

SZEMC-TRF-01 Rev. A/1

Report No.: SZCR240800320202 Page: 1 of 69

TEST REPORT

Application No.:	SZCR2408003202AT		
Applicant:	ShenZhen FLYSKY Technology Co.,Ltd		
Address of Applicant:	16F, Huafeng Building, No. 6006 Shennan Road, Futian District, Shenzhen, Guangdong, China		
Manufacturer:	ShenZhen FLYSKY Technology Co.,Ltd		
Address of Manufacturer:	16F, Huafeng Building, No. 6006 Shennan Road, Futian District, Shenzhen, Guangdong, China		
Factory:	Dongguan Flysky RC Model technology Co.,Ltd		
Address of Factory:	West building 3, Huangjinyuan Ind Park, Qiaoli North Gate, Changping Town, Dongguan, China		
Equipment Under Test (EUT):		
EUT Name:	DIGITAL PROPORTIONAL RADIO CONTROL SYSTEM		
Model No.:	PL18 Ultra		
Trade Mark:	FLYSKY		
FCC ID:	2A2UNPL18ULTRA		
Standard(s) :	47 CFR Part 15, Subpart C 15.247		
Date of Receipt:	2024-08-16		
Date of Test:	2024-09-03 to 2024-09-08		
Date of Issue:	2024-09-29		
Test Result:	Pass*		

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

Keny. XM

Keny Xu EMC Laboratory Manager



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SZEMC-TRF-01 Rev. A/1

Report No.: SZCR240800320202 Page: 2 of 69

	Revision Record						
Version	Version Chapter Date Modifier Re						
01		2024-09-29		Original			

Authorized for issue by:			
	Price Chan		
	Bill Chen/Project Engineer	-	
	Eric Fu		
	Eric Fu/Reviewer	-	



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SZEMC-TRF-01 Rev. A/1

Report No.: SZCR240800320202 Page: 3 of 69

Test Summary 2

Radio Spectrum Technical Requirement					
ltem	Standard	Method	Requirement	Result	
Antenna Requirement		N/A	47 CFR Part 15, Subpart C 15.203 & 15.247(b)(4)	Pass	
Other requirements Frequency Hopping Spread Spectrum System Hopping Sequence	47 CFR Part 15, Subpart C 15.247	N/A	47 CFR Part 15, Subpart C 15.247(a)(1),(g),(h)	Pass	

Radio Spectrum Matter Part						
Item	Standard	Method	Requirement	Result		
Radiated Emissions which fall in the restricted bands		ANSI C63.10 (2013) Section 6.10.5	47 CFR Part 15, Subpart C 15.205 & 15.209	Pass		
Radiated Spurious Emissions Below 1GHz		ANSI C63.10 (2013) Section 6.4,6.5	47 CFR Part 15, Subpart C 15.205 & 15.209	Pass		
Radiated Spurious Emissions Above 1GHz		ANSI C63.10 (2013) Section 6.6	47 CFR Part 15, Subpart C 15.205 & 15.209	Pass		
Conducted Peak Output Power		ANSI C63.10 (2013) Section 7.8.5	47 CFR Part 15, Subpart C 15.247(b)(1)	Pass		
20dB Bandwidth	47 CFR Part 15, Subpart C 15.247	ANSI C63.10 (2013) Section 7.8.7	47 CFR Part 15, Subpart C 15.247(a)(1)	Pass		
Carrier Frequencies Separation		ANSI C63.10 (2013) Section 7.8.2	47 CFR Part 15, Subpart C 15.247a(1)	Pass		
Hopping Channel Number		ANSI C63.10 (2013) Section 7.8.3	47 CFR Part 15, Subpart C 15.247a(1)(iii)	Pass		
Dwell Time		ANSI C63.10 (2013) Section 7.8.4	47 CFR Part 15, Subpart C 15.247a(1)(iii)	Pass		
Conducted Band Edges Measurement		ANSI C63.10 (2013) Section 7.8.6	47 CFR Part 15, Subpart C 15.247(d)	Pass		
Conducted Spurious Emissions		ANSI C63.10 (2013) Section 7.8.8	47 CFR Part 15, Subpart C 15.247(d)	Pass		



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SZEMC-TRF-01 Rev. A/1

Report No.: SZCR240800320202 Page: 4 of 69

3 Contents

		Page
1	Cover Page	1
2	Test Summary	3
2		
3	Contents	4
4	General Information	6
•	4.1 Details of E.U.T.	
	4.1 Details of E.O.T. 4.2 Description of Support Units	-
	4.3 Measurement Uncertainty	
	4.4 Test Location	
	4.5 Test Facility	7
	4.6 Deviation from Standards	
	4.7 Abnormalities from Standard Conditions	7
5	Equipment List	8
6	Radio Spectrum Technical Requirement	10
	6.1 Antenna Requirement	10
	6.1.1 Test Requirement:	
	6.1.2 Conclusion	
	6.2 Other requirements Frequency Hopping Spread Spectrum System Hopping Sequence	
	6.2.1 Test Requirement:	
	6.2.2 Conclusion	
7	Radio Spectrum Matter Test Results	13
	7.1 Radiated Emissions which fall in the restricted bands	
	7.1.1 E.U.T. Operation	
	7.1.2 Test Mode Description	
	7.1.3 Test Setup Diagram	
	7.1.4 Measurement Procedure and Data7.2 Radiated Spurious Emissions Below 1GHz	
	7.2 Radiated Spurious Emissions Below 1912	
	7.2.2 Test Mode Description	
	7.2.3 Test Setup Diagram	
	7.2.4 Measurement Procedure and Data	
	7.3 Radiated Spurious Emissions Above 1GHz	23
	7.3.1 E.U.T. Operation	23
	7.3.2 Test Mode Description	
	7.3.3 Test Setup Diagram	
	7.3.4 Measurement Procedure and Data	
	7.4 Conducted Peak Output Power	
	7.4.1 E.U.T. Operation 7.4.2 Test Mode Description	
	7.4.2 Test Mode Description7.4.3 Test Setup Diagram	



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SZEMC-TRF-01 Rev. A/1

Report No.: SZCR240800320202 Page: 5 of 69

	7.4.4	Measurement Procedure and Data	
7.5	5 2	0dB Bandwidth	
	7.5.1	E.U.T. Operation	
	7.5.2	Test Mode Description	
	7.5.3	Test Setup Diagram	
	7.5.4	Measurement Procedure and Data	
7.6	6 C	arrier Frequencies Separation	34
	7.6.1	E.U.T. Operation	34
	7.6.2	Test Mode Description	
	7.6.3	Test Setup Diagram	
	7.6.4	Measurement Procedure and Data	
7.7	7 H	opping Channel Number	35
	7.7.1	E.U.T. Operation	
	7.7.2	Test Mode Description	
	7.7.3	Test Setup Diagram	
	7.7.4	Measurement Procedure and Data	
7.8		well Time	
	7.8.1	E.U.T. Operation	
	7.8.2	Test Mode Description	
	7.8.3	Test Setup Diagram	
	7.8.4	Measurement Procedure and Data	
7.9		onducted Band Edges Measurement	
	7.9.1	E.U.T. Operation	
	7.9.2	Test Mode Description	
	7.9.3	Test Setup Diagram	
	7.9.4	Measurement Procedure and Data	
7.′		onducted Spurious Emissions	
	7.10.1	E.U.T. Operation	
	7.10.2	Test Mode Description	
	7.10.3	Test Setup Diagram	
	7.10.4	Measurement Procedure and Data	40
8	Test S	etup Photo	41
9	EUT C	onstructional Details (EUT Photos)	41
10	Appen	dix	42



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SZEMC-TRF-01 Rev. A/1

Report No.: SZCR240800320202 Page: 6 of 69

4 General Information

4.1 Details of E.U.T.

Power supply:	Lithium Ion Battery: DC 3.6V 8700mAh 31.32Wh rechargeable battery which charged by USB port
Cable(s):	USB cable: 128cm unshielded
Operation Frequency:	2402.15-2479.85MHz
Modulation Type:	GMSK
Number of Channels:	171
Channel Spacing:	0.45MHz
Antenna Type:	FPC Antenna
Antenna Gain:	3.48dBi

Remark: The information in this section is provided by the applicant or manufacturer, SGS is not liable to the accuracy, suitability, reliability or/and integrity of the information.

4.2 Description of Support Units

Description	Manufacturer	Model No.	Serial No.			
The EUT has been tested as an independent unit.						

4.3 Measurement Uncertainty

Test Item	Measurement Uncertainty
Radiated Emissions which fall in the restricted bands	± 6.0dB (Below 1GHz);± 4.6dB (Above 1GHz)
Radiated Spurious Emissions Below 1GHz	\pm 6.0dB for 3m; \pm 5.0dB for 10m
Radiated Spurious Emissions Above 1GHz	± 4.6dB (1-18GHz);± 4.8dB (18- 40GHz)
Conducted Peak Output Power	± 0.75dB
20dB Bandwidth	± 3%
Carrier Frequencies Separation	± 7.25 x 10-8
Hopping Channel Number	± 7.25 x 10-8
Dwell Time	± 0.37%
Conducted Band Edges Measurement	± 0.75dB
Conducted Spurious Emissions	± 0.75dB
Pomark:	•

Remark:

The Ulab (lab Uncertainty) is less than Ucispr/ETSI (CISPR/ETSI Uncertainty), so the test results

- compliance is deemed to occur if no measured disturbance level exceeds the disturbance limit;

- non-compliance is deemed to occur if any measured disturbance level exceeds the disturbance limit.



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SZEMC-TRF-01 Rev. A/1

Report No.: SZCR240800320202 Page: 7 of 69

4.4 Test Location

All tests were performed at: SGS-CSTC Standards Technical Services Co., Ltd., Shenzhen Branch No. 1 Workshop, M-10, Middle Section, Science & Technology Park, Nanshan District, Shenzhen, Guangdong, China. 518057. Tel: +86 755 2601 2053 Fax: +86 755 2671 0594 No tests were sub-contracted.

4.5 Test Facility

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

• A2LA (Certificate No. 3816.01)

SGS-CSTC Standards Technical Services Co., Ltd., Shenzhen EMC Laboratory is accredited by the American Association for Laboratory Accreditation(A2LA). Certificate No. 3816.01.

VCCI (Member No. 1937)

The 3m Fully-anechoic chamber for above 1GHz, 10m Semi-anechoic chamber for below 1GHz, Shielded Room for Mains Port Conducted Interference Measurement and Telecommunication Port Conducted Interference Measurement of SGS-CSTC Standards Technical Services Co., Ltd. Shenzhen EMC laboratory have been registered in accordance with the Regulations for Voluntary Control Measures with Registration No.: G-20026, R-14188, C-12383 and T-11153 respectively.

FCC –Designation Number: CN1336

SGS-CSTC Standards Technical Services Co., Ltd., Shenzhen EMC Laboratory has been recognized as an accredited testing laboratory.

Designation Number: CN1336. Test Firm Registration Number: 787754.

Innovation, Science and Economic Development Canada

SGS-CSTC Standards Technical Services Co., Ltd., Shenzhen EMC Laboratory has been recognized by ISED as an accredited testing laboratory.

CAB identifier: CN0006.

IC#: 4620C.

4.6 Deviation from Standards

None

4.7 Abnormalities from Standard Conditions

None



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SZEMC-TRF-01 Rev. A/1

Report No.: SZCR240800320202 Page: 8 of 69

5 **Equipment List**

Radiated Emissions which fall in the restricted bands					
Equipment	Manufacturer	Model No.	Inventory No.	Cal Date	Cal Due Date
3m Fully-Anechoic Chamber	AUDIX	N/A	SEM001-02	2024-05-11	2027-05-10
Signal Analyzer	Rohde & Schwarz	FSV40	SEM008-04	2024-03-15	2025-03-14
Horn Antenna	Rohde&Schwarz	HF907	SEM003-07	2023-07-23	2025-07-22
Microwave system amplifier	Agilent	83017A	SEM005-25	2024-09-14	2025-09-13
Measurement Software	AUDIX	e3 V8.2014-6- 27	N/A	N/A	N/A
Coaxial Cable	SGS	N/A	SEM026-01	2024-07-06	2025-07-05
Broad-Band Horn Antenna	Schwarzbeck	BBHA 9170	SEM003-15	2024-08-10	2025-08-09
Pre-Amplifier	Compliance Directions Systems Inc.	PAP-2640-50	SEM005-08	2024-03-15	2025-03-14

Radiated Spurious Emissions Below 1GHz					
Equipment	Manufacturer	Model No.	Inventory No.	Cal Date	Cal Due Date
Loop Antenna	ETS-Lindgren	6502	SEM003-08	2023-11-20	2025-11-19
3m Semi-Anechoic Chamber	ETS-LINDGREN	N/A	SEM001-01	2023-06-19	2026-06-18
MXE EMI Receiver	Agilent Technologies	N9038A	SEM004-15	2024-08-14	2025-08-13
BiConiLog Antenna	ETS-LINDGREN	3142C	SEM003-01	2023-09-16	2025-09-15
Pre-Amplifier	Agilent Technologies	8447D	SEM005-01	2024-03-14	2025-03-13
Measurement Software	AUDIX	e3 V8.2014-6- 27	N/A	N/A	N/A
Coaxial Cable	SGS	N/A	SEM025-01	2024-07-06	2025-07-05



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SZEMC-TRF-01 Rev. A/1

Report No.: SZCR240800320202 Page: 9 of 69

Radiated Spurious Emissions Above 1GHz							
Equipment	Manufacturer	Model No.	Inventory No.	Cal Date	Cal Due Date		
3m Fully-Anechoic Chamber	AUDIX	N/A	SEM001-02	2024-05-11	2027-05-10		
Signal Analyzer	Rohde & Schwarz	FSV40	SEM008-04	2024-03-15	2025-03-14		
Horn Antenna	Rohde&Schwarz	HF907	SEM003-07	2023-07-23	2025-07-22		
Microwave system amplifier	Agilent	83017A	SEM005-25	2024-09-14	2025-09-13		
Measurement Software	AUDIX	e3 V8.2014-6- 27	N/A	N/A	N/A		
Coaxial Cable	SGS	N/A	SEM026-01	2024-07-06	2025-07-05		
Broad-Band Horn Antenna	Schwarzbeck	BBHA 9170	SEM003-15	2024-08-10	2025-08-09		
Pre-Amplifier	Compliance Directions Systems Inc.	PAP-2640-50	SEM005-08	2024-03-15	2025-03-14		

RF Conducted Test						
Equipment	Manufacturer	Model No.	Inventory No.	Cal Date Cal Due I		
Power Sensor	TST PASS	TSPS2023R	SEM009-26	2024-03-27	2025-03-26	
Power Sensor	KEYSIGHT	U2021XA	SEM009-16	2024-03-14	2025-03-13	
DC Power Supply	Chroma	62012P-80-60	SEM011-11	2024-08-14	2025-08-13	
MXA Signal Analyzer	KEYSIGHT	N9020A	SEM004-19 2024-03-14		2025-03-13	
Measurement Software	TST PASS	TST PASS V2.0	N/A	N/A	N/A	
Coaxial Cable	SGS	N/A	SEM031-01	2024-07-06	2025-07-05	
Attenuator	Huber+Suhner	6620_SMA-50- 1	SEM021-09	2024-03-27	2025-03-26	

General used equipment							
Equipment	Manufacturer	Model No.	Inventory No.	Cal Date	Cal Due Date		
Humidity/ Temperature Indicator	deli	8838	SEM002-32	2024-07-24	2025-07-23		
Humidity/ Temperature Indicator	deli	8838	SEM002-33	2024-07-24	2025-07-23		
Barometer	Changchun Meteorological Industry Factory	DYM3	SEM002-01	2024-03-18	2025-03-17		



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SZEMC-TRF-01 Rev. A/1

Report No.: SZCR240800320202 Page: 10 of 69

6 Radio Spectrum Technical Requirement

6.1 Antenna Requirement

6.1.1 Test Requirement:

47 CFR Part 15, Subpart C 15.203 & 15.247(b)(4)

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 integrated on the main PCB and no consideration of replacement. The best case gain of the antenna is 3.48dBi.

Antenna location: Refer to internal photos



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SZEMC-TRF-01 Rev. A/1

Report No.: SZCR240800320202 Page: 11 of 69

6.2 Other requirements Frequency Hopping Spread Spectrum System Hopping Sequence

6.2.1 Test Requirement:

47 CFR Part 15, Subpart C 15.247(a)(1),(g),(h)

6.2.2 Conclusion

Standard Requirement:

The system shall hop to channel frequencies that are selected at the system hopping rate from a Pseudorandom ordered list of hopping frequencies. Each frequency must be used equally on the average by each transmitter. The system receivers shall have input bandwidths that match the hopping channel bandwidths of their corresponding transmitters and shall shift frequencies in synchronization with the transmitted signals.

Frequency hopping spread spectrum systems are not required to employ all available hopping channels during each transmission. However, the system, consisting of both the transmitter and the receiver, must be designed to comply with all of the regulations in this section should the transmitter be presented with a continuous data (or information) stream. In addition, a system employing short transmission bursts must comply with the definition of a frequency hopping system and must distribute its transmissions over the minimum number of hopping channels specified in this section.

The incorporation of intelligence within a frequency hopping spread spectrum system that permits the system to recognize other users within the spectrum band so that it individually and independently chooses and adapts its hopsets to avoid hopping on occupied channels is permitted. The coordination of frequency hopping systems in any other manner for the express purpose of avoiding the simultaneous occupancy of individual hopping frequencies by multiple transmitters is not permitted.

Compliance for section 15.247(a)(1):

According to Technical Specification, the pseudorandom sequence may be generated in a nine-stage shift register whose 5th and 9th stage outputs are added in a modulo-two addition stage. And the result is fed back to the input of the first stage. The sequence begins with the first ONE of 9 consecutive ONEs; i.e. the shift register is initialized with nine ones.

- > Number of shift register stages: 9
- > Length of pseudo-random sequence: 29 -1 = 511 bits
- > Longest sequence of zeros: 8 (non-inverted signal)

Linear Feedback Shift Register for Generation of the PRBS sequence

An example of Pseudorandom Frequency Hopping Sequence as follow:

Each frequency used equally on the average by each transmitter.

According to Technical Specification, the receivers are designed to have input and IF bandwidths that match the hopping channel bandwidths of any transmitters and shift frequencies in synchronization with the transmitted signals.

Compliance for section 15.247(g):

According to Technical Specification, the system transmits the packet with the pseudorandom hopping frequency with a continuous data and the short burst transmission from the Bluetooth system is also transmitted under the frequency hopping system with the pseudorandom hopping frequency system.



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SZEMC-TRF-01 Rev. A/1

Report No.: SZCR240800320202 Page: 12 of 69

Compliance for section 15.247(h):

According to Technical specification, the system incorporates with an adaptive system to detect other user within the spectrum band so that it individually and independently to avoid hopping on the occupied channels.

The system is designed not have the ability to coordinated with other FHSS System in an effort to avoid the simultaneous occupancy of individual hopping frequencies by multiple transmitter.



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SZEMC-TRF-01 Rev. A/1

Report No.: SZCR240800320202 Page: 13 of 69

Radio Spectrum Matter Test Results 7

7.1 Radiated Emissions which fall in the restricted bands

47 CFR Part 15, Subpart C 15.205 & 15.209 Test Requirement ANSI C63.10 (2013) Section 6.10.5 Test Method: Measurement Distance: 3m

Limit:

Frequency(MHz)	Field strength(microvolts/meter)	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

Remark: The emission limits shown in the above table are based on measurements employing a CISPR quasi-peak detector except for the frequency bands 9-90kHz, 110-490kHz and above 1000 MHz. Radiated emission limits in these three bands 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.

7.1.1 E.U.T. Operation

Operating Environment:

Temperature: 22.4 °C

Humidity: 51.8 % RH

Atmospheric Pressure: 1020 mbar

7.1.2 Test Mode Description

Pre-scan / Final test	Mode Code	Description
Final test	01	TX_non-Hop mode_Keep the EUT in continuously transmitting mode with GMSK modulation.



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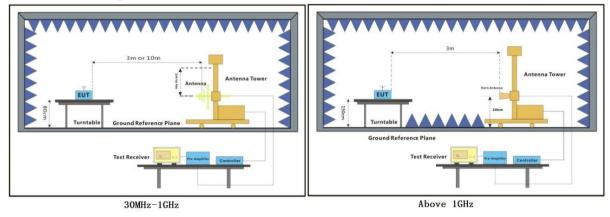
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SZEMC-TRF-01 Rev. A/1

Report No.: SZCR240800320202 Page: 14 of 69

7.1.3 Test Setup Diagram



7.1.4 Measurement Procedure and Data

a. For below 1GHz, the EUT was placed on the top of a rotating table 0.8 meters above the ground at a 3 meter semi-anechoic chamber. The table was rotated 360 degrees to determine the position of the highest radiation.

b. For above 1GHz, the EUT was placed on the top of a rotating table 1.5 meters above the ground at a 3 meter fully-anechoic chamber. The table was rotated 360 degrees to determine the position of the highest radiation.

c. The EUT was set 3 meters away from the interference-receiving antenna, which was mounted on the top of a variable-height antenna tower.

d. 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.

e. 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.

f. The test-receiver system was set to Peak Detect Function and Specified Bandwidth with Maximum Hold Mode.

g. 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.

h. Test the EUT in the lowest channel, the middle channel, the Highest channel.

i. The radiation measurements are performed in X, Y, Z axis positioning for Transmitting mode, and found the X axis positioning which it is the worst case.

j. Repeat above procedures until all frequencies measured was complete.

Remark 1: Level= Read Level+ Cable Loss+ Antenna Factor- Preamp Factor

Remark 2: For frequencies above 1GHz, the field strength limits are based on average limits. However, 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. For the emissions whose peak level is lower than the average limit, only the peak measurement is shown in the report.



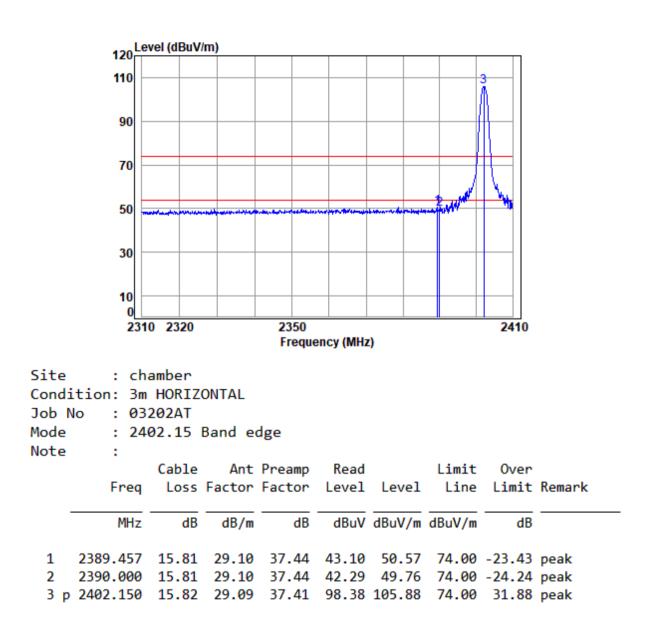
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SZEMC-TRF-01 Rev. A/1

Report No.: SZCR240800320202 Page: 15 of 69

Test Mode: 01; Polarity: Horizontal; Modulation:GFSK; Channel:Low





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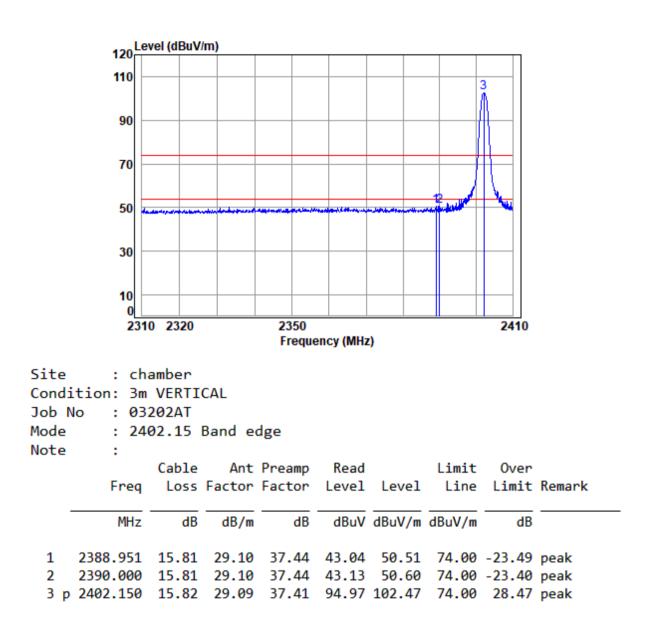
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SZEMC-TRF-01 Rev. A/1

Report No.: SZCR240800320202 Page: 16 of 69

Test Mode: 01; Polarity: Vertical; Modulation:GFSK; Channel:Low





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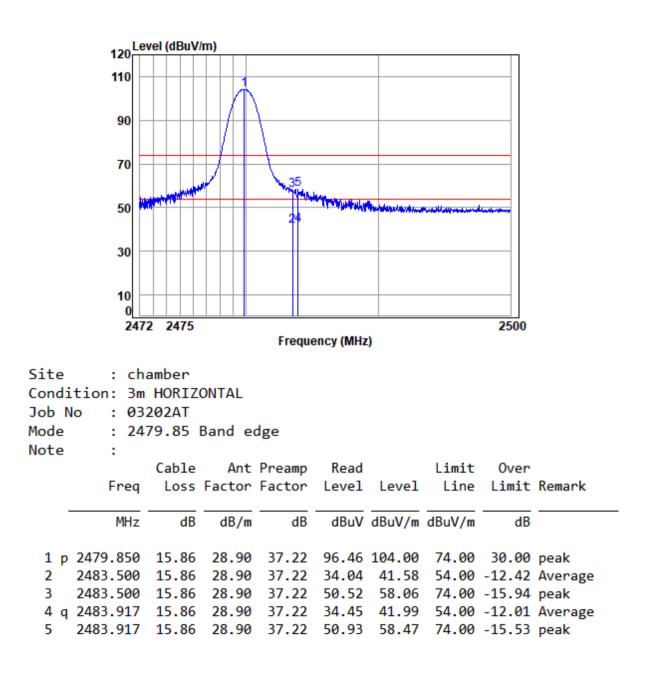
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Test Mode: 01; Polarity: Horizontal; Modulation:GFSK; Channel:High





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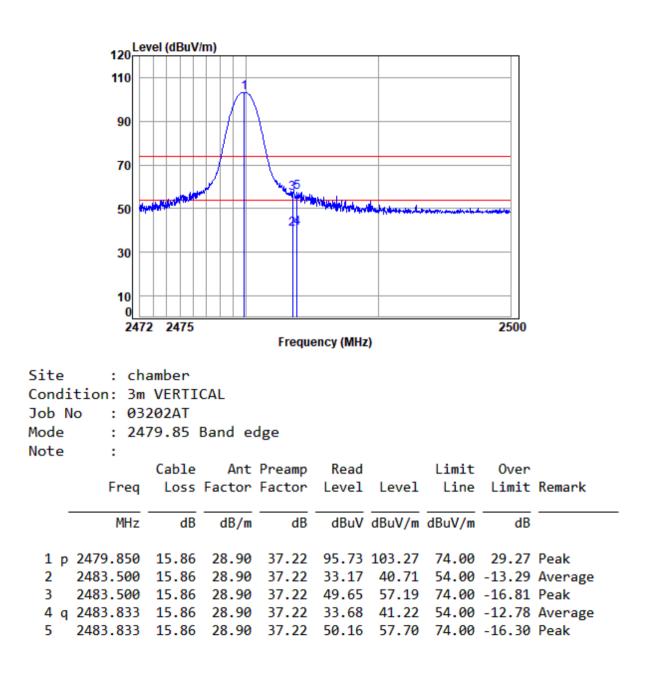
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SZEMC-TRF-01 Rev. A/1

Report No.: SZCR240800320202 Page: 18 of 69

Test Mode: 01; Polarity: Vertical; Modulation:GFSK; Channel:High





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Report No.: SZCR240800320202 Page: 19 of 69

7.2 Radiated Spurious Emissions Below 1GHz

Test Requirement	47 CFR Part 15, Subpart C 15.205 & 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)
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
960-1000	500	3

7.2.1 E.U.T. Operation

Operating Environment:

Temperature: 23.2 °C Humic	ty: 45.8 % RH	Atmospheric Pressure:	1020	mbar
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7.2.2 Test Mode Description

Pre-scan / Final test	Mode Code	Description
Final test	01	TX_non-Hop mode_Keep the EUT in continuously transmitting mode with GMSK modulation.



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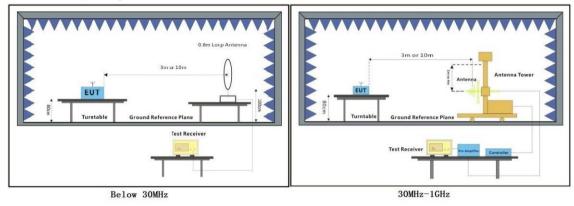
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SZEMC-TRF-01 Rev. A/1

Report No.: SZCR240800320202 Page: 20 of 69

7.2.3 Test Setup Diagram



7.2.4 Measurement Procedure and Data

a. For below 1GHz, the EUT was placed on the top of a rotating table 0.8 meters above the ground 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 quasi-peak method as specified and then reported in a data sheet.

g. Test the EUT in the lowest channel, the middle channel, the Highest channel.

h. The radiation measurements are performed in X, Y, Z axis positioning for Transmitting mode, and found the X axis positioning which it is the worst case.

i. Repeat above procedures until all frequencies measured was complete.

Remark:

1. Level= Read Level+ Cable Loss+ Antenna Factor- Preamp Factor

2. Scan from 9kHz to 30MHz, the disturbance below 30MHz was very low. The points marked on above plots are the highest emissions could be found when testing, so only above points had been displayed. The amplitude of spurious emissions from the radiator which are attenuated more than 20dB below the limit need not be reported.



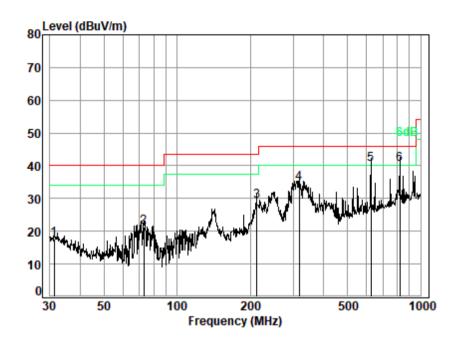
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SZEMC-TRF-01 Rev. A/1

Report No.: SZCR240800320202 Page: 21 of 69

Test Mode: 01; Polarity: Horizontal



Site :	chamber
Condition:	3m HORIZONTAL
Job No. :	03202AT
Test Mode:	01

		Ant	Cable	Preamp	Read		Limit	0ver	
	Freq	Factor	Loss	Factor	Level	Level	Line	Limit	Remark
_									
	MHz	dB/m	dB	dB	dBuV	dBuV/m	dBuV/m	dB	
1	31.29	20.60	0.65	27.79	24.29	17.75	40.00	-22.25	QP
2	72.85	10.44	1.01	27.67	37.44	21.22	40.00	-18.78	QP
3	212.27	14.79	1.78	27.12	39.76	29.21	43.50	-14.29	QP
4	316.59	18.44	2.23	26.82	40.75	34.60	46.00	-11.40	QP
5	625.08	25.06	3.29	27.91	39.92	40.36	46.00	-5.64	QP
6 q	821.71	26.56	3.89	27.32	37.48	40.61	46.00	-5.39	QP



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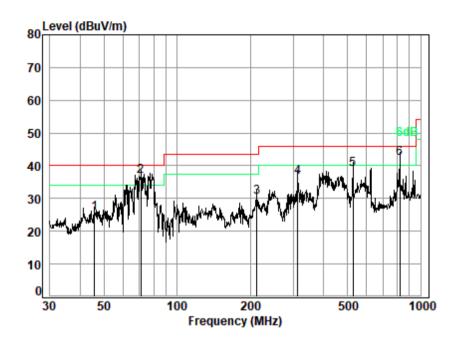
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SZEMC-TRF-01 Rev. A/1

Report No.: SZCR240800320202 Page: 22 of 69

Test Mode: 01; Polarity: Vertical



Site :	chamber
Condition:	3m VERTICAL
Job No. :	03202AT
Test Mode:	01

		Ant	Cable	Preamp	Read		Limit	0ver	
	Freq	Factor	Loss	Factor	Level	Level	Line	Limit	Remark
_									
	MHz	dB/m	dB	dB	dBuV	dBuV/m	dBuV/m	dB	
1	45.69	14.03	0.80	27.75	38.42	25.50	40.00	-14.50	QP
2 q	71.08	10.55	1.00	27.67	52.81	36.69	40.00	-3.31	QP
3	212.27	14.79	1.78	27.12	40.95	30.40	43.50	-13.10	QP
4	312.18	18.41	2.22	26.80	42.80	36.63	46.00	-9.37	QP
5	528.25	23.26	2.98	27.68	40.50	39.06	46.00	-6.94	Q P
6		26.56							-
									•



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SZEMC-TRF-01 Rev. A/1

Report No.: SZCR240800320202 Page: 23 of 69

7.3 Radiated Spurious Emissions Above 1GHz

Test Requirement	47 CFR Part 15, Subpart C 15.205 & 15.209
Test Method:	ANSI C63.10 (2013) Section 6.6
Measurement Distance:	3m

Limit:

Frequency(MHz)	Field strength(microvolts/meter)	Measurement distance(meters)
Above 1000	500	3

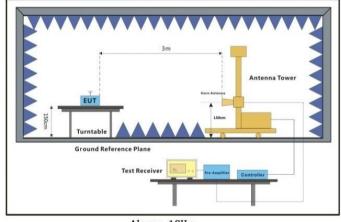
7.3.1 E.U.T. Operation

Operating Enviro	onment:				
Temperature:	22.5 °C	Humidity:	51.7 % RH	Atmospheric Pressure: 1020	mbar

7.3.2 Test Mode Description

Pre-scan / Final test	Mode Code	Description
Final test	01	TX_non-Hop mode_Keep the EUT in continuously transmitting mode with GMSK modulation.

7.3.3 Test Setup Diagram



Above 1GHz



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SZEMC-TRF-01 Rev. A/1

Report No.: SZCR240800320202 Page: 24 of 69

7.3.4 Measurement Procedure and Data

a. For above 1GHz, the EUT was placed on the top of a rotating table 1.5 meters above the ground at a 3 meter fully-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 or average method as specified and then reported in a data sheet.

g. Test the EUT in the lowest channel, the middle channel, the Highest channel.

h. The radiation measurements are performed in X, Y, Z axis positioning for Transmitting mode, and found the X axis positioning which it is the worst case.

i. Repeat above procedures until all frequencies measured was complete.

Remark:

1. Level= Read Level+ Cable Loss+ Antenna Factor- Preamp Factor

2. Scan from 1GHz to 25GHz, the disturbance above 18GHz was very low. The points marked on above plots are the highest emissions could be found when testing, so only above points had been displayed. The amplitude of spurious emissions from the radiator which are attenuated more than 20dB below the limit need not be reported.

3. As shown in this section, for frequencies above 1GHz, the field strength limits are based on average limits. However, 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. For the emissions whose peak level is lower than the average limit, only the peak measurement is shown in the report.



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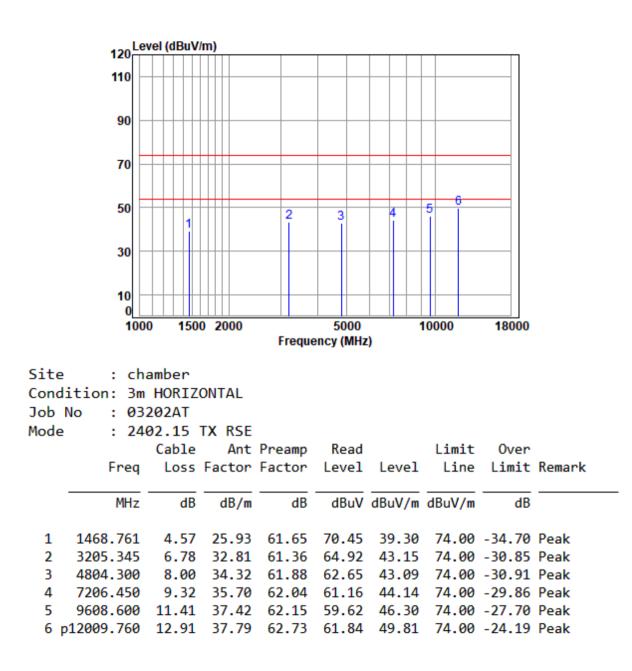
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SZEMC-TRF-01 Rev. A/1

Report No.: SZCR240800320202 Page: 25 of 69

Test Mode: 01; Polarity: Horizontal; Modulation:GFSK; Channel:Low





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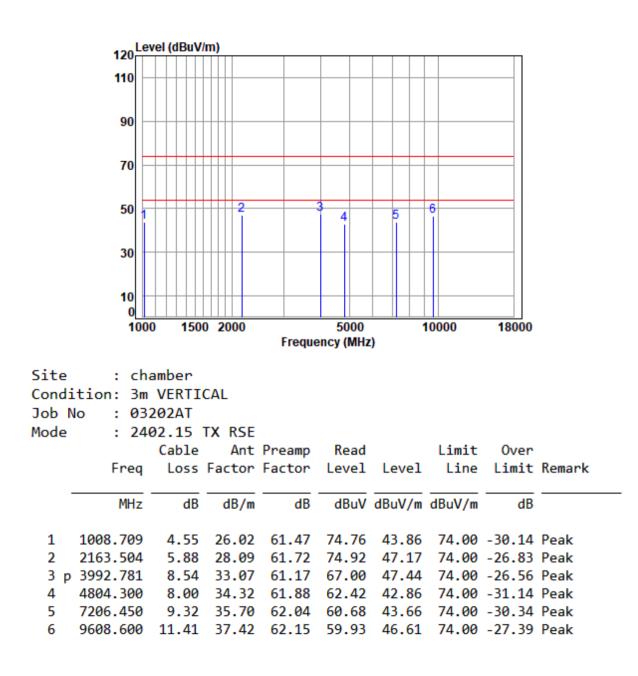
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SZEMC-TRF-01 Rev. A/1

Report No.: SZCR240800320202 Page: 26 of 69

Test Mode: 01; Polarity: Vertical; Modulation:GFSK; Channel:Low





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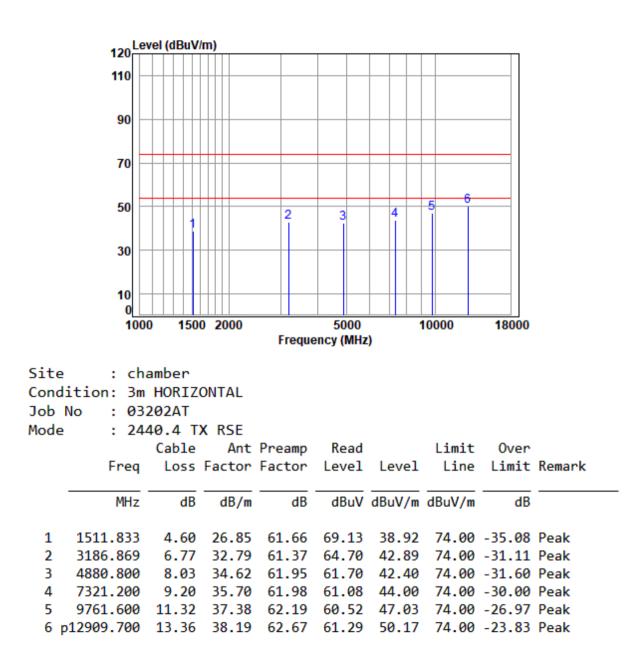
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SZEMC-TRF-01 Rev. A/1

Report No.: SZCR240800320202 Page: 27 of 69

Test Mode: 01; Polarity: Horizontal; Modulation:GFSK; Channel:middle





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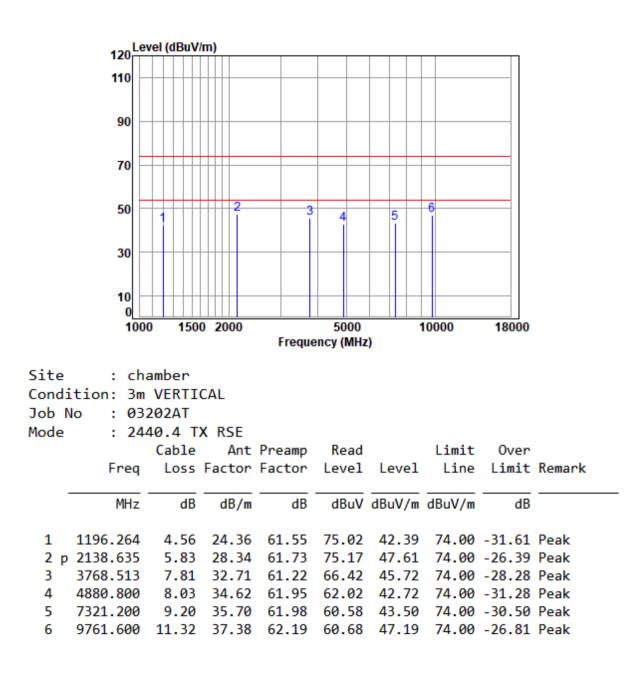
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SZEMC-TRF-01 Rev. A/1

Report No.: SZCR240800320202 Page: 28 of 69

Test Mode: 01; Polarity: Vertical; Modulation:GFSK; Channel:middle





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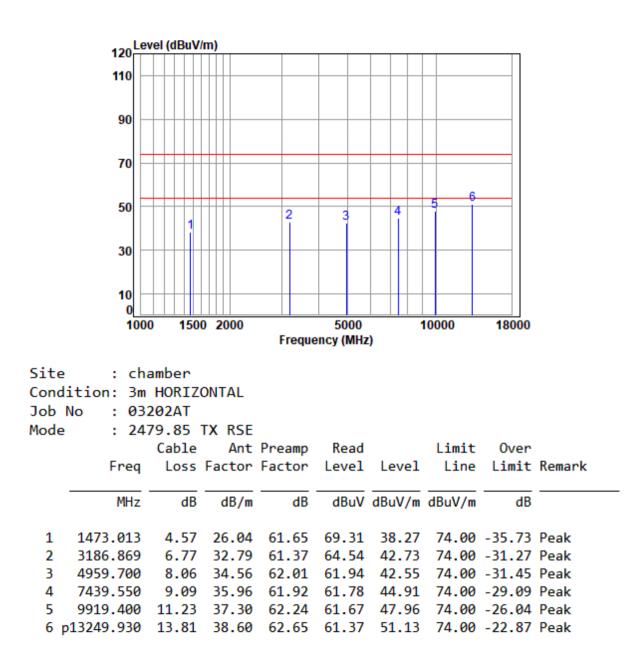
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SZEMC-TRF-01 Rev. A/1

Report No.: SZCR240800320202 Page: 29 of 69

Test Mode: 01; Polarity: Horizontal; Modulation:GFSK; Channel:High





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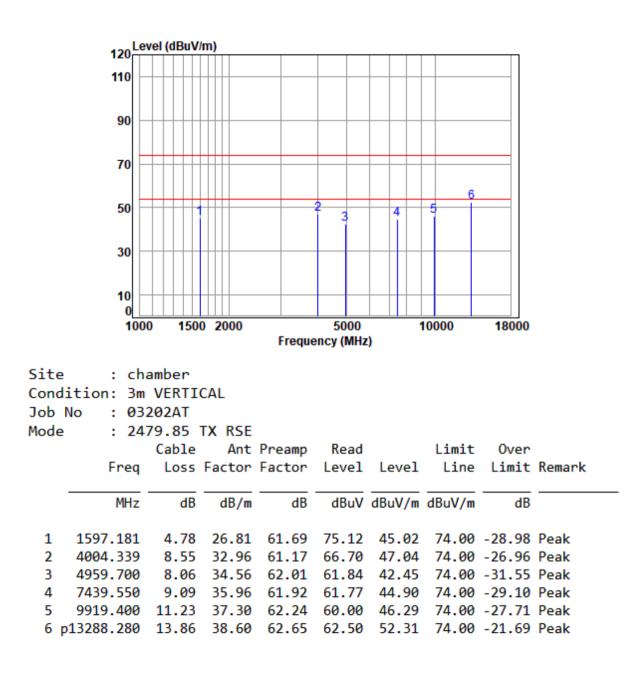
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SZEMC-TRF-01 Rev. A/1

Report No.: SZCR240800320202 Page: 30 of 69

Test Mode: 01; Polarity: Vertical; Modulation:GFSK; Channel:High





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SZEMC-TRF-01 Rev. A/1

Report No.: SZCR240800320202 Page: 31 of 69

7.4 Conducted Peak Output Power

Test Requirement	47 CFR Part 15, Subpart C 15.247(b)(1)
Test Method:	ANSI C63.10 (2013) Section 7.8.5

Limit:	
Frequency range(MHz)	Output power of the intentional radiator(watt)
	1 for ≥50 hopping channels
902-928	0.25 for 25≤ hopping channels <50
	1 for digital modulation
2400-2483.5	1 for ≥75 non-overlapping hopping channels
	0.125 for all other frequency hopping systems
	1 for digital modulation
5725-5850	1 for frequency hopping systems and digital modulation

7.4.1 E.U.T. Operation

Operating Environment: Temperature: 24.6 °C

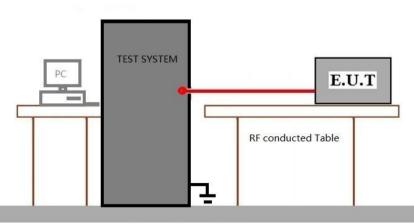
Humidity: 43.6 % RH At

Atmospheric Pressure: 1020 mbar

7.4.2 Test Mode Description

Pre-scan / Final test	Mode Code	Description
Final test	01	TX_non-Hop mode_Keep the EUT in continuously transmitting mode with GMSK modulation.

7.4.3 Test Setup Diagram



Ground Reference Plane



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SZEMC-TRF-01 Rev. A/1

Report No.: SZCR240800320202 Page: 32 of 69

7.4.4 Measurement Procedure and Data

Note: Since the verify power the same operating range bandwidth and smaller power can be covered by the higher power.

Please Refer to Appendix for Details



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Report No.: SZCR240800320202 Page: 33 of 69

7.5 20dB Bandwidth

Test Requirement	47 CFR Part 15, Subpart C 15.247(a)(1)
Test Method:	ANSI C63.10 (2013) Section 7.8.7

7.5.1 E.U.T. Operation

Operating Environment: Temperature: 24.6 °C

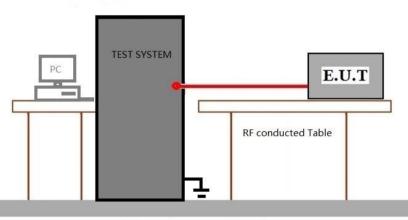
Humidity: 43.6 % RH

Atmospheric Pressure: 1020 mbar

7.5.2 Test Mode Description

Pre-scan / Final test	Mode Code	Description
Final test	01	TX_non-Hop mode_Keep the EUT in continuously transmitting mode with GMSK modulation.

7.5.3 Test Setup Diagram



Ground Reference Plane

7.5.4 Measurement Procedure and Data

Please Refer to Appendix for Details



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SZEMC-TRF-01 Rev. A/1

Report No.: SZCR240800320202 Page: 34 of 69

7.6 Carrier Frequencies Separation

Test Requirement	47 CFR Part 15, Subpart C 15.247a(1)
Test Method:	ANSI C63.10 (2013) Section 7.8.2

Limit:

Frequency hopping systems shall have hopping channel carrier frequencies separated by a minimum of 25 kHz or the 20 dB bandwidth of the hopping channel, whichever is greater. Alternatively, frequency hopping systems operating in the 2400-2483.5 MHz band may have hopping channel carrier frequencies that are separated by 25 kHz or two-thirds of the 20 dB bandwidth of the hopping channel, whichever is greater, provided the systems operate with an output power no greater than 125 mW.

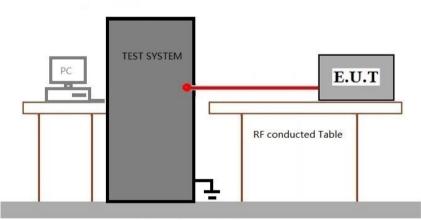
7.6.1 E.U.T. Operation

Operating Environment:					
Temperature:	24.6 °C	Humidity:	43.6 % RH	Atmospheric Pressure: 1020 mbar	

7.6.2 Test Mode Description

Pre-scan / Final test	Mode Code	Description
Final test	00	TX_Hop mode_Keep the EUT in frequency hopping mode with GMSK modulation.

7.6.3 Test Setup Diagram



Ground Reference Plane

7.6.4 Measurement Procedure and Data

Please Refer to Appendix for Details



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SZEMC-TRF-01 Rev. A/1

Report No.: SZCR240800320202 Page: 35 of 69

7.7 Hopping Channel Number

Test Requirement	47 CFR Part 15, Subpart C 15.247a(1)(iii)
Test Method:	ANSI C63.10 (2013) Section 7.8.3

Limit:

Frequency range(MHz)	Number of hopping channels (minimum)
002.028	50 for 20dB bandwidth <250kHz
902-928	25 for 20dB bandwidth ≥250kHz
2400-2483.5	15
5725-5850	75

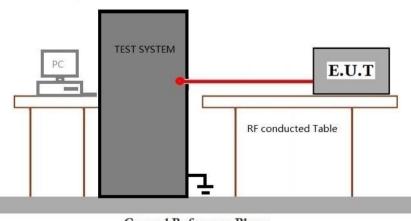
7.7.1 E.U.T. Operation

Operating Environment:						
Temperature:	24.6 °C	Humidity:	43.6 % RH	Atmospheric Pressure:	1020	mbar

7.7.2 Test Mode Description

Pre-scan / Final test	Mode Code	Description
Final test	00	TX_Hop mode_Keep the EUT in frequency hopping mode with GFSK modulation.

7.7.3 Test Setup Diagram



Ground Reference Plane

7.7.4 Measurement Procedure and Data

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SZEMC-TRF-01 Rev. A/1

Report No.: SZCR240800320202 Page: 36 of 69

7.8 Dwell Time

Test Requirement	47 CFR Part 15, Subpart C 15.247a(1)(iii)
Test Method:	ANSI C63.10 (2013) Section 7.8.4

Limit:

Frequency(MHz)	Limit	
002 029	0.4S within a 20S period(20dB bandwidth<250kHz)	
902-928	0.4S within a 10S period(20dB bandwidth≥250kHz)	
0400 0400 5	0.4S within a period of 0.4S multiplied by the number	
2400-2483.5	of hopping channels	
5725-5850	0.4S within a 30S period	

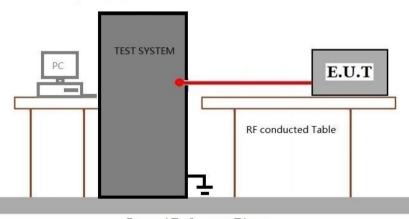
7.8.1 E.U.T. Operation

Operating Environment:						
Temperature:	24.6 °C	Humidity:	43.6 % RH	Atmospheric Pressure:	1020	mbar

7.8.2 Test Mode Description

Pre-scan / Final test	Mode Code	Description
Final test	00	TX_Hop mode_Keep the EUT in frequency hopping mode with GMSK modulation.

7.8.3 Test Setup Diagram



Ground Reference Plane

7.8.4 Measurement Procedure and Data

Please Refer to Appendix for Details



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Report No.: SZCR240800320202 Page: 37 of 69

7.9 Conducted Band Edges Measurement

Test Requirement	47 CFR Part 15, Subpart C 15.247(d)
Test Method:	ANSI C63.10 (2013) Section 7.8.6

Limit:

In any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20 dB below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power, based on either an RF conducted or a radiated measurement, provided the transmitter demonstrates compliance with the peak conducted power limits. If the transmitter complies with the conducted power limits based on the use of RMS averaging over a time interval, as permitted under paragraph (b)(3) of this section, the attenuation required under this paragraph shall be 30 dB instead of 20 dB. Attenuation below the general limits specified in §15.209(a) is not required. In addition, radiated emissions which fall in the restricted bands, as defined in §15.205(a), must also comply with the radiated emission limits specified in §15.205(c).

7.9.1 E.U.T. Operation

Operating Environment:

Temperature: 24.6 °C

Humidity: 43.6 % RH

Atmospheric Pressure: 1020 mbar

Pre-scan / Final test	Mode Code	Description
Final test	00	TX_Hop mode_Keep the EUT in frequency hopping mode with GMSK modulation.
Final test	01	TX_non-Hop mode_Keep the EUT in continuously transmitting mode with GMSK modulation.

7.9.2 Test Mode Description



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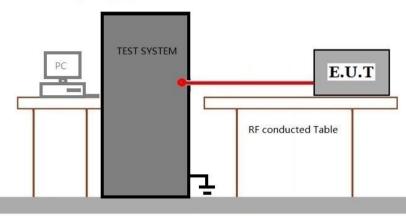
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SZEMC-TRF-01 Rev. A/1

Report No.: SZCR240800320202 Page: 38 of 69

7.9.3 Test Setup Diagram



Ground Reference Plane

7.9.4 Measurement Procedure and Data

Please Refer to Appendix for Details



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SZEMC-TRF-01 Rev. A/1

Report No.: SZCR240800320202 Page: 39 of 69

7.10 Conducted Spurious Emissions

Test Requirement	47 CFR Part 15, Subpart C 15.247(d)
Test Method:	ANSI C63.10 (2013) Section 7.8.8

Limit:

In any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20 dB below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power, based on either an RF conducted or a radiated measurement, provided the transmitter demonstrates compliance with the peak conducted power limits. If the transmitter complies with the conducted power limits based on the use of RMS averaging over a time interval, as permitted under paragraph (b)(3) of this section, the attenuation required under this paragraph shall be 30 dB instead of 20 dB. Attenuation below the general limits specified in §15.209(a) is not required. In addition, radiated emissions which fall in the restricted bands, as defined in §15.205(a), must also comply with the radiated emission limits specified in §15.205(c).

7.10.1 E.U.T. Operation

Operating Environment:

Temperature: 24.6 °C

Humidity: 43.6 % RH

Atmospheric Pressure: 1020 mbar

Pre-scan / Final test	Mode Code	Description
Final test	01	TX_non-Hop mode_Keep the EUT in continuously transmitting mode with GMSK modulation.

7.10.2 Test Mode Description



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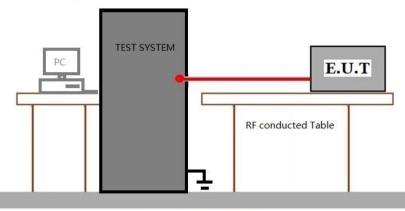
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SZEMC-TRF-01 Rev. A/1

Report No.: SZCR240800320202 Page: 40 of 69

7.10.3 Test Setup Diagram



Ground Reference Plane

7.10.4 Measurement Procedure and Data

Please Refer to Appendix for Details



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SZEMC-TRF-01 Rev. A/1

Report No.: SZCR240800320202 Page: 41 of 69

Test Setup Photo 8

Refer to Appendix - Test Setup Photo for SZCR2408003202AT

EUT Constructional Details (EUT Photos) 9

Refer to External and Internal Photos for SZCR2408003202AT



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SZEMC-TRF-01 Rev. A/1

Report No.: SZCR240800320202 Page: 42 of 69

10 Appendix

1. Duty Cycle

1.1 Test Result

1.1.1 Ant1

	Ant1								
Mode	ТХ Туре	Frequency (MHz)	T_on (ms)	Period (ms)	Duty Cycle (%)	Duty Cycle Correction Factor (dB)	Max. DC Variation (%)		
		2402.15	2.506	10.323	24.28	6.15	12.05		
2.4G	SISO	2440.4	2.506	10.323	24.28	6.15	12.05		
		2479.85	2.506	10.323	24.28	6.15	12.08		



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Report No.: SZCR240800320202 Page: 43 of 69

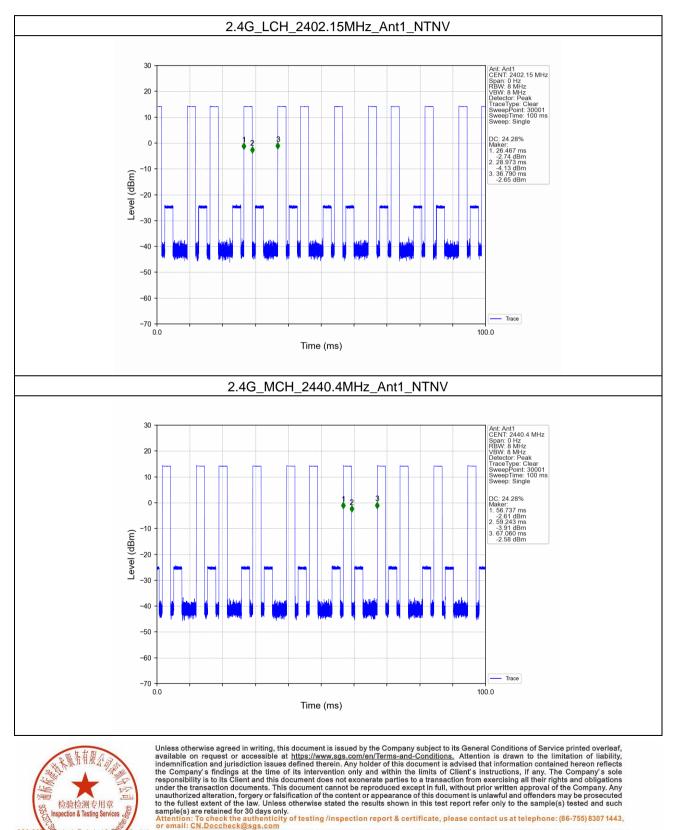
1.2 Test Graph

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1.2.1 Ant1



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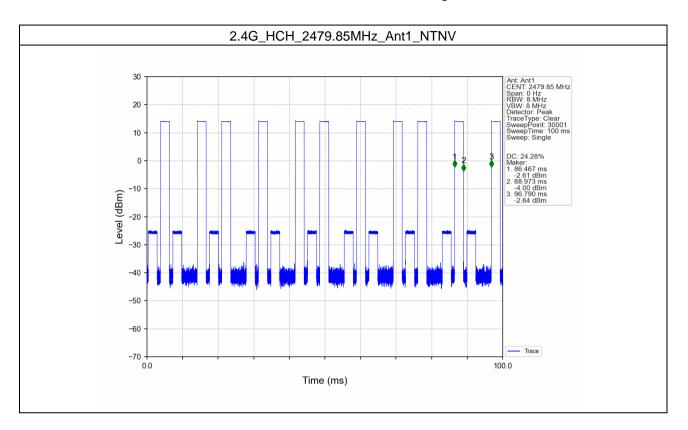
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Report No.: SZCR240800320202 Page: 44 of 69





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SZEMC-TRF-01 Rev. A/1

Report No.: SZCR240800320202 Page: 45 of 69

2. Bandwidth

2.1 Test Result

2.1.1 OBW

Mode	ТΧ	Frequency	ANT	99% Occupied E	andwidth (MHz)	Verdict					
Mode	Туре	(MHz)	ANT	Result	Limit	verdict					
		2402.45	1	0.382	/	Pass					
		2402.15	2402.15	2	0.383	/	Pass				
2.40	SISO	2440.4	1	0.381	/	Pass					
2.4G		5150	3130	3130	3130	3130	2440.4	2	0.383	/	Pass
		2470.95	1	0.383	/	Pass					
	2479.85	2	0.385	/	Pass						

2.1.2 20dB BW

Mada	ТΧ	Frequency	ΔΝΙΤ	20dB Bandw	vidth (MHz)	Vardiat
Mode	Туре	(MHz)	ANT	Result	Limit	- Verdict
		2402.45	1	0.374	/	Pass
		2402.15	2	0.374	/	Pass
		SO 2440.4	1	0.377	/	Pass
2.40	2.4G SISO		2	0.378	/	Pass
		2479.85	1	0.377	/	Pass
			2	0.376	/	Pass



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Report No.: SZCR240800320202 Page: 46 of 69

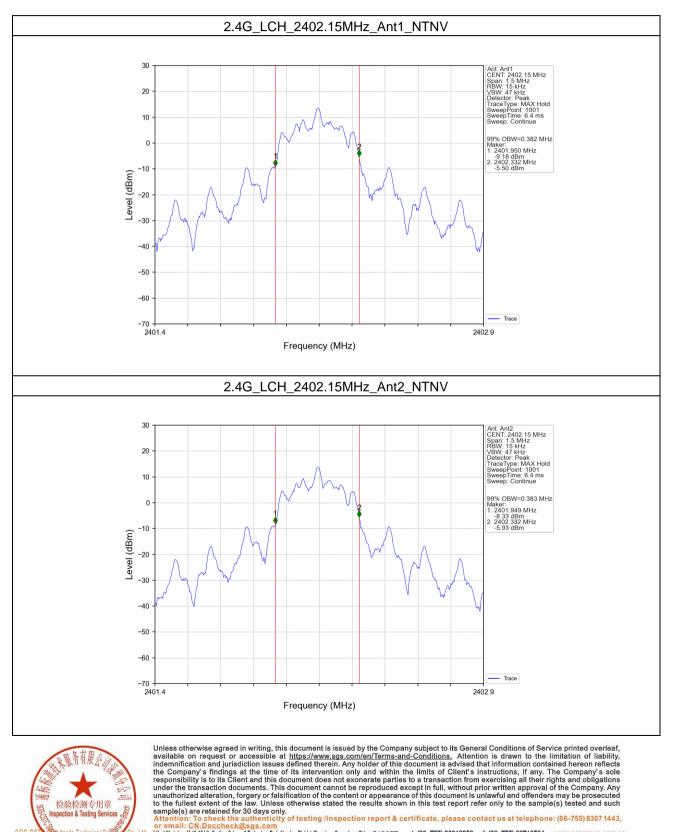
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2.2.1 OBW

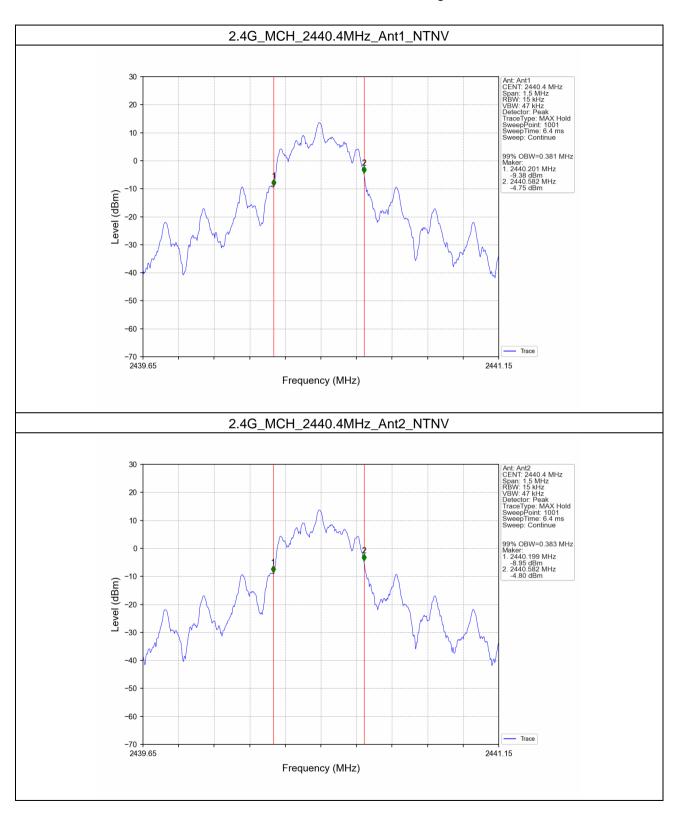


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SZEMC-TRF-01 Rev. A/1

Report No.: SZCR240800320202 Page: 47 of 69





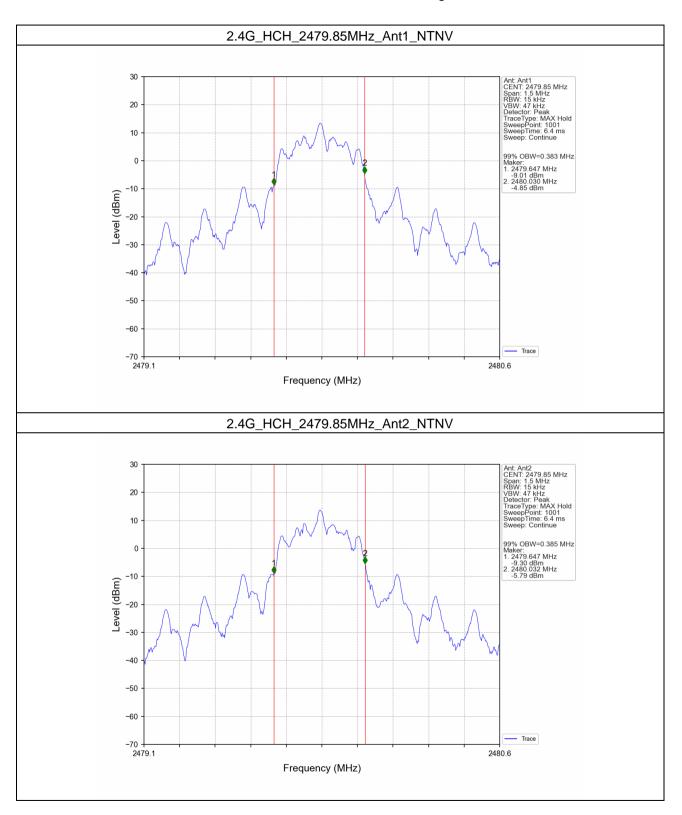
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SZEMC-TRF-01 Rev. A/1

Report No.: SZCR240800320202 Page: 48 of 69





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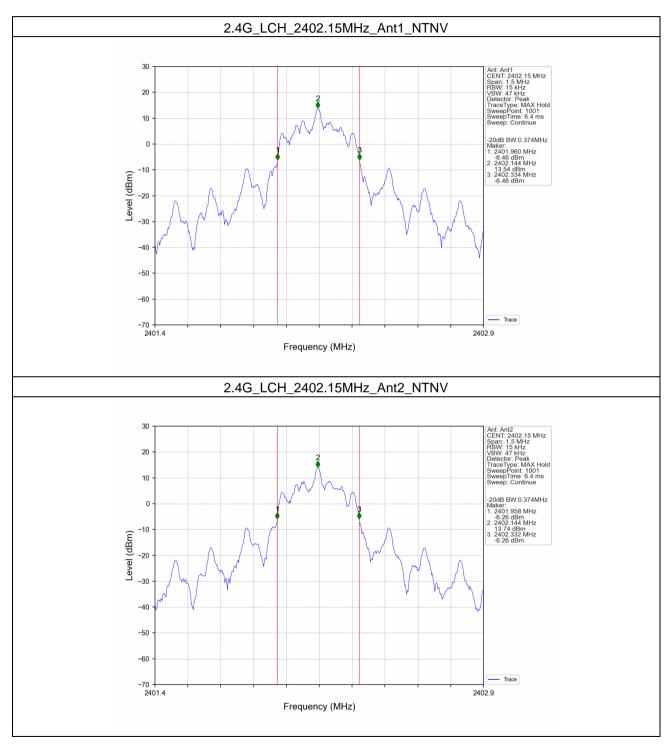
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SZEMC-TRF-01 Rev. A/1

Report No.: SZCR240800320202 Page: 49 of 69

2.2.2 20dB BW





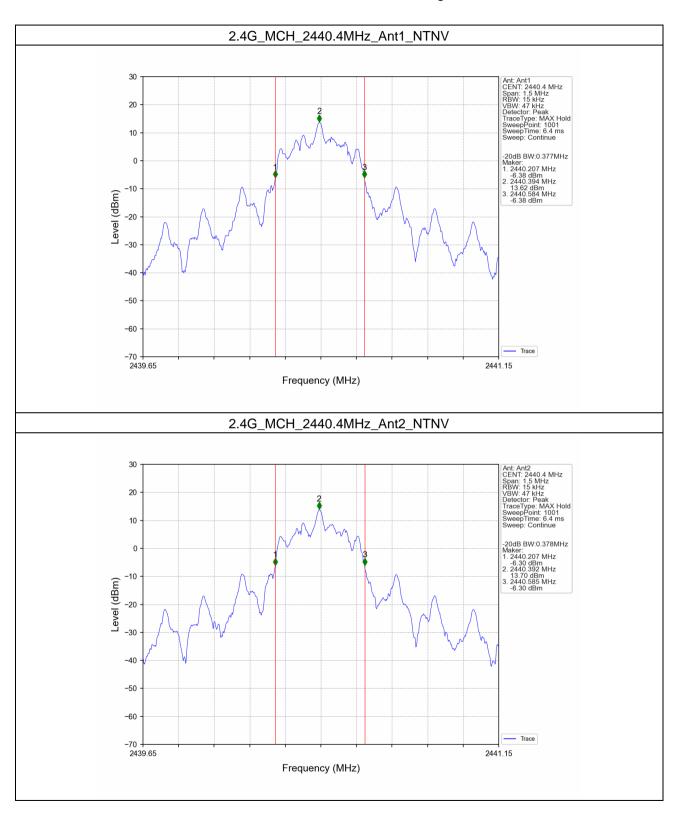
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Report No.: SZCR240800320202 Page: 50 of 69





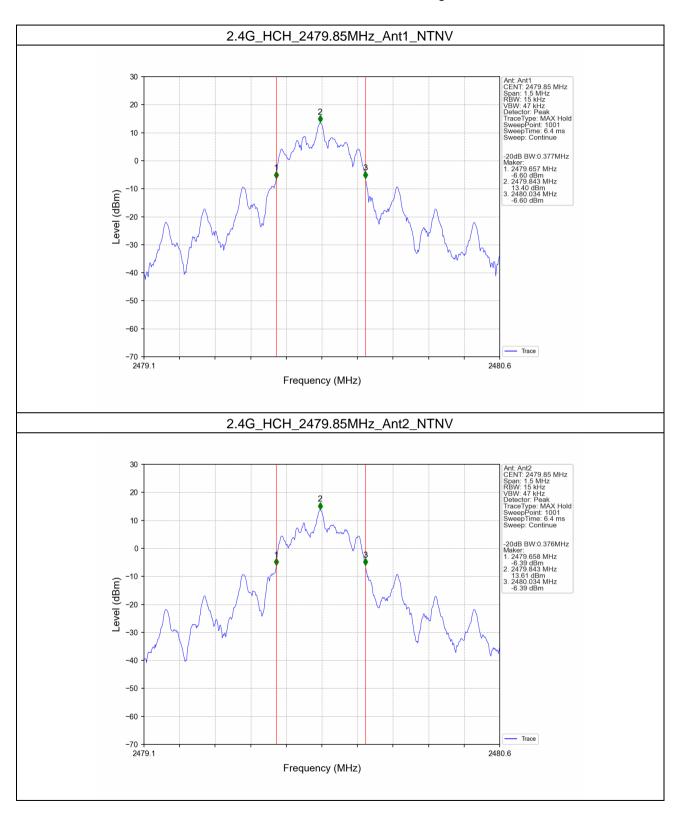
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SZEMC-TRF-01 Rev. A/1

Report No.: SZCR240800320202 Page: 51 of 69





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SZEMC-TRF-01 Rev. A/1

Report No.: SZCR240800320202 Page: 52 of 69

3. Maximum Conducted Output Power

3.1 Test Result

3.1.1 Power

Mada	ΤХ	Frequency	Maximum Avera	Verdict		
Mode	Туре	(MHz)	ANT1	ANT2	Limit	verdict
		2402.15	14.30	14.45	<=20.97	Pass
2.4G	SISO	2440.4	14.36	14.48	<=20.97	Pass
		2479.85	14.25	14.41	<=20.97	Pass



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SZEMC-TRF-01 Rev. A/1

Report No.: SZCR240800320202 Page: 53 of 69

4. Carrier Frequency Separation

4.1 Test Result

4.1.1 Ant1

	Ant1							
Mode	ТХ Туре	Frequency (MHz)	Channel Separation (MHz)	20dB Bandwidth (MHz)	Limit (MHz)	Verdict		
2.4G	SISO	2.4G	SISO	HOPP	0.589	0.384		



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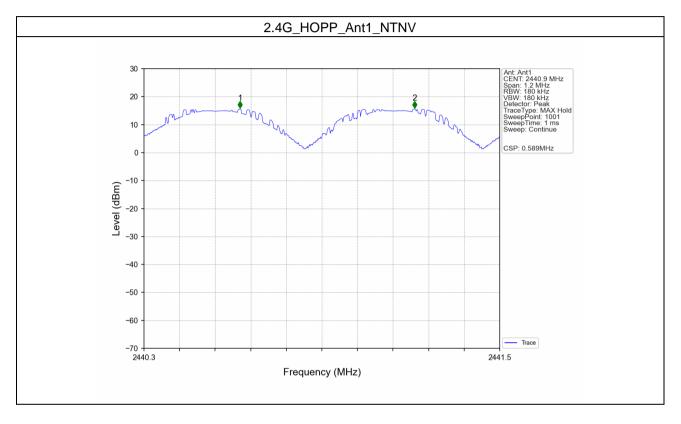


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Report No.: SZCR240800320202 Page: 54 of 69

4.2 Test Graph

4.2.1 Ant1





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SZEMC-TRF-01 Rev. A/1

Report No.: SZCR240800320202 Page: 55 of 69

5. Number of Hopping Frequencies

5.1 Test Result

5.1.1 HoppNum

Mada	ТΧ	Frequency	Verdict		
Mode	Туре	(MHz)	ANT1	Limit	verdict
2.4G	SISO	HOPP	16	>=15	Pass



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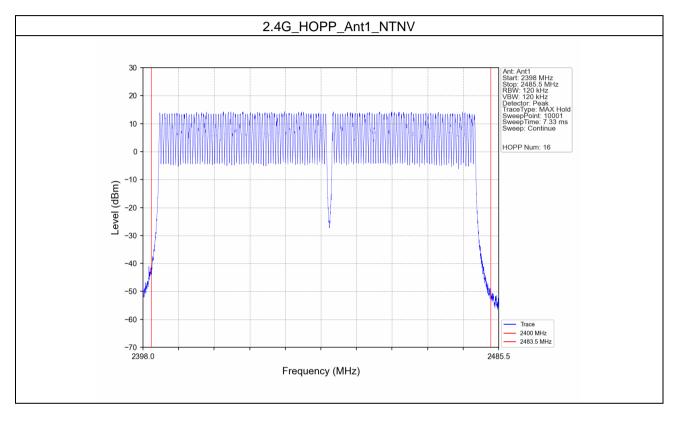


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Report No.: SZCR240800320202 Page: 56 of 69

5.2 Test Graph

5.2.1 HoppNum





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Report No.: SZCR240800320202 Page: 57 of 69

6. Time of Occupancy (Dwell Time)

6.1 Test Result

6.1.1 Ant1

	Ant1							
Mode	ТХ Туре	Frequency (MHz)	Duration of Single Pulse (ms)	Observation Period (s)	Num of Pulse in Observation Period	Dwell Time (ms)	Limit (ms)	Verdict
2.4G	SISO	HOPP	2.508	6.400	5	12.540	<=400	Pass



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Report No.: SZCR240800320202 Page: 58 of 69

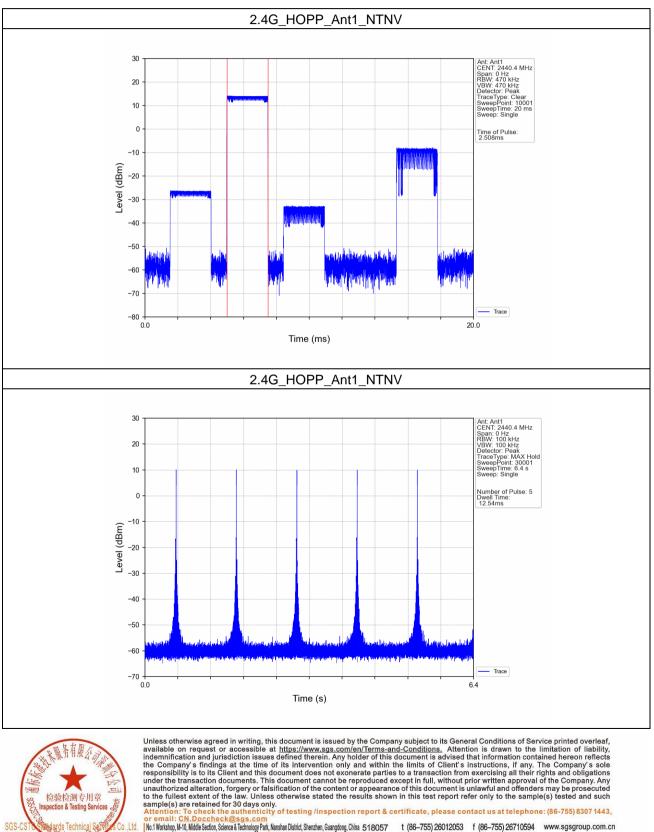
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6.2.1 Ant1





SZEMC-TRF-01 Rev. A/1

Report No.: SZCR240800320202 Page: 59 of 69

7. Unwanted Emissions In Non-restricted Frequency Bands

7.1 Test Result

7.1.1 Ref

Mode	ТХ Туре	Frequency (MHz)	ANT	Level of Reference (dBm)
		0400.45	1	14.18
		2402.15	2	14.25
0.40	0100		1	14.22
2.4G	SISO	2440.4	2	14.29
		0.470.05	1	14.07
		2479.85	2	14.20

7.1.2 CSE

Mode	ТХ Туре	Frequency (MHz)	ANT	Level of Reference (dBm)	Limit (dBm)	Verdict
2.4G	SISO	2402.15	1	14.22	-5.78	Pass
			2	14.29	-5.71	Pass
		2440.4	1	14.22	-5.78	Pass
			2	14.29	-5.71	Pass
		2479.85	1	14.22	-5.78	Pass
			2	14.29	-5.71	Pass
		НОРР	1	14.22	-5.78	Pass
				14.22	-5.78	Pass
			2	14.29	-5.71	Pass
				14.29	-5.71	Pass



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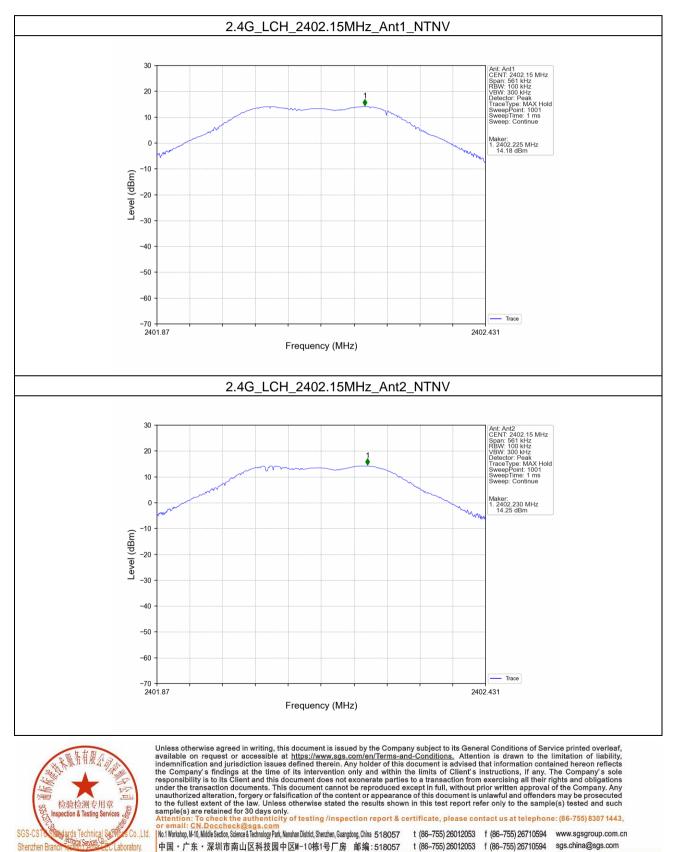


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Report No.: SZCR240800320202 Page: 60 of 69

7.2 Test Graph

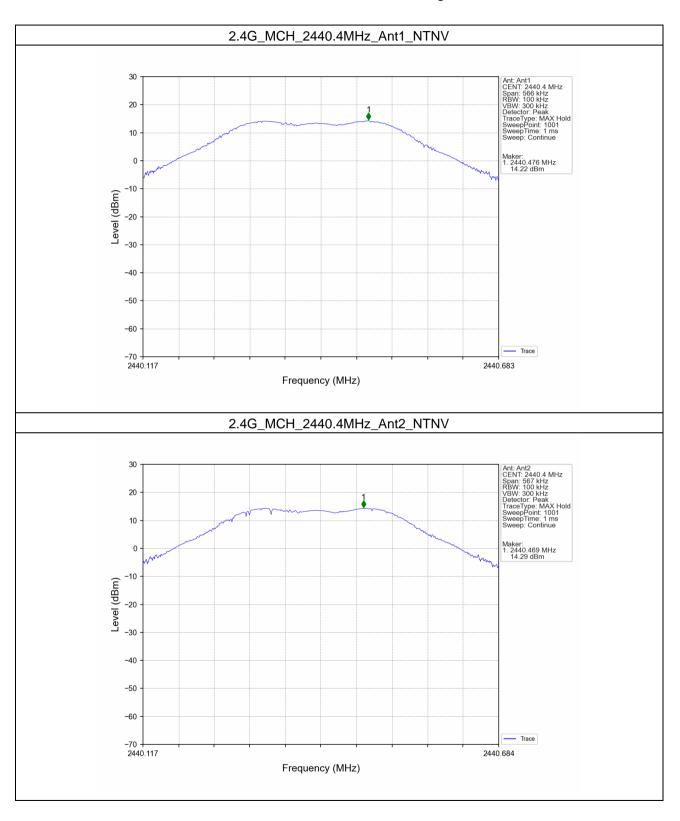
7.2.1 Ref





SZEMC-TRF-01 Rev. A/1

Report No.: SZCR240800320202 Page: 61 of 69





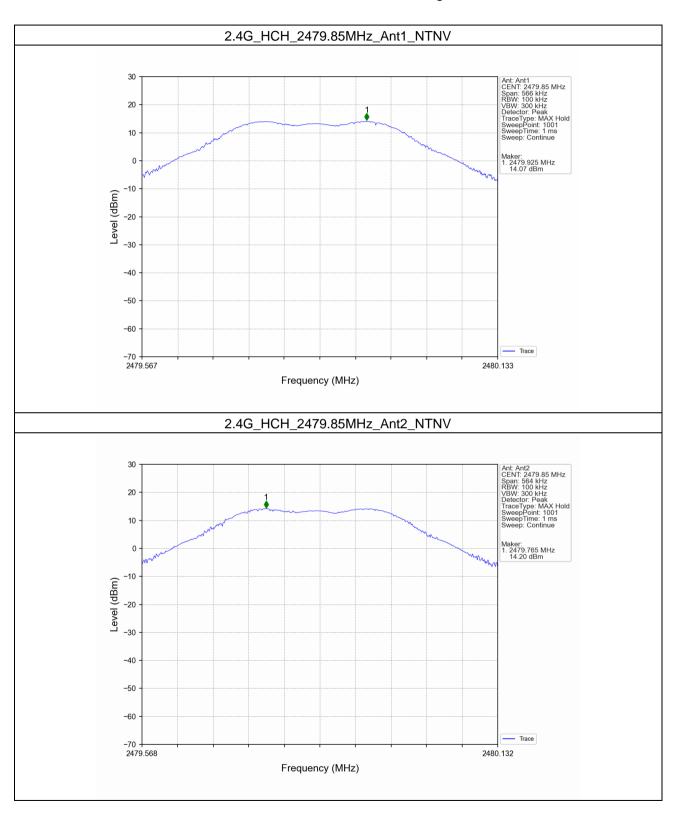
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SZEMC-TRF-01 Rev. A/1

Report No.: SZCR240800320202 Page: 62 of 69





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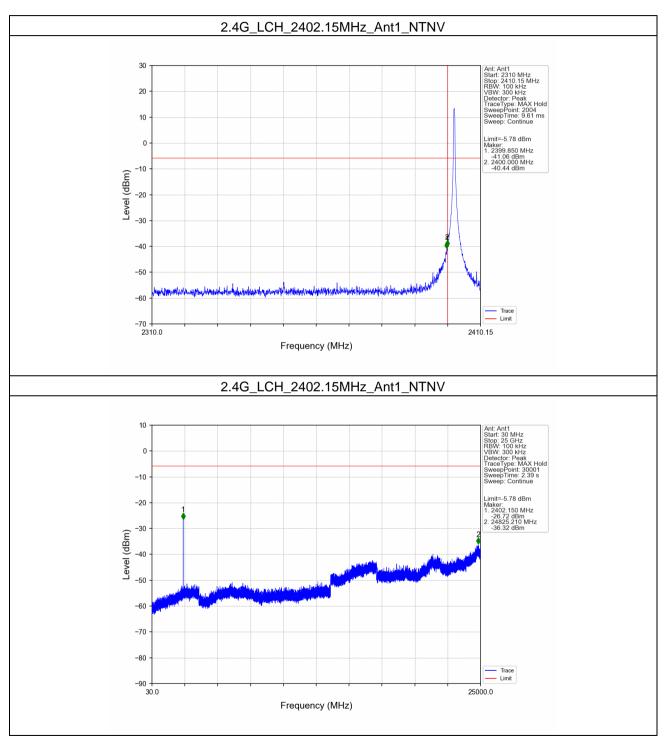
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SZEMC-TRF-01 Rev. A/1

Report No.: SZCR240800320202 Page: 63 of 69

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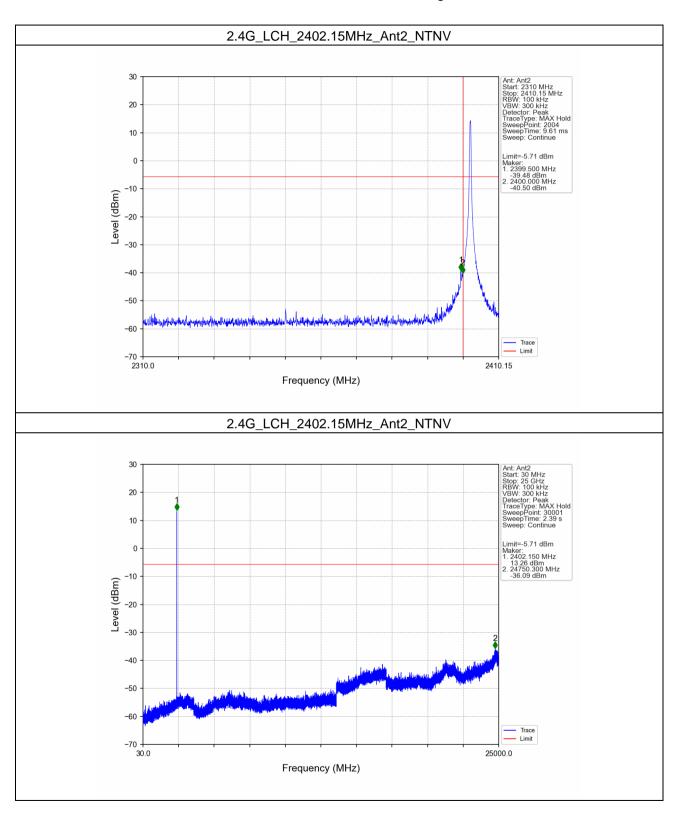
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SZEMC-TRF-01 Rev. A/1

Report No.: SZCR240800320202 Page: 64 of 69





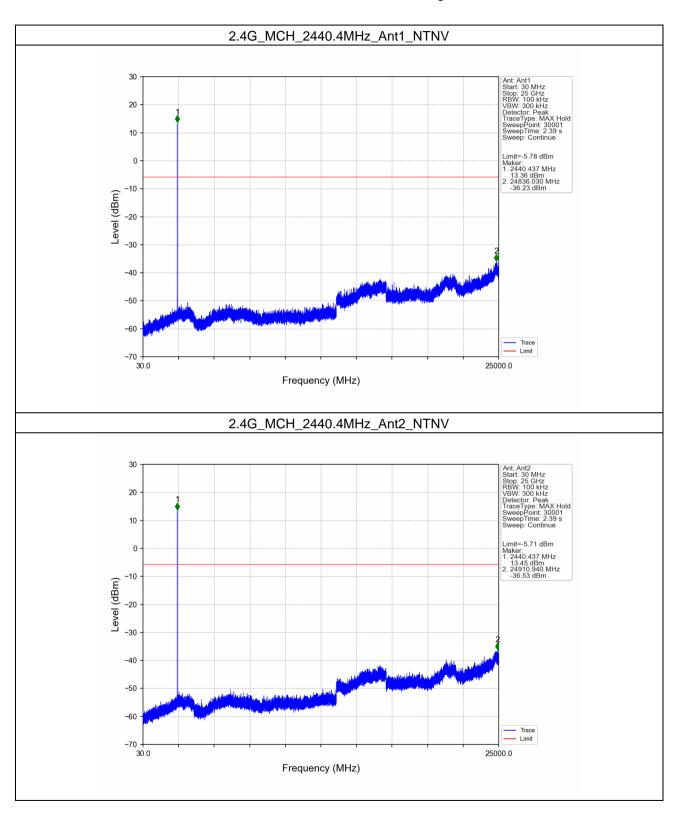
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SZEMC-TRF-01 Rev. A/1

Report No.: SZCR240800320202 Page: 65 of 69





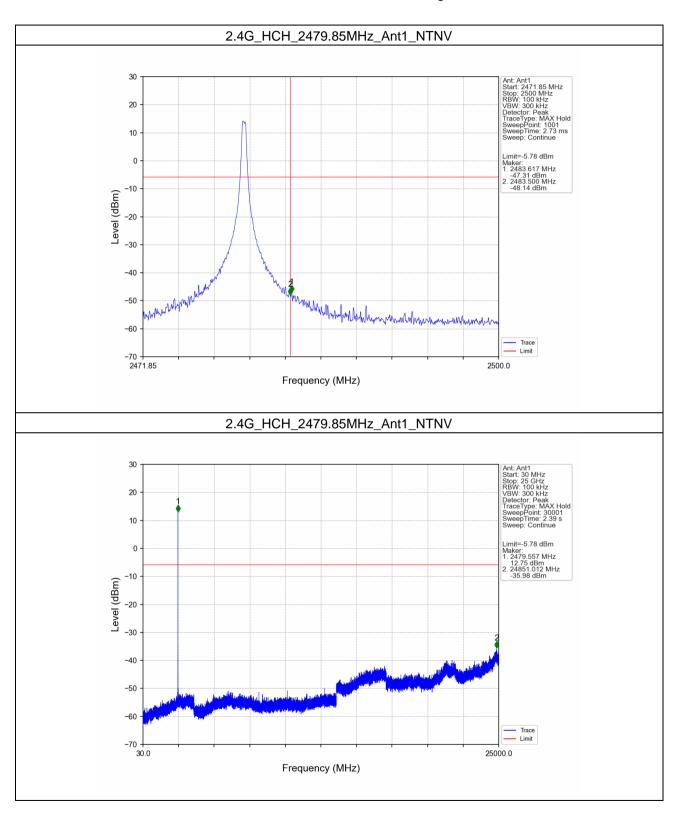
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SZEMC-TRF-01 Rev. A/1

Report No.: SZCR240800320202 Page: 66 of 69





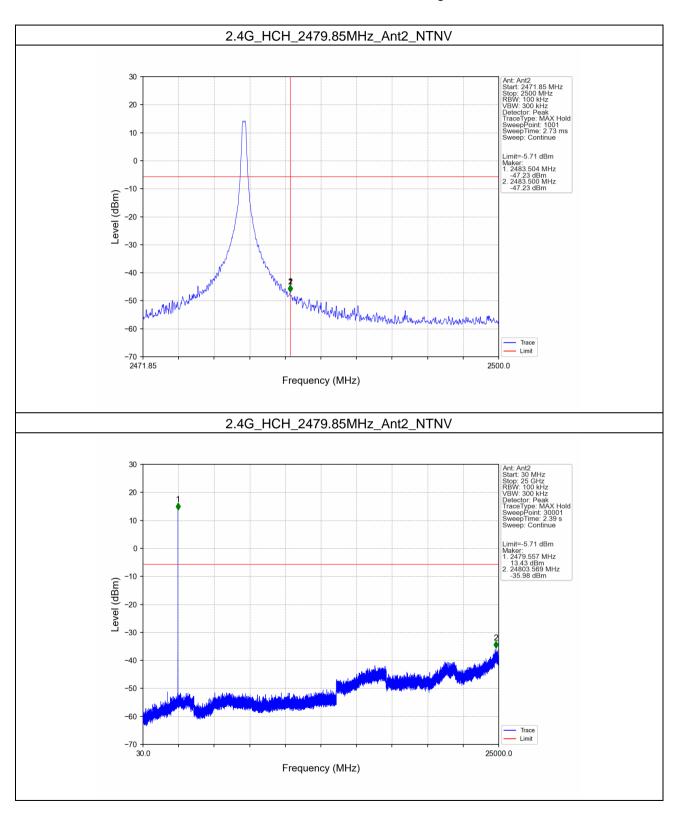
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SZEMC-TRF-01 Rev. A/1

Report No.: SZCR240800320202 Page: 67 of 69





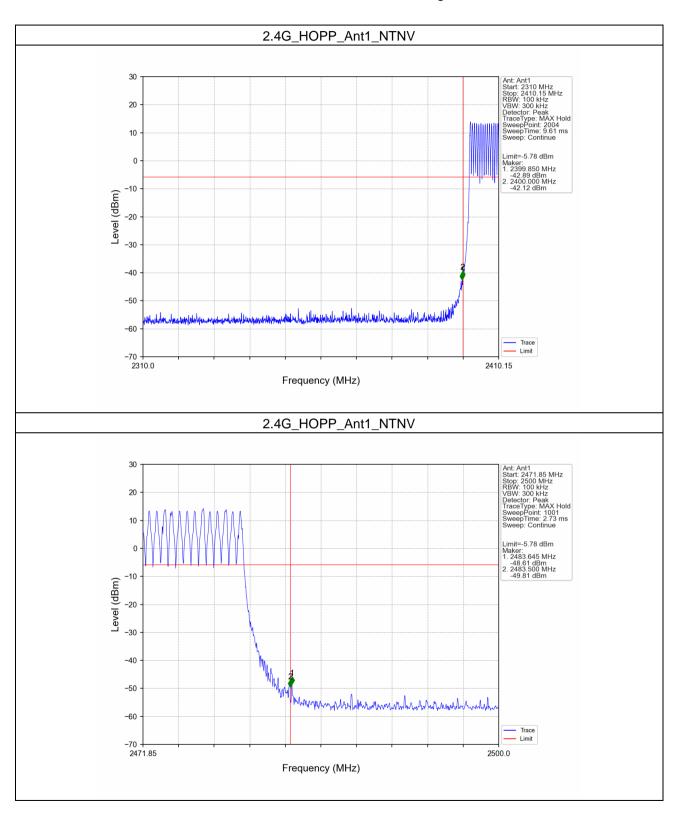
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SZEMC-TRF-01 Rev. A/1

Report No.: SZCR240800320202 Page: 68 of 69





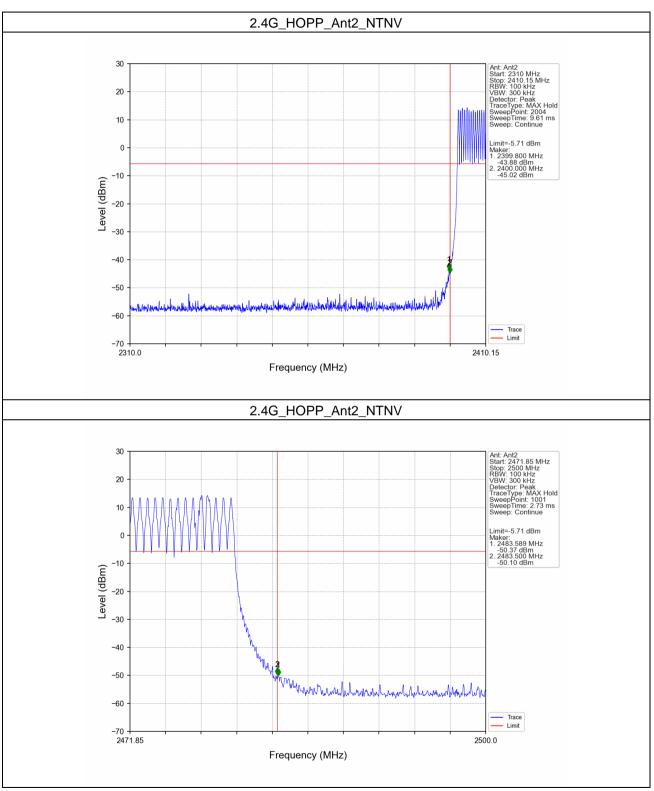
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SZEMC-TRF-01 Rev. A/1

Report No.: SZCR240800320202 Page: 69 of 69



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