SAW components

SAW multiplexer
LTE band 1 + LTE band 3

Series/type:	M5001
Ordering code:	B39212M5001D310
Date:	June 02, 2016
Version:	1.0
Customer:	Qualcomm

Table of contents

1 Application

- Low-loss SAW multiplexer for mobile telephone LTE Band 1 and Band 3 systems, also suitable for WCDMA applications.
- Usable pass bands: 60MHz for Band 1 and 75 MHz for Band 3.
- High out of band selectivity
- High TX-RX isolation
- Terminating impedance 50Ω
- Unbalanced to unbalanced operation

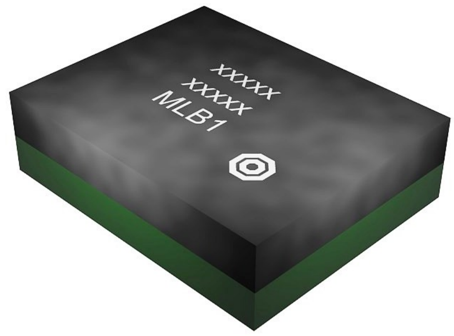


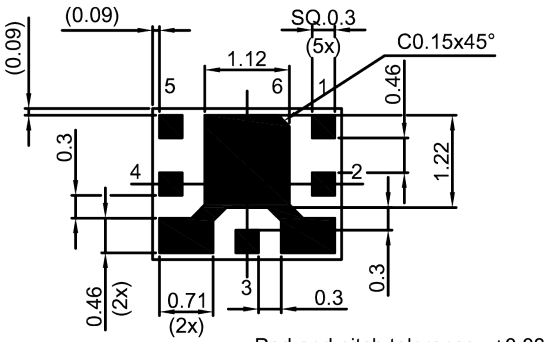
Figure 1: Picture of component with example of product marking.

2 Features

- Package size 2.5±0.1 mm × 2.0±0.1 mm
- Package height 0.69 mm (max.)
- Approximate weight t.b.d.
- RoHS compatible
- Package for Surface Mount Technology (SMT)
- Ni/Au-plated terminals

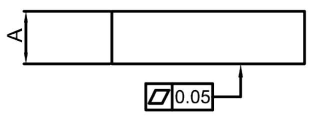
3 Package

BOTTOM VIEW

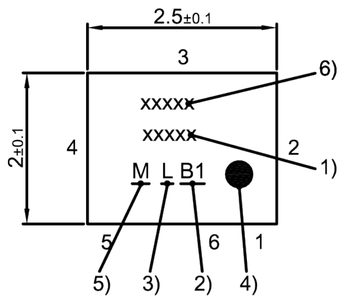


Pad and pitch tolerance ±0.03

SIDE VIEW

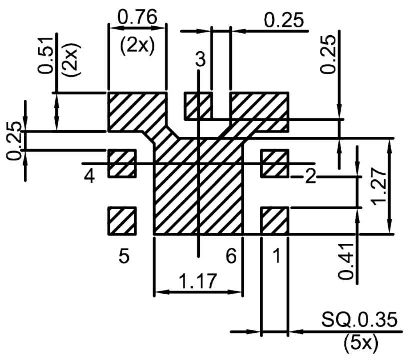


TOP VIEW



6) Tracking ID (5 to 8 digits)
5) Indicating production site (M=Muc, C=Wxi)
4) Marking for pad number 1
3) Date code acc. EPCOS (day)
2) Date code acc. to EN60062 (year, month)
1) Position for type designation

Land pattern
THRU VIEW



Landing pad tolerance -0.02

Figure 2: Drawing of package, height A = 0.69mm (max.). See Sec. Package information (p. 32).

4 Pin configuration

- 1 TX (B1)
- 2 TX (B3)
- 3 ANT (B1 & B3)
- 4 RX (B1)
- 5 RX (B3)
- 6 Ground

5 Matching circuit

- L_{p4} = 8.4 nH
- L_{p5} = 10 nH
- L_{s1} = 1.5 nH
- L_{s2} = 1.3 nH

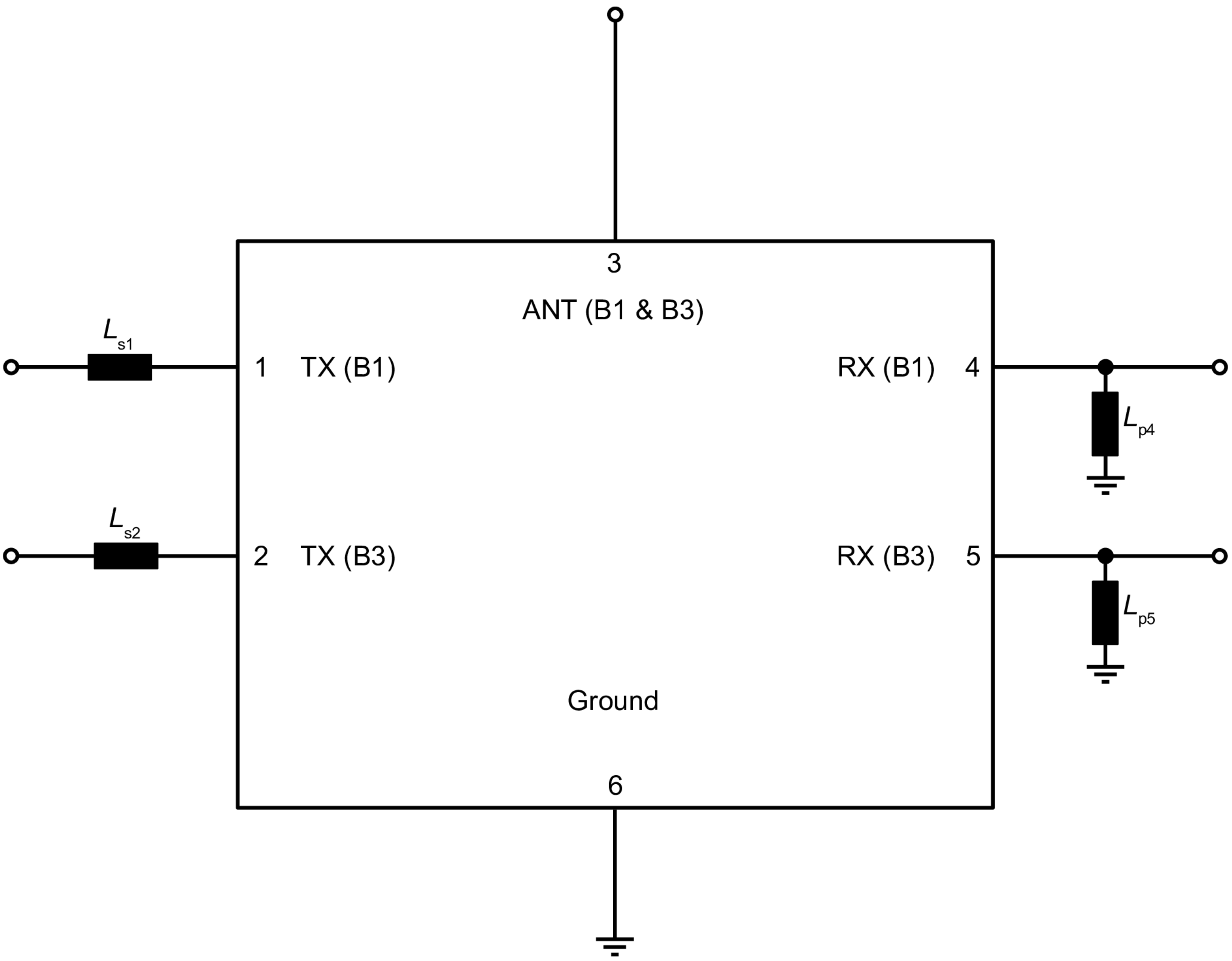


Figure 3: Schematic of matching circuit.

6 Characteristics LTE B1

6.1 TX – ANT

Temperature range for specification	T_{SPEC}	= −30 °C ... +85 °C
B1 TX terminating impedance	$Z_{B1\ TX}$	= 50 Ω with ser. 1.5 nH[1]
ANT terminating impedance	Z_{ANT}	= 50 Ω
B1 RX terminating impedance	$Z_{B1\ RX}$	= 50 Ω with par. 8.4 nH[1]

				Development status[2]			DGL[3]		
Characteristics LTE B1 TX – ANT				**min.** for T_{SPEC}	**typ.** @+25 °C	**max.** for T_{SPEC}	**min.**	**max.**	
Center frequency			f_C	—	1950	—	—	—	MHz
Maximum insertion attenuation			α_{max}						
	1920... 1980	MHz		—	2.5	3.0	—	2.8	dB
	1920.34... 1979.66	MHz		—	2.5	3.0	—	2.8	dB
Amplitude ripple (p-p)			$\Delta\alpha$						
	1920... 1980	MHz		—	0.9	2.0	—	—	dB
Maximum VSWR			$VSWR_{max}$						
@ B1 TX port	1920... 1980	MHz		—	1.5	2.0	—	—	
@ ANT port	1920... 1980	MHz		—	1.6	2.0	—	—	
Minimum attenuation			α_{min}						
	10... 1574	MHz		30	47	—	—	—	dB
	420... 494	MHz		50	63	—	—	—	dB
	815... 960	MHz		48	52	—	—	—	dB
	1226... 1250	MHz		43	48	—	—	—	dB
	1447.9... 1462.9	MHz		30	46	—	—	—	dB
	1475... 1496	MHz		40	46	—	—	—	dB
	1496... 1511	MHz		40	46	—	—	—	dB
	1559... 1586	MHz		37	47	—	—	—	dB
	1597... 1710	MHz		37	47	—	—	—	dB
	1710... 1785	MHz		35	40	—	—	—	dB
	1805... 1879.76	MHz		46	54	—	—	—	dB
	2010... 2025	MHz		t.b.d.	13	—	—	—	dB
	2110... 2170	MHz		45	57	—	—	—	dB
	2400... 2496	MHz		36	49	—	—	—	dB
	2496... 2690	MHz		40	46	—	—	—	dB
	3830... 3960	MHz		35	45	—	—	—	dB
	4900... 5740	MHz		20	27	—	—	—	dB
	5740... 5950	MHz		20	25	—	—	—	dB

1) See Sec. Matching circuit (p. 5).
2) Values in columns min., typ., and max. indicate the development status of the current version.
3) Values in column design goal (DGL) indicate the target performance.

6.2 ANT – RX

Temperature range for specification	T_{SPEC}	= −30 °C ... +85 °C
B1 TX terminating impedance	$Z_{B1\,TX}$	= 50 Ω with ser. 1.5 nH[1)]
ANT terminating impedance	Z_{ANT}	= 50 Ω
B1 RX terminating impedance	$Z_{B1\,RX}$	= 50 Ω with par. 8.4 nH[1)]

Characteristics LTE B1 ANT – RX				Development status[2)] min. for T_{SPEC}	typ. @+25 °C	max. for T_{SPEC}	DGL[3)] min.	max.	
Center frequency			f_C	—	2140	—	—	—	MHz
Maximum insertion attenuation			α_{max}						
	2110... 2170	MHz		—	2.4	3.0	—	2.8	dB
	2110.34... 2169.66	MHz		—	2.4	3.0	—	2.8	dB
Amplitude ripple (p-p)			$\Delta\alpha$						
	2110... 2170	MHz		—	0.6	2.0	—	—	dB
Maximum VSWR			$VSWR_{max}$						
@ ANT port	2110... 2170	MHz		—	1.5	2.0	—	—	
@ B1 RX port	2110... 2170	MHz		—	1.5	2.0	—	—	
Minimum attenuation			α_{min}						
	10... 1920	MHz		37	42	—	—	—	dB
	190	MHz		50	90	—	—	—	dB
	718... 748	MHz		50	64	—	—	—	dB
	814... 915	MHz		50	60	—	—	—	dB
	1427... 1447	MHz		40	50	—	—	—	dB
	1447... 1463	MHz		45	50	—	—	—	dB
	1710... 1785	MHz		48	54	—	—	—	dB
	1920... 1980	MHz		48	57	—	—	—	dB
	1980... 2015	MHz		15	52	—	—	—	dB
	2015... 2050	MHz		25	40	—	—	—	dB
	2050... 2075	MHz		10	20	—	—	—	dB
	2255... 2690	MHz		40	50	—	—	—	dB
	4030... 4150	MHz		40	54	—	—	—	dB
	4220... 4340	MHz		40	53	—	—	—	dB
	4340... 5950	MHz		35	45	—	—	—	dB

1) See Sec. Matching circuit (p. 5).
2) Values in columns min., typ., and max. indicate the development status of the current version.
3) Values in column design goal (DGL) indicate the target performance.

6.3 TX – RX

Temperature range for specification	T_{SPEC}	= −30 °C ... +85 °C
B1 TX terminating impedance	$Z_{B1\ TX}$	= 50 Ω with ser. 1.5 nH[1]
ANT terminating impedance	Z_{ANT}	= 50 Ω
B1 RX terminating impedance	$Z_{B1\ RX}$	= 50 Ω with par. 8.4 nH[1]

Characteristics LTE B1 TX – RX			Development status[2] min. for T_{SPEC}	typ. @+25 °C	max. for T_{SPEC}	DGL[3] min.	max.	
Minimum isolation		α_{min}						
1574 ... 1577	MHz		40	65	—	—	—	dB
1805.24 ... 1879.76	MHz		40	60	—	—	—	dB
1920 ... 1980	MHz		52	59	—	—	—	dB
1920.34 ... 1979.66	MHz		52	59	—	—	—	dB
2110 ... 2170	MHz		50	59	—	—	—	dB
2110.34 ... 2169.66	MHz		50	59	—	—	—	dB
3830 ... 3970	MHz		20	58	—	—	—	dB
5750 ... 5950	MHz		20	62	—	—	—	dB

1) See Sec. Matching circuit (p. 5).
2) Values in columns min., typ., and max. indicate the development status of the current version.
3) Values in column design goal (DGL) indicate the target performance.

6.4 Linearity

Temperature range for specification	T_{SPEC}	= −30 °C ... +85 °C
B1 TX terminating impedance	$Z_{B1\ TX}$	= 50 Ω with ser. 1.5 nH[1)]
ANT terminating impedance	Z_{ANT}	= 50 Ω
B1 RX terminating impedance	$Z_{B1\ RX}$	= 50 Ω with par. 8.4 nH[1)]

Characteristics LTE B1 Linearity			Development status[2)] min. for T_{SPEC}	Development status[2)] typ. @+25 °C	Development status[2)] max. for T_{SPEC}	DGL[3)] min.	DGL[3)] max.	
IMD product levels[4)]								
IMD2								
Blocker 1	190	MHz	—	−123	—	—	—	dBm
Blocker 3	4030... 4150	MHz	—	−116	—	—	—	dBm
IMD3								
Blocker 2	1730... 1790	MHz	—	−116	—	—	—	dBm
Blocker 4	5950... 6130	MHz	—	−123	—	—	—	dBm

1) See Sec. Matching circuit (p. 5).
2) Values in columns min., typ., and max. indicate the development status of the current version.
3) Values in column design goal (DGL) indicate the target performance.
4) @ f_{TX} = 1920....1980 MHz, f_{RX} = 2110....2170 MHz, IMD product levels for power levels P_{TX} = 21 dBm (ANT port output power) and $P_{blocker}$ = -15dBm (ANT port input power).

7 Characteristics LTE B3

7.1 TX – ANT

Temperature range for specification	T_{SPEC}	= −30 °C ... +85 °C
B3 TX terminating impedance	$Z_{B3\ TX}$	= 50 Ω with ser. 1.3 nH[1)]
ANT terminating impedance	Z_{ANT}	= 50 Ω
B3 RX terminating impedance	$Z_{B3\ RX}$	= 50 Ω with par. 10 nH[1)]

Characteristics LTE B3 TX – ANT				Development status[2)] min. for T_{SPEC}	Development status[2)] typ. @+25 °C	Development status[2)] max. for T_{SPEC}	DGL[3)] min.	DGL[3)] max.	
Center frequency			f_C	—	—	—	—	—	MHz
Maximum insertion attenuation			α_{max}						
	1710.24 ... 1784.76	MHz		—	2.6	t.b.d.[4)]	—	—	dB
	1710.24 ... 1784.76	MHz		—	2.6	3.5[5)]	—	—	dB
Amplitude ripple (p-p)			$\Delta\alpha$						
	1710.24 ... 1784.76	MHz		—	1.0	2.0[6)]	—	—	dB
Maximum VSWR			$VSWR_{max}$						
@ B3 TX port	1710.24 ... 1784.76	MHz		—	1.4	2.0	—	—	
@ ANT port	1710.24 ... 1784.76	MHz		—	1.4	2.0	—	—	
Minimum attenuation			α_{min}						
	10 ... 1566	MHz		40	49	—	—	—	dB
	703 ... 960	MHz		44	55	—	—	—	dB
	1226 ... 1250	MHz		43	50	—	—	—	dB
	1496 ... 1511	MHz		40	51	—	—	—	dB
	1559 ... 1586	MHz		43	54	—	—	—	dB
	1597 ... 1606	MHz		43	57	—	—	—	dB
	1805.24 ... 1879.76	MHz		t.b.d[4)]	58	—	—	—	dB
	1805.24 ... 1879.76	MHz		45[5)]	58	—	—	—	dB
	1920 ... 1980	MHz		20	42	—	—	—	dB
	2110 ... 2170	MHz		45	54	—	—	—	dB
	2400 ... 2496	MHz		35	46	—	—	—	dB
	2496 ... 2690	MHz		35	44	—	—	—	dB
	3420 ... 3570	MHz		33	38	—	—	—	dB
	4900 ... 5950	MHz		30	36	—	—	—	dB
	5100 ... 5385	MHz		32	38	—	—	—	dB

1) See Sec. Matching circuit (p. 5).
2) Values in columns min., typ., and max. indicate the development status of the current version.
3) Values in column design goal (DGL) indicate the target performance.
4) Valid for temperature T_{SPEC} = −30 °C...+25 °C.
5) Valid for temperature T_{SPEC} = +25 °C...+85 °C.
6) Over any 5MHz in-band.

7.2 ANT – RX

Temperature range for specification	T_{SPEC}	= −30 °C ... +85 °C
B3 TX terminating impedance	$Z_{B3\ TX}$	= 50 Ω with ser. 1.3 nH[1]
ANT terminating impedance	Z_{ANT}	= 50 Ω
B3 RX terminating impedance	$Z_{B3\ RX}$	= 50 Ω with par. 10 nH[1]

Characteristics LTE B3 ANT – RX				Development status[2]			DGL[3]		
				min. for T_{SPEC}	typ. @+25 °C	max. for T_{SPEC}	min.	max.	
Center frequency			f_C	—	—	—	—	—	MHz
Maximum insertion attenuation			α_{max}						
	1805.24 ... 1879.76	MHz		—	3.0	3.5[4]	—	—	dB
	1805.24 ... 1879.76	MHz		—	3.0	4.0	—	—	dB
Amplitude ripple (p-p)			$\Delta\alpha$						
	1805.24 ... 1879.76	MHz		—	1.2	t.b.d.	—	—	dB
Maximum VSWR			$VSWR_{max}$						
@ ANT port	1805.24 ... 1879.76	MHz		—	1.6	2.0[4]	—	—	
@ B3 RX port	1805.24 ... 1879.76	MHz		—	1.5	2.0	—	—	
Minimum attenuation			α_{min}						
	1.0 ... 1710	MHz		35	47	—	—	—	dB
	95	MHz		50	90	—	—	—	dB
	718 ... 915	MHz		40	58	—	—	—	dB
	1447 ... 1463	MHz		40	48	—	—	—	dB
	1615 ... 1690	MHz		40	48	—	—	—	dB
	1710.24 ... 1784.76	MHz		t.b.d	50	—	45	—	dB
	1785 ... 1790	MHz		10	38	—	—	—	dB
	1920 ... 1980	MHz		40	48	—	—	—	dB
	1980 ... 2400	MHz		30	39	—	—	—	dB
	2400 ... 2570	MHz		40	53	—	—	—	dB
	2570 ... 3515	MHz		35	46	—	—	—	dB
	3515 ... 3665	MHz		45	51	—	—	—	dB
	3665 ... 3760	MHz		40	52	—	—	—	dB
	3760 ... 4900	MHz		15	44	—	—	—	dB
	4900 ... 5950	MHz		30	43	—	—	—	dB

1) See Sec. Matching circuit (p. 5).
2) Values in columns min., typ., and max. indicate the development status of the current version.
3) Values in column design goal (DGL) indicate the target performance.
4) Valid for temperature T_{SPEC} = +25 °C...+85 °C.

7.3 TX – RX

Temperature range for specification	T_{SPEC}	= −30 °C ... +85 °C
B3 TX terminating impedance	$Z_{B3\ TX}$	= 50 Ω with ser. 1.3 nH[1)]
ANT terminating impedance	Z_{ANT}	= 50 Ω
B3 RX terminating impedance	$Z_{B3\ RX}$	= 50 Ω with par. 10 nH[1)]

		Development status[2)]			DGL[3)]		
Characteristics LTE B3 TX – RX		**min.** for T_{SPEC}	**typ.** @+25 °C	**max.** for T_{SPEC}	**min.**	**max.**	
Minimum isolation	α_{min}						
1710.24 ... 1784.76 MHz		t.b.d.	56	—	52	—	dB
1805.24 ... 1879.76 MHz		t.b.d.	59	—	50	—	dB
2110.34 ... 2169.66 MHz		40	62	—	—	—	dB

1) See Sec. Matching circuit (p. 5).
2) Values in columns min., typ., and max. indicate the development status of the current version.
3) Values in column design goal (DGL) indicate the target performance.

7.4 Linearity

Temperature range for specification	T_{SPEC}	= −30 °C ... +85 °C
B3 TX terminating impedance	$Z_{B3\ TX}$	= 50 Ω with ser. 1.3 nH[1)]
ANT terminating impedance	Z_{ANT}	= 50 Ω
B3 RX terminating impedance	$Z_{B3\ RX}$	= 50 Ω with par. 10 nH[1)]

			Development status[2)]			DGL[3)]		
Characteristics LTE B3 Linearity			**min.** for T_{SPEC}	**typ.** @+25 °C	**max.** for T_{SPEC}	**min.**	**max.**	
IMD product levels[4)]								
IMD2								
Blocker 1	95	MHz	—	−124	—	—	—	dBm
Blocker 3	3515... 3665	MHz	—	−114	—	—	—	dBm
IMD3								
Blocker 2	1615... 1690	MHz	—	−105	—	—	—	dBm
Blocker 4	5225... 5450	MHz	—	−116	—	—	—	dBm

1) See Sec. Matching circuit (p. 5).
2) Values in columns min., typ., and max. indicate the development status of the current version.
3) Values in column design goal (DGL) indicate the target performance.
4) @ f_{TX} = 1710....1785 MHz, f_{RX} = 1805....1880 MHz, IMD product levels for power levels P_{TX} = 21 dBm (ANT port output power) and $P_{blocker}$ = -15dBm (ANT port input power).

8 Characteristics cross-isolations

8.1 LTE B1 TX – LTE B3 RX

Temperature range for specification	T_{SPEC}	= −30 °C ... +85 °C
B1 TX terminating impedance	$Z_{B1\ TX}$	= 50 Ω with ser. 1.5 nH[1]
B3 RX terminating impedance	$Z_{B3\ RX}$	= 50 Ω with par. 10 nH[1]

				Development status[2]			DGL[3]		
Characteristics cross-isolation LTE B1 TX – LTE B3 RX				**min.** for T_{SPEC}	**typ.** @+25 °C	**max.** for T_{SPEC}	**min.**	**max.**	
Minimum cross-isolation			α_{min}						
	1805.24 ... 1879.76	MHz		50	54	—	—	—	dB
	1920 ... 1980	MHz		t.b.d.	55	—	50	—	dB
	1920.34 ... 1979.66	MHz		t.b.d.	55	—	50	—	dB

1) See Sec. Matching circuit (p. 5).
2) Values in columns min., typ., and max. indicate the development status of the current version.
3) Values in column design goal (DGL) indicate the target performance.

8.2 LTE B3 TX – LTE B1 RX

Temperature range for specification	T_{SPEC}	= −30 °C ... +85 °C
B3 TX terminating impedance	$Z_{B3\ TX}$	= 50 Ω with ser. 1.3 nH[1]
B1 RX terminating impedance	$Z_{B1\ RX}$	= 50 Ω with par. 8.4 nH[1]

		Development status[2]			DGL[3]		
Characteristics cross-isolation LTE B3 TX – LTE B1 RX		**min.** for T_{SPEC}	**typ.** @+25 °C	**max.** for T_{SPEC}	**min.**	**max.**	
Minimum cross-isolation	α_{min}						
1710.24 ... 1784.76 MHz		53	58	—	—	—	dB
2110 ... 2170 MHz		50	57	—	—	—	dB
2110.34 ... 2169.66 MHz		50	57	—	—	—	dB

1) See Sec. Matching circuit (p. 5).
2) Values in columns min., typ., and max. indicate the development status of the current version.
3) Values in column design goal (DGL) indicate the target performance.

9 Maximum ratings

Operable temperature	T_{OP} = −30 °C ... +85 °C	
Storage temperature	T_{STG} = −40 °C ... +85 °C	
DC voltage	V_{DC} = 0 V (max.)	
ESD voltage		
	V_{ESD}[1)] = t.b.d V (max.)	Machine model.
	V_{ESD}[2)] = t.b.d V (max.)	Human body model.
	V_{ESD}[3)] = t.b.d V (max.)	Charged device model.
Input power	P_{IN}	
@ B1 TX port: 1920 ... 1980 MHz	t.b.d dBm	Continuous wave for 5000 h @ 55 °C.
@ B3 TX port: 1710.24 ... 1784.76 MHz	t.b.d dBm	Continuous wave for 5000 h @ 55 °C.

1) According to JESD22-A115B (MM – Machine Model), 10 negative & 10 positive pulses.
2) According to JESD22-A114F (HBM – Human Body Model), 1 negative & 1 positive pulse.
3) According to JESD22-C101C (CDM – Field Induced Charged Device Model), 3 negative & 3 positive pulses.

10 Transmission coefficients LTE B1

10.1 TX – ANT

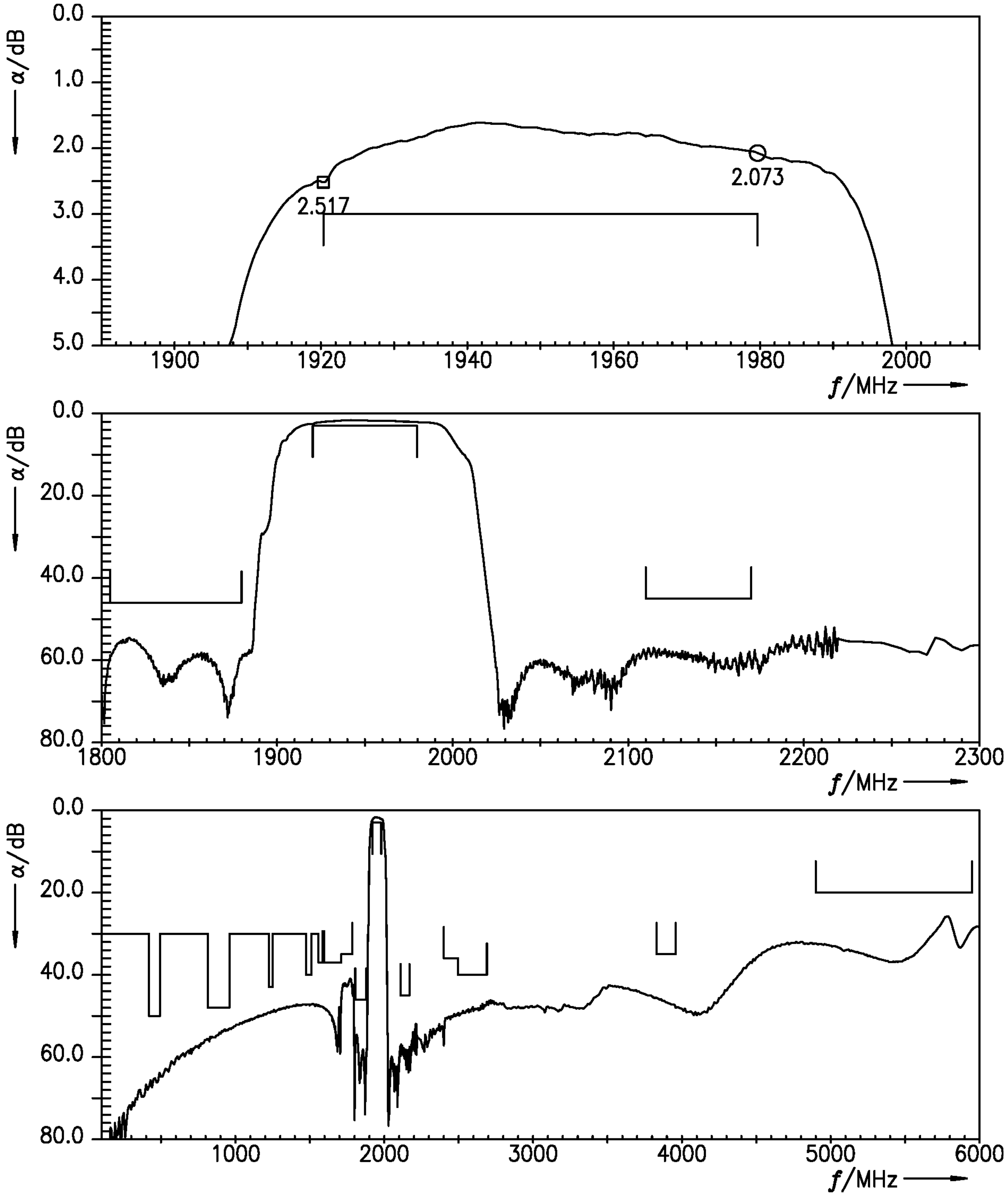


Figure 4: Attenuation LTE B1 TX – ANT.

10.2 ANT – RX

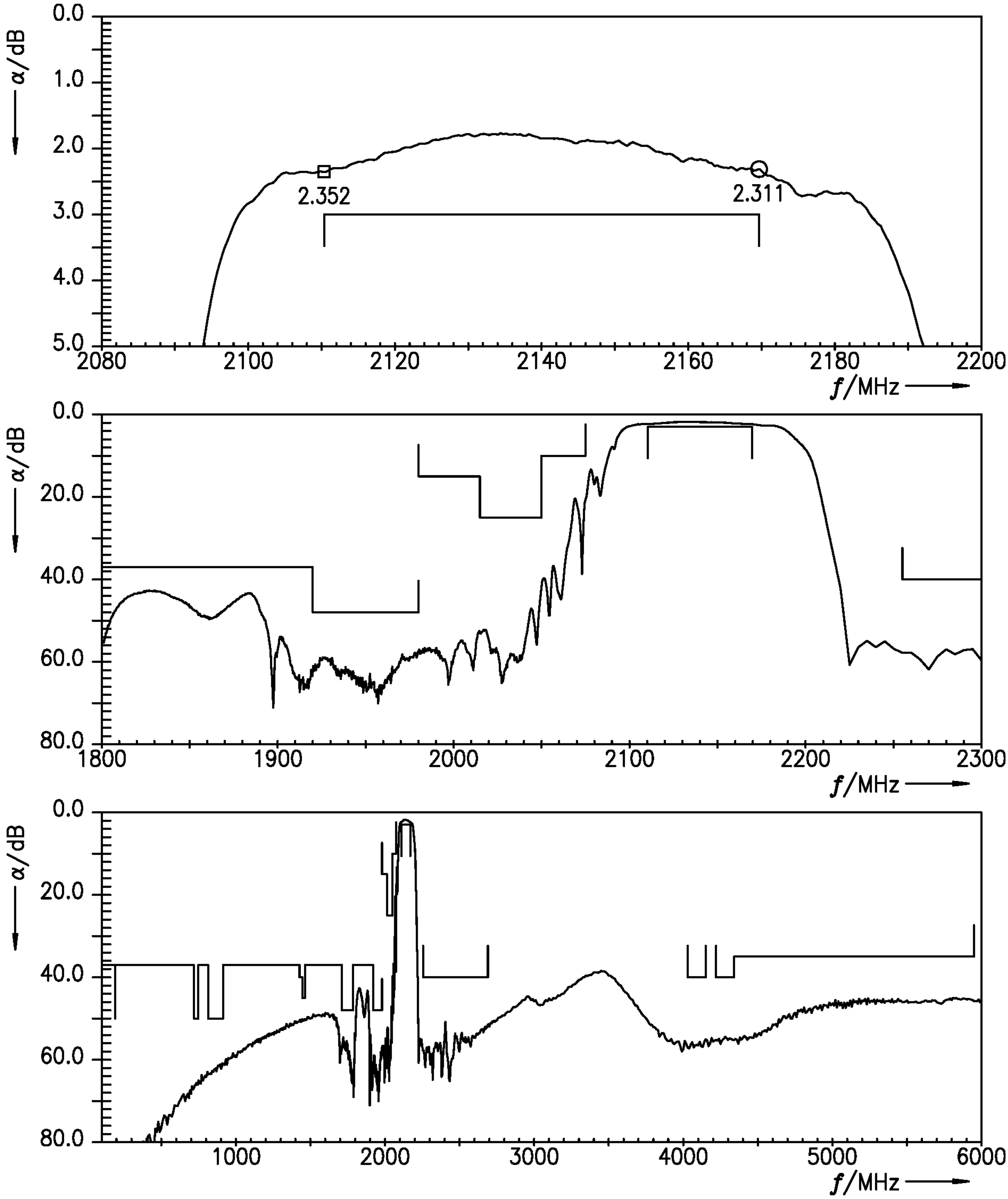


Figure 5: Attenuation LTE B1 ANT – RX.

10.3 TX – RX

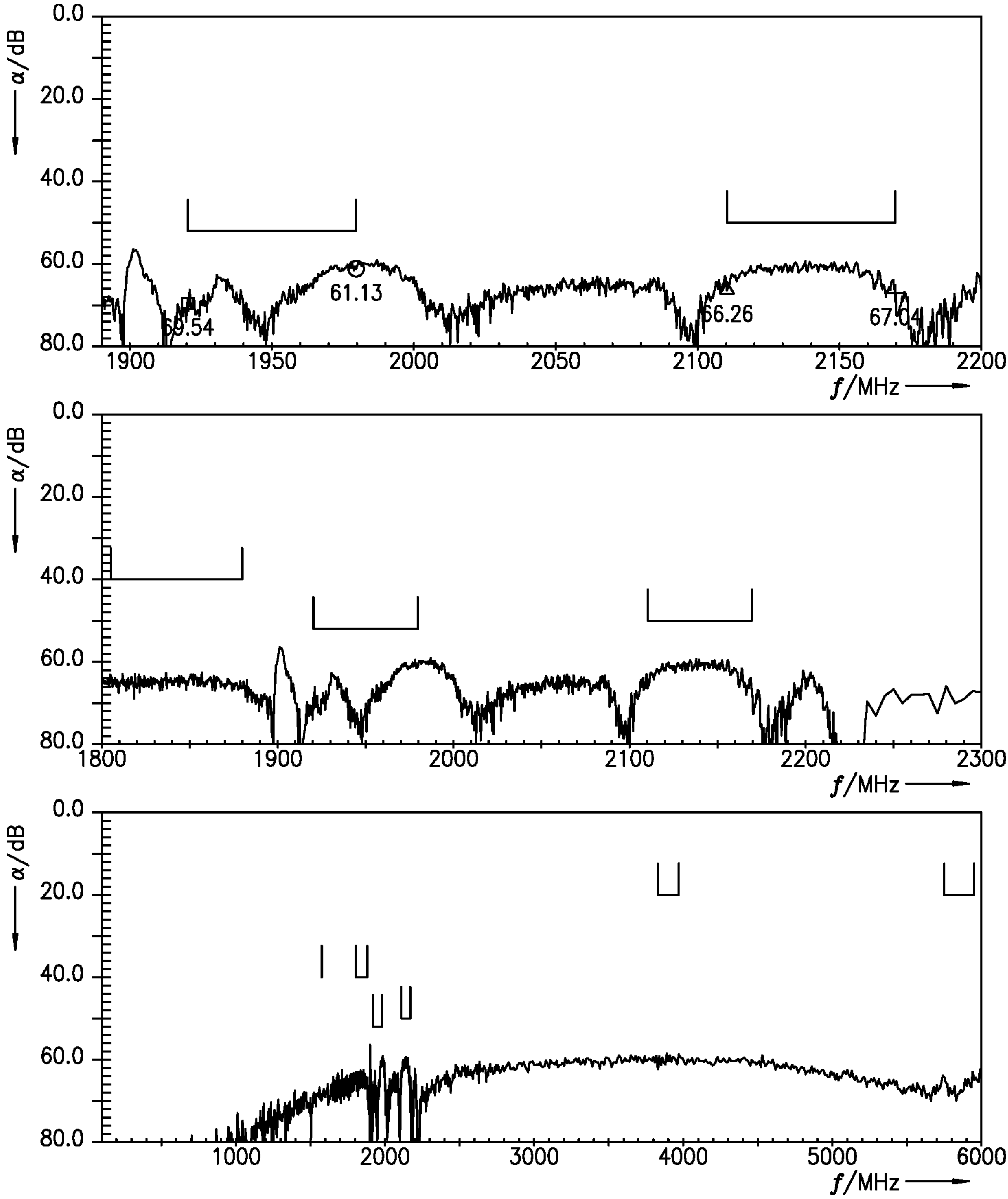


Figure 6: Isolation LTE B1 TX – RX.

11 Reflection coefficients LTE B1

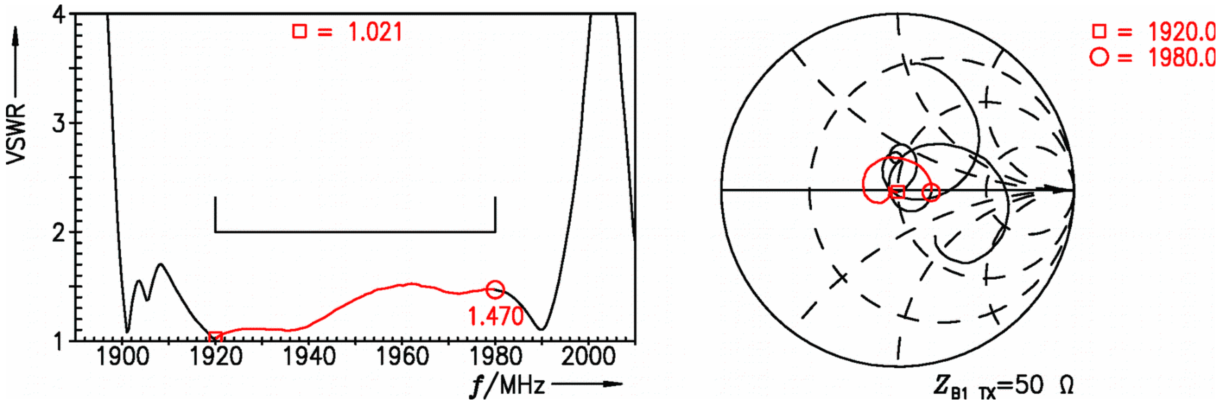


Figure 7: Reflection coefficient LTE B1 at TX port.

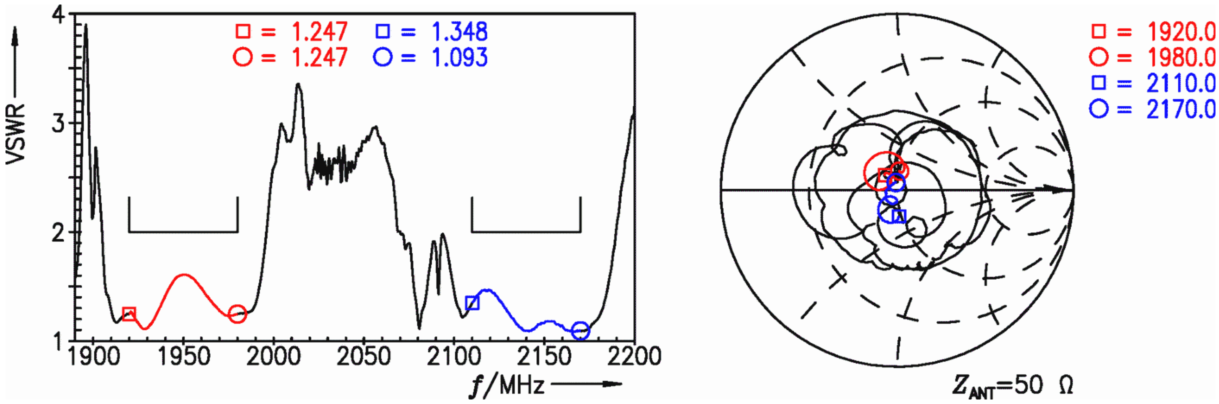


Figure 8: Reflection coefficient LTE B1 at ANT port (TX and RX frequencies).

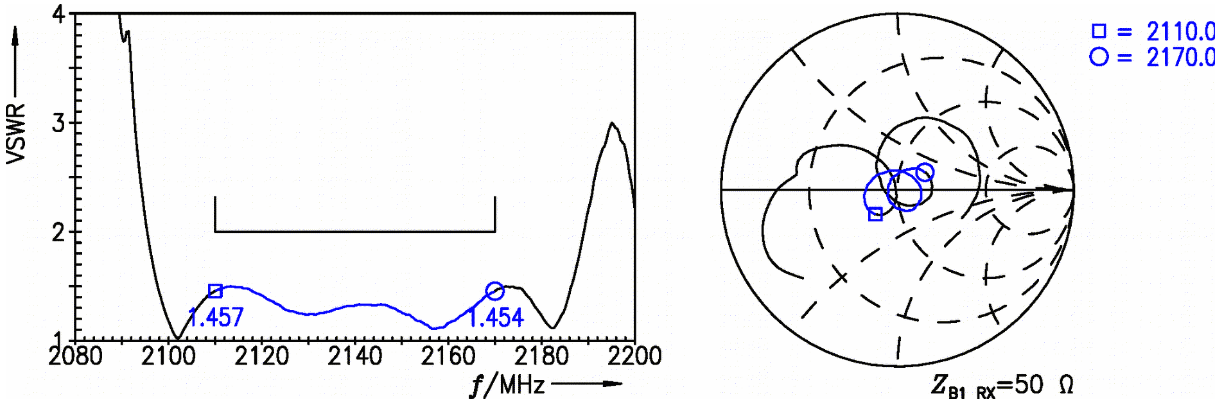


Figure 9: Reflection coefficient LTE B1 at RX port.

12 Transmission coefficients LTE B3

12.1 TX – ANT

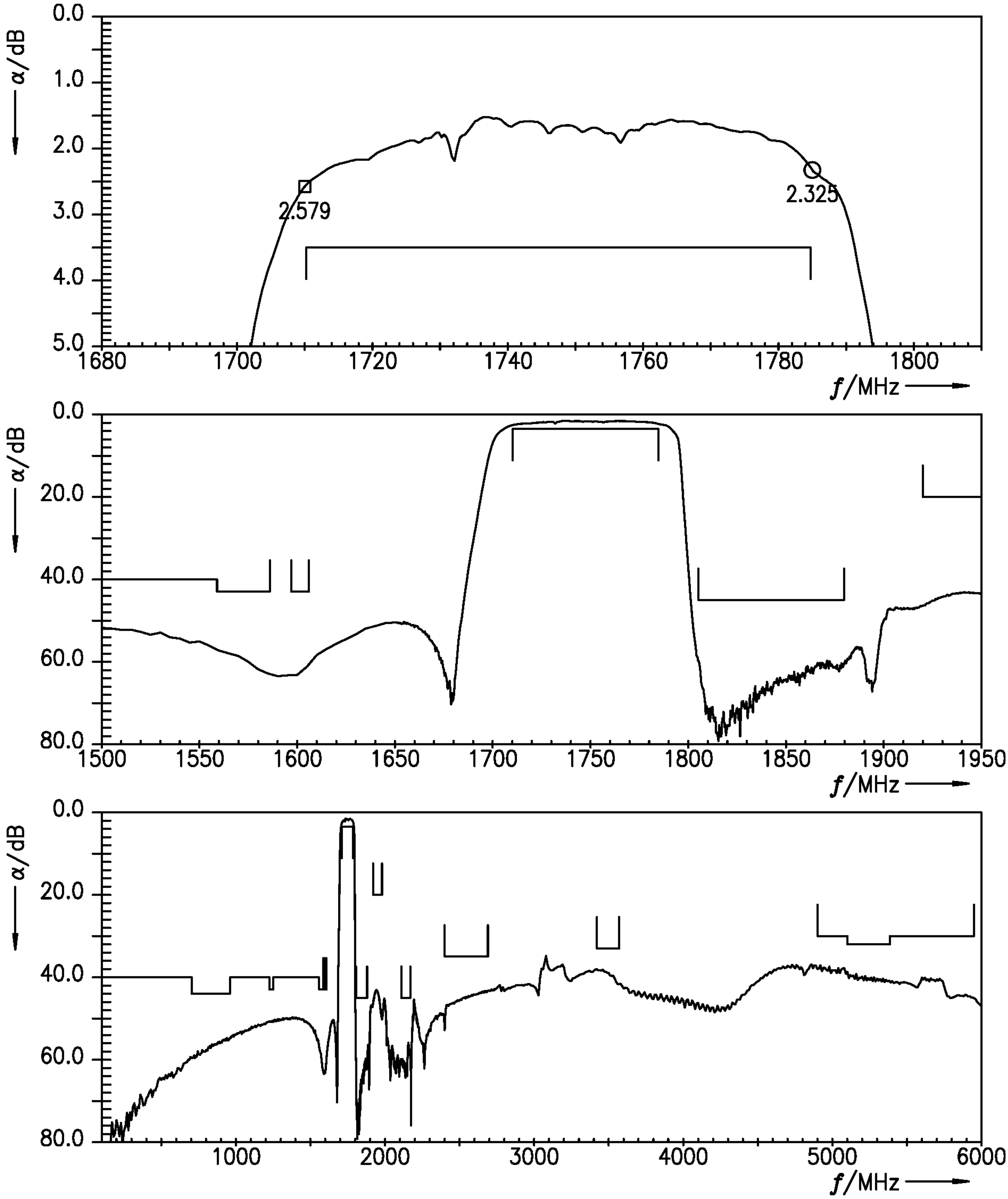


Figure 10: Attenuation LTE B3 TX – ANT.

12.2 ANT – RX

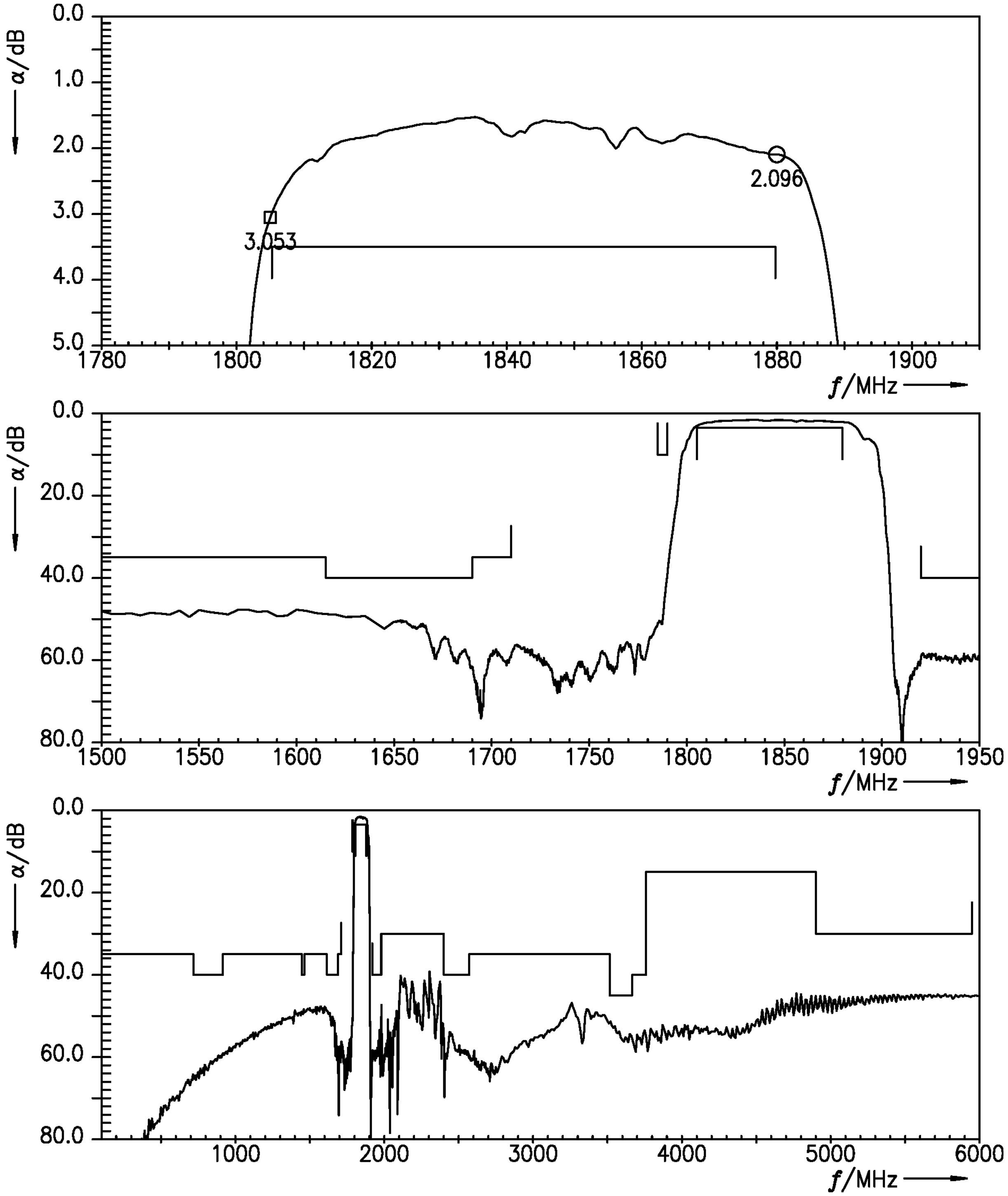


Figure 11: Attenuation LTE B3 ANT – RX.

12.3 TX – RX

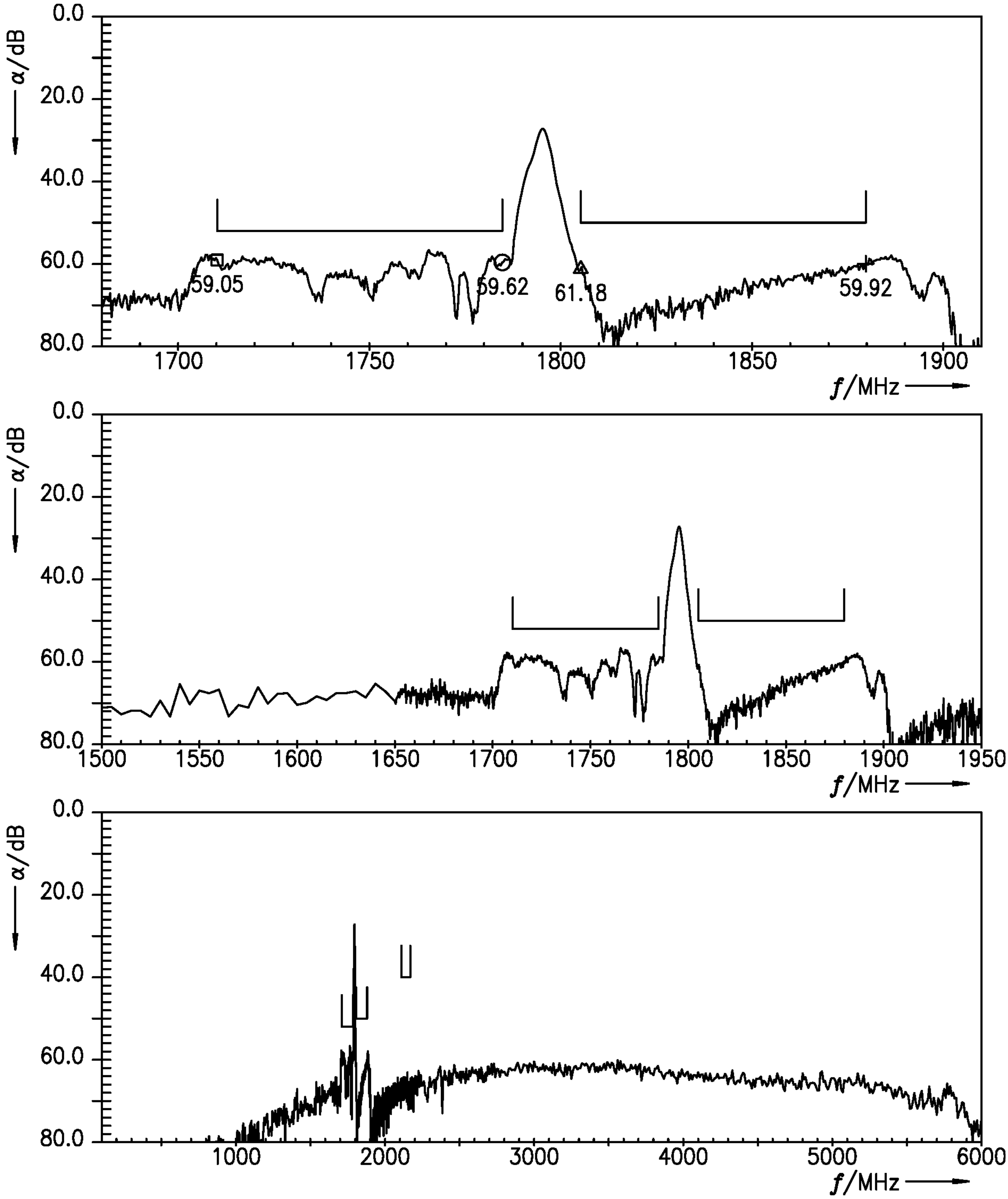


Figure 12: Isolation LTE B3 TX – RX.

13 Reflection coefficients LTE B3

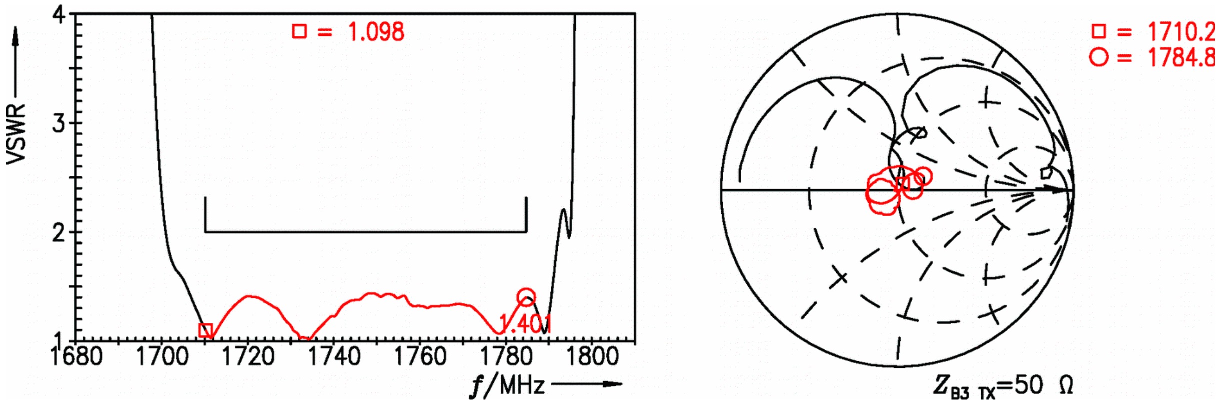


Figure 13: Reflection coefficient LTE B3 at TX port.

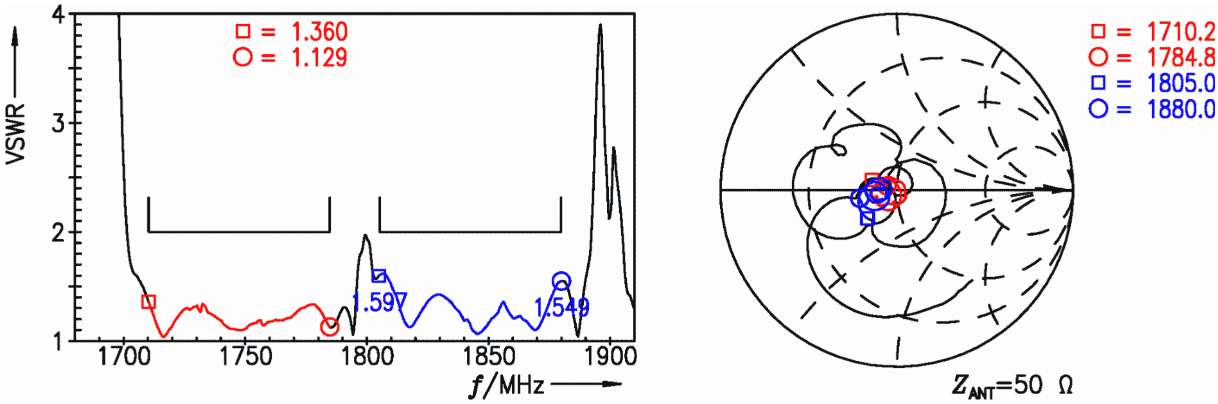


Figure 14: Reflection coefficient LTE B3 at ANT port (TX and RX frequencies).

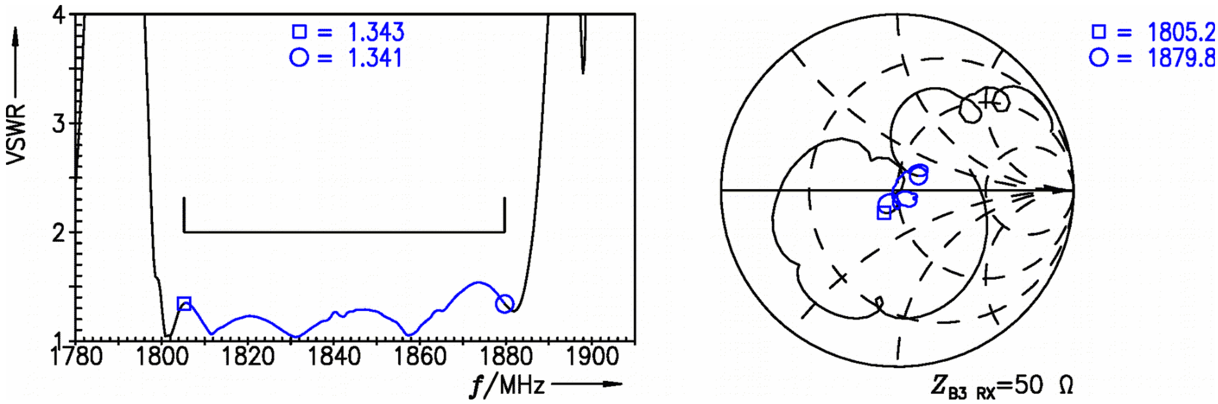


Figure 15: Reflection coefficient LTE B3 at RX port.

14 Transmission coefficients cross-isolations

14.1 LTE B1 TX – LTE B3 RX

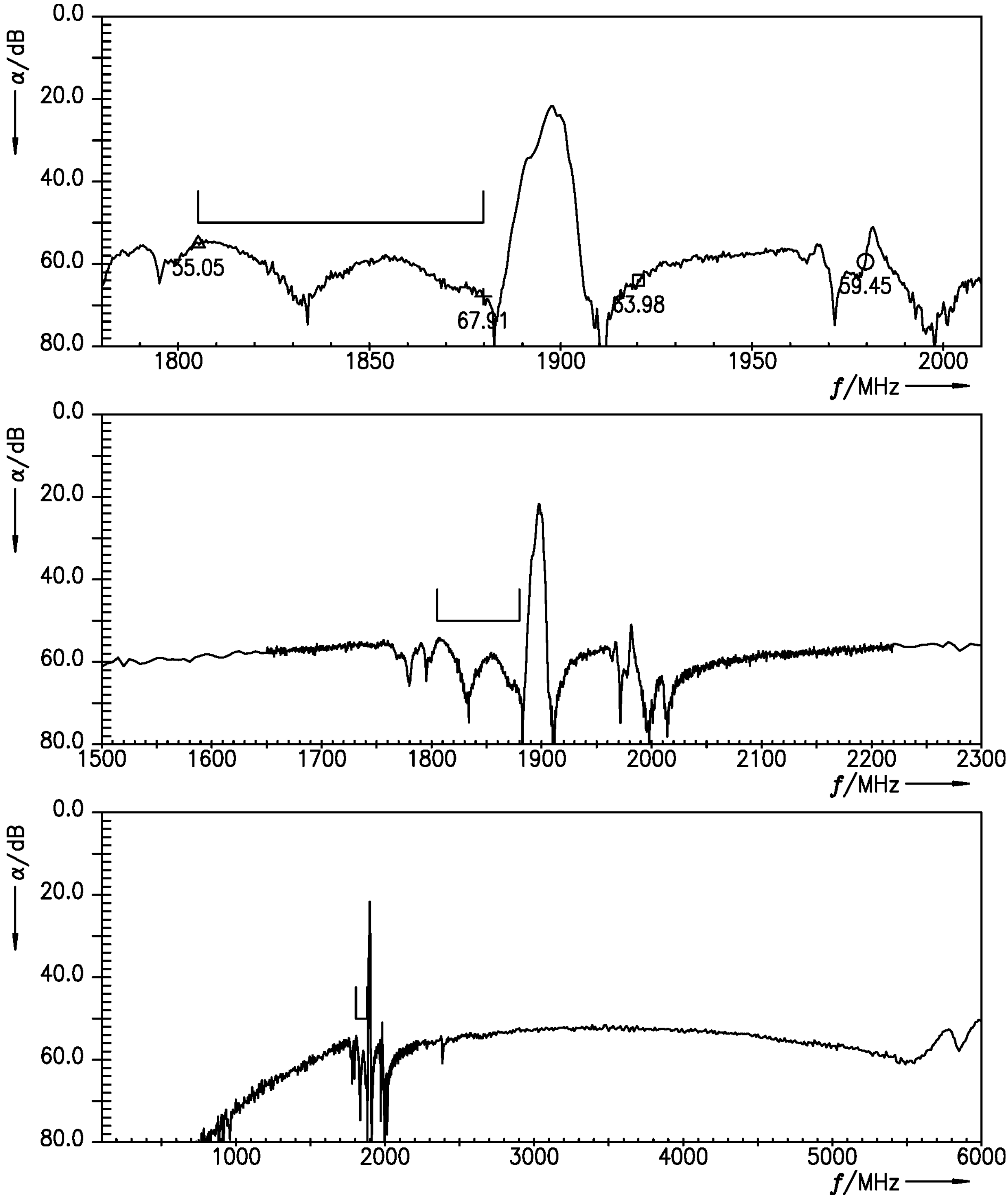


Figure 16: Cross-isolation LTE B1 TX – LTE B3 RX.

14.2 LTE B3 TX – LTE B1 RX

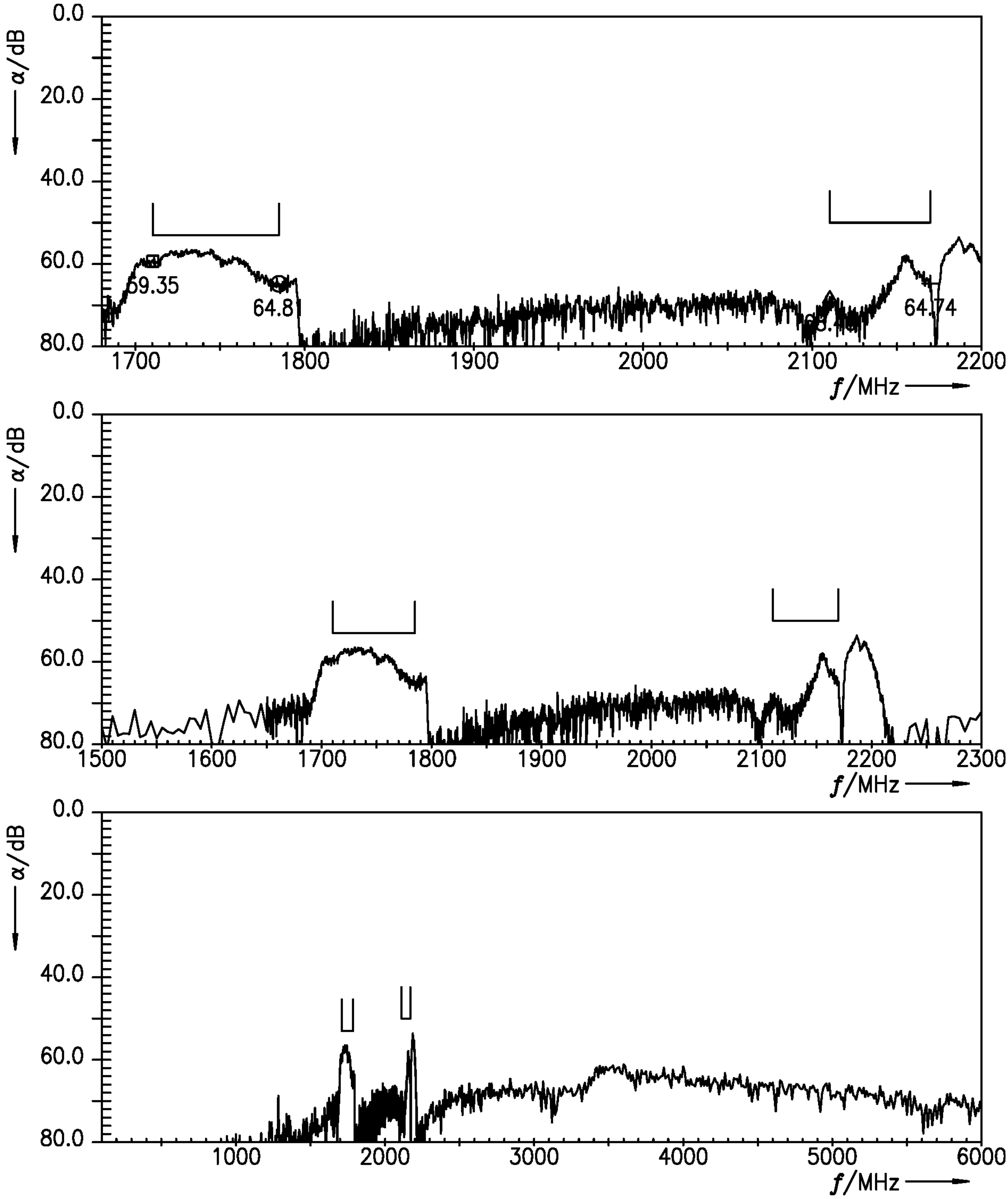


Figure 17: Cross-isolation LTE B3 TX – LTE B1 RX.

15 Packing material

15.1 Tape

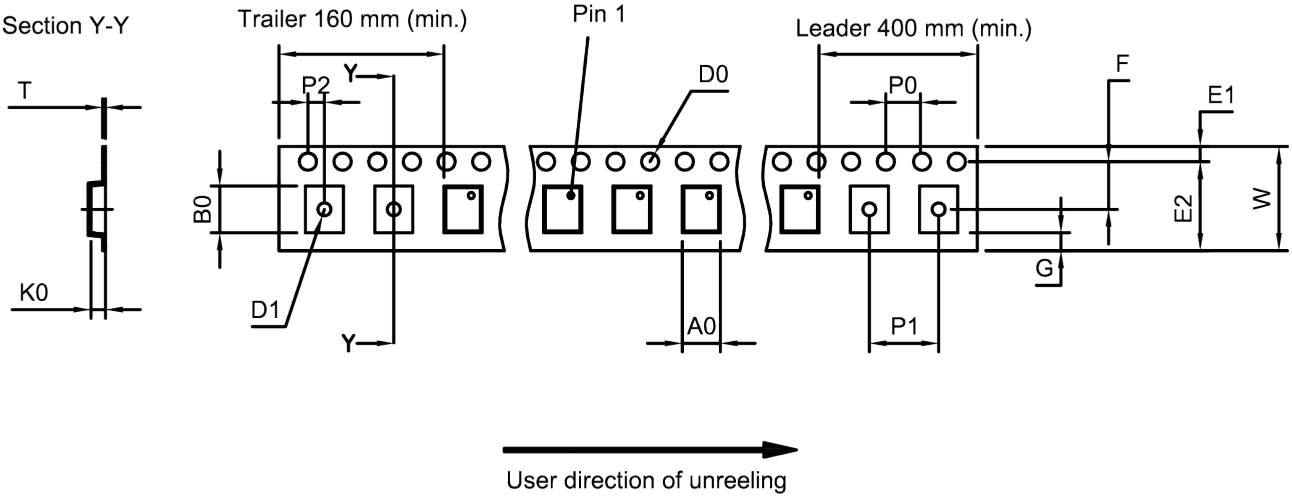


Figure 18: Drawing of tape (first-angle projection) with tape dimensions according to Table 1.

A_0	$2.25_{\pm 0.05}$ mm	E_2	10.25 mm (min.)	P_1	$4.0_{\pm 0.1}$ mm
B_0	$2.75_{\pm 0.05}$ mm	F	$5.5_{\pm 0.05}$ mm	P_2	$2.0_{\pm 0.05}$ mm
D_0	$1.5_{+0.1/-0}$ mm	G	0.75 mm (min.)	T	$0.3_{\pm 0.03}$ mm
D_1	1.0 mm (min.)	K_0	$0.84_{\pm 0.1}$ mm	W	$12.0_{+0.3/-0.1}$ mm
E_1	$1.75_{\pm 0.1}$ mm	P_0	$4.0_{\pm 0.1}$ mm		

Table 1: Tape dimensions.

15.2 Reel with diameter of 180 mm

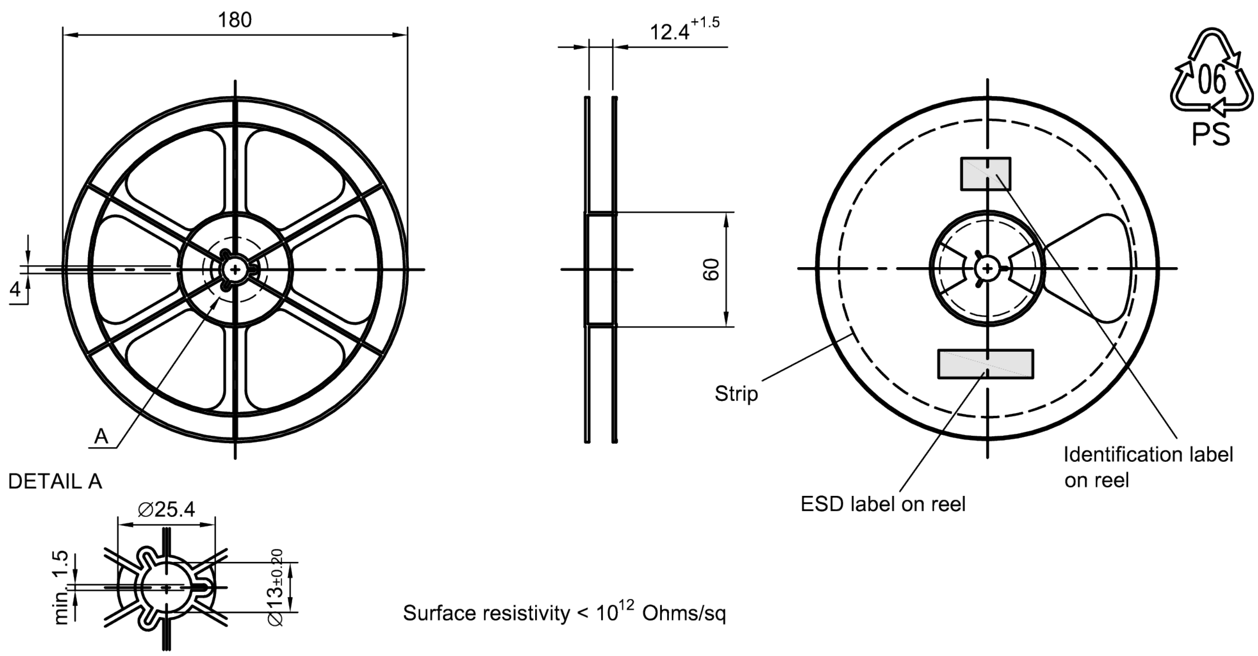
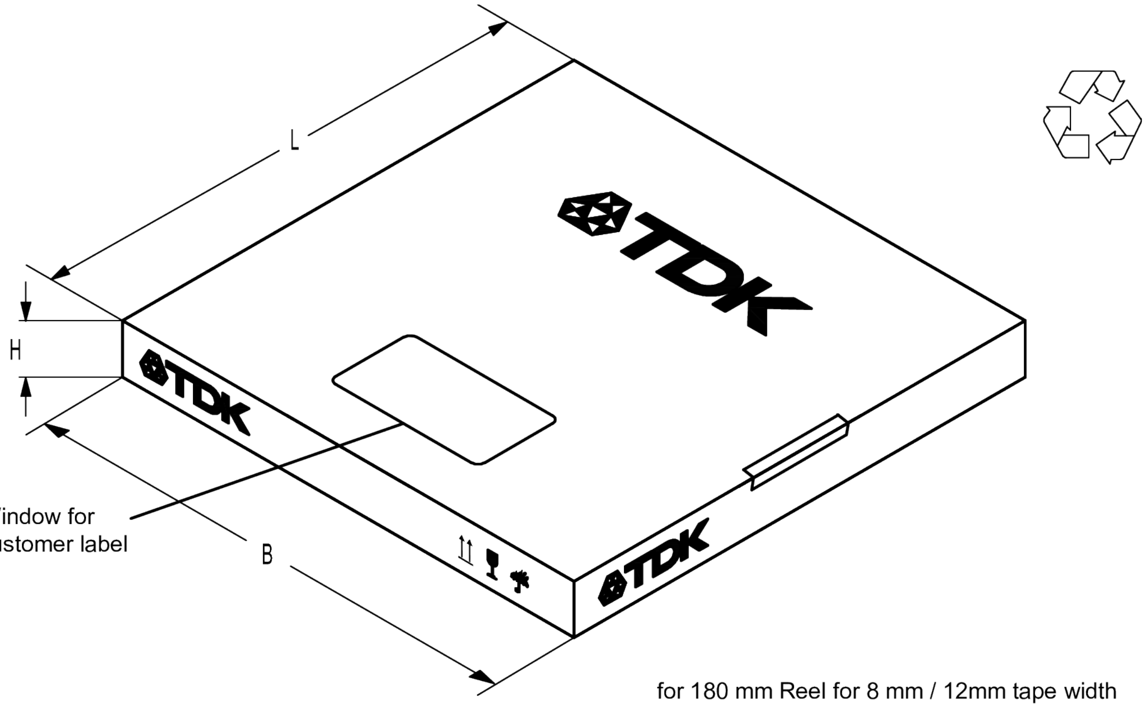


Figure 19: Drawing of reel (first-angle projection) with diameter of 180 mm.



Dimensions

L = 182
B = 185
H = 26

for 180 mm Reel for 8 mm / 12mm tape width
SMD packages

Figure 20: Drawing of folding box for reel with diameter of 180 mm.

15.3 Reel with diameter of 330 mm

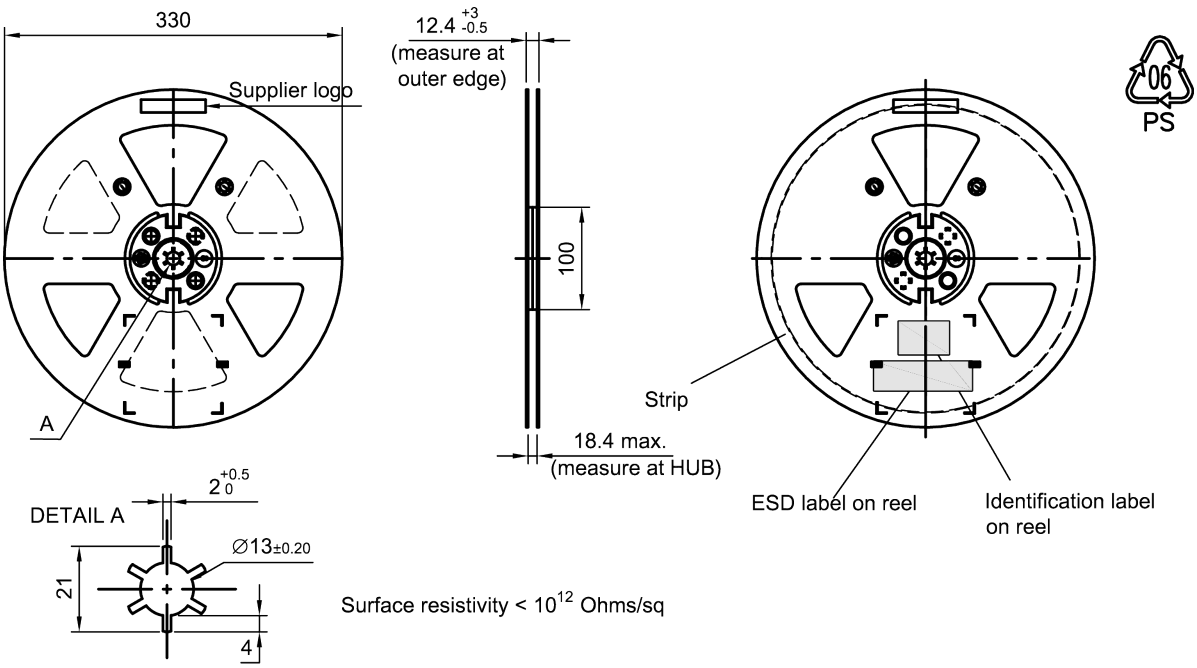
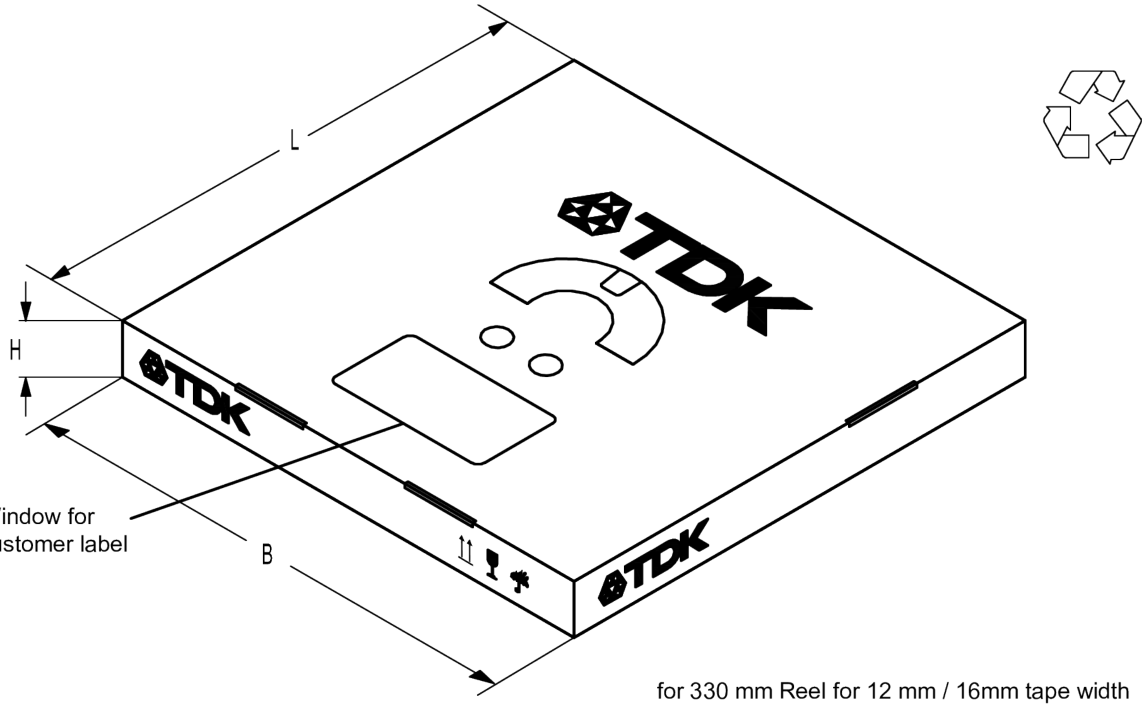


Figure 21: Drawing of reel (first-angle projection) with diameter of 330 mm.



Dimensions

L = 340
B = 340
H = 25

for 330 mm Reel for 12 mm / 16mm tape width
SMD packages

Figure 22: Drawing of folding box for reel with diameter of 330 mm.

16 Soldering profile

The recommended soldering process is in accordance with IEC 60068-2-58 – 3[rd] edit and IPC/JEDEC J-STD-020B.

ramp rate	≤ 3 K/s
preheat	125 °C to 220 °C, 150 s to 210 s, 0.4 K/s to 1.0 K/s
T > 220 °C	30 s to 70 s
T > 230 °C	min. 10 s
T > 245 °C	max. 20 s
T ≥ 255 °C	–
peak temperature T_{peak}	250 °C +0/-5 °C
wetting temperature T_{min}	230 °C +5/-0 °C for 10 s ± 1 s
cooling rate	≤ 3 K/s
soldering temperature T	measured at solder pads

Table 2: Characteristics of recommended soldering profile for lead-free solder (Sn95.5Ag3.8Cu0.7).

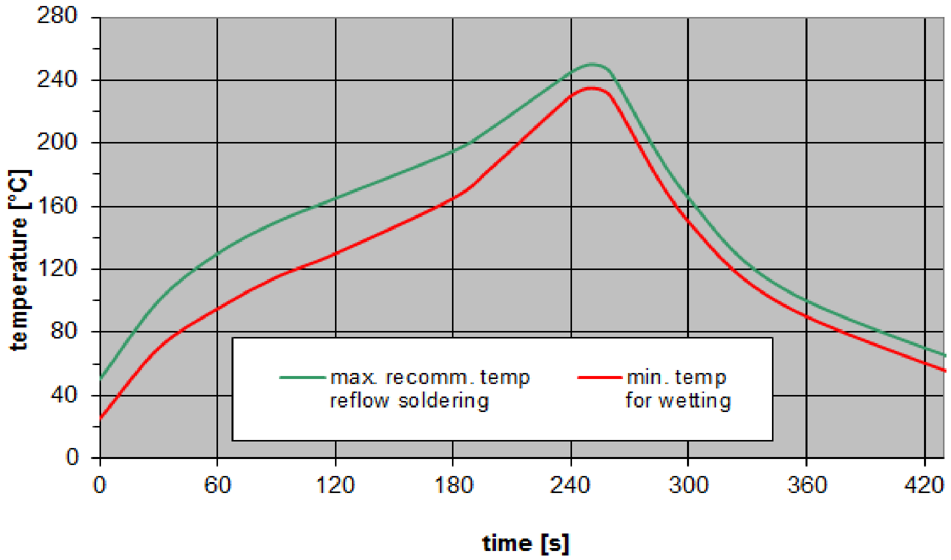


Figure 23: Recommended reflow profile for convection and infrared soldering – lead-free solder.

17 Annotations

17.1 Matching coils

See TDK 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.

17.2 RoHS compatibility

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.

17.3 Scattering parameters (S-parameters)

The pin/port assignment is available in the headers of the S-parameter files. Please contact your local EPCOS sales office.

18 Cautions and warnings

18.1 Display of ordering codes for EPCOS products

The ordering code for one and the same product can be represented differently in data sheets, data books, other publications and the website of EPCOS, or in order-related documents such as shipping notes, order confirmations and product labels. The varying representations of the ordering codes are due to different processes employed and do not affect the specifications of the respective products. Detailed information can be found on the Internet under **www.epcos.com/orderingcodes**.

18.2 Material information

Due to technical requirements components may contain dangerous substances. For information on the type in question please also contact one of our sales offices.

18.3 Moldability

Before using in overmolding environment, please contact your local EPCOS sales office.

18.4 Package information

Landing area

The printed circuit board (PCB) land pattern (landing area) shown is based on EPCOS internal development and empirical data and illustrated for example purposes, only. As customers' SMD assembly processes may have a plenty of variants and influence factors which are not under control or knowledge of EPCOS, additional careful process development on customer side is necessary and strongly recommended in order to achieve best soldering results tailored to the particular customer needs.

Dimensions

Unless otherwise specified all dimensions are understood using unit millimeter (mm).

Projection method

Unless otherwise specified first-angle projection is applied.

19 Revision history

Changes compared to previously issued iteration.

Version	Originator	Detailed specification changes	Date
1.0	J. Seow	Preliminary Datasheet.	Jun 02, 2016

Important notes

The following applies to all products named in this publication:

1. Some parts of this publication contain **statements about the suitability of our products for certain areas of application**. These statements are based on our knowledge of typical requirements that are often placed on our products in the areas of application concerned. We nevertheless expressly point out **that such statements cannot be regarded as binding statements about the suitability of our products for a particular customer application.** As a rule, EPCOS is either unfamiliar with individual customer applications or less familiar with them than the customers themselves. For these reasons, it is always ultimately incumbent on the customer to check and decide whether an EPCOS product with the properties described in the product specification is suitable for use in a particular customer application.
2. We also point out that **in individual cases, a malfunction of electronic components or failure before the end of their usual service life cannot be completely ruled out in the current state of the art, even if they are operated as specified.** In customer applications requiring a very high level of operational safety and especially in customer applications in which the malfunction or failure of an electronic component could endanger human life or health (e.g. in accident prevention or life-saving systems), it must therefore be ensured by means of suitable design of the customer application or other action taken by the customer (e.g. installation of protective circuitry or redundancy) that no injury or damage is sustained by third parties in the event of malfunction or failure of an electronic component.
3. **The warnings, cautions and product-specific notes must be observed.**
4. In order to satisfy certain technical requirements, **some of the products described in this publication may contain substances subject to restrictions in certain jurisdictions (e.g. because they are classed as hazardous)**. Useful information on this will be found in our Material Data Sheets on the Internet (www.epcos.com/material). Should you have any more detailed questions, please contact our sales offices.
5. We constantly strive to improve our products. Consequently, **the products described in this publication may change from time to time**. The same is true of the corresponding product specifications. Please check therefore to what extent product descriptions and specifications contained in this publication are still applicable before or when you place an order. We also **reserve the right to discontinue production and delivery of products**. Consequently, we cannot guarantee that all products named in this publication will always be available.
   The aforementioned does not apply in the case of individual agreements deviating from the foregoing for customer-specific products.
6. Unless otherwise agreed in individual contracts, **all orders are subject to the current version of the "General Terms of Delivery for Products and Services in the Electrical Industry" published by the German Electrical and Electronics Industry Association (ZVEI)**.
7. The trade names EPCOS, Alu-X, CeraDiode, CeraLink, CeraPad, CeraPlas, CSMP, CSSP, CTVS, DeltaCap, DigiSiMic, DSSP, ExoCore, FilterCap, FormFit, LeaXield, MiniBlue, MiniCell, MKD, MKK, MotorCap, PCC, PhaseCap, PhaseCube, PhaseMod, PhiCap, PQSine, SIFERRIT, SIFI, SIKOREL, SilverCap, SIMDAD, SiMic, SIMID, SineFormer, SIOV, SIP5D, SIP5K, TFAP, ThermoFuse, WindCap are **trademarks registered or pending** in Europe and in other countries. Further information will be found on the Internet at www.epcos.com/trademarks.