

Prüfbericht-Nr.: <i>Test report no.:</i>	CN22CM8Q 001	Auftrags-Nr.: <i>Order no.:</i>	180245804	Seite 1 von 23 <i>Page 1 of 23</i>
Kunden-Referenz-Nr.: <i>Client reference no.:</i>	N/A	Auftragsdatum: <i>Order date:</i>	2022.10.31	
Auftraggeber: <i>Client:</i>	Turnils North America 1750 Satellite Blvd, Suite 100, Buford GA 30518			
Prüfgegenstand: <i>Test item:</i>	DC Motor			
Bezeichnung / Typ-Nr.: <i>Identification / Type no.:</i>	1037361			
Auftrags-Inhalt: <i>Order content:</i>	TÜV Rheinland – FCC & ISED Service			
Prüfgrundlage: <i>Test specification:</i>	FCC 47 CFR Part 15.203 FCC 47 CFR Part 15.231 FCC Part 15, Subpart B:2021		RSS-210 Issue 10 RSS-Gen Issue 5 ICES-003 Issue 7:2020	
Wareneingangsdatum: <i>Date of sample receipt:</i>	2022.11.10	Refer to Photo Documentation		
Prüfmuster-Nr.: <i>Test sample no.:</i>	A003369830			
Prüfzeitraum: <i>Testing period:</i>	2022.11.11 - 2023.01.13			
Ort der Prüfung: <i>Place of testing:</i>	Refer to section 1.1			
Prüflaboratorium: <i>Testing laboratory:</i>	TÜV Rheinland / CCIC (Ningbo) Co., Ltd.			
Prüfergebnis*: <i>Test result*:</i>	Pass			
geprüft von: <i>tested by:</i>	genehmigt von: <i>authorized by:</i>			
Datum: <i>Date:</i>	2023.02.13		2023.02.13	
Stellung / Position:	Keda Zhou/PE		Feng Liang/Reviewer	
Sonstiges / Other:	FCC ID: 2AU29AMPLT40V ISED: 25624-AMPLT40V			
Zustand des Prüfgegenstandes bei Anlieferung: <i>Condition of the test item at delivery:</i>	Prüfmuster vollständig und unbeschädigt <i>Test item complete and undamaged</i>			
* Legende:	1 = sehr gut P(ass) = entspricht o.g. Prüfgrundlage(n)	2 = gut F(ail) = entspricht nicht o.g. Prüfgrundlage(n)	3 = befriedigend N/A = nicht anwendbar	4 = ausreichend N/T = nicht getestet
* Legend:	1 = very good P(ass) = passed a.m. test specification(s)	2 = good F(ail) = failed a.m. test specification(s)	3 = satisfactory N/A = not applicable	4 = sufficient N/T = not tested
Dieser Prüfbericht bezieht sich nur auf das o.g. Prüfmuster und darf ohne Genehmigung der Prüfstelle nicht auszugsweise vervielfältigt werden. Dieser Bericht berechtigt nicht zur Verwendung eines Prüfzeichens. <i>This test report only relates to the a. m. test sample. Without permission of the test center this test report is not permitted to be duplicated in extracts. This test report does not entitle to carry any test mark.</i>				

v05

Test Summary

4.1.1 ANTENNA REQUIREMENT

Result:

Pass

4.1.2 DEACTIVATION OF THE TRANSMISSION

Result:

Pass

4.1.3 20DB EMISSION BANDWIDTH

Result:

Pass

4.1.4 99% BANDWIDTH MEASUREMENT

Result:

Pass

4.1.5 FIELD STRENGTH OF FUNDAMENTAL AND UNWANTED EMISSIONS

Result:

Pass

4.2.1 MAINS TERMINAL CONTINUOUS DISTURBANCE VOLTAGE

Result:

Pass

4.2.2 RADIATED DISTURBANCE

Result:

Pass

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1. Test Sites

1.1 Test Facilities

Laboratory: TÜV Rheinland /CCIC (Ningbo) Co., Ltd.

1st Floor, Building 11, Scholar Innovation Park, No.1188 Zhongguan Road, Zhenhai District, Ningbo 315200 P.R. China

FCC Designation Number: CN1237

FCC Test Firm Registration Number: 647754

IC Company Number: 24297

CAB identifier: CN0047

The tests were conducted by TÜV Rheinland/CCIC's engineer directly in the above laboratory.

1.2 List of Test and Measurement Instruments

Table 1: List of Test and Measurement Equipment, Laboratory

Kind of Equipment	Type	Serial No.	Last cal. date	Cal. due date
EMI test receiver	ESR7	101929	2022.10.31	2023.10.30
Spectrum analyzer	FSV40	101412	2022.10.31	2023.10.30
Bilog Antenna	CBL6112D	49033	2021.03.15	2024.03.14
Horn antenna	HF907	102653	2020.11.25	2023.07.21
Pre-amplifier	SCU-18F	180051	2022.10.31	2023.10.30
EMI test receiver	ESR3	102331	2022.10.31	2023.10.30
LISN	ENV216	102250	2022.10.31	2023.10.30

1.3 Uncertainty of Measurement

Table 2: Measurement Uncertainty

Test Item	Expanded Measurement Uncertainty (k=2)
Conducted Emission (9-150kHz)	3.70dB
Conducted Emission (150k-30MHz)	3.30dB
Radiated Emission (30-1000MHz)	4.39dB
Radiated Emission (1-18GHz)	4.67dB

2. General Product Information

2.1 Product Function and Intended Use

The EUT (equipment under test) is a DC Motor operating at 433.05 - 434.79MHz.

For more detail information, refer to the user's manual.

2.2 Ratings and System Details

Table 3: General Description of EUT

General Description of EUT	
Product name:	DC Motor
FCC ID:	2AU29AMPLT40V
ISED:	25624-AMPLT40V
Rated Voltage:	DC 12V
Protection Class:	Class III
Operating Temperature Range:	-5°C~50°C
Technical Specification of SRD (433MHz)	
Operating Frequency band:	433.05 - 434.79MHz
Modulation:	GFSK
Antenna Type:	Line
Antenna Gain:	-2dBi

2.3 Independent Operation Modes

There are some modes:

Mode A: Transmitting on Operating Frequency Band: 433.05 - 434.79MHz

Mode B: Normal Working

Refer to the user's manual for further information.

2.4 Noise Generating and Noise Suppressing Parts

Refer to the Circuit Diagram for further information.

2.5 Submitted Documents

Circuit diagram, Schematics, PCB Layout, Label, User Manual etc.

3. Test Set-up and Operation Modes

3.1 Principle of Configuration Selection

Radio Spectrum: The equipment under test (EUT) was configured at its highest power output in order to measure its highest possible radiation and conducted level. The test modes were adapted accordingly in reference to the instructions for use.

Emission: The equipment under test (EUT) was configured to measure its highest possible radiation level. The test modes were adapted accordingly in reference to the instructions for use.

3.2 Test Operation and Test Software

During testing, Channel & Power Controlling Software provided by the customer was used to control the operating channel as well as the output power level. The RF output power was selected according to the instruction given by the manufacturer. The setting of the RF output power expected by the customer shall be fixed on the firmware of the final end product.

All testing were performed according to the procedures in ANSI C63.10: 2013.

Test Software EMC32 V10.30 was used in the radiated emission test.

More details refer to the related paragraph of this report.

3.3 Special Accessories and Auxiliary Equipment

None.

3.4 Countermeasures to Achieve ERM Compliance

The test sample which has been tested contained the noise suppression parts as described in the Circuit Diagram. No additional measures were employed to achieve compliance.

3.5 Test set-up

Diagram of Measurement Configuration for Radiation Test (Below 1GHz)

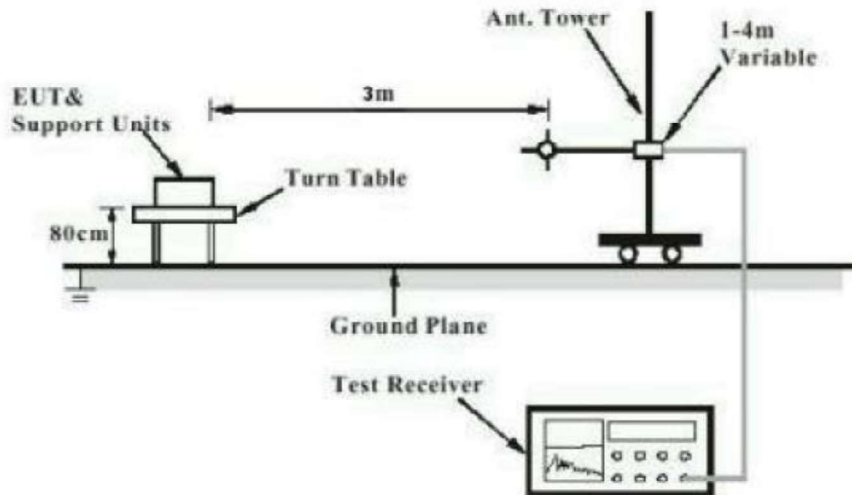


Diagram of Measurement Configuration for Radiation Test (Above 1GHz)

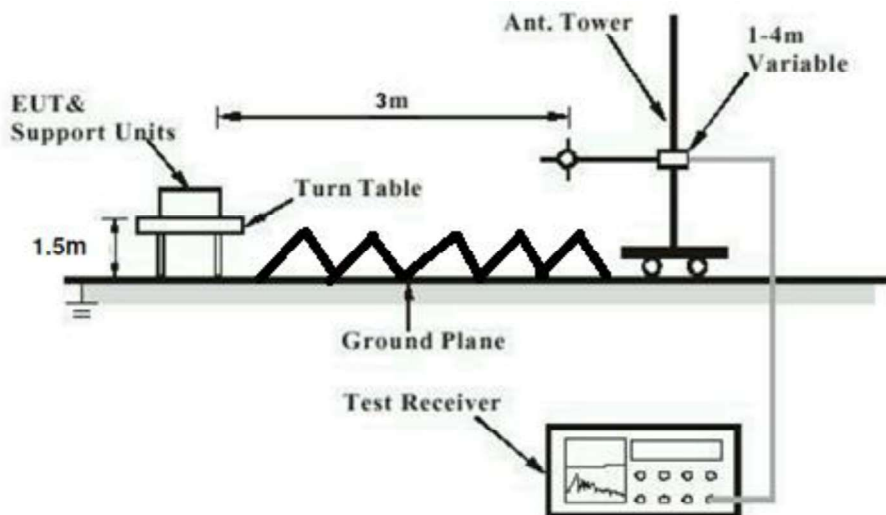
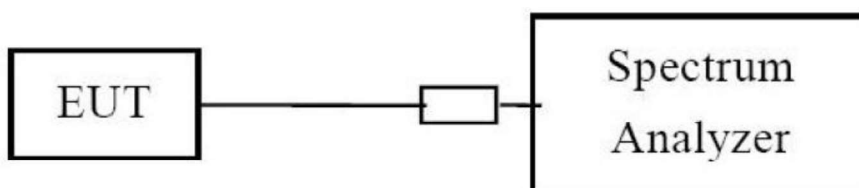


Diagram of Measurement Configuration for Conducted Transmitter Measurement



4. Test Results

4.1 Transmitter Requirement & Test Suites

4.1.1 Antenna Requirement

Result:**Pass**

Test Specification

Test standard

: FCC 47 CFR Part 15.203
RSS-Gen Issue 5

Limit

: FCC: the use of antennas with directional gains that do
not exceed 6 dBi
RSS: Use of approved antennas only

According to the manufacturer declared, the EUT has a fixed external antenna (Wire antenna, Antenna Gain: -2dBi), and the antenna connector is designed with permanent attachment and no consideration of replacement. Therefore the EUT is considered sufficient to comply with the provision.

Refer to EUT Photo for further details.

4.1.2 Deactivation of the Transmission

Result:**Pass**

Test Specification

Test standard : FCC 47 CFR Part 15.231
RSS-210 Issue 10

Basic standard : ANSI C63.10: 2013

Test requirement : CFR47 FCC Part 15.231 (a)(1)
RSS-210 Issue 10, Annex A.1.1Limits : A manually operated transmitter shall employ a switch that will automatically deactivate the transmitter within not more than 5 seconds of being released.
A transmitter activated automatically shall cease transmission within 5 seconds after activation.

Test suite : Shielded Room

Test Setup

Date of testing : 2022.11.11

Test environment: : Normal test conditions

Operational mode : Mode A

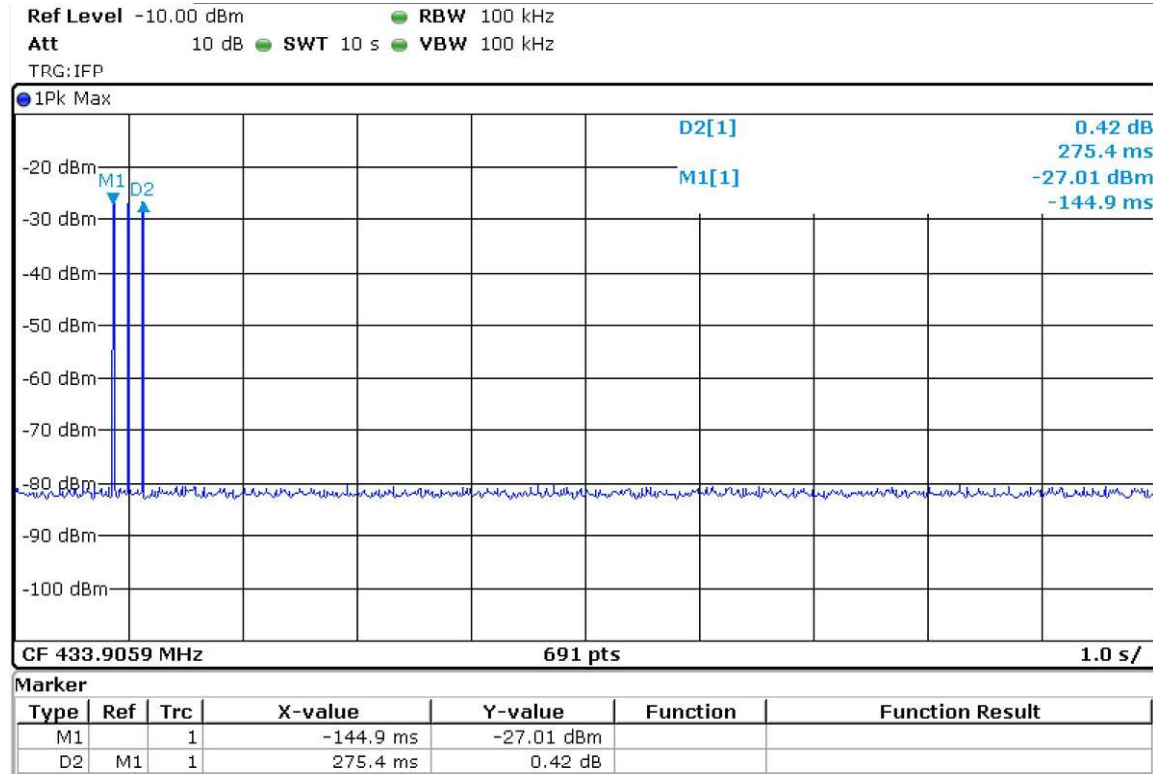
Temperature : 23°C

Relative humidity : 56%

Atmospheric pressure : 101.2 kPa

Figure 1: Test Results of Deactivation of the Transmission

Activated mode	Duration Time (S)	Limit (S)
Manually	0.2754	≤5



4.1.3 20dB Emission Bandwidth

Result:
Pass
Test Specification

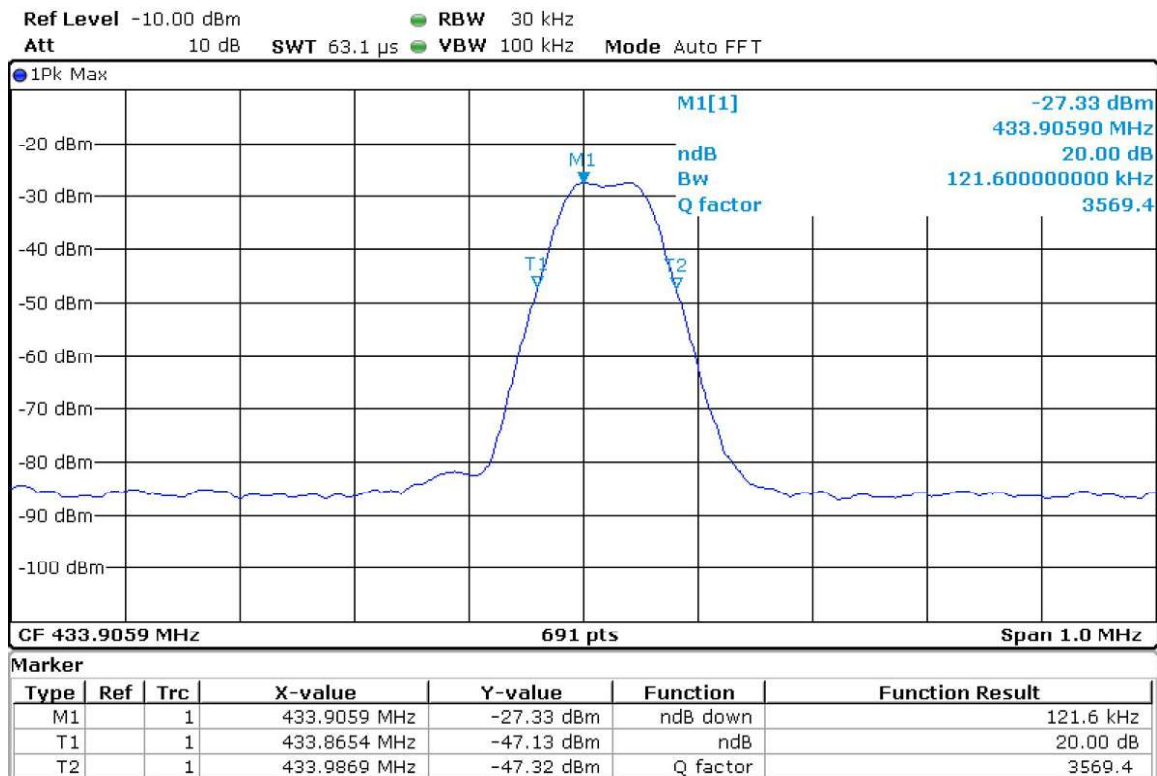
Test standard : FCC 47 CFR Part 15.231
 Basic standard : ANSI C63.10: 2013
 Test requirement : CFR47 FCC Part 15.231 (c)
 Limit : CFR47 FCC Part 15.231 (c)
 Test suite : Shielded Room

Test Setup

Date of testing : 2022.11.11
 Test environment : Normal test conditions
 Operational mode : Mode A
 Temperature : 23°C
 Relative humidity : 56%
 Atmospheric pressure : 101.2 kPa

Figure 2: Test Results of 20dB Emission Bandwidth

Bandwidth (kHz) : 121.6
 Limit (kHz) : ≤1085



4.1.4 99% Bandwidth Measurement

Result:**Pass**

Test Specification

Test standard	: RSS-210 Issue 10
Basic standard	: ANSI C63.10: 2013
Test requirement	: RSS-210 Issue 10, Annex A.1.3
Limit	: The occupied bandwidth of momentarily operated devices shall be less than 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 occupied bandwidth shall be less than or equal to 0.5% of the centre frequency.
Test suite	: Shielded Room

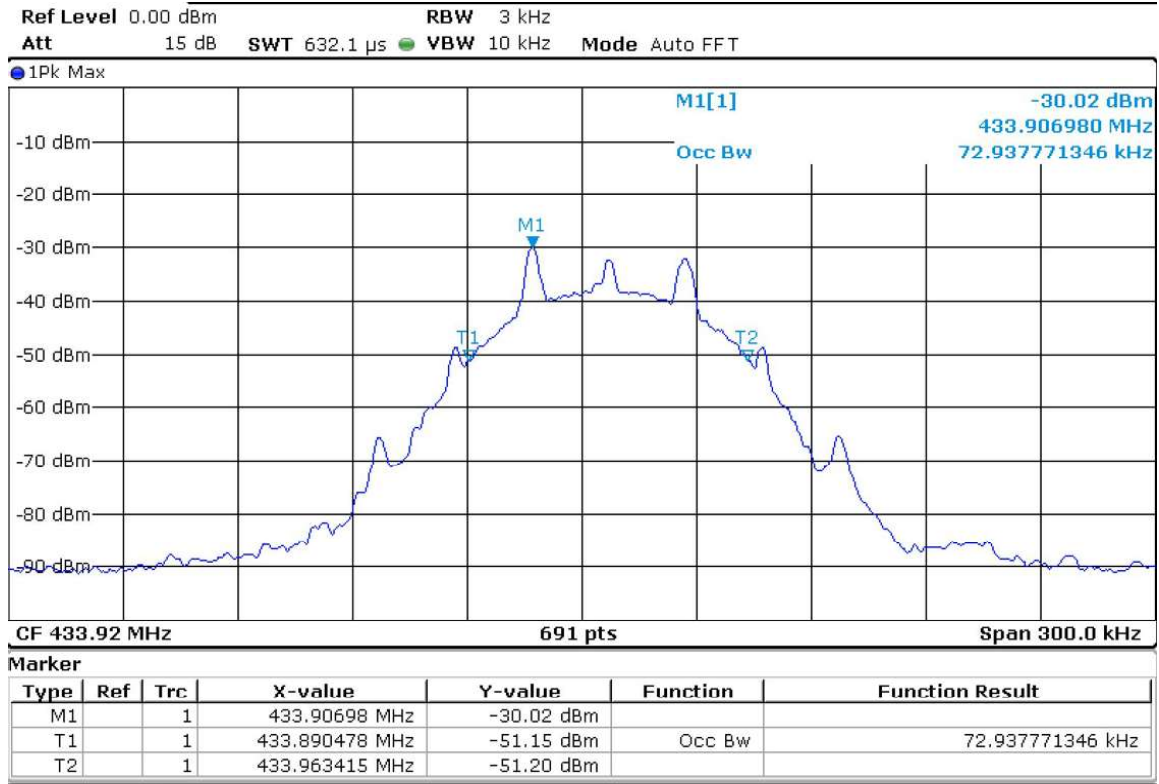
Test Setup

Date of testing	: 2022.11.11
Test environment	: Normal test conditions
Operational mode	: Mode A
Temperature	: 23°C
Relative humidity	: 56%
Atmospheric pressure	: 101.2 kPa

Figure 3: Test Results of 99% Bandwidth

Bandwidth (kHz)
72.94

Limit (kHz)
≤1085



4.1.5 Field strength of fundamental and Unwanted Emissions

Result:**Pass**

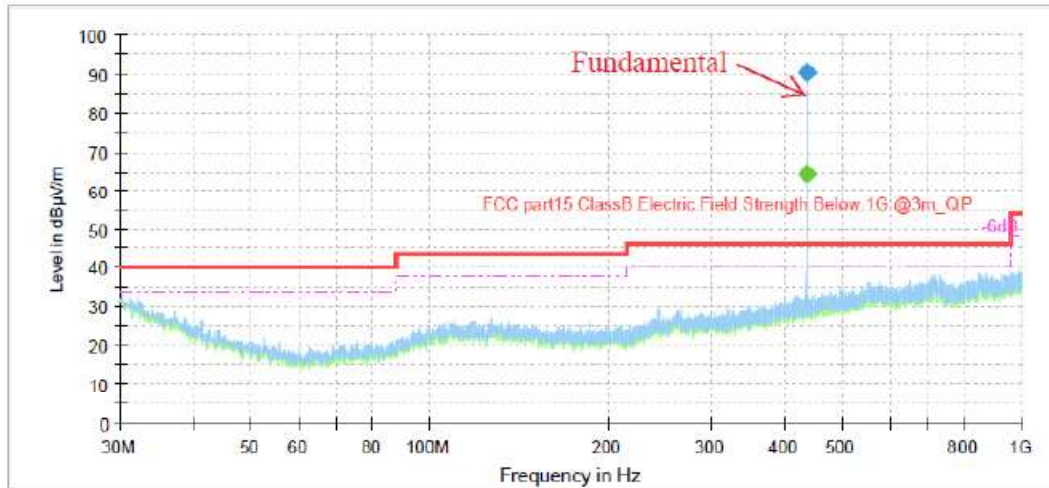
Test Specification	
Test standard	: FCC 47 CFR Part 15.231 CFR47 FCC Part 15.205 CFR47 FCC Part 15.209 RSS-210 Issue 10 RSS-Gen Issue 5
Basic standard	: ANSI C63.10: 2013
Test requirement	: CFR47 FCC Part 15.231 (b)(1)(2)(3) RSS-210 Issue 10, Annex A.1.2 RSS-Gen Issue 5, Clause 8.10
Limits	: CFR47 FCC Part 15.231 (b) RSS-210 Issue 10, Annex A.1.2 RSS-Gen Issue 5, Clause 8.9 & Clause 8.10
Test suite	: 3m Semi Anechoic Room

Test Setup

Date of testing	: 2022.11.22
Test environment	: Normal test conditions
Operational mode	: Mode A
Temperature	: 23°C
Relative humidity	: 56%
Atmospheric pressure	: 101.2 kPa

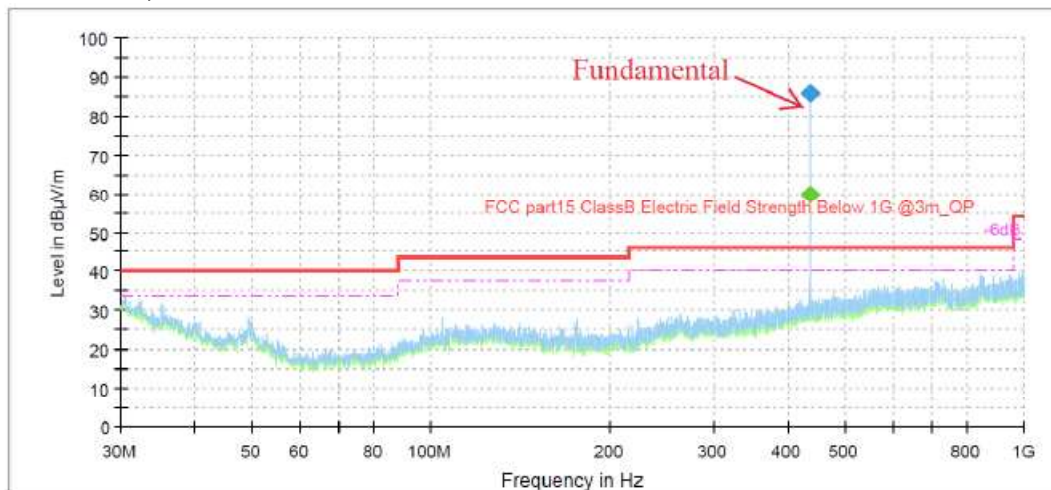
Figure 4: Field strength of fundamental

Fundamental, Horizontal


Final Result

Frequency (MHz)	MaxPeak (dBµV/m)	Average (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)
433.931111	90.51	---	100.83	10.32	1000.0	120.000	223.0	H	132.0
433.931111	---	64.28	80.83	16.55	1000.0	120.000	223.0	H	132.0

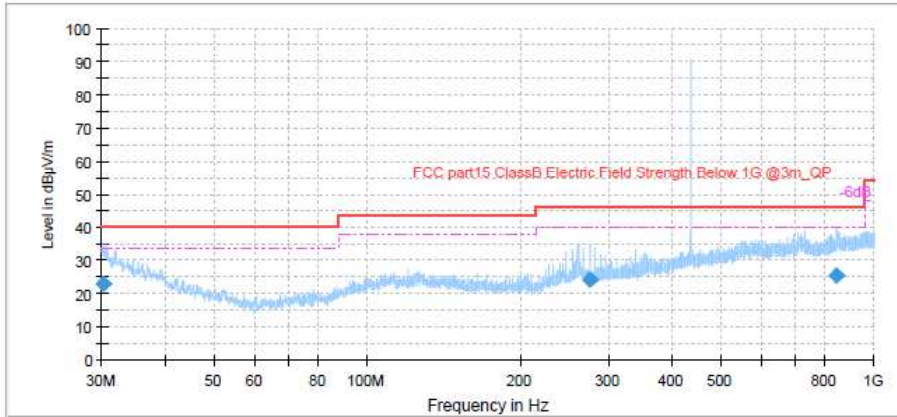
Fundamental, Vertical


Final Result

Frequency (MHz)	MaxPeak (dBµV/m)	Average (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)
433.931111	85.84	---	100.83	14.99	1000.0	120.000	217.0	V	327.0
433.931111	---	59.65	80.83	21.18	1000.0	120.000	217.0	V	327.0

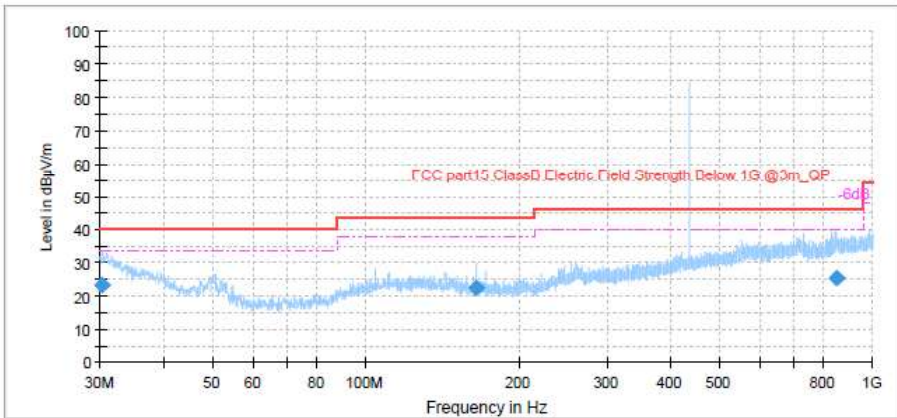
Figure 5: Spectral Diagrams, Radiated Spurious Emission

30MHz-1000MHz, Horizontal

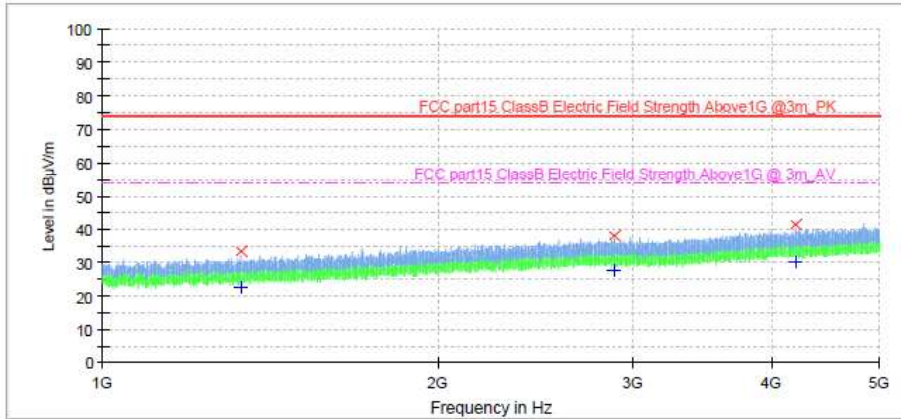

Final Result

Frequency (MHz)	QuasiPeak (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB)
30.223333	22.97	40.00	17.03	1000.0	120.000	245.0	H	10.0	25.8
274.703333	24.44	46.00	21.56	1000.0	120.000	126.0	H	34.0	20.3
844.633889	25.63	46.00	20.37	1000.0	120.000	150.0	H	68.0	29.4

30MHz-1000MHz, Vertical


Final Result

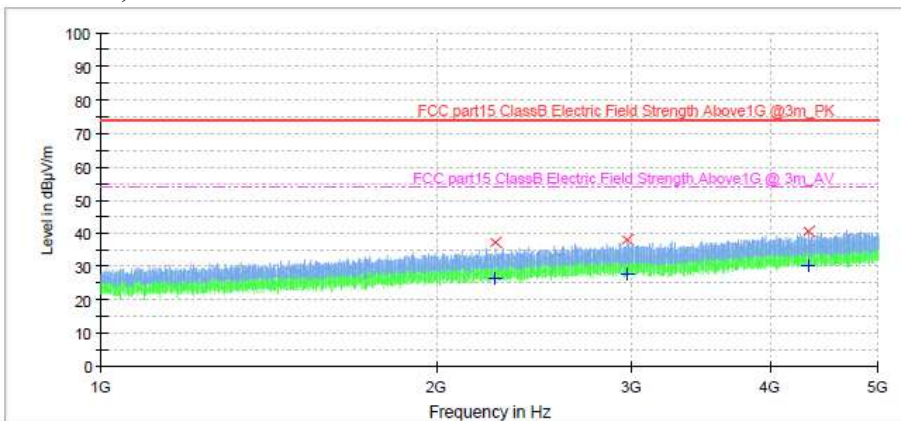
Frequency (MHz)	QuasiPeak (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB)
30.280000	23.27	40.00	16.73	1000.0	120.000	182.0	V	105.0	25.8
165.576667	22.61	43.50	20.89	1000.0	120.000	111.0	V	247.0	17.1
844.967778	25.66	46.00	20.34	1000.0	120.000	107.0	V	116.0	29.4

1GHz-5GHz, Horizontal

Limit and Margin-PK

Frequency (MHz)	MaxPeak (dBµV/m)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB)	Margin - PK+ (dB)	Limit - PK+ (dBµV/m)
1331.375000	33.5	1000.0	1000.000	200.0	H	0.0	-12.9	40.5	74.0
2883.375000	38.2	1000.0	1000.000	200.0	H	0.0	-4.3	35.8	74.0
4193.625000	41.3	1000.0	1000.000	200.0	H	0.0	-0.5	32.7	74.0

Limit and Margin-AV

Frequency (MHz)	Average (dBµV/m)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB)	Margin - AVG (dB)	Limit - AVG (dBµV/m)
1331.375000	22.5	1000.0	1000.000	200.0	H	0.0	-12.9	31.5	54.0
2883.375000	27.4	1000.0	1000.000	200.0	H	0.0	-4.3	26.6	54.0
4193.625000	30.2	1000.0	1000.000	200.0	H	0.0	-0.5	23.8	54.0

1GHz-5GHz, Vertical

Limit and Margin-PK

Frequency (MHz)	MaxPeak (dBµV/m)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB)	Margin - PK+ (dB)	Limit - PK+ (dBµV/m)
2259.000000	37.3	1000.0	1000.000	200.0	V	0.0	-7.4	36.7	74.0
2975.750000	38.2	1000.0	1000.000	200.0	V	0.0	-3.8	35.9	74.0
4324.000000	40.8	1000.0	1000.000	200.0	V	0.0	-0.2	33.2	74.0

Limit and Margin-AV

Frequency (MHz)	Average (dBµV/m)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB)	Margin - AVG (dB)	Limit - AVG (dBµV/m)
2259.000000	26.4	1000.0	1000.000	200.0	V	0.0	-7.4	27.6	54.0
2975.750000	27.7	1000.0	1000.000	200.0	V	0.0	-3.8	26.3	54.0
4324.000000	30.2	1000.0	1000.000	200.0	V	0.0	-0.2	23.8	54.0

4.2 Other Requirement & Test Suites

4.2.1 Mains Terminal Continuous Disturbance Voltage

Result:	Pass
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Date of testing	: 2023.01.13
Test procedure	: ANSI C63.4:2014 and CISPR 16-1 series standards
Frequency range	: 0.15 – 30MHz
Limits	: CFR47 FCC Part 15.207 RSS-Gen Issue 5
Kind of test site	: Shielding Room
Operation modes	: Mode B
Port	: Mains
Temp.& Humidity	: 21°C, 63%

The measurement setup was made according to ANSI C63.4:2014 in a shielded room.

The measurement equipment like test receivers, quasi-peak detector and artificial mains network (AMN) are in compliance with ANSI C63.4:2014 and CISPR 16-1 series standards.

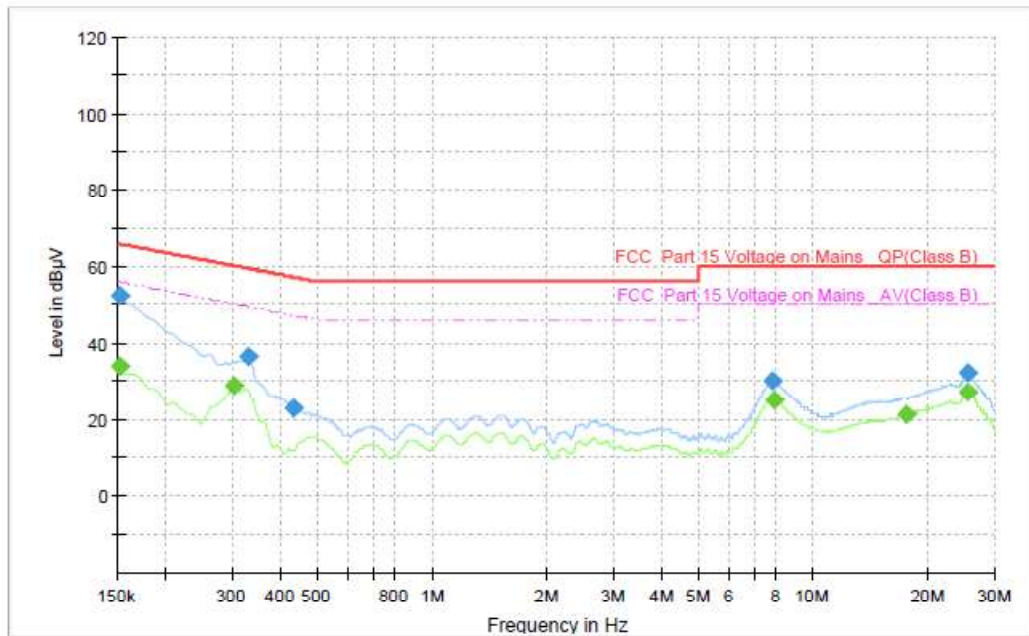
The tested object was set-up on a wooden table. The EUT was set 0.8m away from the AMN. The cord longer than necessary to be connected to the AMN was folded forth and back parallel so as to form a bundle with a length between 0.3m and 0.4m.

The disturbance voltage test was performed on the neutral line and phase line of the power supply of the EUT respectively.

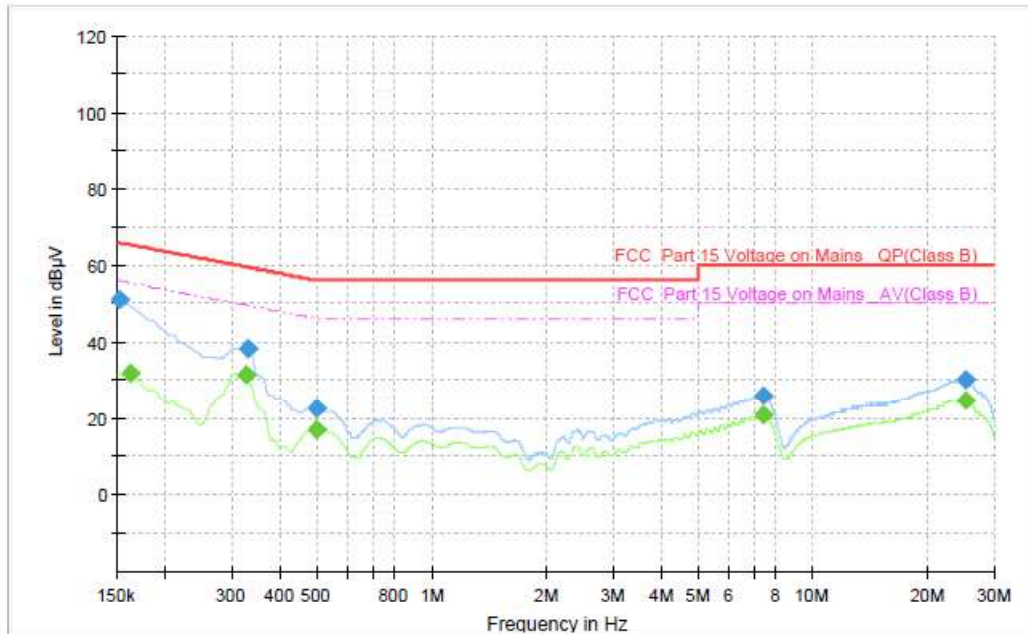
Before measurement, a survey was made to determine in which state the maximum disturbance was obtained. And the measurement was made in the state the maximum disturbance was obtained.

The following figures and tables were those measured by an automatic measuring system. Both Quasi Peak and Average Value were measured. Quasi-Peak and Average Value were measured and listed respectively where they had a maximum in previous scanning survey. In the Figures, “◆” means Quasi-Peak Value and Average Value which were measured in final measurement.

The measurement result is calculated based on the following formula by the test software:
Emission Level = Reading level + Correction (LISN factor + cable loss)

Figure 6: Spectral Diagrams, Conducted Emission, 150KHz - 30MHz, L

Final Result

Frequency (MHz)	QuasiPeak (dBµV)	CAverage (dBµV)	Limit (dBµV)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Line	Filter	Corr. (dB)
0.152250	---	34.07	55.88	21.81	1000.0	9.000	L1	ON	10.2
0.152250	52.17	---	65.88	13.71	1000.0	9.000	L1	ON	10.2
0.300750	---	29.00	50.22	21.22	1000.0	9.000	L1	ON	10.2
0.327750	36.53	---	59.51	22.98	1000.0	9.000	L1	ON	10.2
0.433500	22.89	---	57.19	34.30	1000.0	9.000	L1	ON	10.2
7.836000	30.07	---	60.00	29.93	1000.0	9.000	L1	ON	10.5
7.883250	---	25.15	50.00	24.85	1000.0	9.000	L1	ON	10.5
17.553750	---	20.95	50.00	29.05	1000.0	9.000	L1	ON	10.4
25.334250	32.38	---	60.00	27.62	1000.0	9.000	L1	ON	10.2
25.422000	---	27.04	50.00	22.96	1000.0	9.000	L1	ON	10.2

Figure 7: Spectral Diagrams, Conducted Emission, 150KHz - 30MHz, N

Final Result

Frequency (MHz)	QuasiPeak (dBµV)	CAverage (dBµV)	Limit (dBµV)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Line	Filter	Corr. (dB)
0.152250	51.09	---	65.88	14.79	1000.0	9.000	N	ON	10.2
0.161250	---	31.97	55.40	23.43	1000.0	9.000	N	ON	10.2
0.325500	---	31.57	49.57	18.00	1000.0	9.000	N	ON	10.2
0.327750	38.10	---	59.51	21.41	1000.0	9.000	N	ON	10.2
0.496500	22.28	---	56.06	33.78	1000.0	9.000	N	ON	10.3
0.498750	---	16.67	46.02	29.35	1000.0	9.000	N	ON	10.3
7.379250	25.67	---	60.00	34.33	1000.0	9.000	N	ON	10.5
7.424250	---	20.73	50.00	29.27	1000.0	9.000	N	ON	10.5
25.156500	---	24.69	50.00	25.31	1000.0	9.000	N	ON	10.2
25.253250	29.98	---	60.00	30.02	1000.0	9.000	N	ON	10.2

4.2.2 Radiated disturbance

Result:	Pass
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Date of testing	: 2022.11.22
Test procedure	: ANSI C63.4:2014 and CISPR 16-1 series standards
Frequency range	: 30MHz-1000MHz
Limits	: Quasi-peak limits (3m test distance): FCC Part15, Subpart B:2021 30-88MHz, 40dB μ V/m; 88-216MHz, 43.5dB μ V/m; 216-960MHz, 46dB μ V/m; Above 960MHz, 54dB μ V/m. ICES-003 Issue 7:2020 30-88MHz, 40dB μ V/m; 88-216MHz, 43.5dB μ V/m; 216-230MHz, 46dB μ V/m; 230-960MHz, 47dB μ V/m; Above 960MHz, 54dB μ V/m.
Kind of test site	: Semi-anechoic chamber
Operation modes	: Mode B
Temp.& Humidity	: 23°C, 56%

The radiated disturbance test was carried out in a semi-anechoic chamber. The test distance from the receiving antenna to the EUT is 3m. The normalized site attenuation of the semi-anechoic chamber is regularly calibrated to ensure the radiated disturbance test results are valid. During the test, the EUT was placed on a wooden table, which is 0.8m high. The wooden table was rotated 360° around and the antenna was varied from 1m to 4m to find the maximum disturbance. The test was performed with the antenna both in its horizontal and vertical polarizations.

According to the clause 15.33 “Frequency range of radiated measurements” of FCC Part 15, Subpart B:2021, the highest frequency in the EUT is below 108 MHz, therefore the EUT’s upper frequency of measurement range is 1000MHz.

The following figures and tables were those measured by an automatic measurement system. A preview test was firstly performed with peak detector. The final test was performed with quasi-peak at those critical frequencies during the preview test. In the following figures, “◆” mean final measurement results with quasi-peak detector.

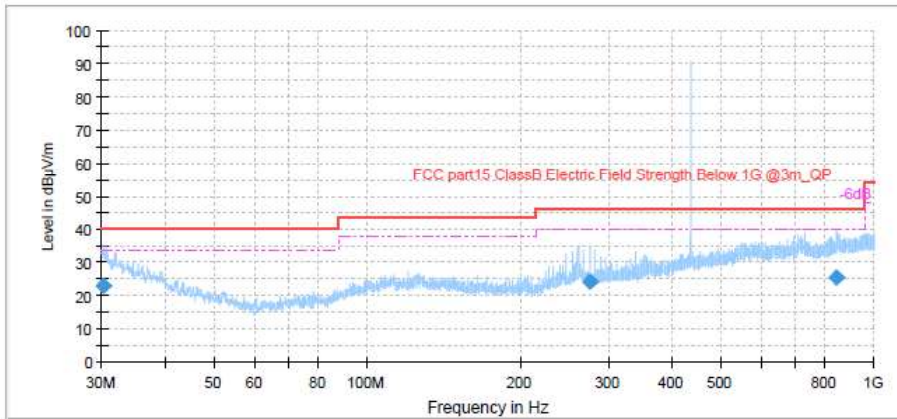
Before measurement, a survey was made to determine in which state the maximum disturbance was obtained. And the measurement was made in the state the maximum disturbance was obtained.

The following figures were those measured and recorded by a test receiver. Peak Value were measured and listed respectively where they had a maximum in previous scanning survey. In the Figures, “◆” means Quasi-Peak Value which were measured in final measurement.

The measurement result is calculated based on the following formula by the test software:
 Emission Level = Reading level + Correction (Antenna factor + Cable loss - preamplifier factor (if used))

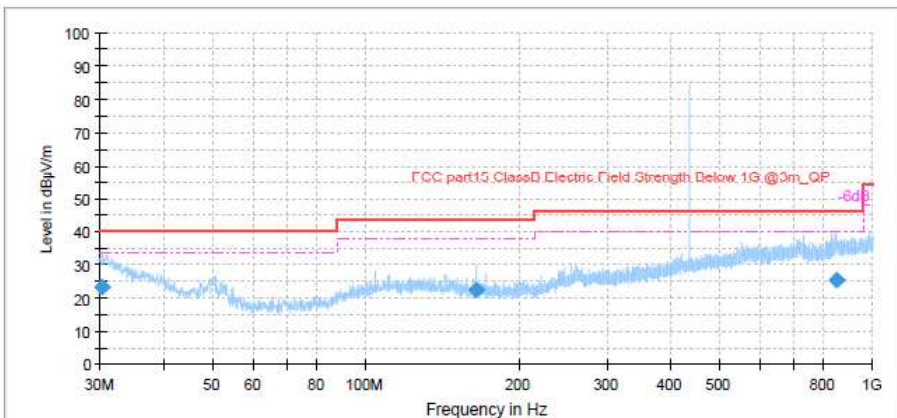
Figure 8: Spectral Diagrams, Radiated disturbance

30MHz-1000MHz, Horizontal


Final Result

Frequency (MHz)	QuasiPeak (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB)
30.223333	22.97	40.00	17.03	1000.0	120.000	245.0	H	10.0	25.8
274.703333	24.44	46.00	21.56	1000.0	120.000	126.0	H	34.0	20.3
844.633889	25.63	46.00	20.37	1000.0	120.000	150.0	H	68.0	29.4

30MHz-1000MHz, Vertical


Final Result

Frequency (MHz)	QuasiPeak (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB)
30.280000	23.27	40.00	16.73	1000.0	120.000	182.0	V	105.0	25.8
165.576667	22.61	43.50	20.89	1000.0	120.000	111.0	V	247.0	17.1
844.967778	25.66	46.00	20.34	1000.0	120.000	107.0	V	116.0	29.4

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