

File Number **22/36404855****TEST REPORT**
FCC/ICES Test Report**Petitioner's Reference: APTIV**

Customer Address : Aptiv Services Poland S.A., ul. Podgórk Tynieckie 2,
30-399 Kraków, Polska
Kinga Stawicka-Wibowo

Received material: RSA (Remote Start Antenna)

Brand:	APTIV	Model:	M#: ST2-RX434UDA
s/n:	1501220102397984	Applus Id:	9819-00001

Result: complies

It has been tested and complies the standard specifications Applicable / s.
See specifications applied on page 7.

Applicable Standards

Emission standard/s: **FCC 47 CFR Part 15 Subpart B (October 2021)¹**
¹The latest modifications of the standard, published at the date of the tests reported in this document, have been considered

ICES-003 Issue 7 – 2020 (updated October 2020)**Date of issue:** Bellaterra, Novembre 07, 2022

Luis Guardiola Echevarría
EMC & Wireless Technical Manager
Electrical and Electronics
LGAi Technological Center S.A.

The results refer only and exclusively to the sample, product or material delivered for testing in "Received Material" section below. The equipment has been tested under conditions stipulated by standard(s) quoted in this document.
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This is the first page of the document, which consists of 18 pages.

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1. EQUIPMENT RECEIVED AND TESTED

EQUIPMENT SPECIFICATIONS:

Brand:	APTIV	Model:	M#: ST2-RX434UDA
s/n:	1501220102397984	Power Supply:	12 V _{DC}
HW Version	1.0	SW Version	3.23
		FCC ID:	L2CST2
Maximum internal frequency:	434 MHz		

Equipment information:

(Information declared by the manufacturer, Applus+ is not responsible)

The Remote Start Antenna integrates the Remote Keyless Entry (RKE), Tire Pressure Monitoring System (TPMS) and Passive Entry/Passive Start (PEPS) Ultra High Frequency (UHF) communication processing into a single module that is a node on the vehicle MS-CAN network and communicates directly with the Body Control Module (BCM) via Lin.

RF FEATURES:

--

Test product reception:	2022-09-23
Test initial date:	2022-09-30
Test final date:	2022-09-30

1.1. Test configuration

Power Supply:	12 VDC
Set-up:	Table-top
Test exercise:	The DUT is supplied at 12 VDC and it is programmed to enable all functions at the same time. Have the homologation test SW installed keeping the parts in a continuous RX mode when power and ground is attached.
Equipment size:	52 mm x 35 mm x 98.5 mm

1.2. Auxiliary and control equipment

The equipment under test does not have any auxiliary or control equipment.

1.3. Input/output wires

- Power supply wires shorter than 3 m.

1.4. Modification performed

No modifications were performed.

2. APPLICABLE STANDARDS

2.1. TEST APPLICABLE STANDARDS

Standard: ANSI C63.4:2014 and ICES-003 issue 7

Basic standard: ANSI C63.4:2014

☒ Radio-frequency radiated emissions (30 MHz – 6 GHz)¹ : FCC Part 15.109, ICES-003 Issue 7(3.2.2)
¹Upper limit according to the fifth harmonic of the maximum internal frequency declared by the manufacturer or to 40 GHz, whichever is lower.

Basic standard: ANSI C63.4:2014

☐ Power line conducted emissions (150 kHz – 30 MHz): FCC Part 15.107, ICES-003 Issue 7(3.2.1)

Note: The EUT is supplied at DC voltage to automotive battery. Therefore, the Power line conducted emission test not apply.

2.1.1. Acceptance criteria for the test

According to standard **FCC 47 CFR Part 15 Subpart B and ICES-003 Issue 7**

2.1.2. Test facilities ID

FCC Test Firm Registration Number:	507478
ISED Assigned Code:	5766A

2.1.3. Competences and Guarantees

LGAI Technological Center, S.A. is a testing laboratory accredited by the National Accreditation Body (ENAC -Entidad Nacional de Acreditación), to perform the tests indicated in the Certificate No. 9/LE894. In order to assure the traceability to other national and international laboratories, Applus+ Laboratories has a calibration and maintenance program for its measurement equipment.

Applus+ Laboratories guarantees the reliability of the data presented in this report, which is the result of the measurements and the tests performed to the item under test on the date and under the conditions stated on the report and, it is based on the knowledge and technical facilities available at Applus+ Laboratories at the time of performance of the test.

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2.1.4. Measuring uncertainties

Radio-frequency radiated emissions:

± 4.30 dB

Expanded uncertainty measurement is obtained multiplying the typical uncertainty measurement with a coverage factor $k=2$, which corresponds to a confidence level of 95% for a normal distribution.

2.2. Used Equipment

RADIO-FREQUENCY RADIATED EMISSIONS (SAC0)					
EQUIPMENT	BRAND	MODEL	NUMBER	LAST CALIBRATION	NEXT CALIBRATION
EMI TEST RECEIVER	ROHDE & SCHWARZ	ESU 40	1041155	30/12/2021	30/12/2022
EMI TEST RECEIVER	ROHDE & SCHWARZ	ESW26	1042124	18/05/2021	18/11/2022
TRILOG ANTENNA	SCHWARZBECK	VULB 9161 SE	1041996	11/06/2021	11/06/2023
ANTENNA	SCHWARZBECK MESS-ELEKTRONIK	VULB9165	104375	--	--
ATTENUATOR 3DB	HUBER/SUHNER	6803.17.B	1042016	15/02/2022	15/02/2023
RF CABLE (FERRITES CABLE)	HUBER/SUHNER	SF104 WITH FERRITE	1042527	20/06/2022	20/06/2023
RF CABLE	HUBER/SUHNER	TL-8A-11N-11N-01500-51	1042588	10/06/2022	10/06/2023
RF PREAMPLIFIER	BONN ELEKTRONIK	BLNA 0110-01N	1041351	20/07/2022	20/07/2023
RF CABLE (SHORT CABLE)	REDISLOGAR	SF104	1042328	28/10/2021	28/10/2022
RF CABLE (WALL PANEL)	-	-	1041305	16/02/2022	16/02/2023
RF CABLE (CONTROL ROOM)	HUBER/SUHNER	SF104/11N/16N/4000	1042583	20/06/2022	20/06/2023
ANTENNA TOWER	MATURO			--	--
TURNABLE	MATURO			--	--
DC BLOCK	WEINSCHEL	WA6043	1042577	10/06/2022	10/06/2023
DC BLOCK	WEINSCHEL	WA6043	1042486	09/12/2021	09/12/2022
HORN ANTENNA	EMCO	3115	05-ER-017	20/10/2021	20/10/2022
HORN ANTENNA	EMCO	3115	05-ER-182	04/11/2021	04/11/2022
LOG ANTENNA	ROHDE & SCHWARZ	HL050	1042575	28/06/2021	28/06/2023
RF CABLE	HUBER/SUHNER	SUCOFLEX 106	1041415	15/02/2022	15/02/2023.
RF CABLE	ASTROLAB	32026-29094-29094-24TC	1041566	22/12/2021	22/12/2022
RF CABLE	HUBER/SUHNER	SF106/11N/11N/	1041903	16/05/2022	16/05/2023
RF PREAMPLIFIER	BONN ELEKTRONIK	BLNA 0118-M	1041733	16/03/2022	16/03/2023
MAST-TABLE CONTROLLER	MATURO	NCD/052/8931211	1041952	--	--
SEMIANECHOIC CHAMBER SAC0	TDK	TC0	104380	19/07/2021	19/07/2023
TEST SOFTWARE	ROHDE & SCHWARZ	EMC32 v.10.50.00	104624	--	--

AUXILIARY EQUIPMENT					
EQUIPMENT	BRAND	MODEL	NUMBER	LAST CALIBRATION	NEXT CALIBRATION
THERMO-HIGROMETER	PCE	THB 40	1042022	05/10/2021	05/10/2022

2.3. Environmental conditions

See results sheets

3. RESULT

PRODUCT:			
Brand:	APTIV	Model:	M#: ST2-RX434UDA
s/n:	1501220102397984	Internal Id:	9819-00001
Class:	B		
TESTING		RESULTS	NOTES
Radio-frequency radiated emissions. (FCC Part 15.109, ICES-003 Issue 7 (3.2.2))		Pass	Note: 4
Power Line conducted emissions. (FCC Part 15.107, ICES-003 Issue 7 (3.2.1))		N/A	Note: N/A
The criteria to give conformity in those cases where it is not implicit in the standard or specification will be, for EMC emissions tests, a non-simple binary decision rule will be followed with a safety zone equal to the value of the uncertainty (w = U). In this case, the upper limit of the value of the probability of false acceptance, according to ILAC G8, is 2.5% and the criteria notes are:			
1: The measured results are above the upper limit, even considering the uncertainty interval.			
2: The measured results are above the specified limits, but within the uncertainty interval. It is therefore not possible to state compliance based on the 95% level of confidence. However, the results indicate that non-compliance is more probable than compliance			
3: The measured results are below the specified limits, but within the uncertainty interval. It is therefore not possible to state compliance based on the 95% level of confidence. However, the results indicate that compliance is more probable than non-compliance			
4: The measured results are within the limits, including the uncertainty interval.			

Service Quality Assurance

Applus+, guarantees that this work has been made in accordance with our Quality and Sustainability System, fulfilling the contractual conditions and legal norms.

Within our improvement program we would be grateful if you would send us any commentary that you consider opportune, to the person in charge who signs this document, or to the Quality Manager of Applus+, in the following e-mail address:

satisfaccion.cliente@applus.com

4. ANNEXES

4.1 Test Results

4.1.1 Radio-frequency radiated emissions

Test Procedures:

The test site, 3 or 10 m semi-anechoic chamber, has met the requirement of NSA tolerance 4 dB according to the standards: ANSI C63.4-2014

The radiated measurements are performed in vertical and horizontal plane in the frequency range from 30 MHz to 1 GHz in semi-anechoic chambers. The receiving antennas are conform to specifications ANSI C63. These antennas can be moved over the height range between 1.0 m and 4.0 m in order to search for maximum field strength emitted from EUT. The measurement distances between EUT and receiving antennas are indicated in the test setups for the various frequency ranges. For each measurement, the EUT is rotated in all three axes until the maximum field strength is received.

EMI Receiver configuration:

During the radiated emission test, the EMI receiver was set with the following configurations:

Frequency band (MHz)	Function	Resolution Bandwidth	Video Bandwidth
30 to 1000	QP	120 kHz	300 kHz
Above 1000	Peak	1 MHz	3 MHz
	Average	1 MHz	10 Hz

Pre-measurement

- The turntable rotates from 0° to 315° using 45° steps
- The antenna is polarized vertical and horizontal
- The antenna height changes from 1 m to 4 m
- At each turntable position, antenna polarization and height the receiver finds the maximum of all emissions

Final measurement

- The final measurement is performed for at least six highest peaks according to the requirements of the ANSI C63.4
- Based on antenna and turntable positions at which the peak values are measured the software maximize the peaks by changing turntable position 360 ° and antenna height between 1 and 4 m
- The final measurement is done with quasi-peak detector (as described in ANSI C63.4) for 30MHz to 1GHz emissions test
- The final measurement is done in the position (azimuth, height and antenna polarization) causing the highest emissions with Peak and RMS detector (as described in ANSI C63.4) for 1GHz to 18GHz test
- Final levels, frequency, measuring time, bandwidth, antenna height, antenna polarization, turntable angle, correction factors, margin to the limit and limit are recorded. A plot with the graph of the premeasurement with marked maximum final results and the limit is shown

Correction Factor:

Emission Level = Read Level + Corrections (Ant.Factor + Cable Loss – Ampli.Gain (if applies) + Attenuator (if applies))

Limits:

According to FCC Part 15.109:

- Limits of Radiated Emission Measurement (Below 1000 MHz)

Frequency (MHz)	Class B (dB μ V/m) (at 3 m)
	QuasiPeak
30 – 88	40
88 – 216	43.5
216 – 960	46
960 – 1000	54

Frequency (MHz)	Class A (dB μ V/m) (at 10 m)
	QuasiPeak
30 – 88	39
88 – 216	43.5
216 – 960	46.4
960 – 1000	49.5

- Limits of Radiated Emission Measurement (Above 1000 MHz)

Frequency (MHz)	Class B (dB μ V/m) (at 3 m)	
	Peak	Average
Above 1000	74	54

Frequency (MHz)	Class A (dB μ V/m) (at 10 m)	
	Peak	Average
Above 1000	69.5	49.5

According to ICES-003 Issue 7 (3.2.2):

- Limits of Radiated Emission Measurement (Below 1000 MHz)

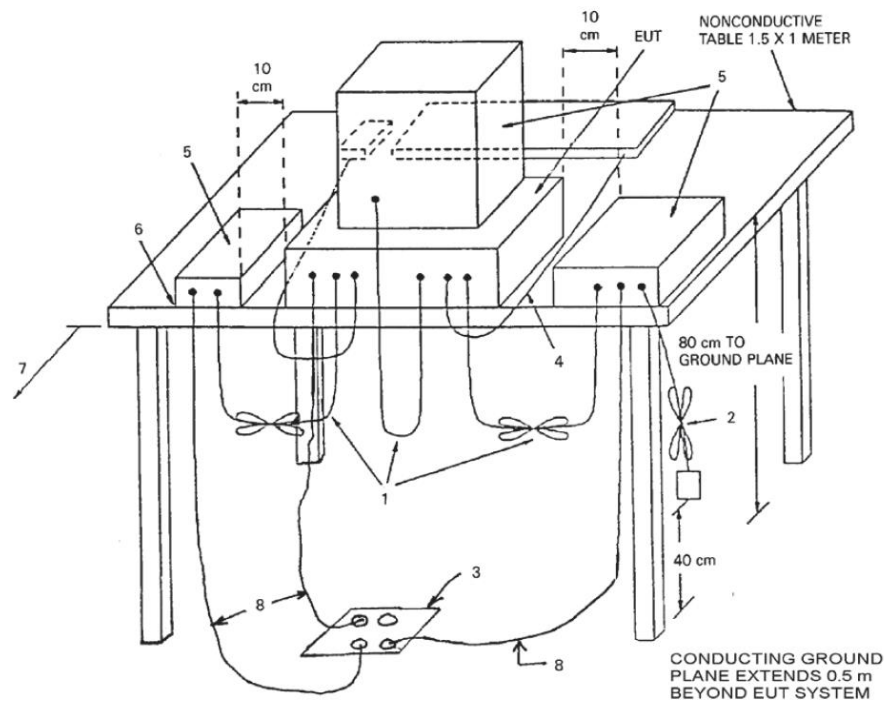
Frequency range (MHz)	Class A (3 m) Quasi-peak (dB μ V/m)	Class A (10 m) Quasi-peak (dB μ V/m)	Class B (3 m) Quasi-peak (dB μ V/m)	Class B (10 m) Quasi-peak (dB μ V/m)
30 – 88	50.0	40.0	40.0	30.0
88 – 216	54.0	43.5	43.5	33.1
216 – 230	56.9	46.4	46.0	35.6
230 – 960	57.0	47.0	47.0	37.0
960 – 1000	60.0	49.5	54.0	43.5

- Limits of Radiated Emission Measurement (Above 1000 MHz)

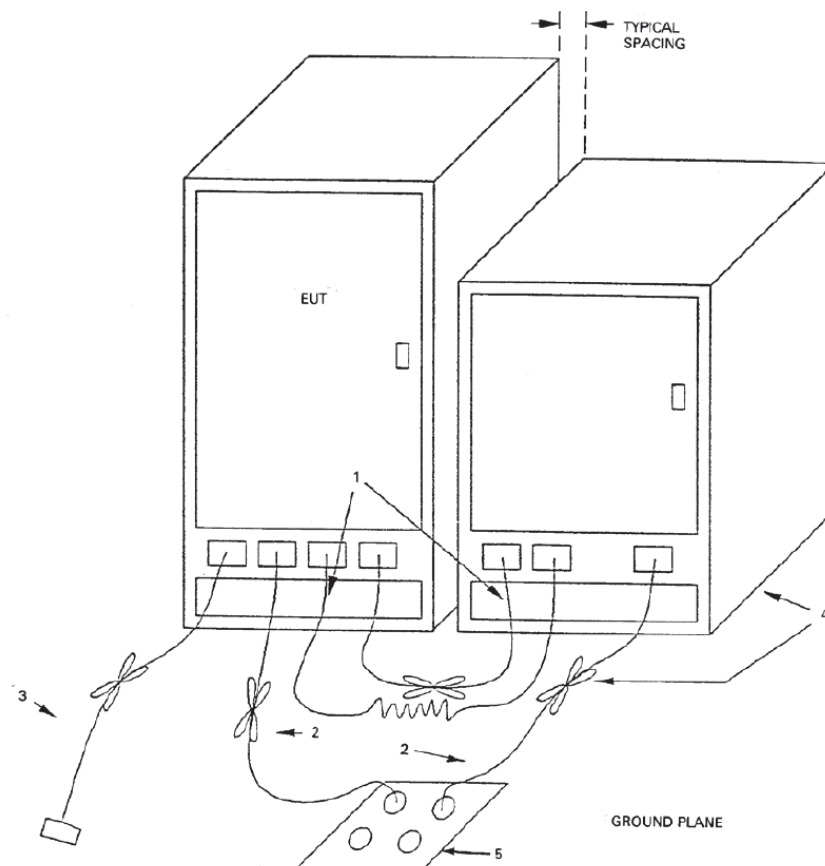
Frequency range (GHz)	Class A (3 m) Average dB(μ V/m)	Class A (3 m) Peak dB(μ V/m)	Class B (3 m) Average dB(μ V/m)	Class B (3 m) Peak dB(μ V/m)
1 - 26	60	80	54	74

If using a different measurement distance, the measured levels shall be extrapolated using a factor of 20 dB per decade of distance. The measurement distance shall place the measurement antenna in the far field of the ITE or digital apparatus under test.

Test Setup (depending on the EUT arrangement):



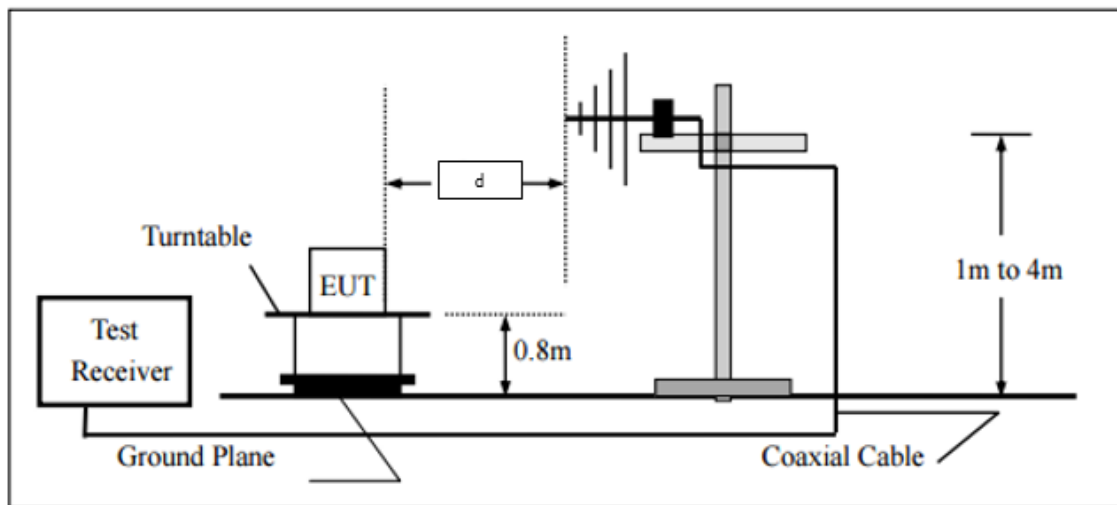
Radio-frequency radiated emissions of tabletop equipment.



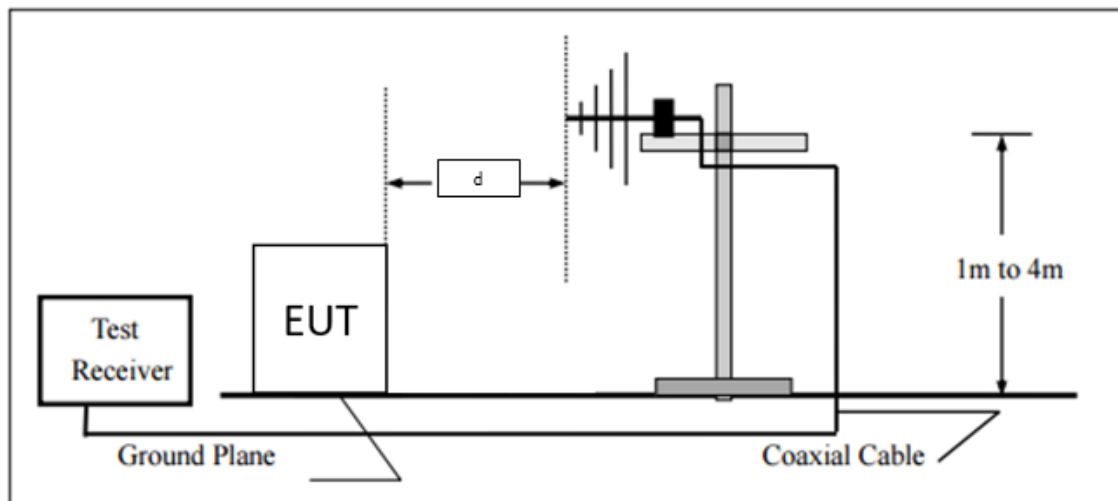
Radio-frequency radiated emissions of floor-standing equipment.

Test Configuration (depending on the EUT arrangement):

- **For radiated emissions from 30 MHz to 1000 MHz:**



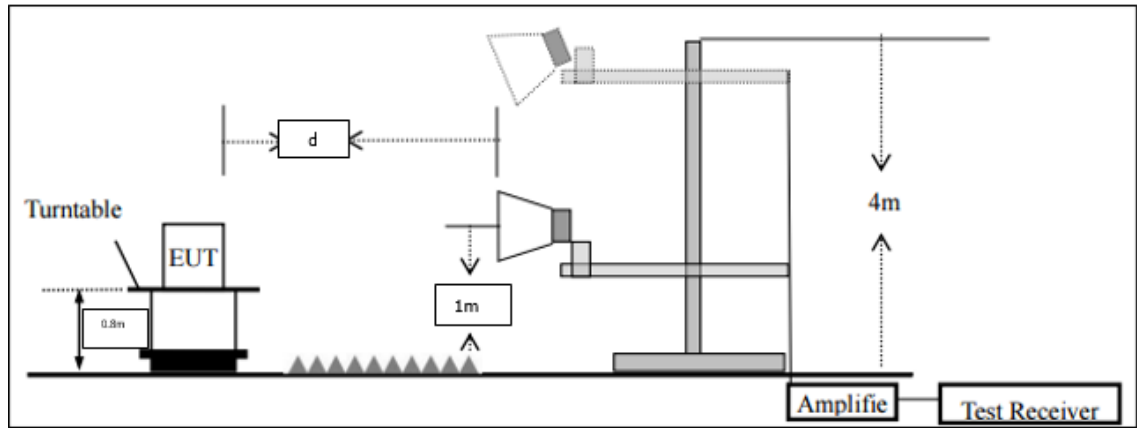
Radio-frequency radiated emissions of tabletop equipment.



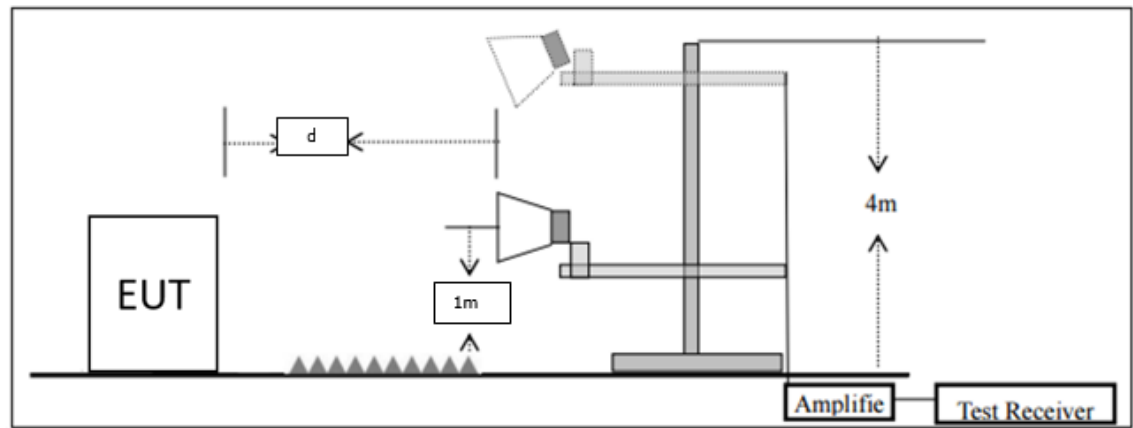
Radio-frequency radiated emissions of floor-standing equipment.

Distance "d" depends on test chamber.

- **For radiated emissions above 1000 MHz:**



Radio-frequency radiated emissions of tabletop equipment.



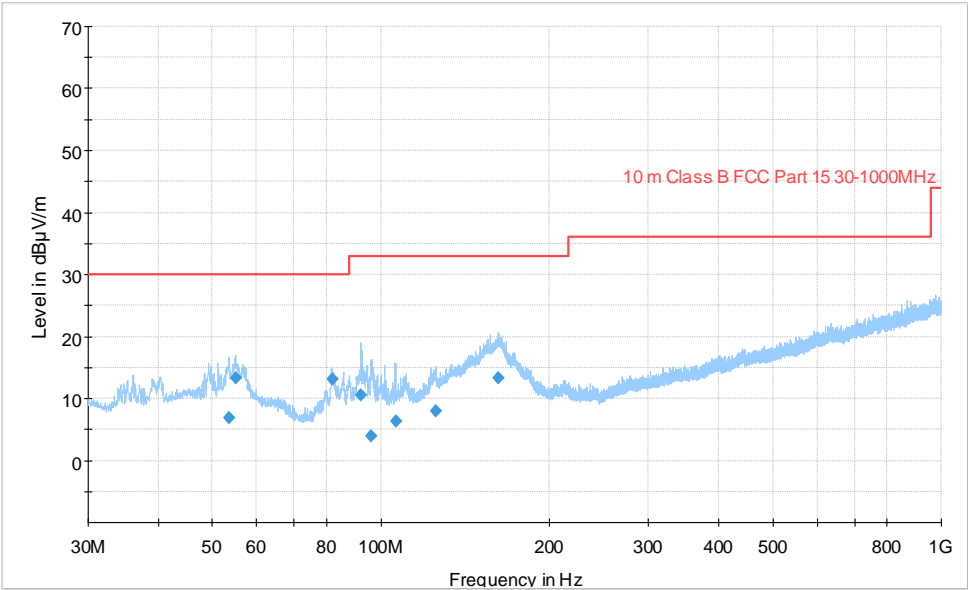
Radio-frequency radiated emissions of floor-standing equipment.

Distance "d" depends on test chamber.

RADIO-FREQUENCY RADIATED EMISSIONS (below 1 GHz)														
Technician: Alfredo Plans			Frequency range: 30 MHz – 1 GHz											
Test date: 2022-09-30														
Basic standard: ANSI C63.4:2014														
<table border="1"> <tr> <td>Temperature:</td> <td>22.7</td> <td>°C</td> </tr> <tr> <td>Humidity:</td> <td>49.5</td> <td>%</td> </tr> <tr> <td>Atm. Pressure:</td> <td>1004.8</td> <td>hPa</td> </tr> </table>						Temperature:	22.7	°C	Humidity:	49.5	%	Atm. Pressure:	1004.8	hPa
Temperature:	22.7	°C												
Humidity:	49.5	%												
Atm. Pressure:	1004.8	hPa												
EUT:	Class	Test Area	Distance	PreScan	Evaluation									
Table Top	B	SAC0	10 m (30 MHz – 1 GHz)	8 faces (45° step)	Individual									
RESULTS: Pass														
Identification		Emissions		Main emission source and type										
DUT: Device under test BB: Broadband NB: Narrowband SPU: Spurs QP: Quasi-peak U: Uncertainty		QP < Limit - I		EBP, NB										
Comments														

RADIO-FREQUENCY RADIATED EMISSIONS (below 1 GHz)

PRESCAN 30 MHz – 1 GHz



Preview Result 1-PK+ 10 m Class B FCC Part 15 30-1000MHz Final_Result QPK

FINAL MEASUREMENTS

Frequency (MHz)	QuasiPeak (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB/m)
53.520000	6.86	30.00	23.14	106.0	V	346.0	-27.5
54.930000	13.35	30.00	16.65	339.0	V	214.0	-25.2
81.960000	13.11	30.00	16.89	172.0	V	202.0	-30.9
92.010000	10.49	33.00	22.51	172.0	V	244.0	-28.9
95.880000	3.90	33.00	29.10	269.0	V	337.0	-28.4
106.110000	6.32	33.00	26.68	288.0	V	85.0	-28.1
125.100000	7.99	33.00	25.01	147.0	V	2.0	-25.7
161.730000	13.29	33.00	19.71	382.0	V	251.0	-18.3

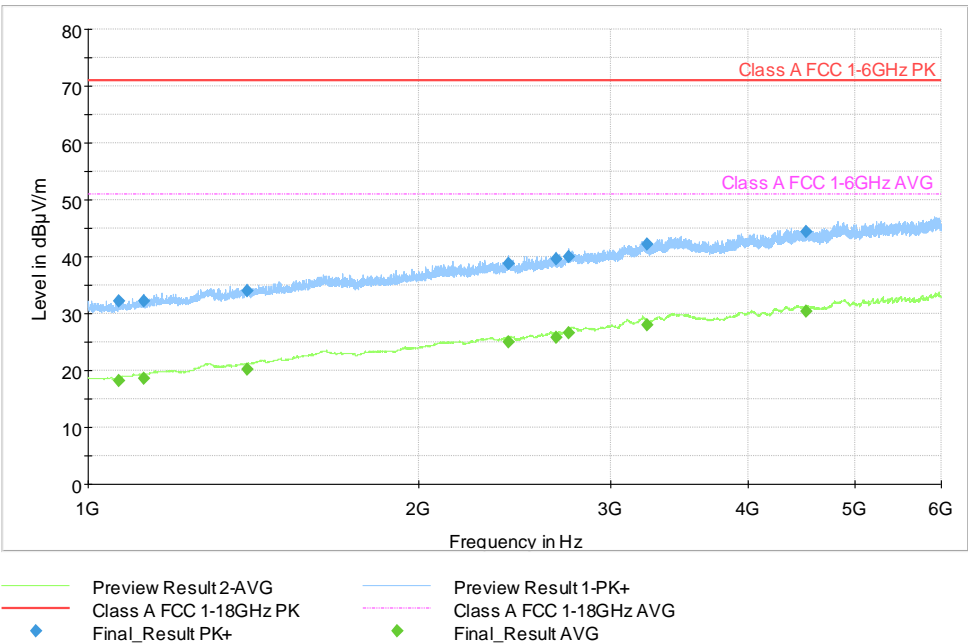
Comments:

Emission Level = Read Level + Corrections (Ant.Factor + Cable Loss – Ampli.Gain + Attenuator)

RADIO-FREQUENCY RADIATED EMISSIONS (above 1 GHz)														
Technician: Alfredo Plans			Frequency range: 1 GHz – 6 GHz											
Test date: 2022-09-30														
Basic standard: ANSI C63.4:2014														
<table border="1"><tr><td>Temperature:</td><td>22.8</td><td>°C</td></tr><tr><td>Humidity:</td><td>47.9</td><td>%</td></tr><tr><td>Atm. Pressure:</td><td>1004.5</td><td>hPa</td></tr></table>						Temperature:	22.8	°C	Humidity:	47.9	%	Atm. Pressure:	1004.5	hPa
Temperature:	22.8	°C												
Humidity:	47.9	%												
Atm. Pressure:	1004.5	hPa												
EUT:	Class	Test Area	Distance	PreScan	Evaluation									
Table-Top	B	SAC0	8.5 m (1 GHz – 6 GHz)	8 faces (45° step)	Individual									
RESULTS: Pass														
Identification		Emissions		Main emission source and type										
DUT: Device under test BB: Broadband NB: Narrowband SPU: Spurs QP: Quasi-peak U: Uncertainty		QP < Limit - I		EBP, NB										
Comments														

RADIO-FREQUENCY RADIATED EMISSIONS (above 1 GHz)

PRESCAN 1 GHz – 6 GHz



FINAL MEASUREMENTS

Frequency (MHz)	MaxPeak (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Average (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB/m)
1066.500	32.19	71.00	38.81	18.13	51.00	32.87	147.0	V	167.0	-27.8
1125.500	32.11	71.00	38.90	18.55	51.00	32.45	268.0	V	121.0	-27.4
1395.000	34.06	71.00	36.94	20.16	51.00	30.84	241.0	V	203.0	-25.2
2416.000	38.80	71.00	32.20	25.09	51.00	25.91	230.0	V	186.0	-19.1
2670.500	39.57	71.00	31.43	25.84	51.00	25.16	237.0	V	266.0	-17.9
2743.250	40.00	71.00	31.01	26.56	51.00	24.44	100.0	V	225.0	-17.2
3233.000	42.17	71.00	28.83	28.10	51.00	22.90	162.0	H	230.0	-15.2
4517.000	44.48	71.00	26.52	30.47	51.00	20.53	151.0	V	260.0	-11.6

Comments:

Emission Level = Read Level + Corrections (Ant.Factor + Cable Loss – Ampli.Gain (+ Attenuator))

Note: radiated emissions from 1 GHz to 6 GHz has been done at 8.5 meters of distance from EUT to antenna. The limits has been modified according to the standard using the following formula: $L_2 = L_1 + 20\log(d_1/d_2)$, where:

L_2 : New limit

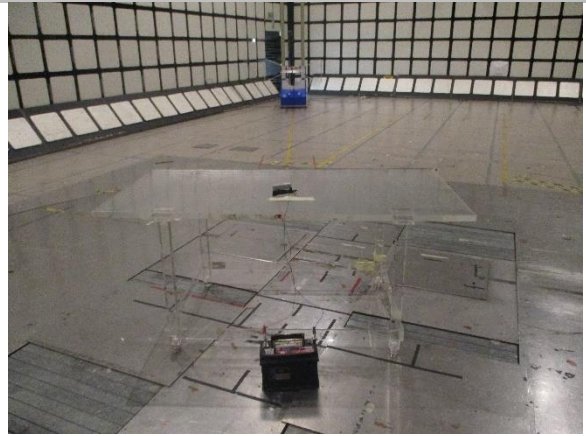
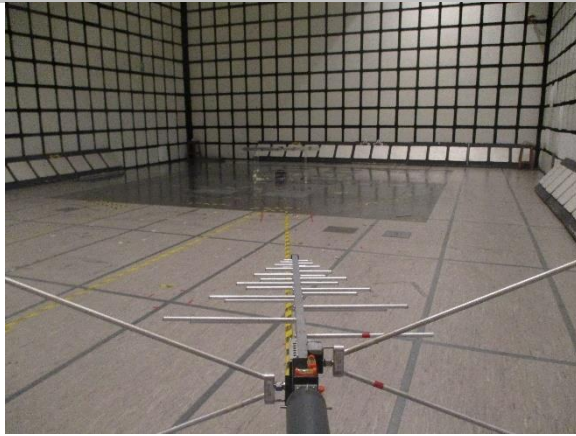
L_1 : Limit at 3 meters

d_1 : 3 meters (standard distance)

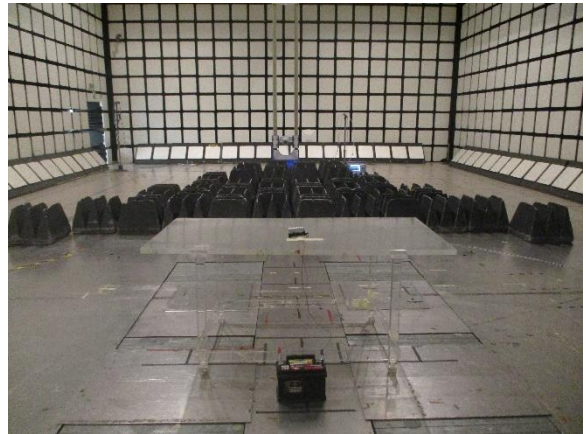
d_2 : 8.5 meters (new measurement distance)

4.2. Test Setup Configuration

From file number: 22/36404855



Radio-frequency radiated emissions 30 MHz to 1 GHz



Radio-frequency radiated emissions 1 GHz to 6 GHz

4.3. Identification pictures

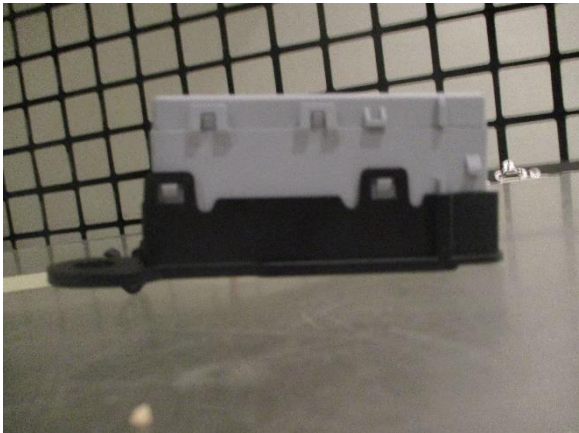
From file number: 22/36404855



Frontal view



Upper view



Rear view



Lateral view



Manufacturer Label



Internal ID