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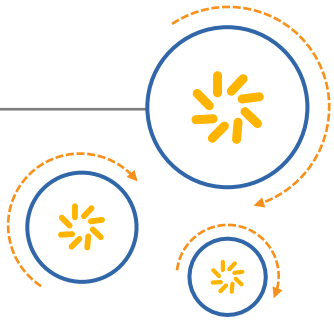

SAW components

SAW duplexer

LTE band 1

Series/type:	B8651
Ordering code:	B39212B8651P810
Date:	May 31, 2016
Version:	2.5

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RF360 Europe GmbH, Anzinger Str. 13, München, Germany

SAW components

SAW duplexer
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Table of contents

1 Application

- Low-loss SAW duplexer for mobile telephone LTE Band 1 systems, also suitable for CDMA applications
- Usable pass bands 60 MHz
- Low insertion attenuation
- Low amplitude ripple
- Terminating impedances 50 Ω
- External matching only needed at ANT port

2 Features

- Package size 1.8±0.1 mm × 1.4±0.1 mm
- Package height 0.475 mm (max.)
- Approximate weight 3 mg
- RoHS compatible
- Package for Surface Mount Technology (SMT)
- Ni/Au-plated terminals
- Electrostatic Sensitive Device (ESD)
- Moisture Sensitivity Level 3 (MSL3)

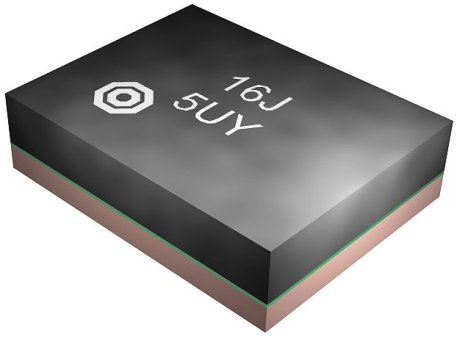

Figure 1: Picture of component with example of product marking.

3 Package

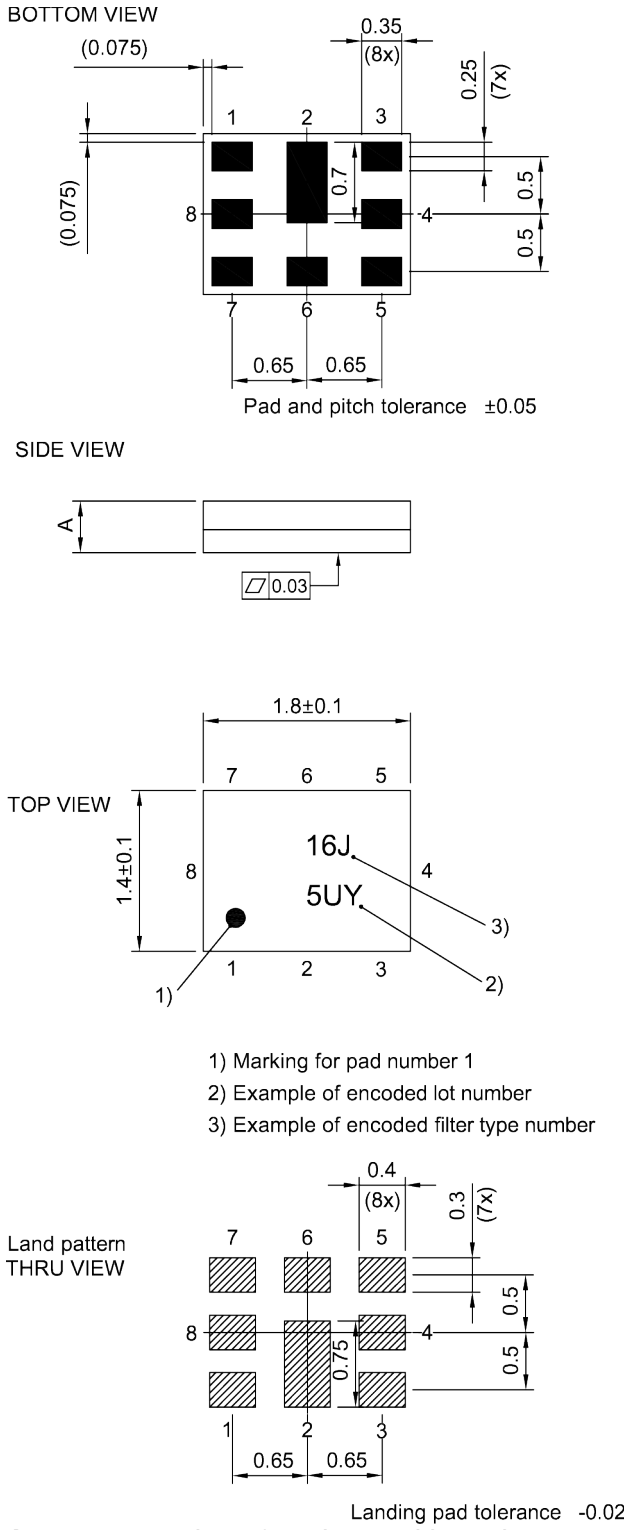

Figure 2: Drawing of package with package height A = 0.475 mm (max.). See Sec. Package information (p. 25).

4 Pin configuration

- 1 RX
- 3 TX
- 6 ANT
- 2, 4, 5, 7, 8 Ground

5 Matching circuit

- L_{p6} = 3.1 nH

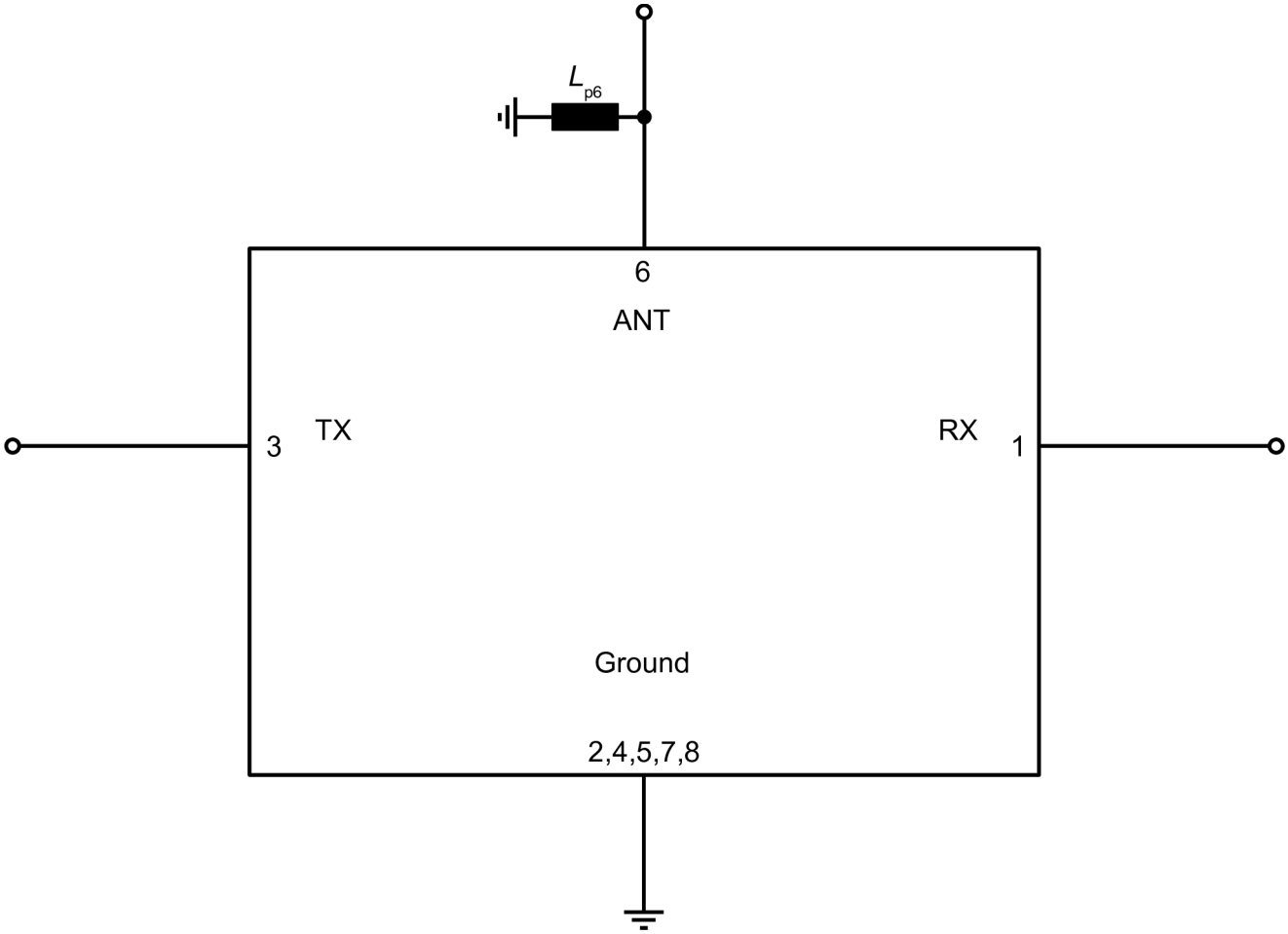

Figure 3: Schematic of matching circuit.

6 Characteristics

6.1 TX – ANT

Temperature range for specification T_{SPEC} = −30 °C ... +90 °C
TX terminating impedance Z_{TX} = 50 Ω
ANT terminating impedance Z_{ANT} = 50 Ω with par. 3.1 nH[1)]
RX terminating impedance Z_{RX} = 50 Ω

Characteristics TX – ANT				min. for T_{SPEC}	typ. @+25 °C	max. for T_{SPEC}	
Center frequency			f_C	—	1950	—	MHz
Maximum insertion attenuation							
	1920.59... 1979.41	MHz	α_{max}	—	1.9	2.3	dB
@$f_{carrier}$	1922.4... 1977.6	MHz	$\alpha_{WCDMA,max}$ [2)]	—	1.8	2.3	dB
Amplitude ripple (p-p)							
	1920.59... 1979.41	MHz	$\Delta\alpha$ [3)]	—	0.5	0.8	dB
	1920.59... 1979.41	MHz	$\Delta\alpha$ [4)]	—	1.0	2.0	dB
Maximum VSWR			$VSWR_{max}$				
@ TX port	1920.59... 1979.41	MHz		—	1.5	2.0	
@ ANT port	1920.59... 1979.41	MHz		—	1.4	2.0	
Maximum error vector magnitude			EVM_{max} [5)]				
	1922.4... 1977.6	MHz		—	1.5	2.5	%
Minimum attenuation			α_{min}				
	10... 1574	MHz		30	41	—	dB
	420... 494	MHz		44	54	—	dB
	843... 894	MHz		38	44	—	dB
	920... 960	MHz		39	44	—	dB
	1226... 1250	MHz		36	41	—	dB
	1470... 1496	MHz		35	41	—	dB
	1496... 1511	MHz		35	41	—	dB
	1559... 1563	MHz		36	42	—	dB
	1565.42... 1573.374	MHz		36	42	—	dB
	1573.374... 1577.466	MHz		36	43	—	dB
	1577.466... 1585.42	MHz		36	43	—	dB
	1597.551... 1605.886	MHz		36	43	—	dB
	1605.886... 1805	MHz		30	38	—	dB
	1805... 1865	MHz		20	29	—	dB
	1865... 1880	MHz		10	23	—	dB
	2010... 2025	MHz		13[6)]	27	—	dB
	2110... 2170	MHz		36	44	—	dB
	2400... 2500	MHz		27	37	—	dB
	2620... 2690	MHz		15	33	—	dB
	3830... 3960	MHz		14	22	—	dB

Characteristics TX – ANT			min. for T_{SPEC}	typ. @+25 °C	max. for T_{SPEC}	
	4900... 5950	MHz	6	12	—	dB
	4905... 5840	MHz	6	12	—	dB

1) See Sec. Matching circuit (p. 5).
2) Attenuation of WCDMA signal ("power transfer function"). Please refer to definition of Power Transfer Function (PTF) of WCDMA signal (p. 24).
3) Over any 5 MHz.
4) Over any 20 MHz.
5) Error Vector Magnitude (EVM) based on definition given in 3GPP TS 25.141.
6) Valid for temperature T_{SPEC} = +15 °C...+90 °C.

6.2 ANT – RX

Temperature range for specification	T_{SPEC}	= −30 °C ... +90 °C
TX terminating impedance	Z_{TX}	= 50 Ω
ANT terminating impedance	Z_{ANT}	= 50 Ω with par. 3.1 nH[1]
RX terminating impedance	Z_{RX}	= 50 Ω

Characteristics ANT – RX				**min.** for T_{SPEC}	**typ.** @+25 °C	**max.** for T_{SPEC}	
Center frequency			f_C	—	2140	—	MHz
Maximum insertion attenuation			α_{max}				
	2110.59... 2169.41	MHz		—	1.9	2.4	dB
Amplitude ripple (p-p)							
	2110.59... 2169.41	MHz	$\Delta\alpha$[2]	—	0.4	0.7	dB
	2110.59... 2169.41	MHz	$\Delta\alpha$[3]	—	0.5	1.5	dB
Maximum VSWR			$VSWR_{max}$				
@ ANT port	2110.59... 2169.41	MHz		—	1.5	2.0	
@ RX port	2110.59... 2169.41	MHz		—	1.7	2.0	
Maximum error vector magnitude			EVM_{max}[4]				
	2112.4... 2167.6	MHz		—	1.2	2.5	%
Minimum attenuation			α_{min}				
	90... 1920	MHz		32	43	—	dB
	190	MHz		50	77	—	dB
	718... 748	MHz		40	55	—	dB
	814... 849	MHz		40	53	—	dB
	880... 910	MHz		40	52	—	dB
	1427... 1447	MHz		40	46	—	dB
	1447... 1463	MHz		39	45	—	dB
	1710... 1780	MHz		32	43	—	dB
	1730... 1790	MHz		30	43	—	dB
	1920... 1980	MHz		36	54	—	dB
	1980... 2010	MHz		25	40	—	dB
	2010... 2050	MHz		28	34	—	dB
	2050... 2070	MHz		18	27	—	dB
	2400... 2500	MHz		25	40	—	dB
	2500... 2570	MHz		32	42	—	dB
	4030... 4150	MHz		34	46	—	dB
	4220... 4340	MHz		29	41	—	dB
	4900... 5950	MHz		28	38	—	dB

1) See Sec. Matching circuit (p. 5).
2) Over any 5 MHz.
3) Over any 20 MHz.
4) Error Vector Magnitude (EVM) based on definition given in 3GPP TS 25.141.

6.3 TX – RX

Temperature range for specification	T_{SPEC}	= −30 °C ... +90 °C
TX terminating impedance	Z_{TX}	= 50 Ω
ANT terminating impedance	Z_{ANT}	= 50 Ω with par. 3.1 nH[1)]
RX terminating impedance	Z_{RX}	= 50 Ω

Characteristics TX – RX					min. for T_{SPEC}	typ. @+25 °C	max. for T_{SPEC}	
Minimum isolation								
		1574 ... 1577	MHz	α_{min}	40	74	—	dB
		1920.59 ... 1979.41	MHz	α_{min}	55	60	—	dB
	$@f_{carrier}$	2112.4 ... 2167.6	MHz	$\alpha_{WCDMA,min}$ [2)]	55	61	—	dB
		3830 ... 3970	MHz	α_{min}	20	60	—	dB
		5750 ... 5950	MHz	α_{min}	20	42	—	dB

1) See Sec. Matching circuit (p. 5).
2) Attenuation of WCDMA signal ("power transfer function"). Please refer to definition of Power Transfer Function (PTF) of WCDMA signal (p. 24).

6.4 Linearity

Temperature range for specification T_{SPEC} = −30 °C ... +90 °C
TX terminating impedance Z_{TX} = 50 Ω
ANT terminating impedance Z_{ANT} = 50 Ω with par. 3.1 nH[1)]
RX terminating impedance Z_{RX} = 50 Ω

Characteristics linearity				min. for T_{SPEC}	typ. @+25 °C	max. for T_{SPEC}	
IMD product levels[2), 3)]							
IMD2							
Blocker 1		190	MHz	—	−117	—	dBm
Blocker 3	4030...	4150	MHz	—	−102	—	dBm
IMD3							
SVLTE		1575	MHz	—	−85	—	dBm
Blocker 2	1730...	1790	MHz	—	−113	—	dBm
SVLTE		2145	MHz	—	−75	—	dBm
Blocker 4	5950...	6130	MHz	—	−118	—	dBm

1) See Sec. Matching circuit (p. 5).
2) @ fTX = 1920...1980 MHz, fRX = Blocker 1...4, IMD product levels for power levels PTX = +21.5 dBm (ANT port output power) and Pblocker = −15 dBm (ANT port input power).
3) @ fTX = 1955 MHz, fANT = 1765, IMD product levels for power levels PTX = +24.5 dBm (ANT port output power) and Pblocker = +14 dBm (ANT port input power).

7 Maximum ratings

Storage temperature	T_{STG} [1] = −40 °C ... +90 °C	
DC voltage	V_{DC} [2] = 5.0 V (max.)	
ESD voltage		
	V_{ESD} [3] = 125 V (max.)	Machine model.
	V_{ESD} [4] = 150 V (max.)	Human body model.
	V_{ESD} [5] = 600 V (max.)	Charged device model.
Input power	P_{IN}	
@ TX port: 1920 ... 1980 MHz	29 dBm	Continuous wave for 5000 h @ 50 °C.
@ TX port: other frequency range(s)	10 dBm	Continuous wave for 5000 h @ 50 °C.

1) Extended upper limit: 168h@125°C acc. to IEC 60 Bb068-2-2.
2) 168h Damp Heat Steady State acc. to IEC600682-67 Cy.
3) According to JESD22-A115B (MM – Machine Model), 10 negative & 10 positive pulses.
4) According to JESD22-A114F (HBM – Human Body Model), 1 negative & 1 positive pulse.
5) According to JESD22-C101C (CDM – Field Induced Charged Device Model), 3 negative & 3 positive pulses.

8 Transmission coefficients

8.1 TX – ANT

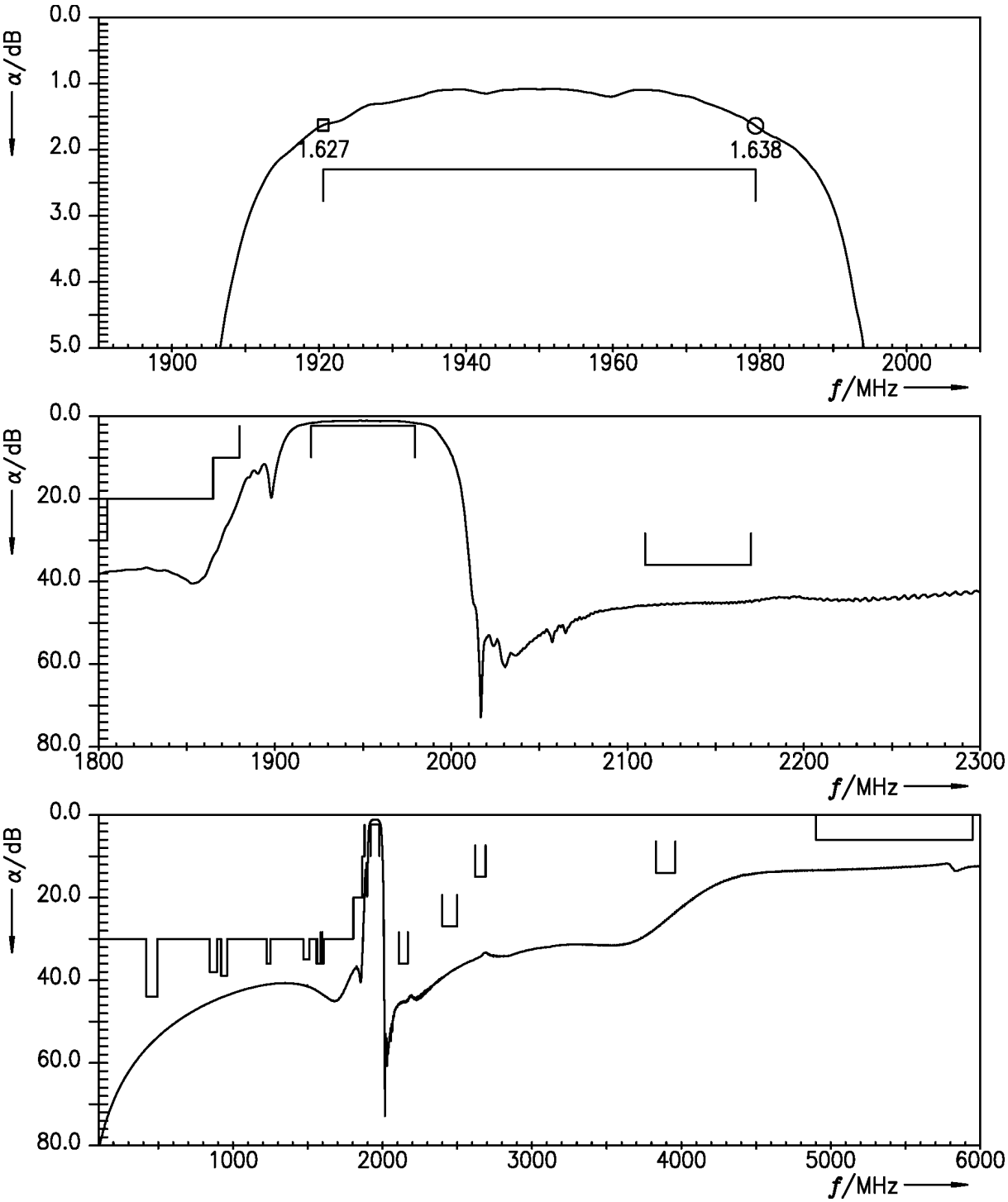

Figure 4: Attenuation TX – ANT.

8.2 ANT – RX

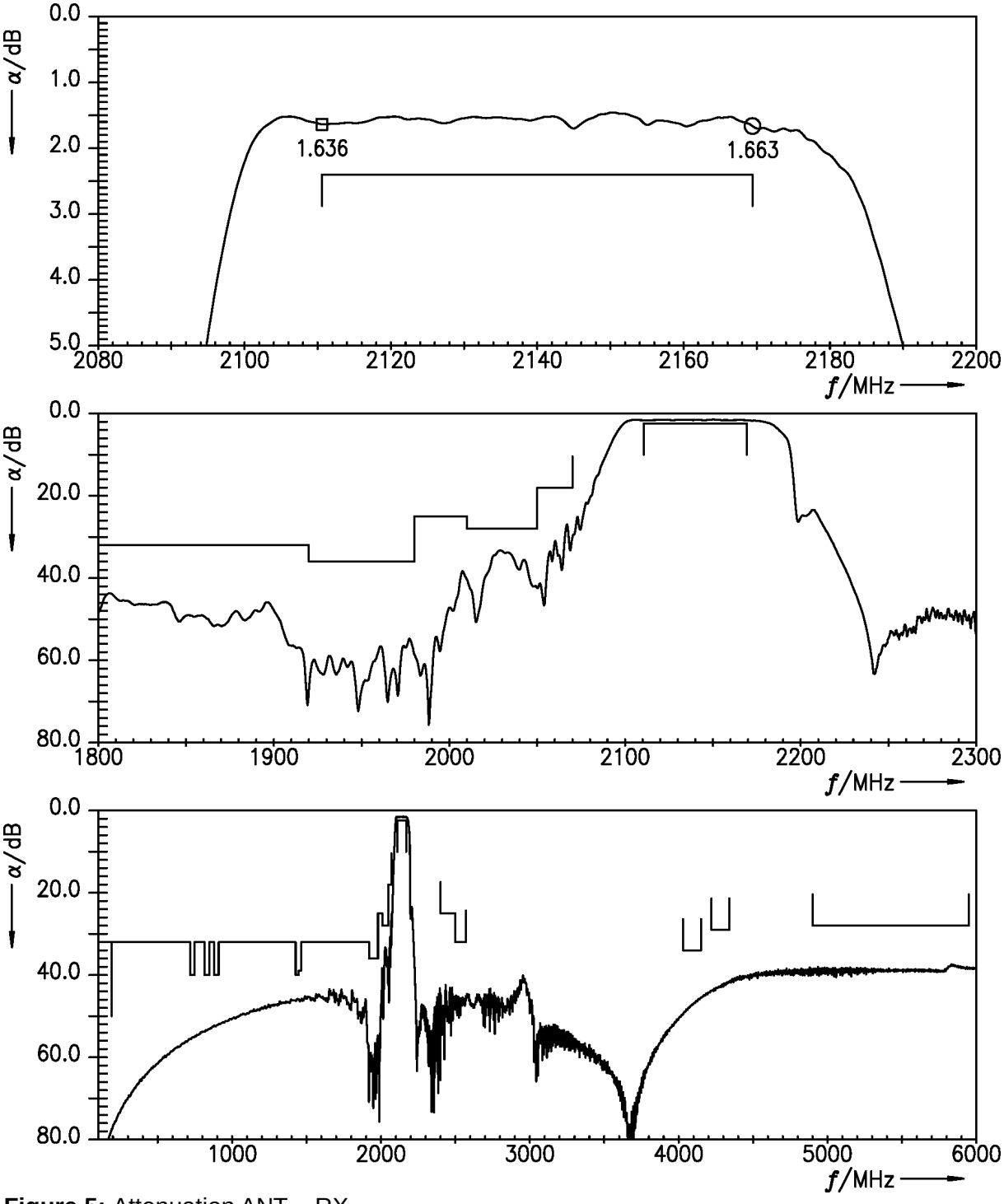

Figure 5: Attenuation ANT – RX.

8.3 TX – RX

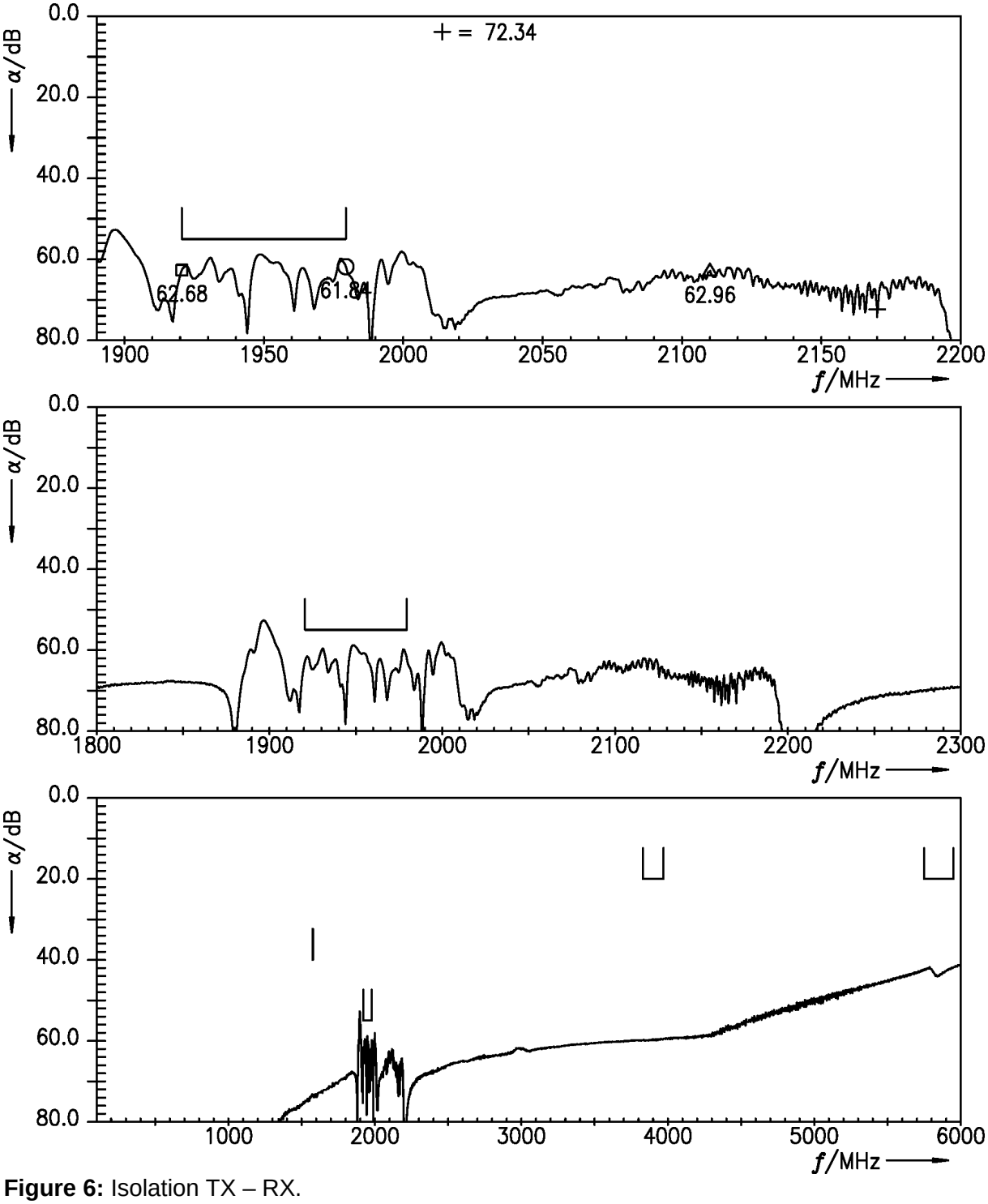

Figure 6: Isolation TX – RX.

9 Reflection coefficients

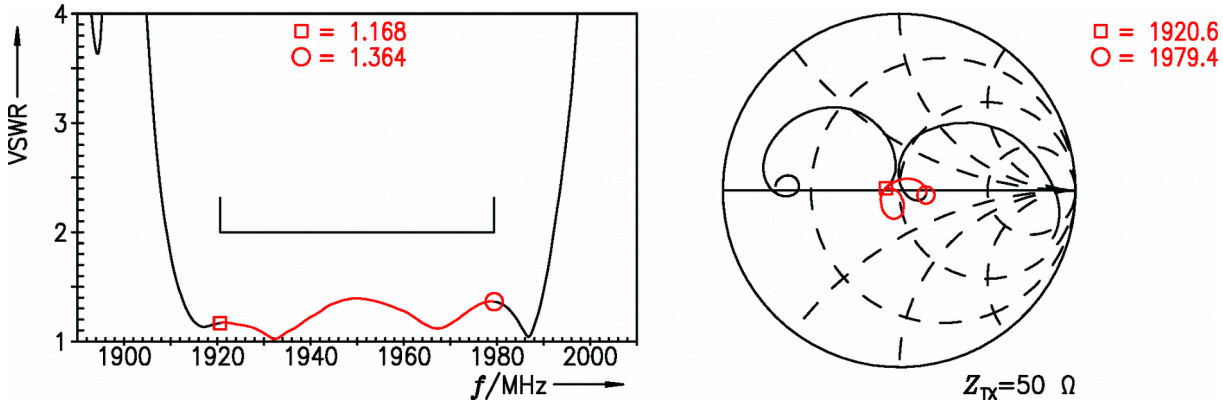

Figure 7: Reflection coefficient at TX port.

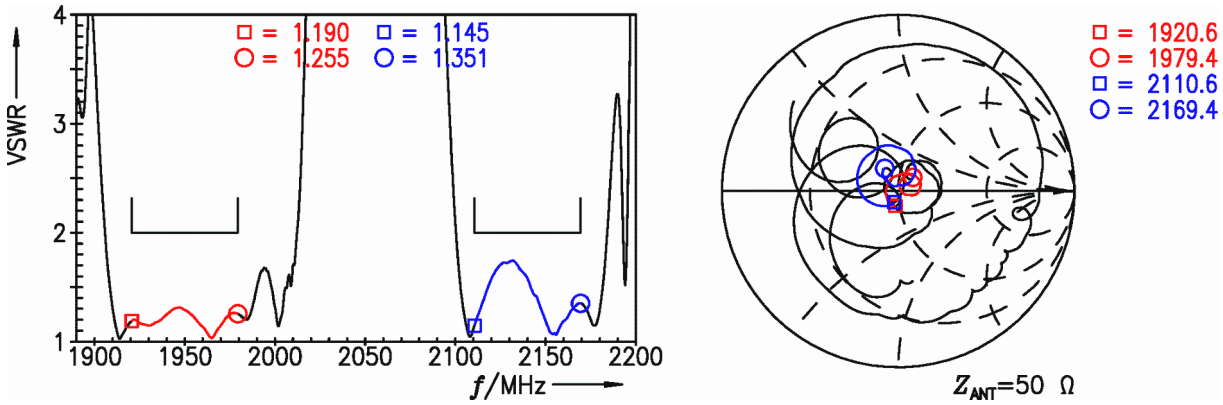

Figure 8: Reflection coefficient at ANT port (TX and RX frequencies).

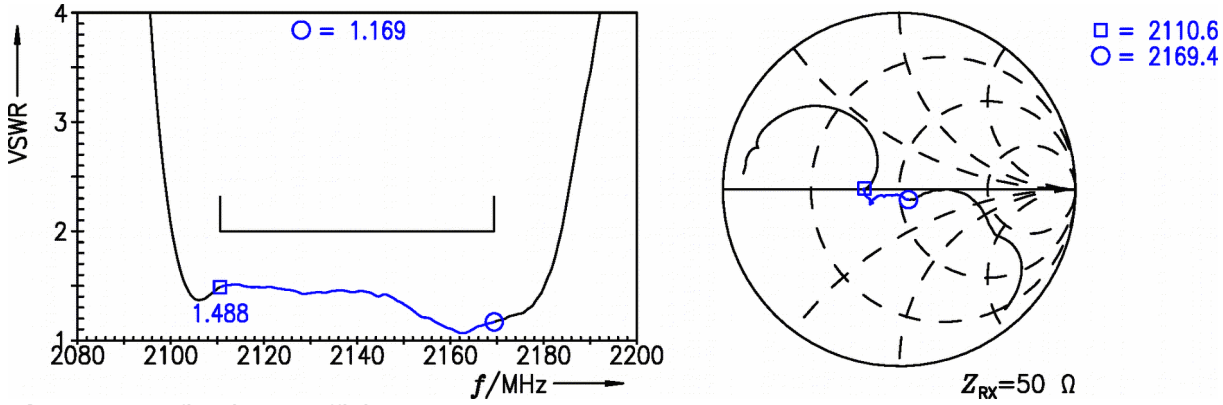

Figure 9: Reflection coefficient at RX port.

10 EVMs

10.1 TX – ANT

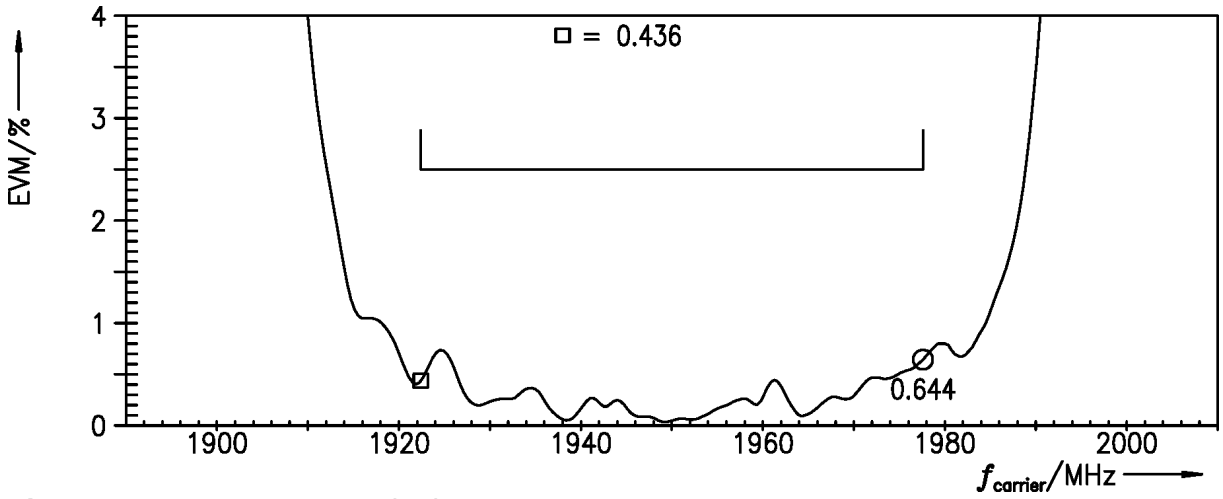

Figure 10: Error vector magnitude TX – ANT.

10.2 ANT – RX

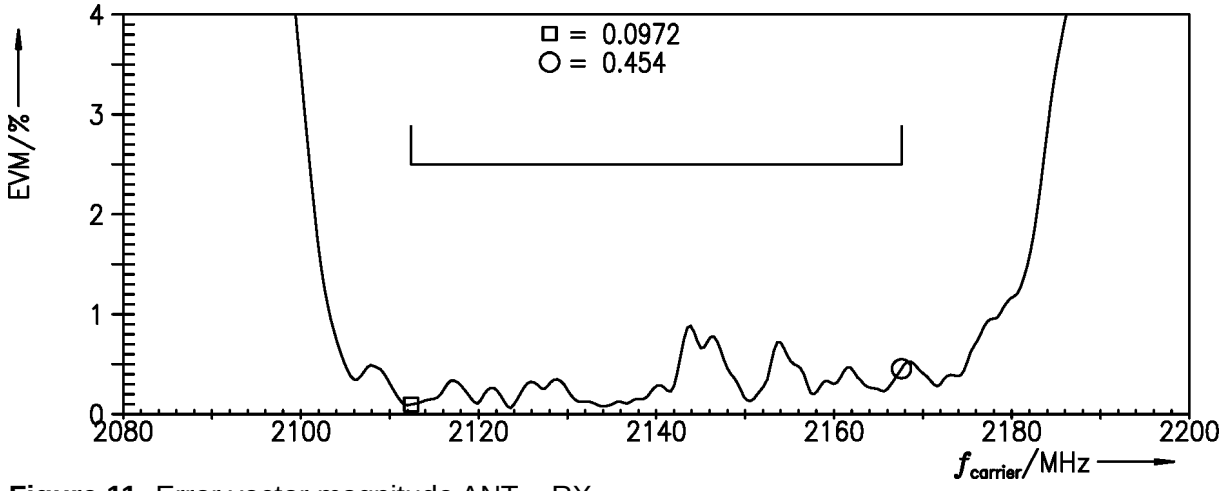

Figure 11: Error vector magnitude ANT – RX.

11 Packing material

11.1 Tape

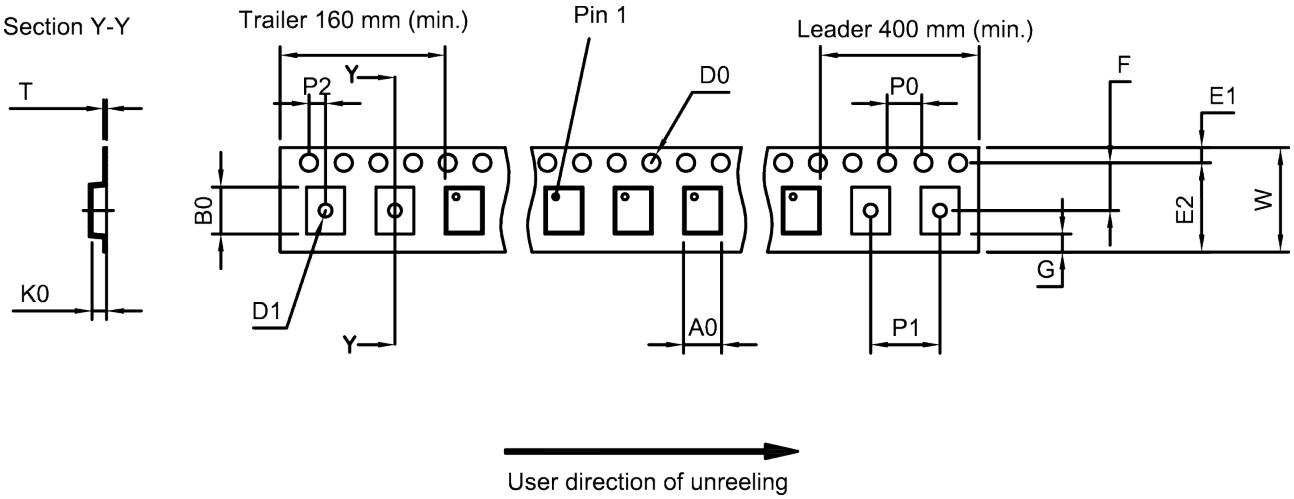

Figure 12: Drawing of tape (first-angle projection) with tape dimensions according to Table 1.

A_0	1.62±0.05 mm
B_0	2.04±0.05 mm
D_0	1.5±0.05 mm
D_1	0.8±0.05 mm
E_1	1.75±0.1 mm

E_2	6.25 mm (min.)
F	3.5±0.05 mm
G	0.75 mm (min.)
K_0	0.62±0.05 mm
P_0	4.0±0.1 mm

P_1	4.0±0.1 mm
P_2	2.0±0.05 mm
T	0.25±0.02 mm
W	8.0±0.1 mm

Table 1: Tape dimensions.

11.2 Reel with diameter of 180 mm

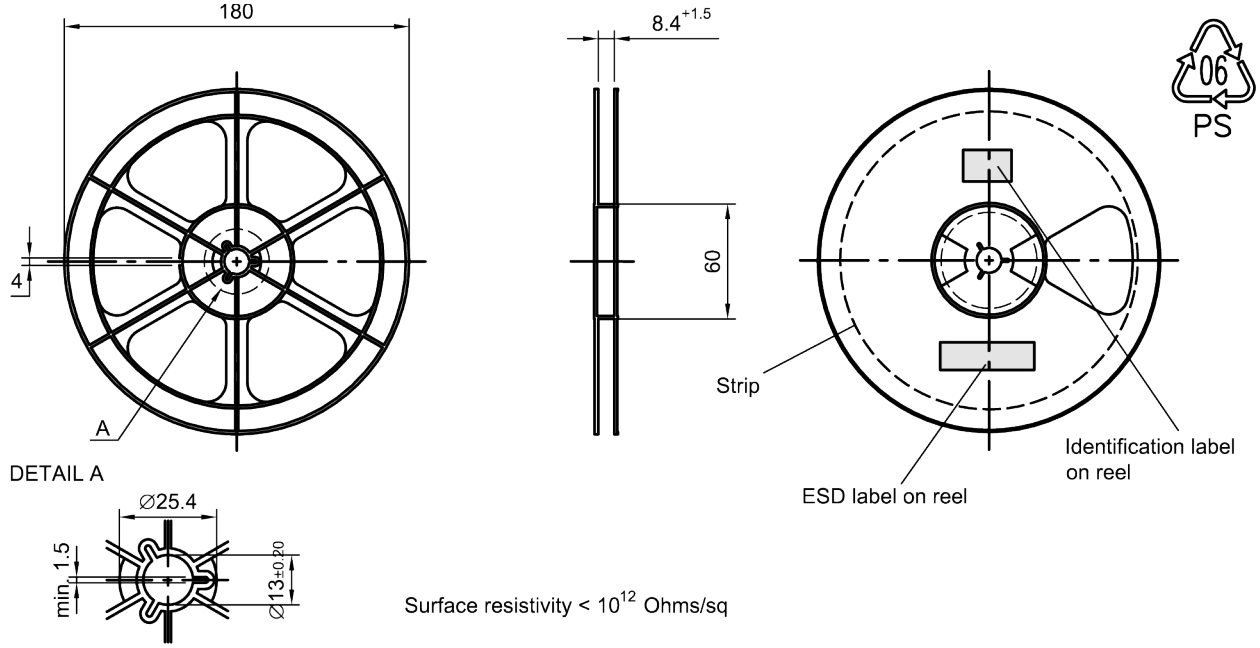

Figure 13: Drawing of reel (first-angle projection) with diameter of 180 mm.

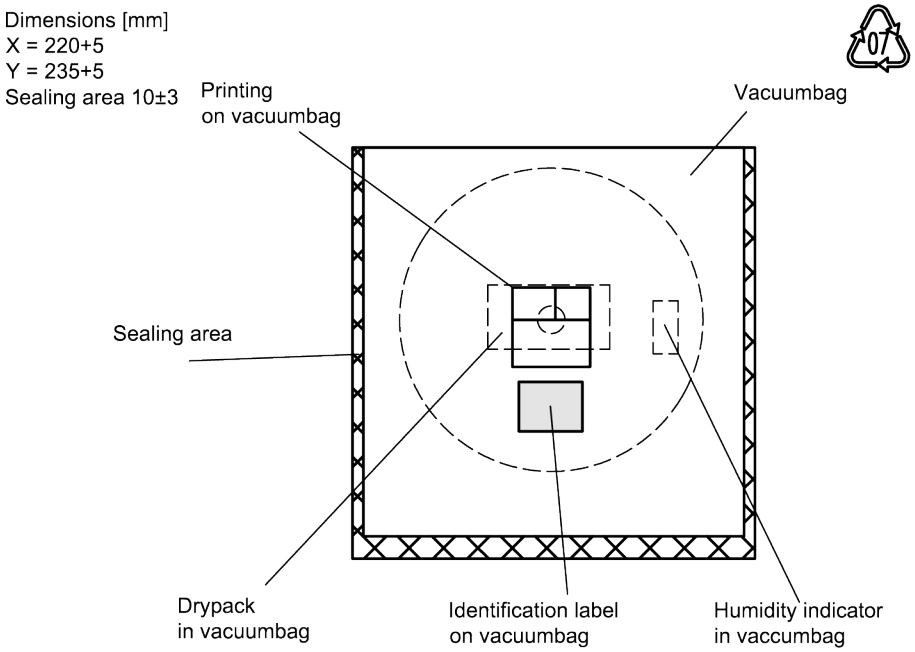

Figure 14: Drawing of moisture barrier bag (MBB) for reel with diameter of 180 mm.

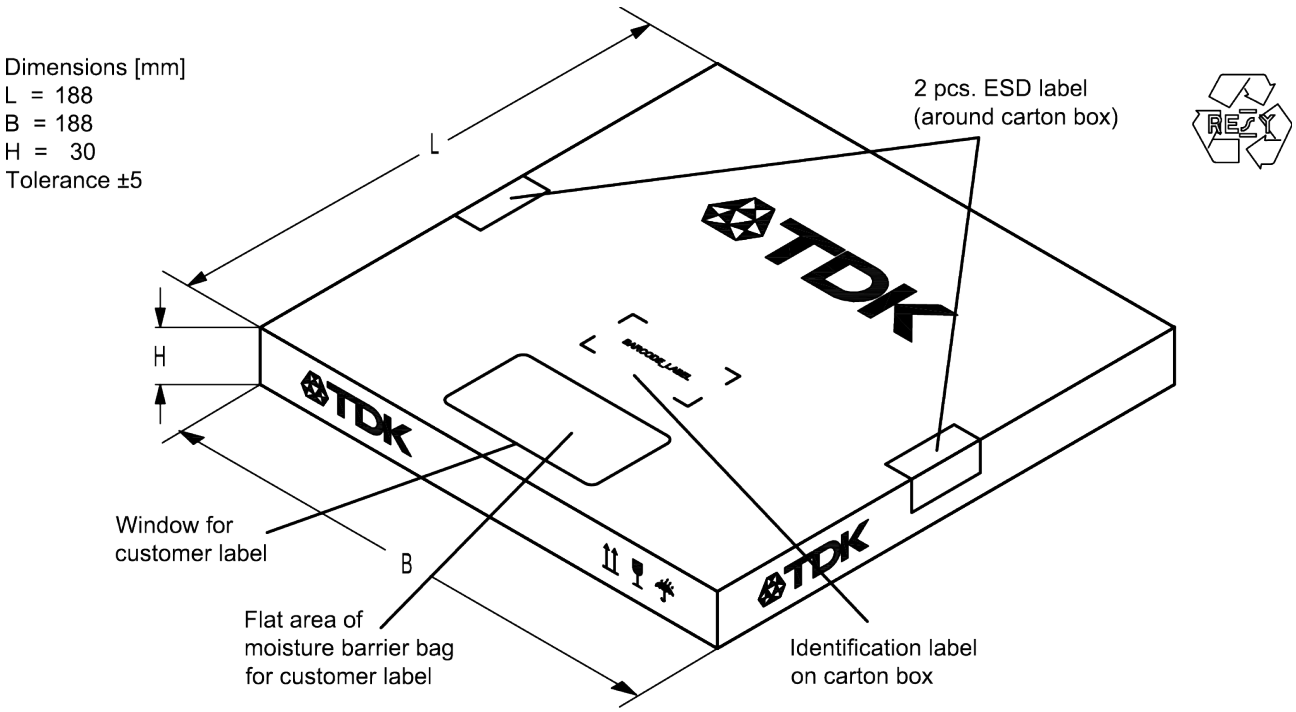

Figure 15: Drawing of folding box for reel with diameter of 180 mm.

11.3 Reel with diameter of 330 mm

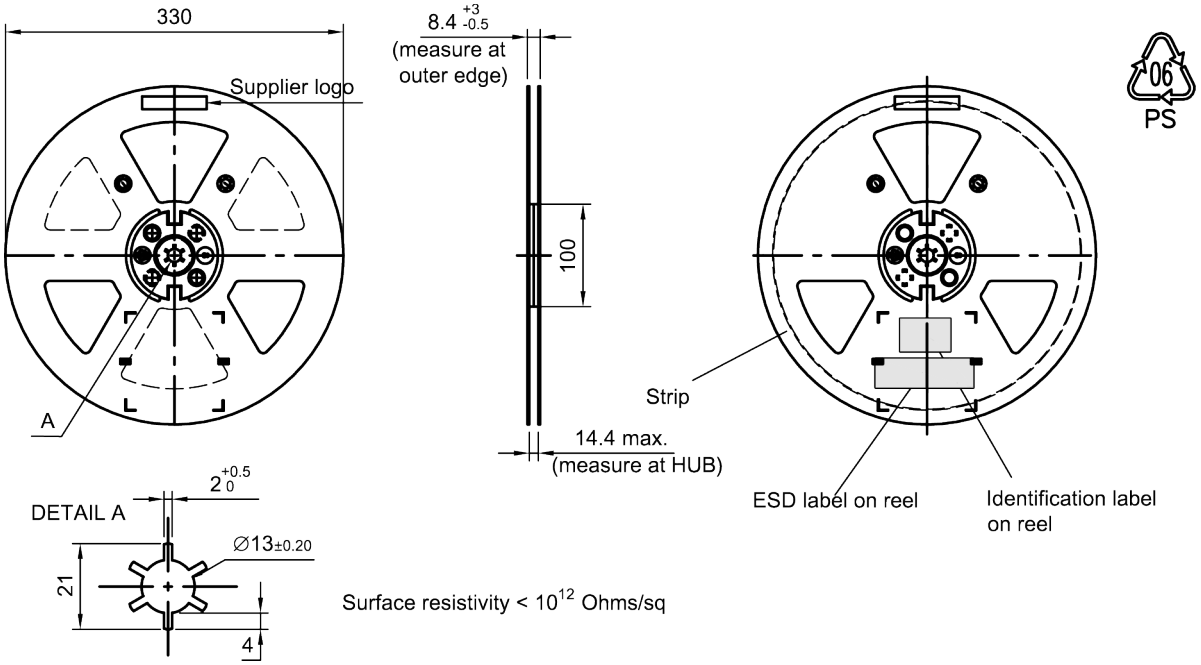

Figure 16: Drawing of reel (first-angle projection) with diameter of 330 mm.

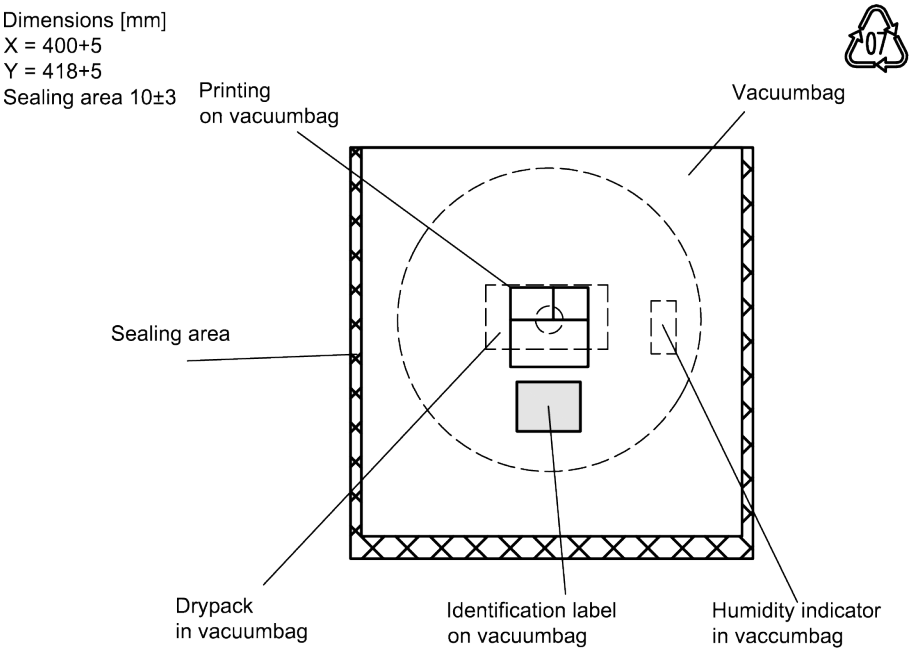

Figure 17: Drawing of moisture barrier bag (MBB) for reel with diameter of 330 mm.

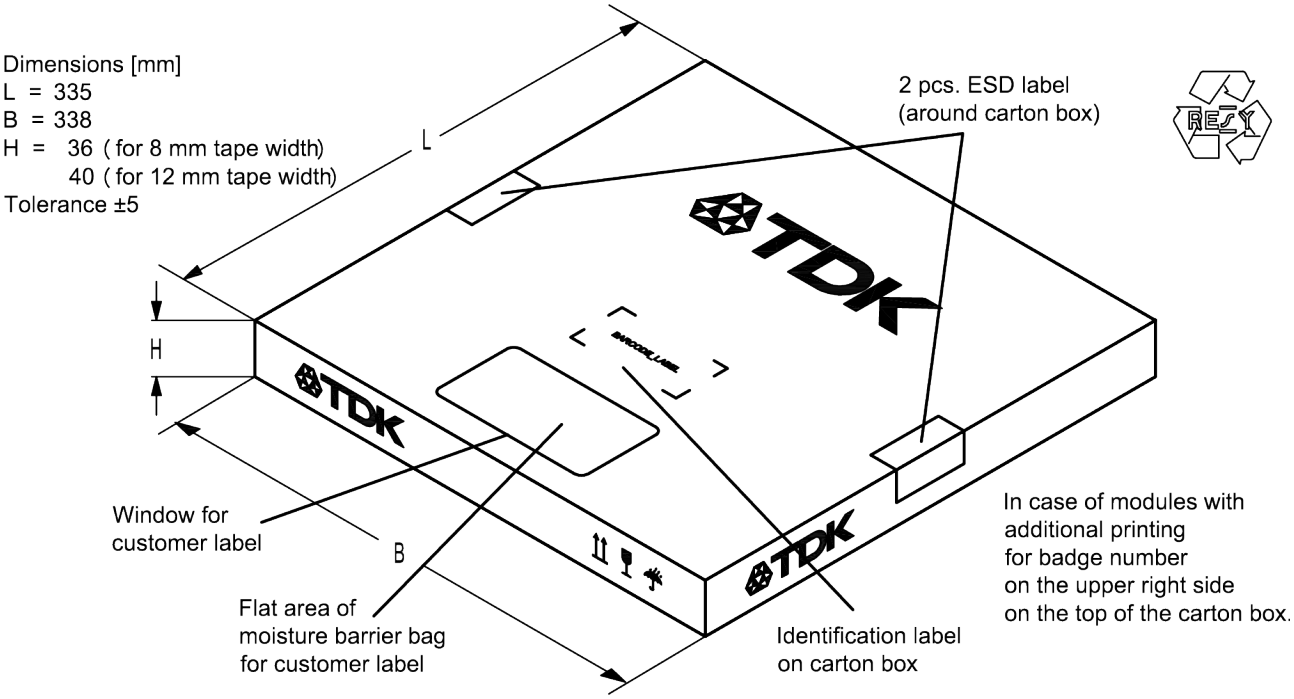

Figure 18: Drawing of folding box for reel with diameter of 330 mm.

12 Marking

Products are marked with product type number and lot number encoded according to Table 2:

- Type number:

  The 4 digit type number of the ordering code, e.g., B3xxxxB**1234**xxxx,
  is encoded by a special BASE32 code into a 3 digit marking.

  Example of decoding type number marking on device in decimal code.

16J	**=>**	**1234**
1 x 32^2 + **6** x 32^1 + **18 (=J)** x 32^0	**=**	**1234**

  The BASE32 code for product type B8651 is 8EB.

- Lot number:

  The last 5 digits of the lot number, e.g., **12345**,
  are encoded based on a special BASE47 code into a 3 digit marking.

  Example of decoding lot number marking on device in decimal code.

5UY	**=>**	**12345**
5 x 47^2 + **27 (=U)** x 47^1 + **31 (=Y)** x 47^0	**=**	**12345**

Adopted BASE32 code for type number			
Decimal value	Base32 code	Decimal value	Base32 code
0	0	16	G
1	1	17	H
2	2	18	J
3	3	19	K
4	4	20	M
5	5	21	N
6	6	22	P
7	7	23	Q
8	8	24	R
9	9	25	S
10	A	26	T
11	B	27	V
12	C	28	W
13	D	29	X
14	E	30	Y
15	F	31	Z

Adopted BASE47 code for lot number			
Decimal value	Base47 code	Decimal value	Base47 code
0	0	24	R
1	1	25	S
2	2	26	T
3	3	27	U
4	4	28	V
5	5	29	W
6	6	30	X
7	7	31	Y
8	8	32	Z
9	9	33	b
10	A	34	d
11	B	35	f
12	C	36	h
13	D	37	n
14	E	38	r
15	F	39	t
16	G	40	v
17	H	41	\
18	J	42	?
19	K	43	{
20	L	44	}
21	M	45	<
22	N	46	>
23	P		

Table 2: Lists for encoding and decoding of marking.

13 Soldering profile

The recommended soldering process is in accordance with IEC 60068-2-58 – 3rd 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 3: Characteristics of recommended soldering profile for lead-free solder (Sn95.5Ag3.8Cu0.7).

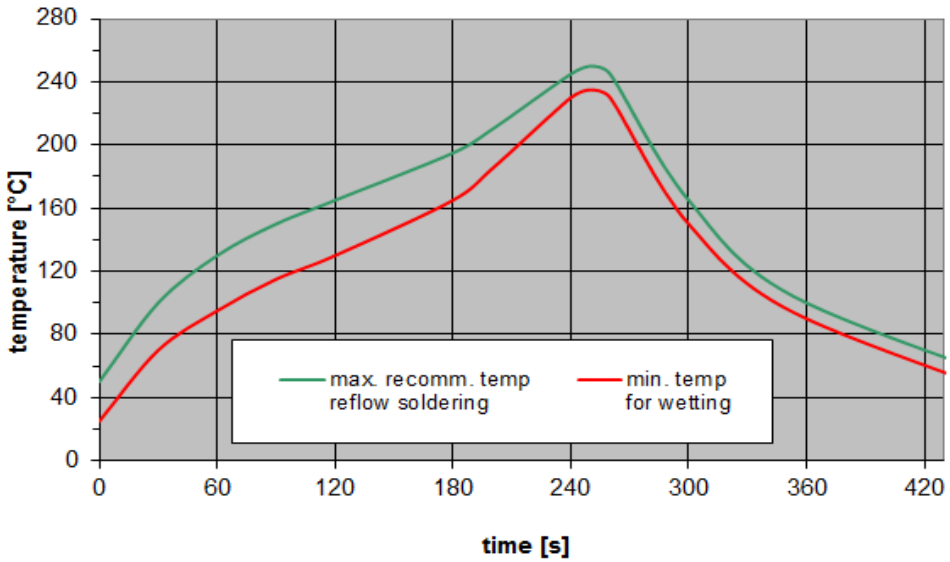

Figure 19: Recommended reflow profile for convection and infrared soldering – lead-free solder.