

TEST REPORT

Application No.: SHCR2307001500AT
FCC ID: 2BBZ4NFCC234
Applicant: DIAS Automotive Electronic Systems Co.,Ltd.
Address of Applicant: Building 4, Lane 33, Jinji Rd, Pudong, Shanghai, China
Manufacturer: DIAS Automotive Electronic Systems Co.,Ltd.
Address of Manufacturer: Building 4, Lane 33, Jinji Rd, Pudong, Shanghai, China
Factory: SAIC DIAS Intelligent Connected Technology (Jiangsu) Co., Ltd.
Address of Factory: Group 5, Siwei Village, Jiuhua Town, Rugao City, Nantong City, 226541 Jiangsu, P.R. China

Equipment Under Test (EUT):

EUT Name: NFC READER MODULE
Model No.: C234
Trade Mark: DIAS
Standard(s) : 47 CFR Part 15, Subpart C 15.225
Date of Receipt: 2023-07-10
Date of Test: 2023-07-11 to 2023-07-28
Date of Issue: 2023-07-28

Test Result:	Pass*
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* In the configuration tested, the EUT complied with the standards specified above.

Parlam Zhan

Parlam Zhan
Laboratory Manager



Revision Record			
Version	Description	Date	Remark
00	Original	2023-07-28	/

Authorized for issue by:			
			
		<hr/> Micheal Niu /Project Engineer	
			
		<hr/> Parlam Zhan /Reviewer	



2 Test Summary

Radio Spectrum Technical Requirement				
Item	Standard	Method	Requirement	Result
Antenna Requirement	47 CFR Part 15, Subpart C 15.225	N/A	47 CFR Part 15, Subpart C 15.203	Customer Declaration

Radio Spectrum Matter Part				
Item	Standard	Method	Requirement	Result
20dB Bandwidth	47 CFR Part 15, Subpart C 15.225	ANSI C63.10 (2013) Section 6.9	47 CFR Part 15, Subpart C 15.215	Pass
Emission Mask		ANSI C63.10 (2013) Section 6.4	47 CFR Part 15, Subpart C 15.225(a)&(b)&(C)	Pass *
Frequency tolerance		ANSI C63.10 (2013) Section 6.8	47 CFR Part 15, Subpart C 15.225(e)	Pass
Radiated Emissions (9kHz-30MHz)		ANSI C63.10 (2013) Section 6.4&6.5	47 CFR Part 15, Subpart C 15.225(d) & 15.209	Pass
Radiated Emissions (30MHz-1GHz)		ANSI C63.10 (2013) Section 6.4&6.5	47 CFR Part 15, Subpart C 15.225(d) & 15.209	Pass

Note1*: The test level of the fundamental signal is below the limit of general spurious emission, so the test item doesn't be performed.



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4 General Information

4.1 Details of E.U.T.

Power supply:	DC 6-16V
Operation Frequency:	13.56MHz
Modulation Type:	ASK
Antenna Type:	Loop Antenna

4.2 Description of Support Units

Description	Manufacturer	Model No.	Serial No.
DC Power Supply	Agilent	E3632A	/

4.3 Measurement Uncertainty

No.	Item	Measurement Uncertainty
1	Radio Frequency	8.4 x 10 ⁻⁸
2	Timeout	2s
3	Occupied Bandwidth	3%
4	RF Radiated power	5.2dB (Below 1GHz)
		5.9dB (Above 1GHz)
5	Radiated Spurious emission test	4.2dB (Below 30MHz)
		4.5dB (30MHz-1GHz)
		5.1dB (1GHz-6GHz)
		5.4dB (6GHz-18GHz)
6	Temperature test	1°C
7	Humidity test	3%
8	Supply voltages	1.5%
9	Time	3%

Note: The measurement uncertainty represents an expanded uncertainty expressed at approximately the 95% confidence level using a coverage factor of k=2.



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4.4 Test Location

All tests were performed at:

SGS-CSTC Standards Technical Services (Shanghai) Co., Ltd. E&E Lab

588 West Jindu Road, Xinqiao, Songjiang, 201612 Shanghai, China

Tel: +86 21 6191 5666

Fax: +86 21 6191 5678

No tests were sub-contracted.

Note:

1. SGS is not responsible for wrong test results due to incorrect information (e.g. max. clock frequency, highest internal frequency, antenna gain, cable loss, etc) is provided by the applicant. (if applicable).
2. SGS is not responsible for the authenticity, integrity and the validity of the conclusion based on results of the data provided by applicant. (if applicable).

4.5 Test Facility

The test facility is recognized, certified, or accredited by the following organizations:

• **A2LA (Certificate No. 6332.01)**

SGS-CSTC Standards Technical Services (Shanghai) Co., Ltd. is accredited by the American Association for Laboratory Accreditation(A2LA).

• **FCC (Designation Number: CN1301)**

SGS-CSTC Standards Technical Services (Shanghai) Co., Ltd. has been recognized as an accredited testing laboratory.

• **ISED (CAB Identifier: CN0020)**

SGS-CSTC Standards Technical Services (Shanghai) Co., Ltd. EMC Laboratory has been recognized by Innovation, Science and Economic Development Canada (ISED) as an accredited testing laboratory. Company Number: 8617A

• **VCCI (Member No.: 3061)**

The 3m Semi-anechoic chamber and Shielded Room of SGS-CSTC Standards Technical Services (Shanghai) Co., Ltd. has been registered in accordance with the Regulations for Voluntary Control Measures with Registration No.: R-13868, C-14336, T-12221, G-10830 respectively.

4.6 Deviation from Standards

None

4.7 Abnormalities from Standard Conditions

None



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5 Equipment List

Equipment	Manufacturer	Model No	Inventory No	Cal Date	Cal Due Date
RF Radiated Test					
EMI test Receiver	R&S	ESU40	SHEM051-1	2022-12-20	2023-12-19
Spectrum Analyzer	Agilent	N9020A	SHEM181-1	2022-08-02	2023-08-01
Loop Antenna (9kHz-30MHz)	Schwarzbeck	FMZB1519	SHEM135-1	2022-12-20	2023-12-19
Antenna (25MHz-2GHz)	Schwarzbeck	VULB9168	SHEM048-1	2021-09-11	2023-09-10
Antenna (25MHz-2GHz)	Schwarzbeck	VULB9168	SHEM202-1	2022-05-07	2024-05-06
Pre-Amplifier	HP	8447D	SHEM236-1	2022-08-02	2023-08-01
Semi/Fully Anechoic	ST	11*6*6M	SHEM078-2	2021-05-25	2024-05-24
RE test Cable	/	RE01, RE02, RE06	/	2023-01-07	2024-01-06
Test software	ESE	E3	Version: 6.111221a	/	/



6 Radio Spectrum Technical Requirement

6.1 Antenna Requirement

6.1.1 Test Requirement:

47 CFR Part 15, Subpart C 15.203

6.1.2 Conclusion

15.203 requirement:

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, the manufacturer may design the unit so that a broken antenna can be replaced by the user, but the use of a standard antenna jack or electrical connector is prohibited.

EUT Antenna:

The antenna is Loop antenna and no consideration of replacement.

Antenna location: Refer to Internal photos



7 Radio Spectrum Matter Test Results

7.1 20dB Bandwidth

Test Requirement 47 CFR Part 15, Subpart C 15.215
Test Method: ANSI C63.10 (2013) Section 6.9
Measurement Distance: 3m

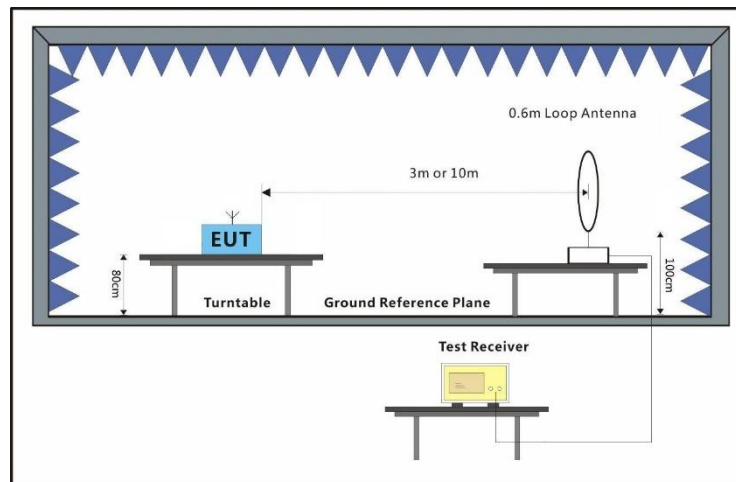
7.1.1 E.U.T. Operation

Operating Environment:
Temperature: 24.8 °C Humidity: 50.5 % RH Atmospheric Pressure: 1010 mbar

7.1.2 Test Mode Description

Pre-scan / Final test	Mode Code	Description
Final test	01	TX mode_Keep the EUT in transmitting mode

7.1.3 Test Setup Diagram



7.1.4 Measurement Procedure and Data

The useful radiated emission from the EUT was detected by the spectrum analyser with peak detector.

Please Refer to Appendix for Details



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7.2 Emission Mask

Test Requirement 47 CFR Part 15, Subpart C 15.225(a)&(b)&(C)
Test Method: ANSI C63.10 (2013) Section 6.4
Measurement Distance: 3m

Limit:

- (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.

Below 30MHz

The limit at 30m test distance is below:

$$FS_{\text{limit}} = FS_{\text{max}} - 40 \log \left(\frac{d_{\text{limit}}}{d_{\text{measure}}} \right)$$

where

FS_{limit} is the calculation of field strength at the limit distance, expressed in dB μ V/m
 FS_{max} is the measured field strength, expressed in dB μ V/m
 d_{measure} is the distance of the measurement point from the EUT
 d_{limit} is the reference distance or the distance of the $\lambda/2\pi$ point

The field strength of any emissions within the band 13.553-13.567 MHz shall not exceed 84dBuV/m at 30 meters.

7.2.1 E.U.T. Operation

Operating Environment:

Temperature: 24.8 °C Humidity: 50.5 % RH Atmospheric Pressure: 1010 mbar



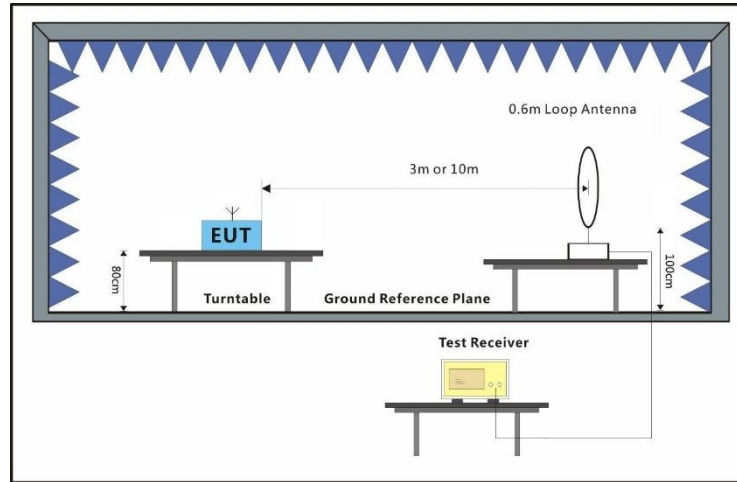
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7.2.2 Test Mode Description

Pre-scan / Final test	Mode Code	Description
Final test	01	TX mode_Keep the EUT in transmitting mode

7.2.3 Test Setup Diagram



7.2.4 Measurement Procedure and Data

For testing performed with the loop antenna, the center of the loop was positioned 1 m above the ground and positioned with its plane vertical at the specified distance from the EUT. During testing the loop was rotated about its vertical axis for maximum response at each azimuth and also investigated with the loop positioned in the horizontal plane. Only the worst position of vertical was shown in the report.

Remark: The test level of the fundamental signal is below the limit of general spurious emission, so the test item doesn't be performed.



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7.3 Frequency tolerance

Test Requirement 47 CFR Part 15, Subpart C 15.225(e)
Test Method: ANSI C63.10 (2013) Section 6.8
Measurement Distance: 3m

Limit:

±0.01

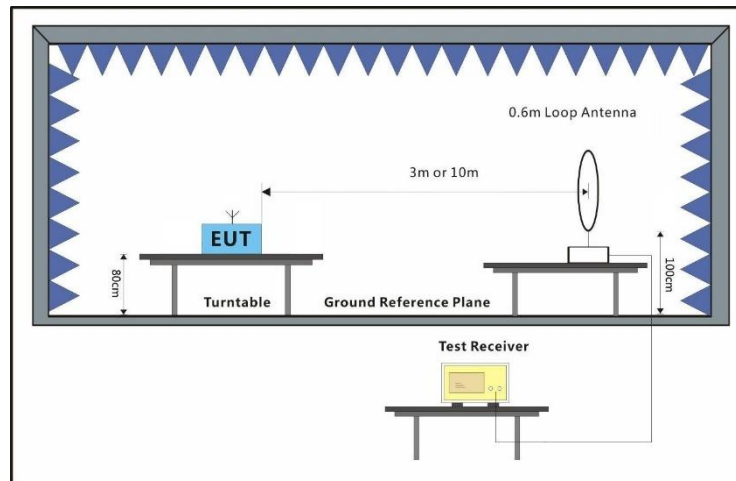
7.3.1 E.U.T. Operation

Operating Environment:
Temperature: 24.8 °C Humidity: 50.5 % RH Atmospheric Pressure: 1010 mbar

7.3.2 Test Mode Description

Pre-scan / Final test	Mode Code	Description
Final test	01	TX mode_Keep the EUT in transmitting mode

7.3.3 Test Setup Diagram



7.3.4 Measurement Procedure and Data

The EUT was placed in an environmental test chamber and powered such that control element received normal voltage and the transmitter provided maximum RF output.

Please Refer to Appendix for Details



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7.4 Radiated Emissions (9kHz-30MHz)

Test Requirement 47 CFR Part 15, Subpart C 15.225(d) & 15.209
Test Method: ANSI C63.10 (2013) Section 6.4&6.5
Measurement Distance: 3m

Limit:

Frequency(MHz)	Field strength (microvolts/meter)	Limit (dBuV/m)	Detector	Measurement Distance (meters)
0.009-0.490	2400/F(kHz)	-	-	300
0.490-1.705	24000/F(kHz)	-	-	30
1.705-30	30	-	-	30

Below 30MHz

If field strength is measured at only a single point, then that point shall be at the radial from the EUT that produces the maximum emission at the frequency being measured, as described in 5.4. If that point is closer to the EUT than $\lambda/2\pi$ and the limit distance is greater than $\lambda/2\pi$, the measurement shall be extrapolated to the limit distance by conservatively presuming that the field strength decreases at a 40 dB/decade of distance rate to the $\lambda/2\pi$ distance, and at a 20 dB/decade of distance rate beyond $\lambda/2\pi$. This shall be accomplished using Equation (2):

$$FS_{(10m)} = FS_{(30/300m)} + 40\log\{d_{(near\ field)}/d_{(10m)}\} + 20\log\{d_{(30/300m)}/d_{(near\ field)}\} \quad (2)$$

If the single point measured is at a distance greater than $\lambda/2\pi$, then extrapolation to the limit distance shall be calculated using Equation (3):

$$FS_{(10m)} = FS_{(30/300m)} + 20\log\{d_{(30/300m)}/d_{(10m)}\} \quad (3)$$

If both the single point and the limit distance are equal to or closer to the EUT than $\lambda/2\pi$, then extrapolation to the limit distance shall be calculated using Equation (4):

$$FS_{(10m)} = FS_{(30/300m)} + 40\log\{d_{(30/300m)}/d_{(10m)}\} \quad (4)$$

Remark:

$$d_{near\ field} = 47.77 / f_{MHz}$$

where f_{MHz} is the frequency of the emission being measured in MHz.

Remark:

1) The field strength is calculated by adding the Antenna Factor, Cable Factor & Preamplifier. The basic equation with a sample calculation is as follows:

Final Test Level = Receiver Reading + Antenna Factor + Cable Factor – Preamplifier Factor



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$$FS_{\text{limit}} = FS_{\text{max}} - 40 \log \left(\frac{d_{\text{limit}}}{d_{\text{measure}}} \right)$$

where

FS_{limit} is the calculation of field strength at the limit distance, expressed in dB μ V/m
 FS_{max} is the measured field strength, expressed in dB μ V/m
 d_{measure} is the distance of the measurement point from the EUT
 d_{limit} is the reference distance or the distance of the $\lambda/2$ point

7.4.1 E.U.T. Operation

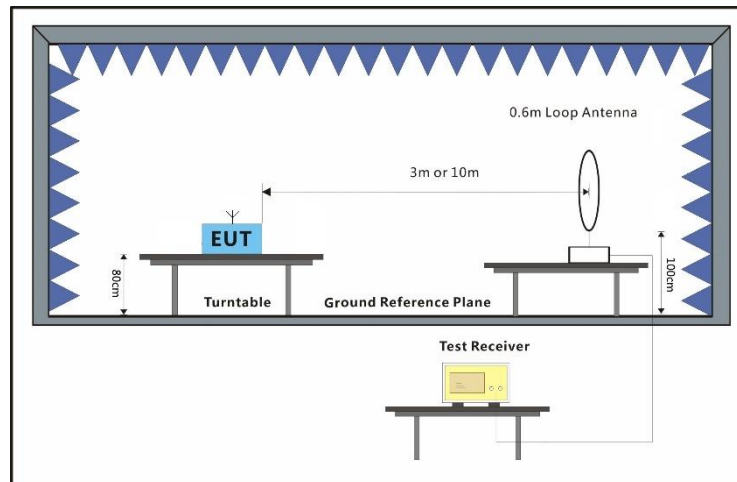
Operating Environment:

Temperature: 24.8 °C Humidity: 50.5 % RH Atmospheric Pressure: 1010 mbar

7.4.2 Test Mode Description

Pre-scan / Final test	Mode Code	Description
Final test	01	TX mode_Keep the EUT in transmitting mode

7.4.3 Test Setup Diagram



7.4.4 Measurement Procedure and Data

For testing performed with the loop antenna, the center of the loop was positioned 1 m above the ground and positioned with its plane vertical at the specified distance from the EUT. During testing the loop was rotated about its vertical axis for maximum response at each azimuth and also investigated with the loop positioned in the horizontal plane. Only the worst position of vertical was shown in the report.

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7.5 Radiated Emissions (30MHz-1GHz)

Test Requirement 47 CFR Part 15, Subpart C 15.225(d) & 15.209
Test Method: ANSI C63.10 (2013) Section 6.4&6.5
Measurement Distance: 3m

Limit:

Frequency(MHz)	Field strength(microvolts/meter)	Measurement distance(meters)
30-88	100	3
88-216	150	3
216-960	200	3
Above 960	500	3

Remark: The emission limits shown in the above table are based on measurements employing a CISPR quasi-peak detector except for the frequency bands above 1000 MHz. Radiated emission limits in these three bands (9-90kHz,110-490kHz and Above 1GHz) are based on measurements employing an average detector, the peak field strength of any emission shall not exceed the maximum permitted average limits specified above by more than 20 dB under any condition of modulation.

7.5.1 E.U.T. Operation

Operating Environment:
Temperature: 24.8 °C Humidity: 50.5 % RH Atmospheric Pressure: 1010 mbar

7.5.2 Test Mode Description

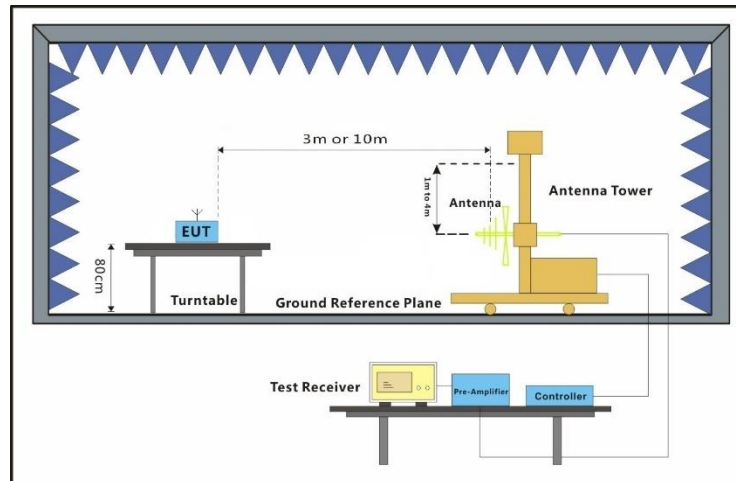
Pre-scan / Final test	Mode Code	Description
Final test	01	TX mode_Keep the EUT in transmitting mode



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7.5.3 Test Setup Diagram



7.5.4 Measurement Procedure and Data

a. The EUT was placed on the top of a rotating table 0.8 meters above the ground for below 1GHz at a 3 meter semi-anechoic chamber. The table was rotated 360 degrees to determine the position of the highest radiation. b. The EUT was set 3 meters away from the interference-receiving antenna, which was mounted on the top of a variable-height antenna tower. c. The antenna height is varied from one meter to four meters above the ground to determine the maximum value of the field strength. Both horizontal and vertical polarizations of the antenna are set to make the measurement. d. For each suspected emission, the EUT was arranged to its worst case and then the antenna was tuned to heights from 1 meter to 4 meters (for the test frequency of below 30MHz, the antenna was tuned to heights 1 meter) and the rotatable table was turned from 0 degrees to 360 degrees to find the maximum reading. e. The test-receiver system was set to Peak Detect Function and Specified Bandwidth with Maximum Hold Mode. f. If the emission level of the EUT in peak mode was 10dB lower than the limit specified, then testing could be stopped and the peak values of the EUT would be reported. Otherwise the emissions that did not have 10dB margin would be re-tested one by one using peak, quasi-peak or average method as specified and then reported in a data sheet. g. The radiation measurements are performed in X, Y, Z axis positioning. And found the X axis positioning which it is worse case, only the test worst case mode is recorded in the report. Remark: Level= Read Level+ Cable Loss+ Antenna Factor- Preamp Factor

Please Refer to Appendix for Details



8 Test Setup Photo

Refer to Appendix - Test Setup Photo for SHCR2307001500AT

9 EUT Constructional Details (EUT Photos)

Refer to Appendix - Photographs of EUT Constructional Details for SHCR2307001500AT



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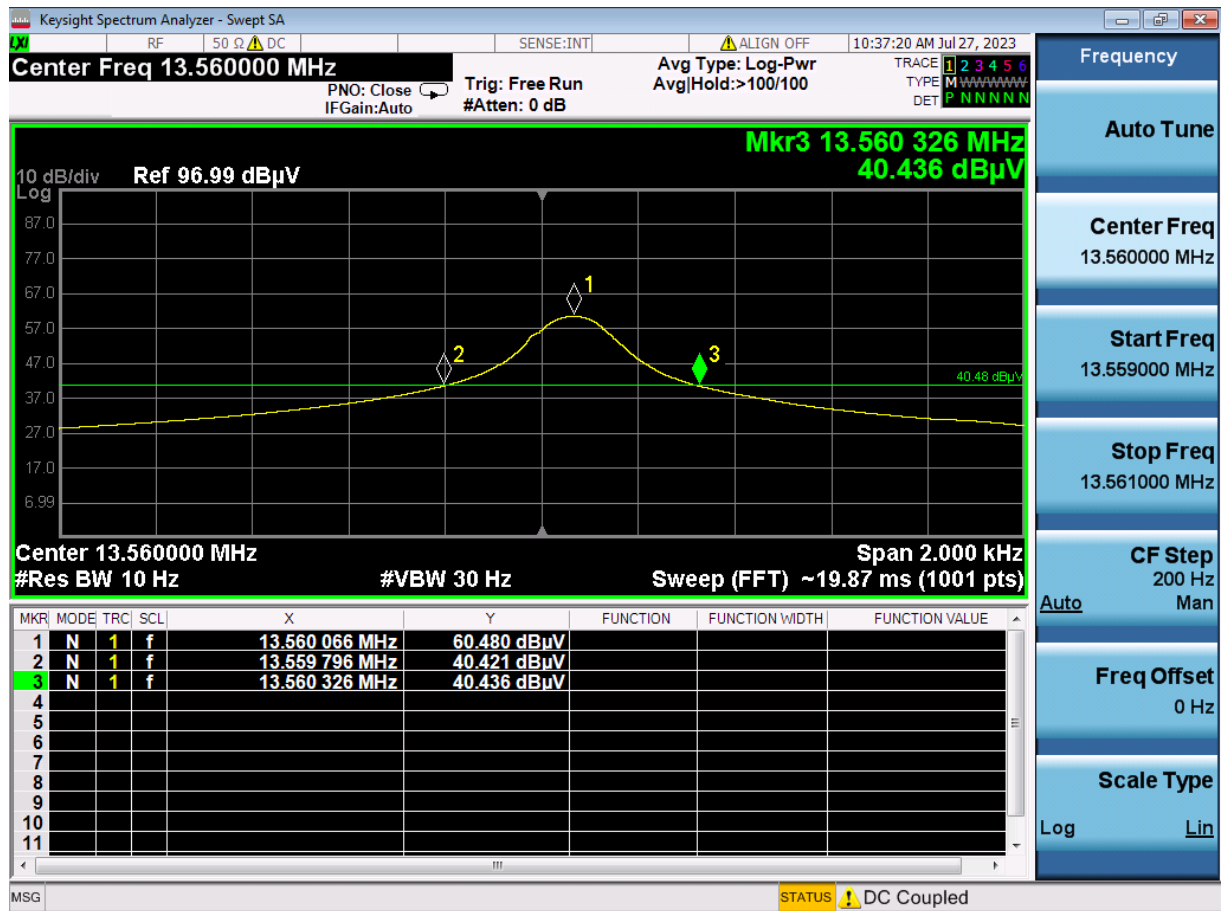
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10 Appendix

1. 20dB Bandwidth

20dB bandwidth (kHz)	F _L (MHz)	F _H (MHz)	Limit (MHz)	Result
0.5300	13.5598	13.5603	13.110 – 14.010	Pass

Test plot as follows:



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2. Frequency tolerance

Nominal Operation Frequency: 13.56MHz

Test Conditions		Test Result (MHz)	Deviation (kHz)	Limit (kHz)	Result
Temp (°C)	Volt (V DC)				
T _{nom} (-20)	V _{nom} (12)	13.56006	0.06	±0.01% (1.3560kHz)	Pass
T _{nom} (-10)	V _{nom} (12)	13.56011	0.11		Pass
T _{nom} (0)	V _{nom} (12)	13.56009	0.09		Pass
T _{nom} (10)	V _{nom} (12)	13.56005	0.05		Pass
T _{nom} (20)	V _{nom} (12)	13.56014	0.14		Pass
T _{nom} (30)	V _{nom} (12)	13.56009	0.09		Pass
T _{nom} (40)	V _{nom} (12)	13.56006	0.06		Pass
T _{nom} (50)	V _{nom} (12)	13.56002	0.02		Pass
T _{nom} (20)	V _{min} (5.1)	13.56008	0.08		Pass
	V _{max} (18.4)	13.56017	0.17		Pass

Note: Deviation (kHz) = (Test Result-13.56MHz)*1000

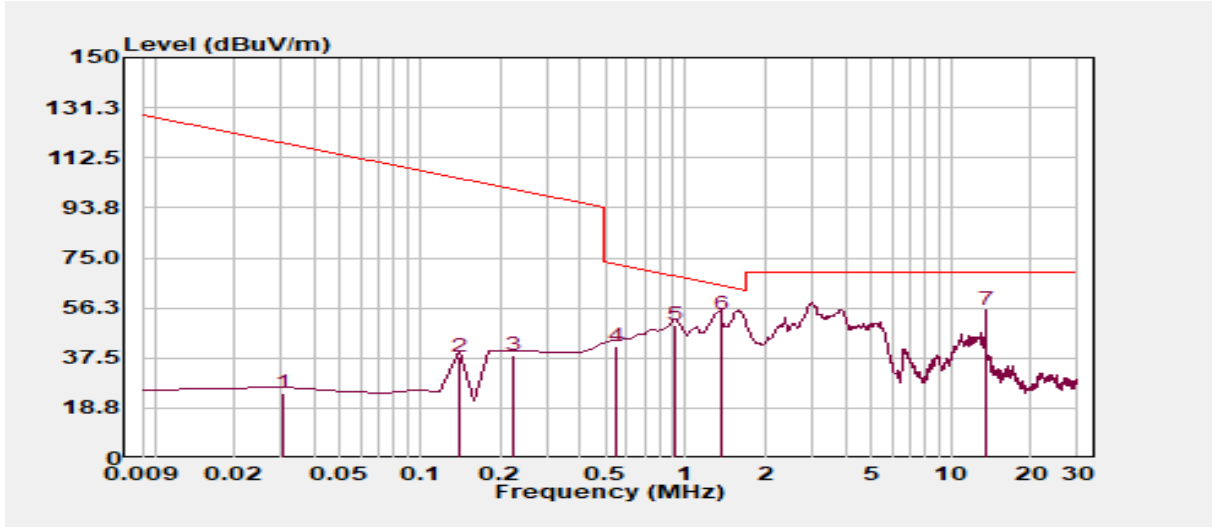


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3. Radiated Emissions(9kHz-30MHz)

Coaxial



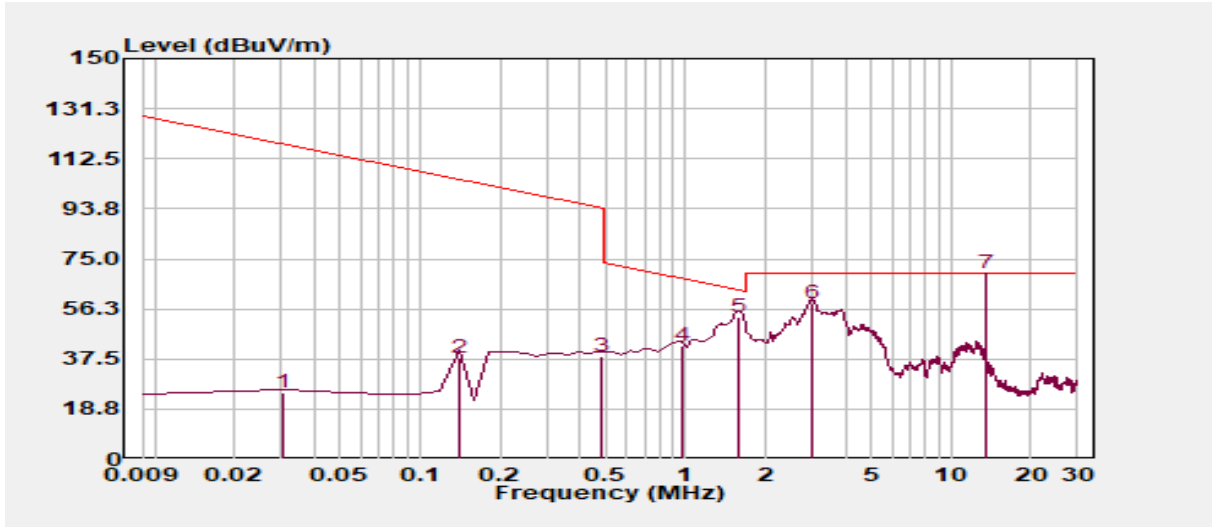
Item	Freq.	Read Level	Correct Factor	Result Level@ 3m	Result Level@S PEC	Limit Line@SP EC	Over Limit	Detector
(Mark)	(MHz)	(dB μ V)	(dB/m)	(dBuV/m)	(dBuV/m)	(dBuV/m)	(dB)	
1	0.031	9.95	14.60	24.55	-55.45	37.78	-93.23	QP
2	0.139	23.75	14.45	38.20	-41.80	24.74	-66.54	QP
3	0.226	23.80	14.43	38.23	-41.77	20.52	-62.29	QP
4	0.552	27.67	14.45	42.12	2.12	32.77	-30.65	QP
5	0.922	35.47	14.52	49.99	9.99	28.31	-18.32	QP
6	1.356	39.21	14.55	53.76	13.76	24.96	-11.20	QP
7	13.560	41.46	13.96	55.42	15.42	84.00	-68.58	Peak



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Coplanar



Item	Freq.	Read Level	Correct Factor	Result Level@3 m	Result Level@SP EC	Limit Line@SP EC	Over Limit	Detector
(Mark)	(MHz)	(dB μ V)	(dB/m)	(dBuV/m)	(dBuV/m)	(dBuV/m)	(dB)	
1	0.031	10.11	14.60	24.71	-55.29	37.78	-93.07	QP
2	0.139	23.63	14.45	38.08	-41.92	24.74	-66.66	QP
3	0.487	24.07	14.44	38.51	-41.49	13.85	-55.34	QP
4	0.965	27.81	14.52	42.33	2.33	27.91	-25.58	QP
5	1.574	38.49	14.57	53.06	13.06	23.66	-10.60	QP
6	2.986	43.87	14.63	58.50	18.50	29.50	-11.00	QP
7	13.560	55.45	13.96	69.41	29.41	84.00	-54.59	PeaK

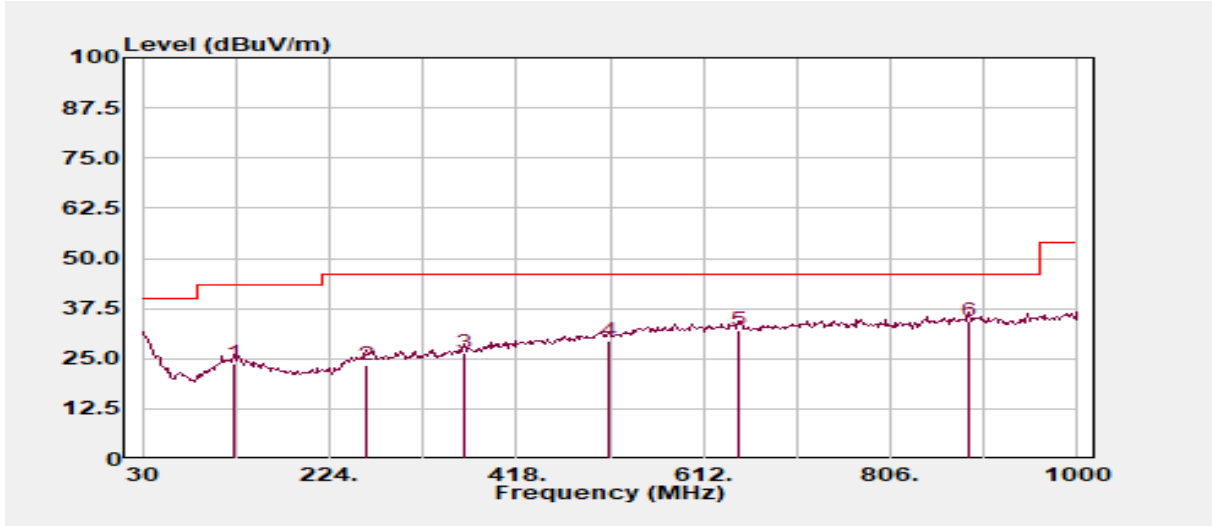


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4. Below 1GHz

Horizontal



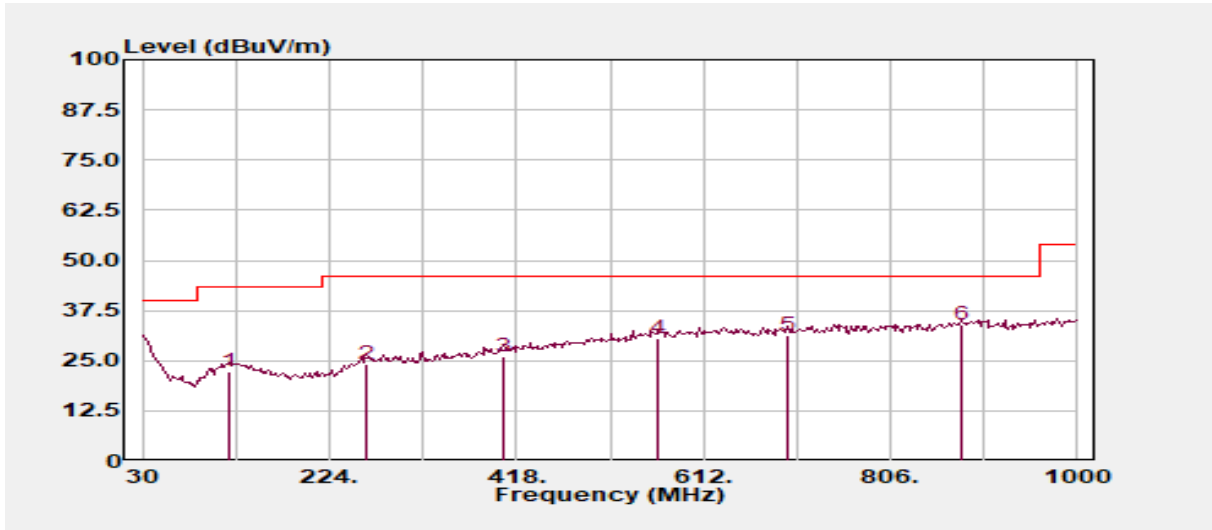
No.	Frequency (MHz)	Reading (dBuV)	Correct Factor(dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Remark
1	125.060	4.22	19.49	23.71	43.50	19.79	QP
2	262.800	2.51	21.00	23.51	46.00	22.49	QP
3	363.680	4.13	22.22	26.35	46.00	19.65	QP
4	513.060	3.57	25.91	29.48	46.00	16.52	QP
5	648.860	4.18	27.76	31.94	46.00	14.06	QP
6	887.480	4.74	29.42	34.16	46.00	11.84	QP



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Vertical



No.	Frequency (MHz)	Reading (dBuV)	Correct Factor(dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Remark
1	119.240	2.87	19.38	22.25	43.50	21.25	QP
2	262.800	3.04	21.00	24.04	46.00	21.96	QP
3	404.420	2.66	23.55	26.21	46.00	19.79	QP
4	565.440	3.03	27.45	30.48	46.00	15.52	QP
5	699.300	3.66	27.61	31.27	46.00	14.73	QP
6	879.720	4.57	29.34	33.91	46.00	12.09	QP

- End of the Report -

