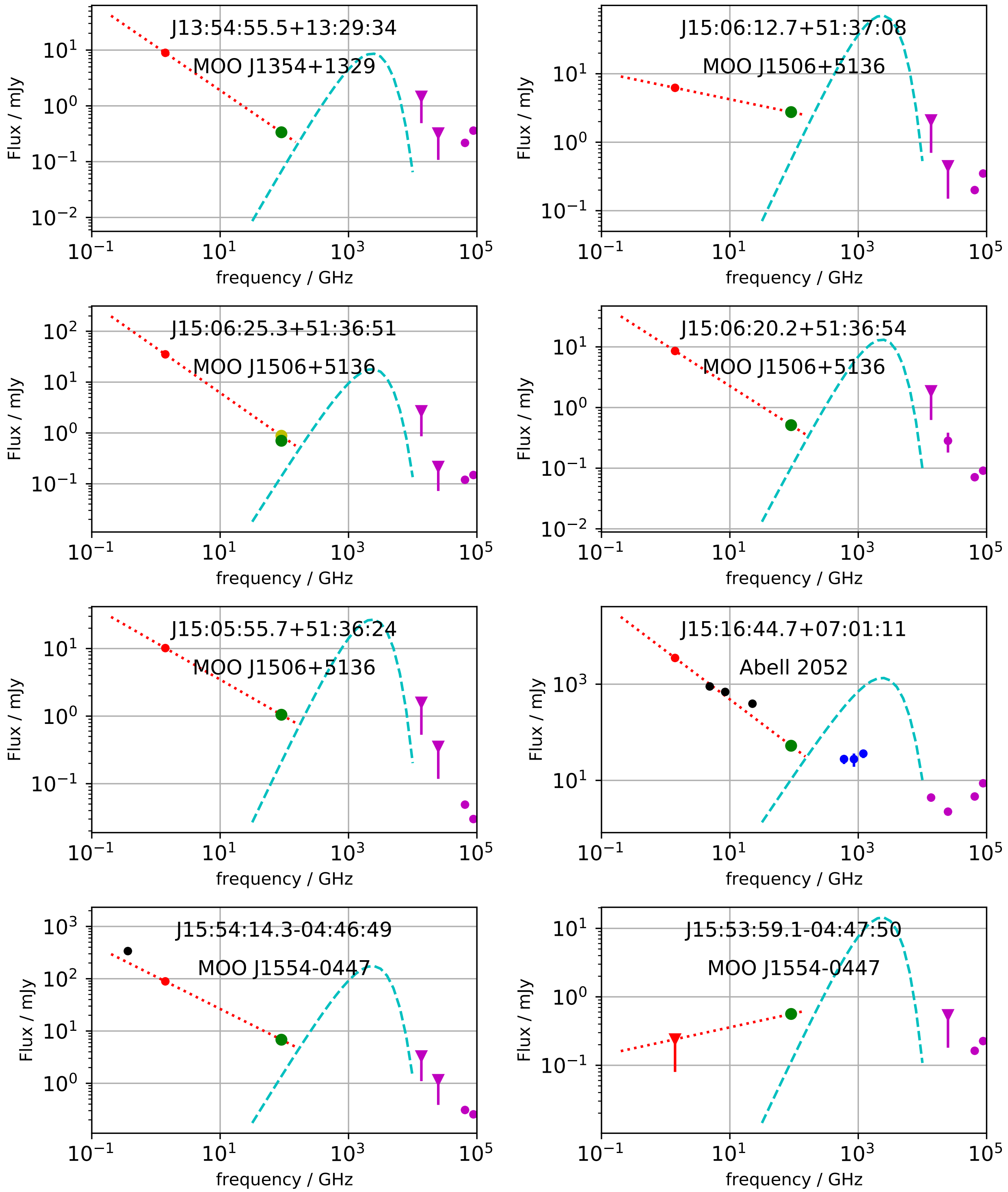

Figure 4a. On-line Extra. SEDs for the sources found by MUSTANG2. The MUSTANG2 flux densities assuming a point or an extended source at 10 arcsec resolution are shown by the green and yellow circles respectively – not all sources show signs of extended emission in which case only the green point is visible. All points have error bars but many are too small to be easily seen. The 1.4GHz data from FIRST/NVSS are in red, where available Herschel/SPIRE data is in blue, black points are from the VLA and BIMA, and the four high frequency points (in purple) are from WISE - note the lower two frequencies of these four points are mostly upper limits (all upper limits are shown as triangles). The fitted spectral index between 90 GHz and 1.4 GHz is the red dashed line. A 40 K black body spectrum with a 90 GHz flux density set at 20 per cent of the measured MUSTANG2 flux density is shown in cyan.
Of the sources on this page, only those in MACS J0717.5+3745 have limits on the cold dust component. Those sources with counterparts (instead of upper limits) at 1.4 GHz all have spectral indices in the range expected from a synchrotron dominated source.

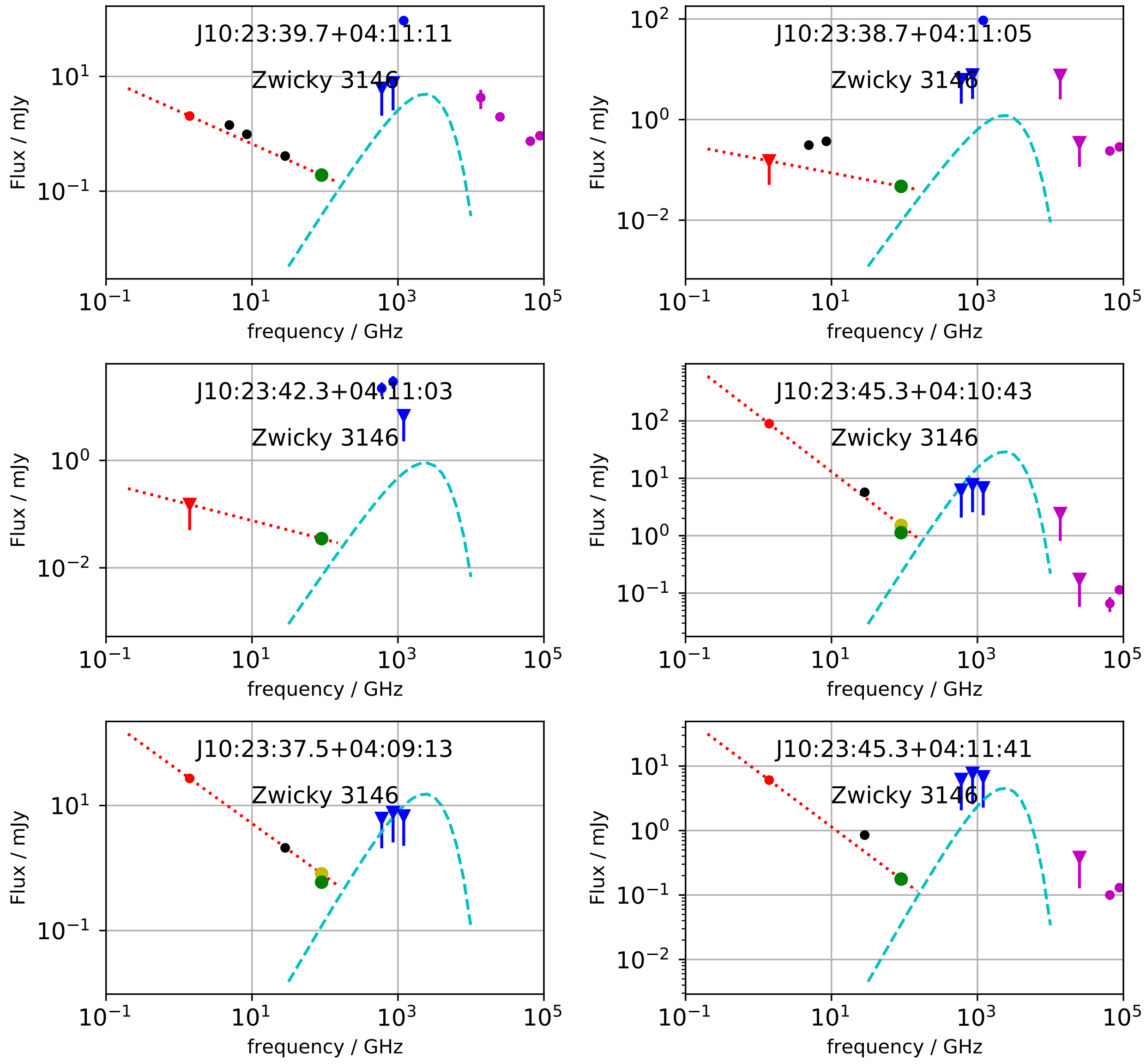

Figure 4b. On-line Extra. SEDs for the sources found by MUSTANG2 in Zwicky 3146, with colors and symbols the same as the previous plot. Zwicky 3146 had by far the most sources, enough that counterparts for some sources (e.g. 10:23:39.7+04:11:11 & 10:23:38.7+04:11:05) are close enough to share the same Herschel counterpart. Of the sources with a 28.5GHz counterpart, 10:23:45.3+04:10:43 & 10:23:45.3+04:11:42, show a steepening of the spectral index towards 90 GHz. Steepening of source spectra at mm wavelengths is predicted by theory (Kellermann 1966; Blandford & Königl 1979) and has been observed in many steep-spectra radio sources (e.g. Tucci et al. 2011). This feature is common in many other MUSTANG2 SEDs (e.g. 07:1737.0+37:44:20 and 13:47:30.6-11:45:10). In some cases this could be due to undetected extended 90 GHz emission around a strong core, however, for the analysis in this paper, this is a small source of error compared to uncertainties due to sample size and the assumption that the spectral index is the same in all sources.

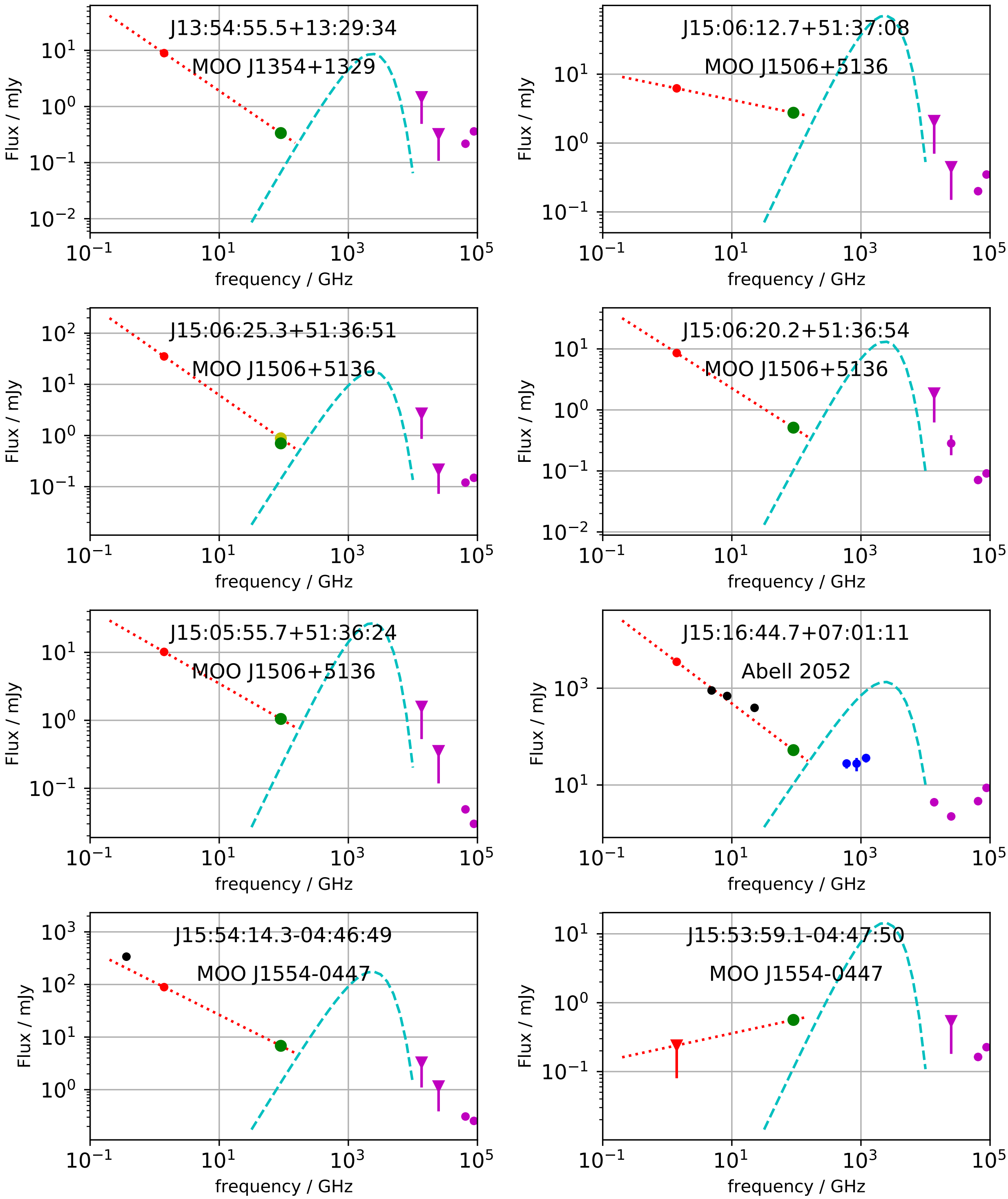

Figure 4c. On-line Extra. SEDs for the sources found by MUSTANG2 plotted with the same symbols and lines as previous SED plots. Of the sources in high-redshift MaDCoWS clusters (those with names beginning with MOO), 13:23:06.0-02:27:20 (and to some extent 11:11:14.1+68:38:49) show a highly inverted spectra with a 1.4 GHz counterpart that is an upper limit. It is possible that a significant part of the 90 GHz flux from these sources is from cold dust. The rest of the MaDCoWS clusters show more typical radio spectra yet at the same time have few constrains on a cold dust component. In MACS J1149.5+2223, Herschel data at 350 and 250 μm indicate the presence of cold dust but the upper limit at 500 μm shows that this emission is low at 90 GHz. However, this could be an example of a source with a spectral index which is changing in the tSZE bands – some dust could be present at frequencies above 150 GHz. In RXJ 1347-1145 the Herschel data rules out any dust component at 90 GHz. The measured flux of the point source is slightly lower than the 2016 measurements of Kitayama et al. (2016) which are in turn lower then the measurements from 2013 in Plagge et al. (2013). This could indicate long-term source variability.

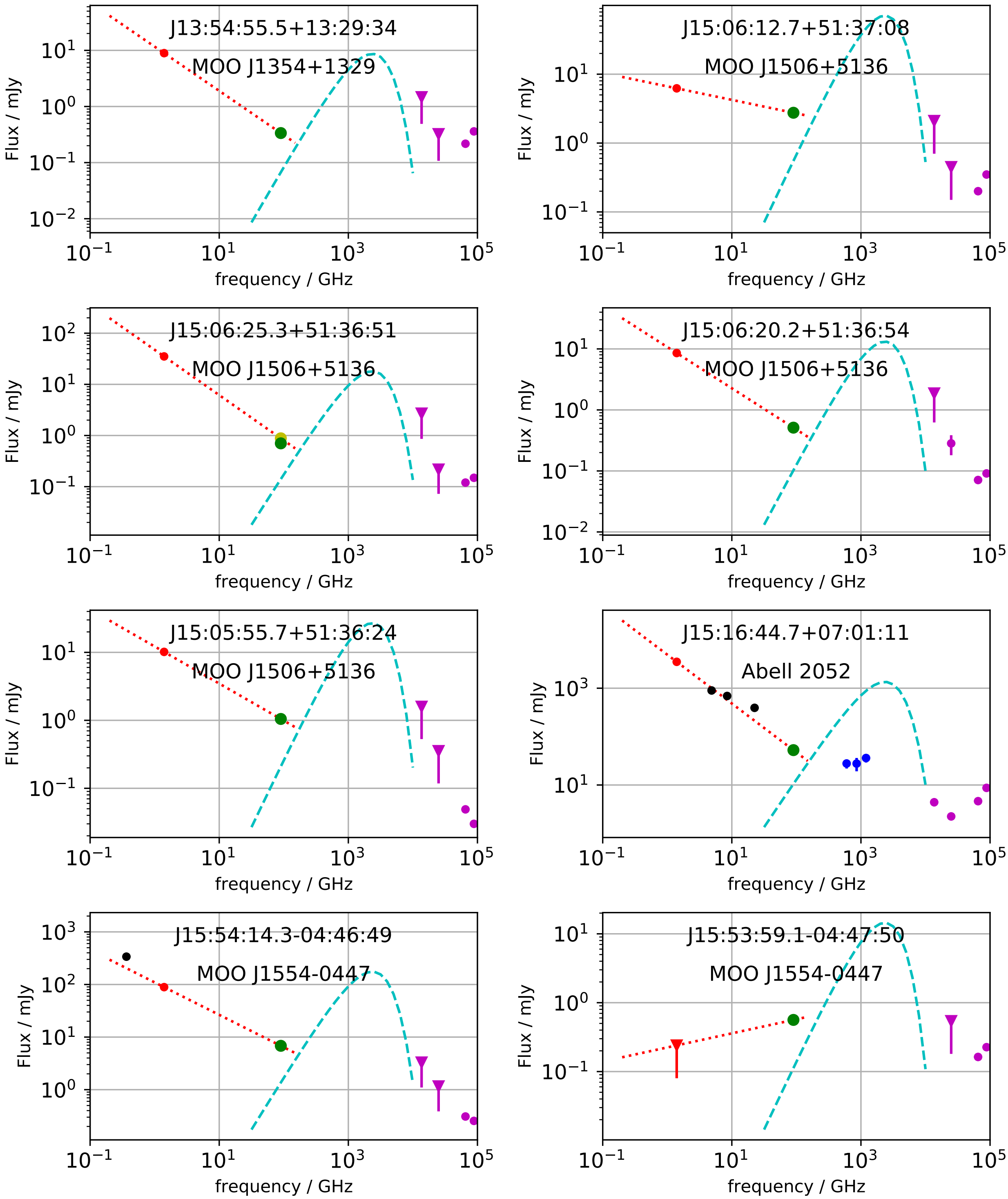

Figure 4d. On-line Extra. SEDs for the sources found by MUSTANG2 plotted with the same symbols and lines as previous SED plots. Again, sources in the MaDCoWS survey show the same pattern with very few constrains on a cold dust component and 1.4–90 GHz spectral indices consistent with radio emission – with the exception of 15:53:59.1-04:47:50 which has only an upper limit at 1.4 GHz and an inverted spectra. The Herschel data for the source in Abell 2052 shows this source is dominated by radio emission at 90 GHz yet at the same time the radio data are not well described by a single spectral index. This could be due to a mixture of source variability, source geometry (faint extended emission not being included in the integrated fluxes) and real changes in the spectral index with frequency.