

Prüfbericht-Nr.: Test report no.:	60415418-003	Auftrags-Nr.: Order no.:	23870414 030	Seite 1 von 54 Page 1 of 54	
Kunden-Referenz-Nr.: Client reference no.:	1005969	Auftragsdatum: Order date:	2020.07.02		
Auftraggeber: Client:	Spotify USA Inc				
Prüfgegenstand: Test item:	Car Thing				
Bezeichnung / Typ-Nr.: Identification / Type no.:	FCC ID: 2AP3D-YX5H6679				
Auftrags-Inhalt: Order content:	Certified testing according to FCC Part 15 subpart C				
Prüfgrundlage: Test specification:	FCC 47 CFR Part 15.247 with parts 15.207 & 15.209 ANSI C63.10: 2013				
Wareneingangsdatum: Date of sample receipt:	2020.07.02				
Prüfmuster-Nr.: Test sample no.:	See section 2.3				
Prüfzeitraum: Testing period:	2020.09.10 – 2020.11.10				
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: 2020.11.16 Date:	Datum: 2020.11.16 Date:				
Stellung / Position:	Senior Technical Expert	Stellung / Position:	Lab Manager		
Sonstiges / Other:	This report covers Bluetooth Low Energy only.				
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 P(ass) = entspricht o.g. Prüfgrundlage(n)	2 = gut F(ail) = entspricht nicht o.g. Prüfgrundlage(n)	3 = befriedigend F(ail) = entspricht nicht o.g. Prüfgrundlage(n)	4 = ausreichend N/A = nicht anwendbar	5 = mangelhaft 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 F(ail) = failed a.m. test specification(s)	4 = sufficient N/A = not applicable	5 = poor 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 History60415418-00360415418-003

REVISION	DATE	REMARKS	AUTHOR
001	2020.10.02	First release	Niall Forrester
002	2020.10.08	Corrected test specification and client information in appendix. Fixed misplaced section	Niall Forrester
003	2020.11.16	Updated conducted radio results	Niall Forrester
Note: Latest revision report will replace all previous reports			
This report based on FCC Part 15.247 Template version 1.1			

Summary of Test Results

FCC 47 CFR Rule Part	Test Description	Applicability	Report Section	RESULT	REMARKS
15.207	AC Power Line Conducted Emissions (Intentional Radiators)	YES	4.1	PASS	
15.209	Radiated Emissions (Intentional Radiators)	YES	4.2	PASS	
15.247 (d)	Out of Band Emissions	YES	4.3	PASS	
15.247 (d)	Band Edge Compliance (Authorized Band)	YES	4.4	PASS	
15.247 (d)	Band Edge Compliance (Restricted Band)	YES	4.5	PASS	
15.247 (a)(1)	20dB Bandwidth	NO	4.6	N/A	BLE is non-hopping
15.247 (a)(1)	Carrier (Hopping Channel) Separation	NO	4.7	N/A	BLE is non-hopping
15.247 (a)(1)	Number of Hopping Channels	NO	4.8	N/A	BLE is non-hopping
15.247 (a)(1)	Time of Occupancy (Dwell Time)	NO	4.9	N/A	BLE is non-hopping
15.247 (a)(2)	6dB Bandwidth	YES	4.10	PASS	
15.247 (b)	Peak Conducted Output Power	YES	4.11	PASS	
15.247 (e)	Power Spectral Density	YES	4.12	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.....	6
2.6 Wireless Technology Details	6
2.7 Ancillary Equipment.....	6
2.8 EUT Diagrams.....	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.....	14
3.6 EUT Operation Modes.....	14
3.7 Deviations from the Test Standard	14
3.8 Environmental Conditions.....	15
4. TEST RESULTS	16
4.1 Test Results – AC Power Line Conducted Emissions (Intentional Transmitter).....	16
4.2 Test Results – Radiated Emissions (Intentional Transmitter)	19
4.3 Test Results – Out of Band Emissions	38
4.4 Test Results – Band Edge Compliance (Authorized Band)	40
4.5 Test Results – Band Edge Compliance (Restricted Band).....	42
4.6 Test Results – 20dB Bandwidth.....	45
4.7 Test Results – Carrier (Hopping Channel) Separation	45
4.8 Test Results – Number of Hopping Channels.....	45
4.9 Test Results – Time of Occupancy (Dwell Time)	45
4.10 Test Results – 6dB Bandwidth.....	46
4.11 Test Results – Peak Conducted Output Power	48
4.12 Test Results – Power Spectral Density.....	50
5. TEST EQUIPMENT STATUS.....	52
5.1 List of Hardware with Calibration Dates	52
5.2 Software / Firmware Versions.....	53
6. MEASUREMENT UNCERTAINTY	54
6.1 Measurement Uncertainty for CTE	54
6.2 Measurement Uncertainty for Conducted Emissions	54
6.3 Measurement Uncertainty for SAC 5 (Radiated Emissions & Band Edge)	54
7. PHOTOGRAPHS.....	54

Appendix 1 Photographs (separate document)

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:	Spotify USA Inc.
Address:	4 World Trade Center, 63 rd floor
	New York, NY 10007
	USA
Contact Person:	Daniel Bromand
Contact e-Mail / Telephone	Danielb@spotify.com / +1 (0) 646-512-0729

2. PRODUCT INFORMATION

2.1 General Description

Model name:	Car Thing
Manufacturer:	Spotify USA Inc.
Model number / Marketing name:	YX5H6679
FCC ID:	2AP3D-YX5H6679
Description:	A voice controlled accessory for phone/Spotify App with supporting display and buttons. Bluetooth enabled for communication with the Car Head Unit. Powered from a 12V outlet.
Ancillary Equipment:	See section 2.7

2.2 Device Characteristics

Type of Power Supply	12V to 5V USB car charger
Nominal Supply Voltage	5V
Supply Voltage Range	4.75-5.25V
Operating Temperature Range	-20 + 45 deg C
Operating Air Humidity Range	
Highest Internal Frequency Source	24 MHz XO, 2480 MHz radio

2.3 Test Samples

EUT #	EUT ID	Description	Used For:
1	A002893981-001	Standard Sample	Radiated emissions Conducted Emissions A/C
2	A002893981-017	Sample with semi-rigid antenna and DTM mode	Conducted radio tests

2.4 Wireless Technologies and Bands Supported by the EUT

Technology	Band	Frequency Range (Tx)	Evaluation Performed*
Bluetooth BDR/EDR	2.4 GHz	2402 MHz - 2480 MHz	NO
Bluetooth Low Energy	2.4 GHz	2402 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
Bluetooth BDR/EDR & Low Energy	2.4 GHz	1	Internal inverted F	-1.33

2.6 Wireless Technology Details

Technology	Band	Modulation Type(s)	No. of Channels	Channel Spacing	Adaptivity
Bluetooth BDR/EDR	2.4 GHz	GFSK, $\pi/4$ -DQPSK, 8-DPSK	79	1 MHz	N/A
Bluetooth Low Energy	2.4 GHz	GFSK	40	2 MHz	N/A

2.7 Ancillary Equipment

ID	Description	Manufacturer / Model	Hardware & Software Versions
A002893981-008	USB-A to USB-C Cable	-	-
A002893981-012	Dual Port USB Car Charger	IBD322 – 3.1A	-
A002893981-014	Dual Port USB Car Charger	IBD322 – 3.1A	-
A002893981-016	12V Car Charger Cable	-	-

2.8 EUT Diagrams

N/A

3. TEST METHODS

3.1 Test Standards

Testing was performed according to the following standards / references

Standard	Version	Description
FCC 47 CFR 15.247	-	Operation within the bands 902-928 MHz, 2400-2483.5 MHz, and 5725-5850 MHz.
FCC 47 CFR 15.207	-	Conducted limits
FCC 47 CFR 15.209	-	Radiated emission limits; general requirements

3.2 Additional references

The following standards / references were also considered for the testing

Standard	Version	Description
ANSI C63.10	2013	American National Standard of Procedures for Compliance Testing of Unlicensed Wireless Devices

3.3 Limits

FCC 47 CFR Rule Part	Test Description	Limit Reference (FCC 47 CFR Reference)
15.207	AC Power Line Conducted Emissions (Intentional Radiators)	15.207 (a)
15.209	Radiated Emissions (Intentional Radiators)	15.209 (a) *See Note 1
15.247 (d)	Out of Band Emissions	15.247 (d)
15.247 (d)	Band Edge Compliance (Authorized Band)	15.247 (d)
15.247 (d)	Band Edge Compliance (Restricted Band)	15.247 (d)
15.247 (a)(1)	20dB Bandwidth	15.247 (a)(1)
15.247 (a)(1)	Carrier (Hopping Channel) Separation	15.247 (a)(1)
15.247 (a)(1)	Number of Hopping Channels	15.247 (a)(1)
15.247 (a)(1)	Time of Occupancy (Dwell Time)	15.247 (a)(1)
15.247 (a)(2)	6dB Bandwidth	15.247 (a)(2)
15.247 (b)	Peak Conducted Output Power	15.247 (b)(1) [Hopping] 15.247 (b)(3) [Non-Hopping]
15.247 (e)	Power Spectral Density	15.247 (e)

Note 1

Radiated Emissions limits in the tables from 47 CFR sections 15.109 & 15.209 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 3.7

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
15.207	AC Power Line Conducted Emissions (Intentional Radiators)	Conducted Emissions
15.209	Radiated Emissions (Intentional Radiators)	SAC5
15.247 (d)	Out of Band Emissions	CTE
15.247 (d)	Band Edge Compliance (Authorized band)	CTE
15.247 (d)	Band Edge Compliance (Restricted band)	SAC 5
15.247 (a)(1)	20dB Bandwidth	CTE
15.247 (a)(1)	Carrier (Hopping Channel) Separation	CTE
15.247 (a)(1)	Number of Hopping Channels	CTE
15.247 (a)(1)	Time of Occupancy (Dwell Time)	CTE
15.247 (a)(2)	6dB Bandwidth	CTE
15.247 (b)	Peak Conducted Output Power	CTE
15.247 (e)	Power Spectral Density	CTE

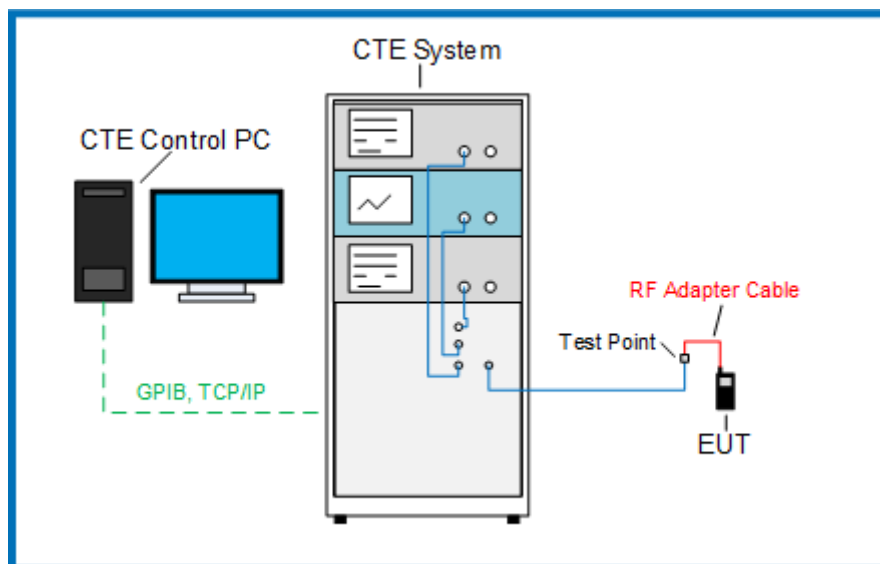
3.4.3 Test Equipment Setup – CTE System

The Comprehensive Test Environment (CTE) system consists of a number of instruments (see section 5.1.1) mounted in a rack together with automated relays and interconnecting hardware. The instruments and other equipment are controlled from a standard PC running software provided by the manufacturer. The RF output of the EUT is connected to the test system via a coaxial cable.

Tests are in the form of pre-defined scripts that can be loaded on the PC. The scripts, as well as the hardware setup, have been verified for conformance with the relevant test specifications.

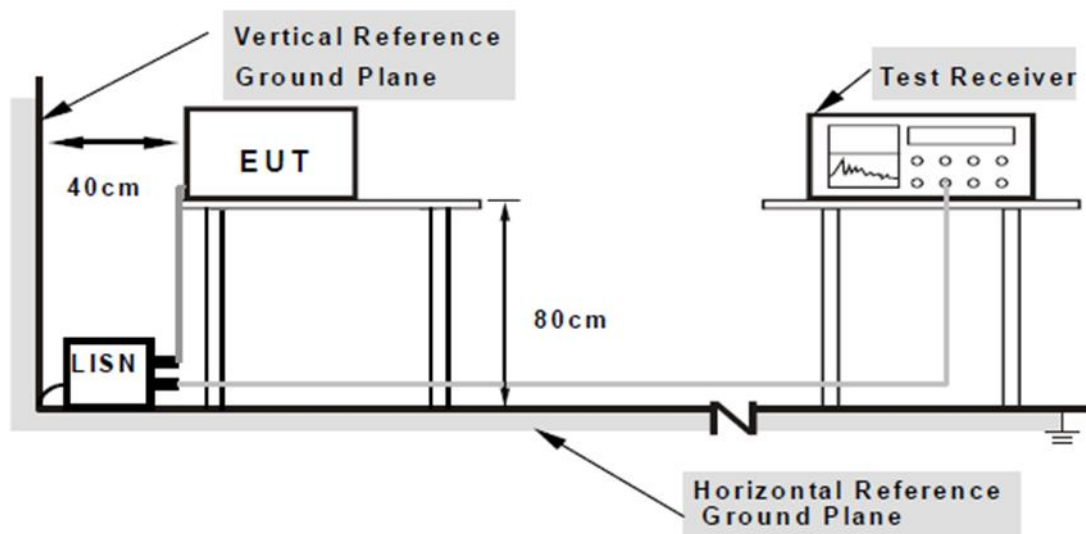
Losses in the cables and interconnects have been measured using the system's own automated routines and are compensated for automatically. Any additional loss in RF adapter cables supplied together with the EUT can be compensated for using the known characteristics of that adapter.

CTE Block Diagram



3.4.4 Test Equipment Setup – Conducted Emissions

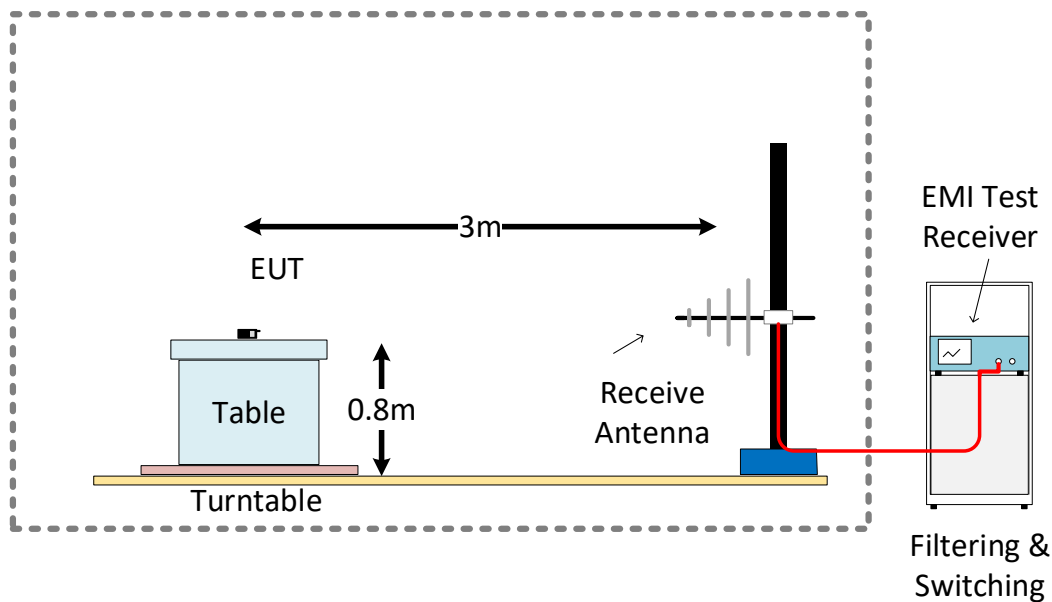
- The EUT was placed 0.4 meters from the conducting wall of the shielded room with EUT being connected to the power mains through a line impedance stabilization network (LISN). Other support units were connected to the power mains through another LISN. The LISNs provide $50\Omega/50\mu\text{H}$ of coupling impedance for the measuring instrument.
- The lines of the power mains connected to the EUT were checked for maximum conducted interference.
- The frequency range from 150 kHz to 30 MHz was searched. Emission levels over 10 dB under the prescribed limits could not be reported.



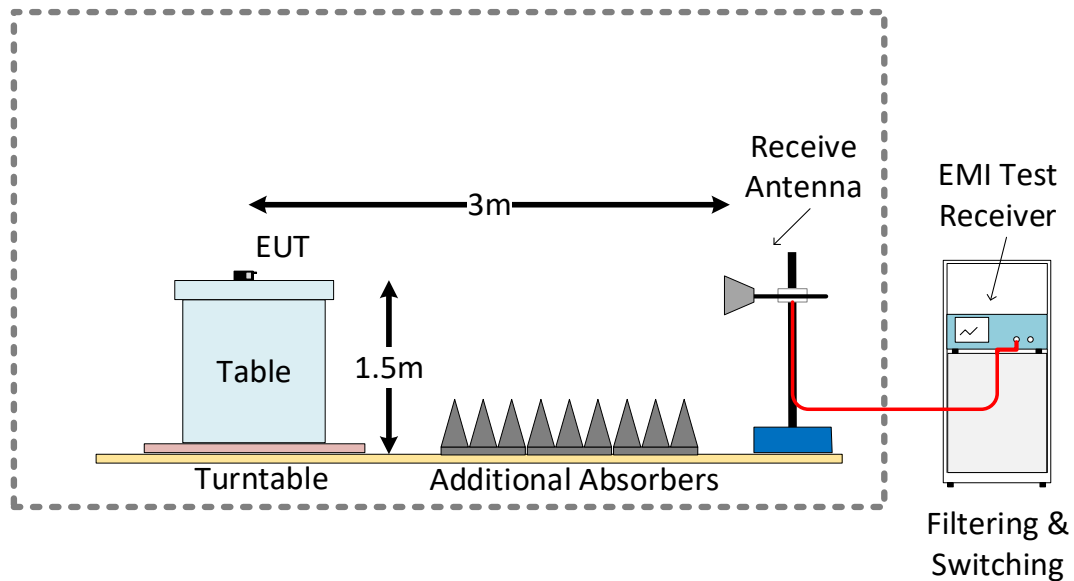
3.4.5 Test Equipment Setup – SAC 5 (Radiated Emissions and Restricted Band Edge)

- 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.

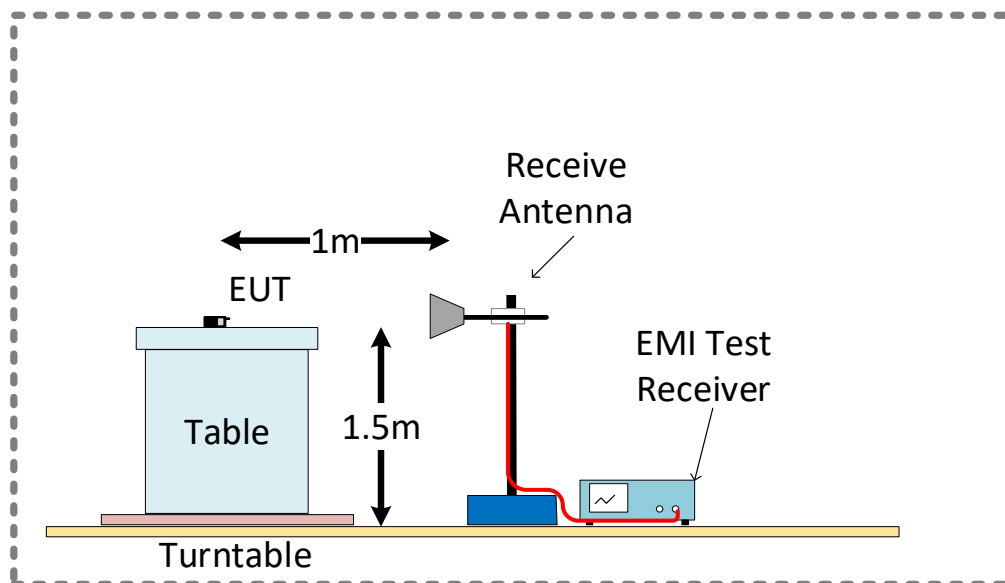
SAC 5 Test Setup Configuration 30MHz – 1GHz



SAC 5 Test Setup Configuration 1GHz – 18GHz



SAC 5 Test Setup Configuration 18GHz – 40GHz



3.5 EUT Configuration During Test

N/A

3.6 EUT Operation Modes

Operation mode	Description
1	Continuous Transmit – Device is set to transmit random data continuously
2	DTM – Device is controlled by the test equipment using Bluetooth Low Energy Direct Test Mode

3.7 Deviations from the Test Standard

None

3.8 Environmental Conditions

3.8.1 Environmental Conditions – CTE System

Environmental Conditions Log - CTE

Date	Time	Temperature (°C)	Relative Humidity (%)
2020/11/10	07:35	19.7	43 %

3.8.2 Environmental Conditions – Conducted Emissions System

Environmental Conditions Log – Conducted Emissions

Date	Time	Temperature (°C)	Relative Humidity (%)
2020.09.25	08:48	23.3	49%

3.8.3 Environmental Conditions – SAC5 (Radiated Emissions)

Environmental Conditions Log – SAC5

Date	Time	Temperature (°C)	Relative Humidity (%)
2020/09/10	09:03	18.7	62 %
2020/09/11	08:16	18.8	58 %
2020/09/14	10:25	18.4	63 %
2020/09/15	07:53	18.6	63 %
2020/09/16	07:33	18.9	65 %
2020/09/17	07:41	19.3	62 %
2020/09/18	08:00	18.6	56 %
2020/09/19	12:20	18.7	65 %
2020/09/20	11:50	20.0	58 %
2020/09/21	07:11	18.4	61 %
2020/09/22	07:18	18.5	61 %

4. TEST RESULTS

4.1 Test Results – AC Power Line Conducted Emissions (Intentional Transmitter)

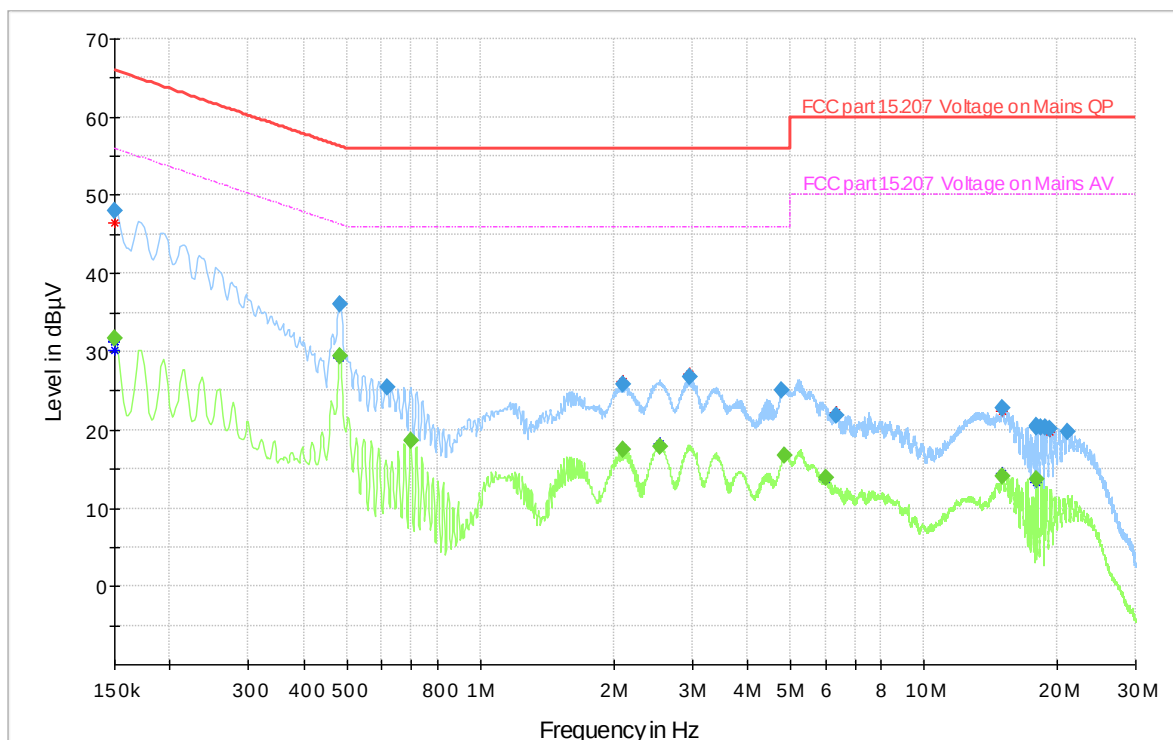
4.1.1 AC Power Line Conducted Emissions (Intentional) – Test Summary

Test Specification	FCC 47 CFR 15.207 (Part 15 Subpart C)		
Test Engineer & Date	Sam Ebadeh	2020.09.25	
EUT and Ancillary Equipment IDs	A002893981-001	A002893981-012	
EUT Operation Mode(s)	Continuous Transmit		
EUT Wireless Configuration(s)	Bluetooth BLE (Mid Channel)		
EUT Hardware Configuration(s)	Power from USB Charger connected to 12V DC		
Overall Result	PAS		
Test Parameter	Wireless Configuration	Frequency Range	Result*
AC Conducted Power Line Emissions – “N” Line	Bluetooth Low Energy 1M Mid Channel (GFSK 2440 MHz)	150 kHz – 80 MHz	PASS
AC Conducted Power Line Emissions – “L1” Line	Bluetooth Low Energy 1M Mid Channel (GFSK 2440 MHz)	150 kHz – 80 MHz	PASS

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

4.1.2 AC Power Line Conducted Emissions (Intentional) – Test Details

Test	Conducted Emission	
Test mode condition	Bluetooth 1M Mid Channel (2440 MHz)	
Standard	47 CFR Part 15.247 Class A	
EUT	A002893981-001	
Ancillary Equipment	Lab phone charger USB A – USB C cable	
Test Engineer	Sam Ebadeh	Date: 2020.09.25



Frequency (MHz)	QuasiPeak (dBµV)	CAverage (dBµV)	Limit (dBµV)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Line	Filter
0.150000	---	31.68	56.00	24.32	1000.0	9.000	N	ON
0.150000	48.03	---	66.00	17.97	1000.0	9.000	L1	ON
0.483000	---	29.34	46.29	16.95	1000.0	9.000	L1	ON
0.483000	36.15	---	56.29	20.13	1000.0	9.000	L1	ON
0.615750	25.37	---	56.00	30.63	1000.0	9.000	N	ON
0.696750	---	18.61	46.00	27.39	1000.0	9.000	L1	ON
2.089500	---	17.44	46.00	28.56	1000.0	9.000	L1	ON
2.091750	25.78	---	56.00	30.22	1000.0	9.000	N	ON
2.539500	---	17.91	46.00	28.09	1000.0	9.000	L1	ON
2.958000	26.75	---	56.00	29.25	1000.0	9.000	N	ON
4.782750	25.01	---	56.00	30.99	1000.0	9.000	L1	ON
4.854750	---	16.65	46.00	29.35	1000.0	9.000	N	ON
6.020250	---	13.93	50.00	36.07	1000.0	9.000	L1	ON
6.330750	21.94	---	60.00	38.06	1000.0	9.000	L1	ON
15.002250	22.81	---	60.00	37.19	1000.0	9.000	L1	ON
15.031500	---	14.01	50.00	35.99	1000.0	9.000	L1	ON
17.938500	20.53	---	60.00	39.47	1000.0	9.000	L1	ON
17.940750	20.41	---	60.00	39.59	1000.0	9.000	L1	ON
17.963250	---	13.71	50.00	36.29	1000.0	9.000	N	ON
18.402000	20.28	---	60.00	39.72	1000.0	9.000	L1	ON
18.809250	20.32	---	60.00	39.68	1000.0	9.000	L1	ON
19.270500	20.14	---	60.00	39.86	1000.0	9.000	L1	ON
21.050250	19.81	---	60.00	40.19	1000.0	9.000	L1	ON

4.2 Test Results – Radiated Emissions (Intentional Transmitter)

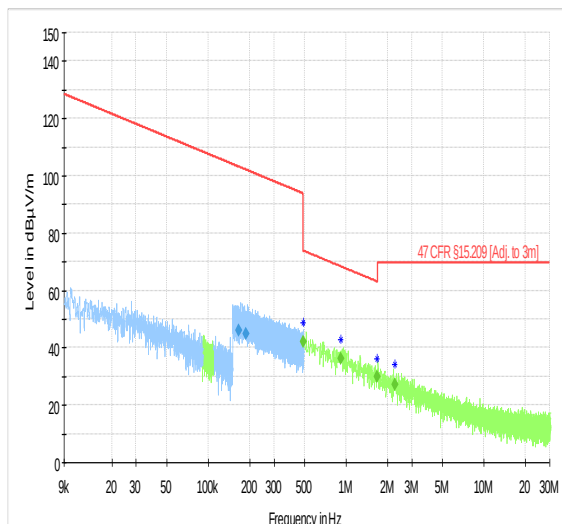
4.2.1 Radiated Emissions (Intentional) – Test Summary

Test Specification		FCC 47 CFR 15.209 (Part 15 Subpart C)	
Test Engineer & Date		Joel Efraimsson Niall Forrester Sam Ebadeh	2020.09.10 – 2020.09.22
EUT and Ancillary Equipment IDs		A002893981-001	A002893981-008 A002893981-014 A002893981-016
EUT Operation Mode(s)		Continuous Transmit	
EUT Wireless Configuration(s)		Bluetooth Low Energy 1M (Low / Mid / High channels)	
EUT Hardware Configuration(s)		Power from USB Charger connected to 12V DC	
Overall Result		PASS	
Test Parameter	Wireless Configuration	Frequency Range	Result
Radiated Emissions	Bluetooth Low Energy 1M Low Channel (GFSK 2402 MHz)	9 kHz – 30 MHz	PASS
Radiated Emissions	Bluetooth Low Energy 1M Low Channel (GFSK 2402 MHz)	30 MHz – 1 GHz	PASS
Radiated Emissions	Bluetooth Low Energy 1M Low Channel (GFSK 2402 MHz)	1 GHz – 18 GHz	PASS
Radiated Emissions	Bluetooth Low Energy 1M Low Channel (GFSK 2402 MHz)	18 GHz – 40 GHz	PASS
Radiated Emissions	Bluetooth Low Energy 1M Mid Channel (GFSK 2440 MHz)	9 kHz – 30 MHz	PASS
Radiated Emissions	Bluetooth Low Energy 1M Mid Channel (GFSK 2440 MHz)	30 MHz – 1 GHz	PASS
Radiated Emissions	Bluetooth Low Energy 1M Mid Channel (GFSK 2440 MHz)	1 GHz – 18 GHz	PASS
Radiated Emissions	Bluetooth Low Energy 1M Mid Channel (GFSK 2440 MHz)	18 GHz – 40 GHz	PASS
Radiated Emissions	Bluetooth Low Energy 1M High Channel (GFSK 2480 MHz)	9 kHz – 30 MHz	PASS
Radiated Emissions	Bluetooth Low Energy 1M High Channel (GFSK 2480 MHz)	30 MHz – 1 GHz	PASS
Radiated Emissions	Bluetooth Low Energy 1M High Channel (GFSK 2480 MHz)	1 GHz – 18 GHz	PASS
Radiated Emissions	Bluetooth Low Energy 1M High Channel (GFSK 2480 MHz)	18 GHz – 40 GHz	PASS

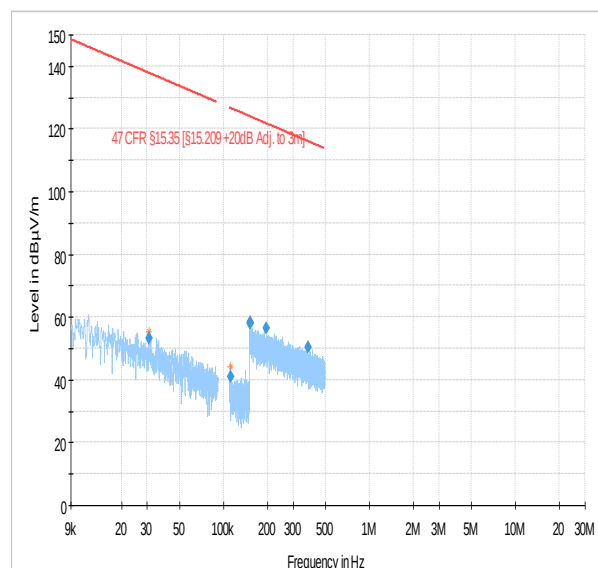
4.2.2 Radiated Emissions (Intentional) – Test Details

Low Channel 9kHz – 30MHz –Parallel to Axis

Test mode condition	Bluetooth Low Energy 1M Low Channel (2402 MHz)	
Antenna orientation	Loop Antenna Parallel to Axis	
Sweep frequency	9 kHz – 30 MHz	
Standard	FCC part 15 subpart C	
EUT	A002893981-001	
Ancillary Equipment	A002893981-014, A002893981-008, A002893981-016 12VDC Power Supply	
Test Engineer	Niall Forrester	Date: 2020-09-21
Chamber details	Chamber: SAC 5	



PreviewResult2-PK+
 Critical_Freqs PK+
 47 CFR §15.209 (Adj. to 3m)
 Final_Result PK+

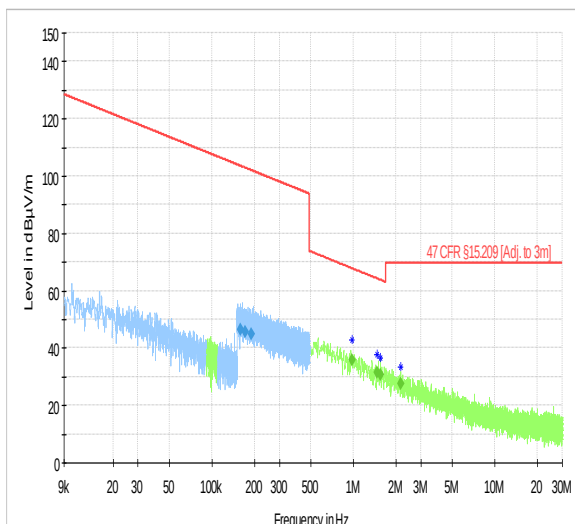


PreviewResult1-PK+
 47 CFR §15.35 (S15.209+20dB Adj. to 3m)
 Critical_Freqs PK+
 Final_Result PK+

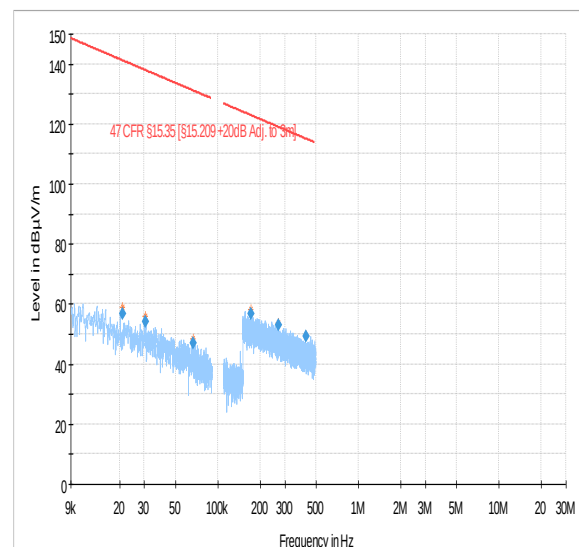
Frequency (MHz)	Average (dBμV/m)	QuasiPeak (dBμV/m)	MaxPeak (dBμV/m)	Limit (dBμV/m)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)
0.165841	46.03	---	---	103.21	57.18	1000.0	9.000	100.0	H	225.0
0.188209	44.89	---	---	102.11	57.22	1000.0	9.000	100.0	H	49.0
0.490021	---	42.28	---	73.80	31.52	1000.0	9.000	100.0	H	139.0
0.917451	---	36.24	---	68.35	32.12	1000.0	9.000	100.0	H	217.0
1.670182	---	29.99	---	63.15	33.15	1000.0	9.000	100.0	H	1.0
2.250014	---	26.97	---	69.54	42.57	1000.0	9.000	100.0	H	11.0
0.031035	---	---	53.33	137.77	84.43	1000.0	0.200	100.0	H	35.0
0.112445	---	---	41.17	126.59	85.42	1000.0	0.200	100.0	H	45.0
0.152606	---	---	58.32	123.93	65.61	1000.0	9.000	100.0	H	135.0
0.153035	---	---	57.94	123.91	65.96	1000.0	9.000	100.0	H	315.0
0.196059	---	---	56.56	121.76	65.20	1000.0	9.000	100.0	H	214.0
0.379822	---	---	50.48	116.01	65.53	1000.0	9.000	100.0	H	256.0

Low Channel 9kHz – 30MHz –Perpendicular to Axis

Test mode condition	Bluetooth Low Energy 1M Low Channel (2402 MHz)	
Antenna orientation	Loop Antenna Perpendicular to Axis	
Sweep frequency	9 kHz – 30 MHz	
Standard	FCC part 15 subpart C	
EUT	A002893981-001	
Ancillary Equipment	A002893981-014, A002893981-008, A002893981-016 12VDC Power Supply	
Test Engineer	Joel Efraimsson	Date: 2020-09-10
Chamber details	Chamber: SAC 5	



— PreviewResult 2-PK+
— PreviewResult 1-AVG
— 47 CFR §15.209 (Adj. to 3m)
♦ Final_Result QPK
♦ Final_Result AVG
♦ Critical_Freqs PK+
♦ Critical_Freqs AVG

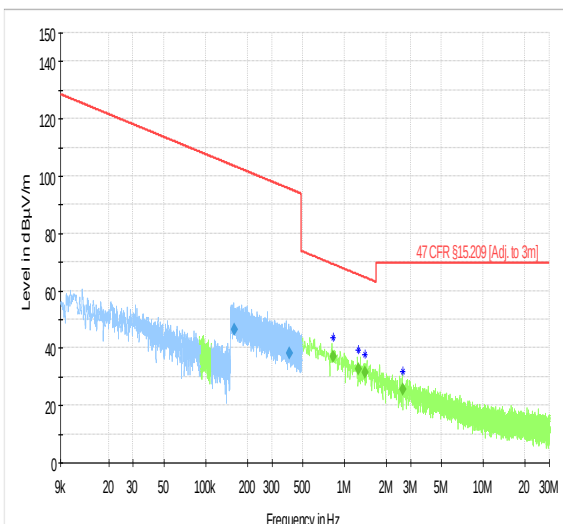


— PreviewResult 1-PK+
— 47 CFR §15.35 (S15.209+20dB Adj. to 3m)
— PreviewResult 2-PK+
♦ Final_Result PK+
x MaxPeak-PK+ (Single)
♦ Critical_Freqs PK+

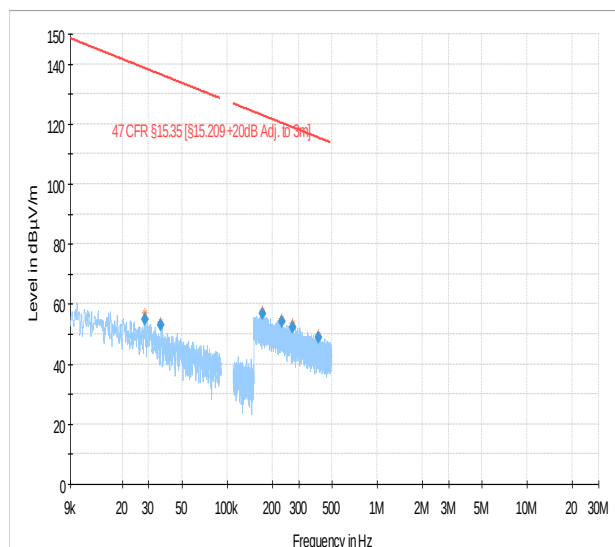
Frequency (MHz)	Average (dBµV/m)	QuasiPeak (dBµV/m)	MaxPeak (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)
0.158932	46.33	---	---	103.58	57.25	1000.0	9.000	100.0	H	-26.0
0.171898	45.72	---	---	102.90	57.18	1000.0	9.000	100.0	H	135.0
0.190499	44.71	---	---	102.01	57.29	1000.0	9.000	100.0	H	89.0
0.973581	---	35.72	---	67.84	32.11	1000.0	9.000	100.0	H	256.0
1.465921	---	31.41	---	64.28	32.87	1000.0	9.000	100.0	H	178.0
1.552071	---	30.73	---	63.79	33.06	1000.0	9.000	100.0	H	109.0
2.157161	---	27.44	---	69.54	42.11	1000.0	9.000	100.0	H	76.0
0.020940	---	---	56.61	141.19	84.58	1000.0	0.200	100.0	H	135.0
0.030669	---	---	54.21	137.87	83.66	1000.0	0.200	100.0	H	304.0
0.066391	---	---	47.18	131.16	83.98	1000.0	0.200	100.0	H	45.0
0.171327	---	---	56.71	122.93	66.22	1000.0	9.000	100.0	H	63.0
0.269727	---	---	53.00	118.99	65.98	1000.0	9.000	100.0	H	203.0
0.421965	---	---	49.24	115.10	65.85	1000.0	9.000	100.0	H	280.0

Low Channel 9kHz – 30MHz –Parallel to Floor

Test mode condition	Bluetooth Low Energy 1M Low Channel (2402 MHz)	
Antenna orientation	Loop Antenna Parallel to Floor	
Sweep frequency	9 kHz – 30 MHz	
Standard	FCC part 15 subpart C	
EUT	A002893981-001	
Ancillary Equipment	A002893981-014, A002893981-008, A002893981-016 12VDC Power Supply	
Test Engineer	Joel Efraimsson	Date: 2020-09-20
Chamber details	Chamber: SAC 5	



PreviewResult 2-PK+
 Critical_Freqs PK+
 47 CFR §15.209 (Adj. to 3m)
 Final_Result QPK

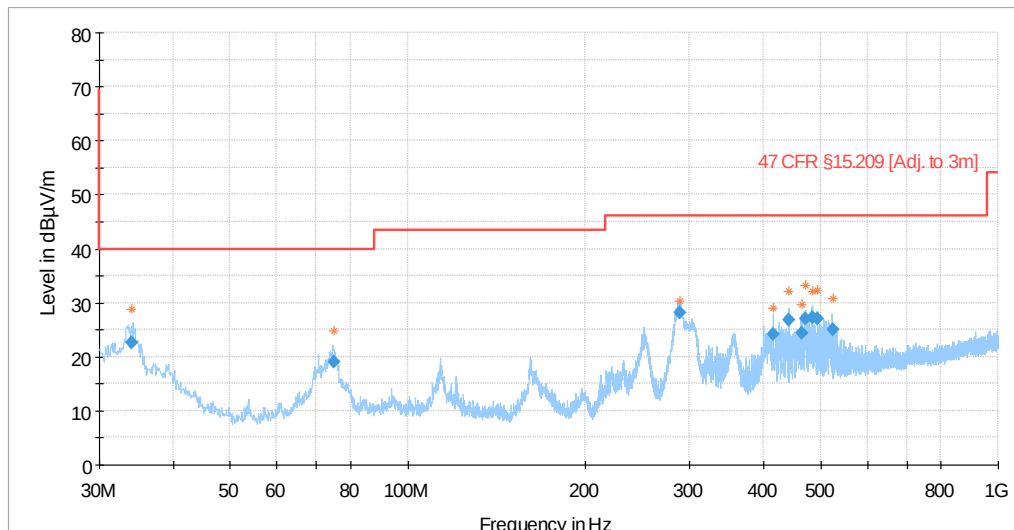


PreviewResult 1-PK+
 47 CFR §15.35 (S15.209 +20dB Adj. to 3m)
 MaxPeak-PK+ (Single)
 Critical_Freqs PK+
 Final_Result PK+

Frequency (MHz)	Average (dBµV/m)	QuasiPeak (dBµV/m)	MaxPeak (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)
0.161691	46.29	---	---	103.43	57.15	1000.0	9.000	100.0	H	25.0
0.399334	38.00	---	---	95.58	57.58	1000.0	9.000	100.0	H	244.0
0.833574	---	36.97	---	69.19	32.21	1000.0	9.000	100.0	H	135.0
1.257219	---	32.79	---	65.62	32.82	1000.0	9.000	100.0	H	-45.0
1.414596	---	31.64	---	64.59	32.95	1000.0	9.000	100.0	H	11.0
2.637842	---	25.59	---	69.54	43.95	1000.0	9.000	100.0	H	307.0
0.028167	---	---	55.00	138.61	83.61	1000.0	0.200	100.0	H	191.0
0.036004	---	---	53.09	136.48	83.39	1000.0	0.200	100.0	H	313.0
0.172829	---	---	56.71	122.85	66.14	1000.0	9.000	100.0	H	-15.0
0.230493	---	---	54.08	120.35	66.27	1000.0	9.000	100.0	H	10.0
0.271562	---	---	52.22	118.93	66.70	1000.0	9.000	100.0	H	-25.0
0.405943	---	---	49.02	115.44	66.41	1000.0	9.000	100.0	H	139.0

Low Channel 30MHz – 1GHz

Test mode condition	Bluetooth Low Energy 1M Low Channel (2402 MHz)	
Antenna orientation	Horizontal and Vertical	
Sweep frequency	30 MHz – 1 GHz	
Standard	FCC part 15 subpart C	
EUT	A002893981-001	
Ancillary Equipment	A002893981-014, A002893981-008, A002893981-016 12VDC Power Supply	
Test Engineer	Sam Ebadeh	Date: 2020-09-15
Chamber details	Chamber: SAC 5	

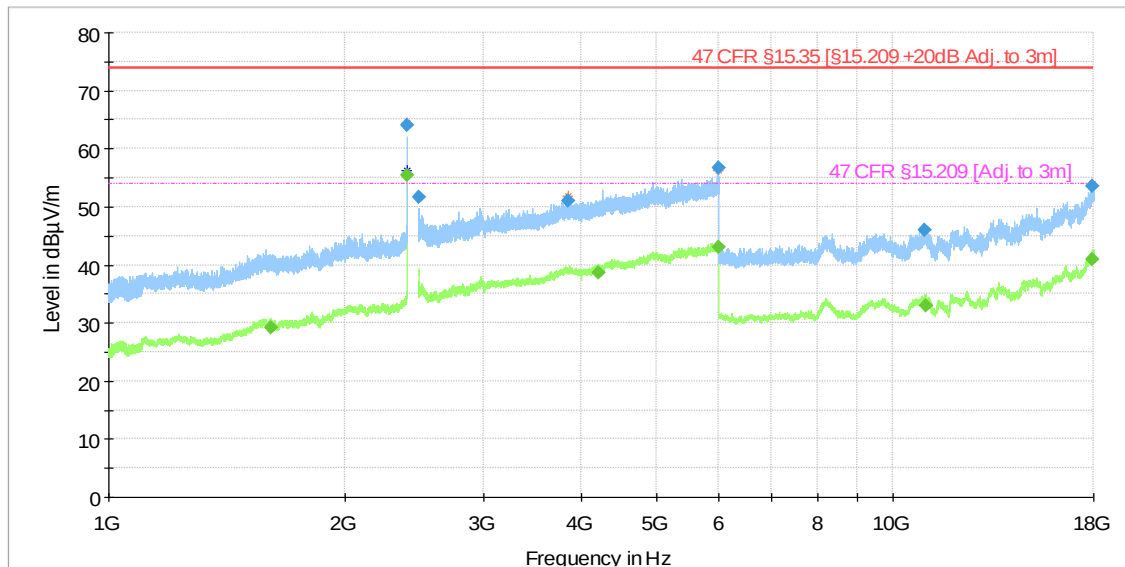


PreviewResult 2-AVG	PreviewResult 1-PK+
* Critical_Freqs AVG	* Critical_Freqs PK+
— 47 CFR §15.209 [Adj. to 3m]	◆ Final_Result QPK
◆ Final_Result AVG	× MaxPeak-PK+ (Single)
+ QuasiPeak-QPK (Single)	× Average-AVG (Single)

Frequency (MHz)	QuasiPeak (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)
34.078640	22.63	40.00	17.37	1000.0	120.000	125.0	V	310.0
288.601920	28.21	46.02	17.82	1000.0	120.000	225.0	V	72.0
440.860080	26.72	46.02	19.30	1000.0	120.000	325.0	H	109.0
471.555760	26.93	46.02	19.09	1000.0	120.000	108.0	V	-4.0
483.826400	27.17	46.02	18.85	1000.0	120.000	125.0	V	-4.0
493.048360	27.04	46.02	18.99	1000.0	120.000	125.0	V	-18.0

Low Channel 1GHz – 18GHz

Test mode condition	Bluetooth Low Energy 1M Low Channel (2402 MHz)	
Antenna orientation	Horizontal and Vertical	
Sweep frequency	1 GHz – 18 GHz	
Standard	FCC part 15 subpart C	
EUT	A002893981-001	
Ancillary Equipment	A002893981-014, A002893981-008, A002893981-016 12VDC Power Supply	
Test Engineer	Niall Forrester	Date: 2020-09-17
Chamber details	Chamber: SAC 5	



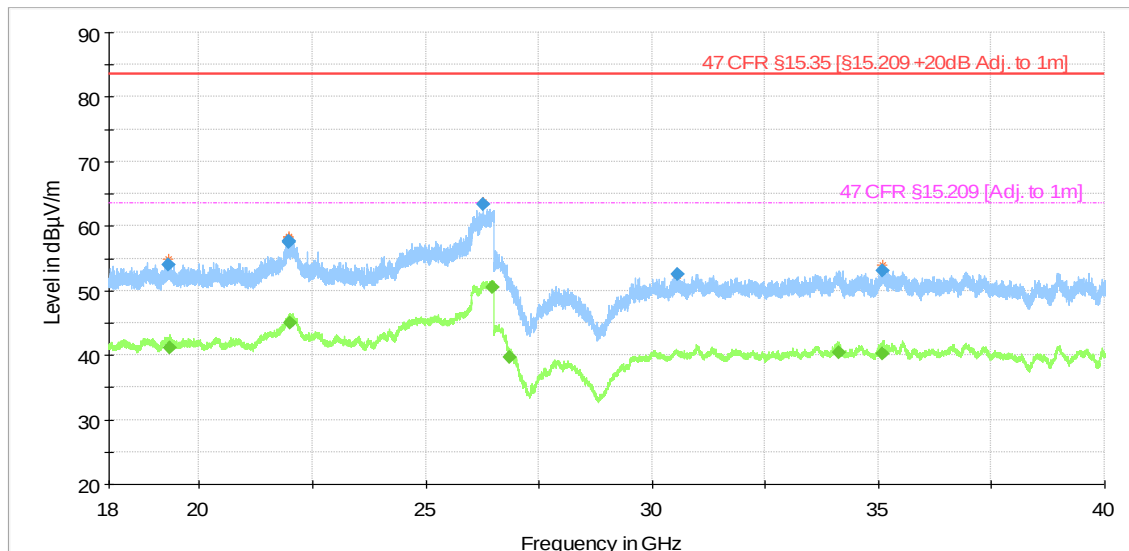
PreviewResult 2-AVG
 * Critical_Freqs AVG
 47 CFR §15.35 [§15.209 +20dB Adj. to 3m]
 ◆ Final_Result PK+

PreviewResult 1-PK+
 * Critical_Freqs PK+
 47 CFR §15.209 [Adj. to 3m]
 ◆ 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)
1608.245000	---	29.13	53.98	24.85	1000.0	1000.000	169.0	V	-22.0
2399.988000	64.12	---	73.98	9.86	1000.0	1000.000	127.0	H	72.0
2399.999500	---	55.36	53.98	-1.38	1000.0	1000.000	170.0	H	72.0
2483.534702	51.65	---	73.98	22.32	1000.0	1000.000	177.0	H	162.0
3844.858000	50.93	---	73.98	23.05	1000.0	1000.000	170.0	V	87.0
4212.754000	---	38.68	53.98	15.30	1000.0	1000.000	177.0	V	112.0
5978.580000	---	42.95	53.98	11.03	1000.0	1000.000	102.0	V	116.0
5978.840000	56.67	---	73.98	17.31	1000.0	1000.000	210.0	V	252.0
10971.843000	45.91	---	73.98	28.07	1000.0	1000.000	125.0	V	292.0
10990.259000	---	32.92	53.98	21.06	1000.0	1000.000	210.0	V	158.0
17930.455000	53.48	---	73.98	20.50	1000.0	1000.000	121.0	V	-22.0
17954.827000	---	40.94	53.98	13.04	1000.0	1000.000	171.0	V	252.0

Low Channel 18GHz – 40GHz

Test mode condition	Bluetooth Low Energy 1M Low Channel (2402 MHz)	
Antenna orientation	Horizontal and Vertical	
Sweep frequency	18 GHz – 40 GHz	
Standard	FCC part 15 subpart C	
EUT	A002893981-001	
Ancillary Equipment	A002893981-014, A002893981-008, A002893981-016 12VDC Power Supply	
Test Engineer	Niall Forrester	Date: 2020-09-22
Chamber details	Chamber: SAC 5	



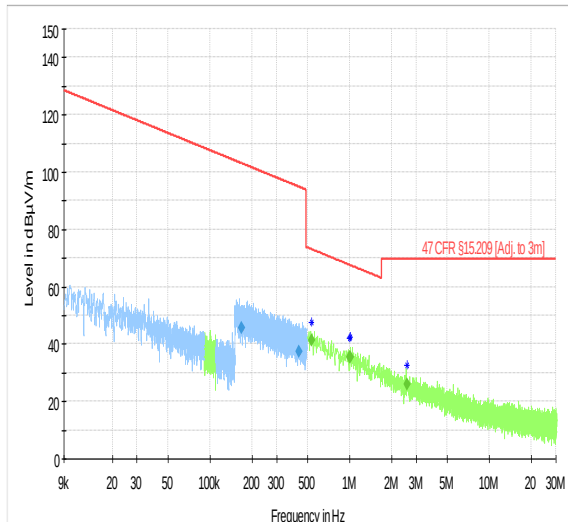
— PreviewResult 2-AVG
* Critical_Freqs AVG
— 47 CFR §15.35 [§15.209 +20dB Adj. to 1m]
◆ Final_Result PK+

— PreviewResult 1-PK+
* Critical_Freqs PK+
— 47 CFR §15.209 [Adj. to 1m]
◆ Final_Result AVG

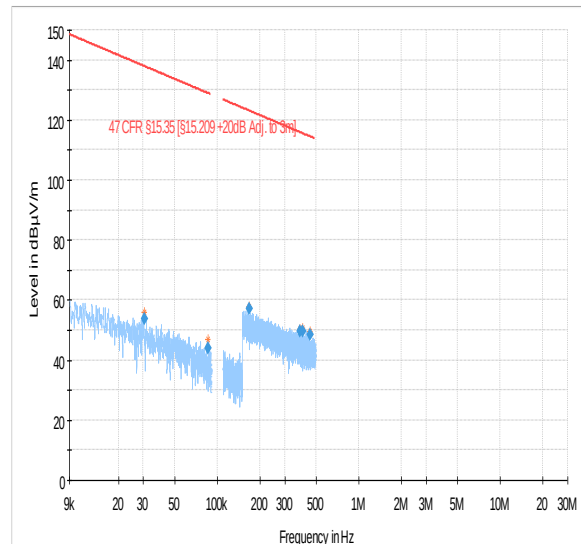
Frequency (MHz)	MaxPeak (dBµV/m)	Average (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)
19322.868000	53.93	---	83.52	29.59	1000.0	1000.000	155.0	V	146.0
19343.685000	---	41.20	63.52	22.32	1000.0	1000.000	155.0	H	68.0
21972.278000	57.60	---	83.52	25.92	1000.0	1000.000	155.0	V	8.0
21978.414000	57.57	---	83.52	25.95	1000.0	1000.000	155.0	V	6.0
22006.873000	---	44.94	63.52	18.58	1000.0	1000.000	155.0	H	282.0
26256.590000	63.35	---	83.52	20.17	1000.0	1000.000	155.0	V	98.0
26463.015000	---	50.44	63.52	13.09	1000.0	1000.000	155.0	H	218.0
26843.283000	---	39.75	63.52	23.77	1000.0	1000.000	155.0	H	306.0
30558.372000	52.48	---	83.52	31.05	1000.0	1000.000	155.0	V	326.0
34117.428000	---	40.31	63.52	23.21	1000.0	1000.000	155.0	V	322.0
35088.146000	---	40.18	63.52	23.35	1000.0	1000.000	155.0	H	128.0
35100.603000	53.05	---	83.52	30.47	1000.0	1000.000	155.0	V	146.0

Mid Channel 9kHz – 30MHz –Parallel to Axis

Test mode condition	Bluetooth Low Energy 1M Mid Channel (2440 MHz)	
Antenna orientation	Loop Antenna Parallel to Axis	
Sweep frequency	9 kHz – 30 MHz	
Standard	FCC part 15 subpart C	
EUT	A002893981-001	
Ancillary Equipment	A002893981-014, A002893981-008, A002893981-016 12VDC Power Supply	
Test Engineer	Niall Forrester	Date: 2020-09-21
Chamber details	Chamber: SAC 5	



PreviewResult 2-PK+
 Critical_Freqs PK+
 47 CFR §15.209 (Adj. to 3m)
 Final_Result QPK
 PreviewResult 1-AVG
 Critical_Freqs AVG
 Final_Result AVG

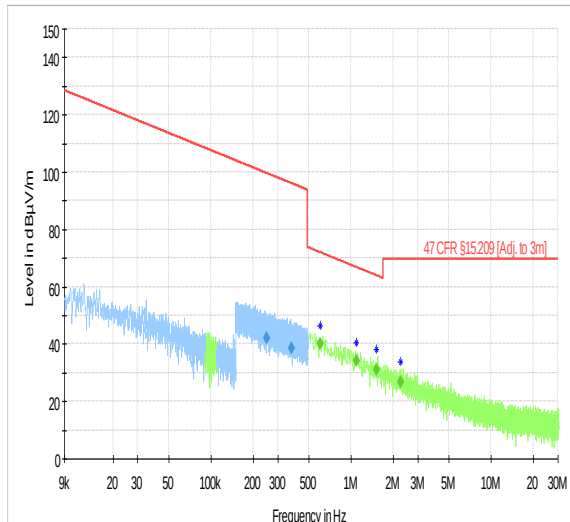


PreviewResult 1-PK+
 47 CFR §15.35 (S15.209+20dB Adj. to 3m)
 MaxPeak-PK+ (Single)
 Critical_Freqs PK+
 Final_Result PK+

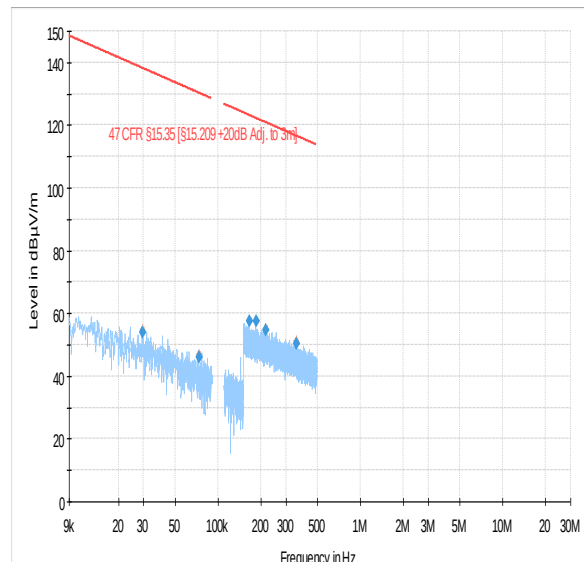
Frequency (MHz)	Average (dBµV/m)	QuasiPeak (dBµV/m)	MaxPeak (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)
0.168687	45.85	---	---	103.06	57.21	1000.0	9.000	100.0	H	308.0
0.434298	37.39	---	---	94.85	57.46	1000.0	9.000	100.0	H	-41.0
0.533374	---	41.51	---	73.06	31.56	1000.0	9.000	100.0	H	139.0
1.004451	---	35.38	---	67.57	32.18	1000.0	9.000	100.0	H	-45.0
1.016640	---	35.47	---	67.46	31.99	1000.0	9.000	100.0	H	244.0
2.568073	---	25.80	---	69.54	43.74	1000.0	9.000	100.0	H	308.0
0.030451	---	---	53.93	137.93	84.00	1000.0	0.200	100.0	H	-41.0
0.086044	---	---	44.08	128.91	84.83	1000.0	0.200	100.0	H	243.0
0.167617	---	---	57.13	123.12	65.99	1000.0	9.000	100.0	H	267.0
0.384288	---	---	49.52	115.91	66.39	1000.0	9.000	100.0	H	214.0
0.400575	---	---	49.73	115.55	65.82	1000.0	9.000	100.0	H	88.0
0.030451	---	---	53.93	137.93	84.00	1000.0	0.200	100.0	H	-41.0

Mid Channel 9kHz – 30MHz –Perpendicular to Axis

Test mode condition	Bluetooth Low Energy 1M Mid Channel (2440 MHz)	
Antenna orientation	Loop Antenna Perpendicular to Axis	
Sweep frequency	9 kHz – 30 MHz	
Standard	FCC part 15 subpart C	
EUT	A002893981-001	
Ancillary Equipment	A002893981-014, A002893981-008, A002893981-016 12VDC Power Supply	
Test Engineer	Joel Efraimsson	Date: 2020-09-21
Chamber details	Chamber: SAC 5	



PreviewResult 2-PK+
 Critical_Freqs PK+
 47 CFR §15.209 (Adj. to 3m)
 Final_Result QPK

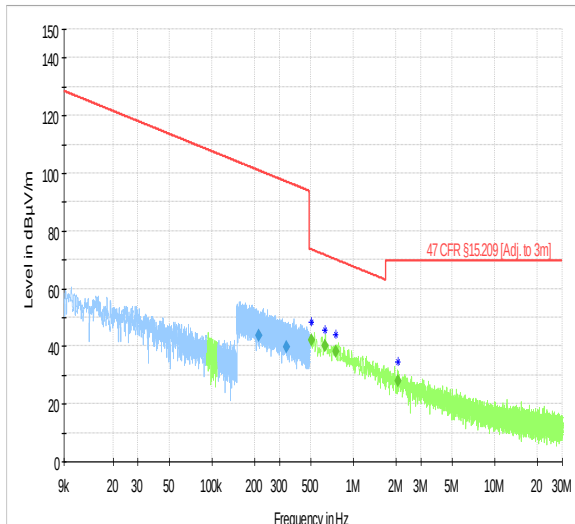


PreviewResult 1-PK+
 47 CFR §15.35 (S15.209+20dB Adj. to 3m)
 Critical_Freqs PK+
 Final_Result PK+

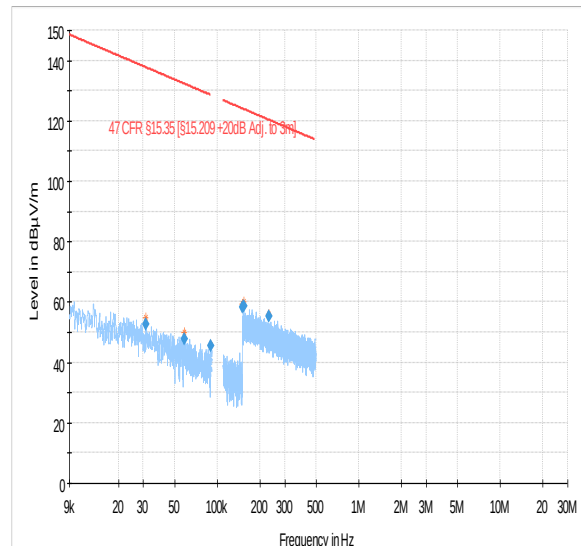
Frequency (MHz)	Average (dBµV/m)	QuasiPeak (dBµV/m)	MaxPeak (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)
0.251089	42.13	---	---	99.61	57.48	1000.0	9.000	100.0	H	45.0
0.375889	38.60	---	---	96.10	57.50	1000.0	9.000	100.0	H	244.0
0.602381	---	40.24	---	72.01	31.77	1000.0	9.000	100.0	H	268.0
1.096057	---	34.41	---	66.81	32.40	1000.0	9.000	100.0	H	154.0
1.514261	---	31.13	---	64.00	32.87	1000.0	9.000	100.0	H	225.0
2.268765	---	26.85	---	69.54	42.70	1000.0	9.000	100.0	H	315.0
0.029646	---	---	54.04	138.17	84.13	1000.0	0.200	100.0	H	256.0
0.073941	---	---	45.91	130.23	84.32	1000.0	0.200	100.0	H	165.0
0.165843	---	---	57.39	123.21	65.82	1000.0	9.000	100.0	H	225.0
0.185427	---	---	57.59	122.24	64.65	1000.0	9.000	100.0	H	45.0
0.215474	---	---	54.61	120.94	66.33	1000.0	9.000	100.0	H	135.0
0.356392	---	---	50.40	116.57	66.17	1000.0	9.000	100.0	H	133.0

Mid Channel 9kHz – 30MHz –Parallel to Floor

Test mode condition	Bluetooth Low Energy 1M Mid Channel (2440 MHz)	
Antenna orientation	Loop Antenna Parallel to Floor	
Sweep frequency	9 kHz – 30 MHz	
Standard	FCC part 15 subpart C	
EUT	A002893981-001	
Ancillary Equipment	A002893981-014, A002893981-008, A002893981-016 12VDC Power Supply	
Test Engineer	Joel Efraimsson	Date: 2020-09-20
Chamber details	Chamber: SAC 5	



PreviewResult 2-PK+
 Critical_Freqs PK+
 47 CFR §15.209 (Adj. to 3m)
 Final_Result QPK
 PreviewResult 1-AVG
 Critical_Freqs AVG
 Final_Result AVG

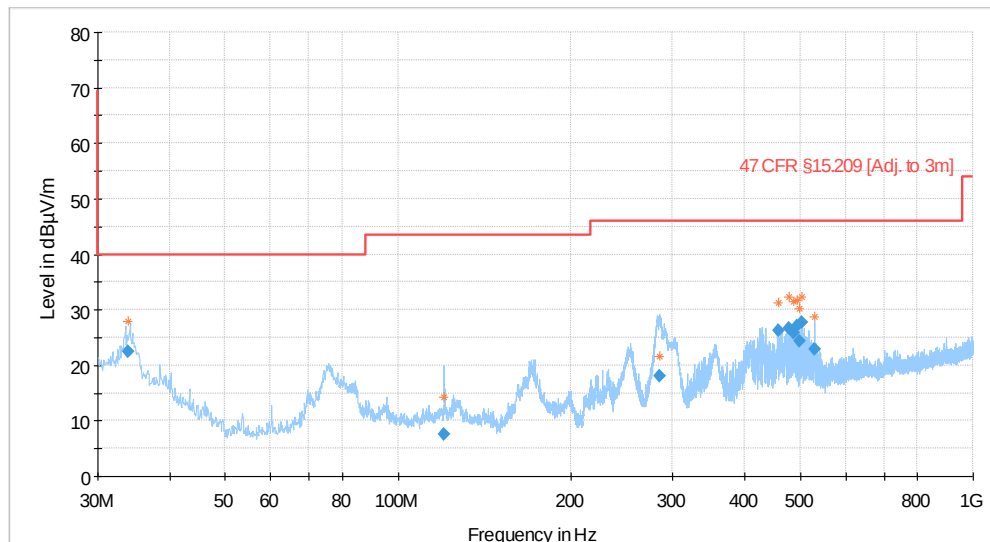


PreviewResult 1-PK+
 47 CFR §15.35 (S15.209+20dB Adj. to 3m)
 MaxPeak-PK+ (Single)
 Critical_Freqs PK+
 Final_Result PK+

Frequency (MHz)	Average (dBµV/m)	QuasiPeak (dBµV/m)	MaxPeak (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)
0.214802	43.89	---	---	100.96	57.07	1000.0	9.000	100.0	H	229.0
0.336991	39.59	---	---	97.05	57.46	1000.0	9.000	100.0	H	225.0
0.506039	---	42.12	---	73.52	31.40	1000.0	9.000	100.0	H	-41.0
0.629127	---	40.08	---	71.63	31.55	1000.0	9.000	100.0	H	25.0
0.751783	---	38.34	---	70.08	31.74	1000.0	9.000	100.0	H	205.0
2.063484	---	28.08	---	69.54	41.46	1000.0	9.000	100.0	H	11.0
0.031093	---	---	52.47	137.75	85.28	1000.0	0.200	100.0	H	124.0
0.058244	---	---	47.61	132.30	84.69	1000.0	0.200	100.0	H	315.0
0.089491	---	---	45.32	128.57	83.25	1000.0	0.200	100.0	H	116.0
0.151244	---	---	58.26	124.01	65.75	1000.0	9.000	100.0	H	-27.0
0.154499	---	---	58.59	123.83	65.24	1000.0	9.000	100.0	H	268.0
0.230172	---	---	55.15	120.36	65.21	1000.0	9.000	100.0	H	315.0

Mid Channel 30MHz – 1GHz

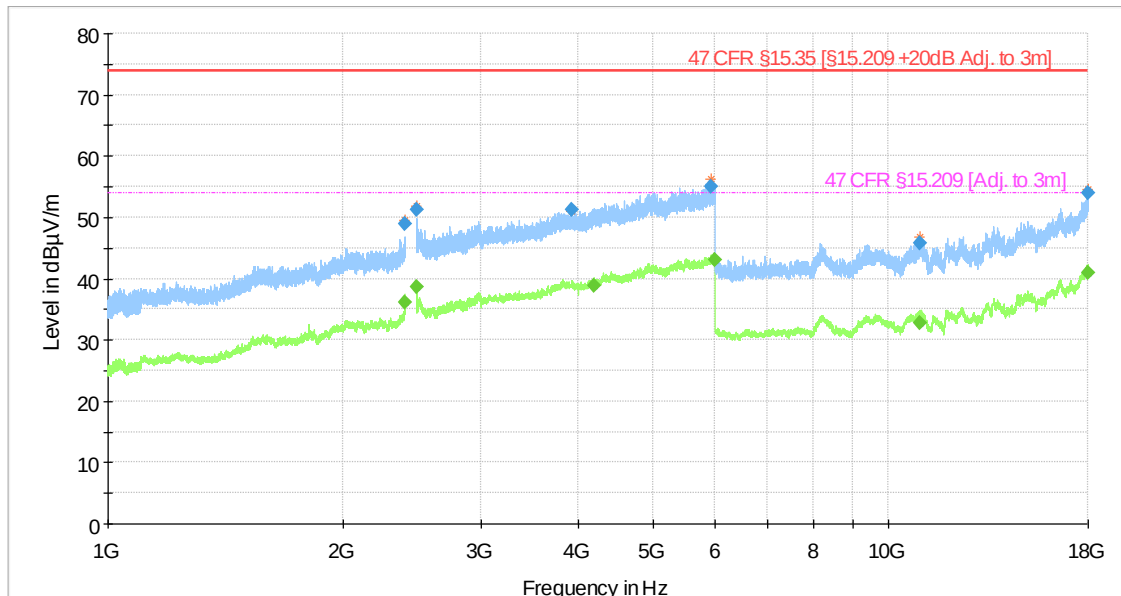
Test mode condition	Bluetooth Low Energy 1M Mid Channel (2440 MHz)	
Antenna orientation	Horizontal and Vertical	
Sweep frequency	30 MHz – 1 GHz	
Standard	FCC part 15 subpart C	
EUT	A002893981-001	
Ancillary Equipment	A002893981-014, A002893981-008, A002893981-016 12VDC Power Supply	
Test Engineer	Sam Ebadeh	Date: 2020-09-15
Chamber details	Chamber: SAC 5	



Frequency (MHz)	QuasiPeak (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)
33.811480	22.46	40.00	17.54	1000.0	120.000	100.0	V	235.0
459.299080	26.17	46.02	19.85	1000.0	120.000	170.0	V	-2.0
477.681640	26.56	46.02	19.46	1000.0	120.000	125.0	V	22.0
486.937080	25.84	46.02	20.19	1000.0	120.000	175.0	V	-18.0
493.059240	27.12	46.02	18.90	1000.0	120.000	175.0	V	8.0
502.284240	27.69	46.02	18.33	1000.0	120.000	133.0	V	-18.0

Mid Channel 1GHz – 18GHz

Test mode condition	Bluetooth Low Energy 1M Mid Channel (2440 MHz)	
Antenna orientation	Horizontal and Vertical	
Sweep frequency	1 GHz – 18 GHz	
Standard	FCC part 15 subpart C	
EUT	A002893981-001	
Ancillary Equipment	A002893981-014, A002893981-008, A002893981-016 12VDC Power Supply	
Test Engineer	Niall Forrester	Date: 2020-09-18
Chamber details	Chamber: SAC 5	

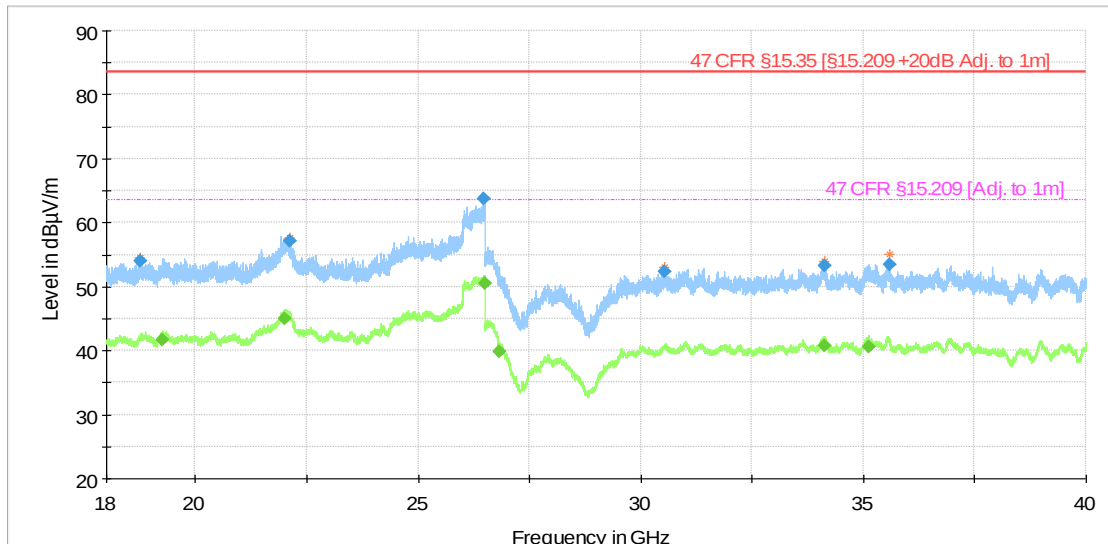


— PreviewResult 2-AVG
— PreviewResult 1-PK+
* Critical_Freqs AVG
* Critical_Freqs PK+
— 47 CFR §15.35 [§15.209 +20dB Adj. to 3m]
— 47 CFR §15.209 [Adj. to 3m]
◆ Final_Result PK+
◆ Final_Result AVG

Frequency (MHz)	MaxPeak (dBµV/m)	Average (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)
2399.942000	---	36.22	53.98	17.76	1000.0	1000.000	100.0	V	158.0
2399.980500	48.94	---	73.98	25.03	1000.0	1000.000	170.0	H	131.0
2483.508588	---	38.55	53.98	15.43	1000.0	1000.000	188.0	V	68.0
2483.538762	51.29	---	73.98	22.69	1000.0	1000.000	121.0	H	338.0
3923.916000	51.27	---	73.98	22.71	1000.0	1000.000	125.0	H	311.0
4196.853000	---	38.81	53.98	15.17	1000.0	1000.000	121.0	V	248.0
5922.892000	55.11	---	73.98	18.87	1000.0	1000.000	100.0	H	290.0
5978.582000	---	42.98	53.98	11.00	1000.0	1000.000	125.0	H	206.0
10962.074000	45.70	---	73.98	28.28	1000.0	1000.000	100.0	H	109.0
10983.166000	---	32.84	53.98	21.14	1000.0	1000.000	175.0	V	129.0
17982.266000	---	40.95	53.98	13.03	1000.0	1000.000	110.0	V	232.0
17993.839680	53.86	---	73.98	20.12	1000.0	1000.000	146.0	H	116.0

Mid Channel 18GHz – 40GHz

Test mode condition	Bluetooth Low Energy 1M Mid Channel (2440 MHz)	
Antenna orientation	Horizontal and Vertical	
Sweep frequency	18 GHz – 40 GHz	
Standard	FCC part 15 subpart C	
EUT	A002893981-001	
Ancillary Equipment	A002893981-014, A002893981-008, A002893981-016 12VDC Power Supply	
Test Engineer	Niall Forrester	Date: 2020-09-22
Chamber details	Chamber: SAC 5	

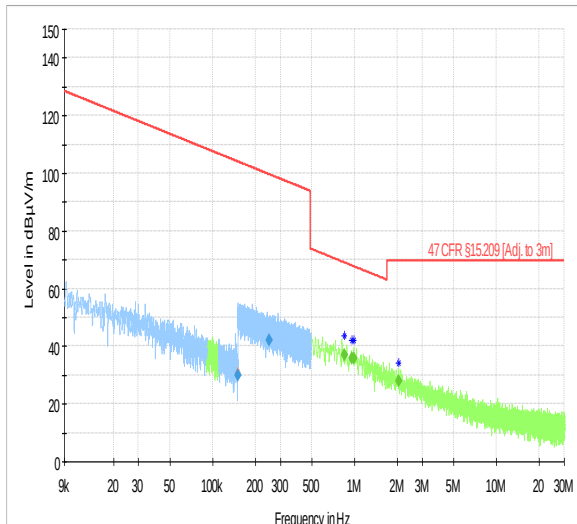


— PreviewResult 2-AVG
— PreviewResult 1-PK+
— 47 CFR §15.35 [§15.209 +20dB Adj. to 1m]
— 47 CFR §15.209 [Adj. to 1m]
★ Critical_Freqs AVG
★ Critical_Freqs PK+
◆ Final_Result PK+
◆ Final_Result AVG

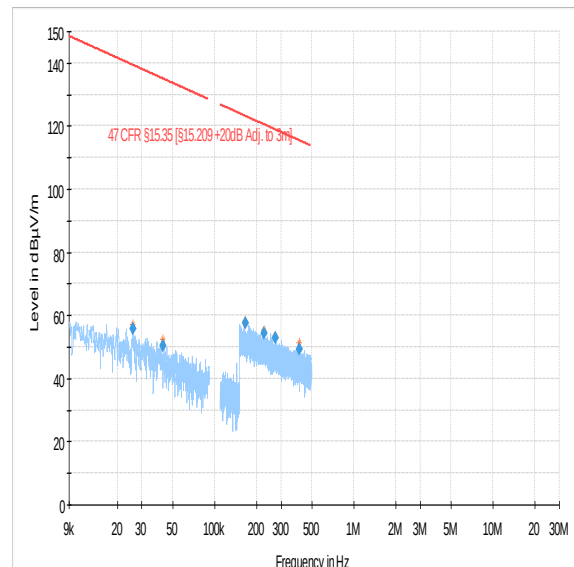
Frequency (MHz)	MaxPeak (dBµV/m)	Average (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)
18768.156000	54.08	---	83.52	29.44	1000.0	1000.000	155.0	V	172.0
19241.892000	---	41.60	63.52	21.92	1000.0	1000.000	155.0	V	172.0
21988.185000	---	45.00	63.52	18.52	1000.0	1000.000	155.0	V	158.0
22124.703000	57.19	---	83.52	26.33	1000.0	1000.000	155.0	H	142.0
26473.184000	63.70	---	83.52	19.83	1000.0	1000.000	155.0	V	322.0
26496.567500	---	50.45	63.52	13.07	1000.0	1000.000	155.0	H	338.0
26837.221000	---	39.80	63.52	23.72	1000.0	1000.000	155.0	H	338.0
30539.950000	52.25	---	83.52	31.28	1000.0	1000.000	155.0	H	82.0
34117.228000	---	40.67	63.52	22.85	1000.0	1000.000	155.0	V	292.0
34124.685000	53.22	---	83.52	30.30	1000.0	1000.000	155.0	H	-4.0
35117.178000	---	40.58	63.52	22.94	1000.0	1000.000	155.0	H	292.0
35588.315000	53.35	---	83.52	30.17	1000.0	1000.000	155.0	V	248.0

High Channel 9kHz – 30MHz –Parallel to Axis

Test mode condition	Bluetooth Low Energy 1M High Channel (2480 MHz)	
Antenna orientation	Loop Antenna Parallel to Axis	
Sweep frequency	9 kHz – 30 MHz	
Standard	FCC part 15 subpart C	
EUT	A002893981-001	
Ancillary Equipment	A002893981-014, A002893981-008, A002893981-016 12VDC Power Supply	
Test Engineer	Niall Forrester	Date: 2020-09-21
Chamber details	Chamber: SAC 5	



PreviewResult 2-PK+
 Critical_Freqs PK+
 47 CFR §15.209 (Adj. to 3m)
 Final_Result QPK
 PreviewResult 1-AVG
 Critical_Freqs AVG
 Final_Result AVG

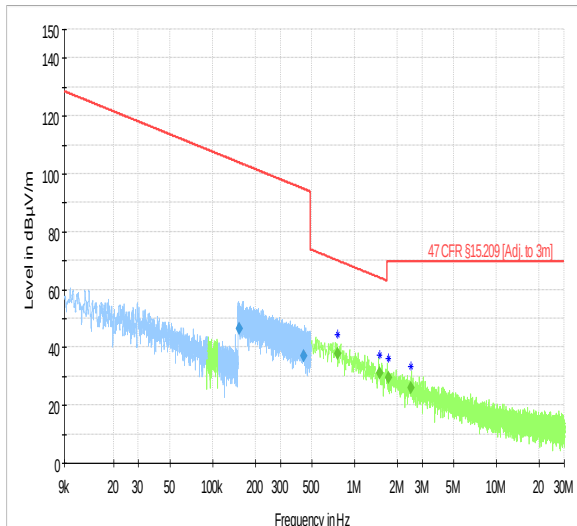


PreviewResult 1-PK+
 Critical_Freqs PK+
 47 CFR §15.35 (S15.209 +20dB Adj. to 3m)
 Final_Result PK+

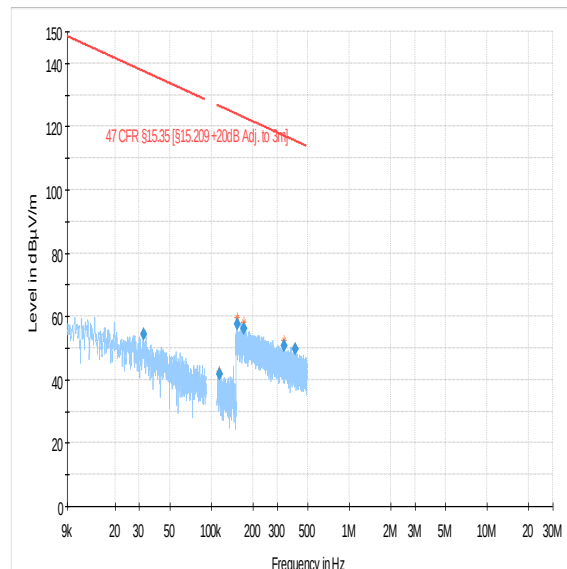
Frequency (MHz)	Average (dBµV/m)	QuasiPeak (dBµV/m)	MaxPeak (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)
0.150000	29.98	---	---	104.08	74.11	1000.0	0.200	100.0	H	244.0
0.251138	42.09	---	---	99.61	57.52	1000.0	9.000	100.0	H	45.0
0.850512	---	36.83	---	69.01	32.18	1000.0	9.000	100.0	H	135.0
0.955194	---	35.97	---	68.00	32.03	1000.0	9.000	100.0	H	64.0
0.992592	---	35.63	---	67.67	32.04	1000.0	9.000	100.0	H	49.0
2.036312	---	28.04	---	69.54	41.50	1000.0	9.000	100.0	H	244.0
0.025784	---	---	55.78	139.38	83.59	1000.0	0.200	100.0	H	11.0
0.042414	---	---	50.53	135.05	84.53	1000.0	0.200	100.0	H	168.0
0.167236	---	---	57.38	123.14	65.75	1000.0	9.000	100.0	H	45.0
0.226485	---	---	54.37	120.50	66.14	1000.0	9.000	100.0	H	-27.0
0.272547	---	---	52.89	118.90	66.00	1000.0	9.000	100.0	H	255.0
0.406571	---	---	49.34	115.42	66.08	1000.0	9.000	100.0	H	43.0

High Channel 9kHz – 30MHz –Perpendicular to Axis

Test mode condition	Bluetooth Low Energy 1M High Channel (2480 MHz)	
Antenna orientation	Loop Antenna Perpendicular to Axis	
Sweep frequency	9 kHz – 30 MHz	
Standard	FCC part 15 subpart C	
EUT	A002893981-001	
Ancillary Equipment	A002893981-014, A002893981-008, A002893981-016 12VDC Power Supply	
Test Engineer	Joel Efraimsson	Date: 2020-09-21
Chamber details	Chamber: SAC 5	



PreviewResult 2-PK+
 Critical_Freqs PK+
 47 CFR §15.209 (Adj. to 3m)
 Final_Result QPK

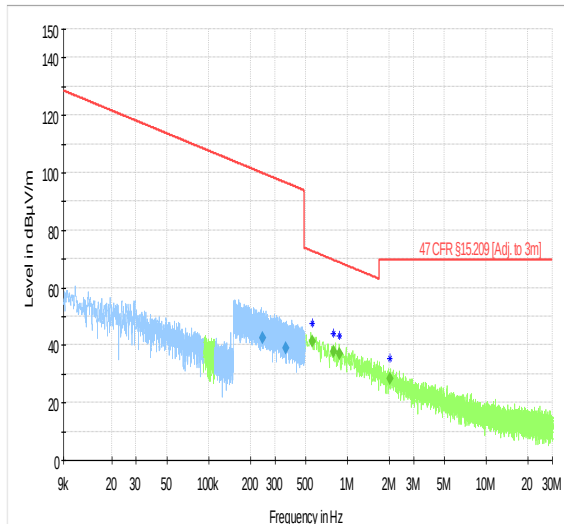


PreviewResult 1-PK+
 Critical_Freqs PK+
 47 CFR §15.35 (S15.209+20dB Adj. to 3m)
 Final_Result PK+

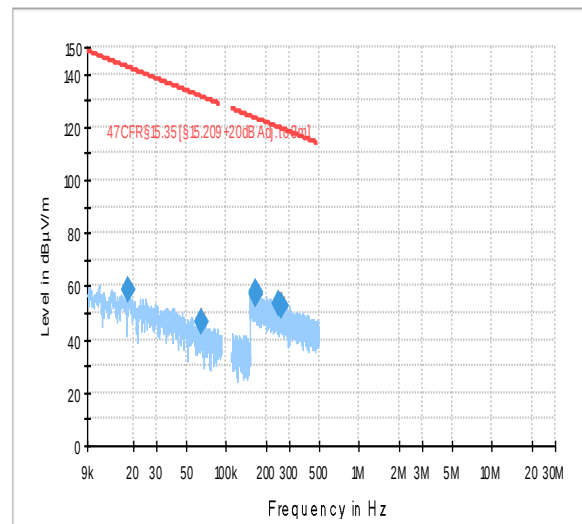
Frequency (MHz)	Average (dBµV/m)	QuasiPeak (dBµV/m)	MaxPeak (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)
0.154346	46.65	---	---	103.83	57.19	1000.0	9.000	100.0	H	117.0
0.438345	37.12	---	---	94.77	57.64	1000.0	9.000	100.0	H	315.0
0.761812	---	37.87	---	69.97	32.10	1000.0	9.000	100.0	H	127.0
1.500854	---	31.11	---	64.08	32.97	1000.0	9.000	100.0	H	315.0
1.724994	---	29.57	---	69.54	39.98	1000.0	9.000	100.0	H	179.0
2.502559	---	26.16	---	69.54	43.38	1000.0	9.000	100.0	H	270.0
0.032142	---	---	54.18	137.46	83.28	1000.0	0.200	100.0	H	225.0
0.114405	---	---	41.63	126.44	84.81	1000.0	0.200	100.0	H	-41.0
0.154122	---	---	57.57	123.85	66.28	1000.0	9.000	100.0	H	21.0
0.171028	---	---	56.22	122.94	66.72	1000.0	9.000	100.0	H	63.0
0.335624	---	---	50.78	117.09	66.31	1000.0	9.000	100.0	H	-2.0
0.405440	---	---	49.64	115.45	65.81	1000.0	9.000	100.0	H	-45.0

High Channel 9kHz – 30MHz –Parallel to Floor

Test mode condition	Bluetooth Low Energy 1M High Channel (2480 MHz)	
Antenna orientation	Loop Antenna Parallel to Floor	
Sweep frequency	9 kHz – 30 MHz	
Standard	FCC part 15 subpart C	
EUT	A002893981-001	
Ancillary Equipment	A002893981-014, A002893981-008, A002893981-016 12VDC Power Supply	
Test Engineer	Joel Efraimsson	Date: 2020-09-20
Chamber details	Chamber: SAC 5	



PreviewResult 2-PK+
 Critical_Freqs PK+
 47 CFR §15.209 (Adj. to 3m)
 Final_Result QPK
 PreviewResult 1-AVG
 Critical_Freqs AVG
 Final_Result AVG

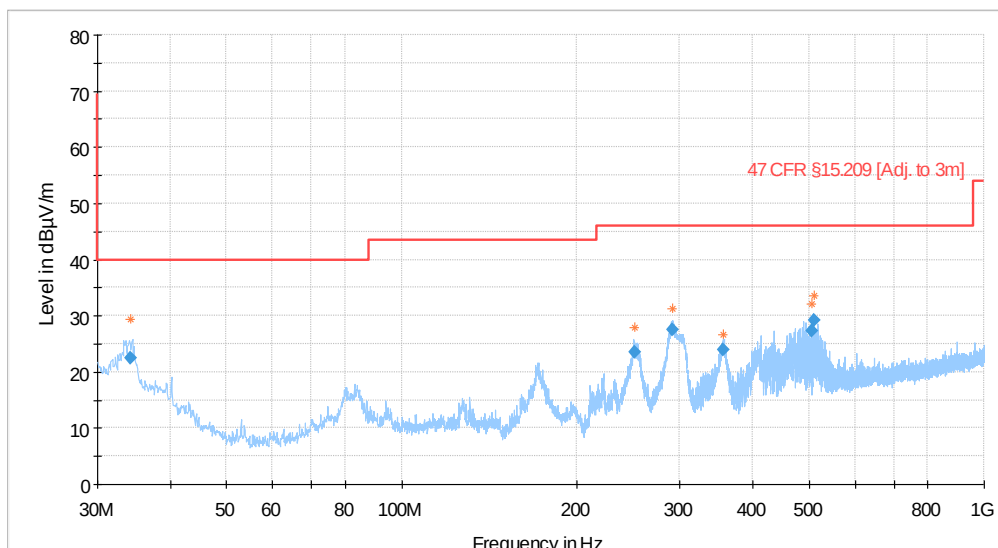


PreviewResult 1-PK+
 47 CFR §15.35 (S 15.209 +20dB Adj. to 3m)
 MaxPeak-PK+ (Single)
 Critical_Freqs PK+
 Final_Result PK+

Frequency (MHz)	Average (dBµV/m)	QuasiPeak (dBµV/m)	MaxPeak (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)
0.245159	42.52	---	---	99.82	57.29	1000.0	9.000	100.0	H	225.0
0.358976	39.08	---	---	96.50	57.43	1000.0	9.000	100.0	H	129.0
0.558436	---	41.18	---	72.67	31.48	1000.0	9.000	100.0	H	217.0
0.792944	---	37.81	---	69.62	31.81	1000.0	9.000	100.0	H	154.0
0.877187	---	36.86	---	68.74	31.88	1000.0	9.000	100.0	H	180.0
2.015647	---	28.24	---	69.54	41.30	1000.0	9.000	100.0	H	-26.0
0.018038	---	---	58.48	142.48	84.00	1000.0	0.200	100.0	H	-15.0
0.064273	---	---	46.65	131.44	84.80	1000.0	0.200	100.0	H	256.0
0.165301	---	---	56.99	123.24	66.25	1000.0	9.000	100.0	H	45.0
0.166733	---	---	57.73	123.16	65.43	1000.0	9.000	100.0	H	306.0
0.248033	---	---	53.48	119.71	66.23	1000.0	9.000	100.0	H	178.0
0.258666	---	---	52.82	119.35	66.53	1000.0	9.000	100.0	H	292.0

High Channel 30MHz – 1GHz

Test mode condition	Bluetooth Low Energy 1M High Channel (2480 MHz)	
Antenna orientation	Horizontal and Vertical	
Sweep frequency	30 MHz – 1 GHz	
Standard	FCC part 15 subpart C	
EUT	A002893981-001	
Ancillary Equipment	A002893981-014, A002893981-008, A002893981-016 12VDC Power Supply	
Test Engineer	Sam Ebadeh	Date: 2020-09-15
Chamber details	Chamber: SAC 5	

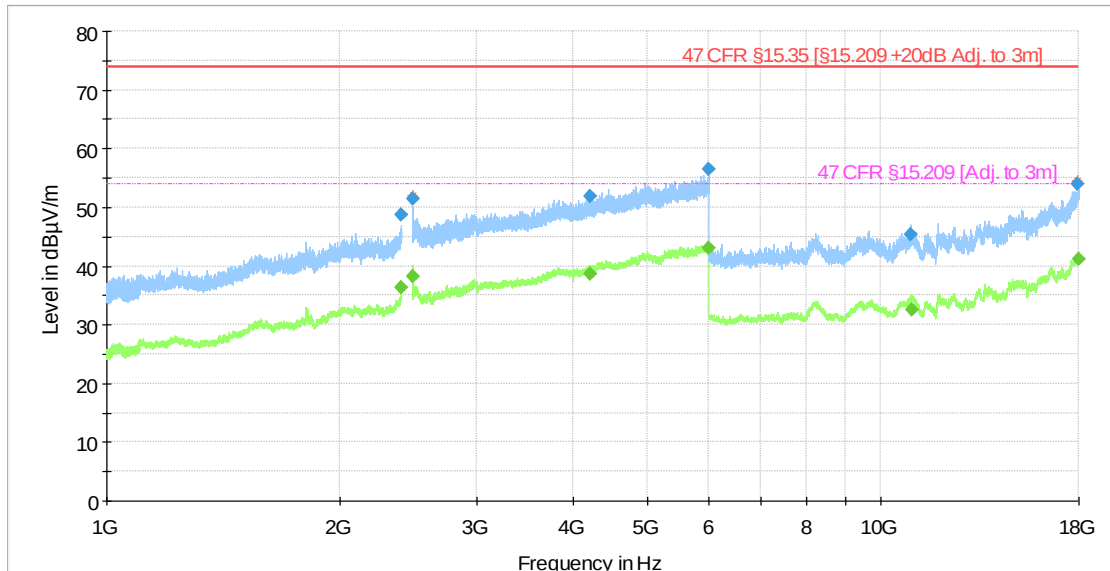


— PreviewResult 2-AVG
* Critical_Freqs AVG
— 47 CFR §15.209 [Adj. to 3m]
◆ Final_Result AVG
— PreviewResult 1-PK+
* Critical_Freqs PK+
◆ Final_Result QPK

Frequency (MHz)	QuasiPeak (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)
34.133920	22.39	40.00	17.61	1000.0	120.000	100.0	V	202.0
250.693360	23.55	46.02	22.48	1000.0	120.000	100.0	V	-18.0
290.890920	27.49	46.02	18.53	1000.0	120.000	125.0	H	296.0
357.134440	23.95	46.02	22.07	1000.0	120.000	100.0	V	52.0
505.348760	27.20	46.02	18.82	1000.0	120.000	125.0	V	8.0
511.484000	29.08	46.02	16.94	1000.0	120.000	125.0	V	-4.0

High Channel 1GHz – 18GHz

Test mode condition	Bluetooth Low Energy 1M High Channel (2480 MHz)	
Antenna orientation	Horizontal and Vertical	
Sweep frequency	1 GHz – 18 GHz	
Standard	FCC part 15 subpart C	
EUT	A002893981-001	
Ancillary Equipment	A002893981-014, A002893981-008, A002893981-016 12VDC Power Supply	
Test Engineer	Niall Forrester	Date: 2020-09-18
Chamber details	Chamber: SAC 5	

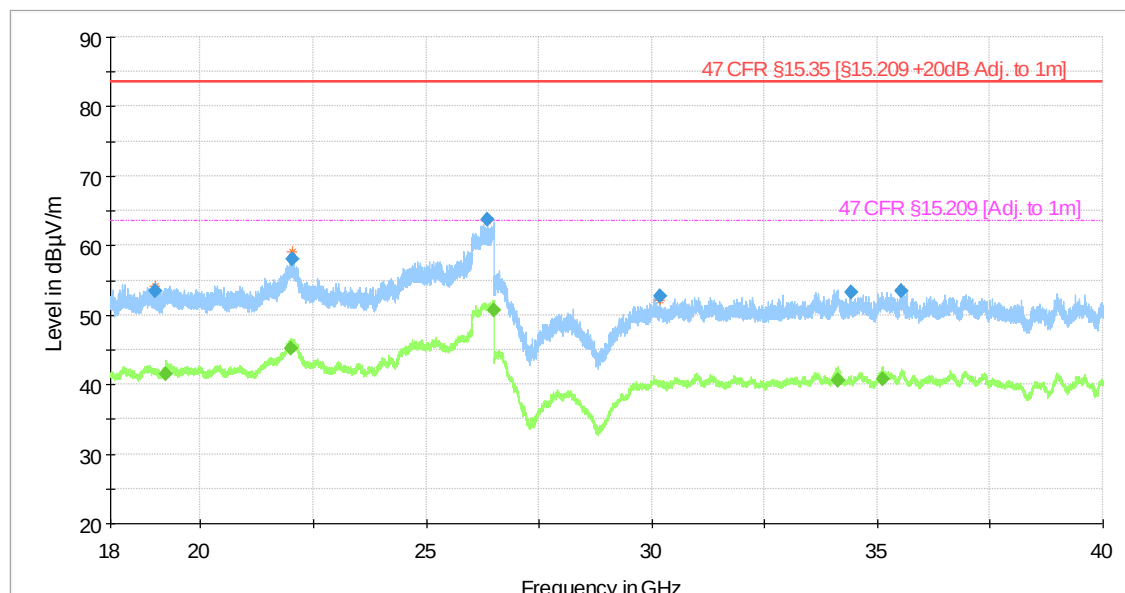


— PreviewResult 2-AVG
— PreviewResult 1-PK+
— 47 CFR §15.35 [§15.209 +20dB Adj. to 3m]
— 47 CFR §15.209 [Adj. to 3m]
◆ Critical_Freqs AVG
◆ Critical_Freqs PK+
◆ Final_Result PK+
◆ Final_Result AVG

Frequency (MHz)	MaxPeak (dBμV/m)	Average (dBμV/m)	Limit (dBμV/m)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)
2399.749000	48.75	---	73.98	25.23	1000.0	1000.000	198.0	V	144.0
2399.959500	---	36.27	53.98	17.71	1000.0	1000.000	175.0	V	-3.0
2483.537116	51.35	---	73.98	22.63	1000.0	1000.000	206.0	V	-3.0
2483.657182	---	38.23	53.98	15.75	1000.0	1000.000	100.0	H	221.0
4208.288000	51.90	---	73.98	22.08	1000.0	1000.000	175.0	V	68.0
4213.242000	---	38.72	53.98	15.26	1000.0	1000.000	102.0	H	-22.0
5980.704000	---	42.98	53.98	11.00	1000.0	1000.000	175.0	H	22.0
5980.906000	56.38	---	73.98	17.60	1000.0	1000.000	175.0	V	155.0
10921.370000	45.35	---	73.98	28.63	1000.0	1000.000	175.0	H	309.0
10953.543000	---	32.49	53.98	21.49	1000.0	1000.000	100.0	V	309.0
17929.895000	54.03	---	73.98	19.95	1000.0	1000.000	206.0	H	109.0
17986.933000	---	41.06	53.98	12.92	1000.0	1000.000	175.0	V	-18.0

High Channel 18GHz – 40GHz

Test mode condition	Bluetooth Low Energy 1M High Channel (2480 MHz)	
Antenna orientation	Horizontal and Vertical	
Sweep frequency	18 GHz – 40 GHz	
Standard	FCC part 15 subpart C	
EUT	A002893981-001	
Ancillary Equipment	A002893981-014, A002893981-008, A002893981-016 12VDC Power Supply	
Test Engineer	Niall Forrester	Date: 2020-09-22
Chamber details	Chamber: SAC 5	



— PreviewResult 2-AVG
* Critical_Freqs AVG
— 47 CFR §15.35 [§15.209 +20dB Adj. to 1m]
◆ Final_Result PK+

— PreviewResult 1-PK+
* Critical_Freqs PK+
— 47 CFR §15.209 [Adj. to 1m]
◆ 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)
18996.377000	53.44	---	83.52	30.09	1000.0	1000.000	155.0	H	96.0
19236.537000	---	41.54	63.52	21.98	1000.0	1000.000	155.0	V	222.0
21994.388000	---	45.21	63.52	18.31	1000.0	1000.000	155.0	V	322.0
22039.817000	57.99	---	83.52	25.53	1000.0	1000.000	155.0	V	172.0
26351.863000	63.65	---	83.52	19.87	1000.0	1000.000	155.0	V	22.0
26495.272480	---	50.71	63.52	12.82	1000.0	1000.000	155.0	H	66.0
30173.864000	52.76	---	83.52	30.76	1000.0	1000.000	155.0	V	36.0
34118.799000	---	40.56	63.52	22.96	1000.0	1000.000	155.0	V	8.0
34125.547000	---	40.60	63.52	22.92	1000.0	1000.000	155.0	V	8.0
34427.353000	53.34	---	83.52	30.18	1000.0	1000.000	155.0	V	126.0
35121.038000	---	40.75	63.52	22.78	1000.0	1000.000	155.0	H	326.0
35537.893000	53.41	---	83.52	30.11	1000.0	1000.000	155.0	H	146.0

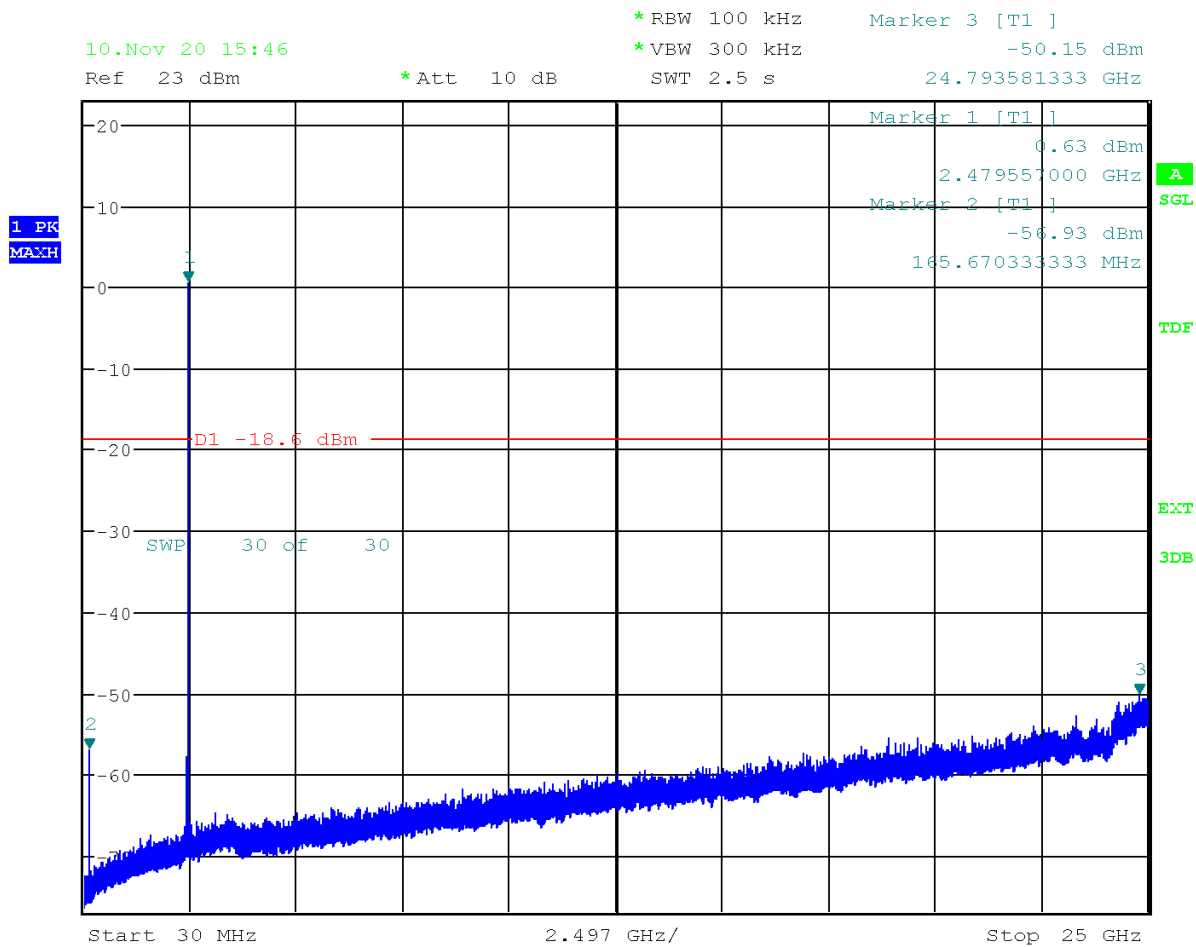
4.3 Test Results – Out of Band Emissions

4.3.1 Out of Band Emissions – Test Summary

Test Specification	47 CFR 15.247 (d)				
Test Engineer & Date	Niall Forrester		2020.11.10		
EUT and Ancillary Equipment IDs	A002893981_017				
EUT Operation Mode(s)	DTM				
EUT Wireless Configuration(s)	Bluetooth Low Energy 1M (See below for details)				
EUT Hardware Configuration(s)	Power from lab power supply via modified USB cable				
Overall Result	PASS				

Test Parameter	Wireless Configuration	Tx Pwr (dBm)	Measured Lvl (dBm)	Limit (dBm)	Result
Spurious Emissions (30 MHz – 25 GHz)	Bluetooth Low Energy 1M Low Channel (GFSK 2402 MHz)	2.67	-50.01	-17.33	PASS
Spurious Emissions (30 MHz – 25 GHz)	Bluetooth Low Energy 1M Mid Channel (GFSK 2440 MHz)	2.28	-49.93	-17.72	PASS
Spurious Emissions (30 MHz – 25 GHz)	Bluetooth Low Energy 1M High Channel (GFSK 2480	1.37	-50.15	-18.63	PASS

4.3.2 Out of Band Emissions – Test Details (Worst Case Plot)



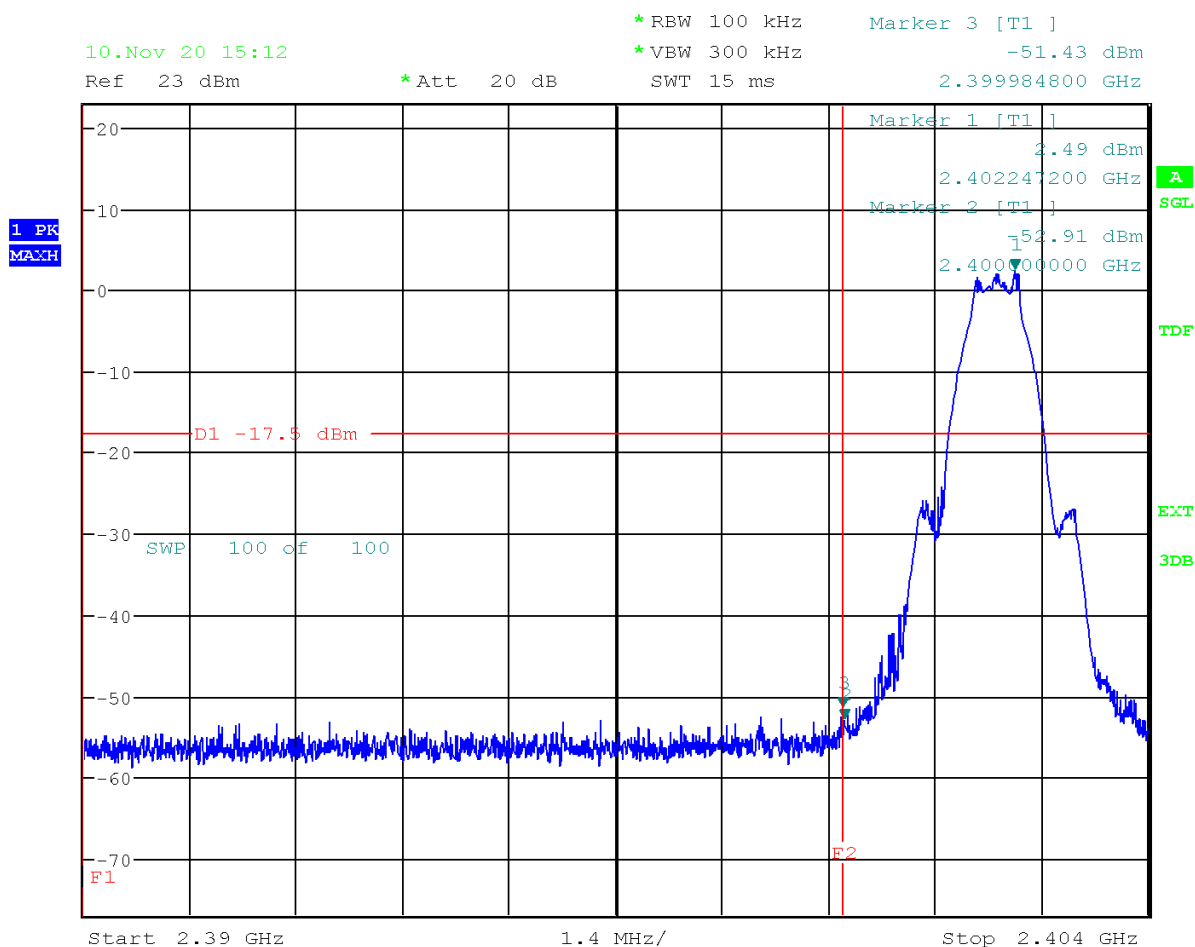
Date: 10.NOV.2020 15:46:04

4.4 Test Results – Band Edge Compliance (Authorized Band)

4.4.1 Band Edge Compliance (Authorized Band) – Test Summary

Test Specification	47 CFR 15.247 (d)			
Test Engineer & Date	Niall Forrester		2020.11.10	
EUT and Ancillary Equipment IDs	A002893981_017			
EUT Operation Mode(s)	DTM			
EUT Wireless Configuration(s)	Bluetooth Low Energy 1M (See below for details)			
EUT Hardware Configuration(s)	Power from lab power supply via modified USB cable			
Overall Result	PASS			
Test Parameter	Wireless Configuration	Measured Level (dBm)	Limit (dBm)	Result
Emissions at Band Edge (Auth. Band – Low Edge)	Bluetooth Low Energy 1M Low Channel (GFSK 2402 MHz)	-51.43	-17.51	PASS
Emissions at Band Edge (Auth. Band – High Edge)	Bluetooth Low Energy 1M High Channel (GFSK 2480 MHz)	-52.97	-18.43	PASS

4.4.2 Band Edge Compliance (Authorized Band) – Test Details (Worst Case Plot)



Date: 10.NOV.2020 15:12:31

4.5 Test Results – Band Edge Compliance (Restricted Band)

4.5.1 Band Edge Compliance (Restricted Band) – Test Summary

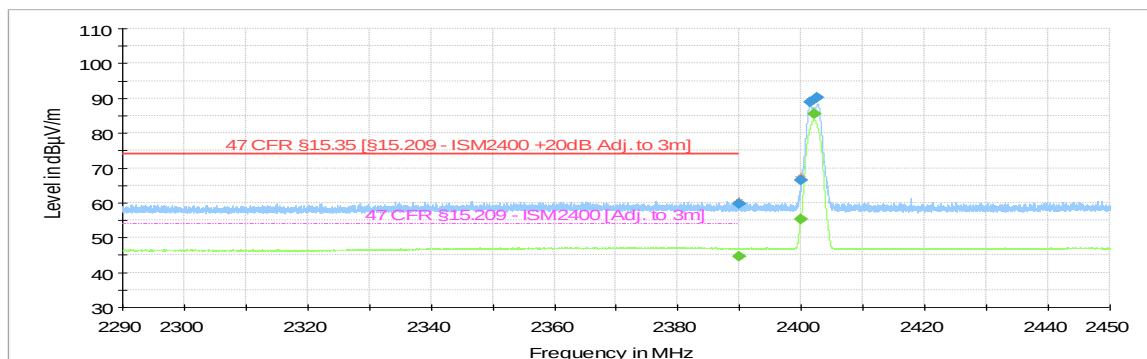
Test Specification	47 CFR 15.209 & 15.247 (d)	
Test Engineer & Date	Sam Ebadeh	2020.09.15
EUT and Ancillary Equipment IDs	A002893981-001	A002893981-008 A002893981-014 A002893981-016
EUT Operation Mode(s)	Continuous Transmit	
EUT Wireless Configuration(s)	Bluetooth Low Energy 1M (Low and High channels)	
EUT Hardware Configuration(s)	Power from USB Charger connected to 12V DC	
Overall Result	PASS	
Test Parameter	Wireless Configuration	Result*
Emissions at Band Edge (Rest. Band – Low Edge)	Bluetooth Low Energy 1M Low Channel (GFSK 2402 MHz)	PASS
Emissions at Band Edge (Rest. Band – High Edge)	Bluetooth Low Energy 1M High Channel (GFSK 2480 MHz)	PASS

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

4.5.2 Band Edge Compliance (Restricted Band) – Test Details

Restricted Band – Low Edge

Test mode condition	Bluetooth Low Energy 1M Low Channel (2402 MHz)	
Antenna orientation	Horizontal and vertical	
Sweep frequency	1 GHz – 18 GHz Lower Band Edge	
Standard	47 CFR Part 15 subpart C	
EUT	A002893981-001	
Ancillary Equipment	A002893981-014, A002893981-008, A002893981-016 12VDC Power Supply	
Test Engineer	Sam Ebadeh	Date: 2020.09.15
Chamber details	Chamber: SAC 5	

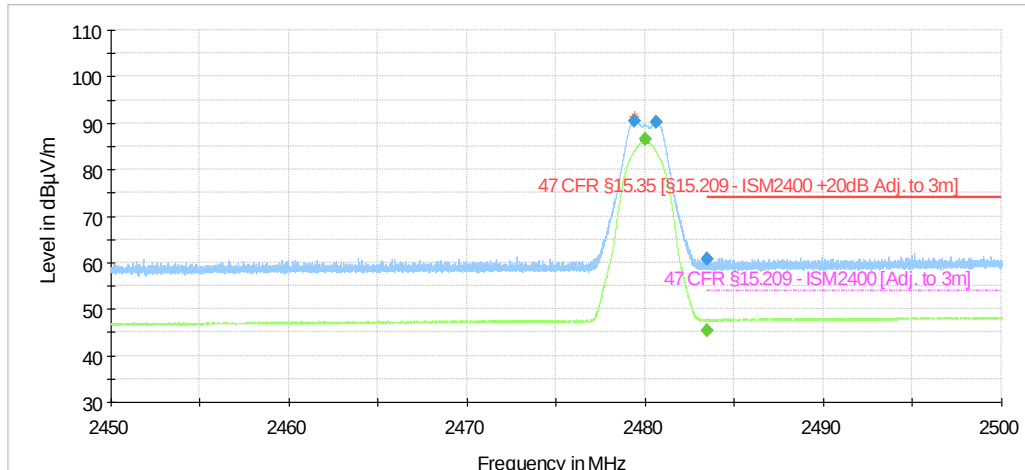


Preview Result 2-AVG
 Preview Result 1-PK+
 Critical_Freqs AVG
 Critical_Freqs PK+
 47 CFR §15.35 [§15.209 - ISM2400 +20dB Adj. to 3m]
 47 CFR §15.209 - ISM2400 [Adj. to 3m]
 Final_Result PK+
 Final_Result AVG

Frequency (MHz)	MaxPeak (dBμV/m)	Average (dBμV/m)	Limit (dBμV/m)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)
2390.000000	---	44.49	53.98	9.49	1000.0	1000.000	136.0	V	331.0
2390.000000	59.76	---	73.98	14.22	1000.0	1000.000	210.0	H	140.0
2400.000000	---	55.28	---	---	1000.0	1000.000	111.0	V	288.0
2400.000000	66.48	---	---	---	1000.0	1000.000	111.0	H	68.0
2401.392000	88.92	---	---	---	1000.0	1000.000	101.0	V	299.0
2402.016000	---	85.51	---	---	1000.0	1000.000	101.0	V	303.0
2402.624000	90.12	---	---	---	1000.0	1000.000	103.0	V	302.0

Restricted Band – High Edge

Test mode condition	Bluetooth Low Energy 1M High Channel (2480 MHz)	
Antenna orientation	Horizontal and vertical	
Sweep frequency	1 GHz – 18 GHz Upper Band Edge	
Standard	47 CFR Part 15 subpart C	
EUT	A002893981-001	
Ancillary Equipment	A002893981-014, A002893981-008, A002893981-016 12VDC Power Supply	
Test Engineer	Sam Ebadeh	Date: 2020.09.15
Chamber details	Chamber: SAC 5	



- PreviewResult 2-AVG
- PreviewResult 1-PK+
- Critical_Freqs AVG
- Critical_Freqs PK+
- 47 CFR §15.35 [§15.209 - ISM2400 +20dB Adj. to 3m]
- 47 CFR §15.209 - ISM2400 [Adj. to 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)
2479.380000	90.38	---	---	---	1000.0	1000.000	180.0	H	340.0
2480.015000	---	86.44	---	---	1000.0	1000.000	102.0	H	338.0
2480.645000	90.19	---	---	---	1000.0	1000.000	121.0	H	335.0
2483.500000	---	45.33	53.98	8.65	1000.0	1000.000	113.0	H	0.0
2483.500000	60.83	---	73.98	13.15	1000.0	1000.000	192.0	H	168.0

4.6 Test Results – 20dB Bandwidth

4.6.1 20dB Bandwidth – Test Summary

Requirement is not applicable as the device is non-hopping

4.7 Test Results – Carrier (Hopping Channel) Separation

4.7.1 Carrier (Hopping Channel) Separation – Test Summary

Requirement is not applicable as the device is non-hopping

4.8 Test Results – Number of Hopping Channels

4.8.1 Number of Hopping Channels – Test Summary

Requirement is not applicable as the device is non-hopping

4.9 Test Results – Time of Occupancy (Dwell Time)

4.9.1 Time of Occupancy (Dwell Time) – Test Summary

Requirement is not applicable as the device is non-hopping

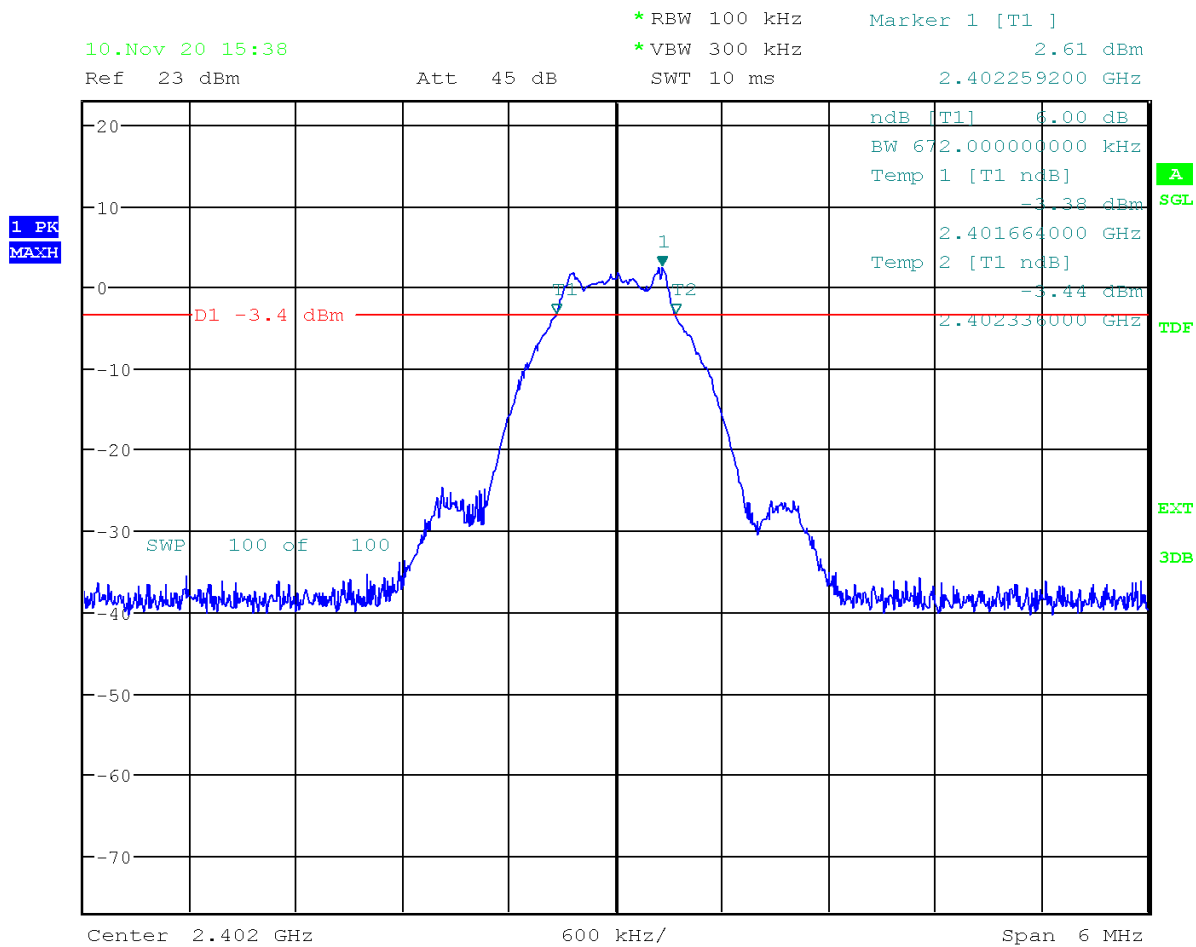
4.10 Test Results – 6dB Bandwidth

4.10.1 6dB Bandwidth – Test Summary

Test Specification	47 CFR 15.247 (a)(2)			
Test Engineer & Date	Niall Forrester		2020.11.10	
EUT and Ancillary Equipment IDs	A002893981_017			
EUT Operation Mode(s)	DTM			
EUT Wireless Configuration(s)	Bluetooth Low Energy 1M (See below for details)			
EUT Hardware Configuration(s)	Power from lab power supply via modified USB cable			
Overall Result	PASS			

Test Parameter	Wireless Configuration	Measured Level (kHz)	Limit Min (kHz)	Result
6dB Bandwidth	Bluetooth Low Energy 1M Low Channel (GFSK 2402	672.00	500	PASS
6dB Bandwidth	Bluetooth Low Energy 1M Mid Channel (GFSK 2440	667.20	500	PASS
6dB Bandwidth	Bluetooth Low Energy 1M High Channel (GFSK 2480	667.20	500	PASS

4.10.2 6dB Bandwidth – Test Details (Worst Case Plot)



Date: 10.NOV.2020 15:38:13

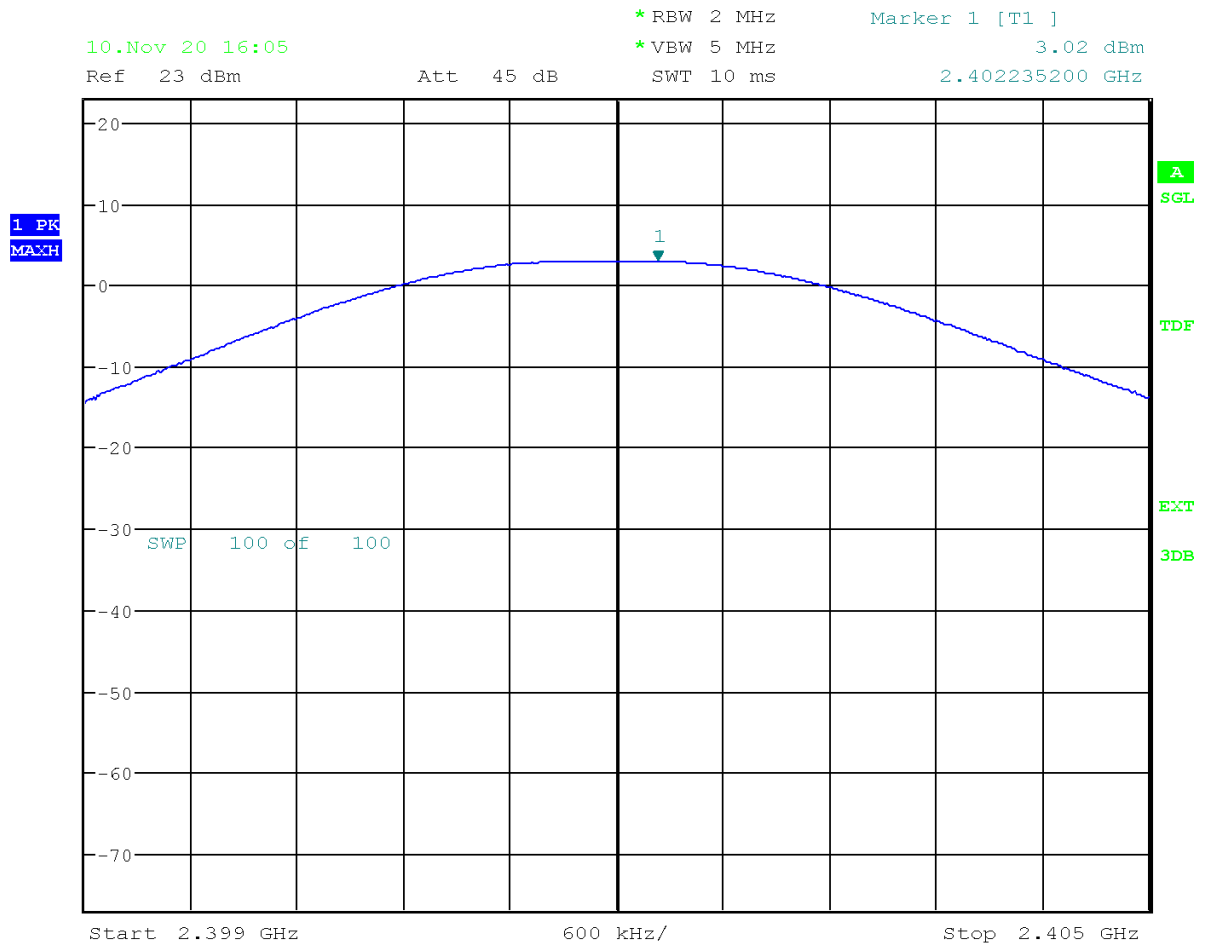
4.11 Test Results – Peak Conducted Output Power

4.11.1 Peak Conducted Output Power – Test Summary

Test Specification	47 CFR 15.247(b)				
Test Engineer & Date	Niall Forrester		2020.11.10		
EUT and Ancillary Equipment IDs	A002893981_017				
EUT Operation Mode(s)	DTM				
EUT Wireless Configuration(s)	Bluetooth Low Energy 1M (See below for details)				
EUT Hardware Configuration(s)	Power from lab power supply via modified USB cable				
Overall Result	PASS				

Test Parameter	Wireless Configuration	Measured Level (dBm)			Limit (dBm)	Result
		Low 4.75V	Nom 5.00V	High 5.25V		
Peak Conducted Output Power	Bluetooth Low Energy 1M Low Channel (GFSK 2402 MHz)	3.02	2.98	3.00	30	PASS
Peak Conducted Output Power	Bluetooth Low Energy 1M Mid Channel (GFSK 2440 MHz)	2.63	2.61	2.61	30	PASS
Peak Conducted Output Power	Bluetooth Low Energy 1M High Channel (GFSK 2480 MHz)	1.94	1.93	2.21	30	PASS

4.11.2 Peak Conducted Output Power – Test Details (Worst Case Plot)



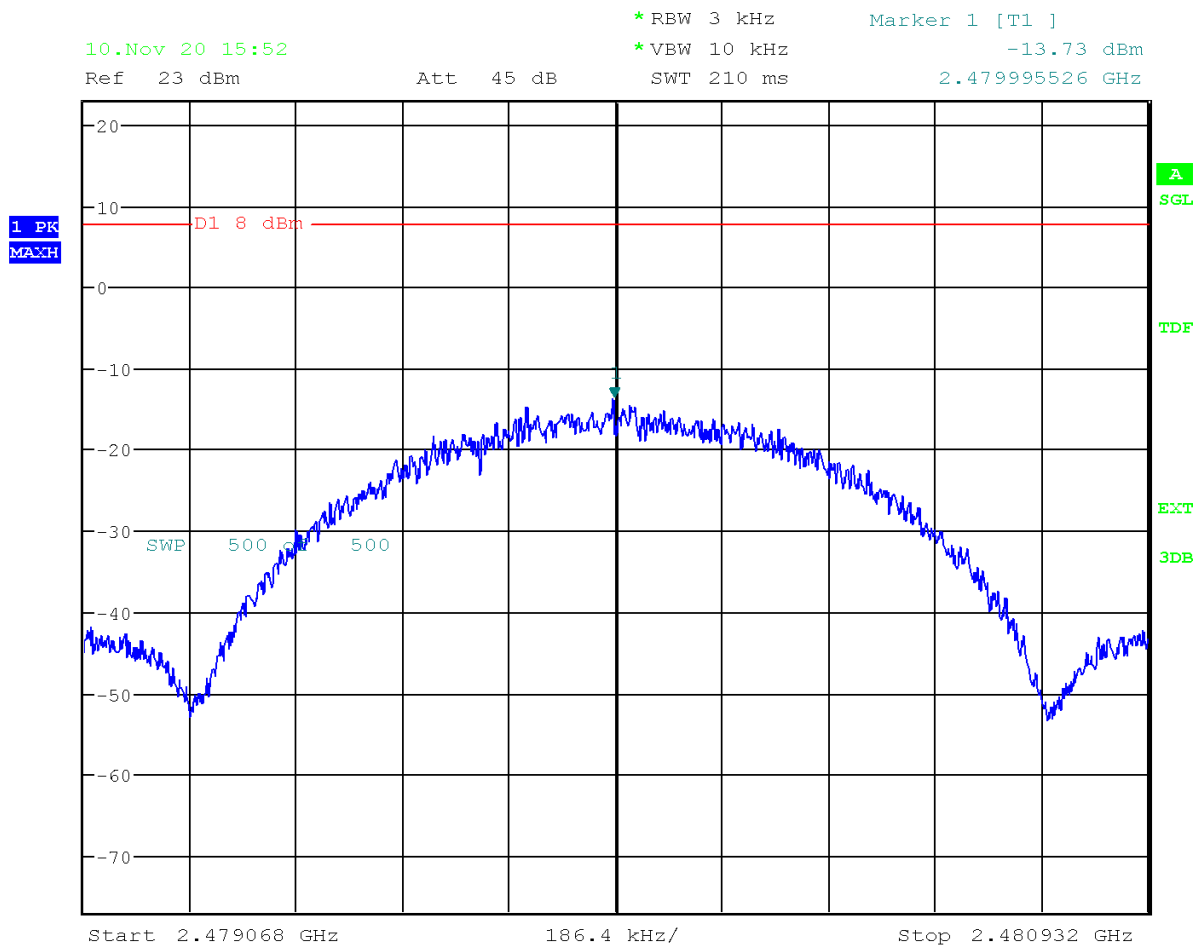
Date: 10.NOV.2020 16:05:46

4.12 Test Results – Power Spectral Density

4.12.1 Power Spectral Density – Test Summary

Test Specification	47 CFR 15.247(e)				
Test Engineer & Date	Niall Forrester		2020.09.10		
EUT and Ancillary Equipment IDs	A002893981_017				
EUT Operation Mode(s)	DTM				
EUT Wireless Configuration(s)	Bluetooth Low Energy 1M (See below for details)				
EUT Hardware Configuration(s)	Power from lab power supply via modified USB cable				
Overall Result	PASS				
Test Parameter	Wireless Configuration	Measured (dBm/3kHz)	Low Limit (dBm/3kHz)	High Limit (dBm/3kHz)	Result
Power Density	Bluetooth Low Energy 1M Low Channel (GFSK 2402 MHz)	-12.70	-30	8	PASS
Power Density	Bluetooth Low Energy 1M Mid Channel (GFSK 2440 MHz)	-13.03	-30	8	PASS
Power Density	Bluetooth Low Energy 1M High Channel (GFSK 2480 MHz)	-13.73	-30	8	PASS

4.12.2 Power Spectral Density – Test Details (Worst Case Plot)



Date: 10.NOV.2020 15:52:54

5. TEST EQUIPMENT STATUS

5.1 List of Hardware with Calibration Dates

5.1.1 Hardware List – CTE System

Type	Manufacturer	Model	Serial Number / ID	Calibration Date	Calibration Due
Comprehensive Testing Environment	TÜV Rheinland LGA Products	HWE 6000	00139	N/A	N/A
Bluetooth Signaling Unit	Rohde & Schwarz	CMW500	163750 2711468	16.07.2020	16.07.2021
Spectrum Analyzer	Rohde & Schwarz	FSU26	100308 2704108	14.07.2020	14.07.2021
Vector Signal Generator	Rohde & Schwarz	SMU200A	101584 2704111	04.08.2020	04.08.2021
Power Supply	Keithley	2303	1198722 2717714	24.07.2020	24.07.2021
Multimeter	Keithley	2700	1035251 2704115	09.07.2020	09.07.2021
Average Power Sensor	Rohde & Schwarz	NRP-Z31	102145 2704104	17.07.2020	17.07.2021
Temperature Chamber	Vötsch	VT4002	58566081940010 2717693	N/A	N/A
Temp. & Humidity Logger	Lufft	Opus 20	113.0118.0802.033 2771025	31.07.2020	31.07.2022

5.1.2 Hardware List – Conducted Emissions System

Type	Manufacturer	Model	Serial Number / ID	Calibration Date	Calibration Due
Two-Line V-network	Rohde & Schwarz	ENV216	101090 2704076	16.07.2020	16.07.2021
Test Receiver 9KHz to 3.5 GHz	Rohde & Schwarz	ESR3	101674 2704016	17.07.2020	17.07.2021
RF PROBE	Fischer Custom Communication	F-52	22 2902256	09.04.2019	09.04.2021
Temp. & Humidity Logger	Lufft	Opus 20	113.0118.0802.033 2771025	31.07.2020	31.07.2022

5.1.3 Hardware List – SAC5 System

Type	Manufacturer	Model	Serial Number / ID	Calibration Date	Calibration Due
EMI Test Receiver	Rohde & Schwarz	ESW44	101760 2881044	17.07.2020	17.07.2021
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
Loop Antenna	EMCO	6502	9206-2775 2759035	16.07.2020	16.07.2021
Horn Antenna – 40GHz	ETS Lindgren	UG-600A/U	20623 2814834	27.07.2020	27.07.2022
Horn Antenna	ETS Lindgren	UG-596A/U	20898 2814839	27.07.2020	27.07.2022
Control Device	Maturo	NCD	NCD/393/2372.01	N/A	N/A
Open Switch & Control Unit	Rohde & Schwarz	OSP150	100081 2884198	04.08.2020	04.08.2021
Open Switch & Control Unit	Rohde & Schwarz	OSP120	100084 2761253	04.08.2020	04.08.2021
Shielded Filter Unit	Rohde & Schwarz	OSP-F Extension	101333 2761265	04.08.2020	04.08.2021
Shielded Filter Unit	Rohde & Schwarz	OSP-F Extension	101335 2761266	04.08.2020	04.08.2021
Shielded Filter Unit	Rohde & Schwarz	OSP-F Base Unit	101330 2761262	04.08.2020	04.08.2021
Temp. & Humidity Logger	Lufft	Opus 20	126.0118.0802.033 2771042	31.07.2020	31.07.2022

5.2 Software / Firmware Versions

Equipment	Software / Firmware Name	Version
Comprehensive Testing Environment (CTE)	CTE – TMF	V47.5
Conducted Emissions System	EMC 32	V10.60.10
SAC 5	EMC 32	V10.60.10

6. MEASUREMENT UNCERTAINTY

6.1 Measurement Uncertainty for CTE

Parameter	Uncertainty (Coverage Factor k=2)
Maximum Output Power (15.247b)	±0.51 dB
6dB / 20dB Channel Bandwidth & 99% Occupied bandwidth (15.247a)	<5%
Carrier Frequency Separation (15.247a)	N/A
Number of Hopping Channels (15.247a)	N/A
Time of Occupancy – Dwell Time (15.247a)	N/A
Band Edge Compliance of Conducted Emissions (15.247a)	±1.04 dB
Conducted Spurious Emissions (15.247d)	±2.98 dB
Power Spectral Density (15.247e)	±0.51 dB

6.2 Measurement Uncertainty for Conducted Emissions

Parameter	Uncertainty (Coverage Factor k=2)
Conducted emissions with LISN 150KHz to 30 MHz	2.98 dB

6.3 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 1