

APPLICATION NOTE FOR LTE BAND-13 2fo IMPROVEMENT

This application note shows an example in order to improve LTE band-13 2fo harmonics. The example of electrical characteristics are shown as follows:

■ Electrical characteristics

DC Characteristics

General condition : $T_a=+25^{\circ}\text{C}$, $Z_s=Z_l=50\Omega$, with application circuit

Parameter	Symbol	Condition	Measurement data	Units
Supply Voltage	V_{DD}		2.8	V
Control Voltage (High)	$V_{CTL(H)}$		1.8	V
Control Voltage (Low)	$V_{CTL(L)}$		0	V
Operating Current (Active mode)	I_{DD1}	RF OFF, $V_{DD}=2.8\text{V}$, $V_{CTL}=1.8\text{V}$	3.57	mA
Operating Current (Standby mode)	I_{DD2}	RF OFF, $V_{DD}=2.8\text{V}$, $V_{CTL}=0\text{V}$	0.1	μA
Control Current	I_{CTL}	RF OFF, $V_{CTL}=1.8\text{V}$	6.3	μA

■ Electrical characteristics

RF Characteristics 1 (V_{DD}=2.8V)

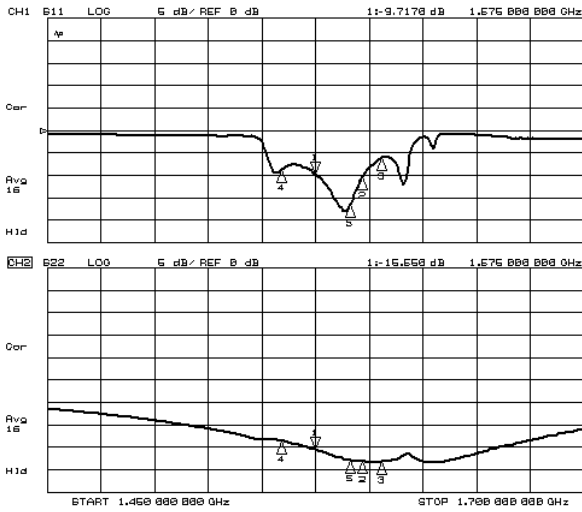
General condition : V_{DD}=2.8V, V_{CTL}=1.8V, f_{RF}=1575, 1597 to 1606, 1559 to 1591MHz,
T_a=+25°C, Z_s=Z_i=50Ω, with application circuit

Parameter	Symbol	Condition	Measurement data	Units
Small Signal Gain (GPS)1	GainGPS1	f=1575MHz (GPS), Exclude PCB, Connector Losses (0.17dB)	16.3	dB
Small Signal Gain (GLONASS)1	GainGLN1	f=1597 to 1606MHz (GLONASS), Exclude PCB, Connector Losses (0.17dB)	15.4 - 16.5	dB
Small Signal Gain (BeiDou, Galileo)1	GainBG1	f=1559 to 1591MHz (Beidou, Galileo), Exclude PCB, Connector Losses (0.17dB)	15.7 - 16.8	dB
Noise Figure (GPS)1	NFGPS1	f=1575MHz (GPS), Exclude PCB, Connector Losses (0.09dB)	1.77	dB
Noise Figure (GLONASS)1	NFGLN1	f=1597 to 1606MHz (GLONASS), Exclude PCB, Connector Losses (0.09dB)	1.52 - 1.88	dB
Noise Figure (BeiDou, Galileo)1	NFBG1	f=1559 to 1591MHz (Beidou, Galileo), Exclude PCB, Connector Losses (0.09dB)	1.55 - 1.91	dB
Input Power at 1dB Gain Compression Point 1	P-1dB(IN)1	f=1575, 1597 to 1606, 1559 to 1591MHz	-10.9 - -9.9	dBm
Input 3rd Order Intercept Point 1	IIP3_1	f1=1575, 1597 to 1606, 1559 to 1591MHz, f2=f1+/- 1MHz, Pin=-30dBm	-2.4 - -1.1	dBm
Out-of-Band Input Power 1dB Compression 1	P-1dB(IN)_OB1-1	fjam=900MHz, fmeas=1575MHz at Pin=-40dBm	>+26.0	dBm
	P-1dB(IN)_OB2-1	fjam=1710MHz, fmeas=1575MHz at Pin=-40dBm	+24.4	dBm
Out-of-Band Input 2nd Order Intercept Point 1	IIP2_OB1	f1=824.6MHz at +15dBm, f2=2400MHz at +15dBm, fmeas=1575.4MHz	+98.7	dBm
Out-of-Band Input 3rd Order Intercept Point 1	IIP3_OB1	f1=1712.7MHz at +15dBm, f2=1850MHz at +15dBm, fmeas=1575.4MHz	+53.4	dBm
700MHz Harmonic 1	2fo1	f _{in} =787.76MHz, Pin=+15dBm, f _{meas} =1575.52MHz	-94.4	dBm
Low Band Rejection 1	BR_L1	f=704 to 915MHz, relative to 1575MHz	58.1 - 85.8	dBc
High Band Rejection 1	BR_H1	f=1710 to 1980MHz, relative to 1575MHz	31.9 - 44.1	dBc
WLAN Band Rejection 1	BR_W1	f=2400 to 2500MHz, relative to 1575MHz	48.5 - 51.2	dBc
RF IN Return Loss (GPS)1	RLiGPS1	f=1575MHz (GPS)	9.7	dB
RF IN Return Loss (GLONASS)1	RLiGLN1	f=1597 to 1606MHz (GLONASS)	6.1 - 10.3	dB
RF IN Return Loss (BeiDou, Galileo)1	RLiBG1	f=1559 to 1591MHz (Beidou, Galileo)	7.6 - 17.9	dB
RF OUT Return Loss (GPS)1	RLoGPS1	f=1575MHz (GPS)	15.6	dB
RF OUT Return Loss (GLONASS)1	RLoGLN1	f=1597 to 1606MHz (GLONASS)	18.1 - 18.3	dB
RF OUT Return Loss (BeiDou, Galileo)1	RLoBG1	f=1559 to 1591MHz (Beidou, Galileo)	13.6 - 17.9	dB
Group Delay Time Deviation (GLONASS) 1	GDTGLN1	f=1597 to 1606MHz (GLONASS)	2.2	ns
Group Delay Time Deviation (BeiDou)1	GDTB1	f=1559 to 1563.2MHz (Beidou)	4.5	ns
Group Delay Time Deviation (Galileo)1	GDTG1	f=1559 to 1591MHz (Galileo)	7.5	ns

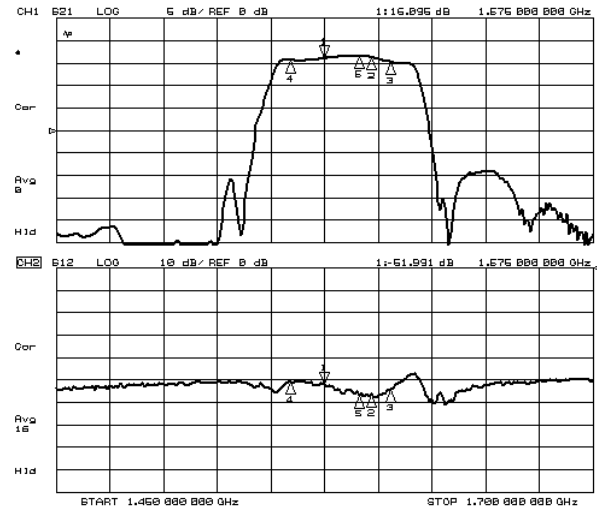
Electrical characteristics

V_{DD}=2.8V

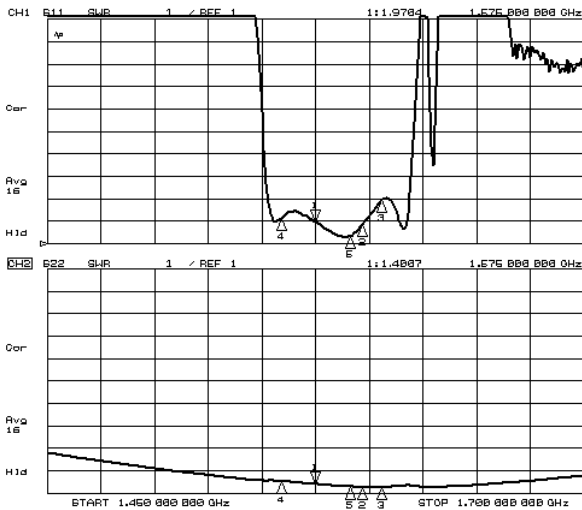
Condition: V_{DD}=2.8V, V_{CTL}=1.8V, Ta=+25°C, Z_s=Z_l=50Ω



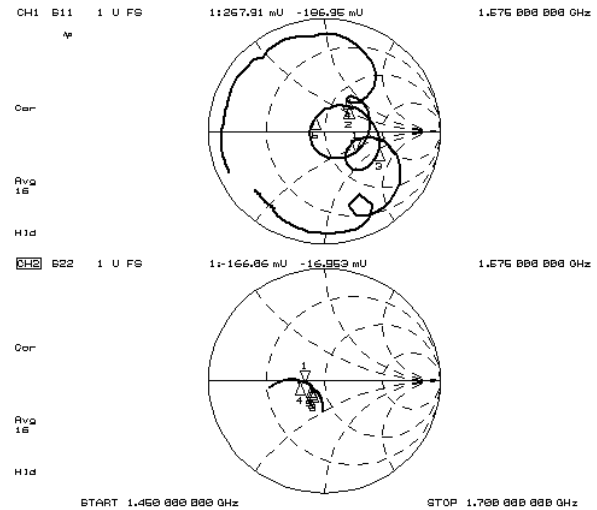
S11, S22 (f=1450 to 1700MHz)



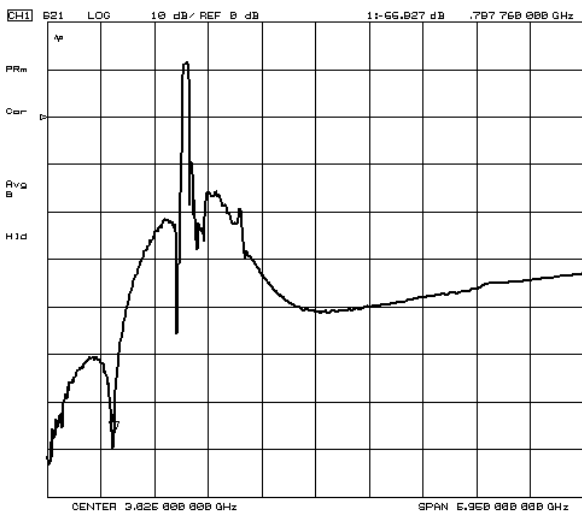
S21, S12 (f=1450 to 1700MHz)



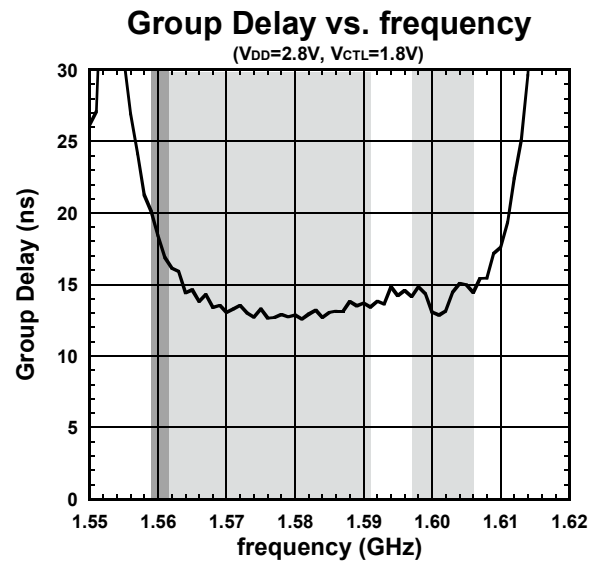
VSWR (f=1450 to 1700MHz)



Zin, Zout (f=1450 to 1700MHz)

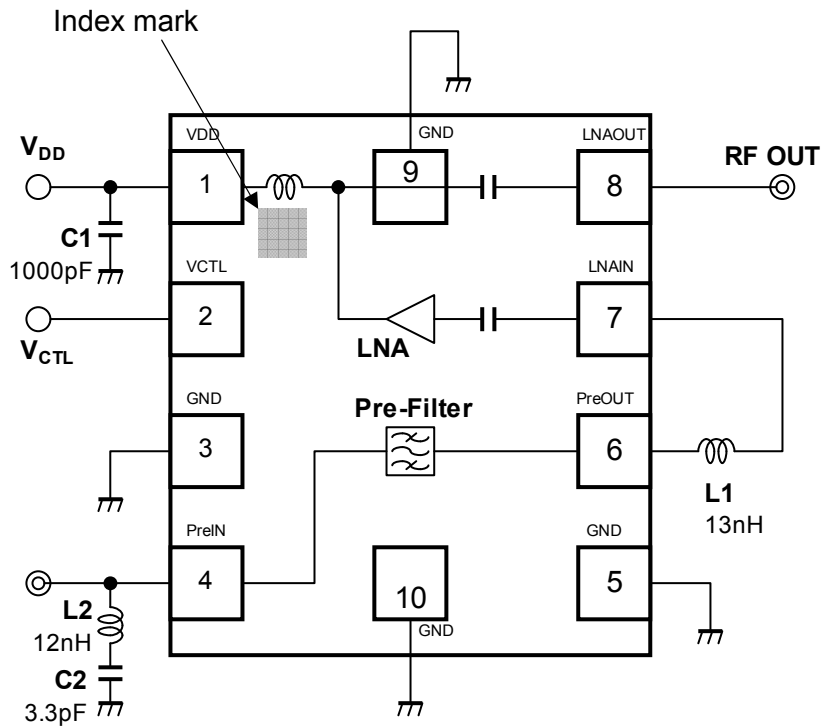


Out-of-band attenuation (f=50M to 6GHz)



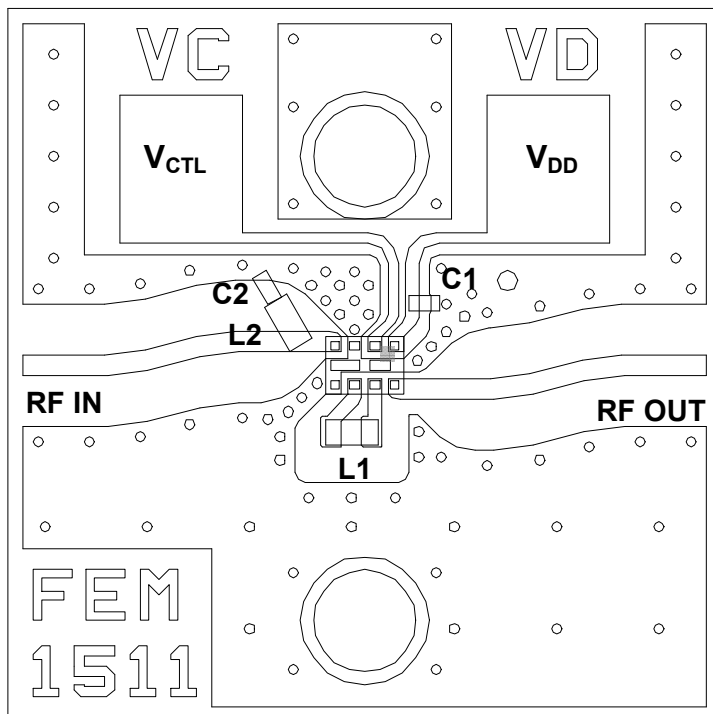
■ LTE band-13 2fo improvement circuit

(Top View)



■ Evaluation board

(Top View)



Parts list

Parts ID	Manufacture
L1,L2	LQW15AN_00 Series (MURATA)
C1,C2	GRM03 Series (MURATA)

PCB

Substrate: FR-4

Thickness: 0.2mm

Microstrip line width: 0.4mm ($Z_0=50\Omega$)

Size: 14.0mm x 14.0mm