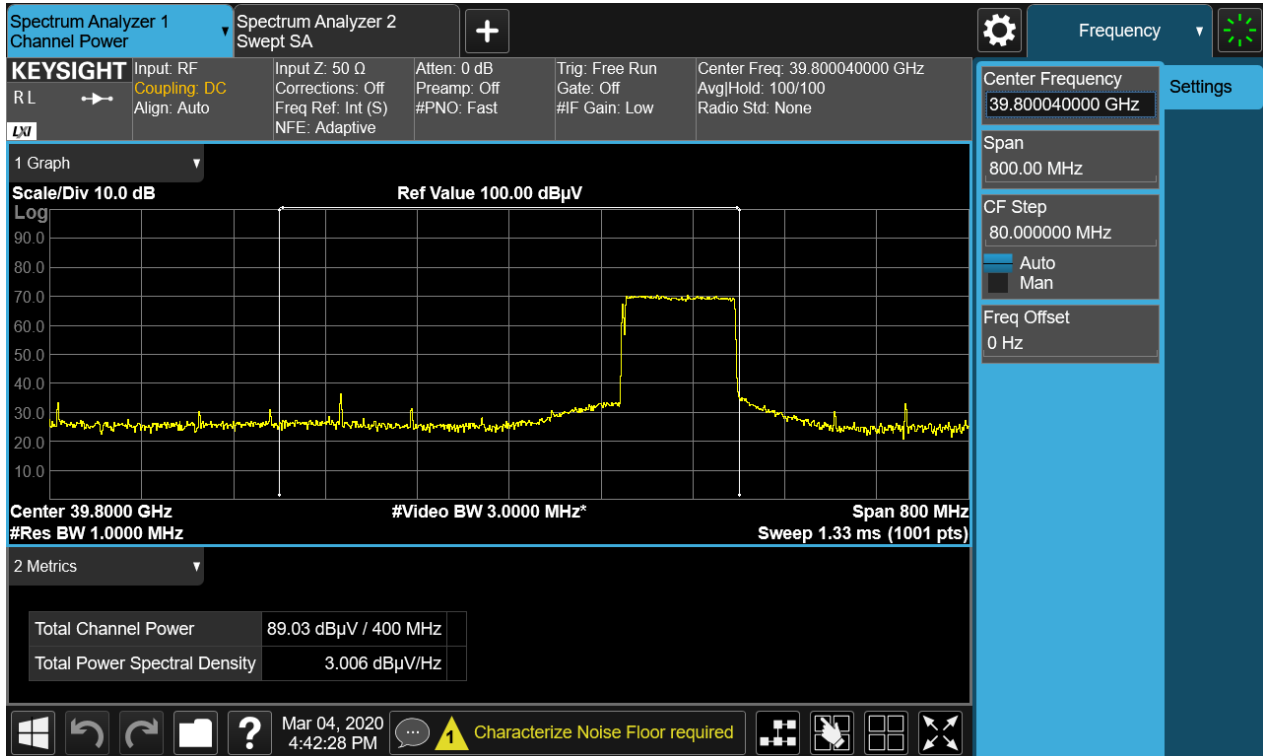
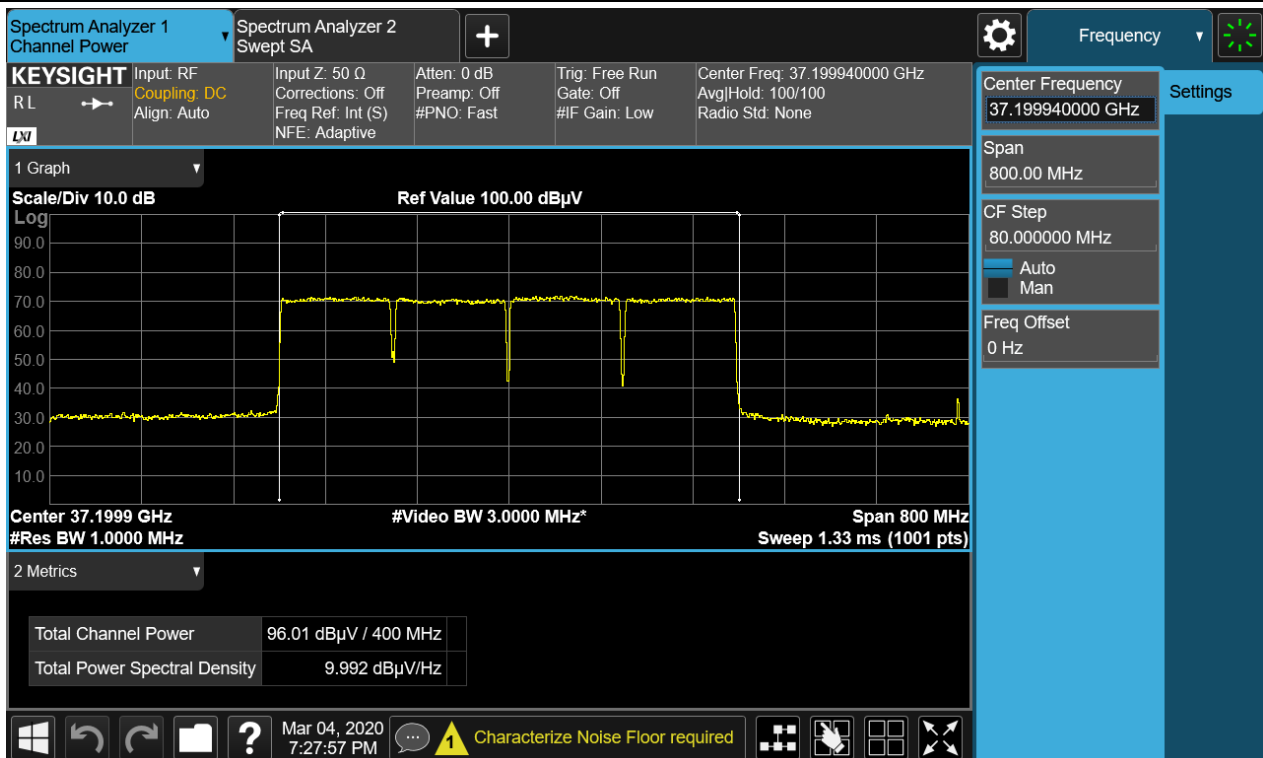


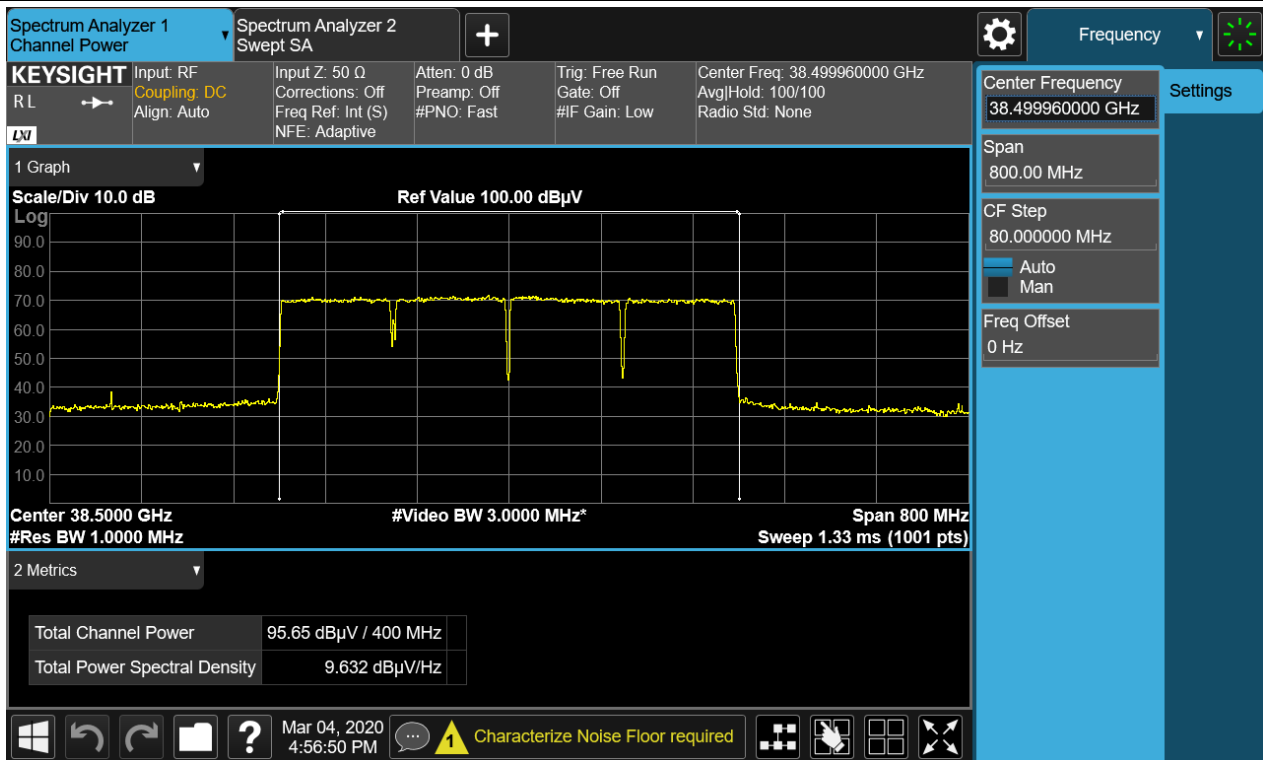
Antenna A / 1cc / 64QAM / High



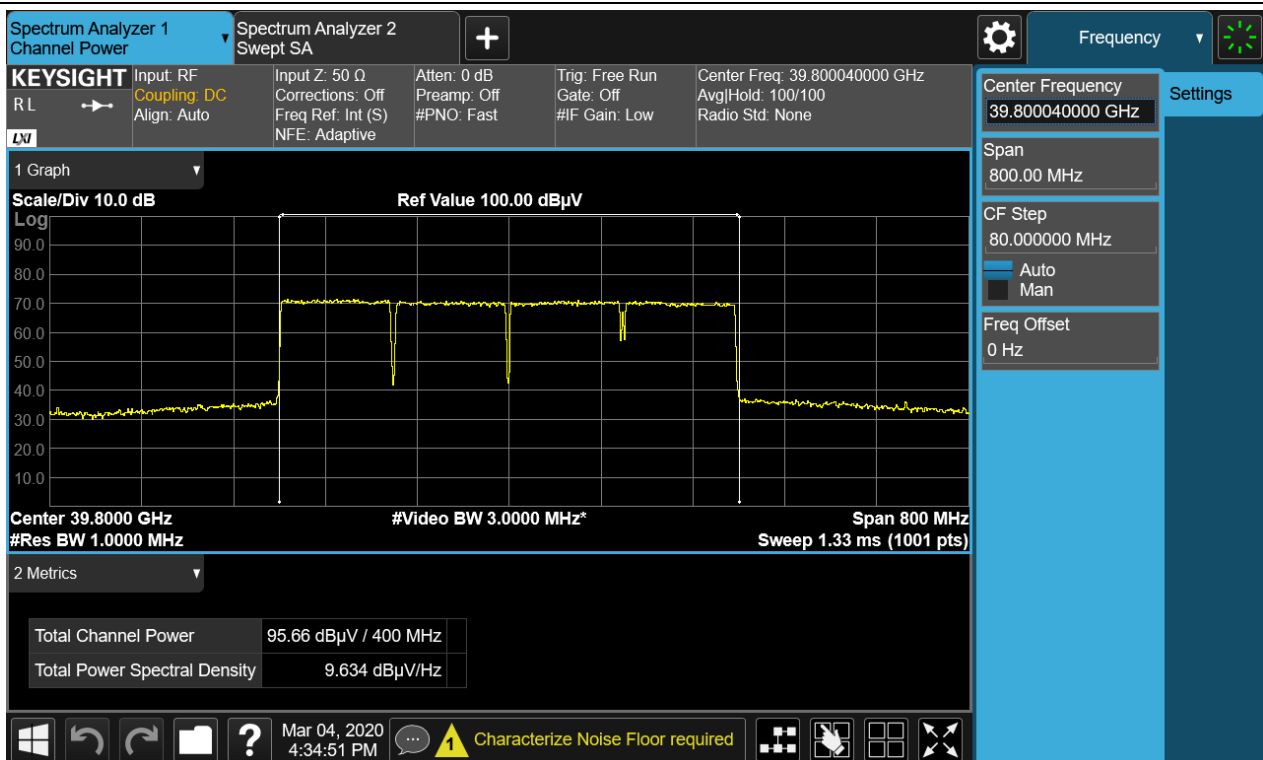
Antenna A / 4cc / 64QAM / Low



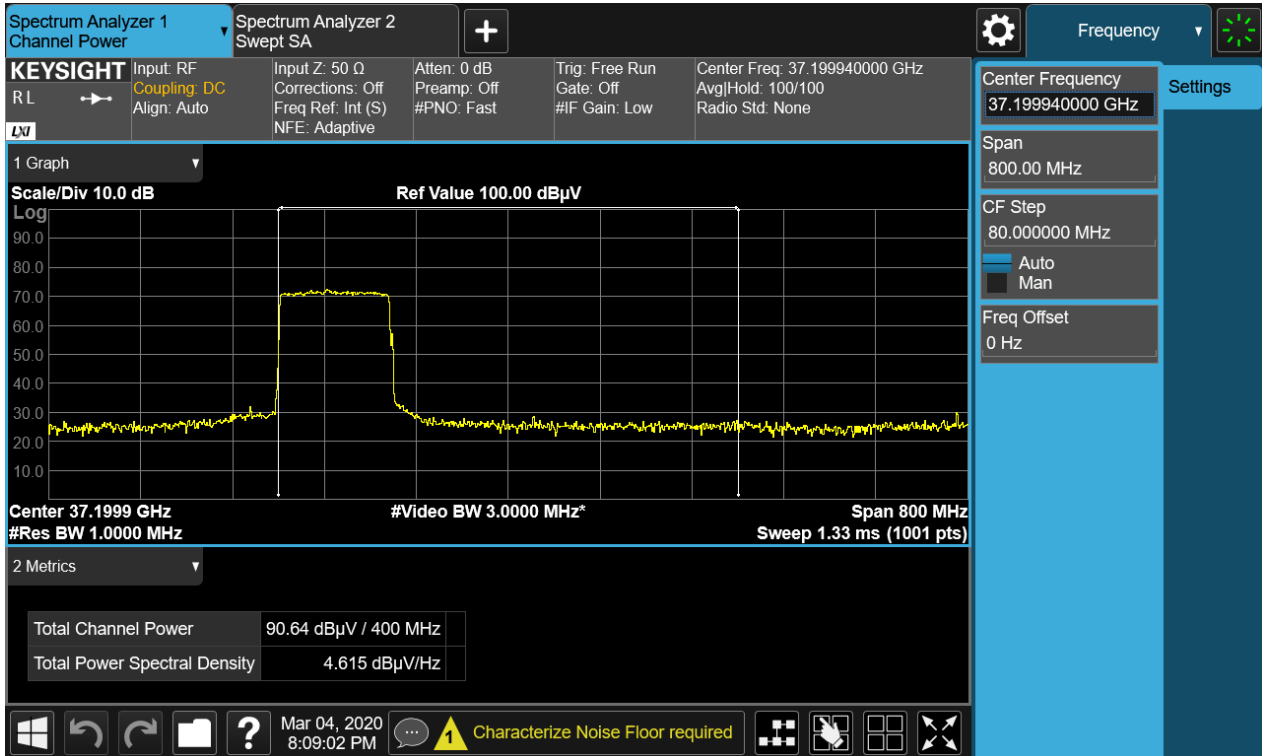
Antenna A / 4cc / 64QAM / Middle



Antenna A / 4cc / 64QAM / High



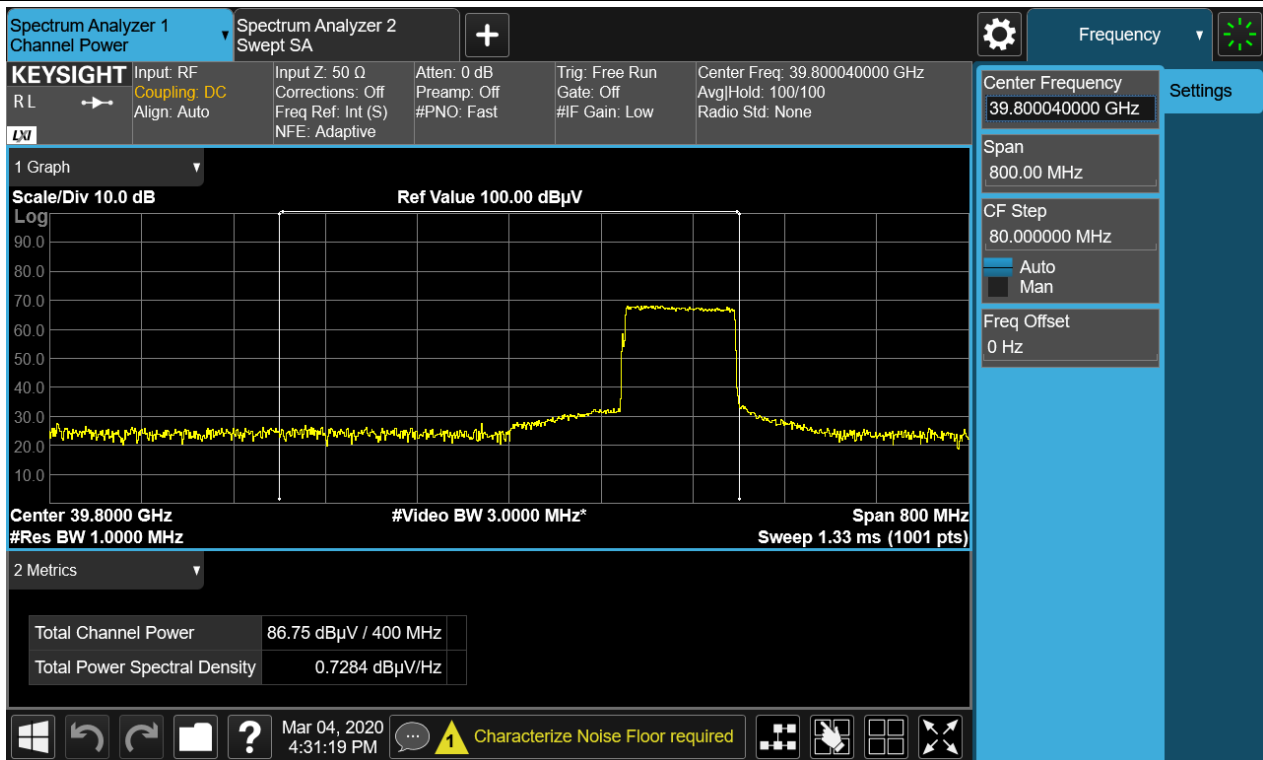
Antenna B / 1cc / 64QAM / Low



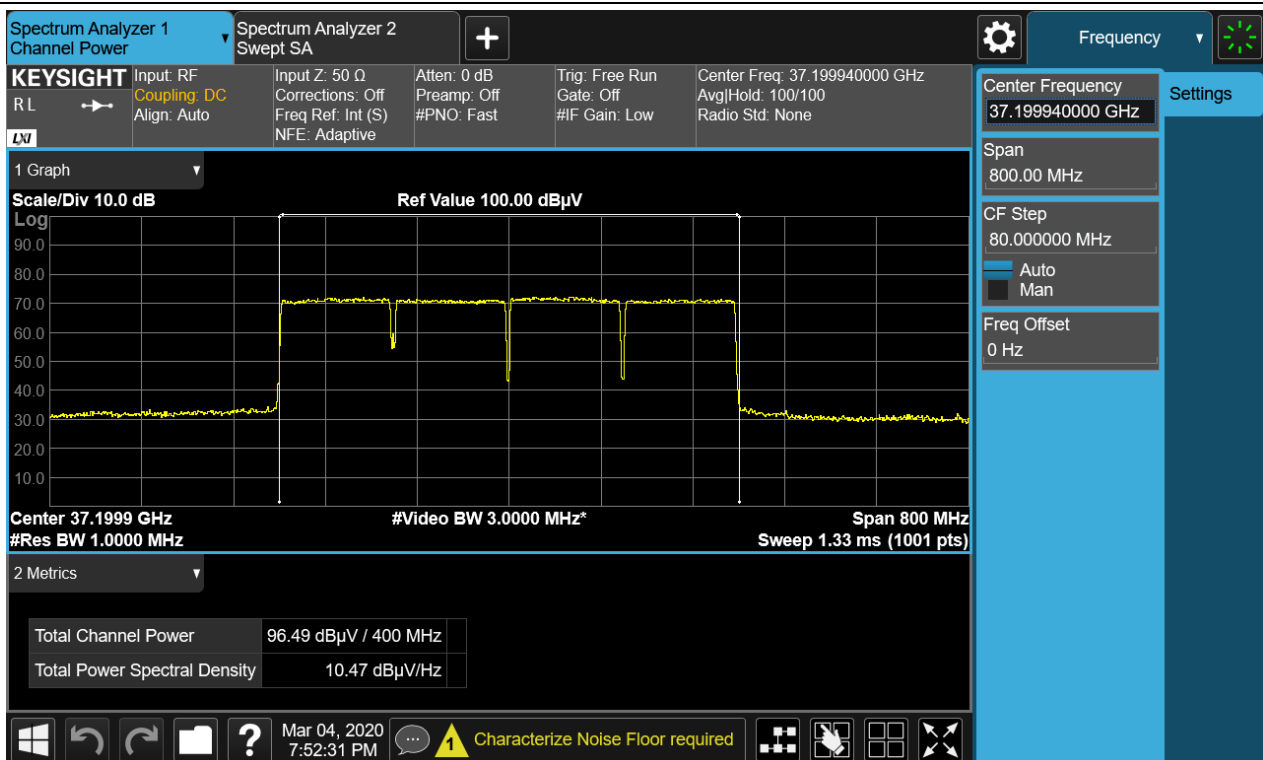
Antenna B / 1cc / 64QAM / Middle



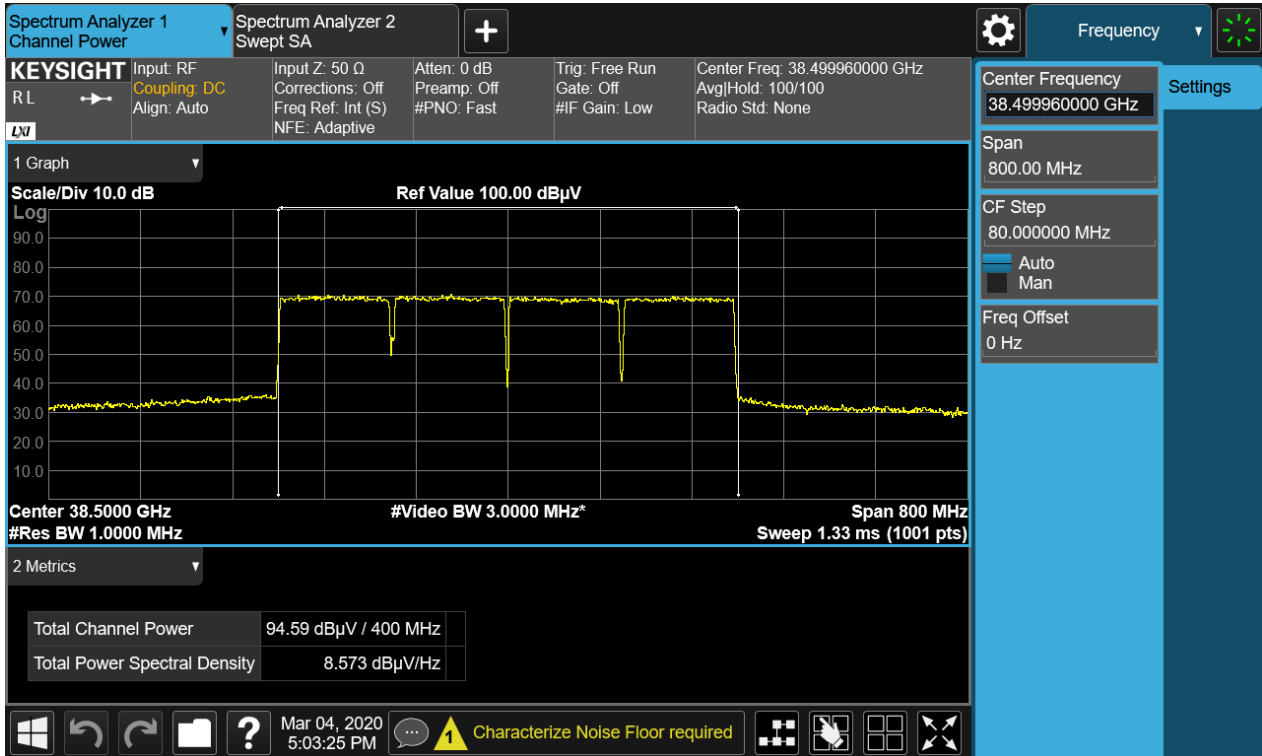
Antenna B / 1cc / 64QAM / High



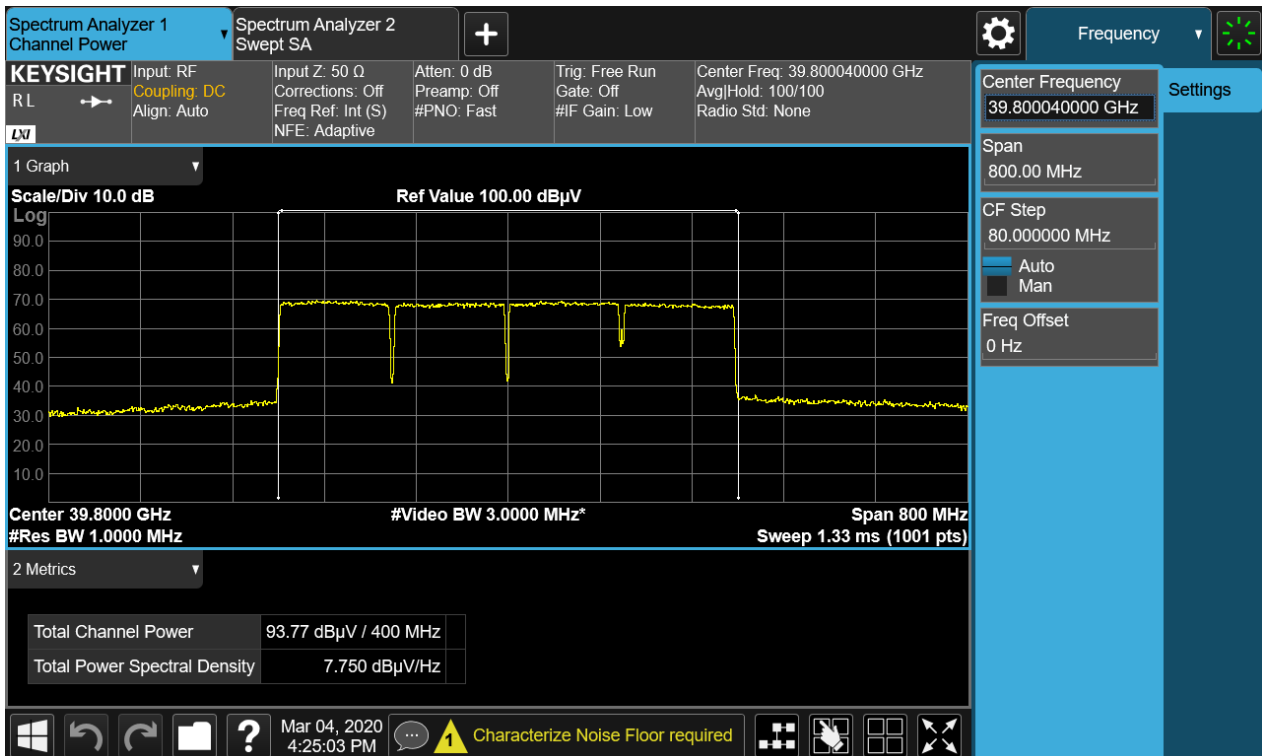
Antenna B / 4cc / 64QAM / Low



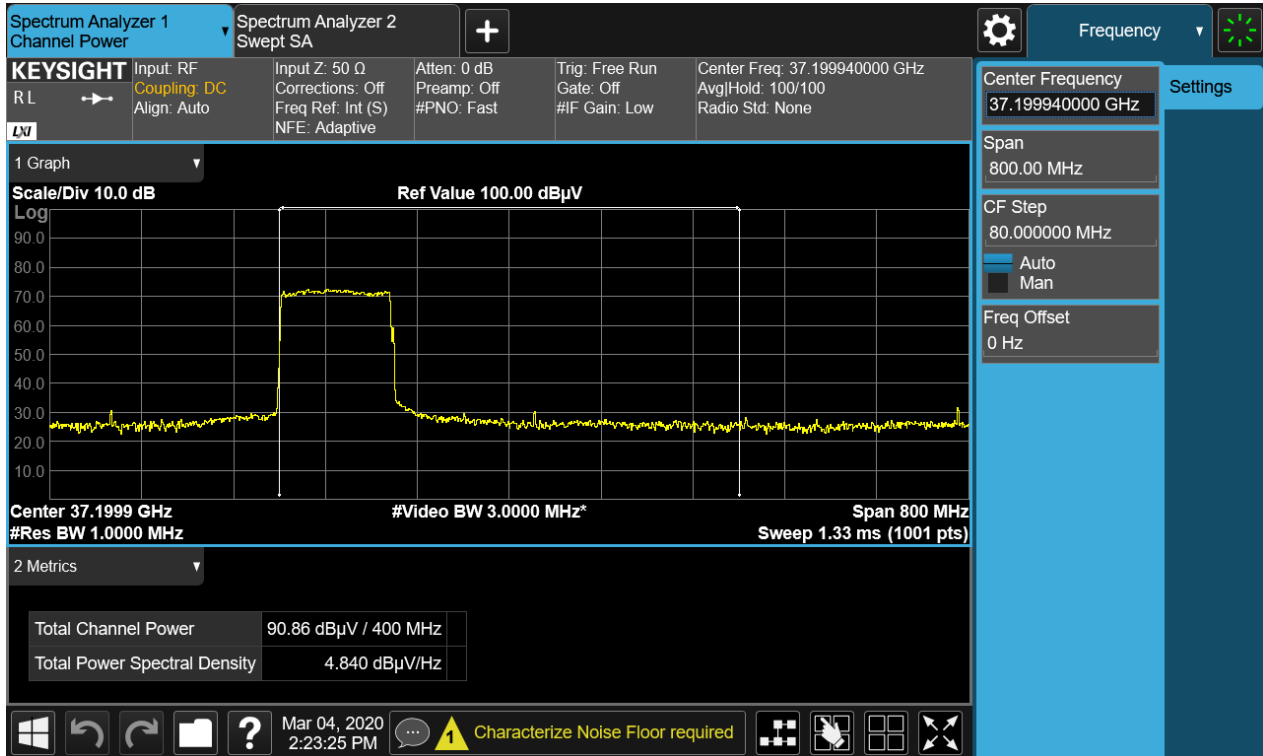
Antenna B / 4cc / 64QAM / Middle



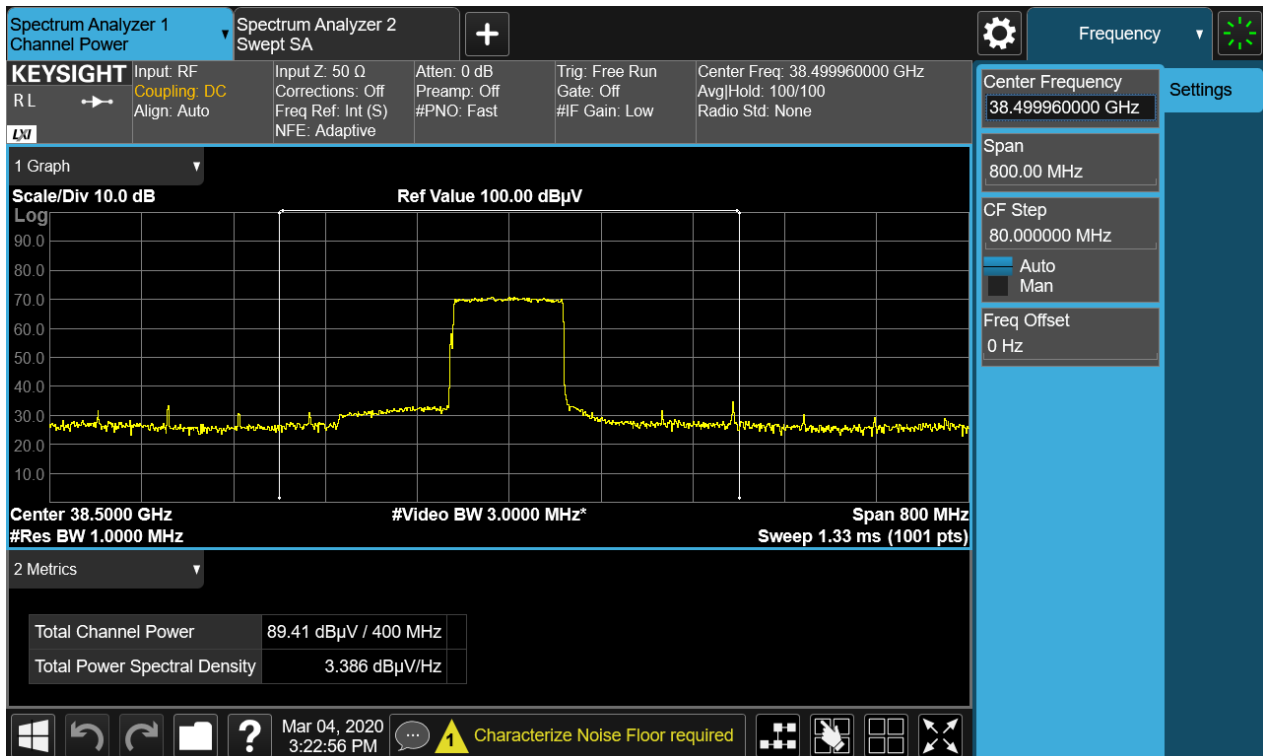
Antenna B / 4cc / 64QAM / High



Antenna C / 1cc / 64QAM / Low



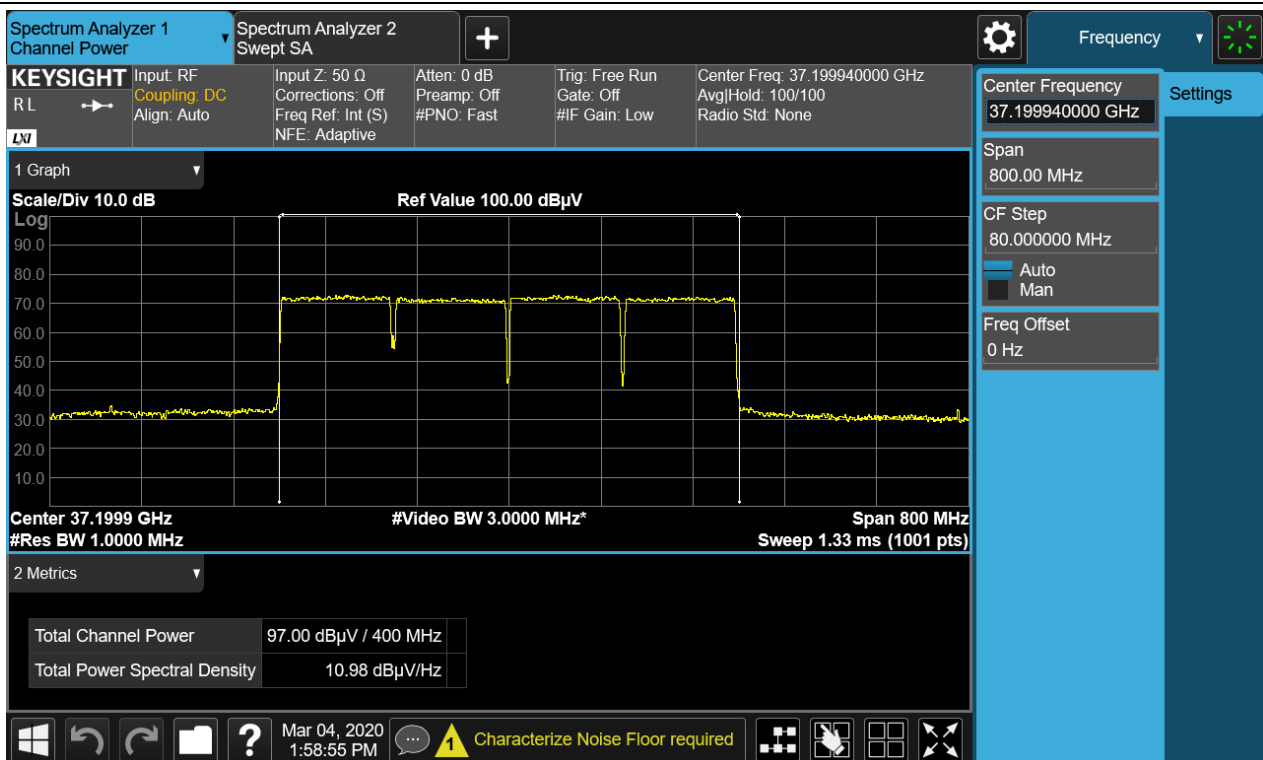
Antenna C / 1cc / 64QAM / Middle



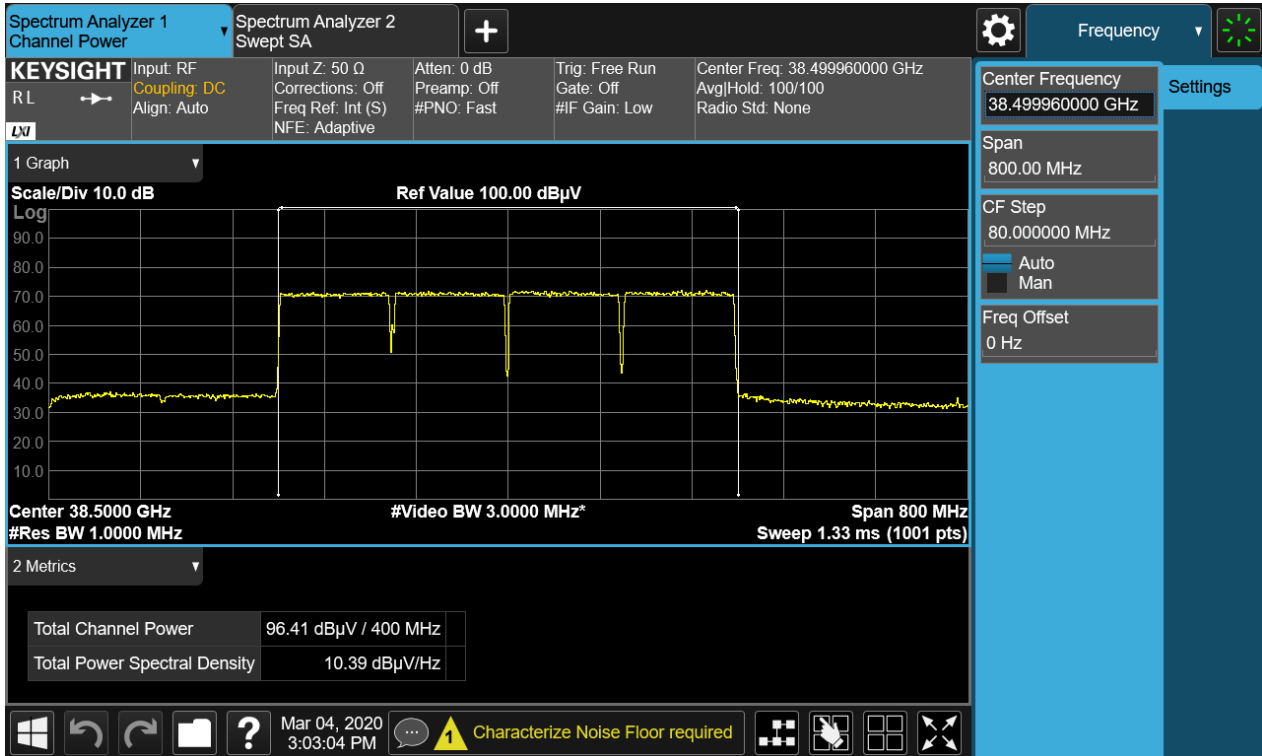
Antenna C / 1cc / 64QAM / High



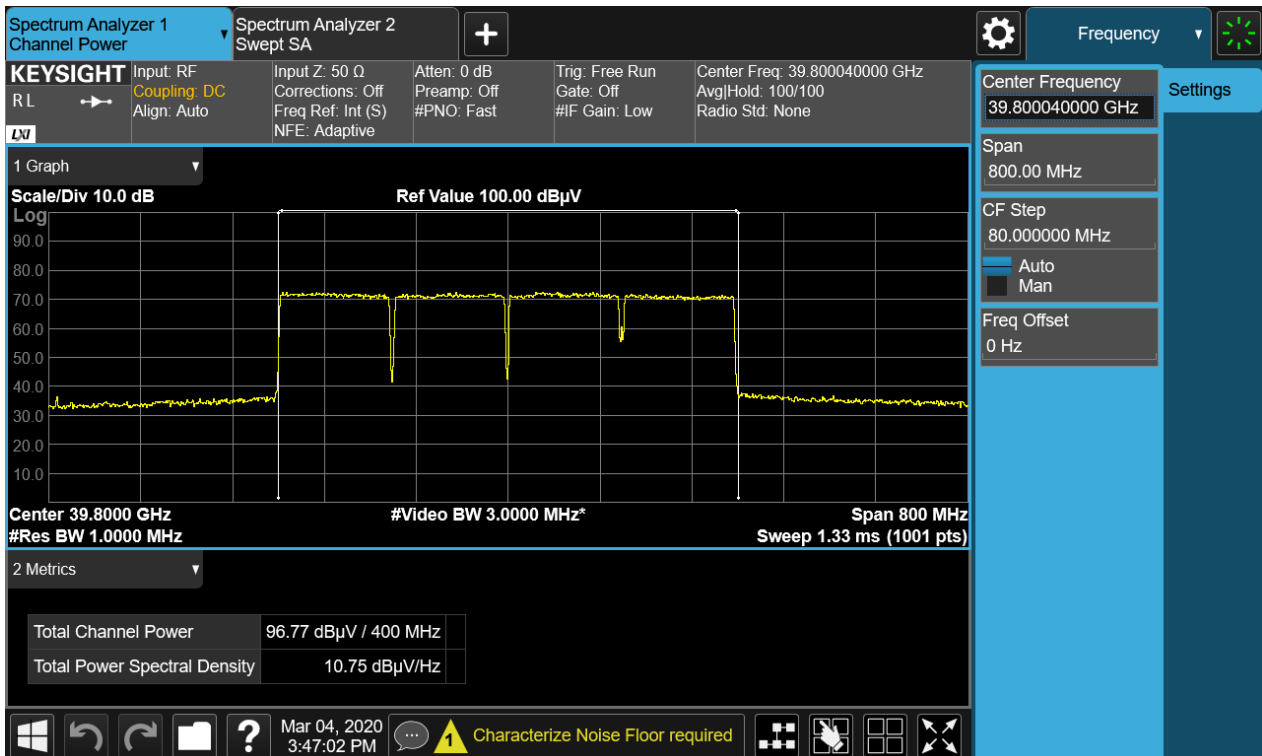
Antenna C / 4cc / 64QAM / Low



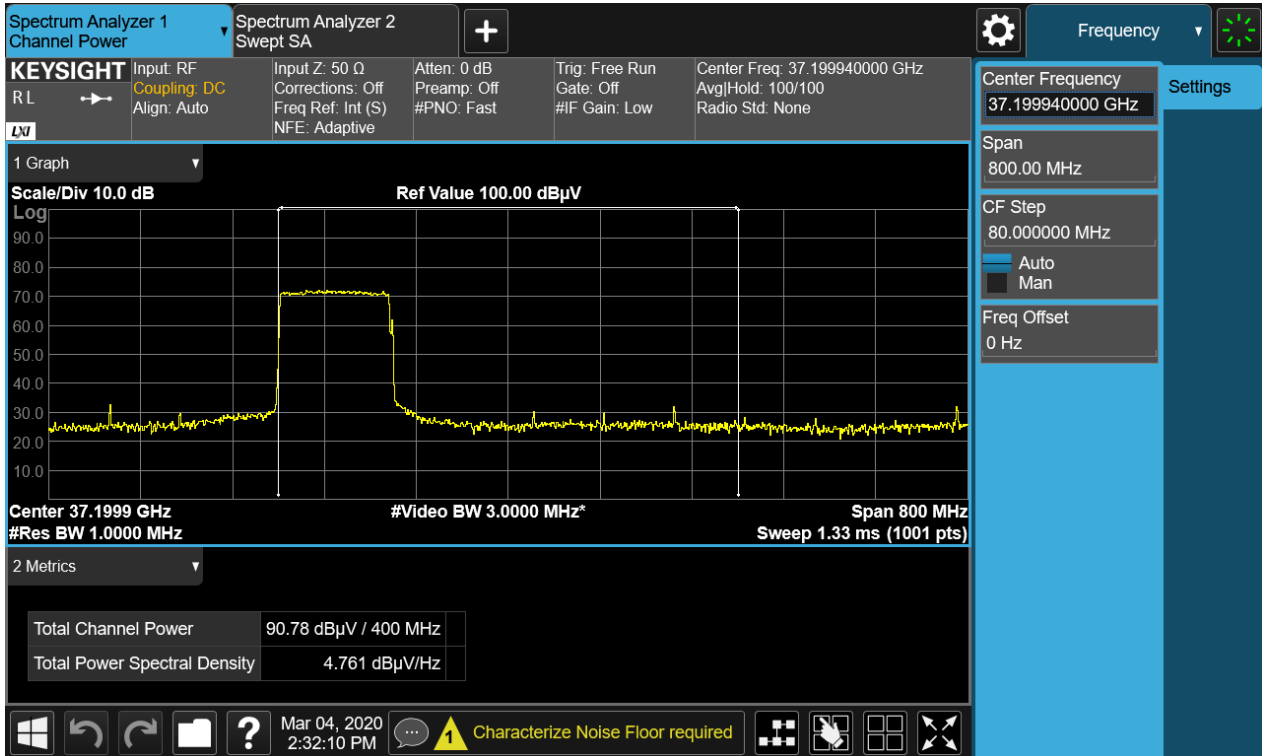
Antenna C / 4cc / 64QAM / Middle



Antenna C / 4cc / 64QAM / High



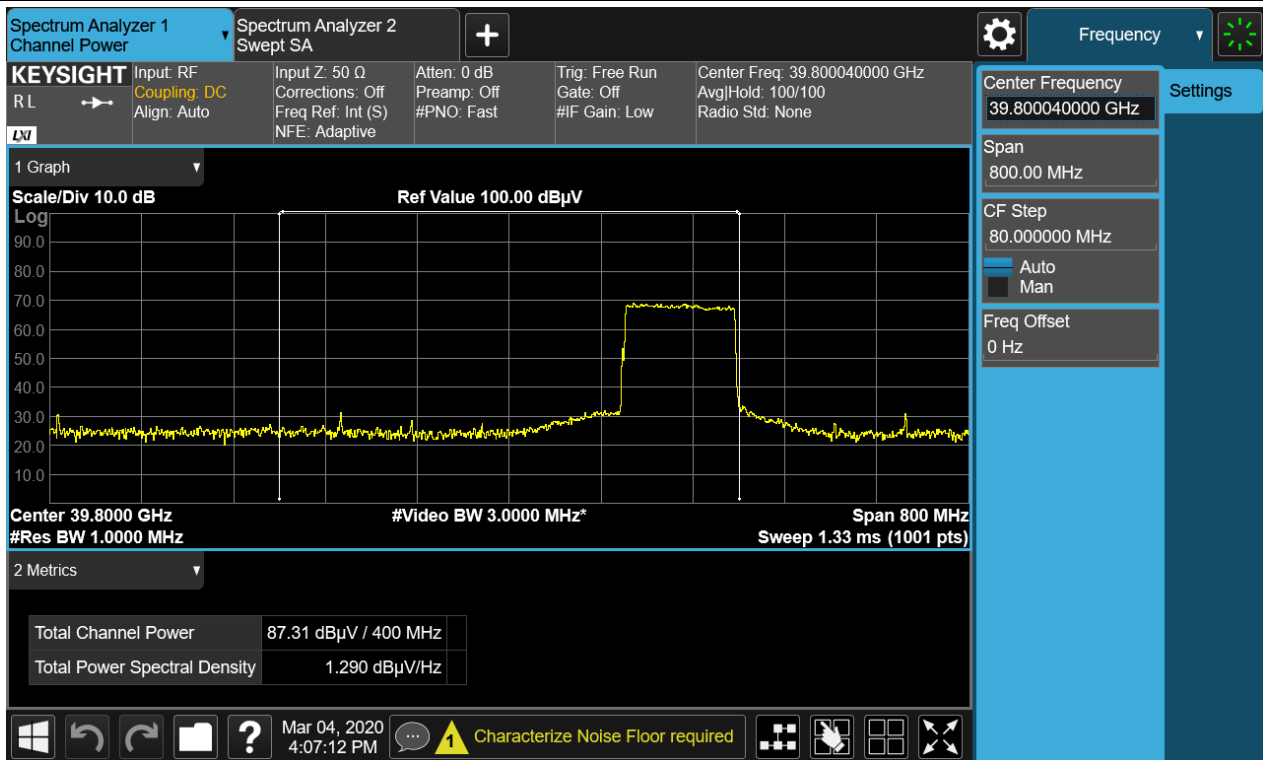
Antenna D / 1cc / 64QAM / Low



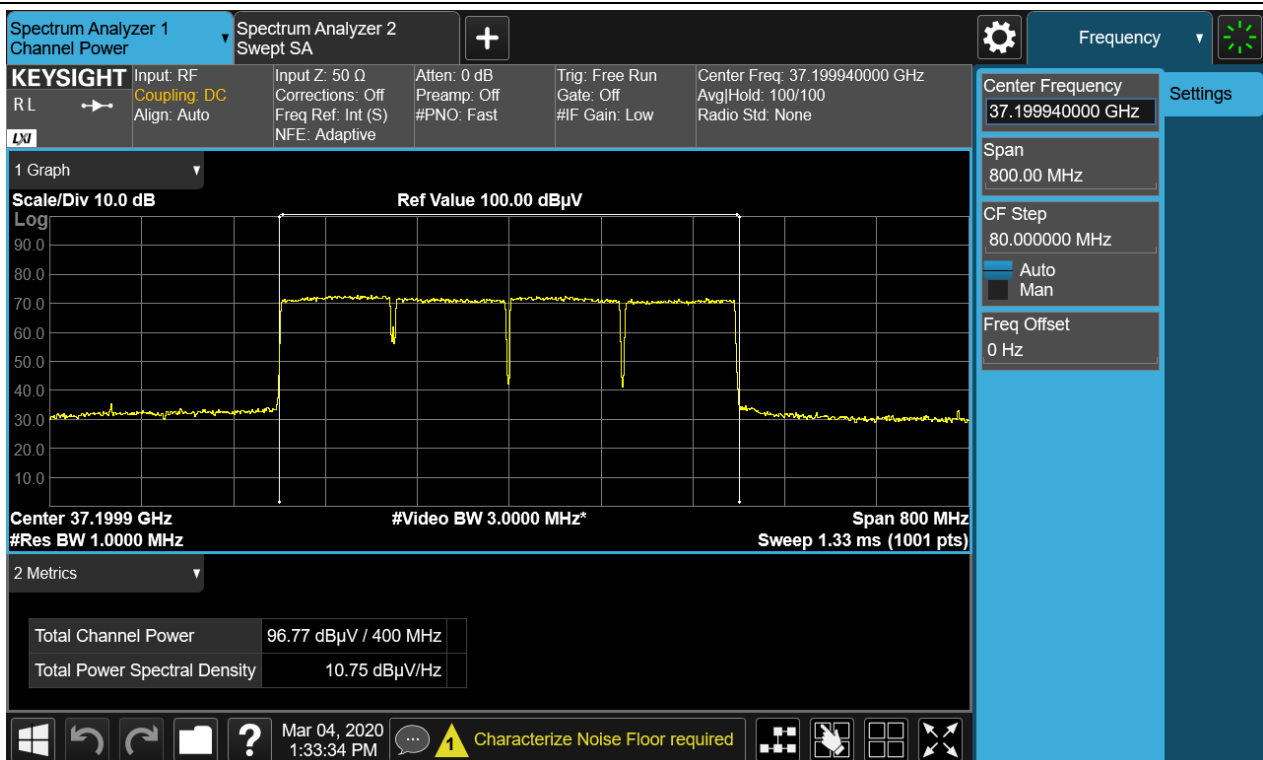
Antenna D / 1cc / 64QAM / Middle



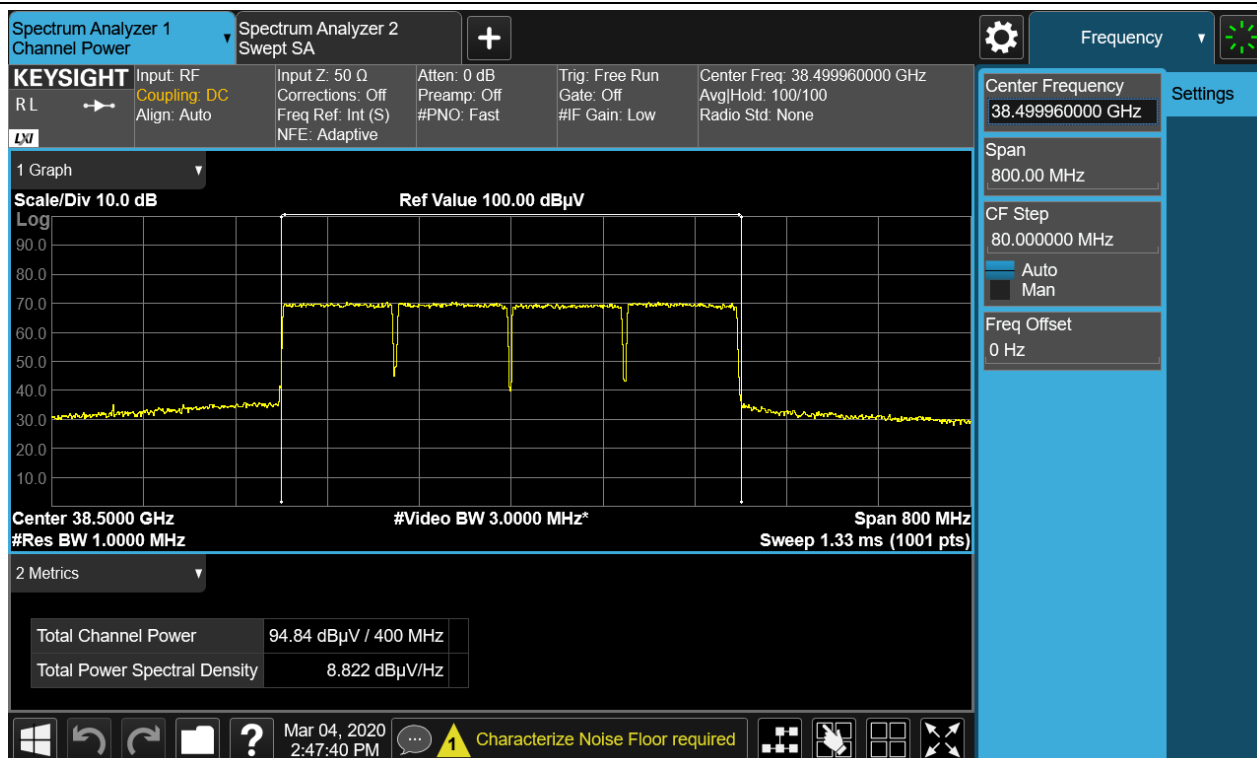
Antenna D / 1cc / 64QAM / High



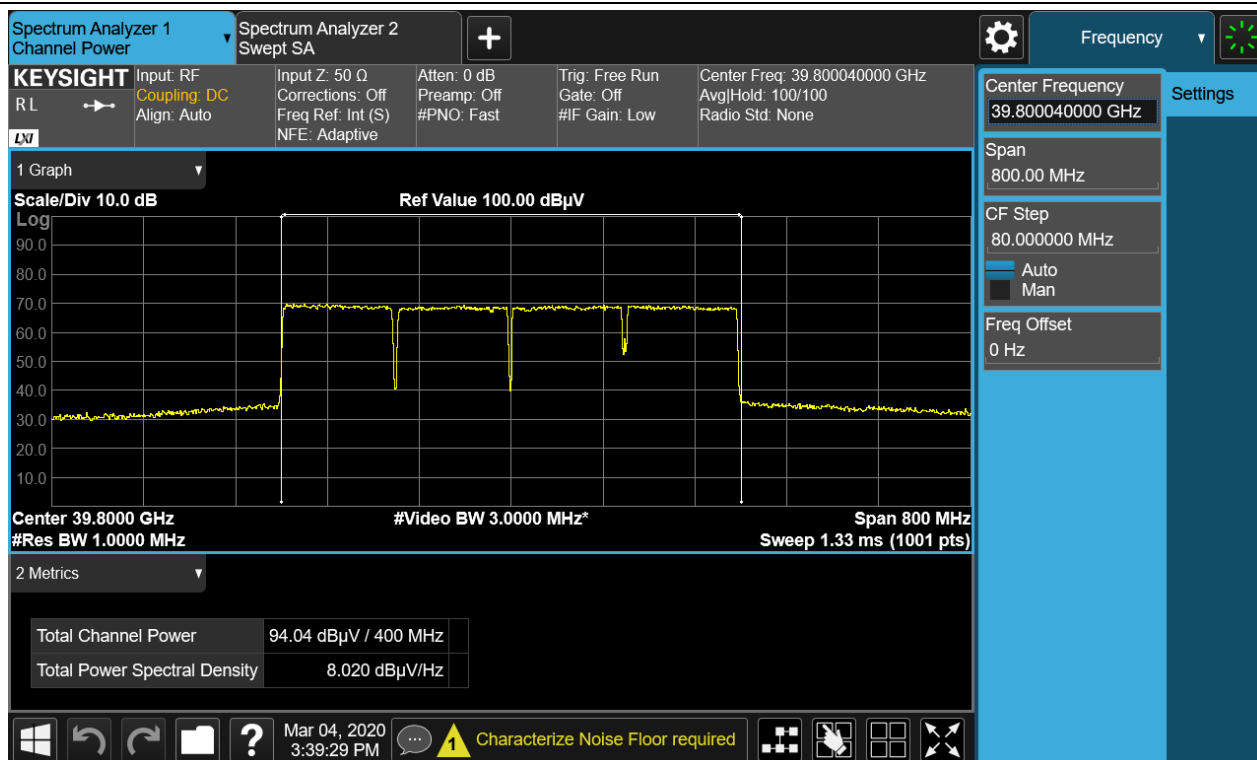
Antenna D / 4cc / 64QAM / Low



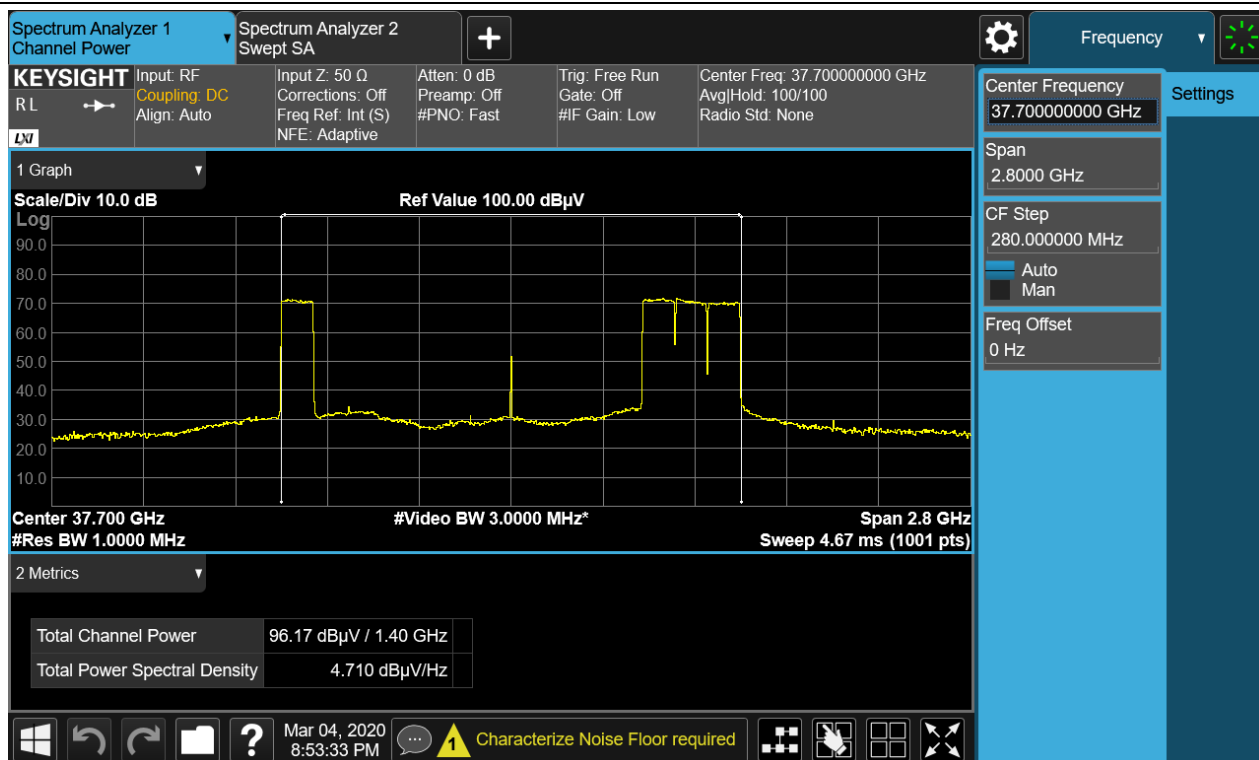
Antenna D / 4cc / 64QAM / Middle



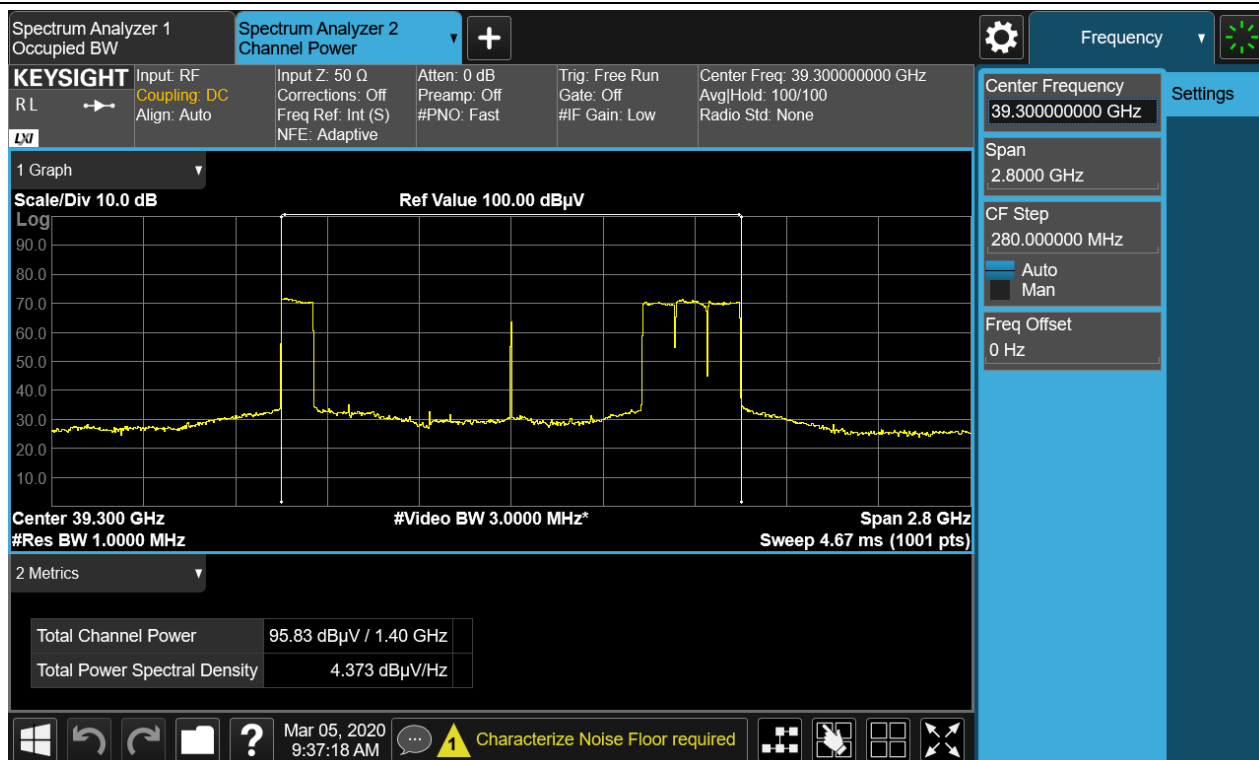
Antenna D / 4cc / 64QAM / High



Antenna A / cc1+3 / 64QAM / Low



Antenna A / cc1+3 / 64QAM / High



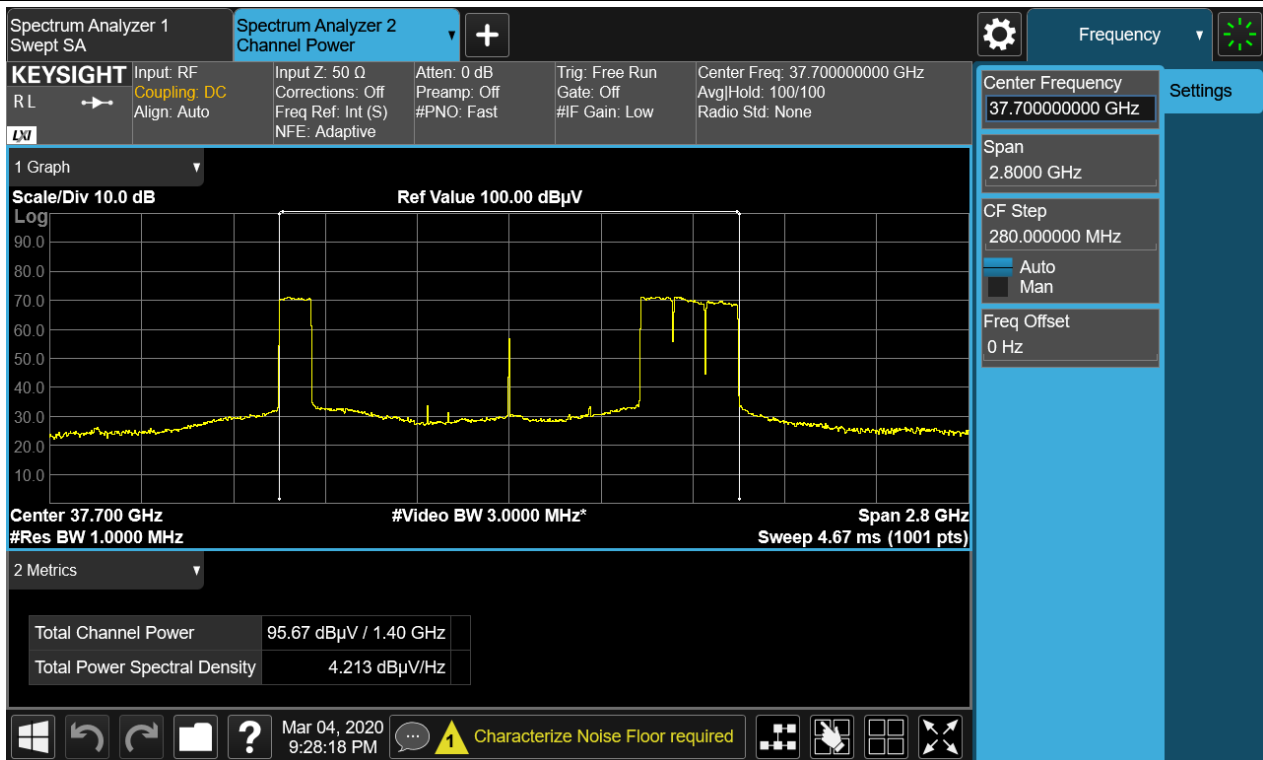
Antenna A / cc3+1 / 64QAM / Low



Antenna A / cc3+1 / 64QAM / High



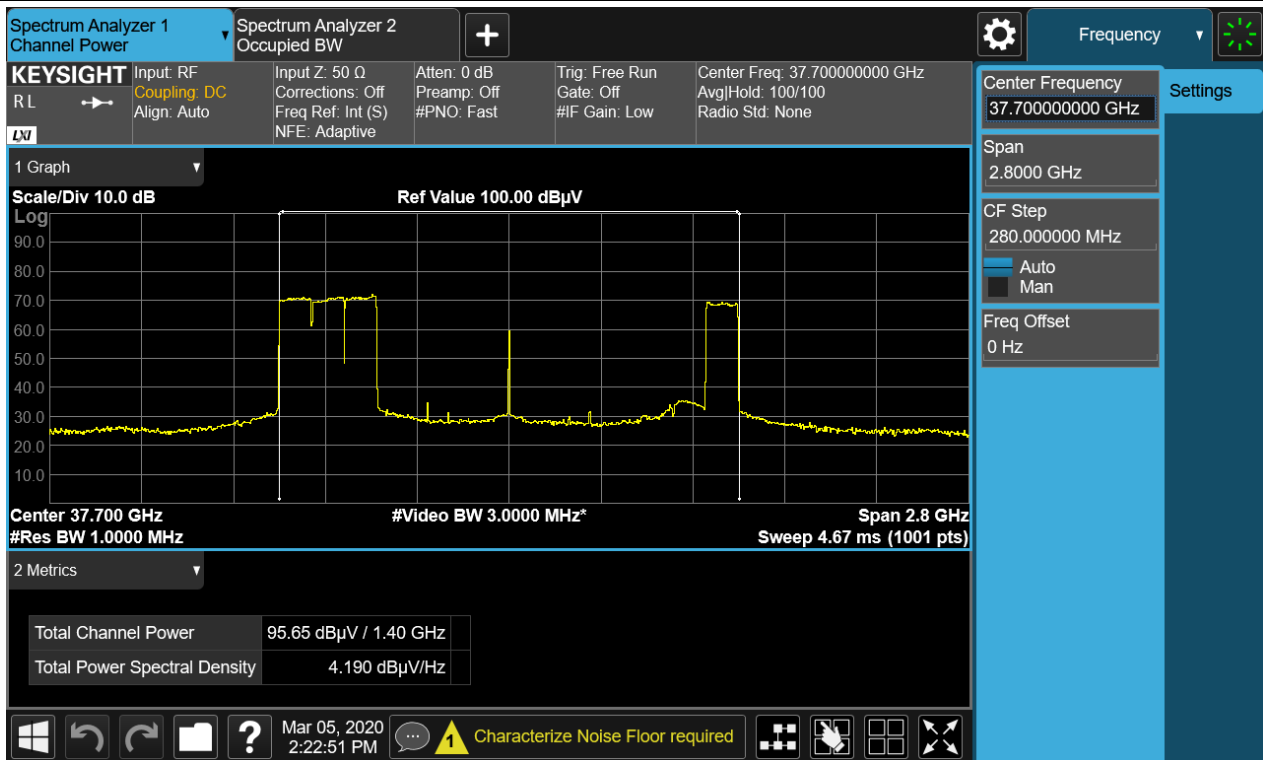
Antenna B / cc1+3 / 64QAM / Low



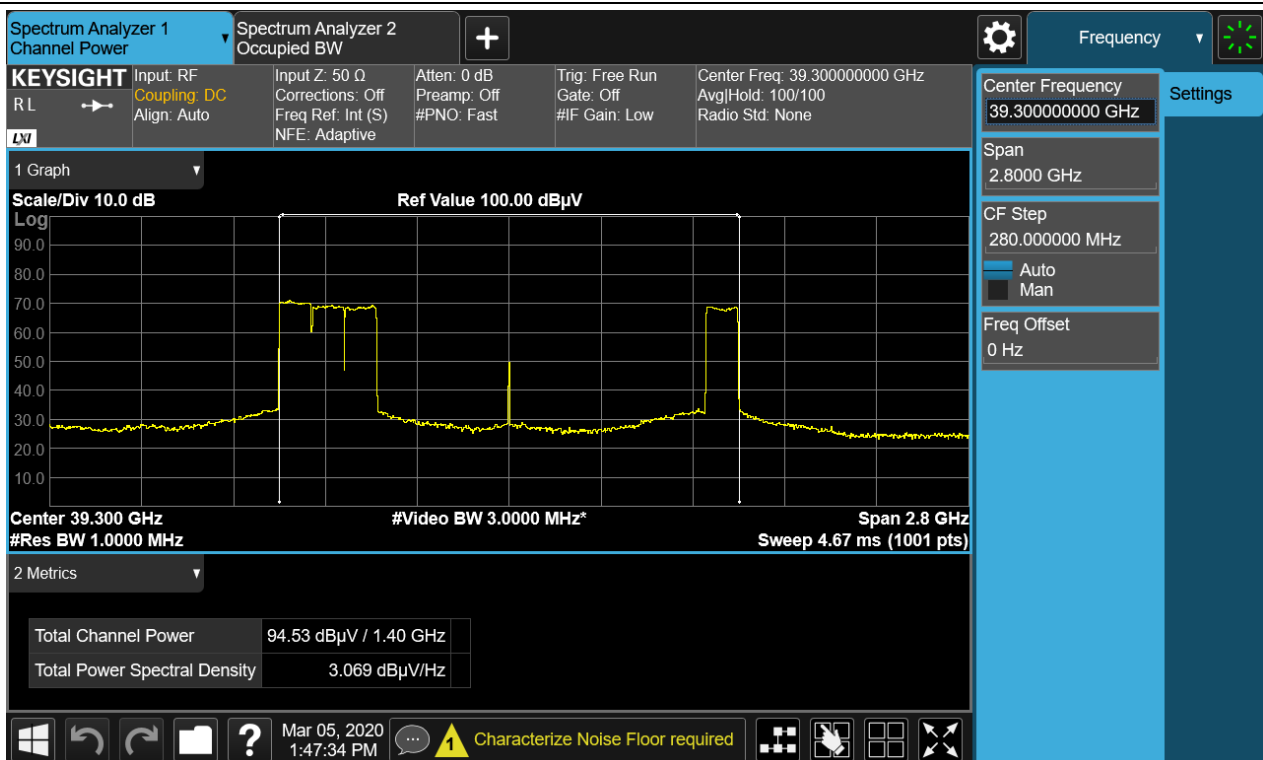
Antenna B / cc1+3 / 64QAM / High



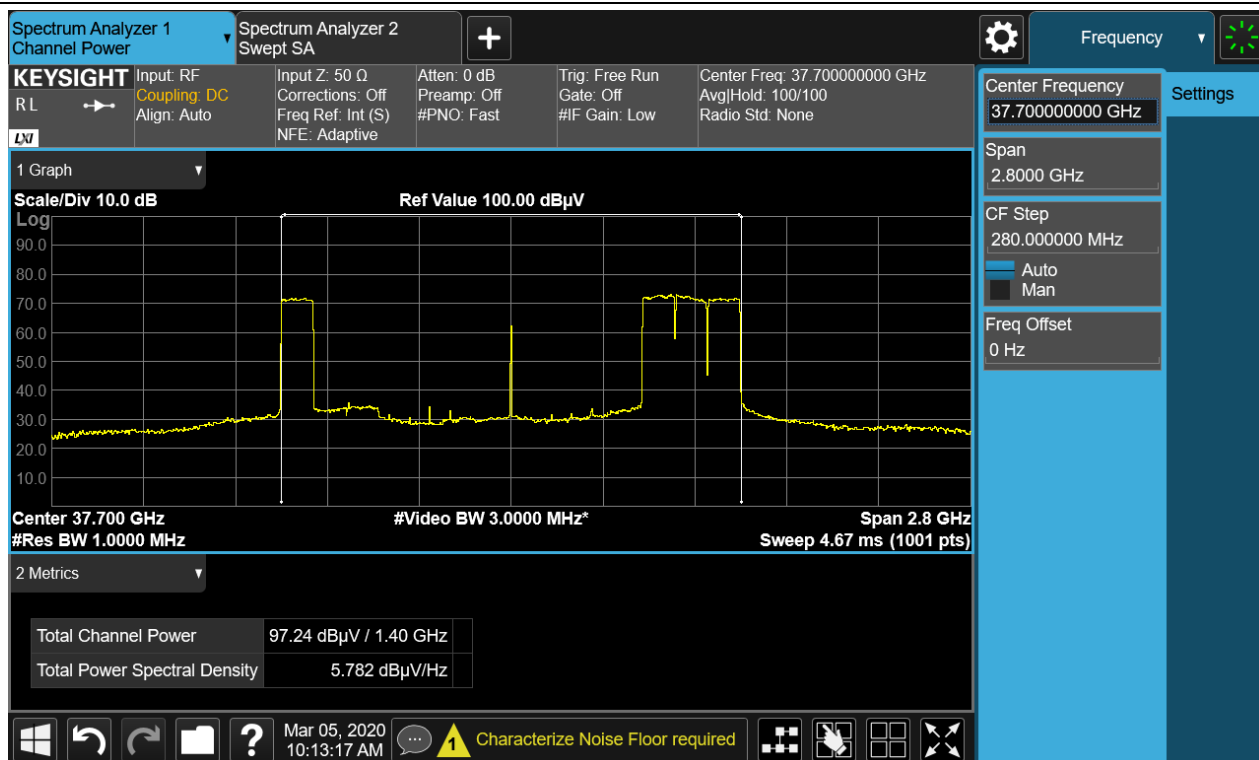
Antenna B / cc3+1 / 64QAM / Low



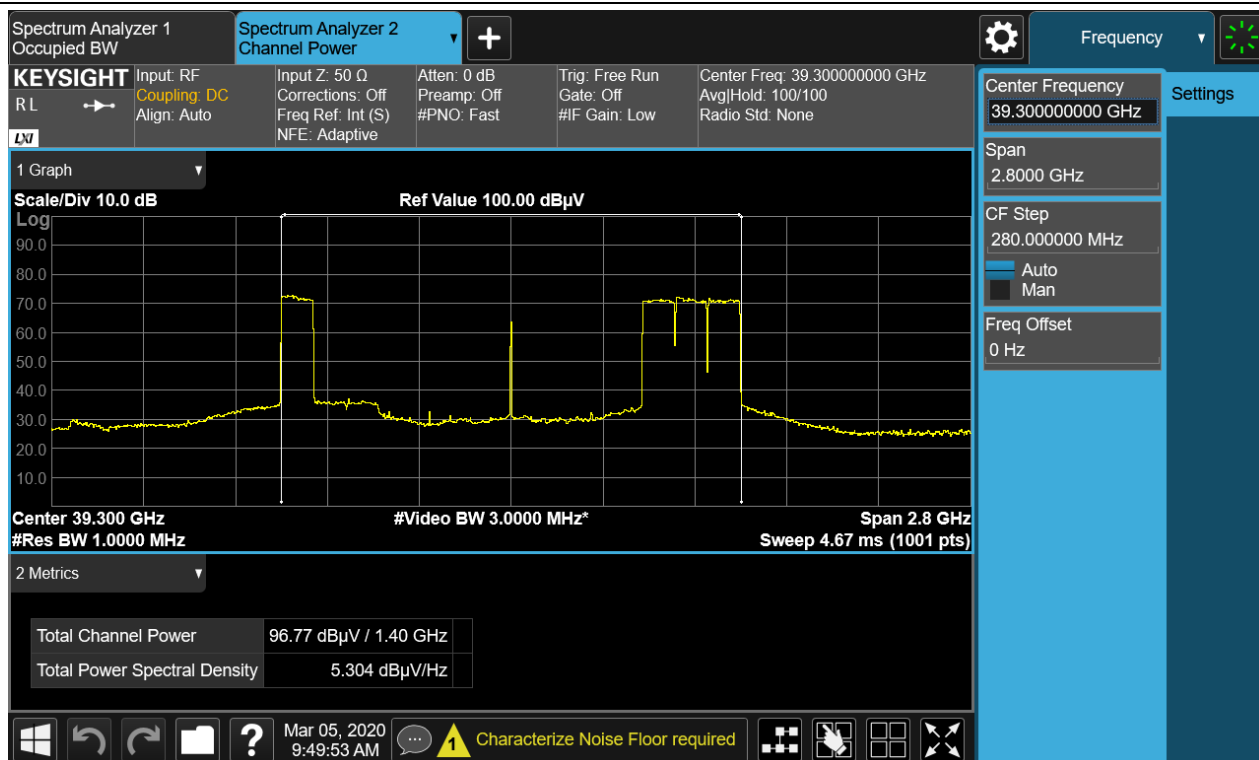
Antenna B / cc3+1 / 64QAM / High



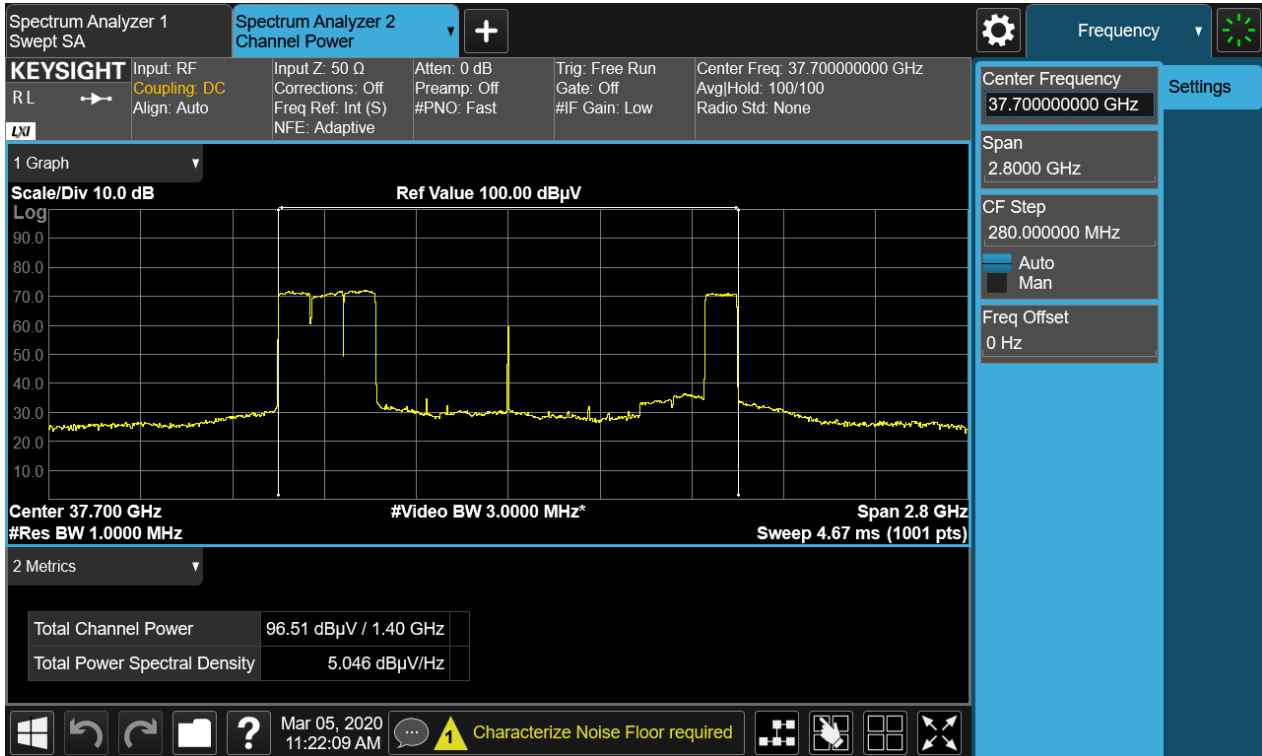
Antenna C / cc1+3 / 64QAM / Low



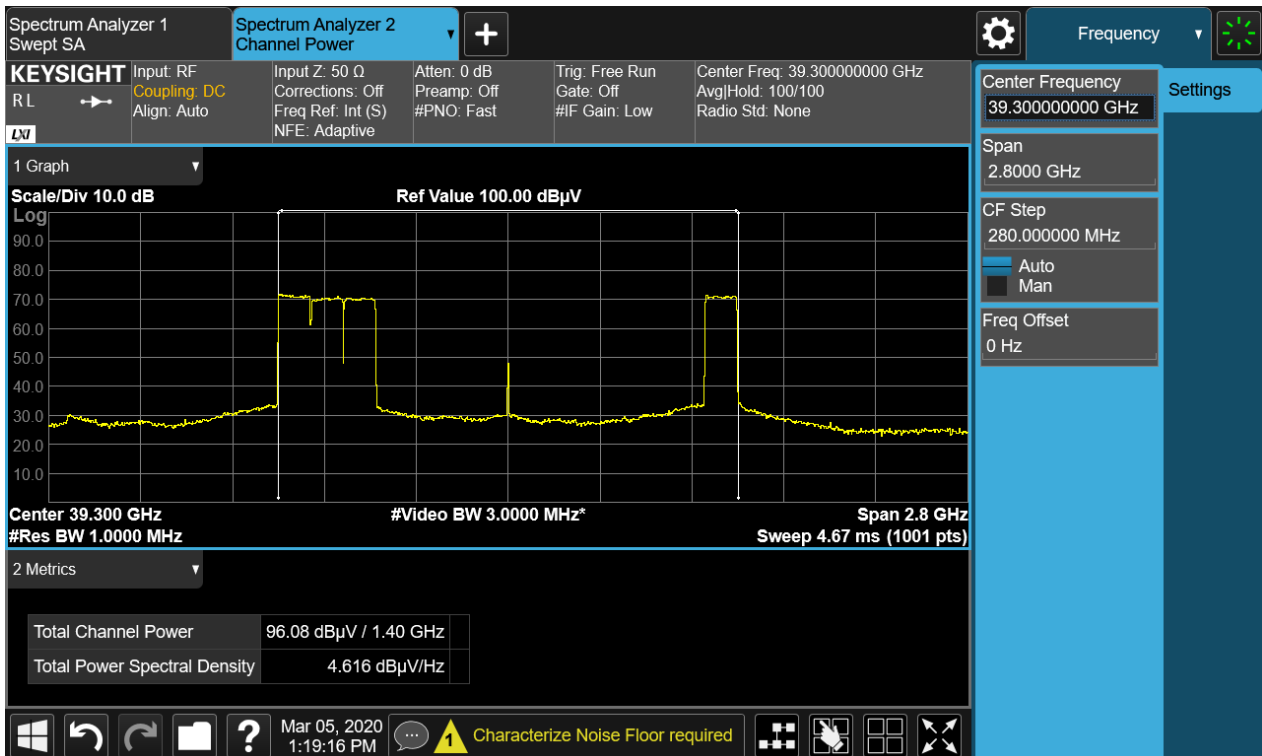
Antenna C / cc1+3 / 64QAM / High



Antenna C / cc3+1 / 64QAM / Low



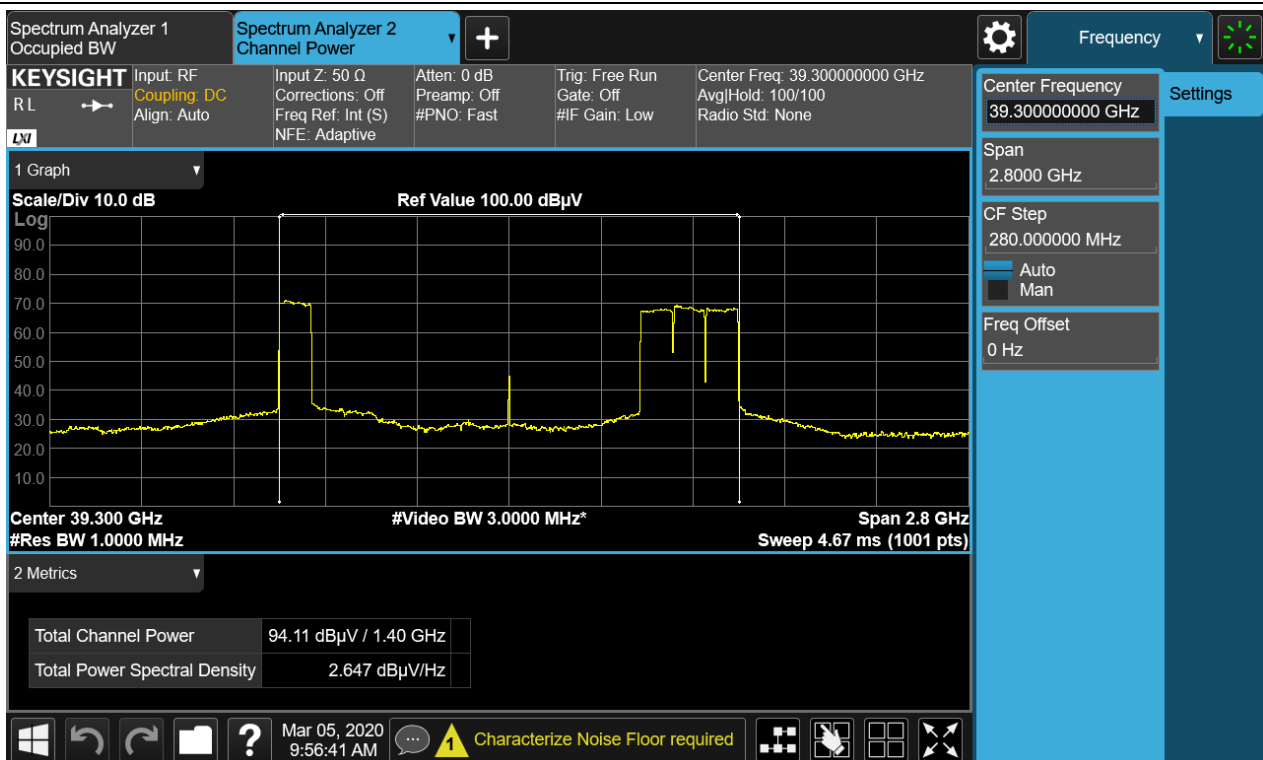
Antenna C / cc3+1 / 64QAM / High



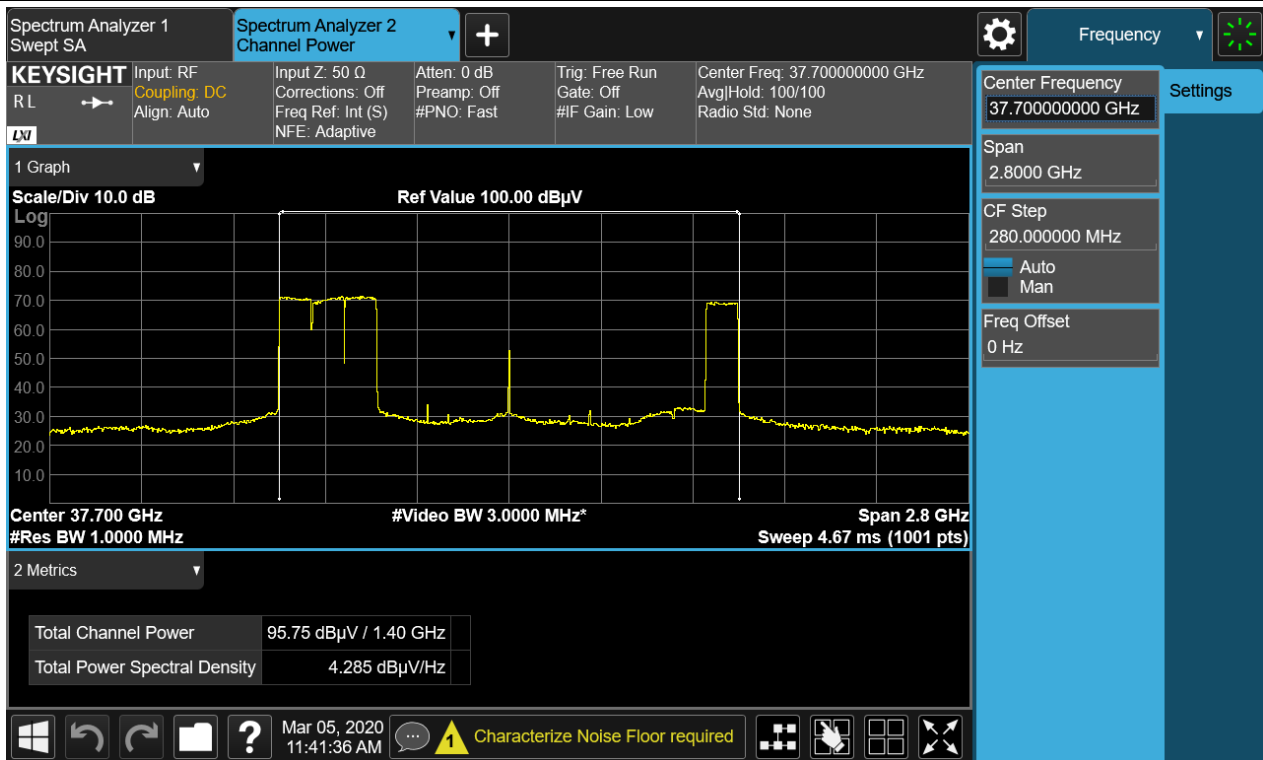
Antenna D / cc1+3 / 64QAM / Low



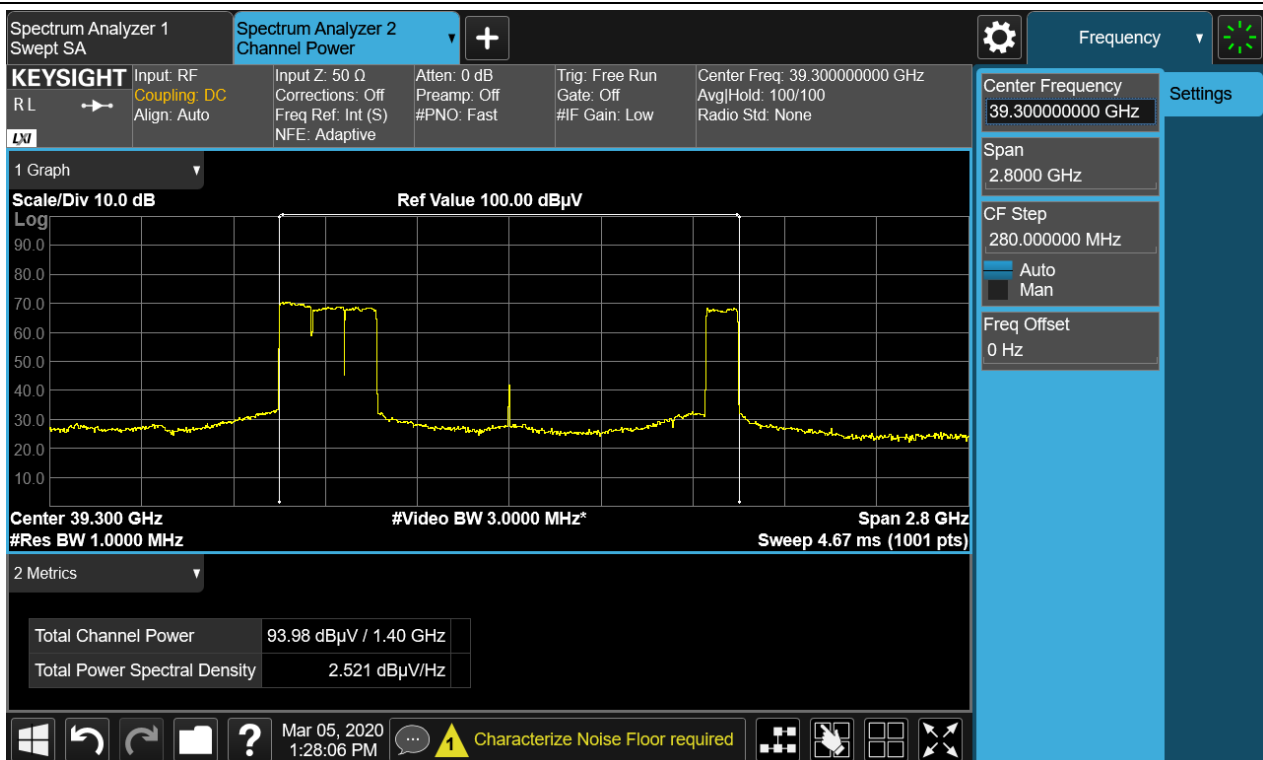
Antenna D / cc1+3 / 64QAM / High



Antenna D / cc3+1 / 64QAM / Low



Antenna D / cc3+1 / 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 $\geq 2 \times \text{span} / \text{RBW}$.
- 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 $> (\text{number of points in sweep}) \times (\text{transmitter period})$ (i.e., the transmit on-time + the off-time). The spectrum analyzer readings shall subsequently be corrected by $[10 \log (1/\text{duty cycle})]$. This assumes that the transmission period and duty cycle is relatively constant (duty cycle variation $\leq \pm 2\%$).
 - 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 24.
- 2) In the band edge test of antenna A, path A, B 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 repeat 2) at the maximum emission position of antenna B.
- 4) Band edge value is calculated as follows.

$$\text{Band Edge} = \text{Measured Value} + 20\log(D) - 104.77 + \text{AFCL} + \text{Duty} - \text{Ant. Gain}$$

- 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, 64QAM:

Antenna A

$$34.217 \text{ dB}\mu\text{V (measured)} + 9.54 \text{ (distance)} - 104.77 + 48.333 \text{ (AFCL)} + 1.305 \text{ (Duty)} = -11.345 \text{ dBm (Antenna A Edge)}$$

Total edge result

Conversion and sum

$$0.073367 \text{ mW (Ant.A)} + 0.041467 \text{ mW (Ant.B)} + 0.039156 \text{ mW (Ant.C)} + 0.038194 \text{ mW (Ant.D)} = 0.192184 \text{ mW}$$

Conversion mW to dBm

$$10\text{LOG} (0.192184 \text{ mW}) - 26.644 \text{ (Antenna gain)} = -33.807 \text{ dBm}$$

Sum each antenna power

$$(-33.807 \text{ dBm}) \text{ (Ant.A)} + (-29.897 \text{ dBm}) \text{ (Ant.B)} + (-30.075 \text{ dBm}) \text{ (Ant.C)} + (-30.957 \text{ dBm}) \text{ (Ant.D)} = -24.931 \text{ dBm}$$

Test Results:
Tabular Data of Band Edge
Contiguous

Pos.	Ant.	Distance	cc	Edge	Mod.	Ant	Measured Level (dBuV)	EIRP (dBm)	Ant Gain (dB)	Result
	Angle	(m)								(dBm)
MAX Ant. A	45°	3	1	Low	64QAM	A	34.217	-11.345	26.6440	-37.9890
						B	31.739	-13.823	26.6440	-40.4670
						C	31.490	-14.072	26.6440	-40.7160
						D	31.382	-14.180	26.6440	-40.8240
				High	64QAM	A	42.36	-9.622	27.0400	-36.6620
						B	34.66	-17.322	27.0520	-44.3740
						C	36.53	-15.452	27.0400	-42.4920
						D	33.72	-18.262	27.0520	-45.3140
			4	Low	64QAM	A	34.247	-11.315	26.6440	-37.9590
						B	30.700	-14.862	26.6440	-41.5060
						C	37.909	-7.653	26.6440	-34.2970
						D	30.971	-14.591	26.6440	-41.2350
				High	64QAM	A	42.48	-9.502	27.0400	-36.5420
						B	34.89	-17.092	27.0520	-44.1440
						C	36.63	-15.352	27.0400	-42.3920
						D	34.35	-17.632	27.0520	-44.6840
MAX Ant. B	135°		1	Low	64QAM	A	33.001	-12.561	26.7664	-39.3274
						B	30.977	-14.585	26.6440	-41.2290
						C	31.868	-13.694	26.7664	-40.4604
						D	40.875	-4.687	26.6440	-31.3310
				High	64QAM	A	38.87	-13.112	27.0520	-40.1640
						B	44.59	-7.392	27.0400	-34.4320
						C	38.01	-13.972	27.0520	-41.0240
						D	37.89	-14.092	27.0400	-41.1320
			4	Low	64QAM	A	32.807	-12.755	26.7664	-39.5214
						B	38.116	-7.446	26.6440	-34.0900
						C	32.136	-13.426	26.7664	-40.1924
						D	34.729	-10.833	26.6440	-37.4770
				High	64QAM	A	38.45	-13.532	27.0520	-40.5840
						B	46.43	-5.552	27.0400	-32.5920
						C	37.78	-14.202	27.0520	-41.2540
						D	41.74	-10.242	27.0400	-37.2820

Pos.	Ant.	Distance	cc	Edge	Mod.	Ant	Measured Level (dBuV)	EIRP (dBm)	Ant Gain (dB)	Result
	Angle	(m)								(dBm)
MAX Ant. C	45°		1	Low	64QAM	A	39.437	-6.125	26.6440	-32.7690
						B	31.308	-14.254	26.6215	-40.8755
						C	36.630	-8.932	26.6440	-35.5760
						D	31.792	-13.770	26.6215	-40.3915
				High	64QAM	A	39.63	-12.352	27.0400	-39.3920
						B	37.48	-14.502	27.0520	-41.5540
						C	40.61	-11.372	27.0400	-38.4120
						D	37.75	-14.232	27.0520	-41.2840
			4	Low	64QAM	A	35.997	-9.565	26.6440	-36.2090
						B	32.223	-13.339	26.6215	-39.9605
						C	36.279	-9.283	26.6440	-35.9270
						D	31.978	-13.584	26.6215	-40.2055
				High	64QAM	A	40.49	-11.492	27.0439	-38.5359
						B	37.56	-14.422	27.0439	-41.4659
						C	41.2	-10.782	27.0400	-37.8220
						D	37.73	-14.252	27.0439	-41.2959
MAX Ant. D	135°		1	Low	64QAM	A	32.650	-12.912	26.6215	-39.5335
						B	38.482	-7.080	26.6440	-33.7240
						C	33.457	-12.105	26.6215	-38.7265
						D	33.336	-12.226	26.6215	-38.8475
				High	64QAM	A	36.19	-15.792	27.0439	-42.8359
						B	39.61	-12.372	27.0400	-39.4120
						C	36.76	-15.222	27.0439	-42.2659
						D	44.43	-7.552	27.0400	-34.5920
			4	Low	64QAM	A	33.793	-11.769	26.6215	-38.3905
						B	37.553	-8.009	26.6440	-34.6530
						C	32.883	-12.679	26.6215	-39.3005
						D	40.103	-5.459	26.6440	-32.1030
				High	64QAM	A	36.65	-15.332	27.0439	-42.3759
						B	42.79	-9.192	27.0400	-36.2320
						C	36.27	-15.712	27.0439	-42.7559
						D	46.37	-5.612	27.0400	-32.6520

MIMO Data of Band Edge

Antenna	cc	Edge	Modulation	Result (dBm)
A+B+C+D	1	Low	64QAM	-24.9309
		High	64QAM	-27.1501
	8	Low	64QAM	-24.7290
		High	64QAM	-25.8594

Non-Contiguous

Pos.	Ant.	Distance	cc	Edge	Mod.	Ant	Measured Level (dBuV)	EIRP (dBm)	Ant Gain (dB)	Result
	Angle	(m)								(dBm)
MAX Ant. A	45°	3	1+3	Low	64QAM	A	35.503	-10.059	26.6440	-36.7030
						B	27.425	-18.137	26.5747	-44.7117
				C		32.379	-13.183	26.6440	-39.8270	
				D		27.561	-18.001	26.6440	-44.6450	
			High	A		43.72	-8.262	27.0400	-35.3020	
				B		35.85	-16.132	27.0535	-43.1855	
				C		37.86	-14.122	27.0400	-41.1620	
				D		36.01	-15.972	27.0535	-43.0255	
MAX Ant. B	135°	3	1+3	Low	64QAM	A	29.074	-16.488	26.5255	-43.0135
						B	32.705	-12.857	26.6440	-39.5010
				C		29.676	-15.886	26.5255	-42.4115	
				D		41.789	-3.773	26.6440	-30.4170	
			High	A		37.85	-14.132	27.0535	-41.1855	
				B		46.47	-5.512	27.0400	-32.5520	
				C		38.41	-13.572	27.0535	-40.6255	
				D		40.87	-11.112	27.0400	-38.1520	
MAX Ant. C	45°	3	1+3	Low	64QAM	A	39.530	-6.032	26.6440	-32.6760
						B	27.382	-18.18	26.5984	-44.7784
				C		39.970	-5.592	26.6440	-32.2360	
				D		27.373	-18.189	26.5984	-44.7874	
			High	A		37.72	-14.262	27.0400	-41.3020	
				B		36.78	-15.202	27.0535	-42.2555	
				C		42.19	-9.792	27.0400	-36.8320	
				D		37.70	-14.282	27.0535	-41.3355	
MAX Ant. D	135°	3	1+3	Low	64QAM	A	29.475	-16.087	26.5255	-42.6125
						B	32.638	-12.924	26.6440	-39.5680
				C		28.776	-16.786	26.5255	-43.3115	
				D		37.513	-8.049	26.6440	-34.6930	
			High	A		37.78	-14.202	27.0535	-41.2555	
				B		40.82	-11.162	27.0400	-38.2020	
				C		37.65	-14.332	27.0535	-41.3855	
				D		46.4	-5.582	27.0400	-32.6220	

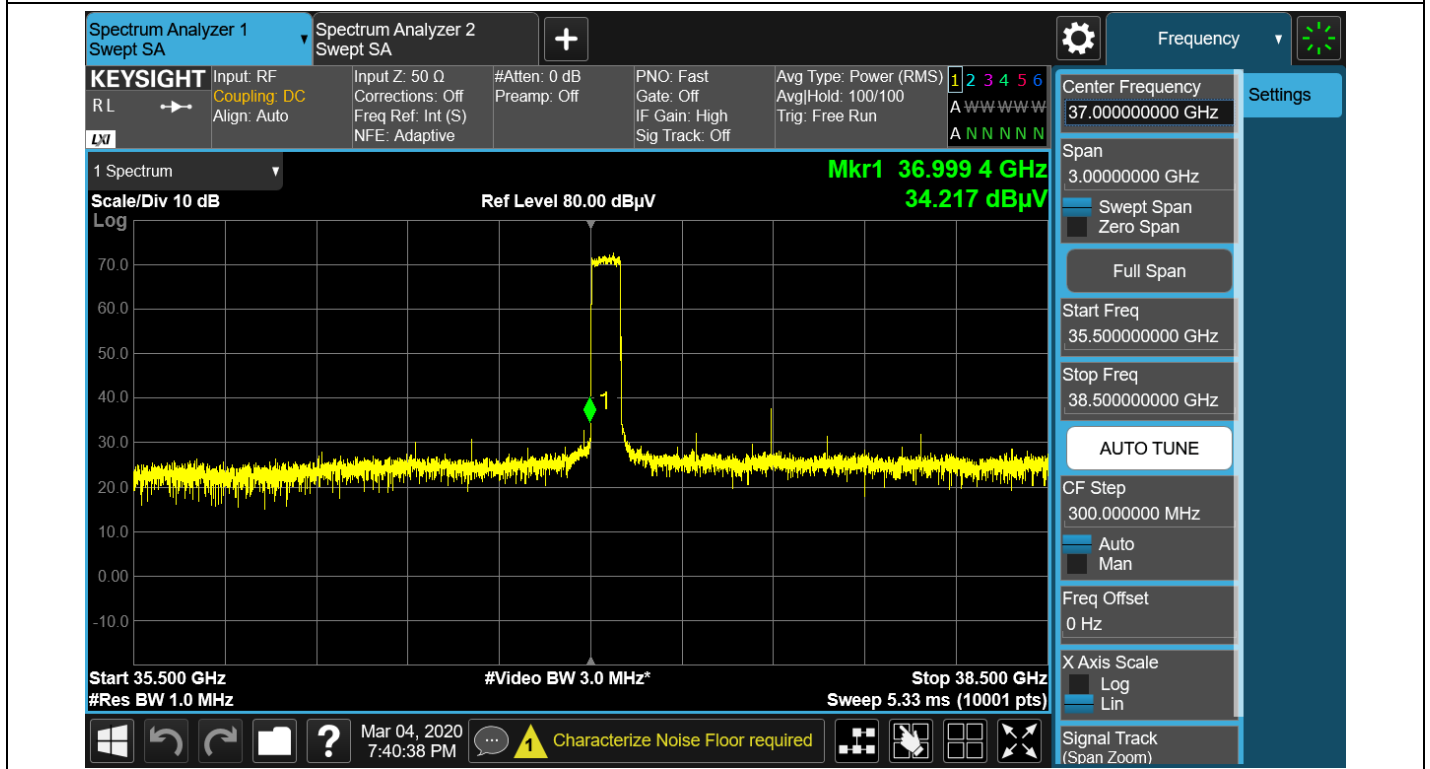
Pos.	Ant.	Distance	cc	Edge	Mod.	Ant	Measured Level (dBuV)	EIRP (dBm)	Ant Gain (dB)	Result
	Angle	(m)								(dBm)
MAX Ant. A	45°	3	Non-Cont	Low	64QAM	A	34.990	-10.572	26.6440	-37.2160
						B	28.436	-17.126	26.5984	-43.7244
						C	36.813	-8.749	26.6440	-35.3930
						D	27.669	-17.893	26.5984	-44.4914
				High		A	41.36	-10.622	27.0400	-37.6620
						B	36.01	-15.972	27.0535	-43.0255
						C	37.75	-14.232	27.0400	-41.2720
						D	35.97	-16.012	27.0535	-43.0655
MAX Ant. B	135°		Non-Cont	Low	64QAM	A	28.193	-17.369	26.5255	-43.8945
						B	39.999	-5.563	26.6440	-32.2070
						C	29.191	-16.371	26.5255	-42.8965
						D	34.902	-10.660	26.6440	-37.3040
				High		A	35.36	-16.622	27.0499	-43.6719
						B	44.78	-7.202	27.0400	-34.2420
						C	33.47	-18.512	27.0499	-45.5619
						D	40.77	-11.212	27.0400	-38.2520
MAX Ant. C	45°	3	Non-Cont	Low	64QAM	A	32.128	-13.434	26.6440	-40.0780
						B	29.122	-16.440	26.5984	-43.0384
						C	40.459	-5.103	26.6440	-31.7470
						D	28.384	-17.178	26.5984	-43.7764
				High		A	37.03	-14.952	27.0400	-41.9920
						B	35.43	-16.552	27.0535	-43.6055
						C	41.59	-10.392	27.0400	-37.4320
						D	36.22	-15.762	27.0535	-42.8155
MAX Ant. D	135°		Non-Cont	Low	64QAM	A	30.122	-15.440	26.5255	-41.9655
						B	32.989	-12.573	26.6440	-39.2170
						C	29.452	-16.110	26.5255	-42.6355
						D	38.322	-7.240	26.6440	-33.8840
				High		A	39.61	-12.372	27.0535	-39.4255
						B	40.73	-11.252	27.0535	-38.3055
						C	39.96	-12.022	27.0535	-39.0755
						D	44.72	-7.262	27.0400	-34.3020

MIMO Data of Band Edge

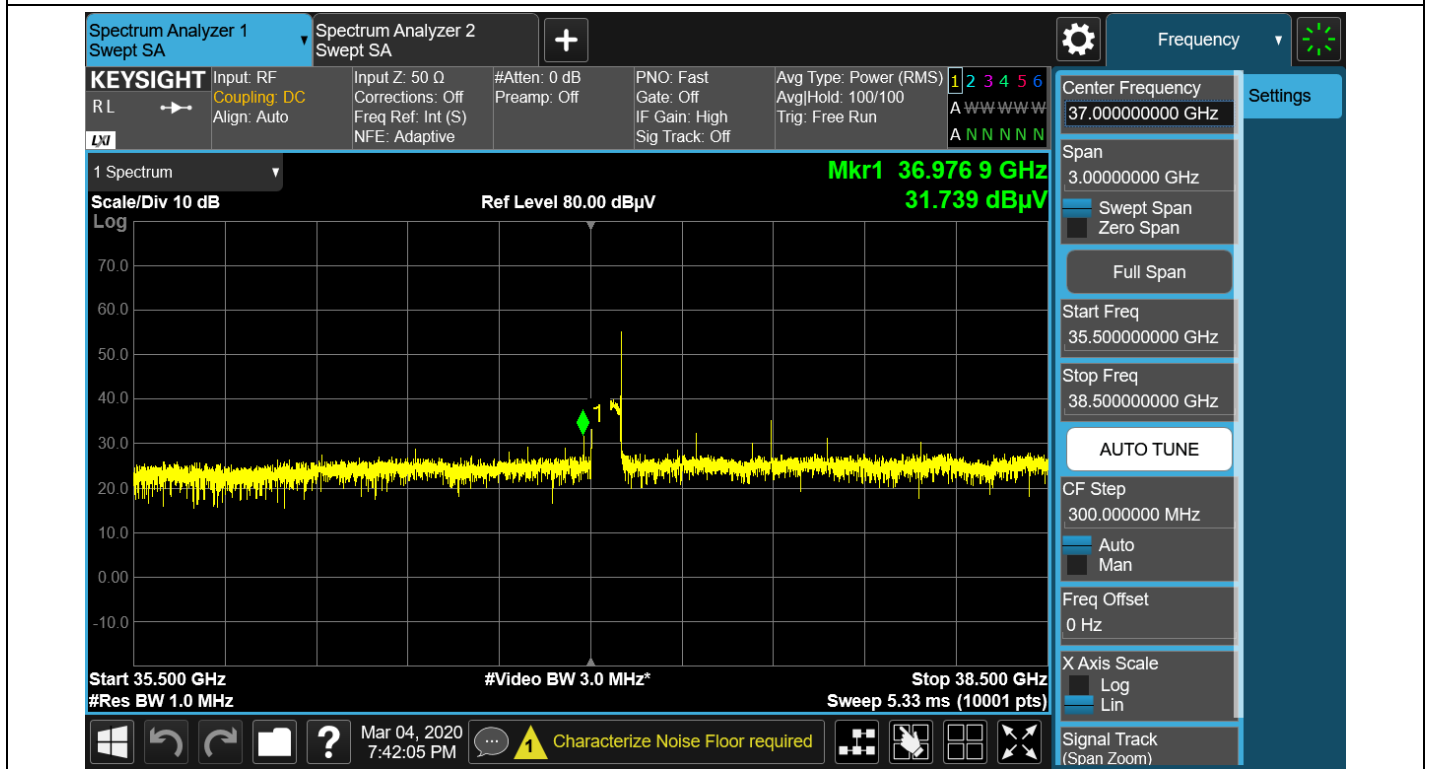
Antenna	cc	Edge	Modulation	Result (dBm)
A+B+C+D	1+3	Low	64QAM	-25.3139
		High	64QAM	-26.9066
	3+1	Low	64QAM	-24.8556
		High	64QAM	-25.8488

Plot data of Band Edge

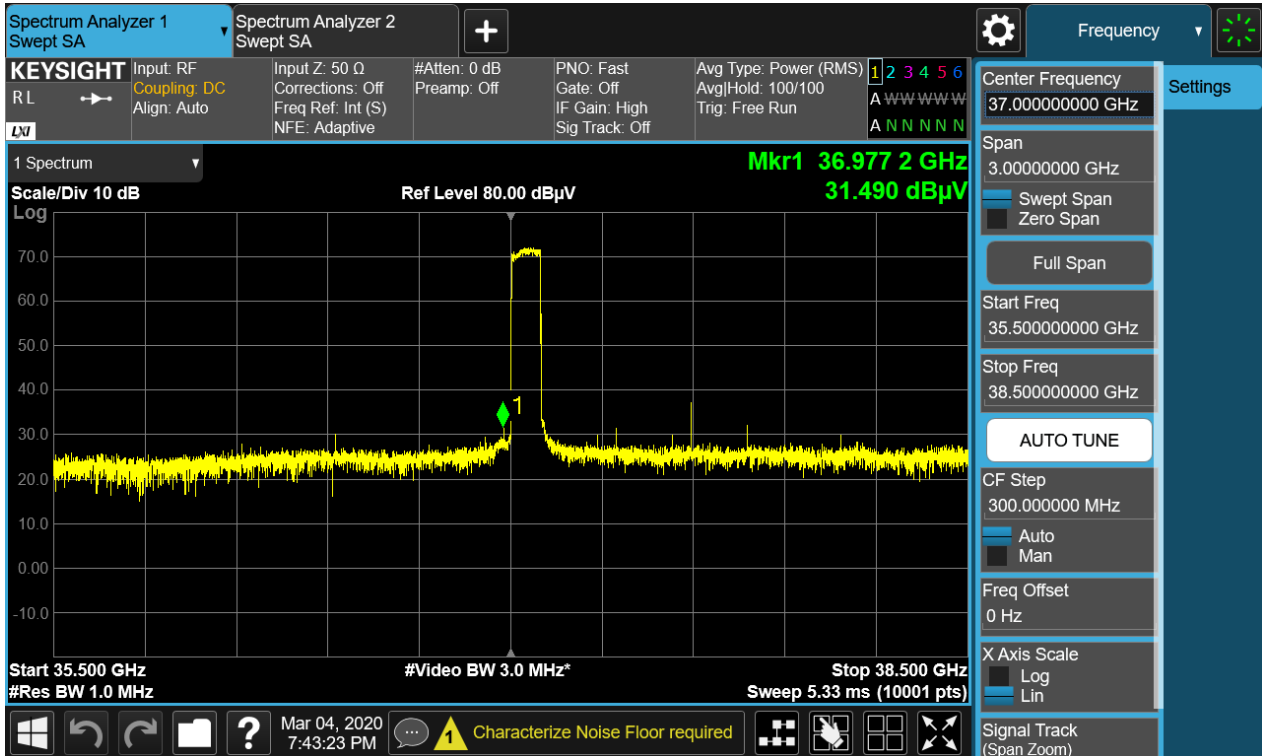
MAX Ant. A Position / 1cc / Low / 64QAM / Ant. A



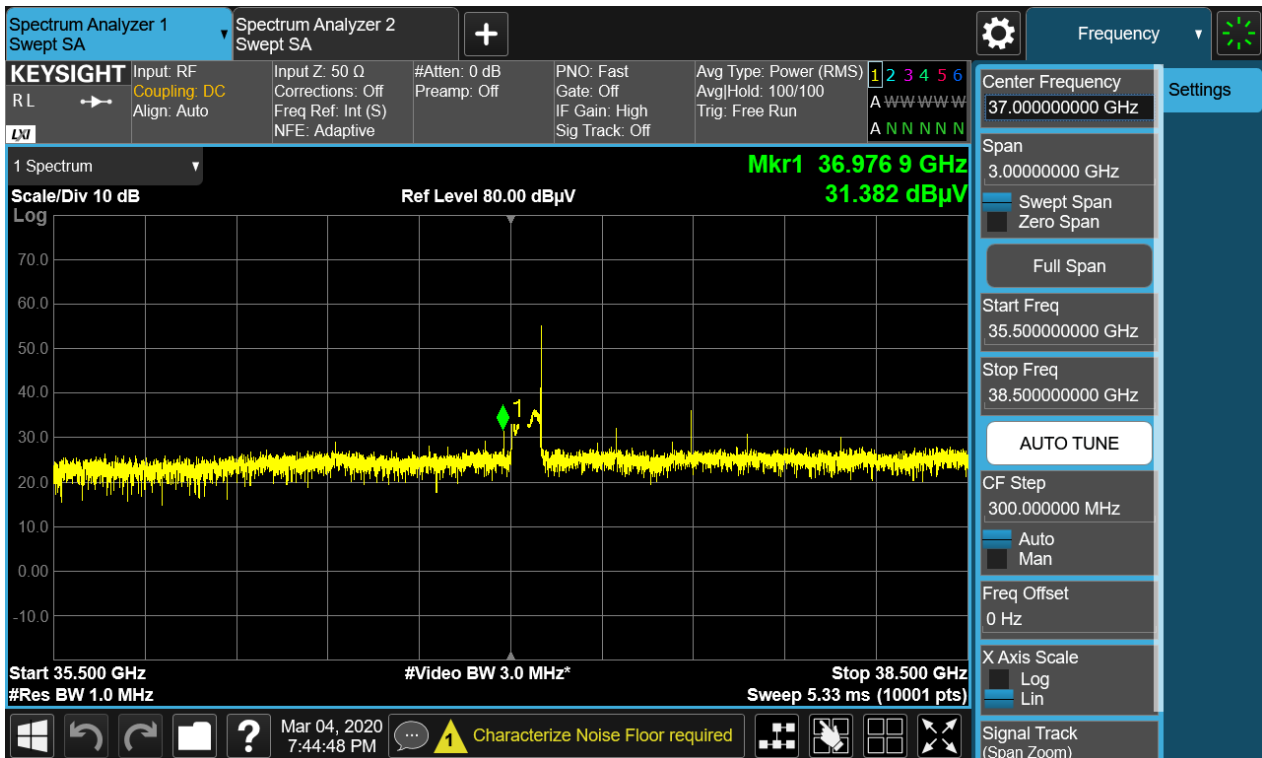
MAX Ant. A Position / 1cc / Low / 64QAM / Ant. B



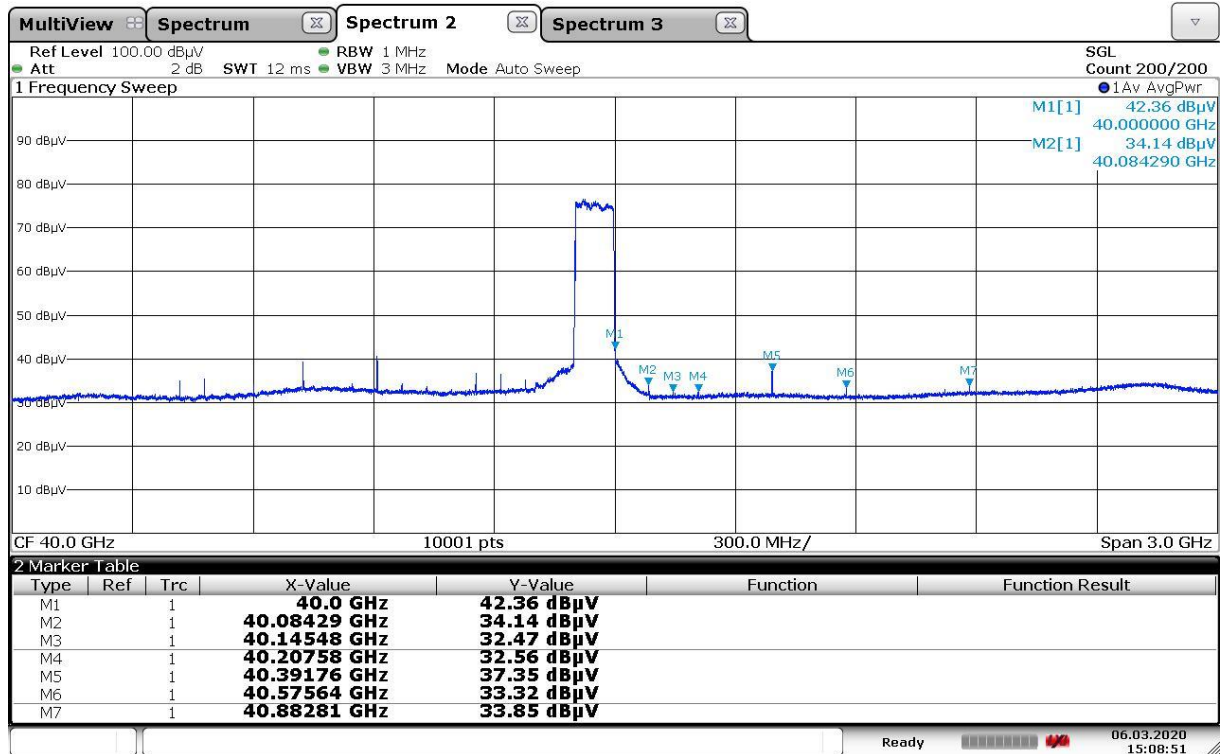
MAX Ant. A Position / 1cc / Low / 64QAM / Ant. C



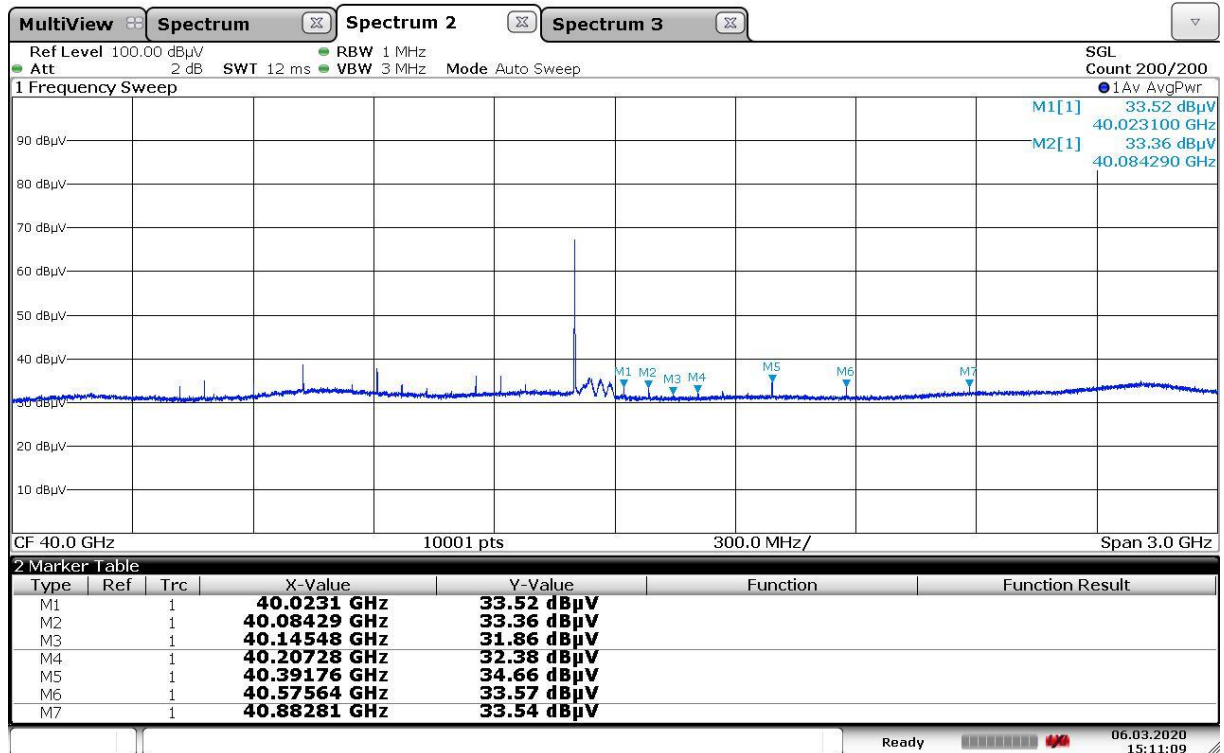
MAX Ant. A Position / 1cc / Low / 64QAM / Ant. D



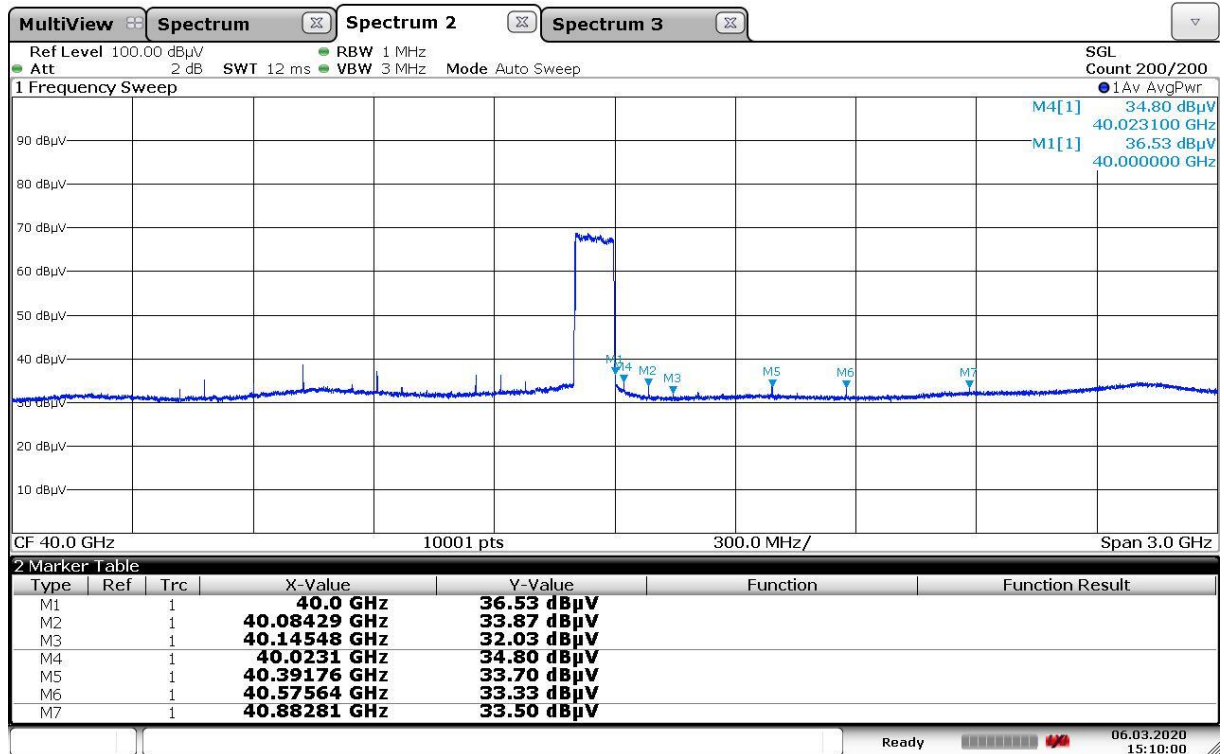
MAX Ant. A Position / 1cc / High / 64QAM / Ant. A



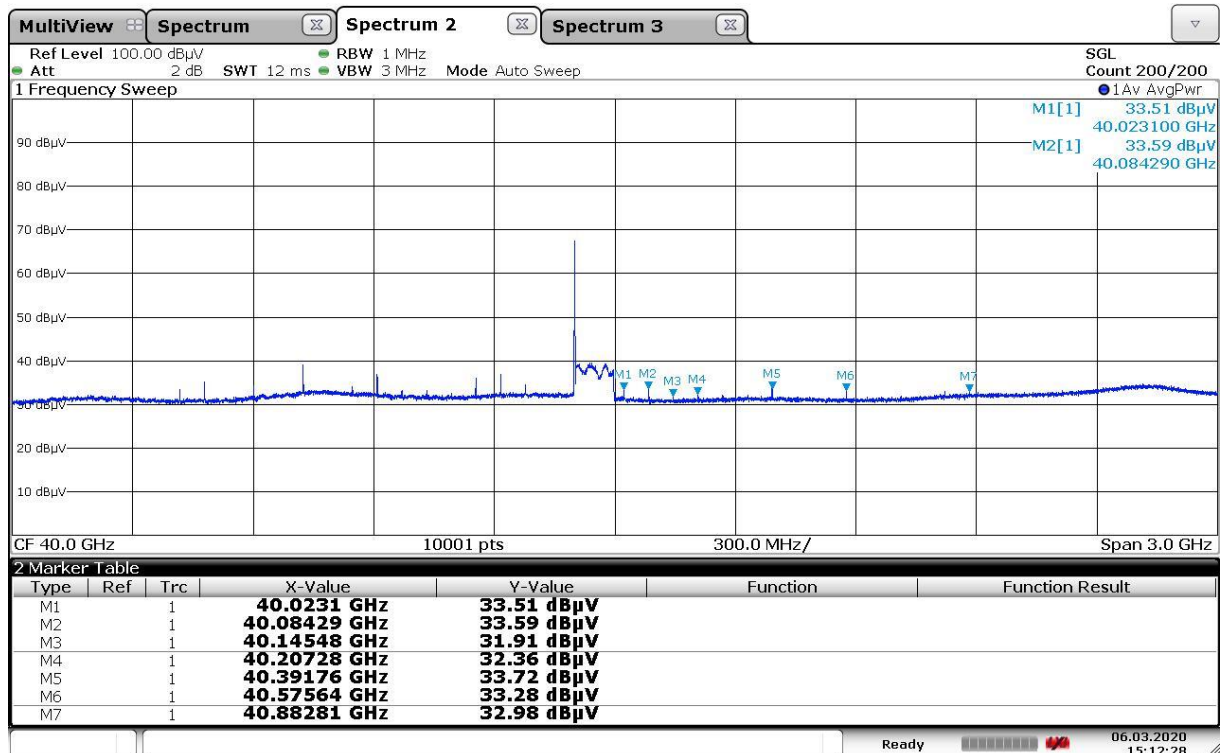
MAX Ant. A Position / 1cc / High / 64QAM / Ant. B



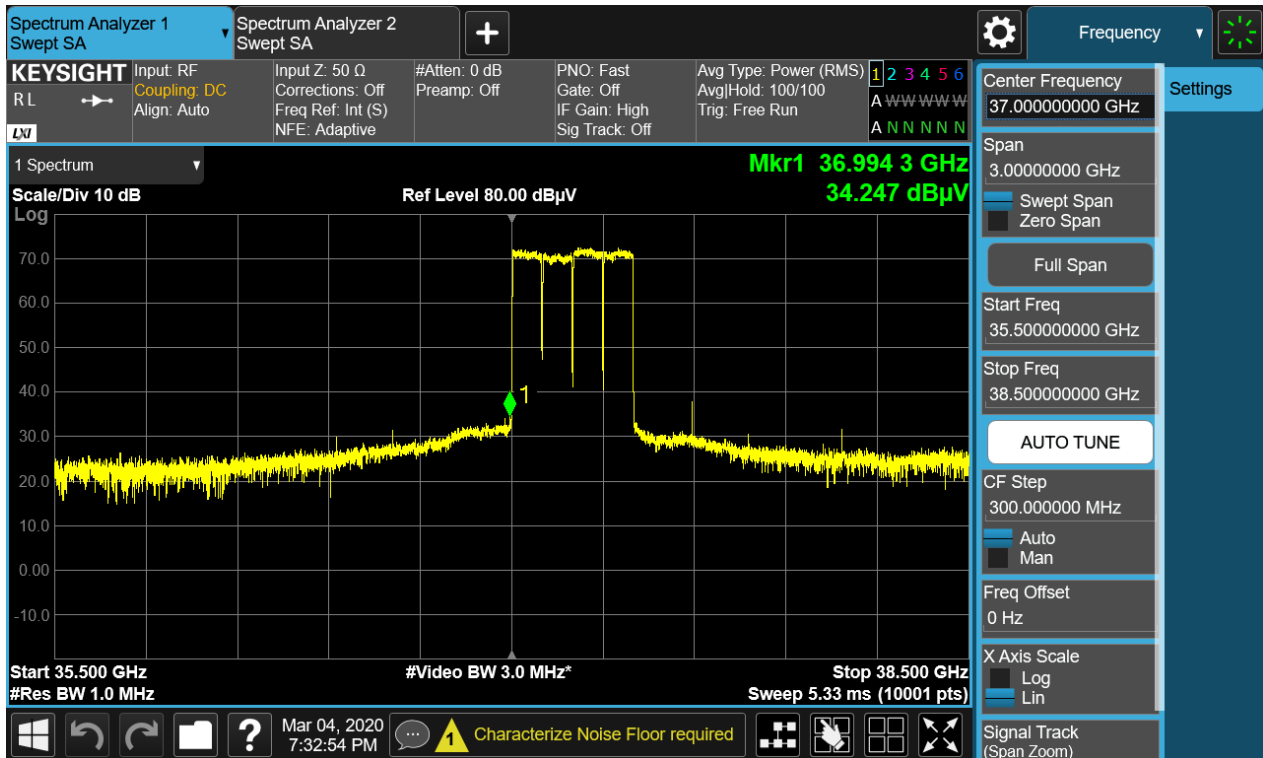
MAX Ant. A Position / 1cc / High / 64QAM / Ant. C



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



MAX Ant. A Position / 4cc / Low / 64QAM / Ant. A



MAX Ant. A Position / 4cc / Low / 64QAM / Ant. B

