



Datasheet

Amplifiers Audi PPC/PPE

Datasheet Audi PPC/PPE

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1 Scope

This document describes the identical BT/WLAN antenna functionality of two product groups packaged in the same mechanical housing.

2 Variants

2.1 BT/WLAN with broadcast amplifier

Fahrzeug	Einzelteil-Nr.	HCC	Funktion	Markt
AU401 A4 Limo	8B5.035.225	920-748-301	FM1/BT-WLAN	ECE/RDW
	8B5.035.225.A	920-748-302	FM2/BT-WLAN	ECE/NAR
	8B5.035.225.B	920-748-003	FM1/DAB1/BT-WLAN	ECE/RDW
	8B5.035.225.C	920-748-004	FM2/DAB2/BT-WLAN	ECE/RDW
	8B5.035.225.D	920-748-305	FM1/BT-WLAN	Japan
	8B5.035.225.E	920-748-306	FM2/BT-WLAN	Japan
	8B5.035.225.F	920-748-007	AM/FM1/DAB1/BT-WLAN	AGCC
	8B5.035.225.G	920-748-008	AM/FM1/BT-WLAN	NAR
AU402 A4 Avant	8B9.035.225	920-748-309	FM1/BT-WLAN	ECE/NAR
	8B9.035.225.A	920-748-310	FM2/BT-WLAN	ECE/NAR
	8B9.035.225.B	920-748-011	FM1/DAB1/BT-WLAN	ECE/RDW
	8B9.035.225.C	920-748-012	FM2/DAB2/BT-WLAN	ECE/RDW
	8B9.035.225.D	920-748-313	FM1/BT-WLAN	Japan
	8B9.035.225.E	920-748-314	FM2/BT-WLAN	Japan
	8B9.035.225.F	920-748-015	AM/FM1/DAB1/BT-WLAN	AGCC
	8B9.035.225.G	920-748-016	AM/FM1/BT-WLAN	NAR
AU436 Q5	8MA.035.225	920-748-317	FM1/BT-WLAN	ECE/NAR
	8MA.035.225.A	920-748-318	FM2/BT-WLAN	ECE/NAR
	8MA.035.225.B	920-748-019	FM1/DAB1/BT-WLAN	ECE/RDW
	8MA.035.225.C	920-748-020	FM2/DAB2/BT-WLAN	ECE/RDW
	8MA.035.225.D	920-748-321	FM1/BT-WLAN	Japan
	8MA.035.225.E	920-748-322	FM2/BT-WLAN	Japan
	8MA.035.225.F	920-748-023	AM/FM1/DAB1/BT-WLAN	AGCC
	8MA.035.225.G	920-748-024	AM/FM1/BT-WLAN	NAR
AU591 A6 Limo	4P5.035.225	920-748-025	FM1/BT-WLAN	ECE/NAR
	4P5.035.225.A	920-748-026	FM2/BT-WLAN	ECE/NAR
	4P5.035.225.B	920-748-027	FM1/DAB1/BT-WLAN	ECE/RDW
	4P5.035.225.C	920-748-028	FM2/DAB2/BT-WLAN	ECE/RDW
	4P5.035.225.D	920-748-029	FM1/BT-WLAN	Japan
	4P5.035.225.E	920-748-030	FM2/BT-WLAN	Japan
	4P5.035.225.F	920-748-031	AM/FM1/DAB1/BT-WLAN	AGCC
	4P5.035.225.G	920-748-032	AM/FM1/BT-WLAN	NAR
AU592 A6 Avant	4P9.035.225	920-748-033	FM1/BT-WLAN	ECE/NAR
	4P9.035.225.A	920-748-034	FM2/BT-WLAN	ECE/NAR
	4P9.035.225.B	920-748-035	FM1/DAB1/BT-WLAN	ECE/RDW
	4P9.035.225.C	920-748-036	FM2/DAB2/BT-WLAN	ECE/RDW
	4P9.035.225.D	920-748-037	FM1/BT-WLAN	Japan
	4P9.035.225.E	920-748-038	FM2/BT-WLAN	Japan

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Fahrzeug	Einzelteil-Nr.	HCC	Funktion	Markt
	4P9.035.225.F	920-748-039	AM/FM1/DAB1/BT-WLAN	AGCC
	4P9.035.225.G	920-748-040	AM/FM1/BT-WLAN	NAR
AU336/0 Q3	83H.035.225	920-748-041	FM1/BT-WLAN	ECE/RDW
	83H.035.225.A	920-748-042	FM2/BT-WLAN	ECE/NAR
	83H.035.225.B	920-748-043	FM1/DAB1/BT-WLAN	ECE/RDW
	83H.035.225.C	920-748-044	FM2/DAB2/BT-WLAN	ECE/RDW
	83H.035.225.D	920-748-045	FM1/BT-WLAN	Japan
	83H.035.225.E	920-748-046	FM2/BT-WLAN	Japan
	83H.035.225.F	920-748-047	AM/FM1/DAB1/BT-WLAN	AGCC
	83H.035.225.G	920-748-048	AM/FM1/BT-WLAN	NAR
AU336/1 Q3 SB	83J.035.225	920-748-049	FM1/BT-WLAN	ECE/RDW
	83J.035.225.A	920-748-050	FM2/BT-WLAN	ECE/NAR
	83J.035.225.B	920-748-051	FM1/DAB1/BT-WLAN	ECE/RDW
	83J.035.225.C	920-748-052	FM2/DAB2/BT-WLAN	ECE/RDW
	83J.035.225.D	920-748-053	FM1/BT-WLAN	Japan
	83J.035.225.E	920-748-054	FM2/BT-WLAN	Japan
	83J.035.225.F	920-748-055	AM/FM1/DAB1/BT-WLAN	AGCC
	83J.035.225.G	920-748-056	AM/FM1/BT-WLAN	NAR
AU416/6 Q4 B-SUV	82D.035.225	920-748-057	AM/FM1/BT-WLAN	NAR
	82D.035.225.A	920-748-058	FM2/BT-WLAN	ECE/NAR
AU546/0 Q7	4MN.035.225	920-748-059	FM1/BT-WLAN	ECE/RDW
	4MN.035.225.A	920-748-060	FM2/BT-WLAN	ECE/NAR
	4MN.035.225.B	920-748-061	FM1/DAB1/BT-WLAN	ECE/RDW
	4MN.035.225.C	920-748-062	FM2/DAB2/BT-WLAN	ECE/RDW
	4MN.035.225.D	920-748-063	FM1/BT-WLAN	Japan
	4MN.035.225.E	920-748-064	FM2/BT-WLAN	Japan
	4MN.035.225.F	920-748-065	AM/FM1/DAB1/BT-WLAN	AGCC
	4MN.035.225.G	920-748-066	AM/FM1/BT-WLAN	NAR
AU616/0 Q9	4MQ.035.225	920-748-085	FM1/BT-WLAN	ECE/RDW
	4MQ.035.225.A	920-748-086	FM2/BT-WLAN	ECE/NAR
	4MQ.035.225.B	920-748-087	FM1/DAB1/BT-WLAN	ECE/RDW
	4MQ.035.225.C	920-748-088	FM2/DAB2/BT-WLAN	ECE/RDW
	4MQ.035.225.D	920-748-089	FM1/BT-WLAN	Japan
	4MQ.035.225.E	920-748-090	FM2/BT-WLAN	Japan
	4MQ.035.225.F	920-748-091	AM/FM1/DAB1/BT-WLAN	AGCC
	4MQ.035.225.G	920-748-092	AM/FM1/BT-WLAN	NAR
AU401/0CN	8BG.035.225	920-748-067	FM1/BT-WLAN	RDW
	8BG.035.225.A	920-748-068	FM2/BT-WLAN	RDW
AU403/0CS	8BD.035.225	920-748-069	FM1/BT-WLAN	RDW
	8BD.035.225.A	920-748-070	FM2/BT-WLAN	RDW
AU591/0CN	4PD.035.225	920-748-071	FM1/BT-WLAN	RDW
	4PD.035.225.A	920-748-072	FM2/BT-WLAN	RDW
AU591/2CN	4PH.035.225	920-748-073	FM1/BT-WLAN	RDW
	4PH.035.225.A	920-748-074	FM2/BT-WLAN	RDW
AU593/0CS	4PG.035.225	920-748-075	FM1/BT-WLAN	RDW
	4PG.035.225.A	920-748-076	FM2/BT-WLAN	RDW
AU436/1ME	8MS.035.225	920-748-077	FM1/BT-WLAN	ECE/RDW
	8MS.035.225.A	920-748-078	FM2/BT-WLAN	ECE/NAR

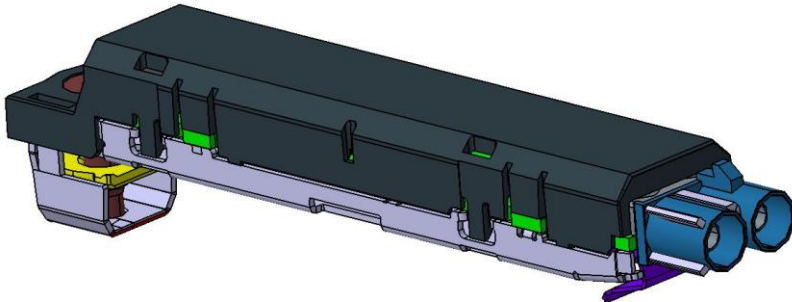
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Fahrzeug	Einzelteil-Nr.	HCC	Funktion	Markt
	8MS.035.225.B	920-748-079	FM1/DAB1/BT-WLAN	ECE/RDW
	8MS.035.225.C	920-748-080	FM2/DAB2/BT-WLAN	ECE/RDW
	8MS.035.225.D	920-748-081	FM1/BT-WLAN	Japan
	8MS.035.225.E	920-748-082	FM2/BT-WLAN	Japan
	8MS.035.225.F	920-748-083	AM/FM1/DAB1/BT-WLAN	AGCC
	8MS.035.225.G	920-748-084	AM/FM1/BT-WLAN	NAR
AU416/2 Q6 e-tron	85H.035.225	920-838-001	FM1/BT-WLAN	ECE/RDW
	85H.035.225.A	920-838-002	FM2/BT-WLAN	ECE/NAR
	85H.035.225.B	920-838-003	FM1/DAB1/BT-WLAN	ECE/RDW
	85H.035.225.C	920-838-004	FM2/DAB2/BT-WLAN	ECE/RDW
	85H.035.225.D	920-838-005	FM1/BT-WLAN	Japan
	85H.035.225.E	920-838-006	FM2/BT-WLAN	Japan
AU416/3 Q6 e-tron SB	85J.035.225	920-838-007	FM1/BT-WLAN	ECE/RDW
	85J.035.225.A	920-838-008	FM2/BT-WLAN	ECE/NAR
	85J.035.225.B	920-838-009	FM1/DAB1/BT-WLAN	ECE/RDW
	85J.035.225.C	920-838-010	FM2/DAB2/BT-WLAN	ECE/RDW
	85J.035.225.D	920-838-011	FM1/BT-WLAN	Japan
	85J.035.225.E	920-838-012	FM2/BT-WLAN	Japan
AU513/4 E6 e-tron SB	85F.035.225	920-838-013	FM1/BT-WLAN	ECE/RDW
	85F.035.225.A	920-838-014	FM2/BT-WLAN	ECE/NAR
	85F.035.225.B	920-838-015	FM1/DAB1/BT-WLAN	ECE/RDW
	85F.035.225.C	920-838-016	FM2/DAB2/BT-WLAN	ECE/RDW
	85F.035.225.D	920-838-017	FM1/BT-WLAN	Japan
	85F.035.225.E	920-838-018	FM2/BT-WLAN	Japan
AU512/4 E6 e-tron AV	85A.035.225	920-838-019	FM1/BT-WLAN	ECE/RDW
	85A.035.225.A	920-838-020	FM2/BT-WLAN	ECE/NAR
	85A.035.225.B	920-838-021	FM1/DAB1/BT-WLAN	ECE/RDW
	85A.035.225.C	920-838-022	FM2/DAB2/BT-WLAN	ECE/RDW
	85A.035.225.D	920-838-023	FM1/BT-WLAN	Japan
	85A.035.225.E	920-838-024	FM2/BT-WLAN	Japan

3 Mechanical description

BT/WLAN with broadcast amplifier



Physical Dimensions: 115 * 19 * 26 mm
Weight: 41 g

Figure 1 Packaging variants:

4 Combined Block Diagram

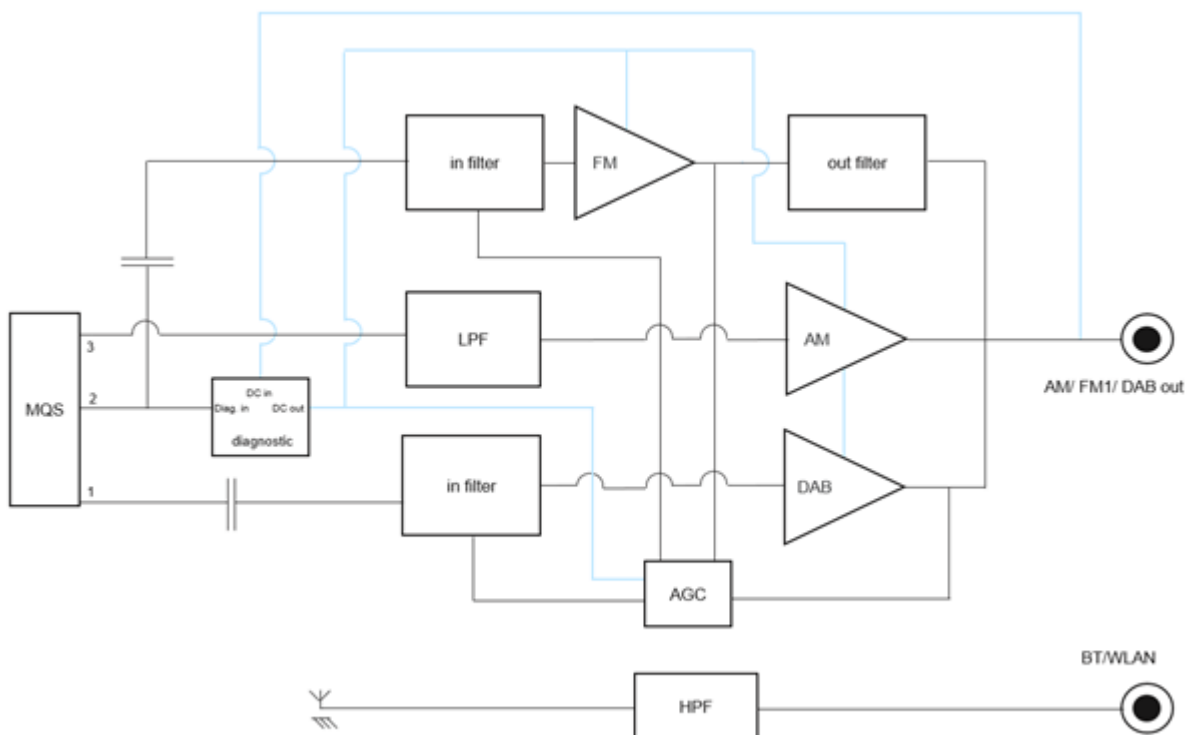
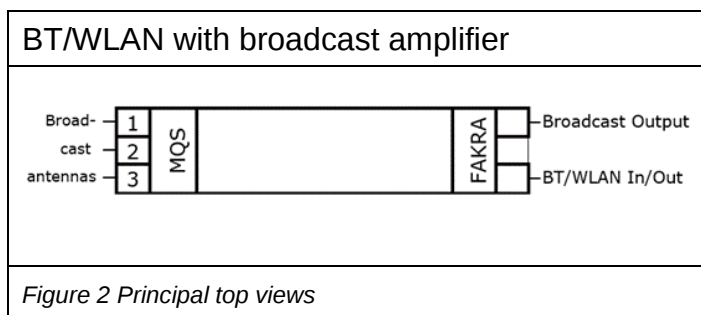


Figure 3 Block diagram.

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5 Principal Top View



6 Pinning Variants

Funktion:	Audi Nr.	MQS Pin 1	MQS Pin 2	MQS Pin 3	Diagnose	Fakra
Cars: AU 401, AU591, ...						
FM1/WLAN_BT ECE NAR	LIM 035 225	open	FM/Dia	open	Masse	Dual Cod. G
FM2/WLAN_BT ECE NAR	LIM 035 225 A	open	FM/Dia	open	Tristate	Dual Cod. E
FM1/DAB1/WLAN_BT ECE RDW	LIM 035 225 B	DAB	FM/Dia	open	Masse	Dual Cod. K
FM2/DAB2/WLAN_BT ECE RDW	LIM 035 225 C	DAB	FM/Dia	open	Tristate	Dual Kod. N
FM1/WLAN_BT JP	LIM 035 225 D	open	FM/Dia	open	Masse	Dual Cod. H
FM2/WLAN_BT JP	LIM 035 225 E	open	FM/Dia	open	Tristate	Dual Cod. F
AM/FM1/DAB1/WLAN_BT AGCC	LIM 035 225 F	DAB	FM/Dia	AM	Masse	Dual Cod. C
AM/FM1/WLAN_BT NAR	LIM 035 225 G	open	FM/Dia	AM	Masse	Dual Cod. D
Cars: AU 402, AU436, AU592, ...						
FM1/WLAN_BT ECE NAR	Ava 035 225	open	FM/Dia	open	Masse	Dual Cod. G
FM2/WLAN_BT ECE NAR	Ava 035 225 A	open	FM/Dia	open	Tristate	Dual Cod. E
FM1/DAB1/WLAN_BT ECE RDW	Ava 035 225 B	DAB	FM/Dia	open	Masse	Dual Cod. K
FM2/DAB2/WLAN_BT ECE RDW	Ava 035 225 C	DAB	FM/Dia	open	Tristate	Dual Kod. N
FM1/WLAN_BT JP	Ava 035 225 D	open	FM/Dia	open	Masse	Dual Cod. H
FM2/WLAN_BT JP	Ava 035 225 E	open	FM/Dia	open	Tristate	Dual Cod. F
AM/FM1/DAB1/WLAN_BT AGCC	Ava 035 225 F	DAB	AM/FM/Dia	open	Tristate	Dual Cod. C
AM/FM1/WLAN_BT NAR	Ava 035 225 G	open	AM/FM/Dia	open	Tristate	Dual Cod. D

7 BT/WLAN Electrical Parameters

7.1 Operating Conditions

Parameter	min.	typ.	max.	Unit
Operating Temperature	-40	25	+95	°C
Supply Voltage of AM/FM/DAB	7.5	8.5	9.0	V

7.2 RF Performance

7.2.1 Technical Data

Parameter	Typical Value	Unit
Impedance	50	Ohm
S11	-6	dB
DC diagnosis resistor	10 ± 5%	kOhm

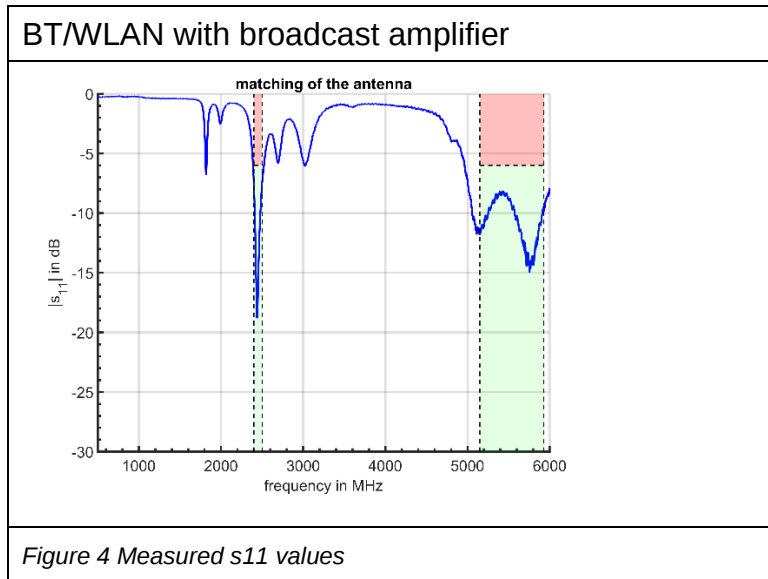
7.2.2 Antenna Gain BT/WLAN with broadcast amplifier

Frequency Band (in MHz)		Partial Average Gain (θ= 0-180°)		Peak Gain (θ= 0-180°)	Unit
Begin	End	Average	Maximum	in Frequency Band	
2400	2500	-3.2	-2.7	2.7	dBi
5150	5250	-2.2	-2.3	4.2	dBi
5745	5825	-2.2	-2.2	5.2	dBi

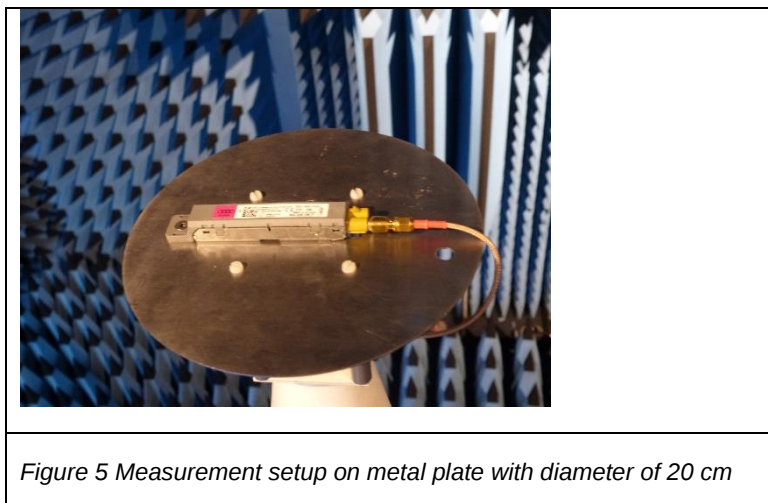
7.2.3 Additional Information

Antenna Type	PIFA
Polarization	Linear

7.3 Typical Antenna Reflection Performance



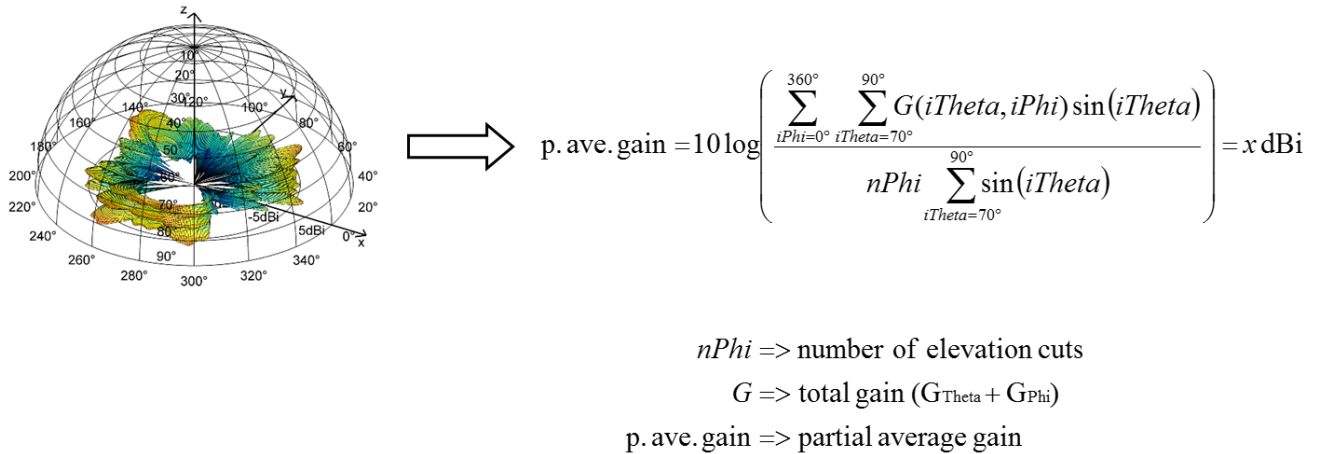
7.4 Typical Antenna Radiation Performance



Note: FAKRA faces in the direction of $\phi=0^\circ$. The ϕ -plane is parallel to the metal plate.

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7.5 Calculation formula of Partial Antenna Gain



7.5.1 2D Radiation Plots BT/WLAN with broadcast amplifier

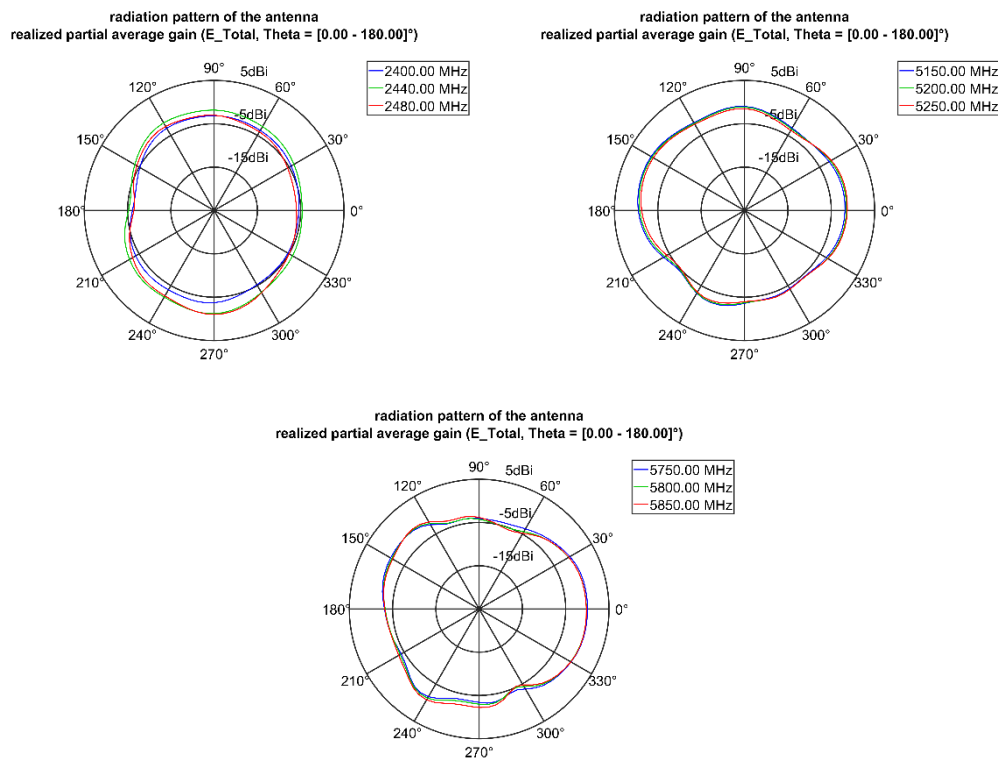


Figure 6 2D Radiation Plots

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8 Broadcast Amplifier Electrical Parameters

8.1 Operating Conditions

Parameter	Test Condition	min.	typ.	max.	Unit
Operating Temperature		-40	25	95	°C
1h Temperature				105	°C
AM/FM/DAB Amplifier					
Supply Voltage		7.5	8.5	9.0	V

8.2 Electrical Parameters

$U_B = U_{typ}$; $T_A = T_{typ}$

Parameter	Test Condition	Test Category ¹	min.	typ.	max.	Unit
AM/FM/DAB Amplifier						
Current diagnose		BC	15	20	25	mA
Current AMFM or FMonly		C	35		90	mA
Current FMDAB		C	35		110	mA
Current AMFMDAB		C	35		150	mA
AM frequency			520		1710	kHz
AM Gain 50Ω Cars: AU 401, AU591	G_{AM50} f=800 kHz		-2	0±0.5	+2	dB
AM Gain 50Ω Cars: AU 402, AU436, AU592	G_{AM50} f=800 kHz		-12	-10±0.5	- 8	dB
AM- frequency response			-3		+3	dB
AM output-noise-level 50Ω				-8 dB + G_{AM50}	-8	dBμV
AM signal-to-intermod- ulation-ratio IM2 IM3	$U_{in} = 100 \text{ dBμV} - G_{AM50}$		50			dB
FM frequency RDW JAP			87 76		108 95	MHz
FM Gain S_{21}	LAH average value over	C	3.5		5.5	dB

¹ A: Customer Requirement; B: Laboratory Test; C Production EOL Test

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Parameter	Test Condition	Test Category ¹	min.	typ.	max.	Unit
	frequency					
FM- frequency response	Basis average value over frequency Not for Jap 90 – 95MHz		-0.5		+0.5	dB
FM stop-band-attenuation S_{21}	without matching network without DAB with the same Input/output RDW: ≤ 60 MHz - ≥ 170 MHz JAP: ≤ 50 MHz -- ≥ 108 MHz		10			dB
FM return loss S_{22}	without matching network	C	10			dB
FM output-noise-level			-12 + Gain			dB μ V
FM AGC Level		C	95		105	dB μ V
Outputlevel with AGC			-1		1	dB
FM- signal-to-intermodulation-ratio IM3 with AGC	U_{in} : 120 dB μ V		60			dB
AM-FM conversion With AGC	average value over testfrequency U_{in} : 120 dB μ V				20	dB μ V
DAB- Amplifier						
frequency			174		240	MHz
Gain S_{21}		C	12	16,6 -15dB	20	dB
frequency response	Basis average value over frequency		-1		+1	dB
DAB stop-band-attenuation S_{21}	without matching network without FM with the same Input/output ≤ 108 MHz --- ≥ 462 MHz		18			dB
return loss S_{22}	without matching network		10			dB
noise-figure	include filter				1,8dB	dB
signal-to-intermodulation-ratio IM3 < 207MHz	U_{in} 102 dB μ V ²		35			dB
signal-to-intermodulation-ratio IM3 > 207MHz	U_{in} 104 dB μ V ²		35			dB
conversion FM – DAB3	U_{in} (FM&DAB) 106 dB μ V				50	dB μ V

² A: Requirement changed in agreement with Audi

9 Document History

Version	Date	Remarks
1.0	2021-06-14	Initial version, fra
2.0	2021-07-21	Change Numbers and Pinning, fra
3.0	2022-03-02	Change DAB Gain, Noise and IM, fra
5.0	2023-07-31	AU401: HCC-partnumbers of all 8 variants updated after antenna-measurements, Fu
6.0	2023-08-02	AU401, variant 920-748-008 corrected [PS]
8.0	2024-02-16	Variants added, APN updated [jhu]

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