Qualcomm

RF360
Europe GmbH

Data sheet

Micro-acoustic triplexer
WiFi 2G / GNSS L1 / WiFi 5-7G

Part number:	B8972
Ordering code:	B39552B8972L210
Date:	December 20, 2022
Version:	2.1

DCN: 80-PA243-715 Rev. B

RF360 Europe GmbH
Anzinger Straße 13
81671 Munich, Germany

Table of contents

1 Application

- Premium-performance GNSS L1 / WiFi 2G / WiFi 5-7G Triplexer with single ended 50 Ω ports.
- Ultra-low-loss acoustic structure.
- Using common antenna for GNSS L1, WiFi 2G and WiFi 5-7G bands.
- Usable GNSS L1 pass bands: 1559.05 MHz – 1563.15 MHz (BeiDou), 1574.39 MHz – 1576.45 MHz (GPS), 1597.55 MHz – 1605.89 MHz (Glonass).
- Usable WiFi 2G pass band: 2403.1 – 2480.9 MHz.
- Usable WiFi 5-7G pass band: 5150 – 7125 MHz.
- No switches and control lines required.

2 Features

- Package size 1.8 mm × 1.4 mm
- Package height 0.54 mm
- Approximate weight 4 mg
- RoHS compatible
- Package for Surface Mount Technology (SMT)
- Ni/Au-plated terminals
- Electrostatic Sensitive Device (ESD)
- Moisture Sensitivity Level 3 (MSL3)

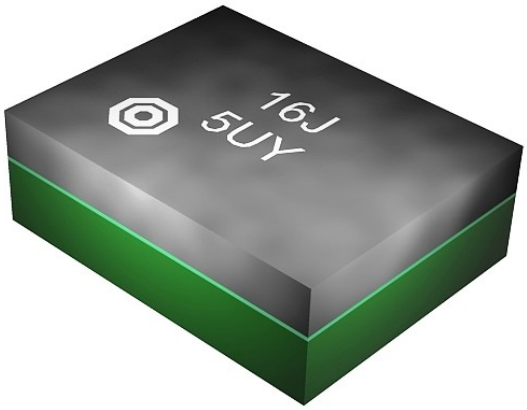

Figure 1: Picture of component with example of product marking.

3 Package

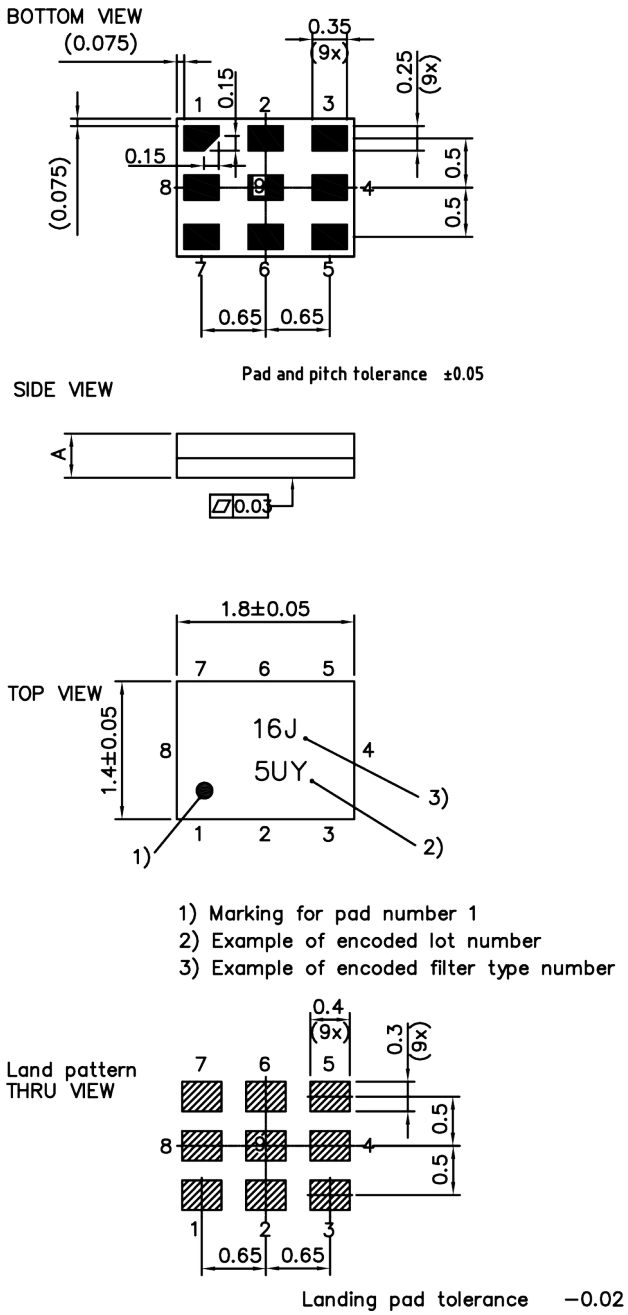

Figure 2: Drawing of package with package height A = 0.64 mm (max.). See Sec. Package information (p. 31).

4 Pin configuration

- 2 WiFi 2G
- 4 WiFi 5-7G
- 6 ANT
- 8 GNSS L1
- 1, 3, 5, 7, 9 Ground

5 Matching circuit

- C_{p2b} = 1.0 pF
- C_{p4a} = 0.2 pF
- L_{p2a} = 8.2 nH
- L_{s4b} = 0.7 nH
- L_{s6} = 0.5 nH

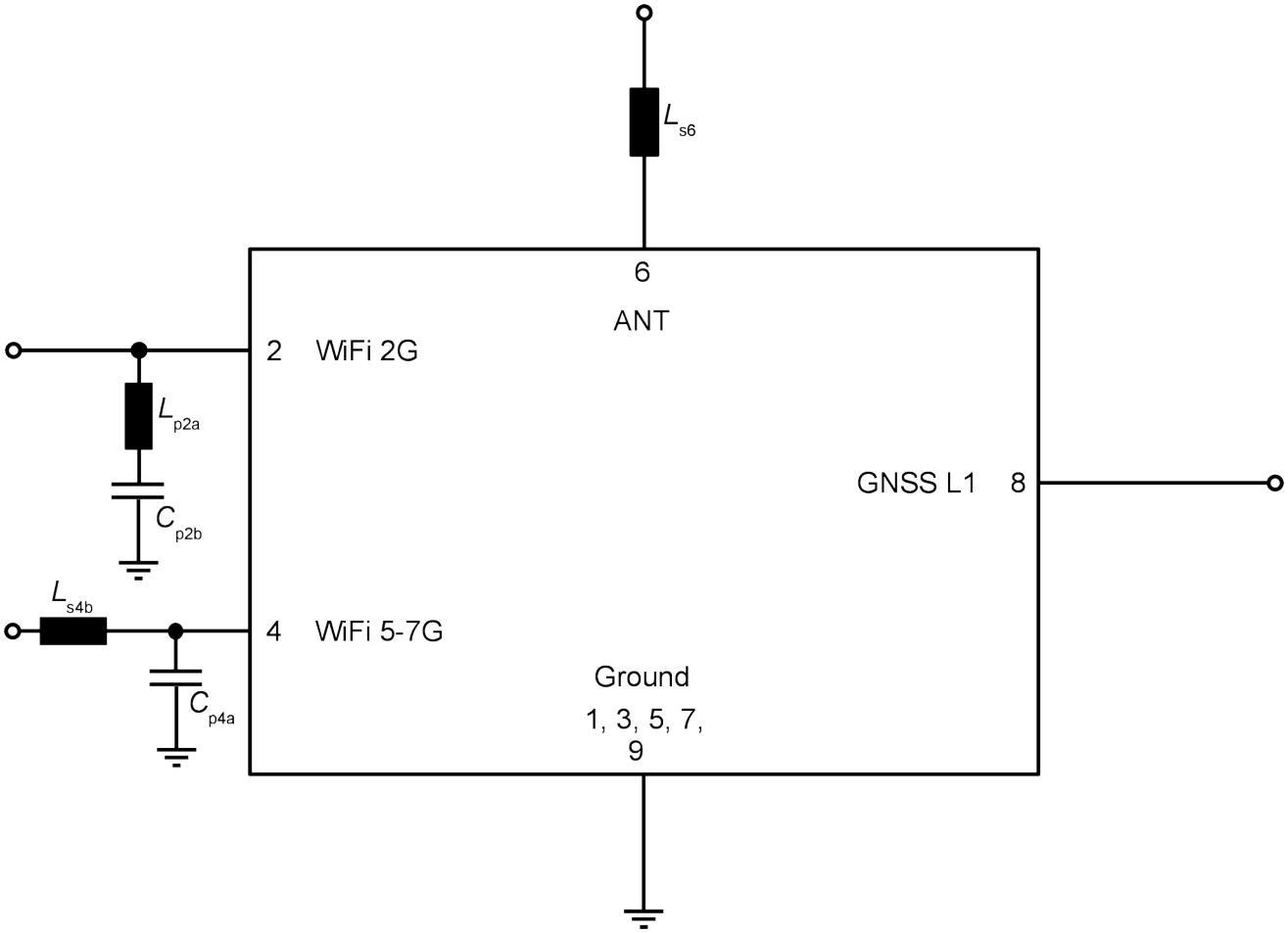

Figure 3: Schematic of matching circuit.

6 Characteristics ANT – WiFi 2G

Temperature range for specification T_{SPEC} = −30 °C ... +85 °C
ANT terminating impedance Z_{ANT} = 50 Ω + 0.5 nH[1)]
WiFi 2G terminating impedance $Z_{WiFi\ 2G}$ = 50 Ω with ext. circuitry.[1)]

Characteristics ANT – WiFi 2G				min. for T_{SPEC}	typ. @ +25 °C	max. for T_{SPEC}	
Insertion loss			α				
Channel 1	2403.1 ... 2420.9	MHz		—	1.9[2)]	2.4[2)]	dB
	2403.1 ... 2420.9	MHz		—	2.3	3.4	dB
Channel 2	2408.1 ... 2425.9	MHz		—	1.8[2)]	2.4[2)]	dB
	2408.1 ... 2425.9	MHz		—	2.0	2.7	dB
Channel 3 – 6	2413.1 ... 2445.9	MHz		—	1.7[2)]	2.3[2)]	dB
	2413.1 ... 2445.9	MHz		—	1.8	2.4	dB
Channel 7 – 8	2433.1 ... 2455.9	MHz		—	1.7[2)]	2.3[2)]	dB
	2433.1 ... 2455.9	MHz		—	1.7	2.5	dB
Channel 9	2443.1 ... 2460.9	MHz		—	1.7[2)]	2.3[2)]	dB
	2443.1 ... 2460.9	MHz		—	1.7	2.6	dB
Channel 10	2448.1 ... 2465.9	MHz		—	1.8[2)]	2.4[2)]	dB
	2448.1 ... 2465.9	MHz		—	1.9	2.7	dB
Channel 11	2453.1 ... 2470.9	MHz		—	1.8[2)]	2.6[2)]	dB
	2453.1 ... 2470.9	MHz		—	2.0	2.8[3)]	dB
	2453.1 ... 2470.9	MHz		—	2.0	3.1	dB
Channel 12	2458.1 ... 2475.9	MHz		—	1.9[2)]	3.0[2)]	dB
	2458.1 ... 2475.9	MHz		—	2.1	3.1[3)]	dB
	2458.1 ... 2475.9	MHz		—	2.1	3.7	dB
Channel 13	2463.1 ... 2480.9	MHz		—	2.0[2)]	3.6[2)]	dB
	2463.1 ... 2480.9	MHz		—	2.3	3.7[3)]	dB
	2463.1 ... 2480.9	MHz		—	2.3	7.0	dB
VSWR							
@ ANT port	2403.1 ... 2480.9	MHz		—	1.4	2.7	
@ WiFi 2G port	2403.1 ... 2480.9	MHz		—	1.3	2.4	
Attenuation			α				
	100 ... 617	MHz		40	45	—	dB
	617 ... 960	MHz		35	40	—	dB
	1427 ... 1511	MHz		37	43	—	dB
	1559.052 ... 1605.89	MHz		38	43	—	dB
	1710 ... 2025	MHz		30	36	—	dB
	2110 ... 2300	MHz		32	37	—	dB
	2300 ... 2370	MHz		32[3), 4)]	37[4)]	—	dB
	2300 ... 2370	MHz		30[3)]	37	—	dB
	2500 ... 2510	MHz		20[4), 5)]	29[4)]	—	dB
	2500 ... 2510	MHz		15[5)]	23	—	dB
	2510 ... 2550	MHz		40[5)]	47	—	dB

Characteristics ANT – WiFi 2G			min. for T_{SPEC}	typ. @ +25 °C	max. for T_{SPEC}	
	2550... 2620	MHz	40	46	—	dB
	2620... 2690	MHz	38	42	—	dB
	3300... 3800	MHz	30	35	—	dB
	4804... 4963	MHz	28	34	—	dB
	5150... 5925	MHz	30	35	—	dB
	5925... 7125	MHz	30	38	—	dB

1) See Sec. Matching circuit (p. 6).
2) Averaged value within each Wifi channel width of 17.8 MHz.
3) @+25°C.
4) Averaged values of linear S-parameter over any 5 MHz.
5) From +25°C to +85°C.

7 Characteristics ANT – GNSS L1

Temperature range for specification T_{SPEC} = −30 °C ... +85 °C
ANT terminating impedance Z_{ANT} = 50 Ω + 0.5 nH[1)]
GNSS L1 terminating impedance $Z_{GNSS\ L1}$ = 50 Ω

Characteristics ANT – GNSS L1			min. for T_{SPEC}	typ. @ +25 °C	max. for T_{SPEC}	
Insertion loss		α				
	1559.052... 1563.144	MHz	—	1.3	3.2	dB
	1574.42... 1576.42	MHz	—	1.2	1.5	dB
	1597.55... 1605.89	MHz	—	1.6	2.5	dB
VSWR						
@ ANT port	1559.052... 1563.144	MHz	—	1.2	2.6	
	1574.42... 1576.42	MHz	—	1.3	1.8	
	1597.55... 1605.89	MHz	—	1.2	1.8	
@ GNSS L1 port	1559.052... 1563.144	MHz	—	1.2	2.6	
	1574.42... 1576.42	MHz	—	1.1	1.8	
	1597.55... 1605.89	MHz	—	1.1	1.8	
Attenuation		α				
	100... 617	MHz	47	53	—	dB
	617... 787	MHz	45	50	—	dB
	787... 960	MHz	43	49	—	dB
	1427.9... 1462.9	MHz	31	37	—	dB
	1710... 1990	MHz	33	39	—	dB
	1990... 2025	MHz	40	47	—	dB
	2110... 2200	MHz	32	39	—	dB
	2300... 2400	MHz	35	41	—	dB
	2401.5... 2480.9	MHz	35	41	—	dB
	2500... 2690	MHz	40	49	—	dB
	3300... 3800	MHz	38	45	—	dB
	3800... 4200	MHz	43	50	—	dB
	4200... 5925	MHz	42	48	—	dB
	5925... 7125	MHz	40	49	—	dB

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

8 Characteristics ANT – WiFi 5-7G

Temperature range for specification T_{SPEC} = −30 °C ... +85 °C
ANT terminating impedance Z_{ANT} = 50 Ω + 0.5 nH[1)]
WiFi 5-7G terminating impedance $Z_{WiFi\ 5\text{-}7G}$ = 50 Ω with ext. circuitry.[1)]

Characteristics ANT – WiFi 5-7G				min. for T_{SPEC}	typ. @ +25 °C	max. for T_{SPEC}	
Insertion loss			α				
	5150 ... 5925	MHz		—	0.9	1.5	dB
	5925 ... 7125	MHz		—	1.1	1.8	dB
VSWR							
@ ANT port	5150 ... 5925	MHz		—	1.3	1.8	
	5925 ... 7125	MHz		—	1.4	2.1	
@ WiFi 5-7G port	5150 ... 5925	MHz		—	1.4	1.8	
	5925 ... 7125	MHz		—	1.3	2.1	
Attenuation			α				
	100 ... 617	MHz		50	55	—	dB
	617 ... 960	MHz		38	43	—	dB
	1427 ... 1511	MHz		30	36	—	dB
	1559.052 ... 1605.89	MHz		32	38	—	dB
	1710 ... 2025	MHz		28	34	—	dB
	2110 ... 2200	MHz		35	41	—	dB
	2300 ... 2370	MHz		35	43	—	dB
	2403.1 ... 2480.9	MHz		30	40	—	dB
	2496 ... 2501	MHz		35	43	—	dB
	2500 ... 2510	MHz		36	46	—	dB
	2510 ... 2690	MHz		35	40	—	dB
	10300 ... 14250	MHz		20	28	—	dB
	15450 ... 21375	MHz		20	25	—	dB

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

9 Characteristics GNSS L1 – WiFi 2G

Temperature range for specification T_{SPEC} = −30 °C ... +85 °C
GNSS L1 terminating impedance $Z_{GNSS\ L1}$ = 50 Ω
WiFi 2G terminating impedance $Z_{WiFi\ 2G}$ = 50 Ω with ext. circuitry.[1)]

Characteristics GNSS L1 – WiFi 2G		**min.** for T_{SPEC}	**typ.** @ +25 °C	**max.** for T_{SPEC}	
Isolation	α				
1559.052... 1563.144 MHz		45	50	—	dB
1574.42... 1576.42 MHz		40	46	—	dB
1597.55... 1605.89 MHz		39	44	—	dB
2403.1... 2480.9 MHz		33	40	—	dB

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

10 Characteristics GNSS L1 – WiFi 5-7G

Temperature range for specification T_{SPEC} = −30 °C ... +85 °C
GNSS L1 terminating impedance $Z_{GNSS\ L1}$ = 50 Ω
WiFi 5-7G terminating impedance $Z_{WiFi\ 5\text{-}7G}$ = 50 Ω with ext. circuitry.[1)]

Characteristics GNSS L1 – WiFi 5-7G		**min.** for T_{SPEC}	**typ.** @ +25 °C	**max.** for T_{SPEC}	
Isolation	α				
1559.052... 1563.144 MHz		36	42	—	dB
1574.42... 1576.42 MHz		35	41	—	dB
1597.55... 1605.89 MHz		35	40	—	dB
5150... 7125 MHz		40	47	—	dB

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

11 Characteristics WiFi 2G – WiFi 5-7G

Temperature range for specification T_{SPEC} = −30 °C ... +85 °C
WiFi 2G terminating impedance $Z_{WiFi\ 2G}$ = 50 Ω with ext. circuitry.[1)]
WiFi 5-7G terminating impedance $Z_{WiFi\ 5\text{-}7G}$ = 50 Ω with ext. circuitry.[1)]

Characteristics WiFi 2G – WiFi 5-7G			min. for T_{SPEC}	typ. @ +25 °C	max. for T_{SPEC}	
Isolation	α					
	2403.1... 2480.9	MHz	30	36	—	dB
	5150... 7125	MHz	28	35	—	dB

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

12 Maximum ratings

Storage temperature	T_{STG} [3] = −40 °C ... +85 °C [1), 2)]	
DC voltage	$\|V_{DC}\|$ [4] = 5.0 V (max.)	
ESD voltage		
	V_{ESD} [5] = 100 V (max.)	Machine model.
	V_{ESD} [6] = 400 V (max.)	Human body model.
	V_{ESD} [7] = 700 V (max.)	Charged device model.
Input power	P_{IN}	
@ ANT port: 1574.42 ... 1576.42 MHz	15 dBm	Continuous wave for 5000 h @ -30...85 °C. CW signal.
@ WiFi 2G port: 2402 ... 2482 MHz	26 dBm	20 MHz WLAN signal for 5000 h @ 50 °C.

1) Extended upper limit: 96h@125°C acc. to IEC 60068-2-2 Bb.
2) Applicable only for components without tape and reel (unpacked).
3) Not valid for packaging material. Storage temperature for packaging material is −25 °C to +40 °C.
4) 168h Damp Heat Steady State acc. to IEC60068-2-67 Cy.
5) According to JESD22-A115B (MM – Machine Model), 10 negative & 10 positive pulses.
6) According to JESD22-A114F (HBM – Human Body Model), 1 negative & 1 positive pulse.
7) According to JESD22-C101C (CDM – Field Induced Charged Device Model), 3 negative & 3 positive pulses.

13 Transmission coefficient ANT – WiFi 2G

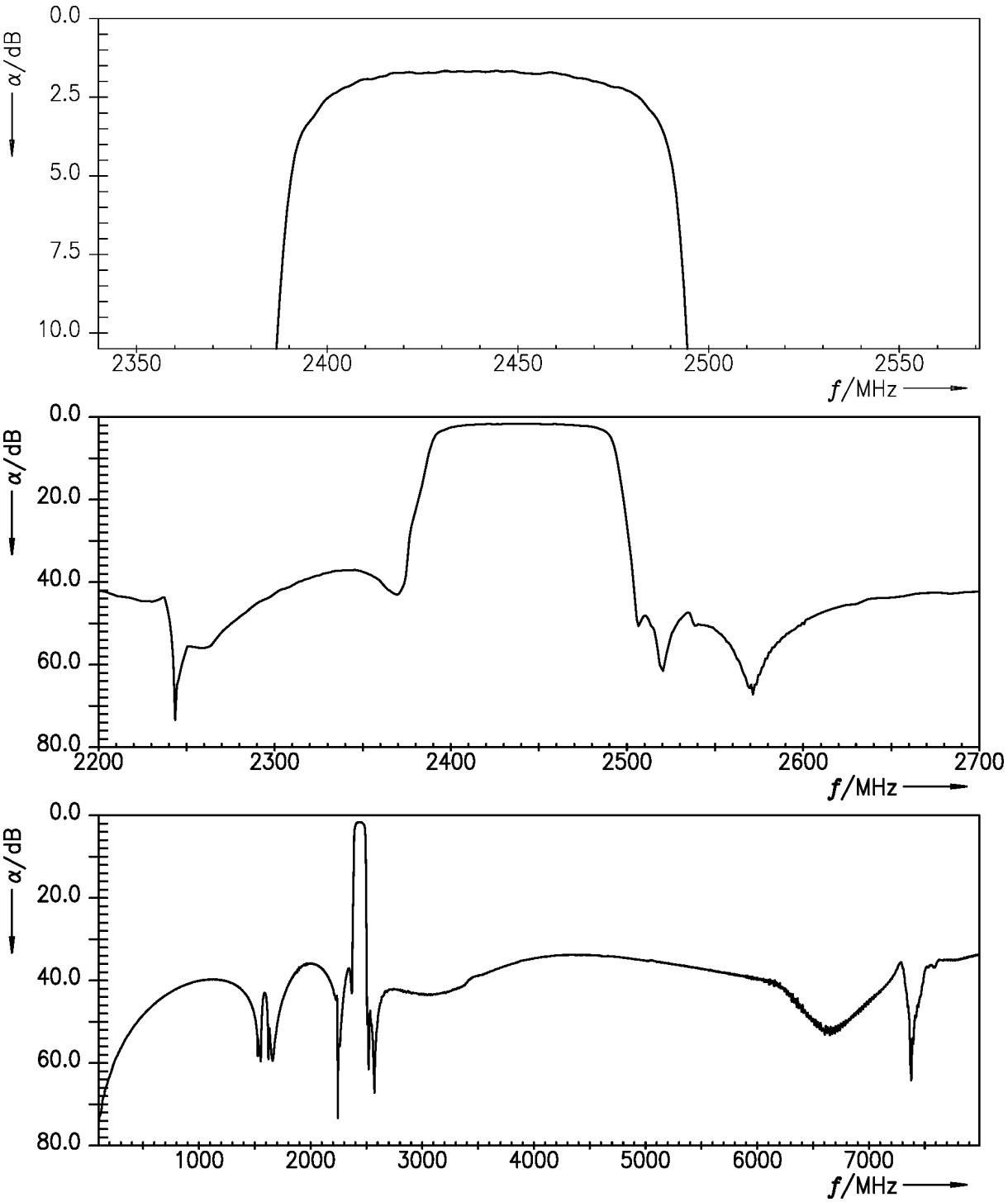

Figure 4: Attenuation ANT – WiFi 2G.

14 Reflection coefficients ANT – WiFi 2G

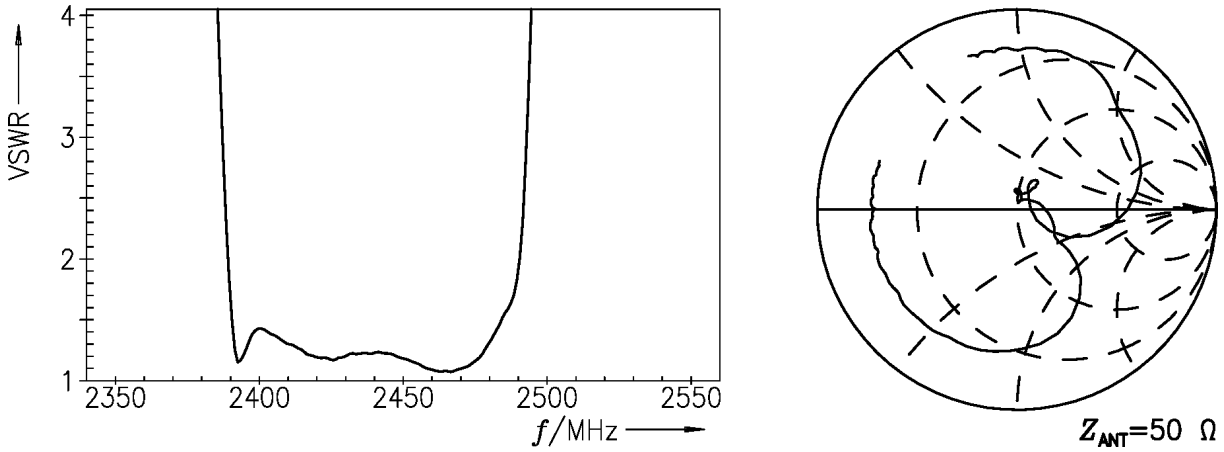

Figure 5: Reflection coefficient at ANT port (WiFi 2G frequencies).

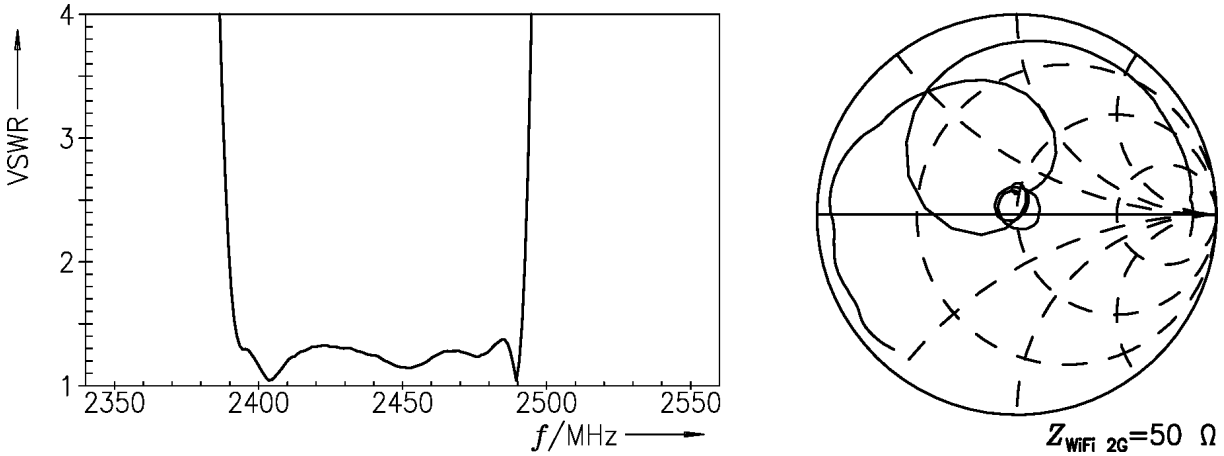

Figure 6: Reflection coefficient at WiFi 2G port.

15 Transmission coefficient ANT – GNSS L1

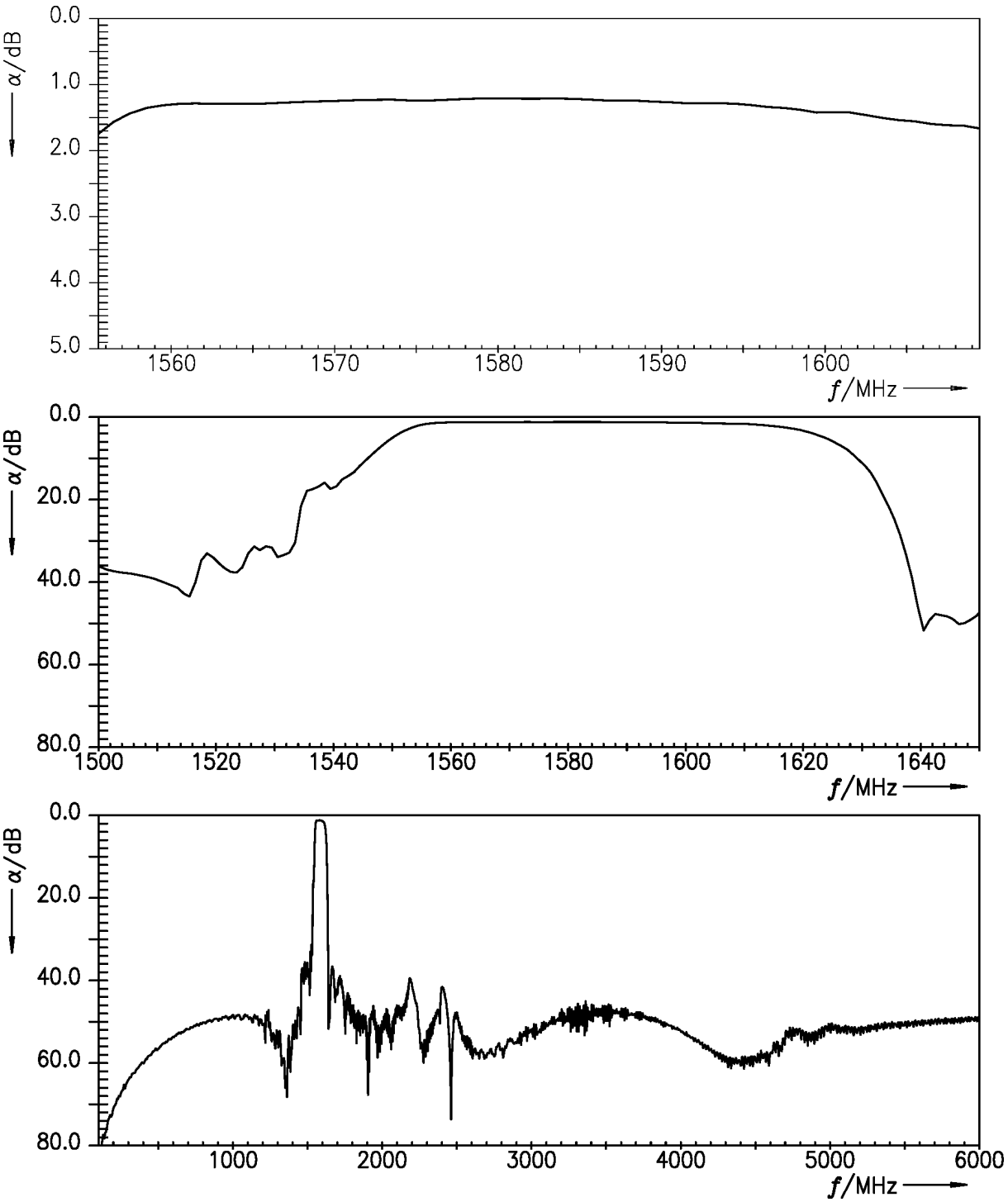

Figure 7: Attenuation ANT – GNSS L1.

16 Reflection coefficients ANT – GNSS L1

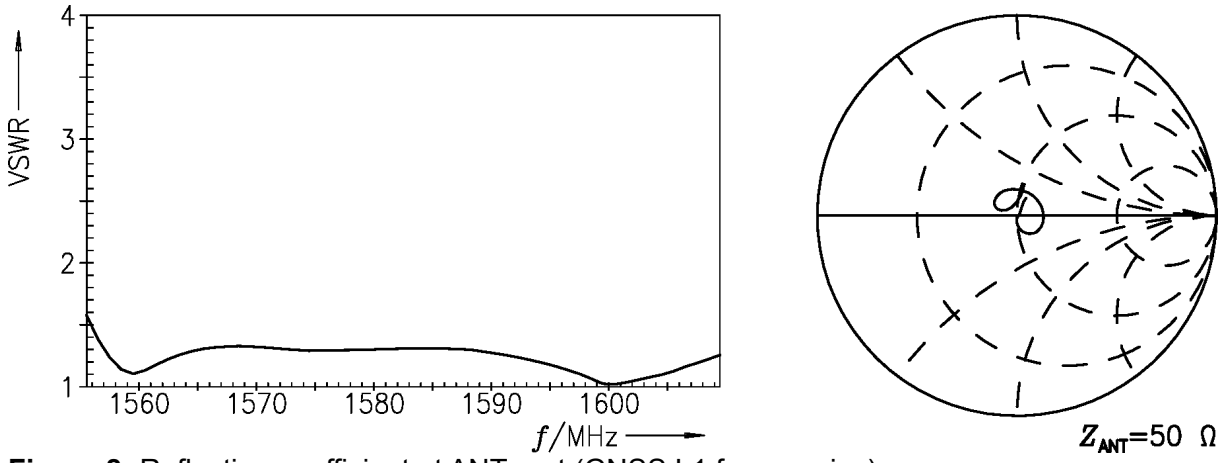

Figure 8: Reflection coefficient at ANT port (GNSS L1 frequencies).

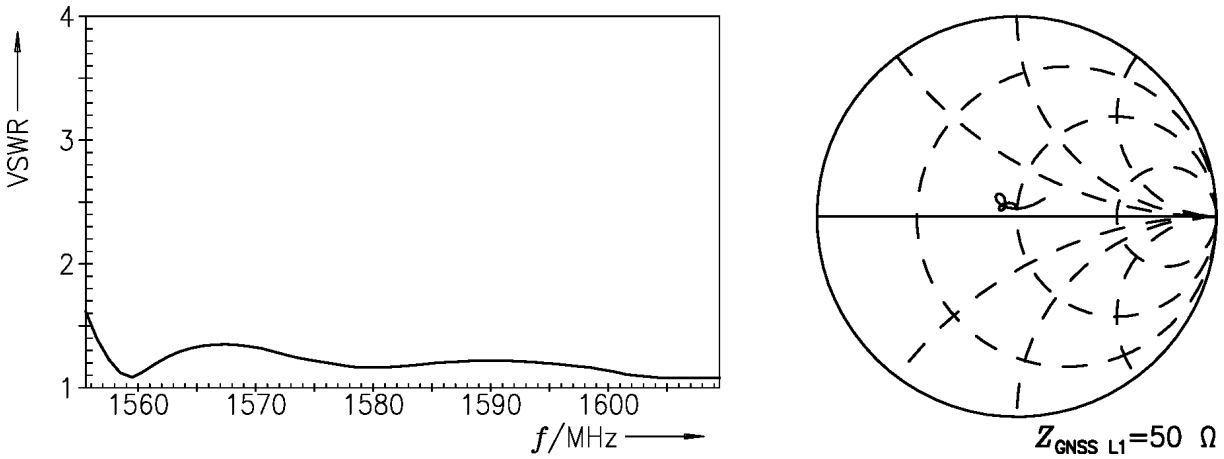

Figure 9: Reflection coefficient at GNSS L1 port.

17 Transmission coefficient ANT – WiFi 5-7G

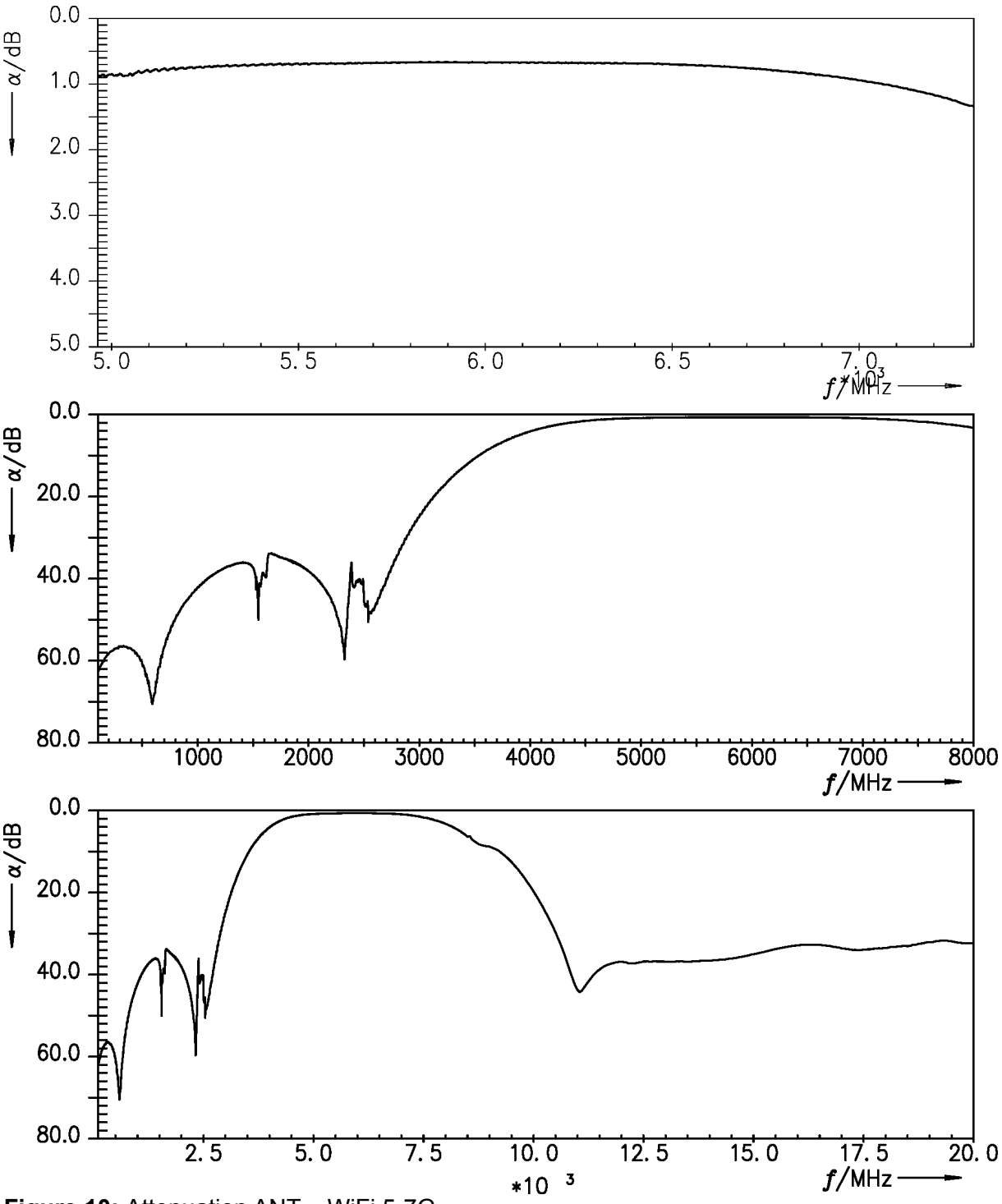

Figure 10: Attenuation ANT – WiFi 5-7G.

18 Reflection coefficients ANT – WiFi 5-7G

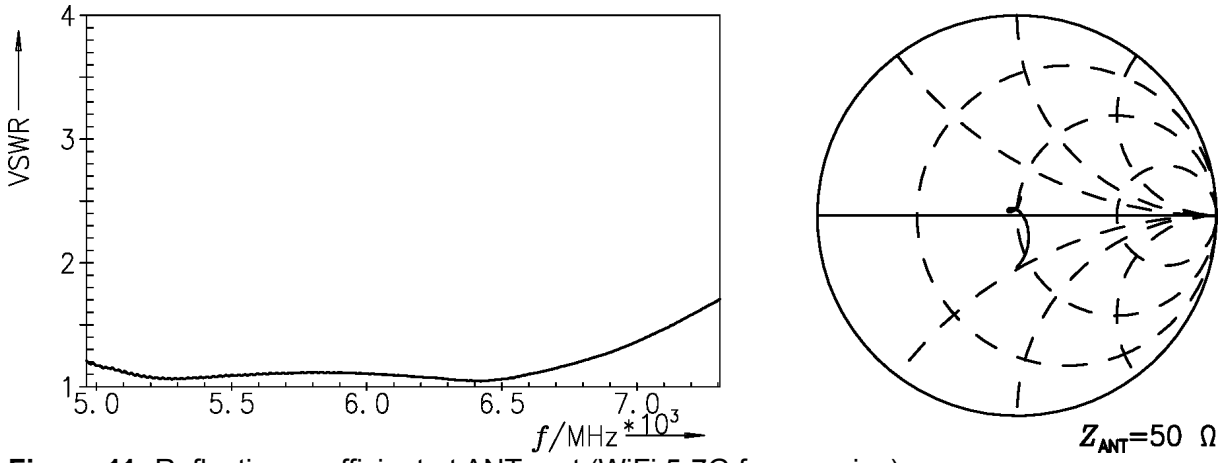

Figure 11: Reflection coefficient at ANT port (WiFi 5-7G frequencies).

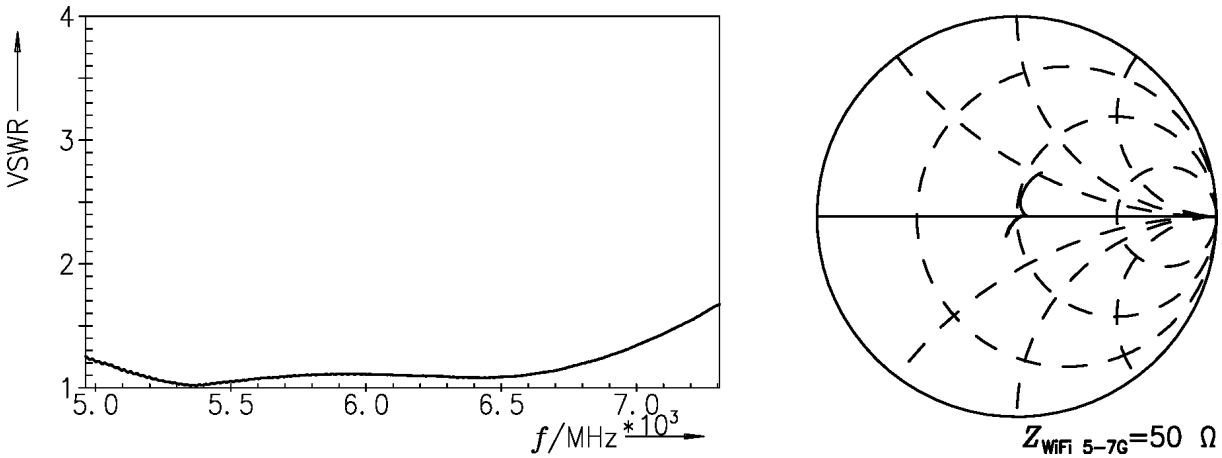

Figure 12: Reflection coefficient at WiFi 5-7G port.

19 Transmission coefficient GNSS L1 – WiFi 2G

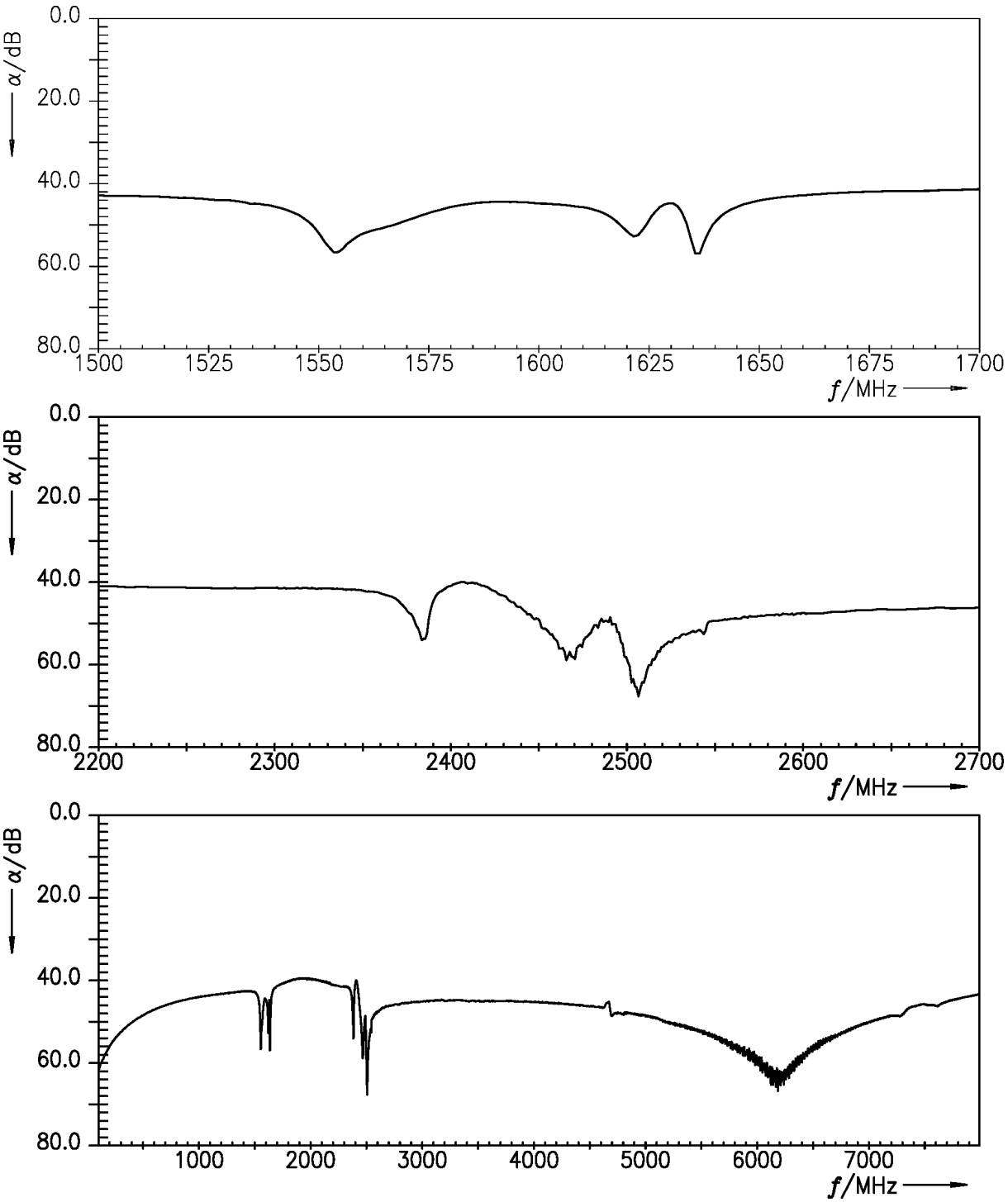

Figure 13: Cross-isolation GNSS L1 – WiFi 2G.

20 Transmission coefficient GNSS L1 – WiFi 5-7G

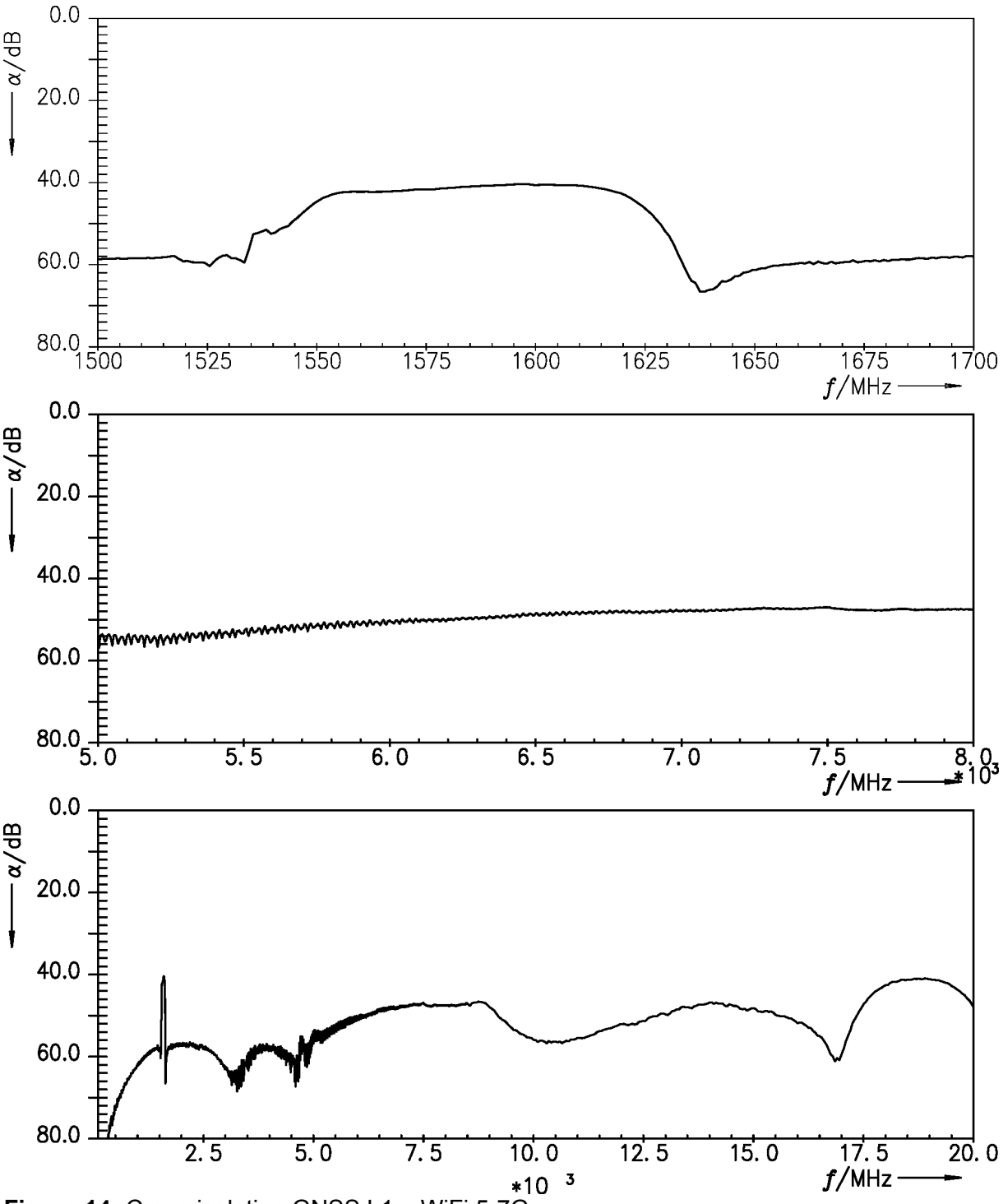

Figure 14: Cross-isolation GNSS L1 – WiFi 5-7G.

21 Transmission coefficient WiFi 2G – WiFi 5-7G

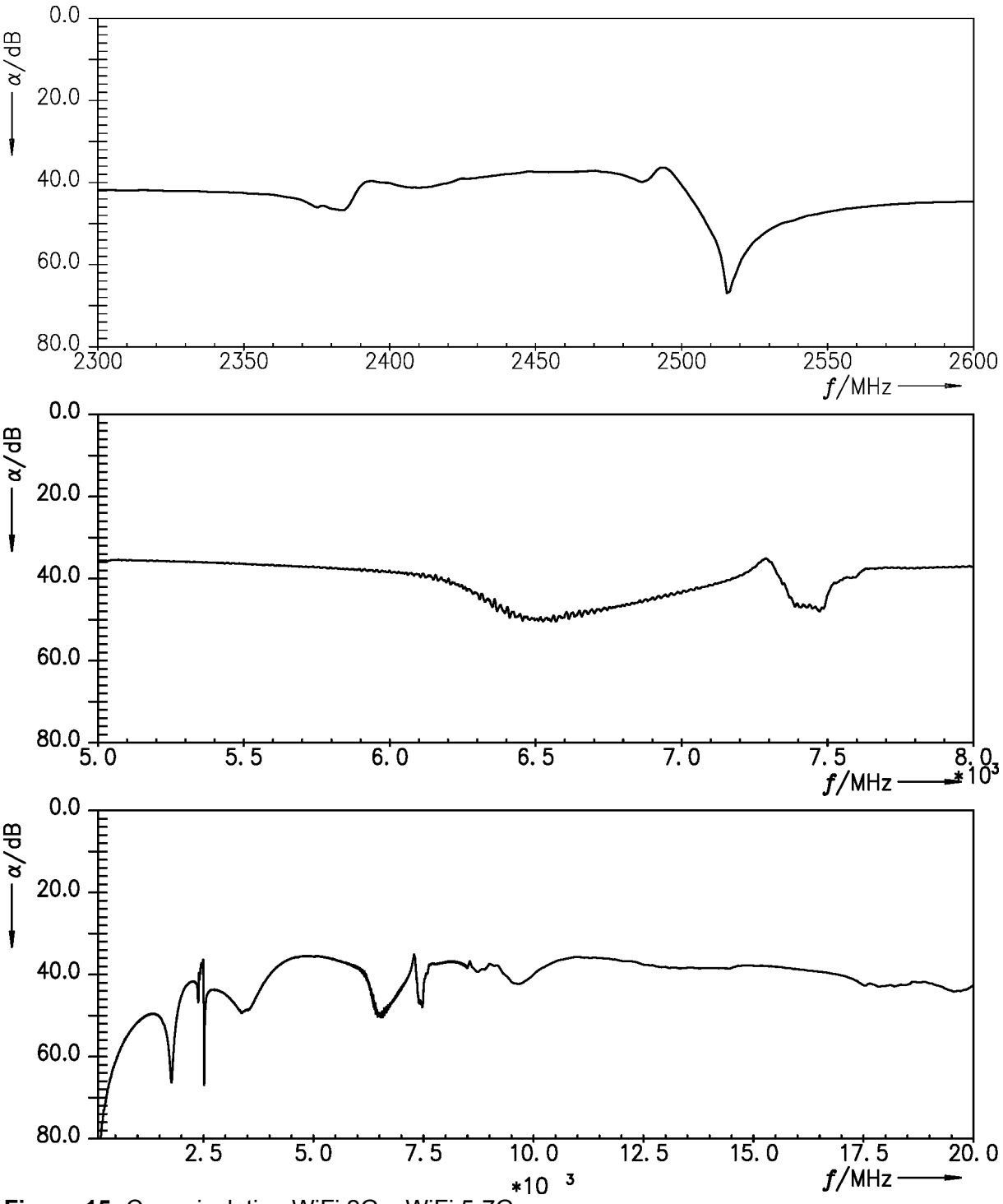

Figure 15: Cross-isolation WiFi 2G – WiFi 5-7G.

22 Packing material

22.1 Tape

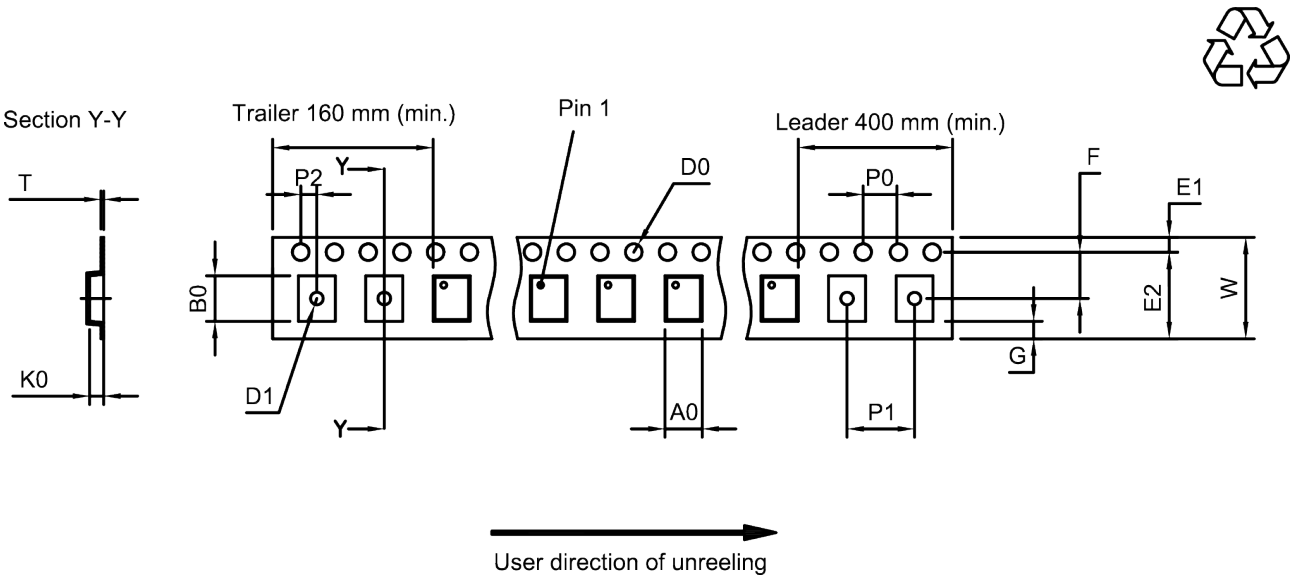

Figure 16: Drawing of tape (first-angle projection) for illustration only and not to scale. The valid tape dimensions are listed in Table 1.

A_0	$1.6_{\pm 0.05}$ mm
B_0	$2.0_{\pm 0.05}$ mm
D_0	$1.5^{+0.1/-0}$ mm
D_1	$0.8^{+0.1/-0}$ mm
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	$0.73_{\pm 0.05}$ 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.

22.2 Reel with diameter of 180 mm

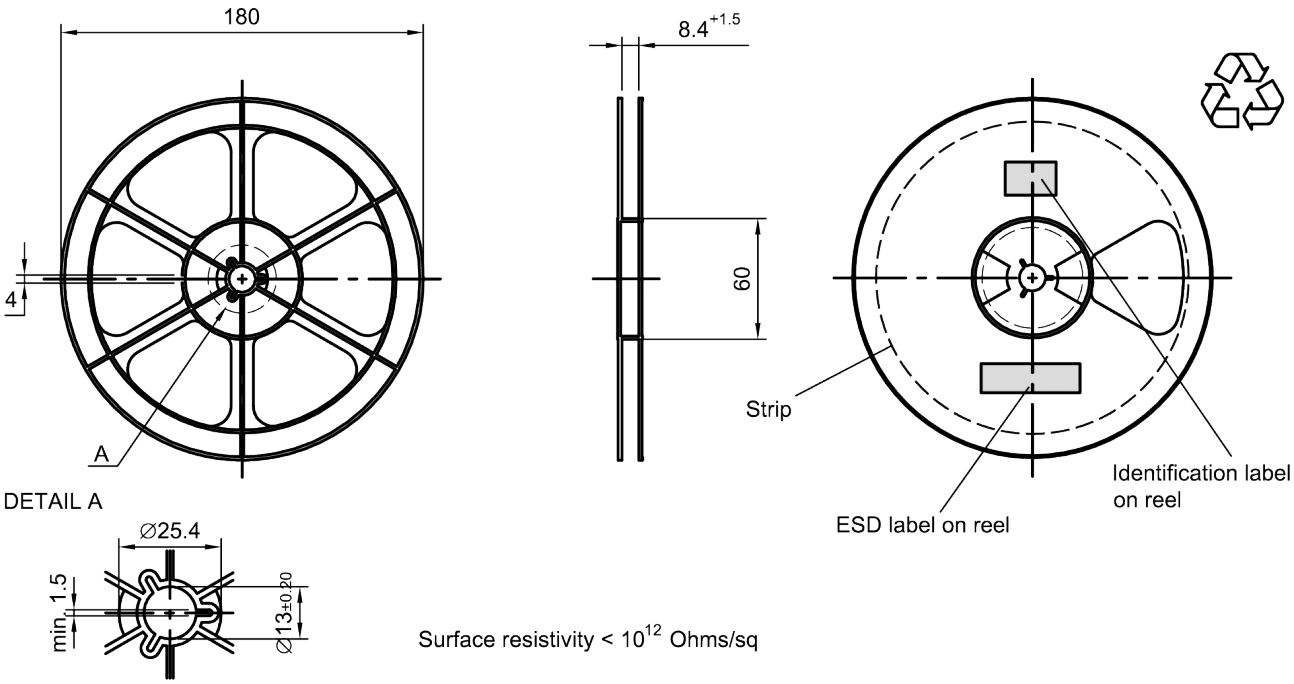

Figure 17: Drawing of reel (first-angle projection) with diameter of 180 mm.

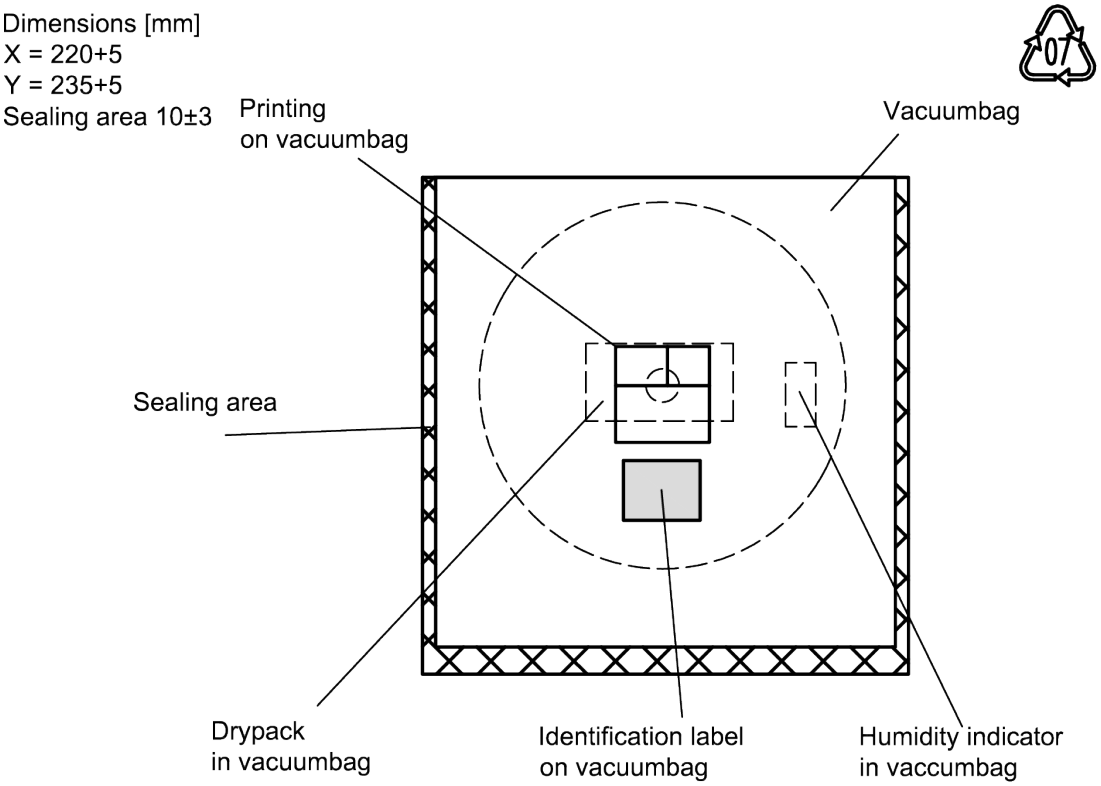

Figure 18: Drawing of moisture barrier bag (MBB) for reel with diameter of 180 mm.

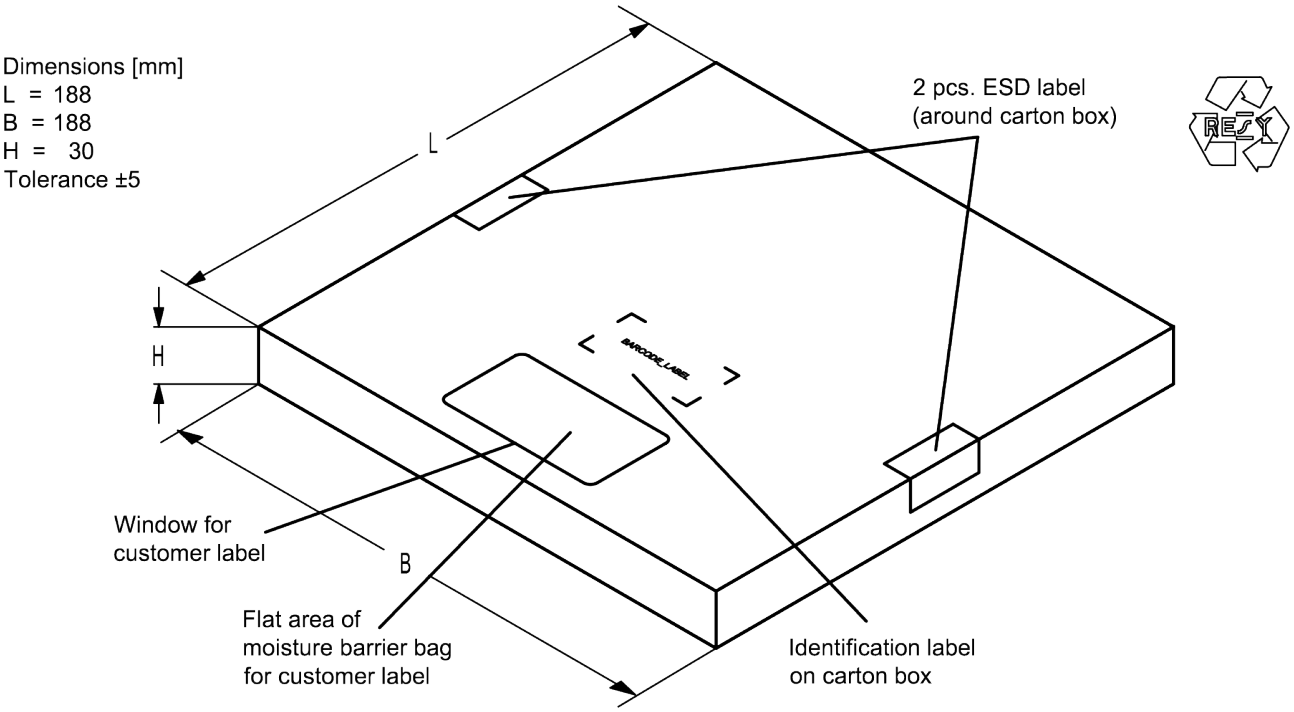

Figure 19: Drawing of folding box for reel with diameter of 180 mm.

22.3 Reel with diameter of 330 mm

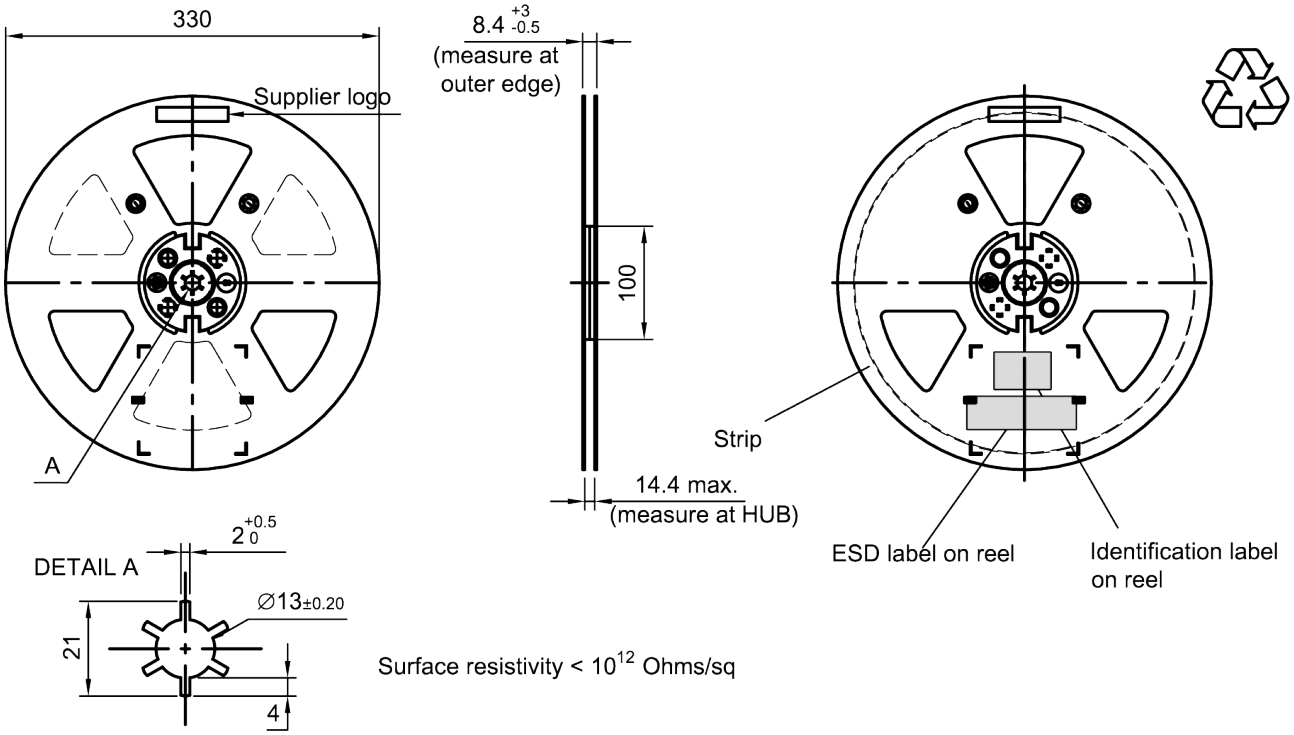

Figure 20: Drawing of reel (first-angle projection) with diameter of 330 mm.

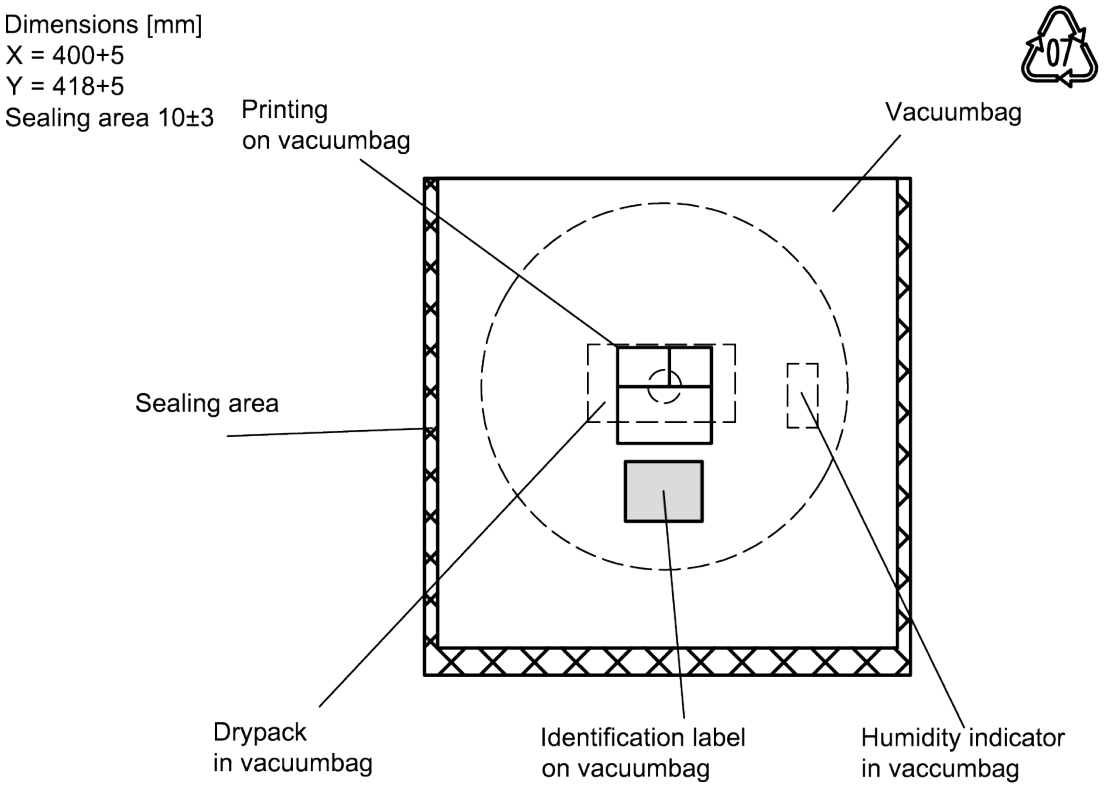

Figure 21: Drawing of moisture barrier bag (MBB) for reel with diameter of 330 mm.

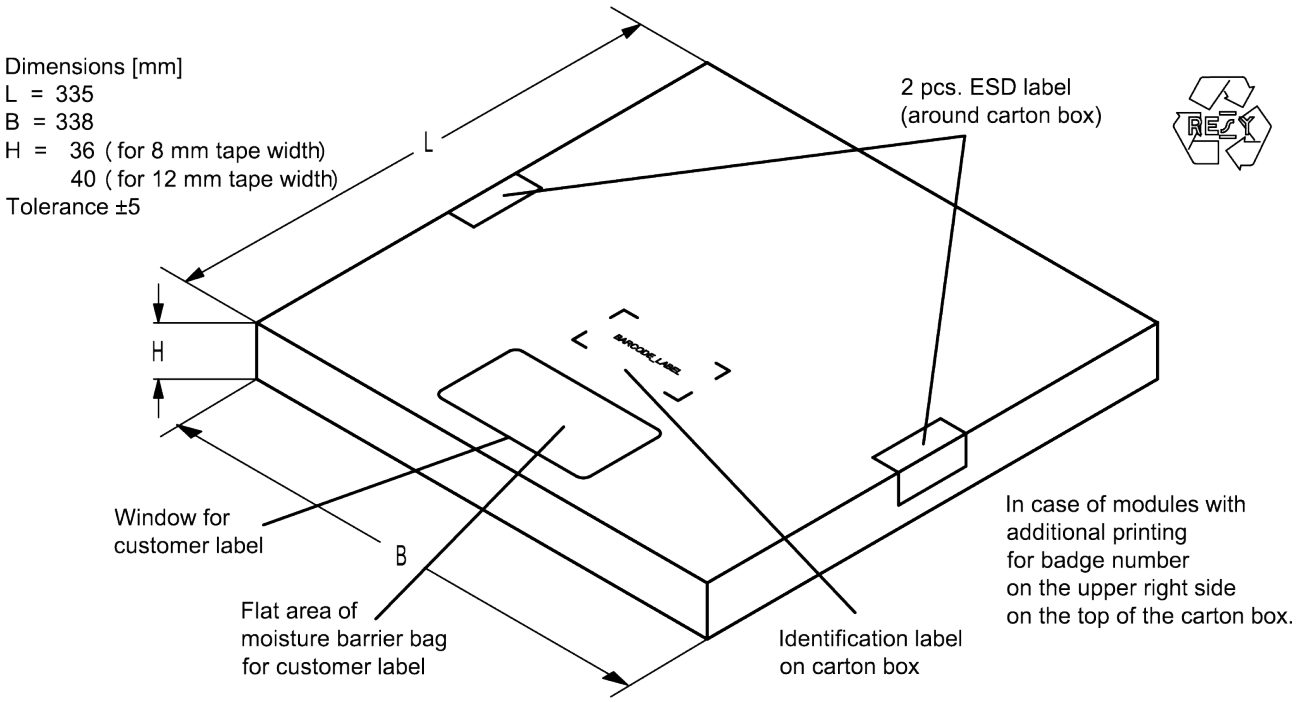

Figure 22: Drawing of folding box for reel with diameter of 330 mm.

23 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 B8972 is 8RC.

- 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.

24 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).

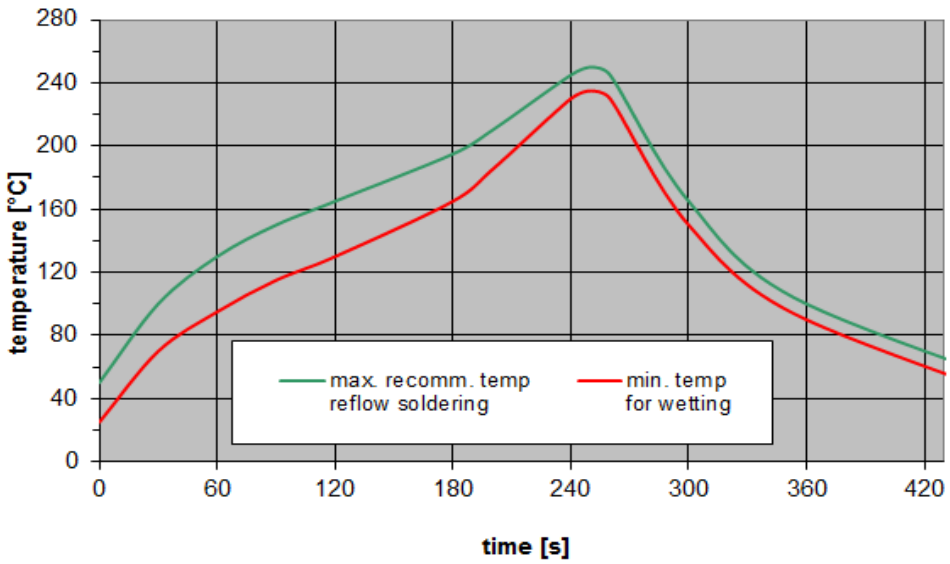

Figure 23: Recommended reflow profile for convection and infrared soldering – lead-free solder.

25 Annotations

25.1 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.

25.2 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.

25.3 Ordering codes, product IDs, labels, and packing units

Ordering code	Product ID	RF360 label	Packing unit
B39552B8972L210	B39552-B8972-L210-S05	B39552B8972L210S 5	5000 pcs
	B39552-B8972-L210-W05	B39552B8972L210W 5	5000 pcs

Table 4: Ordering codes / product IDs and packing units. Shipment will come from either Singapore or Wuxi location.

26 Cautions and warnings

26.1 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/.

26.2 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.

26.3 Moldability

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

26.4 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.

27 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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