SAW Components

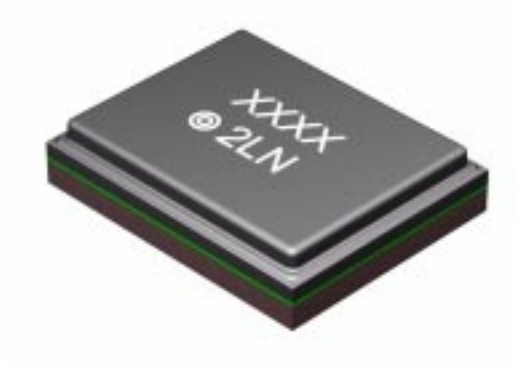
SAW Duplexer

Automotive telematics

Series/type:	**B4401**
Ordering code:	**B39941B4401P810**
Date:	June 13, 2014
Version:	2.3

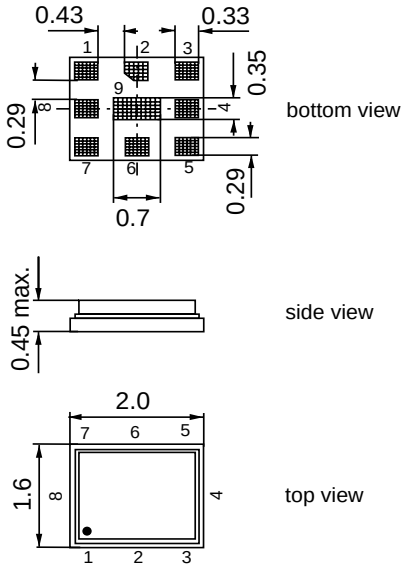
Application

- Low-loss SAW duplexer for W-CDMA Band VIII systems
- Low insertion attenuation
- Low amplitude ripple
- Usable passband 35 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



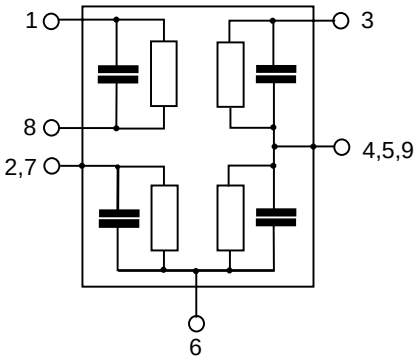
Features

- Package size 2.0 * 1.6 mm²
- Package height max. 0.45mm
- RoHS compatible
- Approximate weight 0.005 g
- Package for **S**urface **M**ount **T**echnology (**SMT**)
- Ni terminals, Au-plated
- **E**lectrostatic **S**ensitive **D**evice (**ESD**)
- AEC-Q200 qualified component family (operable temperature range –40˚C to +85˚C)



Pin configuration

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



Data sheet SMD

Characteristics

Temperature range for specification: T = –20 ˚C to +85 ˚C
ANT terminating impedance: Z_{ANT} = 50 Ω || 7.8nH
TX terminating impedance: Z_{TX} = 50 Ω || 25nH
RX terminating impedance: Z_{RX} = 100 Ω || 39nH (balanced)

Characteristics Tx - Ant						min.	typ. @ 25 ˚C	max.	
Center frequency					f_C	—	897.5	—	MHz
Maximum insertion attenuation									
@$f_{Carrier}$	882.4	...	912.6	MHz	α_{WCDMA} [1]	—	1.8	2.8	dB
	880.0	...	915.0	MHz		—	2.4	3.9	dB
	880.0	...	915.0	MHz		—	2.4	2.8 [2]	dB
Amplitude ripple (p-p)									
@$f_{Carrier}$	882.4	...	912.6	MHz	$\Delta\alpha_{WCDMA}$ [1]	—	1.0	2.0	dB
	880.0	...	915.0	MHz		—	1.6	3.1	dB
Error Vector Magnitude									
@$f_{Carrier}$	882.4	...	912.6	MHz	EVM [3]	—	2.3	6.0	%
@$f_{Carrier}$	882.4	...	912.6	MHz	EVM [3]	—	2.3	4.0 [2]	%
VSWR									
TX port	880.0	...	915.0	MHz		—	1.8	2.1	
ANT port	880.0	...	915.0	MHz		—	1.7	2.0	
Attenuation					α				
	50.0	...	716.0	MHz		30	34	—	dB
	716.0	...	728.0	MHz		30	34	—	dB
	728.0	...	865.0	MHz		30	34	—	dB
	865.0	...	870.0	MHz		10	41	—	dB
@$f_{Carrier}$	927.4	...	957.6	MHz	α_{WCDMA} [1]	38	53	—	dB
@$f_{Carrier}$	927.4	...	957.6	MHz	α_{WCDMA} [1]	45 [4]	53	—	dB
	1452.0	...	1477.0	MHz		20	42	—	dB
	1565.42	...	1573.374	MHz		40	48	—	dB
	1573.374	...	1577.466	MHz		40	49	—	dB
	1577.466	...	1585.42	MHz		40	49	—	dB
	1597.55	...	1605.89	MHz		40	49	—	dB

[1] Attenuation of WCDMA signal (“Powertransferfunction”). Please refer to annotation on page (7).
[2] T= +25˚C
[3] Error Vector Magnitude (EVM) based on definition given in 3GPP TS 25.141.
[4] T = +5˚C to +85˚C

Characteristics

Temperature range for specification: T = –20 ˚C to +85 ˚C
ANT terminating impedance: Z_{ANT} = 50 Ω || 7.8nH
TX terminating impedance: Z_{TX} = 50 Ω || 25nH
RX terminating impedance: Z_{RX} = 100 Ω || 39nH (balanced)

Characteristics Tx - Ant		min.	typ. @ 25 ˚C	max.	
1670.0 ... 1675.0 MHz		25	51	—	dB
1760.0 ... 1830.0 MHz		38	46	—	dB
1830.0 ... 1880.0 MHz		27	45	—	dB
2110.0 ... 2170.0 MHz		27	40	—	dB
2400.0 ... 2500.0 MHz		30	36	—	dB
2620.0 ... 2650.0 MHz		27	31	—	dB
2650.0 ... 2745.0 MHz		30	35	—	dB
3520.0 ... 3660.0 MHz		20	32	—	dB
4400.0 ... 4575.0 MHz		20	32	—	dB
5100.0 ... 5490.0 MHz		15	24	—	dB
5490.0 ... 5850.0 MHz		10	17	—	dB
Characteristics Tx - Rx		**min.**	**typ. @ 25 ˚C**	**max.**	
Differential Mode Isolation					
$@f_{Carrier}$ 882.4 ... 912.6 MHz	α_{WCDMA} [1)]	56	60	—	dB
$@f_{Carrier}$ 927.4 ... 957.6 MHz	α_{WCDMA} [1)]	43	57	—	dB
$@f_{Carrier}$ 927.4 ... 957.6 MHz	α_{WCDMA} [1)]	50 [2)]	57	—	dB
Common Mode Isolation					
$@f_{Carrier}$ 882.4 ... 912.6 MHz	α_{WCDMA} [1)]	55	65	—	dB

1) Attenuation of WCDMA signal (“Powertransferfunction”). Please refer to annotation on page (7).
2) T= +5˚C to +85˚C

Characteristics

Temperature range for specification: T = –20 ˚C to +85 ˚C
ANT terminating impedance: Z_{ANT} = 50 Ω || 7.8nH
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RX terminating impedance: Z_{RX} = 100 Ω || 39nH (balanced)

Characteristics Rx - Ant						min.	typ. @ 25 ˚C	max.	
Center frequency					f_C	—	942.5	—	MHz
Maximum insertion attenuation									
@$f_{Carrier}$	927.4	...	957.6	MHz	α_{WCDMA} 1)	—	1.8	2.5	dB
	925.0	...	960.0	MHz		—	2.4	4.7	dB
	925.0	...	960.0	MHz		—	2.4	3.2 2)	dB
	925.0	...	960.0	MHz		—	2.4	3.7 3)	dB
Amplitude ripple (p-p)									
@$f_{Carrier}$	927.4	...	957.6	MHz	$\Delta\alpha_{WCDMA}$ 1)	—	0.6	1.3	dB
	925.0	...	960.0	MHz		—	1.0	3.5	dB
Error Vector Magnitude									
@$f_{Carrier}$	927.4	...	957.6	MHz	EVM 4)	—	3.3	8.5	%
@$f_{Carrier}$	927.4	...	957.6	MHz	EVM 4)	—	3.3	4.5 2)	%
VSWR									
RX port	925.0	...	960.0	MHz		—	1.8	2.1	
ANT port	925.0	...	960.0	MHz		—	1.7	2.0	
Common Mode Rejection Ratio					α				
	925.0	...	960.0	MHz		23	30		dB
Attenuation					α				
	50.0	...	462.0	MHz		35	90	—	dB
	462.0	...	480.0	MHz		45	86	—	dB
	480.0	...	835.0	MHz		38	68	—	dB
	835.0	...	870.0	MHz		49	65	—	dB
	870.0	...	880.0	MHz		38	67	—	dB
@$f_{Carrier}$	882.4	...	912.6	MHz	α_{WCDMA} 1)	50	57	—	dB
	980.0	...	1045.0	MHz		16	20	—	dB
	1045.0	...	2400.0	MHz		35	57	—	dB

1) Attenuation of WCDMA signal (“Powertransferfunction”). Please refer to annotation on page (7).
2) T= +25˚C
3) T= +5˚C to +85˚C
4) Error Vector Magnitude (EVM) based on definition given in 3GPP TS 25.141.

Characteristics

Temperature range for specification: T = –20 ˚C to +85 ˚C
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Characteristics Rx - Ant		min.	typ. @ 25 ˚C	max.	
Center frequency	f_C	—	942.5	—	MHz
Attenuation	α				
2400.0 ... 2500.0 MHz		45	60	—	dB
2500.0 ... 4810.0 MHz		35	55	—	dB
5100.0 ... 5825.0 MHz		35	52	—	dB

Maximum ratings

Operable temperature range[1)]	T	–40/+85	˚C	
Storage temperature range	T_{stg}	–40/+85	˚C	
DC voltage	V_{DC}	0	V	
Input power at	P_{IN}			
880.0 ... 915.0 MHz		30	dBm	} WCDMA signal 55 ˚C, 10000 h
elsewhere		10	dBm	

1) Defines the temperature range in which the SAW device keeps its typical characteristics, however the specification values are not guaranteed.

Annotation for characteristics section

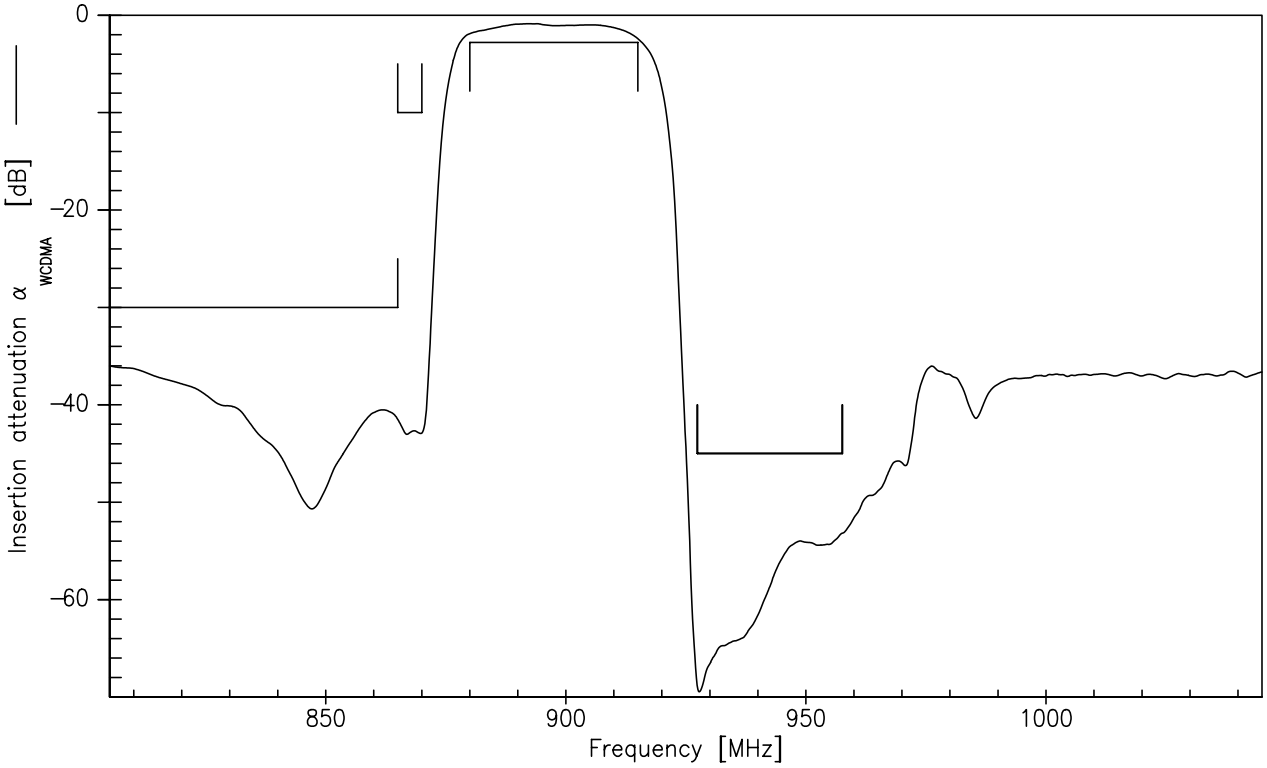
Attenuation of WCDMA signal (“Powertransferfunction”, α_{WCDMA}) is determined by

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

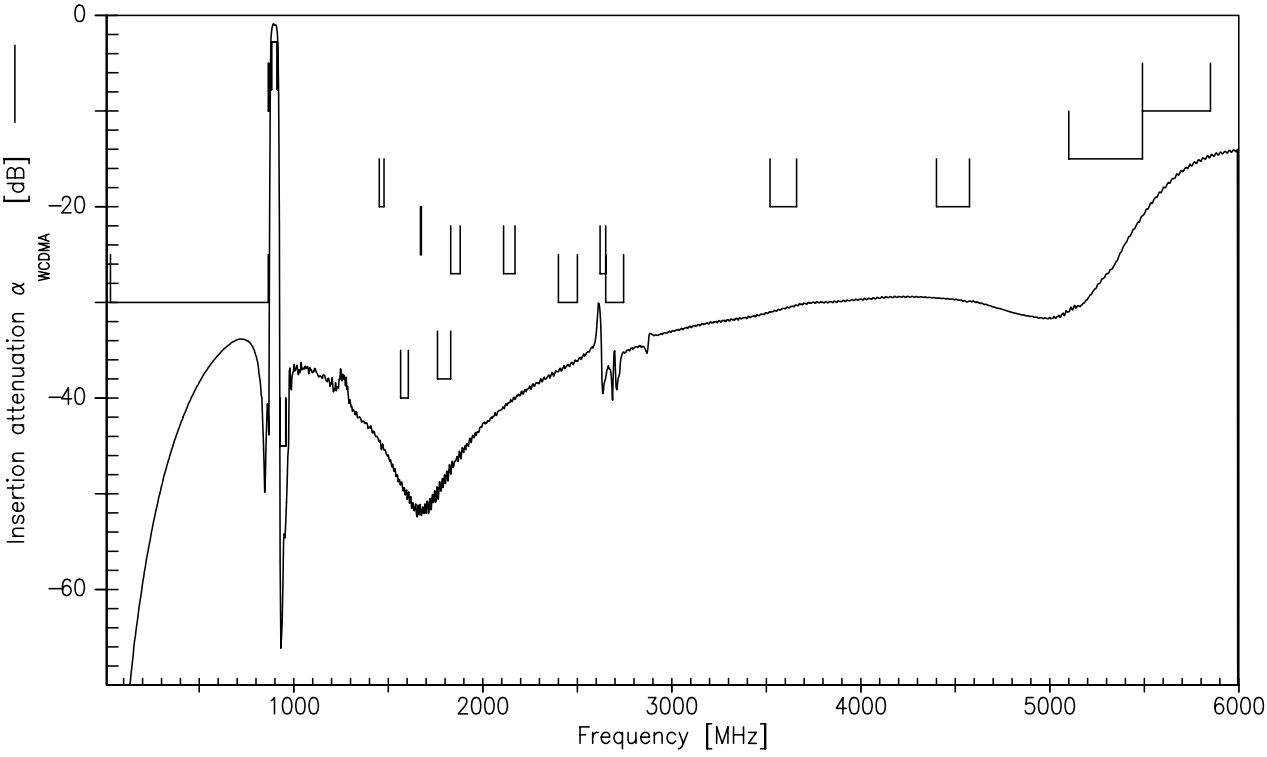
$f_{Carrier}$ according to 3GPP TS 25.101 (e.g. for UMTS-Passband, $f_{Carrier}$ ranges from 2112.4 MHz (lowest Rx channel) to 2167.6 MHz (highest Rx channel)). $H_{RRC}(f)$ is the transfer function of the root-raised cosine transmit pulse shaping filter according to 3GPP TS 25.101 with the following normalization:

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

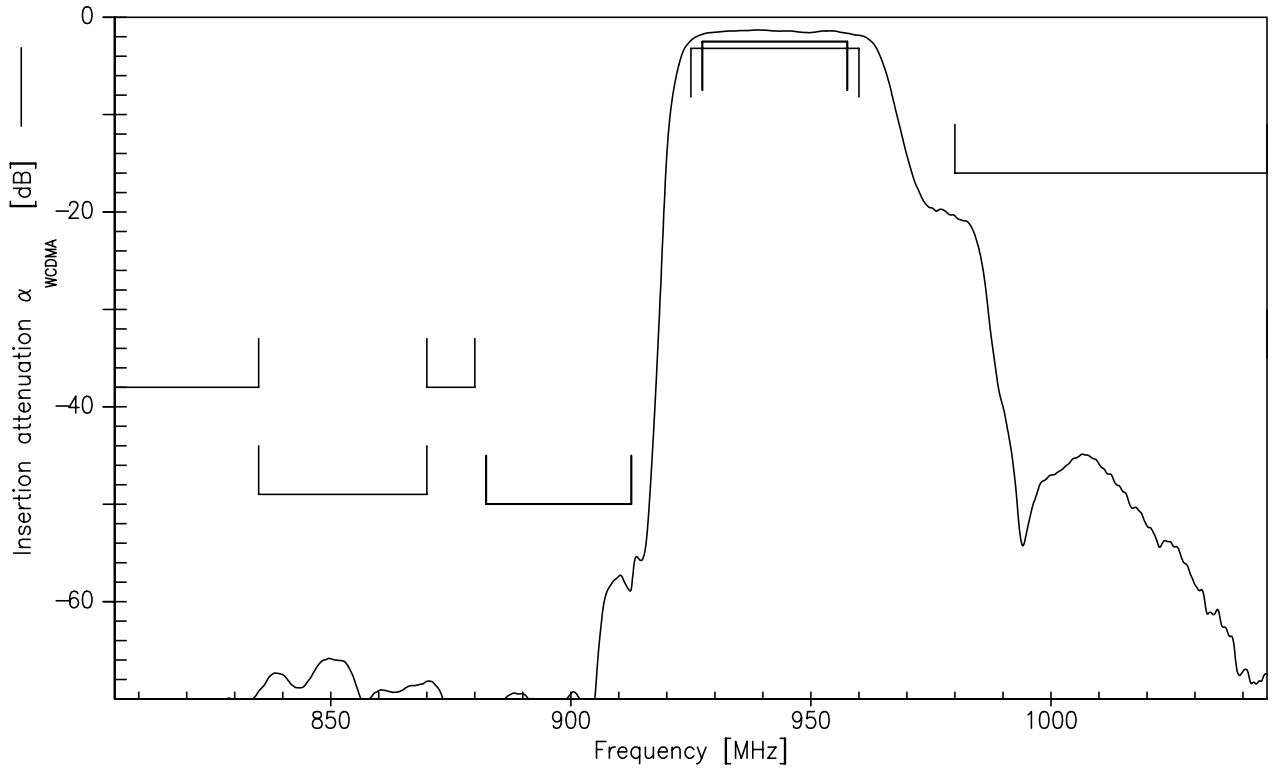
Frequency Response TX-ANT



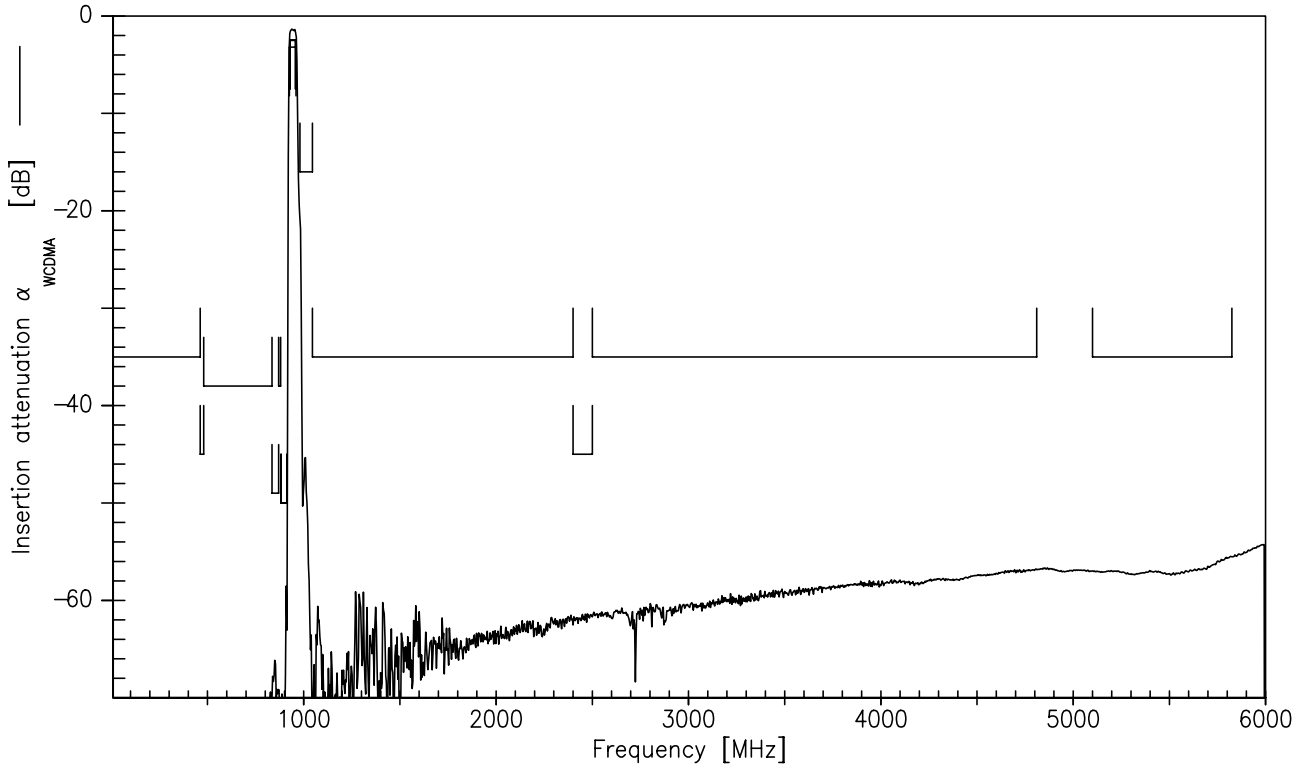
Frequency Response TX-ANT (wideband)



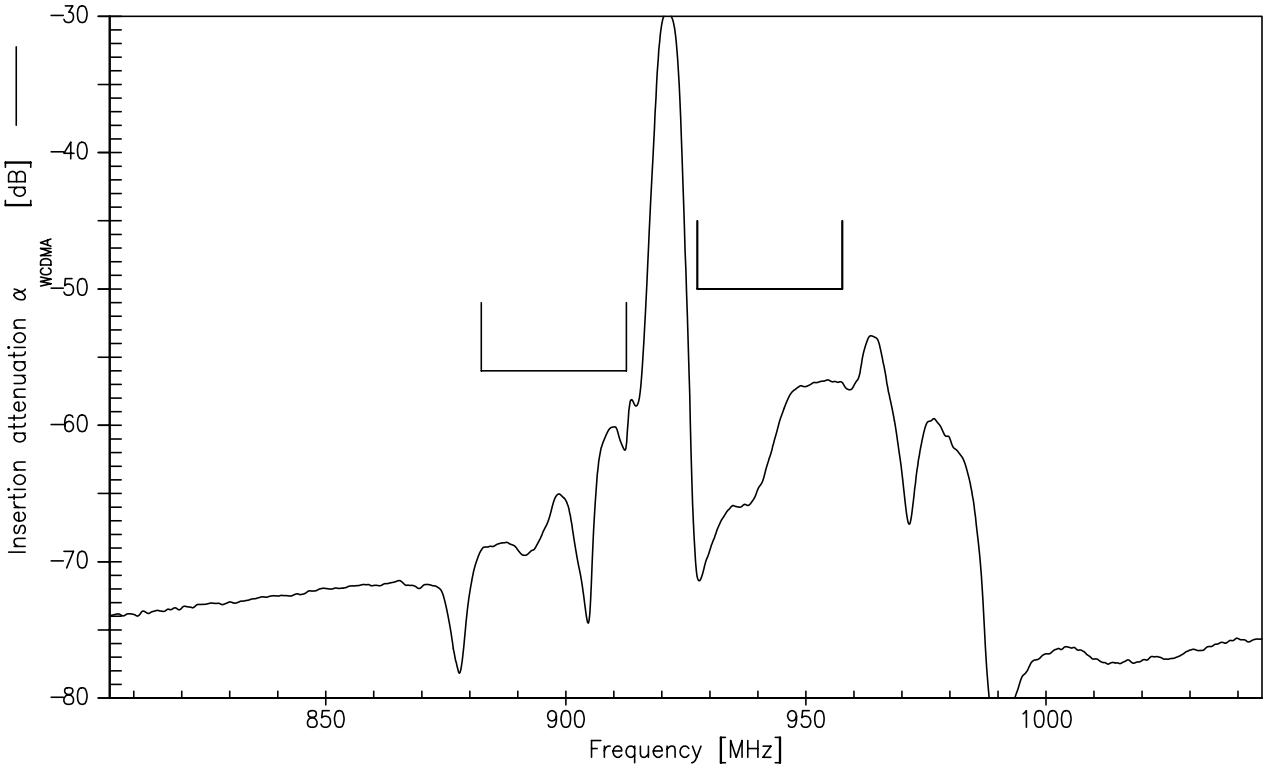
Frequency Response RX-ANT



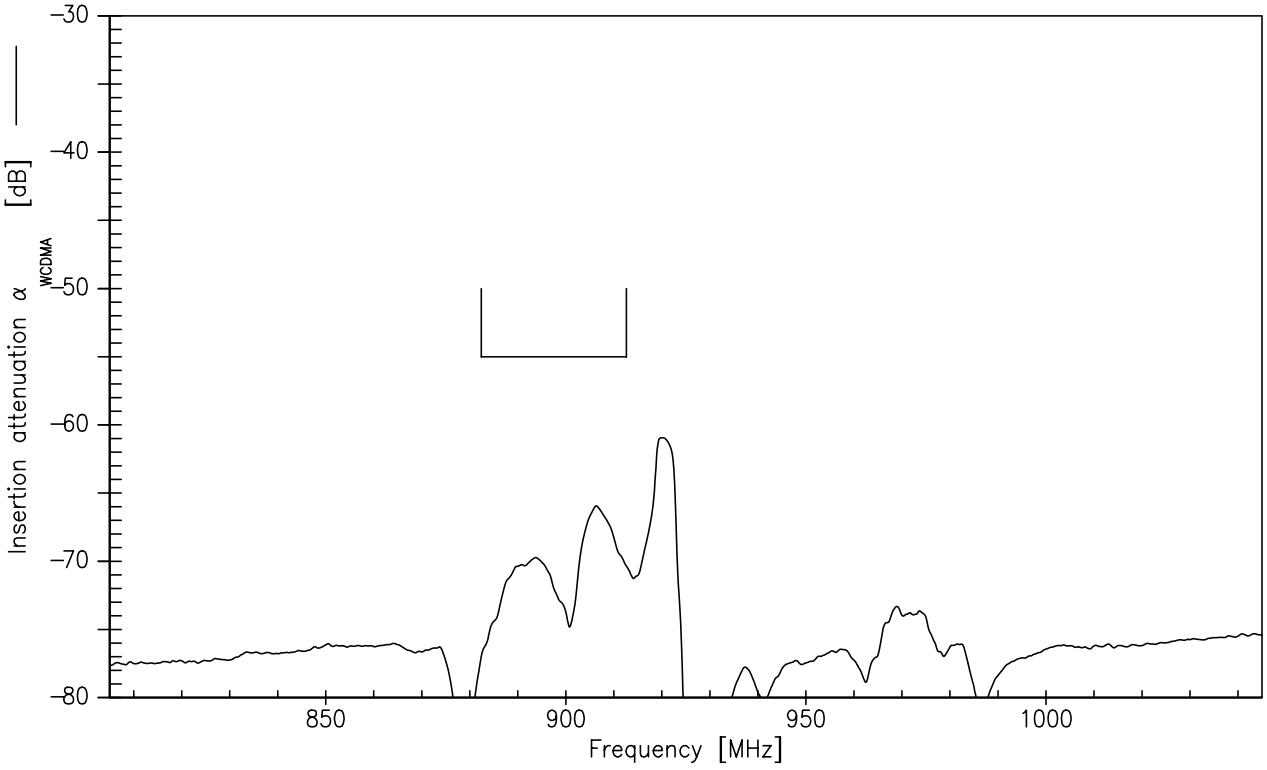
Frequency Response RX-ANT (wideband)



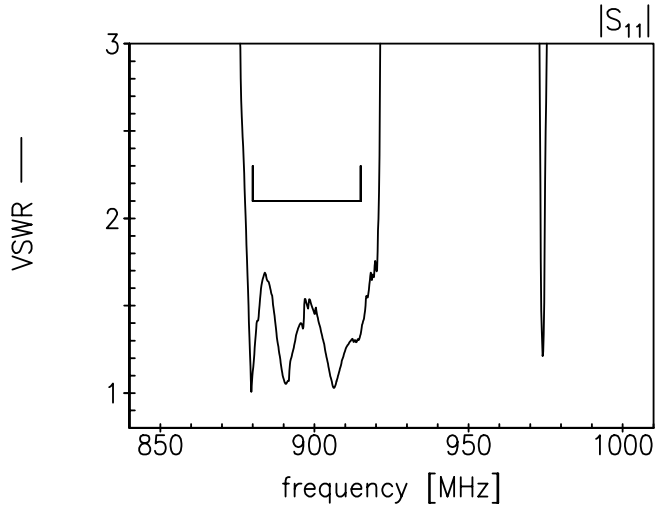
Frequency Response TX-RX

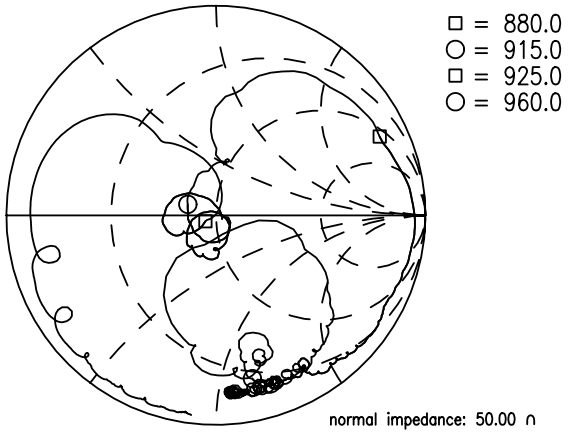


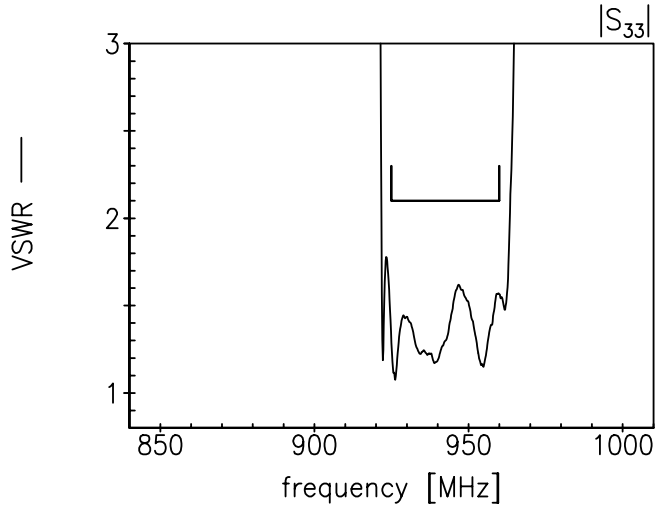
Frequency Response TX-RX (Common Mode)

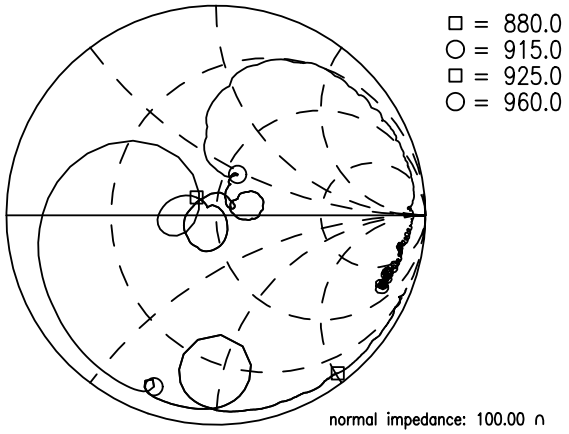


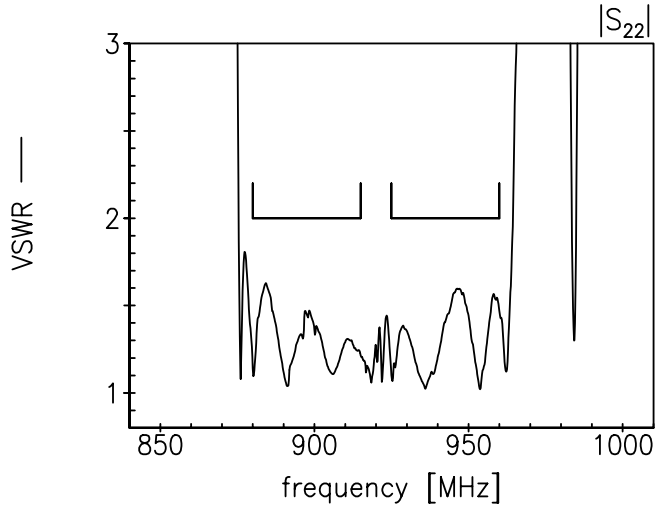
Return Loss **S_{11} TX- port** **S_{33} RX-port** **S_{22} ANT-port**

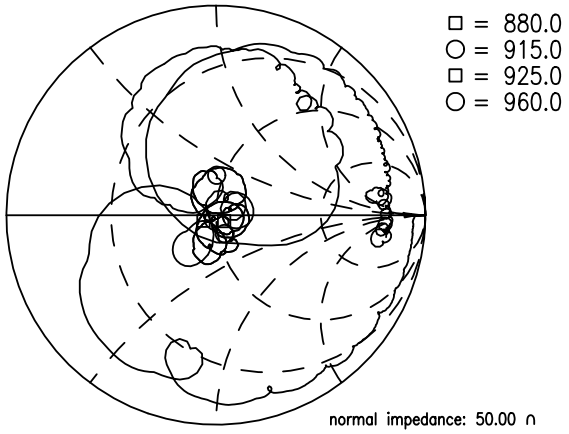












References

Type	B4401
Ordering code	B39941B4401P810
Marking and package	C61157-A8-A37
Packaging	F61074-V8247-Z000
Date codes	L_1126
S-parameters	B4401_NB_UN.s4p, B4401_WB_UN.s4p see file header for port/pin assignment table
Soldering profile	S_6001
RoHS compatible	RoHS-compatible means that products are compatible with the requirements according to Art. 4 (substance restrictions) of Directive 2011/65/EU of the European Parliament and of the Council of June 8th, 2011, on the restriction of the use of certain hazardous substances in electrical and electronic equipment ("Directive") with due regard to the application of exemptions as per Annex III of the Directive in certain cases.
Moldability	Before using in overmolding environment, please contact your EPCOS sales office.
Matching coils	See Inductor pdf-catalog http://www.tdk.co.jp/tefe02/coil.htm#aname1 and Data Library for circuit simulation http://www.tdk.co.jp/etvcl/index.htm

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