PRELIMINARY DATA SHEET

RR88643-21 MMMB Power Amplifier Module

Application and Features:

- Support LTE, WCDMA, CDMA, TDSCDMA applications
- CDMA Bands BC0, BC1, BC4, BC6, BC10, BC15
- WCDMA Bands I, II, III, IV, V, VIII, IX
- TD-SCDMA Bands 34, 39
- FDD LTE Bands 1, 2, 3, 4, 5, 7, 8, 9, 12, 13, 17, 20, 25, 26, 28, 30
- TDD LTE Band 34, 38, 39, 40, 41
- Integrated Input LB Switch
- Integrated HB 2RX Switch
- Optimized for APT DCDC operation
- Support MIPI RFFE
- Compact Low Profile Package Dimension
  - 4.0 x 6.8 x 0.75 mm
  - 42-pad configuration

Block Diagram:

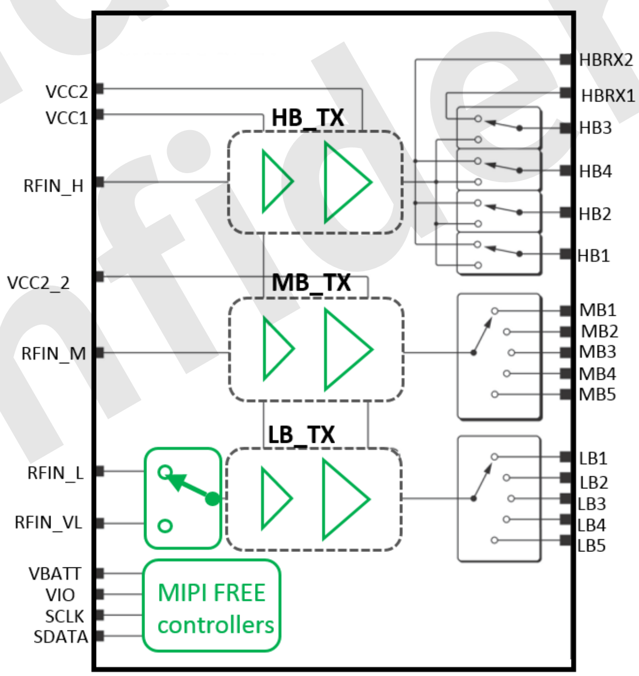

Figure 1. RR88643 Functional Block Diagram

Electrical Spec:

The following table shows the RR88643 absolute max condition.

Table 1. RR88643 Absolute Max Conditions

Parameter		Label	Min	Typical	Max	Unit
RF Input Power		P_{IN}		0	15	dBm
Supply Voltage	No RF	V_{BATT}		3.8	6.0	Volts
		V_{CC1}, V_{CC2},		3.4	6.0	
	With RF	V_{BATT}		3.8	6.0	
		V_{CC1}, V_{CC2},		3.4	5.5	
Digital Control Signal		VIO, SCLK, SDATA			2	Volts
Temperature	Operating	T_{CASE}	-40	25	+100	°C
	Storage	T_{STG}	-40		+150	
HBM ESD		ESD_{HBM}	-1		+1	kV

1 *Exposure to Max rating conditions for ETCended periods may reduce device reliability. There is no damage to device with only one parameter set at the limit and all other parameters set at or below their Typical value.*

2 *Case Operating Temperature (T_{CASE}) refers to the temperature of the GROUND PAD at the underside of the package.*

Table 2. RR88643 Recommended Operating Conditions

Parameter		Label	Min	Typical	Max	Unit
Supply Voltage		V_{CC1}	0.55	3.4	4.8	Volts
		V_{CC2}	0.55	3.4	4.8	
		V_{BATT}	3.0	3.8	4.8	
MIPI RFFE Supply		VIO	1.65	1.8	1.95	Volts
MIPI RFFE Signal Voltage for SCLK, SDATA	Low	V_{MIPI_LOW}	0	0	0.2xVIO	Volts
	High	V_{MIPI_HIGH}	0.8xVIO	1.8	VIO	
Leakage Current	V_{BATT} = 3.4 V	I_BATT_LK			10	µA
	V_{CC1}, V_{CC2}, V_{CC2} = 3.4 V	I_CC_LK			10	
Case Operating Temperature Range		T_{RANGE}	-40	+25	+90	°C

Table 3-0. RR88643 General Electrical Specifications

Parameter		Label	Condition	Min	Typical	Max	Unit
Turn On Time		T_{ON}	Gain settled to within 0.5 dB of GP(POUT = Prated)			5	µS
Turn Off Time		T_{OFF}	Gain ≤ G_P(P_{OUT} = Prated) – 30 dB			5	µS
Mode Switching Time		T_{MODE}	Time to transition from HPM to LPM or LPM to HPM by changing state of Reg 0 [1]			5	µS
Switching Time		T_{SW}	Time to transition from I_{SO} to RX, I_{SO} to TX, TX to RX, RX to TX, RX to I_{SO}, and TX to I_{SO}			3	µS
Quiescent Current	LB	I_{QLB}	I_{BATT}+ I_{CC1}+ I_{CC2_1} + I_{CC2_2}[1]		70		mA
	MB	I_{QMB}	I_{BATT}+ I_{CC1}+ I_{CC2_1} + I_{CC2_2}[1]		90		mA
	HB	I_{QHB}	I_{BATT}+ I_{CC1}+ I_{CC2_1} + I_{CC2_2}[1]		130		mA

1 LB tested using Band 8 LTE bias settings, MB tested using Band 1 LTE bias settings and HB tested using Band 7 LTE bias settings. Other bands and modes may vary.

Table 3-1. MIPI RFFE Standard Register Map

Register Address	Register Name	Bit Position	Description	Default	Notes	Trigger Support	R/W
0x00	PA Mode Control	[7]	Trigger Select	0	0 = Trigger 0,1,2 or'd together 1 = Trigger 0,1,2 fire independently	Trigger 0	R/W
		[6:3]	PA Band Select Control Mode	0000	0000 = PA's Disabled 0001 = LB1_TX 0010 = LB2_TX 0011 = LB3_TX 0100 = LB4_TX 0101 = LB5_TX 0110 = MB1_TX 0111 = MB2_TX 1000 = MB3_TX 1001 = MB4_TX 1010 = MB5_TX 1011 = HB1_TX 1100 = HB2_TX 1101 = HB3_TX 1110 = HB4_TX 1111 = PA's Disabled (High Switch Isolation)		
		[2]	PA Enable	0	0 = PA OFF 1 = PA ON		
		[1]	Power Mode	0	0 = HPM 1 = LPM		
		[0]	LB Input Switch	0	0 = RFIN_L (Default for MHB Operation) 1 = RFIN_VL		
0x01	Primary PA Bias	[7:4]	PA Stage 2 Bias	0000		Trigger 0	R/W
		[3:0]	PA Stage 1 Bias	0000			
0x02	HB Switch RX Control	[7:4]	Reserved	00	Reserved	Trigger 0	R/W
		[3:0]	HB Switch RX Control	0000	0000 = Switch Off (Standby) 0001 = HB1 -> HBRX2 0010 = HB2 -> HBRX2 0011 = HB3 -> HBRX1 0100 = HB4 -> HBRX2 Other States = High Switch Isolation		
0x03	Bias Control	[7]	Bias Mode	0	0 = Limited Bias Mode 1 = Standard Bias Mode	Trigger 0	R/W
		[6:4]	Reserved	0	Reserved		
		[3:0]	PA Boost Stage Bias (IBST)	0000	Details in Bias Table 1		
0x04	Reserved	[7:0]	Reserved	0	Reserved	Trigger0	R/W
0x05	Reserved	[7:0]	Reserved	0	Reserved	Trigger0	R/W
0x06	Reserved	[7:0]	Reserved	0	Reserved	Trigger0	R/W
0x1C	PM_TRIG	[7:6]	PWR_MODE	10	00 = Normal Operation (Active) 01 = Default Settings (Startup) 10 = Low Power 11 = Reserved	NO	R/W
		[5]	Trigger Mask 2	0	0 = Trigger Enable 1 = Trigger Disable		
		[4]	Trigger Mask 1	0	0 = Trigger Enable 1 = Trigger Disable		
		[3]	Trigger Mask 0	0	0 = Trigger Enable 1 = Trigger Disable		
		[2]	Trigger Register 2	0	1 = Latch Register 2 Contents		
		[1]	Trigger Register 1	0	1 = Latch Register 1 Contents		
		[0]	Trigger Register 0	0	1 = Latch Register 0 Contents		
0x1D	Product ID	[7:0]	Product ID	00101101	Product ID = 0x2D	NO	R
0x1E	Manufacture ID	[7:0]	Manufacture ID [7:0]	11110011	Manufacture ID = 0x3F3	NO	R
0x1F	User ID	[7:6]	Reserved	00		NO	R/W
		[5:4]	Manufacture ID [9:8]	11	Manufacture ID = 0x3F3		R
		[3:0]	USID	1111	USID=0x0F		
0x20	EXT_Product ID	[7:0]	Extend Product ID	00000000	EXT_product ID = 0x00	NO	R

LB Electrical Spec:

Table 4. RR88643 Electrical Specifications for NTC – Transmit WCDMA Low Band

VBATT = 3.4 V; TCASE = +25 °C; Voice RMC 12.2 kbps

Parameter		Label	Conditions	Min	Typ	Max	Units
Frequency	Band 5	ƒo		824		849	MHz
	Band 8			880		915	
Max Output Power	Bands 5, 8	Prated_NTC		29			dBm
		Prated_ETC	VBATT = VCC = 3.0 V, TCASE = TRANGE	28.5			
Power Gain		GP_NTC	POUT = Prated	27.5		32.0	dB
		GP_ETC	POUT = Prated, TCASE = TRANGE	26.5		33.0	
		GP_LOW	VCC = 0.55 V, POUT = 3 dBm,		18	20.0	dB
Power Added Efficiency[1]		PAE_APT	pout= Prated		42		%
Total Supply Current[2]		Itotal_MAX	pout= Prated, VBATT = 3.8 V				mA
Adjacent Channel Leakage power Ratio	5 MHz offset	ACLR1	POUT = Prated		-39	-36	dBc
			POUT = Prated _ETC, VBATT = VCC = 3.0 V, TCASE = TRANGE			-36	
	10 MHz offset	ACLR2	POUT = Prated		-50	-48	
			POUT = Prated _ETC, VBATT = VCC = 3.0 V, TCASE = TRANGE			-46	
Modulation Accuracy		EVM	VBATT = 3.0 V to 4.8 V, Load = 50 ohms, TCASE = TRANGE		2.5	5.0	%
Harmonics	Second	2ƒo	POUT ≤Prated		-15	-13	dBm
	Third	3ƒo			-21	-17	
	Fourth and higher	4ƒo				-20	
Noise Power in Rx Band at Duplex Frequency with WCDMA Modulated Tx							dBm/Hz
B5 ƒTX = 824–849 MHz		PNOISE_DPX	ƒRX = ƒTX +45 MHz		-132		
B8 ƒTX = 880–915 MHz			ƒRX = ƒTX +45 MHz		-132		
Input VSWR		VSWR_IN	POUT ≤Prated		1.6:1	2:1	VSWR
Stability		S	No oscillations, all spurious < –36 dBm, POUT ≤Prated, VBATT = 3.0 V to 4.8 V, TCASE = TRANGE	6:1			VSWR
Ruggedness		Ru	No permanent damage to module. POUT ≤Prated, constant forward power, closed loop operation, VBATT = VCC = 4.8 V, TCASE = +25 °C	10:1			VSWR

1 VCC optimized for ACLR1 = –40 dBc.

2 I_TOT = IBATT + (ICC1 + ICC2)(VCC/VBATT)(1/DC_DC_EFF). VCC ~ 2.9 V. DC_DC_EFF ~ 96%.

Table 5-0. RR88643 Electrical Specifications for NTC – Transmit LTE Low Band

VBATT = 3.4 V; TCASE = +25 °C; LTE Signal = QPSK/10 MHz/12RB for MPR = 0 and QPSK/20 MHz/100RB for MPR = 1.

Parameter		Label	Conditions	Min	Typ	Max	Units
Frequency	Band 5	$f0$		824		849	MHz
	Band 8			880		915	
	Band 12			699		716	
	Band 13			777		787	
	Band 17			704		716	
	Band 20			832		862	
	Band 26			814		849	
	Band 28			703		748	
Max Output Power	Bands 20, 28	Prated		28			dBm
		Prated_ETC	VBATT = VCC = 3.0 V, TCASE = TRANGE	26.5			
	Bands 5, 8, 12, 13, 17, 26	Prated		28			
		Prated_ETC	VBATT = VCC = 3.0 V, TCASE = TRANGE	26.5			
Power Gain	Bands12,13,17, 28	GP_NTC	POUT = Prated	28.0		32.0	dB
		GP_ETC	POUT = Prated, TCASE = TRANGE	27.0		33.3	
	Bands 5, 8, 20, 26	GP_NTC	POUT = Prated	27.5		32.0	
		GP_ETC	POUT = Prated, TCASE = TRANGE	26.5		33.5	
		GP_L0W	VCC = 0.55 V, POUT = 3 dBm			20.0	dB
Power Added Efficiency1	Band 12, 17, 28	PAE_APT	Prated		35		%
	Bands 5, 8, 13, 20, 26				35		
Total Supply Current2		I_TOT_MAX_B12,17	POUT = 27.0 dBm, VBATT = 3.8 V				mA
		I_TOT_MAX_B5,8,13, 26					
		I_TOT_MAX_B28	POUT = 27.5 dBm, VBATT = 3.8 V				
		I_TOT_MAX_B20					
Adjacent Channel Leakage power ratio	EUTRA	EUTRA_ACLR1	POUT = Prated		-38	-36	dBc
			POUT = Prated_ETC, VBATT = VCC = 3.0 V,TCASE = TRANGE			-33	
	UTRA1	UTRA_ACLR1	POUT = Prated		-40	-37	
			POUT = Prated_ETC, VBATT = VCC = 3.0 V,TCASE = TRANGE			-36	
	UTRA2	UTRA_ACLR2	POUT = Pratedsss		-43	-41	
			POUT = Prated_ETC, VBATT = VCC = 3.0 V, TCASE = TRANGE			-39	

锐石创芯 RADROCK

Table 5-1. RR88643 Electrical Specifications for NTC – Transmit LTE Low Band

VBATT = 3.4 V; TCASE = +25 °C; LTE Signal = QPSK/10 MHz/12RB for MPR = 0 and QPSK/20 MHz/100RB for MPR = 1.

Parameter			Label	Conditions	Min	Typ	Max	Units
Modulation Accuracy			EVM	V_{BATT} = 3.0 V to 4.8 V, Load = 50 ohms, T_{CASE} = T_{RANGE}		2.5	5.0	%
Harmonics	Second	Bands 12, 17, 28	2ƒo	P_{OUT} ≤ Prated			-15	dBm
		Bands 5, 8, 13, 20, 26					-20	
	Third		3ƒo				-20	
		Fourth and higher	4ƒo				-25	
Noise Power in Rx Band at Duplex Frequency with LTE[3]								dBm/Hz
		B5 f_{TX} = 824–849 MHz	P_{NOISE_DPX}	f_{RX} = f_{TX} + 45 MHz		-132		
		B26 f_{TX} = 814–849 MHz		f_{RX} = f_{TX} + 45 MHz		-132		
		B8 f_{TX} = 880–915 MHz		f_{RX} = f_{TX} + 45 MHz		-132		
		B13 f_{TX} = 777–787 MHz		f_{RX} = f_{TX} – 31 MHz		-132		
		B12/17 f_{TX} = 698–716 MHz		f_{RX} = f_{TX} + 30 MHz		-132		
		B20 f_{TX} = 832–862 MHz		f_{RX} = f_{TX} – 41 MHz		-132		
		B28 f_{TX} = 703–748 MHz		f_{RX} = 758–803 MHz		-132		
Input VSWR			$VSWR_{IN}$	P_{OUT} ≤ Prated			2:1	VSWR
Stability			S	No oscillations, all spurious < –36 dBm, P_{OUT} ≤ Prated, V_{BATT} = 3.0 V to 4.8 V, T_{CASE} = T_{RANGE}	6:1			VSWR
Ruggedness			Ru	No permanent damage to module. P_{OUT} ≤ Prated, constant forward power, closed loop operation, LTE 10 MHz QPSK 12RB modulation, V_{BATT} = V_{CC} = 4.8 V, T_{CASE} = +25 °C	10:1			VSWR

1 VCC optimized for ACLR1_UTRA = –40 dBc.

2 I_TOT = IBATT + (ICC1 + ICC2)(VCC/VBATT)(1/DC_DC_EFF). VCC ~ 2.95 V. DC_DC_EFF ~ 96%.

3 Measured with 10 MHz/1RB LTE Waveform.

Table 6. RR88643 Electrical Specifications for NTC – Transmit CDMA2000 Low Band

V_{BATT} = 3.4 V; T_{CASE} = +25 °C; 1x RC1

Parameter		Label	Conditions	Min	Typ	Max	Units
Frequency	Band BC0	f_0		815		849	MHz
	Band BC10			806		901	
Max Output Power		Prated		29.0			dBm
		Prated_ETC	V_{BATT} = V_{CC} = 3.0 V, T_{CASE} = T_{RANGE}	26.5			
Power Gain		GP_NTC	P_{OUT} = Prated	27.5		31.5	dB
		GP_ETC	P_{OUT} = Prated, T_{CASE} = T_{RANGE}	26.5		33.0	
		GP_LOW	V_{CC} = 0.55 V, P_{OUT} = 3 dBm		14.5	20.0	dB
Power Added Efficiency[1]		PAE_APT	pout= Prated		39.5		%
Total Supply Current[2]		I_TOT_MAX	pout= Prated, V_{BATT} = 3.8 V				mA
Adjacent Channel Leakage power Ratio	885 kHz offset	ACLR1	P_{OUT} = Prated		-50	-47	dBc
			P_{OUT} = Prated_ETC, V_{BATT} = V_{CC} = 3.0 V, T_{CASE} = T_{RANGE}			-45	
	1.98 MHz offset	ACLR2	P_{OUT} = Prated		-60	-58	
			P_{OUT} = Prated_ETC, V_{BATT} = V_{CC} = 3.0 V, T_{CASE} = T_{RANGE}			-57	
Modulation Accuracy		EVM	V_{BATT} = 3.0 V to 4.8 V, Load = 50 ohms, T_{CASE} = T_{RANGE}		2.5	5.0	%
Harmonics	Second	$2f_0$	P_{OUT} ≤ Prated, MBW = 1 MHz			-15	dBm
	Third	$3f_0$				-20	
	Fourth and higher	$4f_0$				-30	
Noise Power in Rx Band at Duplex Frequency							dBm/Hz
	BC0 f_{TX} = 815 MHz –849 MHz	PNOISE_DPX	f_{RX} = f_{TX} +45 MHz		-133		
	BC10 f_{TX} = 806 MHz –901 MHz		f_{RX} = f_{TX} +45 MHz		-133		
Input VSWR		VSWR_IN	P_{OUT} ≤ Prated		1.6:1	2:1	VSWR
Stability		S	No oscillations, all spurious < –36 dBm, P_{OUT} ≤ Prated, V_{BATT} = 3.0 V to 4.8 V, T_{CASE} = T_{RANGE}	6:1			VSWR
Ruggedness		Ru	No permanent damage to module. P_{OUT} ≤ Prated, constant forward power, closed loop operation,	10:1			VSWR
			V_{BATT} = V_{CC} = 4.8 V, T_{CASE} = +25 °C				

1 *V_{CC} optimized for ACLR1 = –50 dBc.*

2 *I_TOT = I_{BATT} + (I_{CC1} + I_{CC2})(V_{CC}/V_{BATT})(1/DC_DC_EFF). VCC = TBD. DC_DC_EFF ~ 96%. .*

MB Electrical Spec:

Table 7. RR88643 Electrical Specifications for NTC –Transmit WCDMA Mid-Band

VBATT = 3.4 V; TCASE = +25 °C; Voice RMC 12.2 kbps

Parameter		Label	Conditions	Min	Typ	Max	Units
Frequency	Band 1	ƒo		1920		1980	MHz
	Band 2			1850		1910	
	Band 3			1710		1785	
	Band 4			1710		1755	
Max Output Power	Band 1, 4	Prated		29.0			dBm
		Prated_ETC	VBATT = VCC = 3.0 V, TCASE = TRANGE	28			
	Bands 2, 3	Prated		29			
		Prated_ETC	VBATT = VCC = 3.0 V, TCASE = TRANGE	28.0			
Power Gain		GP_NTC	POUT = Prated	27.0		31.0	dB
		GP_ETC_B2,3,4	POUT = Prated, TCASE = TRANGE	26.0		32.5	
		GP_ETC_B1		25.5		32.5	
		GP_LOW	VCC = 0.55 V, POUT = 3 dBm			20.0	
Power Added Efficiency[1]		PAE_APT_B1	pout= Prated		41		%
		PAE_APT_B2,3,4			41		
Total Supply Current[2]		I_TOT_MAX_B1	POUT = 28 dBm, VBATT = 3.8 V				mA
		I_TOT_MAX_B2,3	POUT = 28.5 dBm, VBATT = 3.8 V				
		I_TOT_MAX_B4	POUT = 28 dBm, VBATT = 3.8 V				
Adjacent Channel Leakage power Ratio	5 MHz offset	ACLR1	POUT = Prated		-40	-38	dBc
			POUT = Prated_ETC, VBATT = VCC = 3.0 V, TCASE = TRANGE			-36	
	10 MHz offset	ACLR2	POUT = Prated		-52	-48	
			POUT = Prated_ETC, VBATT = VCC = 3.0 V, TCASE = TRANGE			-46	
Modulation Accuracy		EVM	VBATT = 3.0 V to 4.8 V, Load = 50 ohms, TCASE = TRANGE		2.5	5.0	%
Harmonics	Second	2ƒo	POUT ≤ Prated			-15	dBm
	Third	3ƒo				-20	
	Fourth and higher	4ƒo				-20	
Noise Power in Rx Band at Duplex Frequency with WCDMA Modulated Tx							dBm/Hz
	B1 ƒTX = 1920–1980 MHz	PNOISE_DPX	ƒRX = ƒTX +190 MHz		-133.5		
	B2 ƒTX = 1850–1910 MHz		ƒRX = ƒTX +80 MHz		-133.0		
	B3 ƒTX = 1710–1785 MHz		ƒRX = ƒTX +95 MHz		-132.5		
	B4 ƒTX = 1710–1755 MHz		ƒRX = ƒTX +400 MHz		-137.0		
Input VSWR		VSWR_IN	POUT ≤ Prated			2:1	VSWR
Stability		S	No oscillations, all spurious < –36 dBm, POUT ≤ Prated, VBATT = 3 V to 4.8 V, TCASE = TRANGE	6:1			VSWR
Ruggedness		Ru	No permanent damage to module. POUT ≤ Prated, constant forward power, closed loop operation, VBATT = VCC = 4.8 V, TCASE = +25 °C	10;1			VSWR

1 VCC optimized for ACLR1 = –40 dBc.

2 I_TOT = IBATT + (ICC1 + ICC2)(VCC/VBATT)(1/DC_DC_EFF). VCC ~ 3.1 V. DC_DC_EFF ~ 96%

Table 8. RR88643 Electrical Specifications for NTC – Transmit LTE Mid-Band

VBATT = 3.4 V; TCASE = +25 °C; LTE Signal = QPSK/10 MHz/12RB for MPR = 0 and QPSK/20 MHz/100RB for MPR = 1.

Parameter		Label	Conditions	Min	Typ	Max	Units
Frequency	Band 1	ƒ0		1920		1980	MHz
	Band 2			1875		1910	
	Band 3			1710		1785	
	Band 4			1710		1755	
	Band 25			1850		1915	
Max Output Power	Band 1	Prated		28			dBm
		Prated_ETC	VBATT = VCC = 3.0 V, TCASE = TRANGE	26.5			
	Bands 2, 3, 4, 25	Prated		28			
		Prated_ETC	VBATT = VCC = 3.0 V, TCASE = TRANGE	26.5			
Power Gain		GP_NTC	POUT = Prated	27.5		31.5	dB
		GP_ETC	POUT = Prated, TCASE = TRANGE	26.5		33.0	
		GP_LOW	VCC = 0.55 V, POUT = 3 dBm		15.0	20.0	dB
Power Added Efficiency[1]	Band 1, 4	PAE_APT	Prated		36		%
	Band 2, 3, 25				36		
Total Supply Current[2]		I_TOT_MAX_B1	POUT = 27.0 dBm, VBATT = 3.8 V				mA
		I_TOT_MAX_B2,3,25	POUT = 27.5 dBm, VBATT = 3.8 V				
		I_TOT_MAX_B4	POUT = 27.0 dBm, VBATT = 3.8 V				
Adjacent Channel Leakage power Ratio	EUTRA	EUTRA_ACLR1	POUT = Prated		-38	-36	dBc
			POUT = Prated_ETC, VBATT = VCC = 3.0 V, TCASE = TRANGE			-33	
	UTRA1	UTRA_ACLR1	POUT = Prated		-40	-37	
			POUT = Prated_ETC, VBATT = VCC = 3.0 V, TCASE = TRANGE			-36	
	UTRA2	UTRA_ACLR2	POUT = Prated		-43	-41	dBc
			POUT = Prated_ETC, VBATT = VCC = 3.0 V, TCASE = TRANGE			-39	
Modulation Accuracy		EVM	VBATT = 3.0 V to 4.8 V, Load = 50 ohms, TCASE = TRANGE		3.0	5.0	%
Harmonics	Second	2ƒo	POUT ≤ Prated	-25	-10	-12	dBm
	Third	3ƒo		-40	-30	-15	
	Fourth and higher	4ƒo				-20	
Noise Power in Rx Band at Duplex Frequency with LTE[3]							dBm/Hz
	B1 ƒTX = 1920–1980 MHz	PNOISE_DPX	ƒRX = ƒTX +190 MHz		-133		
	B2 ƒTX = 1850–1910 MHz		ƒRX = ƒTX +80 MHz		-131		

B25 f_{TX} = 1850–1915 MHz		f_{RX} = f_{TX} +80 MHz		-131.5		
B3 f_{TX} = 1710–1785 MHz		f_{RX} = f_{TX} +95 MHz		-132.6		
B4 f_{TX} = 1710–1755 MHz		f_{RX} = f_{TX} +400 MHz		-136		
Input VSWR	$VSWR_{IN}$	P_{OUT} ≤ Prated		1.3:1	2:1	VSWR
Stability	S	No oscillations, all spurious < –36 dBm, P_{OUT} ≤ Prated, V_{BATT} = 3.0 V to 4.8V, T_{CASE} = T_{RANGE}	6:1			VSWR
Ruggedness	Ru	No permanent damage to module. P_{OUT} ≤ Prated, constant forward power, closed loop operation, LTE 10 MHz QPSK 12RB modulation, V_{BATT} = V_{CC} = 4.8 V, T_{CASE} = +25 °C	10:1			VSWR

1 *V_{CC} optimized for $ACLR1_{UTRA}$ = –40 dBc.*

2 *I_{TOT} = I_{BATT} + (I_{CC1} + I_{CC2})(V_{CC}/V_{BATT})(1/DC_DC_EFF). VCC ~3.2 V. DC_DC_EFF ~ 96%.*

3 *Measured with 10 MHz/1RB LTE Waveform.*

Table 9. RR88643 Electrical Specifications for NTC – TD-SCDMA Bands 34, 39

VBATT = 3.4 V; TCASE = +25 °C; Voice Modulation

Parameter		Label	Conditions	Min	Typ	Max	Units
Frequency	Band 34	ƒo		2010		2025	MHz
	Band 39			1880		1920	
Max Output Power		Prated		29			dBm
		Prated_ETC	VBATT = VCC = 3.0 V, TCASE = TRANGE	27.5			
Power Gain		GP_NTC	POUT = Prated	27.0		31.0	dB
		GP_ETC	POUT = Prated, TCASE = TRANGE	26.0		32.5	
		GP_LOW	VCC = 0.55 V, POUT = 3 dBm			20.0	dB
Power Added Efficiency1	Band 34	PAE_APT	POUT = Prated		39.5		%
	Band 39				42		
Total Supply Current[2]		I_TOT_MAX_34	POUT = Prated, VBATT = 3.8 V				mA
		I_TOT_MAX_39					
Adjacent Channel Leakage Power Ratio	1.6 MHz offset	ACLR1	POUT = Prated		-40	-38	dBc
			POUT = Prated_ETC, VBATT = VCC = 3.0 V, TCASE = TRANGE			-36	
	3.2 MHz offset	ACLR2	POUT = Prated		-52	-48	
			POUT = Prated_ETC, VBATT = VCC = 3.0 V, TCASE = TRANGE			-46	
Modulation Accuracy		EVM	VBATT = 3.0 V to 4.8 V, Load = 50 ohms, TCASE = TRANGE		2.5	5.0	%
Harmonics	Second	2ƒo	POUT ≤ Prated			-13	dBm
	Third	3ƒo				-20	
	Fourth and higher	4ƒo				-20	
Input VSWR		VSWR_IN	POUT ≤ Prated		1.3:1	2:1	VSWR
Stability		S	No oscillations, all spurious < –36 dBm, POUT ≤ Prated, VBATT = 3.0 V to 4.8 V, TCASE = TRANGE	6:1			VSWR
Ruggedness		Ru	No permanent damage to module. POUT ≤ Prated, constant forward power, closed loop operation,	10:1			VSWR
			VBATT = VCC = 4.8 V, TCASE = +25 °C				

1 VCC optimized for ACLR1 = –40 dBc.

2 I_TOT = IBATT + (ICC1 + ICC2)(VCC/VBATT)(1/DC_DC_EFF). VCC ~ 3.1 V. DC_DC_EFF ~ 96%.

Table 10. RR88643 Electrical Specifications for NTC – Transmit TDD-LTE Bands 34, 39

VBATT = 3.4 V; TCASE = +25 °C; LTE Signal = QPSK/10 MHz/12RB for MPR = 0, QPSK/15 MHz/75RB (B34) and QPSK/20 MHz/100RB (B39) for MPR = 1.

Parameter		Label	Conditions	Min	Typ	Max	Units
Frequency	Band 39	ƒo		1880		1920	MHz
	Band 34			2010		2025	
Max Output Power		Prated		28			dBm
		Prated_ETC	VBATT = VCC = 3.0 V, TCASE = TRANGE	26.5			
Power Gain		GP_NTC	POUT = Prated	27.5		31.0	dB
		GP_ETC	VBATT = VCC = 3.0 V, POUT = Prated, TCASE = TRANGE	26.5		32.5	
		GP_LOW	VCC = 0.55 V, POUT = 3 dBm		15.0	20.0	dB
Power Added Efficiency[1]		PAE_APT	pout= Prated		35		%
Total Supply Current[2]		I_TOT_MAX_B39	pout= Prated, VBATT = 3.8 V				mA
		I_TOT_MAX_B34					
Adjacent Channel Leakage power Ratio	E-UTRA	E-UTRA_ACLR1	POUT = Prated		-38	-36	dBc
			POUT = Prated_RANGE, VBATT = VCC = 3.0 V, TCASE = TRANGE			-33	
		E-UTRA_ACLR1_CA	POUT = Prated, Modulation = QPSK/35 MHz/175RB (B39)		-40		
	UTRA1	UTRA_ACLR1	POUT = Prated		-40	-37	
			POUT = Prated_RANGE, VBATT = VCC = 3.0 V, TCASE = TRANGE			-36	
	UTRA2	UTRA_ACLR2	POUT = Prated		-43	-41	
			POUT = Prated_RANGE, VBATT = VCC = 3.0 V, TCASE = TRANGE			-39	
Modulation Accuracy		EVM	VBATT = 3.0 to 4.8 V, Load = 50 ohms, TCASE = TRANGE		2.5	5	%
Harmonics	Second	2ƒo	POUT = Prated		-16	-13	dBm
	Third	3ƒo			-23	-15	
	Fourth and higher	4ƒo				-20	
Input VSWR		VSWR_IN	POUT ≤ Prated			2：1	VSWR
Stability		S	No oscillations, all spurious < –36 dBm, POUT ≤ Prated, VBATT = 3.0 V to 4.8V, TCASE = TRANGE	6：1			VSWR
Ruggedness		Ru	No permanent damage to module. POUT ≤ Prated, constant forward power, closed loop operation,	10：1			VSWR
			VBATT = VCC = 4.8 V, TCASE = +25 °C				

1 VCC optimized for ACLR1_UTRA = –40 dBc.

2 I_TOT = IBATT + (ICC1 + ICC2)(VCC/VBATT)(1/DC_DC_EFF). VCC ~ 3.4 V. DC_DC_EFF ~ 96%.

Table 11. RR88643 Electrical Specifications for NTC – Transmit CDMA2000 Mid-Band

V_{BATT} = 3.4 V; T_{CASE} = +25 °C; 1x RC1

Parameter		Label	Conditions	Min	Typ	Max	Units
Frequency	Band BC15	f_0		1710		1755	MHz
	Band BC4			1750		1780	
	Band BC1			1850		1910	
	Band BC6			1920		1980	
Max Output Power		P_{rated}		28.5			dBm
		P_{rated_ETC}	V_{BATT} = V_{CC} = 3.0 V, T_{CASE} = T_{RANGE}	27			
Power Gain	Bands BC6, BC15	G_{P_NTC}	P_{OUT} = P_{rated}	27.0		31.0	dB
		G_{P_ETC}	P_{OUT} = P_{rated}, T_{CASE} = T_{RANGE}	26.0		32.5	
	Bands BC1, BC4	G_{P_NTC}	P_{OUT} = P_{rated}	27.0		31.0	
		G_{P_ETC}	P_{OUT} = P_{rated}, T_{CASE} = T_{RANGE}	26.0		32.5	
Power Added Efficiency[1]		PAE_APT	pout= Prated		38		%
Total Supply Current[2]		I_{TOT_MAX}	pout= Prated, V_{BATT} = 3.8 V				mA
Adjacent Channel Leakage power Ratio	885 kHz offset	ACLR1	P_{OUT} = P_{rated}		-50	-47	dBc
			P_{OUT} = P_{rated_ETC}, V_{BATT} = V_{CC} = 3.0 V, T_{CASE} = T_{RANGE}			-45	
	1.98 MHz offset	ACLR2	P_{OUT} = P_{rated}		-60	-56	
			P_{OUT} = P_{rated_ETC}, V_{BATT} = V_{CC} = 3.0 V, T_{CASE} = T_{RANGE}			-55	
Modulation Accuracy		EVM	V_{BATT} = 3.0 V to 4.8 V, Load = 50 ohms, T_{CASE} = T_{RANGE}		2.5	5	%
Harmonics	Second	$2f_0$	P_{OUT} ≤ P_{rated}, MBW = 1 MHz		-16	-12	dBm
	Third	$3f_0$			-18	-13	
	Fourth and higher	$4f_0$				-20	
Noise Power in Rx Band at Duplex Frequency							dBm/Hz
	BC15 f_{TX} = 1710 MHz–1755 MHz	P_{NOISE_DPX}	f_{RX} = f_{TX} +400 MHz		-137		
	BC4 f_{TX} = 1750 MHz–1780 MHz		f_{RX} = f_{TX} +90 MHz		-133		
	BC1 f_{TX} = 1850 MHz–1910 MHz		f_{RX} = f_{TX} +80 MHz		-133		
	BC6 f_{TX} = 1920 MHz–1980 MHz		f_{RX} = f_{TX} +190 MHz		-133.5		
Input VSWR		$VSWR_{IN}$	P_{OUT} ≤ P_{rated}			2：1	VSWR
Stability		S	No oscillations, all spurious < –36 dBm,	6：1			VSWR
			P_{OUT} ≤ P_{rated}, V_{BATT} = 3.0 V to 4.8 V, T_{CASE} = T_{RANGE}				
Ruggedness		Ru	No permanent damage to module. P_{OUT} ≤ P_{rated}, constant forward power, closed loop operation,	10：1			VSWR
			V_{BATT} = V_{CC} = 4.8 V, T_{CASE} = +25 °C				

1 *V_{CC} optimized for ACLR1 = –50 dBc.*

2 *I_{TOT} = I_{BATT} + (I_{CC1} + I_{CC2})(V_{CC}/V_{BATT})(1/DC_DC_EFF). VCC = TBD. DC_DC_EFF ~ 96%.*

3

HB Electrical Spec:

Table 12. RR88643 Electrical Specifications for NTC – FDD LTE Band 7

VBATT = 3.4 V; TCASE = +25 °C; LTE Signal = QPSK/10 MHz/12RB for MPR = 0 and QPSK/20 MHz/100RB for MPR = 1.

Parameter		Label	Condition	Min	Typ	Max	Unit
Frequency		f_0		2500	2535	2537	MHz
Max Output Power		Prated	MPR = 0[1]	28			dBm
		Prated_ETC	VBATT = VCC = 3.0 V, TCASE = TRANGE	27.5			
Gain		GP_NTC	POUT = Prated, TCASE = +25 °C	27.5			dB
		GP_ETC	POUT = Prated, TCASE = TRANGE	26		30	
		GP_LOW	POUT = 3 dBm, VCC = 0.55 V	13	15.5	20.0	
Power Added Efficiency[2]		PAEAPT	POUT = Prated		32		%
Total Supply Current[3]		I_TOT_MAX	POUT = Prated, VBATT = 3.8 V				mA
Adjacent Channel Leakage power	E-UTRA	E-UTRA_ACLR1	POUT = Prated		-38	-35	dBc
Ratio			POUT = Prated_RANGE, VBATT = VCC = 3.0 V, TCASE = TRANGE			-33	
	UTRA1	UTRA_ACLR1	POUT = Prated		-40	-38	
			POUT = Prated_RANGE, VBATT = VCC = 3.0 V, TCASE = TRANGE			-35	
	UTRA2	UTRA_ACLR2	POUT = Prated		-43	-41	
			POUT = Prated_RANGE, VBATT = VCC = 3.0 V, TCASE = TRANGE			-39	
Harmonic Suppression	Second	$2f_0$	POUT ≤ Prated		-25	-21	dBm
	Third	$3f_0$				--20	
	Fourth	$4f_0$				-26	
	Fifth	$5f_0$				-36	
Tx Noise in Rx Bands	Rx Band	PNRX_LTE	2620 MHz–2690 MHz[4]			-126	dBm/Hz
	GPS Rx	PNRX_GPS	1574 MHz–1577 MHz[4]			-140	
	BT, WLAN	PNRX_BT	2400 MHz–2452 MHz[4]			-108	
	WLAN	PNRX_5GHz	4900 MHz–5800 MHz[4]			-140	
EVM		EVM	VBATT = 3.0 V to 4.8 V, Load = 50 ohms, TCASE = TRANGE		3	5	%
Input Voltage Standing Wave Ratio		VSWR				2: 1	
Stability (Spurious output)		S	6:1 VSWR All phases		36		dBm
Ruggedness – no damage		Ru	No permanent damage to module. POUT ≤ Prated, constant forward power, closed loop operation,	10：1			VSWR
			LTE 10 MHz QPSK 12RB modulation, VBATT = VCC = 4.8 V, TCASE = +25 °C				

1 MPR is the Max power reduction as defined in 3GPP TS36.101

2 VCC optimized for ACLR1_EUTRA = –39 dBc, QPSK 10 MHz / 12RB.

3 I_TOT = IBATT + (ICC1 + ICC2)(VCC/VBATT)(1/DC_DC_EFF). VCC ~ 3.4 V, DC_DC_EFF ~ 96%.

4 Measured with 20 MHz/100RB LTE Waveform

Table 13. RR88643 Electrical Specifications for NTC – FDD LTE Band 30 (WCS)

VBATT = 3.4 V; TCASE = +25 °C; LTE Signal = QPSK/10 MHz/12RB for MPR = 0 and QPSK/10 MHz/50RB for MPR = 1.

Parameter		Label	Condition	Min	Typ	Max	Unit
Frequency		ƒ0		2305	2310	2315	MHz
Max Output Power		Prated	MPR = 0[1]	28.2			dBm
		Prated_ETC	VBATT = VCC = 3.0 V, TCASE = TRANGE	27.5			
Gain		GP_NTC	POUT = Prated, TCASE = +25 °C	27.0	28.5	31.5	dB
		GP_ETC	POUT = Prated, TCASE = TRANGE	26.0		32.5	
		GP_LOW	POUT = 3 dBm, VCC = 0.55 V	13.0	15.3	20.0	
Power Added Efficiency[2]		PAEAPT	POUT = Prated		33		%
Total Supply Current[3]		I_TOT_MAX	POUT = Prated, VBATT = 3.8 V				mA
Adjacent Channel Leakage power	E-UTRA	E-UTRA_ACLR1	POUT = Prated		-38	-35	dBc
Ratio			POUT = Prated_RANGE, VBATT = VCC = 3.0 V, TCASE = TRANGE			-33	
	UTRA1	UTRA_ACLR1	POUT = Prated		-40	-38	
			POUT = Prated_RANGE, VBATT = VCC = 3.0 V, TCASE = TRANGE			-35	
	UTRA2	UTRA_ACLR2	POUT = Prated		-43	-41	
			POUT = Prated_RANGE, VBATT = VCC = 3.0 V, TCASE = TRANGE			-39	
Harmonic Suppression	Second	2ƒ0	POUT ≤ Prated		-25	-15	dBm
	Third	3ƒ0			-15	-14	
	Fourth	4ƒ0				-21	
	Fifth	5ƒ0				-36	
Tx Noise in Rx Bands	GPS Rx	PNRX_GPS	1574 MHz–1577 MHz[4]			-140	dBm/Hz
	BT, WLAN	PNRX_BT	2400 MHz–2483.5 MHz[4]			-113	
	WLAN	PNRX_5GHz	4900 MHz–5800 MHz[4]			-140	
EVM		EVM	VBATT = 3.0 V to 4.8 V, Load = 50 ohms, TCASE = TRANGE		3	5	%
Input Voltage Standing Wave Ratio		VSWR				2: 1	
Stability (Spurious output)		S	6:1 VSWR All phases			-36	dBm
Ruggedness		Ru	No permanent damage to module. POUT ≤ Prated, constant forward power, closed loop operation,	10：1			VSWR
			LTE 10 MHz QPSK 12RB modulation,				
			VBATT = VCC = 4.8 V, TCASE = +25 °C				

1 *MPR is the Max power reduction as defined in 3GPP TS36.101*

2 *VCC optimized for ACLR1_EUTRA = –39 dBc, QPSK 10 MHz / 12RB.*

3 *I_TOT = IBATT + (ICC1 + ICC2)(VCC/VBATT)(1/DC_DC_EFF). VCC ~ 3.4 V, DC_DC_EFF ~ 96%.*

4 *Measured with 10 MHz/50RB LTE Waveform.*

Table 14. RR88643 Electrical Specifications for NTC – TDD Band 38

VBATT = 3.4 V; TCASE = +25 °C; LTE Signal = QPSK/10 MHz/12RB for MPR = 0 and QPSK/20 MHz/100 RB for MPR = 1.

Parameter		Label	Condition	Min	Typ	Max	Unit
Frequency		f_0		2570	2595	2620	MHz
Max Output Power		Prated	MPR = 0[1]	28			dBm
		Prated_ETC	VBATT = VCC = 3.0 V, TCASE = TRANGE	27.5			
Gain		GP_NTC	POUT = Prated, TCASE = +25 °C	28.5	29	32.0	
		GP_ETC	POUT = Prated, TCASE = TRANGE	26.0		33.0	dB
		GP_LOW	POUT = 3 dBm, VCC = 0.55 V			20.0	
Power Added Efficiency[2]		PAEAPT	POUT = Prated		33		%
Total Supply Current[3]		I_TOT_MAX	POUT = Prated, VBATT = 3.8 V				mA
Adjacent Channel Leakage power Ratio	E-UTRA	E-UTRA_ACLR1	POUT = Prated		-38	-35	
			POUT = Prated_RANGE, VBATT = VCC = 3.0 V, TCASE = TRANGE			-33	
		E-UTRA_ACLR1_CA	POUT = Prated, Modulation = QPSK/40 MHz/200RB		-37		
	UTRA1	UTRA_ACLR1	POUT = Prated		-40	-38	dBc
			POUT = Prated_RANGE, VBATT = VCC = 3.0 V, TCASE = TRANGE			-35	
	UTRA2	UTRA_ACLR2	POUT = Prated		-43	-41	
			POUT = Prated_RANGE, VBATT = VCC = 3.0 V, TCASE = TRANGE			-39	
Harmonic Suppression	Second	$2f_0$	POUT ≤ Prated			-20	
	Third	$3f_0$				-16	dBm
	Fourth	$4f_0$				-26	
	Fifth	$5f_0$				-36	
Tx Noise in Rx Bands	GPS Rx	PNRX_GPS	1574 MHz–1577 MHz[4]			-140	
	BT, WLAN	PNRX_BT	2400 MHz–2483.5 MHz[4]			-113	dBm/Hz
	WLAN	PNRX_5GHz	4900 MHz–5800 MHz[4]			-140	
EVM		EVM	VBATT = 3.0 V to 4.8 V, Load = 50 ohms, TCASE = TRANGE		3	5	%
Input Voltage Standing Wave Ratio		VSWR				2: 1	
Stability (Spurious output)		S	6:1 VSWR All phases			-36	dBm
Ruggedness – no damage		Ru	No permanent damage to module. POUT ≤ Prated, constant forward power, closed loop operation,	10：1			VSWR
			LTE 10 MHz QPSK 12RB modulation,				
			VBATT = VCC = 4.8 V, TCASE = +25 °C				

1 MPR is the Max power reduction as defined in 3GPP TS36.101

2 VCC optimized for ACLR1_EUTRA = –39 dBc, QPSK 10 MHz / 12RB.

3 I_TOT = IBATT + (ICC1 + ICC2)(VCC/VBATT)(1/DC_DC_EFF). VCC ~ 3.4 V, DC_DC_EFF ~ 96%.

4 Measured with 20 MHz/100RB LTE Waveform.

Table 15. RR88643 Electrical Specifications for NTC – TDD Band 40

VBATT = 3.4 V; TCASE = +25 °C; LTE Signal = QPSK/10 MHz/12RB for MPR = 0 and QPSK/20 MHz/100 RB for MPR = 1.

Parameter		Label	Condition	Min	Typ	Max	Unit
Frequency		f_0		2300	2350	2400	MHz
Max Output Power		Prated	MPR = 0[1]	28			dBm
		Prated_ETC	VBATT = VCC = 3.0 V, TCASE = TRANGE	27.5			
Gain		GP_NTC	POUT = Prated, TCASE = +25 °C	28			
		GP_ETC	POUT = Prated, TCASE = TRANGE	27.0		31.0	dB
		GP_LOW	POUT = 3 dBm, VCC = 0.55 V	13.0	15.0	20.0	
Power Added Efficiency[2]		PAEAPT	pout= Prated		33		%
Total Supply Current[3]		I_TOT_MAX	pout= Prated, VBATT = 3.8				mA
Adjacent Channel Leakage power Ratio	E-UTRA	E-UTRA_ACLR1	POUT = Prated		-38	-35	
			POUT = Prated_RANGE, VBATT = VCC = 3.0 V, TCASE = TRANGE			-33	
		E-UTRA_ACLR1_CA	POUT = Prated, Modulation = QPSK/40 MHz/200RB		-37		
	UTRA1	UTRA_ACLR1	POUT = Prated		-40	-38	dBc
			POUT = Prated_RANGE, VBATT = VCC = 3.0 V, TCASE = TRANGE			-35	
	UTRA2	UTRA_ACLR2	POUT = Prated		-43	-41	
			POUT = Prated_RANGE, VBATT = VCC = 3.0 V, TCASE = TRANGE			-39	
Harmonic Suppression	Second	$2f_0$	POUT ≤ Prated			-21	
	Third	$3f_0$				-16	dBm
	Fourth	$4f_0$				-21	
	Fifth	$5f_0$				-36	
Tx Noise in Rx Bands	GPS Rx	PNRX_GPS	1574 MHz–1577 MHz[4]			-140	
	BT, WLAN	PNRX_BT	2447 MHz–2483.5 MHz[4]			-104	dBm/Hz
	WLAN	PNRX_5GHz	4900 MHz–5800 MHz[4]			-140	
EVM		EVM	VBATT = 3.0 V to 4.8 V, Load = 50 ohms, TCASE = TRANGE		3	5	%
Input Voltage Standing Wave Ratio		VSWR				2: 1	
Stability (Spurious output)		S	6:1 VSWR All phases			-36	dBm
Ruggedness – no damage		Ru	No permanent damage to module. POUT ≤ Prated, constant forward power, closed loop operation, LTE 10 MHz QPSK 12RB modulation, VBATT = VCC = 4.8 V, TCASE = +25 °C	10：1			VSWR

1 *MPR is the Max power reduction as defined in 3GPP TS36.101*

2 *VCC optimized for ACLR1_EUTRA = –39 dBc, QPSK 10 MHz / 12RB.*

3 *I_TOT = IBATT + (ICC1 + ICC2)(VCC/VBATT)(1/DC_DC_EFF). VCC ~ 3.4 V, DC_DC_EFF ~ 96%.*

4 *Measured with 20 MHz/100RB LTE Wave form.*

Table 16. RR88643 Electrical Specifications for NTC – TDD Band 41, TDD AXGP Band

VBATT = 3.4 V; TCASE = +25 °C; LTE Signal = QPSK/10 MHz/12RB for MPR = 0 and QPSK/20 MHz/100 RB for MPR = 1.

Parameter		Label	Condition	Min	Typ	Max	Unit
Frequency		f_0		2496	2595	2690	MHz
Max Output Power		Prated	MPR = 0[1]	28			dBm
		Prated_ETC	VBATT = VCC = 3.0 V, TCASE = TRANGE	27.5			
Gain		GP_NTC	POUT = Prated, TCASE = +25 °C	29.0		30	dB
		GP_ETC	POUT = Prated, TCASE = TRANGE	27.5		31.0	
		GP_LOW	POUT = 3 dBm, VCC = 0.55 V	13.0	15.0	20.0	
Power Added Efficiency[2]		PAEAPT	POUT = Prated		32		%
Total Supply Current[3]		I_TOT_MAX	POUT = Prated, VBATT = 3.8 V				mA
Adjacent Channel Leakage power Ratio	E-UTRA	E-UTRA_ACLR1	POUT = Prated		-38	-35	dBc
			POUT = Prated_RANGE, VBATT = VCC = 3.0 V, TCASE = TRANGE			-33	
		E-UTRA_ACLR1_CA	POUT = Prated, Modulation = QPSK/40 MHz/200RB		-37		
	UTRA1	UTRA_ACLR1	POUT = Prated		-40	-38	
			POUT = Prated_RANGE, VBATT = VCC = 3.0 V, TCASE = TRANGE			-35	
	UTRA2	UTRA_ACLR2	POUT = Prated		-43	-41	
			POUT = Prated_RANGE, VBATT = VCC = 3.0 V, TCASE = TRANGE			-39	
Harmonic Suppression	Second	$2f_0$	POUT ≤ Prated			-18	dBm
	Third	$3f_0$				-16	
	Fourth	$4f_0$				-26	
	Fifth	$5f_0$				-36	
Tx Noise in Rx Bands	GPS Rx	PNRX_GPS	1574 MHz–1577 MHz[4]			-140	dBm/Hz
	BT, WLAN	PNRX_BT	2400 MHz–2452 MHz[4]			-104	
	WLAN	PNRX_5GHz	4900 MHz–5800 MHz[4]			-140	
EVM		EVM	VBATT = 3.0 V to 4.8 V, Load = 50 ohms, TCASE = TRANGE		3	5	%
Input Voltage Standing Wave Ratio		VSWR				2: 1	
Stability (Spurious output)		S	6:1 VSWR All phases			-36	dBm
Ruggedness – no damage		Ru	No permanent damage to module. POUT ≤ Prated, constant forward power, closed loop operation,	10：1			VSWR
			LTE 10 MHz QPSK 12RB modulation,				
			VBATT = VCC = 4.8 V, TCASE = +25 °C				

1 *MPR is the Max power reduction as defined in 3GPP TS36.101*

2 *VCC optimized for ACLR1_EUTRA = –39 dBc, QPSK 10 MHz / 12RB.*

3 *I_TOT = IBATT + (ICC1 + ICC2)(VCC/VBATT)(1/DC_DC_EFF). VCC ~ 3.4 V, DC_DC_EFF ~ 96%.*

4 *Measured with 20 MHz/100RB LTE Wave form.*

Table 17. RR88643 Electrical Specifications for NTC – Band Select Switch

Parameter		Label	Conditions	Min	Typ	Max	Unit
Frequency Range		ƒ_LB		699		915	MHz
		ƒ_MB		1710		1980	
		ƒ_HB		2300		2690	
Insertion Loss		IL	HB1 to TXRx2		0.70		dB
			HB2 to TXRx2		0.75		
			HB3 to TXRx1		0.75		
			HB4 to TXRx2		0.75		
VSWR		SWR	Any RF port tested in Rx mode			1.8：1	
Isolation	Tx Mode	ISO_Tx	Tx output at HB1, Isolation to HB2	30	46		dB
			Tx output at HB1, Isolation to HB3, HB4, TXRX1	32	34.5		
			Tx output at HB1, Isolation to TXRX2	25	27		
			Tx output at HB2, Isolation to HB1, HB3, HB4, TXRX1	30	34		
			Tx output at HB2, Isolation to TXRX2	25	27		
			Tx output at HB3, Isolation to HB1, HB2, HB4, TXRX1	28	29.4		
			Tx output at HB3, Isolation to TXRX2	22	24		
			Tx output at HB4, Isolation to HB2, HB3	30	34.9		
			Tx output at HB4, Isolation to TXRX1	28	31		
			Tx output at HB4, Isolation to HB1, TXRX2	22	23.5		
			Tx output at any LB output, Isolation to any other LB output	35			
			Tx output at any MB output, Isolation to MB1, MB2, MB3, MB4	30			
			Tx output at any MB output, Isolation to MB5	23			
	Rx Mode	ISO_Rx	Rx Path: HB1 to TXRX2, Isolation to HB2, HB3, HB4, TXRX1	25			
			Rx Path: HB2 to TXRX2, Isolation to HB1, HB3, HB4, TXRX1	25			
			Rx Path: HB3 to TXRX1, Isolation to HB1, HB2, HB4, TXRX2	25			
			Rx Path: HB4 to TXRX2, Isolation to HB1, HB2, HB3, TXRX1	25			

EVB Description:

The evaluation board is a platform for testing and interfacing design circuitry. To accommodate the interface testing of the RR88643-21, the evaluation board schematic and assembly diagrams are included for analysis and design. The basic EVB schematic is shown in Figure 2 and the assembly diagram in Figure 3. Table 21 is the Bill of Material list.

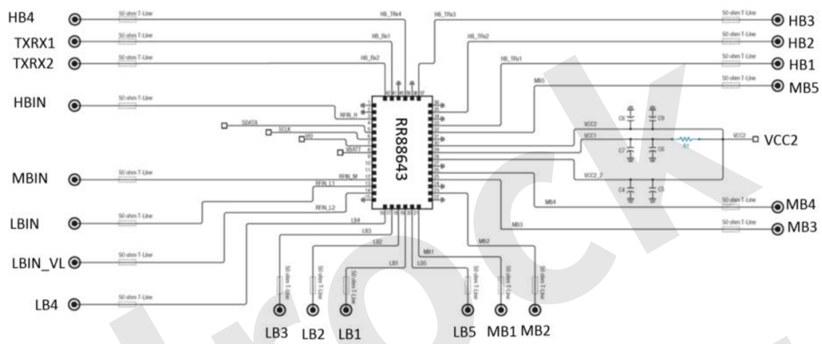

Figure 2. RR88643 Evaluation Board Schematic Diagram

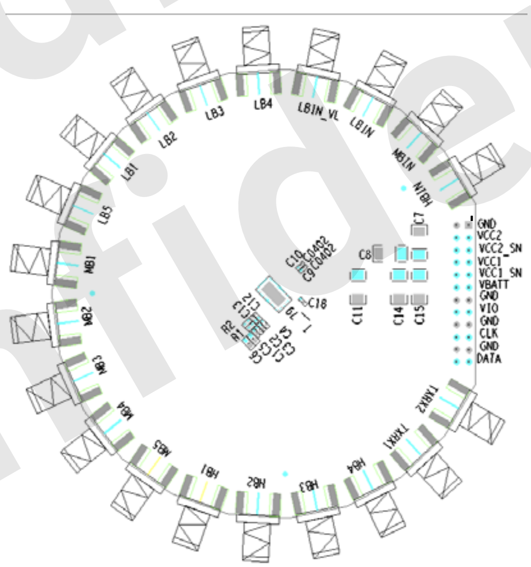

Figure 3. RR88643 Evaluation Board Assembly Diagram

Table 18. RR88643 Evaluation Board Bill of Material

	QTY	REFERENCE DESIGNATORS	PART DESCRIPTION
1	1	J1	CONNECTOR, 12 PINPOST LENGTH = 0.53
2	20	HB1,HB2,HB3,HB4,MB1,MB2,MB3,MB4,MB5, LB1,LB2,LB3,LB4,LB5,TXRX1,TXRX2,LBIN,LBIN_VL,MBIN,HBIN	CONN SMA END LAUNCH JACK TAB CONTACT GOLD .062
3	1	R2	RESISTOR, 0 OHM, JUMPER, 0.063 W, 0402
4	1	C3	CAPACITOR, CERAMIC, 100nf, 10%, 10 V, 0402
5	1	C4	CAPACITOR, CERAMIC, 1nf, 10%, 10 V, 0402
6	1	C5	CAPACITOR, CERAMIC, 10uf, 10%, 10 V, 0402
7	1	C6	CAPACITOR, CERAMIC, 2.2uf, 10%, 10 V, 0603
8	1	C10	CAPACITOR, CERAMIC, 100nf, 10%, 10 V, 0603
9	1	C12	CAPACITOR, CERAMIC, 0.1uf, 10%, 10 V, 0402
10	1	C13	CAPACITOR, CERAMIC, 100pf, 10%, 10 V, 0402
11	5	C7,C8,C11,C14,C15	CAPACITOR 470 µF, TANT, LOW ESR, CASE D, AVX
12	5	R1,C1,C2,C9,C18	Do Not Place

Package Mechanical Drawing:

Figure 4 is a mechanical drawing of the pad layout for the RR88643-21, a 42-pad leadless quad-band power amplifier module. Figure 5 provides a recommended PC board layout footprint of the module to help the designer attain optimum thermal conductivity, good grounding, and Min RF discontinuity for the 50-ohm terminals.

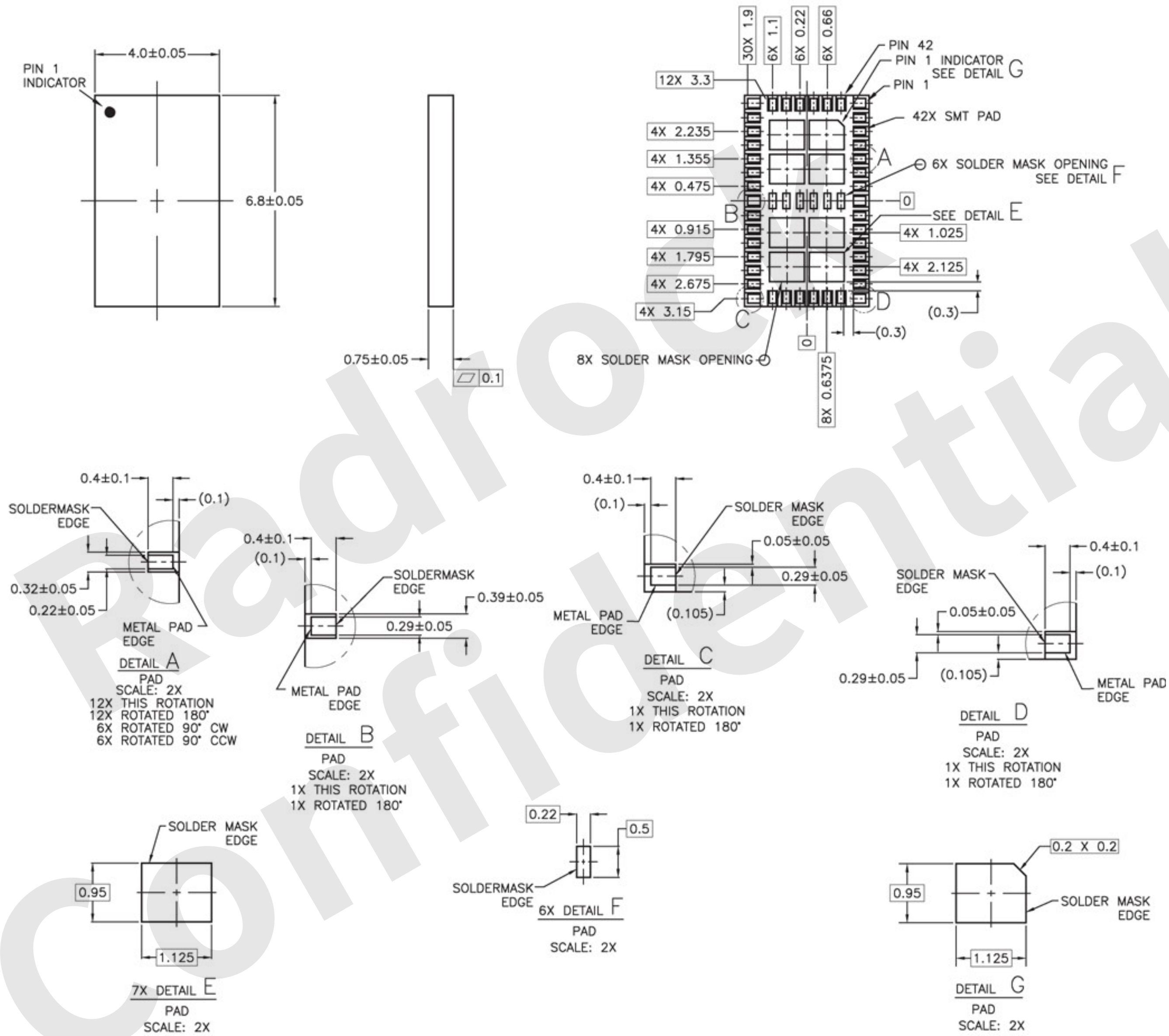

Figure 4. Dimensional Diagram for 4.0 mm x 6.8 mm x 0.75 mm, 42-Pad MCM Package – RR88643

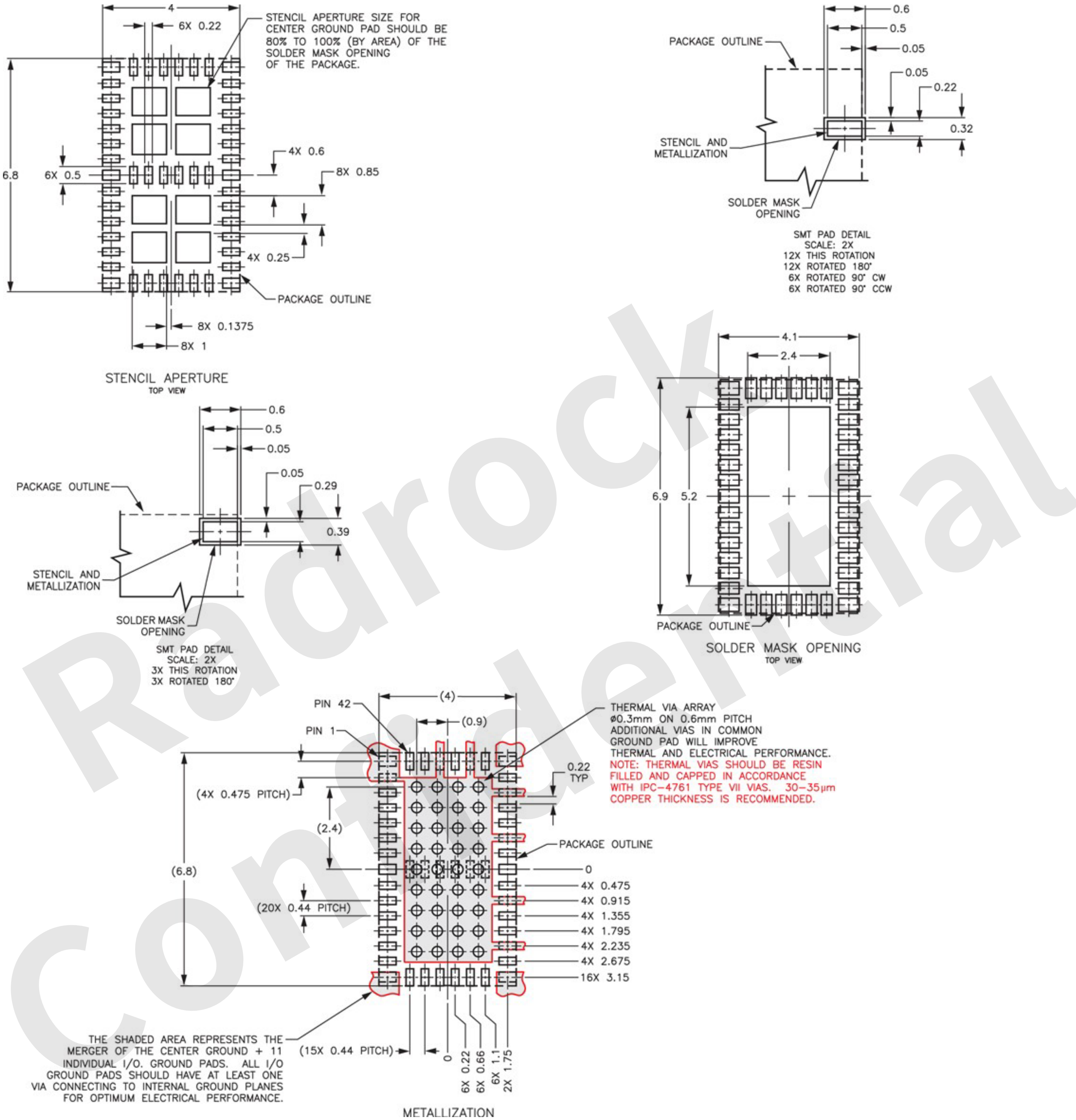

Figure 5. PCB Layout Footprint for 4.0 mm x 6.8 mm, 42-Pad Package – RR88643

Figure 6 shows the device pad configuration and the pad numbering convention, which starts with pad 1 in the upper left corner and increments counter-clockwise around the package.

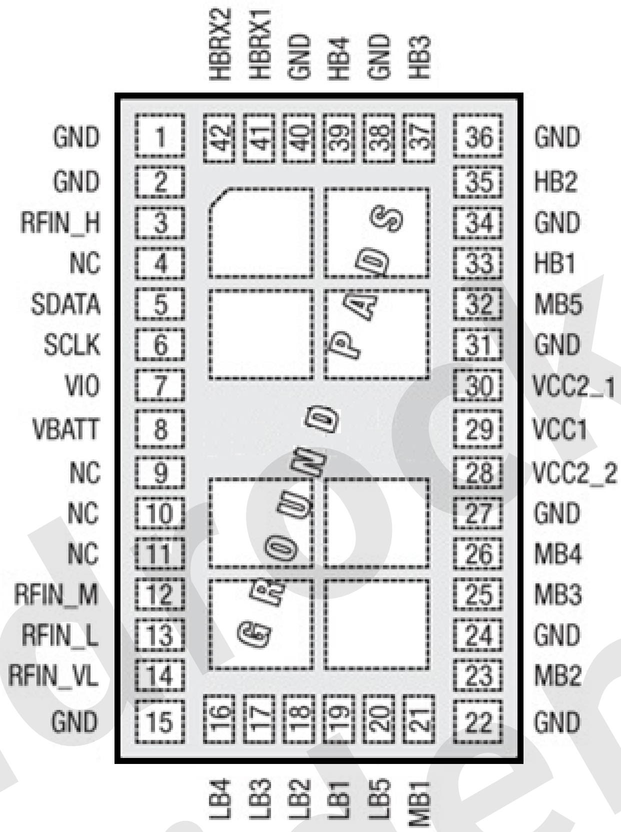

Figure 6. RR88643 Pad Configuration – 42-Pad MCM (Top View)

Table 19. RR88643 Pad Names and Signal Descriptions

Pad No.	Name	Description
3	RFIN_H	High Band (HB) Input
4	NC	Not Used (float or connect to GND)
5	SDATA	MIPI Data Bus
6	SCLK	MIPI Clock Bus
7	VIO	MIPI Supply
8	VBATT	Battery Supply
9	NC	Not Used (float or connect to GND)
10	NC	Not Used (float or connect to GND)
11	NC	Not Used (float or connect to GND)
12	RFIN_M	Mid Band (MB) Input
13	RFIN_L	Low Band (LB) Input
14	RFIN_VL	Alternate Low Band Input for Bands 12, 17, 13, 28
16	LB4	Low Band (LB) 4 RF OUT
17	LB3	Low Band (LB) 3 RF OUT
18	LB2	Low Band (LB) 2 RF OUT
19	LB1	Low Band (LB) 1 RF OUT
20	LB5	Low Band (LB) 5 RF OUT
21	MB1	Mid Band (MB) 1 RF OUT
23	MB2	Mid Band (MB) 2 RF OUT
25	MB3	Mid Band (MB) 3 RF OUT
26	MB4	Mid Band (MB) 4 RF OUT
28	VCC2_2	Mid/Low Band 2nd Stage PA Collector Supply
29	VCC1	High/Mid/Low Band 1st Stage PA Collector Supply
30	VCC2_1	High Band 2nd Stage PA Collector Supply
32	MB5	Mid Band (MB) 5 RF OUT
33	HB1	High Band 1 RF OUT
35	HB2	High Band 2 RF OUT
37	HB3	High Band 3 RF OUT
39	HB4	High Band 4 RF OUT
41	TXRX1	High Band 3 RX OUT
42	TXRX2	High Bands 1, 2, 4 RX OUT
1, 2, 15, 22, 24, 27, 31, 34, 36, 38, and 40	GND	GND

Document Revision Record:

Revision Version	History	Date
A	Initial Release	2018/3/22