Moto G (3rd Generation)
TROUBLESHOOTING GUIDE

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ANTENNA AND ANTENNA FEED LOCATIONS

Antenna:
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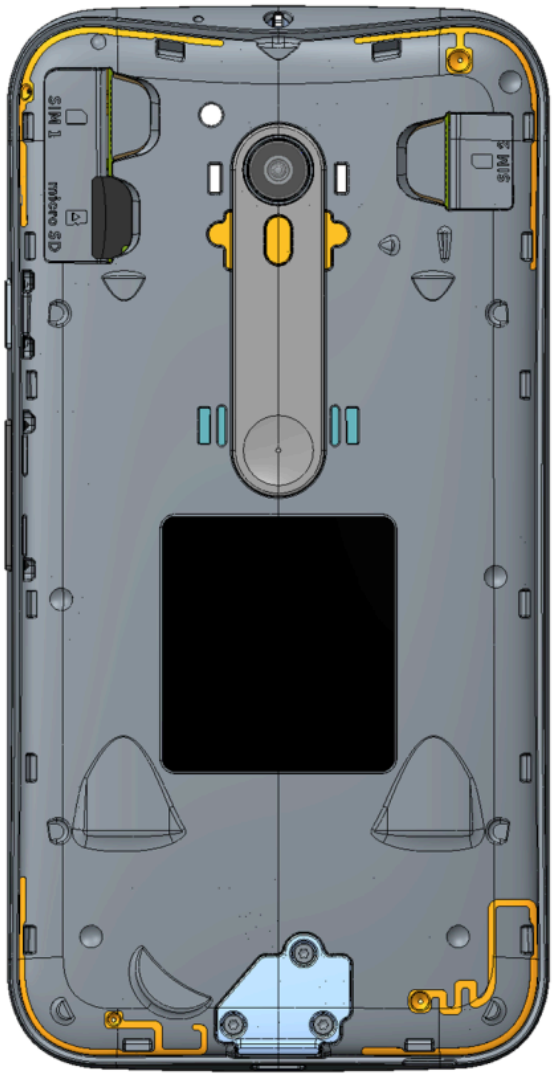


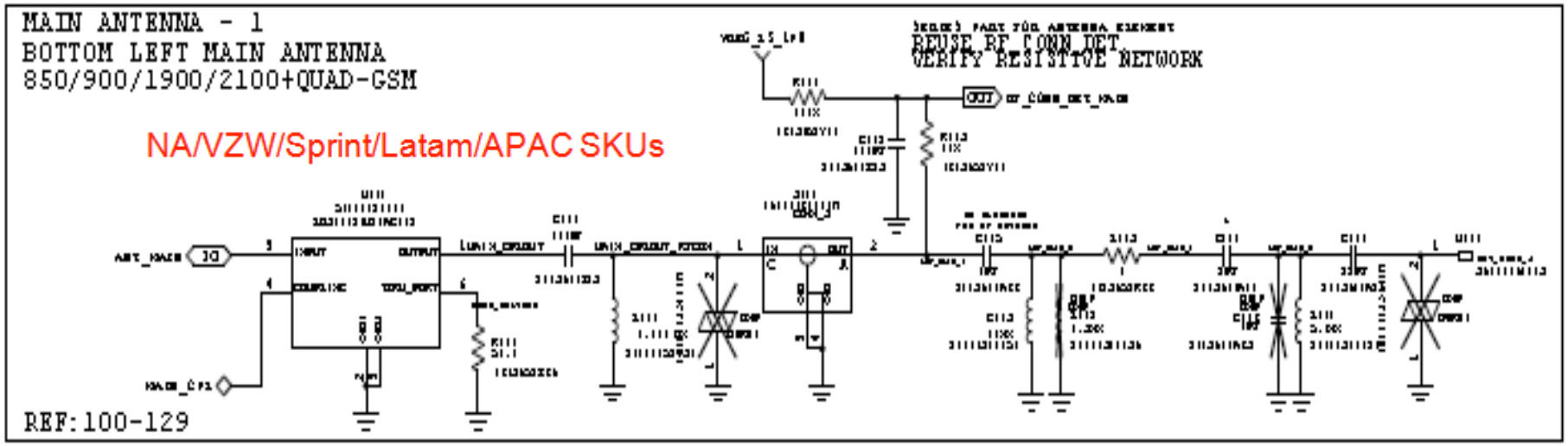
Antenna: Diversity

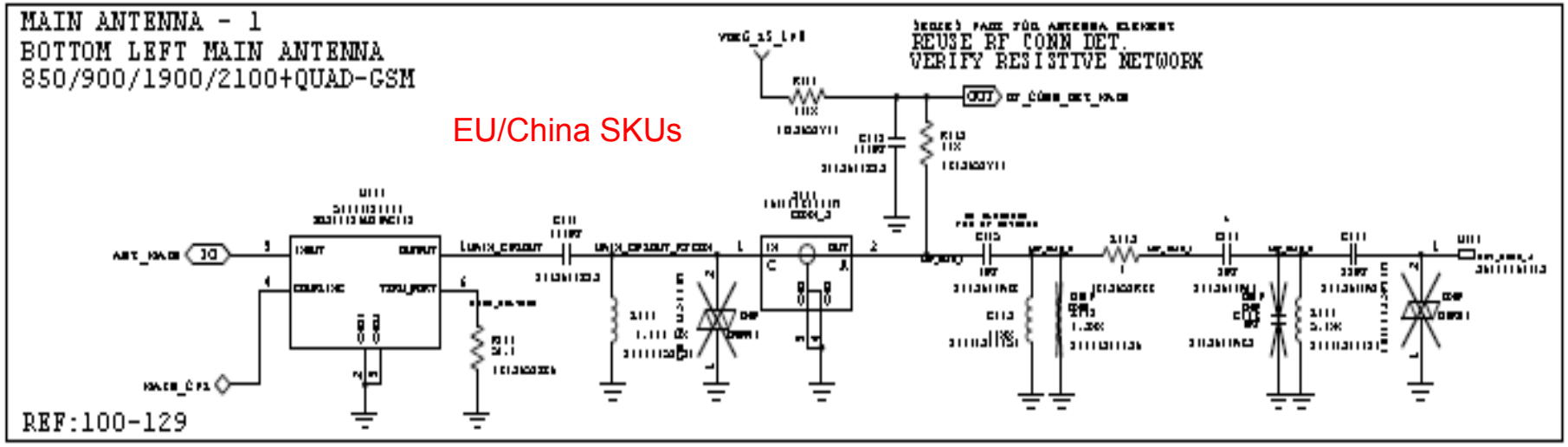
Callisto Antenna

Antenna: Main 1

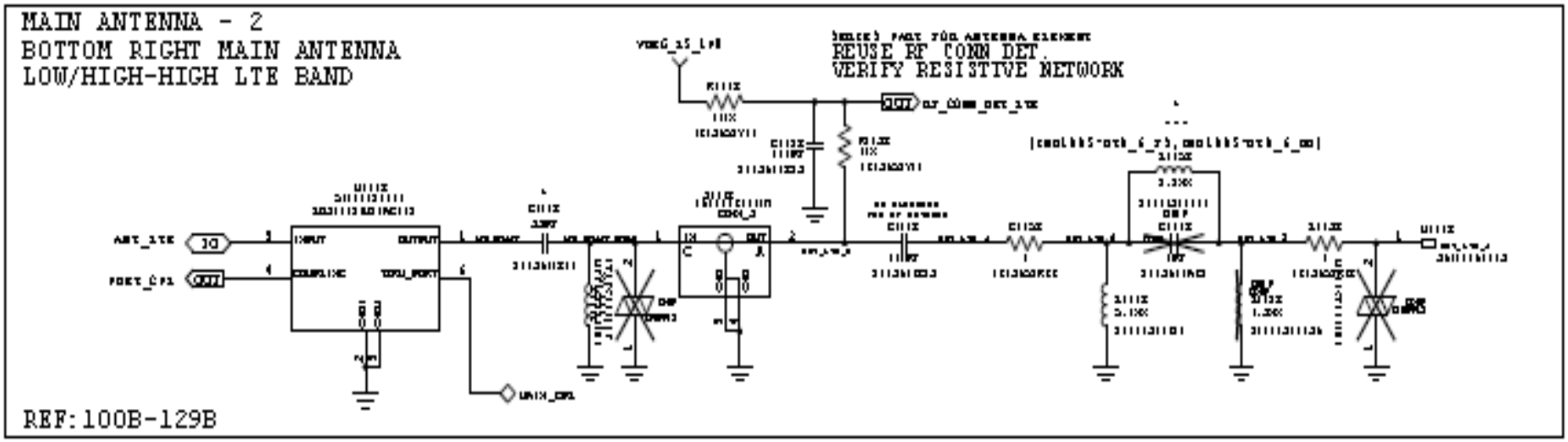
Antenna: LTE

MAIN ANTENNA (LTE/WCDMA/CDMA/GSM) MATCHING CIRCUIT



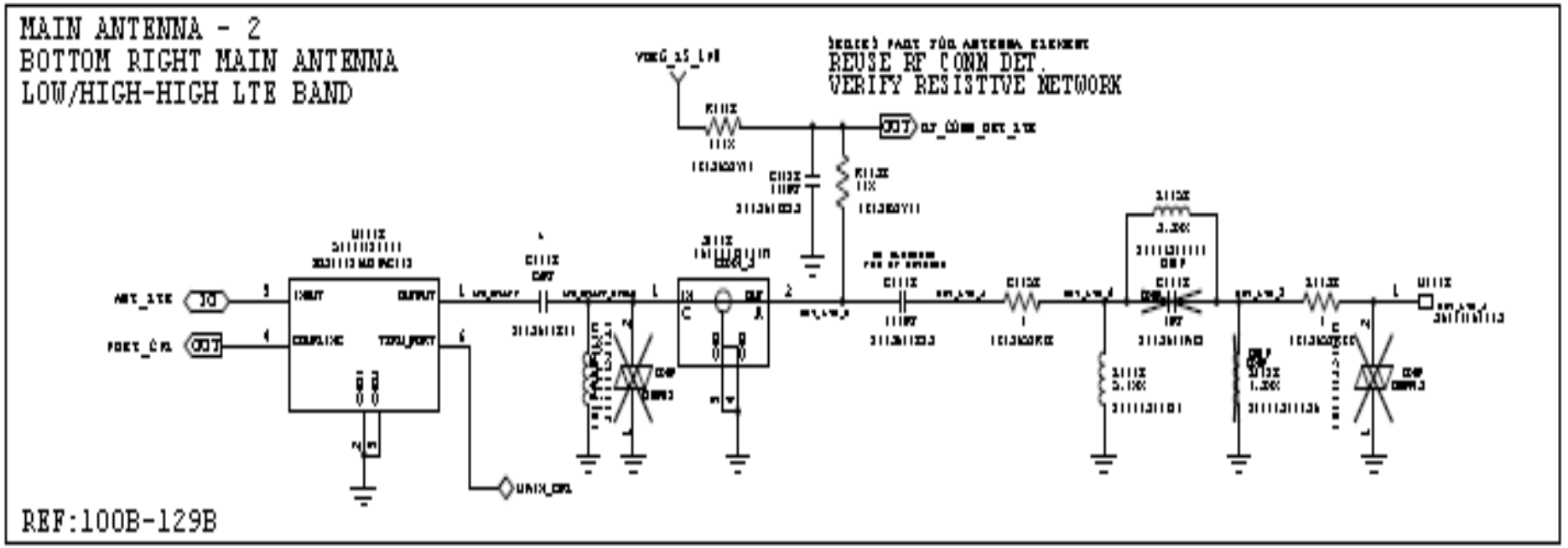


LTE ANTENNA MATCHING CIRCUIT



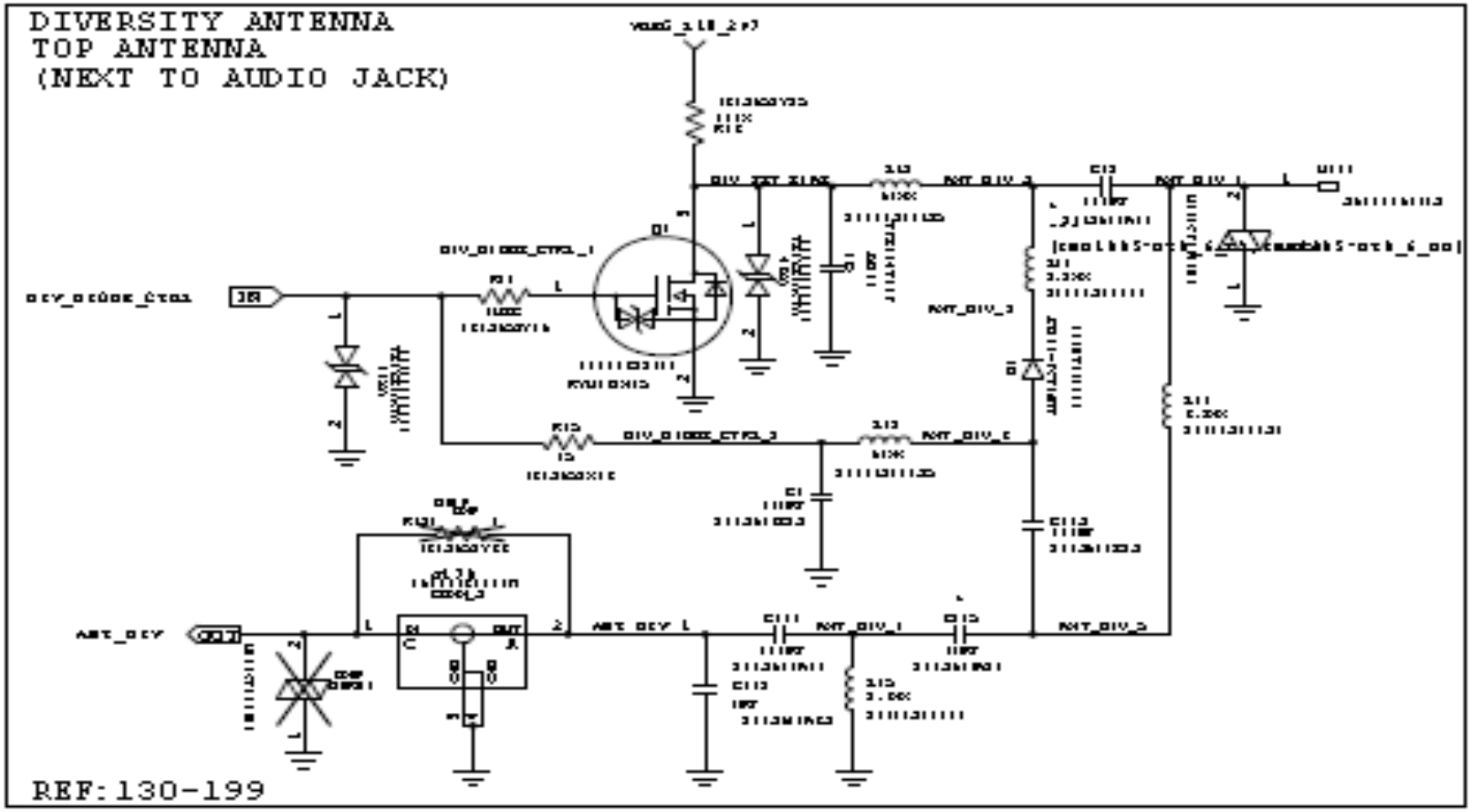
NA/VZW/Sprint/Latam/APAC SKUs

LTE ANTENNA MATCHING CIRCUIT



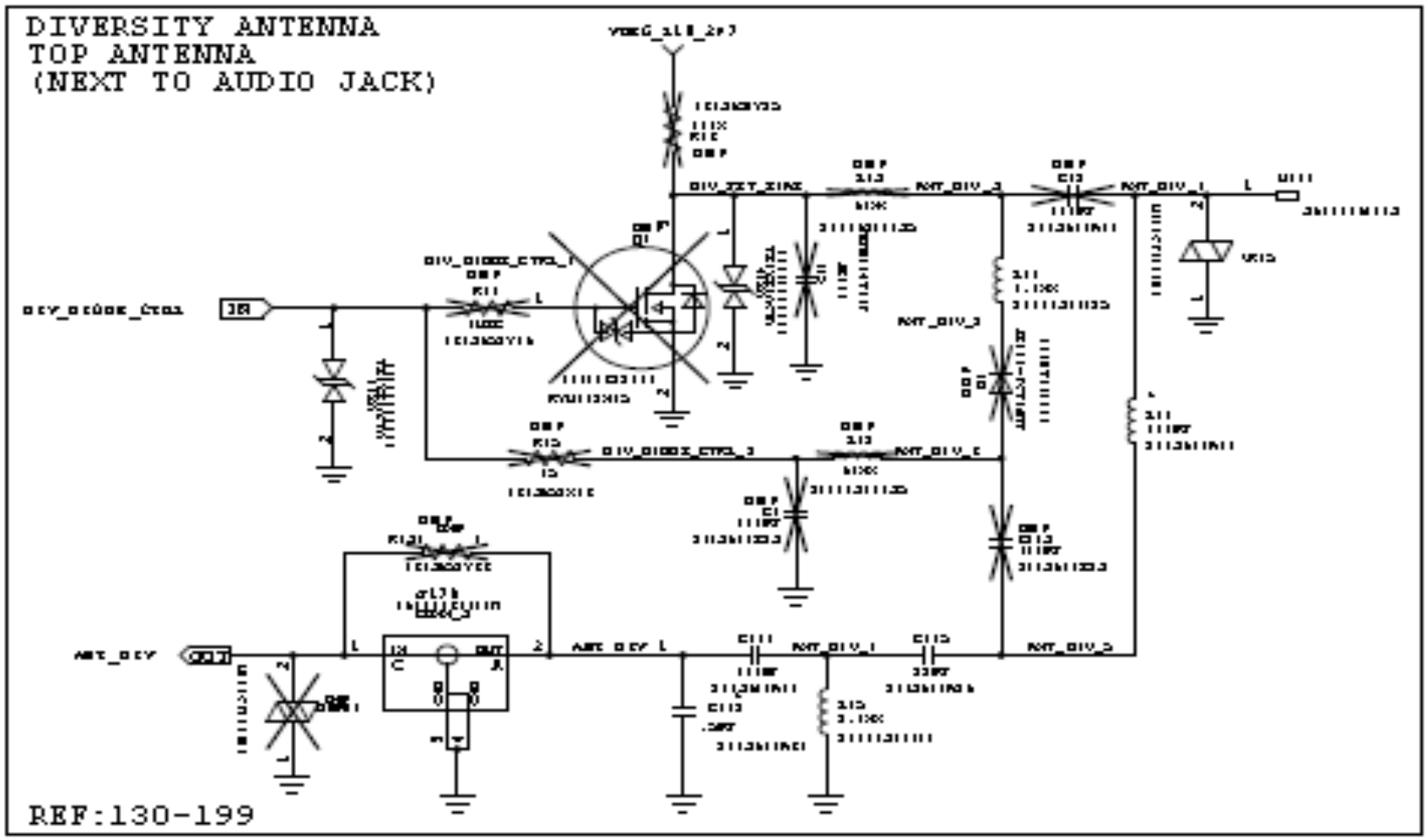
EU/China SKUs

DIVERSITY ANTENNA (LTE/WCDMA/CDMA) MATCHING CIRCUIT



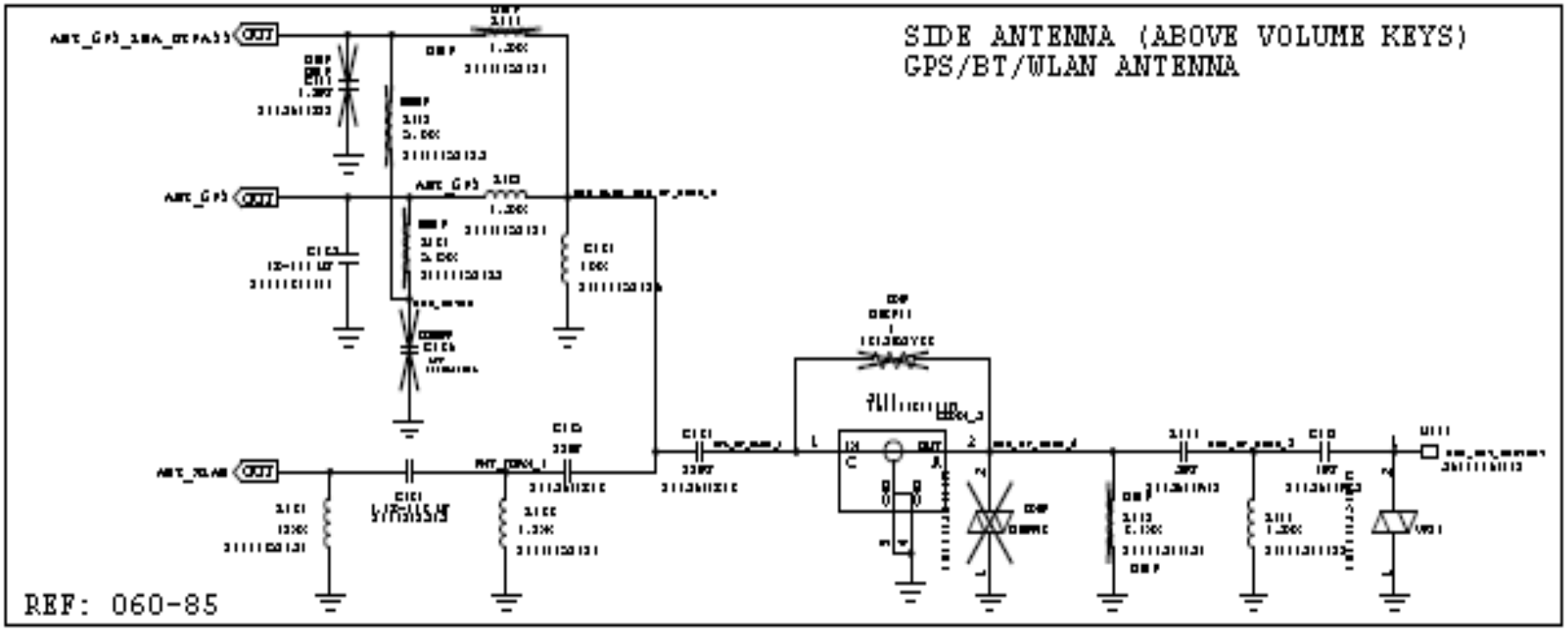
NA/VZW/Sprint/Latam/APAC SKUs

DIVERSITY ANTENNA (LTE/WCDMA/CDMA) MATCHING CIRCUIT



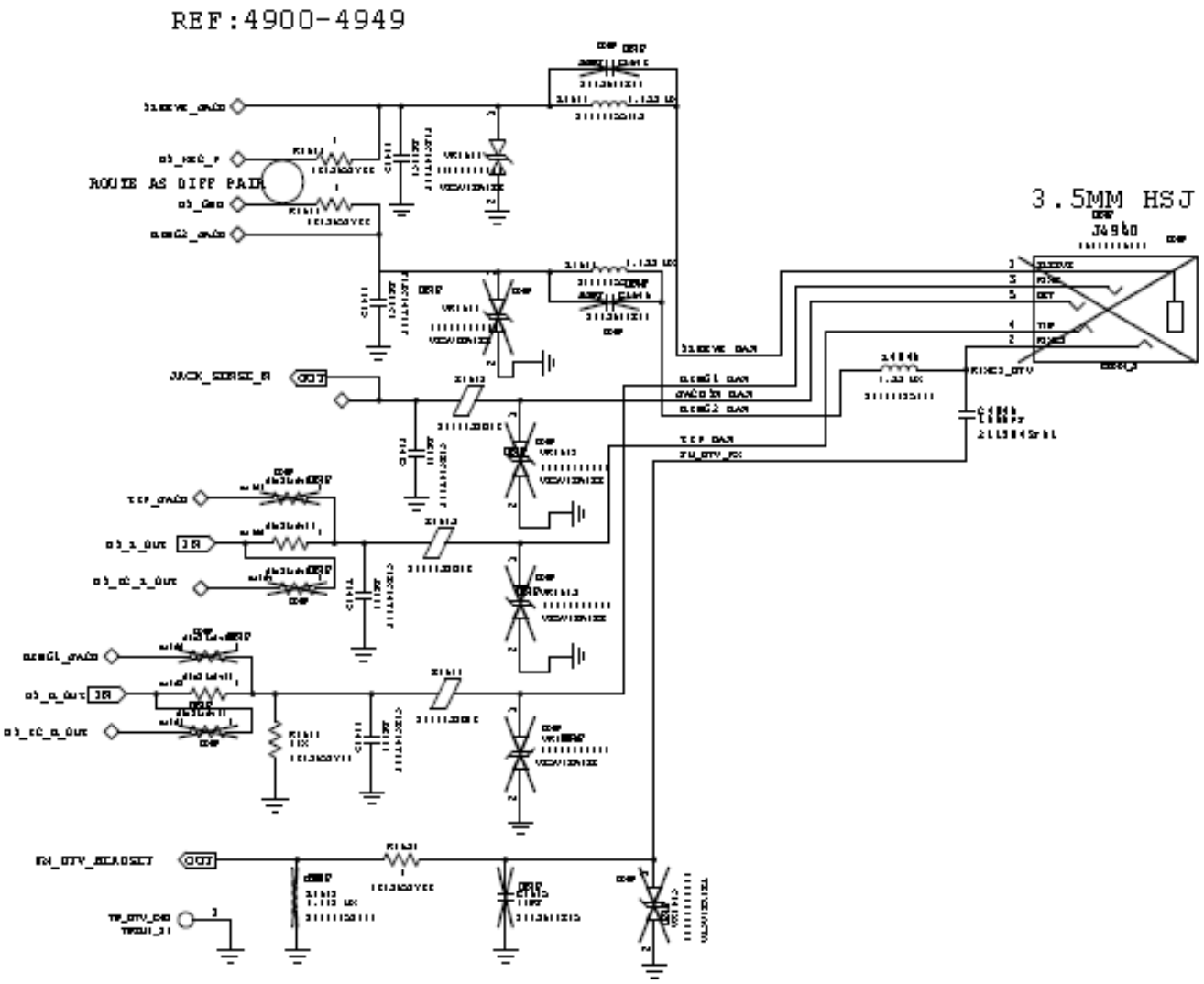
EU/China SKUs

GPS/WIFI/BT MATCHING CIRCUIT



All SKUs

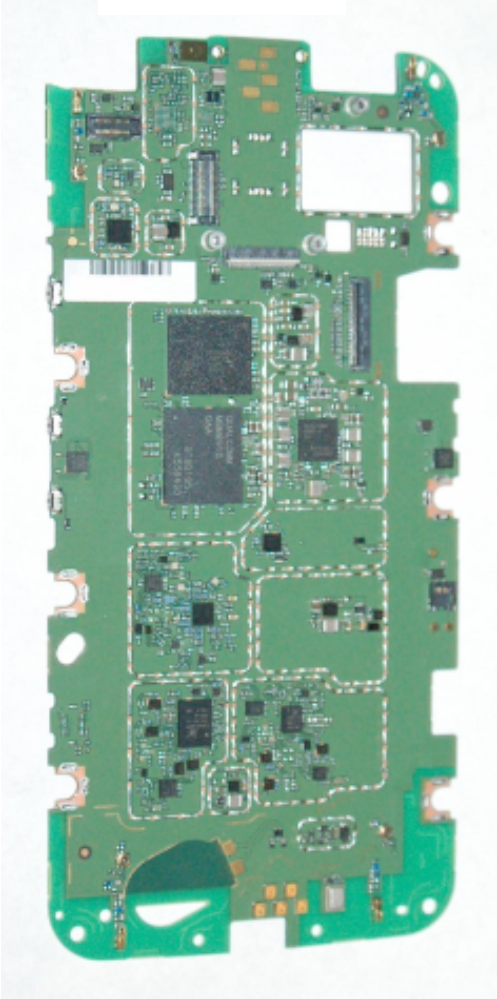
FM MATCHING CIRCUIT



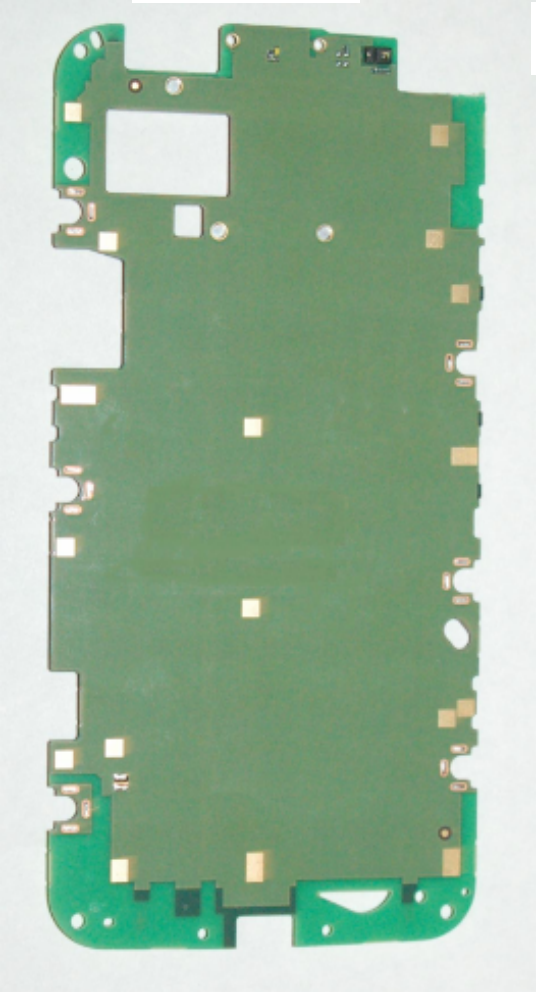
SNAPSHOTS OF MAIN BOARD

Snapshots of Main PCB / Daughter Board – Top and Bottom

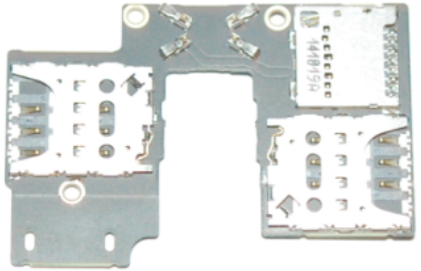
Top Side
(Battery side)



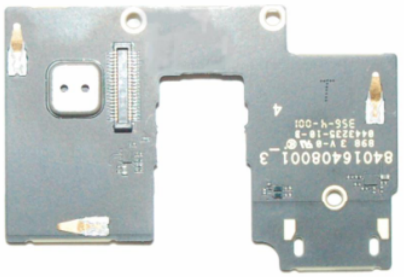
Bottom Side
(Display side)



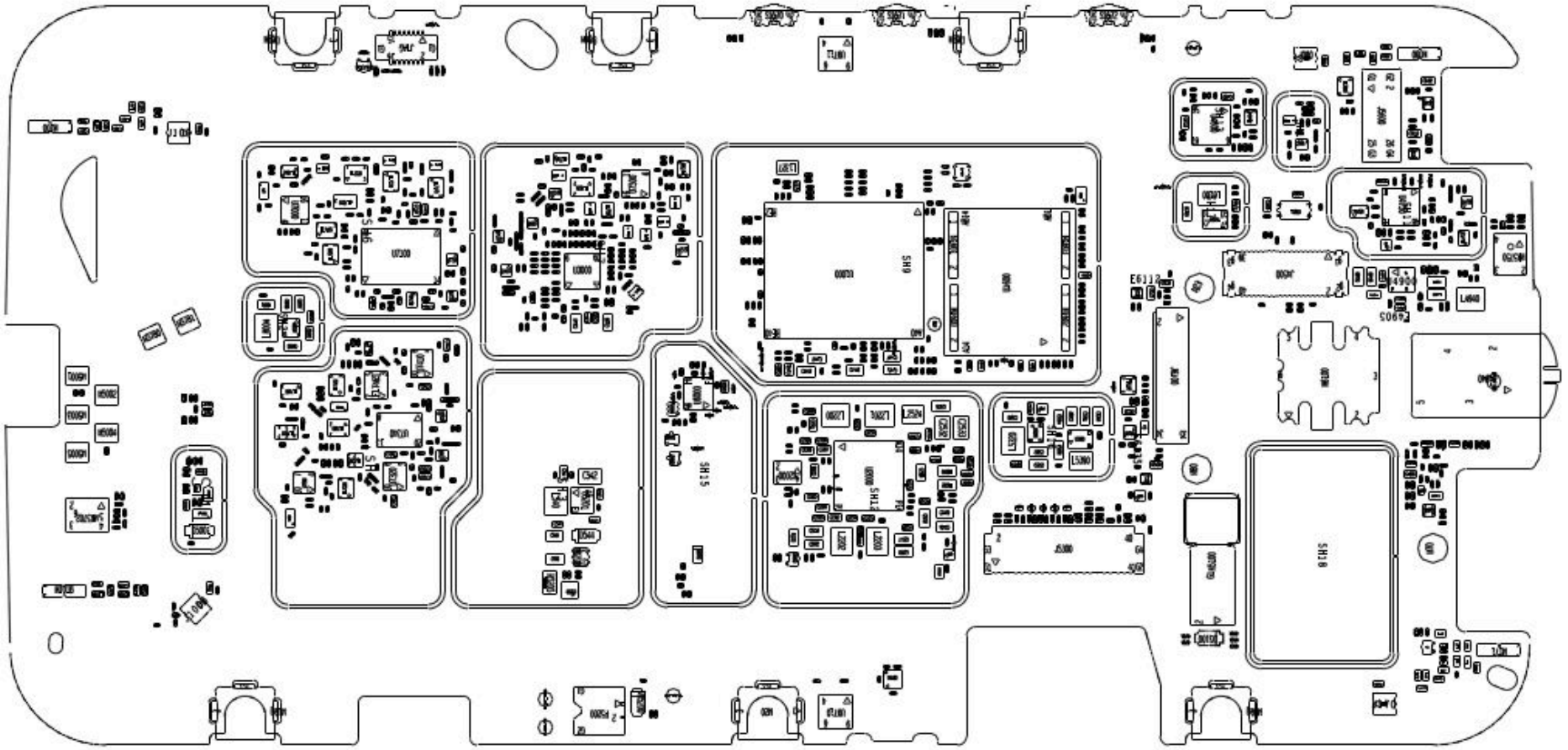
Daughter Board
(Top Side)



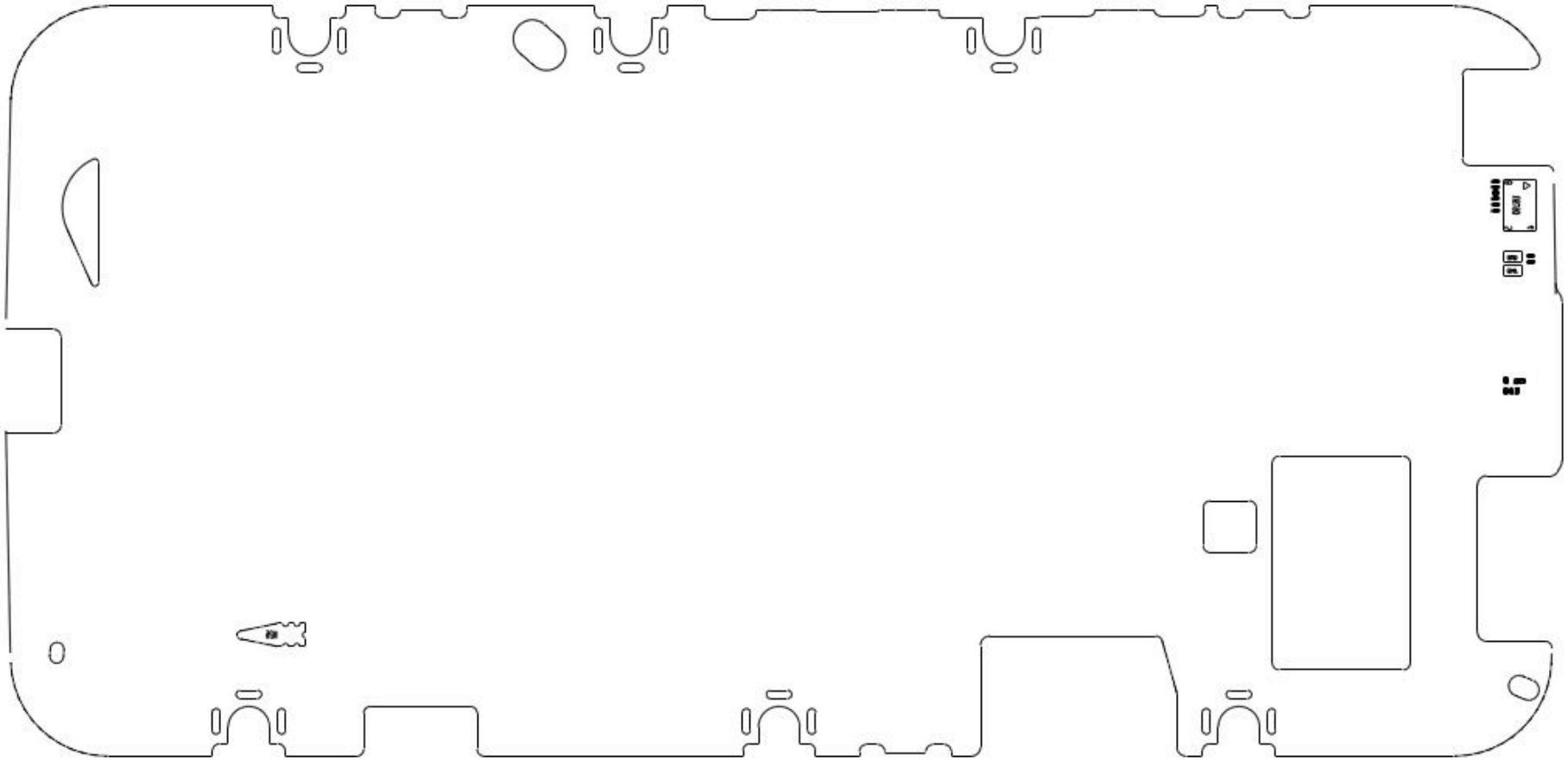
Daughter Board
(Bottom Side)



Main Board – Top Placement

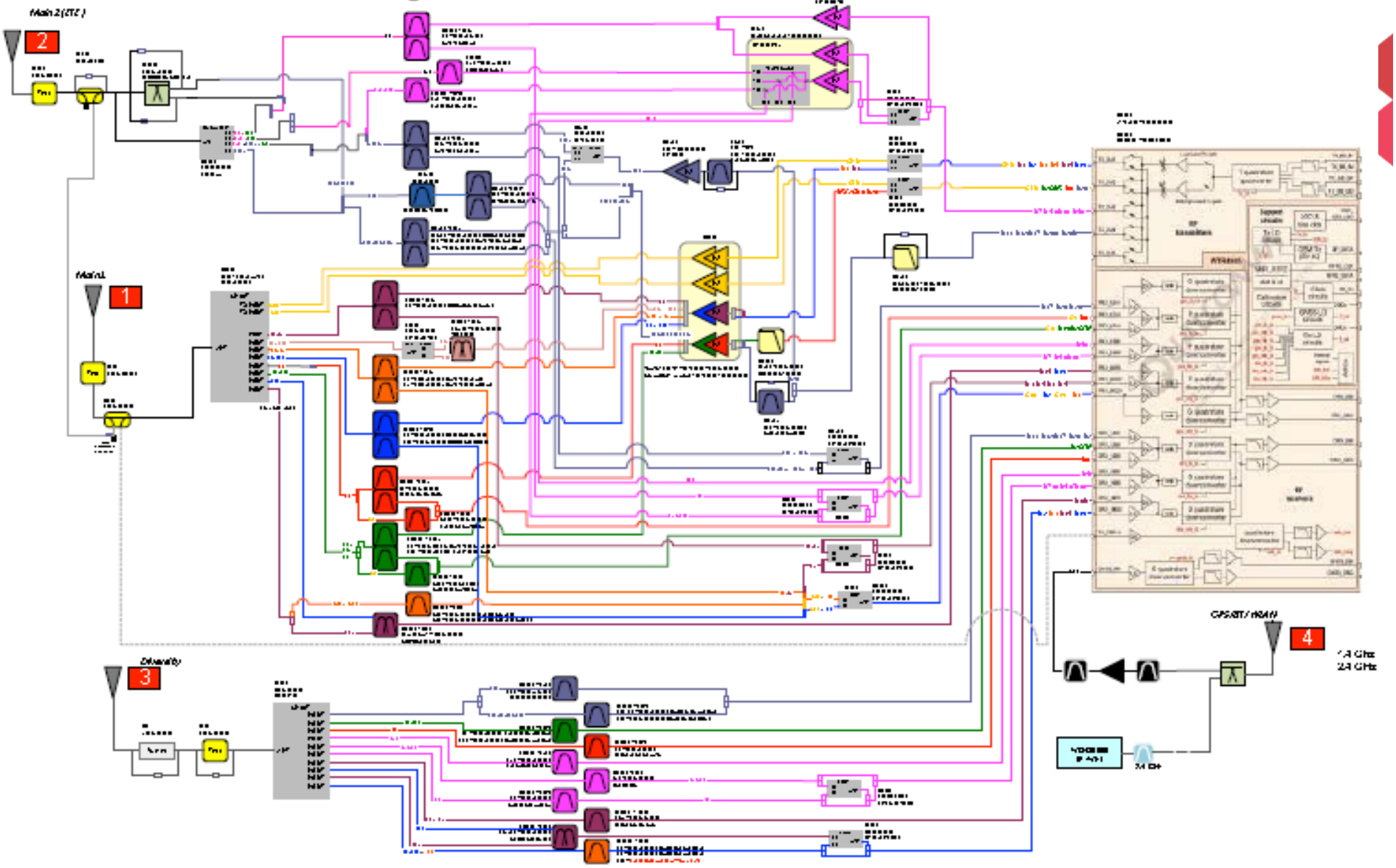


Main Board – Bottom Placement

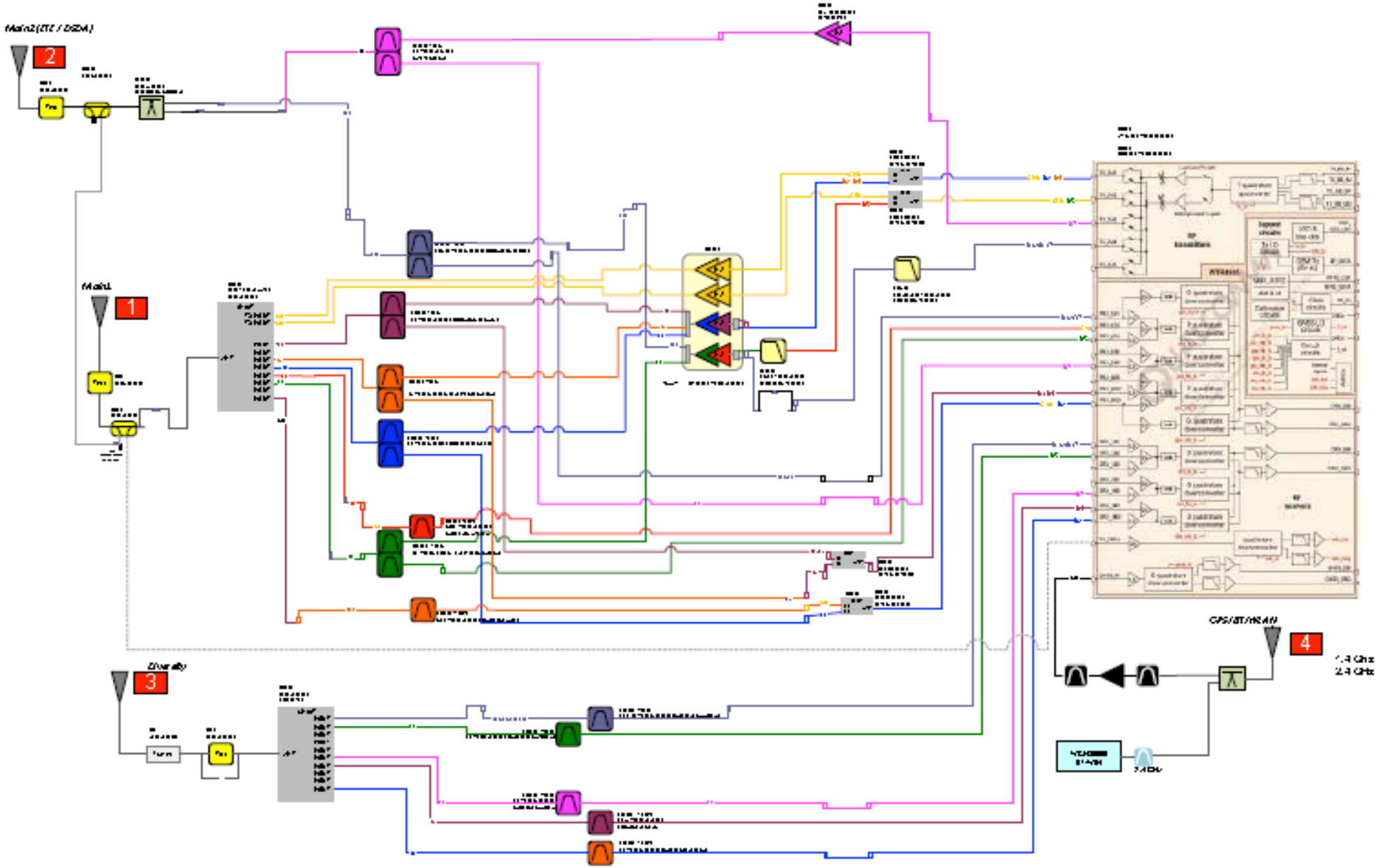


LTE / WCDMA / CDMA / GSM TROUBLESHOOTING

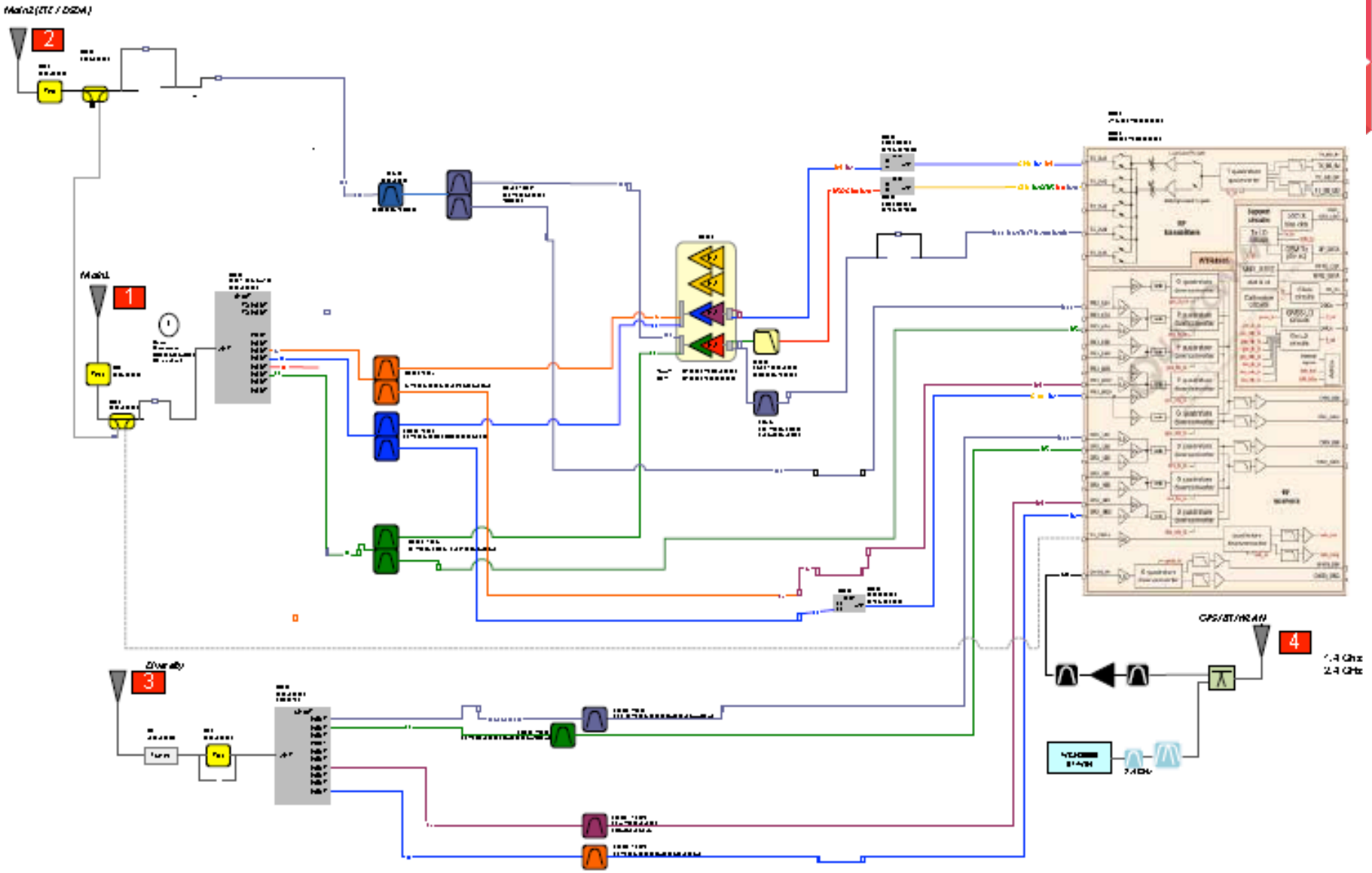
Master Block Diagram



North America SKU Block Diagram



VZW SKU Block Diagram



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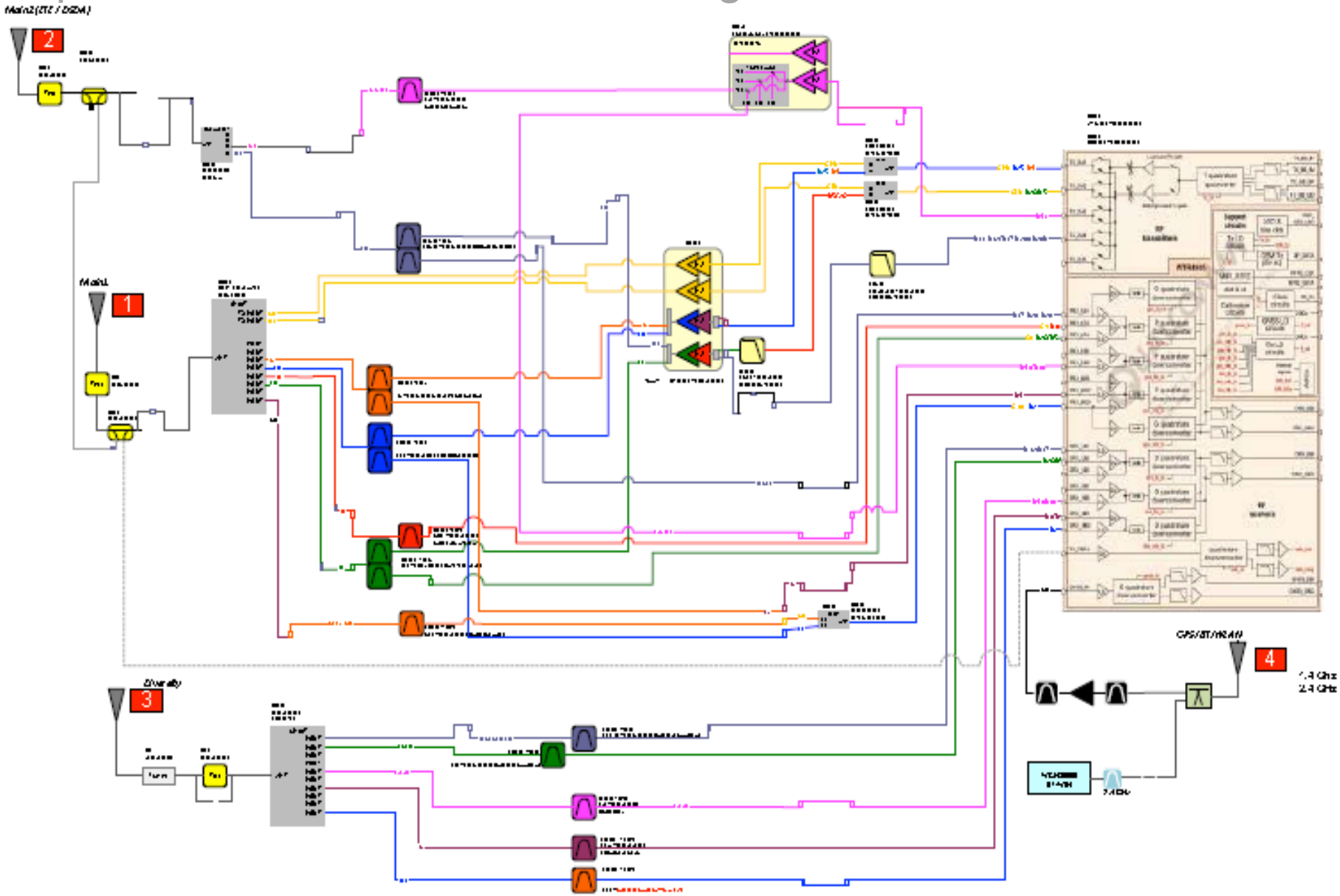

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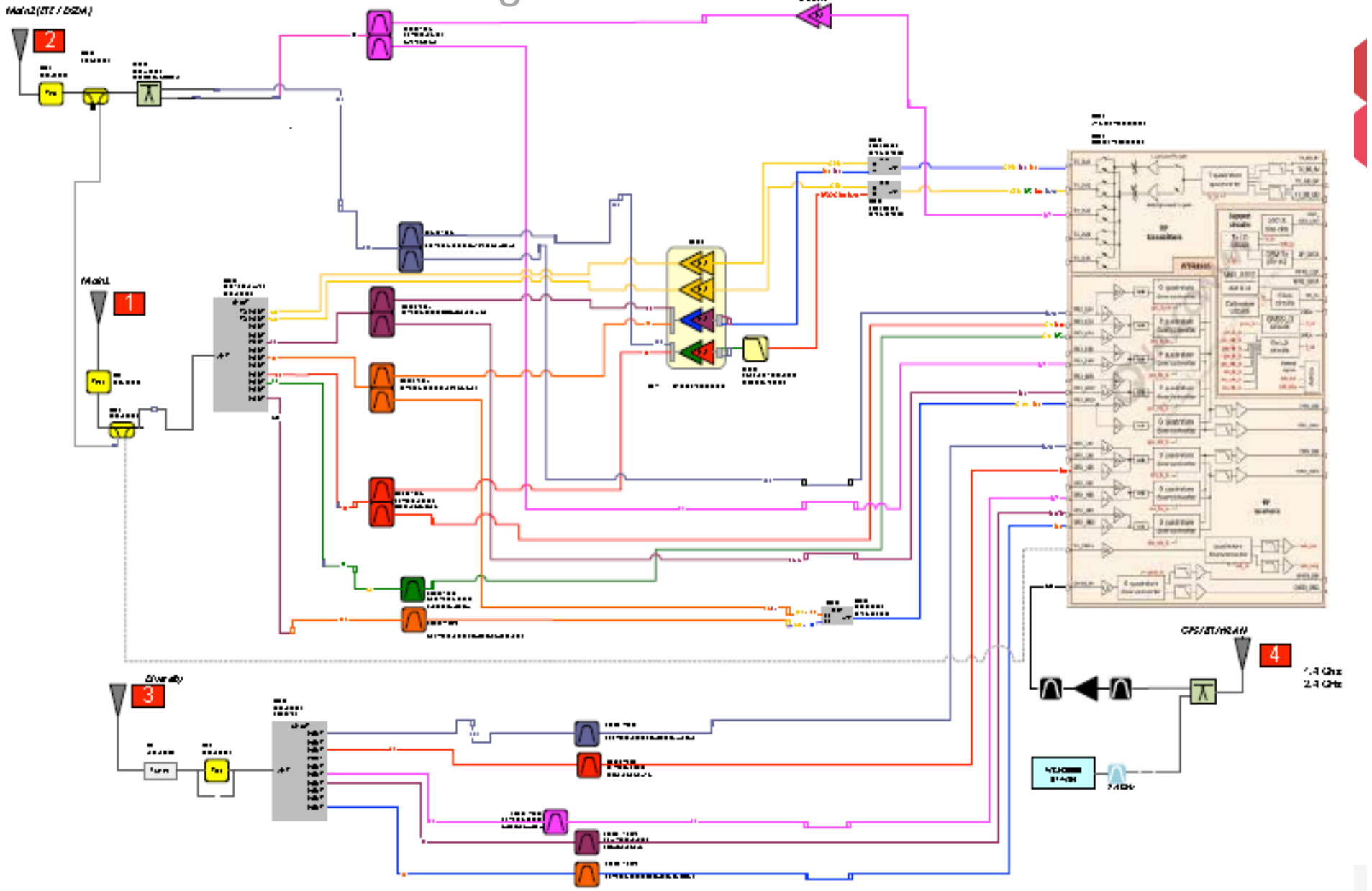
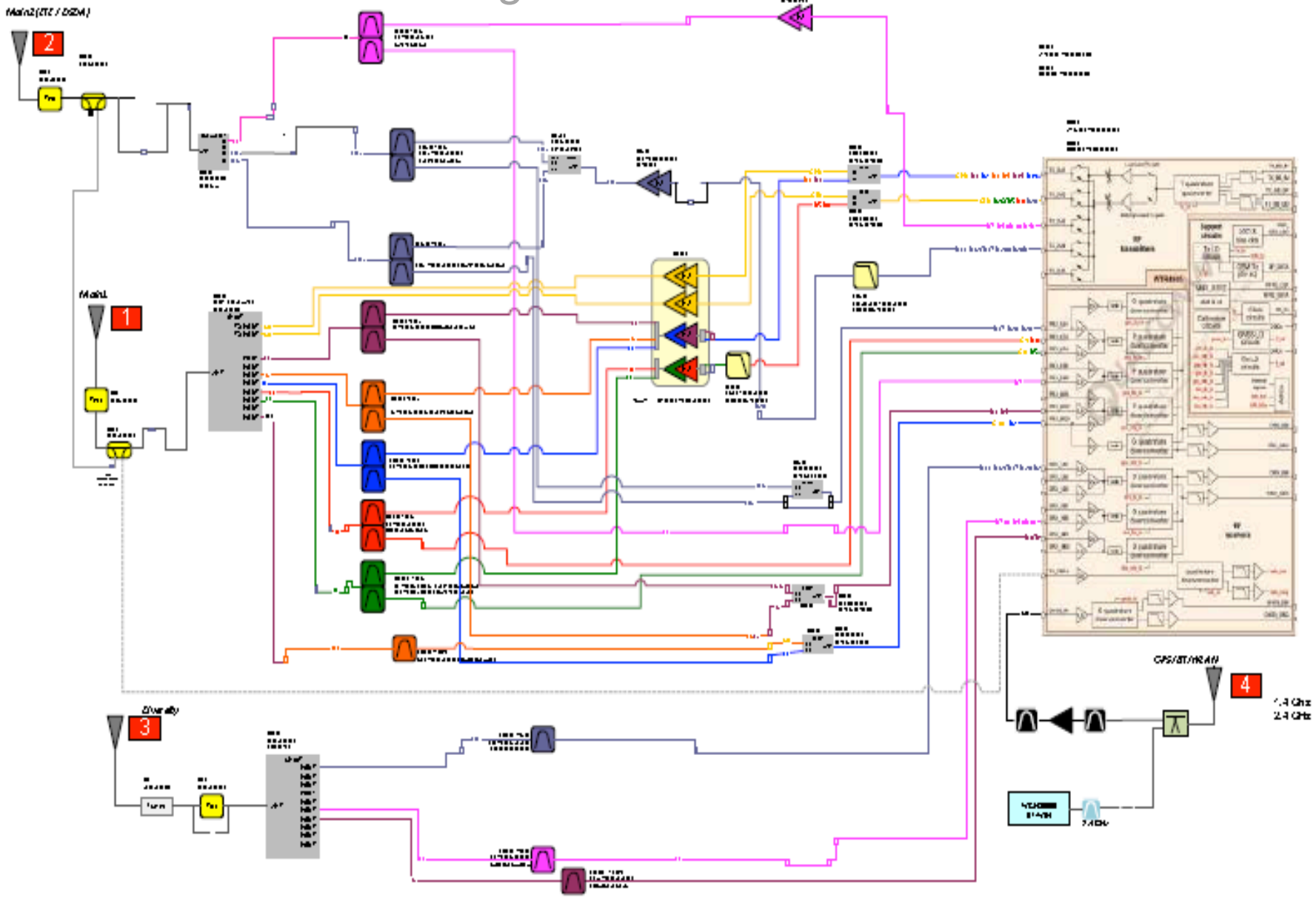


LATAM SKU Block Diagram



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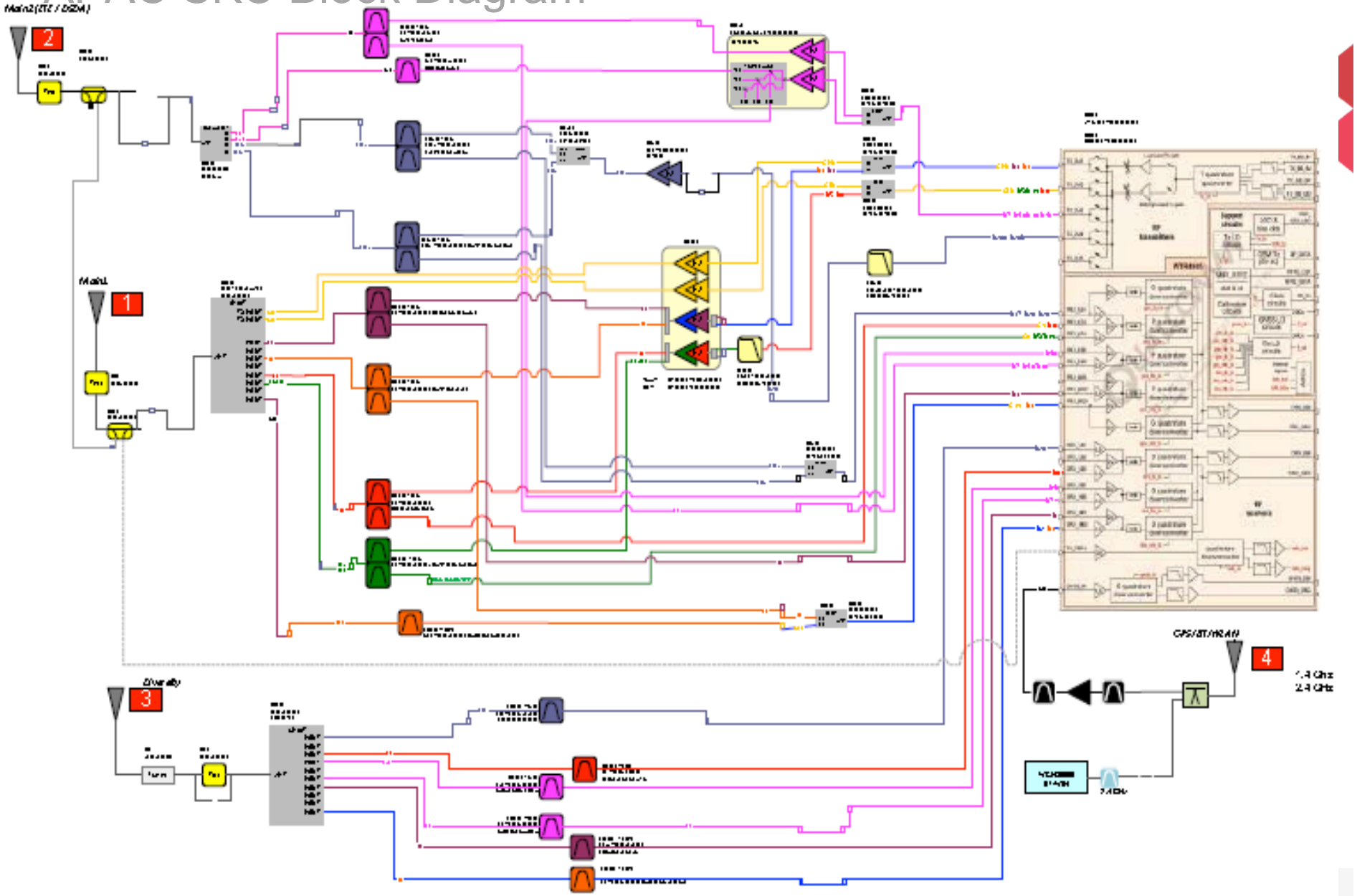
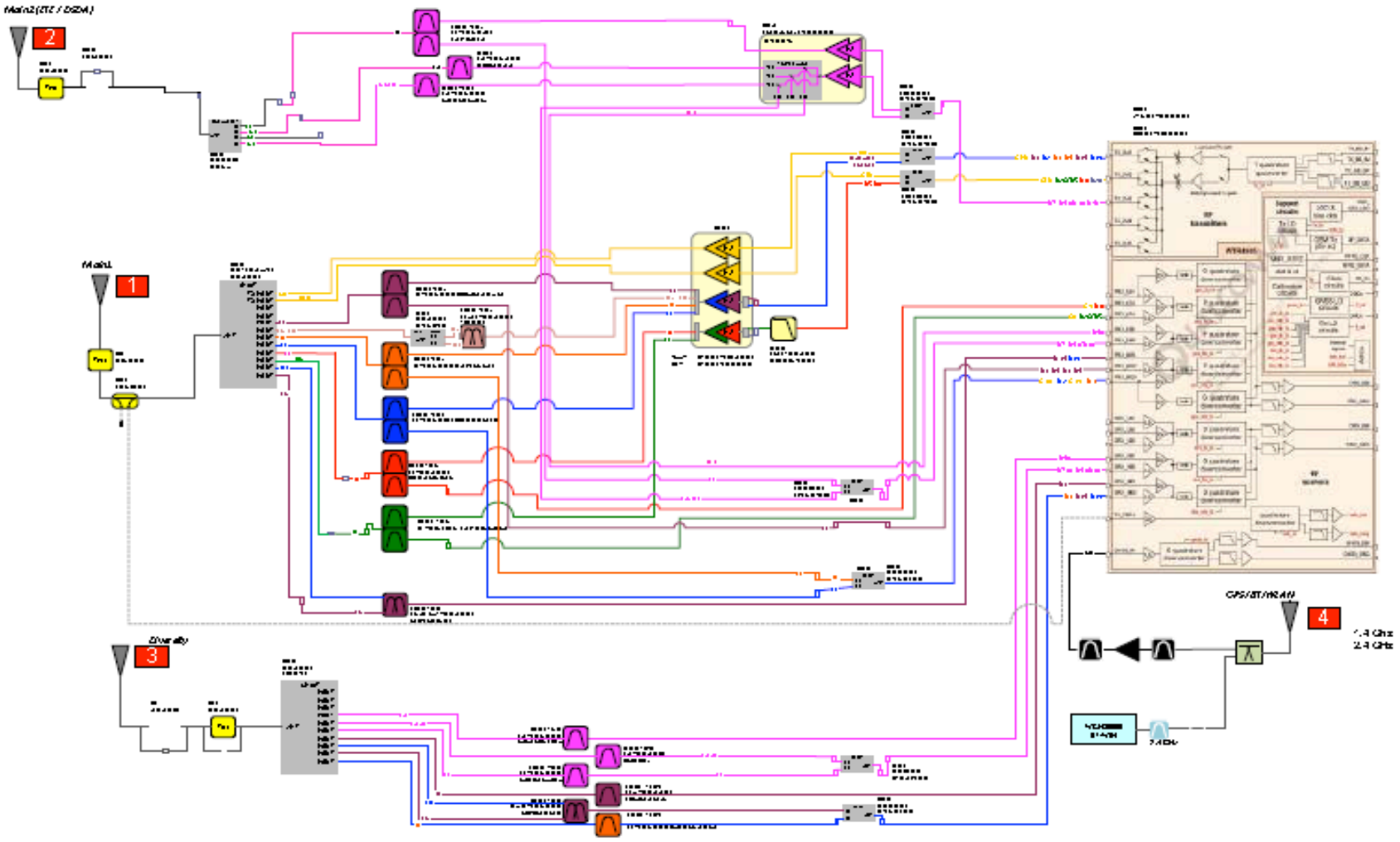
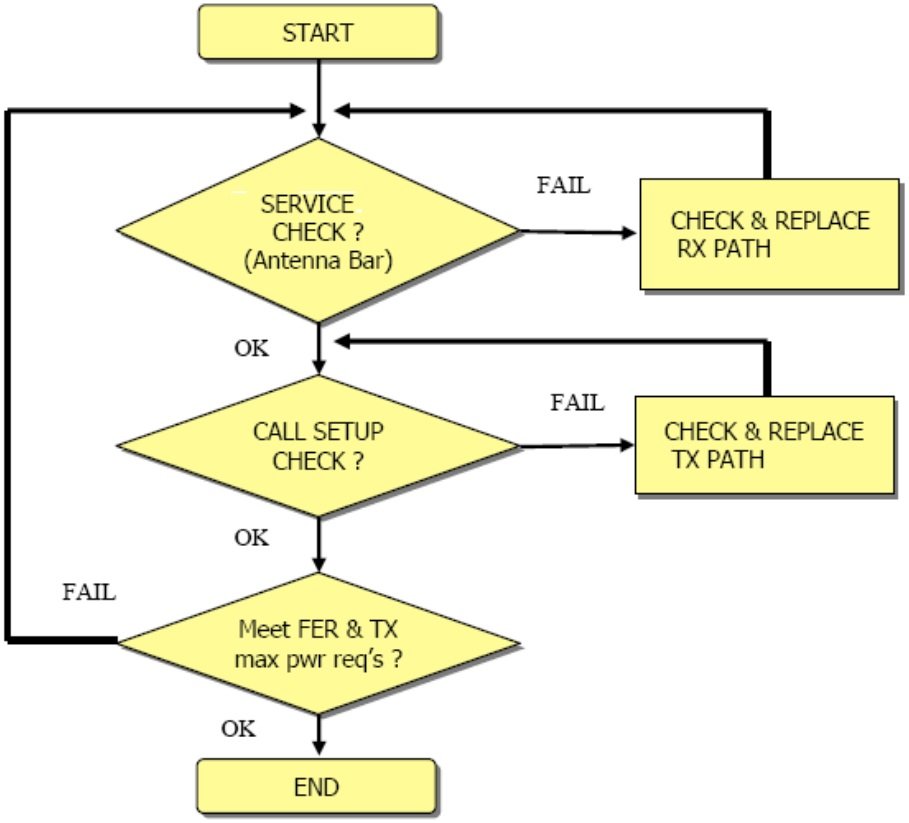


China CDMA SKU Block Diagram

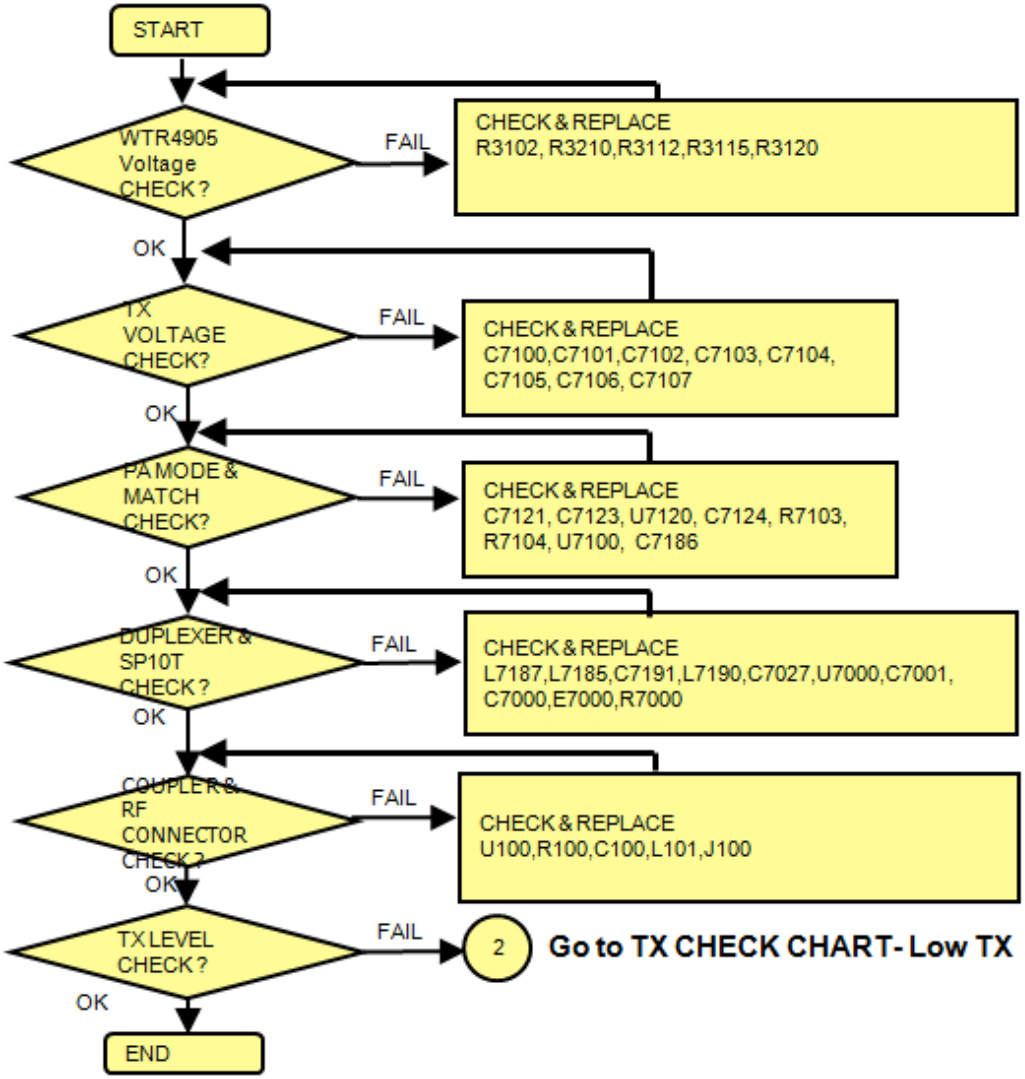


LTE/WCDMA/CDMA/GSM RADIO CHECK

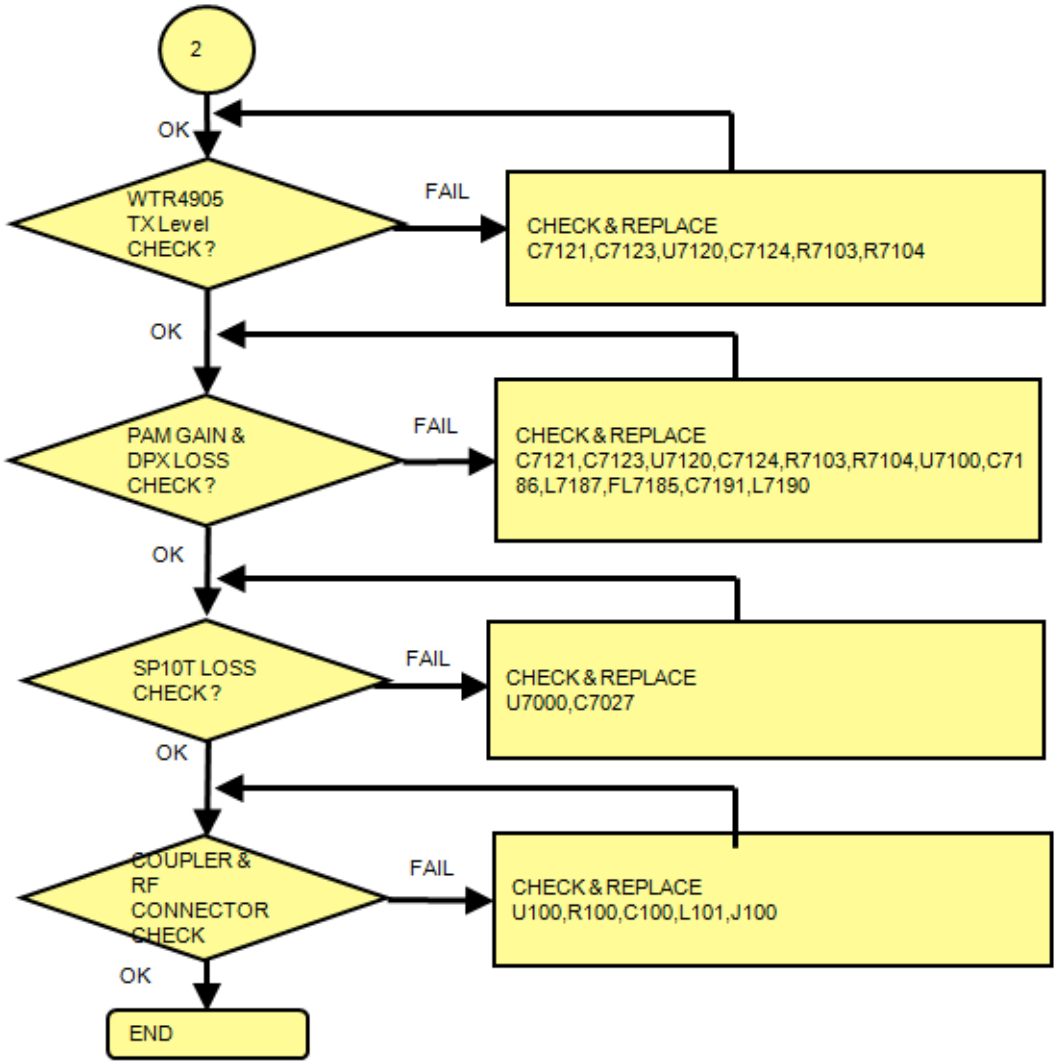


WCDMA B1 Tx and Rx

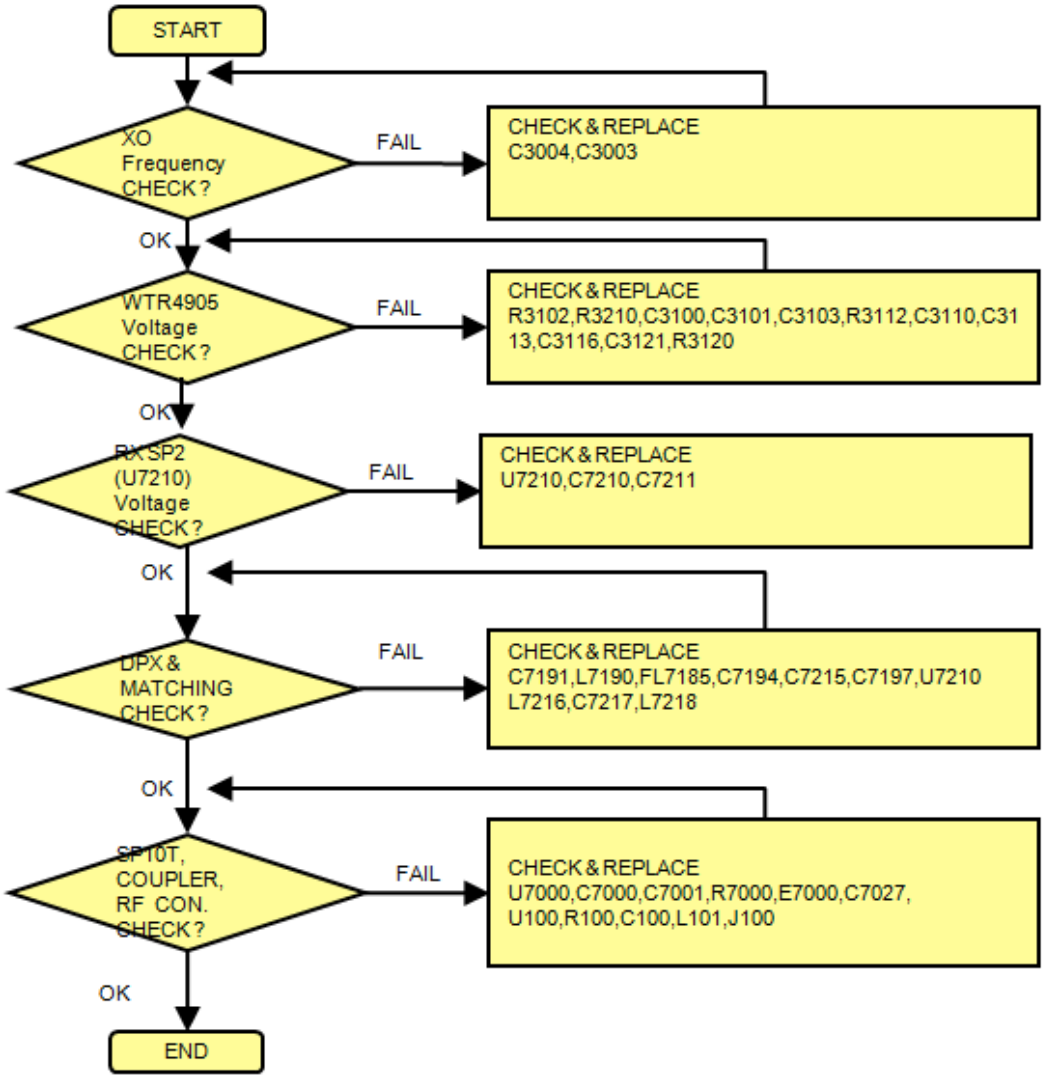
LTE/WCDMA B1 TX Check Chart – No TX



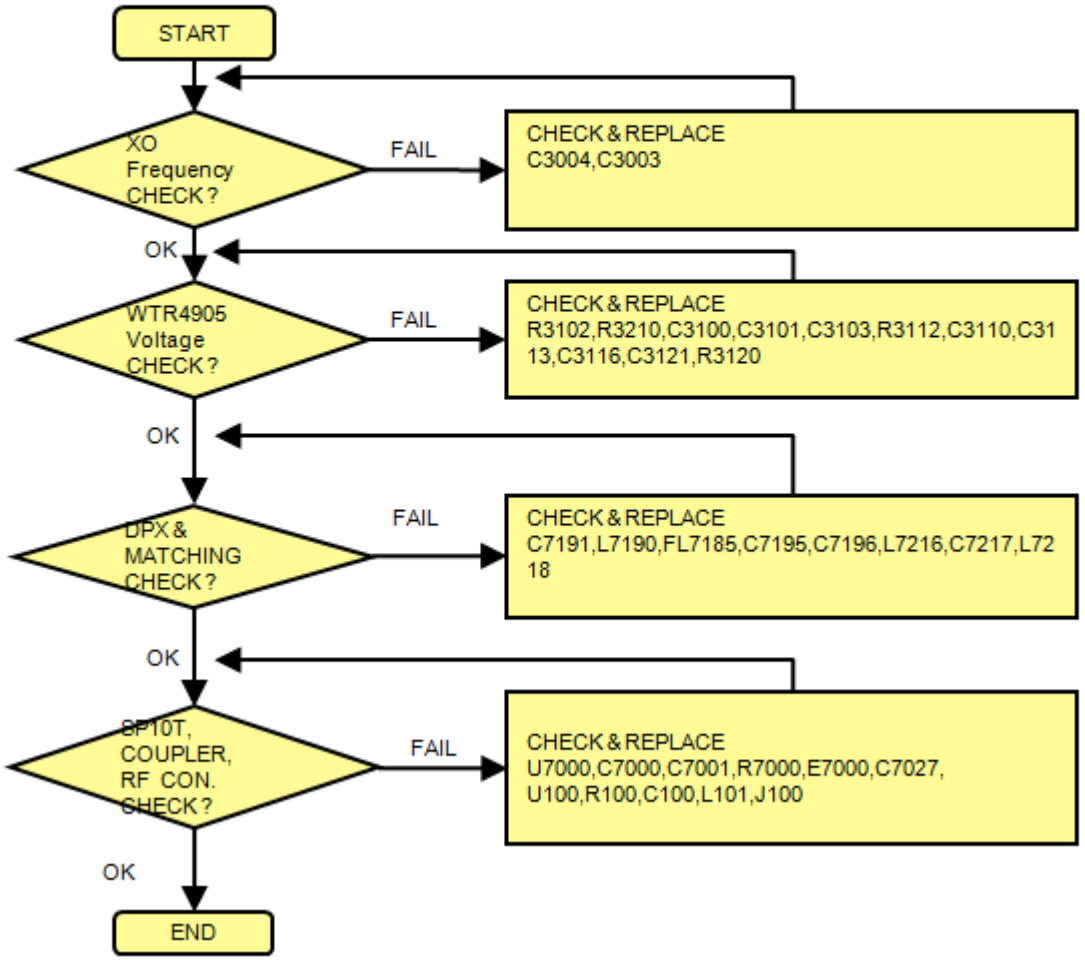
LTE/WCDMA B1 TX Check Chart – Low TX



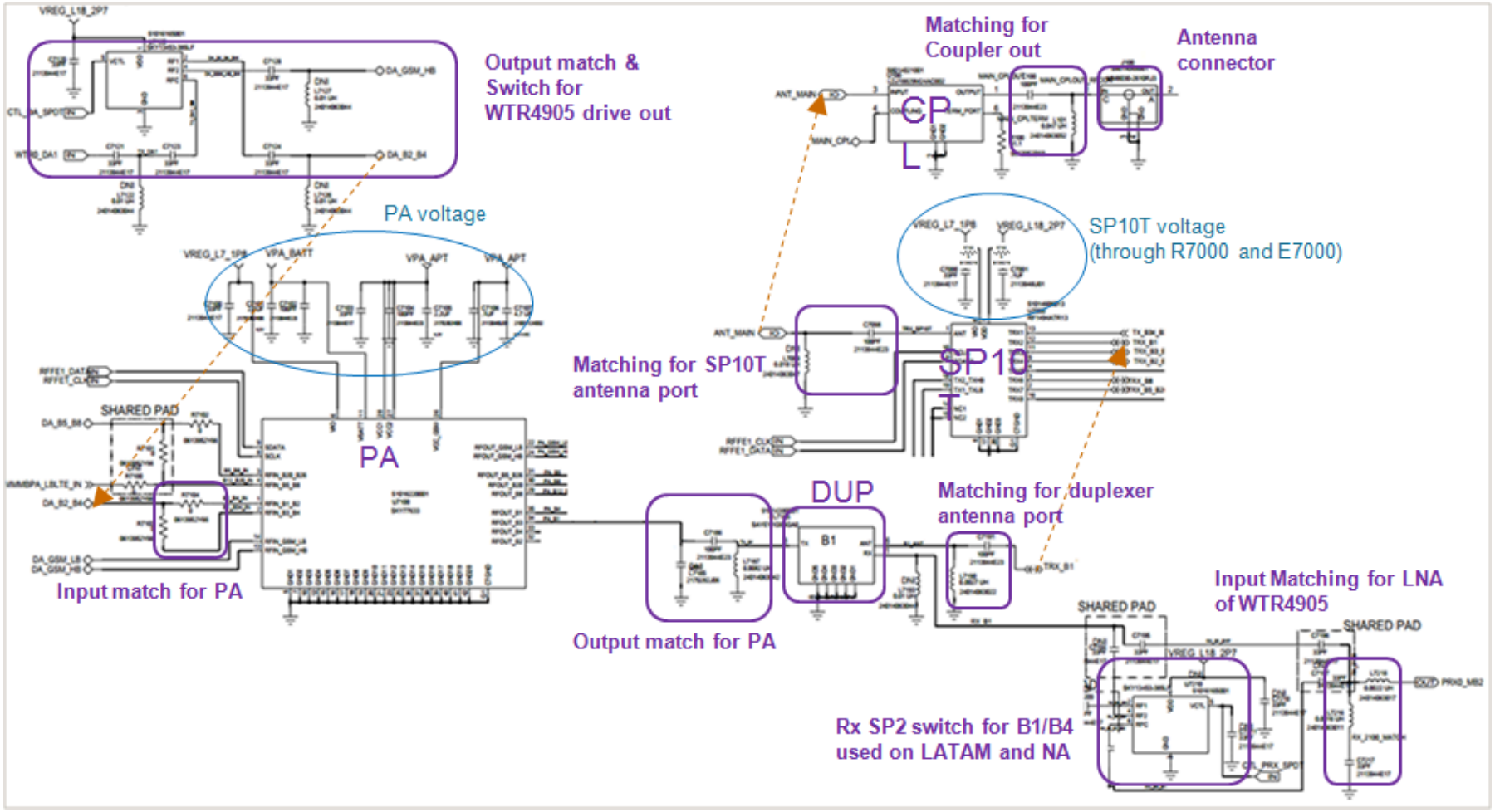
LTE/WCDMA B1 RX Check Chart (LATAM and NA variants)



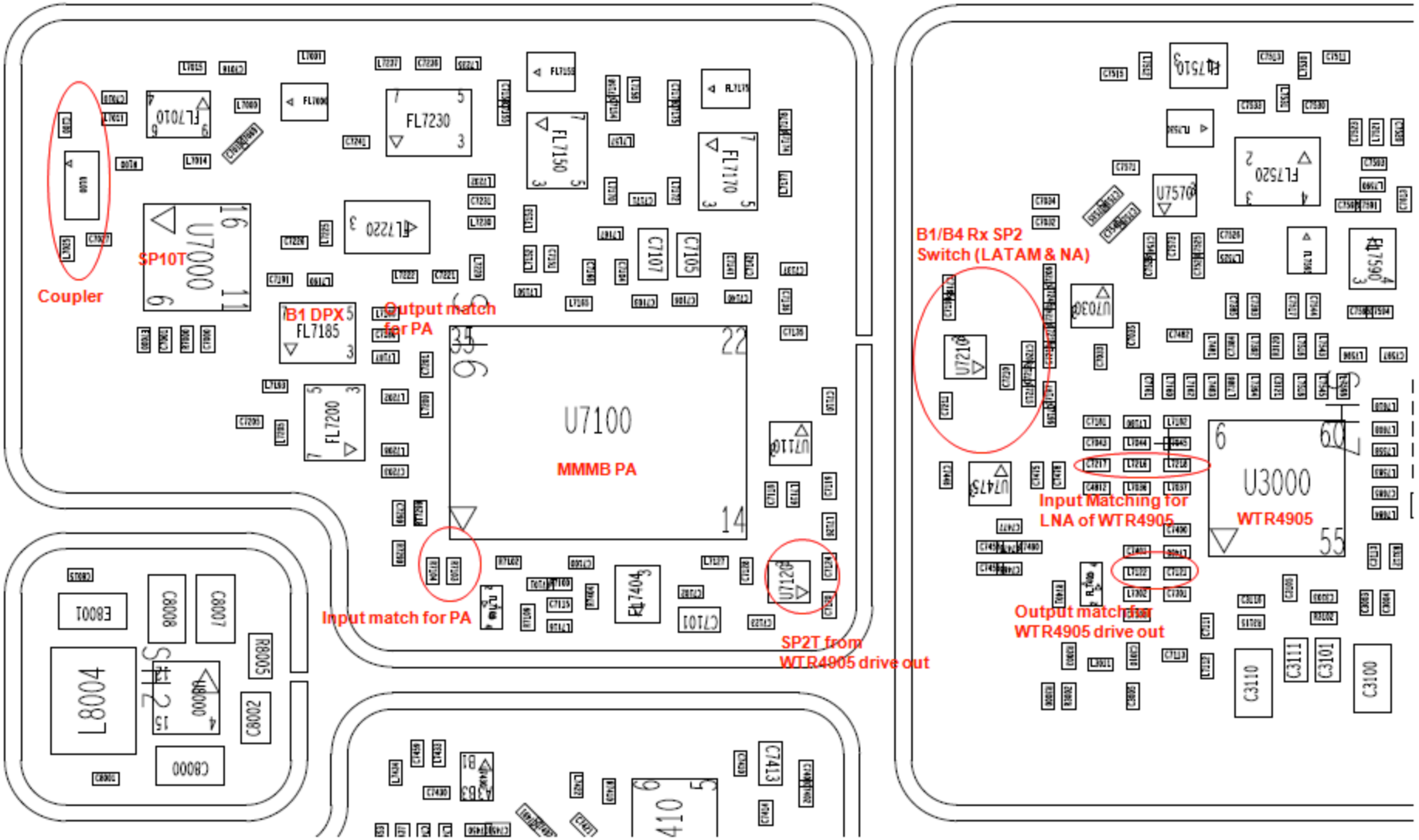
LTE/WCDMA B1 RX Check Chart (APAC, EU, and China variants)



B1 TRX Circuits (PA + DPX + SP10T)

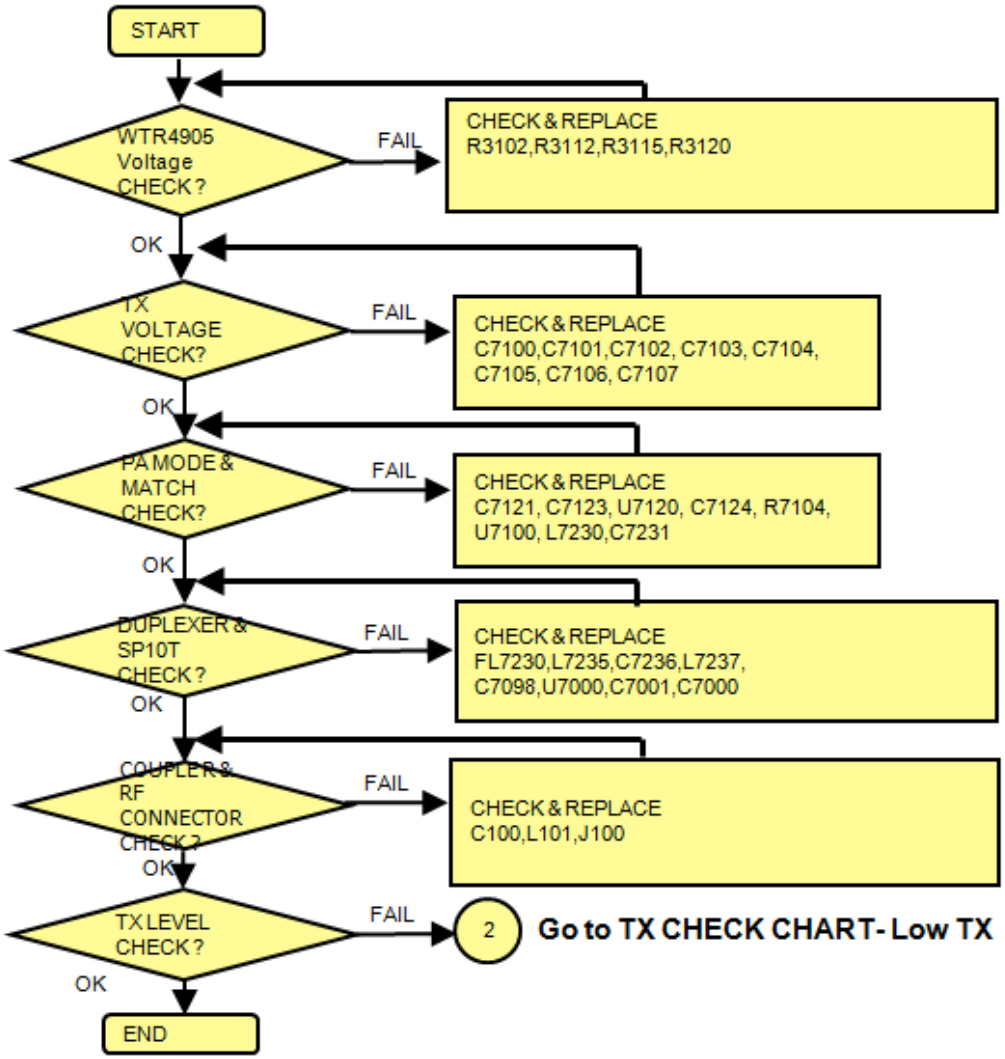


B1 TRX Circuits (WTR + PA + DPX + SP10T) Layout

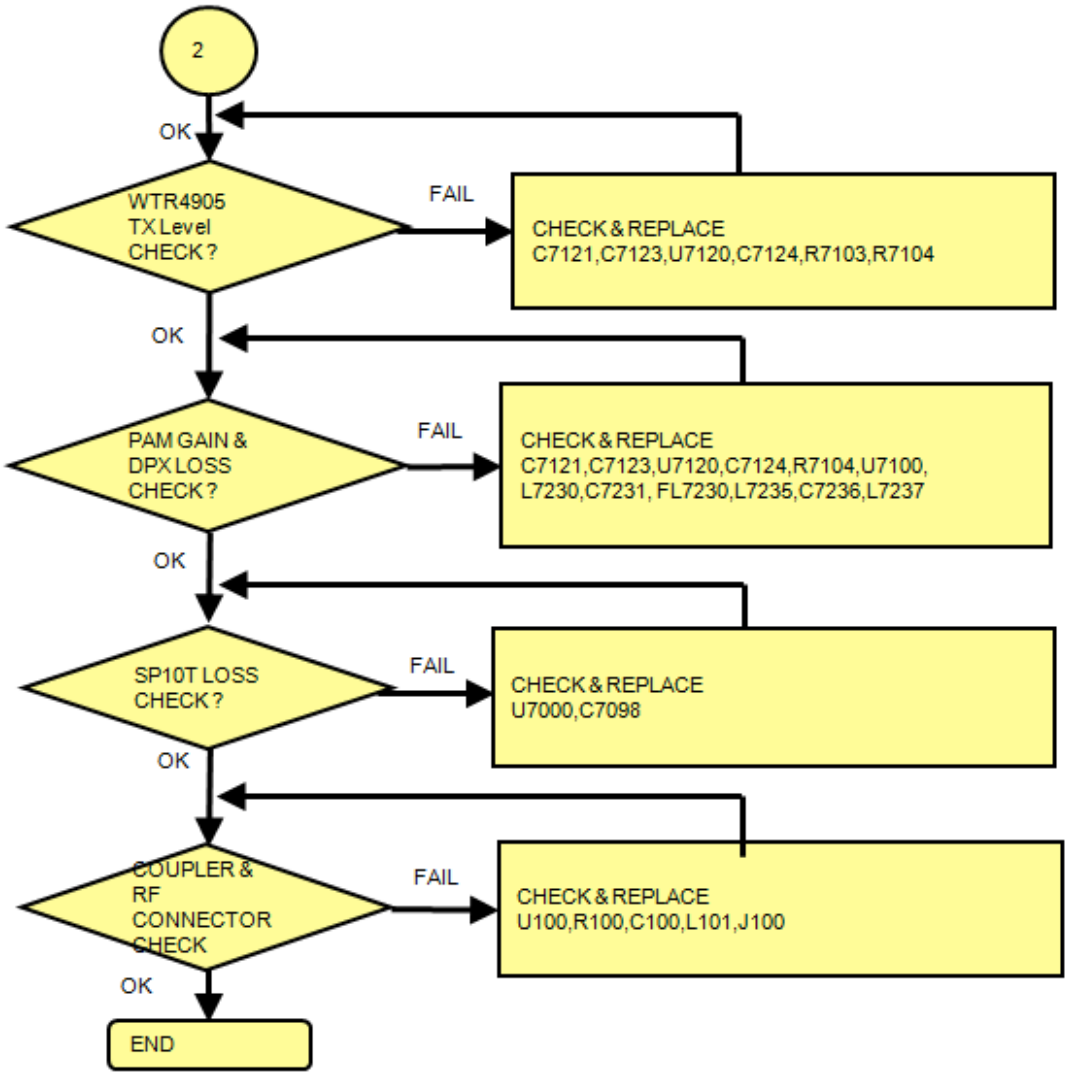


LTE B2,B25/WCDMA B2/CDMA BC1 Tx and Rx

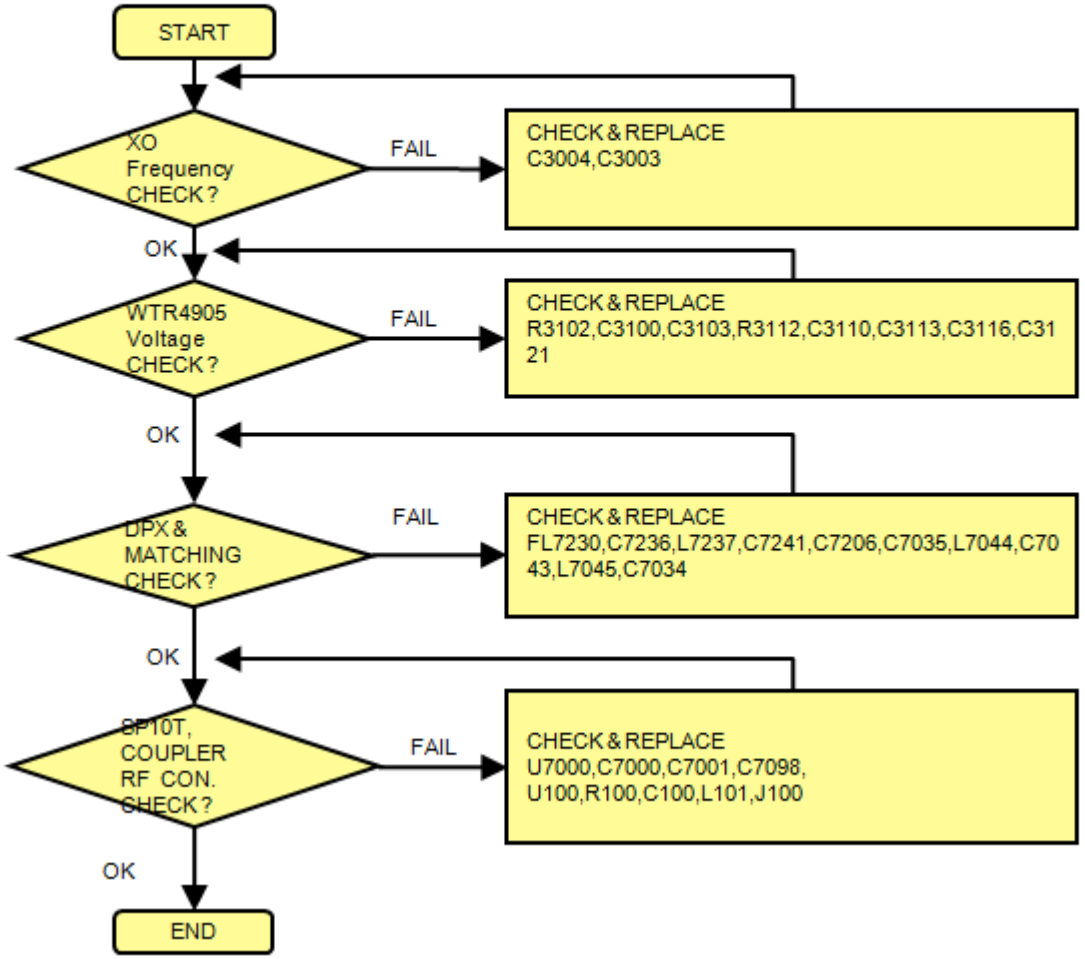
LTE B2,B25/WCDMA B2/BC1 TX Check Chart – No TX



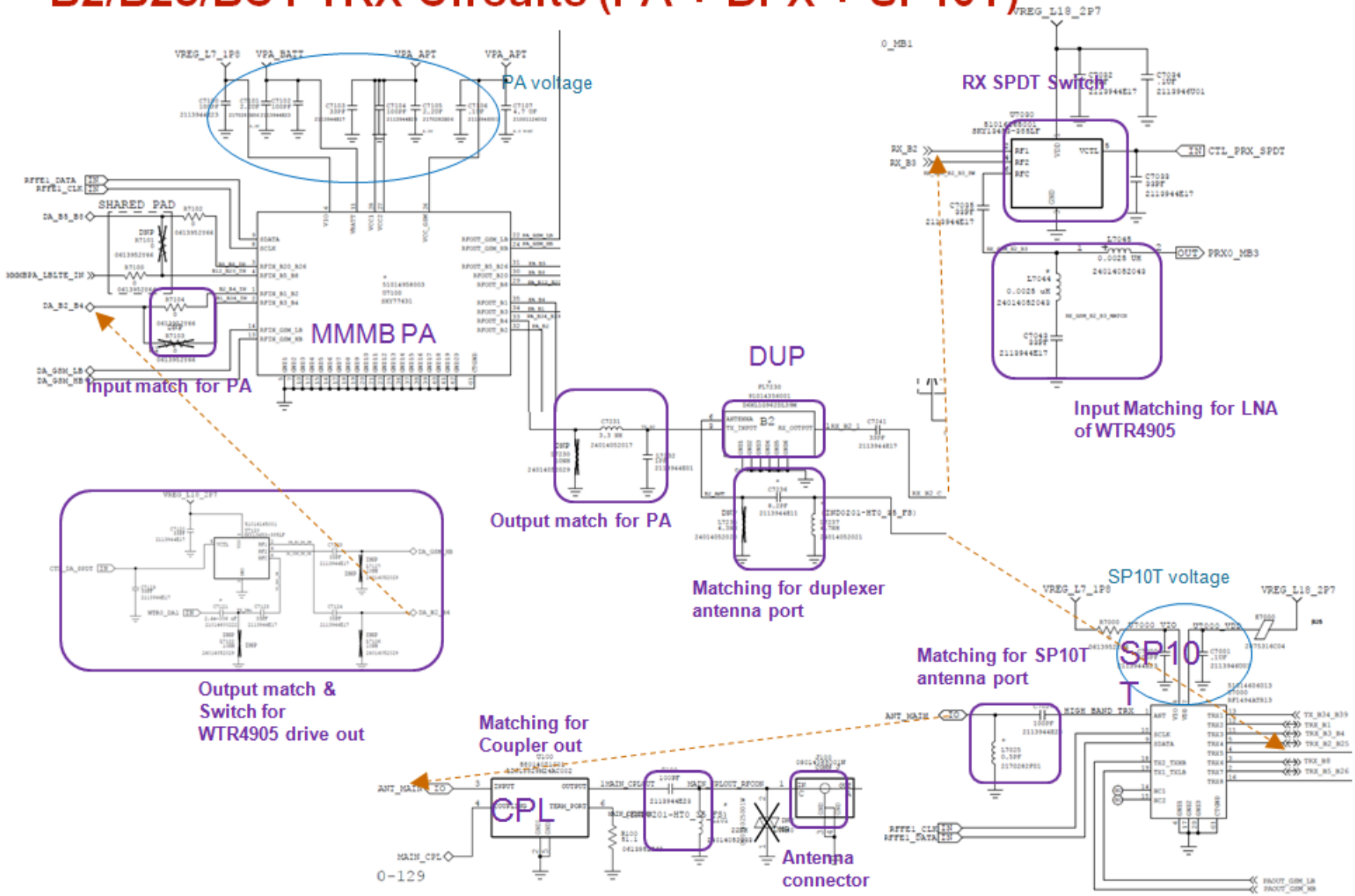
LTE B2,B25/WCDMA B2/BC1 TX Check Chart – Low TX



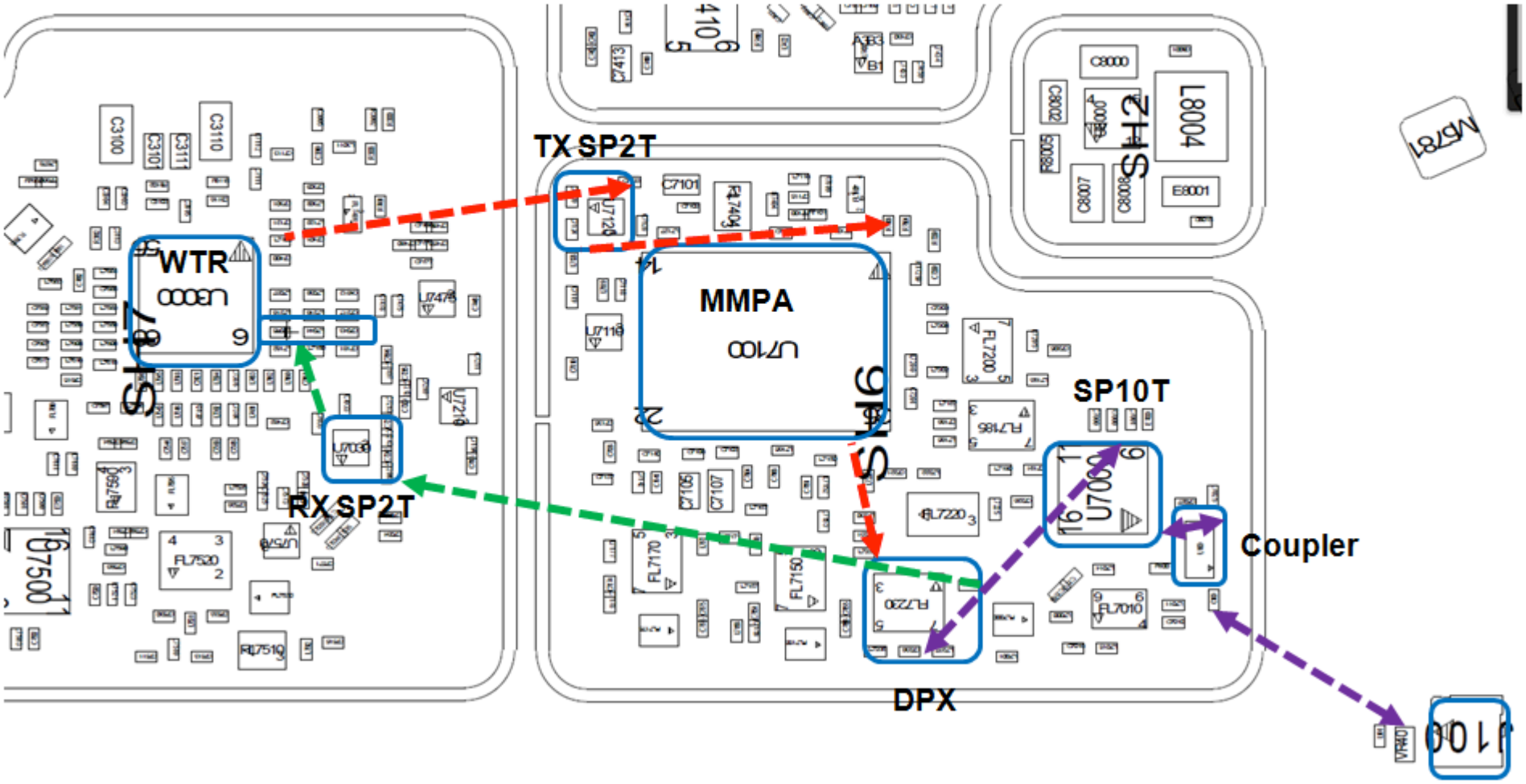
LTE B2,B25/WCDMA B2/BC1 RX Check Chart



B2/B25/BC1 TRX Circuits (PA + DPX + SP10T)

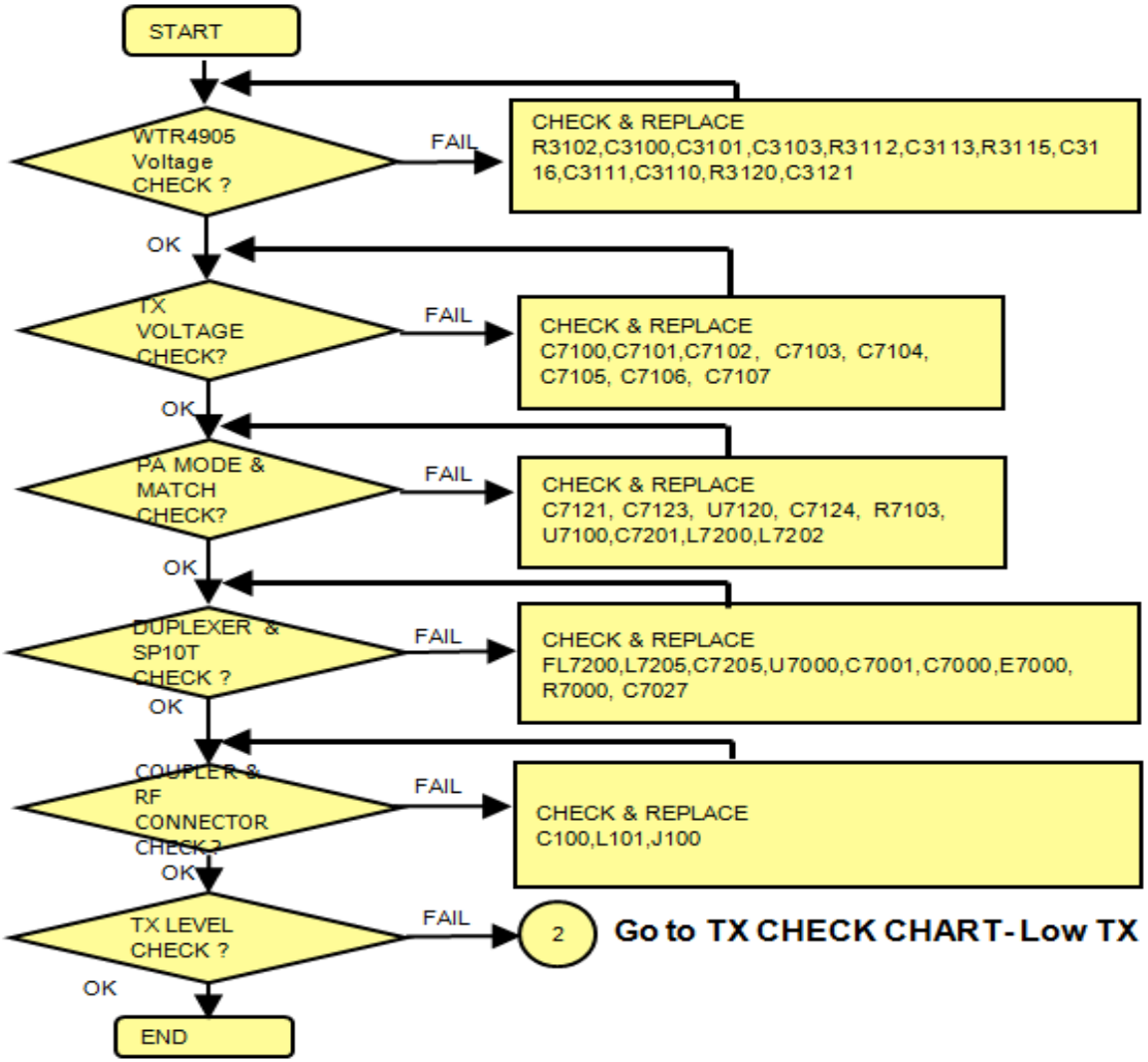


B2/B25/BC1 TRX Circuits (WTR + PA + DPX + SP10T) Layout

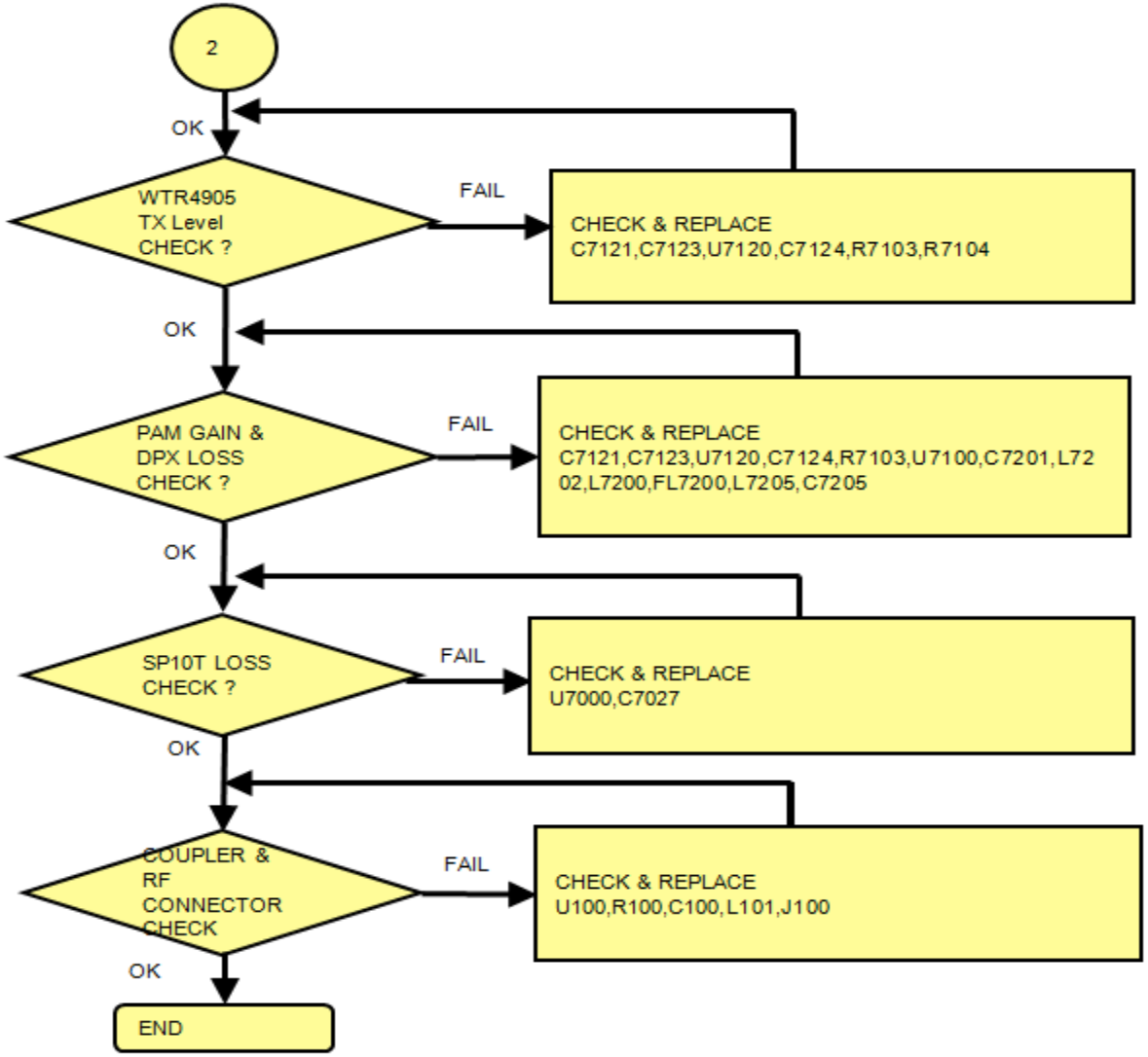


LTE/WCDMA B3/B4 Tx and Rx

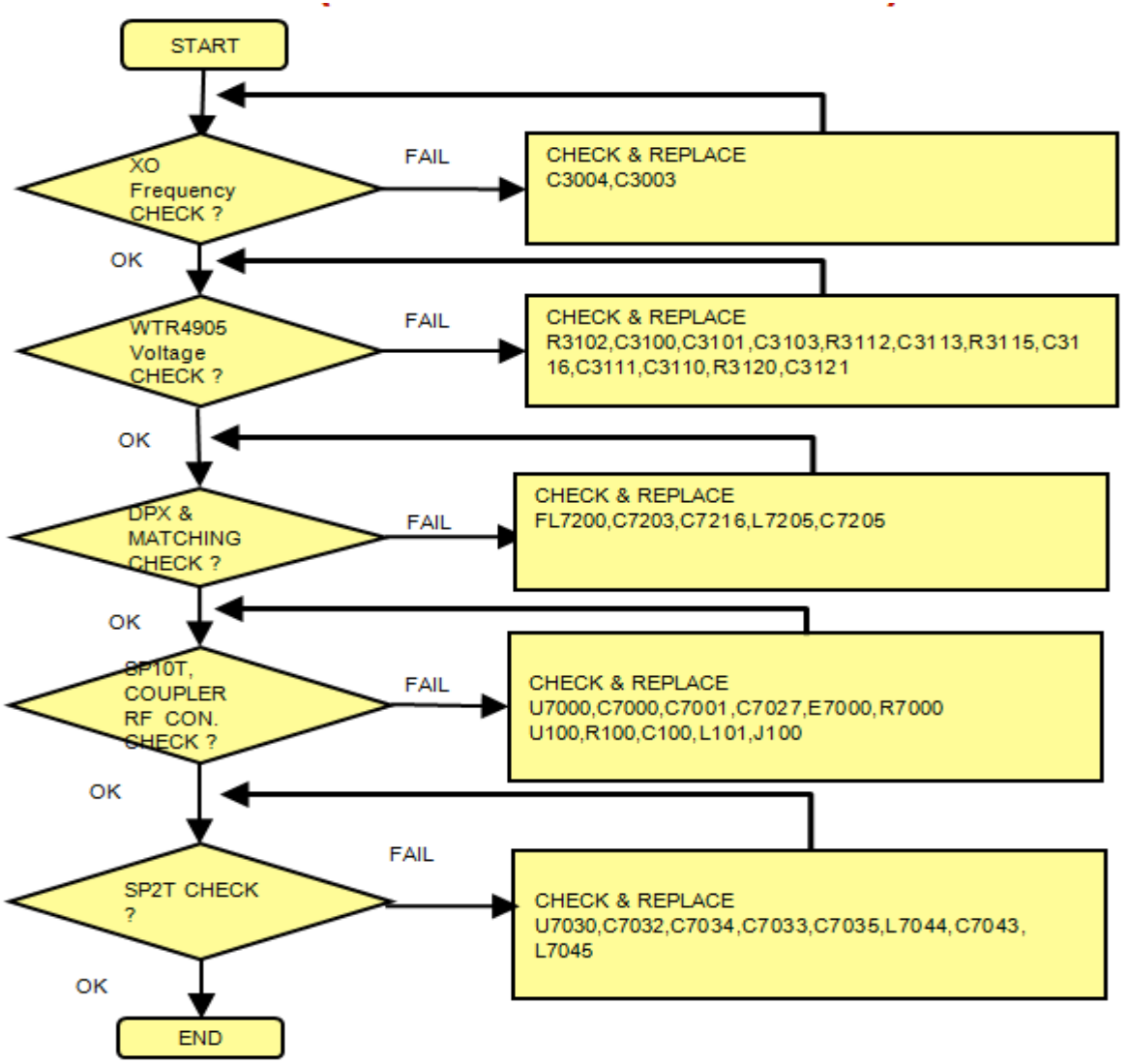
LTE B3 TX Check Chart – No TX (EU/APAC/China SKU)



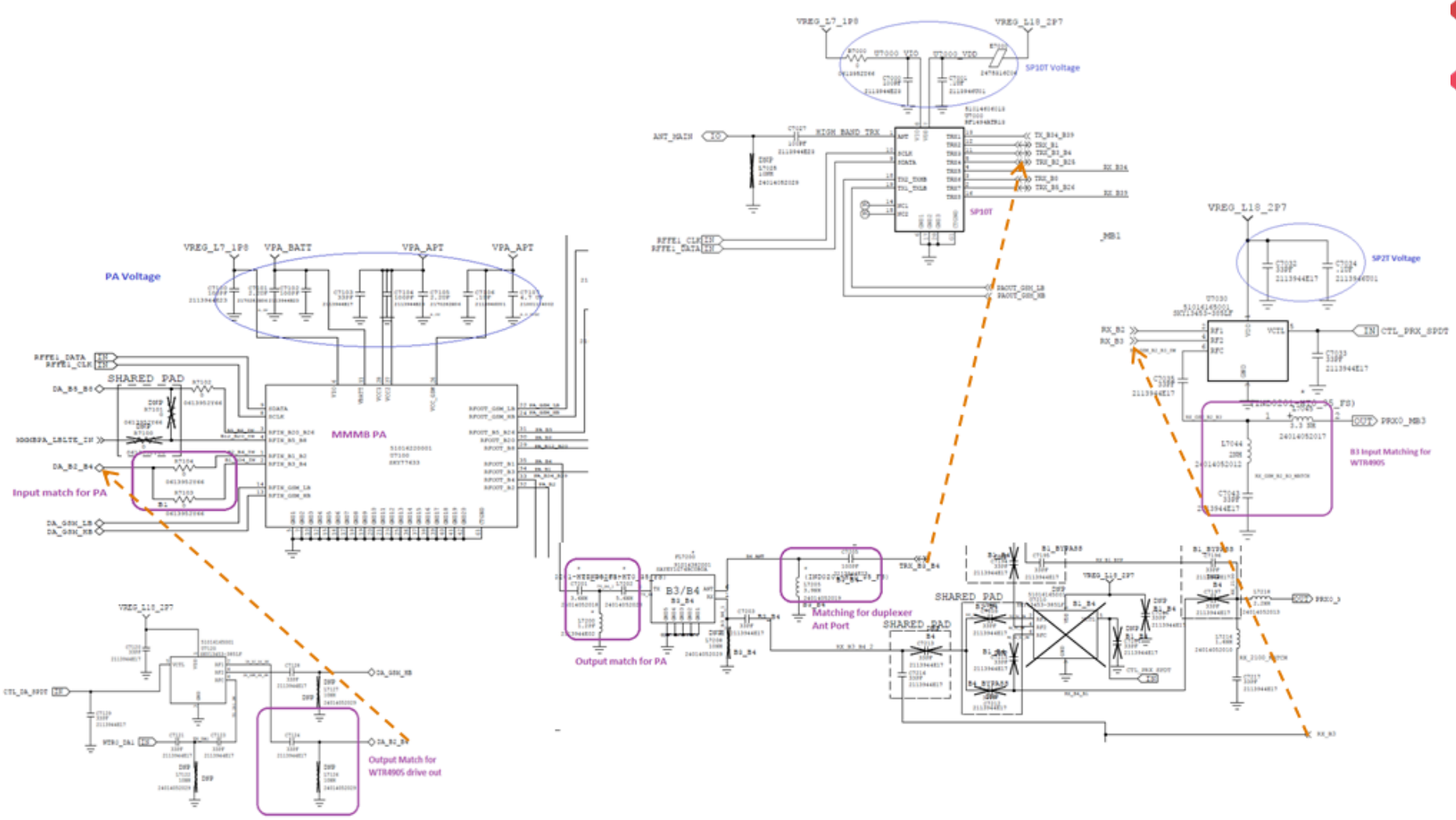
LTE B3 TX Check Chart – Low TX (EU/APAC/China SKU)



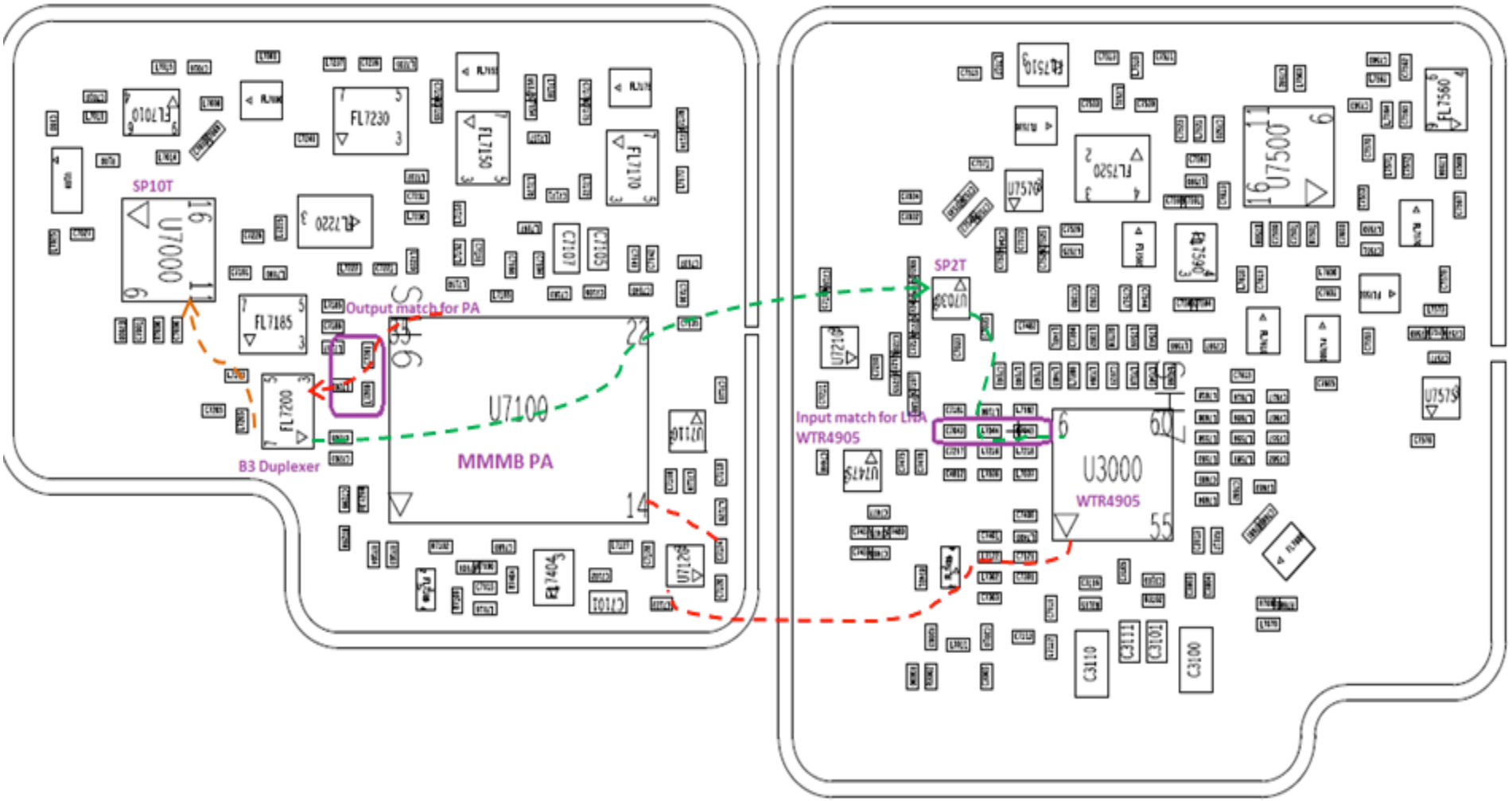
LTE B3 RX Check Chart (EU/APAC/China SKU)



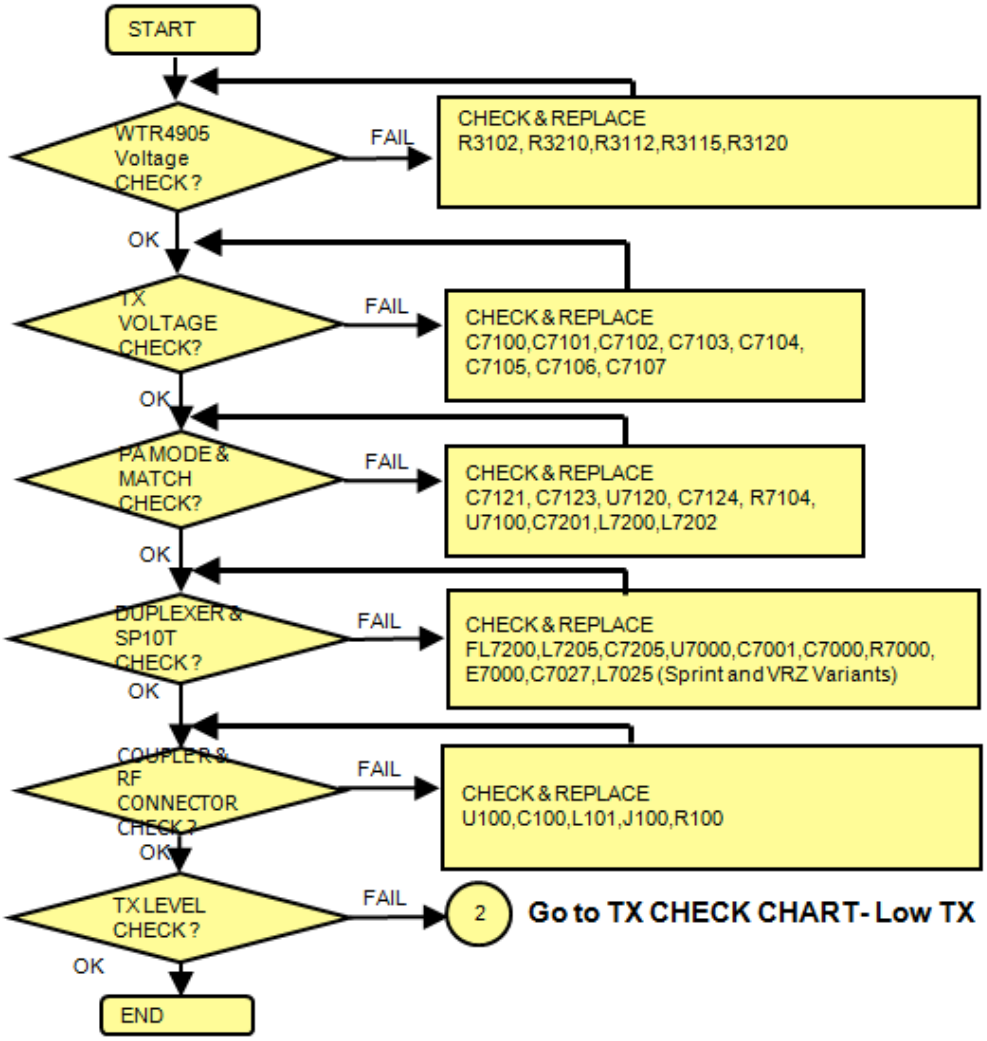
LTE B3 TRX CIRCUITS (PA + DPX + SP10T + SP2T)



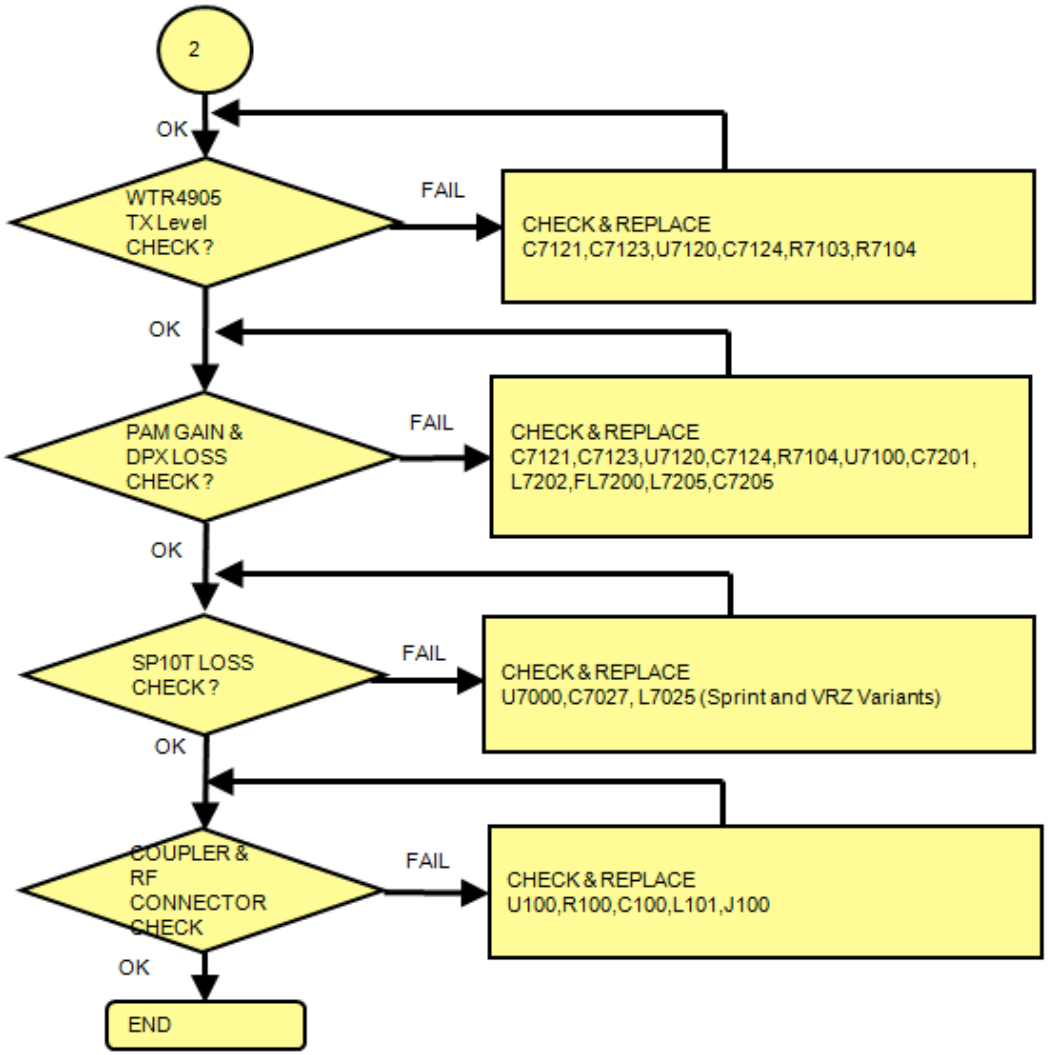
LTE B3 TRX Circuits (WTR + PA + DPX + SP10T + SP2T) Layout



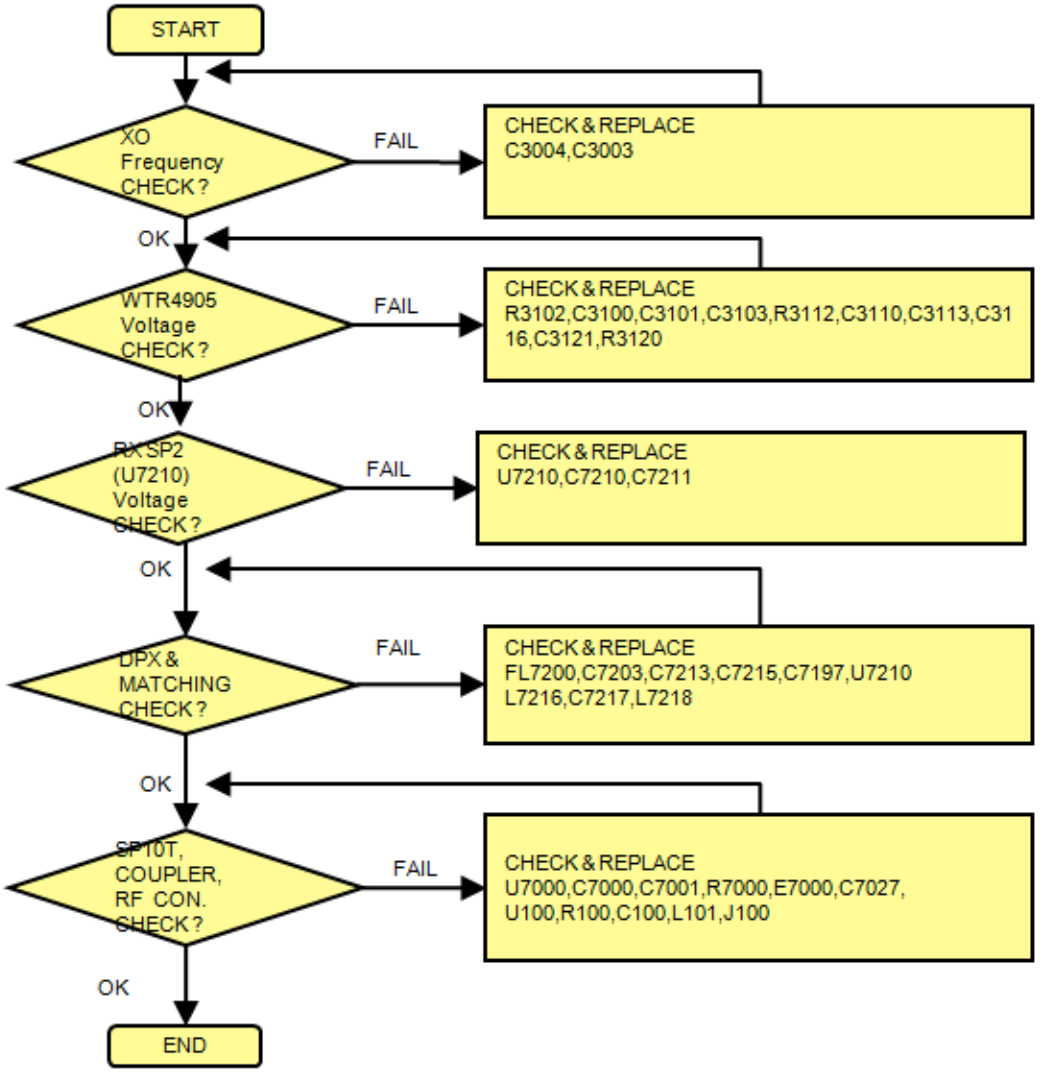
LTE B4 TX Check Chart – No TX



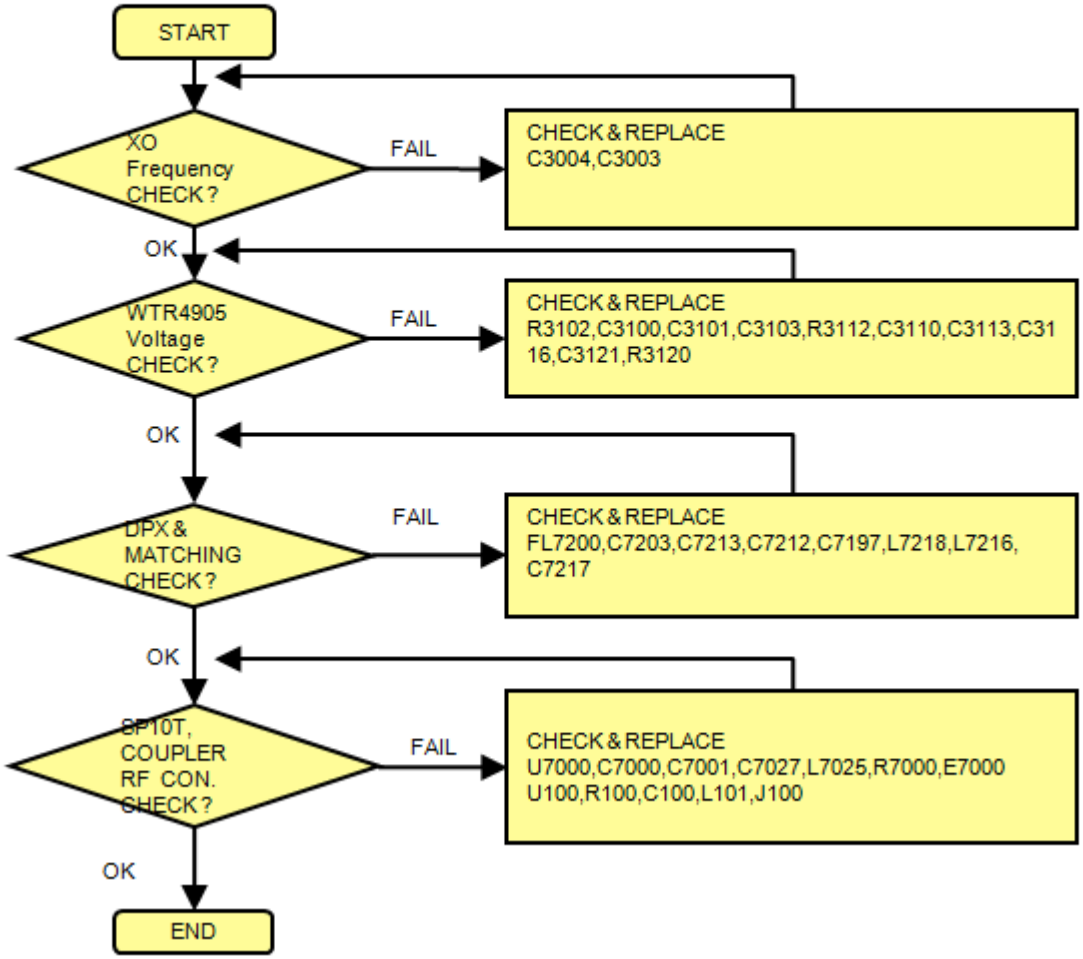
LTE B4/WCDMA B4 TX Check Chart – No TX(LATAM/NA/SPR/VZW SKU)



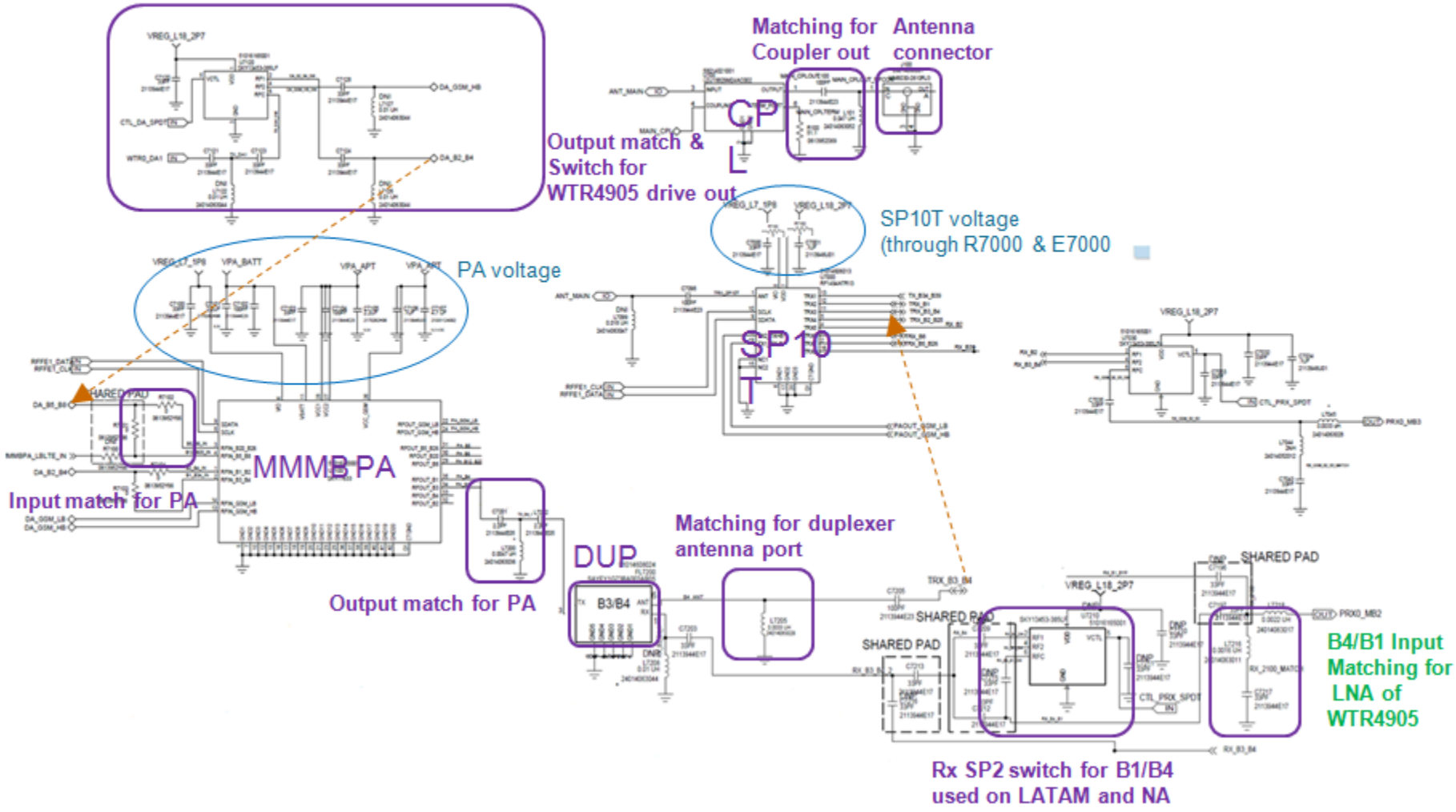
LTE B4/WCDMA B4 RX Check Chart (LATAM and NA SKUs)



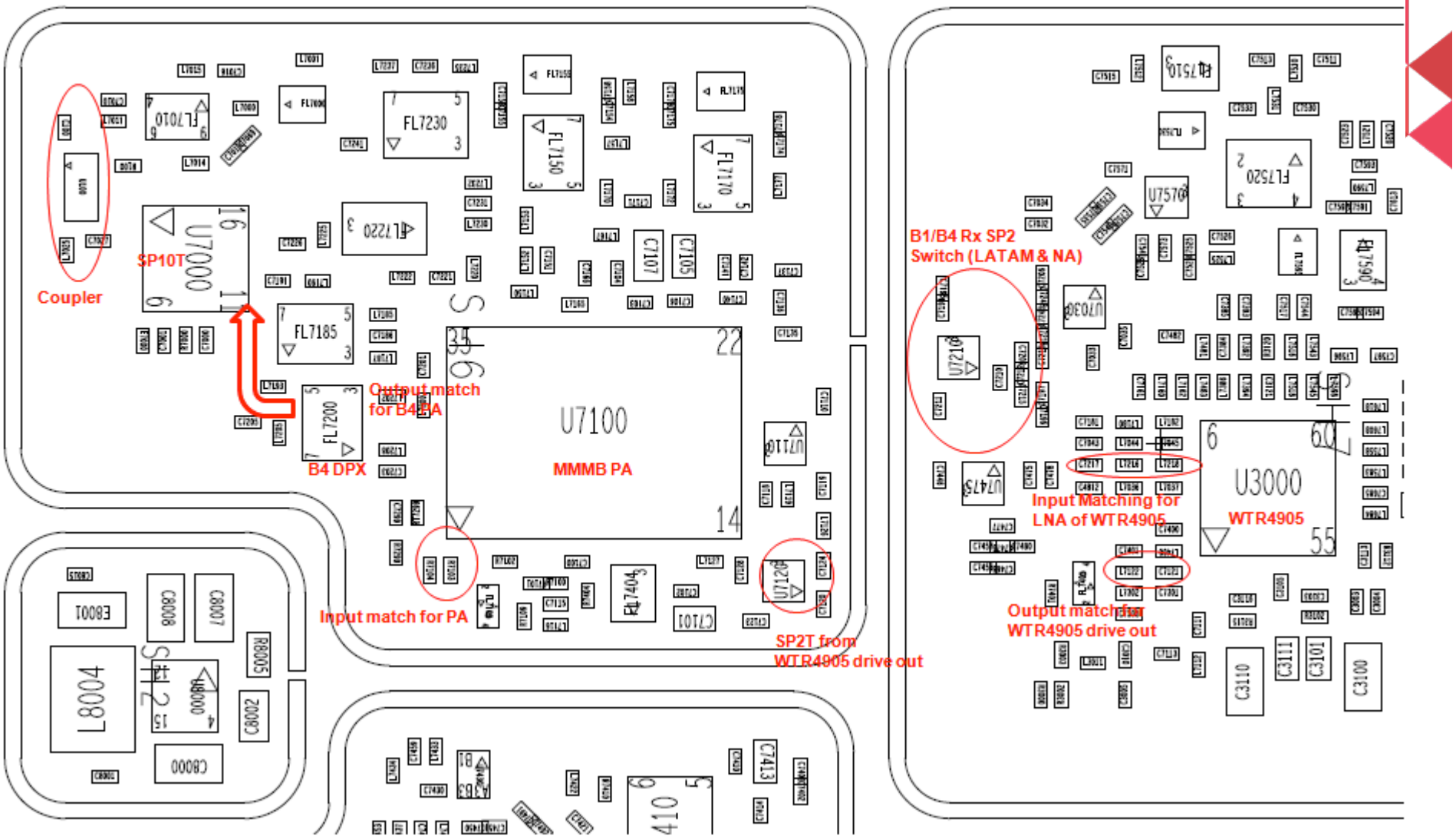
LTE B4/WCDMA B4 RX Check Chart (SPR/VZW SKUs)



LTE B4 WCDMA B4 TRX CIRCUITS (PA + DPX + SP10T)

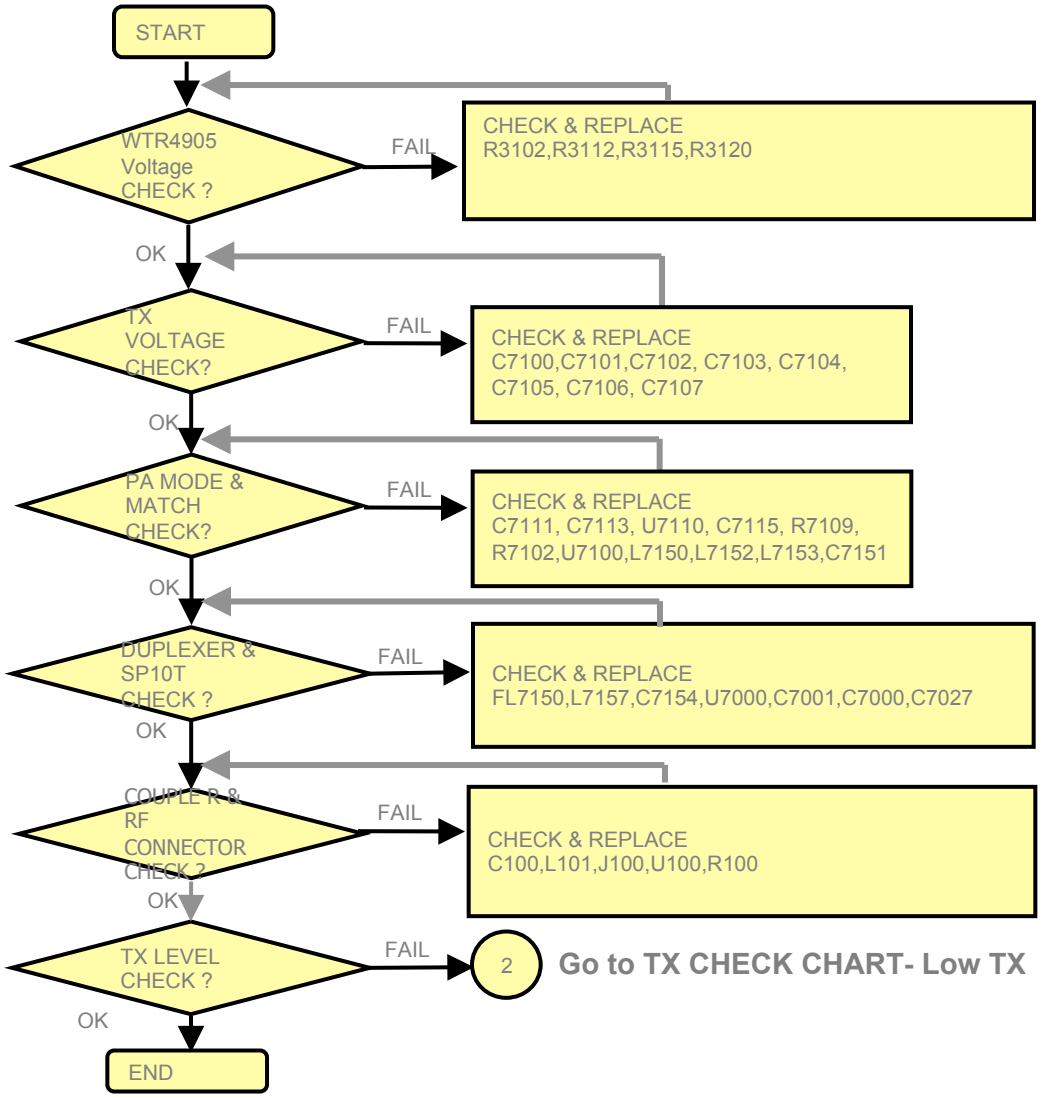


B4 TRX Circuits (WTR + PA + DPX + SP10T) Layout

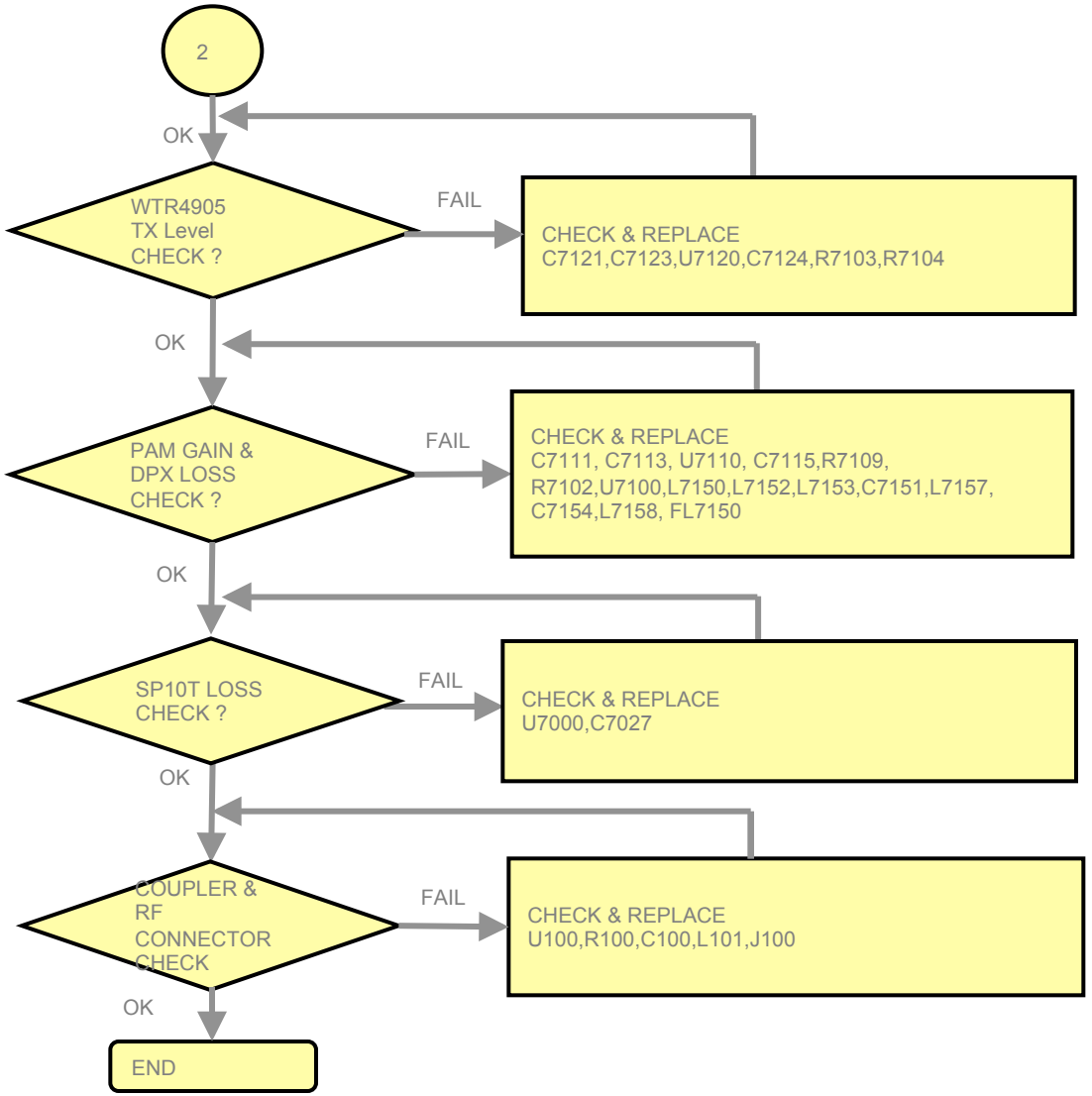


LTE/WCDMA B5/B26 / CDMA BC0/10 Tx and Rx

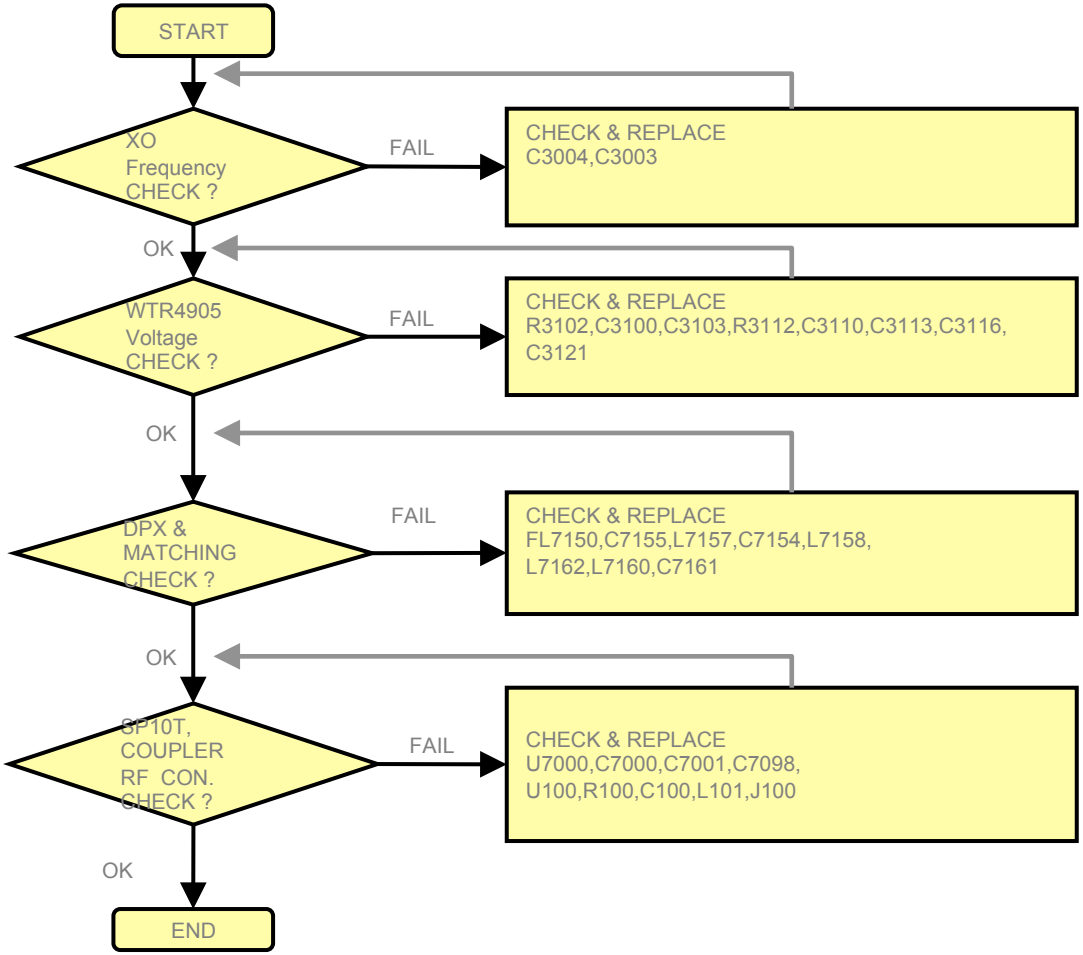
LTE B5/B26 WCDMA B5, CDMA BC0/BC10 TX Check Chart – No TX (NA/ SPR/VZW/LATAM/APAC SKU)



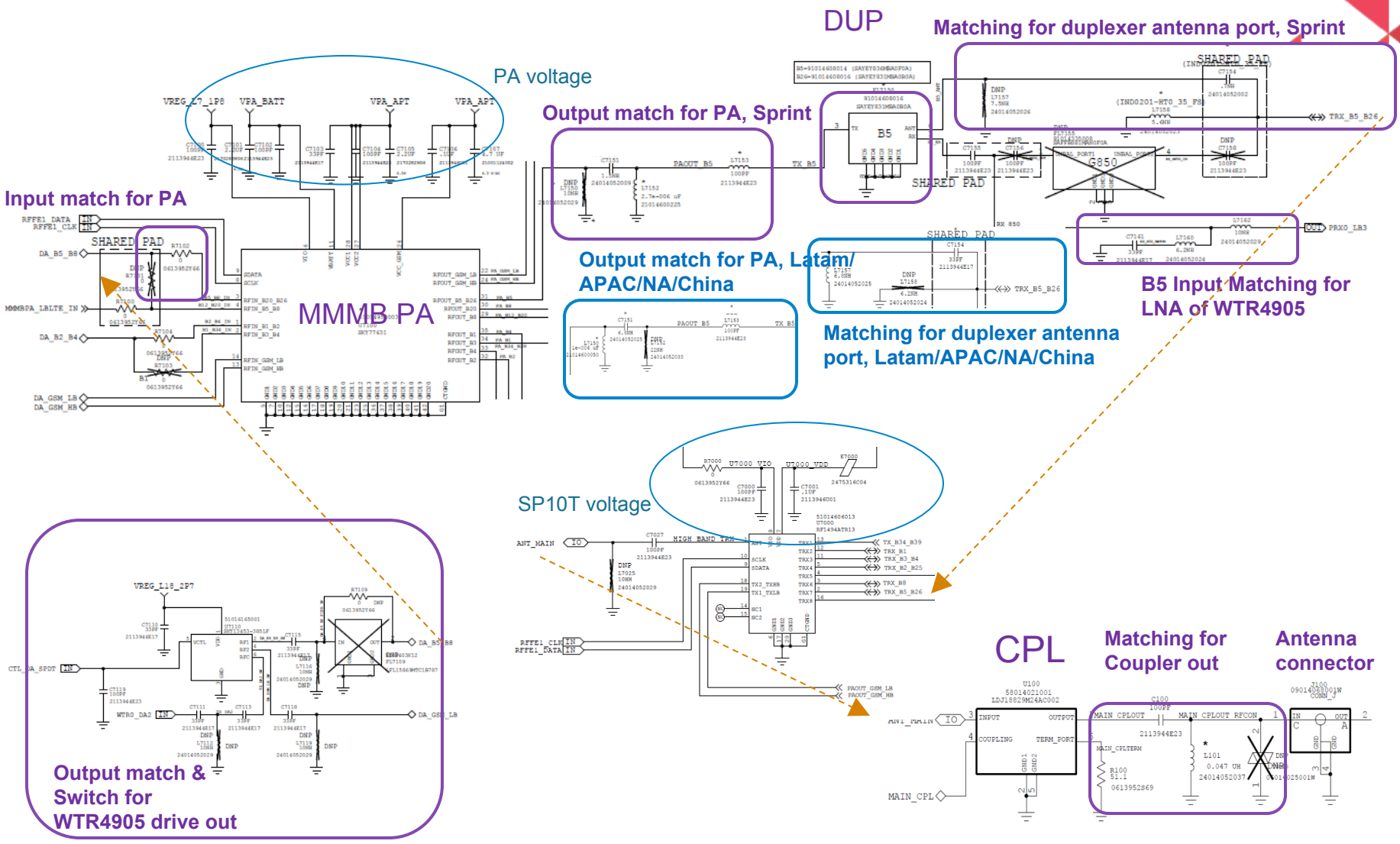
LTE B5/B26 WCDMA B5, CDMA BC0/BC10 TX Check Chart – No TX



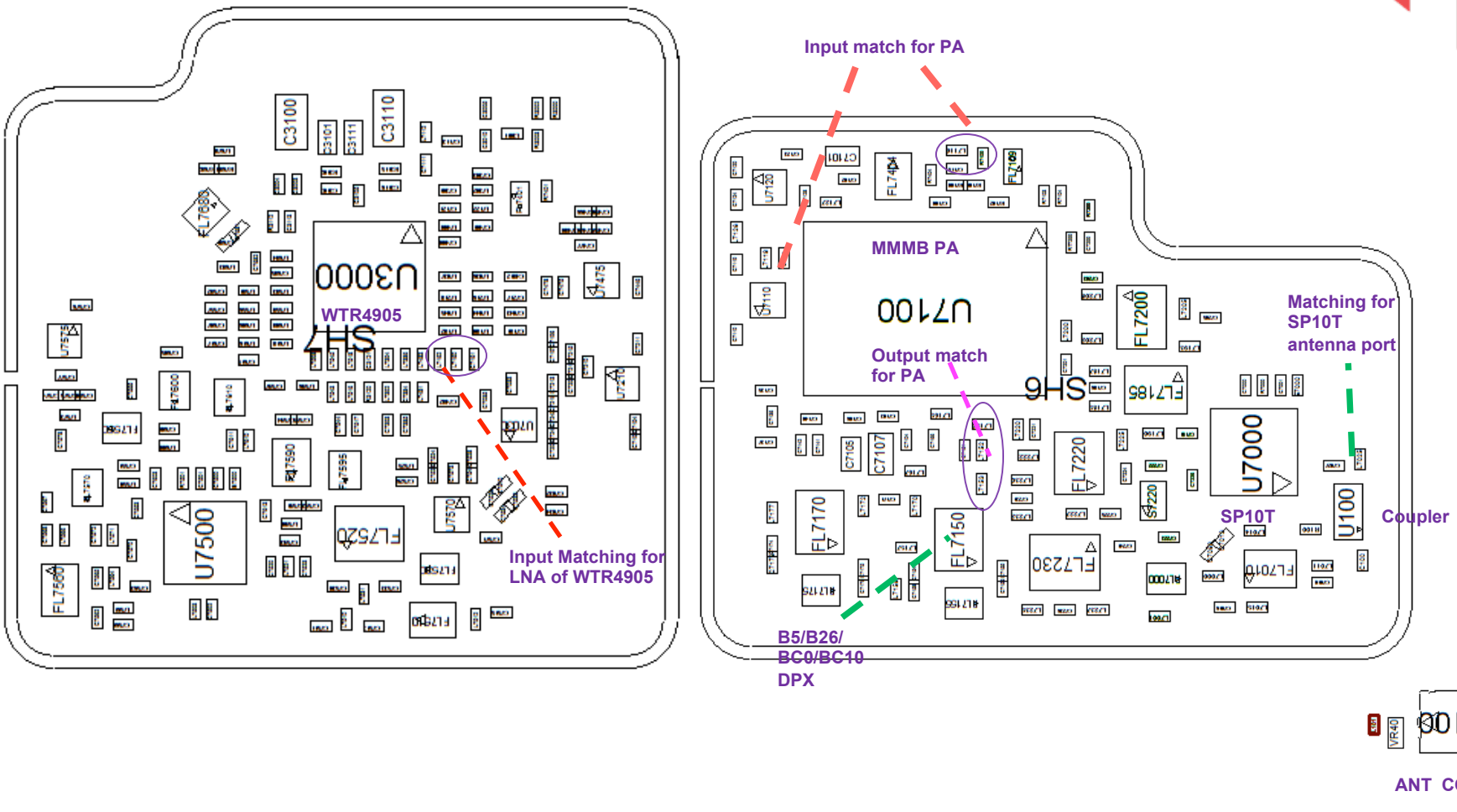
LTE B5/B26 WCDMA B5, CDMA BC0/BC10 RX Check Chart (NA/SPR/ VZW/LATAM/APAC SKU)



LTE B5/B26 WCDMA B5, CDMA BC0/BC10 TRX CIRCUITS (PA+DPX +SP10T)

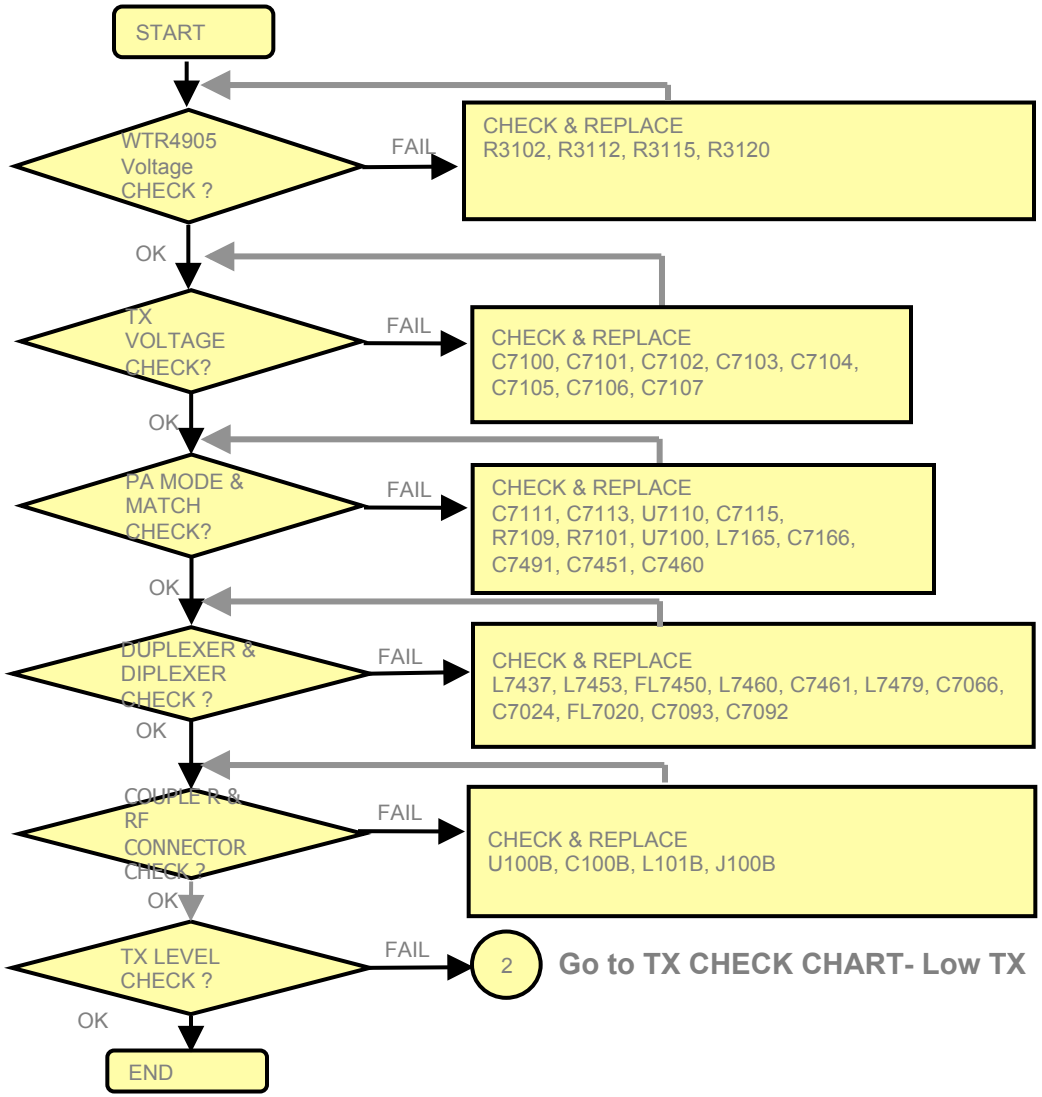


LTE B5/B26 WCDMA B5, CDMA BC0/BC10 TRX Circuits (WTR + PA + DPX + SP10T) Layout

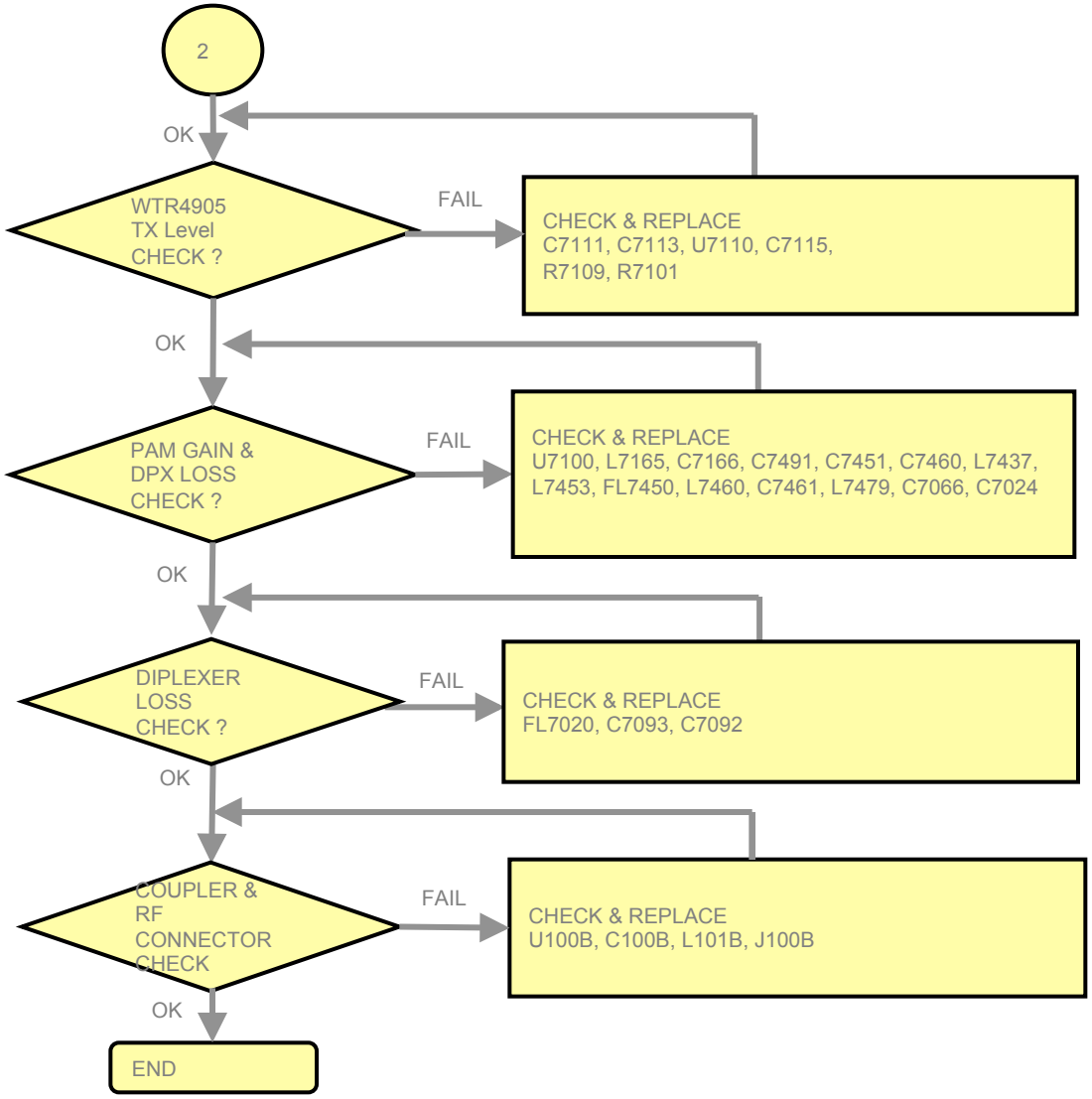


LTE B20, WCDMA B8 Tx and Rx

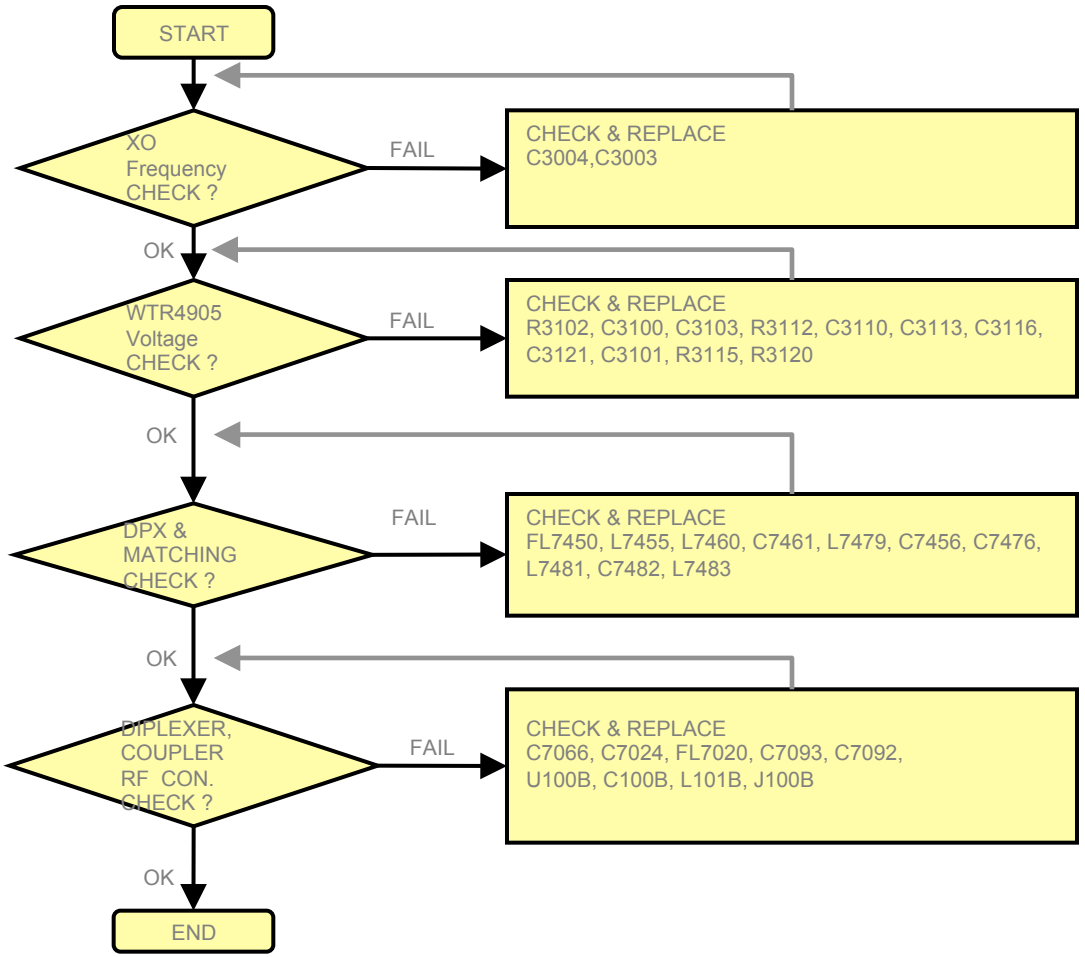
LTE B20 TX Check Chart – No TX (EU SKU)



LTE B20 TX Check Chart – Low TX

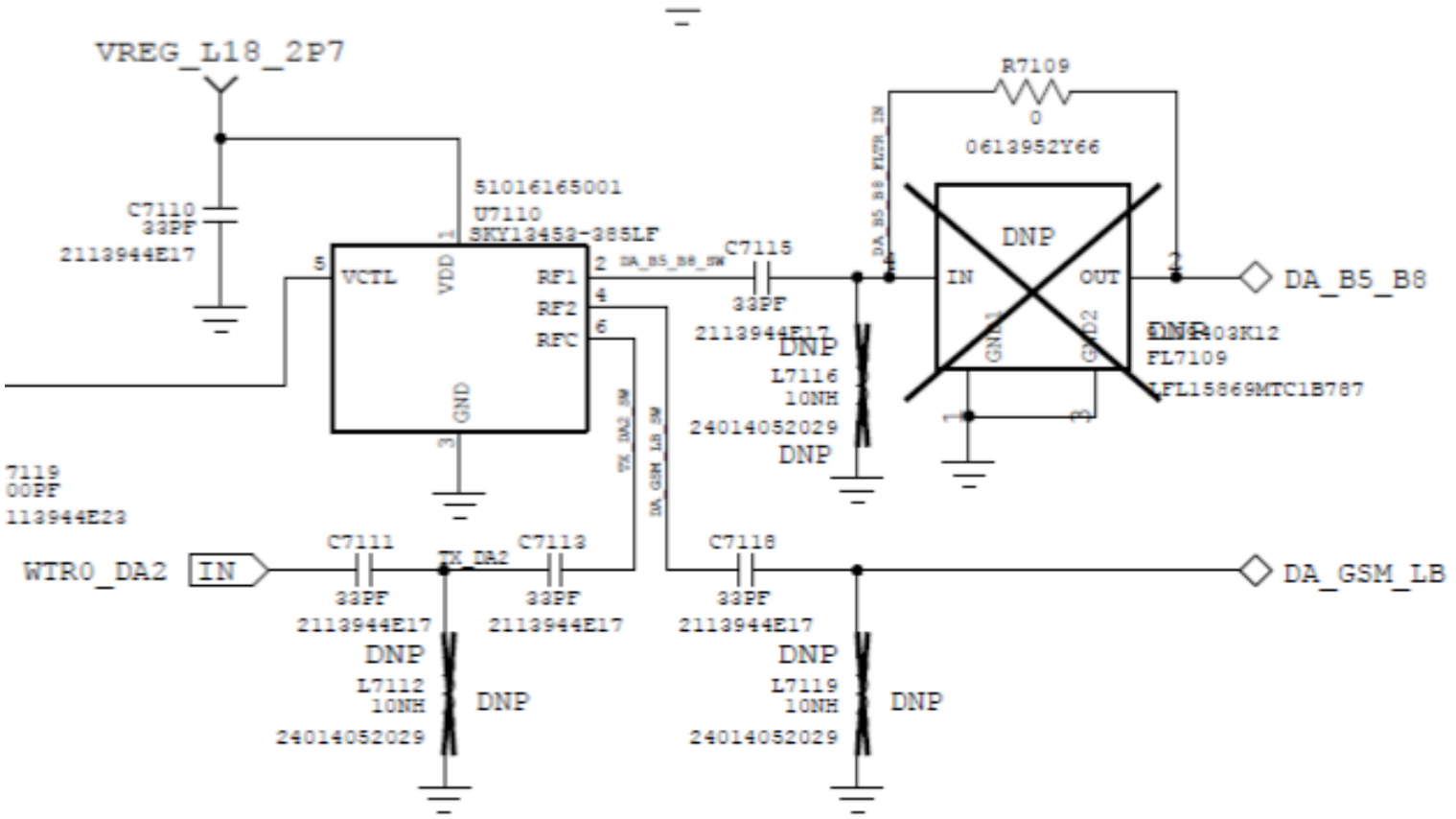


LTE B20 RX Check Chart (EU SKU)



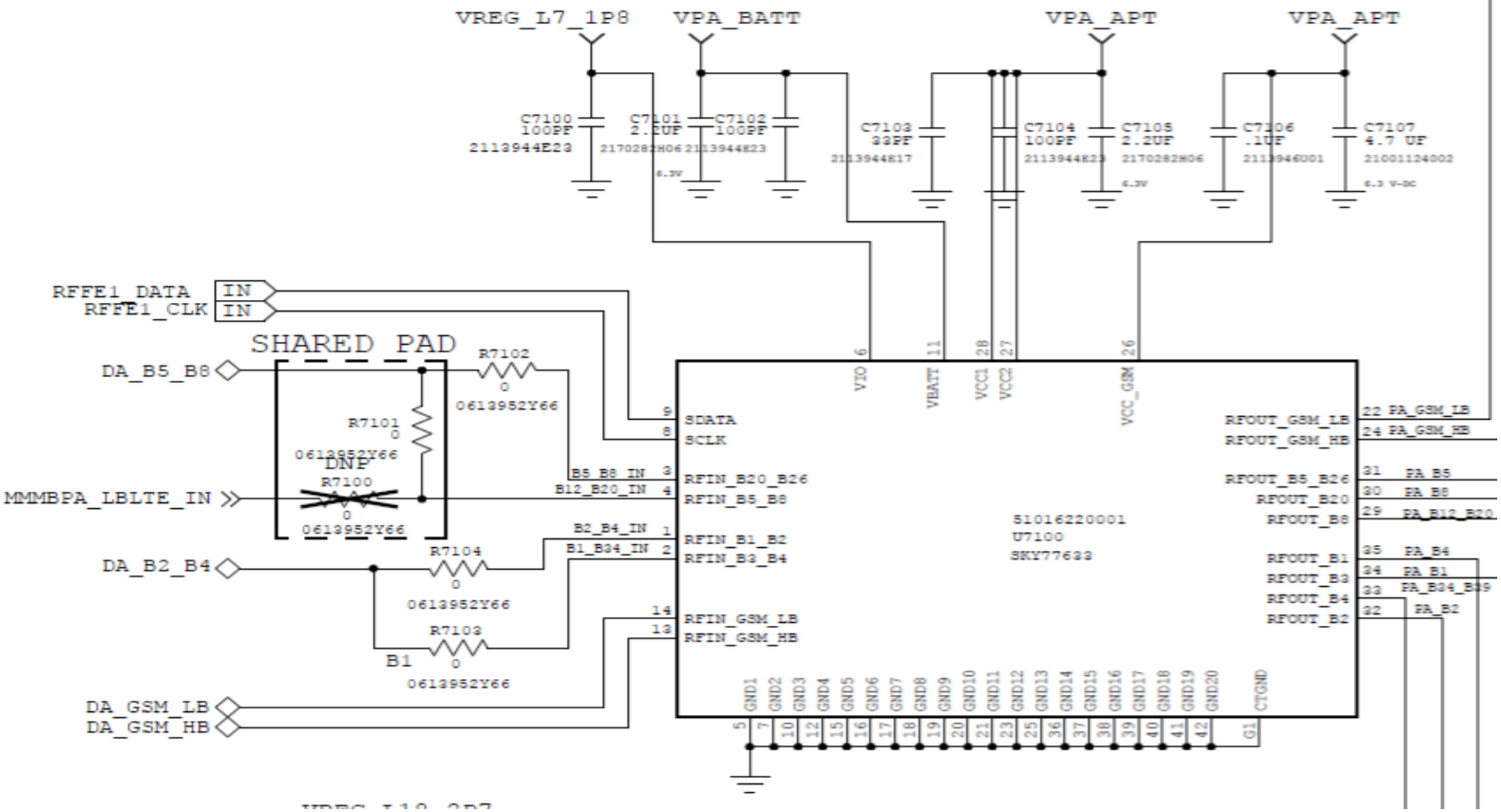
LTE B20 TRX Circuits

Output match & Switch for WTR4905 drive out



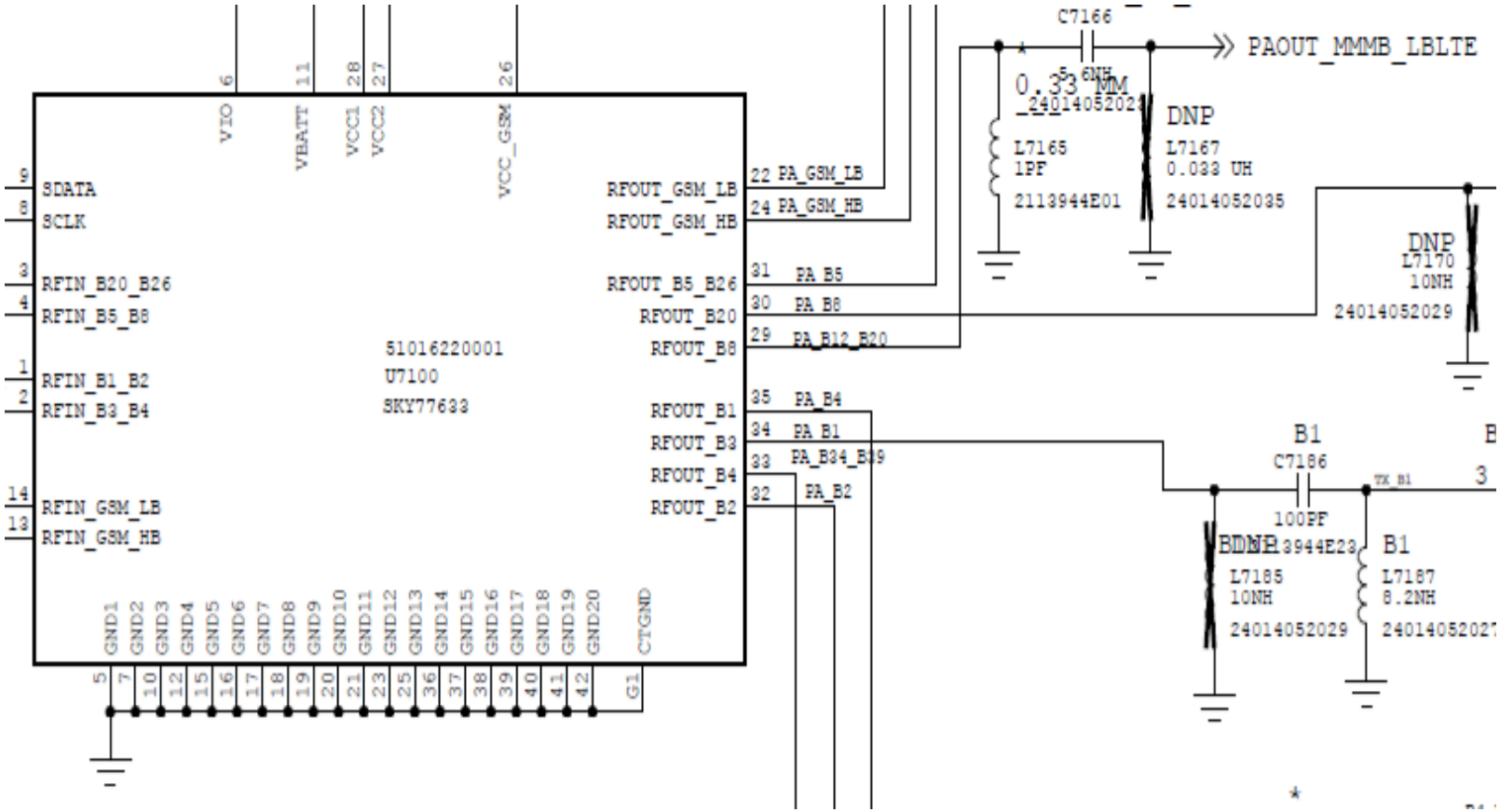
LTE B20 TRX Circuits

Input match for MMMB PA



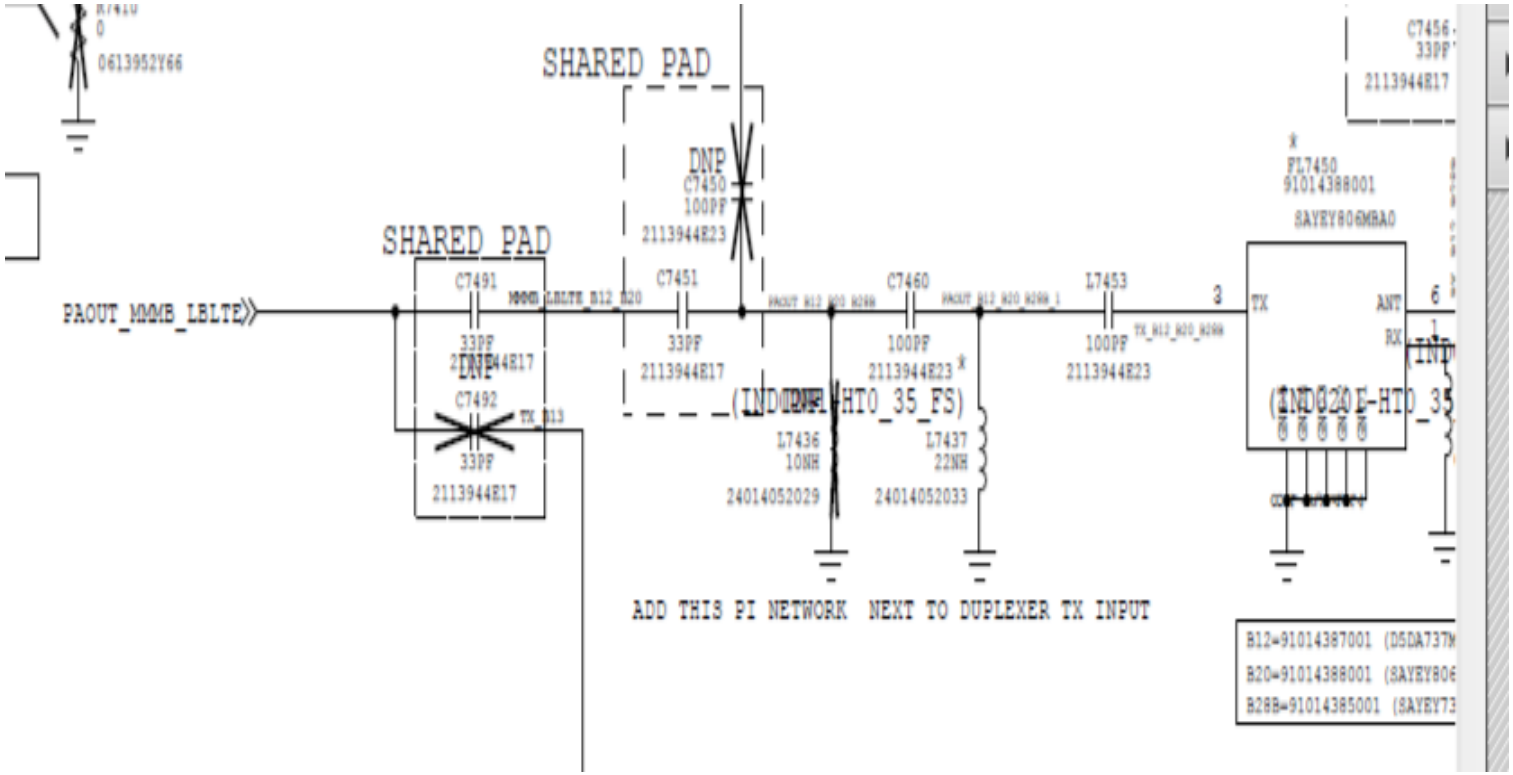
LTE B20 TRX Circuits

Output match for MMMB PA



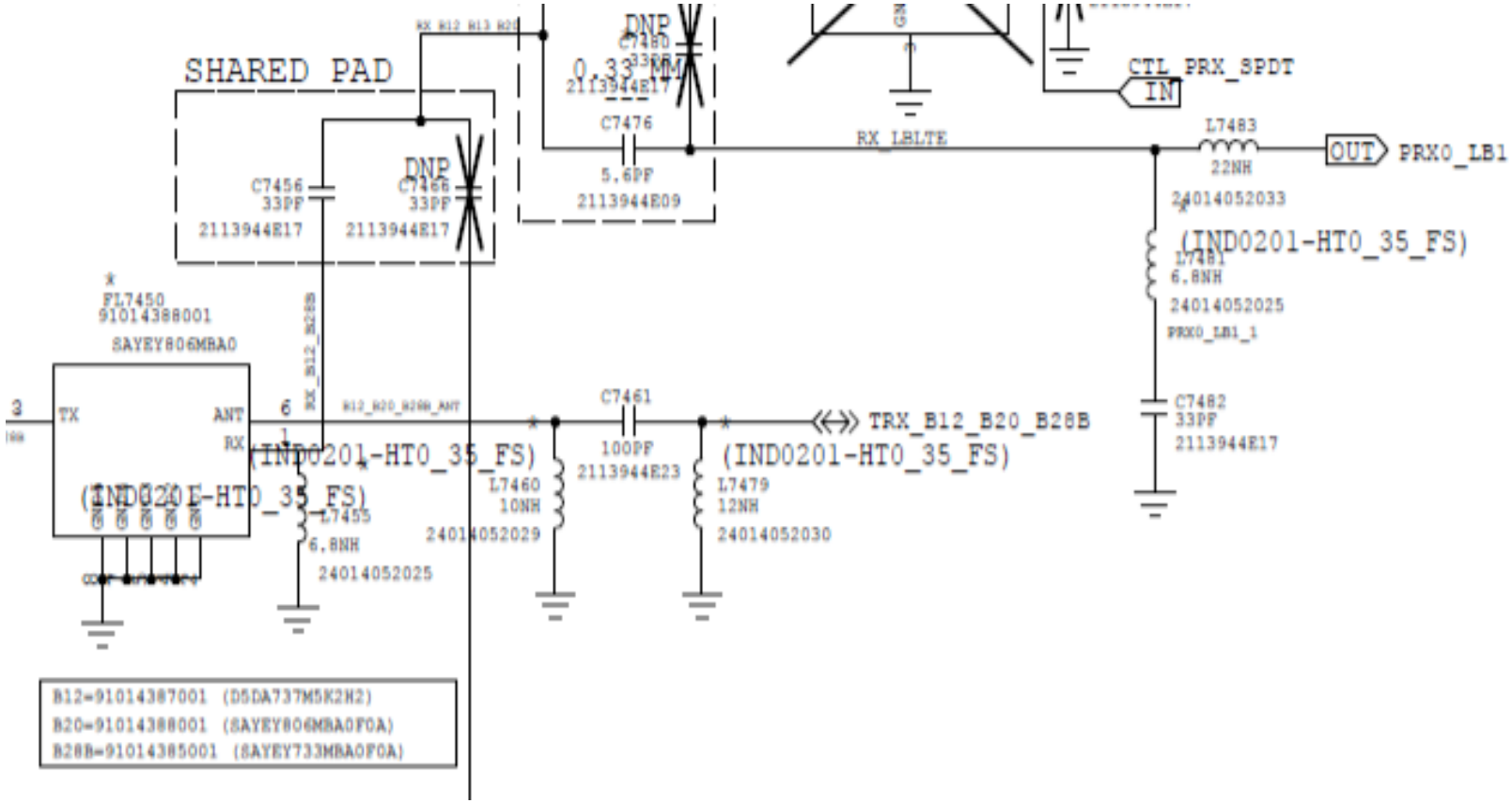
LTE B20 TRX Circuits

Matching for Duplexer TX Port



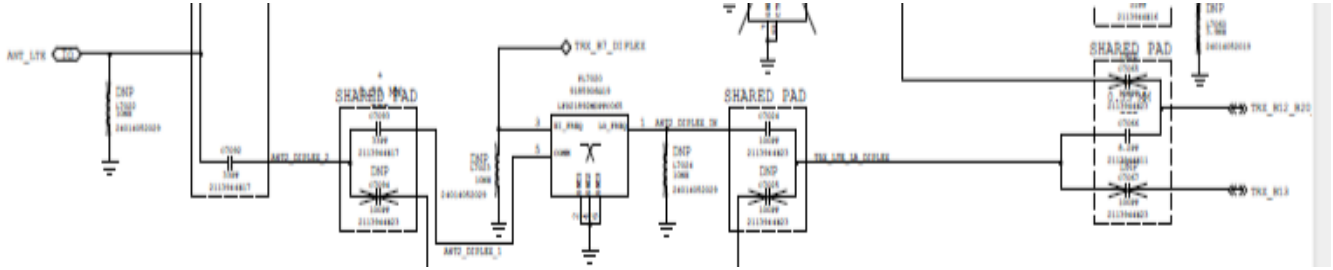
LTE B20 TRX Circuits

Matching for Duplexer ANT, RX ports and WTR input matching

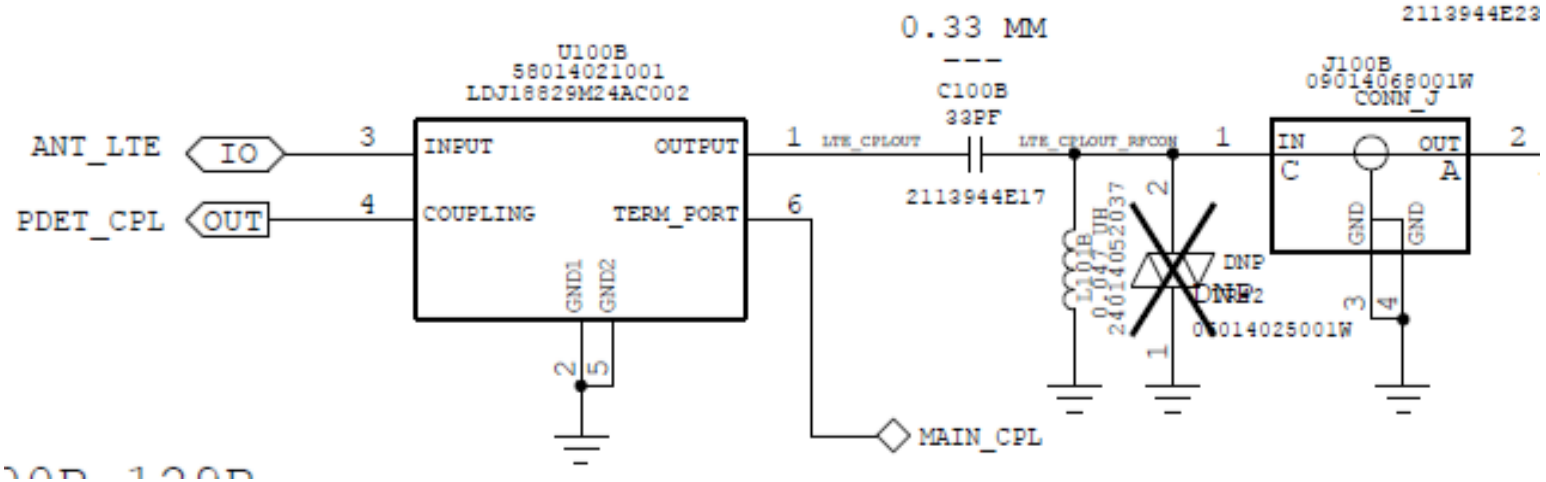


LTE B20 TRX Circuits

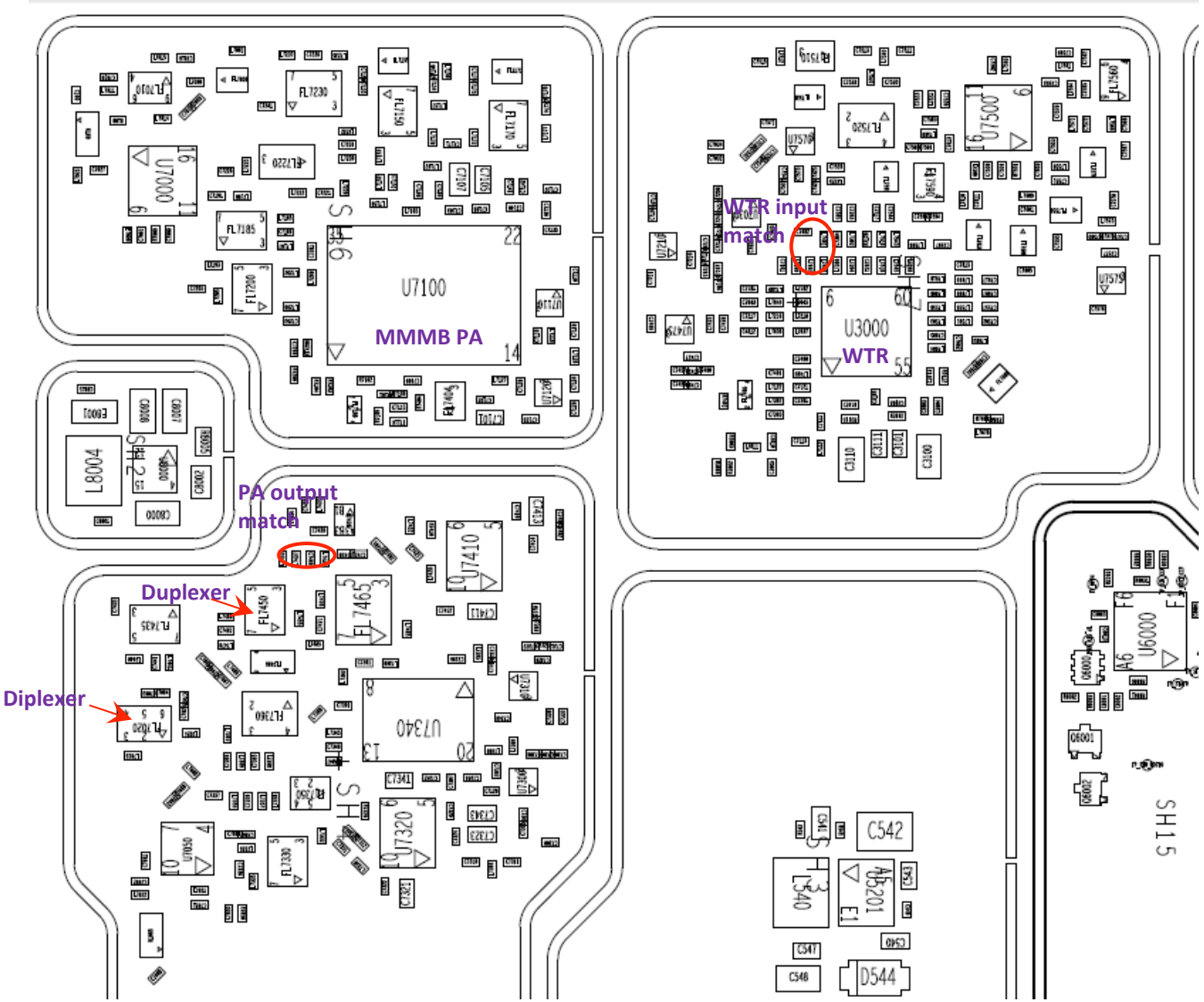
Diplexer



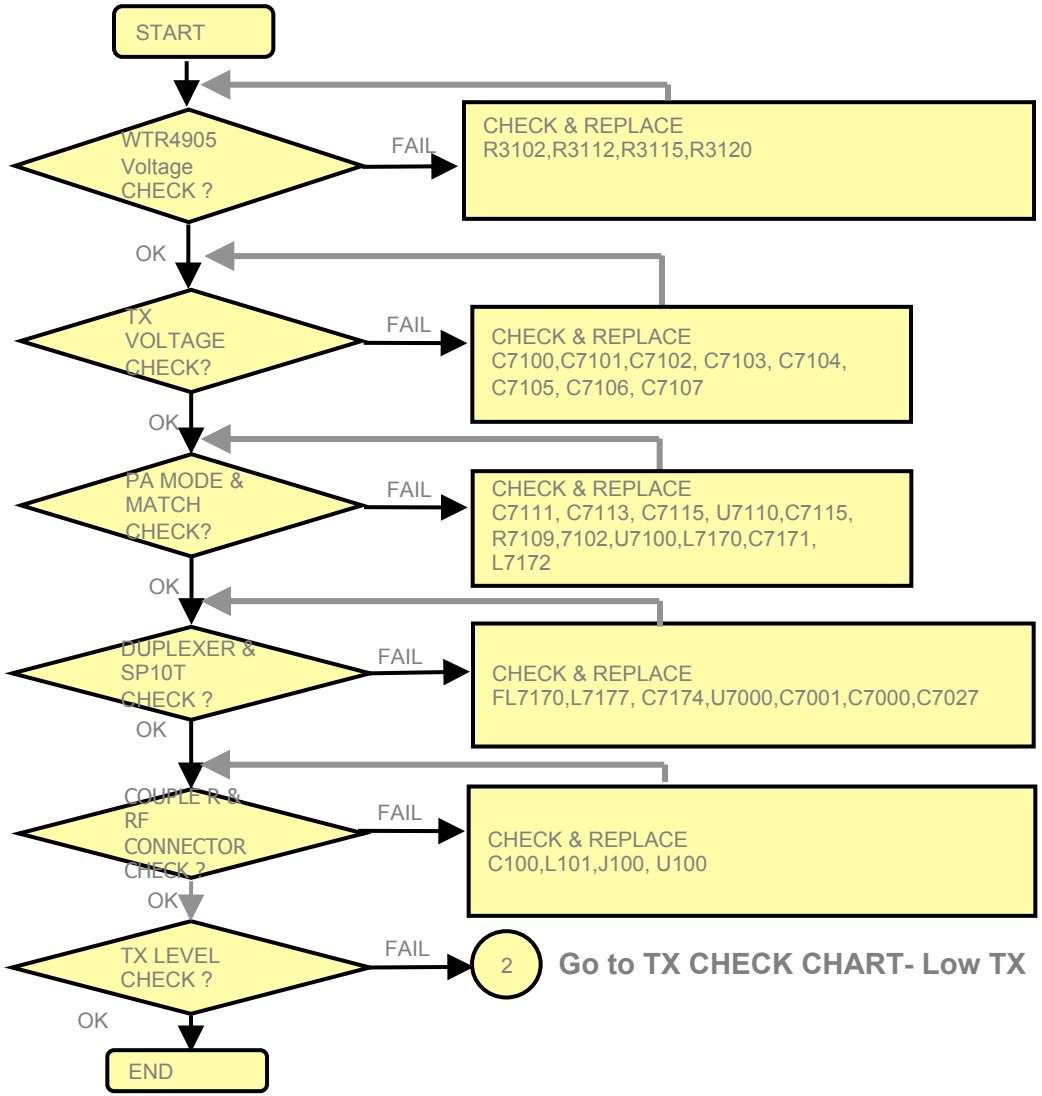
Coupler and RF connector



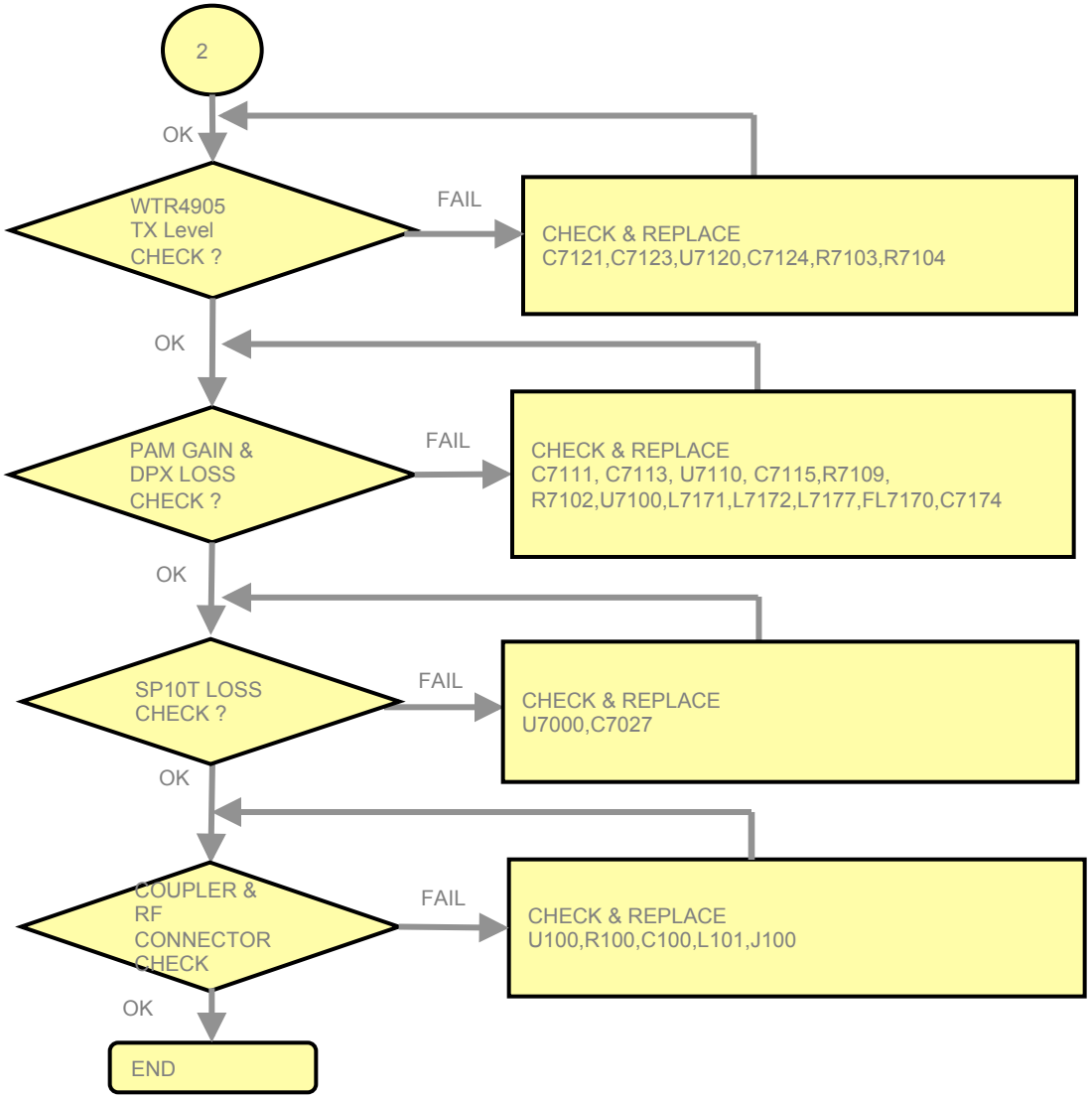
LTE B20 TRX Circuits Layout



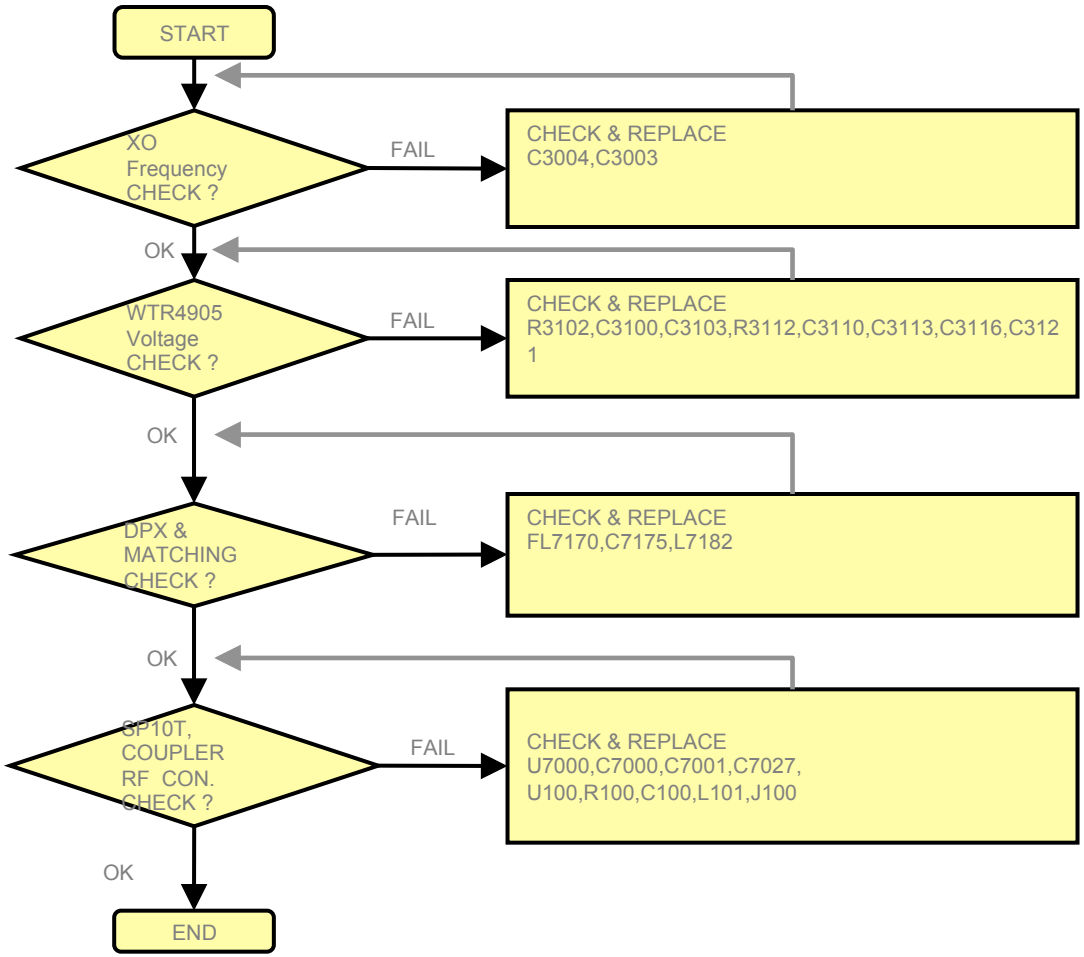
WCDMA B8 TX Check Chart – No TX(EU/LATAM/APAC SKU)



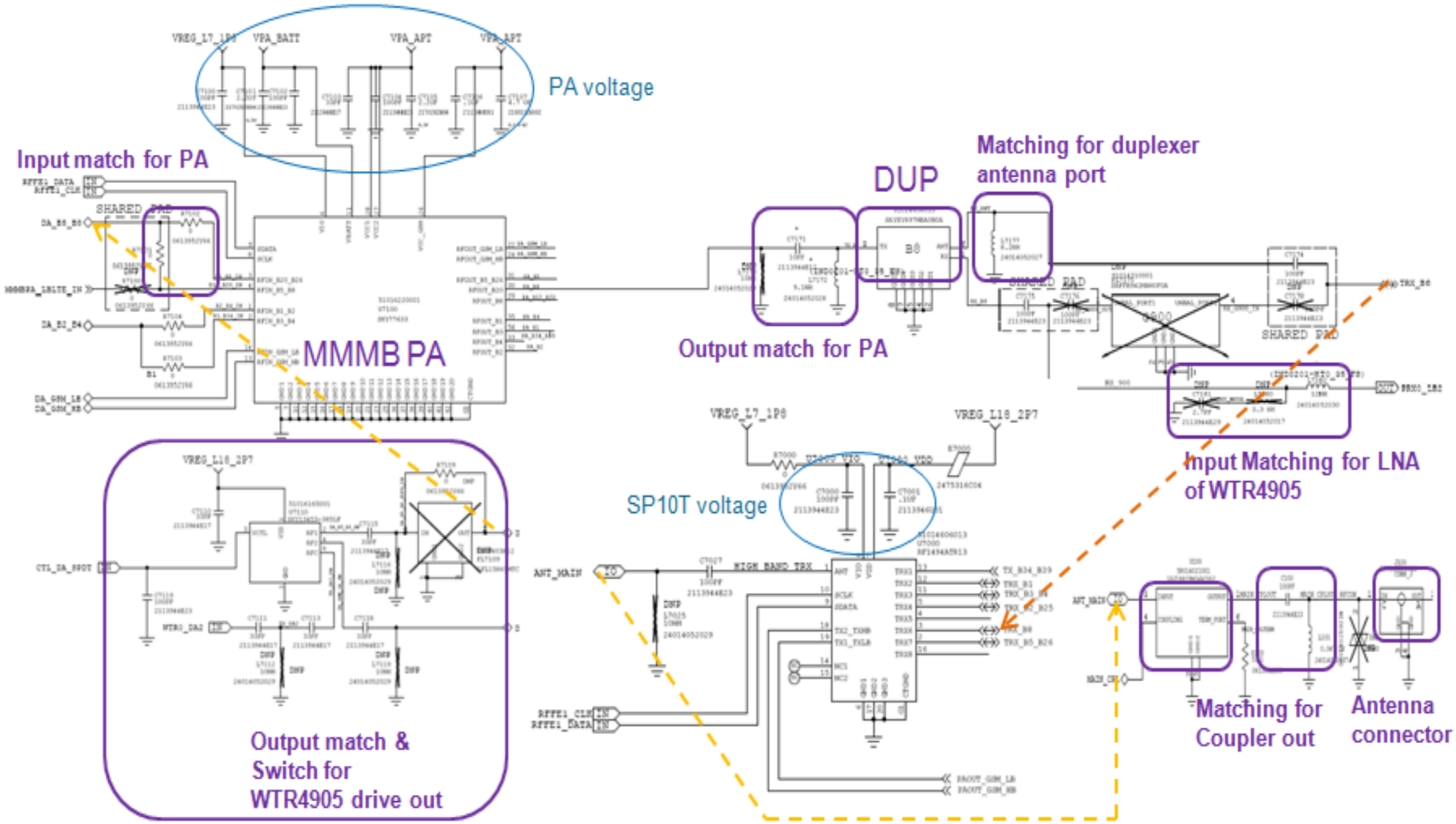
WCDMA B8 TX Check Chart – No TX



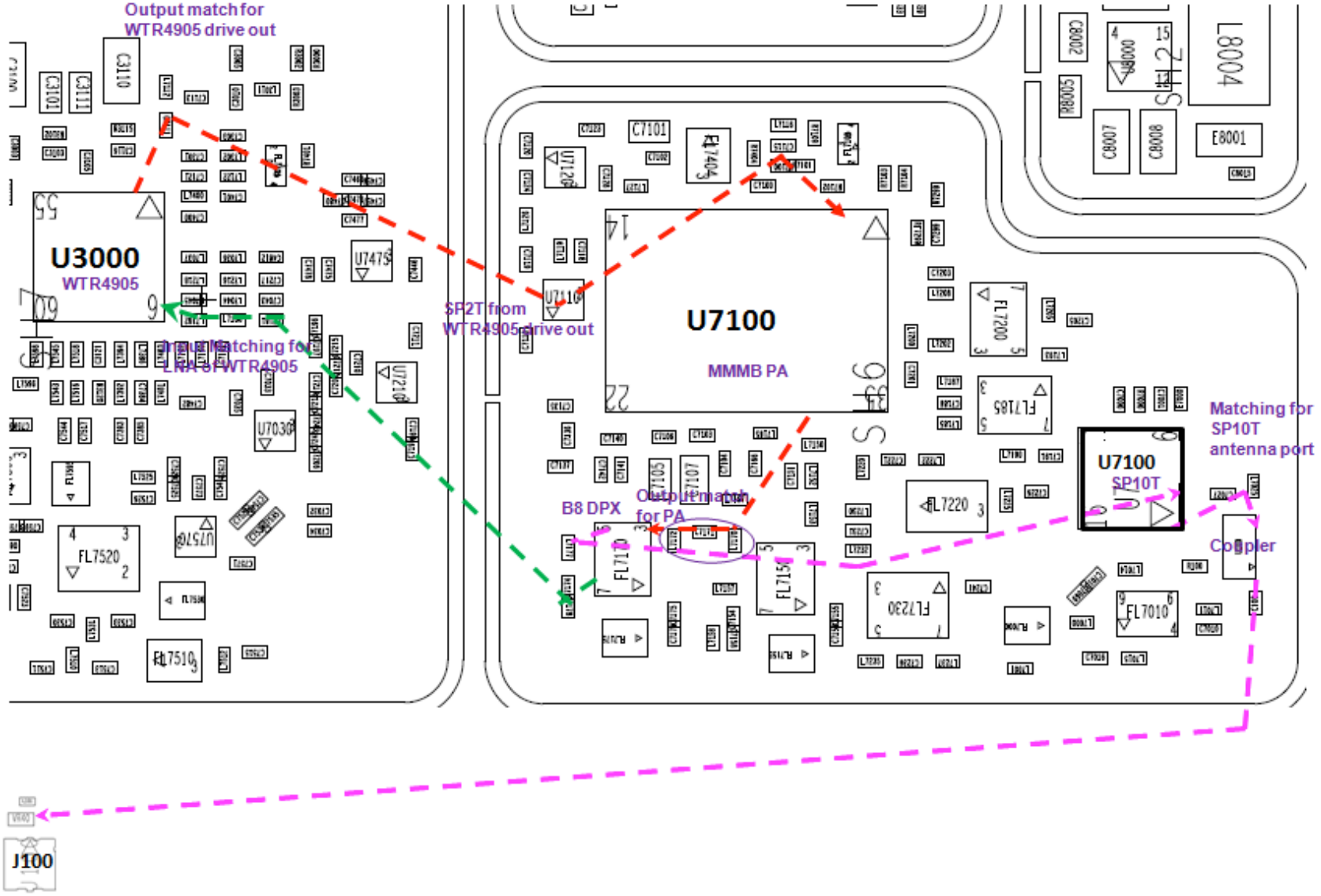
WCDMA B8 RX Check Chart (EU/LATAM/APAC SKU)



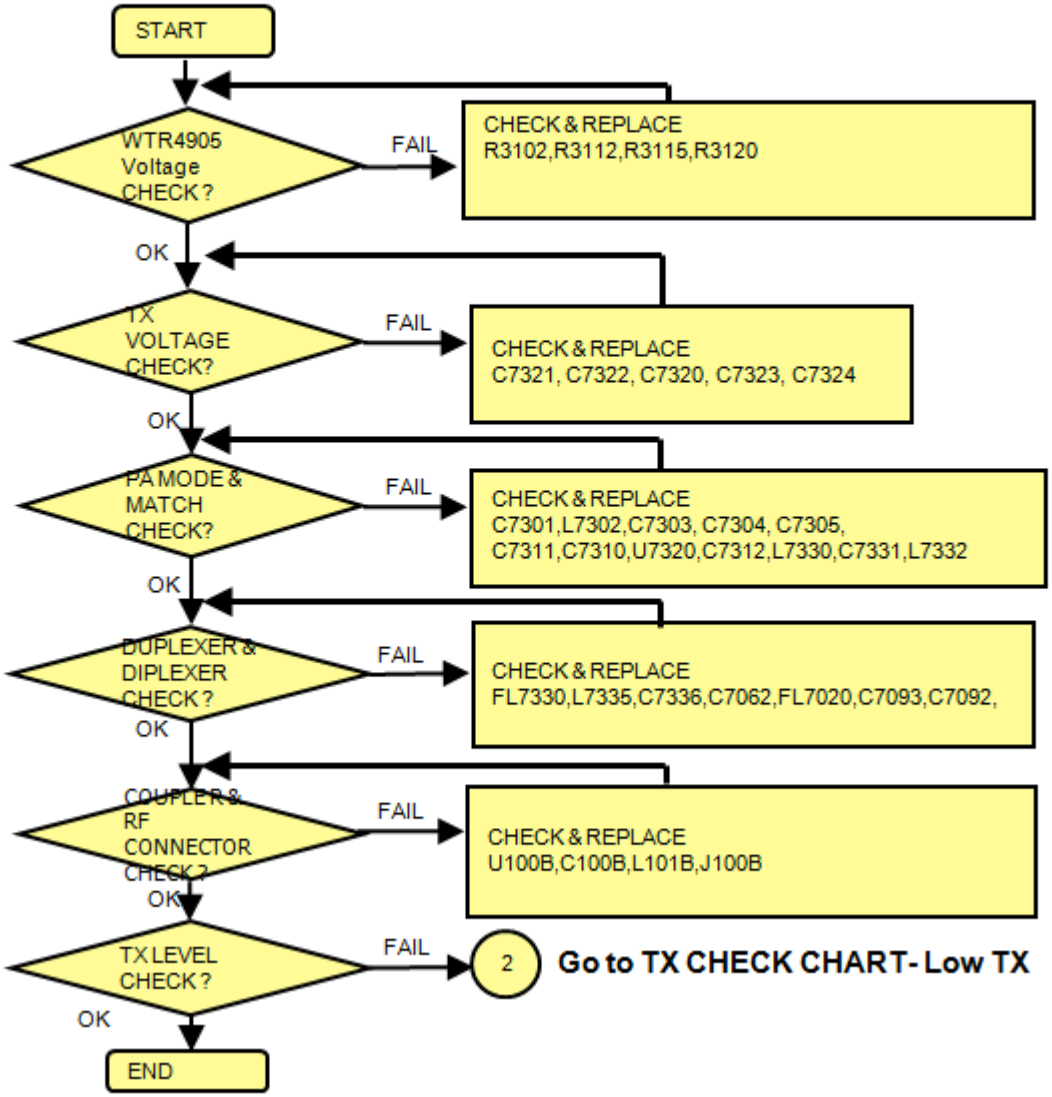
WCDMA B8 TRX CIRCUITS (PA + DPX + SP10T)



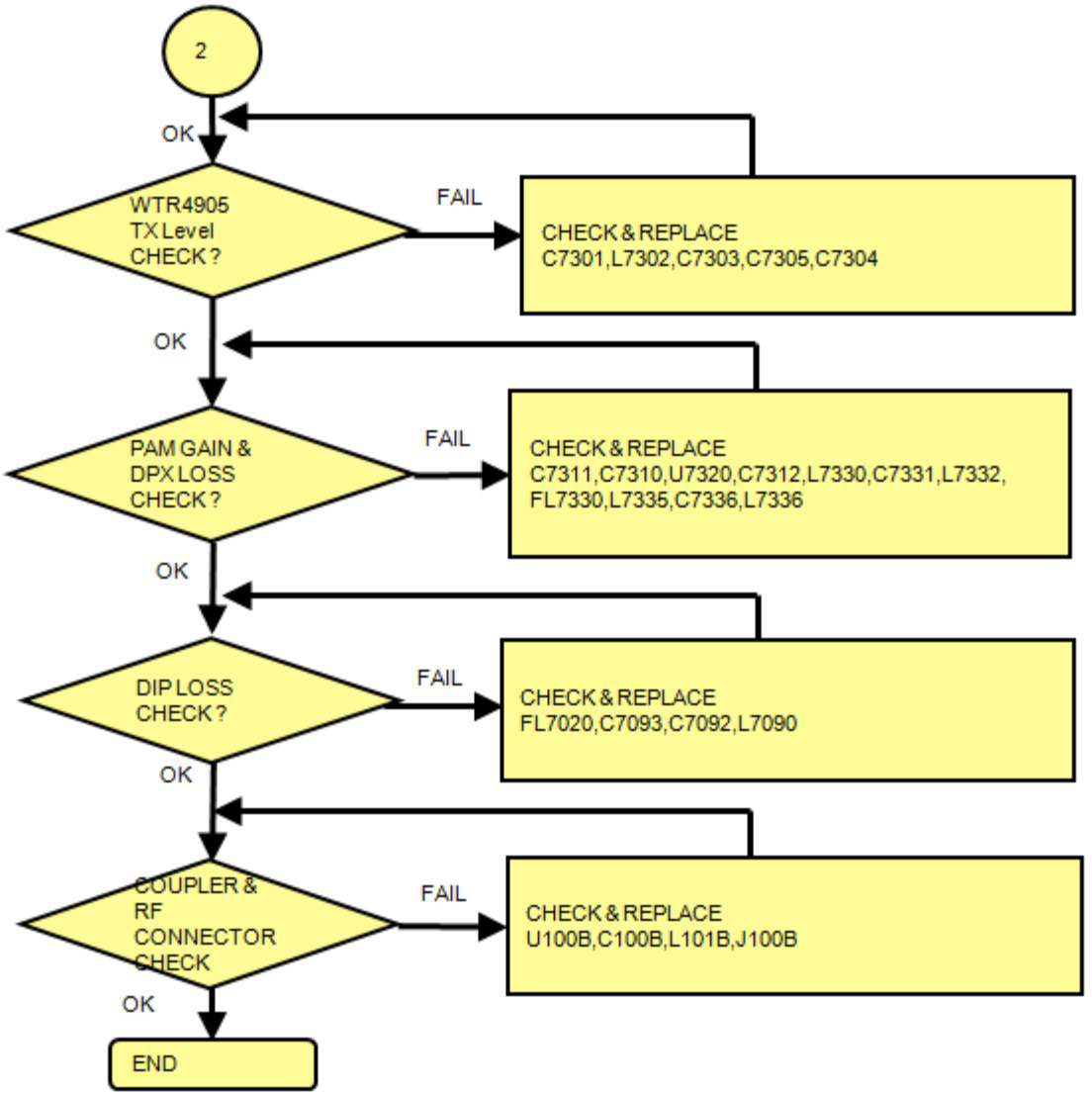
WCDMA B8 TRX Circuits (WTR + PA + DPX + SP10T) Layout



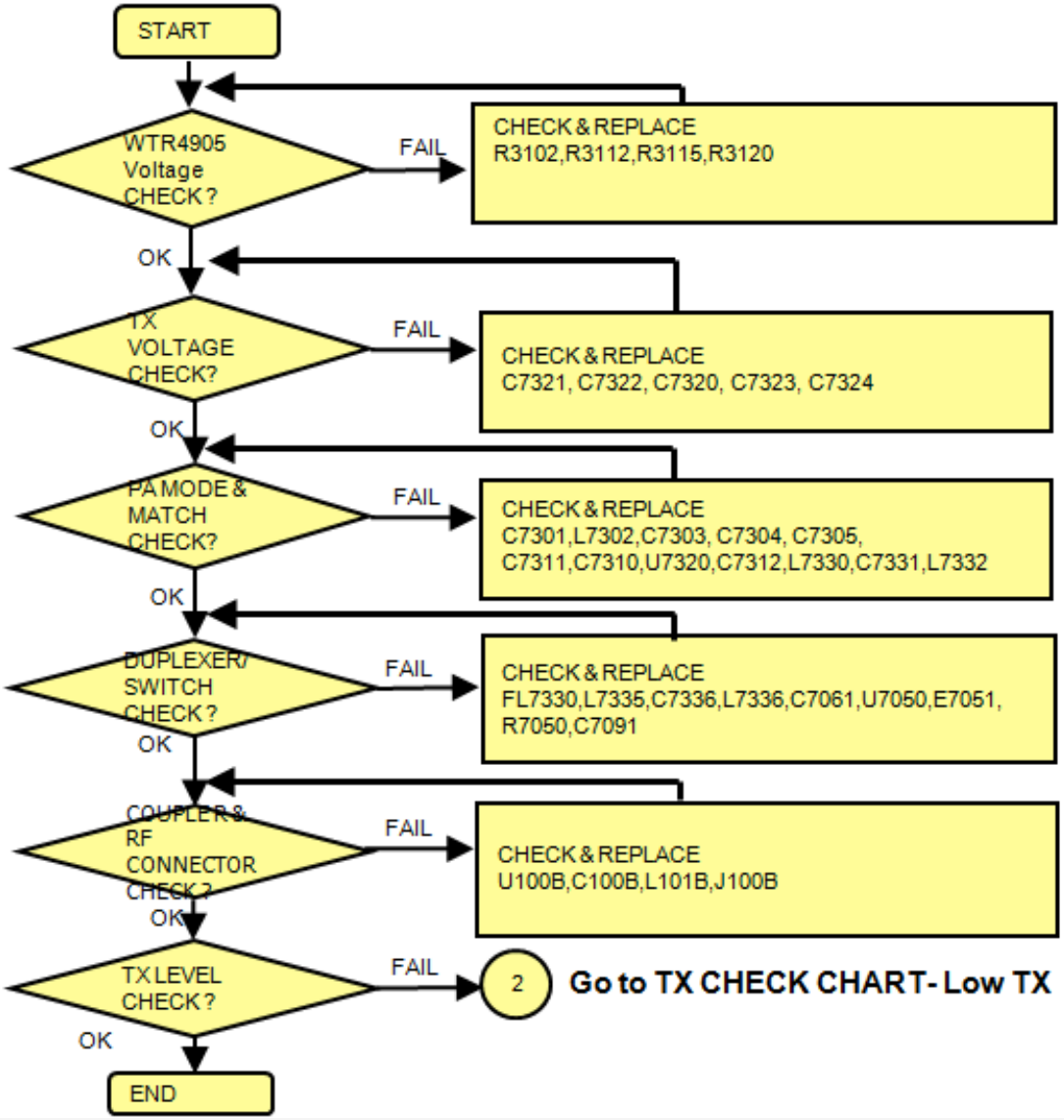
LTE B7 TX Check Chart – No TX(NA/EU SKU)



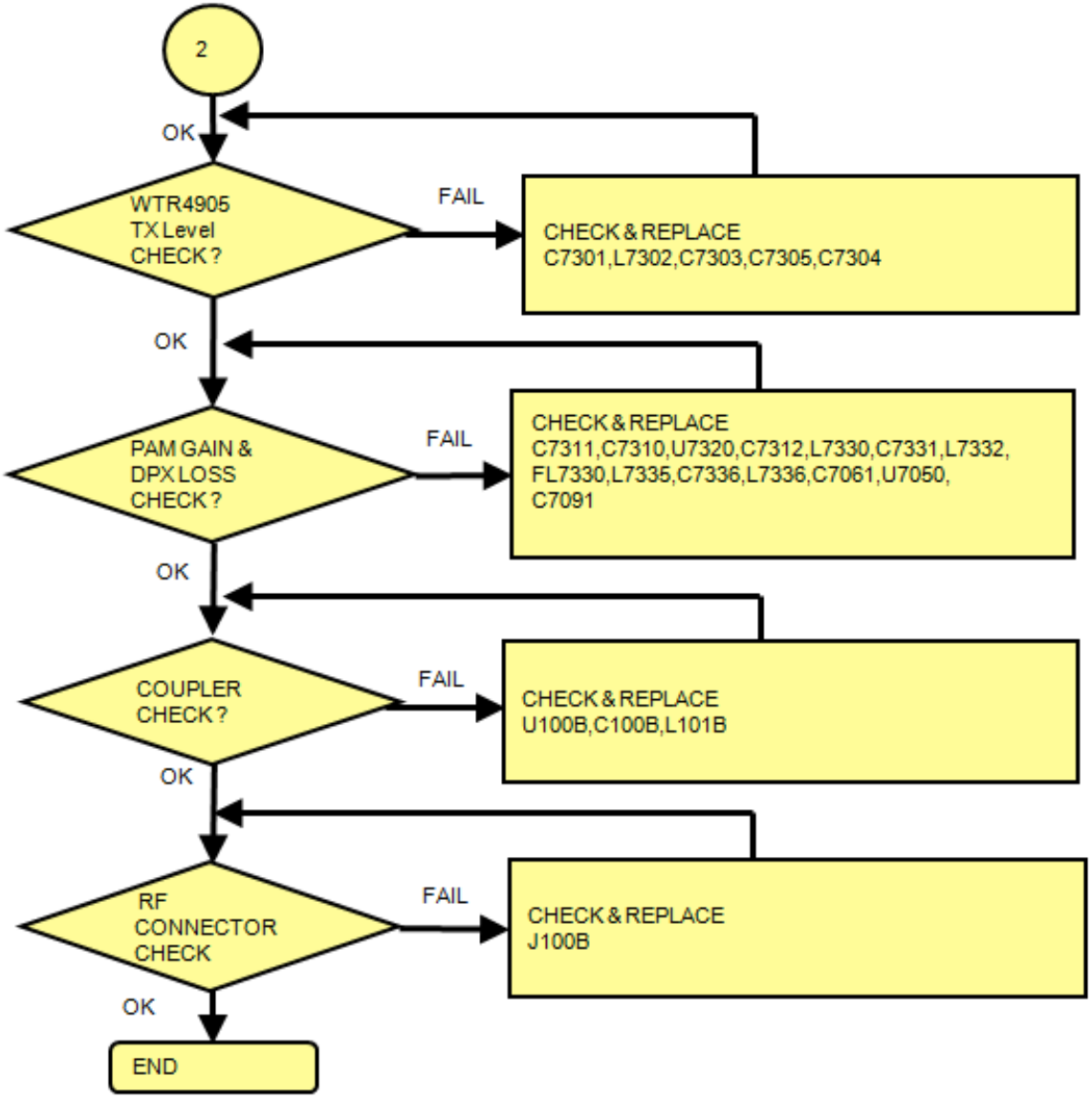
LTE B7 TX Check Chart – Low TX(NA/EU SKU)



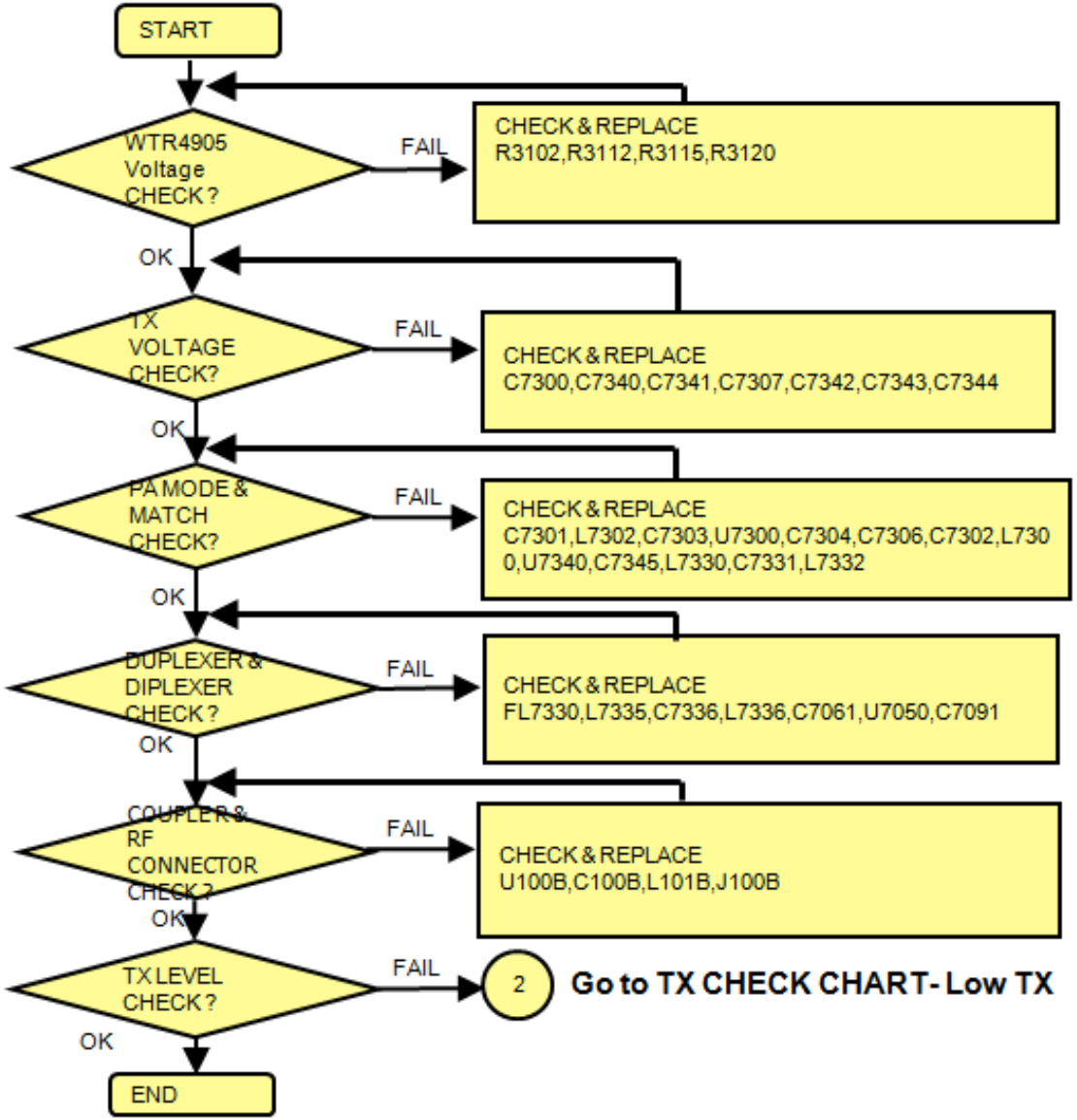
LTE B7 TX Check Chart – No TX(LATAM SKU)



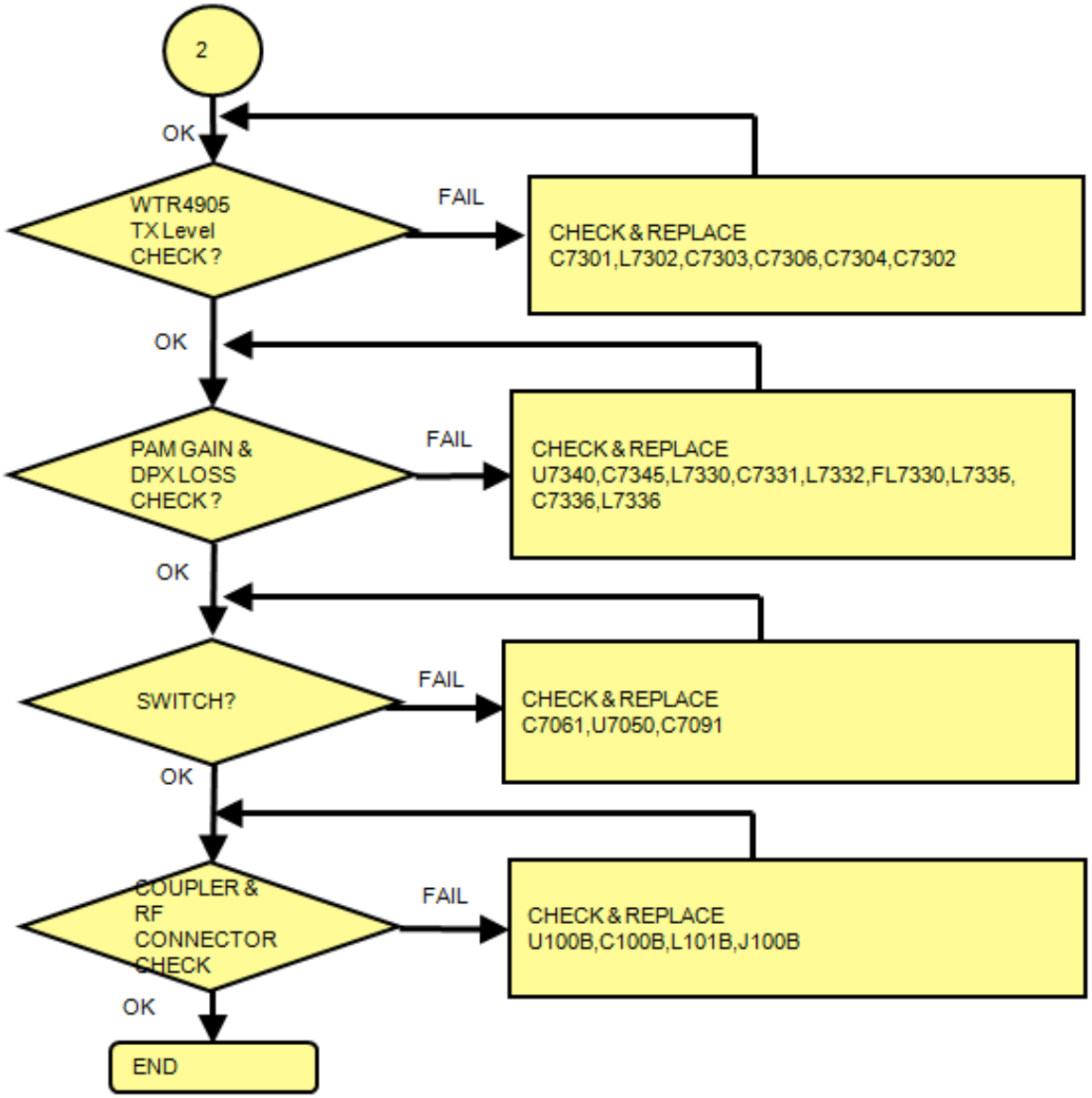
LTE B7 TX Check Chart – Low TX(LATAM SKU)



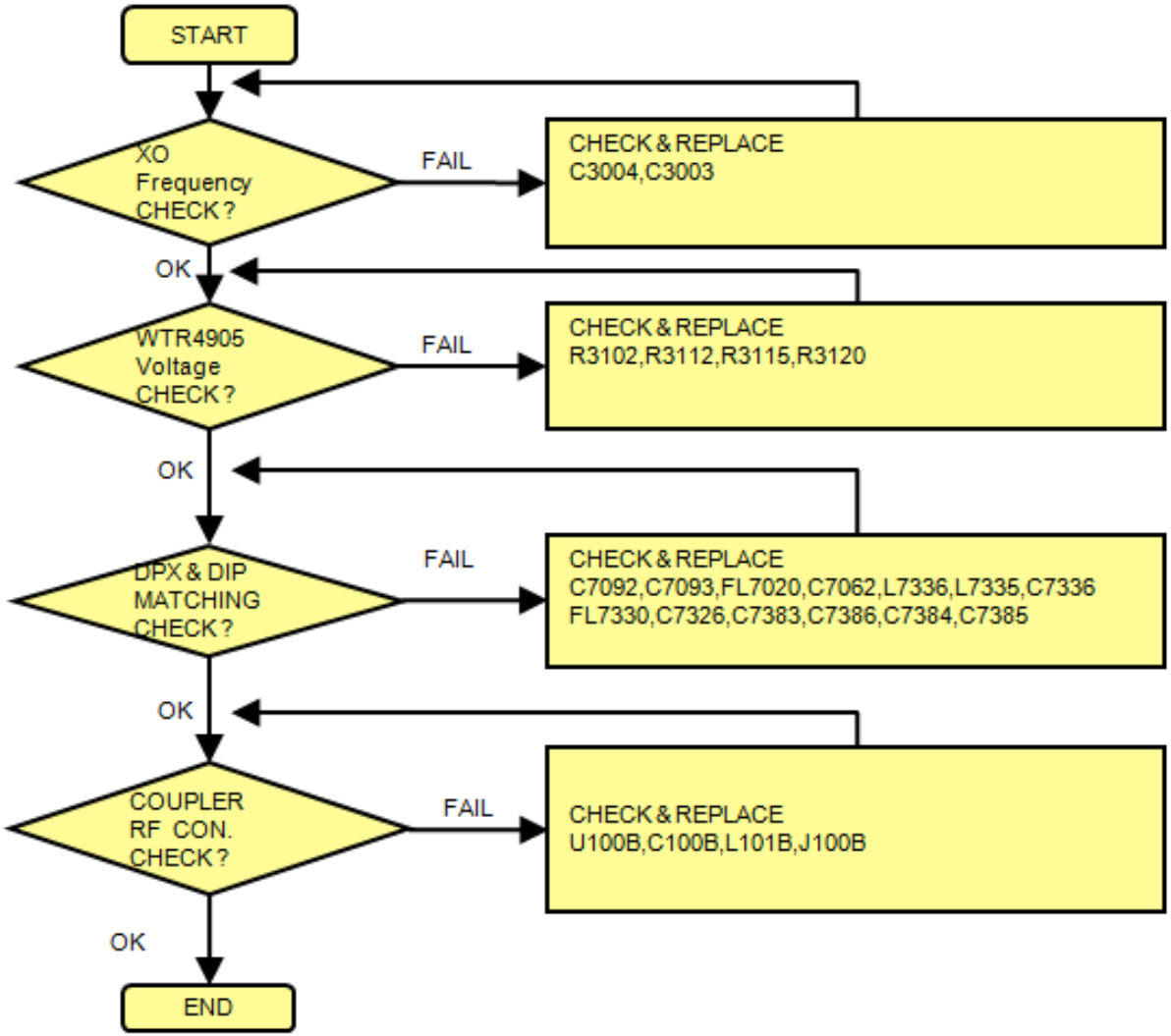
LTE B7 TX Check Chart – No TX(APAC SKU)



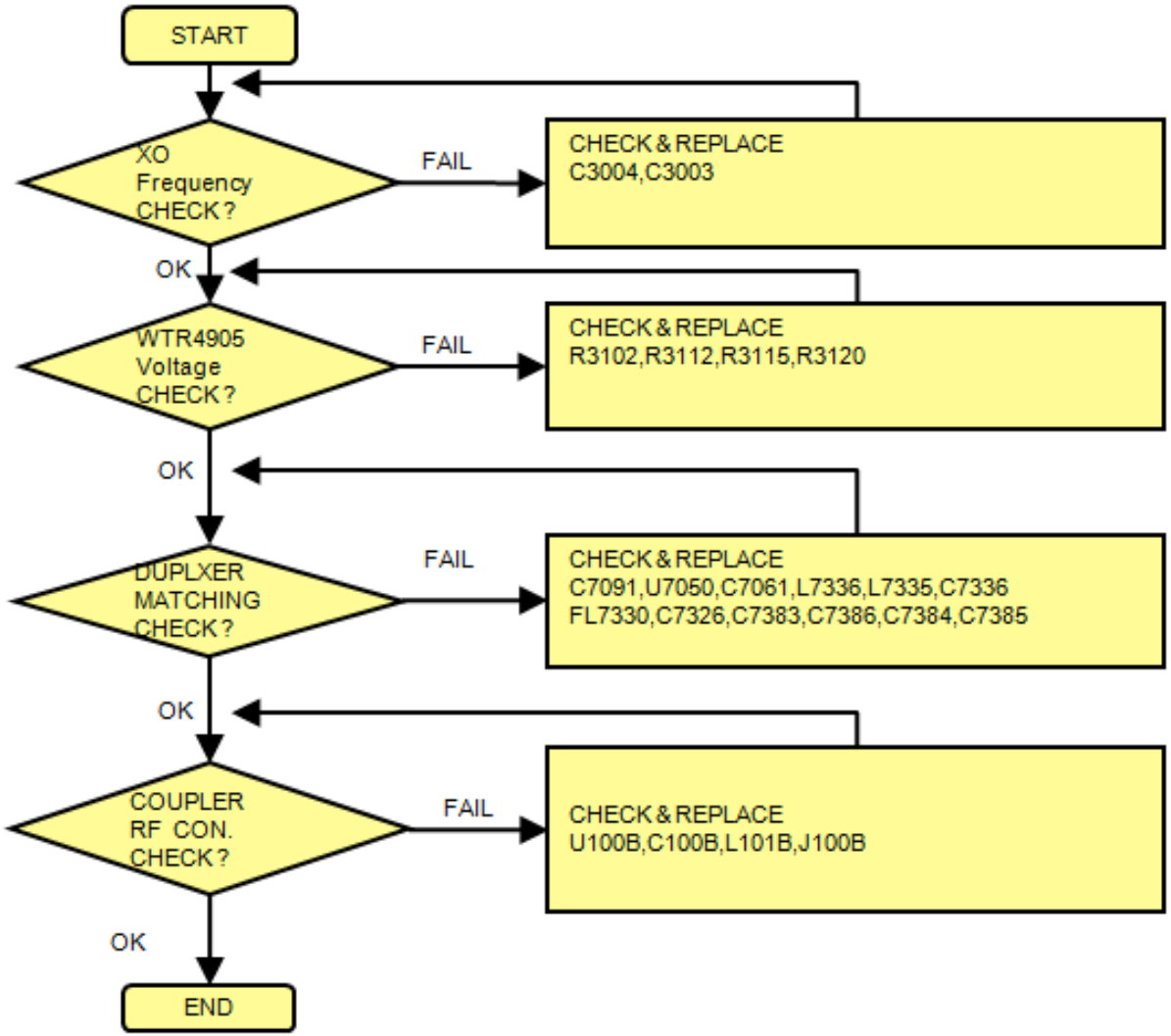
LTE B7 TX Check Chart – Low TX(APAC SKU)



LTE B7 RX Check Chart(NA/EU SKU)

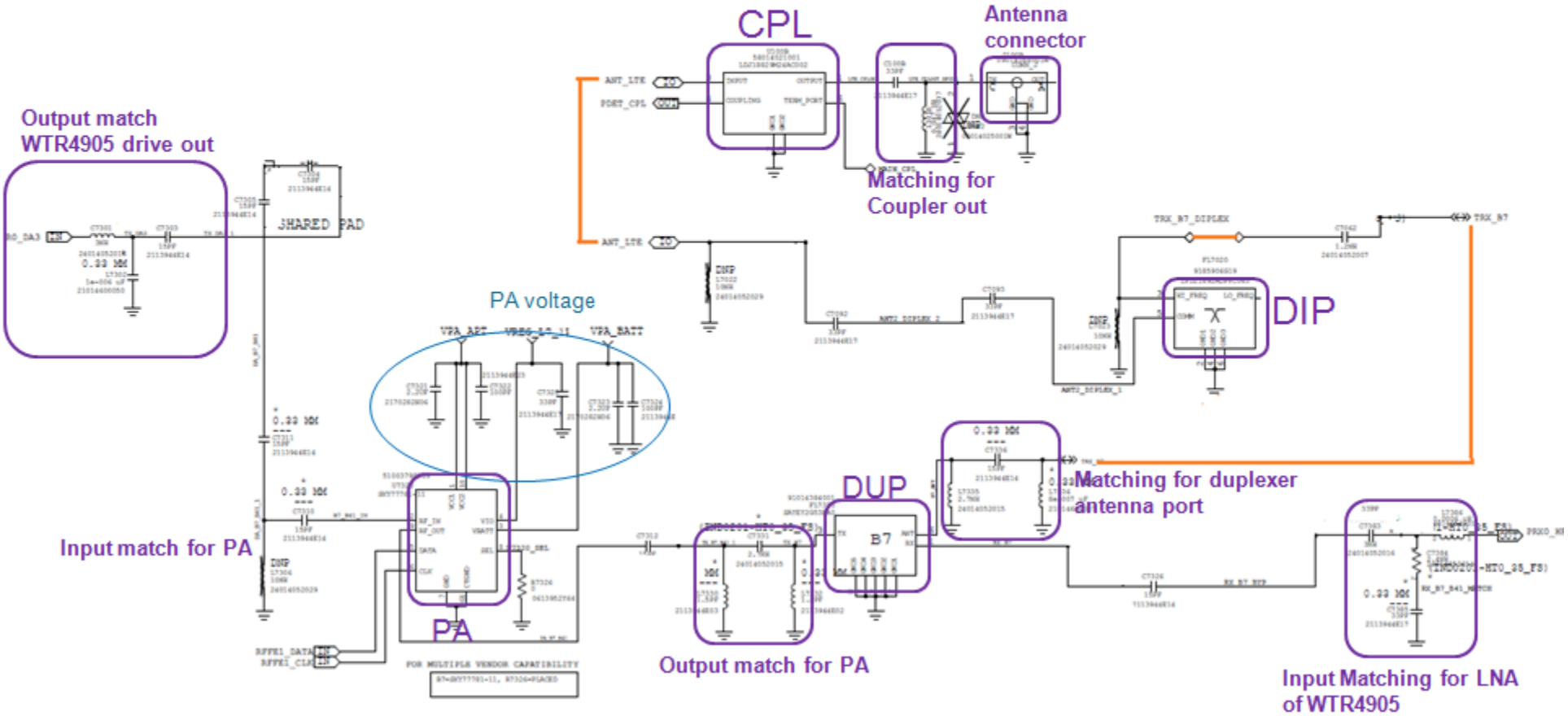


LTE B7 RX Check Chart(LATAM/APAC SKU)



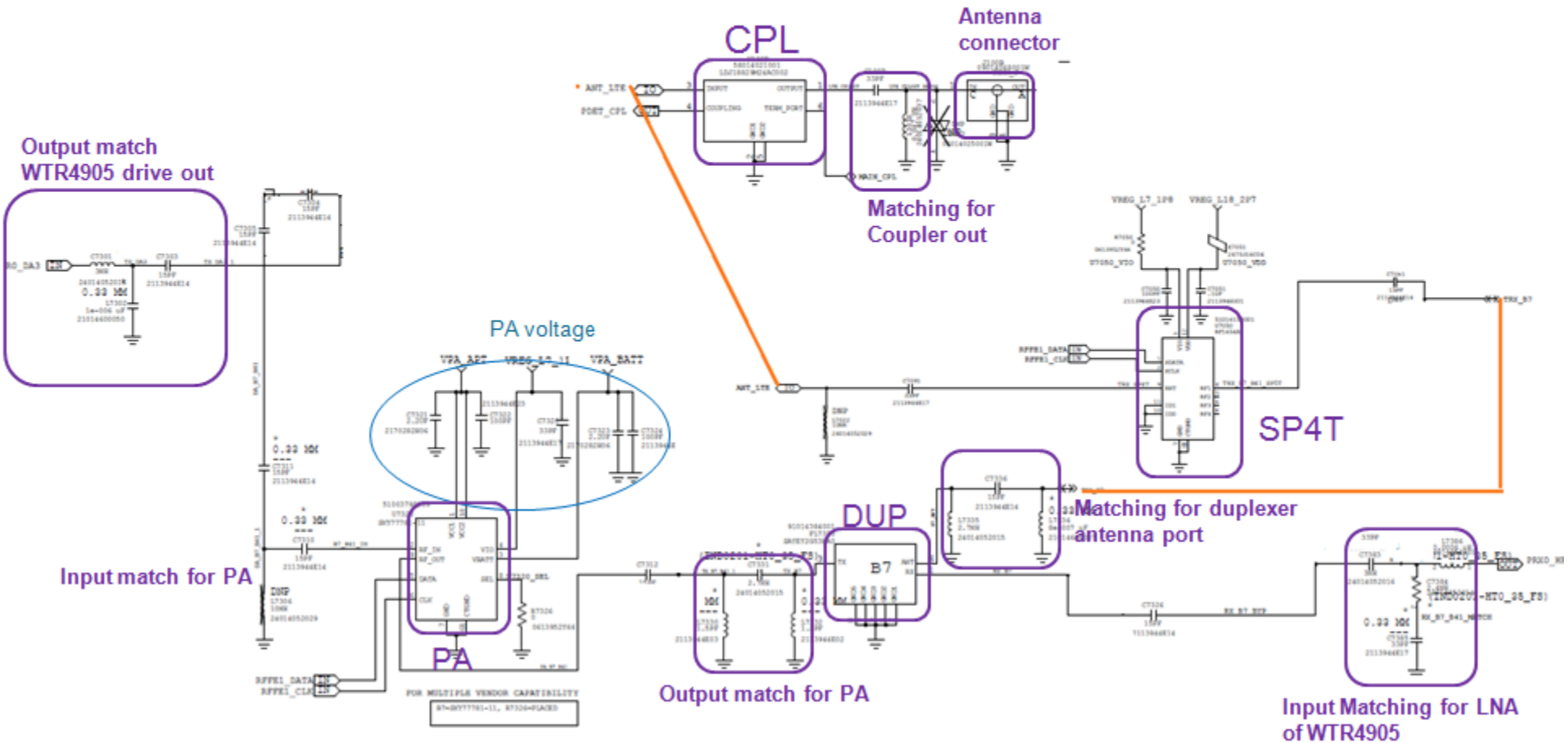
LTE B7 TRX CIRCUITS NA/EU SKU

Please check BOM for the correct values, components here are representational



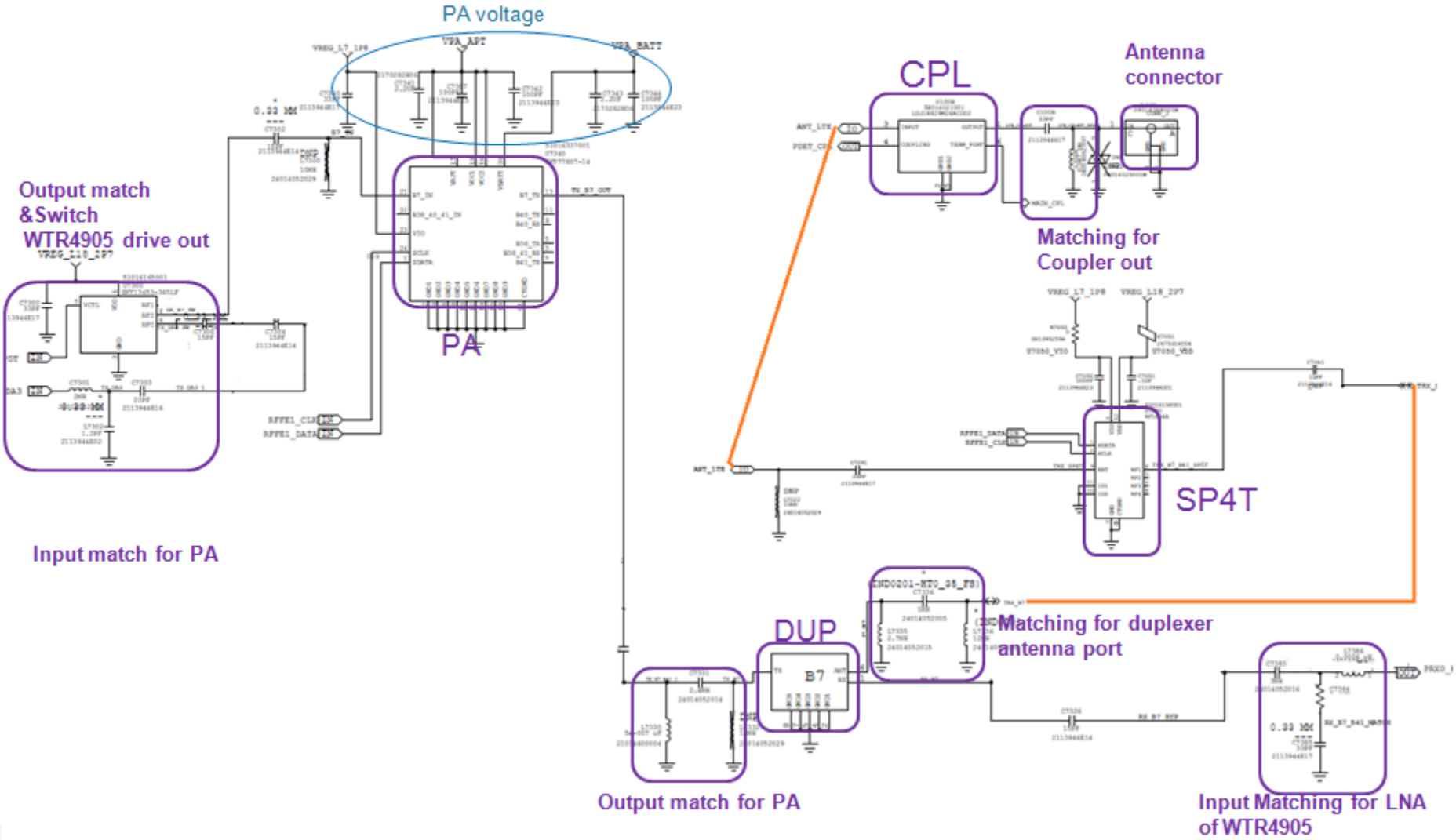
LTE B7 TRX CIRCUITS LATAM SKU

Please check BOM for the correct values, components here are representational

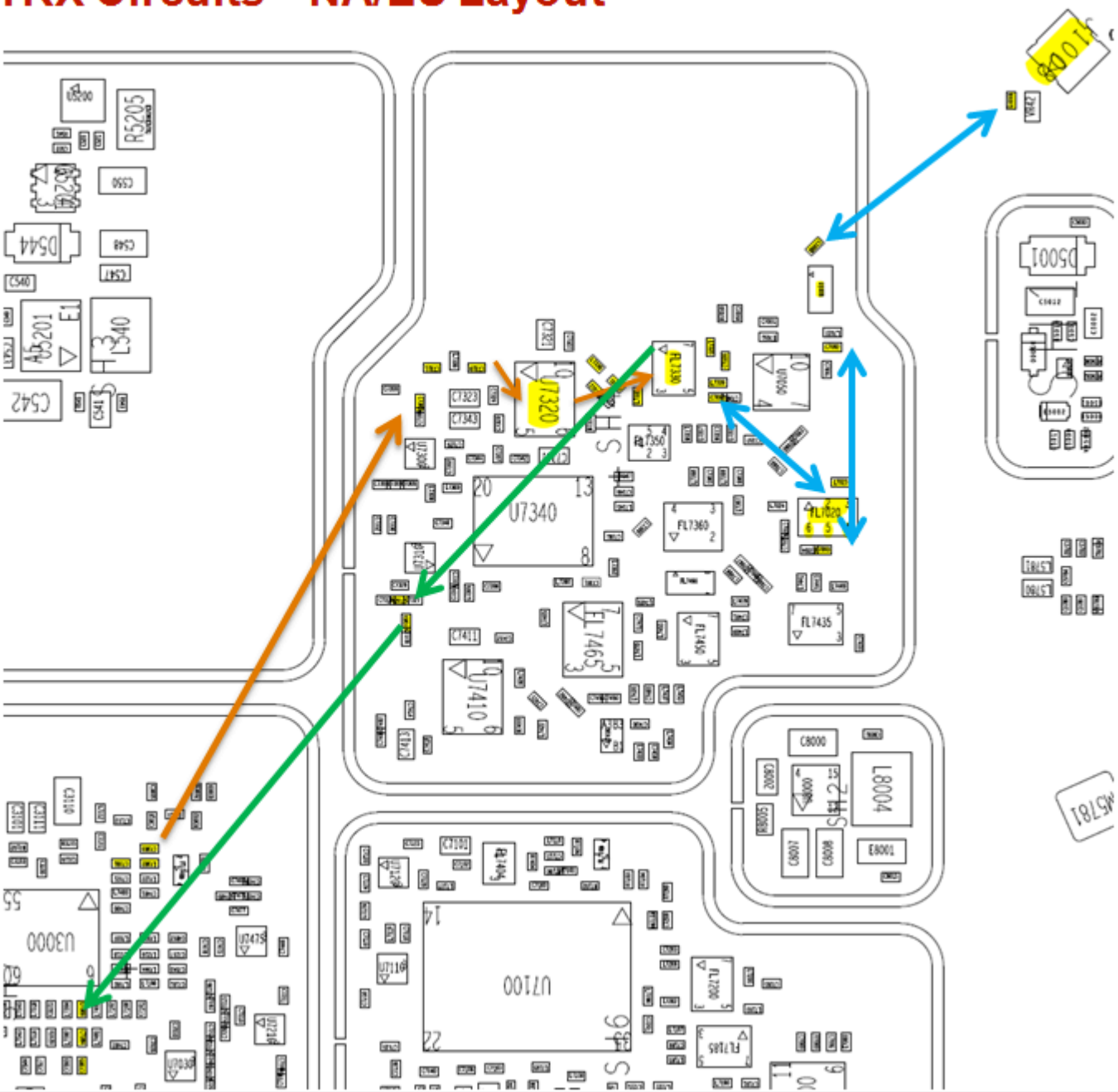


LTE B7 TRX CIRCUITS APAC SKU

Please check BOM for the correct values, components here are representational



LTE B7 TRX Circuits – NA/EU Layout

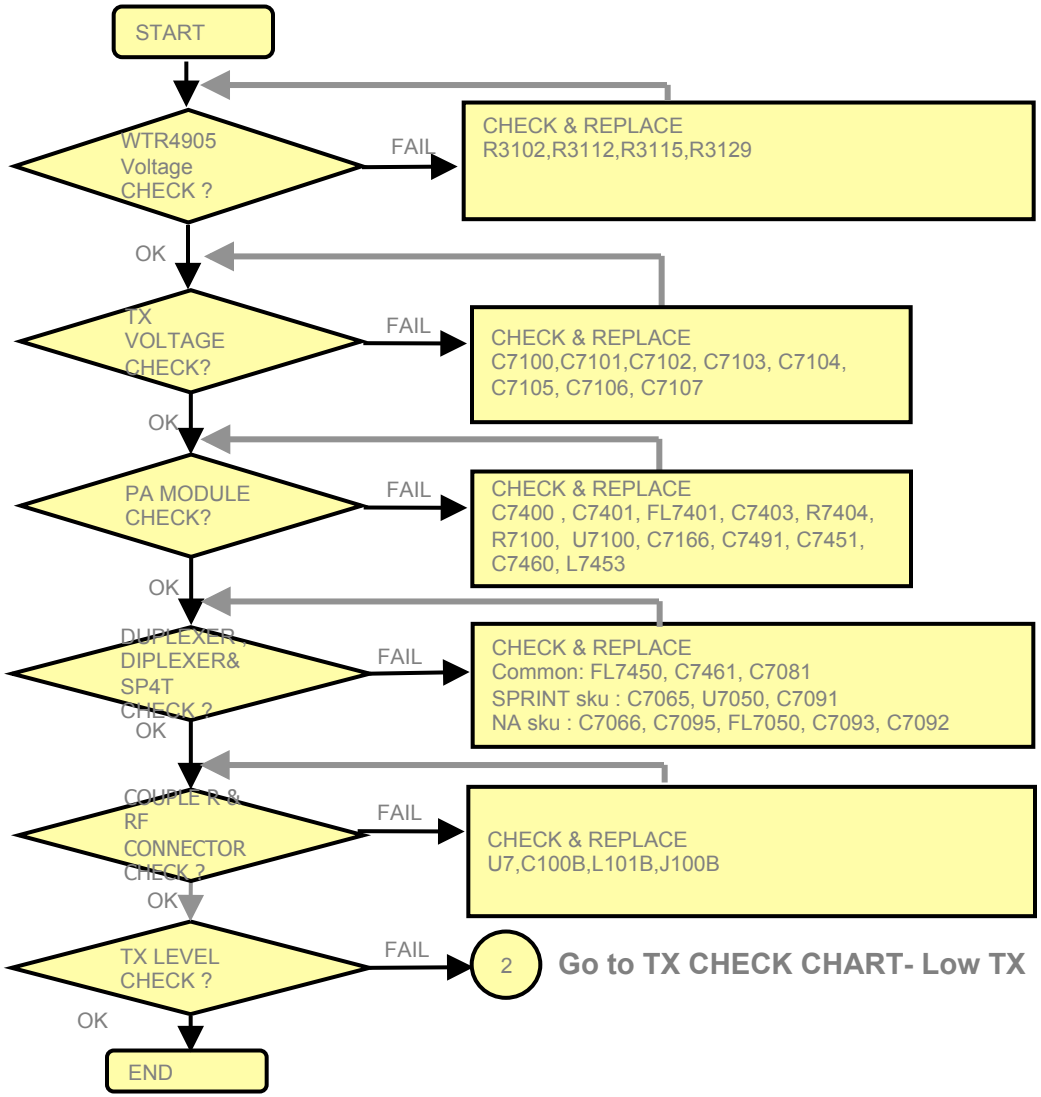


LTE B7 TRX Circuits – LATAM Layout

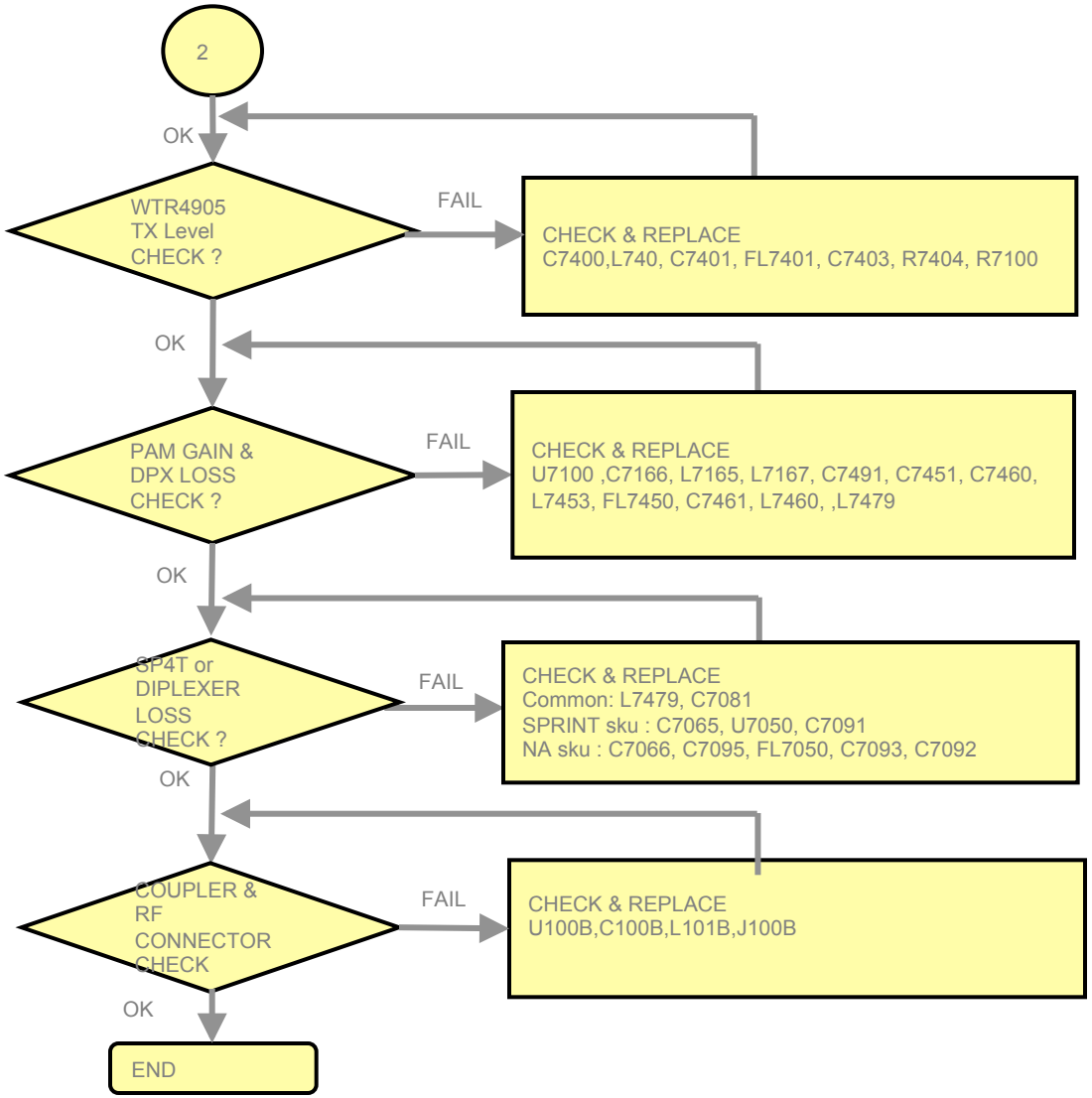
LTE B7 TRX Circuits – APAC Layout

LTE B12/B17 Tx and Rx

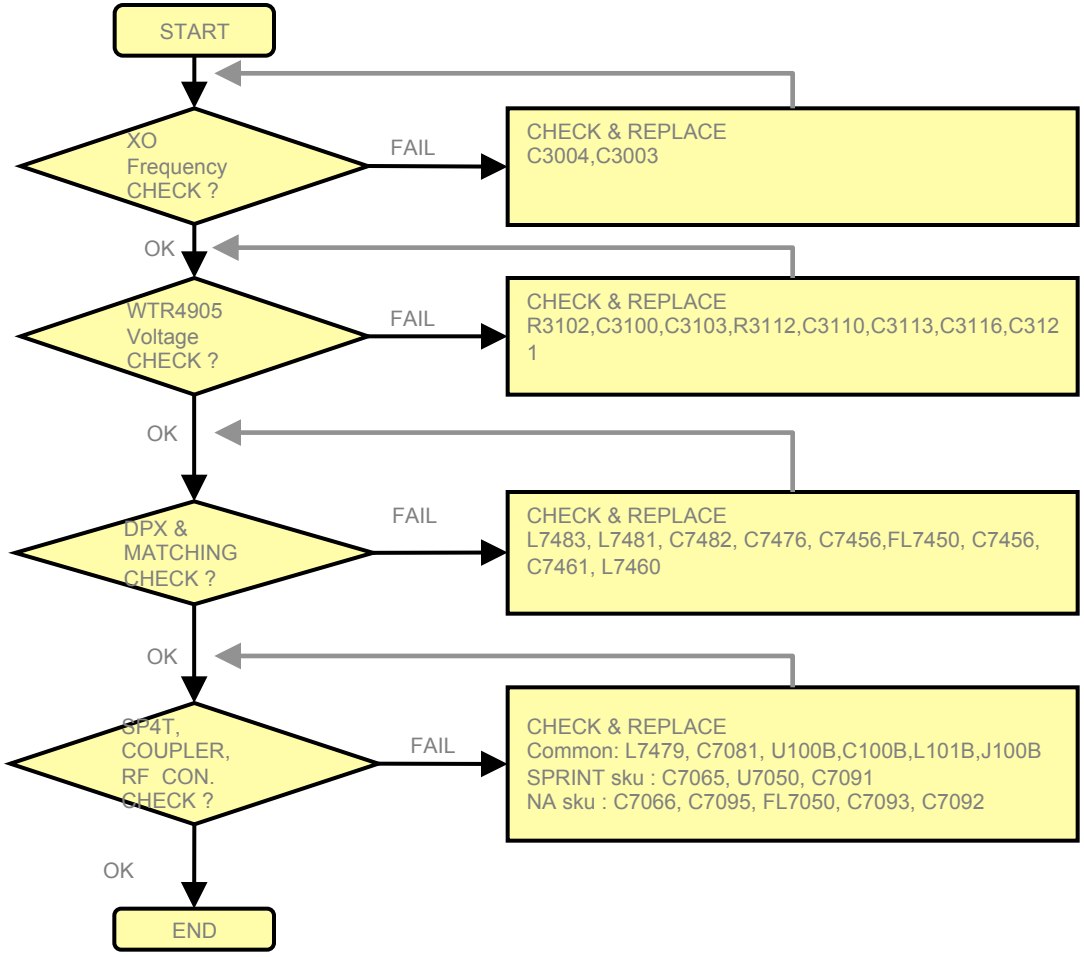
LTE B12/17 TX Check Chart – No TX



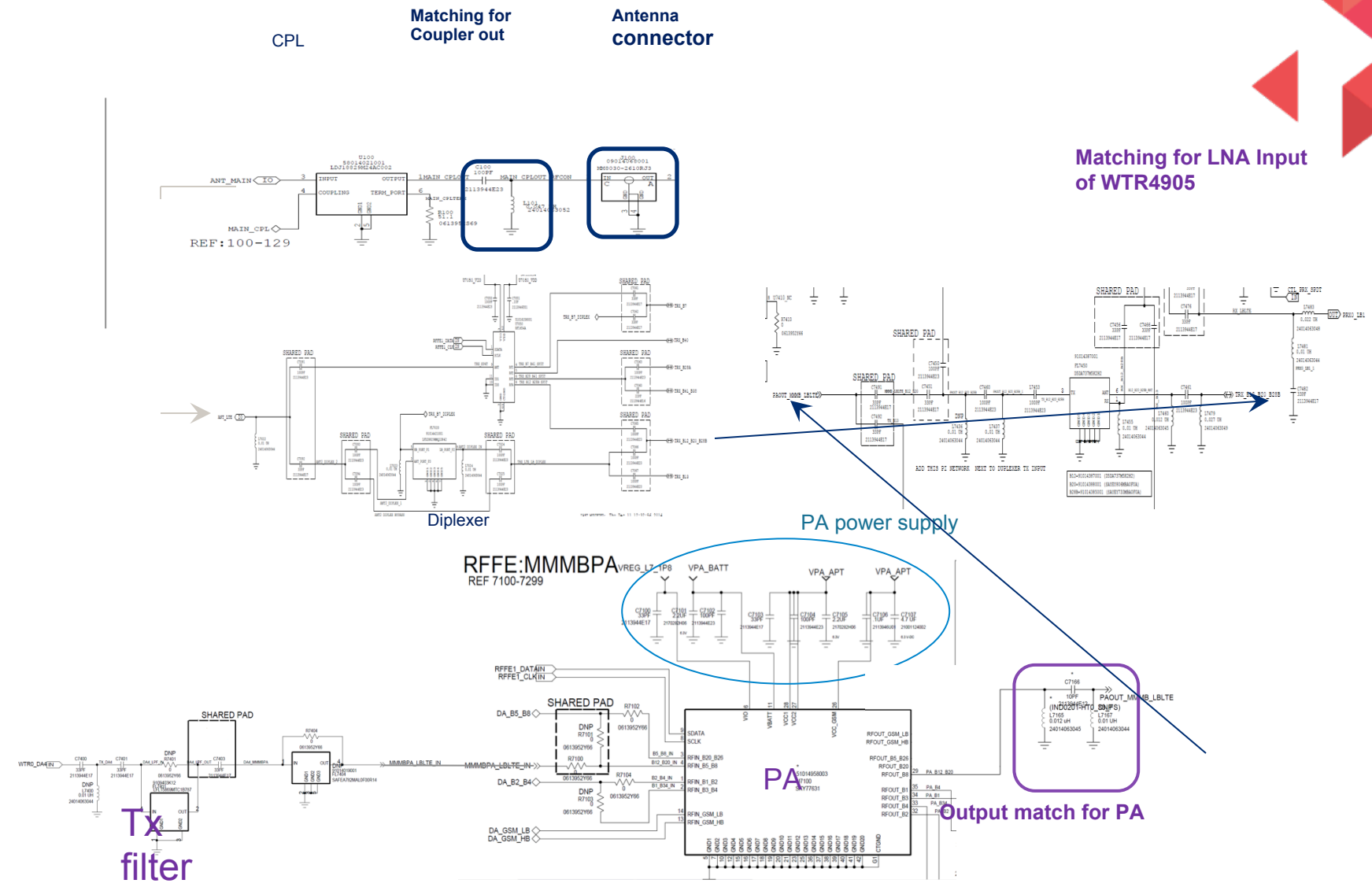
LTE B12/17 TX Check Chart – Low TX



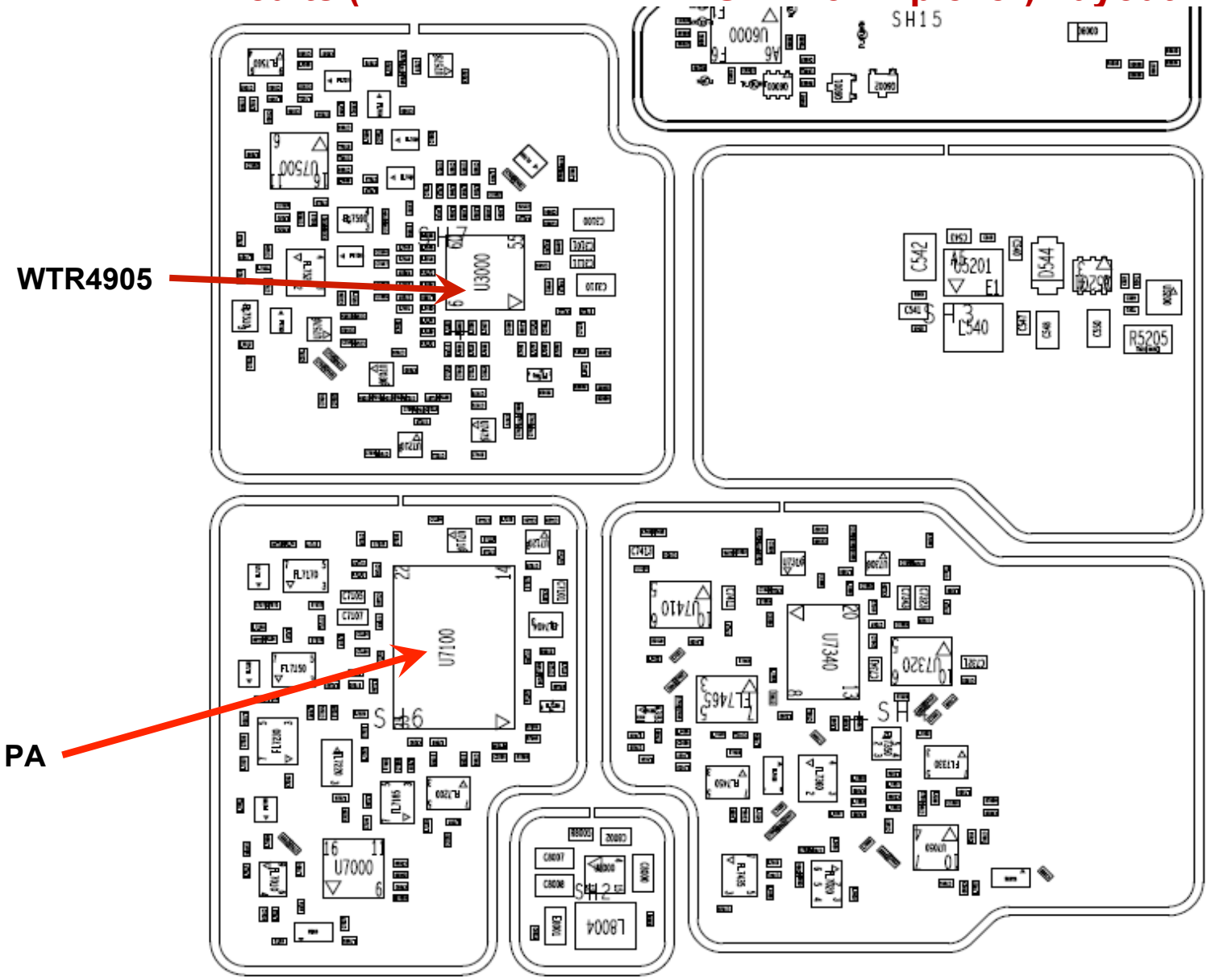
LTE B12/17 RX Check Chart



B12/17 TRX Circuits (PA + DPX + SP4T or Diplexer)

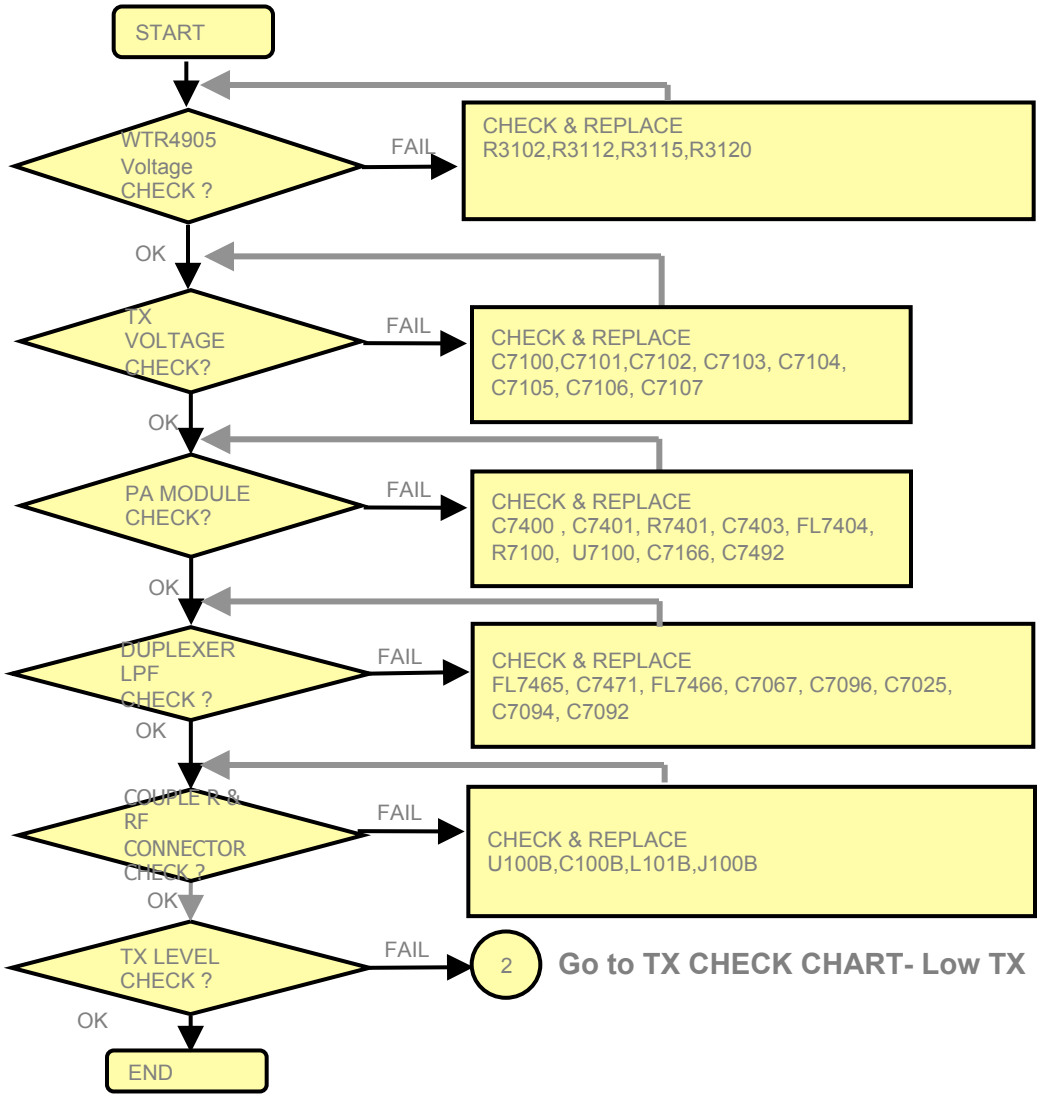


B12/17 TRX Circuits (WTR + PA + DPX + SP4T or Diplexer) Layout

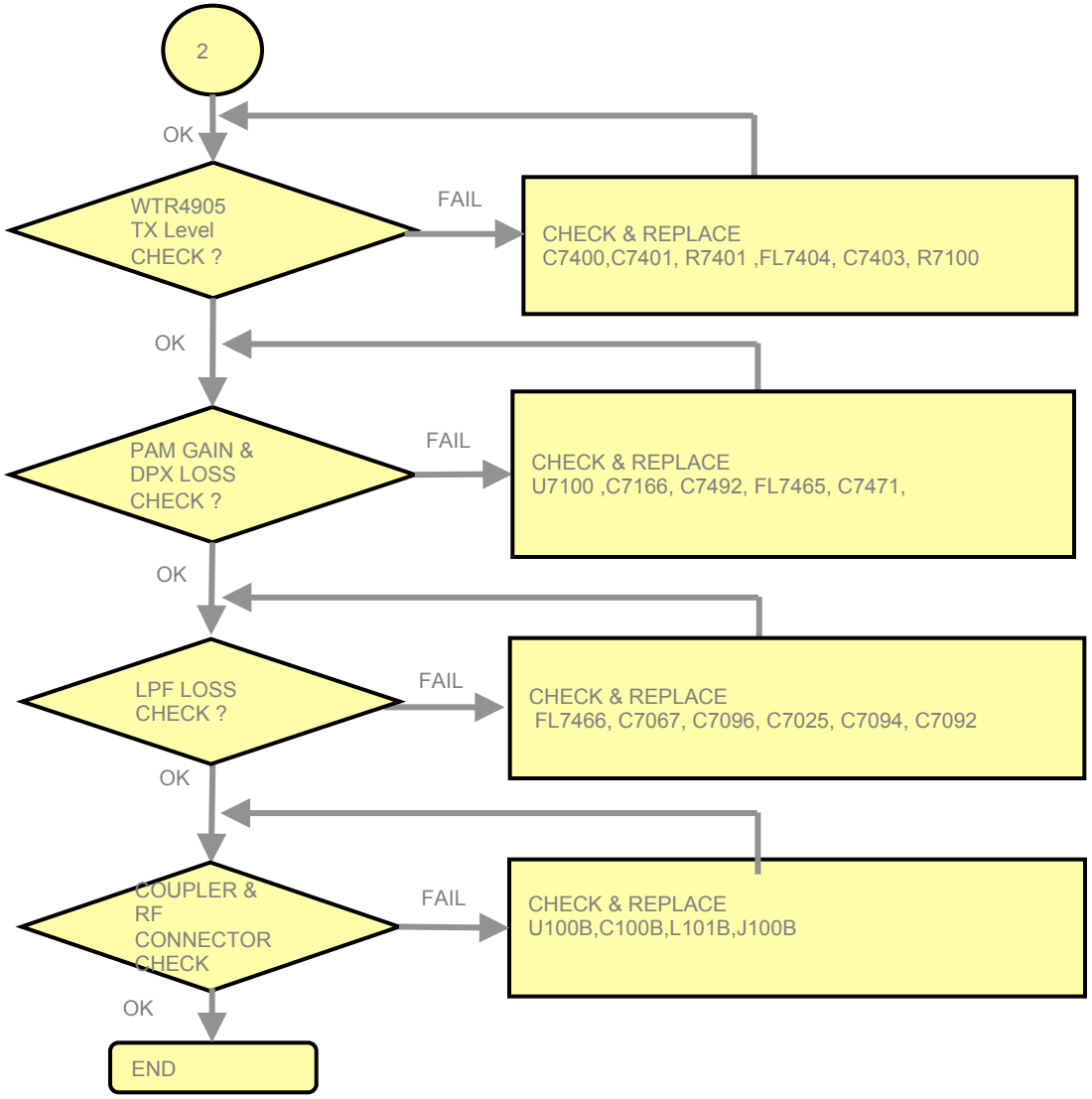


LTE B13 Tx and Rx

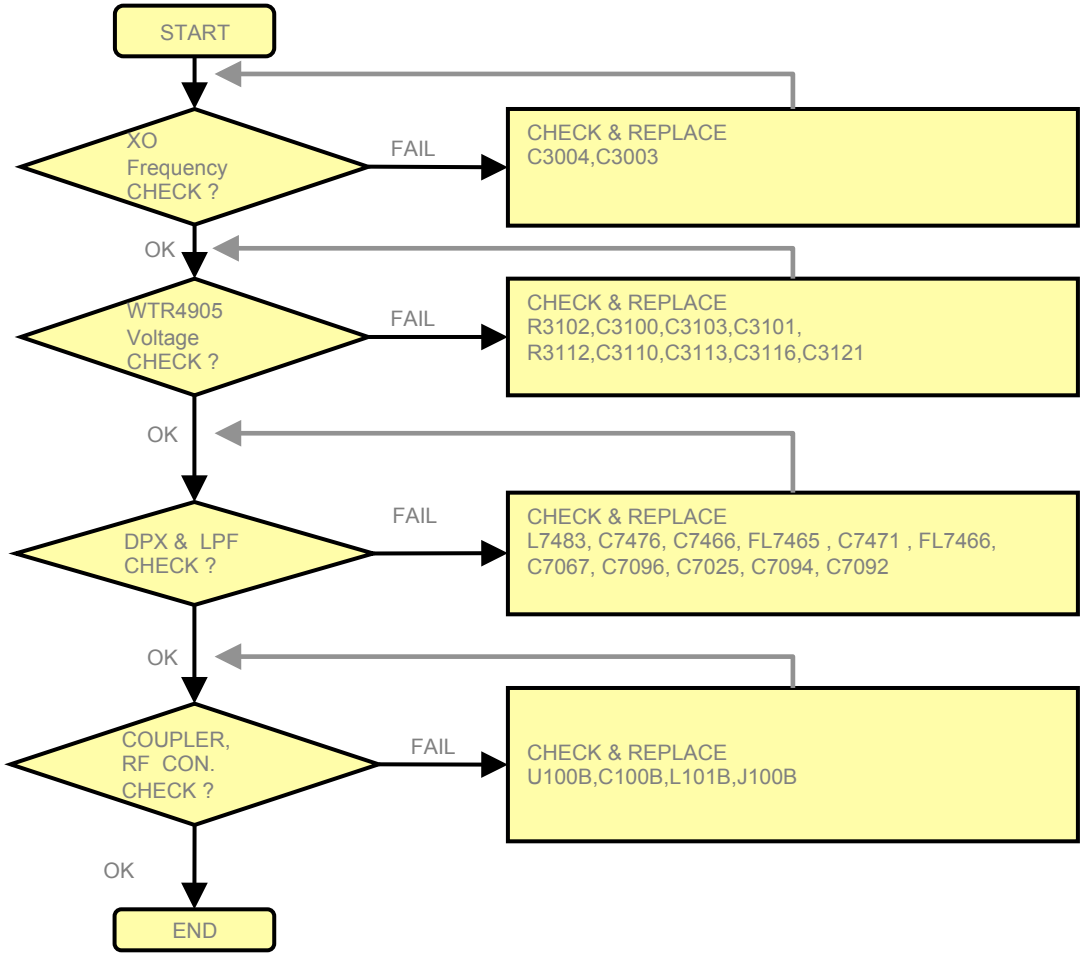
LTE B13 TX Check Chart – No TX



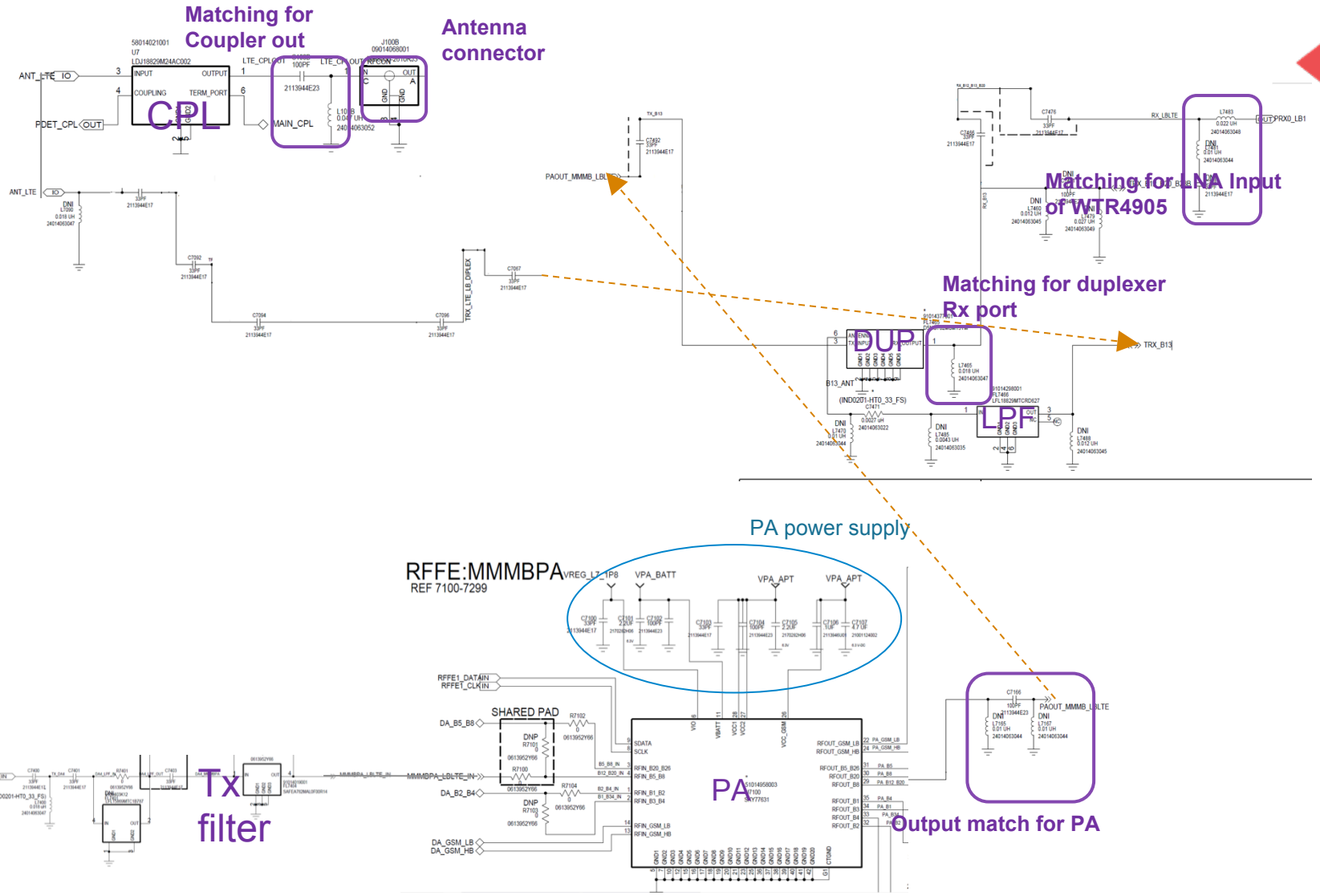
LTE B13 TX Check Chart – Low TX



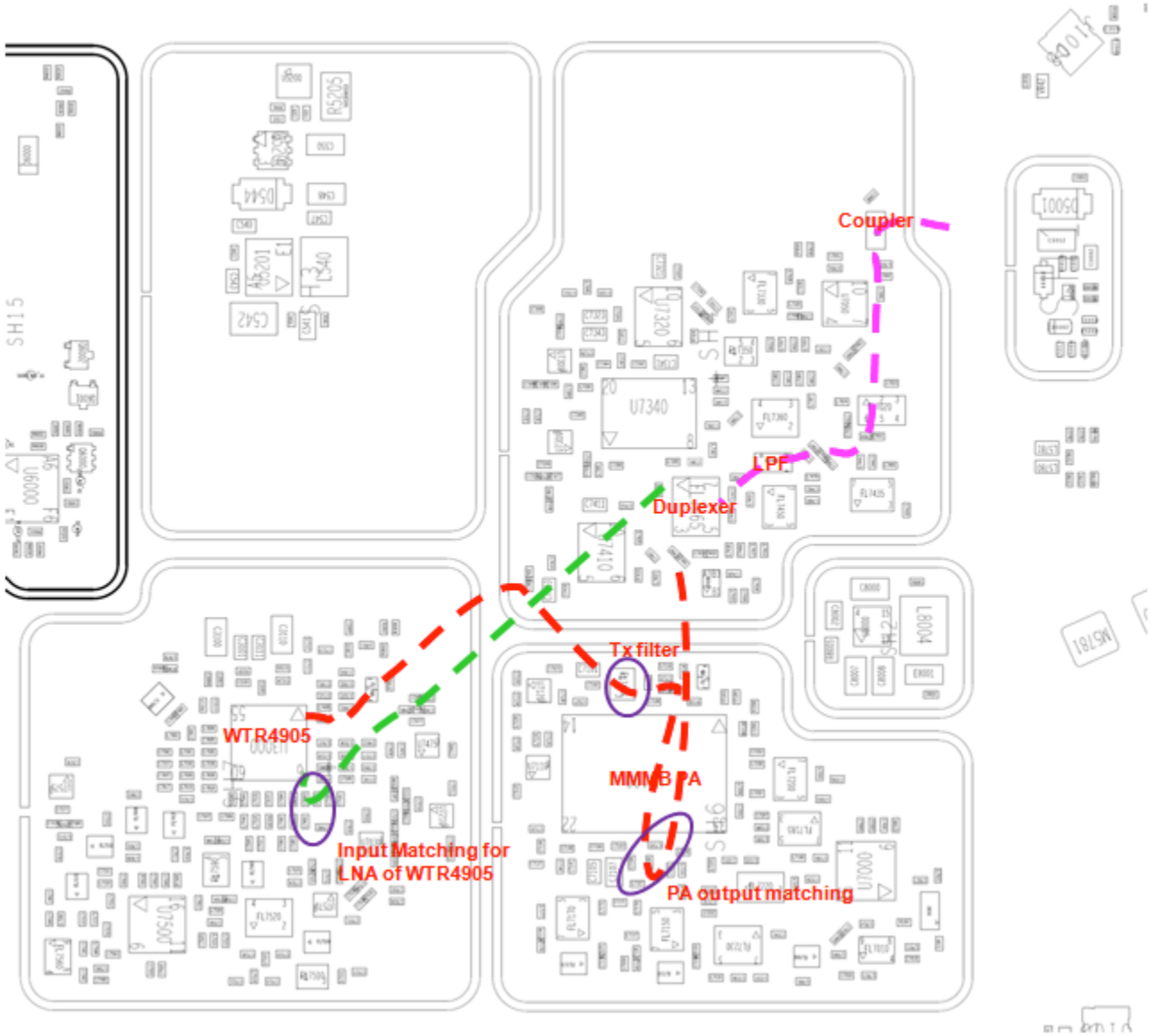
LTE B13 RX Check Chart



B13 TRX Circuits (PA + DPX +LPF)

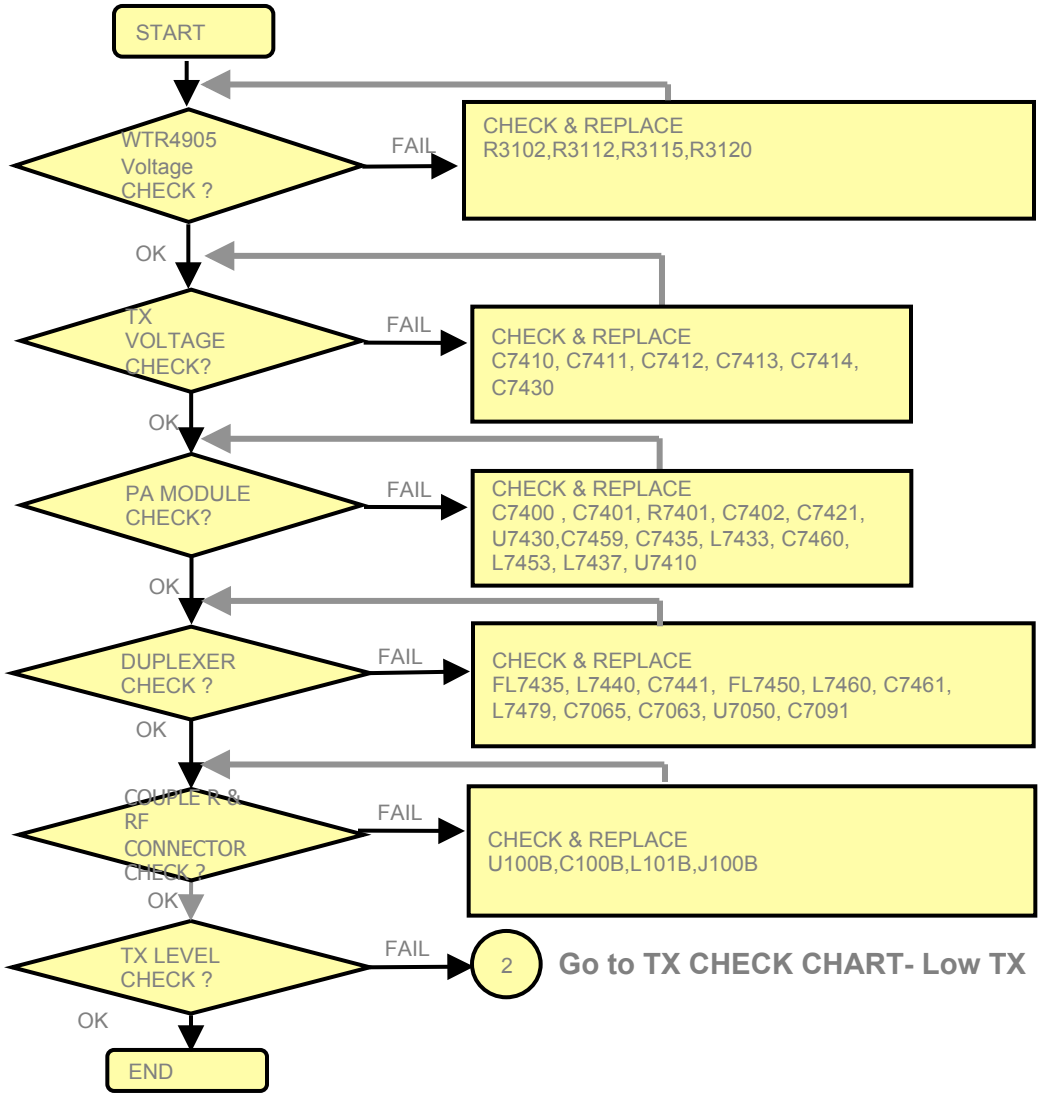


B13 TRX Circuits (WTR + PA + DPX + LPF) Layout

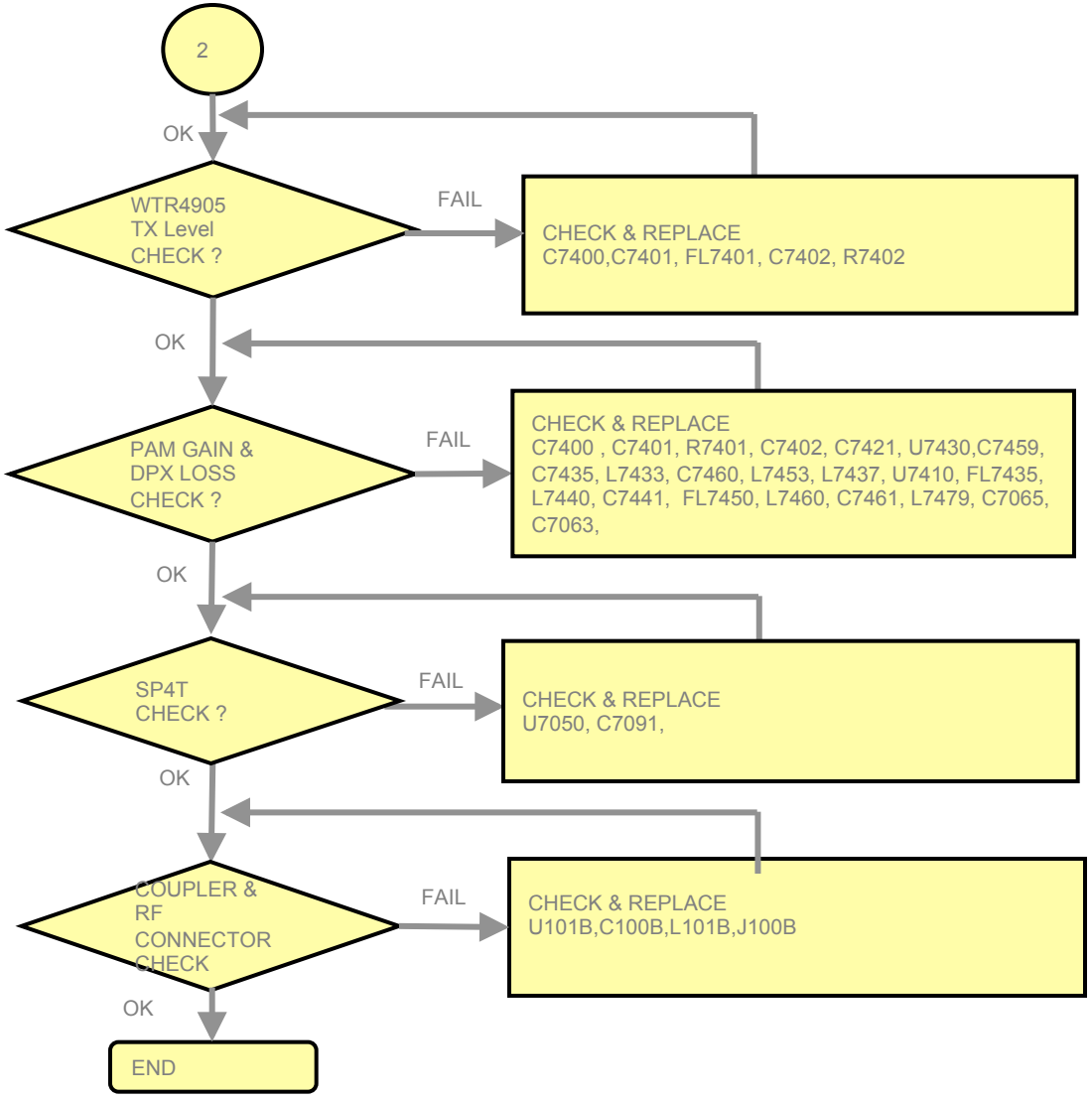


LTE B28A/B Tx and Rx

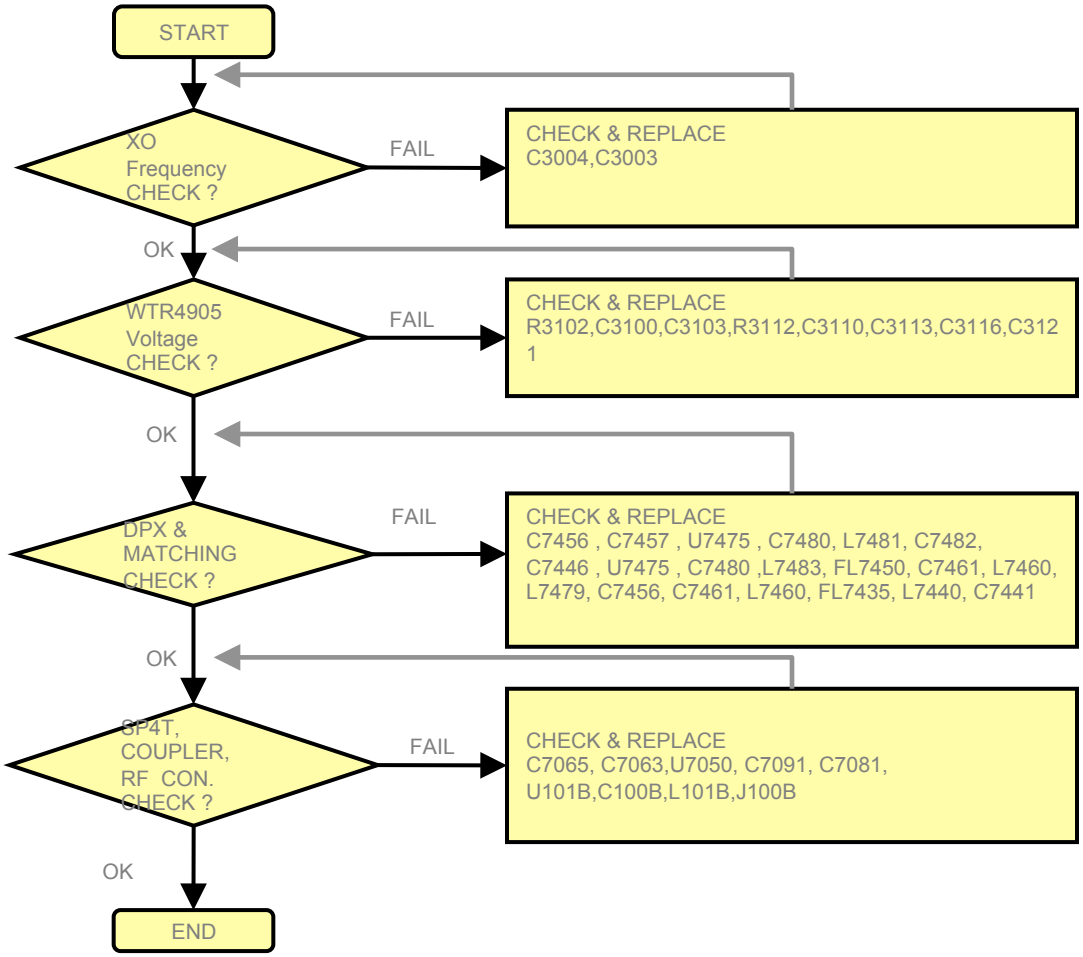
LTE B28A/B TX Check Chart – No TX



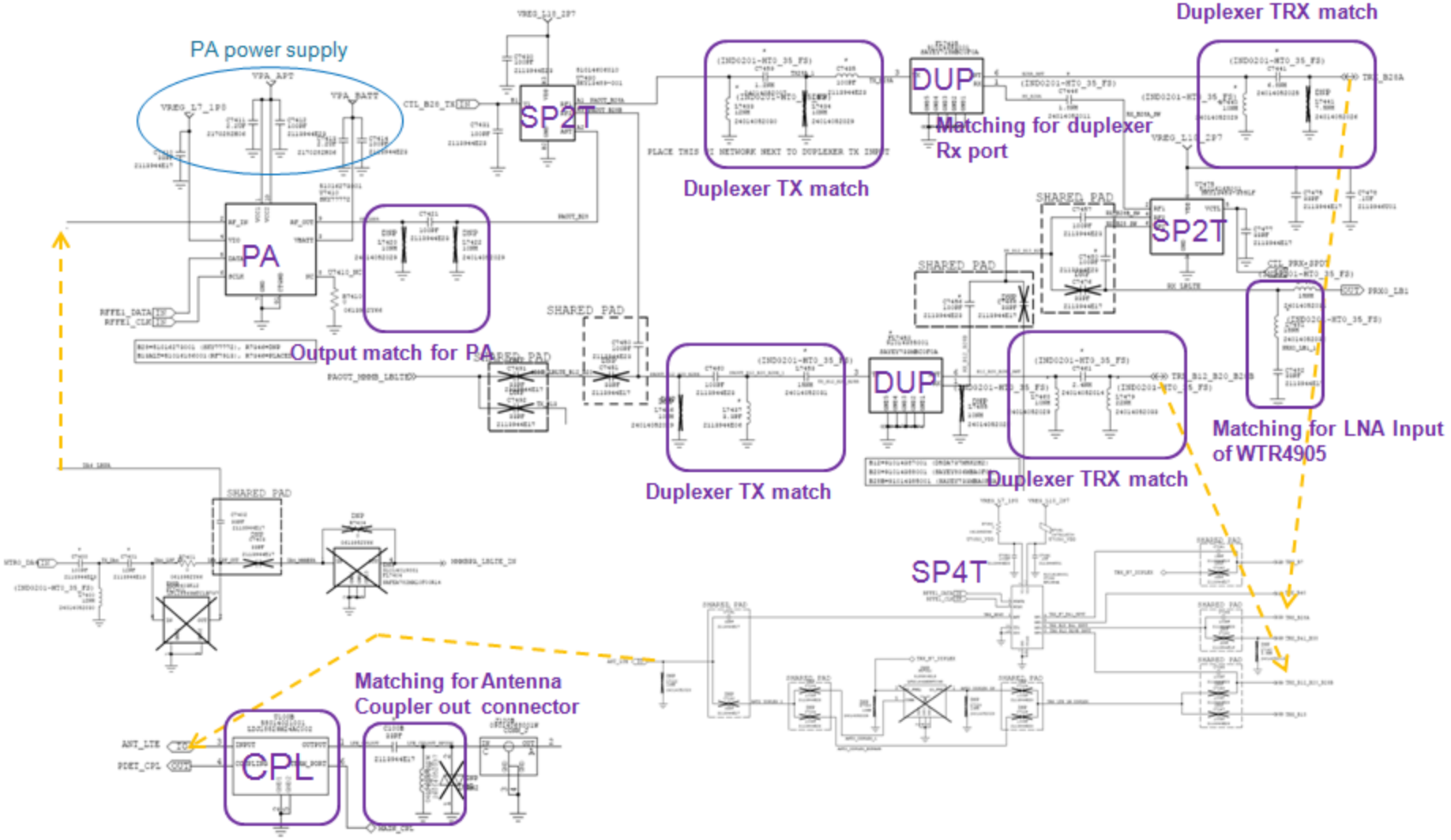
LTE B28A/B TX Check Chart – Low TX



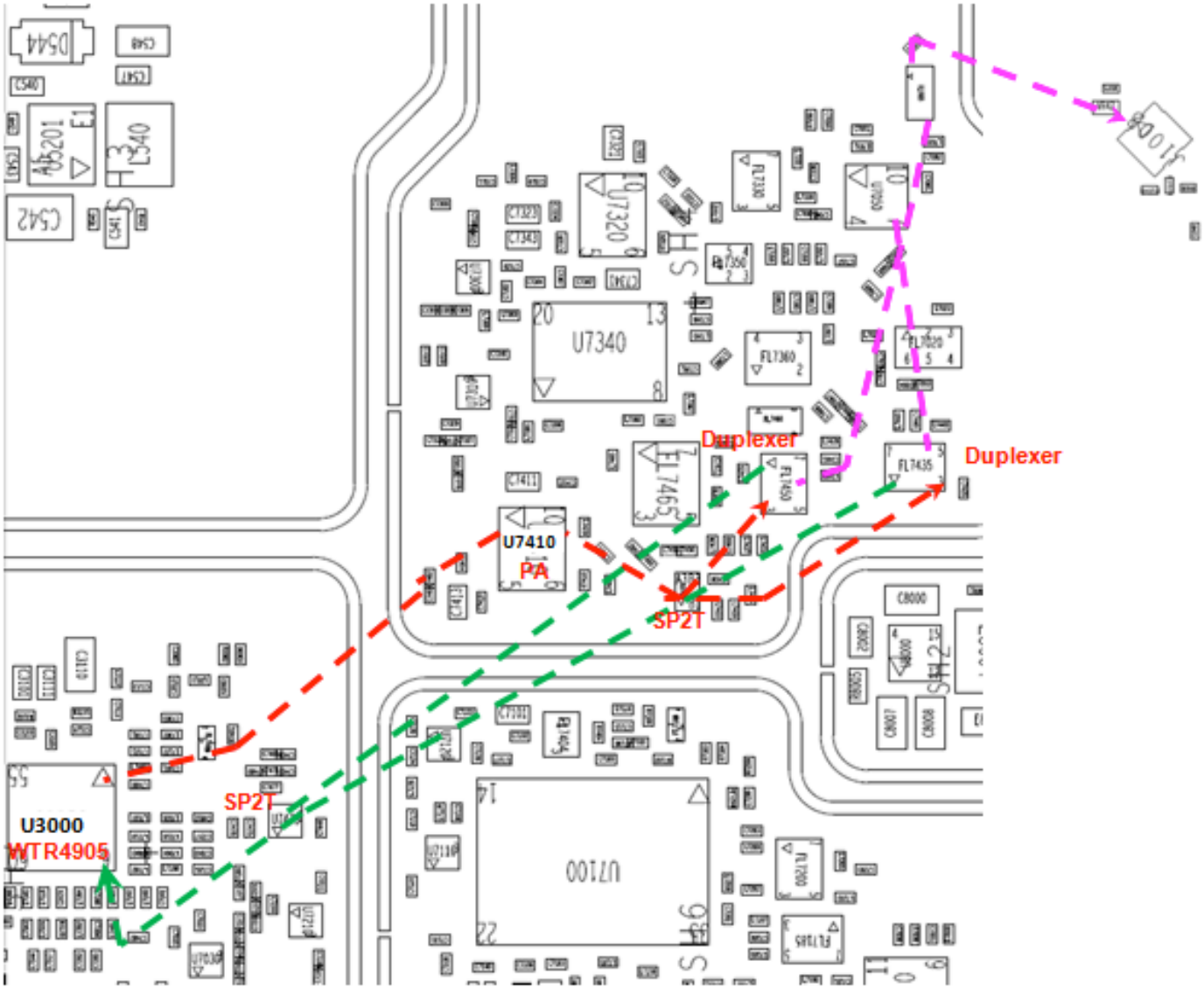
LTE B28A/B RX Check Chart



LTE B28A/B TRX Circuits (PA + DPXs + SP2Ts+SP4T)

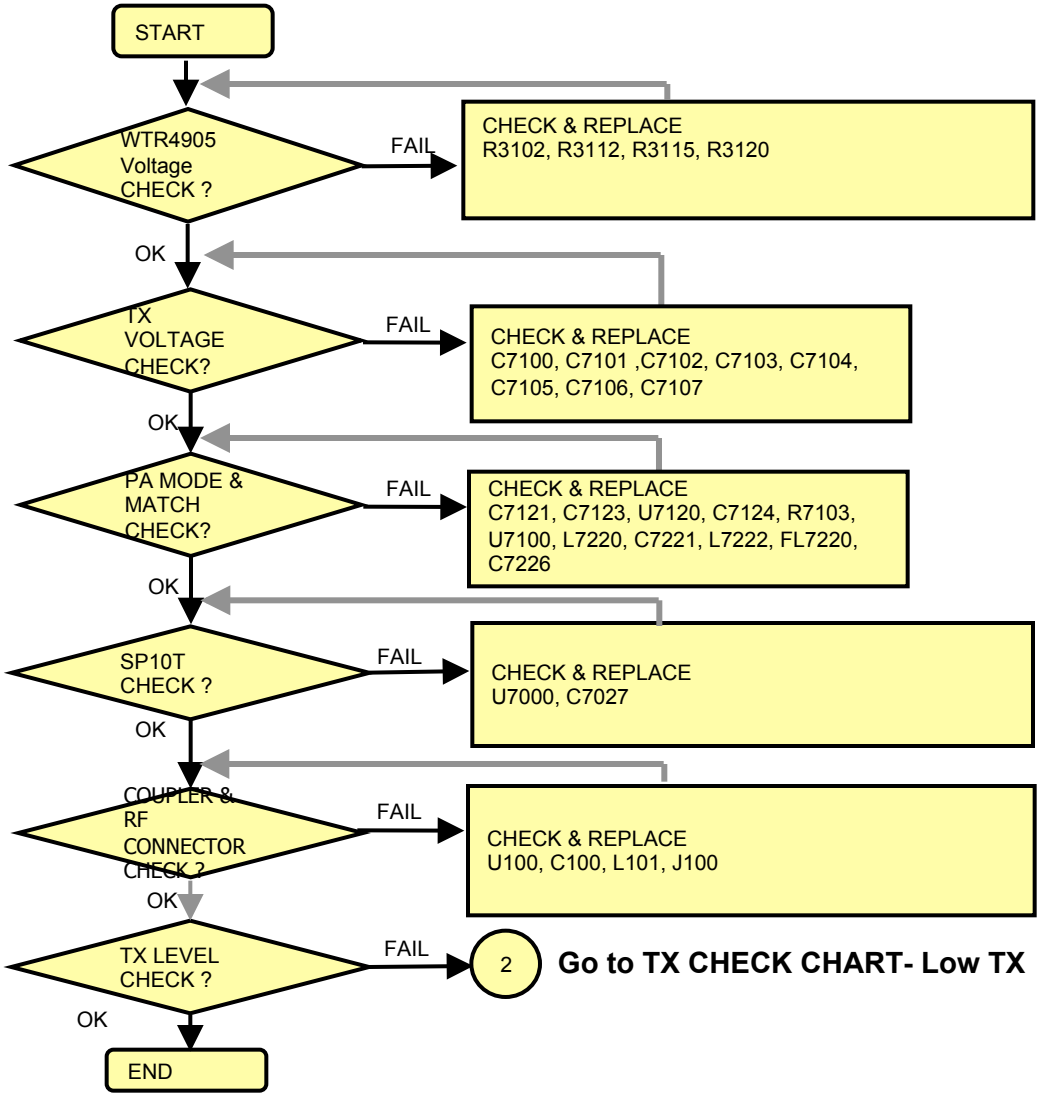


B28A/B TRX Circuits (WTR + PA + DPXs + SP2Ts+SP4T) Layout

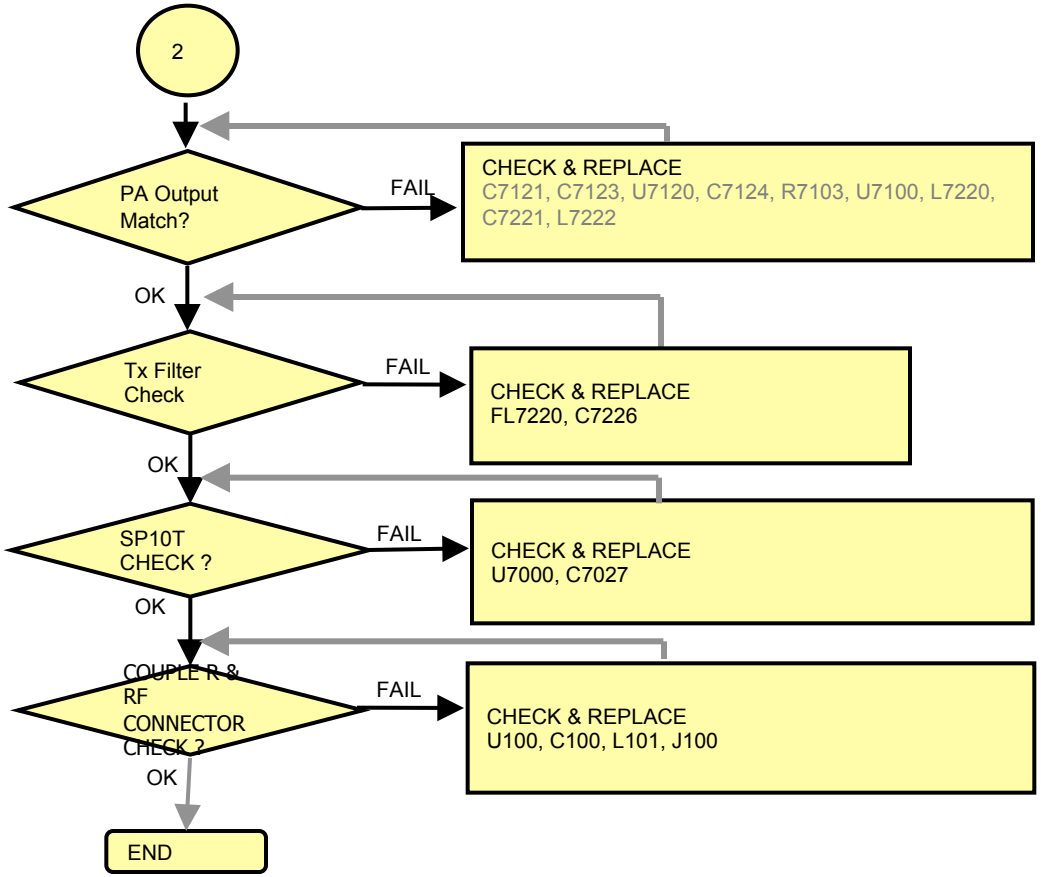


TDD/TD-SCDMA B34/39 Tx and Rx

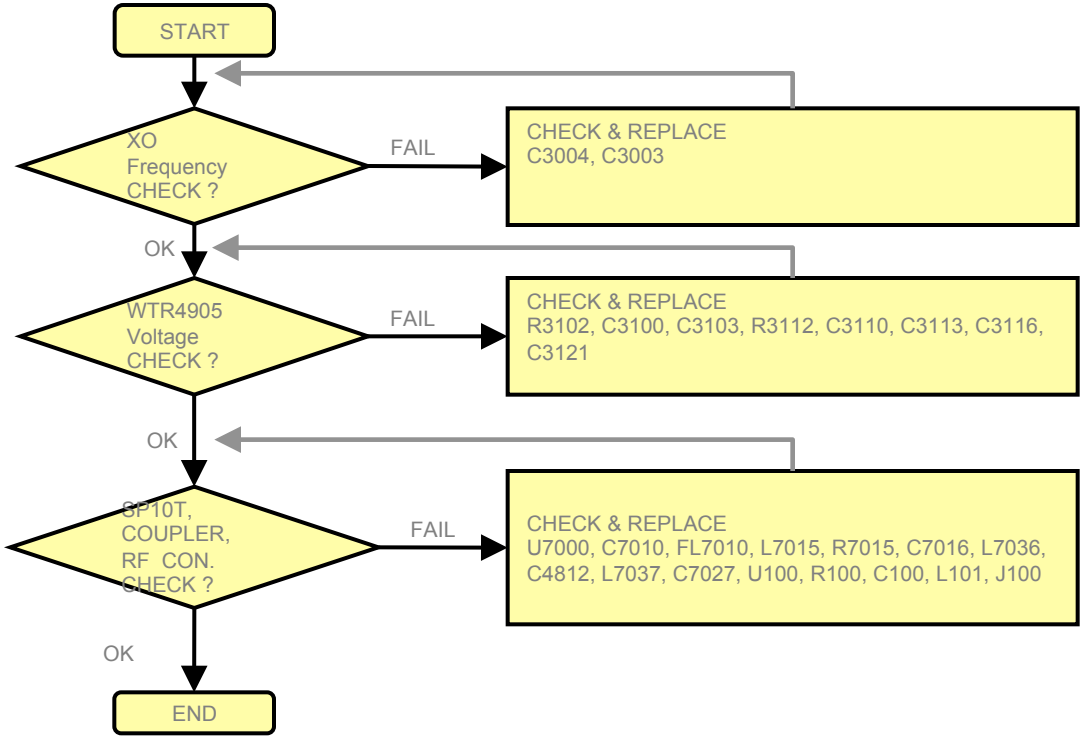
LTE/TD-SCDMA B34/39 TX Check Chart – No Tx



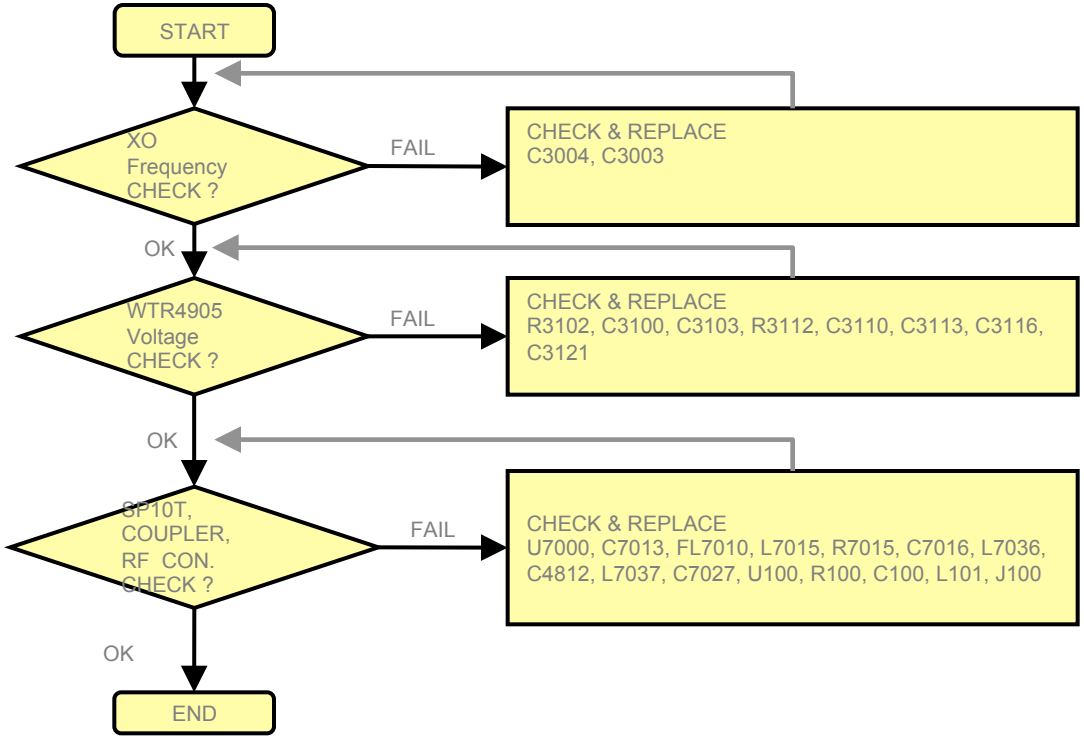
LTE/TD-SCDMA B34/39 TX Check Chart – Low Tx



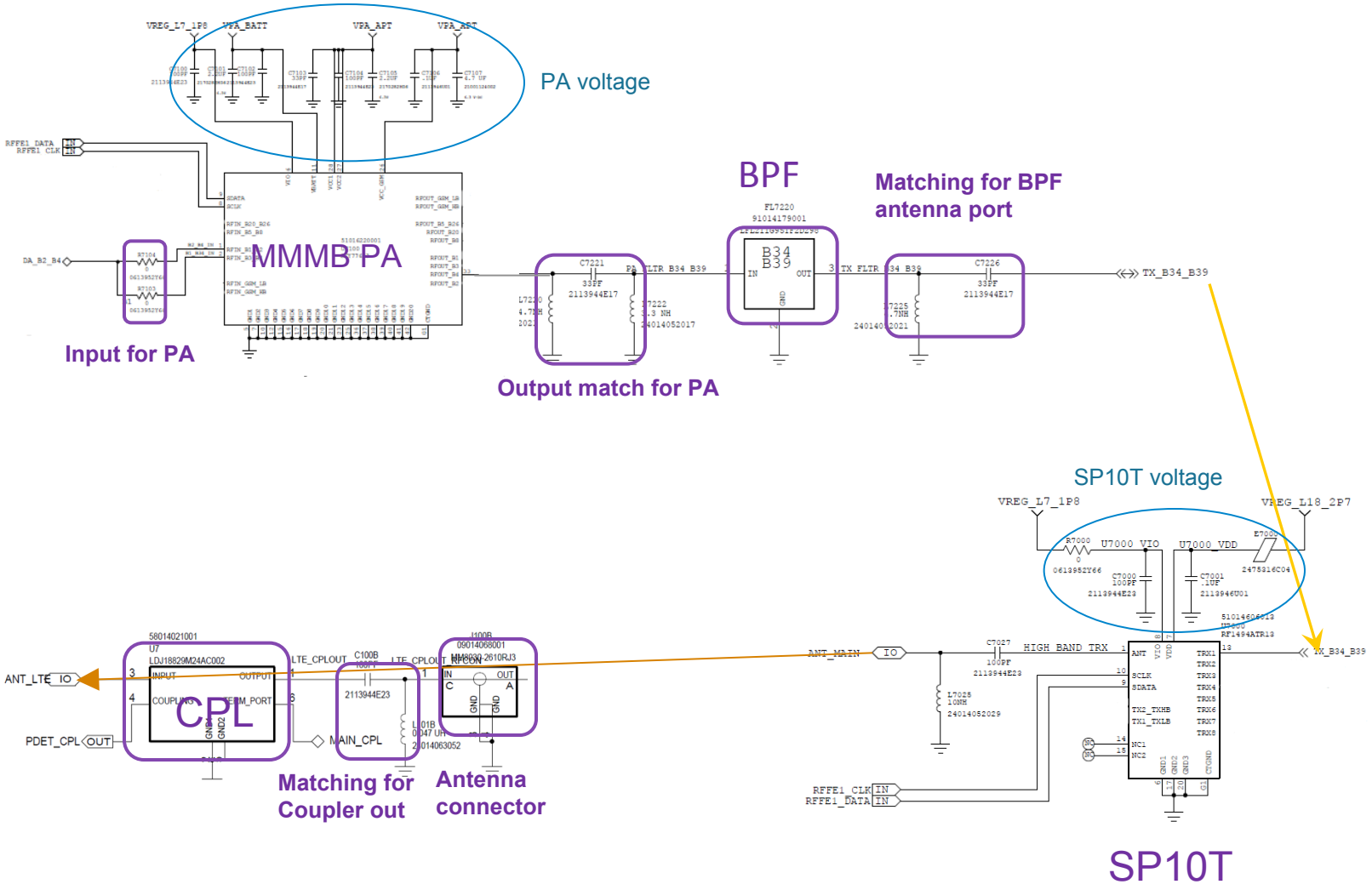
LTE/TD-SCDMA B34 RX Check Chart



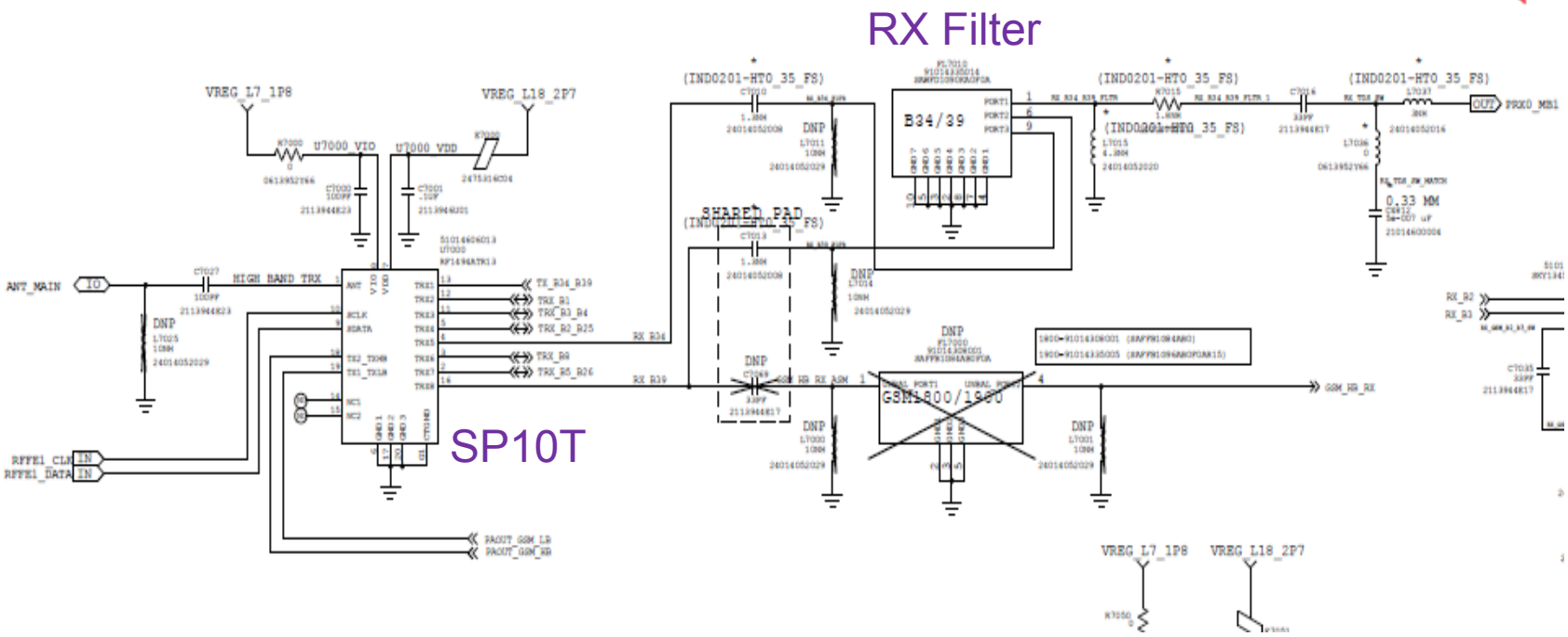
LTE/TD-SCDMA B39 RX Check Chart



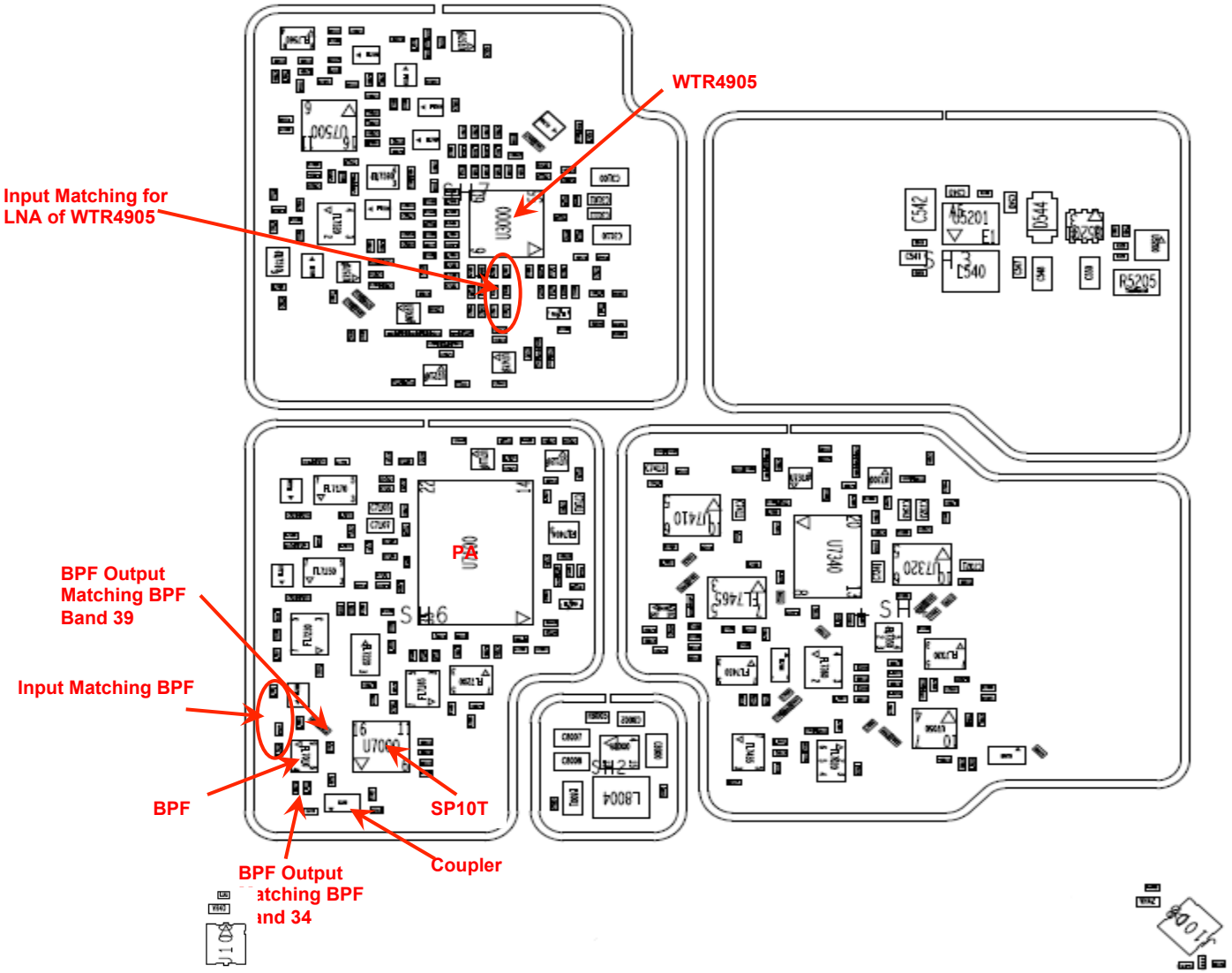
LTE/TD-SCDMA B34/39 TX CIRCUITS (PA + FILTER + SP10T)



LTE/TD-SCDMA B34/39 RX CIRCUITS

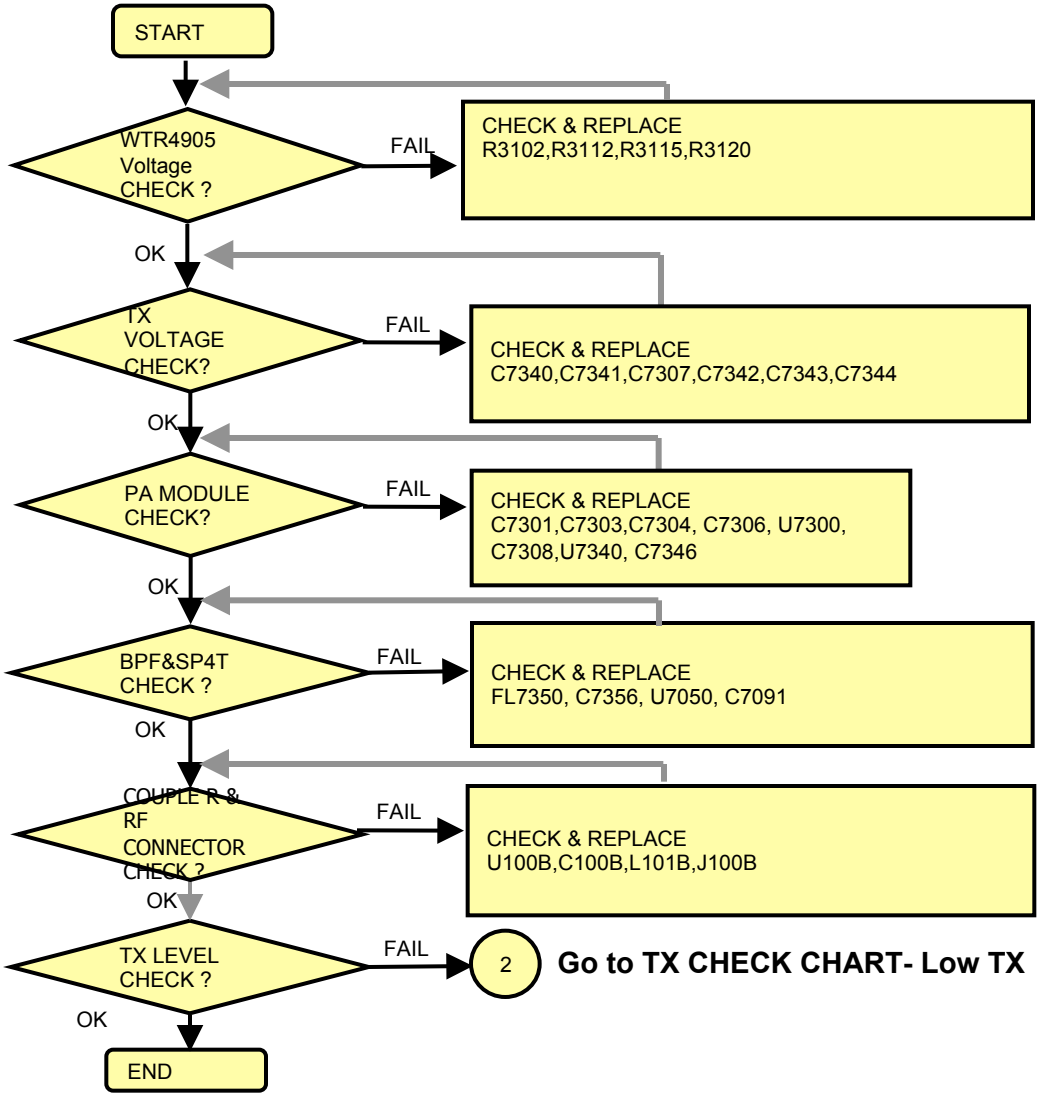


B34/39 TRX Circuits (WTR + PA + SP4T + SP2T) Layout

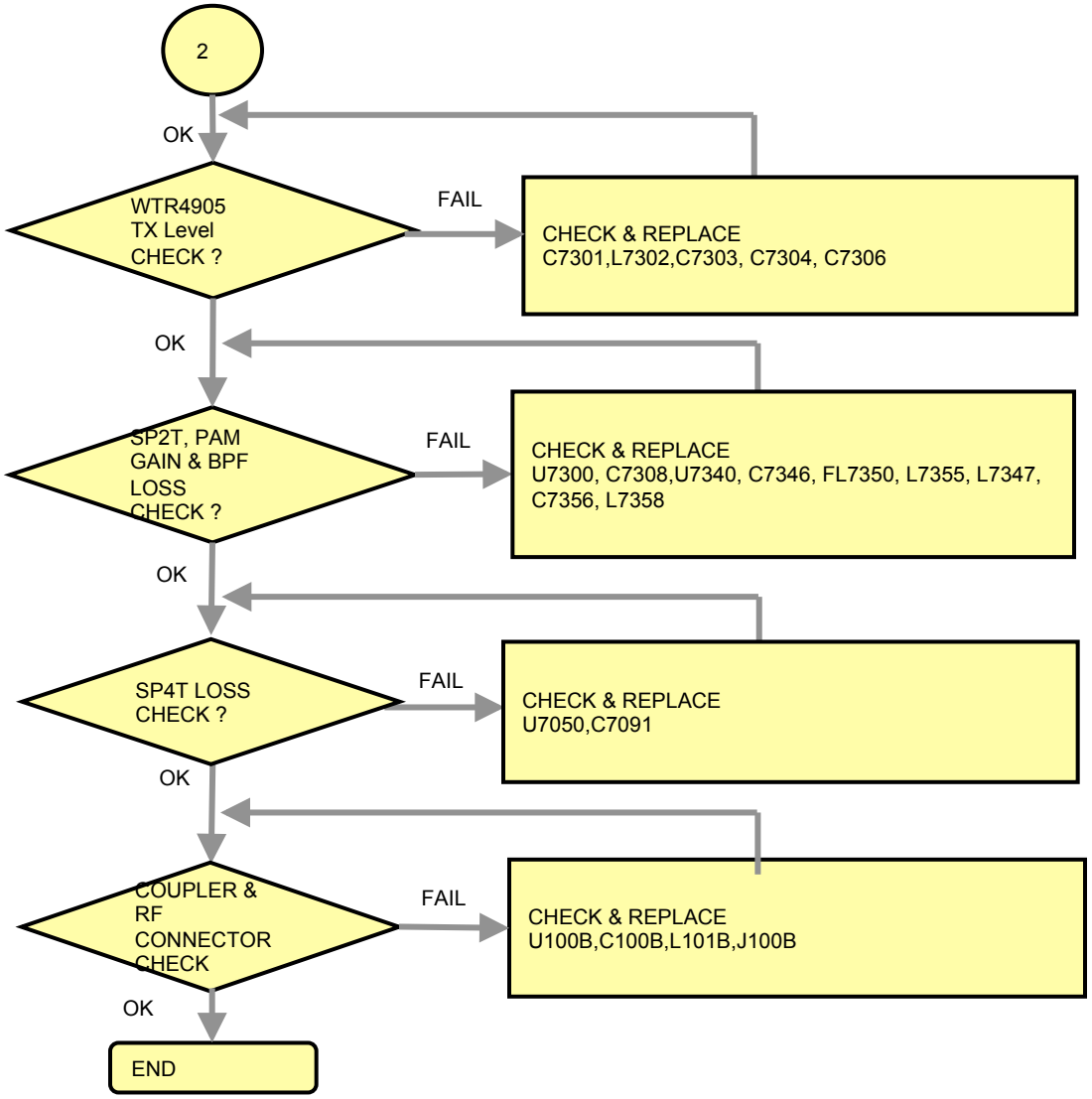


TDD LTE B40 Tx and Rx

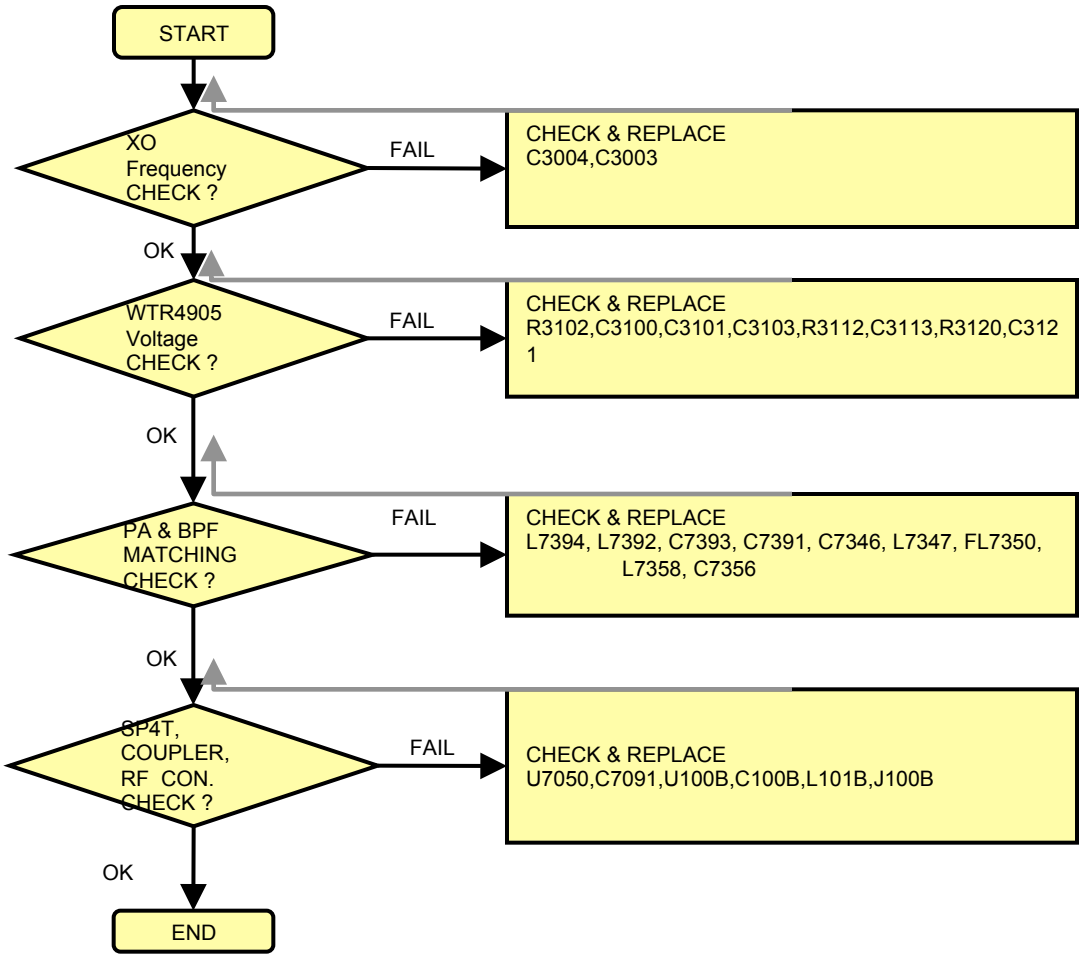
LTE B40 TX Check Chart – No TX



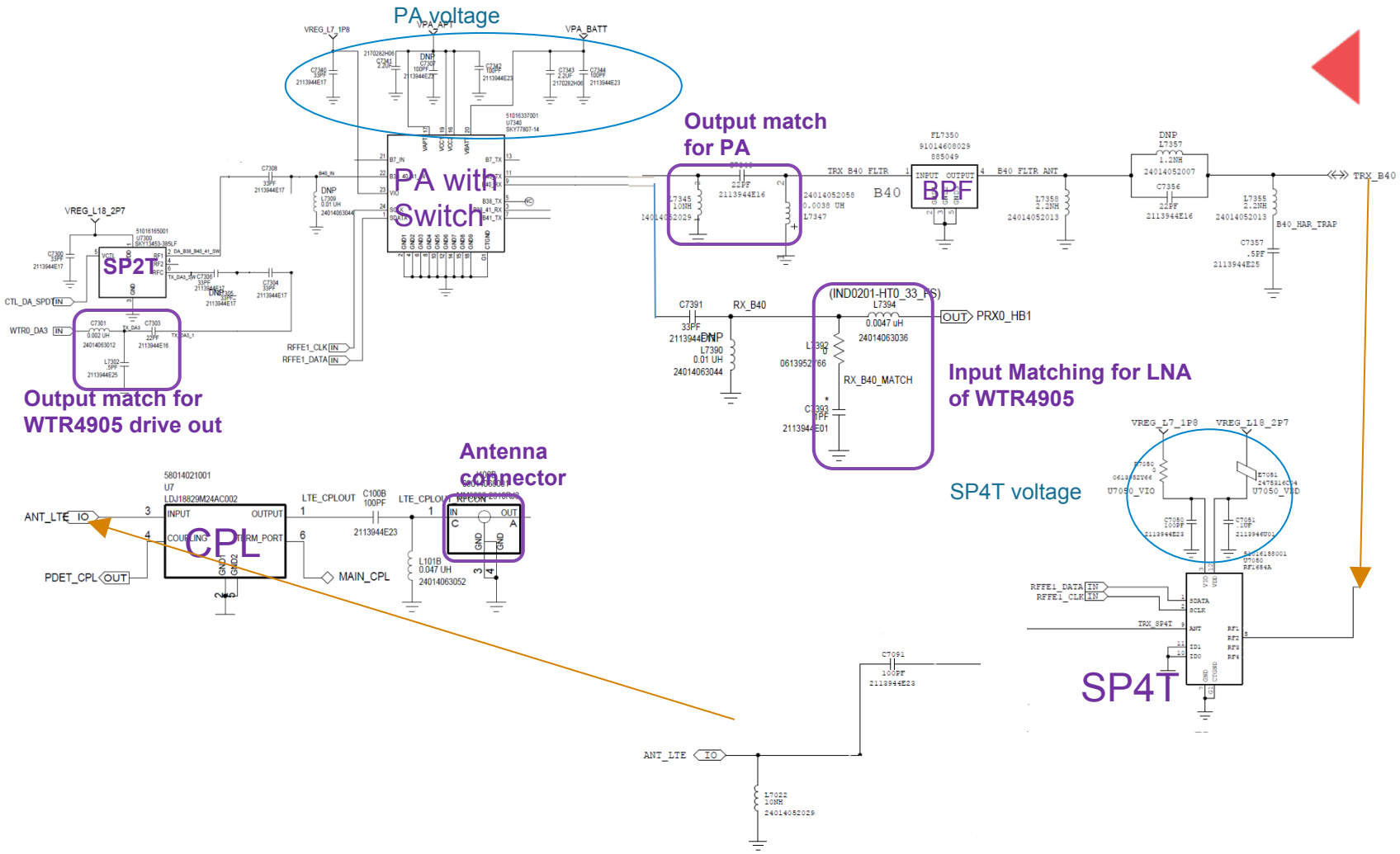
LTE B40 TX Check Chart – Low TX



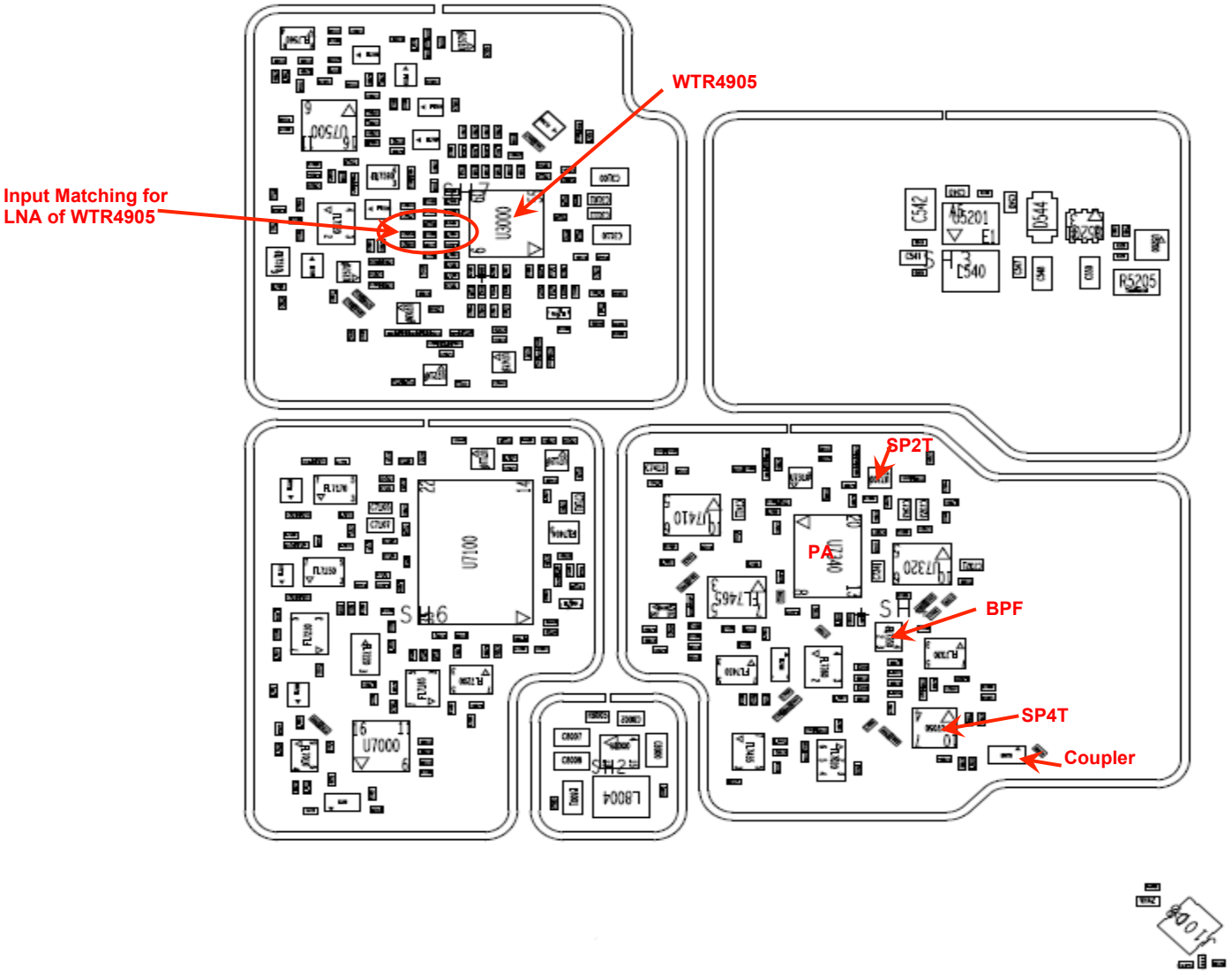
LTE B40 RX Check Chart



B40 TRX Circuits (PA + BPF+ SP4T+SP2T)

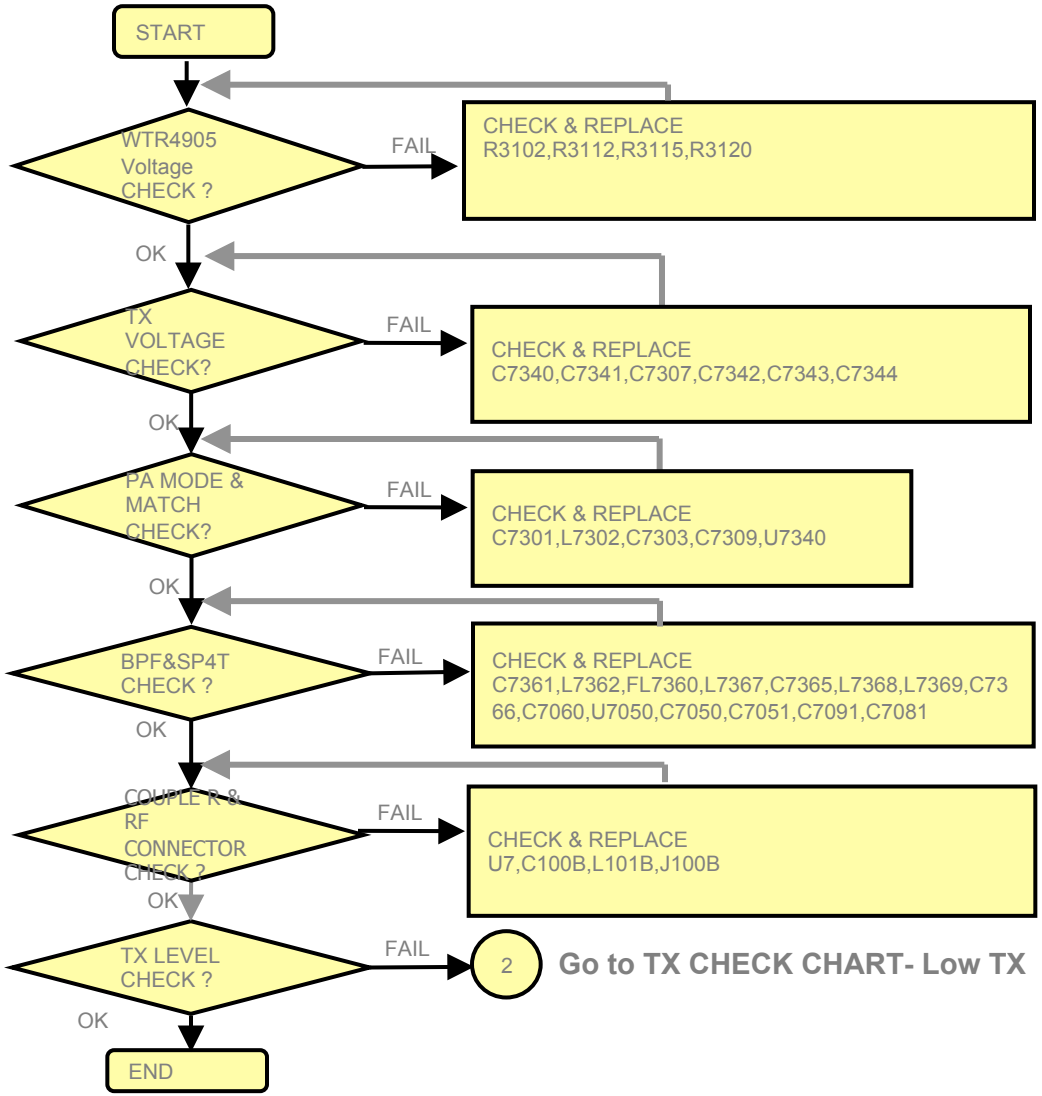


B40 TRX Circuits (WTR + PA + SP4T + SP2T) Layout

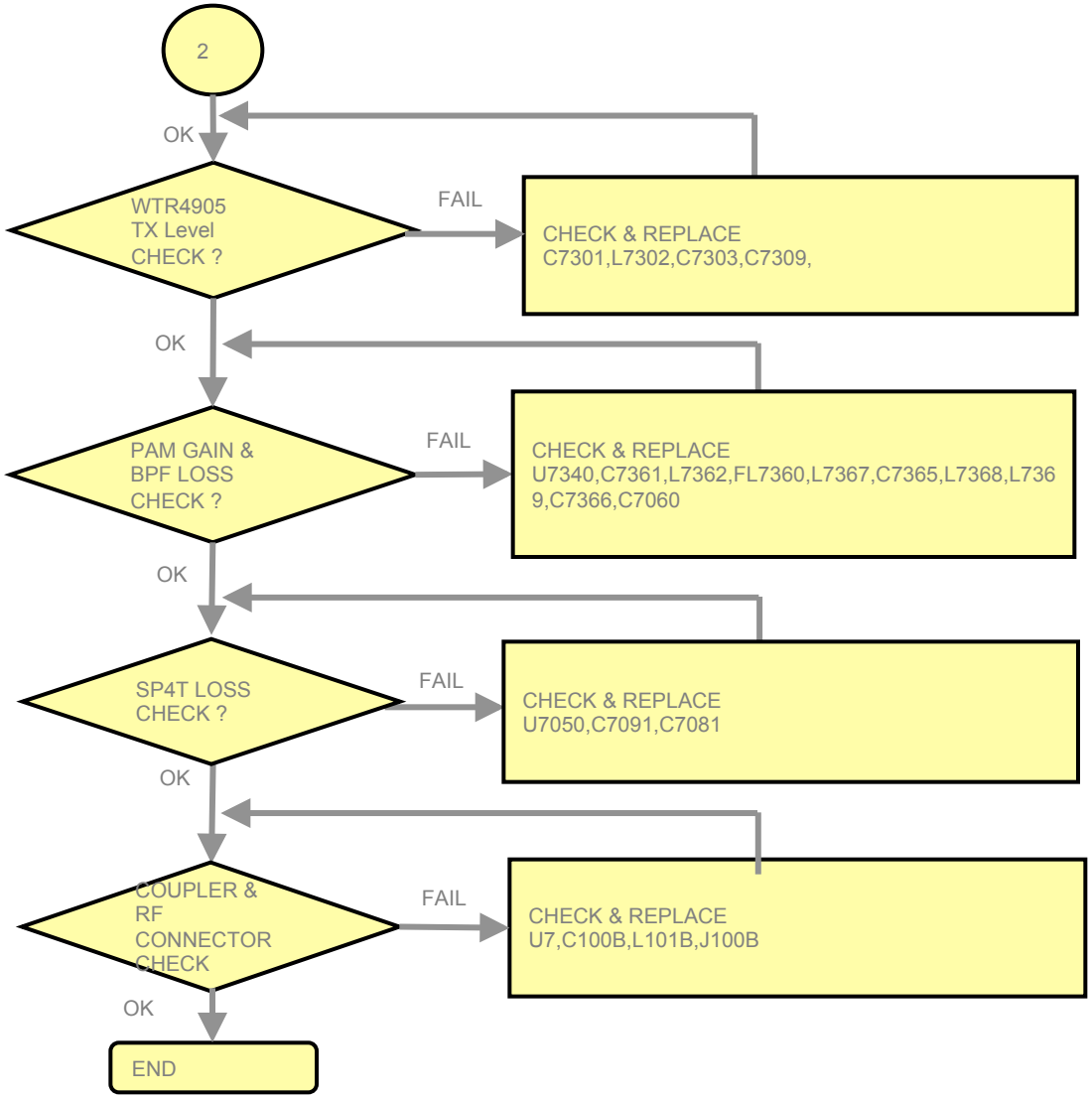


TDD LTE B41 Tx and Rx

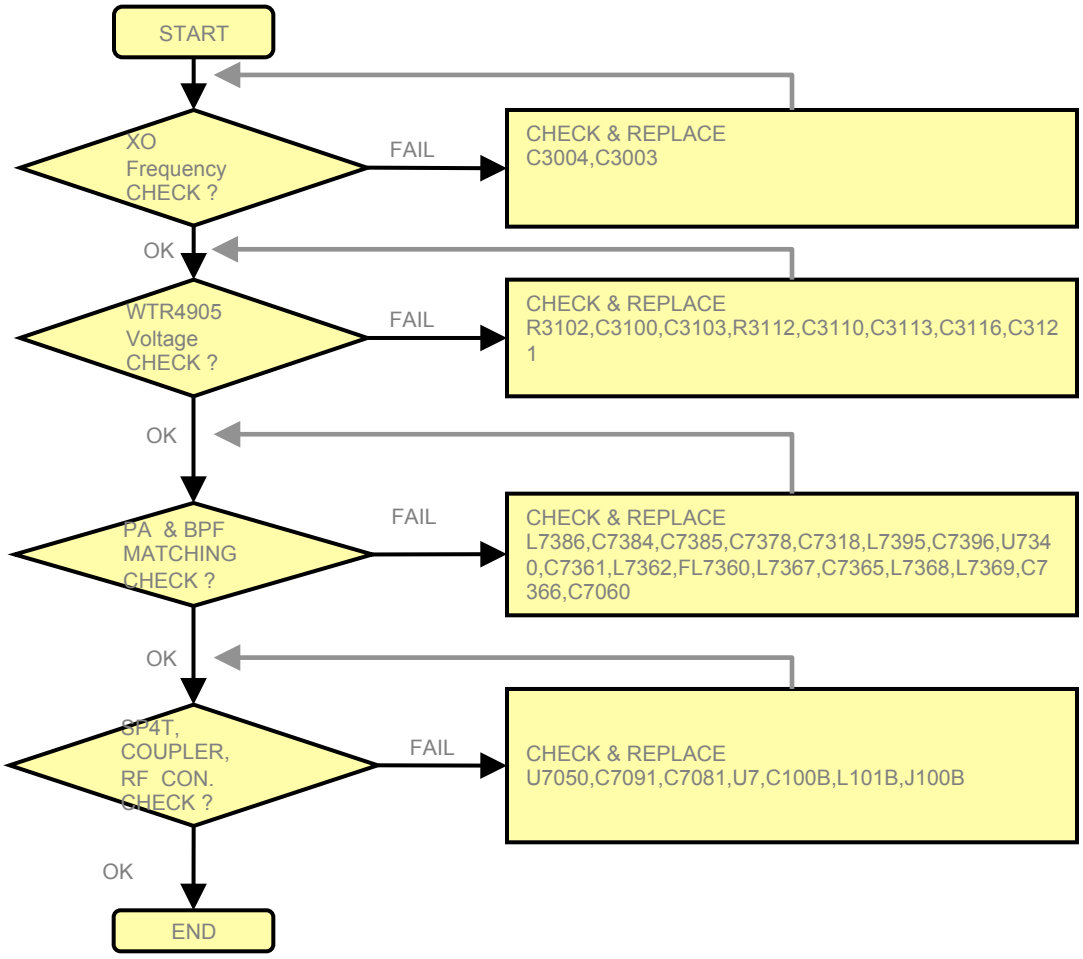
LTE B41 TX Check Chart – No TX



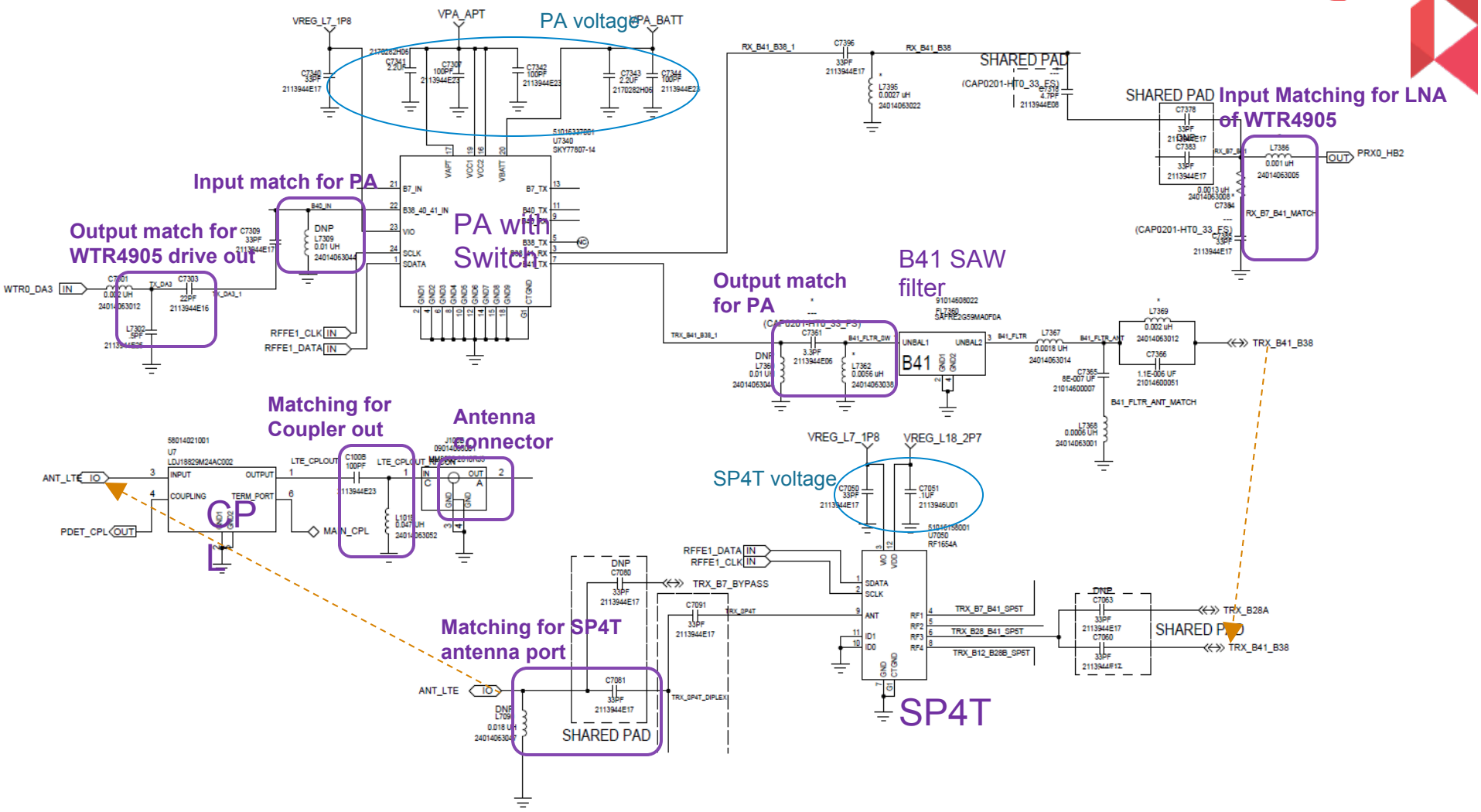
LTE B41 TX Check Chart – Low TX



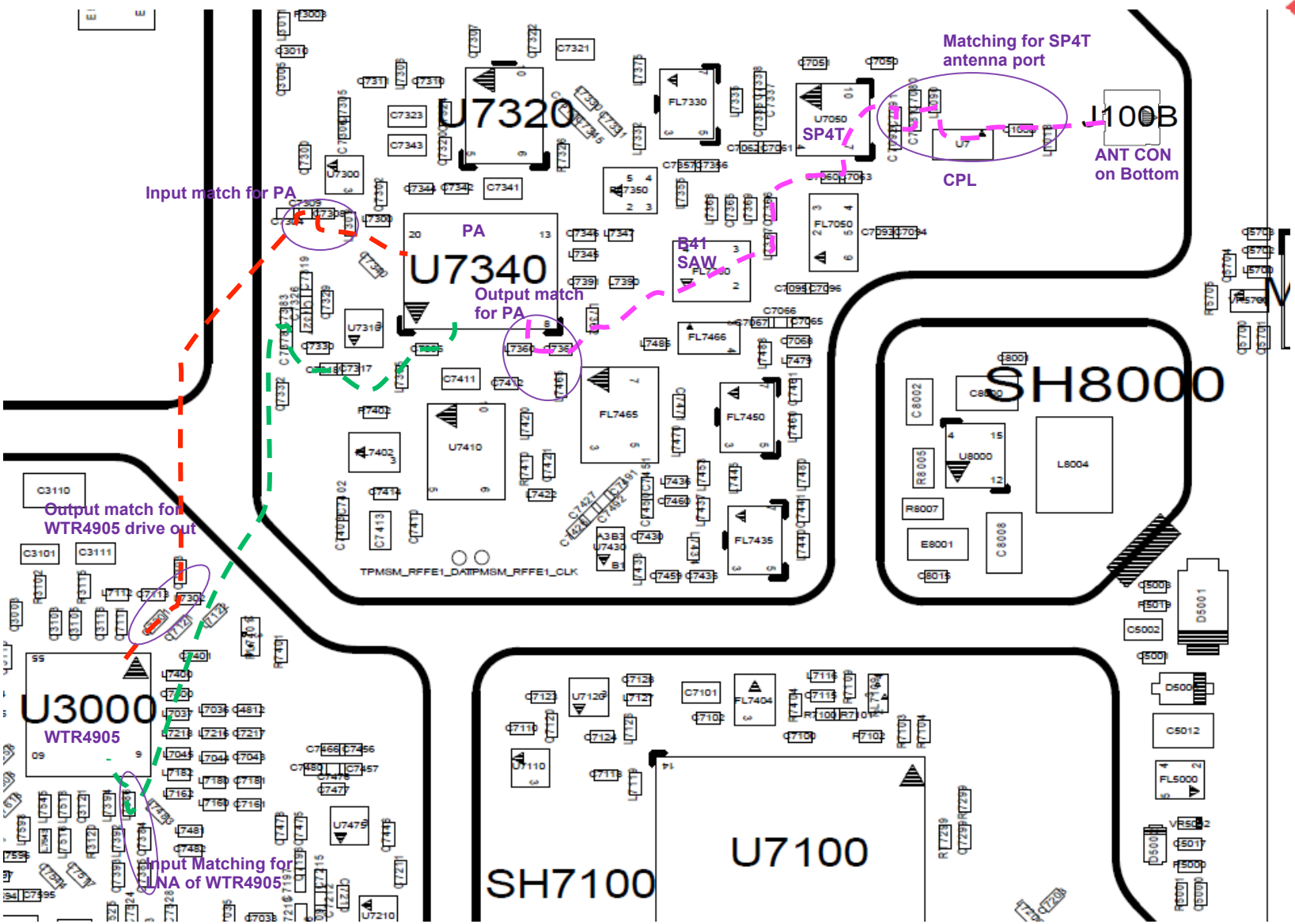
LTE B41 RX Check Chart



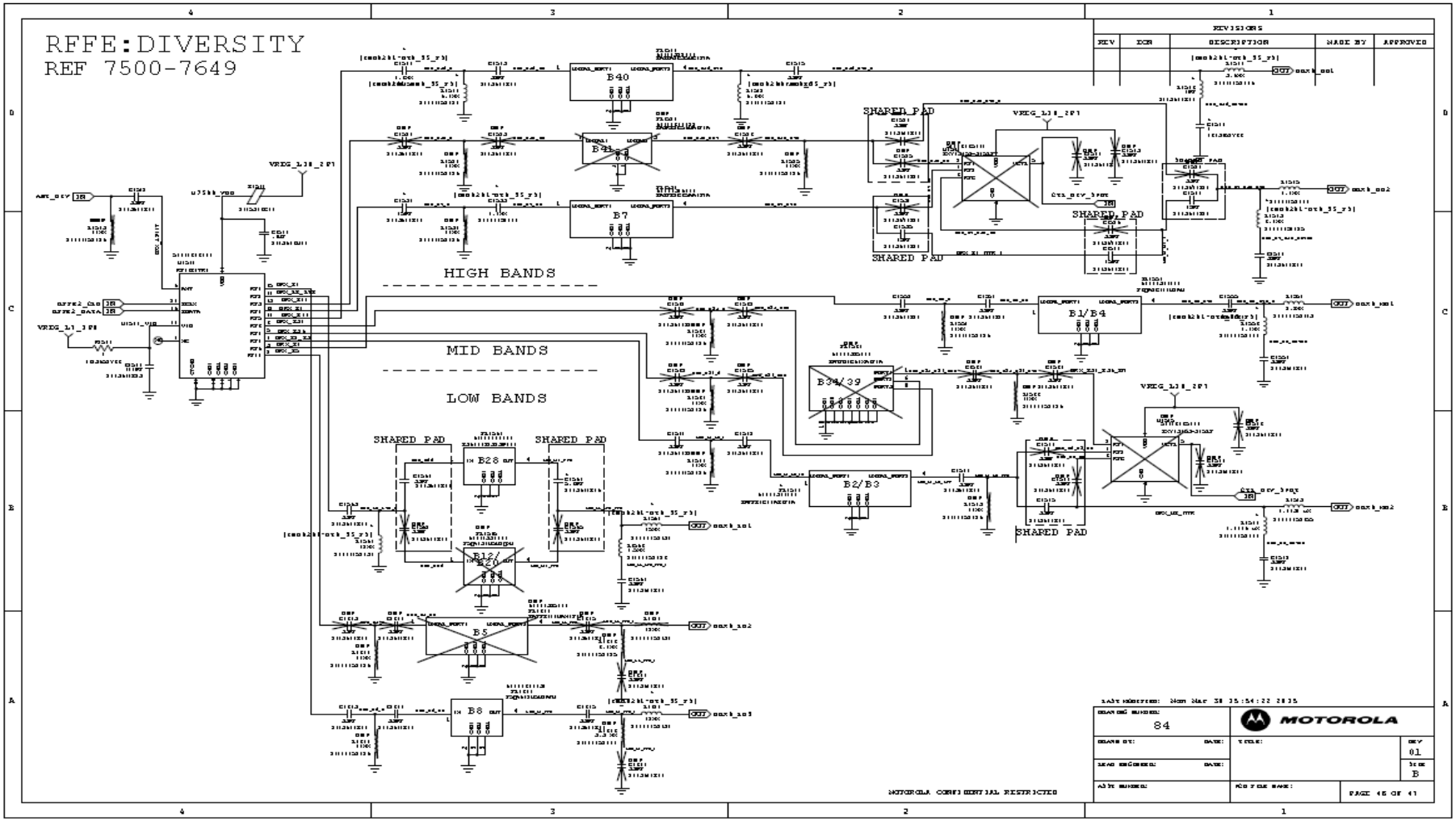
B41 TRX Circuits (PA + SAW FILTER + SP4T)



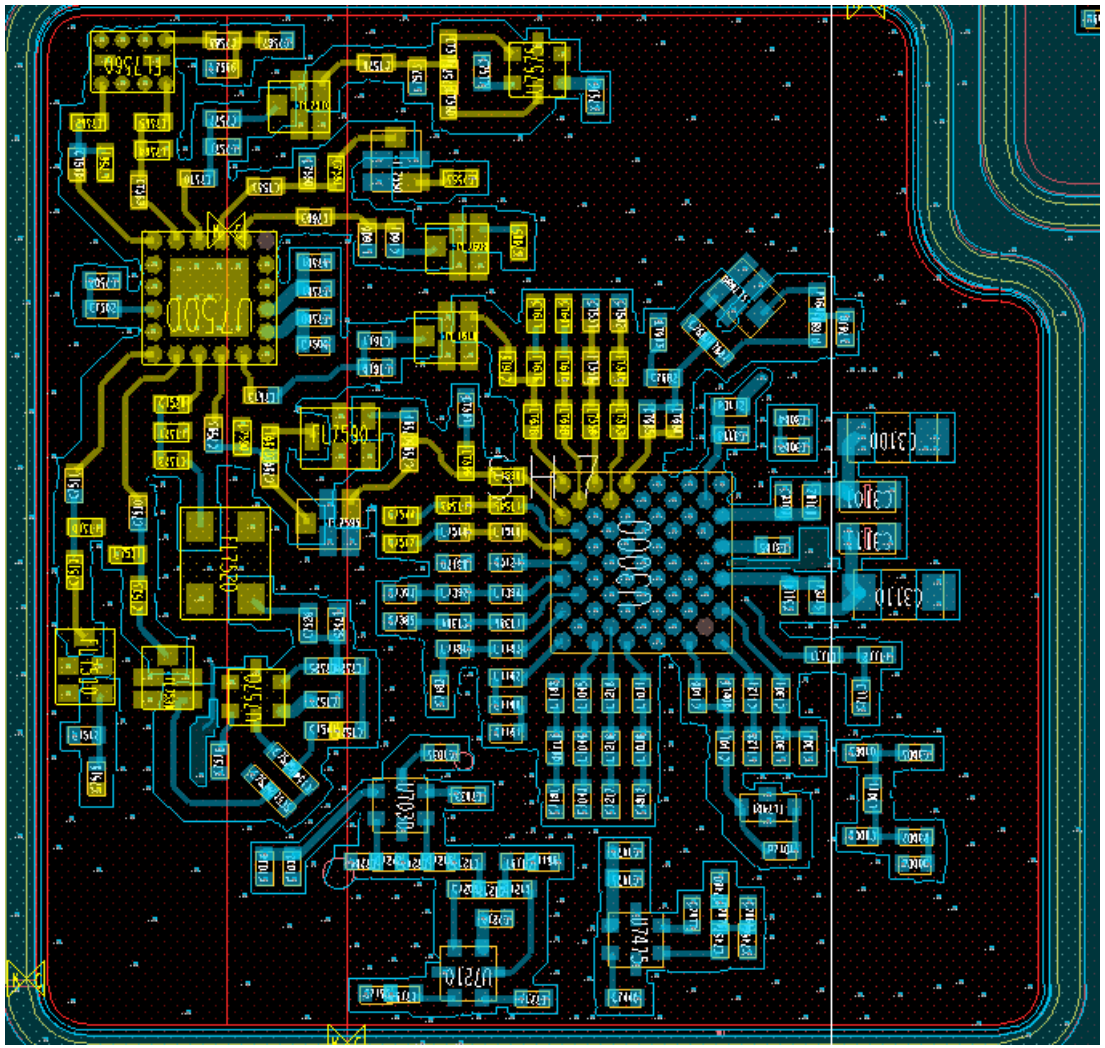
B41 TRX Circuits (WTR + PA + SAW FILTER + SP4T) Layout



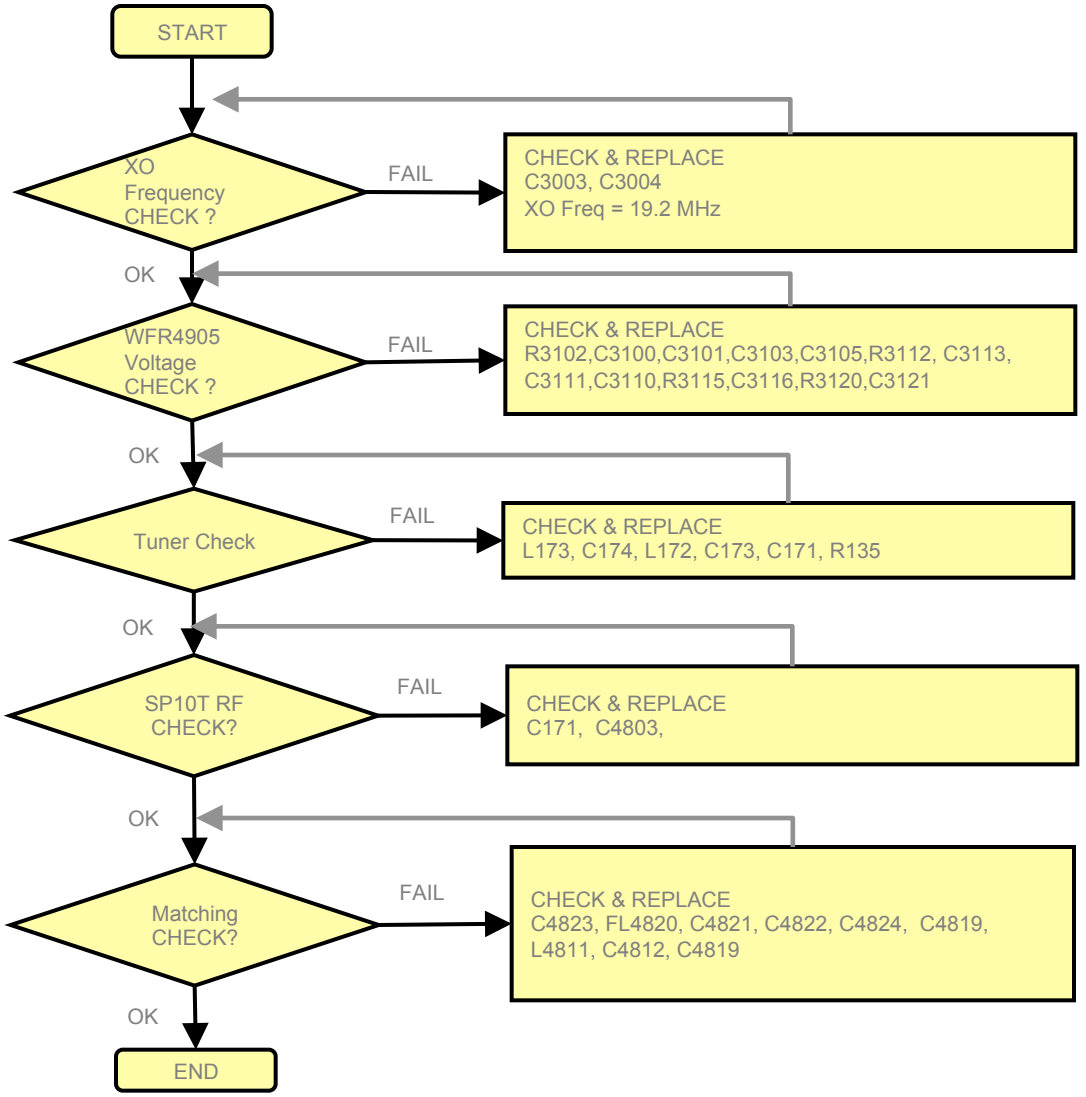
Diversity Rx



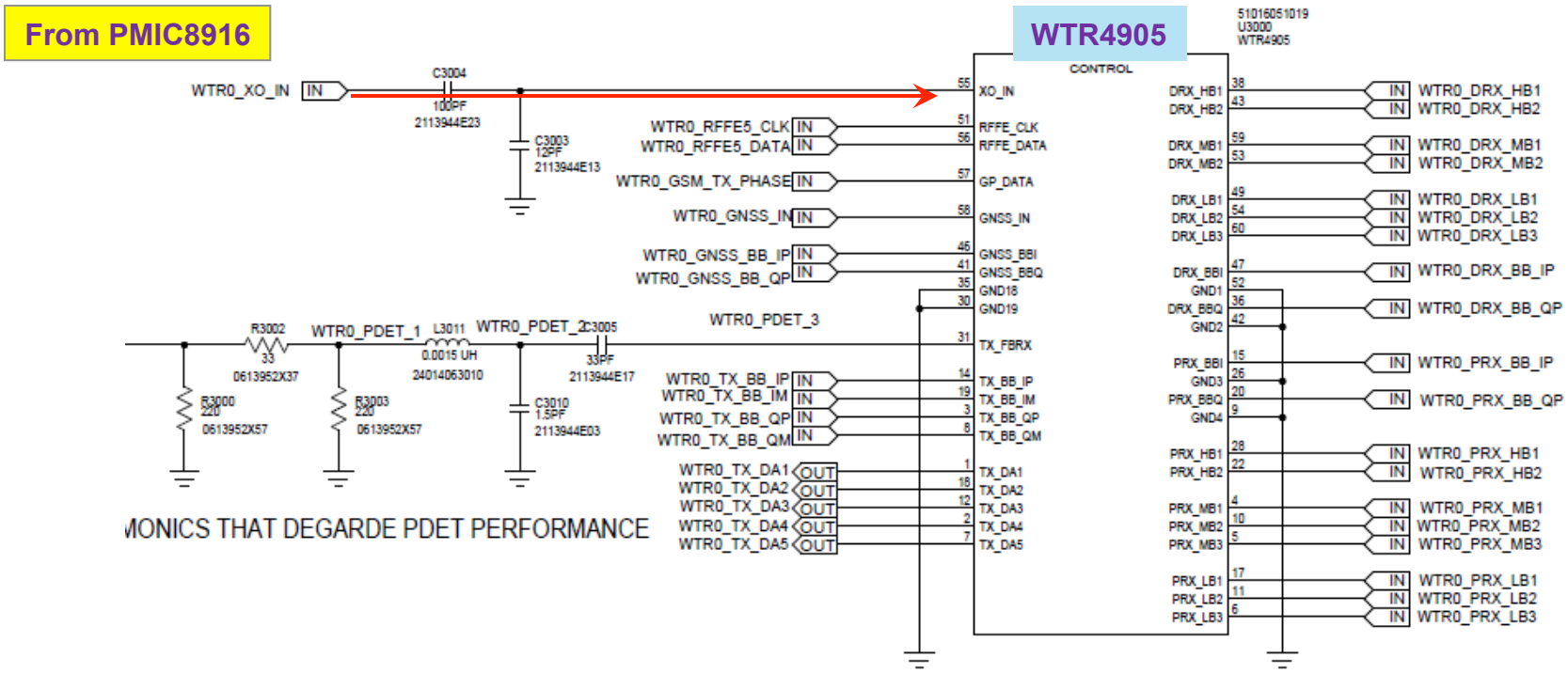
Diversity Rx



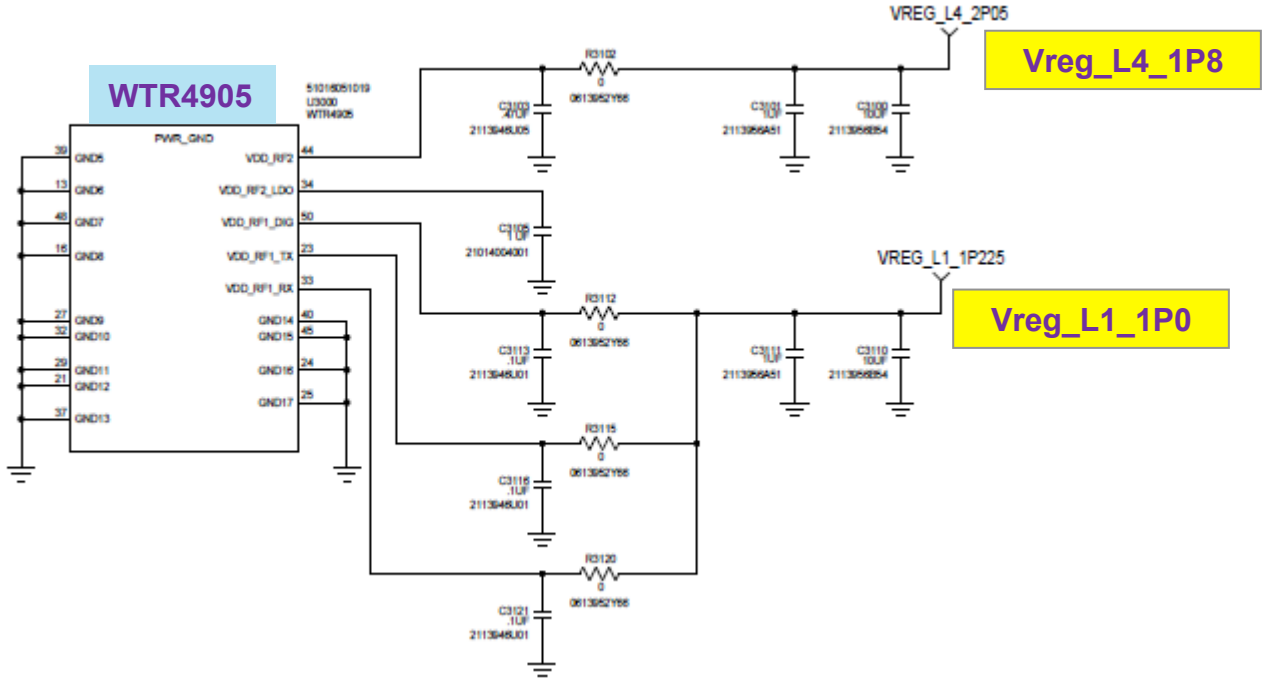
MIMO/Diversity RX Check Chart



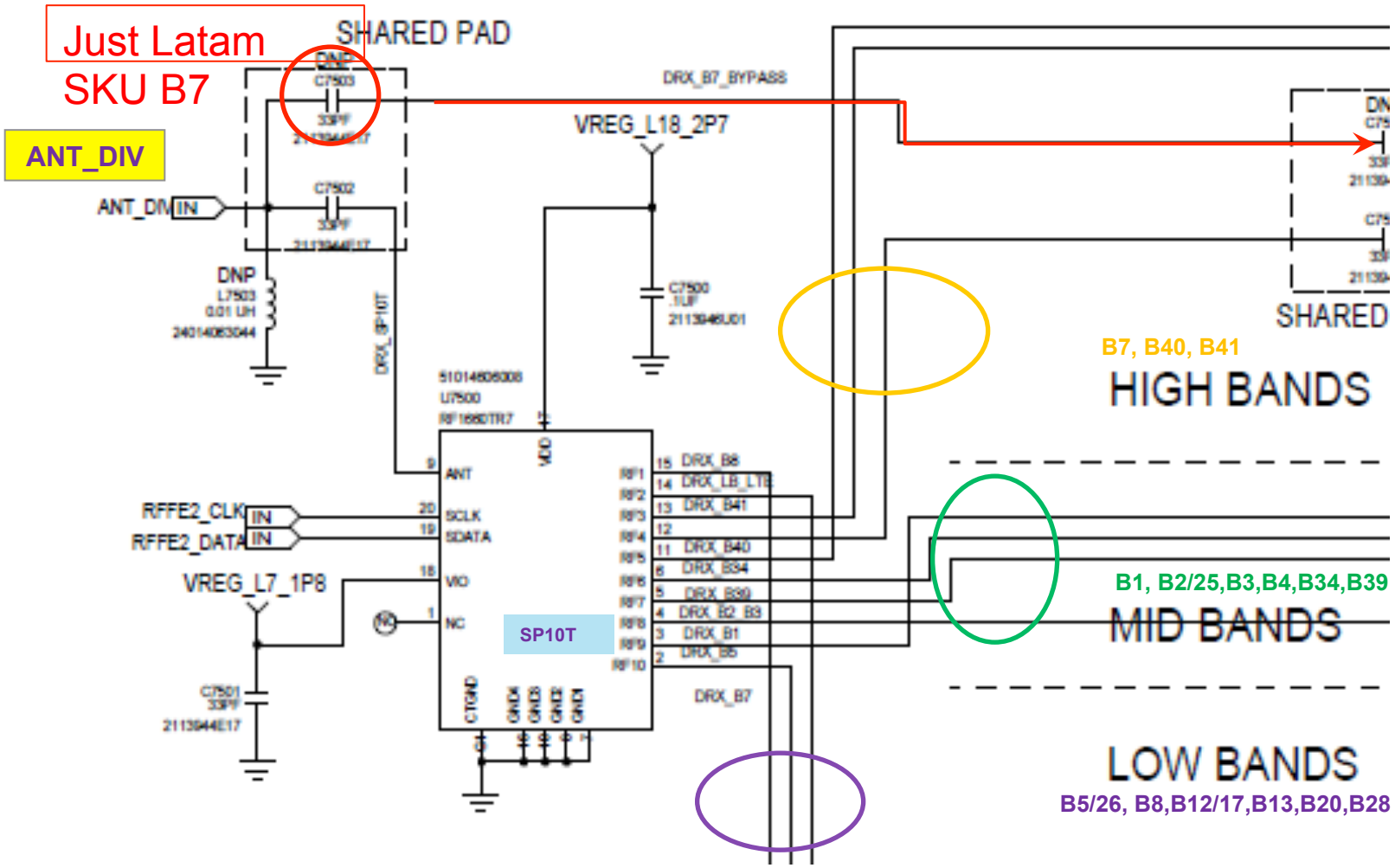
XO Supply Circuit



WFR4905 Voltage Supply Circuits

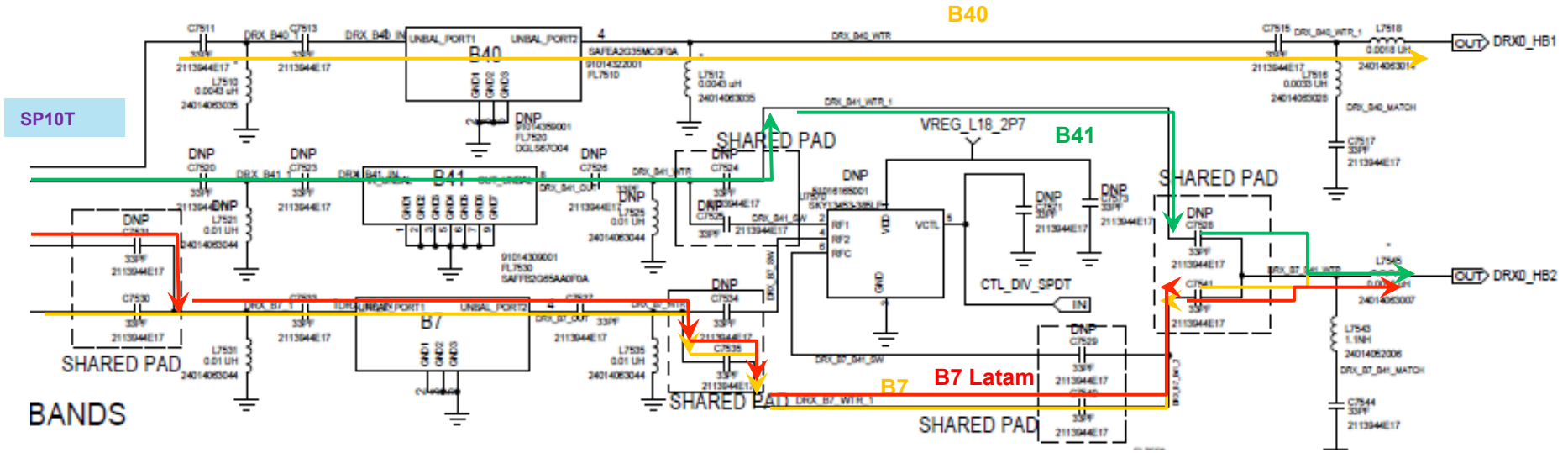


SP10T


Just Latam
SKU B7
ANT_DIV
SHARED PAD
DNP
C7503
33PF
C7502
33PF
DNP
L7503
0.01 UH
24014063044
ANT_DIV
IN
DRX_SP10T
DRX_B7_BYPASS
VREG_L18_2P7
C7500
.1UF
2113946U01
SHARED
B7, B40, B41
HIGH BANDS
B1, B2/25,B3,B4,B34,B39
MID BANDS
LOW BANDS
B5/26, B8,B12/17,B13,B20,B28
51014606308
U7500
RF1668TR7
VDD
ANT
SCLK
SDATA
VIO
NC
SP10T
RFFE2_CLK
RFFE2_DATA
IN
VREG_L7_1P8
C7501
33PF
2113944E17
CTGND
GND4
GND3
GND2
GND1
DRX_B8
DRX_LB_LTE
DRX_B41
DRX_B40
DRX_B34
DRX_B39
DRX_B2_B3
DRX_B1
DRX_B5
DRX_B7

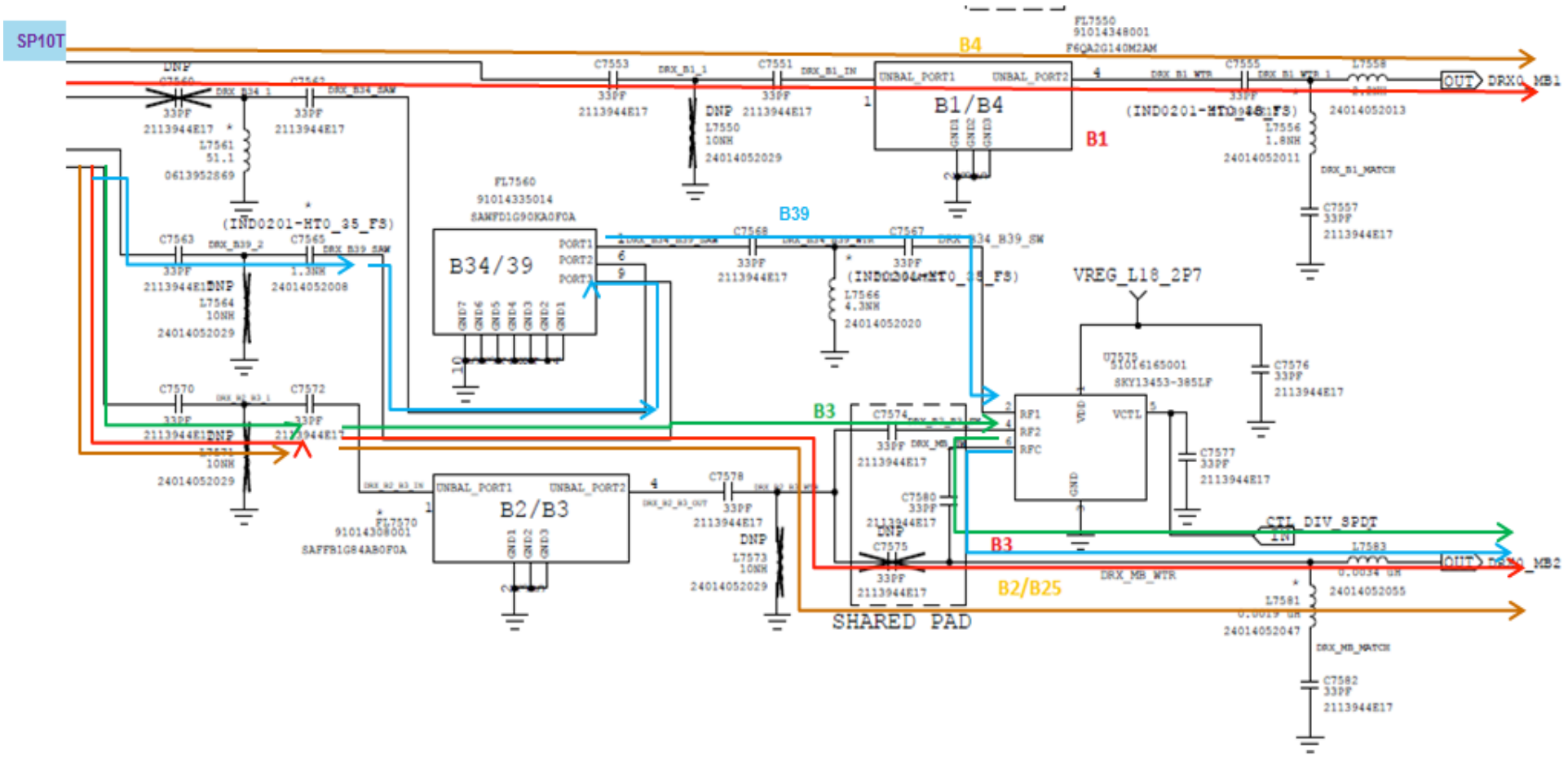
High Bands - B7, B40, B41

NA/EMEA SKU – B7
Sprint SKU – B41
Latam SKU – B7
APAC SKU – B7 and B40

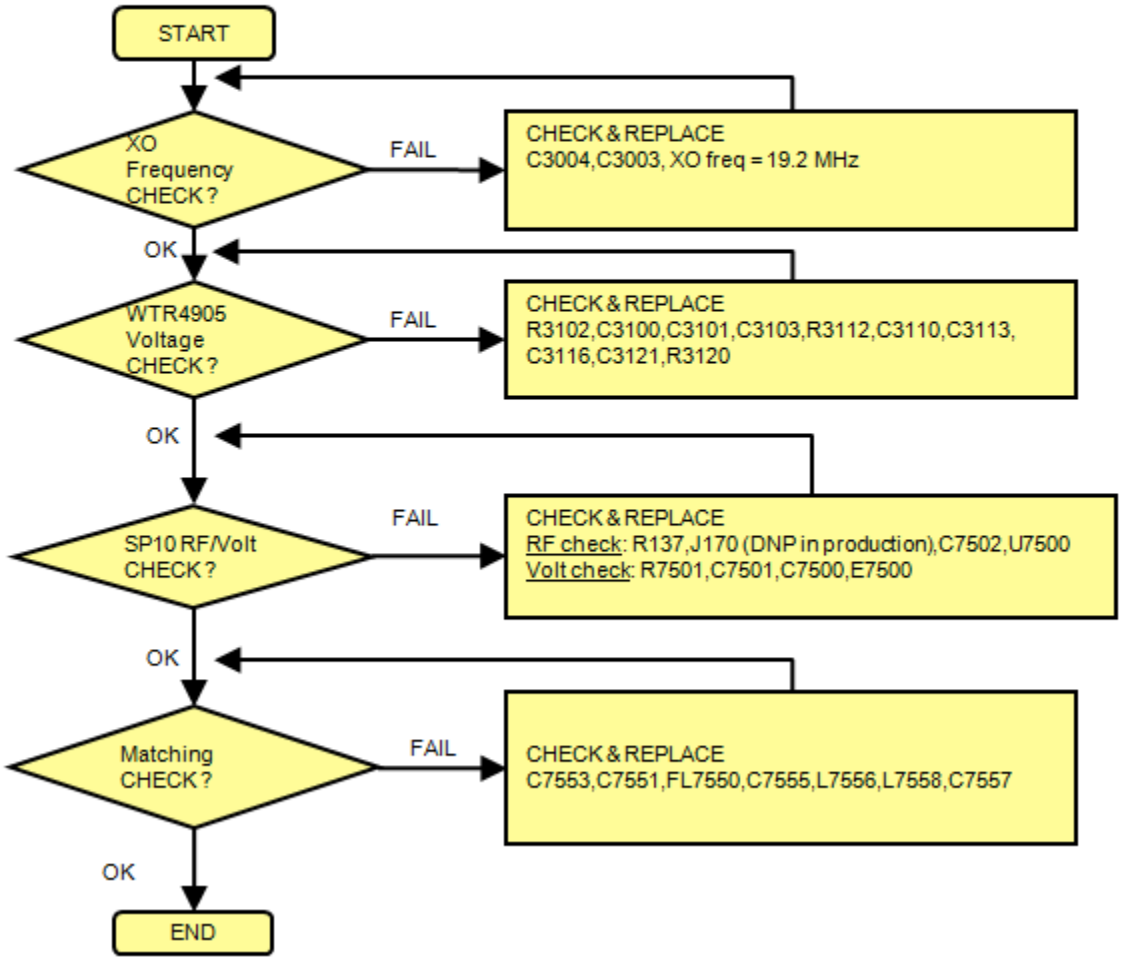


Mid Bands - B1, B2/25, B3, B4, B34, B39

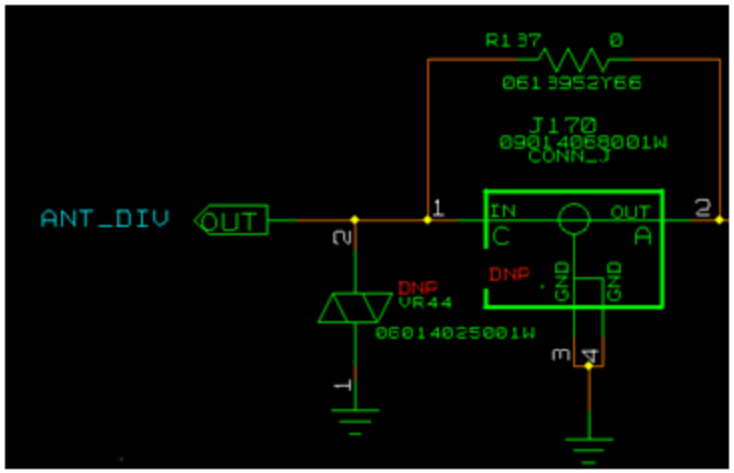
NA/VZW/Sprint SKU – B2/B25, B4
EMEA/APAC SKU – B1, B3
China SKU – B3, B39

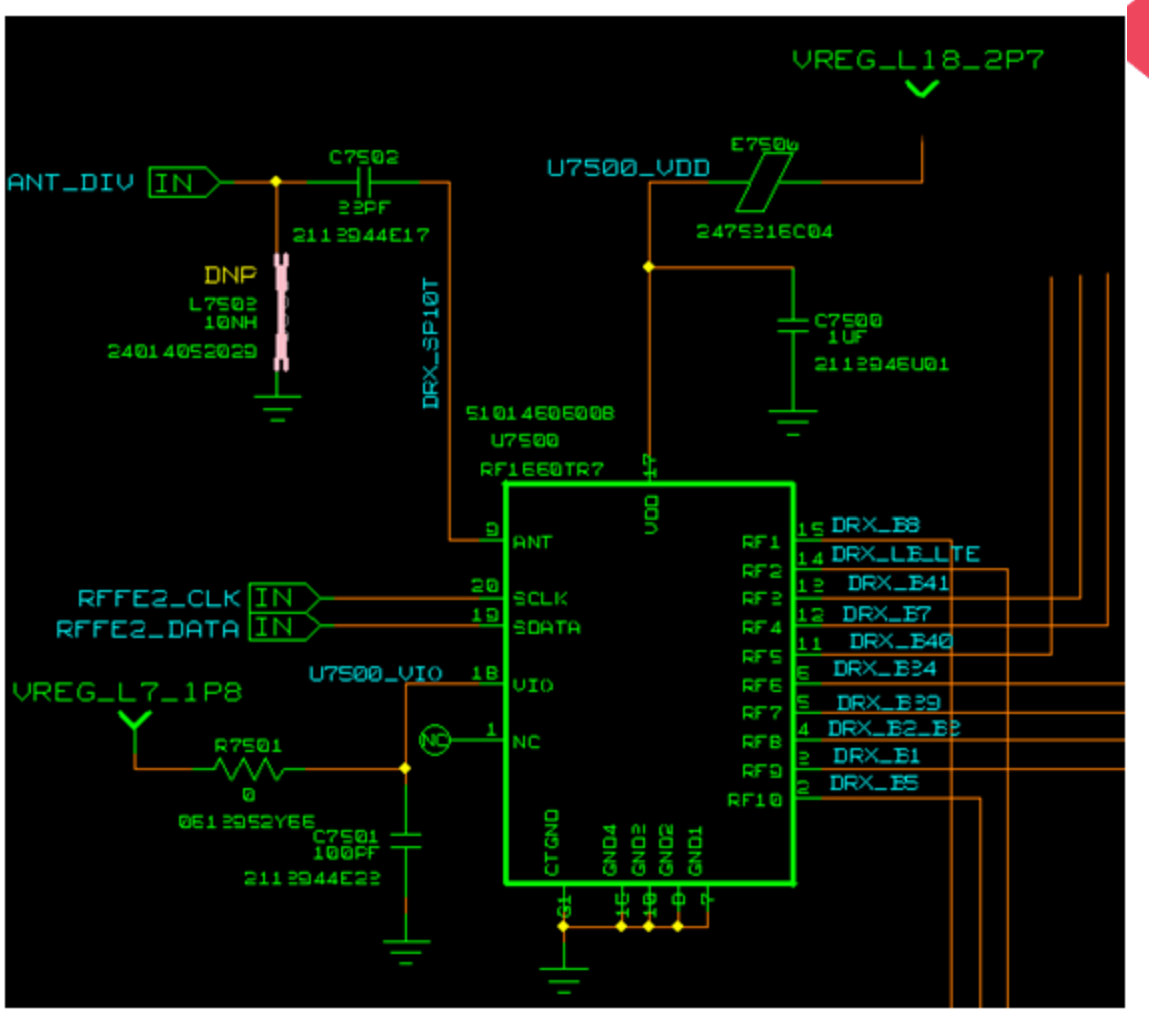


Rx Div B1/B4 Check Chart (All SKUs)

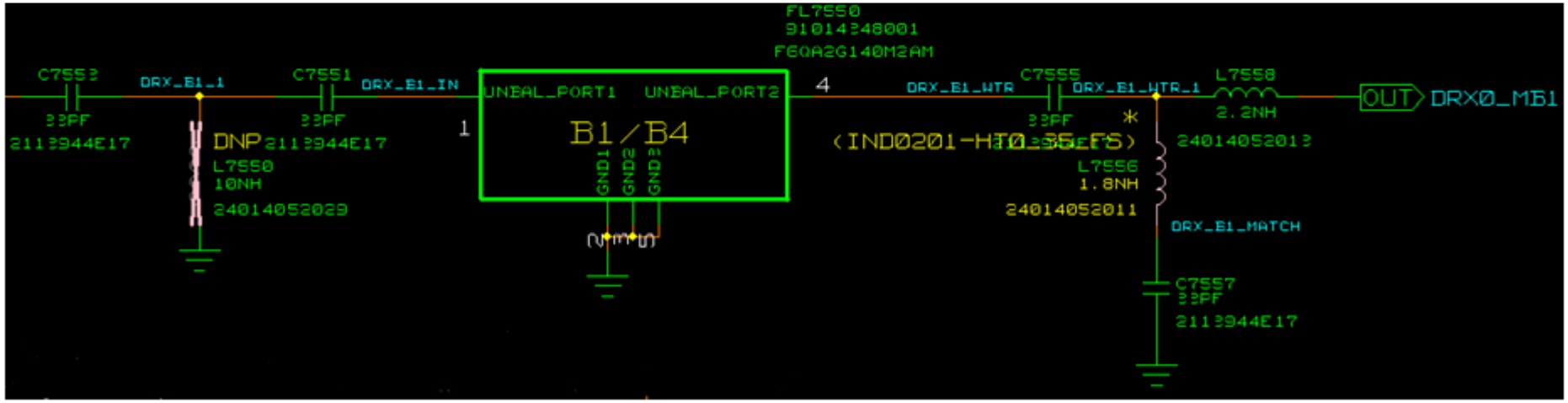


Rx Div B1/B4: (RF port {DNP in production and R137 placed} & SP10)

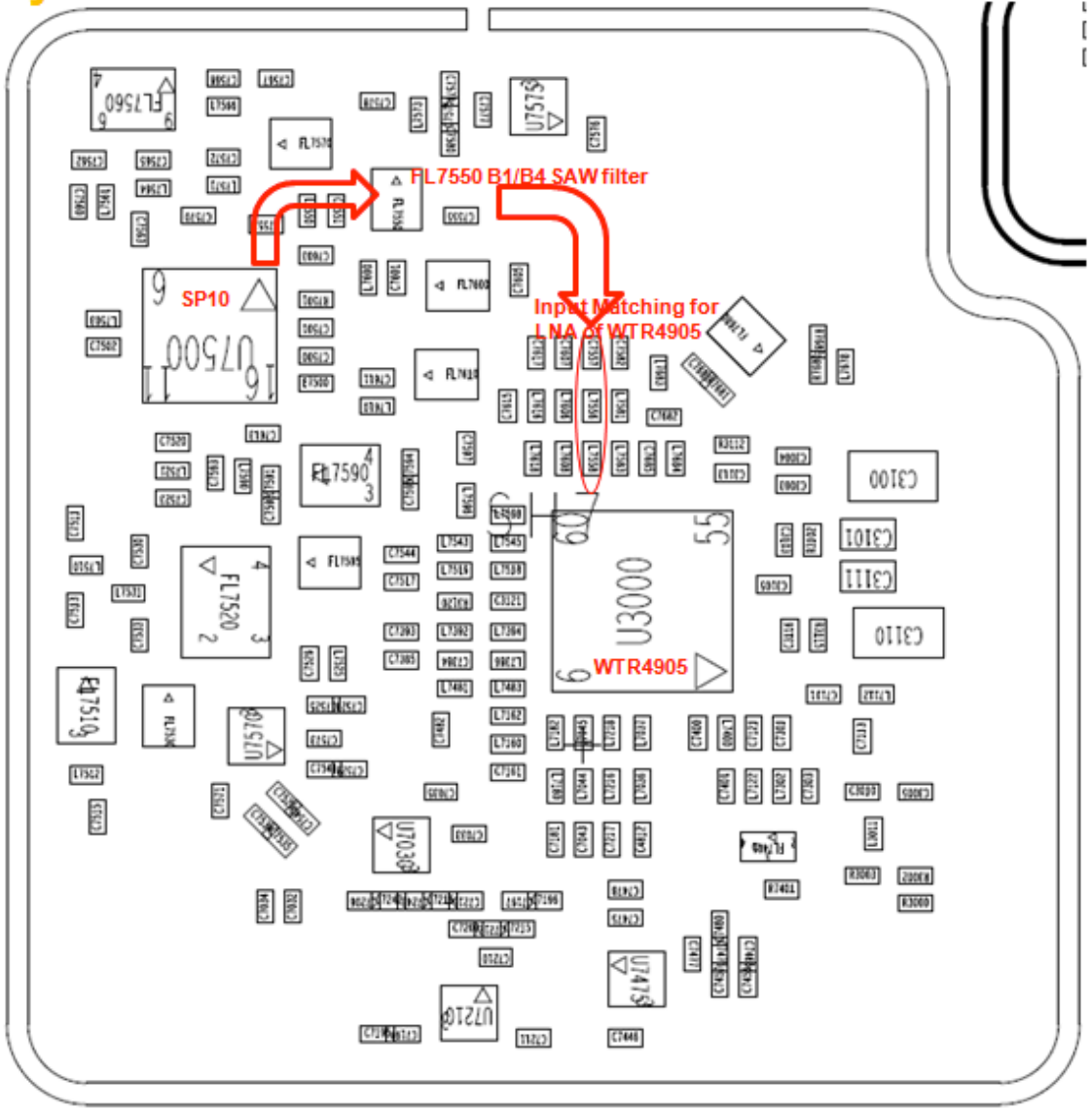




Rx Div B1/B4: Match Comp & SAW filter.



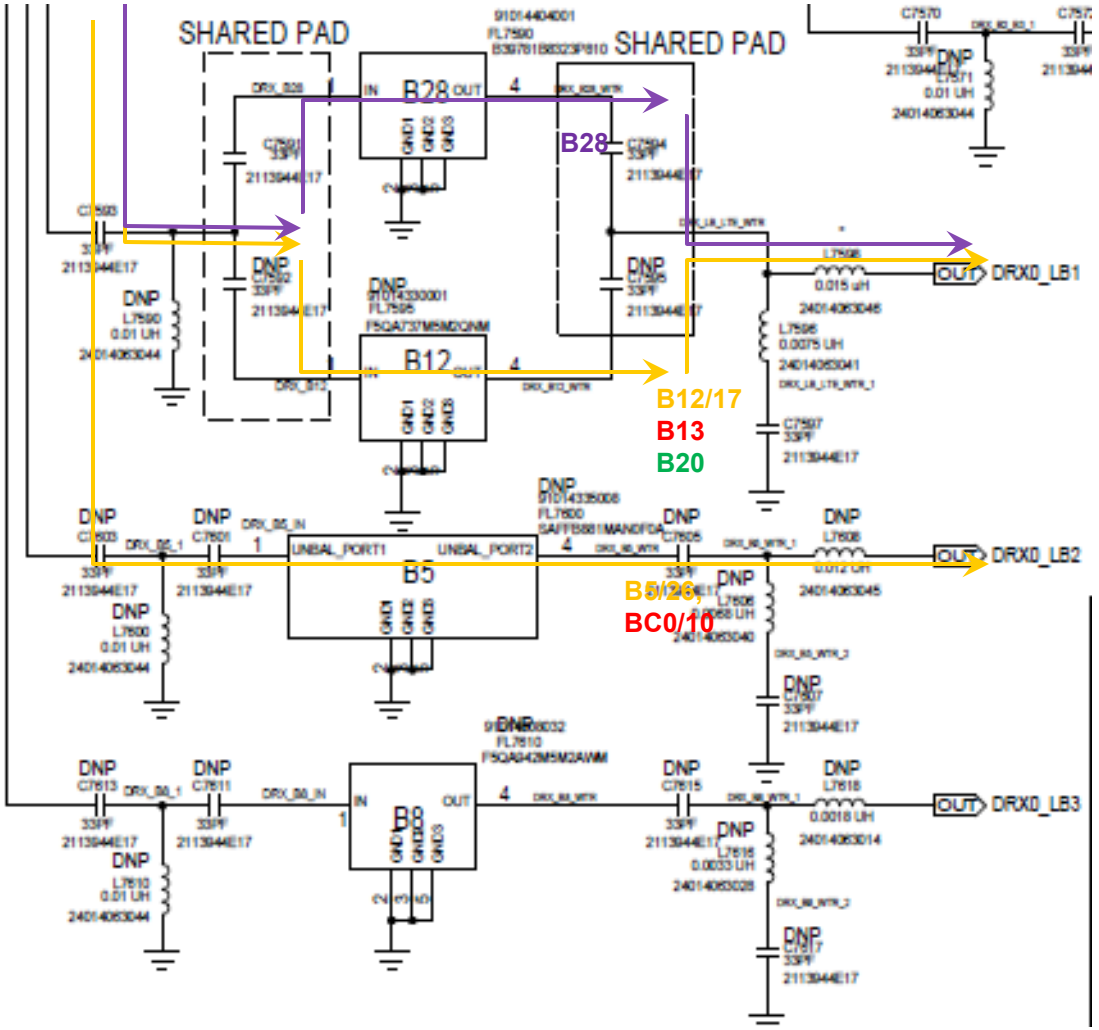
Rx Div B1/B4 layout.



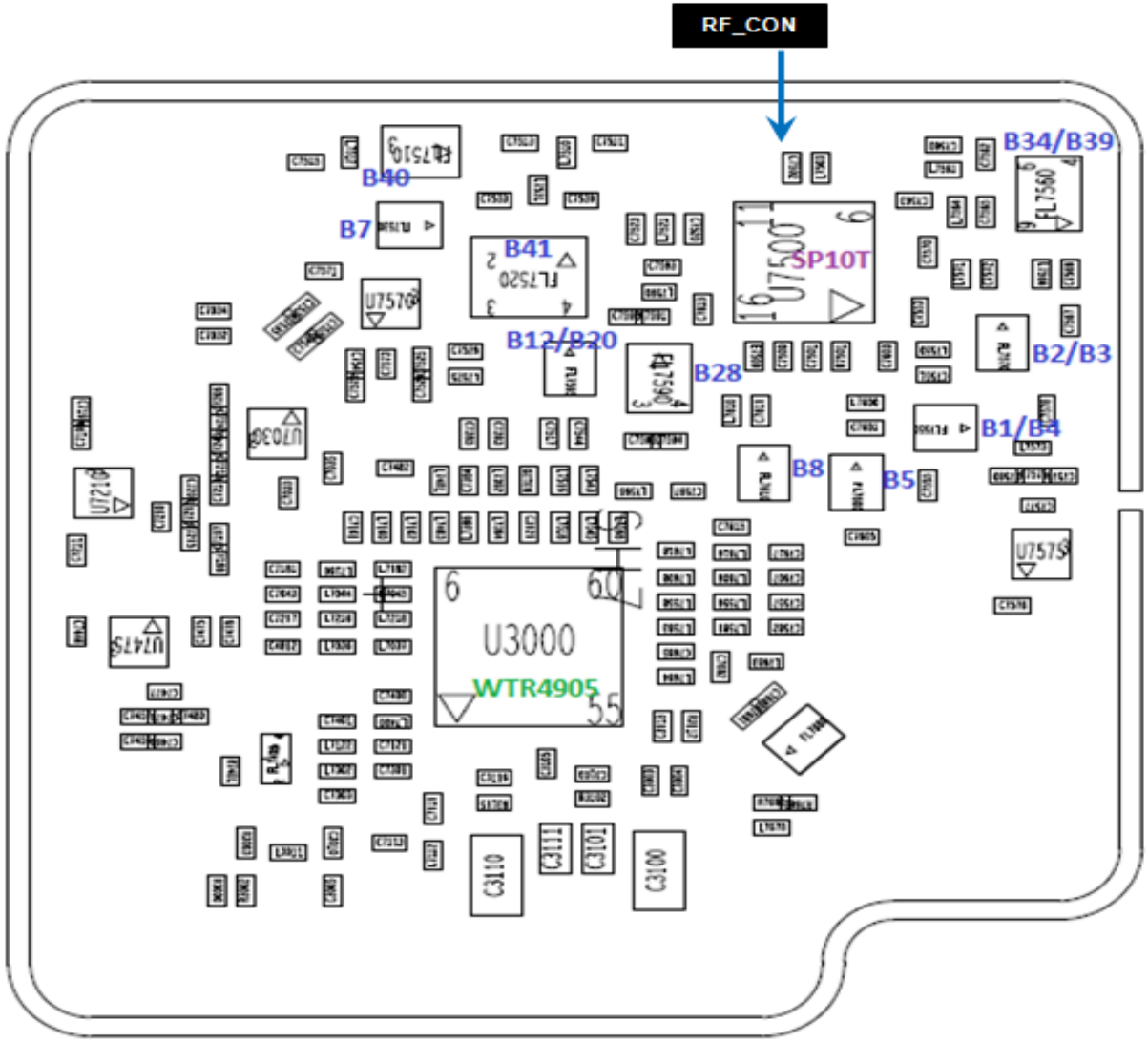
Low Bands - B5/26, B8, B12/17, B13, B20, B28

NASKU – B5, B12/17
VZW SKU – B13, BC0,
Sprint SKU – B5/26, B12/17
EMEA SKU - B20,B8
APAC SKU – B5, B28,B8

ANT_DIV

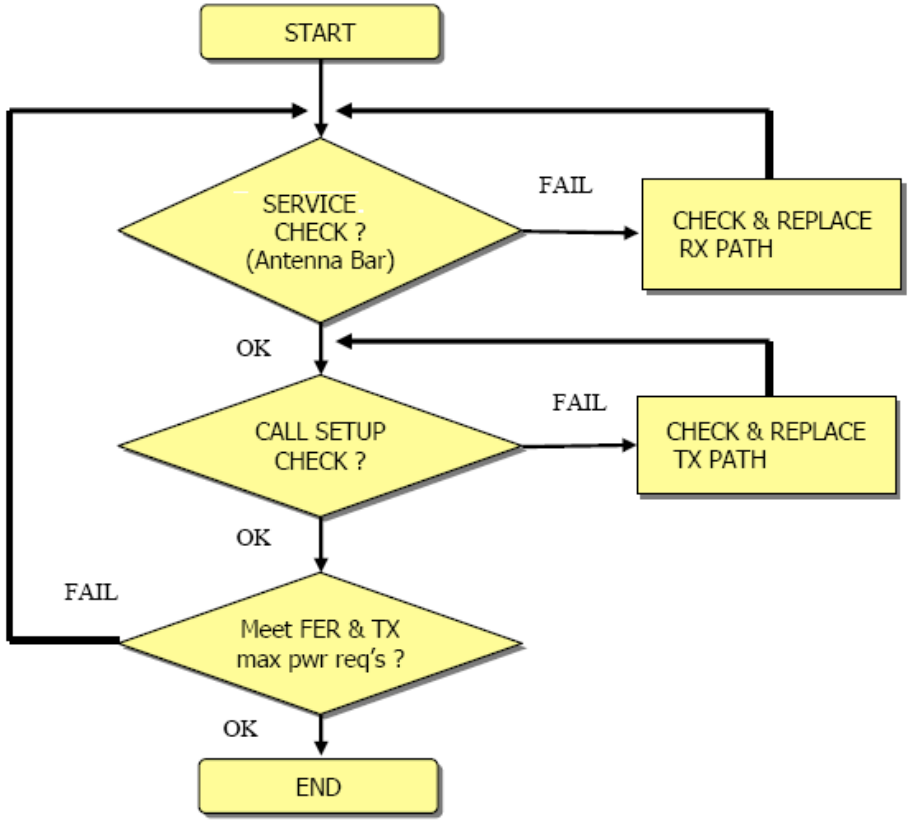


Diversity Circuit Layout

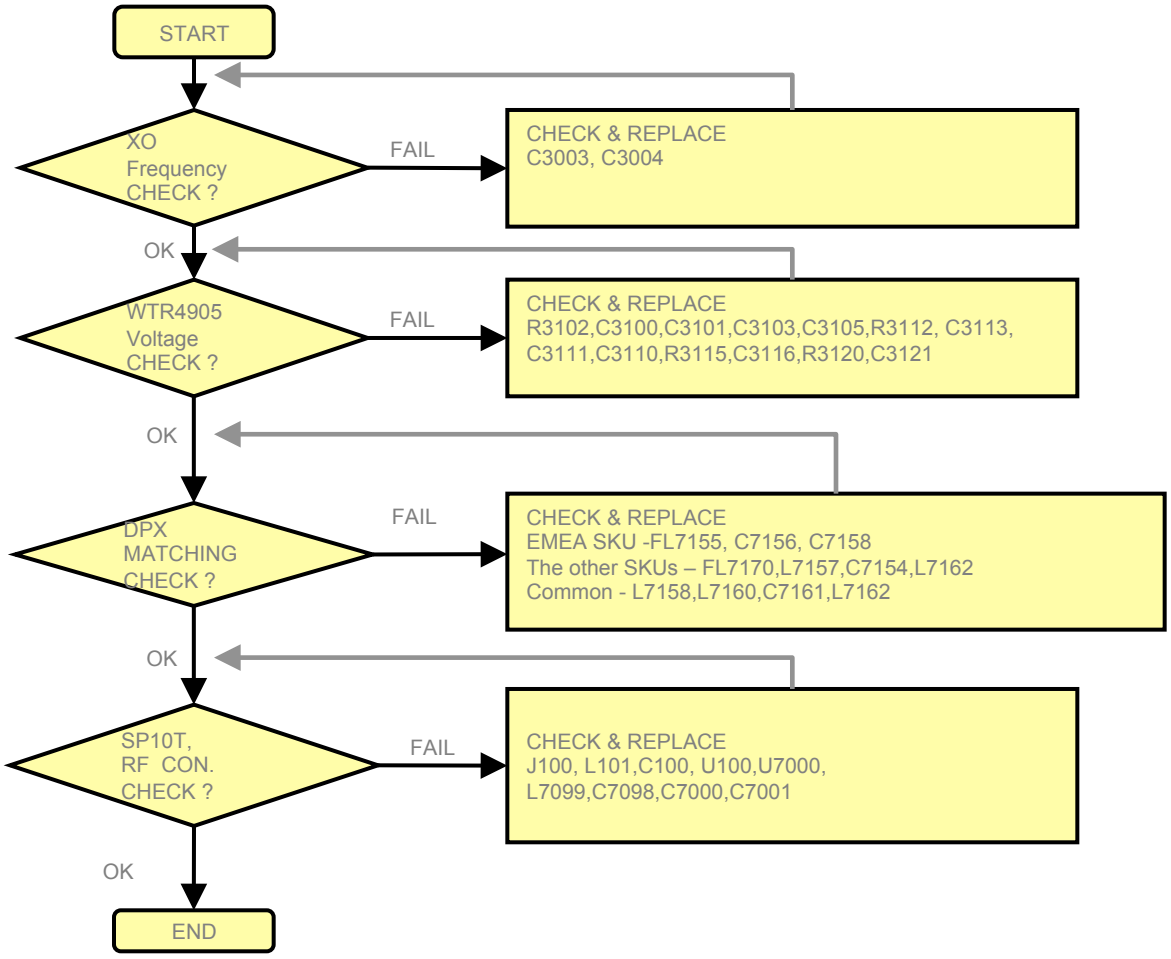


GSM Quad Band Rx

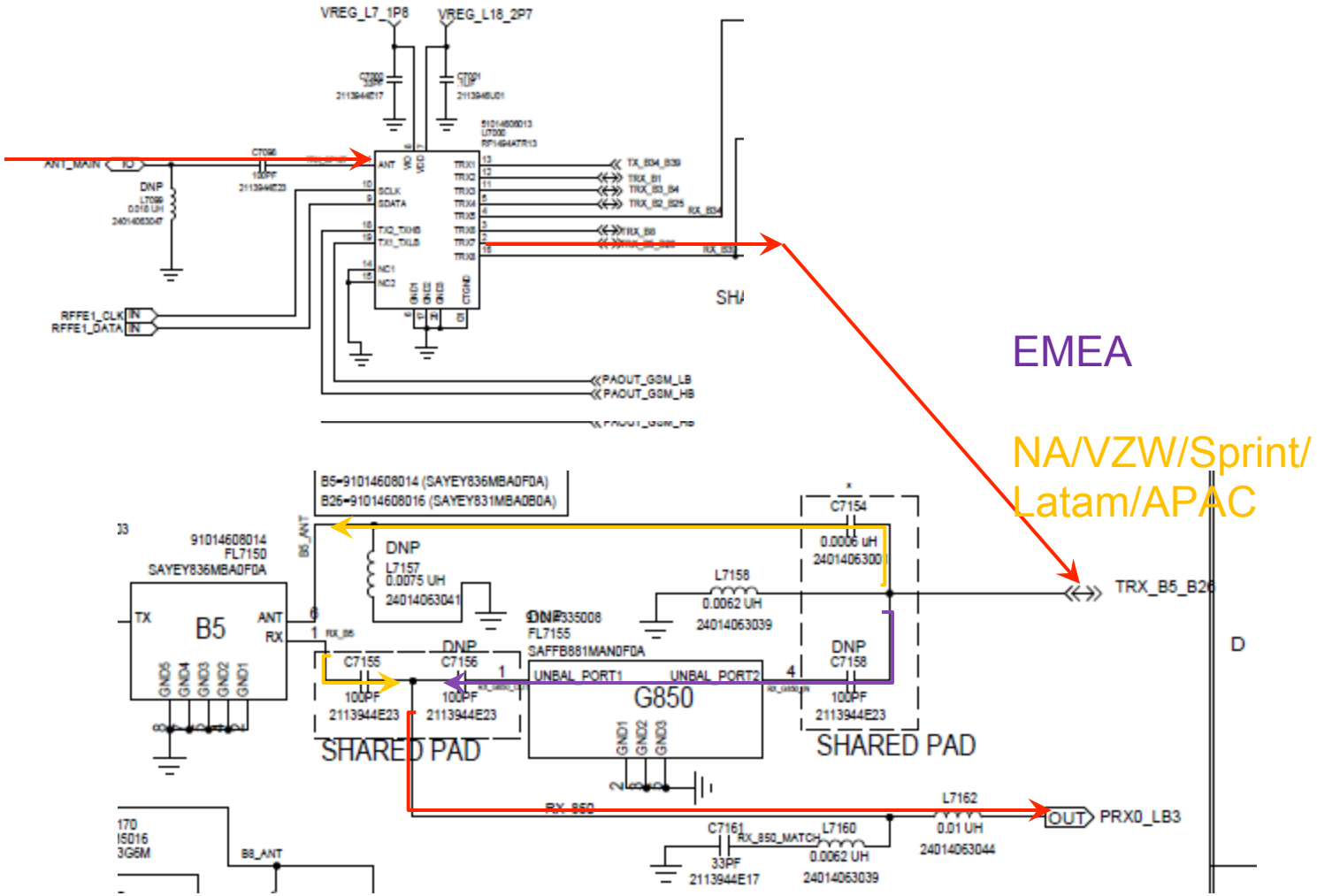
GSM Radio Check



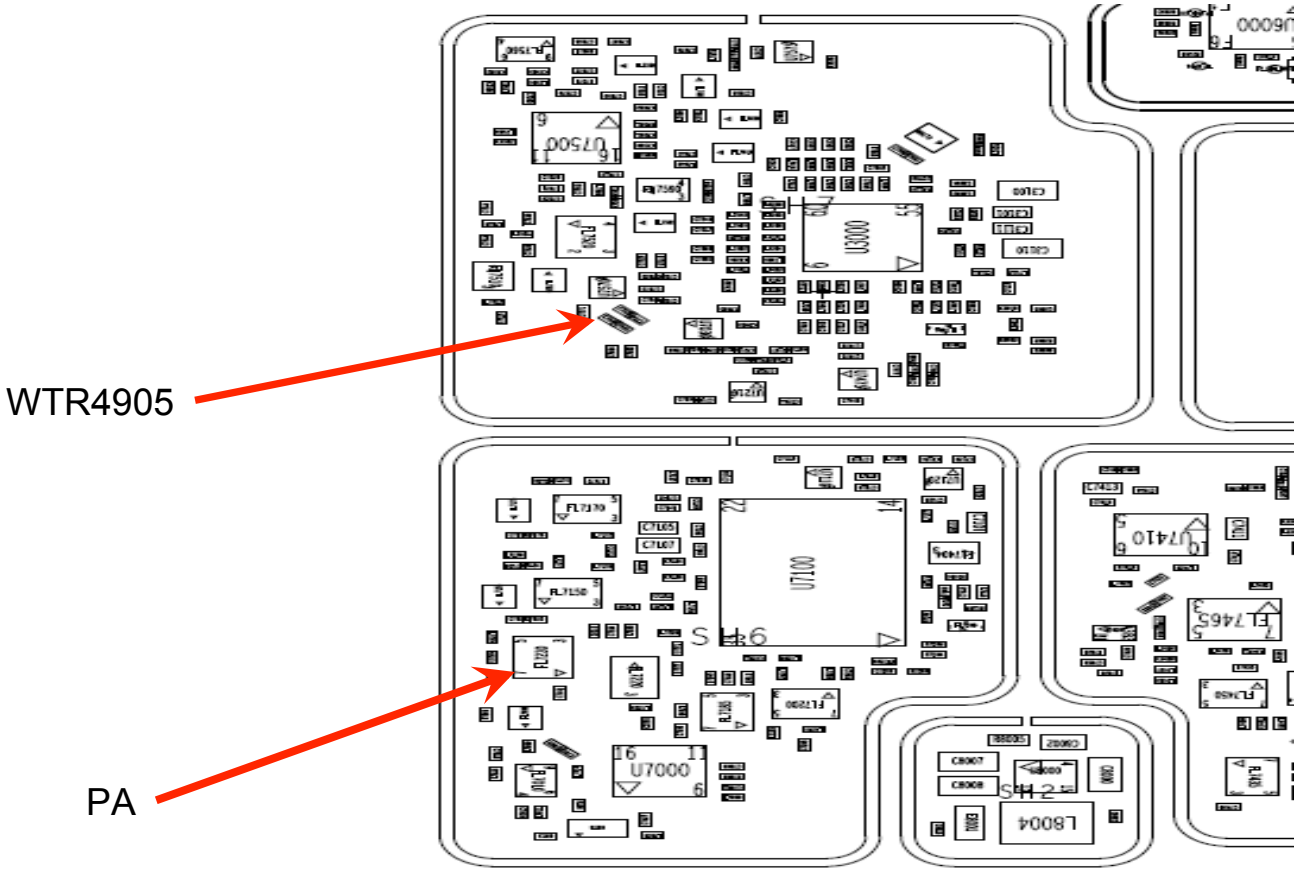
GSM850 Receiver Check Chart



GSM850 Receiver Circuitry

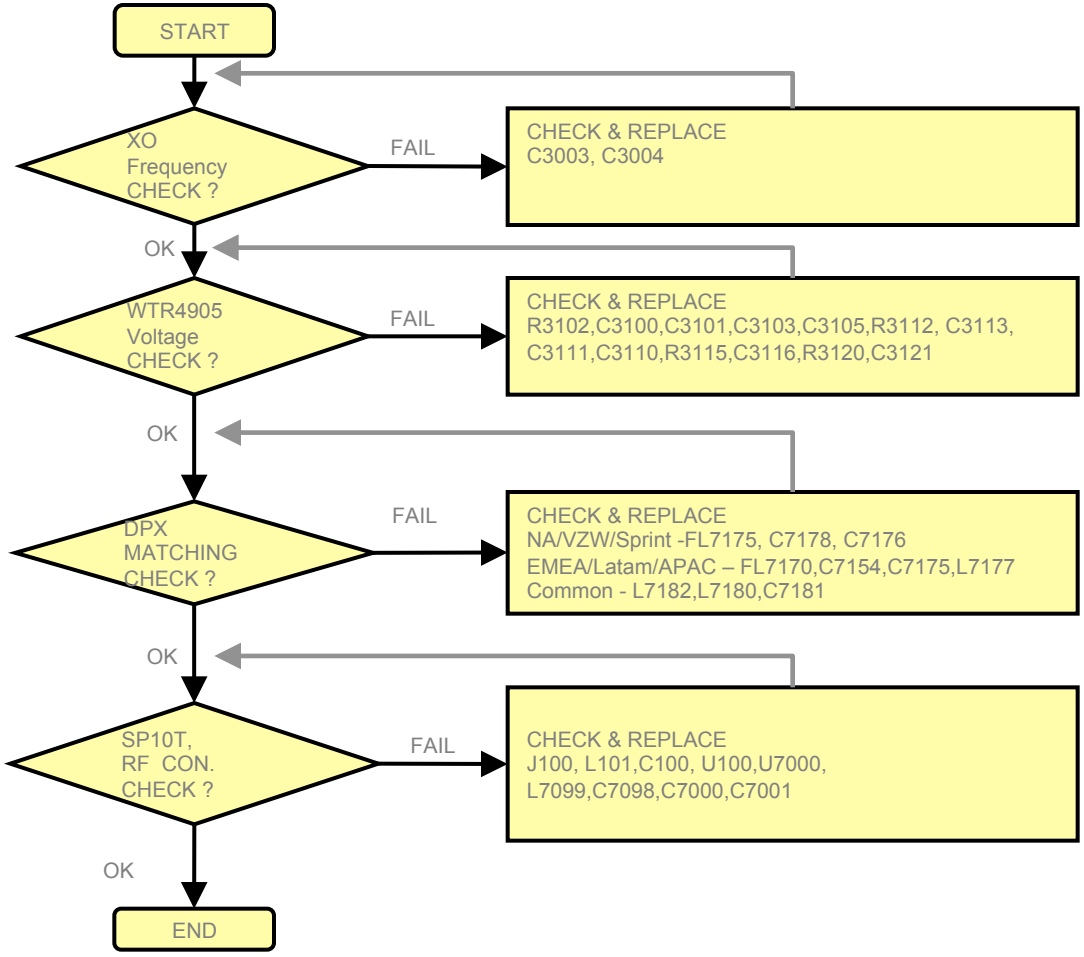


GSM850 Receiver Layout

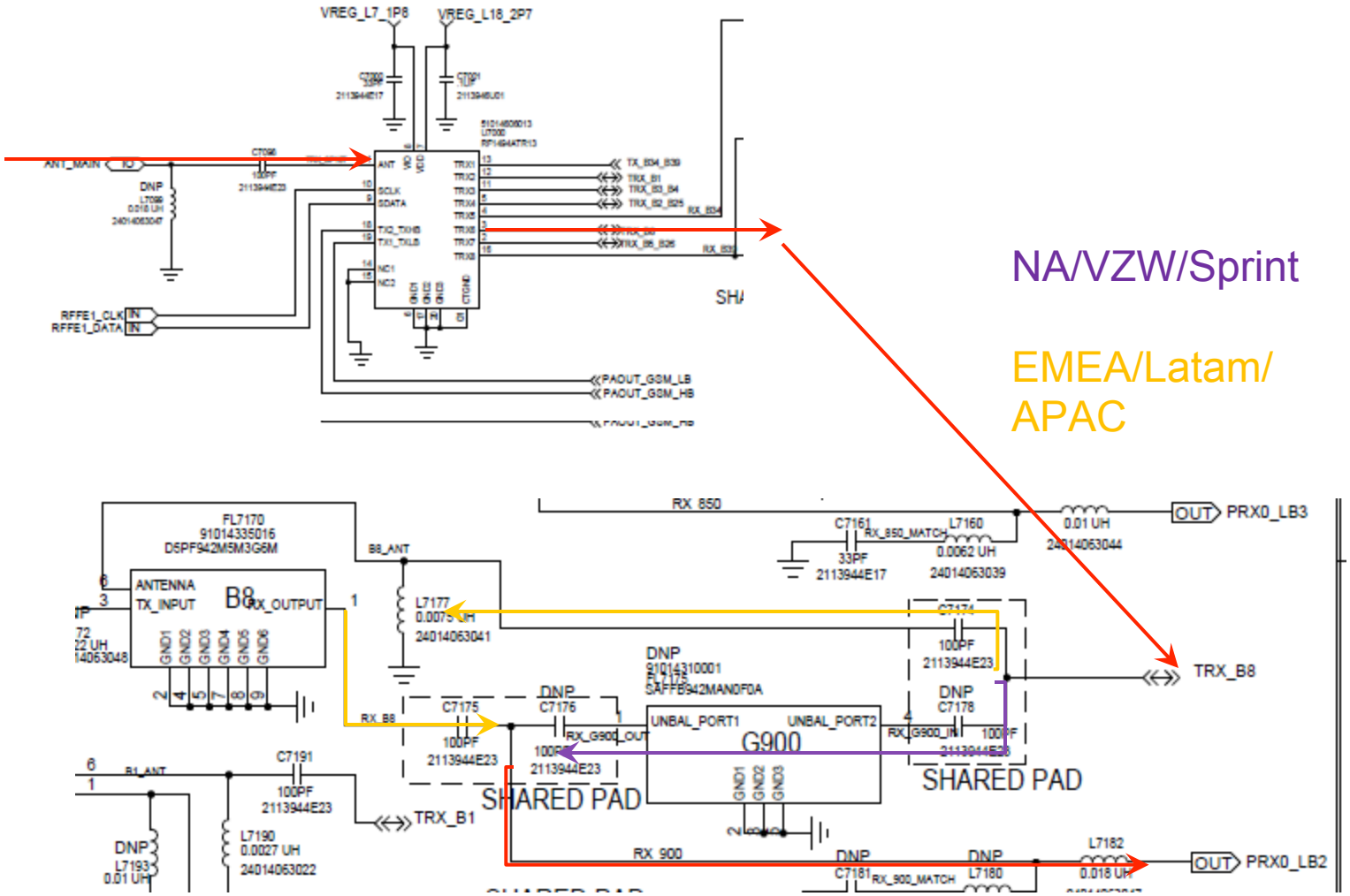


EMEA
NA/VZW/Sprint/Latam/APAC

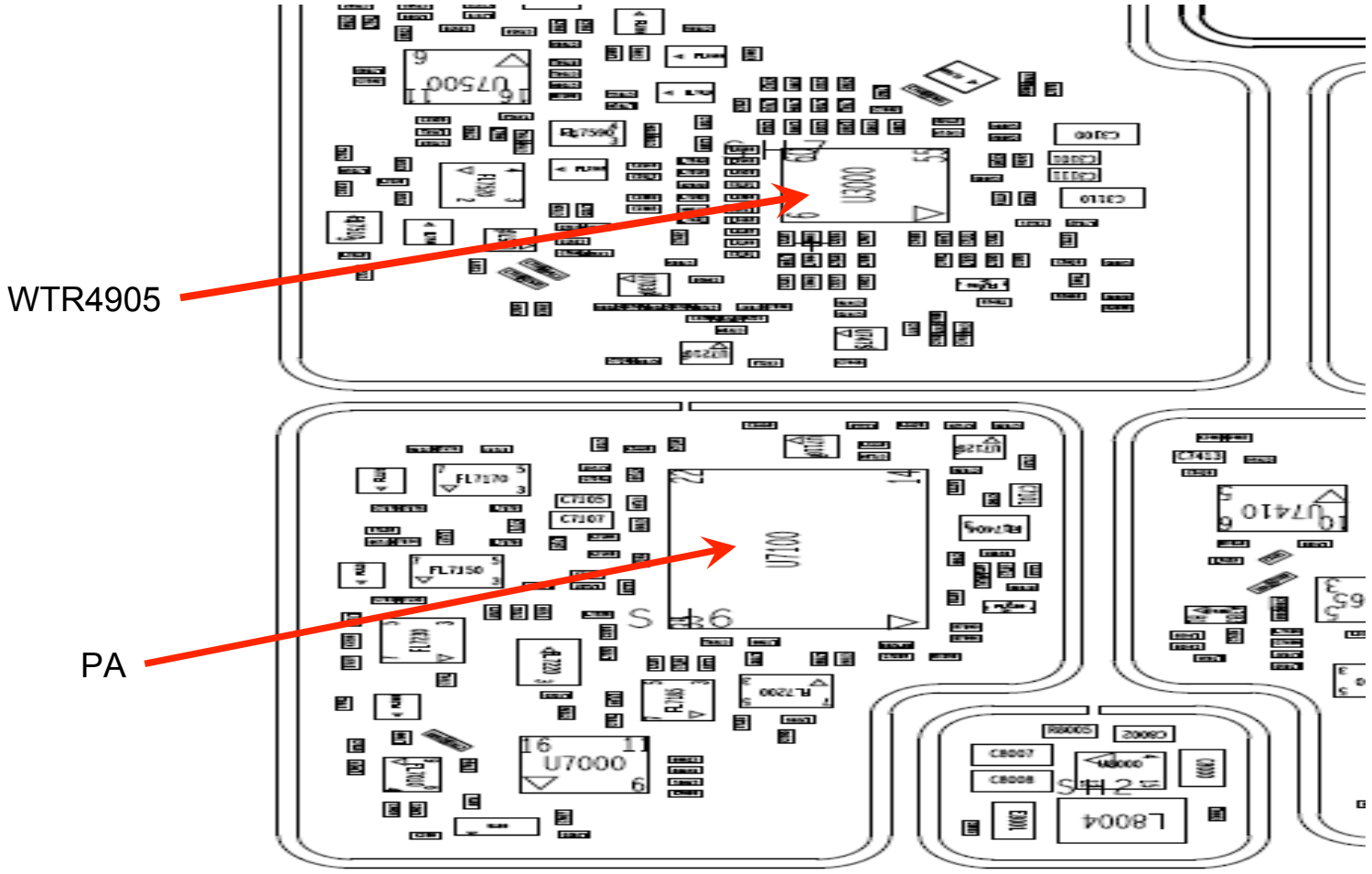
GSM900 Receiver Check Chart



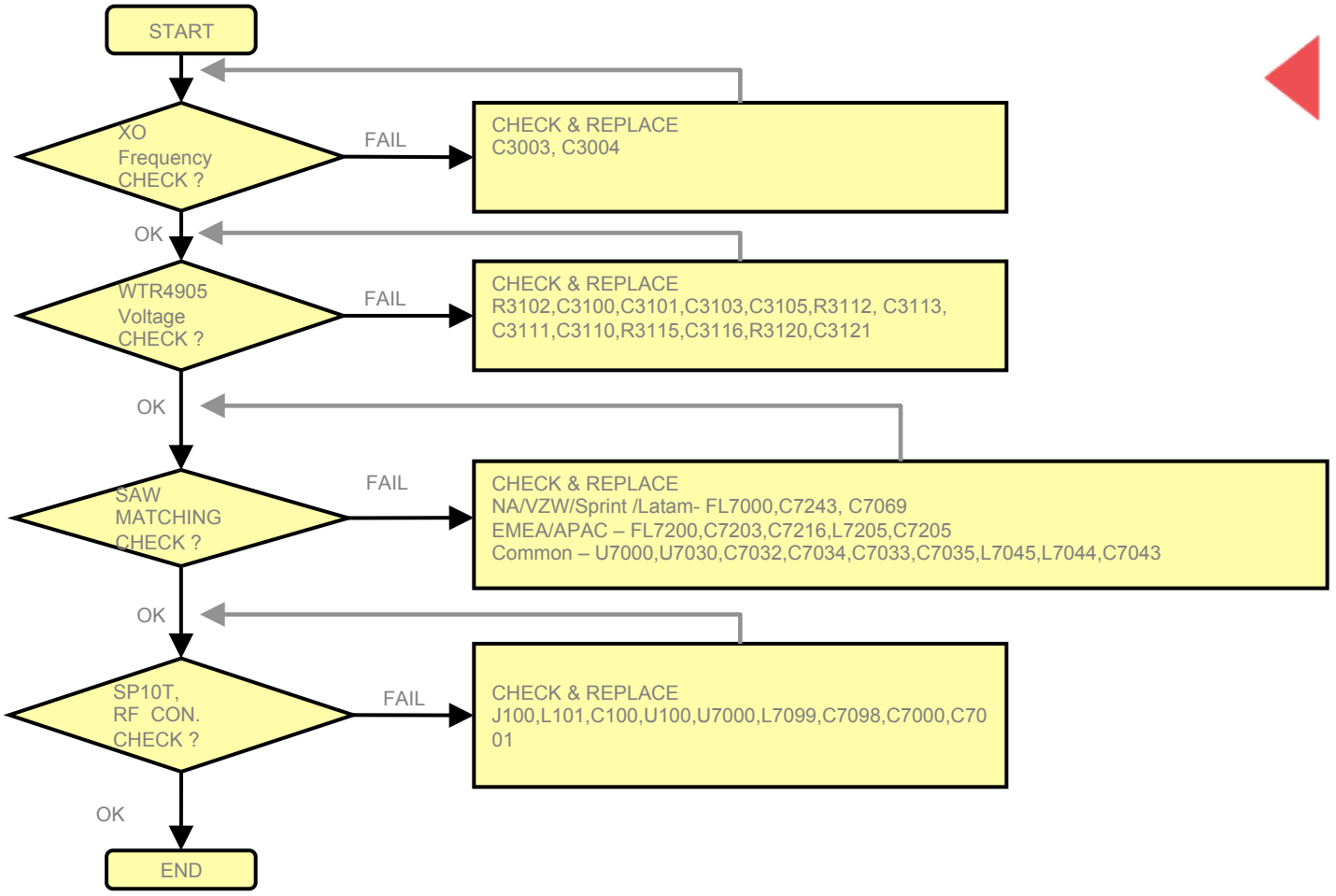
GSM900 Receiver Circuitry



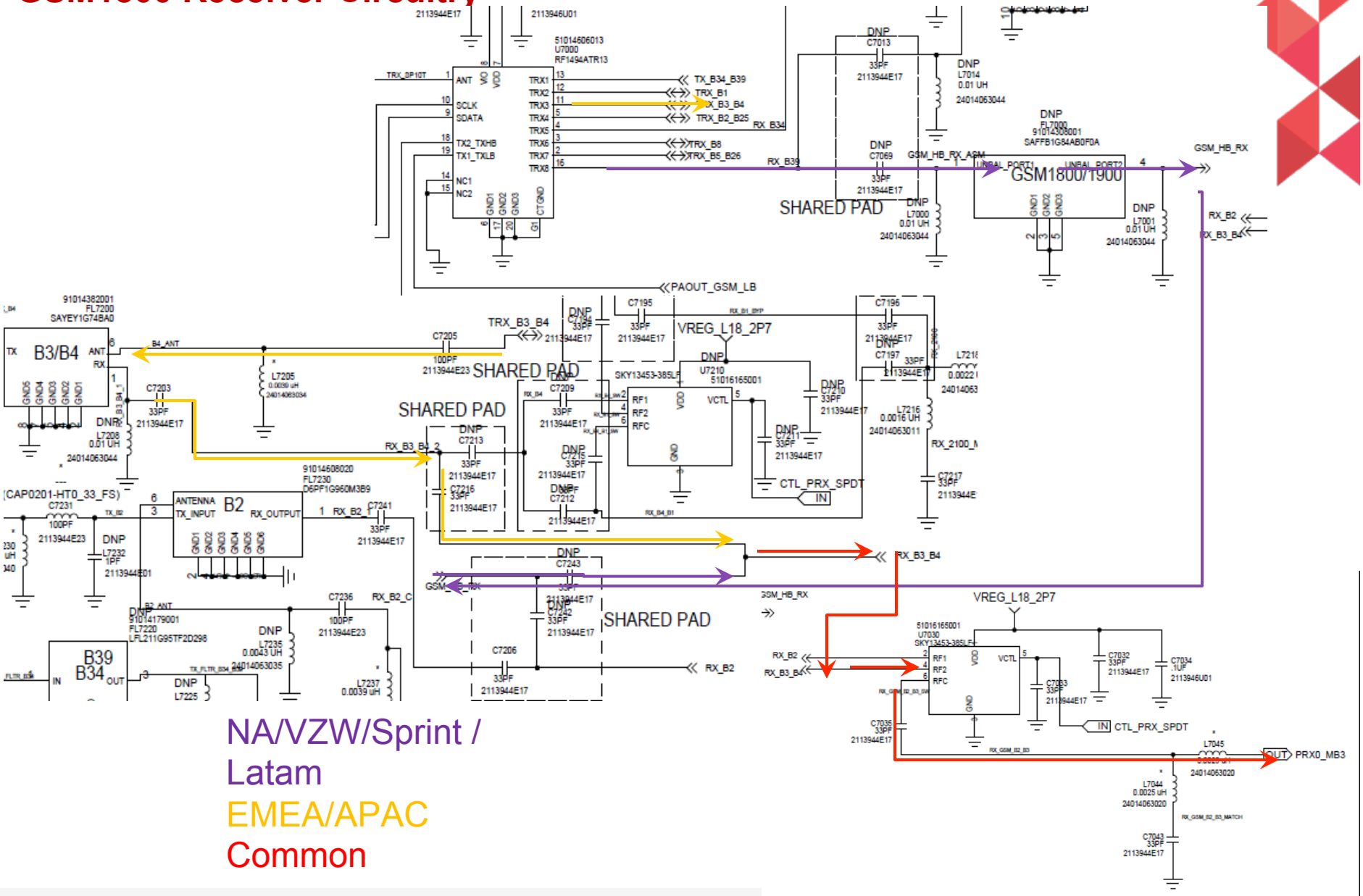
GSM900 Receiver Layout



GSM1800 Receiver Check Chart

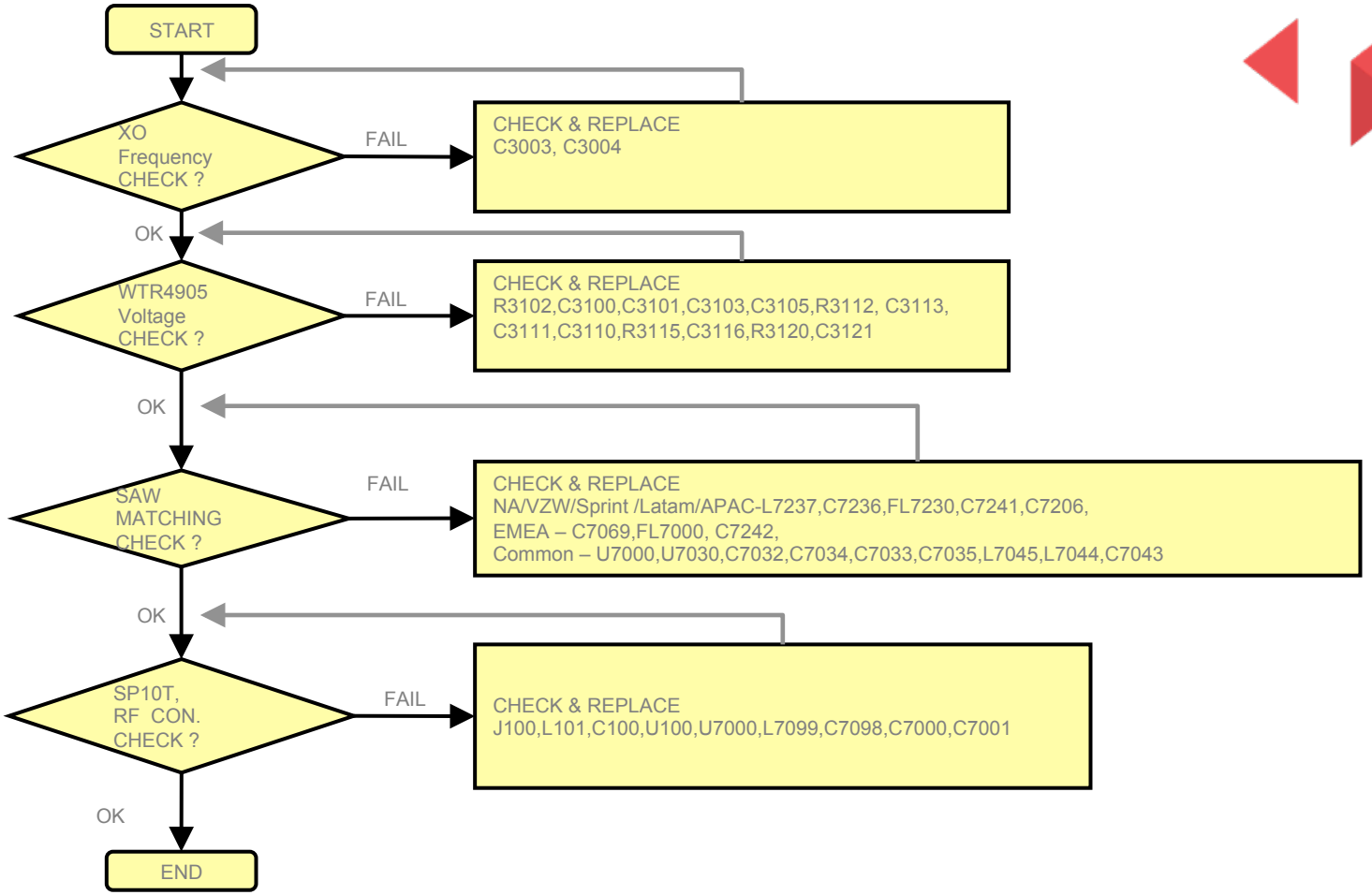


GSM1800 Receiver Circuitry

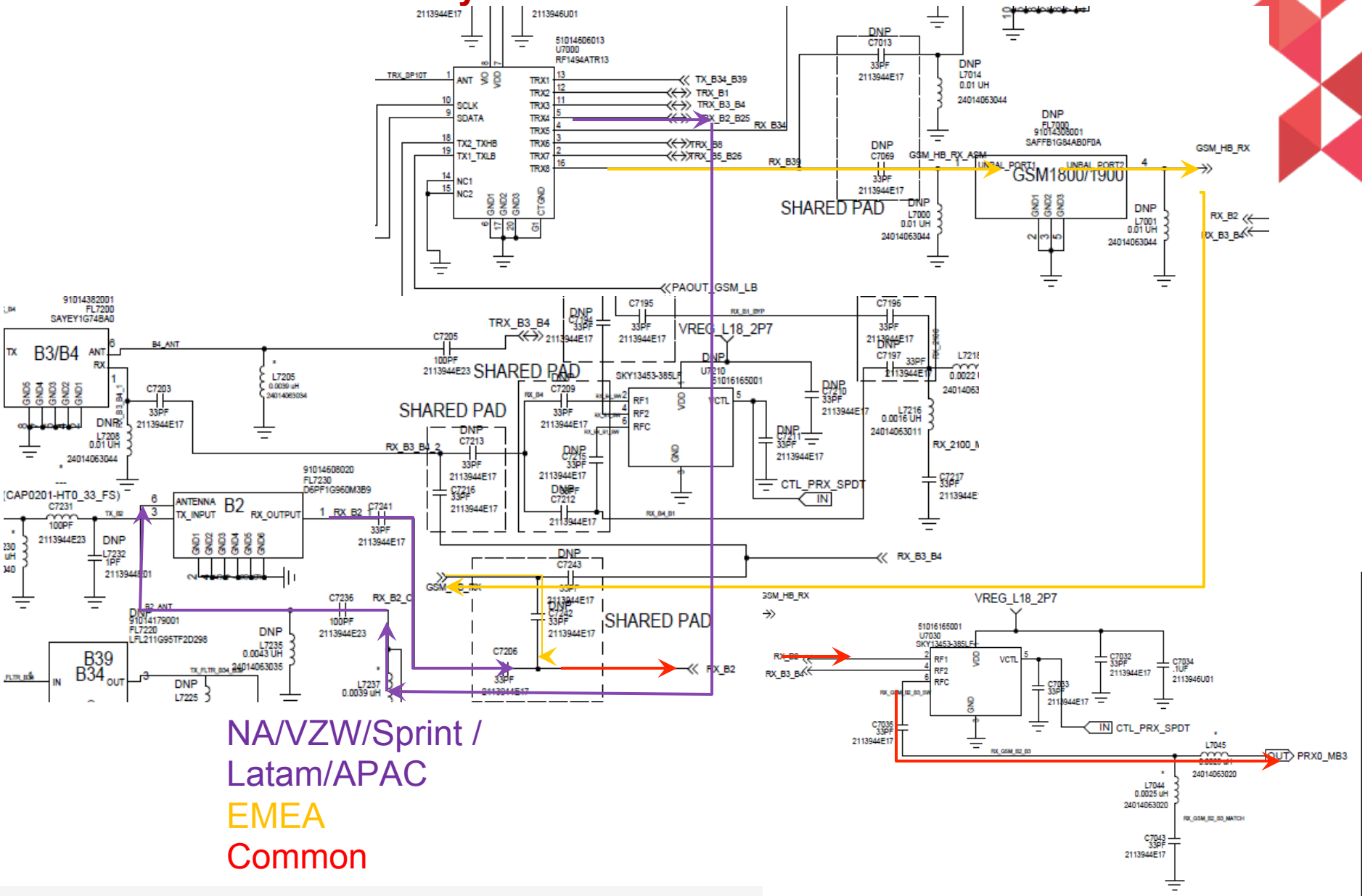


NA/VZW/Sprint /
Latam
EMEA/APAC
Common

GSM1900 Receiver Check Chart

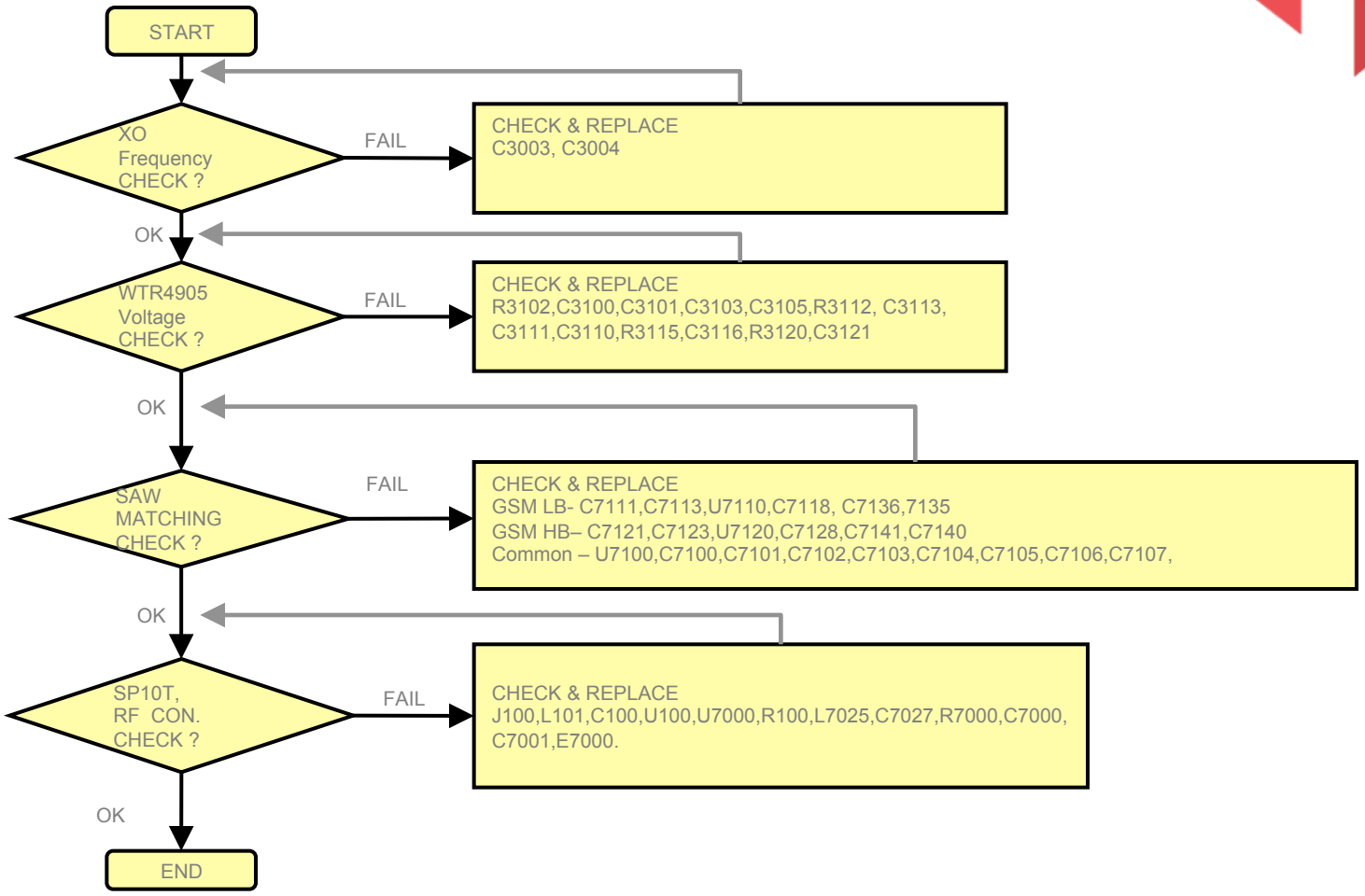


GSM1900 Receiver Circuitry

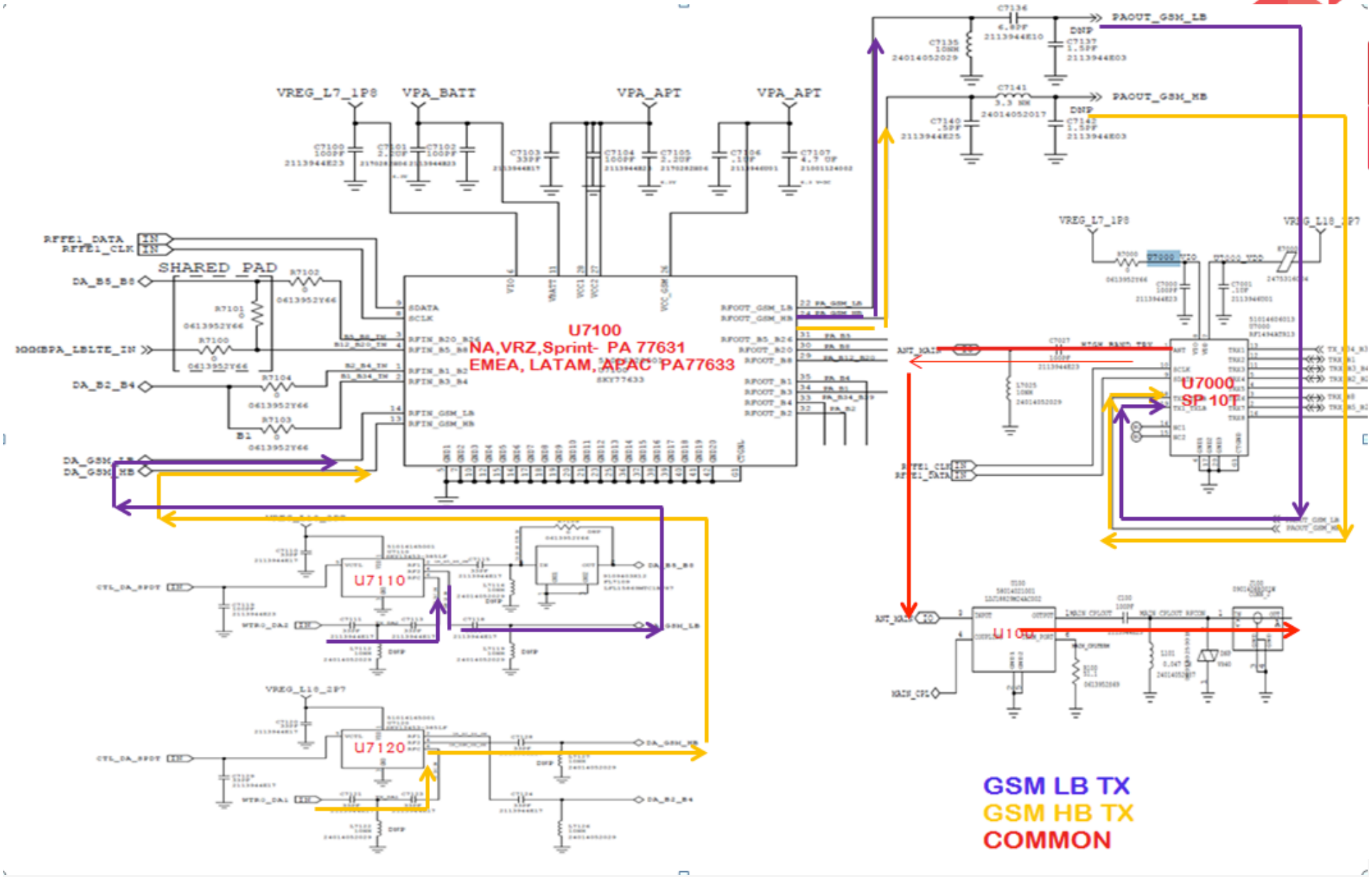


GSM Quad Band Tx

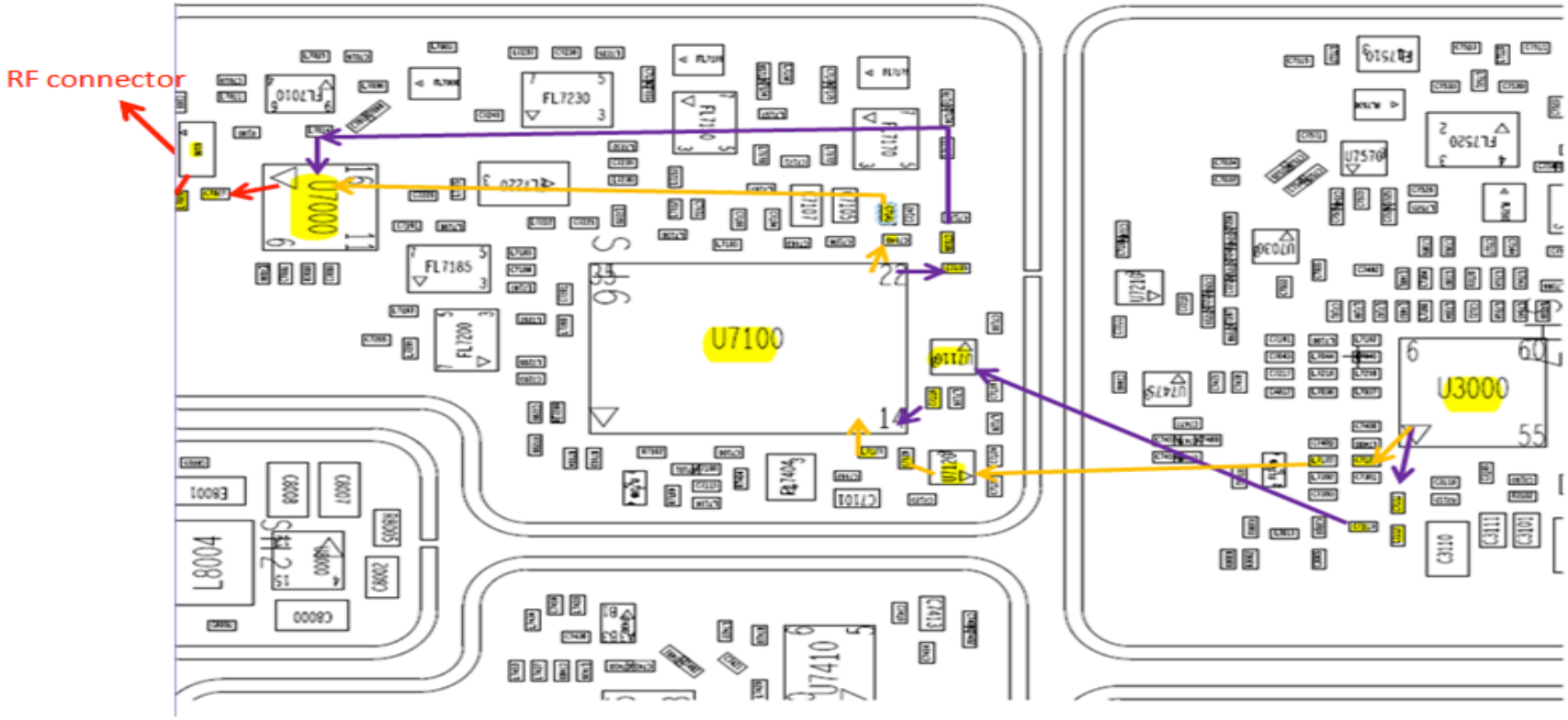
GSM Quad Band Tx Check Chart



GSM Quad Band Tx Circuitry



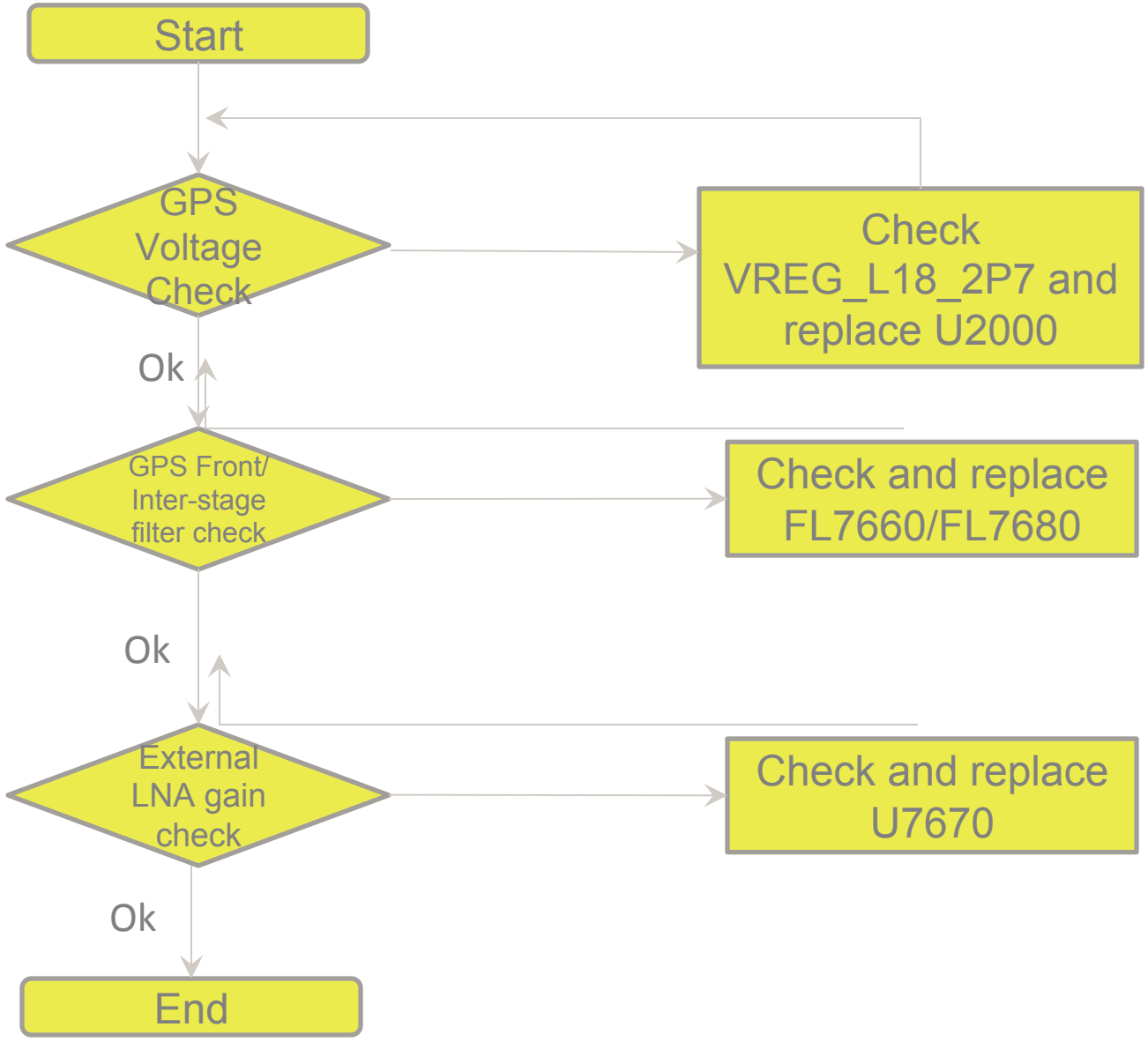
GSM Quad Band Tx Circuitry



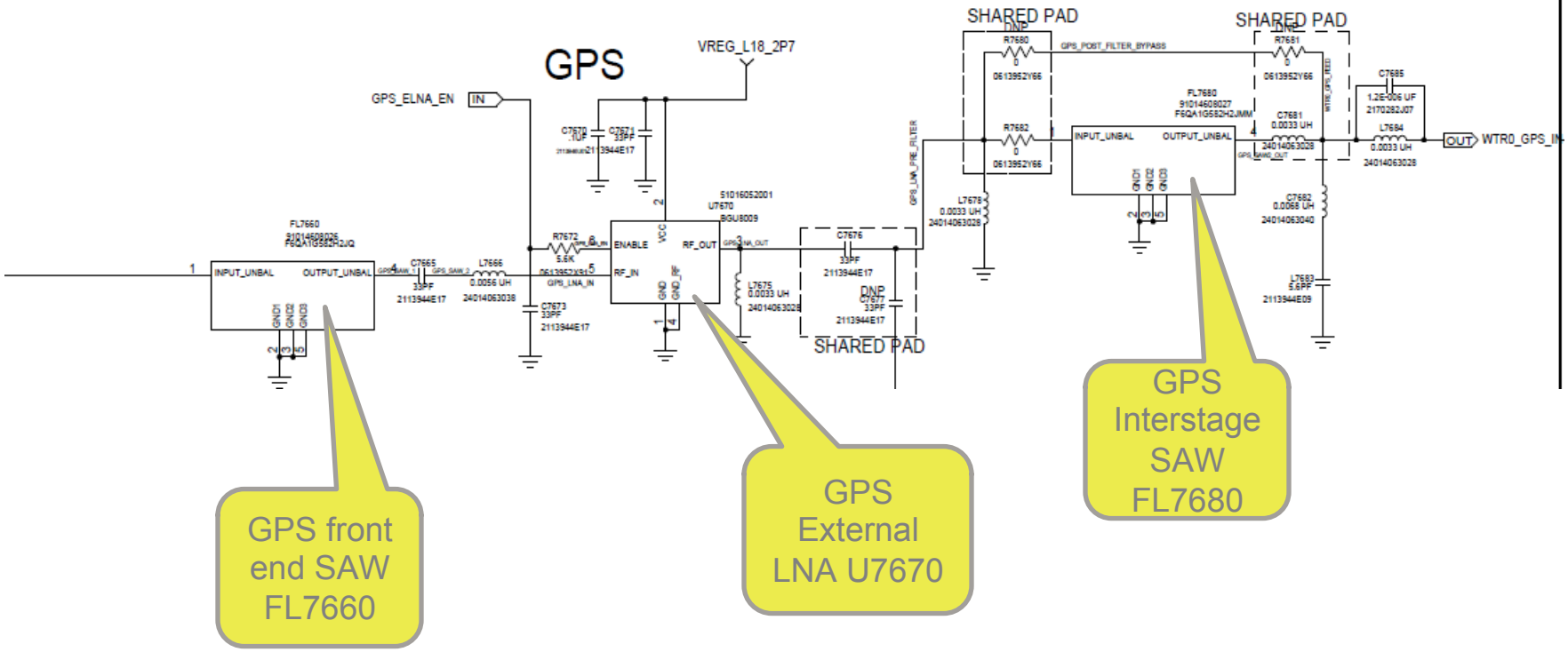
GSM LB Tx
GSM HB Tx
Common

GPS TROUBLESHOOTING

GPS Troubleshoot Flow Chart



GPS Front End Block



WLAN / BT / WiFi TROUBLESHOOTING

Bluetooth/WiFi Power-On Failure

WLAN/BT power-on failure Symptoms:

WLAN DL test firmware test commands fail

Bluetooth power-on test commands fail

Step 1 for BT/Wi-Fi Power-On Failure

- Check if the other functionality fails as well, e.g. check WLAN “power on” if Bluetooth can not be powered on. Check Bluetooth “power on” if WLAN can not be powered on.

- Both WLAN and Bluetooth share the same IC and most of the circuit, so if one of the BT/Wi-Fi fails, the other should fail as well. If only one of them fails, it is highly likely that it is not a hardware problem and it could just that the BT/Wi-Fi is turned on through the UI already and the test commands can not turn it on again.

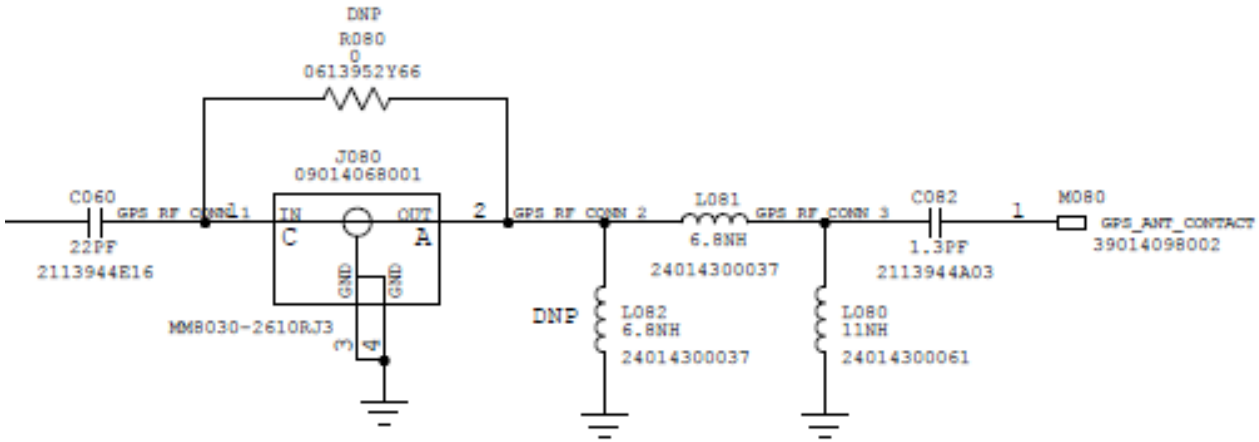
Step 2 for BT/Wi-Fi Power-On Failure

If both BT and WLAN fails, it is highly indicative of a hardware failure.

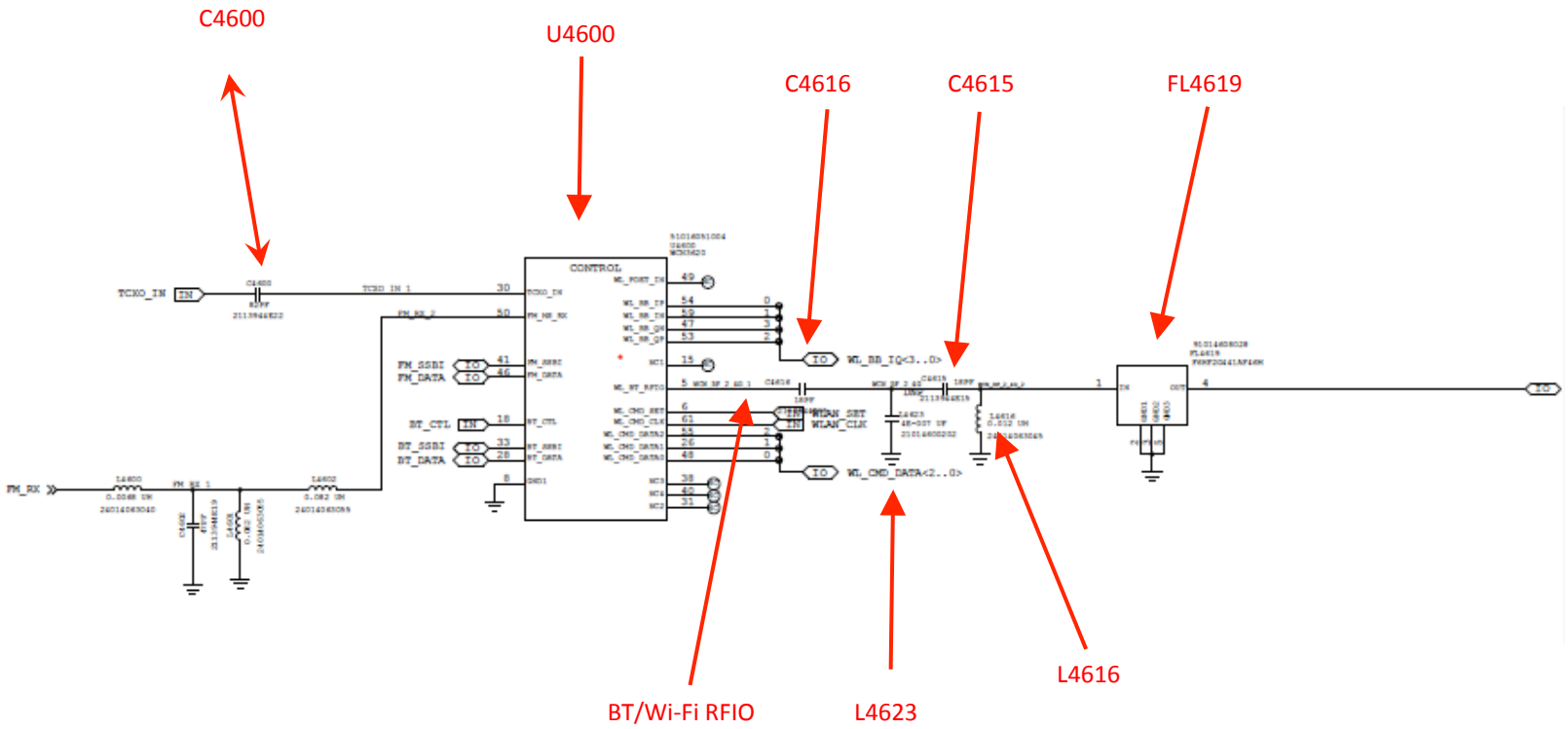
Location of the Bluetooth and WLAN circuit (Shown on the next few pages)

Check for any visible damage around the BT/WLAN antenna/IC area.

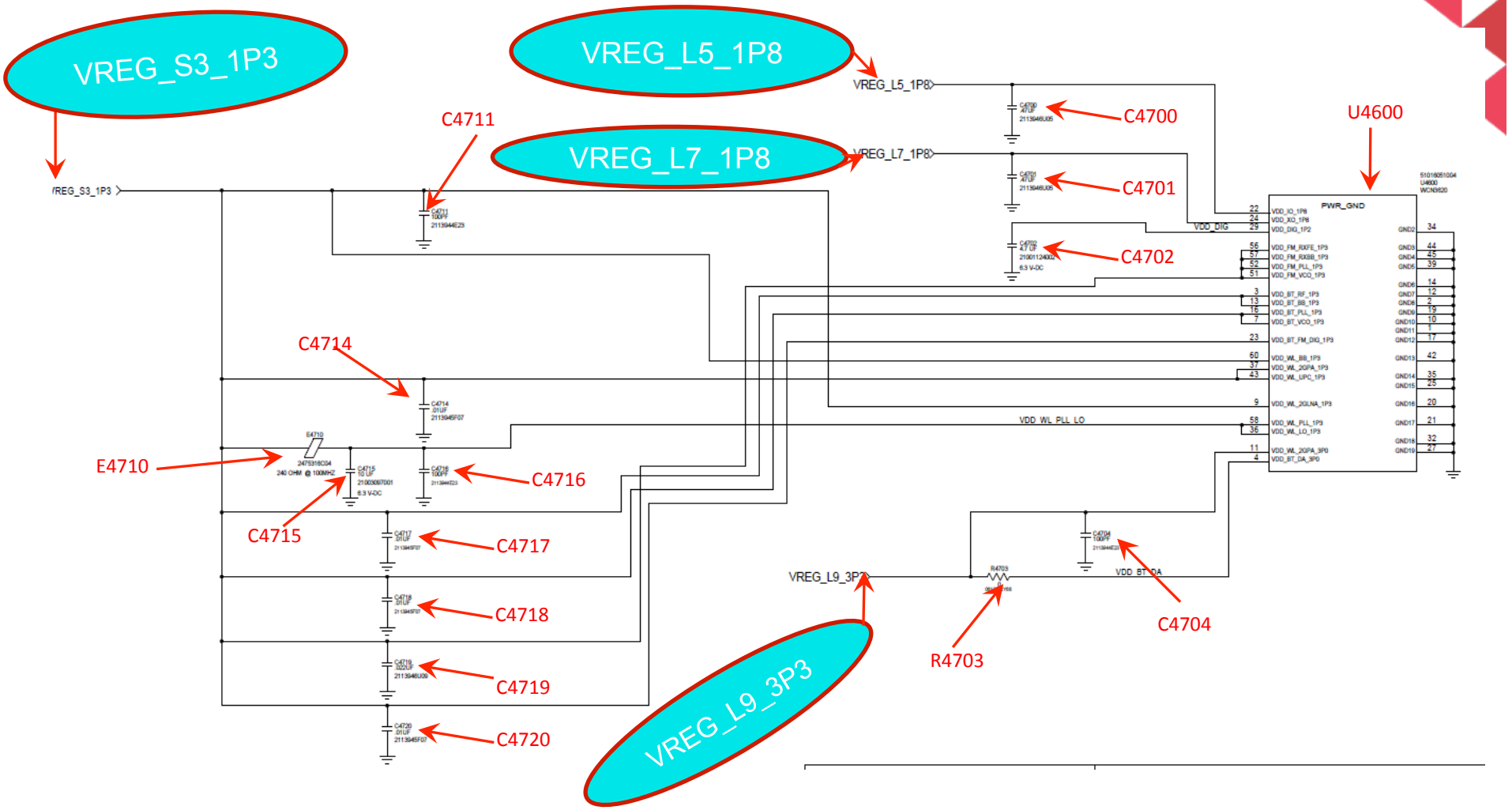
BT/Wi-Fi Antenna Schematic



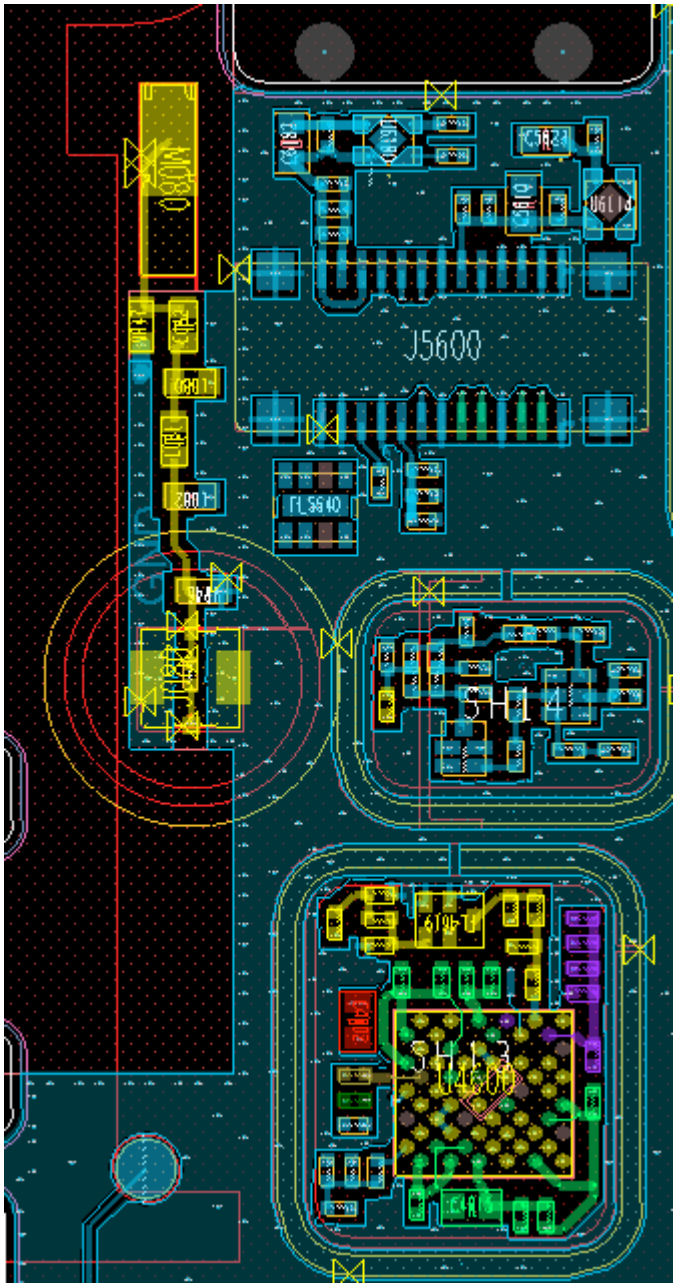
RF & 19.2MHz TCXO Input Schematic



Power Supply Schematic



Part Placement



Part placement - 2


RF Components


VREG_L9_3P3 Components


VREG_S3_1P3 Components

19.2MHz TCXO Components


C4702


VREG_L7_1P8 Component


VREG_L5_1P8 Component

Step 3 for BT/Wi-Fi Power-On Failure

If no visible damage can be seen, open up the shield and check for any visible damage on the IC and components. Look for misplaced or damaged components.

Debugging BT / WLAN Power-Up Failure

- Check clock supplies
  - 19.2MHz Clock: NET TCXO_IN check at component C4600
- Check DC Voltages
  - Typical DC voltages in WCN3620 (U4600) area
    - C4711, C4714, E4710, C4715, C4716, C4717, C4718, C4719 and C4720 should be 1.3V
    - R4703 and C4704 should be 3.3V
    - C4700 and C4701 should be 1.8V

Debugging BT / WLAN Power-up Failure

- Check connections WCN3620 and MSM8226:
  - WLAN: no probing point – use x-ray or other means to make sure following is soldered properly
    - Pins 54, 59, 47 and 53 of U4600 (these are connection points of IQ lines)
    - Pins 55, 26, and 48 of U4600 (these are connection points of DATA lines)
  - Bluetooth: no probing point – use x-ray or other means to make sure following is soldered properly
    - Pins 18, 33 and 28 of U4600 (these are connection points of control, SSBI and data lines)

Debugging BT/WLAN Low TX Power

- Probe and measure the output power at the antenna contact area or at R060 and see in a spectrum analyzer if you see if the phone is transmitting any power

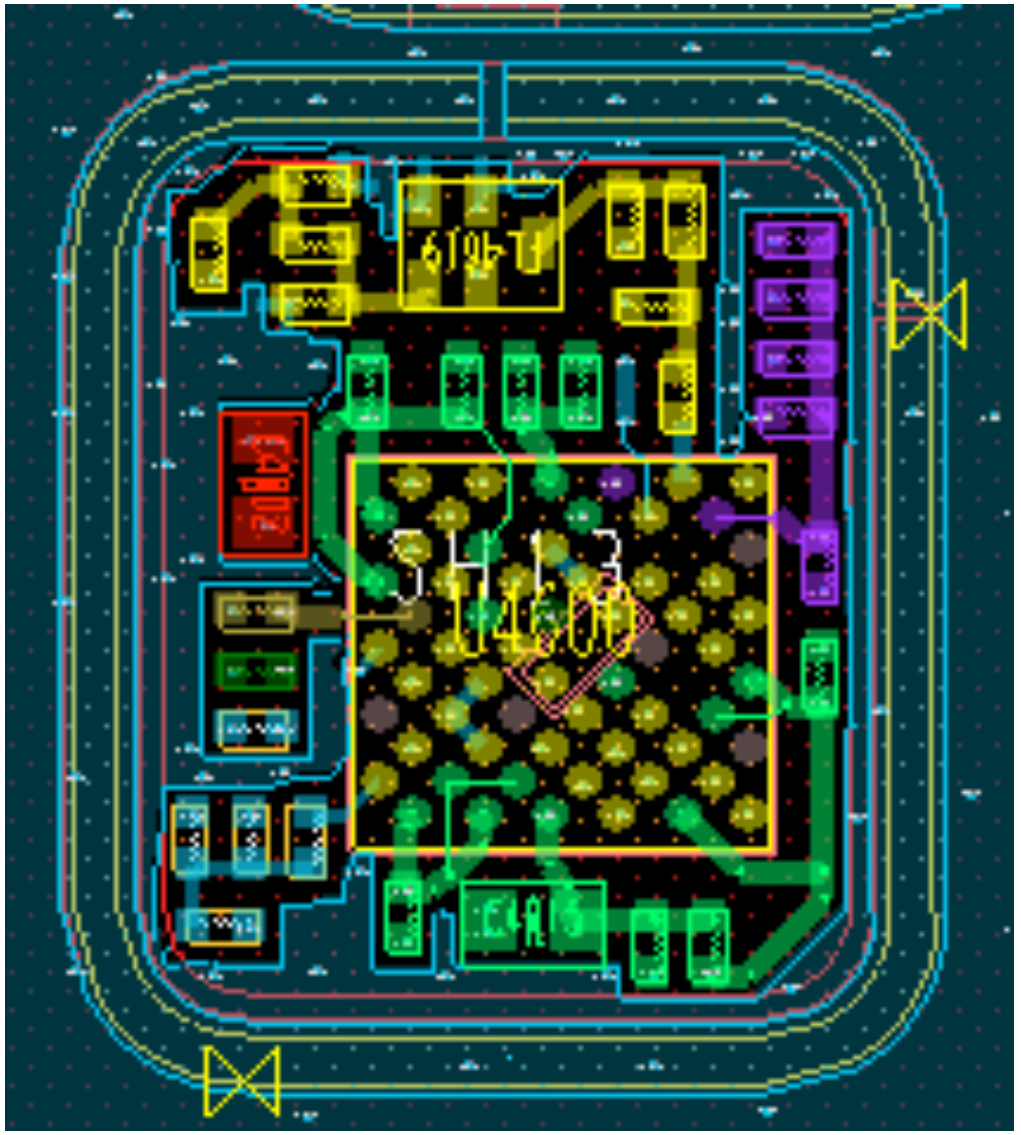
- Please measure the output power in test mode using the Labview test SW

Bluetooth/WiFi TX/RX RF Failure

- BT/Wi-Fi TX/RX RF failure
  - Symptoms:
    - Wi-Fi Radiated TX test value out of limits
    - Bluetooth radiated TX test value out of limits
    - Wi-Fi scan test fails
    - Bluetooth ping test fails

Step 1 for BT/Wi-Fi TX/RX RF failure

Look for visible damage of the BT/WiFi Antenna, Antenna Contacts and BT/WiFi circuits



Step 2 for BT/Wi-Fi TX/RX RF failure

- If there is no visible sign of antenna damage and antenna contacts damage, its most likely something wrong in the BT/Wi-Fi chips or circuits.
- Open up the shield and look for misplaced or damaged RF front-end components. Please refer to the previous slide describing the layout of the WLAN circuit.
- It is recommended to probe the amplitude of the TX signal along the RF path to look for the failure component.

FM TROUBLESHOOTING

Debugging FM RSSI Failure

If FM RSSI is out of limits

1. Check whether the headset connection between the phone and the FM signal generator are correctly done
2. Check and make sure that the headset jack is not damaged
3. Check there is no damage on audio flex, and audio flex is well inserted into connector J4900
4. Then check for any visible damage around the FM antenna/Antenna matching components
5. (For non-DTV variant) Open up the DTV shield and check whether R6010F placed correctly

   (For DTV variant) Open up DTV shied and check whether C6015, C6014, L6015, S6010, R6011 placed correctly, and check S6010 voltage 2.85V

Debugging FM RSSI failure

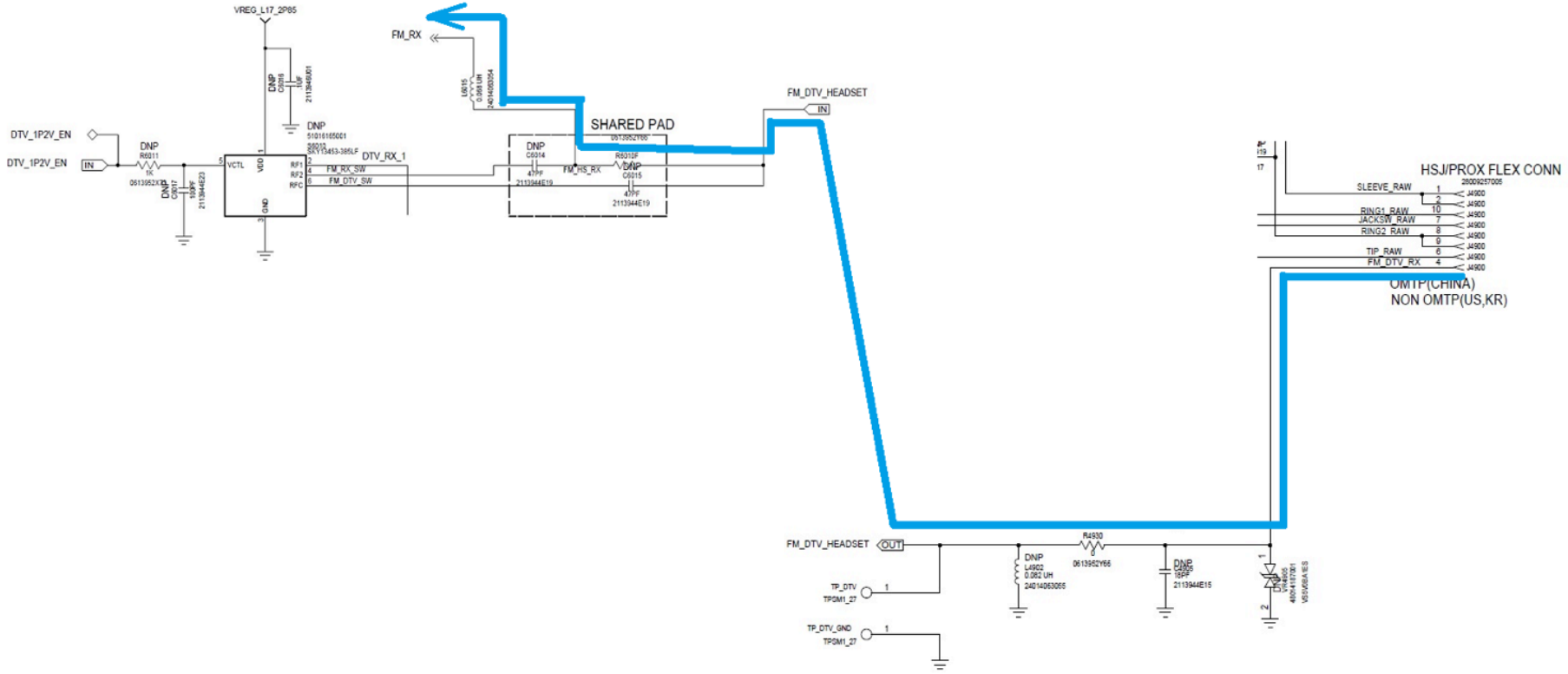
If FM RSSI is out of limits

6. Then open up the WIFI/BT shield and check whether the FM Rx matching components placed correctly/damaged
7. Then Check connections between WCN3620 and MSM8226:

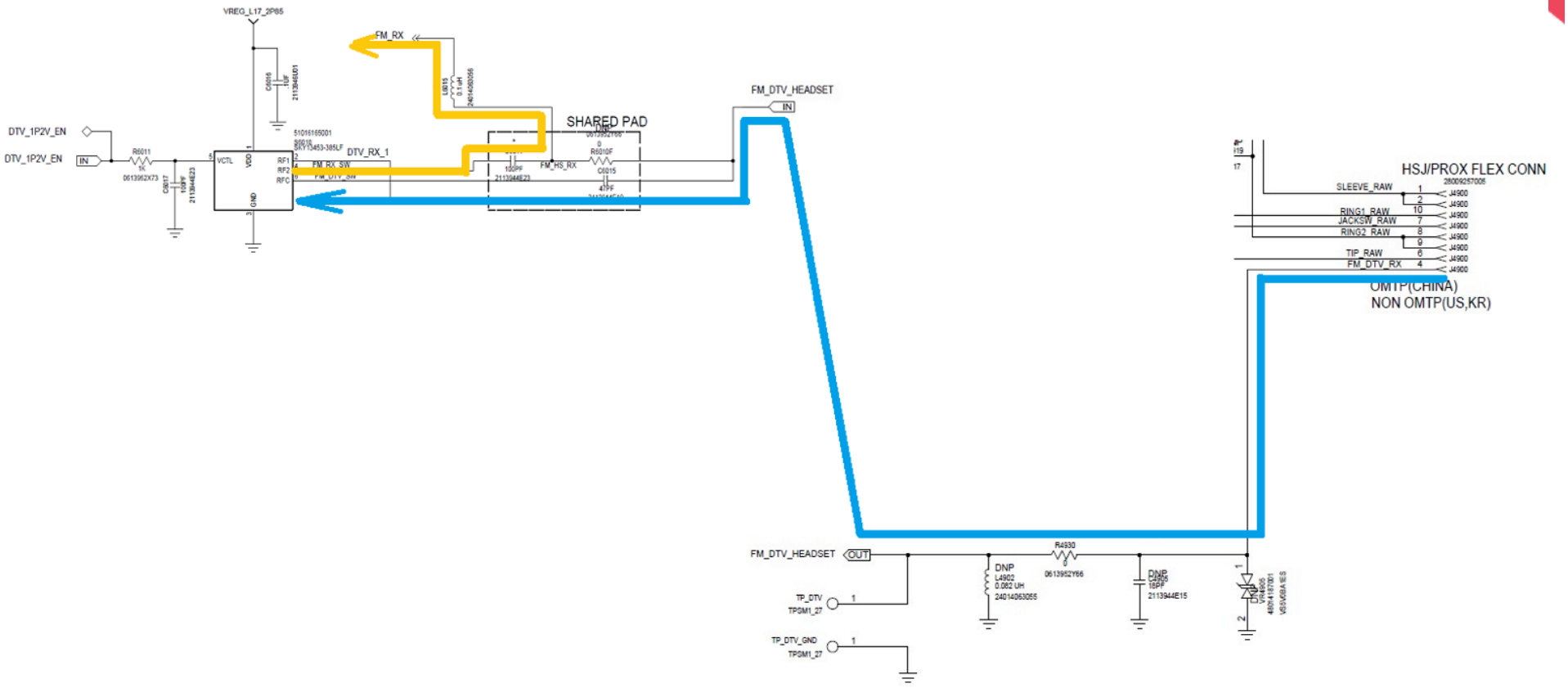
   FM: no probing point – use x-ray or other means to make sure following is soldered properly

   - Pins 50 of U4600 (FM Rx RF line)
   - Pins 41 and 46 of U4600 (these are connection points of SSBI and DATA lines)

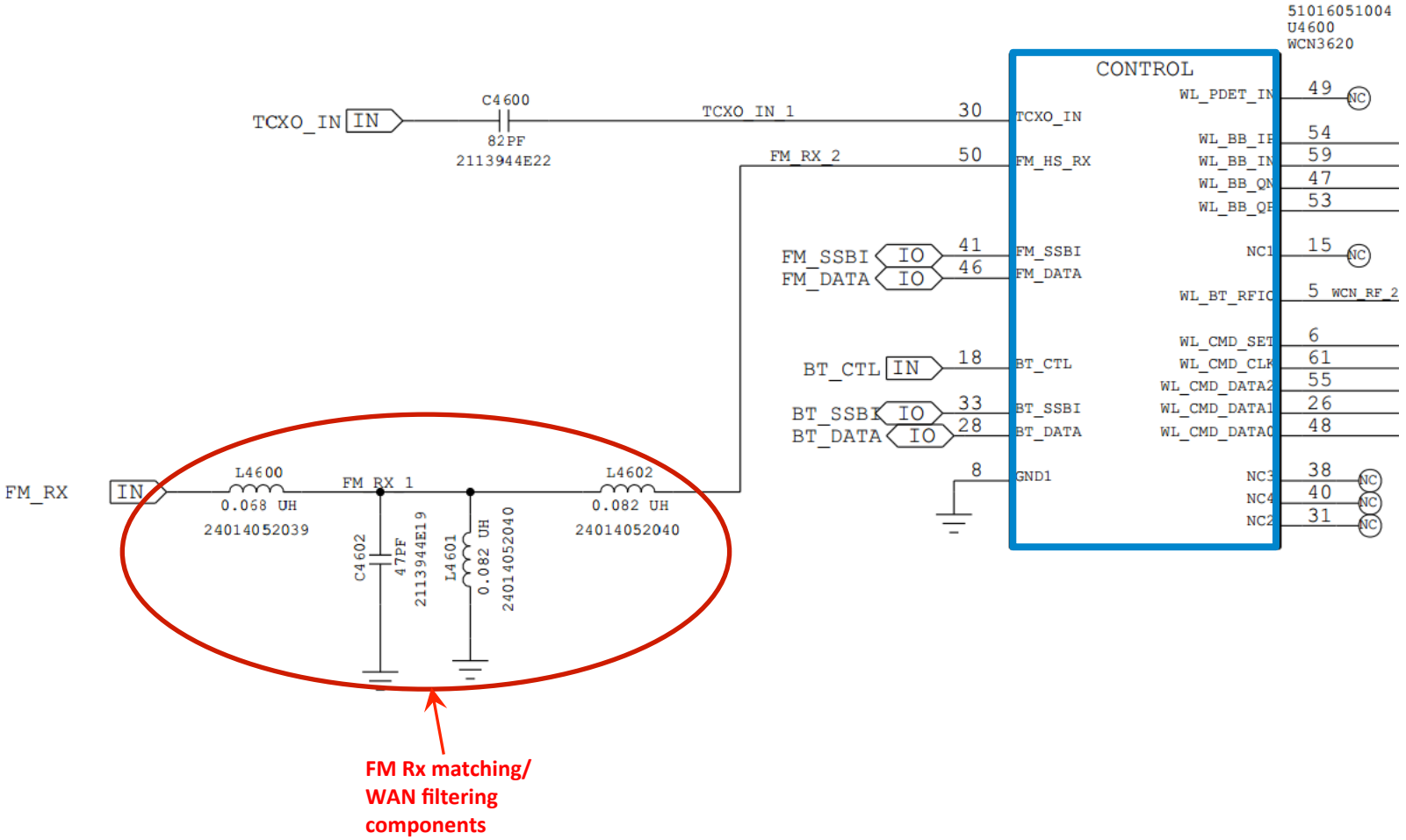
FM Frontend (Non-DTV Version)



FM Frontend (DTV Version)



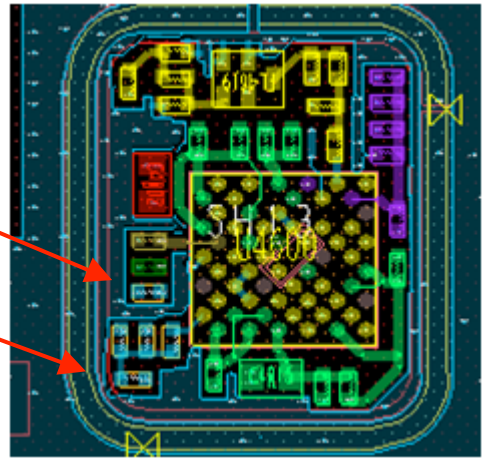
FM Rx Matching



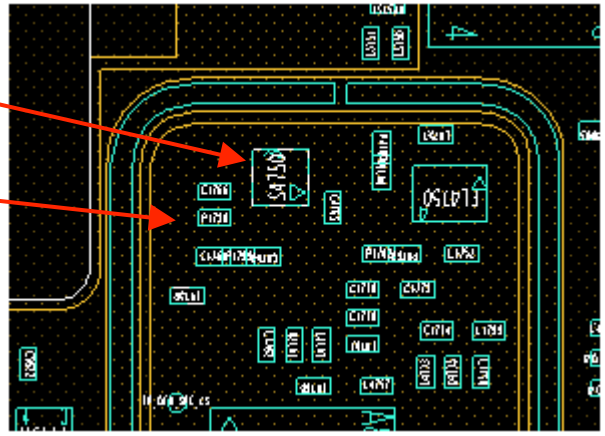
FM Rx matching/ WAN filtering components

FM Part Placement/Routing

Matching components

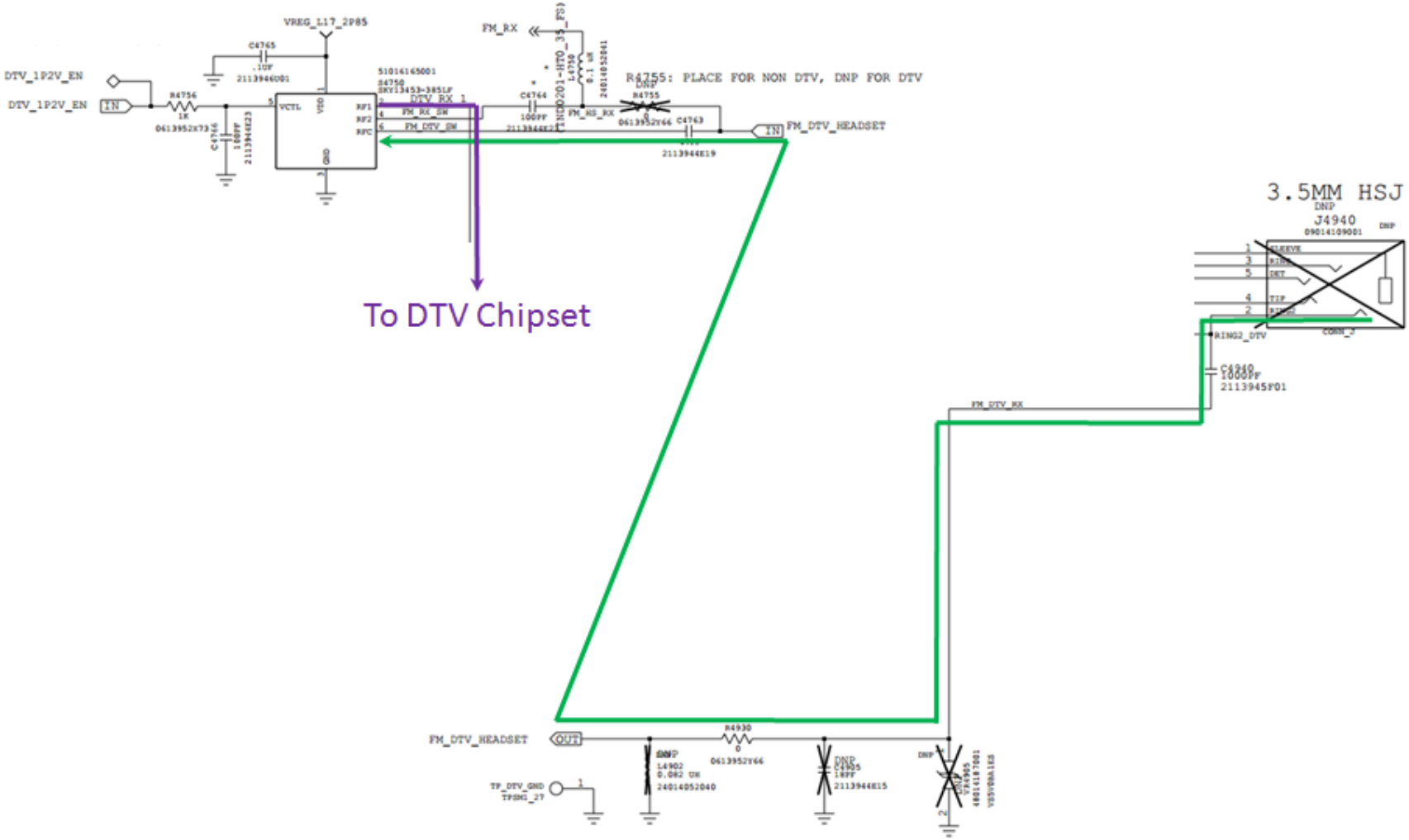


Frontend components

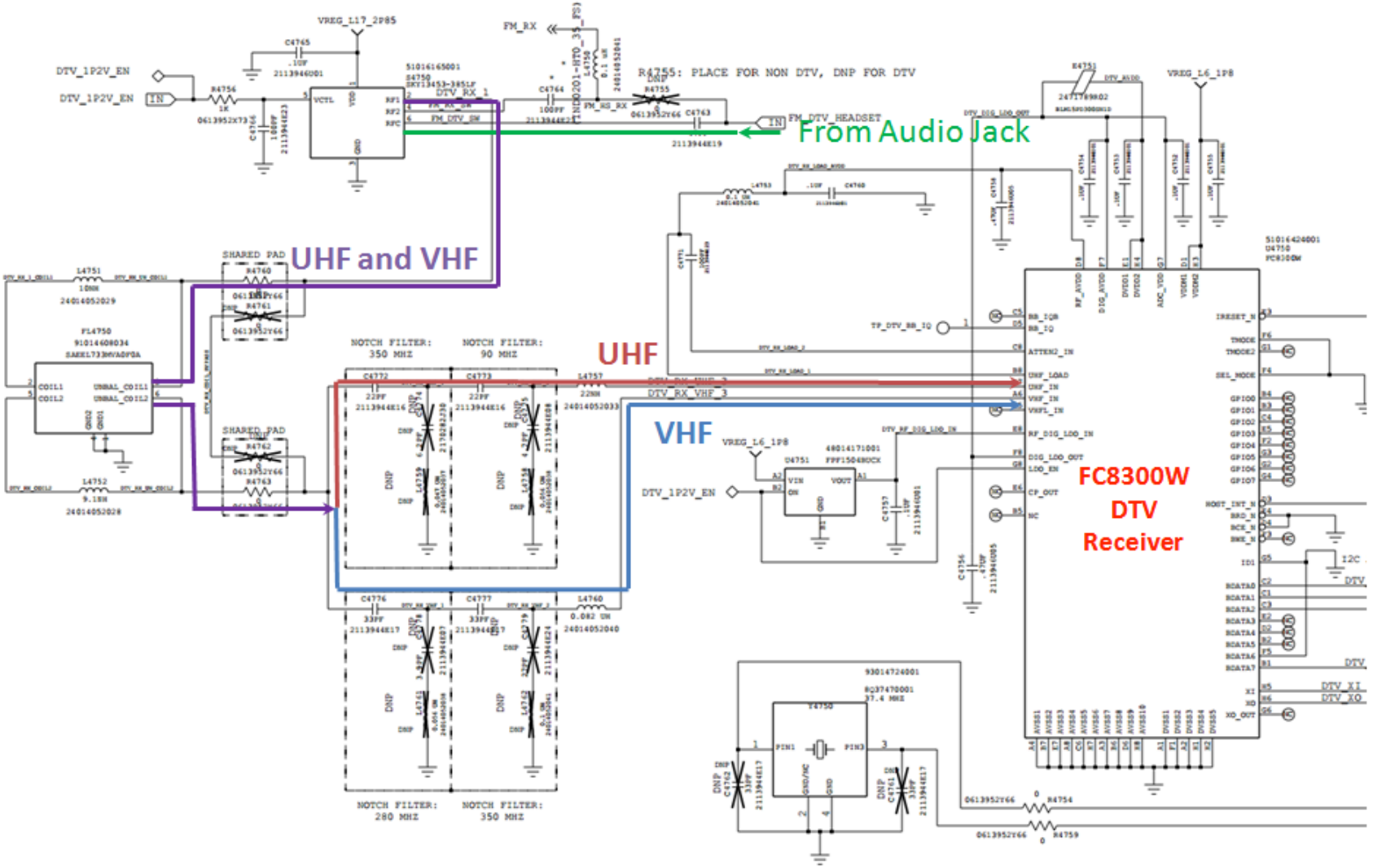


DTV TROUBLESHOOTING

DTV Schematic - 1



DTV Schematic - 2



Debugging DTV RSSI Failure

If DTV RSSI is out of limits

1. Check if the headset connection between the phone and the DTV signal generator are correctly done
2. Check and make sure if the headset jack is not damaged
3. Check if there is any visible damage around the SPDT S4750 and around components
4. Probe the amplitude of the TX signal along the RF path to look for the failure component
5. Check 37.4MHz XO output Y4750
6. Check the voltage
    - DTV_1P2V_EN: R4756 1.8v
    - Vreg_L17_2P85: C4765 should be 2.85v
    - Vreg_L6_1P8: C4755 should be 1.8v
    - DTV_RF_DIG_LDO_IN: C4757 should be 1.8v
    - DTV_DIG_LDO_OUT: C4756, E4751 should be 1.1v
7. Check X-ray if any solder issue under U4750 (DTV FC8300W)

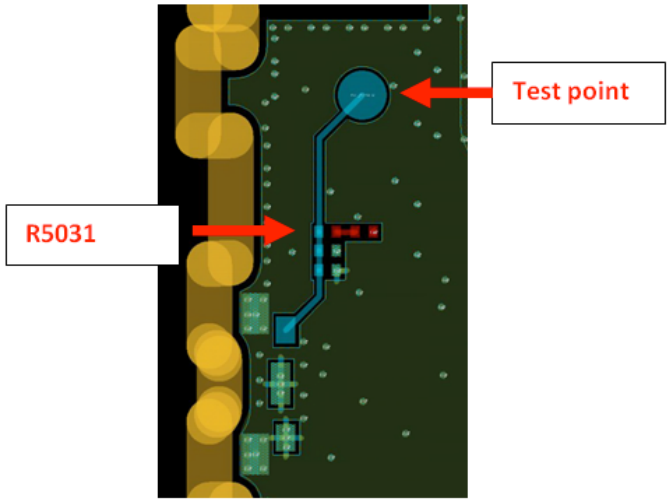
POWER UP FAILURE TROUBLESHOOTING

Power Up Failure Troubleshooting

Phone power could be triggered on with different reasons. Here we assume it is triggered by the power button press.

1. Before any action, the PMIC need to see a valid BATT+ (2.5V to 4.3V), and B+ should be the same as VBATT. If using a battery eliminator, you would see about 50~100uA (off current) being consumed. PMIC is alive, ready to work. BATT+ being 2.5V will power up PMIC but to start a full power up sequence for the phone, SW need to see BATT+ at 3.6V.

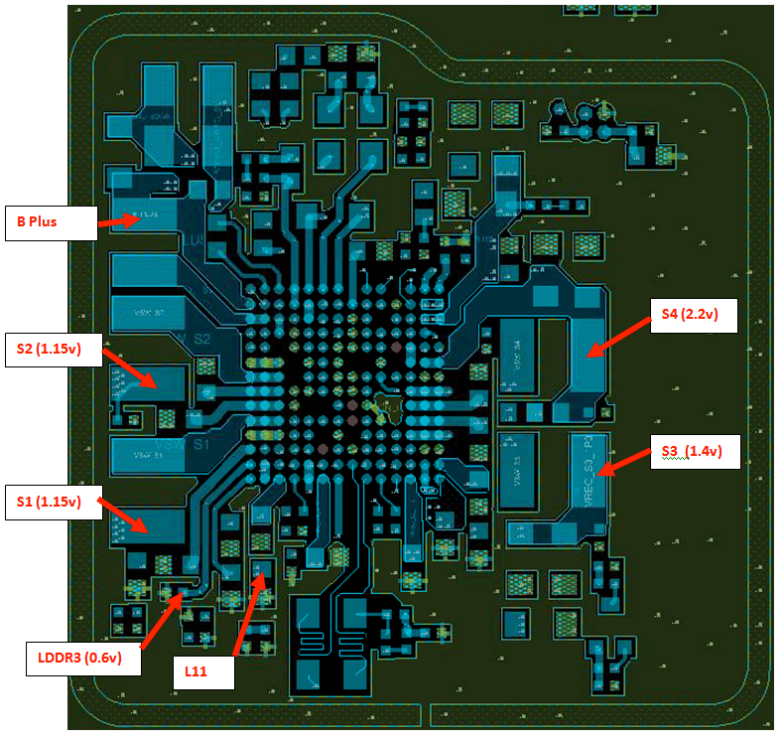
2. Power button is pressed. This is a mechanical button. If pressed, the PMIC should receive a low voltage at pin K10. You can verify it at a resistor **R5031 or a test point below**. If this signal does not get lower, likely the button is failing.



Power Up Failure Troubleshooting

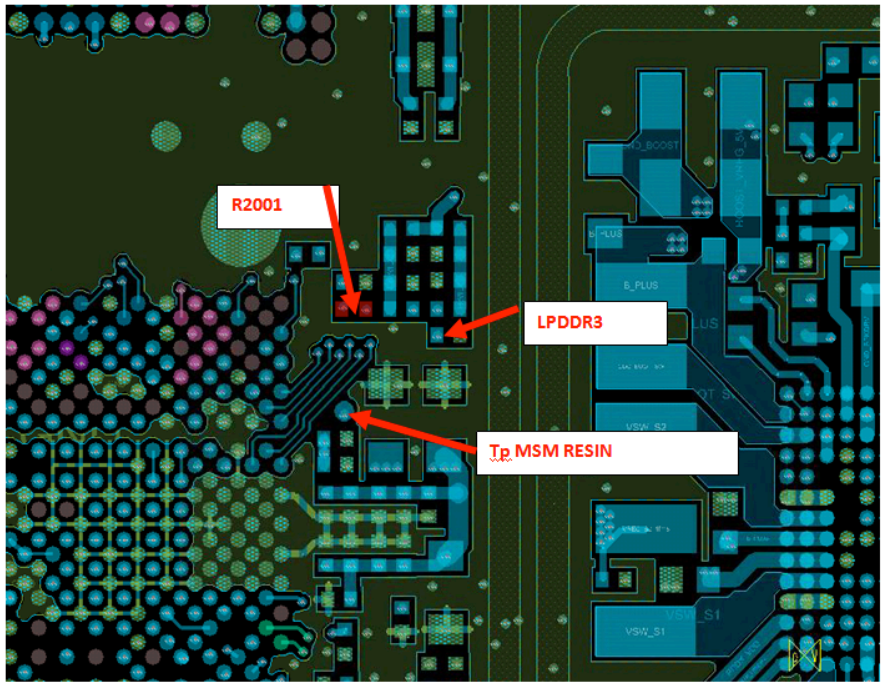
3. At this moment, the PMIC will check the battery voltage. It needs to be higher than 2.7V (default UVLO) to move forward. If the voltage is lower, or the PMIC is locked, (internal logic is messed up), you would see only a tiny current 2mA rises and falls, when you press the power button.

4. A power up sequence is started. From regulator Vreg_S4, to Vreg_L5, one by one, the regulator comes up. And then the PMIC clock comes up and feeds to MSM. Check the picture for reference.



Power Up Failure Troubleshooting

5. After the clock is ready, PMIC continues booting up sequence, until VREG_L11 is available.
6. PMIC will **pull up** the PON_RESET_N to inform MSM to start to work. A test point **TP_MSM_RESIN_N** can be used to verify the signal PON_RESET_N. MSM will run the primary boot load SW.
7. MSM responds back by **pulling up** PS_HOLD, telling PMIC to keep power up. **R2001** can be measured to verify this signal.



Power Up Failure Troubleshooting

8. The rest of the regulators are turned on based on SW. SW will check the environment to see if it need to continue to power up. For example, if the BATT+ is lower than 3.6V, SW will decide to turn off the power, because battery energy is not sufficient to do a meaningful power up.
9. At this moment, if there is an issue in the SW (may or may not be HW related), PS_HOLD could be pulled lower to shut off the power, if the PS hold timer is still working. If not, then phone is stuck and freezing. SW log is critical for the troubleshooting in this case.
10. Some other possible reasons for power failures include, peripheral communication failure, memory failure, SW loading failure, etc.

Note: Some easy things to check. If the board consumes more than 100uA off current, find out what is causing the higher off current. If the PMIC is draining high off current, likely PMIC is bad and its internal logic is messed up. Replace the PMIC. Here are some pins to measure, REF_BYP at C2001, AVDD_BYP at C2002, and the above signals in the power up steps.

Power Up Failure Troubleshooting

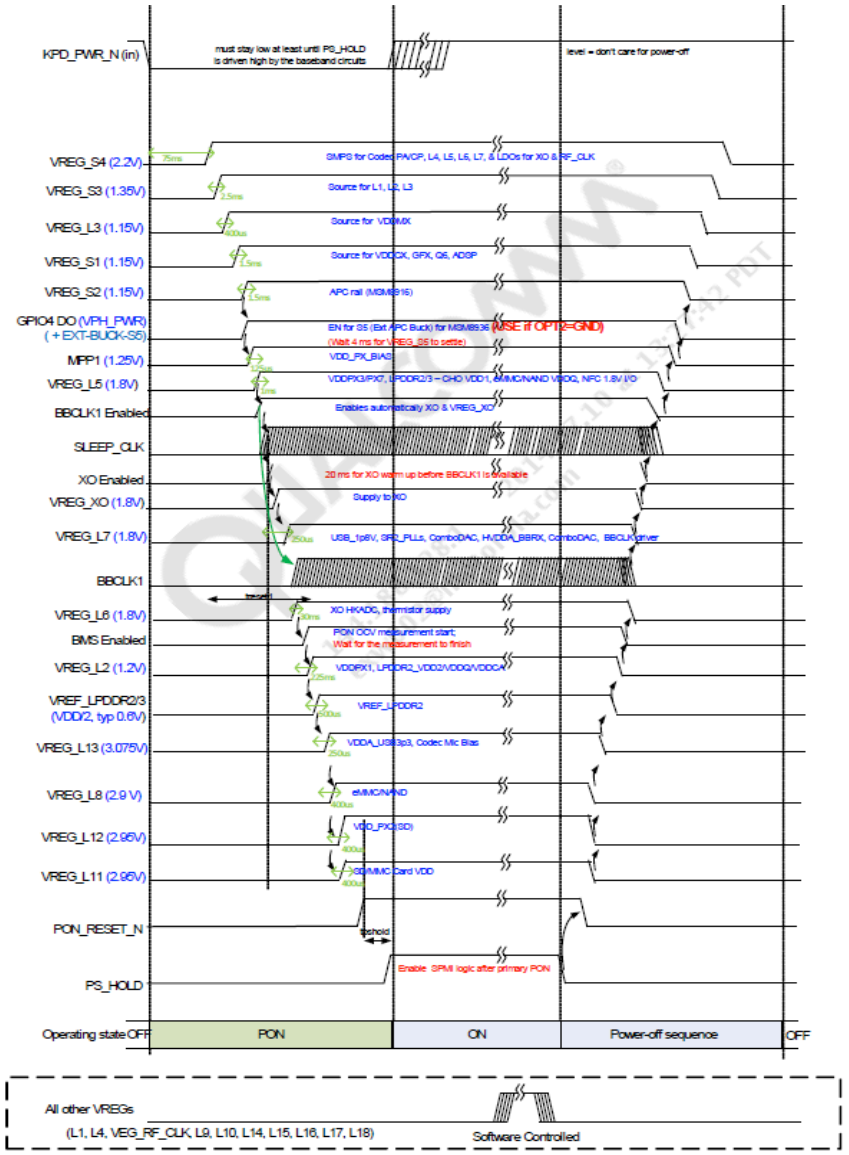


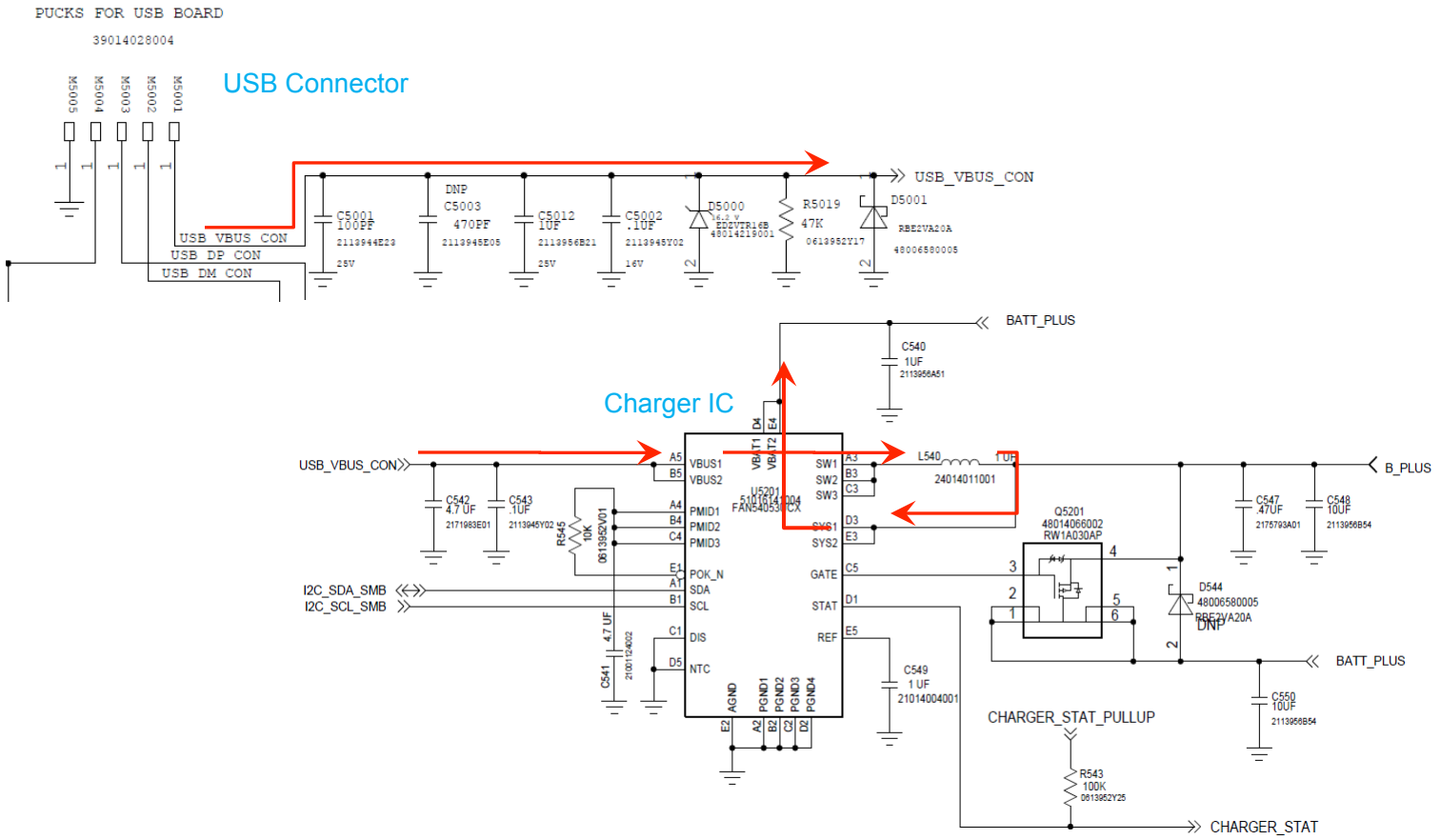
Figure 3-8 Poweron sequence

CHARGING TROUBLESHOOTING

Charging Troubleshooting

- (Charge Path 1/2):

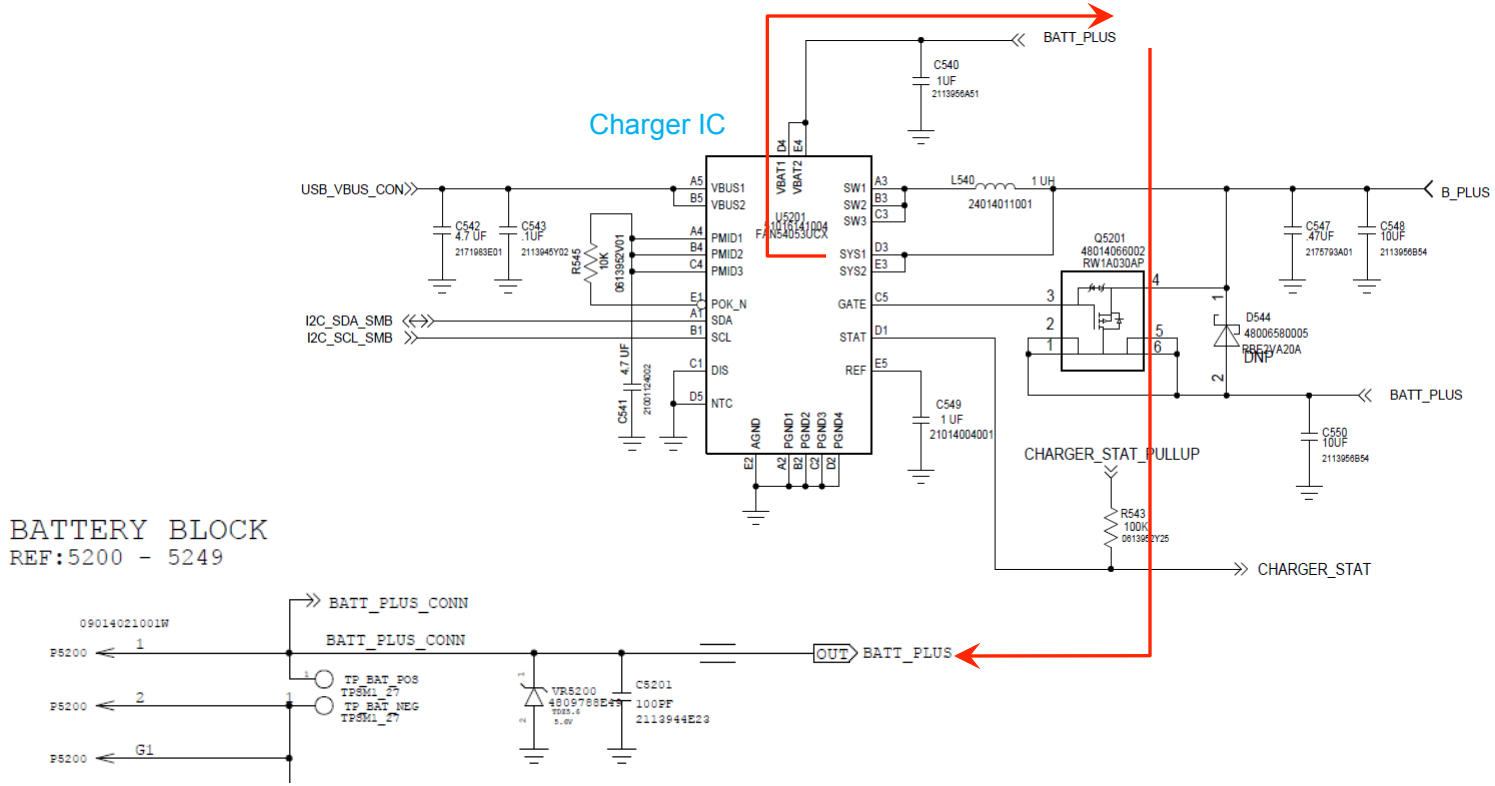
  USB Connector M5001-> Charger IC U5201 (pin A5, B5) -> L540 -> Charger IC U5201 (pin D3, E3)



Charging Troubleshooting

- Charge Path (2/2):

  -> Charger IC U5201 (pin D3, E3) -> Charger IC U5201 (pin D4, E4) -> R5201 -> Battery Connector P5200 (pin 1)



Charging Troubleshooting

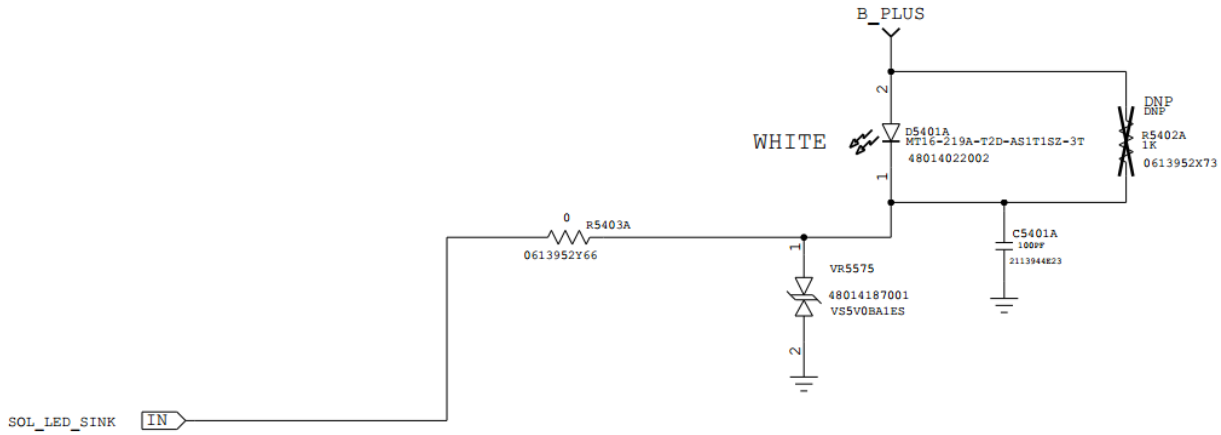
In the event of charging issues:

- Do visual inspection on USB connector and battery connector.
- Check charging voltages along the charging path
  - Measure USB_PWR charger input voltage at D5001. The voltage should be between 4.3V ~ 6V.
  - Check B_PLUS voltage at C548. It should be 4.35V or lower.
  - Check battery voltage at P5200 pin1. It should be 4.35V or lower. If battery is below 2.1V, there maybe a short in the circuit somewhere and the battery protection circuit is triggered.
  - Check battery ground path R5205.
- Battery temperature should be between 0°C ~ 45°C to be fully charged. Check thermistor voltage at test point (TP_BAT_THERM). It should be around half of battery voltage at room temperature (25°C).

LED / VIBRATOR / USIM / microSD TROUBLESHOOTING

SOL (Sign of Life) LED

- SOL LED is driven by U2000 PM8916 CHG_LED_SINK (pin M13) and B_PLUS
- Note: LED is being used only for SOL functionality. Notification LED functionality is not being used and will display the message on the LCD display.



White SOL LED

In the event of SOL LED issue:

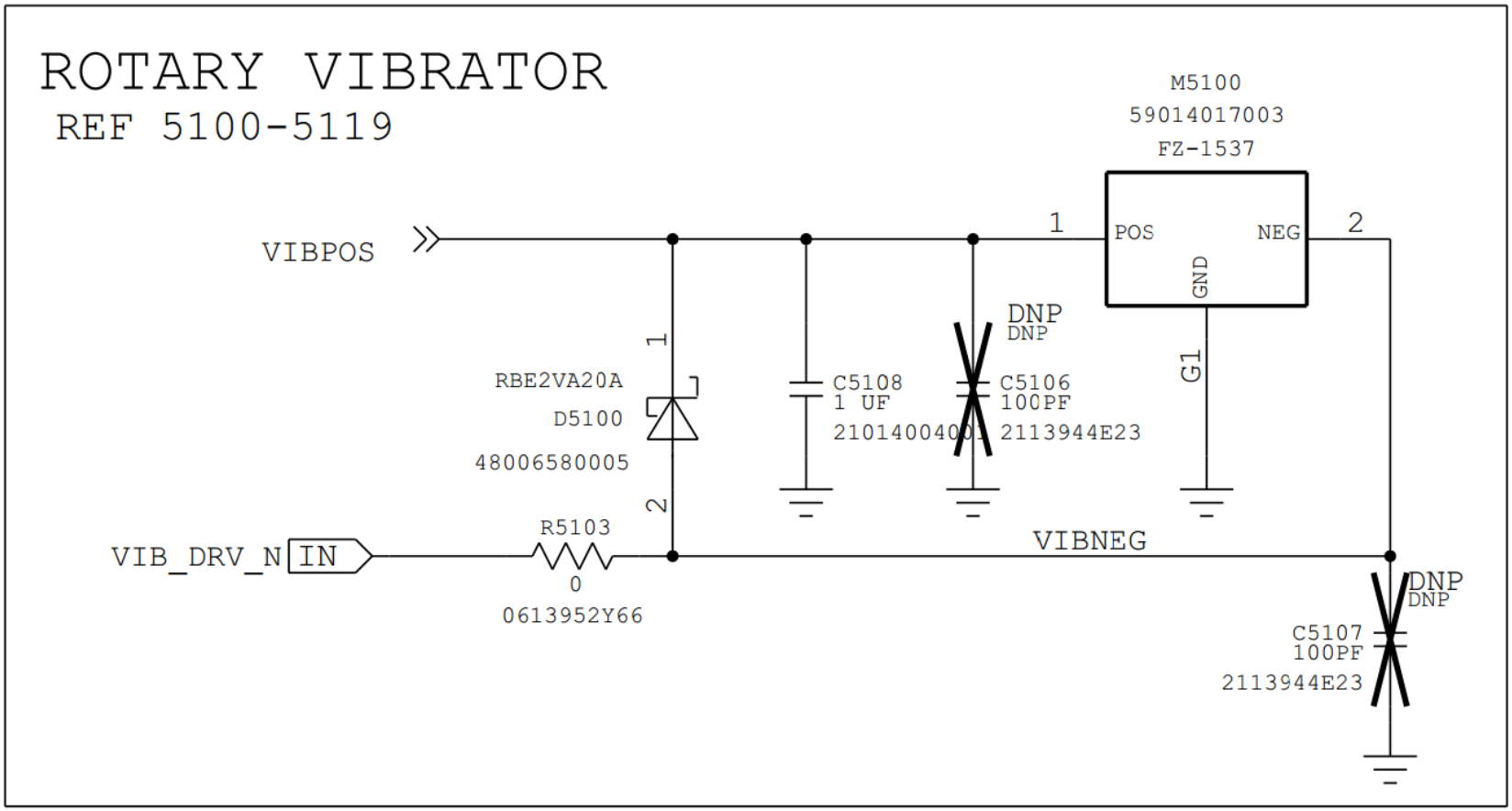
- Check voltage at LED Anode (pin 2) and Cathode (pin 1) of D5401A
- LED Anode voltage = B_PLUS (3.2V to 4.3V) and Cathode voltage = ~(B_PLUS – 3.1V LED forward voltage)

Rotary Vibrator

Rotary vibrator is used for both haptic and vibration alert function. In the event of vibrator failure:

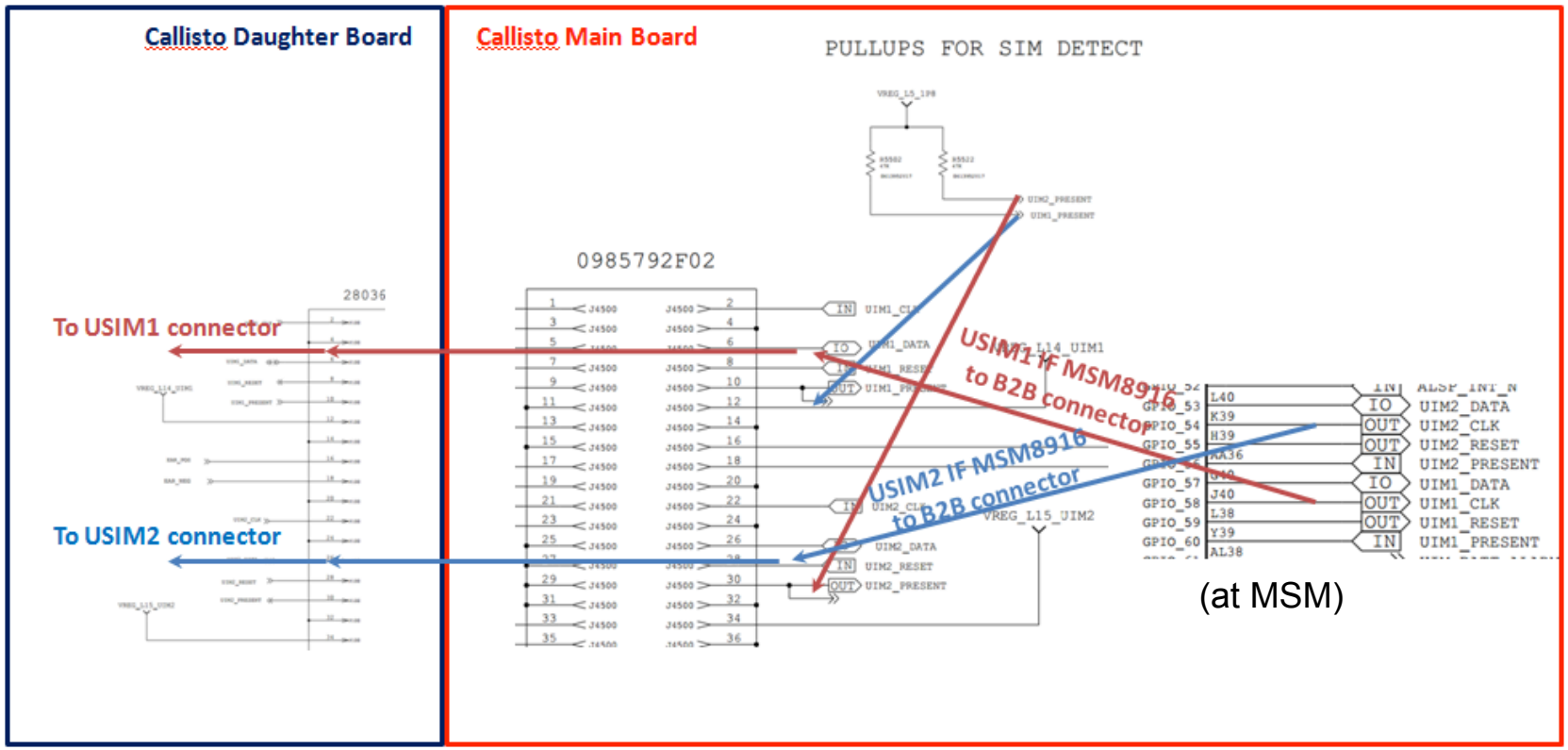
- Inspect physical placement of rotary vibrator related components on main PCB board (see schematic page on next slide)
- Check voltage on pin 2 and 1 of vibrator M5100: Pin 2 Voltage = B_PLUS. Pin 1 voltage will be driven by U2000 PM8916 pin M14.
- When vibrator is active (being driven), the voltage delta between pin 1 and pin 2 of the vibrator should be around 2.4V. When vibrator is not being driven, voltage at pin 1 and pin 2 are about the same.

Rotary Vibrator

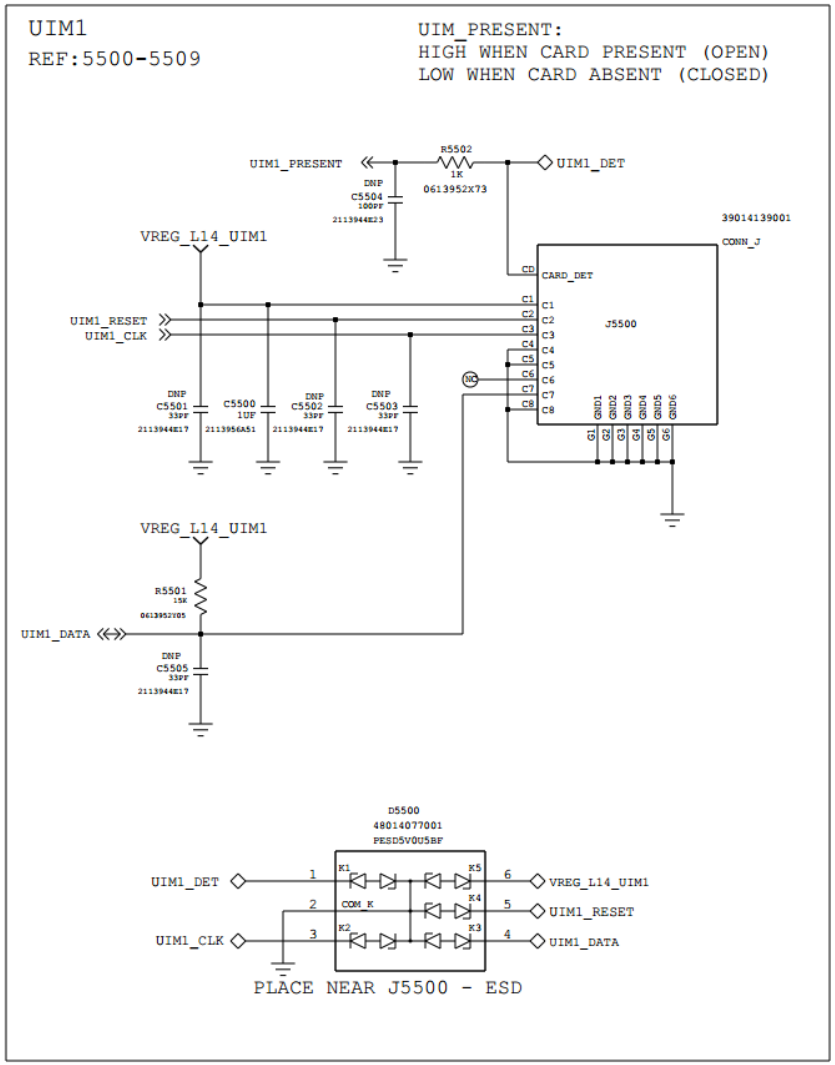


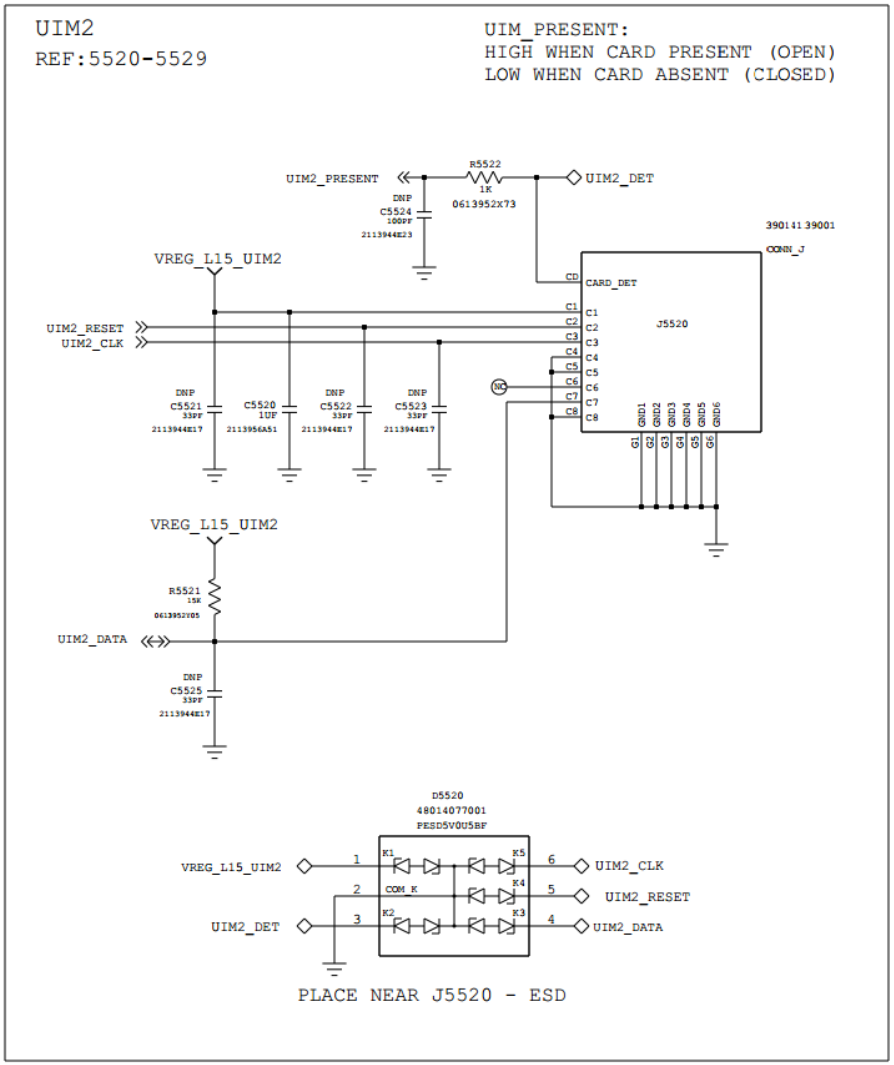
SIM

- Depending on the PCB board variant (Single SIM vs. Dual SIM), there are up to 2 SIM connectors on Moto G (3rd Generation) placed on a Daughterboard connected to the main PCB board via 40 pin B2B connector.
- Each SIM connector is operated independently with its own power, detection and SIM bus interface.



Daughter Board SIM Connector





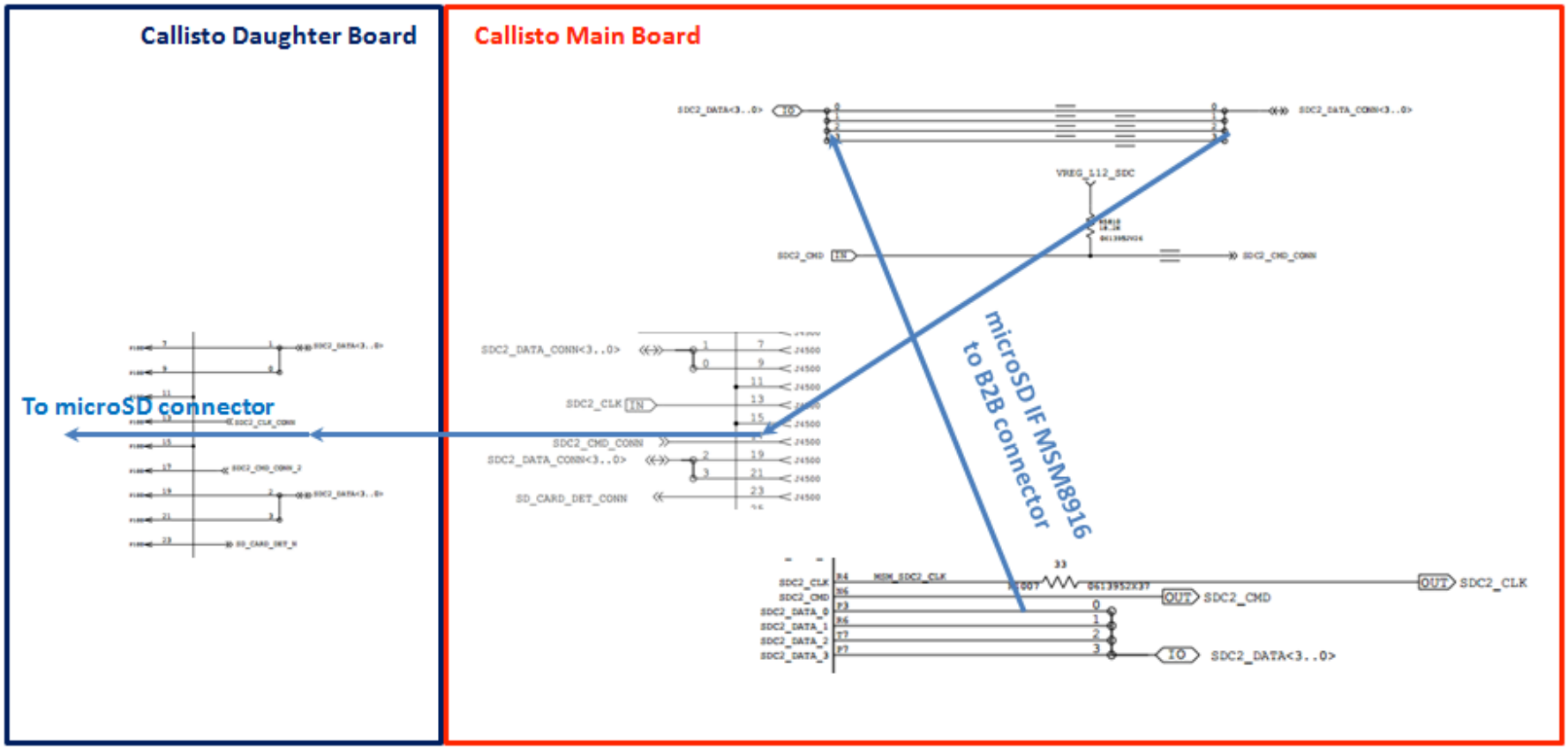
SIM

In the event of SIM issue:

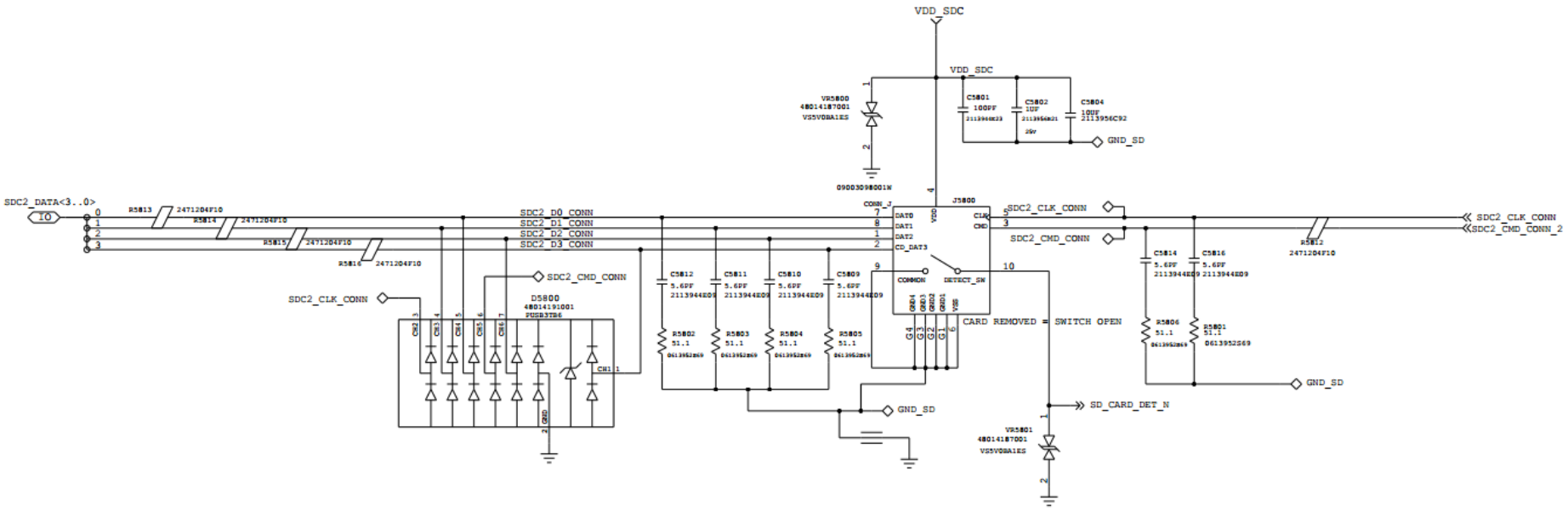
- Do a thorough visual check on SIM connector J5500/J5520 for any sign of mechanical contact issues, FM, solder breaks.
- Inspect all SIM circuit components on PCB (daughter and main board).
- Check SIM power at J5500/J5520 pin C1.
- Check the UIM*X*_PRESENT line for card detection. Ensure the line toggles after each insertion or removal of the SIM card. (HIGH when SIM card is inserted)
- Check SIM bus interface signal activities during SIM access (UIMx_RST, UIMx_CLK, UIMx_DATA). During normal operation after power up, the clock runs at 3.85 MHz, reset is high, and the SIM bus operates at 1.8V or 3V.

microSD

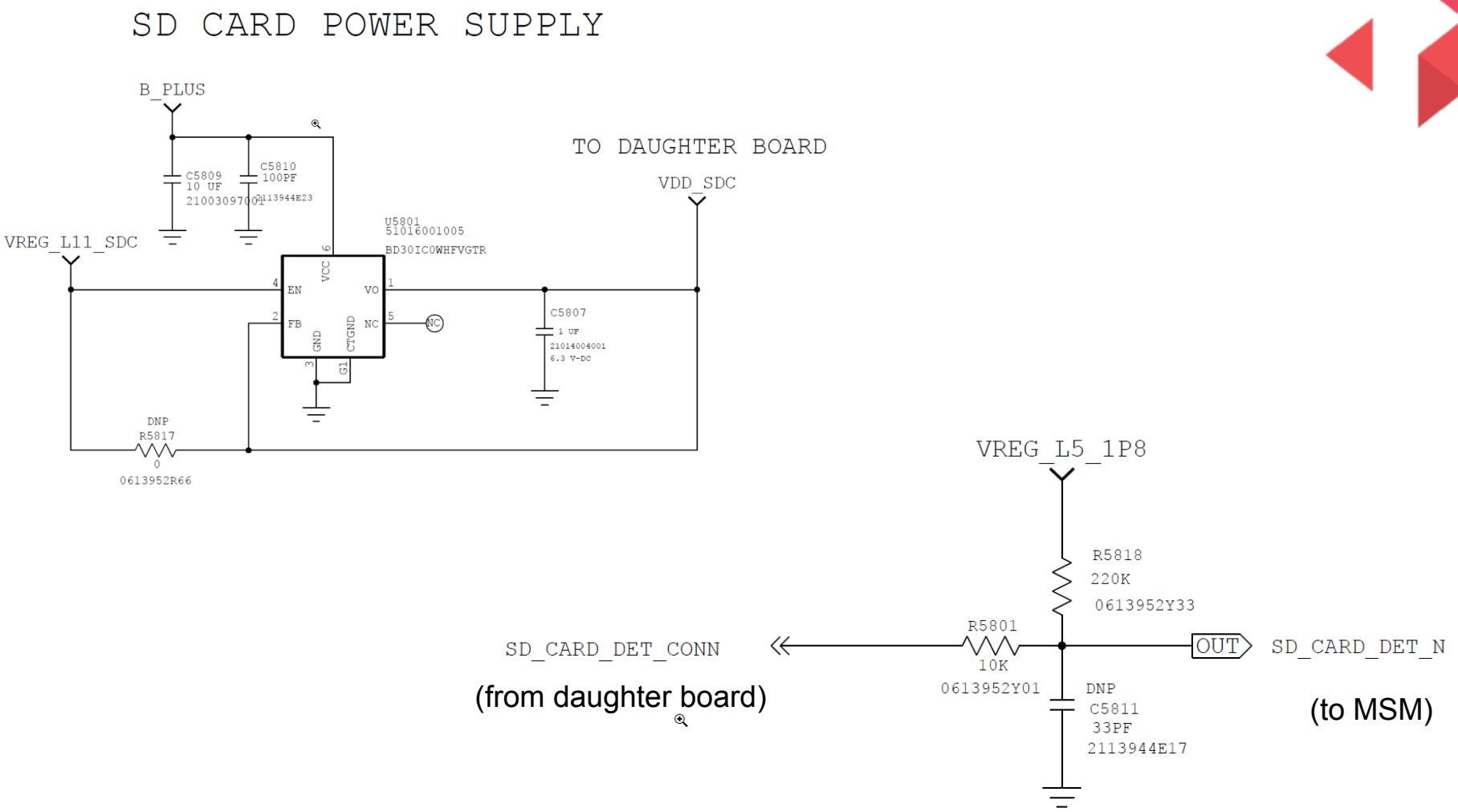
- Moto G (3rd Generation) supports one microSD connector placed on a Daughter board connected to the main PCB board via a 40-pin B2B connector.



Daughter Board microSD Connector



Main board - Power supply and Card Detect



microSD

In the event of microSD issue:

- Do a thorough visual check on the daughter board's microSD connector J5800 for any sign of mechanical contact issues, FM, solder issues.
- Inspect all microSD circuit components on PCB (main and daughter boards).
- Check microSD power (2.85V) at J5800 pin 4 or C5804.
- Check microSD card detection signal at J5800 pin 10 or VR5801 (active LOW when microSD card is inserted).
- Check for activity on microSD bus interface signals during microSD access (SDC2_CLK, SDC2_CMD, SDC2_D[3:0]).

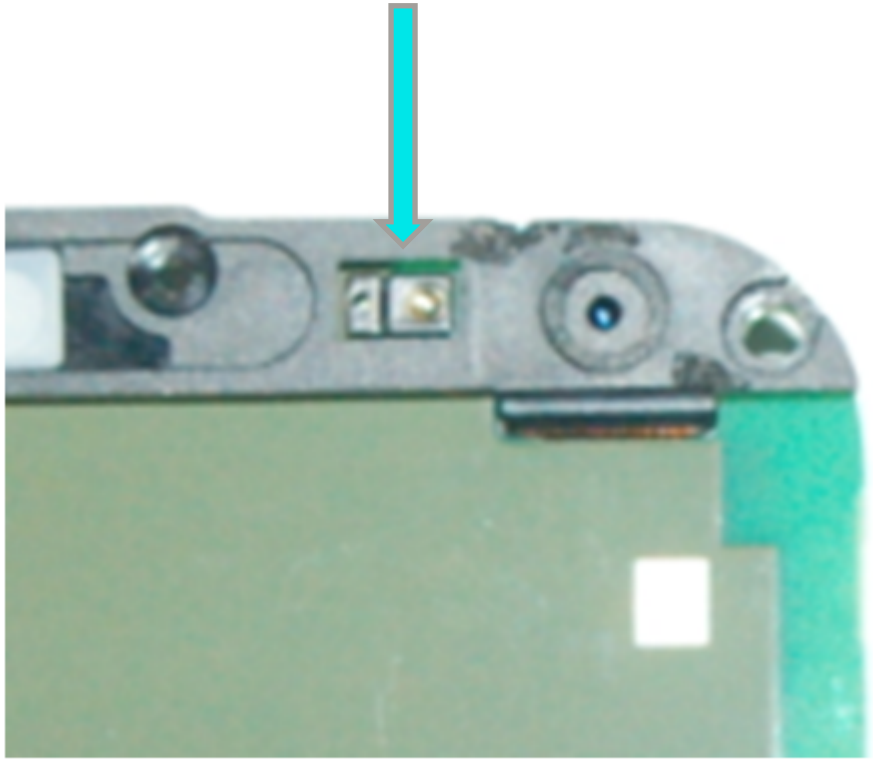
SENSORS TROUBLESHOOTING

IR Proximity Sensor – Ambient Light Sensor

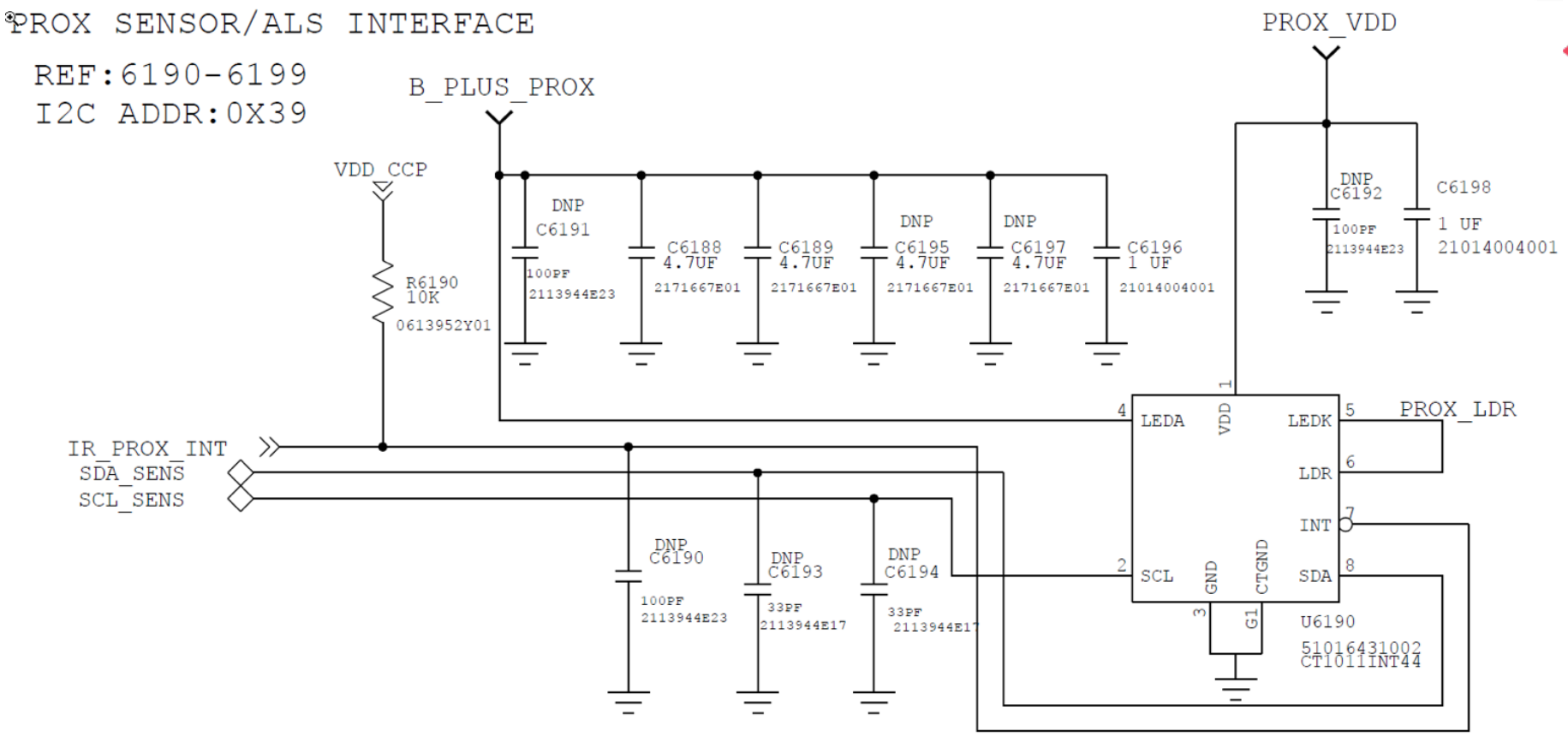
IR Proximity & Ambient Light Senor circuit is located on a flex (audio/IR flex combination). This flex is connected to the main PCB board via a zip connector. In the event of IR proximity or ambient light sensor issue at phone level:

- Inspect the zip connector on main PCB board
- Check physical connection of zip connector and flex
- Rework zip connect or replacing the flex as needed

Proximity/ALS Sensor



Proximity/ALS Sensor



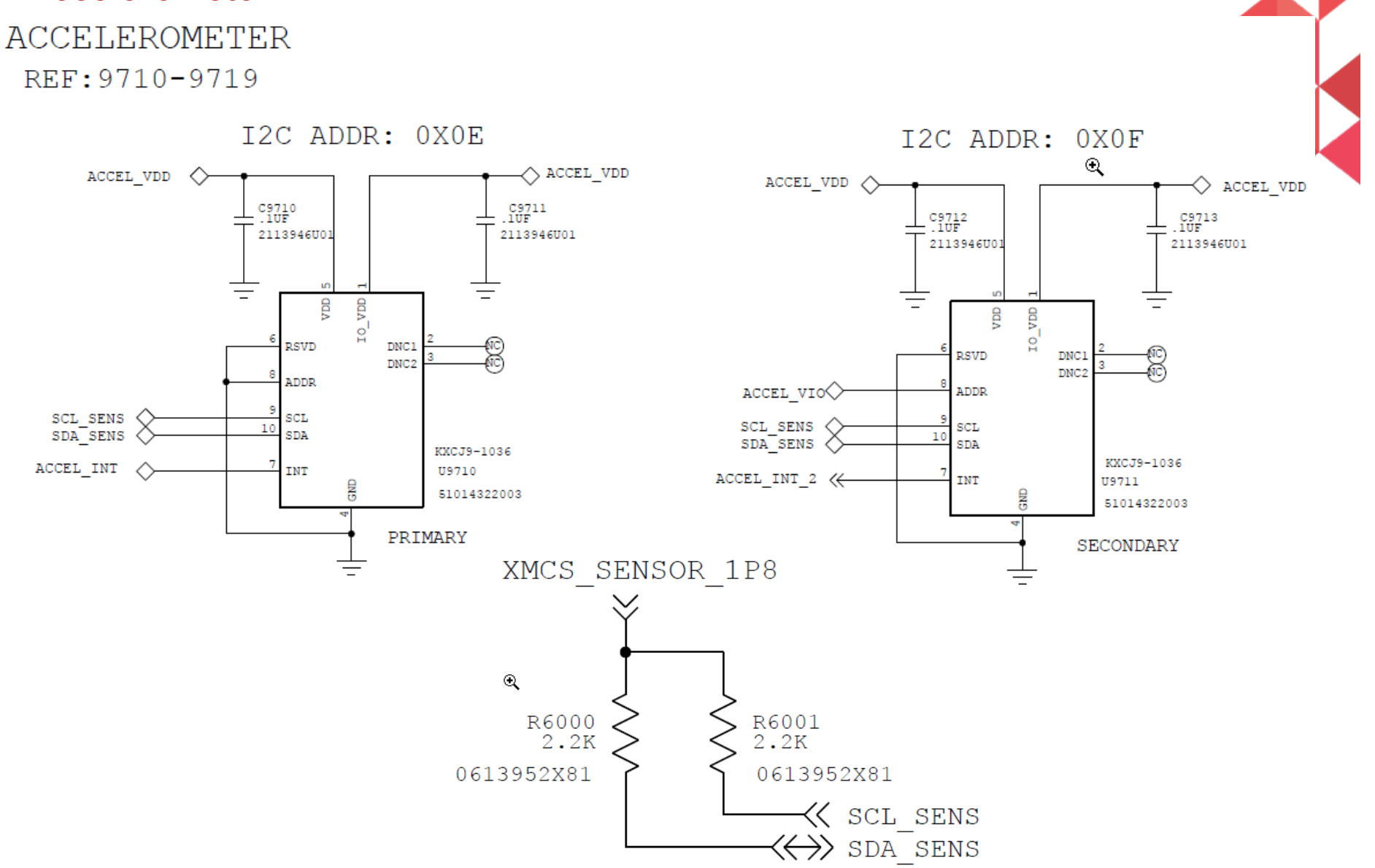
Accelerometer

There are 2 accelerometers IC's on the main PCB boards: primary U9710 and secondary U9711.

In the event of accelerometer failure:

- Inspect physical placement and orientation of U9710 and U9711 and their related components on main PCB board (see accelerometer schematic page on next slide)
- Check power: ACCEL_VDD (1.8V) at pins 1 and 5 of each accelerometer
- Check for activity on the shared I2C interface (SCL_SENS and SDA_SENS) for activity
- Connect the board to a display and power the board/display with a battery or factory cable. Launch the CQA app and test each accelerometer one at a time (CQA Menu Mode -> Sensor -> "Accelerometer" or "Accelerometer Secondary"). Look for accelerometer G-force activity on all axis X,Y,Z.
    - As you move the board's orientation, the X,Y,Z accelerometer readings will change (representing a vector of approximately 1G = 9.8 m/s^2). An ideal accelerometer IC will display a G-force reading of ~ 9.8 next to "Total Acceleration". If no data is shown, then the IC may be faulty.
- Check the interrupt line, which is buried: ACCEL_INT / ACCEL_INT_2
- Make sure the sensor hub (U6000) is working correctly: see the "Sensor Hub" section

Accelerometer



Magnetometer

There is one magnetometer IC (U6160) on the main PCB board.

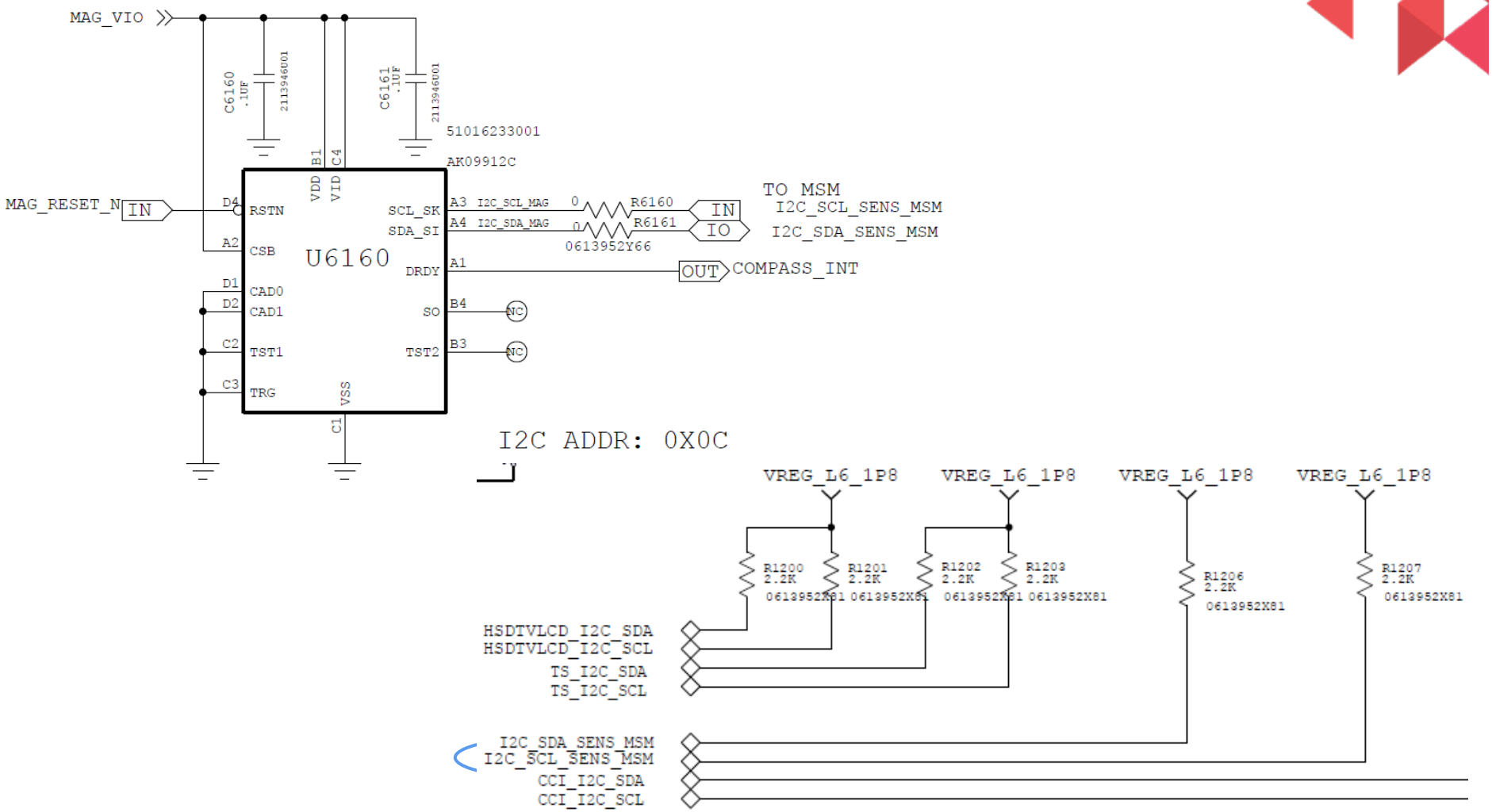
In the event of a magnetometer failure:

- Inspect physical placement and orientation of U6160 and its related components on main PCB board (see magnetometer schematic page on next slide)
- Ensure the magnetometer's glass package is not cracked (improper factory handling could cause cracks since there's no shield over the magnetometer)
- Check power: MAG_VIO (1.8V) at U6160 pins B1 and C4
- Check for activity on the I2C interface (I2C_SCL_SENS_MSM and I2C_SDA_SENS_MSM)
- Connect the board to a display and power the board/display with a battery or factory cable. Launch the CQA app and test each accelerometer one at a time (CQA Menu Mode -> Sensor -> Magnetometer). Look for magnetometer activity on all axis X,Y,Z.
    - As you move the board's orientation, the X,Y,Z accelerometer readings will change. Each x,y,z axis for an ideal magnetometer IC will display its greatest positive value when that axis is aligned with magnetic north. If no data is shown or the data isn't changing values, then the IC may be faulty.
- Check the reset and interrupt lines, which are buried: MAG_RESET_N and COMPASS_INT

Magnetometer

MAGNETOMETER

REF:6160-6169



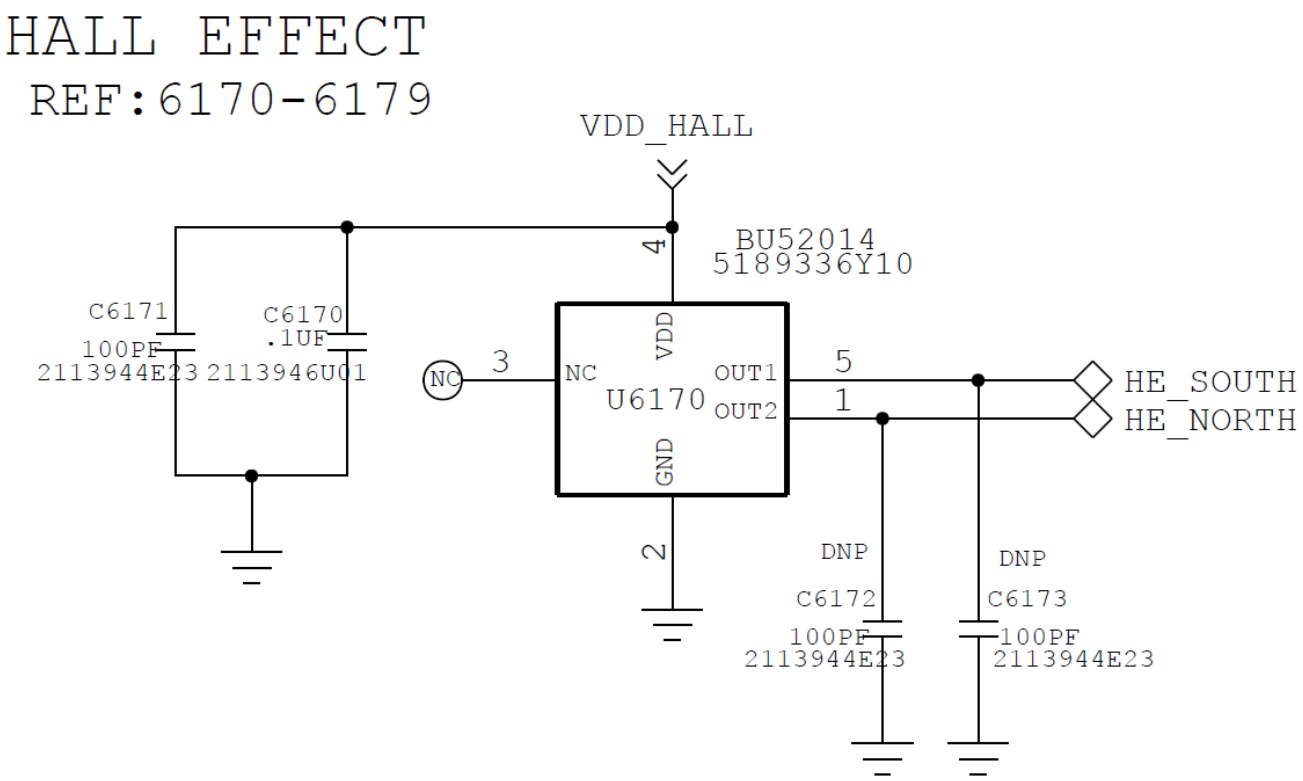
Hall Effect Sensor

There is one hall effect sensor IC (U6170) on the main PCB board.

In the event of a hall effect sensor failure:

- Inspect physical placement and orientation of U6170 and its related components on main PCB board (see hall effect sensor schematic page on next slide)
- Check power: VDD_HALL (1.8V) at U6170 pin 4
- Check that the sensor reports the presence of nearby magnetic fields. Do this by floating the north side of a magnet directly over the sensor **but on the opposite side of the main board**. The sensor is on the bottom/**battery** side of the PCB, while the magnet must be held over the sensor on the opposite/**display** side of the main PCB. When this is done, the display will turn off. The display will turn back on once the magnet is moved far enough away.
- Make sure the sensor hub (U6000) is working correctly: see the “Sensor Hub” section

Hall Effect Sensor



Sensor Hub

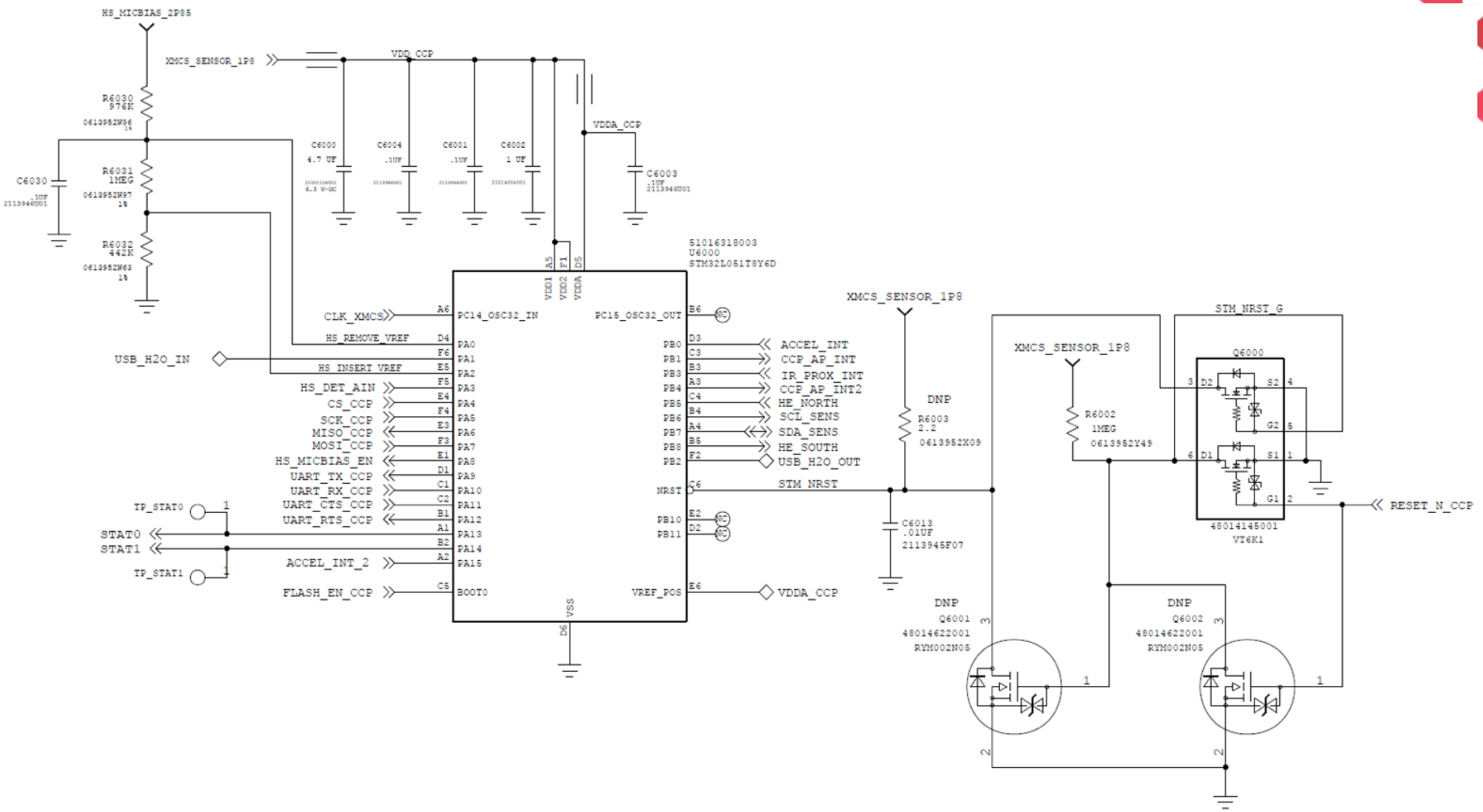
The sensor hub (U6000) on the main PCB board receives data from the dual accelerometers and the hall effect sensor and then routes that data to the MSM. If the sensor hub is not working correctly, then the MSM will NOT receive data updates for the accelerometers and the hall effect sensor.

Therefore, if both the accelerometers and the hall effect sensor are failing **all at the same time**, then this would be a good indication that it's due to a bad sensor hub (please see the accelerometer and hall effect sections for instructions on how to use the CQA test app to check for accel functionality and how to use a magnet's north pole to verify the hall effect sensor).

In the event of a sensor hub failure:

- Inspect physical placement and orientation of U6000 and its related components on main PCB board (see hall effect sensor schematic page on next slide)
- Check power inputs at: U6000 pins A5, F1, and D5
- Check the active-LOW reset line (STM_NRST): should be high for normal operation
- Check the 32 KHz clock (CLK_XMCS) at U6000 pin A6 (buried line)
- Use x-ray to check for shorts under the sensor hub IC

Sensor Hub


HS_MICBIAS_2P85
XMCS_SENSOR_1P8
VDD_CCP
VDDA_CCP
R6030 976K
R6031 1MEG
R6032 442K
C6030
C6000 4.7 UF
C6004 .1UF
C6001 .1UF
C6002 1 UF
C6003 .1UF
51016318003
U6000
STM32L051T8Y6D
CLK_XMCS
HS_REMOVE_VREF
USB_H2O_IN
HS_INSERT_VREF
HS_DET_AIN
CS_CCP
SCK_CCP
MISO_CCP
MOSI_CCP
HS_MICBIAS_EN
UART_TX_CCP
UART_RX_CCP
UART_CTS_CCP
UART_RTS_CCP
TP_STAT0
TP_STAT1
STAT0
STAT1
ACCEL_INT_2
FLASH_EN_CCP
PC14_OSC32_IN
PC15_OSC32_OUT
ACCEL_INT
CCP_AP_INT
IR_PROX_INT
CCP_AP_INT2
HE_NORTH
SCL_SENS
SDA_SENS
HE_SOUTH
USB_H2O_OUT
STM_NRST
VREF_POS
XMCS_SENSOR_1P8
DNP
R6003 2.2
C6013 .01UF
XMCS_SENSOR_1P8
R6002 1MEG
STM_NRST_G
Q6000
48014145001
VT6K1
RESET_N_CCP
DNP
Q6001
48014622001
RYM002N05
DNP
Q6002
48014622001
RYM002N05

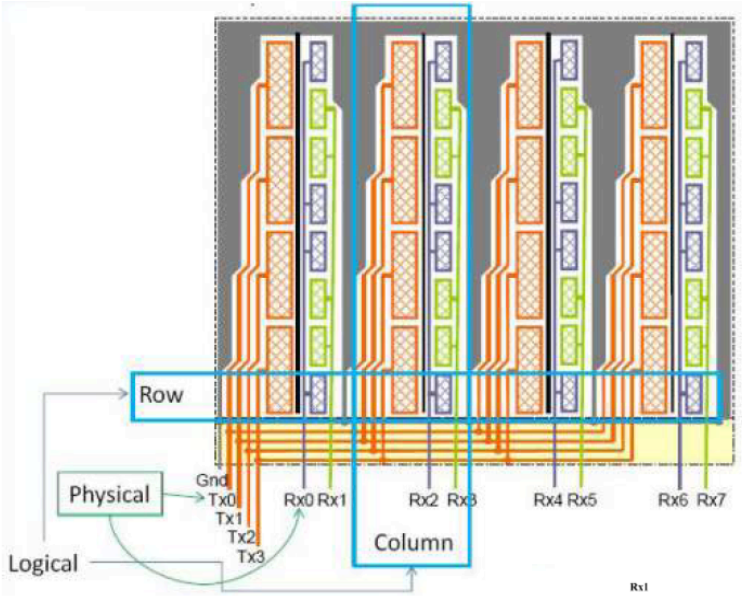
TOUCH TROUBLESHOOTING

Touch Design

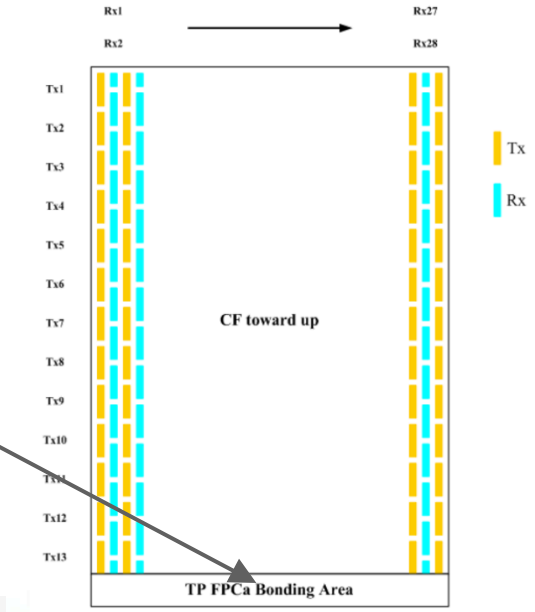
- Single Layer Touch On Display
  - INX (Innolux)
    - On-Cell (similar to DVX or Styx)
    - Synaptics S2316
    - 13 TXs * 28 RXs
  - TDI (Taiwan Display Inc.)
    - In-Cell (similar to Lux/Lynx)
    - Synaptics S3346
    - 27 TXs * 15 RXs

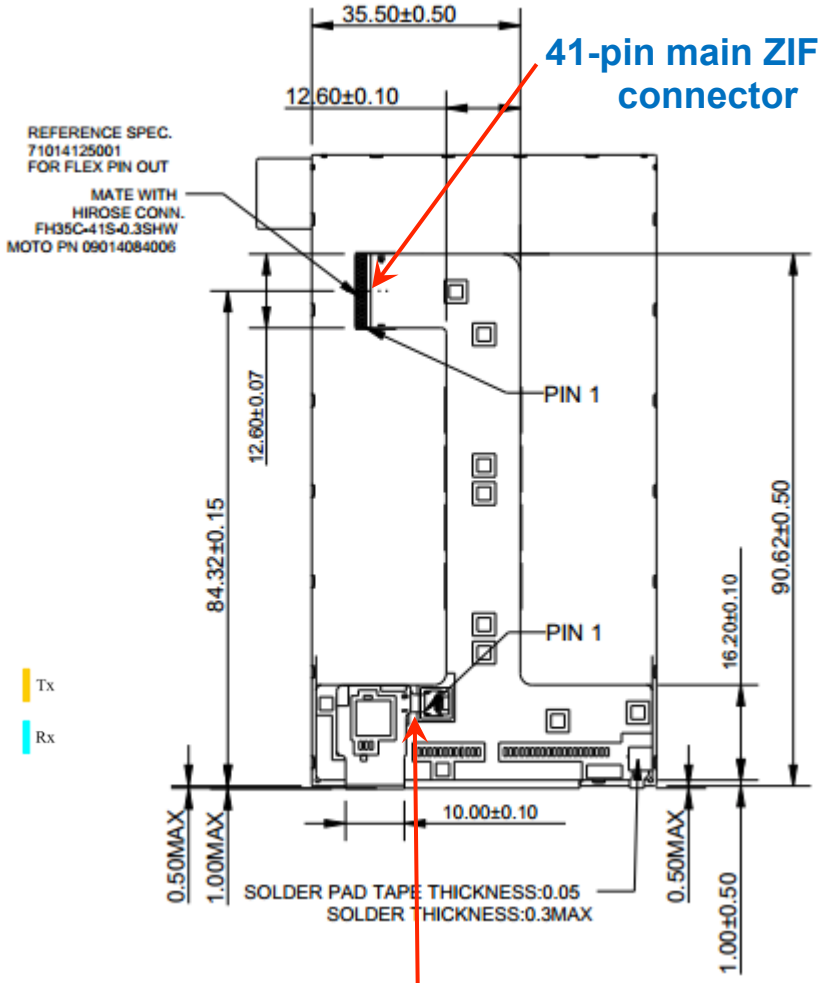
Mechanical

For INX There are 13 X channels (Tx) and 28 Y



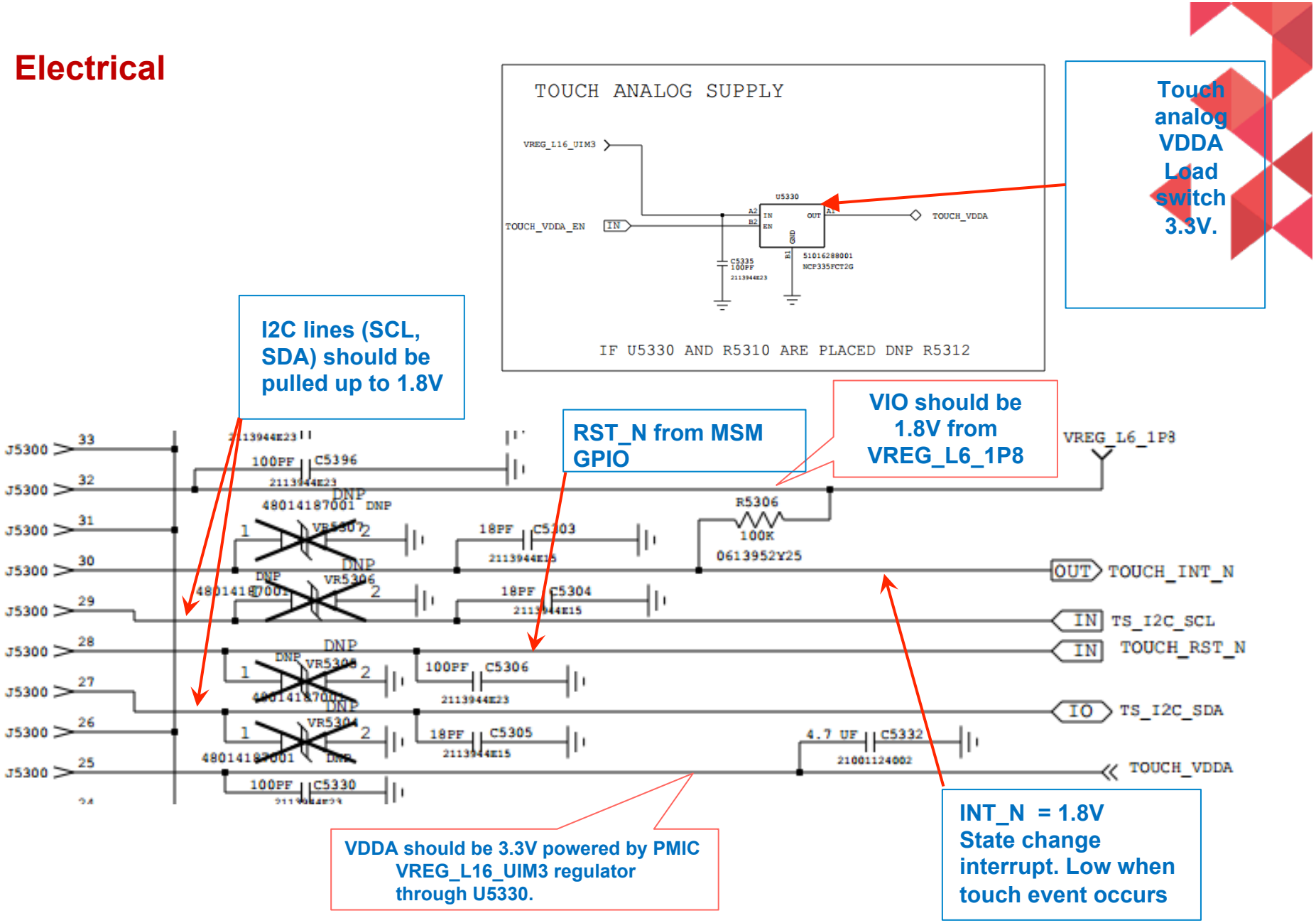
(CF = color filter)
Panel is facing user. FPC bonding area is next to speaker port at top of phone. In this image it is toward bottom.





Touch flex connects to the main flex via an 9-pin ZIF connector

Electrical


TOUCH ANALOG SUPPLY
VREG_L16_UIM3
TOUCH_VDDA_EN
IN
U5330
TOUCH_VDDA
C5335
100PF
51016288001
NCP335FCT2G
IF U5330 AND R5310 ARE PLACED DNP R5312
Touch analog VDDA Load switch 3.3V.
I2C lines (SCL, SDA) should be pulled up to 1.8V
RST_N from MSM GPIO
VIO should be 1.8V from VREG_L6_1P8
VREG_L6_1P8
R5306
100K
0613952Y25
OUT
TOUCH_INT_N
TS_I2C_SCL
TOUCH_RST_N
IO
TS_I2C_SDA
TOUCH_VDDA
J5300
33
32
31
30
29
28
27
26
25
C5396
100PF
DNP
48014187001
VR5307
VR5306
VR5308
VR5304
18PF
C5303
C5304
C5306
C5305
C5330
4.7 UF
C5332
21001124002
VDDA should be 3.3V powered by PMIC VREG_L16_UIM3 regulator through U5330.
INT_N = 1.8V State change interrupt. Low when touch event occurs

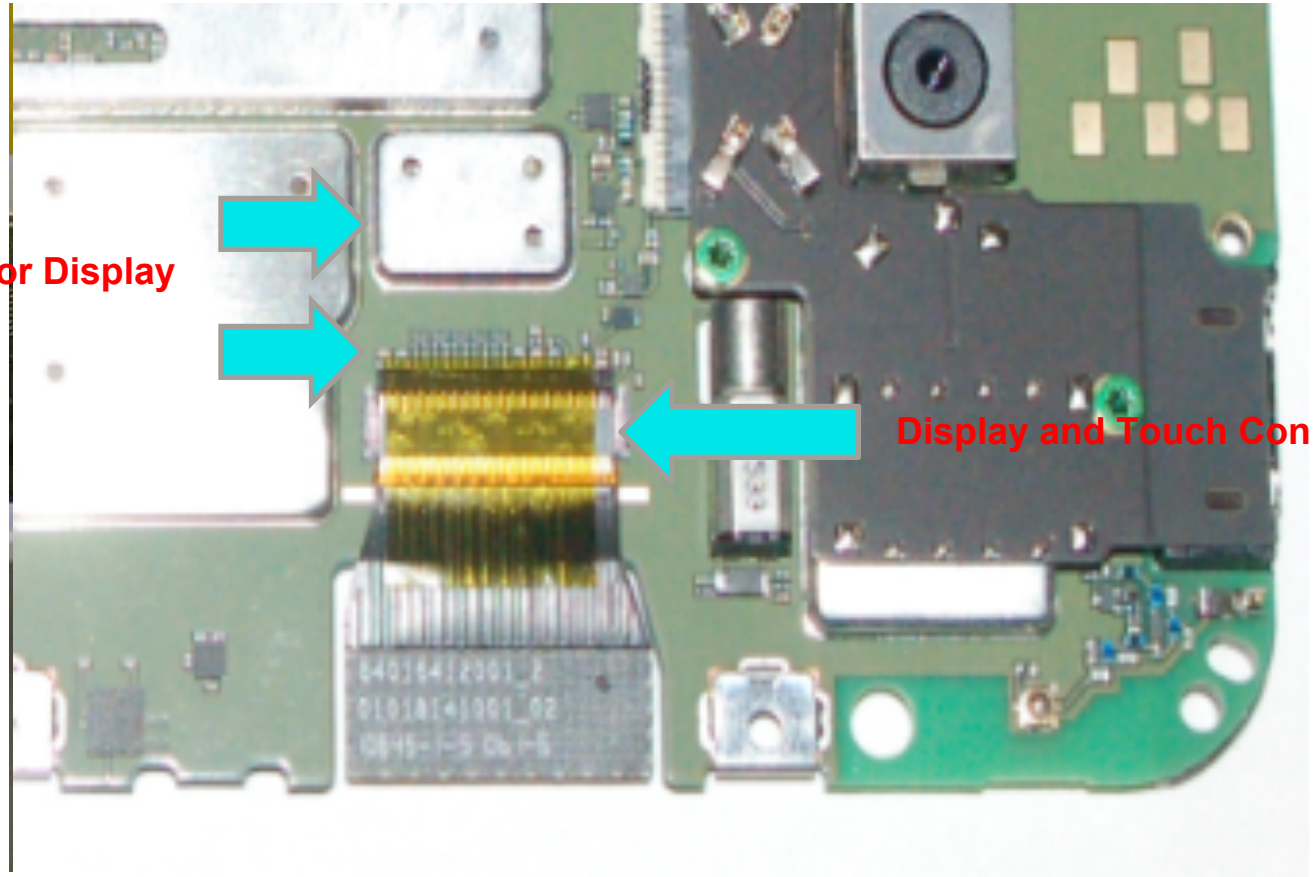
Troubleshooting

- No touch or abnormal touch:
  1) Check power supply voltages - VDDA (C5332) = 3.3V, VREG_L6_1P8 = 1.8V
  2) Check that a touch on the screen causes a low on TOUCH_INT_N
  3) Check touch Zif connector on LCD flex and main PCB for proper insertion or damage
  4) Check the module & firmware version in a command window
     a. “adb shell cat /sys/bus/i2c/devices/2-0020/ic_ver” will output
        Product ID: s3346b
        Build ID: 1b5aff
        Config ID: 27011520
        – Where Product ID: s3346 = TDI, Product ID:s2726 = INX or BOE
  5) If above tests pass, check for a panel crack

DISPLAY TROUBLESHOOTING

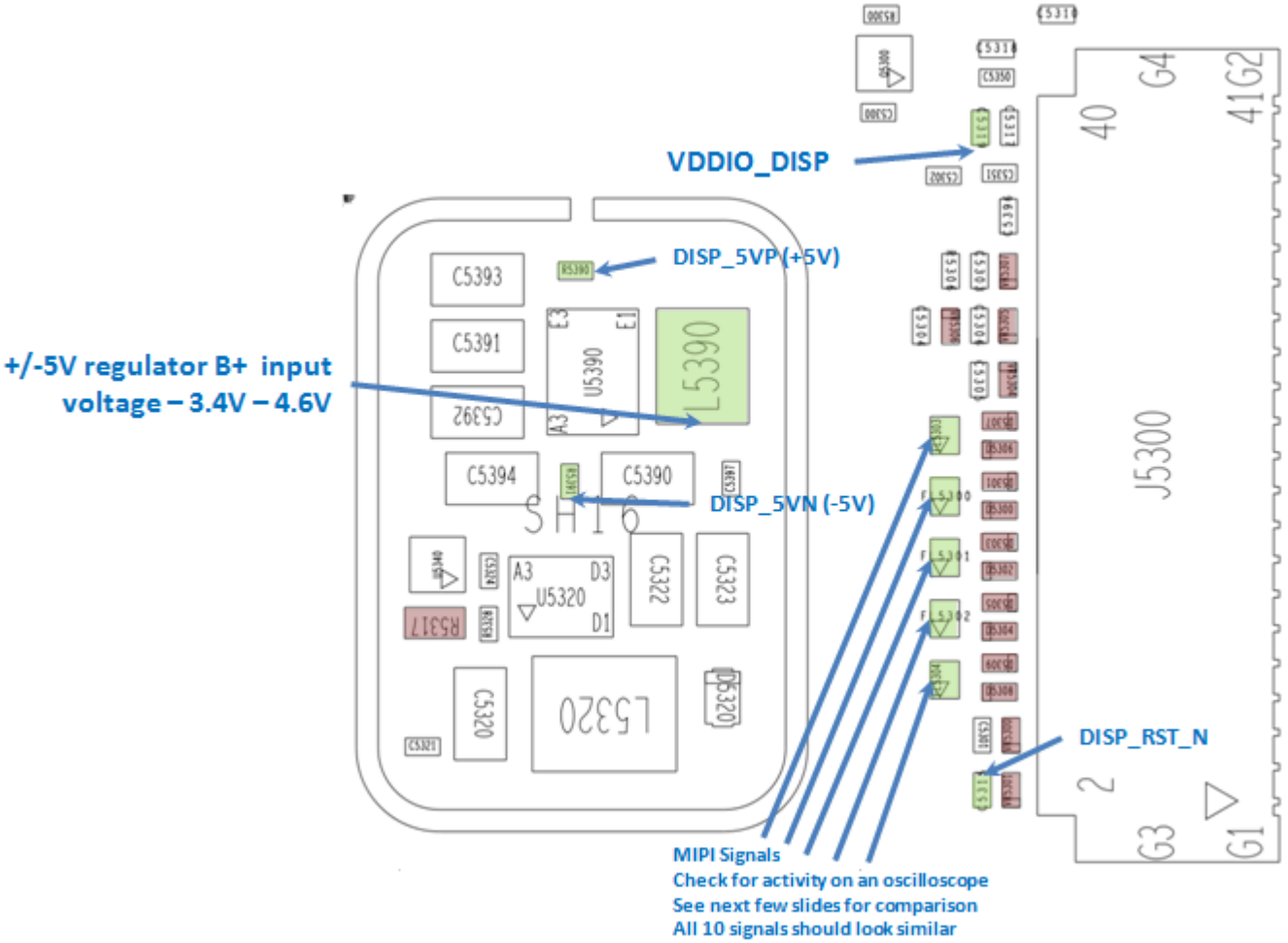
Display Circuit Location

Components for Display and Backlight



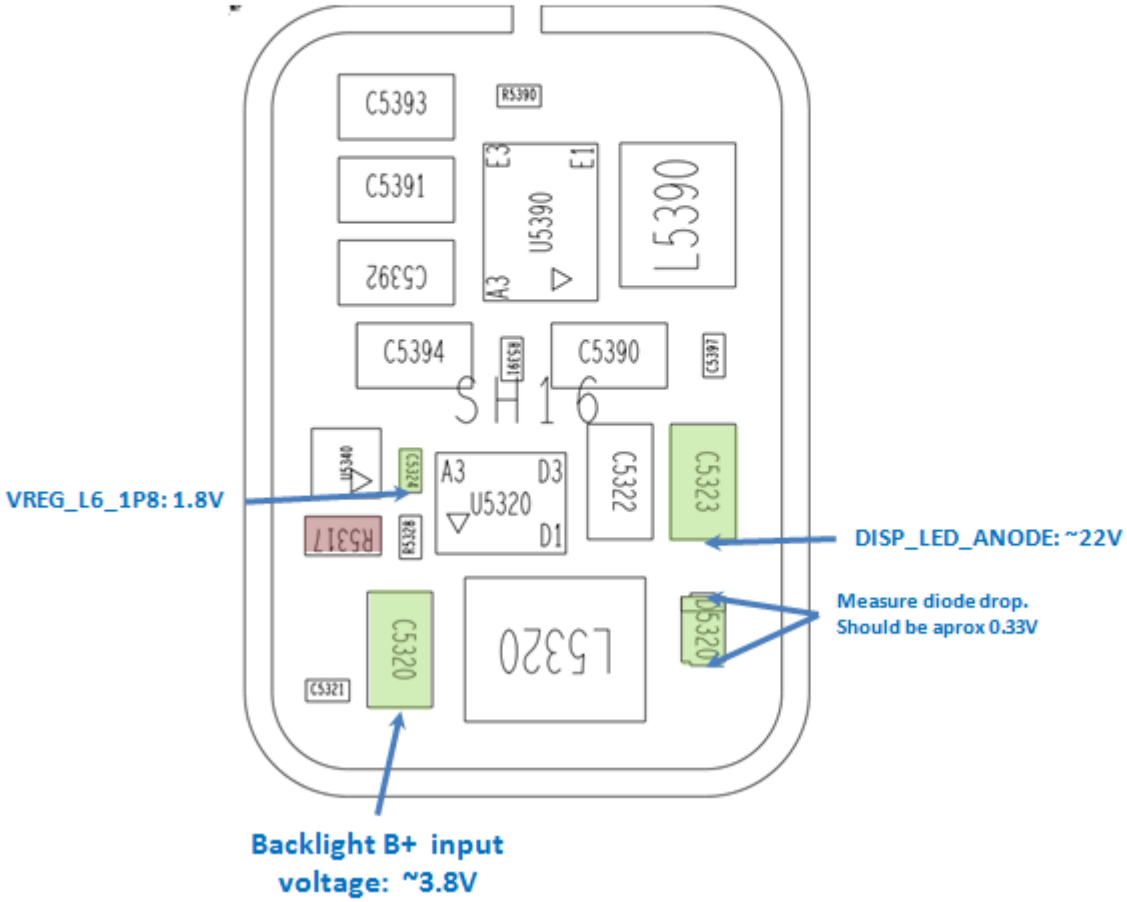
Display Signal Check

Green components placed, Red components NOT placed

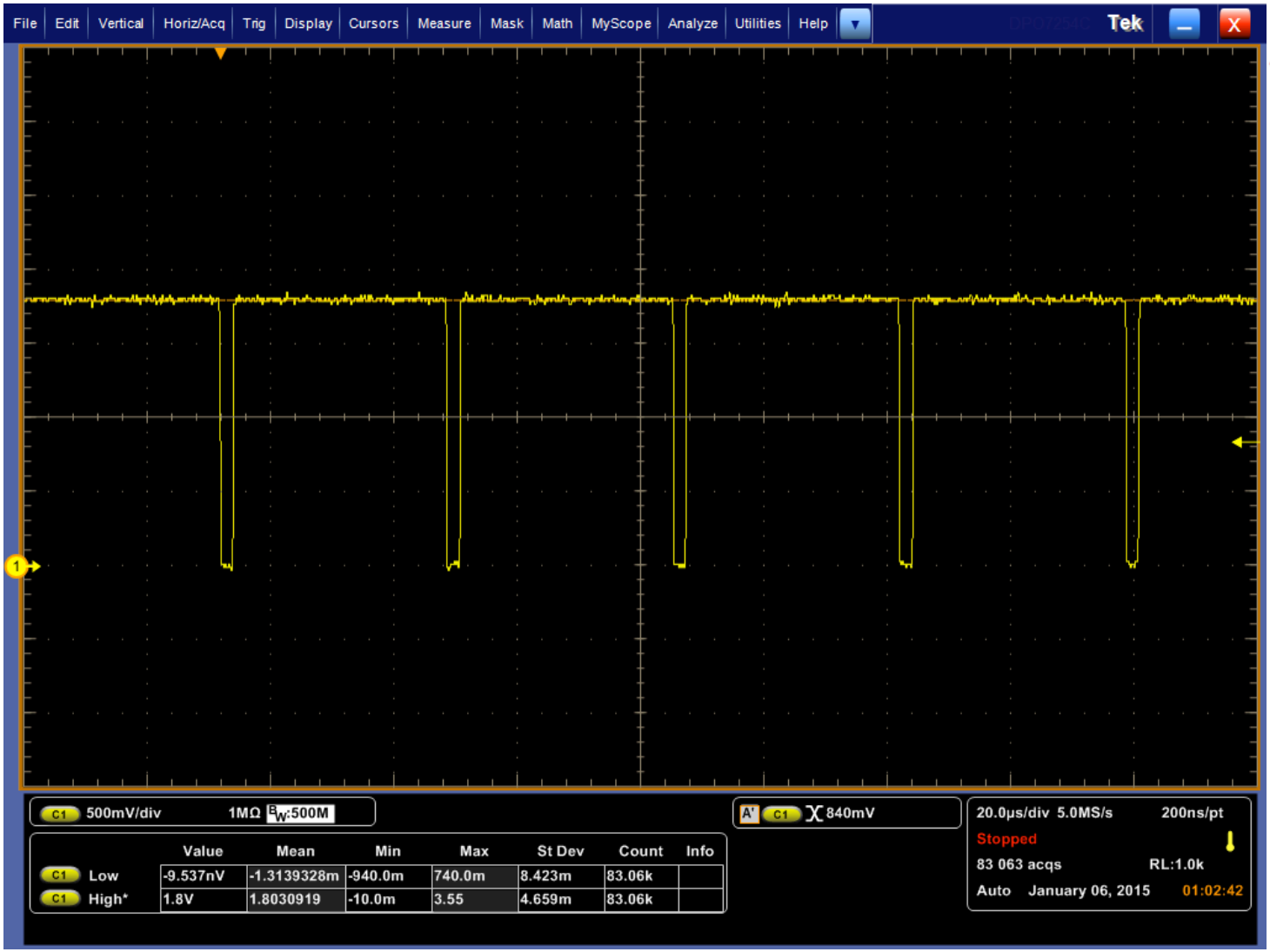


Backlight Driver Signal Check

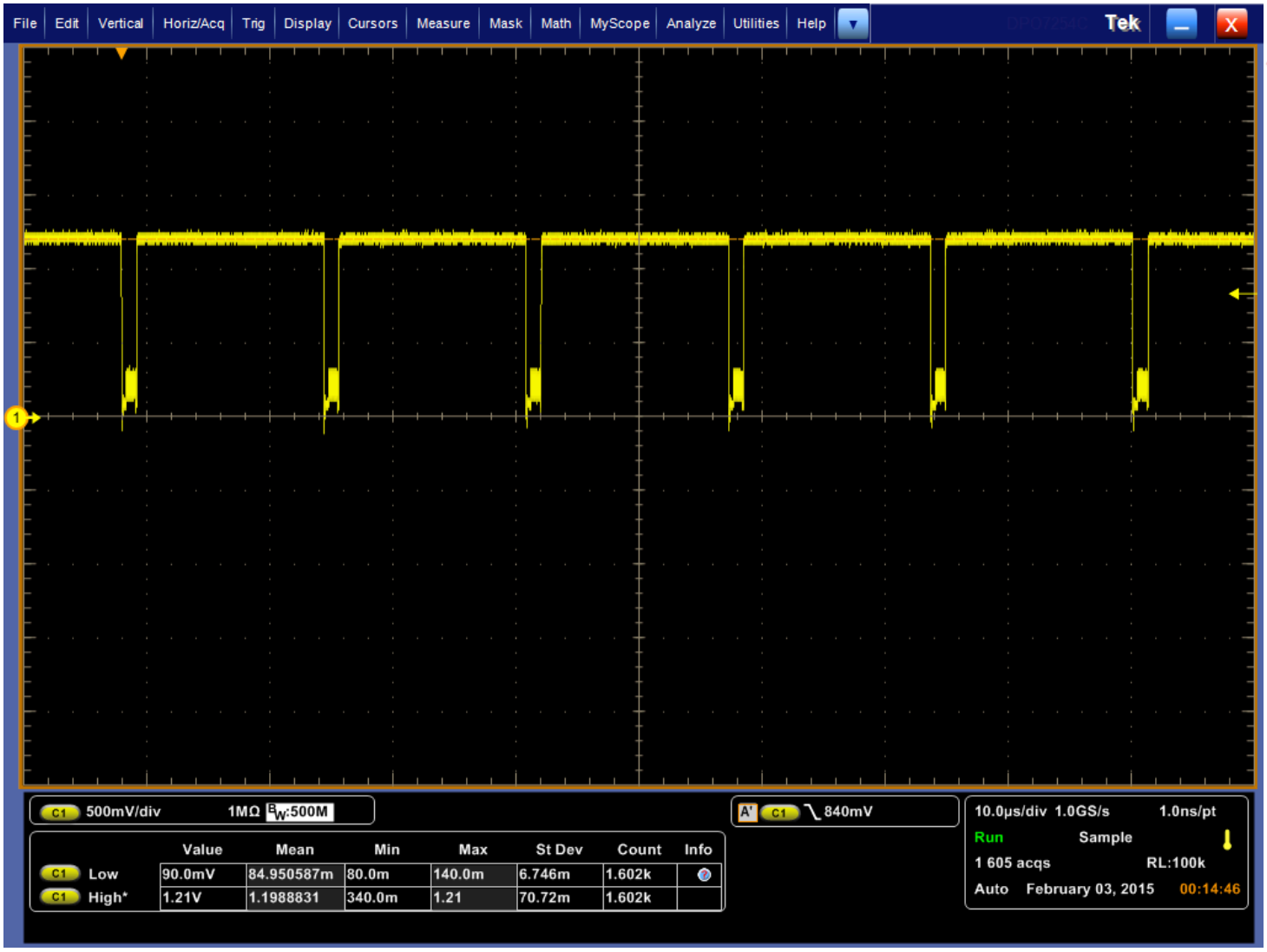
Green components placed, Red components NOT placed



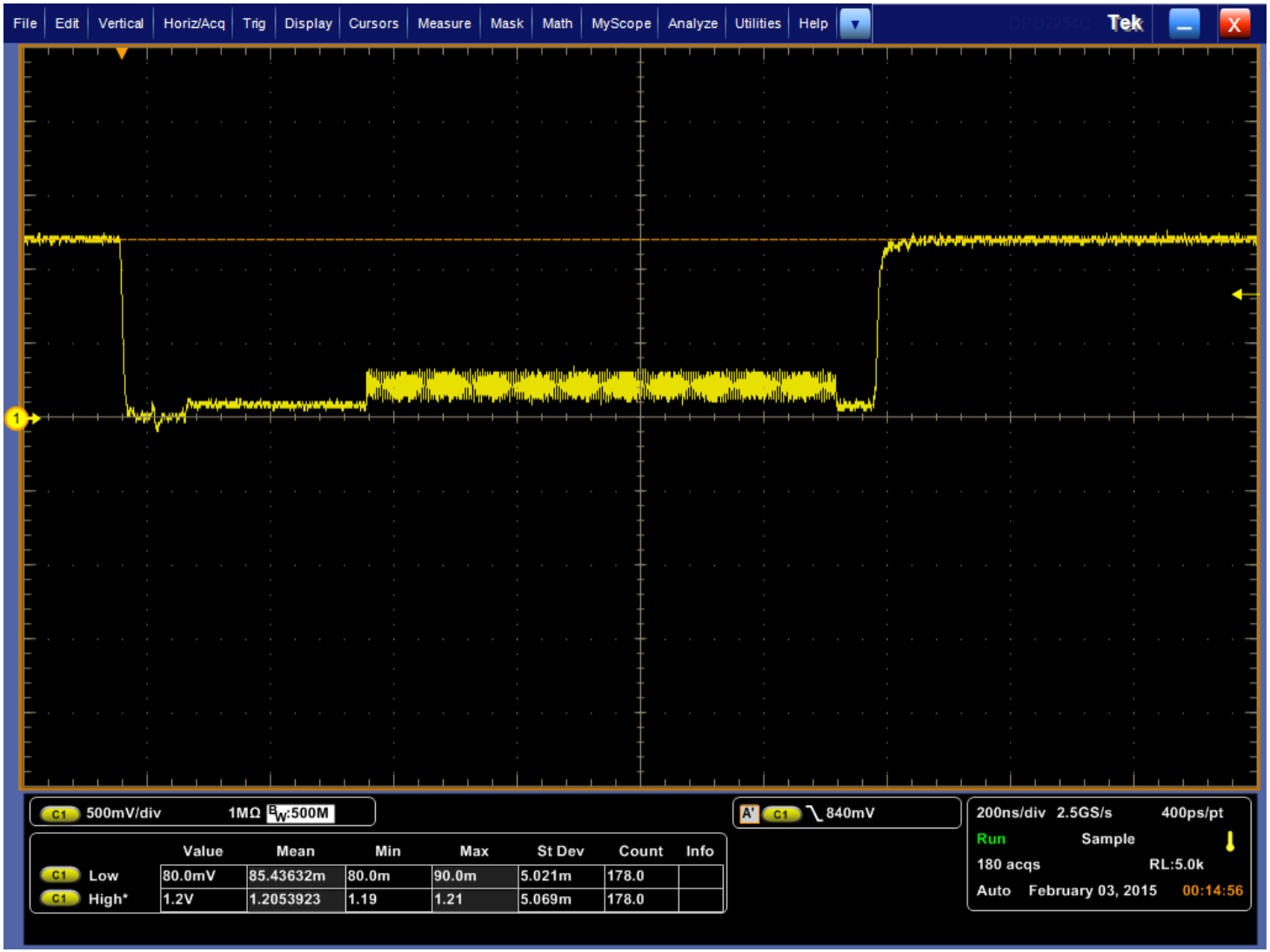
CABC Signal as seen on an oscilloscope



MIPI signal as seen on an oscilloscope (zoomed out)

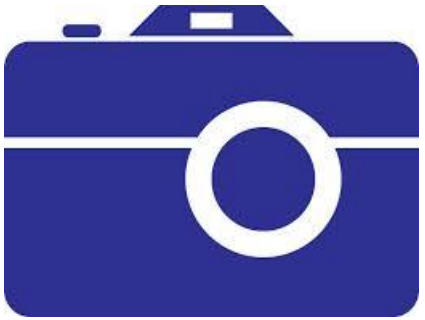


MIPI signal as seen on an oscilloscope (zoomed in)



CAMERA TROUBLESHOOTING

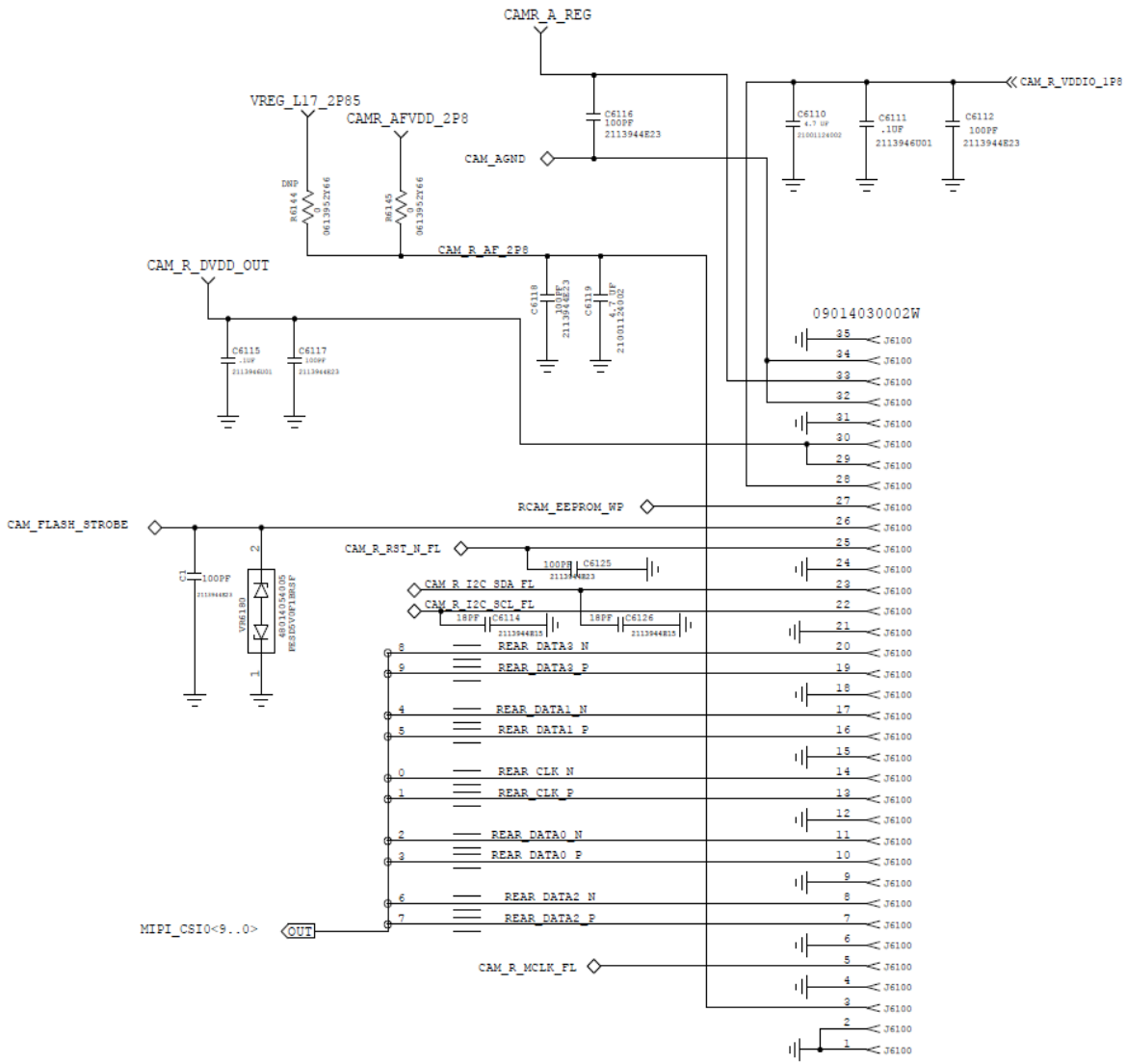
Camera Troubleshooting

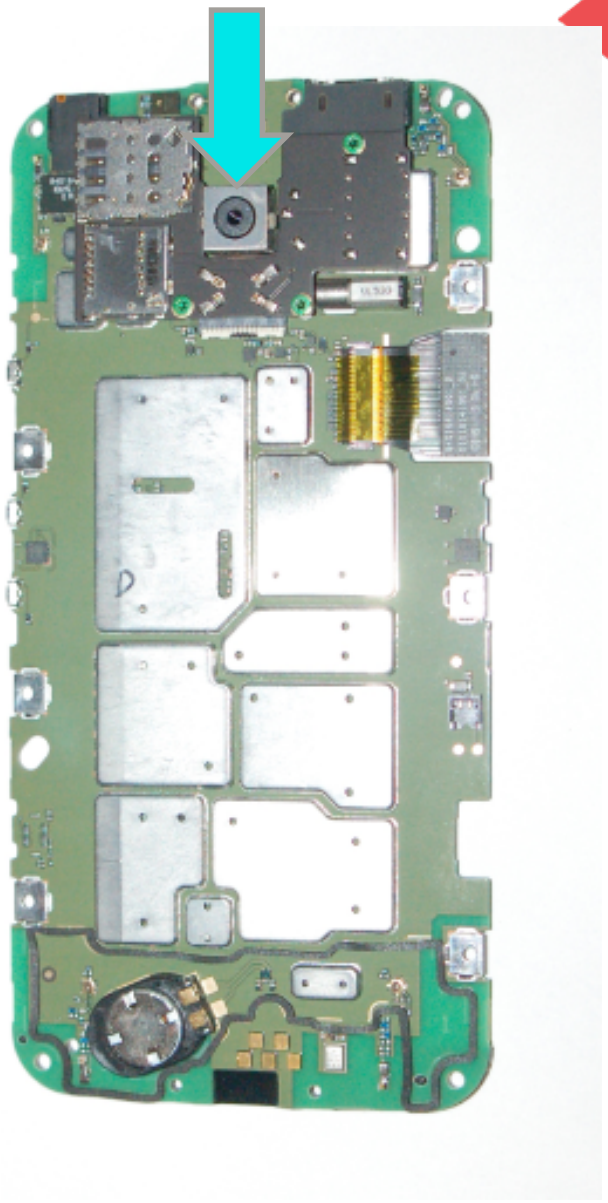


Main Imager

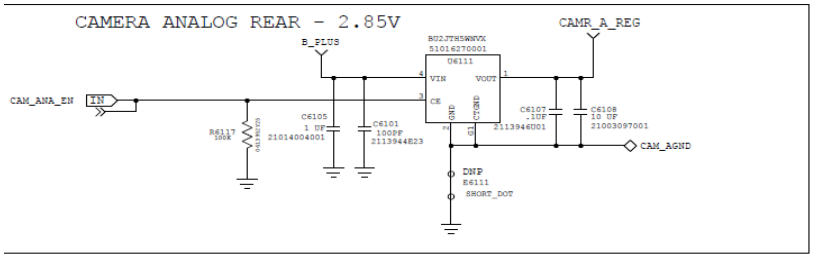
- The image sensor is a color CMOS image sensor with Bayer (blue, green, green, red) pattern filter.
- The sensor is 13MP.
- This module has an Auto Focus (AF) module with integrated driver (VCM).
- Data interface: Dual serial (1 pair-clk, 4 pair-data) mobile industry processor interface (MIPI). I2C is used for control.
- Analog Supply regulator (2.8V) located on Main PCB.
- Digital Supply regulator (1.05V) located on Main PCB.
- Full 1080P video mode
- Zero Shutter Lag

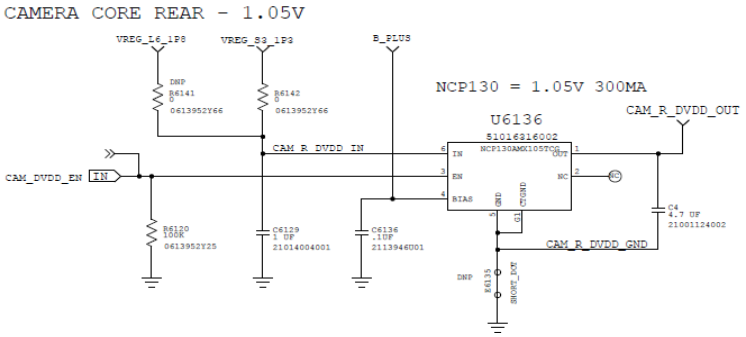
Main Imager

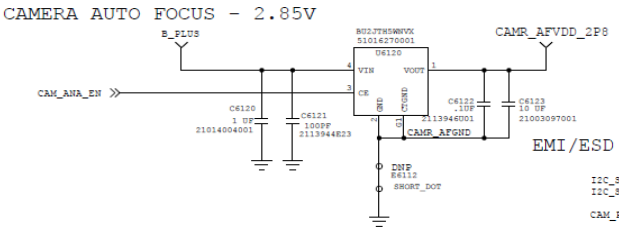

CAMR_A_REG
VREG_L17_2P85
CAMR_AFVDD_2P8
CAM_AGND
CAM_R_VDDIO_1P8
CAM_R_AF_2P8
CAM_R_DVDD_OUT
09014030002W
RCAM_EEPROM_WP
CAM_FLASH_STROBE
CAM_R_RST_N_FL
CAM_R_I2C_SDA_FL
CAM_R_I2C_SCL_FL
REAR_DATA3_N
REAR_DATA3_P
REAR_DATA1_N
REAR_DATA1_P
REAR_CLK_N
REAR_CLK_P
REAR_DATA0_N
REAR_DATA0_P
REAR_DATA2_N
REAR_DATA2_P
MIPI_CSI0<9..0>
OUT
CAM_R_MCLK_FL

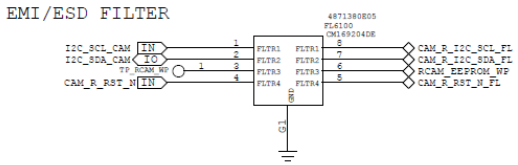


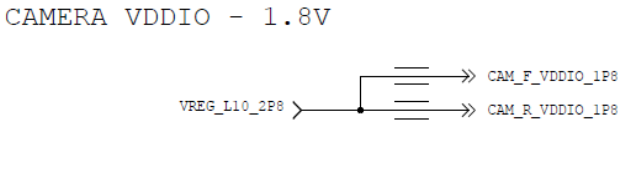
Main Imager (cont.)

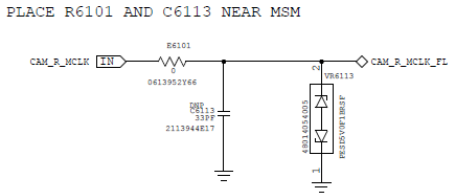


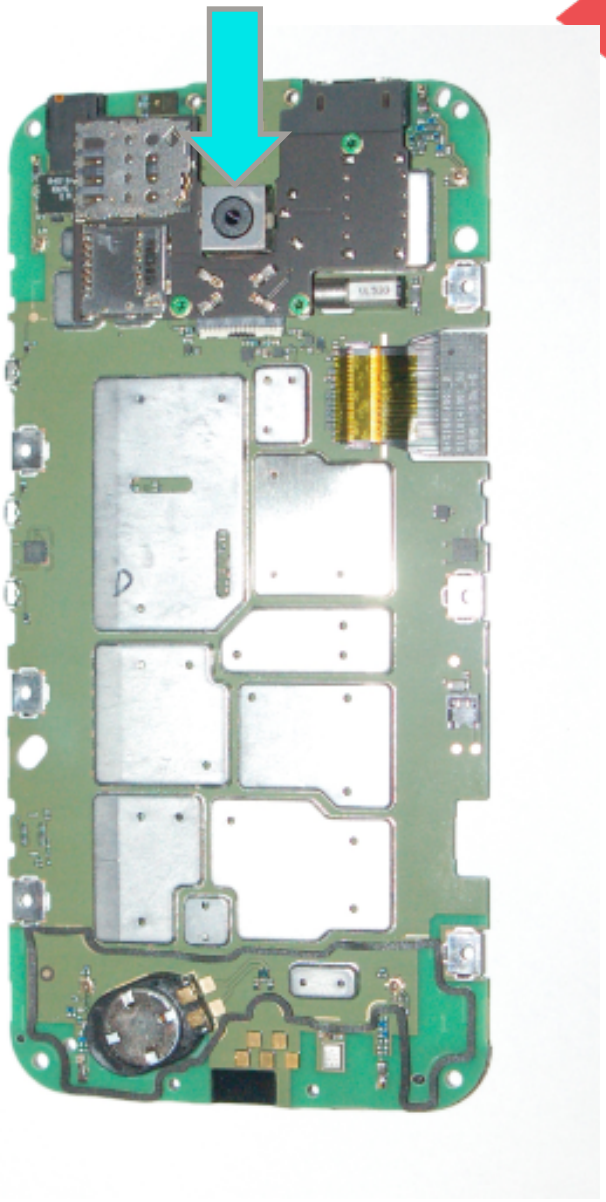




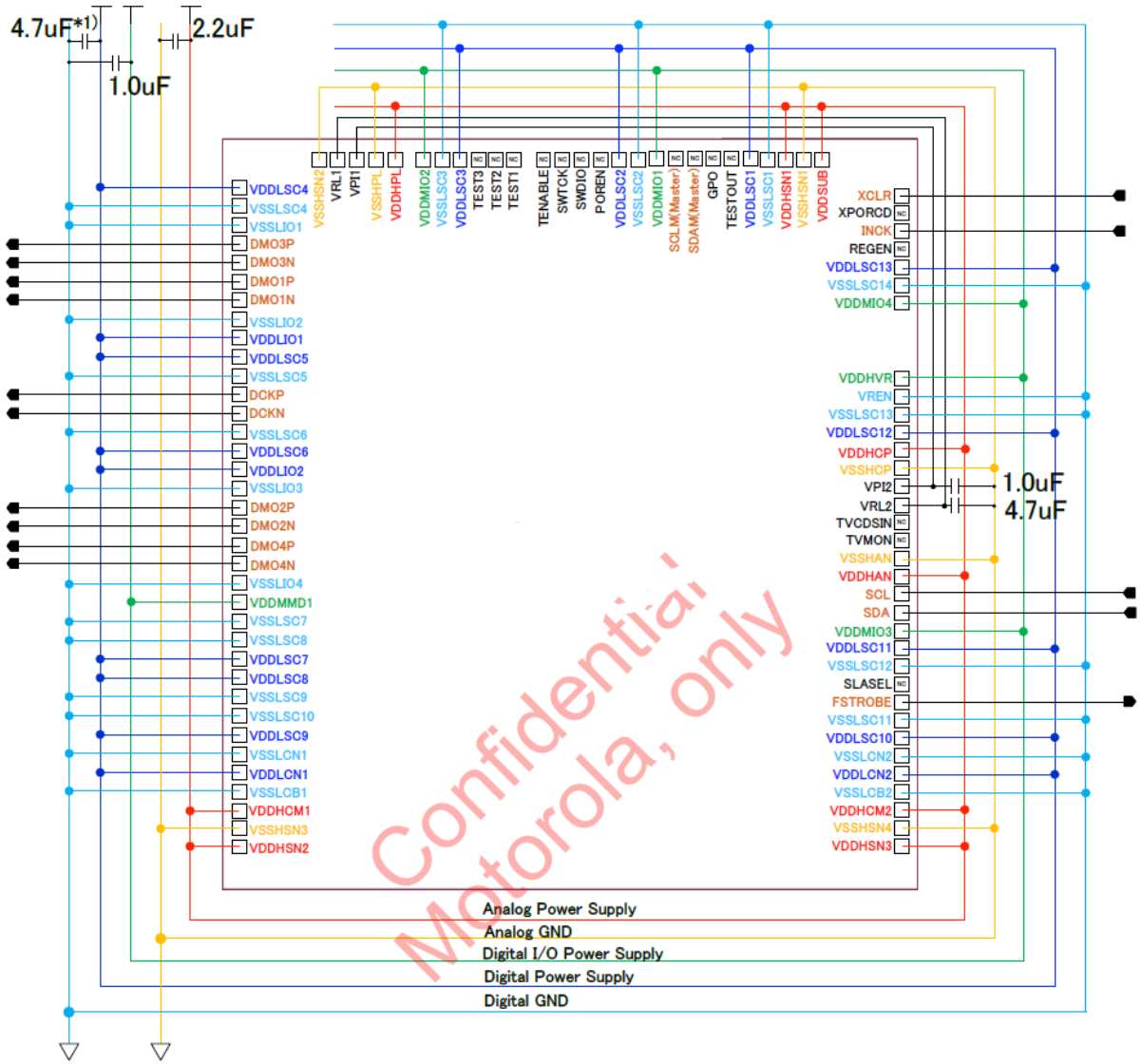








Main Imager Pinout (Looking through PCB)



Main Imager Troubleshooting

Troubleshooting Tips:

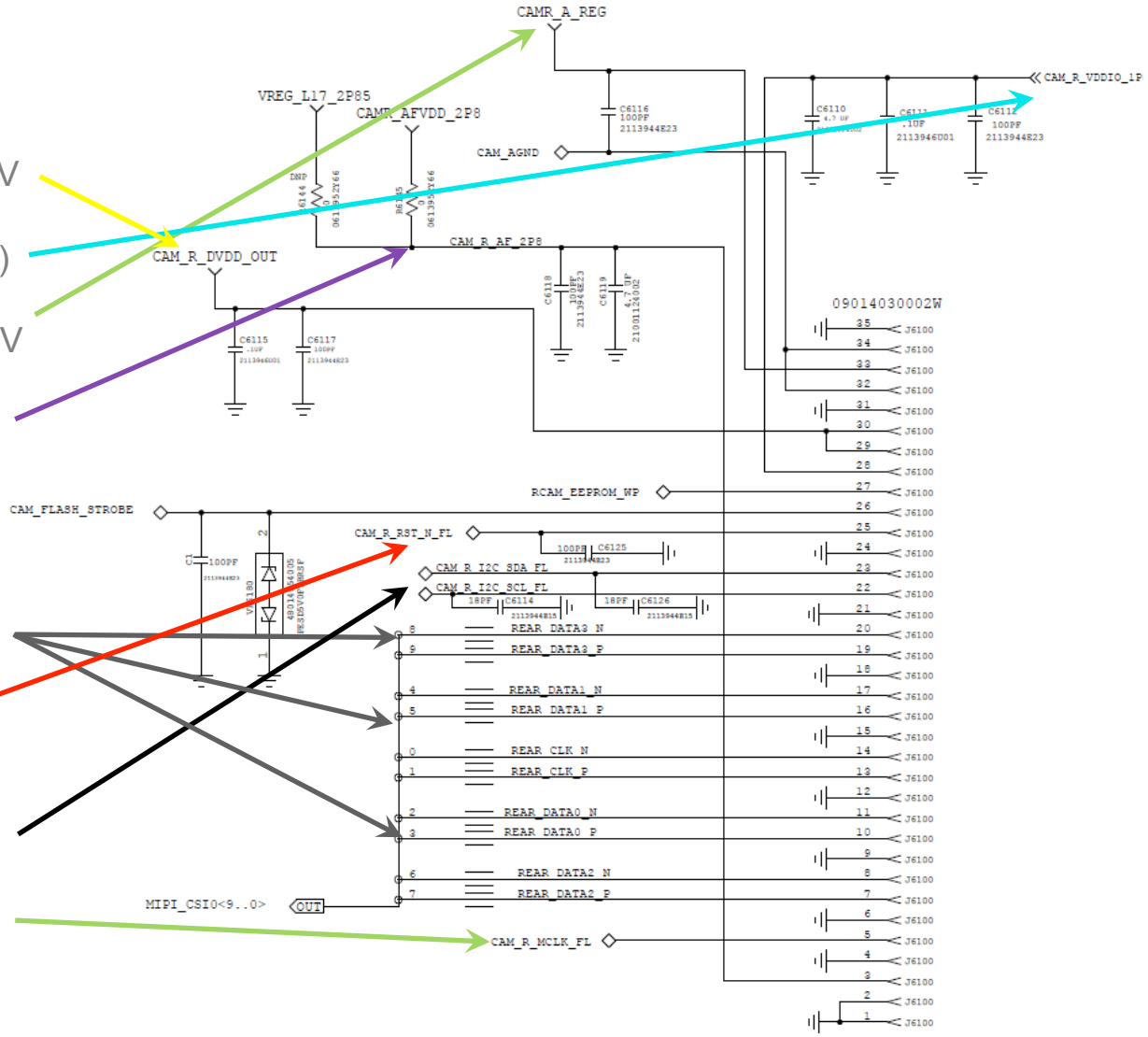
- Check CAM_R_DVDD (digital) =1.05V
- Check CAM_R_VDDIO supply =1.8V)
- Check CAMR_A_REG (analog) = 2.8V
- Check CAMR_AFVDD supply = 2.8V

- Check MIPI data/clk exist on all lines

After imager APP is launched.
- Check reset is high (1.8V)

- Check I2C clk/sda activity is present.

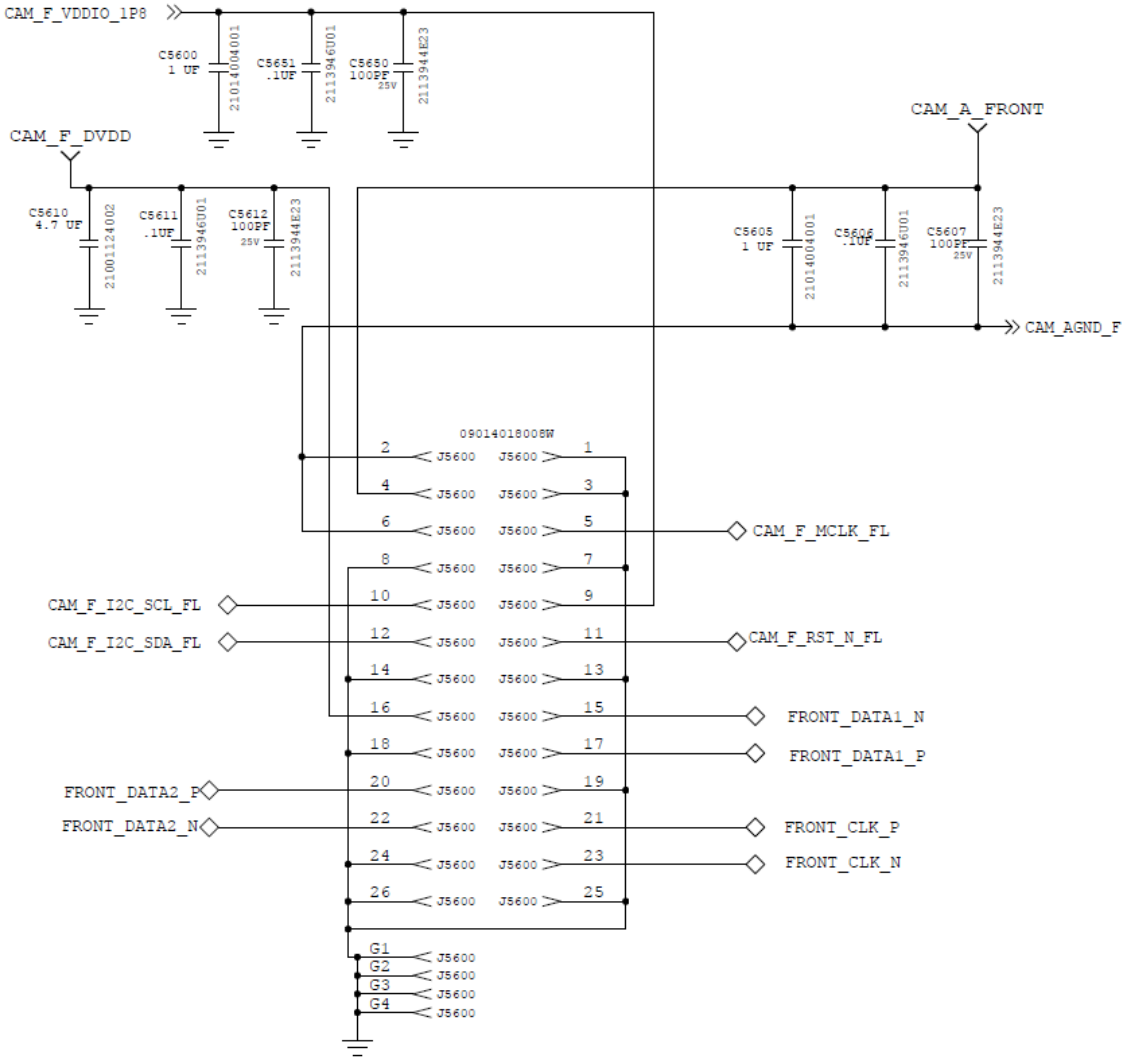
- Check Main reference clk = 23.8Mhz

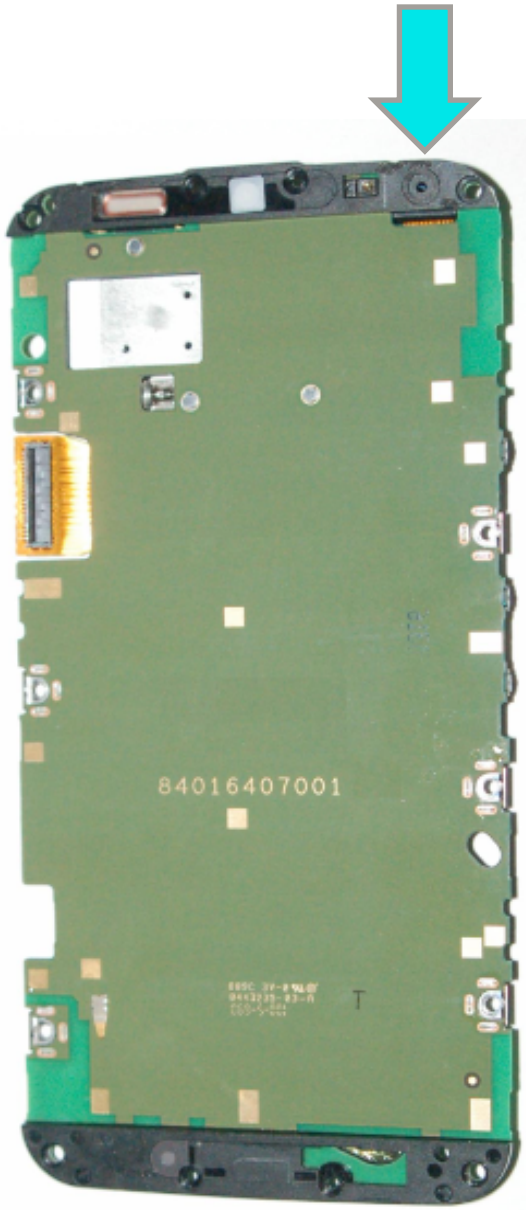


Front Facing VGA Imager

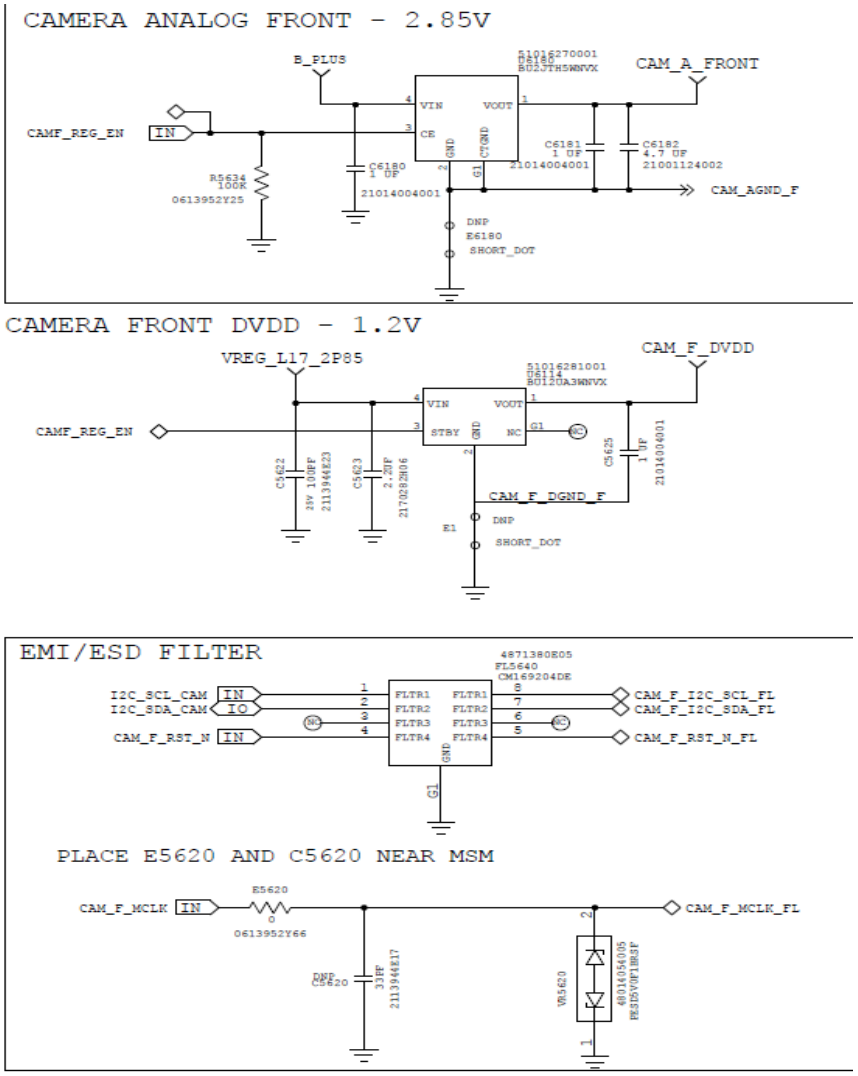
- The Front Facing (FF) imager is VGA.
- The sensor is a color CMOS SOC image sensor with Bayer (Green, Red, Green, Blue) pattern filter.
- The sensor is 5MP - Preview, Capture and video.
- The Module is capable of auto exposure, white balance, color correction, and color conversion.
- This device provides a finished image at up to 30 fps.
- Analog Supply regulator (2.8V) located on main transceiver PCB.

Front Facing VGA Imager

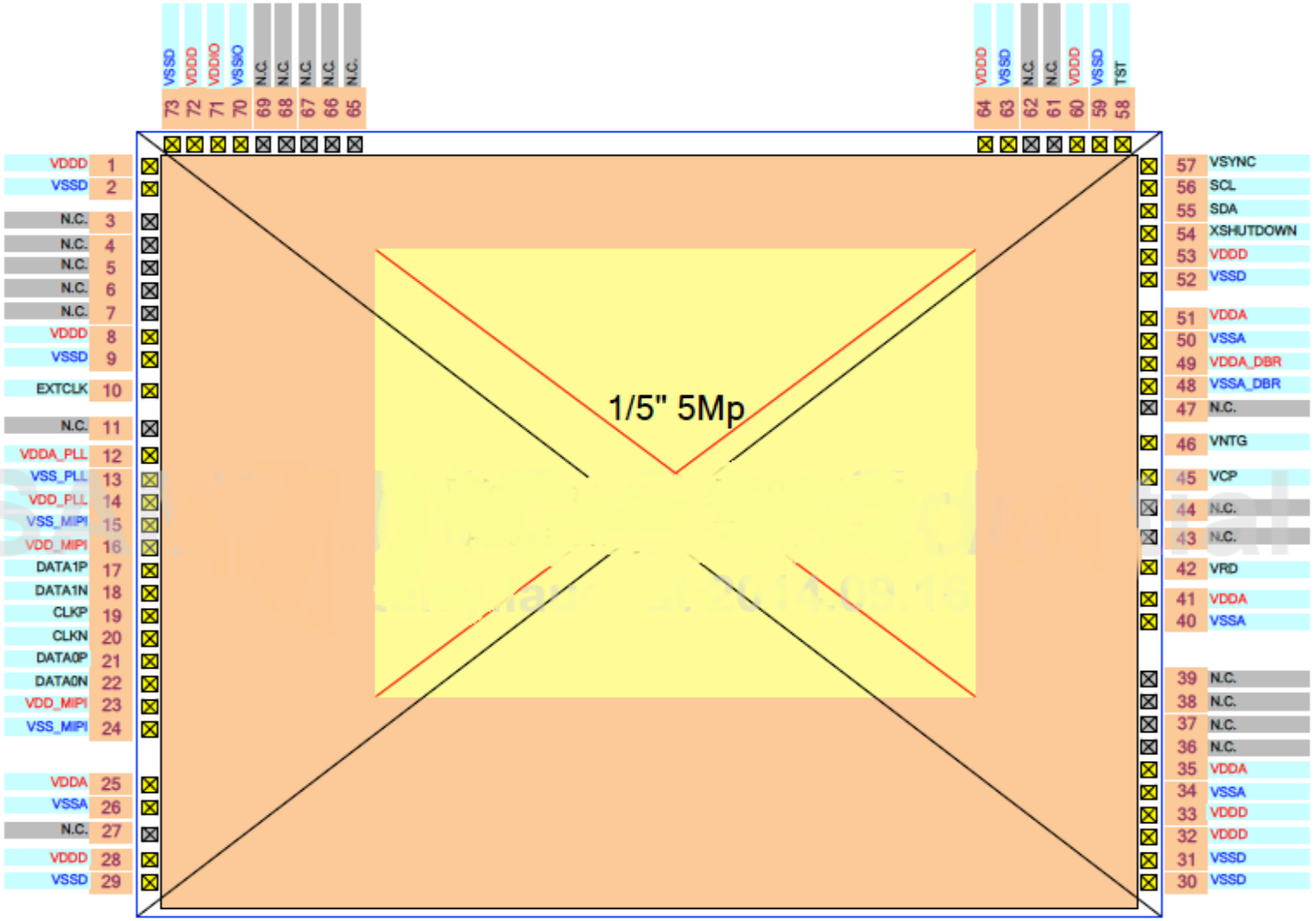




Front Facing VGA Imager (cont.)



Front Facing VGA Imager



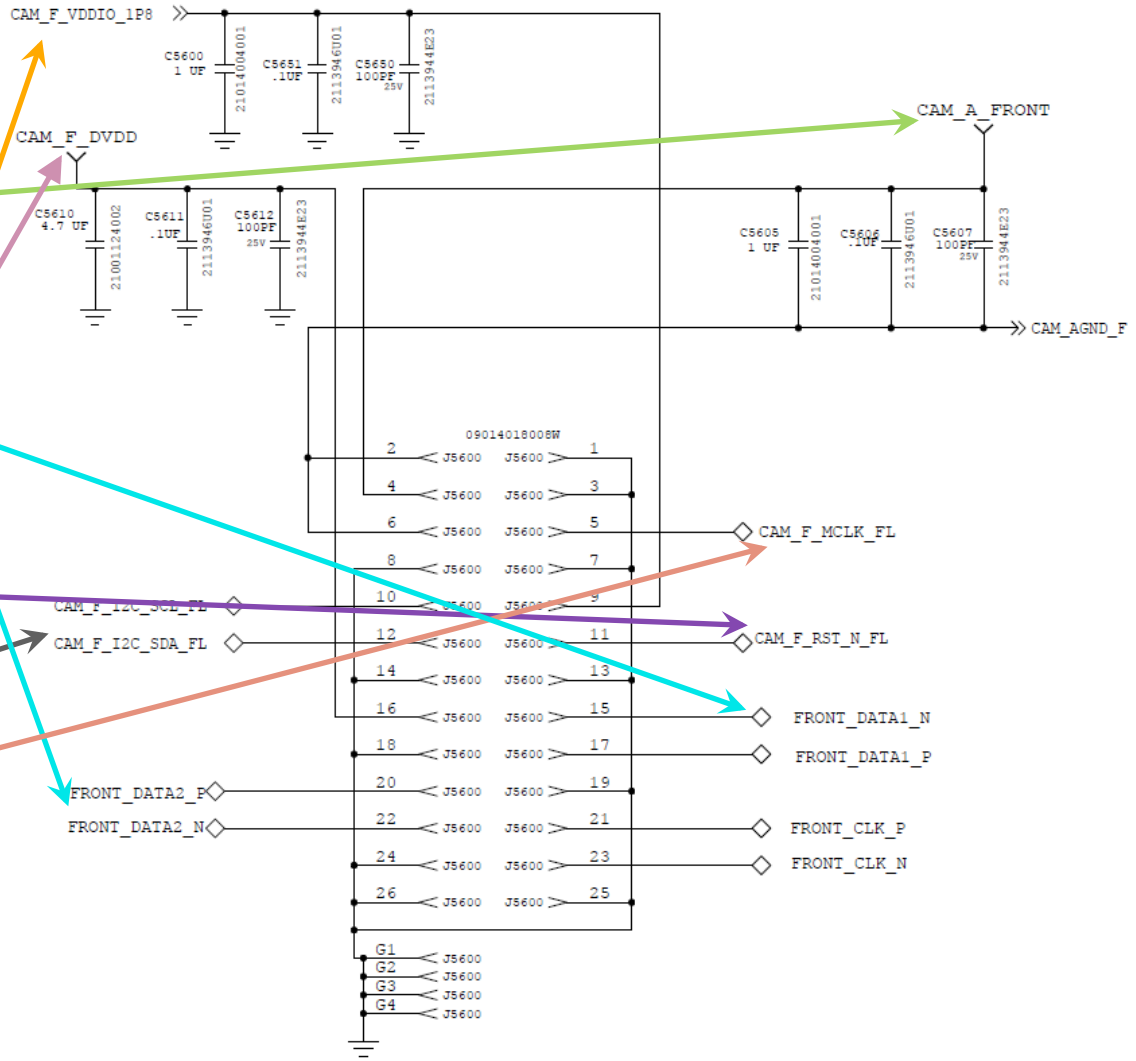
Front Facing VGA Imager Troubleshooting

Troubleshooting Tips (with Imager on):

- Check CAM_A_FRONT (analog) = 2.8V
- Check VDDIO logic supply = 1.8V
- Check CAM_F_DVDD (digital) = 1.2V
- Check MIPI data/clk exist on all lines

After imager APP is launched.

- Check reset is high (1.8V)
- Check I2C clk/sda activity is present
- Check Main reference clk = 23.8MHz

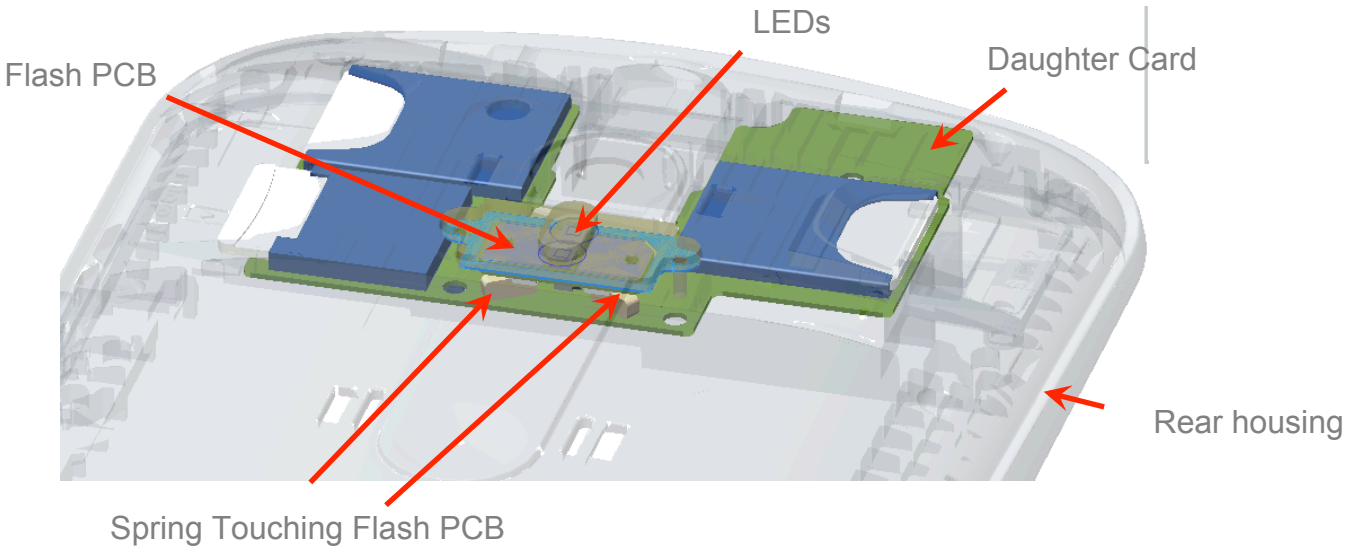


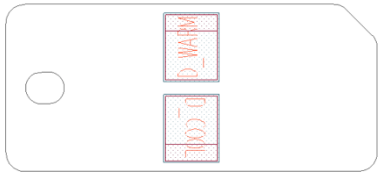
Flash LED and Flash LED Drive

- Flash LED uses two LEDs that are placed on the Flash PCB, see next slide for a picture
- The flash LED drive resides on the main board, see next slide for a picture

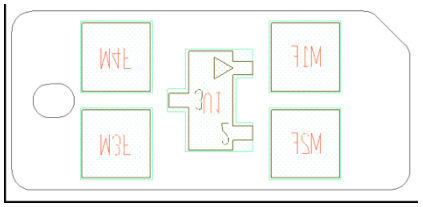
Flash LED and Flash LED Drive

- Flash LED uses two LEDs that are placed on the Flash PCB as shown below





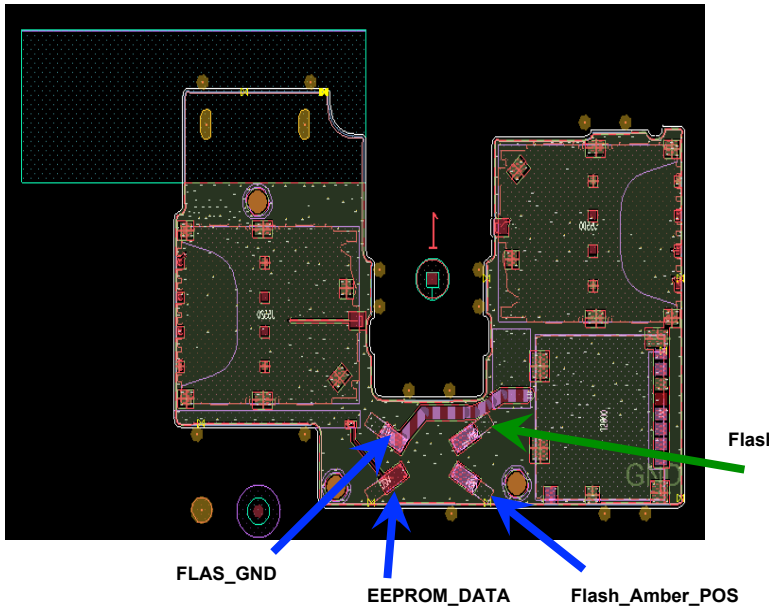
Flash PCB Top Side

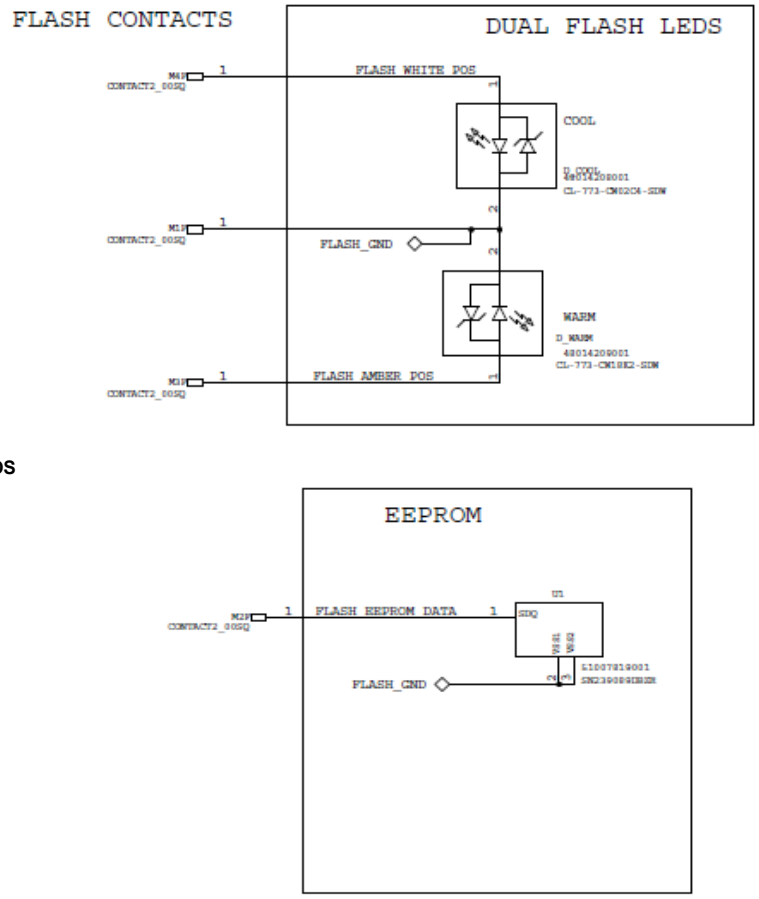


Flash PCB Top Side

Flash LED and Flash LED Drive

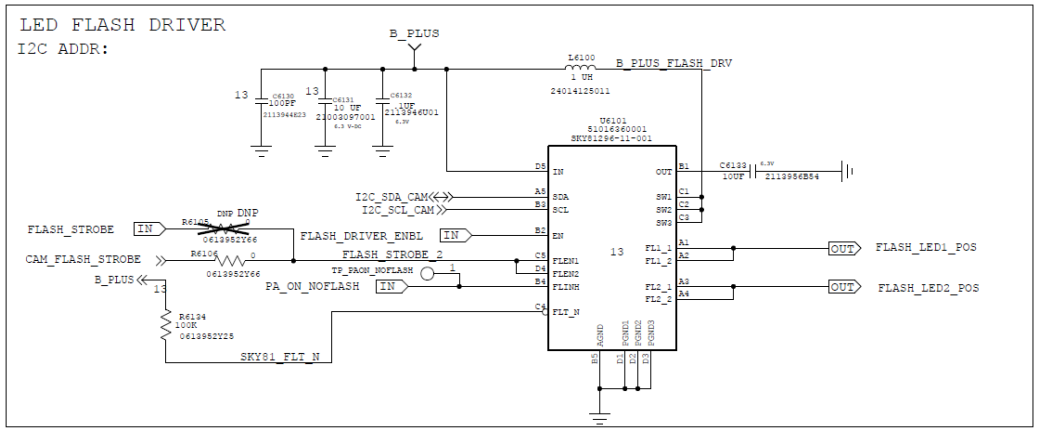
- Flash LED PCB make contacts through four spring contacts that are on the daughter card as shown below

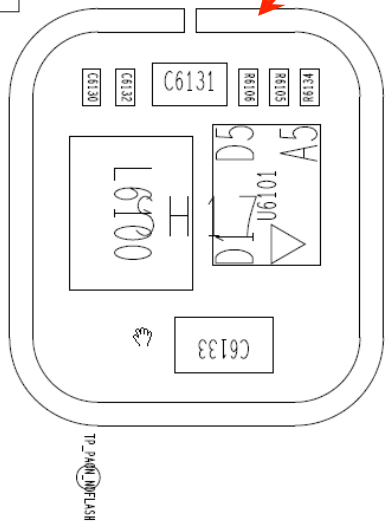


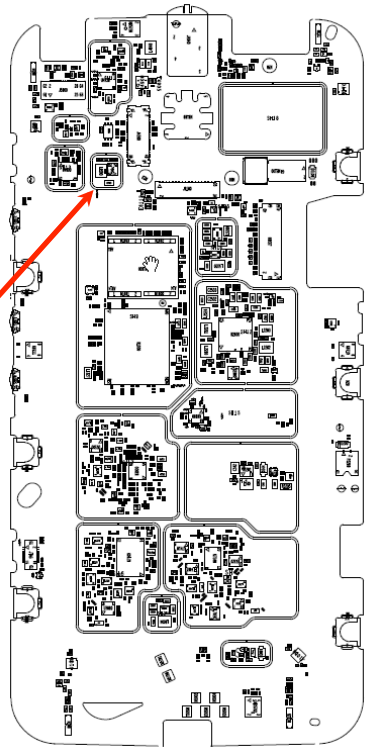


Flash LED and Flash LED Drive

- Flash LED Drive resides on the main PCB and the output of the driver goes to the daughter board then through the spring contacts to the FLASH PCB as shown below







Flash LED and Flash LED Drive

Troubleshooting:

1) Check input voltage to the Flash LED drive – B_Plus at C6132, ensure it within the limits of B_Plus as it varies depending on the battery level or supplied voltage

2) Check the output voltage of the driver (anode of the Flash LEDs) during torch to be around 2.8V and during strobe around 3.6V

3) Check I2C interface of the Flash LED drive (I2C_SDA_cAM and I2C_SCL_CAM)

4) Ensure that the Flash PCB is making contacts with the daughter card

AUDIO TROUBLESHOOTING

Audio Devices

Secondary Microphone

Uses:
•Noise suppression for voice calls
•Multimedia audio recording

Top Ported

Main Microphone

Uses:
•Speech in handset and speakerphone mode

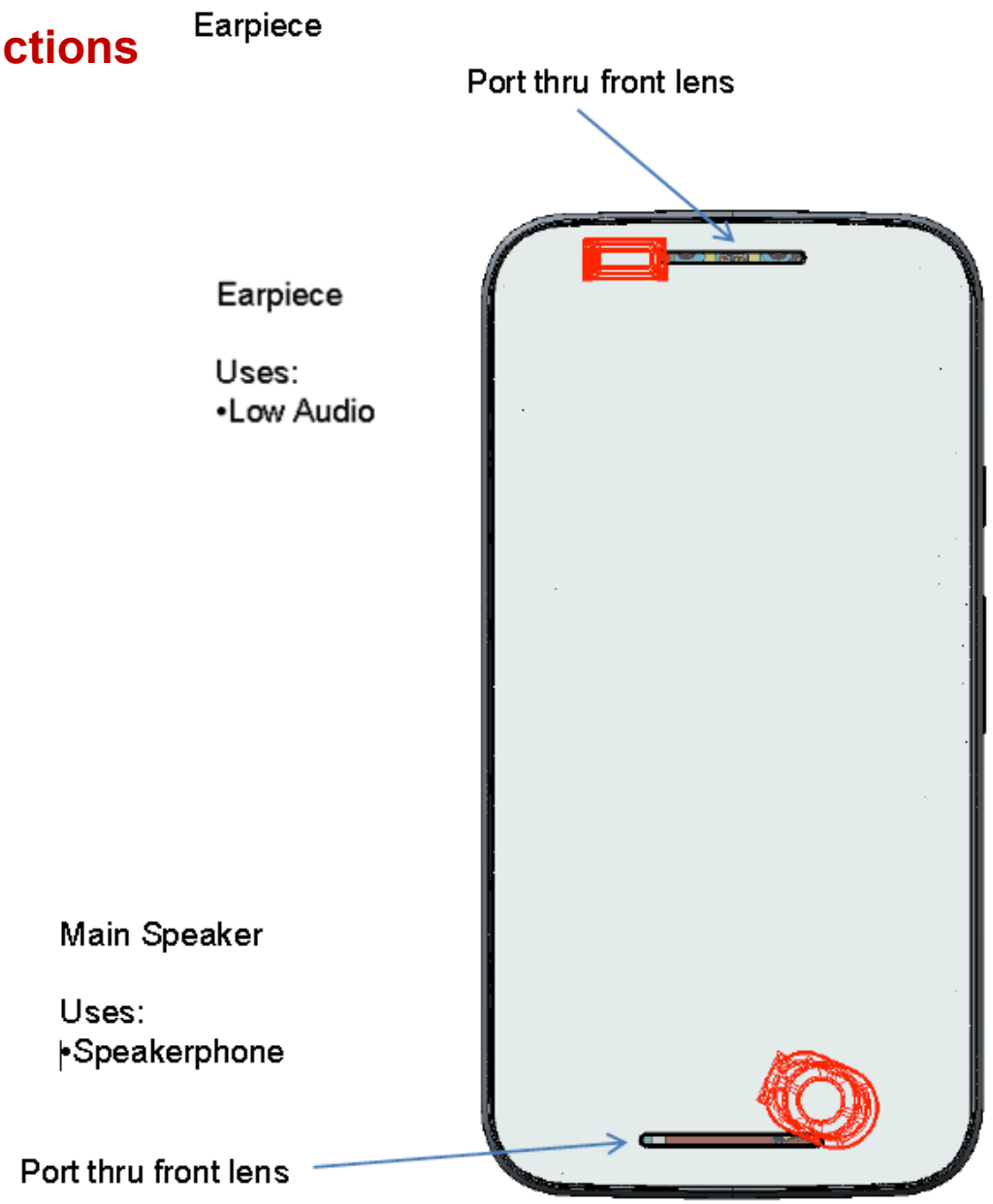
Port thru main speaker opening

Front of the phone

Back of the phone

lic

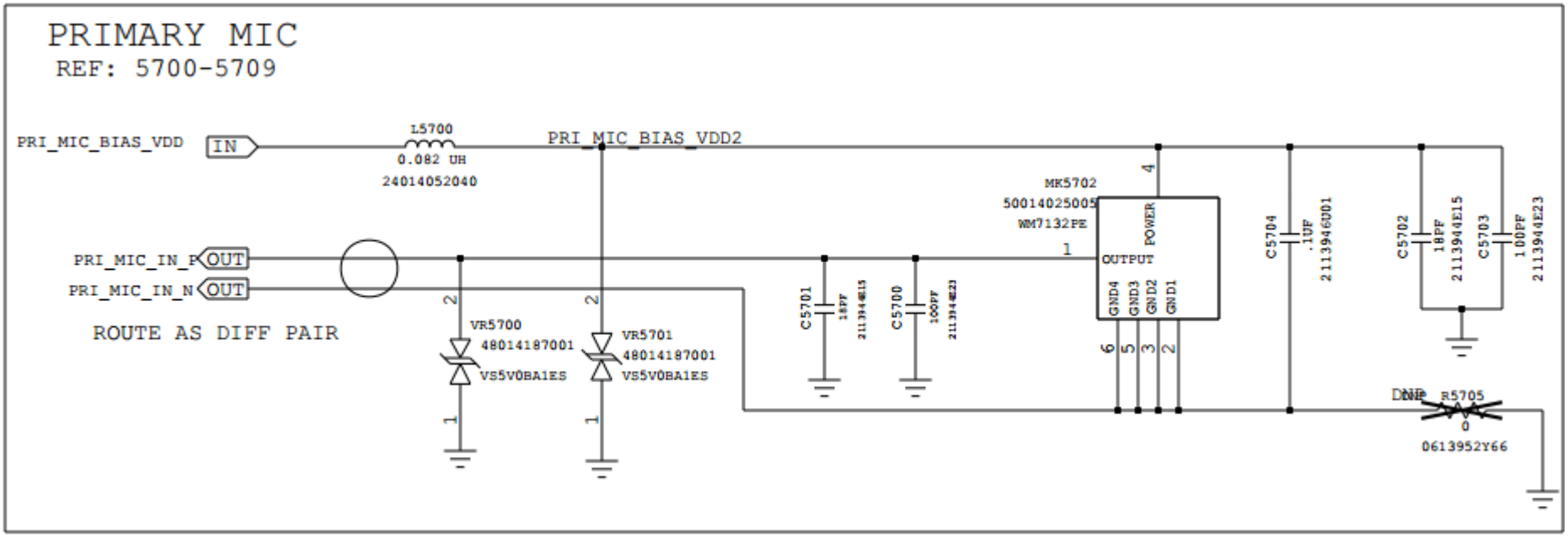
Mic Locations and Functions



“No Audio” Complaints

- The CQA apk can be used to verify a broken audio path. Under the “Audio” menu, select “Mic Loopback”.
  - The “Primary MIC” setting loops mic1 to the earpiece.
  - The “Secondary MIC” setting loops mic2 to the earpiece.
- If both of those are not function, the earpiece speaker path may be damaged. In the “AUDIO” menu of the CQA apk, select “Ear Speaker” and then “Play Harvard speech pattern”.
- The loudspeaker can be tested by selecting “Loudspeaker via the CQA apk. Music should start playing.
- Loudspeaker functionality can be checked quickly by playing a ringtone.

Primary Microphone



Primary Microphone

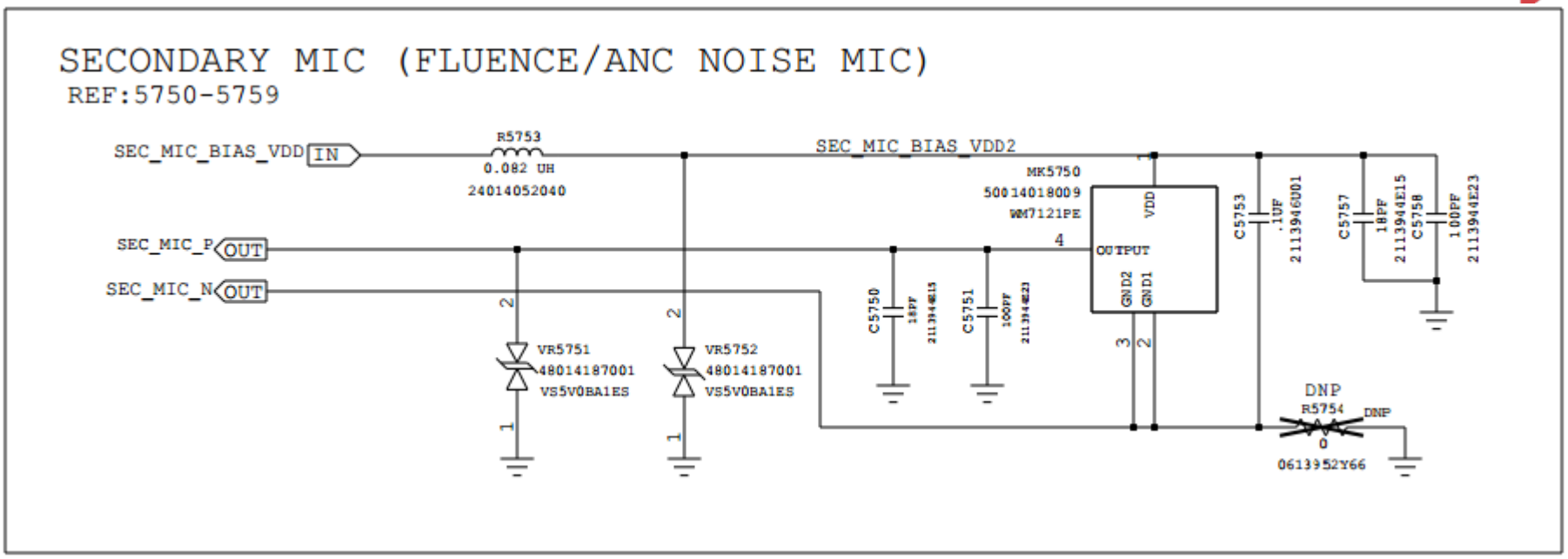
If the Primary mic is not functioning…

Check mic bias at L5700 or C5704. This should be 2.1V when the microphone is enabled.

Check the microphone assembly to make certain it is not damaged, which may indicate a broken diaphragm.

Check the microphone output at C5700 or C5701. The AC amplitude should increase when audio is present.

Secondary Microphone



Secondary Microphone

If the Secondary mic is not functioning…

Check mic bias at R5753 or C5753. This should be 2.1V when the microphone is enabled.

Check the microphone assembly to make certain it is not damaged, which may indicate a broken diaphragm.

Check the microphone output at C5751 or C5750. The AC amplitude should increase when audio is present.

Primary Microphone Seal

If Primary microphone seal is broken:

1.) Open CQA app.

2.) Under the “Audio” menu, select “Mic Loopback”.

The “Primary MIC” setting loops mic1 to the earpiece.

3.) Listen for primary mic audio in handset earpiece.

4.) Block the primary mic port, listen audio in earpiece. If primary mic is sealed, there will be no /very low audio in Handset earpiece.

If primary mic seal is broken, block and unblock audio level almost same.

Second Microphone Seal

If Second microphone seal is broken:

1.) Open CQA app.

2.) Under the “Audio” menu, select “Mic Loopback”.

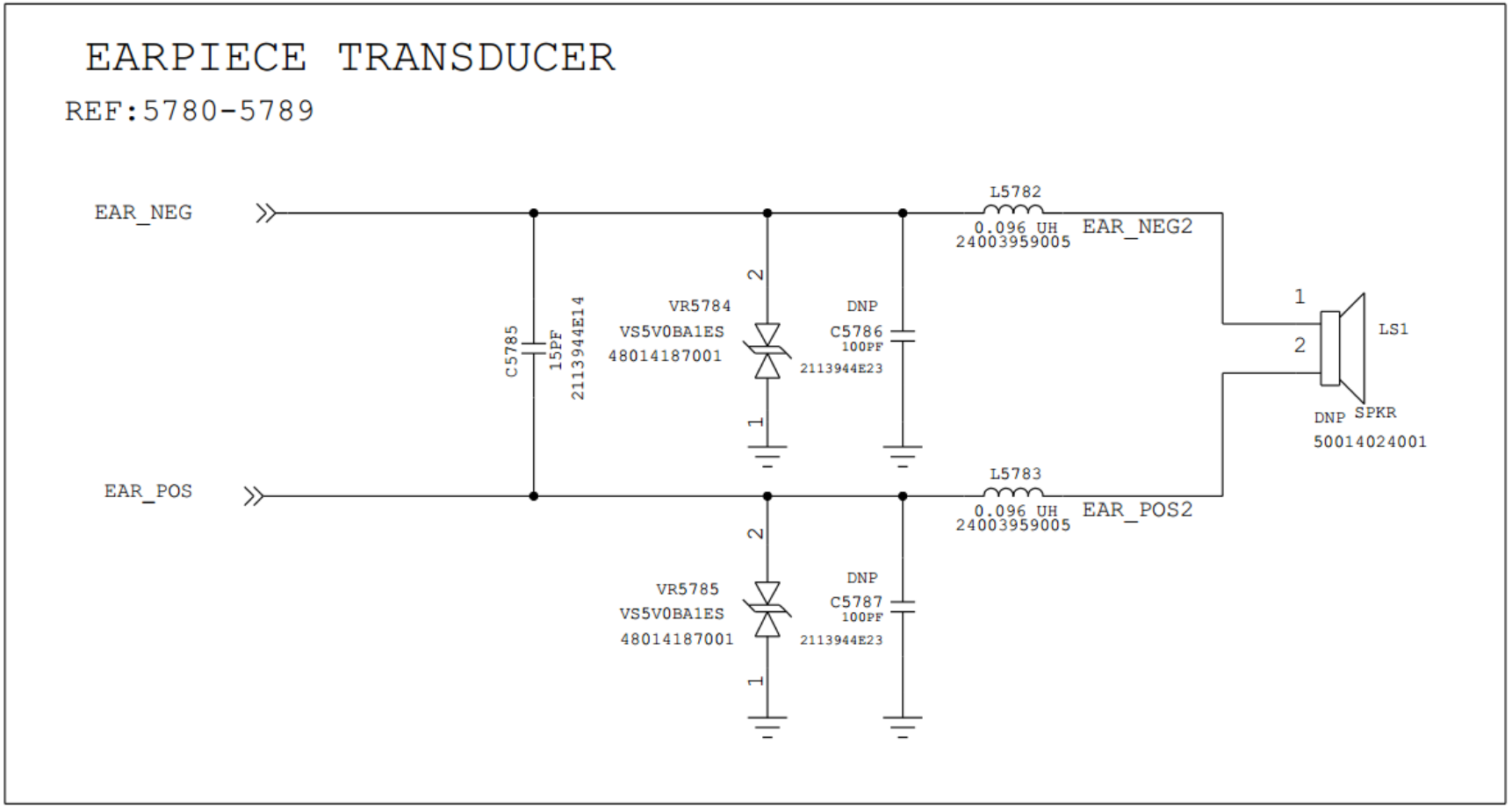
The “second MIC” setting loops mic2 to the earpiece.

3.) Listen for second mic audio in handset earpiece.

4.) Block the second mic with tape, listen earpiece audio. If second mic is sealed, there will be no/very low audio in Handset earpiece.

If second mic seal is broken, block and unblock audio level almost same.

Earpiece


EARPIECE TRANSDUCER
REF:5780-5789
EAR_NEG
EAR_POS
C5785
15PF
2113944E14
VR5784
VS5V0BA1ES
48014187001
VR5785
VS5V0BA1ES
48014187001
DNP
C5786
100PF
2113944E23
DNP
C5787
100PF
2113944E23
L5782
0.096 UH
24003959005
L5783
0.096 UH
24003959005
EAR_NEG2
EAR_POS2
LS1
DNP SPKR
50014024001

Earpiece

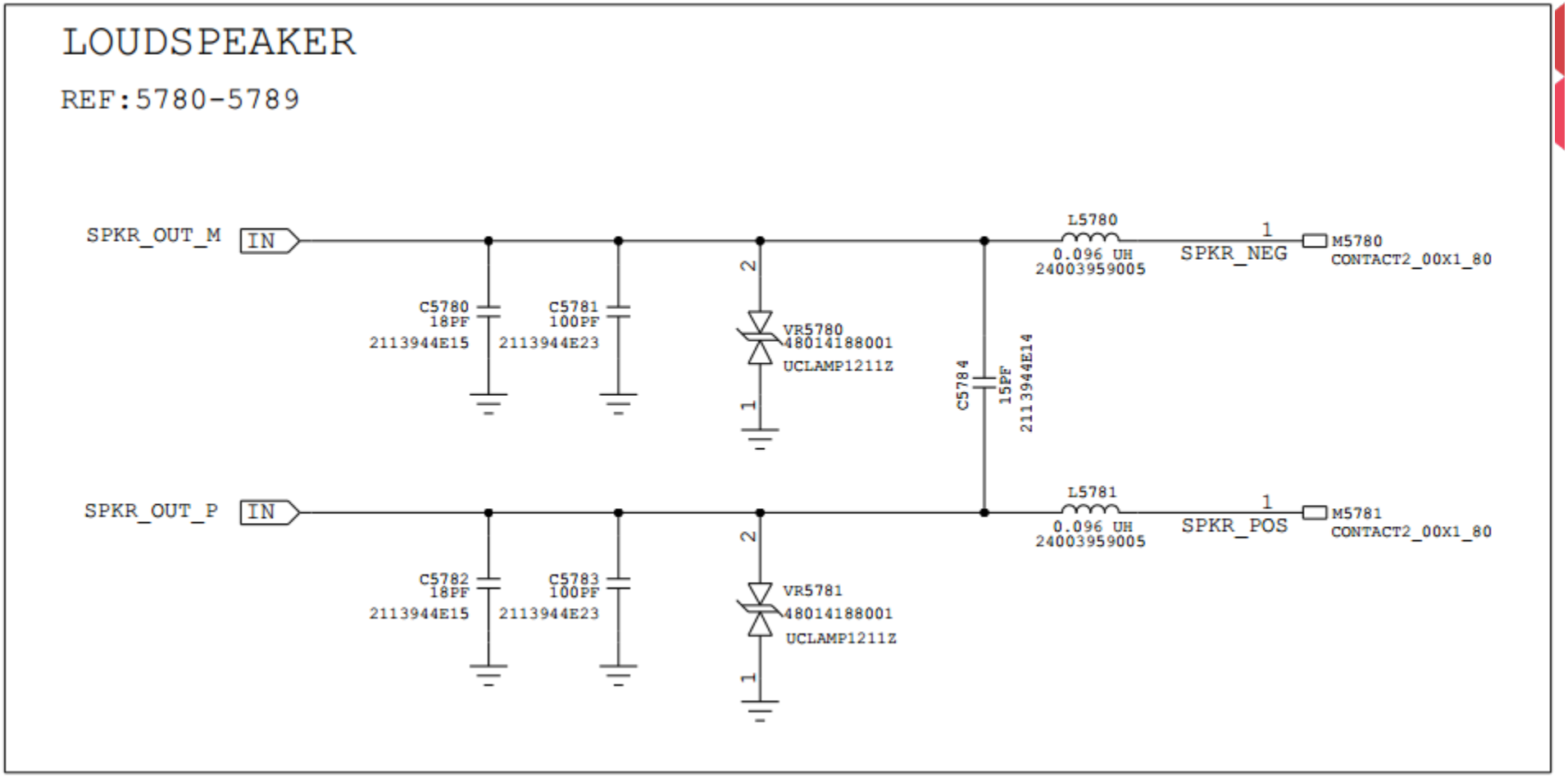
- The earpiece circuit is placed on the daughter board.

- The earpiece speaker have series 0.096uH inductors (L5782, L5783) components. There are shunt components to ground that can be checked (C5786, C5787, and VR5784,VR5785).

- The earpiece speaker has a nominal impedance of about 32Ω.

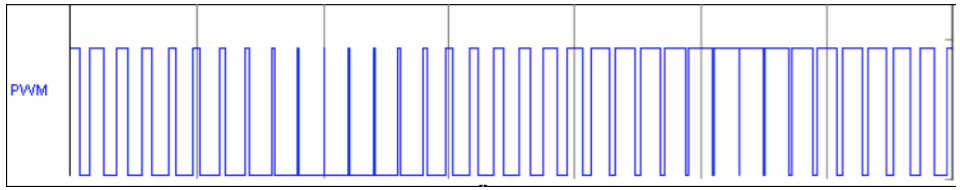
- This is a linear amplifier output, where playing a tone would produce a clean AC output voltage.

Loudspeaker



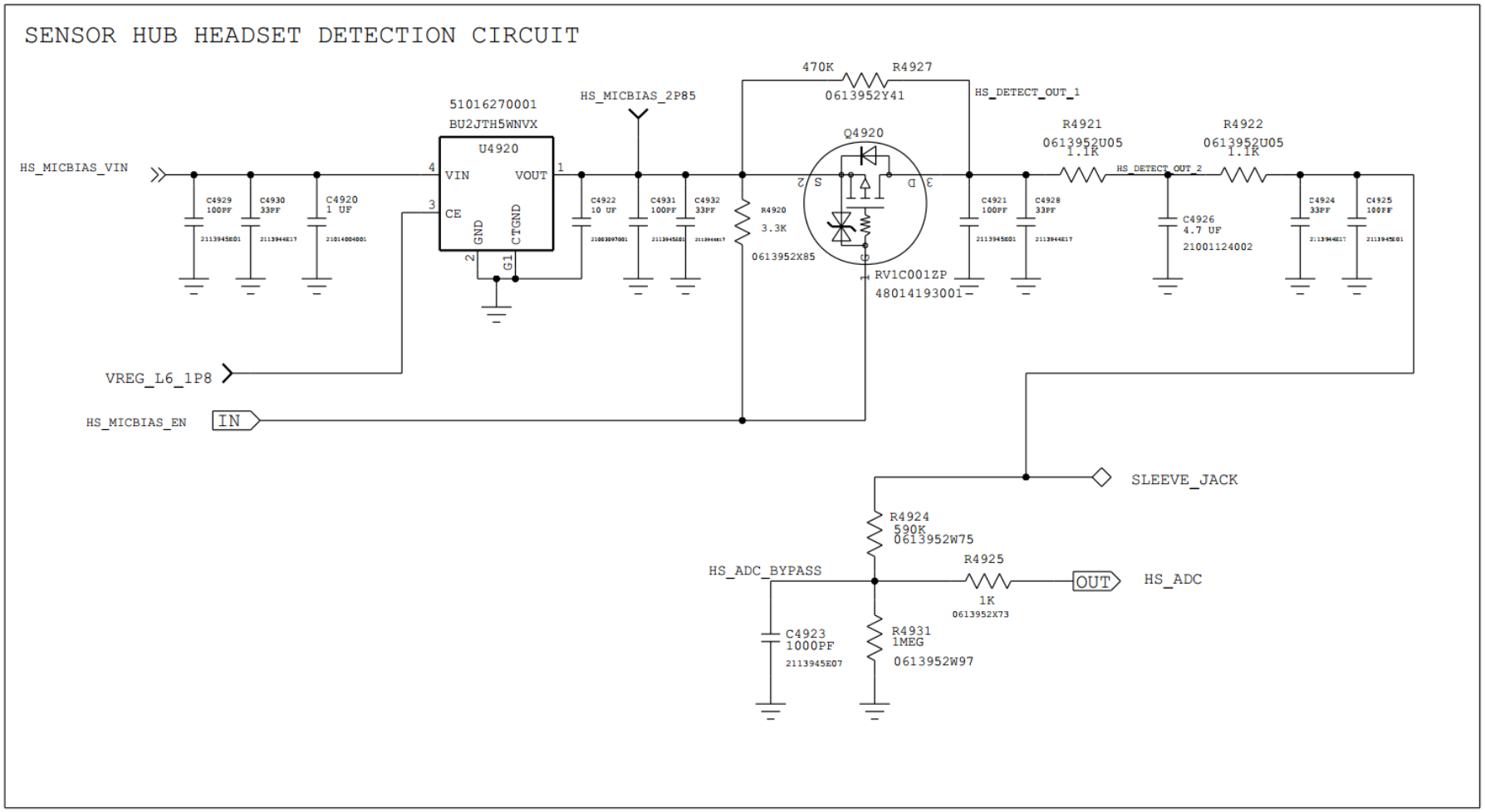
Loudspeaker

- The loudspeaker can be probed at L5780 and L5781
- The impedance of the loudspeaker should be around 8Ω when probing on the component
- The output is a class D waveform (sample wave shown below)

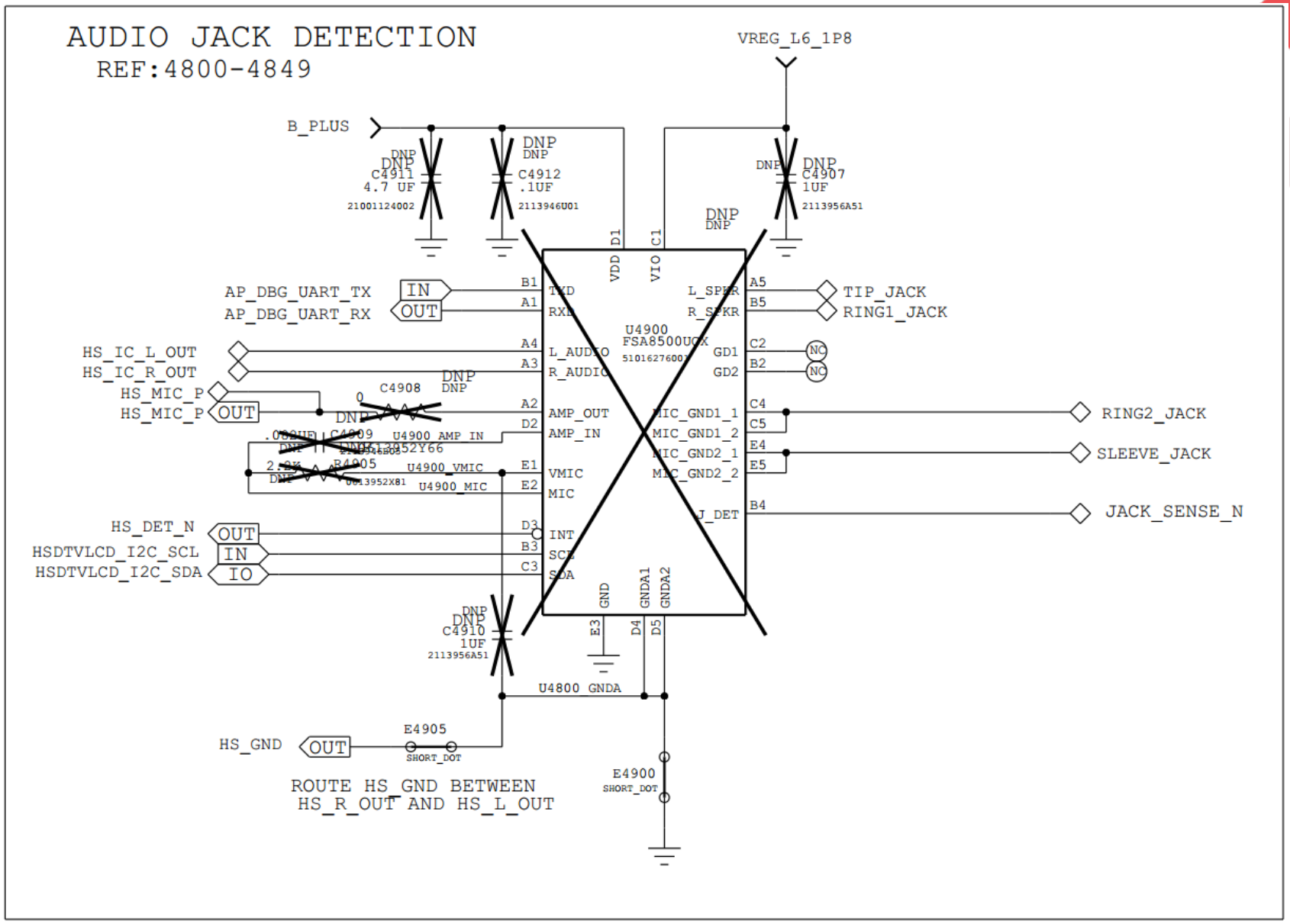


3.5mm Headset Jack

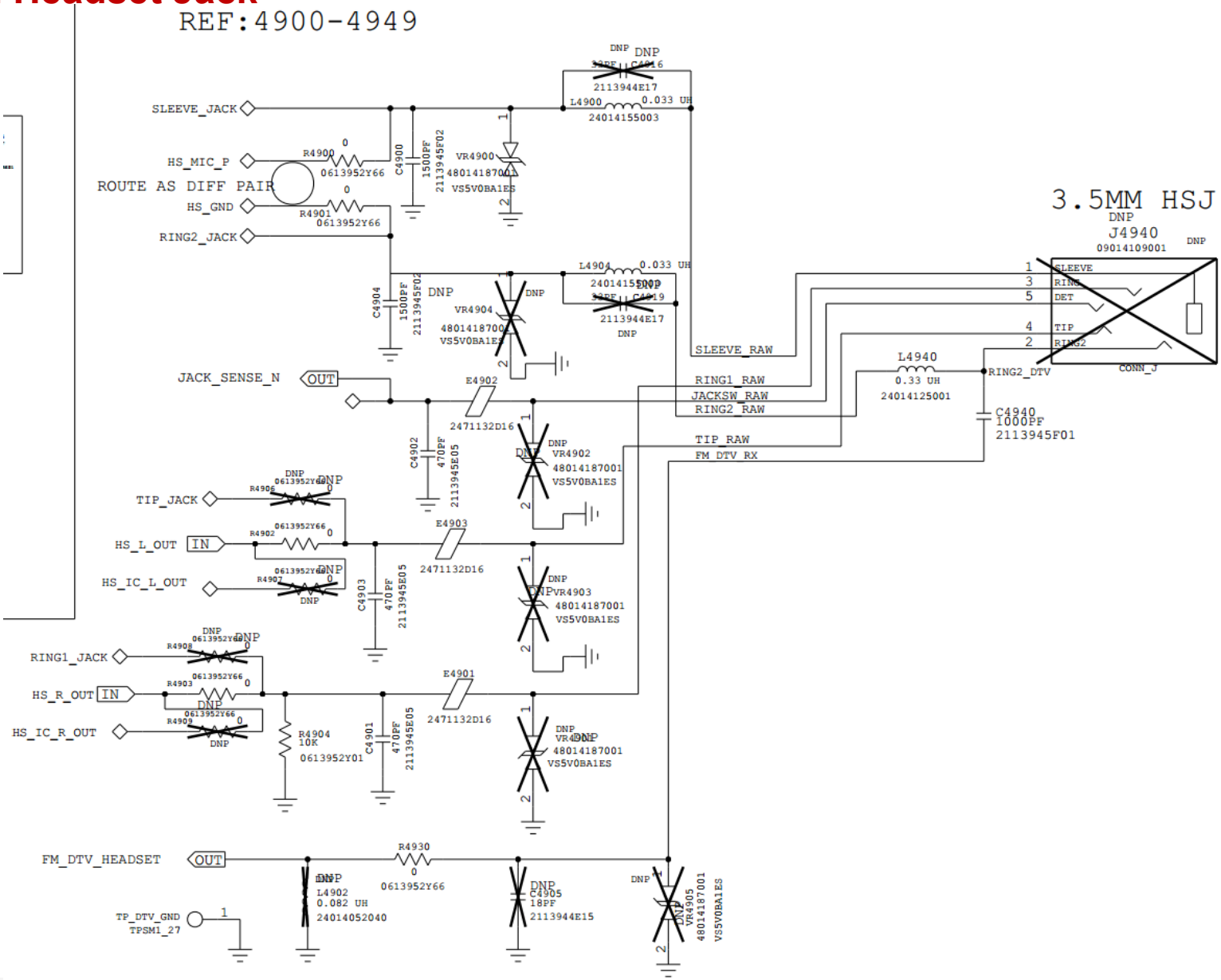
3.5MM HEADSET



3.5mm Headset Jack



3.5mm Headset Jack



HEADSET JACK TROUBLESHOOTING

Phone Level Headset Troubleshooting

- When no headset Inserted:

  Measure voltage at Sleeve_Jack ,voltage should be around 2.3 volt.

- When headset is Inserted:

  Measure voltage at Sleeve_jack, voltage should be around 1.07 volt ~2.4volt(depending on mic impedance of the headset used)

PCB Level Troubleshooting

- **Measure voltage at pin 3 of (LDO) U4920.**

  If pin3 voltage is 1.8 volt,U4920 is enable/ON

  If pin3 voltage is 0 volt,U4920 is disable/OFF

  LDO is only ON when sensor HUB detects headset inserted and turn ON.

  LDO is turn OFF by sensor Hub when headset is detected to be removal

- **Measure voltage across Ref Des R4931(HS_ADC)**:

  When no headset inserted: Voltage across R4931 should be 1.63 volt

  When headset inserted: Voltage across R4931 should be 0.73volt~1.63 volt depending on the headset mic impedance.