

RF360 Europe GmbH
A Qualcomm – TDK Joint Venture

SAW components

Micro-acoustic dual extractor
GNSS / WLAN 2G

Series/type:	AE53G
Ordering code:	B39242B8909L210
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Preliminary data sheet

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1 Application

- High-performance WLAN/GNSS DoubleExtractor with single ended 50 Ω ports.
- Ultra-low-loss acoustic structure.
- Advanced highly-integrated multiplexer structure (no external matching needed).
- Using common antenna for WLAN, GNSS and Cellular bands.
- Placed between antenna and cellular front-end switches and filters.
- Usable GNSS pass bands: 1559.05 – 1563.144 MHz, 1574.42 – 1576.42 MHz, 1597.55 – 1605.89 MHz.
- Usable WLAN pass bands: 2402 – 2481.5 MHz.
- Usable CELL pass bands: 1452 – 1496 MHz, 1710 – 2690 MHz.
- No switches and control lines required.

2 Features

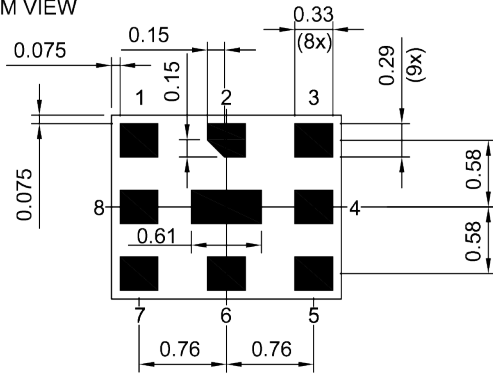
- Package size 2.0 mm × 1.6 mm
- Package height 0.6 mm
- Approximate weight 4 mg
- RoHS compatible
- Package for Surface Mount Technology (SMT)
- Ni/Au-plated terminals
- Electrostatic Sensitive Device (ESD)
- Moisture Sensitivity Level 3 (MSL3)

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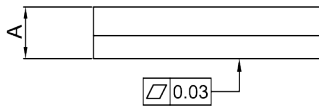
3 Package

BOTTOM VIEW

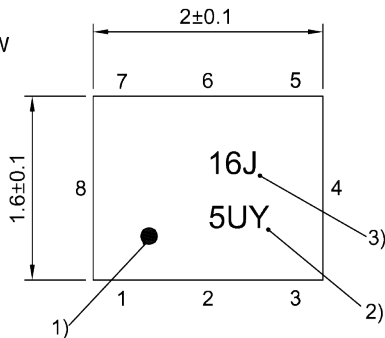


Pad and pitch tolerance ±0.03
 Pad to package edge tolerance ±0.055

SIDE VIEW

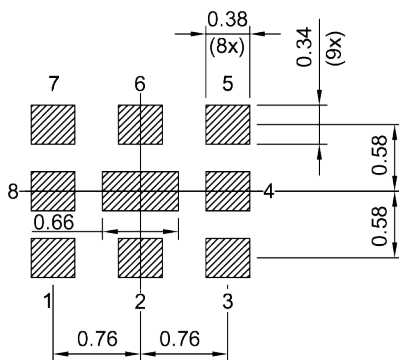


TOP VIEW



- 1) Marking for pad number 1
- 2) Example of encoded lot number
- 3) Example of encoded filter type number

Land pattern THRU VIEW



Landing pad tolerance -0.02

4 Pin configuration

- 1 ANT
- 3 CELL
- 5 GNSS
- 7 WLAN
- 2, 4, 6, 8, 9 Ground

Figure 1: Drawing of package with package height A = 0.6±0.1 mm. See Sec. Package information (p. 29).

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5 Matching circuit

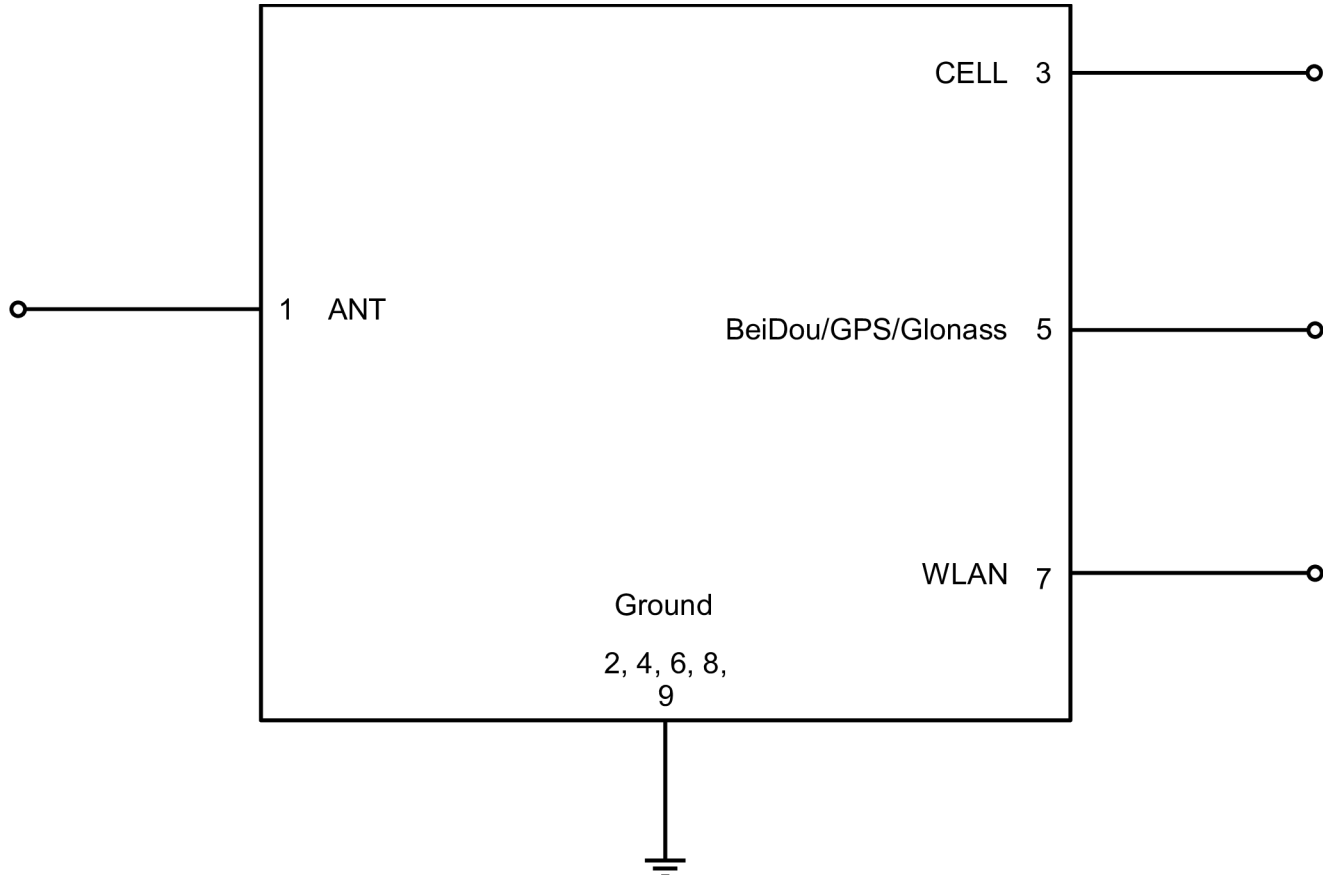


Figure 2: Schematic of matching circuit. No external matching components required.

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6 Characteristics ANT-GNSS

Temperature range for specification	T_{SPEC}	= -20 °C ... +85 °C
ANT terminating impedance	Z_{ANT}	= 50 Ω
GNSS terminating impedance	Z_{GNSS}	= 50 Ω
WLAN terminating impedance	Z_{WLAN}	= 50 Ω

Characteristics ANT-GNSS		min. for T_{SPEC}	typ. @ +25 °C	max. for T_{SPEC}	
Maximum insertion attenuation					
BEIDOU	1559.05... 1563.144 MHz	—	1.2	2.5 ¹⁾	dB
	1559.05... 1563.144 MHz	—	1.2	3.0	
GPS	1574.42... 1576.42 MHz	—	0.9	1.4 ¹⁾	dB
	1574.42... 1576.42 MHz	—	0.9	1.5	
GLONASS	1597.55... 1605.89 MHz	—	1.1	2.5 ¹⁾	dB
	1597.55... 1605.89 MHz	—	1.1	4.0	
Maximum VSWR					
@ ANT port	1559.05... 1563.144 MHz	—	1.2	1.9	VSWR _{max}
	1574.42... 1576.42 MHz	—	1.1	1.9	
	1597.55... 1605.89 MHz	—	1.5	2.1	
@ GNSS port	1559.05... 1563.144 MHz	—	1.2	1.9	VSWR _{max}
	1574.42... 1576.42 MHz	—	1.3	1.9	
	1597.55... 1605.89 MHz	—	1.5	2.1	
Minimum attenuation					
	100... 699 MHz	26	29	—	dB
	777... 798 MHz	28	31	—	dB
	824... 915 MHz	29	32	—	dB
	925... 960 MHz	33	37	—	dB
	1427... 1463 MHz	27	30	—	dB
	1710... 1785 MHz	27	30	—	dB
	1850... 2025 MHz	26	29	—	dB
	2300... 2570 MHz	28	32	—	dB
	2570... 3000 MHz	27	31	—	dB

1) at +25°C

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7 Characteristics ANT-WLAN

Temperature range for specification	T_{SPEC}	= -20 °C ... +85 °C
ANT terminating impedance	Z_{ANT}	= 50 Ω
GNSS terminating impedance	Z_{GNSS}	= 50 Ω
WLAN terminating impedance	Z_{WLAN}	= 50 Ω

Characteristics ANT-WLAN				min. for T_{SPEC}	typ. @ +25 °C	max. for T_{SPEC}	
Maximum insertion attenuation							
			α_{max}				
WiFi Ch 1	2402.5... 2421.5	MHz		—	2.2 ²⁾	2.9 ²⁾	dB
WiFi Ch 2-12	2412.5... 2471.5	MHz		—	2.0 ²⁾	2.4 ²⁾	dB
WiFi Ch 13	2462.5... 2481.5	MHz		—	2.2 ²⁾	2.9 ²⁾	dB
Bluetooth	2401.5... 2480.5	MHz		—	2.4 ¹⁾	3.8 ¹⁾⁴⁾	dB
	2401.5... 2480.5	MHz		—	2.4 ¹⁾	5.5 ¹⁾	dB
Maximum VSWR							
			VSWR _{max}				
@ ANT port	2402... 2481.5	MHz		—	1.4	2.0	
@ WLAN port	2402... 2481.5	MHz		—	1.6	2.0 ⁴⁾	
Minimum attenuation							
			α_{min}				
	100... 1549	MHz		31	35	—	dB
	1549... 1615	MHz		23	28	—	dB
	1710... 1990	MHz		34	37	—	dB
	2110... 2170	MHz		37	45	—	dB
	2300... 2370	MHz		30 ³⁾⁴⁾	38 ³⁾	—	dB
	2300... 2370	MHz		24 ³⁾	38 ³⁾	—	dB
	2370... 2385	MHz		14 ³⁾⁴⁾	20 ³⁾	—	dB
	2370... 2385	MHz		10 ³⁾	20 ³⁾	—	dB
	2500... 2505	MHz		35 ³⁾⁵⁾	48 ³⁾	—	dB
	2500... 2505	MHz		24 ³⁾	48 ³⁾	—	dB
	2505... 2515	MHz		41 ³⁾	48 ³⁾	—	dB
	2515... 2690	MHz		41	47	—	dB
	4900... 5805	MHz		—	21	—	dB

1) Averaged over any 1MHz.

2) Averaged over any 19MHz.

3) Averaged over any 20MHz.

4) at +25°C

5) at +25°C to +85°C

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8 Characteristics ANT-CELL

Temperature range for specification	T_{SPEC}	= -20 °C ... +85 °C
ANT terminating impedance	Z_{ANT}	= 50 Ω
CELL terminating impedance	Z_{CELL}	= 50 Ω
WLAN terminating impedance	Z_{WLAN}	= 50 Ω

Characteristics ANT-CELL				min. for T_{SPEC}	typ. @ +25 °C	max. for T_{SPEC}	
Maximum insertion attenuation				α_{max}			
	1452... 1496	MHz	—		1.0	1.5	dB
	1710... 2200	MHz	—		1.0	1.6	dB
	2300... 2370	MHz	—		1.3 ¹⁾	1.6 ¹⁾³⁾	dB
	2300... 2370	MHz	—		1.3 ¹⁾	1.9 ¹⁾	dB
	2500... 2505	MHz	—		1.7 ¹⁾	2.3 ¹⁾³⁾	dB
	2500... 2505	MHz	—		1.7 ¹⁾	2.8 ¹⁾	dB
	2505... 2690	MHz	—	1.4 ¹⁾	1.9 ¹⁾	dB	
Maximum VSWR				$VSWR_{max}$			
@ ANT port							
	1452... 1496	MHz	—		1.5	2.0	
	1710... 2200	MHz	—		1.4	1.8	
	2300... 2370	MHz	—		1.4	2.0	
	2500... 2550	MHz	—		1.8	2.5	
	2550... 2690	MHz	—		1.4	1.8	
@ CELL port							
	1452... 1496	MHz	—		1.5	2.0	
	1710... 2200	MHz	—		1.3	1.8	
	2300... 2370	MHz	—	1.2	2.0		
	2500... 2550	MHz	—	2.3	2.8 ⁴⁾		
	2550... 2690	MHz	—	1.3	1.8		
Minimum attenuation				α_{min}			
	1559.05... 1563.144	MHz	8 ³⁾		21	—	dB
	1574.42... 1576.42	MHz	9 ³⁾		13	—	dB
	1597.55... 1605.89	MHz	10 ³⁾		16	—	dB
	2402... 2481.5	MHz	10 ²⁾	12 ²⁾	—	dB	

1) Averaged over any 20MHz.

2) Averaged over any 19MHz.

3) at +25°C

4) at +25°C to +85°C

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9 Characteristics Isolations

9.1 CELL – WLAN

Temperature range for specification	T_{SPEC}	= -20 °C ... +85 °C
GNSS terminating impedance	Z_{GNSS}	= 50 Ω
CELL terminating impedance	Z_{CELL}	= 50 Ω
WLAN terminating impedance	Z_{WLAN}	= 50 Ω

Characteristics Isolations			min. for T_{SPEC}	typ. @ +25 °C	max. for T_{SPEC}	
Minimum Isolation CELL-WLAN						
		α_{min}				
	1452... 1496	MHz	34	37	—	dB
	1710... 2200	MHz	34	37	—	dB
	2300... 2370	MHz	30 ¹⁾³⁾	38 ¹⁾	—	dB
	2300... 2370	MHz	24 ¹⁾	38 ¹⁾	—	dB
	2370... 2385	MHz	12 ¹⁾	21 ¹⁾	—	dB
	2402... 2481.5	MHz	10 ²⁾	14 ²⁾	—	dB
	2500... 2505	MHz	35 ¹⁾⁴⁾	53 ¹⁾	—	dB
	2500... 2505	MHz	24 ¹⁾	53 ¹⁾	—	dB
	2505... 2570	MHz	41 ¹⁾	53 ¹⁾	—	dB
	2570... 2690	MHz	39	44	—	dB

1) Averaged over any 20MHz.

2) Averaged over any 19MHz.

3) at +25°C

4) at +25°C to +85°C

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9.2 GNSS – CELL

Temperature range for specification	T_{SPEC}	= -20 °C ... +85 °C
GNSS terminating impedance	Z_{GNSS}	= 50 Ω
CELL terminating impedance	Z_{CELL}	= 50 Ω
WLAN terminating impedance	Z_{WLAN}	= 50 Ω

Characteristics Isolations				min. for T_{SPEC}	typ. @ +25 °C	max. for T_{SPEC}	
Minimum Isolation GNSS-CELL							
			α_{min}				
	1452... 1496	MHz		28	31	—	dB
	1559.05... 1563.144	MHz		8 ²⁾	20	—	dB
	1574.42... 1576.42	MHz		9 ²⁾	14	—	dB
	1597.55... 1605.89	MHz		10 ²⁾	16	—	dB
	1710... 2200	MHz		26	29	—	dB
	2300... 2400	MHz		28	32	—	dB
	2402... 2481.5	MHz		30 ¹⁾	40 ¹⁾	—	dB
	2500... 2690	MHz		30	34	—	dB

¹⁾ Averaged over any 19MHz.

²⁾ at +25°C

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9.3 GNSS – WLAN

Temperature range for specification	T_{SPEC}	= -20 °C ... +85 °C
GNSS terminating impedance	Z_{GNSS}	= 50 Ω
CELL terminating impedance	Z_{CELL}	= 50 Ω
WLAN terminating impedance	Z_{WLAN}	= 50 Ω

Characteristics Isolations		min. for T_{SPEC}	typ. @ +25 °C	max. for T_{SPEC}	
Minimum Isolation GNSS-WLAN					
	α_{min}				
	1559.05... 1563.144 MHz	33	36	—	dB
	1574.42... 1576.42 MHz	33	36	—	dB
	1597.55... 1605.89 MHz	32	35	—	dB
	2402... 2481.5 MHz	30 ²⁾	34 ²⁾	—	dB

²⁾ Averaged over any 19MHz.

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10 Maximum ratings

Storage temperature	$T_{STG}^{3)} = -40^{\circ}\text{C} \dots +85^{\circ}\text{C}^{1) 2)}$	
DC voltage	$ V_{DC} = 0 \text{ V (max.)}^{4)}$	
ESD voltage		
	$V_{ESD}^{5)} = 350 \text{ V}$	Human body model.
	$V_{ESD}^{6)} = 275 \text{ V}$	Machine model.
	$V_{ESD}^{7)} = 700 \text{ V}$	Charged device model.
Input power	P_{IN}	
@ WLAN port: 2402... 2482 MHz	22 dBm	19 MHz WLAN signal for 5000 h @ 50 °C.
@ CELL port: 1452... 2370 MHz	25 dBm	Continuous wave for 5000 h @ 50 °C.
@ CELL port: 2500... 2690 MHz	25 dBm	Continuous wave for 5000 h @ 50 °C.
@ GNSS port: 1559.05...1605.89 MHz	13 dBm	Continuous wave for 5000 h @ 50 °C.

¹⁾ Extended upper limit: 96h @ 125°C acc. to IEC60068-2-2 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⁾ In case of applied DC voltage blocking capacitors are mandatory.

⁵⁾ According to JESD22-A114F (HBM – Human Body Model), 1 negative & 1 positive pulse.

⁶⁾ According to JESD22-A115B (MM – Machine Model), 10 negative & 10 positive pulses.

⁷⁾ According to JESD22-C101C (CDM – Field Induced Charged Device Model), 3 negative & 3 positive pulses.

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11 Transmission coefficient ANT-GNSS

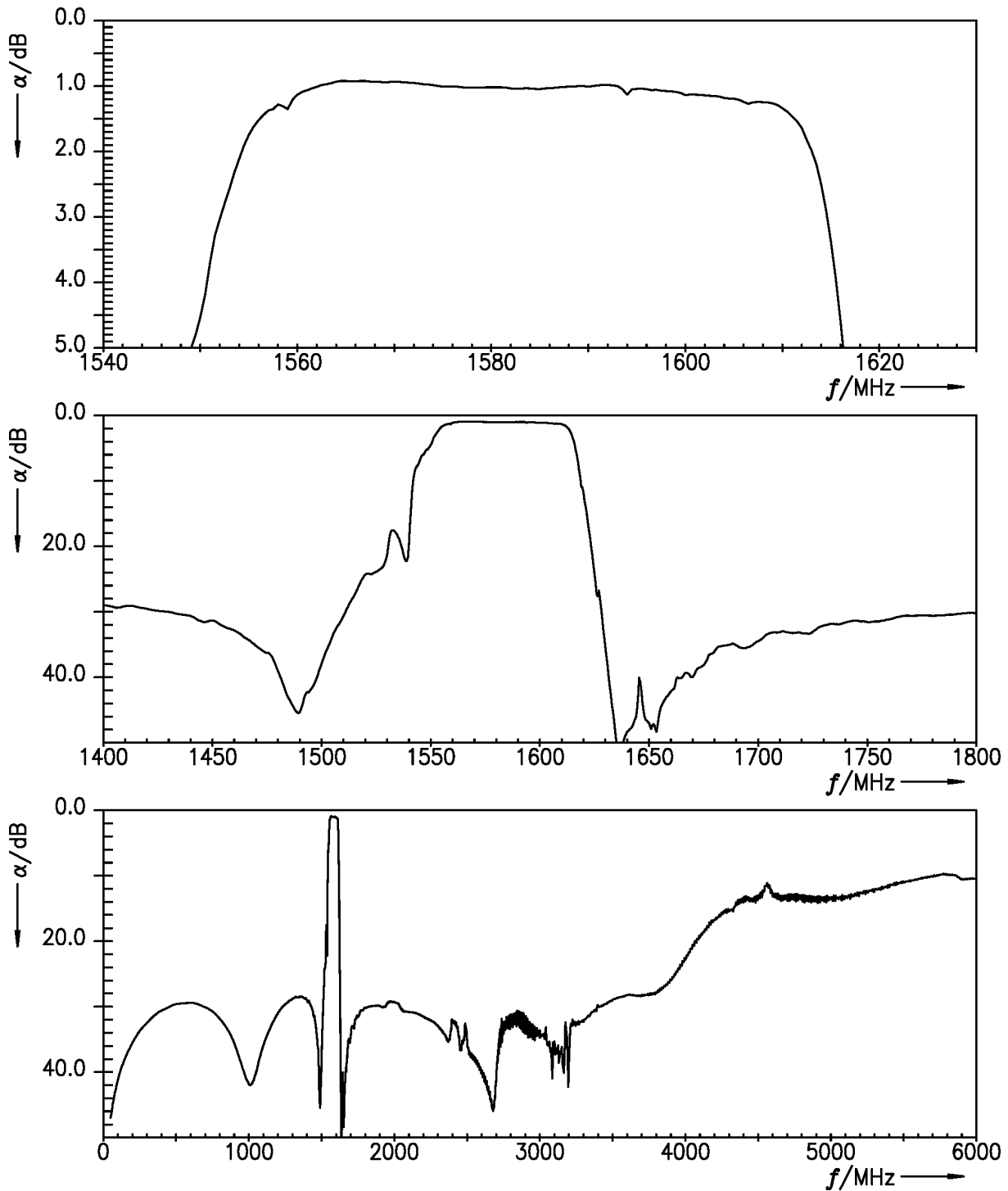


Figure 3: Attenuation ANT-GNSS.

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12 Reflection coefficients ANT- GNSS

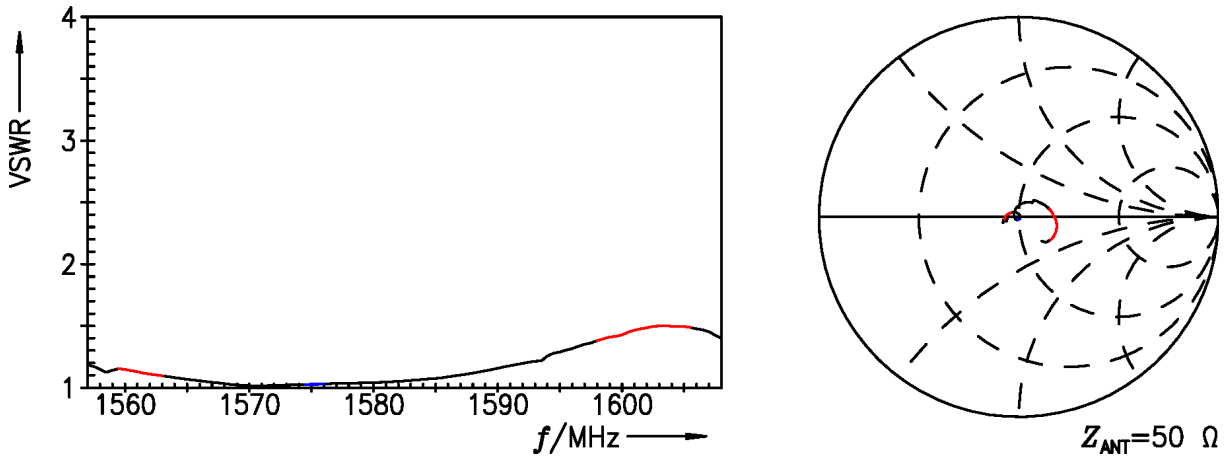


Figure 4: Reflection coefficient at ANT port.

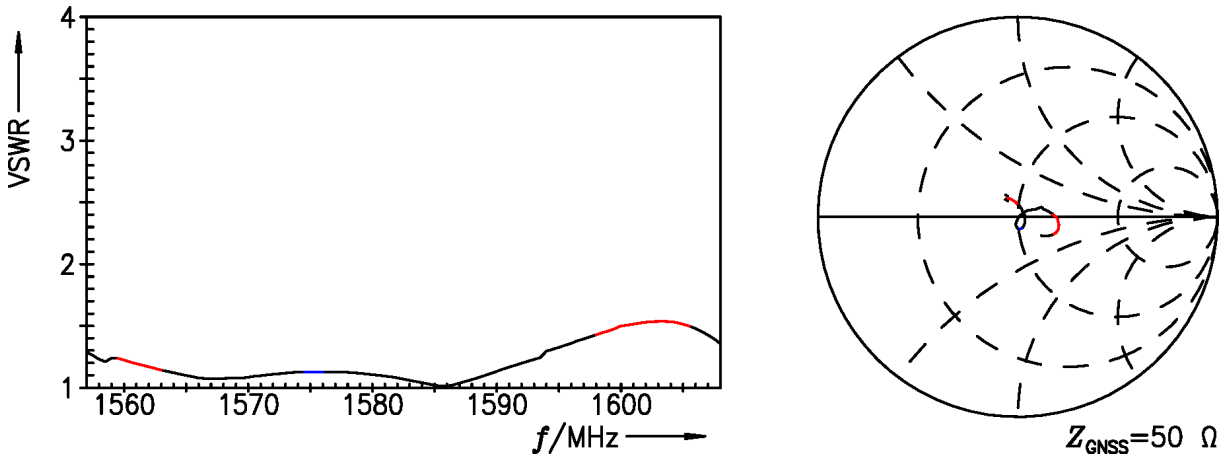


Figure 5: Reflection coefficient at GNSS port.

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13 Transmission coefficient ANT- WLAN

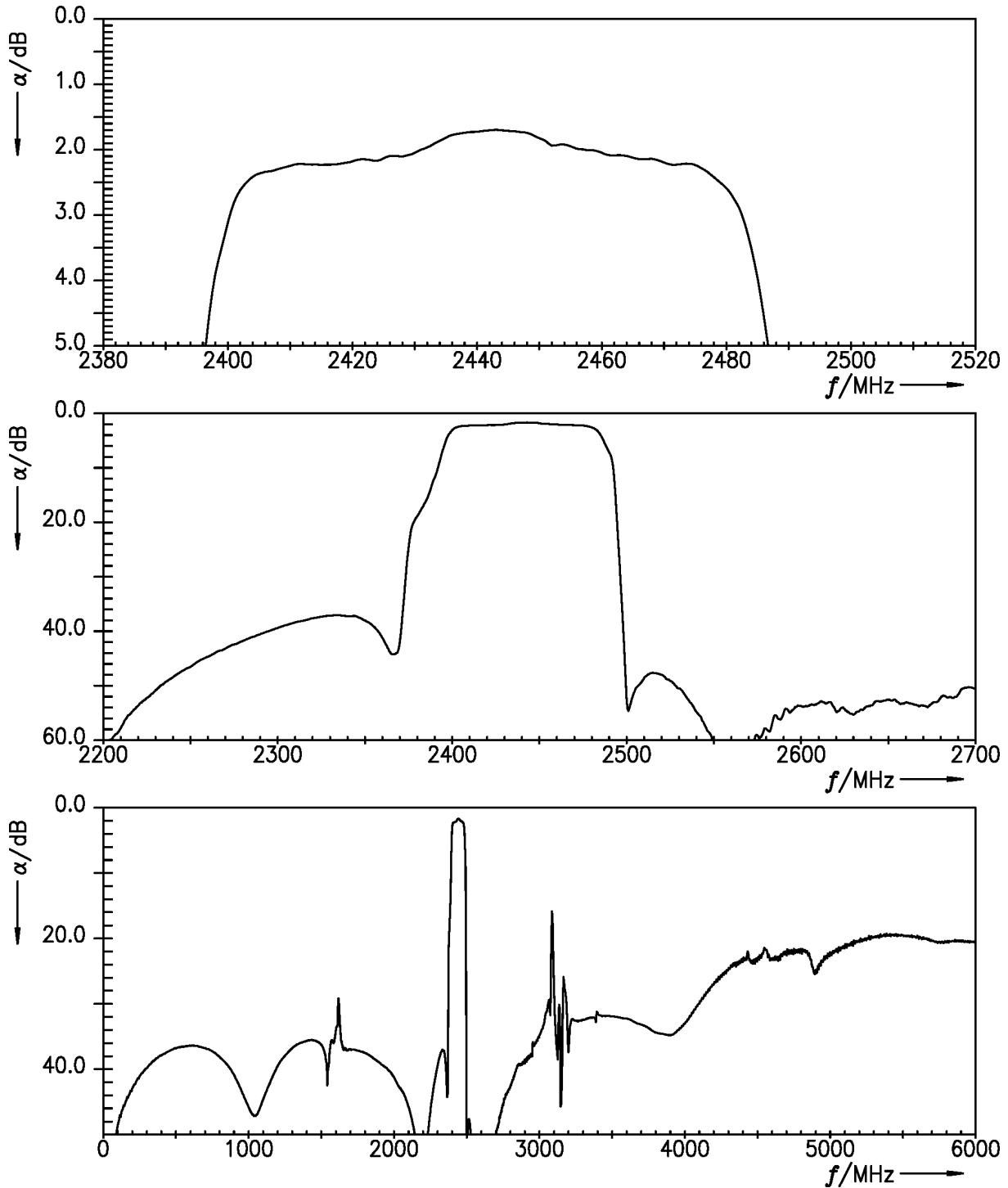


Figure 6: Attenuation ANT-WLAN.

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14 Reflection coefficients ANT- WLAN

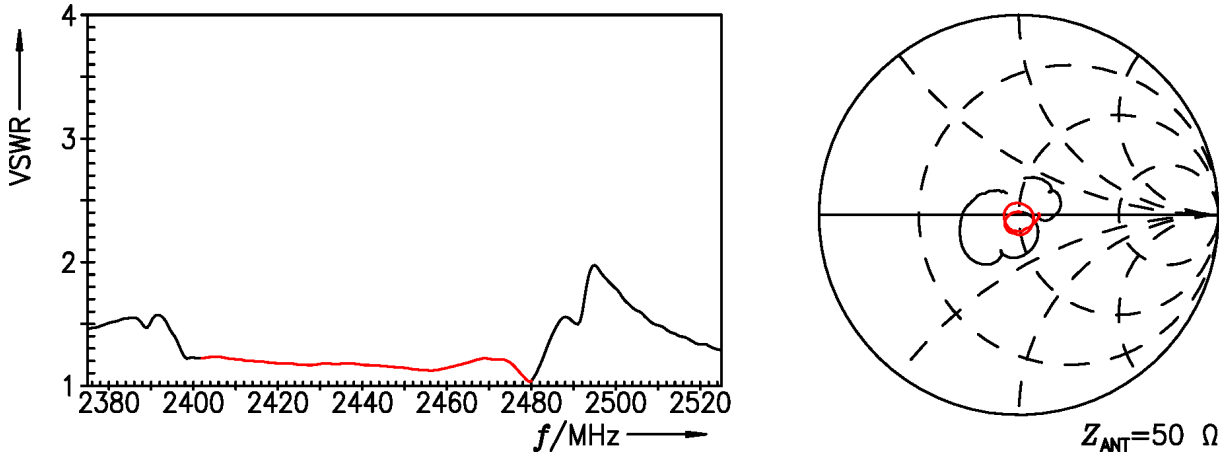


Figure 7: Reflection coefficient at ANT port.

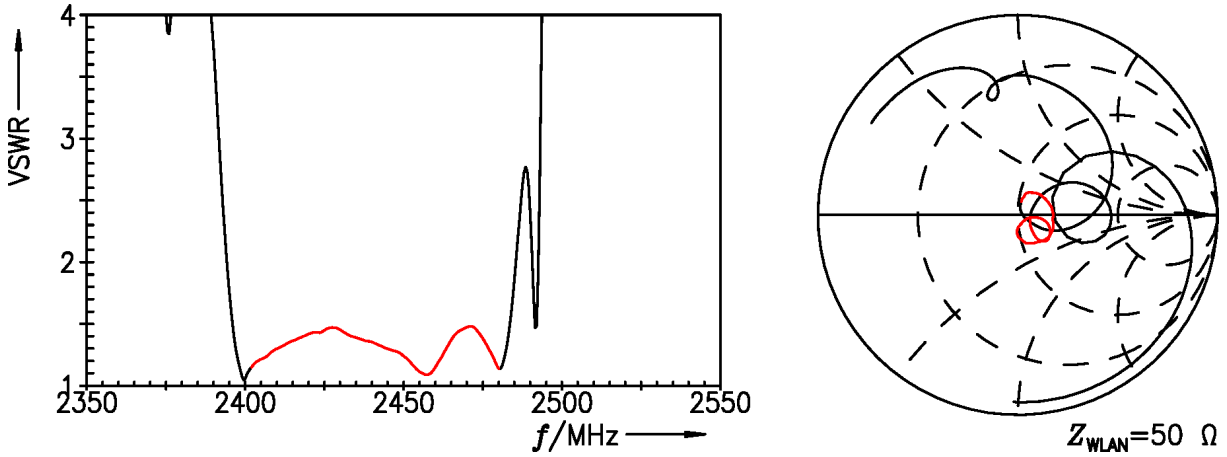


Figure 8: Reflection coefficient at WLAN port.

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15 Transmission coefficient ANT- CELL

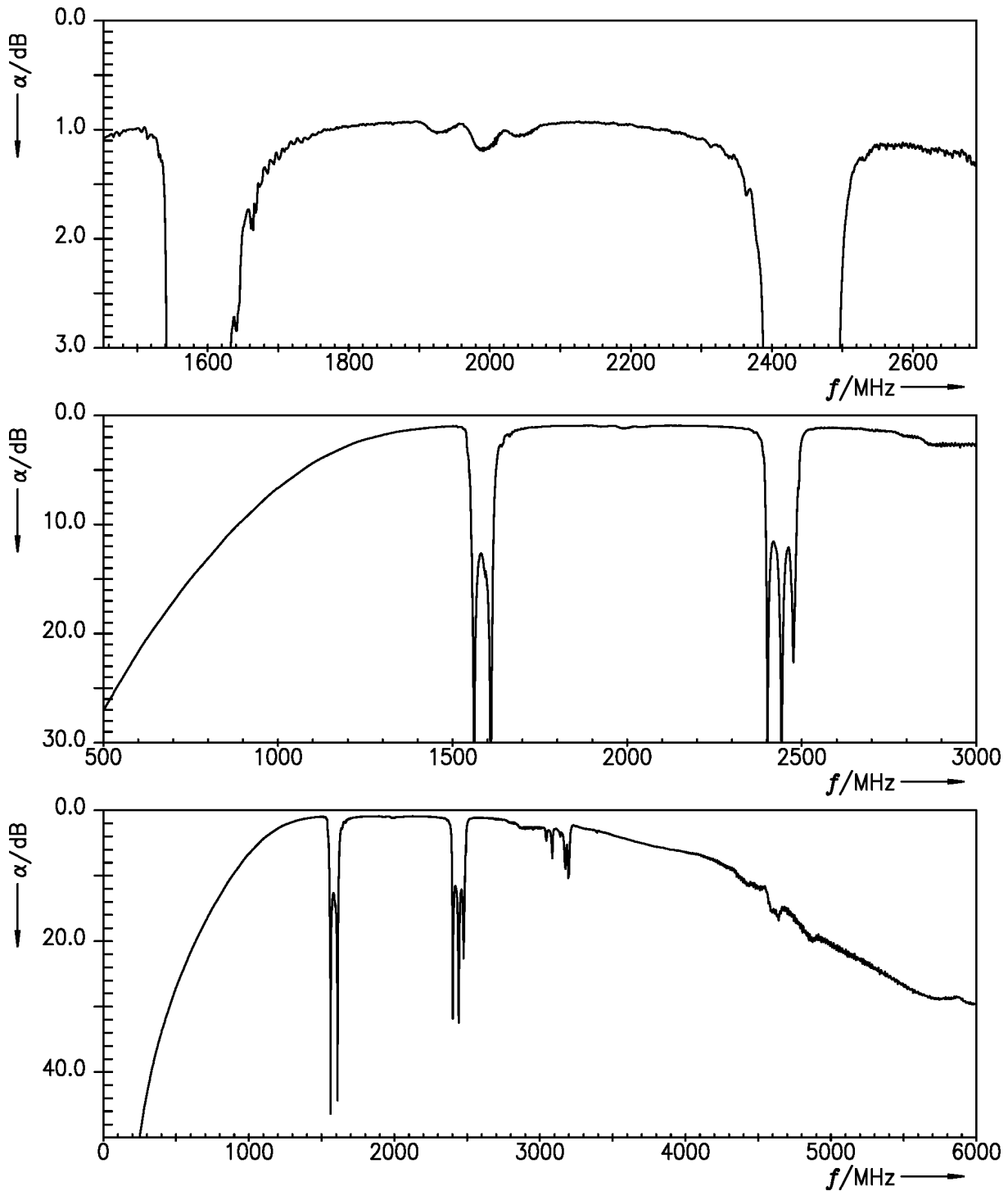


Figure 9: Attenuation ANT-CELL.

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16 Reflection coefficients ANT- CELL

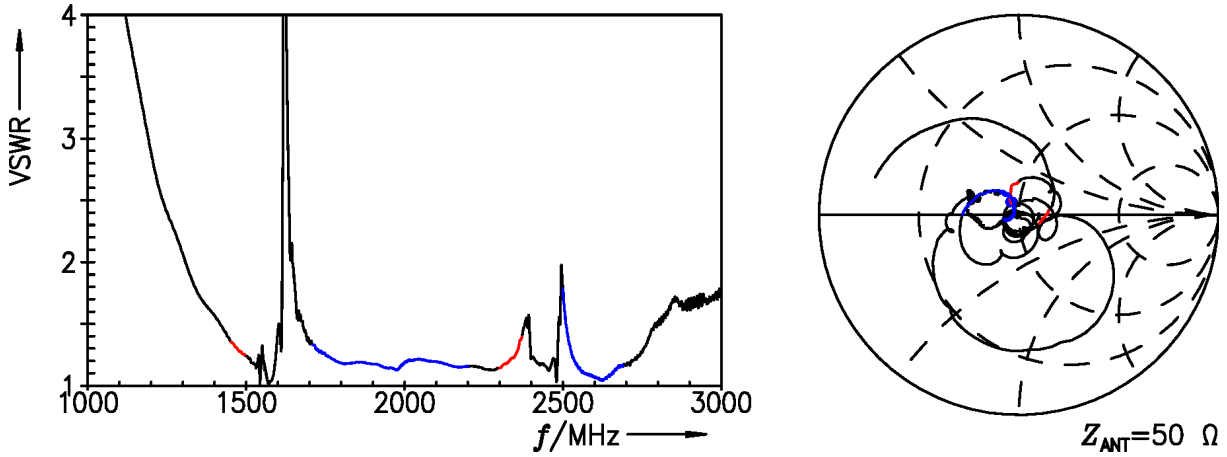


Figure 10: Reflection coefficient at ANT port.

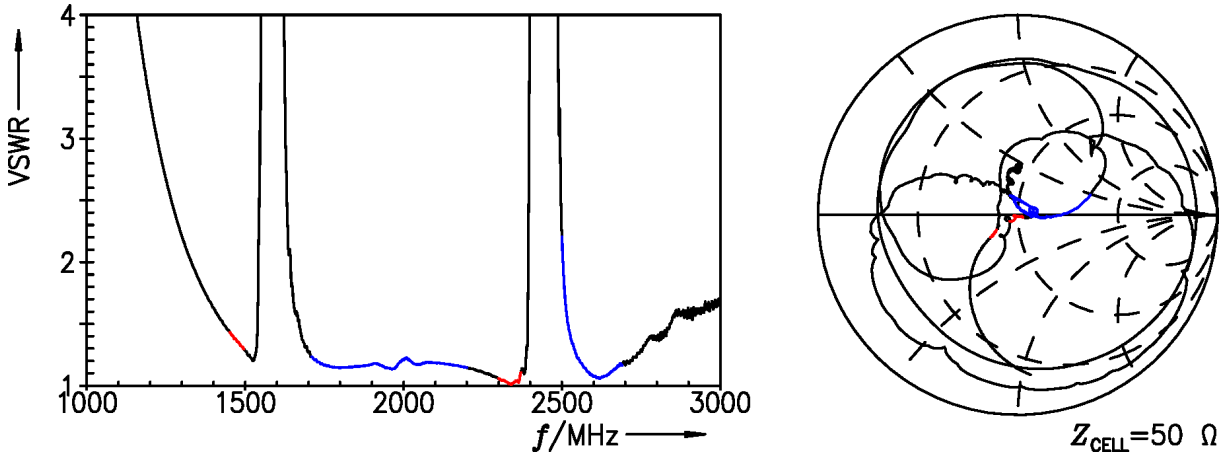


Figure 11: Reflection coefficient at CELL port.

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17 Transmission coefficients

17.1 Isolation CELL – WLAN

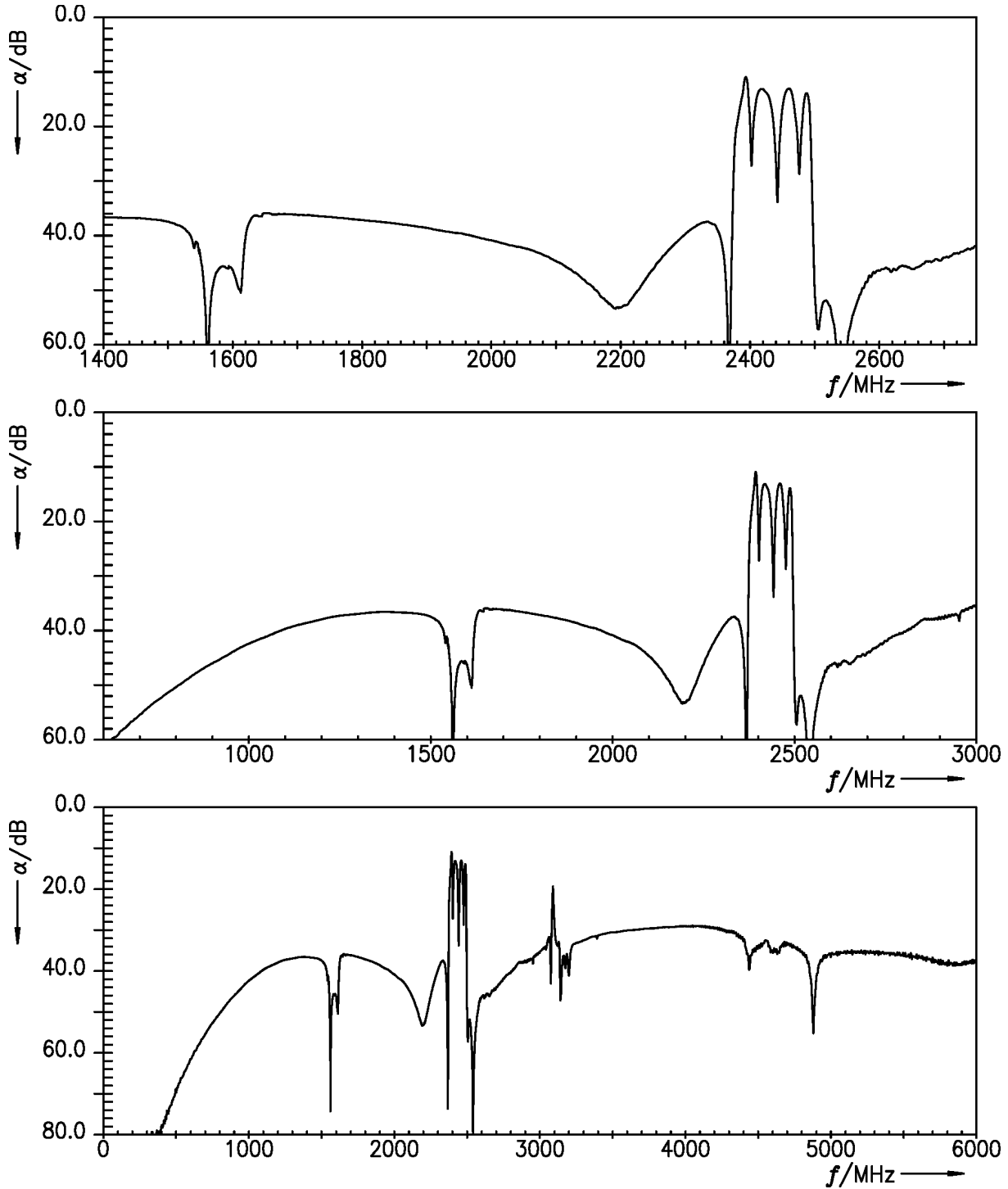


Figure 12: Cross-isolation CELL – WLAN.

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17.2 Isolation GNSS – CELL

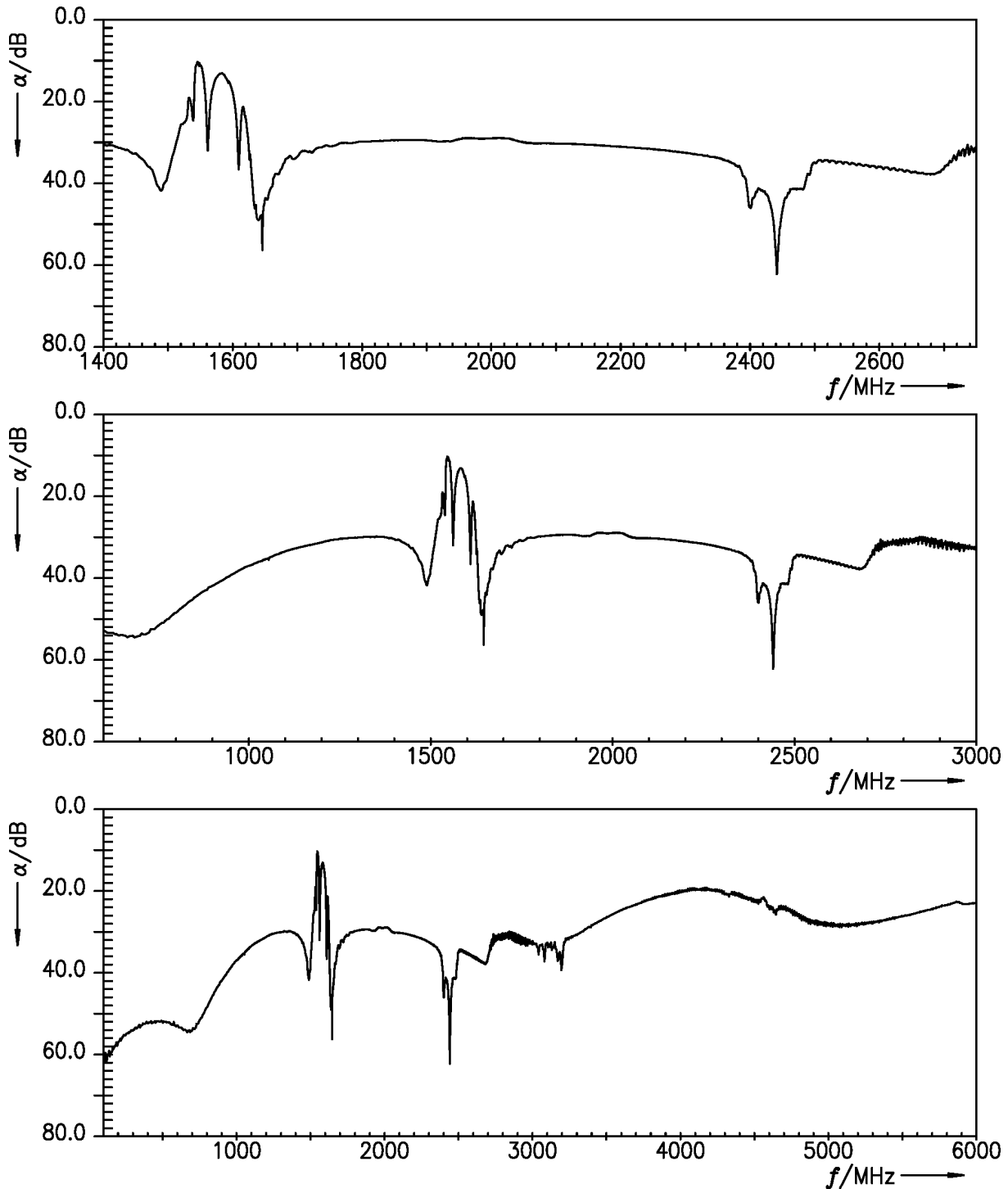


Figure 13: Cross-isolation GNSS – CELL.

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17.3 Isolation GNSS – WLAN

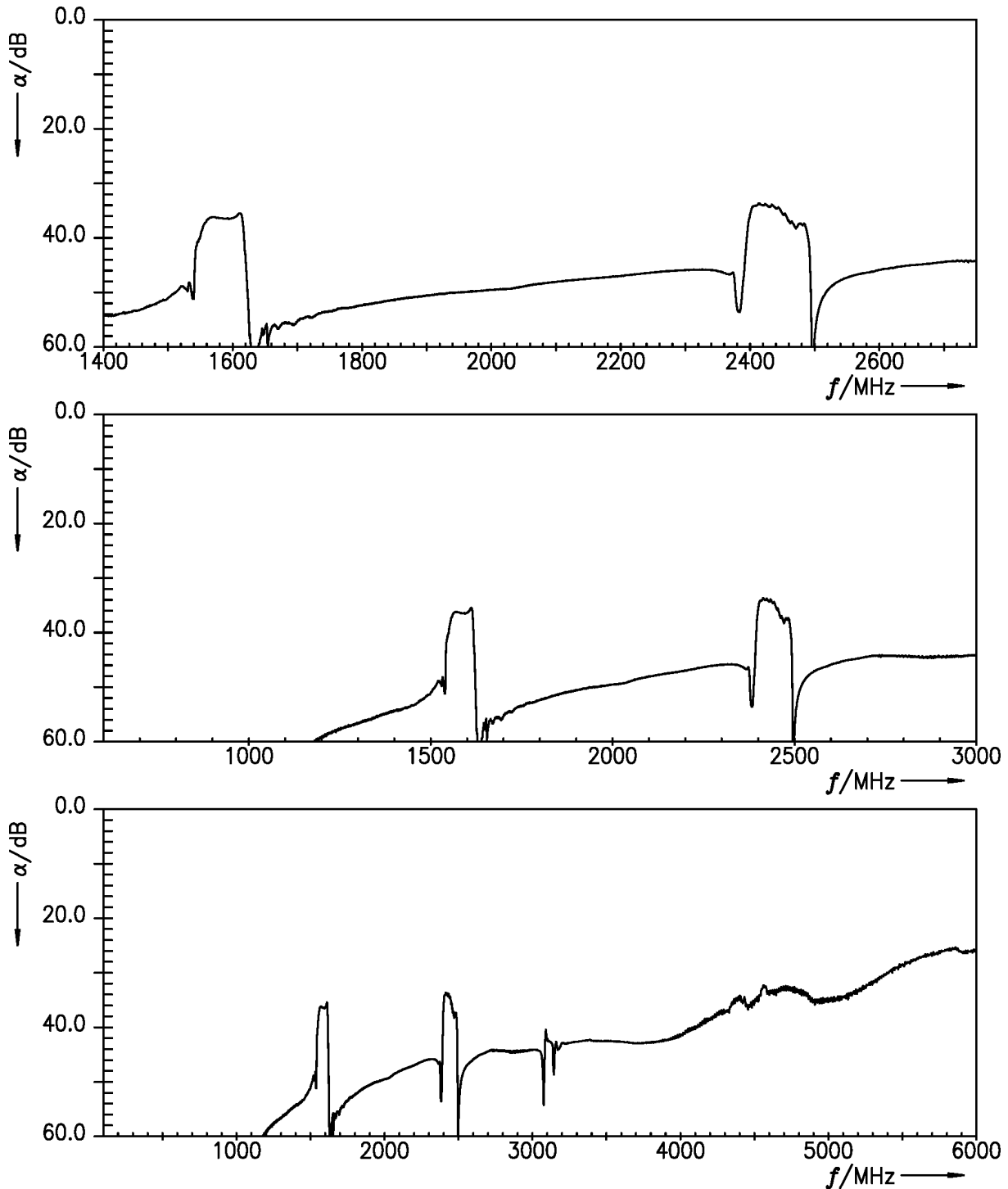


Figure 14: Cross-isolation GNSS – WLAN.

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18 Packing material

18.1 Tape

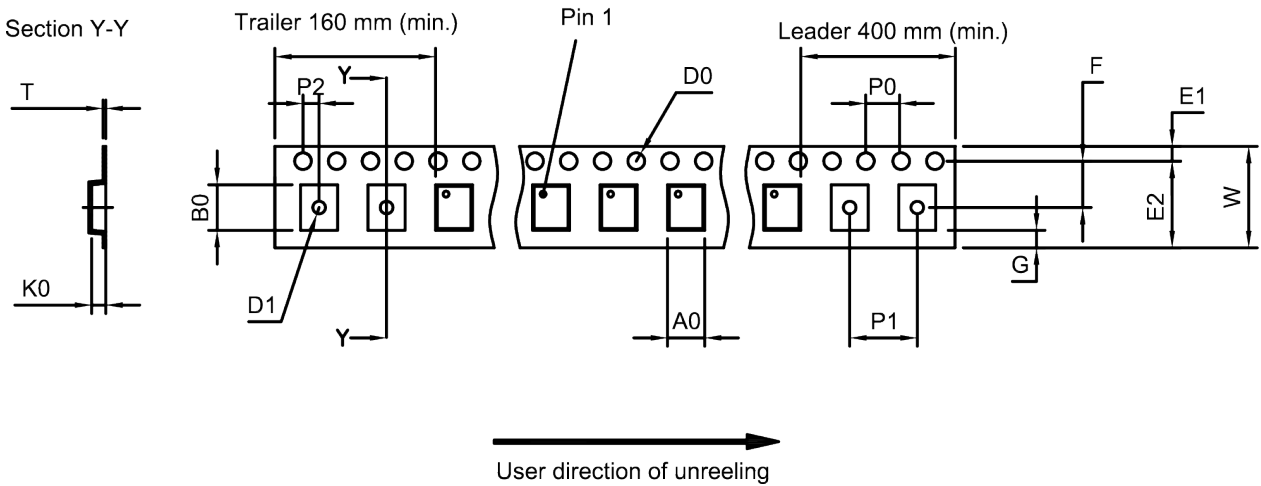


Figure 15: Drawing of tape (first-angle projection) with tape dimensions according to Table 1.

A ₀ –	E ₂ –	P ₁ –
B ₀ –	F –	P ₂ –
D ₀ –	G –	T –
D ₁ –	K ₀ –	W –
E ₁ –	P ₀ –	

Table 1: Tape dimensions.

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18.2 Reel with diameter of 180 mm

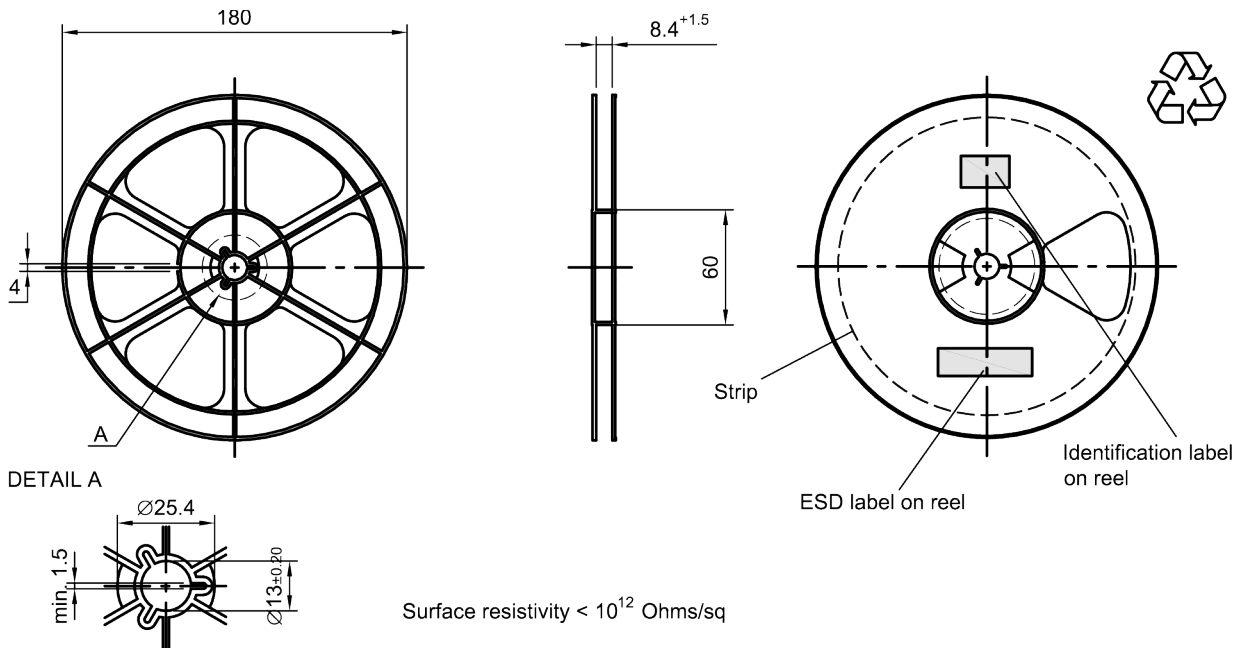


Figure 16: Drawing of reel (first-angle projection) with diameter of 180 mm.

Dimensions [mm]

X = 220+5

Y = 235+5

Sealing area 10±3

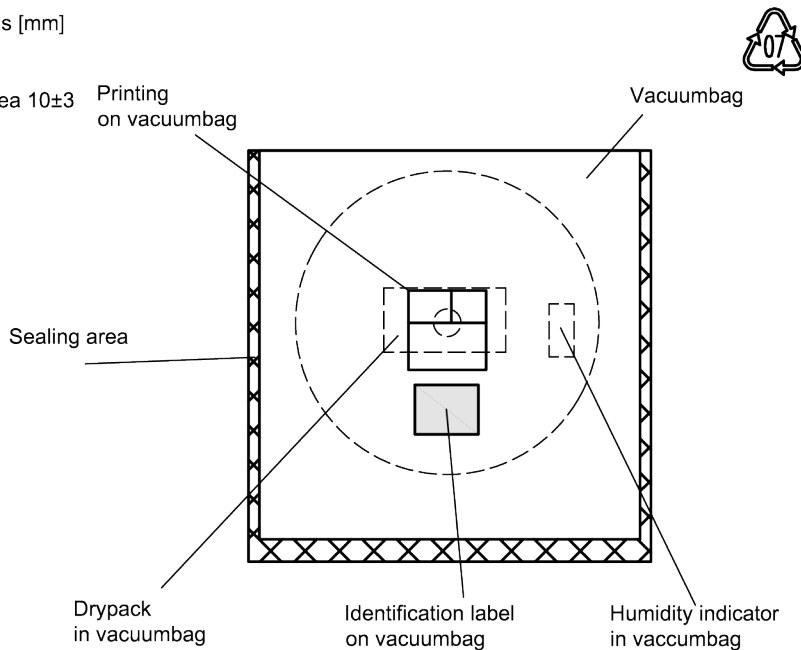


Figure 17: Drawing of moisture barrier bag (MBB) for reel with diameter of 180 mm.

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Dimensions [mm]
 L = 188
 B = 188
 H = 30
 Tolerance ±5

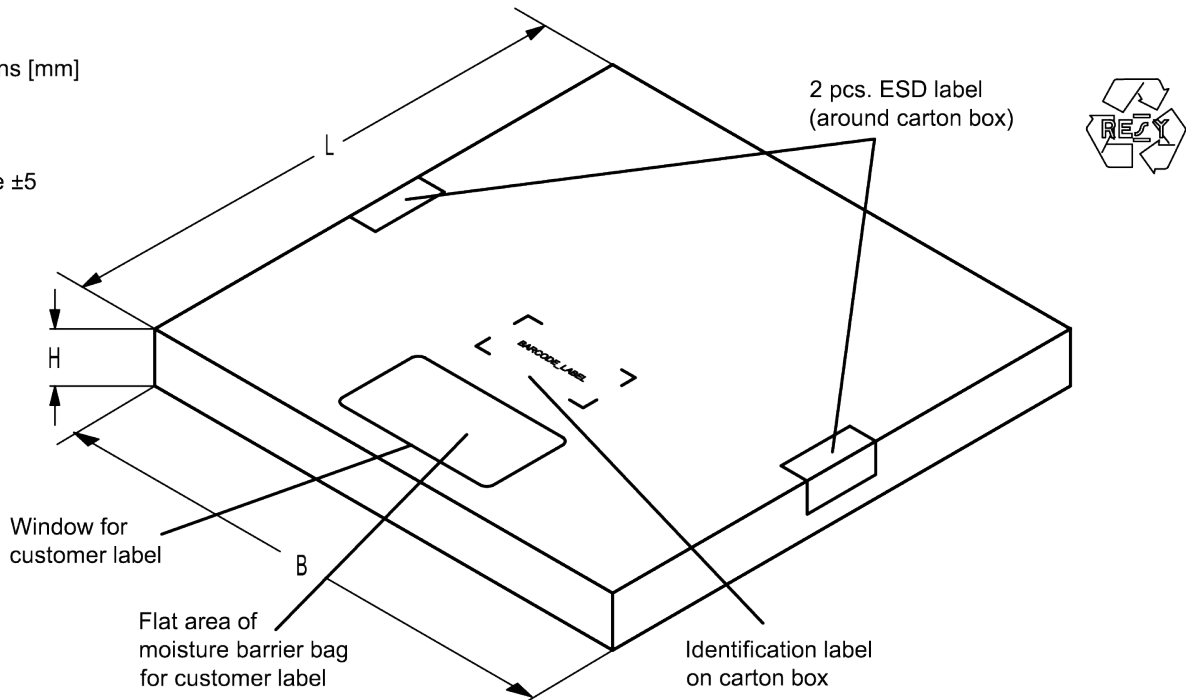


Figure 18: Drawing of folding box for reel with diameter of 180 mm.

18.3 Reel with diameter of 330 mm

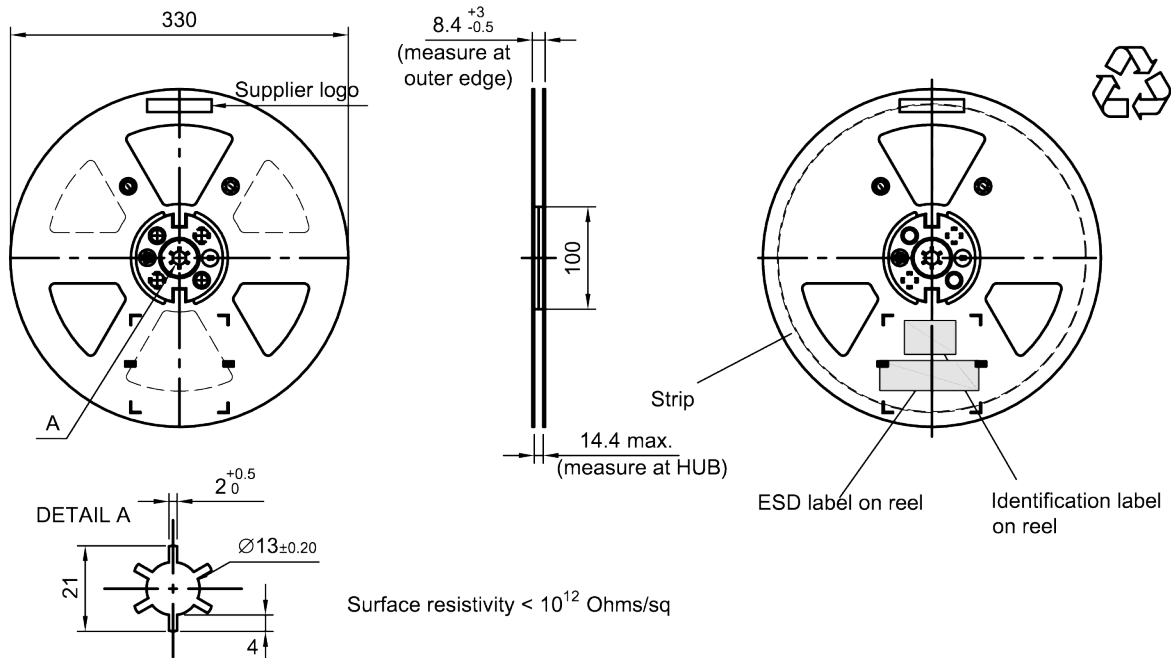


Figure 19: Drawing of reel (first-angle projection) with diameter of 330 mm.

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Dimensions [mm]

X = 400+5

Y = 418+5

Sealing area 10±3

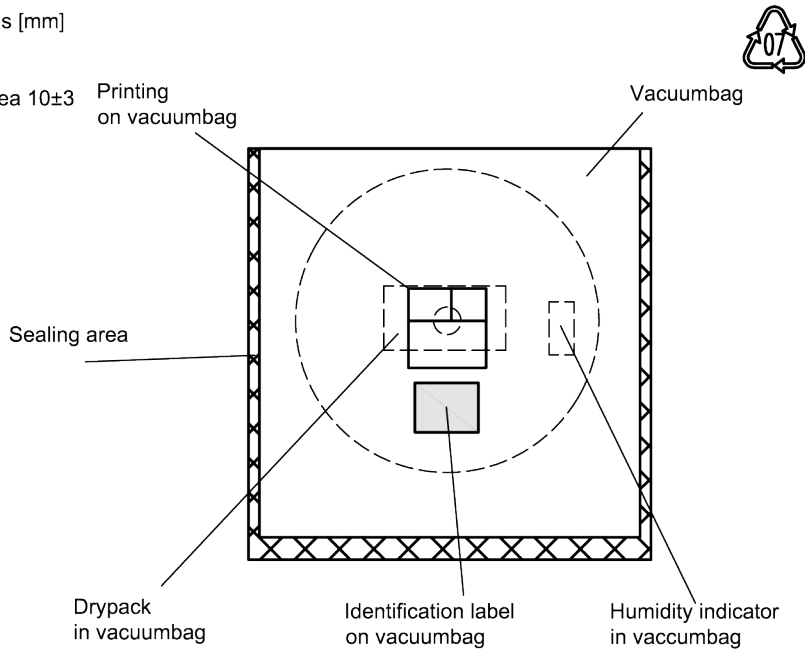


Figure 20: Drawing of moisture barrier bag (MBB) for reel with diameter of 330 mm.

Dimensions [mm]

L = 335

B = 338

H = 36 (for 8 mm tape width)

40 (for 12 mm tape width)

Tolerance ±5

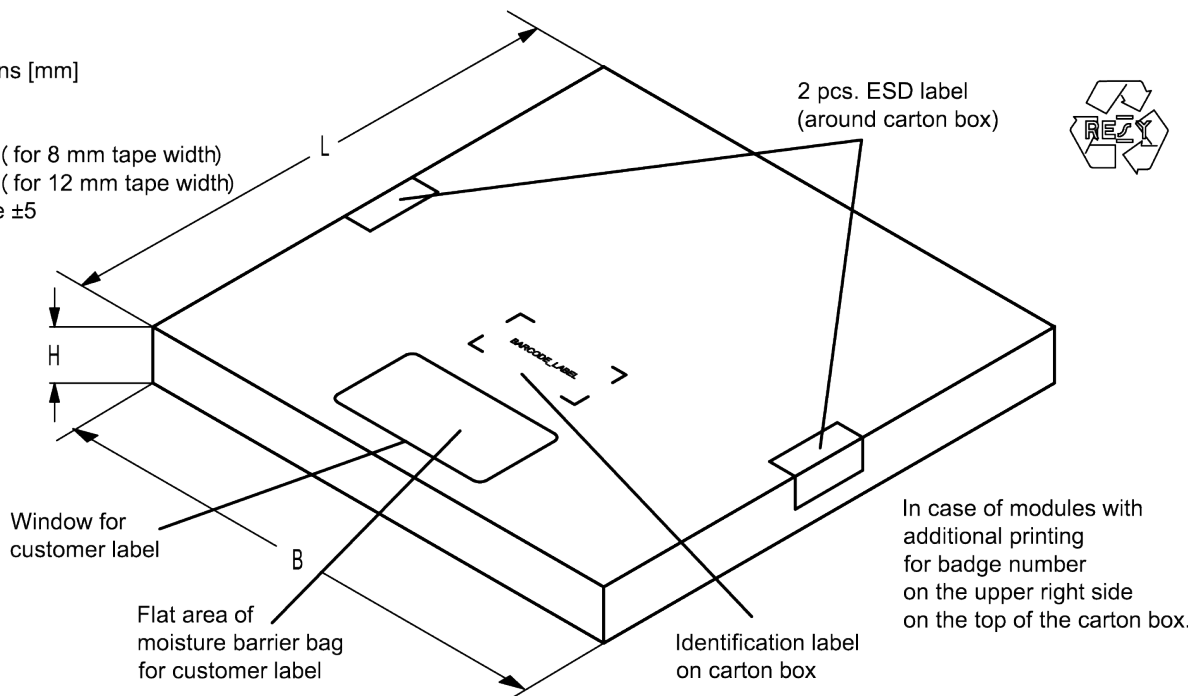


Figure 21: Drawing of folding box for reel with diameter of 330 mm.

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19 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
$T \geq 255$ °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 2: Characteristics of recommended soldering profile for lead-free solder (Sn95.5Ag3.8Cu0.7).

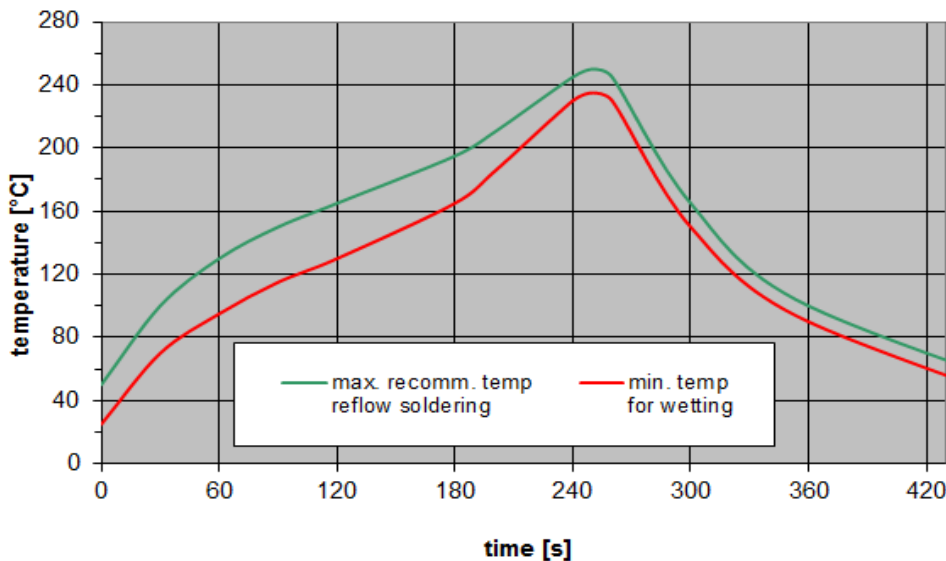


Figure 22: Recommended reflow profile for convection and infrared soldering – lead-free solder.

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20 Annotations

20.1 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>.

20.2 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.

20.3 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.

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21 Cautions and warnings

21.1 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 www.rf360jv.com/orderingcodes.

21.2 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.

21.3 Moldability

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

21.4 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.

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22 Revision history

Changes compared to previously issued iteration.

Version	Originator	Detailed specification changes	Date
1.0	K. Markov	Initial preliminary data sheet.	Sep 29, 2016
1.1	K. Markov	Updated format.	Apr 12, 2017
1.2	V. Novgorodov	Updated specs.	Jun 09, 2017
1.3	V. Novgorodov	Added min/max values based on simulation	Jun 30, 2017
1.4	V. Novgorodov	Minor formal corrections	Jun 30, 2017
1.5	V. Novgorodov	Updated chipcode, minor corrections, updated ESD values	Dec 21, 2017

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 (www.rf360jv.com/material). 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.
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