Antenna D / 1cc / 64QAM / High


Antenna D / 8cc / QPSK / Low


Antenna D / 8cc / 16QAM / Low

Antenna D / 8cc / 64QAM / Low

Antenna D / 8cc / QPSK / Middle

Antenna D / 8cc / 16QAM / Middle

Antenna D / 8cc / 64QAM / Middle

Antenna D / 8cc / QPSK / High

Antenna D / 8cc / 16QAM / High


Antenna D / 8cc / 64QAM / High


5.4. BAND EDGE

FCC Rules

Test Requirements:

§ 2.1051 Measurements required: Spurious emissions at antenna terminals.

The radio frequency voltage or powers generated within the equipment and appearing on a spurious frequency shall be checked at the equipment output terminals when properly loaded with a suitable artificial antenna. Curves or equivalent data shall show the magnitude of each harmonic and other spurious emission that can be detected when the equipment is operated under the conditions specified in § 2.1049 as appropriate. The magnitude of spurious emissions which are attenuated more than 20 dB below the permissible value need not be specified.

§ 30.203 Emission limits.

(a) The conductive power or the total radiated power of any emission outside a licensee's frequency block shall be －13 dBm/MHz or lower. However, in the bands immediately outside and adjacent to the licensee's frequency block, having a bandwidth equal to 10 percent of the channel bandwidth, the conductive power or the total radiated power of any emission shall be －5 dBm/MHz or lower.

(b)(1) Compliance with this provision is based on the use of measurement instrumentation employing a resolution bandwidth of 1 megahertz or greater.

(2) When measuring the emission limits, the nominal carrier frequency shall be adjusted as close to the licensee's frequency block edges as the design permits.

(3) The measurements of emission power can be expressed in peak or average values.

Test Procedures:

The measurement is performed in accordance with Section 5.7.3 of ANSI C63.26.

5.7.3 Out-of-band unwanted emissions measurements

a) Set the spectrum analyzer center frequency to the block, band, or channel edge frequency.

b) Set the span wide enough to capture the fundamental emission closest to the authorized block or band edge, and to include all modulation products that spill into the immediately adjacent frequency band. In some cases, it may be possible to set the center frequency and span so as to encompass the fundamental emission and the unwanted out-of-band (band-edge) emissions on either side of the authorized block, band, or channel. This can be accomplished with a single (slow) sweep, if adequate overload protection and sufficient dynamic range can be maintained.

c) Set the number of points in sweep ≥ 2 × span / RBW.

d) Sweep time should be auto for peak detection. For rms detection the sweep time should be set as follows:

1), 2) Omitted

3) If the device cannot be configured to transmit continuously (duty cycle < 98%) and a free running sweep must be used, set the sweep time so that the averaging is performed over multiple on/off cycles by setting the sweep time > (number of points in sweep) × (transmitter period) (i.e., the transmit on-time + the off-time). The spectrum analyzer readings shall subsequently be corrected by [10 log (1/duty cycle)]. This assumes that the transmission period and duty cycle is relatively

constant (duty cycle variation ≤ ±2%).

4) Omitted

e) The test report shall include the plots of the measuring instrument display and the measured data.

f) See Annex I for example emission mask plots.

Note:

1) Basic test conditions are same as EIRP test on page 30.
2) In the band edge test of antenna A, path A, B, C and D are individually operated and measured at the maximum emission position of antenna A, and the respective measurement results are summed.
3) For measurement of antenna B, C and D repeat 2) at the maximum emission position of antenna B.
4) Band edge value is calculated as follows.

Band Edge = Sum of each position's edge (Measured Value + 20log(D) – 104.77 + AFCL + Duty) – Ant. Gain

5) Antenna Gain of the above formula was applied from actual measurement data of the radiation pattern document.
6) Sample calculation

Maximum Antenna A, 1cc, Low, QPSK:

Antenna A

35.783 dBμV (measured) + 10.88 (distance) - 104.77 + 45.44(AFCL) + 0.98 (Duty)
= -11.686 dBm (Antenna A Edge)

Total edge result

Conversion and sum

0.0678 mW (Ant.A) + 0.0891 mW (Ant.B) + 0.0773 mW (Ant.C) + 0.0837 mW (Ant.D) = 0.3179 mW

Conversion mW to dBm

10LOG (0.3179 mW) – 28.142 (Antenna gain) = -33.12 dBm

Sum each antenna power

-33.12 dBm(Ant.A) + (-30.82 dBm) (Ant.B) + (-31.52 dBm) (Ant.C) + (-34.37 dBm) (Ant.D)
= -26.22 dBm

Test Results:

Tabular Data of Band Edge

Pos.	Ant. Angle	Distance (m)	cc	Edge	Mod.	Ant	Measured Level (dBuV)	EIRP (dBm)	Ant Gain (dB)	Result (dBm)
MAX Ant. A	135°	3.5	1	Low	QPSK	A	35.783	-11.686	28.142	-39.828
						B	36.970	-10.499		-38.641
						C	36.349	-11.120		-39.262
						D	36.696	-10.773		-38.915
					16QAM	A	37.613	-9.856		-37.998
						B	35.844	-11.625		-39.767
						C	35.725	-11.744		-39.886
						D	36.950	-10.519		-38.661
					64QAM	A	37.195	-10.274		-38.416
						B	35.870	-11.599		-39.741
						C	37.108	-10.361		-38.503
						D	36.248	-11.221		-39.363
				High	QPSK	A	41.778	-5.691	28.321	-34.012
						B	36.418	-11.051		-39.372
						C	44.903	-2.566		-30.887
						D	35.119	-12.350		-40.671
					16QAM	A	42.993	-4.476		-32.797
						B	36.026	-11.443		-39.764
						C	43.665	-3.804		-32.125
						D	36.202	-11.267		-39.588
					64QAM	A	41.908	-5.561		-33.882
						B	37.059	-10.410		-38.731
						C	42.953	-4.516		-32.837
						D	35.729	-11.740		-40.061
			8	Low	QPSK	A	47.711	0.242	28.181	-27.939
						B	42.679	-4.790		-32.971
						C	46.404	-1.065		-29.246
						D	43.032	-4.437		-32.618
					16QAM	A	48.617	1.148		-27.033
						B	42.554	-4.915		-33.096
						C	47.062	-0.407		-28.588
						D	42.718	-4.751		-32.932
					64QAM	A	47.025	-0.444		-28.625
						B	42.762	-4.707		-32.888
						C	46.037	-1.432		-29.613
						D	42.465	-5.004		-33.185
				High	QPSK	A	46.903	-0.566	28.21	-28.776
						B	34.326	-13.143		-41.353
						C	44.263	-3.206		-31.416
						D	34.034	-13.435		-41.645
					16QAM	A	45.411	-2.058		-30.268
						B	33.925	-13.544		-41.754
						C	44.851	-2.618		-30.828
						D	33.476	-13.993		-42.203
					64QAM	A	46.373	-1.096		-29.306
						B	35.027	-12.442		-40.652
						C	44.419	-3.050		-31.260
						D	34.366	-13.103		-41.313

Pos.	Ant. Angle	Distance (m)	cc	Edge	Mod.	Ant	Measured Level (dBuV)	EIRP (dBm)	Ant Gain (dB)	Result (dBm)
MAX Ant. B	45°	3.5	1	Low	QPSK	A	39.436	-8.033	28.142	-36.175
						B	37.677	-9.792		-37.934
						C	38.787	-8.682		-36.824
						D	39.010	-8.459		-36.601
					16QAM	A	39.273	-8.196		-36.338
						B	38.827	-8.642		-36.784
						C	38.998	-8.471		-36.613
						D	39.569	-7.900		-36.042
					64QAM	A	38.617	-8.852		-36.994
						B	38.073	-9.396		-37.538
						C	39.650	-7.819		-35.961
						D	39.839	-7.630		-35.772
				High	QPSK	A	33.717	-13.752	28.321	-42.073
						B	45.491	-1.978		-30.299
						C	33.786	-13.683		-42.004
						D	42.138	-5.331		-33.652
					16QAM	A	33.307	-14.162		-42.483
						B	43.665	-3.804		-32.125
						C	33.143	-14.326		-42.647
						D	41.363	-6.106		-34.427
					64QAM	A	33.360	-14.109		-42.430
						B	44.081	-3.388		-31.709
						C	34.167	-13.302		-41.623
						D	42.794	-4.675		-32.996
			8	Low	QPKS	A	38.777	-8.692	28.181	-36.873
						B	45.213	-2.256		-30.437
						C	39.201	-8.268		-36.449
						D	45.119	-2.350		-30.531
					16QAM	A	38.232	-9.237		-37.418
						B	44.750	-2.719		-30.900
						C	38.786	-8.683		-36.864
						D	45.037	-2.432		-30.613
					64QAM	A	38.560	-8.909		-37.090
						B	44.795	-2.674		-30.855
						C	38.591	-8.878		-37.059
						D	43.591	-3.878		-32.059
				High	QPKS	A	33.228	-14.241	28.21	-42.451
						B	47.104	-0.365		-28.575
						C	34.905	-12.564		-40.774
						D	48.780	1.311		-26.899
					16QAM	A	32.898	-14.571		-42.781
						B	45.705	-1.764		-29.974
						C	34.891	-12.578		-40.788
						D	45.504	-1.965		-30.175
					64QAM	A	33.012	-14.457		-42.667
						B	48.636	1.167		-27.043
						C	34.727	-12.742		-40.952
						D	43.687	-3.782		-31.992

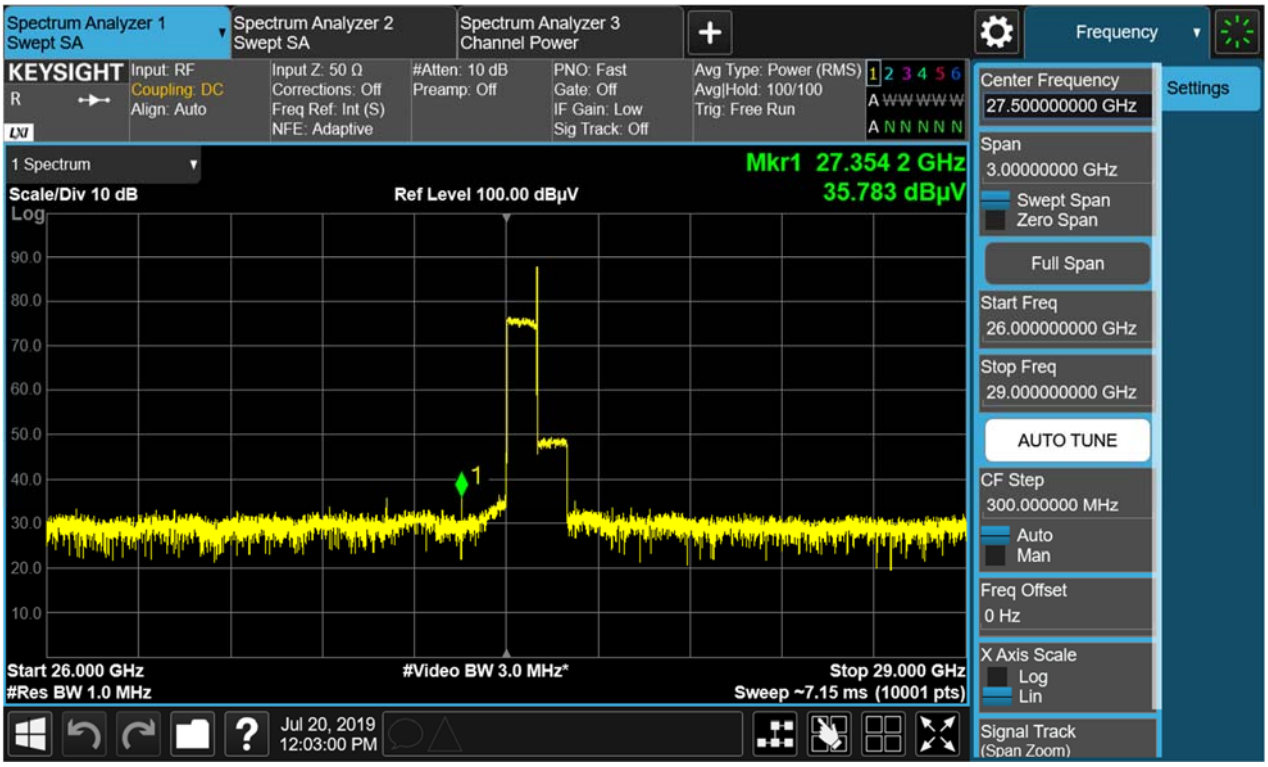
Pos.	Ant. Angle	Distance (m)	cc	Edge	Mod.	Ant	Measured Level (dBuV)	EIRP (dBm)	Ant Gain (dB)	Result (dBm)
MAX Ant. C	135°	3.5	1	Low	QPSK	A	38.263	-9.206	28.142	-37.348
						B	37.810	-9.659		-37.801
						C	37.833	-9.636		-37.778
						D	38.341	-9.128		-37.270
					16QAM	A	38.998	-8.471		-36.613
						B	37.611	-9.858		-38.000
						C	36.113	-11.356		-39.498
						D	38.398	-9.071		-37.213
					64QAM	A	37.902	-9.567		-37.709
						B	38.153	-9.316		-37.458
						C	36.880	-10.589		-38.731
						D	38.808	-8.661		-36.803
				High	QPSK	A	36.835	-10.634	28.321	-38.955
						B	37.999	-9.470		-37.791
						C	35.499	-11.970		-40.291
						D	36.787	-10.682		-39.003
					16QAM	A	38.191	-9.278		-37.599
						B	37.487	-9.982		-38.303
						C	35.695	-11.774		-40.095
						D	37.395	-10.074		-38.395
					64QAM	A	37.584	-9.885		-38.206
						B	37.528	-9.941		-38.262
						C	36.090	-11.379		-39.700
						D	37.202	-10.267		-38.588
			8	Low	QPSK	A	42.548	-4.921	28.181	-33.102
						B	35.426	-12.043		-40.224
						C	45.920	-1.549		-29.730
						D	36.808	-10.661		-38.842
					16QAM	A	42.879	-4.590		-32.771
						B	34.845	-12.624		-40.805
						C	45.377	-2.092		-30.273
						D	34.740	-12.729		-40.910
					64QAM	A	41.690	-5.779		-33.960
						B	34.465	-13.004		-41.185
						C	43.908	-3.561		-31.742
						D	35.248	-12.221		-40.402
				High	QPSK	A	42.335	-5.134	28.21	-33.344
						B	35.147	-12.322		-40.532
						C	47.042	-0.427		-28.637
						D	34.398	-13.071		-41.281
					16QAM	A	39.401	-8.068		-36.278
						B	33.925	-13.544		-41.754
						C	45.507	-1.962		-30.172
						D	33.645	-13.824		-42.034
					64QAM	A	39.897	-7.572		-35.782
						B	33.851	-13.618		-41.828
						C	45.069	-2.400		-30.610
						D	33.682	-13.787		-41.997

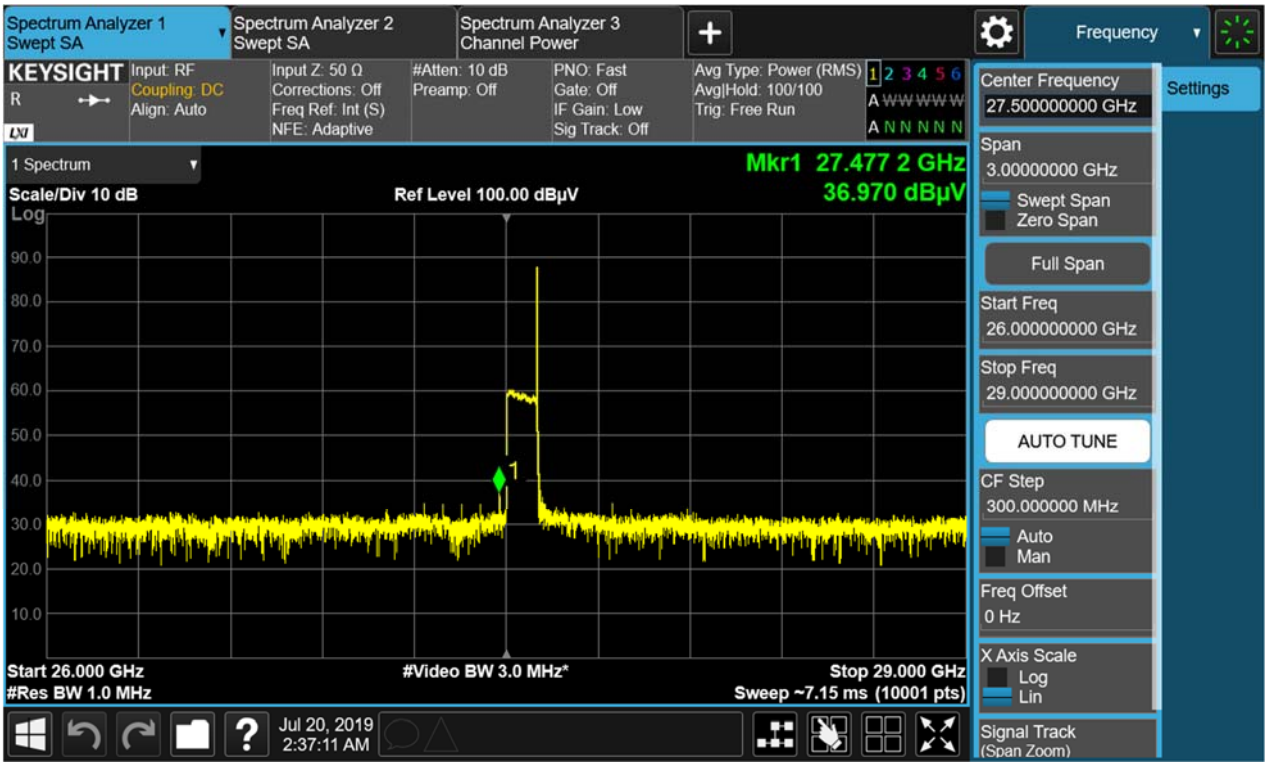
Pos.	Ant. Angle	Distance (m)	cc	Edge	Mod.	Ant	Measured Level (dBuV)	EIRP (dBm)	Ant Gain (dB)	Result (dBm)
MAX Ant. D	45°	3.5	1	Low	QPSK	A	35.887	-11.582	28.142	-39.724
						B	34.288	-13.181		-41.323
						C	36.142	-11.327		-39.469
						D	34.211	-13.258		-41.400
					16QAM	A	38.917	-8.552		-36.694
						B	39.761	-7.708		-35.850
						C	40.033	-7.436		-35.578
						D	39.522	-7.947		-36.089
					64QAM	A	34.545	-12.924		-41.066
						B	34.027	-13.442		-41.584
						C	35.446	-12.023		-40.165
						D	33.023	-14.446		-42.588
				High	QPSK	A	36.306	-11.163	28.321	-39.484
						B	36.243	-11.226		-39.547
						C	36.293	-11.176		-39.497
						D	35.182	-12.287		-40.608
					16QAM	A	36.372	-11.097		-39.418
						B	35.803	-11.666		-39.987
						C	35.975	-11.494		-39.815
						D	35.634	-11.835		-40.156
					64QAM	A	37.222	-10.247		-38.568
						B	36.855	-10.614		-38.935
						C	35.894	-11.575		-39.896
						D	34.493	-12.976		-41.297
			8	Low	QPKS	A	32.932	-14.537	28.181	-42.718
						B	40.803	-6.666		-34.847
						C	33.984	-13.485		-41.666
						D	49.104	1.635		-26.546
					16QAM	A	38.128	-9.341		-37.522
						B	46.500	-0.969		-29.150
						C	39.865	-7.604		-35.785
						D	45.856	-1.613		-29.794
					64QAM	A	37.404	-10.065		-38.246
						B	43.482	-3.987		-32.168
						C	38.863	-8.606		-36.787
						D	44.422	-3.047		-31.228
				High	QPKS	A	33.499	-13.970	28.21	-42.180
						B	47.099	-0.370		-28.580
						C	33.300	-14.169		-42.379
						D	43.125	-4.344		-32.554
					16QAM	A	33.031	-14.438		-42.648
						B	43.211	-4.258		-32.468
						C	33.716	-13.753		-41.963
						D	44.054	-3.415		-31.625
					64QAM	A	32.959	-14.510		-42.720
						B	42.402	-5.067		-33.277
						C	33.109	-14.360		-42.570
						D	44.553	-2.916		-31.126

MIMO Data of Band Edge

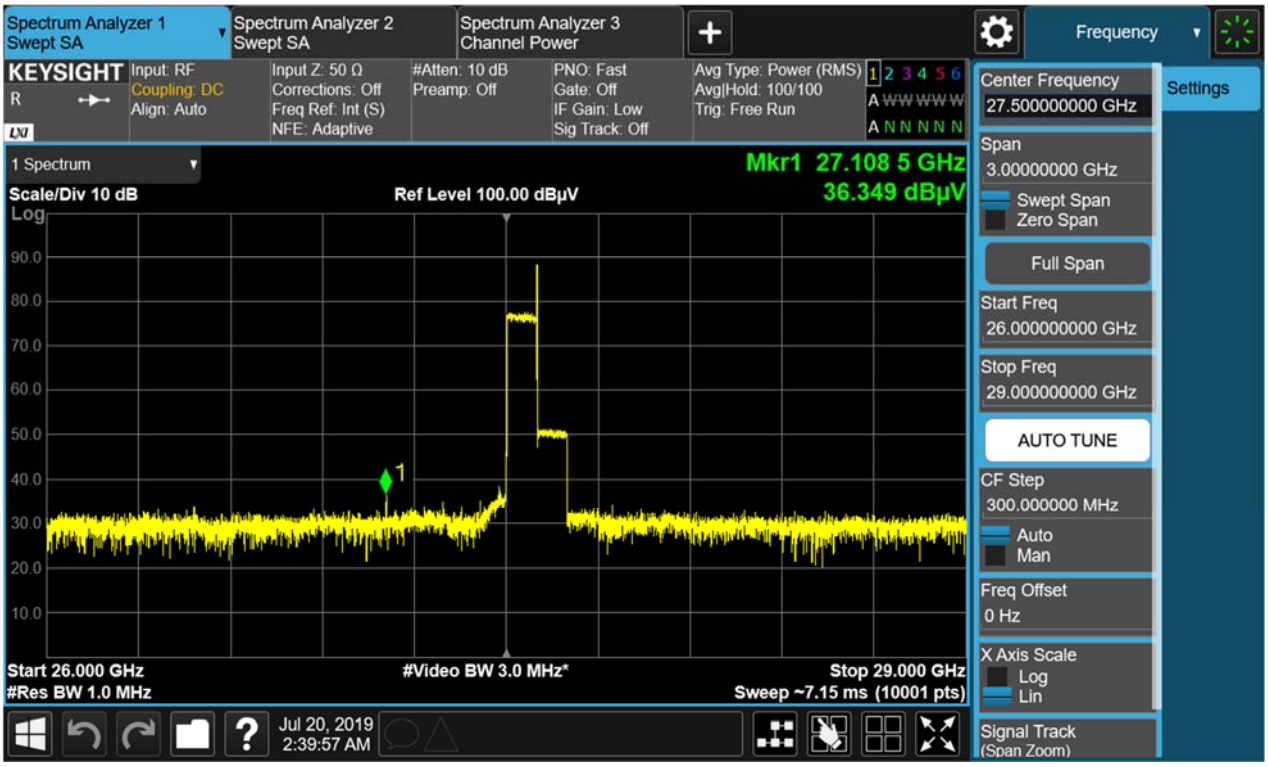
Antenna	cc	Edge	Modulation	Result (dBm)
A+B+C+D	1	Low	QPSK	-26.22
			16QAM	-25.10
			64QAM	-26.21
		High	QPSK	-24.16
			16QAM	-24.66
			64QAM	-24.62
	8	Low	QPSK	-19.78
			16QAM	-19.68
			64QAM	-20.83
		High	QPSK	-20.08
			16QAM	-21.74
			64QAM	-21.29

Plot data of Band Edge

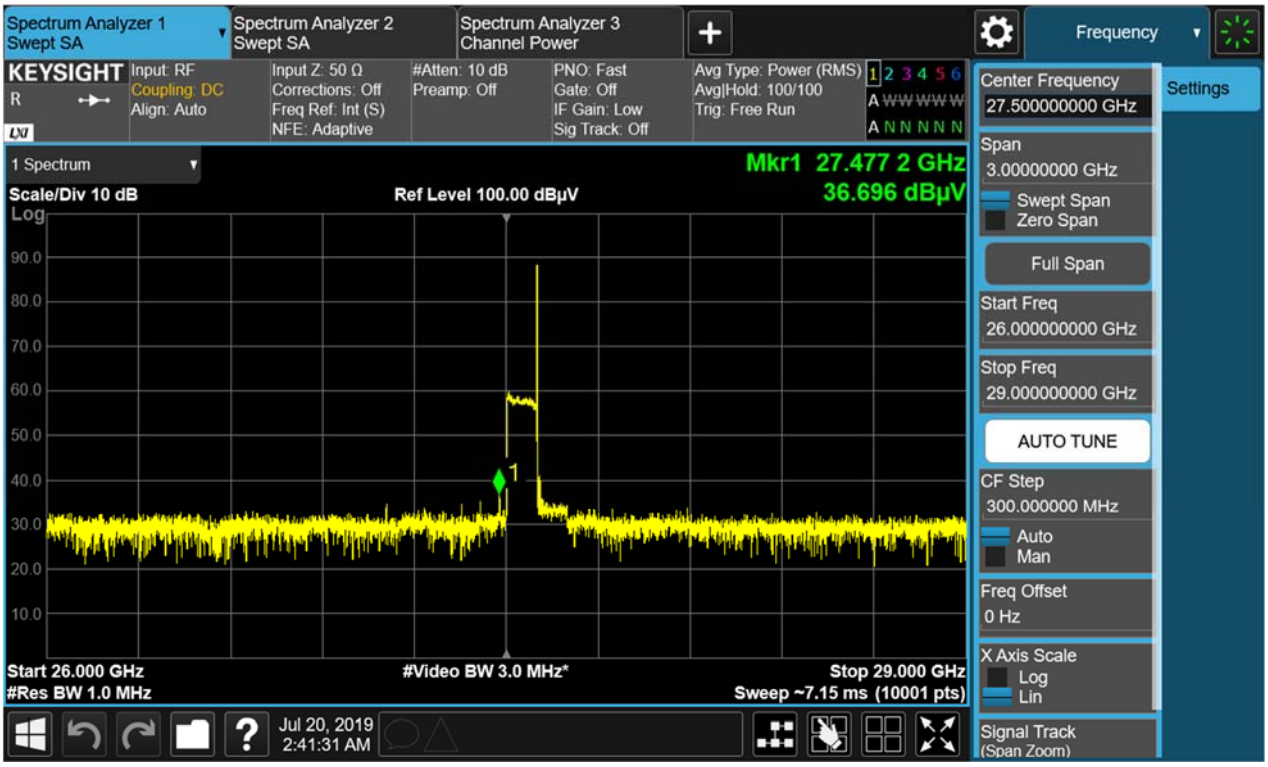
MAX Ant. A Position / 1cc / Low / QPSK / Ant. A


MAX Ant. A Position / 1cc / Low / QPSK / Ant. B


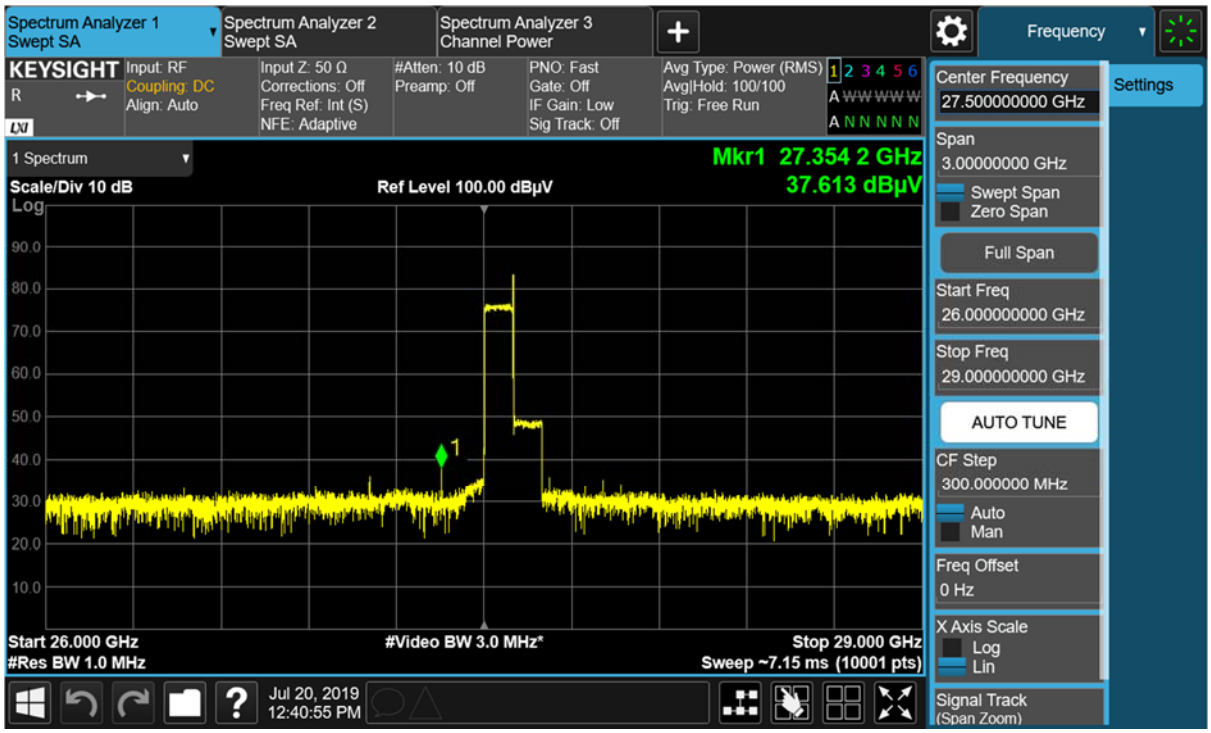
MAX Ant. A Position / 1cc / Low / QPSK / Ant. C



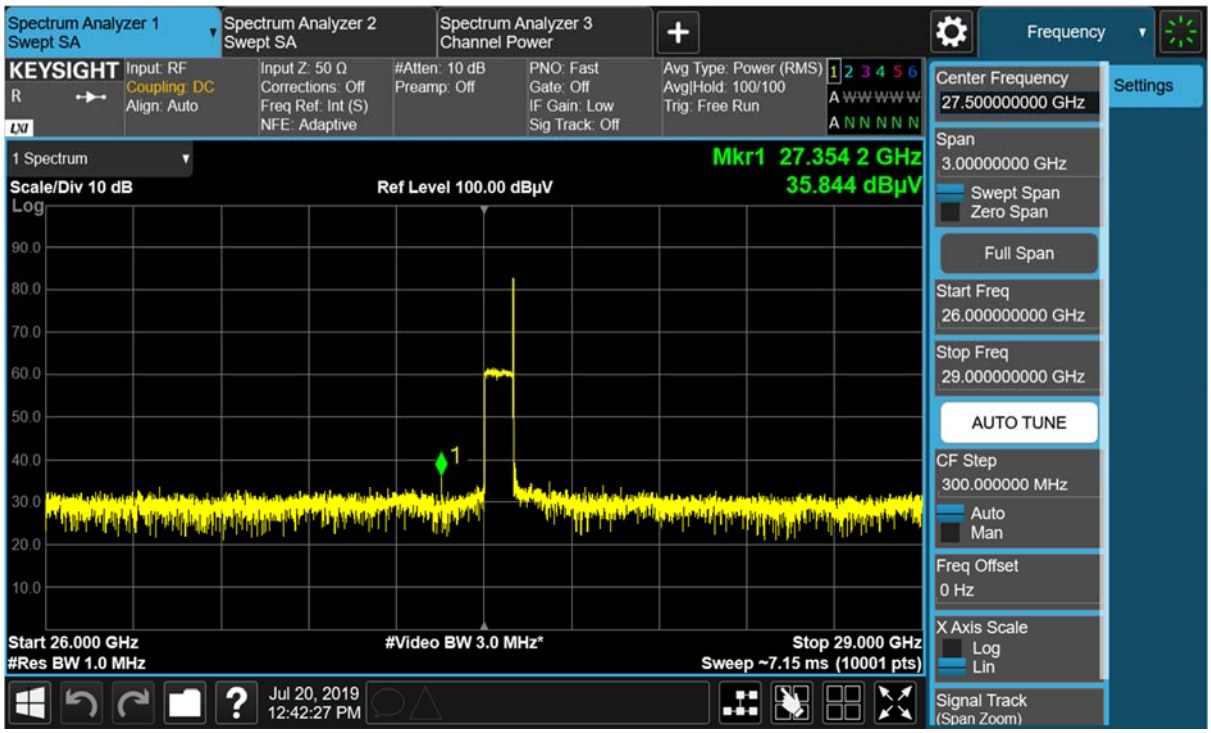
MAX Ant. A Position / 1cc / Low / QPSK / Ant. D



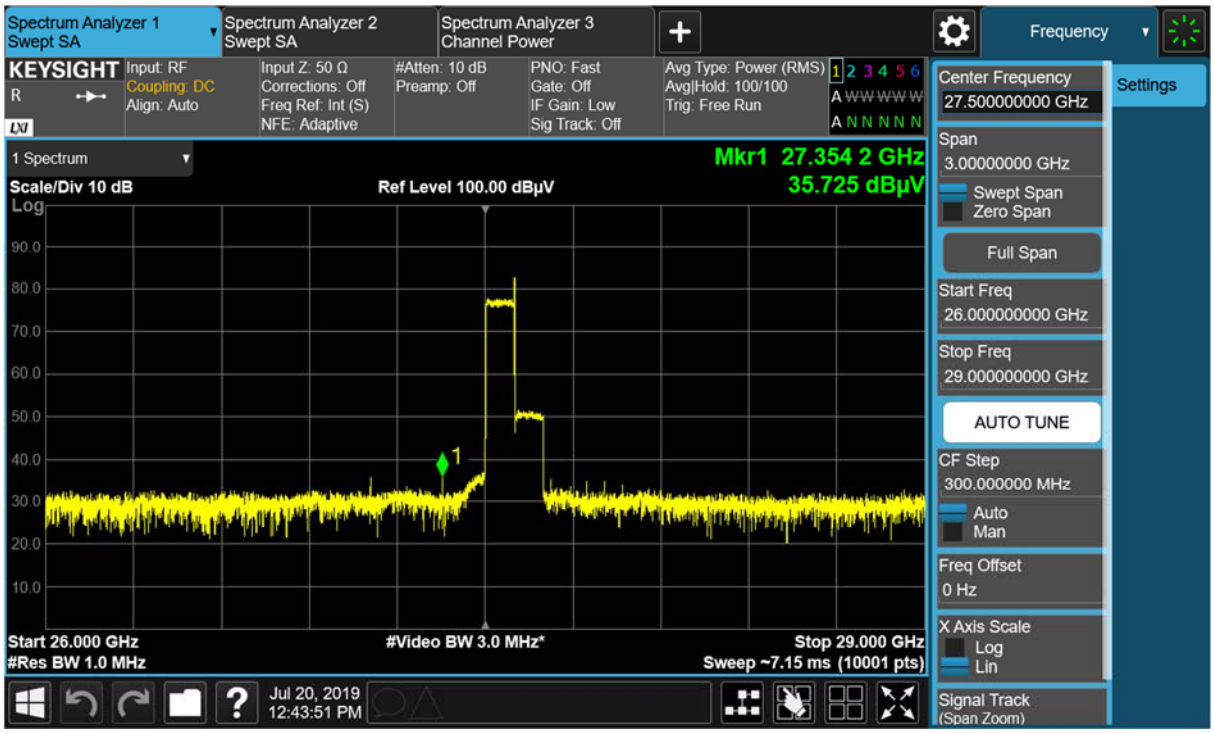
MAX Ant. A Position / 1cc / Low / 16QAM / Ant. A



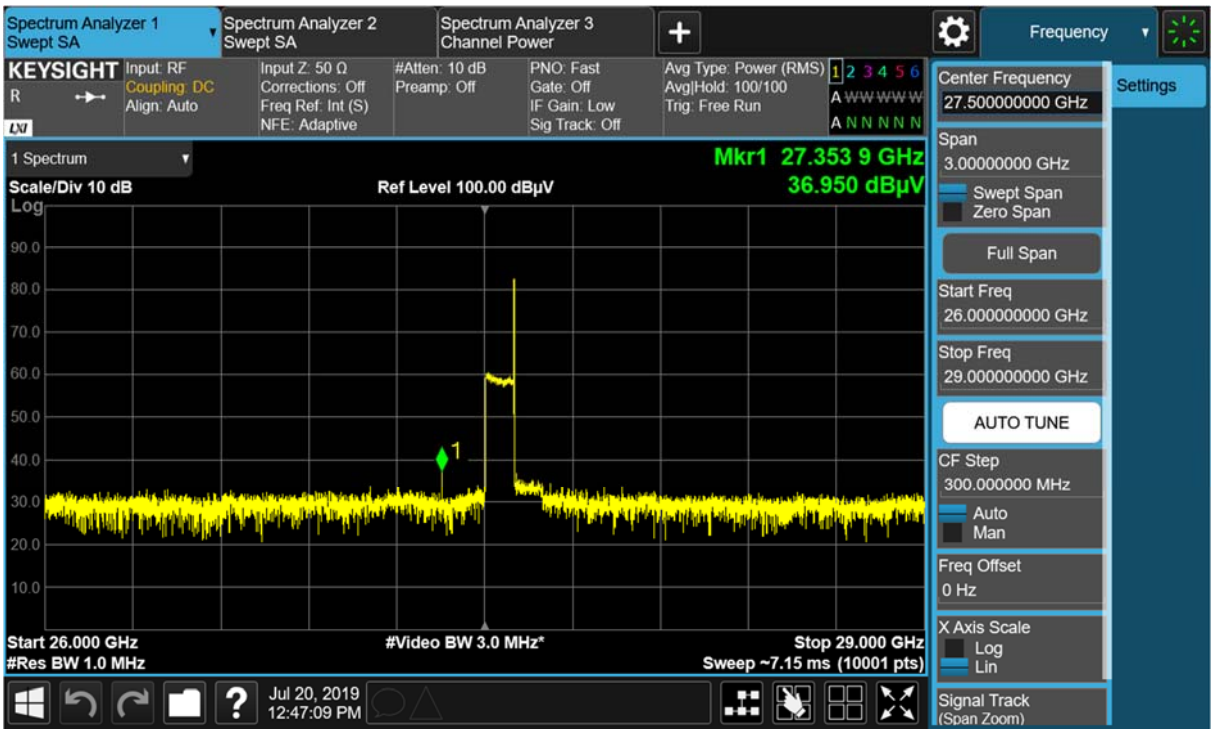
MAX Ant. A Position / 1cc / Low / 16QAM / Ant. B



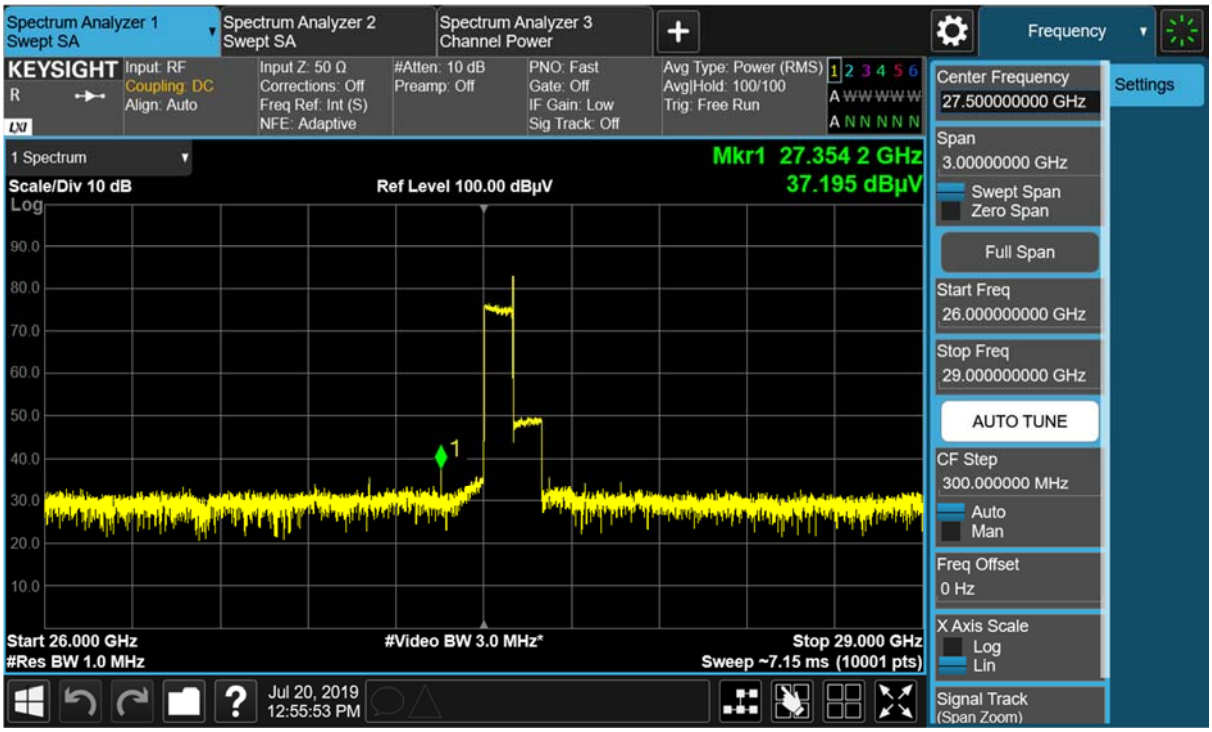
MAX Ant. A Position / 1cc / Low / 16QAM / Ant. C



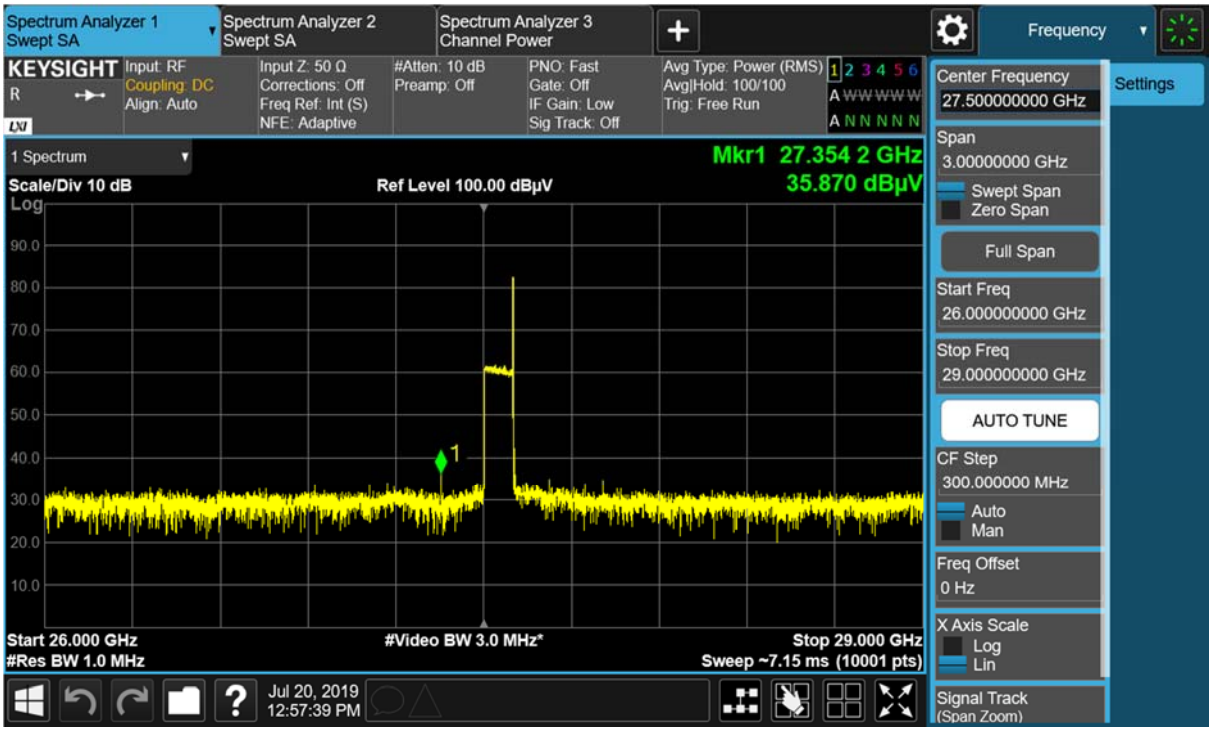
MAX Ant. A Position / 1cc / Low / 16QAM / Ant. D



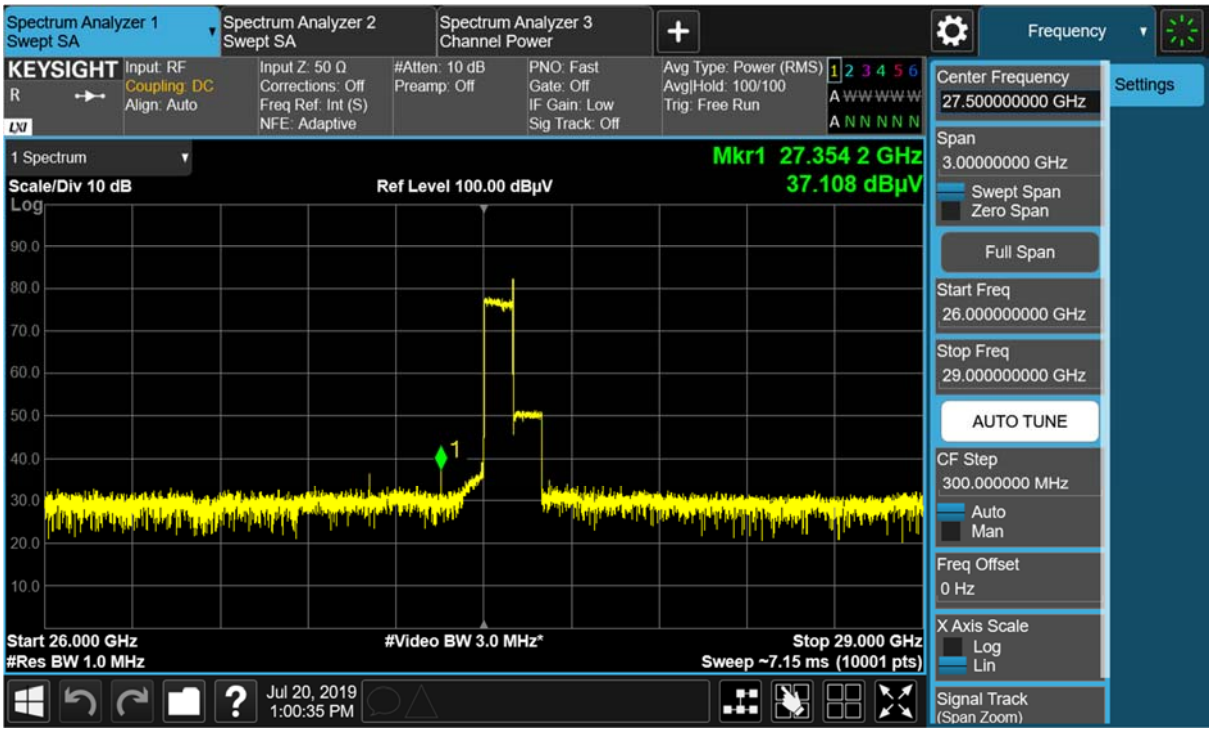
MAX Ant. A Position / 1cc / Low / 64QAM / Ant. A



MAX Ant. A Position / 1cc / Low / 64QAM / Ant. B



MAX Ant. A Position / 1cc / Low / 64QAM / Ant. C



MAX Ant. A Position / 1cc / Low / 64QAM / Ant. D