SKYWORKS®

ADVANCE DATA SHEET

SKY77521 TX-RX FEM for Quad-Band GSM / GPRS / EDGE – Triple-Band WCDMA Antenna Switch Support

Applications

- Quad-band cellular handsets encompassing
  - Class 4 GSM850/900
  - Class 1 DCS1800 PCS1900
  - Class 12 GPRS multi-slot operation
  - EDGE polar modulation
  - Triple band WCDMA antenna switch support

Features

- Small outline: 7 mm x 6 mm
- Very low profile: 1 mm max.
- 30-pad package
- Low input power range
  - 0 to 6 dBm
- High efficiency
  - GSM850 40%
  - GSM900 40%
  - DCS 34%
  - PCS 34%
- TX-VCO-to-antenna and antenna-to-RX-SAW filter RF interface
- TX harmonics below -35 dBm
- Wideband envelop control path
- Input/Output matching 50 Ω internal
- Low APC current: 20 μA
- High impedance control inputs 15 μA, typical

NEW

Pb

Skyworks offers lead (Pb)-free, RoHS (European Parliament for the Restriction of Hazardous Substances) -compliant packaging.

Description

SKY77521 is a transmit and receive Front End Module (FEM) designed in a very low profile (1 mm), compact form factor for quad-band cellular handsets comprising GSM850/900, DCS1800, and PCS1900 operation — a complete transmit VCO-to-Antenna and Antenna-to-receive SAW filter solution. The FEM also supports Class 12 General Packet Radio Service (GPRS) multi-slot operation and EDGE Polar Modulation. WCDMA switch-through support is provided by three dedicated high-linearity ports.

The module consists of a GSM850/900 PA and DCS1800/PCS1900 PA block, impedance-matching circuitry for 50 Ω input and output impedances, TX harmonic filtering, high linearity-low insertion loss switches, and a CMOS Power Amplifier Control (PAC) block. A custom silicon integrated circuit contains decoder circuitry to control the RF switch while providing a low current external control interface.

Fabricated in InGaP/GaAs, the Heterojunction Bipolar Transistor (HBT) PA blocks support the GSM850/900 bands and DCS1800/PCS1900 bands. Both PA blocks share common power supply pads to distribute current. The output of the PA block and the outputs to the seven receive pads connect to the antenna pad through a highly linear antenna switch. The InGaP/GaAs die, switch die, Silicon (Si) controller die, and passive components are mounted on a multi-layer laminate substrate and the entire assembly is encapsulated with plastic overmold.

RF input and output ports of the SKY77521 are internally matched to a 50 Ω load to reduce the number of external components for a quad-band design. Extremely low leakage current (10 μA, typical) of the FEM maximizes handset standby time. Band selection and control of transmit and receive RF signal flows are performed by use of four external control pads. See Figure 1 shown below. Mode of operation TX, RX, Band (GSM850, GSM900, DCS, PCS, and UMTS) is controlled with 4 logic inputs: BS1, BS2, Mode, and Enable. Proper timing of the $\overline{\text{TXEN}}$ input and the VAPC input ensures high isolation between the antenna and TX-VCO while the VCO is being tuned prior to the transmit burst. The Enable input controls the initial turn-on of the PAC circuitry to minimize battery drain.

The integrated power amplifier control (PAC) function provides envelope amplitude control by reducing sensitivity to input drive, temperature, power supply, and process variation.

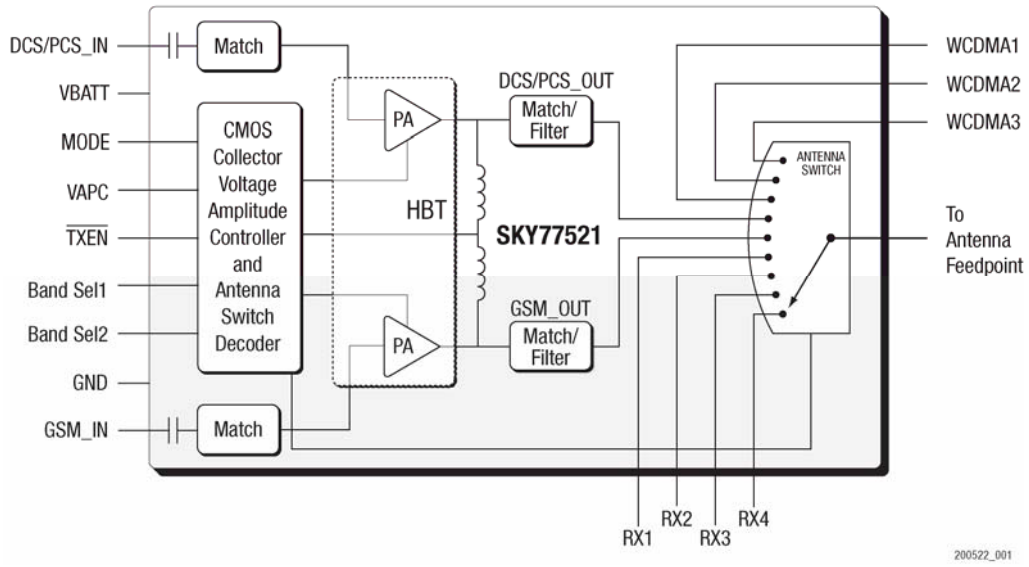


Figure 1. SKY77521 Functional Block Diagram

Electrical Specifications

The following tables list the electrical characteristics of the SKY77521 Front-End Module. Table 1 lists the absolute maximum ratings and Table 2 shows the recommended operating conditions. Table 3 through Table 14 list the electrical characteristics of the SKY77521 for modes GSM850, GSM900, DCS1800 and PCS1900, including control logic descriptions for the various modes. Table 2 is a suggested timing diagram for the SKY77521 and Figure 6 shows an application schematic.

The SKY77521 is a static-sensitive electronic device and should not be stored or operated near strong electrostatic fields. Detailed information on device dimensions, pad descriptions, packaging and handling can be found in later sections of this data sheet.

Table 1. Absolute Maximum Ratings [1]

Parameter		Symbol	Minimum	Maximum	Units
Supply Voltage for ≤ 1µs, (measured to ground)		V_{BATT}	—	7	V
DC Continuous Current During Burst		I_{BATT}	—	2.5	A
Burst Duty Cycle		dB	—	50	%
Input Power		P_{IN}	—	14.5	dBm
Case Temperature	Operating	T_{CASE}	–30	+100	°C
	Storage	T_{STG}	–55	+125	
Electrostatic Discharge (ESD)	Human Body Model –All Ports	JESD22-A114-C	—	TBD	V
	Machine Model –All Ports	JESD22-A115-A	—	TBD	
	Charged Device Model –All Ports	JESD22-C101-A	—	TBD	
	Human Body Model –ANT and V_{BATT} Ports	JESD22-A114-C	—	8 (Direct Contact) 15 (Air Discharge)	kV
Reflow Solder Temperature		T_{SOLDER}	—	J-STD-020C	°C
Moisture Sensitivity Level		MSL	—	3/260	°C
Voltage Standing Wave Ratio		VSWR	—	100:1	—

[1] Beyond which the device may be damaged. Assumes only one parameter is set at limit at a time with all other parameters set at nominal value. Applied voltage must be current-limited to specified range. The limits shall be valid for all bands: 850-, EGSM-, DCS- and PCS-bands.

Table 2. Recommended Operating Conditions

Parameter		Symbol	Minimum	Typical	Maximum	Unit
Supply Voltage		V_{BATT}	3.0	3.6	4.6 [1]	V
Supply Current		I_{BATT}	0	—	2.0 [1]	A
Operating Case Temperature (bottom surface of package)	1-Slot (12.5% duty cycle	T_{CASE}	–20	—	+100	°C
	2-Slot (25% duty cycle)		–20	—	+100	
	3-Slot (37.5% duty cycle)		–20	—	+85	
	4-Slot (50% duty cycle)		–20	—	+85	

[1] In open loop operation, for charging conditions with V_{CC} > 4.6 V, derate I_{CC} linearly down to 0.5 A max. at V_{CC} = 5.5 V.

Table 3. SKY77521 Interface Impedances

Parameter	Symbol	Minimum	Typical	Maximum	Units
Impedance System for All RF Ports	Z_{RF}	—	50	—	Ω
Impedance on $\overline{TXEN}$ Port	$Z_{\overline{TXEN}}$	—	200	—	kΩ
Impedance on BS1 Port	Z_{BS1}	—	200	—	kΩ
Impedance on BS2 Port	Z_{BS2}	—	200	—	kΩ
Impedance on MODE Port	Z_{MODE}	—	200	—	kΩ
Impedance on VAPC Port	Z_{VAPC}	—	200	—	kΩ

Table 4. SKY77521 Modes and Functions

Mode	Parameter	Maximum Current
Standby (IDLE)	OFF state for radio where Radio current consumption is minimized. BS1, BS2 and $\overline{TXEN}$ are low and circuits are disabled.	10 µA
Pre-Transmit	VAPC < 0.2 V. $\overline{TXEN}$ is high for 10 µs before transmit ramp while transitioning control bits into desired TX mode.	100 µA
Transmit	VAPC begins its ramp-up and controls the output power of the PA. Once the ramp is completed, VAPC ramps down to 0.	IPA
Receive	Receive mode. $\overline{TXEN}$ must be asserted high simultaneously or before BS1 or BS2 when transitioning from Standby mode to any RX state to avoid TX glitch.	150 µA

Table 5. SKY77521 Mode Control Logic

Mode	Input Control Bits			
	$\overline{TXEN}$	MODE	BS1	BS2
Standby	0	0	0	0
TX_LOW BAND	0	0	0	1
TX_HIGH BAND	0	0	1	1
TBD	0	1	0	1
TBD	0	1	1	1
RX1	1	X	0	0
RX2	1	X	0	1
RX3	1	X	1	1
RX4	1	X	1	0
WCDMA1	0	0	1	0
WCDMA2	0	1	0	0
WCDMA3	0	1	1	0

Table 6. SKY77521 Logic Control Levels ($\overline{\text{TXEN}}$, BS1, BS2) [1]

Parameter		Symbol	Minimum	Typical	Maximum	Units
Input Logic Level	Low	V_{IL}	–0.3	—	0.55	V
	High	V_{IH}	1.2	—	V_{BATT}	

[1] Temperature range = –20 to +85 °C, unless otherwise specified.

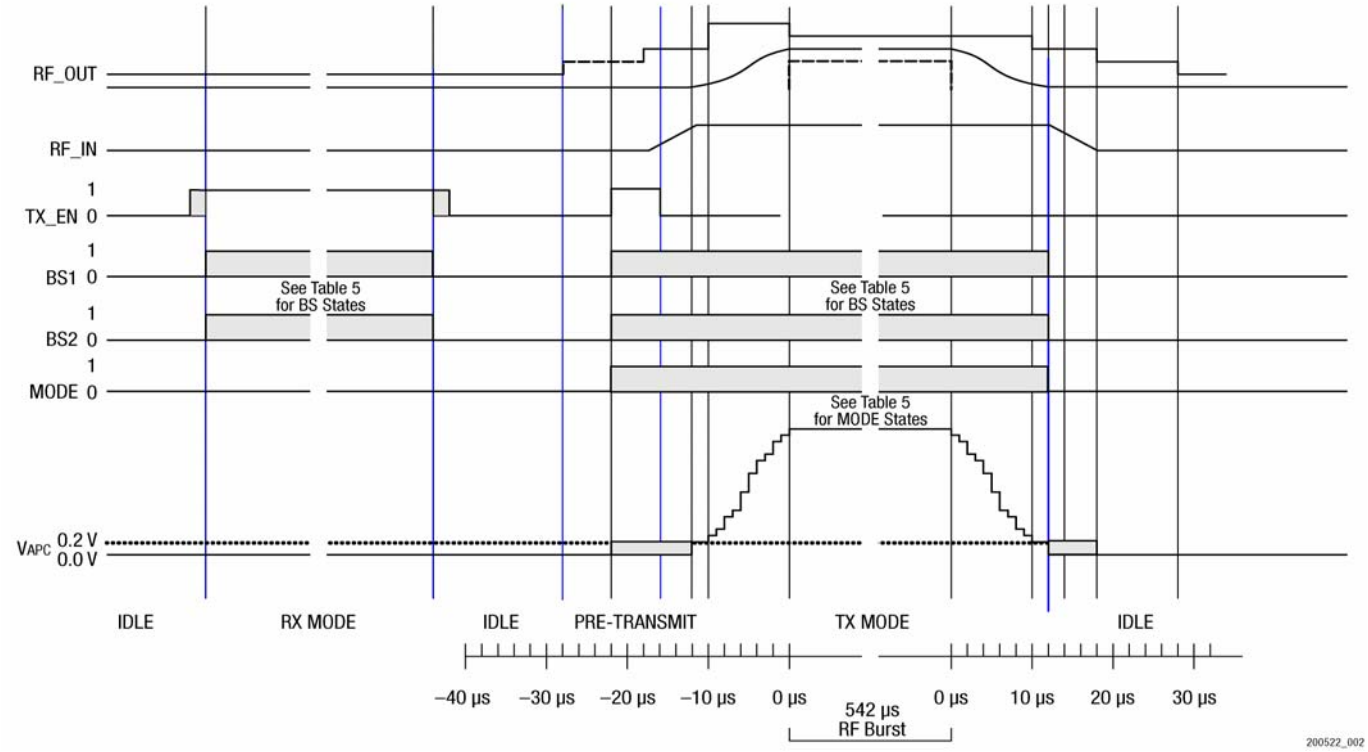


Figure 2. SKY77521 Suggested Timing Diagram

Table 7. SKY77521 Transmit Operating Mode [1]

Parameter	Symbol	Minimum	Typical	Maximum	Units
Burst Duty Cycle	B	12.5 (1 slot)	—	50 (4 slots)	%
Supply Voltage Range	V_{BATT}	3.0	3.6	4.6	V
Continuous Output Current Range During Burst	I_{BATT}	0	—	See Electrical Characteristics	A
Amplitude Control Voltage	V_{APC}	—	—	1.5	V

[1] Temperature range = –20 °C to +85 °C unless otherwise specified.

Table 8. SKY77521 Electrical Characteristics GSM850/900 [1]

GMSK Mode							
Parameter		**Symbol**	**Conditions**	**Minimum**	**Typical**	**Maximum**	**Unit**
Frequency Range	GSM850	f	—	824	—	849	MHz
	GSM900			880	—	915	
Input Power		P_{IN}	—	0	—	6	dBm
Supply Voltage		V_{BATT}	—	3.0	3.6	4.6	V
Supply Current		I_{CC}	—	—	—	2.0	A
Leakage Current			V_{BATT} = 3.6 V T_{CASE} = +25 °C No input power V_{APC} = 0 V	—	—	10 standby 100 pre-TX	µA
Power Added Efficiency		PAE	V_{BATT} = 3.6 V P_{IN} = 6 dBm P_{OUT} = 33.5 dBm T_{CASE} = +25 °C	—	38	—	%
Harmonics		2f_0 to 15f_0	BW = 3 MHz 5 dBm ≤ P_{OUT} ≤ 33.5 dBm	—	–35	–34	dBm
		2f_0 to 7f_0	BW = 3 MHz 5 dBm ≤ P_{OUT} ≤ 33.5 dBm V_{BATT} = 3.6 V T_{CASE} = +25 °C Load VSWR of 5:1 for all phases.	—	–31	–30	
Output power		P_{OUT}	P_{IN} = 0 dBm V_{BATT} = 3.6 V T_{CASE} = +25 °C	33.5	34.0	—	dBm
		$P_{OUT\_DEG\ 1}$	P_{IN} = 0 dBm V_{BATT} = 3.3 V	31.5	—	—	
		$P_{OUT\_DEG\ 2}$	P_{IN} = 0 dBm V_{BATT} = 3.0 V	30.5	—	—	
Input VSWR		Γ_{IN}	P_{OUT} ≤ 33.5 dBm	—	—	2:1	
Isolation			P_{IN} = –15 dBm $\overline{TXEN}$ = high	—	–45	–40	dBm
Stability		Stab	All combinations of the following parameters: P_{IN} = min. to max. V_{BATT} = 3.0 to 4.6 V Load VSWR = 15:1, all phase angles	No parasitic oscillation > –36 dBm			
Load Mismatch		Load	All combinations of the following parameters: P_{IN} = min. to max. V_{BATT} = 3.0 to 4.6 V and V_{BATT} = 7.0 V ≤ 1 µs Load VSWR = 100:1, all phase angles.	No module damage or permanent degradation			
Noise Power (T_{CASE} = +25 °C) (V_{BATT} = 3.6 V)	GSM 850	P_{NOISE_850}	f_0 + 20 MHz (869–894 MHz)	—	—	–84.5	dBm
	GSM 900	P_{NOISE_900}	f_0 + 20 MHz (935–960 MHz)	—	—	–84.5	
			f_0 + 10 MHz (925–935 MHz)	—	—	–74.0	
			1805 – 1880 MHz	—	—	–78.0	
Phase Change			P_{OUT} = 5 to 33.5 dBm V_{APC} = sawtooth signal f = 2166 Hz	—	—	2	°/dB
Phase Moulation Accuracy		εphase, RMS	RMS phase error	—	—	2	degrees

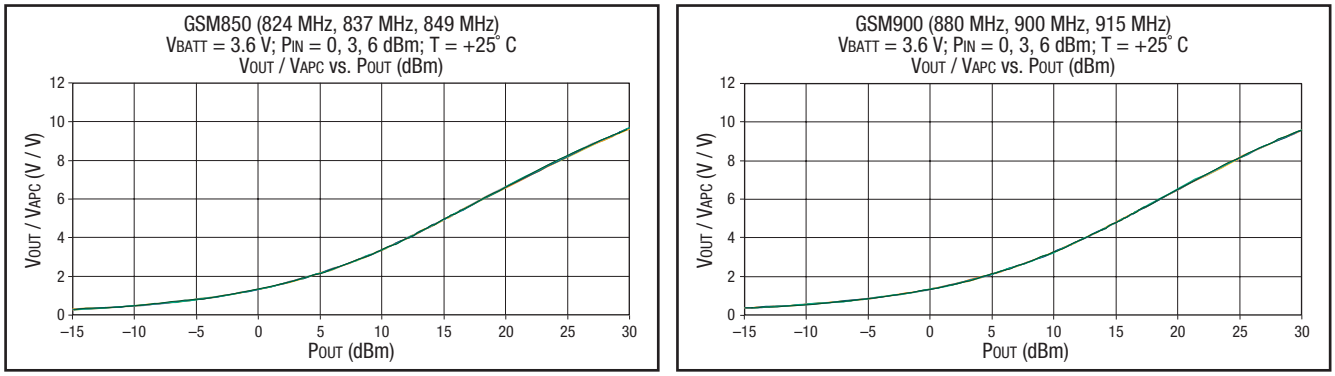
[1] Unless otherwise noted: 50 Ω system, pulsed operation with pulse width 2308 µs duty cycle 4:8, T_{CASE} = –20 °C to +85 °C, V_{BATT} = 3.0 V to 4.6 V. Terminate all unused RF ports with 50 Ω during test.

Table 9. SKY77521 Electrical Characteristics GSM 850/900 [1]

EDGE Mode							
Parameter		**Symbol**	**Conditions**	**Minimum**	**Typical**	**Maximum**	**Unit**
Frequency Range	EDGE 850	f	—	824	—	849	MHz
	EDGE 900			880	—	915	
Input Power		P_{IN}	—	0	—	6	dBm
Supply Voltage		V_{BATT}	—	3.0	3.6	4.6	V
Supply Current		I_{CC}	—	—	—	2.0	A
Leakage Current			V_{BATT} = 3.6 V T_{CASE} = +25 °C No input power V_{APC} = 0 V	—	—	10 standby 100 pre-TX	µA
Power Added Efficiency		PAE	V_{BATT} = 3.6 V P_{IN} = 6 dBm P_{OUT} = 28 dBm T_{CASE} = +25 °C	—	18	—	%
Supply Current		I_{CC}	V_{BATT} = 3.6 V P_{IN} = 6 dBm P_{OUT} = 28 dBm T_{CASE} = +25 °C Load = 50 Ω	—	TBD	—	mA
Harmonics		2f0 to 15f0	BW = 3MHz 5 dBm ≤ P_{OUT} ≤ 28 dBm	—	–35	–34	dBm
		2f0 to 7f0	BW = 3 MHz 5 dBm ≤ P_{OUT} ≤ 28 dBm V_{BATT} = 3.6 V T_{CASE} = +25 °C Load: VSWR of 5:1 for all phases.	—	–31	–30	
Output Power		P_{OUT}	V_{BATT} = 3.6 V T_{CASE} = +25 °C	31.7	—	—	dBm
		$P_{OUT\_DEG\,1}$	P_{IN} = 0 dBm V_{BATT} = 3.3 V	29.5	—	—	
		$P_{OUT\_DEG\,2}$	P_{IN} = 0 dBm V_{BATT} = 3.0 V	28.5	—	—	
Input VSWR		Γ_{IN}	P_{OUT} ≤ 28 dBm	—	—	2:1	
Isolation			P_{IN} = –15 dBm $\overline{TXEN}$ = high	—	–45	–40	dBm
Stability		Stab	All combinations of the following parameters: P_{IN} = min. to max. V_{BATT} = 3.0 to 4.6 V Load VSWR = 15:1, all phase angles	No parasitic oscillation > –36 dBm			
Load Mismatch		Load	All combinations of the following parameters: P_{IN} = min. to max. V_{BATT} = 3.0 to 4.6 V and V_{BATT} = 7.0 V ≤ 1 µs Load VSWR = 100:1, all phase angles.	No module damage or permanent degradation			
Noise Power (T_{CASE} = +25 °C) (V_{BATT} = 3.6 V)	GSM 850	P_{NOISE_850}	f0 + 20 MHz (869–894 MHz)	—	—	–84.5	dBm
	GSM 900	P_{NOISE_900}	fo + 20 MHz (935–960 MHz)	—	—	–84.5	
			fo + 10 MHz (925–935 MHz)	—	—	–74.0	
			1805–1880 MHz	—	—	–78	

[1] Unless otherwise noted: 50 Ω system, pulsed operation with pulse width 2308 µs duty cycle 4:8, T_{CASE} = –20 °C to +85 °C, V_{BATT} = 3.0 V to 4.6 V. Terminate all unused RF ports with 50 Ω during test.

Typical AM/AM Slope



Typical AM/PM Response

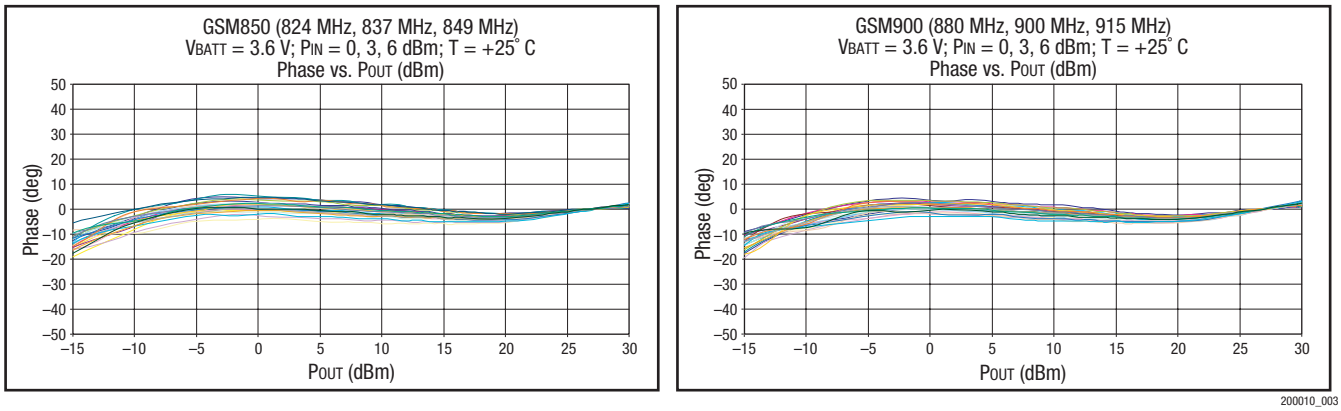


Figure 3. Typical Slope and Response Charts for Low Band – SKY77521 TX-RX Front-End Module

Table 10. SKY77521 Electrical Characteristics GSM 1800/1900 [1]

GMSK Mode							
Parameter		**Symbol**	**Conditions**	**Minimum**	**Typical**	**Maximum**	**Unit**
Frequency Range	GSM1800 (DCS)	f	—	1710	—	1785	MHz
	GSM1900 (PCS)		—	1850	—	1910	
Input Power		P_{IN}	—	0	—	6	dBm
Supply Voltage		V_{BATT}	—	3.0	3.6	4.6	V
Supply Current		I_{CC}	—	—	—	1.4	A
Leakage Current			V_{BATT} = 3.6 V T_{CASE} = +25 °C No input power V_{APC} = 0 V	—	—	10 standby 100 pre-TX	µA
Power Added Efficiency		PAE	V_{BATT} = 3.6 V P_{IN} = 6 dBm P_{OUT} = 30.5 dBm T_{CASE} = +25 °C	—	33	—	%
Harmonics		$2f_0$ to $7f_0$	BW = 3 MHz 0 dBm ≤ P_{OUT} ≤ 30.5 dBm P_{OUTDEG} 50 ohm	—	–35	–34	dBm
		$2f_0$ to $3f_0$	BW = 3 MHz 0 dBm ≤ P_{OUT} ≤ 30.5 dBm V_{BATT} = 3.6 V T_{CASE} = +25 °C Load VSWR = 5:1 for all phases.	—	–31	–30	
Output Power		P_{OUT}	V_{BATT} = 3.6 V T_{CASE} =+25 °C	30.5	31.0	—	dBm
		$P_{OUT\_DEG\,1}$	P_{IN} = 0 dBm V_{BATT} = 3.3 V	28.5	—	—	
		$P_{OUT\_DEG\,2}$	P_{IN} = 0 dBm V_{BATT} = 3.0 V	27.5	—	—	
Input VSWR		Γ_{IN}	P_{OUT} ≤ 30 dBm	—	—	2:1	
Isolation			P_{IN} = –20 dBm $\overline{TXEN}$ = high	—	–55	–52	dBm
Stability		Stab	All combinations of the following parameters: P_{IN} = min. to max. V_{BATT} = 3.0 to 4.6 V Load VSWR = 15:1, all phase angles	No parasitic oscillation >–36 dBm			
Load Mismatch		Load	All combinations of the following parameters: P_{IN} = min. to max. V_{BATT} = 3.0 to 4.6 V and V_{BATT} = 7.0 V ≤ 1 µs Load VSWR = 100:1, all phase angles.	No module damage or permanent degradation			
Noise Power (T_{CASE} = +25 °C) (V_{BATT} = 3.6 V)	GSM 1800	P_{NOISE_DCS}	f_0 + 20 MHz	—	—	–78.0	dBm
			935–960 MHz	—	—	–84.5	
			925–935 MHz	—	—	–74.0	
	GSM 1900	P_{NOISE_PCS}	fo + 20 MHz	—	—	–78.0	
			869–894 MHz	—	—	–84.5	
Phase Modulation Accuracy		εphase, RMS	RMS phase error	—	—	2	degrees
Phase Change			P_{OUT} = 0 to 30.0 dBm V_{APC} = sawtooth signal f = 2166 Hz.	—	—	2	°/dB

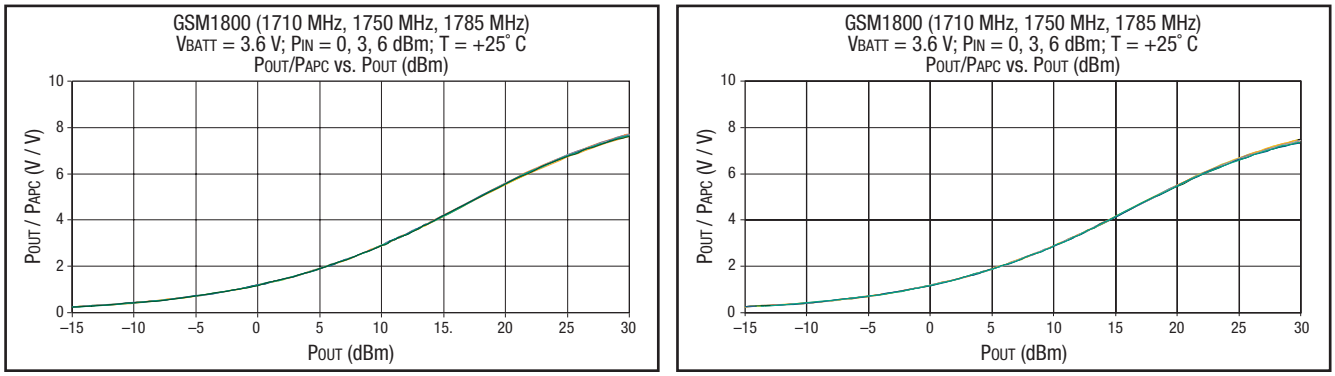
[1] Unless otherwise noted: 50 Ω system, pulsed operation with pulse width 2308 µs, duty cycle 4:8, T_{CASE} = –20 °C to +85 °C, V_{BATT} = 3.0 V to 4.6 V. Terminate all unused RF ports with 50 Ω during test.

Table 11. SKY77521 Electrical Characteristics GSM 1800/1900 [1]

EDGE Mode							
Parameter		**Symbol**	**Conditions**	**Minimum**	**Typical**	**Maximum**	**Unit**
Frequency Range	GSM1800 (DCS)	f	—	1710	—	1785	MHz
	GSM1900 (PCS)			1850	—	1910	
Input Power		P_{IN}	—	0	—	6	dBm
Supply Voltage		V_{BATT}	—	3.0	3.6	4.6	V
Supply Current		I_{CC}	—	—	—	1.4	A
Leakage Current			V_{BATT} = 3.6 V T_{CASE} = +25 °C No input power V_{APC} = 0 V	—	—	10 standby 100 pre-TX	µA
Power Added Efficiency		PAE	V_{BATT} = 3.6 V P_{IN} = 6 dBm P_{OUT} = 27 dBm T_{CASE} = +25 °C	—	18	—	%
Supply Current		I_{CC}	V_{BATT} = 3.6 V P_{IN} = 6 dBm P_{OUT} = 27 dBm T_{CASE} = +25 °C Load = 50 Ω	—	TBD	—	mA
Harmonics		$2f_0$ to $7f_0$	BW = 3 MHz 0 dBm ≤ P_{OUT} ≤ 27 dBm	—	–35	–34	dBm
		$2f_0$ to $3f_0$	BW = 3 MHz 0 dBm ≤ P_{OUT} ≤ 27 dBm V_{BATT} = 3.6 V T_{CASE} = +25 °C Load VSWR = 5:1, all phases.	—	–31	–30	
Output Power		P_{OUT}	V_{BATT} = 3.6 V T_{CASE} = +25 °C	30.7	—	—	dBm
		$P_{OUT\_DEG\ 1}$	P_{IN} = 0 dBm V_{BATT} = 3.3 V	28.5	—	—	
		$P_{OUT\_DEG\ 2}$	P_{IN} = 0 dBm V_{BATT} = 3.0 V	27.5	—	—	
Input VSWR		Γ_{IN}	P_{OUT} ≤ 26.3 dBm	—	—	2:1	
Isolation			P_{IN} =-20 dBm $\overline{TXEN}$ = high	—	–55	–52	dBm
Stability		Stab	All combinations of the following parameters: P_{IN} = min. to max. V_{BATT} = 3.0 to 4.6 V Load VSWR = 15:1, all phase angles	No parasitic oscillation >–36 dBm			
Load Mismatch		Load	All combinations of the following parameters: P_{IN} = min. to max. V_{BATT} = 3.0 to 4.6 V and V_{BATT} = 7.0 V ≤ 1 µs. Load VSWR = 100:1, all phase angles.	No module damage or permanent degradation			
Noise Power (T_{CASE} = +25 °C) (V_{BATT} = 3.6 V)	GSM 1800	P_{NOISE_DCS}	f_0 + 20 MHz	—	—	–78.0	dBm
			935–960 MHz	—	—	–84.5	
			925–935 MHz	—	—	–74.0	
	GSM 1900	P_{NOISE_PCS}	f_0 + 20 MHz	—	—	–78.0	
			869–894 MHz	—	—	–84.5	

[1] Unless otherwise noted: 50 Ω system, pulsed operation with pulse width 2308 µs, duty cycle 4:8, T_{CASE} = –20 °C to +85 °C, V_{BATT} = 3.0 V to 4.6 V. Terminate all unused RF ports with 50 Ω during test.

Typical AM/AM Slope



Typical AM/PM Response

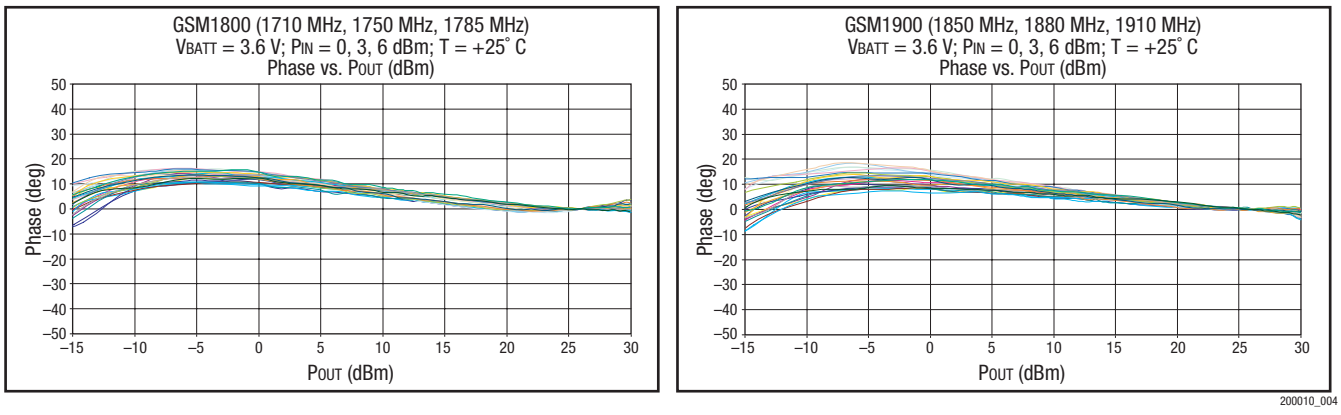


Figure 4. Typical Slope and Response Charts for High Band – SKY77521 TX-RX Front-End Module

Table 12. SKY77521 Electrical Characteristics GSM 850/900 – Ports RX1, RX2 [1]

RX Mode						
Parameter		**Symbol**	**Conditions**	**Minimum**	**Maximum**	**Unit**
Frequency Range	EGSM RX	$f_{EGSM\ RX}$	—	925	960	MHz
	850 RX	$f_{850\ RX}$	—	869	894	
Insertion Loss	ANT – EGSM RX		$f_{EGSM\ RX}$ T_{CASE} = +25 °C	—	1.3	dB
	ANT – 850 RX		$f_{850\ RX}$ T_{CASE} = +25 °C	—	1.3	
Leakage from TX-to-RX ports	EGSM/850 TX–850 RX		$f_{EGSM\ TX}$	—	10	dBm
	EGSM/850 TX–EGSM RX			—	12	
	EGSM/850 TX–DCS RX			—	12	
	EGSM/850 TX–PCS RX			—	12	

[1] Unless otherwise noted: 50 Ω system, pulsed operation with pulse width 2308 µs, duty cycle 4:8, T_{CASE} = –20 °C to +85 °C. Terminate all unused RF ports with 50 Ω during test.

Table 13. SKY77521 Electrical Characteristics GSM 1800/1900 – Ports RX3, RX4 [1]

RX Mode						
Parameter		**Symbol**	**Conditions**	**Minimum**	**Maximum**	**Unit**
Frequency range	DCS RX	$f_{DCS\ RX}$	—	1805	1880	MHz
	PCS RX	$f_{PCS\ RX}$	—	1930	1990	
Insertion Loss	ANT–DCS RX		$f_{DCS\ RX}$ T_{CASE} = +25 °C	—	1.8 [2]	dB
	ANT–PCS RX		$f_{PCS\ RX}$ T_{CASE} = +25 °C	—	1.8 [2]	
Leakage from TX- to RX-ports	DCS/PCS-TX–850 RX		$f_{DCS\ TX}$	—	12	dBm
	DCS/PCS-TX–EGSM RX			—	12	
	DCS/PCS-TX–DCS RX		$f_{PCS\ TX}$	—	10	
	DCS/PCS-TX–PCS RX			—	12	

[1] Unless otherwise noted: 50 Ω system, pulsed operation with pulse width 2308 µs, duty cycle 4:8, T_{CASE} = –20 °C to +85 °C. Terminate all unused RF ports with 50 Ω during test.

[2] With external shunt capacitor, insertion loss is about 1.4 dBm.

Table 14. SKY77521 Electrical Characteristics [1]

WCDMA TX-RX Mode							
Parameter		**Symbol**	**Conditions**	**Minimum**	**Typical**	**Maximum**	**Unit**
Frequency Range	WCDMA_TX/RX	$f_{WCDMA\_TX/RX}$	—	824	—	2170	MHz
Insertion Loss	ANT – WCDMA_TX/RX	$WCDMA_{TX/RX}$	824–960 MHz	—	—	1.1	dB
			1710–1990 MHz	—	—	1.4	
			2110–2170 MHz	—	—	1.5	
Isolation	WCDMA TX–850 RX		f_{WCDMA_TX}	20	—	—	dB
	WCDMA TX–EGSM RX			20	—	—	
	WCDMA TX–DCS RX			20	—	—	
	WCDMA TX–PCS RX			20	—	—	
	WCDMA TX–WCDMA TX			20	—	—	
Harmonics		$2f_0$ to $6f_0$	f_{WCDMA_TX} $P_{OUT} \leq 29$ dBm BW = 1 MHz 50 ohm	—	–46	–44	dBm
Harmonics at Mismatch		$2f_0$ to $3f_0$	f_{WCDMA_TX} $P_{OUT} \leq 29$ dBm BW = 1 MHz V_{BATT} = 3.6 V T_{CASE} =+25°C Load: VSWR of 5:1 for all phases.	—	–40	–36	dBm
Input 3rd order intercept at WCDMA inband		$IM3_{POINT}$	CW1 and CW2 within WCDMA frequency range with 10 MHz separation and power ≤ 0 dBm	63.25	—	—	dBm
IM Products		IM_{WCDMA}	CW Carrier on WCDMA port: P_{OUT} = 20 dBm	—	—	–101.5	dBm
			IM products to be measure at the WCDMA port: BW = 3.84 MHz *See test bench setup in Figure 5				
			2nd Order Spread WCDMA TX Signal: P_{OUT} = 20 dBm	—	—	–98.5	
			IM products to be measure at the WCDMA port: BW = 3.84 MHz *See test bench setup in Figure 5				

[1] Unless otherwise noted:
50 Ω system,
pulsed operation with pulse width 2308 µs,
duty cycle 4:8,
T_{CASE} = –20 °C to +85 °C,
V_{BATT} = 3.0 V to 4.6 V.
Terminate all unused RF ports with 50 Ω during test.

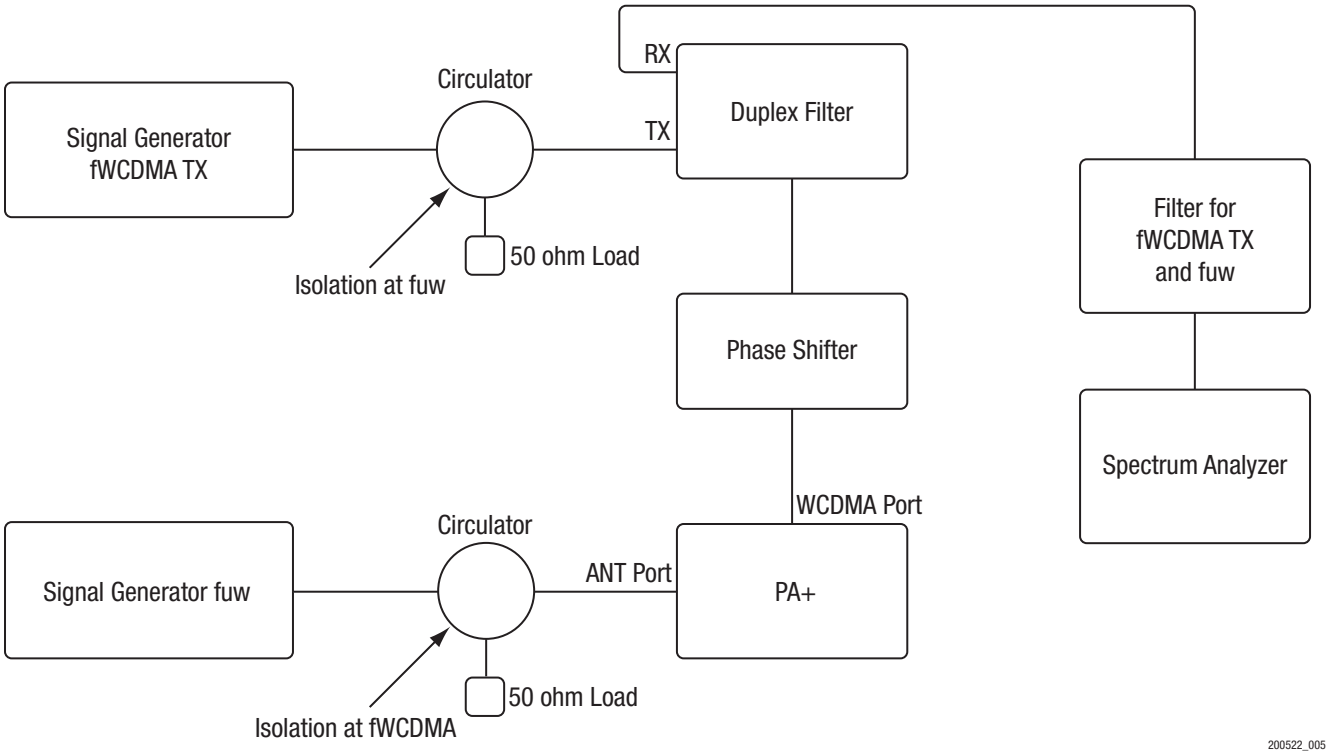


Figure 5. Test Bench Setup for Evaluation of WCDMA IM Products

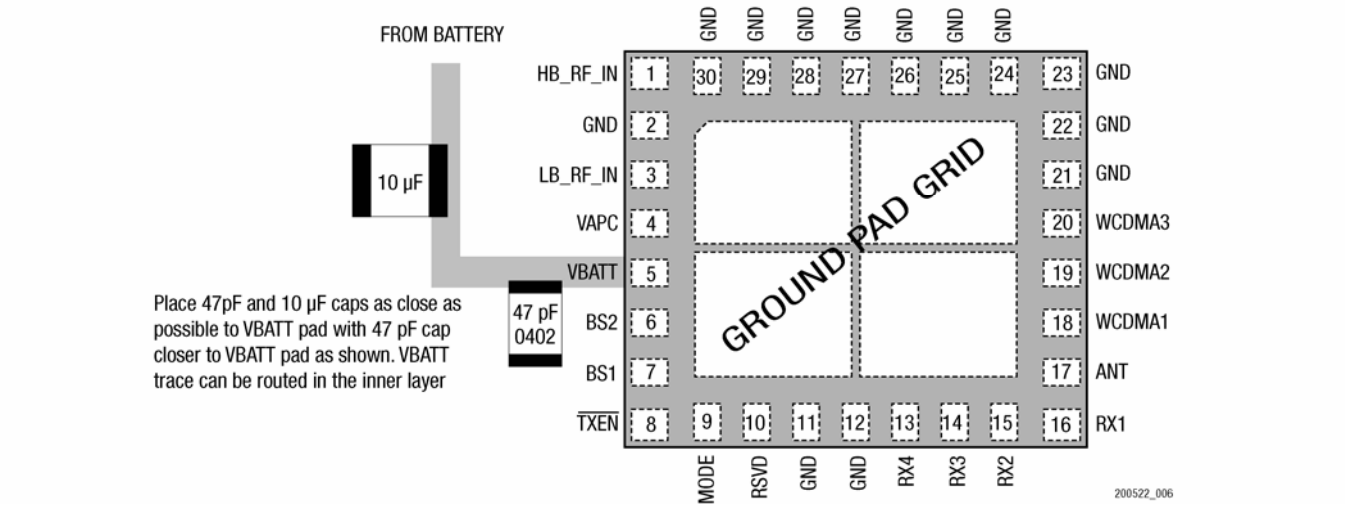
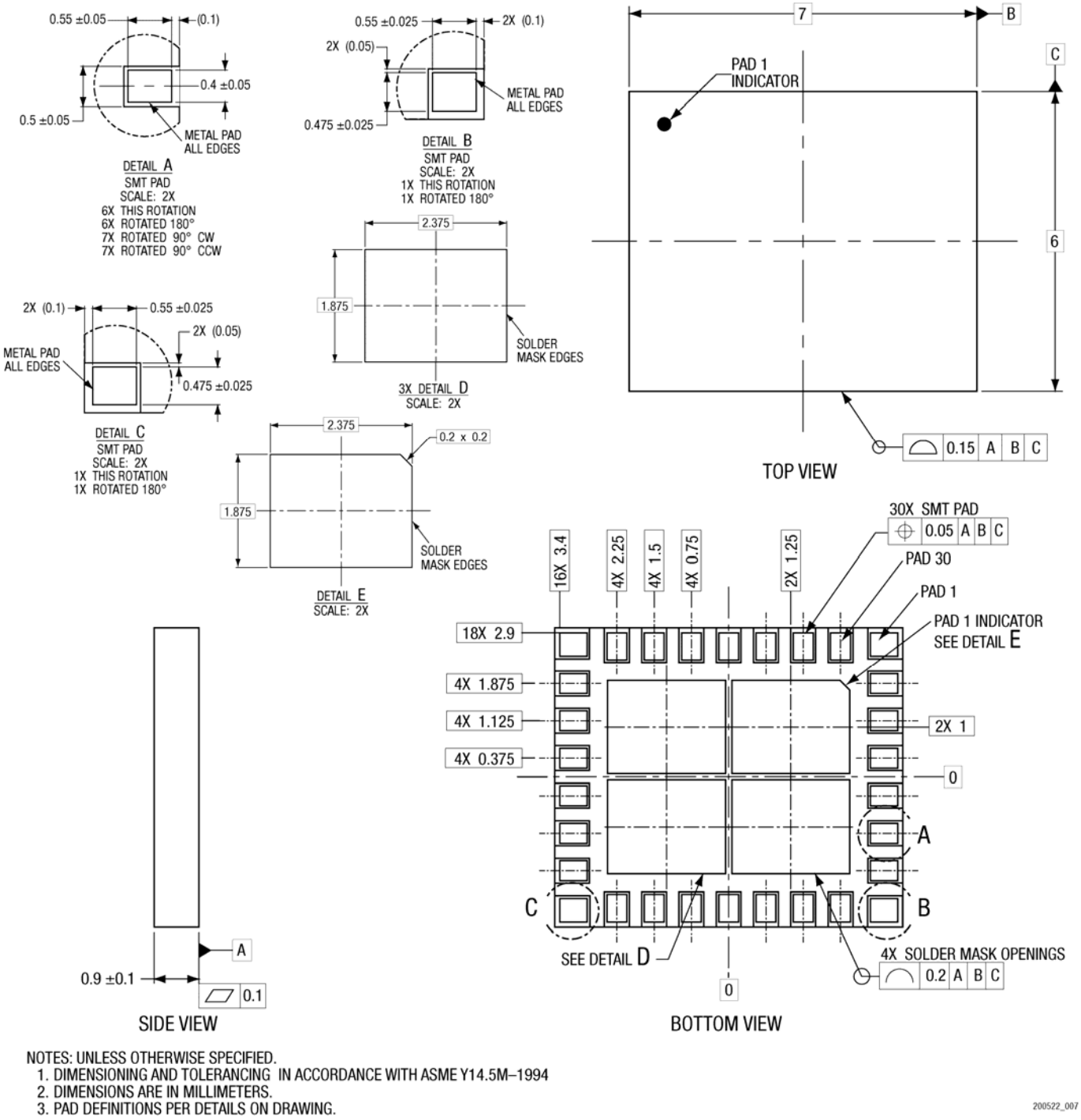


Figure 6. Application Schematic for the SKY77521

Package Dimensions and Descriptions

Figure 7 is a mechanical drawing of the pad layout for the SKY77521, a 30-pad leadless quad-band FEM with three WCDMA pass-through ports. Figure 8 provides a recommended phone board layout footprint for the FEM to help the designer attain optimum thermal conductivity, good grounding, and minimum RF discontinuity for the 50-ohm terminals. Figure 9 shows the device pad configuration and the pad numbering convention, which starts with pad 1 in the upper left and increments counter-clockwise around the package.

Table 15 lists the pad names and signal descriptions. Typical case markings are illustrated in Figure 10.



NOTES: UNLESS OTHERWISE SPECIFIED.
1. DIMENSIONING AND TOLERANCING IN ACCORDANCE WITH ASME Y14.5M–1994
2. DIMENSIONS ARE IN MILLIMETERS.
3. PAD DEFINITIONS PER DETAILS ON DRAWING.

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Figure 7. Dimensional Diagram for 7 x 6 mm, 30-Pad Leadless Package – SKY77521 (All Views)

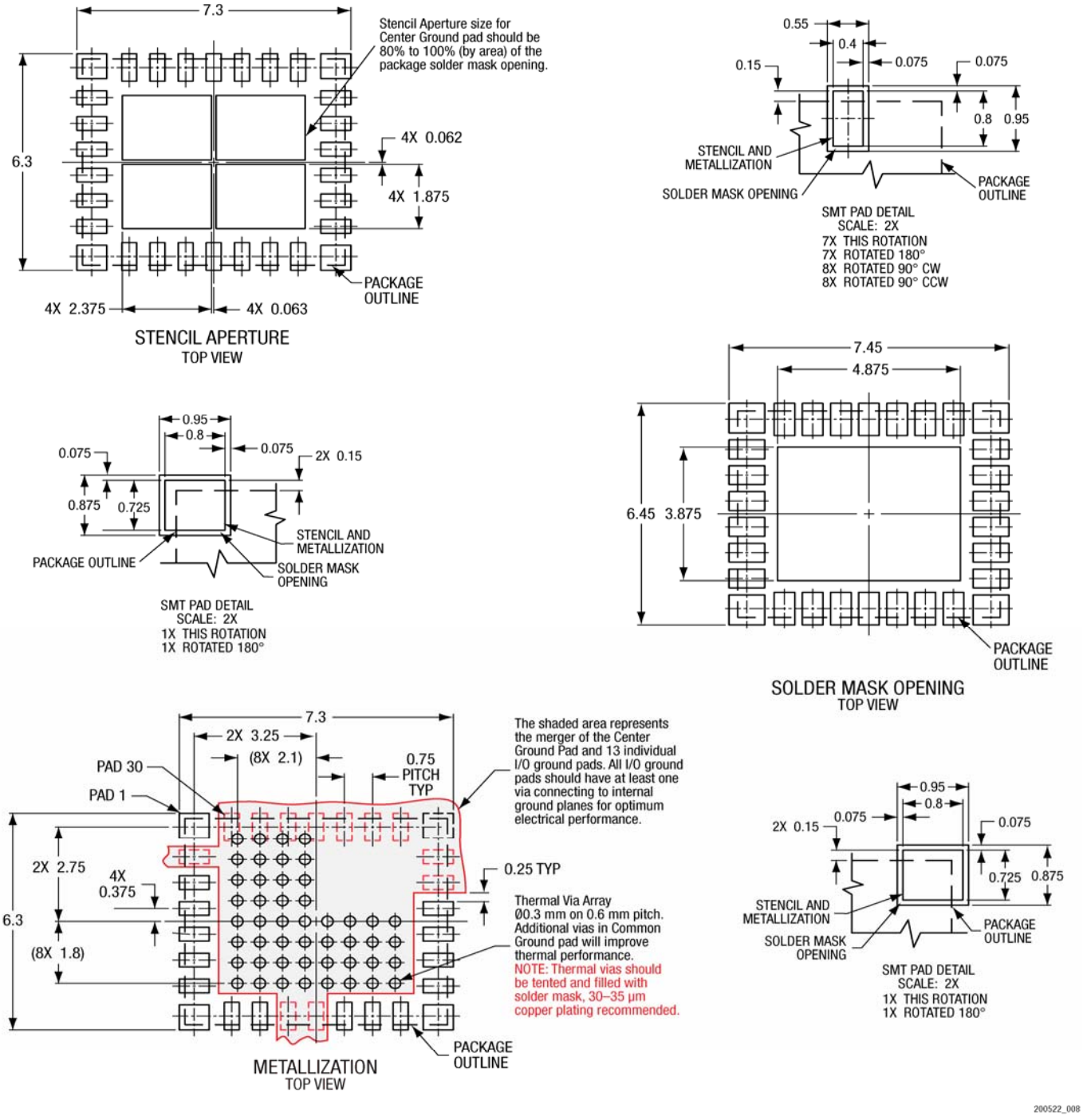

Figure 8. Phone PCB Layout for 7 x 6 mm, 30-Pad Package – SKY77521 Specific

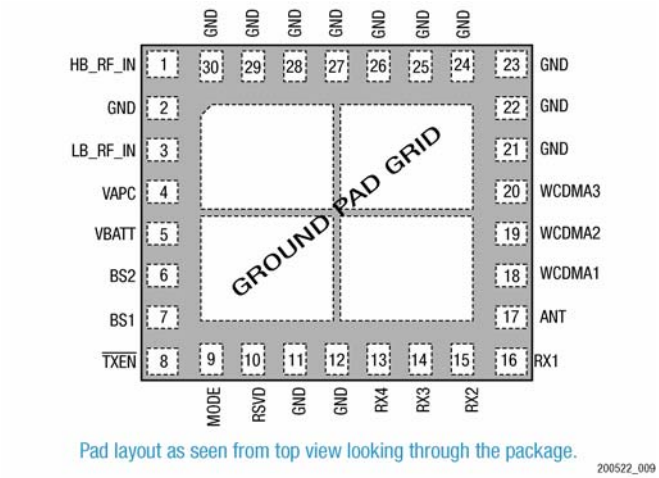

Figure 9. SKY77521 Pad Names and Configuration (Top View)

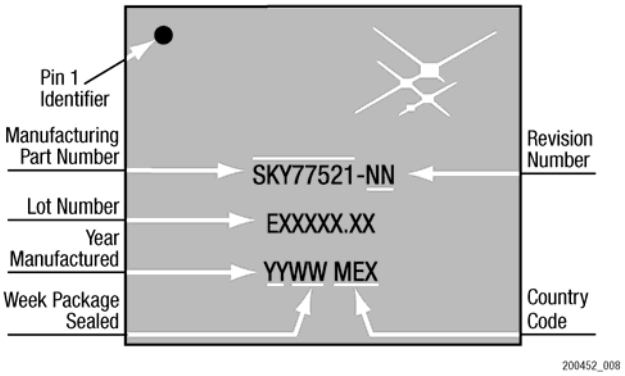

Figure 10. Typical Case Markings

Table 15. SKY77521 Signal Descriptions

Pad [1]	Name	Description	Pad [1]	Name	Description
1	HB_RF_IN	Input TX Signal 1800-1900 MHz	13	RX4	RX Signals 1805–1990 MHz (869-960 MHz optional)
3	LB_RF_IN	Input TX Signal 850-900 MHz	14	RX3	
4	VAPC	Input Modulating Signal	15	RX2	RX Signals 869-960 MHz (1805–1990 MHz optional)
5	VBATT	Battery Supply Voltage	16	RX1	
6	BS2	Band Select 2	17	ANT	TX-RX Signals 824-2170 MHz
7	BS1	Band Select 1	18	WCDMA1	WCDMA Signals 824-2170 MHz
8	$\overline{\text{TXEN}}$	$\overline{\text{TXEN}}$ (0 = TX, 1 = RX)	19	WCDMA2	
9	MODE	Truepower Mode Enable	20	WCDMA3	
10	RSVD	No Connect	GND	Ground Pad Grid	Ground Pad Grid (device underside)

[1] Pads 2, 11, 12, 21–30 are ground pads

Package and Handling Information

Because of its sensitivity to moisture absorption, this device package is baked and vacuum-packed prior to shipment. Instructions on the shipping container label must be followed regarding exposure to moisture after the container seal is broken, otherwise, problems relate to moisture absorption may occur when the part is subjected to high temperature during solder assembly.

The SKY77521 is capable of withstanding an MSL3/260 °C solder reflow. Care must be taken when attaching this product, whether it is done manually or in a production solder reflow environment. If the part is attached in a reflow oven, the temperature ramp rate should not exceed 3 °C per second; maximum temperature should not exceed 260 °C. If the part is manually attached, precaution should be taken to insure that the part is not subjected to temperatures exceeding 260 °C for more than 10 seconds. For details on attachment techniques, precautions, and handling procedures recommended by Skyworks, please refer to Skyworks Application Note: *PCB Design and SMT Assembly/Rework,* Document Number 101752. Additional information on standard SMT reflow profiles can also be found in the *JEDEC Standard J-STD-020*.

Production quantities of this product are shipped in the standard tape-and-reel format. For packaging details, refer to Skyworks Application Note: *Tape and Reel Information – RF Modules,* Document Number 101568.

Technical Information

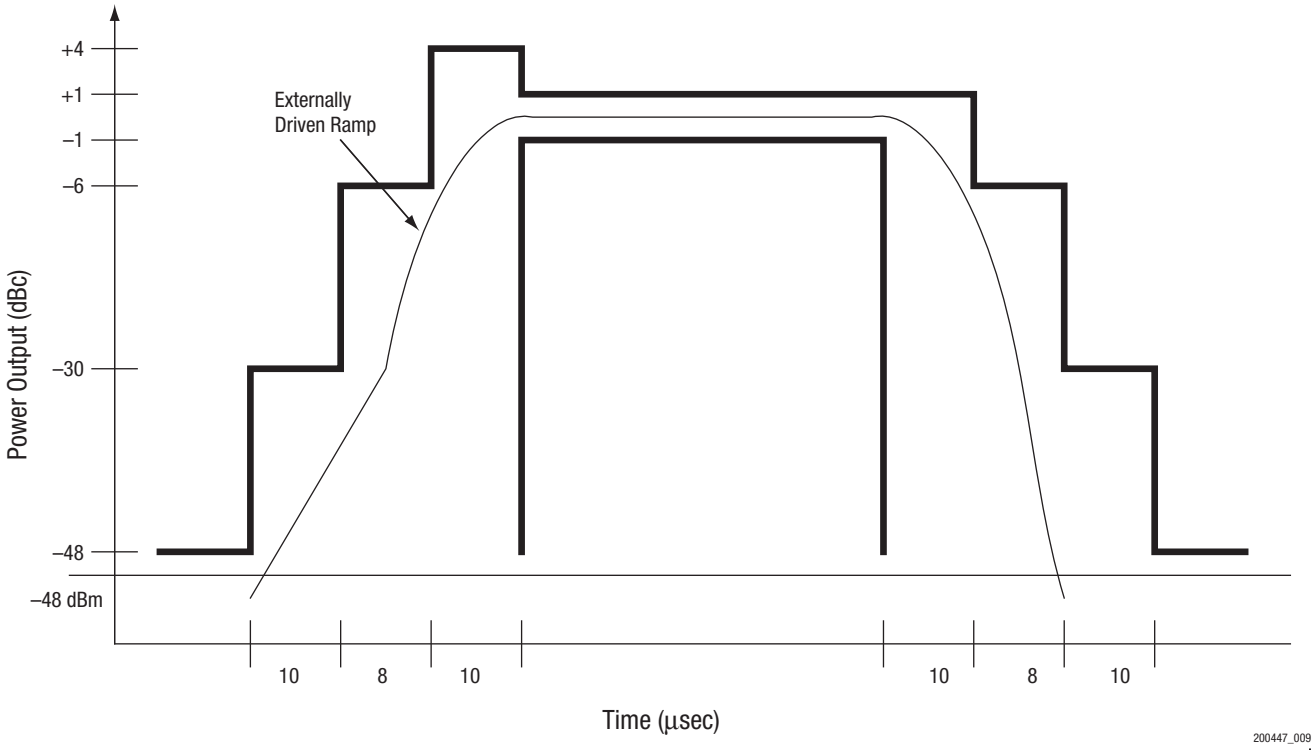

Figure 11. Example of RF Output vs. Time Mask Specification

Ordering Information

Model Number	Manufacturing Part Number	Product Revision	Package	Operating Temperature
SKY77521	SKY77521		7x6 MCM	–20 °C to +100 °C

Revision History

Revision	Level	Date	Description
P1		July 26, 2006	Initial Issue – Advance Information
A		March 5, 2007	Revise: Change data sheet Revision suffix from P1 to A (Advance data sheet status continues); Features list (page 1); Tables 1, 5, 8–15; Figures 1, 2, 6–10; Package and Handling Information section (p16)
B		August 23, 2007	Revise: Tables 2, 4, 7–15; Figures 2, 6–10

References

Application Note: PCB Design and SMT Assembly/Rework, Document Number 101752

Application Note: Tape and Reel Information – RF Modules, Document Number 101568

Standard SMT Reflow Profiles: JEDEC Standard J–STD–020

ELECTROSTATIC DISCHARGE (ESD) SENSITIVITY TESTING HUMAN BODY MODEL (HBM) – JESD22-A114–C

ELECTROSTATIC DISCHARGE (ESD) SENSITIVITY TESTING HUMAN BODY MODEL (MM) – JESD22-A115–A

FIELD-INDUCED CHARGED-DEVICE MODEL TEST METHOD FOR ELECTROSTATIC DISCHARGE – JESD22-C101–A