



## SAW Components

### SAW Duplexer

W-CDMA Band 4 / CDMA 1x AWS Band

<b>Series/type:</b>	<b>B7959</b>
<b>Ordering code:</b>	<b>B39212B7959P810</b>
Date:	February 11, 2011
Version:	2.2

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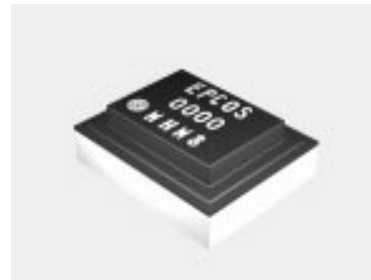


Data sheet



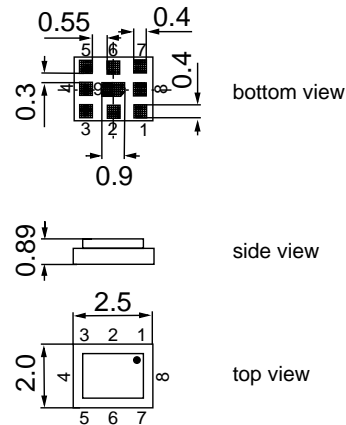
Application

- Low-loss SAW duplexer for mobile telephone W-CDMA Band 4 (UMTS) / CDMA 1x AWS systems
- Low insertion attenuation
- Low amplitude ripple
- Usable passband 45 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



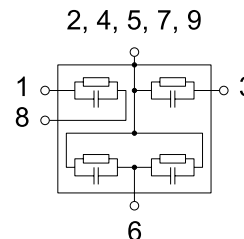
Features

- Package size 2.5 \* 2.0 \* 0.89 mm<sup>3</sup>
- RoHS compatible
- Approximate weight 0.017 g
- Package for **Surface Mount Technology (SMT)**
- Ni, Au-plated terminals
- Balanced Rx port, unbalanced Tx port
- **Electrostatic Sensitive Device (ESD)**
- Fully matched by integrated matching network
- **Moisture Sensitive Level 3**



Pin configuration

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



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



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Characteristics for W-CDMA Band 4

Temperature range for specification: T = -15 °C to +80 °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) || 8.2nH

Characteristics Tx-Antenna		min.	typ. @ 25 °C	max.	
<b>Center frequency</b>	f <sub>c</sub>	-	1732.5	-	MHz
<b>Maximum insertion attenuation</b>	α <sub>W-CDMA</sub> <sup>1)</sup>				
@f <sub>Carrier</sub> 1712.4 ... 1752.6MHz		-	1.6	1.8	dB
<b>Amplitude ripple (p-p)</b>	Δα <sub>W-CDMA</sub> <sup>1)</sup>				
@f <sub>Carrier</sub> 1712.4 ... 1752.6MHz		-	0.3	0.5	dB
<b>Error Vector Magnitude</b>	EVM <sup>2)</sup>				
@f <sub>Carrier</sub> 1712.4 ... 1752.6MHz		-	0.5	2.0	%
<b>Input VSWR (Tx port)</b>					
1710.0 ... 1755.0MHz		-	1.7	2.0	
<b>Output VSWR (Ant Port)</b>					
1710.0 ... 1755.0MHz		-	1.6	2.0	
<b>Attenuation</b>	α				
10.0 ... 1565.4MHz		30	37	-	dB
728.0 ... 764.0MHz		39	43	-	dB
851.0 ... 894.0MHz		37	41	-	dB
1565.4 ... 1573.3MHz		40	48	-	dB
1573.3 ... 1577.5MHz		45	51	-	dB
1577.5 ... 1585.5MHz		40	50	-	dB
1597.5 ... 1605.9MHz		45	50	-	dB
1805.0 ... 1880.0MHz		20	43	-	dB
1930.0 ... 1990.0MHz		38	42	-	dB
@f <sub>Carrier</sub> 2112.4 ... 2152.6MHz	α <sub>W-CDMA</sub> <sup>1)</sup>	43	47	-	dB
2400.0 ... 2500.0MHz		32	35	-	dB
3410.0 ... 3520.0MHz		20	32	-	dB
5120.0 ... 5350.0MHz		20	23	-	dB
5725.0 ... 5850.0MHz		20	25	-	dB

1) Attenuation of W-CDMA signal (Power Transfer Function). Please, refer to page 9 of this document.

2) Error Vector Magnitude (EVM) based on definition given in 3GPP TS 25.141



Data sheet



Characteristics for W-CDMA Band 4

Temperature range for specification: T = -15 °C to +80 °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) || 8.2nH

Characteristics Antenna-Rx		min.	typ. @ 25 °C	max.	
<b>Center frequency</b>	f <sub>c</sub>	-	2132.5	-	MHz
<b>Maximum insertion attenuation</b> @f <sub>Carrier</sub> 2112.4 ... 2152.6MHz	α <sub>W-CDMA</sub> <sup>1)</sup>	-	2.0	2.3	dB
<b>Amplitude ripple (p-p)</b> @f <sub>Carrier</sub> 2112.4 ... 2152.6MHz	Δα <sub>W-CDMA</sub> <sup>1)</sup>	-	0.2	0.5	dB
<b>Input VSWR (Ant port)</b> 2110.0 ... 2155.0MHz		-	1.3	2.0	
<b>Output VSWR (Rx port)</b> 2110.0 ... 2155.0MHz		-	1.4	2.0	
<b>CMRR</b> ( S <sub>32</sub> -S <sub>42</sub>  / S <sub>32</sub> +S <sub>42</sub>  ) 2110.0 ... 2155.0MHz		22 <sup>2)</sup>	25	-	dB
<b>IMD product level limits<sup>3)</sup></b>					
<b>at f<sub>TX</sub>=1732.5 MHz, f<sub>RX</sub>= 2132.5 MHz</b>					
Blocker 1	400.0MHz		-130		dBm
Blocker 2	1332.5MHz		-107		dBm
Blocker 3	3865.0MHz		-117		dBm
Blocker 4	5597.5MHz		-130		dBm

1) Attenuation of W-CDMA signal (Power Transfer Function). Please, refer to page 9 of this document.  
 2) A combination of 10 ° phase balance and 1 dB amplitude balance corresponds to 19.6 dB CMRR  
 3) IMD product level limits for power levels P<sub>TX</sub>=21.5 dBm (antenna port output power) and P<sub>Blocker</sub>=-15dBm (antenna port input power)



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Characteristics for W-CDMA Band 4

Temperature range for specification: T = -15 °C to +80 °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) || 8.2nH

Characteristics Antenna-Rx				min.	typ. @ 25 °C	max.	
<b>Attenuation</b>							
			α				
@f <sub>Carrier</sub>	1.0 ... 1710.0	MHz		35	53	-	dB
	1712.4 ... 1752.6	MHz	α <sub>W-CDMA</sub> <sup>1)</sup>	45	58	-	dB
	1755.0 ... 2025.0	MHz		30	38	-	dB
	2240.0 ... 2400.0	MHz		15	40	-	dB
	2400.0 ... 2484.0	MHz		30	44	-	dB
	2484.0 ... 6000.0	MHz		35	46	-	dB

<sup>1)</sup> Attenuation of W-CDMA signal (Power Transfer Function). Please, refer to page 9 of this document.

Characteristics Tx-Rx				min.	typ. @ 25 °C	max.	
<b>Differential Mode Isolation</b>							
			α				
	1574.0 ... 1577.0	MHz		40	60	-	dB
	1712.4 ... 1752.6	MHz	α <sub>W-CDMA</sub> <sup>1)</sup>	55	60	-	dB
	2112.4 ... 2152.6	MHz	α <sub>W-CDMA</sub> <sup>1)</sup>	50	54	-	dB
	3410.0 ... 3520.0	MHz		20	60	-	dB
	5120.0 ... 5275.0	MHz		20	60	-	dB
<b>Common Mode Isolation</b>							
			α				
	1712.4 ... 1752.6	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 9 of this document.



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Characteristics for CDMA 1x AWS Band

Temperature range for specification:  $T = -30\text{ °C to }+85\text{ °C}$   
 TX terminating impedance:  $Z_{Tx} = 50\ \Omega$   
 ANT terminating impedance:  $Z_{Ant} = 50\ \Omega$   
 RX terminating impedance:  $Z_{Rx} = 100\ \Omega$  (balanced) || 8.2nH

Characteristics Tx-Antenna	min.	typ. @ 25 °C	max.	
<b>Center frequency</b> $f_c$	-	1732.5	-	MHz
<b>Maximum insertion attenuation</b> $\alpha$ 1710.00 ... 1755.00 MHz	-	1.6	2.0	dB
<b>Amplitude ripple (p-p)</b> $\Delta\alpha$ 1710.00 ... 1755.00 MHz	-	0.3	0.7	dB
<b>Input VSWR (Tx port)</b> 1710.00 ... 1755.00 MHz	-	1.7	2.0	
<b>Output VSWR (Ant Port)</b> 1710.00 ... 1755.00 MHz	-	1.6	2.0	
<b>Attenuation</b> $\alpha$				
10.0 ... 1565.4 MHz	30	37	-	dB
728.0 ... 764.0 MHz	39	43	-	dB
851.0 ... 894.0 MHz	37	41	-	dB
1565.4 ... 1573.3 MHz	40	48	-	dB
1573.3 ... 1577.5 MHz	45	51	-	dB
1577.5 ... 1585.5 MHz	40	50	-	dB
1597.5 ... 1605.9 MHz	45	50	-	dB
1805.0 ... 1880.0 MHz	20	43	-	dB
1930.0 ... 1990.0 MHz	38	42	-	dB
2110.0 ... 2155.0 MHz	43	47	-	dB
2400.0 ... 2500.0 MHz	32	35	-	dB
3410.0 ... 3520.0 MHz	20	32	-	dB
5120.0 ... 5350.0 MHz	20	23	-	dB
5725.0 ... 5850.0 MHz	20	25	-	dB



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Characteristics for CDMA 1x AWS Band

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) || 8.2nH

Characteristics Antenna-Rx	min.	typ. @ 25 °C	max.	
<b>Center frequency</b> f <sub>c</sub>	-	2132.5	-	MHz
<b>Maximum insertion attenuation</b> α 2110.00 ... 2155.00 MHz	-	2.0	2.4	dB
<b>Amplitude ripple (p-p)</b> Δα 2110.00 ... 2155.00 MHz	-	0.3	0.7	dB
<b>Input VSWR (Ant port)</b> 2110.00 ... 2155.00 MHz	-	1.3	2.0	
<b>Output VSWR (Rx port)</b> 2110.00 ... 2155.00 MHz	-	1.4	2.0	
<b>CMRR</b> ( S <sub>32</sub> -S <sub>42</sub>  / S <sub>32</sub> +S <sub>42</sub>  ) 2110.0 ... 2155.0 MHz	22 <sup>1)</sup>	25	-	dB
<b>Attenuation</b> α				
1.0 ... 1710.0 MHz	35	53	-	dB
1710.0 ... 1755.0 MHz	45	58	-	dB
1755.0 ... 2025.0 MHz	30	38	-	dB
2240.0 ... 2400.0 MHz	15	40	-	dB
2400.0 ... 2484.0 MHz	30	44	-	dB
2484.0 ... 6000.0 MHz	35	46	-	dB

1) A combination of 10 ° phase balance and 1 dB amplitude balance corresponds to 19.6 dB CMRR



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**Characteristics for CDMA 1x AWS Band**

Temperature range for specification:  $T = -30\text{ °C to }+85\text{ °C}$   
 TX terminating impedance:  $Z_{Tx} = 50\ \Omega$   
 ANT terminating impedance:  $Z_{Ant} = 50\ \Omega$   
 RX terminating impedance:  $Z_{Rx} = 100\ \Omega$  (balanced) || 8.2nH

Characteristics Tx-Rx				min.	typ. @ 25 °C	max.	
<b>Differential Mode Isolation</b> $\alpha$							
1574.0	...	1577.0	MHz	40	60	-	dB
1710.0	...	1755.0	MHz	55	59	-	dB
2110.0	...	2155.0	MHz	50	54	-	dB
3410.0	...	3520.0	MHz	20	60	-	dB
5120.0	...	5275.0	MHz	20	60	-	dB
<b>Common Mode Isolation</b> $\alpha$							
1710.0	...	1755.0	MHz	50	53	-	dB

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





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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 882.4 MHz (lowest Tx channel) to 912.6 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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**SAW Duplexer** **1732.5 / 2132.5 MHz**

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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	machine model, 10 pulses
Input power at				
1710.0 ... 1755.0 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 and 10 positive pulses.



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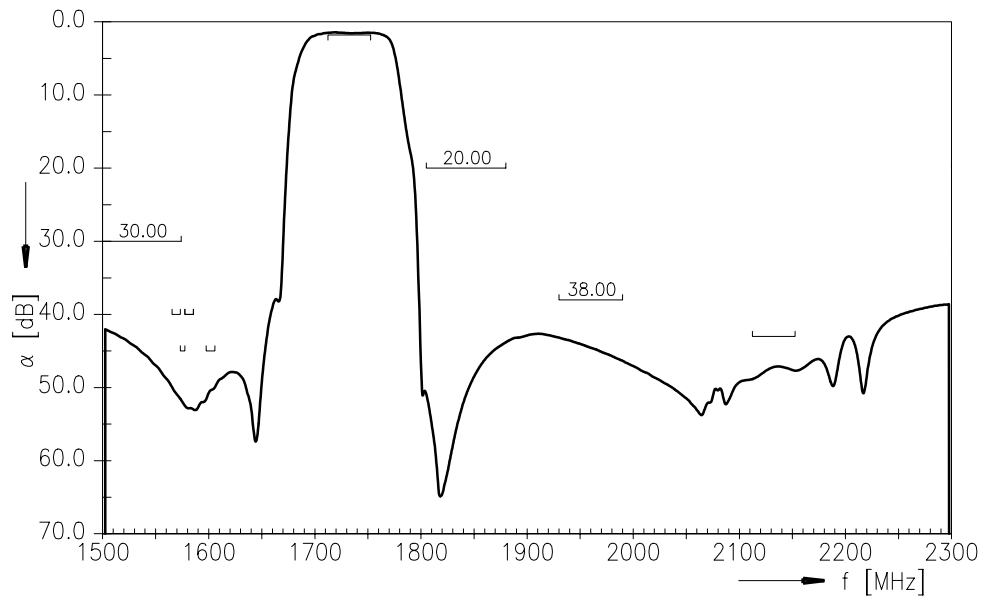
SAW Duplexer

1732.5 / 2132.5 MHz

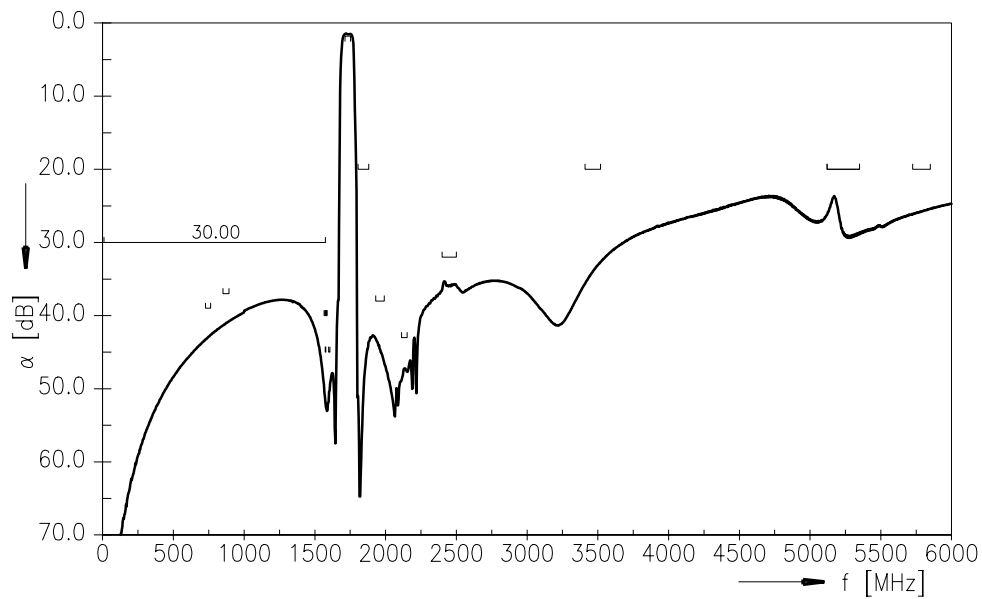
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Frequency Response TX-ANT (PTF)



Frequency Response TX-ANT (wideband)



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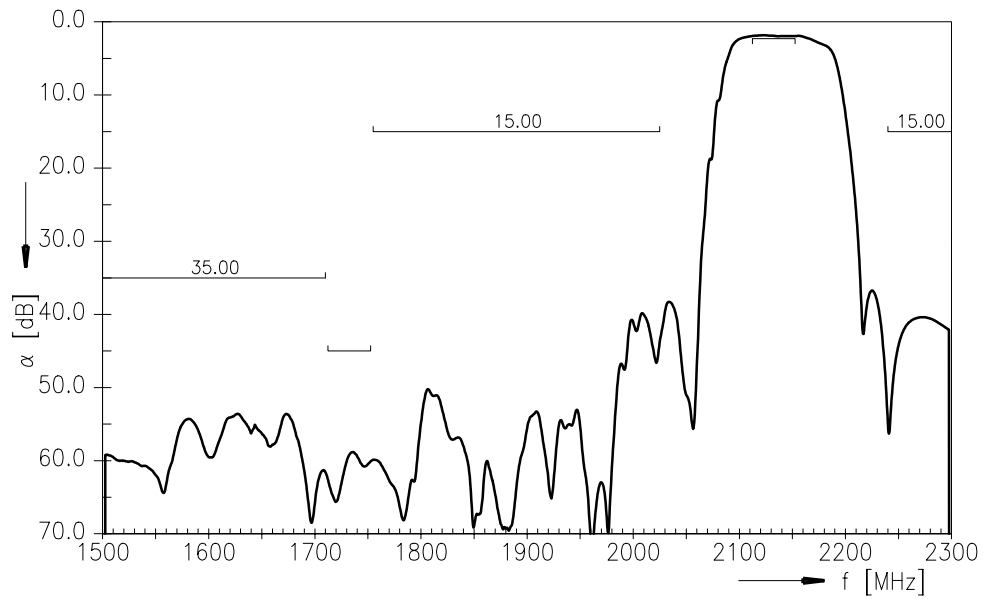
SAW Duplexer

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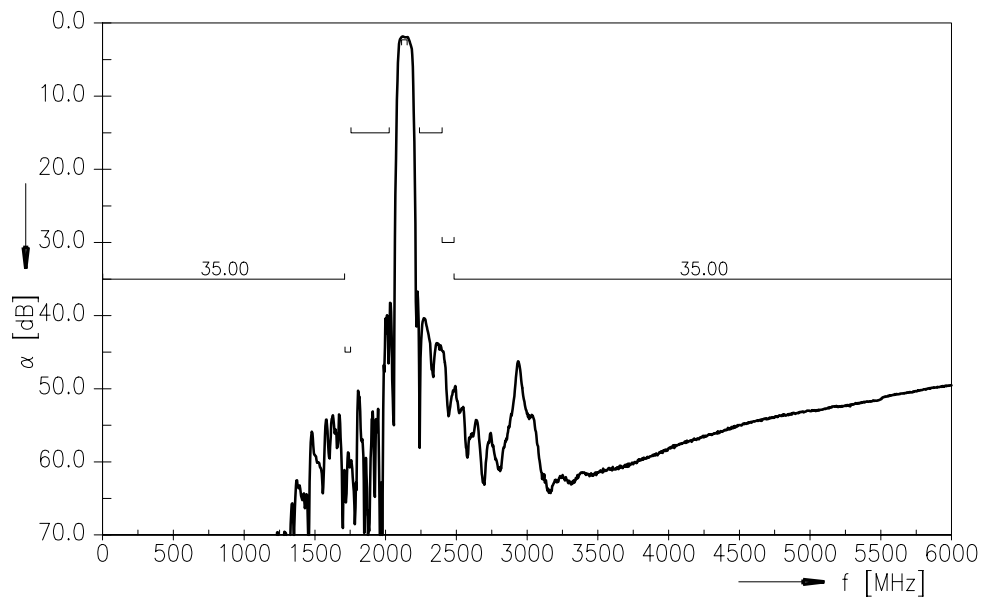
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Frequency Response ANT-RX (PTF)



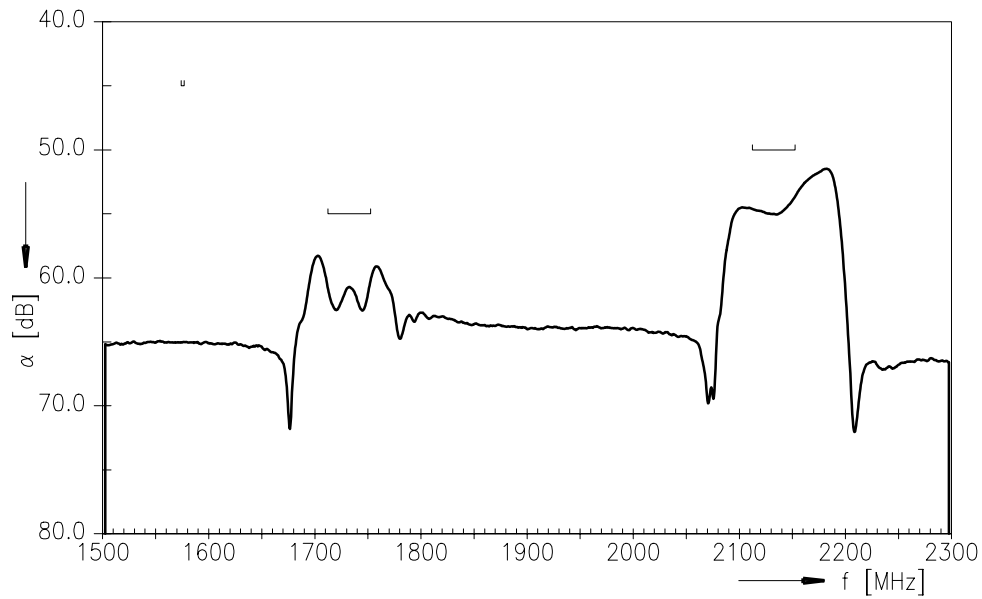
Frequency Response ANT-RX (wideband)



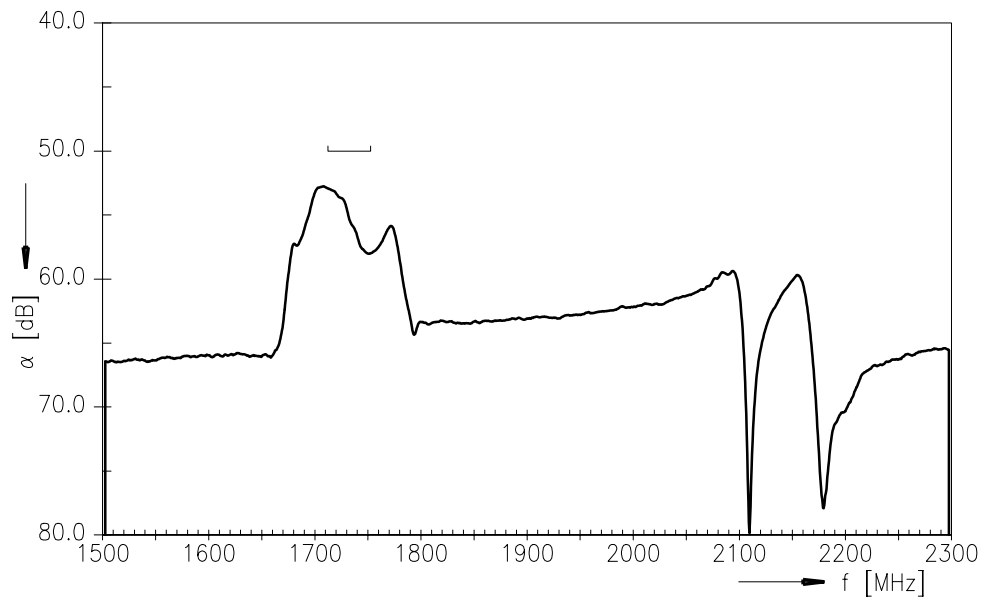
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Frequency Response TX-RX (PTF) Differential Mode



Frequency Response TX-RX (PTF) Common Mode



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References

<b>Type</b>	B7959
<b>Ordering code</b>	B39212B7959P810
<b>Marking and package</b>	C61157-A3-A59
<b>Packaging</b>	F61074-V8153-Z000
<b>Date codes</b>	L_1126
<b>S-parameters</b>	B7959_NB.s4p, B7959_WB.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."
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<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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14 February 11, 2011



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