RF360
Europe GmbH

Data sheet

SAW duplexer

Small cell & femtocell
LTE band 3 partial

Part number:	B8210
Ordering code:	B39192B8210P810

Date:	March 27, 2020
Version:	2.1

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1 Application

- Low-loss SAW duplexer for 3G/LTE small cell & femtocell systems (Band 3 partial)
- Low insertion attenuation
- Usable pass band 50 MHz
- High power durability
- Rx = uplink = 1735-1785 MHz
- Tx = downlink = 1830-1880 MHz

2 Features

- Industrial grade qualified family
- Package size $2.5_{\pm 0.1}$ mm × $2.0_{\pm 0.1}$ mm
- Package height 0.5 mm (max.)
- Approximate weight 0.01 g
- RoHS compatible
- Package for Surface Mount Technology (SMT)
- Ni/Au-plated terminals
- Electrostatic Sensitive Device (ESD)
- Moisture Sensitivity Level 2a (MSL2a)

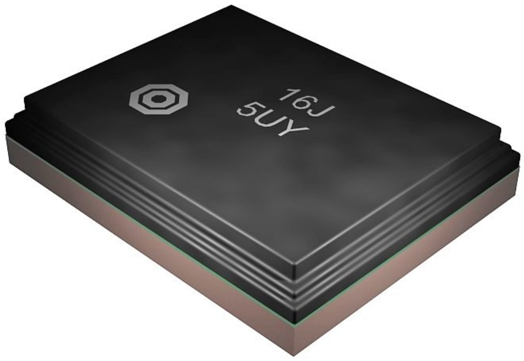

Figure 1: Picture of component with example of product marking.

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3 Package

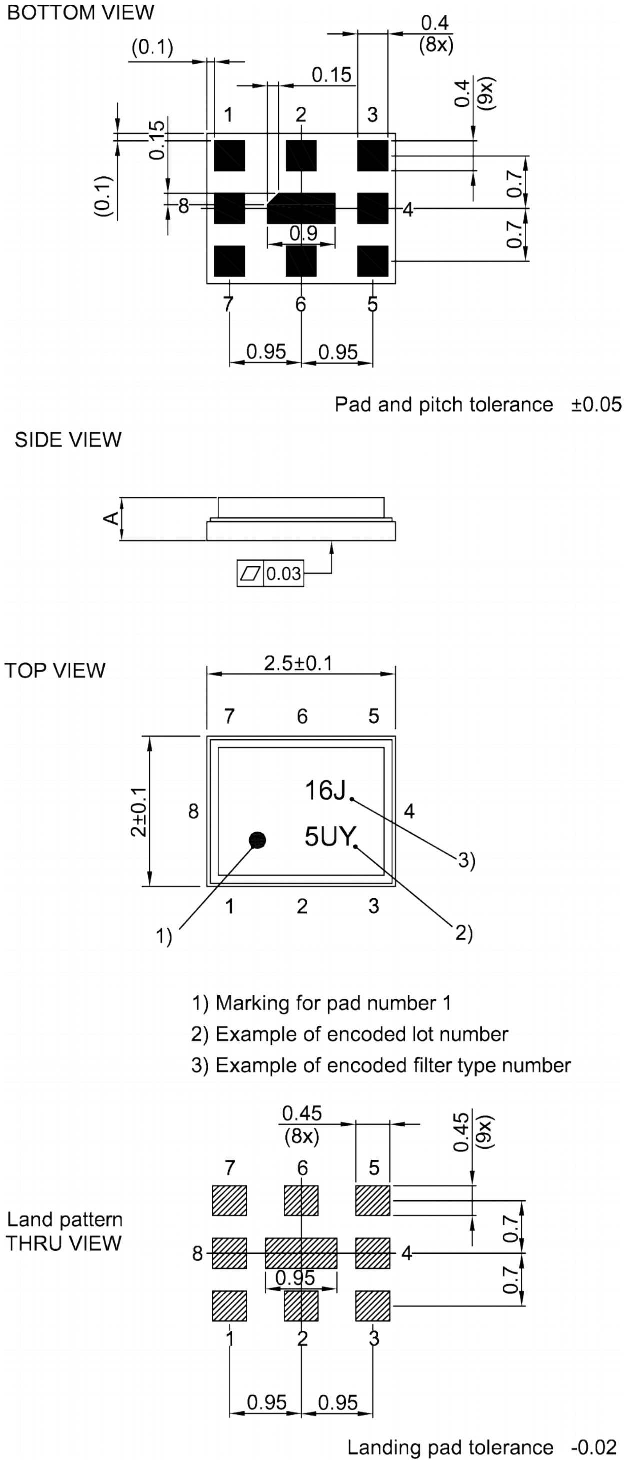

Figure 2: Drawing of package with package height A = 0.5 mm (max.). See Sec. Package information (p. 28).

4 Pin configuration

- 1 TX
- 3 RX
- 6 ANT
- 2, 4, 5, 7, 8, 9 Ground

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5 Matching circuit

- L_{p6} = 3.6 nH

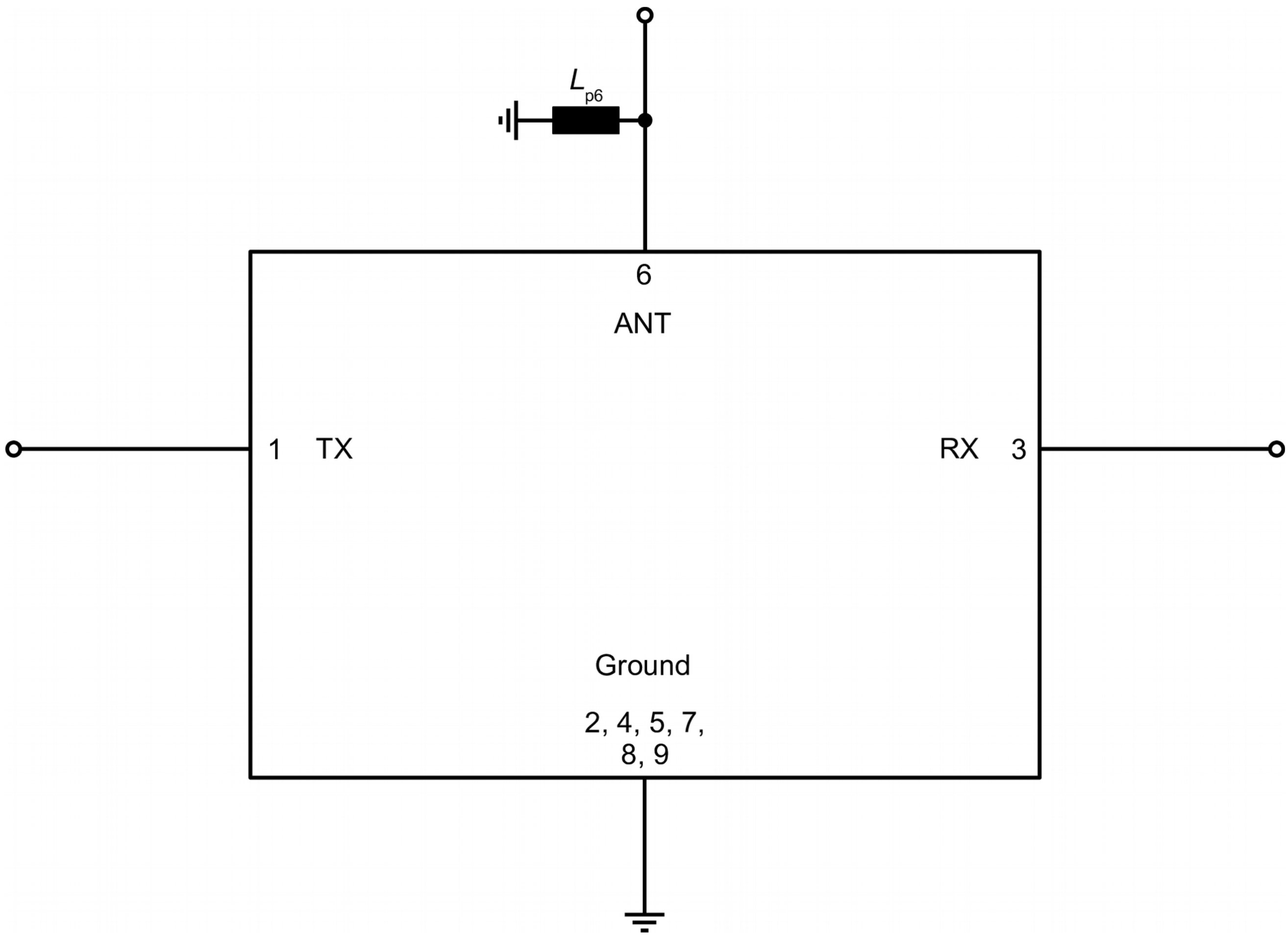

Figure 3: Schematic of matching circuit.

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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 // 3.6 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	—	1855	—	MHz
Insertion attenuation			α_{INT} [2)]				
	1830 ... 1835	MHz		—	1.7	2.4	dB
	1835 ... 1875	MHz		—	1.4	2.2	dB
	1875 ... 1880	MHz		—	1.5	2.4	dB
Maximum insertion attenuation			α_{max}				
	1830 ... 1880	MHz		—	1.8	3.2	dB
Amplitude ripple (p-p)			$\Delta\alpha$				
	1830 ... 1880	MHz		—	0.7	2.0	dB
Maximum group delay			τ_{max}				
	1830 ... 1880	MHz		—	26	42	ns
Group delay ripple			$\Delta\tau_{var}$				
	1830 ... 1880	MHz		—	10	26	ns
Maximum VSWR			$VSWR_{max}$				
@ TX port	1830 ... 1880	MHz		—	1.6	2.1	
@ ANT port	1830 ... 1880	MHz		—	1.6	2.0	
Minimum attenuation			α_{min}				
	10 ... 700	MHz		40	57	—	dB
	700 ... 1000	MHz		40	52	—	dB
	1000 ... 1400	MHz		35	48	—	dB
	1400 ... 1600	MHz		35	48	—	dB
	1600 ... 1710	MHz		35	49	—	dB
	1710 ... 1735	MHz		45	60	—	dB
	1735 ... 1785	MHz		55	58	—	dB
	1785 ... 1790	MHz		40	62	—	dB
	1790 ... 1795	MHz		30	54	—	dB
	1920 ... 1980	MHz		51	57	—	dB
	1980 ... 2300	MHz		40	52	—	dB
	2300 ... 2400	MHz		45	53	—	dB
	2400 ... 2484	MHz		45	54	—	dB
	2484 ... 2690	MHz		45	54	—	dB
	2690 ... 3300	MHz		45	55	—	dB
	3300 ... 3800	MHz		43	52	—	dB
	3800 ... 5150	MHz		28	32	—	dB

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Characteristics TX – ANT			min. for T_{SPEC}	typ. @ +25 °C	max. for T_{SPEC}	
	5150 ... 6000	MHz	20	25	—	dB

1) See Sec. Matching circuit (p. 6).
2) Integrated attenuation α_{INT}: Averaged power $|S_{ij}|^2$ over the center 4.5 MHz of LTE 5 MHz (25 RB) channels.

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Temperature range for specification	T_{SPEC}	= −40 °C ... +95 °C
TX terminating impedance	Z_{TX}	= 50 Ω
ANT terminating impedance	Z_{ANT}	= 50 Ω // 3.6 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	—	1855	—	MHz
Insertion attenuation			α_{INT} [2]				
	1830 ... 1835	MHz		—	1.7	2.6	dB
	1835 ... 1875	MHz		—	1.4	2.2	dB
	1875 ... 1880	MHz		—	1.5	2.6	dB
Maximum insertion attenuation			α_{max}				
	1830 ... 1880	MHz		—	1.8	3.5	dB
Amplitude ripple (p-p)			$\Delta\alpha$				
	1830 ... 1880	MHz		—	0.7	2.3	dB
Maximum group delay			τ_{max}				
	1830 ... 1880	MHz		—	26	46	ns
Group delay ripple			$\Delta\tau_{var}$				
	1830 ... 1880	MHz		—	10	30	ns
Maximum VSWR			$VSWR_{max}$				
@ TX port	1830 ... 1880	MHz		—	1.6	2.1	
@ ANT port	1830 ... 1880	MHz		—	1.6	2.0	
Minimum attenuation			α_{min}				
	10 ... 700	MHz		40	57	—	dB
	700 ... 1000	MHz		40	52	—	dB
	1000 ... 1400	MHz		35	48	—	dB
	1400 ... 1600	MHz		35	48	—	dB
	1600 ... 1710	MHz		35	49	—	dB
	1710 ... 1735	MHz		45	60	—	dB
	1735 ... 1785	MHz		55	58	—	dB
	1785 ... 1790	MHz		40	62	—	dB
	1790 ... 1795	MHz		30	54	—	dB
	1920 ... 1980	MHz		51	57	—	dB
	1980 ... 2300	MHz		40	52	—	dB
	2300 ... 2400	MHz		45	53	—	dB
	2400 ... 2484	MHz		45	53	—	dB
	2484 ... 2690	MHz		45	53	—	dB
	2690 ... 3300	MHz		45	54	—	dB
	3300 ... 3800	MHz		43	52	—	dB
	3800 ... 5150	MHz		28	32	—	dB
	5150 ... 6000	MHz		17	25	—	dB

[1] See Sec. Matching circuit (p. 6).
[2] Integrated attenuation α_{INT}: Averaged power $|S_{ij}|^2$ over the center 4.5 MHz of LTE 5 MHz (25 RB) channels.

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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 // 3.6 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	—	1760	—	MHz
Insertion attenuation			α_{INT} [2)]				
	1735... 1740	MHz		—	1.6	2.5	dB
	1740... 1780	MHz		—	1.3	2.1	dB
	1780... 1785	MHz		—	1.5	2.5	dB
Maximum insertion attenuation			α_{max}				
	1735... 1785	MHz		—	1.8	3.0	dB
Amplitude ripple (p-p)			$\Delta\alpha$				
	1735... 1785	MHz		—	0.8	2.1	dB
Maximum group delay			τ_{max}				
	1735... 1785	MHz		—	28	41	ns
Group delay ripple			$\Delta\tau_{var}$				
	1735... 1785	MHz		—	13	26	ns
Maximum VSWR			$VSWR_{max}$				
@ ANT port	1735... 1785	MHz		—	1.6	2.0	
@ RX port	1735... 1785	MHz		—	1.6	2.1	
Minimum attenuation			α_{min}				
	10... 700	MHz		35	52	—	dB
	700... 1000	MHz		35	46	—	dB
	1000... 1600	MHz		30	40	—	dB
	1600... 1690	MHz		38	43	—	dB
	1805... 1830	MHz		8	26	—	dB
	1805... 1830	MHz		13[2)]	32[2)]	—	dB
	1830... 1880	MHz		50	56	—	dB
	1880... 1920	MHz		35	45	—	dB
	1920... 1980	MHz		35	44	—	dB
	1980... 2110	MHz		35	44	—	dB
	2110... 2200	MHz		35	44	—	dB
	2200... 2400	MHz		35	43	—	dB
	2400... 2500	MHz		35	43	—	dB
	2500... 2690	MHz		37	47	—	dB
	2690... 3300	MHz		35	46	—	dB
	3300... 3800	MHz		35	40	—	dB
	3800... 5150	MHz		30	33	—	dB

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Characteristics ANT – RX			min. for T_{SPEC}	typ. @ +25 °C	max. for T_{SPEC}	
	5150 ... 6000	MHz	20	31	—	dB

1) See Sec. Matching circuit (p. 6).
2) Integrated attenuation α_{INT}: Averaged power $|S_{ij}|^2$ over the center 4.5 MHz of LTE 5 MHz (25 RB) channels.

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Temperature range for specification	T_{SPEC}	= −40 °C ... +95 °C
TX terminating impedance	Z_{TX}	= 50 Ω
ANT terminating impedance	Z_{ANT}	= 50 Ω // 3.6 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	—	1760	—	MHz
Insertion attenuation			α_{INT} [2)]				
	1735 ... 1745	MHz		—	1.6	2.9	dB
	1745 ... 1775	MHz		—	1.3	2.2	dB
	1775 ... 1785	MHz		—	1.5	2.9	dB
Maximum insertion attenuation			α_{max}				
	1735 ... 1785	MHz		—	1.8	3.5	dB
Amplitude ripple (p-p)			$\Delta\alpha$				
	1735 ... 1785	MHz		—	0.8	2.6	dB
Maximum group delay			τ_{max}				
	1735 ... 1785	MHz		—	28	45	ns
Group delay ripple			$\Delta\tau_{var}$				
	1735 ... 1785	MHz		—	13	30	ns
Maximum VSWR			$VSWR_{max}$				
@ ANT port	1735 ... 1785	MHz		—	1.6	2.0	
@ RX port	1735 ... 1785	MHz		—	1.6	2.1	
Minimum attenuation			α_{min}				
	10 ... 700	MHz		35	52	—	dB
	700 ... 1000	MHz		35	46	—	dB
	1000 ... 1600	MHz		30	40	—	dB
	1600 ... 1690	MHz		38	43	—	dB
	1805 ... 1830	MHz		6	26	—	dB
	1805 ... 1830	MHz		10[2)]	32[2)]	—	dB
	1830 ... 1880	MHz		50	56	—	dB
	1880 ... 1920	MHz		35	45	—	dB
	1920 ... 1980	MHz		35	44	—	dB
	1980 ... 2110	MHz		35	44	—	dB
	2110 ... 2200	MHz		35	44	—	dB
	2200 ... 2400	MHz		35	43	—	dB
	2400 ... 2500	MHz		35	43	—	dB
	2500 ... 2690	MHz		37	47	—	dB
	2690 ... 3300	MHz		35	46	—	dB
	3300 ... 3800	MHz		35	40	—	dB
	3800 ... 5150	MHz		29	33	—	dB
	5150 ... 6000	MHz		20	31	—	dB

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[1] See Sec. Matching circuit (p. 6).
[2] Integrated attenuation α_{INT}: Averaged power $|S_{ij}|^2$ over the center 4.5 MHz of LTE 5 MHz (25 RB) channels.

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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 // 3.6 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			α_{min}				
	1735 ... 1785	MHz		55	59	—	dB
	1830 ... 1880	MHz		53	58	—	dB

1) See Sec. Matching circuit (p. 6).

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Temperature range for specification	T_{SPEC}	= −40 °C ... +95 °C
TX terminating impedance	Z_{TX}	= 50 Ω
ANT terminating impedance	Z_{ANT}	= 50 Ω // 3.6 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			α_{min}				
	1735... 1785	MHz		55	59	—	dB
	1830... 1880	MHz		53	58	—	dB

1) See Sec. Matching circuit (p. 6).

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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	
ESD voltage		
	V_{ESD}[3)] = 150 V	Machine model.
	V_{ESD}[4)] = 250 V	Human body model.
Input power	P_{IN}	
@ TX port: 1830 ... 1880 MHz	28 dBm[5), 6)]	5 MHz LTE downlink signal (25 RB) for 100000 h @ 55 °C. P_{IN} average – 39 dBm peak. Source and load impedance 50Ω.
@ RX port: 1735 ... 1785 MHz	27 dBm[5)]	5 MHz LTE uplink signal (25 RB) for 5000 h @ 55 °C. Source and load impedance 50Ω.

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-A115B (MM – Machine Model), 10 negative & 10 positive pulses.
4) According to JESD22-A114F (HBM – Human Body Model), 1 negative & 1 positive pulse.
5) Expected lifetime according to accelerated power durability test and wear out models.
6) T_{SPEC} is the ambient temperature of the PCB at component position. Specified min./max values from section 6 "characteristics" for maximum input power 28dBm are valid for temperature up to 65°C.

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8 Transmission coefficients

8.1 TX – ANT

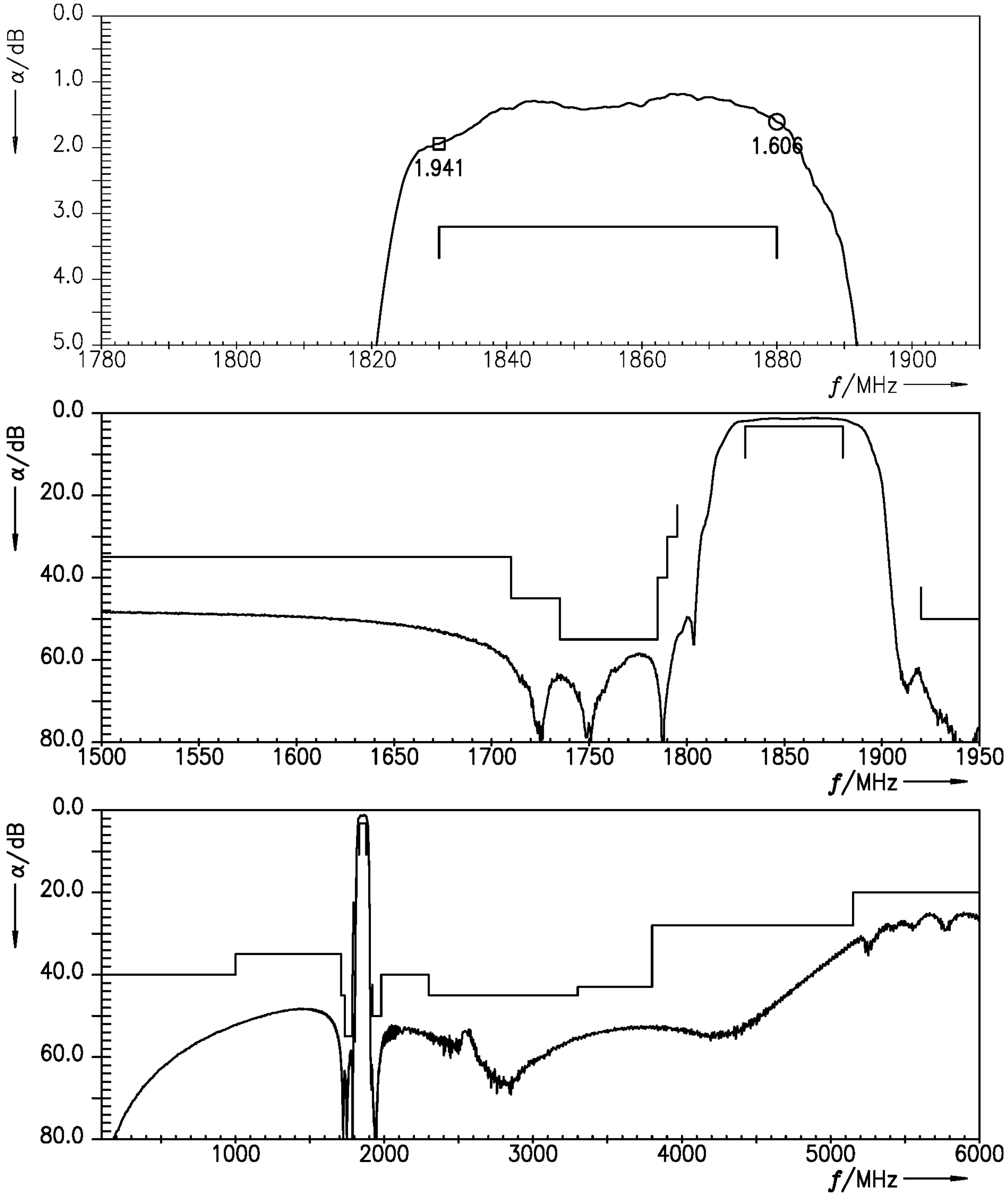

Figure 4: Attenuation TX – ANT.

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8.2 ANT – RX

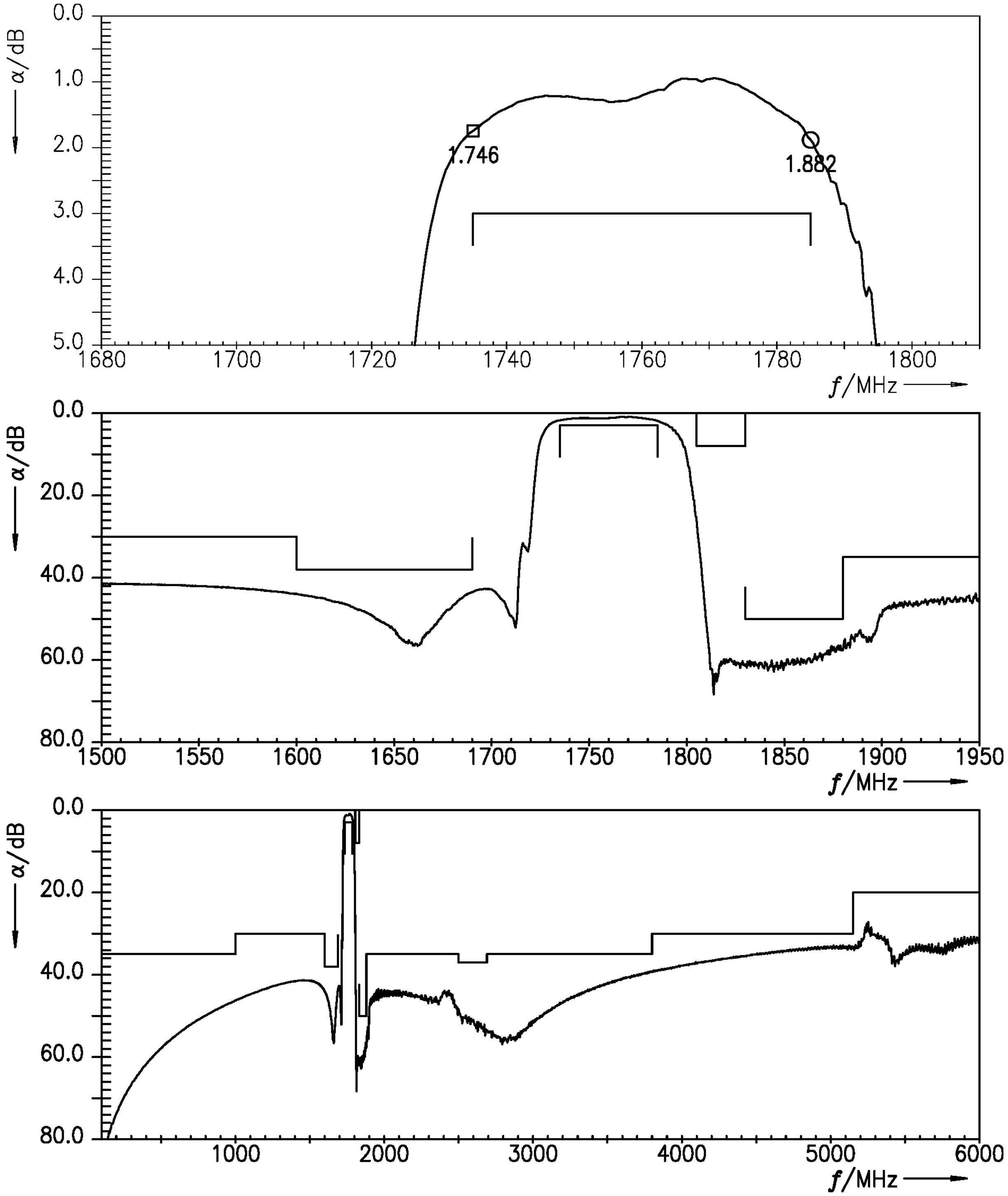

Figure 5: Attenuation ANT – RX.

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8.3 TX – RX

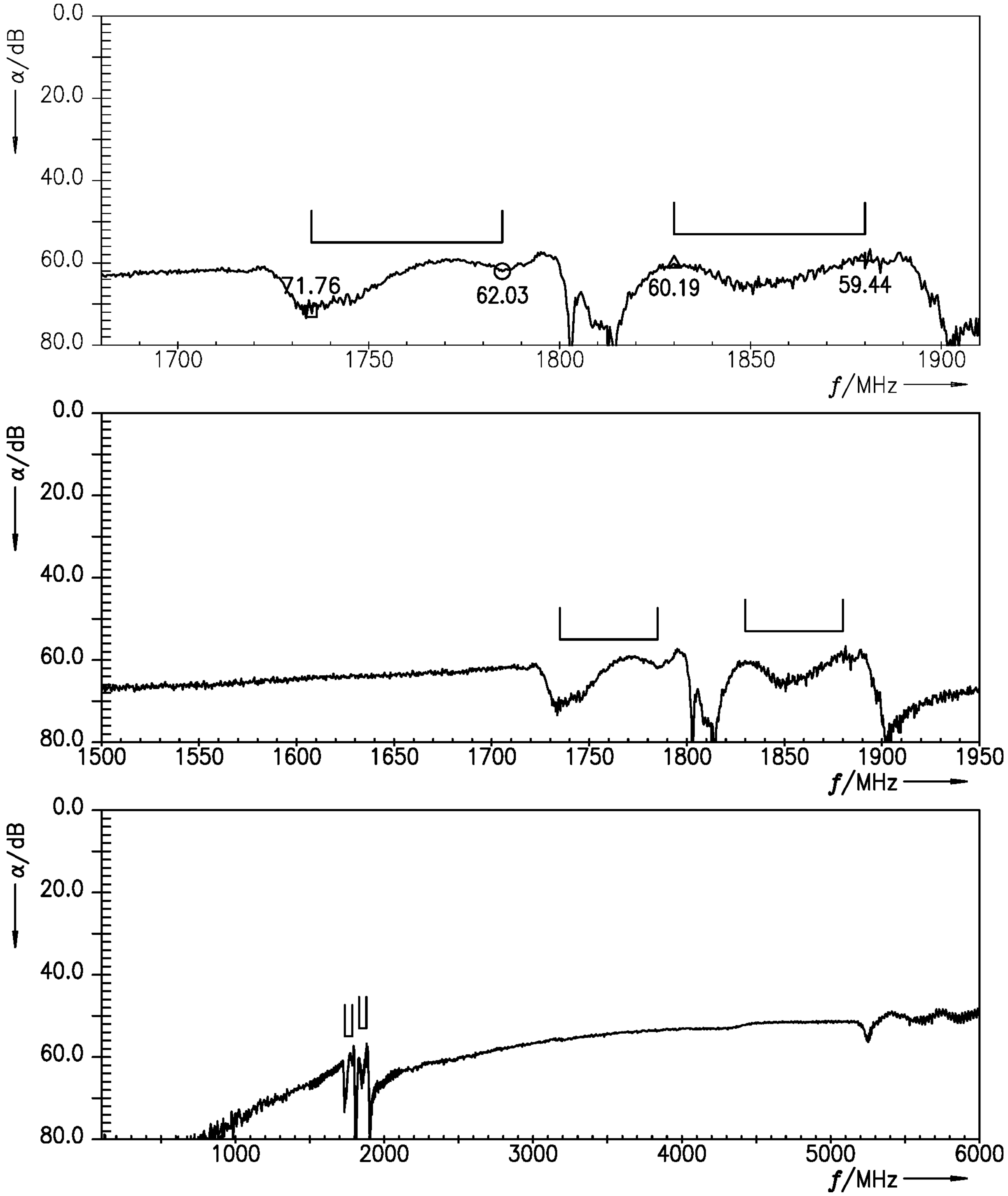

Figure 6: Isolation TX – RX.

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9 Reflection coefficients

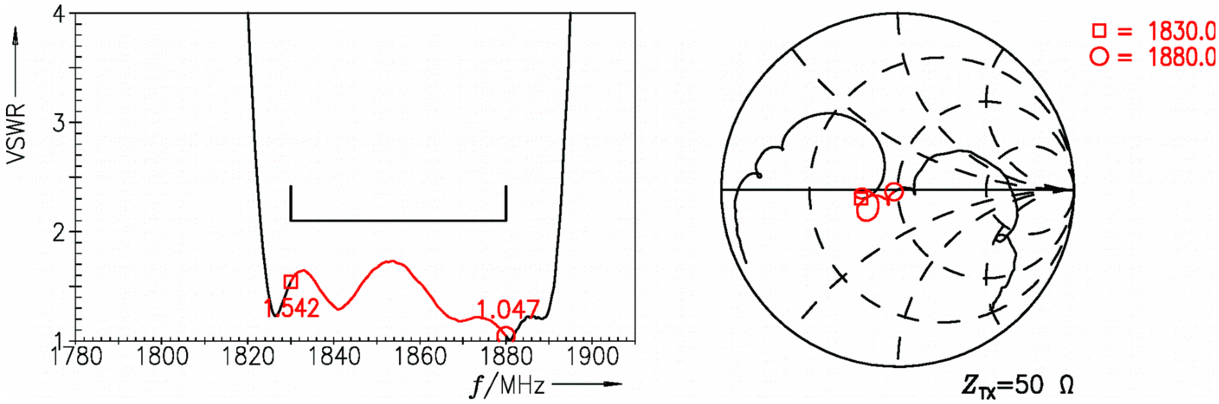

Figure 7: Reflection coefficient at TX port.

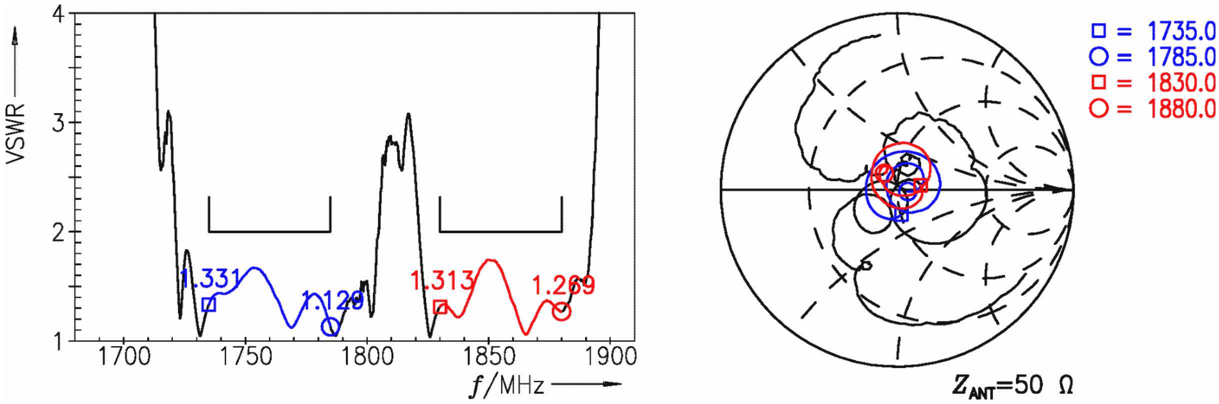

Figure 8: Reflection coefficient at ANT port.

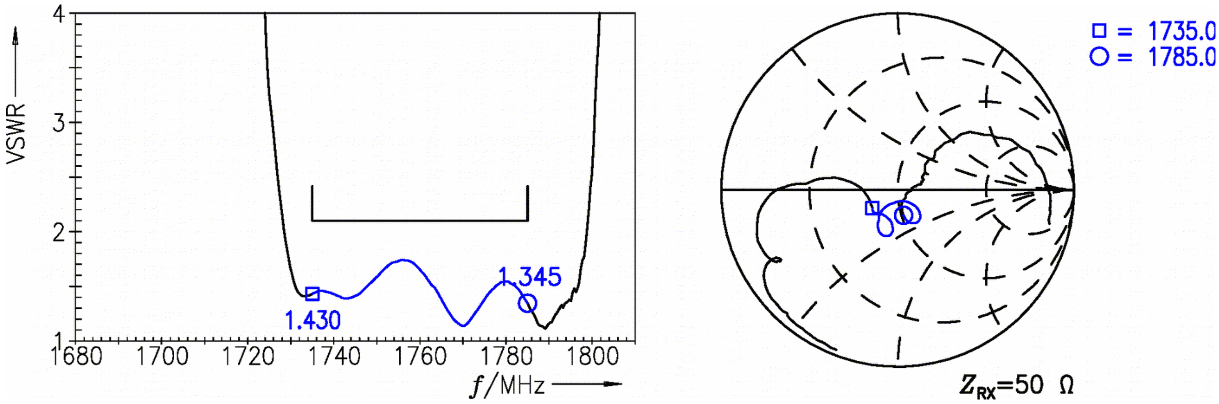

Figure 9: Reflection coefficient at RX port.

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10 Group delay

10.1 TX – ANT

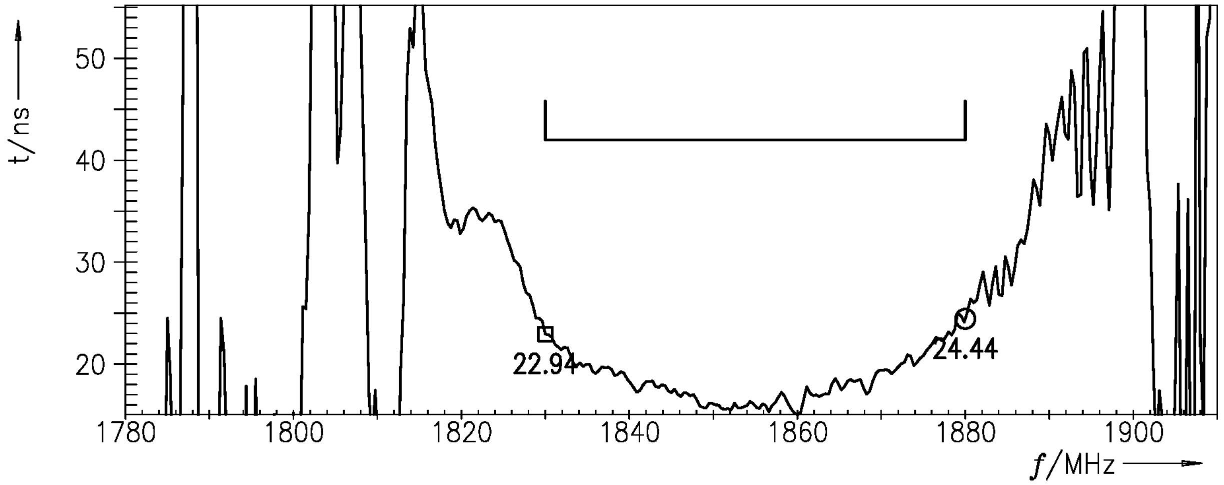

Figure 10: Group delay TX – ANT.

10.2 ANT – RX

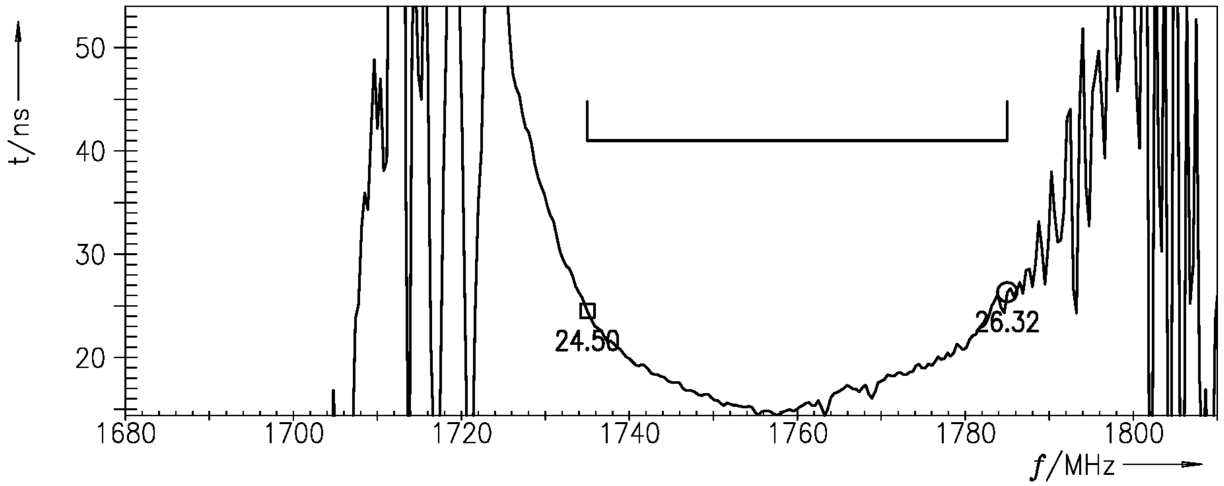

Figure 11: Group delay ANT – RX.

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11 Packing material

11.1 Tape

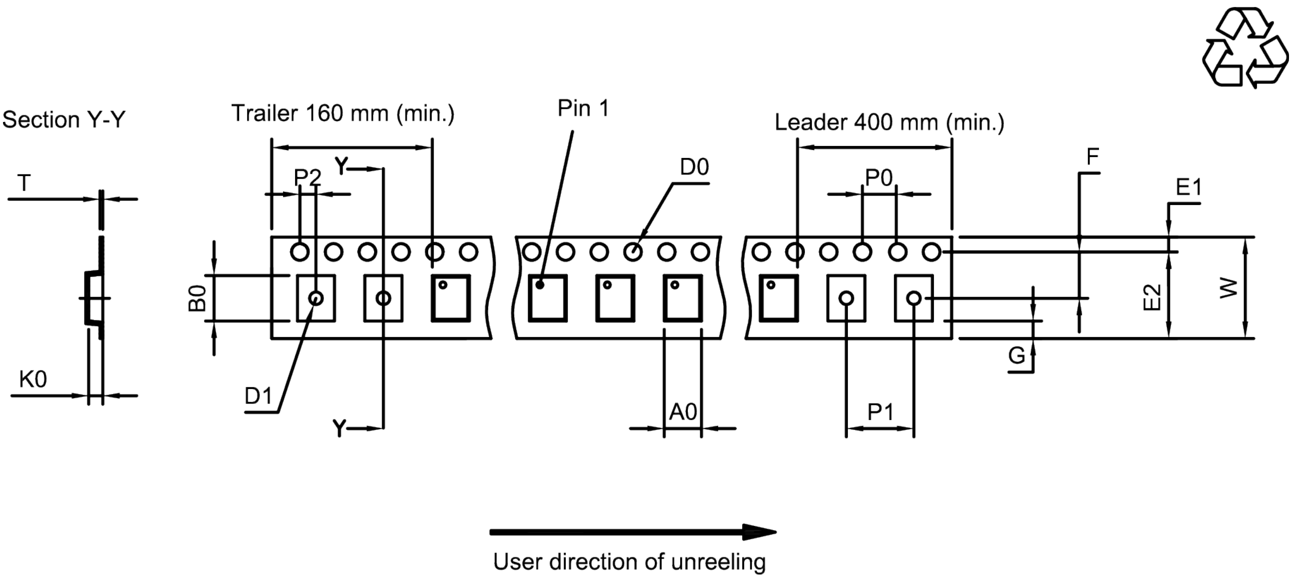

Figure 12: Drawing of tape (first-angle projection) for illustration only and not to scale. The valid tape dimensions are listed in Table 1.

A_0	$2.25_{\pm 0.05}$ mm
B_0	$2.75_{\pm 0.05}$ mm
D_0	$1.5_{+0.1/-0}$ mm
D_1	1.0 mm (min.)
E_1	$1.75_{\pm 0.1}$ mm

E_2	6.25 mm (min.)
F	$3.5_{\pm 0.05}$ mm
G	0.75 mm (min.)
K_0	$0.6_{\pm 0.05}$ mm
P_0	$4.0_{\pm 0.1}$ mm

P_1	$4.0_{\pm 0.1}$ mm
P_2	$2.0_{\pm 0.05}$ mm
T	$0.25_{\pm 0.03}$ mm
W	$8.0_{+0.3/-0.1}$ mm

Table 1: Tape dimensions.

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11.2 Reel with diameter of 180 mm

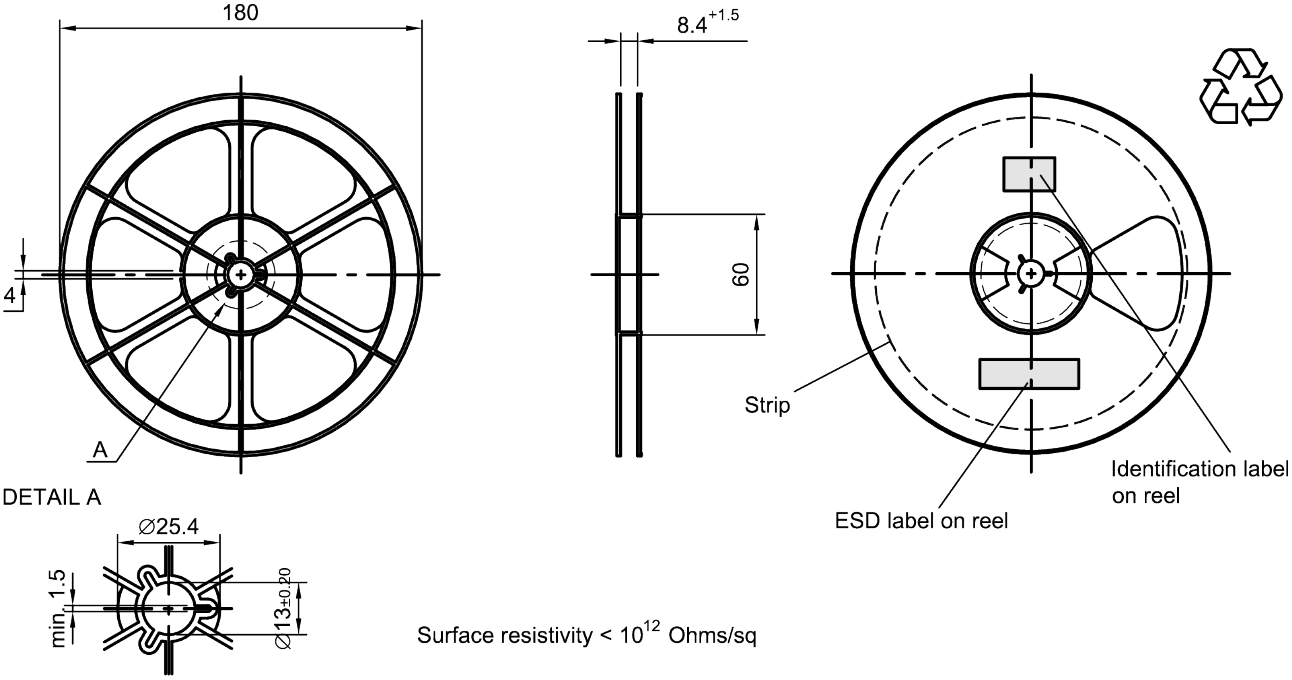

Figure 13: Drawing of reel (first-angle projection) with diameter of 180 mm.

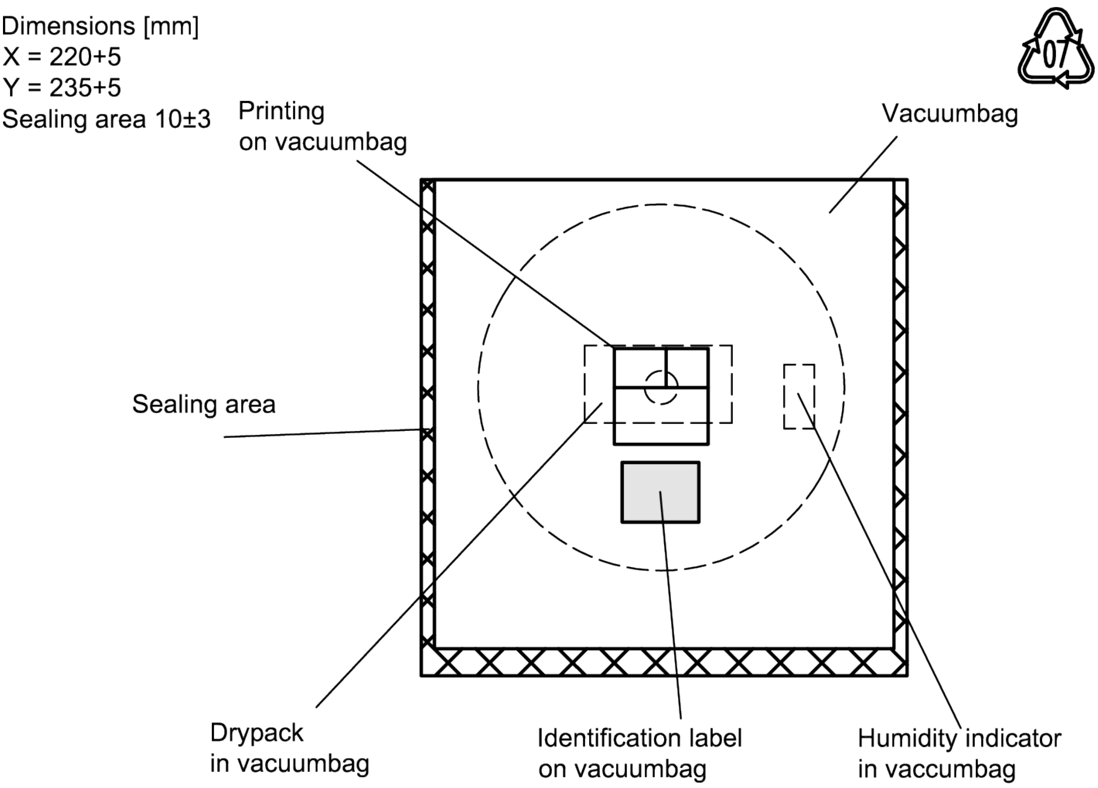

Figure 14: Drawing of moisture barrier bag (MBB) for reel with diameter of 180 mm.

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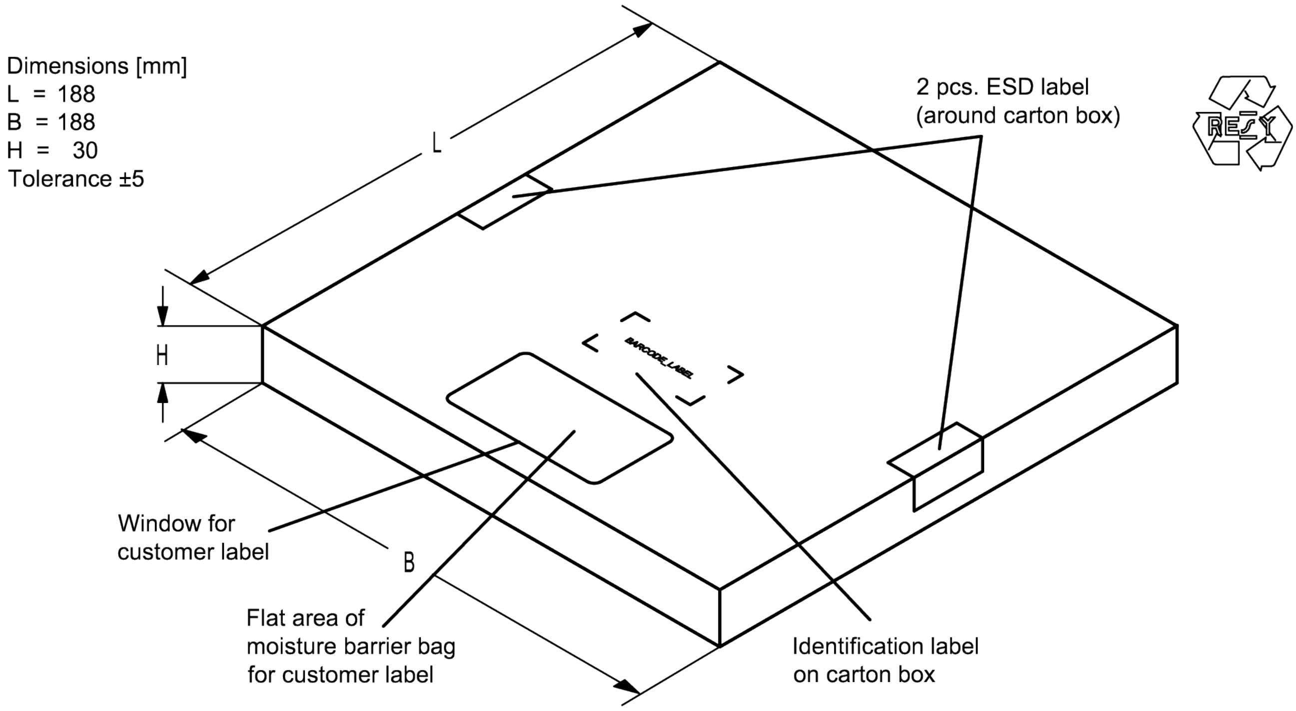

Figure 15: Drawing of folding box for reel with diameter of 180 mm.

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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., B3xxxxB1234xxxx,
  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**

  $\mathbf{1} \times 32^2 + \mathbf{6} \times 32^1 + \mathbf{18\ (=J)} \times 32^0$ = **1234**

  The BASE32 code for product type B8210 is 80J.

- 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**

  $\mathbf{5} \times 47^2 + \mathbf{27\ (=U)} \times 47^1 + \mathbf{31\ (=Y)} \times 47^0$ = **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.

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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).

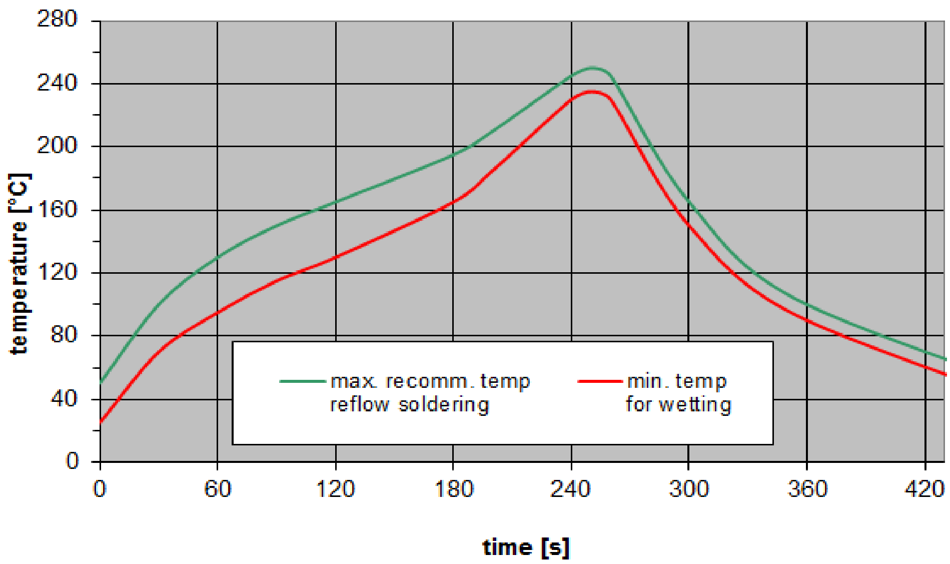

Figure 16: Recommended reflow profile for convection and infrared soldering – lead-free solder.

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14 Annotations

14.1 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.

14.2 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.

14.3 Ordering codes and packing units

Ordering code	Packing unit
B39192B8210P810	5000 pcs

Table 4: Ordering codes and packing units.

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15 Cautions and warnings

15.1 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/.

15.2 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.

15.3 Moldability

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

15.4 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).

Dimensions do not include burrs.

Projection method

Unless otherwise specified first-angle projection is applied.

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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.

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