FCC Test Report

FCC ID	:	**2AEIM-1089774**
Equipment	:	**Security Controller**
Brand Name	:	**Tesla**
Model No.	:	**1089774**
Applicant Manufacturer	:	**Tesla Motors, Inc. 3500 Deer Creek Road Palo Alto, California US 94304 United States Of America**
Standard	:	**47 CFR FCC Part 15.225**

The product sample received on May 03, 2017 and completely tested on May 28, 2019. We, SPORTON, would like to declare that the tested sample has been evaluated in accordance with the procedures given in ANSI C63.10-2013 and shown compliance with the applicable technical standards.

The report must not be used by the client to claim product certification, approval, or endorsement by TAF or any agency of government.

The test results in this variant report apply exclusively to the tested model / sample. Without written approval of SPORTON INTERNATIONAL INC. EMC & Wireless Communications Laboratory, the test report shall not be reproduced except in full.

Approved by: Allen Lin

SPORTON INTERNATIONAL INC. EMC & Wireless Communications Laboratory

No. 52, Huaya 1st Rd., Guishan Dist., Taoyuan City, Taiwan (R.O.C.)

Table of Contents

Summary of Test Result

Conformance Test Specifications					
Report Clause	**Ref. Std. Clause**	**Description**	**Measured**	**Limit**	**Result**
1.1.2	15.203	Antenna Requirement	Antenna connector mechanism complied	FCC 15.203	Complied
3.1	15.225(a)~(d)	Field Strength of Fundamental Emissions and Spectrum Mask	Fundamental Emissions peak: 84.09 dBuV/m at 3m Device complies with spectrum mask – refer to test data	124 dBuV/m at 3m	Complied
3.2	15.225(d)	Transmitter Radiated Unwanted Emissions	41.01[dBuV/m at 3m]: 733.25MHz (Margin 4.99dB) - PK	FCC 15.209	Complied

Declaration of Conformity:
The test results with all measurement uncertainty excluded are presented in accordance with the regulation limits or requirements declared by manufacturers.
Comments and Explanations:
None.

Revision History

Report No.	Version	Description	Issued Date
FR741006-09AR	Rev. 01	Initial issue of report	Jun. 27, 2019
FR741006-09AR	Rev. 02	Revise typo	Jul. 03, 2019

1 General Description

1.1 Information

1.1.1 RF General Information

NFC Chip	Brand Name	Model Name
	ST25R3915	1089774

RF General Information				
Frequency Range	**Modulation**	**Ch. Frequency (MHz)**	**Channel Number**	**Field Strength (dBuV/m)**
13.553 – 13.567 MHz	ISO 14443-3A (ASK)	13.56	1	84.09
Note 1: Field strength performed peak level at 3m.				

1.1.2 Antenna Information

Antenna Category	
☐	Equipment placed on the market without antennas
☒	Integral antenna (antenna permanently attached)
☐	External antenna (dedicated antennas)

Antenna General Information		
No.	**Ant. Cat.**	**Ant. Type**
1	Integral	LOOP

1.1.3 Type of EUT

Identify EUT	
EUT Serial Number	N/A
Presentation of Equipment	☐ Production ; ☐ Pre-Production ; ☒ Prototype

Type of EUT	
☒	Stand-alone
☐	Combined (EUT where the radio part is fully integrated within another device) Combined Equipment - Brand Name / Model No.: …
☐	Plug-in radio (EUT intended for a variety of host systems) Host System - Brand Name / Model No.: …
☐	Other:

1.1.4 Table for Permissive Change

This product is an extension of original one reported under Sporton project number: FR741006AR

Below is the table for the change of the product with respect to the original one.

Modifications	Performance Checking
New second circuit design was added : 1. 12V to 5V transformer was changed 2. NFC Capacitor Package was changed 3. LED driver and layout was added, but not included components 4. Battery power monitor function was added	Radiated was evaluated

1.1.5 Test Signal Duty Cycle

Duty Cycle Operation Restriction			
The transmitter is used for		The transmitter is operated	
☒	Inductive applications	☒	Automatically triggered
☐	Duty cycle fixed mode	☒	Duty cycle random mode
☒	**Duty cycle mode - NFC-A (ISO 14443-3A)**		
Declare transmitter duty cycle / 1 hour =		100%	
☐	**Duty cycle mode - NFC-B (ISO 14443-3B)**		
Declare transmitter duty cycle / 1 hour =		100%	
☐	**Duty cycle mode - NFC-F (ISO 18092)**		
Declare transmitter duty cycle / 1 hour =		100%	
☐	**Duty cycle mode - NFC-V (ISO 15693)**		
Declare transmitter duty cycle / 1 hour =		100%	

1.2 Testing Applied Standards

According to the specifications of the manufacturer, the EUT must comply with the requirements of the following standards:

- 47 CFR FCC Part 15
- ANSI C63.10-2013
- KDB 174176 D01 v01r01

1.3 Testing Location Information

Testing Location			
☒	HWA YA	ADD : No. 52, Huaya 1st Rd., Guishan Dist., Taoyuan City, Taiwan (R.O.C.)	
		TEL : 886-3-327-3456	FAX : 886-3-327-0973
Test site Designation No. TW1190 with FCC.			
☐	JHUBEI	ADD : No.8, Ln. 724, Bo'ai St., Zhubei City, Hsinchu County, Taiwan (R.O.C.)	
		TEL : 886-3-656-9065	FAX : 886-3-656-9085
Test site Designation No. TW1190 with FCC.			

Test Condition	Test Site No.	Test Engineer	Test Environment	Test Date
Radiated	03CH03-HY	Edward	22.5~24.3°C / 63~68%	28/May/2019

2 Test Configuration of EUT

2.1 The Worst Case Measurement Configuration

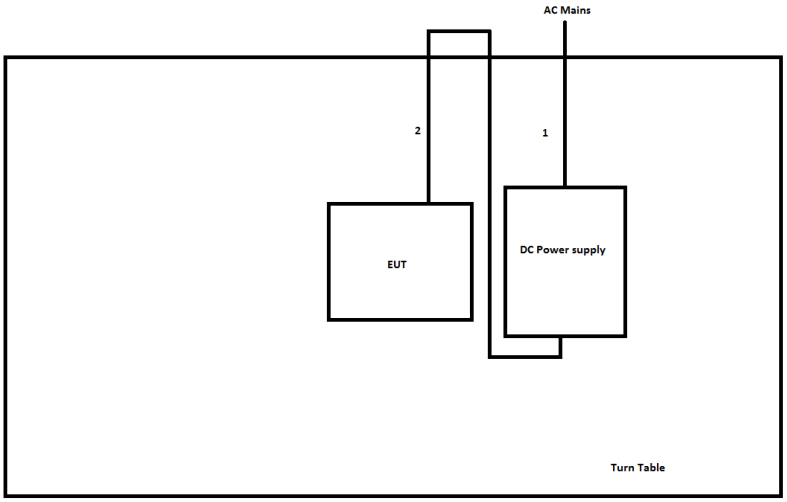
The Worst Case Mode for Following Conformance Tests	
Tests Item	Emission Bandwidth, Field Strength of Fundamental Emissions Spectrum Mask, Transmitter Radiated Unwanted Emissions, Frequency Stability
Test Condition	Radiated measurement
User Position	☐ EUT will be placed in fixed position.
	☒ EUT will be placed in mobile position and operating multiple positions. EUT shall be performed three orthogonal planes.
	☐ EUT will be a hand-held or body-worn battery-powered devices and operating multiple positions. EUT shall be performed three orthogonal planes.
Pretest Mode	☒ 1. EUT Built in NFC A type
	☐ 2. EUT Built in NFC B type
	☐ 3. EUT Built in NFC F type
	☐ 4. EUT Built in NFC V type
Operating Mode	☒ 1. DC Power Supply
Modulation Mode	NFC-Read/Write
Orthogonal Planes of EUT	**Y Plane**
	
Worst Planes of EUT	V

2.2 Support Equipment

Support Equipment - Radiated			
No.	**Equipment**	**Brand Name**	**Model Name**
1	DC power supply	GW	GPS-3030DD

2.3 Test Setup Diagram

Test Setup Diagram - Radiated Test



Item	Connection	Shielded	Length(m)	Remark
1	AC Power line	No	1.5	-
2	Fixture cable	No	2.4	-

3 Transmitter Test Result

3.1 Field Strength of Fundamental Emissions and Spectrum Mask

3.1.1 Field Strength of Fundamental Emissions and Spectrum Mask Limit

Field Strength of Fundamental Emissions For FCC					
Emissions	**(uV/m)@30m**	**(dBuV/m)@30m**	**(dBuV/m)@10m**	**(dBuV/m)@3m**	**(dBuV/m)@1m**
fundamental	15848	84.0	103.1	124.0	143.1
Quasi peak measurement of the fundamental.					

Spectrum Mask For FCC					
Freq. of Emission (MHz)	**(uV/m)@30m**	**(dBuV/m)@30m**	**(dBuV/m)@10m**	**(dBuV/m)@3m**	**(dBuV/m)@1m**
1.705~13.110	30	29.5	48.6	69.5	88.6
13.110~13.410	106	40.5	59.6	80.5	99.6
13.410~13.553	334	50.5	69.6	90.5	109.6
13.553~13.567	15848	84.0	103.1	124.0	143.1
13.567~13.710	334	50.5	69.6	90.5	109.6
13.710~14.010	106	40.5	59.6	80.5	99.6
14.010~30.000	30	29.5	48.6	69.5	88.6

3.1.2 Measuring Instruments

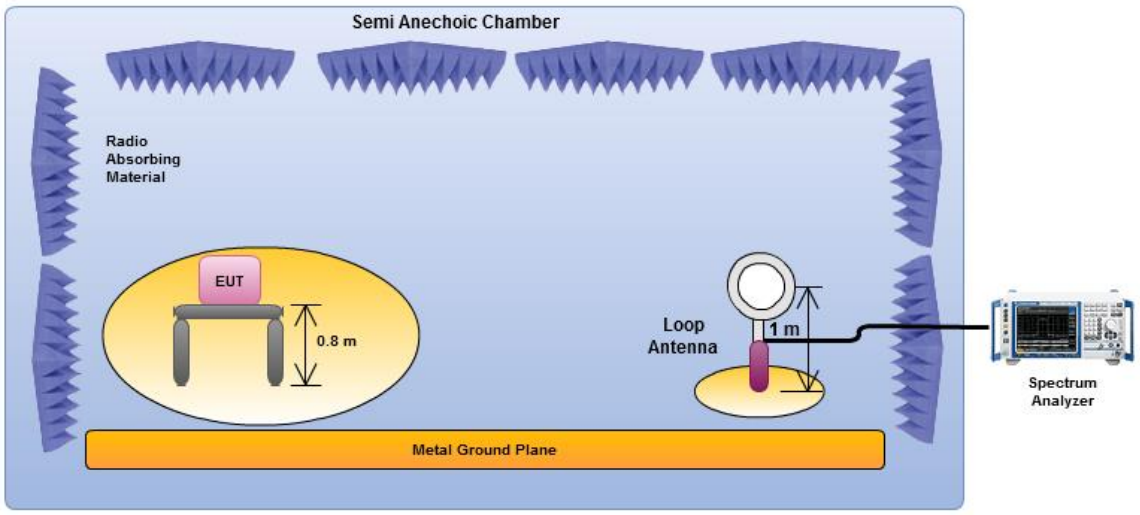
Refer a test equipment and calibration data table in this test report.

3.1.3 Test Procedures

Test Method	
☒	Refer as ANSI C63.10, clause 6.4 for radiated emissions from below 30 MHz and test distance is 3m.
☒	At frequencies below 30 MHz, measurements may be performed at a distance closer than that specified in the requirements; however, an attempt should be made to avoid making measurements in the near field. Pending the development of an appropriate measurement procedure for measurements performed below 30 MHz, when performing measurements at a closer distance than specified, the results shall be following below methods.
☐	The results shall be extrapolated to the specified distance by making measurements at a minimum of two distances on at least one radial to determine the proper extrapolation factor.
☒	The results shall be by using the square of an inverse linear distance extrapolation factor (40 dB/decade).
☒	For radiated measurement. Loop antenna was rotated about the horizontal and vertical axis and the equipment to be measured and the test antenna shall be oriented to obtain the maximum emitted field strength level.

3.1.4 Test Setup

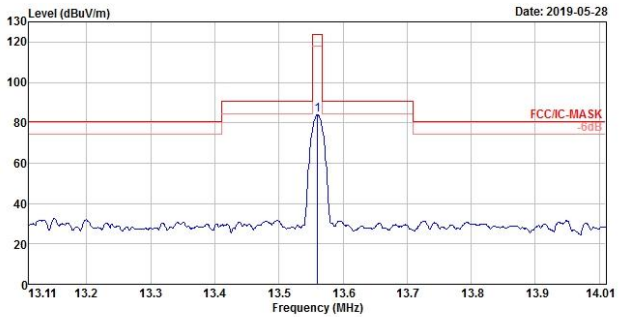
Field Strength of Fundamental Emissions and Spectrum Mask



3.1.5 Test Result of Field Strength of Fundamental Emissions and Spectrum Mask

Field Strength of Fundamental Emissions Result					
Modulation Mode	**Frequency (MHz)**	**Fundamental (dBuV/m)@3m**	**Polarization**	**Margin (dB)**	**Limit (dBuV/m)@3m**
NFC-Read/Write	13.56	84.09	H	39.91	124.00
Result		**Complied**			
Note 1: Measurement worst emissions of receive antenna polarization: H(Horizontal).					

Spectrum Mask Plot



	Freq	Level	Over Limit	Limit Line	Read Level	Antenna Factor	A/Pos	T/Pos	Remark
	MHz	dBuV/m	dB	dBuV/m	dBuV	dB/m	cm	deg	
1 Max	13.56	84.09	-39.91	124.00	61.18	22.18	100	360	Peak

3.2 Transmitter Radiated Unwanted Emissions

3.2.1 Transmitter Radiated Unwanted Emissions Limit

Transmitter Radiated Unwanted Emissions Limit			
Frequency Range (MHz)	**Field Strength (uV/m)**	**Field Strength (dBuV/m)**	**Measure Distance (m)**
0.009~0.490	2400/F(kHz)	48.5 - 13.8	300
0.490~1.705	24000/F(kHz)	33.8 - 23	30
1.705~30.0	30	29	30
30~88	100	40	3
88~216	150	43.5	3
216~960	200	46	3
Above 960	500	54	3

Note 1: Test distance for frequencies at or above 30 MHz, measurements may be performed at a distance other than the limit distance provided they are not performed in the near field and the emissions to be measured can be detected by the measurement equipment. When performing measurements at a distance other than that specified, the results shall be extrapolated to the specified distance using an extrapolation factor of 20 dB/decade (inverse of linear distance for field-strength measurements, inverse of linear distance-squared for power-density measurements).

Note 2: Test distance for frequencies at below 30 MHz, measurements may be performed at a distance closer than the EUT limit distance; however, an attempt should be made to avoid making measurements in the near field. When performing measurements below 30 MHz at a closer distance than the limit distance, the results shall be extrapolated to the specified distance by either making measurements at a minimum of two or more distances on at least one radial to determine the proper extrapolation factor or by using the square of an inverse linear distance extrapolation factor (40 dB/decade). The test report shall specify the extrapolation method used to determine compliance of the EUT.

3.2.2 Measuring Instruments

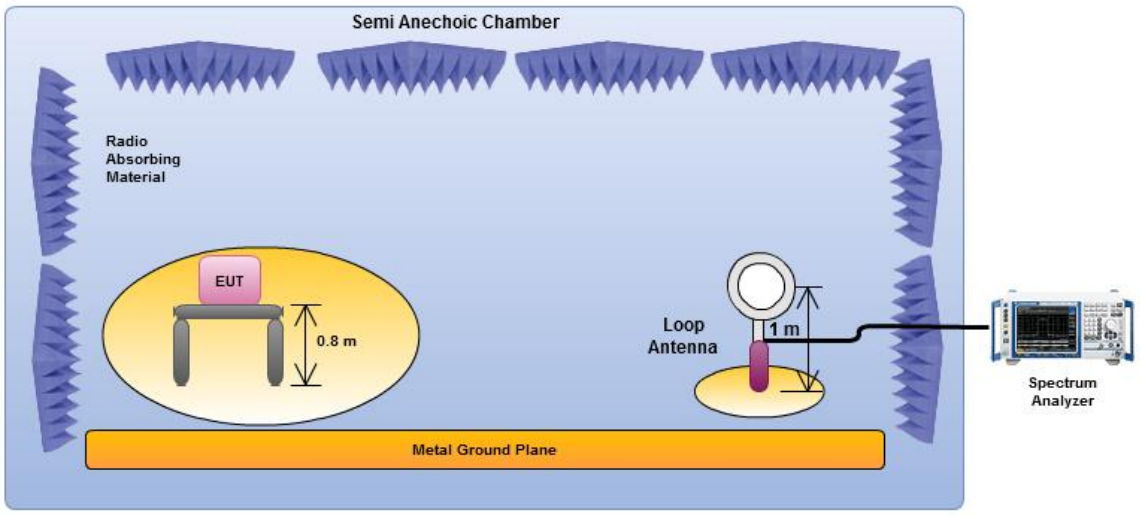
Refer a test equipment and calibration data table in this test report.

3.2.3 Test Procedures

Test Method	
☒	Refer as ANSI C63.10, clause 6.5 for radiated emissions from 30 MHz to 1 GHz and test distance is 3m.
☒	Refer as ANSI C63.10, clause 6.4 for radiated emissions from below 30 MHz and test distance is 3m.
☒	At frequencies below 30 MHz, measurements may be performed at a distance closer than that specified in the requirements; however, an attempt should be made to avoid making measurements in the near field. Pending the development of an appropriate measurement procedure for measurements performed below 30 MHz, when performing measurements at a closer distance than specified, the results shall be following below methods.
	☐ The results shall be extrapolated to the specified distance by making measurements at a minimum of two distances on at least one radial to determine the proper extrapolation factor.
	☒ The results shall be by using the square of an inverse linear distance extrapolation factor (40 dB/decade).
☒	For radiated measurement. Loop antenna was rotated about the horizontal and vertical axis and the equipment to be measured and the test antenna shall be oriented to obtain the maximum emitted field strength level.
☒	The any unwanted emissions level shall not exceed the fundamental emission level.
☒	All amplitude of spurious emissions that are attenuated by more than 20 dB below the permissible value has no need to be reported.

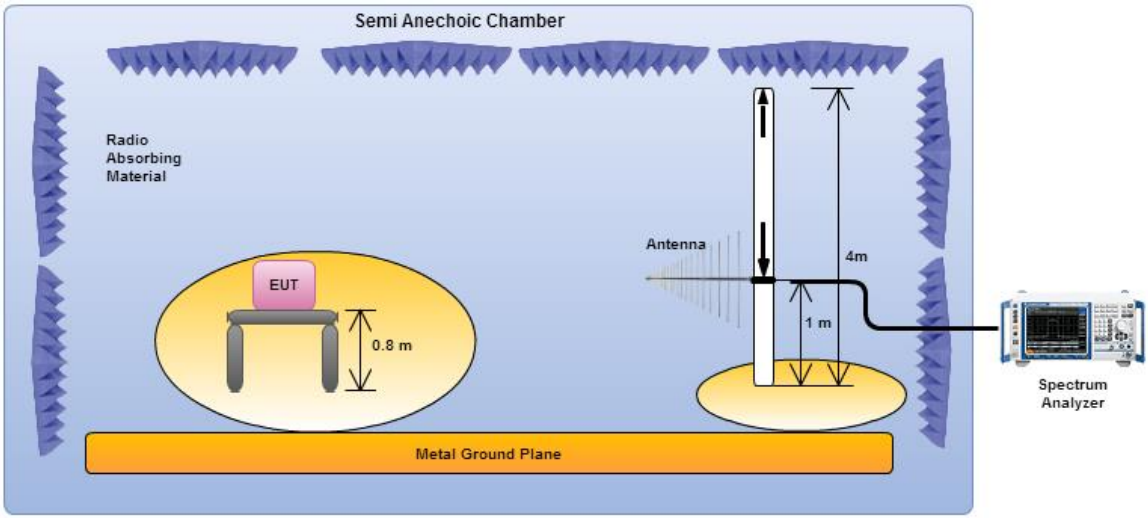
3.2.4 Test Setup

Transmitter Radiated Unwanted Emissions



Magnetic field tests shall be performed in the frequency range of 9 kHz to 30 MHz using a calibrated loop antenna. The center of the loop shall be 1 m above the ground.

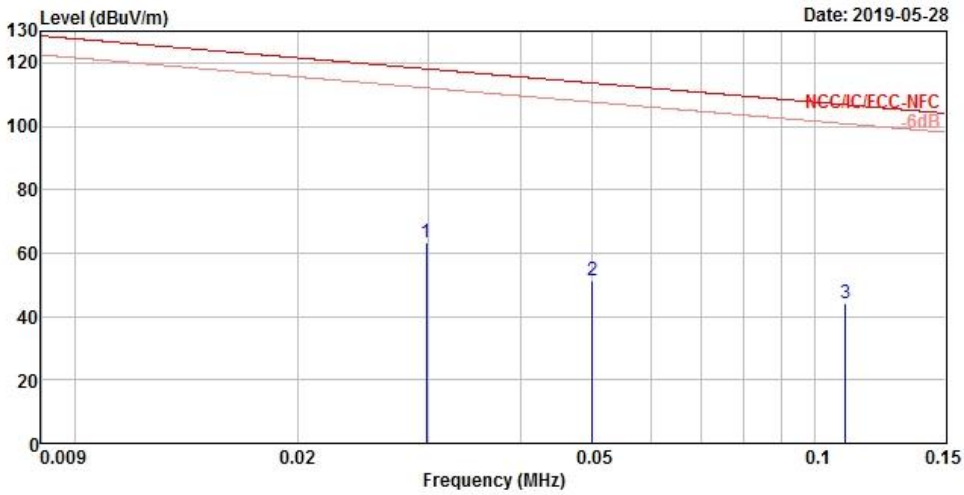
Transmitter Radiated Bandedge Emissions



Electric field tests shall be performed in the frequency range of 30 MHz to 1000 MHz using a calibrated bi-log antenna. the antenna height shall be varied from 1 m to 4 m.

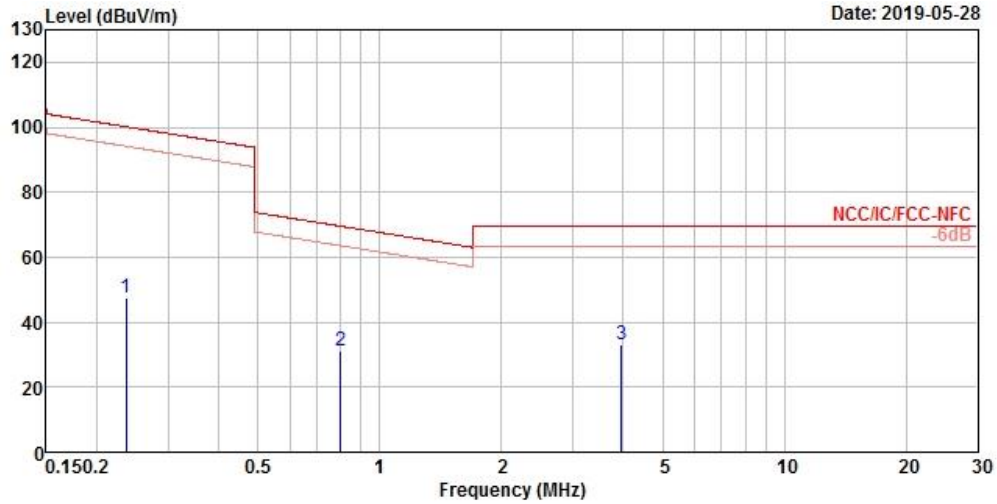
3.2.5 Transmitter Radiated Unwanted Emissions (Below 30MHz)

Transmitter Radiated Unwanted Emissions (9 kHz – 150 kHz)			
Modulation Mode	**NFC-Read/Write**	**Polarization**	H
Operating Function	DC Power Supply		



	Freq	Level	Over Limit	Limit Line	Read Level	Antenna Factor	A/Pos	T/Pos	Remark
	MHz	dBuV/m	dB	dBuV/m	dBuV	dB/m	cm	deg	
1 Max	0.03	63.13	-54.98	118.11	42.83	20.29	100	360	Peak
2	0.05	51.52	-62.12	113.64	31.01	20.50	100	360	Peak
3	0.11	43.92	-62.88	106.80	24.18	19.72	100	360	Peak

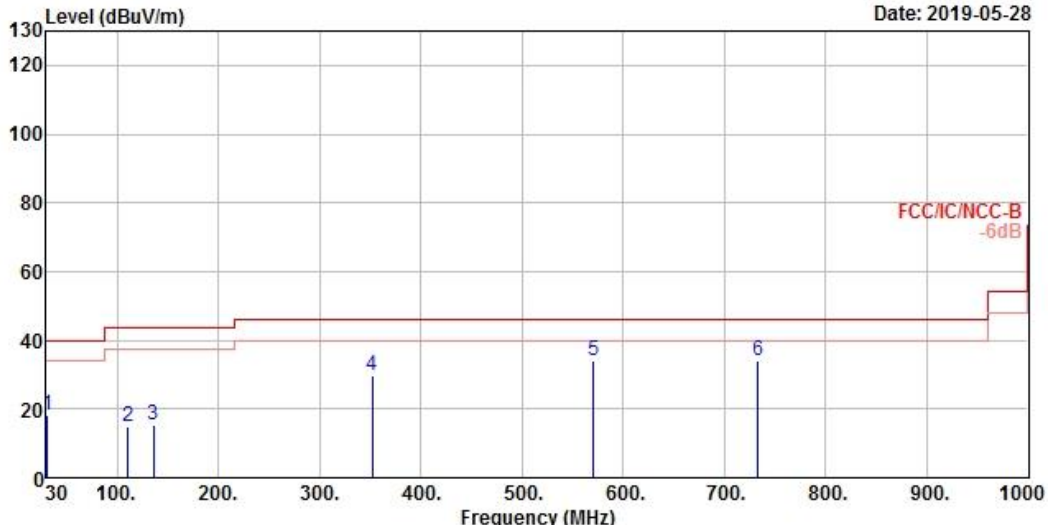
Transmitter Radiated Unwanted Emissions (150 kHz –30 MHz)			
Modulation Mode	**NFC-Read/Write**	**Polarization**	H
Operating Function	DC Power Supply		



	Freq	Level	Over Limit	Limit Line	Read Level	Antenna Factor	A/Pos	T/Pos	Remark
	MHz	dBuV/m	dB	dBuV/m	dBuV	dB/m	cm	deg	
1	0.24	47.37	-52.76	100.13	27.31	20.04	100	0	Peak
2	0.80	31.15	-38.40	69.55	11.03	20.02	100	0	Peak
3 Max	3.96	33.06	-36.48	69.54	12.32	20.24	100	0	Peak

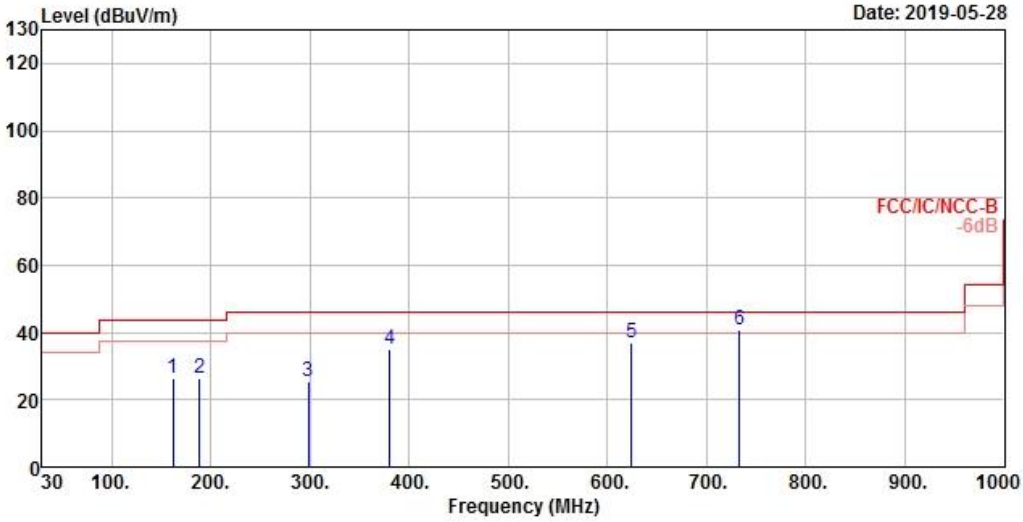
3.2.6 Transmitter Radiated Unwanted Emissions (Above 30MHz)

Transmitter Radiated Spurious Emissions (Above 30MHz)			
Modulation Mode	**NFC-Read/Write**	**Test Freq. (MHz)**	13.56
Operating Function	Transmit	**Polarization**	V



	Freq	Level	Over Limit	Limit Line	Read Level	Antenna Factor	A/Pos	T/Pos	Remark
	MHz	dBuV/m	dB	dBuV/m	dBuV	dB/m	cm	deg	
1	30.97	18.03	-21.97	40.00	26.64	23.15	100	0	Peak
2	110.51	14.63	-28.87	43.50	28.59	16.94	100	0	Peak
3	135.73	15.32	-28.18	43.50	29.48	16.62	100	0	Peak
4	352.04	29.72	-16.28	46.00	39.90	19.46	100	0	Peak
5 Max	570.29	33.84	-12.16	46.00	38.69	23.66	100	0	Peak
6	733.25	33.83	-12.17	46.00	37.18	24.52	100	0	Peak

Transmitter Radiated Spurious Emissions (Above 30MHz)			
Modulation Mode	**NFC-Read/Write**	**Test Freq. (MHz)**	13.56
Operating Function	Transmit	**Polarization**	H



	Freq	Level	Over Limit	Limit Line	Read Level	Antenna Factor	A/Pos	T/Pos	Remark
	MHz	dBuV/m	dB	dBuV/m	dBuV	dB/m	cm	deg	
1	161.92	26.44	-17.06	43.50	42.10	14.97	300	360	Peak
2	189.08	26.25	-17.25	43.50	42.80	13.98	300	360	Peak
3	298.69	25.36	-20.64	46.00	37.01	18.26	300	360	Peak
4	380.17	34.94	-11.06	46.00	44.34	20.08	300	360	Peak
5	624.61	36.93	-9.07	46.00	41.07	24.07	300	360	Peak
6 Max	733.25	41.01	-4.99	46.00	44.36	24.52	300	360	Peak

4 Test Equipment and Calibration Data

Instrument for Radiated Test

Instrument	Manufacturer	Model No.	Serial No.	Characteristics	Calibration Date	Next Calibration Date
3m Semi Anechoic Chamber	SIDT FRANKONIA	SAC-3M	03CH03-HY	30MHz ~ 1GHz 3m	30/Oct/2018	29/Oct/2019
3m Semi Anechoic Chamber	SIDT FRANKONIA	SAC-3M	03CH03-HY	1GHz ~ 18GHz 3m	30/Oct/2018	29/Oct/2019
Amplifier	HP	8447D	2944A08033	10kHz ~ 1.3GHz	22/Apr/2019	21/Apr/2020
EMI Test Receiver	R&S	ESR3	102052	9kHz ~ 3.6GHz	09/Apr/2019	08/Apr/2020
Bilog Antenna with 5dB Pad	ETS	3142B & MTJ6102-05	00022055	26 MHz - 3 GHz	19/Nov/2018	18/Nov/2019
Signal Analyzer	R&S	FSV40	101500	10Hz ~ 40GHz	18/Jul/2018	17/Jul/2019
RF Cable-R03m	Jye Bao	RG142	CB021	9kHz ~ 1GHz	22/Mar/2019	21/Mar/2020
Loop Antenna	TESEQ	HLA 6120	31244	9kHz ~ 30MHz	15/Mar/2019	14/Mar/2020