

Prüfbericht-Nr.: Test report no.:		60374276-002		Auftrags-Nr.: Order no.:		23870362 030		Seite 1 von 17 Page 1 of 17	
Kunden-Referenz-Nr.: Client reference no.:		1288983		Auftragsdatum: Order date:		2020.04.14			
Auftraggeber: Client:		IKEA of Sweden AB							
Prüfgegenstand: Test item:		STYRBAR Remote control stainless							
Bezeichnung / Typ-Nr.: Identification / Type no.:		E2001 FCC ID: FHO-E2001							
Auftrags-Inhalt: Order content:		FCC Compliance testing							
Prüfgrundlage: Test specification:		FCC 47 CFR Part 15B with parts 15.107 & 15.109 ANSI C63.4: 2014							
Wareneingangsdatum: Date of sample receipt:		2020.04.23							
Prüfmuster-Nr.: Test sample no.:		See section 2.3							
Prüfzeitraum: Testing period:		2020.04.24 - 2020.04.29							
Ort der Prüfung: Place of testing:		Lund, Sweden							
Prüflaboratorium: Testing laboratory:		TÜV Rheinland Sweden							
Prüfergebnis*: Test result*:		Pass							
überprüft von: reviewed by:				genehmigt von: authorized by:					
Datum: 2020.08.19 Date:				Datum: 2020.08.19 Date:					
Stellung / Position: Test Engineer				Stellung / Position: Lab Manager					
Sonstiges / Other:									
Zustand des Prüfgegenstandes bei Anlieferung: Condition of the test item at delivery:				Prüfmuster vollständig und unbeschädigt Test item complete and undamaged					
* Legende: 1 = sehr gut 2 = gut 3 = befriedigend 4 = ausreichend 5 = mangelhaft P(ass) = entspricht o.g. Prüfgrundlage(n) F(ail) = entspricht nicht o.g. Prüfgrundlage(n) N/A = nicht anwendbar N/T = nicht getestet * Legend: 1 = very good 2 = good 3 = satisfactory 4 = sufficient 5 = poor P(ass) = passed a.m. test specification(s) F(ail) = failed a.m. test specification(s) N/A = not applicable 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.</i>									

Revision History

REVISION	DATE	REMARKS	AUTHOR
001	2020-06-17	First release	Sam Ebadeh
002	2020-08-19	Added PCB pictures in Appendix	Fariborz Abasi
Note: Latest revision report will replace all previous reports			
This report based on FCC Part 15B no JBP Template version 1.1			

Summary of Test Results

FCC 47 CFR Rule Part	Test Description	Applicability	Report Section	RESULT	REMARKS
15.107	AC Power Line Conducted Emissions (Unintentional Radiators)	NO	4.1	N/A	Battery powered only
15.109	Radiated Emissions (Unintentional Radiators)	YES	4.2	PASS	

Possible test case verdicts:

- | | |
|--|-----------------------|
| - Test case does not apply to the test object: | N/A |
| - Test object complies with the requirement: | PASS or COMPLIANT |
| - Test object does not meet the requirement: | FAIL or NOT COMPLIANT |
| - Test case not performed on the test object: | N.P. |

Table of Contents

1. GENERAL INFORMATION	4
1.1 Test Site.....	4
1.2 Client Information.....	4
2. PRODUCT INFORMATION.....	5
2.1 General Description.....	5
2.2 Device Characteristics.....	5
2.3 Test Samples	5
2.4 Wireless Technologies and Bands Supported by the EUT.....	5
2.5 Antenna Information.....	5
2.6 Wireless Technology Details	6
2.7 Ancillary Equipment.....	6
3. TEST METHODS	7
3.1 Test Standards.....	7
3.2 Additional references.....	7
3.3 Limits	8
3.4 Description of Test Methods and Equipment Setup	9
3.5 EUT Configuration During Test.....	9
3.6 EUT Operation Modes.....	9
3.7 Deviations from the Test Standard	11
3.8 Environmental Conditions.....	11
4. TEST RESULTS	12
4.1 Test Results – Radiated Emissions (Unintentional Transmitter).....	12
5. TEST EQUIPMENT STATUS.....	15
5.1 List of Hardware with Calibration Dates	15
5.2 Software / Firmware Versions.....	16
6. MEASUREMENT UNCERTAINTY	16
6.1 Measurement Uncertainty for SAC 5 (Radiated Emissions & Band Edge)	16
7. PHOTOGRAPHS.....	17
7.1 Photographs of the EUT	17
7.2 Photographs of the Test Setup	17

1. GENERAL INFORMATION

1.1 Test Site

Test Facility:	TÜV Rheinland Sweden AB
Address:	Mobilvägen 10
	223 62 Lund
	Sweden
Swedac Registration Number:	10325
FCC Test Firm Registration Number:	517458
ISED Test Site Registration Number:	24753

1.2 Client Information

Company Name:	IKEA of Sweden AB
Address:	Box 72
	34381 Älmhult
	Sweden
Contact Person:	Torbjörn Samuelsson
Contact e-Mail / Telephone	torbjorn.samuelsson@inter.ikea.com

2. PRODUCT INFORMATION

2.1 General Description

Model name:	STYRBAR Remote control stainless
Manufacturer:	IKEA of Sweden AB
Model number / Marketing name:	E2001
FCC ID:	FHO-E2001
Description:	Remote control to be used to control IKEA Homesmart light sources/drivers
Ancillary Equipment:	See section 2.7

2.2 Device Characteristics

Device Class for 47 CFR Part 15 B	Battery (2xAAA)
Nominal Supply Voltage	3.0 VDC
Supply Voltage Range	-
Operating Temperature Range	0°C - 40°C
Highest Internal Frequency Source	2480 MHz

2.3 Test Samples

EUT #	EUT ID	Used For:
1	A002814306-001	Zigbee

2.4 Wireless Technologies and Bands Supported by the EUT

Technology	Band	Frequency Range (Tx)	Evaluation Performed*
Zigbee	2.4 GHz	2405 MHz - 2480 MHz	Yes

*This statement refers only to this report. Other wireless technologies may be covered by other reports.

2.5 Antenna Information

Technology	Band	Number of Antennas	Antenna Type(s)	Gain
Zigbee	2.4 GHz	1	PCB antenna	-5 dBi

2.6 Wireless Technology Details

Technology	Band	Modulation Type(s)	No. of Channels	Channel Spacing	Adaptivity
Zigbee	2.4 GHz	OQPSK	16	5 MHz	Adaptive Equipment without the possibility to switch to a non-adaptive mode

2.7 Ancillary Equipment

No ancillary equipment was used during the FCC Part 15B tests.

3. TEST METHODS

3.1 Test Standards

Testing was performed according to the following standards / references

Standard	Version	Description
FCC 47 CFR 15.109	-	Radiated emission limits

3.2 Additional references

The following standards / references were also considered for the testing

Standard	Version	Description
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

3.3 Limits

FCC 47 CFR Rule Part	Test Description	Limit Reference (FCC 47 CFR Reference)
15.109	Radiated Emissions (Unintentional Radiators)	15.109 (a) for Class B Devices *See Note 1

Note 1

Radiated Emissions limits in the tables from 47 CFR sections 15.109 are presented in $\mu\text{V/m}$. Measurements on the test system are made in $\text{dB}\mu\text{V/m}$. To convert between these, the following adjustment is used:

$$\text{New Limit} = 20 \log \left(\frac{\text{Original Limit}}{10^6} \right) + 120$$

Example: from 15.209(a) the limit for 30MHz – 88MHz is $100\mu\text{V/m}$ at 3m. This gives:

$$\text{New Limit} = 20 \log \left(\frac{100}{10^6} \right) + 120 = 40\text{dB}\mu\text{V/m at 3m}$$

Additionally, in some cases testing has been performed at distances other than those specified in the tables. When this has occurred, the limits have been adjusted in accordance with the requirements in 47 CFR 15.31, using an extrapolation factor of 40dB/decade at frequencies below 30MHz and 20dB/decade at or above 30MHz

Example: from 15.209(a) the limit for 1.705MHz – 30MHz is $30\mu\text{V/m}$ (=29.54 $\text{dB}\mu\text{V/m}$) at 30m

$$\text{Limit@3m} = \text{Limit@30m} + 40 \log \left(\frac{30}{3} \right) = 29.54 + 40.00 = 69.54 \text{ dB}\mu\text{V/m at 3m}$$

Example: from 15.209(a) the limit for 1GHz – 18GHz is $500\mu\text{V/m}$ (=53.98 $\text{dB}\mu\text{V/m}$) at 3m

$$\text{Limit@1m} = \text{Limit@3m} + 20 \log \left(\frac{3}{1} \right) = 53.98 + 9.54 = 63.52 \text{ dB}\mu\text{V/m at 1m}$$

3.4 Description of Test Methods and Equipment Setup

3.4.1 General Description

Testing was performed in accordance with the various requirements of ANSI C63.4 and ANSI C63.10. Any deviations from the test methods are described in section 3.5

Where different arrangements of equipment were used for different types of measurements, these are tabulated in section 3.4.2 and details of each arrangement are included in subsequent sections

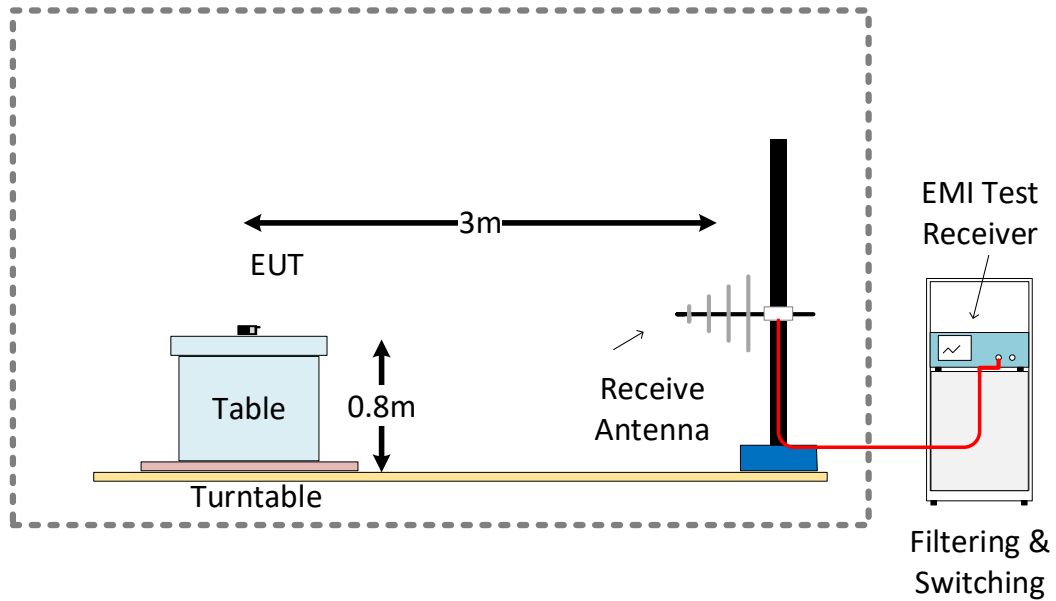
3.4.2 Test Equipment Setup Used by Test Type

FCC 47 CFR Rule Part	Test Description	Test Equipment Used
15.109	Radiated Emissions (Unintentional Radiators)	SAC5

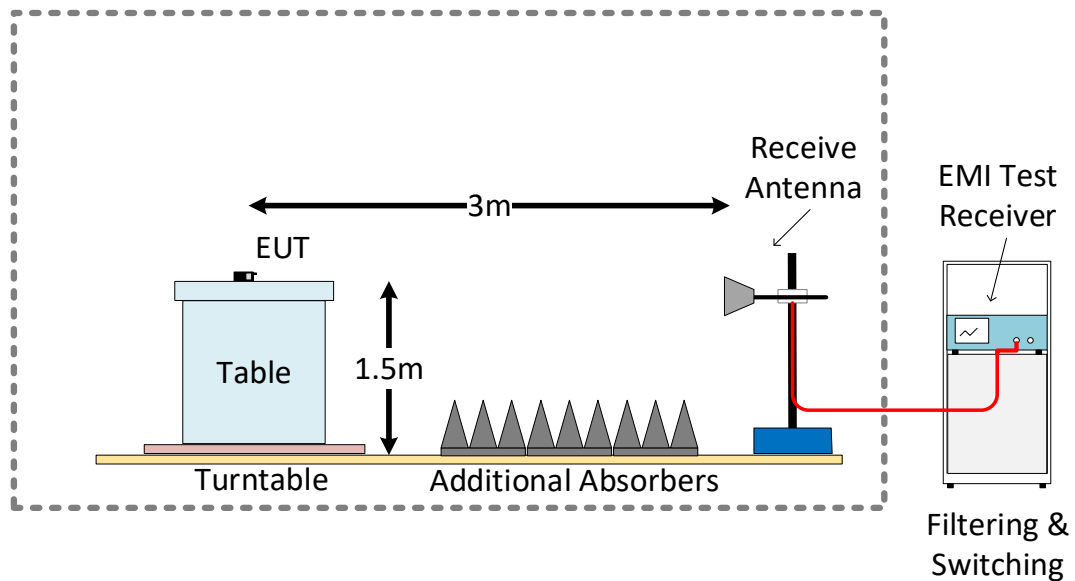
3.4.3 Test Equipment Setup – SAC 5 (Radiated Emissions)

- For frequency range 30MHz-1GHz Log-Periodic Antenna was used. Antenna elevated from 100 cm from floor to 400 cm from floor, and was placed at 3 m from center of turntable in tilted position. The equipment under test (EUT) was placed at the middle of the turntable at 150 cm height from floor. The antenna rotated to repeat the measurements for both the horizontal and vertical antenna polarizations. Repeat the measurement steps until the maximum emissions were obtained.
- For frequency range 1GHz-18GHz horn Antenna was used. Antenna elevated from 100 cm from floor to 200 cm from floor, and was placed at 3 m from center of turntable. The equipment under test (EUT) was placed at the middle of the turntable at 150 cm height from floor. The antenna rotated to repeat the measurements for both the horizontal and vertical antenna polarizations. Repeat the measurement steps until the maximum emissions were obtained.
- For frequency range 18GHz-40GHz double horn Antenna was used. Antenna's height was adjusted to 150 cm from floor, and 1 m distance to center of turntable. The equipment under test (EUT) was placed at the middle of the turntable on at 150 cm height from floor.
- For all frequency ranges the turntable was rotated 360° for obtaining the maximum emission.

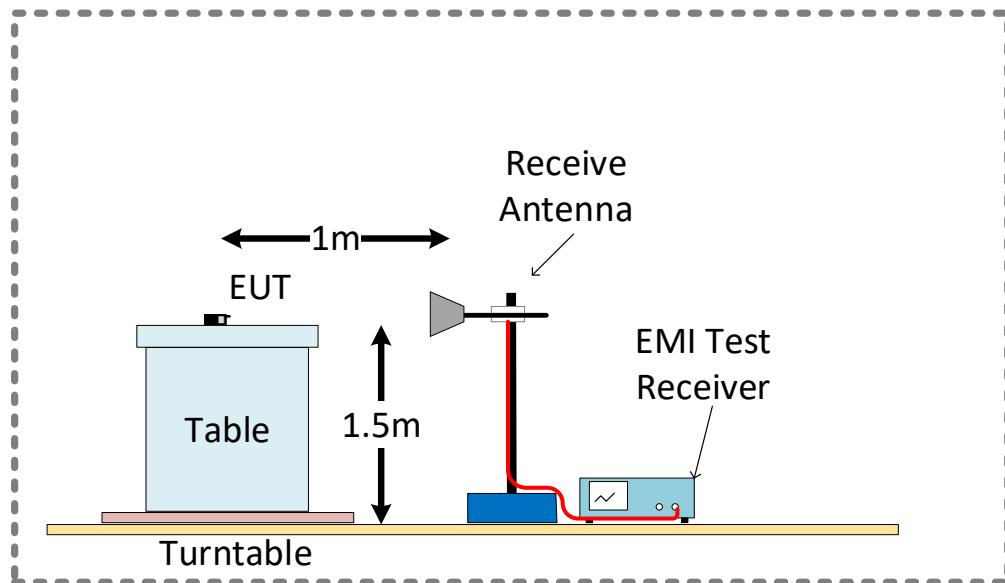
SAC 5 Test Setup Configuration 30MHz – 1GHz



SAC 5 Test Setup Configuration 1GHz – 18GHz



SAC 5 Test Setup Configuration 18GHz – 40GHz



3.5 Deviations from the Test Standard

None.

3.6 Environmental Conditions

3.6.1 Environmental Conditions – SAC5 (Radiated Emissions)

Environmental Conditions Log – SAC5

Date	Temperature (°C)	Relative Humidity (%)
2020-04-24	18.7	32.8
2020-04-29	20.4	31.9

4. TEST RESULTS

4.1 Test Results – Radiated Emissions (Unintentional Transmitter)

4.1.1 Radiated Emissions (Unintentional) – Test Summary

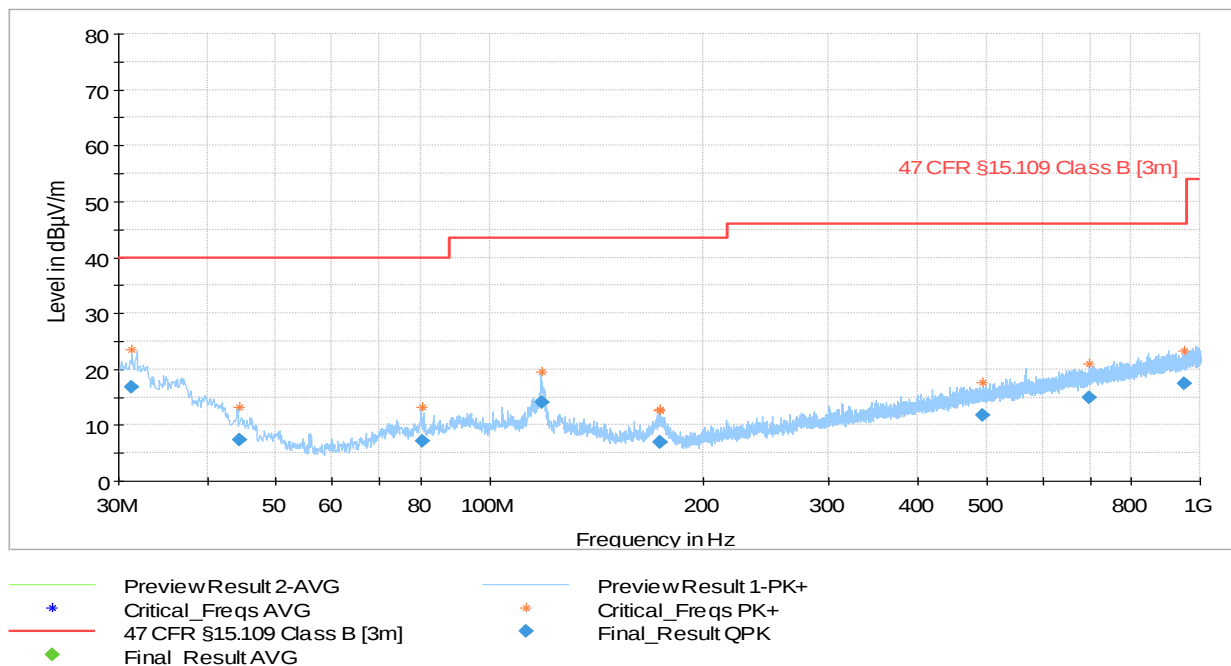
Test Specification	FCC 47 CFR 15.109 (Part 15 Subpart B)	
Test Engineer & Date	Fariborz Abasi Niall Forrester	2020.04.24 – 2020.04.29
EUT and Ancillary Equipment IDs	A002814306-001	None
EUT Operation Mode(s)	Idle mode	
EUT Wireless Configuration(s)	Zigbee Mid channel (2440 MHz)	
EUT Hardware Configuration(s)	P1.1	
Overall Result	PASS	
Test Parameter	Frequency Range	Result*
Radiated Emissions - Idle Mode	30 MHz – 1 GHz	PASS
Radiated Emissions - Idle Mode	1 GHz – 18 GHz	PASS

* For detailed measurements, see tables and graphs in sections below

4.1.2 Radiated Emissions (Unintentional) – Test Details

30MHz – 1GHz

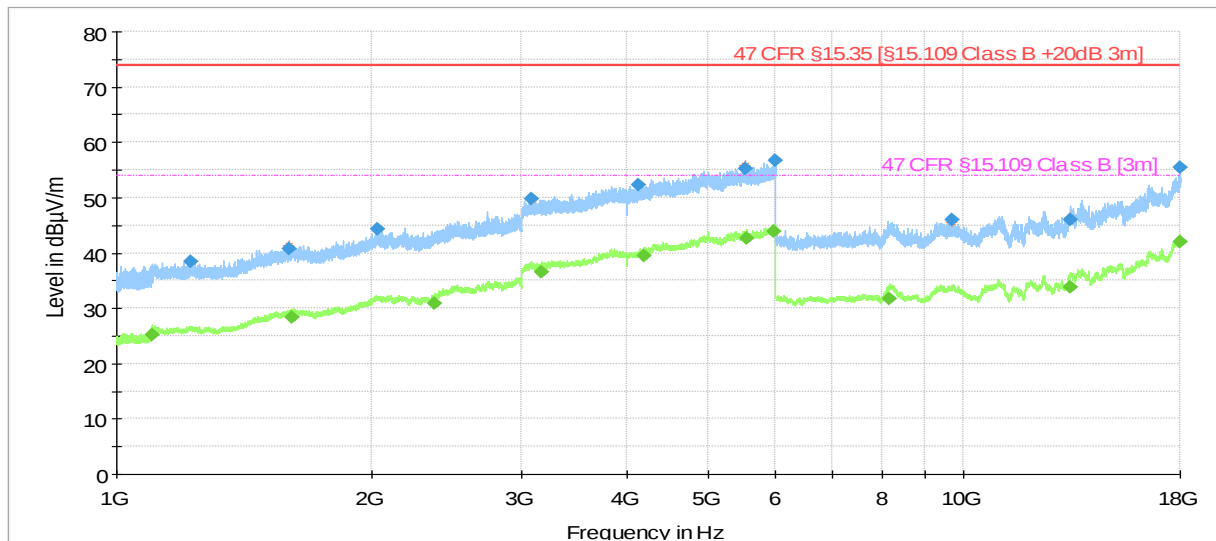
Test	Zigbee	
Test mode condition	Idle mode – Mid channel	
Test frequency	30 MHz-1 GHz	
Antenna position	Vertical and Horizontal	
Standard	FCC Part 15B	
EUT	A002814306-001	
Ancillary Equipment	None	
EUT Configuration	Zigbee – Idle mode	
Test Engineer	Fariborz Abasi	Date: 2020-04-24
Environmental conditions	Temperature: 18,7 °C	Humidity: 32,8 %
Chamber details	Chamber: SAC5	Measurement distance: 3 meter



Frequency (MHz)	QuasiPeak (dBμV/m)	Limit (dBμV/m)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)
31.261840	16.87	40.00	23.13	1000.0	120.000	278.0	V	16.0
44.343080	7.38	40.00	32.62	1000.0	120.000	125.0	H	188.0
80.293880	7.24	40.00	32.76	1000.0	120.000	200.0	V	297.0
118.269600	13.98	43.52	29.54	1000.0	120.000	179.0	V	310.0
696.779480	14.85	46.02	31.17	1000.0	120.000	325.0	H	202.0
948.879680	17.48	46.02	28.54	1000.0	120.000	275.0	H	157.0

1GHz – 18GHz

Test	Zigbee	
Test mode condition	Idle mode – Mid channel	
Test frequency	1 GHz-18 GHz	
Antenna position	Vertical and Horizontal	
Standard	FCC Part 15B	
EUT	A002814306-001	
Ancillary Equipment	None	
EUT Configuration	Zigbee – Idle mode	
Test Engineer	Niall Forrester	Date: 2020-04-29
Environmental conditions	Temperature: 20,4 °C	Humidity: 31,9 %
Chamber details	Chamber: SAC5	Measurement distance: 3 meter



—	PreviewResult 2-AVG	—	PreviewResult 1-PK+
*	Critical_Freqs AVG	*	Critical_Freqs PK+
—	47 CFR §15.35 [§15.109 Class B +20dB 3m]	—	47 CFR §15.109 Class B [3m]
◆	Final_Result PK+	◆	Final_Result AVG

Frequency (MHz)	MaxPeak (dBµV/m)	Average (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)
3173.282000	---	36.59	53.98	17.39	1000.0	1000.000	188.0	H	98.0
4192.618000	---	39.52	53.98	14.46	1000.0	1000.000	315.0	V	86.0
5535.810000	---	42.56	53.98	11.42	1000.0	1000.000	100.0	H	307.0
5975.102000	---	43	53.98	10.18	1000.0	1000.000	365.0	V	37.0
5983.914000	56.67	---	73.98	17.31	1000.0	1000.000	239.0	H	82.0
17985.940000	---	41.98	53.98	11.99	1000.0	1000.000	235.0	H	127.0

5. TEST EQUIPMENT STATUS

5.1 List of Hardware with Calibration Dates

5.1.1 Hardware List – SAC5 System

Type	Manufacturer	Model	Serial Number / ID	Calibration Date	Calibration Due
EMI Test Receiver	Rohde & Schwarz	ESW44	101760 2881044	28.10.2019	28.10.2020
Ultra Broadband Antenna	Rohde & Schwarz	HL562E	100988 2823181	23.07.2019	23.07.2021
Double Ridged Waveguide Horn Antenna	Rohde & Schwarz	HF907	102678 2823164	15.07.2019	15.07.2021
Control Device	Maturo	NCD	NCD/393/2372.01	N/A	N/A
Open Switch & Control Unit	Rohde & Schwarz	OSP150	100081 2884198	11.11.2019	11.11.2020
Open Switch & Control Unit	Rohde & Schwarz	OSP120	100084 2761253	11.11.2019	11.11.2020
Shielded Filter Unit	Rohde & Schwarz	OSP-F Extension	101333 2761265	11.11.2019	11.11.2020
Shielded Filter Unit	Rohde & Schwarz	OSP-F Extension	101335 2761266	01.04.2019	01.04.2020
Shielded Filter Unit	Rohde & Schwarz	OSP-F Base Unit	101330 2761262	01.04.2019	01.04.2020
Humidity Temperature Probe	Rotronic	HF532- DG1XX21X	0061829280 2926379	14.08.2018	14.08.2020

5.2 Software / Firmware Versions

Equipment	Software / Firmware Name	Version
SAC 5	EMC 32	V10.50.40

6. MEASUREMENT UNCERTAINTY

6.1 Measurement Uncertainty for SAC 5 (Radiated Emissions & Band Edge)

Parameter	Uncertainty (Coverage Factor k=2)
Field Strength 10 Hz -9 kHz	3.38 dB
Field Strength 9 kHz -30 MHz	3.38 dB
Field Strength 30 MHz -1000 MHz	3.38 dB
Field Strength 1 GHz -18 GHz	4.88 dB
Field Strength 18 GHz - 40 GHz	5.14 dB

7. PHOTOGRAPHS

See appendix.