

FCC Test Report

Product Name	Door Handle Sensor NFC
Model No.	DHSNFC
FCC ID	KR5DHSNFC

Applicant	Continental Automotive GmbH
Address	Siemensstraße 12, 93055 Regensburg, Germany

Date of Receipt	May 22, 2017
Issued Date	Jun. 15, 2017
Report No.	1750532R-RFUSP17V01
Report Version	V1.0



The test results relate only to the samples tested.

The test results shown in the test report are traceable to the national/international standard through the calibration report of the equipment and evaluated measurement uncertainty herein.

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Test Report

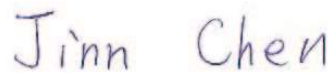
Issued Date: Jun. 15, 2017

Report No.: 1750532R-RFUSP17V01



Product Name	Door Handle Sensor NFC
Applicant	Continental Automotive GmbH
Address	Siemensstraße 12, 93055 Regensburg, Germany
Manufacturer	Continental Automotive GmbH
Model No.	DHSNFC
FCC ID.	KR5DHSNFC
EUT Rated Voltage	DC 12V
EUT Test Voltage	DC 12V
Trade Name	Continental
Applicable Standard	FCC CFR Title 47 Part 15 Subpart C: 2016 ANSI C63.4: 2014, ANSI C63.10: 2013
Test Result	Complied

Documented By :



(Senior Adm. Specialist / Jinn Chen)

Tested By :



(Engineer / Nick Chen)

Approved By :



(Director / Vincent Lin)

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1. GENERAL INFORMATION

1.1. EUT Description

Product Name	Door Handle Sensor NFC
Trade Name	Continental
Model No.	DHSNFC
FCC ID	KR5DHSNFC
Frequency Range	13.56MHz
Modulation	ASK
Antenna Type	Loop coil Antenna

Frequency of Each Channel:

Channel	Frequency
Channel 1:	13.56 MHz

Note:

1. This device is an Door Handle Sensor NFC with a built-in 13.56MHz transceiver.
2. These tests were conducted on a sample of the equipment for the purpose of demonstrating compliance with Part 15 Subpart C Paragraph 15.225.
3. The radiation measurements are performed in X, Y, Z axis positioning. Only the worst case is shown in the report.

Test Mode	Mode 1: Transmit
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1.2. Operational Description

The EUT is an Door Handle Sensor NFC with a built-in 13.56MHz transceiver with ASK modulation. The signal will be transmitted through 13.56MHz RF signal from the Loop coil Antenna.

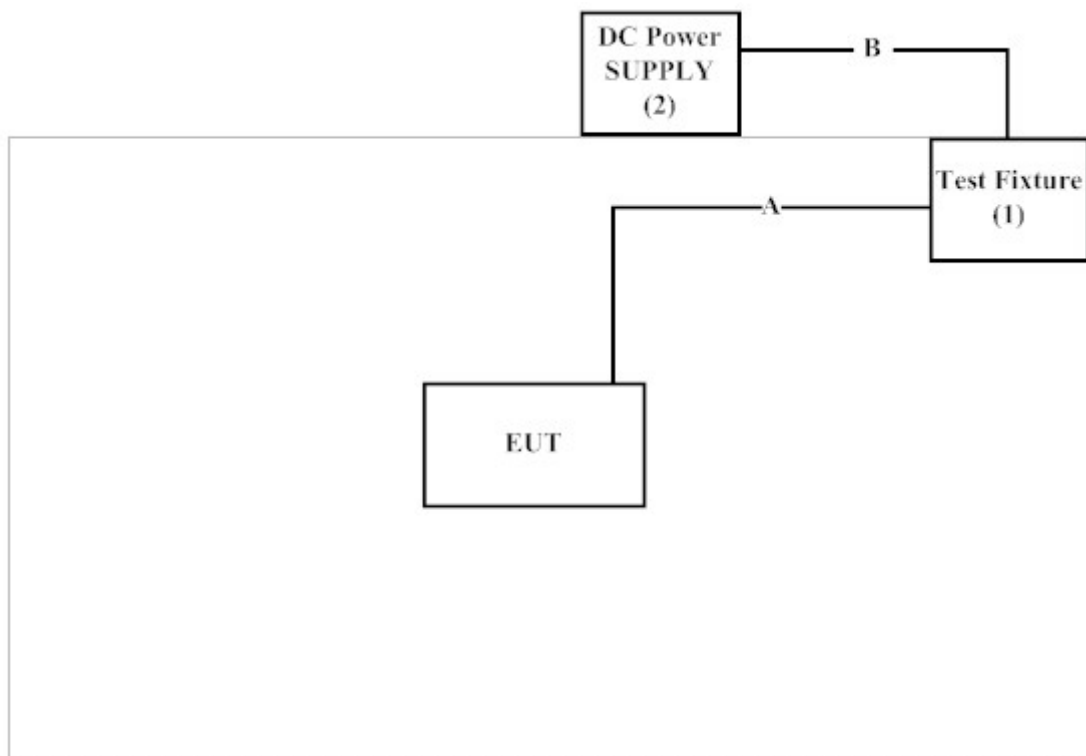
1.3. Tested System Details

The types for all equipment, plus descriptions of all cables used in the tested system (including inserted cards) are:

	Product	Manufacturer	Model No.	Serial No.	Power Cord
(1)	Test Fixture	N/A	N/A	N/A	N/A
(2)	DC POWER SUPPLY	GWInstek	SPD-3606	N/A	N/A

Signal Cable Type	Signal cable Description
A	Signal Cable Non-Shielded, 1.8m
B	Power Cable Non-Shielded, 1.2m

1.4. Configuration of tested System



1.5. EUT Exercise Software

- (1) Setup the EUT as shown in Section 1.4
- (2) Turn on the power of all equipment.
- (3) Using tag to trigger NFC continuous transmission.
- (4) Verify that the EUT works properly.

1.6. Test Facility

Ambient conditions in the laboratory:

Items	Required (IEC 68-1)	Actual
Temperature (°C)	15-35	20-35
Humidity (%RH)	25-75	50-65
Barometric pressure (mbar)	860-1060	950-1000

The related certificate for our laboratories about the test site and management system can be downloaded from DEKRA Testing and Certification Co., Ltd. Web Site:

<http://www.dekra.com.tw/english/about/certificates.aspx?bval=5>

The address and introduction of DEKRA Testing and Certification Co., Ltd. laboratories can be founded in our Web site: http://www.dekra.com.tw/index_en

Site Description: Accredited by TAF
Accredited Number: 3023

Site Name: DEKRA Testing and Certification Co., Ltd.
Site Address: No.159, Sec. 2, Wenhua 1st Rd., Linkou Dist.,
New Taipei City 24457, Taiwan.
TEL: 886-2-2602-7968 / FAX : 866-2-2602-3286
E-Mail : info.tw@dekra.com

FCC Accreditation Number: TW1014

1.7. List of Test Equipment

For Conducted measurements /ASR3

	Equipment	Manufacturer	Model No.	Serial No.	Cali. Data	Due. Data
X	Temperature Chamber	KSON	THS-D4T-100	A0606	2017.03.31	2018.03.30
X	Spectrum Analyzer	R&S	FSV40	101149	2016.12.14	2017.12.13
	Open Switch Control Unit	R&S	OSP120	101538	2017.01.10	2018.01.09
	Signal Generator	R&S	SMB100A	110724	2016.12.06	2017.12.05
	Vector Signal Generator	R&S	SMBV100A	261757	2016.12.06	2017.12.05

Note:

1. All equipments are calibrated every one year.
2. The test instruments marked with "X" are used to measure the final test results.

For Radiated measurements /ACB1

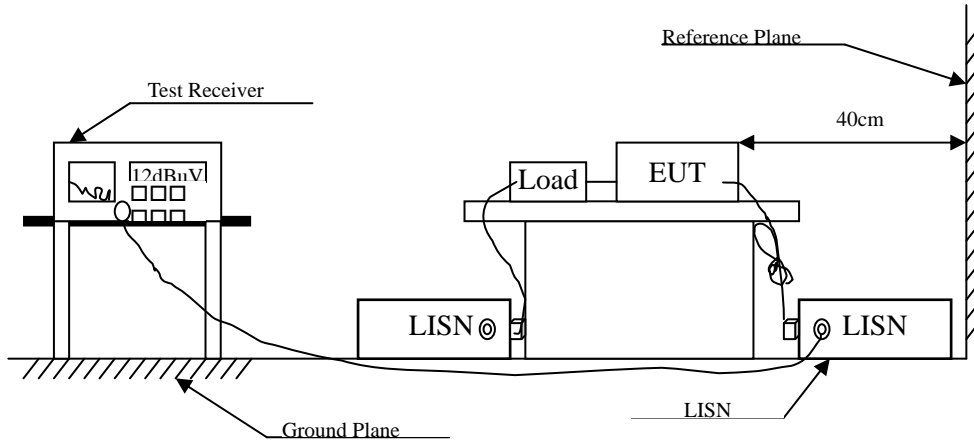
	Equipment	Manufacturer	Model No.	Serial No.	Cali. Data	Due. Data
X	Loop Antenna	A.H.	SAS-562B	272	2016.07.21	2017.07.20
X	Bi-Log Antenna	SCHWARZBECK	VULB9168	9168-674	2017.02.09	2018.02.08
	Horn Antenna	ETS-Lindgren	3117	00203800	2016.10.13	2017.10.12
	Horn Antenna	Com-Power	AH-840	101087	2017.05.24	2018.05.23
X	Pre-Amplifier	EMCI	EMC001330	980316	2017.05.14	2018.05.15
	Pre-Amplifier	EMCI	EMC051835SE	980311	2017.05.15	2018.05.16
	Pre-Amplifier	EMCI	EMC05820SE	980310	2017.05.15	2018.05.16
	Pre-Amplifier	EMCI	EMC184045SE	980314	2017.05.17	2018.05.18
	Filter	MICRO TRONICS	BRM50702	G251	2016.08.11	2017.08.10
	Filter	MICRO TRONICS	BRM50716	G188	2016.08.11	2017.08.10
X	EMI Test Receiver	R&S	ESR7	101602	2016.12.15	2017.12.14
X	Spectrum Analyzer	R&S	FSV40	101148	2017.01.24	2018.01.23
X	Coaxial Cable	SUHNER	SUCOFLEX 106	RF002	2017.05.25	2018.05.24
	Mircoflex Cable	HUBER SUHNER	SUCOFLEX 102	MY3381/2	2016.08.11	2017.08.10

Note:

1. All equipments are calibrated every one year.
2. The test instruments marked with "X" are used to measure the final test results.
3. Test Software version : QuieTek EMI 2.0 V2.1.113

2. Conducted Emission

2.1. Test Setup



2.2. Limits

FCC Part 15 Subpart C Paragraph 15.207 (dBuV) Limit		
Frequency MHz	Limits	
	QP	AV
0.15 - 0.50	66-56 ^(§§)	56-46 ^(§§)
0.50-5.0	56	46
5.0 - 30	60	50

2.3. Test Procedure

The EUT and simulators are connected to the main power through a line impedance stabilization network (L.I.S.N.). This provides a 50 ohm /50uH coupling impedance for the measuring equipment. The peripheral devices are also connected to the main power through a LISN that provides a 50ohm /50uH coupling impedance with 50ohm termination. (Please refers to the block diagram of the test setup and photographs.)

Both sides of A.C. line are checked for maximum conducted interference. In order to find the maximum emission, the relative positions of equipment and all of the interface cables must be changed according to ANSI C63.4: 2014 on conducted measurement.

Conducted emissions were investigated over the frequency range from 0.15MHz to 30MHz using a receiver bandwidth of 9kHz.

2.4. Uncertainty

±2.35dB

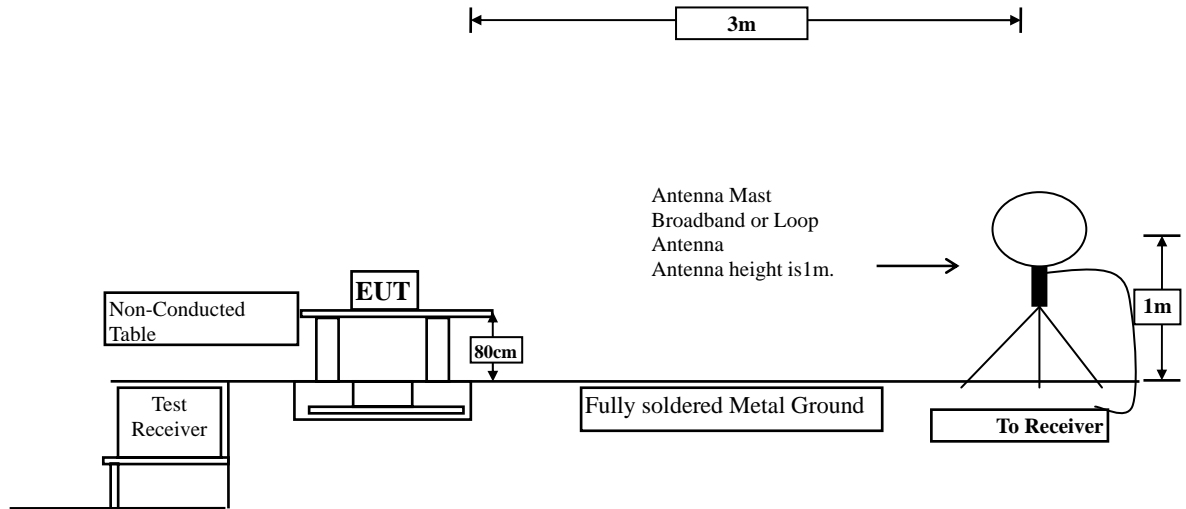
2.5. Test Result of Conducted Emission

Owing to the DC operation of EUT, this test item is not performed.

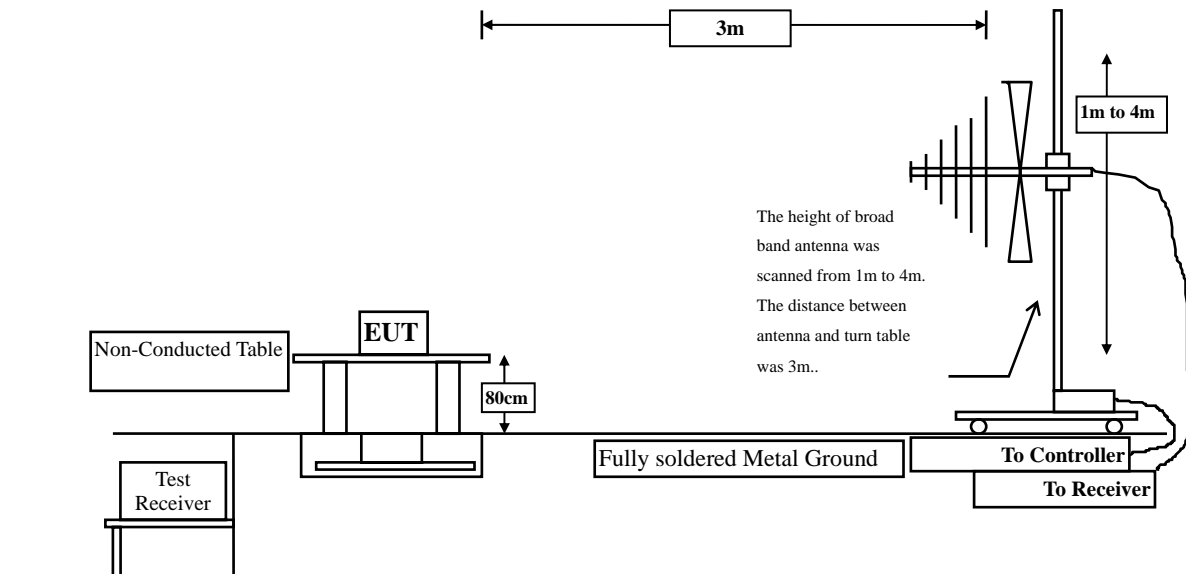
3. Radiated Emission

3.1. Test Setup

Radiated Emission Under 30MHz



Radiated Emission Below 1GHz



3.2. Limits

➤ Fundamental electric field strength Limit

FCC Part 15 Subpart C Paragraph 15.225 Limits				
Fundamental Frequency MHz	Field strength of fundamental			
	uV/m	Distance (meter)	dBuV/m	Distance (meter)
13.553 – 13.567	15848	30	124	3
13.410 – 13.553 and 13.567 – 13.710	334	30	90.50	3
13.110 – 13.410 and 13.710 – 14.010	106	30	80.50	3
Outside of the 13.110 – 14.010	See 15.209 Limits			

Remarks :

1. RF Voltage (dBuV) = 20 log RF Voltage (uV)
2. Distance refers to the distance in meters between the measuring instrument antenna and the closed point of any part of the device or system.
3. The emission limit in this paragraph is based on measurement instrumentation employing an quasi-peak detector.

➤ Spurious electric field strength Limit

FCC Part 15 Subpart C Paragraph 15.209 Limits		
Frequency MHz	Field strength (microvolts/meter)	Measurement distance (meter)
0.009-0.490	2400/F(kHz)	300
0.490-1.705	24000/F(kHz)	30
1.705-30	30	30
30-88	100	3
88-216	150	3
216-960	200	3
Above 960	500	3

Remarks :

1. RF Voltage (dBuV) = 20 log RF Voltage (uV)
2. In the Above Table, the tighter limit applies at the band edges.
3. Distance refers to the distance in meters between the measuring instrument antenna and the closed point of any part of the device or system.

3.3. Test Procedure

Fundamental electric field strength:

The EUT and its simulators are placed on a turn table which is 0.8 meter above ground. The turn table can rotate 360 degrees to determine the position of the maximum electric field strength.

The EUT was positioned such that the distance from antenna to the EUT was 3 meters.

The antenna which is 1 meter above ground. All X-axis, Y-axis and Z-axis polarization of the antenna are set on measurement.

Spurious electric field strength:

The EUT and its simulators are placed on a turn table which is 0.8 meter above ground. The turn table can rotate 360 degrees to determine the position of the maximum emission level.

The antenna can move up and down between 1 meter and 4 meters to find out the maximum emission level. The EUT was positioned such that the distance from antenna to the EUT was 3 meters.

Both horizontal and vertical polarization of the antenna are set on measurement. In order to find the maximum emission, all of the interface cables must be manipulated according to ANSI C63.10: 2013 on radiated measurement.

The bandwidth below 30MHz setting on the field strength meter is 9kHz and above 30MHz is 120kHz. The frequency range from 9kHz to 10th harmonics is checked.

3.4. Uncertainty

Horizontal polarization :

30-300MHz: ± 4.08 dB ; 300M-1GHz: ± 3.86 dB ; 1-18GHz: ± 3.77 dB ; 18-40GHz: ± 3.98 dB

Vertical polarization :

30-300MHz: ± 4.81 dB ; 300M-1GHz: ± 3.87 dB ; 1-18GHz: ± 3.83 dB ; 18-40GHz: ± 3.98 dB

3.5. Test Result of Radiated Emission

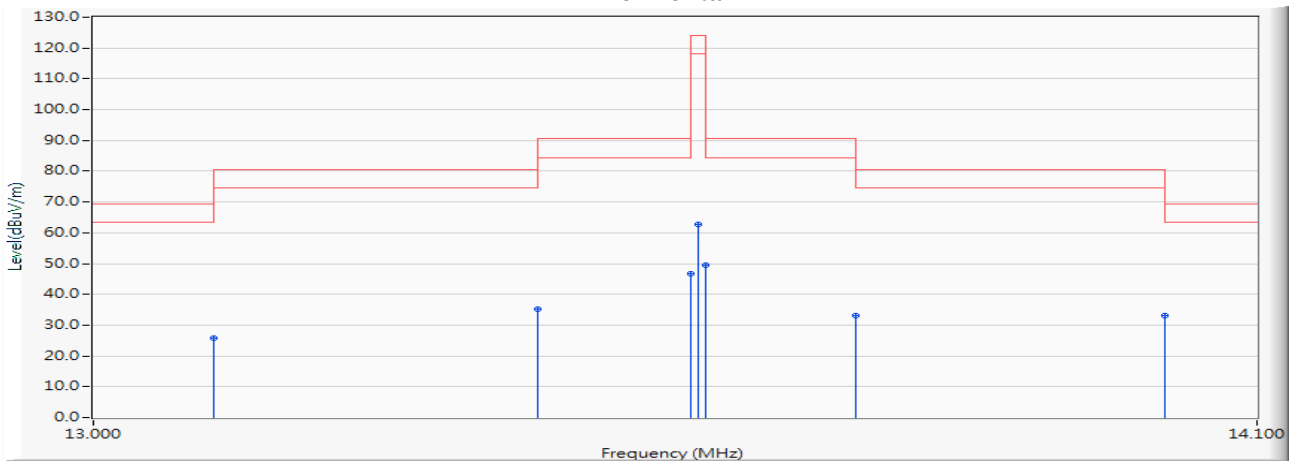
Product	:	Door Handle Sensor NFC
Test Item	:	Fundamental Radiated Emission
Test Mode	:	Mode 1: Transmit
Test date	:	2017/05/23

Frequency MHz	Correct Factor dB	Reading Level dBuV	Measurement Level dBuV/m	Margin dB	Limit dBuV/m
X-axis					
Quasi-Peak					
Horizontal					
13.110	20.020	5.900	25.920	-43.580	69.500
13.410	20.020	15.200	35.220	-45.280	80.500
13.553	20.020	26.800	46.820	-43.680	90.500
13.560	20.020	42.600	62.620	-61.380	124.000
13.567	20.020	29.300	49.320	-41.180	90.500
13.710	20.020	13.200	33.220	-47.280	80.500
14.010	20.020	13.100	33.120	-36.380	69.500
Vertical					
13.110	20.020	4.500	24.520	-44.980	69.500
13.410	20.020	9.900	29.920	-50.580	80.500
13.553	20.020	24.600	44.620	-45.880	90.500
13.560	20.020	40.300	60.320	-63.680	124.000
13.567	20.020	27.000	47.020	-43.480	90.500
13.710	20.020	11.000	31.020	-49.480	80.500
14.010	20.020	4.500	24.520	-44.980	69.500

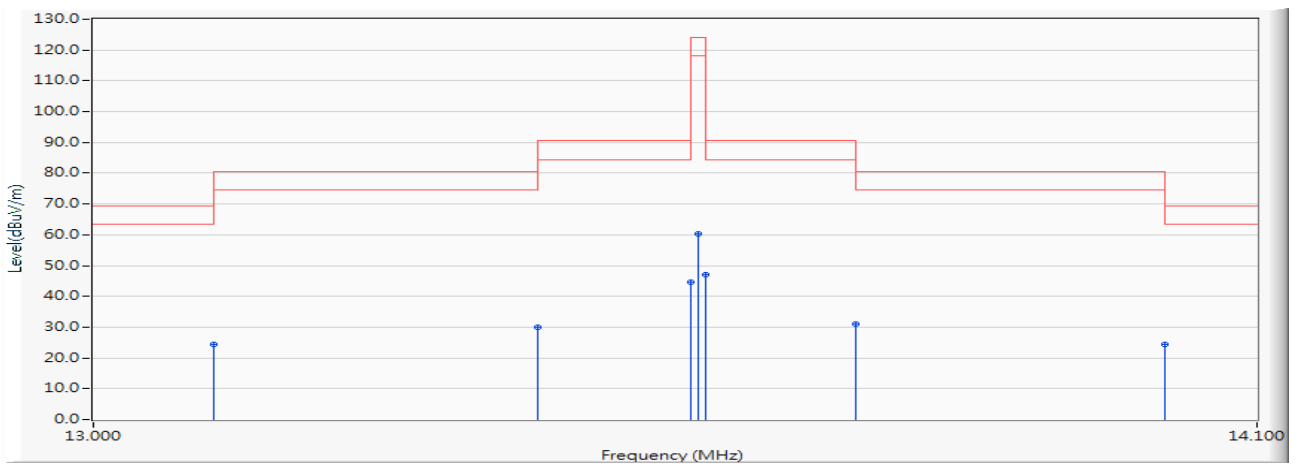
Note:

1. Fundamental Limit=84dBuV/m + 40*Log (30(m)/3(m))=124dBuV/m
2. All Readings below 1GHz are Quasi-Peak, above are average value.
3. "█" means the worst emission level.
4. Measurement Level = Reading Level + Correct Factor.

Horizontal



Vertical



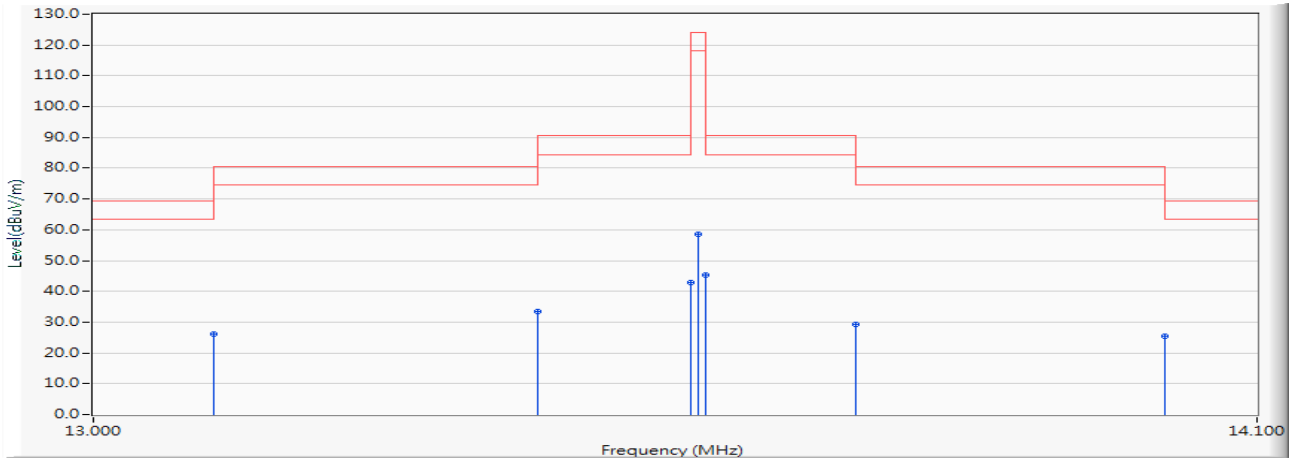
Product : Door Handle Sensor NFC
 Test Item : Fundamental Radiated Emission
 Test Mode : Mode 1: Transmit
 Test date : 2017/05/23

Frequency MHz	Correct Factor dB	Reading Level dBuV	Measurement Level dBuV/m	Margin dB	Limit dBuV/m
Y-axis					
Quasi-Peak					
Horizontal					
13.110	20.020	6.100	26.120	-43.380	69.500
13.410	20.020	13.400	33.420	-47.080	80.500
13.553	20.020	22.900	42.920	-47.580	90.500
13.560	20.020	38.500	58.520	-65.480	124.000
13.567	20.020	25.300	45.320	-45.180	90.500
13.710	20.020	9.400	29.420	-51.080	80.500
14.010	20.020	5.300	25.320	-44.180	69.500
Vertical					
13.110	20.020	4.500	24.520	-44.980	69.500
13.410	20.020	8.000	28.020	-52.480	80.500
13.553	20.020	17.000	37.020	-53.480	90.500
13.560	20.020	32.100	52.120	-71.880	124.000
13.567	20.020	19.100	39.120	-51.380	90.500
13.710	20.020	5.500	25.520	-54.980	80.500
14.010	20.020	4.500	24.520	-44.980	69.500

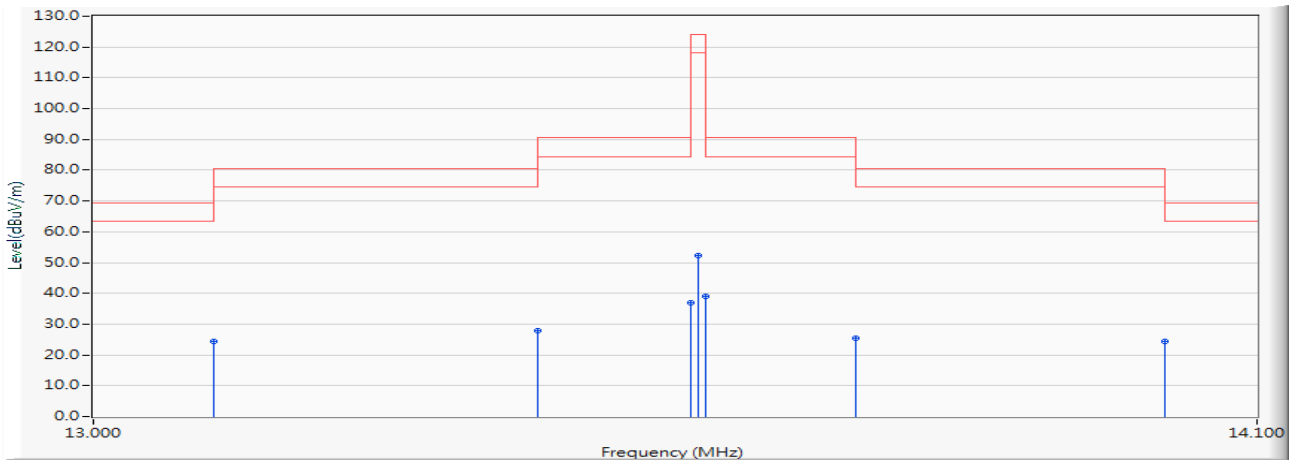
Note:

1. Fundamental Limit=84dBuV/m + 40*Log (30(m)/3(m))=124dBuV/m
2. All Readings below 1GHz are Quasi-Peak, above are average value.
3. "■" means the worst emission level.
4. Measurement Level = Reading Level + Correct Factor.

Horizontal



Vertical



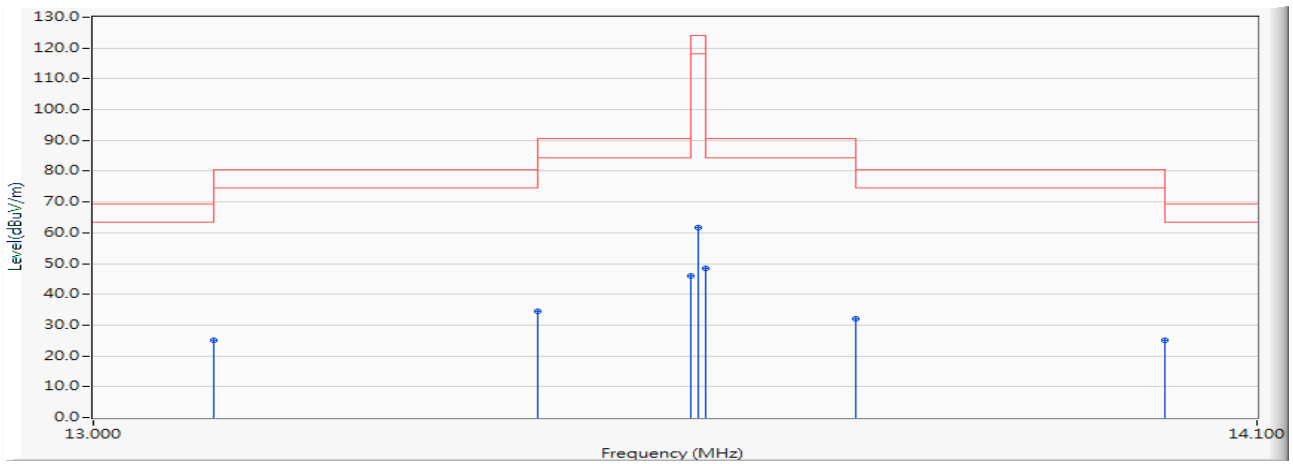
Product : Door Handle Sensor NFC
 Test Item : Fundamental Radiated Emission
 Test Mode : Mode 1: Transmit
 Test date : 2017/05/23

Frequency MHz	Correct Factor dB	Reading Level dBuV	Measurement Level dBuV/m	Margin dB	Limit dBuV/m
Z-axis					
Quasi-Peak					
Horizontal					
13.110	20.020	5.200	25.220	-44.280	69.500
13.410	20.020	14.400	34.420	-46.080	80.500
13.553	20.020	26.000	46.020	-44.480	90.500
13.560	20.020	41.800	61.820	-62.180	124.000
13.567	20.020	28.500	48.520	-41.980	90.500
13.710	20.020	12.100	32.120	-48.380	80.500
14.010	20.020	5.000	25.020	-44.480	69.500
Vertical					
13.110	20.020	4.600	24.620	-44.880	69.500
13.410	20.020	10.200	30.220	-50.280	80.500
13.553	20.020	23.200	43.220	-47.280	90.500
13.560	20.020	38.900	58.920	-65.080	124.000
13.567	20.020	25.700	45.720	-44.780	90.500
13.710	20.020	9.800	29.820	-50.680	80.500
14.010	20.020	4.400	24.420	-45.080	69.500

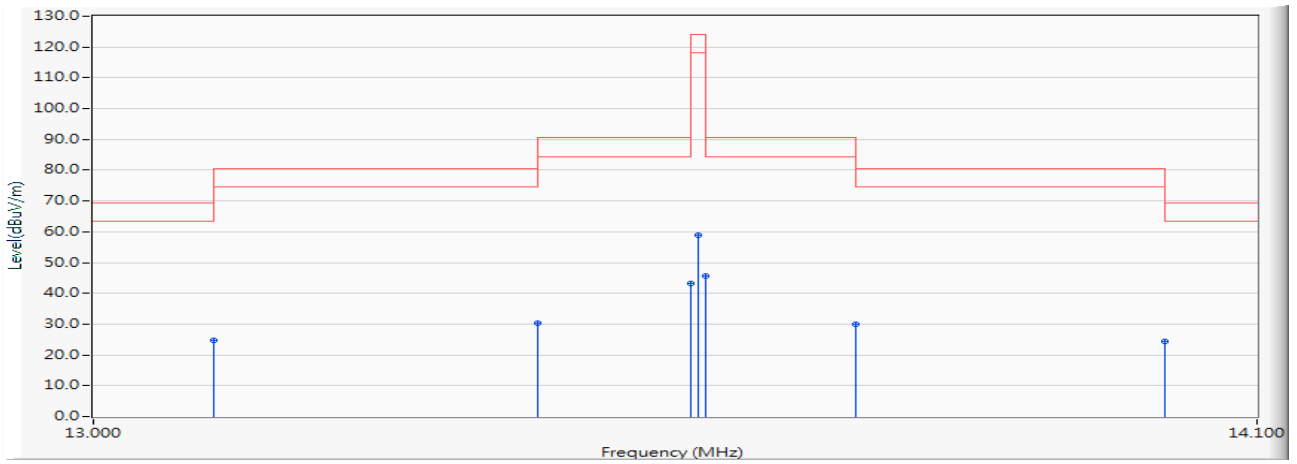
Note:

1. Fundamental Limit=84dBuV/m + 40*Log (30(m)/3(m))=124dBuV/m
2. All Readings below 1GHz are Quasi-Peak, above are average value.
3. "■" means the worst emission level.
4. Measurement Level = Reading Level + Correct Factor.

Horizontal



Vertical



Product : Door Handle Sensor NFC
 Test Item : General Radiated Emission Data (below 30MHz)
 Test Mode : Mode 1: Transmit
 Test date : 2017/05/23

Frequency	Correct	Reading	Measurement	Margin	Limit
MHz	Factor	Level	Level	dB	dBuV/m
	dB	dBuV	dBuV/m		
Quasi-Peak					
Horizontal					
27.120	20.191	5.500	25.691	-43.849	69.540
Vertical					
27.120	20.191	6.400	26.591	-42.949	69.540

Note:

1. All Readings below 1GHz are Quasi-Peak, above are average value.
2. "█" means the worst emission level.
3. Measurement Level = Reading Level + Correct Factor.

Product : Door Handle Sensor NFC
 Test Item : General Radiated Emission Data (above 30MHz)
 Test Mode : Mode 1: Transmit
 Test date : 2017/05/23

Frequency MHz	Correct Factor dB	Reading Level dBuV	Measurement Level dBuV/m	Margin dB	Limit dBuV/m
Quasi-Peak					
Horizontal					
79.203	-15.244	43.952	28.708	-11.292	40.000
256.333	-11.667	50.519	38.853	-7.147	46.000
432.058	-6.837	37.708	30.871	-15.129	46.000
576.855	-3.884	35.999	32.115	-13.885	46.000
814.435	-0.488	41.068	40.580	-5.420	46.000
977.507	1.498	32.771	34.270	-19.730	54.000
Quasi-Peak					
Vertical					
111.536	-14.008	47.130	33.122	-10.378	43.500
297.101	-10.139	29.137	18.998	-27.002	46.000
464.391	-6.163	42.459	36.296	-9.704	46.000
651.362	-2.896	36.166	33.270	-12.730	46.000
786.319	-0.820	36.641	35.821	-10.179	46.000
922.681	0.784	36.082	36.866	-9.134	46.000

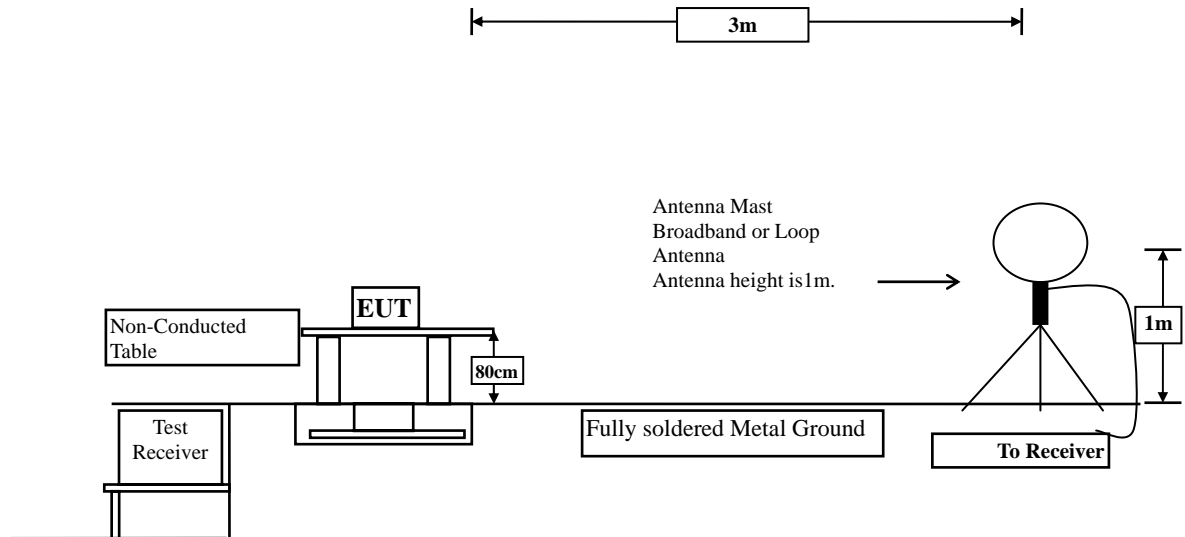
Note:

1. All Readings below 1GHz are Quasi-Peak, above are average value.
2. “█” means the worst emission level.
3. Measurement Level = Reading Level + Correct Factor

4. Band Edge

4.1. Test Setup

Radiated Emission Under 30MHz



4.2. Limits

The field strength of any emissions appearing outside of the 13.110-14.010 MHz band shall not exceed the general radiated emission limits in Section 15.209. In addition, radiated emissions which fall in the restricted bands, as defined in Section 15.205, must also comply with the radiated emission limits specified in Section 15.209

4.3. Test Procedure

The EUT and its simulators are placed on a turn table which is 0.8 meter above ground. The turn table can rotate 360 degrees to determine the position of the maximum emission level.

The antenna can move up and down between 1 meter and 4 meters to find out the maximum emission level. The EUT was positioned such that the distance from antenna to the EUT was 3 meters.

Both horizontal and vertical polarization of the antenna are set on measurement. In order to find the maximum emission, all of the interface cables must be manipulated according to ANSI C63.10: 2013 on radiated measurement.

The bandwidth below 30MHz setting on the field strength meter is 9kHz and above 30MHz is 120kHz.

4.4. Uncertainty

Horizontal polarization :

30-300MHz: $\pm 4.08\text{dB}$; 300M-1GHz: $\pm 3.86\text{dB}$; 1-18GHz: $\pm 3.77\text{dB}$; 18-40GHz: $\pm 3.98\text{dB}$

Vertical polarization :

30-300MHz: $\pm 4.81\text{dB}$; 300M-1GHz: $\pm 3.87\text{dB}$; 1-18GHz: $\pm 3.83\text{dB}$; 18-40GHz: $\pm 3.98\text{dB}$

4.5. Test Result of Band Edge

Product : Door Handle Sensor NFC
 Test Item : Band Edge Data
 Test Mode : Mode 1: Transmit
 Test date : 2017/05/23

RF Radiated Measurement

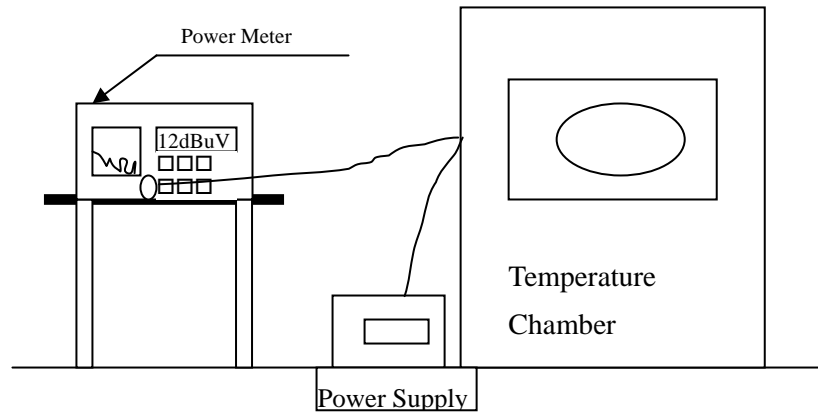
Frequency MHz	Correct Factor dB	Reading Level dBuV	Measurement Level dBuV/m	Margin dB	Limit dBuV/m
Quasi-Peak					
Horizontal					
13.110	20.020	5.100	25.120	-44.420	69.540
13.360	20.020	5.700	25.720	-43.820	69.540
13.410	20.020	13.600	33.620	-35.920	69.540
14.010	20.020	4.900	24.920	-44.620	69.540
Vertical					
13.110	20.020	4.400	24.420	-45.120	69.540
13.360	20.020	4.600	24.620	-44.920	69.540
13.410	20.020	8.600	28.620	-40.920	69.540
14.010	20.020	4.400	24.420	-45.120	69.540

Note:

1. All Readings below 1GHz are Quasi-Peak, above are average value.
2. "█" means the worst emission level.
3. Measurement Level = Reading Level + Correct Factor

5. Frequency Tolerance

5.1. Test Setup



5.2. Limits

The frequency tolerance of the carrier signal shall be maintained within $\pm 0.01\%$ of the operating frequency.

5.3. Test Procedure

The frequency tolerance of the carrier signal shall be maintained within $\pm 0.01\%$ of the operating frequency over a temperature variation of -20 degrees to $+ 50$ degrees C at normal supply voltage, and for a variation in the primary supply voltage from 85% to 115% of the rated supply voltage at a temperature of 20 degrees C. For battery operated equipment, the equipment tests shall be performed using a new battery.

5.4. Uncertainty

$\pm 279.2\text{Hz}$

5.5. Test Result of Frequency Stability

Product : Door Handle Sensor NFC
 Test Item : Frequency Tolerance
 Test Mode : Mode 1: Transmit
 Test date : 2017/05/26

Temperature (°C)	Voltage (V)	Observe Time	Declared Frequency (MHz)	Read Frequency (MHz)	Tolerance (%)	Limit (%)
20	12	start	13.56	13.56026	0.001917	±0.01 %
		2mins	13.56	13.56026	0.001917	
		5mins	13.56	13.56026	0.001917	
		10mins	13.56	13.56026	0.001917	
20	13.8	start	13.56	13.56023	0.001711	±0.01 %
		2mins	13.56	13.56023	0.001711	
		5mins	13.56	13.56023	0.001711	
		10mins	13.56	13.56023	0.001711	
20	10.2	start	13.56	13.56023	0.001711	±0.01 %
		2mins	13.56	13.56023	0.001711	
		5mins	13.56	13.56023	0.001711	
		10mins	13.56	13.56023	0.001711	
50	12	start	13.56	13.56009	0.000642	±0.01 %
		2mins	13.56	13.56009	0.000642	
		5mins	13.56	13.56009	0.000642	
		10mins	13.56	13.56009	0.000642	
40	12	start	13.56	13.56015	0.001077	±0.01 %
		2mins	13.56	13.56015	0.001077	
		5mins	13.56	13.56015	0.001077	
		10mins	13.56	13.56015	0.001077	
30	12	start	13.56	13.56026	0.001917	±0.01 %
		2mins	13.56	13.56026	0.001917	
		5mins	13.56	13.56026	0.001917	
		10mins	13.56	13.56026	0.001917	

10	12	start	13.56	13.56023	0.001704	± 0.01 %
		2mins	13.56	13.56023	0.001704	
		5mins	13.56	13.56023	0.001704	
		10mins	13.56	13.56023	0.001704	
0	12	start	13.56	13.56023	0.001704	± 0.01 %
		2mins	13.56	13.56023	0.001704	
		5mins	13.56	13.56023	0.001704	
		10mins	13.56	13.56023	0.001704	
-10	12	start	13.56	13.56014	0.001010	± 0.01 %
		2mins	13.56	13.56014	0.001010	
		5mins	13.56	13.56014	0.001010	
		10mins	13.56	13.56014	0.001010	
-20	12	start	13.56	13.56024	0.001792	± 0.01 %
		2mins	13.56	13.56024	0.001792	
		5mins	13.56	13.56024	0.001792	
		10mins	13.56	13.56024	0.001792	

6. EMI Reduction Method During Compliance Testing

No modification was made during testing.