ANNEX 1 PROCESSING GAIN OF DIRECT SEQUENCE SPREAD SPECTRUM MEASUREMENT

1. LIMITS OF PROCESSING GAIN OF A DIRECT SEQUENCE SPREAD SPECTRUM MEASUREMENT

The limit of processing gain is 10dB

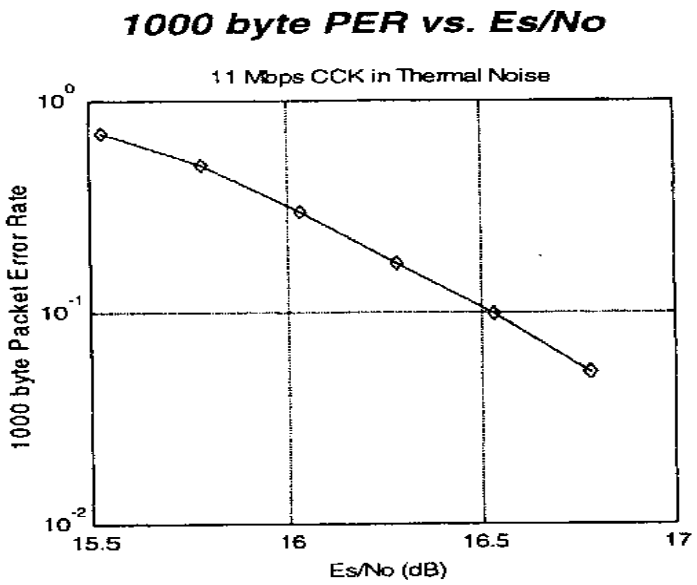
1.1 TEST INSTRUMENTS & SUPPORT UNIT

Description & Manufacturer	Model No.	Serial No.
Anritsu Spectrum Analyzer, 9kHz to 30GHz	MS2667C	M10281
Anritsu Signal Generator, 10kHz to 20GHz	68247B	984703
Hewlett Packard Power Meter,	HP438A	2743A04416
Hewlett Packard Power Sensor, -30 to 20dBm	8485A	2942A08387
Hewlett Packard Step Attenuator, 10dB steps	HP8496B	3247A18505
Mini-Circuits Power Splitter	ZN2PD-9G	NA
DELL Laptop Computer	Inspiron 5000e	NA
Campaq Laptop Computer	PPX	99125

1.2 METHOD OF MEASUREMENT

The processing gain may be measured using the CW jamming margin method. Section 4.7.4 shows the test configuration. The test consists of stepping a signal generator in 50 kHz increments across the passband of the system. At each point, the generator level required to produce the recommended Bit Error Rate (BER) is recorded. This level is 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. The lowest remaining J/S ratio is used when calculating the Process Gain.

The reference PER is specified as 8%. The corresponding Es/No (signal to noise ratio per symbol) is 16.4 dB. The curve is attached as below.



This value and the measured J/S ratio are used in the following equation to calculate the Process Gain (Gp) of the system.

$$Gp = (S/N)_o + Mj + Lsys$$

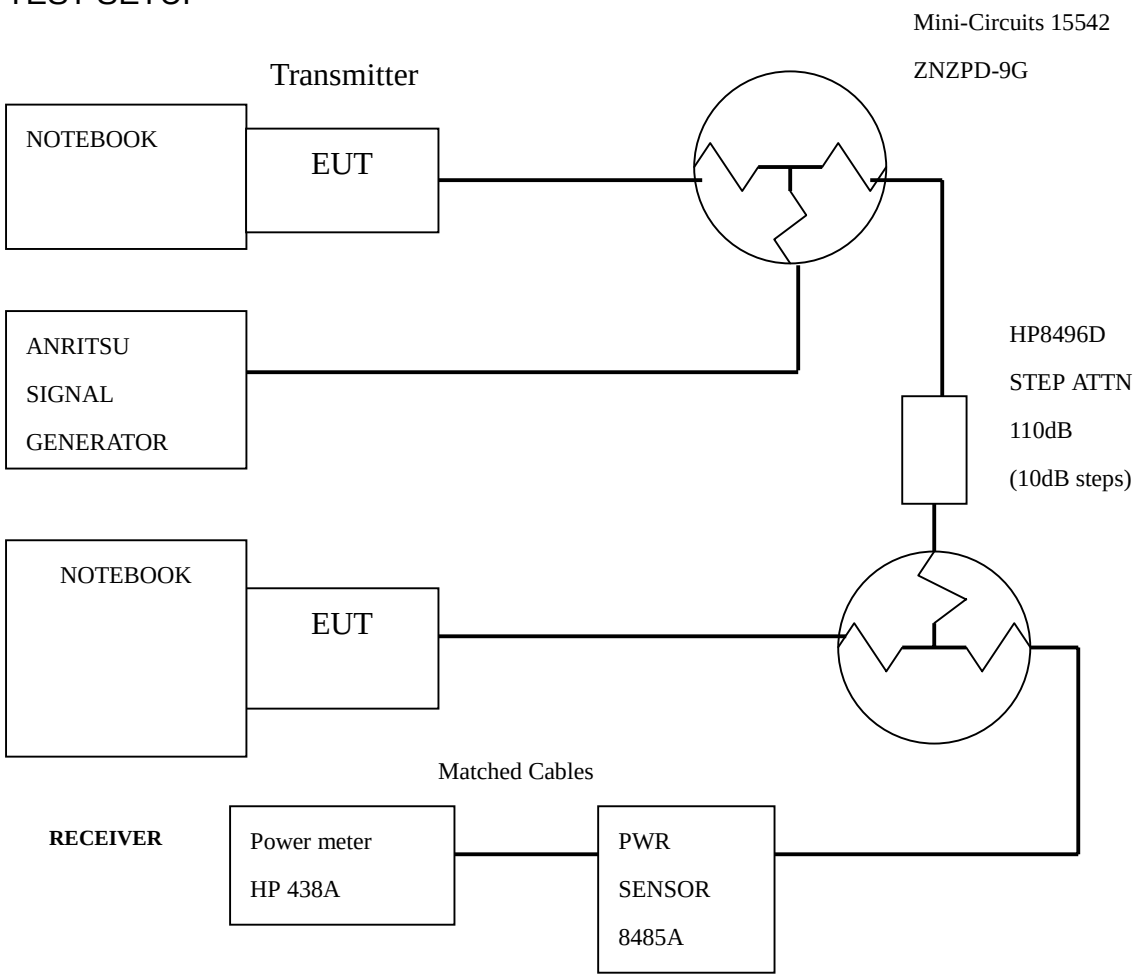
Where:

$(S/N)_o$: Signal to noise ratio for the chosen BER.

Mj : Maximum jammer to Signal Ratio recorded at the detected BER.

Lsys : System losses . For the purpose of this processing gain calculation, we assume Lsys at its minimum value of 2 dB.

TEST SETUP



1.3 TEST PROCEDURES

Obtain the simplex link shown. Perform all independent instrumentation calibrations prior to this procedure. Set operating power levels using fixed and variable attenuators in system to meet the following objectives:

Signal Power at receiver approximately –55dBm (above thermal sensitivity such that thermal noise does not cause bit errors.

Signal Power at power meter between –20 and –30dBm for optimal linearity.

Use spectrum analyzer to monitor test.

Ensure that CW Jammer generator RF output is disabled and measure the power at the power meter port using the power meter. This is the relative signal power, Sr.

Disable Transmitter, and set CW Jammer generator RF output frequency equal to the carrier frequency and enable generator output. Set reference CW Jammer power level at power meter port 8.4dB below Sr (minimum J/S, or 10dB processing gain reference level). Note the power level setting on the generator, this is the reference CW Jammer power setting, Jr.

Disable CW Jammer, re-establish link. PER test should be operating essentially error -free.

Enable CW Jammer at the reference power level and verify that the PER test indicates a PER of less than 8%.

Alternatively, adjust the CW Jammer level to that which causes 8% PER and verify that the S/J is less than 8.4dB.

Repeat step 7 for uniform steps in frequency increments of 50 kHz across the receiver passband with the CW Jammer. In this case the receiver passband is +/- 8.5 MHz.

The numerical data associated with the following radio channel is tabulated and presented for Channel 1,6, and 11.

Note:Since the jamming signal will be blocked by the IF filter if the jamming frequency is far form the center of the carrier frequency. So, only those frequencies around carrier frequency are shown here.

1.4 EUT OPERATING CONDITION

The software provided by client to set the EUT to transmit at lowest, middle and highest channel.

1.5 TEST RESULTS

EUT	FreePort 11M USB WLAN Adapter	**Model**	BUW200-AF
Environmental Conditions	20℃,65%RH	**Tested By**	Steven Lu

Although the theoretical processing gain is lower than 10 dB, but the CCK coding provides an extra coding gain of 2.2dB.

11Mbps CHANNEL 1 Processing Gain				
Gp = (S/N)+ Mj + Lsys				
Freq. (GHz)	**Gp (dB)**	**(S/N) (dB)**	**Mj = J/S (dB)**	**Lsys (dB)**
2.4095	11.5	16.4	-6.9	2
2.40955	13.4	16.4	-5	2
2.4096	13.4	16.4	-5	2
2.40965	13.4	16.4	-5	2
2.4097	11	16.4	-7.4	2
2.40975	11	16.4	-7.4	2
2.4098	10.9	16.4	-7.5	2
2.40985	10.9	16.4	-7.5	2
2.4099	11.3	16.4	-7.1	2
2.40995	11.3	16.4	-7.1	2
2.41	10.6	16.4	-7.8	2
2.41005	10.8	16.4	-7.6	2
2.4101	10.8	16.4	-7.6	2
2.41015	11.6	16.4	-6.8	2
2.4102	11.7	16.4	-6.7	2
2.41025	11.5	16.4	-6.9	2
2.4103	11.1	16.4	-7.3	2
2.41035	11.5	16.4	-6.9	2
2.4104	11.1	16.4	-7.3	2
2.41045	11.2	16.4	-7.2	2
2.4105	11.6	16.4	-6.8	2
2.41055	11	16.4	-7.4	2
2.4106	10.9	16.4	-7.5	2
2.41065	11.2	16.4	-7.2	2
2.4107	11.2	16.4	-7.2	2
2.41075	11.1	16.4	-7.3	2
2.4108	10.9	16.4	-7.5	2

11Mbps CHANNEL 1 Processing Gain				
Gp = (S/N)+ Mj + Lsys				
Freq. (GHz)	Gp (dB)	(S/N) (dB)	Mj = J/S (dB)	Lsys (dB)
2.41085	11.9	16.4	-6.5	2
2.4109	12.1	16.4	-6.3	2
2.41095	12	16.4	-6.4	2
2.411	11.4	16.4	-7	2
2.41105	11.2	16.4	-7.2	2
2.4111	11.1	16.4	-7.3	2
2.41115	11.4	16.4	-7	2
2.4112	11.9	16.4	-6.5	2
2.41125	12	16.4	-6.4	2
2.4113	11.1	16.4	-7.3	2
2.41135	11.6	16.4	-6.8	2
2.4114	11.2	16.4	-7.2	2
2.41145	10.9	16.4	-7.5	2
2.4115	11.6	16.4	-6.8	2
2.41155	11	16.4	-7.4	2
2.4116	11.2	16.4	-7.2	2
2.41165	11.4	16.4	-7	2
2.4117	11.7	16.4	-6.7	2
2.41175	11.6	16.4	-6.8	2
2.4118	11.4	16.4	-7	2
2.41185	11.5	16.4	-6.9	2
2.4119	10.8	16.4	-7.6	2
2.41195	10.6	16.4	-7.8	2
2.412	10.5	16.4	-7.9	2
2.41205	10.5	16.4	-7.9	2
2.4121	10.9	16.4	-7.5	2
2.41215	11.7	16.4	-6.7	2
2.4122	10.8	16.4	-7.6	2
2.41225	10.6	16.4	-7.8	2
2.4123	11.5	16.4	-6.9	2
2.41235	11.9	16.4	-6.5	2
2.4124	11.9	16.4	-6.5	2
2.41245	11.6	16.4	-6.8	2
2.4125	11.5	16.4	-6.9	2
2.41255	11.7	16.4	-6.7	2
2.4126	11.5	16.4	-6.9	2
2.41265	11.1	16.4	-7.3	2
2.4127	12	16.4	-6.4	2
2.41275	11.5	16.4	-6.9	2
2.4128	12.3	16.4	-6.1	2
2.41285	12.1	16.4	-6.3	2

11Mbps CHANNEL 1 Processing Gain				
Gp = (S/N)+ Mj + Lsys				
Freq.	**Gp**	**(S/N)**	**Mj = J/S**	**Lsys**
(GHz)	**(dB)**	**(dB)**	**(dB)**	**(dB)**
2.4129	12.2	16.4	-6.2	2
2.41295	11.4	16.4	-7	2
2.413	11.2	16.4	-7.2	2
2.41305	11.2	16.4	-7.2	2
2.4131	11.9	16.4	-6.5	2
2.41315	12	16.4	-6.4	2
2.4132	11.9	16.4	-6.5	2
2.41325	12.1	16.4	-6.3	2
2.4133	11.2	16.4	-7.2	2
2.41335	11.2	16.4	-7.2	2
2.4134	11.2	16.4	-7.2	2
2.41345	11.9	16.4	-6.5	2
2.4135	12.1	16.4	-6.3	2
2.41355	12.2	16.4	-6.2	2
2.4136	11.5	16.4	-6.9	2
2.41365	11.5	16.4	-6.9	2
2.4137	11.6	16.4	-6.8	2
2.41375	11.6	16.4	-6.8	2
2.4138	11.9	16.4	-6.5	2
2.41385	11.2	16.4	-7.2	2
2.4139	10.9	16.4	-7.5	2
2.41395	10.8	16.4	-7.6	2
2.414	10.9	16.4	-7.5	2
2.41405	11.4	16.4	-7	2
2.4141	11.4	16.4	-7	2
2.41415	11.6	16.4	-6.8	2
2.4142	11.5	16.4	-6.9	2
2.41425	11.7	16.4	-6.7	2
2.4143	11.9	16.4	-6.5	2
2.41435	12	16.4	-6.4	2
2.4144	11.5	16.4	-6.9	2
2.41445	11.2	16.4	-7.2	2
2.4145	11.2	16.4	-7.2	2

11Mbps CHANNEL 6 Processing Gain				
Gp = (S/N)+ Mj + Lsys				
Freq. (GHz)	**Gp (dB)**	**(S/N) (dB)**	**Mj = J/S (dB)**	**Lsys (dB)**
2.4345	11.5	16.4	-6.9	2
2.43455	11.5	16.4	-6.9	2
2.4346	11.5	16.4	-6.9	2
2.43465	11	16.4	-7.4	2
2.4347	11	16.4	-7.4	2
2.43475	10.8	16.4	-7.6	2
2.4348	10.6	16.4	-7.8	2
2.43485	10.7	16.4	-7.7	2
2.4349	11.2	16.4	-7.2	2
2.43495	11.2	16.4	-7.2	2
2.435	11.2	16.4	-7.2	2
2.43505	10.8	16.4	-7.6	2
2.4351	11.1	16.4	-7.3	2
2.43515	11.2	16.4	-7.2	2
2.4352	10.8	16.4	-7.6	2
2.43525	11.6	16.4	-6.8	2
2.4353	11.5	16.4	-6.9	2
2.43535	11.5	16.4	-6.9	2
2.4354	11.7	16.4	-6.7	2
2.43545	11.8	16.4	-6.6	2
2.4355	11.6	16.4	-6.8	2
2.43555	11.5	16.4	-6.9	2
2.4356	10.8	16.4	-7.6	2
2.43565	10.9	16.4	-7.5	2
2.4357	10.9	16.4	-7.5	2
2.43575	11	16.4	-7.4	2
2.4358	11.2	16.4	-7.2	2
2.43585	11.1	16.4	-7.3	2
2.4359	11	16.4	-7.4	2
2.43595	11.4	16.4	-7	2
2.436	11.9	16.4	-6.5	2
2.43605	11.6	16.4	-6.8	2
2.4361	11.2	16.4	-7.2	2
2.43615	11.1	16.4	-7.3	2

11Mbps CHANNEL 6 Processing Gain				
Gp = (S/N)+ Mj + Lsys				
Freq. (GHz)	**Gp (dB)**	**(S/N) (dB)**	**Mj = J/S (dB)**	**Lsys (dB)**
2.4362	11.9	16.4	-6.5	2
2.43625	11.9	16.4	-6.5	2
2.4363	11.9	16.4	-6.5	2
2.43635	11.1	16.4	-7.3	2
2.4364	11.1	16.4	-7.3	2
2.43645	11.2	16.4	-7.2	2
2.4365	11.2	16.4	-7.2	2
2.43655	11.3	16.4	-7.1	2
2.4366	11.3	16.4	-7.1	2
2.43665	12	16.4	-6.4	2
2.4367	12	16.4	-6.4	2
2.43675	10.9	16.4	-7.5	2
2.4368	11	16.4	-7.4	2
2.43685	11.4	16.4	-7	2
2.4369	11.4	16.4	-7	2
2.43695	10.7	16.4	-7.7	2
2.437	10.7	16.4	-7.7	2
2.43705	11	16.4	-7.4	2
2.4371	10.9	16.4	-7.5	2
2.43715	11	16.4	-7.4	2
2.4372	10.8	16.4	-7.6	2
2.43725	11.9	16.4	-6.5	2
2.4373	12.1	16.4	-6.3	2
2.43735	12.1	16.4	-6.3	2
2.4374	11.6	16.4	-6.8	2
2.43745	11.5	16.4	-6.9	2
2.4375	11.2	16.4	-7.2	2
2.43755	11.7	16.4	-6.7	2
2.4376	11.6	16.4	-6.8	2
2.43765	11.2	16.4	-7.2	2
2.4377	11.2	16.4	-7.2	2
2.43775	11	16.4	-7.4	2
2.4378	11.4	16.4	-7	2
2.43785	11.5	16.4	-6.9	2

11Mbps CHANNEL 6 Processing Gain				
Gp = (S/N)+ Mj + Lsys				
Freq. (GHz)	**Gp (dB)**	**(S/N) (dB)**	**Mj = J/S (dB)**	**Lsys (dB)**
2.4379	12.1	16.4	-6.3	2
2.43795	12	16.4	-6.4	2
2.438	12	16.4	-6.4	2
2.43805	11.9	16.4	-6.5	2
2.4381	11.9	16.4	-6.5	2
2.43815	11.5	16.4	-6.9	2
2.4382	11.2	16.4	-7.2	2
2.43825	11	16.4	-7.4	2
2.4383	11	16.4	-7.4	2
2.43835	11.1	16.4	-7.3	2
2.4384	11.6	16.4	-6.8	2
2.43845	11	16.4	-7.4	2
2.4385	11	16.4	-7.4	2
2.43855	11.1	16.4	-7.3	2
2.4386	11.1	16.4	-7.3	2
2.43865	11.2	16.4	-7.2	2
2.4387	11.2	16.4	-7.2	2
2.43875	11.4	16.4	-7	2
2.4388	11	16.4	-7.4	2
2.43885	11.1	16.4	-7.3	2
2.4389	11.4	16.4	-7	2
2.4895	10.8	16.4	-7.6	2
2.439	10.8	16.4	-7.6	2
2.43905	10.7	16.4	-7.7	2
2.4391	10.7	16.4	-7.7	2
2.43915	11	16.4	-7.4	2
2.4392	10.9	16.4	-7.5	2
2.43925	10.8	16.4	-7.6	2
2.4393	11.4	16.4	-7	2
2.43935	11.4	16.4	-7	2
2.4394	11.6	16.4	-6.8	2
2.43945	11.6	16.4	-6.8	2
2.4395	11.4	16.4	-7	2

11Mbps CHANNEL 11 Processing Gain				
Gp = (S/N)+ Mj + Lsys				
Freq. (GHz)	**Gp (dB)**	**(S/N) (dB)**	**Mj = J/S (dB)**	**Lsys (dB)**
2.4595	11.5	16.4	-6.9	2
2.45955	11.6	16.4	-6.8	2
5.4596	11.6	16.4	-6.8	2
2.45965	11.9	16.4	-6.5	2
2.4597	11.9	16.4	-6.5	2
2.45975	11.1	16.4	-7.3	2
2.4598	11.2	16.4	-7.2	2
2.45985	11.2	16.4	-7.2	2
2.4599	11.2	16.4	-7.2	2
2.45995	11	16.4	-7.4	2
2.46	11	16.4	-7.4	2
2.46005	11.1	16.4	-7.3	2
2.4601	11.6	16.4	-6.8	2
2.46015	11.7	16.4	-6.7	2
2.4602	11.7	16.4	-6.7	2
2.46025	11.9	16.4	-6.5	2
2.4603	11.9	16.4	-6.5	2
2.46035	12	16.4	-6.4	2
2.4604	11.5	16.4	-6.9	2
2.46045	11.4	16.4	-7	2
2.4605	11.2	16.4	-7.2	2
2.46055	11	16.4	-7.4	2
2.4606	10.9	16.4	-7.5	2
2.46065	11.1	16.4	-7.3	2
2.4607	11.2	16.4	-7.2	2
2.46075	11.5	16.4	-6.9	2
2.4608	11.5	16.4	-6.9	2
2.46085	11.6	16.4	-6.8	2
2.4609	11.4	16.4	-7	2
2.46095	11.5	16.4	-6.9	2
2.461	11.7	16.4	-6.7	2
2.46105	12	16.4	-6.4	2
2.4611	11.6	16.4	-6.8	2
2.46115	12.2	16.4	-6.2	2

11Mbps CHANNEL 11 Processing Gain				
Gp = (S/N)+ Mj + Lsys				
Freq. (GHz)	**Gp (dB)**	**(S/N) (dB)**	**Mj = J/S (dB)**	**Lsys (dB)**
2.4612	12	16.4	-6.4	2
2.46125	11.9	16.4	-6.5	2
2.4613	11.9	16.4	-6.5	2
2.46135	12.3	16.4	-6.1	2
2.4614	12.2	16.4	-6.2	2
2.46145	12.4	16.4	-6	2
2.4615	11.9	16.4	-6.5	2
2.46155	11.9	16.4	-6.5	2
2.4616	11.8	16.4	-6.6	2
2.46165	12	16.4	-6.4	2
2.4617	12.2	16.4	-6.2	2
2.46175	11.9	16.4	-6.5	2
2.4618	12.1	16.4	-6.3	2
2.46185	12	16.4	-6.4	2
2.4619	11.6	16.4	-6.8	2
2.46195	12	16.4	-6.4	2
2.462	11.8	16.4	-6.6	2
2.46205	12.1	16.4	-6.3	2
2.4621	11.9	16.4	-6.5	2
2.46215	12.4	16.4	-6	2
2.4622	12	16.4	-6.4	2
2.46225	12.2	16.4	-6.2	2
2.4623	12.7	16.4	-5.7	2
2.46235	12.6	16.4	-5.8	2
2.4624	12.5	16.4	-5.9	2
2.46245	12.5	16.4	-5.9	2
2.4625	12.6	16.4	-5.8	2
2.46255	12.7	16.4	-5.7	2
2.4626	12.8	16.4	-5.6	2
2.46265	11.9	16.4	-6.5	2
2.4627	11.9	16.4	-6.5	2
2.46275	12	16.4	-6.4	2
2.4628	12.1	16.4	-6.3	2
2.46285	12.1	16.4	-6.3	2

11Mbps CHANNEL 11 Processing Gain				
Gp = (S/N)+ Mj + Lsys				
Freq. (GHz)	**Gp (dB)**	**(S/N) (dB)**	**Mj = J/S (dB)**	**Lsys (dB)**
2.4629	12.4	16.4	-6	2
2.46295	11.9	16.4	-6.5	2
2.463	12	16.4	-6.4	2
2.46305	12.1	16.4	-6.3	2
2.4631	11.9	16.4	-6.5	2
2.46315	11.7	16.4	-6.7	2
2.4632	12.1	16.4	-6.3	2
2.46325	12.1	16.4	-6.3	2
2.4633	11.5	16.4	-6.9	2
2.46335	12	16.4	-6.4	2
2.4634	12	16.4	-6.4	2
2.46345	11.6	16.4	-6.8	2
2.4635	11.5	16.4	-6.9	2
2.46355	12	16.4	-6.4	2
2.4636	11.7	16.4	-6.7	2
2.46365	12.4	16.4	-6	2
2.4637	12.4	16.4	-6	2
2.46375	12.2	16.4	-6.2	2
2.4638	11.6	16.4	-6.8	2
2.46385	12.3	16.4	-6.1	2
2.4639	12	16.4	-6.4	2
2.46395	11.6	16.4	-6.8	2
2.464	12.1	16.4	-6.3	2
2.46405	12.1	16.4	-6.3	2
2.4641	11.5	16.4	-6.9	2
2.46415	12	16.4	-6.4	2
2.4642	11.7	16.4	-6.7	2
2.46425	12.1	16.4	-6.3	2
2.4643	11.8	16.4	-6.6	2
2.46435	12	16.4	-6.4	2
4.4644	12	16.4	-6.4	2
2.46445	11.9	16.4	-6.5	2
2.4645	11.9	16.4	-6.5	2