

5.3. CONDUCTED OUTPUT POWER

FCC Rules

Test Requirements:

§ 2.1046 Measurements required: RF power output.

(a) For transmitters other than single sideband, independent sideband and controlled carrier radiotelephone, power output shall be measured at the RF output terminals when the transmitter is adjusted in accordance with the tune-up procedure to give the values of current and voltage on the circuit elements specified in § 2.1033(c)(8). The electrical characteristics of the radio frequency load attached to the output terminals when this test is made shall be stated.

(b) For single sideband, independent sideband, and single channel, controlled carrier radiotelephone transmitters the procedure specified in paragraph (a) of this section shall be employed and, in addition, the transmitter shall be modulated during the test as specified and applicable in § 2.1046 (b) (1-5). In all tests, the input level of the modulating signal shall be such as to develop rated peak envelope power or carrier power, as appropriate, for the transmitter.

(c) For measurements conducted pursuant to paragraphs (a) and (b) of this section, all calculations and methods used by the applicant for determining carrier power or peak envelope power, as appropriate, on the basis of measured power in the radio frequency load attached to the transmitter output terminals shall be shown. Under the test conditions specified, no components of the emission spectrum shall exceed the limits specified in the applicable rule parts as necessary for meeting occupied bandwidth or emission limitations.

Test Procedures:

The measurement is performed in accordance with Section 5.2.4.4.2 of ANSI C63.26.

- a) Set span to $2 \times$ to $3 \times$ the OBW.
- b) Set RBW = 1% to 5% of the OBW.
- c) Set VBW $\geq 3 \times$ RBW.
- d) Set number of measurement points in sweep $\geq 2 \times$ span / RBW.
- e) Sweep time:
 - 1) Set = auto-couple, or
 - 2) Set $\geq [10 \times (\text{number of points in sweep}) \times (\text{transmission symbol period})]$ for single sweep (automation-compatible) measurement.
- f) Detector = power averaging (rms).
- g) Set sweep trigger to "free run."
- h) Trace average at least 100 traces in power averaging (rms) mode if sweep is set to auto-couple. To accurately determine the average power over the on and off time of the transmitter, it can be necessary to increase the number of traces to be averaged above 100, or if using a manually configured sweep time, increase the sweep time.
- i) Compute power by integrating the spectrum across the OBW of the signal using the instrument's band or channel power measurement function with band/channel limits set equal to the OBW band edges. If the instrument does not have a band or channel power function, sum the spectrum levels (in linear power units) at intervals equal to the RBW extending across the entire OBW of the spectrum.

j) Add $10 \log (1/\text{duty cycle})$ to the measured power level to compute the average power during continuous transmission.

Note:

- 1) Basic test conditions are same as EIRP test on page 29.
- 2) Same 800 MHz bandwidth applies for 1cc and 8 cc.
- 3) Final conducted power is calculated as follows

$$\text{Conducted Power (dBm)} = \text{EIRP (dBm)} - \text{Antenna Gain (dBi)}$$

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

Antenna A, 1cc, Low, QPSK:

$$\begin{aligned} &96.45 \text{ dB}\mu\text{V (measured)} + 10.88 \text{ (distance)} - 104.77 + 45.44 \text{ (AFCL)} + 0.975 \text{ (Duty)} - 28.142 \text{ (Ant.gain)} \\ &= 20.84 \text{ dBm (Final conducted output power)} \end{aligned}$$

Total Output Power (1cc, Low, QPKS):

Conversion dBm to mW (Antenna A)

$$10^{(20.84 \text{ dBm} / 10)} = 121.34 \text{ mW}$$

Sum each antenna power

$$\begin{aligned} &121.34 \text{ mW (Ant.A)} + 94.62 \text{ mW (Ant.B)} + 103.99 \text{ mW (Ant.C)} + 88.72 \text{ mW (Ant.D)} \\ &= 408.67 \text{ mW} \end{aligned}$$

Conversion mW to dBm

$$10 \text{LOG} (408.67 \text{ mW}) = 26.11 \text{ dBm}$$

Test Results:
Tabular Data of Conducted Output Power

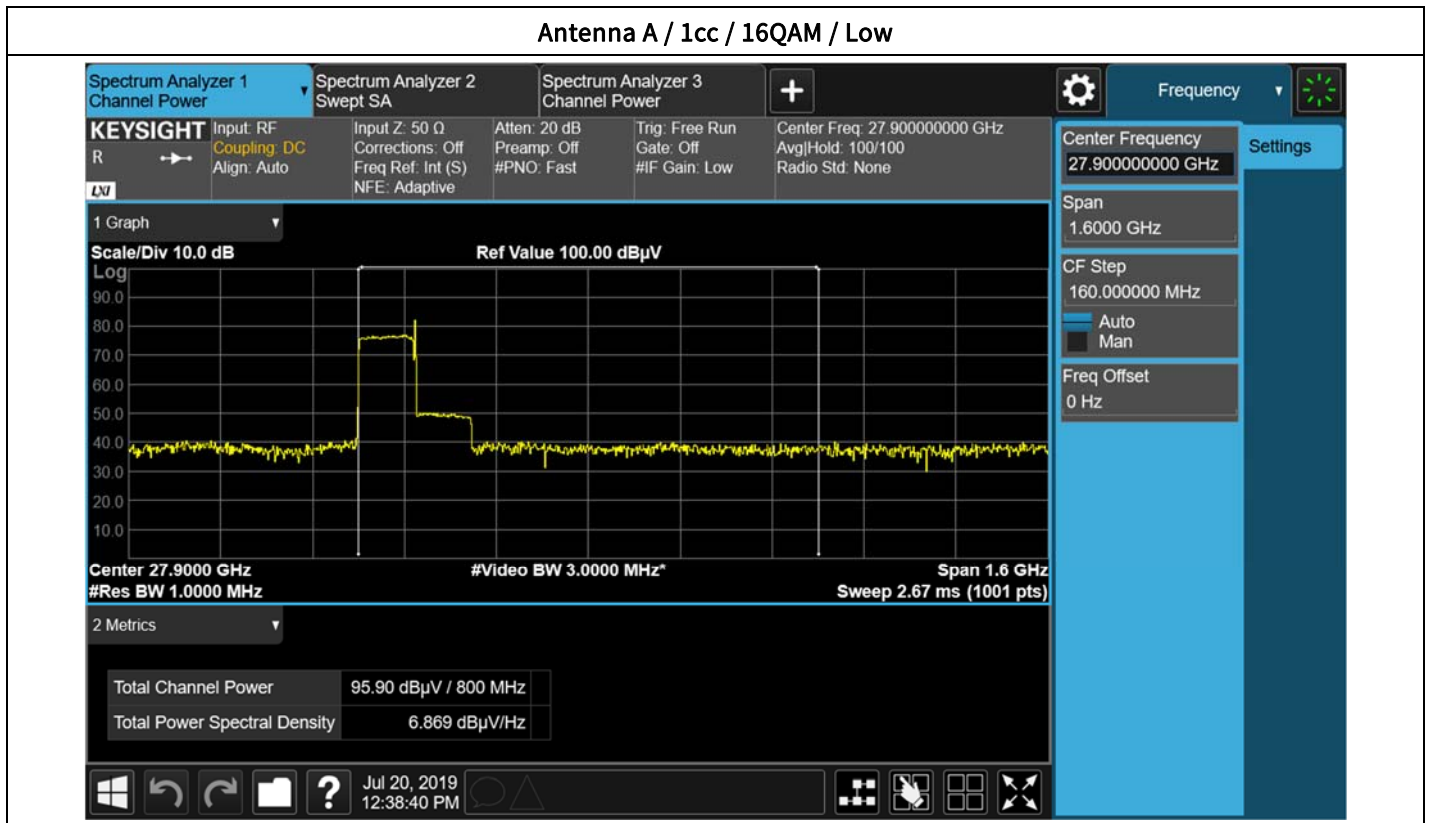
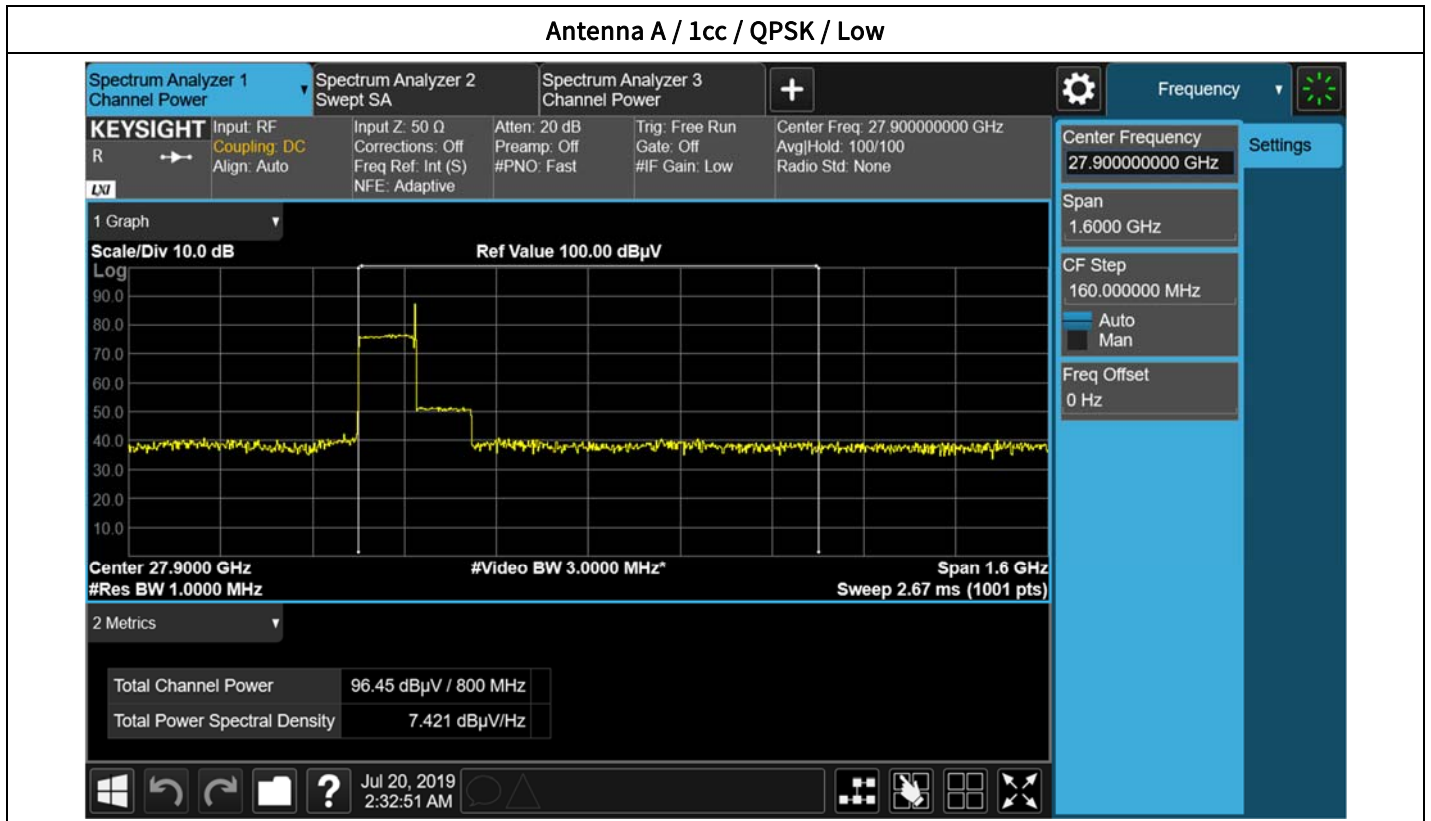
Ant.	Ant.	CC	Channel	Frequency (GHz)	Mod.	Measured Level (dBuV)	EIRP	Ant. Gain	Result		
	Angle						(dBm)	(dBi)	(dBm)		
A	135°	1	Low	27.55	QPSK	96.45	48.98	28.142	20.84		
					16QAM	95.90	48.43		20.29		
					64QAM	96.16	48.69		20.55		
			Middle	27.925	QPSK	96.36	48.89	28.181	20.71		
					16QAM	96.40	48.93		20.75		
					64QAM	95.91	48.44		20.26		
			High	28.3	QPSK	95.84	48.37	28.321	20.05		
					16QAM	96.02	48.56		20.23		
					64QAM	95.93	48.46		20.14		
		8	Low	27.9	QPSK	101.2	53.77	28.181	25.59		
					16QAM	101.4	53.95		25.77		
					64QAM	101.2	53.76		25.58		
			Middle	27.925	QPSK	100.6	53.09	28.181	24.91		
					16QAM	101.1	53.66		25.48		
					64QAM	101.1	53.61		25.43		
			High	27.95	QPSK	100.8	53.31	28.21	25.10		
					16QAM	101.0	53.55		25.34		
					64QAM	101.1	53.67		25.46		
		B	45°	1	Low	27.55	QPSK	95.38	47.91	28.142	19.76
							16QAM	96.49	49.02		20.88
							64QAM	96.52	49.06		20.91
					Middle	27.925	QPSK	95.53	48.06	28.181	19.88
							16QAM	95.61	48.14		19.96
							64QAM	96.90	49.43		21.25
High	28.3				QPSK	95.19	47.72	28.321	19.40		
					16QAM	95.93	48.46		20.14		
					64QAM	95.92	48.45		20.13		
8	Low			27.9	QPSK	101.19	53.72	28.181	25.54		
					16QAM	101.15	53.68		25.50		
					64QAM	101.29	53.82		25.64		
	Middle			27.925	QPSK	101.25	53.78	28.181	25.60		
					16QAM	101.27	53.80		25.62		
					64QAM	101.02	53.56		25.38		
	High			27.95	QPSK	100.86	53.39	28.21	25.18		
					16QAM	101.01	53.54		25.33		
					64QAM	101.63	54.16		25.95		

Ant.	Ant.	CC	Channel	Frequency (GHz)	Mod.	Measured Level (dBuV)	EIRP	Ant. Gain	Result		
	Angle						(dBm)	(dBi)	(dBm)		
C	135°	1	Low	27.55	QPSK	95.78	48.31	28.142	20.17		
					16QAM	95.17	47.70		19.56		
					64QAM	95.49	48.02		19.88		
			Middle	27.925	QPSK	95.85	48.38	28.181	20.20		
					16QAM	95.14	47.67		19.49		
					64QAM	95.91	48.44		20.26		
			High	28.3	QPSK	95.14	47.67	28.321	19.35		
					16QAM	95.08	47.61		19.29		
					64QAM	95.17	47.70		19.38		
		8	Low	27.9	QPSK	101.33	53.86	28.181	25.68		
					16QAM	100.47	53.00		24.82		
					64QAM	100.50	53.03		24.85		
			Middle	27.925	QPSK	101.02	53.55	28.181	25.37		
					16QAM	101.45	53.98		25.80		
					64QAM	101.14	53.67		25.49		
			High	27.95	QPSK	100.51	53.04	28.21	24.83		
					16QAM	101.06	53.59		25.38		
					64QAM	101.32	53.85		25.64		
		D	45°	1	Low	27.55	QPSK	95.09	47.62	28.142	19.48
							16QAM	95.28	47.81		19.67
							64QAM	94.88	47.41		19.27
					Middle	27.925	QPSK	95.61	48.14	28.181	19.96
							16QAM	95.85	48.38		20.20
							64QAM	95.07	47.60		19.42
High	28.3				QPSK	94.87	47.40	28.321	19.08		
					16QAM	94.78	47.31		18.99		
					64QAM	95.06	47.59		19.27		
8	Low			27.9	QPSK	101.1	53.65	28.181	25.46		
					16QAM	100.6	53.09		24.90		
					64QAM	100.6	53.09		24.91		
	Middle			27.925	QPSK	101.1	53.68	28.181	25.50		
					16QAM	101.2	53.70		25.51		
					64QAM	101.5	54.04		25.86		
High	27.95	QPSK	100.8	53.34	28.21	25.13					
		16QAM	100.9	53.42		25.21					
		64QAM	100.9	53.39		25.18					

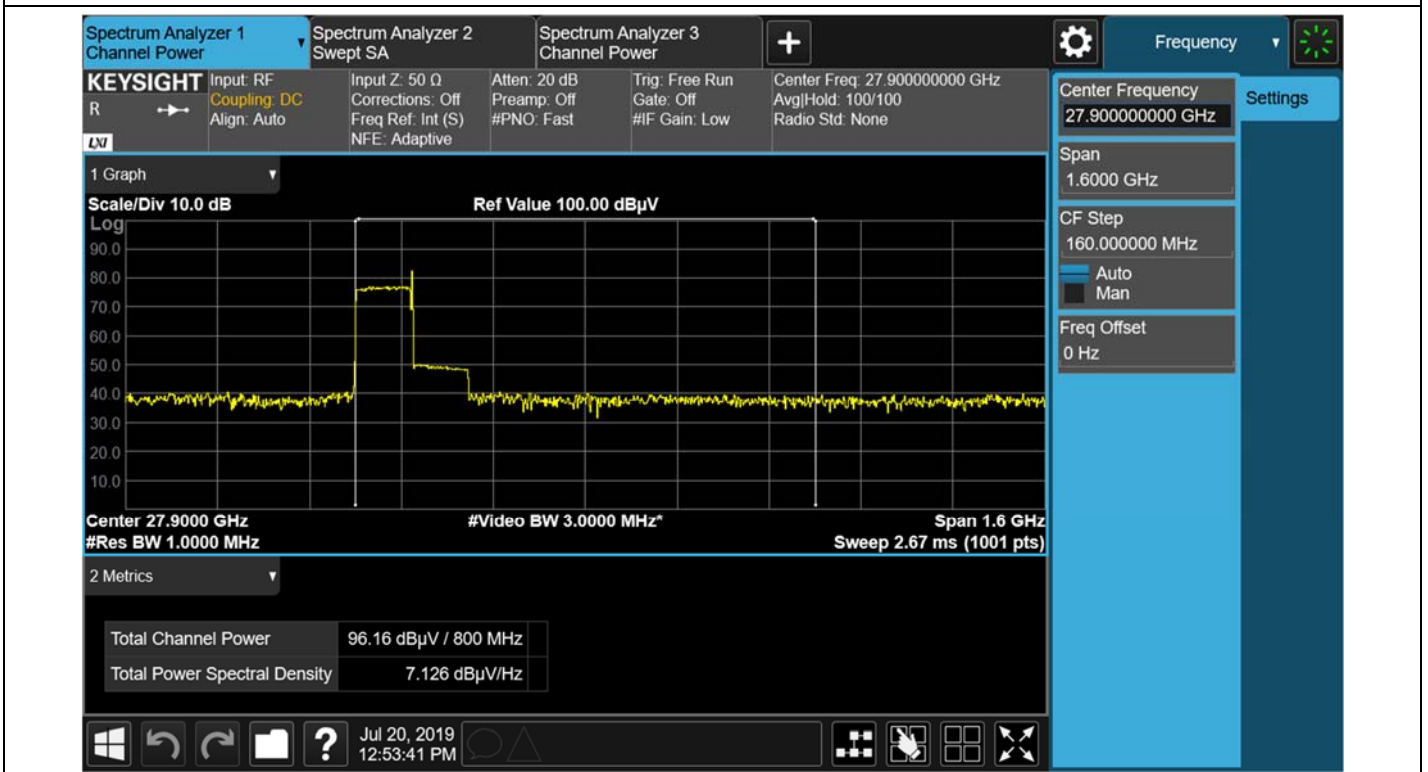
Tabular Data of Conducted Output Power

Antenna	CC	Channel	Mod.	Ant. A (dBm)	Ant. B (dBm)	Ant. C (dBm)	Ant. D (dBm)	Result (dBm)
A+B+C+D	1	Low	QPSK	20.84	19.76	20.17	19.48	26.11
			16QAM	20.29	20.88	19.56	19.67	26.15
			64QAM	20.55	20.91	19.88	19.27	26.22
		Middle	QPSK	20.71	19.88	20.20	19.96	26.22
			16QAM	20.75	19.96	19.49	20.20	26.14
			64QAM	20.26	21.25	20.26	19.42	26.37
		High	QPSK	20.05	19.40	19.35	19.08	25.51
			16QAM	20.23	20.14	19.29	18.99	25.72
			64QAM	20.14	20.13	19.38	19.27	25.77
	8	Low	QPSK	25.59	25.54	25.68	25.46	31.59
			16QAM	25.77	25.50	24.82	24.90	31.29
			64QAM	25.58	25.64	24.85	24.91	31.28
		Middle	QPSK	24.91	25.60	25.37	25.50	31.37
			16QAM	25.48	25.62	25.80	25.51	31.62
			64QAM	25.43	25.38	25.49	25.86	31.56
		High	QPSK	25.10	25.18	24.83	25.13	31.08
			16QAM	25.34	25.33	25.38	25.21	31.34
			64QAM	25.46	25.95	25.64	25.18	31.59

Plot Data of Conducted Output Power



Antenna A / 1cc / 64QAM / Low



Antenna A / 1cc / QPSK / Middle



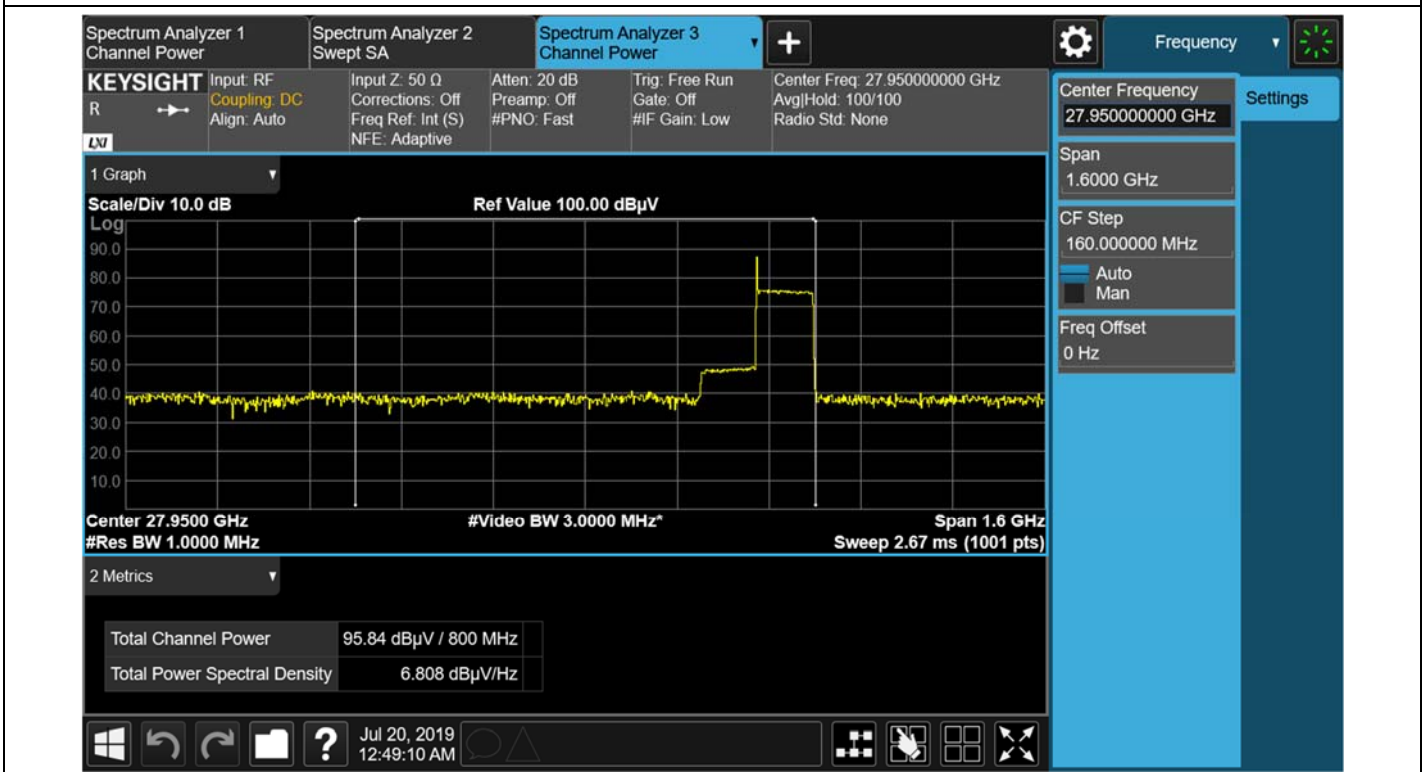
Antenna A / 1cc / 16QAM / Middle



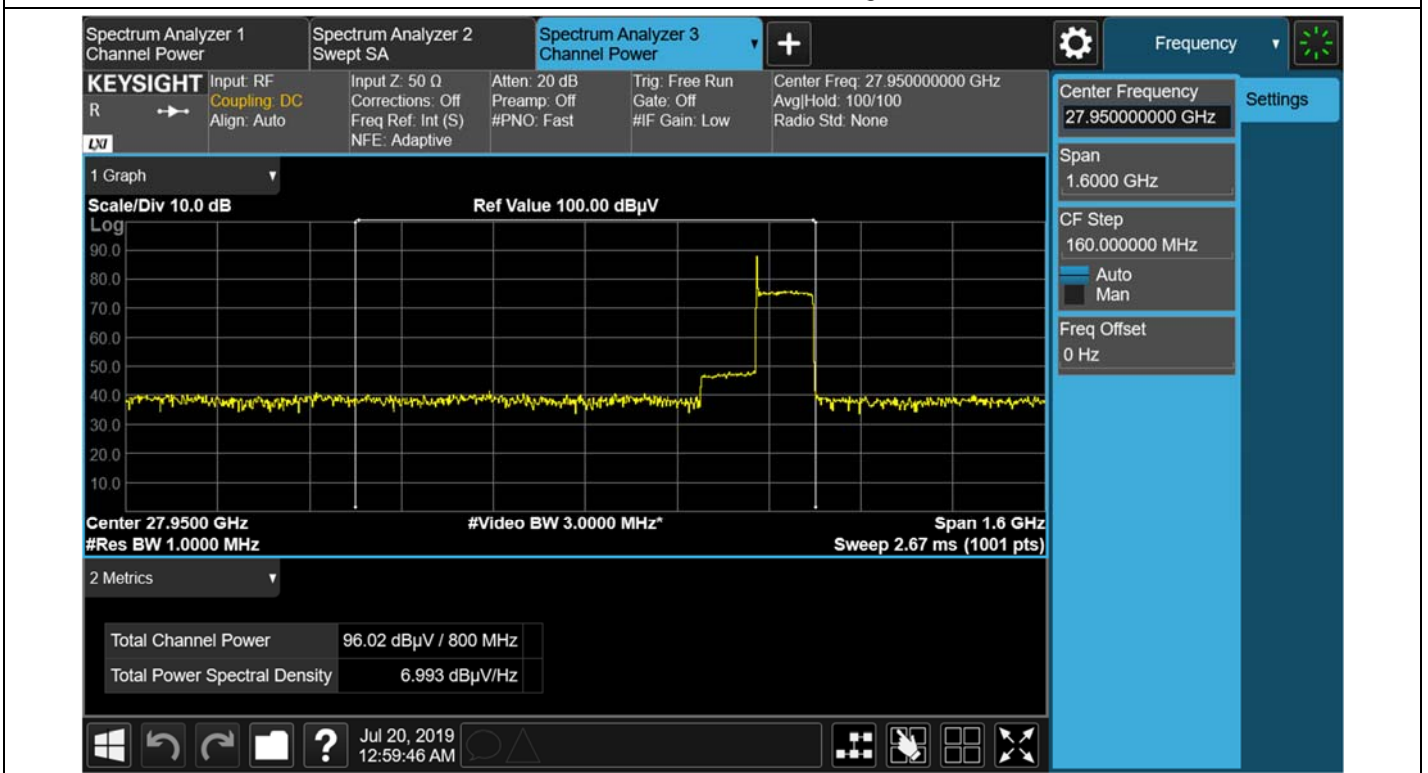
Antenna A / 1cc / 64QAM / Middle



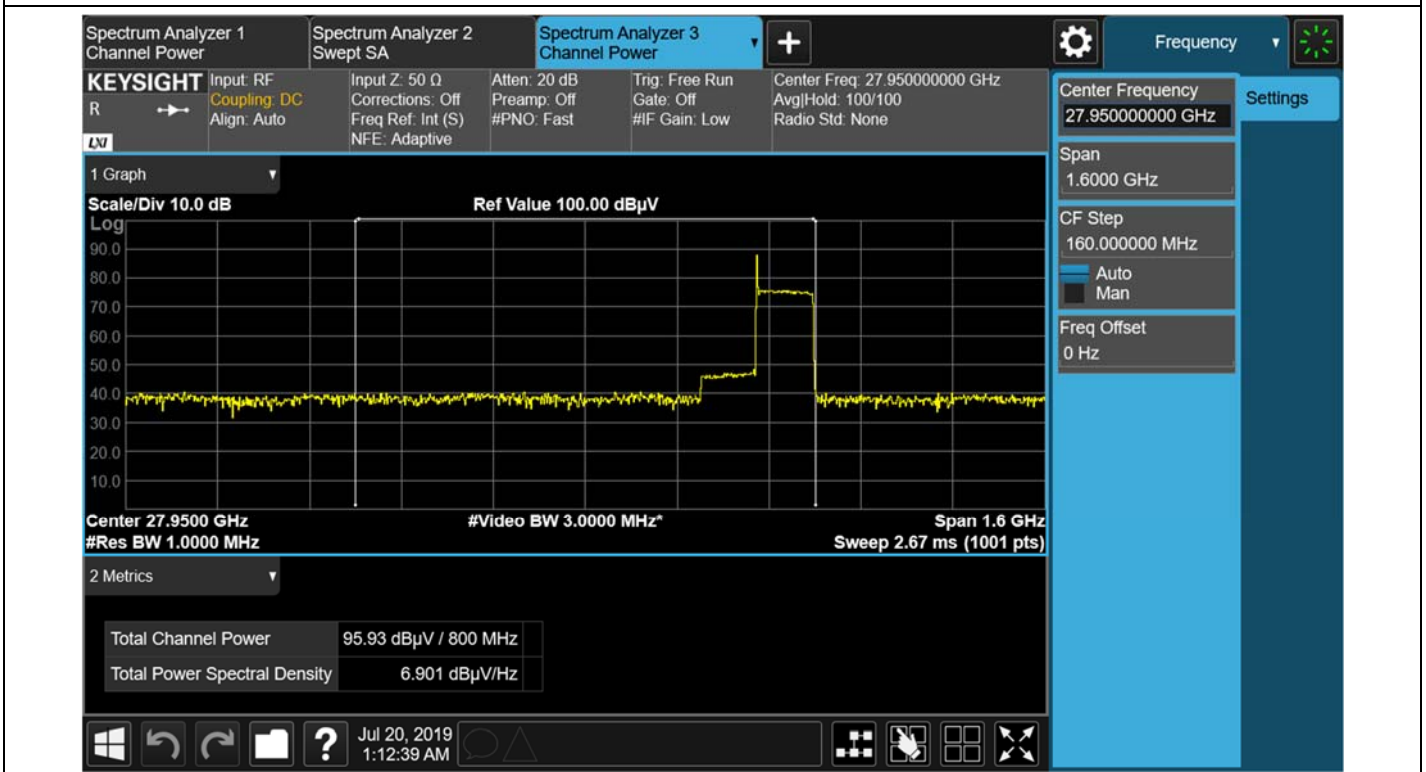
Antenna A / 1cc / QPSK / High



Antenna A / 1cc / 16QAM / High



Antenna A / 1cc / 64QAM / High



Antenna A / 8cc / QPSK / Low



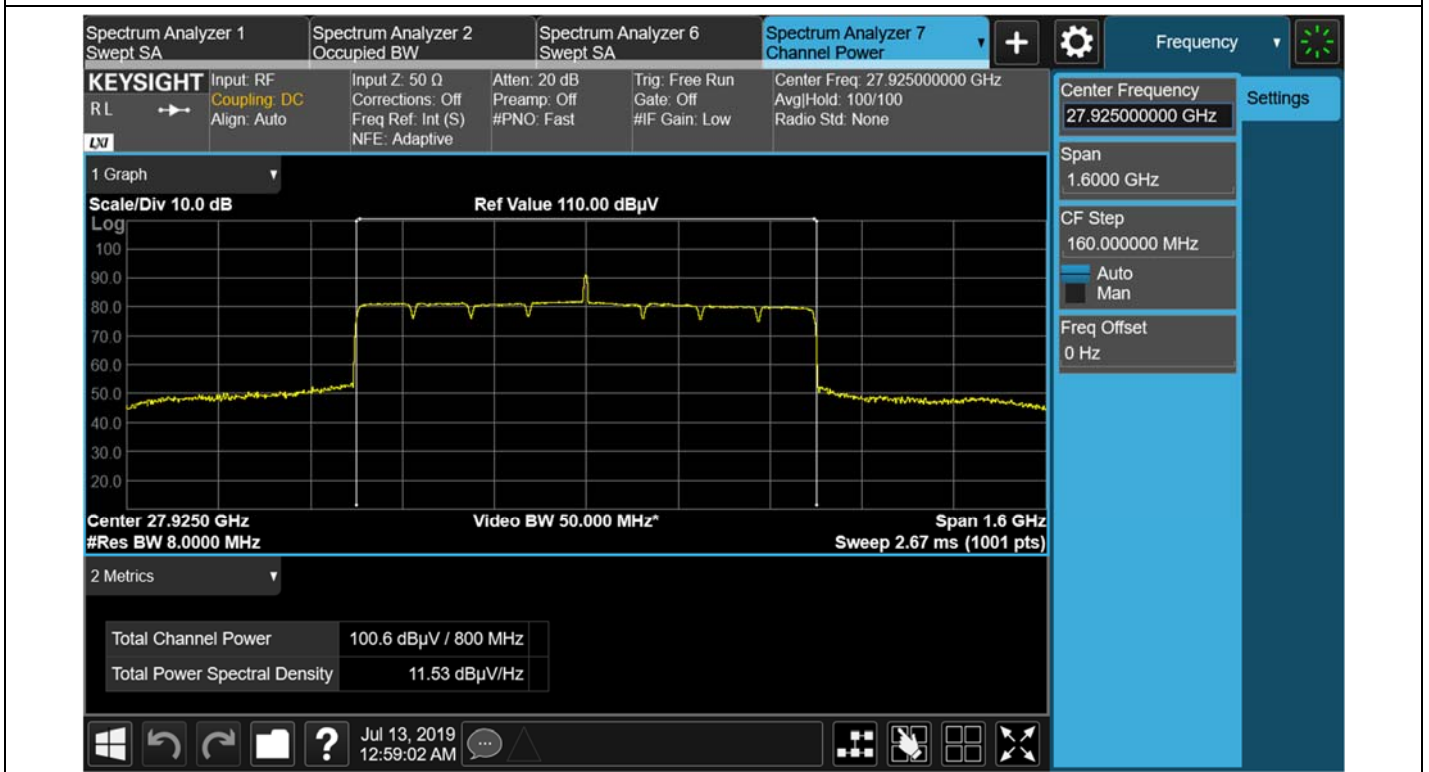
Antenna A / 8cc / 16QAM / Low



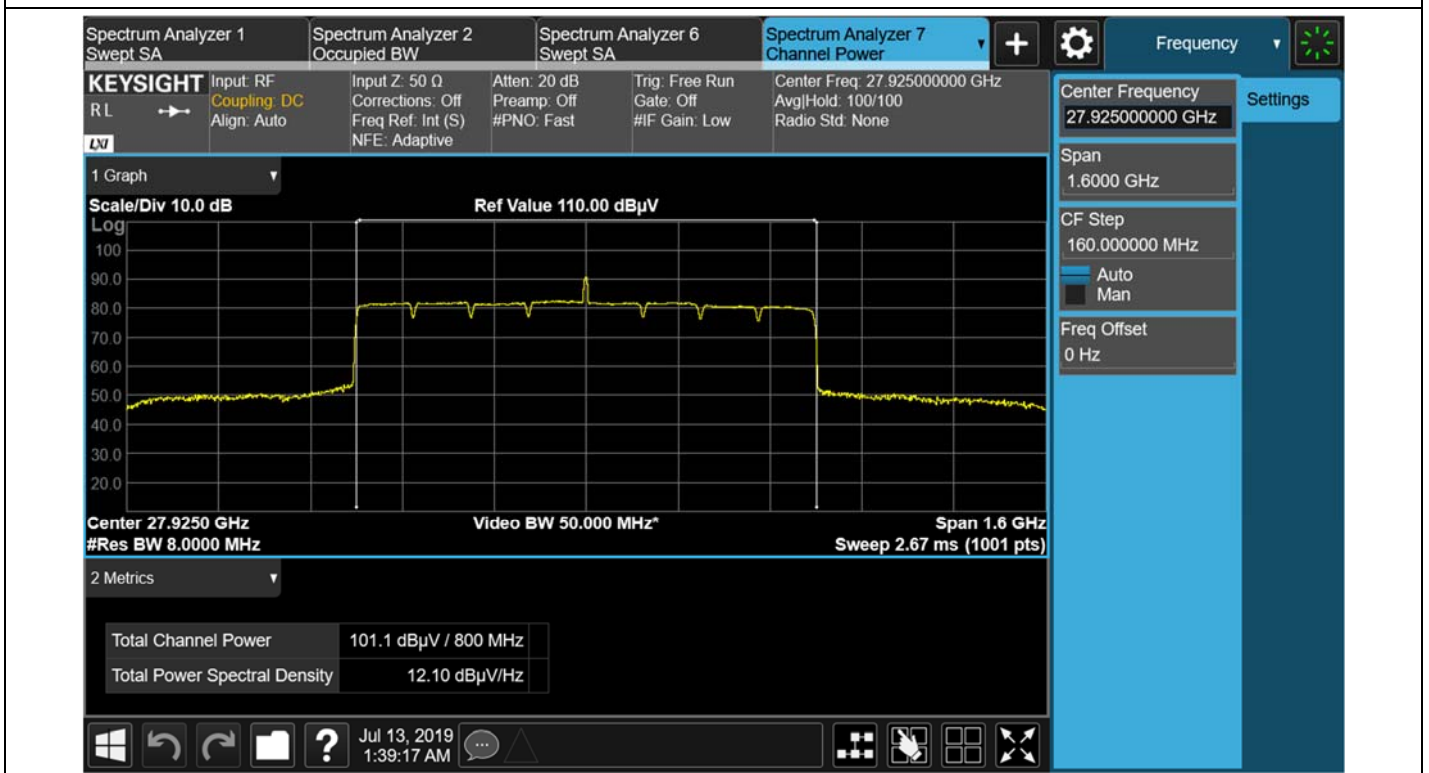
Antenna A / 8cc / 64QAM / Low

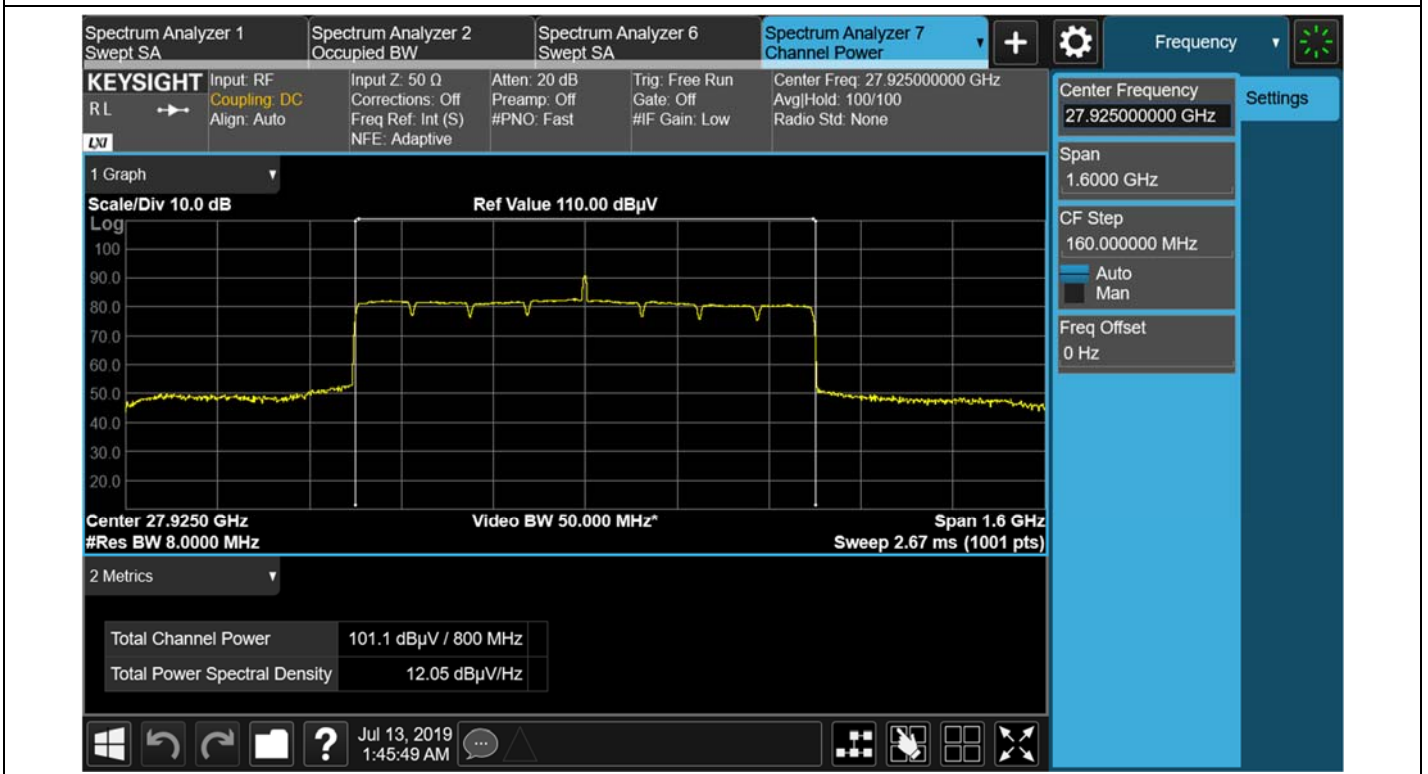
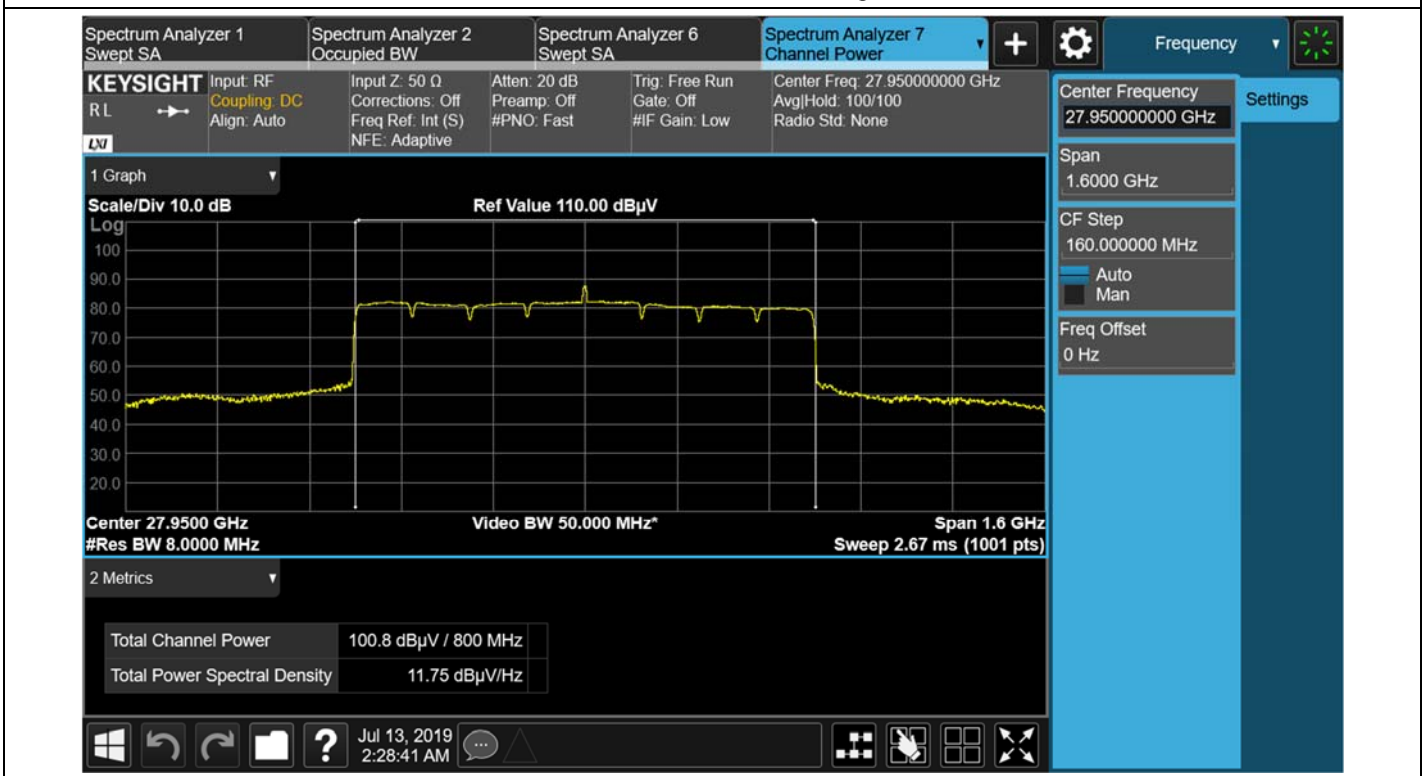


Antenna A / 8cc / QPSK / Middle

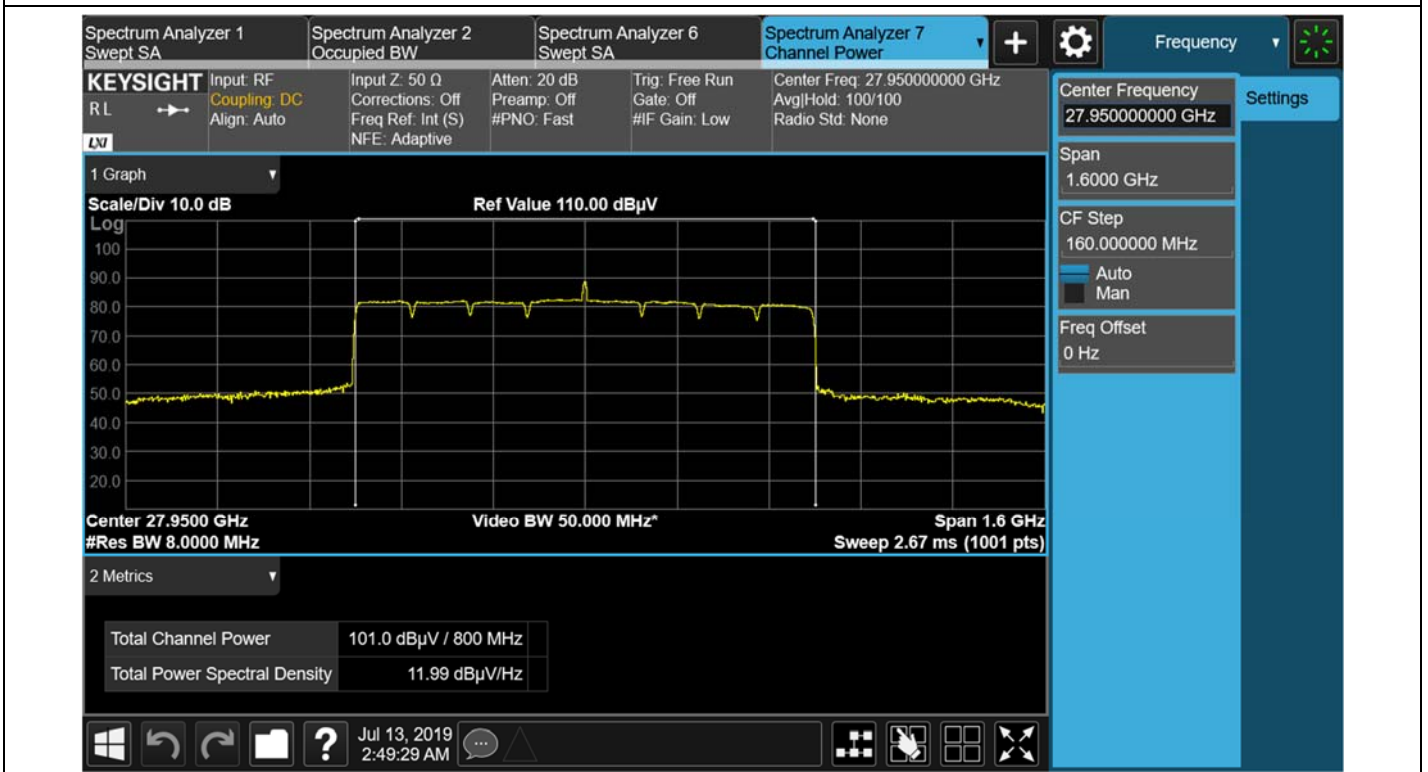


Antenna A / 8cc / 16QAM / Middle



Antenna A / 8cc / 64QAM / Middle

Antenna A / 8cc / QPSK / High


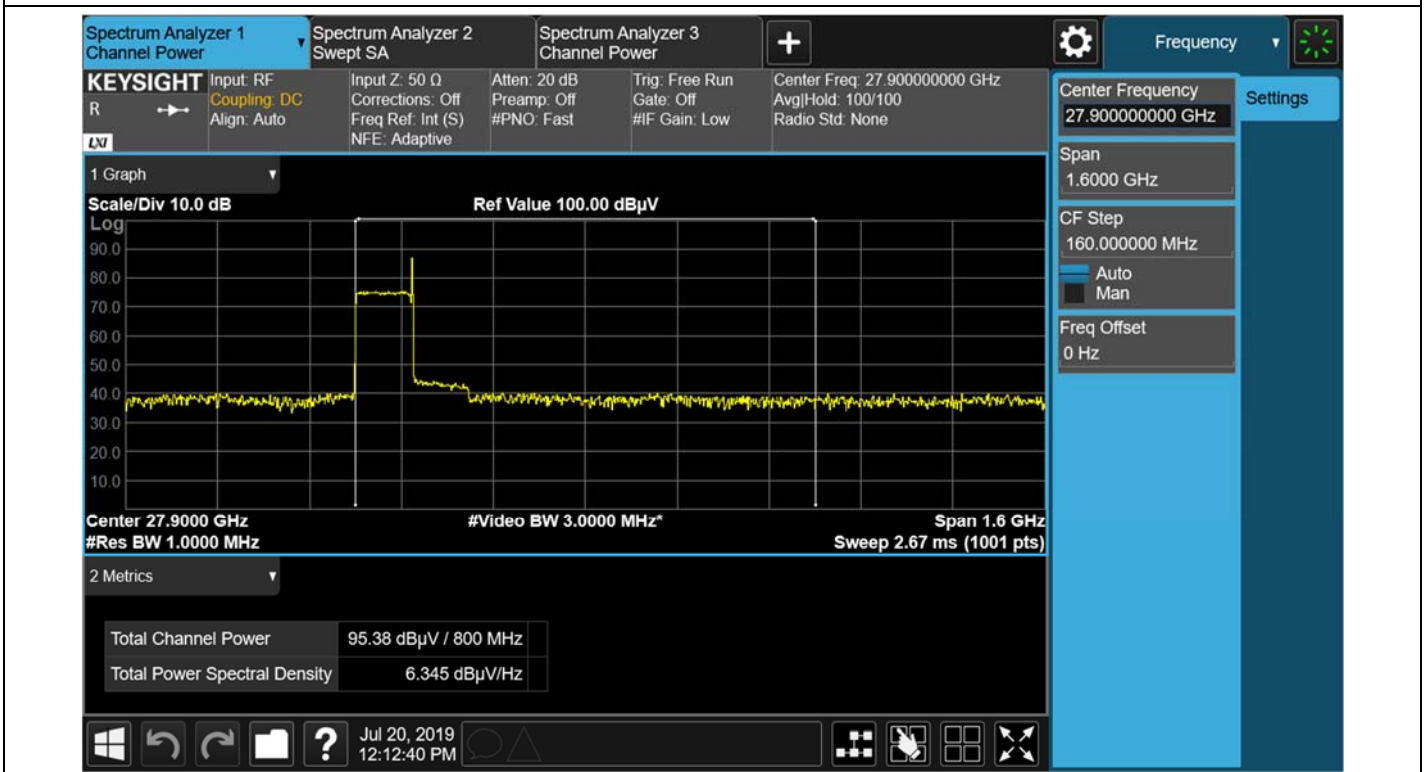
Antenna A / 8cc / 16QAM / High



Antenna A / 8cc / 64QAM / High



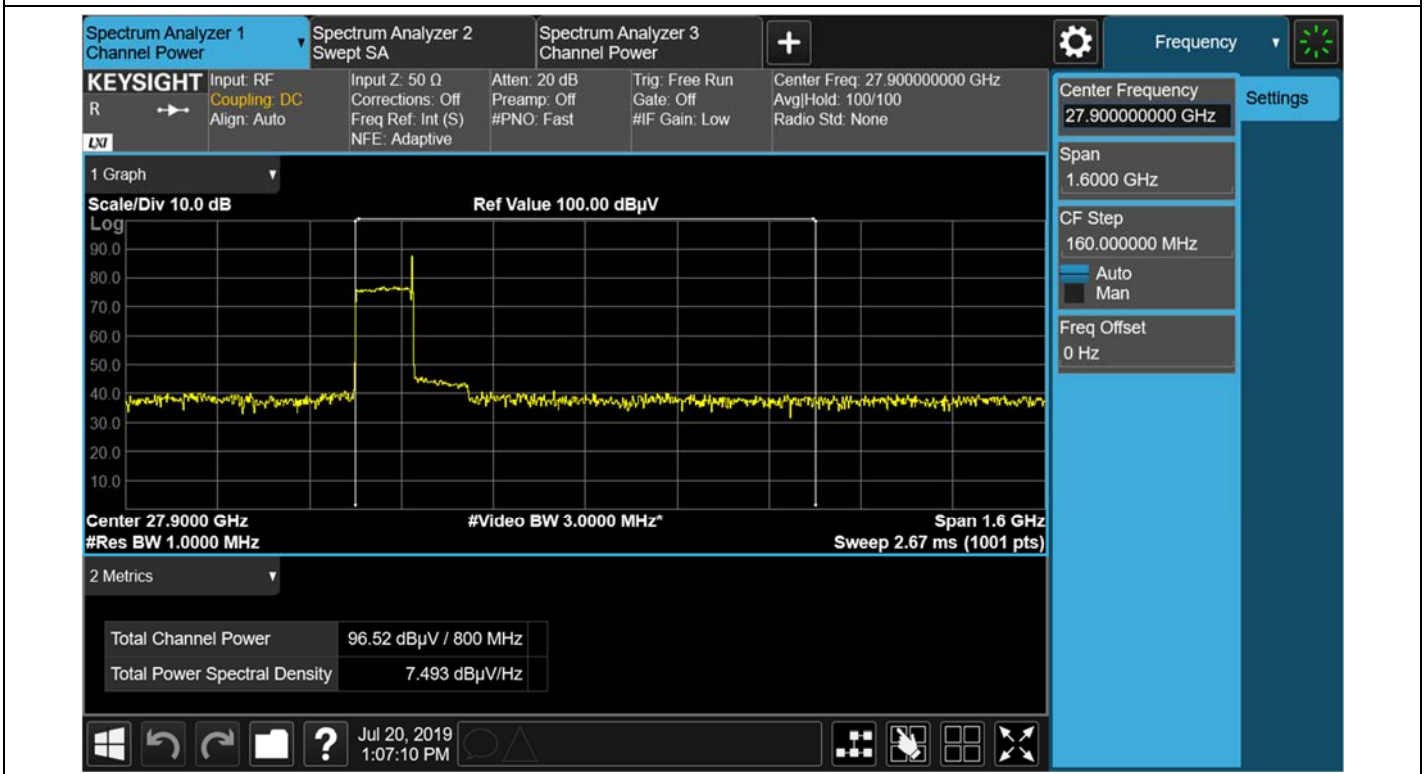
Antenna B / 1cc / QPSK / Low



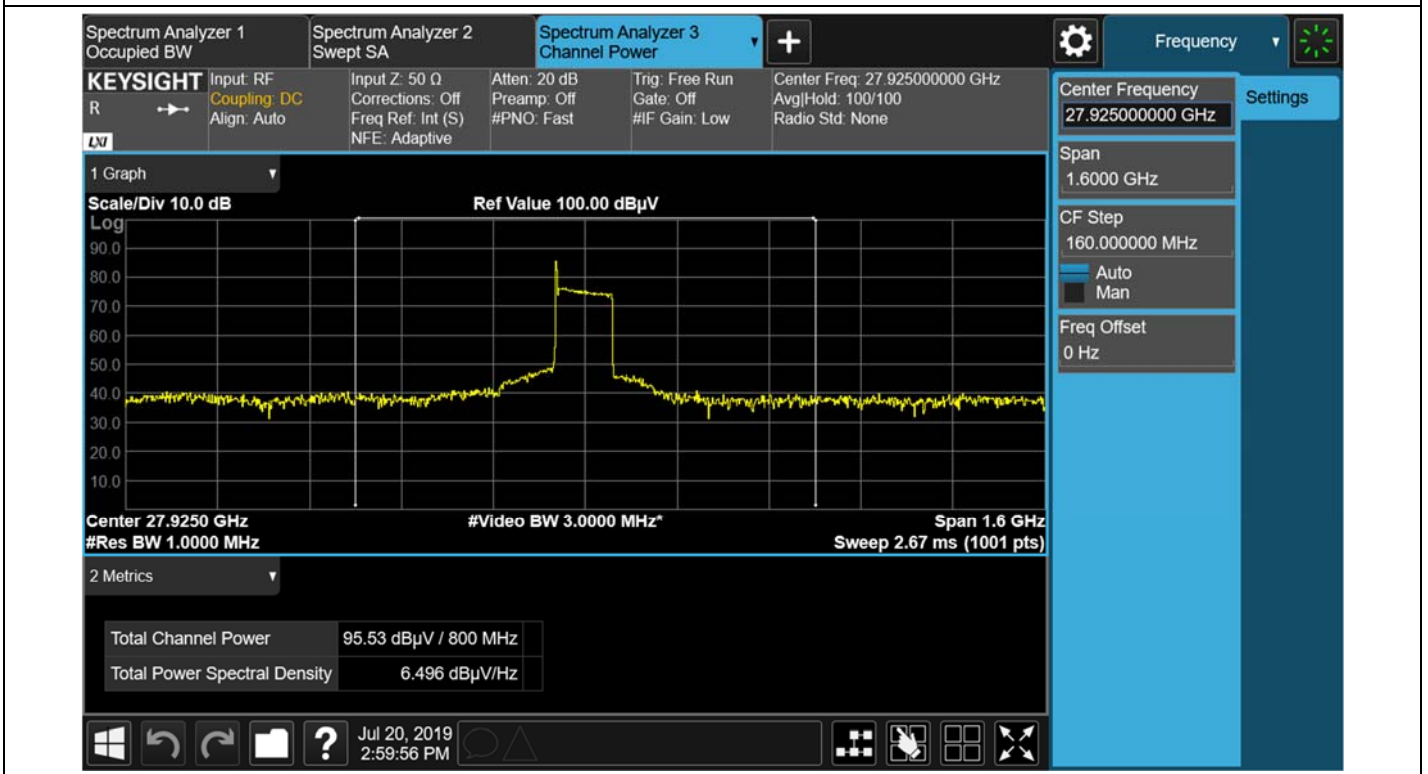
Antenna B / 1cc / 16QAM / Low



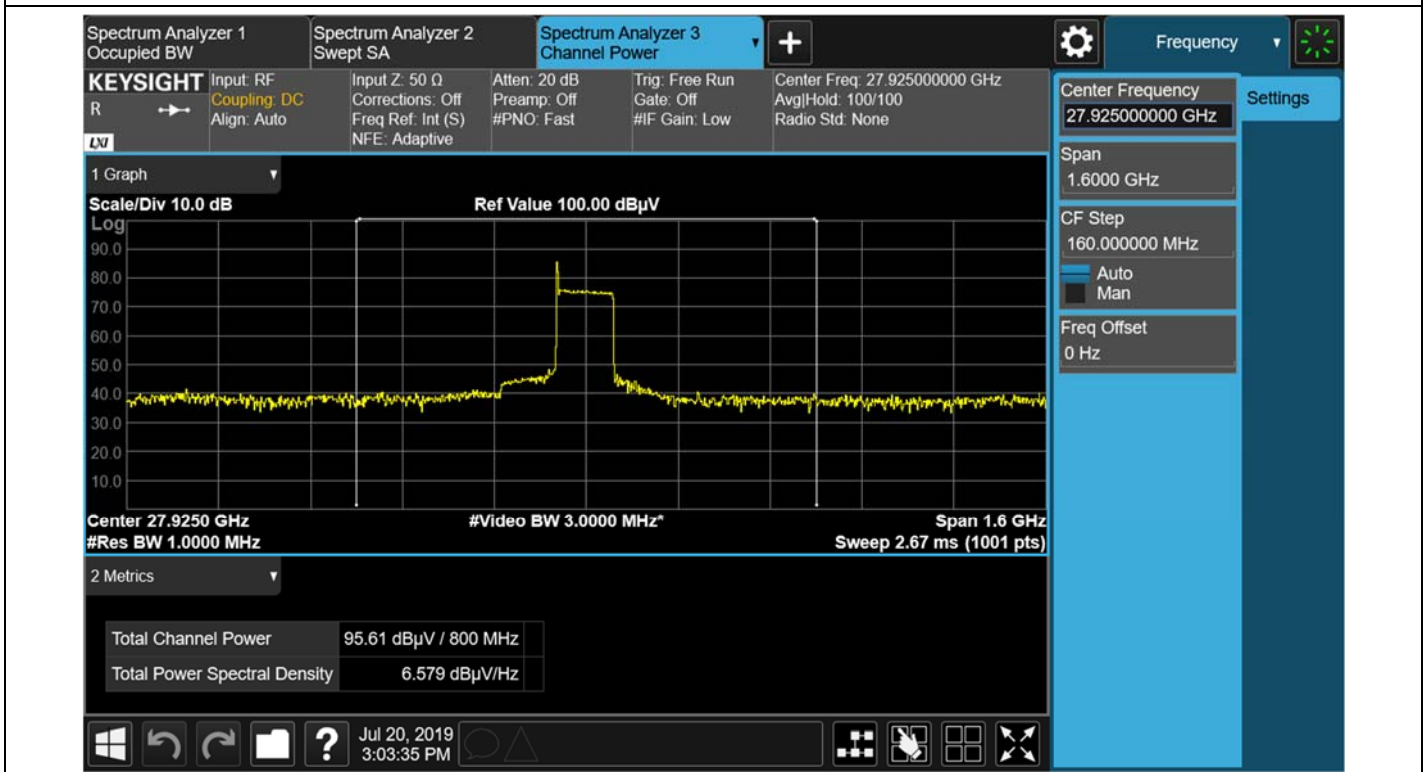
Antenna B / 1cc / 64QAM / Low



Antenna B / 1cc / QPSK / Middle



Antenna B / 1cc / 16QAM / Middle



Antenna B / 1cc / 64QAM / Middle



Antenna B / 1cc / QPSK / High



Antenna B / 1cc / 16QAM / High

