



**On-Body Radio Propagation Channel Characterization
at 2.45 GHz and its Exposure Effects on
Neurophysiological and Behavioral of Adults**

By

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DECLARATION OF THESIS

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TABLE OF CONTENTS

THESIS DECLARATION	i
ACKNOWLEDGEMENT	ii
TABLE OF CONTENTS	iv
LIST OF FIGURES	viii
LIST OF TABLES	xiii
LIST OF ABBREVIATIONS	xvi
LIST OF SYMBOLS	xxi
ABSTRAK	xxv
ABSTRACT	xxvii
CHAPTER 1 INTRODUCTION	1
1.1 Background	1
1.2 Problem Statement and Motivation	3
1.3 Objectives of the Research	6
1.4 Scope of the Research	6
1.5 Organization of the Thesis	8
CHAPTER 2 LITERATURE REVIEW	10
2.1 Introduction	10
2.2 Body-centric Wireless Communications	10

2.3	Frequency Allocation for BCWC	13
2.4	Electromagnetic Waves Interactions	14
2.4.1	Electromagnetic Waves Incidence on Biological Tissues	14
2.4.2	Reflection by a Metal Surface	16
2.5	Overview of Antenna and Propagation for Body-Centric Wireless Communications	18
2.5.1	Antennas for Body-Centric Wireless Communications/WBAN	18
2.5.2	Characterization of On-body Radio Propagation Channel	21
2.5.3	Small-Scale (Fast) Fading	23
2.6	Overview of Radio Frequency Electromagnetic Field Exposure to Human	26
2.6.1	Dosimetry and Specific Absorption Rate (SAR)	27
2.6.2	RF-EMF Reference Levels	28
2.7	Neurophysiological, Behavioral and Physiological Outcomes	29
2.7.1	Neurophysiology (EEG)	29
2.7.2	Neurobehavioral (Cognitive) Performance	34
2.7.3	Subjective Symptoms and Physiological Parameters	37
2.7.4	Statistical Analysis	40
2.8	Radio Channel Characterization for Body-Centric Wireless Communications	42
2.9	The Effect of WBAN Exposure on EEG, Cognitive Performance, Well-being, Body Temperature, Blood Pressure, and Heart Rate	52
2.10	Summary	60
CHAPTER 3 RESEARCH METHODOLOGY		62
3.1	Introduction	62
3.2	Planar Wearable Antennas for Body-centric Radio Propagation Measurements	62
3.2.1	Planar Textile Monopole Antenna	62

3.2.2	Textile Patch Antenna	67
3.2.3	Dielectric Properties of the Textile Substrate	71
3.3	Measurement Setup for Subject-Specific Effect of Metallic Accessories	72
3.3.1	Investigated Scenarios	77
3.3.2	Reference Measurement	78
3.3.3	On-Body Measurement	78
3.4	Experimental Setup for RF Exposure	82
3.5	Shielding Effectiveness Measurement	84
3.6	RF Exposure and Dosimetry	87
3.7	EEG Recording	89
3.8	Cognitive Performance	91
3.9	Body Temperature, Blood Pressure, Heart Rate, and Well-being Subjective Symptoms	93
3.10	Summary	94
 CHAPTER 4 SUBJECT-SPECIFIC ON-BODY RADIO CHANNEL CONSIDERING METALLIC ACCESSORIES ON THE BODY		96
4.1	Introduction	96
4.2	Effect of Metallic Spectacles	96
4.3	Effect of a Loop-Like Metallic Accessory	101
4.4	On-Body Radio Channel Characterization for Dynamic Motion Considering Metallic Watch	107
4.5	Statistical Modelling of Dynamic On-body Channel	114
4.6	Summary	120
 CHAPTER 5 THE EFFECTS OF WBAN TEXTILE ANTENNA RADIATION ON EEG, COGNITIVE PERFORMANCE, WELL-BEING, BODY TEMPERATURE, BLOOD PRESSURE AND HEART RATE		122
5.1	Introduction	122

5.2	Neurophysiological (EEG)	123
5.2.1	WBAN Exposure by Wearable Textile Monopole on Left and Right Brain Hemispheres	123
5.2.2	Effects of Different Types of Wearable Textile Antennas on the Left and Right Brain Hemispheres	129
5.2.3	Effect of Various Types of Wearable Textile Antenna on EEG Rhythms in the Left and Right Hemispheres	133
5.3	Cognitive Performance	138
5.4	Well-being Subjective Symptoms	139
5.5	Body Temperature, Blood Pressure, and Heart Rate	141
5.6	Summary	144
CHAPTER 6 CONCLUSIONS		147
6.1	Conclusions	147
6.2	Major Contributions of the Research	149
6.3	Recommendations for Future Work	150
REFERENCES		152
APPENDIX A		164
APPENDIX B		165
APPENDIX C		168
APPENDIX D		168
PUBLICATIONS		178
RESEARCH AWARD		181

LIST OF FIGURES

NO.		PAGE
2.1	Wearable body-centric wireless communications (Hall et al., 2012).	11
2.2	Analogy of electromagnetic wave incidence on biological tissues (Pozar, 2005).	15
2.3	Reflection of an electromagnetic wave by a metal surface.	17
2.4	The two proposed textile antennas: (a) slotted planar inverted-F antenna (Soh et al., 2012) (PIFA) and (b) slotted patch antenna (Soh et al., 2013).	21
2.5	The human brain structure (“Human Brain Structure,” 2015).	30
2.6	Main regions of the human brain (Mullinger, 2008).	31
2.7	EEG example captured using Emotive EPOC EEG headset.	33
2.8	Frequency bands of EEG rhythms.	33
2.9	Four main features of cognitive function.	35
2.10	Bell-shaped curve.	41
2.11	Measured and modelled path loss versus antenna separation along the torso (Reusens et al., 2009).	44
2.12	Simulated and measured path loss for subjects Female01 and Male01 in NLOS (Zhao et al., 2011).	49

2.13	Simulated and measured path loss for subjects Female01 and Male01 for UWB on-body radio channel in LOS (Abbasi et al., 2012).	51
3.1	Structure and dimensions of (a) planar TM in millimeters and its (b) fabrication prototype in front and back views.	64
3.2	Simulated and measured S_{11} of TM for (a) free space (b) on body (right upper arm and left chest) and (c) on right upper arm when placed at various distances from the body (3, 5, and 10 mm).	66
3.3	Simulated and measured radiation pattern of TM antenna in free space and simulated radiation patterns on the body. (a) $\varphi=90^\circ$ (left) and (b) $\theta=90^\circ$ (right).	67
3.4	Structure and dimension of (a) planar TP in millimeters and (b) its prototype in front view; Simulated and measured S_{11} of TP (c) in free space (FS) and (d) on body.	69
3.5	Simulated and measured radiation pattern of TP antenna in free space and simulated radiation patterns on the body (c) $\varphi=90^\circ$ (left) and (d) $\theta=90^\circ$ (right).	70
3.6	Dielectric properties measurement setup with Agilent 85070B High Temperature Dielectric Probe Kit.	71
3.7	Measurement setup for narrowband on-body characterization investigations (a) Tx and Rx locations on-body; (b) measurement in an RF-shielded room.	73
3.8	Arm with metallic watch moves (a) to the side of body (b) side view: to front of body and back to initial position and (c) side view from front to left side and return to initial position.	77
3.9	Reference measurements: (a) without the presence of a human body; (b) measured S_{21} for without body and with body cases.	79
3.10	(a) AG antenna-body separation of S_{21} ; (b) Simulated and measured S_{11} for all subjects at upper right arm location ($F_1 = 2.1$ GHz, $F_{1\mu} = 2.3$ GHz, $F_2 = 2.9$ GHz, and $F_{2\mu} = 2.8$ GHz).	81

3.11	On-body resting EEG measurement setup in RF-shielded room, subject in sitting position.	83
3.12	Experimental procedures for measuring EEG, cognitive performance, well being, and physiological parameters. The red shaded areas are periods during well-being assessment and the purple shaded areas are periods when physiological parameters are measured.	84
3.13	Measurement of the shielding effectiveness using two horn antennas: (a) in free space; (b) in an RF-shielded room.	86
3.14	Screenshots of Rx output power measured at 2.45 (a) in free space and (b) between outside (Tx position) and inside RF-shielded room (Rx position).	87
3.15	SAR evaluation on the Hugo body model at 10 g on upper right arm (a) TM; (b) TP antennas facing outward.	88
3.16	Emotive EPOC electrode placement according to 10/20 system.	89
3.17	Cognitive tests (a) Paired Associated Learning (b) Spatial Span (c) Rapid Visual Processing and (d) Reaction Time.	92
4.1	Dimensions (mm) of full-rimmed and semi-rimmed spectacles.	97
4.2	Measured data and path loss model in the scenarios without spectacles and with full-rimmed spectacles for normal subjects.	99
4.3	CDF of measured path loss fitted to a normal distribution in the case of without spectacles and wearing (a) full-rimmed spectacles (b) semi-rimmed spectacles for subject specific.	100
4.4	Dimensions (mm) of stainless steel watch in top and perspective views.	101
4.5	Measured data and path loss model in the scenarios with and without tungsten watch: (a) UW1; (b) N1. (N1 showed a significant decrease of path loss at RC, RW, LW, LT and LA locations.)	104

4.6	Measured data and path loss model in the scenarios with and without the gold-plated 18K watch for underweight and normal subjects: (Reference distances for underweight and normal subjects were the average distance of on-body links in eight Rx positions (as shown in Table 3.4).	105
4.7	CDF of measured path loss fitted to the normal distribution in the scenario with metallic watches (a) stainless steel watch (b) tungsten watch (c) gold-plated 18K watch (Normal subjects had a wider spread of data, as indicated by the larger value of σ , i.e., $\sigma = 1.7$.)	107
4.8	Measured path loss of on-body radio links in body motion for underweight subjects.	108
4.9	Mean path loss of Rx locations on on-body radio channel in body motion (left) and arm motion (right) when the subjects were wearing a metallic watch: (a) underweight subjects; (b) normal subjects; (c) overweight subjects.	109
4.10	Mean path loss of dynamic on-body radio channel in the presence of metallic watches (a) body motion on left chest and right ankle positions; (b) arm motion on left waist and left ankle positions.	112
4.11	Cumulative distribution of the path loss fitted to lognormal distribution for (a) overweight subjects on on-body links without watch and (b) normal subjects with metallic watches.	116
4.12	Cumulative distribution of the path loss fitted to lognormal distribution for all subjects (a) without watch and (b) with watch at left waist.	119
5.1	Log-transformed spectral power between Sham (black line) and WBAN-RF (red line) exposures for left and right hemispheres The left column is the left hemisphere and the right column is the right hemisphere.(a), (b) anterior frontal; (c), (d) frontal; (e), (f) frontal central; (g), (h) temporal; (i), (j) parietal; (k), (l) occipital. The changes can be seen between Sham and WBAN RF in the left hemisphere of the frontal, frontal central and both hemispheres of the temporal, parietal, and occipital regions.	124
5.2	Alteration of EEG rhythms in exposed and sham-control conditions for left and right hemispheres: (a) frontal region; (b) temporal region. Beta showed significant effect ($P < 0.001$) between left and right	

hemispheres in frontal and temporal derivations, while theta and alpha demonstrated significant differences in the temporal derivation when the exposed subject was radiated by the TM antenna. Interaction hemisphere x condition was not significant for any of the EEG rhythms.

128

5.3 Estimated marginal means EEG power of Sham (1-blue line), TM (2-green line) and TP (3-yellow line) exposures for 1-left and 2-right hemispheres in frontal (left column) and temporal (right column) cortexes. Significant difference among mean EEG power for antenna ($P<0.001$) except temporal (right hemisphere) ($P=0.56$). Main effect of within-subject hemisphere and interaction antenna x hemisphere were significant ($P<0.001$) in these regions.

132

5.4 EEG power of TM (1-blue line) and TP (2-green line) exposures for frontal region (top) (a) left and (b) right hemispheres and temporal region (bottom) (c) left and (d) right hemispheres.

137

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LIST OF TABLES

NO.		PAGE
2.1	Available unlicensed frequency bands in BCWC (Hall et al., 2012).	14
2.2	Exposure SAR limit values (ICNIRP, 1998)	29
2.3	Classification of normal blood pressure and hypertension.	39
2.4	Comparison of the path loss exponent for the LOS and NLOS scenarios (F-Female, M-Male) (Zhao et al., 2011).	49
2.5	Modeled path loss exponent and standard deviation for LOS UWB on-body radio channel (F-Female, M-Male) (Abbasi et al., 2012).	50
2.6	Studies on the effects of EMF exposure on resting EEG recorded with the eyes open or closed.	55
2.7	Studies on the effects of EMF exposure on cognitive performance.	57
3.1	Parameters of the textile monopole placed in free space and on the body.	64
3.2	Textile patch performance when placed in free space and on the body.	70
3.3	Characteristics of the six subjects.	74
3.4	Distance (cm) between Tx and Rx of the on-body link.	75
3.5	Demographic data of subjects.	82
3.6	Sample of well-being questionnaires completed by the subjects	94

4.1	Characterization of mean path loss for types of metallic spectacles and watches utilizing TM antennas.	98
4.2	Dimensions and conductivities of the watches	101
4.3	Statistical test results for body movements.	113
4.4	Statistical test results for arm movements	114
4.5	AIC_c favored model for each scenario.	117
4.6	Cumulative distribution of the measured path loss fitted to a lognormal distribution.	118
5.1	Summary of statistical findings	125
5.2	Summary of statistical finding in different frequency bands for a wearable textile monopole antenna	127
5.3	Summary of statistical findings for different types of antennas.	130
5.4	Summary of statistical findings in different frequency bands for a wearable TP antenna.	133
5.5	Summary of statistical findings for EEG rhythms for exposures to different types of antennas.	135
5.6	The results for cognitive performance.	138
5.7	Results for well-being subjective symptoms.	140
5.8	Z-scores and p -values for well-being symptoms experienced during Sham and WBAN exposures.	141
5.9	Results of the statistical tests for physiological parameters.	142
5.10	The descriptive statistics for physiological parameters.	143

5.11 The statistical test results for physiological parameters utilizing different antenna topologies.

144

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LIST OF ABBREVIATIONS

.EDF	European Data File
A-Fr	Anterior-Frontal
AIC	Akaike Information Criterion
ANOVA	Analysis of Variance
ANSI	American National Standards Institute
BCWC	Body-centric wireless communication
Be-Cu	Beryllium copper
BMI	Body mass index
BodyLAN	Body Local area network
BPD	Diastolic blood pressure
BPS	Systolic blood pressure
BSI	Brain Symmetry Index
BT	Body temperature
CANTAB	Computer-administered Cambridge Neurophysiological Test Automated Battery
CDF	Cumulative distribution function
CST	Computer Simulation Technology
ECG	Electrocardiography
ECG	Electrocardiography
EEG	Electroencephalogram
EHS	Electromagnetic HyperSensitivity
EM	Electromagnetic

EMF	Electromagnetic fields
FCC	Federal Communications Commission
F-Cn	Fronto-central
FDTD	Finite-difference time-domain
FFT	Fast Fourier transform
FIT	Finite integral technique
fMRI	functional Magnetic Resonance Imaging
fNIRS	functional near-infrared spectroscopy
Fr	Frontal
GND	Ground
GSM	Global System for Mobile Communication
HFP	High frequency power
HR	Hear rate
HSCA	Horn shaped self complementary antenna
ICNIRP	International Commission Non-Ionizing Radiation Protection
IEEE-USA	Institute of Electrical and Electronics Engineers - United States
ISM	Industrial, Scientific, and Medical
ITU-R	International Telecommunication Radio
JNC7	Joint National Committee on Prevention, Detection, Evaluation Treatment of High Blood Pressure
LA	Left ankle
LC	Left chest
LCR	Level crossing rate
LFP	Low-frequency power
LOS	Line-of-Sight

LS	Least squares
LT	Left thigh
LTE-TDD	Long Term Evolution-Time Division Multiplexing
LW	Left waist
MAP	Mean arterial pressure
MEM	Microelectromechanical
MICS	Medical Implanted Communication System
ML	Maximum Likelihood
MRI	Magnetic Resonance Imaging
MRI	Magnetic Resonance Imaging
N	Normal
NLOS	Non-line-of-sight
Oc	Occipital
OW	Overweight
PAL	Paired associated learning
PDP	Power delay profile
PEC	Perfect Electrical Conductor
PICA	Planar inverted cone antenna
PIFA	Planar inverted-F antenna
PNA	Performance Network Analyzer
PP	Pulse pressure
Pr	Parietal
PSD	Power spectral density
PVC	Polyvinyl chloride

RA	Right ankle
RC	Right chest
RF	Radio frequency
RF- EMF	Radio frequency electromagnetic fields
RFID	Radio Frequency Identification
RT	Right thigh
RTI	Reaction time
RUA	Upper right arm
RVP	Rapid virtual processing
RW	Right waist
Rx	Receiving antenna
SA	Spectrum Analyzer
SAR	Specific Absorption Rate
SD	Standard deviation
SE	Standard error
SG	Signal generator
SMA	Subminiature version A
SNR	Signal-to-Noise Ratio
SSM	Scientific Council of Swedish Radiation Safety Authority
SSP	Spatial span
TM	Textile monopole
TMS	Transcranial magnetic simulation
TP	Textile patch
Tp	Temporal

TSA	Tapered slot antennas
Tx	Transmitting antenna
UMTS	Universal Mobile Telecommunications System
UW	Underweight
UWB	Ultra Wideband
VTAM	Clothes for Teleassistance in Medicine Project
WBAN	Wireless body area network
WCDMA	Wide code division multiple access
WEALTHY	European Wearable Healthcare System
WHO	World Health Organizations
WiFi	Wireless Fidelity
WiMAX	Worldwide Interoperability for microwave access
WLAN	Wireless Local Area Network
WMTS	Wireless, Medical Telemetry Services
WPAN	Wireless personal area networks

LIST OF SYMBOLS

c	Speed of light (m/s)
\bar{E}_r	Reflected electric field
E_0	Arbitrary amplitude
\bar{E}_t	Transmitted electric field
E	Electric field
$ E $	Root means square (rms) value of induced electrical field (V/m)/ absolute EEG spectral power
E_i	<i>Incident</i> Electric field
H	Magnetic field
\bar{H}_r	Reflected magnetic field
\bar{H}_t	Reflected magnetic field
V_r	Reflected voltage wave
V_{in}	Incident voltage wave
k	Wavenumber of a plane wave
η	Wave impedance
d	Distance
d_0	Reference distance
γ	Path loss exponent
ρ	Density of tissue (kg/m ³)
α	Alpha wave/p-value
β	Beta wave

θ	Angle/Pattern in the azimuth plane /theta wave
δ	Delta wave
$\tan\delta$	Tangent loss
A	Power
k	Rician k-factor
K	Number approximation parameters in the selected model
m	Nakagami m-factor
M	Mean length
n	Sample size
$\Gamma(m)$	Gamma function
Ω	Ohm/mean square value of amplitude
PL_{dB}	Modeled path loss
$PL(d_0)$	Average path loss at reference distance
P_t	Transmitted power
P_r	Received power
G_t	Transmit antenna gain
G_r	Receive antenna gain
f	Resonant frequency
N	Total number of sampled points
L	System loss factor/maximized log likelihood
L_m	Length of transmission line for textile monopole
L_M	Monopole patch length
t	Thickness of Shieldit Super E-textile
S_{11}	Reflection Loss (VSWR)

S_{21}	Transmission coefficient
$Z_{\lambda/4}$	Quarter-wave impedance
Z_0	Characteristic impedance
Z_L	Antenna impedance
X_σ	Shadowing (large-scale) fading
η_0	Wave impedance of free space
ω_0	Resonant frequency at free space
λ_0	Free space wavelength of the resonant frequency
λ_{eff}	Effective wavelength of the resonant frequency
δ_s	Skin depth
v	Velocity
π	Pi
c	Speed of light
θ_i	Incident angle
θ_r	Reflected angle
θ_t	Transmitted angle
SAR	Specific absorption rate (W/Kg)
Γ	Reflection coefficient
T	Transmission coefficient
T_c	Coherence time
λ	Wavelength (m)
σ	Conductivity (S/m)/standard deviation
σ_{eff}	Effective conductivity (S/m)
ϵ_r	Electric permittivity