

FCC Test Report

FCC ID : 2AJ7M-MN1
Equipment : Mini
Brand Name : Molekule
Model Name : MEP1
Applicant : Molekule Inc.
1308 Folsom St San Francisco CA 94103 United States Of America
Manufacturer : Inventec Appliances(Pudong)Corporation
789 PU XING RD CAOHEJING EXPORT PROCESSING ZONE SHANGHAI
Standard : 47 CFR FCC Part 15.225

The product was received on Jun. 19, 2019, and testing was started from Jun. 26, 2019 and completed on Jul. 05, 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	6
1.3 Testing Location Information	6
1.4 Measurement Uncertainty	6
2 TEST CONFIGURATION OF EUT.....	7
2.1 Test Condition	7
2.2 The Worst Case Modulation Configuration	7
2.3 Test Channel Frequencies Configuration.....	7
2.4 The Worst Case Measurement Configuration	8
2.5 Support Equipment.....	8
2.6 Test Setup Diagram	9
3 TRANSMITTER TEST RESULT	11
3.1 AC Power-line Conducted Emissions	11
3.2 Emission Bandwidth	15
3.3 Field Strength of Fundamental Emissions and Spectrum Mask	17
3.4 Transmitter Radiated Unwanted Emissions	19
3.5 Frequency Stability	30
4 TEST EQUIPMENT AND CALIBRATION DATA	32

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: 2AJ7M-MN1

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:

None

Reviewed by: Jackson Tsai

Report Producer: Jenny Yang

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	ASK	13.56	1	77.69
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	Loop

1.1.3 EUT Information

Operational Condition	
EUT Power Type	From Switching 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

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	Jeff	21.2~23.2°C / 51.8~53.6%	28/Jun/2019
RF Conducted	TH06-HY	Gary	23.2~24.8°C / 62~65%	03/Jul/2019~ 05/Jul/2019
Radiated	03CH01-HY	Edward	26.8~27.2°C / 59.4~62.4%	27/Jun/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	120V
-	Vmin	108V
-	Vmax	132V

2.2 The Worst Case Modulation Configuration

Modulation Used for Conformance Testing	
Modulation Mode	Field Strength (dBuV/m at 3 m)
RFID	77.69

2.3 Test Channel Frequencies Configuration

Modulation Mode	Test Channel Frequencies (MHz)
RFID	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
Operating Mode	☒ 1. Switching Power Supply mode

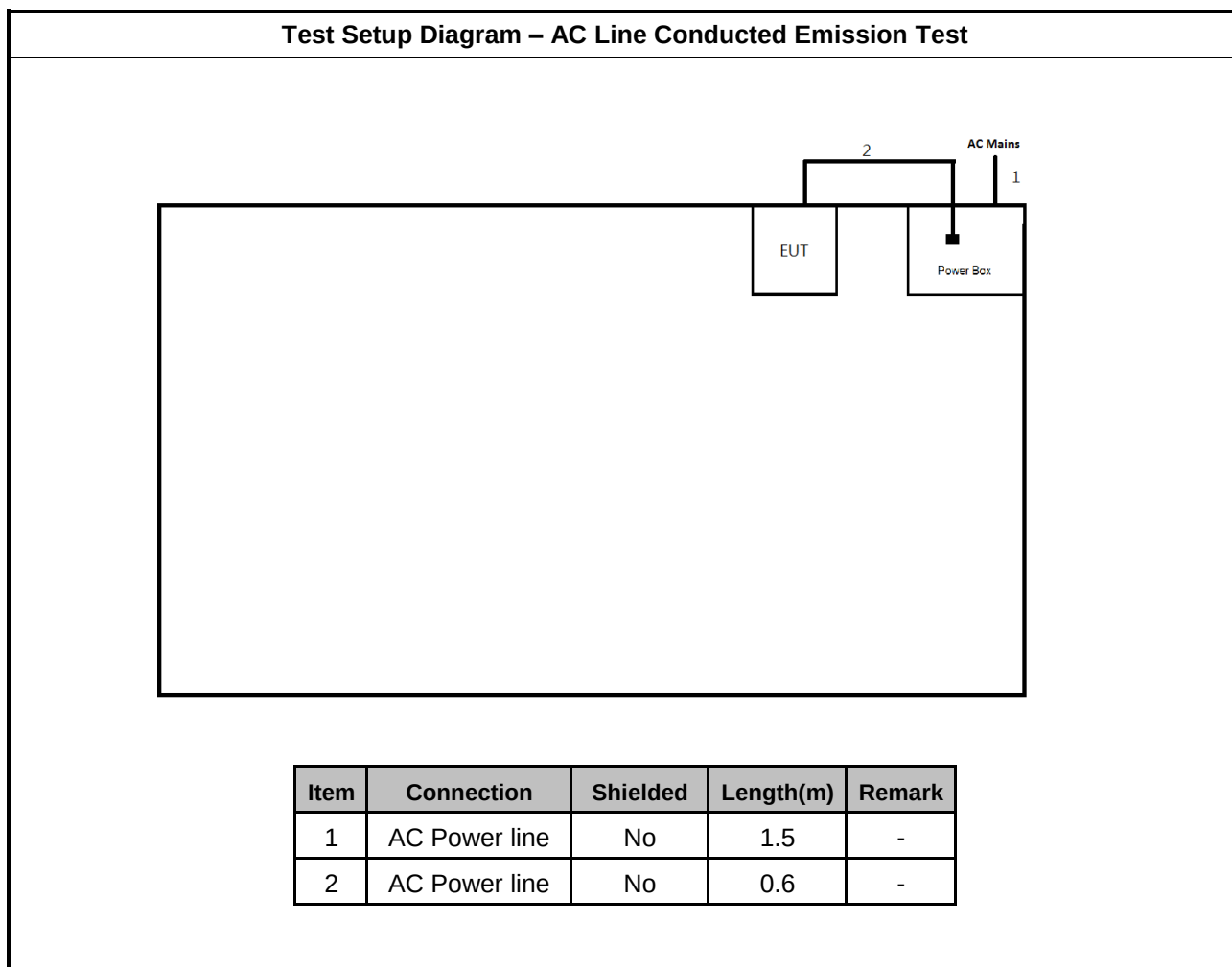
The Worst Case Mode for Following Conformance Tests	
Tests Item	Emission Bandwidth, Frequency Stability
Test Condition	Conducted measurement

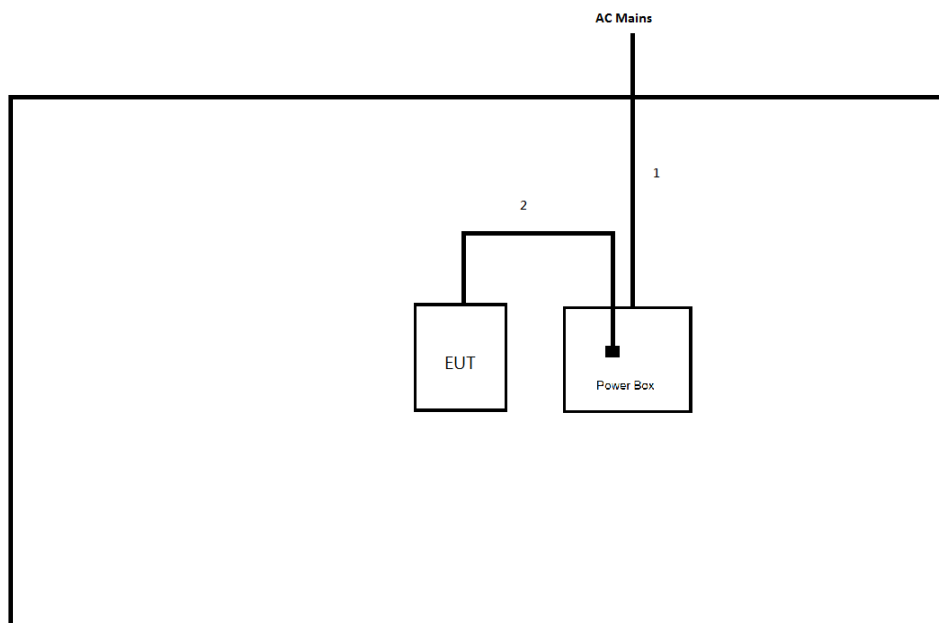
The Worst Case Mode for Following Conformance Tests	
Tests Item	Field Strength of Fundamental Emissions Spectrum Mask, Transmitter Radiated Unwanted Emissions
Test Condition	Radiated measurement
Operating Mode	☒ 1. Switching Power Supply mode
Orthogonal Planes of EUT	Z Plane
	

2.5 Support Equipment

Support Equipment – RF Conducted				
No.	Equipment	Brand Name	Model Name	FCC ID
1	Notebook	DELL	E5410	R33002
2	Adapter for NB	DELL	HA65NM130	R35737
3	AC Power Supply	GW	APS-9102	-
4	Fixture	-	-	-

2.6 Test Setup Diagram



Test Setup Diagram - Radiated Test


Item	Connection	Shielded	Length(m)	Remark
1	AC Power line	No	1.5	-
2	AC Power line	No	0.6	-

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.

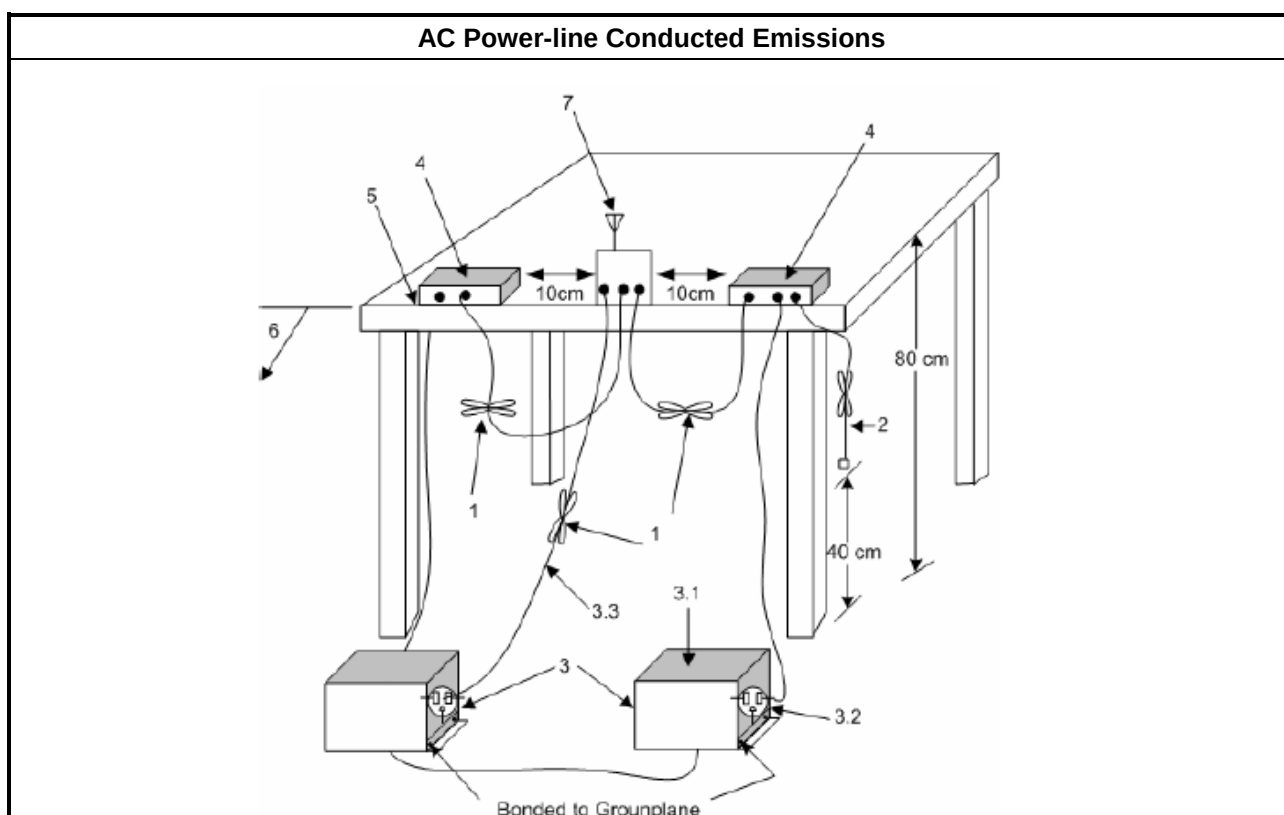
3.1.2 Measuring Instruments

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

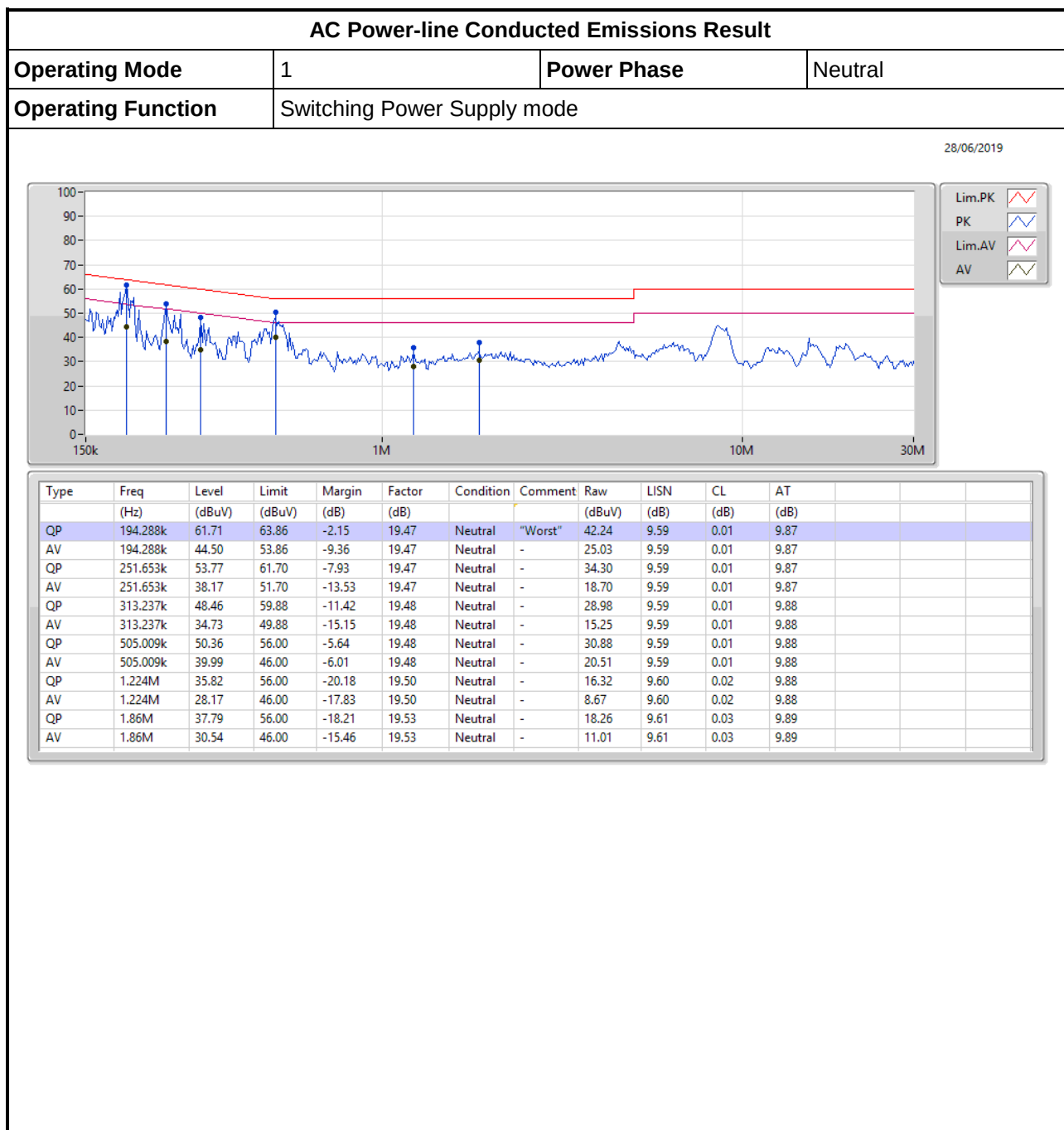
3.1.3 Test Procedures

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



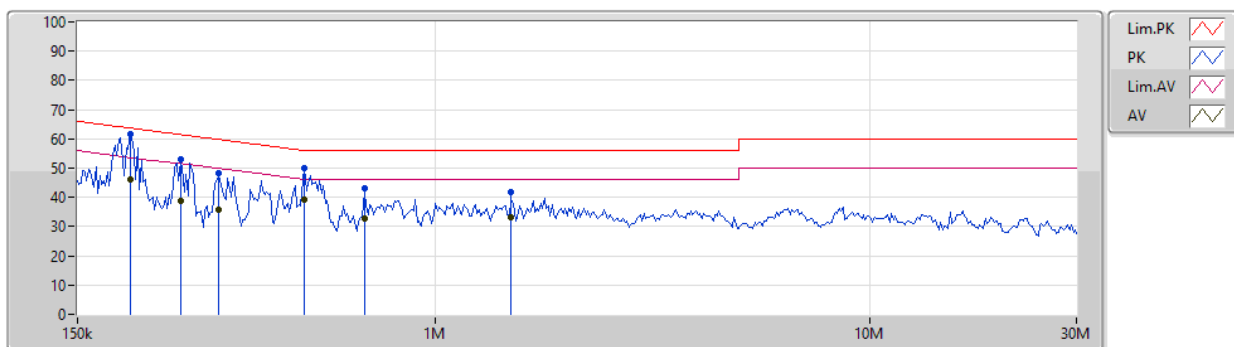
3.1.5 Test Result of AC Power-line Conducted Emissions



AC Power-line Conducted Emissions Result

Operating Mode	1	Power Phase	Line
Operating Function	Switching Power Supply mode		

28/06/2019



Type	Freq (Hz)	Level (dBuV)	Limit (dBuV)	Margin (dB)	Factor (dB)	Condition	Comment	Raw (dBuV)	LISN (dB)	CL (dB)	AT (dB)			
QP	198.194k	61.83	63.69	-1.86	19.48	Line	"Worst"	42.35	9.60	0.01	9.87			
AV	198.194k	45.95	53.69	-7.74	19.48	Line	-	26.47	9.60	0.01	9.87			
QP	259.279k	52.93	61.45	-8.52	19.48	Line	-	33.45	9.60	0.01	9.87			
AV	259.279k	38.64	51.45	-12.81	19.48	Line	-	19.16	9.60	0.01	9.87			
QP	316.369k	48.11	59.80	-11.69	19.48	Line	-	28.63	9.59	0.01	9.88			
AV	316.369k	35.61	49.80	-14.19	19.48	Line	-	16.13	9.59	0.01	9.88			
QP	500k	50.17	56.00	-5.83	19.48	Line	-	30.69	9.59	0.01	9.88			
AV	500k	39.09	46.00	-6.91	19.48	Line	-	19.61	9.59	0.01	9.88			
QP	687.482k	42.94	56.00	-13.06	19.49	Line	-	23.45	9.60	0.01	9.88			
AV	687.482k	32.57	46.00	-13.43	19.49	Line	-	13.08	9.60	0.01	9.88			
QP	1.494M	41.97	56.00	-14.03	19.53	Line	-	22.44	9.61	0.03	9.89			
AV	1.494M	33.28	46.00	-12.72	19.53	Line	-	13.75	9.61	0.03	9.89			

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).

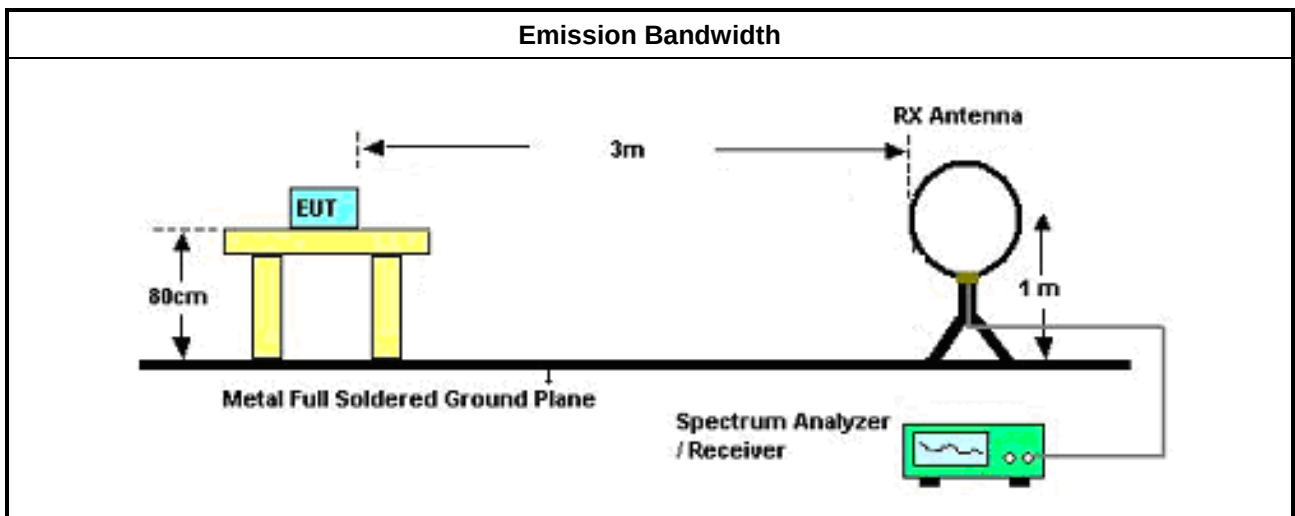
3.2.2 Measuring Instruments

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

3.2.3 Test Procedures

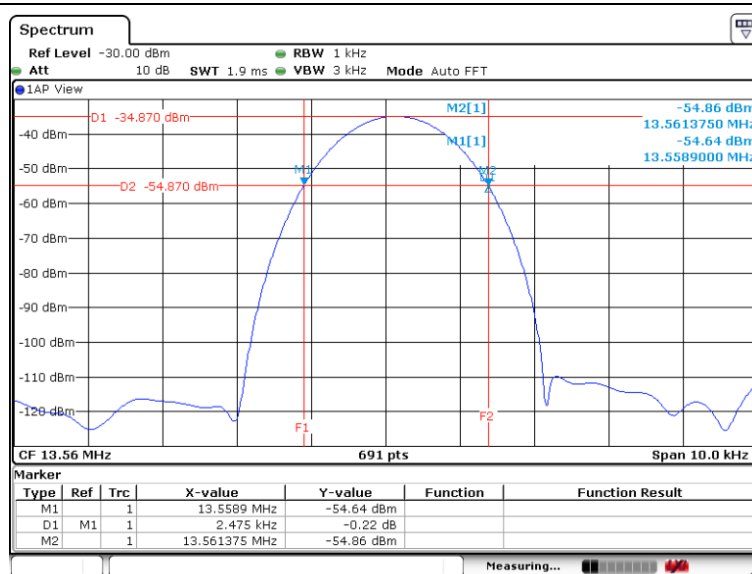
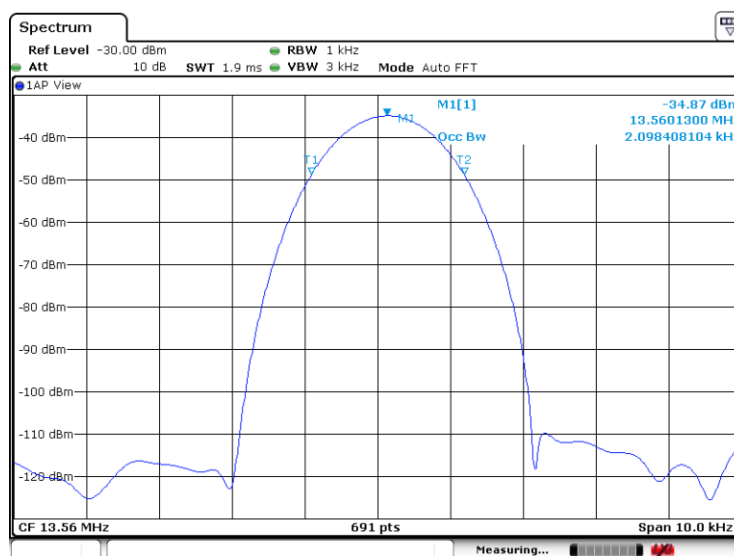
Test Method	
☒	For the emission bandwidth refer ANSI C63.10, clause 6.9.1 for occupied bandwidth testing.
☒	For radiated measurement. Loop antenna was rotated about the horizontal and vertical axis and the equipment to be measured and the test antenna shall be oriented to obtain the maximum emitted field 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)
RFID	13.56	2.47500	2.09841	13.55890	13.56138
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

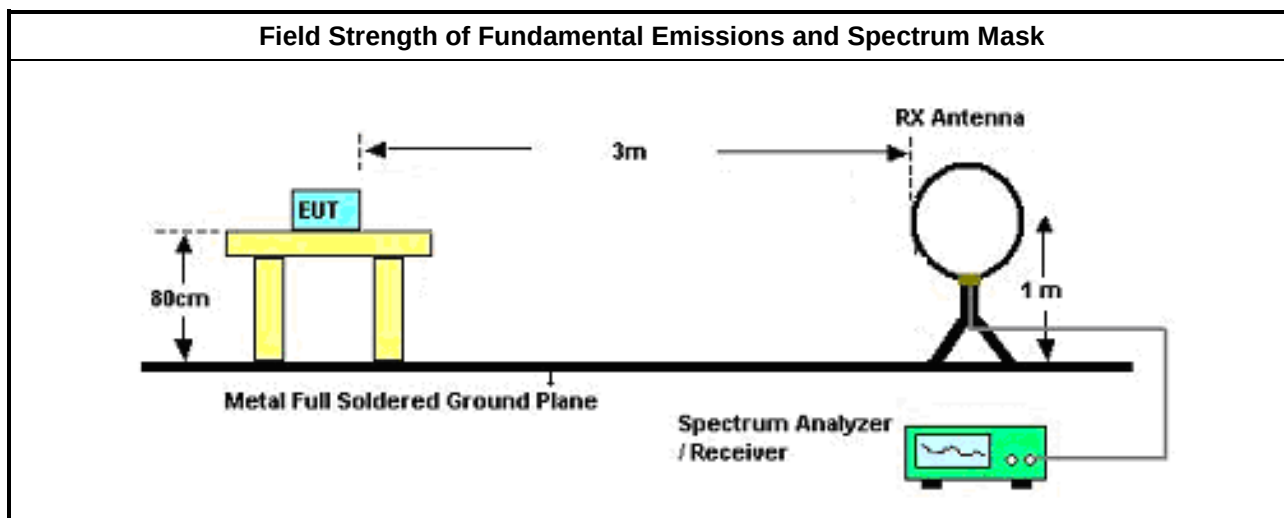
3.3.2 Measuring Instruments

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.

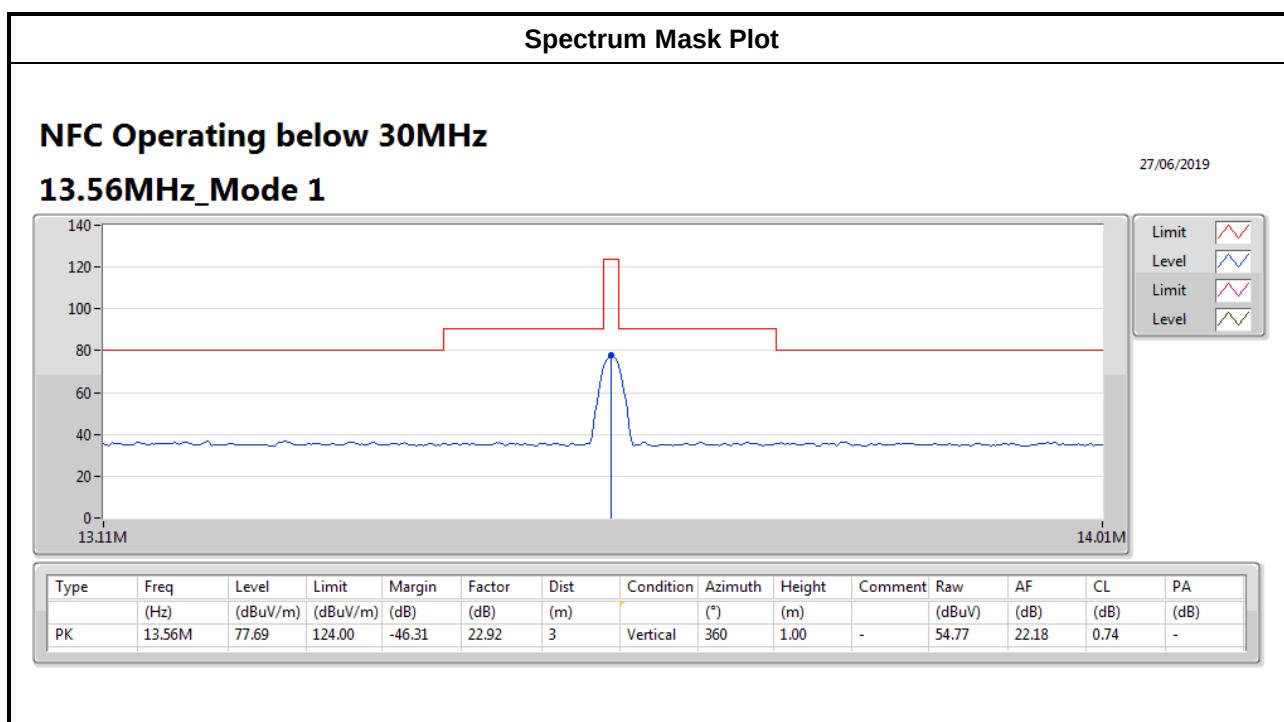
3.3.4 Test Setup



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
RFID	13.56	77.69	V	-46.31	124.00
Result		Complied			

Note 1: Measurement worst emissions of receive antenna polarization: V(Vertical).



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.

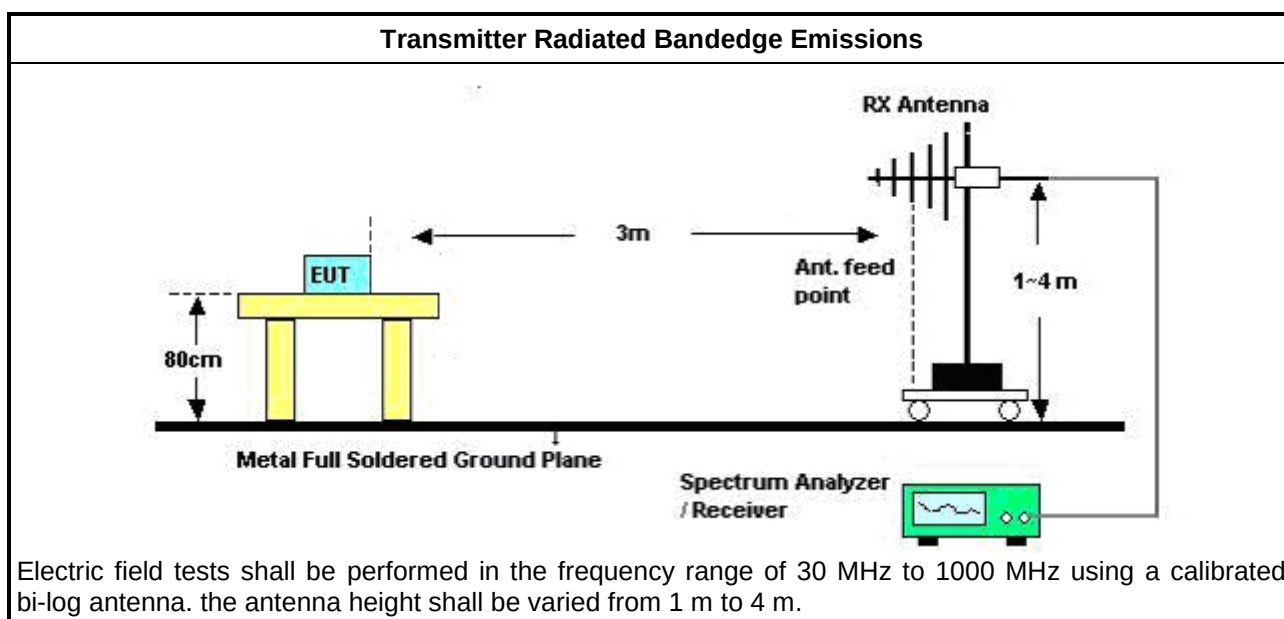
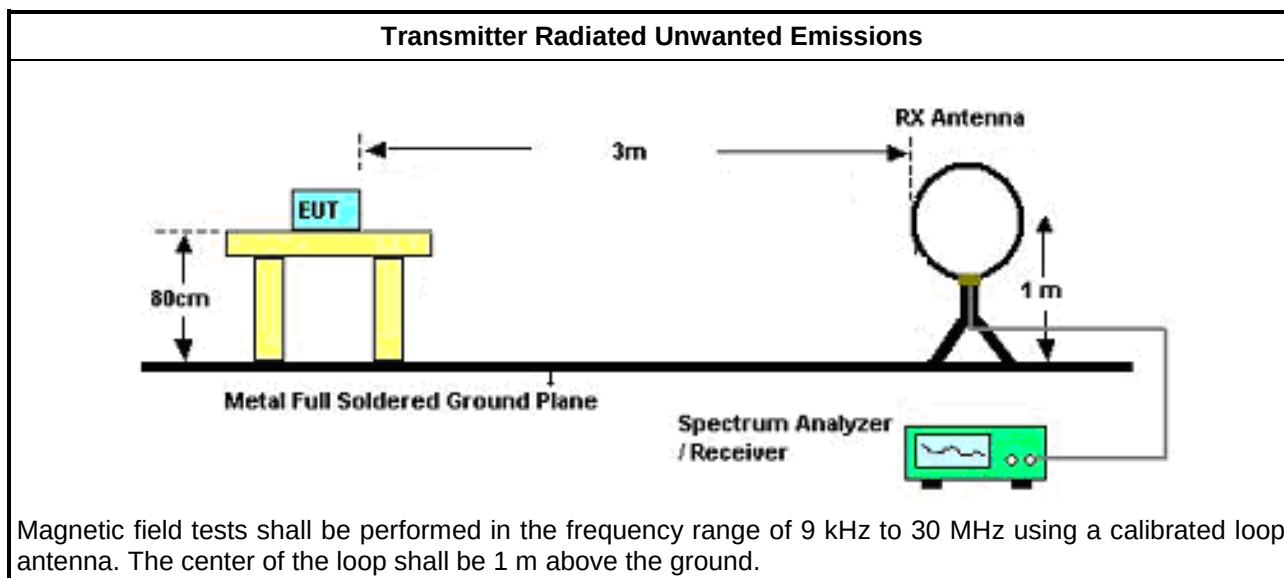
3.4.2 Measuring Instruments

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	-	-	-	-	-	-	-	-	-	-	-
ASK	Pass	PK	582.609k	44.71	72.31	-27.60	19.99	3	360	1.00	-

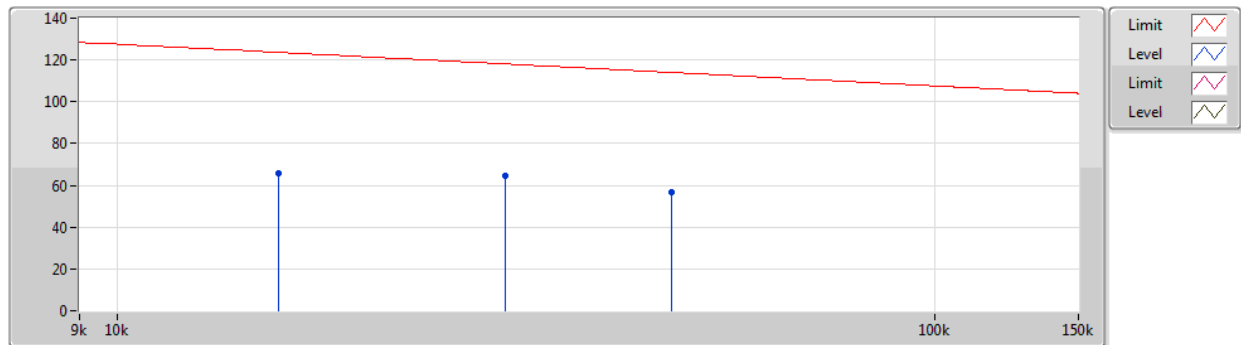
Result

Mode	Result	Type	Freq (Hz)	Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Factor (dB)	Dist (m)	Azimuth (°)	Height (m)	Comments
ASK	-	-	-	-	-	-	-	-	-	-	-
13.56MHz_Mode 1	Pass	PK	15.743k	65.57	123.64	-58.07	19.71	3	0	1.00	-
13.56MHz_Mode 1	Pass	PK	29.843k	64.31	118.09	-53.78	20.30	3	0	1.00	-
13.56MHz_Mode 1	Pass	PK	47.622k	56.81	114.03	-57.22	20.49	3	0	1.00	-
13.56MHz_Mode 1	Pass	PK	582.609k	44.71	72.31	-27.60	19.99	3	360	1.00	-
13.56MHz_Mode 1	Pass	PK	1.058M	35.57	67.12	-31.55	20.24	3	360	1.00	-
13.56MHz_Mode 1	Pass	PK	1.705M	35.53	69.50	-33.97	20.34	3	360	1.00	-

NFC Operating below 30MHz

27/06/2019

13.56MHz_Mode 1

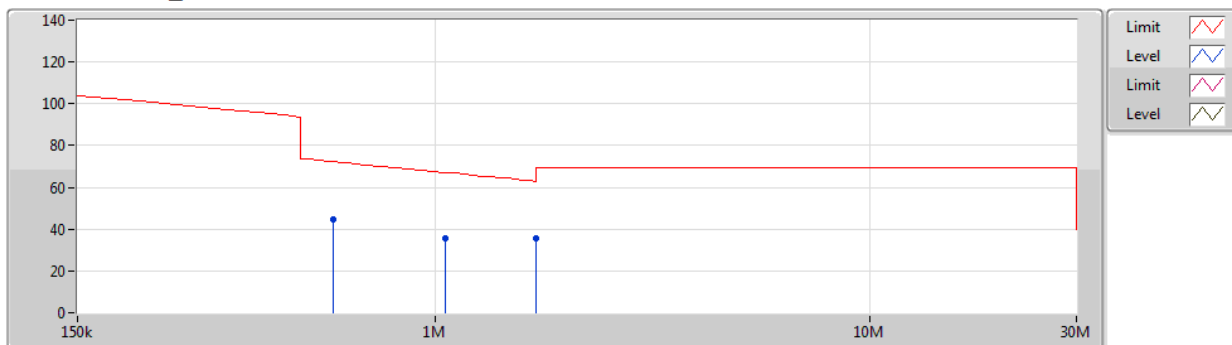


Type	Freq (Hz)	Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Factor (dB)	Dist (m)	Condition	Azimuth (°)	Height (m)	Comment	Raw (dBuV)	AF (dB)	CL (dB)	PA (dB)
PK	15.743k	65.57	123.64	-58.07	19.71	3	Horizontal	0	1.00	-	45.86	19.69	0.02	-
PK	29.843k	64.31	118.09	-53.78	20.30	3	Horizontal	0	1.00	-	44.01	20.29	0.01	-
PK	47.622k	56.81	114.03	-57.22	20.49	3	Horizontal	0	1.00	-	36.32	20.48	0.01	-

NFC Operating below 30MHz

27/06/2019

13.56MHz_Mode 1



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	582.609k	44.71	72.31	-27.60	19.99	3	Horizontal	360	1.00	-	24.72	19.93	0.06	-
PK	1.058M	35.57	67.12	-31.55	20.24	3	Horizontal	360	1.00	-	15.33	20.10	0.14	-
PK	1.705M	35.53	69.50	-33.97	20.34	3	Horizontal	360	1.00	-	15.19	20.10	0.24	-

**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	-	-	-	-	-	-	-	-	-	-	-
ASK	Pass	QP	176.2M	42.77	43.50	-0.73	-16.20	3	157	1.00	-

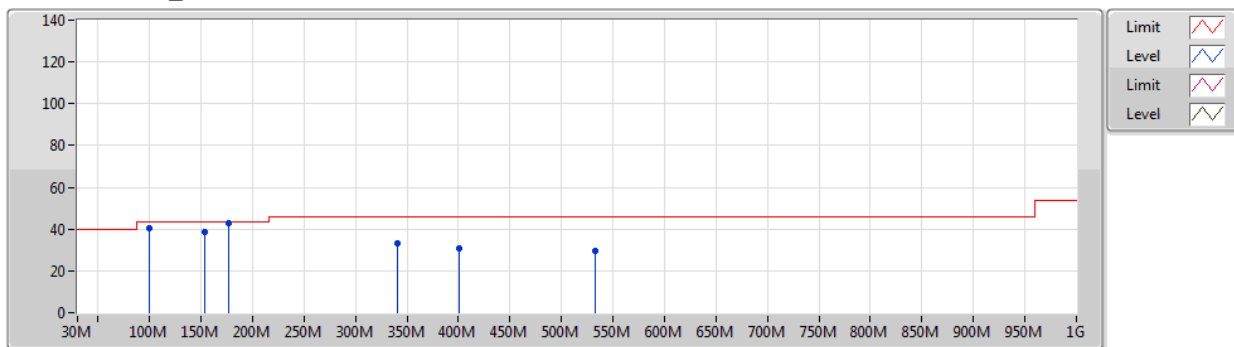
Result

Mode	Result	Type	Freq (Hz)	Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Factor (dB)	Dist (m)	Azimuth (°)	Height (m)	Comments
ASK	-	-	-	-	-	-	-	-	-	-	-
13.56MHz_Mode 1	Pass	PK	340.68M	33.03	46.00	-12.97	-10.64	3	360	1.00	-
13.56MHz_Mode 1	Pass	PK	401.13M	30.83	46.00	-15.17	-8.40	3	360	1.00	-
13.56MHz_Mode 1	Pass	PK	533.28M	29.44	46.00	-16.56	-5.55	3	360	1.00	-
13.56MHz_Mode 1	Pass	QP	100.29M	40.66	43.50	-2.84	-14.96	3	306	1.00	-
13.56MHz_Mode 1	Pass	QP	153.71M	38.66	43.50	-4.84	-15.25	3	150	1.00	-
13.56MHz_Mode 1	Pass	QP	176.2M	42.77	43.50	-0.73	-16.20	3	157	1.00	-
13.56MHz_Mode 1	Pass	PK	39.84M	28.83	40.00	-11.17	-13.03	3	0	1.00	-
13.56MHz_Mode 1	Pass	PK	100.29M	31.49	43.50	-12.01	-14.96	3	0	1.00	-
13.56MHz_Mode 1	Pass	PK	176.2M	35.50	43.50	-8.00	-16.20	3	0	1.00	-
13.56MHz_Mode 1	Pass	PK	342.09M	36.30	46.00	-9.70	-10.57	3	0	1.00	-
13.56MHz_Mode 1	Pass	PK	401.13M	28.76	46.00	-17.24	-8.40	3	0	1.00	-
13.56MHz_Mode 1	Pass	PK	427.84M	26.01	46.00	-19.99	-7.51	3	0	1.00	-

NFC Operating above 30MHz

27/06/2019

13.56MHz_Mode 1

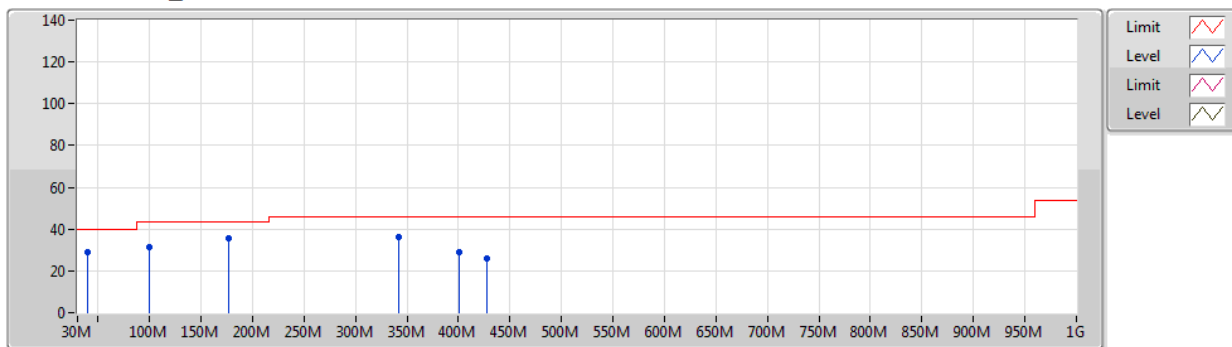


Type	Freq (Hz)	Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Factor (dB)	Dist (m)	Condition	Azimuth (°)	Height (m)	Comment	Raw (dBuV)	AF (dB)	CL (dB)	PA (dB)
PK	340.68M	33.03	46.00	-12.97	-10.64	3	Vertical	360	1.00	-	43.67	19.05	2.53	32.22
PK	401.13M	30.83	46.00	-15.17	-8.40	3	Vertical	360	1.00	-	39.23	20.96	2.78	32.14
PK	533.28M	29.44	46.00	-16.56	-5.55	3	Vertical	360	1.00	-	34.99	23.10	3.26	31.91
QP	100.29M	40.66	43.50	-2.84	-14.96	3	Vertical	306	1.00	-	55.62	16.03	1.56	32.55
QP	153.71M	38.66	43.50	-4.84	-15.25	3	Vertical	150	1.00	-	53.91	15.43	1.81	32.49
QP	176.2M	42.77	43.50	-0.73	-16.20	3	Vertical	157	1.00	-	58.97	14.38	1.89	32.47

NFC Operating above 30MHz

27/06/2019

13.56MHz_Mode 1



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	39.84M	28.83	40.00	-11.17	-13.03	3	Horizontal	0	1.00	-	41.86	18.41	1.13	32.57
PK	100.29M	31.49	43.50	-12.01	-14.96	3	Horizontal	0	1.00	-	46.45	16.03	1.56	32.55
PK	176.2M	35.50	43.50	-8.00	-16.20	3	Horizontal	0	1.00	-	51.70	14.38	1.89	32.47
PK	342.09M	36.30	46.00	-9.70	-10.57	3	Horizontal	0	1.00	-	46.87	19.11	2.54	32.22
PK	401.13M	28.76	46.00	-17.24	-8.40	3	Horizontal	0	1.00	-	37.16	20.96	2.78	32.14
PK	427.84M	26.01	46.00	-19.99	-7.51	3	Horizontal	0	1.00	-	33.52	21.70	2.87	32.08

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).

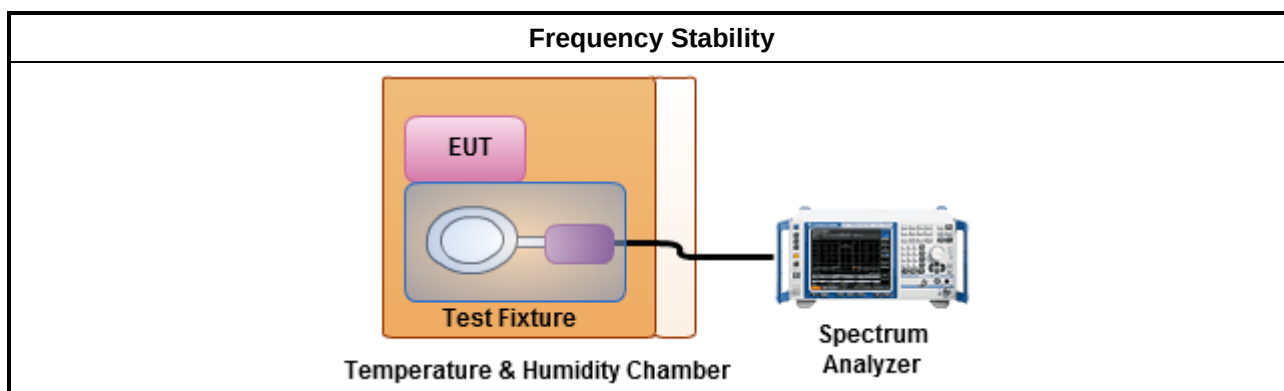
3.5.2 Measuring Instruments

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} Vmax	13.56	13.56014	13.56014	13.56014	13.56014	10.47	10.47	10.47	10.47
T _{20°C} Vmin	13.56	13.56014	13.56014	13.56014	13.56014	10.47	10.47	10.40	10.40
T _{50°C} Vnom	13.56	13.56008	13.56008	13.56008	13.56008	5.90	5.90	5.90	5.90
T _{40°C} Vnom	13.56	13.56010	13.56010	13.56010	13.56010	7.15	7.08	7.08	7.08
T _{30°C} Vnom	13.56	13.56013	13.56013	13.56013	13.56013	9.29	9.29	9.22	9.22
T _{20°C} Vnom	13.56	13.56015	13.56014	13.56014	13.56014	10.69	10.62	10.62	10.62
T _{10°C} Vnom	13.56	13.56016	13.56016	13.56016	13.56016	11.43	11.43	11.43	11.43
T _{0°C} Vnom	13.56	13.56015	13.56015	13.56015	13.56015	10.77	10.77	10.77	10.77
T _{-10°C} Vnom	13.56	13.56013	13.56013	13.56013	13.56013	9.51	9.59	9.59	9.66
T _{-20°C} Vnom	13.56	13.56012	13.56012	13.56012	13.56012	9.00	9.00	9.00	9.00
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	ESR3	102052	9kHz ~ 3.6GHz	09/Apr/2019	08/Apr/2020
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	13/Mar/2019	12/Mar/2020
Loop Antenna	TESEQ	HLA 6120	31244	9kHz ~ 30MHz	15/Mar/2019	14/Mar/2020
*TEMP & humidity Chamber	Giant Force	GTH-225-40-CP-AR	MAA1611-005	-40~100℃ 10~98%RH	04/Dec/2018	03/Dec/2019

Instrument for Radiated Test

Instrument	Manufacturer	Model No.	Serial No.	Characteristics	Calibration Date	Calibration Due Date
3m Semi Anechoic Chamber	Riken	SAC-3M	03CH01-HY	30MHz ~ 1GHz 3m	11/Jan/2019	10/Jan/2020
3m Semi Anechoic Chamber	Riken	SAC-3M	03CH01-HY	1GHz ~ 18GHz 3m	09/Jan/2019	08/Jan/2020
PreAmplifier	COM-POWER	PA-103	161050	1 MHz ~ 1.0GHz	24/Jul/2018	23/Jul/2019
Microwave Preamplifier	Agilent	8449B	3008A02602	1GHz ~ 26.5GHz	27/Mar/2019	26/Mar/2020
Spectrum Analyzer	R&S	FSV40	101407	10Hz ~ 40GHz	16/Aug/2018	15/Aug/2019
RF Cable-R03m	Jye Bao	RG142	CB019	9kHz ~ 1GHz	14/Dec/2018	13/Dec/2019
RF Cable-HIGH	SUHNER	SUCOFLEX 104	SN805196/4+MY 39495	1 GHz ~ 18 GHz	13/Mar/2019	12/Mar/2020
Bilog Antenna & 5db Attenuator	SCHAFFNER/MTJ	CBL6112D / MTJ6102-05	2678 / 001	30MHz ~ 2GHz	07/Jul/2018	06/Jul/2019
EMI Test Receiver	R&S	ESU-26	100422	20Hz ~ 26.5GHz	25/Oct/2018	24/Oct/2019
Loop Antenna	TESEQ	HLA 6120	31244	9k-30MHz	15/Mar/2019	14/Mar/2020
Broadband Horn Antenna	SCHWARZBECK	BBHA 9170	BBHA9170339	18GHz ~ 40GHz	19/Apr/2019	18/Apr/2020
Horn Antenna	SCHWARZBECK	BBHA 9120 D	BBHA 9120 D-1130	1GHz ~ 18GHz	26/Oct/2018	25/Oct/2019