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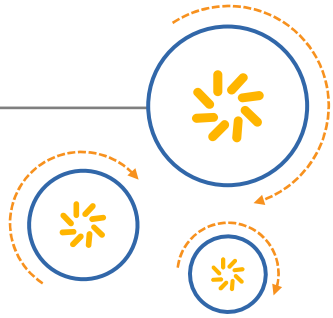

SAW components

SAW duplexer

Small cell & femtocell
LTE band 5

Series/type:	B8013
Ordering code:	B39881B8013P810
Date:	September 14, 2017
Version:	2.8

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SAW components **B8013**

SAW duplexer **836.5 / 881.5 MHz**

Data sheet

SAW components **B8013**

SAW duplexer **836.5 / 881.5 MHz**

Data sheet

Table of contents

1 Application

- Low-loss SAW duplexer for LTE small cell & femtocell systems (Band 5)
- Usable pass band 25MHz
- Rx=uplink=824-849MHz
- Tx=downlink=869-894MHz

2 Features

- Industrial grade qualified family
- Package size 2.5±0.1 mm × 2.0±0.1 mm
- Package height 0.5 mm (max.)
- Approximate weight 1 g
- RoHS compatible
- Package for Surface Mount Technology (SMT)
- Ni/Au-plated terminals
- Electrostatic Sensitive Device (ESD)
- Moisture Sensitivity Level 2a (MSL2a)

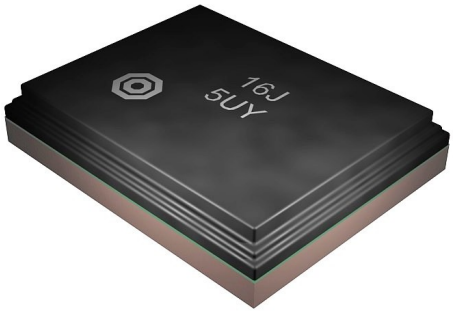

Figure 1: Picture of component with example of product marking.

3 Package

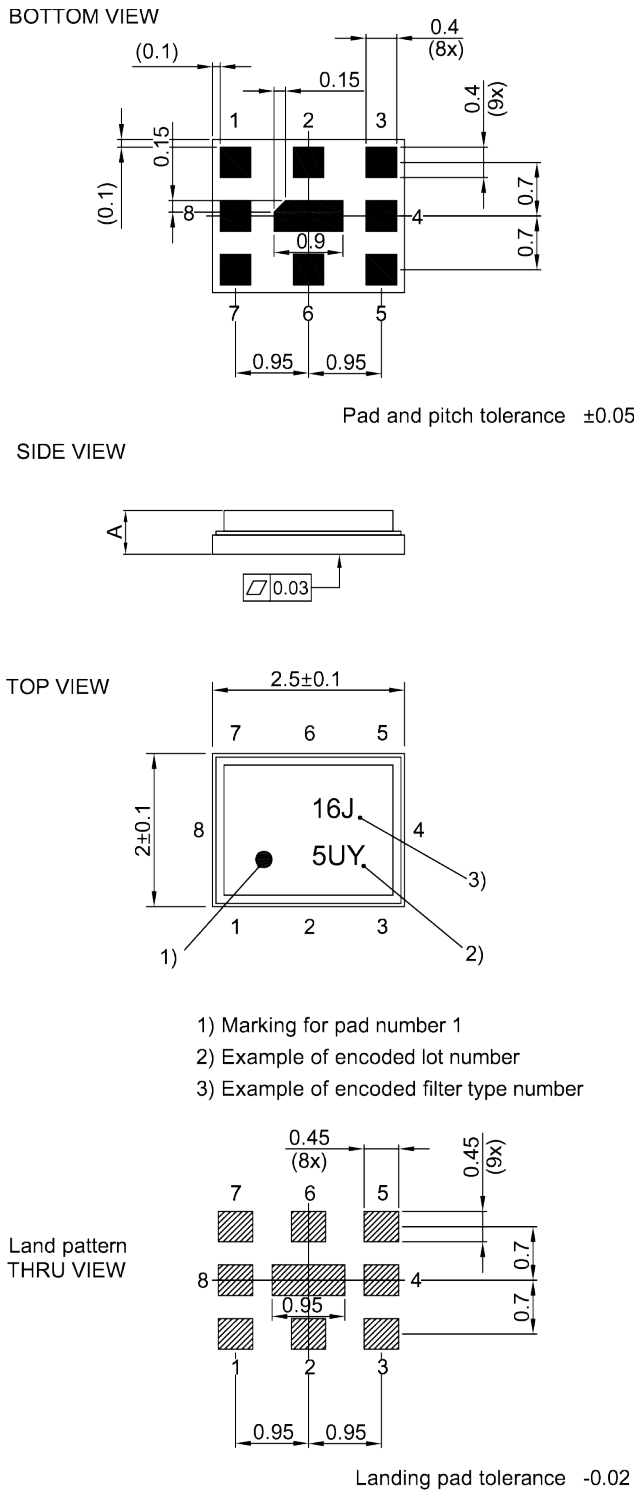

Figure 2: Drawing of package with package height A = 0.5 mm (max.). See Sec. Package information (p. 26).

4 Pin configuration

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

5 Matching circuit

■ L_{p6} = 8.7 nH

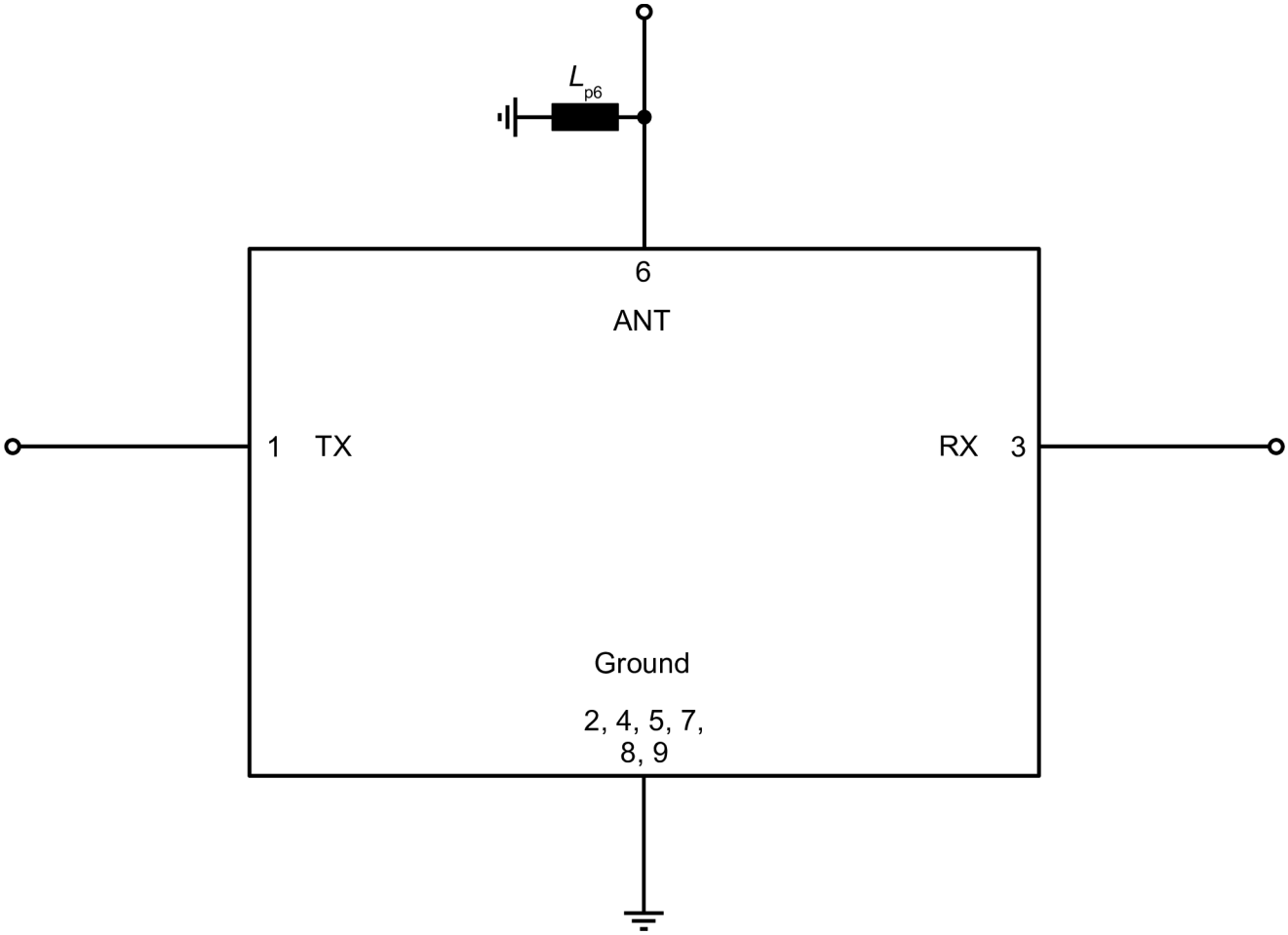

Figure 3: Schematic of matching circuit.

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 with par. 8.7 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	—	881.5	—	MHz
Average insertion attenuation			$\alpha_{INT,avg}$ [2)]				
	869... 874	MHz		—	1.9	2.5	dB
	874... 889	MHz		—	1.5	2.5	dB
	889... 894	MHz		—	1.7	2.5	dB
Maximum insertion attenuation			α_{max}				
	869... 894	MHz		—	1.9	2.5[3)]	dB
Amplitude ripple (p-p)			Δα				
	869... 894	MHz		—	0.6	1.3[4)]	dB
Maximum VSWR			$VSWR_{max}$				
@ TX port	869... 894	MHz		—	1.9	2.1[5)]	
@ ANT port	869... 894	MHz		—	1.8	2.1[5)]	
Maximum error vector magnitude			EVM_{max} [6)]				
	871.4... 891.6	MHz		—	1.4	3.5	%
Minimum attenuation			α_{min}				
	824... 849	MHz		52	59	—	dB
	1574.4... 1576.4	MHz		45	58	—	dB
	1602.5... 1615.5	MHz		35	59	—	dB
	1710... 1788	MHz		40	59	—	dB
	1850... 1910	MHz		40	57	—	dB
	1920... 1980	MHz		40	55	—	dB
	2400... 2484	MHz		21	50	—	dB
	2607... 2682	MHz		21	47	—	dB
	3476... 3576	MHz		21	49	—	dB

1) See Sec. Matching circuit (p. 6).
2) Integrated over 5 MHz.
3) Specification for ILmax is 2.6dB for −20 °C ... +85 °C.
4) Specification for AR is 1.4dB for −20 °C ... +85 °C.
5) Specification for VSWR is 2.2 for −20 °C ... +85 °C.
6) Error Vector Magnitude (EVM) based on definition in 3GPP TS 25.141.

Temperature range for specification	T_{SPEC}	= −40 °C ... +95 °C
TX terminating impedance	Z_{TX}	= 50 Ω
ANT terminating impedance	Z_{ANT}	= 50 Ω with par. 8.7 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	—	881.5	—	MHz
Average insertion attenuation			$\alpha_{INT,avg}$ [2)]				
	869... 874	MHz		—	1.9	3.0	dB
	874... 889	MHz		—	1.5	3.0	dB
	889... 894	MHz		—	1.7	3.0	dB
Maximum insertion attenuation			α_{max}				
	869... 894	MHz		—	1.9	3.0	dB
Amplitude ripple (p-p)			Δα				
	869... 894	MHz		—	0.6	1.7	dB
Maximum VSWR			$VSWR_{max}$				
@ TX port	869... 894	MHz		—	1.9	2.3	
@ ANT port	869... 894	MHz		—	1.8	2.3	
Maximum error vector magnitude			EVM_{max} [3)]				
	871.4... 891.6	MHz		—	1.4	4.0	%
Minimum attenuation			α_{min}				
	824... 849	MHz		52	59	—	dB
	1574.4... 1576.4	MHz		45	58	—	dB
	1602.5... 1615.5	MHz		35	59	—	dB
	1710... 1788	MHz		40	59	—	dB
	1850... 1910	MHz		40	57	—	dB
	1920... 1980	MHz		40	55	—	dB
	2400... 2484	MHz		21	50	—	dB
	2607... 2682	MHz		21	47	—	dB
	3476... 3576	MHz		21	49	—	dB

1) See Sec. Matching circuit (p. 6).
2) Integrated over 5 MHz.
3) Error Vector Magnitude (EVM) based on definition in 3GPP TS 25.141.

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 with par. 8.7 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	—	836.5	—	MHz
Average insertion attenuation			$\alpha_{INT,avg}$ [2)]				
	824 ... 829	MHz		—	2.1	3.1	dB
	829 ... 844	MHz		—	1.8	3.1	dB
	844 ... 849	MHz		—	1.7	3.1	dB
Maximum insertion attenuation			α_{max}				
	824 ... 849	MHz		—	2.6	3.1[3)]	dB
Amplitude ripple (p-p)			$\Delta\alpha$				
	824 ... 849	MHz		—	1.3	1.8[4)]	dB
Maximum VSWR			$VSWR_{max}$				
@ ANT port	824 ... 849	MHz		—	1.9	2.3[5)]	
@ RX port	824 ... 849	MHz		—	2.0	2.3[5)]	
Maximum error vector magnitude			EVM_{max} [6)]				
	826.4 ... 846.6	MHz		—	3.0	4.5	%
Minimum attenuation			α_{min}				
	869 ... 894	MHz		50	57	—	dB
	1648 ... 1698	MHz		25	51	—	dB
	1840 ... 1870	MHz		25	48	—	dB
	1930 ... 1990	MHz		25	46	—	dB
	2110 ... 2170	MHz		25	45	—	dB
	2400 ... 2484	MHz		25	42	—	dB
	2472 ... 2547	MHz		25	41	—	dB
	3296 ... 3396	MHz		20	39	—	dB

1) See Sec. Matching circuit (p. 6).
2) Integrated over 5 MHz.
3) Specification for ILmax is 3.2dB for −20 °C ... +85 °C.
4) Specification for AR is 1.9dB for −20 °C ... +85 °C.
5) Specification for VSWR is 2.4 for −20 °C ... +85 °C.
6) Error Vector Magnitude (EVM) based on definition in 3GPP TS 25.141.

SAW components B8013

SAW duplexer 836.5 / 881.5 MHz

Data sheet

Temperature range for specification	T_{SPEC}	= −40 °C ... +95 °C
TX terminating impedance	Z_{TX}	= 50 Ω
ANT terminating impedance	Z_{ANT}	= 50 Ω with par. 8.7 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	—	836.5	—	MHz
Average insertion attenuation			$\alpha_{INT,avg}$ [2)]				
	824 ... 829	MHz		—	2.1	3.8	dB
	829 ... 844	MHz		—	1.8	3.8	dB
	844 ... 849	MHz		—	1.7	3.8	dB
Maximum insertion attenuation			α_{max}				
	824 ... 849	MHz		—	2.6	3.8	dB
Amplitude ripple (p-p)			$\Delta\alpha$				
	824 ... 849	MHz		—	1.3	2.5	dB
Maximum VSWR			$VSWR_{max}$				
@ ANT port	824 ... 849	MHz		—	1.9	2.5	
@ RX port	824 ... 849	MHz		—	2.0	2.5	
Maximum error vector magnitude			EVM_{max} [3)]				
	826.4 ... 849	MHz		—	3.0	5.0	%
Minimum attenuation			α_{min}				
	869 ... 894	MHz		50	55	—	dB
	1648 ... 1698	MHz		25	51	—	dB
	1840 ... 1870	MHz		25	48	—	dB
	1930 ... 1990	MHz		25	46	—	dB
	2110 ... 2170	MHz		25	45	—	dB
	2400 ... 2484	MHz		25	42	—	dB
	2472 ... 2547	MHz		25	41	—	dB
	3296 ... 3396	MHz		20	39	—	dB

1) See Sec. Matching circuit (p. 6).
2) Integrated over 5 MHz.
3) Error Vector Magnitude (EVM) based on definition in 3GPP TS 25.141.

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 with par. 8.7 nH[1)]
RX terminating impedance	Z_{RX}	= 50 Ω

Characteristics TX – RX				**min.** for T_{SPEC}	**typ.** @ +25 °C	**max.** for T_{SPEC}	
Average isolation			$\alpha_{INT,avg}$ [2)]				
	824... 849	MHz		52	58	—	dB
	869... 894	MHz		53	61	—	dB
Minimum isolation			α_{min}				
	824... 849	MHz		52	58	—	dB
	869... 894	MHz		53	56	—	dB

1) See Sec. Matching circuit (p. 6).
2) Integrated over 5 MHz.

Data sheet

Temperature range for specification	T_{SPEC}	= −40 °C ... +95 °C
TX terminating impedance	Z_{TX}	= 50 Ω
ANT terminating impedance	Z_{ANT}	= 50 Ω with par. 8.7 nH[1)]
RX terminating impedance	Z_{RX}	= 50 Ω

Characteristics TX – RX				**min.** for T_{SPEC}	**typ.** @ +25 °C	**max.** for T_{SPEC}	
Average isolation			$\alpha_{INT,avg}$ [2)]				
	824... 849	MHz		52	58	—	dB
	869... 894	MHz		52	61	—	dB
Minimum isolation			α_{min}				
	824... 849	MHz		52	56	—	dB
	869... 894	MHz		52	56	—	dB

1) See Sec. Matching circuit (p. 6).
2) Integrated over 5 MHz.

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)] = 100 V	Machine model.
	V_{ESD} [4)] = 250 V	Human body model.
Input power	P_{IN}	
@ TX port: 871.5 ... 891.5 MHz	28 dBm [5), 6)]	5 MHz LTE downlink signal for 100000 h @ 55 °C. P_{IN} 28 dBm average - 39 dBm peak. Source and load impedance 50 Ω.
@ TX port: other frequency ranges	10 dBm	Source and load impedance 50Ω.
Operating lifetime with output power at antenna @ ANT port: 871.5 ... 891.5 MHz	P_{OUT} [7)] = 24 dBm	Continuous wave for 100000 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 tests, 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 55°C.
7) According to accelerated high temperature operating life (HTOL) test.

8 Transmission coefficients

8.1 TX – ANT

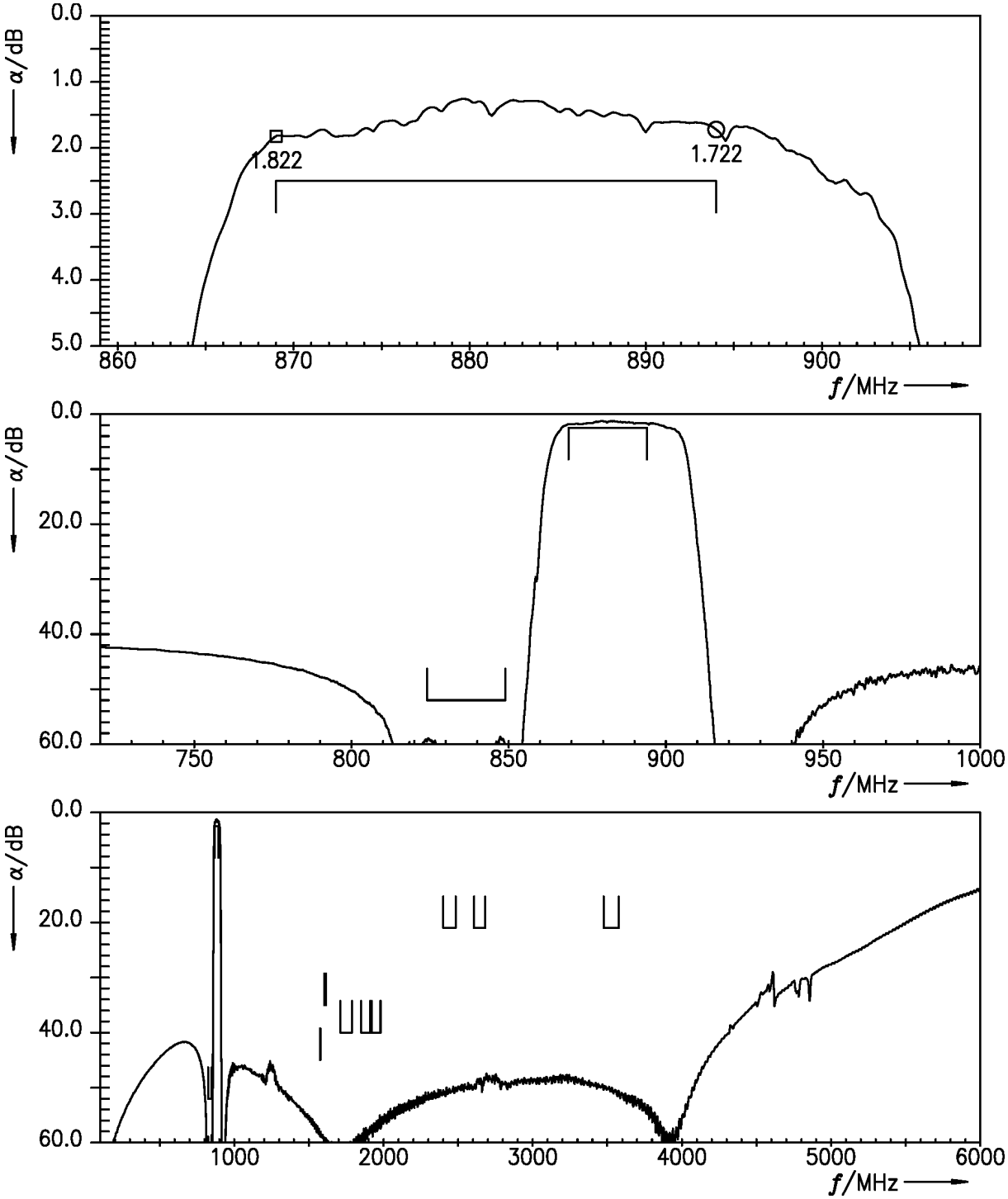

Figure 4: Attenuation TX – ANT.

8.2 ANT – RX

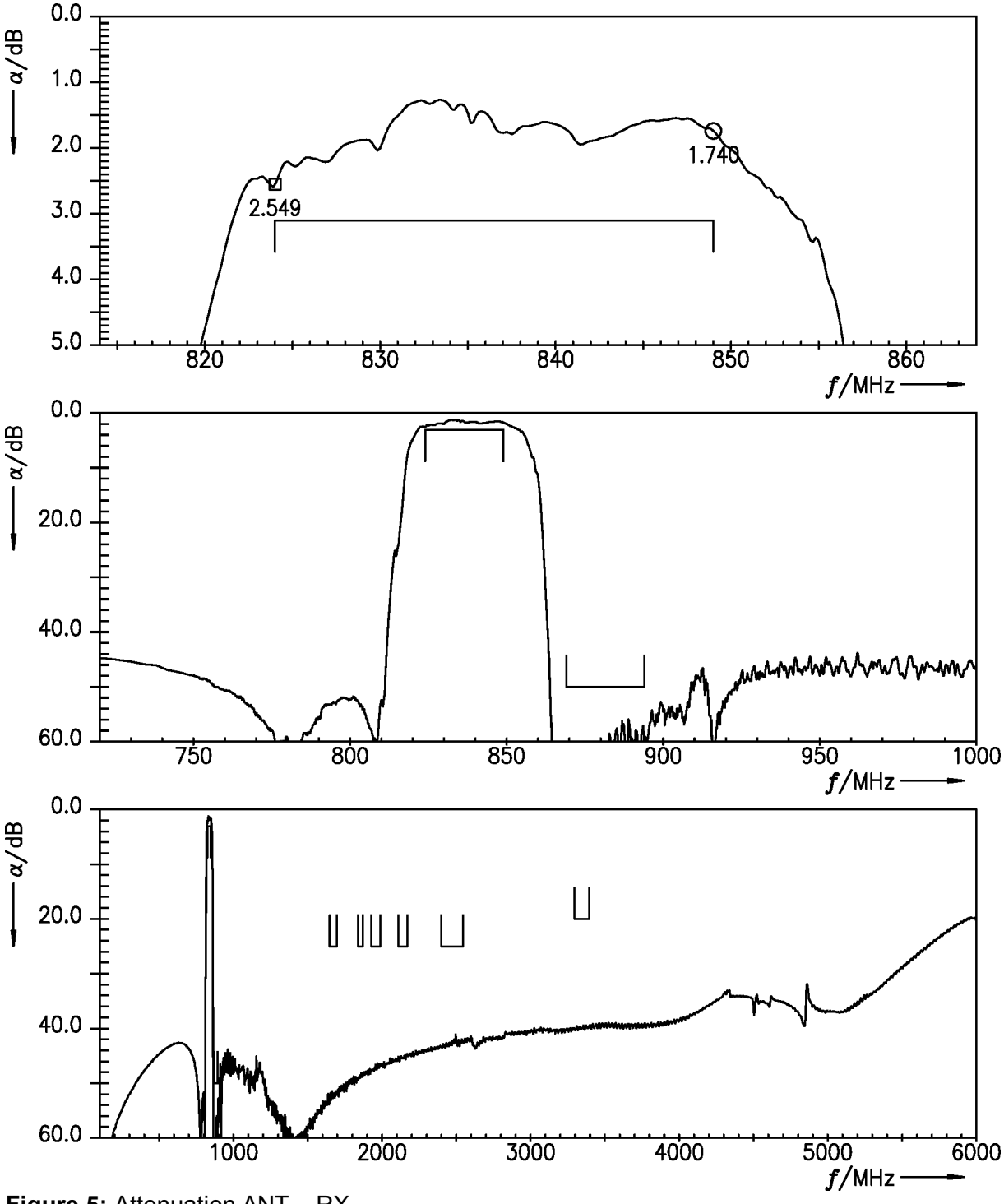

Figure 5: Attenuation ANT – RX.

8.3 TX – RX

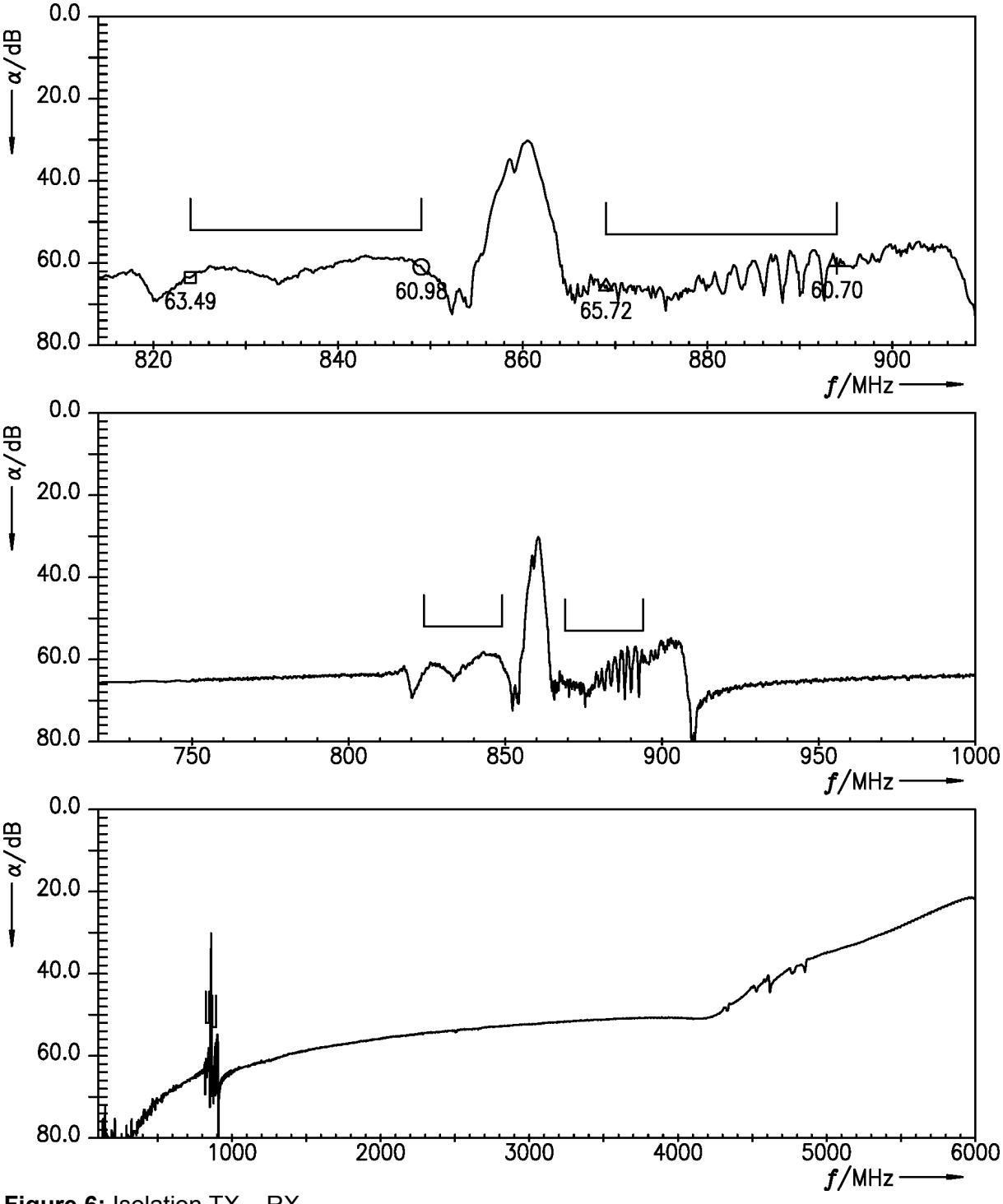

Figure 6: Isolation TX – RX.

9 Reflection coefficients

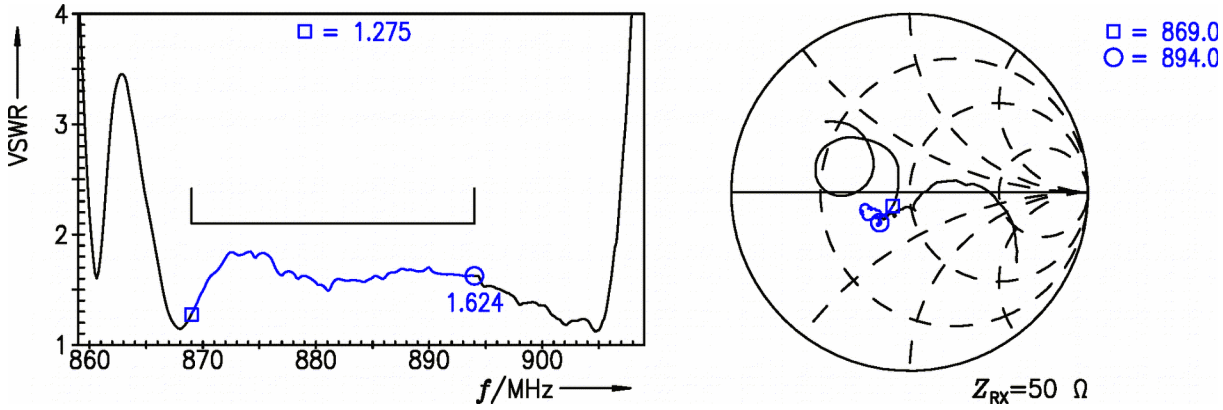

Figure 7: Reflection coefficient at TX port.

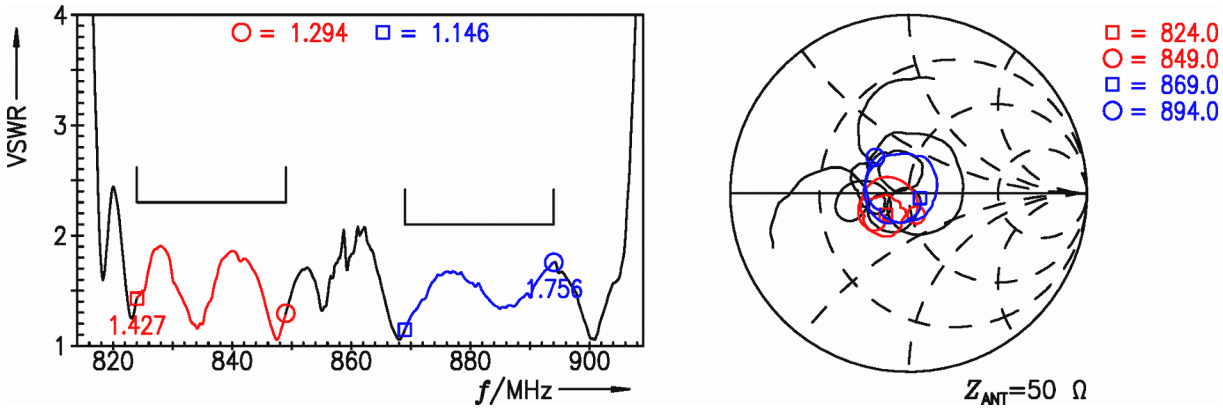

Figure 8: Reflection coefficient at ANT port.

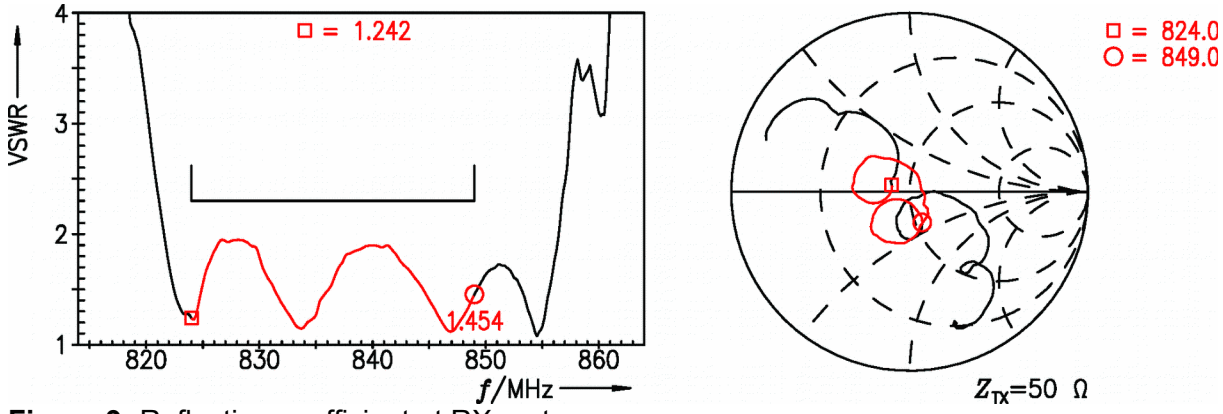

Figure 9: Reflection coefficient at RX port.

10 EVMs

10.1 TX – ANT

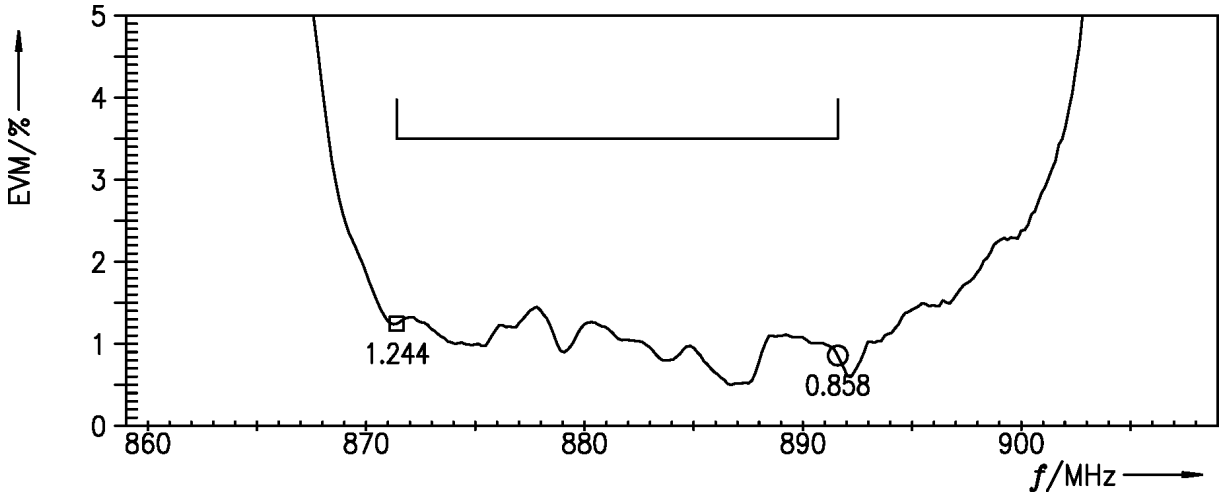

Figure 10: Error vector magnitude TX – ANT.

10.2 ANT – RX

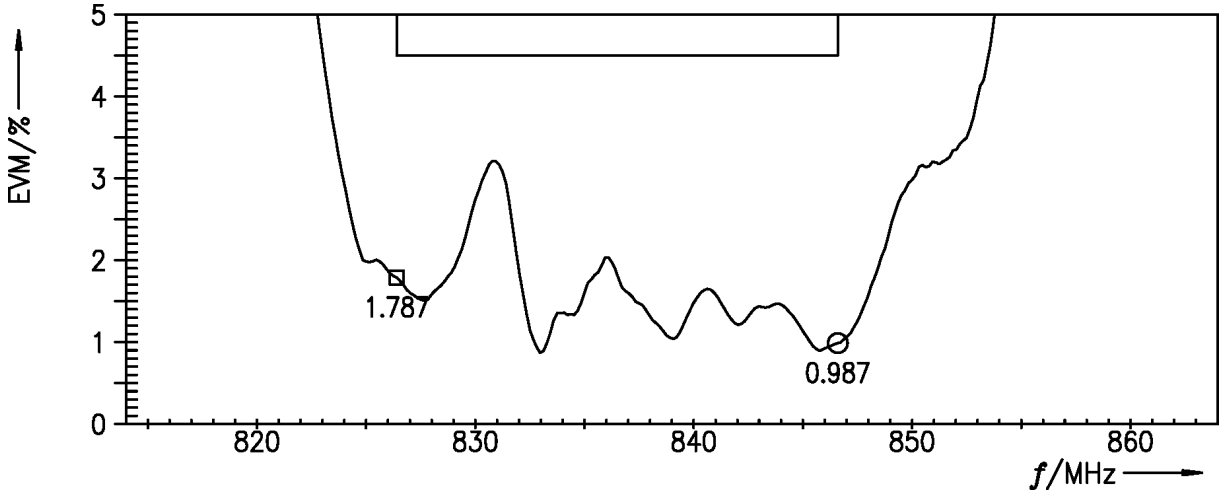

Figure 11: Error vector magnitude ANT – RX.

11 Packing material

11.1 Tape

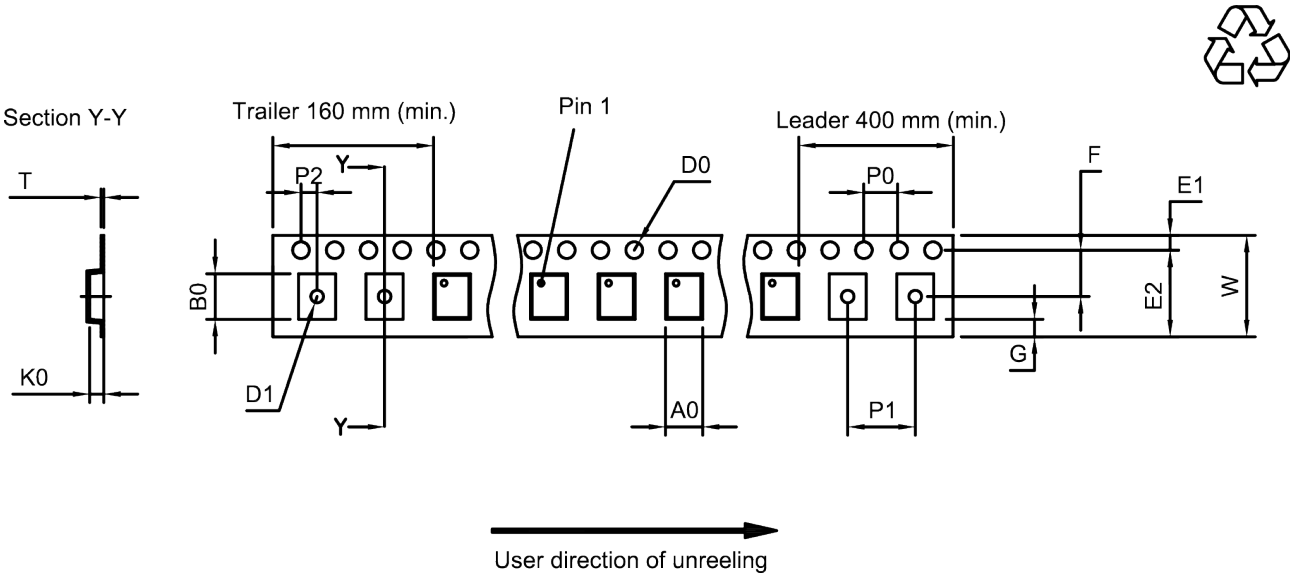

Figure 12: Drawing of tape (first-angle projection) with tape dimensions according to Table 1.

A_0	2.25±0.05 mm
B_0	2.75±0.05 mm
D_0	1.5+0.1/−0 mm
D_1	1.0 mm (min.)
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	0.6±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±0.03 mm
W	8.0+0.3/−0.1 mm

Table 1: Tape dimensions.

11.2 Reel with diameter of 180 mm

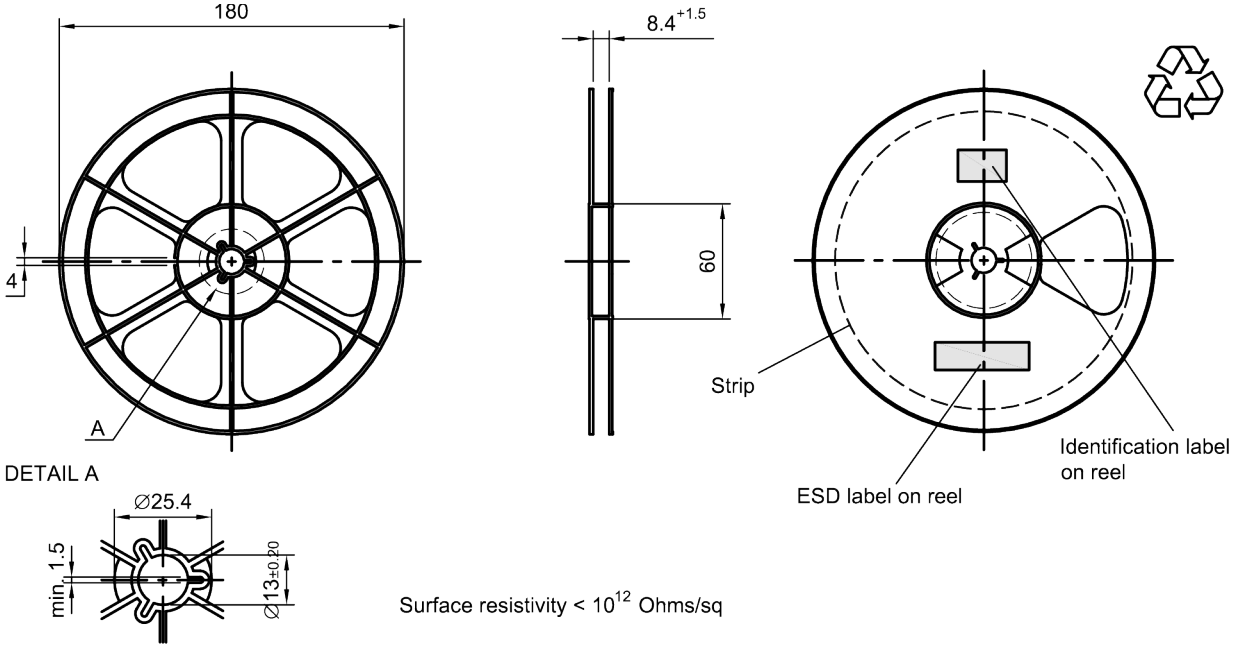

Figure 13: Drawing of reel (first-angle projection) with diameter of 180 mm.

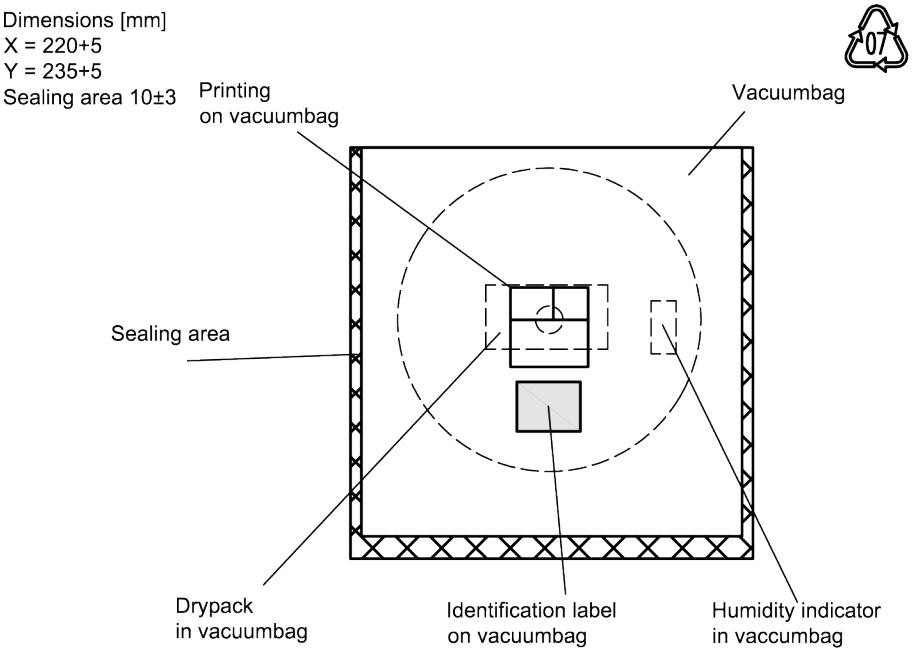

Figure 14: Drawing of moisture barrier bag (MBB) for reel with diameter of 180 mm.

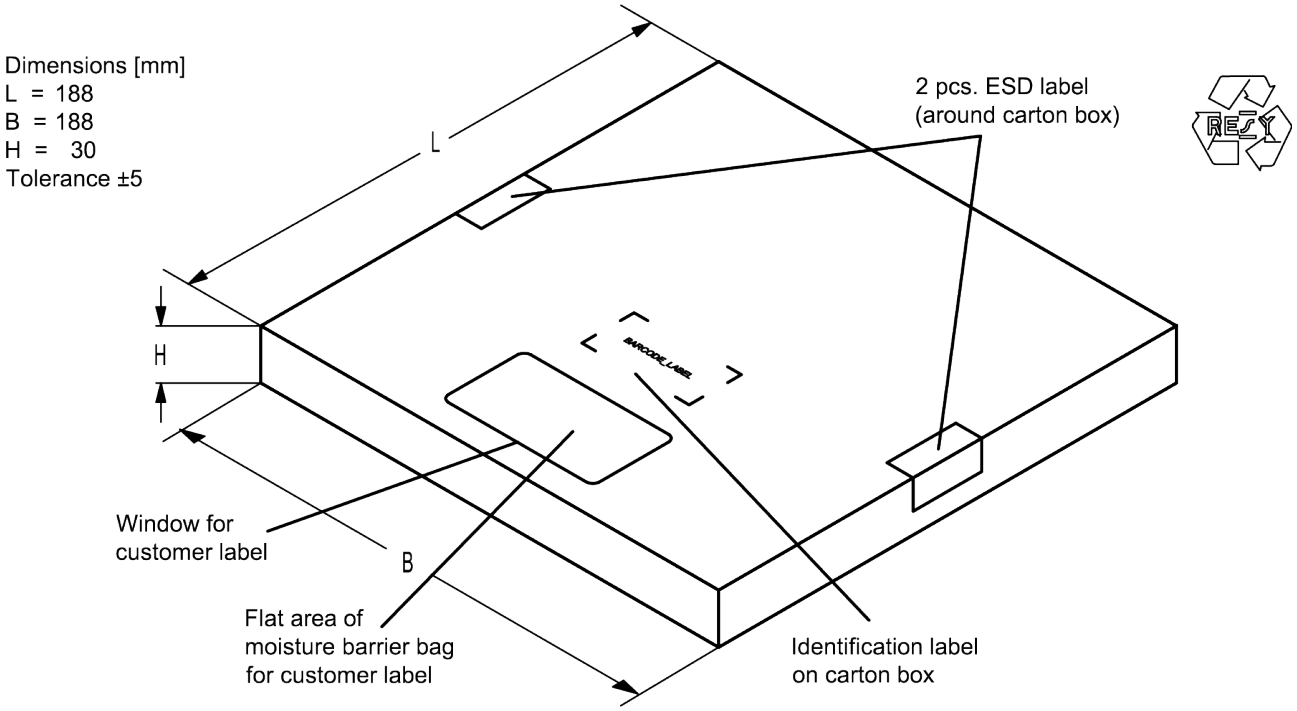

Figure 15: Drawing of folding box for reel with diameter of 180 mm.

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 B8013 is 7TD.

- 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).

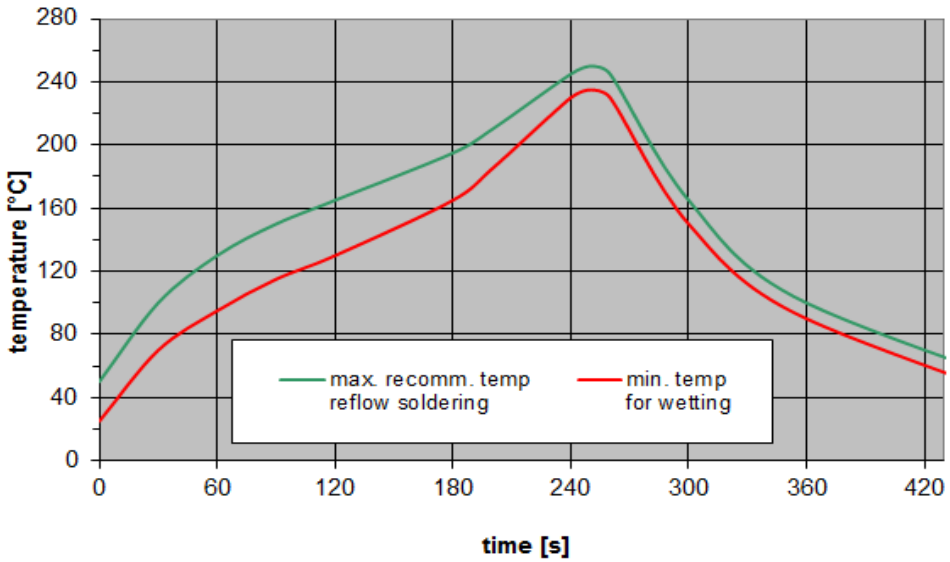

Figure 16: Recommended reflow profile for convection and infrared soldering – lead-free solder.

14 Annotations

14.1 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.

14.2 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.

14.3 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.

14.4 Ordering codes and packing units

Ordering code	Packing unit
B39881B8013P810	5000 pcs

Table 4: Ordering codes and packing units.