

# UTC Fire & Security Americas Corporation, Inc.

## eKey Fob

Report No. SUPR0086 Rev 01

Report Prepared By



[www.nwemc.com](http://www.nwemc.com)  
1-888-EMI-CERT

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EMC Test Report



22975 NW Evergreen Parkway  
Suite 400  
Hillsboro, Oregon 97124

## Certificate of Test

Last Date of Test: August 12, 2011  
UTC Fire & Security Americas Corporation, Inc.  
Model: eKey Fob

Emissions			
Test Description	Specification	Test Method	Pass/Fail
Spurious Radiated Emissions	FCC 15.247:2011	ANSI C63.10:2009	Pass
Occupied Bandwidth	FCC 15.247:2011	ANSI C63.10:2009	Pass
Output Power	FCC 15.247:2011	ANSI C63.10:2009	Pass
Band Edge Compliance	FCC 15.247:2011	ANSI C63.10:2009	Pass
Spurious Conducted Emissions	FCC 15.247:2011	ANSI C63.10:2009	Pass
Power Spectral Density	FCC 15.247:2011	ANSI C63.10:2009	Pass

### Modifications made to the product

See the Modifications section of this report

### Test Facility

The measurement facility used to collect the data is located at:

Northwest EMC, Inc.  
22975 NW Evergreen Parkway, Suite 400  
Hillsboro, OR 97124

Phone: (503) 844-4066 Fax: 844-3826

This site has been fully described in a report filed with and accepted by the FCC (Federal Communications Commission) and Industry Canada (Site filing #2834D-1).

### Approved By:

Tim O'Shea, Operations Manager



NVLAP Lab Code: 200630-0

*This report must not be used to claim product certification, approval, or endorsement by NVLAP, NIST, or any agency of the federal government of the United States of America.*

*Product compliance is the responsibility of the client, therefore the tests and equipment modes of operation represented in this report were agreed upon by the client, prior to testing. This Report may only be duplicated in its entirety. The results of this test pertain only to the sample(s) tested. The specific description is noted in each of the individual sections of the test report supporting this certificate of test.*

Revision Number	Description	Date	Page Number
01	Corrected Test Description for Spurious Radiated Emissions, to remove reference to simultaneous transmissions.	9/1/11	30

**Barometric Pressure**

The recorded barometric pressure has been normalized to sea level.



# Accreditations and Authorizations

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## FCC

Accredited by NVLAP for performance of FCC radio, digital, and ISM device testing. Our Open Area Test Sites, certification chambers, and conducted measurement facilities have been fully described in reports filed with the FCC and accepted by the FCC in letters maintained in our files. Northwest EMC has been accredited by ANSI to ISO / IEC Guide 65 as a product certifier. We have been designated by the FCC as a Telecommunications Certification Body (TCB). This allows Northwest EMC to certify transmitters to FCC specifications in accordance with 47 CFR 2.960 and 2.962.

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## NVLAP

Northwest EMC, Inc. is accredited under the National Voluntary Laboratory Accreditation Program (NVLAP) for satisfactory compliance with the requirements of ISO/IEC 17025 for Testing Laboratories. NVLAP is administered by the National Institute of Standards and Technology (NIST), an agency of the U.S. Commerce Department. The NVLAP accreditation encompasses Electromagnetic Compatibility Testing in accordance with the European Union EMC Directive 2004/108/EC, and ANSI C63.4. Additionally, Northwest EMC is accredited by NVLAP to perform radio testing in accordance with the European Union R&TTE Directive 1999/5/EEC, the requirements of FCC, and the RSS radio standards for Industry Canada.

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## Industry Canada

Accredited by NVLAP for performance of Industry Canada RSS and ICES testing. Our Open Area Test Sites and certification chambers comply with RSS-Gen, Issue 2 and have been filed with Industry Canada and accepted. Northwest EMC has been accredited by ANSI to ISO / IEC Guide 65 as a product certifier. We have been designated by NIST and recognized by Industry Canada as a Certification Body (CB) per the APEC Mutual Recognition Arrangement (MRA). This allows Northwest EMC to certify transmitters to Industry Canada technical requirements. (*Site Filing Numbers - Hillsboro: 2834D-1, 2834D-2, Sultan: 2834C-1, Irvine: 2834B-1, 2834B-2, Brooklyn Park: 2834E-1*)

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## CAB

Designated by NIST and validated by the European Commission as a Conformity Assessment Body (CAB) to conduct tests and approve products to the EMC directive and transmitters to the R&TTE directive, as described in the U.S. - EU Mutual Recognition Agreement.

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## Australia/New Zealand

The National Association of Testing Authorities (NATA), Australia has been appointed by the ACA as an accreditation body to accredit test laboratories and competent bodies for EMC standards. Accredited test reports or assessments by competent bodies must carry the NATA logo. Test reports made by an overseas laboratory that has been accredited for the relevant standards by an overseas accreditation body that has a Mutual Recognition Agreement (MRA) with NATA are also accepted as technical grounds for product conformity. The report should be endorsed with the respective logo of the accreditation body (NVLAP).

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# Accreditations and Authorizations

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## VCCI

Accepted as an Associate Member to the VCCI, Acceptance No. 564. Conducted and radiated measurement facilities have been registered in accordance with Regulations for Voluntary Control Measures, Article 8. *(Registration Numbers. - Hillsboro: C-1071, R-1025, G-84, C-2687, T-1658, and R-2318, Irvine: R-1943, G-85, C-2766, and T-1659, Sultan: R-871, G-83, C-3265, and T-1511, Brooklyn Park: R-3125, G-86, G-141, C-3464, and T-1634).*

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## BSMI

Northwest EMC has been designated by NIST and validated by C-Taipei (BSMI) as a CAB to conduct tests as described in the APEC Mutual Recognition Agreement (US0017).

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## GOST

Northwest EMC, Inc. has been assessed and accredited by the Russian Certification bodies Certinform VNIINMASH, CERTINFO, SAMTES, and Federal CHEC, to perform EMC and Hygienic testing for Information Technology Products. As a result of their laboratory assessment, they will accept test results from Northwest EMC, Inc. for product certification

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## KCC

Northwest EMC, Inc is a CAB designated by MRA partners and recognized by Korea. *(Assigned Lab Numbers: Hillsboro: US0017, Irvine: US0158, Sultan: US0157, Brooklyn Park: US0175)*

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## VIETNAM

Vietnam MIC has approved Northwest EMC as an accredited test lab. Per Decision No. 194/QD-QLCL (dated December 15, 2009), Northwest EMC test reports can be used for Vietnam approval submissions.

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## SCOPE

For details on the Scopes of our Accreditations, please visit:

<http://www.nwemc.com/accreditations/>



# Northwest EMC Locations



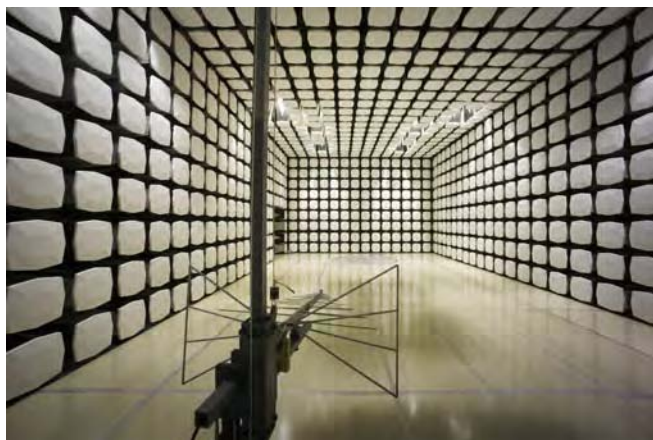
Oregon  
Labs EV01-EV12  
22975 NW Evergreen Pkwy  
Suite 400  
Hillsboro, OR 97124  
(503) 844-4066

California  
Labs OC01-OC13  
41 Tesla  
Irvine, CA 92618  
(949) 861-8918

Minnesota  
Labs MN01-MN08  
9349 W Broadway Ave.  
Brooklyn Park,  
MN 55445  
(763) 425-2281

Washington  
Labs SU01-SU07  
14128 339<sup>th</sup> Ave. SE  
Sultan, WA 98294  
(360) 793-8675

New York  
Labs WA01-WA04  
4939 Jordan Rd.  
Elbridge, NY 13060  
(315) 685-0796



**Party Requesting the Test**

<b>Company Name:</b>	UTC Fire & Security Americas Corporation, Inc.
<b>Address:</b>	4001 Fairview Industrial Drive SE
<b>City, State, Zip:</b>	Salem, OR 97302
<b>Test Requested By:</b>	Adam Purdue
<b>Model:</b>	eKey Fob
<b>First Date of Test:</b>	8/5/2011
<b>Last Date of Test:</b>	8/12/2011
<b>Receipt Date of Samples:</b>	8/5/2011
<b>Equipment Design Stage:</b>	Prototype
<b>Equipment Condition:</b>	No Damage

**Information Provided by the Party Requesting the Test****Functional Description of the EUT (Equipment Under Test):**

Bluetooth EDR radio module - battery powered

**Testing Objective:**

To demonstrate compliance to FCC 15.247 requirements



**CONFIGURATION 1 SUPR0086****Software/Firmware Running during test**

Description	Version
Standard Firmware	N/A

**EUT**

Description	Manufacturer	Model/Part Number	Serial Number
Bluetooth Key Fob	UTC Fire & Security Americas Corporation, Inc.	eKey Fob	L
Bluetooth Key Fob	UTC Fire & Security Americas Corporation, Inc.	eKey Fob	M
Bluetooth Key Fob	UTC Fire & Security Americas Corporation, Inc.	eKey Fob	H

**Peripherals in test setup boundary**

Description	Manufacturer	Model/Part Number	Serial Number
Battery	Varta Microbattery	CR 2/3 AH	N/A

**Cables**

Cable Type	Shield	Length (m)	Ferrite	Connection 1	Connection 2
DC Leads	No	.10m	No	EUT	Battery

PA = Cable is permanently attached to the device. Shielding and/or presence of ferrite may be unknown.

**CONFIGURATION 4 SUPR0086****Software/Firmware Running during test**

Description	Version
Standard Firmware	N/A

**EUT**

Description	Manufacturer	Model/Part Number	Serial Number
Bluetooth Key Fob	UTC Fire & Security Americas Corporation, Inc.	eKey Fob	L
Bluetooth Key Fob	UTC Fire & Security Americas Corporation, Inc.	eKey Fob	M
Bluetooth Key Fob	UTC Fire & Security Americas Corporation, Inc.	eKey Fob	H

**Cables**

Cable Type	Shield	Length (m)	Ferrite	Connection 1	Connection 2
DC Leads	No	.10m	No	EUT	Battery

PA = Cable is permanently attached to the device. Shielding and/or presence of ferrite may be unknown.



Equipment modifications					
Item	Date	Test	Modification	Note	Disposition of EUT
1	8/5/2011	Spurious Radiated Emissions	Tested as delivered to Test Station.	No EMI suppression devices were added or modified during this test.	EUT remained at Northwest EMC following the test.
2	8/12/2011	Band Edge Compliance	Tested as delivered to Test Station.	No EMI suppression devices were added or modified during this test.	EUT remained at Northwest EMC following the test.
3	8/12/2011	Occupied Bandwidth	Tested as delivered to Test Station.	No EMI suppression devices were added or modified during this test.	EUT remained at Northwest EMC following the test.
4	8/12/2011	Output Power	Tested as delivered to Test Station.	No EMI suppression devices were added or modified during this test.	EUT remained at Northwest EMC following the test.
5	8/12/2011	Power Spectral Density	Tested as delivered to Test Station.	No EMI suppression devices were added or modified during this test.	EUT remained at Northwest EMC following the test.
6	8/12/2011	Spurious Conducted Emissions	Tested as delivered to Test Station.	No EMI suppression devices were added or modified during this test.	Scheduled testing was completed.

Testing was performed using the mode(s) of operation and configuration(s) noted within the report. The individuals and/or the organization requesting the test provided the modes, configurations and settings used to complete the evaluation. The actual test parameters are specified in the test data, this includes items such as investigated frequency range (scanned) and test levels. The testing methods and performance specifications, as well as the test site used for the evaluation are indicated in the test data.

TEST EQUIPMENT					
Description	Manufacturer	Model	ID	Last Cal.	Interval
Spectrum Analyzer	Agilent	E4440A	AFD	7/5/2011	12
40GHz DC Block	Miteq	DCB4000	AMD	8/5/2010	13
Attenuator 20 dB, SMA M/F 26GHz	S.M. Electronics	SA26B-20	AUY	8/2/2011	12
EV06 Direct Connect Cable	ESM Cable Corp.	TT	ECA	NCR	0
MXG Vector Signal Generator	Agilent	N5182A	TIF	NCR	0

#### MEASUREMENT UNCERTAINTY

A measurement uncertainty estimation has been performed for each test per our internal quality document WP 342. The estimation is used to compare the measured result with its "true" or theoretically correct value. The expanded measurement uncertainty for radiated emissions measurements is less than +/- 4 dB, and for conducted emissions measurements is less than +/- 2.7 dB. Our measurement data meets or exceeds the measurement uncertainty requirements of CISPR 16-4; therefore, the test data can be compared directly to the specification limit to determine compliance. The calculations for measurement uncertainty are available upon request.

#### TEST DESCRIPTION

The occupied bandwidth was measured with the EUT set to low, medium, and high transmit frequencies. The measurement was made using a direct connection between the RF output of the EUT and the spectrum analyzer. The EUT was transmitting with basic data rate 1's modulated firmware.

NORTHWEST

EMC

Occupied Bandwidth

XMit 2011.08.04  
PsaTx 2011.08.04

EUT: eKey Fob		Work Order: SUPR0086	
Serial Number: See configurations		Date: 08/12/11	
Customer: UTC Fire & Security Americas Corporation, Inc.		Temperature: 23°C	
Attendees: Adam Purdue		Humidity: 39%	
Project: None		Barometric Pres.: 30.06 in	
Tested by: Rod Peloquin	Power: Battery	Job Site: EV06	


TEST SPECIFICATIONS		TEST METHOD	
FCC 15.247:2011		ANSI C63.10:2009	

COMMENTS

Basic data rate 1's modulated firmware

DEVIATIONS FROM TEST STANDARD

None

Configuration #	4	<div>Signature</div> 
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	Value	Limit	Result
Basic data rate			
Low Channel	1.013 MHz	< 1.5 MHz	Pass
Mid Channel	1.012 MHz	< 1.5 MHz	Pass
High Channel	1.014 MHz	< 1.5 MHz	Pass

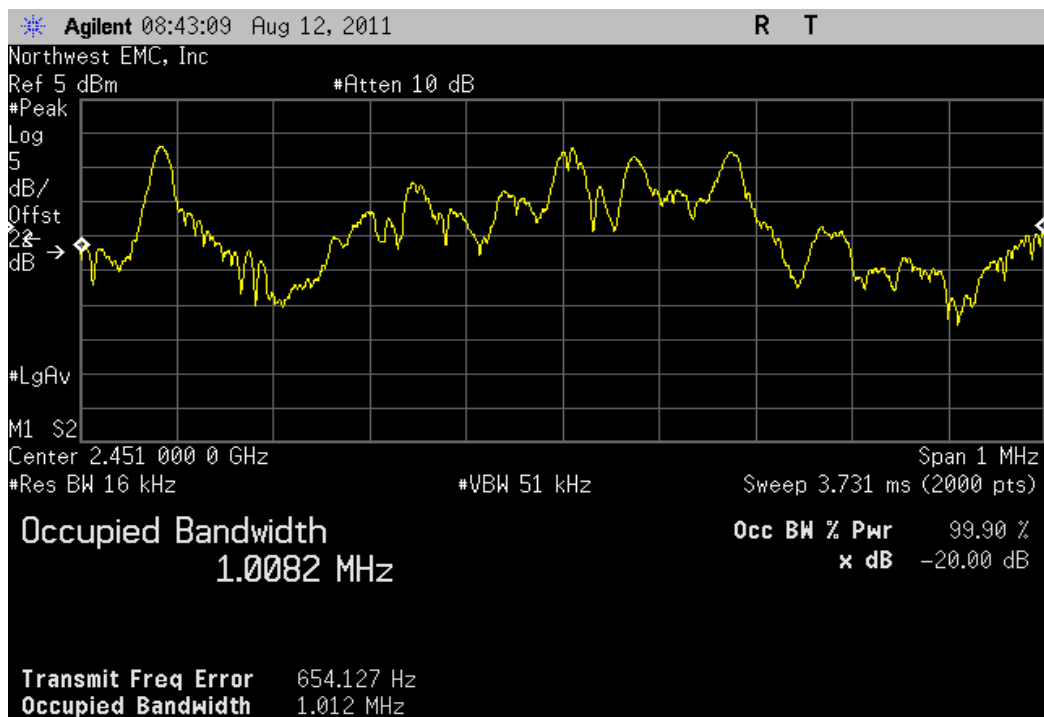
## Basic data rate, Low Channel

				Value	Limit	Result
				1.013 MHz	< 1.5 MHz	Pass



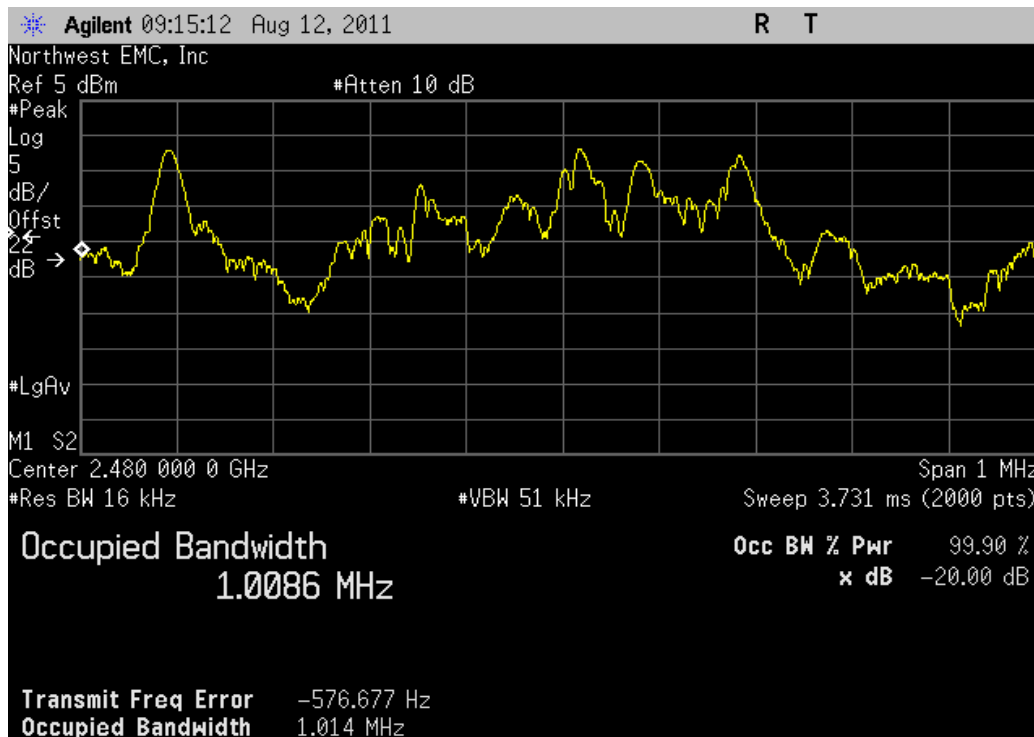
## Basic data rate, Mid Channel

				Value	Limit	Result
				1.012 MHz	< 1.5 MHz	Pass



Basic data rate, High Channel

	Value	Limit	Result
	1.014 MHz	< 1.5 MHz	Pass



Testing was performed using the mode(s) of operation and configuration(s) noted within the report. The individuals and/or the organization requesting the test provided the modes, configurations and settings used to complete the evaluation. The actual test parameters are specified in the test data, this includes items such as investigated frequency range (scanned) and test levels. The testing methods and performance specifications, as well as the test site used for the evaluation are indicated in the test data.

TEST EQUIPMENT					
Description	Manufacturer	Model	ID	Last Cal.	Interval
Spectrum Analyzer	Agilent	E4440A	AFD	7/5/2011	12
40GHz DC Block	Miteq	DCB4000	AMD	8/5/2010	13
Attenuator 20 dB, SMA M/F 26GHz	S.M. Electronics	SA26B-20	AUY	8/2/2011	12
EV06 Direct Connect Cable	ESM Cable Corp.	TT	ECA	NCR	0
MXG Vector Signal Generator	Agilent	N5182A	TIF	NCR	0


#### MEASUREMENT UNCERTAINTY

A measurement uncertainty estimation has been performed for each test per our internal quality document WP 342. The estimation is used to compare the measured result with its "true" or theoretically correct value. The expanded measurement uncertainty for radiated emissions measurements is less than +/- 4 dB, and for conducted emissions measurements is less than +/- 2.7 dB. Our measurement data meets or exceeds the measurement uncertainty requirements of CISPR 16-4; therefore, the test data can be compared directly to the specification limit to determine compliance. The calculations for measurement uncertainty are available upon request.

#### TEST DESCRIPTION

The peak output power was measured with the EUT set to low, medium, and high transmit frequencies. The measurement was made using a direct connection between the RF output of the EUT and a spectrum analyzer. The EUT was transmitting in basic data rate 1's modulated firmware.

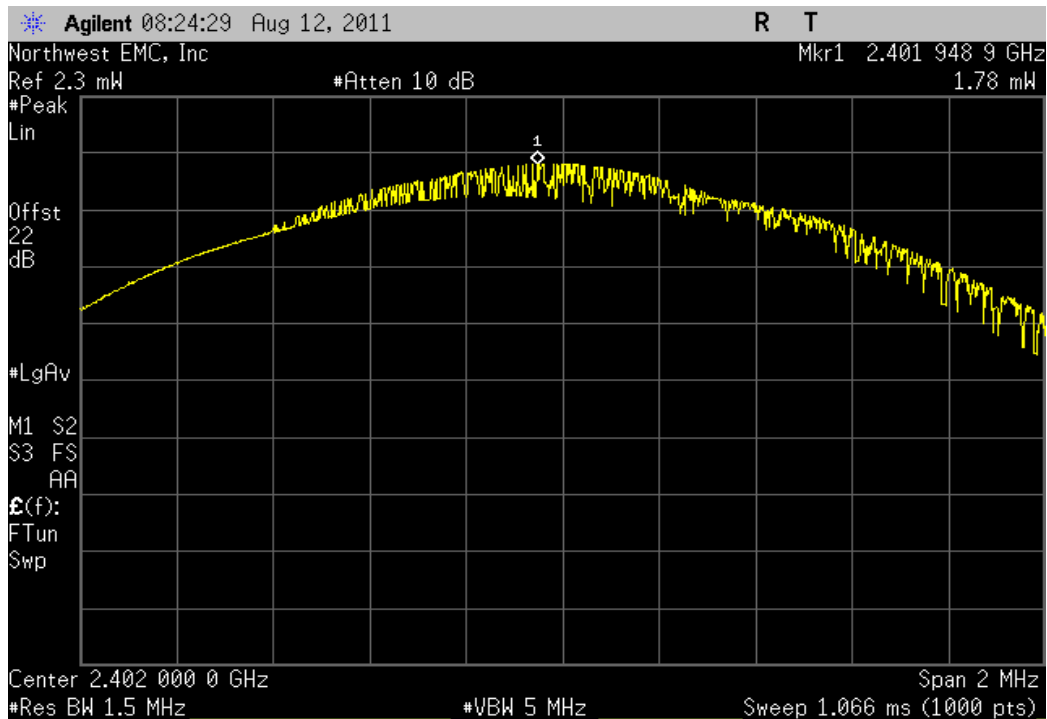
**De Facto EIRP Limit:** Per 47 CFR 15.247 (b)(1-3), the EUT meets the de facto EIRP limit of +36dBm.

NORTHWEST		Output Power		XMit 2011.08.04 PsaTx 2011.08.04	
EMC					
EUT: eKey Fob		Work Order: SUPR0086			
Serial Number: See configurations		Date: 08/12/11			
Customer: UTC Fire & Security Americas Corporation, Inc.		Temperature: 23°C			
Attendees: Adam Purdue		Humidity: 39%			
Project: None		Barometric Pres.: 30.06 in			
Tested by: Rod Peloquin		Power: Battery		Job Site: EV06	
TEST SPECIFICATIONS		TEST METHOD			
FCC 15.247:2011		ANSI C63.10:2009			
COMMENTS					
Basic data rate 1's modulated firmware					
DEVIATIONS FROM TEST STANDARD					
None					
Configuration #	4	 Signature			
		Value	Limit	Result	
Basic data rate					
Low Channel		1.785 mW	< 125 mW	Pass	
Mid Channel		1.962 mW	< 125 mW	Pass	
High Channel		1.958 mW	< 125 mW	Pass	



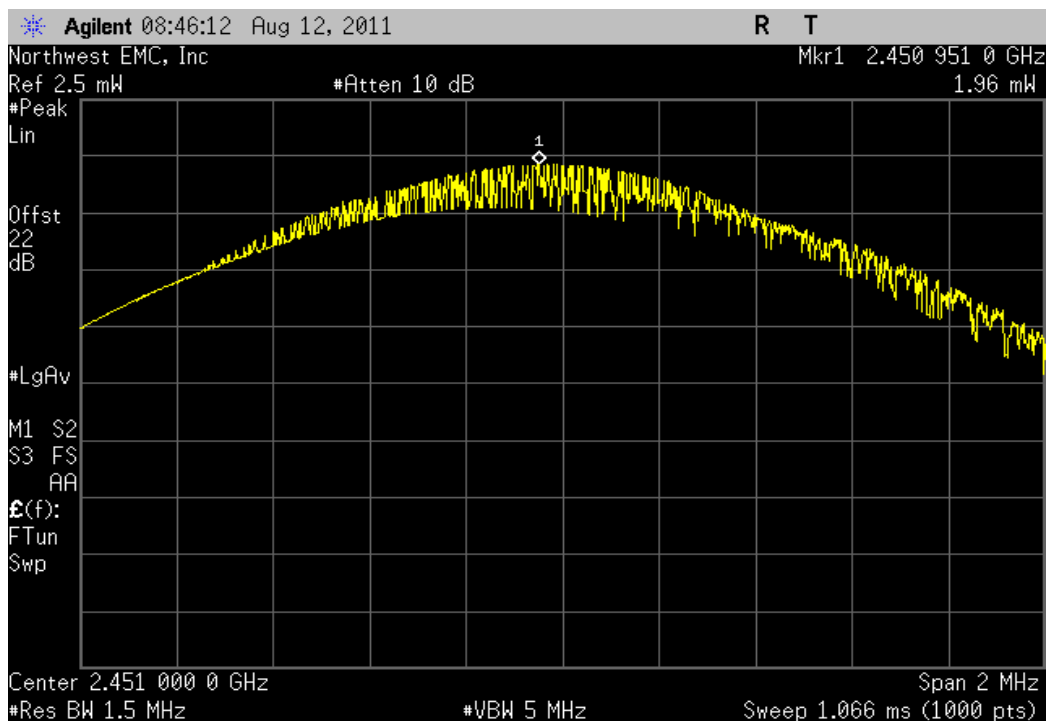
## Basic data rate, Low Channel

				Value	Limit	Result
				1.785 mW	< 125 mW	Pass



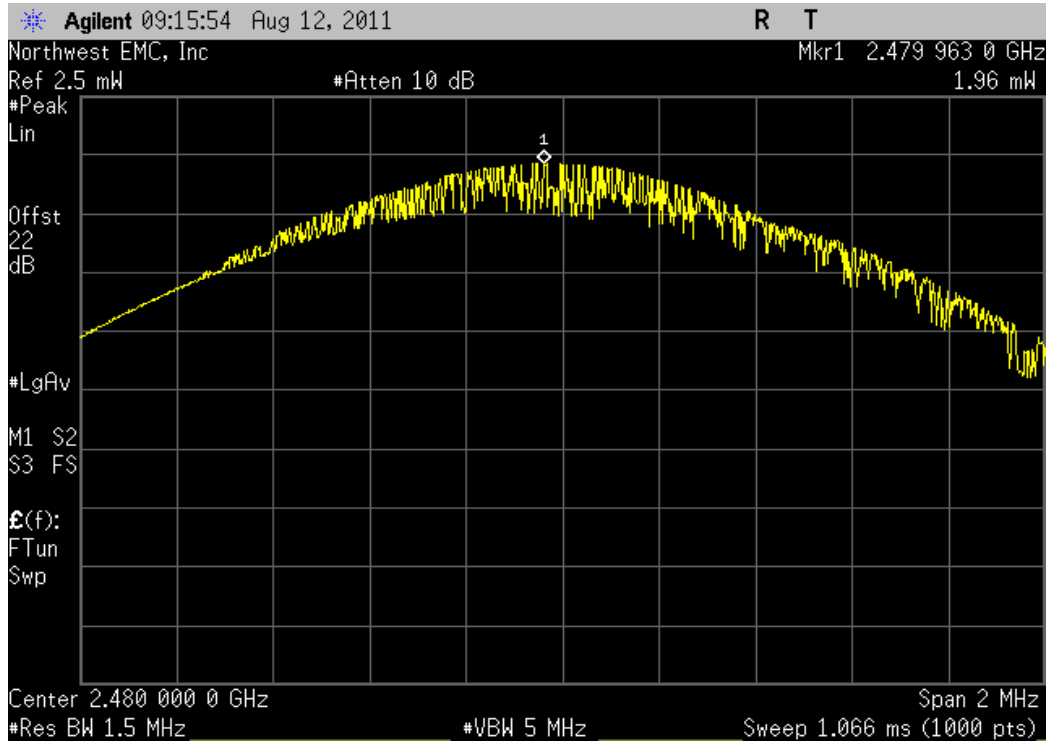
## Basic data rate, Mid Channel

				Value	Limit	Result
				1.962 mW	< 125 mW	Pass



Basic data rate, High Channel

				Value	Limit	Result
				1.958 mW	< 125 mW	Pass



Testing was performed using the mode(s) of operation and configuration(s) noted within the report. The individuals and/or the organization requesting the test provided the modes, configurations and settings used to complete the evaluation. The actual test parameters are specified in the test data, this includes items such as investigated frequency range (scanned) and test levels. The testing methods and performance specifications, as well as the test site used for the evaluation are indicated in the test data.

#### TEST EQUIPMENT

Description	Manufacturer	Model	ID	Last Cal.	Interval
Spectrum Analyzer	Agilent	E4440A	AFD	7/5/2011	12
40GHz DC Block	Miteq	DCB4000	AMD	8/5/2010	13
Attenuator 20 dB, SMA M/F 26GHz	S.M. Electronics	SA26B-20	AUY	8/2/2011	12
MXG Vector Signal Generator	Agilent	N5182A	TIF	NCR	0
EV06 Direct Connect Cable	ESM Cable Corp.	TT	ECA	NCR	0

#### MEASUREMENT UNCERTAINTY

A measurement uncertainty estimation has been performed for each test per our internal quality document WP 342. The estimation is used to compare the measured result with its "true" or theoretically correct value. The expanded measurement uncertainty for radiated emissions measurements is less than +/- 4 dB, and for conducted emissions measurements is less than +/- 2.7 dB. Our measurement data meets or exceeds the measurement uncertainty requirements of CISPR 16-4; therefore, the test data can be compared directly to the specification limit to determine compliance. The calculations for measurement uncertainty are available upon request.

#### TEST DESCRIPTION

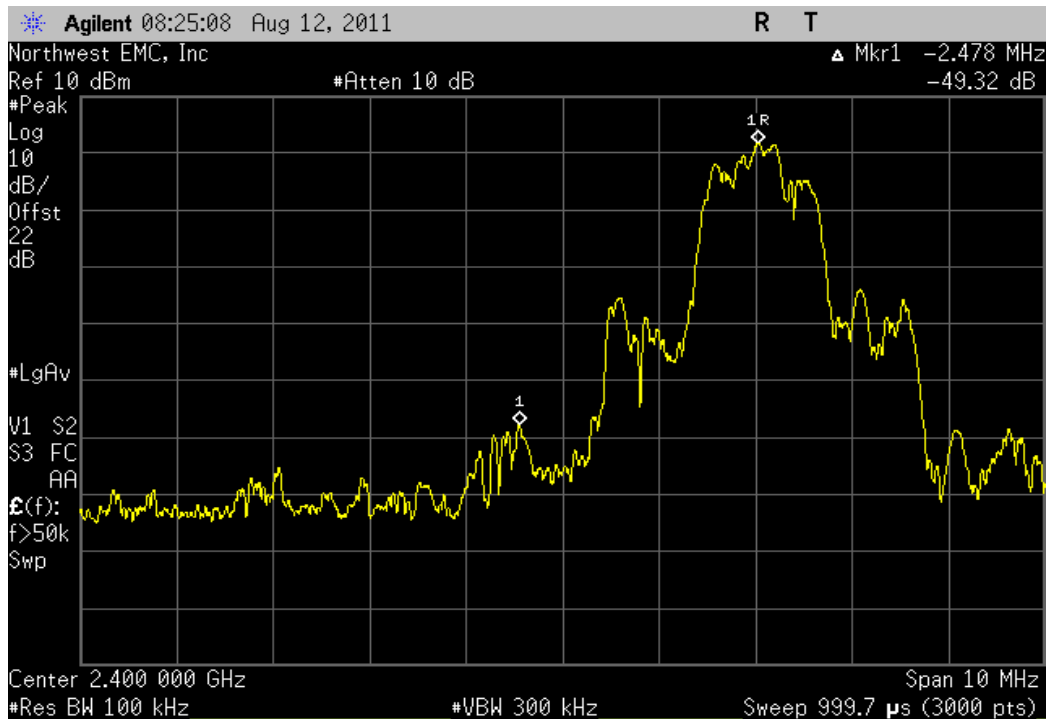
The requirements of FCC 15.247(d) for emissions at least 20dB below the carrier in any 100kHz bandwidth outside the allowable band was measured with the EUT set to low and high transmit frequencies. The measurement was made using a direct connection between the RF output of the EUT and the spectrum analyzer. The channels closest to the band edges were selected. The spectrum was scanned across each band edge from 5 MHz below the band edge to 5 MHz above the band edge.

The EUT was transmitting with basic data rate 1's modulated firmware.



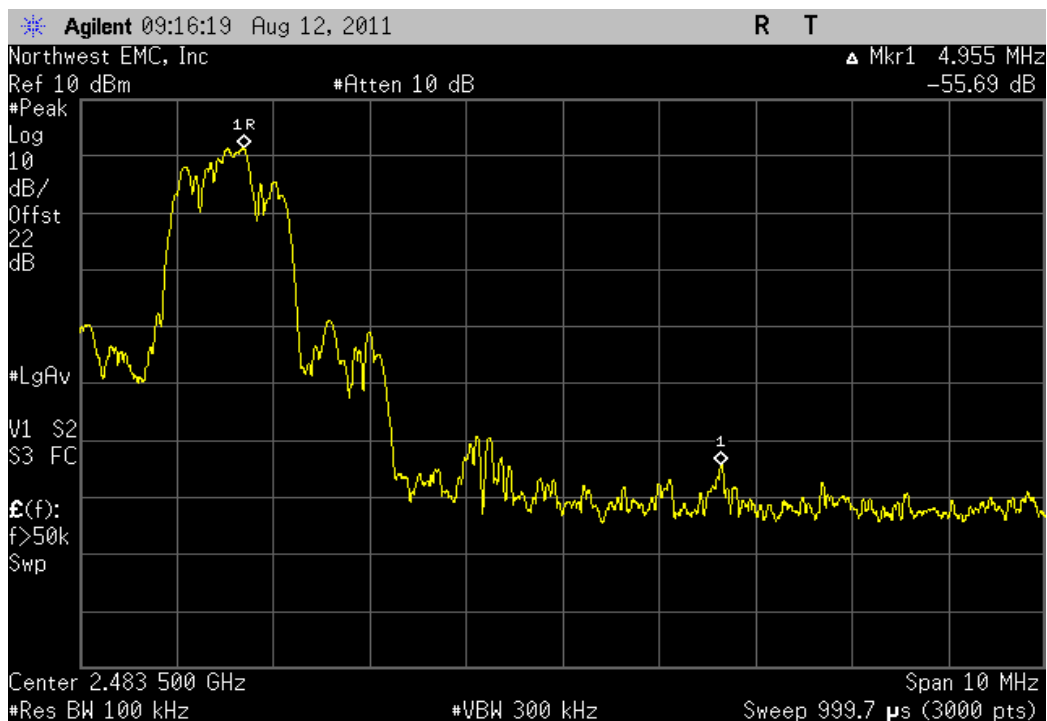
## Basic data rate, Low Channel

				Value	Limit	Result
				-49.32 dBc	$\leq -20$ dBc	Pass



## Basic data rate, High Channel

				Value	Limit	Result
				-55.69 dBc	$\leq -20$ dBc	Pass



Testing was performed using the mode(s) of operation and configuration(s) noted within the report. The individuals and/or the organization requesting the test provided the modes, configurations and settings used to complete the evaluation. The actual test parameters are specified in the test data, this includes items such as investigated frequency range (scanned) and test levels. The testing methods and performance specifications, as well as the test site used for the evaluation are indicated in the test data.

TEST EQUIPMENT					
Description	Manufacturer	Model	ID	Last Cal.	Interval
Spectrum Analyzer	Agilent	E4440A	AFD	7/5/2011	12
40GHz DC Block	Miteq	DCB4000	AMD	8/5/2010	13
Attenuator 20 dB, SMA M/F 26GHz	S.M. Electronics	SA26B-20	AUY	8/2/2011	12
EV06 Direct Connect Cable	ESM Cable Corp.	TT	ECA	NCR	0
MXG Vector Signal Generator	Agilent	N5182A	TIF	NCR	0

#### MEASUREMENT UNCERTAINTY

A measurement uncertainty estimation has been performed for each test per our internal quality document WP 342. The estimation is used to compare the measured result with its "true" or theoretically correct value. The expanded measurement uncertainty for radiated emissions measurements is less than +/- 4 dB, and for conducted emissions measurements is less than +/- 2.7 dB. Our measurement data meets or exceeds the measurement uncertainty requirements of CISPR 16-4; therefore, the test data can be compared directly to the specification limit to determine compliance. The calculations for measurement uncertainty are available upon request.

#### TEST DESCRIPTION

The spurious RF conducted emissions were measured with the EUT set to low, medium, and high transmit frequencies. The measurements were made using a direct connection between the RF output of the EUT and the spectrum analyzer. The EUT was transmitting with basic data rate 1's modulated firmware in a no hop mode. For each transmit frequency, the spectrum was scanned throughout the specified frequency.

NORTHWEST

EMC

Spurious Conducted Emissions

XMit 2011.08.04  
PsaTx 2011.08.04

EUT: eKey Fob		Work Order: SUPR0086	
Serial Number: See configurations		Date: 08/12/11	
Customer: UTC Fire & Security Americas Corporation, Inc.		Temperature: 23°C	
Attendees: Adam Purdue		Humidity: 39%	
Project: None		Barometric Pres.: 30.06 in	
Tested by: Rod Peloquin	Power: Battery	Job Site: EV06	

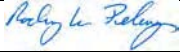
TEST SPECIFICATIONS		TEST METHOD	
FCC 15.247:2011		ANSI C63.10:2009	

COMMENTS

Basic data rate 1's modulated firmware

DEVIATIONS FROM TEST STANDARD

None

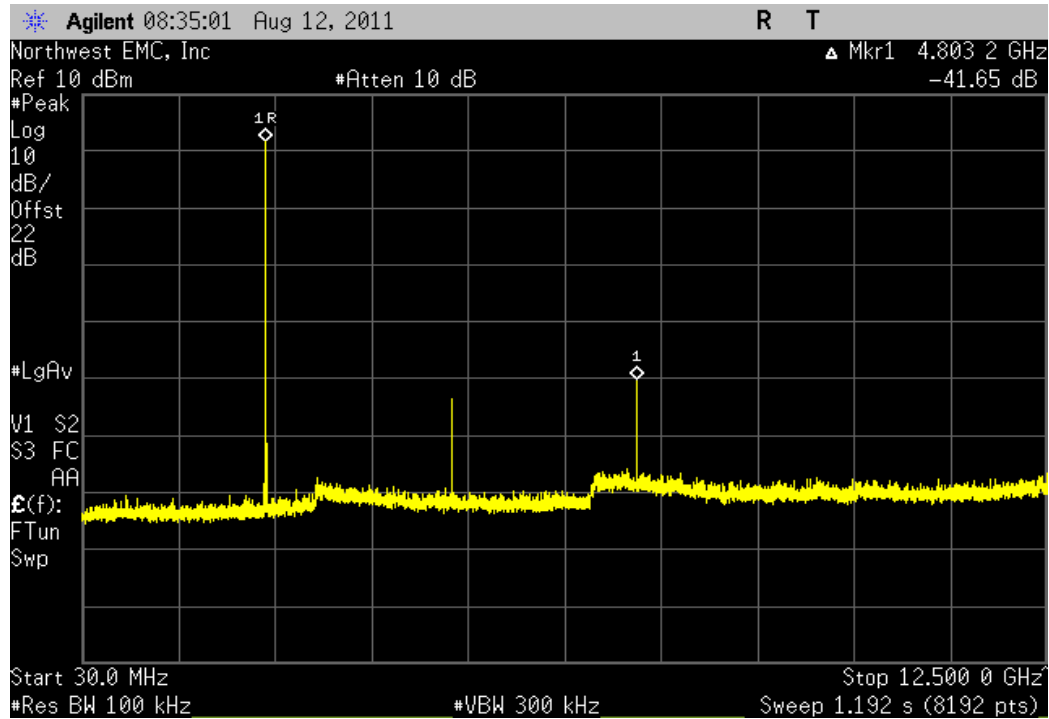
Configuration #	4	<div>Signature</div> 
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	Frequency Range	Value	Limit	Result
Basic data rate				
Low Channel	30 MHz - 12.5 GHz	-41.65 dBc	≤ -20 dBc	Pass
Low Channel	12.5 GHz - 25 GHz	-53.89 dBc	≤ -20 dBc	Pass
Mid Channel	30 MHz - 12.5 GHz	-42.15 dBc	≤ -20 dBc	Pass
Mid Channel	12.5 GHz - 25 GHz	-50.56 dBc	≤ -20 dBc	Pass
High Channel	30 MHz - 12.5 GHz	-44.72 dBc	≤ -20 dBc	Pass
High Channel	12.5 GHz - 25 GHz	-52.41 dBc	≤ -20 dBc	Pass



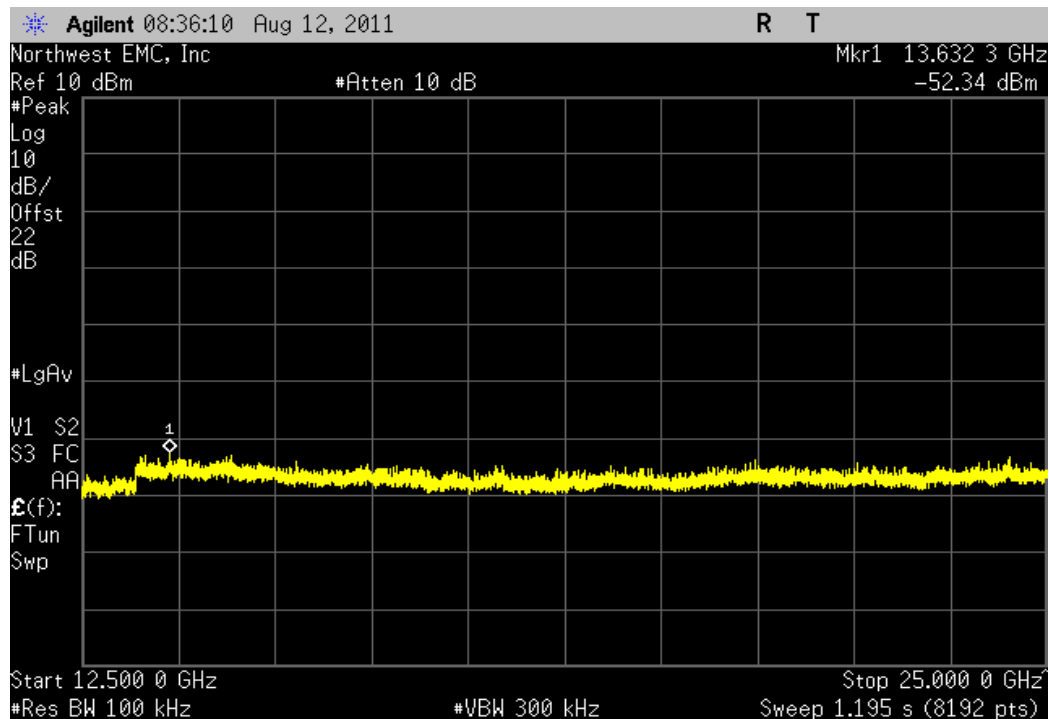
Basic data rate, Low Channel

Frequency Range	Value	Limit	Result
30 MHz - 12.5 GHz	-41.65 dBc	≤ -20 dBc	Pass



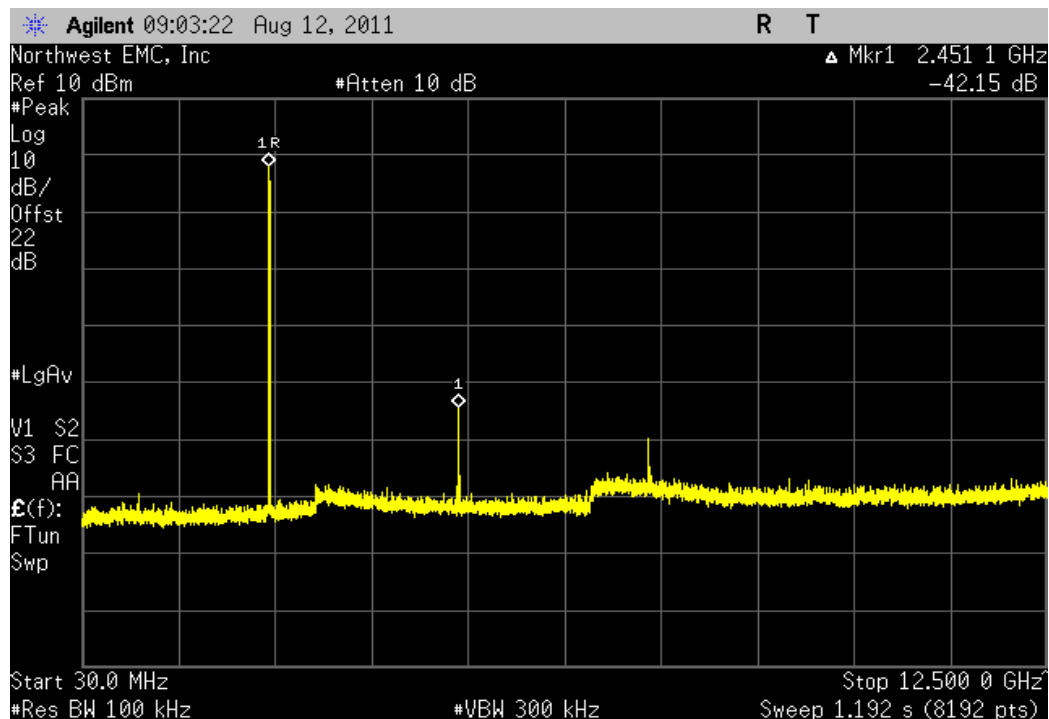
Basic data rate, Low Channel

Frequency Range	Value	Limit	Result
12.5 GHz - 25 GHz	-53.89 dBc	≤ -20 dBc	Pass



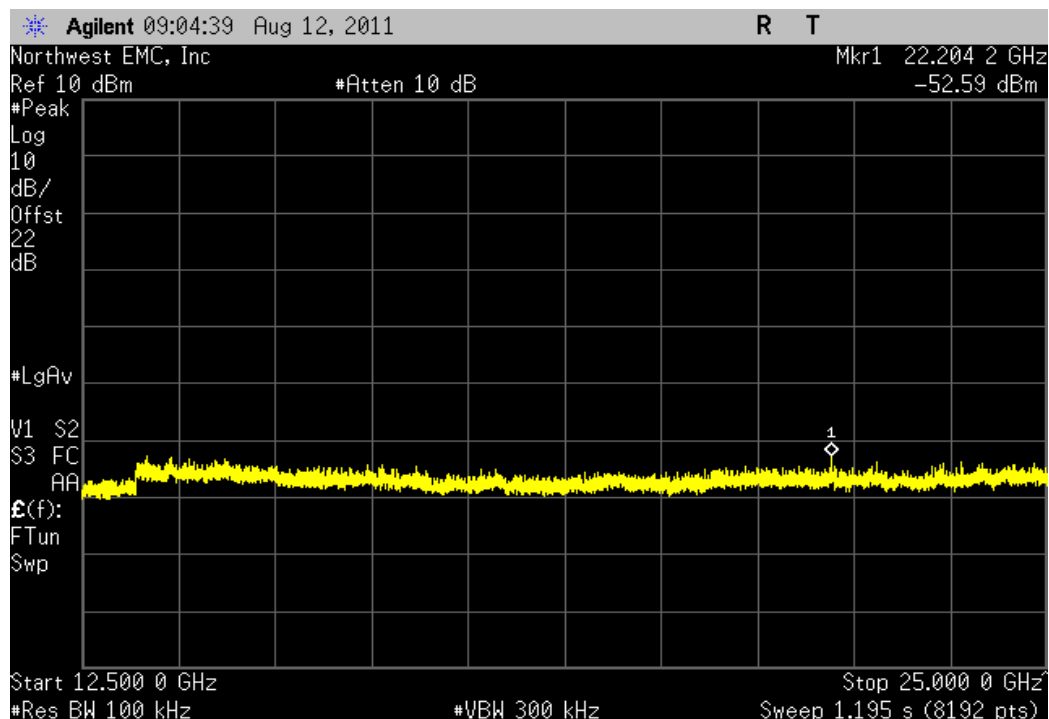
Basic data rate, Mid Channel

Frequency Range	Value	Limit	Result
30 MHz - 12.5 GHz	-42.15 dBc	≤ -20 dBc	Pass



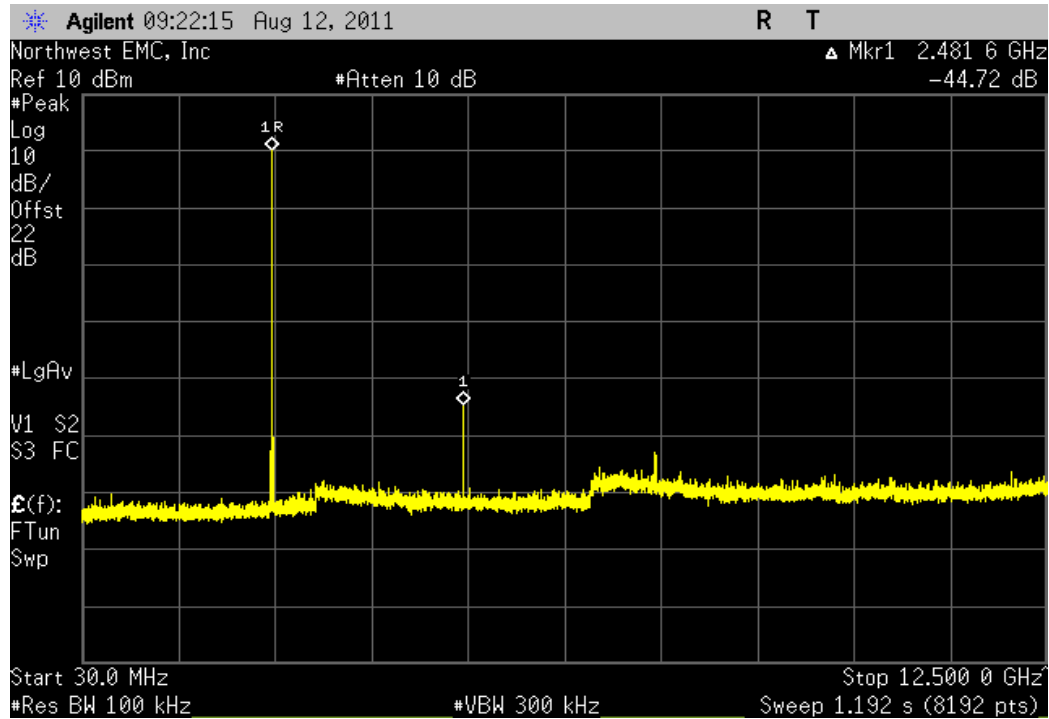
Basic data rate, Mid Channel

Frequency Range	Value	Limit	Result
12.5 GHz - 25 GHz	-50.56 dBc	≤ -20 dBc	Pass



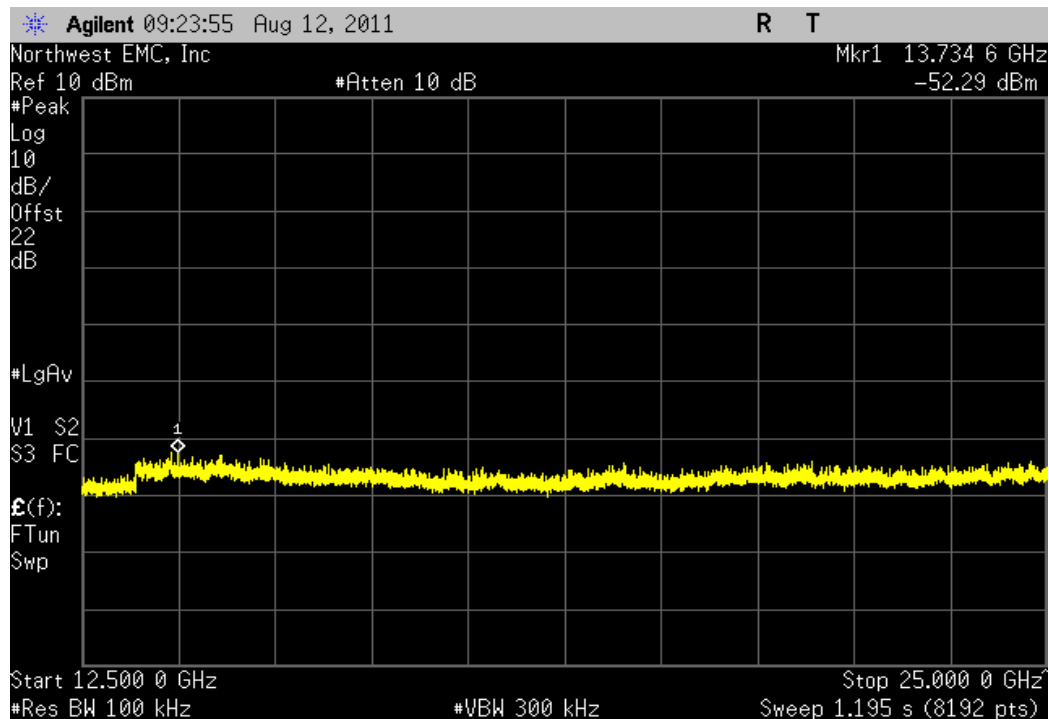
Basic data rate, High Channel

Frequency Range	Value	Limit	Result
30 MHz - 12.5 GHz	-44.72 dBc	≤ -20 dBc	Pass



Basic data rate, High Channel

Frequency Range	Value	Limit	Result
12.5 GHz - 25 GHz	-52.41 dBc	≤ -20 dBc	Pass



Testing was performed using the mode(s) of operation and configuration(s) noted within the report. The individuals and/or the organization requesting the test provided the modes, configurations and settings used to complete the evaluation. The actual test parameters are specified in the test data, this includes items such as investigated frequency range (scanned) and test levels. The testing methods and performance specifications, as well as the test site used for the evaluation are indicated in the test data.

TEST EQUIPMENT					
Description	Manufacturer	Model	ID	Last Cal.	Interval
Spectrum Analyzer	Agilent	E4440A	AFD	7/5/2011	12
40GHz DC Block	Miteq	DCB4000	AMD	8/5/2010	13
Attenuator 20 dB, SMA M/F 26GHz	S.M. Electronics	SA26B-20	AUY	8/2/2011	12
EV06 Direct Connect Cable	ESM Cable Corp.	TT	ECA	NCR	0
MXG Vector Signal Generator	Agilent	N5182A	TIF	NCR	0

#### MEASUREMENT UNCERTAINTY

A measurement uncertainty estimation has been performed for each test per our internal quality document WP 342. The estimation is used to compare the measured result with its "true" or theoretically correct value. The expanded measurement uncertainty for radiated emissions measurements is less than +/- 4 dB, and for conducted emissions measurements is less than +/- 2.7 dB. Our measurement data meets or exceeds the measurement uncertainty requirements of CISPR 16-4; therefore, the test data can be compared directly to the specification limit to determine compliance. The calculations for measurement uncertainty are available upon request.

#### TEST DESCRIPTION

The power spectral density measurements were measured with the EUT set to low, mid, and high transmit frequencies. The measurement was made using a direct connection between the RF output of the EUT and the spectrum analyzer. The EUT was transmitting in the basic data rate with 1's modulated firmware. ANSI C63.10:2009, Section 6.11.2.3 was followed. The spectrum analyzer was set as follows:

The emission peak was located and zoomed in on within the passband.

a) RBW = 3 kHz


b) VBW = 10 kHz

c) Span = 300 kHz

d) Sweep time = 100s

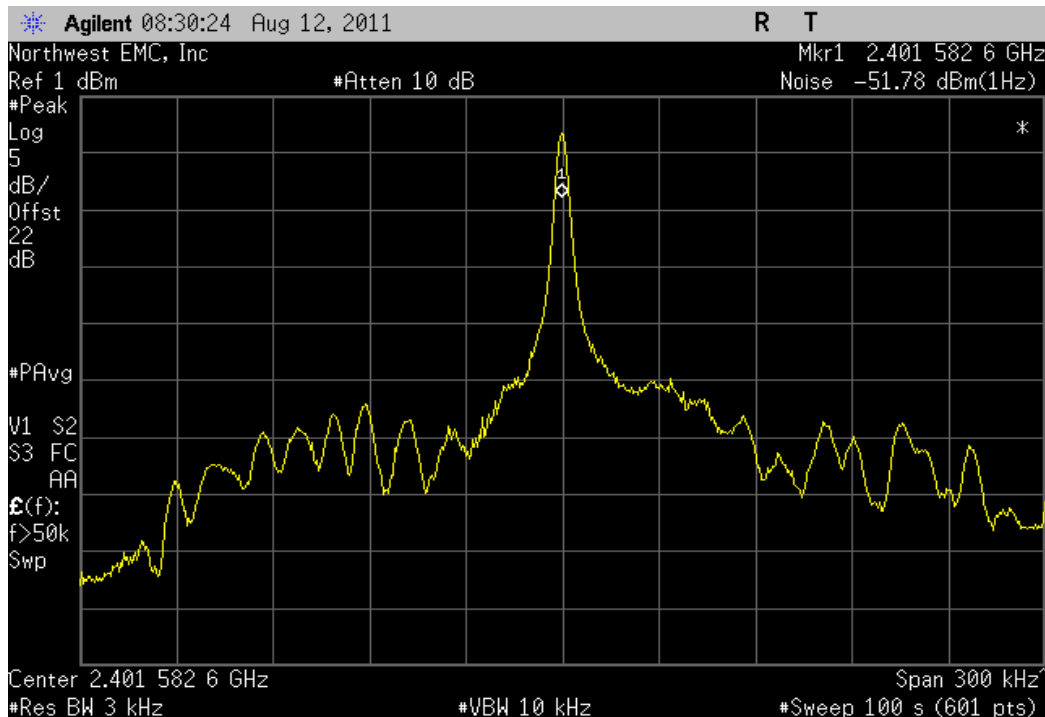
e) Trace set to MAX

f) The 1 hz Marker Noise function on the analyzer was used. The data was corrected to 3 kHz by adding 34.8 dB to the reading.

NORTHWEST		Power Spectral Density		XMit 2011.08.04 PsaTx 2011.08.04		
EMC						
EUT: eKey Fob		Work Order: SUPR0086				
Serial Number: See configurations		Date: 08/12/11				
Customer: UTC Fire & Security Americas Corporation, Inc.		Temperature: 23°C				
Attendees: Adam Purdue		Humidity: 39%				
Project: None		Barometric Pres.: 30.06 in				
Tested by: Rod Peloquin		Power: Battery		Job Site: EV06		
TEST SPECIFICATIONS		TEST METHOD				
FCC 15.247:2011		ANSI C63.10:2009				
COMMENTS						
Basic data rate 1's modulated firmware						
DEVIATIONS FROM TEST STANDARD						
None						
Configuration #	4	<div>Signature</div> 				
		Value (dBm / Hz)	(dBm / Hz) To (dBm / 3 kHz)	Value (dBm / 3 kHz)	Limit (dBm / 3 kHz)	Result
Basic data rate						
Low Channel		-51.775	34.8	-16.975	8	Pass
Mid Channel		-51.579	34.8	-16.779	8	Pass
High Channel		-51.666	34.8	-16.866	8	Pass

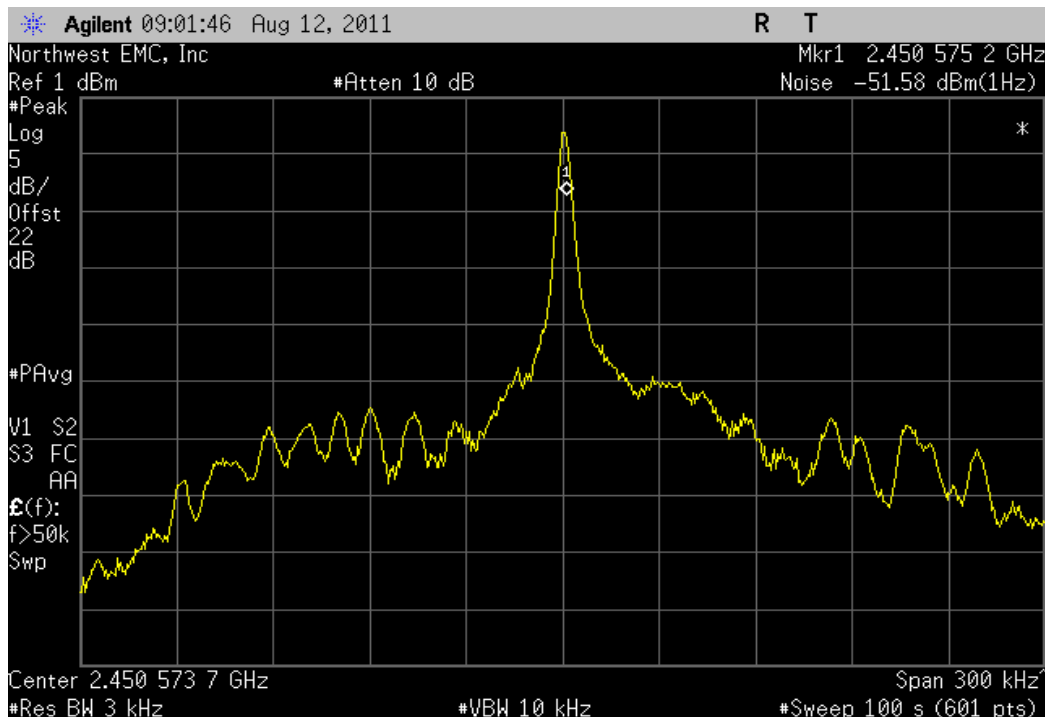
## Basic data rate, Low Channel

Value (dBm / Hz)	(dBm / Hz) To (dBm / 3 kHz)	Value (dBm / 3 kHz)	Limit (dBm / 3 kHz)	Result
-51.775	34.8	-16.975	8	Pass



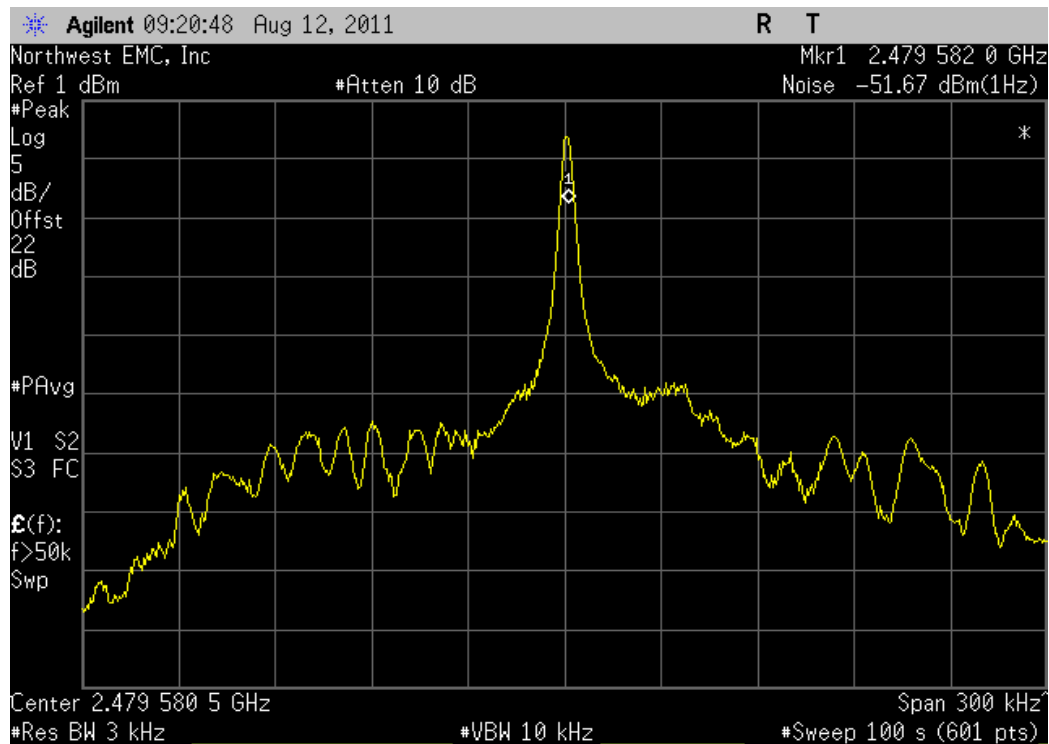
## Basic data rate, Mid Channel

Value (dBm / Hz)	(dBm / Hz) To (dBm / 3 kHz)	Value (dBm / 3 kHz)	Limit (dBm / 3 kHz)	Result
-51.579	34.8	-16.779	8	Pass



## Basic data rate, High Channel

	Value	(dBm / Hz) To	Value	Limit	
	(dBm / Hz)	(dBm / 3 kHz)	(dBm / 3 kHz)	(dBm / 3 kHz)	Result
	-51.666	34.8	-16.866	8	Pass





# Spurious Radiated Emissions

Testing was performed using the mode(s) of operation and configuration(s) noted within the report. The individuals and/or the organization requesting the test provided the modes, configurations and settings used to complete the evaluation. The actual test parameters are specified in the test data, this includes items such as investigated frequency range (scanned) and test levels. The testing methods and performance specifications, as well as the test site used for the evaluation are indicated in the test data.

## MODES OF OPERATION

Transmitting High Channel  
Transmitting Mid Channel  
Transmitting Low Channel

## POWER SETTINGS INVESTIGATED

Battery

## FREQUENCY RANGE INVESTIGATED

Start Frequency 30MHz Stop Frequency 26GHz

## SAMPLE CALCULATIONS

Radiated Emissions: Field Strength = Measured Level + Antenna Factor + Cable Factor - Amplifier Gain + Distance Adjustment Factor + External Attenuation

## TEST EQUIPMENT

Description	Manufacturer	Model	ID	Last Cal.	Interval
Pre-Amplifier	Miteq	AM-1616-1000	AOL	6/28/2011	12
Antenna, Bilog	Teseq	CBL 6141B	AXR	11/29/2010	12
EV01 Cables	N/A	Bilog Cables	EVA	6/28/2011	12
Pre-Amplifier	Miteq	AMF-4D-010100-24-10P	APW	6/28/2011	12
Antenna, Horn	ETS	3115	AIZ	1/24/2011	24
EV01 Cables	N/A	Double Ridge Horn Cables	EVB	6/28/2011	12
Pre-Amplifier	Miteq	AMF-6F-08001200-30-10P	AVC	3/2/2011	12
Antenna, Horn	ETS	3160-07	AHU	NCR	0
EV01 Cables	N/A	Standard Gain Horns Cables	EVF	3/2/2011	12
Pre-Amplifier	Miteq	AMF-6F-12001800-30-10P	AVD	3/2/2011	12
Antenna, Horn	ETS	3160-08	AHV	NCR	0
Cable	ESM Cable Corp.	KMKM-72	EVY	9/15/2010	12
Pre-Amplifier	Miteq	AMF-6F-18002650-25-10P	AVU	9/15/2010	12
Antenna, Horn	ETS Lindgren	3160-09	AIV	NCR	0
Spectrum Analyzer	Agilent	E4446A	AAQ	6/24/2011	12

## MEASUREMENT BANDWIDTHS

	Frequency Range	Peak Data	Quasi-Peak Data	Average Data
	(MHz)	(kHz)	(kHz)	(kHz)
	0.01 - 0.15	1.0	0.2	0.2
	0.15 - 30.0	10.0	9.0	9.0
	30.0 - 1000	100.0	120.0	120.0
	Above 1000	1000.0	N/A	1000.0

Measurements were made using the bandwidths and detectors specified. No video filter was used.

## MEASUREMENT UNCERTAINTY

A measurement uncertainty estimation has been performed for each test per our internal quality document WP 342. The estimation is used to compare the measured result with its "true" or theoretically correct value. Our measurement data meets or exceeds the measurement uncertainty requirements of CISPR 16-4. The measurement uncertainty estimation is available upon request.

## TEST DESCRIPTION

The highest gain of each type of antenna to be used with the EUT was tested. The EUT was configured for low, mid, and high band transmit frequencies. For each configuration, the spectrum was scanned throughout the specified range. In addition, measurements were made in the restricted bands to verify compliance. While scanning, emissions from the EUT were maximized by rotating the EUT on a turntable, adjusting the position of the EUT and EUT antenna in three orthogonal axis, and adjusting the measurement antenna height and polarization (per ANSI C63.10:2009). A preamp and high pass filter were used for this test in order to provide sufficient measurement sensitivity.

## Spurious Radiated Emissions

EUT: eKey Fob	Work Order: SUPR0086
Serial Number: None	Date: 08/05/11
Customer: UTC Fire & Security Americas Corporation, Inc.	Temperature: 23.36
Attendees: None	Humidity: 49%
Project: None	Barometric Pres.: 1013.2
Tested by: Travis Rychener	Power: Battery
	Job Site: EV01

## TEST SPECIFICATIONS

FCC 15.247:2011

## TEST METHOD

ANSI C63.10:2009

## TEST PARAMETERS

Antenna Height(s) (m) 1 - 4 Test Distance (m) 3

## COMMENTS

None

## EUT OPERATING MODES

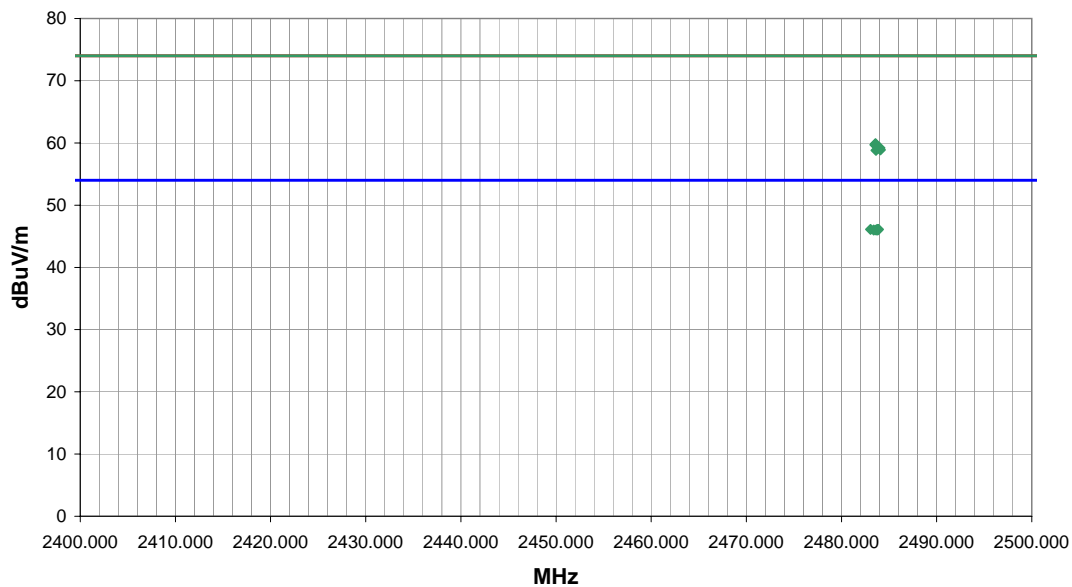
Transmitting High Channel

## DEVIATIONS FROM TEST STANDARD

No deviations.

Run #	1
Configuration #	1
Results	Pass

Signature



Freq (MHz)	Amplitude (dBuV)	Factor (dB)	Azimuth (degrees)	Height (meters)	Distance (meters)	External Attenuation (dB)	Polarity	Detector	Distance Adjustment (dB)	Adjusted dBuV/m	Spec. Limit dBuV/m	Compared to Spec. (dB)	Comments
2483.042	23.8	2.3	39.0	1.0	0.0	20.0	V-Horn	AV	0.0	46.1	54.0	-7.9	EUT on Side
2483.762	23.8	2.3	18.0	2.2	0.0	20.0	H-Horn	AV	0.0	46.1	54.0	-7.9	EUT on Side
2483.890	23.8	2.3	19.0	2.2	0.0	20.0	H-Horn	AV	0.0	46.1	54.0	-7.9	EUT Vertical
2483.390	23.7	2.3	359.0	2.2	0.0	20.0	H-Horn	AV	0.0	46.0	54.0	-8.0	EUT on back
2483.638	23.7	2.3	194.0	1.0	0.0	20.0	V-Horn	AV	0.0	46.0	54.0	-8.0	EUT on back
2483.812	23.7	2.3	331.0	1.0	0.0	20.0	V-Horn	AV	0.0	46.0	54.0	-8.0	EUT Vertical
2483.567	37.6	2.3	19.0	2.2	0.0	20.0	H-Horn	PK	0.0	59.9	74.0	-14.1	EUT Vertical
2483.513	37.4	2.3	39.0	1.0	0.0	20.0	V-Horn	PK	0.0	59.7	74.0	-14.3	EUT on Side
2483.520	37.4	2.3	331.0	1.0	0.0	20.0	V-Horn	PK	0.0	59.7	74.0	-14.3	EUT Vertical
2484.040	36.9	2.3	359.0	2.2	0.0	20.0	H-Horn	PK	0.0	59.2	74.0	-14.8	EUT on back
2484.090	36.6	2.3	18.0	2.2	0.0	20.0	H-Horn	PK	0.0	58.9	74.0	-15.1	EUT on Side
2483.615	36.5	2.3	194.0	1.0	0.0	20.0	V-Horn	PK	0.0	58.8	74.0	-15.2	EUT on back

## Spurious Radiated Emissions

EUT: eKey Fob	Work Order: SUPR0086
Serial Number: None	Date: 08/05/11
Customer: UTC Fire & Security Americas Corporation, Inc.	Temperature: 23.36
Attendees: None	Humidity: 49%
Project: None	Barometric Pres.: 1013.2
Tested by: Travis Rychener	Power: Battery
	Job Site: EV01

## TEST SPECIFICATIONS

FCC 15.247:2011

## TEST METHOD

ANSI C63.10:2009

## TEST PARAMETERS

Antenna Height(s) (m)	1 - 4	Test Distance (m)	3
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## COMMENTS

None

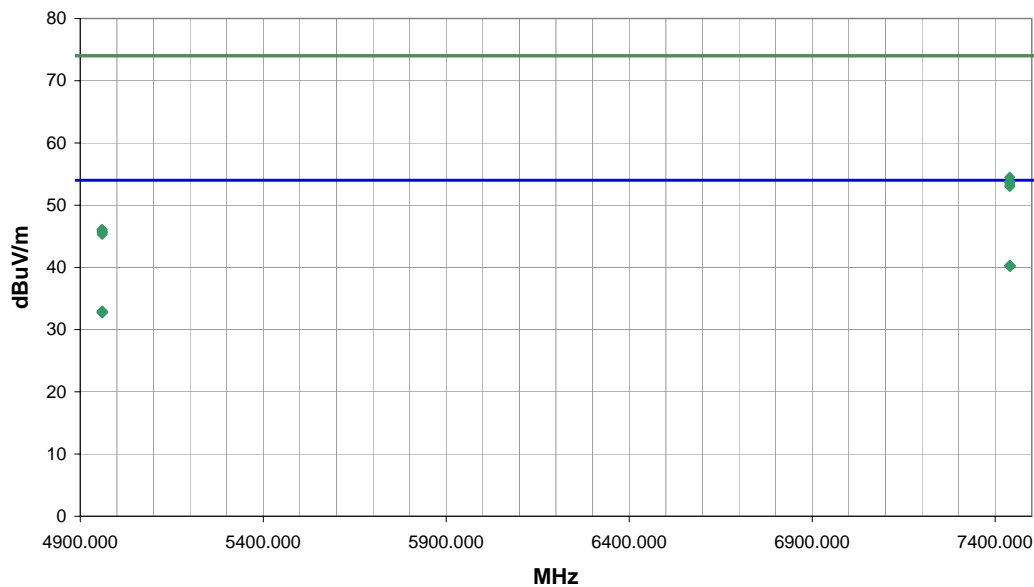
## EUT OPERATING MODES

Transmitting High Channel

## DEVIATIONS FROM TEST STANDARD

No deviations.

Run #	2	Signature 
Configuration #	1	
Results	Pass	



Freq (MHz)	Amplitude (dBuV)	Factor (dB)	Azimuth (degrees)	Height (meters)	Distance (meters)	External Attenuation (dB)	Polarity	Detector	Distance Adjustment (dB)	Adjusted dBuV/m	Spec. Limit dBuV/m	Compared to Spec. (dB)	Comments
7439.146	23.6	16.7	40.0	1.0	0.0	0.0	H-Horn	AV	0.0	40.3	54.0	-13.7	High Channel EUT Vertical
7440.430	23.6	16.7	190.0	1.0	0.0	0.0	H-Horn	AV	0.0	40.3	54.0	-13.7	High Channel EUT On Side
7440.697	23.6	16.7	94.0	1.0	0.0	0.0	V-Horn	AV	0.0	40.3	54.0	-13.7	High Channel EUT Vertical
7440.533	23.5	16.7	88.0	1.0	0.0	0.0	V-Horn	AV	0.0	40.2	54.0	-13.8	High Channel EUT On Side
7440.613	23.5	16.7	166.0	1.0	0.0	0.0	V-Horn	AV	0.0	40.2	54.0	-13.8	High Channel EUT On Side
7440.815	23.5	16.7	181.0	1.0	0.0	0.0	H-Horn	AV	0.0	40.2	54.0	-13.8	High Channel EUT Vertical
7439.505	37.8	16.7	181.0	1.0	0.0	0.0	H-Horn	PK	0.0	54.5	74.0	-19.5	High Channel EUT Vertical
7439.782	37.1	16.7	94.0	1.0	0.0	0.0	V-Horn	PK	0.0	53.8	74.0	-20.2	High Channel EUT Vertical
7440.227	37.0	16.7	166.0	1.0	0.0	0.0	V-Horn	PK	0.0	53.7	74.0	-20.3	High Channel EUT On Side
7439.670	36.9	16.7	88.0	1.0	0.0	0.0	V-Horn	PK	0.0	53.6	74.0	-20.4	High Channel EUT Vertical
7440.315	36.5	16.7	190.0	1.0	0.0	0.0	H-Horn	PK	0.0	53.2	74.0	-20.8	High Channel EUT On Side
4959.958	23.5	9.5	49.0	1.0	0.0	0.0	V-Horn	AV	0.0	33.0	54.0	-21.0	High Channel EUT Vertical
7439.592	36.3	16.7	40.0	1.0	0.0	0.0	H-Horn	PK	0.0	53.0	74.0	-21.0	High Channel EUT Vertical
4959.982	23.4	9.5	114.0	1.0	0.0	0.0	V-Horn	AV	0.0	32.9	54.0	-21.1	High Channel EUT Vertical
4960.007	23.3	9.5	179.0	2.1	0.0	0.0	H-Horn	AV	0.0	32.8	54.0	-21.2	High Channel EUT On Side
4960.083	23.3	9.5	87.0	2.1	0.0	0.0	H-Horn	AV	0.0	32.8	54.0	-21.2	High Channel EUT On Side
4959.388	23.2	9.5	80.0	2.1	0.0	0.0	H-Horn	AV	0.0	32.7	54.0	-21.3	High Channel EUT On Side
4960.515	23.2	9.5	98.0	1.0	0.0	0.0	V-Horn	AV	0.0	32.7	54.0	-21.3	High Channel EUT On Side
4959.570	36.6	9.5	114.0	1.0	0.0	0.0	V-Horn	PK	0.0	46.1	74.0	-27.9	High Channel EUT Vertical
4959.617	36.5	9.5	49.0	1.0	0.0	0.0	V-Horn	PK	0.0	46.0	74.0	-28.0	High Channel EUT On Side

Freq (MHz)	Amplitude (dBuV)	Factor (dB)	Azimuth (degrees)	Height (meters)	Distance (meters)	External Attenuation (dB)	Polarity	Detector	Distance Adjustment (dB)	Adjusted dBuV/m	Spec. Limit dBuV/m	Compared to Spec. (dB)	Comments
7206.104	26.7	16.2	171.0	1.0	0.0	0.0	V-Horn	AV	0.0	42.9	54.0	-11.1	Mid Channel EUT Vertical
7206.083	24.1	16.2	343.0	1.0	0.0	0.0	H-Horn	AV	0.0	40.3	54.0	-13.7	Mid Channel EUT Vertical
7349.132	23.7	16.6	294.0	3.3	0.0	0.0	H-Horn	AV	0.0	40.3	54.0	-13.7	Mid Channel EUT Vertical
7349.585	23.6	16.6	147.0	3.7	0.0	0.0	V-Horn	AV	0.0	40.2	54.0	-13.8	Mid Channel EUT Vertical
7206.235	39.4	16.2	171.0	1.0	0.0	0.0	V-Horn	PK	0.0	55.6	74.0	-18.4	Mid Channel EUT Vertical
7350.258	37.1	16.6	294.0	3.3	0.0	0.0	H-Horn	PK	0.0	53.7	74.0	-20.3	Mid Channel EUT Vertical
4803.887	24.3	9.4	212.0	1.0	0.0	0.0	H-Horn	AV	0.0	33.7	54.0	-20.3	Mid Channel EUT Vertical
4803.847	24.2	9.4	177.0	1.5	0.0	0.0	V-Horn	AV	0.0	33.6	54.0	-20.4	Mid Channel EUT Vertical
7350.342	36.8	16.6	147.0	3.7	0.0	0.0	V-Horn	PK	0.0	53.4	74.0	-20.6	Mid Channel EUT Vertical
7205.678	36.8	16.2	343.0	1.0	0.0	0.0	H-Horn	PK	0.0	53.0	74.0	-21.0	Mid Channel EUT Vertical
4899.979	23.5	9.4	11.0	2.8	0.0	0.0	V-Horn	AV	0.0	32.9	54.0	-21.1	Mid Channel EUT Vertical
4900.408	23.5	9.4	167.0	2.3	0.0	0.0	H-Horn	AV	0.0	32.9	54.0	-21.1	Mid Channel EUT Vertical
4900.343	37.3	9.4	167.0	2.3	0.0	0.0	H-Horn	PK	0.0	46.7	74.0	-27.3	Mid Channel EUT Vertical
4900.078	37.1	9.4	11.0	2.8	0.0	0.0	V-Horn	PK	0.0	46.5	74.0	-27.5	Mid Channel EUT Vertical
4804.100	37.0	9.4	177.0	1.5	0.0	0.0	V-Horn	PK	0.0	46.4	74.0	-27.6	Mid Channel EUT Vertical
4804.113	37.0	9.4	212.0	1.0	0.0	0.0	H-Horn	PK	0.0	46.4	74.0	-27.6	Mid Channel EUT Vertical

## **BLUETOOTH APPROVALS**

**FCC Procedure Received from Joe Dichoso on 2-15-02**

The following exhibit indicates the FCC Spread Spectrum requirements in Section 15.247 for devices meeting the Bluetooth Specifications in the 2.4 GHz band as of February 2001 operating in the USA. The purpose of this exhibit is to help expedite the approval process for Bluetooth devices. This exhibit provides items that vary for each device and also provides a list of items that are common to Bluetooth devices that explains the remaining requirements. The list of common items can be submitted for each application for equipment authorization. This exhibit only specifies requirements in Section 15.247, requirements in other rule Sections for intentional radiators such as in Section 15.203 or 15.207 must be also be addressed. A Bluetooth device is a FHSS transmitter in the data mode and applies as a Hybrid spread spectrum device in the acquisition mode.

For each individual device, the following items, 1-7 will vary from one device to another and must be submitted.

- 1) The occupied bandwidth in Section 15.247(a)(1)(ii).
- 2) Conducted output power specified in Section 15.247(b)(1).
- 3) EIRP limit in Section 15.247(b)(3).
- 4) RF safety requirement in Section 15.247(b)(4)
- 5) Spurious emission limits in Section 15.247(c).
- 6) Processing gain and requirements for Hybrids in Section 15.247(f) in the acquisition mode.
- 7) Power spectral density requirement in Section 15.247(f) in the acquisition mode.

For all devices, the following items, 1-12, are common to all Bluetooth devices and will not vary from one device to another. This list can be copied into the filing.

### **1 Output power and channel separation of a Bluetooth device in the different operating modes:**

The different operating modes (data-mode, acquisition-mode) of a Bluetooth device don't influence the output power and the channel spacing. There is only one transmitter which is driven by identical input parameters concerning these two parameters.

Only a different hopping sequence will be used. For this reason, the RF parameters in one op-mode is sufficient.

### **2 Frequency range of a Bluetooth device:**

The maximum frequency of the device is: **2402 – 2480 MHz**.

This is according the Bluetooth Core Specification V 1.0B (+ critical errata) for devices which will be operated in the USA. Other frequency ranges ( e.g. for Spain, France, Japan) which are allowed according the Core Specification must **not be** supported by the device.

### **3 Co-ordination of the hopping sequence in data mode to avoid simultaneous occupancy by multiple transmitters:**

Bluetooth units which want to communicate with other units must be organized in a structure called piconet. This piconet consist of max. 8 Bluetooth units. One unit is the master the other seven are the slaves. The master co-ordinates frequency occupation in this piconet for all units. As the master hop sequence is derived from it's BD address which is unique for every Bluetooth device, additional masters intending to establish new piconets will always use different hop sequences.

### **4 Example of a hopping sequence in data mode:**

Example of a 79 hopping sequence in data mode:

40, 21, 44, 23, 42, 53, 46, 55, 48, 33, 52, 35, 50, 65, 54, 67,  
56, 37, 60, 39, 58, 69, 62, 71, 64, 25, 68, 27, 66, 57, 70, 59,  
72, 29, 76, 31, 74, 61, 78, 63, 01, 41, 05, 43, 03, 73, 07, 75,  
09, 45, 13, 47, 11, 77, 15, 00, 64, 49, 66, 53, 68, 02, 70, 06,  
01, 51, 03, 55, 05, 04

#### **5 Equally average use of frequencies in data mode and short transmissions:**

The generation of the hopping sequence in connection mode depends essentially on two input values:

1. LAP/UAP of the master of the connection
2. Internal master clock

The LAP (lower address part) are the 24 LSB's of the 48 BD\_ADDRESS. The BD\_ADDRESS is an unambiguous number of every Bluetooth unit. The UAP (upper address part) are the 24 MSB's of the 48 BD\_ADDRESS. The internal clock of a Bluetooth unit is derived from a free running clock which is never adjusted and is never turned off. For synchronization with other units, only the offsets are used. It has no relation to the time of the day. Its resolution is at least half the RX/TX slot length of 312.5  $\mu$ s. The clock has a cycle of about one day (23h30). In most case it is implemented as 28 bit counter. For the deriving of the hopping sequence the entire LAP (24 bits), 4 LSB's (4 bits) (Input 1) and the 27 MSB's of the clock (Input 2) are used. With this input values different mathematical procedures (permutations, additions, XOR-operations) are performed to generate the sequence. This will be done at the beginning of every new transmission.

Regarding short transmissions, the Bluetooth system has the following behavior:

The first connection between the two devices is established, a hopping sequence is generated. For transmitting the wanted data, the complete hopping sequence is not used and the connection ends. The second connection will be established. A new hopping sequence is generated. Due to the fact that the Bluetooth clock has a different value, because the period between the two transmission is longer (and it cannot be shorter) than the minimum resolution of the clock (312.5  $\mu$ s). The hopping sequence will always differ from the first one.

#### **6 Receiver input bandwidth, synchronization and repeated single or multiple packets:**

The input bandwidth of the receiver is 1 MHz.

In every connection, one Bluetooth device is the master and the other one is the slave. The master determines the hopping sequence (see chapter 5). The slave follows this sequence. Both devices shift between RX and TX time slot according to the clock of the master. Additionally the type of connection (e.g. single or multi-slot packet) is set up at the beginning of the connection. The master adapts its hopping frequency and its TX/RX timing is according to the packet type of the connection. Also, the slave of the connection uses these settings. Repeating of a packet has no influence on the hopping sequence. The hopping sequence generated by the master of the connection will be followed in any case. That means, a repeated packet will not be send on the same frequency, it is send on the next frequency of the hopping sequence

#### **7 Dwell time in data mode**

The dwell time of 0.3797s within a 30 second period in data mode is independent from the packet type (packet length). The calculation for a 30 second period is as follows:

Dwell time = time slot length \* hop rate / number of hopping channels \* 30s

Example for a DH1 packet (with a maximum length of one time slot)

Dwell time = 625  $\mu$ s \* 1600 1/s / 79 \* 30s = 0.3797s (in a 30s period)

For multi-slot packet the hopping is reduced according to the length of the packet.

Example for a DH5 packet (with a maximum length of five time slots)

Dwell time =  $5 * 625 \mu s * 1600 * 1/5 * 1/s / 79 * 30s = 0.3797s$  (in a 30s period)

This is according the Bluetooth Core Specification V 1.0B (+ critical errata) for all Bluetooth devices. Therefore, all Bluetooth devices **comply** with the FCC dwell time requirement in the data mode.

This was checked during the Bluetooth Qualification tests.

The Dwell time in hybrid mode is approximately 2.6 mS (in a 12.8s period)

### **8 Channel Separation in hybrid mode**

The nominal channel spacing of the Bluetooth system is 1Mhz independent of the operating mode.

The maximum "initial carrier frequency tolerance" which is allowed for Bluetooth is fcenter = 75 kHz.

This was checked during the Bluetooth Qualification tests (Test Case: TRM/CA/07-E) for three frequencies (2402, 2441, 2480 MHz).

### **9 Derivation and examples for a hopping sequence in hybrid mode**

For the generation of the inquiry and page hop sequences the same procedures as described for the data mode are used (see item 5), but this time with different input vectors:

**\*\*For the inquiry hop sequence, a predefined fixed address is always used. This results in the same 32 frequencies used by all devices doing an inquiry but every time with a different start frequency and phase in this sequence.**

**\*\*For the page hop sequence, the device address of the paged unit is used as the input vector. This results in the use of a subset of 32 frequencies which is specific for that initial state of the connection establishment between the two units. A page to different devices would result in a different subset of 32 frequencies.**

So it is ensured that also in hybrid mode, the frequency is used equally on average.

Example of a hopping sequence in inquiry mode:

48, 50, 09, 13, 52, 54, 41, 45, 56, 58, 11, 15, 60, 62, 43, 47, 00, 02, 64, 68, 04, 06, 17, 21, 08, 10, 66, 70, 12, 14, 19, 23

Example of a hopping sequence in paging mode:

08, 57, 68, 70, 51, 02, 42, 40, 04, 61, 44, 46, 63, 14, 50, 48, 16, 65, 52, 54, 67, 18, 58, 56, 20, 53, 60, 62, 55, 06, 66, 64

### **10 Receiver input bandwidth and synchronization in hybrid mode:**

The receiver input bandwidth is the same as in the data mode (1 MHz). When two Bluetooth devices establish contact for the first time, one device sends an inquiry access code and the other device is scanning for this inquiry access code. If two devices have been connected previously and want to start a new transmission, a similar procedure takes place. The only difference is, instead of the inquiry access code, a special access code, derived from the BD\_ADDRESS of the paged device will be, will be sent by the master of this connection. Due to the fact that both units have been connected before (in the inquiry procedure) the paging unit has timing and frequency information about the page scan of the paged unit. For this reason the time to establish the connection is reduced.

### **11 Spread rate / data rate of the direct sequence signal**

The Spread rate / Data rate in inquiry and paging mode can be defined via the access code. The access code is the only criterion for the system to check if there is a valid transmission or not. If you regard the presence of a valid access code as one bit of information, and compare it with the length of the access code of 68 bits, the Spread rate / Data rate will be 68/1.

### **12 Spurious emission in hybrid mode**



The Dwell in hybrid mode is shorter than in data mode. For this reason the spurious emissions average level in data mode is worst case. The spurious emissions peak level is the same for both modes.