Radio Test Report

FCC ID: 2A2V6-FZ

IC: 27624-FZ

Report No.	:	TB-RF185808
Applicant	:	Flipper Devices Inc
Equipment Under Test (EUT)		
EUT Name	:	Flipper Zero
Model No.	:	FZ.1
Series Model No.	:	----
Brand Name	:	Flipper Zero
Sample ID	:	20210916-08-1#& 20210916-08-2#
Receipt Date	:	2021-12-05
Test Date	:	2021-12-06 to 2021-12-31
Issue Date	:	2021-12-31
Standards	:	FCC Part 15, Subpart C 15.225 RSS-210 Issue 10 December 2019 RSS-Gen Issue 5 March 2019
Test Method	:	ANSI C63.10: 2013
Conclusions	:	**PASS**

In the configuration tested, the EUT complied with the standards specified above.

Test/Witness Engineer	:	Seven Wu
Engineer Supervisor	:	Ivan Su
Engineer Manager	:	Ray Lai

This report details the results of the testing carried out on one sample. The results contained in this test report do not relate to other samples of the same product. The manufacturer should ensure that all products in series production are in conformity with the product sample detailed in the report.

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Revision History

Report No.	Version	Description	Issued Date
TB-RF185808	Rev.01	Initial issue of report	2021-12-31

1. General Information about EUT

1.1 Client Information

Applicant	:	Flipper Devices Inc
Address	:	2803 Philadelphia Pike, Suite B #551 Claymont, DE 19703, USA
Manufacturer	:	Flipper Devices Inc
Address	:	2803 Philadelphia Pike, Suite B #551 Claymont, DE 19703, USA

1.2 General Description of EUT (Equipment Under Test)

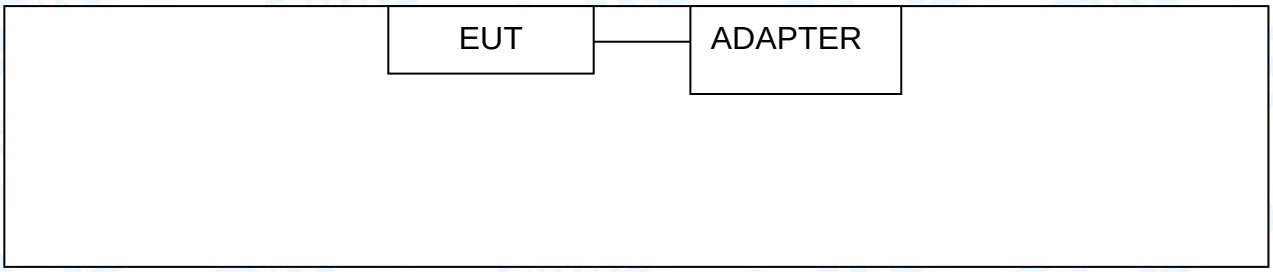
EUT Name	:	Flipper Zero	
HVIN/Models No.	:	FZ.1	
Model Different	:	N/A	
Product Description	:	Operation Frequency:	NFC: 13.56MHz RFID: 125KHz
		Number of Channel:	1 channel
		Antenna Gain:	0dBi PCB Antenna
		Modulation Type:	OOK, AM
Power Rating	:	USB Input: DC 5V1.0A or DC 3.7V by 2100mAh Rechargeable Li-ion battery	
Software Version	:	fw-0.40.1	
Hardware Version	:	12.F7B9C6	

Remark:
(1) The antenna gain and USB cable provided by the applicant, the verified for the RF conduction test and adapter provided by TOBY test lab.
(2) For a more detailed features description, please refer to the manufacturer's specifications or the User's Manual.
(3) Antenna information provided by the applicant.

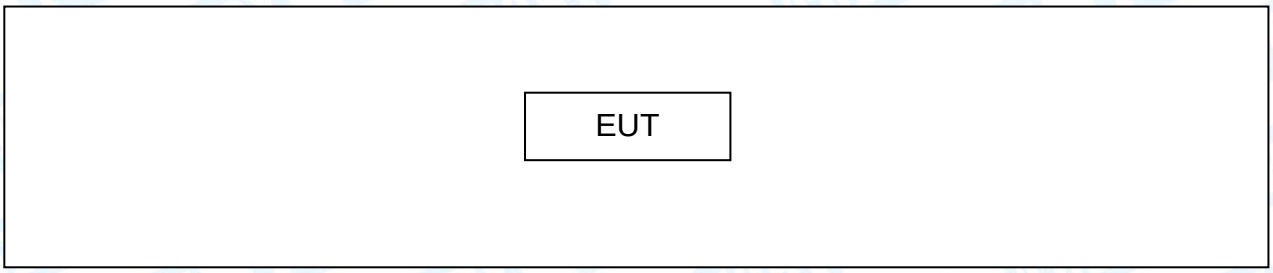
Flipper Zero: Portable handheld electronic device featuring virtual pet, designed for education, development and prototyping of electronics and software.

1.3 Block Diagram Showing the Configuration of System Tested

Conducted Test



Radiated Test



1.4 Description of Support Units

Equipment Information				
Name	**Model**	**FCC ID/VOC**	**Manufacturer**	**Used "√"**
---	----	----	---	---
Cable Information				
Number	**Shielded Type**	**Ferrite Core**	**Length**	**Note**
Cable 1	NO	NO	0.2M	Accessory

1.5 Description of Test Mode

To investigate the maximum EMI emission characteristics generates from EUT, the test system was pre-scanning tested base on the consideration of following EUT operation mode or test configuration mode which possible have effect on EMI emission level. Each of these EUT operation mode(s) or test configuration mode(s) mentioned follow was evaluated respectively.

For Conducted Test	
Final Test Mode	**Description**
Mode 1	USB Charging + NFC TX Mode
Mode 2	USB Charging + RFID TX Mode
For Radiated Test	
Final Test Mode	**Description**
Mode 3	NFC TX Mode
Mode 4	RFID TX Mode

Note:

(1) For all test, we have verified the construction and function in typical operation. And all the test modes were carried out with the EUT in transmitting operation in maximum power with all kinds of data rate.
According to ANSI C63.10 standards, the measurements are performed at the highest, middle, lowest available channels, and the worst case data rate as follows:
TX Mode: Transmitting mode.

(2) During the testing procedure, the continuously transmitting with the maximum power mode was programmed by the customer.

(3) The EUT is considered a portable unit; in normal use it was positioned on X-plane. The worst case was found positioned on X-plane. Therefore only the test data of this X-plane was used for radiated emission measurement test.

1.6 Description of Test Software Setting

During testing channel& Power controlling software provided by the customer was used to control the operating channel as well as the output power level. The RF output power selection is for the setting of RF output power expected by the customer and is going to be fixed on the firmware of the final end product power parameters of RF setting.

Test Software Version	**N/A**
Frequency	13.56 MHz
NFC	DEF
Frequency	125KHz
RFID	DEF

1.7 Measurement Uncertainty

The reported uncertainty of measurement y ± U，where expended uncertainty U is based on a standard uncertainty multiplied by a coverage factor of k=2，providing a level of confidence of approximately 95 %.

Test Item	**Parameters**	**Expanded Uncertainty (U_{Lab})**
Conducted Emission	Level Accuracy: 9kHz~150kHz 150kHz to 30MHz	±3.50 dB ±3.10 dB
Radiated Emission	Level Accuracy: 9kHz to 30 MHz	±4.60 dB
Radiated Emission	Level Accuracy: 30MHz to 1000 MHz	±4.50 dB
Radiated Emission	Level Accuracy: Above 1000MHz	±4.20 dB

1.8 Test Facility

The testing report were performed by the Shenzhen Toby Technology Co., Ltd., in their facilities located at 1A/F., Bldg.6, Yusheng Industrial Zone, The National Road No.107 Xixiang Section 467, Xixiang, Bao'an, Shenzhen, Guangdong, China. At the time of testing, the following bodies accredited the Laboratory:

CNAS (L5813)

The Laboratory has been accredited by CNAS to ISO/IEC 17025: 2017 General Requirements for the Competence of Testing and Calibration Laboratories for the competence in the field of testing. And the Registration No.: CNAS L5813.

A2LA Certificate No.: 4750.01

The laboratory has been accredited by American Association for Laboratory Accreditation(A2LA) to ISO/IEC 17025：2017 General Requirements for the Competence of Testing and Calibration Laboratories for the technical competence in the field of Electrical Testing. And the A2LA Certificate No.: 4750.01.FCC Accredited Test Site Number: 854351. Designation Number: CN1223.

IC Registration No.: (11950A)

The Laboratory has been registered by Certification and Engineering Bureau of Industry Canada for radio equipment testing. The site registration: Site# 11950A. CAB identifier: CN0056.

2. Test Summary

FCC Part 15 Subpart C(15.225)					
Standard Section		Test Item	Test Sample(s)	Judgment	Remark
FCC	IC				
15.207(a)	RSS-GEN 8.8	Conducted Emission	20210916-08-01#	PASS	N/A
15.209(a)&15.225	RSS-Gen 8.9	Radiated emissions	20210916-08-01#	PASS	N/A
15.225(a)	RSS 210 B.6	Fundamental field strength limit	20210916-08-01#	PASS	N/A
15.225(e)	RSS 210 B.6	Fundamental frequency tolerance	20210916-08-01#	PASS	N/A
15.225	RSS 210 B.6	Band edge compliance	20210916-08-01#	PASS	N/A
15.215(c)	RSS Gen 4.6.1	Occupied bandwidth	20210916-08-01#	PASS	N/A
Note: N/A is an abbreviation for Not Applicable.					

3. Test Software

Test Item	Test Software	Manufacturer	Version No.
Conducted Emission	EZ-EMC	EZ	CDI-03A2
Radiation Emission	EZ-EMC	EZ	FA-03A2RE
RF Conducted Measurement	MTS-8310	MWRFtest	V2.0.0.0
RF Test System	JS1120	Tonscend	V2.6.88.0336

4. Test Equipment

Conducted Emission Test					
Equipment	**Manufacturer**	**Model No.**	**Serial No.**	**Last Cal.**	**Cal. Due Date**
EMI Test Receiver	Rohde & Schwarz	ESCI	100321	Jul. 02, 2021	Jul. 01, 2022
RF Switching Unit	Compliance Direction Systems Inc	RSU-A4	34403	Jul. 02, 2021	Jul. 01, 2022
AMN	SCHWARZBECK	NNBL 8226-2	8226-2/164	Jul. 02, 2021	Jul. 01, 2022
LISN	Rohde & Schwarz	ENV216	101131	Jul. 02, 2021	Jul. 01, 2022
Radiation Emission Test					
Equipment	**Manufacturer**	**Model No.**	**Serial No.**	**Last Cal.**	**Cal. Due Date**
Spectrum Analyzer	KEYSIGT	N9020B	MY60110172	Sep. 03, 2021	Sep. 02, 2022
Spectrum Analyzer	Rohde & Schwarz	FSV40-N	102197	Jul. 02, 2021	Jul. 01, 2022
Bilog Antenna	SCHWARZBECK	VULB 9168	1225	Dec. 05, 2021	Dec. 04, 2023
Horn Antenna	SCHWARZBECK	BBHA 9120 D	2463	May 20, 2021	May 19, 2022
Horn Antenna	SCHWARZBECK	BBHA 9170	1118	May 20, 2021	May 19, 2022
Loop Antenna	SCHWARZBECK	FMZB 1519 B	1519B-059	Jul. 06, 2021	Jul. 05, 2022
HF Amplifier	Tonscend	TAP9E6343	AP21C806117	Sep. 03, 2021	Sep. 02, 2022
HF Amplifier	Tonscend	TAP051845	AP21C806141	Sep. 03, 2021	Sep. 02, 2022
HF Amplifier	Tonscend	TAP0184050	AP21C806129	Sep. 03, 2021	Sep. 02, 2022
Antenna Conducted Emission					
Equipment	**Manufacturer**	**Model No.**	**Serial No.**	**Last Cal.**	**Cal. Due Date**
Spectrum Analyzer	Rohde & Schwarz	FSV40-N	102197	Jul. 02, 2021	Jul. 01, 2022
Vector Signal Generator	Agilent	5182B	MY59101429	Sep. 03, 2021	Sep. 02, 2022
Analog Signal Generator	Agilent	5181A	MY48180463	Sep. 03, 2021	Sep. 02, 2022
RF Control Unit	Tonsced	JS0806-2	21F8060439	Sep. 03, 2021	Sep. 02, 2022
Band Reject Filter Group	Tonsced	JS0806-F	21D8060414	Jul. 02, 2021	Jul. 01, 2022
Power Control Box	Tonsced	JS0806-4ADC	21C8060387	N/A	N/A

5. Conducted Emission Test

5.1 Test Standard and Limit

5.1.1Test Standard

FCC Part 15.207
RSS-GEN 8.8

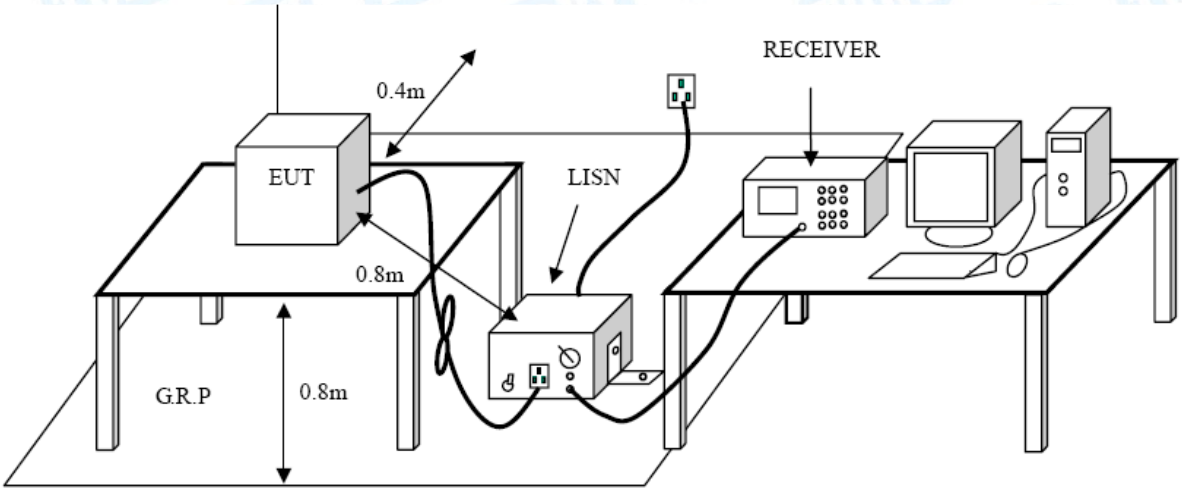
5.1.2 Test Limit

Conducted Emission Test Limit

Frequency	Maximum RF Line Voltage (dBμV)	
	Quasi-peak Level	Average Level
150kHz~500kHz	66 ~ 56 *	56 ~ 46 *
500kHz~5MHz	56	46
5MHz~30MHz	60	50

Notes:
(1) *Decreasing linearly with logarithm of the frequency.
(2) The lower limit shall apply at the transition frequencies.
(3) The limit decrease in line with the logarithm of the frequency in the range of 0.15 to 0.50MHz.

5.2 Test Setup



5.3 Test Procedure

The EUT was placed 0.8 meters from the horizontal ground plane with EUT being connected to the power mains through a line impedance stabilization network (LISN). All other support equipments powered from additional LISN(s). The LISN provide 50 Ohm/ 50uH of coupling impedance for the measuring instrument.

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 to 40 cm long.

I/O cables that are not connected to a peripheral 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.

LISN at least 80 cm from nearest part of EUT chassis.

The bandwidth of EMI test receiver is set at 9 kHz, and the test frequency band is from 0.15MHz to 30MHz.

5.4 Deviation From Test Standard

No deviation

5.5 EUT Operating Mode

Please refer to the description of test mode.

5.6 Test Data

Please refer to the Attachment A.

6. Radiated Emission Test

6.1 Test Standard and Limit

6.1.1 Test Standard

FCC Part 15.209(a)&15.225

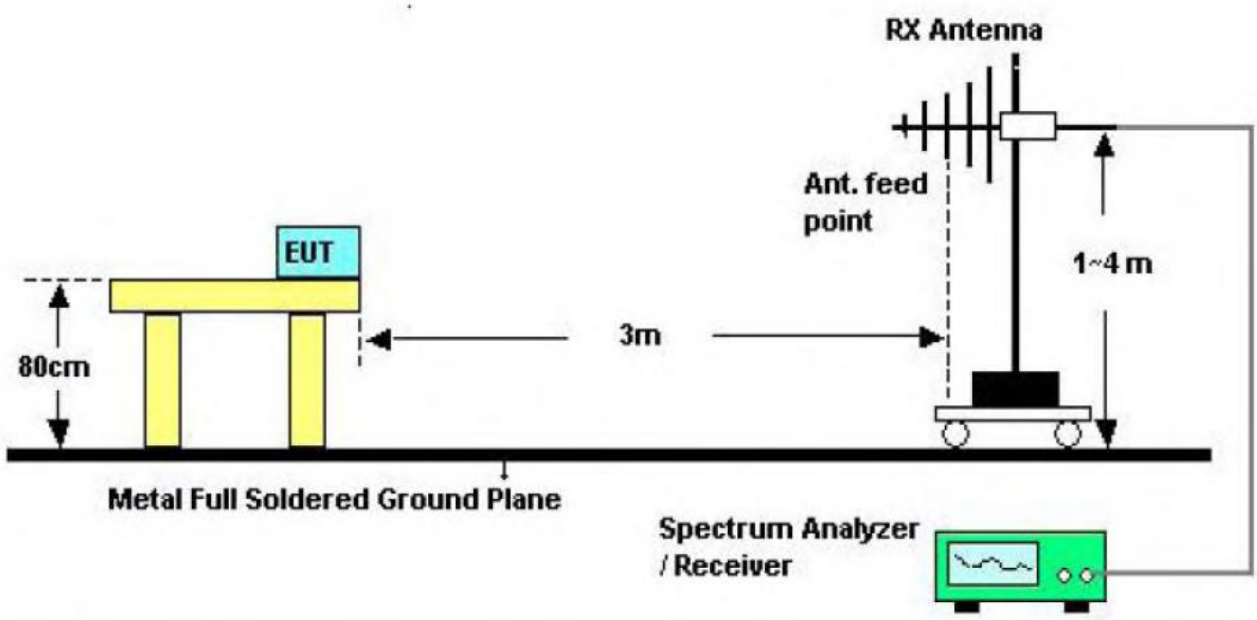
RSS-GEN 8.8

6.1.2 Test Limit

Radiated Emission Limits (30MHz~1000MHz)

Frequency Range (MHz)	E-field Strength Limit @ 3m (mV/m)	E-field Strength Limit @ 3m (dBμV/m)	E-field Strength Limit @ 10m (dBμV/m)
30-88	100	40	30
88-216	150	43.5	33.5
216-960	200	46	36
960-1000	500	54	44

5.2 Test Setup



Below 1000MHz Test Setup

6.3 Test Procedure

(1) The measuring distance of 3m shall be used for measurements at frequency up to 1GHz and above 1 GHz. The EUT was placed on a rotating 0.8m high above ground, the table was rotated 360 degrees to determine the position of the highest radiation.
(2) The Test antenna shall vary between 1m and 4m, Both Horizontal and Vertical antenna are set to make measurement.
(3) The initial step in collecting conducted emission data is a spectrum analyzer peak detector mode pre-scanning the measurement frequency range. Significant peaks are then marked and then Quasi Peak detector mode re-measured.
(4) If the Peak Mode measured value compliance with and lower than Quasi Peak Mode Limit Bellow 1 GHz, the EUT shall be deemed to meet QP Limits and then no additional QP Mode measurement performed. But the Peak Value and average value both need to comply with applicable limit above 1 GHz.
(5) Testing frequency range below 1GHz the measuring instrument use VBW=120 kHz with Quasi-peak detection.
(6) For the actual test configuration, please see the test setup photo.

6.4 Deviation From Test Standard

No deviation

6.5 EUT Operating Condition

The Equipment Under Test was set to Continual Transmitting in maximum power.

6.6 Test Data

Please refer to the Attachment B.

7. Electric Field Strength of Fundamental and Outside the Allocated bands

7.1 Test Standard and Limit

7.1.1 Test Standard

FCC Part 15.225(a)
FCC Part 15.225
RSS 210 B.6

7.1.2 Test Limit

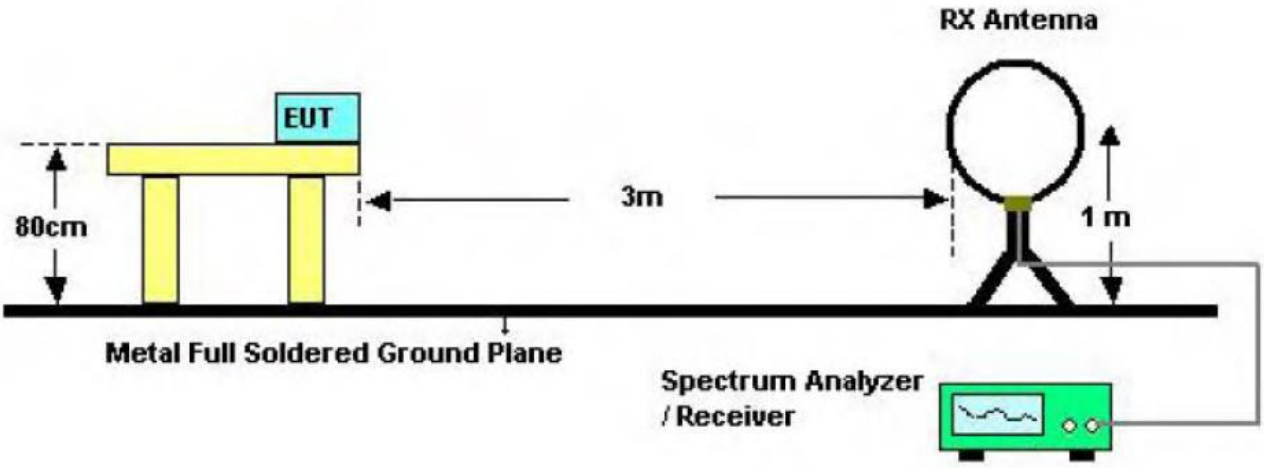
Electric Field Strength of Fundamental

Frequency Range (MHz)	E-field Strength Limit @ 30m (μV/m)	E-field Strength Limit @ 3m (dBμV/m)
0.009-0.490	2400/F(kHz)	129-94
0.490-1.705	24000/F(kHz)	74-63
1.705-30	30	70
Note: Where the limits have been defined at one distance, and a signal level measured at another, the limits have been extrapolated using the following formula: $\text{Extrapolation(dB)} = 40\log_{10}(\text{Measurement Distance}/\text{Specification Distance})$		

Outside the Allocated bands

Frequency Range (MHz)	E-field Strength Limit @ 30 m (μV/m)	E-field Strength Limit @ 3 m (dBμV/m)
13.560 ± 0.007	+15,848	124
13.410 to 13.553 13.567 to 13.710	+334	90
13.110 to 13.410 13.710 to 14.010	+106	81
Note: Where the limits have been defined at one distance, and a signal level measured at another, the limits have been extrapolated using the following formula: $\text{Extrapolation(dB)} = 40\log_{10}(\text{Measurement Distance}/\text{Specification Distance})$		

7.2 Test Setup



7.3 Test Procedure

The transmitter carrier output levels (E-Field) from the EUT are measured in a semi-anechoic chamber. The EUT is placed on a non-conductive stand of 80cm high, and at a measurement distance of 3m from the receiving antenna. The center of the receiving loop antenna is 1.0 meter above the ground. The E-field is measured with a shielded loop antenna connected to a measurement receiver. Detected E-field was maximized by rotating the EUT through 360° and adjusting the receiving antenna polarizations. The maximization processes were repeated with the EUT positioned respectively in its three orthogonal axes. The measurements were performed with the peak detector and if required, the quasi-peak detector.

7.4 Deviation From Test Standard

No deviation

7.5 EUT Operating Condition

The measurement of EUT is carried out under the transmit state of NFC.

7.6 Test Data

Please refer to the Attachment C.

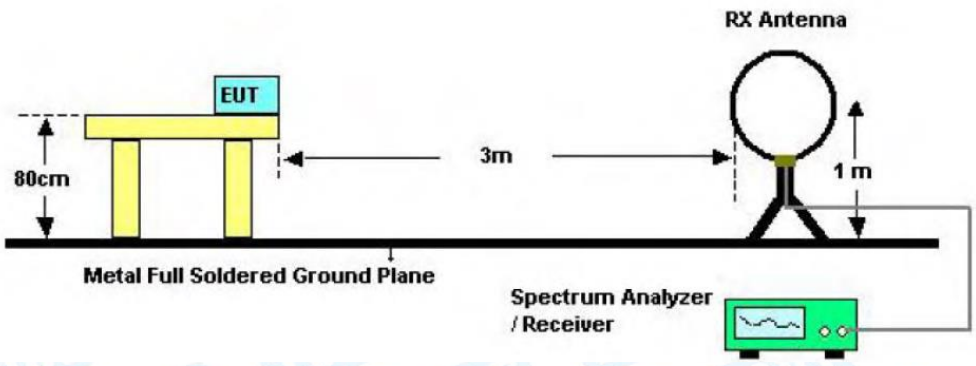
8. Occupied Bandwidth Test

8.1 Test Standard and Limit

8.1.1 Test Standard

FCC Part 15.215 (c)
RSS-Gen 4.6.1

8.2 Test Setup



8.3 Test Procedure

The EUT is turned ON and connected to measurement instrument; the center frequency of the spectrum analyzer is set to the fundamental frequency. The captured power is measured and recorded; the measurement is repeated until all frequencies required were complete.

1. RBW used in the range of 1% to 5% of the anticipated emission bandwidth
2. Set the video bandwidth (VBW) ≥ 3 x RBW.
3. Detector = Peak.
4. Trace mode = Max Hold.
5. Sweep = Auto couple.
6. Allow the trace to stabilize.
7. OBW 99% function of spectrum analyzer used

8.4 Deviation From Test Standard

No deviation

8.5 EUT Operating Condition

The measurement of EUT is carried out under the transmit state of NFC.

8.6 Test Data

Please refer to the Attachment D.

9. Fundamental Frequency Tolerance

9.1 Test Standard and Limit

9.1.1 Test Standard

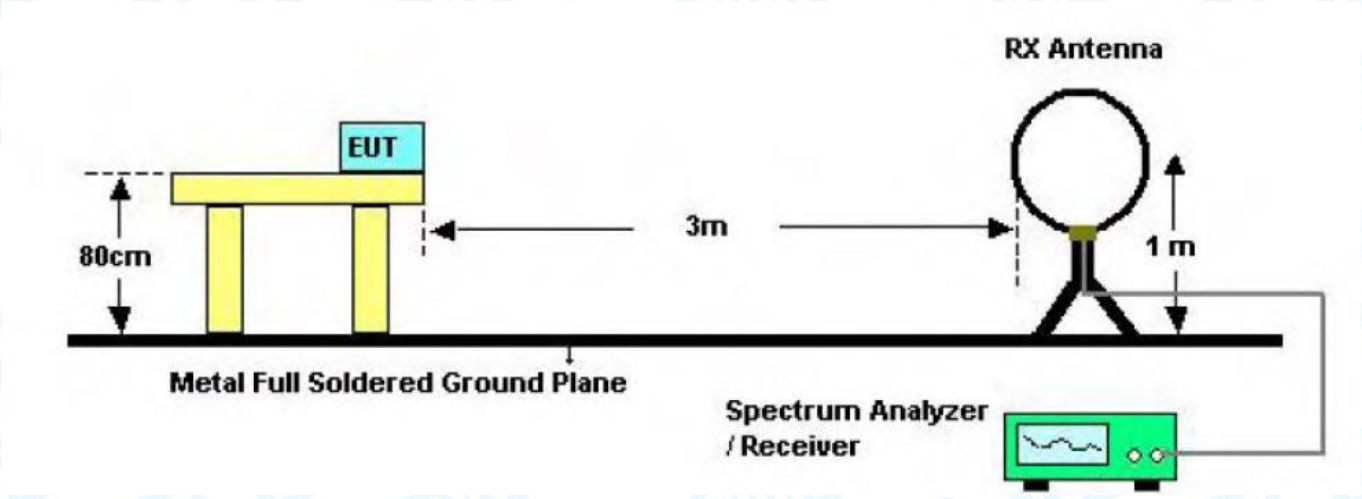
FCC Part 15.225 (e)

RSS 210 B.6

9.1.2 Test Limit

The frequency tolerance of the carrier signal shall be maintained within +/- 0.01% of the operating frequency.

9.2 Test Setup



9.3 Test Procedure

The transmitter output signal was picked up by coil antenna connected to the frequency counter. The center frequency was measured with 30Hz RBW and 1kHz span. During the test, the EUT was placed in a thermal chamber until thermal balance and lasting appropriate time.

9.4 Deviation From Test Standard

No deviation

9.5 EUT Operating Condition

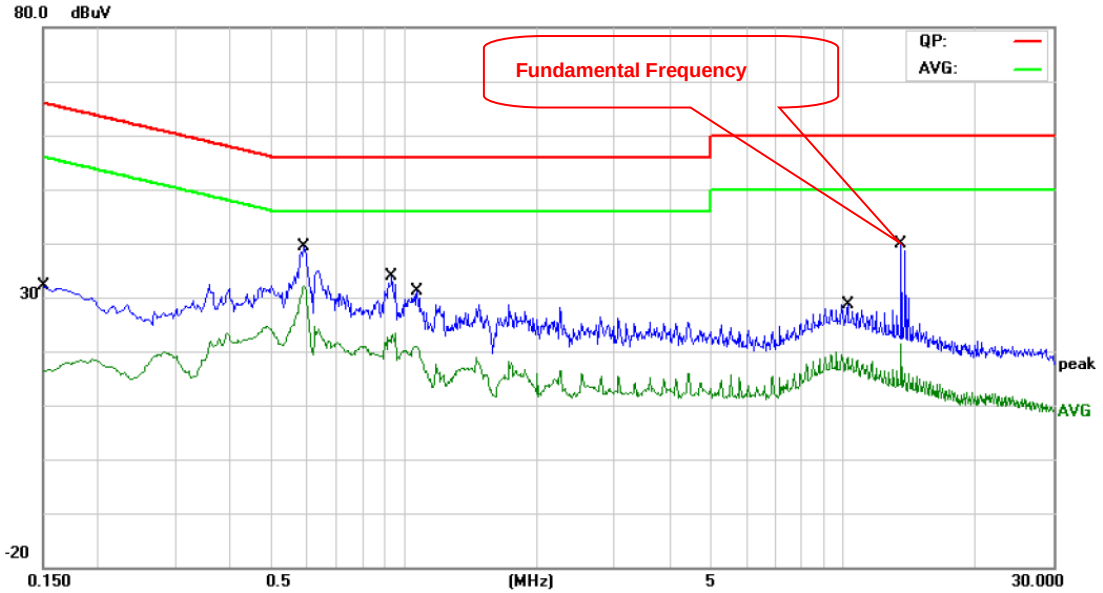
The EUT was set to continuously transmitting in the max power during the test.

9.6 Test Data

Please refer to the Attachment E.

Attachment A-- Conducted Emission Test Data

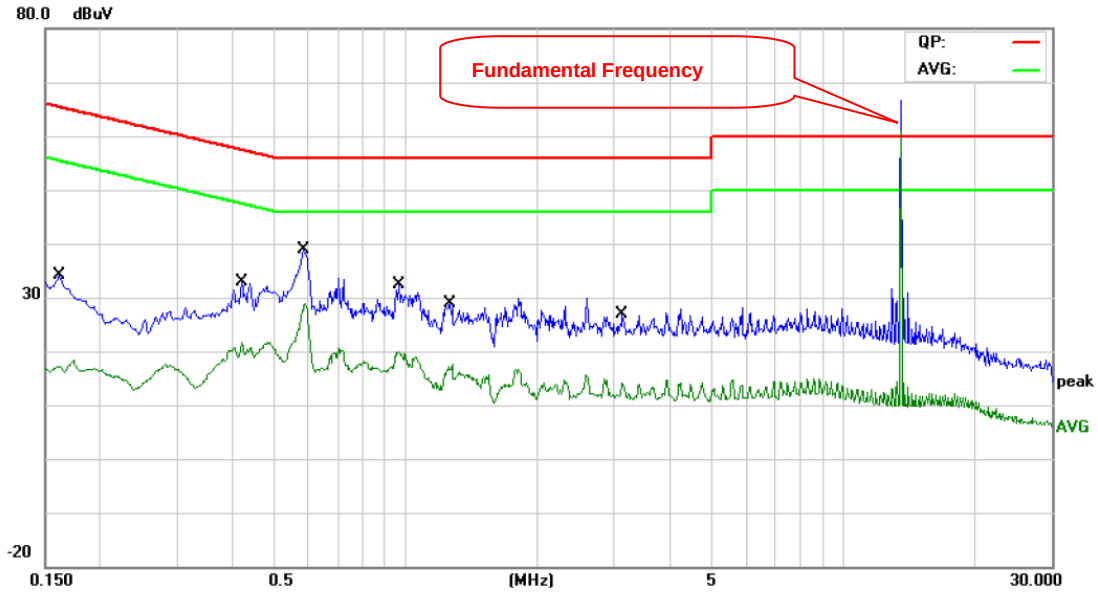
Temperature:	24.3℃	**Relative Humidity:**	45%
Test Voltage:	AC 120V/60 Hz		
Terminal:	Line		
Test Mode:	NFC TX Mode		
Remark:	Only worst case is reported.		



No.	Mk.	Freq.	Reading Level	Correct Factor	Measure-ment	Limit	Over	
		MHz	dBuV	dB	dBuV	dBuV	dB	Detector
1		0.1500	15.92	11.62	27.54	65.99	-38.45	QP
2		0.1500	4.36	11.62	15.98	55.99	-40.01	AVG
3		0.5899	24.37	11.45	35.82	56.00	-20.18	QP
4	*	0.5899	20.61	11.45	32.06	46.00	-13.94	AVG
5		0.9340	13.36	11.23	24.59	56.00	-31.41	QP
6		0.9340	8.06	11.23	19.29	46.00	-26.71	AVG
7		1.0660	14.80	11.15	25.95	56.00	-30.05	QP
8		1.0660	9.59	11.15	20.74	46.00	-25.26	AVG
9		10.1820	11.30	10.23	21.53	60.00	-38.47	QP
10		10.1820	6.03	10.23	16.26	50.00	-33.74	AVG
11		13.5140	15.28	10.38	25.66	60.00	-34.34	QP
12		13.5140	2.88	10.38	13.26	50.00	-36.74	AVG

Remark:
1. Corr. Factor (dB) = LISN Factor (dB) + Cable Loss (dB)
2. Margin (dB) =QuasiPeak/Average (dBuV)-Limit (dBuV)

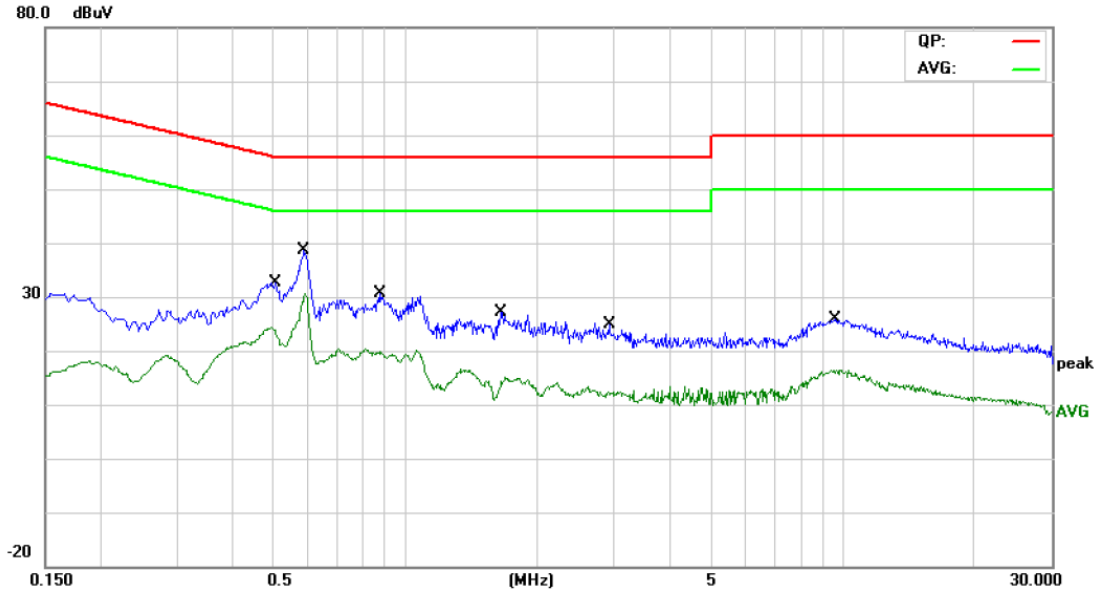
Temperature:	24.3℃	**Relative Humidity:**	45%
Test Voltage:	AC 120V/60 Hz		
Terminal:	Neutral		
Test Mode:	NFC TX Mode		
Remark:	Only worst case is reported.		



No.	Mk.	Freq.	Reading Level	Correct Factor	Measure-ment	Limit	Over	
		MHz	dBuV	dB	dBuV	dBuV	dB	Detector
1		0.1620	15.34	11.60	26.94	65.36	-38.42	QP
2		0.1620	3.17	11.60	14.77	55.36	-40.59	AVG
3		0.4220	13.39	11.48	24.87	57.41	-32.54	QP
4		0.4220	7.79	11.48	19.27	47.41	-28.14	AVG
5		0.5860	22.92	11.48	34.40	56.00	-21.60	QP
6	*	0.5860	17.08	11.48	28.56	46.00	-17.44	AVG
7		0.9660	12.60	11.22	23.82	56.00	-32.18	QP
8		0.9660	5.46	11.22	16.68	46.00	-29.32	AVG
9		1.2660	9.52	11.00	20.52	56.00	-35.48	QP
10		1.2660	3.09	11.00	14.09	46.00	-31.91	AVG
11		3.1300	7.99	10.17	18.16	56.00	-37.84	QP
12		3.1300	1.21	10.17	11.38	46.00	-34.62	AVG

Remark:
1. Corr. Factor (dB) = LISN Factor (dB) + Cable Loss (dB)
2. Margin (dB) =QuasiPeak/Average (dBuV)-Limit (dBuV)

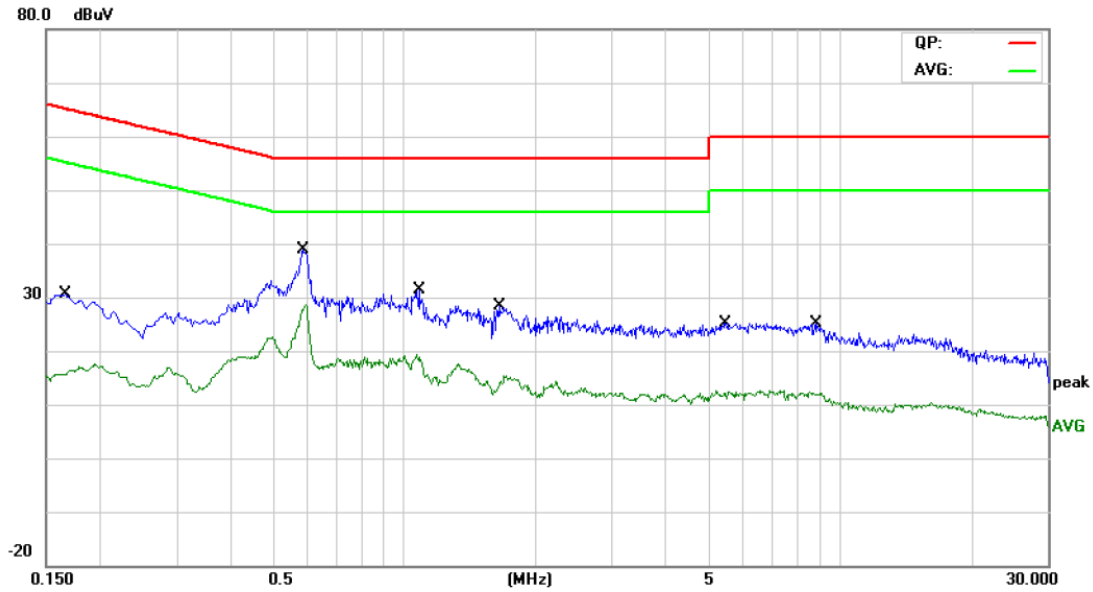
Temperature:	24.3℃	**Relative Humidity:**	45%
Test Voltage:	AC 120V/60 Hz		
Terminal:	Line		
Test Mode:	RFID TX Mode		
Remark:	Only worst case is reported.		



No.	Mk.	Freq.	Reading Level	Correct Factor	Measure-ment	Limit	Over	
		MHz	dBuV	dB	dBuV	dBuV	dB	Detector
1		0.5060	18.86	11.49	30.35	56.00	-25.65	QP
2		0.5060	10.08	11.49	21.57	46.00	-24.43	AVG
3		0.5859	23.91	11.45	35.36	56.00	-20.64	QP
4	*	0.5859	18.53	11.45	29.98	46.00	-16.02	AVG
5		0.8739	17.06	11.28	28.34	56.00	-27.66	QP
6		0.8780	8.64	11.28	19.92	46.00	-26.08	AVG
7		1.6499	23.47	10.78	34.25	56.00	-21.75	QP
8		1.6539	3.68	10.78	14.46	46.00	-31.54	AVG
9		2.9180	11.97	10.27	22.24	56.00	-33.76	QP
10		2.9420	1.58	10.26	11.84	46.00	-34.16	AVG
11		9.5699	21.38	10.20	31.58	60.00	-28.42	QP
12		9.6379	6.02	10.21	16.23	50.00	-33.77	AVG

Remark:
1. Corr. Factor (dB) = LISN Factor (dB) + Cable Loss (dB)
2. Margin (dB) =QuasiPeak/Average (dBuV)-Limit (dBuV)

Temperature:	24.3℃	**Relative Humidity:**	45%
Test Voltage:	AC 120V/60 Hz		
Terminal:	Neutral		
Test Mode:	RFID TX Mode		
Remark:	Only worst case is reported.		



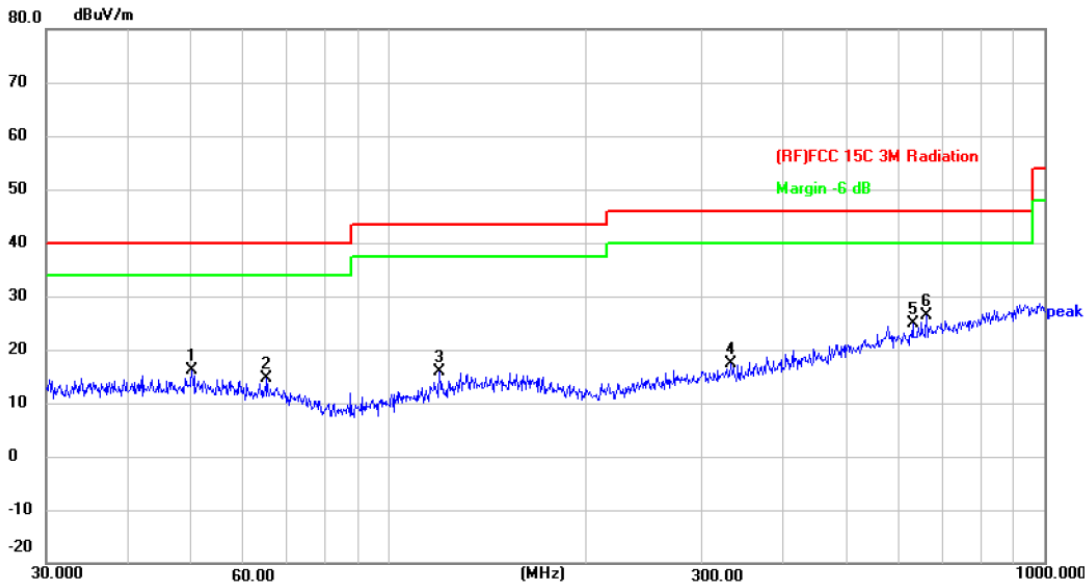
No.	Mk.	Freq.	Reading Level	Correct Factor	Measure-ment	Limit	Over	
		MHz	dBuV	dB	dBuV	dBuV	dB	Detector
1		0.1660	13.74	11.62	25.36	65.15	-39.79	QP
2		0.1660	3.95	11.62	15.57	55.15	-39.58	AVG
3		0.5823	23.76	11.48	35.24	56.00	-20.76	QP
4	*	0.5858	16.18	11.48	27.66	46.00	-18.34	AVG
5		1.0820	18.21	11.14	29.35	56.00	-26.65	QP
6		1.0859	6.87	11.14	18.01	46.00	-27.99	AVG
7		1.6498	13.85	10.73	24.58	56.00	-31.42	QP
8		1.6538	3.49	10.72	14.21	46.00	-31.79	AVG
9		5.4339	11.52	10.06	21.58	60.00	-38.42	QP
10		5.4339	1.95	10.06	12.01	50.00	-37.99	AVG
11		8.8658	13.16	10.09	23.25	60.00	-36.75	QP
12		8.8658	1.83	10.09	11.92	50.00	-38.08	AVG

Remark:
1. Corr. Factor (dB) = LISN Factor (dB) + Cable Loss (dB)
2. Margin (dB) =QuasiPeak/Average (dBuV)-Limit (dBuV)

Attachment B-- Radiated Emission Test Data

30MHz~1GHz

Temperature:	24.3℃	**Relative Humidity:**	45%
Test Voltage:	DC 3.7V		
Ant. Pol.	Horizontal		
Test Mode:	NFC TX Mode		
Remark:	Only worst case is reported.		

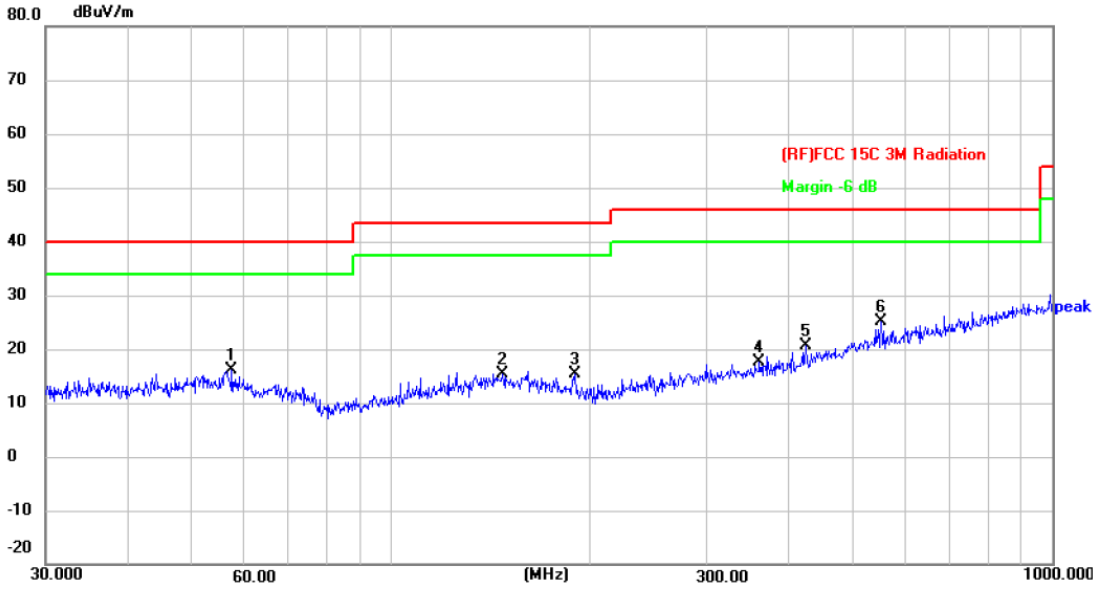


No.	Frequency (MHz)	Reading (dBuV)	Factor (dB/m)	Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Detector
1	50.0566	38.73	-22.56	16.17	40.00	-23.83	peak
2	65.1145	38.51	-23.96	14.55	40.00	-25.45	peak
3	119.4361	39.22	-23.33	15.89	43.50	-27.61	peak
4	332.5187	37.43	-20.05	17.38	46.00	-28.62	peak
5	629.4772	37.77	-12.78	24.99	46.00	-21.01	peak
6 *	661.1505	38.60	-12.31	26.29	46.00	-19.71	peak

*:Maximum data x:Over limit !:over margin

Remark:
1. Corr. = Antenna Factor (dB/m) + Cable Loss (dB)
2. QuasiPeak (dBμV/m)= Corr. (dB/m)+ Read Level (dBμV)
3. Margin (dB) = QuasiPeak (dBμV/m)-Limit QPK(dBμV/m)

Temperature:	24.3℃	**Relative Humidity:**	45%
Test Voltage:	DC 3.7V		
Ant. Pol.	Vertical		
Test Mode:	NFC TX Mode		
Remark:	Only worst case is reported.		

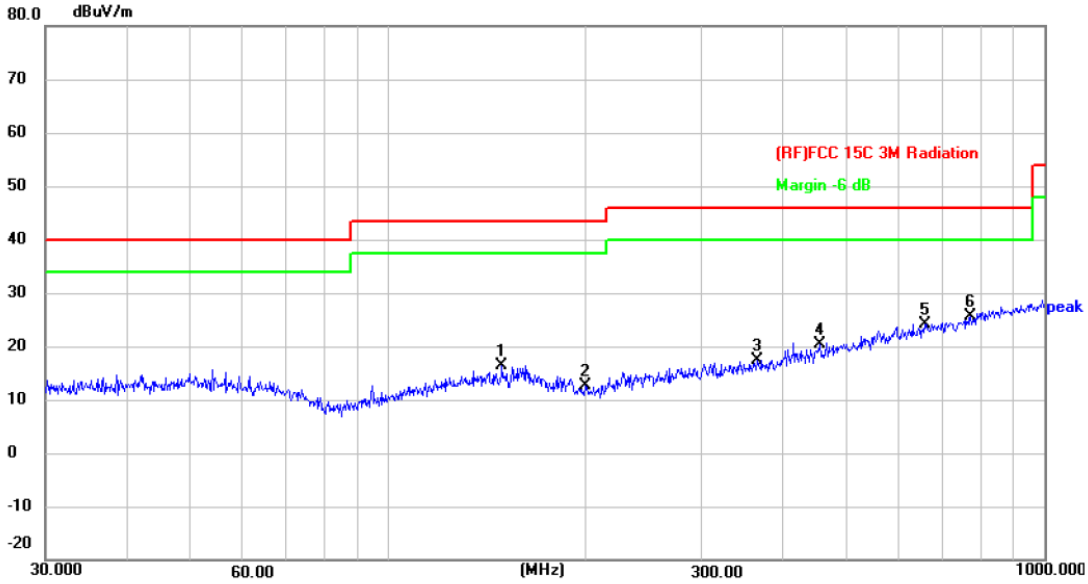


No.	Frequency (MHz)	Reading (dBuV)	Factor (dB/m)	Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Detector
1	57.3923	39.44	-23.34	16.10	40.00	-23.90	peak
2	147.4036	37.31	-21.82	15.49	43.50	-28.01	peak
3	189.7385	38.87	-23.58	15.29	43.50	-28.21	peak
4	360.4476	37.05	-19.41	17.64	46.00	-28.36	peak
5	423.5403	38.30	-17.76	20.54	46.00	-25.46	peak
6 *	550.9480	39.36	-14.35	25.01	46.00	-20.99	peak

*:Maximum data x:Over limit !:over margin

Remark:
1. Corr. = Antenna Factor (dB/m) + Cable Loss (dB)
2. QuasiPeak (dBμV/m)= Corr. (dB/m)+ Read Level (dBμV)
3. Margin (dB) = QuasiPeak (dBμV/m)-Limit QPK(dBμV/m)

Temperature:	24.3℃	**Relative Humidity:**	45%
Test Voltage:	DC 3.7V		
Ant. Pol.	Horizontal		
Test Mode:	RFID TX Mode		
Remark:	Only worst case is reported.		

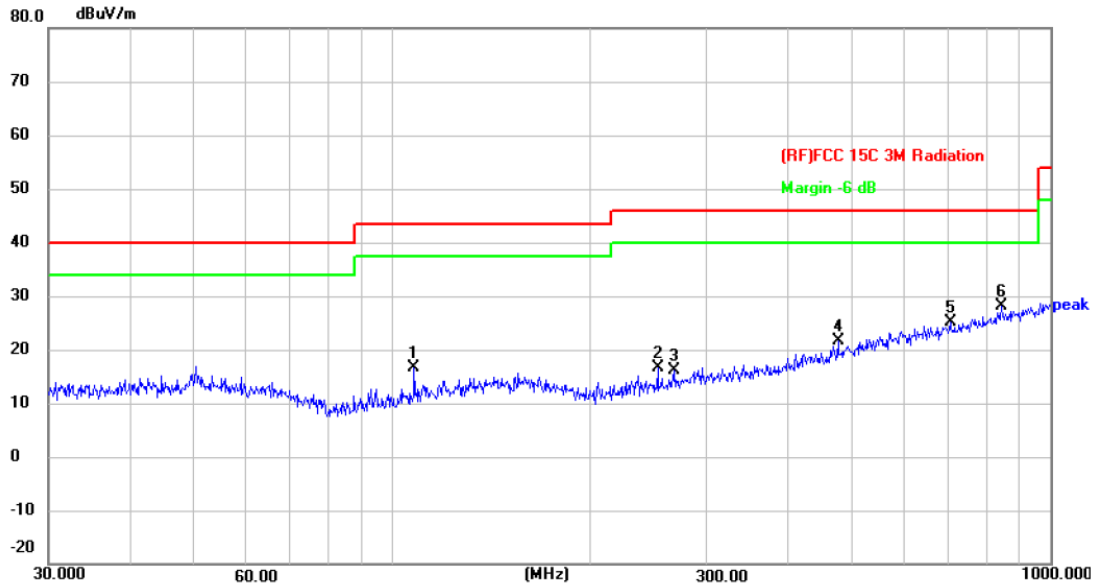


No.	Frequency (MHz)	Reading (dBuV)	Factor (dB/m)	Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Detector
1	148.9625	38.07	-21.77	16.30	43.50	-27.20	peak
2	199.9856	36.84	-24.11	12.73	43.50	-30.77	peak
3	364.2595	36.65	-19.31	17.34	46.00	-28.66	peak
4	454.3100	37.21	-16.89	20.32	46.00	-25.68	peak
5	656.5300	36.56	-12.37	24.19	46.00	-21.81	peak
6 *	771.4486	36.07	-10.36	25.71	46.00	-20.29	peak

*:Maximum data x:Over limit !:over margin

Remark:
1. Corr. = Antenna Factor (dB/m) + Cable Loss (dB)
2. QuasiPeak (dBμV/m)= Corr. (dB/m)+ Read Level (dBμV)
3. Margin (dB) = QuasiPeak (dBμV/m)-Limit QPK(dBμV/m)

Temperature:	24.3℃	**Relative Humidity:**	45%
Test Voltage:	DC 3.7V		
Ant. Pol.	Vertical		
Test Mode:	RFID TX Mode		
Remark:	Only worst case is reported.		



No.	Frequency (MHz)	Reading (dBuV)	Factor (dB/m)	Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Detector
1	107.8877	41.17	-24.48	16.69	43.50	-26.81	peak
2	252.9482	38.81	-22.28	16.53	46.00	-29.47	peak
3	268.4853	37.81	-21.71	16.10	46.00	-29.90	peak
4	475.4991	37.91	-16.26	21.65	46.00	-24.35	peak
5	704.2261	36.67	-11.63	25.04	46.00	-20.96	peak
6 *	842.1296	37.55	-9.37	28.18	46.00	-17.82	peak

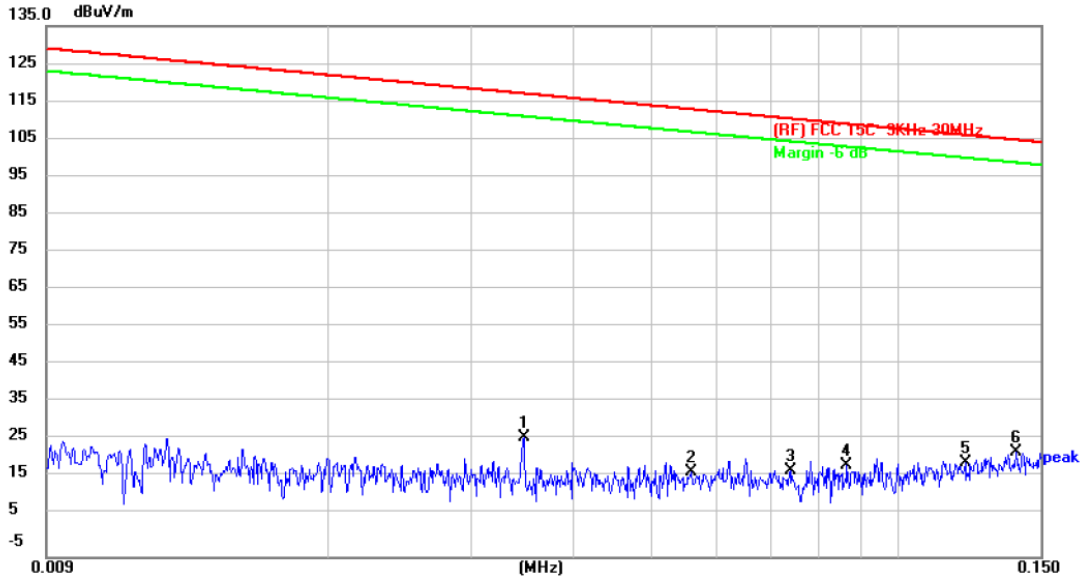
*:Maximum data x:Over limit !:over margin

Remark:
1. Corr. = Antenna Factor (dB/m) + Cable Loss (dB)
2. QuasiPeak (dBμV/m)= Corr. (dB/m)+ Read Level (dBμV)
3. Margin (dB) = QuasiPeak (dBμV/m)-Limit QPK(dBμV/m)

Attachment C--Electric Field Strength of Fundamental and Outside the Allocated bands

(1) Electric Field Strength of Fundamental

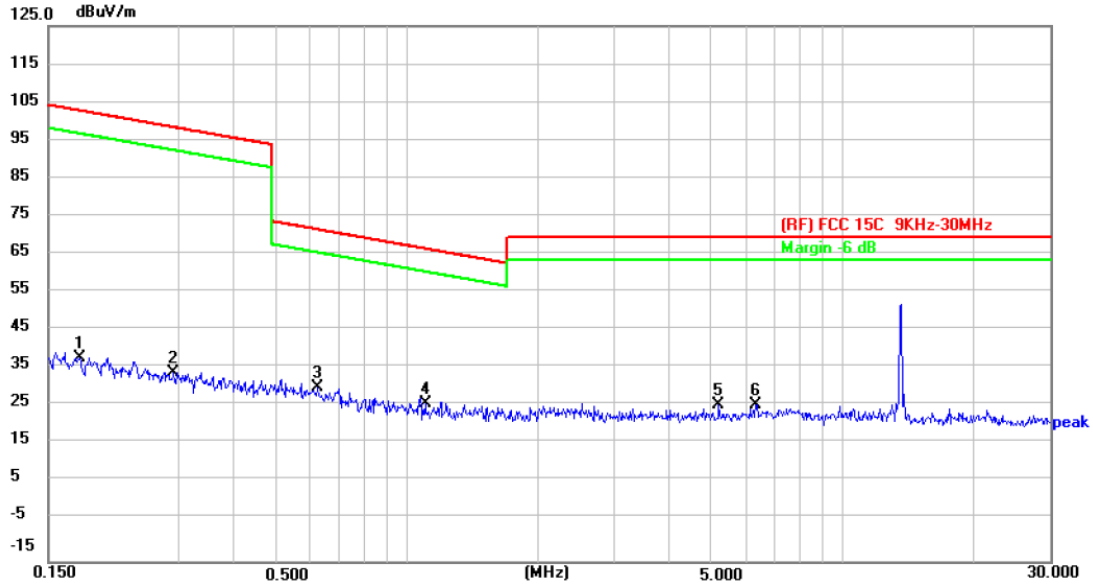
Temperature:	23.7℃	**Relative Humidity:**	46%
Test Voltage:	DC 3.7V		
Ant. Pol.	Ant. 0°		
Test Mode:	NFC TX Mode		
Remark:	N/A		



No.	Frequency (MHz)	Reading (dBuV)	Factor (dB/m)	Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Detector
1	0.0347	49.41	-22.87	26.54	117.18	-90.64	peak
2	0.0559	40.61	-22.89	17.72	113.01	-95.29	peak
3	0.0740	40.41	-22.55	17.86	110.55	-92.69	peak
4	0.0867	41.80	-22.41	19.39	109.17	-89.78	peak
5	0.1211	42.76	-22.59	20.17	106.24	-86.07	peak
6 *	0.1398	45.71	-22.95	22.76	104.98	-82.22	peak

Remark:
1. Corr. = Antenna Factor (dB/m) + Cable Loss (dB)
2. QuasiPeak (dBμV/m)= Corr. (dB/m)+ Read Level (dBμV)
3. Margin (dB) = QuasiPeak (dBμV/m)-Limit QPK(dBμV/m)

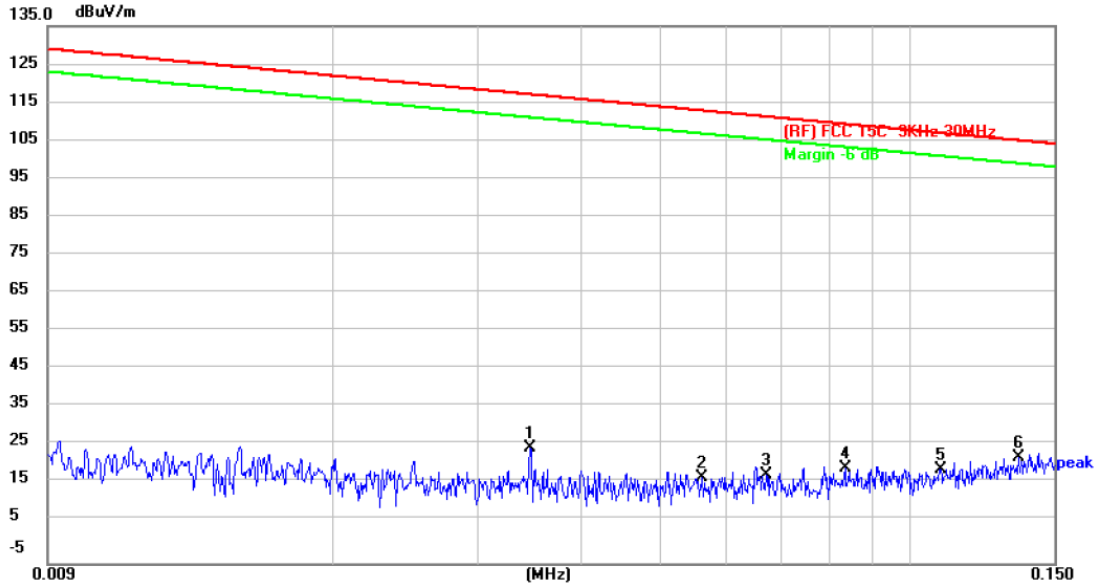
Temperature:	23.7℃	**Relative Humidity:**	46%
Test Voltage:	DC 3.7V		
Ant. Pol.	Ant. 0°		
Test Mode:	NFC TX Mode		
Remark:	N/A		



No.	Frequency (MHz)	Reading (dBuV)	Factor (dB/m)	Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Detector
1	0.1768	61.40	-22.97	38.43	102.93	-64.50	peak
2	0.2909	57.43	-22.74	34.69	98.57	-63.88	peak
3	0.6238	53.55	-22.71	30.84	71.87	-41.03	peak
4 *	1.0997	49.16	-22.63	26.53	66.87	-40.34	peak
5	5.1937	38.01	-12.03	25.98	70.00	-44.02	peak
6	6.3520	35.70	-9.50	26.20	70.00	-43.80	peak

Remark:
1. Corr. = Antenna Factor (dB/m) + Cable Loss (dB)
2. QuasiPeak (dBμV/m)= Corr. (dB/m)+ Read Level (dBμV)
3. Margin (dB) = QuasiPeak (dBμV/m)-Limit QPK(dBμV/m)

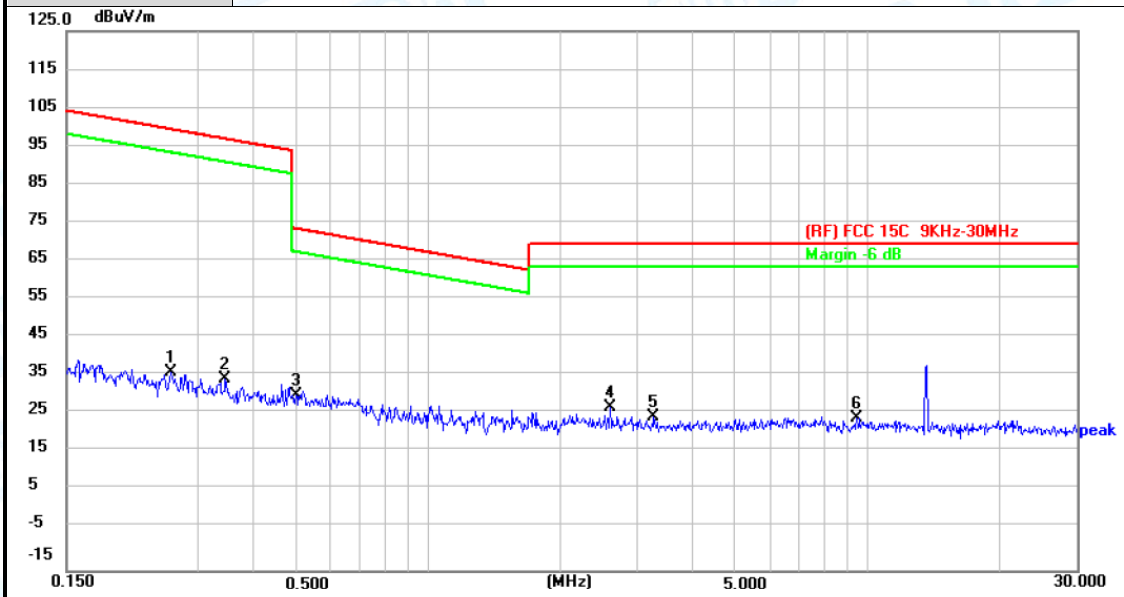
Temperature:	23.7℃	**Relative Humidity:**	46%
Test Voltage:	DC 3.7V		
Ant. Pol.	Ant. 90°		
Test Mode:	NFC TX Mode		
Remark:	N/A		



No.	Frequency (MHz)	Reading (dBuV)	Factor (dB/m)	Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Detector
1	0.0346	48.07	-22.87	25.20	117.21	-92.01	peak
2	0.0560	40.50	-22.89	17.61	112.99	-95.38	peak
3	0.0670	41.04	-22.66	18.38	111.42	-93.04	peak
4	0.0836	42.50	-22.45	20.05	109.48	-89.43	peak
5	0.1091	42.01	-22.27	19.74	107.15	-87.41	peak
6 *	0.1356	45.90	-22.91	22.99	105.25	-82.26	peak

Remark:
1. Corr. = Antenna Factor (dB/m) + Cable Loss (dB)
2. QuasiPeak (dBμV/m)= Corr. (dB/m)+ Read Level (dBμV)
3. Margin (dB) = QuasiPeak (dBμV/m)-Limit QPK(dBμV/m)

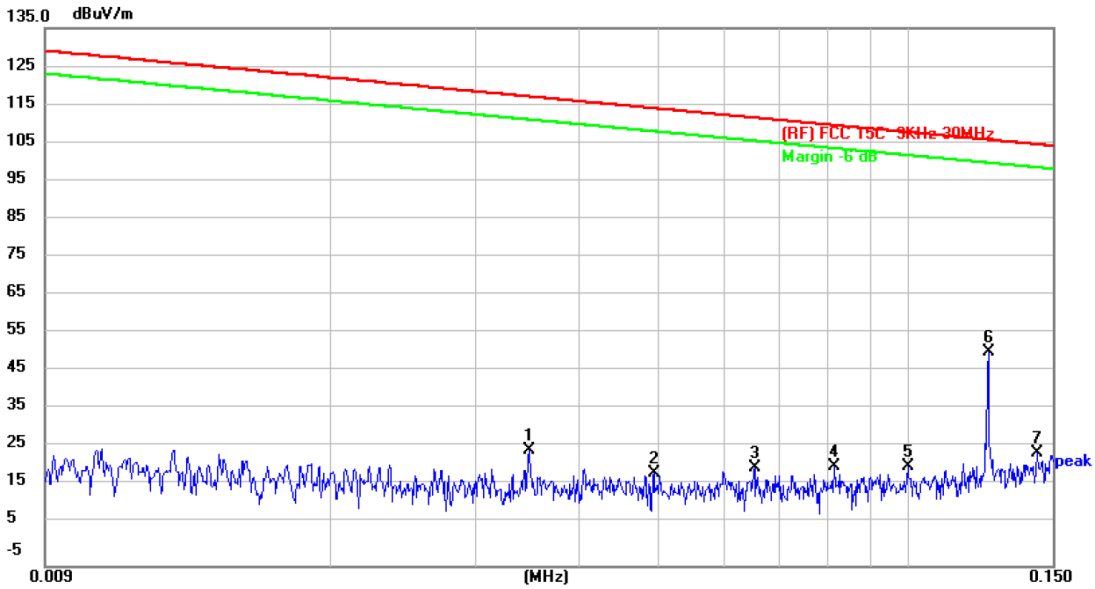
Temperature:	23.7℃	**Relative Humidity:**	46%
Test Voltage:	DC 3.7V		
Ant. Pol.	Ant. 90°		
Test Mode:	NFC TX Mode		
Remark:	N/A		



No.	Frequency (MHz)	Reading (dBuV)	Factor (dB/m)	Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Detector
1	0.2589	59.27	-22.80	36.47	99.59	-63.12	peak
2	0.3446	57.70	-22.68	35.02	97.08	-62.06	peak
3	0.4994	53.10	-22.58	30.52	73.83	-43.31	peak
4 *	2.5945	50.43	-22.75	27.68	70.00	-42.32	peak
5	3.2583	47.86	-22.72	25.14	70.00	-44.86	peak
6	9.4514	46.83	-22.15	24.68	70.00	-45.32	peak

Remark:
1. Corr. = Antenna Factor (dB/m) + Cable Loss (dB)
2. QuasiPeak (dBμV/m)= Corr. (dB/m)+ Read Level (dBμV)
3. Margin (dB) = QuasiPeak (dBμV/m)-Limit QPK(dBμV/m)

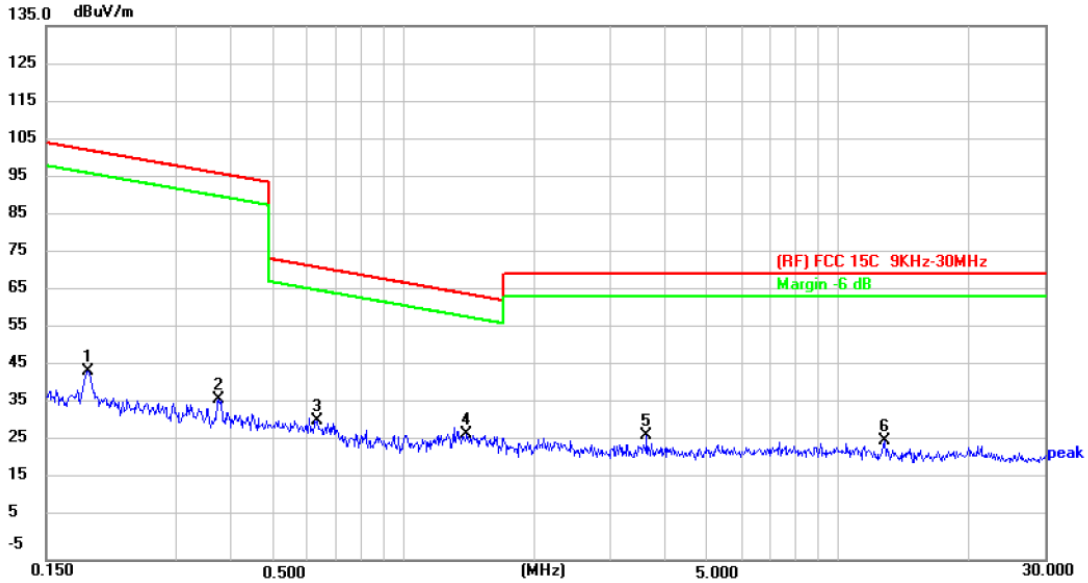
Temperature:	23.7℃	**Relative Humidity:**	46%
Test Voltage:	DC 3.7V		
Ant. Pol.	Ant. 0°		
Test Mode:	RFID TX Mode		
Remark:	N/A		



No.	Frequency (MHz)	Reading (dBuV)	Factor (dB/m)	Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Detector
1	0.0347	48.01	-22.87	25.14	117.18	-92.04	peak
2	0.0492	42.35	-23.00	19.35	114.13	-94.78	peak
3	0.0652	43.58	-22.70	20.88	111.66	-90.78	peak
4	0.0815	43.58	-22.47	21.11	109.71	-88.60	peak
5	0.1000	43.36	-22.33	21.03	107.92	-86.89	peak
6 *	0.1252	73.46	-22.72	50.74	105.95	-55.21	peak
7	0.1434	47.41	-22.97	24.44	104.76	-80.32	peak

Remark:
1. Corr. = Antenna Factor (dB/m) + Cable Loss (dB)
2. QuasiPeak (dBμV/m)= Corr. (dB/m)+ Read Level (dBμV)
3. Margin (dB) = QuasiPeak (dBμV/m)-Limit QPK(dBμV/m)

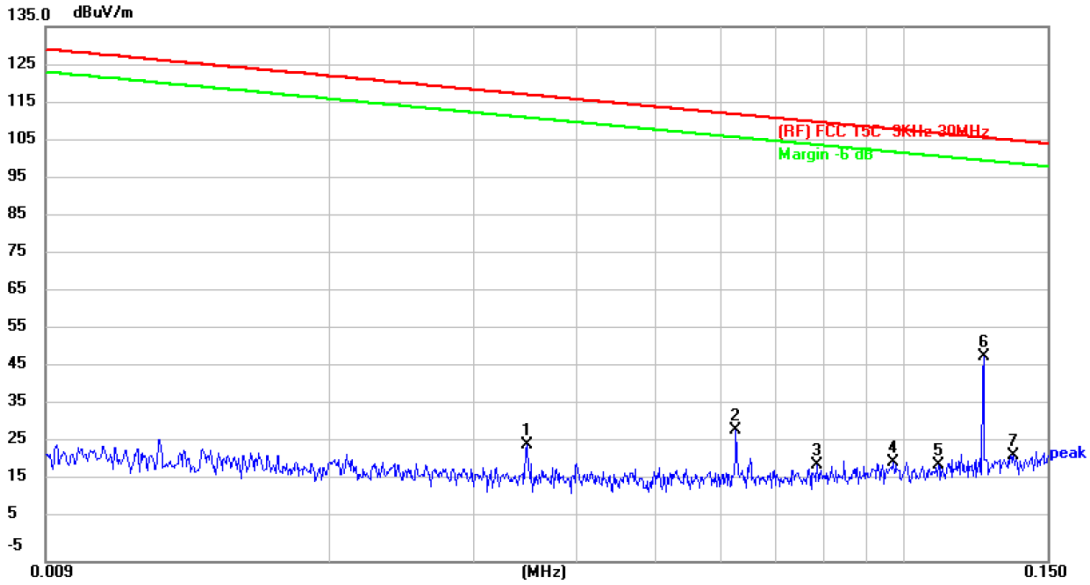
Temperature:	23.7℃	**Relative Humidity:**	46%
Test Voltage:	DC 3.7V		
Ant. Pol.	Ant. 0°		
Test Mode:	RFID TX Mode		
Remark:	N/A		



No.	Frequency (MHz)	Reading (dBuV)	Factor (dB/m)	Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Detector
1	0.1874	67.58	-22.95	44.63	102.42	-57.79	peak
2	0.3731	59.76	-22.66	37.10	96.39	-59.29	peak
3	0.6305	54.40	-22.72	31.68	71.78	-40.10	peak
4 *	1.3958	50.86	-22.65	28.21	64.77	-36.56	peak
5	3.6225	50.29	-22.66	27.63	70.00	-42.37	peak
6	12.7837	48.74	-22.54	26.20	70.00	-43.80	peak

Remark:
1. Corr. = Antenna Factor (dB/m) + Cable Loss (dB)
2. QuasiPeak (dBμV/m)= Corr. (dB/m)+ Read Level (dBμV)
3. Margin (dB) = QuasiPeak (dBμV/m)-Limit QPK(dBμV/m)

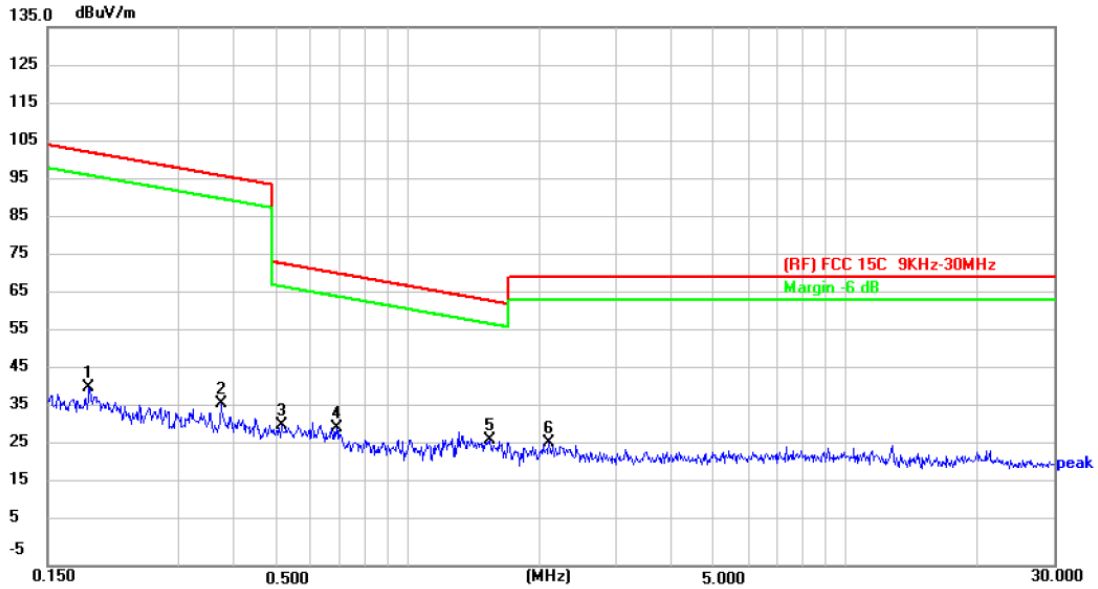
Temperature:	23.7℃	**Relative Humidity:**	46%
Test Voltage:	DC 3.7V		
Ant. Pol.	Ant. 90°		
Test Mode:	RFID TX Mode		
Remark:	N/A		



No.	Frequency (MHz)	Reading (dBuV)	Factor (dB/m)	Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Detector
1	0.0347	48.64	-22.87	25.77	117.18	-91.41	peak
2	0.0625	52.37	-22.75	29.62	112.03	-82.41	peak
3	0.0785	42.75	-22.50	20.25	110.04	-89.79	peak
4	0.0973	43.31	-22.34	20.97	108.16	-87.19	peak
5	0.1104	42.78	-22.28	20.50	107.05	-86.55	peak
6 *	0.1252	71.42	-22.72	48.70	105.95	-57.25	peak
7	0.1363	45.77	-22.91	22.86	105.20	-82.34	peak

Remark:
1. Corr. = Antenna Factor (dB/m) + Cable Loss (dB)
2. QuasiPeak (dBμV/m)= Corr. (dB/m)+ Read Level (dBμV)
3. Margin (dB) = QuasiPeak (dBμV/m)-Limit QPK(dBμV/m)

Temperature:	23.7℃	**Relative Humidity:**	46%
Test Voltage:	DC 3.7V		
Ant. Pol.	Ant. 90°		
Test Mode:	RFID TX Mode		
Remark:	N/A		

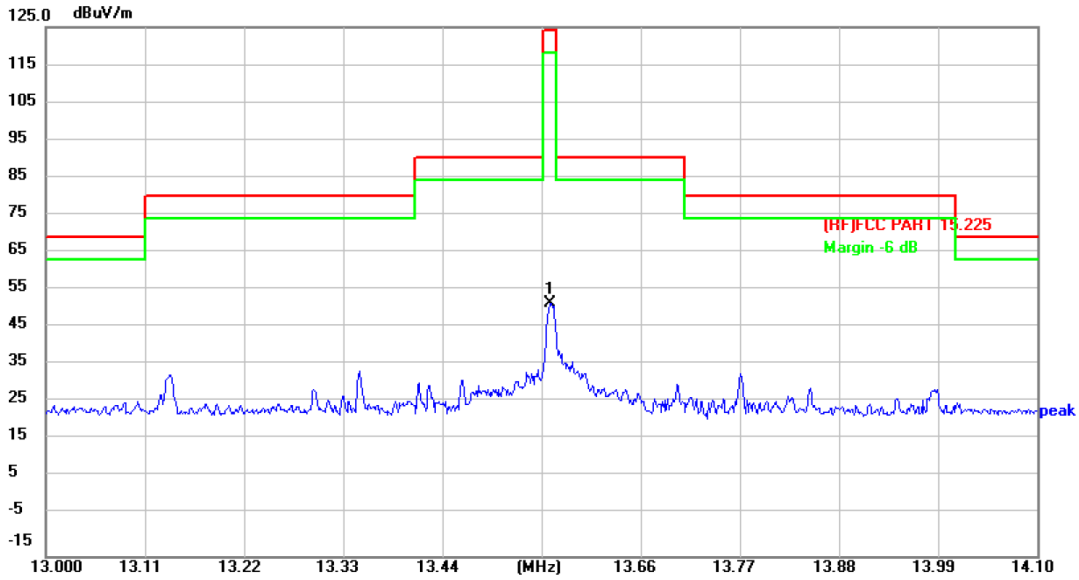


No.	Frequency (MHz)	Reading (dBuV)	Factor (dB/m)	Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Detector
1	0.1864	64.22	-22.96	41.26	102.46	-61.20	peak
2	0.3731	59.76	-22.66	37.10	96.39	-59.29	peak
3	0.5128	54.12	-22.59	31.53	73.60	-42.07	peak
4	0.6863	53.60	-22.78	30.82	71.03	-40.21	peak
5 *	1.5355	50.48	-22.65	27.83	63.92	-36.09	peak
6	2.0989	49.68	-22.70	26.98	70.00	-43.02	peak

Remark:
1. Corr. = Antenna Factor (dB/m) + Cable Loss (dB)
2. QuasiPeak (dBμV/m)= Corr. (dB/m)+ Read Level (dBμV)
3. Margin (dB) = QuasiPeak (dBμV/m)-Limit QPK(dBμV/m)

(2) Test Fundamental and Outside the Allocated bands

Temperature:	23.7℃	**Relative Humidity:**	46%
Test Voltage:	DC 3.7V		
Test Mode:	NFC TX Mode		
Remark:	N/A		



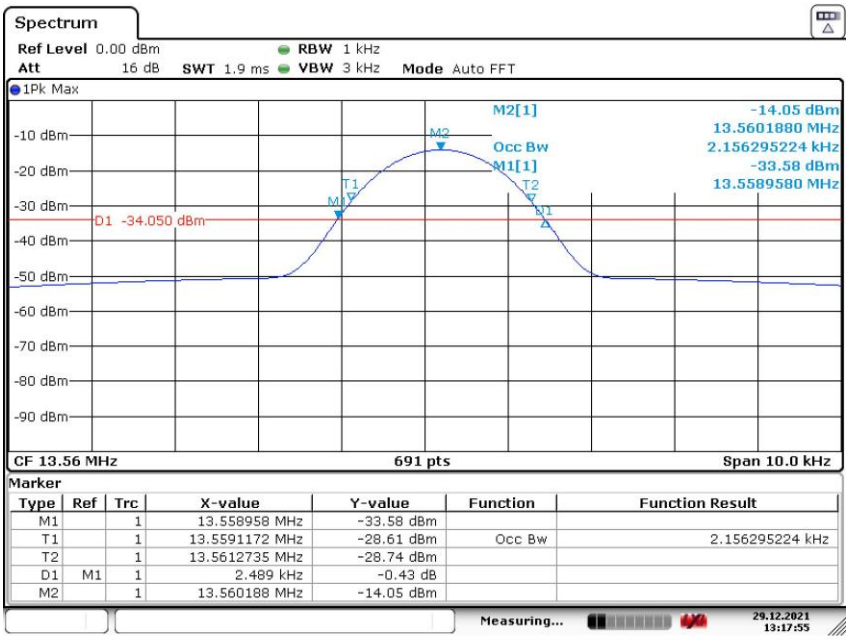
No.	Frequency (MHz)	Reading (dBuV)	Factor (dB/m)	Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Detector
1 *	13.5600	74.53	-22.64	51.89	124.00	-72.11	peak

Remark:
1. Corr. = Antenna Factor (dB/m) + Cable Loss (dB)
2. QuasiPeak (dBμV/m)= Corr. (dB/m)+ Read Level (dBμV)
3. Margin (dB) = QuasiPeak (dBμV/m)-Limit QPK(dBμV/m)

Attachment D-- Bandwidth Test Data

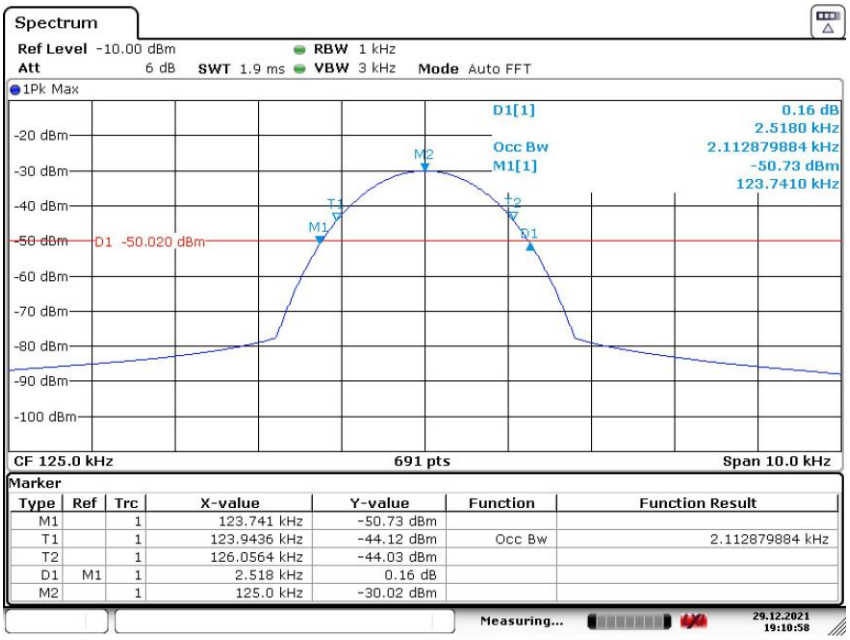
Temperature:	23.4℃	**Relative Humidity:**	49%
Test Voltage:	DC 3.70V		
Test Mode:	NFC TX Mode		
Channel Frequency(MHz)		**-20dB Bandwidth(KHz)**	**99% Bandwidth(KHz)**
13.56		2.489	2.156295224

13.56 MHz



Temperature:	23.4℃	Relative Humidity:	49%
Test Voltage:	DC 3.70V		
Test Mode:	RFID TX Mode		
Channel Frequency(KHz)		-20dB Bandwidth(KHz)	99% Bandwidth(KHz)
125		2.518	2.112879884

125KHz



Attachment E--Fundamental Frequency Tolerance

Frequency Stability Versus Temperature					
Temperature (℃)	Power Supply(V)	Measured Frequency (MHz)	Frequency Drift %	Limit %	Result
50	DC 3.7V	13.5601880	0.001386431	0.01	PASS
40		13.5601890	0.001393805	0.01	PASS
30		13.5601870	0.001379056	0.01	PASS
20		13.5601880	0.001386431	0.01	PASS
10		13.5601860	0.001371681	0.01	PASS
0		13.5601900	0.001401180	0.01	PASS
-10		13.5601880	0.001386431	0.01	PASS
-20		13.5601870	0.001379056	0.01	PASS

Frequency Stability Versus Temperature					
Temperature (℃)	Power Supply(V)	Measured Frequency (MHz)	Frequency Drift %	Limit %	Result
20	DC 3.30	13.5601880	0.001386431	0.01	PASS
	DC 3.70	13.5601850	0.001364307	0.01	PASS
	DC 5.00	13.5601840	0.001356932	0.01	PASS

-----END OF REPORT------