



FCC RADIO TEST REPORT

FCC ID : 2AEIM-1877513
Equipment : V4 Supercharger NA Connector/Handle
Brand Name : Tesla
Model Name : 1877513-XX-Y
Applicant : Tesla, Inc.
3500 DEER CREEK ROAD PALO ALTO, CA 94304
Manufacturer : Tesla, Inc.
3500 DEER CREEK ROAD PALO ALTO, CA 94304
Standard : FCC Part 15 Subpart C §15.231

The product was received on Jul. 06, 2023, and testing was performed from Jul. 26, 2023 to Jul. 27, 2023. We, Sporton International (USA) Inc., would like to declare that the tested sample has been evaluated in accordance with the test procedures and has been in compliance with the applicable technical standards.

The test results in this report apply exclusively to the tested model / sample. Without written approval from Sporton International (USA) Inc., the test report shall not be reproduced except in full.

Approved by: Abi Lin

Sporton International (USA) Inc.
1175 Montague Expressway, Milpitas, CA 95035



Table of Contents

History of this test report.....	3
Summary of The Result.....	4
1. General Information	5
1.1 Product Feature of Equipment Under Test	5
1.2 Product Specification of Equipment Under Test	5
1.3 Modification of EUT	5
1.4 Testing Location	5
1.5 Applicable Standards.....	5
2. Test Configuration of Equipment Under Test.....	6
2.1 Descriptions of Test Mode	6
2.2 Connection Diagram of Test System	6
2.3 Support Unit used in test configuration and system	6
2.4 EUT Operation Test Setup	6
3. Test Results	7
3.1 Types of Momentarily Operated Devices.....	7
3.2 20dB and 99% Occupied Bandwidth Measurement	9
3.3 Field Strength of Fundamental and Spurious Emissions	12
4. List of Measuring Equipment	16
5. Uncertainty of Evaluation	17
Appendix A. Test Results of Radiated Test Items	
Appednix B. Setup Photographs	



Summary of The Result

Report Clause	Ref Std. Clause	Test Items	Result (PASS/FAIL)	Remark
-	15.207	AC Power Line Conducted Emissions	Not Required	See Note
3.1	15.231(a)	Types of Momentary Signals	PASS	-
3.2	15.231(c)	20dB and 99% Occupied Bandwidth	PASS	-
3.3	15.231(b) 15.231(e)	Field Strength of Fundamental and Spurious Emissions	PASS	5.48 dB Under the limit at 1260.00 MHz

Note: The EUT is powered by DC power source, it does not operate from the AC power lines or contain provisions for operation while connected to the AC power lines, according to 47 CFR § 15.207(c), the conducted emission limits are not applicable to the device hence the test is not performed.

Conformity Assessment Condition:

1. The test results (PASS/FAIL) with all measurement uncertainty excluded are presented against the regulation limits or in accordance with the requirements stipulated by the applicant/manufacturer who shall bear all the risks of non-compliance that may potentially occur if measurement uncertainty is taken into account.
2. Please refer to the section " Uncertainty of Evaluation " for measurement uncertainty.

Disclaimer:

The product specifications of the EUT presented in the test report that may affect the test assessments are declared by the manufacturer who shall take full responsibility for the authenticity.



1. General Information

1.1 Product Feature of Equipment Under Test

Product Feature	
Equipment	V4 Supercharger NA Connector/Handle
Brand Name	Tesla
Model Name	1877513-XX-Y
FCC ID	2AEIM-1877513
EUT supports Radios application	Bluetooth – LE UHF 315 MHz

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

1.2 Product Specification of Equipment Under Test

Product Specification is subject to this standard	
Tx/Rx Frequency Range	315 MHz
Antenna Type	PCB Antenna
Antenna Gain	-10.94 dBi
Type of Modulation	OOK

Remark: The above EUT's information was declared by manufacturer. Please refer to Disclaimer in report summary.

1.3 Modification of EUT

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

1.4 Testing Location

Test Site	Sporton International (USA) Inc.
Test Site Location	1175 Montague Expressway, Milpitas, CA 95035 TEL : 408 9043300
Test Site No.	Sporton Site No.
	03CH01-CA

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

FCC Designation No.: US1250

1.5 Applicable Standards

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

- ♦ FCC Part 15 Subpart C §15.231
- ♦ ANSI C63.10-2013
- ♦ FCC KDB 414788 D01 Radiated Test Site v01r01

Remark: All the test items were validated and recorded in accordance with the standards without any modification during the testing.

2. Test Configuration of Equipment Under Test

2.1 Descriptions of Test Mode

Investigation has been done on all the possible configurations for searching the worst cases.

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

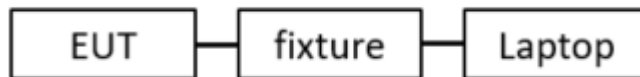
The measured emission level of the EUT was maximized by rotating the EUT on a turntable, adjusting the orientation of the EUT and EUT antenna in three orthogonal axis (X: flat, Y: portrait, Z: landscape), and adjusting the measurement antenna orientation, following C63.10 exploratory test procedures and only the worst case emissions were reported in this report.

Test Items	
Transmission time	
20dB and 99% occupied bandwidth	
Field Strength of Fundamental and Spurious Emissions	

Test Configuration – Radiated measurement	
Mode	Frequency
1	315MHz

2.2 Connection Diagram of Test System

Radiated measurement:



2.3 Support Unit used in test configuration and system

Item	Equipment	Brand Name	Model Name	FCC ID	Data Cable	Power Cord
1.	Notebook	Acer	N18Q13	PD9AX201NG	N/A	AC I/P: Unshielded, 1.2 m DC O/P: Shielded, 1.8 m
2.	Fixture board	Texas Instruments	CC1352R1	N/A	Unshielded, 1.0 m	N/A

2.4 EUT Operation Test Setup

Connect EUT to Laptop via fixture board. Use the software “SmartRF Studio” to set EUT in continuous transmission mode.

3. Test Results

3.1 Types of Momentarily Operated Devices

3.1.1 Limit

<input checked="" type="checkbox"/>	§15.231 (a)(1) A manually operated transmitter shall employ a switch that will automatically deactivate the transmitter within not more than 5 seconds of being released.
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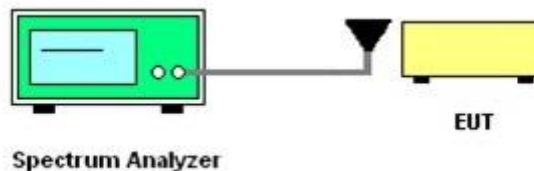
3.1.2 Measuring Instruments

See list of measuring instruments of this test report.

3.1.3 Test Procedures

1. The antenna is placed 3 meter away from EUT and connected to spectrum analyzer.
2. RBW is set to be greater than EUT bandwidth. $VBW \geq RBW$.
3. Set the spectrum to clear-write and zero span.
4. Measured the transmission time of EUT under specified condition.

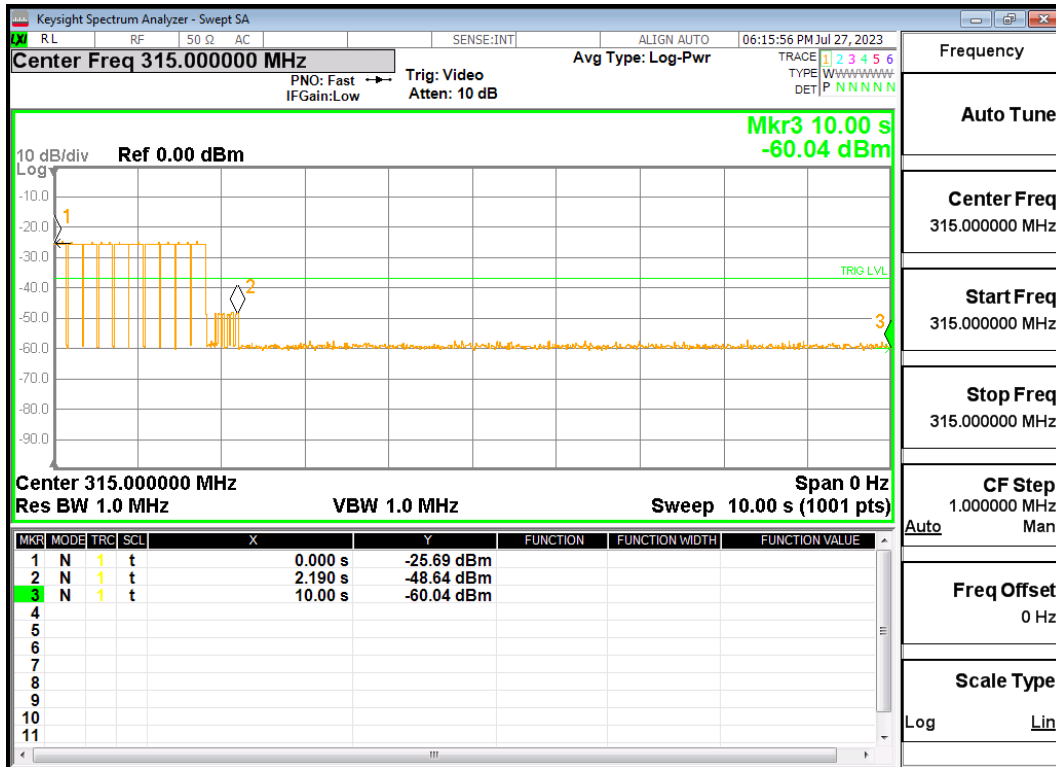
3.1.4 Test Setup



3.1.5 Test Result of transmission time

☒ §15.231 (a)(1)

A manually operated transmitter shall employ a switch that will automatically deactivate the transmitter within not more than 5 seconds of being released.



Transmission is activated at the same time as marker 1.

The transmission stopped at the same time as marker 2.

Transmission time: 2.19 sec.

3.2 20dB and 99% Occupied Bandwidth Measurement

3.2.1 Limit

The bandwidth of the emission shall be no wider than 0.25% of the center frequency for devices operating above 70 MHz and below 900 MHz. For devices operating above 900 MHz, the emission shall be no wider than 0.5% of the center frequency. Bandwidth is determined at the points 20 dB down from the modulated carrier.

The 99% bandwidth of momentarily operated devices shall be less or equal to 0.25% of the centre frequency for devices operating between 70 MHz and 900 MHz. For devices operating above 900 MHz, the 99% bandwidth shall be less or equal to 0.5% of the centre frequency.

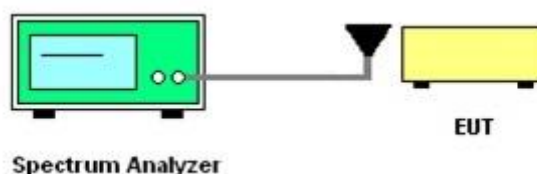
3.2.2 Measuring Instruments

See list of measuring instruments of this test report.

3.2.3 Test Procedures

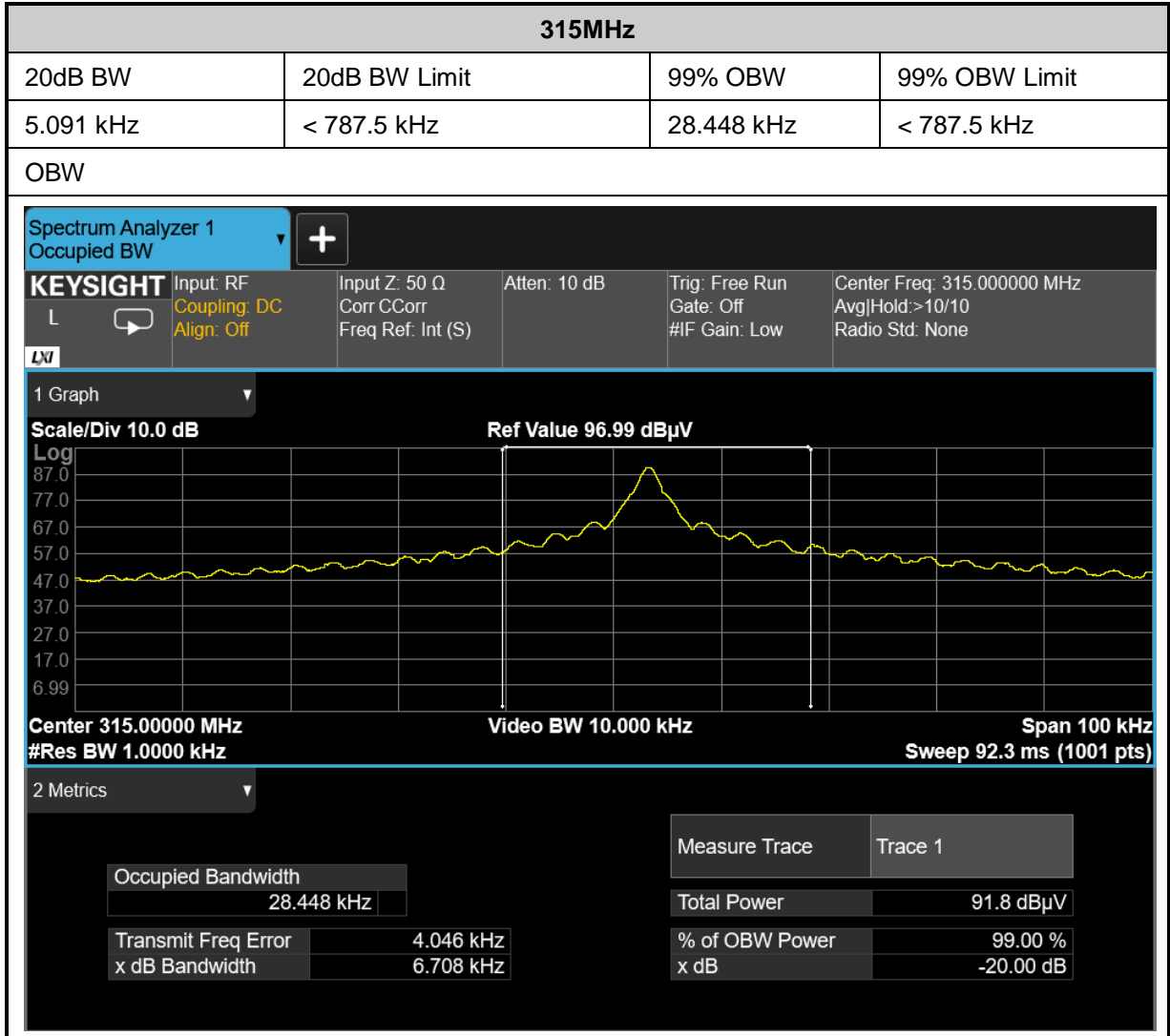
1. The antenna is placed 3 meter away from EUT and connected to spectrum analyzer.
2. RBW is set to be greater than 1% of OBW but less than 5% of OBW.
3. VBW is set to be $\geq 3 * RBW$
4. Set the spectrum to peak detector and max hold.
5. Measured the 20dB bandwidth.
6. Measured the 99% OBW.

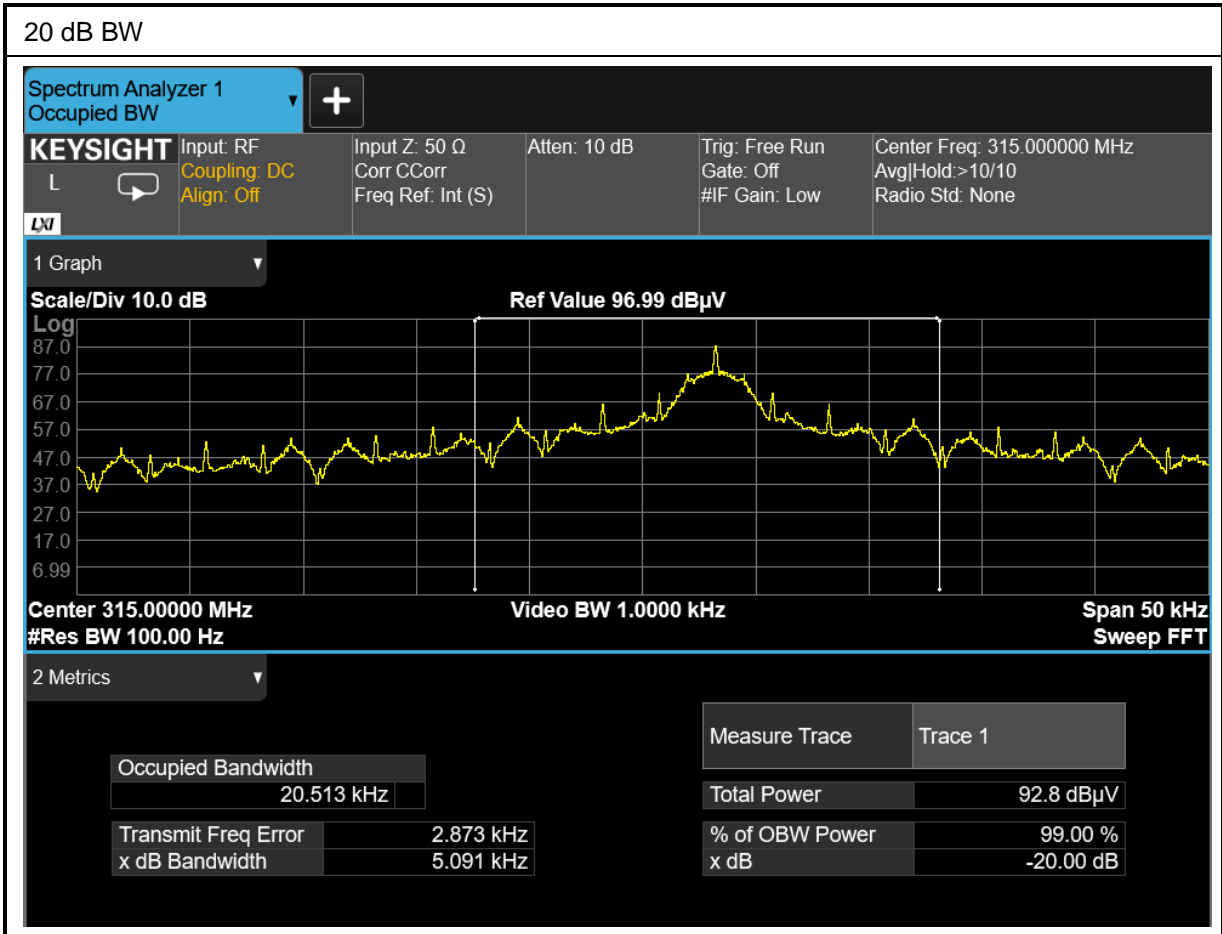
3.2.4 Test Setup





3.2.5 Test Result of 20dB BW and OBW





3.3 Field Strength of Fundamental and Spurious Emissions

3.3.1 Limit

☒	<p>15.231(b)</p> <p>In addition to the provisions of §15.205, the field strength of emissions from intentional radiators operated under this section shall not exceed the following</p> <p>From 15.231(b)(3), the limits on the field strength of the spurious emissions in the above table are based on the fundamental frequency of the intentional radiator. Spurious emissions shall be attenuated to the average (or, alternatively, CISPR quasi-peak) limits shown in this table or to the general limits shown in § 15.209, whichever limit permits a higher field strength.</p>		
	Rules and specifications	FCC CFR 47 Part 15 section 15.231	
	Fundamental frequency (f) (MHz)	Field strength of fundamental (μ V/m) at 3m	Field strength of spurious emissions (dB μ V/m) at 3m
	$40.66 \leq f \leq 40.70$	2250	225
	$70 < f \leq 130$	1250	125
	$130 < f \leq 174$	1250 to 3750*	125 to 375*
	$174 < f \leq 260$	3750	375
	$260 < f \leq 470$	3750 to 12500*	375 to 1250*
	$470 < f$	12500	1250
	* Linear interpolation with frequency, f, in MHz.		

3.3.2 Measuring Instruments

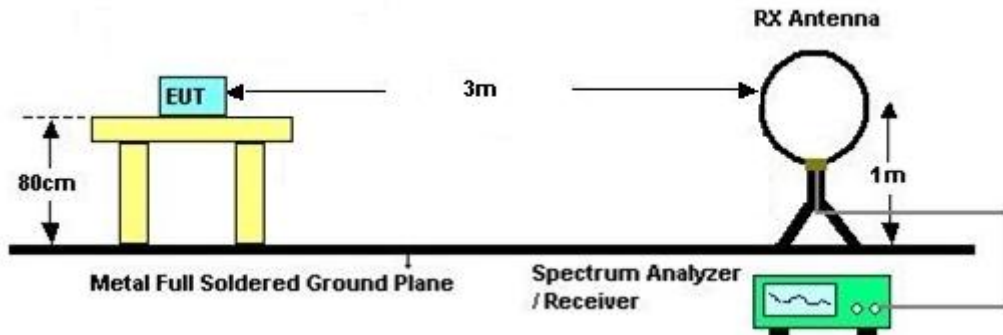
See list of measuring instruments of this test report.

3.3.3 Test Procedures

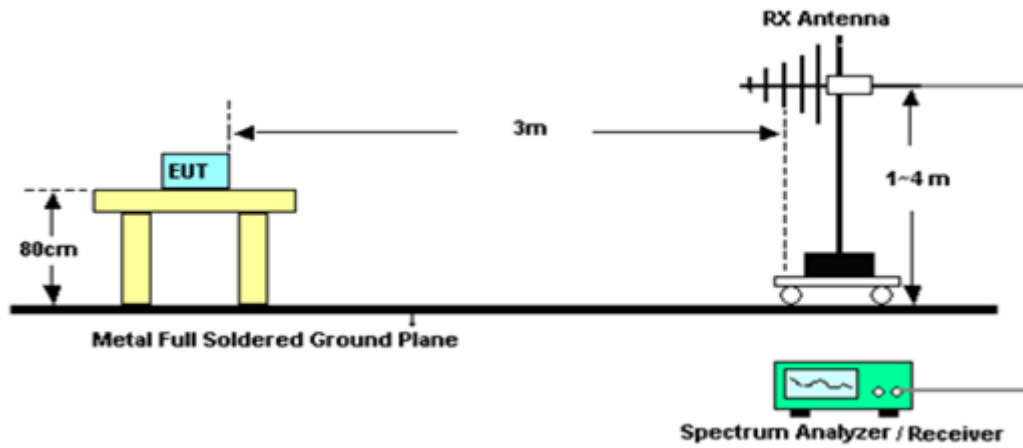
1. Configure the EUT according to ANSI C63.10. The EUT was placed on the top of the turntable 0.8 meter above ground. The phase center of the loop receiving antenna mounted antenna tower was placed 3 meters far away from the turntable.
2. Power on the EUT and all the supporting units. The turntable was rotated by 360 degrees to determine the position of the highest radiation.
3. The height of the receiving antenna was fixed at one meter above ground to find the maximum emissions field strength.
4. For Fundamental emissions, use the receiver to measure Average reading.
5. For average measurement: use duty cycle correction factor method per 15.35(c).
Duty cycle = On time/100 milliseconds
On time = $N1*L1+N2*L2+...+Nn-1*LNn-1+Nn*Ln$
Where N1 is number of type 1 pulses, L1 is length of type 1 pulses, etc.
Average Emission Level = Peak Emission Level + $20*\log$ (Duty cycle)
6. Radiated testing below 1 GHz is performed by adjusting the antenna tower from 1 m to 4 m and by rotating the turn table from 0 degree to 360 degrees to find the peak maximum hold reading. When there is no suspected emission found and the emission level is with at least 6 dB margin against QP limit line, the position is marked as “-“.
7. Radiated testing above 1 GHz is performed by adjusting the antenna tower from 1 m to 4 m and by rotating the turn table from 0 degree to 360 degrees to find the peak maximum hold reading for scanning all frequencies. When there is no suspected emission found and the harmonic emission level is with at least 6 dB margin against average limit line, the position is marked as “-“.

3.3.4 Test Setup

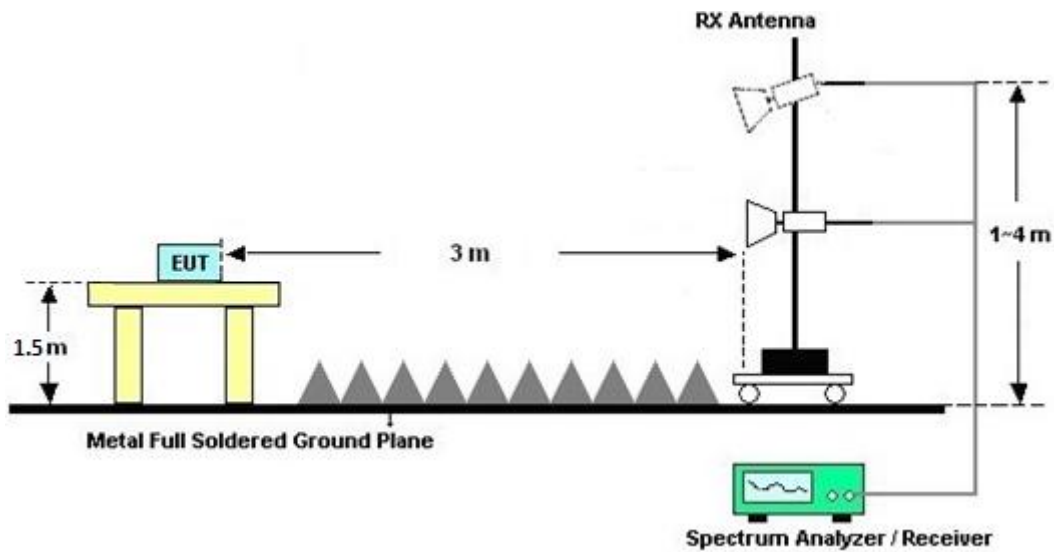
For radiated emissions below 30MHz



For radiated emissions from 30MHz to 1GHz



For radiated emissions above 1GHz



3.3.5 Test Results of Radiated Spurious Emissions (9 kHz ~ 30 MHz)

The low frequency, which starts from 9 kHz to 30 MHz, is pre-scanned and the result which is 20 dB lower than the limit line is not reported.

There is adequate comparison measurement of both open-field test site and alternative test site - semi-Anechoic chamber according to 414788 D01 Radiated Test Site v01r01, and the result comes out very similar.

3.3.6 Duty Cycle

315MHz on time Plot



Note:

1. Max Duty cycle in any 100ms = 40.1248 ms / 100 ms = 40.1248 %
2. Duty cycle correction factor = 20*log(Duty cycle) = -7.93 dB

3.3.7 Test Result of Fundamental and Spurious Emissions

Please refer to Appendix A.



4. List of Measuring Equipment

Instrument	Brand Name	Model No.	Serial No.	Characteristics	Calibration Date	Test Date	Due Date	Remark
Loop Antenna	Rohde & Schwarz	HFH2-Z2	100840	9kHz~30MHz	Jun. 29, 2023	Jul. 26, 2023~ Jul. 27, 2023	Jun. 28, 2024	Radiation (03CH01-CA)
Bilog Antenna	TESEQ	6111D	54683	30MHz~1GHz	Nov. 01, 2022	Jul. 26, 2023~ Jul. 27, 2023	Oct. 31, 2023	Radiation (03CH01-CA)
Horn Antenna	SCHWARZBECK	BBHA 9120D	02115	1GHz~18GHz	Aug. 16, 2022	Jul. 26, 2023~ Jul. 27, 2023	Aug. 15, 2023	Radiation (03CH01-CA)
Amplifier	SONOMA	310N	372241	N/A	May 03, 2023	Jul. 26, 2023~ Jul. 27, 2023	May 02, 2024	Radiation (03CH01-CA)
Spectrum Analyzer	Keysight	N9010B	MY63440343	10Hz - 44GHz	Jan. 15, 2023	Jul. 26, 2023~ Jul. 27, 2023	Jan. 14, 2024	Radiation (03CH01-CA)
Preamplifier	E-instrument	ERA-100M-18 G-56-01-A70	EC1900252	1GHz~18GHz	May 23, 2023	Jul. 26, 2023~ Jul. 27, 2023	May 22, 2024	Radiation (03CH01-CA)
RF Cable	HUBER+SUHNER	SUCOFLEX 102	8015932/2, 8015762/2, 804938/2	N/A	Mar. 06, 2023	Jul. 26, 2023~ Jul. 27, 2023	Mar. 05, 2024	Radiation (03CH01-CA)
High pass Filter	Wainwright	WHKX12-900- 1000-15000-60 TS	SN2	1GHz High Pass Filter	Jun. 05, 2023	Jul. 26, 2023~ Jul. 27, 2023	Jun. 04, 2024	Radiation (03CH01-CA)
Filter	Wainwright	WLK12-1200-1 272-11000-40 SS	SN1	1.2GHz Low Pass Filter	Jun. 05, 2023	Jul. 26, 2023~ Jul. 27, 2023	Jun. 04, 2024	Radiation (03CH01-CA)
Hygrometer	TESEO	608-H1	45142559	N/A	Sep. 12, 2022	Jul. 26, 2023~ Jul. 27, 2023	Sep. 11, 2023	Radiation (03CH01-CA)
Spectrum Analyzer	Keysight	N9010A	MY56070412	10Hz - 44GHz	Nov. 21, 2022	Jul. 26, 2023~ Jul. 27, 2023	Nov. 20, 2023	Radiation (03CH01-CA)
Controller	Chaintek	EM-1000	060881	Control Turn Table & Antenna Mast	N/A	Jul. 26, 2023~ Jul. 27, 2023	N/A	Radiation (03CH01-CA)
Antenna Mast	ChainTek	MBS-520-1	N/A	1m~4m	N/A	Jul. 26, 2023~ Jul. 27, 2023	N/A	Radiation (03CH01-CA)
Turn Table	ChainTek	T-200-S-1	N/A	0~360 Degree	N/A	Jul. 26, 2023~ Jul. 27, 2023	N/A	Radiation (03CH01-CA)
Test Software	Audix E3	E6.2009-8-24d	PK-002093	N/A	N/A	Jul. 26, 2023~ Jul. 27, 2023	N/A	Radiation (03CH01-CA)



5. Uncertainty of Evaluation

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

Measuring Uncertainty for a Level of Confidence of 95% ($U = 2Uc(y)$)	4.6 dB
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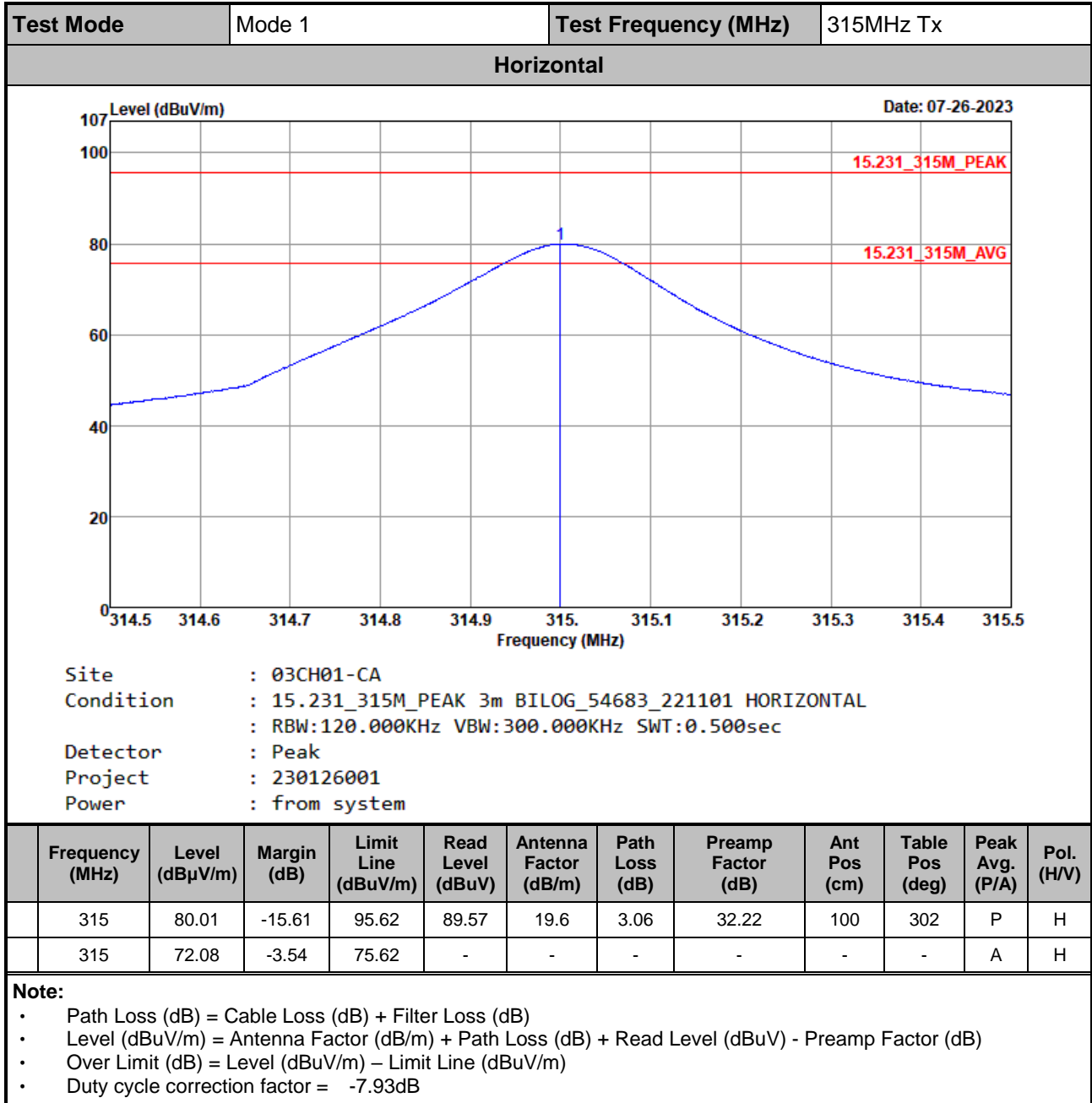
Uncertainty of Radiated Emission Measurement (1000 MHz ~ 18000 MHz)

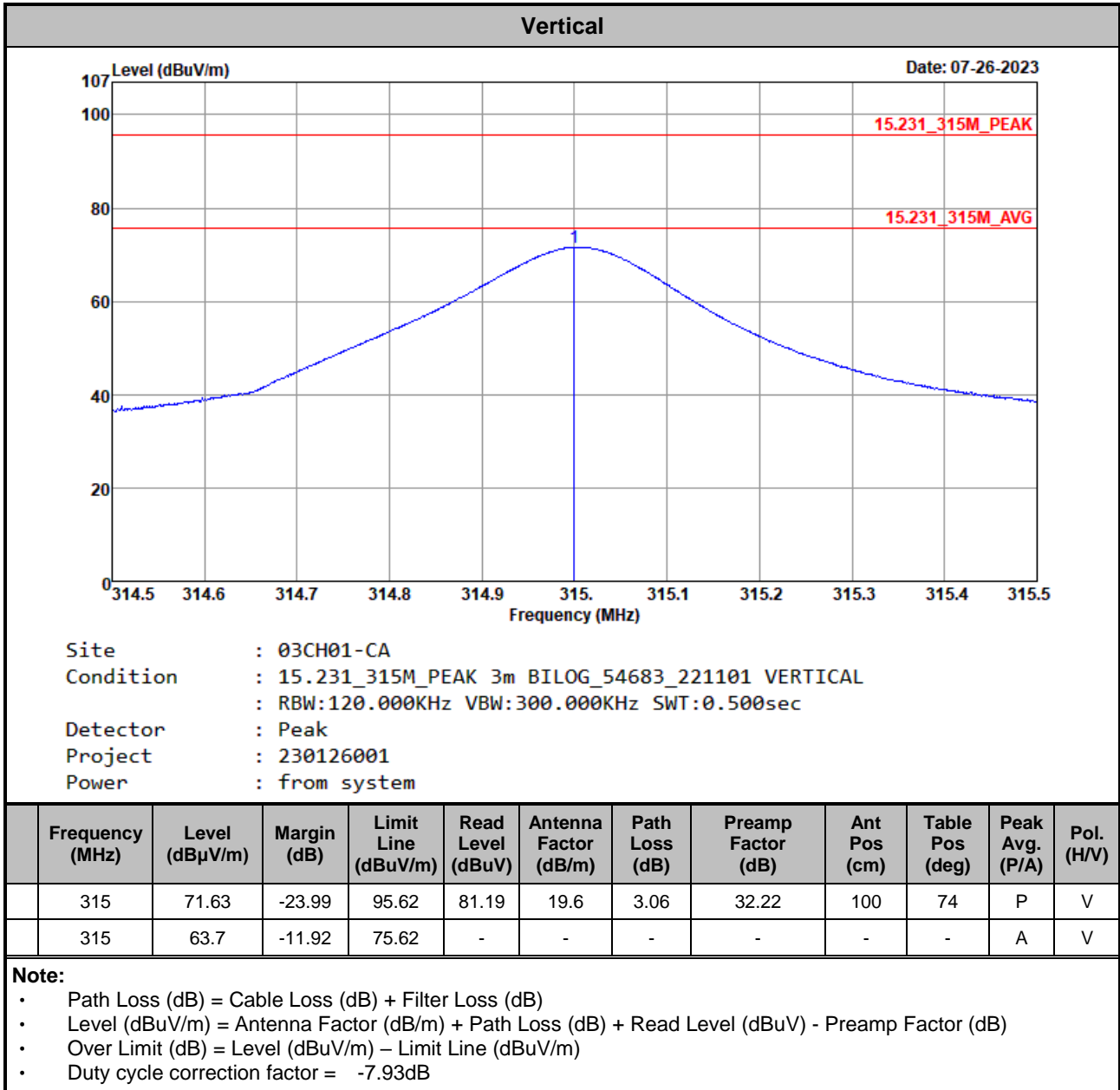
Measuring Uncertainty for a Level of Confidence of 95% ($U = 2Uc(y)$)	5.2 dB
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Appendix A. Test Results of Radiated Test Items

A1. Test Result of Field Strength of Fundamental Emissions



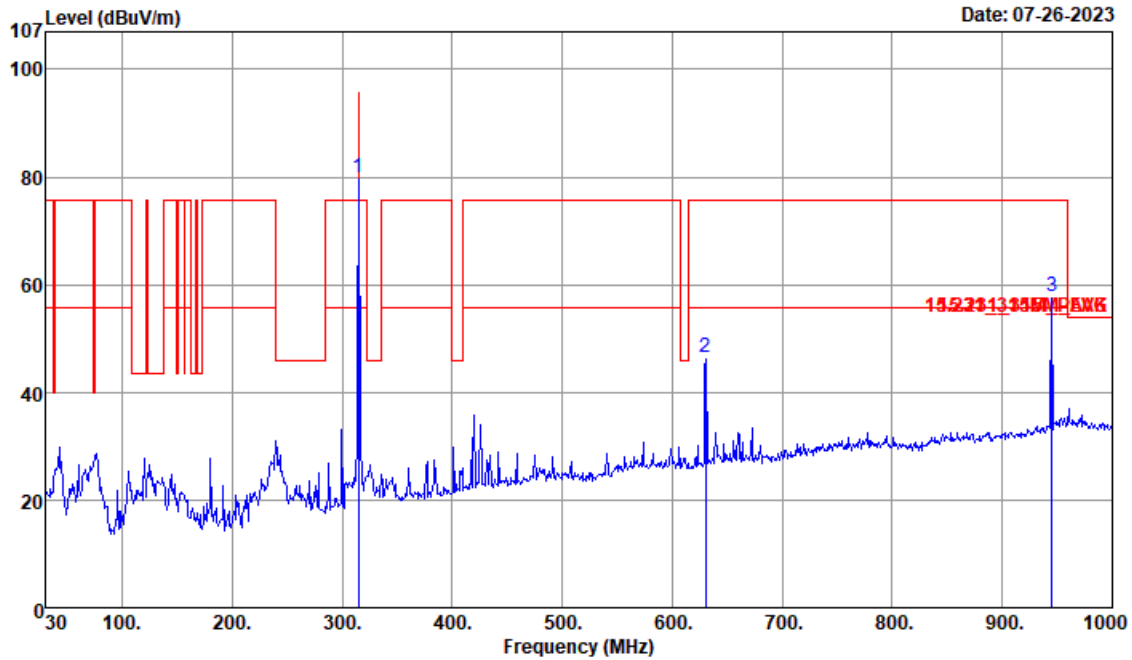




A2. Test Result of Radiated Spurious Emissions (30MHz~1GHz)

Test Mode	Mode 1	Test Frequency (MHz)	315MHz Tx
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Horizontal

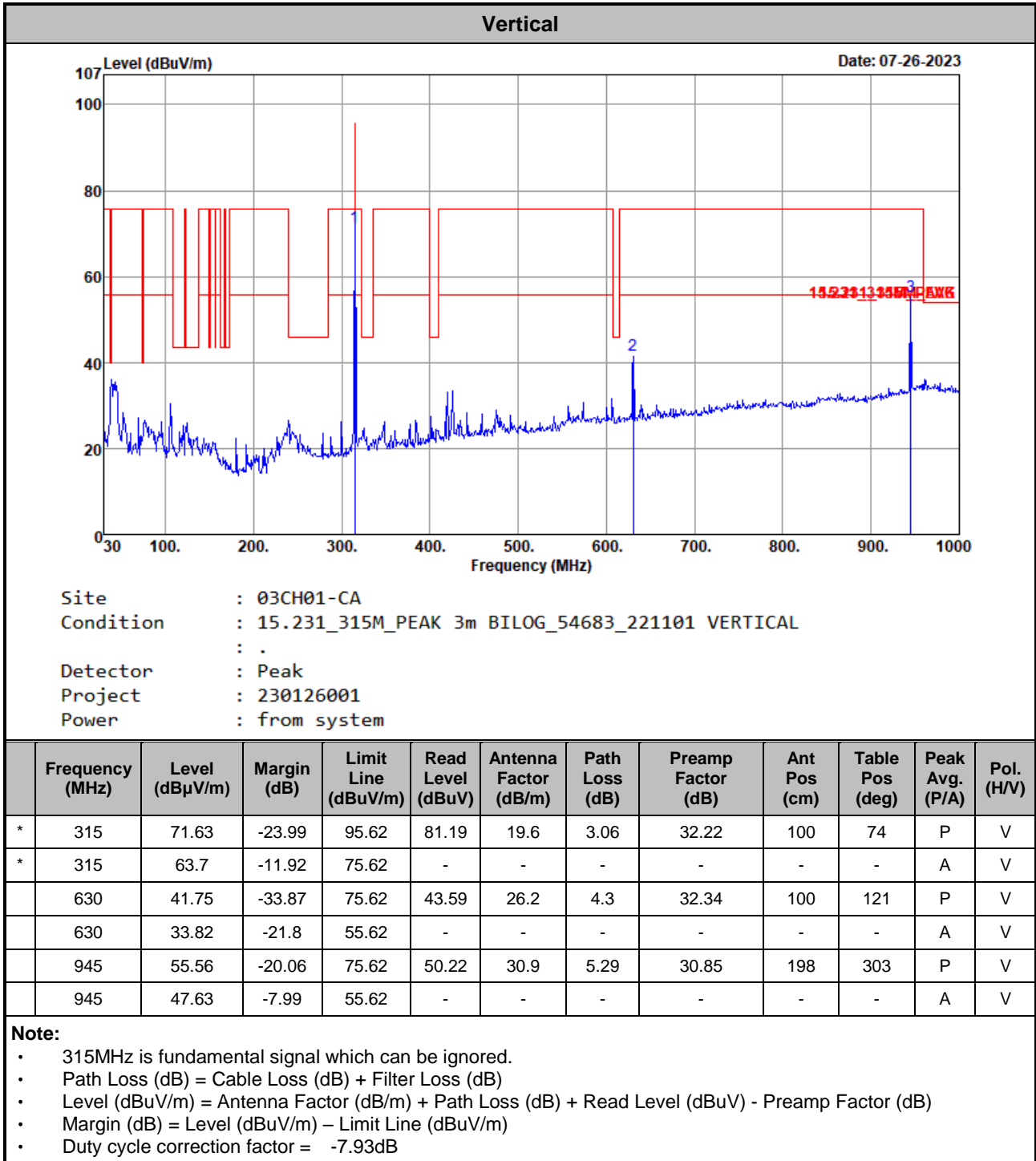


Site : 03CH01-CA
 Condition : 15.231_315M_PEAK 3m BILOG_54683_221101 HORIZONTAL
 : .
 Detector : Peak
 Project : 230126001
 Power : from system

	Frequency (MHz)	Level (dBμV/m)	Margin (dB)	Limit Line (dBuV/m)	Read Level (dBuV)	Antenna Factor (dB/m)	Path Loss (dB)	Preamp Factor (dB)	Ant Pos (cm)	Table Pos (deg)	Peak Avg. (P/A)	Pol. (H/V)
*	315	80.01	-15.61	95.62	89.57	19.6	3.06	32.22	100	304	P	H
*	315	72.08	-3.54	75.62	-	-	-	-	-	-	A	H
	630	46.58	-29.04	75.62	48.42	26.2	4.3	32.34	144	1	P	H
	630	38.65	-16.97	55.62	-	-	-	-	-	-	A	H
	945	57.79	-17.83	75.62	52.45	30.9	5.29	30.85	100	125	P	H
	945	49.86	-5.76	55.62	-	-	-	-	-	-	A	H

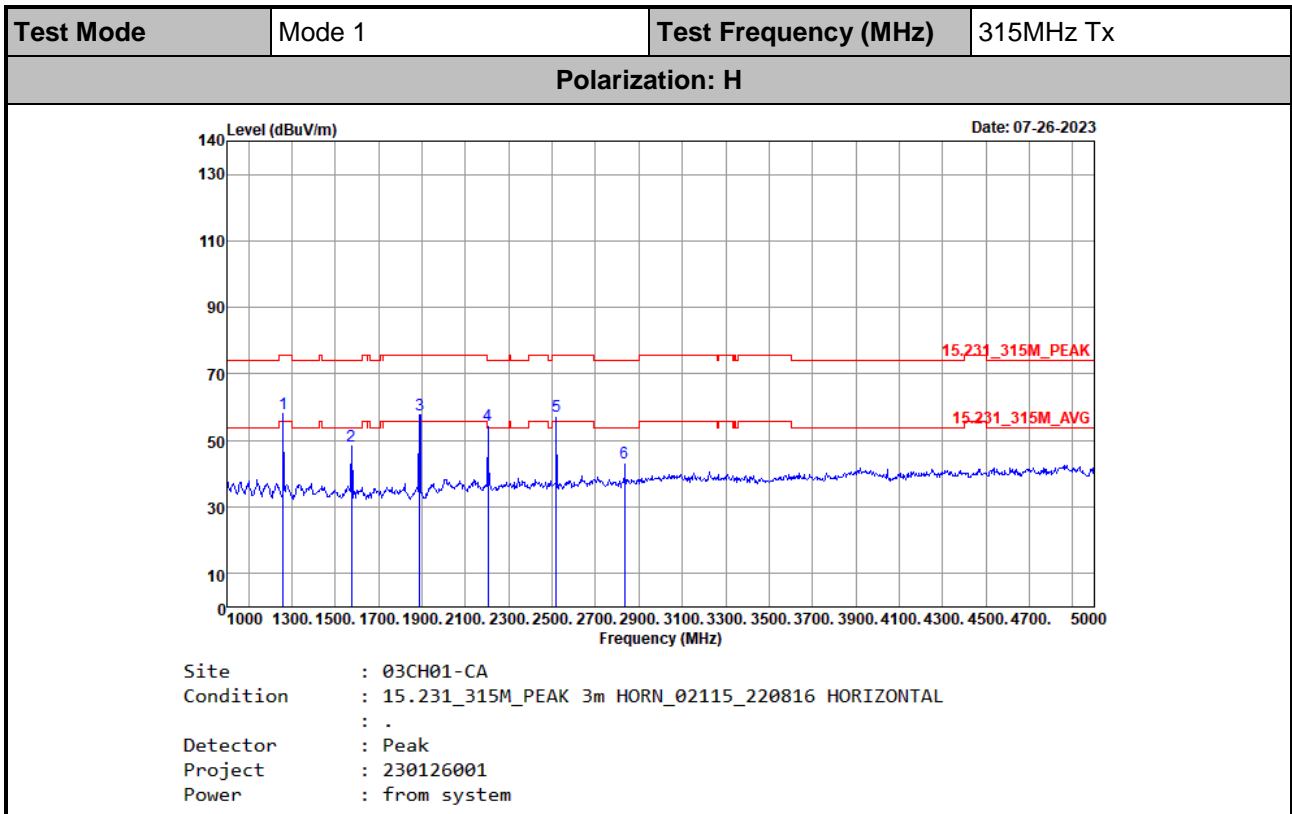
Note:

- 315 MHz is fundamental signal which can be ignored
- Path Loss (dB) = Cable Loss (dB) + Filter Loss (dB)
- Level (dBuV/m) = Antenna Factor (dB/m) + Path Loss (dB) + Read Level (dBuV) - Preamp Factor (dB)
- Margin (dB) = Level (dBuV/m) – Limit Line (dBuV/m)
- Duty cycle correction factor = -7.93dB





A3. Test Result of Field Radiated Spurious Emissions (1GHz~5GHz)



Frequency (MHz)	Level (dBμV/m)	Margin (dB)	Limit Line (dBμV/m)	Read Level (dBμV)	Antenna Factor (dB/m)	Path Loss (dB)	Preamp Factor (dB)	Ant Pos (cm)	Table Pos (deg)	Peak Avg. (P/A)	Pol. (H/V)
1260	58.07	-17.55	75.62	93.9	26.16	6.47	68.46	200	300	P	H
1260	50.14	-5.48	55.62	-	-	-	-	-	-	A	H
1575	48.44	-25.56	74	84.09	25.36	6.74	67.75	300	267	P	H
1575	40.51	-13.49	54	-	-	-	-	-	-	A	H
1890	57.87	-17.75	75.62	92.52	25.59	7.25	67.49	296	278	P	H
1890	49.94	-5.68	55.62	-	-	-	-	-	-	A	H
2205	54.47	-19.53	74	87.38	27.19	7.73	67.83	137	296	P	H
2205	46.54	-7.46	54	-	-	-	-	-	-	A	H
2520	57.23	-18.39	75.62	88.8	27.92	8.12	67.61	130	325	P	H
2520	49.3	-6.32	55.62	-	-	-	-	-	-	A	H
2835	43.26	-30.74	74	72.69	28.52	8.58	66.53	125	280	P	H
2835	35.33	-18.67	54	-	-	-	-	-	-	A	H

Note:

- Path Loss (dB) = Cable Loss (dB) + Filter Loss (dB)
- Level (dBuV/m) = Antenna Factor (dB/m) + Path Loss (dB) + Read Level (dBuV) - Preamp Factor (dB)
- Margin (dB) = Level (dBuV/m) – Limit Line (dBuV/m)
- Duty cycle correction factor = -7.93dB
- The emission position marked as “-” means no emission found with sufficient margin against limit line or noise floor only.

