX
 2.3 OPERATING MODE: LATCHING SELF CUT-OFF

3. MECHANICAL:

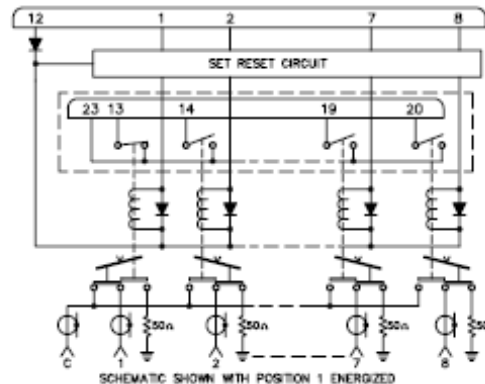
- 3.1 RF CONTACTS: BREAK BEFORE MAKE
 3.2 WEIGHT: 16oz. (510g.) NOMINAL
 3.3 DESIGN LIFE: 1,000,000 CYCLES MIN

4. ENVIRONMENTAL:

- 4.1 OPERATING TEMPERATURE: -25°C TO +65°C
 4.2 STORAGE TEMPERATURE: -55°C TO +85°C
 4.3 SEAL: SAND AND DUST

SCHEMATIC:

PIN NO.	FUNCTION
1	- POS. 1
2	- POS. 2
3	- POS. 3
4	- POS. 4
5	- POS. 5
6	- POS. 6
7	- POS. 7
8	- POS. 8
9,10,11	SPARE
12	+VDC
13	IND POS 1
14	IND POS 2
15	IND POS 3
16	IND POS 4
17	IND POS 5
18	IND POS 6
19	IND POS 7
20	IND POS 8
21-22	SPARE
23	IND CCM
24-25	SPARE

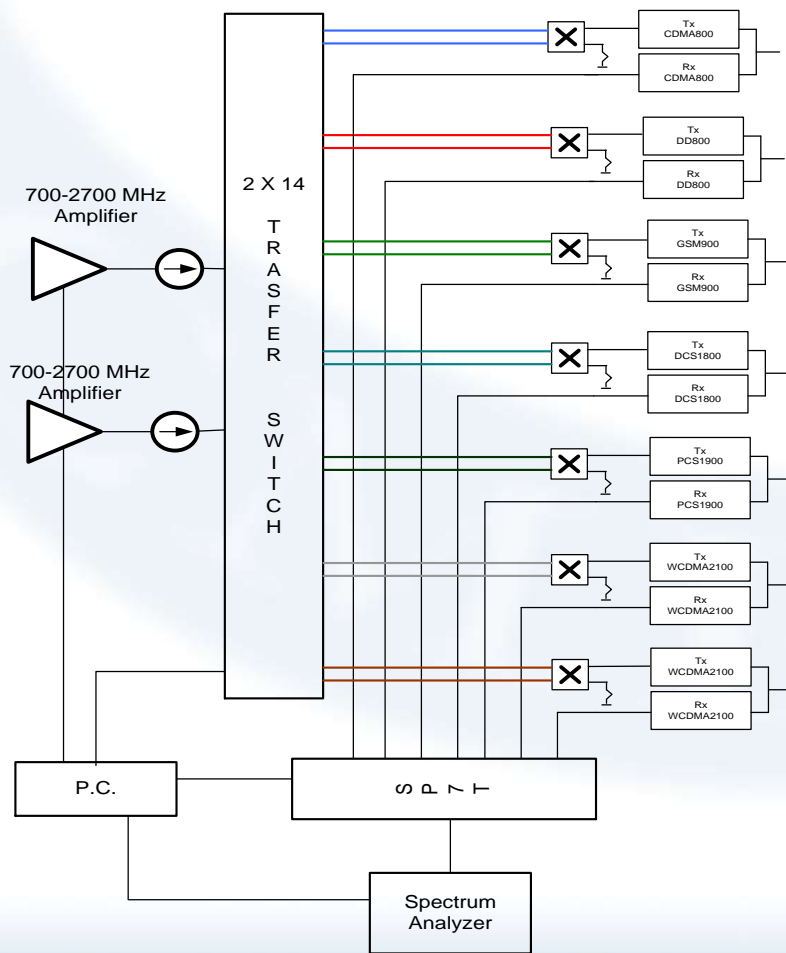


CODE IDENT. NO.	DWG. NO.	REV.
00471	5Y1JW-4X0823	B
SCALE NONE	SHEET 3 OF 3	

04-0004 REV. B 9/21/99



Substitution for Array of PIM Analyzers for Reflection Mode Measurements



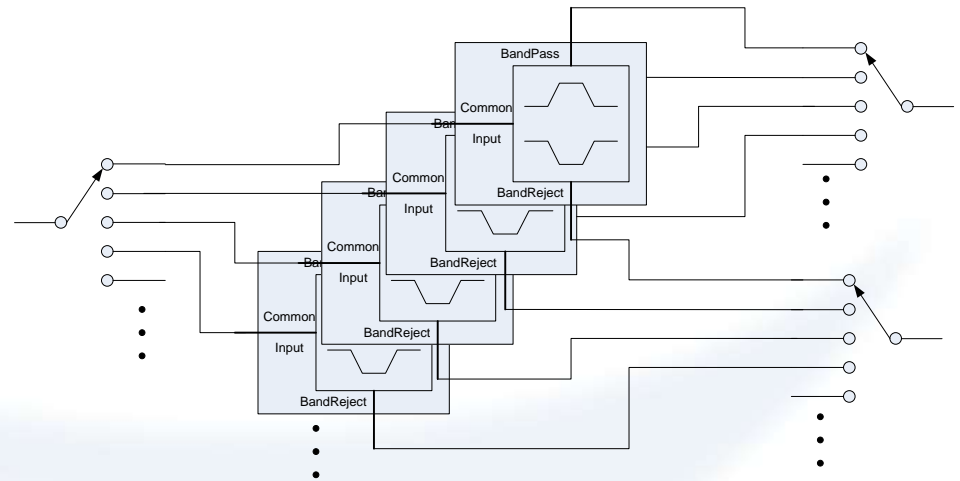
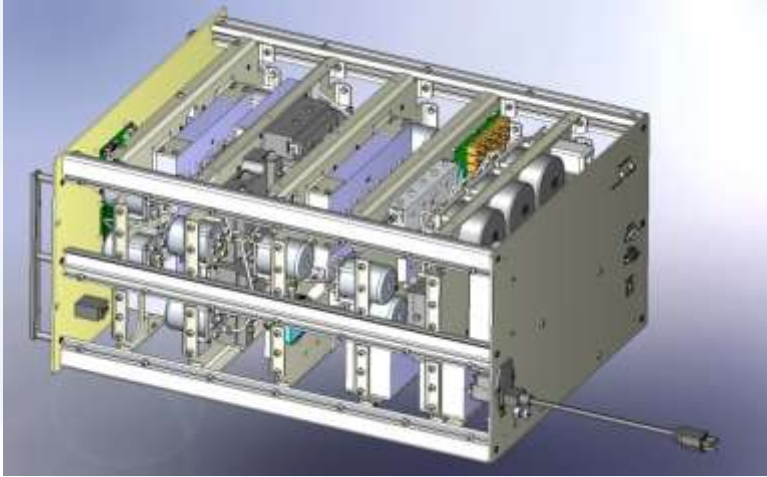
Lower Cost than an Array of PIM Analyzers

Spectrum Analyzer, Amplifiers, PC, etc. can be dual-purpose units.

Rack Mountable Configuration.

Product Innovations

Broad Band Emission Monitoring ATE



ATE Integrations

- Supports automated production testing of wireless systems and semiconductor product families covering all LTE Bands
- Provides emissions monitoring while maintaining a good impedance match with the device under test
- Can be used to measure IM products, as well as interfering signals

Short Overview of ATE Switch Matrices

- The typical test sequence for broad-band emission requires insertion of multiple filters and diplexers between the D.U.T. and the test equipment. Although the execution of a simple test can be accomplished using a manual filter insertion process, more advanced tests require switchable RF interfaces providing complex signal routing and conditioning, and allowing test automation and data acquisition.
- RF interfaces are primarily integrated using standard rack mountable enclosures. The most popular platforms are 19" rack enclosures. The simplest systems are integrated inside a 1RU enclosure, while the complex ones may require a 12RU enclosure or a set of smaller boxes.
- The switchable RF test interfaces may also be design around standard test platforms, such as PXI, LXI, etc.

ATE Switch Matrices (continued)

- Most switchable RF interfaces are equipped with remote and/or local interfaces. Typical unit is equipped with one or two following interfaces:
 - **SNMP**
 - SNMP v.1
 - SNMP v.3
 - LXI
 - IVI Drivers
 - Built-in Web Server
 - Application Software/Drivers
 - LabVIEW Based Web Services
 - **GPIB**
 - **RS-232/RS-485**
 - **CANbus**

Dow-Key Switch Matrices

- All of Dow-Key's electromechanical switch matrices are designed around CANbus switches.
- This powerful interface offers an expandable control architecture and allows creating systems with up to 256 CANbus devices.
- Dow-Key offers a very broad portfolio of CANbus switches starting from a simple SPDT configuration and covering all typical configurations up to SP12T.
- A significant advantage of Dow-Key's systems is the ability to add additional CANbus switches and other CANbus components (attenuators) with automatic full control access through all standard remote control interfaces.



Specialized Low-PIM Test Equipment

- Dow-Key switches cover operating frequencies up to 40 GHz and power handling exceeding 1000 W.
- To support requirements for base station equipment testing, a special family of low-PIM switches has been developed. While standard switches can meet the PIM requirement (for two carriers +43dBm) at the level of -110dBc, these switches meet -160dBc.
- The integration of ATE switch matrix, 11 filters, and 11 diplexers in two switchable banks comprises a complex signal routing system.
- A 7RU enclosure houses all RF components interconnected with semi-flexible RF cables and the control system with power supply. The system uses an Ethernet interface for remote control and keypad and LCD display for local control.



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