

FCC TEST REPORT

Product Name: MBSA E TAG
Trade Mark: N/A
Model No.: MT-2-9-x-RFBU
Report Number: 210814007EMC-1
Test Standards: FCC 47 CFR Part 15 Subpart B
FCC ID: 2A2X8-MT29XRFBU
Test Result: PASS
Date of Issue: September 25, 2021

Prepared for:

Mercedes-Benz South Africa Ltd
C8 Building, 7 Settlers Way, Gately Industrial Park East London,
5200, South Africa

Prepared by:

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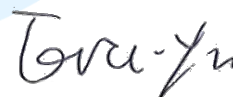
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September 25, 2021

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Version

Version No.	Date	Description
V1.0	September 25, 2021	Original

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1. GENERAL INFORMATION

1.1 CLIENT INFORMATION

Applicant:	Mercedes-Benz South Africa Ltd
Address of Applicant:	C8 Building, 7 Settlers Way, Gately Industrial Park East London, 5200, South Africa
Manufacturer:	Electronic Design and Manufacture (Pty) Ltd
Address of Manufacturer:	613 Marneweck Street, Moreleta Park, Pretoria, South Africa

1.2 EUT INFORMATION

1.2.1 General Description of EUT

Product Name:	MBSA E TAG
Model No.:	MT-2-9-x-RFBU
Trade Mark:	N/A
DUT Stage:	Identical Prototype
Rated Voltage:	☒ Battery: 3VDC
Classification of digital devices:	Class B
Highest Internal Frequency:	915.5 MHz
Sample Received Date:	August 14, 2021
Sample Tested Date:	August 30, 2021 to August 30, 2021

1.2.2 Description of Accessories

None.

1.3 DESCRIPTION OF SUPPORT UNITS

The EUT has been tested with associated equipment below.

1) Support Equipment

Description	Manufacturer	Model No.	Serial Number	Supplied by
Battery *3	Panasonic	CR2477	6938181025274	Applicant
MBSA ETAG GATEWAY	Electronic Design and Manufacture (Pty) Ltd	GW-2-8	N/A	Applicant
POE INJECTOR&SURGE PROTECTION	N/A	12-00708	N/A	Applicant
Mouse	DELL	MS111	CN-011D3V-738	UnionTrust
Notebook	Lenovo	E450	SL10G10780	UnionTrust

2) Support Cable

Description	Quantity	Cable Type	Length	Supplied by
Ethernet Cable	RJ45	without ferrite	3.3 m Unshielded	Applicant
Ethernet Cable	RJ45	without ferrite	5.0 m Unshielded	Applicant

1.4 TEST LOCATION

Shenzhen UnionTrust Quality and Technology Co., Ltd.

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1.5 TEST FACILITY

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

CNAS-Lab Code: L9069

The measuring equipment utilized to perform the tests documented in this report has been calibrated once a year or in accordance with the manufacturer's recommendations, and is traceable under the ISO/IEC 17025 to international or national standards. Equipment has been calibrated by accredited calibration laboratories.

A2LA-Lab Certificate No.: 4312.01

Shenzhen UnionTrust Quality and Technology Co., Ltd. has been accredited by A2LA for technical competence in the field of electrical testing, and proved to be in compliance with ISO/IEC 17025 General Requirements for the Competence of Testing and Calibration Laboratories and any additional program requirements in the identified field of testing.

ISED Wireless Device Testing Laboratories

CAB identifier: CN0032

FCC Accredited Lab.

Designation Number: CN1194

Test Firm Registration Number: 259480

1.6 DEVIATION FROM STANDARDS

None.

1.7 ABNORMALITIES FROM STANDARD CONDITIONS

None.

1.8 OTHER INFORMATION REQUESTED BY THE CUSTOMER

None.

1.9 MEASUREMENT UNCERTAINTY

Where relevant, the following measurement uncertainty levels have been estimated for tests performed on the Product as specified in CISPR 16-4-2. This uncertainty represents an expanded uncertainty expressed at approximately the 95% confidence level using a coverage factor of k=2.

No.	Item	Measurement Uncertainty
1	Conducted emission 9kHz-150kHz	±3.8 dB
2	Conducted emission 150kHz-30MHz	±3.4 dB
3	Radiated emission 9kHz-30MHz	±4.9 dB
4	Radiated emission 30MHz-1GHz	±4.7 dB
5	Radiated emission 1GHz-18GHz	±5.1 dB
6	Radiated emission 18GHz-26GHz	±5.2 dB
7	Radiated emission 26GHz-40GHz	±5.2 dB

2. TEST SUMMARY

FCC 47 CFR Part 15 Subpart B Test Cases			
Test Item	Test Requirement	Test Method	Result
Conducted Emission	FCC 47 CFR Part 15.107	ANSI C63.4-2014	N/A (Note1&2)
Radiated Emission	FCC 47 CFR Part 15.109	ANSI C63.4-2014	PASS
Note: 1) N/A: In this whole report not applicable. 2) The EUT is powered by button battery			

3. EQUIPMENT LIST

Radiated Emission Test Equipment List						
Used	Equipment	Manufacturer	Model No.	Serial Number	Cal. date (mm dd, yyyy)	Cal. Due date (mm dd, yyyy)
☒	3m SAC	ETS-LINDGREN	3m	N/A	Jan. 22, 2021	Jan. 21, 2024
☒	Receiver	R&S	ESIB26	100114	Nov. 18, 2020	Nov. 17, 2021
☒	Broadband Antenna	ETS-LINDGREN	3142E	00201566	Nov. 14, 2020	Nov. 13, 2021
☒	6dB Attenuator	Talent	RA6A5-N-18	18103001	Nov. 14, 2020	Nov. 13, 2021
☒	Preamplifier	HP	8447F	2805A02960	Nov. 10, 2020	Nov. 09, 2021
☒	Double-Ridged Waveguide Horn Antenna (Pre-amplifier)	ETS-LINDGREN	3117-PA	00201874	Dec. 03, 2018	Dec. 03, 2021
☒	Pre-amplifier	ETS-Lindgren	118385	00201874	Nov. 10, 2020	Nov. 9, 2021
☐	Double-Ridged Waveguide Horn Antenna (Pre-amplifier)	ETS-LINDGREN	3116C-PA	00202652	Nov. 14, 2020	Nov. 13, 2021
☐	Pre-amplifier	ETS-Lindgren	00118384	00202652	Nov. 14, 2020	Nov. 13, 2022
☒	Multi device Controller	ETS-LINDGREN	7006-001	00160105	N/A	N/A
☒	Test Software	Audix	e3	Software Version: 9.160323		

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4. TEST CONFIGURATION

4.1 ENVIRONMENTAL CONDITIONS FOR TESTING

4.1.1 Normal or Extreme Test Conditions

Environment Parameter	Selected Values During Tests		
Test Condition	Ambient		
	Temperature (°C)	Voltage (V)	Relative Humidity (%)
NT/NV	+15 to +35	3.0	20 to 75
Remark: 1) NV: Normal Voltage; NT: Normal Temperature			

4.1.2 Record of Normal Environment

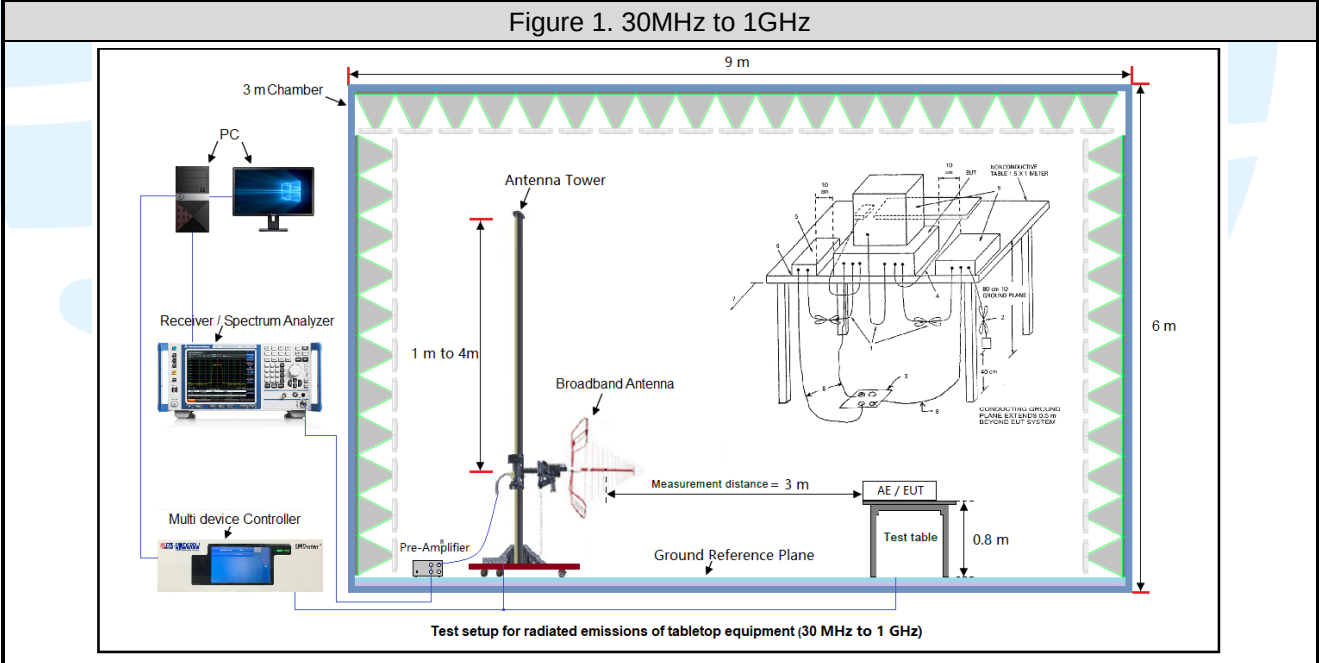
Test Item	Temperature (°C)	Relative Humidity (%)	Pressure (kPa)	Tested by
Radiated Emission	25.4	51	99.86	Asia Yan

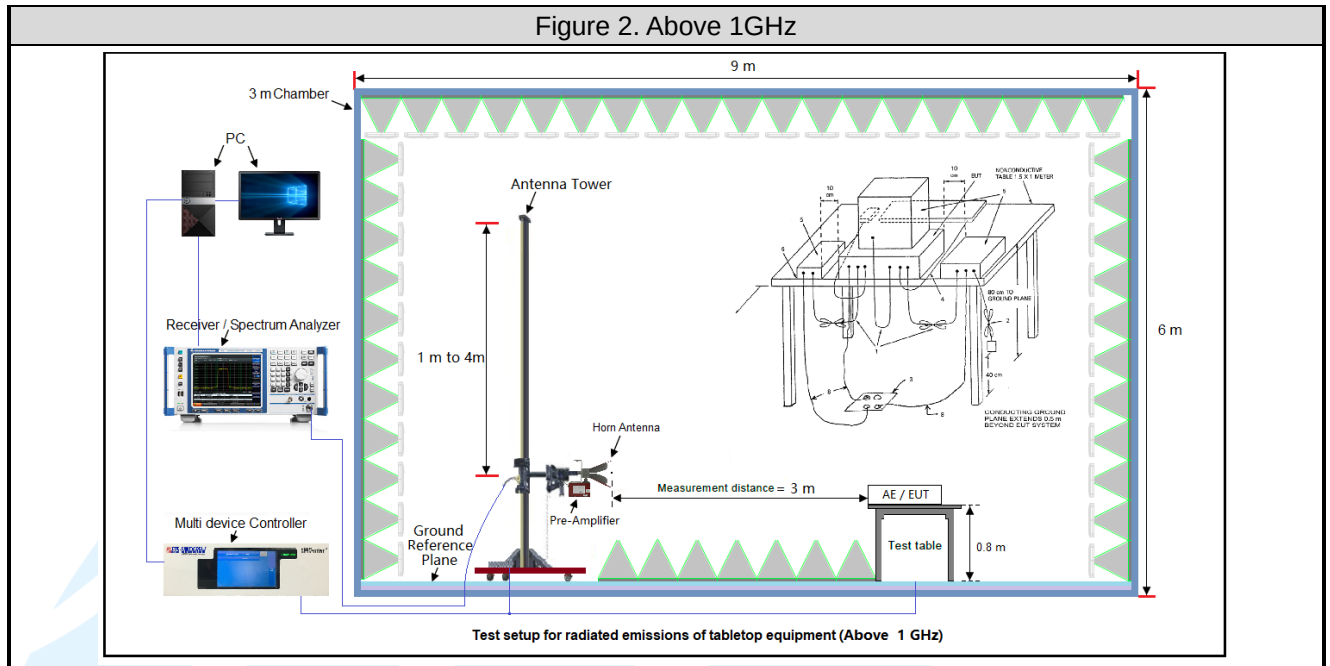
4.2 TEST MODES

Test Item	EMI Test Modes
Radiated Emission	Test Mode1: Tag ON Test Mode2: Tag ON (865.6-867.6MHz Receiver only) Test Mode3: Tag ON (915.4-919MHz Receiver only)
Remark: The above test modes in boldface were the worst cases, only the test data of these modes were reported.	

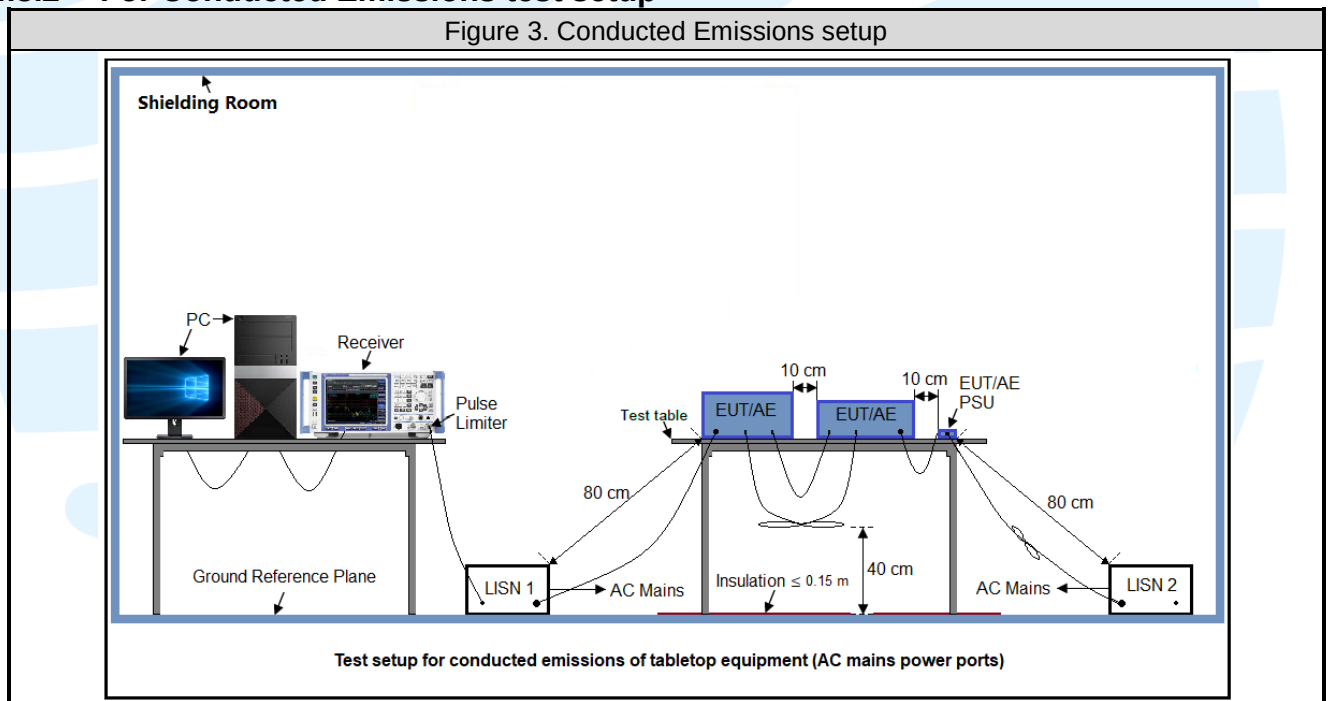
4.3 TEST SETUP

4.3.1 For Radiated Emissions test setup





4.3.2 For Conducted Emissions test setup



4.4 SYSTEM TEST CONFIGURATION

All readings are extrapolated back to the equivalent three meter reading using inverse scaling with distance. Analyzer resolution is 100 kHz or greater for frequencies below 1000MHz. The resolution is 1 MHz or greater for frequencies above 1000MHz. The spurious emissions more than 20 dB below the permissible value are not reported.

Radiated emission measurement were performed from the lowest radio frequency signal generated in the device which is greater than 9 kHz to the tenth harmonic (according to KDB 896810 D02 SDoC FAQ v01r01) of the highest fundamental frequency or to 40 GHz, whichever is lower.

5. REFERENCE DOCUMENTS FOR TESTING

No.	Identity	Document Title
1	FCC 47 CFR Part15 Subpart B	Unintentional Radiators
2	ANSI C63.4-2014	American National Standard for Methods of Measurement of Radio-Noise Emissions from Low-Voltage Electrical and Electronic Equipment in the Range of 9 kHz to 40 GHz
3	KDB 174176 D01 Line Conducted FAQ v01r01	AC power-line conducted emission frequency asked questions
4	KDB 896810 D02 SDoC FAQ v01r02	Supplier's Declaration of Conformity frequency asked questions

6. EMC REQUIREMENTS SPECIFICATION

6.1 RADIATED EMISSION

Test Requirement: FCC 47 CFR Part 15.109

Test Method: ANSI C63.4-2014

Receiver Setup:

Frequency: (f) (MHz)	Detector type	Measurement receiver bandwidth	
		RBW	VBW
$30 \leq f \leq 1\,000$	Quasi Peak	120 kHz	300 kHz
$f \geq 1000$	Peak	1 MHz	3 MHz
	Average	1 MHz	3 MHz

Measured frequency range

Highest frequency generated or used in the device or on which the device operates or tunes (MHz)	Upper frequency of measurement range (MHz)
Below 1.705	30.
1.705-108	1000.
108-500	2000.
500-1000	5000.
Above 1000	5th harmonic of the highest frequency or 40 GHz, whichever is lower.

Limits:

Limits for Class B devices

Frequency (MHz)	limits at 3m (dB μ V/m)		
	QP Detector	PK Detector	AV Detector
30-88	40.0	--	--
88-216	43.5	--	--
216-960	46.0	--	--
960 to 1000	54.0	--	--
Above 1000	--	74.0	54.0

Remark:

- The lower limit shall apply at the transition frequencies.
- Emission level (dB μ V/m) = 20 log Emission level (μ V/m).
- For frequencies above 1000 MHz, the field strength limits are based on average detector, 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.

Test Setup: Refer to section 4.3.1 for details.

Test Procedures:

- From 30 MHz to 1GHz test procedure as below:

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- 1) The Product was placed on the non-conductive turntable 0.8 m above the ground at a chamber.
- 2) Set the spectrum analyzer/receiver in Peak detector, Max Hold mode, and 120 kHz RBW. Record the maximum field strength of all the pre-scan process in the full band when the antenna is varied between 1~4 m in both horizontal and vertical, and the turntable is rotated from 0 to 360 degrees.
- 3) For each frequency whose maximum record was higher or close to limit, measure its QP value: vary the antenna's height and rotate the turntable from 0 to 360 degrees to find the height and degree where Product radiated the maximum emission, then set the test frequency analyzer/receiver to QP Detector and specified bandwidth with Maximum Hold Mode, and record the maximum value.

2. Above 1GHz test procedure as below:

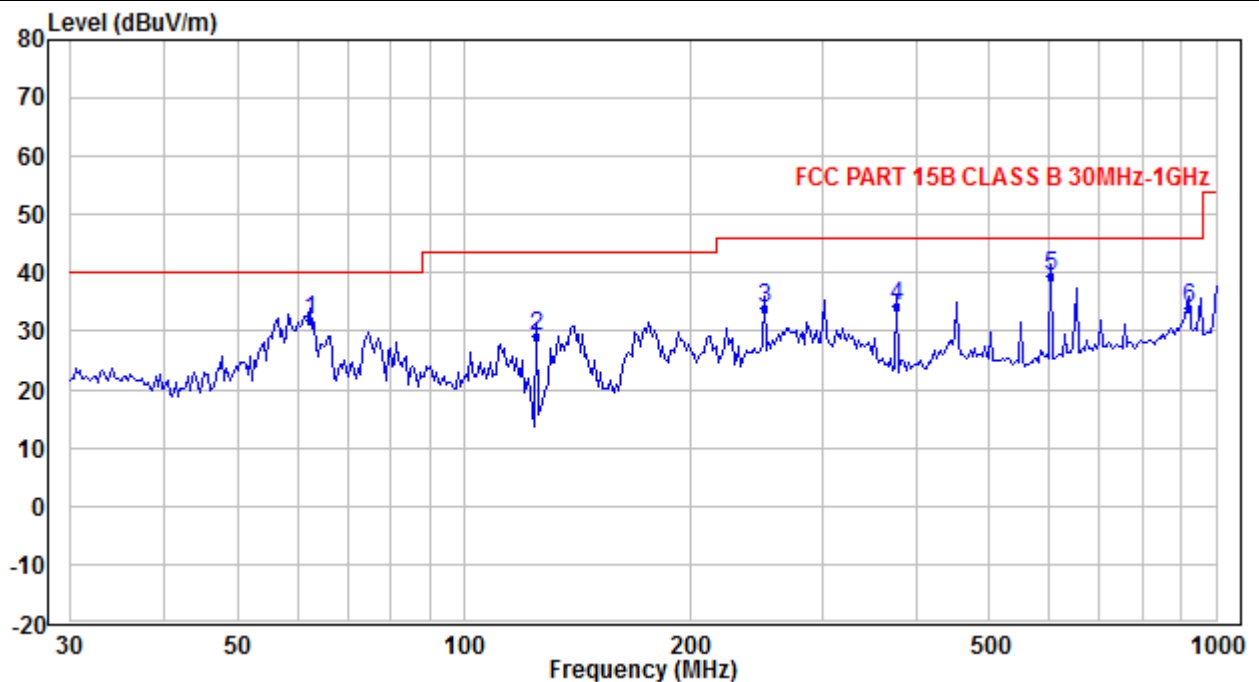
- 1) The Product was placed on the non-conductive turntable 0.8 m above the ground at a chamber.
- 2) Set the spectrum analyzer/receiver in Peak detector, Max Hold mode, and 1MHz RBW. Record the maximum field strength of all the pre-scan process in the full band when the antenna is varied in both horizontal and vertical, and the turntable is rotated from 0 to 360 degrees.
- 3) For each frequency whose maximum record was higher or close to limit, measure its AV value: rotate the turntable from 0 to 360 degrees to find the degree where Product radiated the maximum emission, then set the test frequency analyzer/receiver to AV value and specified bandwidth with Maximum Hold Mode, and record the maximum value.

Equipment Used: Refer to section 3 for details.

Test Result: Pass

The measurement data as follows:

Below 1GHz(Quasi Peak):
Test Mode2
Horizontal



No.	Frequency (MHz)	Reading (dBμV)	Correction factor (dB/m)	Result (dBμV/m)	Limit (dBμV/m)	Margin (dB)	Detector
1	62.304	49.37	-17.37	32.00	40.00	-8.00	QP
2	124.925	45.13	-15.83	29.30	43.50	-14.20	QP
3	250.486	42.78	-8.93	33.85	46.00	-12.15	QP
4	376.523	39.81	-5.43	34.38	46.00	-11.62	QP
5	602.929	40.24	-0.82	39.42	46.00	-6.58	QP
6	919.132	29.88	4.24	34.12	46.00	-11.88	QP

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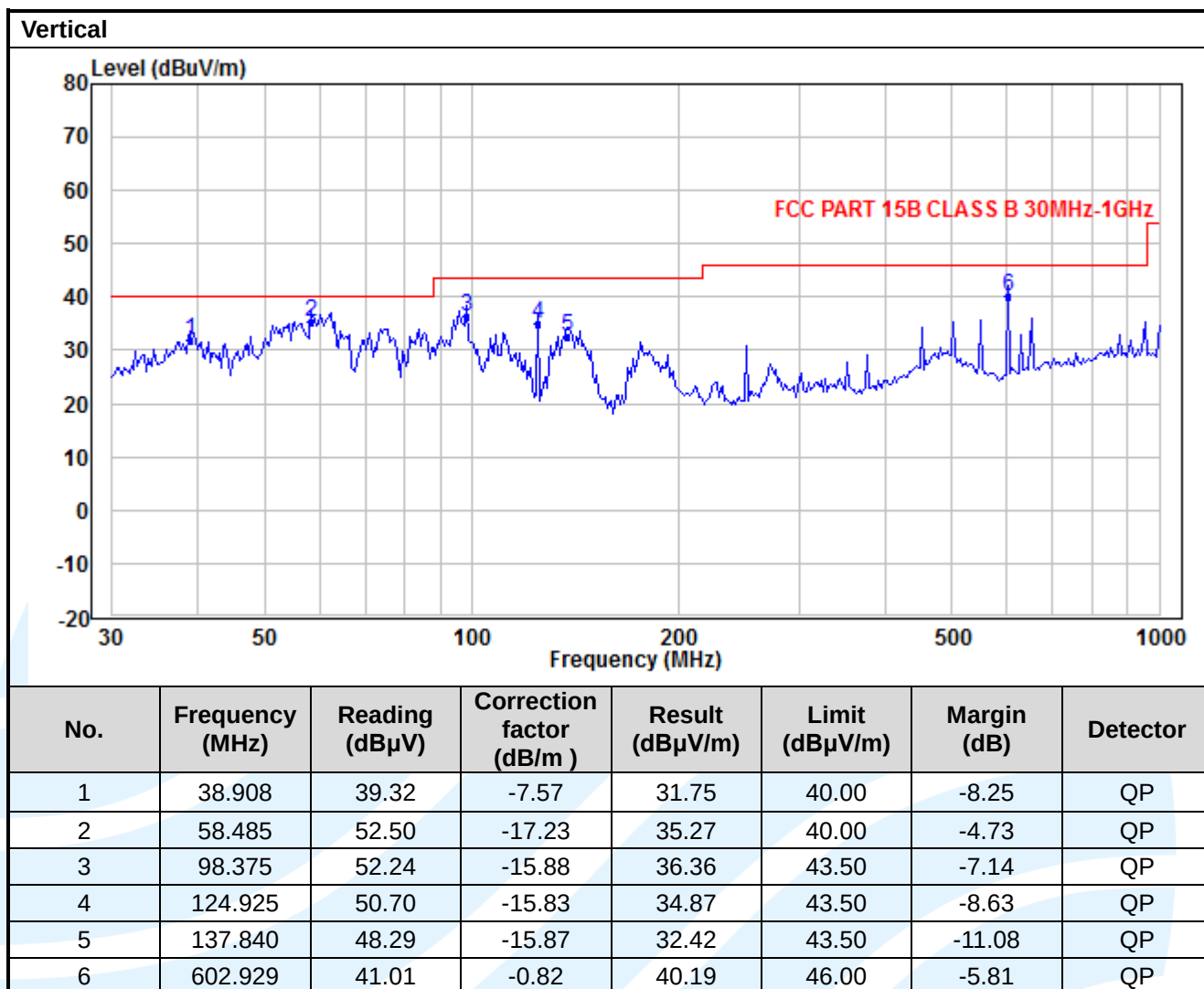
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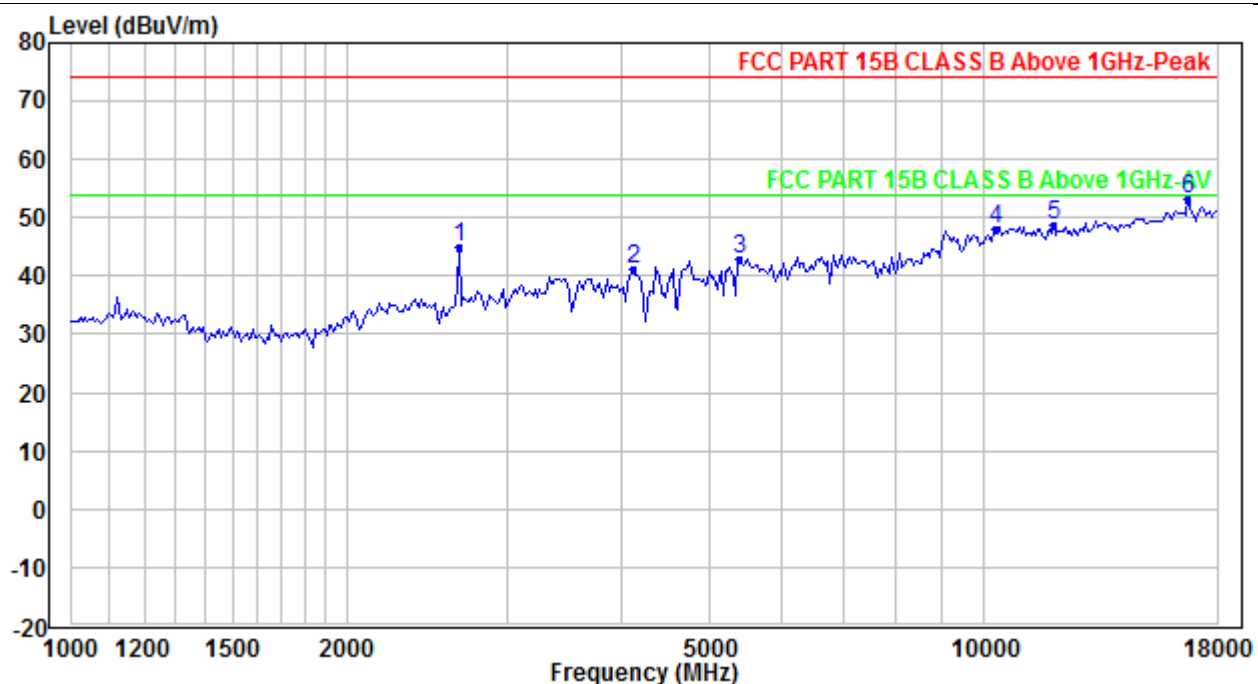
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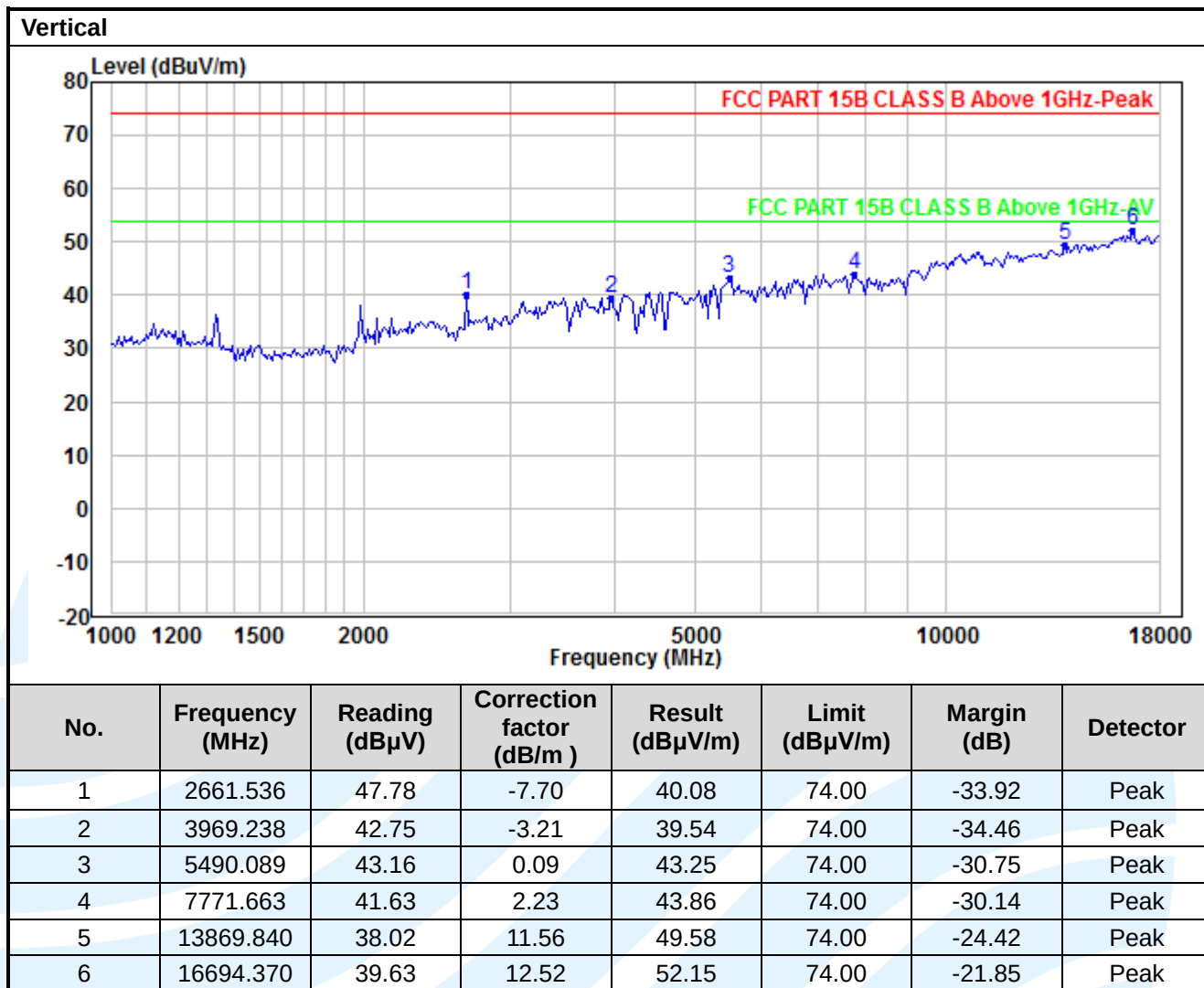
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Above 1GHz(Peak & Average)
Test Mode3
Horizontal



No.	Frequency (MHz)	Reading (dBμV)	Correction factor (dB/m)	Result (dBμV/m)	Limit (dBμV/m)	Margin (dB)	Detector
1	2661.536	52.71	-7.70	45.01	74.00	-28.99	Peak
2	4133.483	44.10	-2.90	41.20	74.00	-32.80	Peak
3	5395.512	43.35	-0.43	42.92	74.00	-31.08	Peak
4	10322.320	41.95	6.21	48.16	74.00	-25.84	Peak
5	11930.720	40.95	7.75	48.70	74.00	-25.30	Peak
6	16694.370	40.54	12.52	53.06	74.00	-20.94	Peak



Remark:

1. Correct Factor = Antenna Factor + Cable Loss - Amplifier Gain, the value was added to Original Receiver Reading by the software automatically.
2. Result = Reading + Correct Factor.
3. Margin = Result – Limit
4. 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. So, only the peak measurements were shown in the report.

6.2 CONDUCTED EMISSION

Test Requirement: FCC 47 CFR Part 15.107

Test Method: ANSI C63.4-2014

Limits:

Limits for Class B devices

Frequency range (MHz)	Limits (dB(μV))	
	Quasi-peak	Average
0,15 to 0,50	66 to 56	56 to 46
0,50 to 5	56	46
5 to 30	60	50

Remark:

1. The lower limit shall apply at the transition frequencies.
2. The limit decreases linearly with the logarithm of the frequency in the range 0.15 to 0.50 MHz.

Test Setup: Refer to section 4.3.2 for details.

Test Procedures:

- 1) The Product was placed on a nonconductive table 0.8 m above the horizontal ground reference plane, and 0.4 m from the vertical ground reference plane, and connected to the main through Line Impedance Stability Network (L.I.S.N).
- 2) The RBW of the receiver was set at 9 kHz in 150 kHz ~ 30MHz with Peak and AVG detector in Max Hold mode. Run the receiver's pre-scan to record the maximum disturbance generated from Product in all power lines in the full band.
- 3) For each frequency whose maximum record was higher or close to limit, measure its QP and AVG values and record.

Equipment Used: Refer to section 3 for details.

Test Result: N/A

APPENDIX 1 PHOTOS OF TEST SETUP

See test photos attached in Appendix 1 for the actual connections between Product and support equipment.

APPENDIX 2 PHOTOS OF EUT CONSTRUCTIONAL DETAILS

Refer to Appendix 2 for EUT external and internal photos.

***** End of Report *****

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