MSM7627 Chipset Training

RF Topics

80-VM151-26 Rev. A

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Revision History

Revision	Date	Description
A	April 2009	Initial release

RF Transceiver IC Topics

Air interfaces	Operating bands	RFICs
WCDMA GSM GPS	Quad-band UMTS Quad-band GSM L1 band	RTR6285
CDMA GPS	Dual-band CDMA L1 band	RTR6500
CDMA WCDMA GSM GPS	Dual-band CDMA Quad-band UMTS Quad-band GSM L1 band	RTR6500 & RTR6285

- **RF architectures**
- **RFIC introductions**
- **RFIC topics**
  - **RTR6500™ dual-band CDMA transceiver IC**
  - **RTR6285™ quad-band WCDMA and quad-band GSM transceiver IC**
- **Other Mobile Station Modem™ (MSM™)/RF connections**

RF Architectures and IC Introductions

Application #1

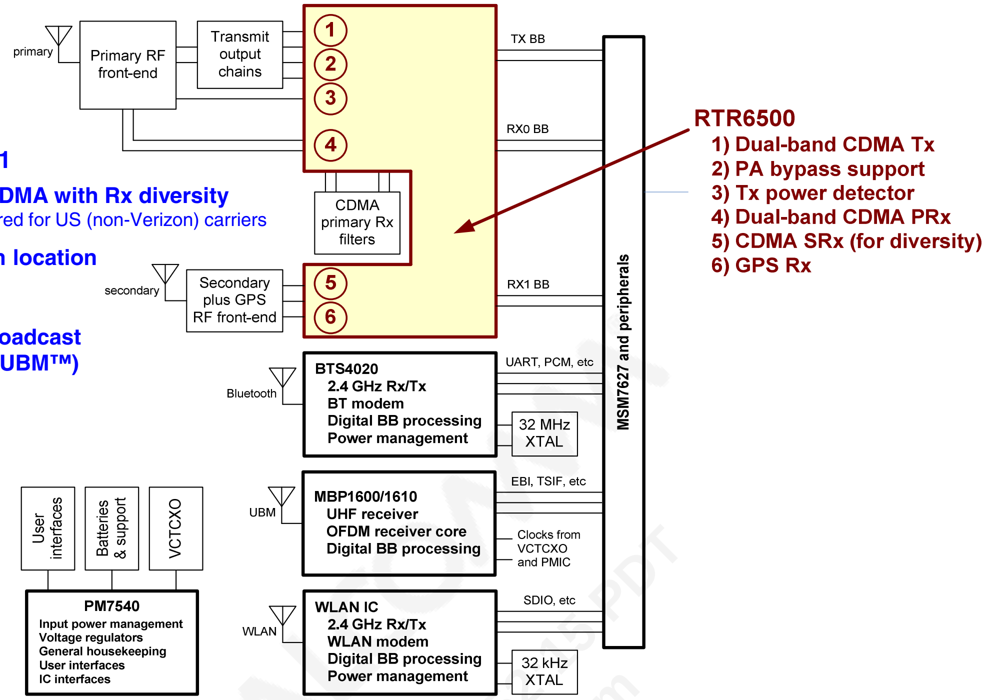
Dual-band CDMA with Rx diversity
- FTS is required for US (non-Verizon) carriers

GPS position location

Bluetooth®

Universal Broadcast Modem™ (UBM™)

WLAN



RF Architectures and IC Introductions (continued)

No new RFICs

Application #2

Quad-band UMTS with Rx diversity

Dual-band CDMA with Rx diversity
- FTS is required for US (non-Verizon) carriers

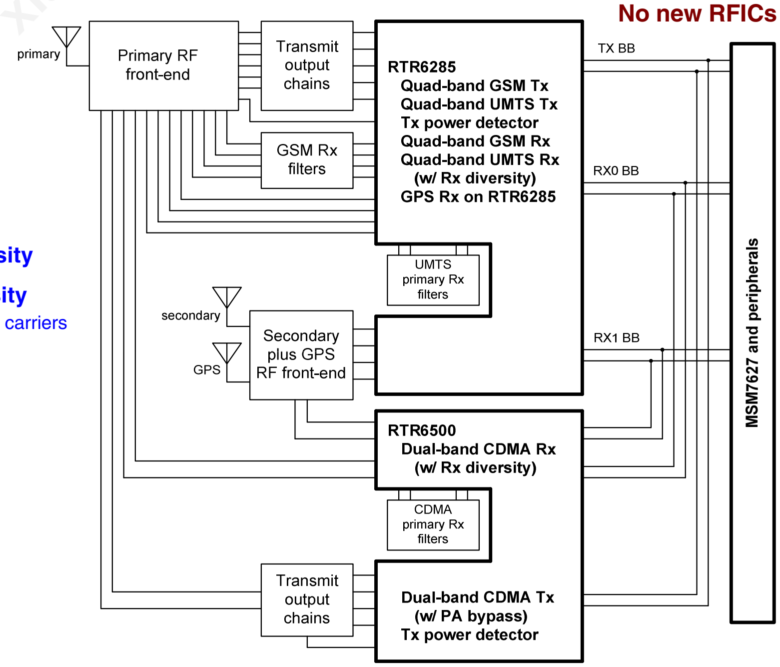
Quad-band GSM

GPS position location

Bluetooth

UBM

WLAN



Plus Bluetooth, UBM, WLAN, and power management from other examples

Example RF Functional Block Diagram

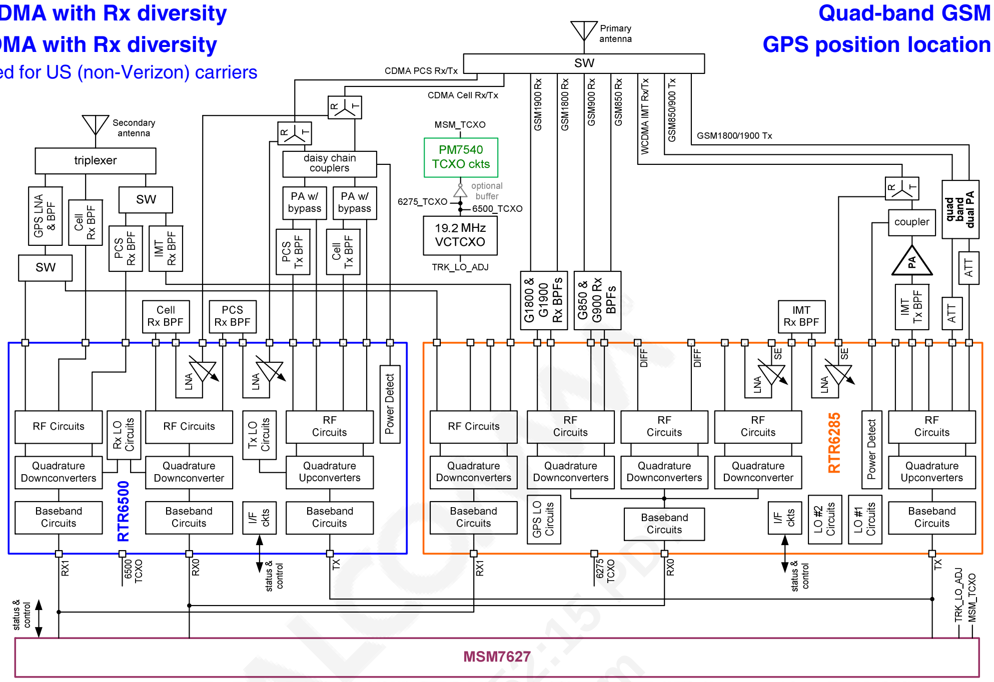
IMT-band WCDMA with Rx diversity

Dual-band CDMA with Rx diversity

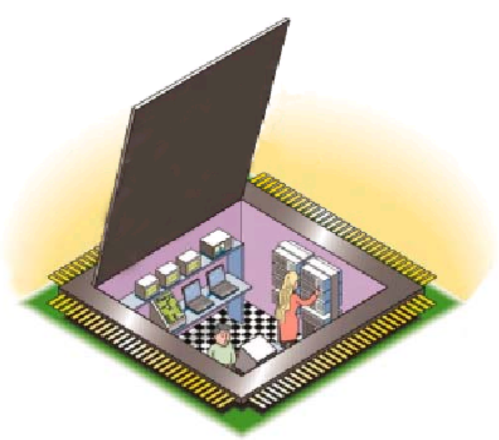
- FTS is required for US (non-Verizon) carriers

Quad-band GSM

GPS position location



Architecture Questions?



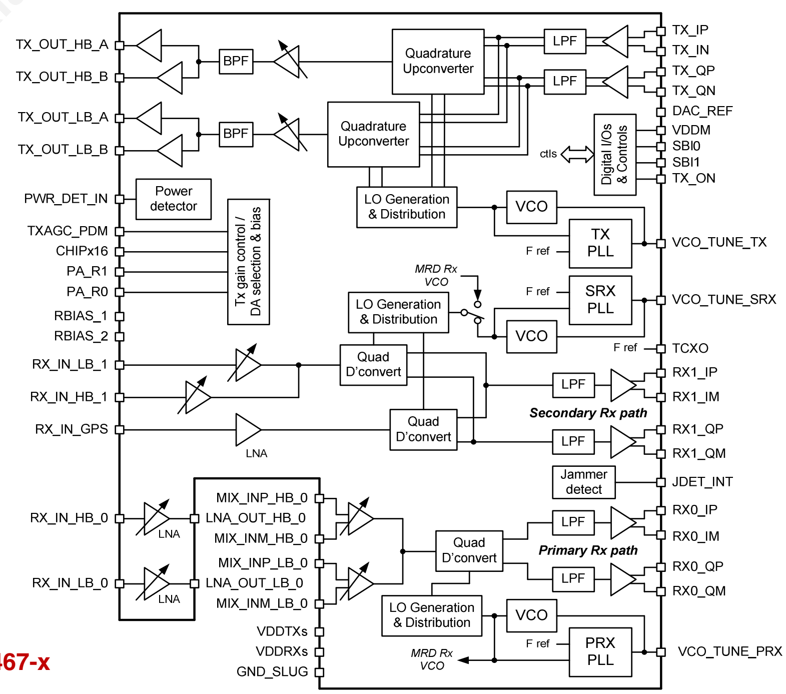
- **Questions can also be submitted via service requests:**
  https://support.cdmatech.com

RTL6500 Design Guidelines

- **Functional block diagram and features**
- **Package and pin assignments**
- **Interfaces**
  - **Top-level**
  - **MSM interfaces**
  - **RTR6500 IC operating modes**
  - **Analog baseband – Rx and Tx**
  - **Tx gain control**
  - **RF matching networks – Rx and Tx**
  - **Tx power detector**
- **LO generation and distribution**
- **DC power supplies and bias setting resistors**
- **PCB layout guidelines**
- **Performance specifications**

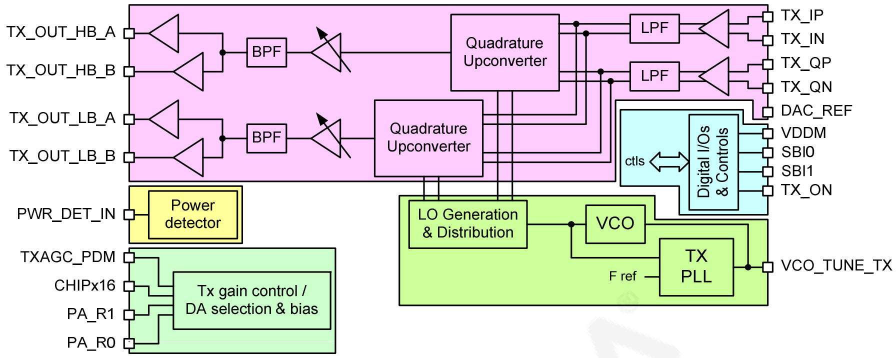
RTR6500 Introduction

- **Dual-band CDMA2000® 1x EV-DO Rev. A**
- **One low-band, one high-band**
- **Low-band options:**
  - Cellular-CDMA (BC0)
  - JCDMA (BC3)
  - New JCDMA (BC0-SC3)
- **High-band options:**
  - US-PCS (BC1 and BC14-block G)
  - KPCS (BC4)
  - IMT (BC6)
  - AWS (BC15)
- **Plus S-GPS position location**



RTR6500 document family: 80-VC467-x

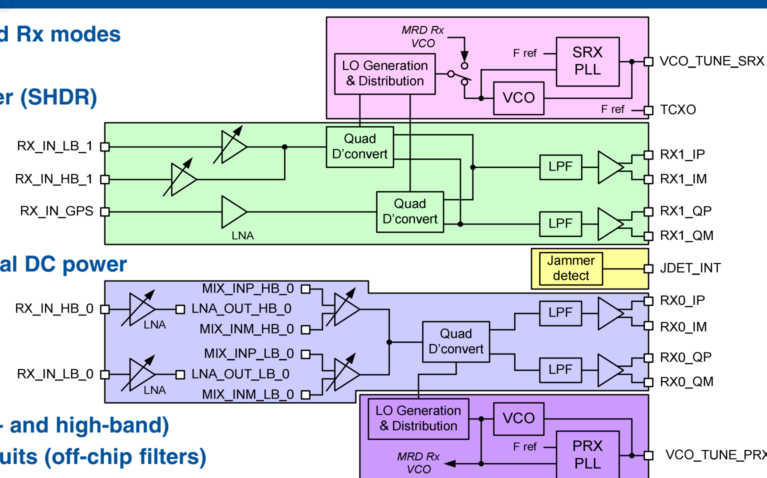
RTR6500 Features (1 of 2)



- CDMA Tx signal paths (low- and high-band)
  - Shared baseband Tx interface from MSM
  - Baseband buffers and filters
  - Low- and high-band ZIF quadrature upconverters
  - Low- and high-band RF AGC amplifiers and filters
  - Four driver amplifier outputs (PA bypass, each band)
- CDMA Tx power detector and supporting circuits
- Tx VCO and PLL
- LO distribution for all Tx modes
- Configurable SBI for efficient status and control
- Tx power control range supports standards
- MSM-controlled power reduction features
- 2.1 V nominal supply voltage
  - Allows SMPS source
  - Higher overall efficiency
  - DC power reduction
- Small, thermally efficient package (68 mQFN)

RTR6500 Features (2 of 2)

- Dual receiver architecture; advanced Rx modes
  - Mobile receive diversity (MRD)
  - Simultaneous hybrid dual receiver (SHDR)
  - Simultaneous-GPS (S-GPS)
- IntelliCeiver® operation
  - PRx jammer detection
  - Adequate Rx linearity with minimal DC power

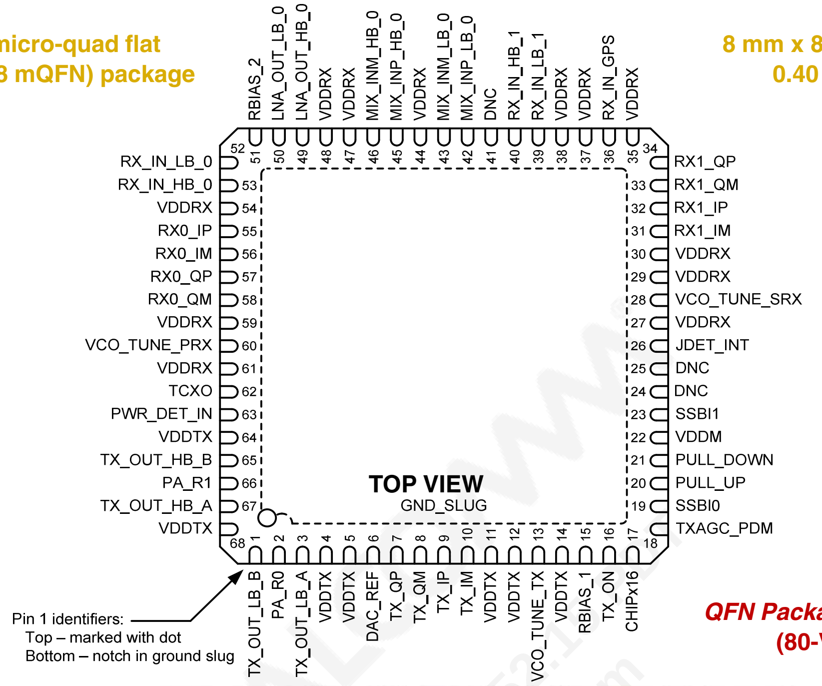


- Primary CDMA Rx signal paths (low- and high-band)
  - Dedicated gain-stepped LNA circuits (off-chip filters)
  - Shared ZIF quadrature downconverter
  - Shared baseband filters and RX0 interface to MSM
- Secondary CDMA Rx signal paths (low- and high-band)
  - Same as PRx but without external filters
  - RX1 interface to MSM (shared with GPS path)
- Secondary GPS Rx signal path
  - Same as SRx, but fixed-gain LNA
- Primary Rx VCO and PLL
  - Supports PRx plus MRD reception
- Secondary Rx VCO and PLL
  - For SHDR and S-GPS modes
- LO distribution for all Rx modes

RTR6500 Package and Pin Assignments

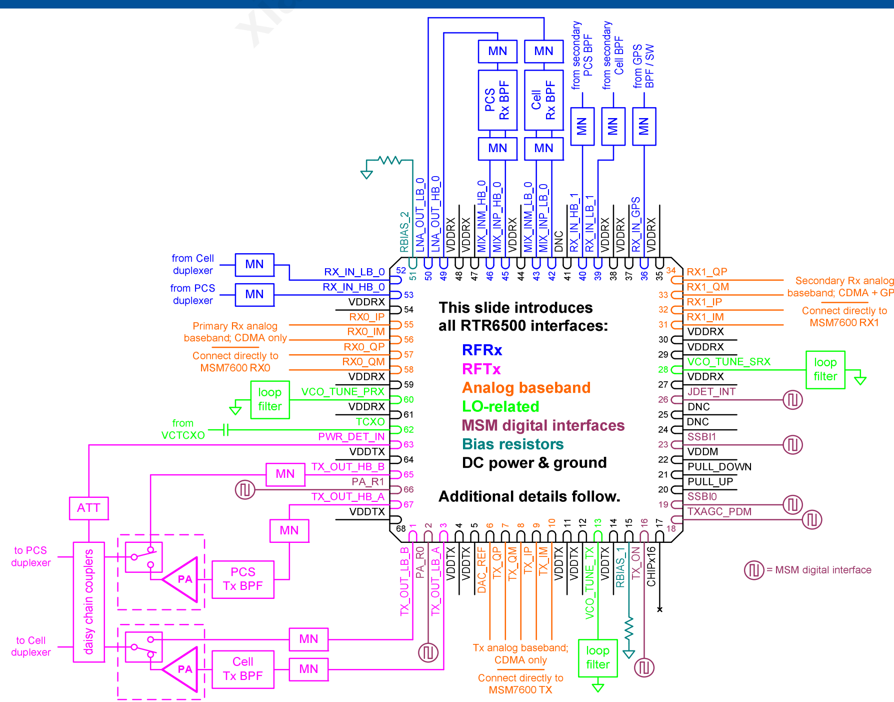
68 pin micro-quad flat
No-lead (68 mQFN) package

8 mm x 8 mm x 0.9 mm
0.40 mm pitch

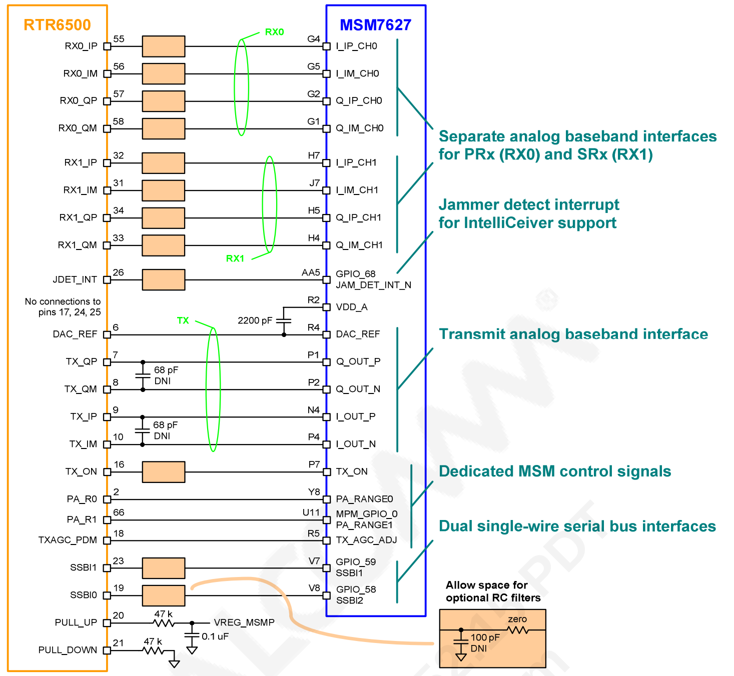


QFN Package User Guide
(80-V5243-1)

RTR6500 Interfaces



RTR6500/MSM7627 Connections



RTR6500 IC Operating Modes

Primary IC operating mode is determined by handset software via SBI programming.

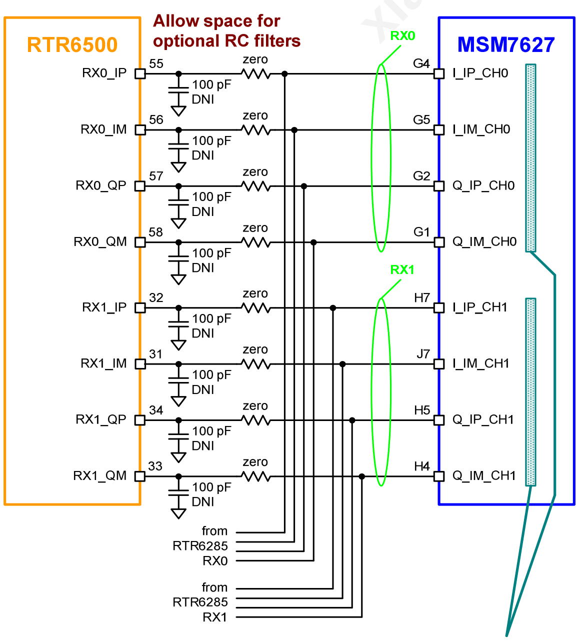
Mode	TX_ON	Description
Sleep	X	IC powerdown mode; all internal circuits are off.
Rx warm-up	X	Rx PLL circuits are not locked; receiver is set to a low-power mode with only necessary Rx VCO, PLL, and LO circuits on.
Primary Rx Low- or high-band CDMA	X	All necessary PRx signal path and LO circuits are on; Tx is off; SRx is off. All CDMA modes are supported on PRx (1x and DO).
Tx warm-up	X	Tx PLL circuits are not locked; transmitter is set to a low-power mode with only necessary Tx VCO, PLL, and LO circuits on.
Tx puncture	L	TX_ON = low forces Tx puncture mode – all Tx signal path circuits are off, but LO circuits are on. TX_ON = high → active Tx.
Primary Rx/Tx Low- or high-band CDMA	H	All necessary PRx signal path, Tx signal path, and LO circuits are on; SRx is off. All CDMA modes are supported.
PA bypass (see note)	H	Each Tx band uses both of its driver amplifier outputs (one at a time). One drives the PA, the other bypasses the PA.
IntelliCeiver modes Low or high current	X	PRx configuration is set based on detected jammer: • High-current modes optimize PRx linearity (IIP2 and IIP3). • Low-current modes minimize DC consumption while maintaining adequate linearity per existing jammers.
Secondary Rx modes MRD, SHDR, S-GPS	X	All necessary SRx signal path and LO circuits are on, with LO configured to support the selected mode.

When SW is enabled, PA_R0 & PA_R1 help determine PA active or bypass mode and driver amp bias.

RTR6500 Configurable Parameters

- **Rx-related functions and parameters:**
  - **Internal circuit gains and bias conditions**
  - **Enabling and disabling circuit blocks**
  - **LNA parameters**
  - **Downconverter parameters**
  - **Rx VCO controls: primary and secondary VCOs**
  - **Rx PLL controls (PRx and SRx): counter values, charge-pump current, etc.**
  - **Rx LO generation and distribution controls: primary and secondary**
  - **Baseband parameters**
  - **Test and calibration functions**
- **Tx-related functions and parameters:**
  - **Internal circuit gains, bias conditions, and output drive levels**
  - **Enabling and disabling circuit blocks**
  - **Puncture controls**
  - **Tx VCO controls**
  - **Tx PLL controls: counter values, charge-pump current, etc.**
  - **Tx LO generation and distribution controls**
  - **Tx power detector**
  - **Baseband parameters**
  - **Test and calibration functions**

RTR6500 Rx Analog Baseband Outputs

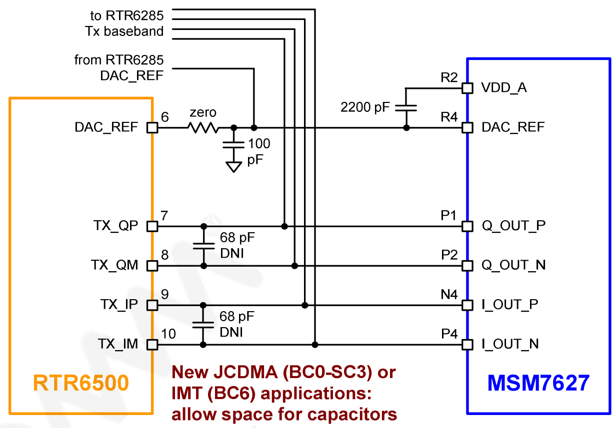


Separate analog baseband interfaces for PRx (RX0) and SRx (RX1)

- **Extremely sensitive I and Q baseband outputs are configured as differential pairs.**
  - **In-phase plus component is RX0_IP or RX1_IP, minus is RX0_IM or RX1_IM.**
  - **Quadrature plus component is RX0_QP or RX1_IP, minus is RX0_QM or RX1_QM.**
- **Route I/Q as phase-critical differential pairs.**
  - **Keep plus and minus lines parallel to one another and closely spaced.**
  - **Keep electrical lengths for the I-pair and Q-pair equal (preserve quadrature relationship).**
- **Load resistance and capacitance on each pair should be equal.**
  - **Minimize individual trace capacitance on each connection – *do not exceed 8 pF to ground (short, direct traces).***
  - **No external shunt resistor! Only the MSM device should load these lines.**
- **Avoid crossing these traces; if necessary, cross them only near the MSM end points.**
- **Isolate from digital logic and clock traces (including TCXO signal) with ground on both sides, plus ground above and below if routed on internal layers. Treat similar to controlled impedance traces.**

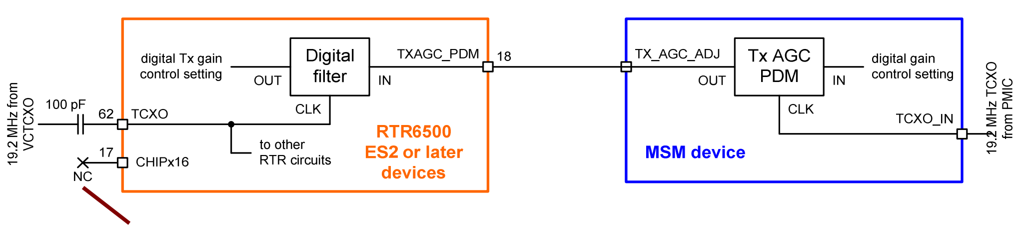
RTR6500 Tx Analog Baseband Input

- Extremely sensitive I and Q baseband inputs are configured as differential pairs.
  - In-phase plus component is TX_IP, minus is TX_IM.
  - Quadrature plus component is TX_QP, minus is TX_QM.
- Route I/Q as phase-critical differential pairs.
  - Keep plus and minus lines parallel to one another and closely spaced.
  - Keep electrical lengths for the I-pair and Q-pair equal (preserve quadrature relationship).
- Avoid crossing these traces; if necessary, cross them only near the start or end points.
- Isolate from digital logic and clock traces (including TCXO signal) with ground on both sides, plus ground above and below if routed on internal layers. Treat this similar to controlled impedance traces.
- Treat the sensitive DAC_REF signal carefully also.
- Include 2200 pF bypass cap between the DAC_REF input and the TX DAC supply pin.



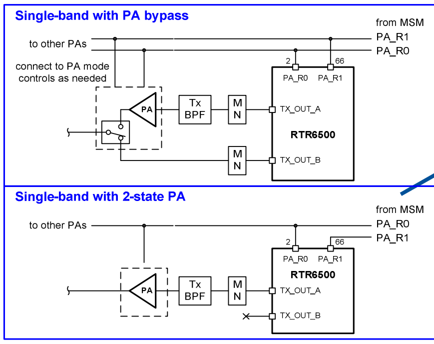
RTR6500 Tx Gain Control

Previous-generation off-chip filtering and analog gain control is replaced by RTR6500 digital gain control and on-chip digital filtering; external 2-pole RC filter is eliminated.



CS must leave pin 17 (CHIPx16) unconnected; this pin is only connected to the VCTCXO output for ES1 devices.

PA_R0 and PA_R1 Control Signals



PA_R1	PA_R0	PA mode	DA bias
1	1	PA active	H
1	0	bypass	H
0	0	bypass	L

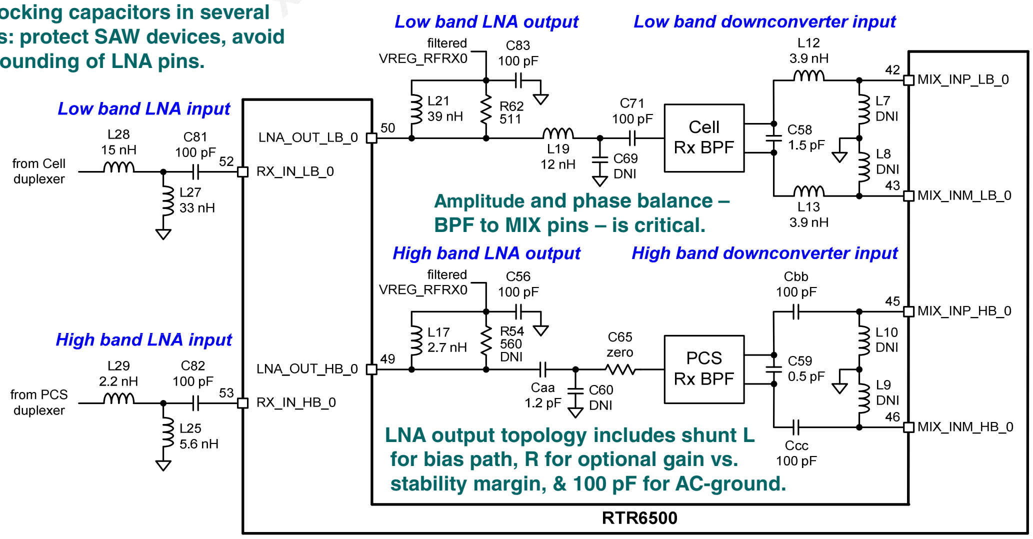
PA_R1	PA_R0	PA mode	DA bias
1	0	H	H
1	1	L	H
0	1	L	L

See the truth tables above for 2-state PA.

- **See the Application Note: *PA Bypass Technique for CDMA2000 and EV-DO* (80-VD656-1) for additional bypass details.**
- **See the *Application Note: RTR6500 Tx AGC and PA Compatibility* (80-VC467-10) for needed information on Tx state control.**
- **In all cases: PA_R0 and PA_R1 must be connected between the MSM and the RTR6500 pins.**
- **PA_R0 and PA_R1 functions and logic can be configured through API software.**
- **TX_OUT ports – A and B – are interchangeable; their assignments via SW should optimize PCB routing.**

RTR6500 PRx Matching Networks

DC blocking capacitors in several places: protect SAW devices, avoid DC grounding of LNA pins.



Include "DNI" components in initial layouts for matching flexibility.

If necessary, use high-Q, low-tolerance inductors throughout to reduce losses and improve performance.

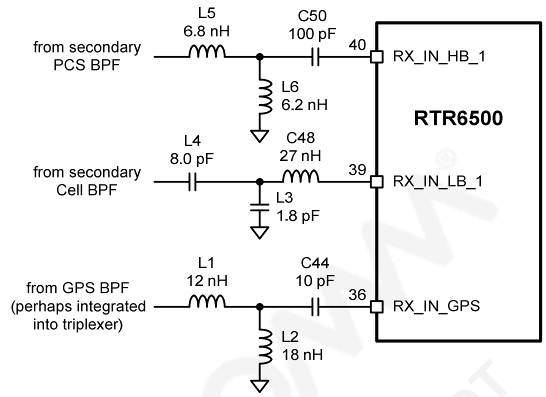
Differential MIX configuration provides better isolation, higher common-mode rejection, and higher linearity (higher IM2).

Component values shown are suggested starting values only; each handset application and PCB layout will yield different results.

RTR6500 SRx and GPS Matching Networks

DC blocking capacitors are in several places to protect SAW devices and to avoid DC grounding of RTR pins.

Some intended components were altered during optimization; C48 became a 27 nH inductor, for example.

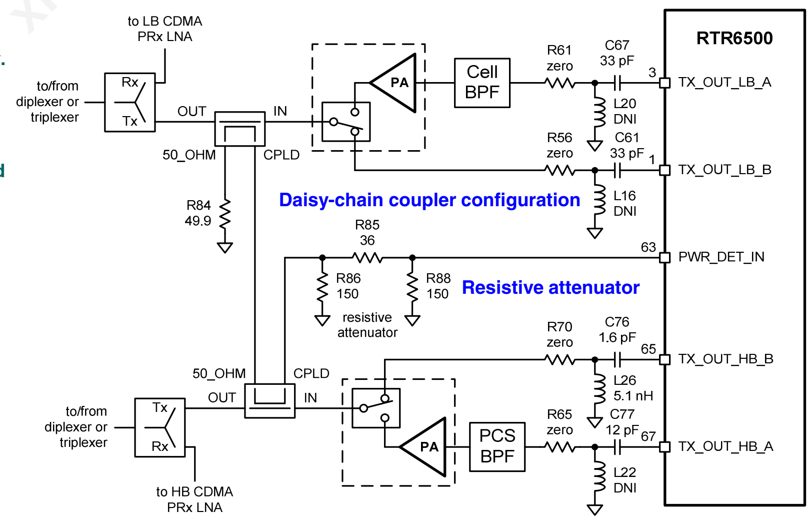


If necessary, use high-Q, low-tolerance inductors throughout to reduce losses and improve performance.

Component values shown are suggested starting values only; each handset application and PCB layout will yield different results.

RTR6500 Tx Matching and Tx Power Detect

- **Include "DNI" components in initial layouts for matching flexibility.**
- **DC-blocking capacitors are required (C67, C61, C76, C77).**
- **If PA modules are not AC-coupled internally, the zero-ohm resistors need to be replaced by capacitors (R61, R56, R70, R65).**



- **Component values shown are suggested starting values only; each handset application and PCB layout will yield different results.**
- **Design guidelines for all matching networks (PRx, SRx, and Tx) are available in the *RTR6500 Multiband CDMA RF Transceiver Design Guidelines* (80-VC467-5).**

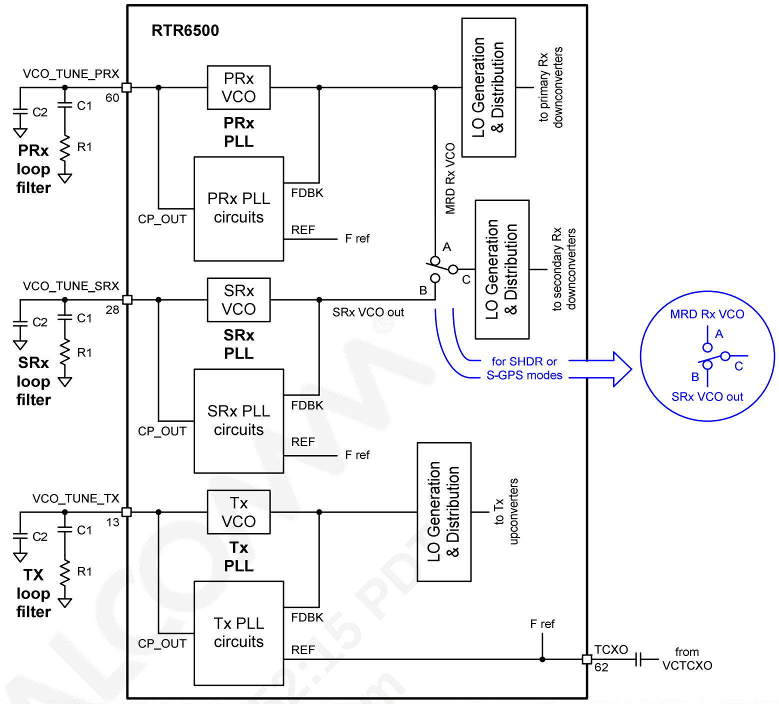
- **PWR_DET_IN presents a nominal 50-ohm load – match not required.**
- **Use coupling ratio and attenuator to optimize PWR_DET_IN level.**
  - **Reference design uses 24 dB couplers and a 6 dB attenuator.**

RTR6500 LO-Related Signals and Connections

R1	C1	C2
560	82 nF	4.7 nF
CP_I	L_BW	lock
200 µA	10 kHz	1 msec

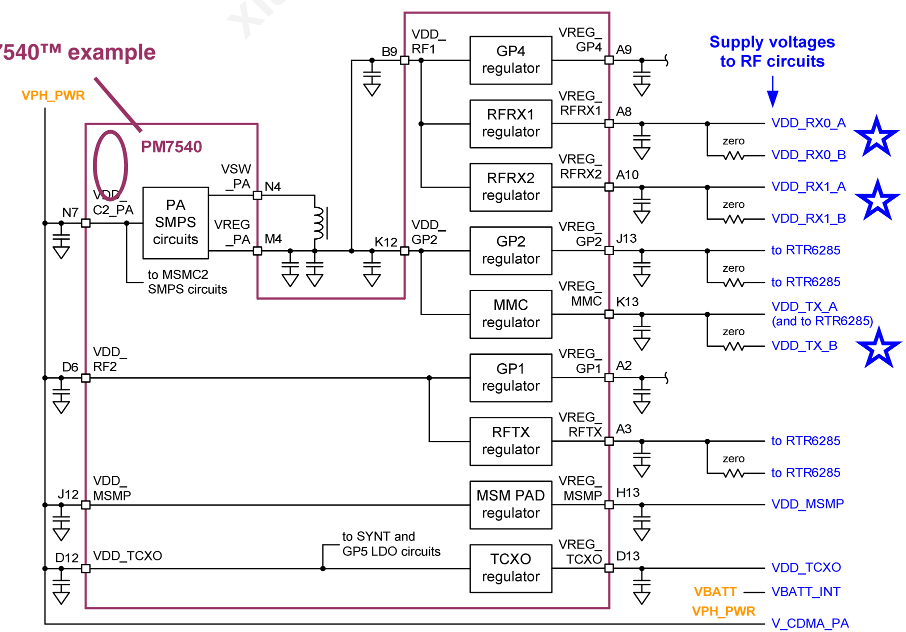
R1	C1	C2
1.5 k	1.8 nF	1.2 nF
CP_I	L_BW	lock
200 µA	10 kHz	1 msec

R1	C1	C2
5.1 k	3300 pF	220 pF
CP_I	L_BW	lock
200 µA	40 kHz	200 µsec



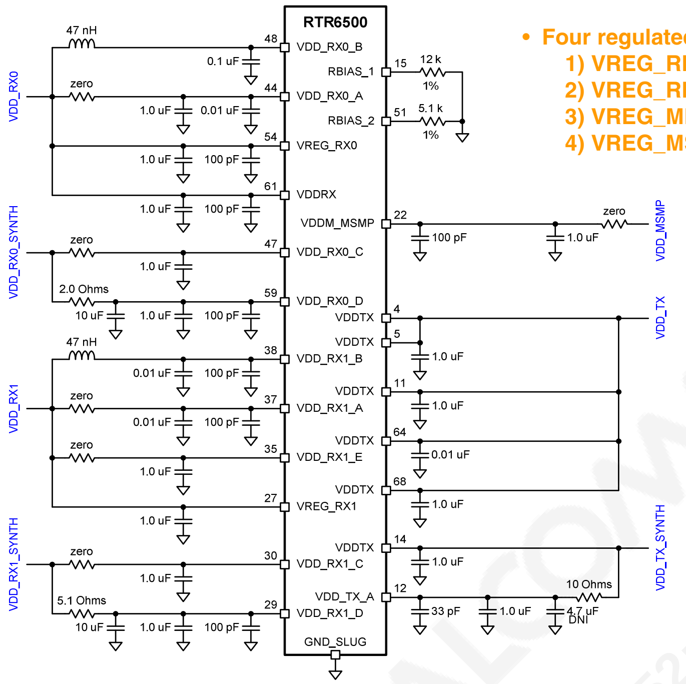
Subregulation for Some RF Power Supplies

PM7540™ example



Subregulation of RX0, RX1, and TX supply voltages provides higher efficiency and higher regulation performance (clean power supplies for key RF circuits).

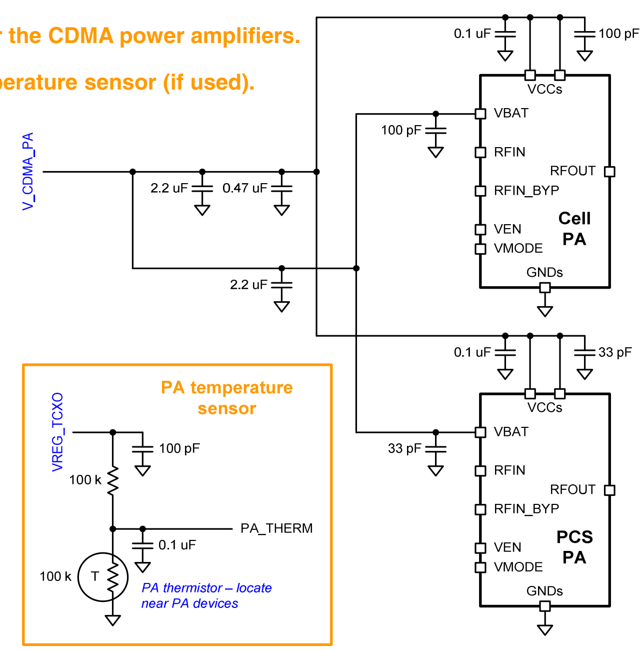
RTR6500 DC Power and Bias Resistors



- Four regulated voltages are used, all from the PM7540 IC:
  1) VREG_RFRX2 = VDD_RX0_A & VDD_RX0_B
  2) VREG_RFRX1 = VDD_RX1_A & VDD_RX1_B
  3) VREG_MMC = VDD_TX_A
  4) VREG_MSMP = VDD_MSMP
- Zero-ohm resistors are included to allow a series isolating element to be added if needed.
- Components shown represent the recommended starting point; some might be eliminated if proven to be unnecessary through testing.
- VCO power pins (12, 29, 59) require extra filtering as shown.
- Refer to *TRF6500 RF Reference Schematic for Full-time SHDR* (80-VC467-44).
- Critical bias currents are set using the external resistors at pins 15 and 51; 1% tolerance is required.

Power Amplifiers' DC Power Supplies

- VPH_PWR = V_CDMA_PA is used to power the CDMA power amplifiers.
- VREG_TCXO is used to power the PA temperature sensor (if used).

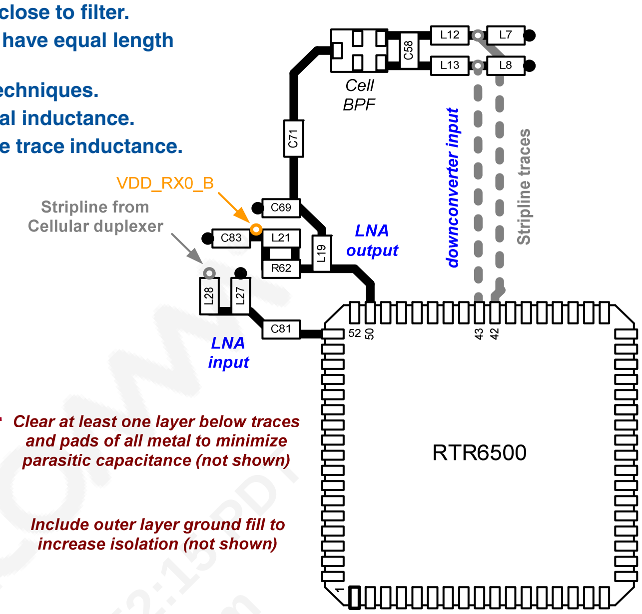


- V_CDMA_PA is connected to each PA's VCC supply pins and its VBAT pin.

- This example is representative, and is based on the PAs used on the reference design:
  - Anadigics AWT6331 (cellular)
  - Anadigics AWT6332 (PCS)

Low-band PRx Layout Guidelines

- Clear areas below pads and traces of metal on at least one layer – **minimize parasitic capacitance!**
- All RF traces are as short and direct as possible.
- Components are located very close to RFIC pins or close to filter.
- Differential paths are symmetrical – plus and minus have equal length (preserves phase balance).
- Long separations must use controlled-impedance techniques.
- Position inductors for low cross-coupling and mutual inductance.
- Position ground vias at component pads to minimize trace inductance.
- DC-blocking capacitors are provided as mentioned on the schematic page.



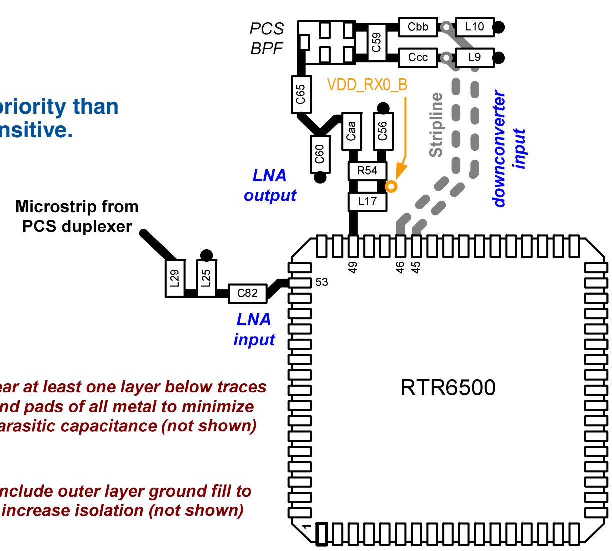
Clear at least one layer below traces and pads of all metal to minimize parasitic capacitance (not shown)

High parasitic capacitance could make optimal match impossible!

Include outer layer ground fill to increase isolation (not shown)

High-band PRx Layout Guidelines

- Same notes as previous page … plus:
- PCS components and routing are given higher priority than cellular — higher operating frequency – more sensitive.



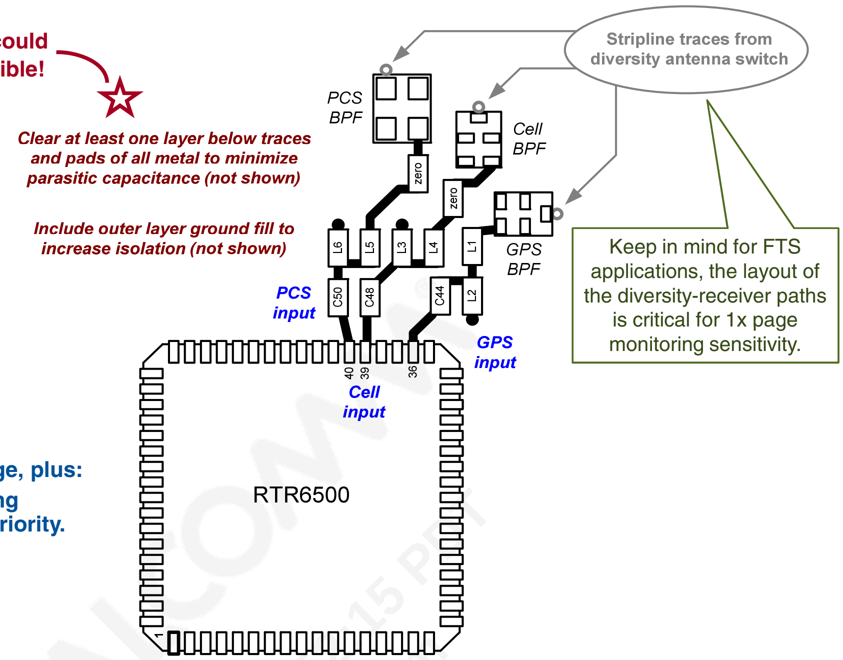
Clear at least one layer below traces and pads of all metal to minimize parasitic capacitance (not shown)

High parasitic capacitance could make optimal match impossible!

Include outer layer ground fill to increase isolation (not shown)

Dual-band SRx and GPS Layout Guidelines

High parasitic capacitance could make optimal match impossible!

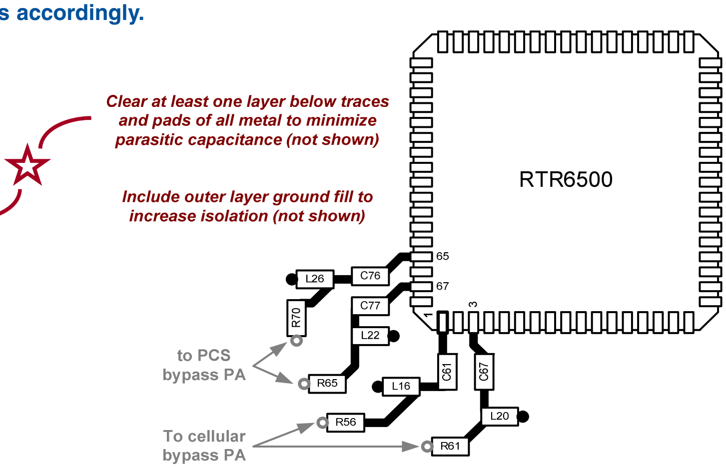


- Same notes as previous page, plus:
- GPS components and routing should also be given high priority.

Tx Layout Guidelines

- Similar guidelines as Rx layouts, plus:
- Only series capacitors are absolutely required, but
  - Other shunt and series components should be included to allow flexibility.
- If bypass PA is used, ensure adequate isolation between the bypass and active paths.
- Assign the ‘A’ and ‘B’ Tx outputs for the best possible RF routing.
  - Modify software assignments accordingly.

High parasitic capacitance could make optimal match impossible!



Example RTR6500 Receiver Performance Specs

Parameter	Condition	Min	Typ	Max	Unit
RF input frequency range					
CDMA2000® band class 0	Cellular	869		894	MHz
CDMA2000 band class 3	JCDMA	843		870	MHz
CDMA2000 band class 0, SC3	New JCDMA	860		875	MHz
CDMA2000 band class 10	Secondary 800 MHz	851		869	MHz
Input VSWR (in-band)	50 Ω with external match			2:1	---
Output VSWR (in-band)	50 Ω with external match			2:1	---
High-current mode, gain mode G0					
Power gain					
U.S. cell and new JCDMA		15.5	16.8	18	dB
JCDMA and BC10		15	16.7	17	dB
Noise figure	Small signal				
U.S. cell and new JCDMA			1.6	2.2	dB
JCDMA and BC10			1.6	2.3	dB
Input IP3[1]		+8.0			dBm
Reverse isolation	S12		20		dB
High-current mode, gain mode G1					
Power gain					
U.S. cell and new JCDMA		5.5	6.7	7.5	dB
JCDMA and BC10		4.5	5.6	6.5	dB
Noise figure	Small signal		4.0	6.0	dB
Input IP3		+5.0			dBm
Reverse isolation	S12		10		dB
Low-current mode, gain mode G0					
Power gain					
U.S. cell and new JCDMA		15	16	17.5	dB
JCDMA and BC10		15	16	17	dB
Noise figure	Small signal		1.6	2.3	dB
Input IP3 [1]		-5.0			dBm
Reverse isolation	S12		20		dB

PRX LNA Specifications above

Parameter	Condition	Min	Typ	Max	Unit
RF input frequency range					
CDMA2000 band class 0	Cellular	869		894	MHz
CDMA2000 band class 3	JCDMA	843		870	MHz
CDMA2000 band class 0, SC3	New JCDMA	860		875	MHz
CDMA2000 band class 10	Secondary 800 MHz	851		869	MHz
Input VSWR (in-band)	100 Ω differential; ext match			2:1	---
LO to RF leakage (LNA in)					
All gain modes	In-band (F_{VCO}/4)			-85	dBm
All gain modes	Out-of-band (F_{VCO})			-57	dBm
LO to RF leakage (D'conv in)[1]	Differential				
High-gain mode	In-band (F_{VCO}/4)			-79	dBm
Low-gain mode	In-band (F_{VCO}/4)			-63	dBm
All gain modes	Out-of-band (F_{VCO})			-48	dBm
Jammer detection threshold[2]	100 Ω differential input		-50		dBm
Output load capacitance[3]	I and Q, each differential			8	pF
Noise figure[4]	Double sideband				
High-gain mode			8	10	dB
Low-gain mode			18	27	dB
Input IP3[5]					
High-gain mode		+5.0	7.5		dBm
Low-gain mode		-5.0	8		dBm
Input IP2[6]					
High-gain mode		+50			dBm
Low-gain mode		+30			dBm

PRX downcoverter specifciation listed above

Some low-band receiver performance specifications are listed as an example.

See the *RTR6500 Multiband CDMA RF Transceiver Device Specification* (80-VC467-1) for complete performance specifications – all modes, all bands, etc.

Example RTR6500 Transmitter Performance Specs

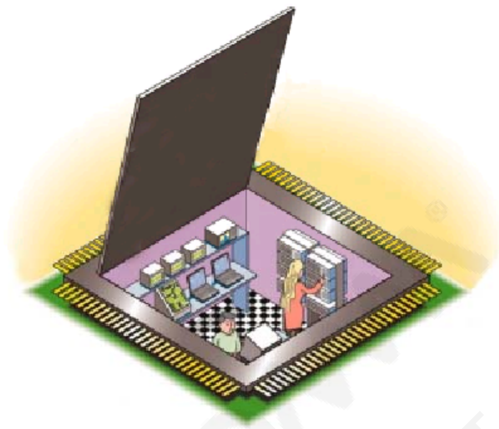
Parameter	Condition	Min	Typ	Max	Unit
RF output					
RF output frequency range					
CDMA2000 band class 0	Cellular	824		849	MHz
CDMA2000 band class 3	JCDMA	898		925	MHz
CDMA2000 band class 0, SC3	New JCDMA	815		830	MHz
CDMA2000 band class 10	Secondary 800 MHz	806		824	MHz
Maximum rated output power (P_{rated})[1]	Average channel power				
Low-current mode					
ACPR1 = -48.0 dBc/30 kHz		-3			dBm
ACPR1 = -42.5 dBc/30 kHz		-1			dBm
High-current mode					
ACPR1 = -48.0 dBc/30 kHz		+7			dBm
ACPR1 = -42.5 dBc/30 kHz		+9			dBm

Minimum output power	Average channel power				
Low-current mode	All band classes			-74	dBm
High-current mode	BC0, BC10			-61	dBm
High-current mode	BC3			-53	dBm
Driver amplifier isolation	Isolation between output pins	21			dB
Power detector isolation	Output pin to PWR_DET_IN	30			dB
Output VSWR	50 Ω nominal, external match		2:1		–
Baseband-to-RF signal path					
Gain flatness over frequency		-1.5		1.5	dB
ACPR1[1]					
±885 kHz offsets					
Low-current mode					
P_{out} = -3 dBm				-48	dBc/30 kHz
P_{out} = -1 dBm				-42.5	dBc/30 Hz
High-current mode					
P_{out} = +7 dBm				-48	dBc/30 kHz
P_{out} = +9 dBm				-42.5	dBc/30 Hz
ACPR2[1]					
±1.98 MHz offsets					
Low-current mode					
P_{out} = -3 dBm				-63	dBc/30 kHz
P_{out} = -1 dBm				-54.5	dBc/30 Hz
High-current mode					
P_{out} = +7 dBm				-63	dBc/30 kHz
P_{out} = +9 dBm				-54.5	dBc/30 kHz
In-band spurious signals					
Cellular band (BC0), 2nd 800 band	Offset > 4 MHz, 100 kHz BW			-43	dBm
Secondary 800 MHz band (BC10)	1.25 MHz ≤ offset ≤ 4 MHz, 30 kHz BW			-43	dBm
JCDMA band (BC3)	Offset > 1.98 MHz, 30 kHz BW			-60	dBc
New JCDMA band (BC0, SC3)	Offset > 4 MHz, 100 kHz BW			-43	dBm

Some low band transmitter performance specifications are listed as an example.

See the *RTR6500 Multiband CDMA RF Transceiver Device Specification* (80-VC467-1) for complete performance specifications – all modes, all bands, etc.

RTR6500 Questions?

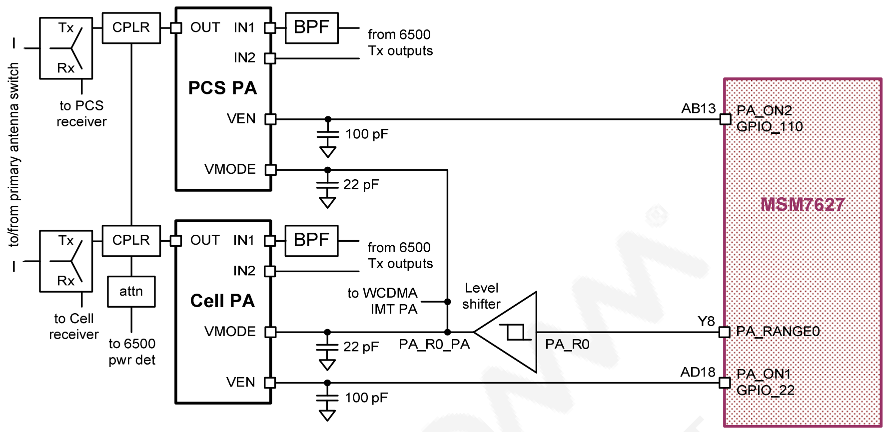


- **Questions can also be submitted via service requests:** **https://support.cdmatech.com**

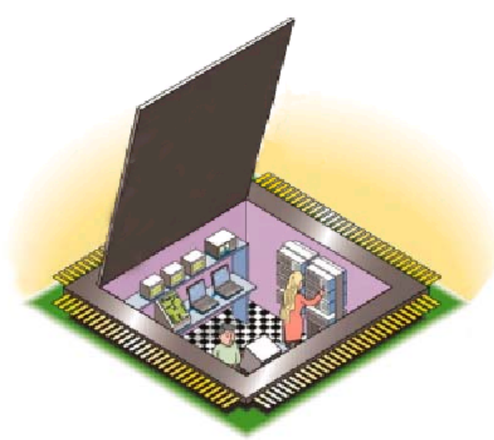
RF Status and Controls – Group 1 of 2

- **RTR6500 IC – see earlier pages within this section of slides**
- **TCXO controls – see pages within the RF Subsystem slides**

RF Status and Control – Group 2 of 2



Questions?



Multimode Configuration

- **Conventions used**
  - **2G multimode: CDMA + GSM**
  - **3G multimode: CDMA + WCDMA/UMTS + GSM**
- Naming conventions
  - Rename external document (reference schematic) title to reflect the band configuration supported.
  - For example, *UCG124 3G Multimode FTS-3: Using MSM7600TM/MSM7625TM with RTR6500 and RTR6285 Reference Schematic* (80-VC467-46)

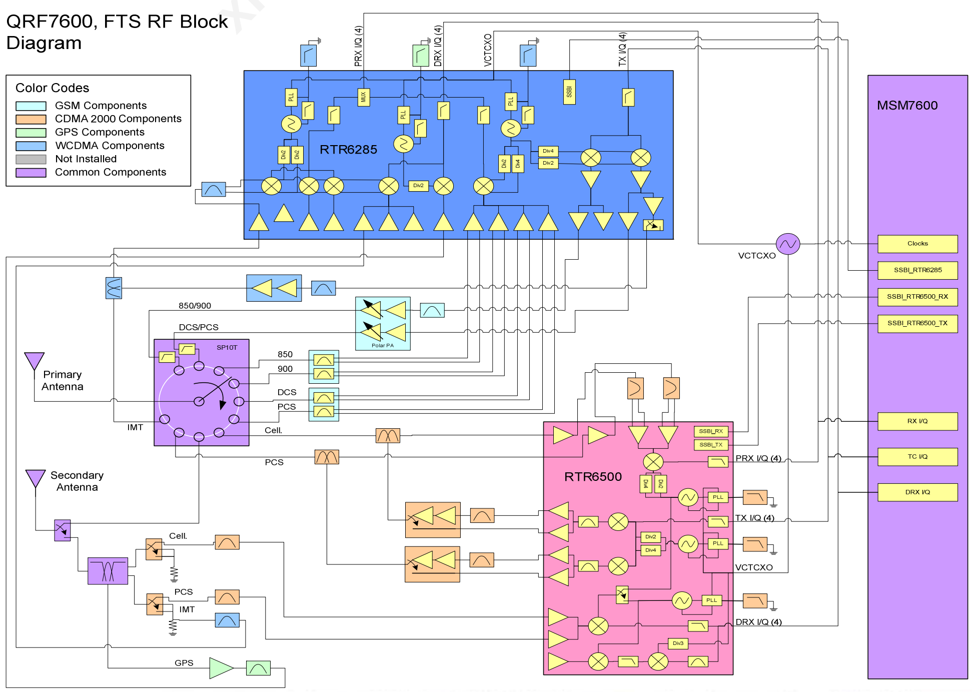
    U -> UMTS/WCDMA band (U - > 1)

    C -> CDMA (C -> 2)

    G -> GSM (G -> 4)

    124 - > # of bands supported in U/C/G respectively

QRF7600 FFA Block Diagram



QRF7600 FFA Band Support

- 3G multimode configuration
  - 1X/GSM/UMTS/EVDO.A/EDGE/GPRS/EGPRS/S-GPS
- Chipset involved
  - MSM7600 device
  - RTR6500 device with diversity enabled
  - RTR6285 devicewith diversity enabled
  - PM7540 device
- Band configuration
  - Dual-band CDMA (1X, EV-DO Rev.A, SHDR)
    - U.S. cell band – BC0
    - U.S. PCS – BC1
  - Quad-band GSM (GPRS and EGPRS)
    - GSM 850
    - GSM 900
    - DCS 1800
    - PCS 1900
  - Single-band UMTS/WCDMA
    - UMTS IMT 2100 – B1
  - GPS
    - S-GPS MUST be through the RTR6285 device
- Supports PA bypass on the RTR6500 device
- Please refer to: *UCG124 3G Multimode FTS-3: MSM7600/MSM7625 with RTR6500 and RTR6285 Reference Schematic* (80-VC467-46).

UCG424 3G MM Configuration

- 3G multimode configuration
  - 1X/GSM/UMTS/EVDO.A/EDGE/GPRS/EGPRS/S-GPS – “Concept ONLY”, not a reflection of Qualcomm FFA
- Chipset involved
  - MSM76XX™ device
  - RTR6500 device with diversity enabled; supports PA bypass
  - RTR6285 device with diversity enabled
  - PM7540 device
- Band configuration
  - Dual-band CDMA (1X, EV-DO Rev.A, SHDR)
    - U.S. cell band – BC0
    - U.S. PCS – BC1
  - Quad-band GSM (GPRS and EGPRS)
    - GSM 850
    - GSM 900
    - DCS 1800
    - PCS 1900
  - Quad-band UMTS/WCDMA (2H/2L)
    - UMTS IMT – B1
    - UMTS PCS – B2
    - UMTS cell – B5/6
    - UMTS 900 – B8
  - GPS
    - S-GPS MUST be through the RTR6285 device
- Please refer to: *UCG424 FTS-3 for MSM7K 3G Multimode Phone using RTR6500 and RTR6285 (Concept Only) Design Example* (80-VC467-47).

HMA Implementation for US (non-Verizon) Carriers

- For all EVDO-capable devices intended for the US market (except Verizon), hybrid mode alternative (HMA) configuration must be included in the design implementation.
- HMAs include:
  - FTS (full-time SHDR)
  - Or DCM (dedicated C2K mode)
  - Or HHO (HDR hybrid-off)
- Please refer to *Documentation Definition for HMA README* (80-VH591-9) for a list of HMA documents to begin with when working on an HMA design.

Questions?