

Radiation effects and optimum radiation

Abstract: Radiation from computers, televisions is a human health and mind. This paper focuses on measurement of radiation based on three control parameters such as : 1. Distance, 2. Flux and 3. Angle of measurement. Levels fixed are two in number. A Taguchi design of it is made and tested and results are plotted. Based on Taguchi model, optimum condition is obtained.

1. Introduction:

Radiation is emitted by electrical, electronic sources etc. cannot be neglected as human body is continuously affected by radiation due to computers, laptops, televisions, WI-FI devices etc. Due to need of world today electronic devices cannot be substituted by any other devices. Hence it is necessary to study the control parameters or factors of radiation and find a optimum solution so that radiation can be kept at a low level. Mobile telephones, television, radio transmitters and radar produce RF fields. These fields are used to transmit information over long distances and form the basis of telecommunications as well as radio and television broadcasting all over the world. According to the World Health Organisation, the time varying electromagnetic fields produced by electrical appliances are an example of extremely low frequency (ELF) fields, which generally have frequencies upto 300 Hz, our electricity power supply and all appliances using electricity are the main sources of ELF fields.

The National Institute of Environmental Health Sciences describe EMFs as invisible areas of energy, often referred to as radiation, that are associated with the use of electrical power and various forms of natural and man made lighting. Electromagnetic radiation may surround

us in modern everyday life. while some forms of electromagnetic radiation are known to be harmful, other forms are more controversial. In today's world

Electromagnetic Radiation are electric fields that develop through variances in voltage, and there are magnetic fields that develop from the flow of electric current. The higher the electric field or the greater the magnetic field, the stronger the electromagnetic radiation.

Wi-Fi is a relatively newer technology, some organisations deem it safe while others say its posing a public health threat. Technically Wi-Fi works in the range of 2.4 GHz frequency, the same as microwave oven.

Environmental Health Trust warns of the dangers of electromagnetic radiation, saying it contributes to body burden. The organisation points to research showing that the protective barrier of the brain- the blood-brain barrier -is compromised due to wireless electromagnetic radiation. Several studies suggest wireless radiation pokes holes in this protective barrier, causing more toxic compounds to reach the brain.

2. Modelling of System:

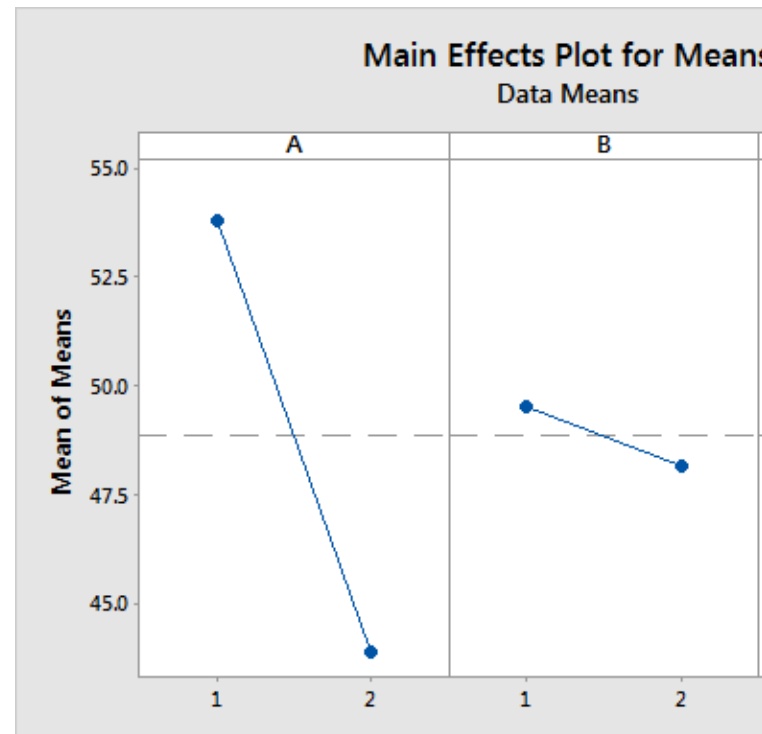
A system is designed such that it includes source of radiation, radiation measurement meter. The control factor taken into consideration are 1. Distance, 2. Flux and 3. angle of measurement of radiation. Levels of measurements are decided to be two, level 1 and level 2. In case of distance level 1 is near the source of radiation i.e. computer. Level 2 is away from source of radiation at a distance of 1 m. For flux level 1 signifies maximum level and level 2 signifies minimum level. Angle level 1 refers to angle of 90 degrees of measurement of radiation, angle level 2 signifies angle of 180 degrees.

Depending on three control parameters, experiment to measure radiation is performed several times (8 times). Mean values of radiation are used for Taguchi analysis. Basic aim of the system is to find the combination and levels of control factors such as distance from source, flux and angle of measurement of radiation so that radiation emitted is lowest which is advantageous for human body.

Taguchi means Robust design. The system is analysed by Taguchi method. Mean values of radiation are entered in computer along with levels of three control factors and Taguchi design is analysed. Accordingly, optimum condition is studied.

3. Results and Discussions:

After entering mean values of radiation, Taguchi design is analysed. Following results are obtained:



From the above means table, it is clear that factor A i.e. distance of measurement from source affects radiation the most, then factor C i.e. Angle of measurement affects radiation, whereas factor B i.e. flux affects least.

When Taguchi design is analysed following results are produced by computer.

Taguchi Design

Taguchi Orthogonal Array Design

L8 (2³)

Factors: 3
Runs: 8

Columns of L8 (2⁷) Array

1 2 4

Taguchi Analysis: C4 versus A, B, C

* NOTE * Unable to perform linear model analysis.

The following terms cannot be estimated and were removed:

A*B
A*C
B*C

Response Table for Means

Level	A	B	C
1	53.78	49.53	47.56
2	43.91	48.16	50.13
Delta	9.88	1.38	2.56
Rank	1	3	2

Response Table for Standard Deviations

Level	A	B	C
1	*	*	*
2	*	*	*
Delta	*	*	*
Rank	2	2	2

Taguchi Analysis: C4 versus A, B, C

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Response Table for Standard Deviations

Level	A	B	C
1	*	*	*
2	*	*	*
Delta	*	*	*
Rank	2	2	2

Results for: Worksheet 3

Taguchi Analysis: C4 versus A, B, C

Predicted values

* NOTE * The response labeled "Ln(StDev)" contains all missing values. No predictions will be computed or stored for this response.

* NOTE * The response labeled "StDev" contains all missing values. No predictions will be computed or stored for this response.

Mean
53.4063

Factor levels for predictions

A	B	C
1	1	1

Above results are taken for condition of control parameters: 1.distance, 2. Flux and 3. Angle of measurement at level 1. Level 1 for distance is nearest to source, flux is maximum at level 1 and level 1 for angle of measurement of radiation is 90 degrees. Hence at these levels , distance from source affects radiation the most, then angle of measurement and then flux.

Response Table for Means

Level	A	B	C
1	53.78	49.53	47.56
2	43.91	48.16	50.13
Delta	9.88	1.38	2.56
Rank	1	3	2

Response Table for Standard Deviations

Level	A	B	C
1	*	*	*
2	*	*	*
Delta	*	*	*
Rank	2	2	2

Main Effects Plot for Means

* ERROR * No graphs will be plotted for SN ratios. All values are missing.

Taguchi Analysis: C4 versus A, B, C

Predicted values

* NOTE * The response labeled "Ln(StDev)" contains all missing values. No predictions will be computed or stored for this response.
 * NOTE * The response labeled "StDev" contains all missing values. No predictions will be computed or stored for this response.

Mean
 51.8125

Factor levels for predictions

A	B	C
1	2	1

The above results are for levels 1,2,1 for distance, flux and angle.

Taguchi Analysis: C4 versus A, B, C

Predicted values

* NOTE * The response labeled "Ln(StDev)" contains all missing values. No predictions will be computed or stored for this response.
 * NOTE * The response labeled "StDev" contains all missing values. No predictions will be computed or stored for this response.
 * NOTE * The response labeled "S/N Ratio" contains all missing values. No predictions will be computed or stored for this response.

Mean
 44.5

Factor levels for predictions

A	B	C
2	2	2

Taguchi Analysis: C4 versus A, B, C

* NOTE * Unable to perform linear model analysis.

Response Table for Means

Level	A	B	C
1	53.78	49.53	47.56
2	43.91	48.16	50.13
Delta	9.88	1.38	2.56
Rank	1	3	2

Response Table for Standard Deviations

Level	A	B	C
1	*	*	*
2	*	*	*
Delta	*	*	*
Rank	2	2	2

Main Effects Plot for Means

* ERROR * No graphs will be plotted for SN ratios. All values are missing.

Results for: Worksheet 3

Taguchi Analysis: C4 versus A, B, C

Predicted values

* NOTE * The response labeled "Ln(StDev)" contains all missing values. No predictions will be computed or stored for this response.
 * NOTE * The response labeled "StDev" contains all missing values. No predictions will be computed or stored for this response.

Mean
 44.7188

Factor levels for predictions

A	B	C
2	2	2

Taguchi Analysis: C4 versus A, B, C

Predicted values

* NOTE * The response labeled "Ln(StDev)" contains all missing values. No predictions will be computed or stored for this response.
 * NOTE * The response labeled "StDev" contains all missing values. No predictions will be

computed or stored for this response.

Mean
41.9375

Factor levels for predictions

A	B	C
2	2	1

Studying all the combinations of control factors and their levels, it is clear that radiation is least when source of radiation is far , fux is minimum and angle of measurement of radiation is 90 degrees. The mean value of radiation at this condition is 41.9375 excluding effect of terms AB,BC,AC which is minimum.

Taguchi Analysis: C4 versus A, B, C

The following terms cannot be estimated and were removed:

A*B
A*C
B*C

Response Table for Signal to Noise Ratios
Smaller is better

Level	A	B	C
1	-34.60	-33.84	-33.51
2	-32.85	-33.62	-33.95
Delta	1.76	0.22	0.44
Rank	1	3	2

Response Table for Means

Level	A	B	C
1	53.78	49.53	47.56
2	43.91	48.16	50.13
Delta	9.88	1.38	2.56
Rank	1	3	2

Taguchi Analysis: C4 versus A, B, C

Predicted values

* NOTE * The response labeled "Ln(StDev)" contains all missing values. No predictions will be computed or stored for this response.

* NOTE * The response labeled "StDev" contains all missing values. No predictions will be computed or stored for this response.

Mean
43.1563

Factor levels for predictions

A	B	C
2	2	1

The above result is obtained if we consider interactions of all three control factors.

4. Conclusions:

The radiation is measured for two levels for distance, flux and angle of measurement. Using Taguchi design optimum solution is found out so that radiation is at minimum level. Such condition arises when distance between source and measurement meter is large, flux is minimum and angle of measurement is 90 degrees.

If such optimal condition is satisfied radiation level at workplace can be safe.