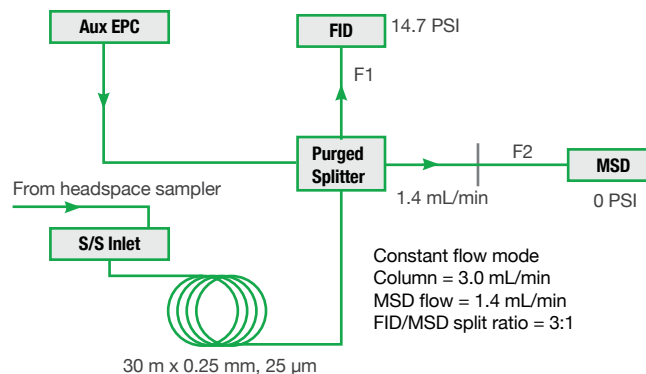


## Methodologies for Rapid and Robust Cannabis Terpene Analysis

- Full scan acquisition with a run time just over 5 minutes
- Uses Headspace GC with both FID and MS for quantitation
- Optimum lab productivity for Terpene Analysis

Agilent 5977B MSD Conditions		FID Conditions	
Aquisition mode	Scan (40 m/z-400 m/z)	Detector temp	300 °C
Solvent delay	1.8 minutes	H <sub>2</sub> flow	40 mL/min
Tune file	etune.u	Air flow	400 mL/min
EM setting mode	Gain = 1	Makeup flow	25 mL/min
Scan speed	Normal	Flame & electrometer	On
Threshold	125	<i>Aux EPC 3 supplies Column 2 with 1.4 mL/min constant flow to Restrictor 1 going to the MSD, FID/MSD split ratio approximately 3:1.</i>	
MSD Source temp	300 °C		
MSD Quadrupole temp	150 °C		



### 1. Standard Calibrator Preparation

5 or 10 point calibration curve with Terpenes Standards.

#### STANDARD CALIBRATOR PREPARATION PRODUCTS

PART NO	DESCRIPTION
5190-2285	10 mL Headspace vial, crimp-top, flat-bottom, grad. marks & write-on spot, 23 x 46 mm, 100/pk
5183-4477	Headspace aluminum crimp cap, PTFE/Silicone, 20 mm, 100/pk
RTK-34095	Cannabis terpenes standard #1 (19 components)
RTK-34096	Cannabis terpenes standard #2 (2 components)



#### Cannabis Terpenes Standard #1

(-)- $\alpha$ -Bisabolol	(-)-Guaiaol	Linalool	(-)- $\beta$ -Pinene
Camphene	$\alpha$ -Humulene	$\beta$ -Myrcene	$\alpha$ -Terpinene
$\delta$ -3-Carene	p-Isopropyltoluene	Nerolidol	$\gamma$ -Terpinene
$\beta$ -Caryophyllene	(-)-Isopulegol	Ocimene	Terpinolene
Geraniol	d-Limonene	$\alpha$ -Pinene	



#### Cannabis Terpenes Standard #2

(-)-Caryophyllene oxide
1,8-Cineole (Eucalyptol)

### 2. Sample Preparation

Freeze samples prior to grinding, or grind under liquid nitrogen to reduce the loss of the volatile terpenes. Use small sample amount (10-50 mg) of plant or wax material, place in headspace vial, and cap.

#### SAMPLE PREPARATION PRODUCTS

PART NO	DESCRIPTION
5190-2285	10 mL Headspace vial, crimp-top, flat-bottom, grad. marks & write-on spot, 23 x 46 mm, 100/pk
5183-4477	Headspace aluminum crimp cap, PTFE/Silicone, 20 mm, 100/pk

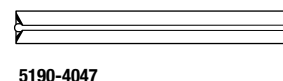


### 3. Quantitation

Agilent 7697A Headspace Sampler, Agilent 7890B GC with FID and Agilent 5977B MSD (Residual Solvent Analyzer).

#### QUANTITATION PRODUCTS

PART NO	DESCRIPTION
5190-4047	Ultra inert inlet liner, straight, 1 mm ID
CP8877	J&W VF-35ms GC column, 30 m, 0.25 mm, 0.25 $\mu$ m, 7" cage



5190-4047

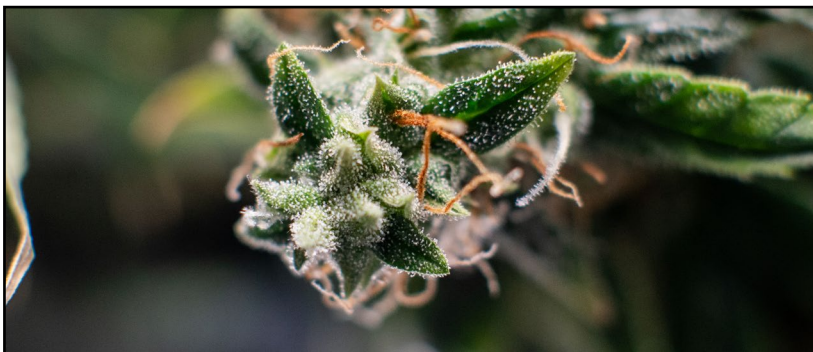


Figure 1. FID and MS Chromatograms 10 ppm, 100 ppm, and 1250 ppm of a 22 compound terpene mix, 10 minute cycle times

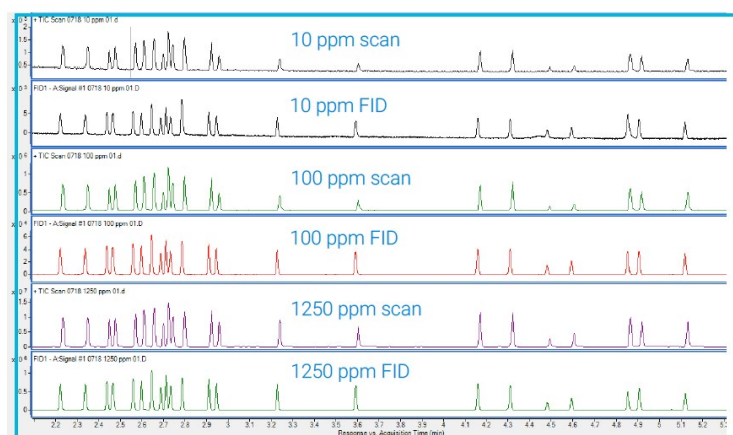
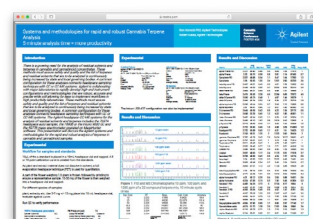


Figure 2. 8 Replicates for reproducibility (50 ppm)

Name	RT	Avg Conc.	Std. Dev.	Conc. RSD	LOQ	LOD	Avg. Resp.	Resp. RSD
alpha Pinene FID	2.221	49.40	0.46	0.9	4.65	1.39	17573	1
alpha Pinene	2.23	50.70	0.38	0.8	3.81	1.14	87450	0.7
Camphene FID	2.337	48.88	0.54	1.1	5.47	1.64	17390	1.2
Camphene	2.35	50.00	1.30	2.6	13.01	3.90	52233	2.6
beta Myrcene FID	2.437	49.21	0.43	0.9	4.31	1.29	15002	0.9
beta Myrcene	2.448	49.35	2.83	5.7	28.36	8.50	32674	5.9
beta Pinene FID	2.465	49.37	0.45	0.9	4.58	1.37	16699	1
beta Pinene	2.476	50.53	2.28	4.5	22.84	6.85	73972	4.5
delta-3-Carene FID	2.559	49.75	0.48	1	4.87	1.46	18078	1
delta-3-Carene	2.569	50.76	0.92	1.8	9.26	2.77	75715	1.8
alpha terpinene FID	2.598	49.64	0.36	0.7	3.68	1.10	15808	0.8
alpha terpinene	2.61	49.41	0.60	1.2	6.07	1.82	63342	1.3
D-Limonene FID	2.645	49.59	0.42	0.9	4.22	1.26	23170	0.9
D-Limonene	2.658	52.29	0.60	1.2	6.02	1.80	49501	1.1
.beta.-Ocimene FID	2.687	49.54	0.52	1.1	5.25	1.57	10924	1.1
.beta.-Ocimene	2.699	49.10	1.87	3.8	18.74	5.62	12853	4
p-Cymene FID	2.712	48.99	0.55	1.1	5.55	1.66	18568	1.2
p-Cymene	2.722	53.50	0.69	1.3	6.98	2.09	174993	1.2
Eucalyptol FID	2.732	55.98	0.63	1.1	6.31	1.8	15425	1.2
Eucalyptol	2.743	59.51	1.20	2	12.02	3.60	26624	2
.gamma.-Terpinene FID	2.787	45.75	3.42	7.5	34.24	10.27	18691	6.7
.gamma.-Terpinene	2.797	50.81	0.51	1	5.13	1.53	71814	1
Terpinolene FID	2.911	49.43	0.47	1	4.79	1.43	16371	1
Terpinolene	2.923	50.48	0.77	1.5	7.71	2.31	46268	1.5
Linalool FID	2.946	49.00	0.43	0.9	4.30	1.29	14363	0.9
Linalool	2.957	48.00	1.17	2.4	11.72	3.51	11918	2.7
Isopulegol FID	3.228	48.99	0.42	0.9	4.24	1.27	14174	0.9
Isopulegol	3.24	42.82	2.23	5.2	22.31	6.69	7449	6.5
Geraniol FID	3.593	49.68	0.34	0.7	3.49	1.04	13415	0.7
Geraniol	3.605	47.91	1.12	2.3	11.20	3.36	16929	2.6
beta Caryophyllene FID	4.16	50.16	0.31	0.6	3.10	0.93	16524	0.6
beta Caryophyllene	4.171	46.59	1.01	2.2	10.15	3.04	19222	2.4
alpha Humulene FID	4.31	50.12	0.29	0.6	2.95	0.88	16531	0.6
alpha Humulene	4.324	47.85	0.15	0.3	1.50	0.45	61806	0.3
Nerolidol 1 FID	4.483	54.25	2.72	5	27.24	8.17	5904	5
Nerolidol 1	4.493	41.91	1.59	3.8	15.99	4.79	3914	5.1
Nerolidol 2 FID	4.595	53.05	0.49	0.9	4.92	1.47	8781	0.9
Nerolidol 2	4.607	39.69	1.55	3.9	15.57	4.67	6641	5.5
Guaiol FID	4.853	54.61	0.79	1.5	7.93	2.38	17152	1.2
Guaiol	4.864	40.22	0.66	1.7	6.67	2.00	19534	2.1
Caryophyllene oxide FID	4.906	57.90	0.99	1.7	9.90	2.97	17140	1.7
Caryophyllene oxide	4.919	51.70	1.28	2.5	12.81	3.84	9868	2.6
alpha-Bisabolol FID	5.119	53.73	0.71	1.3	7.19	2.15	13491	1.3
alpha-Bisabolol	5.134	39.81	0.83	2.1	8.31	2.49	11553	2.7

Products and solutions are intended to be used for cannabis quality control and safety testing in laboratories where such use is permitted under state/country law. For research use only, not for diagnostic procedures.



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