RF360
Europe GmbH

Data sheet

E-Duplexer
Small cell
LTE band 2

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Ordering code:	B39202D7911D310
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Version:	2.1

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Table of contents

1 Application....4
2 Features....4
3 Package....5
4 Pin configuration....6
5 Matching circuit....7
6 Characteristics....8
7 Maximum ratings....16
8 Transmission coefficients....17
9 Reflection coefficients....20
10 Packing material....21
11 Marking....24
12 Soldering profile....26
13 Annotations....27
14 Cautions and warnings....28
15 ESD protection of SAW filters....29
16 Important notes....30

1 Application

- Enhanced Duplexer for LTE small cell systems (Band 2)
- Usable pass band 60 MHz
- Low VSWR
- RX = uplink = 1850 – 1910 MHz
- TX = downlink = 1930 – 1990 MHz

2 Features

- Package size $8.1_{\pm 0.1}$ mm × $8.1_{\pm 0.1}$ mm
- Package height 1.1 mm (max.)
- Approximate weight 0.2 g
- RoHS compatible
- Package for Surface Mount Technology (SMT)
- Ni/Au-plated terminals
- Electrostatic Sensitive Device (ESD)
- Moisture Sensitivity Level 3 (MSL3)

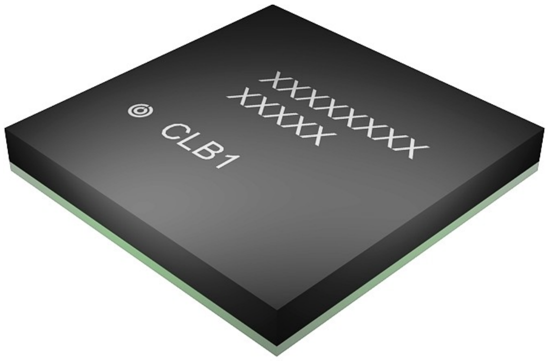
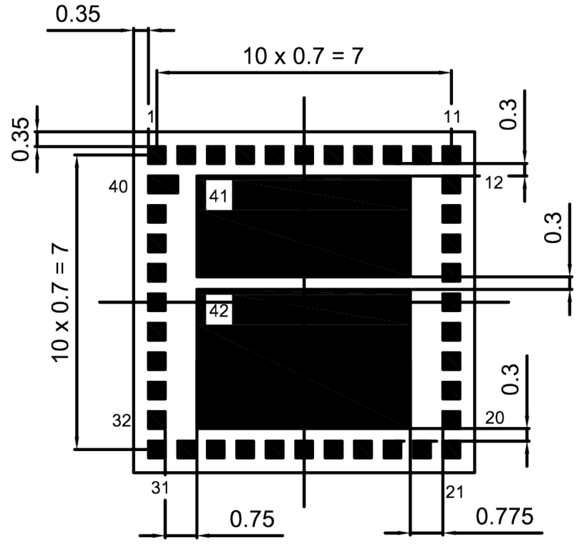


Figure 1: Picture of component with example of product marking.

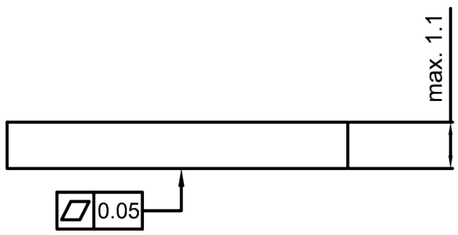
3 Package

BOTTOM VIEW

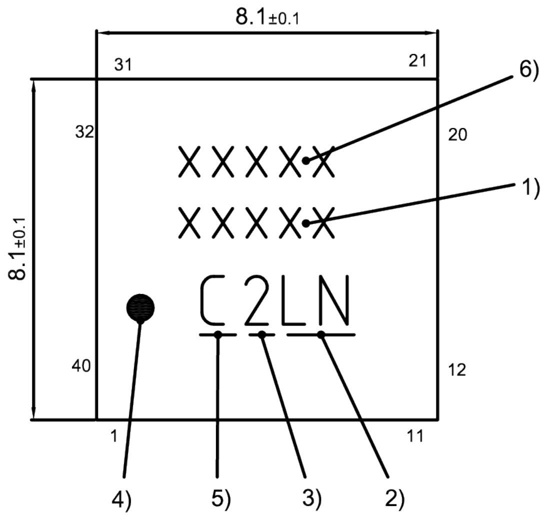


Pad sizes:
Pad 1-39: 0.40 x 0.40 mm²
Pad 40: 0.70 x 0.40 mm²
Pad 41: 5.075 x 2.395 mm²
Pad 42: 5.075 x 3.305 mm²
Pad tolerance ±0.05

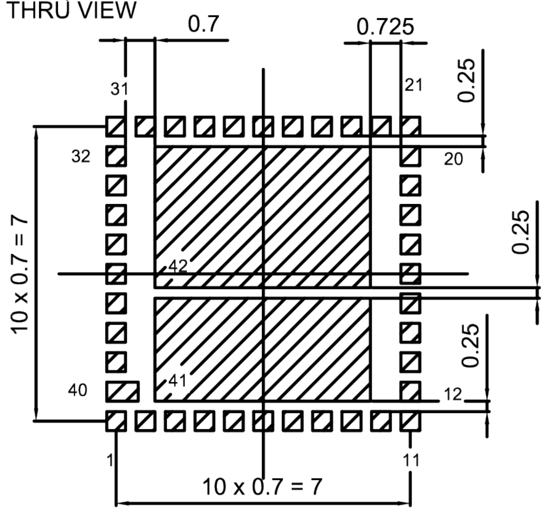
SIDE VIEW



TOP VIEW



Land pattern
THRU VIEW



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

Landing pad sizes:
Pad 1-39: 0.45 x 0.45 mm²
Pad 40: 0.70 x 0.40 mm²
Pad 41: 5.125 x 2.445 mm²
Pad 42: 5.125 x 3.355 mm²
Landing pad tolerance -0.02

Figure 2: Drawing of package with package height A = 1.1 mm (max.). See Sec. Package information (p. 28).

4 Pin configuration

- 3 TX
- 13 RX
- 29 ANT
- 1, 2, 4, 5, 6, 7, 8, 9, 10, 11, 12, 14, 15, 16, 17, 18, 19, 20, 21, 22, 23, 24, 25, 26, 27, 28, 30, 31, 32, 33, 34, 35, 36, 37, 38, 39, 40, 41, 42 Ground

5 Matching circuit

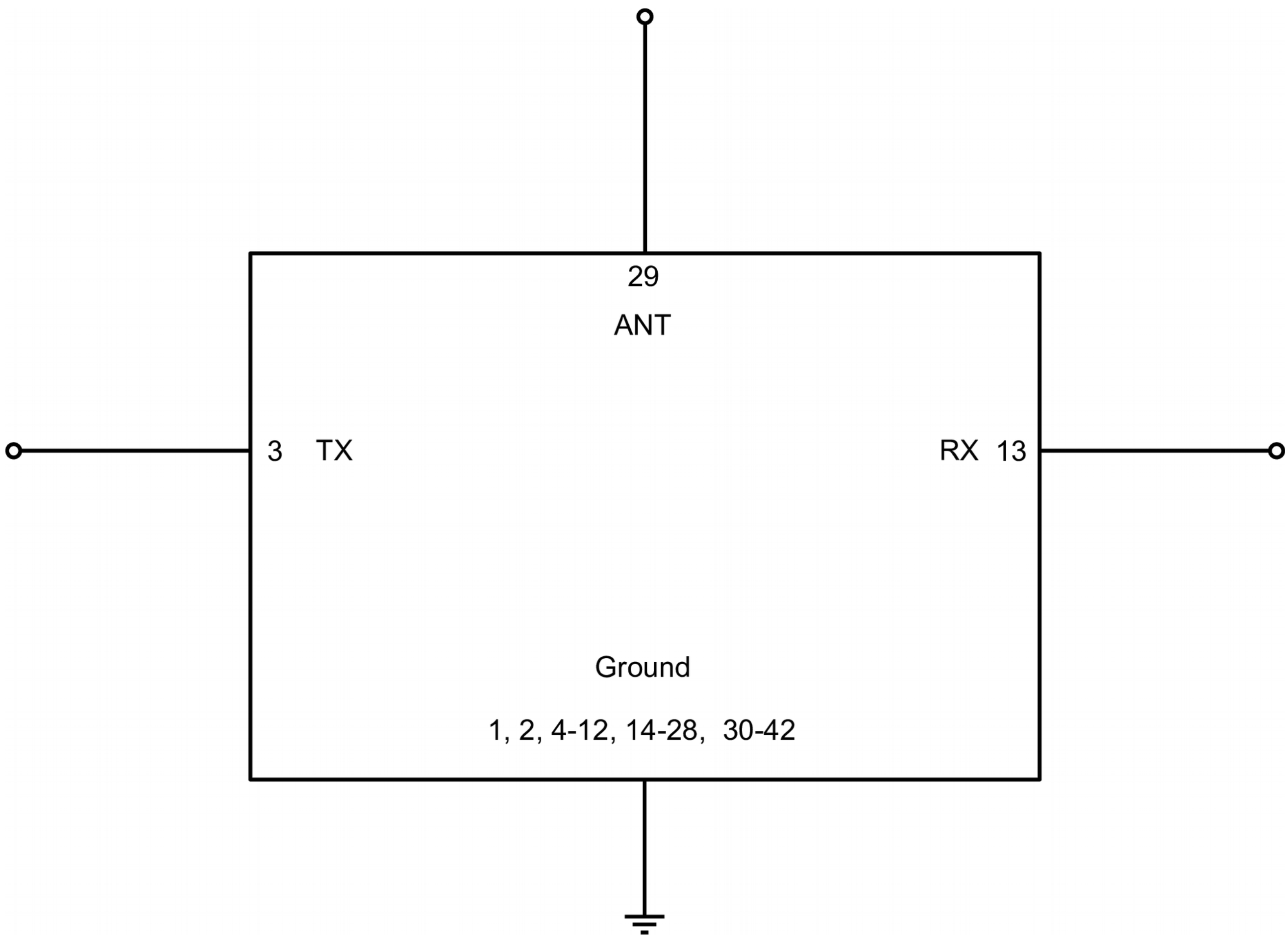


Figure 3: Schematic of matching circuit. No external matching components required.

6 Characteristics

6.1 TX – ANT

Temperature range for specification	T_{SPEC}	= −10 °C ... +85 °C
TX terminating impedance	Z_{TX}	= 50 Ω
ANT terminating impedance	Z_{ANT}	= 50 Ω
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	—	1960	—	MHz
Insertion attenuation			α_{INT} 1)				
	1930 ... 1935	MHz		—	3.0	3.8	dB
	1935 ... 1985	MHz		—	3.0	3.6	dB
	1985 ... 1990	MHz		—	2.7	3.9	dB
Maximum insertion attenuation			α_{max}				
	1930.25 ... 1989.75	MHz		—	2.8	4.5	dB
Amplitude ripple (p-p)			$\Delta\alpha$				
	1930.25 ... 1989.75	MHz		—	0.6	2.2	dB
Group delay ripple			$\Delta\tau_{var}$ 2)				
	1930 ... 1935	MHz		—	8	18	ns
	1935 ... 1985	MHz		—	5	13	ns
	1985 ... 1990	MHz		—	3	7	ns
Maximum VSWR			$VSWR_{max}$				
@ TX port	1930.25 ... 1989.75	MHz		—	1.2	1.8	
@ ANT port	1930.25 ... 1989.75	MHz		—	1.2	1.8	
Minimum attenuation			α_{min}				
	50 ... 699	MHz		30	33	—	dB
	699 ... 798	MHz		29	32	—	dB
	798 ... 824	MHz		29	32	—	dB
	824 ... 894	MHz		28	31	—	dB
	894 ... 1559	MHz		26	29	—	dB
	1559 ... 1606	MHz		26	29	—	dB
	1606 ... 1710	MHz		27	30	—	dB
	1710 ... 1785	MHz		31	34	—	dB
	1785 ... 1850	MHz		39	42	—	dB
	1850.25 ... 1909.75	MHz		43	49	—	dB
	2010 ... 2110	MHz		4.7	7	—	dB
	2110 ... 2200	MHz		35	37	—	dB
	2200 ... 2251	MHz		35	39	—	dB
	2251 ... 2400	MHz		37	41	—	dB
	2400 ... 2500	MHz		45	49	—	dB
	2500 ... 2690	MHz		50	56	—	dB
	2690 ... 3000	MHz		50	58	—	dB

Characteristics TX – ANT			min. for T_{SPEC}	typ. @ +25 °C	max. for T_{SPEC}	
	3000 ... 3300	MHz	20	39	—	dB
	3300 ... 3400	MHz	45	57	—	dB
	3400 ... 3800	MHz	45	56	—	dB
	3800 ... 5150	MHz	35	44	—	dB
	5150 ... 5850	MHz	35	38	—	dB

1) Integrated attenuation α_{INT}: Averaged power $|S_{ij}|^2$ over the center 4.5 MHz of LTE 5 MHz (25 RB) channels.

2) Aperture = 1 MHz, within any gliding window of 5 MHz completely inside the given frequency range.

Temperature range for specification	T_{SPEC}	= −40 °C ... +95 °C
TX terminating impedance	Z_{TX}	= 50 Ω
ANT terminating impedance	Z_{ANT}	= 50 Ω
RX terminating impedance	Z_{RX}	= 50 Ω

Characteristics TX – ANT				**min.** for T_{SPEC}	**typ.** @ +25 °C	**max.** for T_{SPEC}	
Insertion attenuation			α_{INT} 1)				
	1930 ... 1935	MHz		—	3.0	3.9	dB
	1935 ... 1985	MHz		—	3.0	3.6	dB
	1985 ... 1990	MHz		—	2.7	4.0	dB
Maximum insertion attenuation			α_{max}				
	1930.25 ... 1989.75	MHz		—	2.8	5.0	dB
Amplitude ripple (p-p)			$\Delta\alpha$				
	1930.25 ... 1989.75	MHz		—	0.6	2.8	dB
Group delay ripple			$\Delta\tau_{var}$ 2)				
	1930 ... 1935	MHz		—	8	24	ns
	1935 ... 1985	MHz		—	5	13	ns
	1985 ... 1990	MHz		—	3	9	ns
Maximum VSWR			$VSWR_{max}$				
@ TX port	1930.25 ... 1989.75	MHz		—	1.2	1.8	
@ ANT port	1930.25 ... 1989.75	MHz		—	1.2	1.8	
Minimum attenuation			α_{min}				
	50 ... 699	MHz		30	33	—	dB
	699 ... 798	MHz		29	32	—	dB
	798 ... 824	MHz		29	32	—	dB
	824 ... 894	MHz		28	31	—	dB
	894 ... 1559	MHz		26	29	—	dB
	1559 ... 1606	MHz		26	29	—	dB
	1606 ... 1710	MHz		27	30	—	dB
	1710 ... 1785	MHz		31	34	—	dB
	1785 ... 1850	MHz		39	42	—	dB
	1850.25 ... 1909.75	MHz		36	49	—	dB
	2010 ... 2110	MHz		3.8	7	—	dB
	2110 ... 2200	MHz		35	37	—	dB
	2200 ... 2251	MHz		35	39	—	dB
	2251 ... 2400	MHz		37	41	—	dB
	2400 ... 2500	MHz		45	49	—	dB
	2500 ... 2690	MHz		50	56	—	dB
	2690 ... 3000	MHz		50	58	—	dB
	3000 ... 3300	MHz		20	39	—	dB
	3300 ... 3400	MHz		45	57	—	dB
	3400 ... 3800	MHz		45	56	—	dB
	3800 ... 5150	MHz		35	44	—	dB

Characteristics TX – ANT			min. for T_{SPEC}	typ. @ +25 °C	max. for T_{SPEC}	
	5150 ... 5850	MHz	35	38	—	dB

1) Integrated attenuation α_{INT}: Averaged power $|S_{ij}|^2$ over the center 4.5 MHz of LTE 5 MHz (25 RB) channels.

2) Aperture = 1 MHz, within any gliding window of 5 MHz completely inside the given frequency range.

6.2 ANT – RX

Temperature range for specification	T_{SPEC}	= −10 °C ... +85 °C
TX terminating impedance	Z_{TX}	= 50 Ω
ANT terminating impedance	Z_{ANT}	= 50 Ω
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	—	1880	—	MHz
Insertion attenuation			α_{INT} [1)]				
	1850... 1855	MHz		—	2.4	3.0	dB
	1855... 1905	MHz		—	2.7	3.0	dB
	1905... 1910	MHz		—	2.4	4.0	dB
Maximum insertion attenuation			α_{max}				
	1850.25... 1909.75	MHz		—	2.6	4.7	dB
Amplitude ripple (p-p)			$\Delta\alpha$				
	1850.25... 1909.75	MHz		—	0.9	2.6	dB
Group delay ripple			$\Delta\tau_{var}$ [2)]				
	1850... 1855	MHz		—	3	8	ns
	1855... 1905	MHz		—	6	13	ns
	1905... 1910	MHz		—	10	33	ns
Maximum VSWR			$VSWR_{max}$				
@ ANT port	1850.25... 1909.75	MHz		—	1.2	1.8	
@ RX port	1850.25... 1909.75	MHz		—	1.2	1.8	
Minimum attenuation			α_{min}				
	50... 1600	MHz		36	39	—	dB
	1600... 1710	MHz		26	31	—	dB
	1710... 1785	MHz		20	23	—	dB
	1930.25... 1989.75	MHz		46	54	—	dB
	1990... 2110	MHz		30	35	—	dB
	2110... 2200	MHz		25	29	—	dB
	2400... 2500	MHz		17	20	—	dB
	2500... 2690	MHz		12	16	—	dB
	2690... 3400	MHz		10	15	—	dB
	3400... 3800	MHz		10	18	—	dB
	3800... 5150	MHz		15	20	—	dB
	5150... 5850	MHz		23	32	—	dB

1) Integrated attenuation α_{INT}: Averaged power $|S_{ij}|^2$ over the center 4.5 MHz of LTE 5 MHz (25 RB) channels.
2) Aperture = 1 MHz, within any gliding window of 5 MHz completely inside the given frequency range.

Temperature range for specification	T_{SPEC}	= −40 °C ... +95 °C
TX terminating impedance	Z_{TX}	= 50 Ω
ANT terminating impedance	Z_{ANT}	= 50 Ω
RX terminating impedance	Z_{RX}	= 50 Ω

Characteristics ANT – RX				min. for T_{SPEC}	typ. @ +25 °C	max. for T_{SPEC}	
Insertion attenuation			α_{INT} [1)]				
	1850 ... 1855	MHz		—	2.4	3.1	dB
	1855 ... 1905	MHz		—	2.7	3.1	dB
	1905 ... 1910	MHz		—	2.4	4.1	dB
Maximum insertion attenuation			α_{max}				
	1850.25 ... 1909.75	MHz		—	2.6	5.2	dB
Amplitude ripple (p-p)			$\Delta\alpha$				
	1850.25 ... 1909.75	MHz		—	0.9	3.0	dB
Group delay ripple			$\Delta\tau_{var}$ [2)]				
	1850 ... 1855	MHz		—	3	8	ns
	1855 ... 1905	MHz		—	6	14	ns
	1905 ... 1910	MHz		—	10	37	ns
Maximum VSWR			$VSWR_{max}$				
@ ANT port	1850.25 ... 1909.75	MHz		—	1.2	1.8	
@ RX port	1850.25 ... 1909.75	MHz		—	1.2	1.8	
Minimum attenuation			α_{min}				
	50 ... 1600	MHz		36	39	—	dB
	1600 ... 1710	MHz		26	31	—	dB
	1710 ... 1785	MHz		20	23	—	dB
	1930.25 ... 1989.75	MHz		40	54	—	dB
	1990 ... 2110	MHz		30	35	—	dB
	2110 ... 2200	MHz		25	29	—	dB
	2400 ... 2500	MHz		17	20	—	dB
	2500 ... 2690	MHz		12	16	—	dB
	2690 ... 3400	MHz		10	15	—	dB
	3400 ... 3800	MHz		10	18	—	dB
	3800 ... 5150	MHz		15	20	—	dB
	5150 ... 5850	MHz		23	32	—	dB

1) Integrated attenuation α_{INT}: Averaged power $|S_{ij}|^2$ over the center 4.5 MHz of LTE 5 MHz (25 RB) channels.
2) Aperture = 1 MHz, within any gliding window of 5 MHz completely inside the given frequency range.

6.3 TX – RX

Temperature range for specification	T_{SPEC}	= −10 °C ... +85 °C
TX terminating impedance	Z_{TX}	= 50 Ω
ANT terminating impedance	Z_{ANT}	= 50 Ω
RX terminating impedance	Z_{RX}	= 50 Ω

Characteristics TX – RX				min. for T_{SPEC}	typ. @ +25 °C	max. for T_{SPEC}	
Isolation			α_{INT} [1)]				
	1850 ... 1900	MHz		60	75	—	dB
	1900 ... 1910	MHz		52	64	—	dB
	1930 ... 1990	MHz		62	78	—	dB
Minimum isolation			α_{min}				
	1850.25 ... 1897	MHz		60	71	—	dB
	1897 ... 1900	MHz		57	71	—	dB
	1900 ... 1909.75	MHz		51.5	65	—	dB
	1930.25 ... 1989.75	MHz		61	78	—	dB

1) Integrated attenuation α_{INT}: Averaged power $|S_{ij}|^2$ over the center 4.5 MHz of LTE 5 MHz (25 RB) channels.

Temperature range for specification	T_{SPEC}	= −40 °C ... +95 °C
TX terminating impedance	Z_{TX}	= 50 Ω
ANT terminating impedance	Z_{ANT}	= 50 Ω
RX terminating impedance	Z_{RX}	= 50 Ω

Characteristics TX – RX				**min.** for T_{SPEC}	**typ.** @ +25 °C	**max.** for T_{SPEC}	
Isolation			α_{INT} [1]				
	1850 ... 1900	MHz		60	75	—	dB
	1900 ... 1910	MHz		50	64	—	dB
	1930 ... 1990	MHz		62	78	—	dB
Minimum isolation			α_{min}				
	1850.25 ... 1897	MHz		60	71	—	dB
	1897 ... 1900	MHz		55	71	—	dB
	1900 ... 1909.75	MHz		50	65	—	dB
	1930.25 ... 1989.75	MHz		59	78	—	dB

[1] Integrated attenuation α_{INT}: Averaged power $|S_{ij}|^2$ over the center 4.5 MHz of LTE 5 MHz (25 RB) channels.

7 Maximum ratings

Operable temperature	T_{OP} = −40 °C ... +95 °C	
Storage temperature	T_{STG} 1) = −40 °C ... +95 °C	
DC voltage	$\|V_{DC}\|$ 2) = 0 V (max.)	
ESD voltage		
	V_{ESD} 3) = 150 V (max.)	Machine model.
	V_{ESD} 4) = 250 V (max.)	Human body model.
Input power	P_{IN}	
@ TX port: 1930.24 ... 1989.76 MHz	31 dBm 5)	5 MHz LTE downlink signal (25 RB) for 100000 h @ 55 °C. P_{IN} average – 42 dBm peak. Source and load impedance 50 Ω.
@ TX port: other frequency ranges	10 dBm	Source and load impedance 50 Ω.

1) Not valid for packaging material. Storage temperature for packaging material is −25 °C to +40 °C.
2) In case of applied DC voltage blocking capacitors are mandatory.
3) According to JESD22-A115C (MM – Machine Model), 10 negative & 10 positive pulses.
4) According to JEDEC JS-001-2017 (HBM – Human Body Model), 1 negative & 1 positive pulse.
5) Expected lifetime according to power durability simulations, and wear out models.

8 Transmission coefficients

8.1 TX – ANT

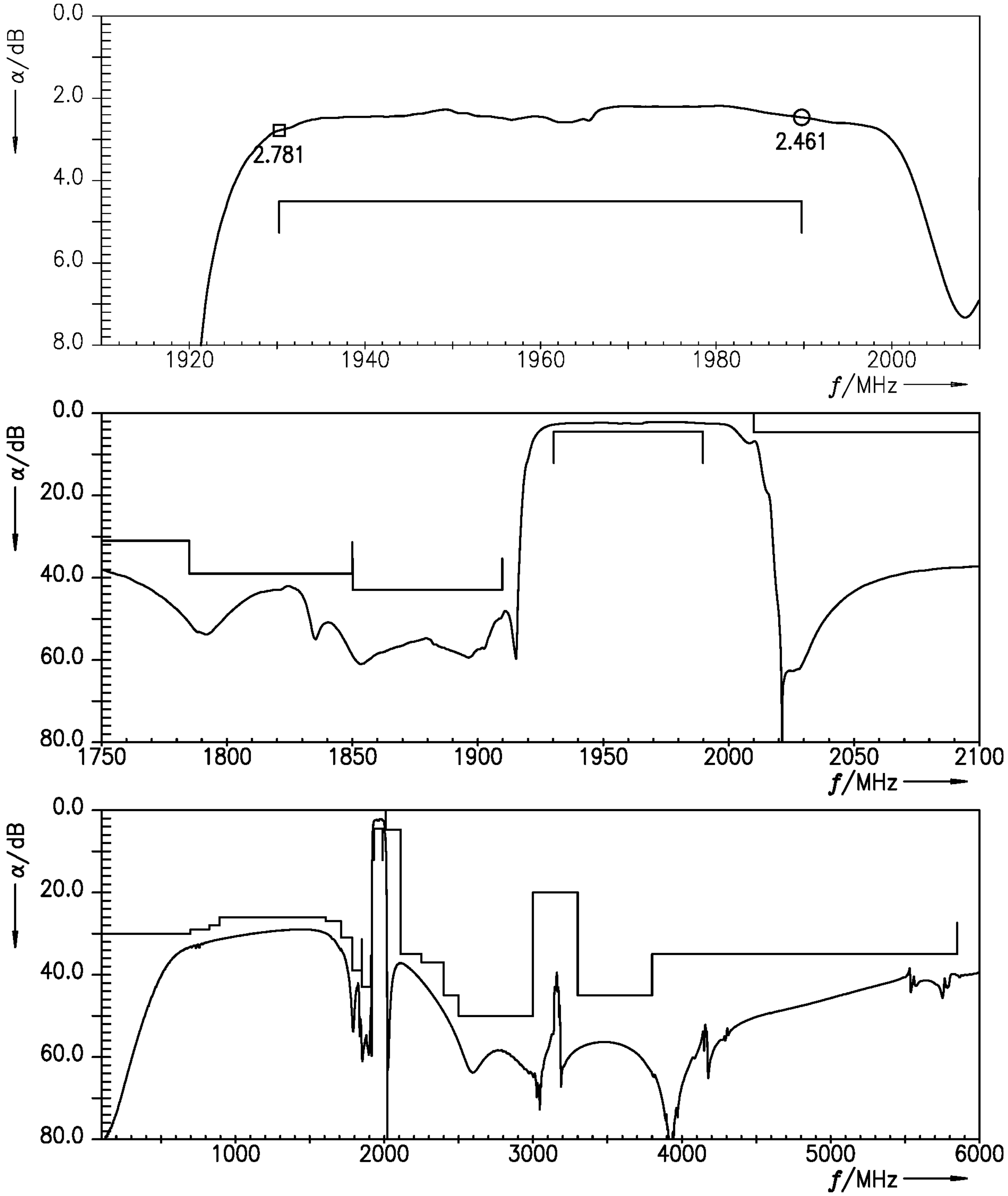


Figure 4: Attenuation TX – ANT.

8.2 ANT – RX

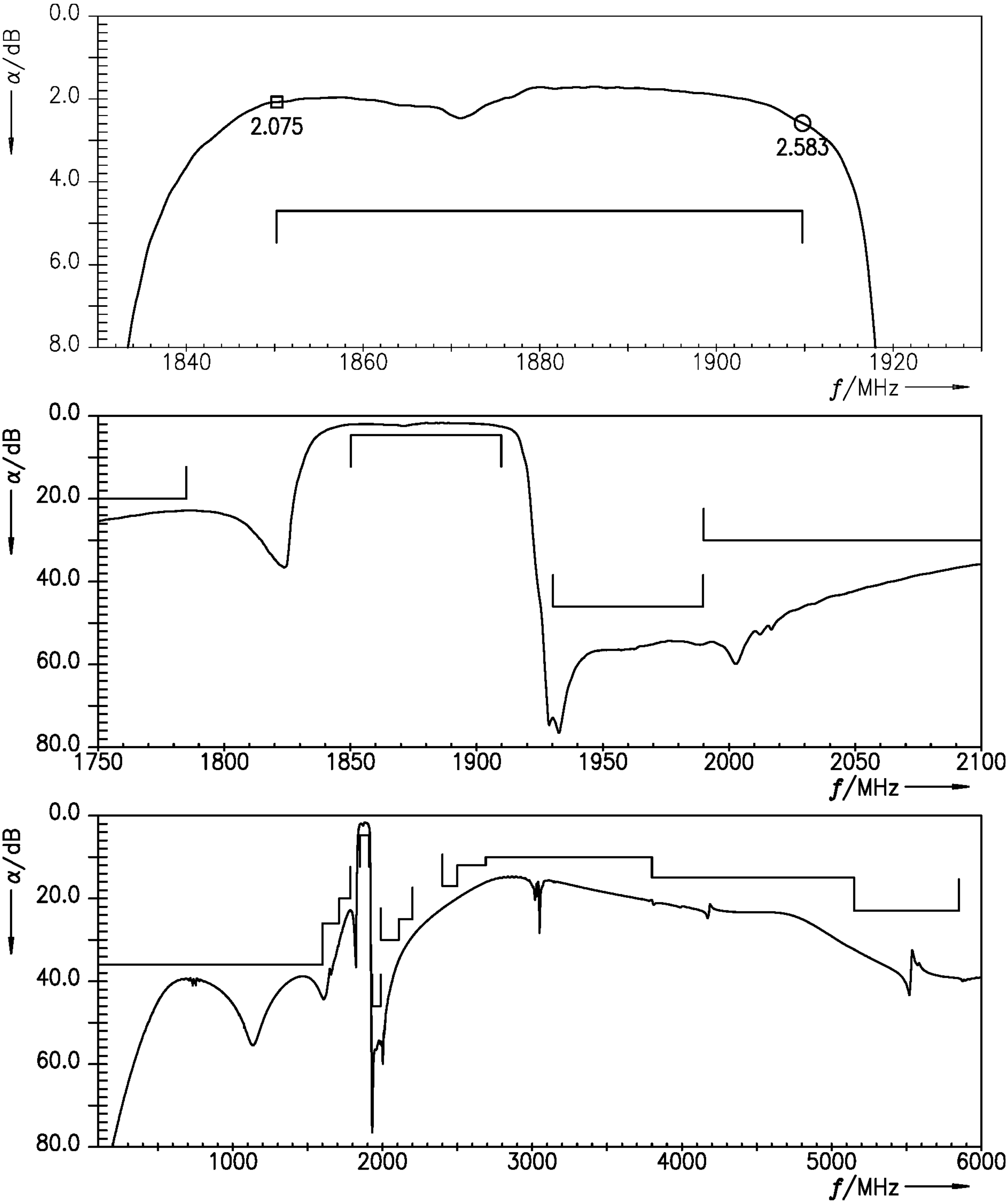


Figure 5: Attenuation ANT – RX.

8.3 TX – RX

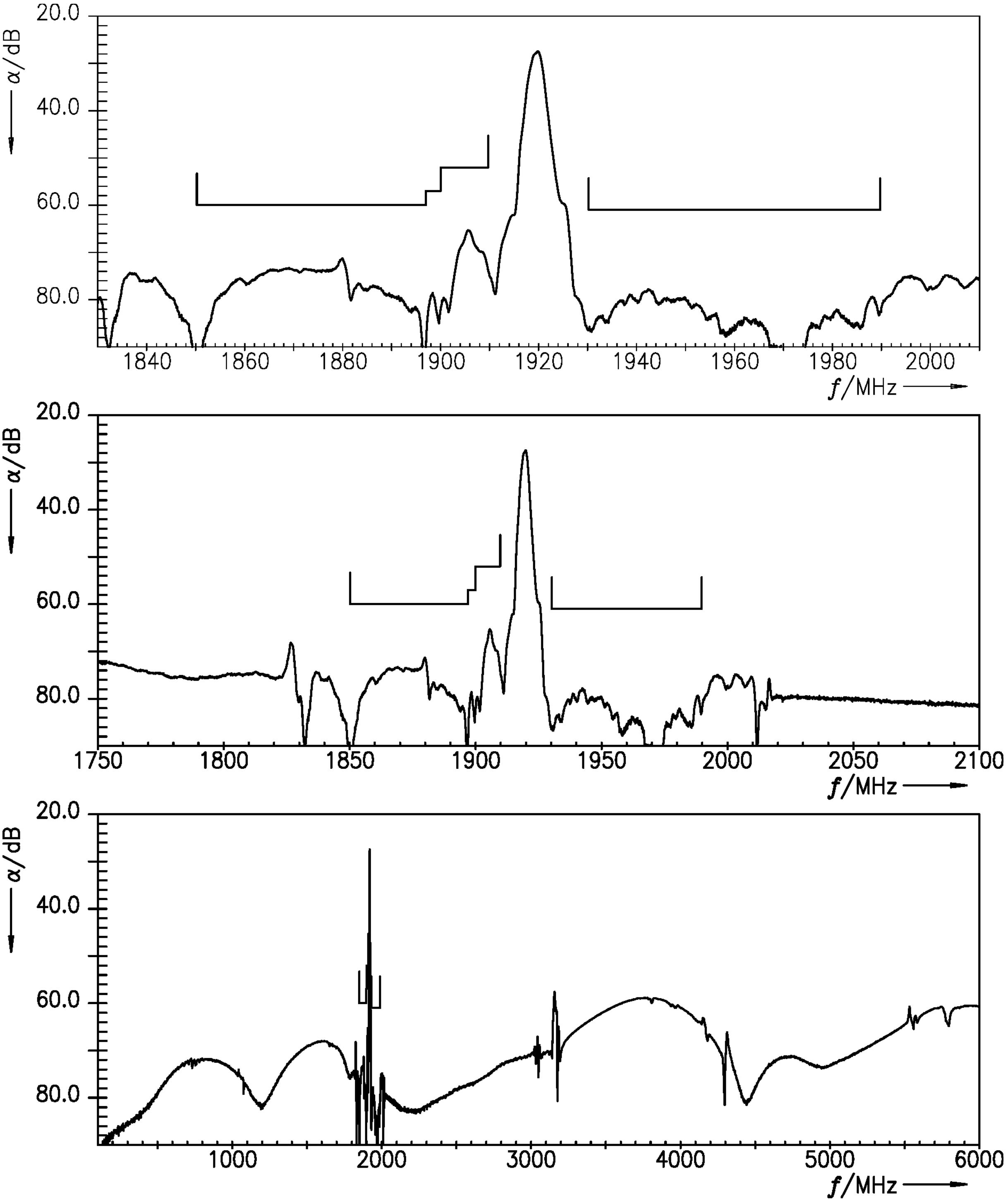


Figure 6: Isolation TX – RX.

9 Reflection coefficients

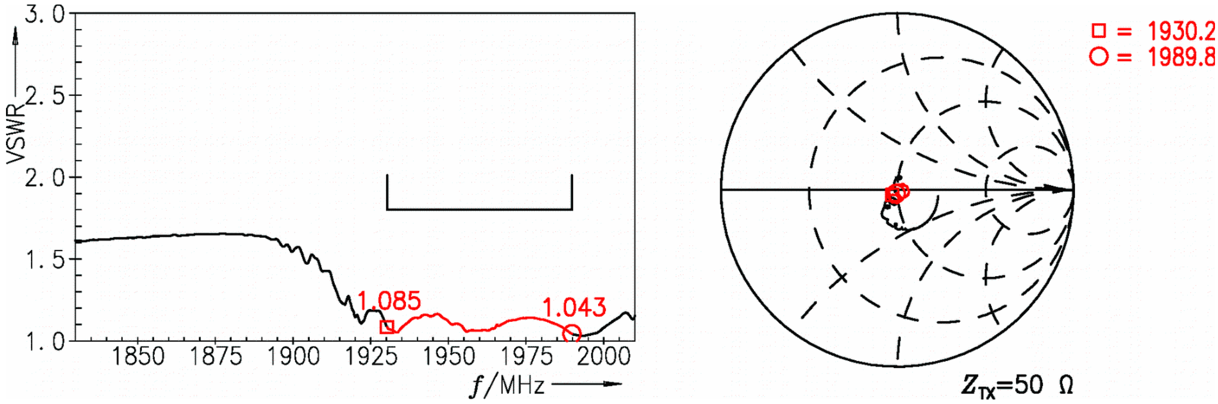


Figure 7: Reflection coefficient at TX port.

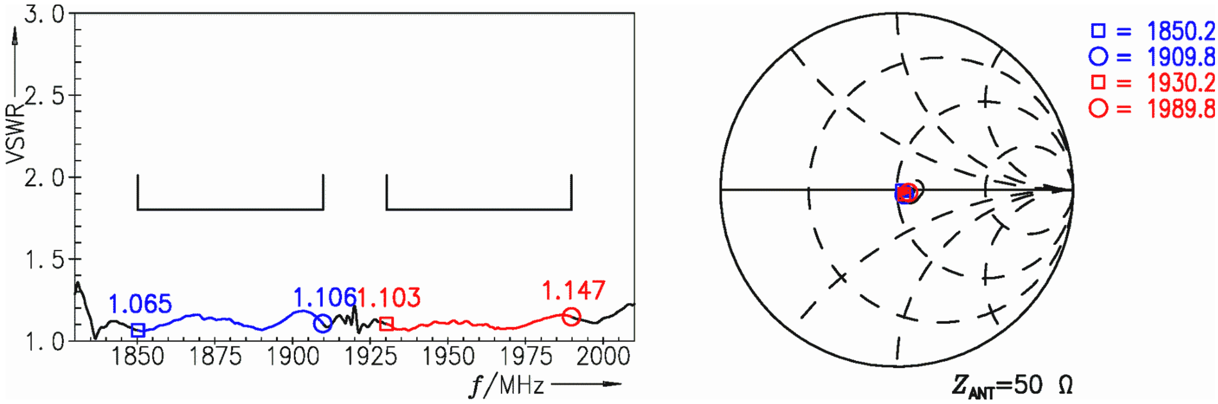


Figure 8: Reflection coefficient at ANT port.

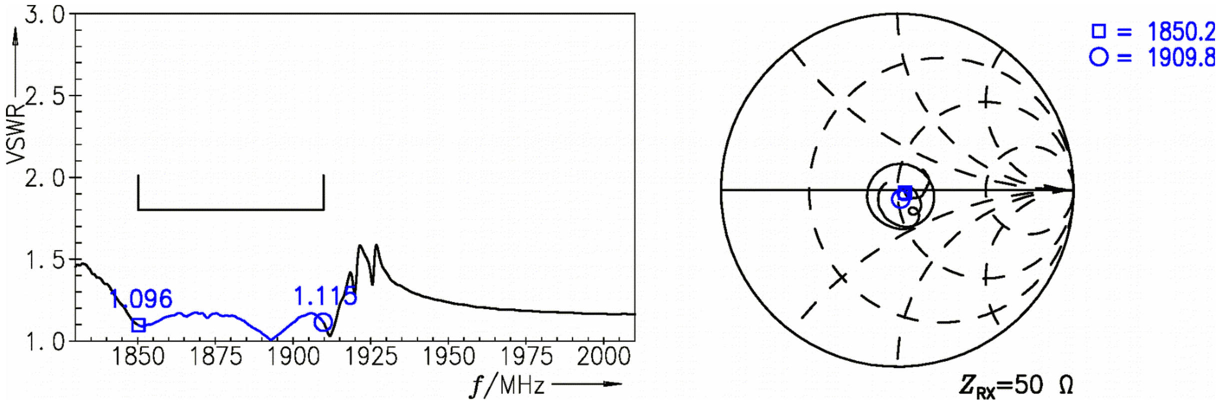


Figure 9: Reflection coefficient at RX port.

10 Packing material

10.1 Tape

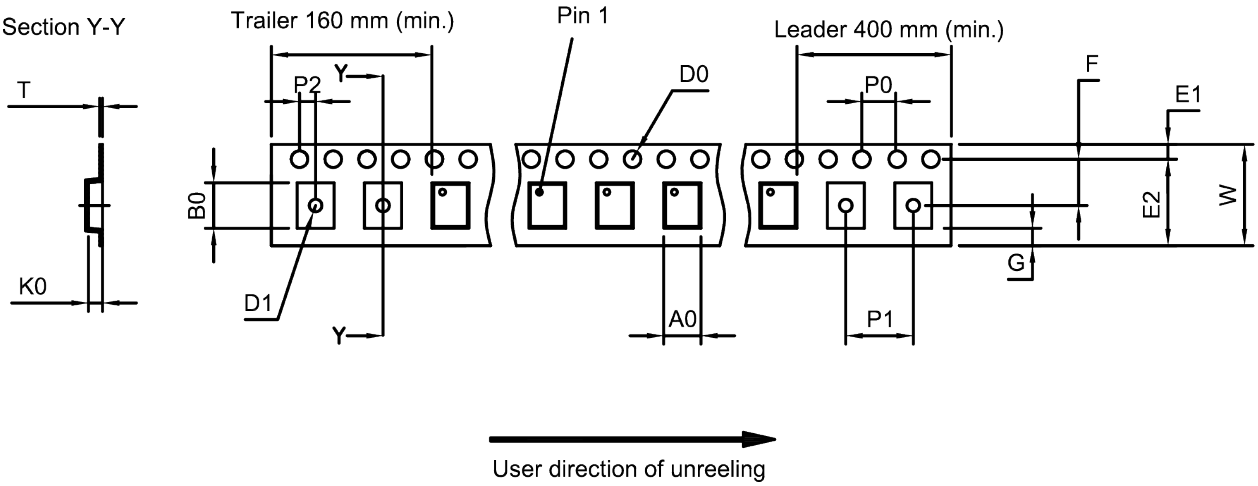


Figure 10: Drawing of tape (first-angle projection) for illustration only and not to scale. The valid tape dimensions are listed in Table 1.

A_0	8.4±0.05 mm	E_2	14.25 mm (min.)	P_1	12.0±0.1 mm
B_0	8.4±0.05 mm	F	7.5±0.1 mm	P_2	2.0±0.1 mm
D_0	1.5+0.1/−0 mm	G	0.75 mm (min.)	T	0.3±0.05 mm
D_1	1.5 mm (min.)	K_0	1.3±0.1 mm	W	16.0+0.3/−0.1 mm
E_1	1.75±0.1 mm	P_0	4.0±0.1 mm		

Table 1: Tape dimensions.

10.2 Reel with diameter of 330 mm

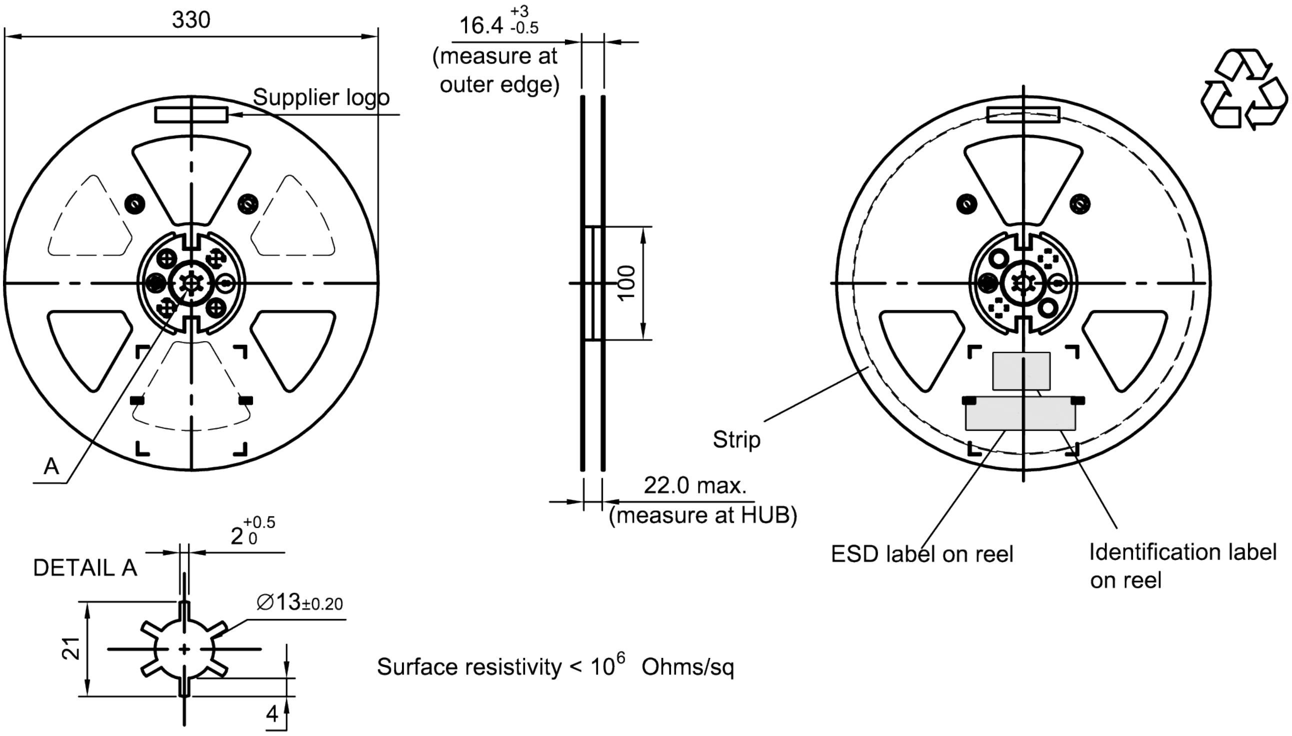


Figure 11: Drawing of reel (first-angle projection) with diameter of 330 mm.

Dimensions [mm]
X = 400+5
Y = 418+5
Sealing area 10±3

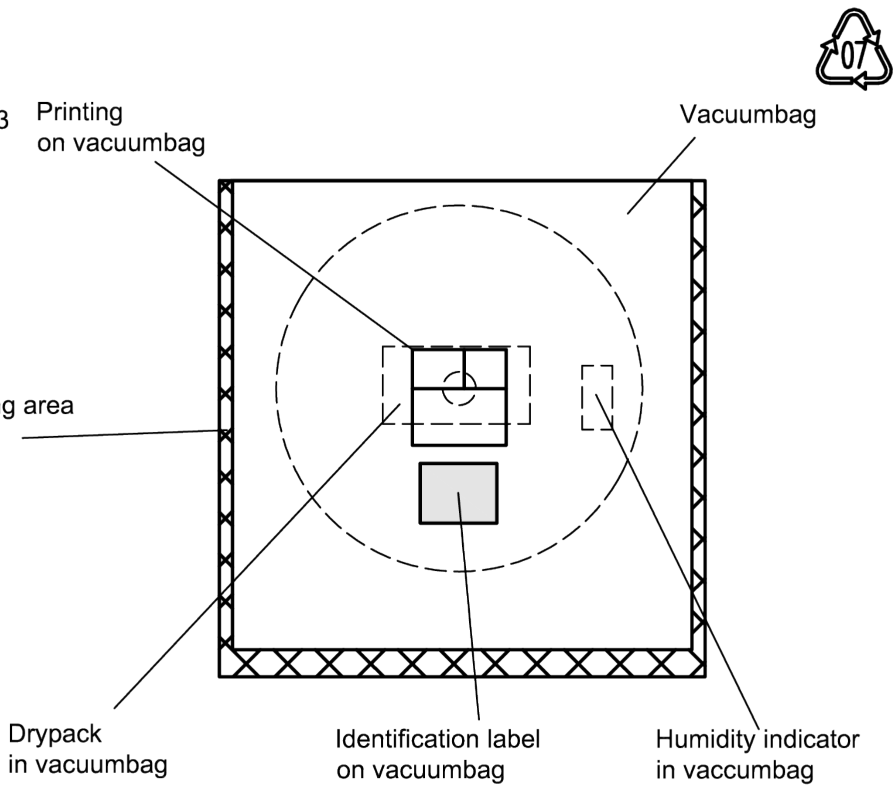


Figure 12: Drawing of moisture barrier bag (MBB) for reel with diameter of 330 mm.

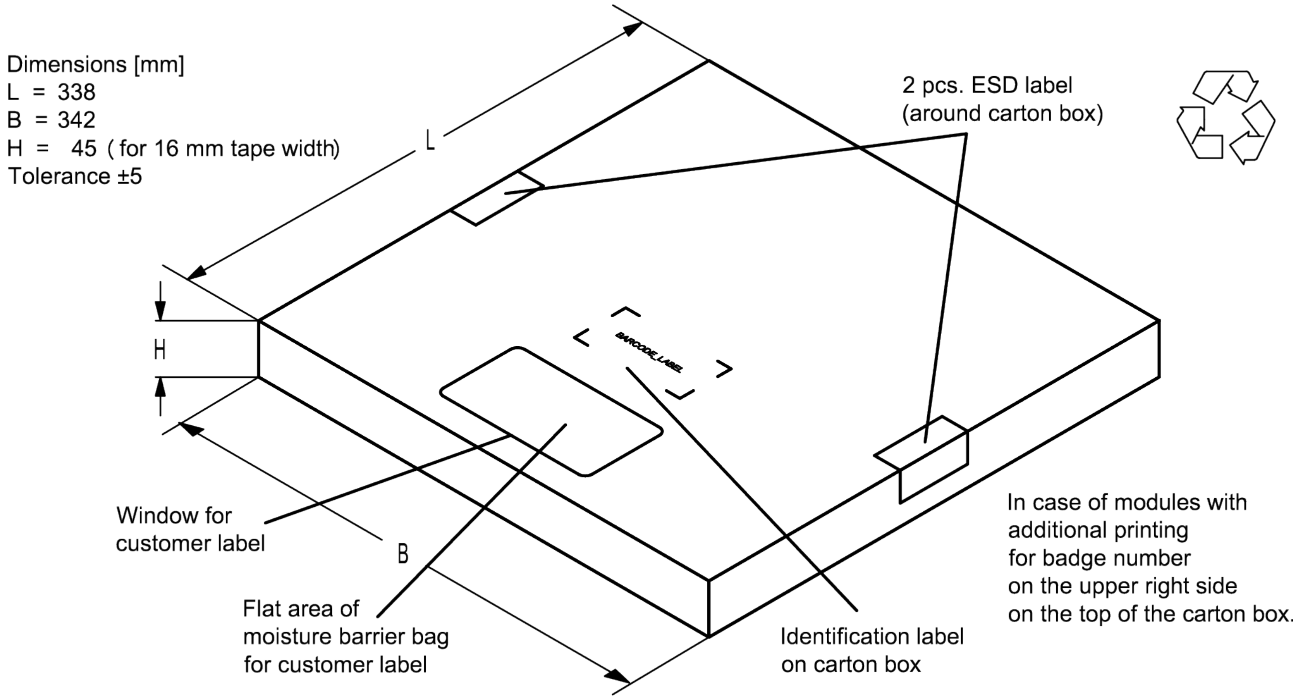


Figure 13: Drawing of folding box for reel with diameter of 330 mm.

11 Marking

Products are marked with tracking number (5 or 8 characters), type designator (5 characters), as well as production location and date code (4 characters). The marking corresponds to one of the following schemes:

XXXXX	5-character tracking number
XXXXX	5-character type designator
M5C6	1-character location code + 3-character date code (example)

Table 2: Marking for 5-character tracking number (standard).

XXXXXXXX	8-character tracking number
XXXXX	5-character type designator
M5C6	1-character location code + 3-character date code (example)

Table 3: Marking for 8-character tracking number.

??? XXXXXXXX	8-character tracking number
XXXXX	5-character type designator
M5C6	1-character location code + 3-character date code (example)

Table 4: Marking for 8-character tracking number with 4 lines.

- Tracking number: *t.b.d.*

- Type designator: The 5-character type designator of the ordering code is used for the marking.

  Example: B3xxxx**D1234**xxxx

- Production-location and date code: The production-location is encoded in the first character according to Table 5. The production date code is encoded in the last three characters according to Table 6.

Code:	M or no letter	J	C	H
Location:	Munich	Singapore	Wuxi	SAE, Hong Kong

Table 5: Production location code.

1st digit (day)						2nd digit (year)				3rd digit (month)			
Day	Code	Day	Code	Day	Code	Year	Code	Year	Code	Month	Code	Month	Code
1	1	11	A	21	M	2010	A	2022	P	Jan	1	Jul	7
2	2	12	B	22	N	2011	B	2023	R	Feb	2	Aug	8
3	3	13	C	23	P	2012	C	2024	S	Mar	3	Sep	9
4	4	14	D	24	R	2013	D	2025	T	Apr	4	Oct	0
5	5	15	E	25	S	2014	E	2026	U	May	5	Nov	N
6	6	16	F	26	T	2015	F	2027	V	Jun	6	Dec	D
7	7	17	H	27	U	2016	H	2028	W				
8	8	18	J	28	V	2017	J	2029	X				
9	9	19	K	29	W	2018	K	2030	Z				
10	0	20	L	30	X	2019	L	2031	A				
				31	Z	2020	M	2032	B				
						2021	N	and so on					

Table 6: Production date code.

Example of how to decode production location and date code:

Code: **M 5 C 6**

Location: M → Munich
Day: 5 → 5th
Year: C → 2012
Month: 6 → June

12 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 7: Characteristics of recommended soldering profile for lead-free solder (Sn95.5Ag3.8Cu0.7).

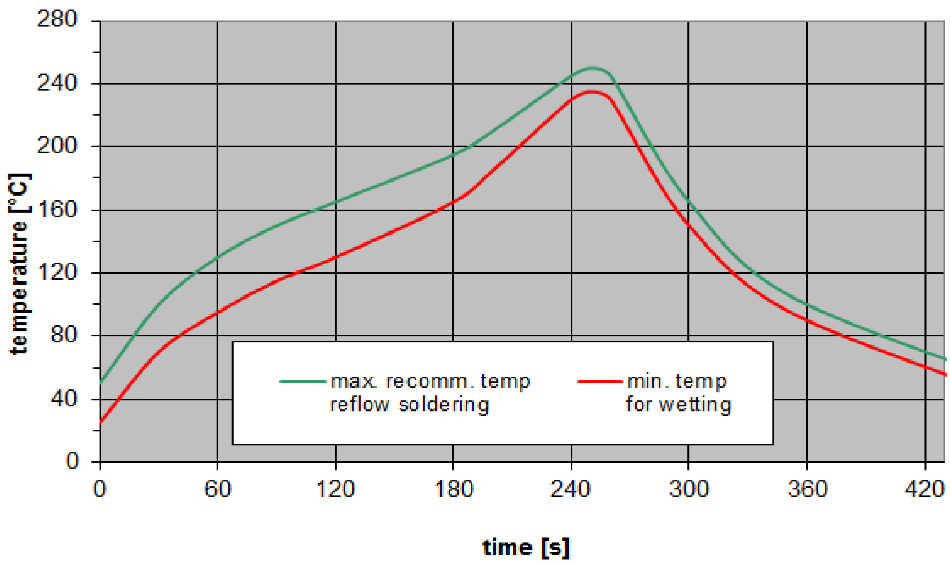


Figure 14: Recommended reflow profile for convection and infrared soldering – lead-free solder.

13 Annotations

13.1 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.

13.2 Scattering parameters (S-parameters)

The pin/port assignment is available in the headers of the S-parameter files. Please contact your local RF360 sales office.

13.3 Ordering codes and packing units

Ordering code	Packing unit
B39202D7911D310	3000 pcs

Table 8: Ordering codes and packing units.

14 Cautions and warnings

14.1 Display of ordering codes for RF360 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 RF360, 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 https://rffe.qualcomm.com/.

14.2 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.

For information on recycling of tapes and reels please contact one of our sales offices.

14.3 Moldability

Before using in overmolding environment, please contact your local RF360 sales office.

14.4 Package information

Landing area

The printed circuit board (PCB) land pattern (landing area) shown is based on RF360 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 RF360, 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.

15 ESD protection of SAW filters

SAW filters are **E**lectro **S**tatic **D**ischarge sensitive devices. To reduce the probability of damages caused by ESD, special matching topologies have to be applied.

In general, “ESD matching” has to be ensured at that filter port, where electrostatic discharge is expected.

Electrostatic discharges predominantly appear at the antenna input of RF receivers. Therefore, only the input matching of the SAW filter has to be designed to short circuit or to block the ESD pulse.

Below three figures show recommended “ESD matching” topologies.

For wide band filters the high-pass ESD matching structure needs to be at least of 3rd order to ensure a proper matching for any impedance value of antenna and SAW filter input. The required component values have to be determined from case to case.

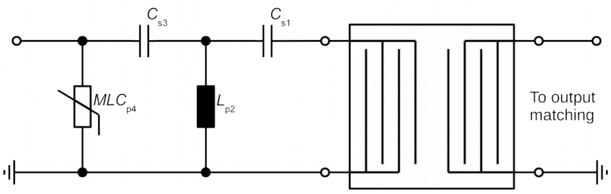


Figure 15: MLC varistor plus ESD matching.

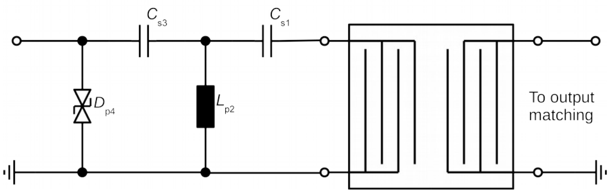


Figure 16: Suppressor diode plus ESD matching.

In cases where minor ESD occur, following simplified “ESD matching” topologies can be used alternatively.

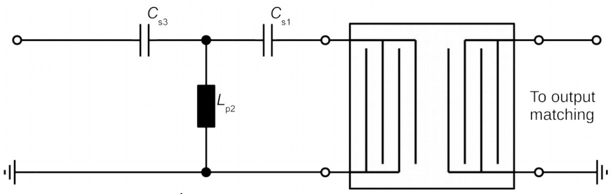


Figure 17: 3rd order high-pass structure for basic ESD protection.

In all three figures the shunt inductor L_{p2} could be replaced by a shorted microstrip with proper length and width. If this configuration is possible depends on the operating frequency and available PCB space.

Effectiveness of the applied ESD protection has to be checked according to relevant industry standards or customer specific requirements.

For further information, please refer to RF360 Application report: **“ESD protection for SAW filters”.** This report can be found under https://rffe.qualcomm.com.

16 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, RF360 Europe GmbH and its affiliates are 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 RF360 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 (https://rffe.qualcomm.com). 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.