FCC Test Report

Equipment	:	**B-pillar Endpoint**
Brand Name	:	**Tesla**
Model No.	:	**1089773**
FCC ID	:	**2AEIM-1089773**
Standard	:	**47 CFR FCC Part 15.225**
Operating Band	:	**13.553 – 13.567 MHz**
Applicant / Manufacturer	:	**Tesla Motors, Inc. 3500 Deer Creek Road Palo Alto, California US 94304 United States Of America**

The product sample received on Jun. 12, 2017 and completely tested on Jun. 16, 2017. 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 test results in this report apply exclusively to the tested model / sample. Without written approval of SPORTON INTERNATIONAL INC., the test report shall not be reproduced except in full.

Phoenix Chen
SPORTON INTERNATIONAL INC.

Testing Laboratory
1190

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	15.207	AC Power-line Conducted Emissions	-	FCC 15.207	N/A
3.2	15.215(c)	Emission Bandwidth	20dB Bandwidth 2.489 [kHz] F_L: 13.558755 MHz F_H: 13.561245 MHz	Fall in band $F_L \geq$ 13.553 MHz $F_H \leq$ 13.567 MHz	Complied
3.3	15.225(a)~(d)	Field Strength of Fundamental Emissions and Spectrum Mask	Fundamental Emissions peak: 69.35 dBuV/m at 3m Device complies with spectrum mask – refer to test data	124 dBuV/m at 3m	Complied
3.4	15.225(d)	Transmitter Radiated Unwanted Emissions	refer as test result	FCC 15.209	Complied
3.5	15.225(e)	Frequency Stability	-26.03 ppm	± 0.01% (100ppm)	Complied

Revision History

Report No.	Version	Description	Issued Date
FR752630AR	Rev. 01	Initial issue of report	Jul. 28, 2017
FR752630AR	Rev. 02	Revise typo	Aug. 01, 2017

1 General Description

1.1 Information

1.1.1 RF General Information

NFC Chip	Brand Name	Model Name
	ST25R3915	1089773

RF General Information				
Frequency Range	**Modulation**	**Ch. Frequency (MHz)**	**Channel Number**	**Field Strength (dBuV/m)**
13.553 – 13.567 MHz	NFC-A (ISO 14443-3A)	13.56	1	69.35
Note 1: Field strength performed peak level at 3m.				

1.1.2 Antenna Information

Antenna Category	
☒	Integral antenna (antenna permanently attached)
	☐ Temporary RF connector provided
	☒ 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.
☐	External antenna (dedicated antennas)

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

1.1.3 Type of EUT

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 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 Limit			
☐	Class 1 - < 0.1 %	☐	Class 2 - < 1.0 %
☐	Class 3 - < 10 %	☒	Class 4 - Up to 100 %

1.1.5 EUT Operational Condition

Supply Voltage	☐ AC mains	☒ DC	
Type of DC Source	☒ Internal DC supply	☐ External AC adapter	☐ Battery
Test Voltage	☒ Vnom (12 V)	☒ Vmax (13.8 V)	☒ Vmin (10.5 V)
Test Climatic	☒ Tnom (20°C)	☒ Tmax (85°C)	☒ Tmin (-40°C)

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 15.225
- 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. TW0006 with FCC.			

Test Condition	Test Site No.	Test Engineer	Test Environment	Test Date
RF Conducted	TH06-HY	Gary	21°C / 61%	16/Jun/2017
Radiated	03CH03-HY	Thor	23°C / 65.4%	15/Jun/2017

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)

Measurement Uncertainty		
Test Item		**Uncertainty**
AC power-line conducted emissions		±2.2 dB
Emission bandwidth		±1.4 %
Unwanted emissions, conducted	9 – 150 kHz	±0.38 dB
	0.15 – 30 MHz	±0.42 dB
	30 – 1000 MHz	±0.51 dB
All emissions, radiated	9 – 150 kHz	±2.49 dB
	0.15 – 30 MHz	±2.28 dB
	30 – 1000 MHz	±2.56 dB
Temperature		±0.8 °C
Humidity		±3 %
DC and low frequency voltages		±3 %
Time		±1.4 %
Duty Cycle		±1.4 %

2 Test Configuration of EUT

2.1 The Worst Case Modulation Configuration

Modulation Used for Conformance Testing	
Modulation Mode	**Field Strength (dBuV/m at 3 m)**
NFC-Read/Write	69.35

2.2 Test Channel Frequencies Configuration

Modulation Mode	Test Channel Frequencies (MHz)
NFC-Read/Write	13.56

2.3 The Worst Case Measurement Configuration

The Worst Case Mode for Following Conformance Tests	
Tests Item	Emission Bandwidth, Frequency Stability
Test Condition	Conducted 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	
User Position	☐ EUT will be placed in fixed position.	
	☒ EUT will be placed in mobile position and operating multiple positions.	
	☐ EUT will be a hand-held or body-worn battery-powered devices and operating multiple positions.	
Pretest Mode	☒ 1. EUT Built in NFC A type	
Operating Mode < 1GHz	☒ 1. DC Power Supply	
Modulation Mode	NFC-Read/Write	
Orthogonal Planes of EUT	**Y Plane**	**Z Plane**
		
Worst Planes of EUT	V	

2.4 Support Equipment

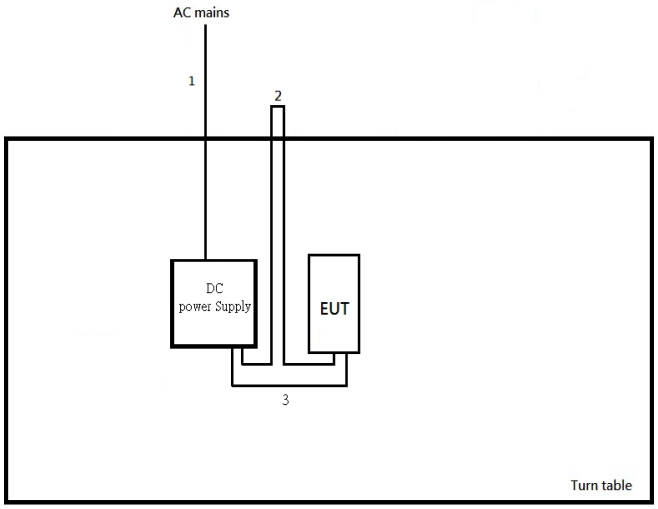
Support Equipment – RF Conducted				
No.	**Equipment**	**Brand Name**	**Model Name**	**FCC ID**
1	Notebook	-	-	-
2	DC Source	GW	GPS-3030DD	-

Note: Support equipment No.1 was provided by customer.

Support Equipment – Radiated Emission				
No.	**Equipment**	**Brand Name**	**Model Name**	**FCC ID**
1	DC Power Source	G.W.	GPS-3030DD	-

2.5 Test Setup Diagram

Test Setup Diagram - Radiated Test



Item	Connection	Shielded	Length(m)
1	AC power line	No	1.8m
2	DC power cable	No	2.3m
3	GND line	No	0.9M

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

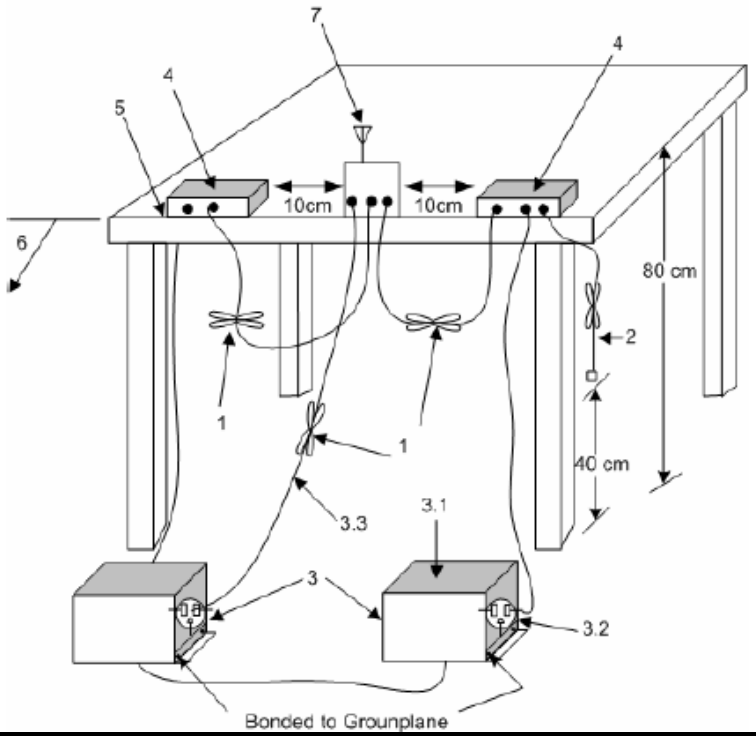
Refer a test equipment and calibration data table in this test report.

3.1.3 Test Procedures

Test Method	
☒	Refer as ANSI C63.10-2013, clause 6.2 for AC power-line conducted emissions.
☒	If AC conducted emissions fall in operating band, then following below test method confirm final result.
☐	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.
☒	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

AC Power-line Conducted Emissions



3.1.5 Test Result of AC Power-line Conducted Emissions

Please refer to Part 15.207(c) which states, “Measurements to demonstrate compliance with the conducted limits are not required for devices employ DC power source 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
☒ 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

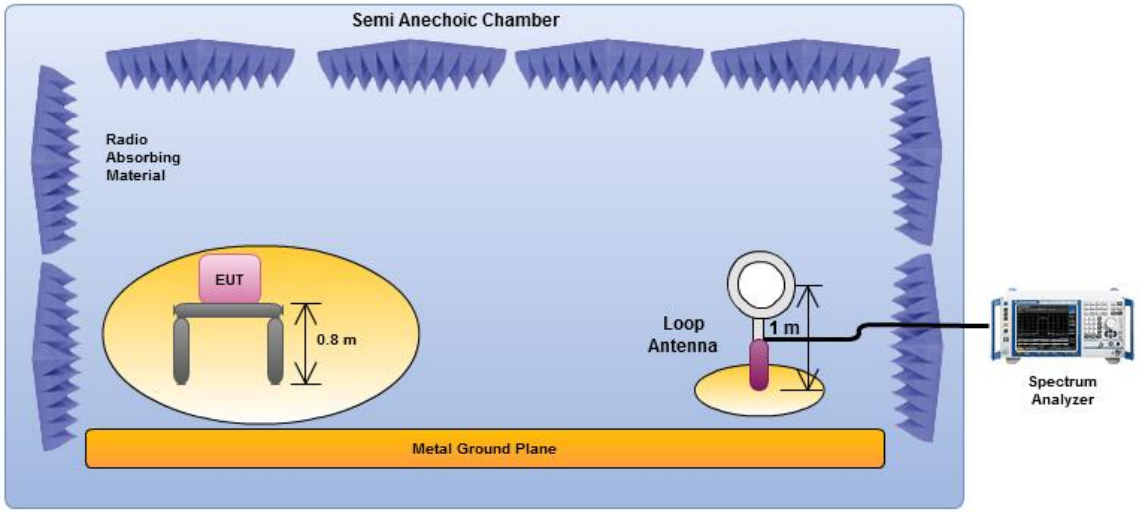
Refer a test equipment and calibration data table in this test report.

3.2.3 Test Procedures

Test Method
☒ For the emission bandwidth refer ANSI C63.10, clause 6.9.3 for occupied bandwidth testing.
☒ 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

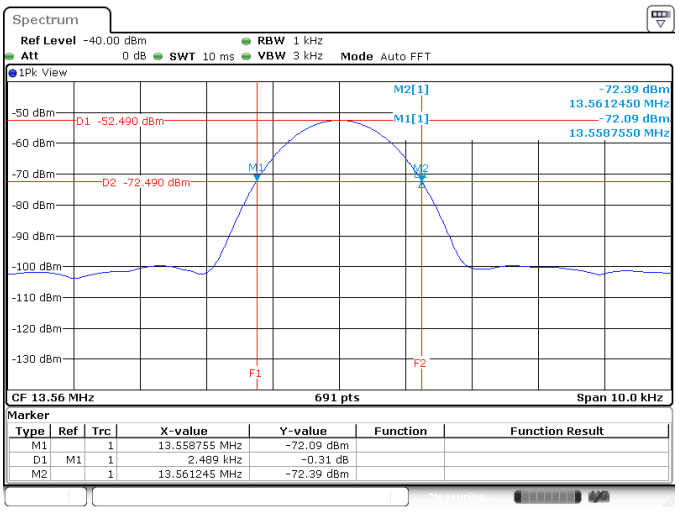
Emission Bandwidth



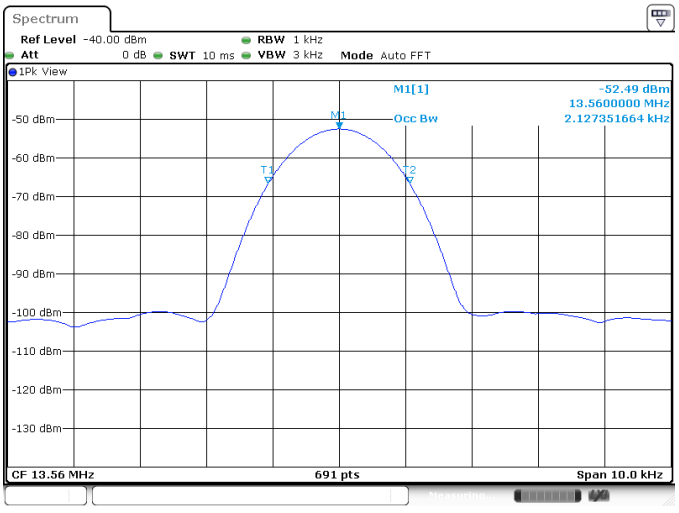
3.2.5 Test Result of Emission Bandwidth

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-Read/Write	13.56	2.48900	2.12735	13.558755	13.561245
Limit		**N/A**	**N/A**	**13.553**	**13.567**
Result		**Complied**			

Emission Bandwidth Plot - 20dB



Emission Bandwidth Plot - 99%



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					
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					
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

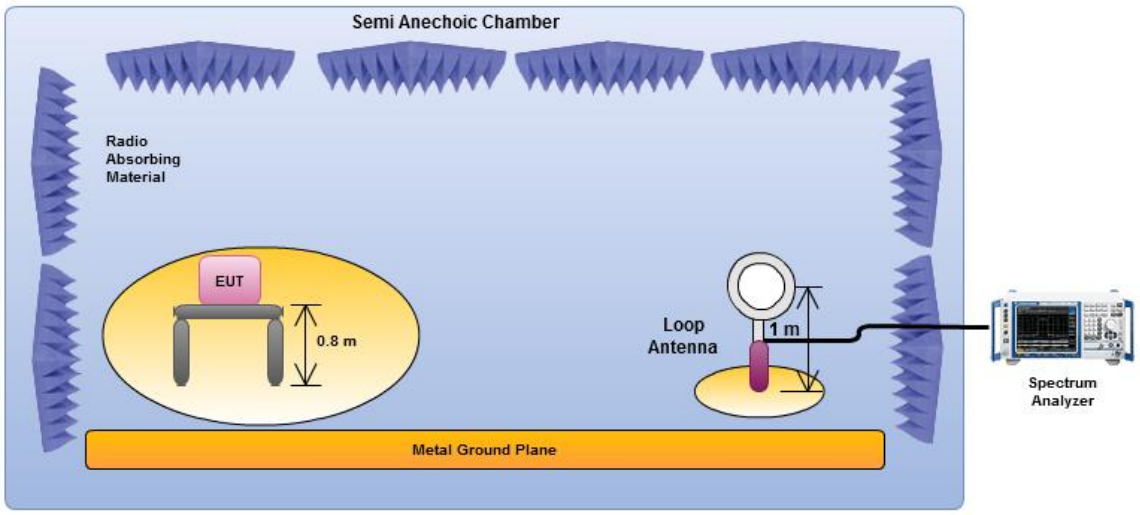
Refer a test equipment and calibration data table in this test report.

3.3.3 Test Procedures

Test Method	
☒	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.

3.3.4 Test Setup

Field Strength of Fundamental Emissions and Spectrum Mask

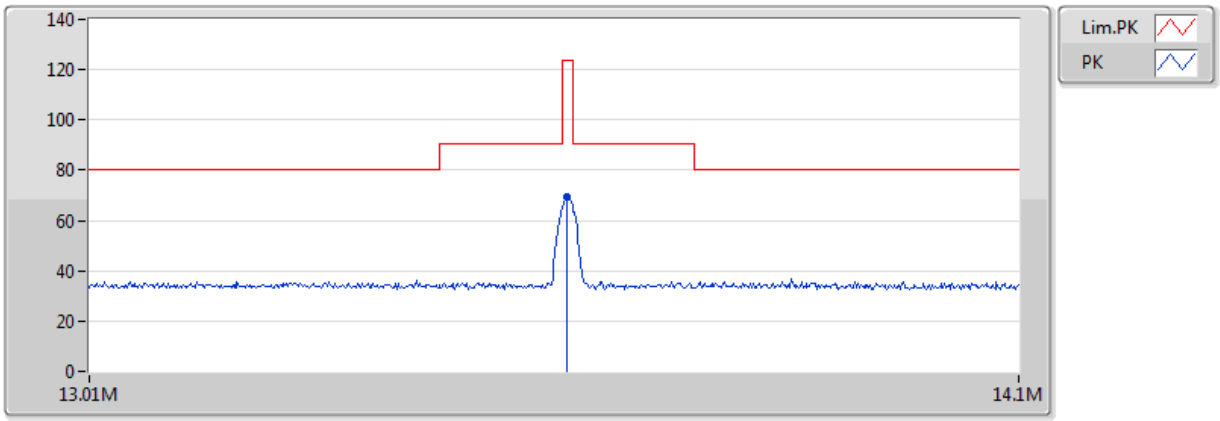


3.3.5 Test Result of Field Strength of Fundamental Emissions and Spectrum Mask

Spectrum Mask Plot

NFC Operating below 30MHz

13.56MHz_TX



EUT=Y

Type	Freq	Level	Limit	Margin	Factor	Dist	Condition	Azimuth	Height	Comments	Raw	AF	CL	PA
	(Hz)	(dBuV)	(dBuV)	(dB)	(dB)	(m)		(°)	(m)		(dBuV)	(dB)	(dB)	(dB)
PK	13.559739M	69.35	124.00	-54.65	22.51	3	Horizontal	-	-	-	46.84	21.82	0.69	-

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

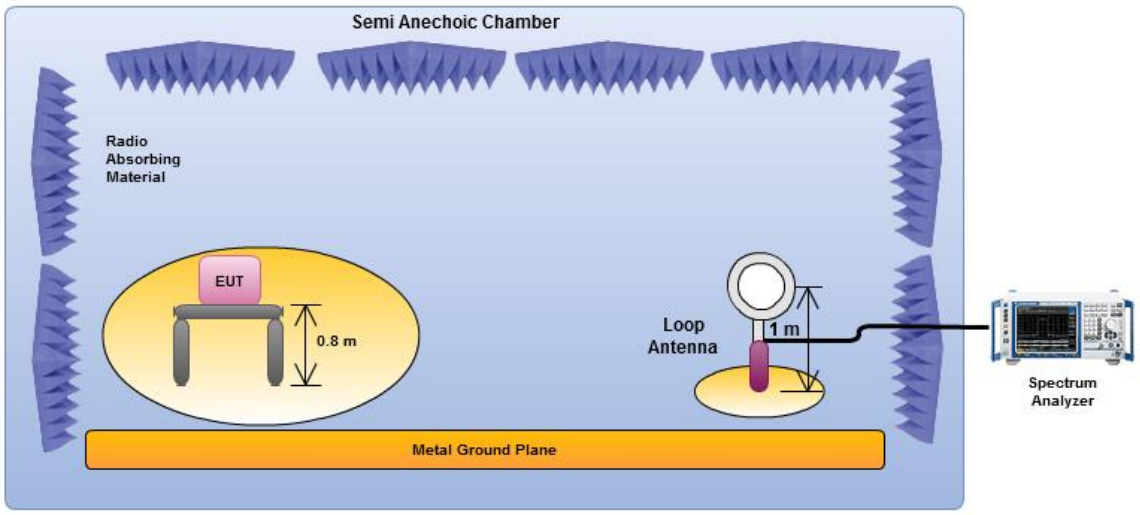
Refer a test equipment and calibration data table in this test report.

3.4.3 Test Procedures

Test Method	
☒	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.

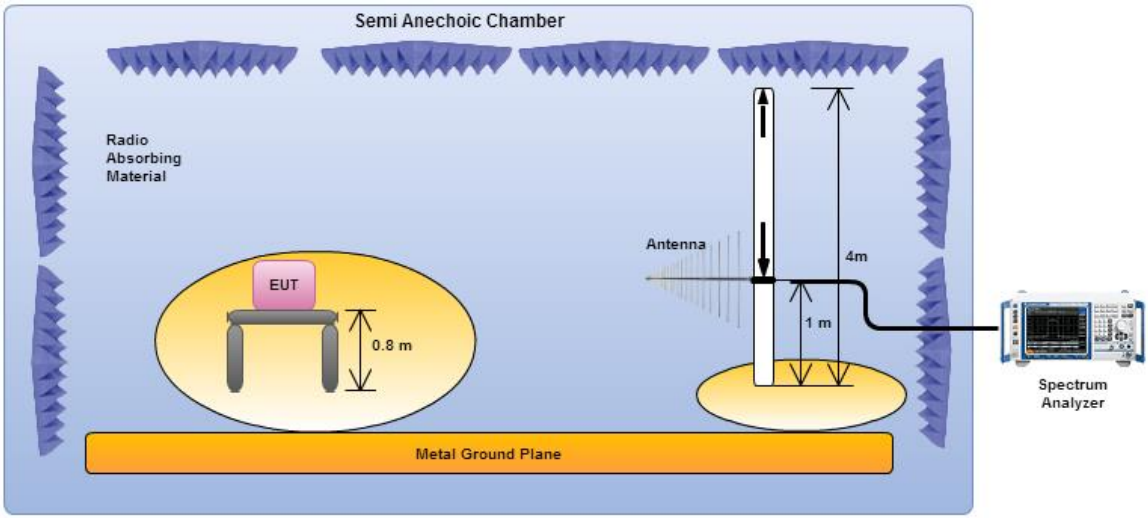
3.4.4 Test Setup

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.

3.4.5 Transmitter Radiated Unwanted Emissions (Below 30MHz)

Summary

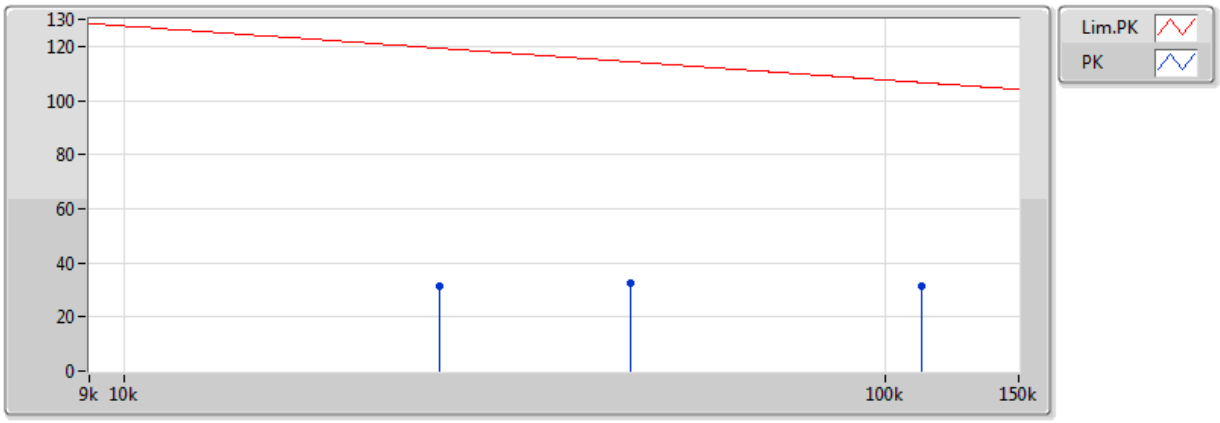
Mode	Result	Type	Freq (Hz)	Level (dBuV)	Limit (dBuV)	Margin (dB)	Factor (dB)	Dist (m)	Condition	Azimuth (°)	Height (m)	Comments
NFC	-	-	-	-	-	-	-	-	-	-	-	-
13.553-13.567MHz	Pass	PK	2.053478M	36.24	69.50	-33.26	20.90	3	Horizontal	-	-	-

Result

Mode	Result	Type	Freq (Hz)	Level (dBuV)	Limit (dBuV)	Margin (dB)	Factor (dB)	Dist (m)	Condition	Azimuth (°)	Height (m)	Comments
NFC	-	-	-	-	-	-	-	-	-	-	-	-
13.56MHz_TX	Pass	PK	25.96087k	31.31	119.30	-87.99	22.03	3	Horizontal	-	-	-
13.56MHz_TX	Pass	PK	46.395652k	32.63	114.26	-81.63	21.32	3	Horizontal	-	-	-
13.56MHz_TX	Pass	PK	111.991304k	31.32	106.61	-75.29	20.77	3	Horizontal	-	-	-
13.56MHz_TX	Pass	PK	236.521739k	42.72	100.12	-57.40	20.68	3	Horizontal	-	-	-
13.56MHz_TX	Pass	PK	2.053478M	36.24	69.50	-33.26	20.90	3	Horizontal	-	-	-
13.56MHz_TX	Pass	PK	9.840435M	35.40	69.50	-34.10	22.06	3	Horizontal	-	-	-

NFC Operating below 30MHz

13.56MHz_TX

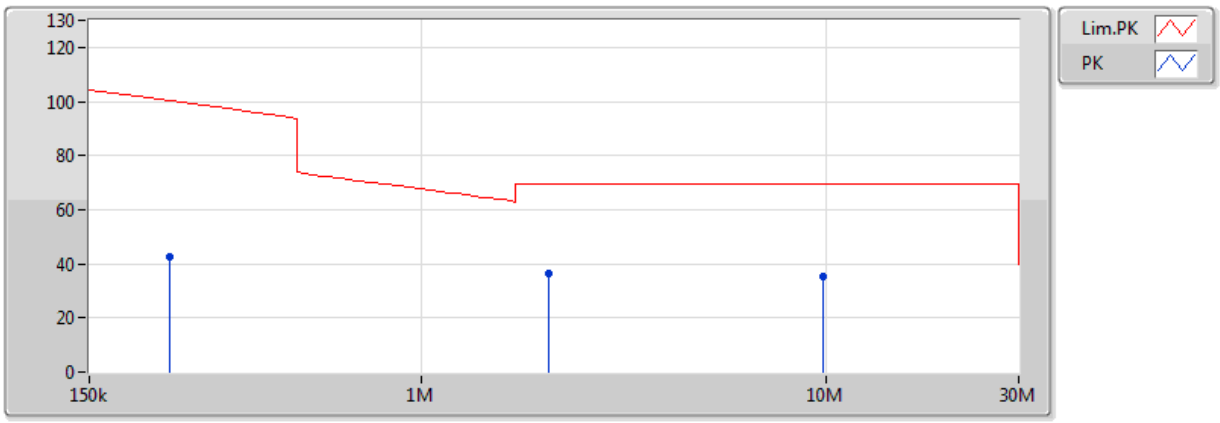


EUT=Y

Type	Freq	Level	Limit	Margin	Factor	Dist	Condition	Azimuth	Height	Comments	Raw	AF	CL	PA
	(Hz)	(dBuV)	(dBuV)	(dB)	(dB)	(m)		(°)	(m)		(dBuV)	(dB)	(dB)	(dB)
PK	25.96087k	31.31	119.30	-87.99	22.03	3	Horizontal	-	-	-	9.28	21.96	0.07	-
PK	46.395652k	32.63	114.26	-81.63	21.32	3	Horizontal	-	-	-	11.31	21.25	0.07	-
PK	111.991304k	31.32	106.61	-75.29	20.77	3	Horizontal	-	-	-	10.55	20.69	0.08	-

NFC Operating below 30MHz

13.56MHz_TX



EUT=Y

Type	Freq	Level	Limit	Margin	Factor	Dist	Condition	Azimuth	Height	Comments	Raw	AF	CL	PA
	(Hz)	(dBuV)	(dBuV)	(dB)	(dB)	(m)		(°)	(m)		(dBuV)	(dB)	(dB)	(dB)
PK	236.521739k	42.72	100.12	-57.40	20.68	3	Horizontal	-	-	-	22.04	20.56	0.12	-
PK	2.053478M	36.24	69.50	-33.26	20.90	3	Horizontal	-	-	-	15.34	20.54	0.36	-
PK	9.840435M	35.40	69.50	-34.10	22.06	3	Horizontal	-	-	-	13.34	21.47	0.58	-

3.4.6 Transmitter Radiated Unwanted Emissions (Above 30MHz)

Summary

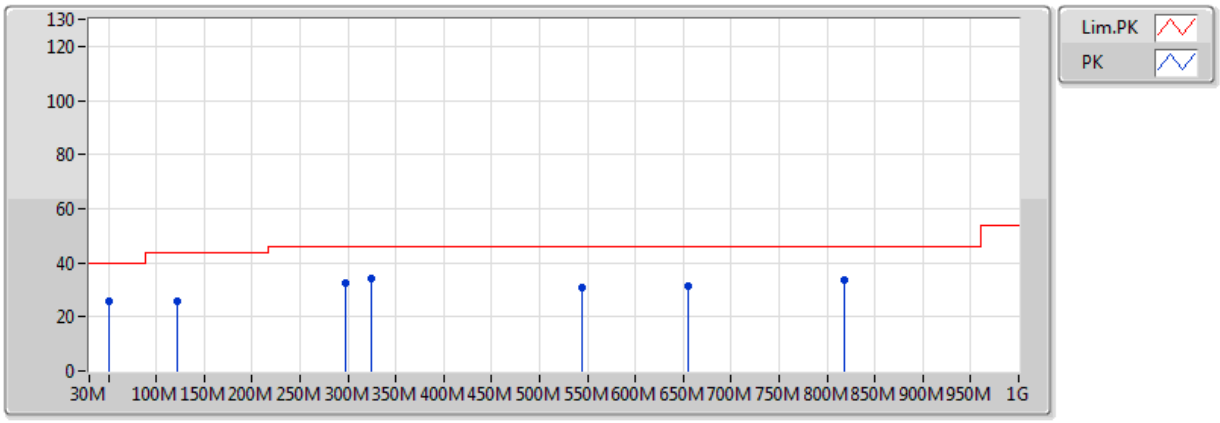
Mode	Result	Type	Freq (Hz)	Level (dBuV)	Limit (dBuV)	Margin (dB)	Factor (dB)	Dist (m)	Condition	Azimuth (°)	Height (m)	Comments
NFC	-	-	-	-	-	-	-	-	-	-	-	-
13.553-13.567MHz	Pass	PK	324.88M	34.43	46.00	-11.57	-5.44	3	Horizontal	360	1.00	-

Result

Mode	Result	Type	Freq (Hz)	Level (dBuV)	Limit (dBuV)	Margin (dB)	Factor (dB)	Dist (m)	Condition	Azimuth (°)	Height (m)	Comments
NFC	-	-	-	-	-	-	-	-	-	-	-	-
13.56MHz_TX	Pass	PK	121.18M	24.96	43.50	-18.54	-7.92	3	Horizontal	360	1.00	-
13.56MHz_TX	Pass	PK	270.56M	28.17	46.00	-17.83	-6.31	3	Horizontal	360	1.00	-
13.56MHz_TX	Pass	PK	297.72M	33.26	46.00	-12.74	-6.09	3	Horizontal	360	1.00	-
13.56MHz_TX	Pass	PK	324.88M	34.43	46.00	-11.57	-5.44	3	Horizontal	360	1.00	-
13.56MHz_TX	Pass	PK	540.22M	30.46	46.00	-15.54	-0.68	3	Horizontal	360	1.00	-
13.56MHz_TX	Pass	PK	786.6M	33.76	46.00	-12.24	1.64	3	Horizontal	360	1.00	-
13.56MHz_TX	Pass	PK	51.34M	25.81	40.00	-14.19	-12.90	3	Vertical	0	1.00	-
13.56MHz_TX	Pass	PK	121.18M	25.54	43.50	-17.96	-7.92	3	Vertical	0	1.00	-
13.56MHz_TX	Pass	PK	297.72M	32.25	46.00	-13.75	-6.09	3	Vertical	0	1.00	-
13.56MHz_TX	Pass	PK	324.88M	34.06	46.00	-11.94	-5.44	3	Vertical	0	1.00	-
13.56MHz_TX	Pass	PK	544.1M	30.87	46.00	-15.13	-0.58	3	Vertical	0	1.00	-
13.56MHz_TX	Pass	PK	654.68M	31.34	46.00	-14.66	0.22	3	Vertical	0	1.00	-
13.56MHz_TX	Pass	PK	817.64M	33.45	46.00	-12.55	1.93	3	Vertical	0	1.00	-

NFC Operating above 30MHz

13.56MHz_TX

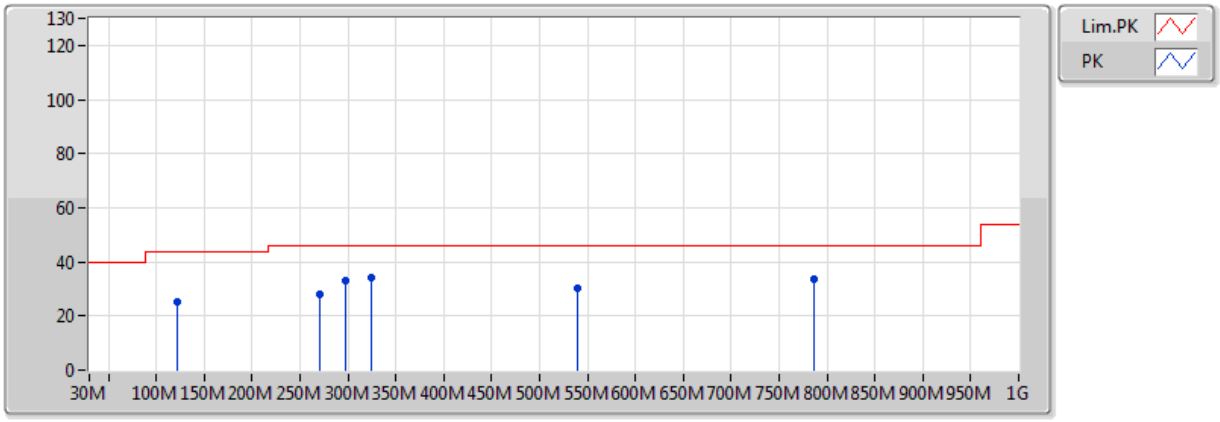


EUT=Y

Type	Freq	Level	Limit	Margin	Factor	Dist	Condition	Azimuth	Height	Comments	Raw	AF	CL	PA
	(Hz)	(dBuV)	(dBuV)	(dB)	(dB)	(m)		(°)	(m)		(dBuV)	(dB)	(dB)	(dB)
PK	51.34M	25.81	40.00	-14.19	-12.90	3	Vertical	0	1.00	-	38.71	12.89	1.74	27.53
PK	121.18M	25.54	43.50	-17.96	-7.92	3	Vertical	0	1.00	-	33.46	17.25	2.11	27.27
PK	297.72M	32.25	46.00	-13.75	-6.09	3	Vertical	0	1.00	-	38.34	18.20	2.39	26.68
PK	324.88M	34.06	46.00	-11.94	-5.44	3	Vertical	0	1.00	-	39.50	18.71	2.68	26.83
PK	544.1M	30.87	46.00	-15.13	-0.58	3	Vertical	0	1.00	-	31.45	23.67	3.65	27.90
PK	654.68M	31.34	46.00	-14.66	0.22	3	Vertical	0	1.00	-	31.12	24.01	4.18	27.97
PK	817.64M	33.45	46.00	-12.55	1.93	3	Vertical	0	1.00	-	31.52	24.97	4.65	27.70

NFC Operating above 30MHz

13.56MHz_TX



EUT=Y

Type	Freq	Level	Limit	Margin	Factor	Dist	Condition	Azimuth	Height	Comments	Raw	AF	CL	PA
	(Hz)	(dBuV)	(dBuV)	(dB)	(dB)	(m)		(°)	(m)		(dBuV)	(dB)	(dB)	(dB)
PK	121.18M	24.96	43.50	-18.54	-7.92	3	Horizontal	360	1.00	-	32.88	17.25	2.11	27.27
PK	270.56M	28.17	46.00	-17.83	-6.31	3	Horizontal	360	1.00	-	34.48	17.93	2.51	26.75
PK	297.72M	33.26	46.00	-12.74	-6.09	3	Horizontal	360	1.00	-	39.35	18.20	2.39	26.68
PK	324.88M	34.43	46.00	-11.57	-5.44	3	Horizontal	360	1.00	-	39.87	18.71	2.68	26.83
PK	540.22M	30.46	46.00	-15.54	-0.68	3	Horizontal	360	1.00	-	31.14	23.57	3.64	27.89
PK	786.6M	33.76	46.00	-12.24	1.64	3	Horizontal	360	1.00	-	32.12	24.80	4.61	27.77

3.5 Frequency Stability

3.5.1 Frequency Stability Limit

Frequency Stability Limit	
☒	Carrier frequency stability shall be maintained to ±0.01% (±100 ppm).

3.5.2 Measuring Instruments

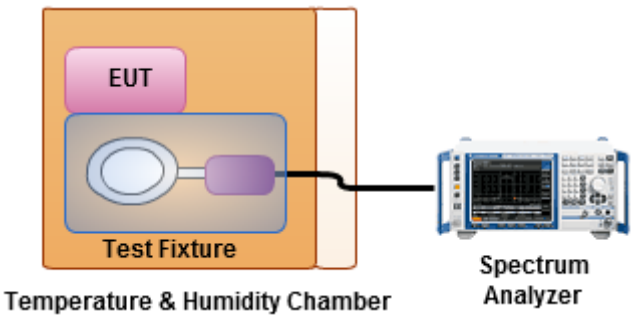
Refer a test equipment and calibration data table in this test report.

3.5.3 Test Procedures

Test Method		
☒	Refer as ANSI C63.10, clause 6.8 for frequency stability tests	
	☒	Frequency stability with respect to ambient temperature
	☒	Frequency stability when varying supply voltage
☐	For conducted measurement.	
☒	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

Frequency Stability



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
$T_{20°C}$Vmax	13.56	13.559987	13.559982	13.559980	13.559979	-0.96	-1.33	-1.47	-1.55
$T_{20°C}$Vmin	13.56	13.559978	13.559975	13.559982	13.559981	-1.62	-1.84	-1.33	-1.40
$T_{85°C}$Vnom	13.56	13.559653	13.559652	13.559656	13.559652	-25.59	-25.66	-25.37	-25.66
$T_{80°C}$Vnom	13.56	13.559647	13.559652	13.559651	13.559650	-26.03	-25.66	-25.74	-25.81
$T_{70°C}$Vnom	13.56	13.559684	13.559684	13.559683	13.559686	-23.30	-23.30	-23.38	-23.16
$T_{60°C}$Vnom	13.56	13.559737	13.559736	13.559734	13.559735	-19.40	-19.47	-19.62	-19.54
$T_{50°C}$Vnom	13.56	13.559796	13.559795	13.559793	13.559794	-15.04	-15.12	-15.27	-15.19
$T_{40°C}$Vnom	13.56	13.559855	13.559854	13.559859	13.559863	-10.69	-10.77	-10.40	-10.10
$T_{30°C}$Vnom	13.56	13.559895	13.559899	13.559900	13.559910	-7.74	-7.45	-7.37	-6.64
$T_{20°C}$Vnom	13.56	13.559990	13.559990	13.559985	13.559989	-0.74	-0.74	-1.11	-0.81
$T_{10°C}$Vnom	13.56	13.560077	13.560080	13.560085	13.560082	5.68	5.90	6.27	6.05
$T_{0°C}$Vnom	13.56	13.560123	13.560120	13.560125	13.560115	9.07	8.85	9.22	8.48
$T_{-10°C}$Vnom	13.56	13.560158	13.560158	13.560157	13.560159	11.65	11.65	11.58	11.73
$T_{-20°C}$Vnom	13.56	13.560168	13.560161	13.560169	13.560165	12.39	11.87	12.46	12.17
$T_{-30°C}$Vnom	13.56	13.560156	13.560153	13.560163	13.560155	11.50	11.28	12.02	11.43
$T_{-40°C}$Vnom	13.56	13.560132	13.560123	13.560131	13.560133	9.73	9.07	9.66	9.81
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 1.1.5 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.	Spec.	Calibration Date	Calibration Due Date
Spectrum Analyzer	R&S	FSV 40	101013	9kHz~40GHz	08/Feb/2017	07/Feb/2018
Temp. and Humidity Chamber	Giant Force	GTH-225-40-CP-AR	MAA1611-005	-40 ~ 100℃	21/Nov/2016	20/Nov/2018
Loop Antenna	TESEQ	HLA 6120	31244	9 kHz~30 MHz	02/Mar/2017	01/Mar/2018

Instrument for Radiated Test

Instrument	Manufacturer	Model No.	Serial No.	Spec.	Calibration Date	Calibration Due Date
3m Semi Anechoic Chamber	SIDT FRANKONIA	SAC-3M	03CH03-HY	30MHz ~ 1GHz	28/Nov/2016	27/Nov/2017
Amplifier	HP	8447D	2944A08033	10kHz ~ 1.3GHz	19/Apr/2017	18/Apr/2018
Spectrum	R&S	FSV40	101515	9kHz ~ 40GHz	28/Nov/2016	27/Nov/2017
Bilog Antenna	SCHAFFNER	CBL 6112D	2723	30MHz ~ 1GHz	01/Oct/2016	30/Sep/2017
Loop Antenna	TESEQ	HLA 6120	24155	9 kHz~30 MHz	02/Mar/2017	01/Mar/2018
RF Cable-R03m	Jye Bao	RG142	CB021	9kHz ~ 1GHz	27/Oct/2016	26/Oct/2017
Receiver	R&S	ESU-26	100422/026	20Hz ~ 26.5GHz	21/Sep/2016	20/Sep/2017