TEST REPORT

Applicant Name:	Mighton Products Ltd
Address:	Hinxton Grange,Hinxton,Cambridgeshire CB10 1RG England,United Kingdom
Report Number:	SZ1240118-04056E-RF-00A
FCC ID:	2BEY2-5055661500470

Test Standard (s)

FCC PART 15.225

Sample Description

Product Type:	Avia Smart Deadbolt+
Model No.:	US 001
Multiple Model(s) No.:	N/A
Trade Mark:	AVIA
Date Received:	2024/01/18
Issue Date:	2024/04/19

Test Result:	Pass▲

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

Prepared and Checked By:

April Zhang

April Zhang
RF Engineer

Approved By:

Nancy Wang

Nancy Wang
RF Supervisor

TABLE OF CONTENTS

DOCUMENT REVISION HISTORY

Revision Number	Report Number	Description of Revision	Date of Revision
0	SZ1240118-04056E-RF-00A	Original Report	2024/04/19

GENERALINFORMATION

Product Description for Equipment under Test (EUT)

Product	Avia Smart Deadbolt+
Tested Model	US 001
Multiple Model(s)	N/A
Frequency Range	13.56 MHz
E-field Strength	71.68dBuV/m@3m
Modulation Technique	ASK
Voltage Range	DC 1.5V*4 by Alkaline battery
Sample serial number	2GRY-2 for Radiated Emissions Test 2GRY-1 for RF Conducted Test (Assigned by BACL, Shenzhen)
Sample/EUT Status	Good condition
Adapter Information	N/A

Objective

This Type approval report is in accordance with Part 2- Subpart J, and Part 15-Subparts A and C of the Federal Communication Commissions rules.

The objective is to determine the compliance of the EUT with FCC rules, section 15.203, 15.205, 15.209 and 15.225.

Test Methodology

All measurements contained in this report were conducted with ANSI C63.10-2013, American National Standard of Procedures for Compliance Testing of Unlicensed Wireless Devices.

All emissions measurement was performed at Bay Area Compliance Laboratories Corp. (Shenzhen). The radiated testing was performed at an antenna-to-EUT distance of 3 meters.

Measurement Uncertainty

Parameter		Uncertainty
Occupied Channel Bandwidth		±5%
AC Power Lines Conducted Emissions	9kHz~150 kHz	3.94dB(k=2, 95% level of confidence)
	150 kHz ~30MHz	3.84dB(k=2, 95% level of confidence)
Radiated Emissions	9kHz - 30MHz	3.30dB(k=2, 95% level of confidence)
	30MHz~200MHz (Horizontal)	4.48dB(k=2, 95% level of confidence)
	30MHz~200MHz (Vertical)	4.55dB(k=2, 95% level of confidence)
	200MHz~1000MHz (Horizontal)	4.85dB(k=2, 95% level of confidence)
	200MHz~1000MHz (Vertical)	5.05dB(k=2, 95% level of confidence)
Temperature		±1℃
Humidity		±1%
Supply voltages		±0.4%

Note: The extended uncertainty given in this report is obtained by combining the standard uncertainty times the coverage factor K with the 95% confidence interval. Otherwise required by the applicant or Product Regulations, Decision Rule in this report did not consider the uncertainty.

Test Facility

The Test site used by Bay Area Compliance Laboratories Corp. (Shenzhen) to collect test data is located on the 5F(B-West) , 6F, 7F, the 3rd Phase of Wan Li Industrial Building D, Shihua Rd, FuTian Free Trade Zone, Shenzhen, China.

The lab has been recognized by Innovation, Science and Economic Development Canada to test to Canadian radio equipment requirements, the CAB identifier: CN0023.

SYSTEM TEST CONFIGURATION

Description of Test Configuration

The system was configured for testing in a typical fashion (as normally used by a typical user).

EUT Exercise Software

"nRF_DTM.exe"[#] Exercise Software was used.

Equipment Modifications

No modification on the EUT.

Support Equipment List and Details

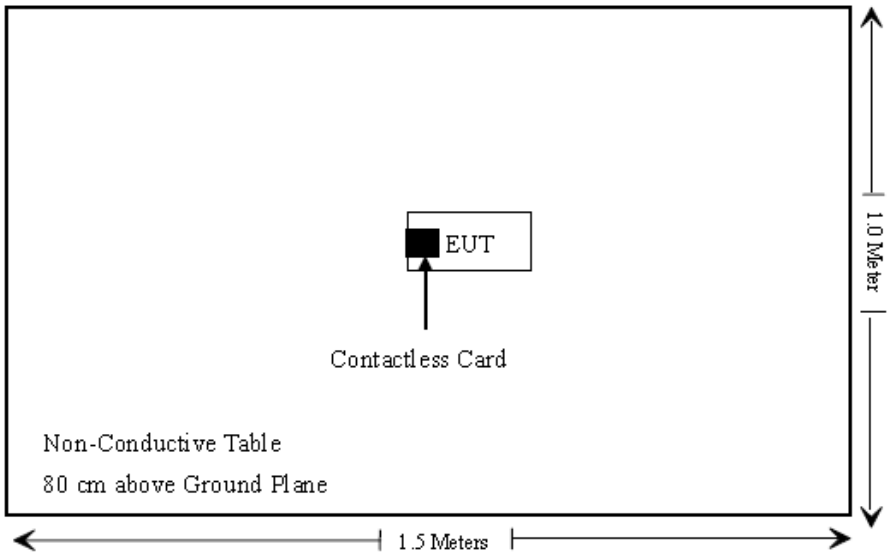
Manufacturer	Description	Model	Serial Number
Unknown	Contactless Card	Unknown	Unknown

External I/O Cable

Cable Description	Length (m)	From Port	To
/	/	/	/

Block Diagram of Test Setup

For Radiated Emissions:



SUMMARY OF TEST RESULTS

FCC Rules	Description of Test	Result
§15.203	Antenna Requirement	Compliant
§2.1091	Maximum Permissible Exposure (MPE)	Compliant
§15.207	AC Line Conducted Emission	Not Applicable
§15.225 §15.209§15.205	Radiated Emission Test	Compliant
§15.225(e)	Frequency Stability	Compliant
§15.215(c)	20dB Emission Bandwidth	Compliant

Not Applicable: The EUT cannot connect directly to the public power network.

TEST EQUIPMENT LIST

Manufacturer	Description	Model	Serial Number	Calibration Date	Calibration Due Date
Radiated Emission Test					
R&S	EMI Test Receiver	ESR3	102455	2024/01/16	2025/01/15
Sonoma instrument	Pre-amplifier	310 N	186238	2023/06/08	2024/06/07
Sunol Sciences	Broadband Antenna	JB1	A040904-1	2023/07/20	2024/07/19
BACL	Active Loop Antenna	1313-1A	4031911	2024/03/21	2025/03/20
Unknown	Cable	Chamber Cable 1	F-03-EM236	2023/08/03	2024/08/02
Unknown	Cable	Chamber Cable 4	EC-007	2023/08/03	2024/08/02
Audix	EMI Test software	E3	19821b(V9)	NCR	NCR
Frequency Stability					
R&S	EMI Test Receiver	ESR3	102455	2024/01/16	2025/01/15
ETS	Passive Loop Antenna	6512	29604	2023/07/07	2024/07/06
BACL	Temperature & Humidity Chamber	BTH-150-40	30144	2024/01/16	2025/01/15
instek	DC Power Supply	GPS-3030DD	EM832096	NCR	NCR
Fluke	Digital Multimeter	287	19000011	2023/06/08	2024/06/07

*** Statement of Traceability:** Bay Area Compliance Laboratories Corp. (Shenzhen) attests that all calibrations have been performed in accordance to requirements that traceable to National Primary Standards and International System of Units (SI).

FCC§15.203 - ANTENNA REQUIREMENT

Applicable Standard

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.

Antenna Connected Construction

The EUT has one internal antenna arrangement for NFC which was permanently attached; fulfill the requirement of this section. Please refer to the EUT photos.

Result: Compliant.

FCC §2.1091- MAXIMUM PERMISSIBLE EXPOSURE (MPE)

Applicable Standard

According to subpart 2.1091 systems operating under the provisions of this section shall be operated in a manner that ensures the public is not exposed to RF energy level in excess of the communication guidelines.

Limits for General Population/Uncontrolled Exposure

Limits for General Population/Uncontrolled Exposure				
Frequency Range (MHz)	**Electric Field Strength (V/m)**	**Magnetic Field Strength (A/m)**	**Power Density (mW/cm^2)**	**Averaging Time (Minutes)**
0.3-1.34	614	1.63	*(100)	30
1.34-30	824/f	2.19/f	*($180/f^2$)	30
30-300	27.5	0.073	0.2	30
300-1500	/	/	f/1500	30
1500-100,000	/	/	1.0	30

f = frequency in MHz
* = Plane-wave equivalent power density

Result

Calculated Formulary:

Predication of MPE limit at a given distance

$$S = \frac{PG}{4\pi R^2}$$

S = power density (in appropriate units, e.g. mW/cm^2)
P = power input to the antenna (in appropriate units, e.g., mW).
G = power gain of the antenna in the direction of interest relative to an isotropic radiator, the power gain factor, is normally numeric gain.
R = distance to the center of radiation of the antenna (appropriate units, e.g., cm)

Mode	Frequency (MHz)	Antenna Gain#	Tune up output power#	Evaluation Distance (cm)	Power Density (mW/cm^2)	MPE Limit (mW/cm^2)
		(dBi)	(dBm)			
BLE	2402-2480	2.88	0.5	20	0.0004	1

Note: The antenna gain and tune up output power was provided by applicant,BLE and NFC cannot transmit simultaneously.

Mode	Frequency (MHz)	Tune up output power#	Evaluation Distance (cm)	Power Density (mW/cm^2)	MPE Limit (mW/cm^2)
		(dBm)			
NFC	13.56	-23	20	0.000001	0.98

Note: the maximum E-field strength is 71.68dBuV/m@3m=-23.52dBm

Result: Compliant

FCC§15.225, §15.205& §15.209 - RADIATED EMISSIONS TEST

Applicable Standard

As per FCC Part 15.225

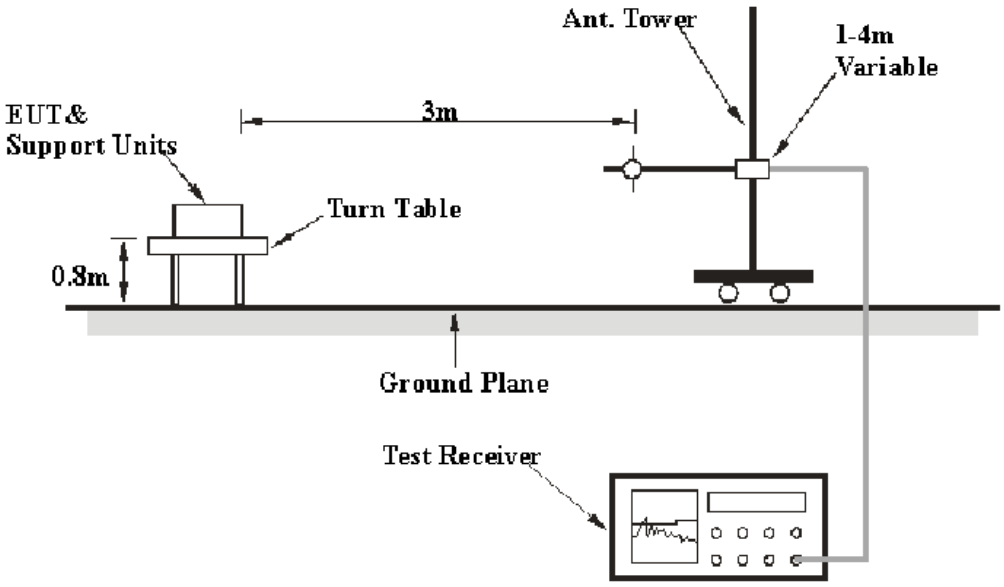
(a) The field strength of any emissions within the band 13.553–13.567 MHz shall not exceed 15,848 microvolts/meter at 30 meters.

(b) Within the bands 13.410–13.553 MHz and 13.567–13.710 MHz, the field strength of any emissions shall not exceed 334 microvolts/meter at 30 meters.

(c) Within the bands 13.110–13.410 MHz and 13.710–14.010 MHz the field strength of any emissions shall not exceed 106 microvolts/meter at 30 meters.

(d) The field strength of any emissions appearing outside of the 13.110–14.010 MHz band shall not exceed the general radiated emission limits in §15.209.

EUT Setup



Note: Antenna is set up at 1m during test for below 30MHz.

The radiated emission tests were performed in the 3-meter chamber a test site, using the setup accordance with the ANSI C63.10-2013.

EMI Test Receiver Setup

During the radiated emission test, the EMI test receiver & Spectrum Analyzer Setup were set with the following configurations:

Frequency Range	RBW	Video B/W	IF B/W	Measurement
9 kHz – 150 kHz	/	/	200 Hz	QP
	300 Hz	1 kHz	/	PK
150 kHz – 30 MHz	/	/	9 kHz	QP
	10 kHz	30 kHz	/	PK
30 MHz – 1000 MHz	/	/	120 kHz	QP
	100 kHz	300 kHz	/	PK

Test Procedure

All final data was recorded in Quasi-peak detection mode except for the frequency bands 9–90 kHz, 110–490 kHz and above 1000 MHz, average detection modes for frequency bands 9–90 kHz and 110–490 kHz, peak and average detection modes for frequencies above 1 GHz.

If the maximized peak measured value complies with under the QP/Average limit more than 6dB, then it is unnecessary to perform an QP/Average measurement.

All emissions under the average limit and under the noise floor have not recorded in the report.

Level & Over Limit Calculation

The Level is calculated by adding the Antenna Factor and Cable Loss, and subtracting the Amplifier Gain from the Meter Reading. The basic equation is as follows:

Factor = Antenna Factor + Cable Loss- Amplifier Gain
Level= Read Level + Factor

The "**Over Limit**" column of the following data tables indicates the degree of compliance with the applicable limit. For example, an over Limit of -7 dB means the emission is 7 dB below the limit. The equation for margin calculation is as follows:

Over Limit = Level – Limit

Test Data

Environmental Conditions

Temperature:	24-28 ℃
Relative Humidity:	50-55 %
ATM Pressure:	101 kPa

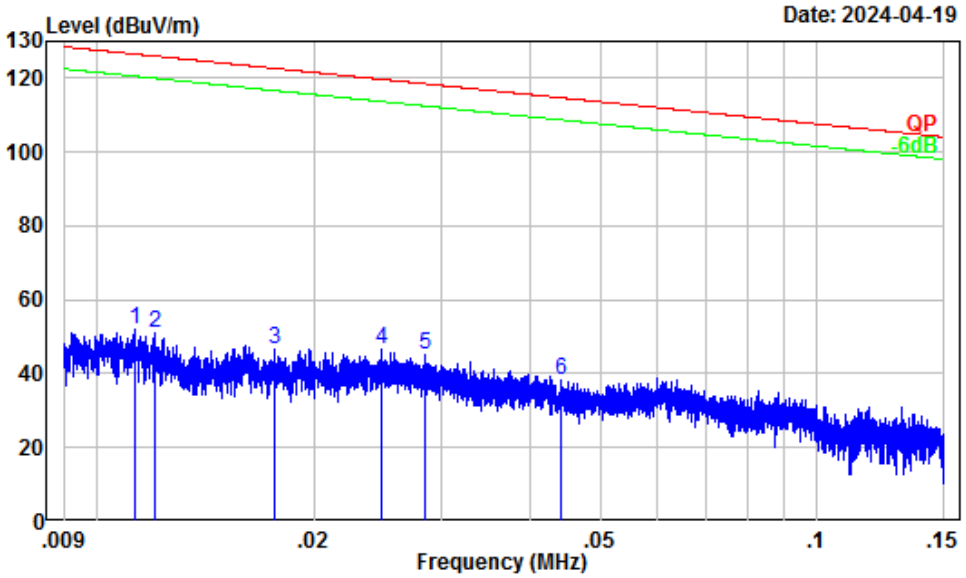
The testing was performed by Warren Huang from 2024-02-20 to 2024-04-19.

Test mode: Transmitting (Pre-scan in the X, Y and Z axes of orientation, the worst case of X-axis orientation were recorded)

1) Spurious Emissions (9 kHz~30 MHz):

Part 15 Section 15.31(f)(2) (9kHz-30MHz)
Limit @ 3m=Limit @ 300m-40*log(3(m)/300(m))
Limit @ 3m=Limit @ 30m-40*log(3(m)/30(m))

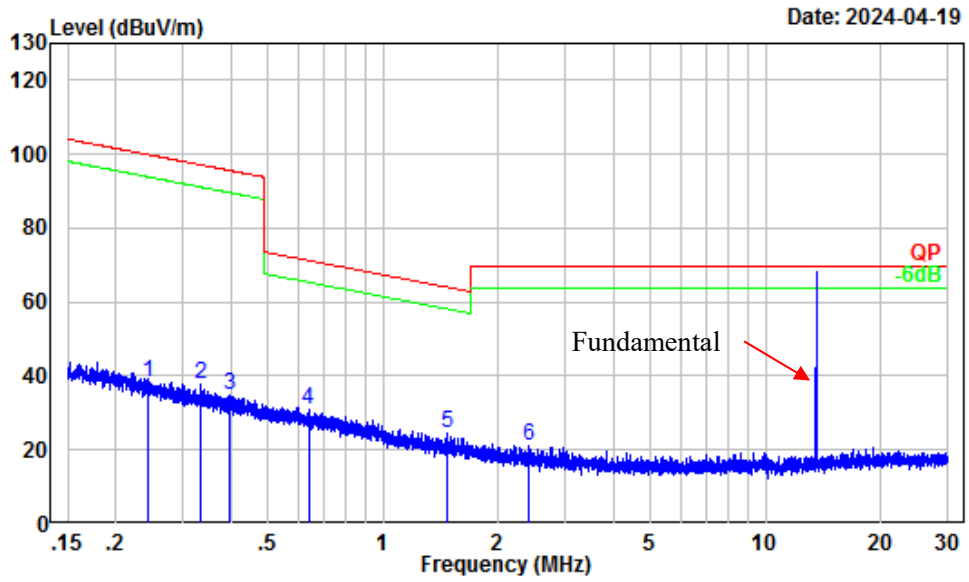
Ground-parallel
9 kHz~150 kHz



Site : Chamber A
Condition : 3m
Project Number: SZ1240118-04056E-RF
Note : NFC Transmitting
Note : Ground-parallel
Tester : Warren Huang

	Freq	Factor	Read Level	Level	Limit Line	Over Limit	Remark
	MHz	dB/m	dBuV	dBuV/m	dBuV/m	dB	
1	0.01	37.03	14.77	51.80	126.54	-74.74	Peak
2	0.01	36.64	14.47	51.11	125.98	-74.87	Peak
3	0.02	33.80	12.80	46.60	122.69	-76.09	Peak
4	0.02	30.14	16.57	46.71	119.72	-73.01	Peak
5	0.03	28.19	17.05	45.24	118.47	-73.23	Peak
6	0.04	24.36	13.81	38.17	114.71	-76.54	Peak

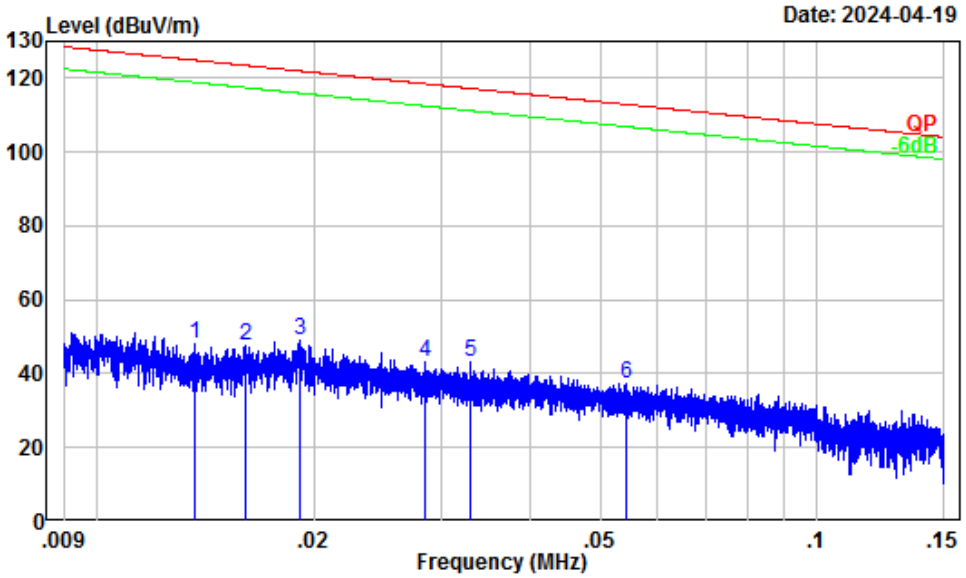
150 kHz~30 MHz



Site : Chamber A
Condition : 3m
Project Number: SZ1240118-04056E-RF
Note : NFC Transmitting
Note : Ground-parallel
Tester : Warren Huang

	Freq	Factor	Read Level	Level	Limit Line	Over Limit	Remark
	MHz	dB/m	dBuV	dBuV/m	dBuV/m	dB	
1	0.24	10.34	28.06	38.40	99.86	-61.46	Peak
2	0.33	7.00	30.72	37.72	97.13	-59.41	Peak
3	0.40	5.67	29.22	34.89	95.64	-60.75	Peak
4	0.64	1.82	29.30	31.12	71.45	-40.33	Peak
5	1.46	-3.21	27.52	24.31	64.09	-39.78	Peak
6	2.40	-5.40	26.45	21.05	69.54	-48.49	Peak

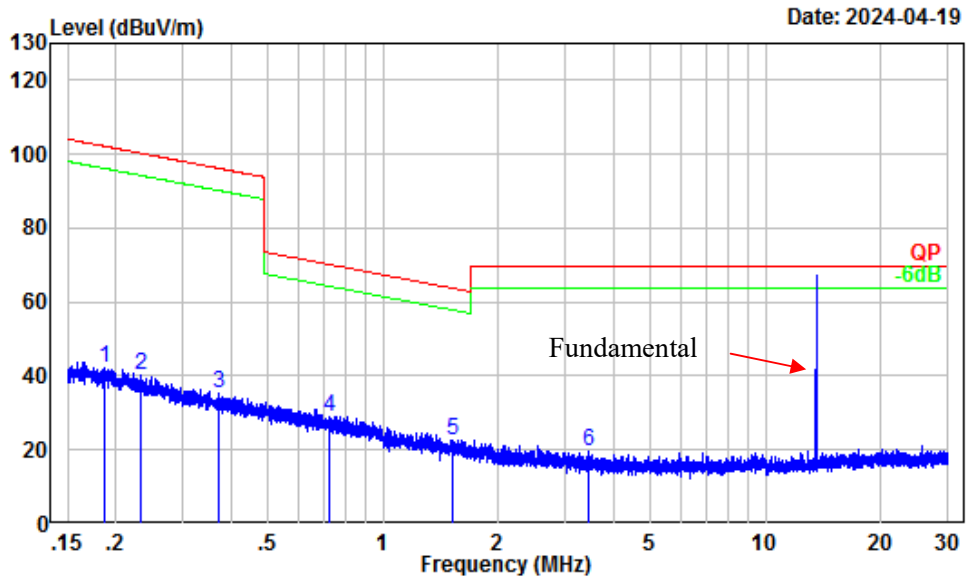
Perpendicular
9 kHz~150 kHz



Site : Chamber A
Condition : 3m
Project Number: SZ1240118-04056E-RF
Note : NFC Transmitting
Note : Perpendicular
Tester : Warren Huang

	Freq	Factor	Read Level	Level	Limit Line	Over Limit	Remark
	MHz	dB/m	dBuV	dBuV/m	dBuV/m	dB	
1	0.01	35.80	12.34	48.14	124.87	-76.73	Peak
2	0.02	34.59	12.97	47.56	123.48	-75.92	Peak
3	0.02	33.02	15.95	48.97	121.96	-72.99	Peak
4	0.03	28.19	15.05	43.24	118.47	-75.23	Peak
5	0.03	26.83	16.47	43.30	117.24	-73.94	Peak
6	0.05	22.50	14.98	37.48	112.92	-75.44	Peak

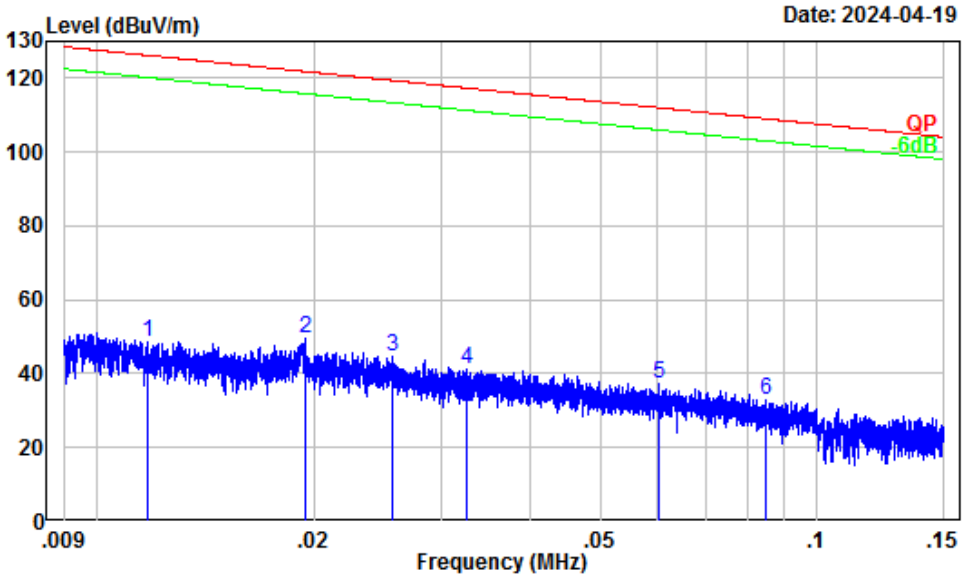
150 kHz~30 MHz



Site : Chamber A
Condition : 3m
Project Number: SZ1240118-04056E-RF
Note : NFC Transmitting
Note : Perpendicular
Tester : Warren Huang

	Freq	Factor	Read Level	Level	Limit Line	Over Limit	Remark
	MHz	dB/m	dBuV	dBuV/m	dBuV/m	dB	
1	0.19	13.03	29.25	42.28	102.20	-59.92	Peak
2	0.23	10.87	29.23	40.10	100.27	-60.17	Peak
3	0.37	6.22	29.29	35.51	96.22	-60.71	Peak
4	0.72	0.80	28.38	29.18	70.34	-41.16	Peak
5	1.52	-3.40	26.04	22.64	63.76	-41.12	Peak
6	3.46	-6.29	25.80	19.51	69.54	-50.03	Peak

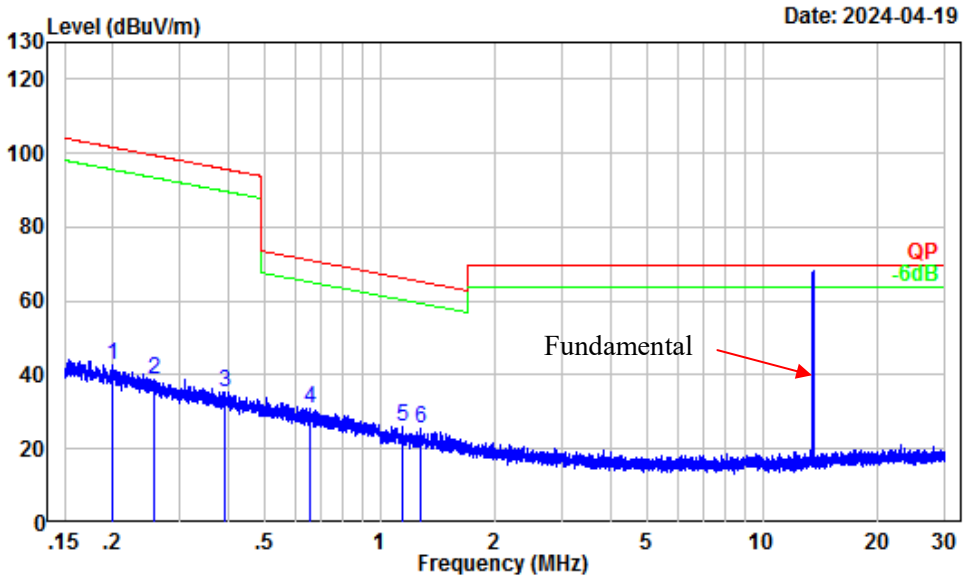
Parallel
9 kHz~150 kHz



Site : Chamber A
Condition : 3m
Project Number: SZ1240118-04056E-RF
Note : NFC Transmitting
Note : Parallel
Tester : Warren Huang

	Freq	Factor	Read Level	Level	Limit Line	Over Limit	Remark
	MHz	dB/m	dBuV	dBuV/m	dBuV/m	dB	
1	0.01	36.80	11.71	48.51	126.21	-77.70	Peak
2	0.02	32.83	16.76	49.59	121.80	-72.21	Peak
3	0.03	29.66	14.81	44.47	119.40	-74.93	Peak
4	0.03	26.91	14.53	41.44	117.34	-75.90	Peak
5	0.06	21.69	15.71	37.40	112.01	-74.61	Peak
6	0.08	18.54	14.31	32.85	109.02	-76.17	Peak

150 kHz~30 MHz

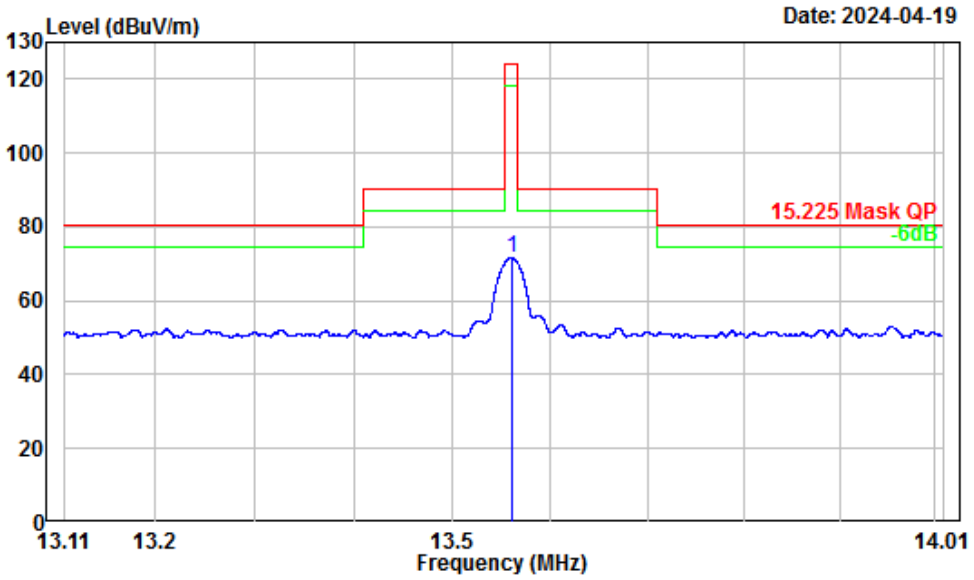


Site : Chamber A
Condition : 3m
Project Number: SZ1240118-04056E-RF
Note : NFC Transmitting
Note : Parallel
Tester : Warren Huang

	Freq	Factor	Read Level	Level	Limit Line	Over Limit	Remark
	MHz	dB/m	dBuV	dBuV/m	dBuV/m	dB	
1	0.20	12.41	30.43	42.84	101.61	-58.77	Peak
2	0.26	9.70	29.06	38.76	99.39	-60.63	Peak
3	0.39	5.73	29.66	35.39	95.69	-60.30	Peak
4	0.66	1.61	29.29	30.90	71.21	-40.31	Peak
5	1.14	-2.09	28.01	25.92	66.28	-40.36	Peak
6	1.27	-2.55	28.14	25.59	65.32	-39.73	Peak

2) Emission Mask & Fundamental:

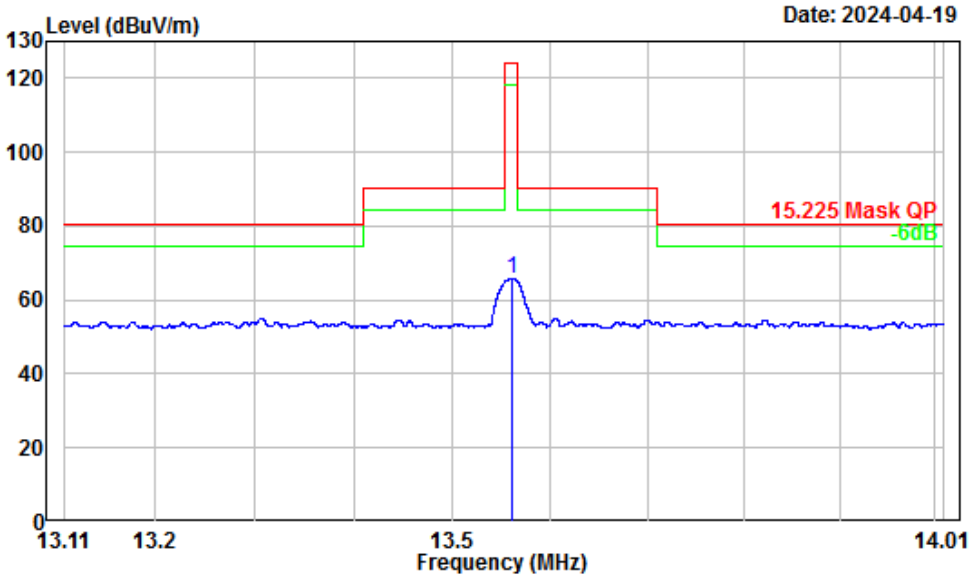
Ground-parallel



Site : Chamber A
Condition : 3m
Project Number: SZ1240118-04056E-RF
Note : NFC Transmitting
Note : Ground-parallel
Tester : Warren Huang

	Freq	Factor	Read Level	Level	Limit Line	Over Limit	Remark
	MHz	dB/m	dBuV	dBuV/m	dBuV/m	dB	
1	13.56	-5.69	77.37	71.68	124.00	-52.32	Peak

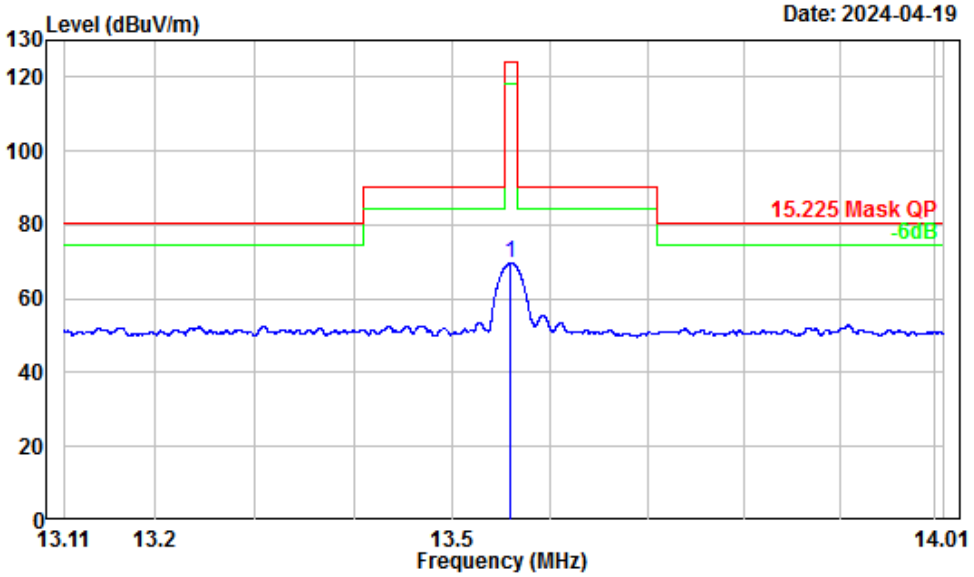
Perpendicular



Site : Chamber A
Condition : 3m
Project Number: SZ1240118-04056E-RF
Note : NFC Transmitting
Note : Perpendicular
Tester : Warren Huang

	Freq	Factor	Read Level	Level	Limit Line	Over Limit	Remark
	MHz	dB/m	dBuV	dBuV/m	dBuV/m	dB	
1	13.56	-5.69	71.48	65.79	124.00	-58.21	Peak

Parallel

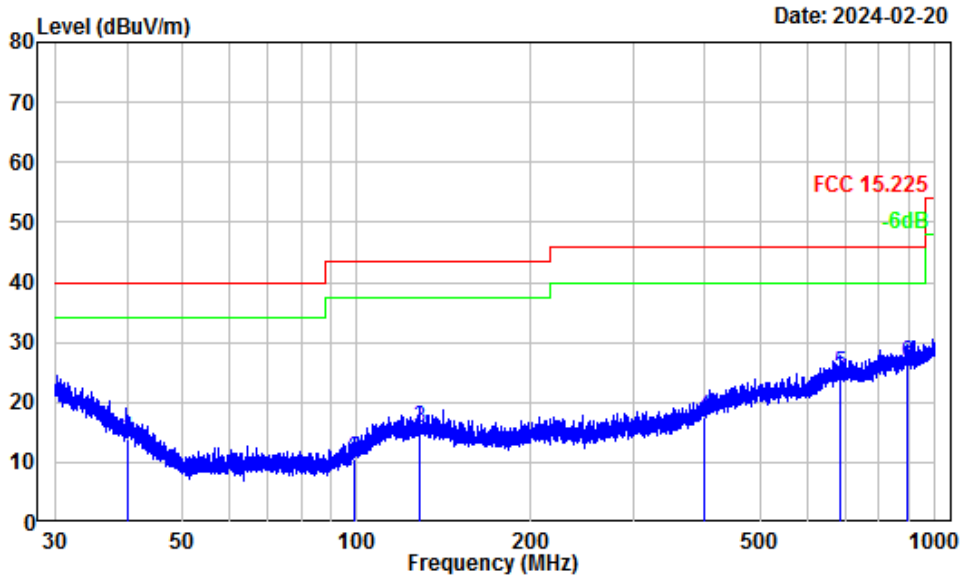


Site : Chamber A
Condition : 3m
Project Number: SZ1240118-04056E-RF
Note : NFC Transmitting
Note : Parallel
Tester : Warren Huang

	Freq	Factor	Read Level	Level	Limit Line	Over Limit	Remark
	MHz	dB/m	dBuV	dBuV/m	dBuV/m	dB	
1	13.56	-5.69	75.42	69.73	124.00	-54.27	Peak

3) Spurious Emissions (30 MHz~1GHz):

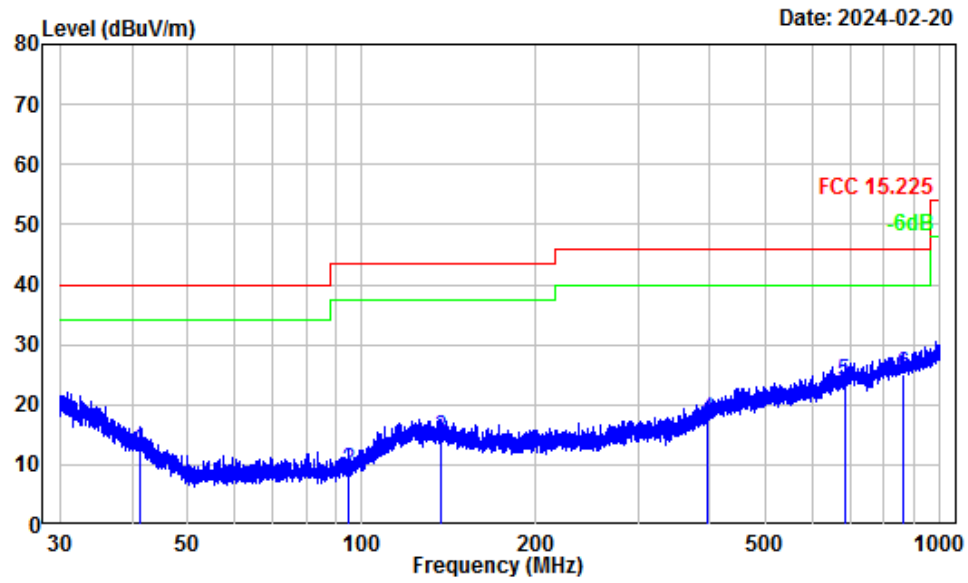
Horizontal



Site : chamber
Condition : 3m Horizontal
Project Number: SZ1240118-04056E-RF
Note : NFC Transmitting
Tester : Warren Huang

	Freq	Factor	Read Level	Level	Limit Line	Over Limit	Remark
	MHz	dB/m	dBuV	dBuV/m	dBuV/m	dB	
1	40.22	-10.53	24.40	13.87	40.00	-26.13	QP
2	98.96	-14.02	24.66	10.64	43.50	-32.86	QP
3	128.23	-10.29	26.04	15.75	43.50	-27.75	QP
4	399.73	-7.38	24.82	17.44	46.00	-28.56	QP
5	686.25	-1.77	26.65	24.88	46.00	-21.12	QP
6	898.57	0.99	25.45	26.44	46.00	-19.56	QP

Vertical



Site : chamber
Condition : 3m Vertical
Project Number: SZ1240118-04056E-RF
Note : NFC Transmitting
Tester : Warren Huang

	Freq	Factor	Read Level	Level	Limit Line	Over Limit	Remark
	MHz	dB/m	dBuV	dBuV/m	dBuV/m	dB	
1	41.17	-12.55	24.93	12.38	40.00	-27.62	QP
2	94.47	-16.41	25.58	9.17	43.50	-34.33	QP
3	137.18	-11.17	25.60	14.43	43.50	-29.07	QP
4	396.42	-7.75	25.30	17.55	46.00	-28.45	QP
5	683.25	-2.22	26.11	23.89	46.00	-22.11	QP
6	863.06	0.07	25.13	25.20	46.00	-20.80	QP

FCC§15.225(e) - FREQUENCY STABILITY

Applicable Standard

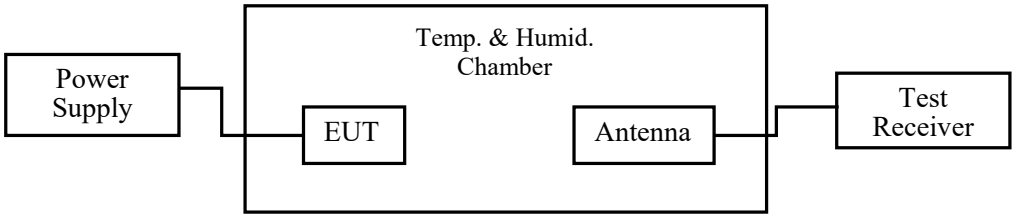
The frequency tolerance of the carrier signal shall be maintained within ±0.01% of the operating frequency over a temperature variation of −20 degrees to +50 degrees C at normal supply voltage, and for a variation in the primary supply voltage from 85% to 115% of the rated supply voltage at a temperature of 20 degrees C. For battery operated equipment, the equipment tests shall be performed using a new battery.

Test Procedure

Frequency Stability vs. Temperature: The equipment under test was connected to an external DC power supply and inductive antenna was connected to a Spectrum Analyzer. The EUT was placed inside the temperature chamber.

After the temperature stabilized for approximately 20 minutes, the frequency output was recorded from the Spectrum Analyzer.

Frequency Stability vs. Voltage: An external DC power supply Source. The voltage was set to 115% of the nominal value and was then decreased until the transmitter light no longer illuminated; i.e., the end point. The output frequency was recorded for each voltage.



Test Data

Environmental Conditions

Temperature:	24 ℃
Relative Humidity:	55 %
ATM Pressure:	101 kPa

The testing was performed by Warren Huang on 2024-02-20.

Test Mode: Transmitting

Test Result: Pass

Voltage Supply (V_{DC})	Temperature (℃)	Voltage (V_{DC})	Measured Frequency (MHz)	Frequency Error (%)	Part 15.225 Limit (%)
Frequency Stability vs. Temperature	-20	6.00	13.56125	0.0092	0.01
	-10	6.00	13.56012	0.0009	0.01
	0	6.00	13.56123	0.0091	0.01
	10	6.00	13.56101	0.0074	0.01
	20	6.00	13.55987	-0.0010	0.01
	30	6.00	13.56102	0.0075	0.01
	40	6.00	13.56107	0.0079	0.01
	50	6.00	13.56108	0.0080	0.01

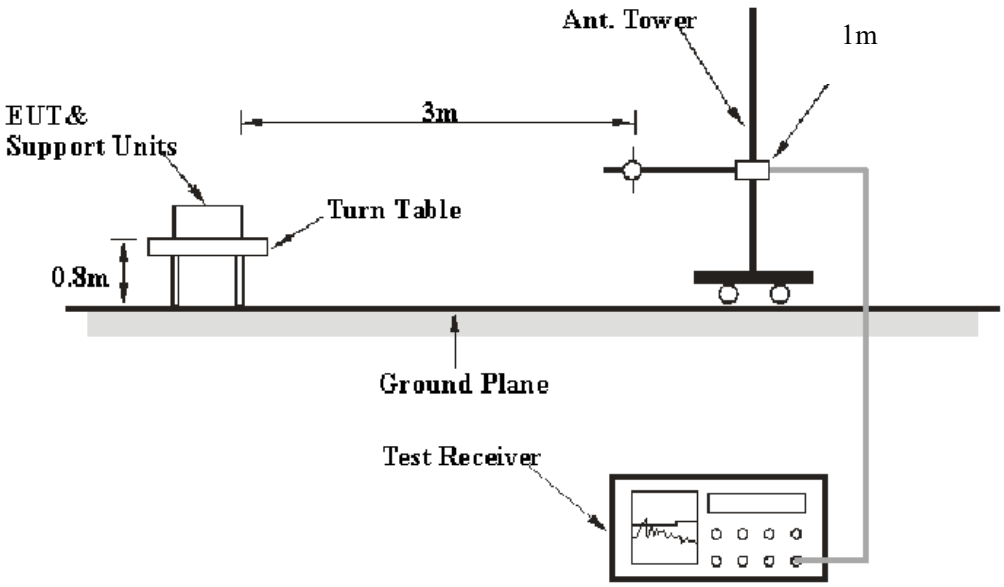
FCC§15.215(c) - 20dBEMISSION BANDWIDTH

Requirement

Per 15.215 (c) Intentional radiators operating under the alternative provisions to the general emission limits, as contained in §§ 15.217 through 15.257 and in Subpart E of this part, must be designed to ensure that the 20 dB bandwidth of the emission, or whatever bandwidth may otherwise be specified in the specific rule section under which the equipment operates, is contained within the frequency band designated in the rule section under which the equipment is operated. The requirement to contain the designated bandwidth of the emission within the specified frequency band includes the effects from frequency sweeping, frequency hopping and other modulation techniques that may be employed as well as the frequency stability of the transmitter over expected variations in temperature and supply voltage. If a frequency stability is not specified in the regulations, it is recommended that the fundamental emission be kept within at least the central 80% of the permitted band in order to minimize the possibility of out-of-band operation.

Test Procedure

Measure the frequency difference of two frequencies that were attenuated 20 dB from the reference level. Record the frequency difference as the emission bandwidth.



Test Data

Environmental Conditions

Temperature:	25.9 ℃
Relative Humidity:	55 %
ATM Pressure:	101 kPa

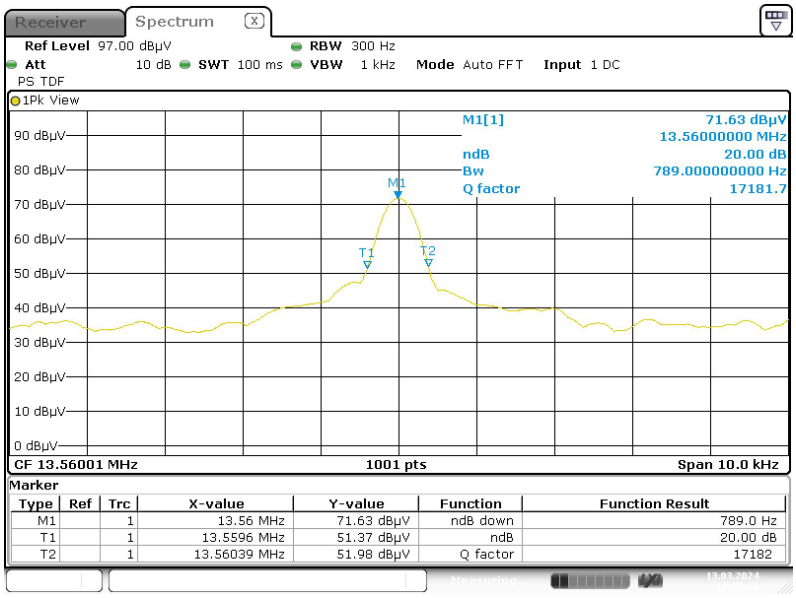
The testing was performed by Warren Huang on 2024-03-13.

Test Mode: Transmitting

Test Result: Pass

Test Frequency (MHz)	20dB Bandwidth (kHz)
13.56	0.789

20 dB Emission Bandwidth



EUT PHOTOGRAPHS

Please refer to the attachment SZ1240118-04056E-RF External photo and SZ1240118-04056E-RF Internal photo.

TEST SETUP PHOTOGRAPHS

Please refer to the attachment SZ1240118-04056E-RF-00A Test Setup photo.

******* END OF REPORT ******