

ELECTROMAGNETIC EMISSIONS COMPLIANCE REPORT



Applicant: Harman Professional, Inc.
8500 Balboa Blvd., Northridge, CA 91329 USA

Manufacturer: Harman Professional, Inc.
8500 Balboa Blvd., Northridge, CA 91329 USA

Product Name: 15.6 inches Touch Panel

Brand Name: AMX

Model No.: VARIA-150

Report Number: TERF2310002550ER

FCC ID 2AUHEVARIA-150

Date of EUT Received: October 12, 2023

Date of Test: October 12, 2023~October 16, 2023

Issue Date: October 20, 2023

Approved By _____

Jim Chang

We hereby certify that:

The above equipment was tested by SGS Taiwan Ltd. Central RF Lab The test data, data evaluation, test procedures, and equipment configurations shown in this report were made in accordance with the procedures given in ANSI C63.10:2013 and the energy emitted by the sample EUT comply with FCC rule part §15.225.

The results of this report relate only to the sample identified in this report.

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Revision History

Report Number	Revision	Description	Issue Date	Revised By	Remark
TERF2310002550ER	00	Antenna change	October 20, 2023	Yami Kuo	

Note:

- 1、The remark "*" indicates modification of the report upon requests from certification body.

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1 GENERAL INFORMATION

1.1 Product Description

Product Name:	15.6 inches Touch Panel
Brand Name:	AMX
Model No.:	VARIA-150
Hardware Version:	N/A
Firmware Version:	N/A
EUT Series No.:	15600812302
Power Supply:	100-240V 50/60Hz
Test Software (Name/Version)	default

1.2 RF specification

Radio Technology:	NFC
Operating Frequency	13.56MHz
Transmit Power	23.27 dBuV/m at 30m.
Number of Channels	1
Modulation Type	ASK
Antenna Type	Loop Antenna

Note: Antenna information is provided by the applicant.

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1.3 Test Methodology

FCC Part 15, Subpart C §15.225

ANSI C63.10:2013.

1.4 Test Facility

Laboratory	Test Site Address	Test Site Name	FCC Designation number	IC CAB identifier
SGS Taiwan Ltd. Central RF Lab. (TAF code 3702)	No.134, Wu Kung Road, New Taipei Industrial Park, Wuku District, New Taipei City, Taiwan.	SAC 1	TW0027	TW3702
		SAC 2		
		SAC 3		
		Conduction 1		
		Conducted 1		
		Conducted 2		
		Conducted 3		
		Conducted 4		
		Conducted 5		
	Conducted 6			
	No.2, Keji 1st Rd., Guishan District, Taoyuan City, Taiwan 333	Conduction C	TW0028	
		SAC C		
		SAC D		
		SAC G		
		Conducted A		
		Conducted B		
		Conducted C		
		Conducted D		
		Conducted E		
Conducted F				
Conducted G				

Note: Test site name is remarked on the equipment list in each section of this report as an indication where measurements occurred in specific test site and address.

1.5 Special Accessories

There is no other accessory attached. This is the worst case condition.

1.6 Equipment Modifications

There was no modification incorporated into the EUT.

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2 SYSTEM TEST CONFIGURATION

2.1 EUT Configuration

The EUT configuration for testing is installed on RF field strength measurement to meet the Commissions requirement and operating in a manner which intends to maximize its emission characteristics in a continuous normal application.

2.2 EUT Exercise

The Transmitter was operated in the normal operating mode. The Tx frequency was fixed which was for the purpose of the measurements.

2.3 Test Procedure

2.3.1 Conducted Emissions

The EUT is placed on a table which is 0.8 m above ground plane. Conducted emissions from the EUT measured in the frequency range between 0.15 MHz and 30MHz. The CISPR Quasi-Peak and Average detector mode is employed. The two LISNs provide 50uH/50 ohm of coupling impedance for the measuring instrument. Both lines of the power mains connected to the EUT were checked for maximum conducted interference.

2.3.2 Radiated Emissions

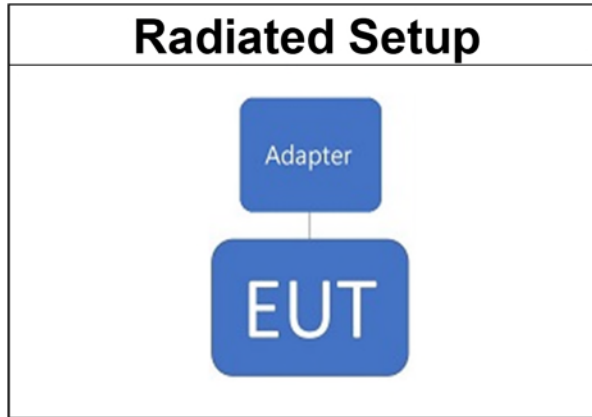
The EUT is placed on a turn table. For emissions testing at or below 1 GHz, the table height shall be 0.8 m above the reference ground plane. For emission measurements above 1 GHz, the table height shall be 1.5 m. The turn table shall rotate 360 degrees to determine the position of maximum emission level. EUT is set 3m away from the receiving antenna which varied from 1m to 4m to find out the highest emission. And also, each emission was to be maximized by changing the polarization of receiving antenna both horizontal and vertical. In order to find out the max. emission, the relative positions of this transmitter (EUT) was rotated through three orthogonal axes and measurement procedures for electric field radiated emissions above 1 GHz the EUT measurement is to be made "while keeping the antenna in the 'cone of radiation' from that area and pointed at the area both in azimuth and elevation, with polarization oriented for maximum response." is still within the 3dB illumination BW of the measurement antenna.

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2.4 Test Configuration



2.5 Control Unit(s)

Radiated Emission Test Site: SAC 1					
EQUIPMENT TYPE	MFR	MODEL NUMBER	SERIAL NUMBER	LAST CAL.	CAL DUE.
Adapter	ZYXEL	PoE12-30W	S212L47585844	N/A	N/A

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3 SUMMARY OF TEST RESULTS

FCC Rules	ISED Rules	Description Of Test	Result
§15.225 (a)-(d)	RSS210 Annex B B.6 (a)	Radiated Emission	Compliant
§15.209	RSS-Gen § 8.9	Radiated Emission Limits, general requirement	Compliant

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4 DESCRIPTION OF TEST MODES

4.1 The Worst Test Modes and Channel Details

1. The EUT stay in continuous transmission mode.
2. The frequency 13.56 MHz is the default channel to test, where it is the only manipulative channel as this application supports.
3. Only one configuration is supported/applicable as follows.

RADIATED EMISSION TEST			
MODE	AVAILABLE CHANNEL	TESTED CHANNEL	MODULATION
NFC	1	1	ASK

The field strength of radiated emission was measured as the EUT positioned in different orthogonal planes (E1/E2/H) based on actual usage of the EUT to pre-scan the emissions for determining the worst case scenario.

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5 MEASUREMENT UNCERTAINTY

Test Items	Uncertainty
AC Power Line Conducted Emission	+/- 2.32 dB
Frequency Stability	+/- 1.53 Hz
Emission Bandwidth	+/- 1.53 Hz
Temperature	+/- 0.7 °C
Humidity	+/- 3 %
DC / AC Power Source	+/- 1 %

Radiated Spurious Emission Measurement Uncertainty			
Polarization: Vertical	+/-	2.8 dB	9kHz~30MHz
	+/-	4.82 dB	30MHz - 1000MHz
	+/-	4.37 dB	1GHz - 18GHz
	+/-	4.21 dB	18GHz - 40GHz
Polarization: Horizontal	+/-	2.8 dB	9kHz~30MHz
	+/-	4.54 dB	30MHz - 1000MHz
	+/-	4.37 dB	1GHz - 18GHz
	+/-	4.21 dB	18GHz - 40GHz

Note:

1. This uncertainty represents an expanded uncertainty expressed at approximately the 95% confidence level using a coverage factor of k=2.
2. The conformity assessment statement in this report is based solely on the test results, measurement uncertainty is excluded.

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6 MEASUREMENT EQUIPMENT USED

6.1 Radiated Measurement

Radiated Emission Test Site: SAC 1					
EQUIPMENT TYPE	MFR	MODEL NUMBER	SERIAL NUMBER	LAST CAL.	CAL DUE.
Loop Antenna	SCHWARZBECK	FMZB 1513-60	1513-60-028	12/27/2022	12/26/2023
Bi-log Antenna	TESEO	CBL 6112D	35242 & AT-N0555	12/27/2022	12/26/2023
Spectrum Analyzer	Agilent	E4446A	MY51100003	10/28/2022	10/27/2023
Test Software	Audix	e3	Ver. 9.210616	N.C.R	N.C.R
EMI Test Receiver	R&S	ESR 7	102525	02/18/2023	02/17/2024
Site Cal	SGS	SAC 1	N/A	08/31/2023	08/30/2024
Pre-Amplifier	HP	8447D	2944A09469	08/31/2023	08/30/2024
Coaxial Cable	EMCI	EMC104-SM-SM-8000+EMC106-SM-SM-7600	RX Cable 9K-18G(160125+150817)	09/12/2023	09/11/2024

NOTE: N.C.R refers to Not Calibrated Required.

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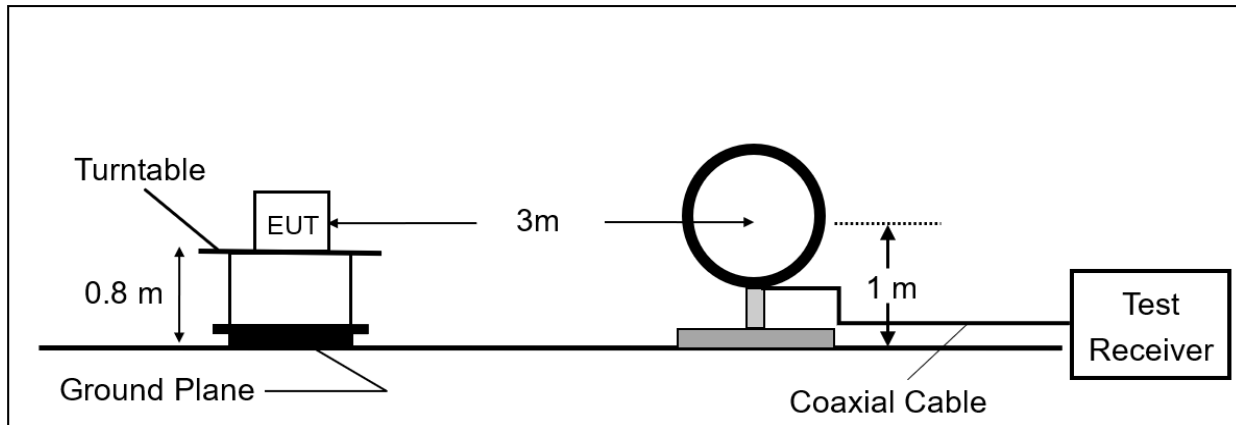
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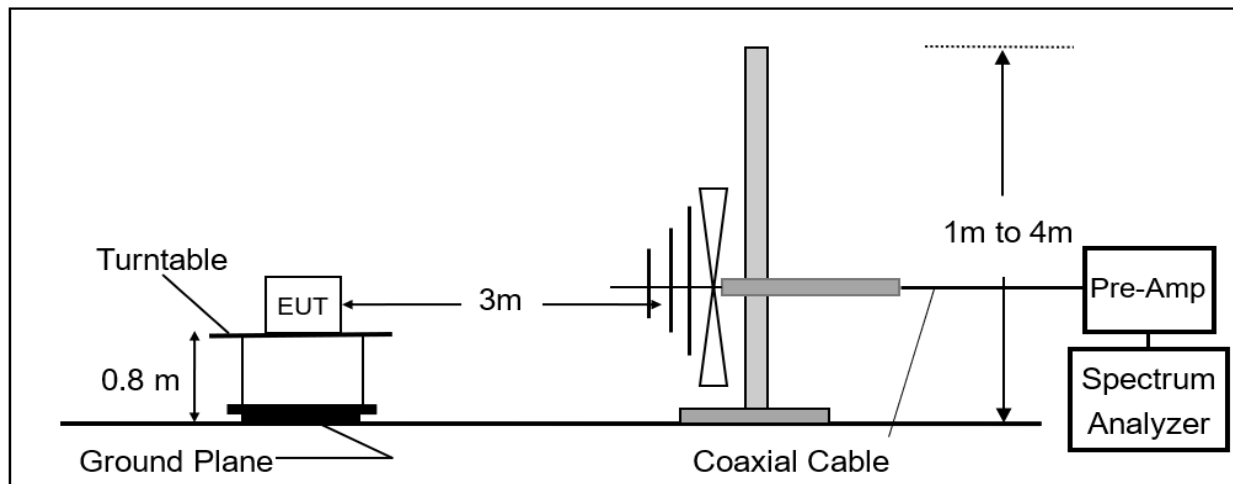
7 RADIATED EMISSION TEST

7.1 Test SET-UP (Block Diagram of Configuration)

(A) Radiated Emission Test Set-Up, Frequency Below 30MHz.



(B) Radiated Emission Test Set-Up, Frequency From 30MHz to 1000MHz.



7.2 Measurement Procedure

1. Configure the EUT according to ANSI C63.10.
2. The EUT was placed on a turn table which is 0.8m above ground plane and been measured in the frequency range between 0.009MHz to 30MHz and 30MHz to 1GHz.
3. The turn table shall rotate 360 degrees to determine the position of maximum emission level.
4. EUT is set 3m away from the receiving antenna which varied from 1m to 4m to find out the highest emission.
5. Maximum procedure was performed on the six highest emissions to ensure EUT compliance.
6. And also, each emission was to be maximized by changing the polarization of receiving antenna both horizontal and vertical.
7. Repeat above procedures until all default test channel measured were complete.

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7.3 Field Strength Calculation

The field strength is calculated by adding the Antenna Factor and Cable Factor and subtracting the Amplifier Gain and Duty Cycle Correction Factor (if any) from the measured reading. The basic equation with a sample calculation is as follows:

$$FS = RA + AF + CL - AG$$

Where	FS = Field Strength	CL = Cable Attenuation Factor (Cable Loss)
	RA = Reading Amplitude	AG = Amplifier Gain
	AF = Antenna Factor	

7.4 Field Strength of Fundamental Emission

7.4.1 Applicable standard

Rules and specifications	CFR 47 Part 15 section 15.225(a)-(d)	
Frequency of Emission (MHz)	Field Strength (μV/m)at 30m	Field Strength (dBμV/m)at 30m
1.705~13.110	30	29.5
13.110~13.410	106	40.5
13.410~13.553	334	50.5
13.553~13.567	15848	84
13.567~13.710	334	50.5
13.710~14.010	106	40.5
14.010~30.00	30	29.5

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7.4.2 Distance Extrapolation Factor

30m to 3m

Distance extrapolation = $40 \cdot \log(30/3) = 40$ dB

30m to 10m

Distance extrapolation = $40 \cdot \log(30/10) = 19.08$ dB

10m to 3m

Distance extrapolation = $40 \cdot \log(10/3) = 20.92$ dB

Note:

1. Distance extrapolation factor = $40 \log(\text{required distance}/\text{test distance})$ (dB)
2. The lower limit shall apply at the transition frequencies.
3. KDB 414788 D01 OATS and 3m semi-anechoic chamber Justification:
Base on FCC 15.31 (f) (2): measurements may be performed at a distance closer than that specified in the regulations; however, an attempt should be made to avoid making measurements in the near field. OATS and 3m SAC chamber testing had been performed and 3m SAC measured test result is the worst case test result.

Actual FS(dB μ V/m) = Spectrum. Reading level(dB μ V) + Factor(dB)

Below 30 MHz of Factor(dB) = Antenna Factor(dB μ V/m) + Cable Loss(dB) – Distance Factor (dB)

Above 30 MHz of Factor(dB) = Antenna Factor(dB μ V/m) + Cable Loss(dB) – Pre_Amp Gain (dB)

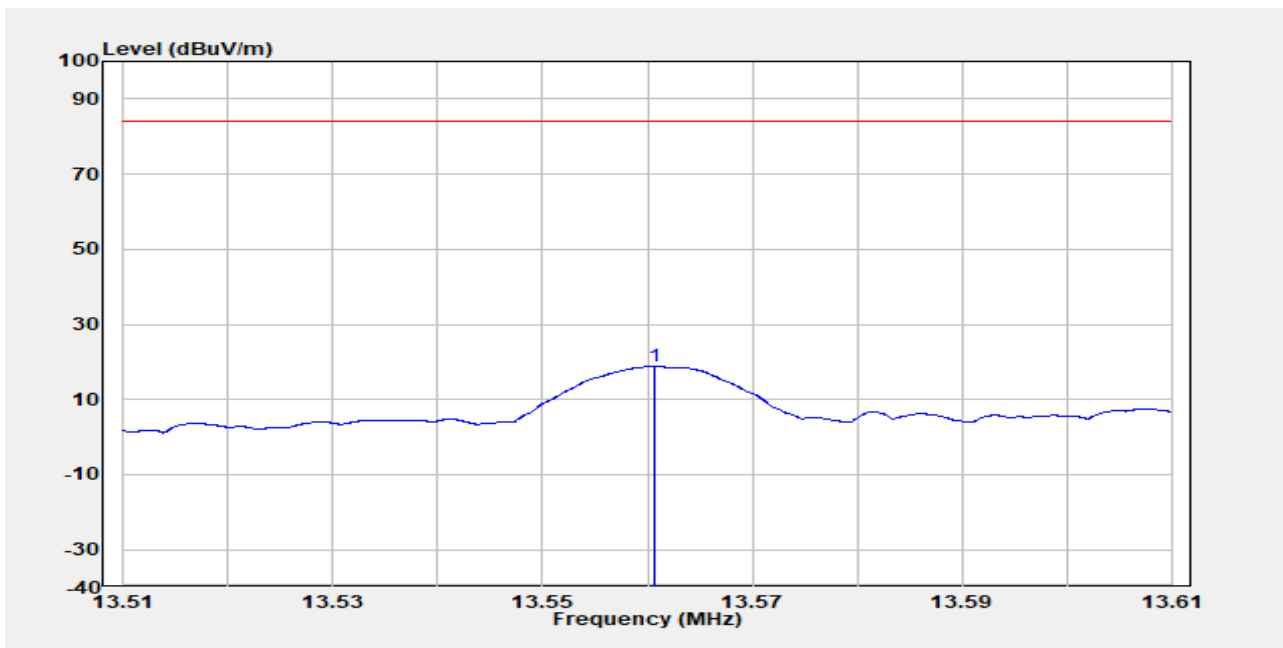
The trace on RE(radiation emission) plot is as colored blue, and the detection manner we've employed is peak detector.

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7.4.3 Field Strength of Fundamental Emission Measurement Result

Report Number	:TERF2310002550ER	Test Site	:SAC 1
Operation Mode	:NFC	Test Date	:2023-10-16
Test Frequency	:13.56 MHz	Temp./Humi.	:23.8°C/56%
Test Mode	:Main	Antenna Pol.	:Vertical
EUT Pol	:H Plane	Engineer	:WJ Lin



Freq. MHz	Detector Mode PK/QP/AV	Spectrum Reading Level dBuV	Factor dB	Actual FS dBuV/m	Limit dBuV/m	Margin dB
13.56	Peak	36.81	-18.08	18.73	84.00	-65.27

Actual level = Reading level + Factor

Factor = Antenna factor + cable loss – Pre_Amplifier Gain – distance factor

Test distance= 3m

For Actual level and limit:

Field strength (dBuV/m) at 300m, within the band 9 kHz - 490 kHz.

Field strength (dBuV/m) at 30m, within the band 490 kHz - 30 MHz.

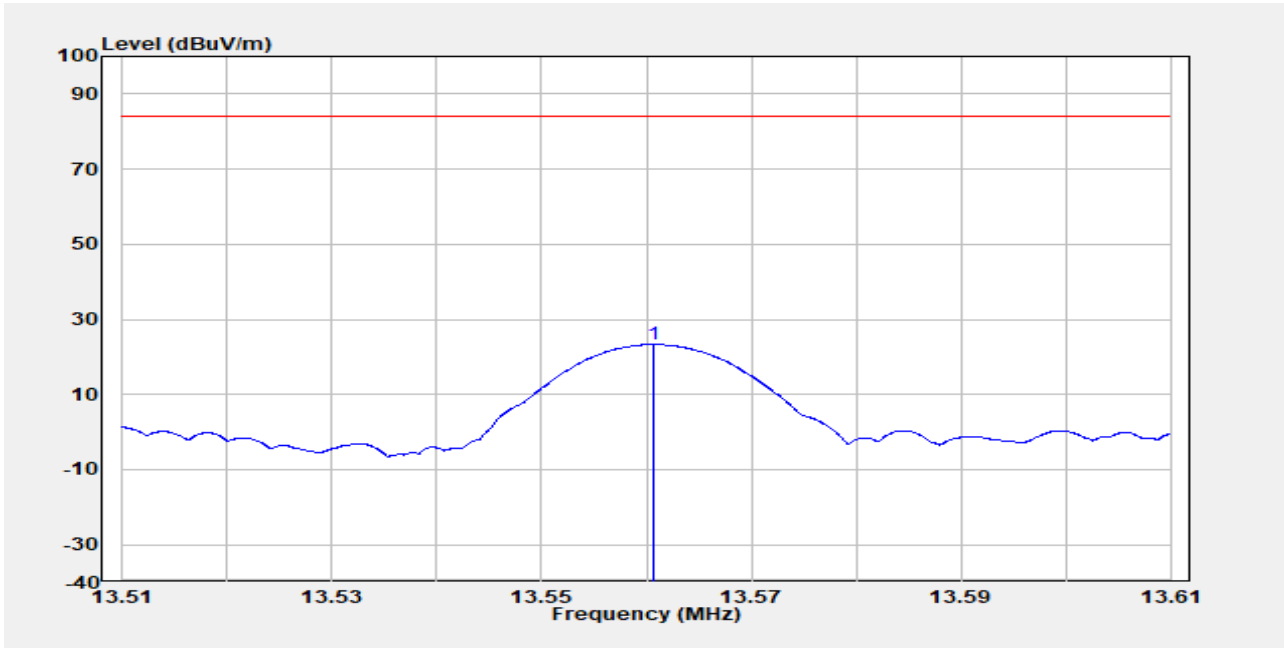
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Report Number :TERF2310002550ER
 Operation Mode :NFC
 Test Frequency :13.56 MHz
 Test Mode :Main
 EUT Pol :H Plane

Test Site :SAC 1
 Test Date :2023-10-16
 Temp./Humi. :23.8°C/56%
 Antenna Pol. :Horizontal
 Engineer :WJ Lin



Freq. MHz	Detector Mode PK/QP/AV	Spectrum Reading Level d μ V	Factor dB	Actual FS d μ V/m	Limit d μ V/m	Margin dB
13.56	Peak	41.35	-18.08	23.27	84.00	-60.73

Actual level = Reading level + Factor

Factor = Antenna factor + cable loss – Pre_Amplifier Gain – distance factor

Test distance= 3m

For Actual level and limit:

Field strength (dBUV/m) at 300m,within the band 9 kHz - 490 kHz.

Field strength (dBUV/m) at 30m,within the band 490 kHz - 30 MHz.

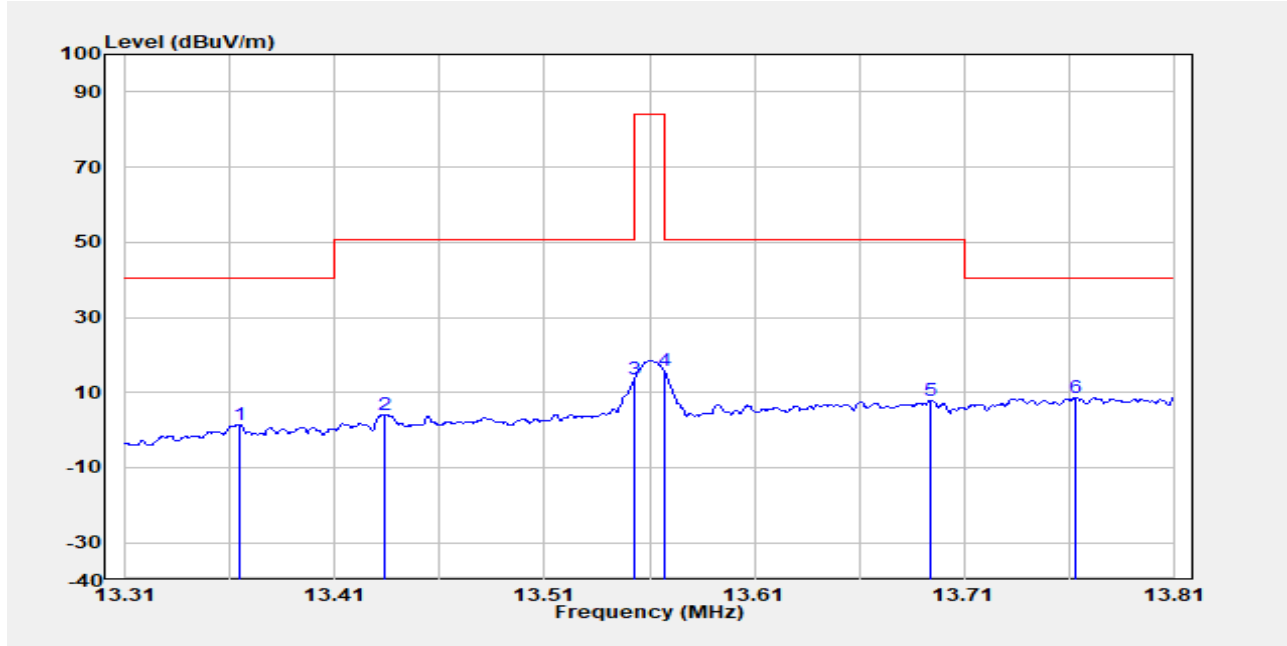
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Report Number :TERF2310002550ER
 Operation Mode :NFC
 Test Frequency :13.56 MHz
 Test Mode :Mask
 EUT Pol :H Plane

Test Site :SAC 1
 Test Date :2023-10-16
 Temp./Humi. :23.8°C/56%
 Antenna Pol. :Vertical
 Engineer :WJ Lin



Freq. MHz	Detector Mode PK/QP/AV	Spectrum Reading Level dB μ V	Factor dB	Actual FS dB μ V/m	Limit dB μ V/m	Margin dB
13.36	Peak	19.42	-18.10	1.32	40.50	-39.18
13.43	Peak	22.04	-18.09	3.95	50.50	-46.55
13.55	Peak	31.72	-18.08	13.64	50.50	-36.86
13.57	Peak	33.88	-18.08	15.80	50.50	-34.70
13.69	Peak	25.93	-18.06	7.87	50.50	-42.63
13.76	Peak	26.69	-18.06	8.63	40.50	-31.87

Actual level = Reading level + Factor

Factor = Antenna factor + cable loss – Pre_Amplifier Gain – distance factor

Test distance= 3m

For Actual level and limit:

Field strength (dBuV/m) at 300m, within the band 9 kHz - 490 kHz.

Field strength (dBuV/m) at 30m, within the band 490 kHz - 30 MHz.

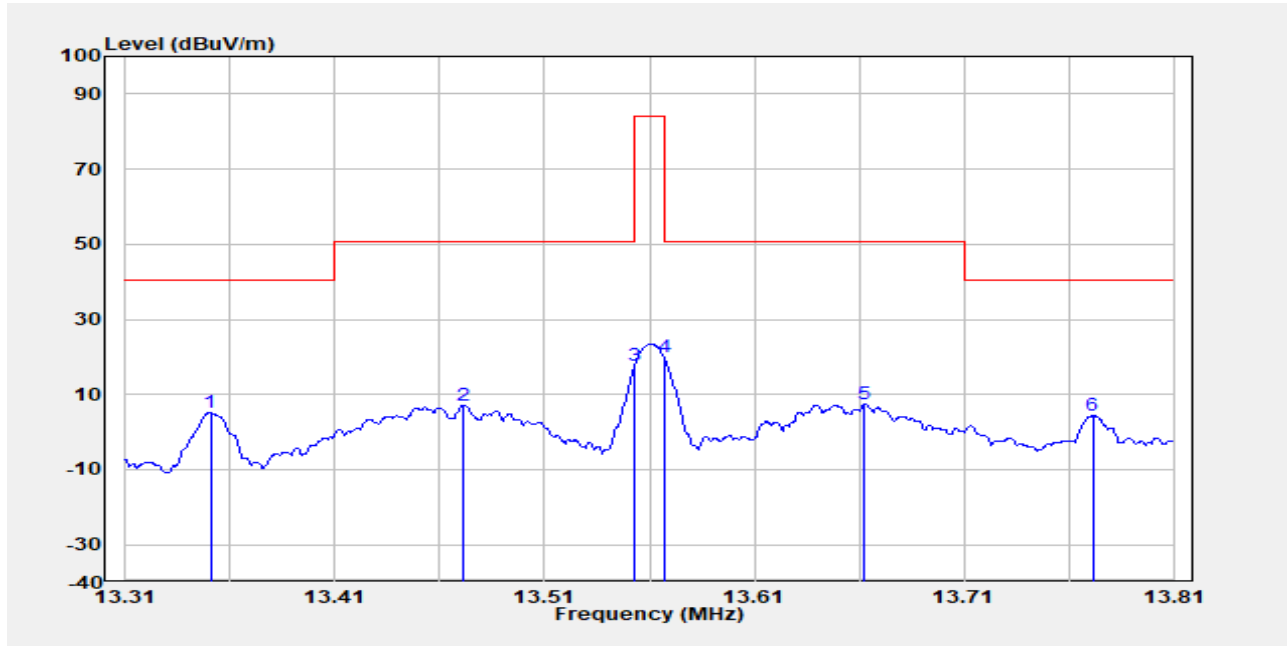
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Report Number :TERF2310002550ER
 Operation Mode :NFC
 Test Frequency :13.56 MHz
 Test Mode :Mask
 EUT Pol :H Plane

Test Site :SAC 1
 Test Date :2023-10-16
 Temp./Humi. :23.8°C/56%
 Antenna Pol. :Horizontal
 Engineer :WJ Lin



Freq. MHz	Detector Mode PK/QP/AV	Spectrum Reading Level dB μ V	Factor dB	Actual FS dB μ V/m	Limit dB μ V/m	Margin dB
13.35	Peak	23.13	-18.10	5.03	40.50	-35.47
13.47	Peak	25.18	-18.09	7.09	50.50	-43.41
13.55	Peak	35.79	-18.08	17.71	50.50	-32.79
13.57	Peak	37.84	-18.08	19.76	50.50	-30.74
13.66	Peak	25.51	-18.07	7.45	50.50	-43.05
13.77	Peak	22.33	-18.06	4.27	40.50	-36.23

Actual level = Reading level + Factor

Factor = Antenna factor + cable loss – Pre_Amplifier Gain – distance factor

Test distance= 3m

For Actual level and limit:

Field strength (dBuV/m) at 300m, within the band 9 kHz - 490 kHz.

Field strength (dBuV/m) at 30m, within the band 490 kHz - 30 MHz.

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7.5 Radiated Spurious Emission Measurement

7.5.1 Standard Applicable

The field strength of any emissions appearing outside of the 13.110-14.010 MHz shall not exceed the general radiated emission limits as below.

Frequency (MHz)	Field strength ($\mu\text{V/m}$)	Distance (meters)
0.009~0.490	2400/F(kHz)	300
0.490~1.705	24000/F(kHz)	30
1.705-30	30	30
30-88	100	3
88-216	150	3
216-960	200	3
Above 960	500	3

Note:

1. Emission level in $\text{dB}\mu\text{V/m} = 20 \log(\mu\text{V/m})$
2. Distance extrapolation factor = $40 \log(\text{required distance}/\text{test distance})$ (dB)
3. $20 * \log(30\mu\text{V/m}) = 29.54 \text{ dBuV/m}$
4. The lower limit shall apply at the transition frequencies.
5. The measurement was undertaken in closer distance at 3m, where extrapolation factor is offset to convert the limit of the measurement.
6. Only spurious frequency is permitted to locate within the Restricted Bands specified in provision of §15.205.
7. The general radiated emission limits in §15.209 apply for the spurious emission generate from UE, except for the fundamental emission where the respective section specifies otherwise.

Unless otherwise stated the results shown in this test report refer only to the sample(s) tested and such sample(s) are retained for 90 days only.

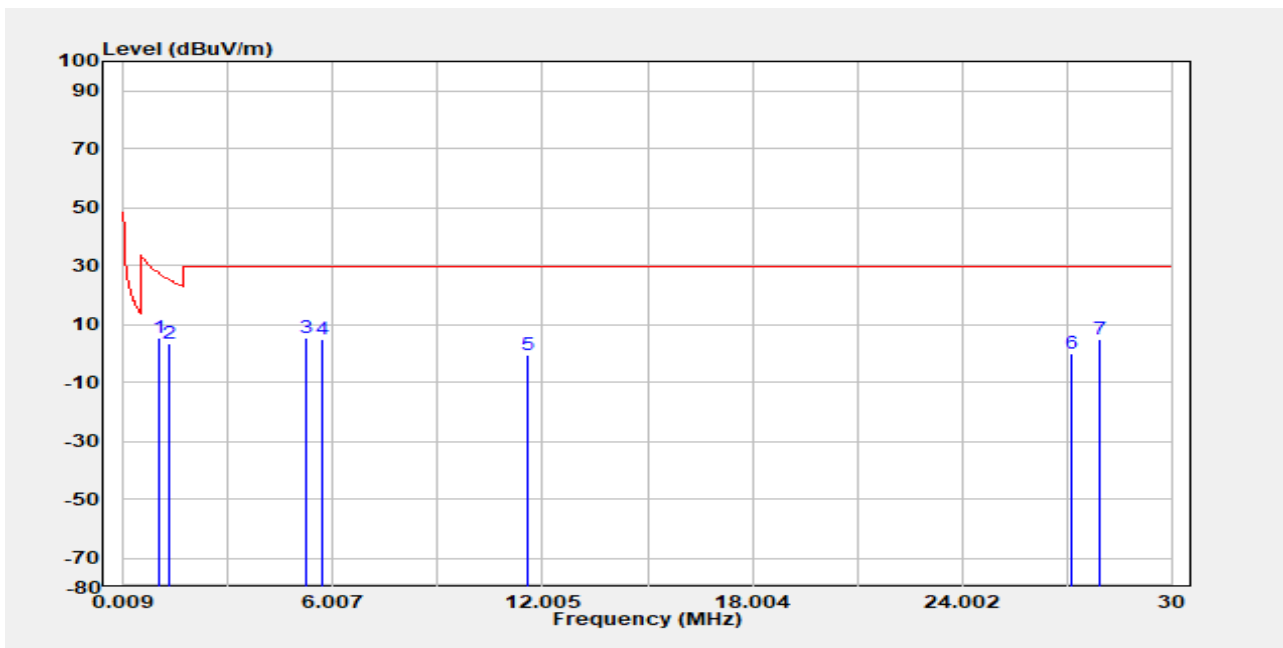
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7.5.2 Radiated Spurious Emission Measurement Result

Report Number	:TERF2310002550ER	Test Site	:SAC 1
Operation Mode	:NFC	Test Date	:2023-10-16
Test Frequency	:13.56 MHz	Temp./Humi.	:23.8°C/56%
Test Mode	:Tx	Antenna Pol.	:Vertical
EUT Pol	:H Plane	Engineer	:WJ Lin



Freq. MHz	Detector Mode PK/QP/AV	Spectrum Reading Level dBuV	Factor dB	Actual FS dBuV/m	Limit dBuV/m	Margin dB
1.00	Peak	26.02	-20.57	5.44	27.61	-22.17
1.33	Peak	23.83	-20.57	3.26	25.14	-21.88
5.23	Peak	25.50	-20.15	5.35	29.54	-24.19
5.68	Peak	24.90	-19.99	4.91	29.54	-24.63
11.56	Peak	17.92	-18.30	-0.38	29.54	-29.92
27.12	Peak	17.75	-17.57	0.18	29.54	-29.36
27.96	Peak	22.24	-17.60	4.65	29.54	-24.89

Actual level = Reading level + Factor

Factor = Antenna factor + cable loss – Pre_Amplifier Gain – distance factor

Test distance= 3m

For Actual level and limit:

Field strength (dBuV/m) at 300m, within the band 9 kHz - 490 kHz.

Field strength (dBuV/m) at 30m, within the band 490 kHz - 30 MHz.

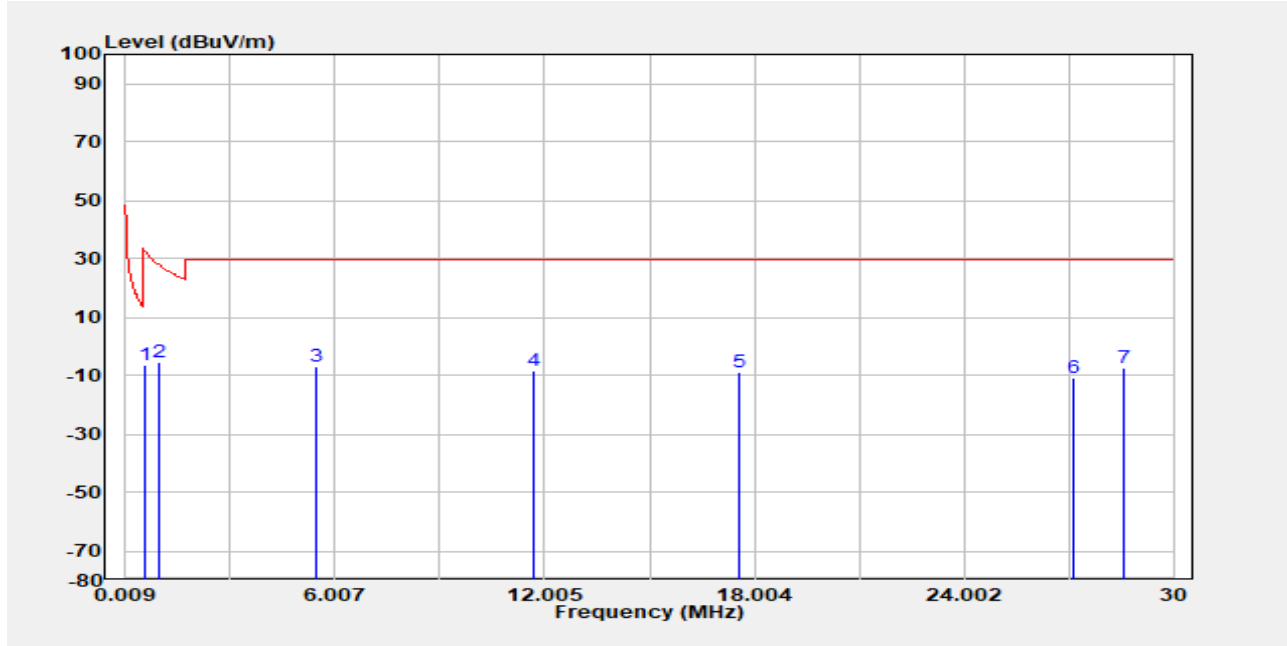
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Report Number :TERF2310002550ER
 Operation Mode :NFC
 Test Frequency :13.56 MHz
 Test Mode :Tx
 EUT Pol :H Plane

Test Site :SAC 1
 Test Date :2023-10-16
 Temp./Humi. :23.8°C/56%
 Antenna Pol. :Horizontal
 Engineer :WJ Lin



Freq. MHz	Detector Mode PK/QP/AV	Spectrum Reading Level dBuV	Factor dB	Actual FS dBuV/m	Limit dBuV/m	Margin dB
0.55	Peak	14.51	-20.67	-6.16	32.82	-38.98
0.97	Peak	15.10	-20.58	-5.48	27.88	-33.36
5.44	Peak	13.13	-20.07	-6.95	29.54	-36.49
11.71	Peak	10.00	-18.28	-8.29	29.54	-37.83
17.55	Peak	9.02	-17.64	-8.62	29.54	-38.16
27.12	Peak	6.61	-17.57	-10.96	29.54	-40.50
28.59	Peak	10.47	-17.61	-7.15	29.54	-36.69

Actual level = Reading level + Factor

Factor = Antenna factor + cable loss – Pre_Amplifier Gain – distance factor

Test distance= 3m

For Actual level and limit:

Field strength (dBuV/m) at 300m, within the band 9 kHz - 490 kHz.

Field strength (dBuV/m) at 30m, within the band 490 kHz - 30 MHz.

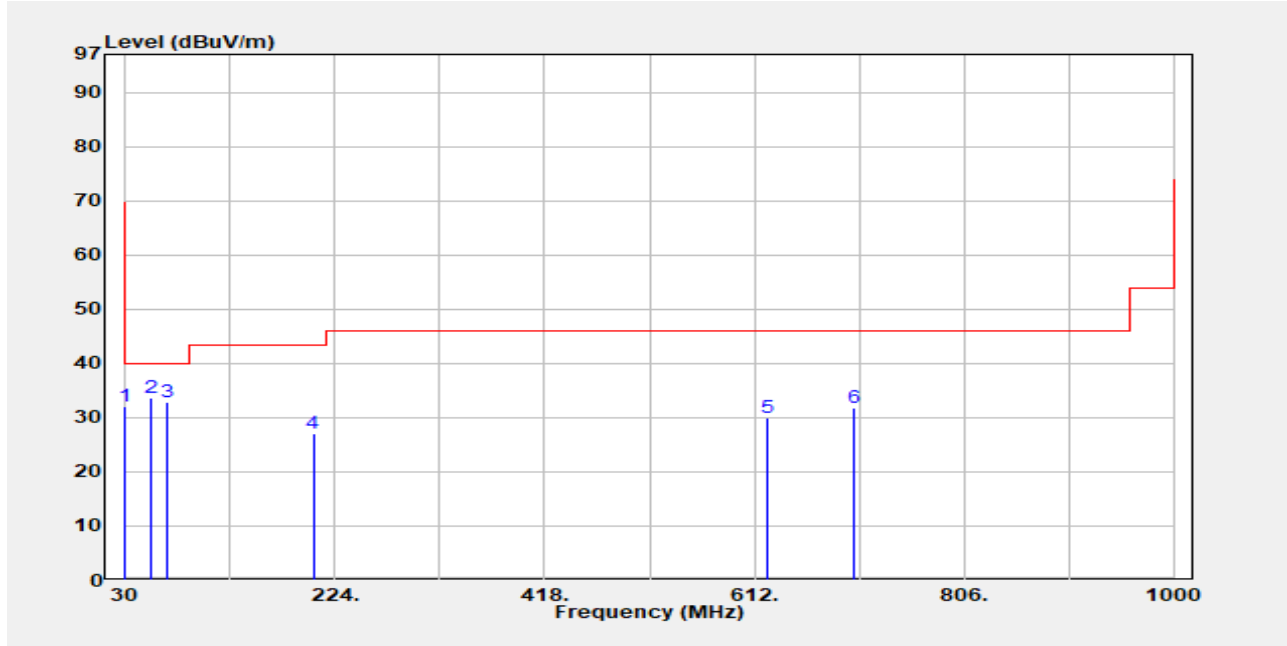
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Report Number :TERF2310002550ER
 Operation Mode :NFC
 Test Frequency :13.56 MHz
 Test Mode :Tx
 EUT Pol :H Plane

Test Site :SAC 1
 Test Date :2023-10-16
 Temp./Humi. :23.8°C/56%
 Antenna Pol. :Vertical
 Engineer :WJ Lin



Freq. MHz	Detector Mode PK/QP/AV	Spectrum Reading Level dB μ V	Factor dB	Actual FS dB μ V/m	Limit dB μ V/m	Margin dB
30.00	QP	37.11	-5.16	31.95	40.00	-8.05
54.25	Peak	51.39	-17.80	33.60	40.00	-6.40
67.83	Peak	50.64	-17.88	32.76	40.00	-7.24
203.63	Peak	40.78	-13.63	27.15	43.50	-16.35
624.61	Peak	33.92	-4.00	29.92	46.00	-16.08
705.12	Peak	35.37	-3.44	31.93	46.00	-14.07

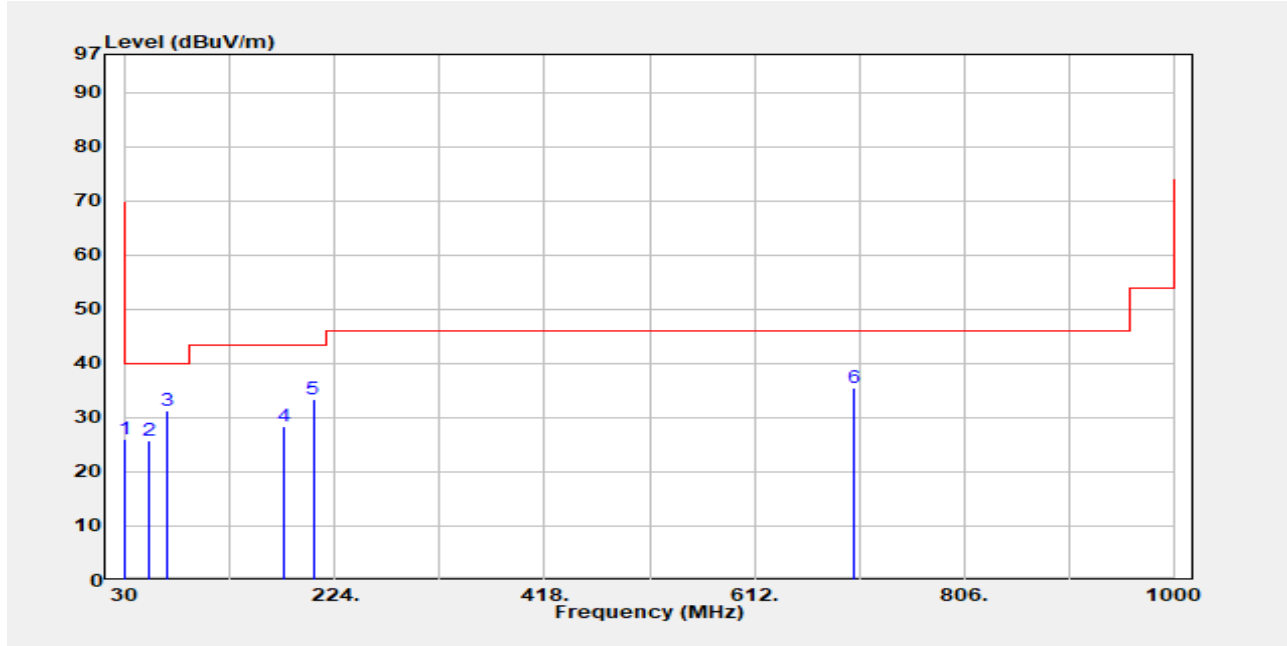
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Report Number :TERF2310002550ER
 Operation Mode :NFC
 Test Frequency :13.56 MHz
 Test Mode :Tx
 EUT Pol :H Plane

Test Site :SAC 1
 Test Date :2023-10-16
 Temp./Humi. :23.8°C/56%
 Antenna Pol. :Horizontal
 Engineer :WJ Lin



Freq. MHz	Detector Mode PK/QP/AV	Spectrum Reading Level d μ V	Factor dB	Actual FS d μ V/m	Limit d μ V/m	Margin dB
30.00	Peak	31.21	-5.16	26.05	40.00	-13.95
51.34	Peak	42.71	-16.85	25.86	40.00	-14.14
67.83	Peak	49.21	-17.88	31.33	40.00	-8.67
176.47	Peak	42.50	-14.02	28.48	43.50	-15.02
203.63	Peak	46.98	-13.63	33.35	43.50	-10.15
705.12	Peak	38.91	-3.44	35.47	46.00	-10.53

~ End of Report ~

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