

FCC Test Report

FCC ID : NYOSYECNWPC1903

Equipment : Wireless Charging System

Brand Name : HYUNDAI, KIA

Model Name : SYECNWPC1903

Applicant : SEOYON ELECTRONICS Co.,Ltd
100, Saneop-ro 156beon-gil, Gwonseon-gu,
Suwon-si, Gyeonggi-do, South Korea

Manufacturer : SEOYON ELECTRONICS Co.,Ltd
100, Saneop-ro 156beon-gil, Gwonseon-gu,
Suwon-si, Gyeonggi-do, South Korea

Standard : 47 CFR FCC Part 15.225

The product was received on Jan. 09, 2019, and testing was started from Jan. 24, 2019 and completed on Jan. 25, 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.)

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Appendix A. Test Photos

Photographs of EUT V01



History of this test report

[illegible]

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	PASS	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:

Transmit by EUT itself.

Reviewed by: Sam Tsai

Report Producer: Amber Chiu

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) ISO 14443-3B (ASK) ISO 18092 (ASK)	13.56	1	59.08
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)
☐	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	Coil

1.1.3 EUT Information

Operational Condition	
EUT Power Type	From DC Power supply
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 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.			

Test Condition	Test Site No.	Test Engineer	Test Environment	Test Date
AC Conduction	CO04-HY	Lego	23°C / 54%	25/Jan/2019
RF Conducted	TH01-HY	Barry	23.8°C / 61%	24/Jan/2019
Radiated Emission	03CH03-HY	Paul	22.7°C / 53.2%	24/Jan/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	-20°C
-	Tmax	50°C
-	Vnom	12V
-	Vmin	10.8V
-	Vmax	13.2V

2.2 The Worst Case Modulation Configuration

Modulation Used for Conformance Testing	
Modulation Mode	Field Strength (dBuV/m at 3 m)
NFC	59.08

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	AC power-line conducted emissions
Condition	AC power-line conducted measurement for line and neutral Test Voltage: DC 12V
Operating Mode	DC Power Supply Mode

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
Pretest Mode	☒ 1. NFC-A (ISO 14443-3A)
	☒ 2. NFC-B (ISO 14443-3B)
	☒ 3. NFC-F (ISO 18092)
Operating Mode	DC Power Supply Mode
Orthogonal Planes of EUT	Z Plane
	
Worst Planes of EUT	V

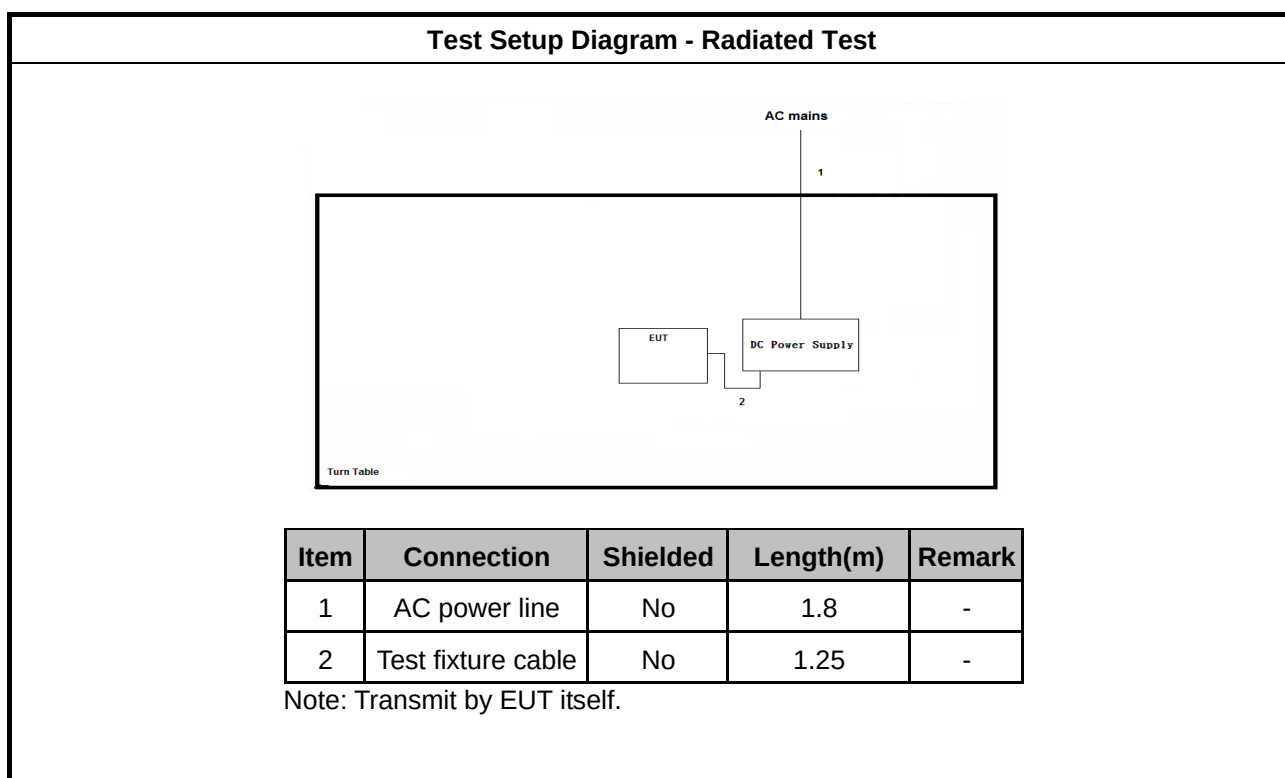
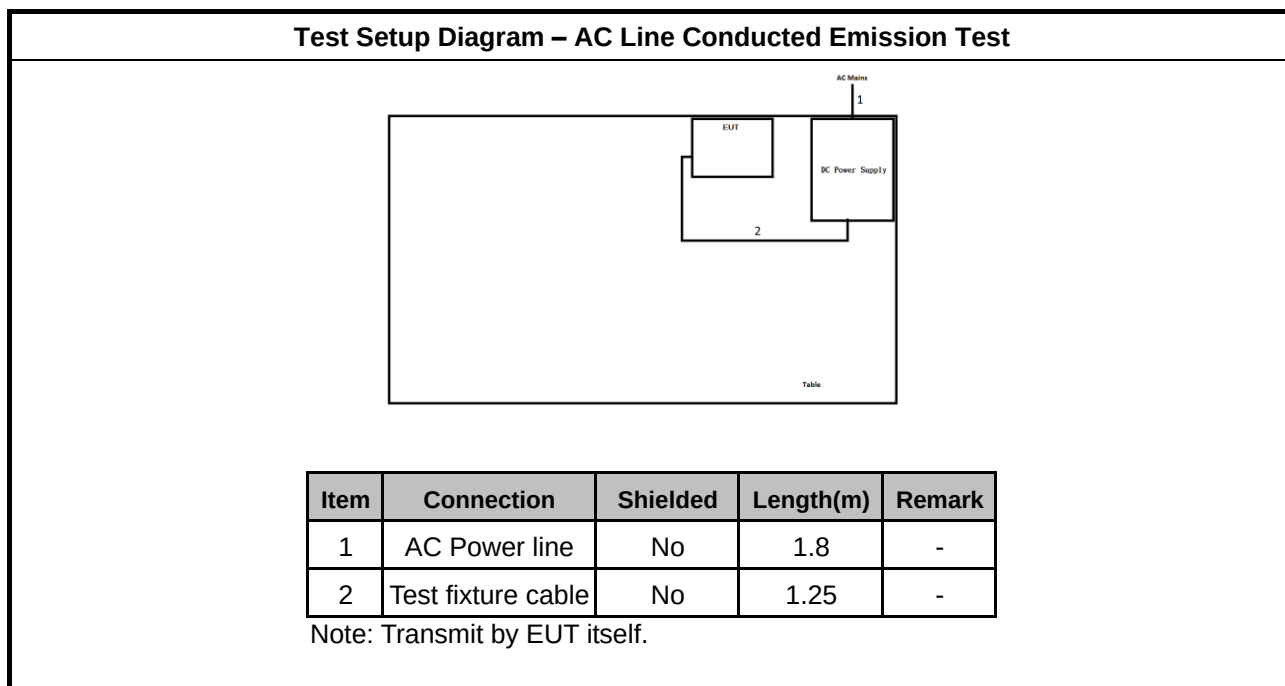
2.5 Support Equipment

Support Equipment - AC Conduction			
No.	Equipment	Brand Name	Model Name
1	DC Power supply	GW	GPS-3030DD

Support Equipment - RF Conducted			
No.	Equipment	Brand Name	Model Name
1	DC Power supply	GW	GPS-3030DD

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

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.

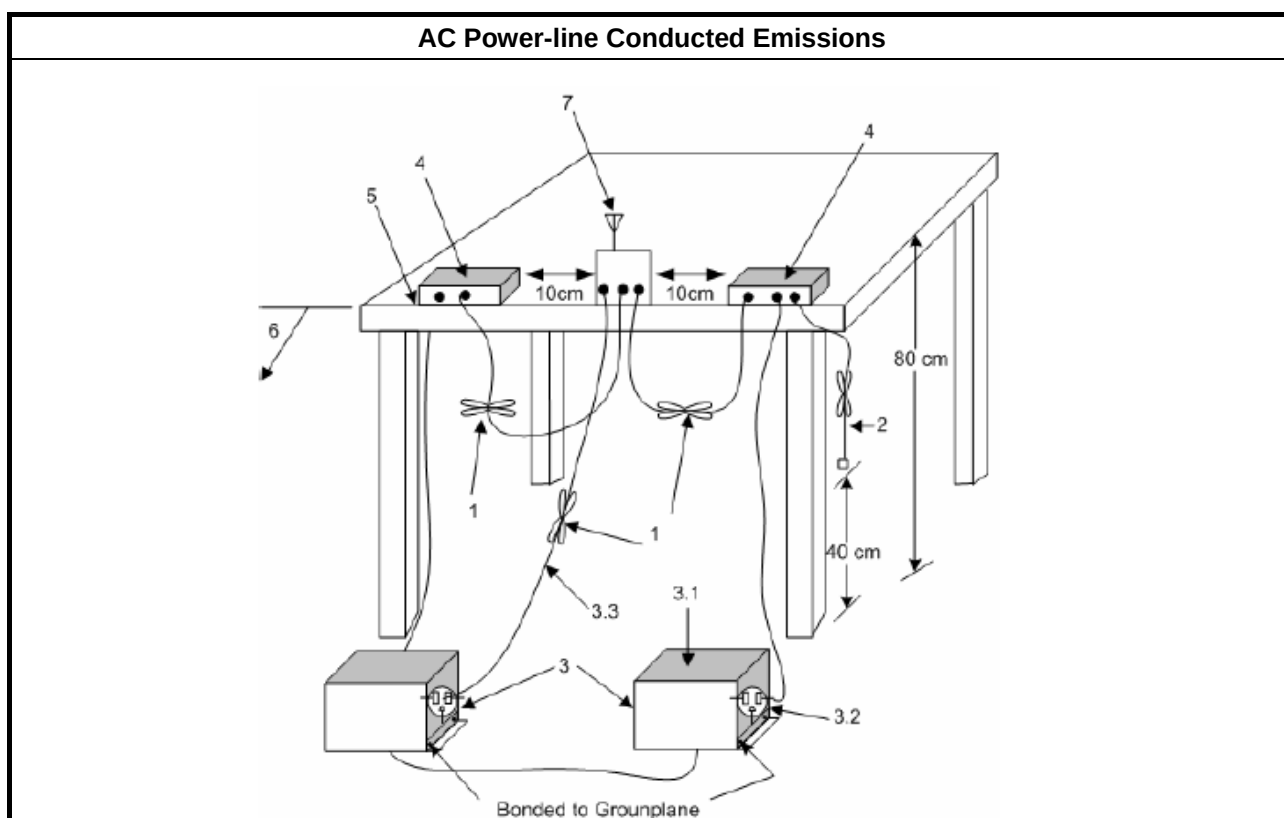
3.1.2 Measuring Instruments

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

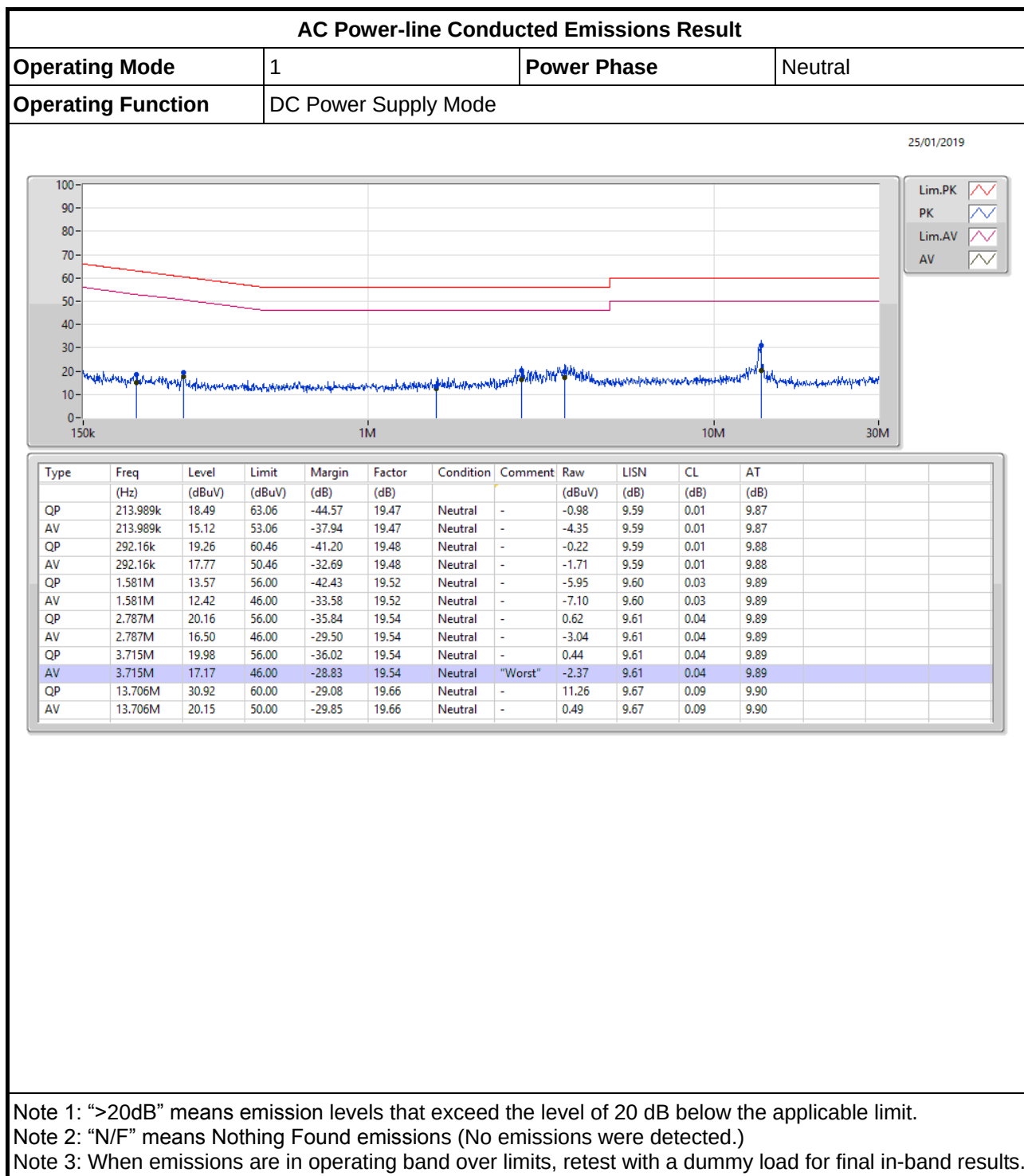
3.1.3 Test Procedures

Test Method	
☒	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



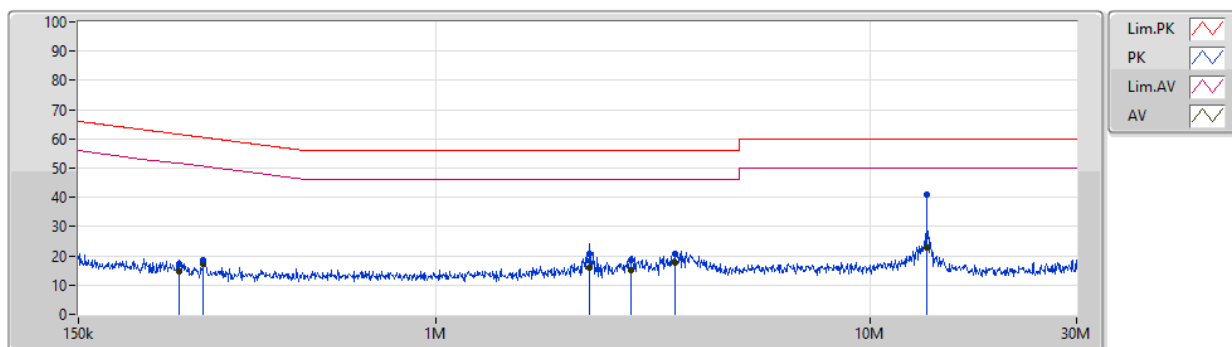
3.1.5 Test Result of AC Power-line Conducted Emissions



AC Power-line Conducted Emissions Result

Operating Mode	1	Power Phase	Line
Operating Function	DC Power Supply Mode		

25/01/2019



Type	Freq (Hz)	Level (dBuV)	Limit (dBuV)	Margin (dB)	Factor	Condition	Comment	Raw (dBuV)	LISN (dB)	CL (dB)	AT (dB)			
QP	256.1k	17.07	61.56	-44.49	19.48	Line	-	-2.41	9.60	0.01	9.87			
AV	256.1k	14.51	51.56	-37.05	19.48	Line	-	-4.97	9.60	0.01	9.87			
QP	290.996k	18.54	60.49	-41.95	19.48	Line	-	-0.94	9.59	0.01	9.88			
AV	290.996k	17.14	50.49	-33.35	19.48	Line	-	-2.34	9.59	0.01	9.88			
QP	2.265M	20.66	56.00	-35.34	19.55	Line	-	1.11	9.62	0.04	9.89			
AV	2.265M	15.91	46.00	-30.09	19.55	Line	-	-3.64	9.62	0.04	9.89			
QP	2.81M	18.38	56.00	-37.62	19.55	Line	-	-1.17	9.62	0.04	9.89			
AV	2.81M	14.97	46.00	-31.03	19.55	Line	-	-4.58	9.62	0.04	9.89			
QP	3.57M	20.77	56.00	-35.23	19.56	Line	-	1.21	9.63	0.04	9.89			
AV	3.57M	17.64	46.00	-28.36	19.56	Line	-	-1.92	9.63	0.04	9.89			
QP	13.543M	40.95	60.00	-19.05	19.63	Line	"Worst"	21.32	9.65	0.08	9.90			
AV	13.543M	22.96	50.00	-27.04	19.63	Line	-	3.33	9.65	0.08	9.90			

Note 1: ">20dB" means emission levels that exceed the level of 20 dB below the applicable limit.

Note 2: "N/F" means Nothing Found emissions (No emissions were detected.)

Note 3: When emissions are in operating band over limits, retest with a dummy load for final in-band results.

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).

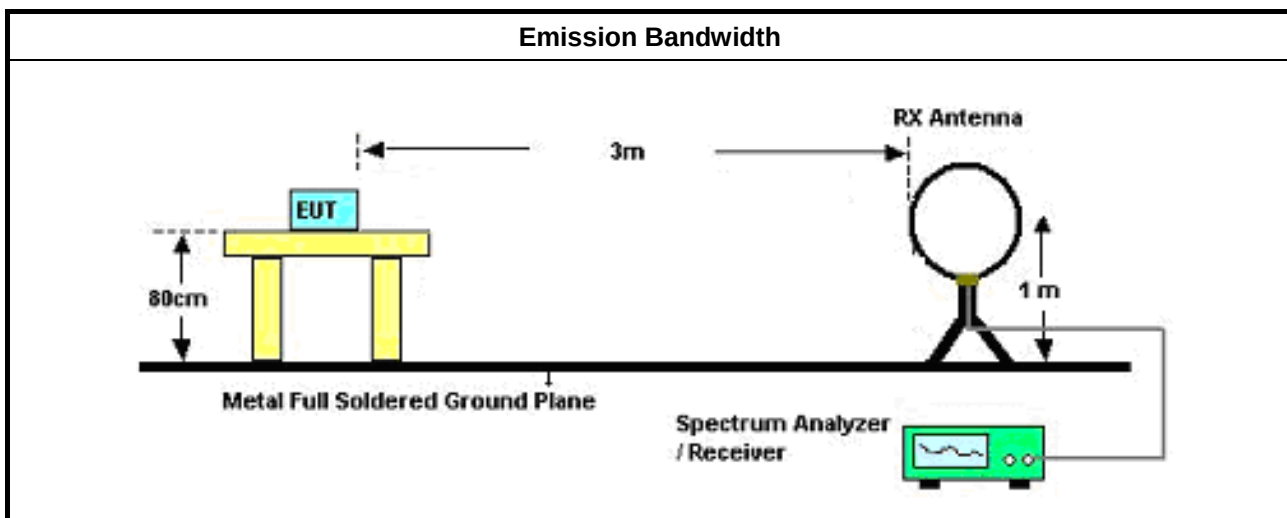
3.2.2 Measuring Instruments

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 6.9.1 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.

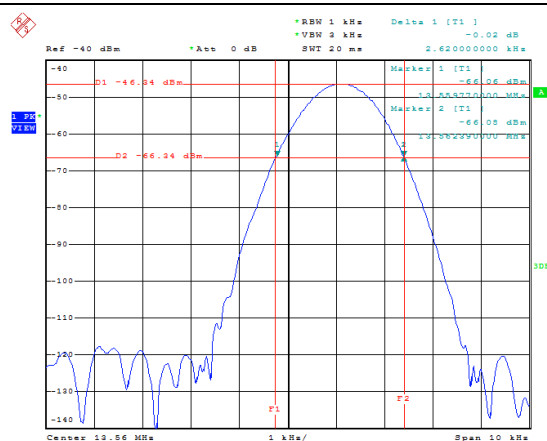
3.2.4 Test Setup



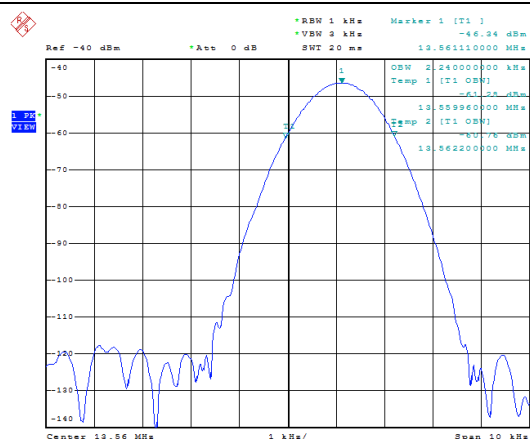
3.2.5 Test Result of Emission Bandwidth

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	2.62000	2.24000	13.55977	13.56239
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

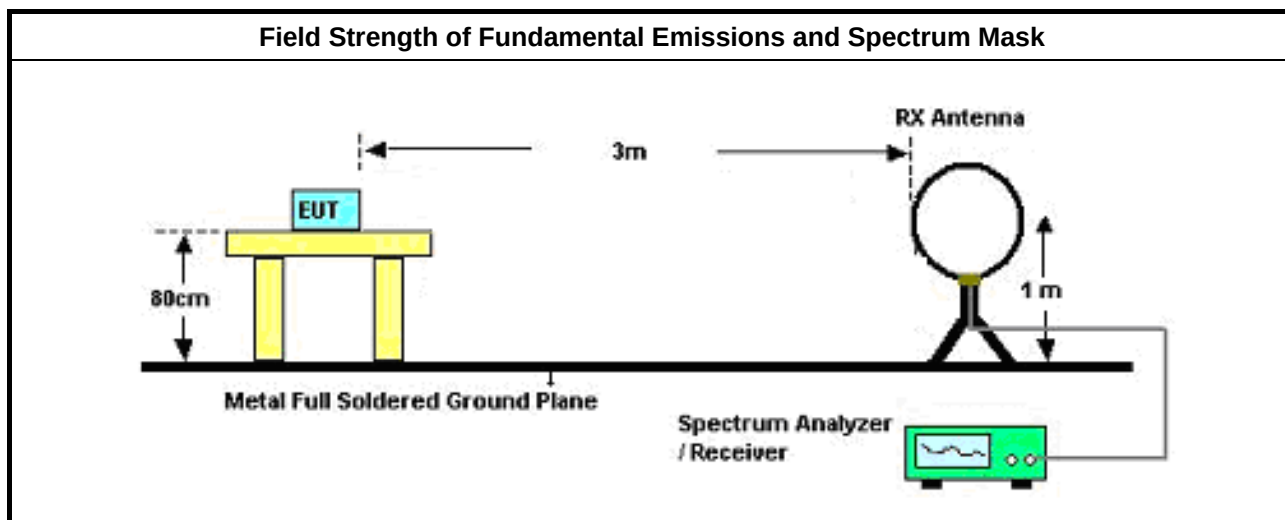
3.3.2 Measuring Instruments

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

3.3.3 Test Procedures

Test Method	
☒	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.

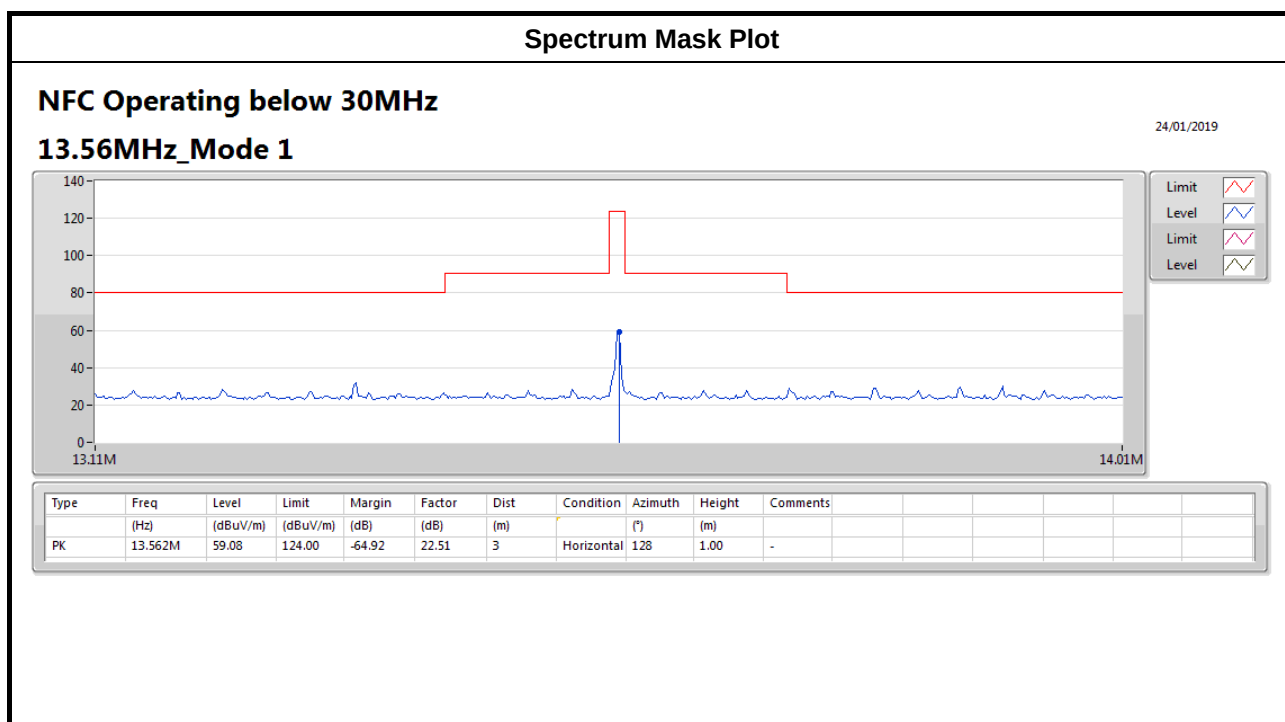
3.3.4 Test Setup



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	Polarization	Margin (dB)	Limit (dBuV/m)@3m
NFC	13.56	59.08	H	64.92	124.00
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.

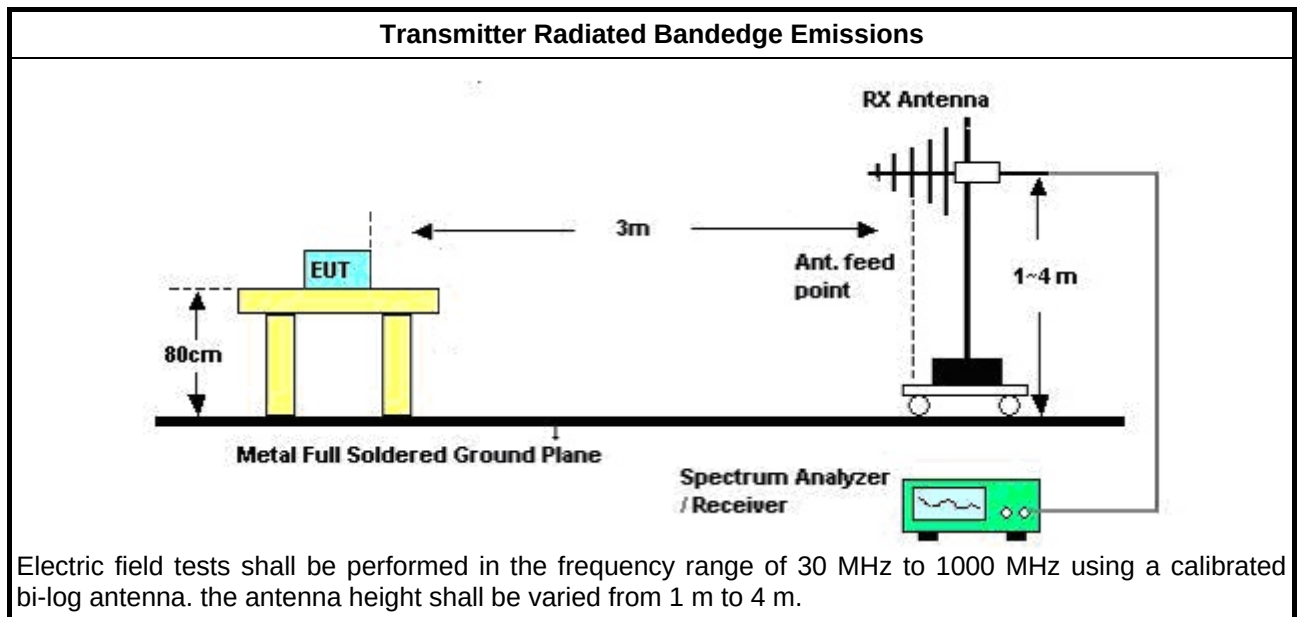
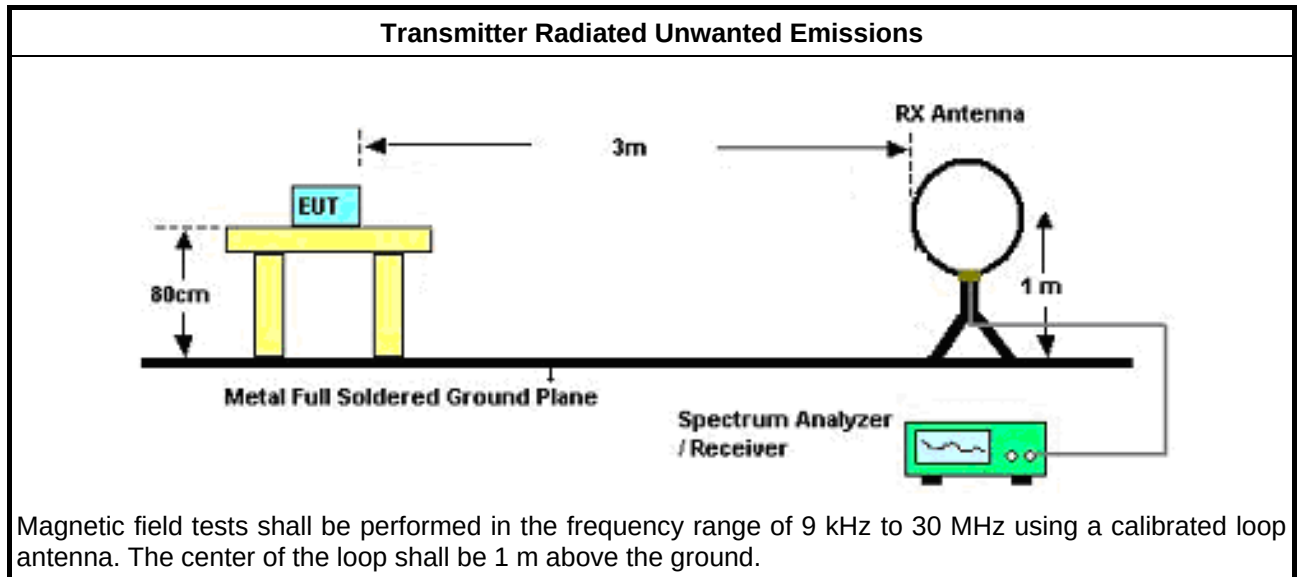
3.4.2 Measuring Instruments

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

3.4.3 Test Procedures

Test Method	
☒	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



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	5.702M	36.63	69.50	-32.87	21.27	3	0	1.00	-

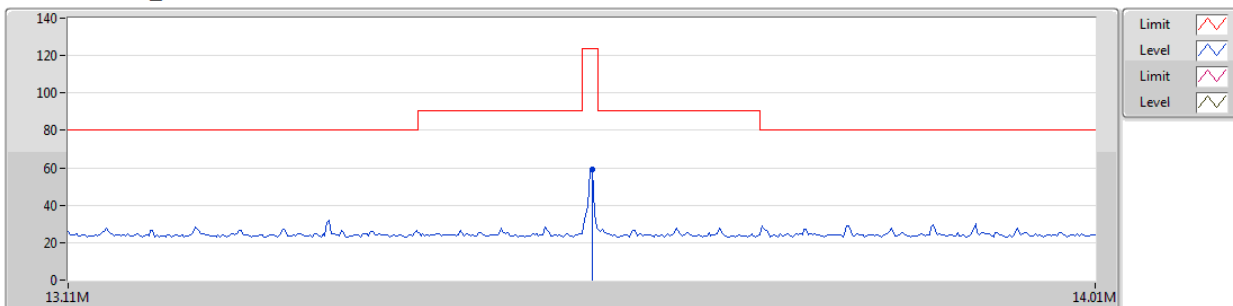
Result

Mode	Result	Type	Freq (Hz)	Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Factor (dB)	Dist (m)	Azimuth (°)	Height (m)	Comments
NFC	-	-	-	-	-	-	-	-	-	-	-
13.56MHz_Mode 1	Pass	PK	13.562M	59.08	124.00	-64.92	22.51	3	128	1.00	-
13.56MHz_Mode 1	Pass	PK	40.02k	56.73	115.55	-58.82	21.62	3	360	1.00	-
13.56MHz_Mode 1	Pass	PK	55.812k	54.71	112.65	-57.94	21.12	3	360	1.00	-
13.56MHz_Mode 1	Pass	PK	46.506k	54.47	114.23	-59.76	21.31	3	360	1.00	-
13.56MHz_Mode 1	Pass	PK	2.717M	34.81	69.50	-34.69	20.81	3	0	1.00	-
13.56MHz_Mode 1	Pass	PK	5.702M	36.63	69.50	-32.87	21.27	3	0	1.00	-
13.56MHz_Mode 1	Pass	PK	10.836M	36.32	69.50	-33.18	22.20	3	0	1.00	-

NFC Operating below 30MHz

13.56MHz_Mode 1

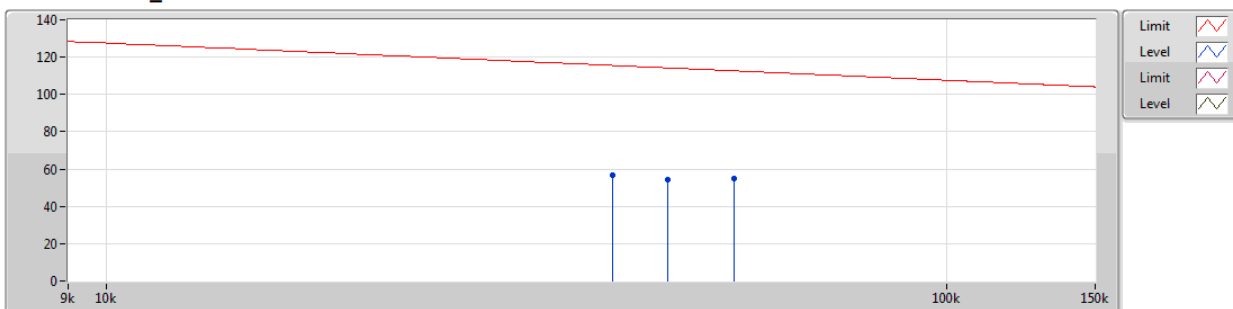
24/01/2019



Type	Freq (Hz)	Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Factor (dB)	Dist (m)	Condition	Azimuth (°)	Height (m)	Comments						
PK	13.562M	59.08	124.00	-64.92	22.51	3	Horizontal	128	1.00	-						

NFC Operating below 30MHz
13.56MHz_Mode 1

24/01/2019



Type	Freq (Hz)	Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Factor (dB)	Dist (m)	Condition	Azimuth (°)	Height (m)	Comments							
PK	40.02k	56.73	115.55	-58.82	21.62	3	Horizontal	360	1.00	-							
PK	55.812k	54.71	112.65	-57.94	21.12	3	Horizontal	360	1.00	-							
PK	46.506k	54.47	114.23	-59.76	21.31	3	Horizontal	360	1.00	-							

3.4.6 Transmitter Radiated Unwanted Emissions (Above 30MHz)

Summary

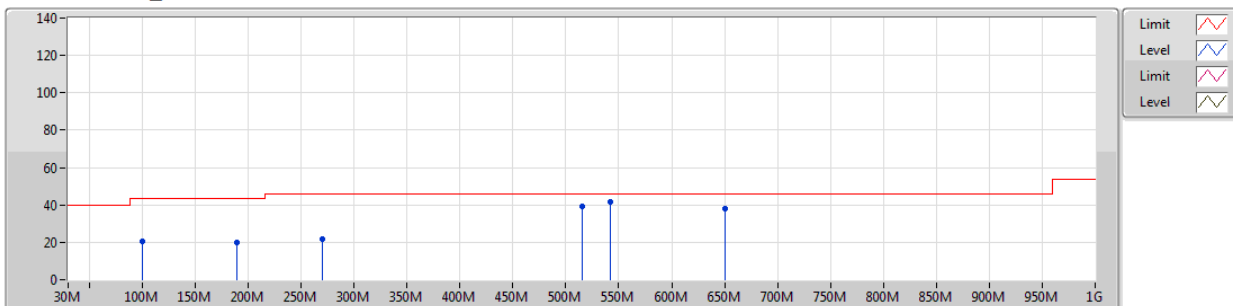
Mode	Result	Type	Freq (Hz)	Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Factor (dB)	Dist (m)	Azimuth (°)	Height (m)	Comments
13.553-13.567MHz	-	-	-	-	-	-	-	-	-	-	-
NFC	Pass	PK	542.16M	41.74	46.00	-4.26	-0.60	3	0	1.00	-

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_Mode 1	Pass	PK	99.84M	20.65	43.50	-22.85	-9.31	3	0	1.00	-
13.56MHz_Mode 1	Pass	PK	189.08M	20.19	43.50	-23.31	-10.49	3	0	1.00	-
13.56MHz_Mode 1	Pass	PK	270.56M	21.63	46.00	-24.37	-6.22	3	0	1.00	-
13.56MHz_Mode 1	Pass	PK	515M	39.04	46.00	-6.96	-1.64	3	0	1.00	-
13.56MHz_Mode 1	Pass	PK	542.16M	41.74	46.00	-4.26	-0.60	3	0	1.00	-
13.56MHz_Mode 1	Pass	PK	650.8M	37.92	46.00	-8.08	0.48	3	0	1.00	-
13.56MHz_Mode 1	Pass	PK	189.08M	23.75	43.50	-19.75	-10.49	3	360	1.00	-
13.56MHz_Mode 1	Pass	PK	216.24M	22.11	46.00	-23.89	-10.07	3	360	1.00	-
13.56MHz_Mode 1	Pass	PK	270.56M	23.37	46.00	-22.63	-6.22	3	360	1.00	-
13.56MHz_Mode 1	Pass	PK	487.84M	32.88	46.00	-13.12	-1.56	3	360	1.00	-
13.56MHz_Mode 1	Pass	PK	542.16M	33.53	46.00	-12.47	-0.60	3	360	1.00	-
13.56MHz_Mode 1	Pass	PK	677.96M	35.59	46.00	-10.41	0.34	3	360	1.00	-

NFC Operating above 30MHz

24/01/2019

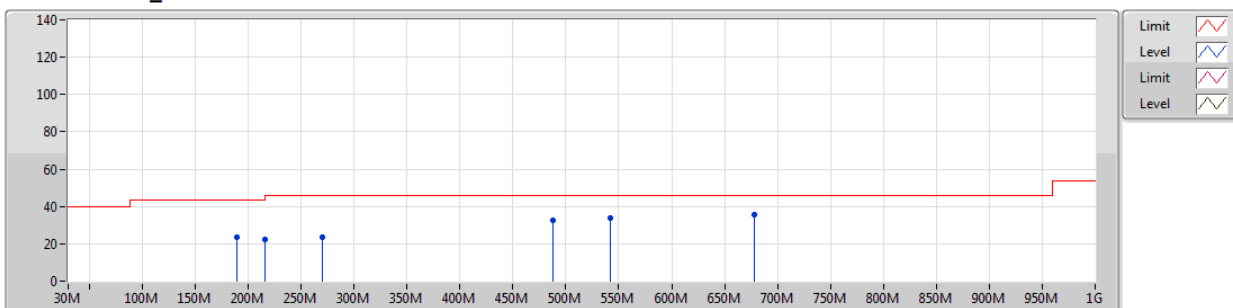
13.56MHz_Mode 1


Type	Freq (Hz)	Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Factor (dB)	Dist (m)	Condition	Azimuth (°)	Height (m)	Comments
PK	99.84M	20.65	43.50	-22.85	-9.31	3	Vertical	0	1.00	-
PK	189.08M	20.19	43.50	-23.31	-10.49	3	Vertical	0	1.00	-
PK	270.56M	21.63	46.00	-24.37	-6.22	3	Vertical	0	1.00	-
PK	515M	39.04	46.00	-6.96	-1.64	3	Vertical	0	1.00	-
PK	542.16M	41.74	46.00	-4.26	-0.60	3	Vertical	0	1.00	-
PK	650.8M	37.92	46.00	-8.08	0.48	3	Vertical	0	1.00	-

NFC Operating above 30MHz

13.56MHz_Mode 1

24/01/2019



Type	Freq (Hz)	Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Factor (dB)	Dist (m)	Condition	Azimuth (°)	Height (m)	Comments
PK	189.08M	23.75	43.50	-19.75	-10.49	3	Horizontal	360	1.00	-
PK	216.24M	22.11	46.00	-23.89	-10.07	3	Horizontal	360	1.00	-
PK	270.56M	23.37	46.00	-22.63	-6.22	3	Horizontal	360	1.00	-
PK	487.84M	32.88	46.00	-13.12	-1.56	3	Horizontal	360	1.00	-
PK	542.16M	33.53	46.00	-12.47	-0.60	3	Horizontal	360	1.00	-
PK	677.96M	35.59	46.00	-10.41	0.34	3	Horizontal	360	1.00	-

3.5 Frequency Stability

3.5.1 Frequency Stability Limit

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

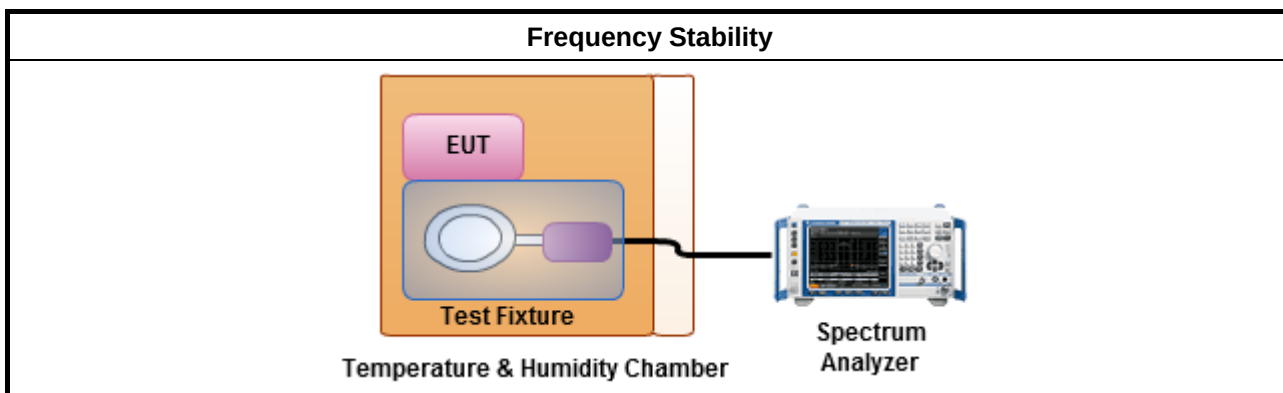
3.5.2 Measuring Instruments

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

3.5.3 Test Procedures

Test Method	
☒	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



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	13.56108	13.56130	13.56032	13.56076	79.57	95.87	23.75	56.34
T _{20°C} V _{min}	13.56	13.56007	13.56114	13.56111	13.56113	5.16	83.78	81.56	83.04
T _{50°C} V _{nom}	13.56	13.56114	13.56112	13.56110	13.56093	84.29	82.52	80.75	68.88
T _{40°C} V _{nom}	13.56	13.56116	13.56112	13.56125	13.56118	85.84	82.74	92.04	87.32
T _{30°C} V _{nom}	13.56	13.56121	13.56110	13.56133	13.56133	89.23	81.12	98.38	98.23
T _{20°C} V _{nom}	13.56	13.56118	13.56048	13.56119	13.56107	86.95	35.47	87.91	78.76
T _{10°C} V _{nom}	13.56	13.56134	13.56134	13.56131	13.56132	98.97	98.75	96.39	97.57
T _{0°C} V _{nom}	13.56	13.56132	13.56132	13.56128	13.56054	97.49	97.42	94.32	39.75
T _{-10°C} V _{nom}	13.56	13.56135	13.56132	13.56077	13.56133	99.26	97.27	56.64	98.23
T _{-20°C} V _{nom}	13.56	13.56106	13.56132	13.56129	13.56082	77.88	97.42	95.35	60.32
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 AC Conduction

Instrument	Manufacturer	Model No.	Serial No.	Characteristics	Calibration Date	Calibration Due Date
EMC Receiver	R&S	ESR	102051	9KHz ~ 3.6GHz	03/May/2018	02/May/2019
LISN	R&S	ENV216	101295	9kHz ~ 30MHz	08/Nov/2018	07/Nov/2019
RF Cable-CON	MTJ	RG142	CB002-CO	9kHz ~ 200MHz	17/Sep/2018	16/Sep/2019
AC POWER	APC	AFC-11005G	F310050055	47Hz~63Hz 5~300V	NCR	NCR
Impuls Begrenzer Pulse Limiter	SCHWARZBECK	VTSD 9561-F	9561-F041	9 kHz ~ 30 MHz	12/Oct/2018	11/Oct/2019

Instrument for Conducted Test

Instrument	Manufacturer	Model No.	Serial No.	Characteristics	Calibration Date	Calibration Due Date
Spectrum Analyzer	R&S	FSV 40	101013	9kHz~40GHz	05/Feb/2018	04/Feb/2019
TEMP & humidity Chamber	GIANT FORCE	GTH-225-40-CP-AR	MAA1311-008	-40~100℃ 10~98%RH	30/May/2018	29/May/2019
Loop Antenna	TESEQ	HLA 6120	31244	9kHz ~ 30MHz	28/Mar/2018	27/Mar/2019

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/Oct/2018	29/Oct/2019
Amplifier	HP	8447D	2944A08033	10kHz ~ 1.3GHz	23/Apr/2018	19/Apr/2019
EMI Test Receiver	R&S	ESR3	102052	9kHz ~ 3.6GHz	10/Apr/2018	09/Apr/2019
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	29/Jan/2018	28/Jan/2019
Loop Antenna	TESEQ	HLA 6120	31244	9kHz ~ 30MHz	28/Mar/2018	27/Mar/2019