

CHAPTER ONE: INTRODUCTION.....	1
STUDY GOALS AND OBJECTIVES.....	1
REASONS FOR DOING THE STUDY	1
CONTRIBUTIONS OF THE STUDY.....	1
SCOPE OF REPORT	2
METHODOLOGY AND INFORMATION SOURCES.....	2
ABOUT THE AUTHOR.....	3
RELATED BCC REPORTS	3
BCC ONLINE SERVICES.....	3
DISCLAIMER	3
 CHAPTER TWO: SUMMARY.....	 4
SUMMARY.....	4
<i>SUMMARY TABLE GLOBAL SALES OF ANTI-COUNTERFEITING PACKAGING TECHNOLOGIES TO THE DRUG AND FOOD INDUSTRIES BY TYPE, THROUGH 2015 (\$ MILLIONS)</i>	 5
<i>SUMMARY FIGURE PROJECTED SHARES OF GLOBAL SALES OF ANTI-COUNTERFEITING PACKAGING TECHNOLOGIES TO THE DRUG AND FOOD INDUSTRIES BY TYPE, 2015 (\$ MILLIONS)</i>	 6
 CHAPTER THREE: OVERVIEW	 7
DEFINING A COUNTERFEIT PRODUCT.....	7
PREVALENCE OF COUNTERFEITING	8
INDUSTRY CONCEPTS	9
SECURE SUPPLY CHAIN.....	9
PRODUCT PACKAGING	10
Packaging Concepts and Materials.....	10
Levels of Packaging	11
Smart Packaging	12
PRODUCT IDENTIFICATION	12
Universal Product Code.....	12
Global Trade Item Number	13
Symbology	13
Covert and Overt Secure Technologies.....	13
Paper and Electronic Drug Pedigree	13
Automatic Identification and Data Capture	14
Electronic Product Code	14
Mass Serialization	14
Radio Frequency Definitions.....	15
Read Range	15
IMPORTANCE OF SECURE PACKAGING TECHNOLOGIES	15
FORESEEABLE DEVELOPMENTS	16
 CHAPTER FOUR: DRUG AND FOOD MARKETING.....	 17
INTRODUCTION	17

U.S. DRUG MARKETING.....	17
DRUG MANUFACTURERS	18
Drug Manufacturing Industry Classification.....	18
<i>TABLE 1 U.S. DRUG MANUFACTURING BY INDUSTRY</i>	
<i>CLASSIFICATION</i>	18
<i>TABLE 2 BUSINESS PATTERN OF U.S. PHARMACEUTICAL</i>	
<i>PREPARATION MANUFACTURING INDUSTRY</i>	19
Brand-Name Drug Manufacturers	19
<i>TABLE 3 MAJOR BRAND-NAME DRUG MANUFACTURERS RANKED</i>	
<i>BY MARKET CAPITALIZATION, SECOND QUARTER 2010</i>	20
Generic Drug Manufacturers	20
<i>TABLE 4 MAJOR GENERIC DRUG MANUFACTURERS RANKED BY</i>	
<i>MARKET CAPITALIZATION, SECOND QUARTER 2010</i>	21
Prescription Drug Distribution Channel.....	21
Stimulating Demand for Prescription Drugs	22
Global Sales of Pharmaceutical Preparations.....	22
<i>TABLE 5 ESTIMATED GLOBAL SALES AND MARKET SHARES OF</i>	
<i>MAJOR MANUFACTURERS OF PHARMACEUTICAL</i>	
<i>PREPARATIONS FOR HUMAN USE, 2009</i>	23
U.S. Sales of Pharmaceutical Preparations	23
<i>TABLE 6 U.S. SALES AND MARKET SHARES OF MAJOR</i>	
<i>MANUFACTURERS OF PHARMACEUTICAL PREPARATIONS FOR</i>	
<i>HUMAN USE, 2009</i>	24
<i>TABLE 7 U.S. SALES OF PHARMACEUTICAL PREPARATIONS FOR</i>	
<i>HUMAN USE BY END USE, 2009</i>	24
<i>FIGURE 1 ESTIMATED U.S. SALES OF PHARMACEUTICAL</i>	
<i>PREPARATIONS FOR HUMAN USE BY TYPE, 2009 (%)</i>	25
International Trade in Pharmaceutical Preparations	26
<i>TABLE 8 U.S. EXPORTS OF PHARMACEUTICAL PREPARATIONS,</i>	
<i>2009</i>	26
WHOLESALE DRUG DISTRIBUTORS	26
U.S. Wholesale Drug Industry Classification.....	26
<i>TABLE 9 U.S. DRUG WHOLESALERS BY INDUSTRY</i>	
<i>CLASSIFICATION</i>	27
<i>TABLE 10 BUSINESS PATTERN OF U.S. WHOLESALE DRUG</i>	
<i>DISTRIBUTION INDUSTRY</i>	27
U.S. Wholesale Drug Industry Structure	27
<i>TABLE 11 MERCHANT DRUG DISTRIBUTORS RANKED BY MARKET</i>	
<i>CAPITALIZATION, SECOND QUARTER 2010</i>	28
<i>TABLE 12 DRUG SALES BY U.S. MERCHANT WHOLESALE DRUG</i>	
<i>DISTRIBUTORS, 2009</i>	29
<i>FIGURE 2 DRUG SALES BY THE BIG THREE U.S. MERCHANT</i>	
<i>WHOLESALE DRUG DISTRIBUTORS BY SALES CHANNEL, 2009</i>	
<i>(%)</i>	29

<i>FIGURE 2 (CONTINUED)</i>	30
Secondary Wholesalers.....	30
RETAIL DRUG DISTRIBUTORS	31
U.S. Retail Drug Industry Structure	31
<i>TABLE 13 BUSINESS PATTERN OF U.S. RETAIL DRUG</i> <i>DISTRIBUTION INDUSTRY</i>	31
U.S. Retail Prescription Drug Sales	31
<i>TABLE 14 PRESCRIPTION DRUGS FILLED IN THE U.S. BY RETAIL</i> <i>DRUG SEGMENT, 2009</i>	32
<i>TABLE 15 U.S. RETAIL PRESCRIPTION DRUG SALES BY RETAIL</i> <i>DRUG SEGMENT, 2009</i>	32
INTERNET DRUG DISTRIBUTION	32
Benefits of Internet Drug Distribution.....	33
Challenges Posed by Internet Drug Distribution.....	33
OpSec Security’s Survey on Bulk Pharmaceuticals and APIs.....	33
European Alliance for Access to Safe Medicines’ Internet Research	34
Addressing the Illegitimate Internet Drug Distribution	35
U.S. FOOD MARKETING	35
FOOD PROCESSORS OR MANUFACTURERS	36
Food Manufacturing Industry Classification	36
<i>TABLE 16 U.S. FOOD MANUFACTURING INDUSTRY FOR HUMAN</i> <i>CONSUMPTION BY INDUSTRY CLASSIFICATION</i>	36
Food Manufacturing Industry Structure.....	36
<i>TABLE 17 BUSINESS PATTERN OF U.S. FOOD MANUFACTURING</i> <i>INDUSTRY FOR HUMAN CONSUMPTION</i>	37
Food Distribution from Manufacturer to Wholesale to Retail.....	37
U.S. Sales of Processed Foods for Human Consumption	38
<i>TABLE 18 ESTIMATED U.S. SALES BY MAJOR PROCESSORS OF</i> <i>FOOD FOR HUMAN CONSUMPTION, 2009</i>	38
U.S. International Trade in Processed Foods for Human Consumption	39
<i>TABLE 19 U.S. EXPORTS OF PROCESSED FOODS FOR HUMAN</i> <i>CONSUMPTION, 2009</i>	39
<i>TABLE 20 U.S. EXPORTS OF PROCESSED FOODS FOR HUMAN</i> <i>CONSUMPTION BY TYPE, 2009</i>	40
WHOLESALE FOOD DISTRIBUTORS.....	40
U.S. Wholesale Food Industry Classification	40
<i>TABLE 21 U.S. FOOD WHOLESALE INDUSTRY BY INDUSTRY</i> <i>CLASSIFICATION</i>	40
U.S. Wholesale Food Distribution Industry Structure	41

<i>TABLE 22 BUSINESS PATTERN OF U.S. WHOLESALE FOOD DISTRIBUTION INDUSTRY</i>	42
U.S. Wholesale Food Sales	42
<i>TABLE 23 ESTIMATED U.S. SALES BY MAJOR FOOD WHOLESALERS, 2009</i>	42
RETAIL FOOD DISTRIBUTORS.....	43
U.S. Retail Food Industry Classification.....	43
<i>TABLE 24 U.S. RETAIL FOOD INDUSTRY BY INDUSTRY CLASSIFICATION</i>	43
U.S. Retail Food Distribution Industry Structure	43
U.S. Retail Food ... (Continued).....	44
U.S. Retail Food ... (Continued).....	45
<i>TABLE 25 BUSINESS PATTERN OF U.S. RETAIL FOOD DISTRIBUTION INDUSTRY</i>	46
U.S. Retail Food Sales	46
<i>TABLE 26 ESTIMATED U.S. SALES BY RETAIL FOOD DISTRIBUTORS, 2009</i>	46
CHAPTER FIVE: AUTHENTICATION PACKAGING TECHNOLOGIES	47
INTRODUCTION	47
AUTHENTICATION PACKAGING TECHNOLOGIES BY TYPE	47
INKS AND DYES.....	47
Security Inks.....	48
<i>TABLE 27 TYPES OF SECURITY INKS AND PRINTING METHOD</i>	48
Color-Shifting Inks	48
Holographic Inks.....	49
Pearlescent Pigments	49
Thermochromic and Photo-Chromic Inks	49
Taggant Inks	50
Watermark Inks.....	50
Examples of Proprietary Inks	50
AlpVision SA: Cryptoglyph Solution.....	50
Evident Technologies: EviDots.....	51
Inksure Technologies: SmartInk.....	51
HOLOGRAMS	51
Hologram Types.....	52
2D and 3D Holograms.....	52
Dot-Matrix Holograms.....	52
Electronic Beam Holograms.....	53
Volume Holograms.....	53
Light of Holograms	53
Overt and Covert Holograms	53
Recent Trends in Security Holograms	54
3D AG's Holo-Encrypt System	54
3M's Holographic Authentication Solutions	54

CFC International's Dot-Matrix System	55
DNA-Encoded Holograms	55
DuPont's 3D Hologram	55
JDSU's HoloFuse	56
Security Hologram's Integrated Label	56
Tesa-Scribos' tesa Holospot: Mass Serialization Holograms	56
WATERMARKS	56
Categories of Watermark	57
Physical Paper Watermark	57
Digital Watermark	57
Recent Innovations in Watermarking	58
Incorporation of Encryption Keys	58
Multi-Layered Watermarking	58
TAGGANTS	58
JDSU's Charms	59
Microtrace's Taggants	59
Authentix and Forensic Marking	59
REGULATORY PROVISIONS FOR AUTHENTICATION TECHNOLOGIES	59
STRUCTURE OF THE GLOBAL AUTHENTICATION TECHNOLOGY INDUSTRY	60
STRATEGIC ALLIANCES	61
Digimarc and AlpVision	61
Microtrace and PhotoScribe Technologies	62
Microtrace and the Flint Group	62
NAME RECOGNITION AND FULL-SERVICE CAPABILITIES	62
RECENT AND PROJECTED GLOBAL SALES OF AUTHENTICATION PACKAGING TECHNOLOGIES TO THE DRUG AND FOOD INDUSTRIES	63
INDUSTRY DATA	63
RECENT GLOBAL SALES OF AUTHENTICATION PACKAGING TECHNOLOGIES TO THE DRUG AND FOOD INDUSTRIES BY TYPE	63
Recent Global Sales of Packaging Inks and Dyes	64
<i>FIGURE 3 SALES OF PACKAGING INKS TO THE DRUG AND FOOD INDUSTRIES AS A SHARE OF THE GLOBAL AUTHENTICATION PACKAGING MARKET, 2009 (%)</i>	<i>64</i>
<i>TABLE 28 GLOBAL SALES OF PACKAGING INKS TO THE DRUG AND FOOD INDUSTRIES BY END USE, 2009</i>	<i>65</i>
<i>FIGURE 4 ESTIMATED MARKET SHARES OF GLOBAL SALES OF PACKAGING INKS TO THE DRUG AND FOOD INDUSTRIES, BY REGION, 2009 (%)</i>	<i>65</i>
<i>FIGURE 4 (CONTINUED)</i>	<i>66</i>

Recent Global Sales of Packaging Holograms	66
<i>FIGURE 5 SALES OF PACKAGING HOLOGRAMS TO THE DRUG AND FOOD INDUSTRIES AS A SHARE OF THE GLOBAL AUTHENTICATION PACKAGING MARKET, 2009 (%)</i>	66
<i>FIGURE 5 (CONTINUED)</i>	67
<i>TABLE 29 GLOBAL SALES OF PACKAGING HOLOGRAMS TO THE DRUG AND FOOD INDUSTRIES BY END USE, 2009 (\$ MILLIONS/%)</i>	67
<i>FIGURE 6 ESTIMATED MARKET SHARES OF GLOBAL SALES OF PACKAGING HOLOGRAMS TO THE DRUG AND FOOD INDUSTRIES, BY REGION, 2009 (%)</i>	68
Recent Global Sales of Packaging Watermarks	68
<i>FIGURE 7 SALES OF PACKAGING WATERMARKS TO THE DRUG AND FOOD INDUSTRIES AS A SHARE OF THE GLOBAL AUTHENTICATION PACKAGING MARKET, 2009 (%)</i>	69
<i>TABLE 30 GLOBAL SALES OF PACKAGING WATERMARKS TO THE DRUG AND FOOD INDUSTRIES BY END USE, 2009</i>	69
<i>FIGURE 8 ESTIMATED MARKET SHARES OF GLOBAL SALES OF PACKAGING WATERMARKS TO THE DRUG AND FOOD INDUSTRIES BY REGION, 2009 (%)</i>	70
Recent Global Sales of Packaging Taggants	71
<i>FIGURE 9 SALES OF PACKAGING TAGGANTS TO THE DRUG AND FOOD INDUSTRIES AS A SHARE OF THE GLOBAL AUTHENTICATION PACKAGING MARKET, 2009 (%)</i>	71
<i>TABLE 31 GLOBAL SALES OF PACKAGING TAGGANTS TO THE DRUG AND FOOD INDUSTRIES BY END USE, 2009</i>	72
<i>FIGURE 10 ESTIMATED MARKET SHARES OF GLOBAL SALES OF PACKAGING TAGGANTS TO THE DRUG AND FOOD INDUSTRIES BY REGION, 2009 (%)</i>	72
<i>FIGURE 10 (CONTINUED)</i>	73
Total Recent Global Sales of Authentication Packaging Technologies	73
<i>FIGURE 11 TOTAL GLOBAL SALES OF AUTHENTICATION PACKAGING TECHNOLOGIES TO THE DRUG AND FOOD INDUSTRIES BY TYPE, 2009 (\$ MILLIONS)</i>	73
<i>FIGURE 11 (CONTINUED)</i>	74
<i>TABLE 32 GLOBAL SALES OF AUTHENTICATION PACKAGING TECHNOLOGIES TO THE DRUG AND FOOD INDUSTRIES BY END USE, 2009 (\$ MILLIONS/%)</i>	74
<i>FIGURE 12 ESTIMATED MARKET SHARES OF TOTAL GLOBAL SALES OF AUTHENTICATION PACKAGING TECHNOLOGIES TO THE DRUG AND FOOD INDUSTRIES BY REGION, 2009 (%)</i>	75
MAJOR SUPPLIERS OF AUTHENTICATION PACKAGING TECHNOLOGIES.....	75

<i>TABLE 33 MAJOR SUPPLIERS OF AUTHENTICATION PACKAGING TECHNOLOGIES TO THE DRUG AND FOOD INDUSTRIES, 2009</i>	76
MARKET DRIVERS AND DRAWBACKS	76
SALES AND MARKET SIZE PROJECTIONS	77
Projected Total Global Sales of Packaging Inks and Dyes	78
<i>TABLE 34 GLOBAL SALES OF PACKAGING INKS TO THE DRUG AND FOOD INDUSTRIES BY END USE, THROUGH 2015 (\$ MILLIONS)</i>	79
<i>FIGURE 13 SHARES OF GLOBAL SALES OF PACKAGING INKS TO THE DRUG AND FOOD INDUSTRIES BY END USE, 2010 AND 2015 (%)</i>	79
<i>FIGURE 13 (CONTINUED)</i>	80
<i>TABLE 35 GLOBAL SALES OF PACKAGING INKS TO THE DRUG AND FOOD INDUSTRIES BY GEOGRAPHY, THROUGH 2015 (\$ MILLIONS)</i>	80
Projected Total Global Sales of Packaging Holograms	80
<i>TABLE 36 GLOBAL SALES OF PACKAGING HOLOGRAMS TO THE DRUG AND FOOD INDUSTRIES BY END USE, THROUGH 2015 (\$ MILLIONS)</i>	81
<i>FIGURE 14 SHARES OF GLOBAL SALES OF PACKAGING HOLOGRAMS TO THE DRUG AND FOOD INDUSTRIES BY END USE, 2010 AND 2015 (%)</i>	81
<i>FIGURE 14 (CONTINUED)</i>	82
<i>TABLE 37 GLOBAL SALES OF PACKAGING HOLOGRAMS TO THE DRUG AND FOOD INDUSTRIES BY GEOGRAPHY, THROUGH 2015 (\$ MILLIONS)</i>	82
Projected Total Global Sales of Packaging Watermarks	82
<i>TABLE 38 GLOBAL SALES OF PACKAGING WATERMARKS TO THE DRUG AND FOOD INDUSTRIES BY END USE, THROUGH 2015 (\$ MILLIONS)</i>	83
<i>FIGURE 15 SHARES OF GLOBAL SALES OF PACKAGING WATERMARKS TO THE DRUG AND FOOD INDUSTRIES BY END USE, 2010 AND 2015 (%)</i>	83
<i>FIGURE 16 (CONTINUED)</i>	84
<i>TABLE 39 GLOBAL SALES OF PACKAGING WATERMARKS TO THE DRUG AND FOOD INDUSTRIES BY GEOGRAPHY, THROUGH 2015 (\$ MILLIONS)</i>	84
Projected Total Global Sales of Packaging Taggants.....	84
<i>TABLE 40 GLOBAL SALES OF PACKAGING TAGGANTS TO THE DRUG AND FOOD INDUSTRIES BY END USE, THROUGH 2015 (\$ MILLIONS)</i>	85
<i>FIGURE 16 SHARES OF GLOBAL SALES OF PACKAGING TAGGANTS TO THE DRUG AND FOOD INDUSTRIES BY END USE, 2010 AND 2015 (%)</i>	85

<i>FIGURE 16 (CONTINUED)</i>	86
<i>TABLE 41 GLOBAL SALES OF PACKAGING TAGGANTS TO THE DRUG AND FOOD INDUSTRIES BY GEOGRAPHY, THROUGH 2015 (\$ MILLIONS)</i>	86
Projected Total Regional Sales of Authentication Packaging Technologies by Type	86
North American Sales of Authentication Packaging Technologies by Type Through 2015	86
<i>TABLE 42 NORTH AMERICAN SALES OF AUTHENTICATION PACKAGING TECHNOLOGIES TO THE DRUG AND FOOD INDUSTRIES BY TYPE, THROUGH 2015 (\$ MILLIONS)</i>	87
<i>FIGURE 17 ESTIMATED SHARES OF NORTH AMERICAN SALES OF AUTHENTICATION PACKAGING TECHNOLOGIES TO THE DRUG AND FOOD INDUSTRIES BY TYPE, 2010 AND 2015 (%)</i>	87
<i>FIGURE 17 (CONTINUED)</i>	88
European Sales of Authentication Packaging Technologies by Type Through 2015	88
<i>TABLE 43 EUROPEAN SALES OF AUTHENTICATION PACKAGING TECHNOLOGIES TO THE DRUG AND FOOD INDUSTRIES BY TYPE, THROUGH 2015 (\$ MILLIONS)</i>	88
<i>FIGURE 18 ESTIMATED SHARES OF EUROPEAN SALES OF AUTHENTICATION PACKAGING TECHNOLOGIES TO THE DRUG AND FOOD INDUSTRIES BY TYPE, 2010 AND 2015 (%)</i>	89
Asia-Pacific Sales of Authentication Packaging Technologies by Type Through 2015	89
<i>TABLE 44 ASIA-PACIFIC SALES OF AUTHENTICATION PACKAGING TECHNOLOGIES TO THE DRUG AND FOOD INDUSTRIES BY TYPE, THROUGH 2015 (\$ MILLIONS)</i>	90
<i>FIGURE 19 ESTIMATED SHARES OF ASIA-PACIFIC SALES OF AUTHENTICATION PACKAGING TECHNOLOGIES TO THE DRUG AND FOOD INDUSTRIES BY TYPE, 2010 AND 2015 (%)</i>	90
<i>FIGURE 19 (CONTINUED)</i>	91
Projected Total Global Sales of Authentication Packaging Technologies by Type	91
<i>TABLE 45 GLOBAL SALES OF AUTHENTICATION PACKAGING TECHNOLOGIES TO THE DRUG AND FOOD INDUSTRIES BY TYPE, THROUGH 2015 (\$ MILLIONS)</i>	91
<i>FIGURE 20 SHARES OF GLOBAL SALES OF AUTHENTICATION PACKAGING TECHNOLOGIES TO THE DRUG AND FOOD INDUSTRIES BY TYPE, 2010 AND 2015 (%)</i>	92
<i>FIGURE 21 ESTIMATED MARKET SHARES OF GLOBAL SALES OF AUTHENTICATION PACKAGING TECHNOLOGIES TO THE DRUG AND FOOD INDUSTRIES, 2010 AND 2015 (%)</i>	93

Projected Total Global Sales of Authentication Packaging Technologies by End Use	93
<i>TABLE 46 GLOBAL SALES OF AUTHENTICATION PACKAGING TECHNOLOGIES TO THE DRUG AND FOOD INDUSTRIES BY END USE, THROUGH 2015 (\$ MILLIONS)</i>	<i>94</i>
<i>FIGURE 22 SHARES OF GLOBAL SALES OF AUTHENTICATION PACKAGING TECHNOLOGIES TO THE DRUG AND FOOD INDUSTRIES BY END USE, 2010 AND 2015 (%).....</i>	<i>94</i>
CHAPTER SIX: TRACK AND TRACE PACKAGING TECHNOLOGIES.....	95
INTRODUCTION	95
TRACK AND TRACE PACKAGING TECHNOLOGIES BY TYPE	96
BAR CODES	96
A Brief History of Bar Codes.....	96
Commercial Applications of Bar Codes	96
Bar Code Specifications.....	96
Bar Codes for Different Environment.....	97
Paper Bar Code Labels	97
Aluminum Bar Code Labels	97
Polyester Bar Code Labels.....	97
Ceramic Bar Code Labels	97
Bar Code Symbology.....	97
Continuous or Discrete Symbology	98
Two-Width or Multiple-Width Symbology	98
GS1 Bar Code Standards	98
EAN/UPC Symbology	98
ITF-14 Symbology	98
GS1-128 Symbology	99
GS1 DataBar (RSS)	99
GS1 DataMatrix.....	99
Composite Component Symbology	100
Bar Code Implementation Steps.....	100
Bar Code Printing.....	100
Bar Code Quality	101
RADIO FREQUENCY IDENTIFICATION TECHNOLOGY.....	101
Commercial Applications of radio frequency identification Technology.....	101
Overview of the RFID Technology	101
RFID Tags for Different Uses	102
Components of a RFID Tag.....	102
Classification of RFID Tags	102
Classification of RFID Tags Based on Power Source	103
Active RFID Tags.....	103
Passive RFID Tags.....	103
Read-Write Functionality.....	103

Classification Based on Radio Frequency	103
Low-Frequency RFID Tags	104
High-Frequency RFID Tags	104
Ultra-High-Frequency RFID Tags	104
EPCglobal and RFID Standards	104
Class 1 Generation 2 UHF Air Interface Protocol Standard	105
EPCglobal Adoption Roadmap	106
Advantages of RFID Tags	106
Early Adopters of RFID Tags	107
Wal-Mart and RFID Adoption	108
U.S. Department of Defense and RFID Adoption	108
Early Exploratory Adoptions Through Pilot Studies	109
Pilot Studies: Drug Industry	109
Pfizer's Pilot Study: Viagra Tagging	109
Purdue Pharma's Pilot Study: OxyContin Tagging	109
Pilot Studies: U.S. Food Industry	110
Wells' Dairy Pilot Study: An Integrated Approach	110
Del Monte's Pilot Study: RFID and Small Metallic Objects with Fluids	110
Pilot Studies: U.S. Wholesale Distributors	111
McKesson Corporation and On Track Pilot	111
AmerisourceBergen's Pilot	111
Cardinal Health's UHF RFID Pilot Study	112
Current State of RFID Tagging: Rise of UHF RFID	112
Printed RFID Tags	113
Some Notable UHF RFID Tags	113
Alien Technology's Brand	113
Impinj RFID Solution	114
Intermec's Rugged RFID Tag	114
Examples of RFID Adoption-Enablers	115
Data Systems International's dcLINK RFIDActivator	115
GlobeRanger's iMotion Edgeware	115
Systech International's Serialized Product Tracking	115
Addressing Privacy Concerns Regarding RFID Tags	116
RFID Tags for Cold Chain Compliance	117
Recyclable RFID Tags	117
REGULATORY PROVISIONS FOR TRACK AND TRACE TECHNOLOGIES	117
U.S. BAR CODE REGULATIONS RELATING TO DRUG PRODUCTS	118

Key Objectives of the Rule	118
Entities Subject to the Rule	119
Products that Require Bar Codes	119
Information Contained in a Bar Code	119
Specific Bar Code Requirements.....	119
Bar Code Placement	120
U.S. REGULATION RELATING TO RADIO FREQUENCY	
DEVICES	120
FCC regulations define radiators as:.....	120
FCC Restriction on Devices Operating Within the 13.110-	
14.010 MHz Band (Section 15.225)	121
FCC Restrictions on Devices Operating Within the 890-	
940 MHz Band (Section 15.243)	121
STRUCTURE OF THE GLOBAL TRACK AND TRACE	
TECHNOLOGY INDUSTRY.....	122
RECENT AND PROJECTED GLOBAL SALES OF TRACK AND	
TRACE PACKAGING TECHNOLOGIES TO THE DRUG AND	
FOOD INDUSTRIES.....	123
INDUSTRY DATA.....	123
RECENT GLOBAL SALES OF TRACK AND TRACE	
PACKAGING TECHNOLOGIES TO THE DRUG AND	
FOOD INDUSTRIES BY TYPE	124
Recent Global Sales of Packaging Bar Codes.....	124
<i>FIGURE 23 SALES OF PACKAGING BAR CODES TO THE DRUG AND</i>	
<i>FOOD INDUSTRIES AS A SHARE OF THE GLOBAL TRACK AND</i>	
<i>TRACE PACKAGING MARKET, 2009 (%).....</i>	<i>124</i>
<i>FIGURE 23 (CONTINUED)</i>	<i>125</i>
<i>TABLE 47 GLOBAL SALES OF PACKAGING BAR CODES TO THE</i>	
<i>DRUG AND FOOD INDUSTRIES BY END USE, 2009 (\$</i>	
<i>MILLIONS/%).....</i>	<i>125</i>
<i>FIGURE 24 ESTIMATED MARKET SHARES OF GLOBAL SALES OF</i>	
<i>PACKAGING BAR CODES TO THE DRUG AND FOOD</i>	
<i>INDUSTRIES, 2009 (%)</i>	<i>126</i>
Recent Global Sales of Packaging RFID Tags.....	126
<i>FIGURE 25 SALES OF PACKAGING RFID TAGS TO THE DRUG AND</i>	
<i>FOOD INDUSTRIES AS A SHARE OF GLOBAL TRACK AND TRACE</i>	
<i>PACKAGING MARKET, 2009 (%)</i>	<i>127</i>
<i>TABLE 48 GLOBAL SALES OF PACKAGING RFID TAGS TO THE</i>	
<i>DRUG AND FOOD INDUSTRIES BY END USE, 2009 (\$</i>	
<i>MILLIONS/%).....</i>	<i>127</i>
<i>FIGURE 26 ESTIMATED MARKET SHARES OF GLOBAL SALES OF</i>	
<i>PACKAGING RFID TAGS TO THE FOOD AND DRUG INDUSTRIES,</i>	
<i>2009 (%).....</i>	<i>128</i>

Total Recent Global Sales of Track and Trace Packaging Technologies	129
<i>TABLE 49 GLOBAL SALES OF TRACK AND TRACE PACKAGING TECHNOLOGIES TO THE DRUG AND FOOD INDUSTRIES BY TYPE, 2009 (\$ MILLIONS/%)</i>	129
<i>TABLE 50 GLOBAL SALES OF TRACK AND TRACE PACKAGING TECHNOLOGIES TO THE DRUG AND FOOD INDUSTRIES BY END USE, 2009 (\$ MILLIONS/%)</i>	129
<i>FIGURE 27 ESTIMATED MARKET SHARES OF GLOBAL SALES OF TRACK AND TRACE PACKAGING TECHNOLOGIES TO THE DRUG AND FOOD INDUSTRIES, 2009 (%)</i>	130
MAJOR SUPPLIERS OF TRACK AND TRACE PACKAGING TECHNOLOGIES.....	130
<i>TABLE 51 MAJOR SUPPLIERS OF TRACK AND TRACE PACKAGING TECHNOLOGIES, 2009</i>	131
MARKET DRIVERS AND DRAWBACKS	131
Market Drivers and Drawbacks (Continued).....	132
SALES AND MARKET SIZE PROJECTIONS.....	133
Projected Total Global Sales of Packaging Bar Codes	134
<i>TABLE 52 GLOBAL SALES OF PACKAGING BAR CODES TO THE DRUG AND FOOD INDUSTRIES BY END USE, THROUGH 2015 (\$ MILLIONS)</i>	134
<i>FIGURE 28 SHARES OF GLOBAL SALES OF PACKAGING BAR CODES TO THE DRUG AND FOOD INDUSTRIES BY END USE, 2010 AND 2015 (%)</i>	135
<i>TABLE 53 GLOBAL SALES OF PACKAGING BAR CODES TO THE DRUG AND FOOD INDUSTRIES BY GEOGRAPHY, THROUGH 2015 (\$ MILLIONS)</i>	136
<i>FIGURE 29 ESTIMATED MARKET SHARES OF GLOBAL SALES OF PACKAGING BAR CODES TO THE DRUG AND FOOD INDUSTRIES, 2010 AND 2015 (%)</i>	137
Projected Total Global Sales of RFID Tags	137
<i>TABLE 54 GLOBAL SALES OF PACKAGING RFID TAGS TO THE DRUG AND FOOD INDUSTRIES BY END USE, THROUGH 2015 (\$ MILLIONS)</i>	138
<i>FIGURE 30 SHARES OF GLOBAL PACKAGING RFID TAGS TO THE DRUG AND FOOD INDUSTRIES BY END USE, 2010 AND 2015 (%)</i>	138
<i>FIGURE 30 (CONTINUED)</i>	139
<i>TABLE 55 GLOBAL SALES OF PACKAGING RFID TAGS TO THE DRUG AND FOOD INDUSTRIES BY GEOGRAPHY, THROUGH 2015 (\$ MILLIONS)</i>	139
<i>FIGURE 31 ESTIMATED MARKET SHARES OF GLOBAL SALES OF PACKAGING RFID TAGS TO THE DRUG AND FOOD INDUSTRIES, 2010 AND 2015 (%)</i>	140

Projected Total Regional Sales of Track and Trace Packaging Technologies by Type	140
North American Sales of Track and Trace Packaging Technologies by Type Through 2015	140
<i>TABLE 56 NORTH AMERICAN SALES OF TRACK AND TRACE PACKAGING TECHNOLOGIES TO THE DRUG AND FOOD INDUSTRIES BY TYPE, THROUGH 2015 (\$ MILLIONS)</i>	141
<i>FIGURE 32 SHARES OF NORTH AMERICAN SALES OF TRACK AND TRACE PACKAGING TECHNOLOGIES TO THE DRUG AND FOOD INDUSTRIES BY TYPE, 2010 AND 2015 (%)</i>	141
European Sales of Track and Trace Packaging Technologies by Type Through 2015	142
<i>TABLE 57 EUROPEAN SALES OF TRACK AND TRACE PACKAGING TECHNOLOGIES TO THE DRUG AND FOOD INDUSTRIES BY TYPE, THROUGH 2015 (\$ MILLIONS)</i>	142
<i>FIGURE 33 SHARES OF EUROPEAN SALES OF TRACK AND TRACE PACKAGING TECHNOLOGIES TO THE DRUG AND FOOD INDUSTRIES BY TYPE, 2010 AND 2015 (%)</i>	142
<i>FIGURE 33 (CONTINUED)</i>	143
Asia-Pacific Sales of Track and Trace Packaging Technologies by Type Through 2015	143
<i>TABLE 58 ASIAN SALES OF TRACK AND TRACE PACKAGING TECHNOLOGIES TO THE DRUG AND FOOD INDUSTRIES BY TYPE, THROUGH 2015 (\$ MILLIONS)</i>	143
<i>FIGURE 34 SHARES OF ASIA-PACIFIC SALES OF TRACK AND TRACE PACKAGING TECHNOLOGIES TO THE DRUG AND FOOD INDUSTRIES BY TYPE, 2010 AND 2015 (%)</i>	144
Projected Total Global Sales of Track and Trace Packaging Technologies by Type	144
<i>TABLE 59 GLOBAL SALES OF TRACK AND TRACE PACKAGING TECHNOLOGIES TO THE DRUG AND FOOD INDUSTRIES BY TYPE, THROUGH 2015 (\$ MILLIONS)</i>	145
<i>FIGURE 35 SHARES OF GLOBAL SALES OF TRACK AND TRACE PACKAGING TECHNOLOGIES TO THE DRUG AND FOOD INDUSTRIES BY TYPE, 2010 AND 2015</i>	145
Projected Total Global Sales of Track and Trace Packaging Technologies by End Use	146
<i>TABLE 60 GLOBAL SALES OF PACKAGING TRACK AND TRACE PACKAGING TECHNOLOGIES TO THE DRUG AND FOOD INDUSTRIES BY END USE, THROUGH 2015 (\$ MILLIONS)</i>	146
<i>FIGURE 36 SHARES OF GLOBAL SALES OF TRACK AND TRACE PACKAGING TECHNOLOGIES TO THE DRUG AND FOOD INDUSTRIES BY END USE, 2010 AND 2015 (%)</i>	147
CHAPTER SEVEN: TECHNOLOGY AND PATENT ANALYSIS	148

INTRODUCTION	148
RECAP OF AUTHENTICATION PACKAGING TECHNOLOGIES	148
INKS AND DYES	148
HOLOGRAPHY	149
WATERMARKING	150
TAGGANTS	151
RECAP OF TRACK AND TRACE PACKAGING TECHNOLOGIES	152
BAR CODING TECHNOLOGY	152
RFID TECHNOLOGY	153
PATENT ANALYSIS	154
PATENTS RELATING TO AUTHENTICATION PACKAGING TECHNOLOGIES	154
<i>TABLE 61 PATENT AWARDS FOR AUTHENTICATION PACKAGING TECHNOLOGIES BY TYPE, 2009 (NUMBER OF PATENTS/%)</i>	155
<i>TABLE 62 PATENT AWARDS FOR AUTHENTICATION PACKAGING TECHNOLOGIES BY REGION, 2009 (NUMBER OF PATENTS/%)</i>	155
Samples of Patents for Inks and Dyes	155
<i>TABLE 63 PATENT AWARDS FOR INKS AND DYES BY REGION, 2009 (NUMBER OF PATENTS/%)</i>	156
Printing Process with Edible Inks	156
Phthalocyanine Dyes Suitable for Use in Offset Inks	157
Waxes for Producing Printing Inks.....	157
Method for Producing a Proof for a Printing Process Having More Than Four Printing Inks	158
Reproduction of Security Documents and Color Images with Metallic Inks.....	158
Sample of Patents for Holographic Technology.....	159
<i>TABLE 64 PATENT AWARDS FOR HOLOGRAPHY BY REGION, 2009 (NUMBER OF PATENTS/%)</i>	159
Three-Dimensional Hologram Image Display Apparatus and Three-Dimensional Hologram Image Display System.....	159
Computer Hologram and Creation Method Thereof.....	160
Fabrication Process for Cholesteric Liquid Crystal Media Having a Volume Hologram.....	161
Volume Hologram Layer and Volume Hologram Transfer Foil	161
Method for Optical Recording, Method for Optical Reproducing, Optical Recording Medium, and Optical Recording and Reproducing Apparatus Utilizing Holography	162
Patents for Watermarking Technology.....	163

<i>TABLE 65 PATENT AWARDS FOR WATERMARK TECHNOLOGY BY REGION, 2009 (NUMBER OF PATENTS/%)</i>	163
Protecting Images with an Image Watermark	163
Holographic Digital Watermark.....	164
Reversible Watermarking.....	164
Visual Watermark	165
Layered Security in Digital Watermarking.....	165
PATENTS RELATING TO TRACK AND TRACE PACKAGING TECHNOLOGIES	166
<i>TABLE 66 PATENT AWARDS FOR TRACK AND TRACE PACKAGING TECHNOLOGIES BY TYPE, 2009 (NUMBER OF PATENTS/%)</i>	166
<i>TABLE 67 PATENT AWARDS FOR TRACK AND TRACE PACKAGING TECHNOLOGIES BY REGION, 2009 (NUMBER OF PATENTS/%)</i>	166
Sample of Patents for Bar Coding Technology	167
<i>TABLE 68 PATENT AWARDS FOR BAR CODING TECHNOLOGY BY REGION, 2009 (NUMBER OF PATENTS/%)</i>	167
Pallet Content Identification Mechanism that Converts RFID Information to Corresponding Bar Code Information.....	167
Concentric-Ring Circular Bar Code	167
Method of and Apparatus for Identifying Consumer Products in a Retail Environment When Bar Code Symbols on the Products are Not Readable or Have Been Removed from Packaging.....	168
Methods and Apparatus for Bar Code Conversion	168
Color Bar Code Producing Method and Apparatus, Color Bar Code Reading Method and Apparatus, and Color Bar Code Reproducing Method and Apparatus	169
Sample of Patents for RFID Technology	169
<i>TABLE 69 PATENT AWARDS FOR RFID TECHNOLOGY BY REGION, 2009 (NUMBER OF PATENTS/%)</i>	169
Active RFID Tag with New Use Automatic Updating	170
RFID Tag Housing	170
RFID Tag Data Retention Verification and Refresh	171
RFID Tag Sensitivity	171
RFID Tags for Enabling Batch Reading of Stacks of Cartons.....	172
 CHAPTER EIGHT: SAFEGUARDING THE GLOBAL DRUG AND FOOD SUPPLY CHAINS	173
INTRODUCTION	173
SNAPSHOTS OF GLOBAL DRUG SAFETY	173
FDA AND DRUG SAFETY	173

Revised Requirements for Prescribing Information for Drug Products Since 2006.....	174
FDA’s Supply Chain Pilot Program	175
E.U. AND DRUG SAFETY	175
Key Elements of the E.U. Pharmavigilance Proposals	176
Clear Roles and Responsibilities for Responsible Parties	176
Creation of the Pharmacovigilance Risk Assessment Advisory Committee.....	176
Transparency and Communication.....	176
WHO TASK FORCE: IMPACT.....	177
RECENT INITIATIVES FOR STANDARDS IN THE GLOBAL DRUG SUPPLY CHAIN	178
MASS SERIALIZATION.....	178
U.S. FDA Guidance for Numerical Identification	178
Unit of Packaging	179
Package-Level SNI for Most Prescription Drugs.....	180
SNI Including Expiration Date and/or Lot and Batch Number.....	180
SNI in Human- and Machine-Readable Forms	180
FDA-Recommended SNI Compatibility with International Standards.....	181
Coding and Identification of Drug Products in Europe	181
GS1 U.S. 2015 Readiness Program: Visibility/Traceability for Healthcare Applications—Product Recalls, Serialization, and Drug Pedigree	182
GS1 Healthcare Industry Sunrise Dates.....	183
GS1 Canada’s Pharmacy Sector Engagement.....	184
Global RFID Interoperability Forum for Standards	184
U.S. DRUG PEDIGREE REQUIREMENTS: THE PRESCRIPTION DRUG MARKETING ACT	185
FDA Risk-Based Enforcement of Pedigree Requirement, 2006 to 2007.....	186
FDA Guidance for Industry on PDMA Requirements	186
Who Should Maintain a Written Agreement?	186
What Information About the ADR Must a Manufacturer Make Available on the List?.....	186
How Often Should Manufacturers Update Their ADR Lists?	187
Is Placing the ADR List on the Manufacturer’s Website Adequate to Meet the Provision of Making the List Available on Request to the Public?.....	187

What Information Does a Manufacturer Have to Provide to a Wholesaler to Enable that Wholesaler to Comply with the PDMA?	187
What Information Does an ADR Have to Provide to a Non-ADR to Enable that Non-ADR to Comply with the PDMA (e.g., to pass a pedigree that lists all prior transactions back to the manufacturer)?	187
Are Contract Manufacturers Considered <i>Manufacturers</i> Under the PDMA?	188
Is a Repackager or Relabeler Exempt from Providing a Pedigree?	188
Is a Pedigree Required if an Exclusive Distribution Agreement Exists?	188
What are the Recordkeeping Requirements for Pedigree Recipients?	188
Is a Pedigree Required for the Distribution of Drug Samples?	188
Can Paper or Electronic Pedigrees be Used?	189
Is RFID the Only Way to Achieve an Electronic Pedigree?	189
State Initiatives Targeting Wholesale Distributor Licensing	189
California State Pedigree Law	190
California Law Requirements	190
Drug Pedigree	191
Florida Drug Pedigree Law	192
Which Prescription Drugs are Subject to the Pedigree Requirements?	192
Who Must Provide a Pedigree?	192
To Whom Must the Pedigree Be Provided?	193
Does a Wholesale Distributor or Repackager Require a Pedigree for the Distribution of an active pharmaceutical ingredient (API)?	193
May a Drug Repackager Provide a Direct Purchase Pedigree?	193
How Are Drop Shipments Handled?	194
Florida Provisions	194
SNAPSHOTS OF GLOBAL FOOD TRACEABILITY	194
CODEX ALIMENTARIUS COMMISSION	194
Codex and Food Traceability	195
Public Sector Motivation for Traceability	195
Private Sector Motivation for Traceability	196
Codex General Principles on Prepackaged Food	196

Codex Mandatory Labeling of Prepackaged Foods	197
Codex Mandatory ... (Continued).....	198
U.S. FOOD SAFETY REGULATIONS.....	199
<i>TABLE 70 FEDERAL AGENCIES RESPONSIBLE FOR U.S. FOOD</i>	
<i>SAFETY SYSTEM</i>	199
<i>TABLE 70 (CONTINUED)</i>	200
U.S. BIOTERRORISM ACT RELATING TO FOOD PRODUCTS.....	200
Mandatory Recordkeeping	201
Recordkeeping Requirement for Transporters of Food.....	201
Recordkeeping Requirement for Non-Transporters of Food....	201
Effective Date for Compliance.....	202
Reportable Food Registry	202
FDA Food Protection Plan.....	203
FOOD TRACEABILITY IN CANADA.....	204
FOOD TRACEABILITY IN EUROPE.....	204
<i>TABLE 71 ROLES AND RESPONSIBILITIES WITHIN THE E.U. FOOD</i>	
<i>SYSTEM</i>	205
RECENT INITIATIVES FOR STANDARDS IN THE GLOBAL	
FOOD SUPPLY CHAIN	205
GS1 U.S. Standards Initiative for the Food Service Sector	205
GS1 U.S. Standards for Fresh Foods.....	206
GS1 Canada	207
GS1 Canada Product Recall Initiative.....	207
Produce Traceability Initiative 2012	207
CHAPTER NINE: COMPANY PROFILES	208
MAJOR MANUFACTURERS OF AUTHENTICATION PACKAGING	
TECHNOLOGIES.....	208
3D AG.....	208
3M COMPANY	208
APPLIED DNA SCIENCES.....	209
ALPVISION SA	209
ATLAS TELECOM.....	209
AUTHENTIX.....	210
CFC INTERNATIONAL, INC.	210
CONSTANTIA FLEXIBLES.....	211
CORTEGRA GROUP, INC.	211
DIC (INCLUDING SUN CHEMICAL).....	211
DIGIMARC CORPORATION	212
DUPONT AUTHENTICATION.....	212
EVEREST HOLOVISIONS, LTD.	212
EVIDENT TECHNOLOGIES	213
FLINT GROUP.....	213
G & W RFID, LLC (INCLUDING PARELEC).....	214
HOLOFLEX, LTD.	214

HOLOMEX	214
INKSURE TECHNOLOGIES.....	215
INTERNATIONAL INK COMPANY, LLC	215
JDSU AUTHENTICATION SOLUTIONS.....	215
MICROTRACE SOLUTIONS, LLC.....	216
NOVAVISION, INC	216
OPSEC SECURITY GROUP, PLC	217
OPTAGLIO GROUP.....	217
PACIFIC HOLOGRAPHICS.....	217
SECURITY HOLOGRAM, LLC.....	218
SICPA HOLDING SA.....	218
TESA SCRIBOS GMBH.....	219
ZELLER+GMELIN GMBH.....	219
MAJOR MANUFACTURERS OF TRACK AND TRACE PACKAGING	
TECHNOLOGIES.....	219
ALIEN TECHNOLOGY	219
AVERY DENNISON RFID	220
DATA SYSTEMS INTERNATIONAL.....	220
DATAMAX-O'NEIL	221
DOMINO INTEGRATED SOLUTIONS GROUP	221
ELEMENT ID.....	221
FEIG ELECTRONICS, INC.	222
GLOBERANGER CORPORATION.....	222
IMPINJ	222
INTERMEC TECHNOLOGIES.....	223
KOVIO, INC.	223
OMRON RFID	224
PRINTRONIX, INC.....	224
SATO AMERICA, INC.	224
SAVI TECHNOLOGY, INC.	225
SYSTECH INTERNATIONAL	225
SYMBOL TECHNOLOGIES (MOTOROLA)	226
TAGSYS RFID.....	226
THINGMAGIC	226
TEXAS INSTRUMENTS RFID SYSTEMS.....	227
ZEBRA TECHNOLOGIES.....	227