Specification, Version 1.1, 2001-07-30

PMB 2110
GSM Dualband TX VCO

Wireless Components

Never stop thinking.

Edition 2001-07-30

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Specification

Revision History:	**2001-07-30**	PMB 2110
Previous Version:	May 2001	

Page (in previous Version)	Page (in current Version)	Subjects (major changes since last revision)
	16 ff	AC/DC Characteristics specified vs Temperature
	16/17	Max Supply current added: GSM:34mA, DCS:37mA
	18	Itune max: 2nA added
	5 ff	SupplyVoltage changed: 2.7V to 2.95V

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Product Info

General Description

- The PMB 2110 is a Transmit VCO for Dualband (900/1800) GSM mobiles.

P-TSSOP-10

Features

- Fully integrated, monolithic solution
- Very small outline and low profile TSSOP10 package
- Two single ended RF power outputs to drive the power amplifier
- Low power balanced output for PLL downconverter for optimized bill of material (no external power splitter required)
- Band select and power down function
- Supply voltage range 2.7V to 2.95V
- -20°C to +75°C operational temperature range

Application

- Transmit VCO for GSM Dualband (900/1800) transceivers

Type	Ordering Code	Package
PMB 2110	Q67034-H0005	P-TSSOP-10

Table of Contents **Page**

1 Product Description

1.1 Overview

- The PMB 2110 is a Transmit VCO for Dualband (900/1800) GSM mobiles.

1.2 Features

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- Very small outline and low profile TSSOP10 package
- Two single ended RF power outputs to drive the power amplifier
- Low power balanced output for PLL downconverter for optimized bill of material (no external power splitter required)
- Band select and power down function
- Supply voltage range from 2.7V to 2.95V
- -20°C to +75°C operational temperature range

1.3 Application

- Transmit VCO for GSM Dualband (900/1800) transceivers

1.4 Package Outlines

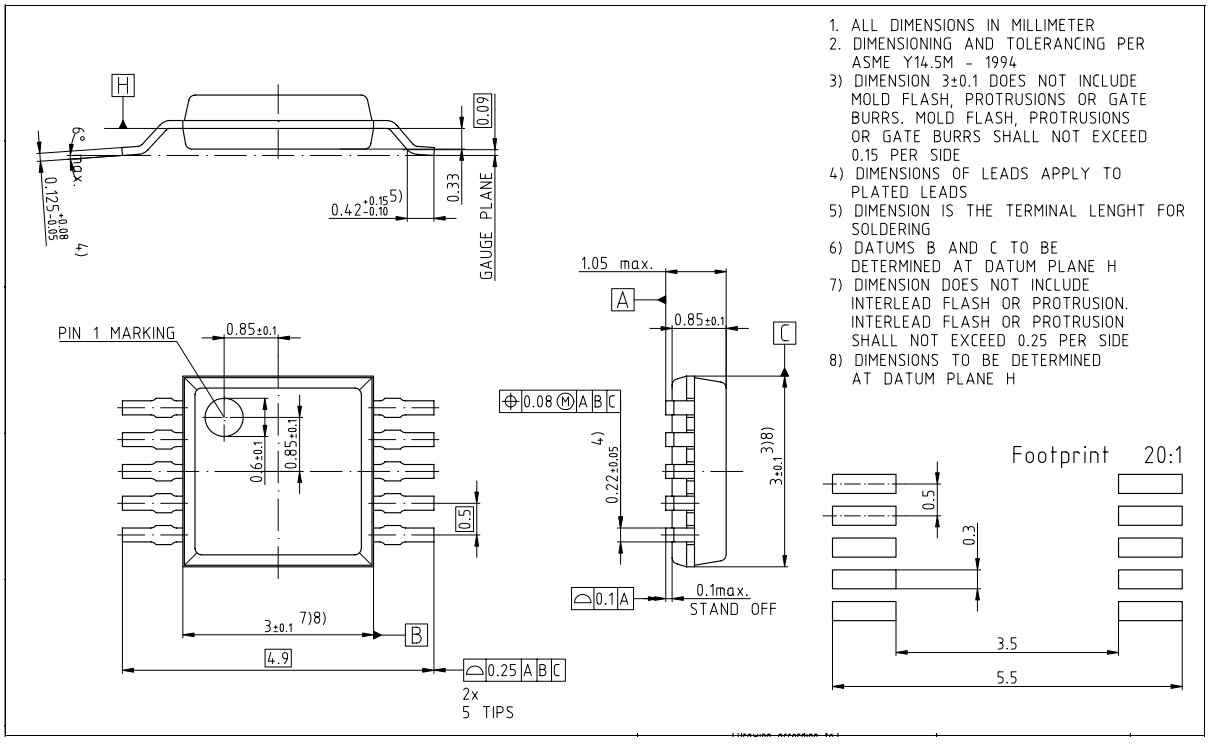
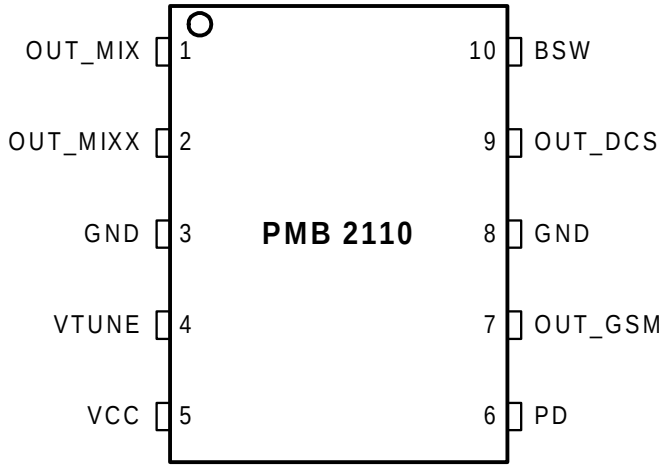


Figure 1-1 Package Outline P-TSSOP-10

2 Functional Description

2.1 Pin Configuration



Pin_config.wmf

Figure 2-1 Pin Configuration

2.2 Pin Definitions and Functions

Table 2-1 Pin Definition and Function

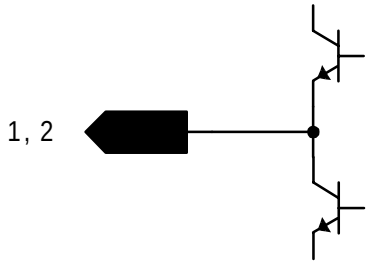
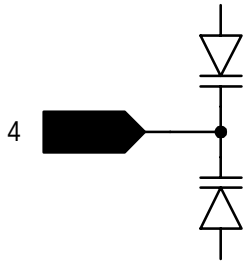
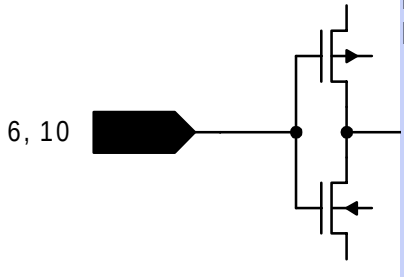
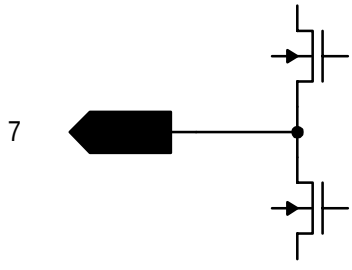
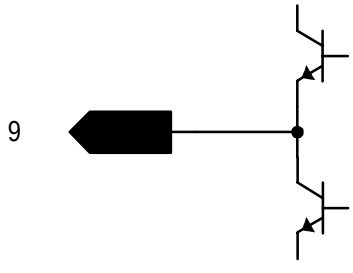
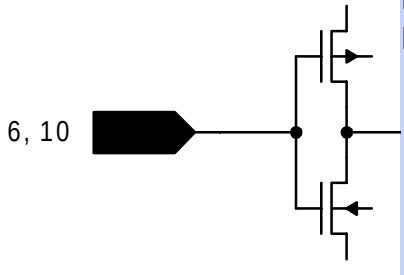
Pin No.	Symbol	Equivalent I/O-Schematic	Function
1	OUT_MIX		Downconverter Output
2	OUT_MIXX		Downconverter Output, inverted
3	GND		Ground
4	VTUNE		Frequency control voltage input
5	VCC		Supply voltage
6	PD		Power down PD=Low: VCO off PD=High: VCO on

Table 2-1 Pin Definition and Function (continued)

Pin No.	Symbol	Equivalent I/O-Schematic	Function
7	OUT_GSM		RF output GSM900
8	GND		Ground
9	OUT_DCS		RF output DCS1800
10	BSW		Band select: BSW=Low GSM 900 VCO on BSW=High DCS1800 VCO on

2.3 Functional Block Diagram

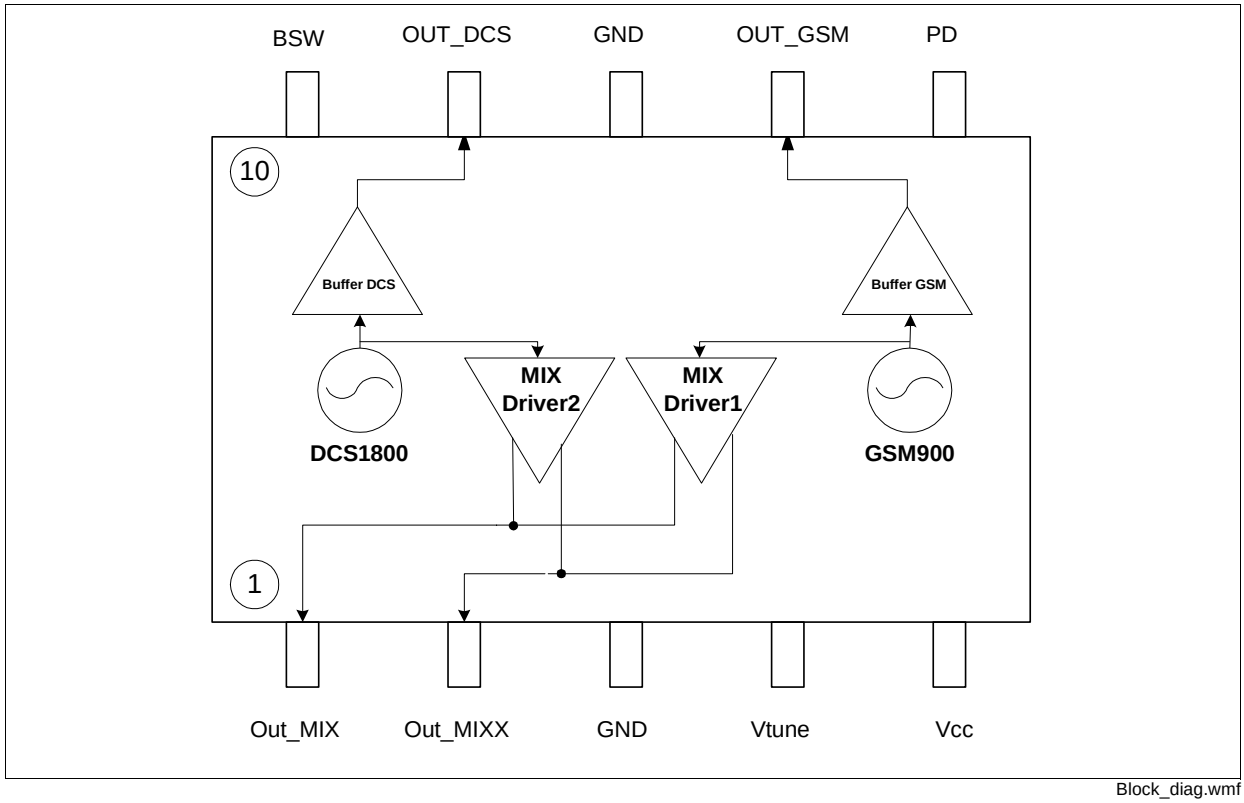


Figure 2-2 Block Diagram

2.4 Functional Block Description

The PMB 2110 contains all circuits including resonators required for a TX VCO for a dualband (900/1800) GSM transceiver.

2.4.1 VCO core

Separate VCO cores are used for the two frequency bands. The band required can be selected with the BSW input. Both VCOs have a common frequency control input VTUNE and a common voltage supply pin VCC.

2.4.2 VCO Buffer

Separate buffers are used for both cores to amplify the VCO signals. There are two outputs for each VCO. High power single ended outputs are used to drive separate inputs for each band of the power amplifier.

A separate balanced output is used to drive the downconverter of the transmit PLL. Thus the need for external circuitry to provide an input signal for this function is eliminated and the number of components required in the application is considerably reduced.

3 Application

3.1 Application Circuit

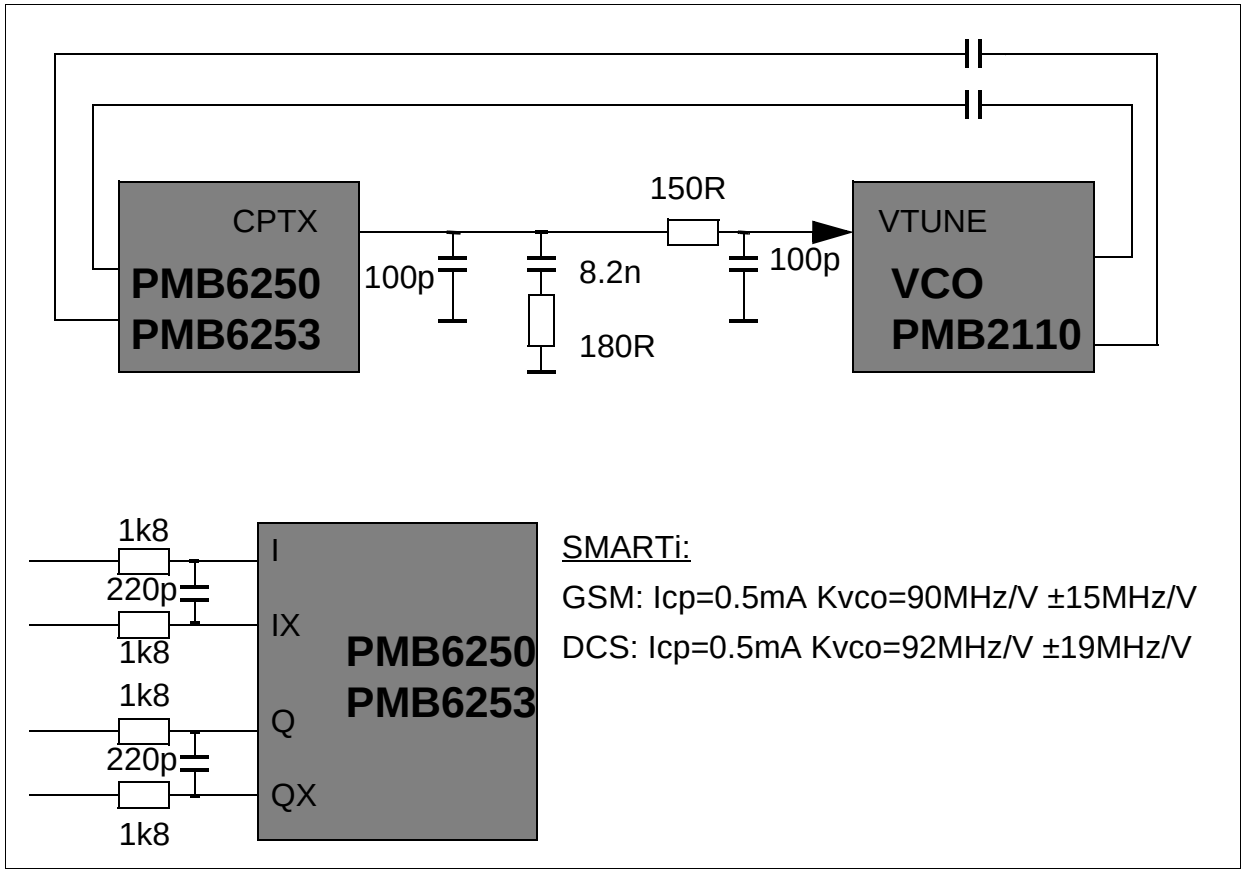


Figure 3-1 Application Circuit

The TX Loopfilter is designed to get an optimum of RMS Phase error, 400kHz and 1800kHz suppression for GSM900/GSM1800. For more details please refer to separate application note.

3.2 Hints

- DC blocking capacitors must be used at each RF output.
- Baseband Preemphase:
  The combination of IQ filtering and phase filtering due to the upconversions loops phase transfer function shows a partial cancellation of the correlated rms phase error introduced by the different blocks. This effect is utilized in the application circuit proposal. It leads to a phase error optimum for the recommended combination of loop dynamics and IQ filtering.
- Loop filter precharge function must be enabled together with PMB6250/PMB6253.

4 Reference

4.1 Electrical Data

4.1.1 Absolute Maximum Ratings

WARNING

The maximum ratings may not be exceeded under any circumstances, not even momentarily and individually, as permanent damage to the IC will result.

Table 4-1 Absolute Maximum Ratings, T_{AMB}=-30°C ... + 85°C

#	Parameter	Symbol	Limit Values		Unit	Remarks
			min	max		
1	Supply voltage	V_{CC}	-0.3	4.0	V	
2	Input voltage	V_{Tune}, V_{EN_GSM}, V_{EN_DCS}	-0.3	V_{CC}	V	
3	Output voltage	V_{Out}		V_{CC}	V	
4	Junction Temperature	T_J		125	°C	
5	Storage Temperature	T_S	-40	125	°C	
6	Thermal Resistance	R_{thJA}		200	K/W	
7	ESD integrity	V_{ESD}		1.25	kV	Human body model acc. EIA/JESD22-A114-B

4.1.2 Operating Range

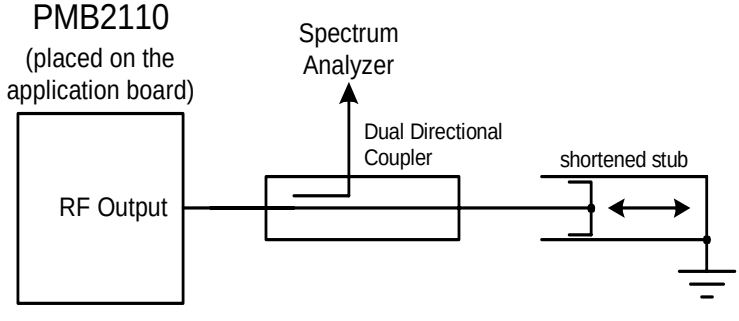
Within the operational range the IC operates as described in the circuit description. Supply voltage V_{CC} = 2.7 to 2.95V, ambient temperature T_A = -20 to 75°C, V_{Tune}=0.5 to 1.9V(DCS),V_{Tune}=1.1 to 1.9V(GSM), Output VSWR<4:1

Table 4-2 Operating Range

#	Parameter	Symbol	Limit Values min	Limit Values max	Unit	Test Conditions	■	Item
Frequency								
1	Frequency Range	f_L	880	915	MHz	GSM900 *)	■	
2	Frequency Range	f_H	1710	1785	MHz	DCS1800 *)	■	
Control inputs								
3	Frequency Control Voltage	V_{in}	+0.1	Vcc	V	Oscillation Signal available, but Frequency can be outside specified Range. The AC/DC characteristic limits are not guaranteed	■	
4	Control inputs OSW, PD		0	Vcc	V			
5	Input capacitance OSW, PD	C_{Input}		2	pF		■	
Stability:								
6	No parasitic oscillation under any output termination **)						■	

■ guaranteed by design.

*) Minimum frequency range covered under all operating range conditions
**)Measurement Setup for Stability:



4.1.3 Current Consumption and Operation Modes

All current consumption values are measured with Vcc=2.8V.

Table 4-3 Current Consumption

Mode	Logic		Current (typ.) [mA]
	PD	BSW	total
Off	L	X	< 10µA
GSM900	H	L	28
DCS1800	H	H	32

4.1.4 AC/DC Characteristics

AC/DC characteristics involve the spread of values guaranteed within the specified supply voltage and ambient temperature range.
Typical characteristics are the median of the production at T_A=25°C.

Table 4-4 AC/DC Characteristics with T_A = 25°C, V_{CC} = 2.7V to 2.95V valid within the specified frequency range.

#	Parameter	Symbol	Limit Values			Unit	Test Conditions	■	Item
			min	typ	max				
GSM Mode									
1	Supply Current	I_{total}		28	34	mA	Ta=-20°C..75°C		1.1
2	Frequency Range	fL	880		915	MHz	Ta=-20°C..75°C		2.1
3	Control Voltage	V_{Tune}	1.1		1.9	V	Ta=-20°C..75°C		3.1
4	Tuning Sensitivity	K_{VCO}	76	90	104	MHz/V	dVtune measured within a ±5MHz frequency step.		4.1
4a	Tuning Sensitivity	K_{VCO}	75	90	105	MHz/V	dVtune measured within a ±5MHz frequency step. Ta=-20°C..75°C	■	4.2
5	Frequency Pushing	Δf_{Push}			1.0	MHz	V_{CC}=2.8 ±0.1V Ta=-20°C..75°C	■	5.1

Table 4-4 AC/DC Characteristics with T_A = 25°C, V_{CC} = 2.7V to 2.95V valid within the specified frequency range.

#	Parameter	Symbol	Limit Values			Unit	Test Conditions	■	Item
			min	typ	max				
6	Load Pulling	Δf_{Pull}			1.5	MHz	VSWR=4:1, all phases Ta=-20°C..75°C	■	6.1
7	SSB Phase Noise @ Δf 400kHz 10000kHz 20000kHz	L_φ		 -165	 -128 -156 -162	 dBc/Hz	Ta=-20°C..75°C	■	7.1
8	Output power	P_{out}	4	6	8	dBm			8.1
8a	Output power	Pout	3	6	9	dBm	Ta=-20°C..75°C	■	8.2
9	Harmonics				-15	dBc	Ta=-20°C..75°C	■	9.1
10	Spurious emissions				-80	dBc	Ta=-20°C..75°C	■	10.1
DCS1800									
11	Supply Current	I_{total}		32	37	mA	Ta=-20°C..75°C		11.1
12	Frequency Range	ff	1710		1785	MHz	Ta=-20°C..75°C		12.1
13	Control Voltage	V_{Tune}	0.5		1.9	V	Ta=-20°C..75°C		13.1
14	Tuning Sensitivity	K_{VCO}	74	92	110	MHz/V	dVtune measured within a ±5MHz frequency step.		14.1
14a	Tuning Sensitivity	K_{VCO}	73	92	111	MHz/V	dVtune measured within a ±5MHz frequency step. Ta=-20°C..75°C	■	14.2
15	Frequency Pushing	Δf_{Push}			1.0	MHz	V_{CC}=2.8±0.1V Ta=-20°C..75°C	■	15.1

Table 4-4 AC/DC Characteristics with T_A = 25°C, V_{CC} = 2.7V to 2.95V valid within the specified frequency range.

#	Parameter	Symbol	Limit Values			Unit	Test Conditions	■	Item
			min	typ	max				
16	Load Pulling	Δf_{Pull}			3	MHz	VSWR≤4:1, all phases Ta=-20°C..75°C	■	16.1
17	SSB Phase Noise @ Δf 400kHz 20000kHz	L_φ		 -157	 -120 -154	dBc/Hz	Ta=-20°C..75°C	■	17.1
18	Output power	P_{out}	4	6	8	dBm			18.1
18a	Output power	Pout	3	6	9	dBm	Ta=-20°C..75°C	■	18.2
19	Harmonics				-15	dBc	Ta=-20°C..75°C	■	19.1
20	Spurious emissions				-75	dBc	Ta=-20°C..75°C	■	20.1
	Differential output (OUT_MIX)								
	Differential output impedance	Z_{out}		100		Ω	Measurement condition		
21	Output Power		-12	-9	-6	dBm			21.1
21a	Output Power		-13	-9	-5	dBm	Ta=-20°C..75°C **+)**	■	21.2
			-25			dBm	V_{Tune}=0.1.. Vcc Ta=-20°C..75°C	■	21.3
22	Harmonics				-20	dBc	Ta=-20°C..75°C	■	22.1
	Control inputs								
23	Frequency Control Input Current	I_{Tune}			2	nA	Ta=-20°C..75°C		23.1
24	Control Voltage Input Capacitance	C_{Tune}	16		30	pF	Ta=-20°C..75°C	■	24.1

+) Any output termination at OUT_GSM and OUT_DCS resp. measurement setup as for stability

Table 4-4 AC/DC Characteristics with T_A = 25°C, V_{CC} = 2.7V to 2.95V valid within the specified frequency range.

#	Parameter	Symbol	Limit Values			Unit	Test Conditions	■	Item
			min	typ	max				
25	Digital control inputs H-Input Volt.	V_{IH}	1.5			V	Vcc=2.7V, Ta=-20°C..75°c		25.1
26	Digital control inputs L-Input Volt.	V_{IL}	0		0.5	V	Ta=-20°C..75°C		26.1
27	Digital control inputs H-Input Curr.	I_{IH}			30	µA	Ta=-20°C..75°C		27.1
28	Digital control inputs L-Input Curr.	I_{IL}	-30			µA	Ta=-20°C..75°C		28.1
29	Tswitch	t_{swON}			4	µs	Oscillation signal available after Power on or change of band Ta=-20°C..75°C	■	29.1
30	Tswitch	t_{swOFF}			4	µs	Output power <-20dBm Ta=-20°C..75°C	■	30.1

■ guaranteed by design.

4.2 Output Impedance

Table 4-5 Output Impedance

Pin	f	
OUT_GSM	900	(43-j5)Ω
OUT_DCS	1750	(24-j12)Ω
OUT_MIXX/OUT_MIX	900	(81-j8)Ω
OUT_MIXX/OUT_MIX	1750	(78+j4)Ω

Note:

Values are simulated.

Differential output impedances are single ended impedances for each pin.

4.3 Test Conditions

Unless otherwise specified, the performance indicated in this section shall be achievable using an FR4 circuit board, with a solid ground plane as the secondary layer.

4.4 Test Circuit

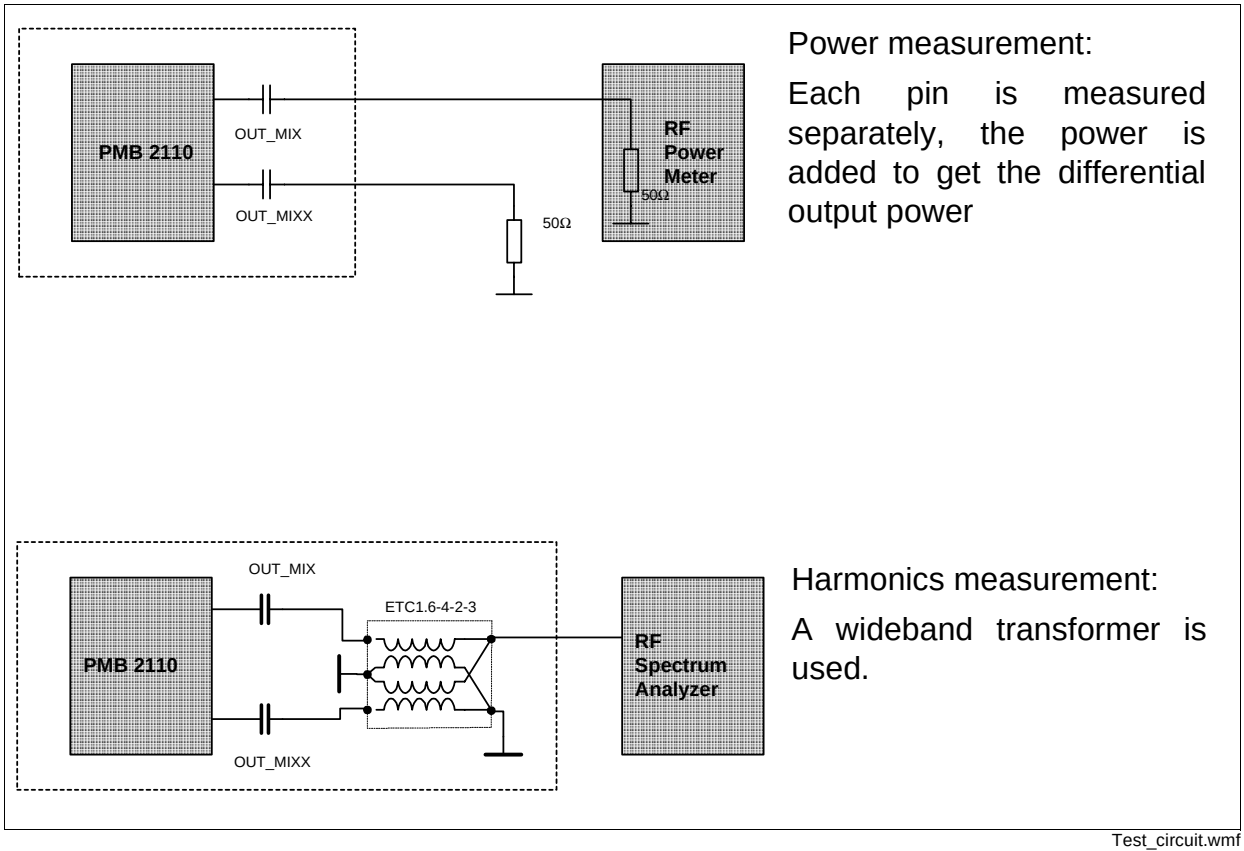


Figure 4-1 Test Circuit, differential output