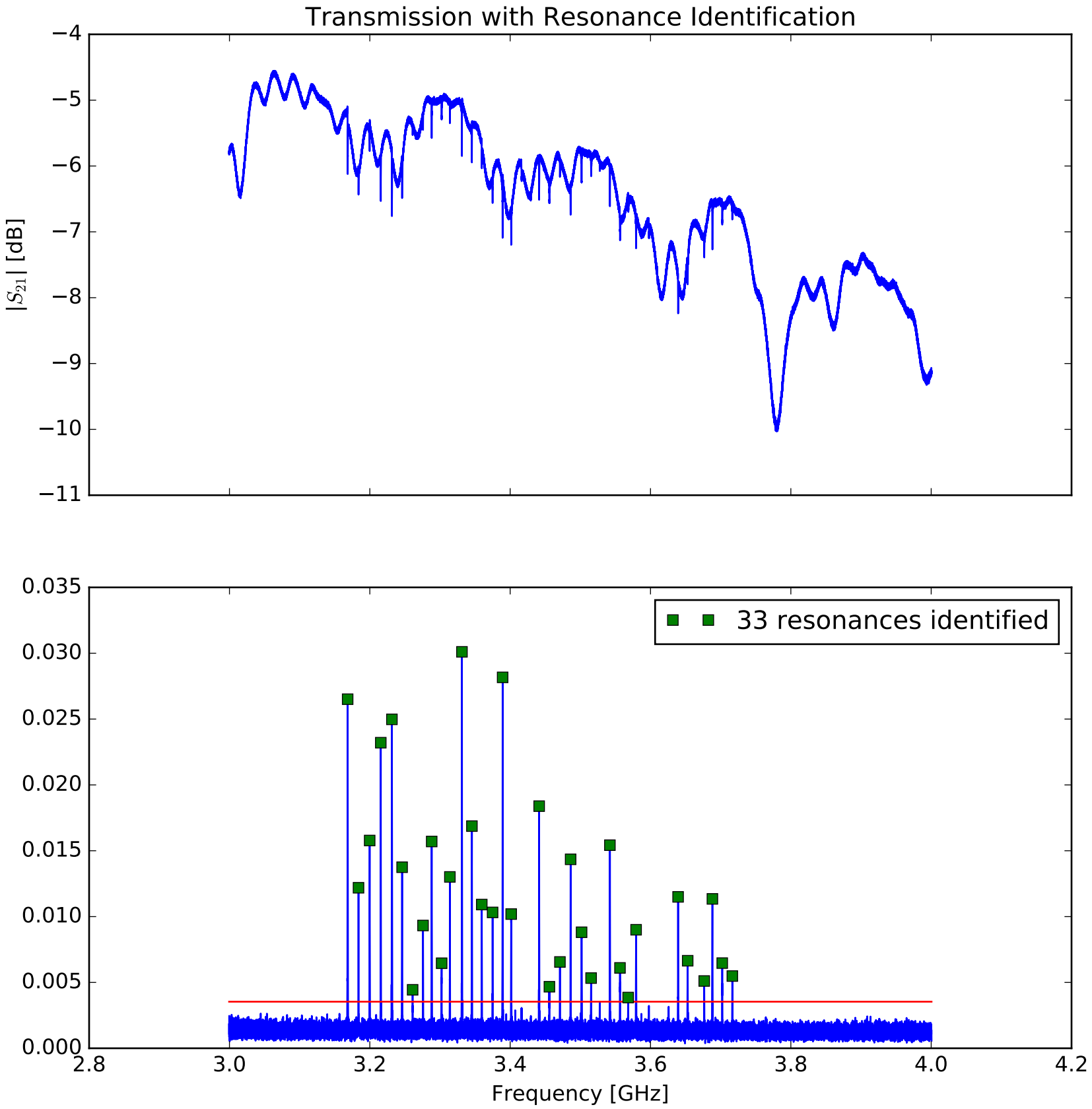
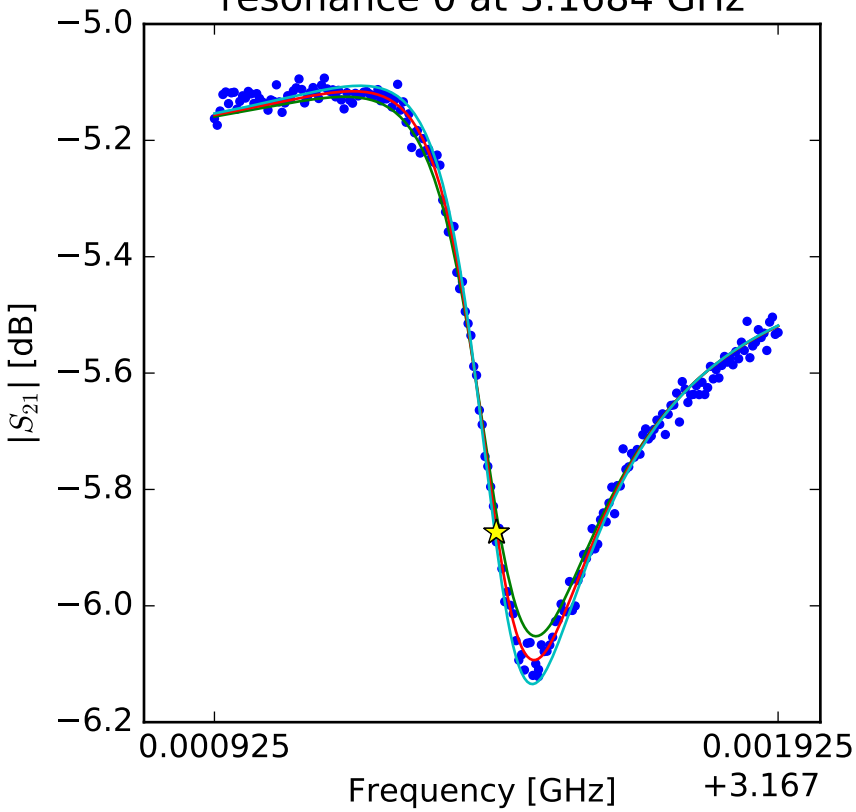
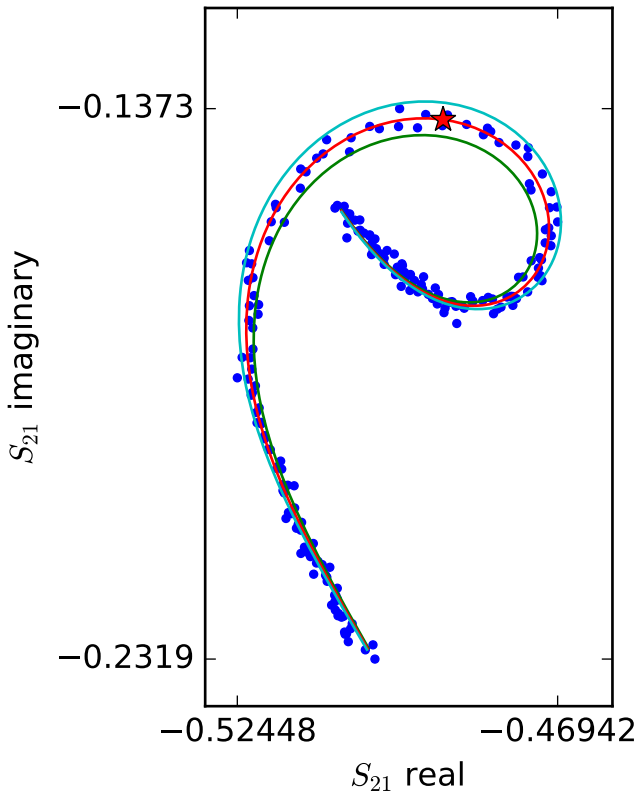
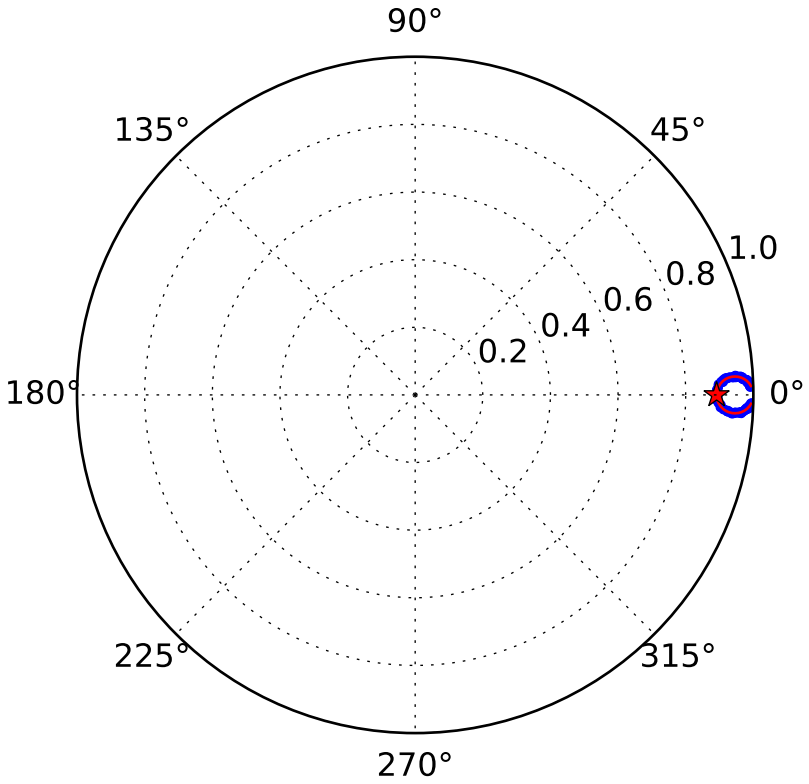
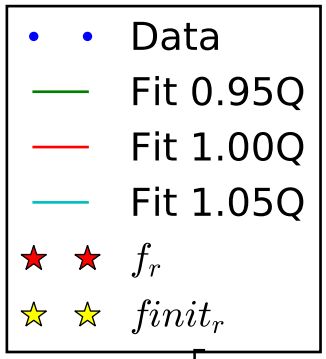

Transmission with Resonance Identification
$|S_{21}|$ [dB]
−4
−5
−6
−7
−8
−9
−10
−11
33 resonances identified
0.035
0.030
0.025
0.020
0.015
0.010
0.005
0.000
2.8
3.0
3.2
3.4
3.6
3.8
4.0
4.2
Frequency [GHz]



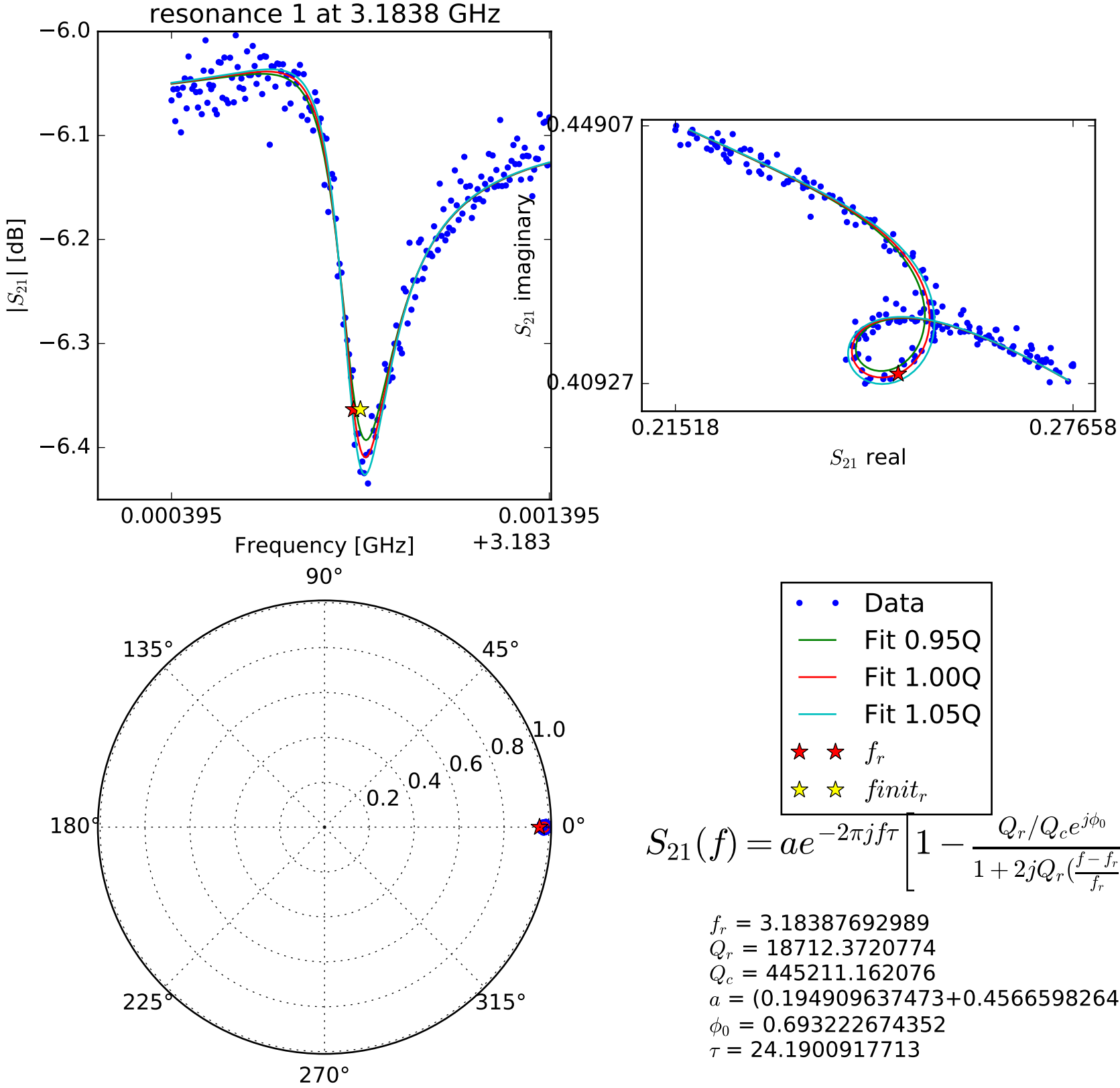






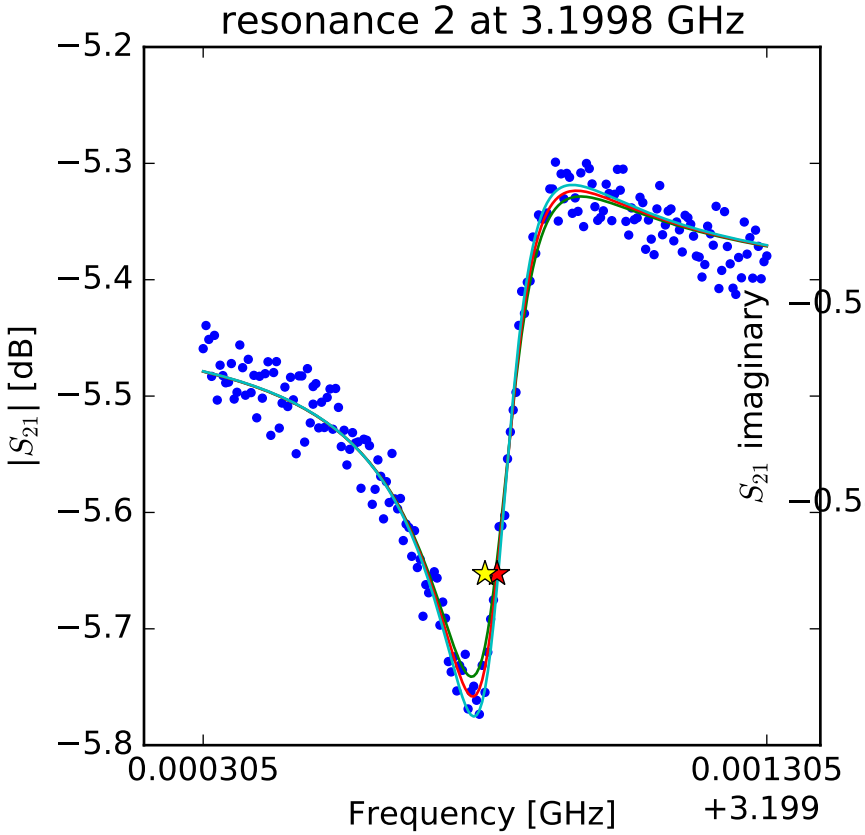
$$S_{21}(f) = ae^{-2\pi jf\tau}\left[1 - \frac{Q_r/Q_c e^{j\phi_0}}{1 + 2jQ_r(\frac{f-f_r}{f_r})}\right]$$

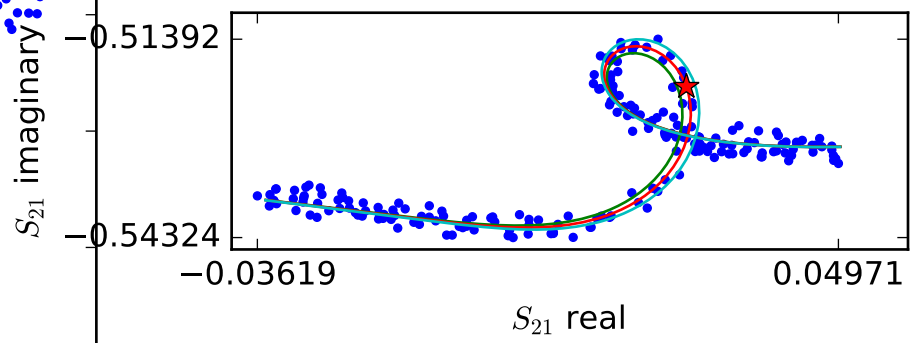
f_r = 3.16842594841
Q_r = 12199.9718594
Q_c = 112186.75237
a = (-0.0441819466754+0.541491748685j)
ϕ_0 = 0.8969881463
τ = 26.4182802764

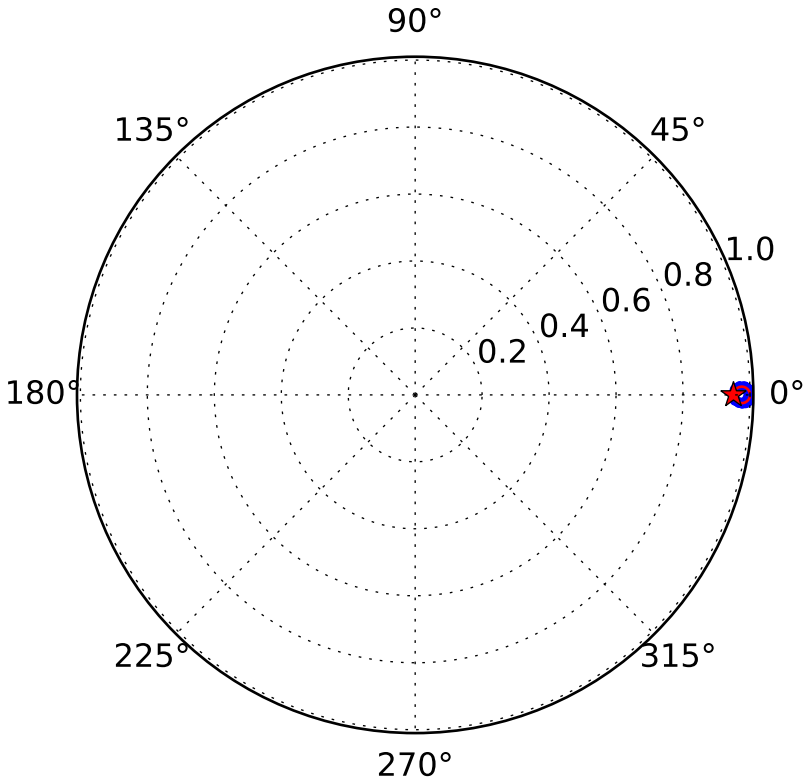


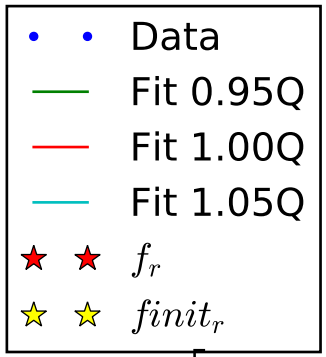
$$S_{21}(f) = ae^{-2\pi jf\tau}\left[1 - \frac{Q_r/Q_c e^{j\phi_0}}{1 + 2jQ_r(\frac{f-f_r}{f_r})}\right]$$

f_r = 3.18387692989
Q_r = 18712.3720774
Q_c = 445211.162076
a = (0.194909637473+0.456659826425j)
ϕ_0 = 0.693222674352
τ = 24.1900917713



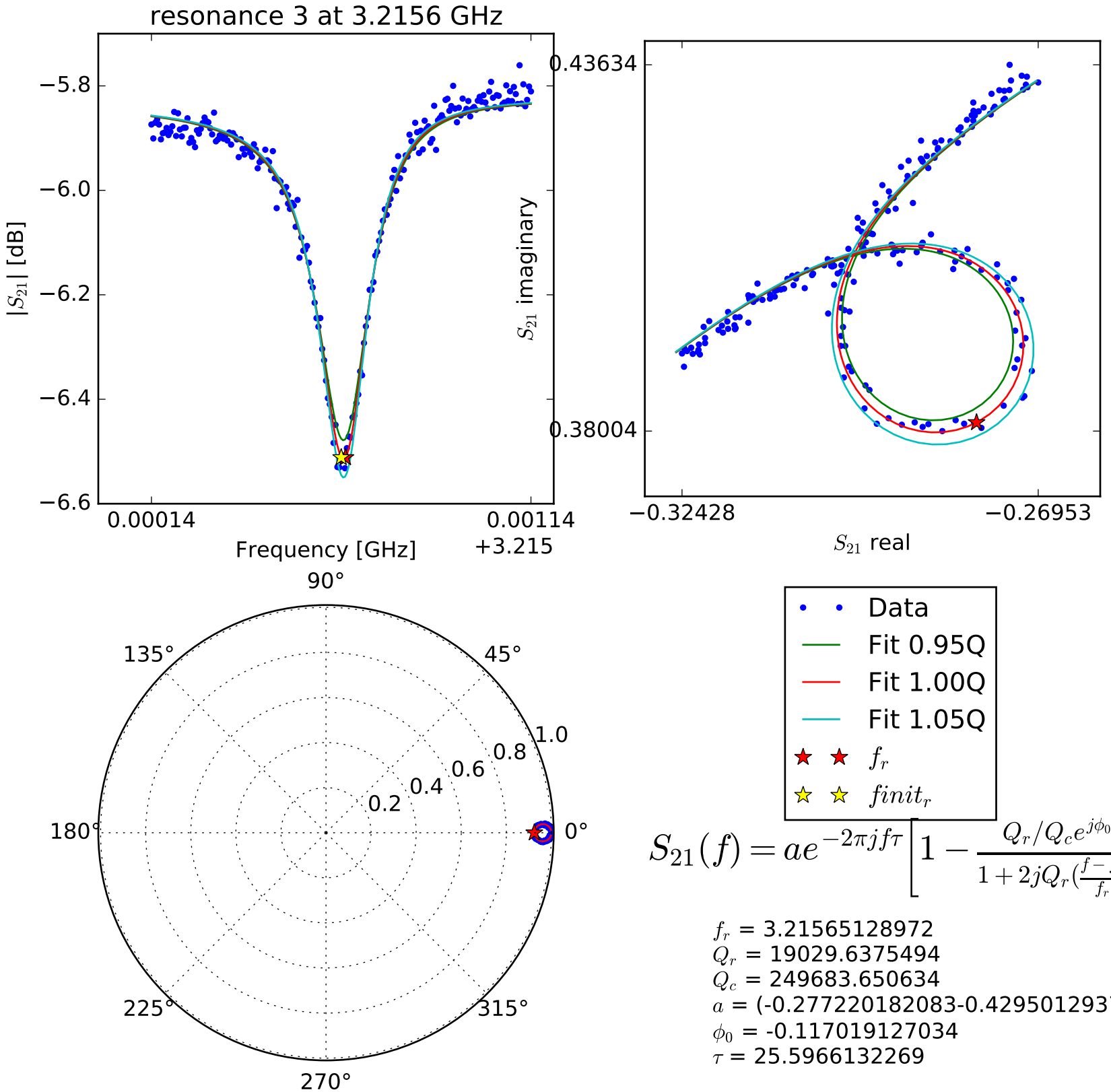






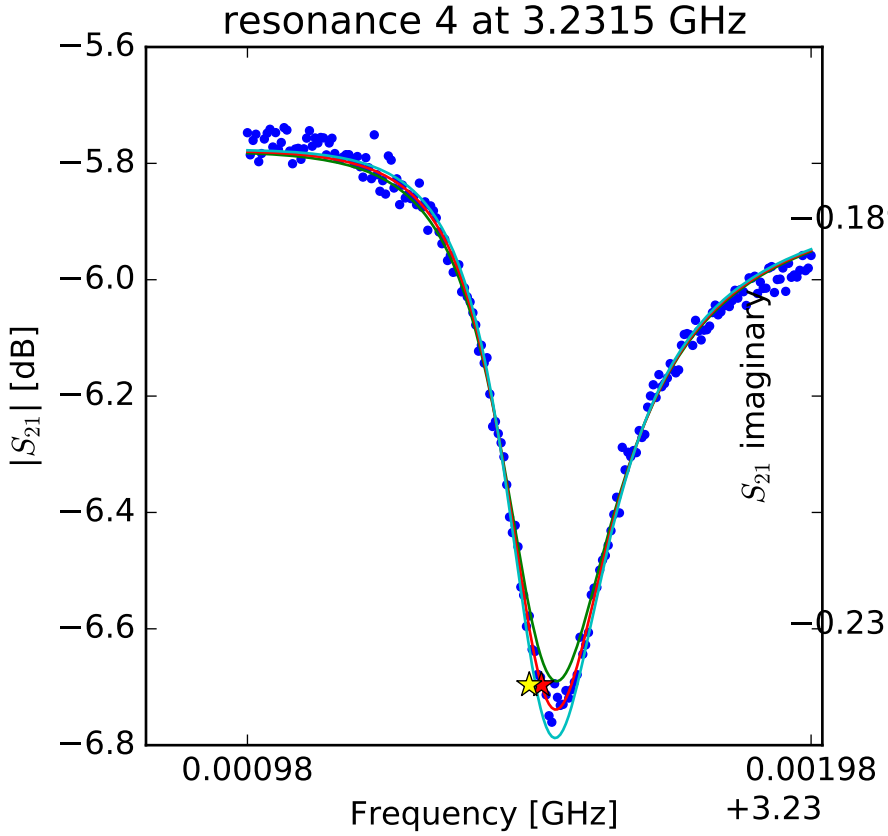
$$S_{21}(f) = ae^{-2\pi jf\tau}\left[1 - \frac{Q_r/Q_c e^{j\phi_0}}{1 + 2jQ_r(\frac{f-f_r}{f_r})}\right]$$

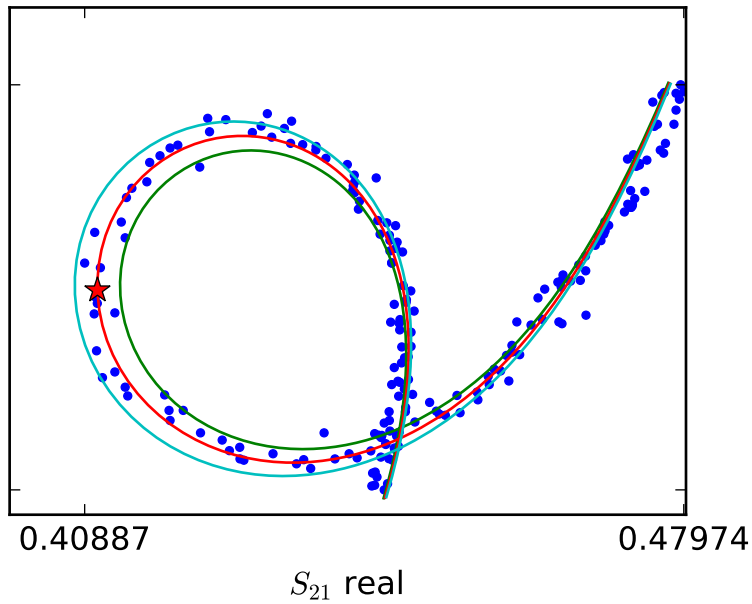
f_r = 3.19982638312
Q_r = 20600.4286625
Q_c = 417154.985053
a = (0.534317011981+0.0386669629896j)
ϕ_0 = -0.988513034228
τ = 26.6451732891

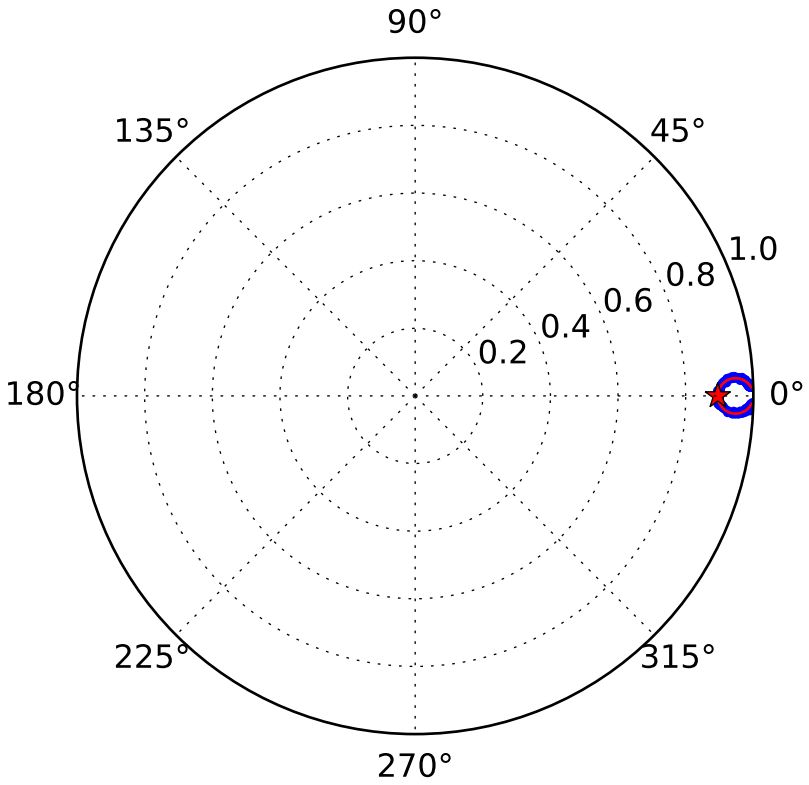


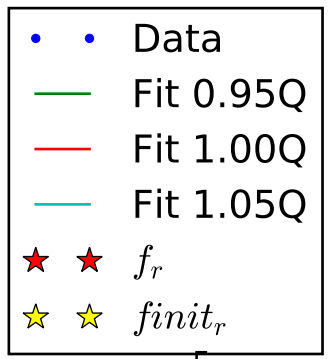
$$S_{21}(f) = ae^{-2\pi jf\tau}\left[1 - \frac{Q_r/Q_c e^{j\phi_0}}{1 + 2jQ_r(\frac{f-f_r}{f_r})}\right]$$

f_r = 3.21565128972
Q_r = 19029.6375494
Q_c = 249683.650634
a = (-0.277220182083-0.429501293713j)
ϕ_0 = -0.117019127034
τ = 25.5966132269



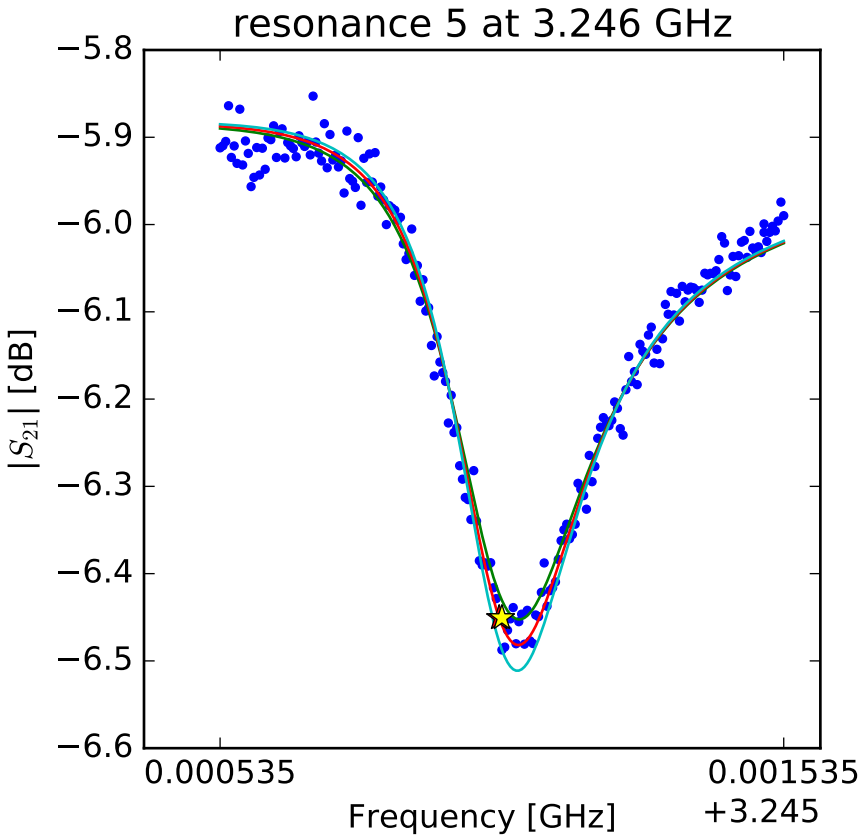


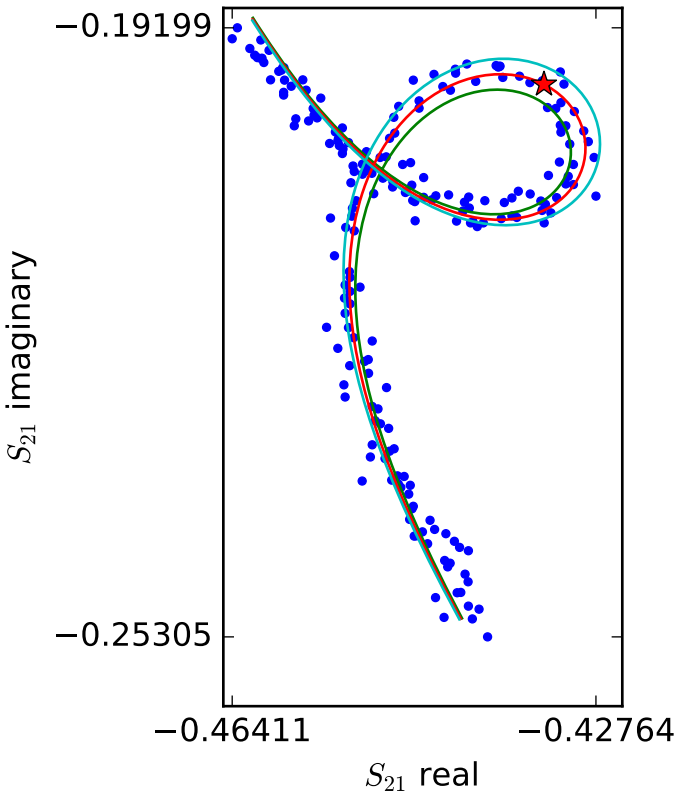


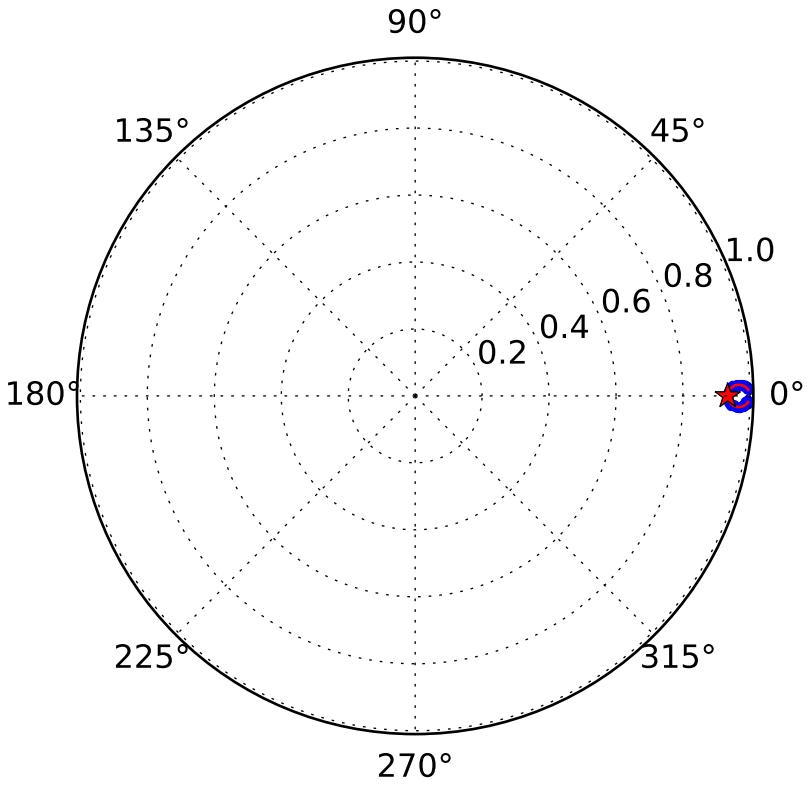


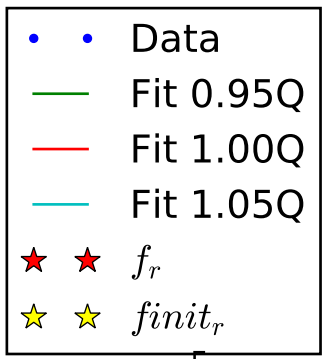
$$S_{21}(f) = ae^{-2\pi jf\tau}\left[1 - \frac{Q_r/Q_c e^{j\phi_0}}{1 + 2jQ_r(\frac{f-f_r}{f_r})}\right]$$

f_r = 3.23150157742
Q_r = 12920.6340668
Q_c = 122978.402358
a = (-0.0141211923697-0.511885500058j)
ϕ_0 = 0.381034784901
τ = 25.6274212796



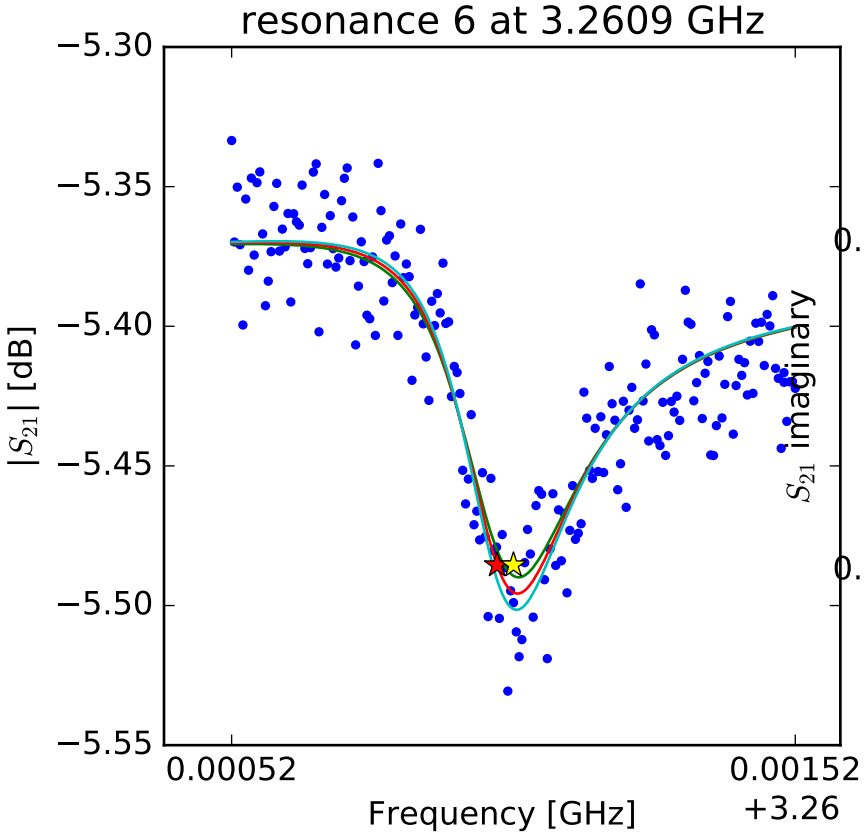


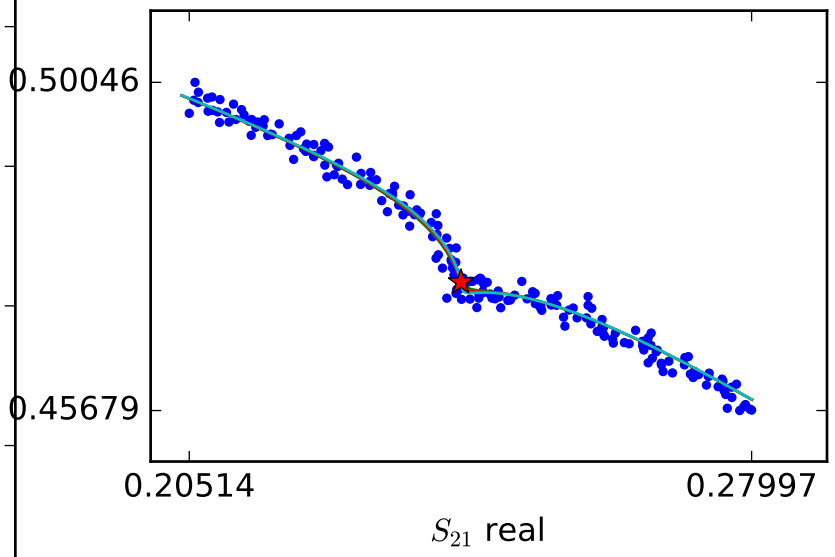


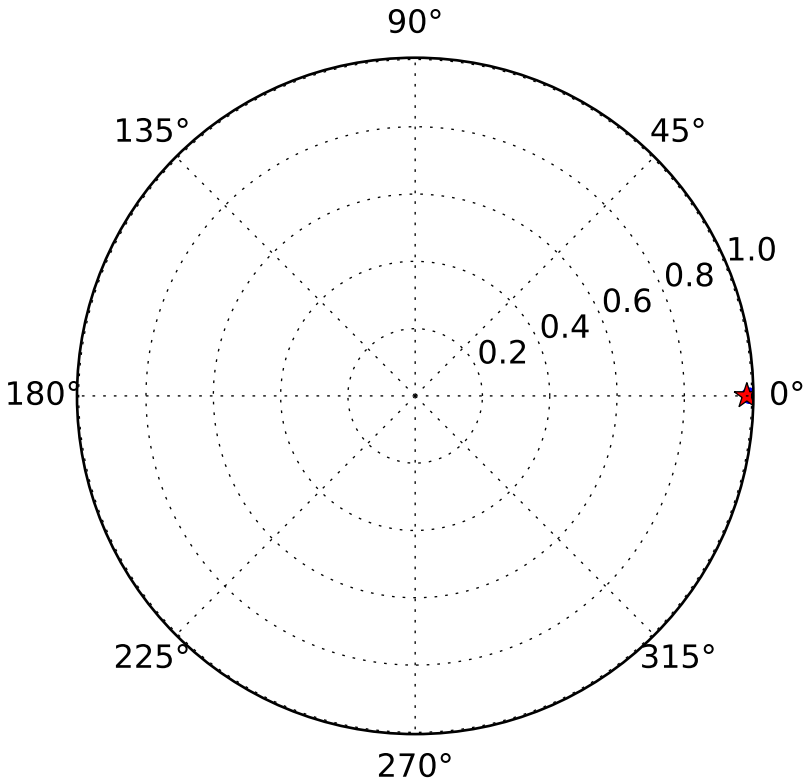


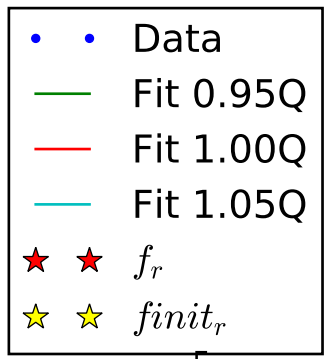
$$S_{21}(f) = ae^{-2\pi jf\tau}\left[1 - \frac{Q_r/Q_c e^{j\phi_0}}{1 + 2jQ_r(\frac{f-f_r}{f_r})}\right]$$

f_r = 3.24603017015
Q_r = 10854.7838392
Q_c = 162841.998891
a = (-0.311413504201-0.399190140878j)
ϕ_0 = 0.431347883587
τ = 25.2837041048



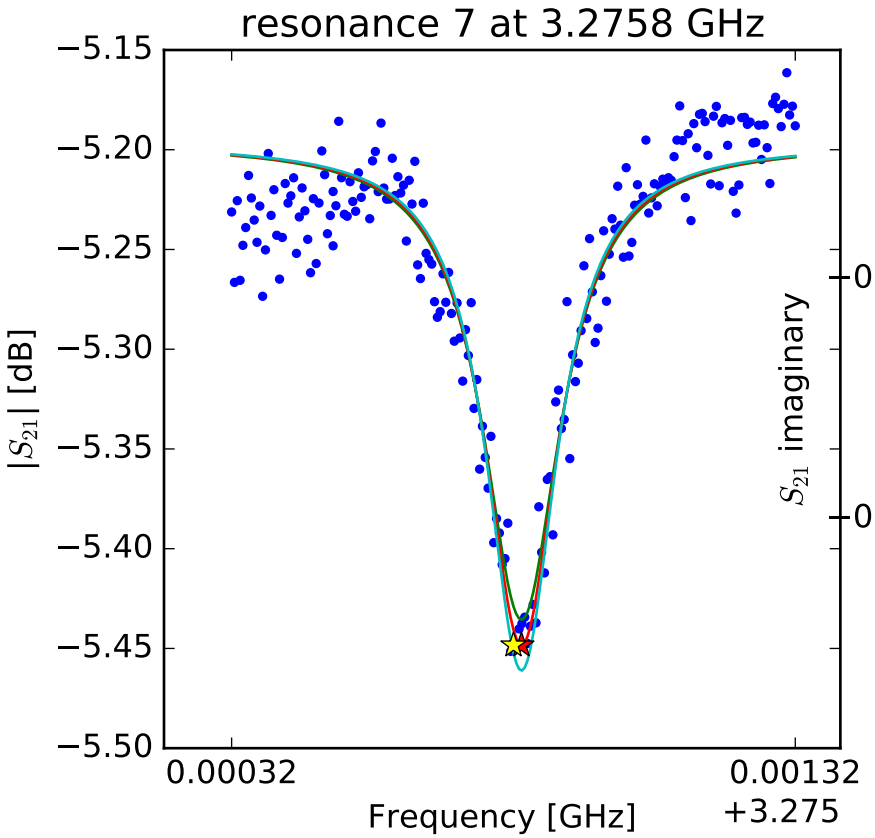


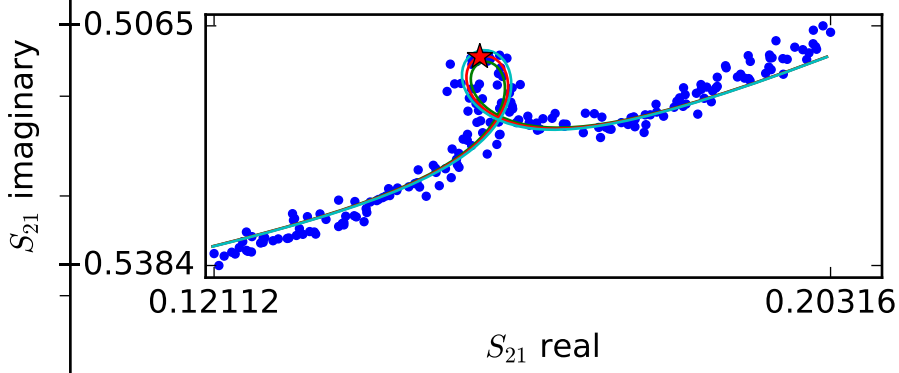


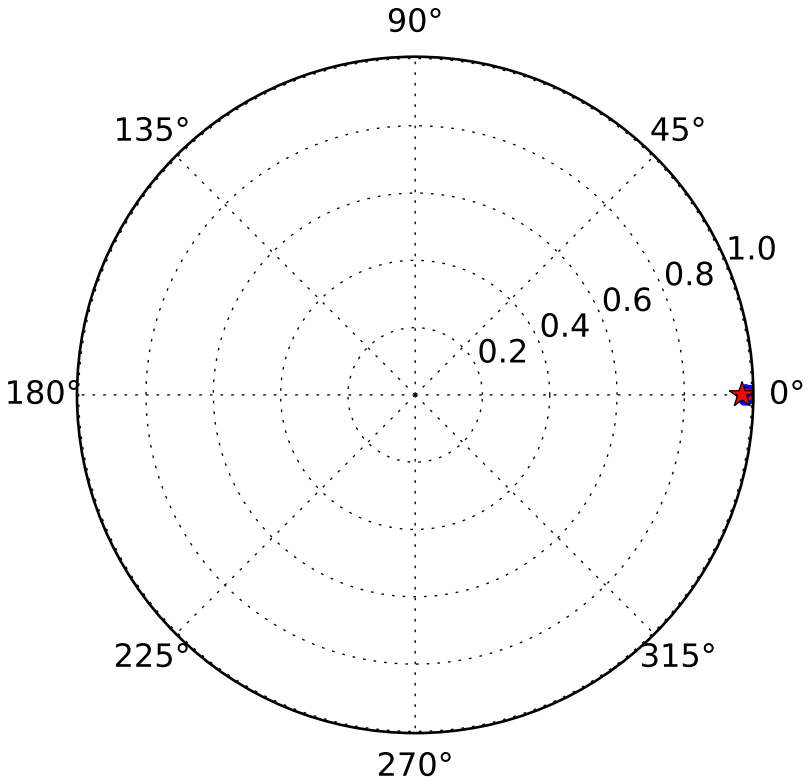


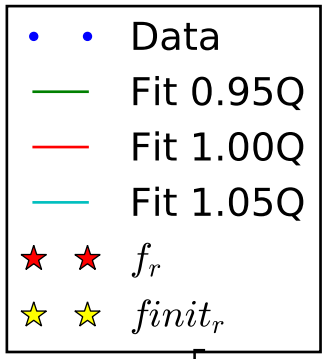
$$S_{21}(f) = ae^{-2\pi jf\tau}\left[1 - \frac{Q_r/Q_c e^{j\phi_0}}{1 + 2jQ_r(\frac{f-f_r}{f_r})}\right]$$

f_r = 3.26099088354
Q_r = 13250.4958626
Q_c = 921276.345334
a = (0.174802994481+0.509095764141j)
ϕ_0 = 0.57057553208
τ = 26.3788115188



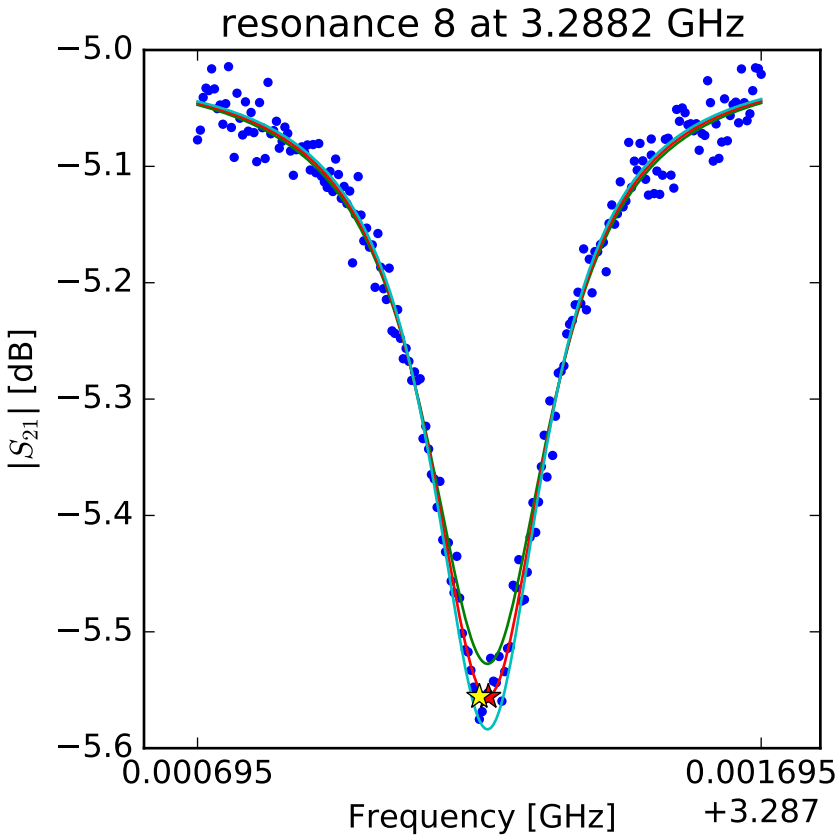


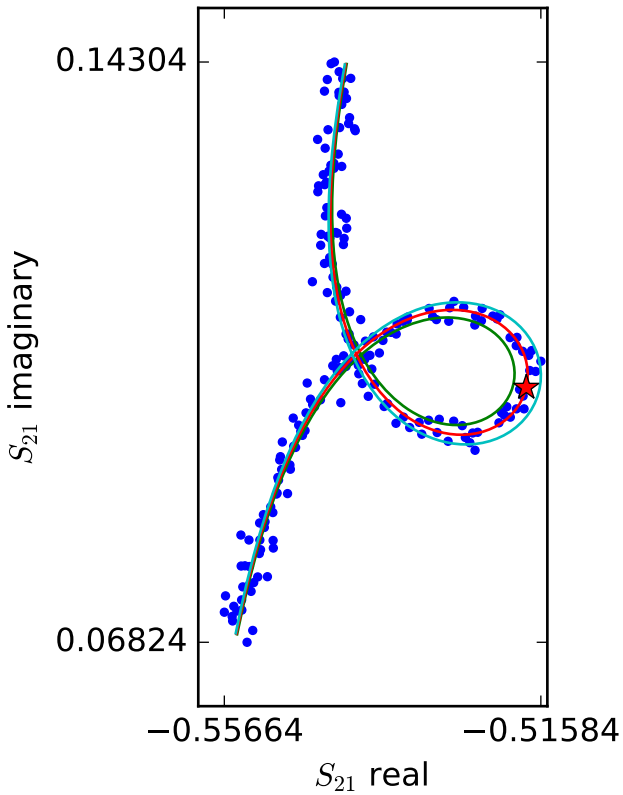


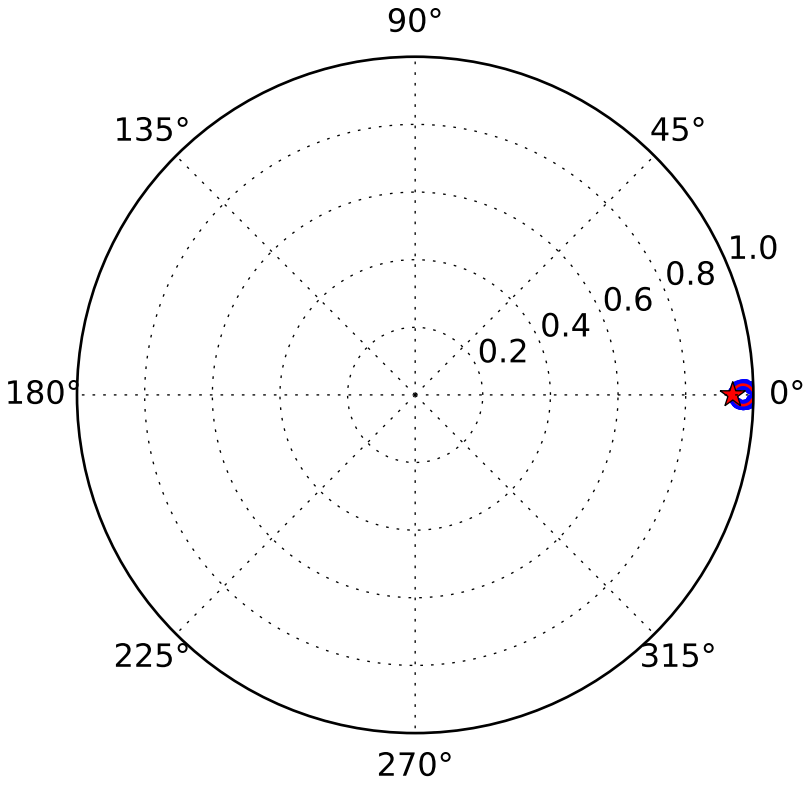


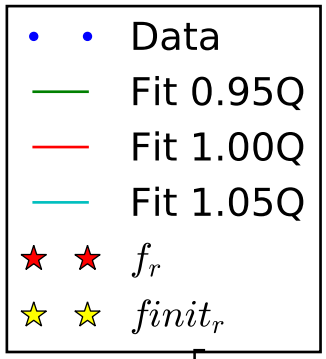
$$S_{21}(f) = ae^{-2\pi jf\tau}\left[1 - \frac{Q_r/Q_c e^{j\phi_0}}{1 + 2jQ_r(\frac{f-f_r}{f_r})}\right]$$

f_r = 3.27583421183
Q_r = 20189.4828335
Q_c = 707011.762244
a = (0.0700245310498-0.545270605908j)
ϕ_0 = 0.00165626238456
τ = 26.2446099524



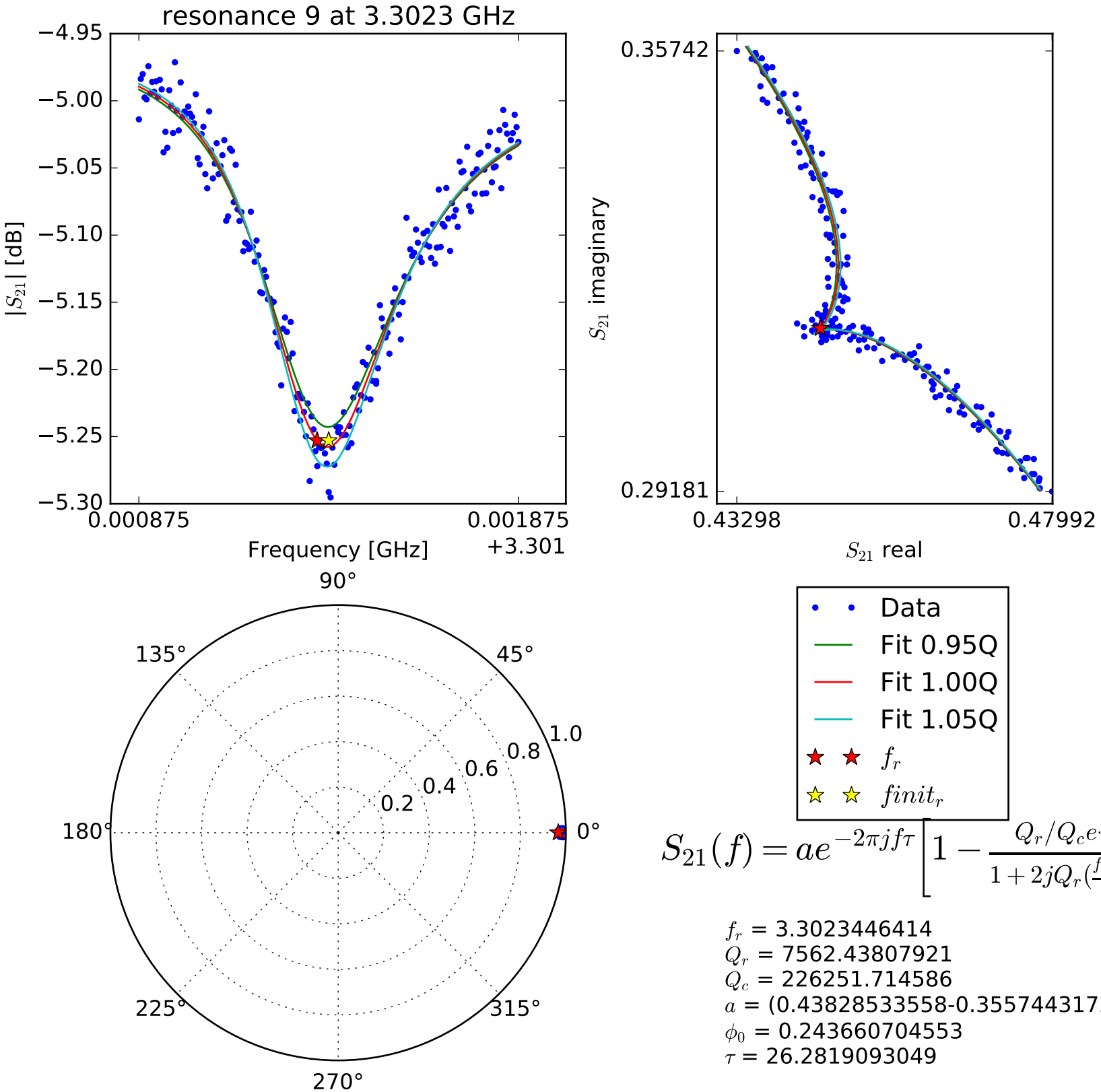


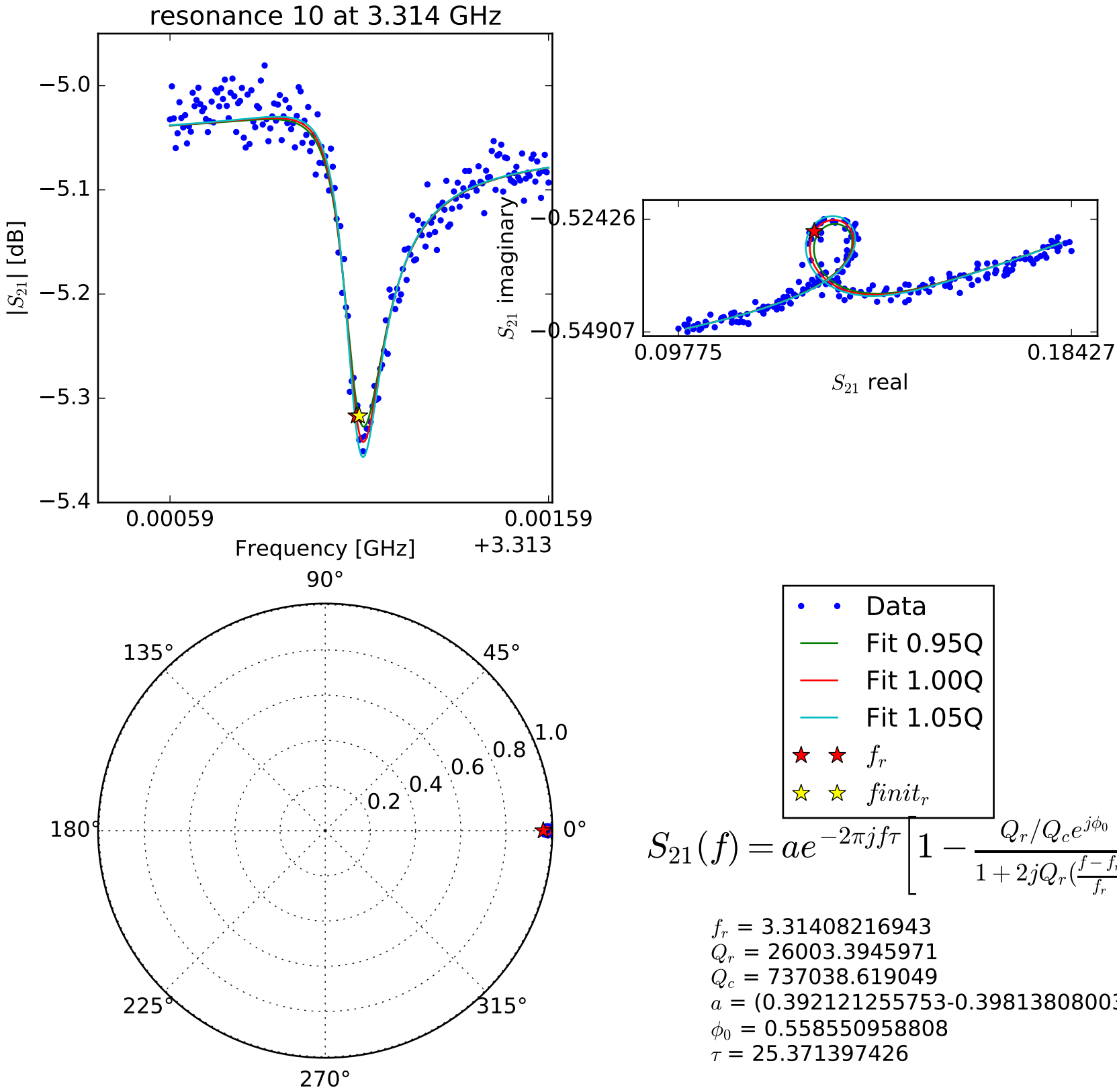


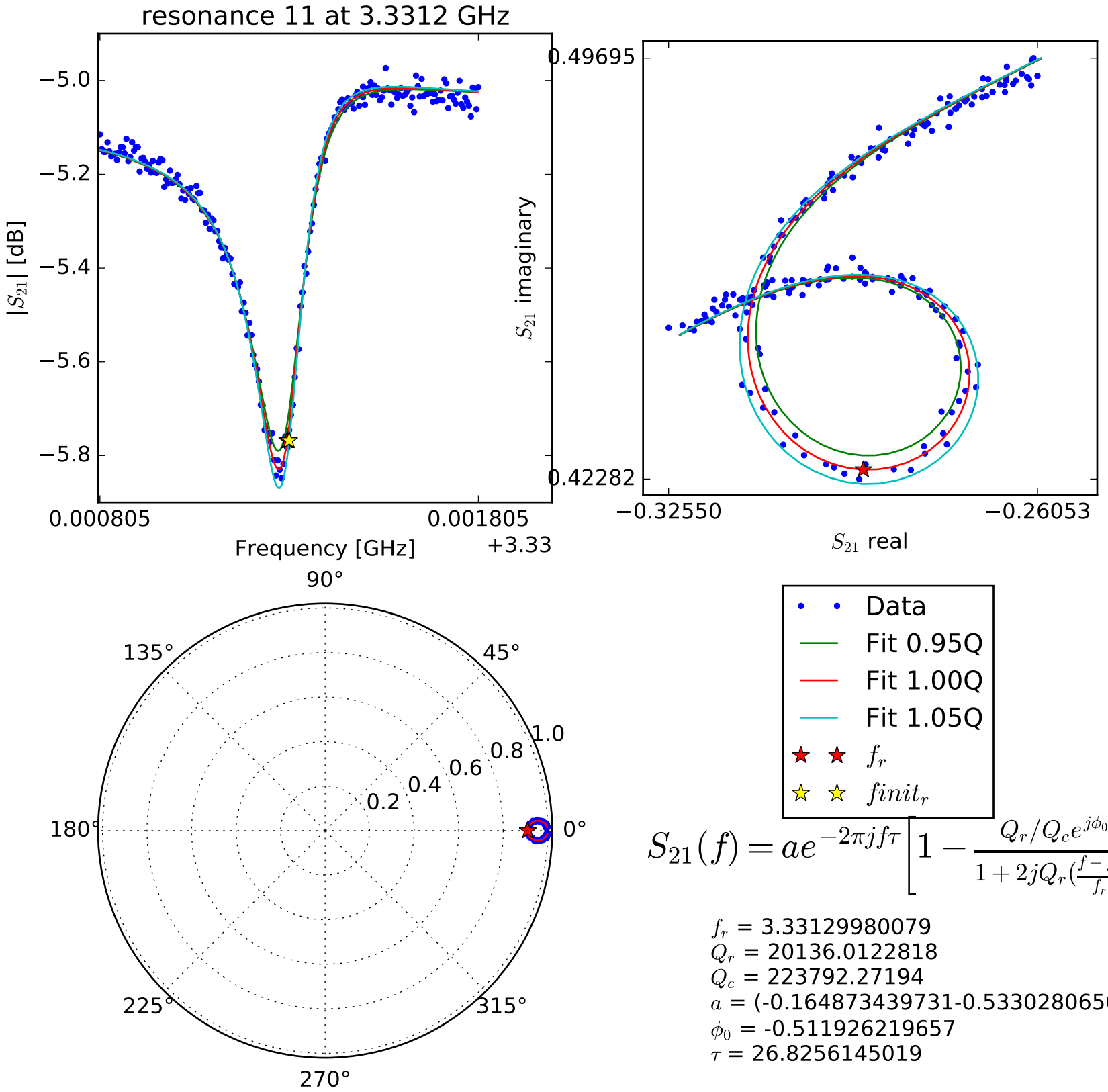


$$S_{21}(f) = ae^{-2\pi jf\tau}\left[1 - \frac{Q_r/Q_c e^{j\phi_0}}{1 + 2jQ_r(\frac{f-f_r}{f_r})}\right]$$

f_r = 3.28821091685
Q_r = 12275.7995494
Q_c = 201655.29932
a = (-0.52016469581+0.211922098122j)
ϕ_0 = -0.0221092158401
τ = 26.1447165876

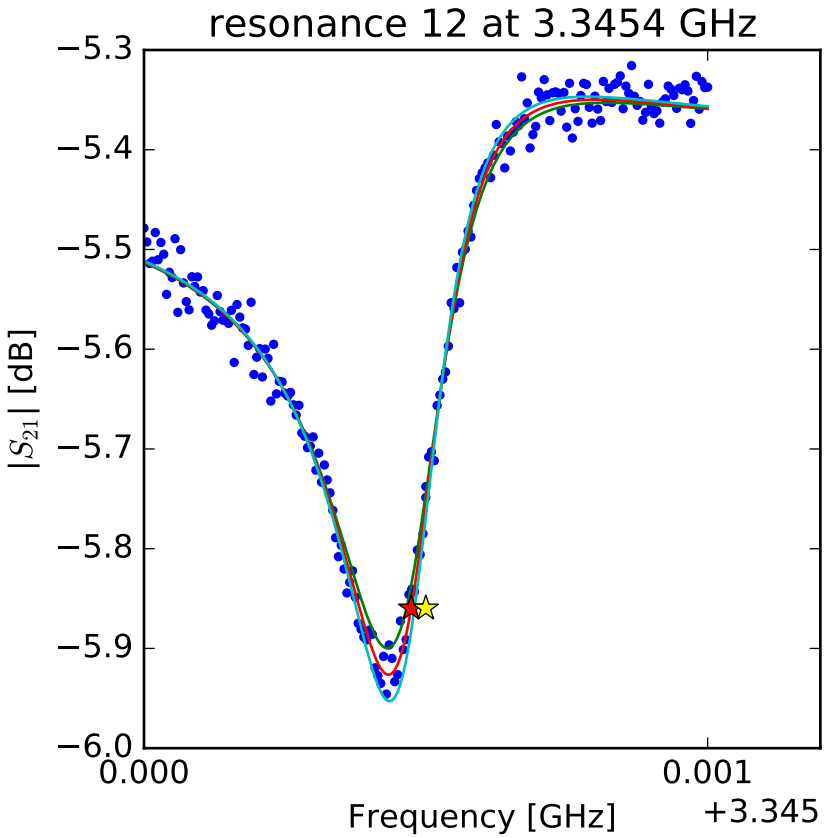

resonance 9 at 3.3023 GHz
−4.95
−5.00
−5.05
−5.10
−5.15
−5.20
−5.25
−5.30
$|S_{21}|$ [dB]
0.000875
0.001875
+3.301
Frequency [GHz]
0.35742
0.29181
S_{21} imaginary
0.43298
0.47992
S_{21} real
90°
135°
45°
180°
0°
225°
315°
270°
0.2
0.4
0.6
0.8
1.0
Data
Fit 0.95Q
Fit 1.00Q
Fit 1.05Q
f_r
$finit_r$
$S_{21}(f) = ae^{-2\pi jf\tau}\left[1 - \frac{Q_r/Q_c e^{j\phi_0}}{1 + 2jQ_r(\frac{f-f_r}{f_r})}\right]$
f_r = 3.3023446414
Q_r = 7562.43807921
Q_c = 226251.714586
a = (0.43828533558-0.35574431728j)
ϕ_0 = 0.243660704553
τ = 26.2819093049

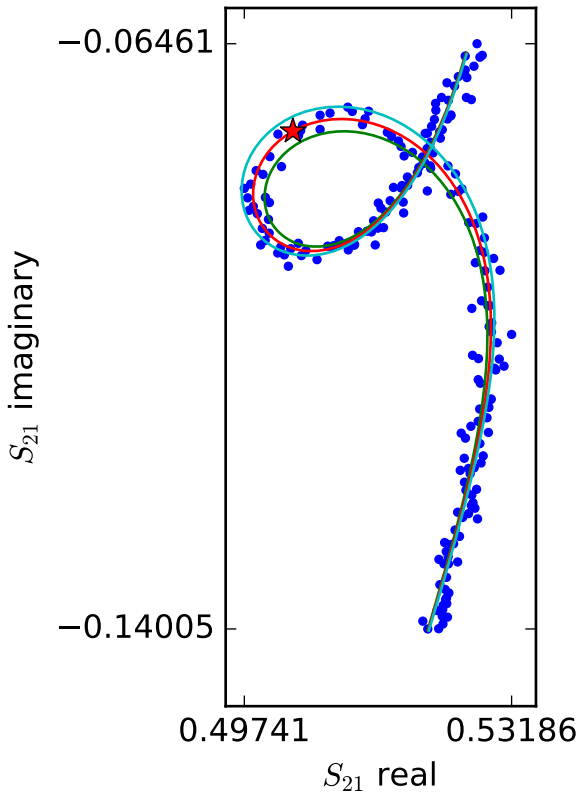

resonance 10 at 3.314 GHz
−5.0
−5.1
−5.2
−5.3
−5.4
$|S_{21}|$ [dB]
0.00059
0.00159
Frequency [GHz]
+3.313
S_{21} imaginary
−0.52426
−0.54907
0.09775
0.18427
S_{21} real
90°
135°
45°
180°
0°
225°
315°
270°
0.2
0.4
0.6
0.8
1.0
Data
Fit 0.95Q
Fit 1.00Q
Fit 1.05Q
f_r
$finit_r$
$S_{21}(f) = ae^{-2\pi jf\tau}\left[1 - \frac{Q_r/Q_c e^{j\phi_0}}{1 + 2jQ_r(\frac{f-f_r}{f_r})}\right]$
f_r = 3.31408216943
Q_r = 26003.3945971
Q_c = 737038.619049
a = (0.392121255753-0.398138080037j)
ϕ_0 = 0.558550958808
τ = 25.371397426

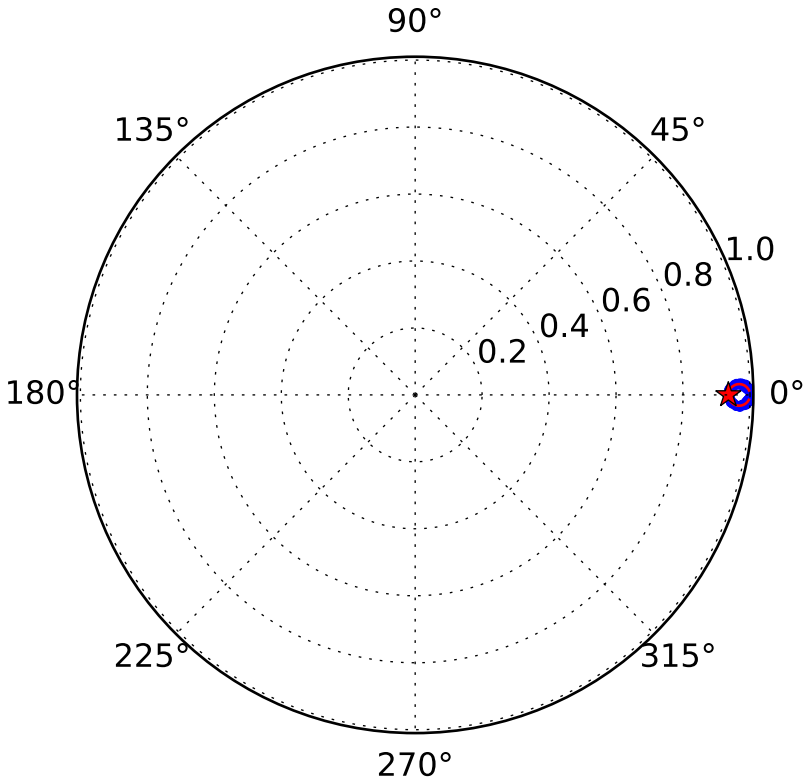


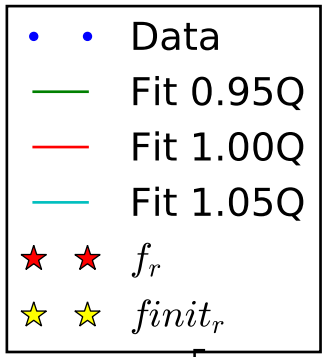
$$S_{21}(f) = ae^{-2\pi jf\tau}\left[1 - \frac{Q_r/Q_c e^{j\phi_0}}{1 + 2jQ_r(\frac{f-f_r}{f_r})}\right]$$

f_r = 3.33129980079
Q_r = 20136.0122818
Q_c = 223792.27194
a = (-0.164873439731-0.533028065015j)
ϕ_0 = -0.511926219657
τ = 26.8256145019



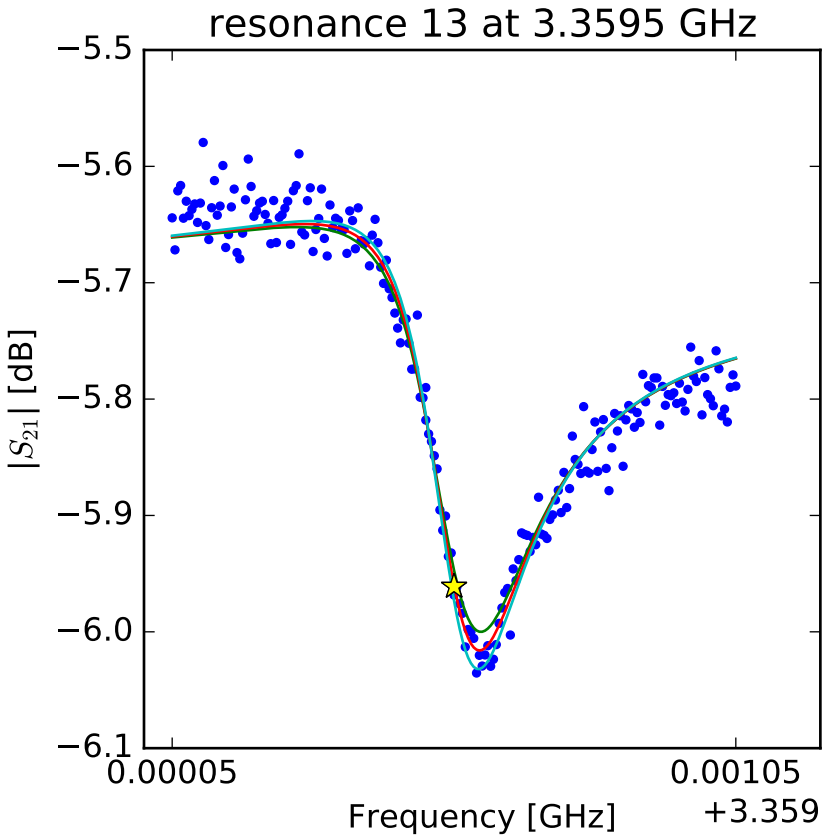


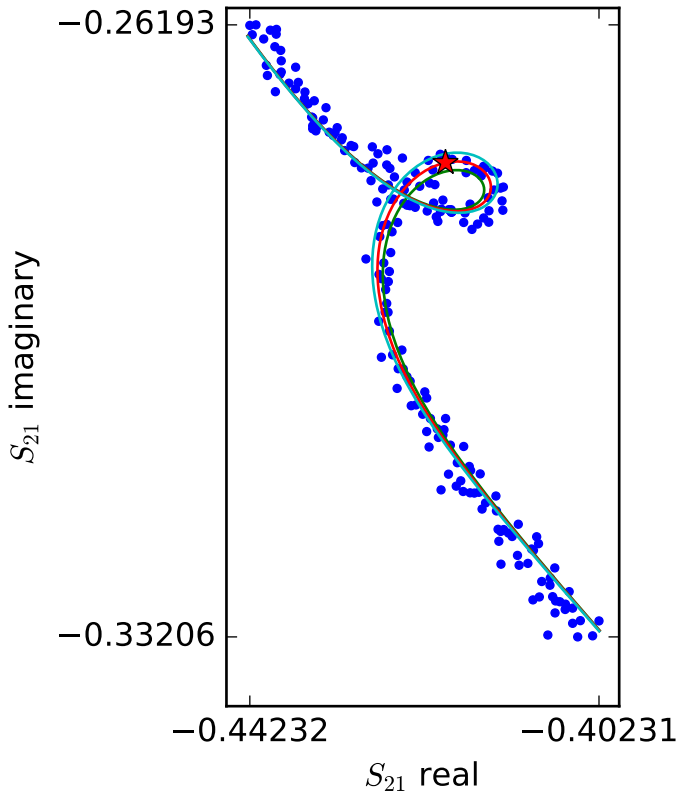


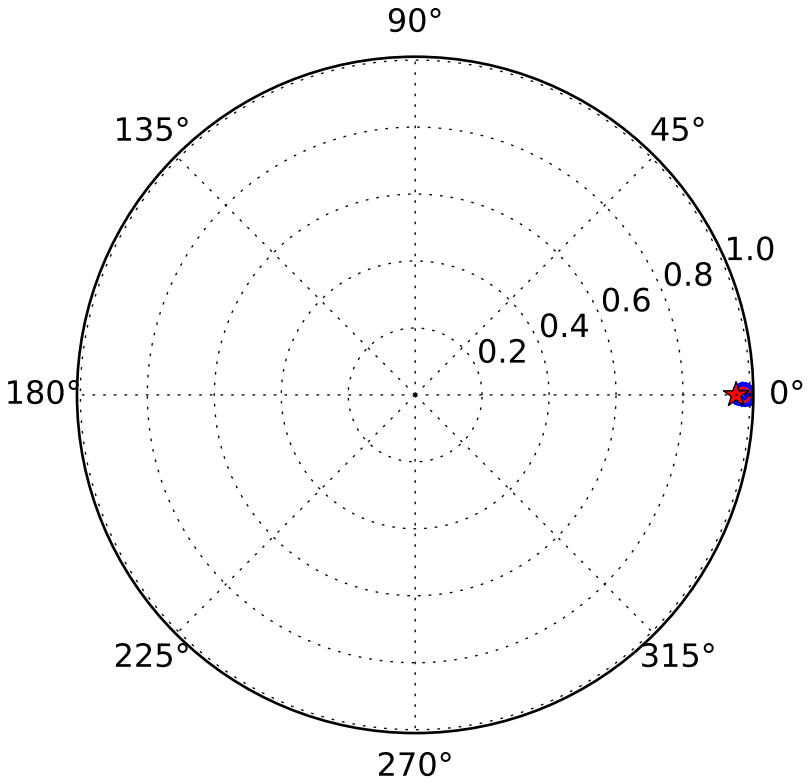


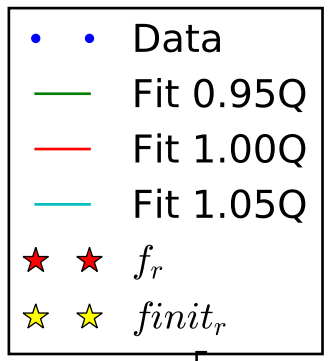
$$S_{21}(f) = ae^{-2\pi jf\tau}\left[1 - \frac{Q_r/Q_c e^{j\phi_0}}{1 + 2jQ_r(\frac{f-f_r}{f_r})}\right]$$

f_r = 3.34547406356
Q_r = 14546.0824699
Q_c = 224921.832103
a = (-0.417693722555+0.336648850505j)
ϕ_0 = -0.652855762626
τ = 25.533726321



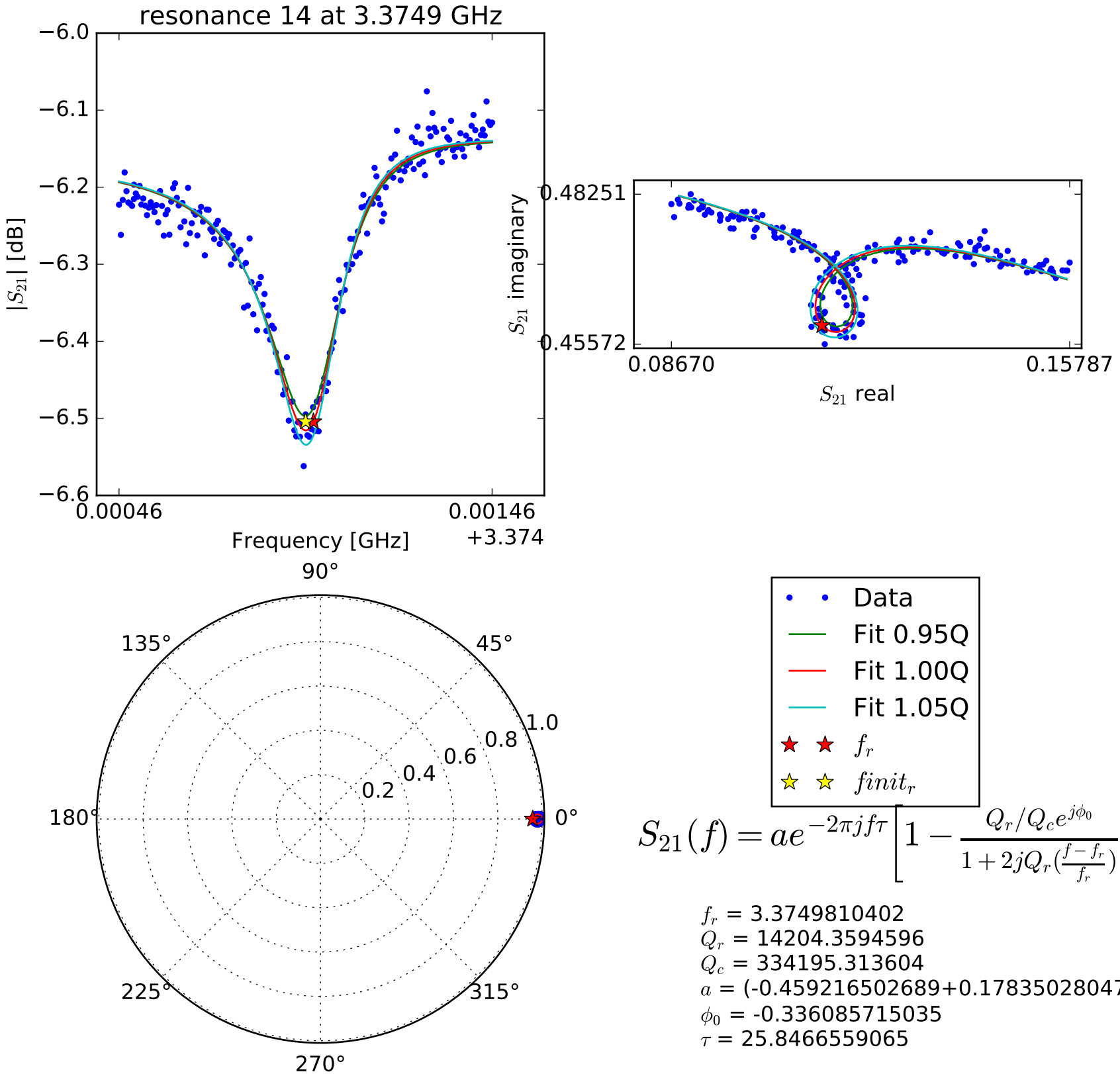






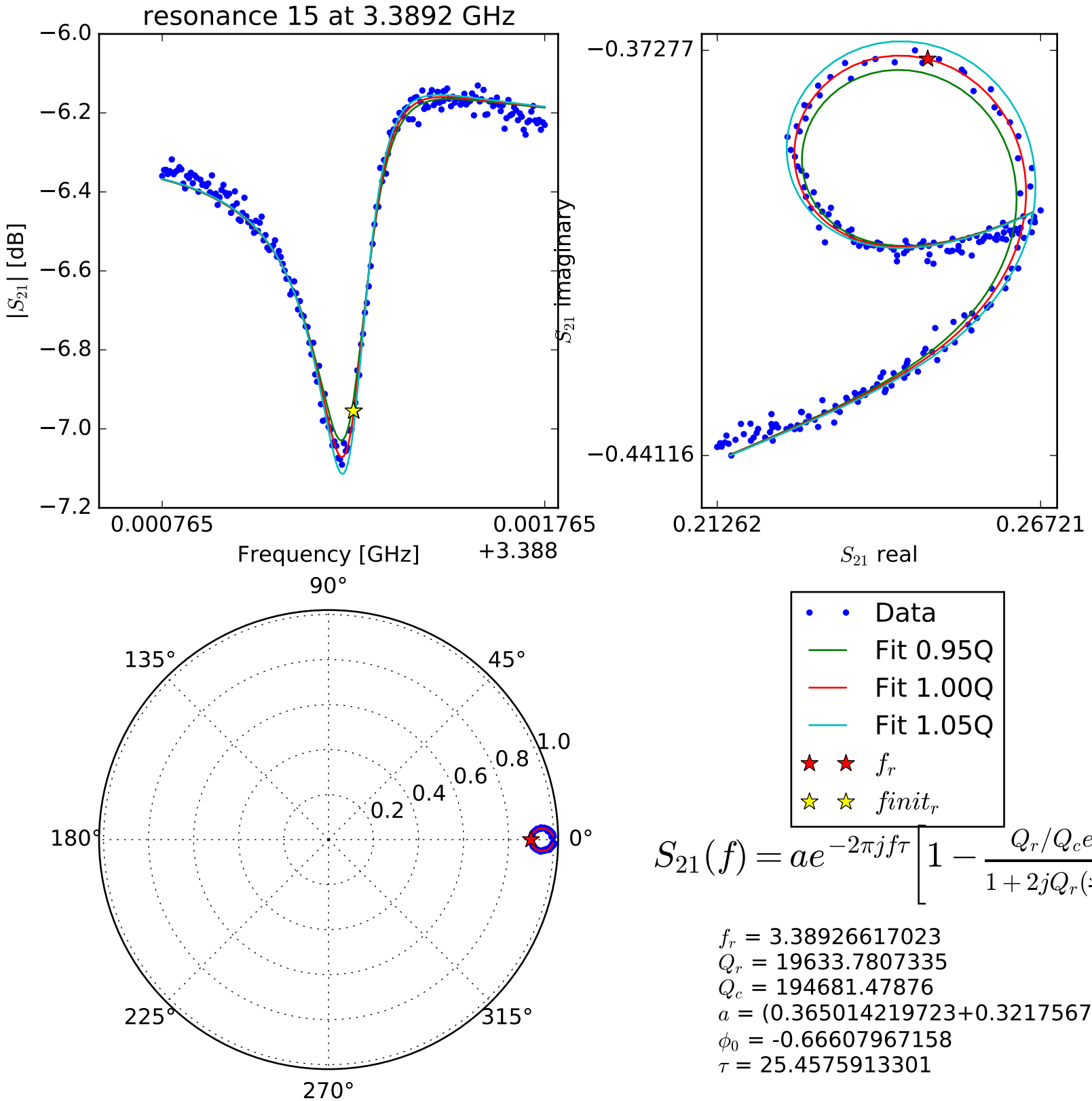
$$S_{21}(f) = ae^{-2\pi jf\tau}\left[1 - \frac{Q_r/Q_c e^{j\phi_0}}{1 + 2jQ_r(\frac{f-f_r}{f_r})}\right]$$

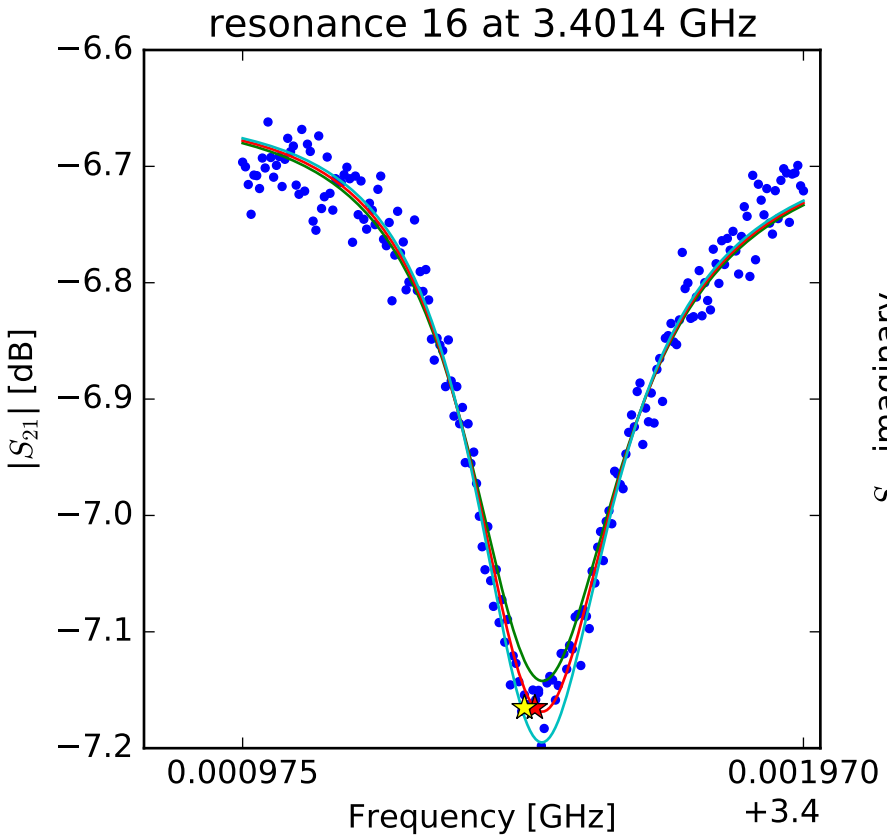
f_r = 3.35955043057
Q_r = 15403.8756776
Q_c = 370626.100919
a = (0.0941167195736-0.510146626277j)
ϕ_0 = 0.766003234443
τ = 26.2479490056

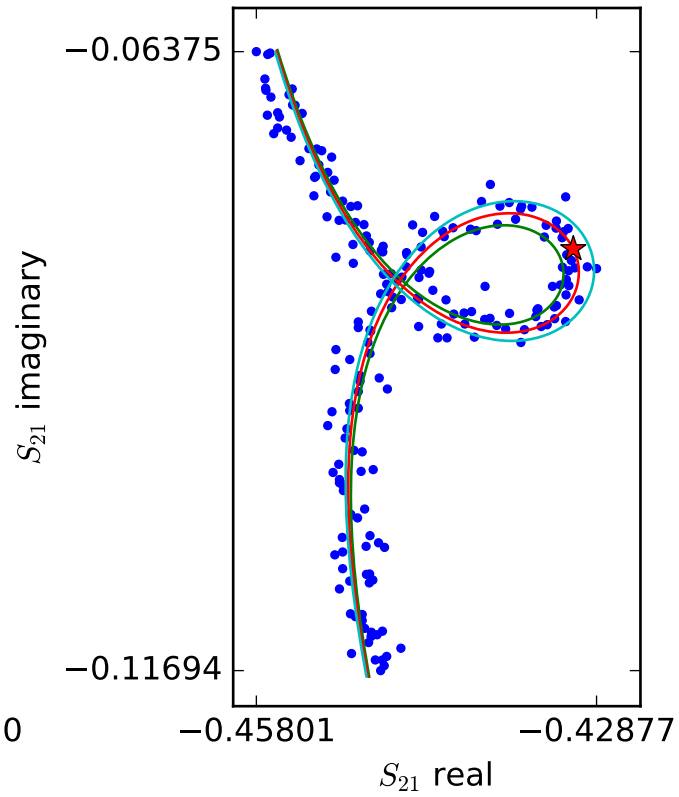


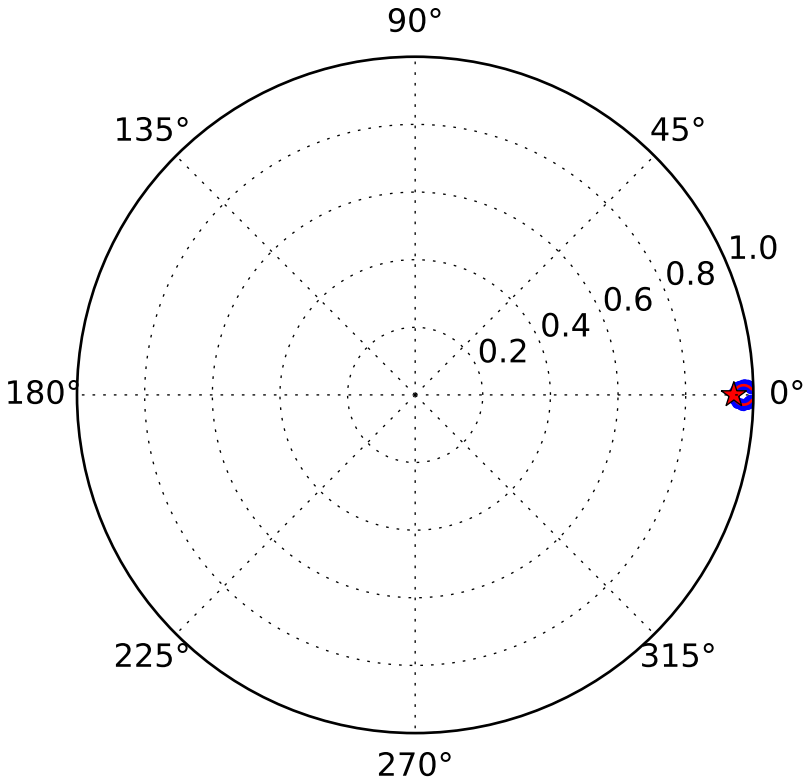
$$S_{21}(f) = ae^{-2\pi jf\tau}\left[1 - \frac{Q_r/Q_c e^{j\phi_0}}{1 + 2jQ_r(\frac{f-f_r}{f_r})}\right]$$

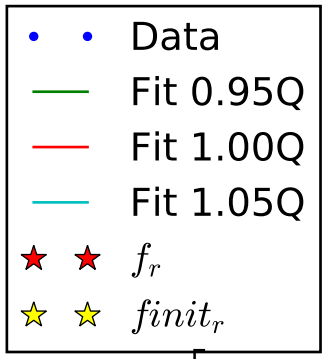
f_r = 3.3749810402
Q_r = 14204.3594596
Q_c = 334195.313604
a = (-0.459216502689+0.178350280472j)
ϕ_0 = -0.336085715035
τ = 25.8466559065


resonance 15 at 3.3892 GHz
−6.0
−6.2
−6.4
−6.6
−6.8
−7.0
−7.2
$|S_{21}|$ [dB]
0.000765
0.001765
+3.388
Frequency [GHz]
−0.37277
−0.44116
S_{21} imaginary
0.21262
0.26721
S_{21} real
90°
135°
45°
180°
0°
225°
315°
270°
0.2
0.4
0.6
0.8
1.0
Data
Fit 0.95Q
Fit 1.00Q
Fit 1.05Q
f_r
$finit_r$
$S_{21}(f) = ae^{-2\pi jf\tau}\left[1 - \frac{Q_r/Q_c e^{j\phi_0}}{1 + 2jQ_r(\frac{f-f_r}{f_r})}\right]$
f_r = 3.38926617023
Q_r = 19633.7807335
Q_c = 194681.47876
a = (0.365014219723+0.321756725186j)
ϕ_0 = -0.66607967158
τ = 25.4575913301



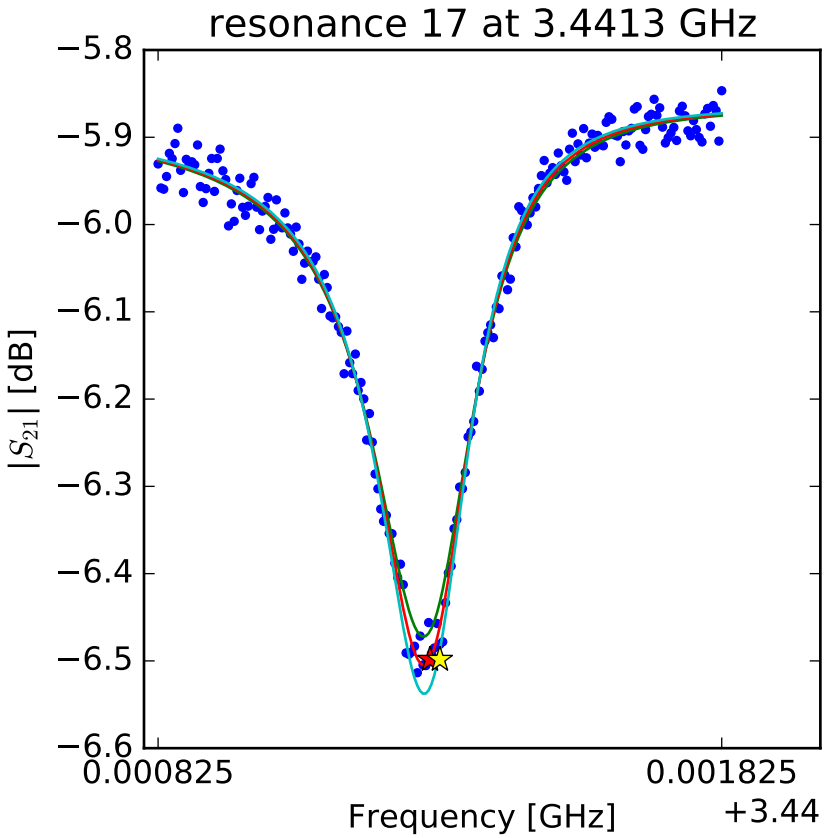


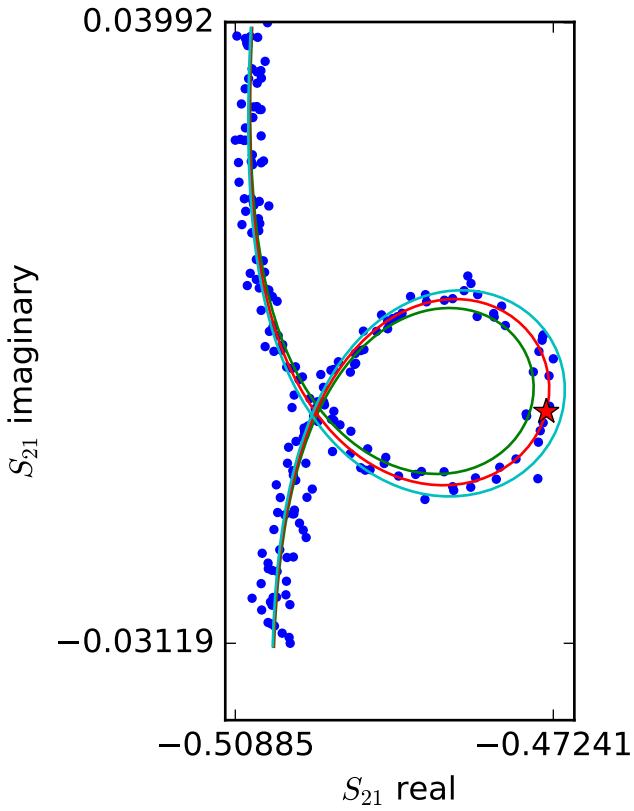


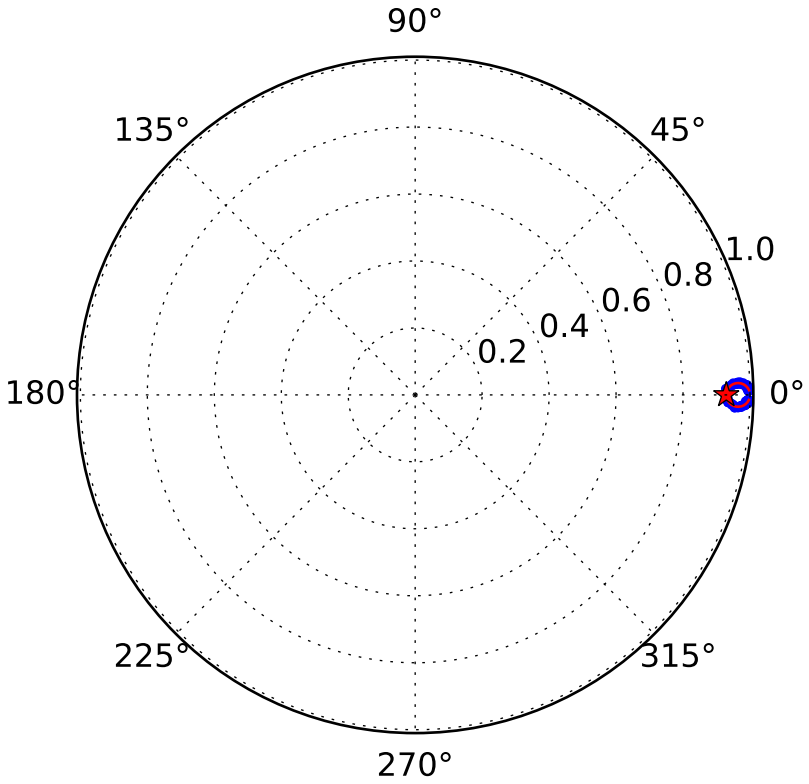


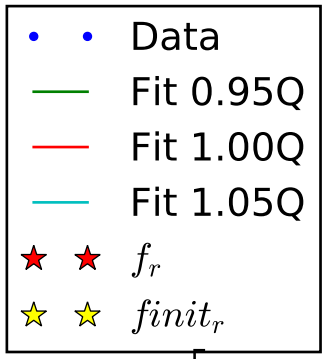
$$S_{21}(f) = ae^{-2\pi jf\tau}\left[1 - \frac{Q_r/Q_c e^{j\phi_0}}{1 + 2jQ_r(\frac{f-f_r}{f_r})}\right]$$

f_r = 3.40149344079
Q_r = 10336.3114594
Q_c = 179218.047704
a = (0.386503561996-0.258057687644j)
ϕ_0 = 0.153231564898
τ = 24.2174055736



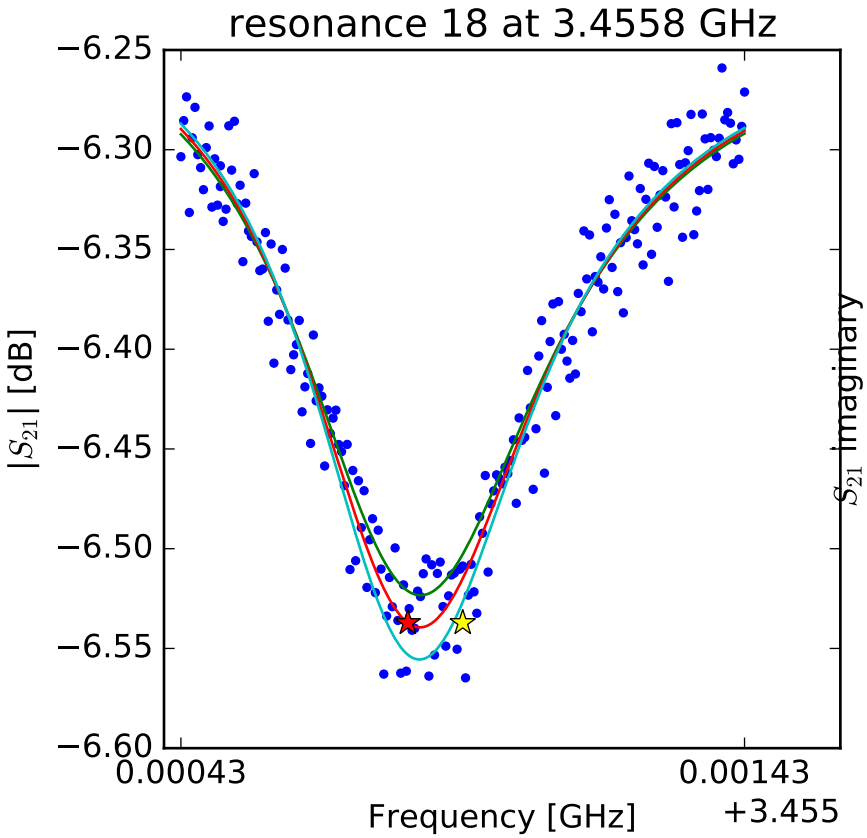


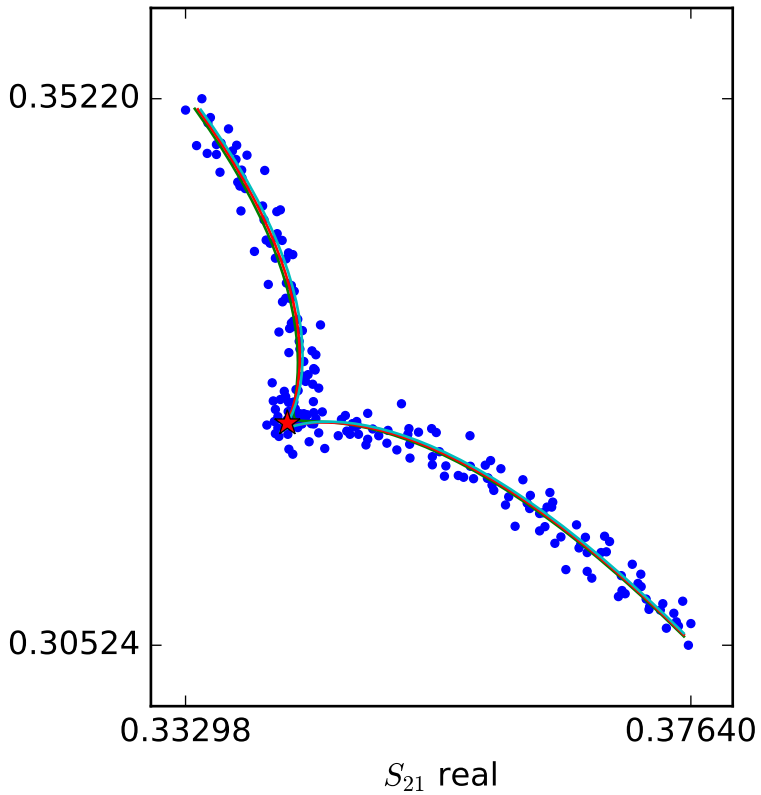


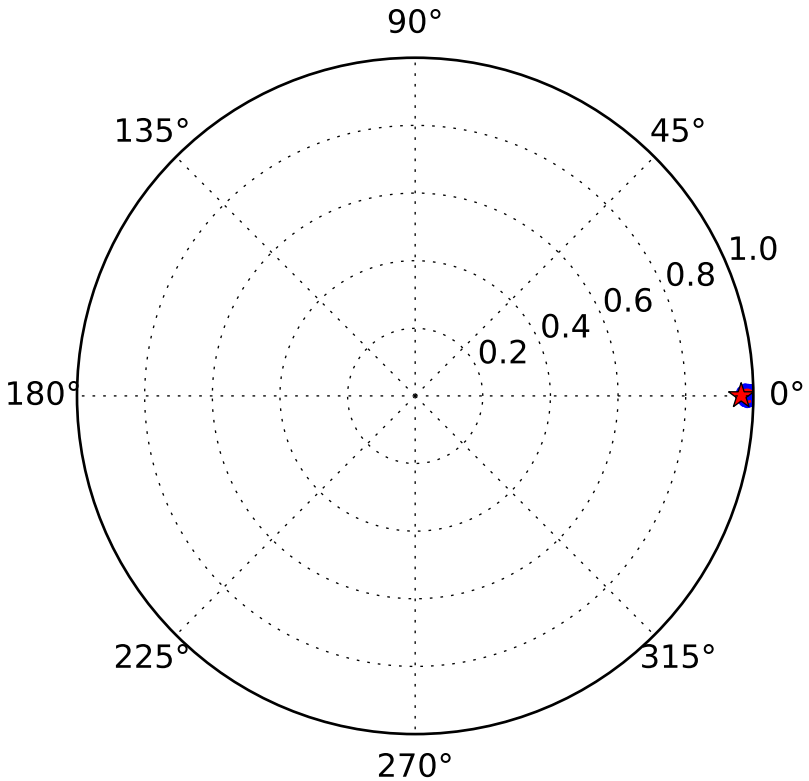


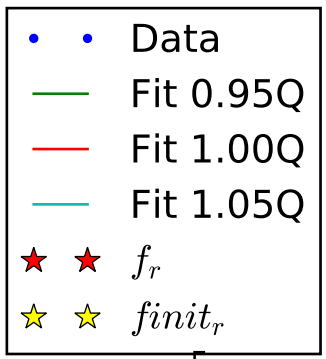
$$S_{21}(f) = ae^{-2\pi jf\tau}\left[1 - \frac{Q_r/Q_c e^{j\phi_0}}{1 + 2jQ_r(\frac{f-f_r}{f_r})}\right]$$

f_r = 3.44130733754
Q_r = 15849.3420795
Q_c = 223587.733342
a = (0.399511568271-0.31473605003j)
ϕ_0 = -0.189803196523
τ = 26.8486717319



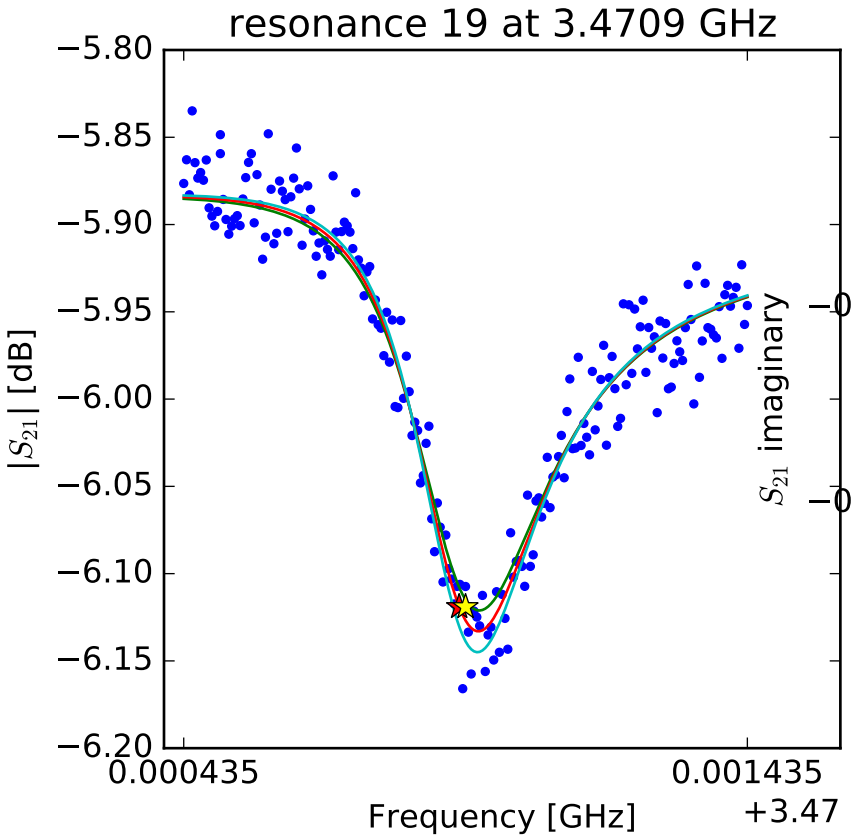


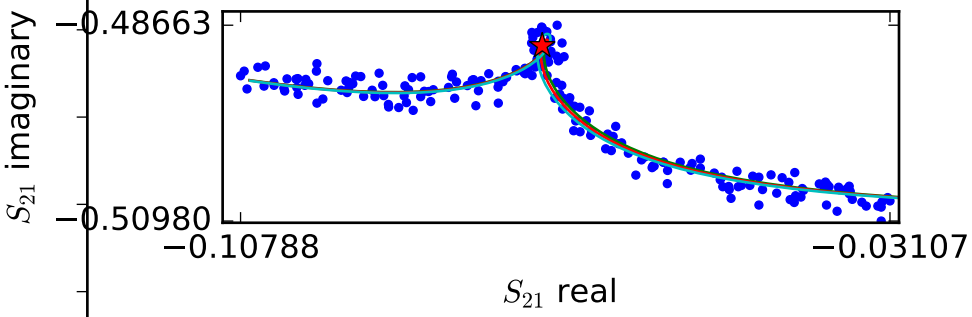


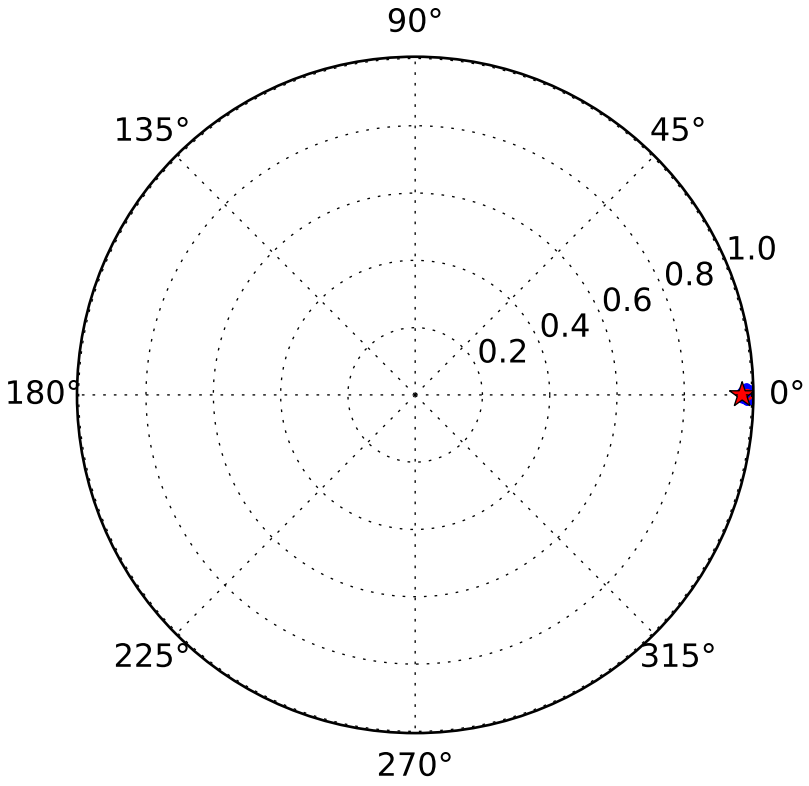


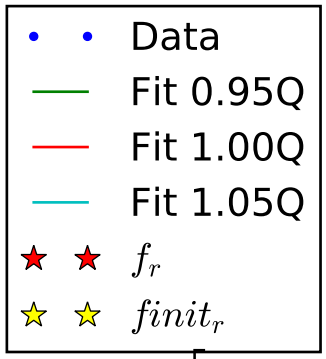
$$S_{21}(f) = ae^{-2\pi jf\tau}\left[1 - \frac{Q_r/Q_c e^{j\phi_0}}{1 + 2jQ_r(\frac{f-f_r}{f_r})}\right]$$

f_r = 3.45583254333
Q_r = 6652.20839306
Q_c = 184803.275885
a = (-0.460971367822-0.161587538195j)
ϕ_0 = 0.163109086353
τ = 25.0104279308



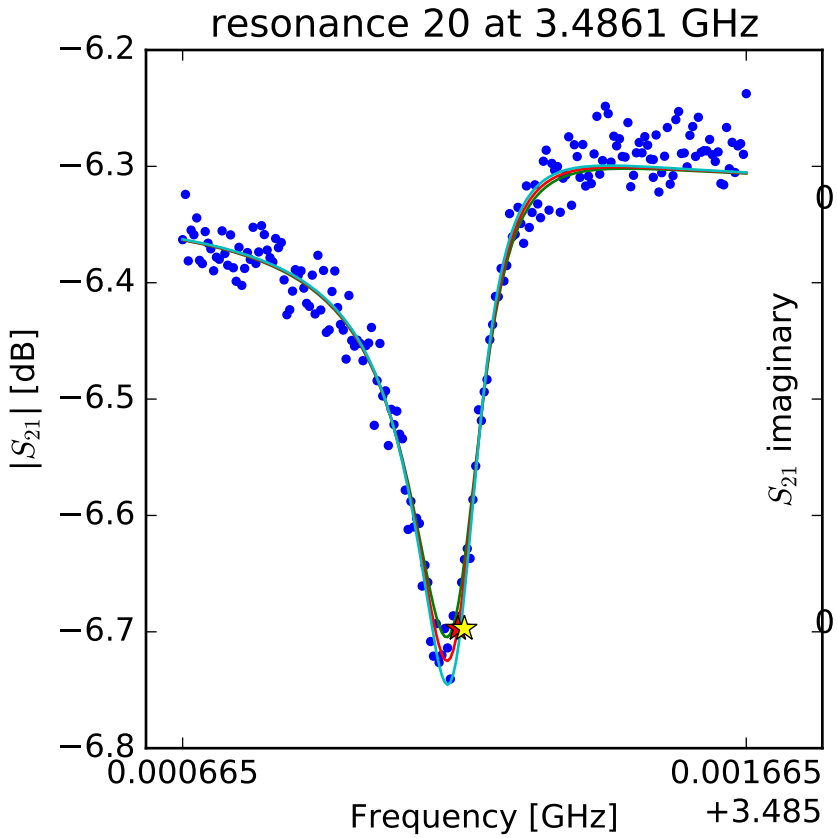


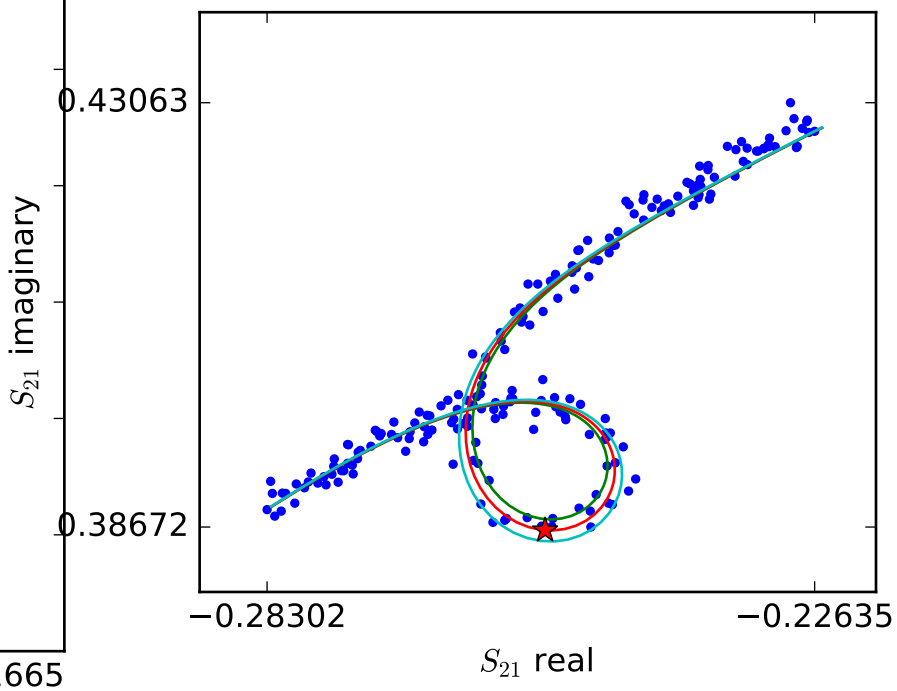


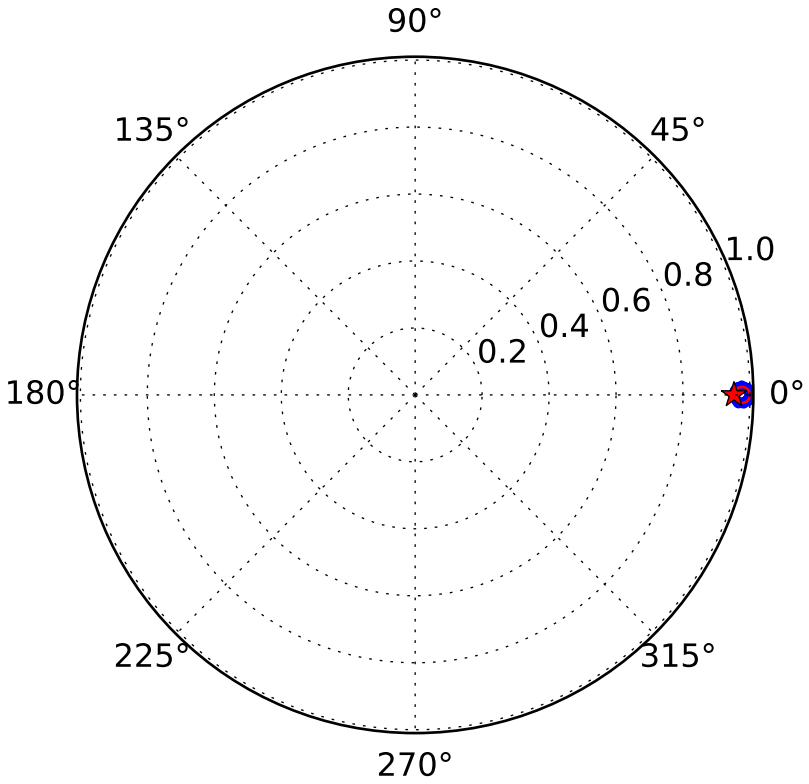


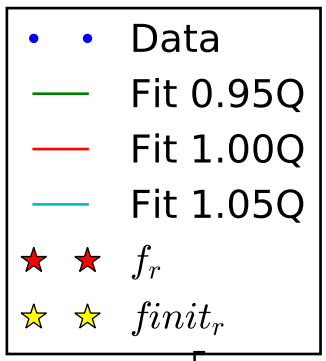
$$S_{21}(f) = ae^{-2\pi jf\tau}\left[1 - \frac{Q_r/Q_c e^{j\phi_0}}{1 + 2jQ_r(\frac{f-f_r}{f_r})}\right]$$

f_r = 3.47092367429
Q_r = 12263.9937388
Q_c = 432777.040004
a = (0.465859737994-0.200472940777j)
ϕ_0 = 0.465956058191
τ = 26.5654275173



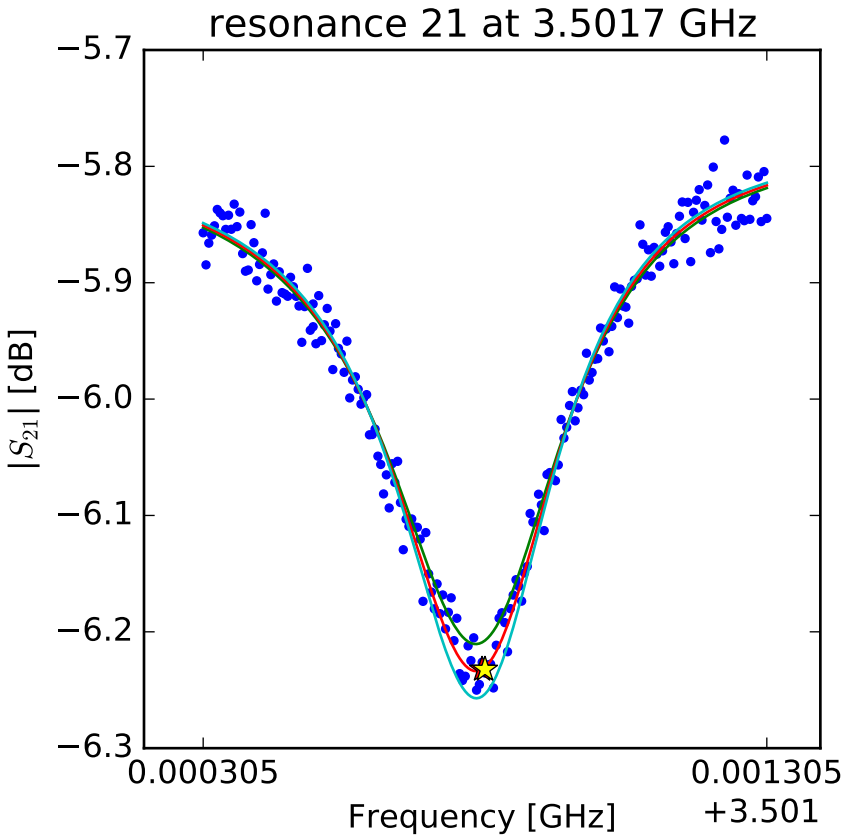


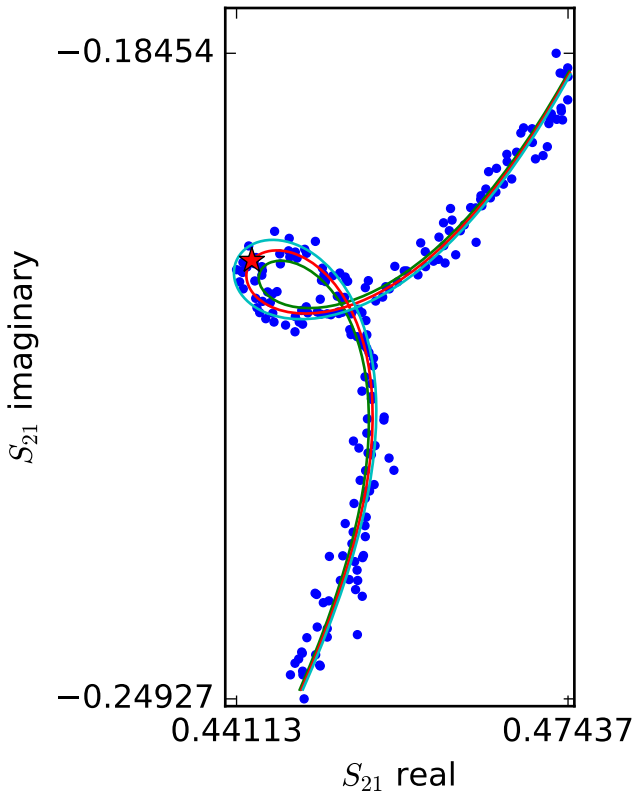


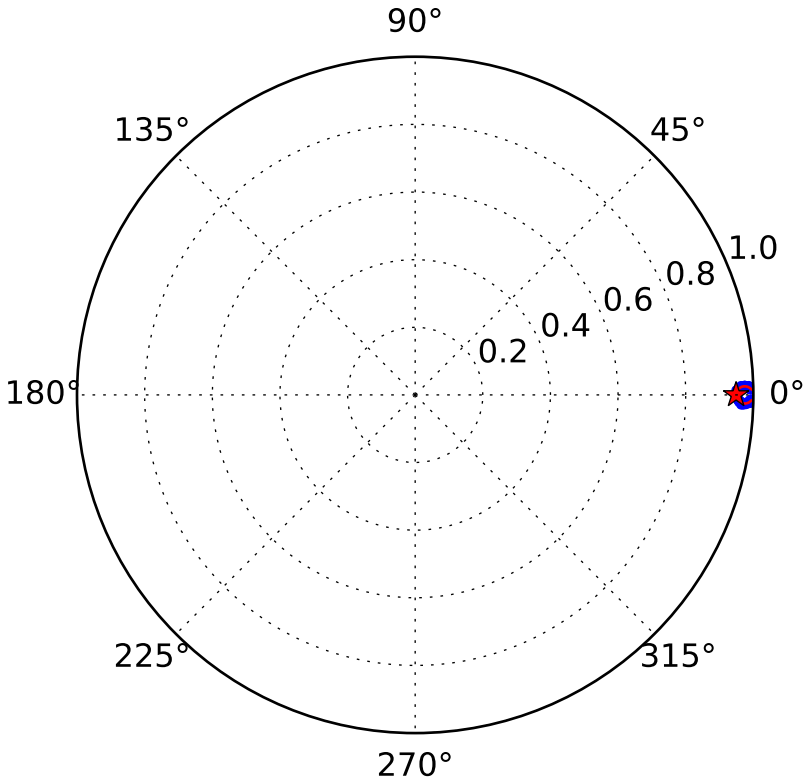


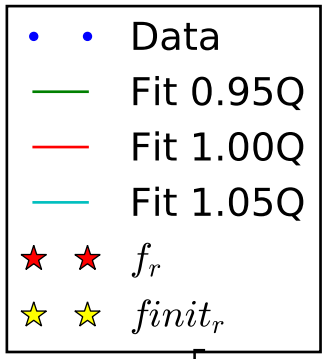
$$S_{21}(f) = ae^{-2\pi jf\tau}\left[1 - \frac{Q_r/Q_c e^{j\phi_0}}{1 + 2jQ_r(\frac{f-f_r}{f_r})}\right]$$

f_r = 3.48615322873
Q_r = 23851.529332
Q_c = 498617.162312
a = (-0.410349811773-0.254221332624j)
ϕ_0 = -0.49546493002
τ = 24.7405727726



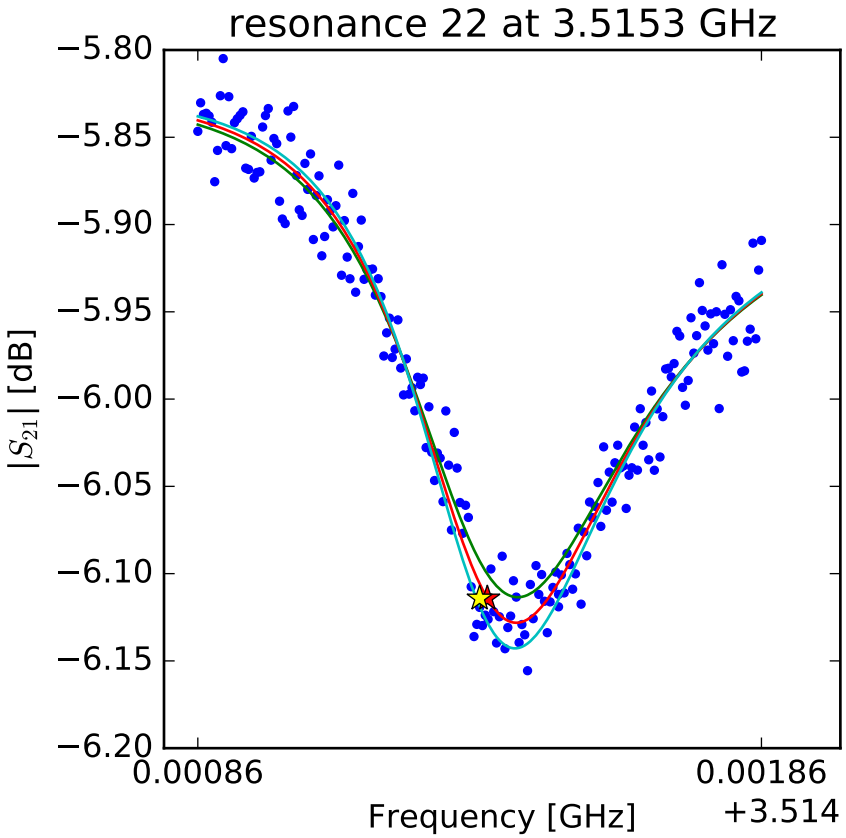


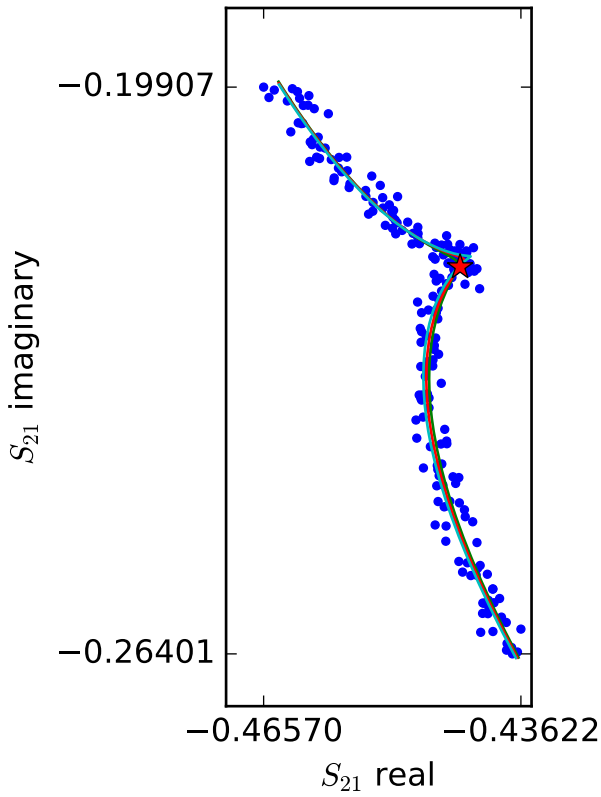


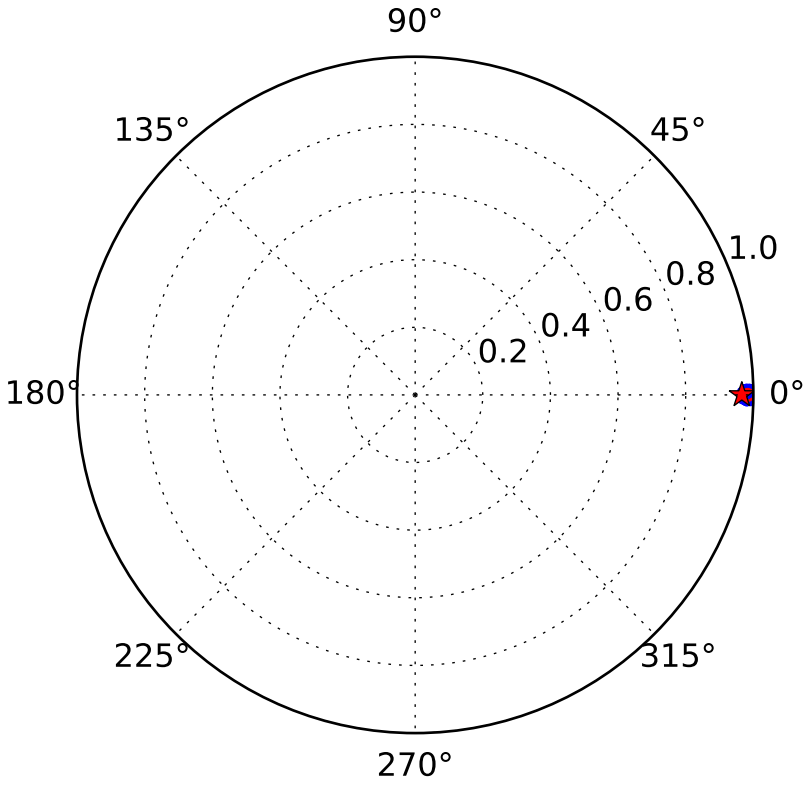


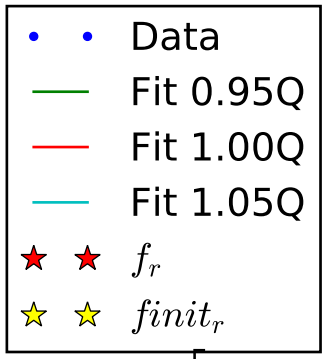
$$S_{21}(f) = ae^{-2\pi jf\tau}\left[1 - \frac{Q_r/Q_c e^{j\phi_0}}{1 + 2jQ_r(\frac{f-f_r}{f_r})}\right]$$

f_r = 3.50179982057
Q_r = 9316.45209918
Q_c = 182354.773013
a = (0.0768692682398+0.508278475811j)
ϕ_0 = -0.109567841581
τ = 26.3567798686



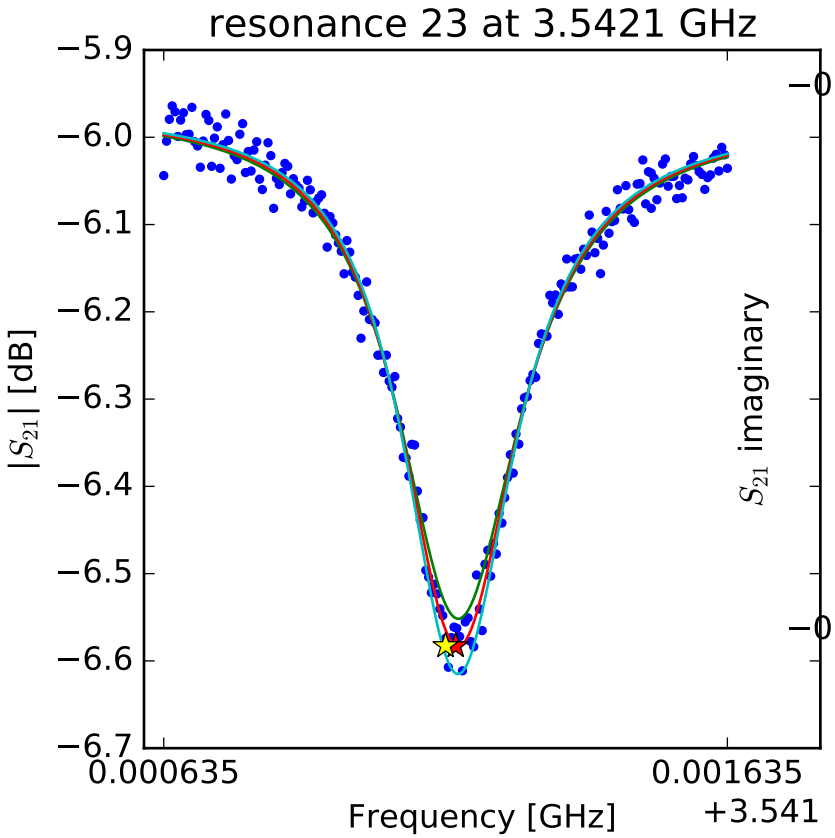


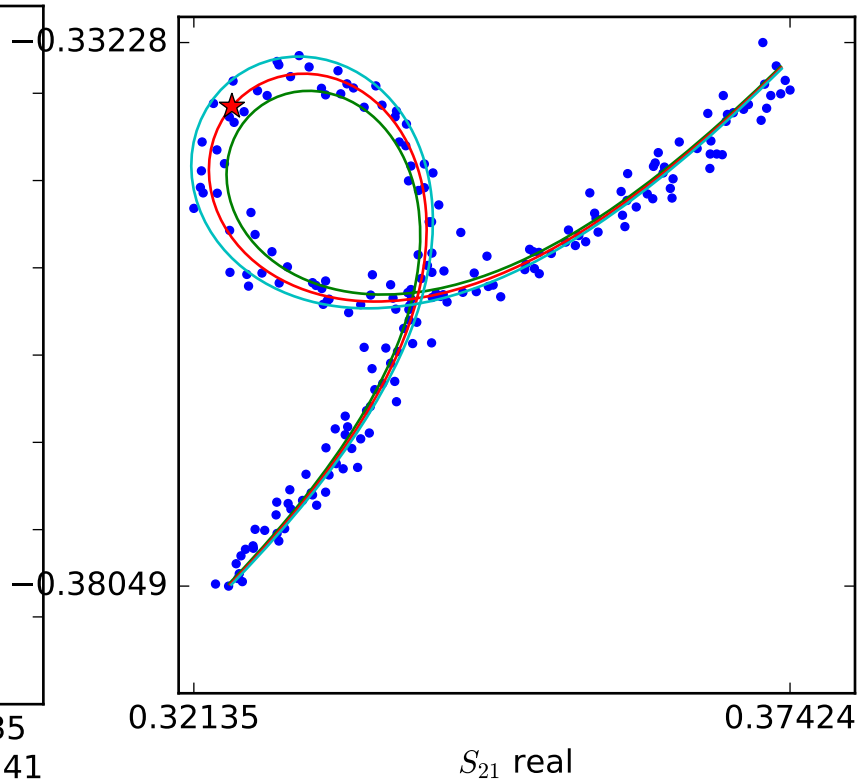


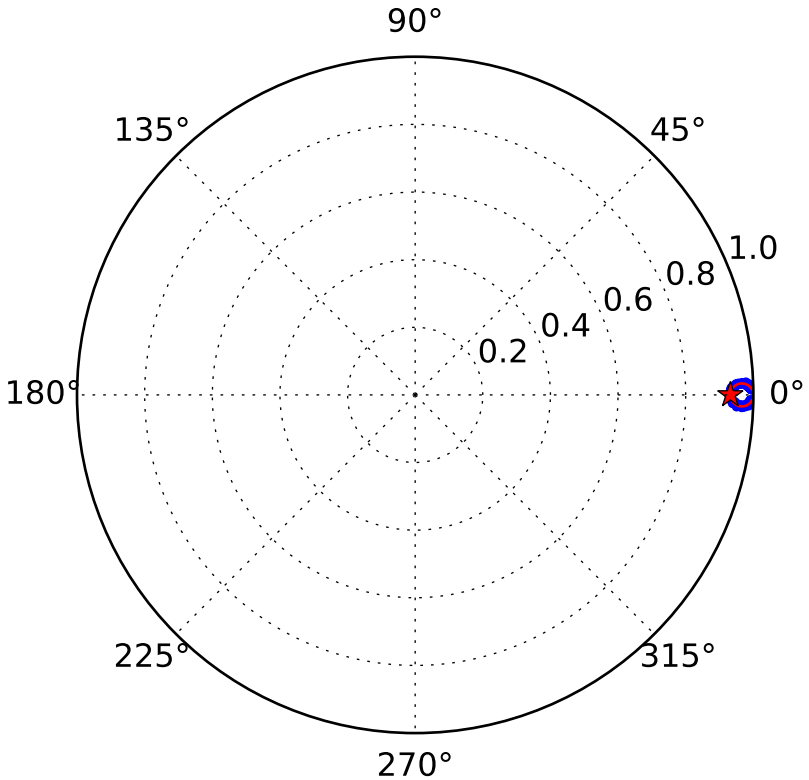


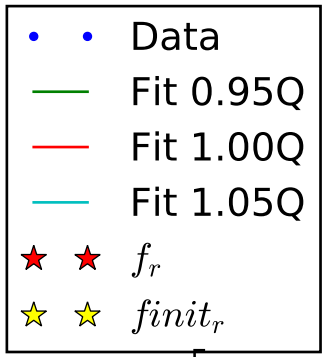
$$S_{21}(f) = ae^{-2\pi jf\tau}\left[1 - \frac{Q_r/Q_c e^{j\phi_0}}{1 + 2jQ_r(\frac{f-f_r}{f_r})}\right]$$

f_r = 3.51537364042
Q_r = 7414.38203588
Q_c = 216946.480521
a = (-0.383344873628+0.337163705368j)
ϕ_0 = 0.420434498826
τ = 26.1166138595



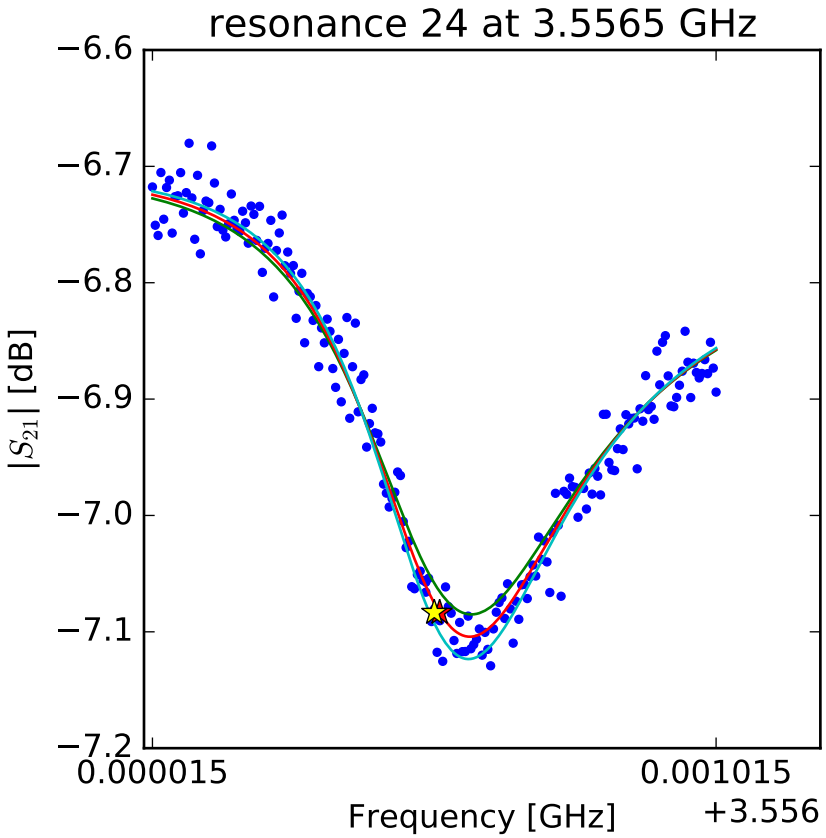


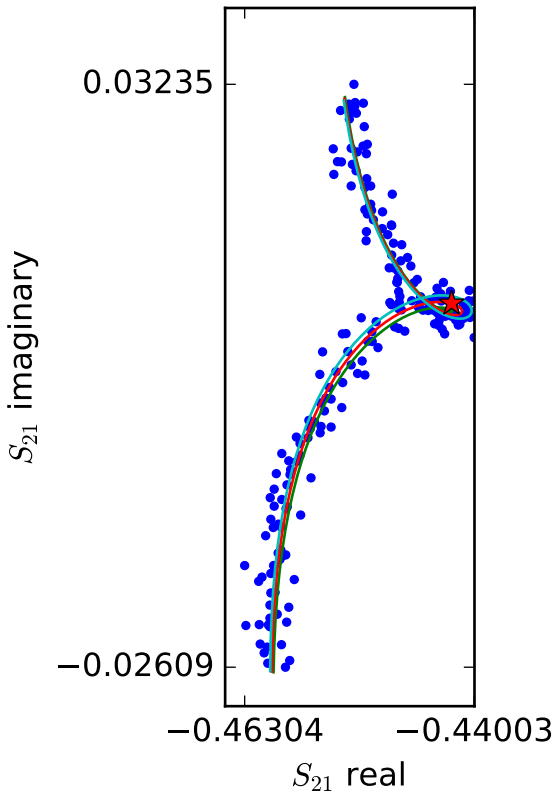


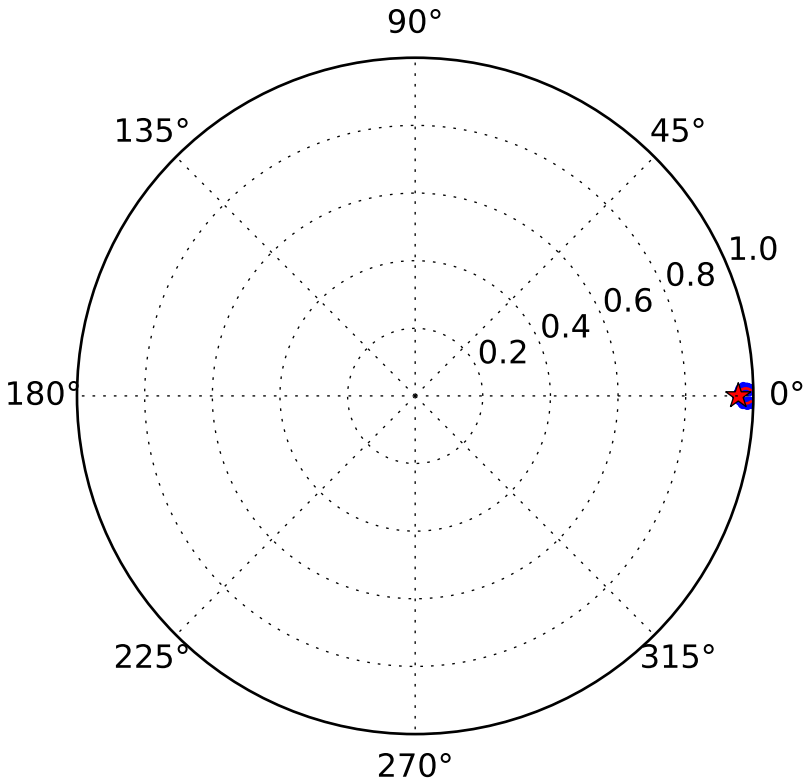


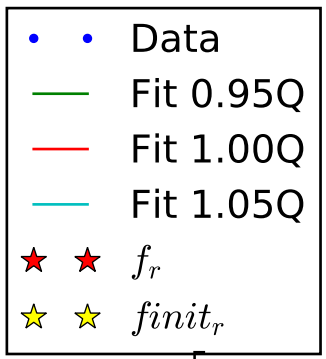
$$S_{21}(f) = ae^{-2\pi jf\tau}\left[1 - \frac{Q_r/Q_c e^{j\phi_0}}{1 + 2jQ_r(\frac{f-f_r}{f_r})}\right]$$

f_r = 3.54215307841
Q_r = 13565.4887257
Q_c = 199292.396544
a = (0.315697829787+0.391355777904j)
ϕ_0 = 0.0638388856003
τ = 26.6135865271



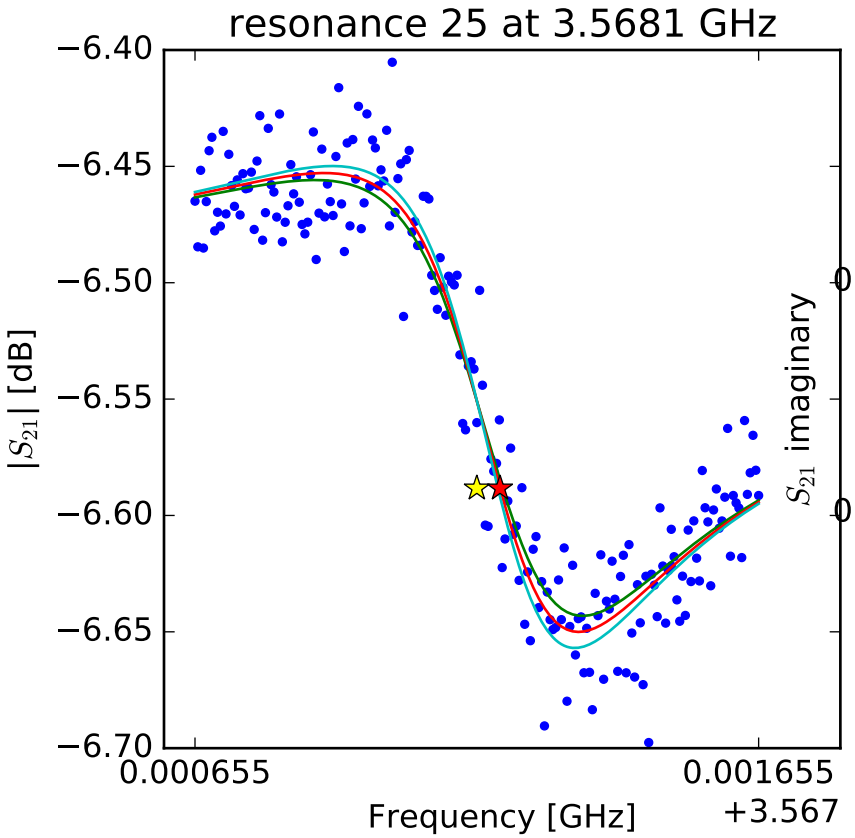


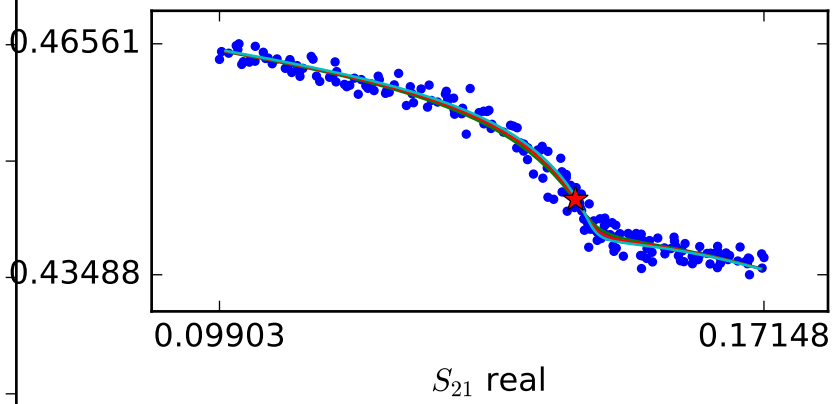


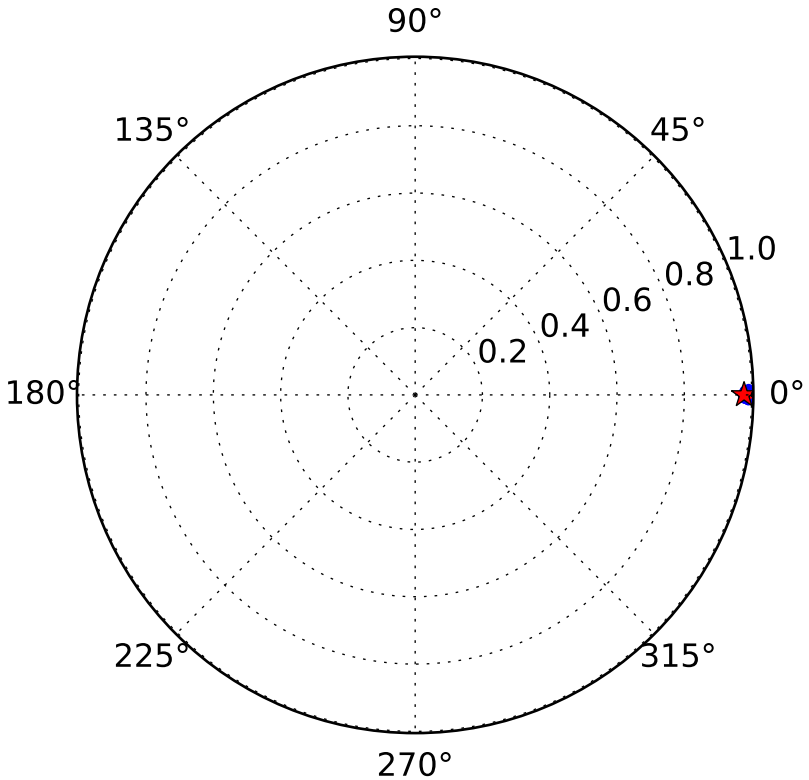


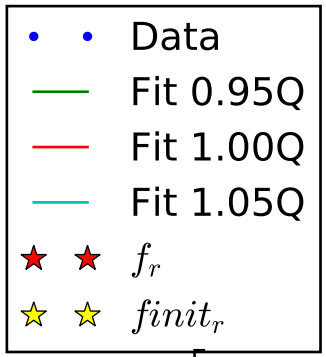
$$S_{21}(f) = ae^{-2\pi jf\tau}\left[1 - \frac{Q_r/Q_c e^{j\phi_0}}{1 + 2jQ_r(\frac{f-f_r}{f_r})}\right]$$

f_r = 3.55652451902
Q_r = 7636.29633659
Q_c = 171330.938303
a = (0.45318379554+0.0839014826257j)
ϕ_0 = 0.44297991803
τ = 24.8921969287



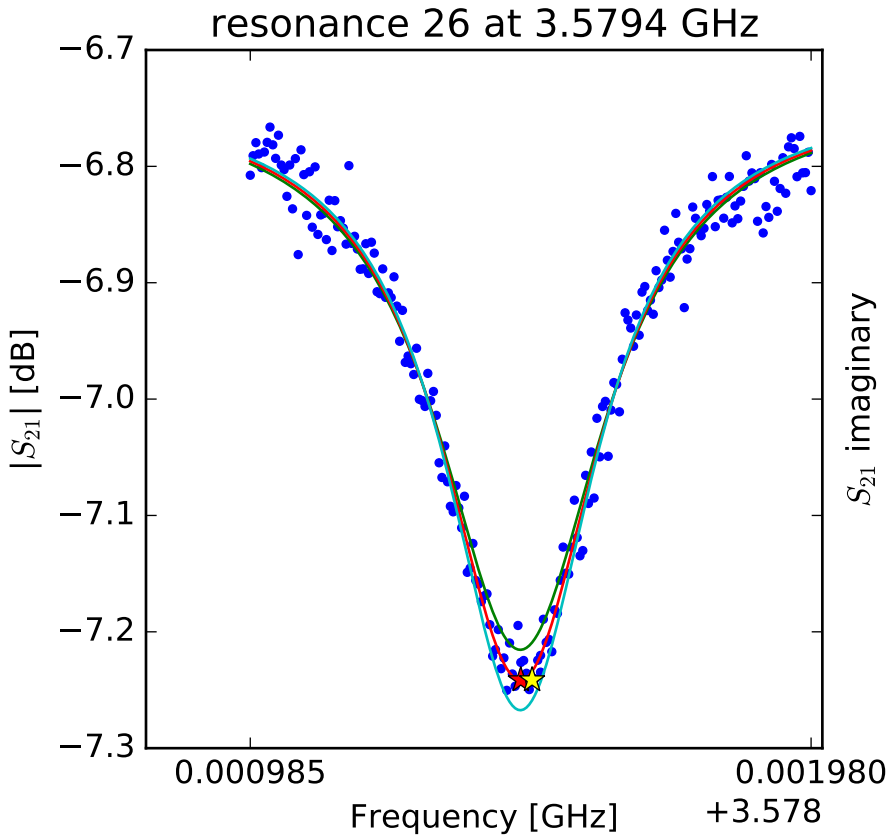


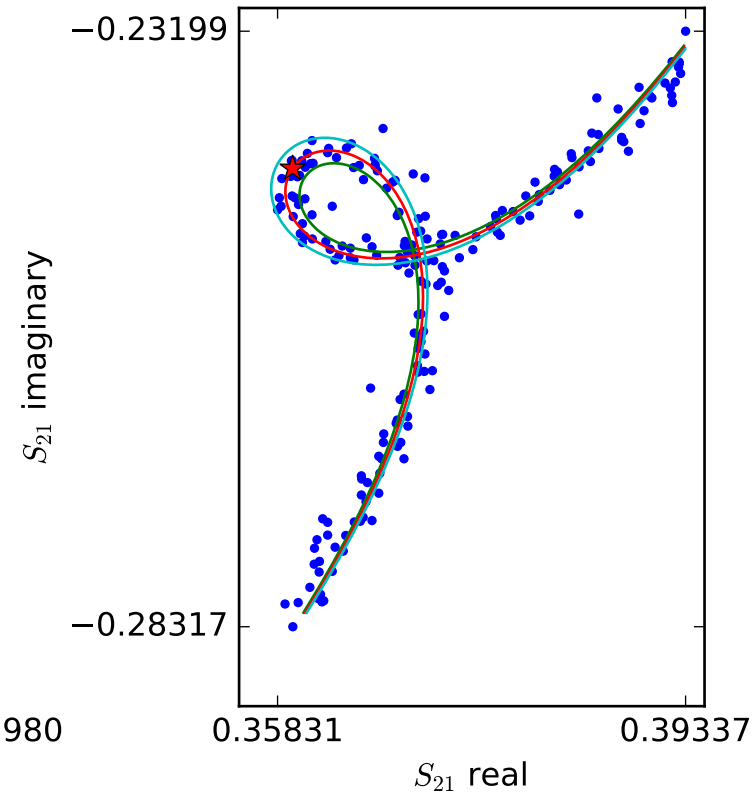


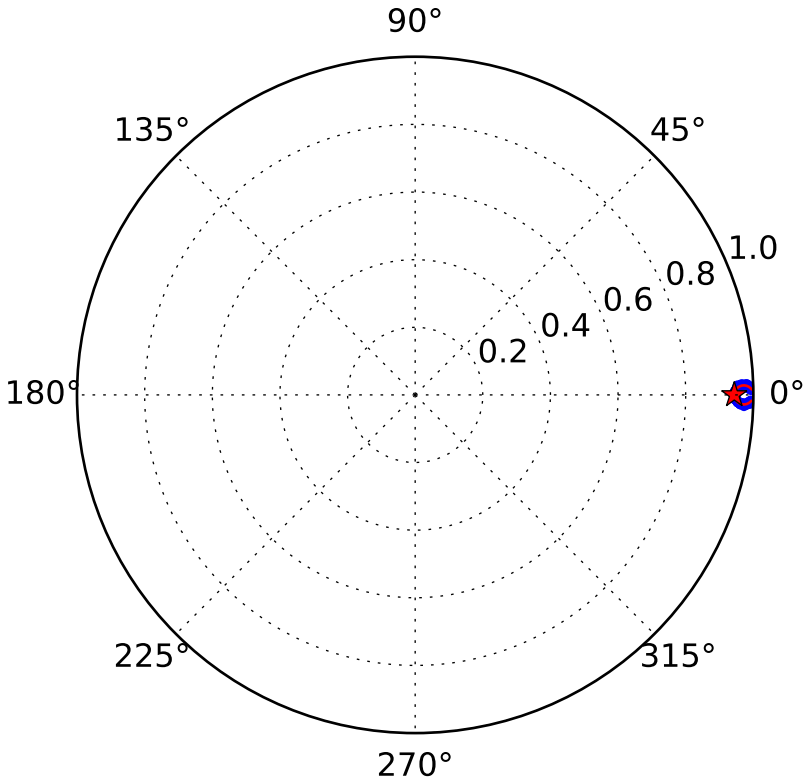


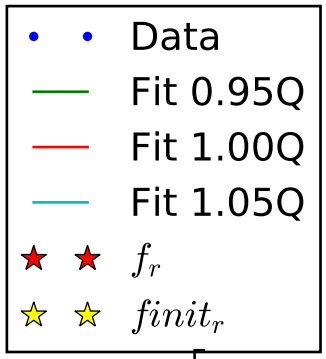
$$S_{21}(f) = ae^{-2\pi jf\tau}\left[1 - \frac{Q_r/Q_c e^{j\phi_0}}{1 + 2jQ_r(\frac{f-f_r}{f_r})}\right]$$

f_r = 3.56819618346
Q_r = 8554.66547876
Q_c = 378496.853425
a = (-0.46635005492-0.075739998985j)
ϕ_0 = 1.1667003155
τ = 26.7145853094



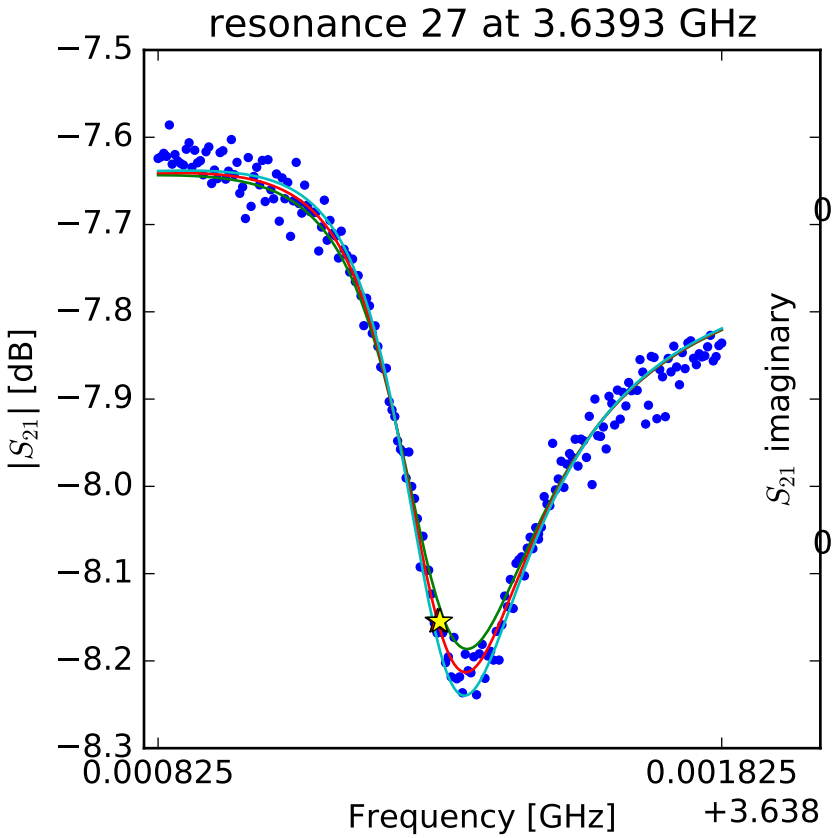


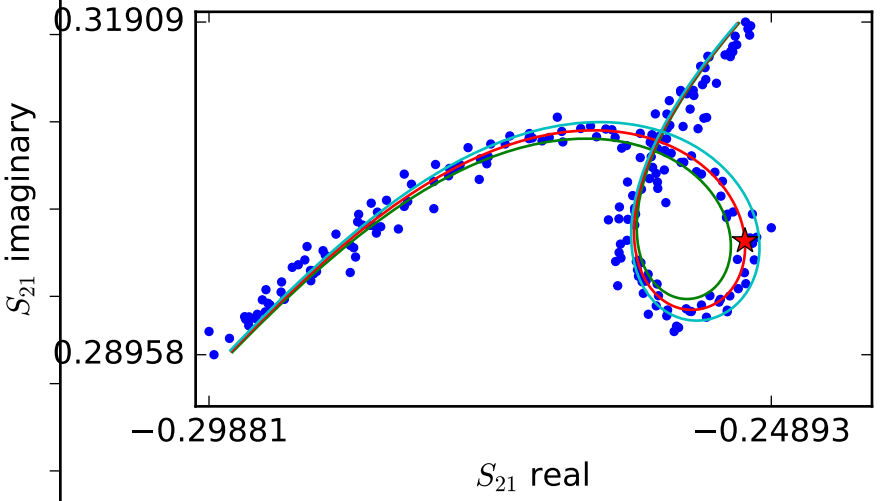


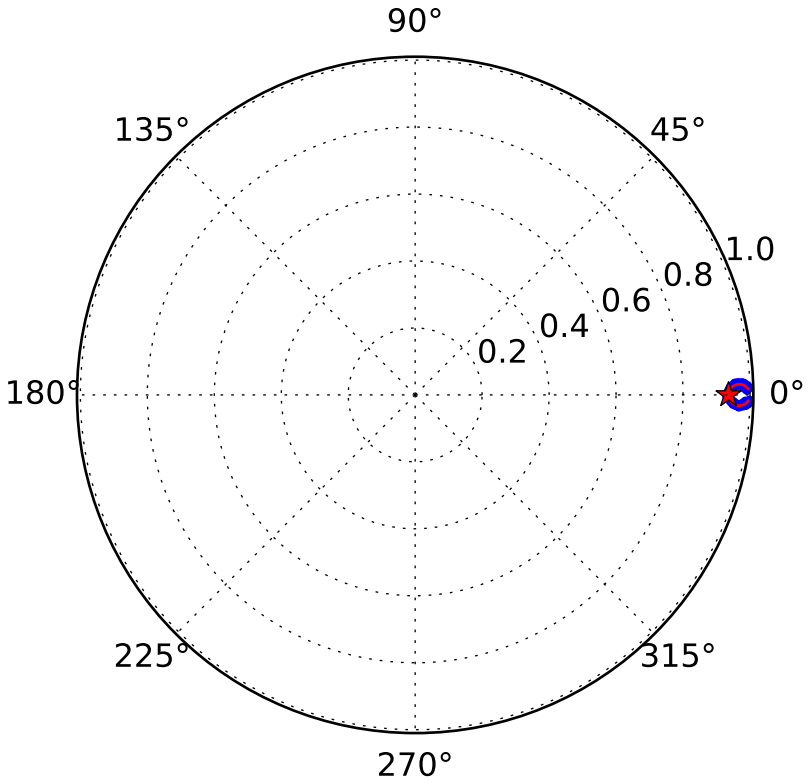


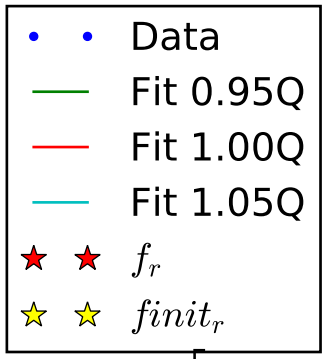
$$S_{21}(f) = ae^{-2\pi jf\tau}\left[1 - \frac{Q_r/Q_c e^{j\phi_0}}{1 + 2jQ_r(\frac{f-f_r}{f_r})}\right]$$

f_r = 3.57946491551
Q_r = 10142.6821394
Q_c = 179851.542604
a = (-0.339689171685-0.310778783164j)
ϕ_0 = -0.00777859574833
τ = 26.1806790208



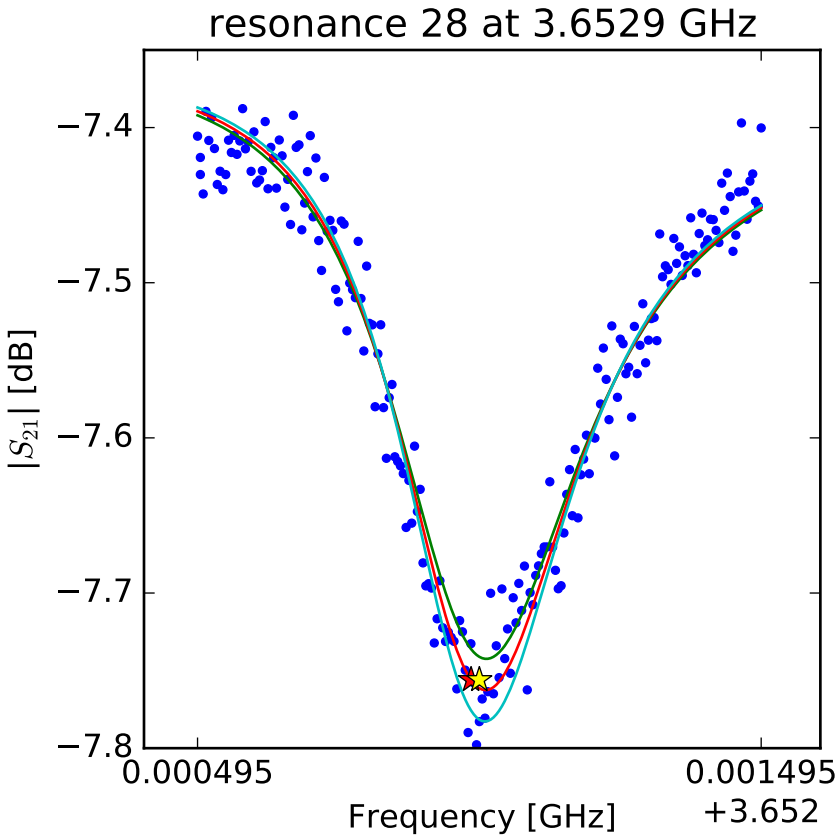


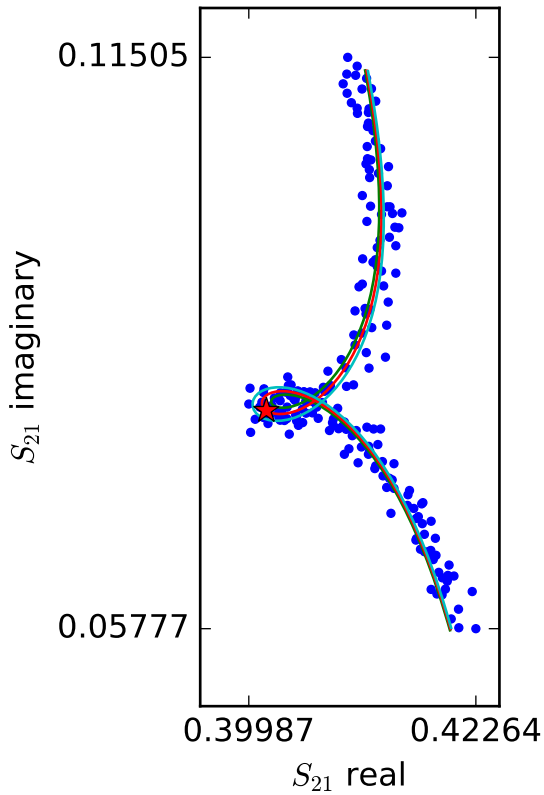


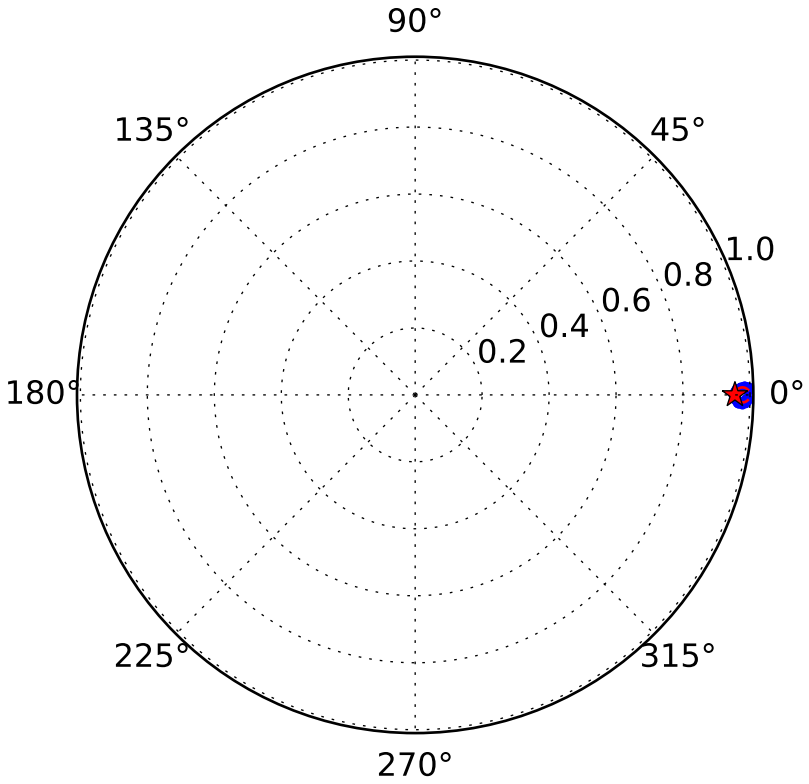


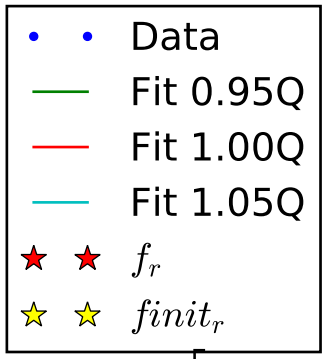
$$S_{21}(f) = ae^{-2\pi jf\tau}\left[1 - \frac{Q_r/Q_c e^{j\phi_0}}{1 + 2jQ_r(\frac{f-f_r}{f_r})}\right]$$

f_r = 3.63932093161
Q_r = 11919.4198543
Q_c = 185809.031817
a = (0.410694524411+0.0380047630924j)
ϕ_0 = 0.611219654794
τ = 25.1825694158



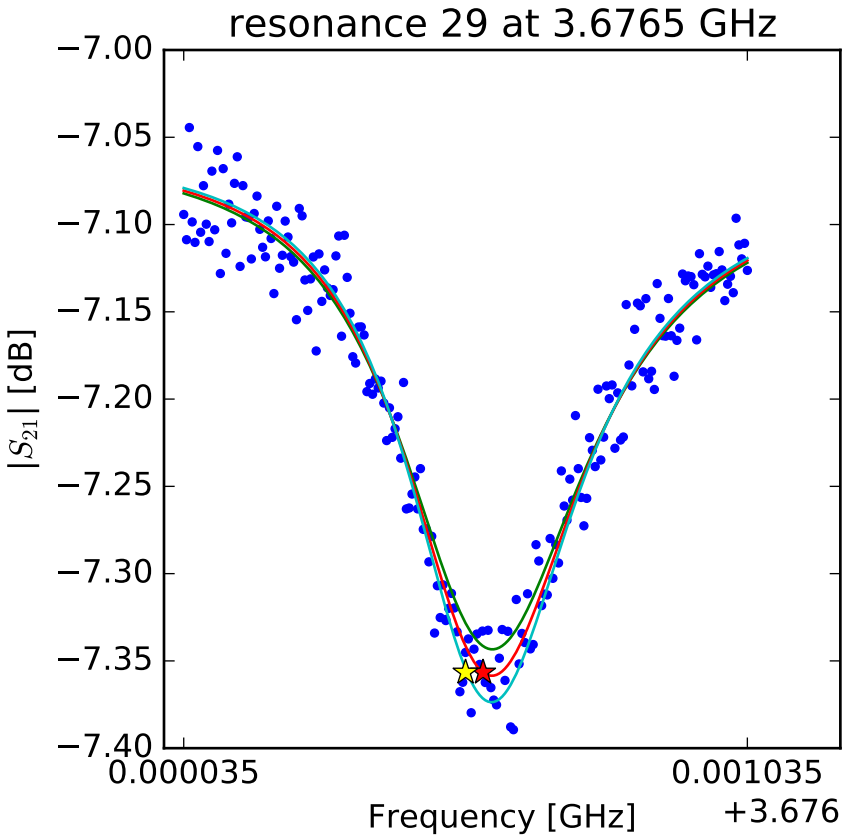


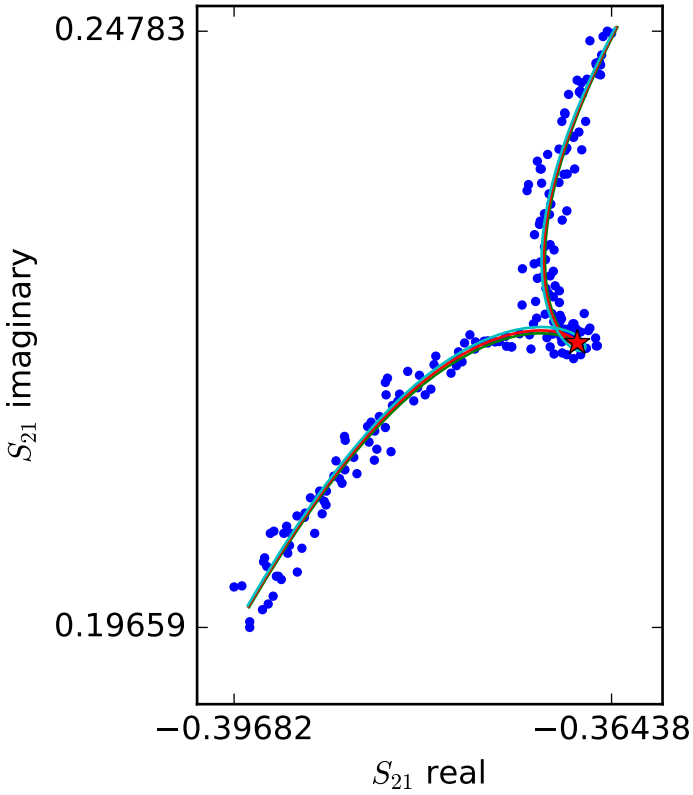


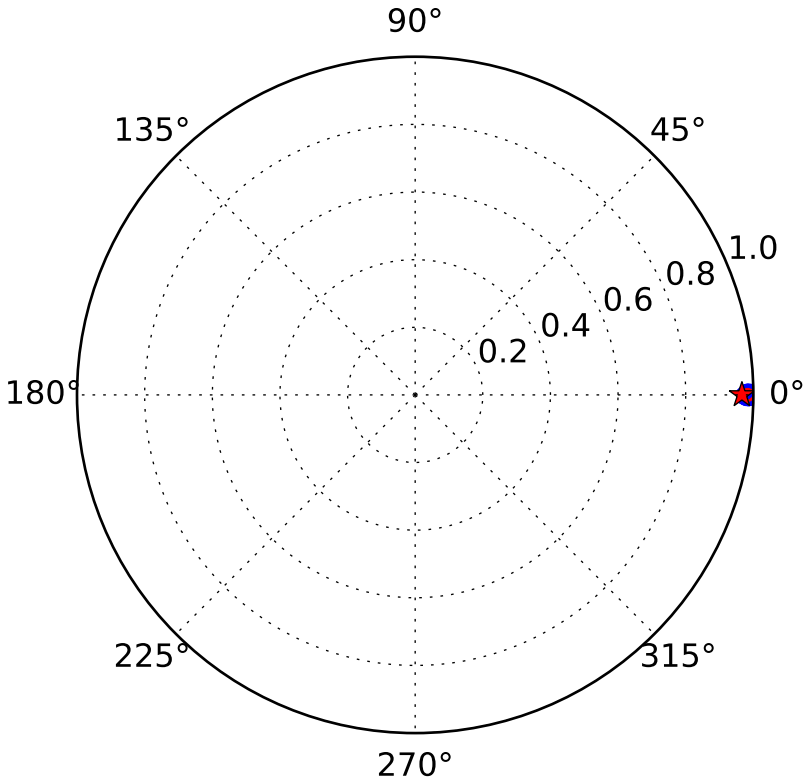


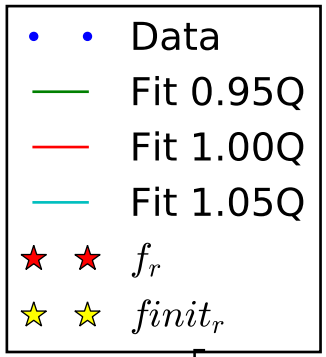
$$S_{21}(f) = ae^{-2\pi jf\tau}\left[1 - \frac{Q_r/Q_c e^{j\phi_0}}{1 + 2jQ_r(\frac{f-f_r}{f_r})}\right]$$

f_r = 3.65298031993
Q_r = 9000.57464195
Q_c = 199682.417014
a = (0.141738174068+0.403995372921j)
ϕ_0 = 0.246928157435
τ = 26.0508685061



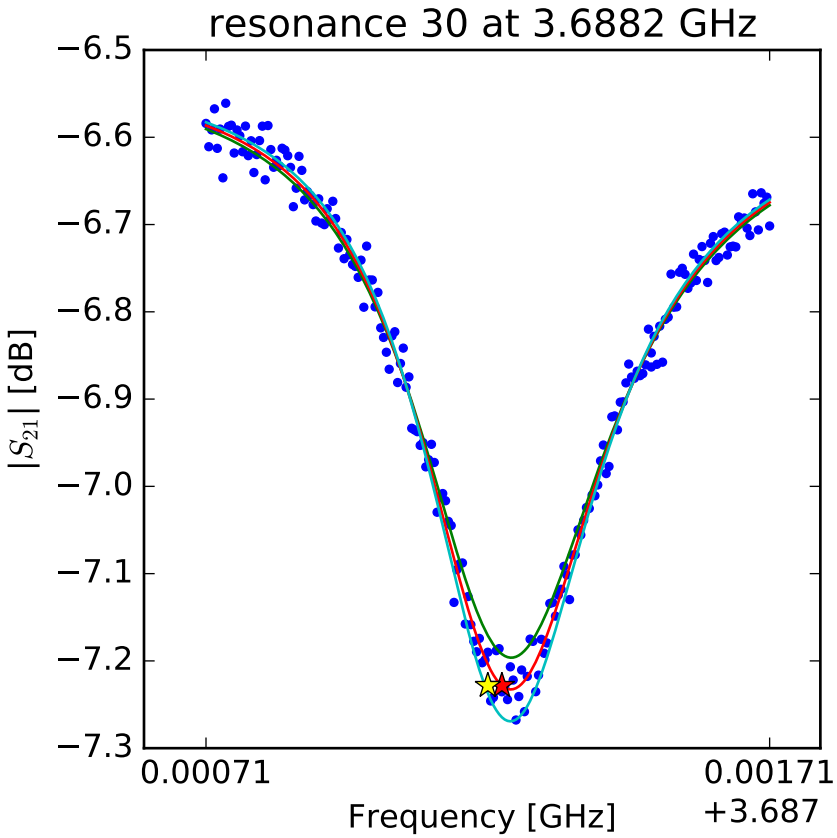


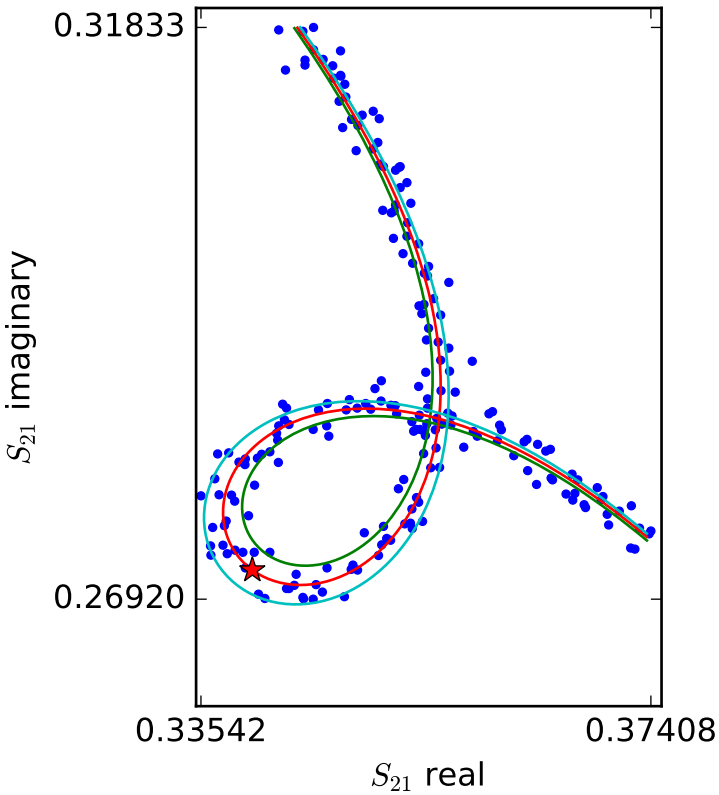


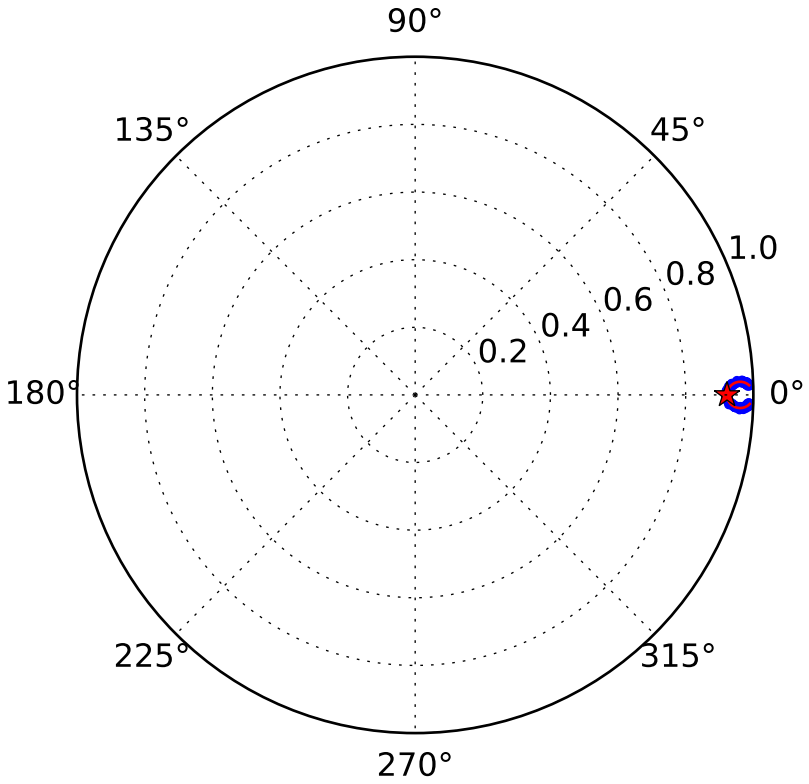


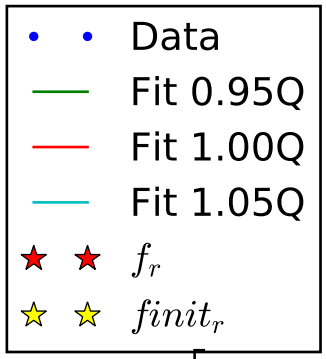
$$S_{21}(f) = ae^{-2\pi jf\tau}\left[1 - \frac{Q_r/Q_c e^{j\phi_0}}{1 + 2jQ_r(\frac{f-f_r}{f_r})}\right]$$

f_r = 3.67656610766
Q_r = 9333.10139324
Q_c = 275377.006931
a = (0.251564547353-0.365325428058j)
ϕ_0 = 0.156310816051
τ = 24.8686759912



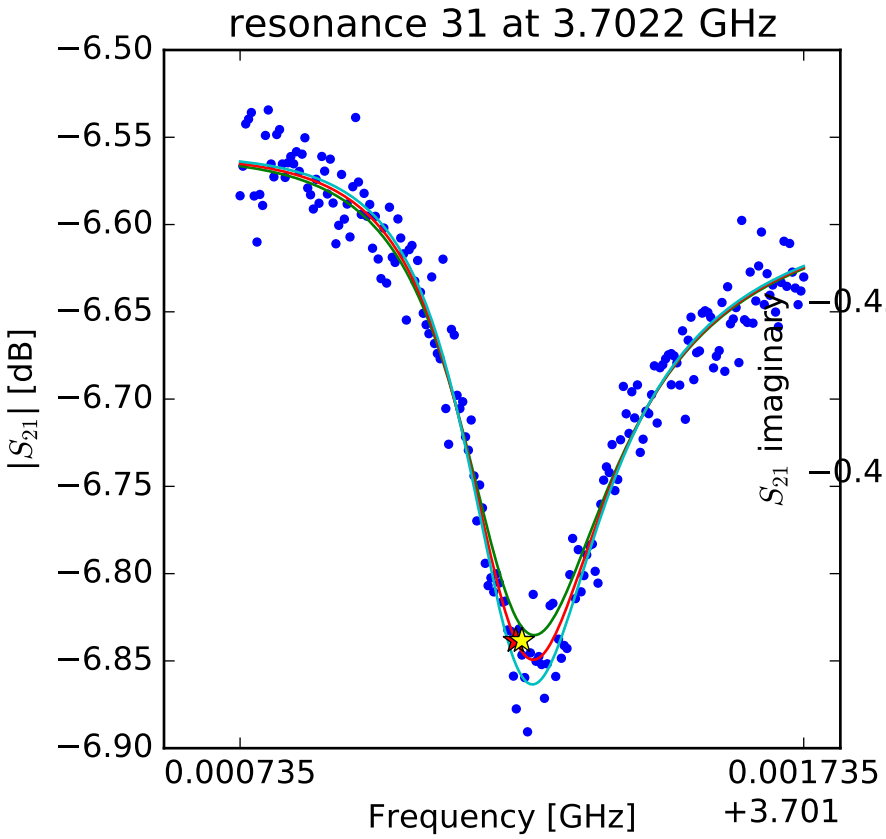


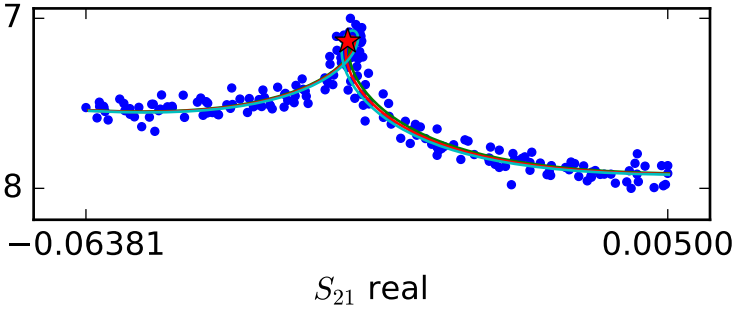


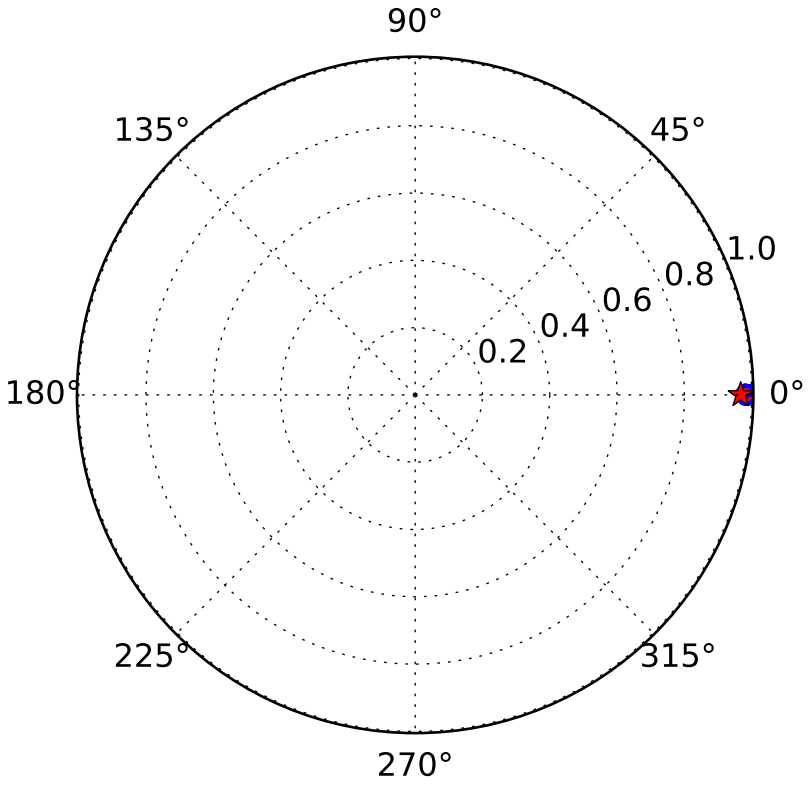


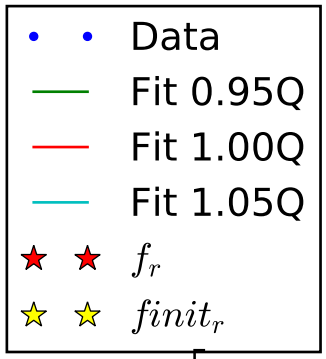
$$S_{21}(f) = ae^{-2\pi jf\tau}\left[1 - \frac{Q_r/Q_c e^{j\phi_0}}{1 + 2jQ_r(\frac{f-f_r}{f_r})}\right]$$

f_r = 3.68823499248
Q_r = 8849.79101218
Q_c = 113614.323088
a = (0.436184529831+0.178753525632j)
ϕ_0 = 0.145610940952
τ = 26.8292588959



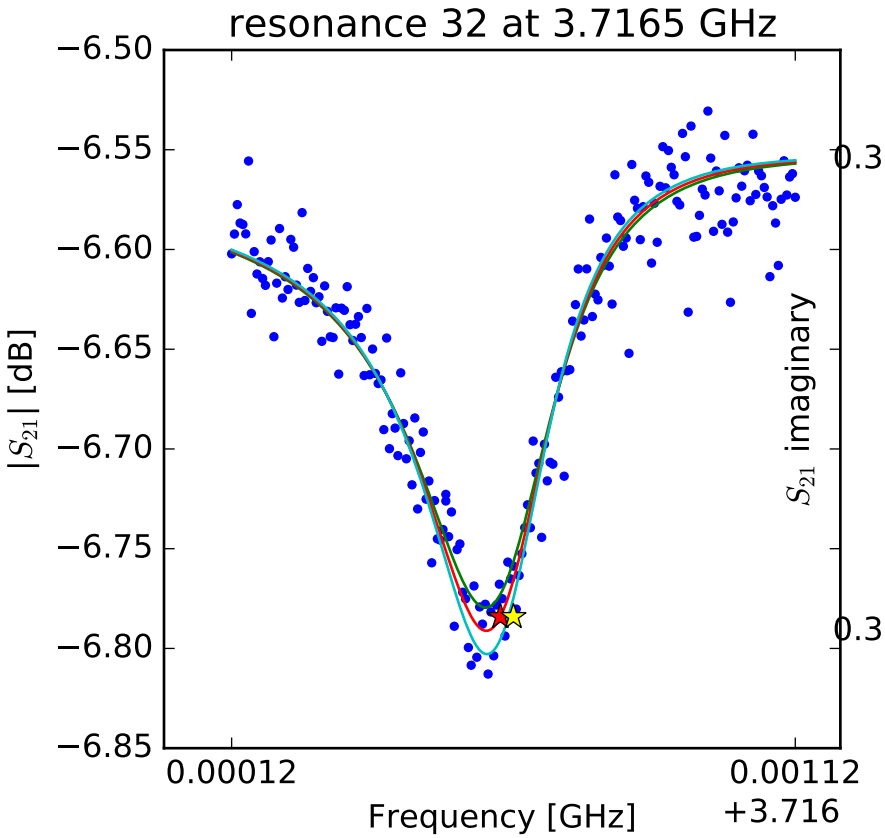


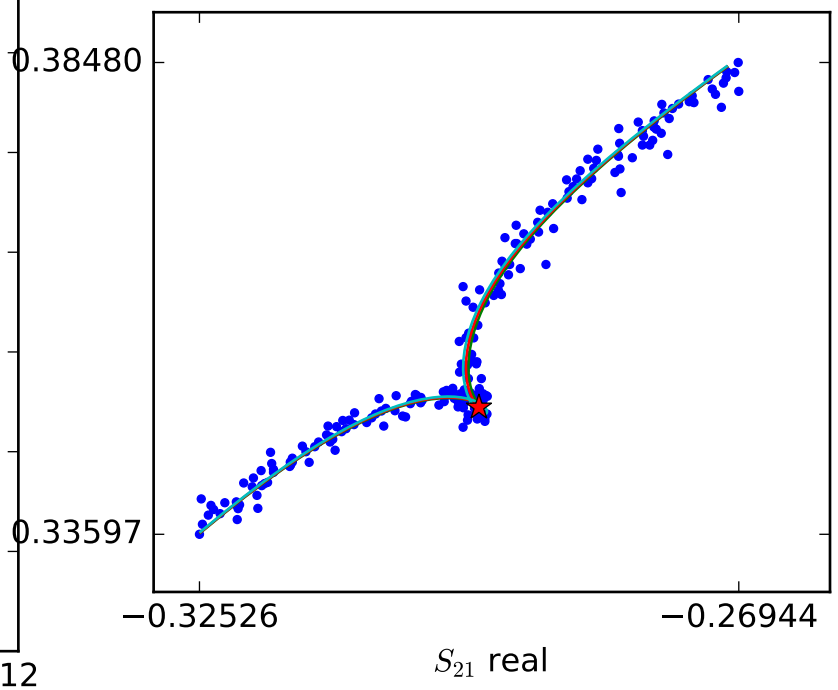


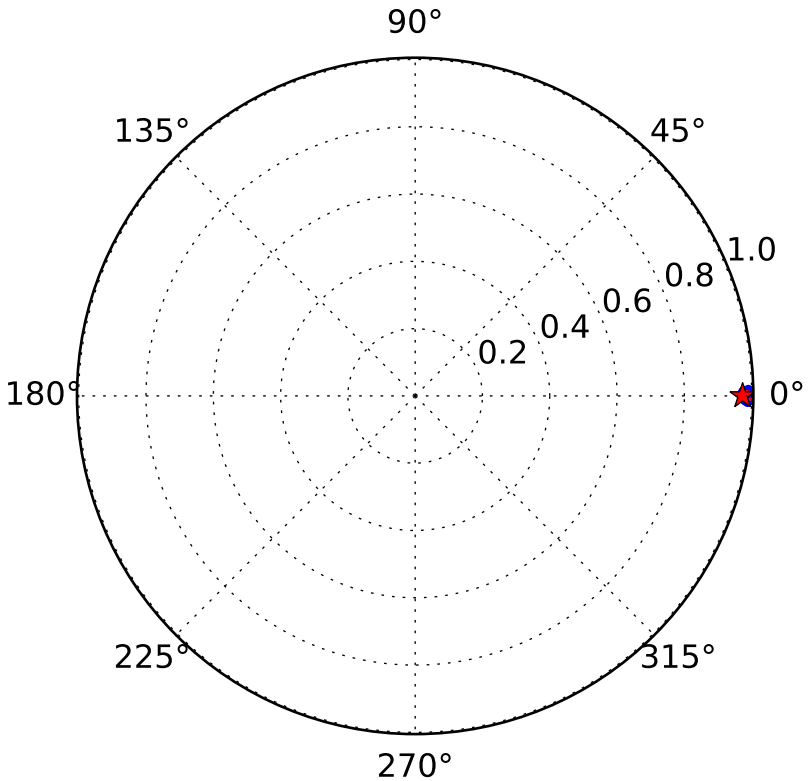


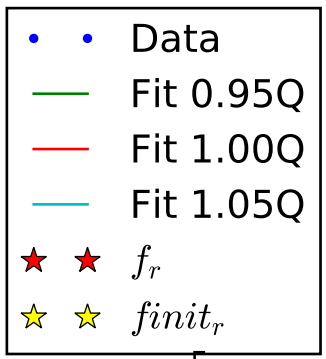
$$S_{21}(f) = ae^{-2\pi jf\tau}\left[1 - \frac{Q_r/Q_c e^{j\phi_0}}{1 + 2jQ_r(\frac{f-f_r}{f_r})}\right]$$

f_r = 3.70222406074
Q_r = 11648.6966883
Q_c = 356408.622205
a = (0.468529849205+0.0264631428696j)
ϕ_0 = 0.380677168464
τ = 26.27298786









$$S_{21}(f) = ae^{-2\pi jf\tau}\left[1 - \frac{Q_r/Q_c e^{j\phi_0}}{1 + 2jQ_r(\frac{f-f_r}{f_r})}\right]$$

f_r = 3.71659687254
Q_r = 12843.8225564
Q_c = 476092.778179
a = (0.321340658597+0.342799882259j)
ϕ_0 = -0.338338698891
τ = 26.8443393418