

Prescaler Circuit 1.1 GHz

PMB 2313T

Version 1.5

Wireless Infrastructure



N e v e r s t o p t h i n k i n g .

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Prescaler Circuit 1.1 GHz

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Revision History: 2003-12-01

Version 1.2

Previous Version: 1.1

Page	Subjects (major changes since last revision)
20	Replacing the PMB 2312 by the PMB 2313 removed

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1 Overview – Prescaler Circuit 1.1 GHz

1.1 Functional Description/ Application

This IC is designed for use in mobile radio communication devices up to 1100 MHz.

Due to low power consumption and low phase noise generation, the PMB2313T is suitable for use in battery powered handheld systems, e.g. GSM, cordless telephones and cordless consumer products, as well as in basestations.

Low supply voltage down to 2.7V. It can be switched to a low-power standby mode. Internal current source at the emitter follower output.

No external resistor needed in typical applications.

The divide ratio is 1:64/65 or 1:128/129 depending on the external circuit configuration.

The IC is board level compatible to the PMB 2312 prescaler.

1.2 Circuit Description

The differential inputs of the IC may be connected either balanced or single ended. In the latter case the unused input must be RF-grounded with a capacitor (about 1.5 nF) with a low serial inductance.

Depending on the logic level at SW input the basic divide ratio of the ECL-stages is fixed to 1:64/65 or 1:128/129. The MOD input determines whether modulus 1:n or 1:n+1 (n=64 or 128 according to SW-level) is active.

The IC can be switched to a low-power standby mode (input STB).

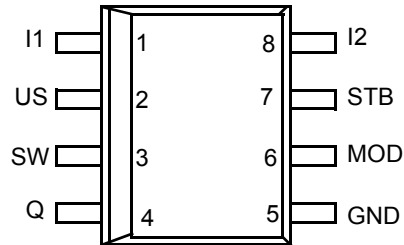
The MOD input is TTL/CMOS compatible.

The emitter follower output is CMOS compatible according to the application circuit on page 11. The minimum logic swing is $0.8 V_{pp}$.

Table 1 Function Table

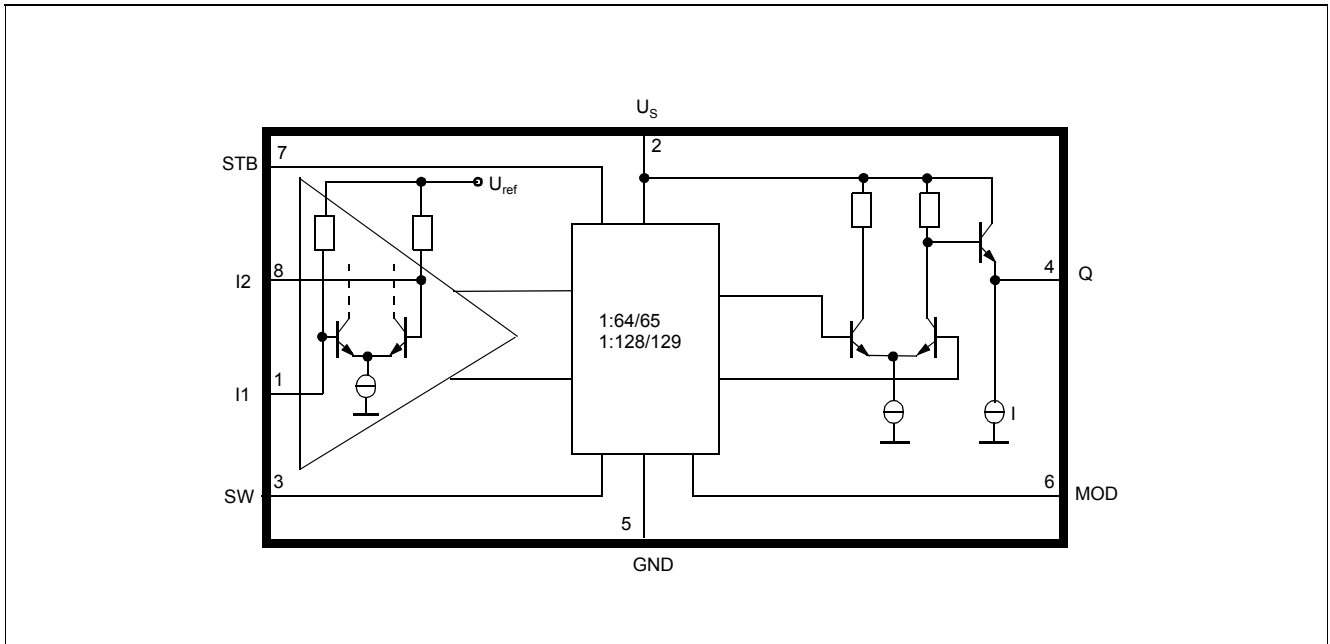
Input pin	Logic level	Prescaler function
SW	HIGH = $U_S - 0.1 V$ to U_S LOW = GND to 0.8 V or open	1:64/65 1:128/129
MOD	HIGH = 2.0 V to U_S or open LOW = GND to 0.8 V	1:64/1:128 1:65/1:129
STB	HIGH = $U_S - 0.1 V$ to U_S LOW = GND to 0.8 V	Divider Q=HIGH, STANDBY-mode

2 Pin Assignment



Pin 1	RF-input I1
Pin 2	supply voltage U_S
Pin 3	divide ratio 1:64/65 - 1:128/129 control input (SW)
Pin 4	output Q
Pin 5	GND
Pin 6	modulus 1:n/n+1 (n=64 or 128) control input (MOD)
Pin 7	standby mode control input (STB)
Pin 8	RF-input I2

3 Block Diagram



4 Absolute Maximum Ratings

$T_A = -40$ to $85\text{ }^\circ\text{C}$

Parameter	Symbol	Limit Values		Unit	Remarks
		min.	max.		
Supply voltage	U_S	-0.3	6	V	
Input level (Pin 1; Pin 8)	U_I		2	V	$U_S=0V$
Voltage swing (Pin 1 to 8)	U_{I18}	-2	2	V	
Input level (Pin 3; Pin 6; Pin 7)	$U_{SW},$ $U_{MOD},$ $U_{STB},$	-0.3	$U_S+0.7V$ or $5.5V$ if $U_S+0.7V >$ $5.5V$	V	$U_S=2.7...5.5V$
Output level (Pin 4)	U_Q		U_S	V	
Output current (Pin 4)	$-I_Q$		5	mA	
Junction temperature	T_j		125	$^\circ\text{C}$	
Storage temperature	T_S	-65	125	$^\circ\text{C}$	
Thermal resistance system-ambient	R_{thsa}		185	K/W	

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

ESD-integrity (according MIL-STD 883D, Meth. 3015.7): 500V

5 Operating Range

Parameter	Symbol	Limit Values		Unit	Remarks
		min.	max.		
Supply Voltage	U_S	2.7	5.5	V	
Input frequency	f	50	1400	MHz	
Ambient temperature	T_A	-40	85	$^\circ\text{C}$	

Within the operational range the IC operates as described in the circuit description. The AC / DC characteristic limits are not guaranteed.

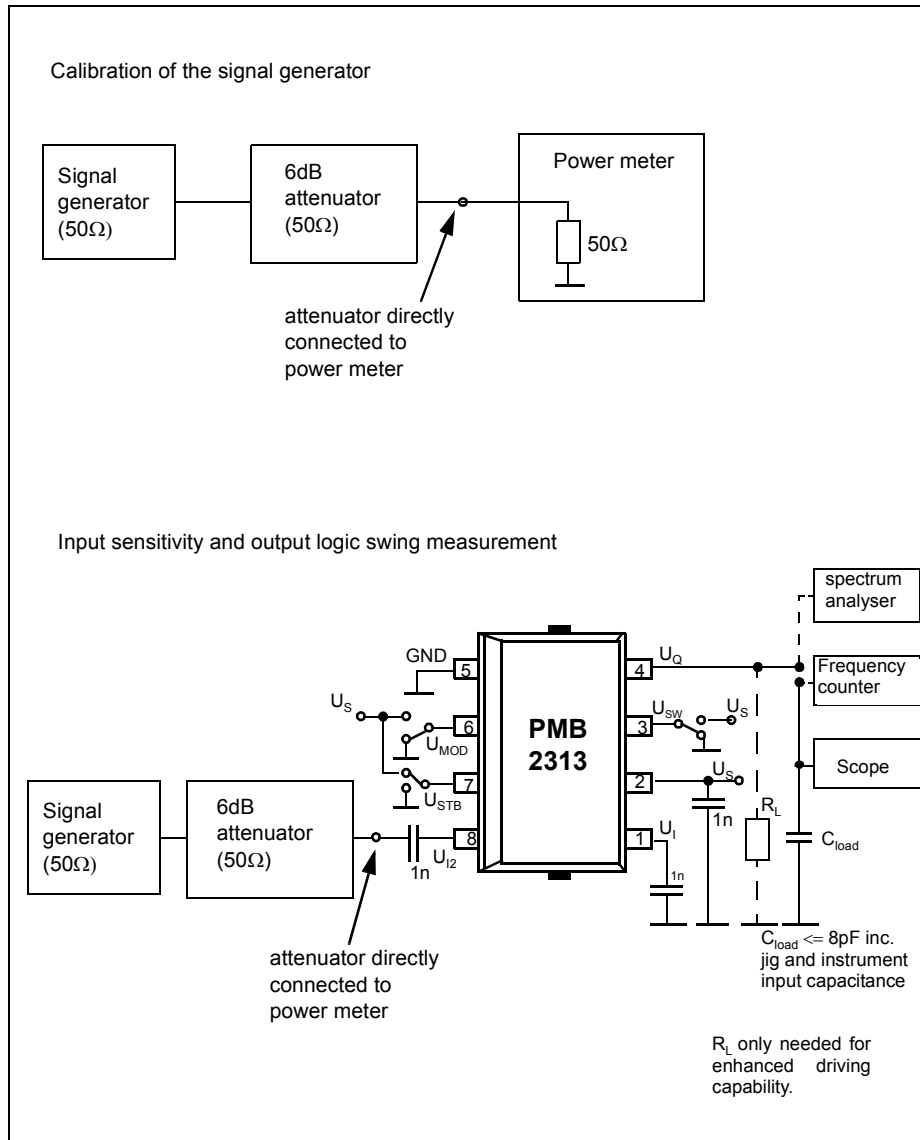
6 AC/DC Characteristics

Supply voltage $U_S=2.7$ to $5.5V$
Ambient temperature $T_A = -20$ to 85 °C (referred to the test circuit)

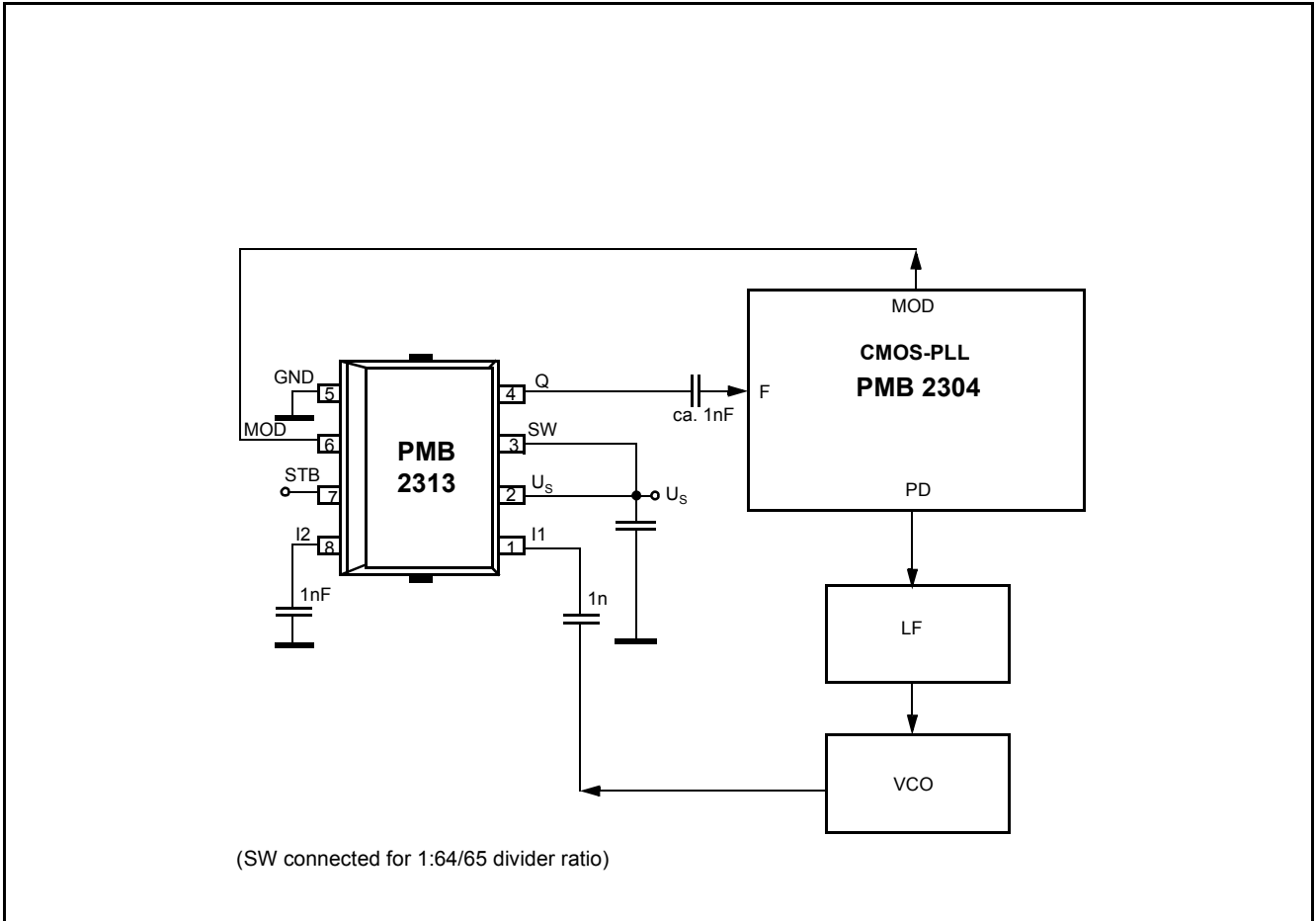
Parameter	Symbol	Limit Values			Unit	Test Condition
		min.	typ.	max.		
Supply current	I_S		1.9	2.4	mA	inputs RF-grounded, $U_S=2.7$, $T_A = 25$ °C, STB= U_S output open
	I_S		1.95	2.45	mA	inputs RF-grounded, $U_S=4.0$, $T_A = 25$ °C, STB= U_S output open
	I_S		2.00	2.5	mA	inputs RF-grounded, $U_S=5.5$, $T_A = 25$ °C, STB= U_S output open
Supply current in standby-mode	I_{STB}			0.1	mA	inputs RF-grounded, output open, STB = GND
Input level	U_{in}	25		400	mV _{rms}	100-1000MHz (sine wave)
dynamic range	P_{in}	-19		5	dBm	100-1000MHz (sine wave)
(see diagram 2)	U_{in}	25		280	mV _{rms}	1000-1100MHz (sine wave)
	P_{in}	-19		2	dBm	1000-1100MHz (sine wave)
Output logic swing	U_Q	1	1.1		V _{PP}	$C_L \leq 12pF$, $R_L=2k\Omega$
	U_Q	0.8	1.1		V _{PP}	$C_L \leq 8pF$
SW voltage High	U_{SWH}	$U_S-0.1V$		U_S	V	
SW voltage Low	U_{SWL}	GND		0.8	V	
SW input current High	I_{SWH}			60	μA	SW= U_S
SW input current Low	$-I_{SWL}$			30	μA	SW=GND
MOD voltage High	U_{MODH}	2.3		U_S	V	
MOD voltage Low	U_{MODL}	GND		0.8	V	
MOD input current High	I_{MODH}			50	μA	MOD= U_S
MOD input current Low	I_{MODL}			120	μA	MOD=GND
STB voltage High	U_{STBH}	$U_S-0.1$		U_S	V	
STB voltage Low	U_{STBL}	GND		0.8	V	
STB input current High	I_{STBH}			30	μA	STB = U_S
STB input current Low	$-I_{STBL}$			60	μA	STB = GND
Internal current source (see block diagram)	I		400		μA	
Delay times						
MOD setup time (diagram 1)	t_{set}			29	ns	

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.

7 Test Circuit



8 Application Circuit



9 Definition of Modulus Set-Up Time

Diagram 1

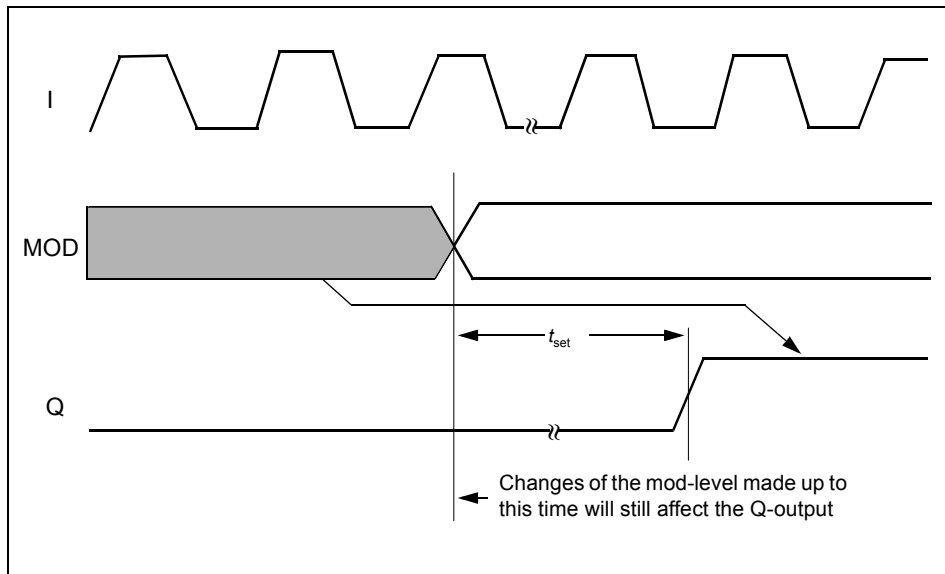


Diagram 2

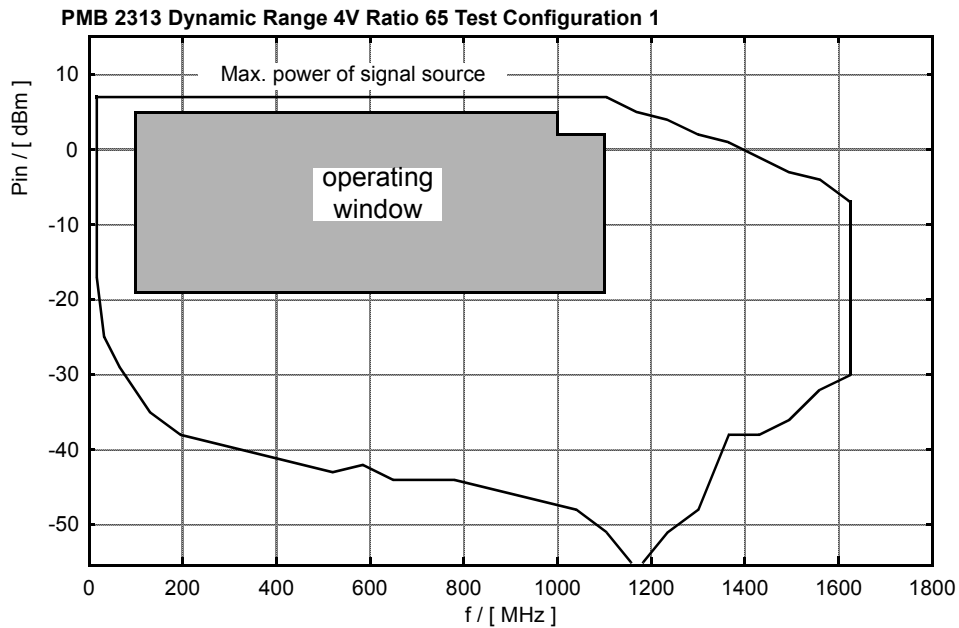
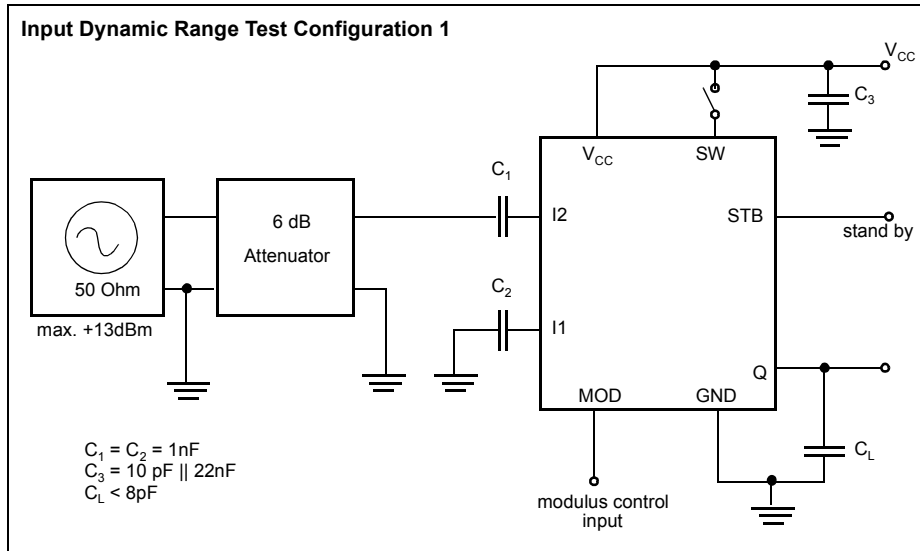
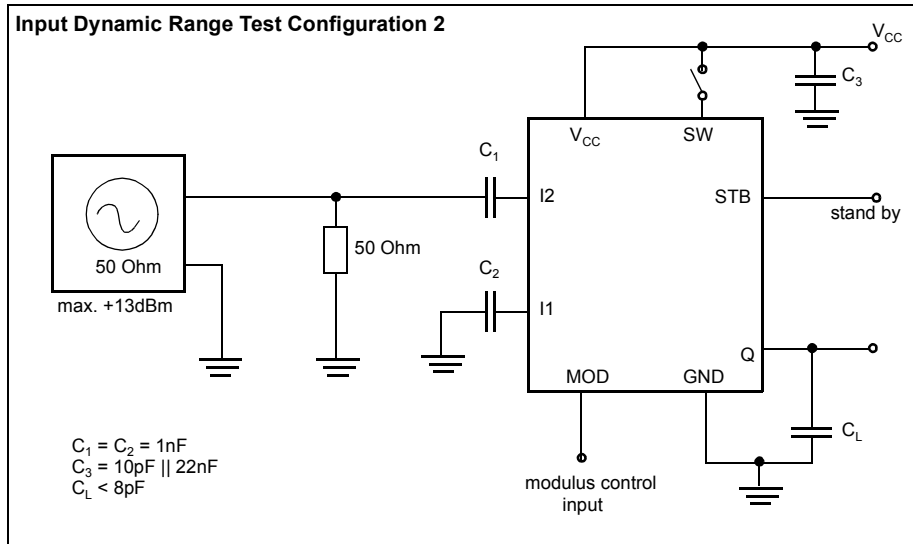
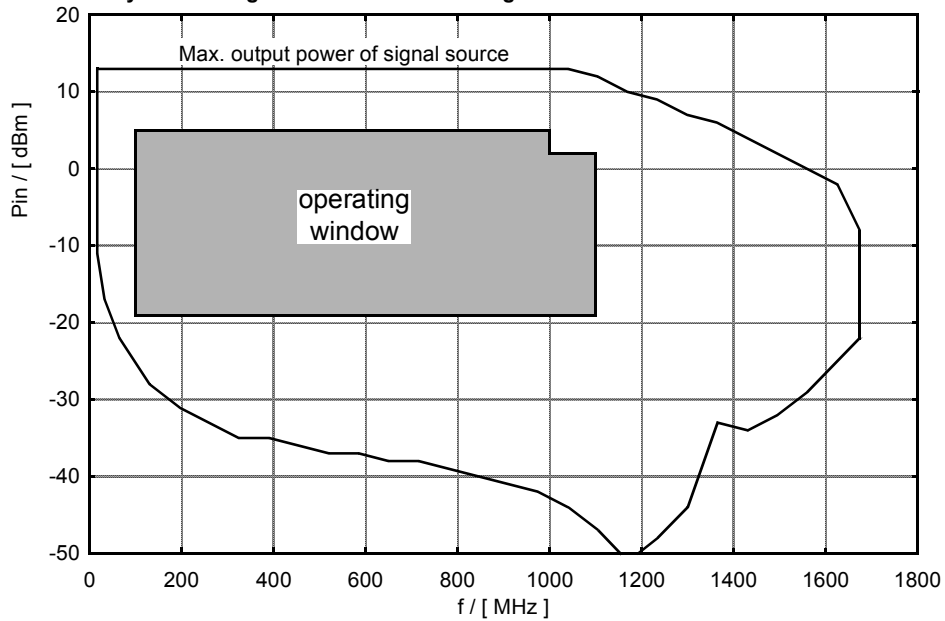


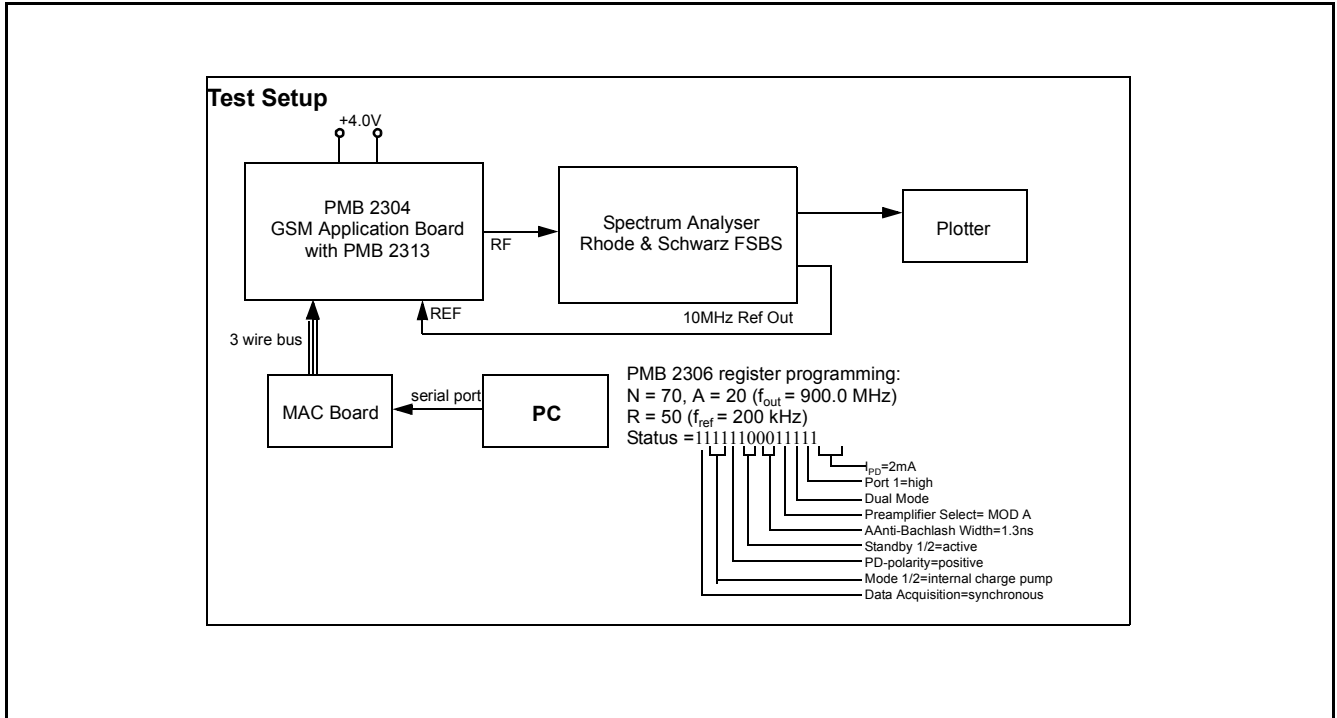
Diagram 3



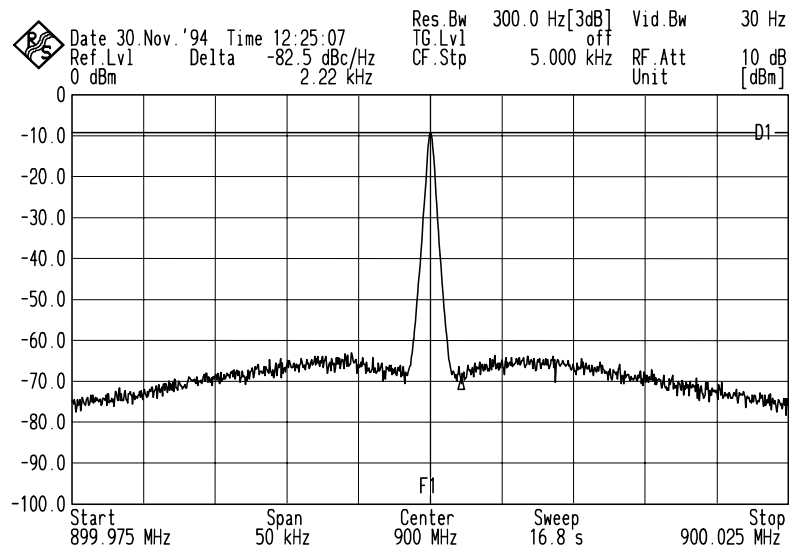
PMB 2313 Dynamic Range 4V Ratio 65 Test Configuration 2



10 Phase Noise Measurement



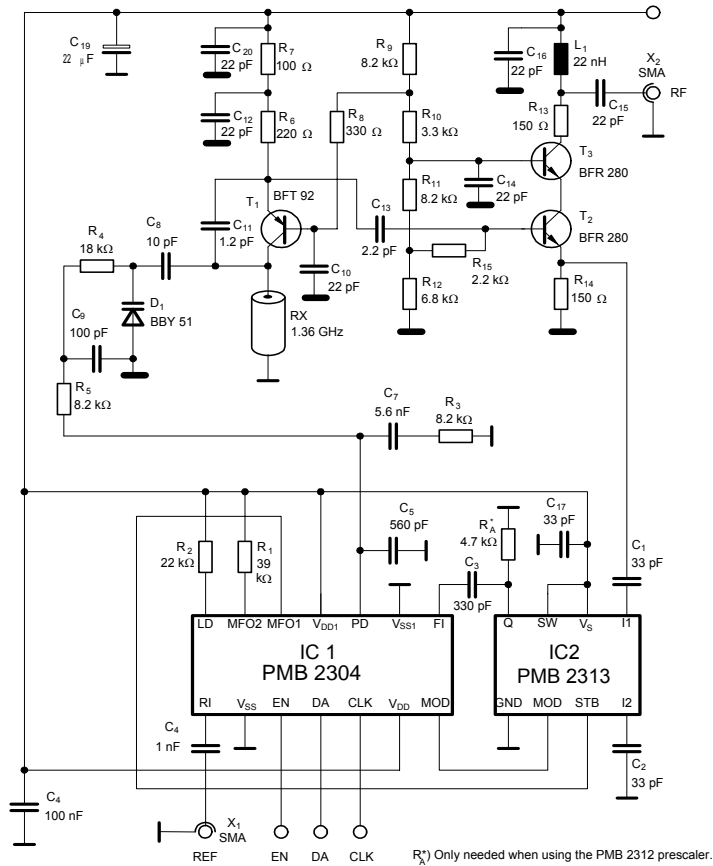
11 Measured Spectrum



Using PMB 2306T

12 GSM Application Board

PMB 2304 GSM Application Board

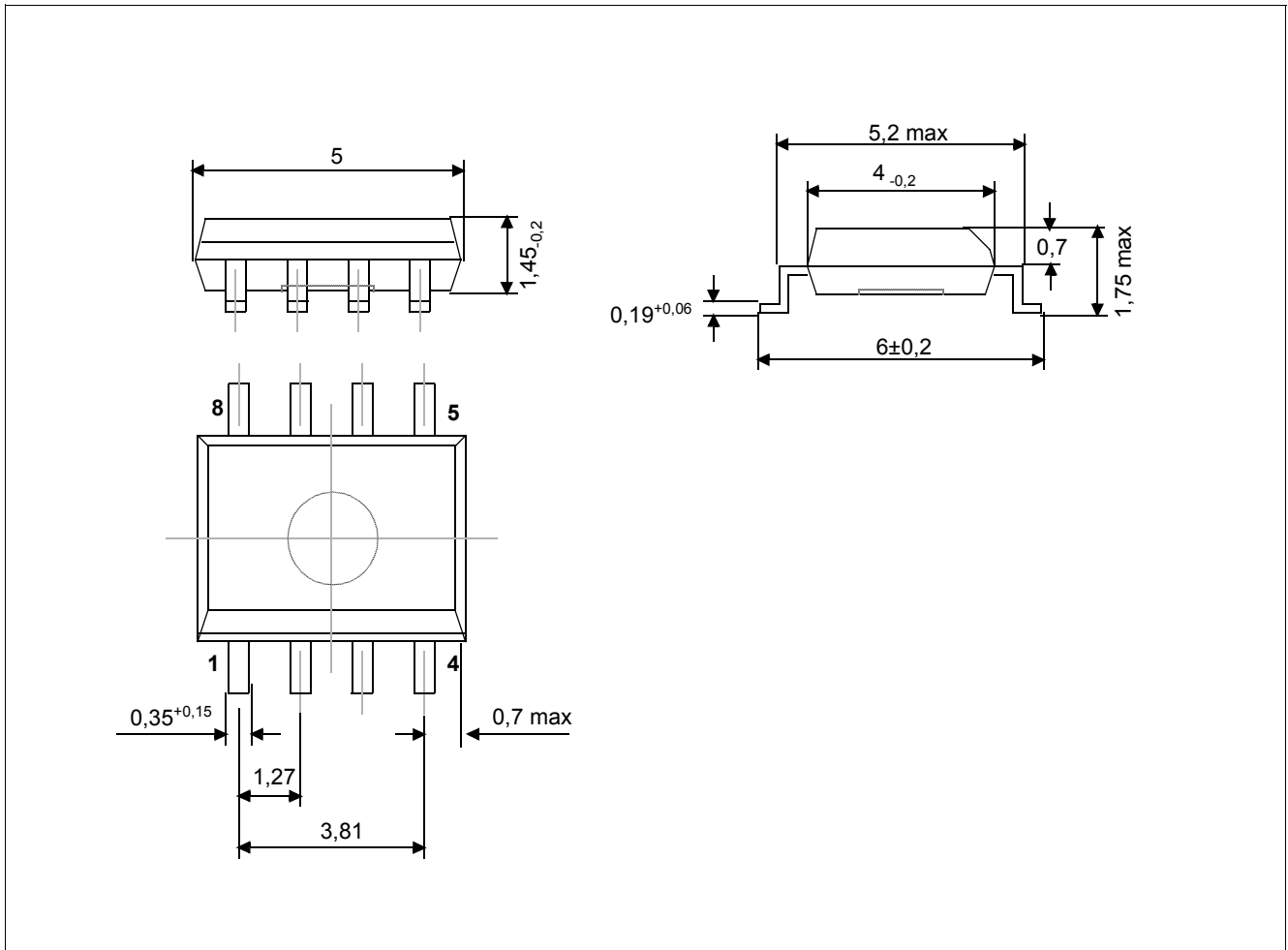


PMB 2306 GSM Application Board

List of Components

Item	Quantity	Reference		Part	
1	1	R7	100Ω	SMD/0805	B54102-A1101-X60
2	2	R13, R14	150Ω	SMD/0805	B54102-A1151-J60
3	1	R6	220Ω	SMD/0805	B54102-A1221-J60
4	1	R8	330Ω	SMD/0805	B54102-A1331-J60
5	1	R15	2.2kΩ	SMD/0805	B54102-A1222-J60
6	1	R10	3.3kΩ	SMD/0805	B54102-A1332-J60
7	1	RA	4.7kΩ	SMD/0805	B54102-A1472-J60
8	1	R12	6.8kΩ	SMD/0805	B54102-A1682-J60
9	4	R3, R5, R9, R11	8.2kΩ	SMD/0805	B54102-A1822-J60
10	1	R4	18kΩ	SMD/0805	B54102-A1183-J60
11	1	R2	22kΩ	SMD/0805	B54102-A1223-J60
12	1	R1	39kΩ	SMD/0805	B54102-A1393-J60
13	1	L1	22nH	SIMID 01	B82412-A3220-M
14	1	C11	1.2pF	COG/0805	B37940-K5010-C262
15	1	C13	2.2pF	COG/0805	B37940-K5020-C262
16	1	C8	10pF	COG/0805	B37940-K5100-J62
17	6	C10, C12, C14			
		C15, C16, C30	22pF	COG/0805	B37940-K5220-J62
18	3	C1, C2, C17	33pF	COG/0805	B37940-K5330-J62
19	1	C9	100pF	COG/0805	B37940-K5101-J62
20	1	C3	330pF	COG/0805	B37940-K5331-J62
21	1	C5	560pF	COG/0805	B37940-K5561-J62
22	1	C4	1.0nF		
23	1	C7	5.6nF	COG/1210	
24	1	C6	100nF	X7R/1210	B37950-K5104-K62
25	1	C19	22μF		
26	1	D1	BBY51		Q62702-B631
27	2	T2, T3	BFR280		Q62702-F1298
28	1	T1	BFT92		Q62702-F1062
29	2	X1, X2	SMA		Connector
30	1	RX	1.3GHz		B69620-G1307-A410
31	1	IC1	PMB 2304T P-DSO-14		Q 67106-H9101 (TUBE)
		or	PMB 2304T P-DSO-14		Q 67106-H9101 (T+R)
32	1	IC2	PMB 2313T P-DSO-8-1		Q 67006-A6116 (TUBE)
		or	PMB 2313T P-DSO-8-1		Q 67006-A6116 (T+R)

13 Package Outlines



Plastic-Package, P-DSO-8, Dual-in-Line-Package, 20 A 8 DIN 41870 T16 (SMD)

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