Product datasheet of Audi DDA Gen2 MLB BM roof antenna with LTE, GNSS, FFB and active Bluetooth

History

Date	Version	Description of modification
21.09.2023	1.0	Initial version

Table of contents

1 General description

1.1 Features

The DDA MLB Gen2 is a compact roof antenna series applied to the MLBevo platform vehicles.

This Audi DDA roof antenna comprises the services:

- active Bluetooth tranceiver as gateway for “remote parking”, “light control” and “user recognition” to be used in combination with the branded mobile phone apps.
- cellular phone,
- navigation,
- remote control (FFB)

This version is “SFD2” (UNECE cybersecurity) compliant with K-Matrix V8.18.

This roof antenna is designed to be screwed to a metal roof at the rear end of the vehicle.

1.2 Bluetooth

The Bluetooth tranceiver supports application specific Bluetooth low energy (BLE) characteristics only.
It is configured as a strictly restricted gateway to prevent unauthorized access, as it is allowed to wake up the vehicle's CAN bus while parked. User recognition is done while passing the vehicle with the mobile. Thus, this may happen several times while parked user recognition does not wake up the car. The latest IDs are kept in the gateway waiting for a wake up of the CAN bus triggered by other events. The sleep current limits are allowed to be slightly increased due to the BLE activities while parked.
The cryptographic keys to use the BLE features are exchanged via the brand specific backend. This exchange is done over cellular protocols. The cellular transfer of these keys is no feature of this device it is done between the rest of the vehicle and the backend as well the backend and the mobile. The keys are exchanged via the CAN bus with the vehicles remaining infrastructure.
There is no direct exchange of private keys towards the mobile. The gateway expects the mobiles to connect with valid keys.
Connect trials with standard BLE characteristics are rejected without any action. Connection requests with correct keys but no valid user actions afterwards are counted to prevent the battery from discharging. This feature is called “play protection”. Triggering the play protection limit shuts down the BLE tranceiver until the CAN bus was woken by another event.
The BLE tranceiver is shut down in drive cycles not classified as remote parking action - it is active in stand still scenarios only.
After the connection procedure with the mobile the device is just a logical transparent wireless modem. The control of the park and light scenarios are handled via this transparent logical channel between the users mobile and the vehicles remaining infrastructure. IDs kept by user recognition are announced towards the vehicles remaining infrastructure, only.
The Bluetooth tranceiver is powered as contact 30 device with logical contact 15 via the connection to the vehicle’s infotainment CAN. The closed-circuit current is allowed to be increased.

1.3 Cellular phone

The cellular phone is a passive circuit which covers the frequency ranges 3G LTE and 4G LTE.

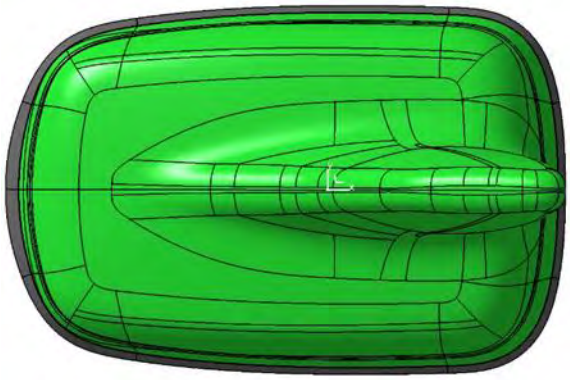
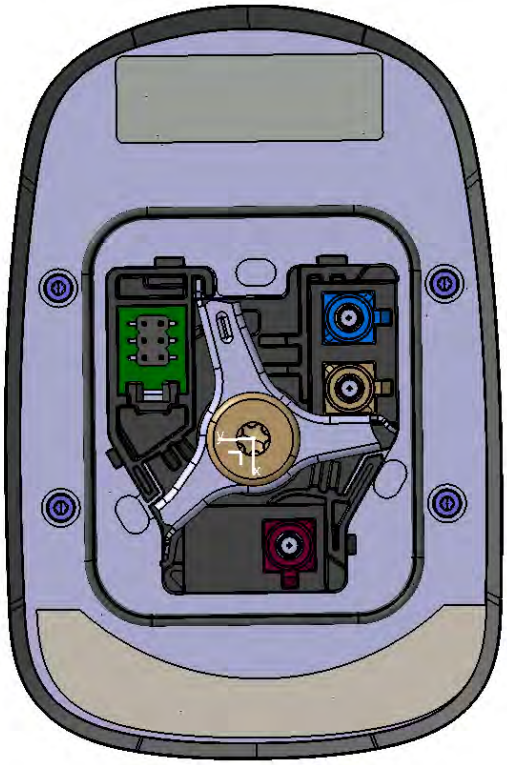
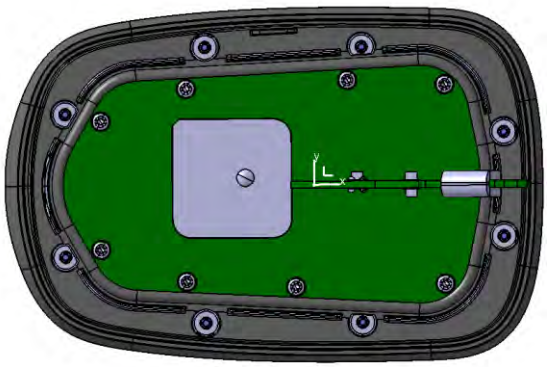
1.4 Navigation

A ceramic patch and a two-stage low noise amplifier (LNA) build up the GNSS antenna providing reception for the upper L-band signals GPS L1, GLONASS G1, Beidou B1 and Galileo G1 as well as associated augmentation signals like WAAS, EGNOS and MSAS (1559 …1606 MHz).
The GNSS circuit must be supplied with power via phantom feed.

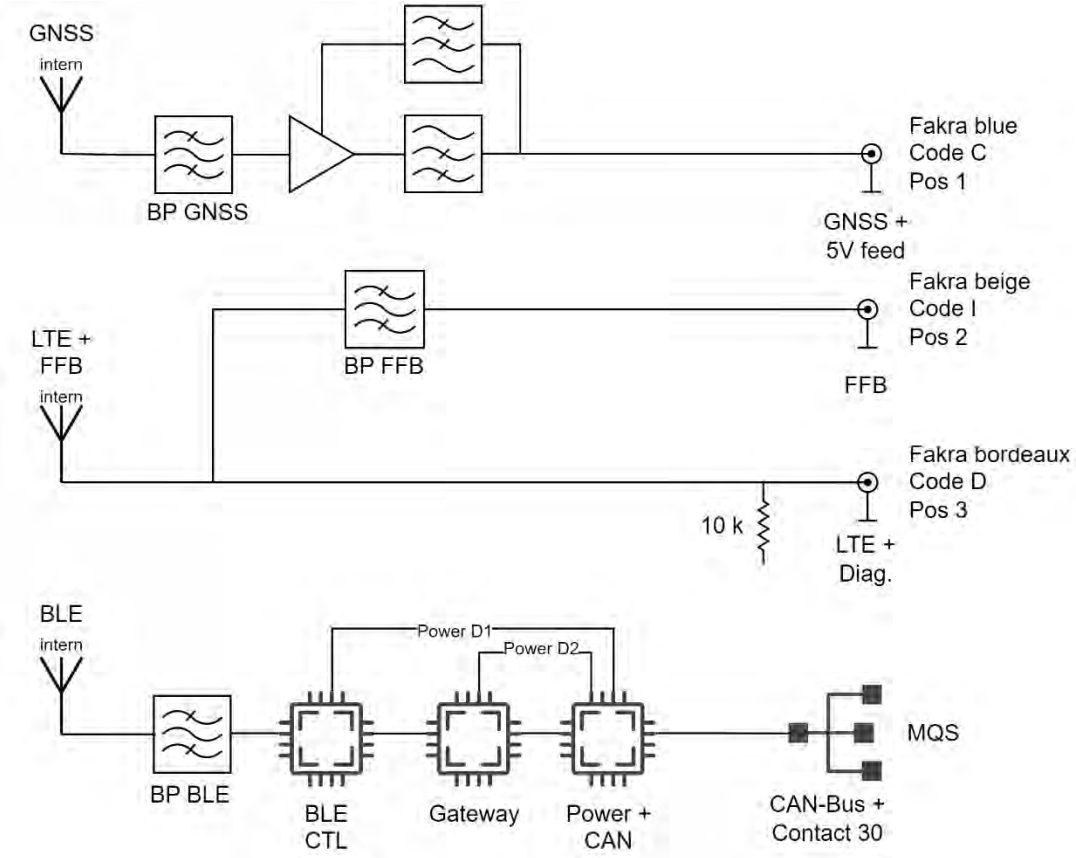
1.5 Remote control

The remote control circuit is a passive circuit which covers the ISM Band at 868 MHz (FFB). It is used for applications like remote climate control e.g.

1.6 Views

Top view	Bottom view
	
	

1.7 Block diagram



1.8 Pin configuration

Pos	Connector	Pin acc. to drawing	Description	Potential in car
1	Fakra blue (C)	Inner contact	GNSS (RF / UB+)	+5V
		Outer contact	Ground (RF / DC)	0V
2	Fakra beige (I)	Inner contact	FFB (RF)	
		Outer contact	Ground (RF)	
3	Fakra bordeaux (D)	Inner contact	LTE (RF)	
		Outer contact	Ground (RF)	
4	Not used			
MQS	MQS	1	Contact 30	$+U_{BAT}$ (+12V)
		2	Contact 31	0V
		3	CAN_H	
		4	CAN_L	
		5	N.C.	
		6	N.C.	

2 Model numbering

OEM part number	4N0.035.503.BM
Supplier part number	52521495

Further supplier part numbers:						
52521496	52521497	52521498	52521499	52521500	52521501	52521502
52521503	52521504	52521505	52521506	52521507	52521508	52521509
52521510	52521511	52521512	52521513	52521514	52521515	52521516
52521517	52521518	52521519	52521520	52521521	52521522	52521523
52521524	52521525	52521526	52521527	52521528	52521529	52521530
52521531	52521532	52521533	52521534	52521535	52521536	52521537
52521538	52521539	52521540	52521541	52521542	52521543	52521544
52521545	52521546	52521547	52521548	52521549	52521550	52521551
52521552	52521553	52521554	52521555	52521556	52521557	52521558
52523112	52523113	52523114	52523115	52523190	52523191	52523192
52523220	52523221	52523242	52524031	52524127	52524128	

3 Specification

3.1 General specification

Operating temperature	-40 °C … +95 °C
Storage temperature	-40 °C … +95 °C
Validation tests	compliant to VW80000, VW80101 and LAH 4M0.035.G
EMC tests	compliant to VW81000 and EMV-LAH-Module 2.4

3.2 GNSS specification

3.2.1 Antenna performance

Table 3-1: Typical electrical properties of the passive GNSS adapter

Parameter	Condition	Value
Patch dimensions	Width x Length x Height	25 mm x 25 mm x 4 mm
Frequency ranges	Beidou	1559,052 … 1563,144 MHz
	GPS/Galileo	1571,42 … 1579,4 MHz
	Glonass	1598,0625 … 1605,375 MHz
Return loss	GPS/Galileo	min. 10 dB
Linear Average Gain	Zenith, on 1 m ground plane, GPS/Galileo	typ. 2,9 dBic
Axial ratio	GPS/Galileo	typ. 4,1 dB
Peak gain		3,9 dBic
Impedance		50 Ω
Polarization		RHCP

Radiated measurement has been performed in the center of the turntable on conducting ground.

3.2.2 LNA performance

Table 3-2: RF LNA performance (GNSS)

Parameter	Condition	Value
Supply voltage		4,5 ... 5,5 V
Current consumption	4,5 V / -40 °C	20,3 mA (min)
	5,0 V / +30 °C	24,1 mA (typ)
	5,5 V / +100 °C	27,5 mA (max)
Noise figure	5,0 V / 1559 … 1605 MHz	max. 2,4 dB
Gain		typ. 29,6 dB
Output return loss		min. 13,7 dB
Gain ripple		max. 1,8 dB
Input 1dB Compression Point	5,0 V / 1575 MHz	typ. -21,6 dBm
Output Third Order Intercept	f1 / f2 = 1574,9 MHz / 1575,1 MHz	typ. 18,1 dBm
Selectivity	800 … 1000 MHz	min. 54,1 dB
	1700 … 2700 MHz	min. 35 dB
	100 … 1450 MHz	min. 42,1 dB
	1450 … 1525 MHz	min. 37,1 dB
	1650 … 2100 MHz	min. 27,3 dB
	2100 … 2400 MHz	min. 48,6 dB
	2400 … 2700 MHz	min. 63,5 dB

3.2.3 Overall performance

Table 3-3: Typical electrical properties of the active GNSS antenna

Parameter	Condition	Value
Return loss	GPS/Galileo	min. 9,8 dB
Linear Average Gain	Zenith, on 1 m ground plane, GPS/Galileo	typ. 32,5 dBic
Axial ratio	Zenith, GPS/Galileo	typ. 5,4 dB
Peak gain		33,5 dBic
Impedance		50 Ω
Polarization		RHCP

Radiated measurement has been performed in the center of the turntable on conducting ground.

Table 3-4: Isolation (GNSS) to other services of the active antenna

Parameter	Condition	Value
GNSS (Rx) and cellular phone (Tx)	698 … 894 MHz	min. 51,9 dB
	1710 … 1990 MHz	min. 15,8 dB
	2110 … 2155 MHz	min. 31,1 dB
	2400 … 2484 MHz	min. 40,2 dB
	2496 … 2690 MHz	min. 41,3 dB
GNSS (Rx) and Bluetooth (Tx)	2400 … 2484 MHz	min. 36,4 dB

3.3 Cellular phone specification

Table 3-5: Typical electrical properties (cellular phone)

Parameter	Condition		Value
Frequency ranges	Low-band (LB)		698 … 960 MHz
	Mid-band (MB)		1710 … 2170 MHz
	High-band (HB)		2400 … 2700 MHz
Return loss	698 … 960 MHz		min. 7,3 dB[1]
	1710 … 2170 MHz		typ. 10 dB
	2400 … 2700 MHz		typ. 10 dB[1]
Linear Average Gain	698 … 960 MHz	on 1 m ground plane; ΔΦ = 0 … 359° and Δθ = 60 … 90°	typ. 2,8 dBi
	1710 … 2170 MHz		typ. 1,7 dBi
	2400 … 2700 MHz		typ. -1 dBi
Peak gain			max. 8 dBi
Impedance			50 Ω
Polarization	Combination of vertical and horizontal		Linear H + V
Diagnosis resistance			typ. 10 kΩ

Radiated measurement has been performed in the center of the turntable on conducting ground.

3.4 Remote control specification

Table 3-6: Typical electrical properties (remote control)

Parameter	Condition		Value
Frequency ranges	Low-band (LB)		698 … 960 MHz
Return loss	867,5 … 869,5 MHz		min. 7,3 dB[2]
Linear Average Gain	867,5 … 869,5 MHz		typ. -6,5 dBi
Peak gain			max. -3 dBi
Impedance			50 Ω
Polarization	Combination of vertical and horizontal		Linear H + V
Diagnosis resistance			none

[1] including 5 m long RTK031 RF cable
[2] including 5 m long RTK031 RF cable

3.5 Bluetooth specification

3.5.1 Antenna performance

Table 3-7: Typical electrical properties (Bluetooth) passive

Parameter	Condition	Value
Frequency range		2400 … 2483,5 MHz
Linear Average Gain	on 1 m ground plane, ΔΦ = 0 … 359° and Δθ = 60 … 90°	typ. 1,1 dBi
Peak gain		max. 6,4 dBi
Polarization	Combination of vertical and horizontal	Linear H + V

Radiated measurement has been performed in the center of the turntable on conducting ground.

3.5.2 Tranceiver performance

Table 3-8: Typical electrical properties (Bluetooth) active

Parameter	Condition	Value
Frequency range		2400 … 2483,5 MHz
Channel width		2 MHz
Output-Power	at antenna feed point	+1 dBm (+- 1dB)
Modulation		GFSK
Nominal supply voltage		12 V
Operating voltage range		7 V ... 18 V
Max. current (transceiver)		100 mA
Sleep current	Depending on advertisement status	80 µA … 168 µA
Bluetooth low energy	VW group specific Bluetooth low energy (BLE) characteristics only	
Data bus	CAN	High speed at 500 kBit/s
	Termination	high impedance RT1 + RT2 = 9,28 kΩ (= 2 x 4,64kΩ)

3.5.3 Overall performance

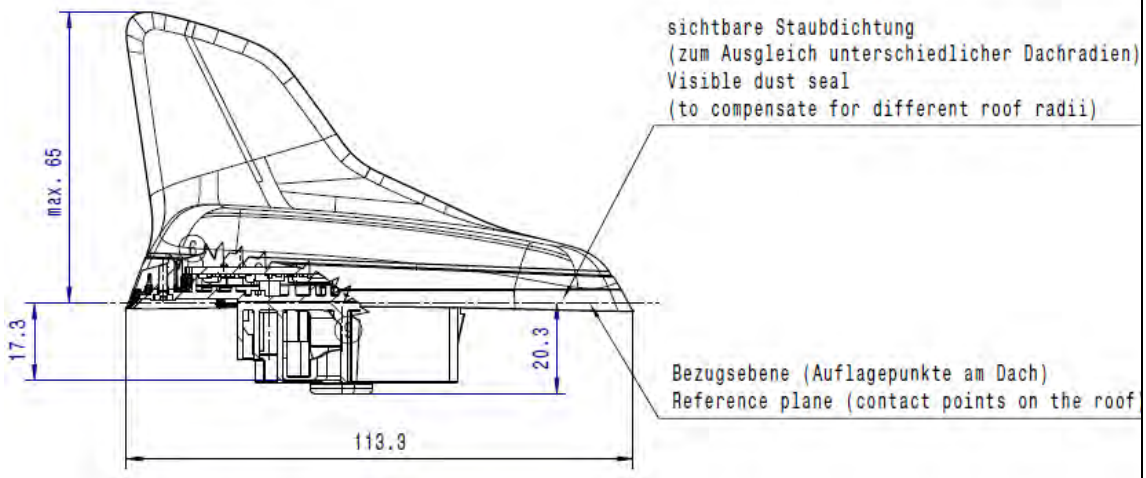
Parameter	Condition	Value
Radiated power (EIRP)	2400 … 2483,5 MHz	max. 8,4 dBm

Table 3-9: Isolation (Bluetooth) to other services

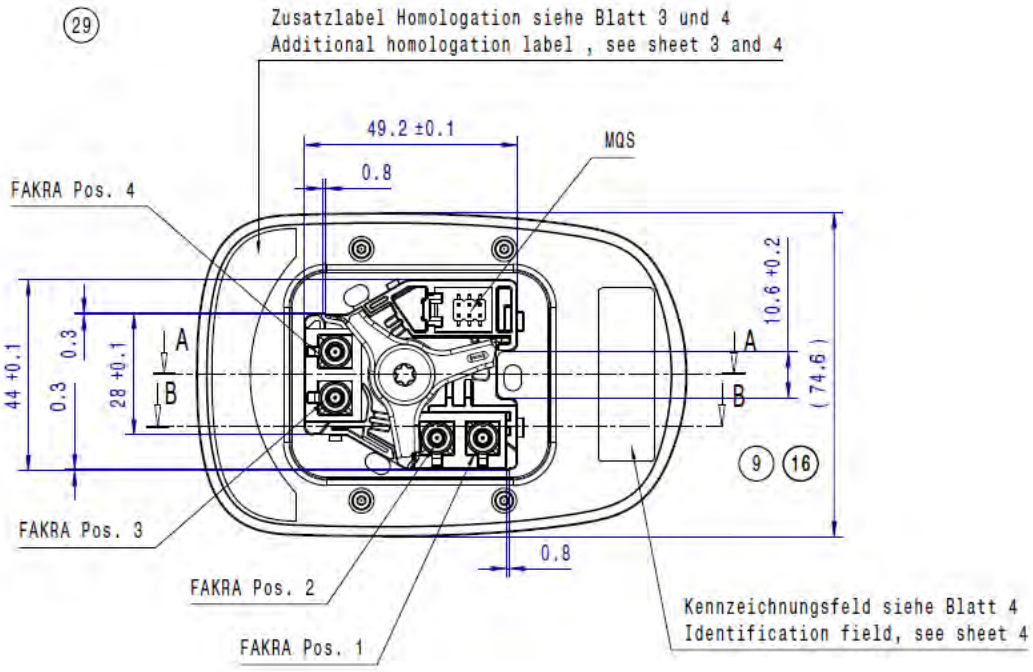
Parameter	Condition	Value
Bluetooth (Rx) and cellular phone (Tx)	698 … 894 MHz	min. 49,5 dB
	1710 … 1990 MHz	min. 40,2 dB
	2110 … 2155 MHz	min. 37,7 dB
	2400 … 2484 MHz	min. 13 dB
	2496 … 2690 MHz	min. 45,4 dB

4 Dimensions

As-received condition



Bottom view



Roof hole

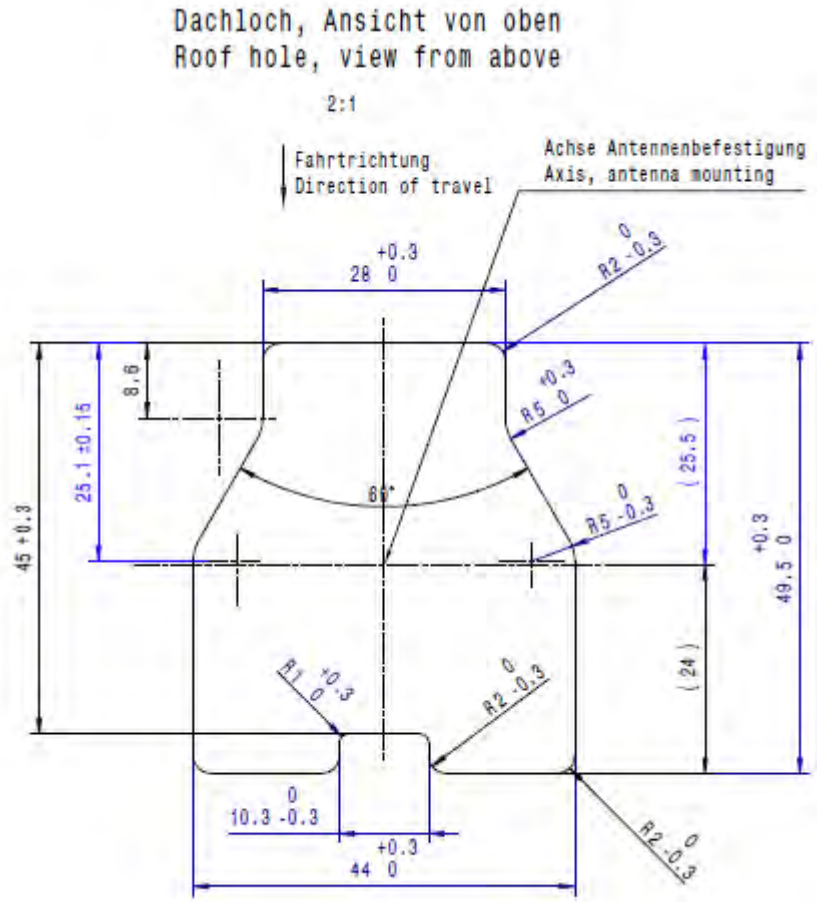


Figure 4-1: Mechanical drawing

Index of Tables and Figures

Messbericht Komponenten DDA2_perso

4N0 035 503 DC

Datei	MESSBERICHT_KOMPONENTENMESSUNG_4N0 035 503 DC V01.DOC
Autor	Thomas.Schano@continental.com
Version	V01
Status	C sample
Datum	07.09.2023
Projekt	4N0 035 503 DC
Fahrzeug / Bauteile	

Freigabe	Version		Datum	
	Name		Unterschrift	

Die Komponente

4N0 035 503 DC

ist hardwareseitig identisch mit der Variante

4N0 035 503 AP.

Die Varianten unterscheiden sich nur in Der SW des Maincontollers.
Diese SW Update hat keinen Einfluss auf die Ergebnisse aus diesem Messbericht.

Messbericht Komponenten DDA2_perso

4N0 035 503 AP

Datei	MESSBERICHT_KOMPONENTENMESSUNG_4N0 035 503 AP V01.DOC			
Autor	Klaus.Jaeger@kathreinautomotive.com			
Version	V01			
Status	C sample			
Datum	26.07.2019			
Projekt	4N0 035 503 AP			
Fahrzeug / Bauteile				
Freigabe	Version		Datum	
	Name		Unterschrift	

INHALT

1 Einleitung

1.1 Lieferantenangaben

Tabelle 1: Lieferantenangaben.

Firma	Continental Advanced Antenna GmbH
Adresse	Römerring 1, 31137 Hildesheim / DE
Lieferanten Code (auf Bauteil Etikett)	BN2
Produktionort (Adresse, Land)	Vila Real, Portugal
Produktionsdatum	KW28/2019
DUNS-Nummer	341229368

Tabelle 2: Übersicht und Status der vermessenen Komponenten.

VW/AudiTeile-nummer	Funktion	HW-stand	Leiterplattenstand	Muster ter-stand	Abweichungen
4N0 035 503 AP	LTE/GNSS/BT/FFB BD	01S	13612260B02P01V01	C	

2 Zusammenfassung

GNSS03

	Limit	DUT	Result
Ubat (V)	4,5…5,5		pass
Is (mA)	18…30	24	pass
Gain (dB)	27…33	29	pass
NF (dB)	2 (2,6)	1.8…2.7	pass
BW(3dB)	50…70		pass
Fmin (MHz)	1571,42		pass
Fmax(MHz)	1605,37		pass
IP3(out) (dBm)	11	17	pass
Entkopplung LTE (dB)	>45	0,8…1GHz	pass
	>40	1,7…2.7GHz	pass
Ripple (dB)pp	1,5 (2)	pass band	pass
Selektion	40	0,1…1,3G	pass
	30	1,3…1,49G	pass
	23	1,49…1,525G	pass
	15	1,645…1,65G	pass
	30	1,65…1,84G	pass
	37	1,84…2G	pass
	28	2,4…2,7G	pass

FFB

Parameter		Erfüllt J/N	Bemerkung
Inband: Durchlassbereich Telestart			
Einfügedämpfung Antenneneingang->Mobilfunk (Inband)	IS21I	J	
Einfügedämpfung Antenneneingang->Telestart (Inband)	IS31I	N	11dB
Entkopplung Mobilfunk-Telestart (Inband)	IS32I	N	11dB
Anpassung (Inband)	IS33I	J	
Ausserband Durchlassbereich TEL(4G), TEL(3G)			
Einfügedämpung Antenneneingang-Mobilfunk (Ausser-band)	IS21I	J (*)	Max 2dB
Entkopplung Mobilfunk-Telestart (Ausserband)	IS31I	J	
Entkopplung Mobilfunk-Telestart (Ausserband)	IS32I	J	
Anpassung (Ausserband)	IS11I, IS22I	J	

LTE

Erfüllt nicht durchgängig die RL>10dB Anforderung.

BT2 (aktiv)

TBD

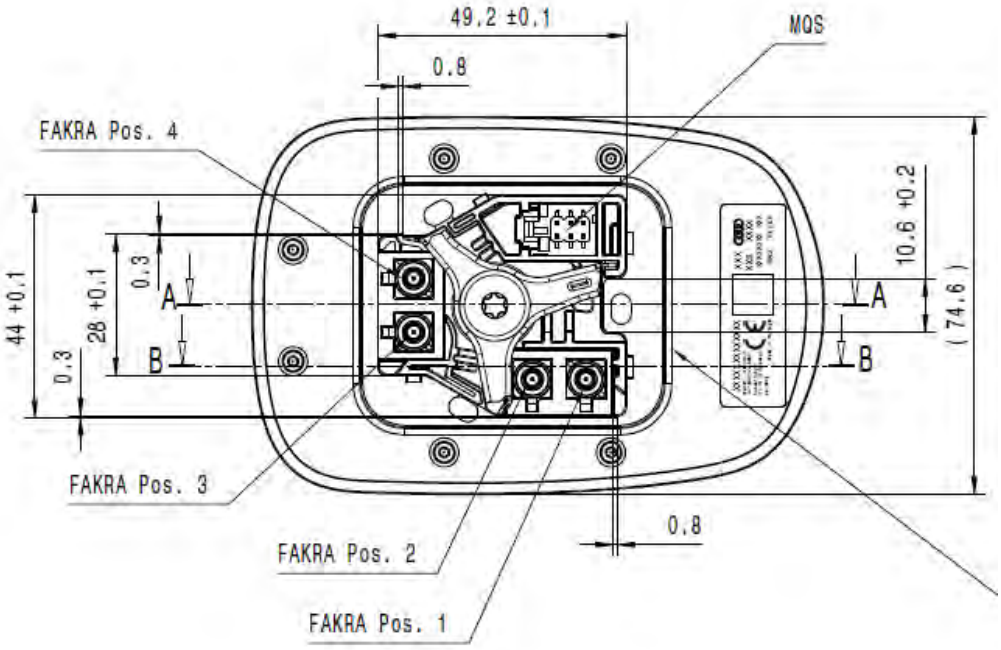
3 Allgemeine Angaben

3.1 Temperatur und sonstige Angaben

Raumtemperatur 23°C

Anpassungsmessungen auf Metall-GND-Platte (Durchmesser 600mm)

3.2 Steckerbelegung



Variante	AUDI-Nr.	Einbauart	Fakra-Pos.1	Fakra-Pos.2	Fakra-Pos.3	Fakra-Pos.4
DDA: TEL+GNSS+FFB+BT(V2)	4N0.035.503.AP	Volldach	blue Code C	-	bordeaux Code D	beige Code I

GNSS Fakra blue

LTE Fakra bordeaux

FFB Fakra beige

4 Angaben zur Mechanik

4.1 Zeichnungsstand und KVS-Stand

TAB_010_425_BE_DRW_TZ__015_001_ANTENNE_VOLLDACH_____20190528

4.2 Mechanische Abweichungen

n.a.

5 Messungen

5.1 GNSS-Messungen (ohne Antenne)

5.1.1 Stromaufnahme über Ub

Ub (V)	Ib (mA)
4.5	21
5.0	24
5.5	26

5.1.2 S-Parameter

5.1.2.1 Messaufbau

Entspr. *TL82133*

5.1.2.2 Messergebnisse

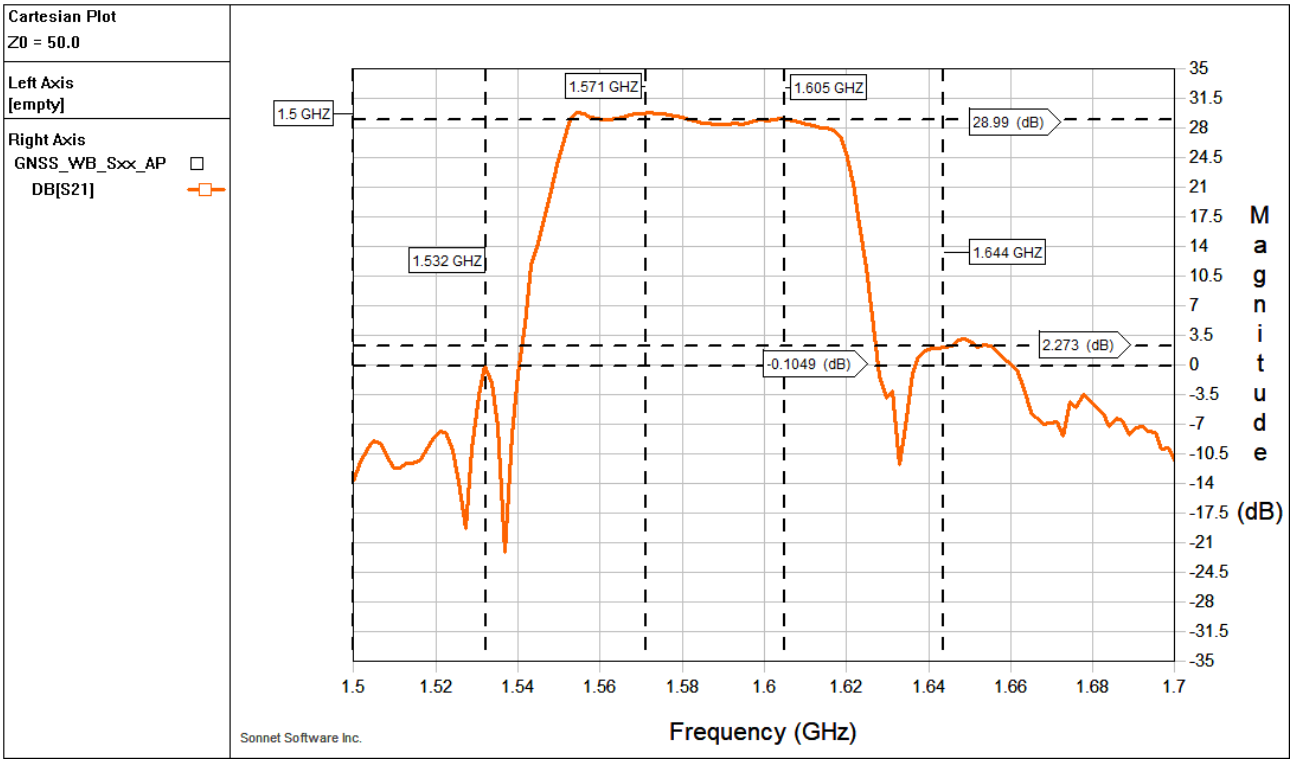


Abbildung 1 GNSS Selektion (NB)

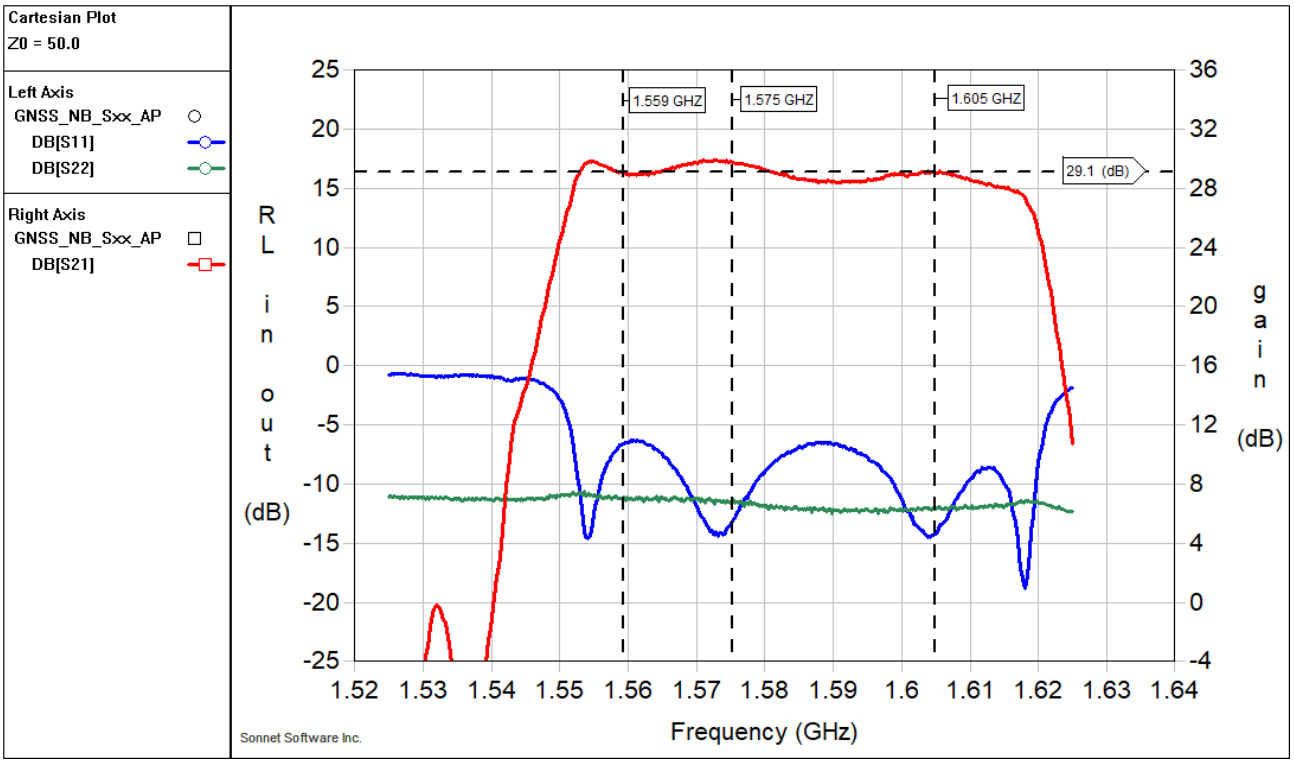


Abbildung 2 GNSS (NB) S-parameter

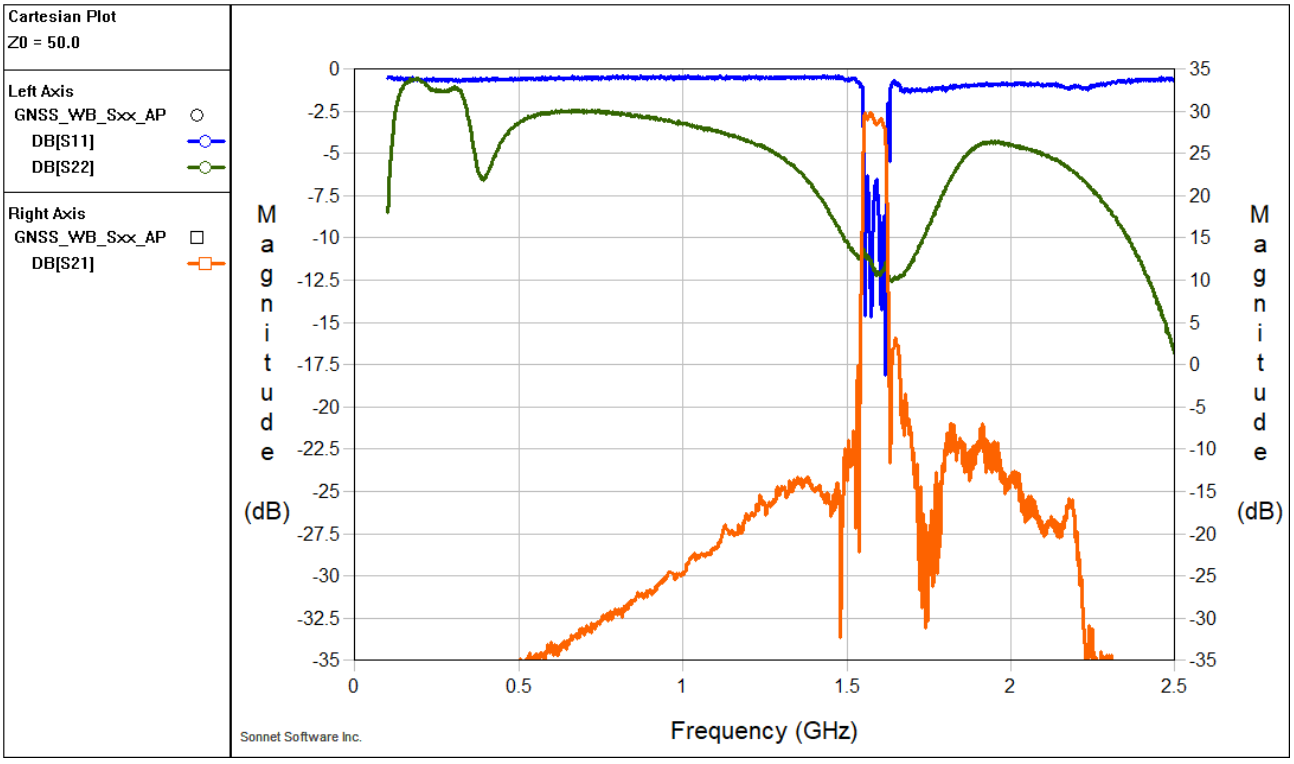


Abbildung 3 GNSS S-Parameter (WB)

5.1.2.3 Stabilitätsnachweis

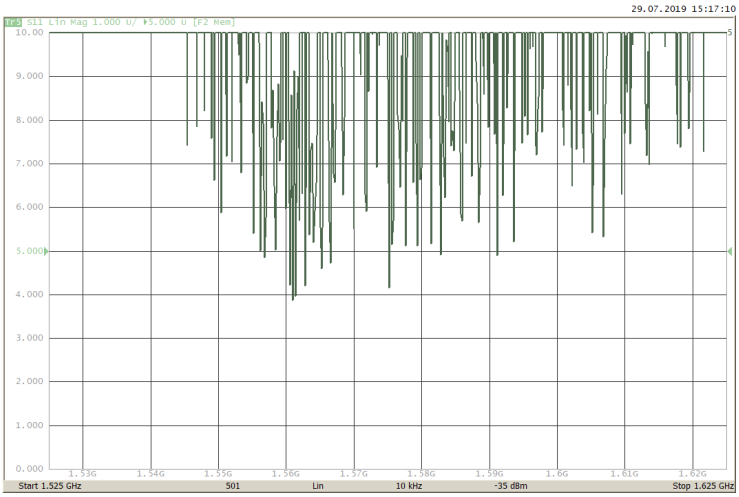


Abbildung 4 GNSS K-Faktor (NB)

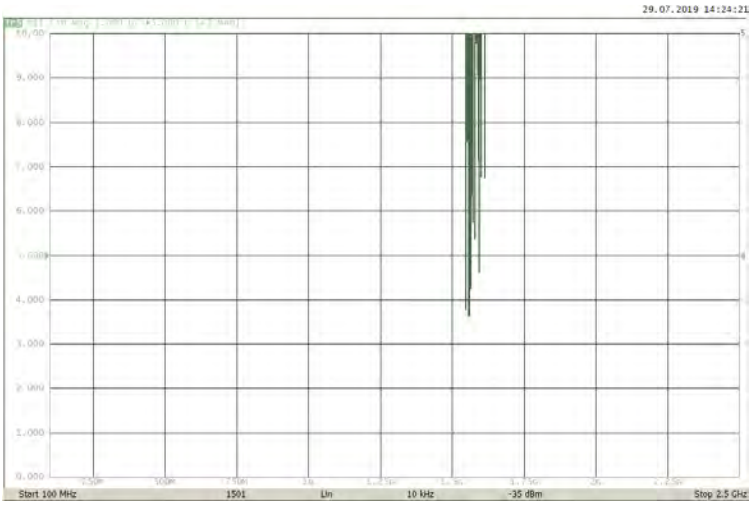
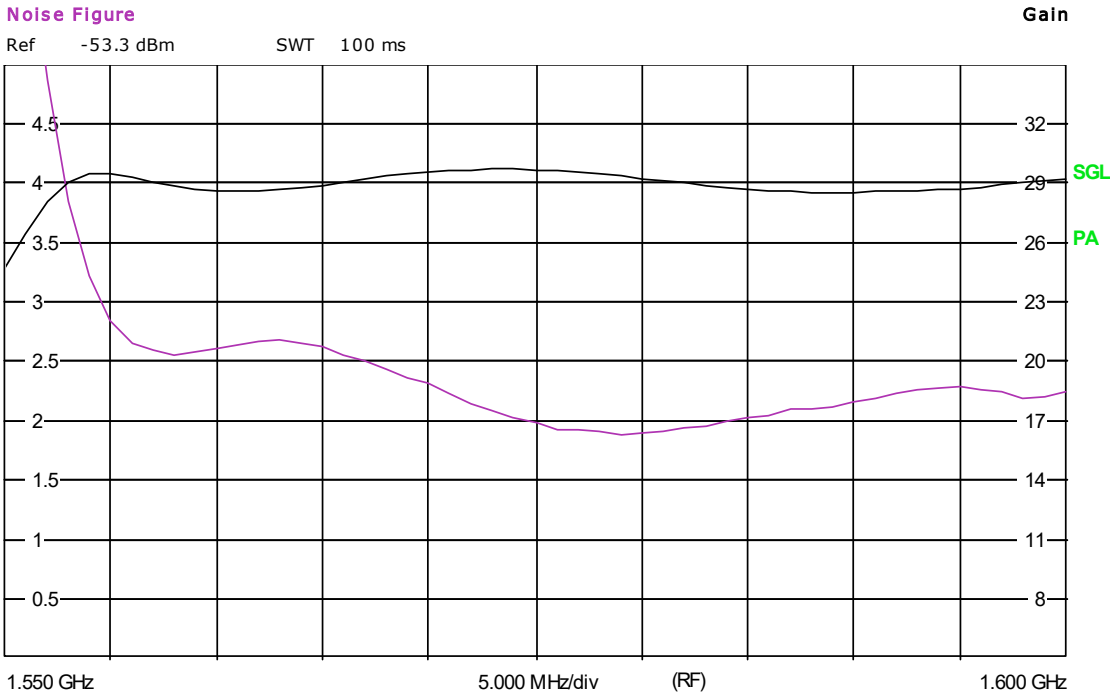


Abbildung 5 GNSS K-Faktor (WB)

5.1.3 Rauschzahl

5.1.3.1 Messergebnisse

Direct		NOISE & GAIN			CALIBRATED
RBW:	1 MHz	RF Atten.	0 dB	2nd Stage Corr.	On
Average:	4	Auto Ref Level	On	Image Rejection	...
		Current Value			
RF:	1.6 GHz	ENR	15.45 dB	NF.	2.23 dB
LO:	...	Loss In	0 dB	Noise Temp.	194.89 K
IF:	...	Loss Out	0 dB	Gain	29.18 dB



Measurement Complete

Date: 29.JUL.2019 14:29:00

Abbildung 6 GNSS NF & Gain

5.1.4 Intermodulation / Kompression

5.1.4.1 Messaufbau

Entspr. *TL82133*

5.1.4.2 Messergebnisse OIP3

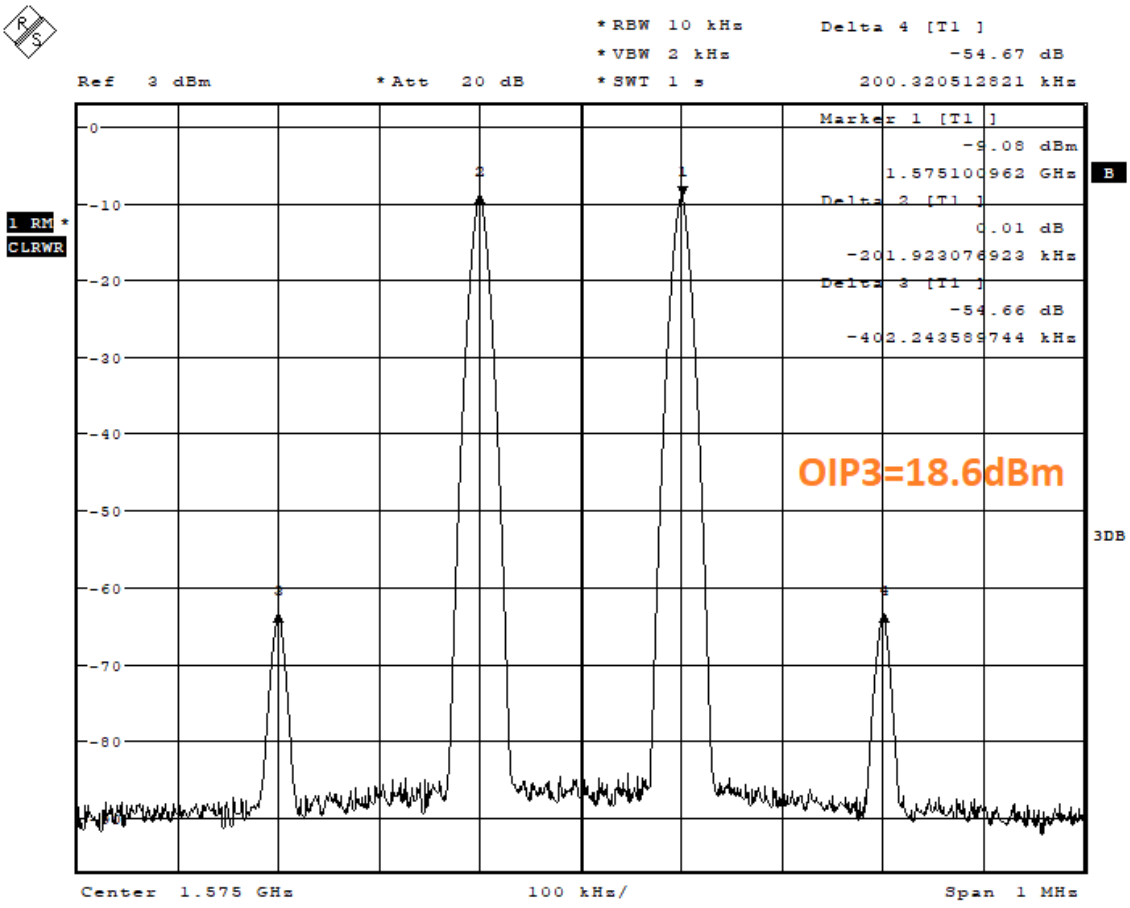


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Abbildung 7 GNSS IM3

5.1.4.3 Messergebnisse P1dB

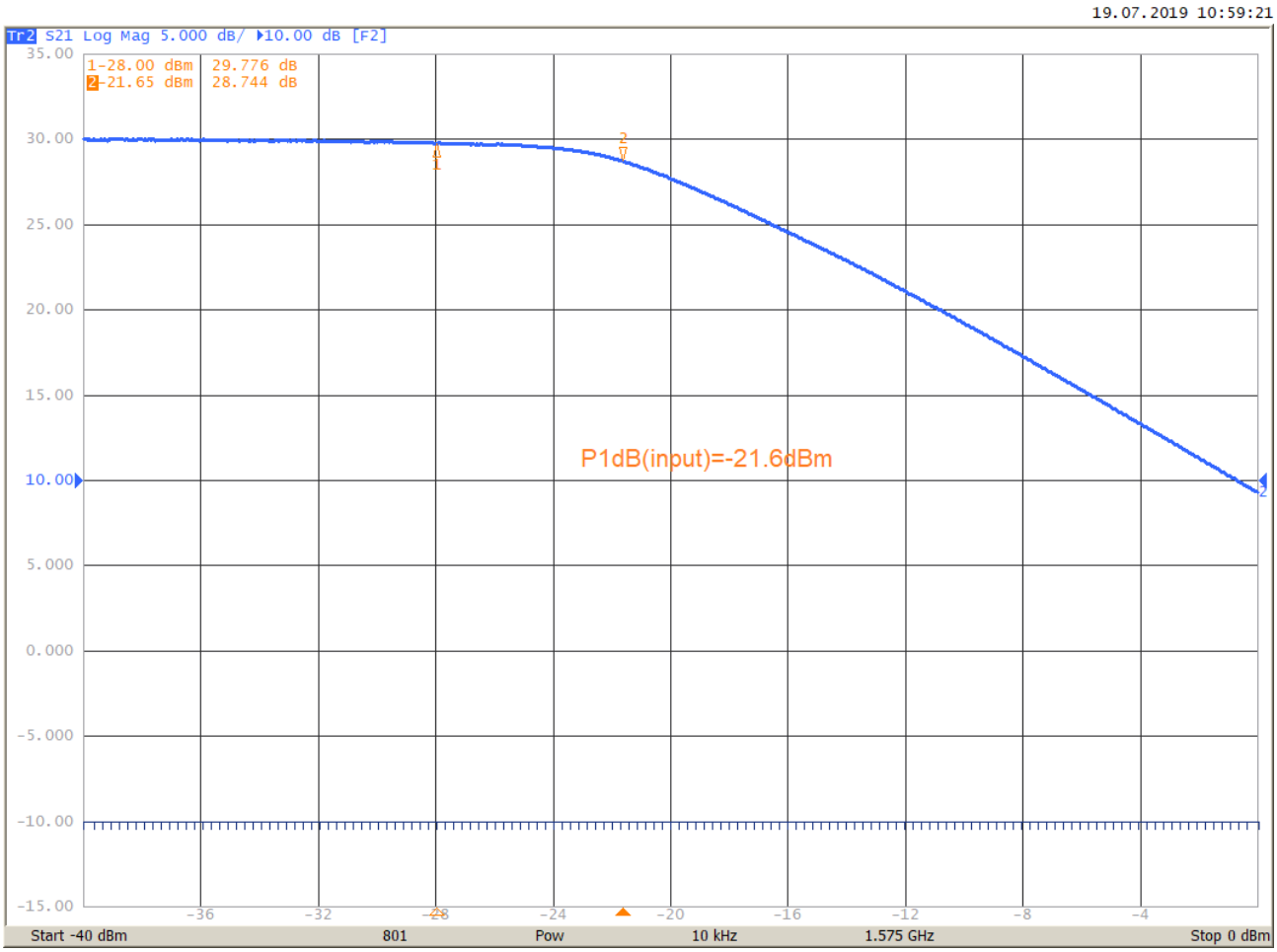


Abbildung 8 GNSS P1dB Kompression

5.2 Telefon-Messungen

5.2.1 Stromaufnahme über Ub

5.2.1.1 Messergebnisse

12V 1.2mA (R_{sense}=10kOhm)

5.2.2 S-Parameter

5.2.2.1 Messaufbau

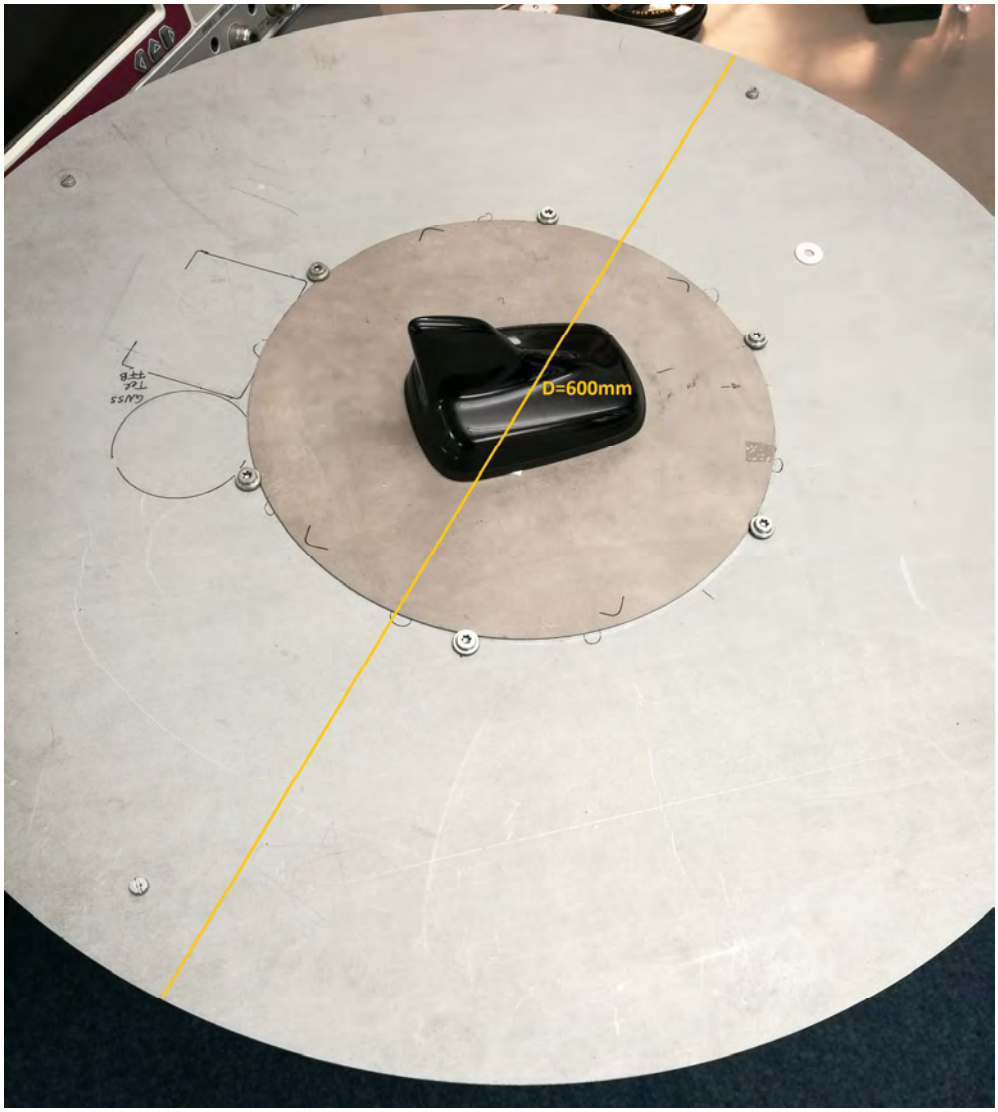


Abbildung 9 Messung RL auf Metallplatte D=0.6m

5.2.2.2 Messergebnisse

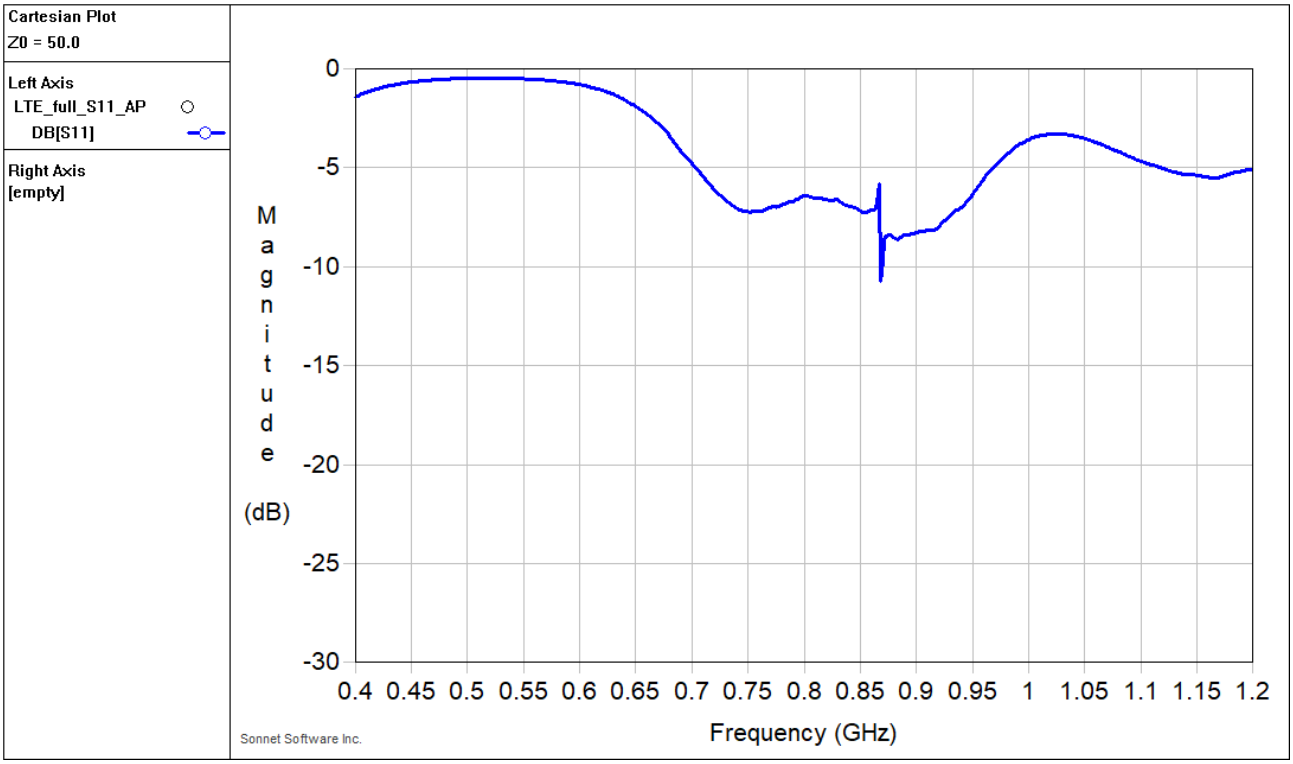


Abbildung 10 RL GSM900

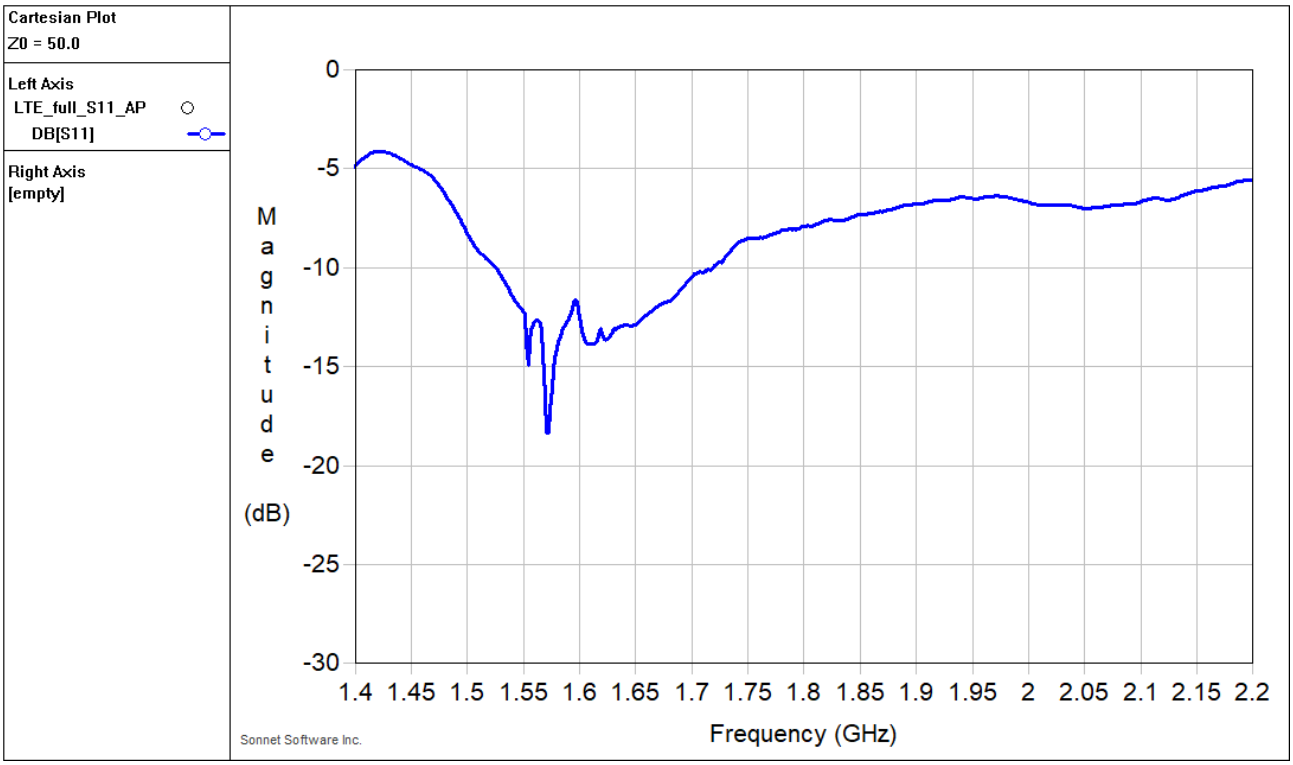


Abbildung 11 LTE RL GSM1800

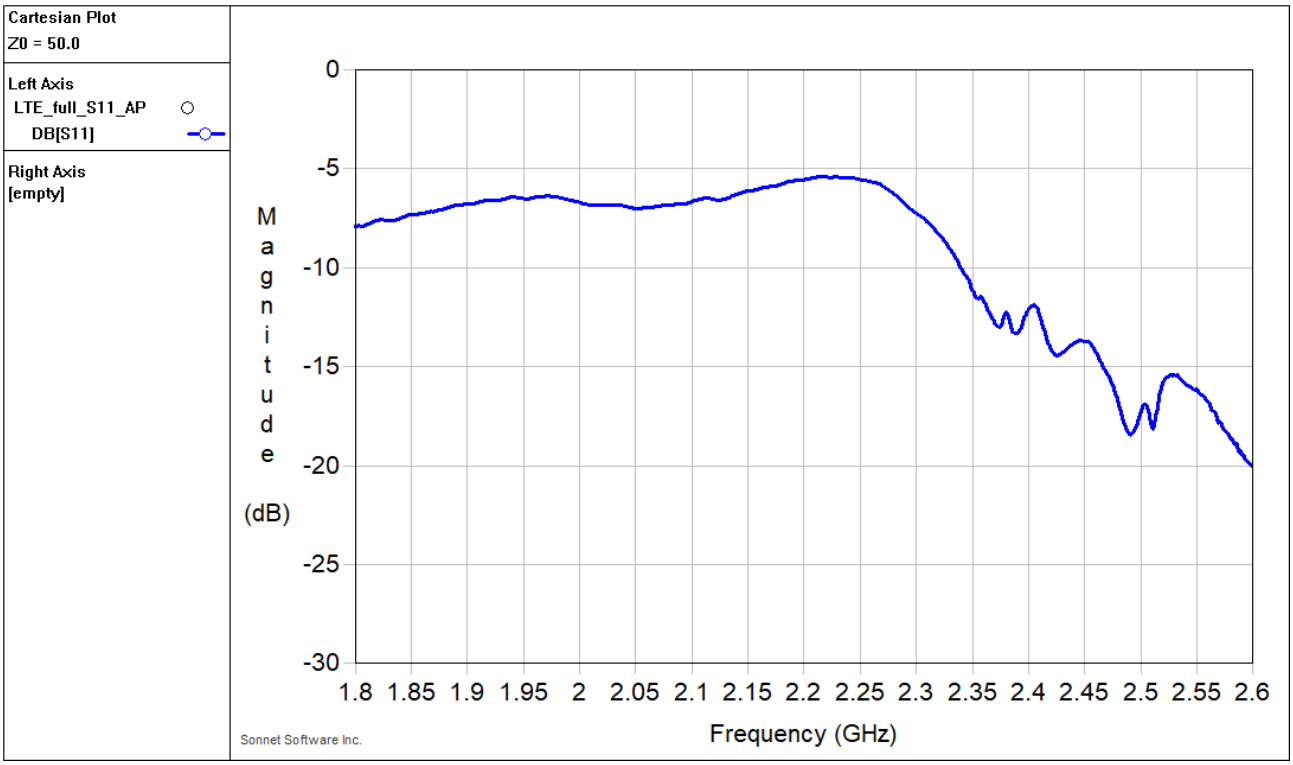


Abbildung 12 LTE RL UMTS

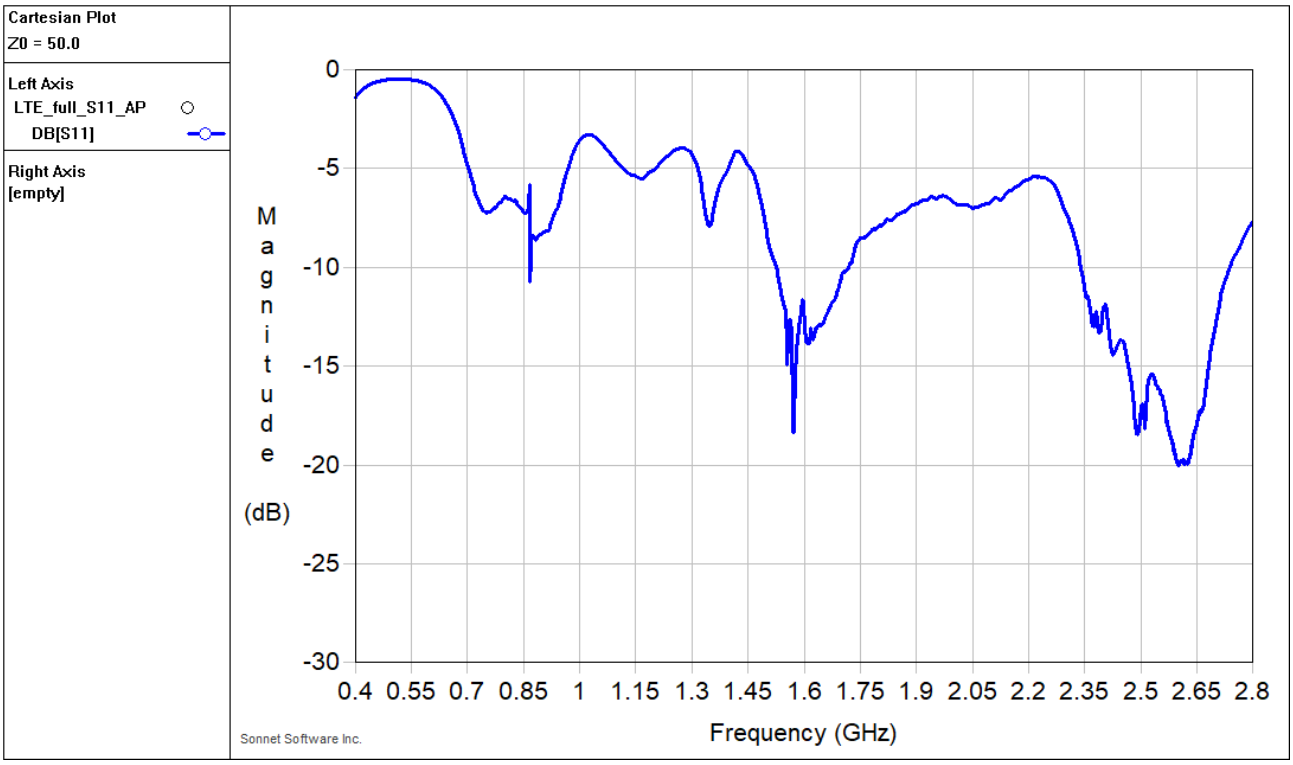


Abbildung 13 LTE RL Gesamt

5.3 FFB-Messungen

5.3.1 Anpassung mit Antenne

5.3.1.1 Messaufbau

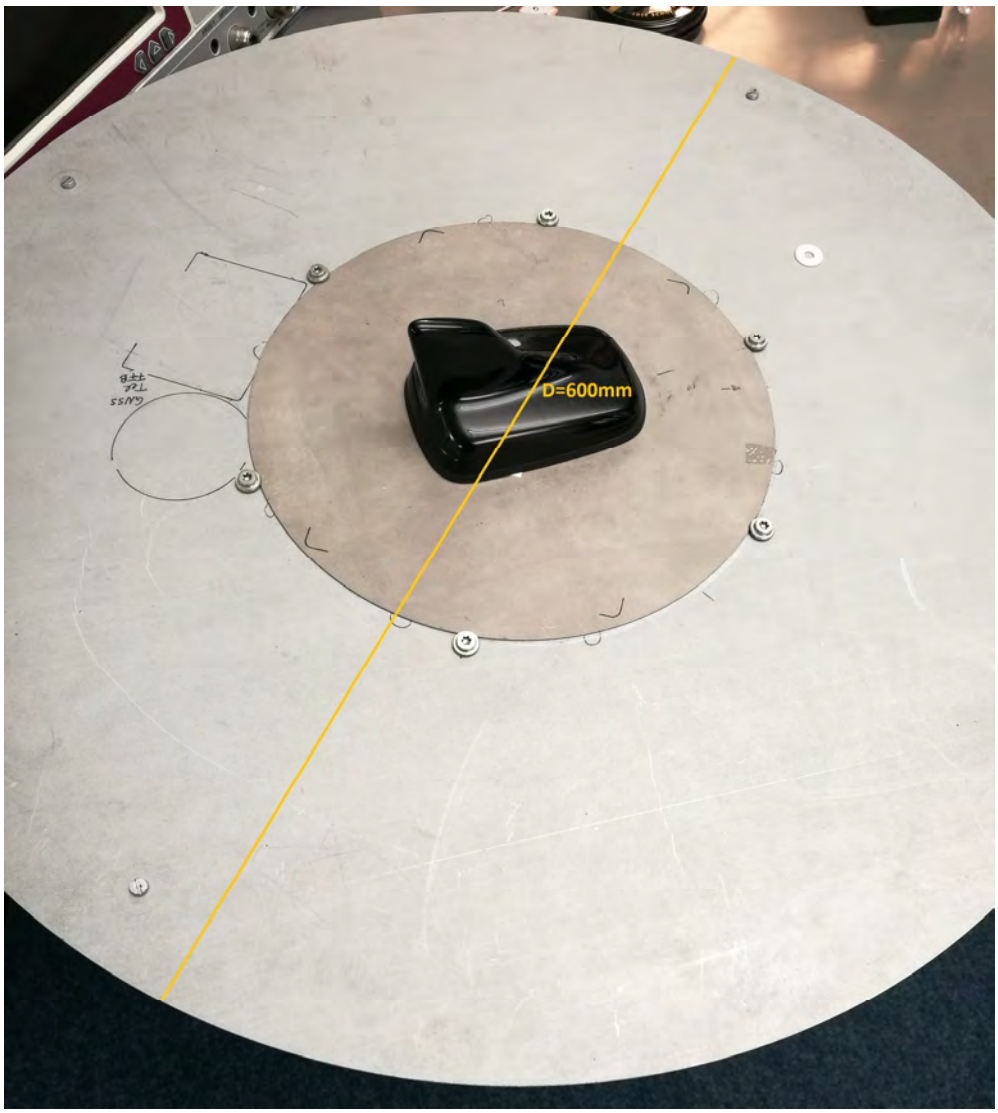


Figure 1 Messung RL auf Metallplatte D=0.6m

5.3.1.2 Messergebnisse

5.3.1.2.1 FFB Narrow Band

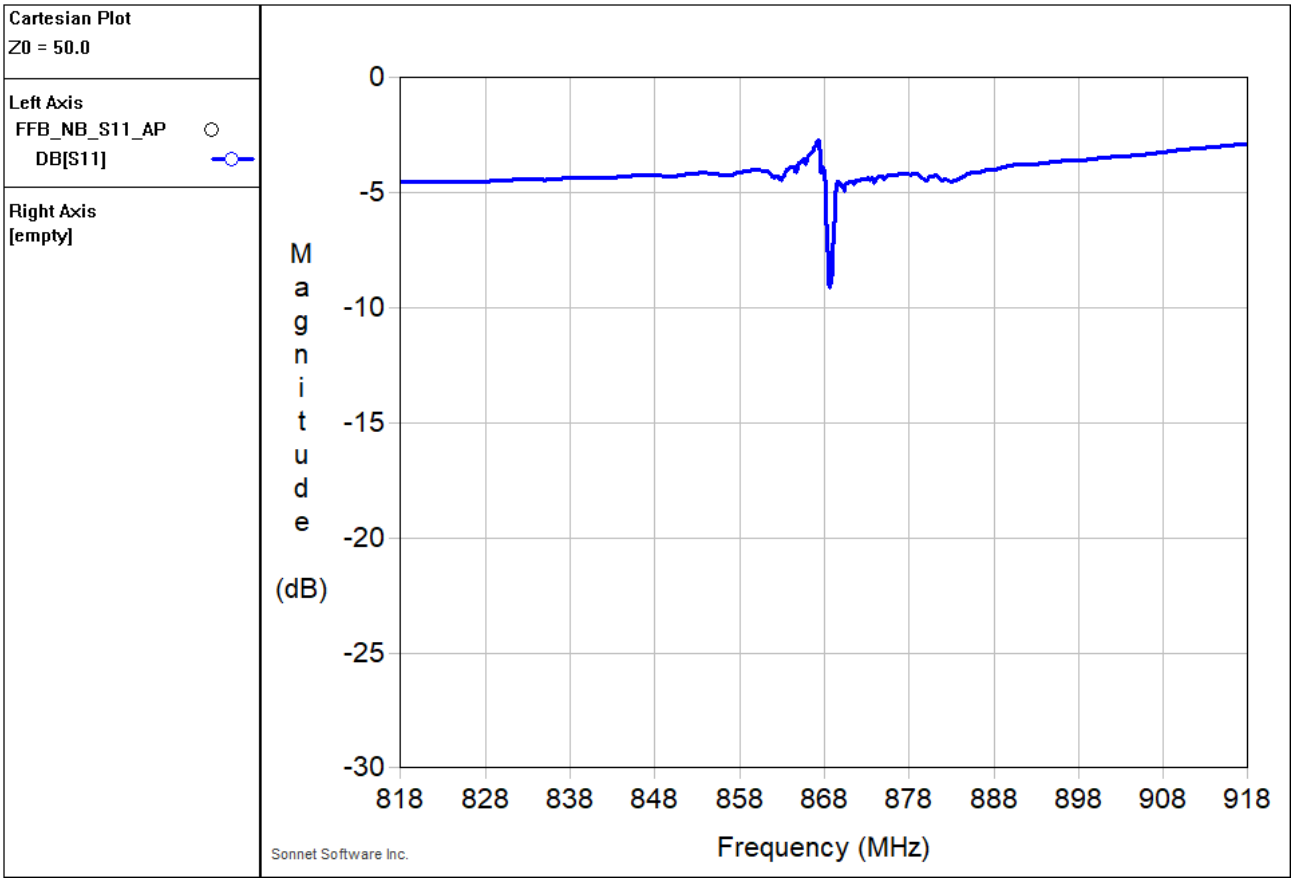


Abbildung 14 FFB NB RL (mit Antenne auf GND)

5.3.1.2.2 FFB Wide Band

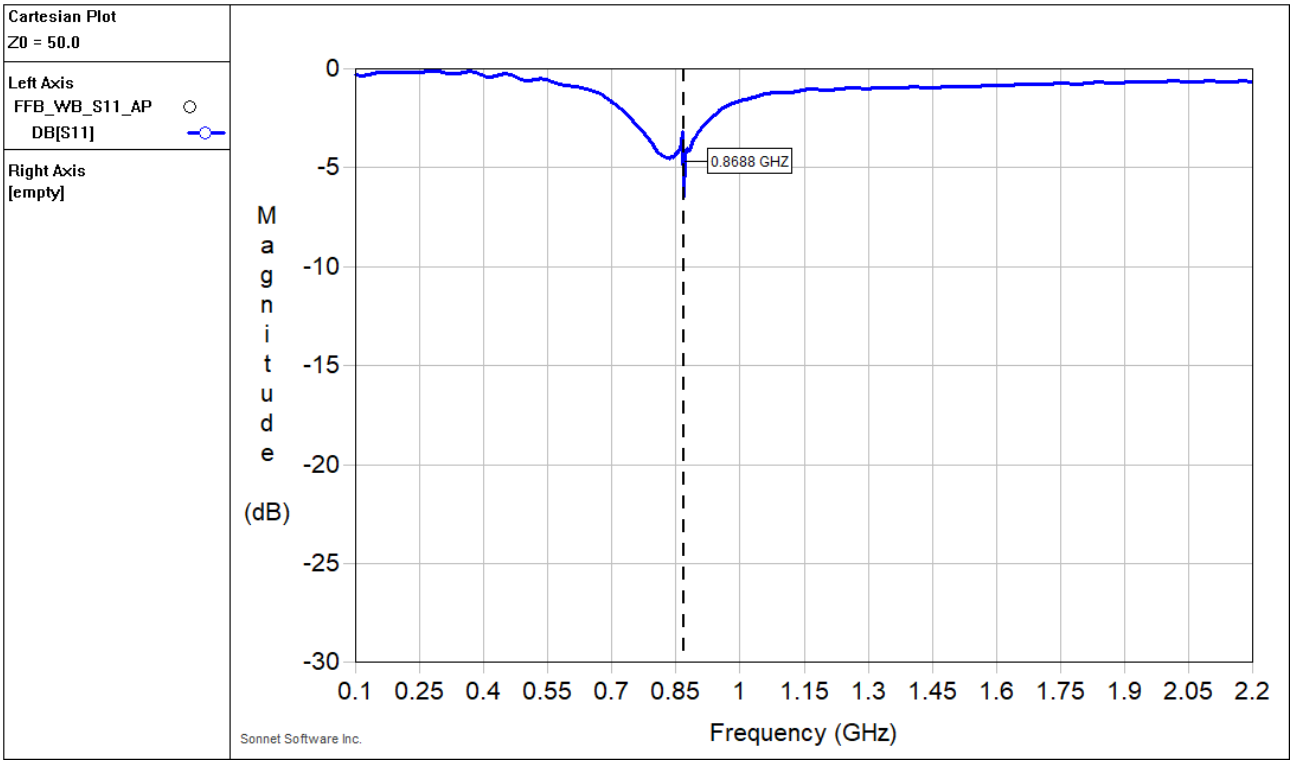
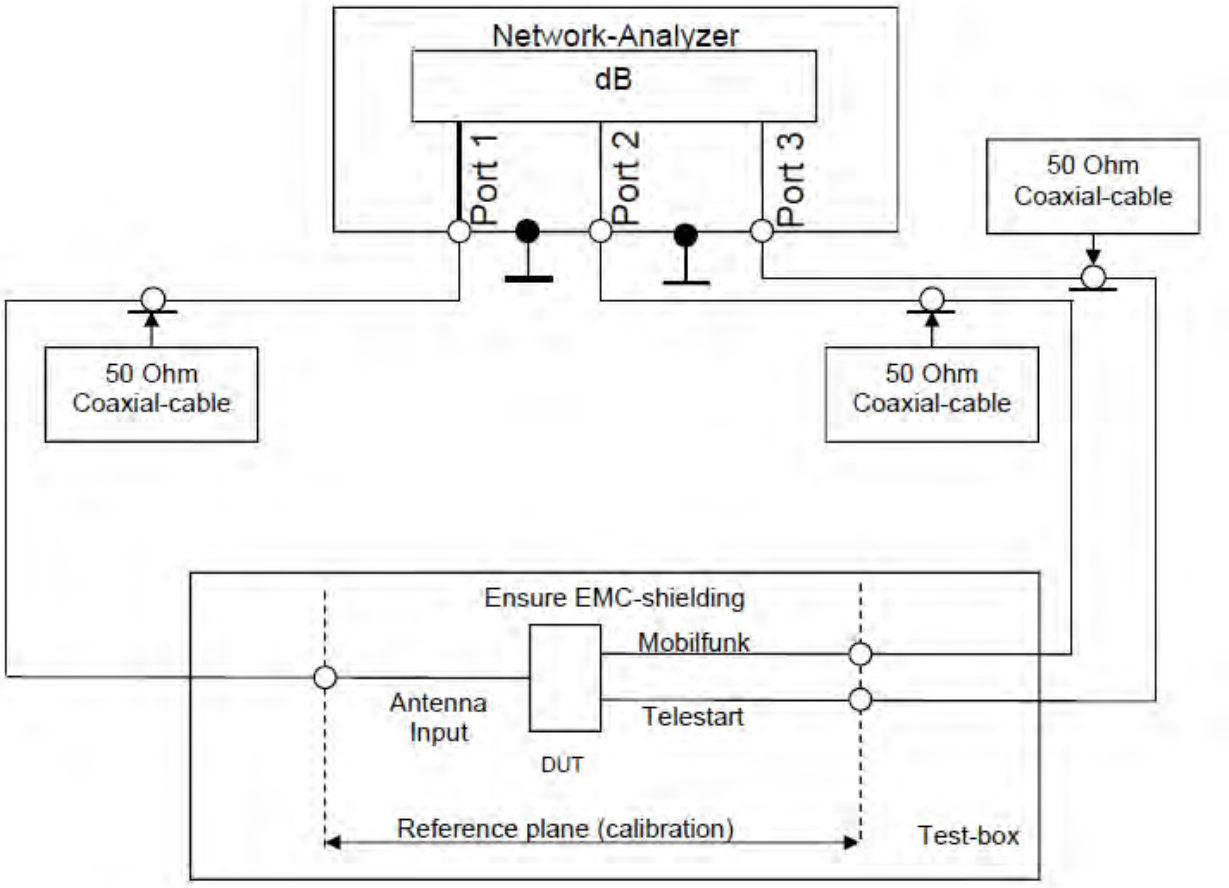


Abbildung 15 FFB WB RL (mit Antenne auf GND)

5.3.2 S-Parameter PCB

5.3.2.1 Messaufbau



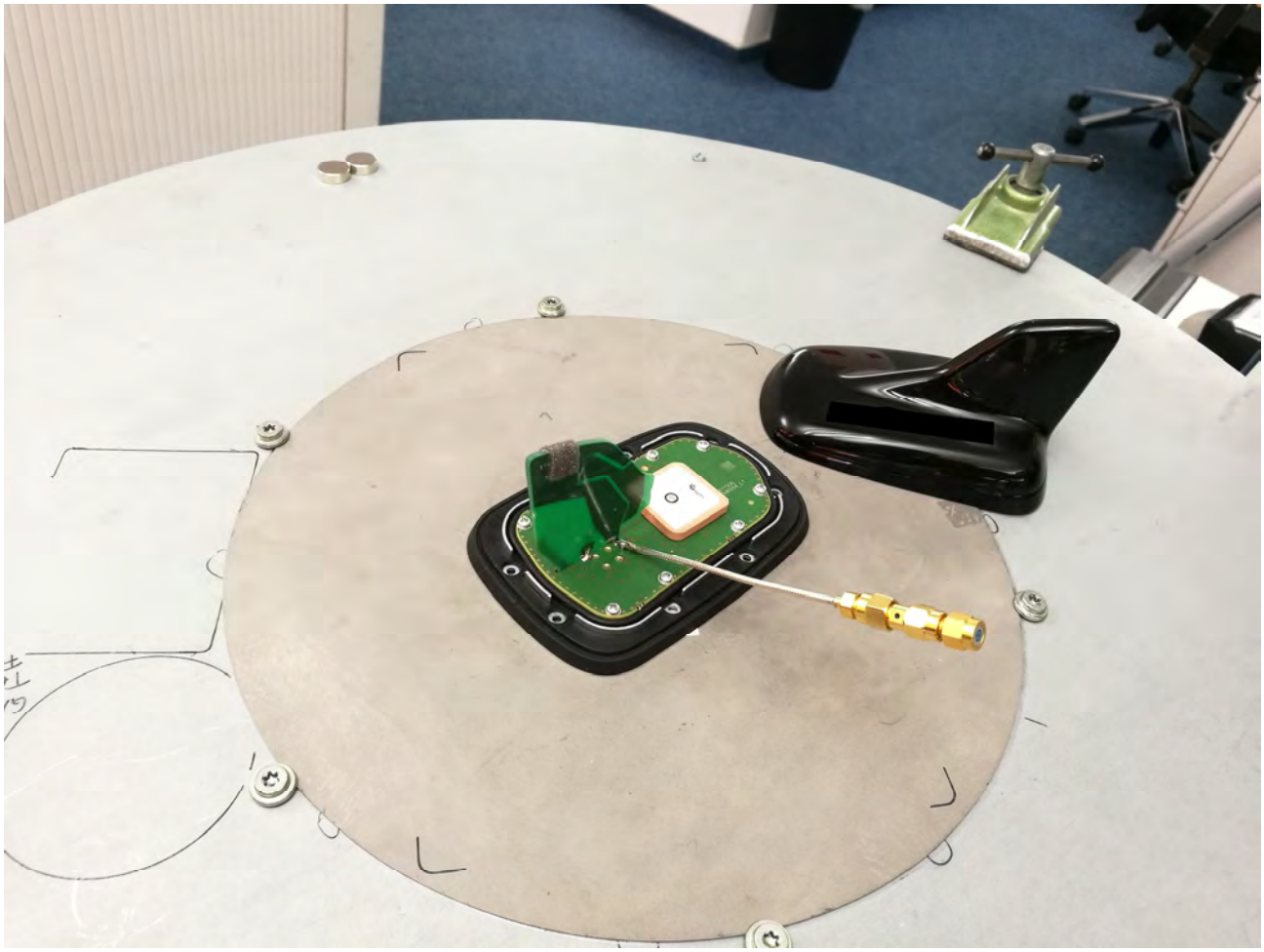


Abbildung 16 FFB Messaufbau S-parameter

5.3.2.2 Entkopplung

5.3.2.2.1 Antenne – FFB

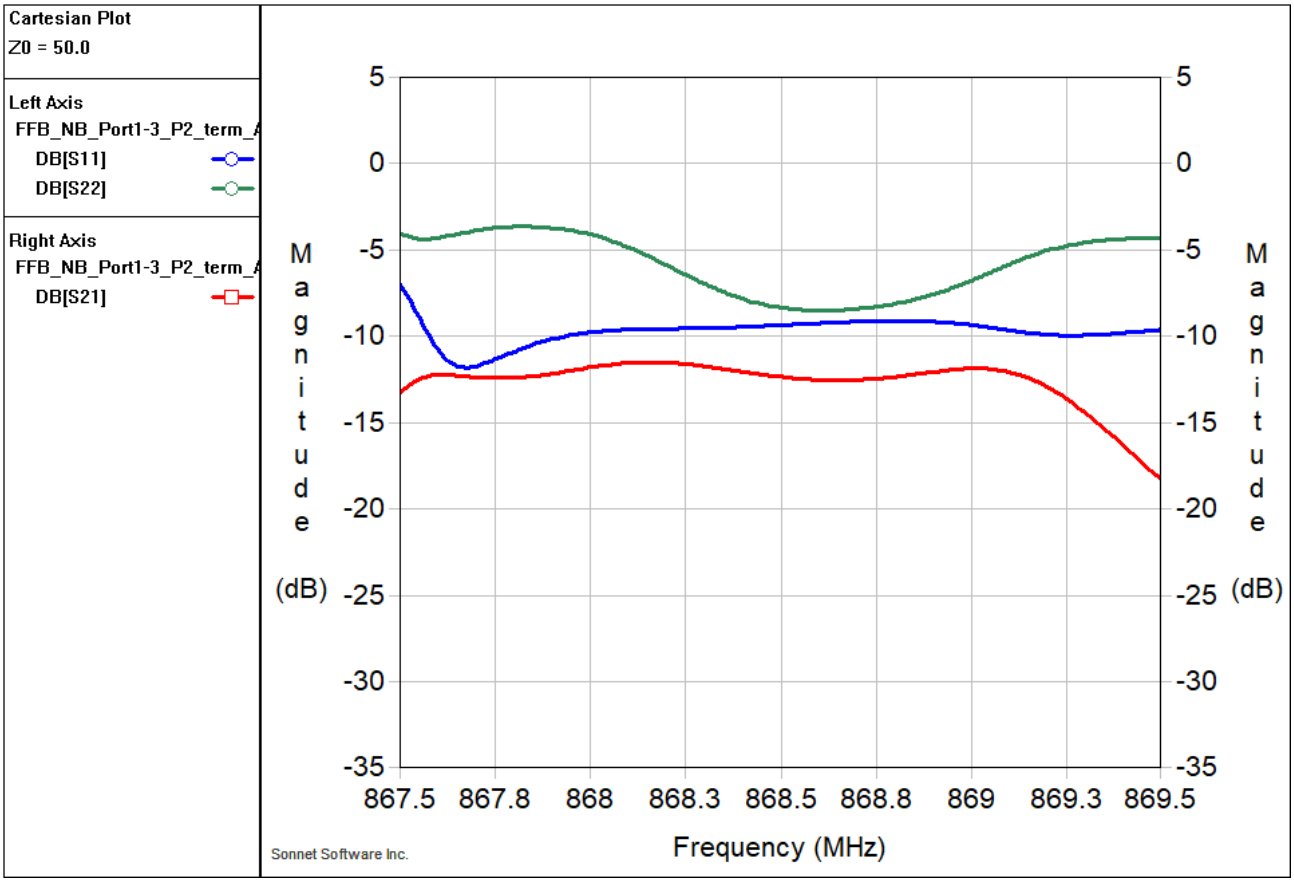


Abbildung 17 Antenne (P1)-FFB (P3)

5.3.2.2.2 Antenne –Telefon

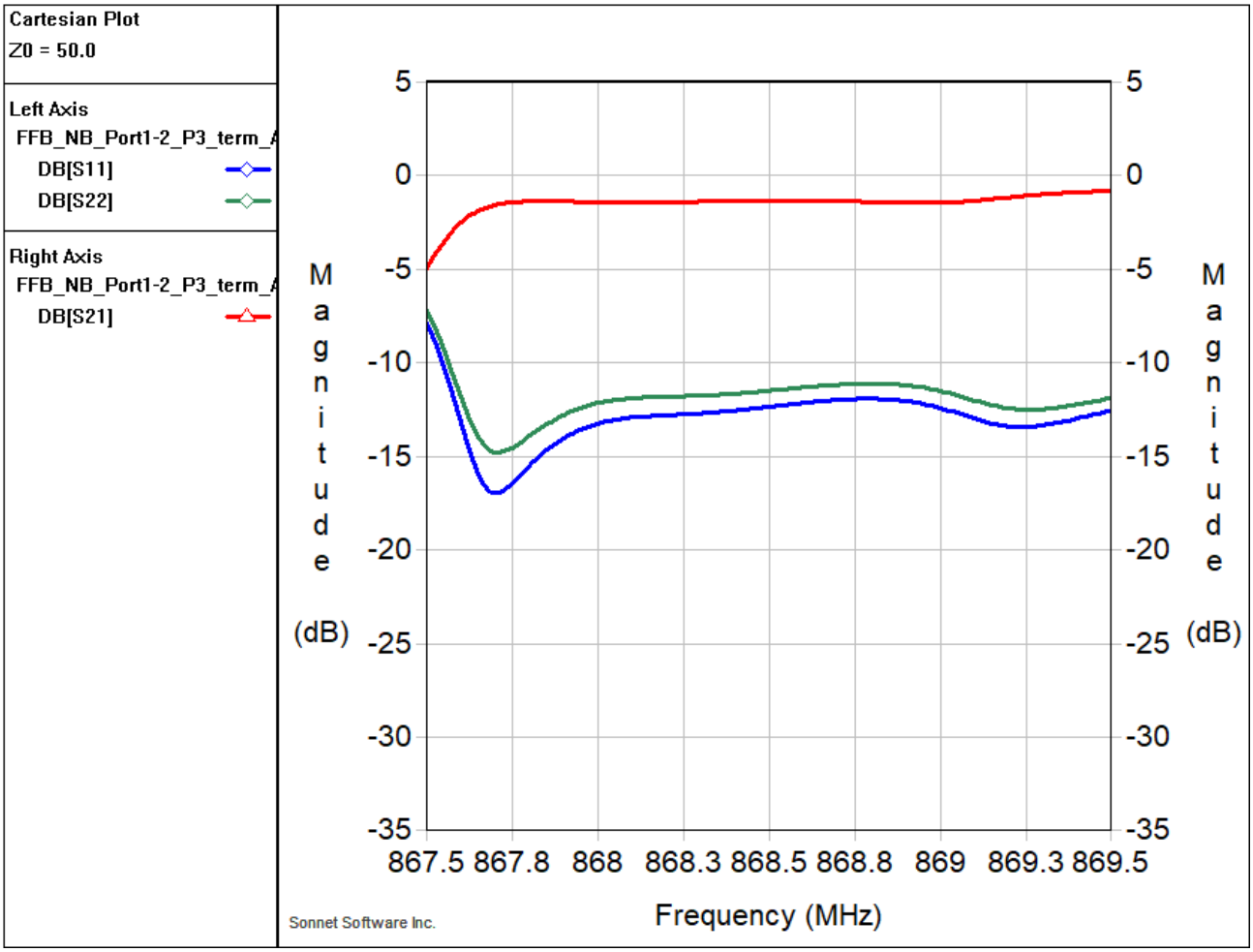


Abbildung 18 Antenne (P1)-LTE (P2)

5.3.2.2.3 Telefon – FFB

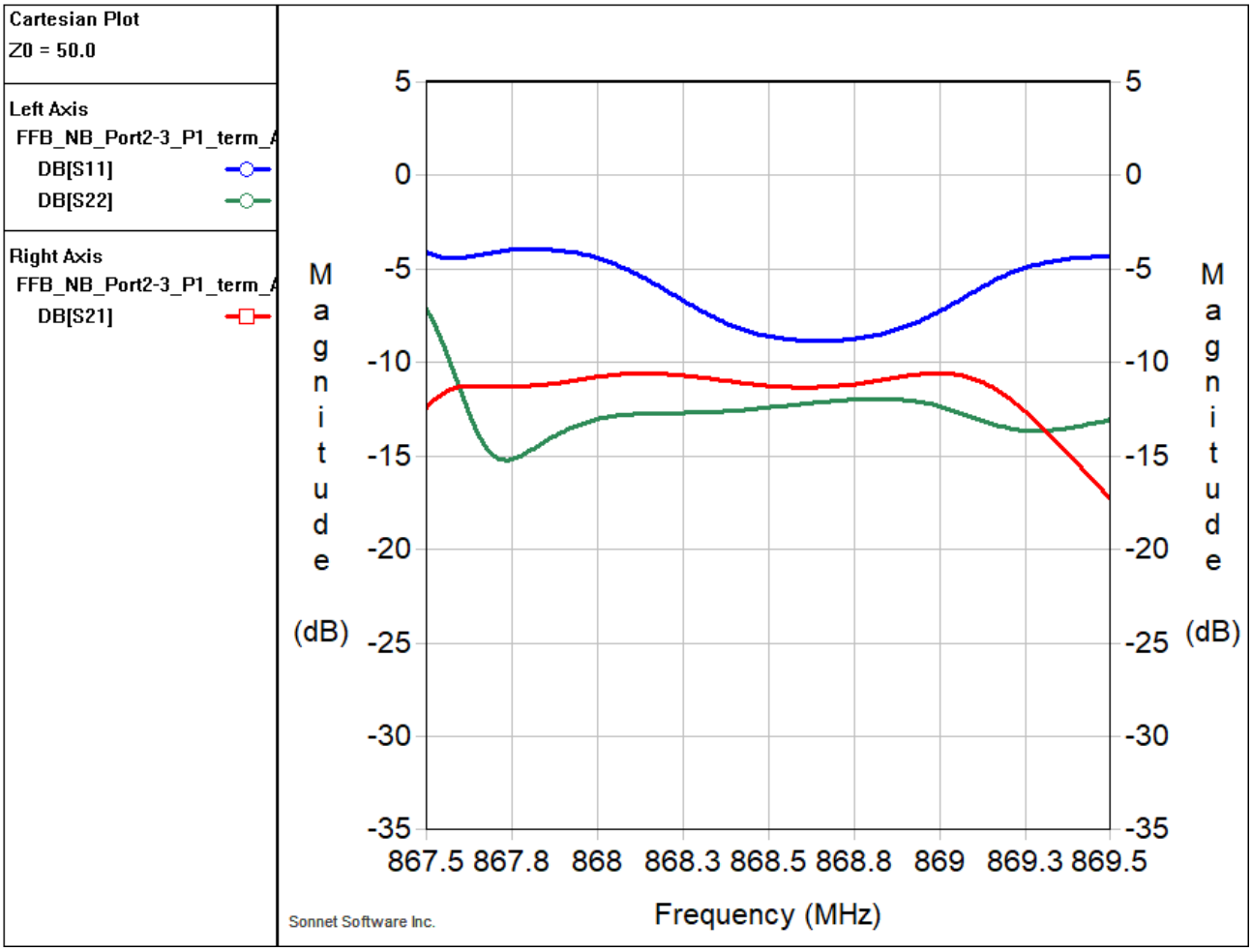


Abbildung 19 FFB (P3)-LTE (P2)

5.4 Bluetooth v2 (aktiv) Messungen

5.4.1 Messaufbau

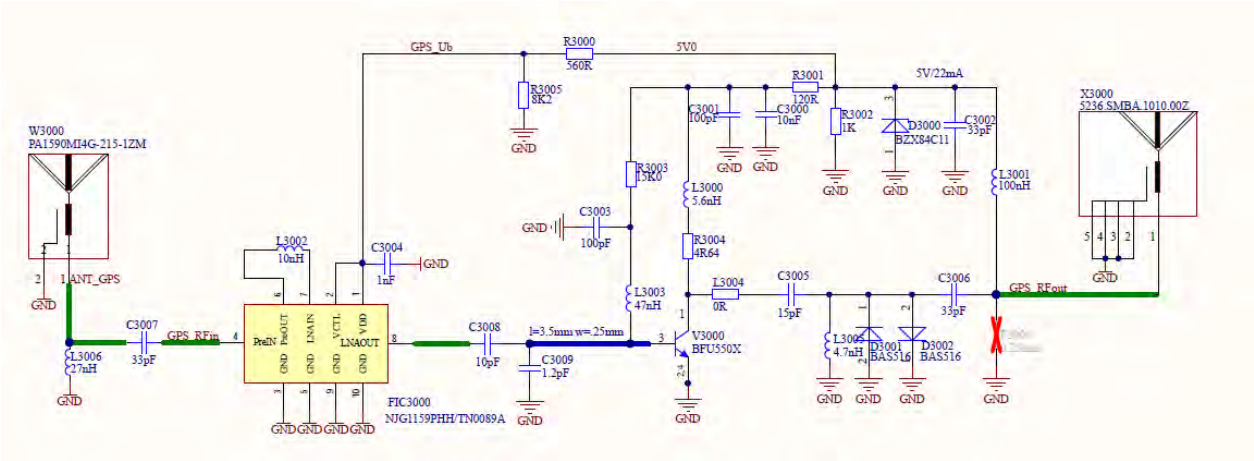
5.4.2 Messergebnisse

6 Detaillierter Schaltplan

Tabelle 3: Zuordnung der Komponenten zu den Schaltplänen.

Komponente	Schaltplanversion
4N0 035 503 AP	C-sample

6.1 GNSS_LNA



6.2 LTE / FFB

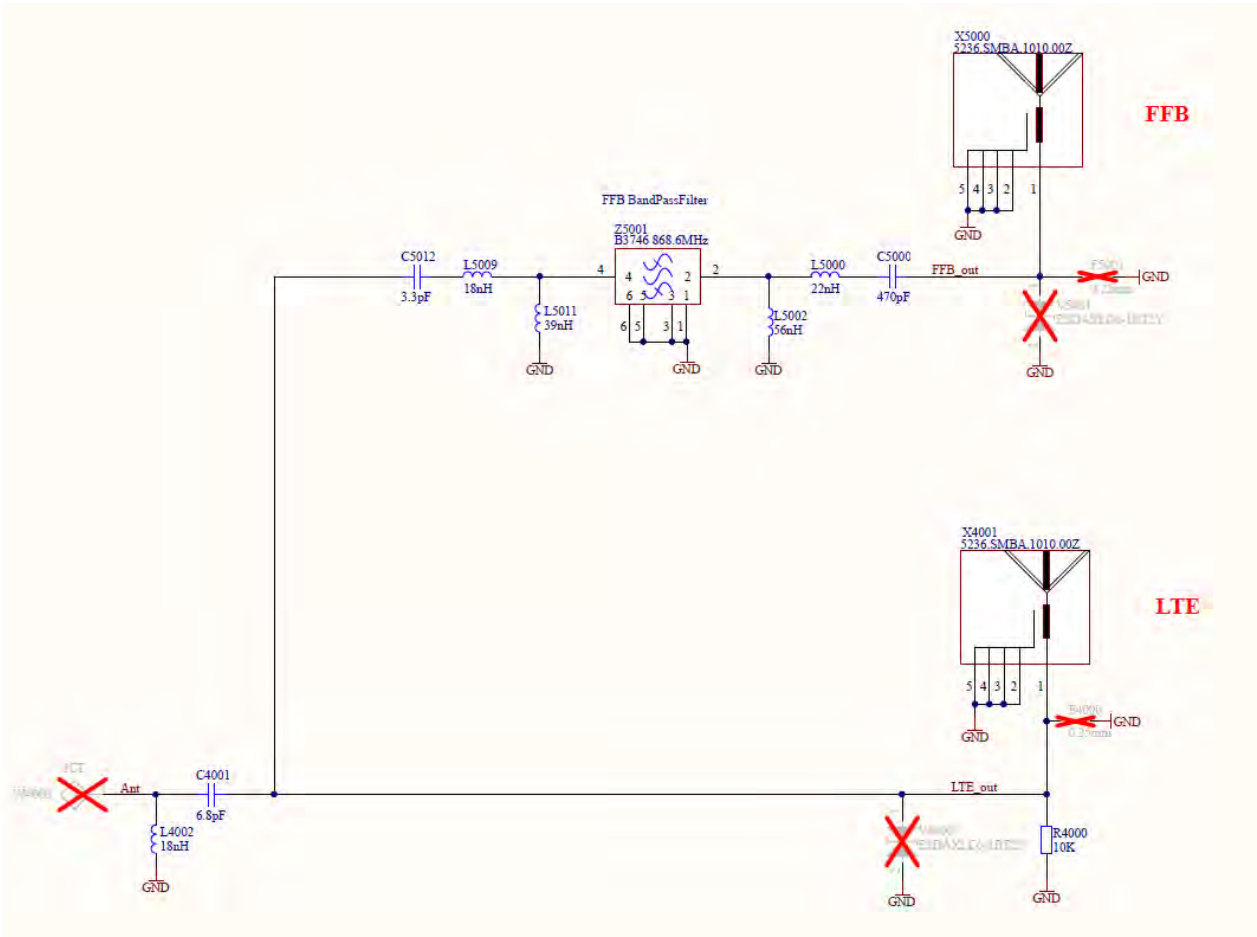


Abbildung 20 LTE / FFB DDA2_AP

6.3 Bluetooth v2 (aktiv)

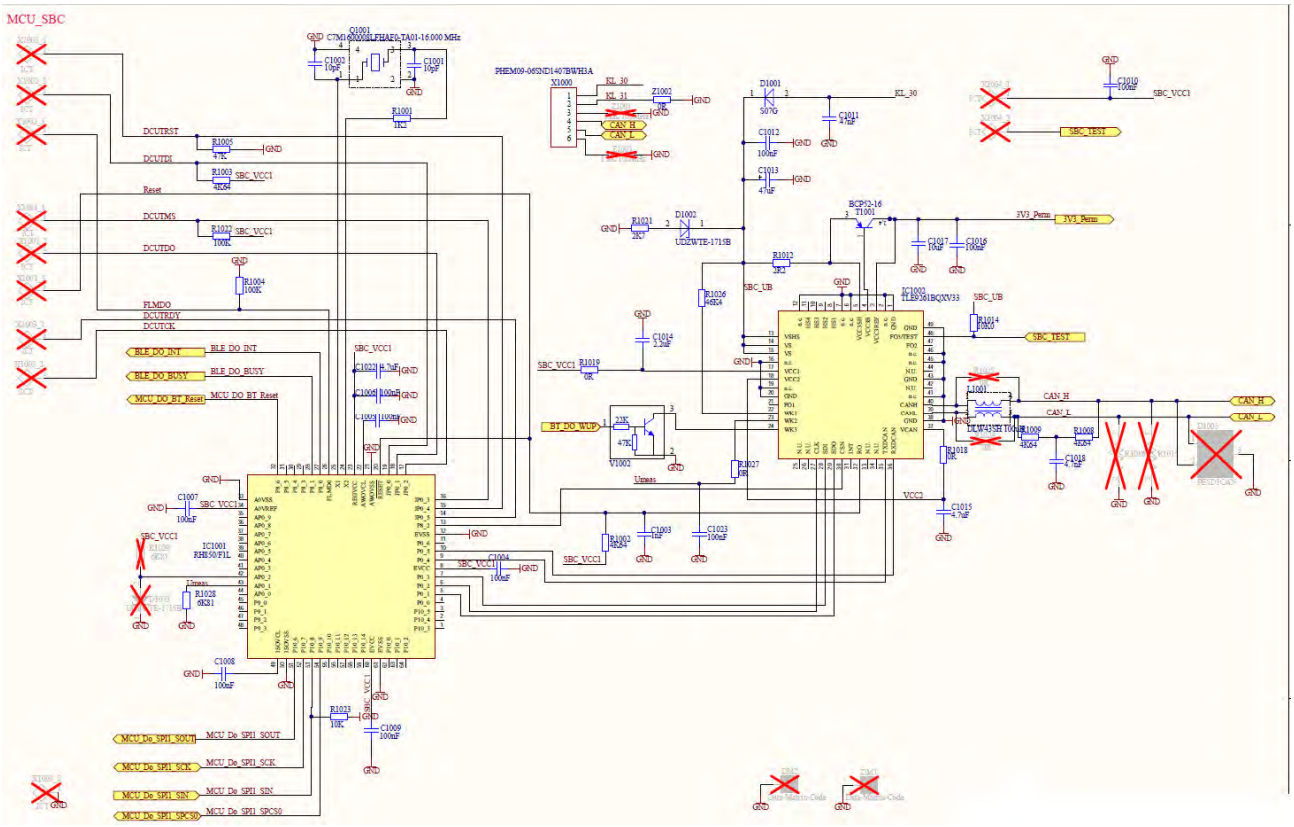


Abbildung 21 BTv2_Controller

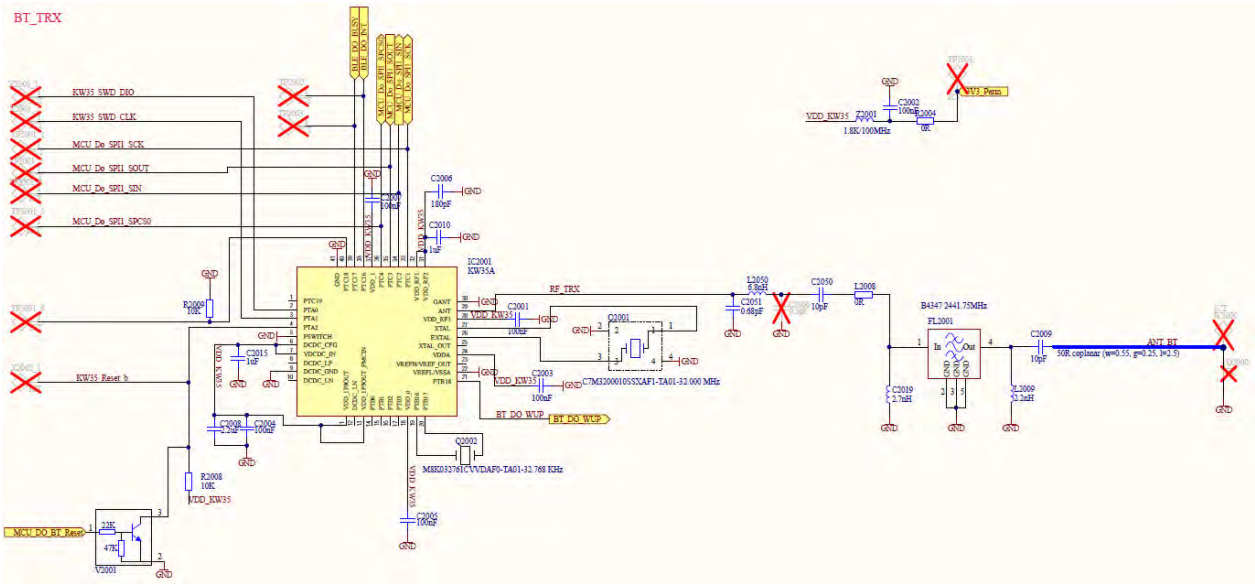
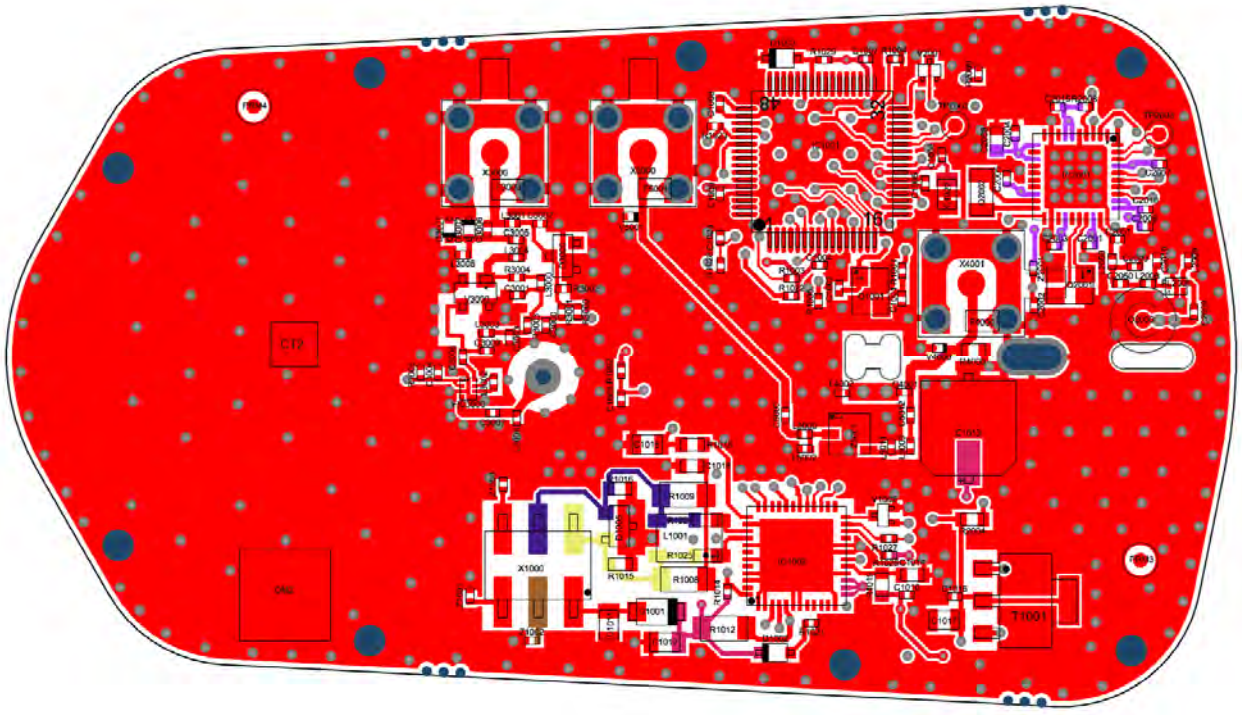


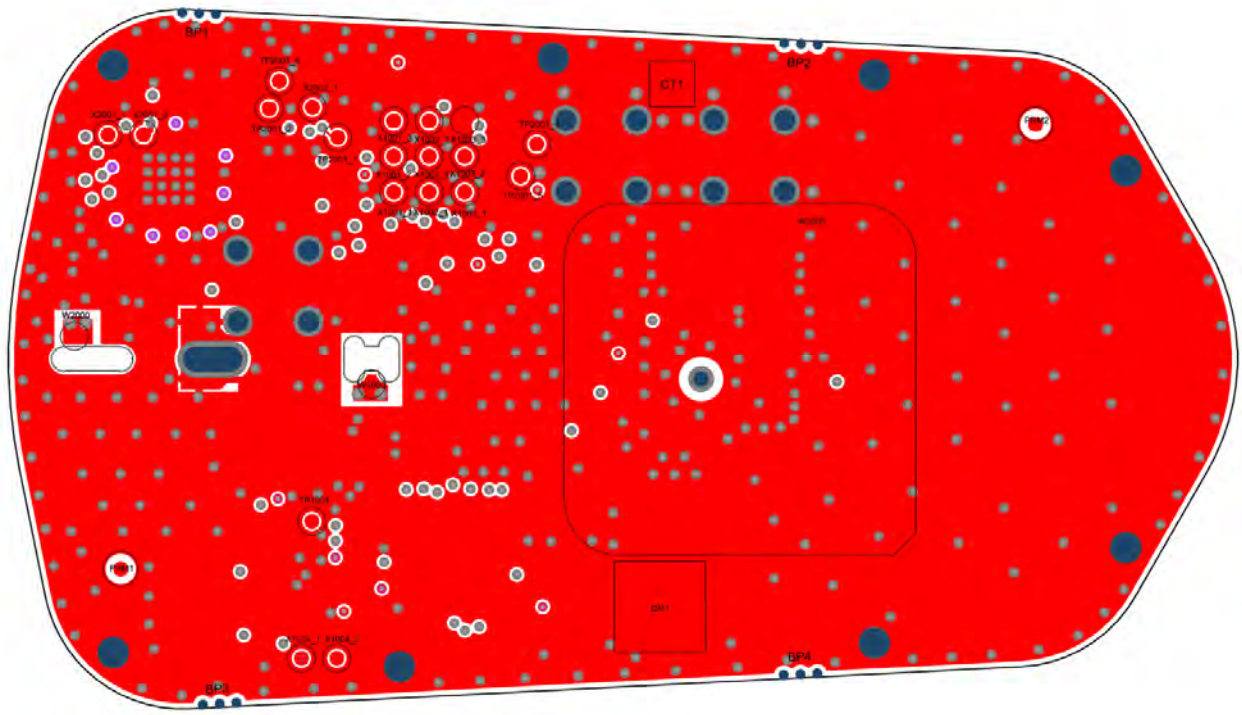
Abbildung 22 BTv2_RX/TX

7 Layout mit Bestückungsplan

7.1 Bottom



7.2 Top



7.3 Stückliste

Item	Level	LibRef	Description	Quantity	Designator
1	1	9009618	SMD, Capacitor, Chip 0402	5	C1001, C1002, C2009, C2050, C3008
2	1	9009735	SMD, Capacitor, Chip 0402	2	C1003, C3004
3	1	9009867	SMD, Capacitor, Chip 0402	15	C1004, C1005, C1006, C1007, C1008, C1009, C1010, C1016, C1023, C2001, C2002, C2003, C2004, C2005, C2007
4	1	9009913	SMD, Capacitor, Chip 0805, Fail save	1	C1011
5	1	9009914	SMD, Capacitor, Chip 0805, Fail save	1	C1012
6	1	9009915	Electrolytic Capacitors,Chip EEEFP1V470AP	1	C1013
7	1	9009909	SMD, Capacitor, Chip 0603	2	C1014, C2008
8	1	9009911	SMD, Capacitor, Chip 0805	2	C1015, C1022
9	1	9009912	SMD, Capacitor, Chip 0805	1	C1017
10	1	9009675	SMD, Capacitor, Chip 0603	1	C1018
11	1	9009694	SMD, Capacitor, Chip 0402	1	C2006
12	1	9009910	SMD, Capacitor, Chip 0402	2	C2010, C2015
13	1	0951745	SMD, Inductor, Chip 0402	1	C2019
14	1	9009418	SMD, Capacitor, Chip 0402	1	C2051

15	1	9009697	SMD, Capacitor, Chip 0402	1	C3000
16	1	9009619	SMD, Capacitor, Chip 0402	2	C3001, C3003
17	1	9009626	SMD, Capacitor, Chip 0402	3	C3002, C3006, C3007
18	1	9009622	SMD, Capacitor, Chip 0402	1	C3005
19	1	9009605	SMD, Capacitor, Chip 0402	1	C3009
20	1	9009615	SMD, Capacitor, Chip 0402	1	C4001
21	1	9009696	SMD, Capacitor, Chip 0402	1	C5000
22	1	9009611	SMD, Capacitor, Chip 0402	1	C5012
23	1	9053889	SMD, DO-219AB,Standard Recovery Rectifier High Voltage Surface Mount	1	D1001
24	1	9053467	SMD, UMD2, 15V Z-Diode, UDZW B Series	1	D1002
25	1	9053486	SMD, SOT23, BZX84/C11, 11V Z-Diode	1	D3000
26	1	9053489	SMD, High-Speed Si-Diode, SC79, SCD80	2	D3001, D3002
27	1	9053853	GPS, GLONASS, Beidou and Galileo Front-End Module.NJG1159PHH/TN0089A	1	FIC3000
28	1	0993650	SMD,1.4X1.1mm,2441.75MHz SAW RF filter	1	FL2001
29	1	9053852	SMD, QFP64,Body 10x10mm, Pitch 0.5mm,High-end MCU with a 32-bit RH850G3K core.	1	IC1001
30	1	90510012	SMD, VQFN48, power package with LTI feature	1	IC1002
31	1	9054116	SMD,HVQFN40,Automotive and Industrial Qualified Wireless MCUs	1	IC2001
32	1	0951842	SMD,DLW43SH101XK2, Common Mode Filter	1	L1001
33	1	9036102	SMD, Resistor, Chip 0402	2	L2008, R1027
34	1	0951648	SMD, Inductor, Chip 0402	1	L2009
35	1	0951652	SMD, Inductor, Chip 0402	1	L2050
36	1	0951703	SMD, Inductor, Chip 0402	1	L3000
37	1	0951662	SMD, Inductor, Chip 0402	1	L3001
38	1	0951654	SMD, Inductor, Chip 0402	1	L3002
39	1	0951660	SMD, Inductor, Chip 0402	1	L3003
40	1	9036597	SMD, Resistor, Chip 0402	2	L3004, Z1002
41	1	0951651	SMD, Inductor, Chip 0402	1	L3005
42	1	0951657	SMD, Inductor, Chip 0402	1	L3006
43	1	0951791	SMD, Inductor, Chip 0402	2	L4002, L5009
44	1	0951746	SMD, Inductor, Chip 0402	1	L5000
45	1	0951661	SMD, Inductor, Chip 0402	1	L5002
46	1	0951659	SMD, Inductor, Chip 0402	1	L5011
47	1	9073365	SMD,3.2X2.5MM 4 PADS TYPE,Frequency 16.000MHz,CERAMIC SMD CRYSTAL	1	Q1001

48	1	9073363	SMD,3.2X2.5MM typ,Frequency 32.000MHz,CERAMIC SMD CRYSTAL	1	Q2001
49	1	9073364	SMD,3.2X1.5MM typ,Frequency 32.768 KHz,TUNING FORK SMD CRYSTAL	1	Q2002
50	1	9036530	SMD, Resistor, Chip 0402	1	R1001
51	1	9036279	SMD, Resistor, Chip 0402	2	R1002, R1003
52	1	9036294	SMD, Resistor, Chip 0402	2	R1004, R1022
53	1	9036578	SMD, Resistor, Chip 0402	1	R1005
54	1	P9035376	SMD, Resistor, Chip 1206	2	R1008, R1009
55	1	9036501	SMD, Resistor, Chip 1206	1	R1012
56	1	9036286	SMD, Resistor, Chip 0402	1	R1014
57	1	9036469	SMD, Resistor, Chip 0603	3	R1018, R1019, R2004
58	1	9036534	SMD, Resistor, Chip 0402	1	R1021
59	1	9036571	SMD, Resistor, Chip 0402	3	R1023, R2008, R2009
60	1	9036292	SMD, Resistor, Chip 0402	1	R1026
61	1	9036283	SMD, Resistor, Chip 0402	1	R1028
62	1	9036568	SMD, Resistor, Chip 0402	1	R3000
63	1	9036560	SMD, Resistor, Chip 0402	1	R3001
64	1	9036595	SMD, Resistor, Chip 0402	1	R3002
65	1	9036287	SMD, Resistor, Chip 0402	1	R3003
66	1	9036223	SMD, Resistor, Chip 0402	1	R3004
67	1	9036540	SMD, Resistor, Chip 0402	1	R3005
68	1	9032053	SMD, Resistor, Chip 0603	1	R4000
69	1	9053855	SMD, SOT223,PNP Silicon AF Transistors	1	T1001
70	1	9053476	SMD, SC75, NPN-Transistor mit Wider-stand 22k/47k	2	V1002, V2001
71	1	9053871	SMD, SOT143B, NPN wideband silicon RF transistor	1	V3000
72	1	0993515	SMD,2.54mm Pin Header Dual Row SMT Type, PHEM09-06SND1407BWH3A	1	X1000
73	1	0923335	Fakra Insert Pin in Paste	3	X3000, X4001, X5000
74	1	0951397	SMD, CHIP 0402, 1k8/100MHz EMI-Filter	1	Z2001
75	1	0993656	SMD, SAW RF Filter B3746 868.6MHz	1	Z5001
76	1	03611921 b02	raw PCB	1	PCB

8 Änderungshistorie

Version	Datum	Autor	Änderungen
V01	06.08.19	Jaeger	

Anhang A Referenzen und Begriffe

A.1 Referenzen

Referenz	Dokument
[1]	TL82133, Ausgabe 2008-06

A.2 Verwendete Begriffe

Begriff	Erklärung

A.3 Verwendete Abkürzungen

Abk.	Definition

Anhang B Verzeichnis der Abbildungen und Tabellen