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Facsimile Cover Sheet

To: Joe Dickson

Company:

Phone:

Fax:

From: D. Case

Company:

Phone:

Fax:

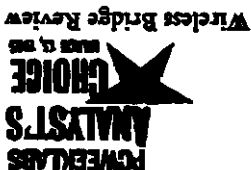
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Pages including
this cover page: 5 pgs

Comments:



APRIL 1996



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2/12/99

Joe Dichoso
FCC

Joe,

Per our conversation on 2/10/99, the data for the 11 MB processing gain marked confidential was for internal reasons only. It is our understanding that this data and test method does not fall under the confidential rulings and will be added to the file. However, I also understand that the research data done on this issue will remain confidential per our conversation.

Regards

A handwritten signature in cursive script, appearing to read "David A. Case".

David A. Case NCE
Senior EMC and Reliability Engineer
Airnet Wireless Communications.



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PRODUCT NAME: AIRNET LM4800 RADIO
NAME OF TEST: The Processing Gain of a Direct Sequence System.

FCC Part 15.247 (e) specifies:

The processing gain of a direct sequence system shall be at least 10 dB.

Guidance on measurement by FCC

The processing gain may be measured using the CW jamming margin method. The test consists of stepping a signal generator in 50kHz increments across the passband of the system. At each point, the generator level required to produce the recommended Bit Error Rate (10⁻⁵) is recorded. This is the jammer level. The output power of the transmitting unit is measured at the same point. The jammer to signal (J/S) ratio is then calculated. Discard the worst 20% of the J/S data points. Total losses in a system including transmitter and receiver, should be assumed to be no more than 2 dB.

therefore, processing gain = S/N + Mj + Lsys

Where :

S/N = Signal to noise ratio required at the receiver output for 10⁻⁵ error rate of a ideal receiver for your demodulation scheme

Mj = Jammer to signal ratio

Lsys = System losses (2dB max)

Test results :

for 1 mb data rate:

S/N = 13 dB ; taken from Wireless Information Networks by Pahlavan & Levesque
Mj = - 2.5 dB ; worst case jamming margin from tests in lab
Lsys = 0.5 dB ; system losses
therefore the processing gain at 1mb is 13 dB - 2.5 dB + 0.5 dB = 11.0 dB

for 2 mb data rate:

S/N = 13 dB ; taken from Wireless Information Networks by Pahlavan & Levesque
Mj = - 2.9 dB ; worst case jamming margin from tests in lab
Lsys = 1.0 dB ; system losses
therefore the processing gain at 2mb is 13 dB - 2.9 dB + 1.0 dB = 11.1 dB



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H.

for 5.5 mb data rate:

S/N = 13.6 dB : taken from Harris CCK encoding modulation

Mj = - 5.2 dB : worst case jamming margin from tests in lab

Lsys = 2.0 dB : system losses

therefore the processing gain at 5.5mb is 13.6 dB - 5.2 dB + 2.0 dB = 10.4 dB

for 11 mb data rate:

S/N = 16.0 dB : taken from Harris CCK encoding modulation

Mj = - 7.3 dB : worst case jamming margin from tests in lab (after 20% discarded)

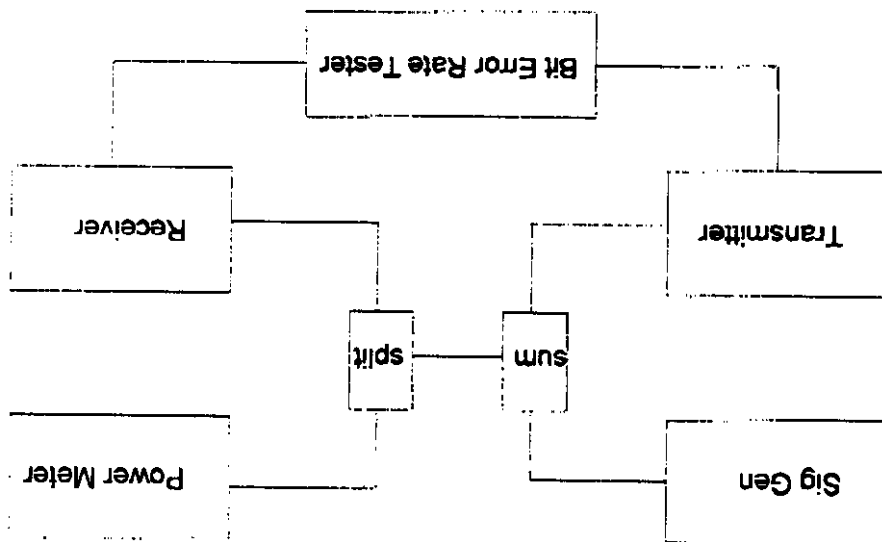
Lsys = 2.0 dB : system losses

therefore the processing gain at 11mb is 16.0 dB - 7.3 dB + 2.0 dB = 10.7 dB

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Jamming Test Setup



AIRONET RF Systems Engineering	
2.4 GHz SPREAD SPECTRUM RADIO, 2nd GEN	
Jammer Test, R240	
eng: J. Friedman	Rev: R240
des: J. Friedman	Date: 02/19/98

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11/30/98

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radio conditions : supply voltage 5v, at room temp, rx s/n = #2000, tx s/n = #2003, Rev AC2 with Harris HFA3860B (CCK modulation)

$$G_p = S/N + M_f + L_{sys}; \text{ where } S/N = 13.6 \text{ dB as per CCK modulation; } L_{sys} = 2.0 \text{ dB}$$
$$G_o = S/N + M_i + L_{sys}; \text{ where } S/N = 13.6 \text{ dB as per CCK modulation; } L_{sys} = 2.0 \text{ dB}$$

input signal level = -60 dBm, jammer level = -65.2 dBm, then $M_i = -5.2$ dB for 10.5 BER

$G_p = 13.6 \text{ dB} + -5.2 \text{ dB} + 2.0 \text{ dB} = 10.4 \text{ dB}$ (worst case point after lowest 20% discarded)

hammer	rate under	hammer	rate under	hammer
--------	------------	--------	------------	--------

freq	Gp	1x10-5	freq	Gp	1x10-5	freq	Gp	1x10-5
------	----	--------	------	----	--------	------	----	--------

161	2464.50	10 pass-disc	206	2468.75	10.4 pass	251	2469.00	10.4 pass	296	2471.25	13.0 pass
MHZ	DB	FAILURE	pass /	MHZ	DB	FAILURE	pass /	MHZ	DB	FAILURE	pass /
162	2464.55	10.4 pass-disc	207	2468.80	10.4 pass	252	2469.05	10.5 pass	297	2471.30	13.0 pass
163	2464.60	10 pass-disc	208	2468.85	10.4 pass	253	2469.10	11 pass	298	2471.35	13.0 pass
164	2464.65	9.5 Fail-discard	209	2468.90	10.4 pass	254	2469.15	11 pass	299	2471.40	13.5 pass
165	2464.70	9.5 Fail-discard	210	2468.95	10.4 pass	255	2469.20	11 pass	300	2471.45	13.5 pass
166	2464.75	9.5 Fail-discard	211	2469.00	10.4 pass	256	2469.25	11 pass	301	2471.50	13.5 pass
167	2464.80	10 pass-disc	212	2469.05	10.4 pass	257	2469.30	11 pass	302	2471.55	13.5 pass
168	2464.85	9.5 Fail-discard	213	2469.10	10.4 pass	258	2469.35	11 pass	303	2471.60	14.0 pass
169	2464.90	9.5 Fail-discard	214	2469.15	10.4 pass	259	2469.40	11 pass	304	2471.65	14.0 pass
170	2464.95	10 pass-disc	215	2469.20	10.4 pass	260	2469.45	11 pass	305	2471.70	14.0 pass
171	2465.00	10.4 pass	216	2469.25	10.4 pass	261	2469.50	11 pass	306	2471.75	14.0 pass
172	2465.05	10.4 pass	217	2469.30	10 pass-disc	262	2469.55	11 pass	307	2471.80	14.5 pass
173	2465.10	10.4 pass	218	2469.35	9.5 Fail-discard	263	2469.60	11 pass	308	2471.85	14.5 pass
174	2465.15	10.4 pass	219	2469.40	9.5 Fail-discard	264	2469.65	11 pass	309	2471.90	14.5 pass
175	2465.20	10.4 pass	220	2469.45	9.5 Fail-discard	265	2469.70	11 pass	310	2471.95	14.5 pass
176	2465.25	10.4 pass	221	2469.50	9.5 Fail-discard	266	2469.75	11 pass	311	2472.00	14.5 pass
177	2465.30	10.4 pass	222	2469.55	9.5 Fail-discard	267	2469.80	11 pass	312	2472.05	15 pass
178	2465.35	10.4 pass	223	2469.60	9.5 Fail-discard	268	2469.85	11 pass	313	2472.10	15.5 pass
179	2465.40	10.4 pass	224	2469.65	9.5 Fail-discard	269	2469.90	11 pass	314	2472.15	15.5 pass
180	2465.45	10.4 pass	225	2469.70	9.5 Fail-discard	270	2469.95	11 pass	315	2472.20	15.5 pass
181	2465.50	10.4 pass	226	2469.75	10 pass-disc	271	2470.00	11 pass	316	2472.25	15.5 pass
182	2465.55	10.4 pass	227	2469.80	10 pass-disc	272	2470.05	11 pass	317	2472.30	15.5 pass
183	2465.60	10.4 pass	228	2469.85	9.5 Fail-discard	273	2470.10	11 pass	318	2472.35	16 pass
184	2465.65	10.4 pass	229	2469.90	9.5 Fail-discard	274	2470.15	11.5 pass	319	2472.40	16.5 pass
185	2465.70	10.4 pass	230	2469.95	9.5 Fail-discard	275	2470.20	11.5 pass	320	2472.45	16.5 pass
186	2465.75	10.4 pass	231	2468.00	10.5 pass	276	2470.25	11.5 pass	321	2472.50	16.5 pass
187	2465.80	10.4 pass	232	2468.05	10.5 pass	277	2470.30	11.5 pass	322	2472.55	16.5 pass
188	2465.85	10.4 pass	233	2468.10	10.5 pass	278	2470.35	11.5 pass	323	2472.60	17 pass
189	2465.90	10.4 pass	234	2468.15	10.5 pass	279	2470.40	12 pass	324	2472.65	17 pass
190	2465.95	10.4 pass	235	2468.20	10.5 pass	280	2470.45	12 pass	325	2472.70	17.5 pass
191	2466.00	10.4 pass	236	2468.25	10.5 pass	281	2470.50	12 pass	326	2472.75	17.5 pass
192	2466.05	10 pass-disc	237	2468.30	10.5 pass	282	2470.55	12 pass	327	2472.80	17.5 pass
193	2466.10	9.5 Fail-discard	238	2468.35	10.5 pass	283	2470.60	12 pass	328	2472.85	18 pass
194	2466.15	9.5 Fail-discard	239	2468.40	10.5 pass	284	2470.65	12 pass	329	2472.90	18 pass
195	2466.20	10 pass-disc	240	2468.45	10.5 pass	285	2470.70	12 pass	330	2472.95	18 pass
196	2466.25	10 pass-disc	241	2468.50	10.5 pass	286	2470.75	12.5 pass	331	2473.00	18.5 pass
197	2466.30	10.4 pass	242	2468.55	10.5 pass	287	2470.80	12.5 pass	332	2473.05	18.5 pass
198	2466.35	10.4 pass	243	2468.60	10.5 pass	288	2470.85	12.5 pass	333	2473.10	19 pass
199	2466.40	10.4 pass	244	2468.65	10.5 pass	289	2470.90	12.5 pass	334	2473.15	19 pass
200	2466.45	10.4 pass	245	2468.70	10.5 pass	290	2470.95	12.5 pass	335	2473.20	19 pass
201	2466.50	10.3 pass	246	2468.75	10.5 pass	291	2471.00	12.5 pass	336	2473.25	19 pass
202	2466.55	10.2 pass	247	2468.80	10.5 pass	292	2471.05	12.5 pass	337	2473.30	19 pass
203	2466.60	10.4 pass	248	2468.85	10.5 pass	293	2471.10	12.5 pass	338	2473.35	19 pass
204	2466.65	10.4 pass	249	2468.90	10.4 pass	294	2471.15	13 pass	339	2473.40	20 pass
205	2466.70	10.4 pass	250	2468.95	10.5 pass	295	2471.20	13 pass	340	2473.45	20.5 pass

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processing gain by method of jamming margin using Debugger Software Linktest											
radio conditions : supply voltage 5v, at room temp, rx s/n = #2000, tx s/n = #2003, Rev AC2 with Harris HFA3860B (CCK modulation)											
tester name : Jim Nahra / Jim Friedmann											
test date : 11/12/98											
radio carrier freq=2465											
Gp = S/N + Mj + Lsys; where S/N = 16.0 dB as per CCK modulation; Lsys = 2dB											
input signal level = -60 dbm, jammer level = - 67.3 dbm, then Mj = - 7.3 dB for 10-5 BER											
Gp = 16.0 dB + -7.3 dB + 2 dB = 10.7 dB (worst case point after lowest 20% discarded)											
pass (error rate under 1x10-5)	jammer freq	pass / failure	MHz	dB	pass / failure	jammer freq	pass / failure	MHz	dB		
1	2456.50	19.7	pass	81	2460.50	11.7	pass	121	2462.50	10.7	pass
2	2456.55	19.7	pass	82	2460.55	11.7	pass	122	2462.55	10.7	pass
3	2456.60	19.7	pass	83	2460.60	11.2	pass	123	2462.60	10.7	pass
4	2456.65	19.2	pass	84	2460.65	11.2	pass	124	2462.65	10.7	pass
5	2456.70	19.2	pass	85	2460.70	11.2	pass	125	2462.70	10.7	pass
6	2456.75	19.2	pass	86	2460.75	11.2	pass	126	2462.75	10.7	pass
7	2456.80	19.2	pass	87	2460.80	11.2	pass	127	2462.80	10.7	pass
8	2456.85	19.2	pass	88	2460.85	11.2	pass	128	2462.85	10.7	pass
9	2456.90	18.7	pass	89	2460.90	11.2	pass	129	2462.90	10.7	pass
10	2456.95	18.7	pass	90	2460.95	11.2	pass	130	2462.95	10.7	pass
11	2457.00	18.7	pass	91	2461.00	11.2	pass	131	2463.00	10.7	pass
12	2457.05	18.7	pass	92	2461.05	11.2	pass	132	2463.05	10.7	pass
13	2457.10	18.7	pass	93	2461.10	11.2	pass	133	2463.10	10.7	pass
14	2457.15	18.7	pass	94	2461.15	11.2	pass	134	2463.15	10.7	pass
15	2457.20	18.2	pass	95	2461.20	11.2	pass	135	2463.20	10.7	pass
16	2457.25	18.2	pass	96	2461.25	11.2	pass	136	2463.25	10.7	pass
17	2457.30	18.2	pass	97	2461.30	11.2	pass	137	2463.30	10.7	pass
18	2457.35	17.7	pass	98	2461.35	11.2	pass	138	2463.35	10.7	pass
19	2457.40	17.2	pass	99	2461.40	11.2	pass	139	2463.40	10.7	pass
20	2457.45	17.2	pass	100	2461.45	11.2	pass	140	2463.45	10.7	pass
21	2457.50	17.2	pass	101	2461.50	11.2	pass	141	2463.50	10.7	pass
22	2457.55	17.2	pass	102	2461.55	11.2	pass	142	2463.55	10.7	pass
23	2457.60	16.7	pass	103	2461.60	11.2	pass	143	2463.60	10.7	pass
24	2457.65	16.7	pass	104	2461.65	11.2	pass	144	2463.65	10.7	pass
25	2457.70	16.2	pass	105	2461.70	11.2	pass	145	2463.70	10.7	pass
26	2457.75	15.7	pass	106	2461.75	11.2	pass	146	2463.75	10.7	pass
27	2457.80	15.7	pass	107	2461.80	11.2	pass	147	2463.80	10.7	pass
28	2457.85	15.7	pass	108	2461.85	11.2	pass	148	2463.85	10.7	pass
29	2457.90	15.2	pass	109	2461.90	11.2	pass	149	2463.90	10.7	pass
30	2457.95	14.7	pass	110	2461.95	11.2	pass	150	2463.95	10.7	pass
31	2458.00	14.7	pass	111	2462.00	11.2	pass	151	2464.00	10.7	pass
32	2458.05	14.7	pass	112	2462.05	11.2	pass	152	2464.05	10.7	pass
33	2458.10	13.7	pass	113	2462.10	11.2	pass	153	2464.10	10.7	pass
34	2458.15	13.7	pass	114	2462.15	11.2	pass	154	2464.15	10.7	pass
35	2458.20	13.7	pass	115	2462.20	11.2	pass	155	2464.20	10.7	pass
36	2458.25	13.7	pass	116	2462.25	10.7	pass	156	2464.25	10.7	pass
37	2458.30	13.7	pass	117	2462.30	10.7	pass	157	2464.30	10.7	pass
38	2458.35	13.7	pass	118	2462.35	10.7	pass	158	2464.35	10.7	pass
39	2458.40	13.7	pass	119	2462.40	10.7	pass	159	2464.40	10.7	pass
40	2458.45	13.7	pass	120	2462.45	10.7	pass	160	2464.45	10.7	pass
drop 20% = 340 x 20% = 68 : therefore can drop up to 68 lowest pts											

processing gain by method of jamming margin using Debugger Software Linktest

tester name : Jim Nahra / Jim Friedmann

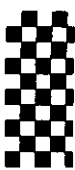
$$G_p = S/N + M_I + L_{sys}; \text{ where } S/N = 16.0 \text{ dB as per CCK modulation; } L_{sys} = 2\text{dB}$$

input signal level = -60 dBm, jammer level = -67.3 dBm, then $M_j = -7.3$ dB for 10.5 BER

$G_p = 16.0 \text{ dB} + -7.3 \text{ dB} + 2 \text{ dB} = 10.7 \text{ dB}$ (worst case point after lowest 20% discarded)

[illegible]

test	drop 20% = 340 x 20% = 68 ; therefore can drop 68 lowest pts, next lowest pt is 10.7 dB, therefore unit passes proc gain														
161	2464.50	10.7	pass	207	2466.80	10.7	pass	252	2469.00	11.2	pass	296	2471.25	13.7	pass
162	2464.55	10.7	pass	208	2466.85	10.7	pass	253	2469.05	11.2	pass	297	2471.30	14.2	pass
163	2464.60	10.7	pass	209	2466.90	10.7	pass	254	2469.10	11.2	pass	298	2471.35	14.2	pass
164	2464.65	10.7	pass	210	2466.95	10.7	pass	255	2469.15	11.2	pass	299	2471.40	14.2	pass
165	2464.70	10.7	pass	211	2467.00	10.7	pass	256	2469.20	11.2	pass	300	2471.45	14.2	pass
166	2464.75	10.7	pass	212	2467.05	10.7	pass	257	2469.25	11.2	pass	301	2471.50	14.2	pass
167	2464.80	10.7	pass	213	2467.10	10.7	pass	258	2469.30	11.2	pass	302	2471.55	14.7	pass
168	2464.85	10.7	pass	214	2467.15	10.7	pass	259	2469.40	11.2	pass	303	2471.60	14.7	pass
169	2464.90	10.7	pass	215	2467.20	10.7	pass	260	2469.45	11.2	pass	304	2471.65	14.7	pass
170	2464.95	10.7	pass	216	2467.25	10.7	pass	261	2469.50	11.2	pass	305	2471.70	14.7	pass
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172	2465.05	10.7	pass	218	2467.35	10.2	pass-disc	263	2469.60	11.2	pass	307	2471.80	15.2	pass
173	2465.10	10.7	pass	219	2467.40	10.2	pass-disc	264	2469.65	11.2	pass	308	2471.85	15.7	pass
174	2465.15	10.7	pass	220	2467.45	9.2	Fail-discard	265	2469.70	11.2	pass	309	2471.90	15.7	pass
175	2465.20	10.7	pass	221	2467.50	9.2	Fail-discard	266	2469.75	11.2	pass	310	2471.95	15.7	pass
176	2465.25	10.7	pass	222	2467.55	9.2	Fail-discard	267	2469.80	11.2	pass	311	2472.00	16.2	pass
177	2465.30	10.7	pass	223	2467.60	9.2	Fail-discard	268	2469.85	11.2	pass	312	2472.05	16.2	pass
178	2465.35	10.7	pass	224	2467.65	9.2	Fail-discard	269	2469.90	11.2	pass	313	2472.10	16.2	pass
179	2465.40	10.7	pass	225	2467.70	9.2	Fail-discard	270	2469.95	11.2	pass	314	2472.15	16.7	pass
180	2465.45	10.7	pass	226	2467.75	9.2	Fail-discard	271	2470.00	11.2	pass	315	2472.20	16.7	pass
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184	2465.65	10.7	pass	230	2467.95	9.7	Fail-discard	275	2470.20	11.7	pass	319	2472.40	17.2	pass
185	2465.70	10.7	pass	231	2468.00	9.7	Fail-discard	276	2470.25	11.7	pass	320	2472.45	17.2	pass
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190	2465.95	10.7	pass	236	2468.25	10.2	pass-disc	281	2470.50	12.2	pass	325	2472.70	18.7	pass
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194	2466.15	10.7	pass	240	2468.45	10.2	pass-disc	285	2470.70	13.2	pass	329	2472.90	19.2	pass
195	2466.20	10.7	pass	241	2468.50	10.2	pass-disc	286	2470.75	13.2	pass	330	2472.95	19.7	pass
196	2466.25	10.7	pass	242	2468.55	10.2	pass-disc	287	2470.80	13.2	pass	331	2473.00	19.7	pass
197	2466.30	10.7	pass	243	2468.60	10.2	pass-disc	288	2470.85	13.2	pass	332	2473.05	20.2	pass
198	2466.35	10.7	pass	244	2468.65	10.2	pass-disc	289	2470.90	13.2	pass	333	2473.10	20.2	pass
199	2466.40	10.7	pass	245	2468.70	10.2	pass-disc	290	2470.95	13.2	pass	334	2473.15	20.2	pass
200	2466.45	10.7	pass	246	2468.75	10.7	pass	291	2471.00	13.2	pass	335	2473.20	20.2	pass
201	2466.50	10.7	pass	247	2468.80	10.7	pass	292	2471.05	13.7	pass	336	2473.25	20.7	pass
202	2466.55	10.7	pass	248	2468.85	10.7	pass	293	2471.10	13.7	pass	337	2473.30	20.7	pass
203	2466.60	10.7	pass	249	2468.90	10.7	pass	294	2471.15	13.7	pass	338	2473.35	21.7	pass
204	2466.65	10.7	pass	250	2468.95	11.2	pass	295	2471.20	13.7	pass	339	2473.40	21.7	pass
205	2466.70	10.7	pass									340	2473.45	22.2	pass



MFG
M. Flom Associates, Inc. - Global Compliance Center
3356 North San Marcos Place, Suite 107, Chandler, Arizona 85224-1571
www.goodnet.com/~mflom, (602) 926-3100, FAX: 926-3598

TOTAL PAGES:	1
DATE:	February 10, 1999
VIA FAX:	1 301 344 2050
TO:	Federal Communications Commission,
ATTENTION:	Joe Dichoso, Electronics Engineer
APPLICANT:	Airnet Wireless Communications, Inc.
EQUIPMENT:	FCC ID: LOZ102035 Confirm. EA92699
SUBJECT:	Your phone call today

Joe:

Once again, thank you for your prompt phone response to our fax. It is very much appreciated in saving time.
In searching through our lab test records, we found the information which is required, i.e.

TUNED, MHZ.

CONDUCTED POWER, dbm and mw

2412	20	1003
2442	19.3	85
2442	19.3	85

Trust this meets your needs.

Regards,

M. Flom

MORTON FLOM, P. Eng.

mfl.mgt