

FCC Test Report

FCC ID : 2AEIM-1509518
Equipment : B-pillar Endpoint
Brand Name : Tesla
Model Name : 1509518
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 was received on Oct. 28, 2019, and testing was started from Oct. 30, 2019 and completed on Nov. 18, 2019. We, SPORTON INTERNATIONAL INC. EMC & Wireless Communications Laboratory, 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 United States government.

The test results in this 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

HISTORY OF THIS TEST REPORT	3
SUMMARY OF TEST RESULT	4
1 GENERAL DESCRIPTION	5
1.1 Information.....	5
1.2 Testing Applied Standards	7
1.3 Testing Location Information	7
1.4 Measurement Uncertainty	7
2 TEST CONFIGURATION OF EUT.....	8
2.1 Test Condition	8
2.2 The Worst Case Modulation Configuration	8
2.3 Test Channel Frequencies Configuration.....	8
2.4 The Worst Case Measurement Configuration	9
2.5 Support Equipment.....	10
2.6 Test Setup Diagram	10
3 TRANSMITTER TEST RESULT	11
3.1 AC Power-line Conducted Emissions	11
3.2 Emission Bandwidth	13
3.3 Field Strength of Fundamental Emissions and Spectrum Mask	15
3.4 Transmitter Radiated Unwanted Emissions	17
3.5 Frequency Stability	26
4 TEST EQUIPMENT AND CALIBRATION DATA	28

Appendix A. Test Photos

Photographs of EUT V01



History of this test report

TEL : 886-3-327-3456
FAX : 886-3-327-0973
Report Template No.: HE1-C6 Ver2.3
FCC ID: 2AEIM-1509518

Summary of Test Result

Report Clause	Ref. Std. Clause	Test Items	Result (PASS/FAIL)	Remark
1.1.2	15.203	Antenna Requirement	PASS	FCC 15.203
3.1	15.207	AC Power-line Conducted Emissions	Not Required	FCC 15.207
3.2	15.215(c)	Emission Bandwidth	PASS	Fall in band $F_L \geq 13.553 \text{ MHz}$ $F_H \leq 13.567 \text{ MHz}$
3.3	15.225(a)~(d)	Field Strength of Fundamental Emissions and Spectrum Mask	PASS	124 dBuV/m at 3m
3.4	15.225(d)	Transmitter Radiated Unwanted Emissions	PASS	FCC 15.209
3.5	15.225(e)	Frequency Stability	PASS	$\pm 0.01\%$ (100ppm)

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

Reviewed by: Sam Tsai

Report Producer: Kate Lo

1 General Description

1.1 Information

1.1.1 RF General Information

RF General Information				
Frequency Range	Modulation Mode	Ch. Frequency (MHz)	Channel Number	Field Strength (dBuV/m)
13.553 – 13.567 MHz	ISO 14443-3A (ASK)	13.56	1	66.89
Note 1: Field strength performed peak level at 3m.				

1.1.2 Antenna Information

Antenna Category	
<input type="checkbox"/>	Equipment placed on the market without antennas
<input checked="" type="checkbox"/>	Integral antenna (antenna permanently attached)
<input type="checkbox"/>	Temporary RF connector provided
<input checked="" type="checkbox"/>	No temporary RF connector provided Transmit chains bypass antenna and soldered temporary RF connector provided for connected measurement. In case of conducted measurements the transmitter shall be connected to the measuring equipment via a suitable attenuator and correct for all losses in the RF path.
<input type="checkbox"/>	External antenna (dedicated antennas)

Antenna General Information		
No.	Ant. Cat.	Ant. Type
1	Integral	Loop

1.1.3 EUT Information

Operational Condition	
EUT Power Type	From Battery
Type of EUT	
<input checked="" type="checkbox"/>	Stand-alone
<input type="checkbox"/>	Combined (EUT where the radio part is fully integrated within another device)
<input type="checkbox"/>	Combined Equipment - Brand Name / Model No.: <input type="text"/>
<input type="checkbox"/>	Plug-in radio (EUT intended for a variety of host systems)
<input type="checkbox"/>	Host System - Brand Name / Model No.: <input type="text"/>
<input type="checkbox"/>	Other: <input type="text"/>

1.1.4 Test Signal Duty Cycle

Duty Cycle Operation Restriction	
The transmitter is used for	The transmitter is operated
<input checked="" type="checkbox"/> Inductive applications	<input checked="" type="checkbox"/> Automatically triggered
<input type="checkbox"/> Duty cycle fixed mode	<input checked="" type="checkbox"/> Duty cycle random mode
<input checked="" type="checkbox"/> Duty cycle mode - NFC-A (ISO 14443-3A)	
Declare transmitter duty cycle / 1 hour =	100%
<input type="checkbox"/> Duty cycle mode - NFC-B (ISO 14443-3B)	
Declare transmitter duty cycle / 1 hour =	100%
<input type="checkbox"/> Duty cycle mode - NFC-F (ISO 18092)	
Declare transmitter duty cycle / 1 hour =	100%
<input type="checkbox"/> 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
- ♦ KDB 414788 D01 v01r01

1.3 Testing Location Information

Testing Location					
<input checked="" type="checkbox"/>	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.					

Test Condition	Test Site No.	Test Engineer	Test Environment	Test Date
RF Conducted	TH06-HY	Alan	21.4~23.3°C / 65~69%	30/Oct/2019
Radiated Emission	03CH03-HY	Patrick	24.5~25.6°C / 52.8~54.5%	30/Oct/2019~ 18/Nov/2019

1.4 Measurement Uncertainty

ISO/IEC 17025 requires that an estimate of the measurement uncertainties associated with the emissions test results be included in the report. The measurement uncertainties given below are based on a 95% confidence level (based on a coverage factor (k=2))

Test Items	Uncertainty	Remark
Conducted Emission (150kHz ~ 30MHz)	3.54 dB	Confidence levels of 95%
Radiated Emission (9kHz ~ 30MHz)	1.6 dB	Confidence levels of 95%
Radiated Emission (30MHz ~ 1,000MHz)	4.3 dB	Confidence levels of 95%
Conducted Emission	1.3 dB	Confidence levels of 95%
Temperature	0.7 °C	Confidence levels of 95%
Humidity	4 %	Confidence levels of 95%

2 Test Configuration of EUT

2.1 Test Condition

Condition Item	Abbreviation/Remark	Remark
Frequency Stability	Tnom	20°C
-	Tmin	-40°C
-	Tmax	85°C
-	Vnom	120V
-	Vmin	102V
-	Vmax	138V

2.2 The Worst Case Modulation Configuration




Modulation Used for Conformance Testing	
Modulation Mode	Field Strength (dBuV/m at 3 m)
NFC	66.89

2.3 Test Channel Frequencies Configuration

Modulation Mode	Test Channel Frequencies (MHz)
NFC	13.56

2.4 The Worst Case Measurement Configuration

The Worst Case Mode for Following Conformance Tests	
Tests Item	Emission Bandwidth, Frequency Stability
Test Condition	Radiated measurement

The Worst Case Mode for Following Conformance Tests			
Tests Item	Field Strength of Fundamental Emissions Spectrum Mask, Transmitter Radiated Unwanted Emissions		
Test Condition	Radiated measurement		
Operating Mode	1. Battery Mode without passive tag		
	2. Battery Mode with passive tag		
Mode 1 configuration was pretested and found to be the worst case and measured during the test.			
Orthogonal Planes of EUT	X Plane	Y Plane	Z Plane
			
Worst Planes of EUT	V		
Note: Loop antenna Open configuration was pretested and found to be the worst case and measured during the test.			

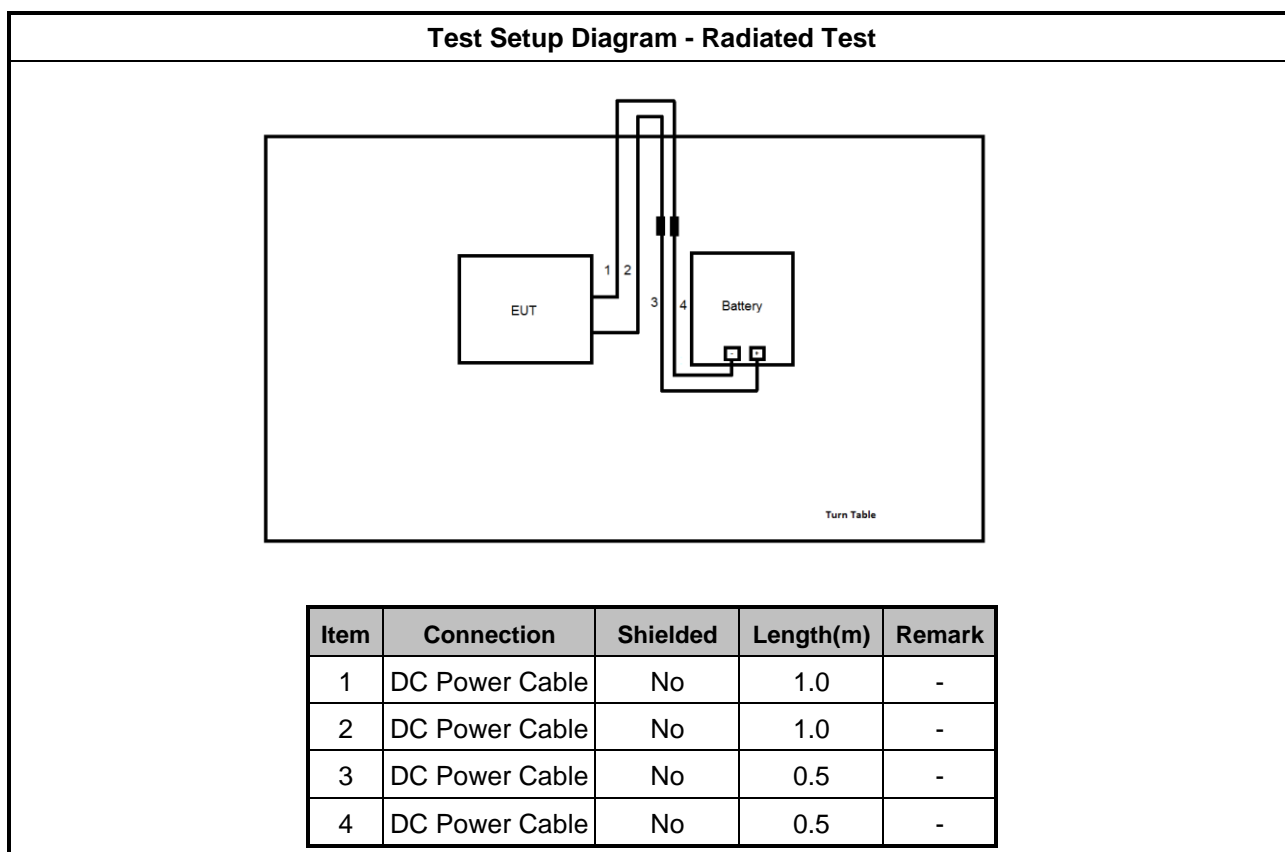
2.5 Support Equipment

Support Equipment - RF Conducted			
No.	Equipment	Brand Name	Model Name
1	Notebook	HP	-
2	Adapter for NB	HP	-
3	DC Power Supply	GW	GPS-3030DD
4	Fixture	-	-

Note: Support equipment No.1, No.2 and No.4 were provided by customer.

Support Equipment - Radiated			
No.	Equipment	Brand Name	Model Name
1	Battery	YUASA	H5E41R

2.6 Test Setup Diagram



3 Transmitter Test Result

3.1 AC Power-line Conducted Emissions

3.1.1 AC Power-line Conducted Emissions Limit

AC Power-line Conducted Emissions Limit		
Frequency Emission (MHz)	Quasi-Peak	Average
0.15-0.5	66 - 56 *	56 - 46 *
0.5-5	56	46
5-30	60	50

Note 1: * Decreases with the logarithm of the frequency.

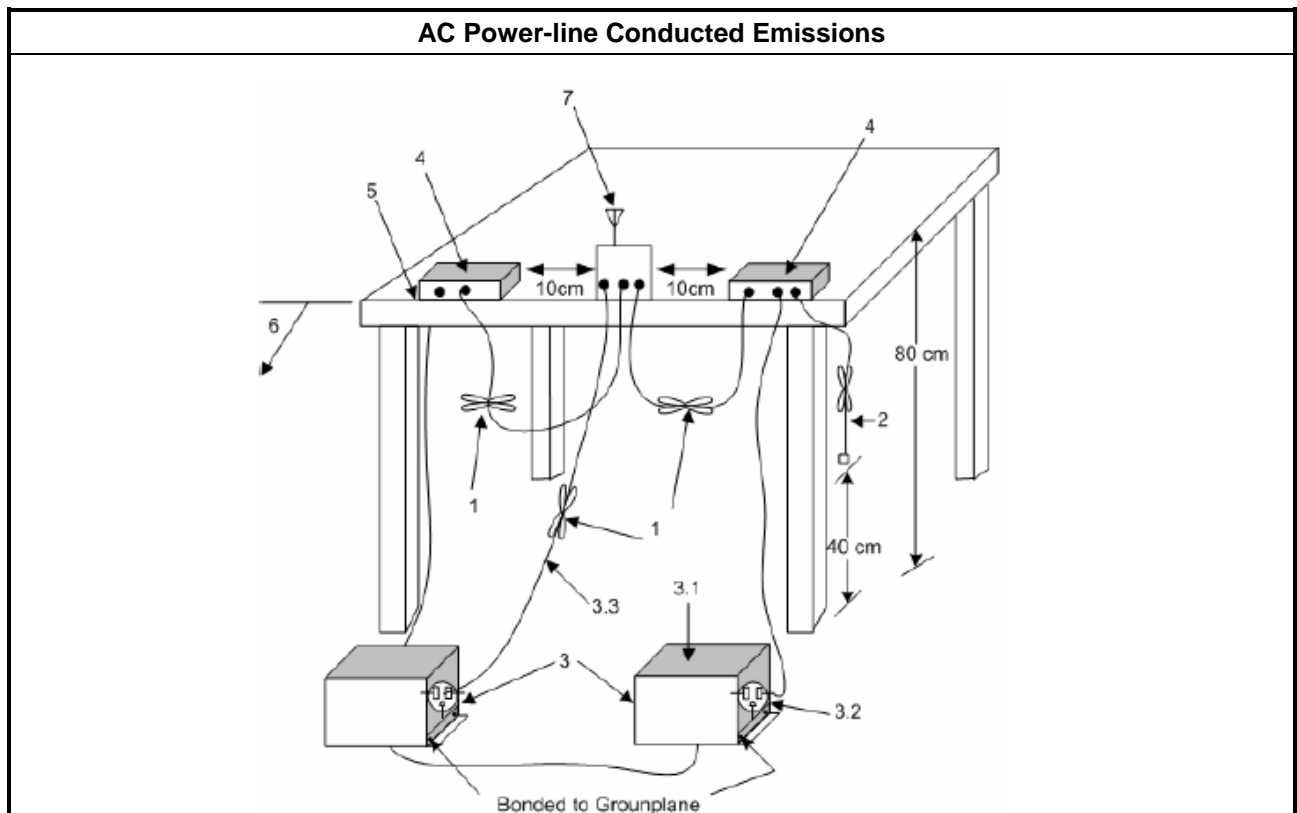
3.1.2 Measuring Instruments

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

3.1.3 Test Procedures

Test Method	
<input checked="" type="checkbox"/>	Refer as ANSI C63.10-2013, clause 6.2 for AC power-line conducted emissions.
<input checked="" type="checkbox"/>	If AC conducted emissions fall in operating band, then following below test method confirm final result.
<input type="checkbox"/>	Accept measurements done with a suitable dummy load replacing the antenna under the following conditions: (1) Perform the AC line conducted tests with the antenna connected to determine compliance with FCC 15.207 limits outside the transmitter's fundamental emission band; (2) Retest with a dummy load to determine compliance with FCC 15.207 limits within the transmitter's fundamental emission band.
<input checked="" type="checkbox"/>	For a device with a permanent antenna operating at or below 30 MHz, accept measurements done with a suitable dummy load, in lieu of the permanent antenna under the following conditions: (1) Perform the AC line conducted tests with the permanent antenna to determine compliance with the FCC 15.207 limits outside the transmitter's fundamental emission band; (2) Retest with a dummy load in lieu of the permanent antenna to determine compliance with the FCC 15.207 limits within the transmitter's fundamental emission band.

3.1.4 Test Setup



3.1.5 Test Result of AC Power-line Conducted Emissions

Please refer to FCC 15.207 which states, "Measurements to demonstrate compliance with the conducted limits are not required for devices employ Battery for operation and which do not operate from the AC power lines or contain provisions for operation while connected to the AC power lines".

Therefore, for this device, AC Power Line Conducted Emissions investigation is not required.

3.2 Emission Bandwidth

3.2.1 Emission Bandwidth Limit

20dB Bandwidth Limit	
<input checked="" type="checkbox"/>	Intentional radiators must be designed to ensure that the 20 dB bandwidth of the emissions in the specific band (13.553 – 13.567 MHz).

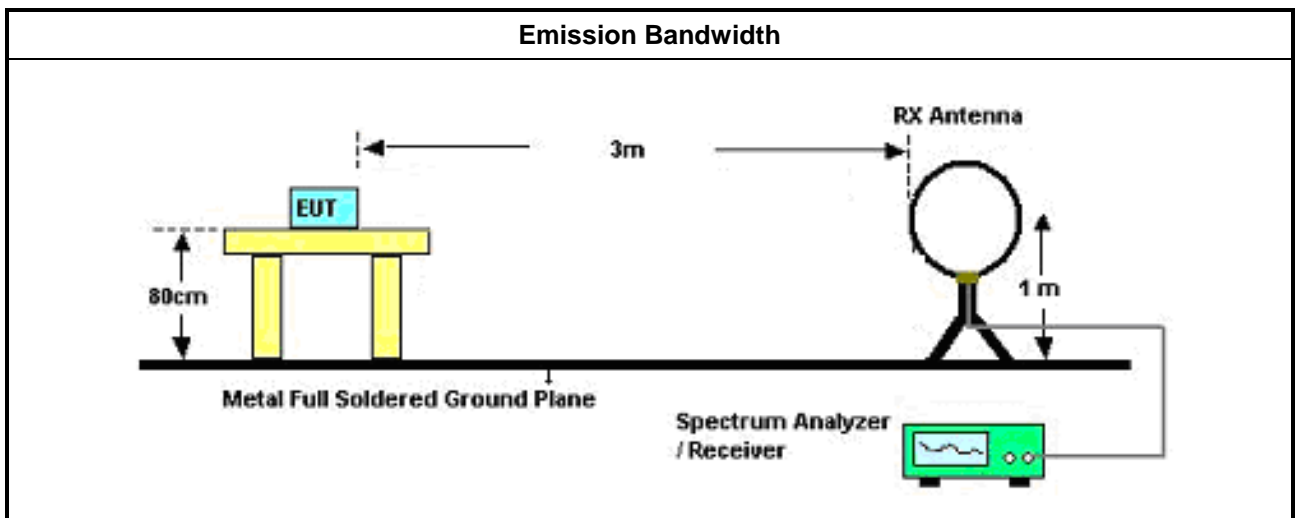
3.2.2 Measuring Instruments

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

3.2.3 Test Procedures

Test Method	
<input checked="" type="checkbox"/>	Because the measured signal is CW or CW-like adjusting the RBW per C63.10 would not be practical since measured bandwidth will always follow the RBW and the result will be approximately twice the RBW.
<input checked="" type="checkbox"/>	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.

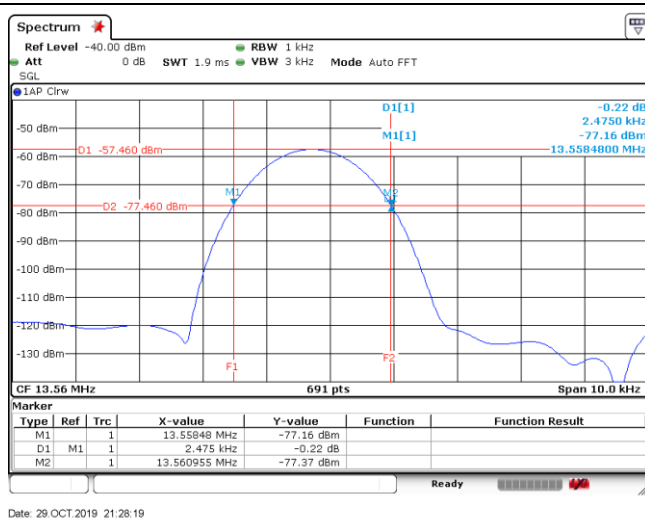
3.2.4 Test Setup



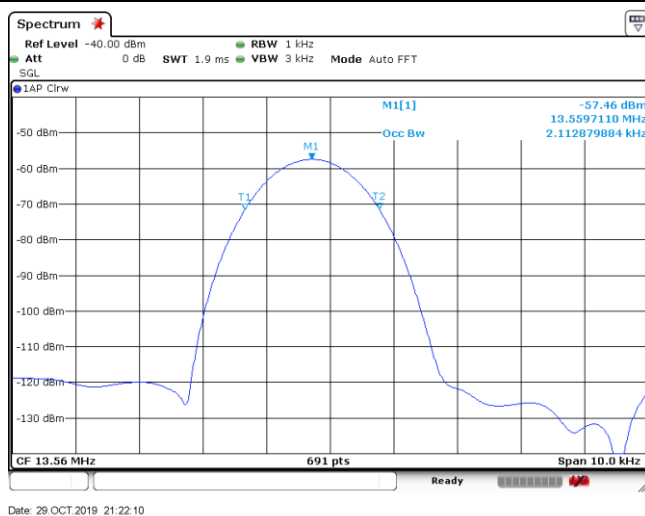
3.2.5 Test Result of Emission Bandwidth

Occupied Channel Bandwidth Result					
Modulation Mode	Frequency (MHz)	20dB Bandwidth (kHz)	99% Bandwidth (kHz)	F _L at 20dB BW (MHz)	F _H at 20dB BW (MHz)
NFC	13.56	2.475	2.113	13.558	13.561
Limit		N/A	N/A	13.553	13.567
Result		Complied			

Emission Bandwidth Plot - 20dB Bandwidth



Emission Bandwidth Plot - 99% Bandwidth



3.3 Field Strength of Fundamental Emissions and Spectrum Mask

3.3.1 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

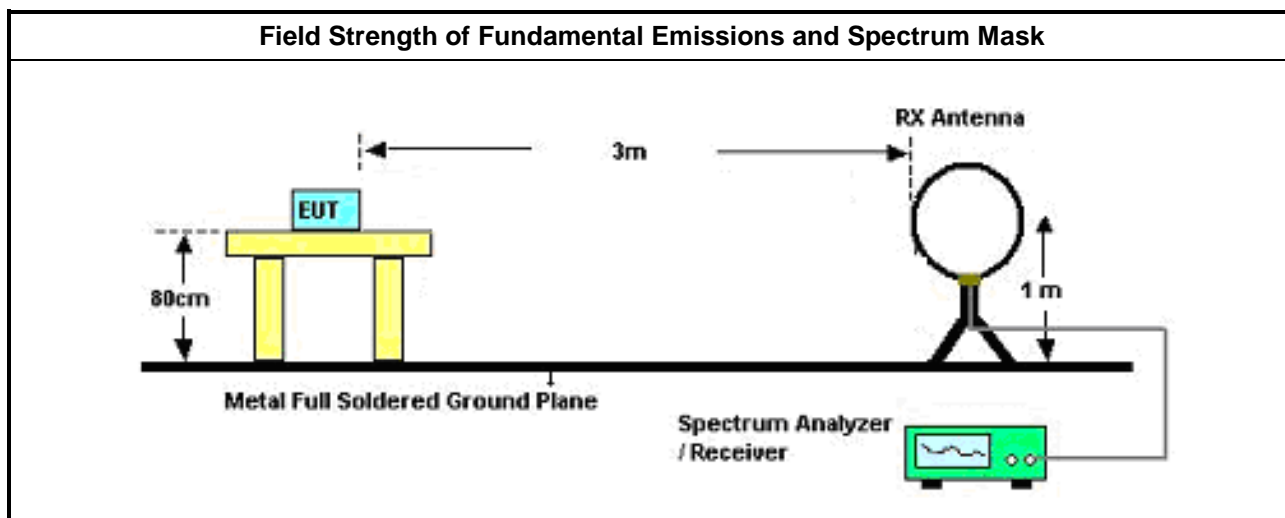
3.3.2 Measuring Instruments

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

3.3.3 Test Procedures

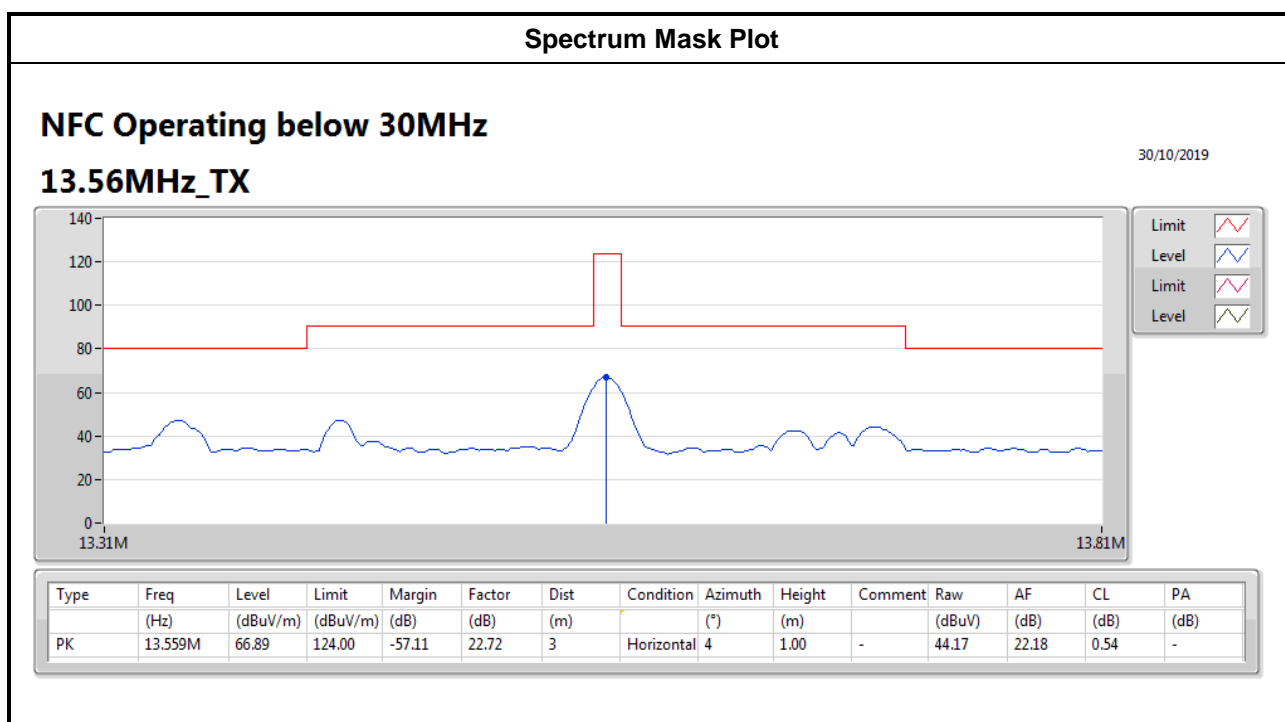
Test Method	
<input checked="" type="checkbox"/>	Refer as ANSI C63.10, clause 6.4 for radiated emissions from below 30 MHz and test distance is 3m.
<input checked="" type="checkbox"/>	At frequencies below 30 MHz, measurements may be performed at a distance closer than that specified in the requirements; 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.
<input type="checkbox"/>	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.
<input checked="" type="checkbox"/>	The results shall be by using the square of an inverse linear distance extrapolation factor (40 dB/decade).
<input checked="" type="checkbox"/>	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.

3.3.4 Test Setup



3.3.5 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	Fundamental (dBuV/m)@30 m	Polarization	Margin (dB)	Limit (dBuV/m)@30 m
NFC	13.56	66.89	26.89	H	-57.11	84
Result		Complied				
Note 1: Measurement worst emissions of receive antenna polarization: H(Horizontal).						



3.4 Transmitter Radiated Unwanted Emissions

3.4.1 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.

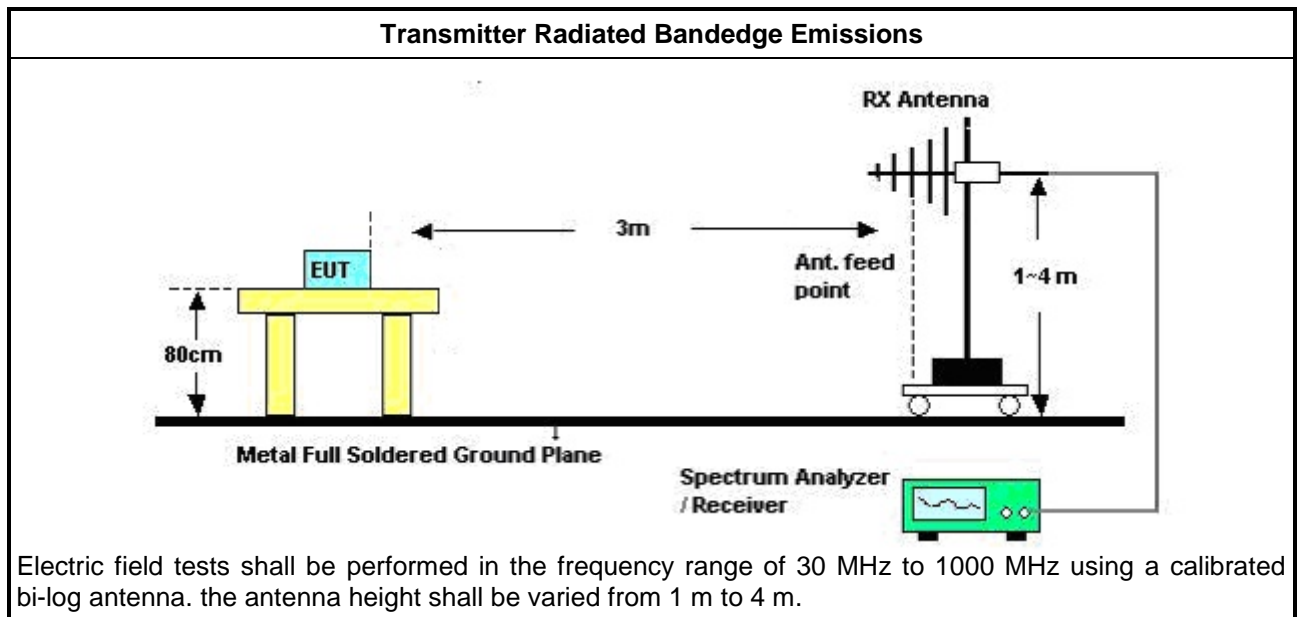
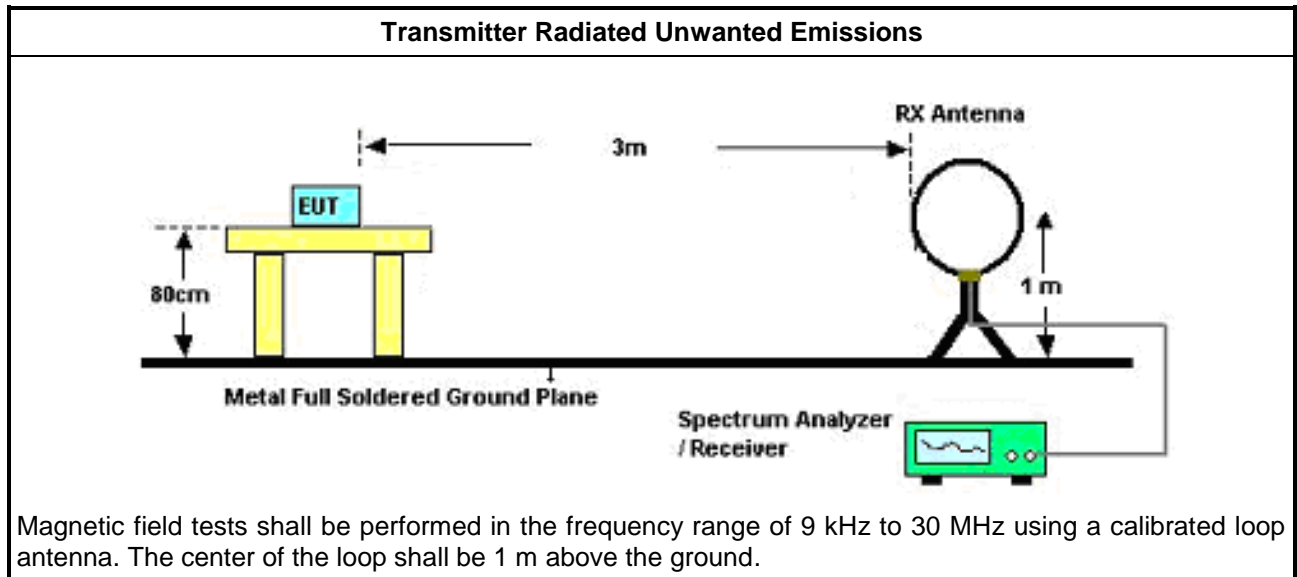
3.4.2 Measuring Instruments

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

3.4.3 Test Procedures

Test Method	
<input checked="" type="checkbox"/>	Refer as ANSI C63.10, clause 6.5 for radiated emissions from 30 MHz to 1 GHz and test distance is 3m.
<input checked="" type="checkbox"/>	Refer as ANSI C63.10, clause 6.4 for radiated emissions from below 30 MHz and test distance is 3m.
<input checked="" type="checkbox"/>	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.
<input type="checkbox"/>	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.
<input checked="" type="checkbox"/>	The results shall be by using the square of an inverse linear distance extrapolation factor (40 dB/decade).
<input checked="" type="checkbox"/>	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.
<input checked="" type="checkbox"/>	The any unwanted emissions level shall not exceed the fundamental emission level.
<input checked="" type="checkbox"/>	All amplitude of spurious emissions that are attenuated by more than 20 dB below the permissible value has no need to be reported.
▪ KDB 414788 D01 v01r01 Open-Field Test Sites and Chamber Correlation Justification.	
▪	Based on FCC 15.31 (f) (2): measurements may be performed at a distance closer than that specified in regulations; however, an attempt should be made to avoid making measurements in the near field.
▪	Open-field site and chamber correlation testing had been performed and chamber measured test result is the worst case test result.

3.4.4 Test Setup



3.4.5 Transmitter Radiated Unwanted Emissions (Below 30MHz)

Summary

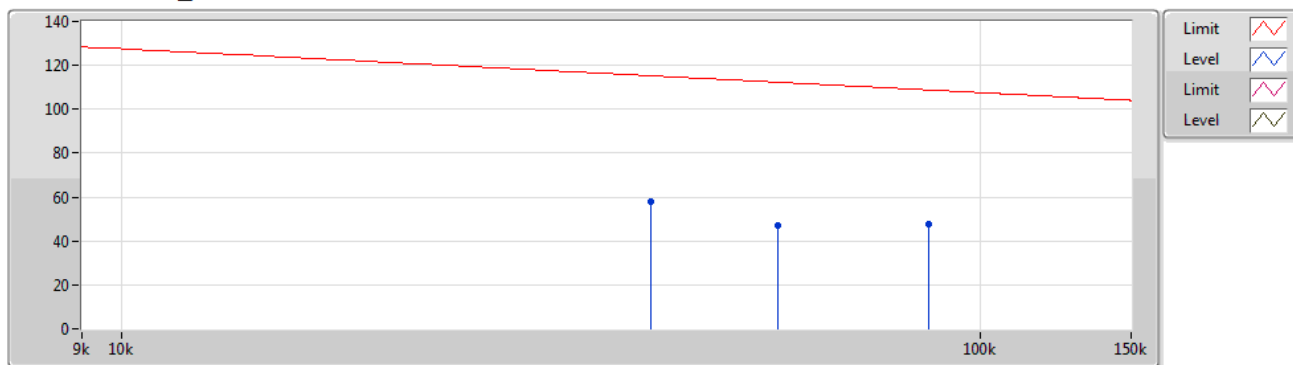
Mode	Result	Type	Freq (Hz)	Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Factor (dB)	Dist (m)	Azimuth (°)	Height (m)	Comments
13.553-13.567MHz	-	-	-	-	-	-	-	-	-	-	-
NFC	Pass	PK	1.702M	1.05	22.99	-21.94	20.28	30	0	1.00	-

Result

Mode	Result	Type	Freq (Hz)	Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Factor (dB)	Dist (m)	Azimuth (°)	Height (m)	Comments
NFC	-	-	-	-	-	-	-	-	-	-	-
13.56MHz_TX	Pass	PK	13.559M	26.89	84.00	-57.11	22.72	30	4	1.00	-
13.56MHz_TX	Pass	PK	41.43k	-22.03	35.26	-57.29	20.49	300	360	1.00	-
13.56MHz_TX	Pass	PK	58.068k	-33.18	32.33	-65.51	20.45	300	360	1.00	-
13.56MHz_TX	Pass	PK	87.114k	-32.32	28.80	-61.12	19.99	300	360	1.00	-
13.56MHz_TX	Pass	PK	1.702M	1.05	22.99	-21.94	20.28	30	0	1.00	-
13.56MHz_TX	Pass	PK	4.329M	-0.43	29.54	-29.97	20.54	30	0	1.00	-
13.56MHz_TX	Pass	PK	27.134M	3.79	29.54	-25.75	23.76	30	0	1.00	-

NFC Operating below 30MHz

30/10/2019

13.56MHz_TX


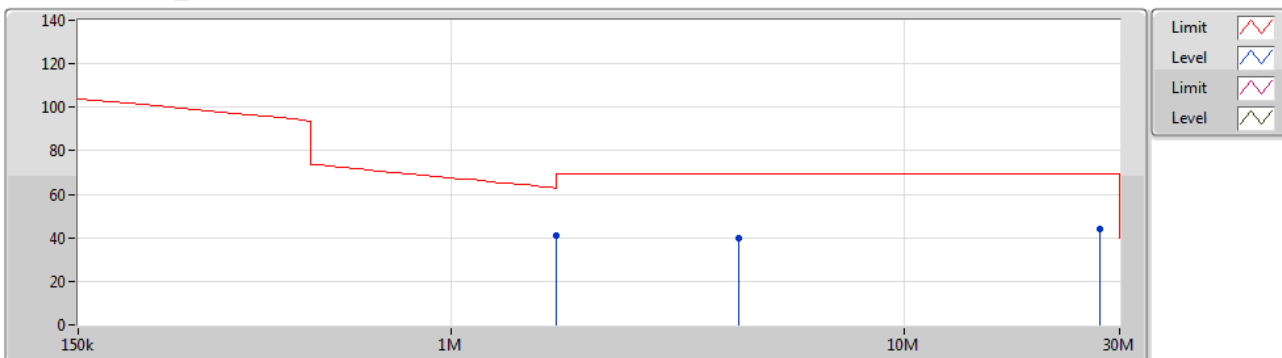
Type	Freq (Hz)	Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Factor (dB)	Dist (m)	Condition	Azimuth (°)	Height (m)	Comment	Raw (dBuV)	AF (dB)	CL (dB)	PA (dB)
PK	41.43k	57.97	115.25	-57.28	20.49	3	Horizontal	360	1.00	-	37.48	20.42	0.07	-
PK	58.068k	46.82	112.31	-65.49	20.45	3	Horizontal	360	1.00	-	26.37	20.37	0.08	-
PK	87.114k	47.68	108.79	-61.11	19.99	3	Horizontal	360	1.00	-	27.69	19.90	0.09	-

Frequency (kHz)	Level (dBuV/m)	Level (dBuV/m)	limit (dBuV/m)	Margin
41.43	57.97 @ 3m	-22.03 @ 300m	35.26	-57.29
58.068	46.82 @ 3m	-33.18 @ 300m	32.33	-65.51
87.114	47.68 @ 3m	-32.32 @ 300m	28.80	-61.12

NFC Operating below 30MHz

30/10/2019

13.56MHz_TX



Type	Freq (Hz)	Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Factor (dB)	Dist (m)	Condition	Azimuth (°)	Height (m)	Comment	Raw (dBuV)	AF (dB)	CL (dB)	PA (dB)
PK	1.702M	41.05	63.02	-21.97	20.28	3	Horizontal	0	1.00	-	20.77	20.10	0.18	-
PK	4.329M	39.57	69.50	-29.93	20.54	3	Horizontal	0	1.00	-	19.03	20.30	0.24	-
PK	27.134M	43.79	69.50	-25.71	23.76	3	Horizontal	0	1.00	-	20.03	23.00	0.76	-

Frequency (kHz)	Level (dBuV/m)	Level (dBuV/m)	limit (dBuV/m)	Margin
1702	41.05 @ 3m	1.05 @ 30m	22.99	-21.94
4329	39.57 @ 3m	-0.43 @ 30m	29.54	-29.97
27134	43.79 @ 3m	3.79 @ 30m	29.54	-25.75

3.4.6 Transmitter Radiated Unwanted Emissions (Above 30MHz)

Summary

Mode	Result	Type	Freq (Hz)	Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Factor (dB)	Dist (m)	Azimuth (°)	Height (m)	Comments
13.553-13.567MHz	-	-	-	-	-	-	-	-	-	-	-
NFC	Pass	QP	53.28M	36.92	40.00	-3.08	-14.18	3	0	1.00	-

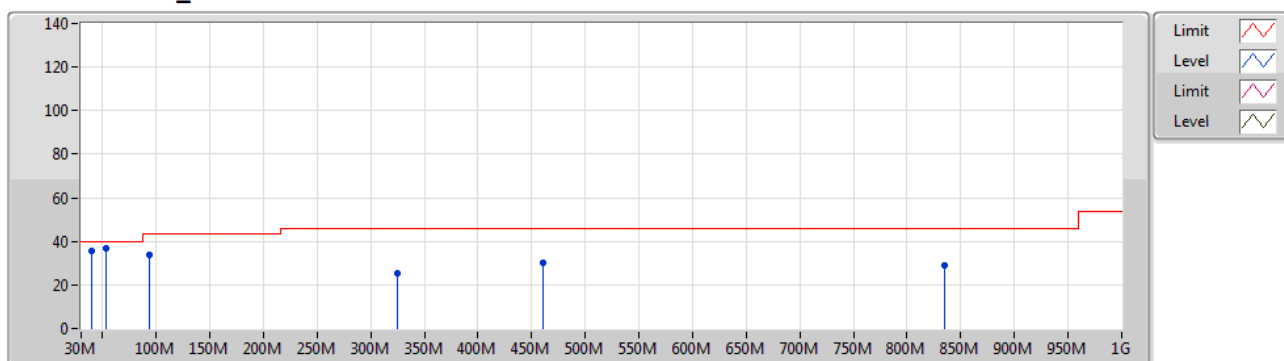
Result

Mode	Result	Type	Freq (Hz)	Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Factor (dB)	Dist (m)	Azimuth (°)	Height (m)	Comments
NFC	-	-	-	-	-	-	-	-	-	-	-
13.56MHz_TX	Pass	PK	39.7M	35.80	40.00	-4.20	-8.99	3	360	1.00	-
13.56MHz_TX	Pass	PK	94.02M	33.92	43.50	-9.58	-11.10	3	360	1.00	-
13.56MHz_TX	Pass	PK	324.88M	25.21	46.00	-20.79	-5.20	3	360	1.00	-
13.56MHz_TX	Pass	PK	460.68M	29.90	46.00	-16.10	-2.13	3	360	1.00	-
13.56MHz_TX	Pass	PK	835.1M	28.90	46.00	-17.10	2.34	3	360	1.00	-
13.56MHz_TX	Pass	QP	53.28M	36.92	40.00	-3.08	-14.18	3	0	1.00	-
13.56MHz_TX	Pass	PK	66.86M	30.78	40.00	-9.22	-14.97	3	0	1.00	-
13.56MHz_TX	Pass	PK	94.02M	32.23	43.50	-11.27	-11.10	3	0	1.00	-
13.56MHz_TX	Pass	PK	229.82M	30.42	46.00	-15.58	-9.14	3	0	1.00	-
13.56MHz_TX	Pass	PK	324.88M	28.19	46.00	-17.81	-5.20	3	0	1.00	-
13.56MHz_TX	Pass	PK	447.1M	30.98	46.00	-15.02	-2.38	3	0	1.00	-
13.56MHz_TX	Pass	PK	747.8M	30.04	46.00	-15.96	1.35	3	0	1.00	-

NFC Operating above 30MHz

18/11/2019

13.56MHz_TX

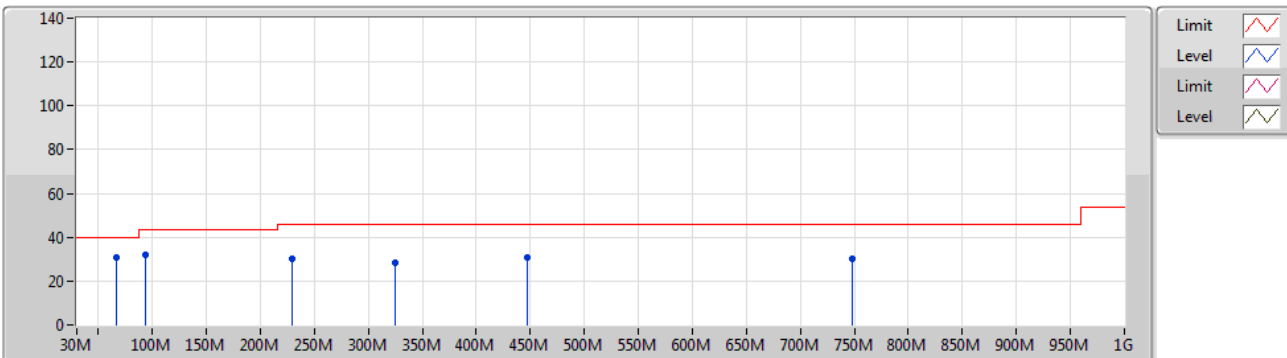


Type	Freq (Hz)	Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Factor (dB)	Dist (m)	Condition	Azimuth (°)	Height (m)	Comment	Raw (dBuV)	AF (dB)	CL (dB)	PA (dB)
PK	39.7M	35.80	40.00	-4.20	-8.99	3	Vertical	360	1.00	-	44.79	17.62	0.93	27.54
PK	94.02M	33.92	43.50	-9.58	-11.10	3	Vertical	360	1.00	-	45.02	14.83	1.46	27.39
PK	324.88M	25.21	46.00	-20.79	-5.20	3	Vertical	360	1.00	-	30.41	18.78	2.86	26.84
PK	460.68M	29.90	46.00	-16.10	-2.13	3	Vertical	360	1.00	-	32.03	22.16	3.43	27.72
PK	835.1M	28.90	46.00	-17.10	2.34	3	Vertical	360	1.00	-	26.56	25.27	4.84	27.77
QP	53.28M	36.92	40.00	-3.08	-14.18	3	Vertical	0	1.00	-	51.10	12.24	1.09	27.51

NFC Operating above 30MHz

18/11/2019

13.56MHz_TX



Type	Freq	Level	Limit	Margin	Factor	Dist	Condition	Azimuth	Height	Comment	Raw	AF	CL	PA
	(Hz)	(dBuV/m)	(dBuV/m)	(dB)	(dB)	(m)		(°)	(m)		(dBuV)	(dB)	(dB)	(dB)
PK	66.86M	30.78	40.00	-9.22	-14.97	3	Horizontal	0	1.00	-	45.75	11.27	1.23	27.47
PK	94.02M	32.23	43.50	-11.27	-11.10	3	Horizontal	0	1.00	-	43.33	14.83	1.46	27.39
PK	229.82M	30.42	46.00	-15.58	-9.14	3	Horizontal	0	1.00	-	39.56	15.31	2.37	26.82
PK	324.88M	28.19	46.00	-17.81	-5.20	3	Horizontal	0	1.00	-	33.39	18.78	2.86	26.84
PK	447.1M	30.98	46.00	-15.02	-2.38	3	Horizontal	0	1.00	-	33.36	21.92	3.38	27.68
PK	747.8M	30.04	46.00	-15.96	1.35	3	Horizontal	0	1.00	-	28.69	24.89	4.50	28.04

3.5 Frequency Stability

3.5.1 Frequency Stability Limit

Frequency Stability Limit	
<input checked="" type="checkbox"/>	Carrier frequency stability shall be maintained to $\pm 0.01\%$ (± 100 ppm).

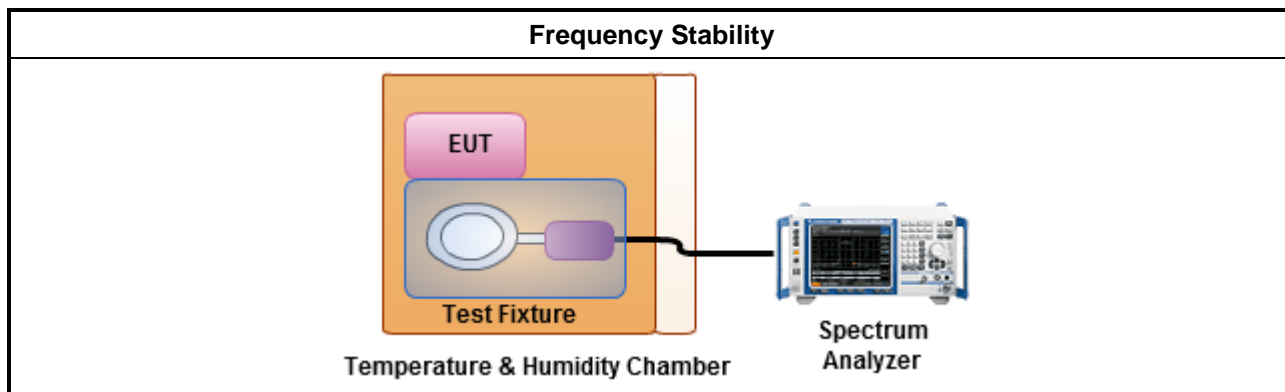
3.5.2 Measuring Instruments

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

3.5.3 Test Procedures

Test Method	
<input checked="" type="checkbox"/>	Refer as ANSI C63.10, clause 6.8 for frequency stability tests
<input checked="" type="checkbox"/>	Frequency stability with respect to ambient temperature
<input checked="" type="checkbox"/>	Frequency stability when varying supply voltage
<input type="checkbox"/>	For conducted measurement.
<input checked="" type="checkbox"/>	For radiated measurement. The equipment to be measured and the test antenna shall be oriented to obtain the maximum emitted power level.

3.5.4 Test Setup



3.5.5 Test Result of Frequency Stability

Frequency Stability Result									
Condition	Ch. Freq. (MHz)	Frequency Stability (ppm)							
		Test Frequency (MHz)				Frequency Stability (ppm)			
		0 min	2 min	5 min	10 min	0 min	2 min	5 min	10 min
T _{20°C} V _{max}	13.56	13.55975	13.55976	13.55975	13.55976	-18.36	-17.70	-18.29	-17.70
T _{20°C} V _{min}	13.56	13.55976	13.55976	13.55976	13.55976	-17.92	-18.07	-17.99	-17.77
T _{50°C} V _{nom}	13.56	13.55973	13.55974	13.55974	13.55974	-19.69	-19.54	-19.47	-19.47
T _{40°C} V _{nom}	13.56	13.55979	13.55978	13.55979	13.55979	-15.41	-16.22	-15.49	-15.56
T _{30°C} V _{nom}	13.56	13.55984	13.55975	13.55984	13.55985	-11.65	-18.81	-11.73	-11.21
T _{20°C} V _{nom}	13.56	13.55975	13.55975	13.55975	13.55976	-18.58	-18.51	-18.44	-17.99
T _{10°C} V _{nom}	13.56	13.55977	13.55978	13.55978	13.55978	-16.96	-16.45	-16.37	-16.37
T _{0°C} V _{nom}	13.56	13.55982	13.55982	13.55982	13.55982	-13.42	-13.57	-13.50	-13.35
T _{-10°C} V _{nom}	13.56	13.55991	13.55991	13.55991	13.55991	-6.93	-6.56	-6.71	-7.01
T _{-20°C} V _{nom}	13.56	13.55999	13.55999	13.55999	13.56000	-0.66	-0.59	-0.66	-0.29
Limit (ppm)		-				100			
Result		Complied							
Note 1: Measure at 85 % [Vmin] and 115 % [Vmax] of the nominal voltage [Vnom]. The nominal voltage refer test report clause 2.1 for EUT operational condition.									
Note 2: Measure maximum deviation frequency at operating frequency at startup and two, five, and ten min.									

4 Test Equipment and Calibration Data

Instrument for Conducted Test

Instrument	Manufacturer	Model No.	Serial No.	Characteristics	Calibration Date	Calibration Due Date
Spectrum Analyzer	R&S	FSV 40	101013	10Hz~40GHz	13/Mar/2019	12/Mar/2020
Temp. and Humidity Chamber	Giant Force	GTH-225-20-SP-SD	MAA1112-007	-20~100℃	21/May/2019	20/May/2020
Loop Antenna	TESEQ	HLA 6120	31244	9kHz~30MHz	15/Mar/2019	14/Mar/2020
DC Power Supply	GWINSTEK	GPS-3030DD	GEN854443	0~30V,0~3A	NCR	NCR

Instrument for Radiated Test

Instrument	Manufacturer	Model No.	Serial No.	Characteristics	Calibration Date	Calibration Due Date
3m Semi Anechoic Chamber	SIDT FRANKONIA	SAC-3M	03CH03-HY	30MHz~1GHz 3m	30/ Aug/2019	29/ Aug/2020
3m Semi Anechoic Chamber	SIDT FRANKONIA	SAC-3M	03CH03-HY	1GHz~18GHz 3m	30/ Aug/2019	29/ Aug/2020
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 & 5dB Attenuator	SCHAFFNER / MTJ	CBL 6112B / MTJ6102-05	2723 / 2	30MHz~2GHz	11/Oct/2019	10/Oct//2020
Microwave System Preamplifier	KEYSIGHT	83017A	MY53270196	1GHz~26.5GHz	09/Sep/2019	08/Sep/2020
Signal Analyzer	R&S	FSP40	100305	9kHz~40GHz; -140~+30dBm	10/Jun/2019	09/Jun/2020
RF Cable-R03m	Jye Bao	RG142	CB021	9kHz~1GHz	22/Mar/2019	21/Mar/2020
RF CABLE 6m	HUBER+SUHNER	SUOFLEX 104	SN 805801/4	1GHz~40GHz	21/Mar/2019	20/Mar/2020
RF CABLE	HUBER+SUHNER	SUOFLEX 104	802378/4	1GHz~18 GHz	04/Jul/2019	03/Jul/2020
Double Ridged Guide Horn Antenna	SCHWARZBECK	BBHA 9120 D	BBHA 9120 D 1531	1GHz~18GHz	09/Mar/ 2019	08/Mar/2020
Loop Antenna	TESEQ	HLA 6120	31244	9k~30MHz	15/Mar/2019	14/Mar/2020