FCC Radio Test Report

FCC ID	:	**2AUSZ-BRUNO**
Equipment	:	**SERVER**
Brand Name	:	**hyve solutions**
Model Name	:	**Bruno1F, Bruno2F**
Applicant	:	**Hyve Solutions Corporation 44217 Nobel Drive Fremont, CA 94538-3178,United States Of America**
Manufacturer	:	**For more manufacturer please refer to section 1.1**
Standard	:	**47 CFR FCC Part 15.225**

The product was received on Aug. 04, 2021, and testing was started from Sep. 01, 2021 and completed on Sep. 10, 2021. We, SPORTON INTERNATIONAL INC. Hsinhua 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 test results in this report apply exclusively to the tested model / sample. Without written approval of SPORTON INTERNATIONAL INC. Hsinhua Laboratory, the test report shall not be reproduced except in full.

Approved by: Allen Lin

SPORTON INTERNATIONAL INC. Hsinhua Laboratory

No.52, Huaya 1st Rd., Guishan Dist., Taoyuan City 333411, Taiwan (R.O.C.)

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History of this test report

Report No.	Version	Description	Issued Date
FR180310AR	01	Initial issue of report	Sep. 22, 2021

Summary of Test Result

Report Clause	Ref. Std. Clause	Test Items	Result (PASS/FAIL)	Remark
1.1.2	15.203	Antenna Requirement	PASS	-
3.1	15.207	AC Power-line Conducted Emissions	PASS	-
3.2	15.215(c)	Emission Bandwidth	PASS	-
3.3	15.225(e)	Frequency Stability	PASS	
3.4	15.225(a)~(d)	Field Strength of Fundamental Emissions and Spectrum Mask	PASS	-
3.5	15.225(d)	Transmitter Radiated Unwanted Emissions	PASS	-

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: Amber Chiu

1 General Description

1.1 Information

Manufacturer List
1. Hyve Solutions Corporation
44217 Nobel Drive Fremont, CA 94538-3178, United States Of America
2. Hyve Solutions Corporation
44131 Nobel Drive Fremont, CA 94538, United States Of America
3. Hyve Solutions, Inc. Europe Limited
Synnex House, Nedge Hill, Shropshire, Telford TF3 3AH, UK
4. Hyve Solutions China Limited
Block Z9-1 of the exporting processing zone of Wuxi Xinwu District, Jiangsu, China
5. Synnex Corporation
10381 State Line Road, Olive Branch, MS 38654,United States Of America
6. Hyve SNX Solutions Ireland Limited
One Earlsfort Centre, Earlsfort Terrace, 2 Dublin, Ireland

1.1.1 RF General Information

RF General Information					
Frequency Range(MHz)	**Type**	**Mode**	**Ch. Frequency (MHz)**	**Channel Number**	**Field Strength (dBuV/m)**
13.553 – 13.567	NFC-F (ISO 18092)	NFC	13.56	1	51.78

Note :
- Field strength performed peak level at 3m.
- Uses a ASK modulation.

1.1.2 Antenna Information

Ant.	Brand	Model Name	Antenna Type	Connector
1	Hyve Solutions	001	Coil / embedded	N/A
2	Hyve Solutions	001	Coil / embedded	N/A

For NFC mode (2T2R)
Ant. 1, 2 could transmit/receive simultaneously.

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
☐	**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%	

1.1.5 Table for Multiple Listing

The brand/model names in the following table are all refer to the identical product.

Brand Name	Model Name	Description
hyve solutions	Bruno1F, Bruno2F	All the models are identical, the different model served as marketing strategy.

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

The following reference test guidance is not within the scope of accreditation of TAF:

- KDB 414788 D01 v01r01

1.3 Testing Location Information

Test Lab. : Sporton International Inc. Hsinhua Laboratory				
☒ Hsinhua (**TAF:** 3785)	**ADD:** No.52, Huaya 1st Rd., Guishan Dist., Taoyuan City 333411, Taiwan (R.O.C.)			
	TEL: 886-3-327-3456		**FAX:** 886-3-327-0973	
Test site Designation No. TW3785 with FCC.				
Test Condition	**Test Site No.**	**Test Engineer**	**Test Environment**	**Test Date**
AC Conduction	CO04-HY	Daniel Lin	20.3~22.5°C / 52~56%	09/Sep/2021
RF Conducted	TH07-HY	Alan Chien	20.1~26.9°C / 50~60%	10/Sep/2021
Radiated	03CH02-HY	Lego Lin	22.5~25.2°C / 58.9~61.3%	01/Sep/2021~ 07/Sep/2021
☐ Wen 33rd.St. (**TAF:** 3785)	**ADD:** No.14-1, Ln. 19, Wen 33rd St., Guishan Dist., Taoyuan City 333010, Taiwan (R.O.C.)			
	TEL: 886-3-318-0787		**FAX:** 886-3-318-0287	
Test site Designation No. TW0008 with FCC.				

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)	0.9 dB	Confidence levels of 95%
Radiated Emission (9kHz ~ 30MHz)	2.4 dB	Confidence levels of 95%
Radiated Emission (30MHz ~ 1,000MHz)	3.7 dB	Confidence levels of 95%
Conducted Emission	1.0 dB	Confidence levels of 95%
Temperature	0.41 °C	Confidence levels of 95%
Humidity	3.4 %	Confidence levels of 95%

2 Test Configuration of EUT

2.1 Test Condition

Condition Item	Abbreviation/Remark	Remark
TnomVnom	Tnom	20°C
-	Vnom	230V
Freq. Stability	Abbreviation	Remark
-20°C	-	-
-10°C	-	-
0°C	-	-
10°C	-	-
20°C	-	-
30°C	-	-
40°C	-	-
50°C	-	-
20°C-240V	-	-
20°C-230V	-	-
20°C-196V	-	-

2.2 Test Channel Mode

Test Software Version	DoS 6.1

Mode	Power Setting
NFC	-
13.56MHz	default

2.3 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	CTX
	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 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)
	☐ 4. NFC-V (ISO 15693)
Mode 3 configuration was pretested and found to be the worst case and measured during the test.	
Operating Mode	CTX
	Switching Power Supply mode
Orthogonal Planes of EUT	**Z Plane**

2.4 Support Equipment

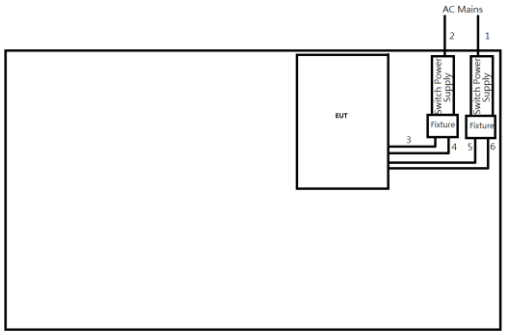
Support Equipment – AC Conduction					
No.	**Equipment**	**Brand Name**	**Model Name**	**FCC ID**	**Remark**
1	Fixture	Hyve	001	-	Provided by Customer
2	Fixture	Hyve	001	-	Provided by Customer
3	Switching Power supply	DELTA	DPS-1200AB-14 A	-	-
4	Switching Power supply	DELTA	DPS-1200AB-14 A	-	-

Support Equipment – Conducted					
No.	**Equipment**	**Brand Name**	**Model Name**	**FCC ID**	**Remark**
1	Fixture	Hyve	001	-	Provided by Customer
2	Fixture	Hyve	001	-	Provided by Customer
3	Switching Power supply	DELTA	DPS-1200AB-14 A	-	-
4	Switching Power supply	DELTA	DPS-1200AB-14 A	-	-
5	AC Power Supply	GW	APS-9102	-	-

Support Equipment – Radiated					
No.	**Equipment**	**Brand Name**	**Model Name**	**FCC ID**	**Remark**
1	Fixture	Hyve	001	-	Provided by Customer
2	Fixture	Hyve	001	-	Provided by Customer
3	Switching Power supply	DELTA	DPS-1200AB-14 A	-	-
4	Switching Power supply	DELTA	DPS-1200AB-14 A	-	-

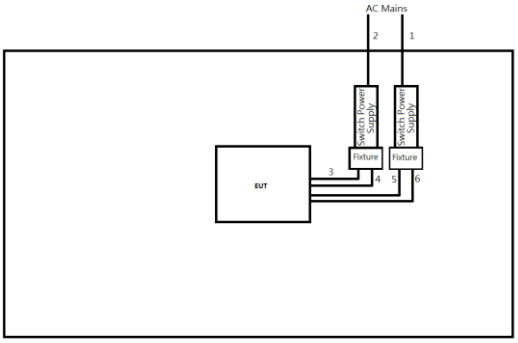
2.5 Test Setup Diagram

Test Setup Diagram – AC Line Conducted Emission Test



Item	Connection	Shielded	Length(m)	Remark
1	AC Power cable	No	1.8	-
2	AC Power cable	No	1.8	-
3	DC Power cable(+)	No	0.6	-
4	DC Power cable(-)	No	0.6	-
5	DC Power cable(+)	No	0.6	-
6	DC Power cable(-)	No	0.6	-

Test Setup Diagram - Radiated Test



Item	Connection	Shielded	Length(m)	Remark
1	AC Power cable	No	1.8	-
2	AC Power cable	No	1.8	-
3	DC Power cable(+)	No	0.6	-
4	DC Power cable(-)	No	0.6	-
5	DC Power cable(+)	No	0.6	-
6	DC Power cable(-)	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

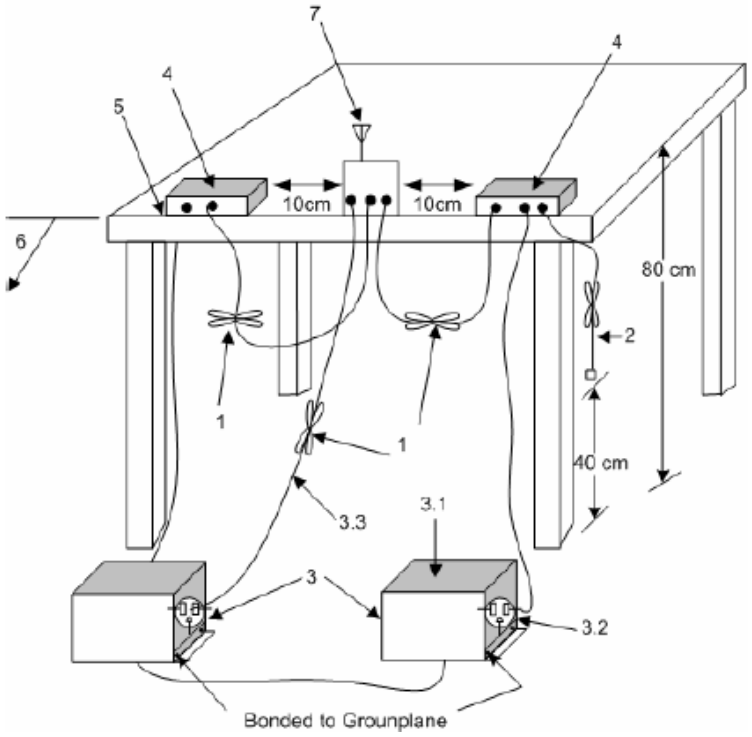
Test Method		
☒	Refer as ANSI C63.10-2013, clause 6.2 for AC power-line conducted emissions.	
☒	If AC conducted emissions fall in operating band, then following below test method confirm final result.	
	☐	Accept measurements done with a suitable dummy load replacing the antenna under the following conditions: (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 Measurement Results Calculation

The measured Level is calculated using:
Corrected Reading: Raw(Read Level) +LISN(LISN Factor) + CL(Cable Loss) + AT(Attenuator).

3.1.5 Test Setup

AC Power-line Conducted Emissions



1—Interconnecting cables that hang closer than 40 cm to the ground plane shall be folded back and forth in the center forming a bundle 30 cm to 40 cm long.
2—The I/O cables that are not connected to an accessory shall be bundled in the center. The end of the cable may be terminated, if required, using the correct terminating impedance. The overall length shall not exceed 1 m.
3—EUT connected to one LISN. Unused LISN measuring port connectors shall be terminated in 50Ω loads. LISN may be placed on top of, or immediately beneath, reference ground plane.
3.1—All other equipment powered from additional LISN(s).
3.2—A multiple-outlet strip may be used for multiple power cords of non-EUT equipment.
3.3—LISN at least 80 cm from nearest part of EUT chassis.
4—Non-EUT components of EUT system being tested.
5—Rear of EUT, including peripherals, shall all be aligned and flush with edge of tabletop.
6—Edge of tabletop shall be 40 cm removed from a vertical conducting plane that is bonded to the ground plane.
7—Antenna can be integral or detachable. If detachable, then the antenna shall be attached for this test.

3.1.6 Test Result of AC Power-line Conducted Emissions

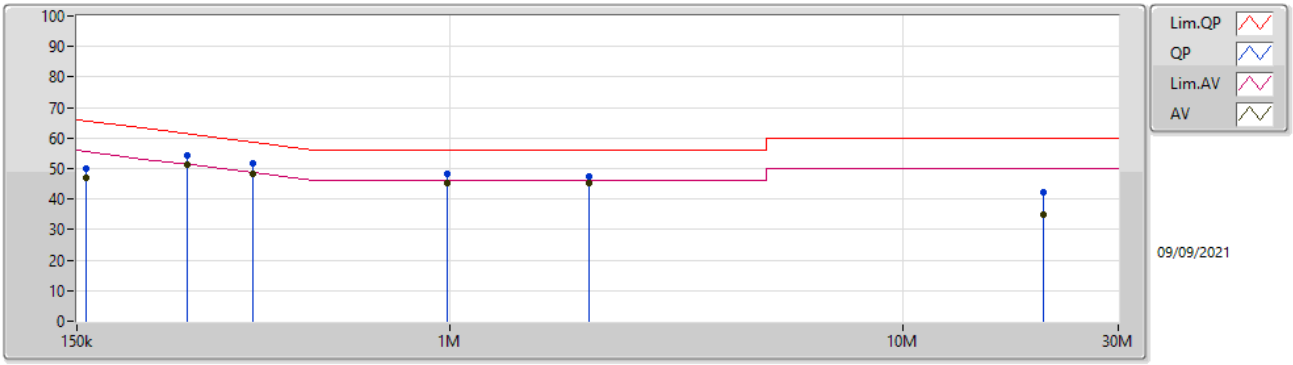
Summary

Mode	Result	Type	Freq (Hz)	Level (dBuV)	Limit (dBuV)	Margin (dB)	Condition
Mode 1	Pass	AV	263.357k	51.25	51.32	-0.07	Line

Mode Configure

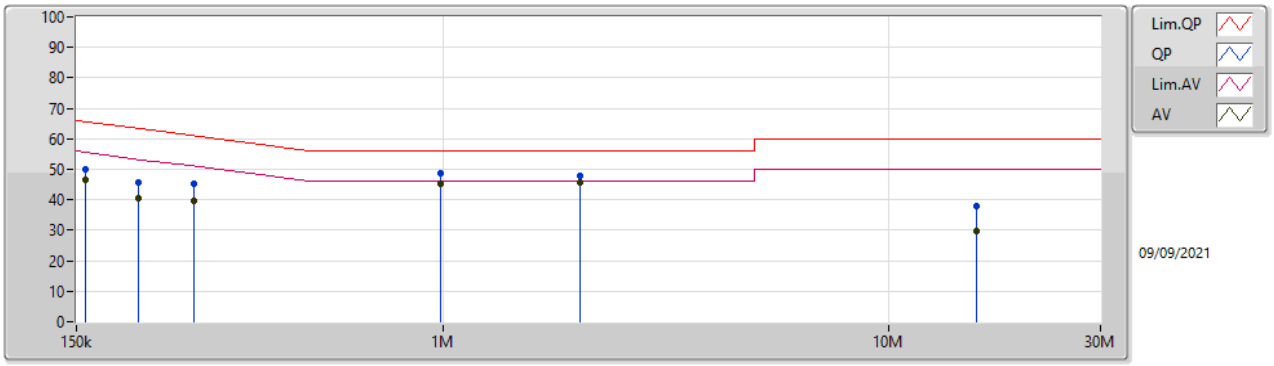
Mode	Result	Type	Freq (Hz)	Level (dBuV)	Limit (dBuV)	Margin (dB)	Condition	Comments
Mode 1	Pass	QP	156.734k	50.20	65.64	-15.44	Line	-
Mode 1	Pass	AV	156.734k	46.78	55.64	-8.86	Line	-
Mode 1	Pass	QP	263.357k	54.25	61.32	-7.07	Line	-
Mode 1	Pass	AV	263.357k	51.25	51.32	-0.07	Line	-
Mode 1	Pass	QP	366.811k	51.84	58.58	-6.74	Line	-
Mode 1	Pass	AV	366.811k	48.18	48.58	-0.40	Line	-
Mode 1	Pass	QP	987.197k	48.44	56.00	-7.56	Line	-
Mode 1	Pass	AV	987.197k	45.14	46.00	-0.86	Line	-
Mode 1	Pass	QP	2.025M	47.55	56.00	-8.45	Line	-
Mode 1	Pass	AV	2.025M	45.14	46.00	-0.86	Line	-
Mode 1	Pass	QP	20.513M	42.07	60.00	-17.93	Line	-
Mode 1	Pass	AV	20.513M	35.01	50.00	-14.99	Line	-
Mode 1	Pass	QP	156.734k	50.08	65.64	-15.56	Neutral	-
Mode 1	Pass	AV	156.734k	46.67	55.64	-8.97	Neutral	-
Mode 1	Pass	QP	207.263k	45.50	63.30	-17.80	Neutral	-
Mode 1	Pass	AV	207.263k	40.50	53.30	-12.80	Neutral	-
Mode 1	Pass	QP	275.179k	45.15	60.95	-15.80	Neutral	-
Mode 1	Pass	AV	275.179k	39.62	50.95	-11.33	Neutral	-
Mode 1	Pass	QP	987.197k	48.56	56.00	-7.44	Neutral	-
Mode 1	Pass	AV	987.197k	45.19	46.00	-0.81	Neutral	-
Mode 1	Pass	QP	2.025M	47.77	56.00	-8.23	Neutral	-
Mode 1	Pass	AV	2.025M	45.52	46.00	-0.48	Neutral	-
Mode 1	Pass	QP	15.762M	38.07	60.00	-21.93	Neutral	-
Mode 1	Pass	AV	15.762M	29.91	50.00	-20.09	Neutral	-

Conducted Emissions at Powerline_Mode 1



Type	Freq	Level	Limit	Margin	Factor	Condition	Comment	Raw	LISN	CL	AT
	(Hz)	(dBuV)	(dBuV)	(dB)	(dB)			(dBuV)	(dB)	(dB)	(dB)
QP	156.734k	50.20	65.64	-15.44	19.63	Line	-	30.57	9.69	0.04	9.90
AV	156.734k	46.78	55.64	-8.86	19.63	Line	-	27.15	9.69	0.04	9.90
QP	263.357k	54.25	61.32	-7.07	19.63	Line	-	34.62	9.68	0.05	9.90
AV	263.357k	51.25	51.32	-0.07	19.63	Line	-	31.62	9.68	0.05	9.90
QP	366.811k	51.84	58.58	-6.74	19.63	Line	-	32.21	9.67	0.06	9.90
AV	366.811k	48.18	48.58	-0.40	19.63	Line	-	28.55	9.67	0.06	9.90
QP	987.197k	48.44	56.00	-7.56	19.55	Line	-	28.89	9.67	0.08	9.80
AV	987.197k	45.14	46.00	-0.86	19.55	Line	-	25.59	9.67	0.08	9.80
QP	2.025M	47.55	56.00	-8.45	19.58	Line	-	27.97	9.68	0.10	9.80
AV	2.025M	45.14	46.00	-0.86	19.58	Line	-	25.56	9.68	0.10	9.80
QP	20.513M	42.07	60.00	-17.93	19.86	Line	-	22.21	9.66	0.30	9.90
AV	20.513M	35.01	50.00	-14.99	19.86	Line	-	15.15	9.66	0.30	9.90

Conducted Emissions at Powerline_Mode 1



Type	Freq	Level	Limit	Margin	Factor	Condition	Comment	Raw	LISN	CL	AT
	(Hz)	(dBuV)	(dBuV)	(dB)	(dB)			(dBuV)	(dB)	(dB)	(dB)
QP	156.734k	50.08	65.64	-15.56	19.63	Neutral	-	30.45	9.69	0.04	9.90
AV	156.734k	46.67	55.64	-8.97	19.63	Neutral	-	27.04	9.69	0.04	9.90
QP	207.263k	45.50	63.30	-17.80	19.62	Neutral	-	25.88	9.68	0.04	9.90
AV	207.263k	40.50	53.30	-12.80	19.62	Neutral	-	20.88	9.68	0.04	9.90
QP	275.179k	45.15	60.95	-15.80	19.63	Neutral	-	25.52	9.68	0.05	9.90
AV	275.179k	39.62	50.95	-11.33	19.63	Neutral	-	19.99	9.68	0.05	9.90
QP	987.197k	48.56	56.00	-7.44	19.55	Neutral	-	29.01	9.67	0.08	9.80
AV	987.197k	45.19	46.00	-0.81	19.55	Neutral	-	25.64	9.67	0.08	9.80
QP	2.025M	47.77	56.00	-8.23	19.58	Neutral	-	28.19	9.68	0.10	9.80
AV	2.025M	45.52	46.00	-0.48	19.58	Neutral	-	25.94	9.68	0.10	9.80
QP	15.762M	38.07	60.00	-21.93	19.90	Neutral	-	18.17	9.74	0.26	9.90
AV	15.762M	29.91	50.00	-20.09	19.90	Neutral	-	10.01	9.74	0.26	9.90

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).

3.2.2 Measuring Instruments

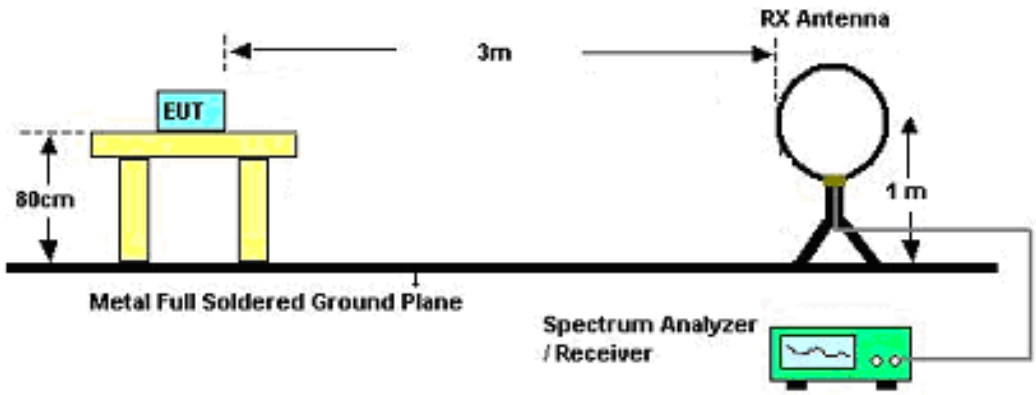
Refer a test equipment and calibration data table in this test report.

3.2.3 Test Procedures

Test Method
☒ 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.
☒ 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



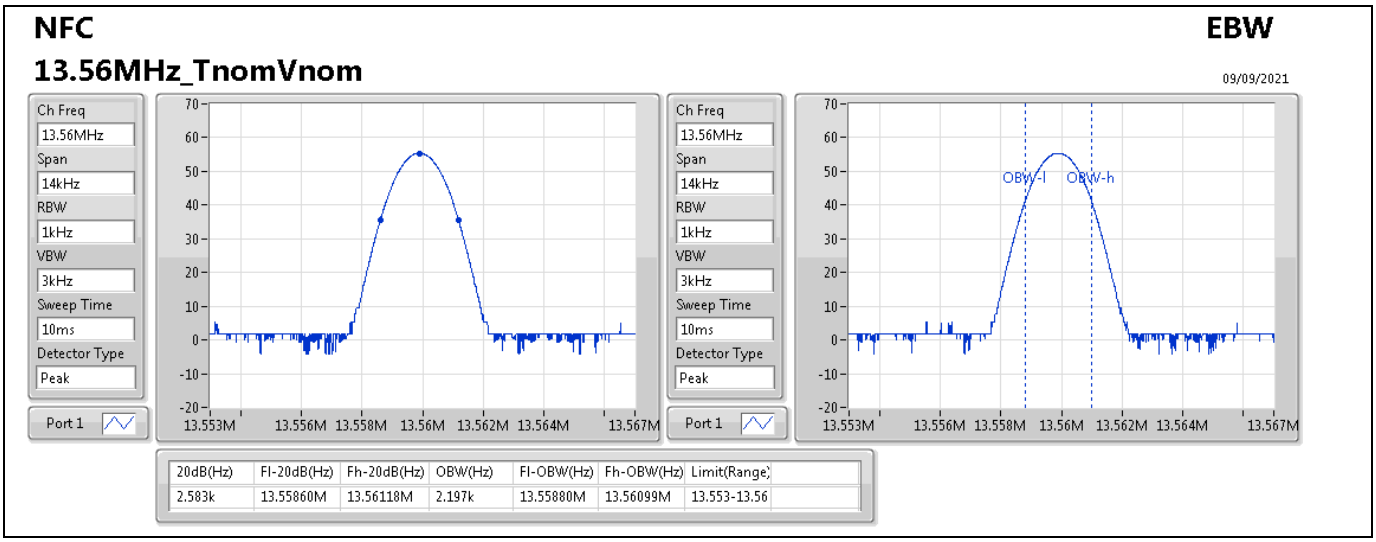
3.2.5 Test Result of Emission Bandwidth

Summary

Mode	20dB (Hz)	Fl-20dB (Hz)	Fh-20dB (Hz)	OBW (Hz)	Limit (Range)
13.553-13.567MHz	-	-	-	-	-
NFC	2.583k	13.55860M	13.56118M	2.197k	13.553-13.567

Result

Mode	Result	20dB (Hz)	Fl-20dB (Hz)	Fh-20dB (Hz)	OBW (Hz)	Fl-OBW (Hz)	Fh-OBW (Hz)	Limit (Range)
NFC	-	-	-	-	-	-	-	-
13.56MHz_TnomVnom	Pass	2.583k	13.55860M	13.56118M	2.197k	13.55880M	13.56099M	13.553-13.567



3.3 Frequency Stability

3.3.1 Frequency Stability Limit

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

3.3.2 Measuring Instruments

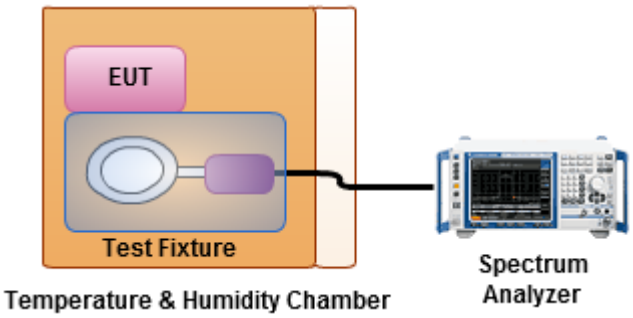
Refer a test equipment and calibration data table in this test report.

3.3.3 Test Procedures

Test Method	
☒	Refer as ANSI C63.10, clause 6.8 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.

3.3.4 Test Setup

Frequency Stability



3.3.5 Test Result of Frequency Stability

Summary

Mode	Result	Ch (Hz)	Center (Hz)	ppm	Limit (ppm)	Port	Remark
13.553-13.567MHz	-	-	-	-	-	-	-
NFC	Pass	13.56M	13.559809M	14.0654	100	1	10 min

Result

Mode	Result	Ch (Hz)	Center (Hz)	ppm	Limit (ppm)	Port	Remark
NFC	-	-	-	-	-	-	-
13.56MHz_-20°C	Pass	13.56M	13.559847M	11.291	100	1	0 min
13.56MHz_-20°C	Pass	13.56M	13.559847M	11.291	100	1	2 min
13.56MHz_-20°C	Pass	13.56M	13.559847M	11.291	100	1	5 min
13.56MHz_-20°C	Pass	13.56M	13.559847M	11.291	100	1	10 min
13.56MHz_-10°C	Pass	13.56M	13.559845M	11.42	100	1	0 min
13.56MHz_-10°C	Pass	13.56M	13.559845M	11.42	100	1	2 min
13.56MHz_-10°C	Pass	13.56M	13.559845M	11.42	100	1	5 min
13.56MHz_-10°C	Pass	13.56M	13.559845M	11.42	100	1	10 min
13.56MHz_0°C	Pass	13.56M	13.559832M	12.3878	100	1	0 min
13.56MHz_0°C	Pass	13.56M	13.559833M	12.3233	100	1	2 min
13.56MHz_0°C	Pass	13.56M	13.559832M	12.3878	100	1	5 min
13.56MHz_0°C	Pass	13.56M	13.559833M	12.3233	100	1	10 min
13.56MHz_10°C	Pass	13.56M	13.55983M	12.5169	100	1	0 min
13.56MHz_10°C	Pass	13.56M	13.559831M	12.4524	100	1	2 min
13.56MHz_10°C	Pass	13.56M	13.55983M	12.5169	100	1	5 min
13.56MHz_10°C	Pass	13.56M	13.55983M	12.5169	100	1	10 min
13.56MHz_20°C	Pass	13.56M	13.559818M	13.4202	100	1	0 min
13.56MHz_20°C	Pass	13.56M	13.559818M	13.4202	100	1	2 min
13.56MHz_20°C	Pass	13.56M	13.559817M	13.4847	100	1	5 min
13.56MHz_20°C	Pass	13.56M	13.559818M	13.4202	100	1	10 min
13.56MHz_30°C	Pass	13.56M	13.559812M	13.8718	100	1	0 min
13.56MHz_30°C	Pass	13.56M	13.559812M	13.8718	100	1	2 min
13.56MHz_30°C	Pass	13.56M	13.559811M	13.9363	100	1	5 min
13.56MHz_30°C	Pass	13.56M	13.559811M	13.9363	100	1	10 min
13.56MHz_40°C	Pass	13.56M	13.559811M	13.9363	100	1	0 min
13.56MHz_40°C	Pass	13.56M	13.55981M	14.0008	100	1	2 min
13.56MHz_40°C	Pass	13.56M	13.55981M	14.0008	100	1	5 min
13.56MHz_40°C	Pass	13.56M	13.55981M	14.0008	100	1	10 min
13.56MHz_50°C	Pass	13.56M	13.55981M	14.0008	100	1	0 min
13.56MHz_50°C	Pass	13.56M	13.55981M	14.0008	100	1	2 min
13.56MHz_50°C	Pass	13.56M	13.55981M	14.0008	100	1	5 min
13.56MHz_50°C	Pass	13.56M	13.559809M	14.0654	100	1	10 min
13.56MHz_20°C-240V	Pass	13.56M	13.559891M	8.065	100	1	0 min

Mode	Result	Ch (Hz)	Center (Hz)	ppm	Limit (ppm)	Port	Remark
13.56MHz_20°C-240V	Pass	13.56M	13.559892M	7.936	100	1	2 min
13.56MHz_20°C-240V	Pass	13.56M	13.559892M	7.936	100	1	5 min
13.56MHz_20°C-240V	Pass	13.56M	13.559892M	7.936	100	1	10 min
13.56MHz_20°C-230V	Pass	13.56M	13.559892M	7.936	100	1	0 min
13.56MHz_20°C-230V	Pass	13.56M	13.559892M	7.936	100	1	2 min
13.56MHz_20°C-230V	Pass	13.56M	13.559892M	7.936	100	1	5 min
13.56MHz_20°C-230V	Pass	13.56M	13.559892M	7.936	100	1	10 min
13.56MHz_20°C-196V	Pass	13.56M	13.559892M	7.936	100	1	0 min
13.56MHz_20°C-196V	Pass	13.56M	13.559892M	7.936	100	1	2 min
13.56MHz_20°C-196V	Pass	13.56M	13.559892M	7.936	100	1	5 min
13.56MHz_20°C-196V	Pass	13.56M	13.559892M	7.936	100	1	10 min

3.4 Field Strength of Fundamental Emissions and Spectrum Mask

3.4.1 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

3.4.2 Measuring Instruments

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

3.4.3 Test Procedures

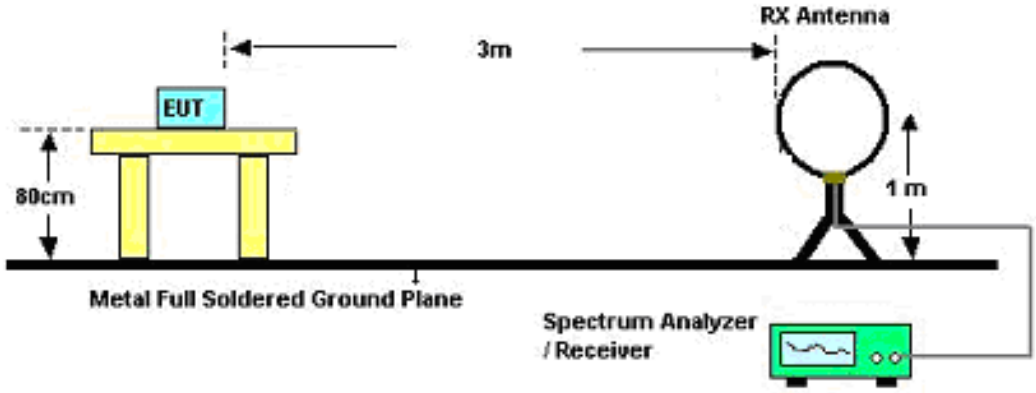
Test Method		
☒	Refer as ANSI C63.10, clause 6.4 for radiated emissions from below 30 MHz and test distance is 3m.	
☒	At frequencies below 30 MHz, measurements may be performed at a distance closer than that specified in the requirements; however, an attempt should be made to avoid making measurements 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.	

3.4.4 Measurement Results Calculation

The measured Level is calculated using:
Corrected Reading: Raw(Read Level) + AF(Antenna Factor) + CL(Cable Loss) - PA(Preamp Factor).

3.4.5 Test Setup

Field Strength of Fundamental Emissions and Spectrum Mask

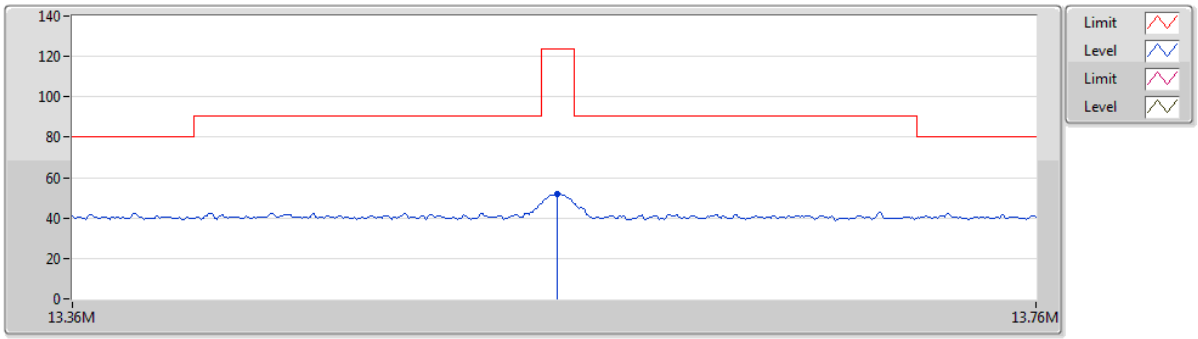


3.4.6 Test Result of Field Strength of Fundamental Emissions and Spectrum Mask

NFC Operating below 30MHz

13.56MHz_Switching Power Supply

07/09/2021



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	13.56M	51.78	124.00	-72.22	23.25	3	Horizontal	360	1.00	-	28.53	22.58	0.67	-

3.5 Transmitter Radiated Unwanted Emissions

3.5.1 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.

3.5.2 Measuring Instruments

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

3.5.3 Test Procedures

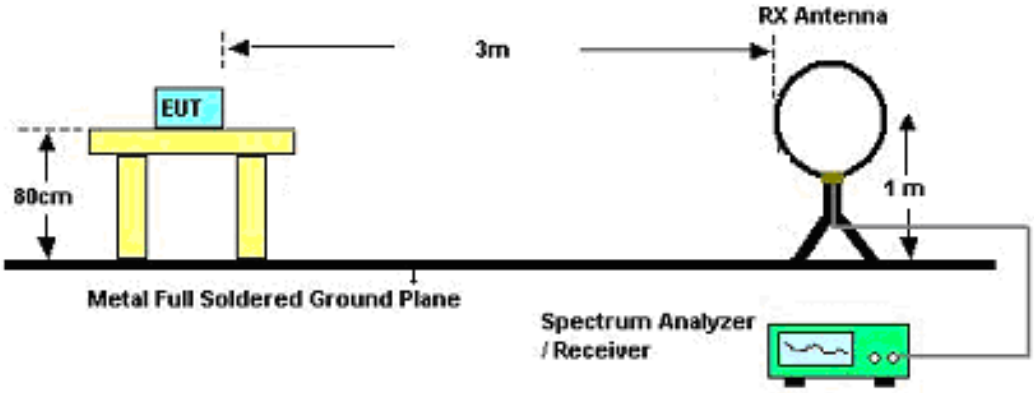
Test Method		
☒	Refer as ANSI C63.10, clause 6.5 for radiated emissions from 30 MHz to 1 GHz and test distance is 3m.	
☒	Refer as ANSI C63.10, clause 6.4 for radiated emissions from below 30 MHz and test distance is 3m.	
☒	At frequencies below 30 MHz, measurements may be performed at a distance closer 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.	
☒	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.

3.5.4 Measurement Results Calculation

The measured Level is calculated using:
Corrected Reading: Raw(Read Level) + AF(Antenna Factor) + CL(Cable Loss) - PA(Preamp Factor)

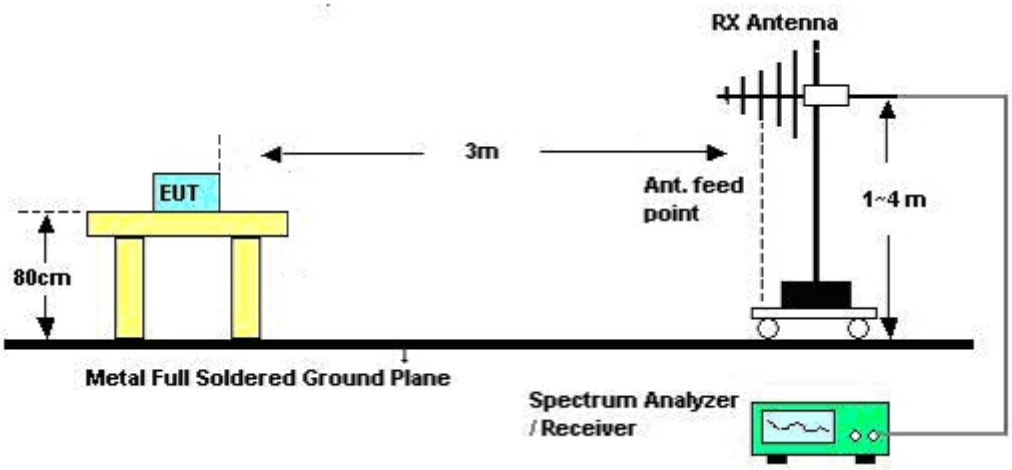
3.5.5 Test Setup

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.

3.5.6 Test Result of 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	1.762M	49.43	69.50	-20.07	20.62	3	360	1.00	-

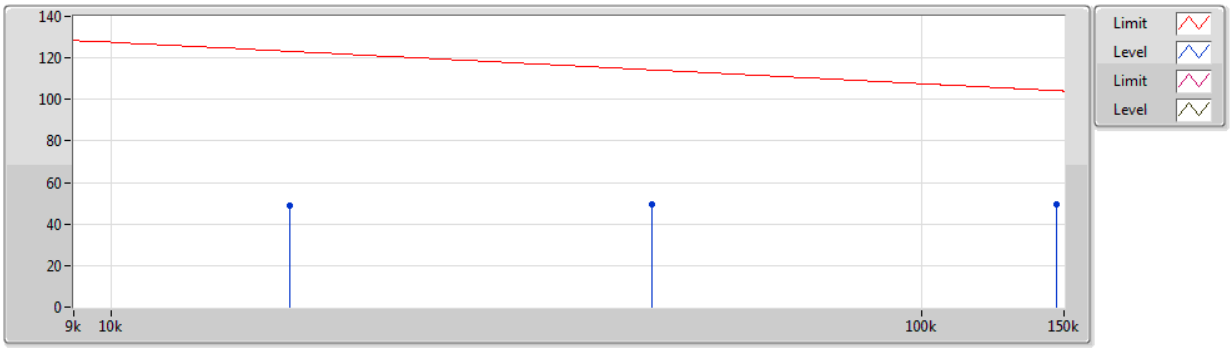
Result

Mode	Result	Type	Freq (Hz)	Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Factor (dB)	Dist (m)	Azimuth (°)	Height (m)	Comments
NFC	-	-	-	-	-	-	-	-	-	-	-
13.56MHz_Switching Power Supply	Pass	PK	16.614k	49.12	123.18	-74.06	20.32	3	0	1.00	-
13.56MHz_Switching Power Supply	Pass	PK	46.506k	49.65	114.23	-64.58	21.26	3	0	1.00	-
13.56MHz_Switching Power Supply	Pass	PK	146.616k	49.69	104.27	-54.58	20.35	3	0	1.00	-
13.56MHz_Switching Power Supply	Pass	PK	806.7k	48.99	69.48	-20.49	20.70	3	360	1.00	-
13.56MHz_Switching Power Supply	Pass	PK	1.762M	49.43	69.50	-20.07	20.62	3	360	1.00	-
13.56MHz_Switching Power Supply	Pass	PK	2.359M	48.15	69.50	-21.35	20.57	3	360	1.00	-

NFC Operating below 30MHz

13.56MHz_Switching Power Supply

07/09/2021

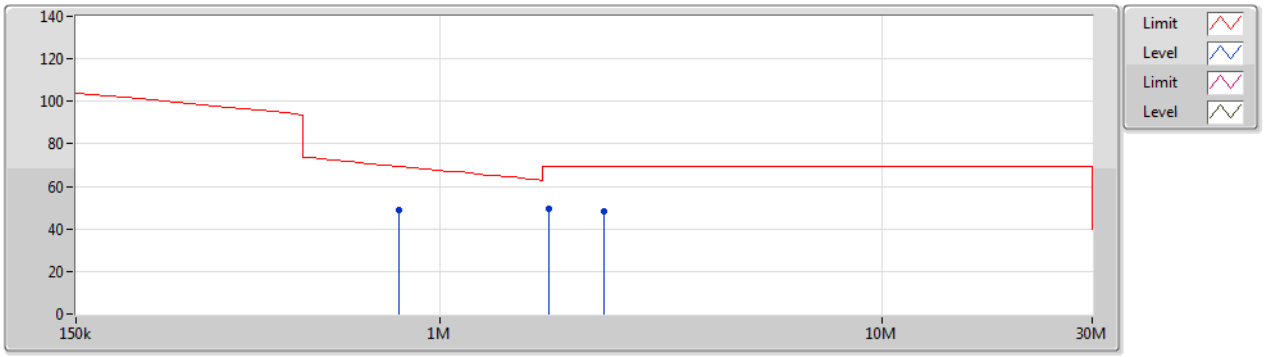


Type	Freq	Level	Limit	Margin	Factor	Dist	Condition	Azimuth	Height	Comment	Raw	AF	CL	PA
	(Hz)	(dBuV/m)	(dBuV/m)	(dB)	(dB)	(m)		(°)	(m)		(dBuV)	(dB)	(dB)	(dB)
PK	16.614k	49.12	123.18	-74.06	20.32	3	Horizontal	0	1.00	-	28.80	20.11	0.21	-
PK	46.506k	49.65	114.23	-64.58	21.26	3	Horizontal	0	1.00	-	28.39	21.04	0.22	-
PK	146.616k	49.69	104.27	-54.58	20.35	3	Horizontal	0	1.00	-	29.34	20.11	0.24	-

NFC Operating below 30MHz

07/09/2021

13.56MHz_Switching Power Supply



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	806.7k	48.99	69.48	-20.49	20.70	3	Horizontal	360	1.00	-	28.29	20.40	0.30	-
PK	1.762M	49.43	69.50	-20.07	20.62	3	Horizontal	360	1.00	-	28.81	20.25	0.37	-
PK	2.359M	48.15	69.50	-21.35	20.57	3	Horizontal	360	1.00	-	27.58	20.17	0.40	-

3.5.7 Test Result of 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	825.4M	42.79	46.00	-3.21	1.37	3	330	1.00	-

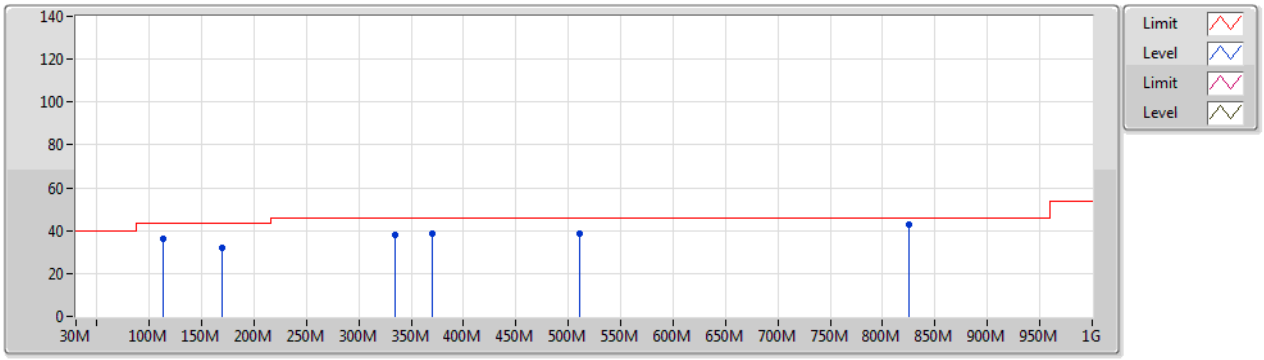
Result

Mode	Result	Type	Freq (Hz)	Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Factor (dB)	Dist (m)	Azimuth (°)	Height (m)	Comments
NFC	-	-	-	-	-	-	-	-	-	-	-
13.56MHz_Switching Power Supply	Pass	PK	169.68M	31.93	43.50	-11.57	-10.83	3	0	1.00	-
13.56MHz_Switching Power Supply	Pass	PK	334.58M	38.31	46.00	-7.69	-5.79	3	0	1.00	-
13.56MHz_Switching Power Supply	Pass	PK	369.5M	38.66	46.00	-7.34	-4.90	3	0	1.00	-
13.56MHz_Switching Power Supply	Pass	PK	511.12M	38.73	46.00	-7.27	-2.41	3	0	1.00	-
13.56MHz_Switching Power Supply	Pass	QP	113.42M	35.92	43.50	-7.58	-9.03	3	140	1.00	-
13.56MHz_Switching Power Supply	Pass	QP	825.4M	42.57	46.00	-3.43	1.37	3	339	1.00	-
13.56MHz_Switching Power Supply	Pass	PK	113.42M	40.13	43.50	-3.37	-9.03	3	360	1.00	-
13.56MHz_Switching Power Supply	Pass	PK	167.74M	35.33	43.50	-8.17	-10.76	3	360	1.00	-
13.56MHz_Switching Power Supply	Pass	PK	255.04M	41.64	46.00	-4.36	-6.75	3	360	1.00	-
13.56MHz_Switching Power Supply	Pass	PK	344.28M	39.43	46.00	-6.57	-5.48	3	360	1.00	-
13.56MHz_Switching Power Supply	Pass	PK	431.58M	35.73	46.00	-10.27	-3.30	3	360	1.00	-
13.56MHz_Switching Power Supply	Pass	QP	825.4M	42.79	46.00	-3.21	1.37	3	330	1.00	-

NFC Operating above 30MHz

13.56MHz_Switching Power Supply

01/09/2021

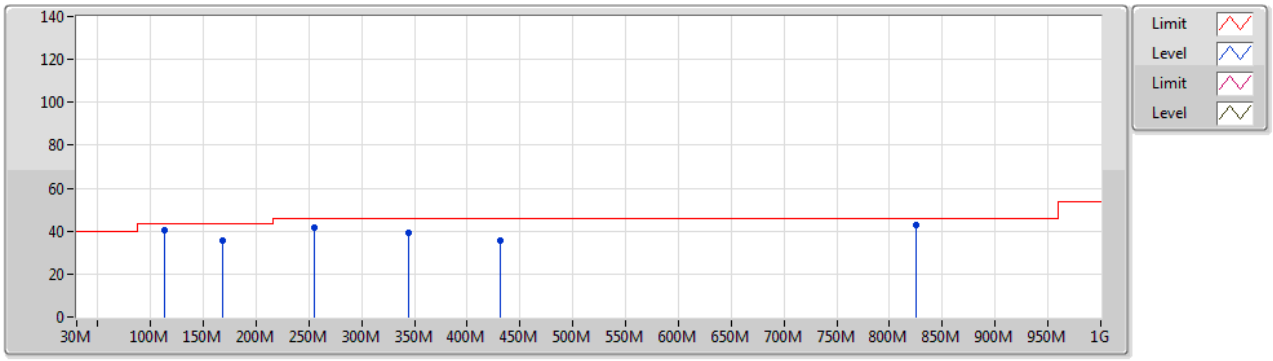


Type	Freq	Level	Limit	Margin	Factor	Dist	Condition	Azimuth	Height	Comment	Raw	AF	CL	PA
	(Hz)	(dBuV/m)	(dBuV/m)	(dB)	(dB)	(m)		(°)	(m)		(dBuV)	(dB)	(dB)	(dB)
PK	169.68M	31.93	43.50	-11.57	-10.83	3	Vertical	0	1.00	-	42.76	14.85	1.81	27.49
PK	334.58M	38.31	46.00	-7.69	-5.79	3	Vertical	0	1.00	-	44.10	18.97	2.49	27.25
PK	369.5M	38.66	46.00	-7.34	-4.90	3	Vertical	0	1.00	-	43.56	19.99	2.62	27.51
PK	511.12M	38.73	46.00	-7.27	-2.41	3	Vertical	0	1.00	-	41.14	22.83	3.10	28.34
QP	113.42M	35.92	43.50	-7.58	-9.03	3	Vertical	140	1.00	-	44.95	17.26	1.50	27.79
QP	825.4M	42.57	46.00	-3.43	1.37	3	Vertical	339	1.00	-	41.20	25.23	3.94	27.80

NFC Operating above 30MHz

01/09/2021

13.56MHz_Switching Power Supply



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	113.42M	40.13	43.50	-3.37	-9.03	3	Horizontal	360	1.00	-	49.16	17.26	1.50	27.79
PK	167.74M	35.33	43.50	-8.17	-10.76	3	Horizontal	360	1.00	-	46.09	14.94	1.80	27.50
PK	255.04M	41.64	46.00	-4.36	-6.75	3	Horizontal	360	1.00	-	48.39	18.10	2.17	27.02
PK	344.28M	39.43	46.00	-6.57	-5.48	3	Horizontal	360	1.00	-	44.91	19.29	2.53	27.30
PK	431.58M	35.73	46.00	-10.27	-3.30	3	Horizontal	360	1.00	-	39.03	21.82	2.84	27.96
QP	825.4M	42.79	46.00	-3.21	1.37	3	Horizontal	330	1.00	-	41.42	25.23	3.94	27.80

4 Test Equipment and Calibration Data

Instrument for AC Conduction

Instrument	Manufacturer / Brand	Model No.	Serial No.	Characteristics	Calibration Date	Calibration Due Date
EMI Test Receiver	R&S	ESR	102052	9kHz ~ 3.6GHz	19/Apr/2021	18/Apr/2022
LISN	R&S	ENV216	101295	9kHz ~ 30MHz	11/Nov/2020	10/Nov/2021
RF Cable 5m	TITAN	TITAN	CO04-cable-01	0.1MHz~200MHz	03/Mar/2021	02/Mar/2022
Impuls Begrenzer Pulse Limiter	SCHWARZBECK	VTSD 9561-F	9561-F041	9kHz ~ 30MHz	21/Sep/2020	20/Sep/2021

Instrument for Conducted Test

Instrument	Manufacturer / Brand	Model No.	Serial No.	Characteristics	Calibration Date	Calibration Due Date
Signal Analyzer	R&S	FSV 40	101515	10Hz~40GHz	26/Mar/2021	25/Mar/2022
Programmable Temp. & Humi. Chamber	Giant Force	GTH-225-40-CP-AR	MAA1311-008	-40~100℃	08/Jun/2021	07/Jun/2022

Instrument for Radiated Test

Instrument	Manufacturer / Brand	Model No.	Serial No.	Characteristics	Calibration Date	Calibration Due Date
3m Semi Anechoic Chamber	SIDT FRANKONIA	SAC-3M	03CH02-HY	30MHz~1GHz 3m	02/Aug/2021	01/Aug/2022
Signal Analyzer	R&S	FSP40	100593	9kHz~40GHz	12/Mar/2021	11/Mar/2022
Amplifier	Agilent	8447D	2944A11149	100kHz~1.3GHz	29/Jun/2021	28/Jun/2022
Bilog Antenna & 5dB Attenuator	SCHAFFNER / MTJ	CBL 6112B / MTJ6102-05	2723 / 2	30MHz~1GHz	06/Sep/2020	05/Sep/2021
RF Cable	MVE	400LL	MVE-1-0802	9kHz~30MHz	05/May/2021	04/May/2022
RF Cable	MVE	400LL	MVE-1-0802	30MHz~1GHz	05/May/2021	04/May/2022
Loop Antenna	TESEQ	HLA 6120	31244	9kHz~30MHz	16/Mar/2021	15/Mar/2022
EMI Test Receiver	R&S	ESR3	102052	9kHz~3.6GHz	19/Apr/2021	18/Apr/2022