FCC RADIO TEST REPORT

FCC ID	:	UZ7TC720L
Equipment	:	Touch computer
Brand Name	:	Zebra
Model Name	:	TC720L
Applicant	:	Zebra Technologies Corporation 1 Zebra Plaza Holtsville, NY 11742
Manufacturer	:	Zebra Technologies Corporation 1 Zebra Plaza Holtsville, NY 11742
Standard	:	FCC Part 15 Subpart C §15.225

The product was received on Jul. 25, 2018 and testing was started from Aug. 06, 2018 and completed on Aug. 11, 2018. We, SPORTON INTERNATIONAL INC., would like to declare that the tested sample has been evaluated in accordance with the test procedures and has been in 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 government.

The test results in this variant 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: Joseph 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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History of this test report

Report No.	Version	Description	Issued Date
FR872508D	01	Initial issue of report	Sep. 20, 2018

Summary of Test Result

Report Clause	Ref Std. Clause	Test Items	Result (PASS/FAIL)	Remark
-	15.207	AC Power Line Conducted Emissions	Not Required	-
-	15.215(c)	20dB Spectrum Bandwidth	Not Required	-
	2.1049	99% OBW Spectrum Bandwidth	Not Required	-
-	15.225(e)	Frequency Stability	Not Required	-
3.1	15.225(a)(b)(c)	Field Strength of Fundamental Emissions	Pass	Max level 59.22 dBμV/m at 13.560 MHz
3.2	15.225(d) 15.209	Radiated Spurious Emissions	Pass	Under limit 4.26 dB at 40.800MHz
3.3	15.203	Antenna Requirements	Pass	-

Remark:

1. This is a variant report which can be referred Product Equality Declaration. All the test cases were performed on original report which can be referred to Sporton Report Number FR872506D. Based on the original report, the test cases were verified.

2. Not required means after assessing, test items are not necessary to carry out.

Reviewed by: Wii Chang

Report Producer: Nancy Yang

1. General Description

1.1 Product Feature of Equipment Under Test

Product Feature	
Equipment	Touch computer
Brand Name	Zebra
Model Name	TC720L
FCC ID	UZ7TC720L
EUT supports Radios application	NFC WLAN 11a/b/g/n HT20/HT40 WLAN 11ac VHT20/VHT40/VHT80 Bluetooth BR/EDR/LE
HW Version	DV
SW Version	Android version 8.1.0
FW Version	91-09-14.00-OG-U00-STD
MFD	03JUL18
EUT Stage	Engineering Sample

Remark: The above EUT's information was declared by manufacturer.

Specification of Accessories				
AC Adapter	**Brand Name**	Zebra	**Part Number**	PWR-BUA5V16W0WW
4 PIN DC power cable	**Brand Name**	Zebra	**Part Number**	CBL-DC-383A1-01
AC Power cable	**Brand Name**	Zebra	**Part Number**	50-16000-182R
Snap-On USB/Charge Cable	**Brand Name**	Zebra	**Part Number**	CBL-TC7X-USB1-01
Snap-On Charging Cable Cup	**Brand Name**	Zebra	**Part Number**	CHG-TC7X-CBL1-01
Battery 1	**Brand Name**	Zebra	**Part Number**	BT-000318-01
Battery 2 (Falcon 1S3P Battery Pack)	**Brand Name**	Zebra	**Part Number**	BT-000318-51
Battery 3	**Brand Name**	Symbol	**Part Number**	82-171249-02
Earphone 1	**Brand Name**	Zebra	**Part Number**	HDST-35MM-PTVP-01
Earphone 2	**Brand Name**	Zebra	**Part Number**	HS2100-OTH
Snap-on 3.5MM Audio Jack Adapter	**Brand Name**	Symbol	**Part Number**	ADP-TC7X-AUD35-01
3.5mm Jack 43"(1.1m) Standard Cable	**Brand Name**	Zebra	**Part Number**	CBL-HS2100-3MS1-01
Holster	**Brand Name**	Zebra	**Part Number**	SG-TC7X-HLSTR1-02
Rigid Holster	**Brand Name**	Zebra	**Part Number**	SG-TC7X-RHLSTR1-01

1.2 Modification of EUT

No modifications are made to the EUT during all test items.

1.3 Testing Location

Sporton Lab is accredited to ISO 17025 by Taiwan Accreditation Foundation (TAF code : 1190) and the FCC designation No. TW0007 under the FCC 2.948(e) by Mutual Recognition Agreement (MRA) in FCC Test.

Test Site	SPORTON INTERNATIONAL INC.
Test Site Location	No.52, Huaya 1st Rd., Guishan Dist., Taoyuan City, Taiwan (R.O.C.) TEL: +886-3-327-3456 FAX: +886-3-328-4978
Test Site No.	**Sporton Site No.**
	03CH07-HY
Test Engineer	Stan Hsieh
Temperature	23~24℃
Relative Humidity	51~53%

Note: The test site complies with ANSI C63.4 2014 requirement.

1.4 Applicable Standards

According to the specifications of the manufacturer, the EUT must comply with the requirements of the following standards:

- FCC Part 15 Subpart C §15.225
- ANSI C63.10-2013

2. Test Configuration of Equipment Under Test

2.1 Descriptions of Test Mode

Investigation has been done on all the possible configurations.

The following table is a list of the test modes shown in this test report.

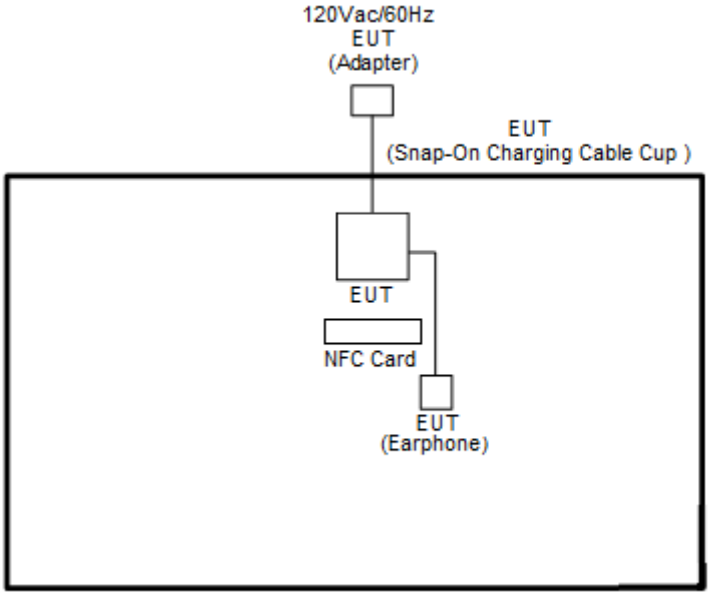
Test Items	
Radiated Emissions 9kHz~30MHz	Radiated Emissions 30MHz~1GHz

Remark: For Radiated Test Cases, the tests were performed with Battery 2 and Earphone 1.

Pre-scanned tests, X, Y, Z in three orthogonal panels to determine the final configuration (Y plane as worst plane) from all possible combinations.

2.2 Connection Diagram of Test System

<Radiated Emission Mode>



2.3 Table for Supporting Units

Item	Equipment	Trade Name	Model Name	FCC ID	Data Cable	Power Cord
1.	NFC Card	N/A	N/A	N/A	N/A	N/A

2.4 EUT Operation Test Setup

The EUT was programmed to be in continuously transmitting mode.

The ancillary equipment, NFC card, is used to make the EUT (NFC) continuously transmit at 13.56MHz and is placed around 0 cm gap to the EUT.

3. Test Results

3.1 Field Strength of Fundamental Emissions and Mask Measurement

3.1.1 Limit

Rules and specifications	FCC CFR 47 Part 15 section 15.225			
Description	Compliance with the spectrum mask is tested with RBW set to 9kHz.			
Freq. of Emission (MHz)	Field Strength (μV/m) at 30m	Field Strength (dBμV/m) at 30m	Field Strength (dBμV/m) at 10m	Field Strength (dBμV/m) at 3m
1.705~13.110	30	29.5	48.58	69.5
13.110~13.410	106	40.5	59.58	80.5
13.410~13.553	334	50.5	69.58	90.5
13.553~13.567	15848	84.0	103.08	124.0
13.567~13.710	334	50.5	69.58	90.5
13.710~14.010	106	40.5	59.58	80.5
14.010~30.000	30	29.5	48.58	69.5

3.1.2 Measuring Instruments

See list of measuring instruments of this test report.

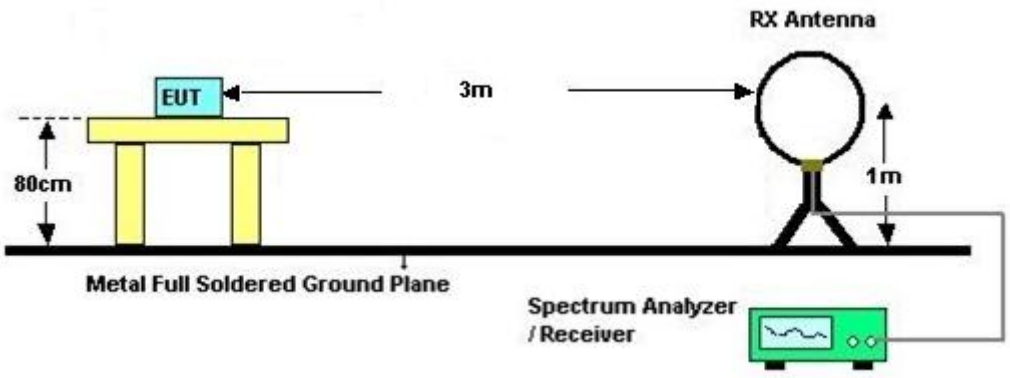
3.1.3 Test Procedures

1. Configure the EUT according to ANSI C63.10. The EUT was placed on the top of the turntable 0.8 meter above ground. The phase center of the loop receiving antenna mounted antenna tower was placed 3 meters far away from the turntable.
2. Power on the EUT and all the supporting units. The turntable was rotated by 360 degrees to determine the position of the highest radiation.
3. The height of the receiving antenna was fixed at one meter above ground to find the maximum emissions field strength.
4. For Fundamental emissions, use the receiver to measure QP reading.
5. When the radiated emissions limits are expressed in terms of the average value of the emissions, and pulsed operation is employed, the measurement field strength shall be determined by averaging over one complete pulse train, including blanking intervals, as long as the pulse train does not exceed 0.1 seconds. As an alternative (provided the transmitter operates for longer than 0.1 seconds) or in cases where the pulse train exceeds 0.1 seconds, the measured field strength shall be determined from the average absolute voltage during a 0.1 second interval during which the field strength is at its maximum value.
6. Compliance with the spectrum mask is tested with RBW set to 9kHz.

   Note: Emission level (dBμV/m) = 20 log Emission level (μV/m).

3.1.4 Test Setup

For radiated emissions below 30MHz



3.1.5 Test Result of Field Strength of Fundamental Emissions and Mask

Please refer to Appendix A.

3.2 Radiated Emissions Measurement

3.2.1 Limit

The field strength of any emissions which appear outside of 13.110 ~14.010MHz band shall not exceed the general radiated emissions limits.

Frequencies (MHz)	Field Strength (μV/m)	Measurement Distance (meters)
0.009~0.490	2400/F(kHz)	300
0.490~1.705	24000/F(kHz)	30
1.705~30.0	30	30
30~88	100	3
88~216	150	3
216~960	200	3
Above 960	500	3

3.2.2 Measuring Instruments

See list of measuring instruments of this test report.

3.2.3 Measuring Instrument Setting

The following table is the setting of receiver:

Receiver Parameter	Setting
Attenuation	Auto
Frequency Range: 9kHz~150kHz	RBW 200Hz for QP
Frequency Range: 150kHz~30MHz	RBW 9kHz for QP
Frequency Range: 30MHz~1000MHz	RBW 120kHz for Peak

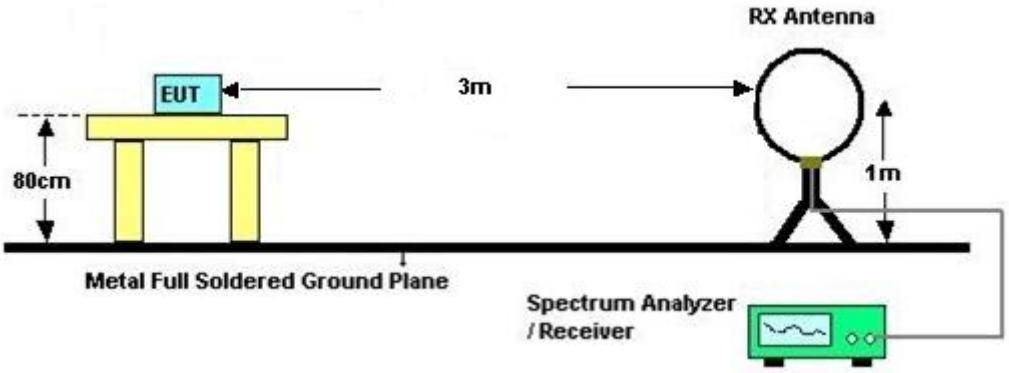
Note: The emission limits shown in the above table are based on measurements employing a CISPR quasi-peak detector except for the frequency bands 9-90 kHz and 110-490 kHz. Radiated emission limits in these two bands are based on measurements employing an average detector.

3.2.4 Test Procedures

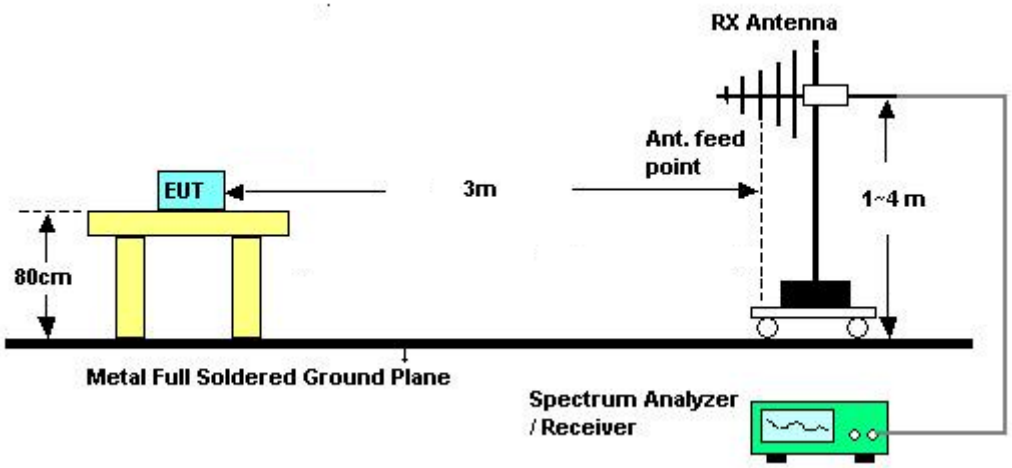
1. Configure the EUT according to ANSI C63.10. The EUT was placed on the top of the turntable 0.8 meter above ground. The phase center of the receiving antenna mounted on the top of a height-variable antenna tower was placed 3 meters far away from the turntable.
2. Power on the EUT and all the supporting units. The turntable was rotated by 360 degrees to determine the position of the highest radiation.
3. The height of the broadband receiving antenna was varied between one meter and four meters above ground to find the maximum emissions field strength of both horizontal and vertical polarization.
4. For each suspected emissions, the antenna tower was scan (from 1 M to 4 M) and then the turntable was rotated (from 0 degree to 360 degrees) to find the maximum reading.
5. Set the test-receiver system to Peak or CISPR quasi-peak Detect Function with specified bandwidth under Maximum Hold Mode.
6. When the radiated emissions limits are expressed in terms of the average value of the emissions, and pulsed operation is employed, the measurement field strength shall be determined by averaging over one complete pulse train, including blanking intervals, as long as the pulse train does not exceed 0.1 seconds. As an alternative (provided the transmitter operates for longer than 0.1 seconds) or in cases where the pulse train exceeds 0.1 seconds, the measured field strength shall be determined from the average absolute voltage during a 0.1 second interval during which the field strength is at its maximum value.
7. In case the emission is lower than 30MHz, loop antenna has to be used for measurement and the recorded data should be QP measured by receiver.

3.2.5 Test Setup

For radiated emissions below 30MHz



For radiated emissions above 30MHz



3.2.6 Test Result of Radiated Emissions Measurement

Please refer to Appendix A.

Remark: There is a comparison data of both open-field test site and semi-Anechoic chamber, and the result came out very similar.

3.3 Antenna Requirements

3.3.1 Standard Applicable

Except for special regulations, the Low-power Radio-frequency Devices must not be equipped with any jacket for installing an antenna with extension cable. An intentional radiator shall be designed to ensure that no antenna other than that furnished by the responsible party shall be used with the device. The use of a permanently attached antenna or of an antenna that uses a unique coupling to the intentional radiator shall be considered sufficient to comply with the provisions of this Section. The manufacturer may design the unit so that the user can replace a broken antenna, but the use of a standard antenna jack or electrical connector is prohibited.

The use of a permanently attached antenna or of an antenna that uses a unique coupling to the intentional radiator shall be considered sufficient to comply with the rule.

3.3.2 Antenna Anti-Replacement Construction

An embedded-in antenna design is used.

4. List of Measuring Equipment

Instrument	Manufacturer	Model No.	Serial No.	Characteristics	Calibration Date	Test Date	Due Date	Remark
Bilog Antenna	TESEQ	CBL 6111D&00800N1D01N-06	35419&03	30MHz to 1GHz	Dec. 18, 2017	Aug. 06, 2018~ Aug. 07, 2018	Dec. 17, 2018	Radiation (03CH07-HY)
Double Ridge Horn Antenna	ESCO	3117	00075962	1GHz ~ 18GHz	Aug. 23, 2017	Aug. 06, 2018~ Aug. 07, 2018	Aug. 22, 2018	Radiation (03CH07-HY)
Loop Antenna	Rohde & Schwarz	HFH2-Z2	100315	9 kHz~30 MHz	Nov. 10, 2017	Aug. 06, 2018~ Aug. 07, 2018	Nov. 09, 2018	Radiation (03CH07-HY)
Preamplifier	COM-POWER	PA-103A	161241	10MHz-1GHz	May 21, 2018	Aug. 06, 2018~ Aug. 07, 2018	May 20, 2019	Radiation (03CH07-HY)
Filter	Wainwright	WHK20/1000C7/40SS	SN3	20M High Pass	Nov. 21, 2017	Aug. 06, 2018~ Aug. 07, 2018	Nov. 20, 2018	Radiation (03CH07-HY)
RF Cable	HUBER + SUHNER	SUCOFLEX 104	MY24971/4,MY28655/4	9KHz~30MHz	Jan. 02, 2018	Aug. 06, 2018~ Aug. 07, 2018	Jan. 01, 2019	Radiation (03CH07-HY)
RF Cable	HUBER + SUHNER	SUCOFLEX 104	MY28655/4, MY24971/4, MY15682/4	30MHz~1GHz	Feb. 27, 2018	Aug. 06, 2018~ Aug. 07, 2018	Feb. 26, 2019	Radiation (03CH07-HY)
Software	Audix	E3 6.2009-8-24	80504004656H	N/A	N/A	Aug. 06, 2018~ Aug. 07, 2018	N/A	Radiation (03CH07-HY)
Antenna Mast	Max-Full	MFA520BS	N/A	1m~4m	N/A	Aug. 06, 2018~ Aug. 07, 2018	N/A	Radiation (03CH07-HY)
Turn Table	ChainTek	Chaintek 3000	N/A	0~360 Degree	N/A	Aug. 06, 2018~ Aug. 07, 2018	N/A	Radiation (03CH07-HY)
EMI Test Receiver	Agilent	N9038A (MXE)	MY53290053	20Hz to 26.5GHz	Jan. 16, 2018	Aug. 06, 2018~ Aug. 07, 2018	Jan. 15, 2019	Radiation (03CH07-HY)

5. Uncertainty of Evaluation

Uncertainty of Radiated Emission Measurement (9 kHz ~ 30 MHz)

Measuring Uncertainty for a Level of Confidence of 95% (U = 2Uc(y))	**3.4**

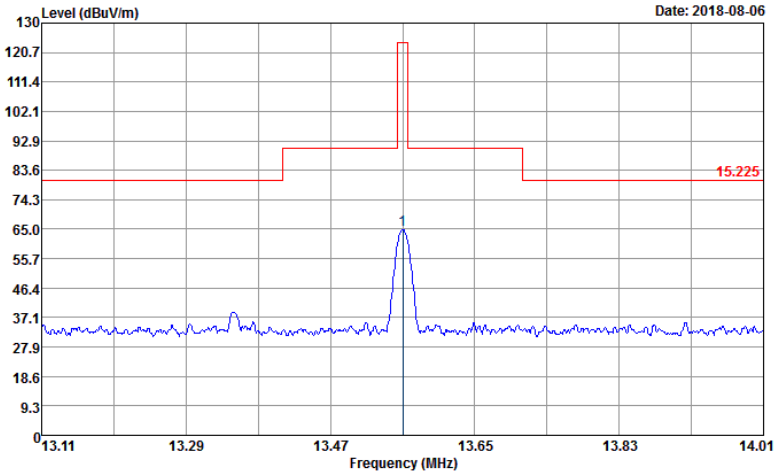
Uncertainty of Radiated Emission Measurement (30 MHz ~ 1000 MHz)

Measuring Uncertainty for a Level of Confidence of 95% (U = 2Uc(y))	**5.7**

Appendix A. Test Results of Radiated Test Items

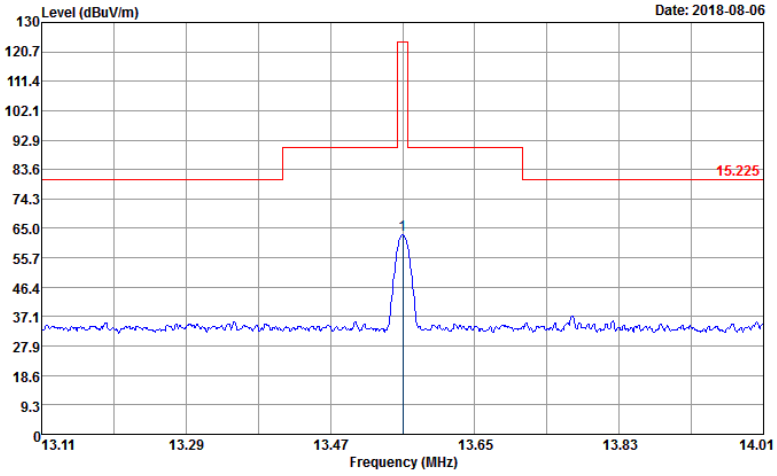
A1. Test Result of Field Strength of Fundamental Emissions

Test Mode :	NFC Tx	Test Frequency (MHz)	13.56



Site : 03CH07-HY
Condition : 15.225 3m LOOP_ANT(H)_100315 HORIZONTAL
: RBW:9.000KHz VBW:9.000KHz SWT:Auto
Project : 872508
Mode : 1

	Freq	Level	Over Limit	Limit Line	ReadAntenna Level	Factor	Cable Loss	A/Pos	T/Pos	Remark
	MHz	dBuV/m	dB	dBuV/m	dBuV	dB/m	dB	cm	deg	
1	13.56	64.78	-59.22	124.00	44.44	19.91	0.43	100	0	QP

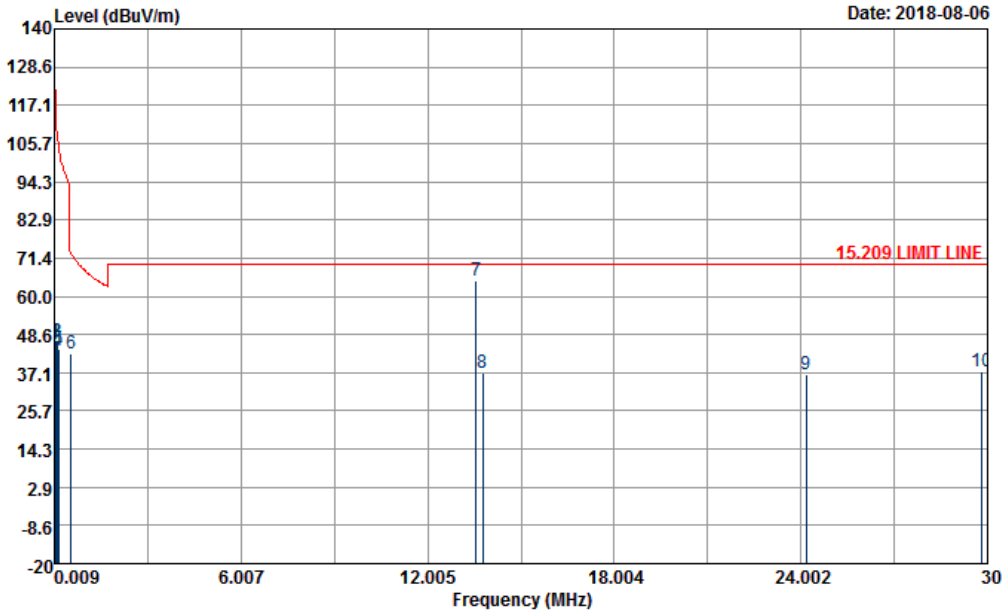


Site : 03CH07-HY
Condition : 15.225 3m LOOP_ANT(V)_100315 VERTICAL
: RBW:9.000KHz VBW:9.000KHz SWT:Auto
Project : 872508
Mode : 1

	Freq	Level	Over Limit	Limit Line	ReadAntenna Level	Factor	Cable Loss	A/Pos	T/Pos	Remark
	MHz	dBuV/m	dB	dBuV/m	dBuV	dB/m	dB	cm	deg	
1	13.56	62.97	-61.03	124.00	42.63	19.91	0.43	100	88	QP

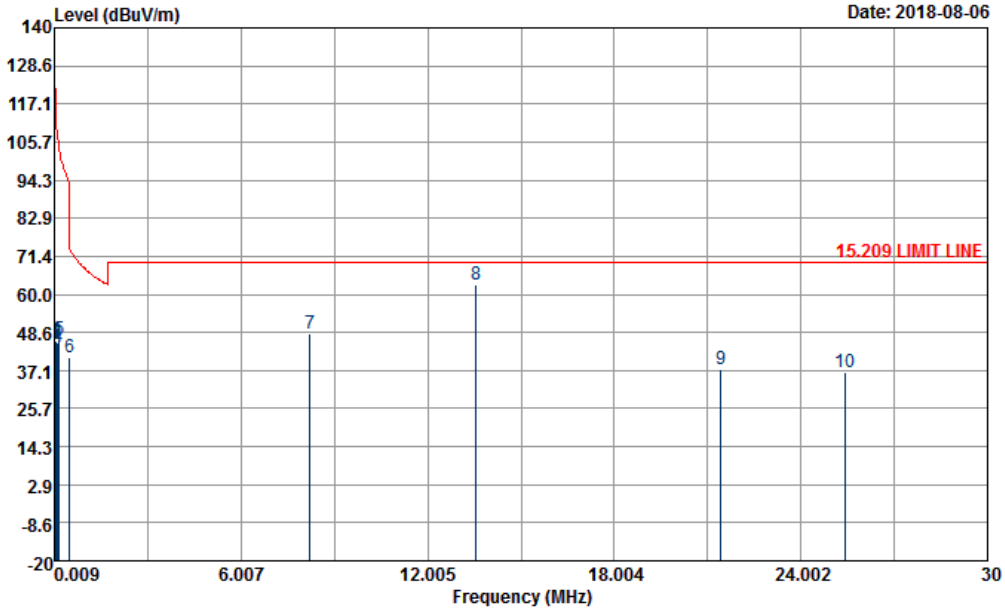
A2. Results of Radiated Spurious Emissions (9 kHz~30MHz)

Test Mode :	NFC Tx	Polarization :	Horizontal



Frequency (MHz)	Level (dBµV/m)	Over Limit (dB)	Limit Line (dBµV/m)	Read Level (dBµV)	Antenna Factor (dB)	Cable Loss (dB)	Ant Pos (cm)	Table Pos (deg)	Remark
0.009	46.21	-82.31	128.52	25.15	20.63	0.43			Average
0.06222	46.58	-65.15	111.73	26.05	20.1	0.43			Average
0.09248	46.48	-61.8	108.28	25.96	20.09	0.43			QP
0.12304	43.59	-62.21	105.8	23.09	20.07	0.43			Average
0.1517	44.05	-59.93	103.98	23.56	20.06	0.43			Average
0.55008	43	-29.8	72.8	22.58	19.99	0.43	100	0	QP
13.56	64.78	-4.72	69.5	44.44	19.91	0.43			QP
13.776	36.85	-32.65	69.5	16.51	19.91	0.43			QP
24.172	36.45	-33.05	69.5	14.75	20.5	1.2			QP
29.8	37.38	-32.12	69.5	16.19	19.99	1.2			QP

Test Mode :	NFC Tx	Polarization :	Vertical



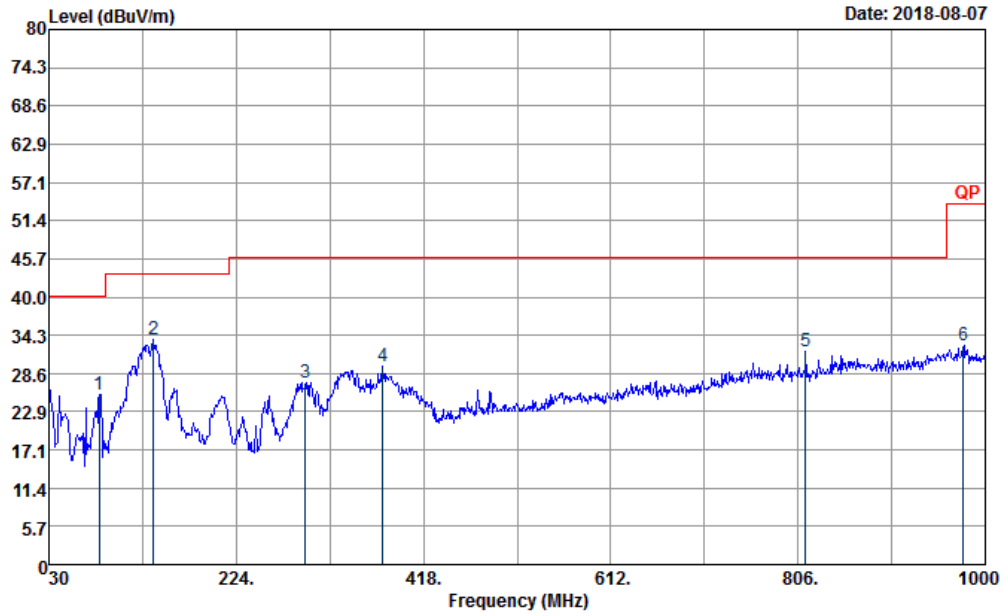
Frequency (MHz)	Level (dBµV/m)	Over Limit (dB)	Limit Line (dBµV/m)	Read Level (dBµV)	Antenna Factor (dB)	Cable Loss (dB)	Ant Pos (cm)	Table Pos (deg)	Remark
0.00971	45.36	-82.5	127.86	24.3	20.63	0.43			Average
0.06177	46.04	-65.75	111.79	25.51	20.1	0.43			Average
0.0927	45.49	-62.77	108.26	24.97	20.09	0.43			QP
0.1144	44.05	-62.39	106.44	23.55	20.07	0.43			Average
0.1551	46.36	-57.43	103.79	25.87	20.06	0.43			Average
0.49751	41	-32.67	73.67	20.58	19.99	0.43			QP
8.232	48.27	-21.23	69.5	27.86	19.98	0.43	100	0	QP
13.56	62.97	-6.53	69.5	42.63	19.91	0.43			QP
21.418	37.29	-32.21	69.5	15.75	20.34	1.2			QP
25.4	36.75	-32.75	69.5	15.07	20.48	1.2			QP

Note:

1. 13.56 MHz is fundamental signal which can be ignored.
2. The amplitude of spurious emissions which are attenuated by more than 20dB below the permissible value has no need to be reported.
3. Distance extrapolation factor = 40 log (specific distance / test distance) (dB);
4. Limit line = specific limits (dBµV) + distance extrapolation factor.

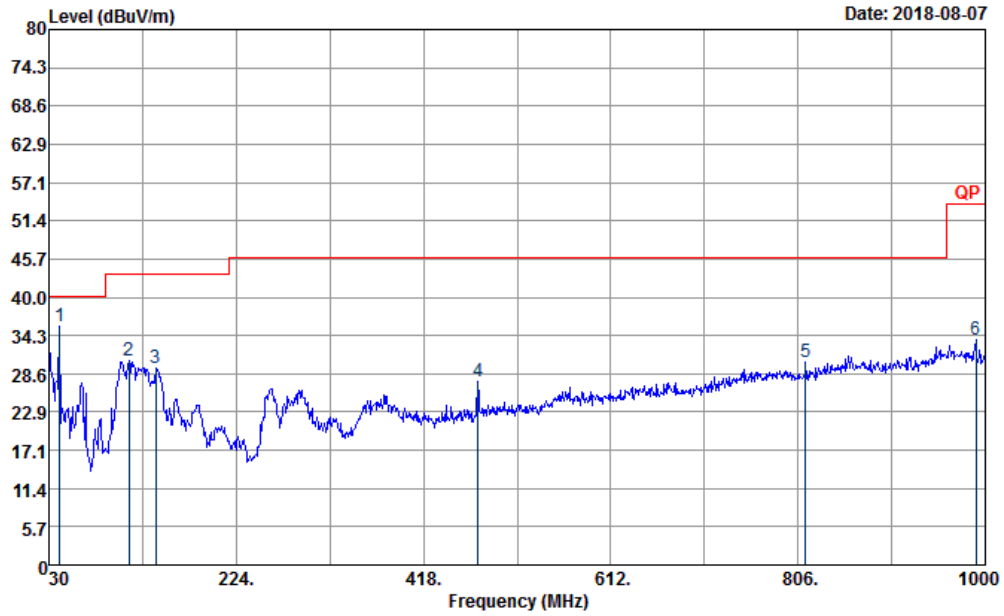
A3. Results of Radiated Spurious Emissions (30MHz~1GHz)

Test Mode :	NFC Tx	Polarization :	Horizontal



Frequency (MHz)	Level (dBµV/m)	Over Limit (dB)	Limit Line (dBµV/m)	Read Level (dBµV)	Antenna Factor (dB)	Cable Loss (dB)	Preamp Factor (dB)	Ant Pos (cm)	Table Pos (deg)	Remark
82.11	25.36	-14.64	40	41.87	13.52	1.55	31.58			Peak
138	33.58	-9.92	43.5	45.85	17.42	1.83	31.52	100	0	Peak
295.95	27.25	-18.75	46	36.82	19.08	2.66	31.31			Peak
375.6	29.72	-16.28	46	37.17	20.87	2.85	31.17			Peak
813.8	31.8	-14.2	46	30.23	27.83	4.32	30.58			Peak
977.6	32.72	-21.28	54	27.69	30.83	4.71	30.51			Peak

Test Mode :	NFC Tx	Polarization :	Vertical



Frequency (MHz)	Level (dBµV/m)	Over Limit (dB)	Limit Line (dBµV/m)	Read Level (dBµV)	Antenna Factor (dB)	Cable Loss (dB)	Preamp Factor (dB)	Ant Pos (cm)	Table Pos (deg)	Remark
40.8	35.74	-4.26	40	47.22	18.81	1.2	31.49	100	0	Peak
113.16	30.42	-13.08	43.5	43.01	17.13	1.83	31.55			Peak
140.43	29.34	-14.16	43.5	41.4	17.4	2.06	31.52			Peak
474.3	27.33	-18.67	46	31.53	23.42	3.4	31.02			Peak
813.8	30.37	-15.63	46	28.8	27.83	4.32	30.58			Peak
990.2	33.65	-20.35	54	28.87	30.53	4.76	30.51			Peak

Note:

1. The amplitude of spurious emissions which are attenuated by more than 20dB below the permissible value has no need to be reported.
2. Emission level (dBµV/m) = 20 log Emission level (µV/m).
3. Corrected Reading: Antenna Factor + Cable Loss + Read Level - Preamp Factor= Level.