Qualcomm

RF360
Europe GmbH

# Data sheet

## SAW multiplexer
EN-DC 4G/5G band n1 + n66 + n3 + n7

| | |
|---|---|
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| Ordering code: | B39272M5009D310 |
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| Version: | 2.1 |

DCN: 80-PA243-592 Rev. B



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## 1 Application

- Low-loss SAW multiplexer for mobile telephone EN-DC 4G/5G Band n1, Band n66, Band n3 and Band n7 systems.
- EN-DC 4G/5G band n1 uplink: 1950 MHz (pass band 60 MHz)
- EN-DC 4G/5G band n1 downlink: 2140 MHz (pass band 60 MHz)
- EN-DC 4G/5G band n3 uplink: 1747.5 MHz (pass band 75 MHz)
- EN-DC 4G/5G band n3 downlink: 1842.5 MHz (pass band 75 MHz)
- EN-DC 4G/5G band n7 uplink: 2535 MHz (pass band 70 MHz)
- EN-DC 4G/5G band n7 downlink: 2655 MHz (pass band 70 MHz)
- EN-DC 4G/5G band n66 uplink: 1745 MHz (pass band 70 MHz)
- EN-DC 4G/5G band n66 downlink: 2155 MHz (pass band 90 MHz)
- Usable pass bands: 60MHz for Band n1, 70/90MHz for Band n66, 75MHz for Band n3 and 70MHz for Band n7.
- High out of band selectivity
- High TX-RX isolation
- Terminating impedance 50Ω
- Unbalanced to unbalanced operation

## 2 Features

- Package size $2.5_{\pm 0.1}$ mm × $2.0_{\pm 0.1}$ mm
- Package height 0.65 mm (max.)
- Approximate weight 0.008 g
- RoHS compatible
- Package for Surface Mount Technology (SMT)
- Ni/Au-plated terminals
- Electrostatic Sensitive Device (ESD)
- Moisture Sensitivity Level 3 (MSL3)

## 3 Package

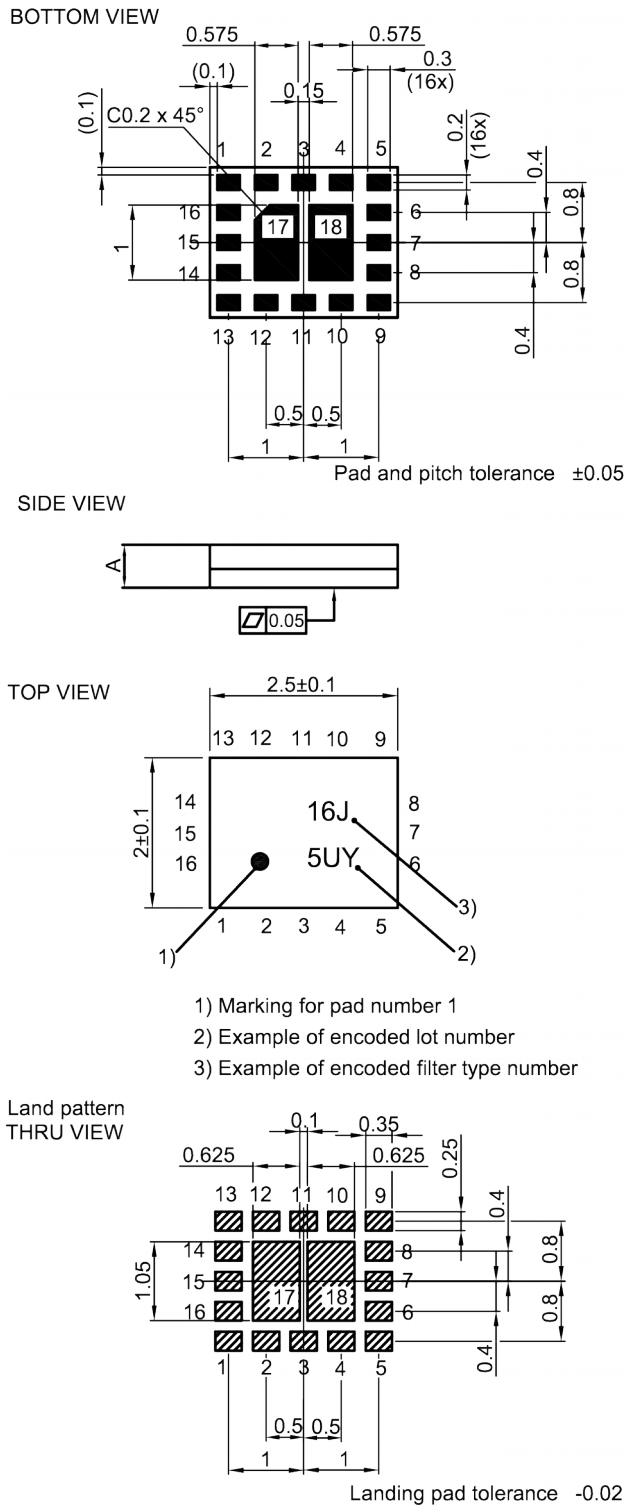


**Figure 1:** Drawing of package with package height A = 0.65 mm (max.). See Sec. Package information (p. 52).

## 4 Pin configuration

- 1 TX (n1)
- 5 RX (n3)
- 7 RX (n66)
- 9 RX (n7)
- 11 ANT (n1, n3, n7, & n66)
- 13 TX (n7)
- 15 TX (n3)
- 2, 3, 4, 6, 8, 10, 12, 14, 16, 17, 18 Ground

## 5 Matching circuit

- $L_{s1}$ = 2.4 nH
- $L_{s5}$ = 3.8 nH
- $L_{s7}$ = 2.9 nH
- $L_{s9}$ = 2.1 nH
- $L_{s13}$ = 1.2 nH
- $L_{s15}$ = 1.8 nH

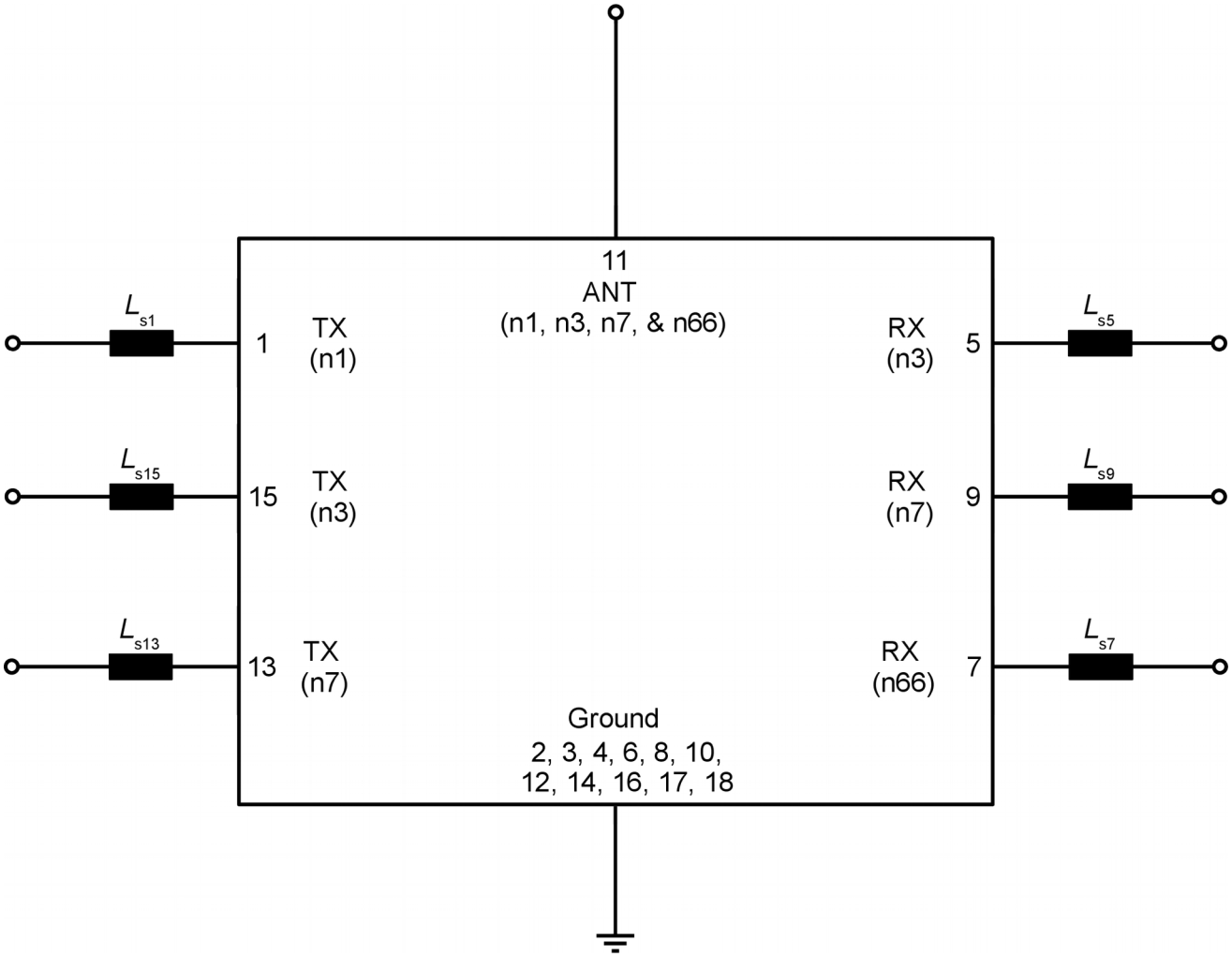


**Figure 2:** Schematic of matching circuit.

External shunt inductor for ESD protection is recommended at any ports towards antenna.

## 6 Characteristics EN-DC 4G/5G n1

Temperature range for specification $T_{SPEC}$ = −30 °C ... +85 °C
n1 TX terminating impedance $Z_{n1\ TX}$ = 50 Ω + 2.4 nH[1)]
ANT terminating impedance $Z_{ANT}$ = 50 Ω

| **Characteristics EN-DC 4G/5G n1 TX – ANT** | | | | **min.** for $T_{SPEC}$ | **typ.** @ +25 °C | **max.** for $T_{SPEC}$ | |
|---|---|---|---|---|---|---|---|
| **Maximum insertion attenuation** | | | $\alpha_{max}$ | | | | |
| | 1920... 1980 | MHz | | — | 1.6 | 2.4 | dB |
| **Amplitude ripple (p-p)** | | | $\Delta\alpha$[2)] | | | | |
| | 1920... 1980 | MHz | | — | 0.2 | 2.0 | dB |
| **Maximum VSWR** | | | $VSWR_{max}$ | | | | |
| @ n1 TX port | 1920... 1980 | MHz | | — | 1.6 | 2.0 | |
| @ ANT port | 1920... 1980 | MHz | | — | 1.5 | 2.0 | |
| **Minimum attenuation** | | | $\alpha_{min}$ | | | | |
| | 10... 1574 | MHz | | 40 | 56 | — | dB |
| | 1166... 1187 | MHz | | 44 | 56 | — | dB |
| | 1559... 1606 | MHz | | 43 | 66 | — | dB |
| | 1710... 1785 | MHz | | 40 | 48 | — | dB |
| | 1805... 1880 | MHz | | 45 | 58 | — | dB |
| | 1880... 1895 | MHz | | 10 | 15 | — | dB |
| | 2010... 2025 | MHz | | 20[3)] | 37 | — | dB |
| | 2110... 2200 | MHz | | 45 | 63 | — | dB |
| | 2400... 2500 | MHz | | 40 | 55 | — | dB |
| | 2496... 2690 | MHz | | 45 | 55 | — | dB |
| | 2500... 2570 | MHz | | 40 | 55 | — | dB |
| | 3300... 4200 | MHz | | 40 | 61 | — | dB |
| | 3840... 3960 | MHz | | 40 | 69 | — | dB |
| | 4400... 5000 | MHz | | 40 | 64 | — | dB |
| | 5150... 5925 | MHz | | 40 | 60 | — | dB |

1) See Sec. Matching circuit (p. 6).
2) Over any 5 MHz.
3) Valid for temperature $T$ = +15 °C...+85 °C.

# 7 Characteristics EN-DC 4G/5G n3

## 7.1 TX – ANT

Temperature range for specification $T_{SPEC}$ = −30 °C ... +85 °C
n3 TX terminating impedance $Z_{n3\ TX}$ = 50 Ω + 1.8 nH[1)]
ANT terminating impedance $Z_{ANT}$ = 50 Ω
n3 RX terminating impedance $Z_{n3\ RX}$ = 50 Ω + 3.8 nH[1)]

| Characteristics EN-DC 4G/5G n3 TX – ANT | | | | min. for $T_{SPEC}$ | typ. @ +25 °C | max. for $T_{SPEC}$ | |
|---|---|---|---|---|---|---|---|
| **Maximum insertion attenuation** | | | $\alpha_{max}$ | | | | |
| | 1710... 1785 | MHz | | — | 2.1 | 2.8 | dB |
| **Amplitude ripple (p-p)** | | | $\Delta\alpha$[2)] | | | | |
| | 1710... 1785 | MHz | | — | 0.6 | 2.0 | dB |
| **Maximum VSWR** | | | $VSWR_{max}$ | | | | |
| @ n3 TX port | 1710... 1785 | MHz | | — | 1.5 | 2.0 | |
| @ ANT port | 1710... 1785 | MHz | | — | 1.5 | 2.0 | |
| **Minimum attenuation** | | | $\alpha_{min}$ | | | | |
| | 10... 1566 | MHz | | 40 | 47 | — | dB |
| | 703... 960 | MHz | | 40 | 48 | — | dB |
| | 1166... 1187 | MHz | | 44 | 47 | — | dB |
| | 1559... 1606 | MHz | | 45 | 60 | — | dB |
| | 1805... 1880 | MHz | | 45 | 61 | — | dB |
| | 1920... 1980 | MHz | | 35 | 42 | — | dB |
| | 2110... 2200 | MHz | | 45 | 62 | — | dB |
| | 2400... 2500 | MHz | | 36 | 40 | — | dB |
| | 2496... 2690 | MHz | | 35 | 41 | — | dB |
| | 2500... 2570 | MHz | | 35 | 41 | — | dB |
| | 3300... 4200 | MHz | | 35 | 54 | — | dB |
| | 3420... 3570 | MHz | | 35 | 54 | — | dB |
| | 4400... 5000 | MHz | | 35 | 54 | — | dB |
| | 5130... 5925 | MHz | | 35 | 53 | — | dB |

1) See Sec. Matching circuit (p. 6).
2) Over any 5 MHz.

## 7.2 ANT – RX

| | | |
|---|---|---|
| Temperature range for specification | $T_{SPEC}$ | = −30 °C ... +85 °C |
| n3 TX terminating impedance | $Z_{n3\ TX}$ | = 50 Ω + 1.8 nH[1)] |
| ANT terminating impedance | $Z_{ANT}$ | = 50 Ω |
| n3 RX terminating impedance | $Z_{n3\ RX}$ | = 50 Ω + 3.8 nH[1)] |

| **Characteristics EN-DC 4G/5G n3 ANT – RX** | | | | **min.** for $T_{SPEC}$ | **typ.** @ +25 °C | **max.** for $T_{SPEC}$ | |
|---|---|---|---|---|---|---|---|
| **Maximum insertion attenuation** | | | $\alpha_{max}$ | | | | |
| | 1805... 1880 | MHz | | — | 2.0 | 3.3 | dB |
| **Amplitude ripple (p-p)** | | | $\Delta\alpha$[2)] | | | | |
| | 1805... 1880 | MHz | | — | 0.4 | 2.0 | dB |
| **Maximum VSWR** | | | $VSWR_{max}$ | | | | |
| @ ANT port | 1805... 1880 | MHz | | — | 1.5 | 2.0 | |
| @ n3 RX port | 1805... 1880 | MHz | | — | 1.6 | 2.0 | |
| **Minimum attenuation** | | | $\alpha_{min}$ | | | | |
| | 10... 1720 | MHz | | 45 | 56 | — | dB |
| | 95 | MHz | | 50 | 102 | — | dB |
| | 1615... 1690 | MHz | | 40 | 56 | — | dB |
| | 1710... 1785 | MHz | | 45 | 55 | — | dB |
| | 1720... 1755 | MHz | | 12 | 60 | — | dB |
| | 1785... 1790 | MHz | | 10 | 34 | — | dB |
| | 1920... 1980 | MHz | | 45 | 61 | — | dB |
| | 1940... 1965 | MHz | | 12 | 61 | — | dB |
| | 1965... 6000 | MHz | | 25 | 41 | — | dB |
| | 2400... 2500 | MHz | | 35 | 53 | — | dB |
| | 2496... 2690 | MHz | | 38 | 50 | — | dB |
| | 2500... 2570 | MHz | | 45 | 58 | — | dB |
| | 3300... 4200 | MHz | | 35 | 60 | — | dB |
| | 3610... 3760 | MHz | | 35 | 62 | — | dB |
| | 4400... 5000 | MHz | | 35 | 65 | — | dB |
| | 5150... 5925 | MHz | | 35 | 66 | — | dB |

1) See Sec. Matching circuit (p. 6).
2) Over any 5 MHz.

## 7.3 TX – RX

| | | |
|---|---|---|
| Temperature range for specification | $T_{SPEC}$ | = −30 °C ... +85 °C |
| n3 TX terminating impedance | $Z_{n3\ TX}$ | = 50 Ω + 1.8 nH[1)] |
| ANT terminating impedance | $Z_{ANT}$ | = 50 Ω |
| n3 RX terminating impedance | $Z_{n3\ RX}$ | = 50 Ω + 3.8 nH[1)] |

| **Characteristics EN-DC 4G/5G n3 TX – RX** | | | | **min.** for $T_{SPEC}$ | **typ.** @ +25 °C | **max.** for $T_{SPEC}$ | |
|---|---|---|---|---|---|---|---|
| **Minimum isolation** | | | | | | | |
| | 1710... 1785 | MHz | $\alpha_{INT,min}$ [2)] | 55 | 62 | — | dB |
| | 1805... 1880 | MHz | $\alpha_{min}$ | 55 | 64 | — | dB |

1) See Sec. Matching circuit (p. 6).
2) Integrated attenuation $\alpha_{INT}$: Averaged power $|S_{ij}|^2$ over the center 4.5 MHz of LTE 5.0 MHz (25 RB) channels.

# 8 Characteristics EN-DC 4G/5G n7

## 8.1 TX – ANT

| | | |
|---|---|---|
| Temperature range for specification | $T_{SPEC}$ | = −30 °C ... +85 °C |
| n7 TX terminating impedance | $Z_{n7\ TX}$ | = 50 Ω + 1.2 nH[1] |
| ANT terminating impedance | $Z_{ANT}$ | = 50 Ω |
| n7 RX terminating impedance | $Z_{n7\ RX}$ | = 50 Ω + 2.1 nH[1] |

| Characteristics EN-DC 4G/5G n7 TX – ANT | | | | min. for $T_{SPEC}$ | typ. @ +25 °C | max. for $T_{SPEC}$ | |
|---|---|---|---|---|---|---|---|
| **Maximum insertion attenuation** | | | $\alpha_{max}$ | | | | |
| | 2500... 2570 | MHz | | — | 1.8 | 2.4 | dB |
| **Amplitude ripple (p-p)** | | | $\Delta\alpha$[2] | | | | |
| | 2500... 2570 | MHz | | — | 0.3 | 2.0 | dB |
| **Maximum VSWR** | | | $VSWR_{max}$ | | | | |
| @ n7 TX port | 2500... 2570 | MHz | | — | 1.3 | 2.0 | |
| @ ANT port | 2500... 2570 | MHz | | — | 1.6 | 2.0 | |
| **Minimum attenuation** | | | | | | | |
| | 10... 1566 | MHz | $\alpha_{min}$ | 40 | 55 | — | dB |
| | 1452... 1496 | MHz | $\alpha_{min}$ | 45 | 63 | — | dB |
| | 1559... 1606 | MHz | $\alpha_{min}$ | 35 | 70 | — | dB |
| | 1606... 1680 | MHz | $\alpha_{min}$ | 35 | 57 | — | dB |
| | 1710... 1785 | MHz | $\alpha_{min}$ | 40 | 44 | — | dB |
| | 1805... 1880 | MHz | $\alpha_{min}$ | 45 | 62 | — | dB |
| | 1900... 1920 | MHz | $\alpha_{min}$ | 30 | 60 | — | dB |
| | 1920... 1980 | MHz | $\alpha_{min}$ | 40 | 59 | — | dB |
| | 2010... 2025 | MHz | $\alpha_{min}$ | 30 | 74 | — | dB |
| | 2110... 2200 | MHz | $\alpha_{min}$ | 45 | 61 | — | dB |
| | 2300... 2400 | MHz | $\alpha_{min}$ | 37 | 44 | — | dB |
| | 2403... 2471 | MHz | $\alpha_{WLAN,min}$[3] | 35 | 44 | — | dB |
| | 2458... 2476 | MHz | $\alpha_{WLAN,min}$[3] | 20 | 31 | — | dB |
| | 2463... 2481 | MHz | $\alpha_{WLAN,min}$[3] | 10 | 19 | — | dB |
| | 2595... 2620 | MHz | $\alpha_{min}$ | 12[4] | 17 | — | dB |
| | 2620... 2690 | MHz | $\alpha_{min}$ | 45 | 59 | — | dB |
| | 3300... 3800 | MHz | $\alpha_{min}$ | 25 | 34 | — | dB |
| | 3400... 3600 | MHz | $\alpha_{min}$ | 35 | 47 | — | dB |
| | 5000... 5140 | MHz | $\alpha_{min}$ | 30 | 37 | — | dB |
| | 5150... 5925 | MHz | $\alpha_{min}$ | 32 | 35 | — | dB |

1) See Sec. Matching circuit (p. 6).
2) Over any 5 MHz.
3) Average over each WLAN channel with band width of 18 MHz.
4) Valid for temperature $T$ = +25 °C...+85 °C.

## 8.2 ANT – RX

| | | |
|---|---|---|
| Temperature range for specification | $T_{SPEC}$ | = −30 °C ... +85 °C |
| n7 TX terminating impedance | $Z_{n7\ TX}$ | = 50 Ω + 1.2 nH[1)] |
| ANT terminating impedance | $Z_{ANT}$ | = 50 Ω |
| n7 RX terminating impedance | $Z_{n7\ RX}$ | = 50 Ω + 2.1 nH[1)] |

| **Characteristics EN-DC 4G/5G n7 ANT – RX** | | | | **min.** for $T_{SPEC}$ | **typ.** @ +25 °C | **max.** for $T_{SPEC}$ | |
|---|---|---|---|---|---|---|---|
| **Maximum insertion attenuation** | | | $\alpha_{max}$ | | | | |
| | 2620... 2690 | MHz | | — | 1.8 | 2.6 | dB |
| **Amplitude ripple (p-p)** | | | $\Delta\alpha$[2)] | | | | |
| | 2620... 2690 | MHz | | — | 0.3 | 2.0 | dB |
| **Maximum VSWR** | | | $VSWR_{max}$ | | | | |
| @ ANT port | 2620... 2690 | MHz | | — | 1.5 | 2.0 | |
| @ n7 RX port | 2620... 2690 | MHz | | — | 1.3 | 2.0 | |
| **Minimum attenuation** | | | | | | | |
| | 1.0... 2500 | MHz | $\alpha_{min}$ | 40 | 43 | — | dB |
| | 40... 50 | MHz | $\alpha_{min}$ | 50 | 103 | — | dB |
| | 880... 915 | MHz | $\alpha_{min}$ | 45 | 57 | — | dB |
| | 1310... 1345 | MHz | $\alpha_{min}$ | 40 | 59 | — | dB |
| | 1710... 1785 | MHz | $\alpha_{min}$ | 45 | 58 | — | dB |
| | 1920... 1980 | MHz | $\alpha_{min}$ | 45 | 58 | — | dB |
| | 2400... 2480 | MHz | $\alpha_{min}$ | 40 | 58 | — | dB |
| | 2500... 2570 | MHz | $\alpha_{min}$ | 45 | 56 | — | dB |
| | 2750... 2775 | MHz | $\alpha_{min}$ | 18 | 72 | — | dB |
| | 2775... 3300 | MHz | $\alpha_{min}$ | 40 | 54 | — | dB |
| | 3300... 3800 | MHz | $\alpha_{INT,min}$[3)] | 32 | 51 | — | dB |
| | 3800... 4200 | MHz | $\alpha_{INT,min}$[3)] | 30 | 34 | — | dB |
| | 4200... 6000 | MHz | $\alpha_{min}$ | 40 | 51 | — | dB |
| | 5150... 5925 | MHz | $\alpha_{min}$ | 40 | 51 | — | dB |

1) See Sec. Matching circuit (p. 6).
2) Over any 5 MHz.
3) Integrated over 10 MHz.

## 8.3 TX – RX

| | | |
|---|---|---|
| Temperature range for specification | $T_{SPEC}$ | = −30 °C ... +85 °C |
| n7 TX terminating impedance | $Z_{n7\ TX}$ | = 50 Ω + 1.2 nH[1)] |
| ANT terminating impedance | $Z_{ANT}$ | = 50 Ω |
| n7 RX terminating impedance | $Z_{n7\ RX}$ | = 50 Ω + 2.1 nH[1)] |

| **Characteristics EN-DC 4G/5G n7 TX – RX** | | | | **min.** for $T_{SPEC}$ | **typ.** @ +25 °C | **max.** for $T_{SPEC}$ | |
|---|---|---|---|---|---|---|---|
| **Minimum isolation** | | | $\alpha_{min}$ | | | | |
| | 2500... 2570 | MHz | | 55 | 60 | — | dB |
| | 2620... 2690 | MHz | | 55 | 61 | — | dB |

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

## 9 Characteristics EN-DC 4G/5G n66

Temperature range for specification $T_{SPEC}$ = −30 °C ... +85 °C
ANT terminating impedance $Z_{ANT}$ = 50 Ω
n66 RX terminating impedance $Z_{n66\ RX}$ = 50 Ω + 2.9 nH[1)]

| **Characteristics EN-DC 4G/5G n66 ANT – RX** | | | | **min.** for $T_{SPEC}$ | **typ.** @ +25 °C | **max.** for $T_{SPEC}$ | |
|---|---|---|---|---|---|---|---|
| **Maximum insertion attenuation** | | | $\alpha_{max}$ | | | | |
| | 2110... 2200 | MHz | | — | 1.8 | 2.4 | dB |
| **Amplitude ripple (p-p)** | | | $\Delta\alpha$[2)] | | | | |
| | 2110... 2200 | MHz | | — | 0.3 | 1.5 | dB |
| **Maximum VSWR** | | | $VSWR_{max}$ | | | | |
| @ ANT port | 2110... 2200 | MHz | | — | 1.4 | 2.0 | |
| @ n66 RX port | 2110... 2200 | MHz | | — | 1.4 | 2.0 | |
| **Minimum attenuation** | | | $\alpha_{min}$ | | | | |
| | 10... 2025 | MHz | | 40 | 43 | — | dB |
| | 190 | MHz | | 50 | 90 | — | dB |
| | 699... 748 | MHz | | 40 | 66 | — | dB |
| | 1055... 1085 | MHz | | 48 | 61 | — | dB |
| | 1710... 1785 | MHz | | 45 | 61 | — | dB |
| | 1730... 1790 | MHz | | 40 | 61 | — | dB |
| | 1920... 1980 | MHz | | 45 | 63 | — | dB |
| | 2015... 2025 | MHz | | 37 | 52 | — | dB |
| | 2025... 2050 | MHz | | 22 | 57 | — | dB |
| | 2050... 2075 | MHz | | 8 | 40 | — | dB |
| | 2230... 2255 | MHz | | 12 | 53 | — | dB |
| | 2255... 6000 | MHz | | 25 | 42 | — | dB |
| | 2400... 2500 | MHz | | 38 | 63 | — | dB |
| | 2500... 2570 | MHz | | 45 | 60 | — | dB |
| | 3300... 4200 | MHz | | 38 | 60 | — | dB |
| | 4030... 4150 | MHz | | 40 | 61 | — | dB |
| | 4220... 4340 | MHz | | 35 | 64 | — | dB |
| | 4400... 5500 | MHz | | 35 | 64 | — | dB |
| | 5150... 5950 | MHz | | 35 | 65 | — | dB |
| | 5950... 6000 | MHz | | 35 | 67 | — | dB |

1) See Sec. Matching circuit (p. 6).
2) Over any 5 MHz.

# 10 Cross-isolations

## 10.1 EN-DC 4G/5G n1 TX – n3 RX

Temperature range for specification $T_{SPEC}$ = −30 °C ... +85 °C
n1 TX terminating impedance $Z_{n1\ TX}$ = 50 Ω + 2.4 nH[1)]
n3 RX terminating impedance $Z_{n3\ RX}$ = 50 Ω + 3.8 nH[1)]

| **Characteristics cross-isolation EN-DC 4G/5G n1 TX – n3 RX** | | | **min.** for $T_{SPEC}$ | **typ.** @ +25 °C | **max.** for $T_{SPEC}$ | |
|---|---|---|---|---|---|---|
| **Minimum cross-isolation** | | $\alpha_{min}$ | | | | |
| | 1805... 1880 | MHz | 55 | 60 | — | dB |
| | 1920... 1980 | MHz | 55 | 61 | — | dB |

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

## 10.2 EN-DC 4G/5G n1 TX – n7 RX

Temperature range for specification $T_{SPEC}$ = −30 °C ... +85 °C
n1 TX terminating impedance $Z_{n1\ TX}$ = 50 Ω + 2.4 nH[1)]
n7 RX terminating impedance $Z_{n7\ RX}$ = 50 Ω + 2.1 nH[1)]

| **Characteristics cross-isolation EN-DC 4G/5G n1 TX – n7 RX** | | | **min.** for $T_{SPEC}$ | **typ.** @ +25 °C | **max.** for $T_{SPEC}$ | |
|---|---|---|---|---|---|---|
| **Minimum cross-isolation** | | $\alpha_{min}$ | | | | |
| | 1920... 1980 | MHz | 53 | 58 | — | dB |
| | 2620... 2690 | MHz | 55 | 62 | — | dB |

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

## 10.3 EN-DC 4G/5G n1 TX – n66 RX

Temperature range for specification $T_{SPEC}$ = −30 °C ... +85 °C
n1 TX terminating impedance $Z_{n1\ TX}$ = 50 Ω + 2.4 nH[1)]
n66 RX terminating impedance $Z_{n66\ RX}$ = 50 Ω + 2.9 nH[1)]

| Characteristics cross-isolation<br>EN-DC 4G/5G n1 TX – n66 RX | | | min.<br>for $T_{SPEC}$ | typ.<br>@ +25 °C | max.<br>for $T_{SPEC}$ | |
|---|---|---|---|---|---|---|
| **Minimum cross-isolation** | $\alpha_{min}$ | | | | | |
| | 1574... 1577 | MHz | 40 | 74 | — | dB |
| | 1920... 1980 | MHz | 55 | 64 | — | dB |
| | 2110... 2200 | MHz | 55 | 64 | — | dB |
| | 3830... 3970 | MHz | 30 | 70 | — | dB |
| | 5750... 5950 | MHz | 30 | 73 | — | dB |

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

## 10.4 EN-DC 4G/5G n3 TX – n7 RX

Temperature range for specification $T_{SPEC}$ = −30 °C ... +85 °C
n3 TX terminating impedance $Z_{n3\ TX}$ = 50 Ω + 1.8 nH[1)]
n7 RX terminating impedance $Z_{n7\ RX}$ = 50 Ω + 2.1 nH[1)]

| Characteristics cross-isolation<br>EN-DC 4G/5G n3 TX – n7 RX | | | min.<br>for $T_{SPEC}$ | typ.<br>@ +25 °C | max.<br>for $T_{SPEC}$ | |
|---|---|---|---|---|---|---|
| **Minimum cross-isolation** | $\alpha_{min}$ | | | | | |
| | 1710... 1785 | MHz | 55 | 59 | — | dB |
| | 2620... 2690 | MHz | 55 | 61 | — | dB |

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

## 10.5 EN-DC 4G/5G n3 TX – n66 RX

Temperature range for specification $T_{SPEC}$ = −30 °C ... +85 °C
n3 TX terminating impedance $Z_{n3\ TX}$ = 50 Ω + 1.8 nH[1)]
n66 RX terminating impedance $Z_{n66\ RX}$ = 50 Ω + 2.9 nH[1)]

| Characteristics cross-isolation<br>EN-DC 4G/5G n3 TX – n66 RX | | | min.<br>for $T_{SPEC}$ | typ.<br>@ +25 °C | max.<br>for $T_{SPEC}$ | |
|---|---|---|---|---|---|---|
| **Minimum cross-isolation** | $\alpha_{min}$ | | | | | |
| | 1710... 1785 | MHz | 55 | 63 | — | dB |
| | 2110... 2200 | MHz | 55 | 62 | — | dB |

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

## 10.6 EN-DC 4G/5G n7 TX – n3 RX

Temperature range for specification $T_{SPEC}$ = −30 °C ... +85 °C
n7 TX terminating impedance $Z_{n7\ TX}$ = 50 Ω + 1.2 nH[1)]
n3 RX terminating impedance $Z_{n3\ RX}$ = 50 Ω + 3.8 nH[1)]

| Characteristics cross-isolation<br>EN-DC 4G/5G n7 TX – n3 RX | | | min.<br>for $T_{SPEC}$ | typ.<br>@ +25 °C | max.<br>for $T_{SPEC}$ | |
|---|---|---|---|---|---|---|
| **Minimum cross-isolation** | $\alpha_{min}$ | | | | | |
| | 1805... 1880 | MHz | 55 | 64 | — | dB |
| | 2500... 2570 | MHz | 53 | 57 | — | dB |

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

## 10.7 EN-DC 4G/5G n7 TX – n66 RX

| | | |
|---|---|---|
| Temperature range for specification | $T_{SPEC}$ | = −30 °C ... +85 °C |
| n7 TX terminating impedance | $Z_{n7\ TX}$ | = 50 Ω + 1.2 nH[1)] |
| n66 RX terminating impedance | $Z_{n66\ RX}$ | = 50 Ω + 2.9 nH[1)] |

| **Characteristics cross-isolation**<br>**EN-DC 4G/5G n7 TX – EN-DC 4G/5G n66 RX** | | | **min.**<br>for $T_{SPEC}$ | **typ.**<br>@ +25 °C | **max.**<br>for $T_{SPEC}$ | |
|---|---|---|---|---|---|---|
| **Minimum cross-isolation** | $\alpha_{min}$ | | | | | |
| | 2110... 2200 | MHz | 55 | 60 | — | dB |
| | 2500... 2570 | MHz | 55 | 59 | — | dB |

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

## 11 Maximum ratings

| | | |
|---|---|---|
| Storage temperature | $T_{STG}$ [1] = −40 °C ... +85 °C | |
| DC voltage | $\lvert V_{DC} \rvert$ [2] = 0 V (max.) | |
| ESD voltage | $V_{ESD}$ [3] = 225 V (max.) | Human body model. |
| Input power | $P_{IN}$ | |
| @ n1 TX port: 1920 ... 1980 MHz | 30 dBm | Continuous wave for 5000 h @ 50 °C.<br>5 MHz LTE uplink signal (1 RB) for 5000 h @ 50 °C.<br>5 MHz 5G NR (DFT-s-OFDM) (1 RB) for 5000 h @ 50 °C. |
| @ n1 TX port: 1920 ... 1980 MHz | 28.5 dBm | 5 MHz 5G NR (CP-OFDM) (1 RB) for 5000 h @ 50 °C. |
| @ n3 TX port: 1710 ... 1785 MHz | 30 dBm | Continuous wave for 5000 h @ 50 °C.<br>5 MHz LTE uplink signal (1 RB) for 5000 h @ 50 °C.<br>5 MHz 5G NR (DFT-s-OFDM) (1 RB) for 5000 h @ 50 °C. |
| @ n3 TX port: 1710 ... 1785 MHz | 28.5 dBm | 5 MHz 5G NR (CP-OFDM) (1 RB) for 5000 h @ 50 °C. |
| @ n7 TX port: 2500 ... 2570 MHz | 30 dBm | Continuous wave for 5000 h @ 50 °C.<br>5 MHz LTE uplink signal (1 RB) for 5000 h @ 50 °C.<br>5 MHz 5G NR (DFT-s-OFDM) (1 RB) for 5000 h @ 50 °C. |
| @ n7 TX port: 2500 ... 2570 MHz | 28.5 dBm | 5 MHz 5G NR (CP-OFDM) (1 RB) for 5000 h @ 50 °C. |

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

## 12 Transmission coefficient EN-DC 4G/5G n1

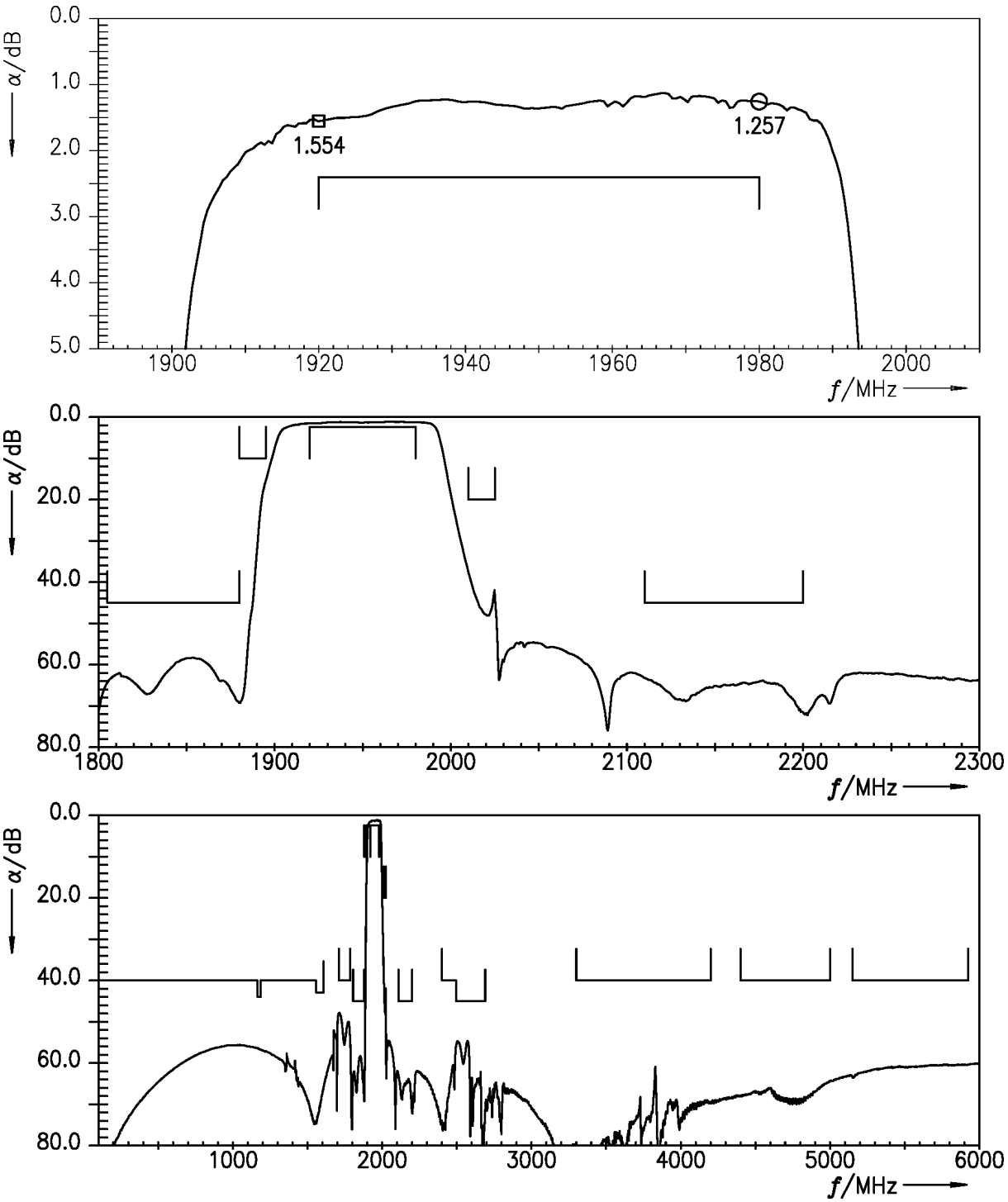


**Figure 3:** Attenuation TX – ANT.

## 13 Reflection coefficients EN-DC 4G/5G n1

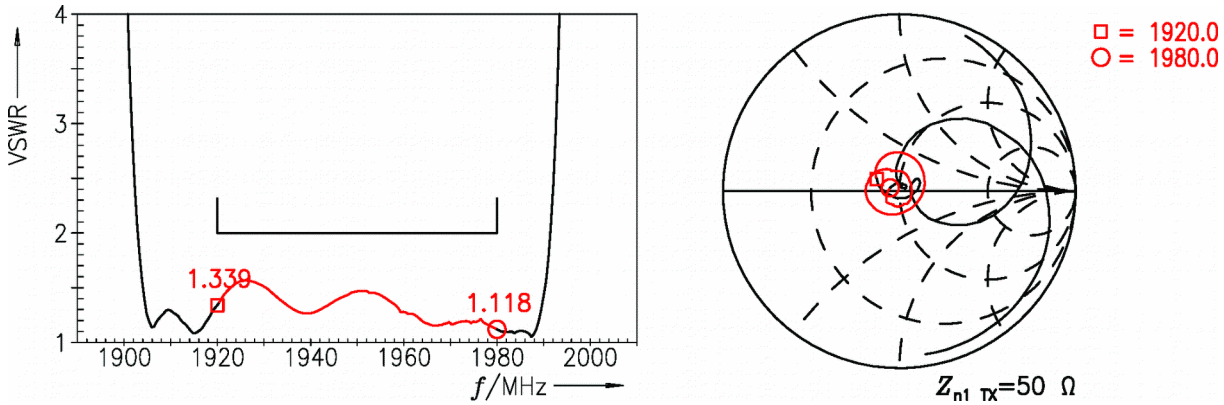


**Figure 4:** Reflection coefficient at n1 TX port.

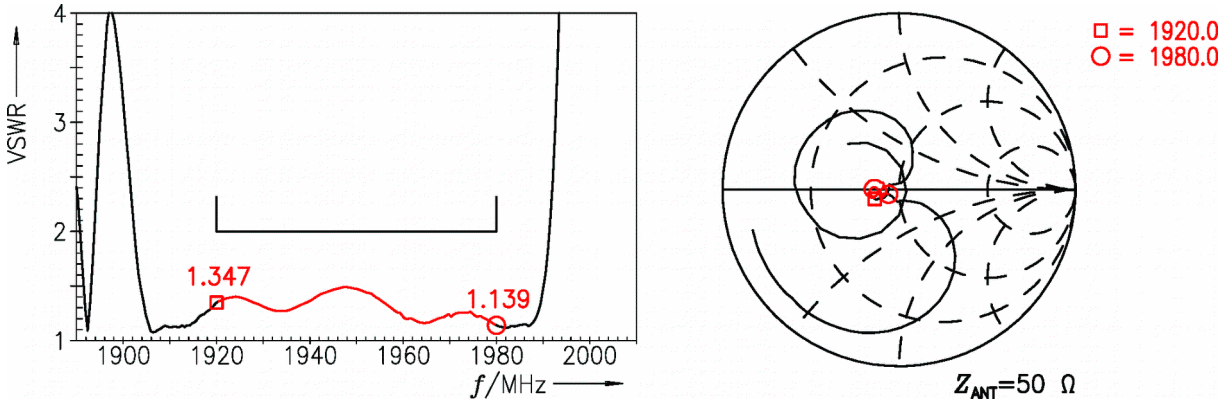


**Figure 5:** Reflection coefficient at ANT port (TX frequencies).

## 14 Transmission coefficients EN-DC 4G/5G n3

### 14.1 TX – ANT

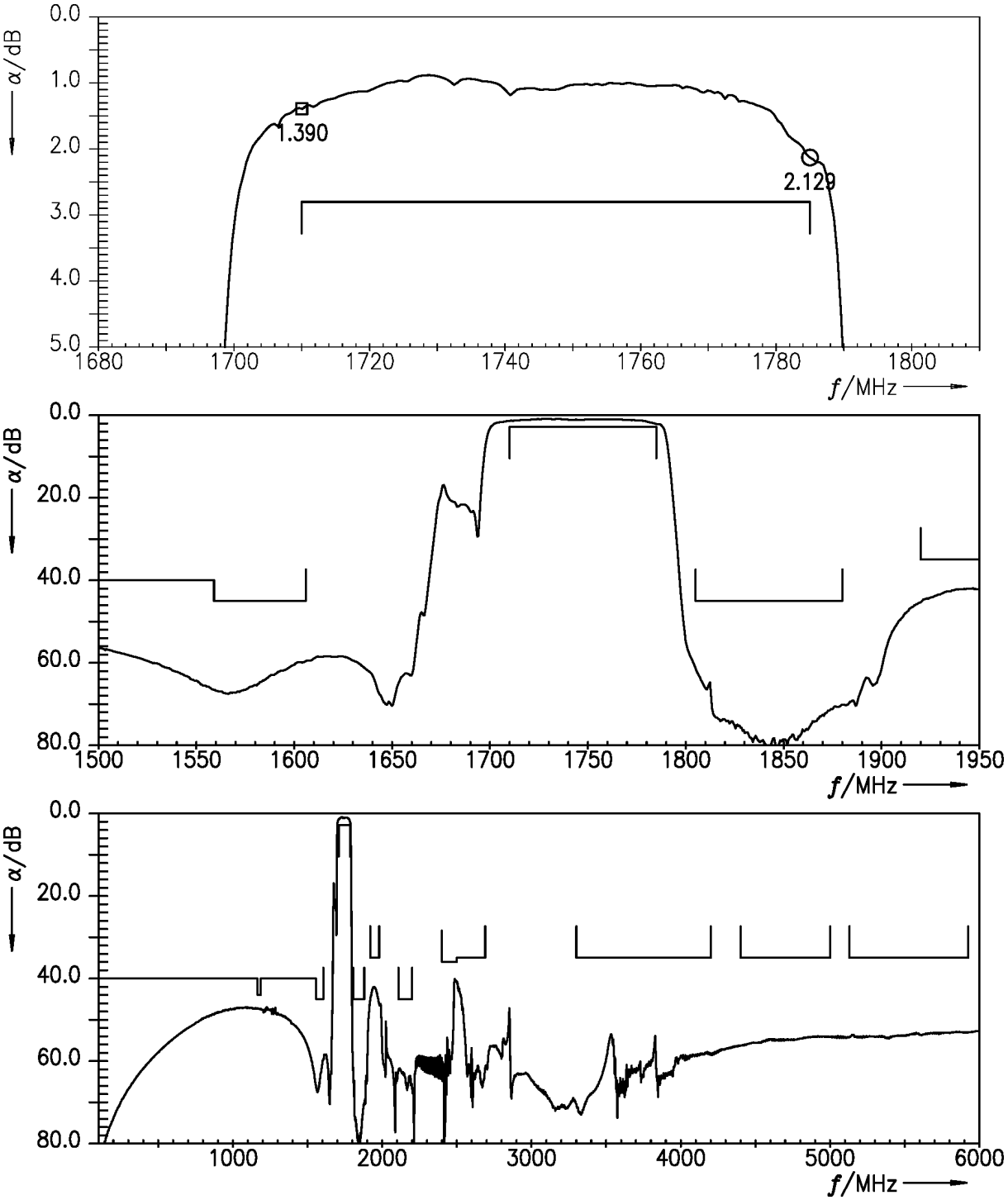


**Figure 6:** Attenuation TX – ANT.

## 14.2 ANT – RX

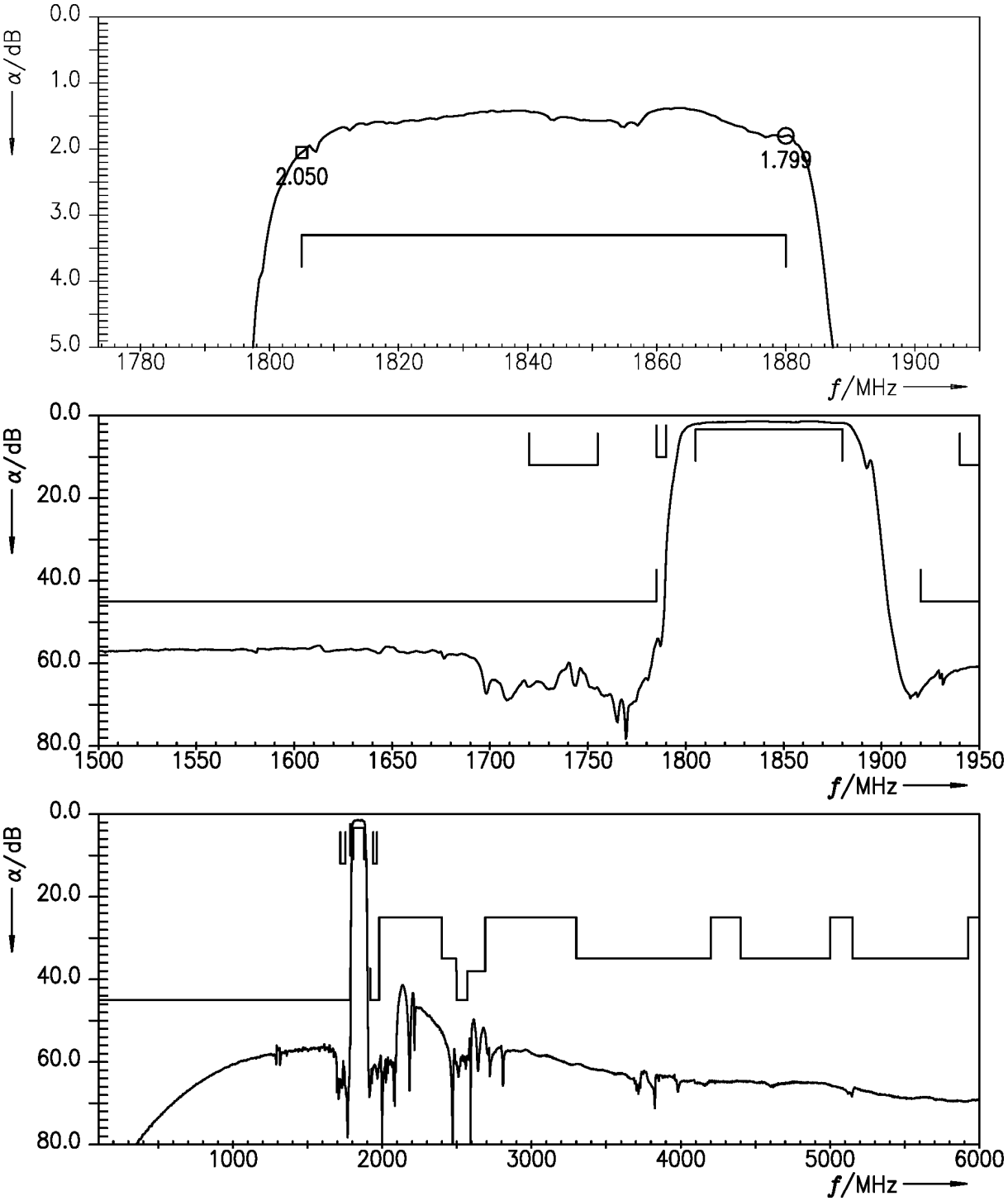


**Figure 7:** Attenuation ANT – RX.

### 14.3 TX – RX

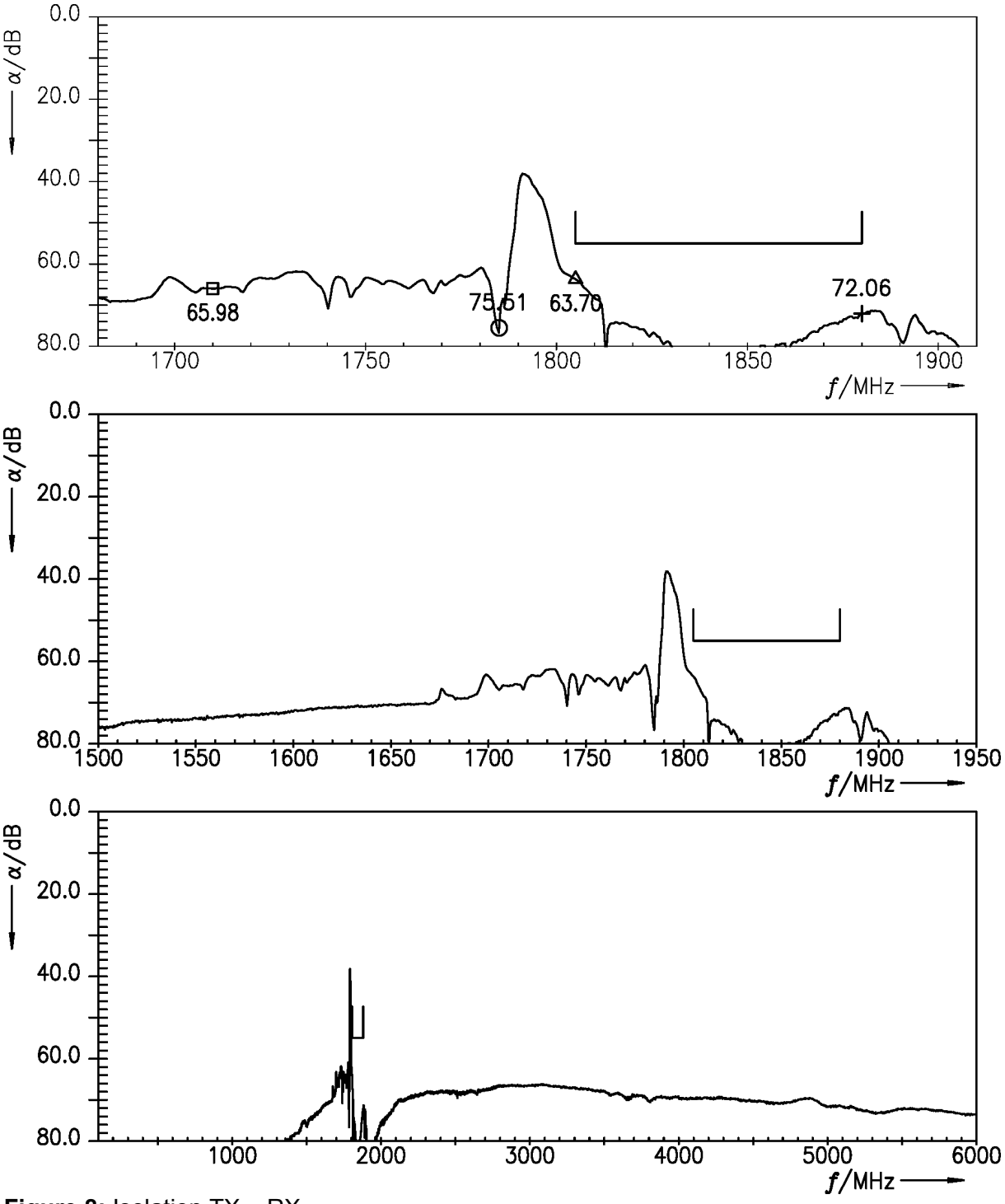


**Figure 8:** Isolation TX – RX.

## 15 Transmission coefficient (LTE) EN-DC 4G/5G n3

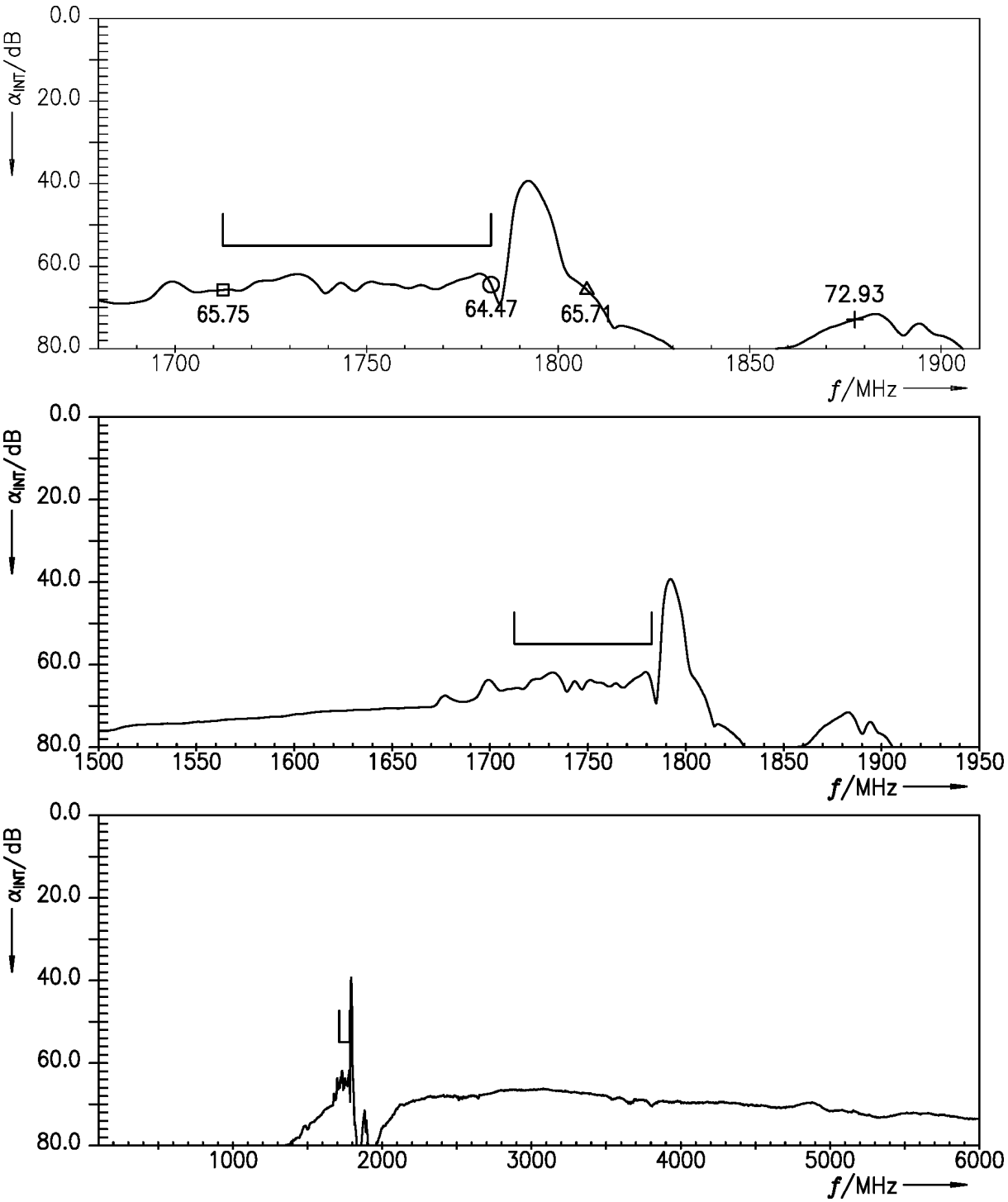


**Figure 9:** Isolation (LTE) (integration window = 5.0 MHz) TX – RX.

## 16 Reflection coefficients EN-DC 4G/5G n3

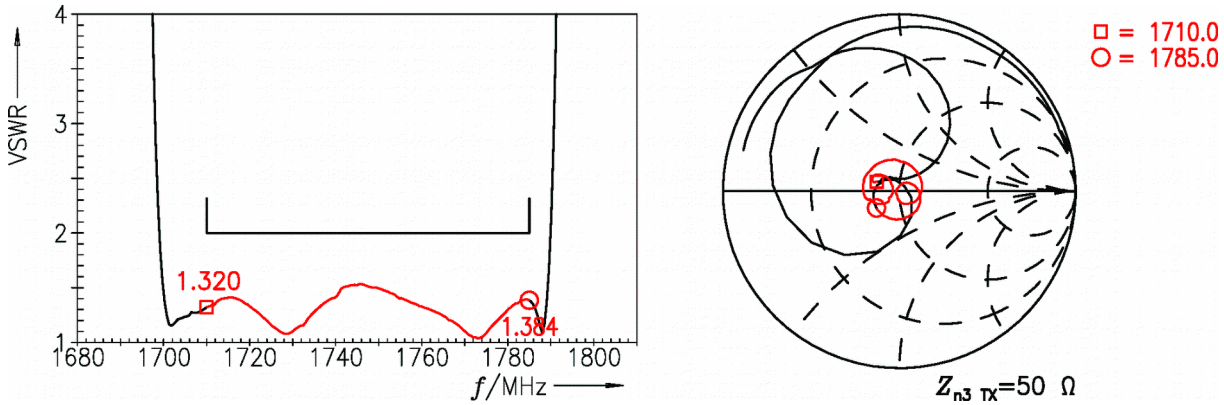


**Figure 10:** Reflection coefficient at n3 TX port.

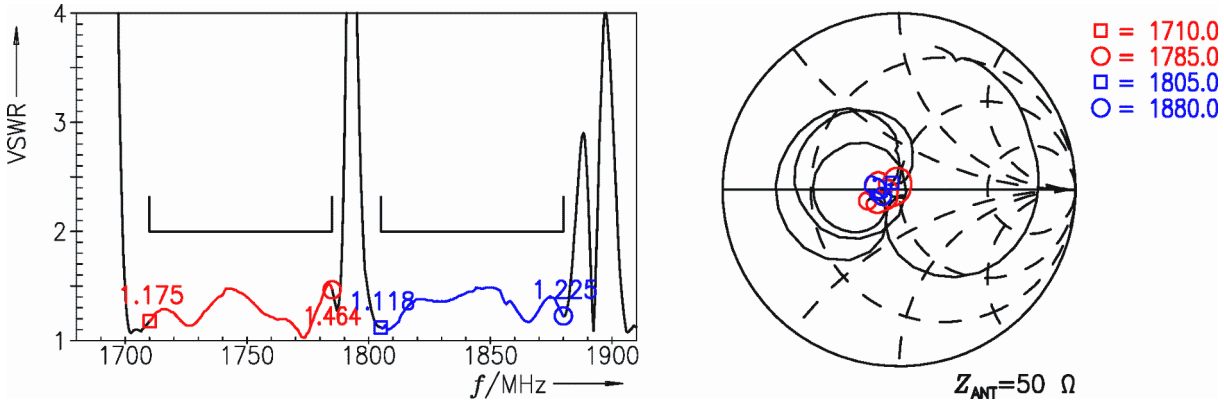


**Figure 11:** Reflection coefficient at ANT port (TX and RX frequencies).

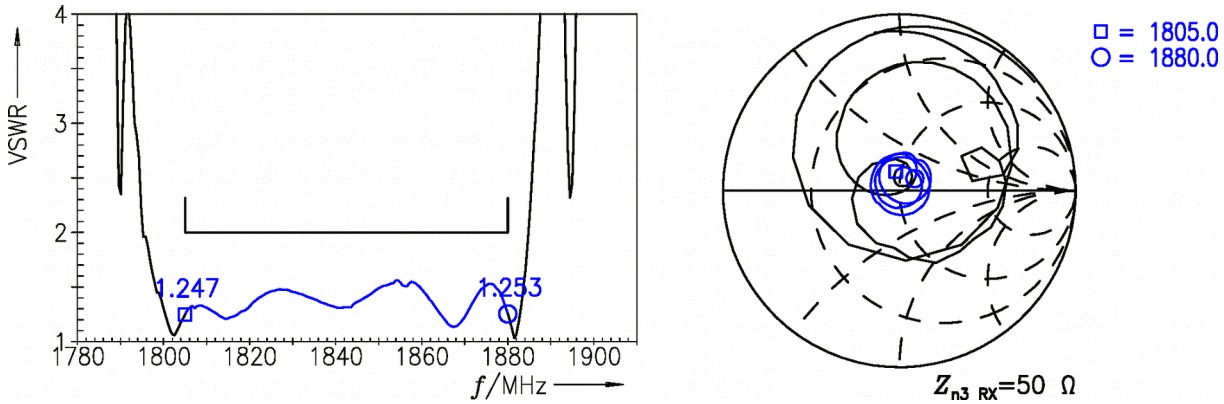


**Figure 12:** Reflection coefficient at n3 RX port.

## 17 Transmission coefficients EN-DC 4G/5G n7

### 17.1 TX – ANT

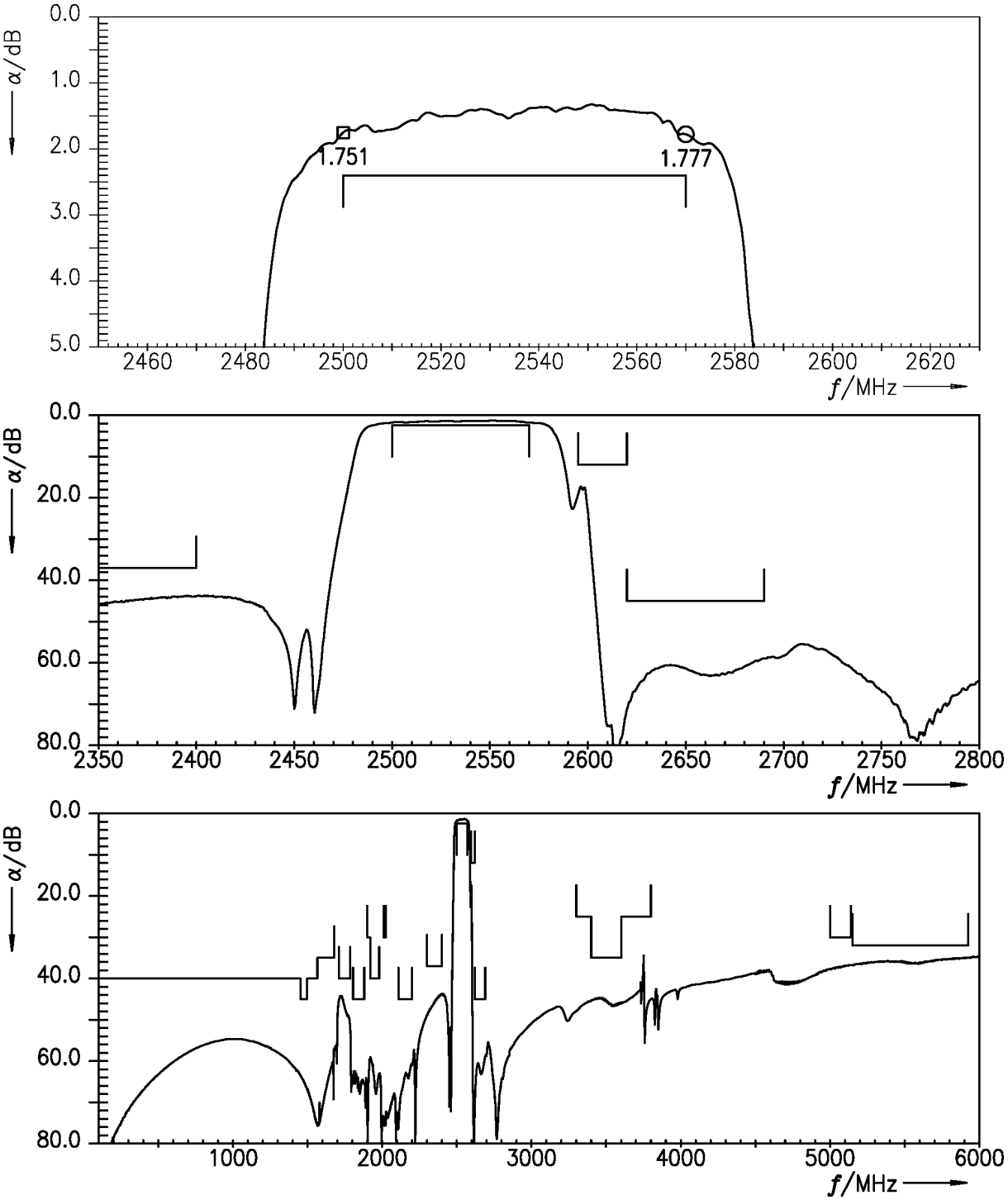


**Figure 13:** Attenuation TX – ANT.

### 17.2 ANT – RX

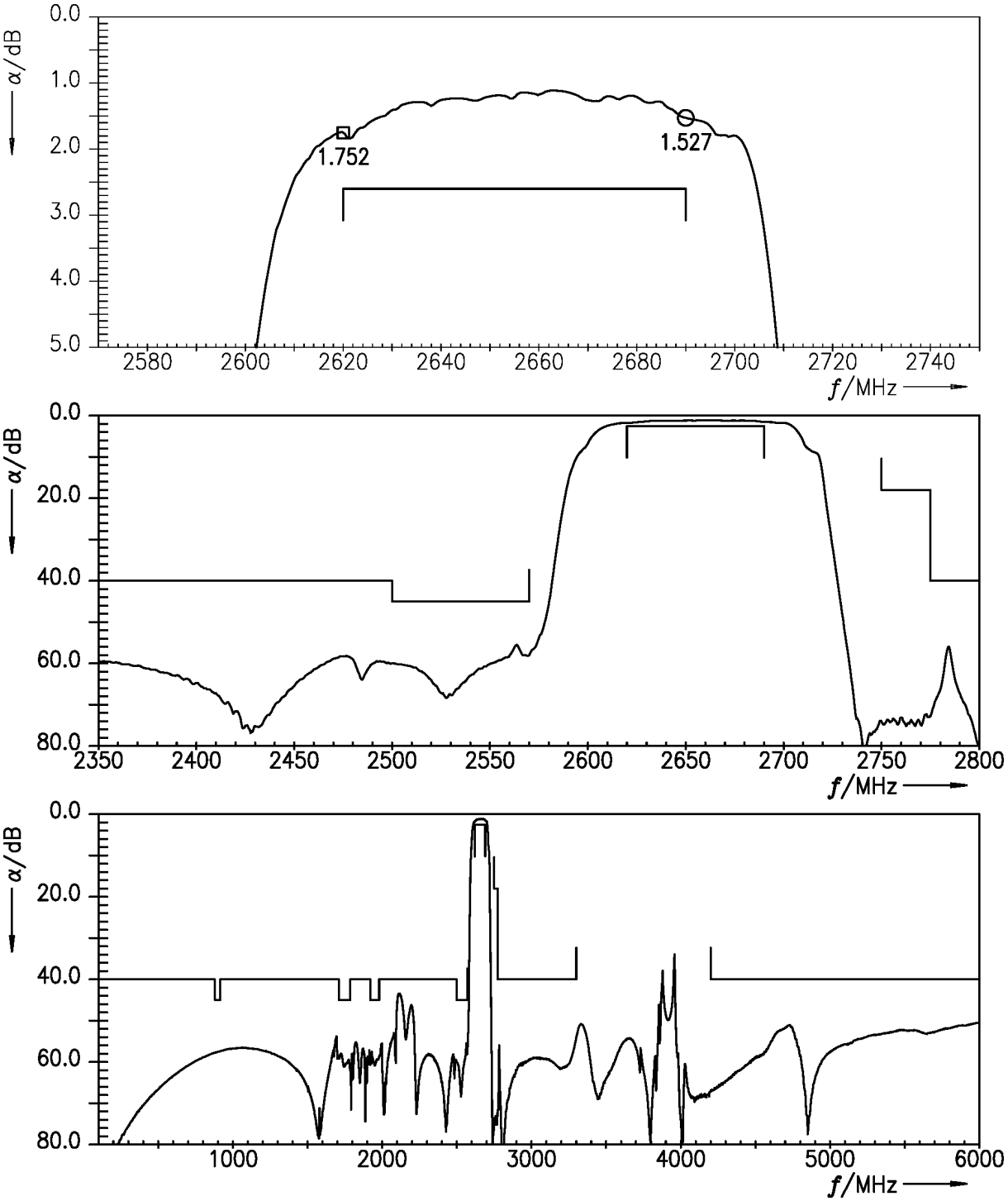


**Figure 14:** Attenuation ANT – RX.

### 17.3 TX – RX

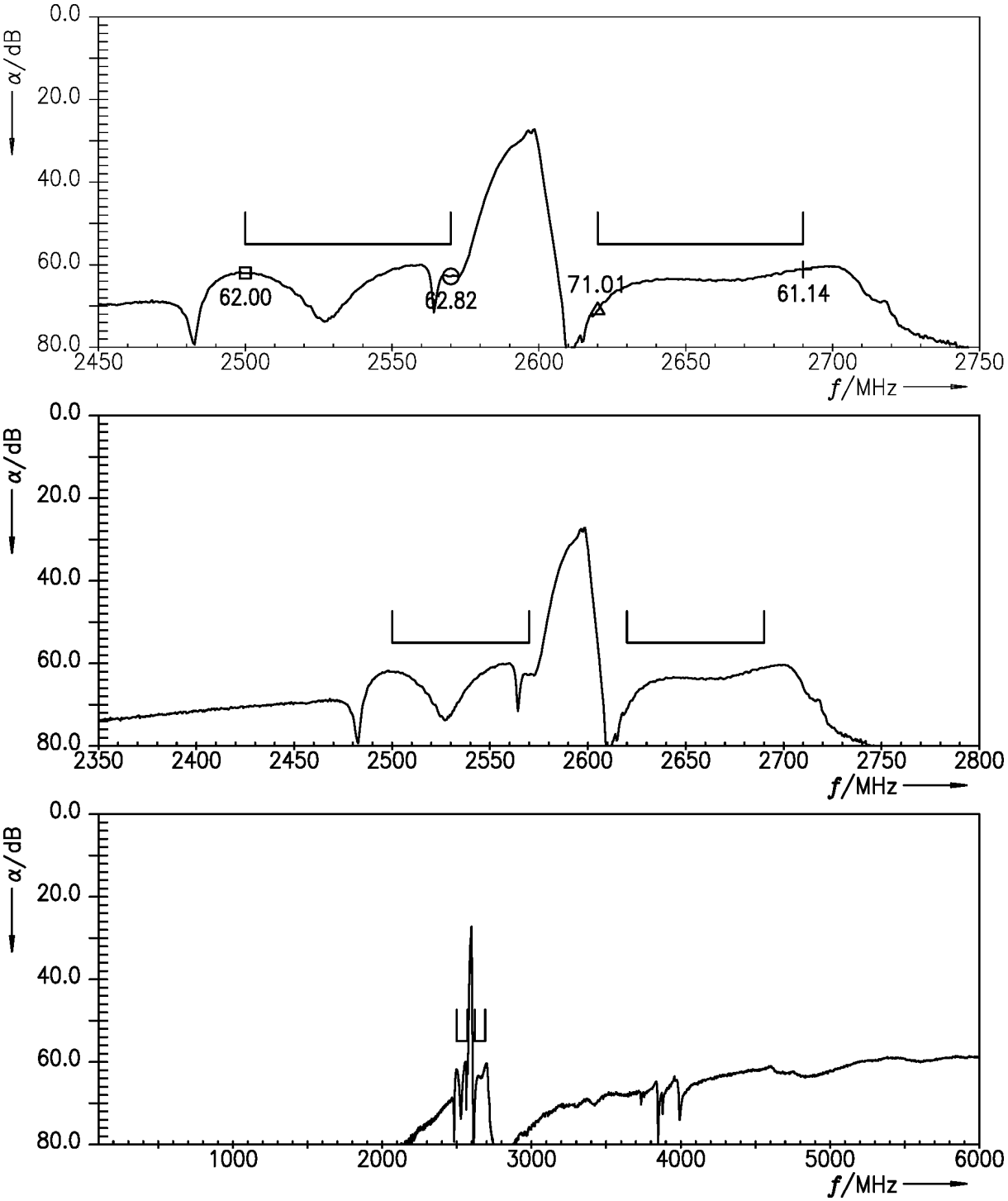


**Figure 15:** Isolation TX – RX.

## 18 Transmission coefficient (WLAN) EN-DC 4G/5G n7

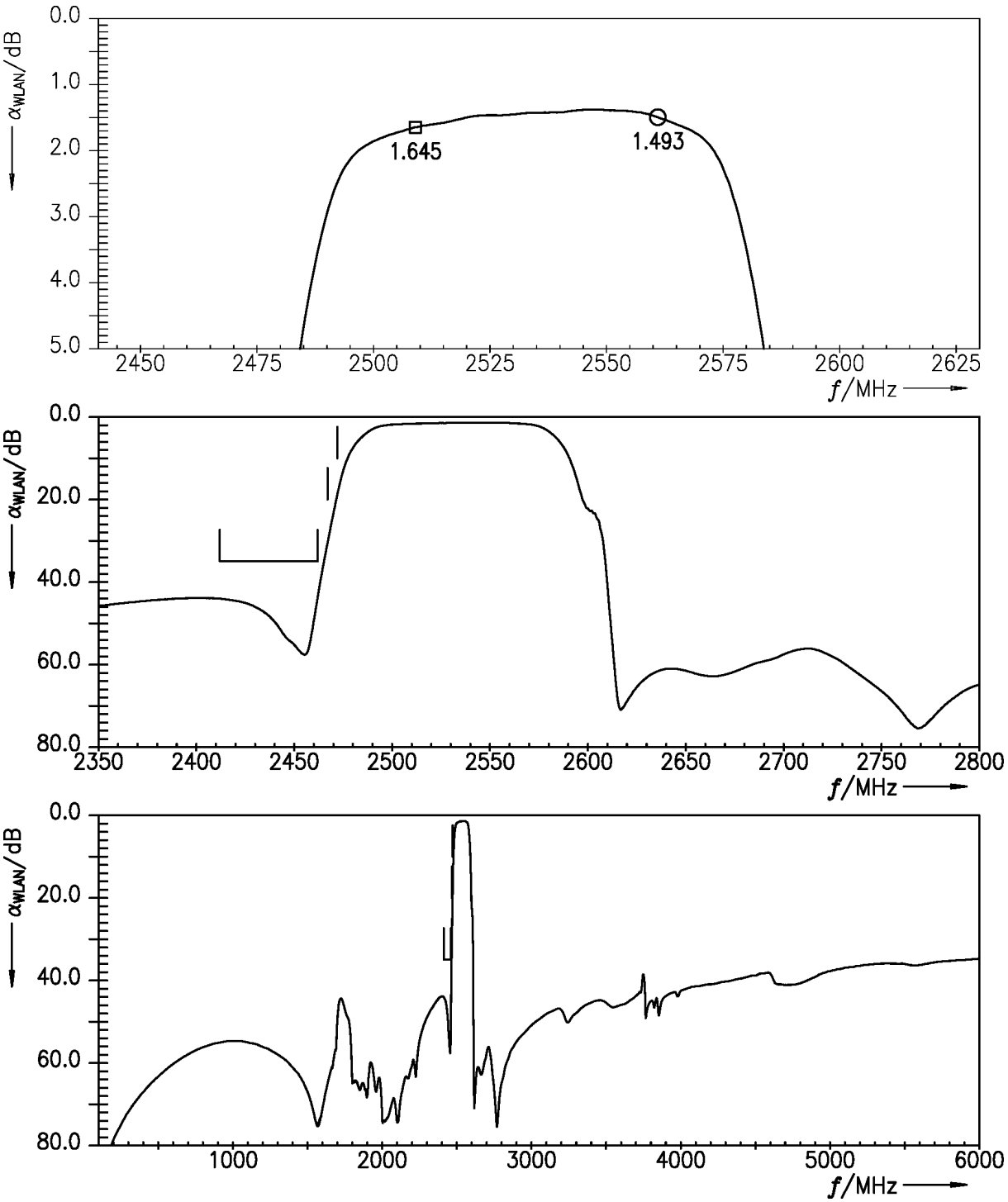


**Figure 16:** Attenuation (WLAN) (integration window = 18 MHz) TX – ANT.

## 19 Transmission coefficient (integrated) EN-DC 4G/5G n7

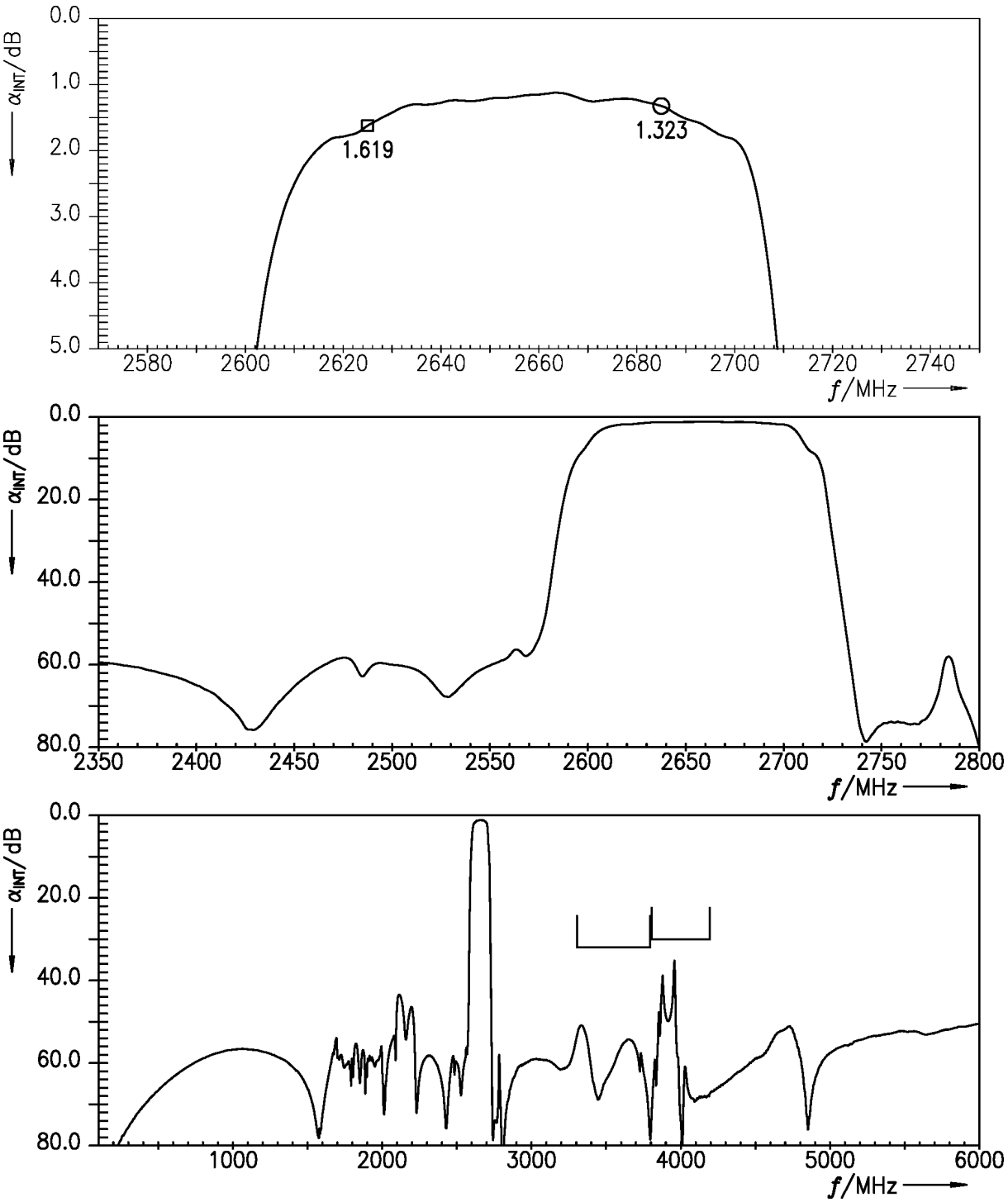


**Figure 17:** Integrated attenuation (integration window = 10 MHz) ANT – RX.

## 20 Reflection coefficients EN-DC 4G/5G n7

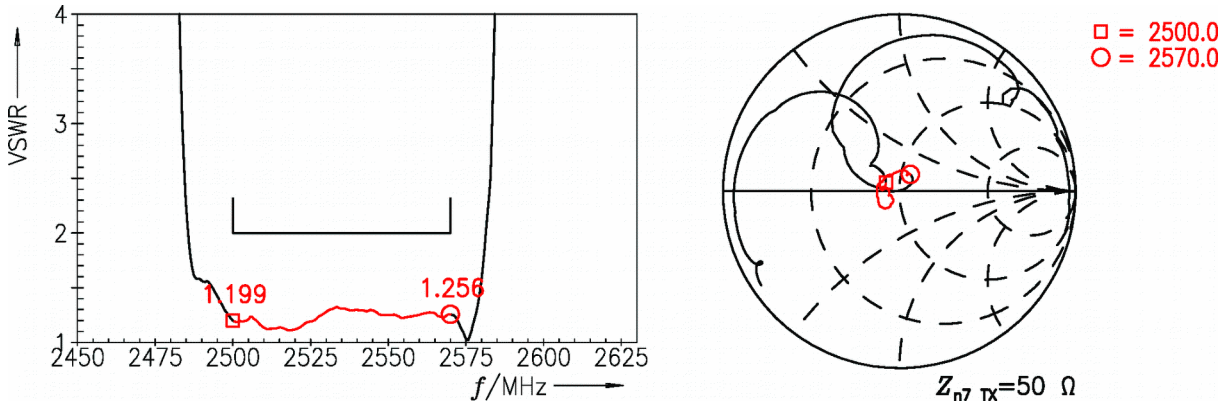


**Figure 18:** Reflection coefficient at n7 TX port.

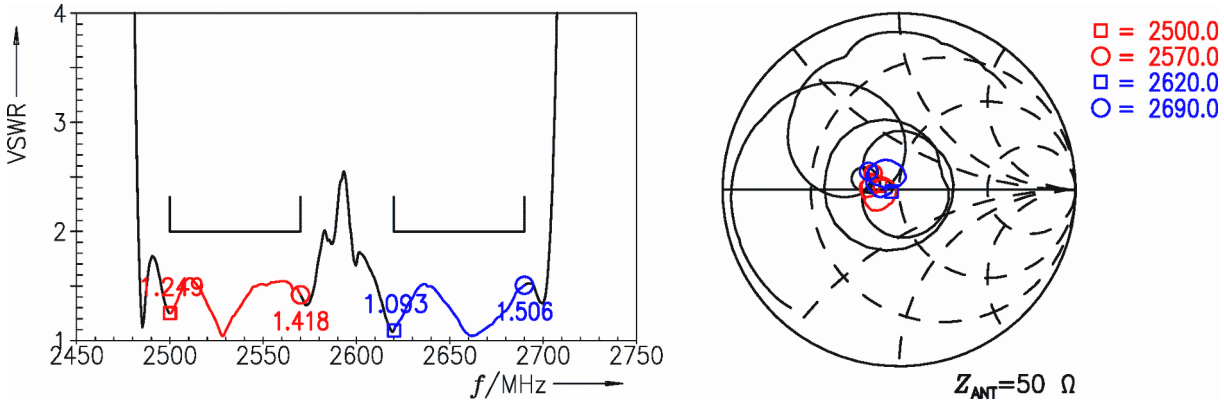


**Figure 19:** Reflection coefficient at ANT port (TX and RX frequencies).

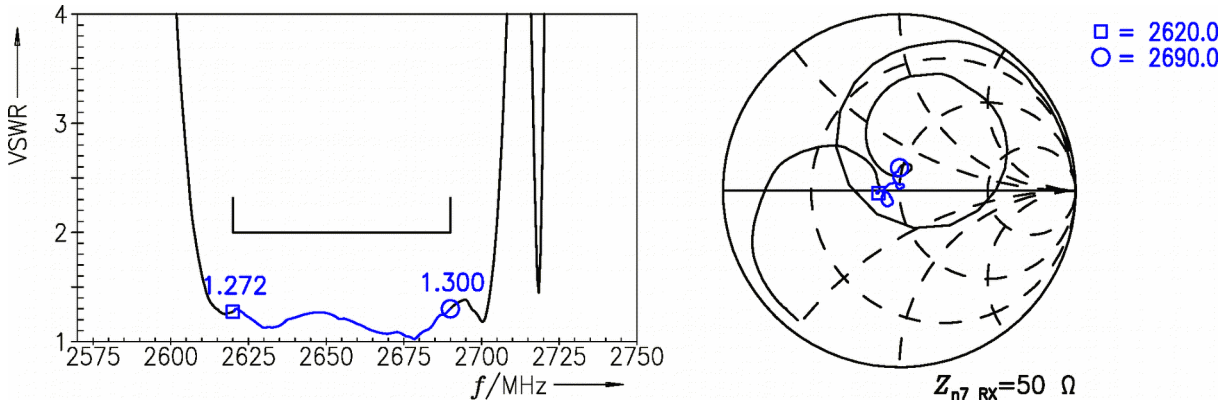


**Figure 20:** Reflection coefficient at n7 RX port.

## 21 Transmission coefficient EN-DC 4G/5G n66

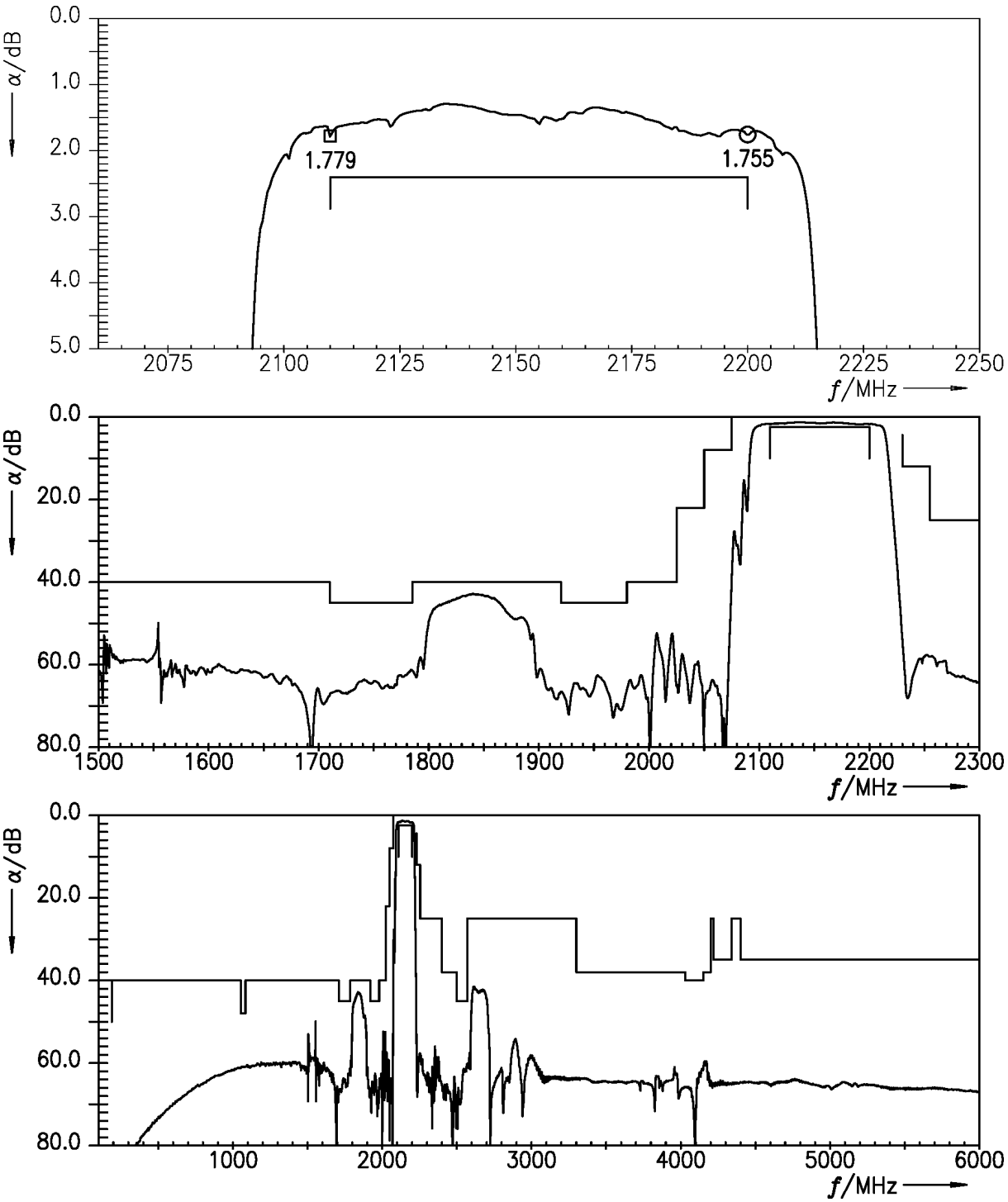


**Figure 21:** Attenuation ANT – RX.

## 22 Reflection coefficients EN-DC 4G/5G n66

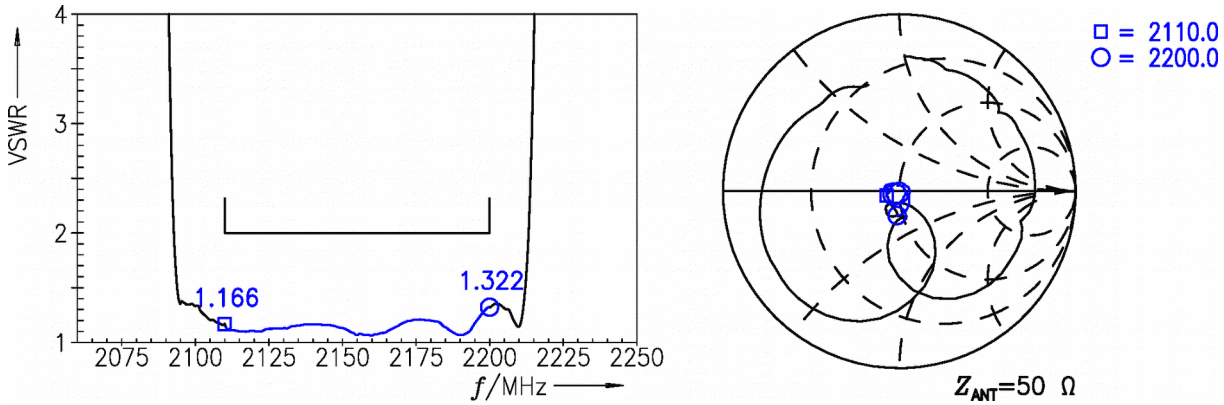


**Figure 22:** Reflection coefficient at ANT port (RX frequencies).

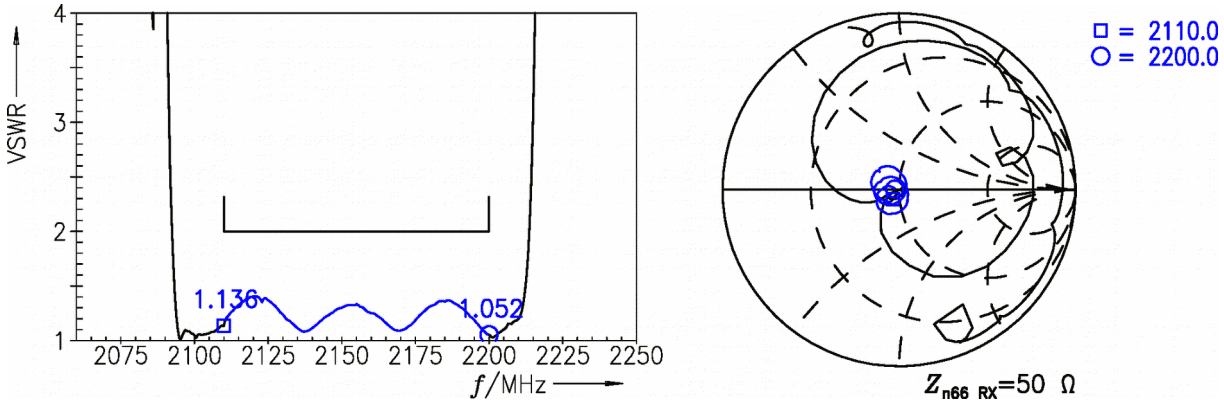


**Figure 23:** Reflection coefficient at n66 RX port.

## 23 Transmission coefficients cross-isolations

### 23.1 EN-DC 4G/5G n1 TX – EN-DC 4G/5G n3 RX

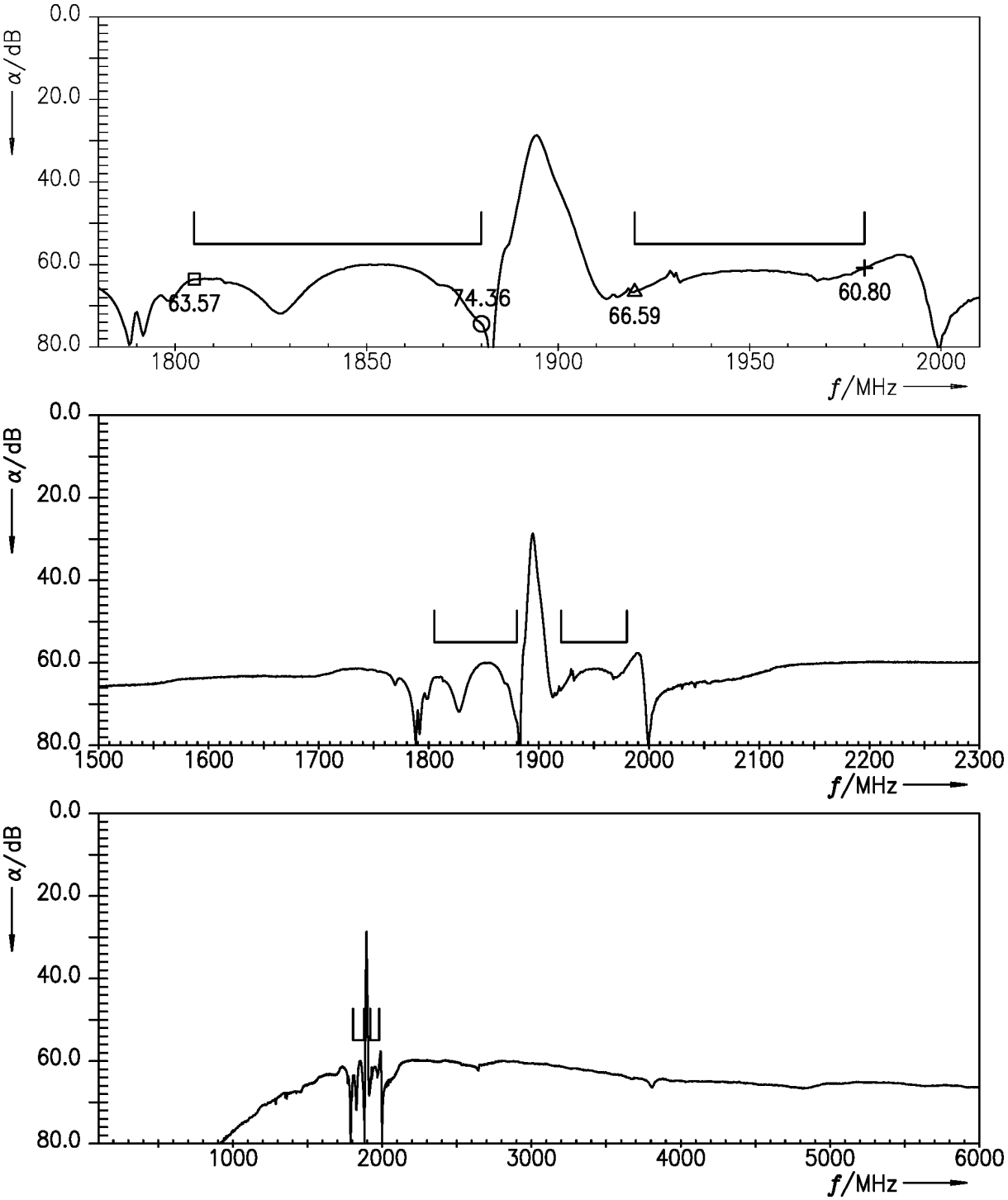


**Figure 24:** Cross-isolation EN-DC 4G/5G n1 TX – EN-DC 4G/5G n3 RX.

### 23.2 EN-DC 4G/5G n1 TX – EN-DC 4G/5G n7 RX

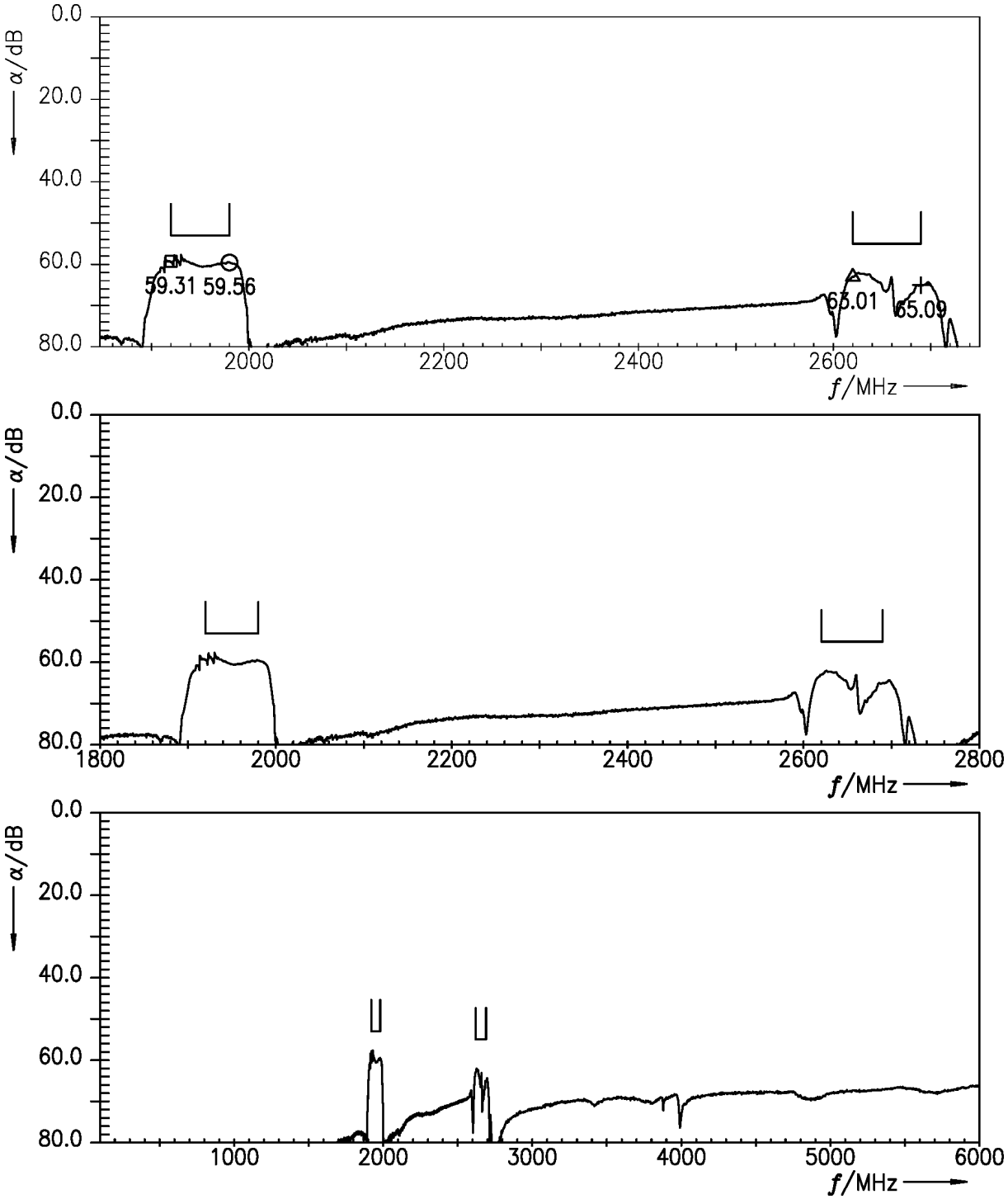


**Figure 25:** Cross-isolation EN-DC 4G/5G n1 TX – EN-DC 4G/5G n7 RX.

### 23.3 EN-DC 4G/5G n1 TX – EN-DC 4G/5G n66 RX

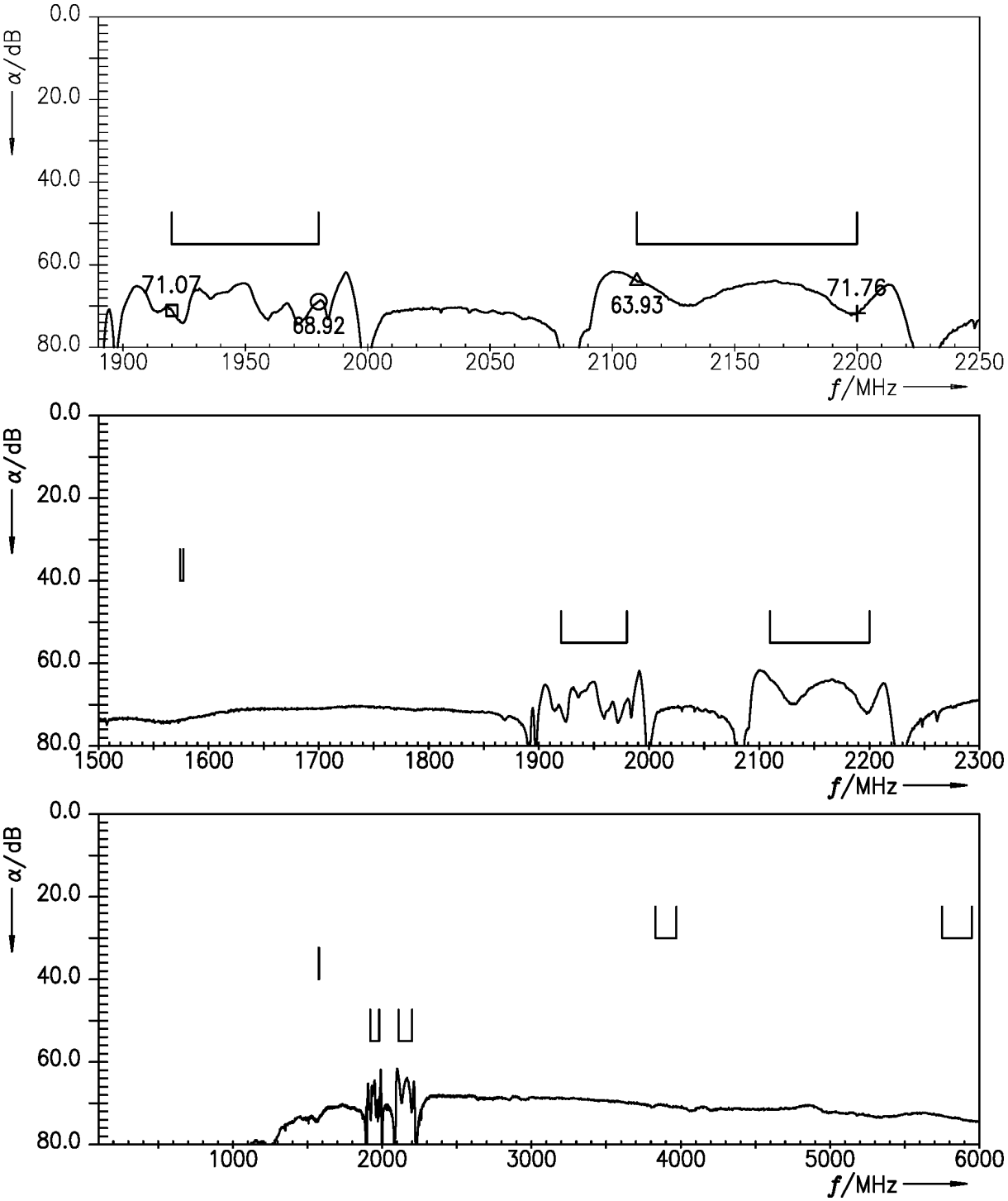


**Figure 26:** Cross-isolation EN-DC 4G/5G n1 TX – EN-DC 4G/5G n66 RX.

### 23.4 EN-DC 4G/5G n3 TX – EN-DC 4G/5G n7 RX

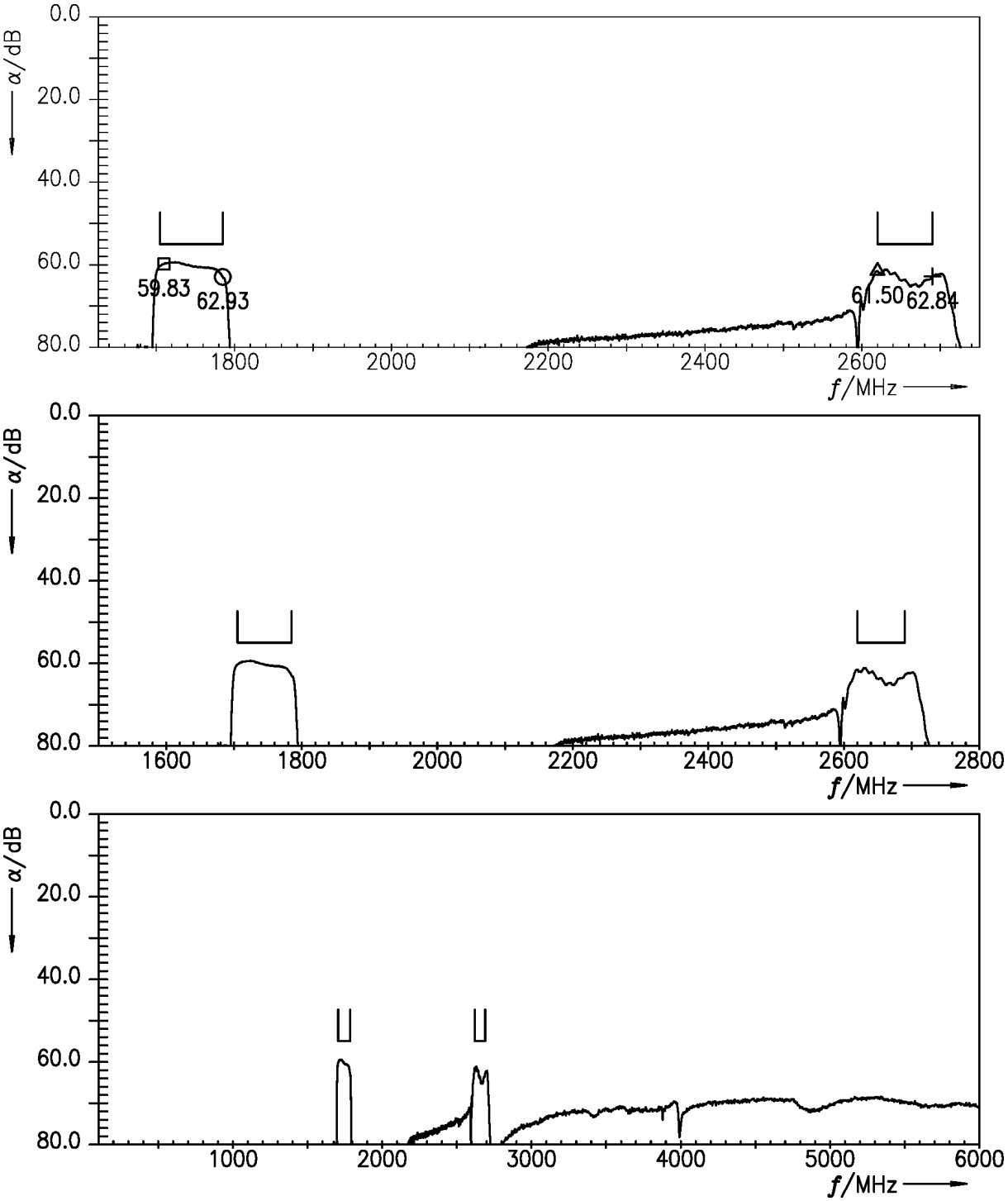


**Figure 27:** Cross-isolation EN-DC 4G/5G n3 TX – EN-DC 4G/5G n7 RX.

### 23.5 EN-DC 4G/5G n3 TX – EN-DC 4G/5G n66 RX

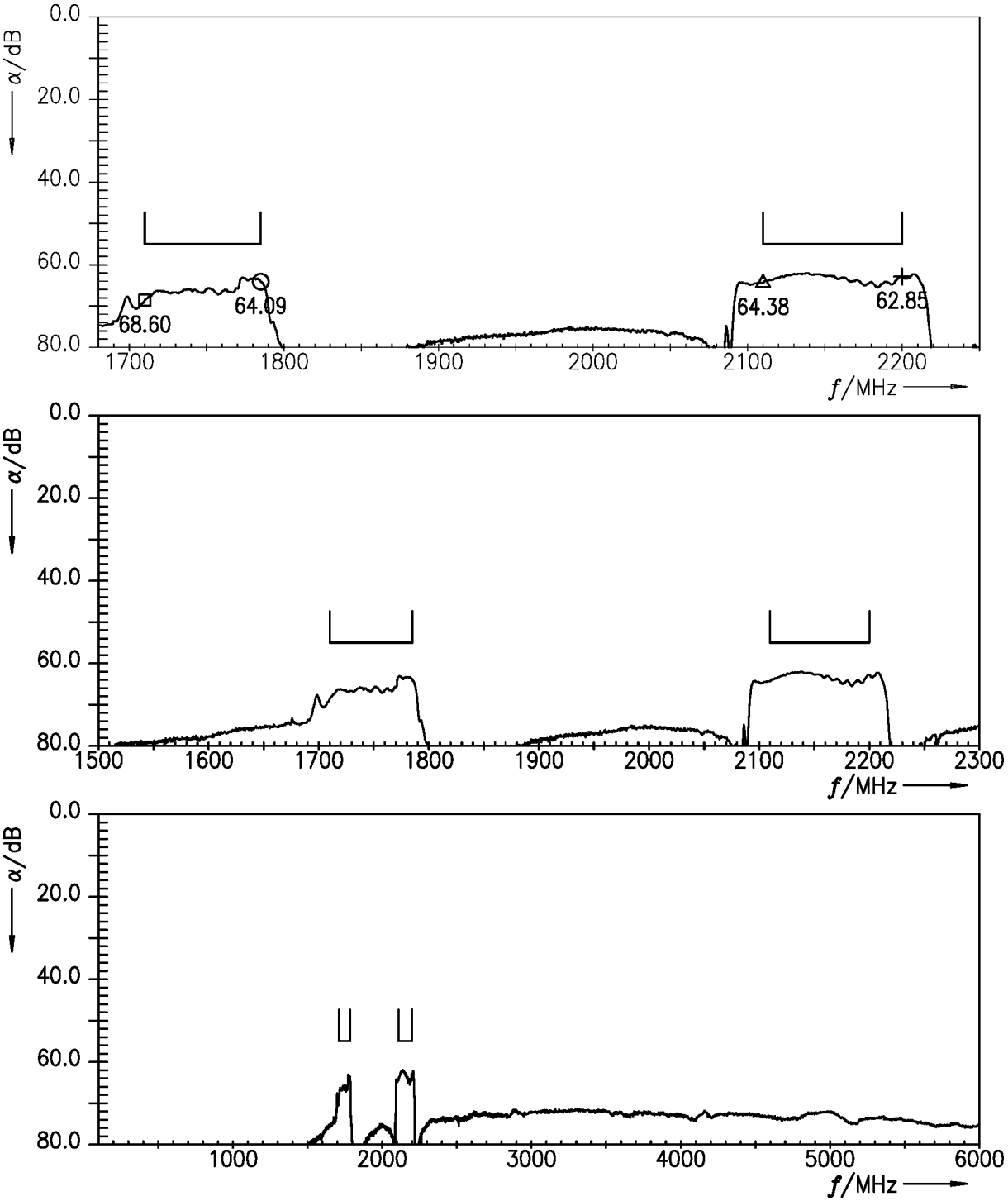


**Figure 28:** Cross-isolation EN-DC 4G/5G n3 TX – EN-DC 4G/5G n66 RX.

### 23.6 EN-DC 4G/5G n7 TX – EN-DC 4G/5G n3 RX

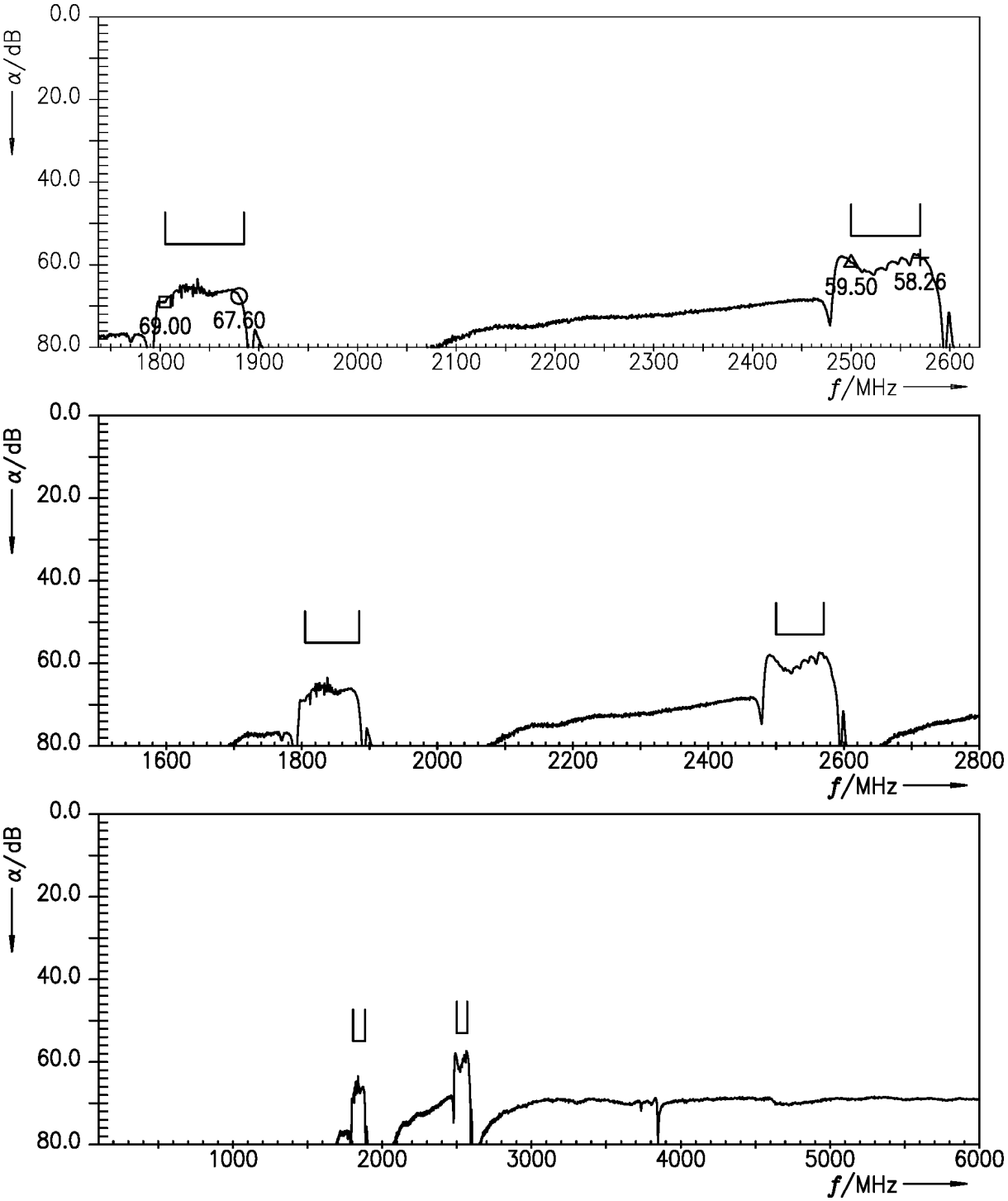


**Figure 29:** Cross-isolation EN-DC 4G/5G n7 TX – EN-DC 4G/5G n3 RX.

### 23.7 EN-DC 4G/5G n7 TX – EN-DC 4G/5G n66 RX

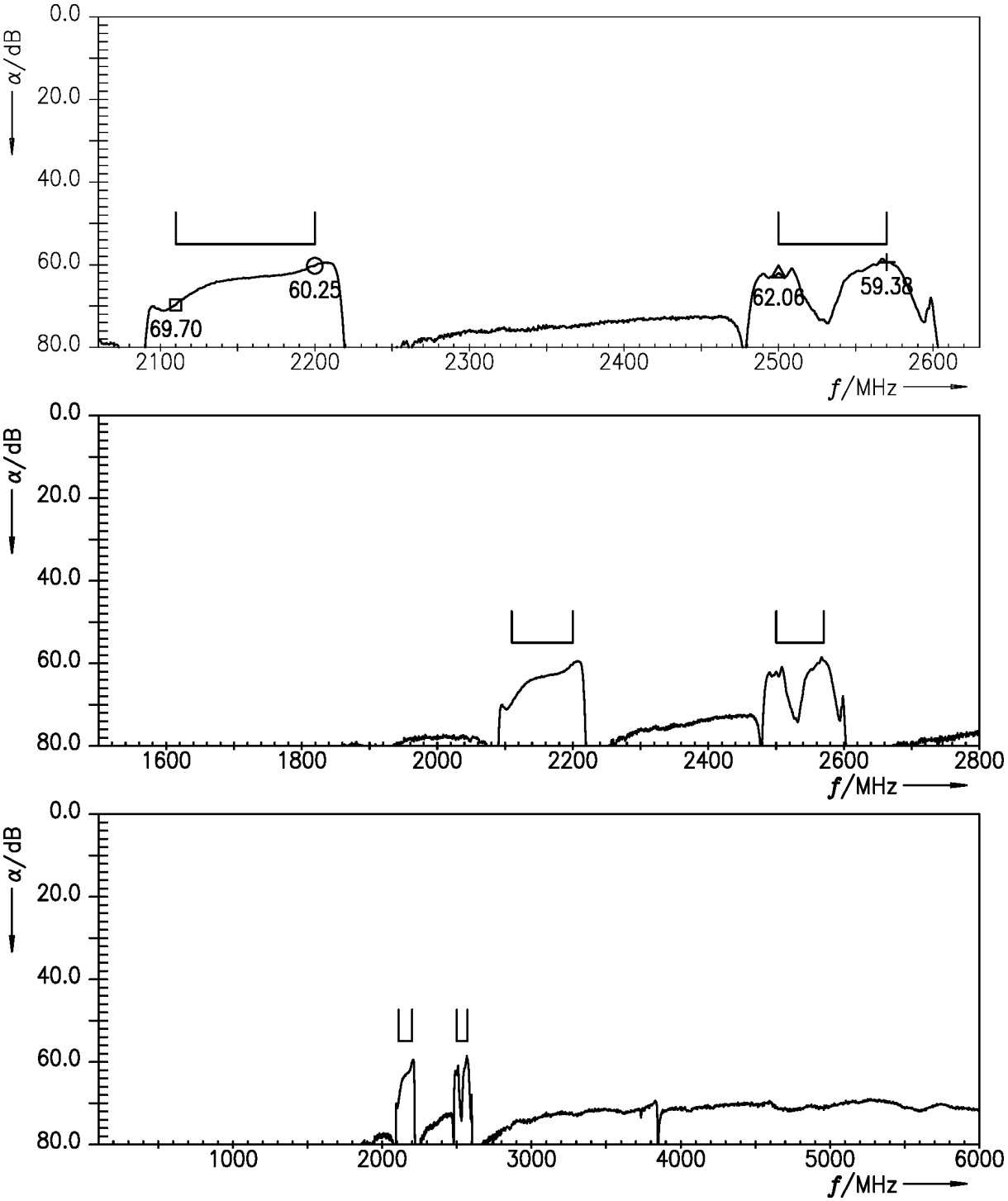


**Figure 30:** Cross-isolation EN-DC 4G/5G n7 TX – EN-DC 4G/5G n66 RX.

## 24 Packing material

### 24.1 Tape

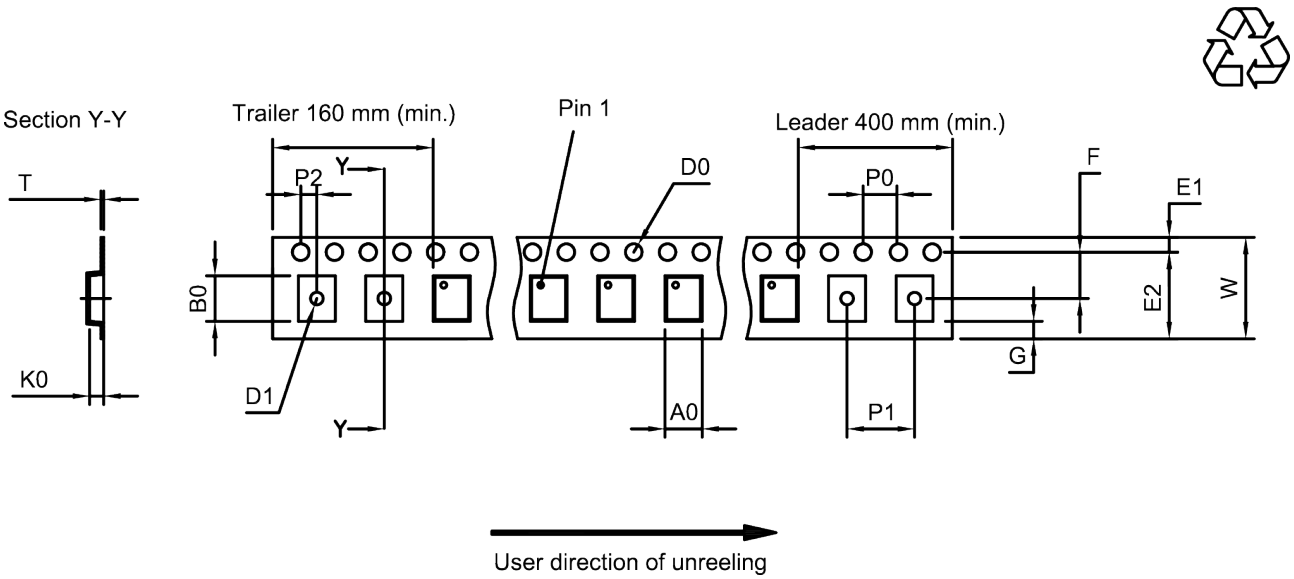


**Figure 31:** Drawing of tape (first-angle projection) for illustration only and not to scale. The valid tape dimensions are listed in Table 1.

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

| | |
|---|---|
| $E_2$ | $10.25_{+0.2/-0}$ mm |
| F | $5.5_{\pm 0.05}$ mm |
| G | 0.75 mm (min.) |
| $K_0$ | $0.84_{\pm 0.1}$ 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 | $0.3_{\pm 0.03}$ mm |
| W | $12.0_{+0.3/-0.1}$ mm |

**Table 1:** Tape dimensions.

## 24.2 Reel with diameter of 180 mm

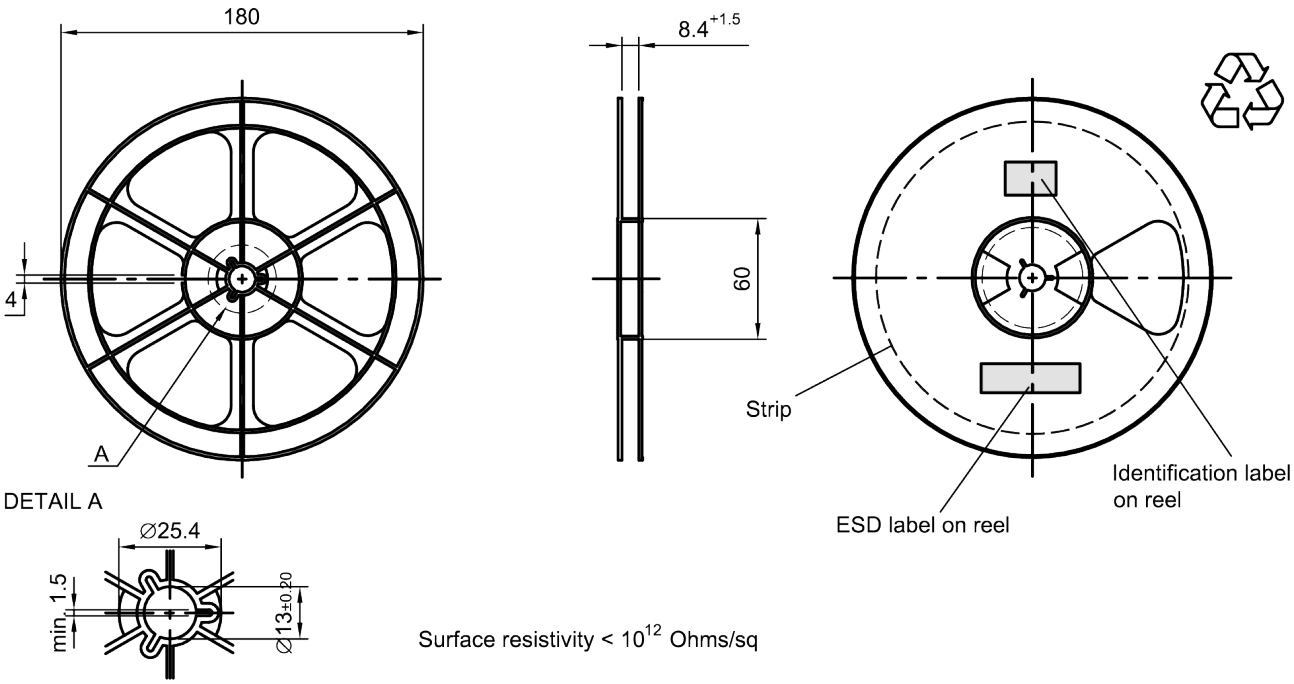


**Figure 32:** Drawing of reel (first-angle projection) with diameter of 180 mm.

Dimensions [mm]
X = 220+5
Y = 235+5
Sealing area 10±3

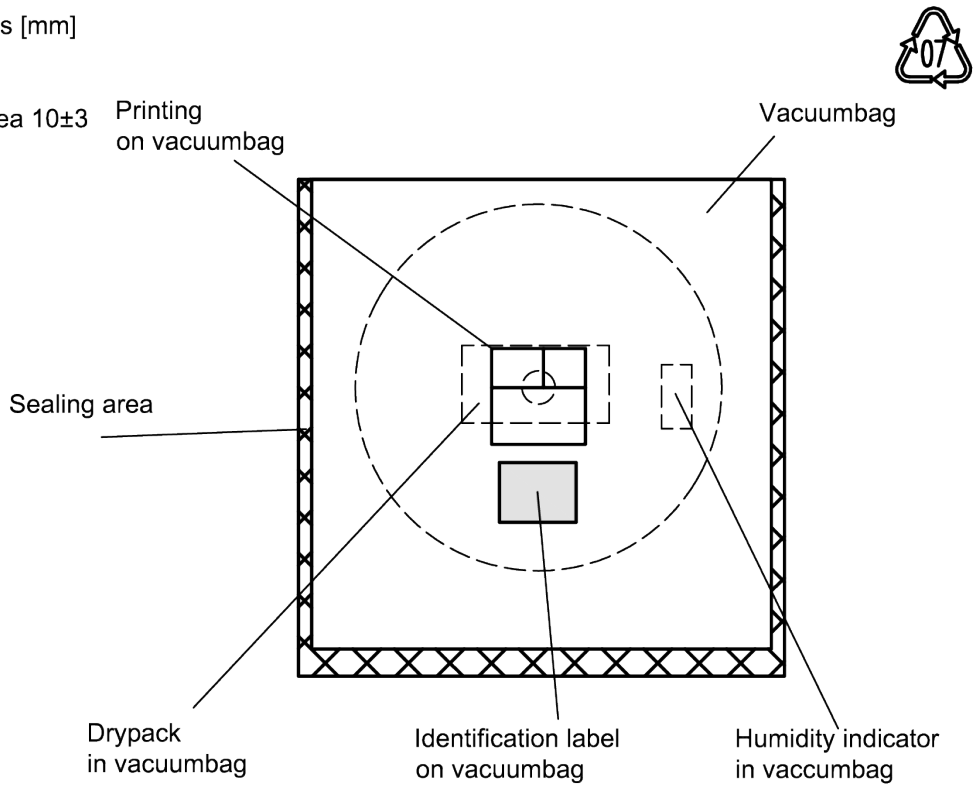


**Figure 33:** Drawing of moisture barrier bag (MBB) for reel with diameter of 180 mm.

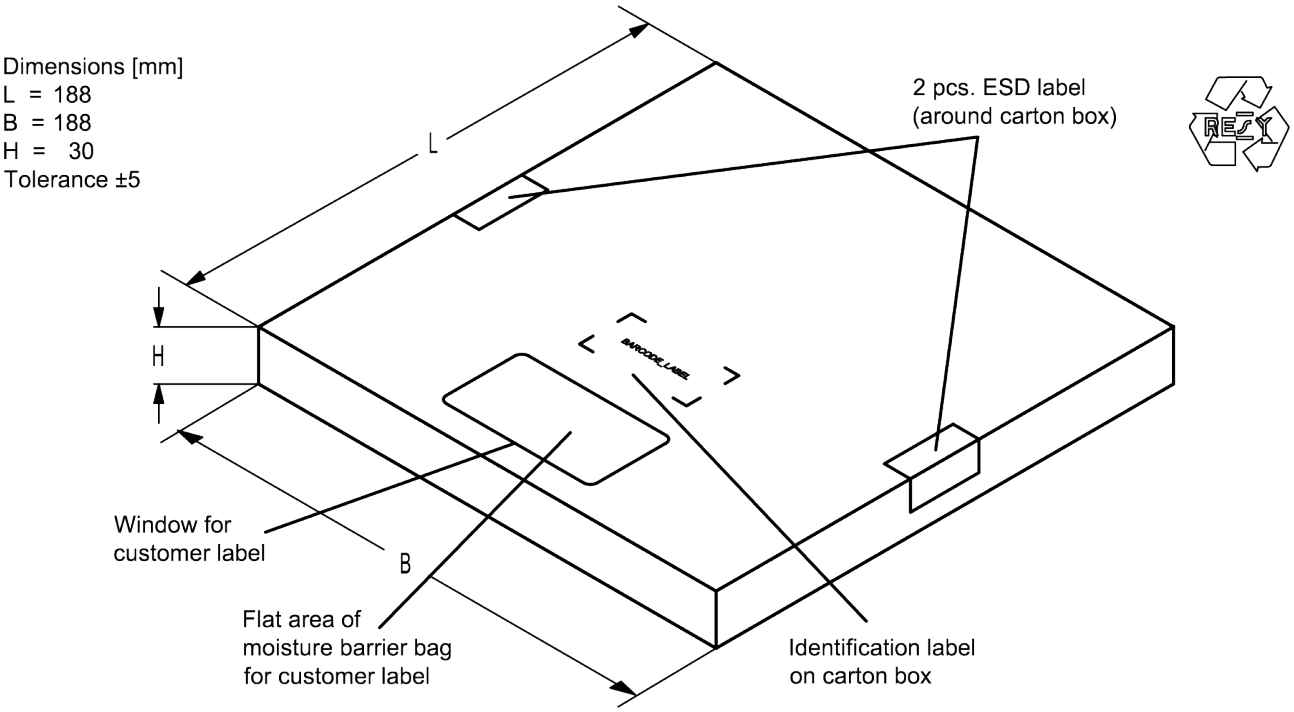


**Figure 34:** Drawing of folding box for reel with diameter of 180 mm.

### 24.3 Reel with diameter of 330 mm

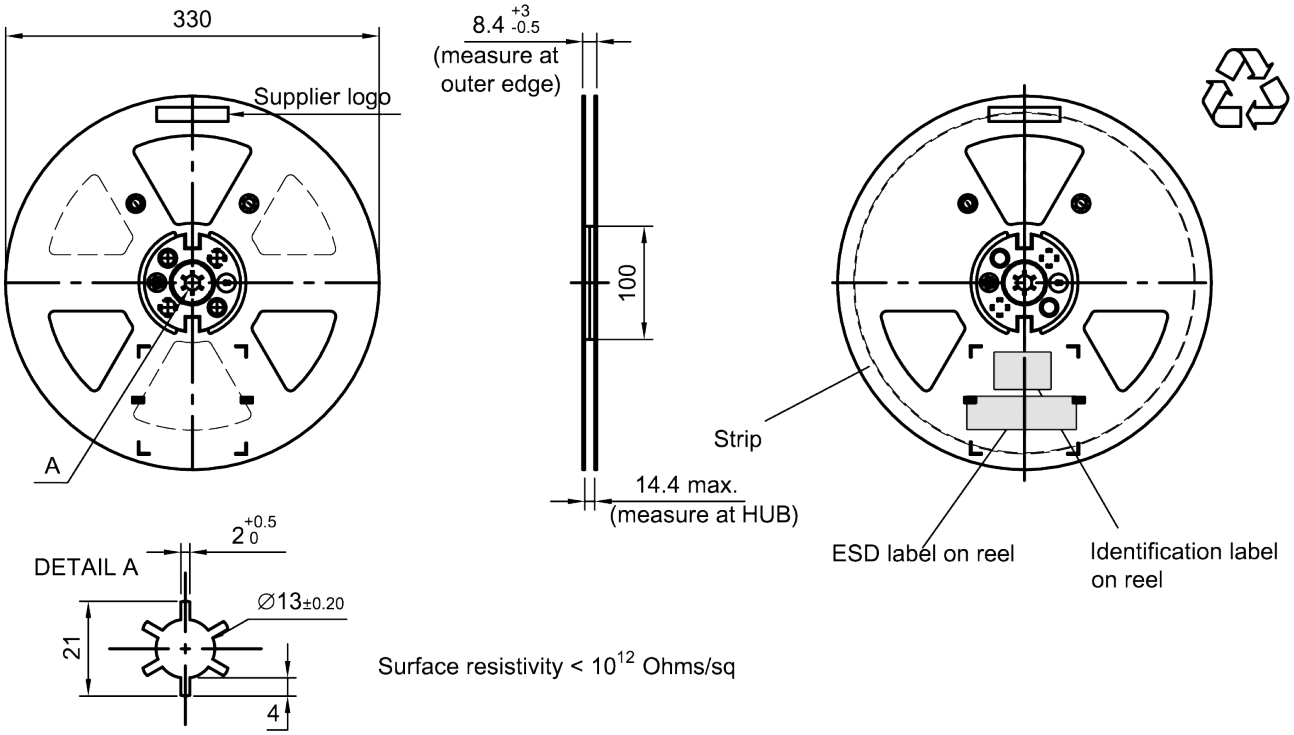


**Figure 35:** Drawing of reel (first-angle projection) with diameter of 330 mm.

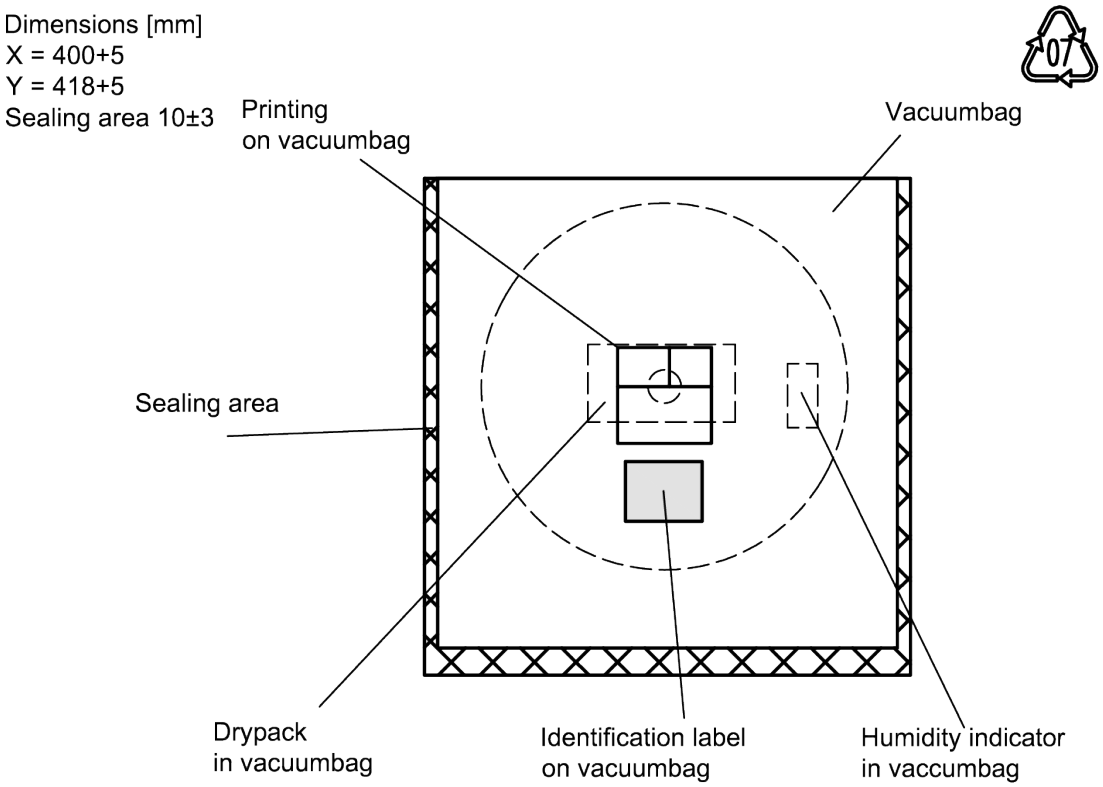


**Figure 36:** Drawing of moisture barrier bag (MBB) for reel with diameter of 330 mm.

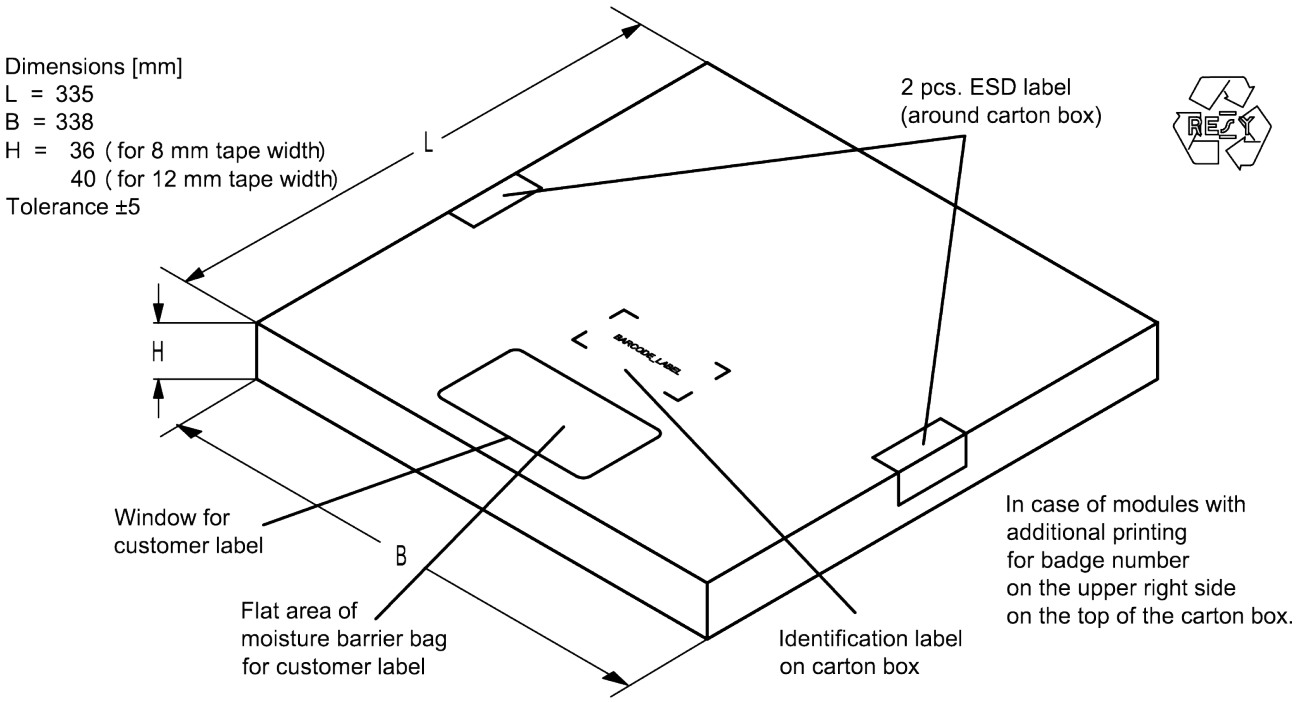


**Figure 37:** Drawing of folding box for reel with diameter of 330 mm.

## 25 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 M5009 is 4WH.

- 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.

## 26 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).

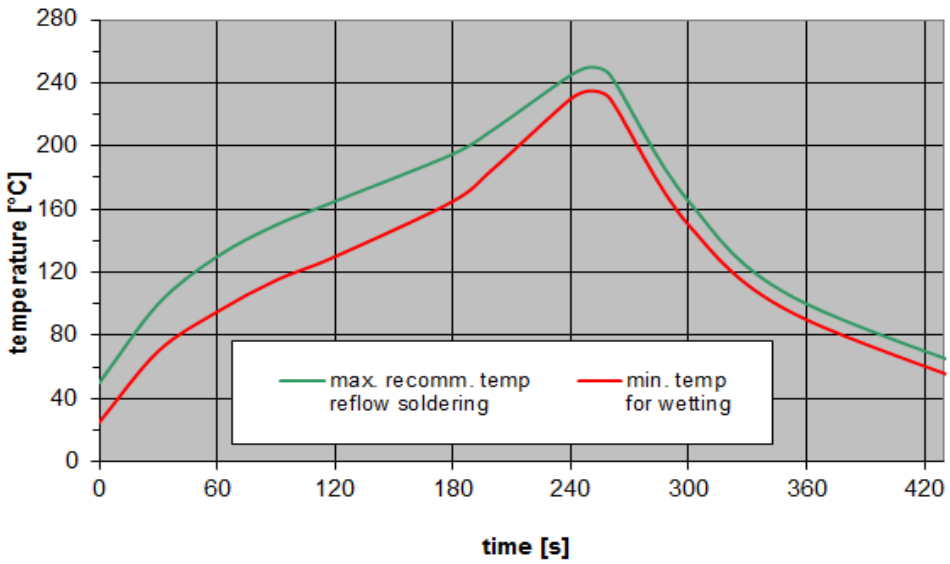


**Figure 38:** Recommended reflow profile for convection and infrared soldering – lead-free solder.

# 27 Annotations

## 27.1 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.

## 27.2 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.

## 27.3 Ordering codes / product IDs and packing units

| Ordering code / product ID | RF360 label | Packing unit |
|---|---|---|
| B39272M5009D310W 1 | B39272-M5009-D310-W01 | 10000 pcs |

**Table 4:** Ordering codes / product IDs and packing units.

# 28 Cautions and warnings

## 28.1 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/.

## 28.2 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.

## 28.3 Moldability

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

## 28.4 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.

## 29 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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