

6.8 Effective Radiated Power (ERP)

As described in more detail in Exhibit 7.1.b. the radiated power received at a spectrum analyzer was measured from the radio specimen with integral antenna at 2 degree increments as the specimen was rotated. These recorded power readings are uncalibrated ERP measurements. To convert these readings to ERP values a reference reading was obtained from a calibrated (to an ideal dipole) antenna to which was applied the same power level as the measured output power of the radio specimen. The reading at the spectrum analyzer from this calibrated reference antenna served to calibrate the spectrum analyzer readings for ERP measurements. By comparing the readings between the reference antenna and the radio specimen, and with a measurement of the output power of the radio specimen, this measurement also serves to determine the radio specimen antenna gain.

6.8.1 806 MHz - 825 MHz band

The following calculation shows how ERP was determined, then listed in the Table 6-31. For this example the greatest level observed was used. This occurred at several angular positions (such as 210 degrees) as noted in the Table 6-31.

- a. Analyzer reading for radio specimen, as tested at 28.6 dBm (722 milliwatts) output power: -17.7 dBm
- b. Analyzer reading for a substitution ideal dipole antenna, at 28.6 dBm applied power: -17.5 dBm
- c. Antenna gain (logarithmic) compared to an ideal dipole: $(-17.7) - (-17.5) = -0.2$ dBd
- d. Measured ERP: $(28.6) + (-0.2) = 28.4$ dBm
- e. Measured ERP: 692 milliwatts

However, the measured ERP value above was not determined at the production controlled maximum output power of the radio product so it is necessary to scale this number. The antenna gain permits the ERP to be calculated for any output power value in a manner similar to steps c and d above. The following calculations were used to determine the maximum ERP based upon the maximum output power rating (700 milliwatts) stated in Exhibit 6.1.1.

- f. Maximum output power rated: 700 milliwatts
- g. Output Power measured: 722 milliwatts
- h. Scaled ERP: $692 \times (700/722) = 671$ milliwatts

The method above was used for all information provided in the data table which follows that, for brevity, only lists values of items a, e and h as a function of rotational angle. The following graph (Figure 6-31) of item h is provided to serve as a simplified summary of that tabulated data and to visualize the maximum calculated ERP at the 210 and other rotational positions.

6.8.1 896 MHz - 901 MHz band

The following calculation shows how ERP was determined, then listed in the Table 6-31. For this example the greatest level observed was used. This occurred at two angular positions (228 and 232 degrees) as noted in the Table 6-31.

- a. Analyzer reading for radio specimen, as tested at 28.5 dBm (716 milliwatts) output power: -16.6 dBm
- b. Analyzer reading for a substitution ideal dipole antenna, at 28.5 dBm applied power: -17.1 dBm
- c. Antenna gain (logarithmic) compared to an ideal dipole: $(-16.6) - (-17.1) = 0.5$ dBd
- d. Measured ERP: $(28.5) + (0.5) = 29.0$ dBm
- e. Measured ERP: 794 milliwatts

However, the measured ERP value above was not determined at the production controlled maximum output power of the radio product so it is necessary to scale this number. The antenna gain permits the ERP to be calculated for any output power value in a manner similar to steps c and d above. The following calculations were used to determine the maximum Calculated ERP based upon the maximum output power rating (700 milliwatts) stated in Exhibit 12.1.A.

- f. Maximum output power rated: 700 milliwatts
- g. Output Power measured: 716 milliwatts
- h. Maximum calculated ERP: $794 \times (700/716) = 777$ milliwatts

The method above was used for all information provided in the data table which follows that, for brevity, only lists values of items a, e and h as a function of rotational angle. The following graph of item h is provided to serve as a simplified summary of that tabulated data and to visualize the maximum calculated ERP at the 228 and 230 degrees rotational positions.

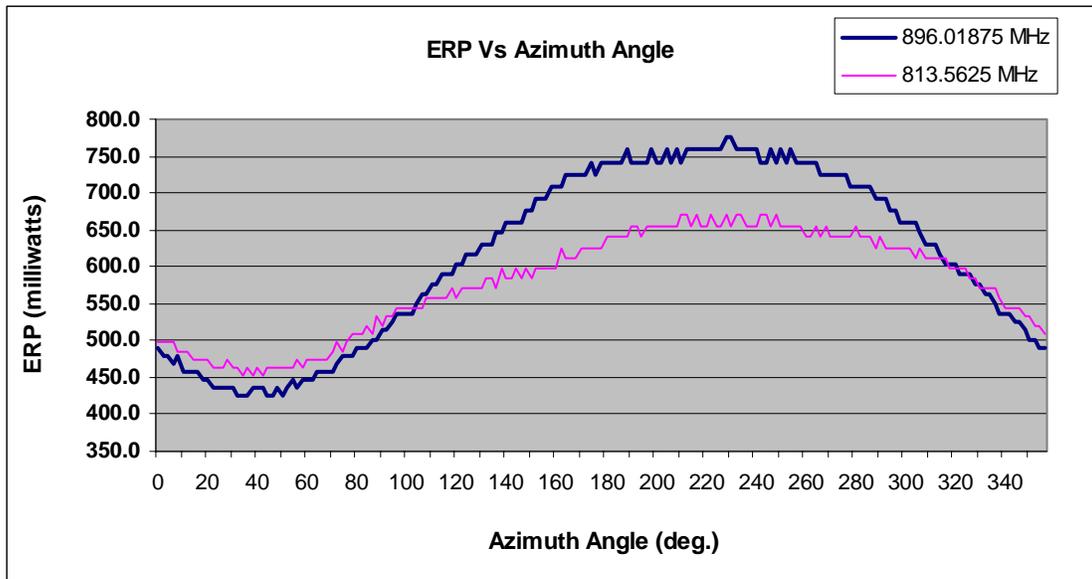


Figure 6-31: Scaled ERP vs. Azimuth Angle

6.8.3 Tabulated ERP

Table 6.6 Scaled ERP vs Azimuth Angle

Azimuth Angle (degrees)	813.5625MHz			896.01875 MHz			Notes
	Spectrum Analyzer Reading (dBm)	Measured ERP (mW)	Scaled ERP (mW)	Spectrum Analyzer Reading (dBm)	Measured ERP (mW)	Scaled ERP (mW)	
0	-19	512.9	497.2	-18.6	501.2	490.0	Front
2	-19	512.9	497.2	-18.7	489.8	478.8	
4	-19	512.9	497.2	-18.7	489.8	478.8	
6	-19	512.9	497.2	-18.8	478.6	467.9	
8	-19.1	501.2	485.9	-18.7	489.8	478.8	
10	-19.1	501.2	485.9	-18.9	467.7	457.3	
12	-19.1	501.2	485.9	-18.9	467.7	457.3	
14	-19.2	489.8	474.9	-18.9	467.7	457.3	
16	-19.2	489.8	474.9	-18.9	467.7	457.3	
18	-19.2	489.8	474.9	-19	457.1	446.9	
20	-19.2	489.8	474.9	-19	457.1	446.9	
22	-19.3	478.6	464.0	-19.1	446.7	436.7	
24	-19.3	478.6	464.0	-19.1	446.7	436.7	
26	-19.3	478.6	464.0	-19.1	446.7	436.7	
28	-19.2	489.8	474.9	-19.1	446.7	436.7	
30	-19.3	478.6	464.0	-19.1	446.7	436.7	
32	-19.3	478.6	464.0	-19.2	436.5	426.8	
34	-19.4	467.7	453.5	-19.2	436.5	426.8	
36	-19.3	478.6	464.0	-19.2	436.5	426.8	
38	-19.4	467.7	453.5	-19.1	446.7	436.7	
40	-19.3	478.6	464.0	-19.1	446.7	436.7	
42	-19.4	467.7	453.5	-19.1	446.7	436.7	
44	-19.3	478.6	464.0	-19.2	436.5	426.8	
46	-19.3	478.6	464.0	-19.2	436.5	426.8	
48	-19.3	478.6	464.0	-19.1	446.7	436.7	
50	-19.3	478.6	464.0	-19.2	436.5	426.8	
52	-19.3	478.6	464.0	-19.1	446.7	436.7	
54	-19.3	478.6	464.0	-19	457.1	446.9	
56	-19.2	489.8	474.9	-19.1	446.7	436.7	
58	-19.3	478.6	464.0	-19	457.1	446.9	
60	-19.2	489.8	474.9	-19	457.1	446.9	
62	-19.2	489.8	474.9	-19	457.1	446.9	
64	-19.2	489.8	474.9	-18.9	467.7	457.3	

Table 6-6 Scaled ERP vs Azimuth Angle (cont.)

66	-19.2	489.8	474.9	-18.9	467.7	457.3
68	-19.2	489.8	474.9	-18.9	467.7	457.3
70	-19.1	501.2	485.9	-18.9	467.7	457.3
72	-19	512.9	497.2	-18.8	478.6	467.9
74	-19.1	501.2	485.9	-18.7	489.8	478.8
76	-19	512.9	497.2	-18.7	489.8	478.8
78	-18.9	524.8	508.8	-18.7	489.8	478.8
80	-18.9	524.8	508.8	-18.6	501.2	490.0
82	-18.9	524.8	508.8	-18.6	501.2	490.0
84	-18.8	537.0	520.7	-18.6	501.2	490.0
86	-18.9	524.8	508.8	-18.5	512.9	501.4
88	-18.7	549.5	532.8	-18.5	512.9	501.4
90	-18.8	537.0	520.7	-18.4	524.8	513.1
92	-18.7	549.5	532.8	-18.4	524.8	513.1
94	-18.7	549.5	532.8	-18.3	537.0	525.0
96	-18.6	562.3	545.2	-18.2	549.5	537.3
98	-18.6	562.3	545.2	-18.2	549.5	537.3
100	-18.6	562.3	545.2	-18.2	549.5	537.3
102	-18.6	562.3	545.2	-18.2	549.5	537.3
104	-18.6	562.3	545.2	-18.1	562.3	549.8
106	-18.6	562.3	545.2	-18	575.4	562.6
108	-18.5	575.4	557.9	-18	575.4	562.6
110	-18.5	575.4	557.9	-17.9	588.8	575.7
112	-18.5	575.4	557.9	-17.9	588.8	575.7
114	-18.5	575.4	557.9	-17.8	602.6	589.1
116	-18.5	575.4	557.9	-17.8	602.6	589.1
118	-18.4	588.8	570.9	-17.8	602.6	589.1
120	-18.5	575.4	557.9	-17.7	616.6	602.8
122	-18.4	588.8	570.9	-17.7	616.6	602.8
124	-18.4	588.8	570.9	-17.6	631.0	616.9
126	-18.4	588.8	570.9	-17.6	631.0	616.9
128	-18.4	588.8	570.9	-17.6	631.0	616.9
130	-18.4	588.8	570.9	-17.5	645.7	631.2
132	-18.3	602.6	584.2	-17.5	645.7	631.2
134	-18.3	602.6	584.2	-17.5	645.7	631.2
136	-18.4	588.8	570.9	-17.4	660.7	645.9
138	-18.2	616.6	597.8	-17.4	660.7	645.9
140	-18.3	602.6	584.2	-17.3	676.1	661.0
142	-18.3	602.6	584.2	-17.3	676.1	661.0
144	-18.2	616.6	597.8	-17.3	676.1	661.0
146	-18.3	602.6	584.2	-17.3	676.1	661.0
148	-18.2	616.6	597.8	-17.2	691.8	676.4

Table 6-6 Scaled ERP vs Azimuth Angle (cont.)

150	-18.3	602.6	584.2	-17.2	691.8	676.4	
152	-18.2	616.6	597.8	-17.1	707.9	692.1	
154	-18.2	616.6	597.8	-17.1	707.9	692.1	
156	-18.2	616.6	597.8	-17.1	707.9	692.1	
158	-18.2	616.6	597.8	-17	724.4	708.2	
160	-18.2	616.6	597.8	-17	724.4	708.2	
162	-18	645.7	626.0	-17	724.4	708.2	
164	-18.1	631.0	611.7	-16.9	741.3	724.7	
166	-18.1	631.0	611.7	-16.9	741.3	724.7	
168	-18.1	631.0	611.7	-16.9	741.3	724.7	
170	-18	645.7	626.0	-16.9	741.3	724.7	
172	-18	645.7	626.0	-16.9	741.3	724.7	
174	-18	645.7	626.0	-16.8	758.6	741.6	
176	-18	645.7	626.0	-16.9	741.3	724.7	
178	-18	645.7	626.0	-16.8	758.6	741.6	
180	-17.9	660.7	640.6	-16.8	758.6	741.6	Back
182	-17.9	660.7	640.6	-16.8	758.6	741.6	
184	-17.9	660.7	640.6	-16.8	758.6	741.6	
186	-17.9	660.7	640.6	-16.8	758.6	741.6	
188	-17.9	660.7	640.6	-16.7	776.2	758.9	
190	-17.8	676.1	655.5	-16.8	758.6	741.6	
192	-17.8	676.1	655.5	-16.8	758.6	741.6	
194	-17.9	660.7	640.6	-16.8	758.6	741.6	
196	-17.8	676.1	655.5	-16.8	758.6	741.6	
198	-17.8	676.1	655.5	-16.7	776.2	758.9	
200	-17.8	676.1	655.5	-16.8	758.6	741.6	
202	-17.8	676.1	655.5	-16.8	758.6	741.6	
204	-17.8	676.1	655.5	-16.7	776.2	758.9	
206	-17.8	676.1	655.5	-16.8	758.6	741.6	
208	-17.8	676.1	655.5	-16.7	776.2	758.9	
210	-17.7	691.8	670.8	-16.8	758.6	741.6	Maximum
212	-17.7	691.8	670.8	-16.7	776.2	758.9	
214	-17.8	676.1	655.5	-16.7	776.2	758.9	
216	-17.7	691.8	670.8	-16.7	776.2	758.9	
218	-17.8	676.1	655.5	-16.7	776.2	758.9	
220	-17.8	676.1	655.5	-16.7	776.2	758.9	
222	-17.7	691.8	670.8	-16.7	776.2	758.9	
224	-17.8	676.1	655.5	-16.7	776.2	758.9	
226	-17.8	676.1	655.5	-16.7	776.2	758.9	
228	-17.7	691.8	670.8	-16.6	794.3	776.6	Maximum
230	-17.8	676.1	655.5	-16.6	794.3	776.6	

Table 6-6 Scaled ERP vs Azimuth Angle (cont.)

232	-17.7	691.8	670.8	-16.7	776.2	758.9
234	-17.7	691.8	670.8	-16.7	776.2	758.9
236	-17.8	676.1	655.5	-16.7	776.2	758.9
238	-17.8	676.1	655.5	-16.7	776.2	758.9
240	-17.8	676.1	655.5	-16.7	776.2	758.9
242	-17.7	691.8	670.8	-16.8	758.6	741.6
244	-17.7	691.8	670.8	-16.8	758.6	741.6
246	-17.8	676.1	655.5	-16.7	776.2	758.9
248	-17.7	691.8	670.8	-16.8	758.6	741.6
250	-17.8	676.1	655.5	-16.7	776.2	758.9
252	-17.8	676.1	655.5	-16.8	758.6	741.6
254	-17.8	676.1	655.5	-16.7	776.2	758.9
256	-17.8	676.1	655.5	-16.8	758.6	741.6
258	-17.8	676.1	655.5	-16.8	758.6	741.6
260	-17.9	660.7	640.6	-16.8	758.6	741.6
262	-17.9	660.7	640.6	-16.8	758.6	741.6
264	-17.8	676.1	655.5	-16.8	758.6	741.6
266	-17.9	660.7	640.6	-16.9	741.3	724.7
268	-17.8	676.1	655.5	-16.9	741.3	724.7
270	-17.9	660.7	640.6	-16.9	741.3	724.7
272	-17.9	660.7	640.6	-16.9	741.3	724.7
274	-17.9	660.7	640.6	-16.9	741.3	724.7
276	-17.9	660.7	640.6	-16.9	741.3	724.7
278	-17.9	660.7	640.6	-17	724.4	708.2
280	-17.8	676.1	655.5	-17	724.4	708.2
282	-17.9	660.7	640.6	-17	724.4	708.2
284	-17.9	660.7	640.6	-17	724.4	708.2
286	-17.9	660.7	640.6	-17	724.4	708.2
288	-18	645.7	626.0	-17.1	707.9	692.1
290	-17.9	660.7	640.6	-17.1	707.9	692.1
292	-18	645.7	626.0	-17.1	707.9	692.1
294	-18	645.7	626.0	-17.2	691.8	676.4
296	-18	645.7	626.0	-17.2	691.8	676.4
298	-18	645.7	626.0	-17.3	676.1	661.0
300	-18	645.7	626.0	-17.3	676.1	661.0
302	-18	645.7	626.0	-17.3	676.1	661.0
304	-18.1	631.0	611.7	-17.3	676.1	661.0
306	-18	645.7	626.0	-17.4	660.7	645.9
308	-18.1	631.0	611.7	-17.5	645.7	631.2
310	-18.1	631.0	611.7	-17.5	645.7	631.2
312	-18.1	631.0	611.7	-17.5	645.7	631.2
314	-18.1	631.0	611.7	-17.6	631.0	616.9

Table 6-6 Scaled ERP vs Azimuth Angle (cont.)

316	-18.1	631.0	611.7	-17.7	616.6	602.8	
318	-18.2	616.6	597.8	-17.7	616.6	602.8	
320	-18.2	616.6	597.8	-17.7	616.6	602.8	
322	-18.2	616.6	597.8	-17.8	602.6	589.1	
324	-18.2	616.6	597.8	-17.8	602.6	589.1	
326	-18.3	602.6	584.2	-17.8	602.6	589.1	
328	-18.3	602.6	584.2	-17.9	588.8	575.7	
330	-18.4	588.8	570.9	-17.9	588.8	575.7	
332	-18.4	588.8	570.9	-18	575.4	562.6	
334	-18.4	588.8	570.9	-18	575.4	562.6	
336	-18.4	588.8	570.9	-18.1	562.3	549.8	
338	-18.5	575.4	557.9	-18.2	549.5	537.3	
340	-18.6	562.3	545.2	-18.2	549.5	537.3	
342	-18.6	562.3	545.2	-18.2	549.5	537.3	
344	-18.6	562.3	545.2	-18.3	537.0	525.0	
346	-18.6	562.3	545.2	-18.3	537.0	525.0	
348	-18.7	549.5	532.8	-18.4	524.8	513.1	
350	-18.7	549.5	532.8	-18.5	512.9	501.4	
352	-18.8	537.0	520.7	-18.5	512.9	501.4	
354	-18.8	537.0	520.7	-18.6	501.2	490.0	
356	-18.9	524.8	508.8	-18.6	501.2	490.0	