



# SAW Components

## Duplexers for Cellular Phones

**Series/Type: B7965**

The following products presented in this data sheet are being withdrawn.

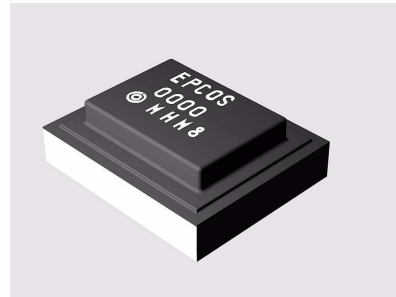
Ordering Code	Substitute Product	Date of Withdrawal	Deadline Last Orders	Last Shipments
B39212B7965P810	B39212B8575P810	2012-12-21	2013-12-31	2014-02-28

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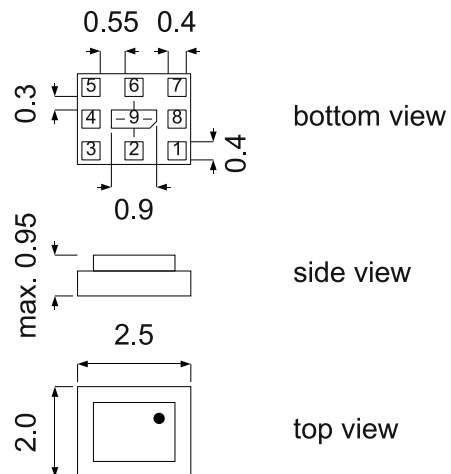
**Application**

- Low-loss SAW duplexer for mobile telephone W-CDMA Band 1 / CDMA2000 1x (BC6) systems
- Low insertion attenuation
- Low amplitude ripple
- Usable passband 60 MHz
- Single-ended to balanced transformation in Antenna-Rx path
- Impedance transformation 50 Ω to 100 Ω in Antenna-Rx path
- High isolation between Tx and Rx



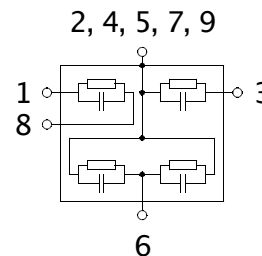
**Features**

- Package size 2.5 \* 2.0 mm<sup>2</sup>
- Max. height 0.95 mm
- RoHS compatible
- Approximate weight 0.017 g
- Package for **Surface Mount Technology (SMT)**
- Ni terminals, Au-plated
- Balanced Rx port, unbalanced Tx port
- **Electrostatic Sensitive Device (ESD)**
- Fully matched by integrated matching network
- **Moisture Sensitive Level (MSL) 3**



**Pin configuration**

- 3 Tx input, unbalanced
- 1, 8 Rx output, balanced
- 6 Antenna
- 2, 4, 5, 7, 9 To be grounded





**Characteristics**

Temperature range for specification: T = -30 °C to +85 °C  
 TX terminating impedance: Z<sub>Tx</sub> = 50 Ω  
 ANT terminating impedance: Z<sub>Ant</sub> = 50 Ω  
 RX terminating impedance: Z<sub>Rx</sub> = 100 Ω (balanced) || 10 nH

Characteristics Tx-Antenna				min.	typ. @ 25 °C	max.	
<b>Center frequency</b>			f <sub>c</sub>				MHz
<b>Maximum insertion attenuation</b>			α				
	1920.0 ... 1980.0	MHz		1.7	2.1		dB
	1922.4 ... 1977.6	MHz	α <sub>W-CDMA</sub> <sup>1)</sup>	1.6	2.0		dB
<b>Amplitude ripple (p-p)</b>			α				
	1920.0 ... 1980.0	MHz		0.4	0.8		dB
	1922.4 ... 1977.6	MHz	α <sub>W-CDMA</sub> <sup>1)</sup>	0.3	0.7		dB
<b>Error Vector Magnitude</b>			EVM <sup>2)</sup>				
	1922.4 ... 1977.6	MHz		1.0	2.0		%
<b>Input VSWR</b>							
	1920.0 ... 1980.0	MHz		1.5	1.8		
<b>Output VSWR</b>							
	1920.0 ... 1980.0	MHz		1.4	1.8		
<b>Attenuation</b>			α				
	10.0 ... 1574.0	MHz		24	27		dB
	420.0 ... 494.0	MHz		44	63		dB
	843.0 ... 894.0	MHz		31	35		dB
	1565.42 ... 1573.374	MHz		38	49		dB
	1573.374 ... 1577.466	MHz		45	50		dB
	1577.466 ... 1585.42	MHz		40	51		dB
	1597.5515 ... 1605.886	MHz		45	50		dB
	1605.886 ... 1805.0	MHz		25	32		dB
	1805.0 ... 1880.0	MHz		10	21		dB
	1840.0 ... 1870.0	MHz		19	23		dB
	2110.0 ... 2170.0	MHz		44	47		dB
	2112.4 ... 2167.6	MHz	α <sub>W-CDMA</sub> <sup>1)</sup>	44	47		dB
	2400.0 ... 2500.0	MHz		29	32		dB
	2620.0 ... 2690.0	MHz		20	27		dB
	3840.0 ... 3960.0	MHz		20	28		dB
	5150.0 ... 5940.0	MHz		9	13		dB

1) Attenuation of W-CDMA signal (Power Transfer Function). Please, refer to page 7 of this document.  
 2) Error Vector Magnitude (EVM) based on definition given in 3GPP TS 25.141



**Characteristics**

Temperature range for specification: T = -30 °C to +85 °C  
 TX terminating impedance: Z<sub>Tx</sub> = 50 Ω  
 ANT terminating impedance: Z<sub>Ant</sub> = 50 Ω  
 RX terminating impedance: Z<sub>Rx</sub> = 100 Ω (balanced) || 10 nH

Characteristics Antenna-Rx		min.	typ. @ 25 °C	max.	
<b>Center frequency</b>	f <sub>c</sub>				MHz
<b>Maximum insertion attenuation</b>	α				
2110.0 ... 2170.0 MHz			2.3	2.6	dB
2112.4 ... 2167.6 MHz	α <sub>W-CDMA</sub> <sup>1)</sup>		2.2	2.5	dB
<b>Amplitude ripple (p-p)</b>	α				
2110.0 ... 2170.0 MHz			0.7	1.0	dB
2112.4 ... 2167.6 MHz	α <sub>W-CDMA</sub> <sup>1)</sup>		0.6	0.9	dB
<b>Error Vector Magnitude</b>	EVM <sup>2)</sup>				
2112.4 ... 2167.6 MHz			1.0	2.0	%
<b>Input VSWR</b>					
2110.0 ... 2170.0 MHz			1.6	2.0	
<b>Output VSWR</b>					
2110.0 ... 2170.0 MHz			1.7	2.0	
<b>CMRR ( S<sub>32</sub>-S<sub>42</sub> / S<sub>32</sub>+S<sub>42</sub> )</b>					
2110.0 ... 2170.0 MHz		20 <sup>3)</sup>	22		dB
<b>IMD product level limits<sup>4)</sup></b>					
<b>at f<sub>TX</sub>=1950.0 MHz, f<sub>RX</sub>=2140.0 MHz</b>					
Blocker 1	190.0 MHz		-130	-106	dBm
Blocker 2	1760.0 MHz		-115	-109	dBm
Blocker 3	4090.0 MHz		-115	-106	dBm

1) Attenuation of W-CDMA signal (Power Transfer Function). Please, refer to page 7 of this document.  
 2) Error Vector Magnitude (EVM) based on definition given in 3GPP TS 25.141  
 3) A combination of 10 ° phase balance and 1 dB amplitude balance corresponds to 19.6 dB CMRR  
 4) IMD product level limits for power levels P<sub>TX</sub>=21.5 dBm (antenna port output power) and P<sub>Block-er</sub>=-15dBm (antenna port input power)



<b>SAW Components</b>	<b>B7965</b>
<b>SAW Duplexer</b>	<b>1950.0 / 2140.0 MHz</b>

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**Characteristics**

Temperature range for specification:	T = -30 °C to +85 °C
TX terminating impedance:	Z <sub>Tx</sub> = 50 Ω
ANT terminating impedance:	Z <sub>Ant</sub> = 50 Ω
RX terminating impedance:	Z <sub>Rx</sub> = 100 Ω (balanced)    10 nH

Characteristics Antenna-Rx	min.	typ. @ 25 °C	max.	
<b>Attenuation</b>				
10.0 ... 1920.0 MHz	35	48		dB
1920.0 ... 1980.0 MHz	45	55		dB
1922.4 ... 1977.6 MHz	45	55		dB
1980.0 ... 2025.0 MHz	15	45		dB
2255.0 ... 2400.0 MHz	15	43		dB
2400.0 ... 2484.0 MHz	30	46		dB
2484.0 ... 6000.0 MHz	35	39		dB

<sup>1)</sup> Attenuation of W-CDMA signal (Power Transfer Function). Please, refer to page 7 of this document.



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<b>SAW Duplexer</b>	<b>1950.0 / 2140.0 MHz</b>

Data Sheet



**Characteristics**

Temperature range for specification:	T = -30 °C to +85 °C
TX terminating impedance:	Z <sub>Tx</sub> = 50 Ω
ANT terminating impedance:	Z <sub>Ant</sub> = 50 Ω
RX terminating impedance:	Z <sub>Rx</sub> = 100 Ω (balanced)    10 nH

Characteristics Tx-Rx	min.	typ. @ 25 °C	max.	
<b>Differential Mode Isolation</b>				
1920.0 ... 1980.0 MHz	53	56		dB
1922.4 ... 1977.6 MHz α <sub>W-CDMA</sub> <sup>1)</sup>	54	57		dB
2110.0 ... 2170.0 MHz	50	53		dB
2112.4 ... 2167.6 MHz α <sub>W-CDMA</sub> <sup>1)</sup>	50	53		dB
3840.0 ... 3960.0 MHz	20	56		dB
5760.0 ... 5940.0 MHz	20	39		dB
<b>Common Mode Isolation</b>				
1920.0 ... 1980.0 MHz	50	53		dB
1922.4 ... 1977.6 MHz α <sub>W-CDMA</sub> <sup>1)</sup>	50	53		dB

<sup>1)</sup> Attenuation of W-CDMA signal (Power Transfer Function). Please, refer to page 7 of this document.



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SAW Duplexer

1950.0 / 2140.0 MHz

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**SMD**

**Annotation for characteristics section**

Attenuation of W-CDMA signal (Power Transfer Function,  $\alpha_{W-CDMA}$ ) is determined by

$$\int_{-\infty}^{\infty} |S_{ds21}(f)H_{RRC}(f - f_{Carrier})|^2 df$$

with  $f_{Carrier}$  according to 3GPP TS 25.101 (e.g. for UMTS pass band,  $f_{Carrier}$  ranges from 1912.4 MHz (lowest Tx channel) to 1977.6 MHz (highest Tx channel)). Here,  $H_{RRC}(f)$  is the transfer function of the root-raised cosine transmit pulse shaping filter according to 3GPP TS 25.101 with the following normalization:

$$\int_{-\infty}^{\infty} |H_{RRC}(f)|^2 df = 1$$



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<b>SAW Duplexer</b>	<b>1950.0 / 2140.0 MHz</b>
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**Maximum Ratings**

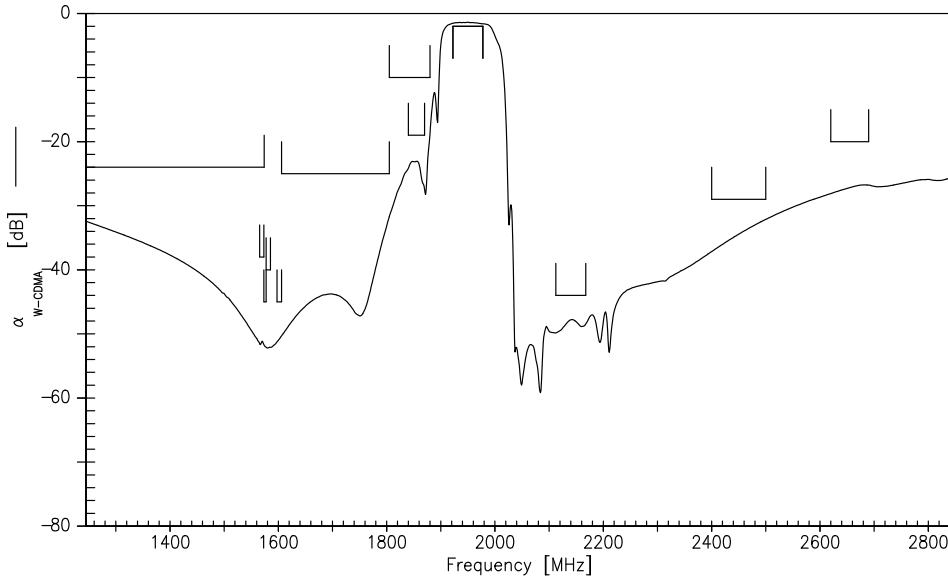
Storage temperature range	T <sub>stg</sub>	-40/+85	°C	
DC voltage	V <sub>DC</sub>	5	V	
ESD voltage	V <sub>ESD</sub>	50 <sup>1)</sup>	V	
Input power at				
1920.0 ... 1980.0 MHz	P <sub>in</sub>	29	dBm	} continuous wave 50 °C, 5000h
elsewhere	P <sub>in</sub>	10	dBm	

<sup>1)</sup> According to JESD22-A115A (machine model), 10 negative & 10 positive pulses.

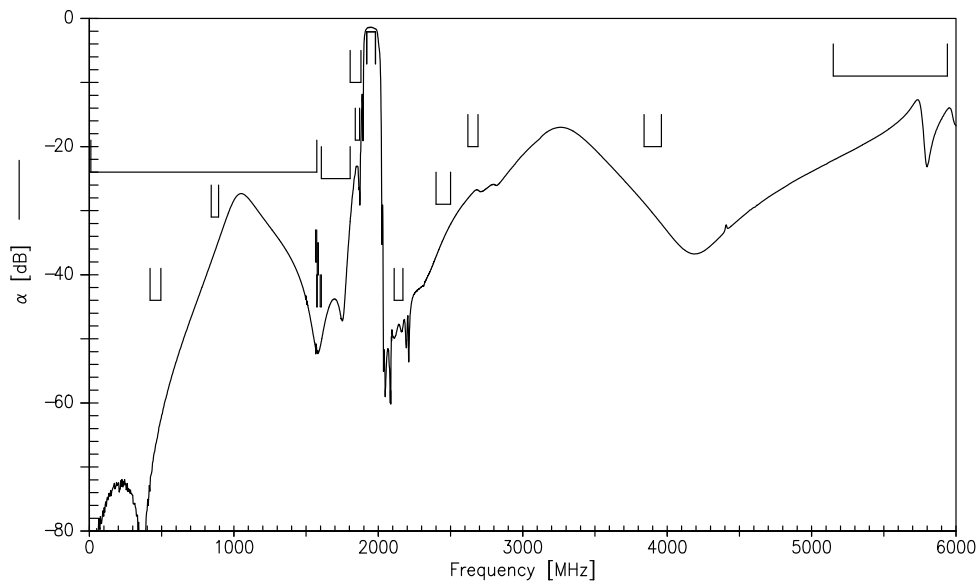




Frequency Response TX-ANT



Frequency Response TX-ANT





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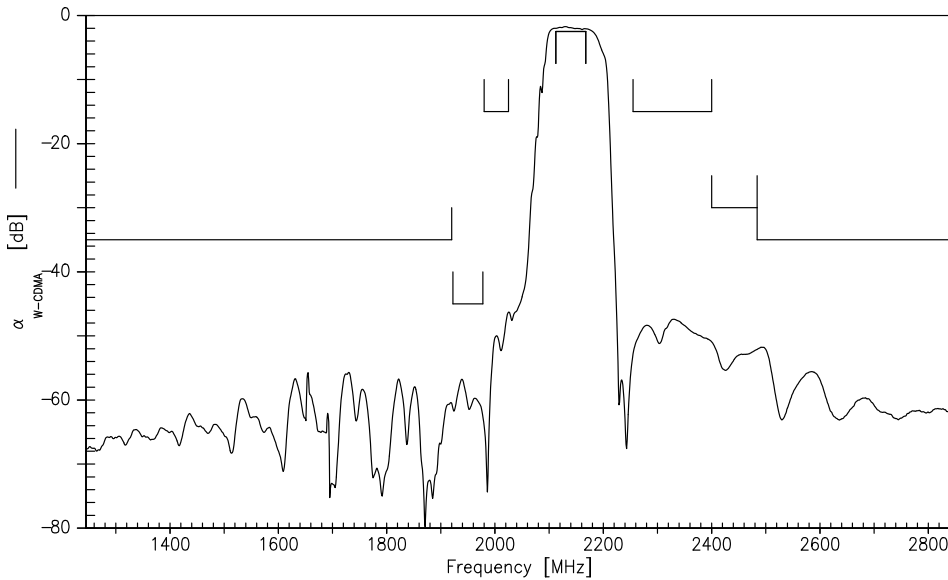
SAW Duplexer

1950.0 / 2140.0 MHz

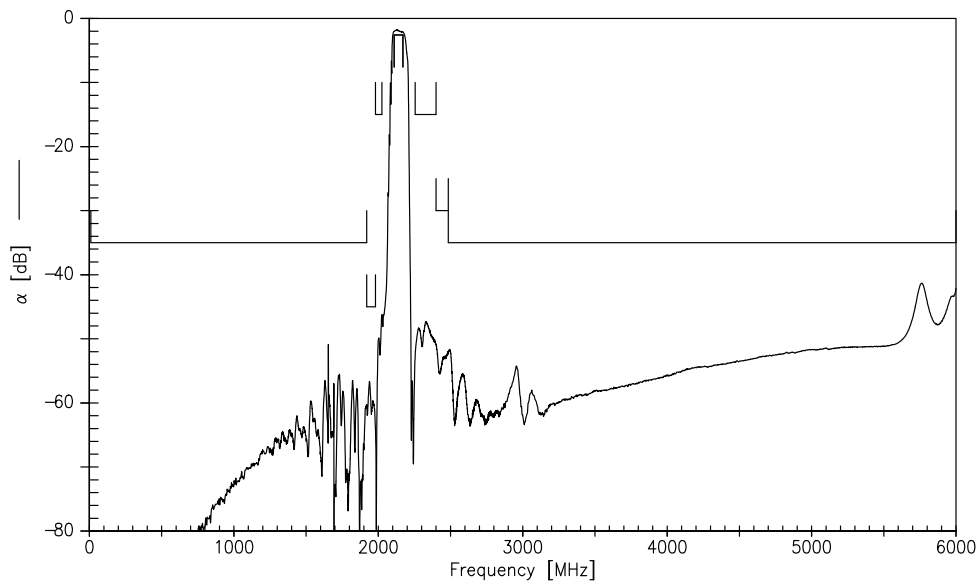
Data Sheet



### Frequency Response ANT-RX



### Frequency Response ANT-RX



Please read *cautions and warnings* and *important notes* at the end of this document.



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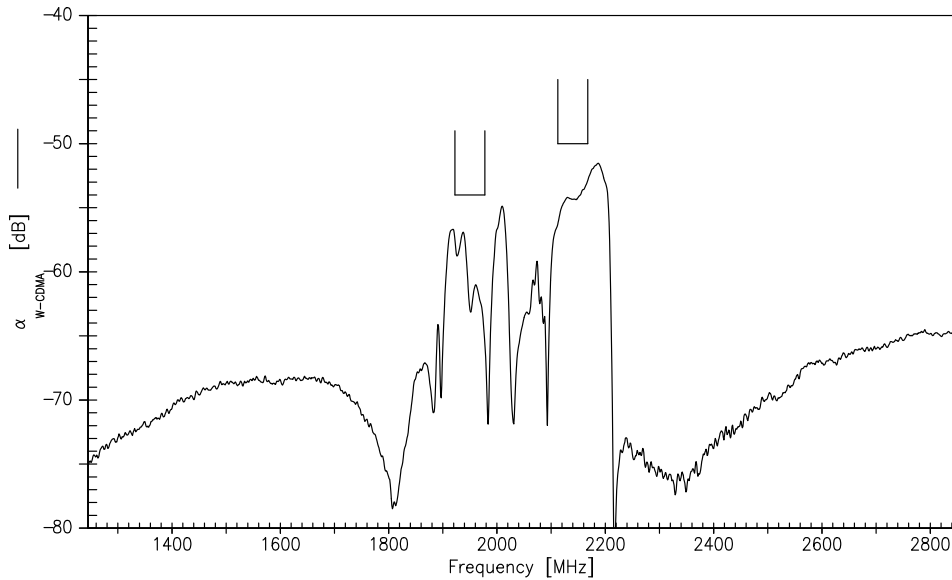
SAW Duplexer

1950.0 / 2140.0 MHz

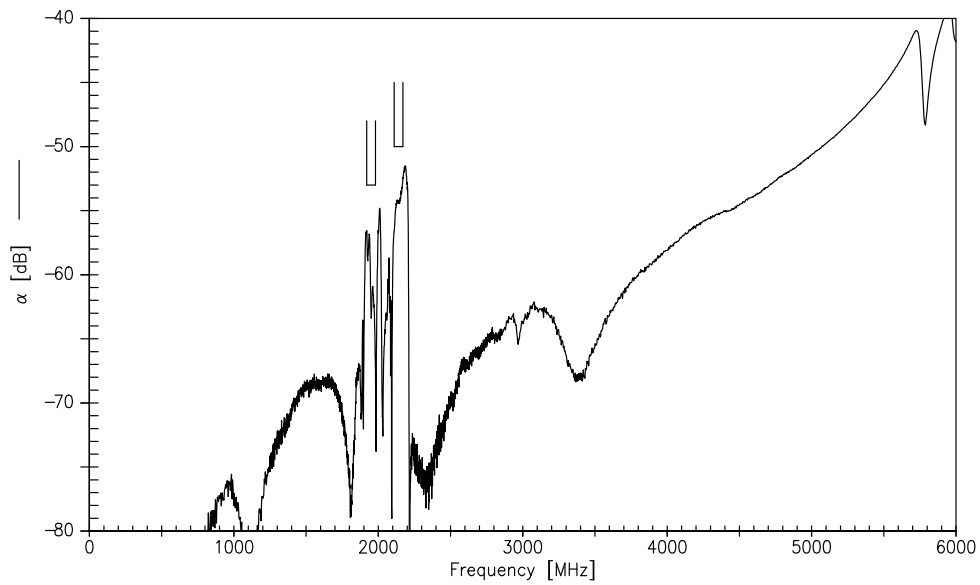
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Frequency Response TX-RX (Differential Mode)



Frequency Response TX-RX (Differential Mode)



Please read *cautions and warnings and important notes* at the end of this document.



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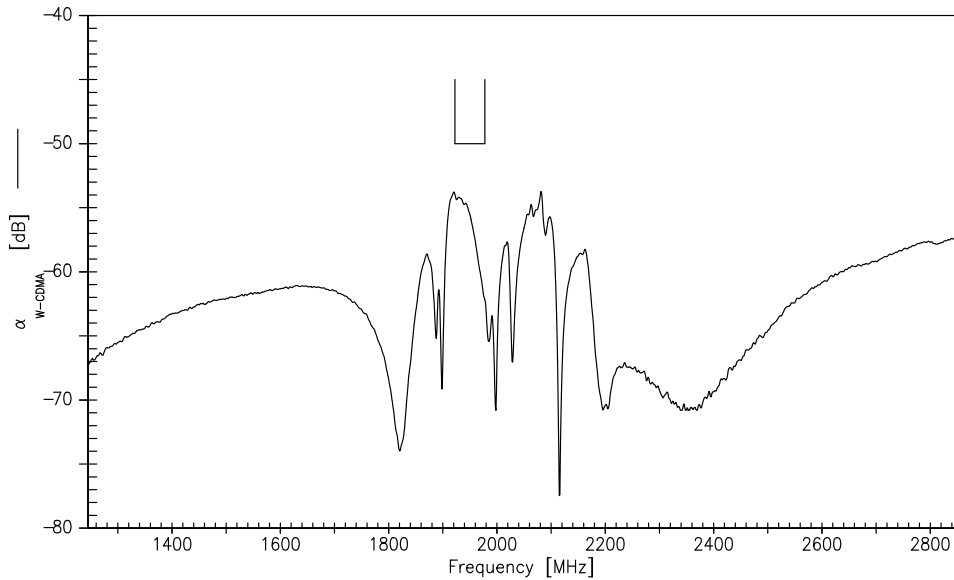
SAW Duplexer

1950.0 / 2140.0 MHz

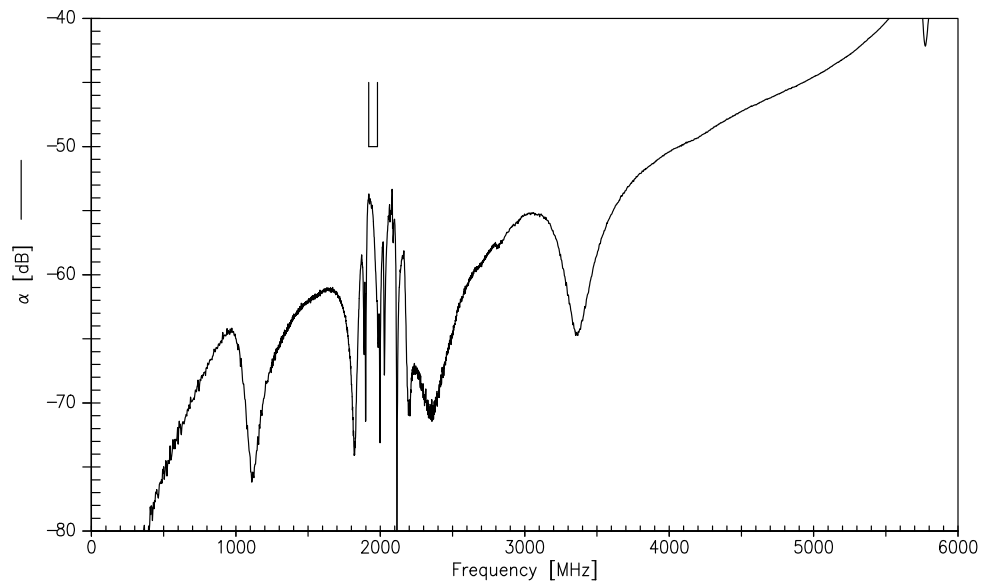
Data Sheet



Frequency Response TX-RX (Common Mode)



Frequency Response TX-RX (Common Mode)

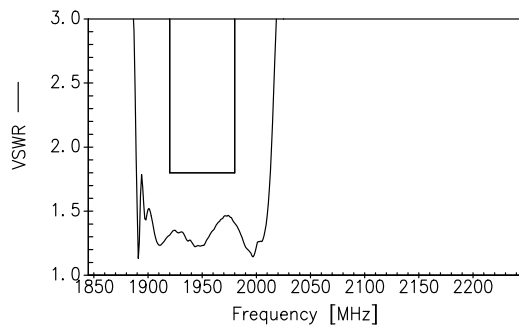


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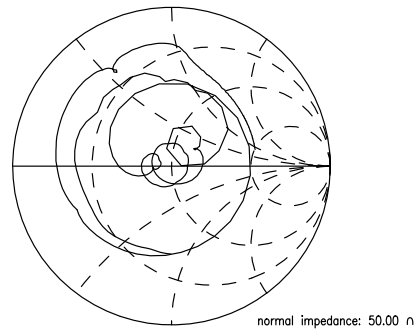


Matching

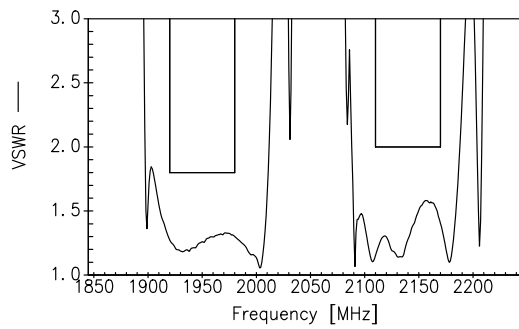
**S<sub>11</sub> (TX) VSWR**



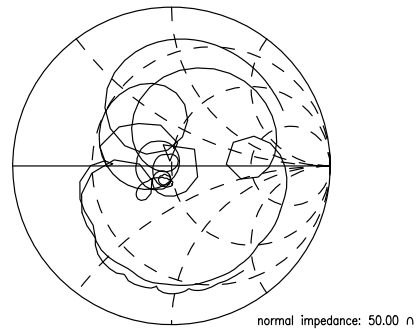
**S<sub>11</sub> (TX)**



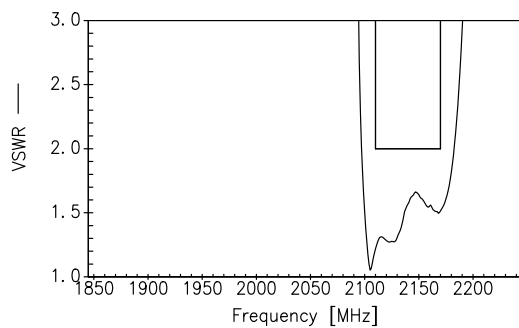
**S<sub>22</sub> (ANT) VSWR**



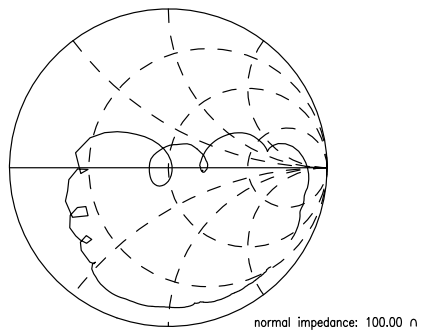
**S<sub>22</sub> (ANT)**



**S<sub>33</sub> (RX) VSWR**



**S<sub>33</sub> (RX)**





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References

<b>Type</b>	B7965
<b>Ordering code</b>	B39212B7965P810
<b>Marking and package</b>	C61157-A3-A44
<b>Packaging</b>	F61074-V8153-Z000
<b>Date codes</b>	L_1126
<b>S-parameters</b>	B7965_NB_UN.s4p, B7965_WB_UN.s4p see file header for port/pin assignment table
<b>Soldering profile</b>	S_6001
<b>RoHS compatible</b>	Defined as compatible with the following documents: "DIRECTIVE 2002/95/EC OF THE EUROPEAN PARLIAMENT AND OF THE COUNCIL of 27 January 2003 on the restriction of the use of certain hazardous substances in electrical and electronic equipment. 2005/618/EC from April 18th, 2005, amending Directive 2002/95/EC of the European Parliament and of the Council for the purposes of establishing the maximum concentration values for certain hazardous substances in electrical and electronic equipment."
<b>Matching coils</b>	See Inductor pdf-catalog <a href="http://www.tdk.co.jp/tefe02/coil.htm#aname1">http://www.tdk.co.jp/tefe02/coil.htm#aname1</a> and Data Library for circuit simulation <a href="http://www.tdk.co.jp/etvcl/index.htm">http://www.tdk.co.jp/etvcl/index.htm</a>

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