

Prüfbericht-Nr.: Test report no.:	60343169-003	Auftrags-Nr.: Order no.:	23870303 030	Seite 1 von 44 Page 1 of 44	
Kunden-Referenz-Nr.: Client reference no.:		Auftragsdatum: Order date:	2020.02.10		
Auftraggeber: Client:	GN Audio A/S				
Prüfgegenstand: Test item:	Jabra Link 380a				
Bezeichnung / Typ-Nr.: Identification / Type no.:	END060W FCC ID: BCE-END060W / IC ID: 2386C-END060W				
Auftrags-Inhalt: Order content:	FCC Certification Testing				
Prüfgrundlage: Test specification:	FCC 47 CFR Part 15.247 with parts 15.107, 15.207, 15.109 & 15.209 ANSI C63.4: 2014 & ANSI C63.10: 2013				
Wareneingangsdatum: Date of sample receipt:	2020.01.13				
Prüfmuster-Nr.: Test sample no.:					
Prüfzeitraum: Testing period:	2020.01.21 – 2020.02.20				
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: 2020.03.17 Date:	Datum: 2020.03.17 Date:				
Stellung / Position:	Senior Technical Expert	Stellung / Position:	Lab Manager		
Sonstiges / Other:	Only Bluetooth BLE (Low Energy) is covered by this report				
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 History

REVISION	DATE	REMARKS	AUTHOR
001	2020-02-21	First Release	Niall Forrester
002	2020-03-11	Updated based on new template, corrected packet types, added missing test data and reformatted all tables.	Niall Forrester
003	2020-03-17	Fixing text and picture errors	Niall Forrester
Note: Latest revision report will replace all previous reports			
This report based on FCC Part 15.247 Template version 1.0			

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)	YES	4.1	N.P.	See BDR/EDR Report
15.109	Radiated Emissions (Unintentional Radiators)	YES	4.2	N.P.	See BDR/EDR Report
15.207	AC Power Line Conducted Emissions (Intentional Radiators)	YES	4.3	PASS	
15.209	Radiated Emissions (Intentional Radiators)	YES	4.4	PASS	
15.247 (d)	Out of Band Emissions	YES	4.5	PASS	
15.247 (d)	Band Edge Compliance (Authorized Band)	YES	4.6	PASS	
15.247 (d)	Band Edge Compliance (Restricted Band)	YES	4.7	PASS	
15.247 (a)(1)	20dB Bandwidth	NO	4.8	N/A	Non-Hopping
15.247 (a)(1)	Carrier (Hopping Channel) Separation	NO	4.9	N/A	Non-Hopping
15.247 (a)(1)	Number of Hopping Channels	NO	4.10	N/A	Non-Hopping
15.247 (a)(1)	Time of Occupancy (Dwell Time)	NO	4.11	N/A	Non-Hopping
15.247 (a)(2)	6dB Bandwidth	YES	4.12	PASS	
15.247 (b)	Peak Conducted Output Power	YES	4.13	PASS	
15.247 (e)	Power Spectral Density	YES	4.14	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.....	6
2.5 Antenna Information.....	6
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 Operation Modes.....	14
3.6 Deviations from the Test Standard	14
3.7 Environmental Conditions.....	14
4. TEST RESULTS.....	15
4.1 Test Results – AC Power Line Conducted Emissions (Unintentional Trans.)	15
4.2 Test Results – Radiated Emissions (Unintentional Transmitter).....	15
4.3 Test Results – AC Power Line Conducted Emissions (Intentional Transmitter).....	15
4.4 Test Results – Radiated Emissions (Intentional Transmitter)	18
4.5 Test Results – Out of Band Emissions	28
4.6 Test Results – Band Edge Compliance (Authorized Band)	30
4.7 Test Results – Band Edge Compliance (Restricted Band).....	32
4.8 Test Results – 20dB Bandwidth.....	35
4.9 Test Results – Carrier (Hopping Channel) Separation	35
4.10 Test Results – Number of Hopping Channels.....	35
4.11 Test Results – Time of Occupancy (Dwell Time)	35
4.12 Test Results – 6dB Bandwidth.....	35
4.13 Test Results – Peak Conducted Output Power	37
4.14 Test Results – Power Spectral Density.....	39
5. TEST EQUIPMENT STATUS.....	41
5.1 List of Hardware with Calibration Dates	41
5.2 Software / Firmware Versions.....	42
6. MEASUREMENT UNCERTAINTY	43
6.1 Measurement Uncertainty for CTE	43
6.2 Measurement Uncertainty for Conducted Emissions	43
6.3 Measurement Uncertainty for SAC 5 (Radiated Emissions & Band Edge)	43
7. PHOTOGRAPHS.....	44
7.1 Photographs of the Test Setup	44

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:	GN Audio A/S
Address:	Lautrupbjerg 7
	2750 Ballerup
	Denmark
Contact Person:	Lily Zhuang
Contact e-Mail / Telephone	lizhuang@jabra.com +86 592 2634855

2. PRODUCT INFORMATION

2.1 General Description

Model name:	Jabra Link 380a
Manufacturer:	GN Audio A/S
Model number / Marketing name:	END060W
FCC ID:	BCE-END060W
Description:	Bluetooth USB Type A dongle
Ancillary Equipment:	See section 2.7

2.2 Device Characteristics

Device Class for 47 CFR Part 15 B	Class B
Type of Power Supply	USB
Nominal Supply Voltage	5.0V
Supply Voltage Range	4.75V – 5.25V
Highest Internal Frequency Source	2480 MHz

2.3 Test Samples

EUT #	EUT ID	Description	Used For:
1	A000252971-001 (s/n 00301802657)	Standard Sample HW: Alpha 3, SW: 0.5.4	Radiated Tests (SAC 5) Conducted Emissions
2	A000252971-003 (s/n 00301802580)	Modified with semi-rigid antenna connector HW: Alpha 3, SW: 0.5.4	Conducted Tests (CTE)

2.4 Wireless Technologies and Bands Supported by the EUT

Technology	Band	Frequency Range (Tx)	Evaluation Performed*
Bluetooth BDR/EDR	2.4GHz	2400.0 MHz – 2483.5 MHz	NO
Bluetooth Low Energy (BLE)	2.4GHz	2400.0 MHz – 2483.5 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/DER/BLE	2.4 GHz	1	Printed PIFA-type	1.8 dBi

2.6 Wireless Technology Details

Technology	Band	Modulation Type(s)	No. of Channels	Channel Spacing	Adaptivity
Bluetooth BLE	2.4 GHz	GFSK	40	2 MHz	Non-Adaptive

2.7 Ancillary Equipment

A000252971-007	Control Computer
A000252971-009	Power Supply to Control Computer
A000252971-013	Control Computer
A000252971-015	USB Cable

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 15.107	-	Conducted limits
FCC 47 CFR 15.109	-	Radiated emission limits
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 C63.4	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
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)
15.107	AC Power Line Conducted Emissions (Unintentional Radiators)	15.107 (a) for Class B Devices
15.109	Radiated Emissions (Unintentional Radiators)	15.109 (a) for Class B Devices *See Note 1
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)(3)
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 3.6

3.4.2 Test Equipment Setup Used by Test Type

FCC 47 CFR Rule Part	Test Description	Test Equipment Used
15.107	AC Power Line Conducted Emissions (Unintentional Radiators)	N.P.
15.109	Radiated Emissions (Unintentional Radiators)	N.P.
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)	SAC5
15.247 (a)(1)	20dB Bandwidth	N/A
15.247 (a)(1)	Carrier (Hopping Channel) Separation	N/A
15.247 (a)(1)	Number of Hopping Channels	N/A
15.247 (a)(1)	Time of Occupancy (Dwell Time)	N/A
15.247 (a)(2)	6dB Bandwidth	CTE
15.247 (b)	Peak Conducted Output Power	CTE
15.247 (e)	Power Spectral Density	CTE

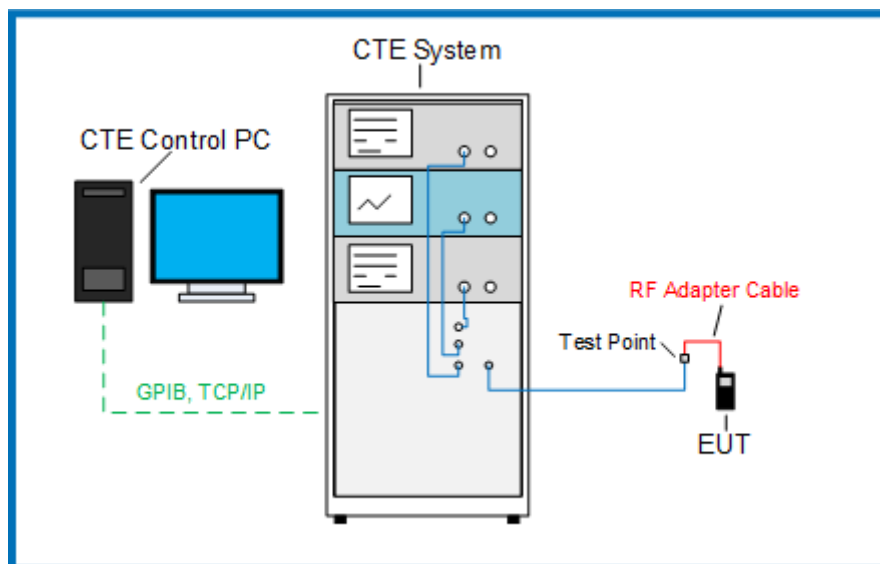
3.4.3 Test Equipment Setup – CTE System

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.

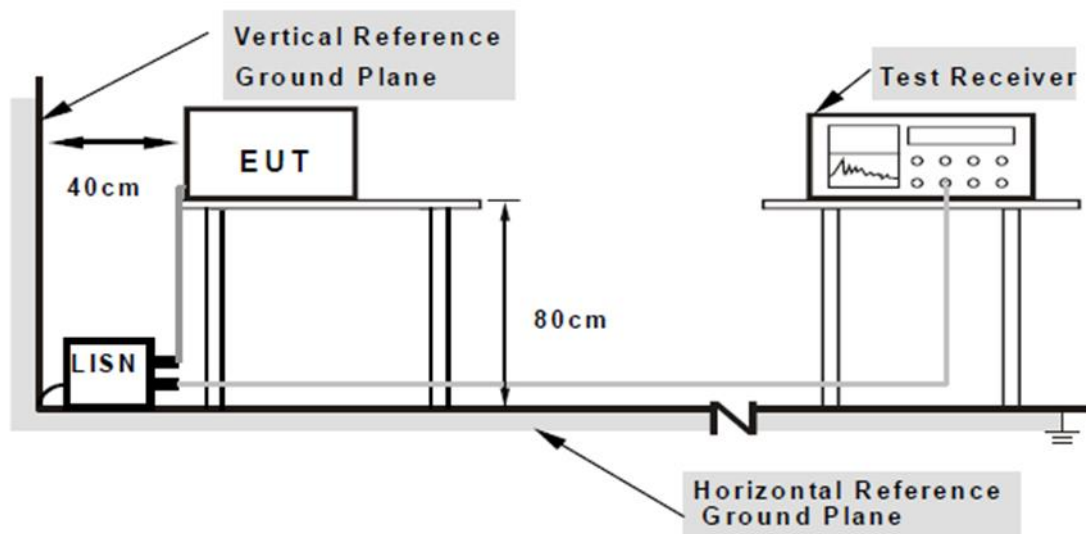
Losses in the cables and interconnects have been measured using the system's own automated routines and are compensated for automatically. Any additional loss in RF adapter cables supplied together with the EUT can be compensated for using the known characteristics of that adapter.

CTE Block Diagram



3.4.4 Test Equipment Setup – Conducted Emissions

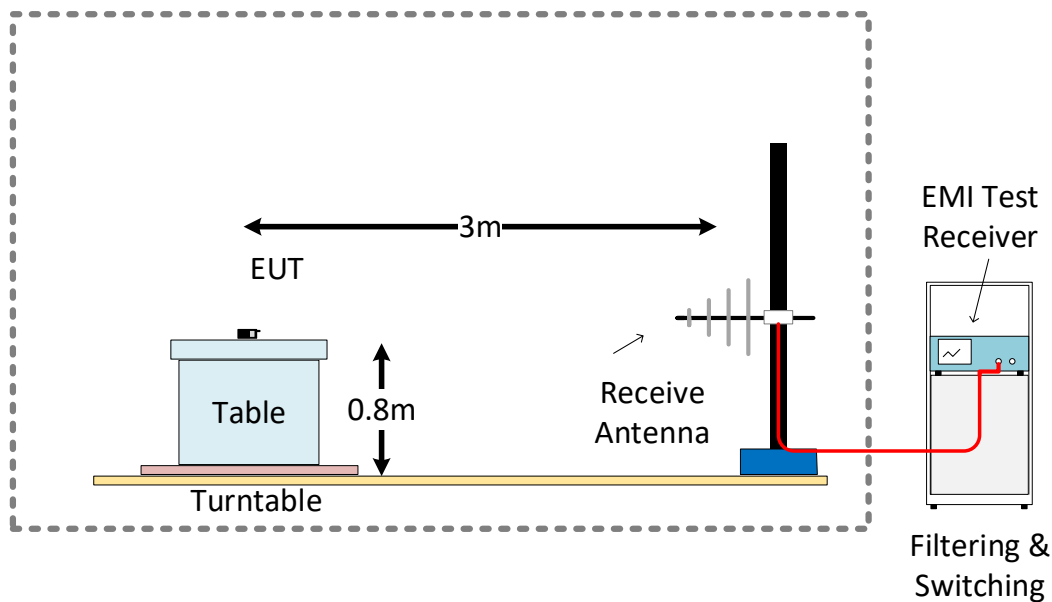
- The EUT was placed 0.4 meters from the conducting wall of the shielded room with EUT being connected to the power mains through a line impedance stabilization network (LISN). Other support units were connected to the power mains through another LISN. The LISNs provide 50Ω/ 50μH of coupling impedance 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.



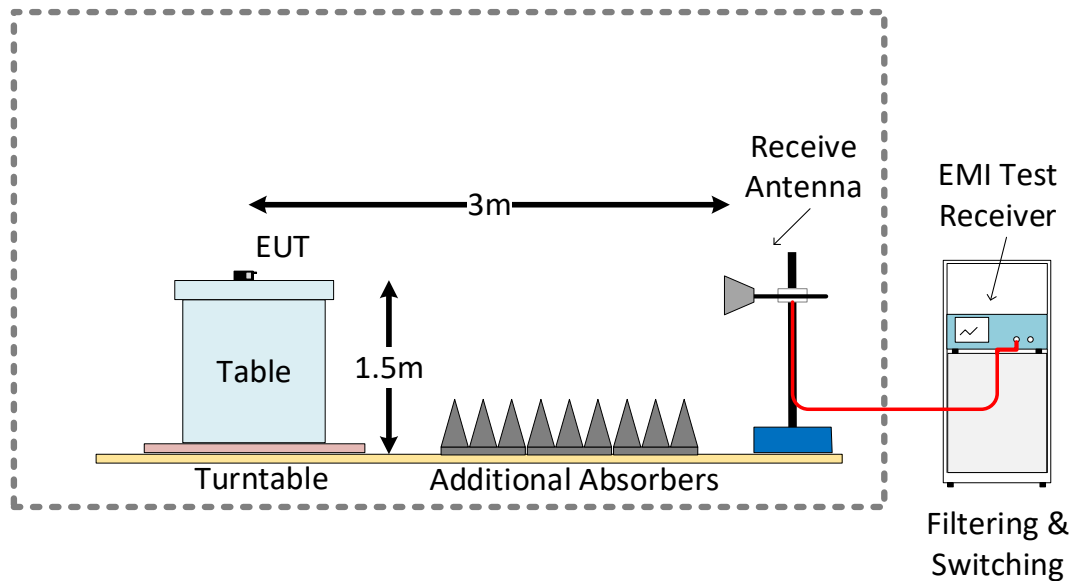
3.4.5 Test Equipment Setup – SAC 5 (Radiated Emissions and Restricted Band Edge)

- 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.

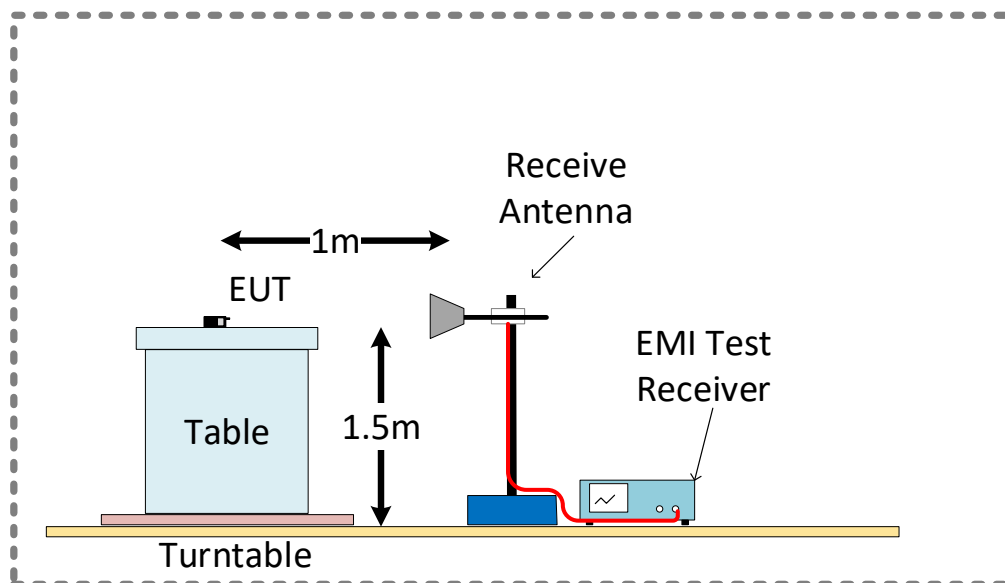
SAC 5 Test Setup Configuration 30MHz – 1GHz



SAC 5 Test Setup Configuration 1GHz – 18GHz



SAC 5 Test Setup Configuration 18GHz – 40GHz



3.5 EUT Operation Modes

Operation mode	Description
#1	Transmitting at maximum power with a modulated signal on channels Low; Mid or High as required, using the supported data. A PC was used in order to set the EUT in the different required operation modes
#2	Operating in Direct Test Mode (DTM) as defined by Bluetooth specifications. Device is controlled by the test instrument via a wired serial interface (over a USB connection using the test laptop as an intermediary

3.6 Deviations from the Test Standard

None

3.7 Environmental Conditions

3.7.1 Environmental Conditions – CTE System

Date	Time	Temperature (°C)	Relative Humidity (%)
2020.02.17	07:30	22.6	30.1
2020.02.20	09:20	22.6	29.6

3.7.2 Environmental Conditions – Conducted Emissions System

See details for each individual test below

3.7.3 Environmental Conditions – SAC5 (Radiated Emissions)

See details for each individual test below

4. TEST RESULTS

4.1 Test Results – AC Power Line Conducted Emissions (Unintentional Trans.)

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

Testing for unintentional transmissions (47 CFR 15 subpart B) is covered in the Bluetooth BDR/EDR report

4.2 Test Results – Radiated Emissions (Unintentional Transmitter)

4.2.1 Radiated Emissions (Unintentional) – Test Summary

Testing for unintentional transmissions (47 CFR 15 subpart B) is covered in the Bluetooth BDR/EDR report

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

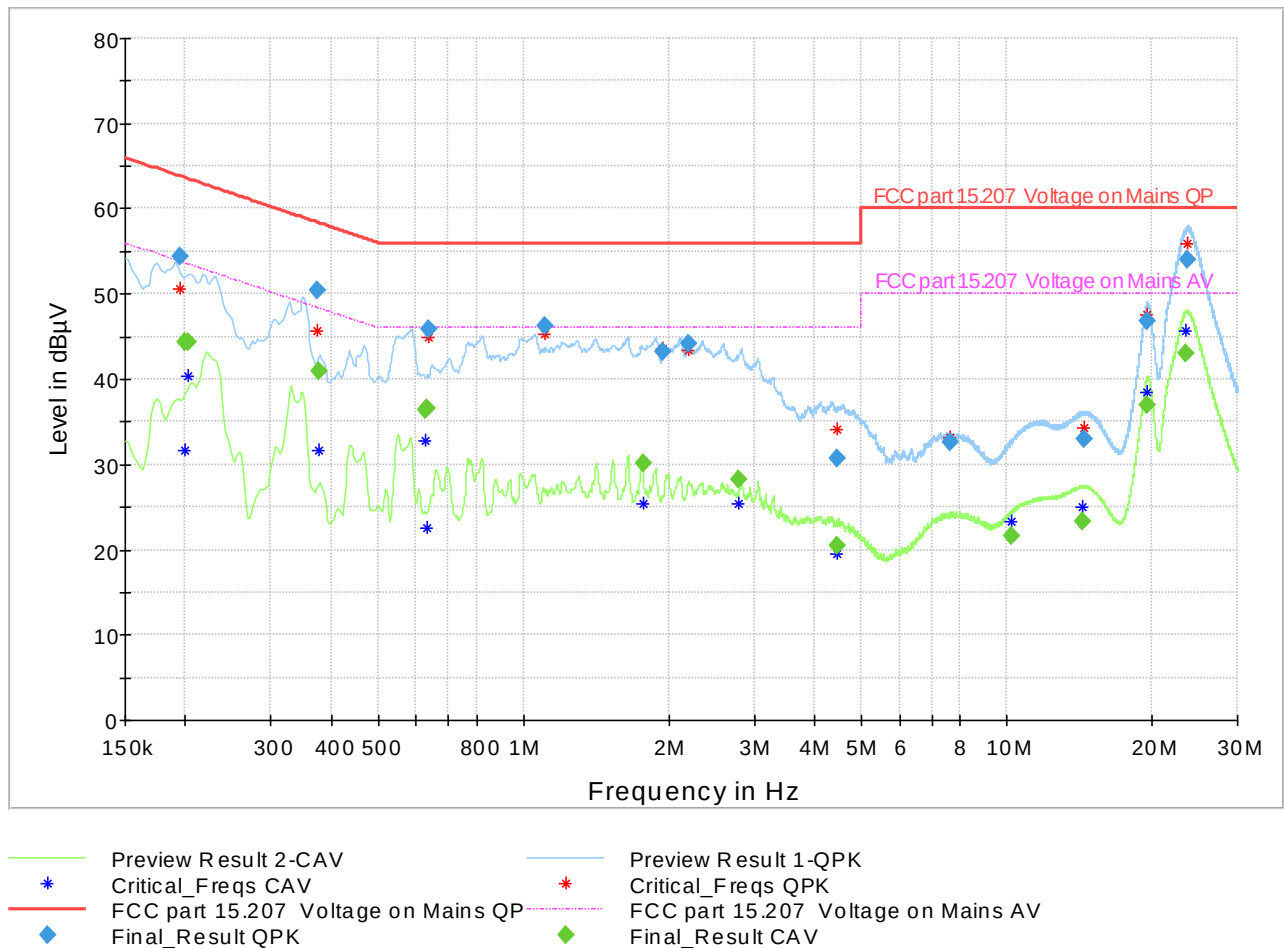
4.3.1 AC Power Line Conducted Emissions (Intentional) – Test Summary

Test Specification	FCC 47 CFR 15.207 (Part 15 Subpart C)		
Test Engineer & Date	Fariborz Abasi	2020.02.18	
EUT and Ancillary Equipment IDs	A000252971-001	A000252971-007 A000252971-009	
EUT Operation Mode(s)	#1		
EUT Wireless Configuration(s)	See below		
EUT Hardware Configuration(s)	-		
Overall Result	PASS		
Test Parameter	Wireless Configuration	Frequency Range	Result*
AC Conducted Power Line Emissions – “N” Line	BLE Mid Channel (2440 MHz) GFSK	150 kHz – 30 MHz	PASS
AC Conducted Power Line Emissions – “L1” Line	BLE Mid Channel (2440 MHz) GFSK	150 kHz – 30 MHz	PASS

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

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

Test	Conducted Emission	
Test mode condition	Traffic mode attached to Bluetooth Low Energy Mid channel	
Standard	FCC part 15.207	
EUT	A000252971-001	
Ancillary Equipment	Ancillary devices inside the chamber:	- A000252971-007 Control computer - A000252971-009 Power supply to Control computer
Test Engineer	Fariborz Abasi	Date: 2020-02-18
Environmental conditions	Temperature: 21,6 °C	Humidity: 31,1 %



The graph shows the maximum of N and L1 line measurements (i.e. whichever is higher) for each measured point

Final_Result

Frequency (MHz)	QuasiPeak (dBµV)	CAverage (dBµV)	Limit (dBµV)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Line	Filter
0.195000	54.32	---	63.82	9.50	1000.0	9.000	N	ON
0.199500	---	44.27	53.63	9.37	1000.0	9.000	N	ON
0.201750	---	44.28	53.54	9.26	1000.0	9.000	N	ON
0.375000	50.44	---	58.39	7.95	1000.0	9.000	L1	ON
0.377250	---	41.02	48.34	7.32	1000.0	9.000	L1	ON
0.629250	---	36.41	46.00	9.59	1000.0	9.000	L1	ON
0.631500	---	36.59	46.00	9.41	1000.0	9.000	L1	ON
0.636000	45.93	---	56.00	10.07	1000.0	9.000	L1	ON
1.108500	46.26	---	56.00	9.74	1000.0	9.000	N	ON
1.774500	---	30.22	46.00	15.78	1000.0	9.000	L1	ON
1.943250	43.20	---	56.00	12.80	1000.0	9.000	L1	ON
2.197500	44.24	---	56.00	11.76	1000.0	9.000	L1	ON
2.780250	---	28.28	46.00	17.72	1000.0	9.000	L1	ON
4.445250	---	20.41	46.00	25.59	1000.0	9.000	N	ON
4.456500	30.66	---	56.00	25.34	1000.0	9.000	N	ON
7.631250	32.57	---	60.00	27.43	1000.0	9.000	N	ON
10.239000	---	21.55	50.00	28.45	1000.0	9.000	N	ON
14.320500	---	23.36	50.00	26.64	1000.0	9.000	N	ON
14.448750	32.95	---	60.00	27.05	1000.0	9.000	N	ON
19.542750	---	37.06	50.00	12.94	1000.0	9.000	N	ON
19.576500	46.81	---	60.00	13.19	1000.0	9.000	N	ON
23.527500	---	43.04	50.00	6.96	1000.0	9.000	N	ON
23.687250	54.08	---	60.00	5.92	1000.0	9.000	N	ON

4.4 Test Results – Radiated Emissions (Intentional Transmitter)

4.4.1 Radiated Emissions (Intentional) – Test Summary

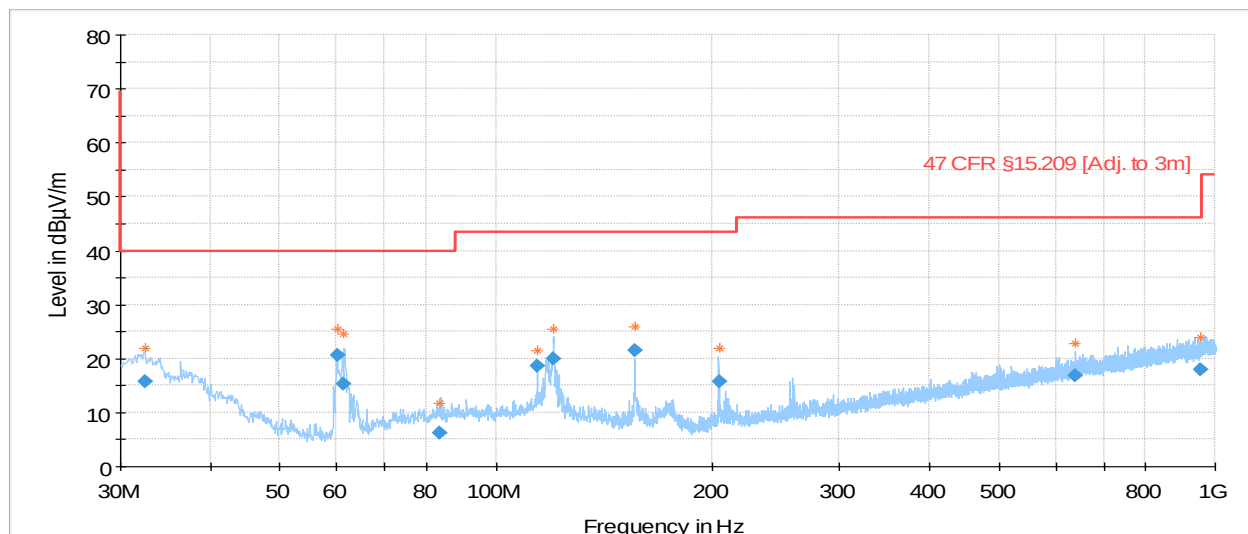
Test Specification		FCC 47 CFR 15.209 (Part 15 Subpart C)	
Test Engineer & Date		Fariborz Abasi Sam Ebadeh Simon Palmhager	2020.01.21 – 2020.02.03
EUT and Ancillary Equipment IDs		A000252971-001	A000252971-013 A000252971-015
EUT Operation Mode(s)		#1	
EUT Wireless Configuration(s)		See below	
EUT Hardware Configuration(s)		-	
Overall Result		PASS	

Test Parameter	Wireless Configuration	Frequency Range	Result
Radiated Emissions	BLE Low Channel (2402 MHz) GFSK	30 MHz – 1 GHz	PASS
Radiated Emissions	BLE Low Channel (2402 MHz) GFSK	1 GHz – 18 GHz	PASS
Radiated Emissions	BLE Low Channel (2402 MHz) GFSK	18 GHz – 40 GHz	PASS
Radiated Emissions	BLE Mid Channel (2444 MHz) GFSK	30 MHz – 1 GHz	PASS
Radiated Emissions	BLE Mid Channel (2444 MHz) GFSK	1 GHz – 18 GHz	PASS
Radiated Emissions	BLE Mid Channel (2444 MHz) GFSK	18 GHz – 40 GHz	PASS
Radiated Emissions	BLE High Channel (2480 MHz) GFSK	30 MHz – 1 GHz	PASS
Radiated Emissions	BLE High Channel (2480 MHz) GFSK	1 GHz – 18 GHz	PASS
Radiated Emissions	BLE High Channel (2480 MHz) GFSK	18 GHz – 40 GHz	PASS

4.4.2 Radiated Emissions (Intentional) – Test Details

Low Channel

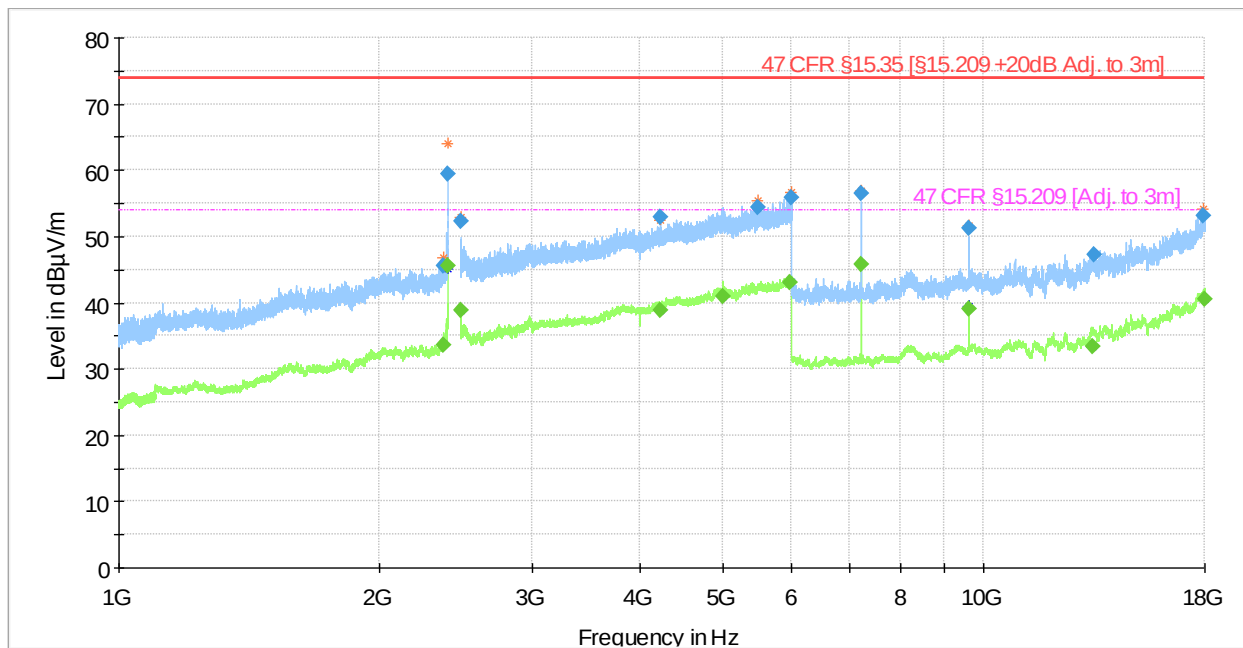
Test	BLE	
Test mode condition	Low channel - TX Mode	
Test frequency	30 MHz-1 GHz	
antenna position	Vertical and Horizontal	
Standard	FCC Part 15 Subpart C	
EUT	A000252971-001	
Ancillary Equipment	Ancillary devices inside the chamber: - A000252971-015 USB cable Ancillary devices outside the chamber: - A000252971-013 Control computer	
EUT Configuration	Back on table	
Test Engineer	Sam Ebadeh	Date: 2020-01-29
Environmental conditions	Temperature: 21,1 °C	Humidity: 35,0%
Chamber details	Chamber: SAC 5	Measurement distance: 3 meter



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)	Average (dBµV/m)	Limit (dBµV/m)	Margin dB	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)
32.441520	15.83	---	40.00	24.17	1000.0	120.000	171.0	V	8.0
60.016840	20.53	---	40.00	19.47	1000.0	120.000	410.0	H	175.0
61.317240	15.24	---	40.00	24.76	1000.0	120.000	331.0	H	-4.0
113.984960	18.69	---	43.52	24.83	1000.0	120.000	100.0	V	247.0
120.072120	19.95	---	43.52	23.58	1000.0	120.000	125.0	V	268.0
156.007520	21.46	---	43.52	22.06	1000.0	120.000	100.0	V	25.0

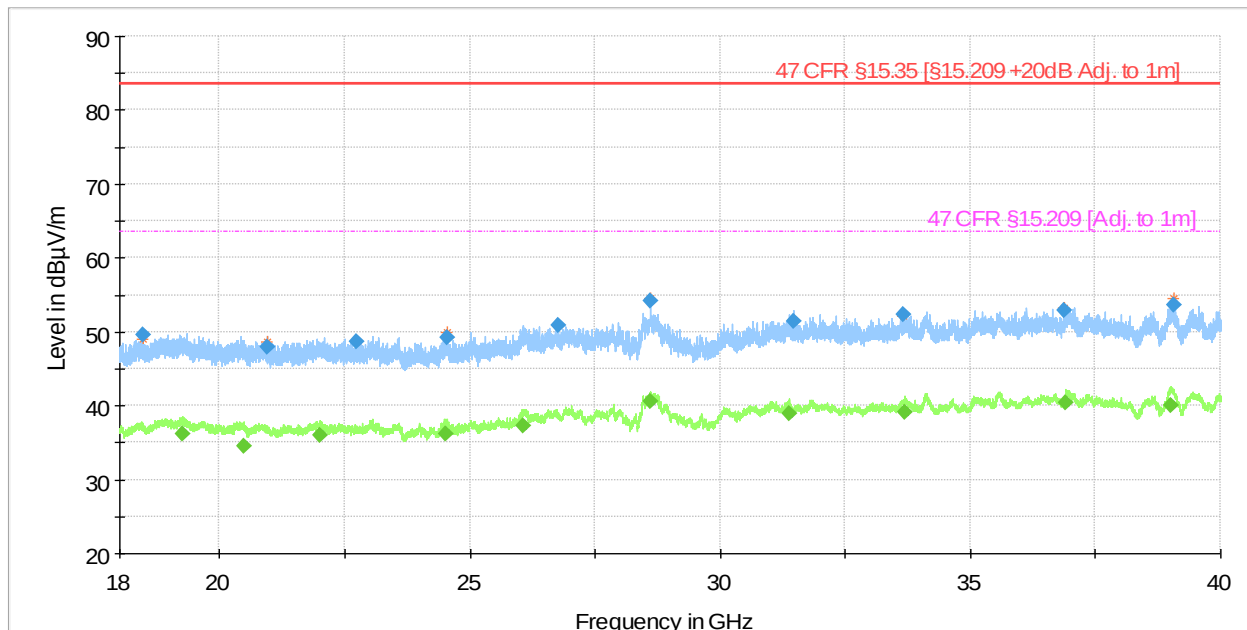
Test	BLE	
Test mode condition	Low channel - TX Mode	
Test frequency	1 GHz-18 GHz	
antenna position	Vertical and Horizontal	
Standard	FCC Part 15 Subpart C	
EUT	A000252971-001	
Ancillary Equipment	Ancillary devices inside the chamber: - A000252971-015 USB cable Ancillary devices outside the chamber: - A000252971-013 Control computer	
EUT Configuration	Back on table	
Test Engineer	Simon Palmhager	Date: 2020-01-21
Environmental conditions	Temperature: 21,2 °C	Humidity: 36,2%
Chamber details	Chamber: SAC 5	Measurement distance: 3 meter



— 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)
2399.926000	59.39	---	73.98	14.59	1000.0	1000.000	135.0	H	293.0
2399.997000	---	45.61	53.98	8.37	1000.0	1000.000	150.0	H	265.0
4999.471000	---	40.91	53.98	13.07	1000.0	1000.000	121.0	H	67.0
5976.762000	---	42.99	53.98	10.99	1000.0	1000.000	128.0	V	310.0
7205.362000	---	45.78	53.98	8.20	1000.0	1000.000	186.0	H	202.0
17985.278000	---	40.51	53.98	13.47	1000.0	1000.000	100.0	V	184.0

Test	BLE	
Test mode condition	Low channel - TX Mode	
Test frequency	18 GHz-40 GHz	
antenna position	Vertical and Horizontal	
Standard	FCC Part 15 Subpart C	
EUT	A000252971-001	
Ancillary Equipment	Ancillary devices inside the chamber: - A000252971-015 USB cable Ancillary devices outside the chamber: - A000252971-013 Control computer	
EUT Configuration	Back on table	
Test Engineer	Sam Ebadeh	Date: 2020-01-27
Environmental conditions	Temperature: 21,1 °C	Humidity: 36,0%
Chamber details	Chamber: SAC 5	Measurement distance: 3 meter

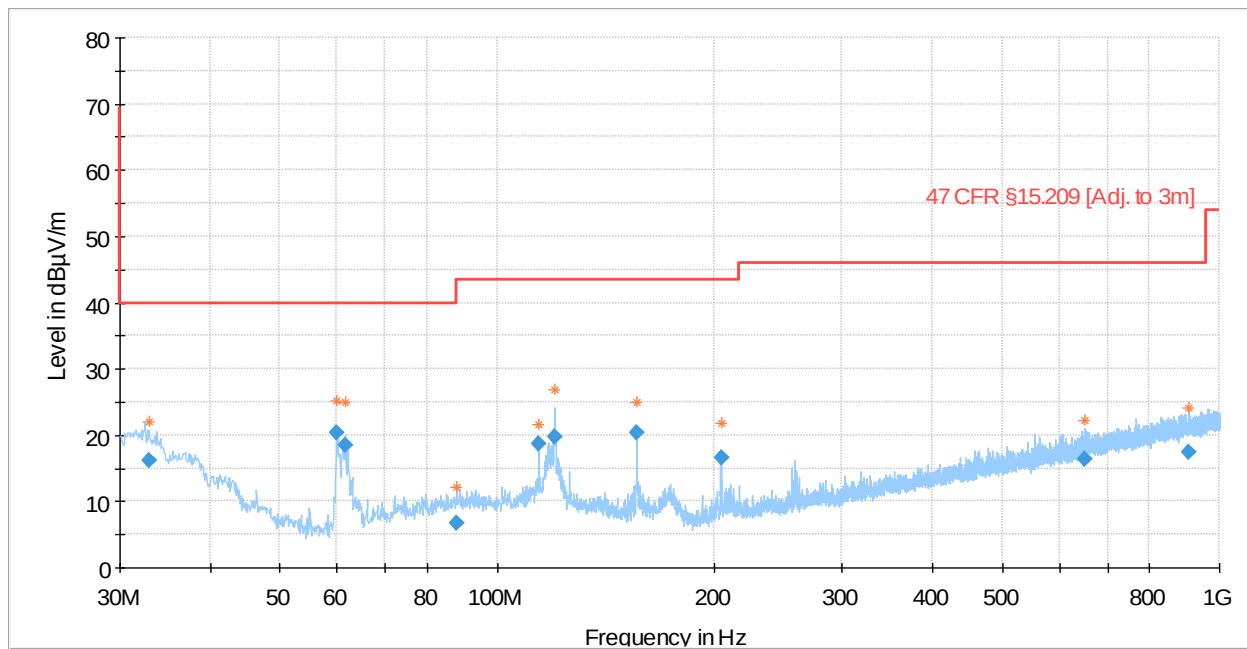


PreviewResult 2-AVG	PreviewResult 1-PK+
Critical_Freqs AVG	Critical_Freqs PK+
47 CFR §15.35 [§15.209 +20dB Adj. to 1m]	47 CFR §15.209 [Adj. to 1m]
Final_Result PK+	Final_Result AVG

Frequency (MHz)	MaxPeak (dBµV/m)	Average (dBµV/m)	Limit (dBµV/m)	Margin dB	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)
26068.500000	---	37.20	63.52	26.32	1000.0	1000.000	155.0	V	112.0
28612.139000	---	40.64	63.52	22.89	1000.0	1000.000	155.0	V	37.0
31368.776000	---	38.98	63.52	24.54	1000.0	1000.000	155.0	H	322.0
33690.895000	---	39.03	63.52	24.49	1000.0	1000.000	155.0	V	172.0
36916.112000	---	40.40	63.52	23.12	1000.0	1000.000	155.0	H	22.0
39004.496000	---	40.02	63.52	23.50	1000.0	1000.000	155.0	H	112.0

Mid Channel

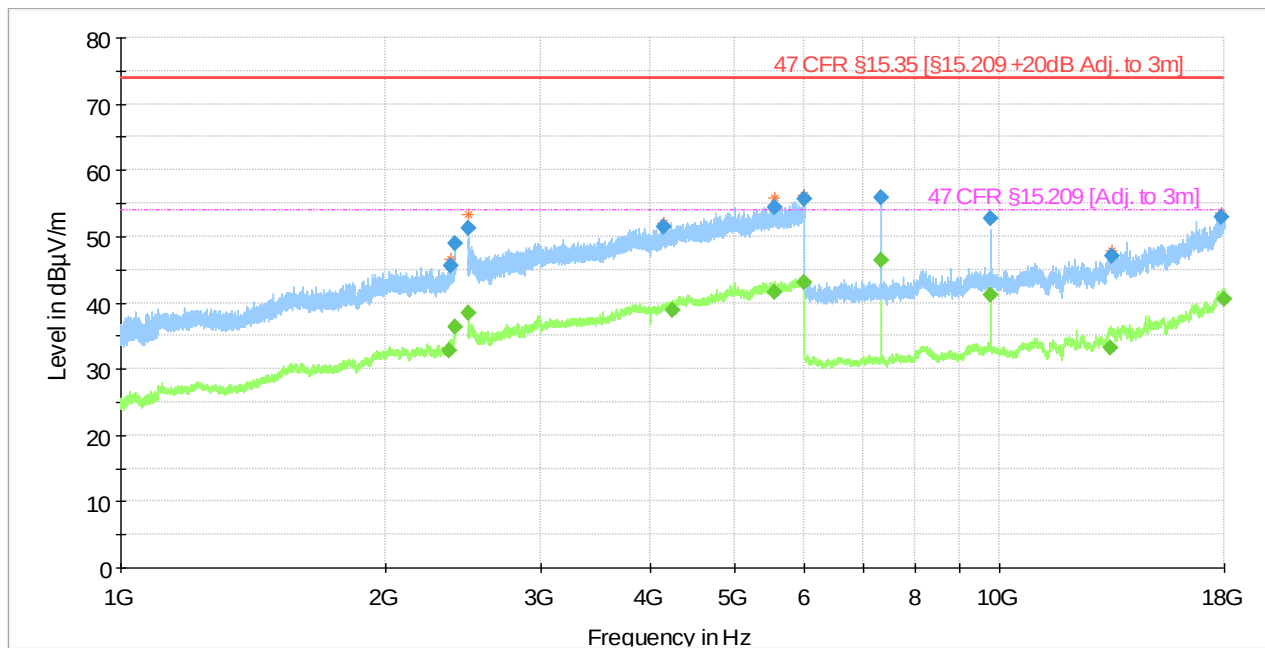
Test	BLE	
Test mode condition	Mid channel TX Mode	
Test frequency	30 MHz-1 GHz	
antenna position	Vertical and Horizontal	
Standard	FCC Part 15 Subpart C	
EUT	A000252971-001	
Ancillary Equipment	Ancillary devices inside the chamber: - A000252971-015 USB cable Ancillary devices outside the chamber: - A000252971-013 Control computer	
EUT Configuration	Back on table	
Test Engineer	Sam Ebadeh	Date: 2020-01-29
Environmental conditions	Temperature: 21,1 °C	Humidity: 35,0%
Chamber details	Chamber: SAC 5	Measurement distance: 3 meter



— 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)	Average (dBµV/m)	Limit (dBµV/m)	Margin dB	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)
32.9468	16.26	---	40	23.74	1000	120	325	V	203
60.00936	20.44	---	40	19.56	1000	120	375	H	-3
61.56628	18.46	---	40	21.54	1000	120	267	H	9
113.99188	18.75	---	43.52	24.77	1000	120	100	V	240
120.22252	19.68	---	43.52	23.84	1000	120	125	V	247
155.99088	20.46	---	43.52	23.06	1000	120	100	V	71

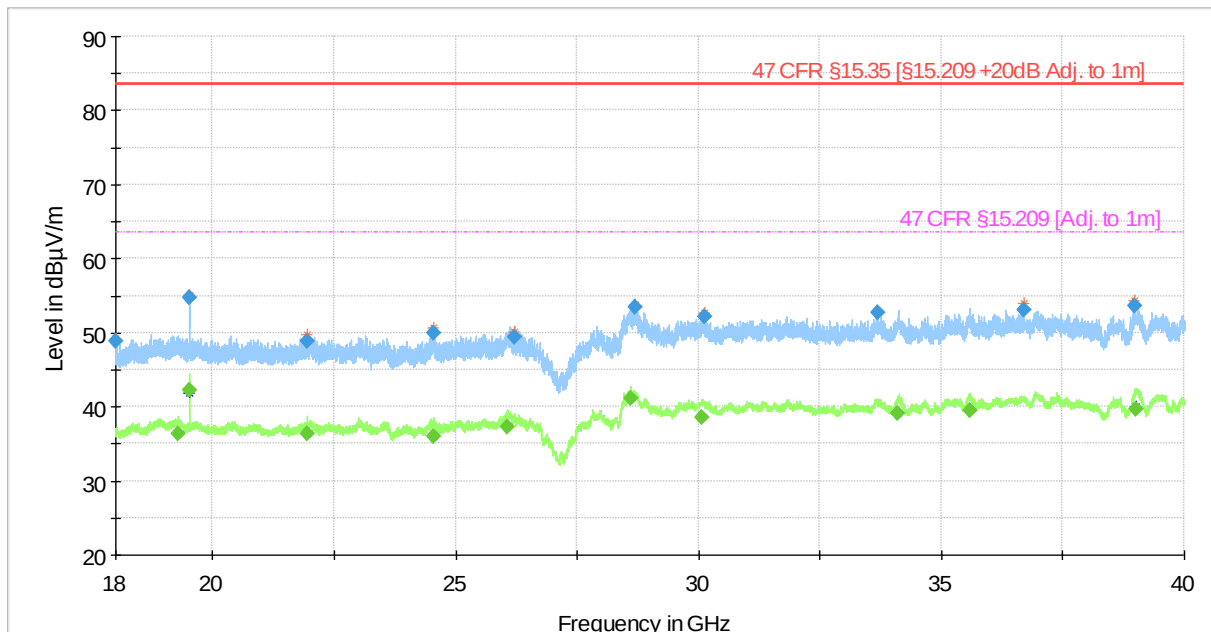
Test	BLE	
Test mode condition	Mid channel - TX Mode	
Test frequency	1 GHz-18 GHz	
antenna position	Vertical and Horizontal	
Standard	FCC Part 15 Subpart C	
EUT	A000252971-001	
Ancillary Equipment	Ancillary devices inside the chamber: - A000252971-015 USB cable Ancillary devices outside the chamber: - A000252971-013 Control computer	
EUT Configuration	Back on table	
Test Engineer	Sam Ebadeh	Date: 2020-01-22
Environmental conditions	Temperature: 21,3 °C	Humidity: 36,2%
Chamber details	Chamber: SAC 5	Measurement distance: 3 meter



—	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)
4235.614000	---	38.87	53.98	15.11	1000.0	1000.000	198.0	V	250.0
5543.187000	---	41.58	53.98	12.40	1000.0	1000.000	175.0	H	160.0
5978.036000	---	42.96	53.98	11.01	1000.0	1000.000	121.0	H	310.0
7319.358000	---	46.35	53.98	7.63	1000.0	1000.000	136.0	V	157.0
9759.070000	---	41.20	53.98	12.78	1000.0	1000.000	126.0	H	318.0
17987.960000	---	40.48	53.98	13.50	1000.0	1000.000	100.0	V	112.0

Test	BLE	
Test mode condition	Mid channel - TX Mode	
Test frequency	18 GHz-40 GHz	
antenna position	Vertical and Horizontal	
Standard	FCC Part 15 Subpart C	
EUT	A000252971-001	
Ancillary Equipment	Ancillary devices inside the chamber: - A000252971-015 USB cable Ancillary devices outside the chamber: - A000252971-013 Control computer	
EUT Configuration	Back on table	
Test Engineer	Simon Palmhager	Date: 2020-01-31
Environmental conditions	Temperature: 21,6 °C	Humidity: 36,6%
Chamber details	Chamber: SAC 5	Measurement distance: 3 meter

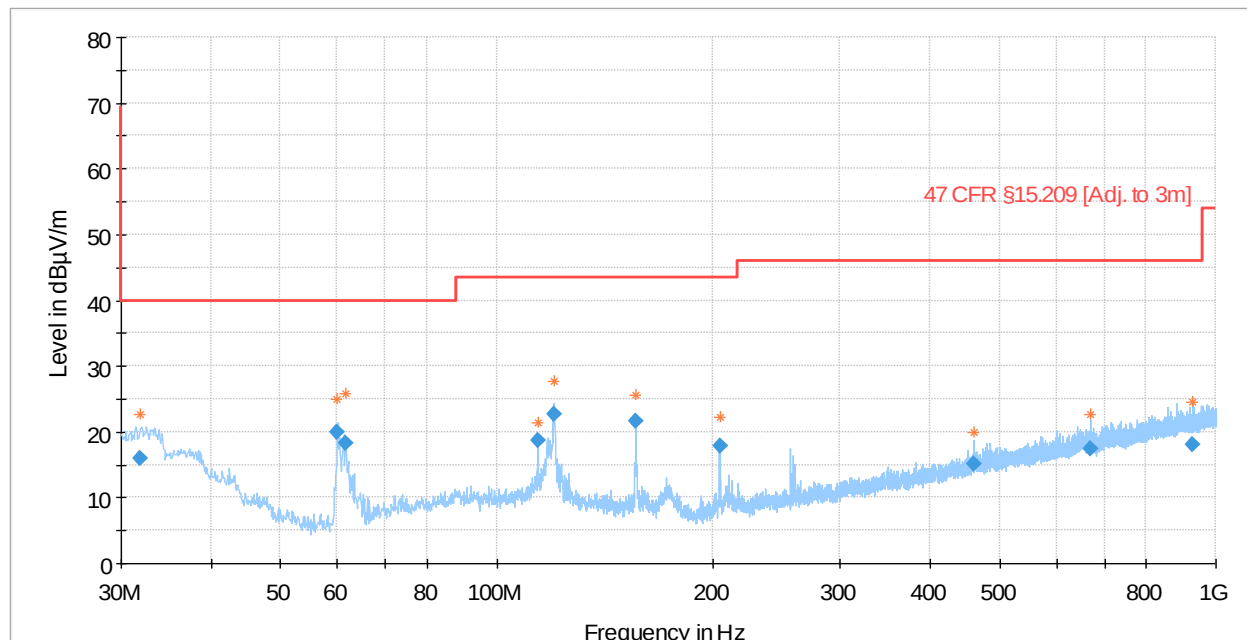


— PreviewResult 2-AVG
— PreviewResult 1-PK+
* Critical_Freqs AVG
* Critical_Freqs PK+
— 47 CFR §15.35 [§15.209 +20dB Adj. to 1m]
— 47 CFR §15.209 [Adj. to 1m]
◆ Final_Result PK+
◆ Final_Result AVG

Frequency (MHz)	MaxPeak (dBµV/m)	Average (dBµV/m)	Limit (dBµV/m)	Margin dB	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)
19518.035000	---	42.23	63.52	21.29	1000.0	1000.000	155.0	V	42.0
28597.597000	---	41.10	63.52	22.42	1000.0	1000.000	155.0	V	22.0
30075.824000	---	38.49	63.52	25.03	1000.0	1000.000	155.0	H	232.0
34095.373000	---	39.07	63.52	24.46	1000.0	1000.000	155.0	V	22.0
35599.045000	---	39.45	63.52	24.08	1000.0	1000.000	155.0	V	322.0
39020.435000	---	39.70	63.52	23.83	1000.0	1000.000	155.0	H	142.0

High Channel

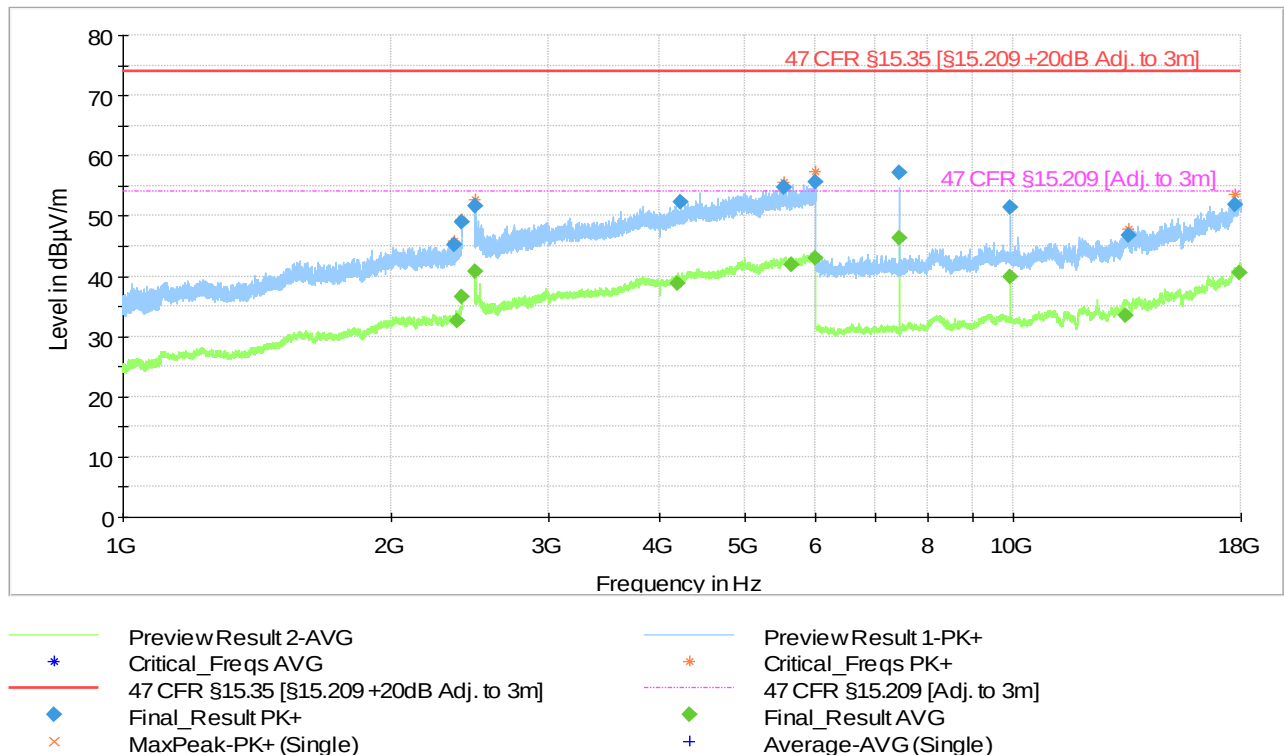
Test	BLE	
Test mode condition	High channel - TX Mode	
Test frequency	30 MHz-1 GHz	
antenna position	Vertical and Horizontal	
Standard	FCC Part 15 Subpart C	
EUT	A000252971-001	
Ancillary Equipment	Ancillary devices inside the chamber: - A000252971-015 USB cable Ancillary devices outside the chamber: - A000252971-013 Control computer	
EUT Configuration	Back on table	
Test Engineer	Sam Ebadeh	Date: 2020-01-29
Environmental conditions	Temperature: 21,1 °C	Humidity: 35,0%
Chamber details	Chamber: SAC 5	Measurement distance: 3 meter



— 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

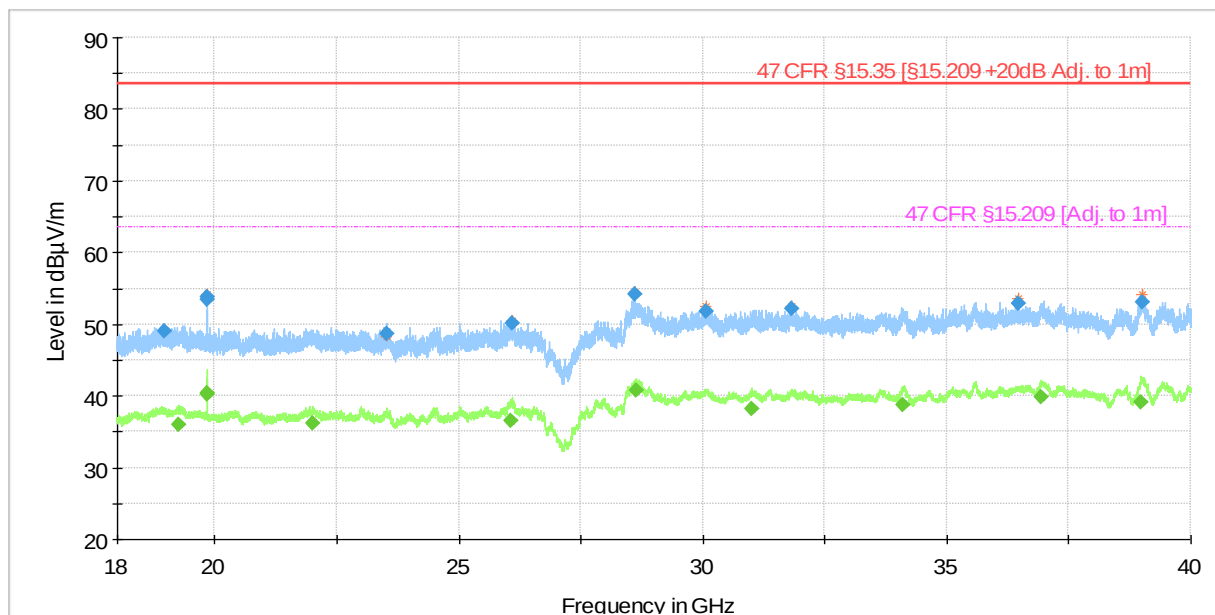
Frequency (MHz)	QuasiPeak (dBµV/m)	Average (dBµV/m)	Limit (dBµV/m)	Margin dB	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)
31.876800	16.06	---	40.00	23.94	1000.0	120.000	229.0	H	265.0
60.010480	20.02	---	40.00	19.98	1000.0	120.000	375.0	H	187.0
61.593320	18.27	---	40.00	21.73	1000.0	120.000	328.0	H	338.0
114.010600	18.76	---	43.52	24.77	1000.0	120.000	100.0	V	240.0
120.005200	22.58	---	43.52	20.94	1000.0	120.000	364.0	H	319.0
156.003840	21.60	---	43.52	21.92	1000.0	120.000	125.0	V	22.0

Test	BLE	
Test mode condition	High channel - TX Mode	
Test frequency	1 GHz-18 GHz	
antenna position	Vertical and Horizontal	
Standard	FCC Part 15 Subpart C	
EUT	A000252971-001	
Ancillary Equipment	Ancillary devices inside the chamber: - A000252971-015 USB cable Ancillary devices outside the chamber: - A000252971-013 Control computer	
EUT Configuration	Back on table	
Test Engineer	Sam Ebadeh	Date: 2020-01-22
Environmental conditions	Temperature: 21,3 °C	Humidity: 36,2%
Chamber details	Chamber: SAC 5	Measurement distance: 3 meter



Frequency (MHz)	MaxPeak (dBµV/m)	Average (dBµV/m)	Limit (dBµV/m)	Margin dB	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)
5631.48	---	41.82	53.98	12.16	1000	1000	125	V	115
2483.5041	---	40.72	53.98	13.26	1000	1000	100	H	175
5986.571	---	42.89	53.98	11.09	1000	1000	175	V	130
7439.407	---	46.28	53.98	7.7	1000	1000	100	V	157
9919.141	---	39.84	53.98	14.14	1000	1000	175	H	308
17960.927	---	40.5	53.98	13.48	1000	1000	100	H	247

Test	BLE	
Test mode condition	High channel - TX Mode	
Test frequency	18 GHz-40 GHz	
antenna position	Vertical and Horizontal	
Standard	FCC Part 15 Subpart C	
EUT	A000252971-001	
Ancillary Equipment	Ancillary devices inside the chamber: - A000252971-015 USB cable Ancillary devices outside the chamber: - A000252971-013 Control computer	
EUT Configuration	Back on table	
Test Engineer	Fariborz Abasi	Date: 2020-02-03
Environmental conditions	Temperature: 21,7 °C	Humidity: 34,6%
Chamber details	Chamber: SAC 5	Measurement distance: 3 meter



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

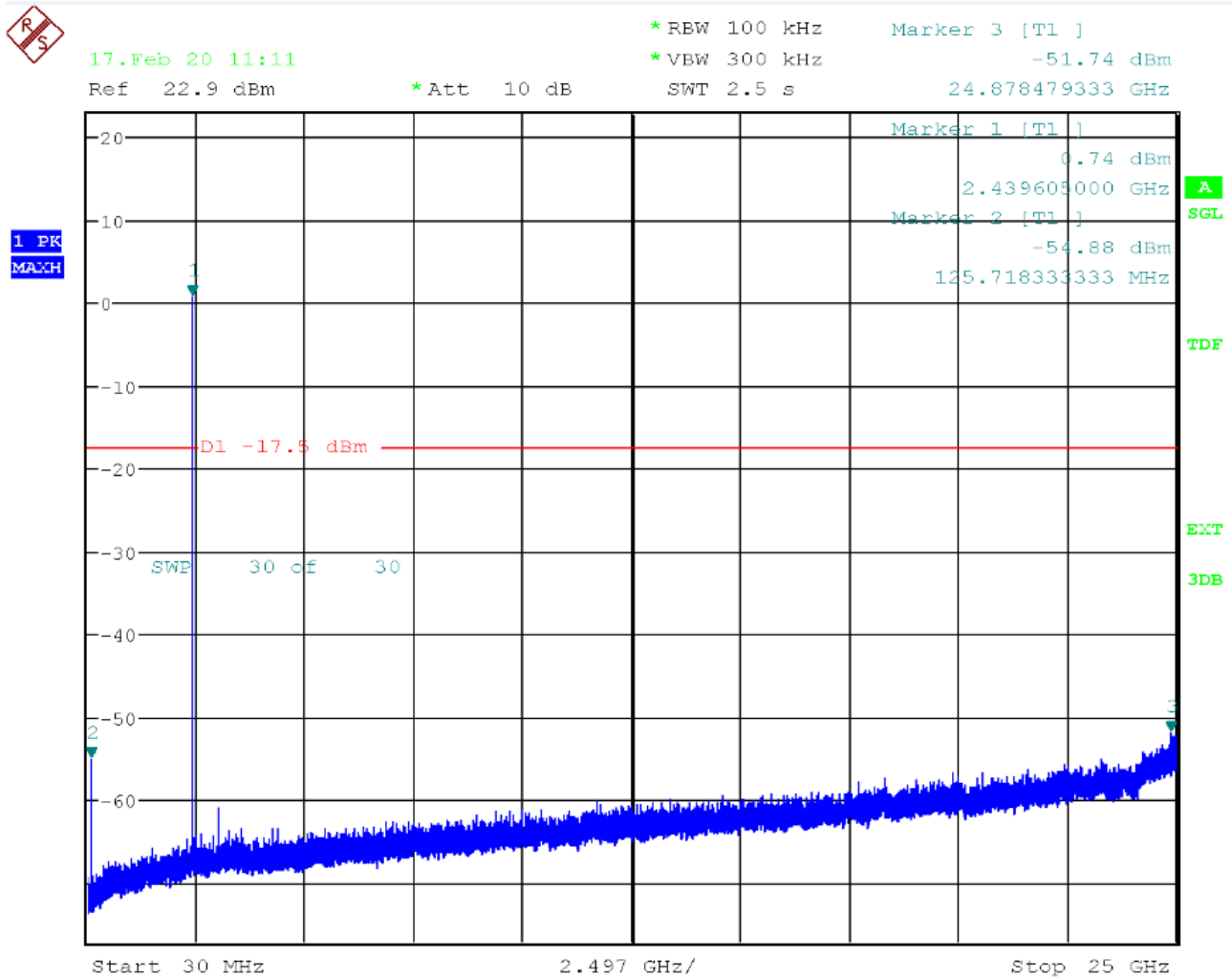
Frequency (MHz)	MaxPeak (dBµV/m)	Average (dBµV/m)	Limit (dBµV/m)	Margin dB	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)
19837.971	---	40.42	63.52	23.1	1000	1000	155	V	7
19837.983	---	40.24	63.52	23.28	1000	1000	155	V	7
28629.673	---	40.84	63.52	22.68	1000	1000	155	H	97
34091.026	---	38.79	63.52	24.73	1000	1000	155	V	67
36923.65	---	39.77	63.52	23.75	1000	1000	155	H	247
38975.868	---	39.08	63.52	24.45	1000	1000	155	H	202

4.5 Test Results – Out of Band Emissions

4.5.1 Out of Band Emissions – Test Summary

Test Specification		47 CFR 15.247 (d)			
Test Engineer & Date		Niall Forrester		2020.02.17	
EUT and Ancillary Equipment IDs		A000252971-003		A000252971-013 A000252971-015	
EUT Operation Mode(s)		#2			
EUT Wireless Configuration(s)		See below			
EUT Hardware Configuration(s)		-			
Overall Result		PASS			
Test Parameter	Wireless Configuration	Tx Pwr (dBm)	Measured Lvl (dBm)	Limit (dBm)	Result
Spurious Emissions (30 MHz – 25 GHz)	BLE Low Channel (2402 MHz) GFSK	2.44	-52.11	-17.56	PASS
Spurious Emissions (30 MHz – 25 GHz)	BLE Mid Channel (2444 MHz) GFSK	2.46	-51.74	-17.54	PASS
Spurious Emissions (30 MHz – 25 GHz)	BLE High Channel (2480 MHz) GFSK	2.60	-52.27	-17.40	PASS

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



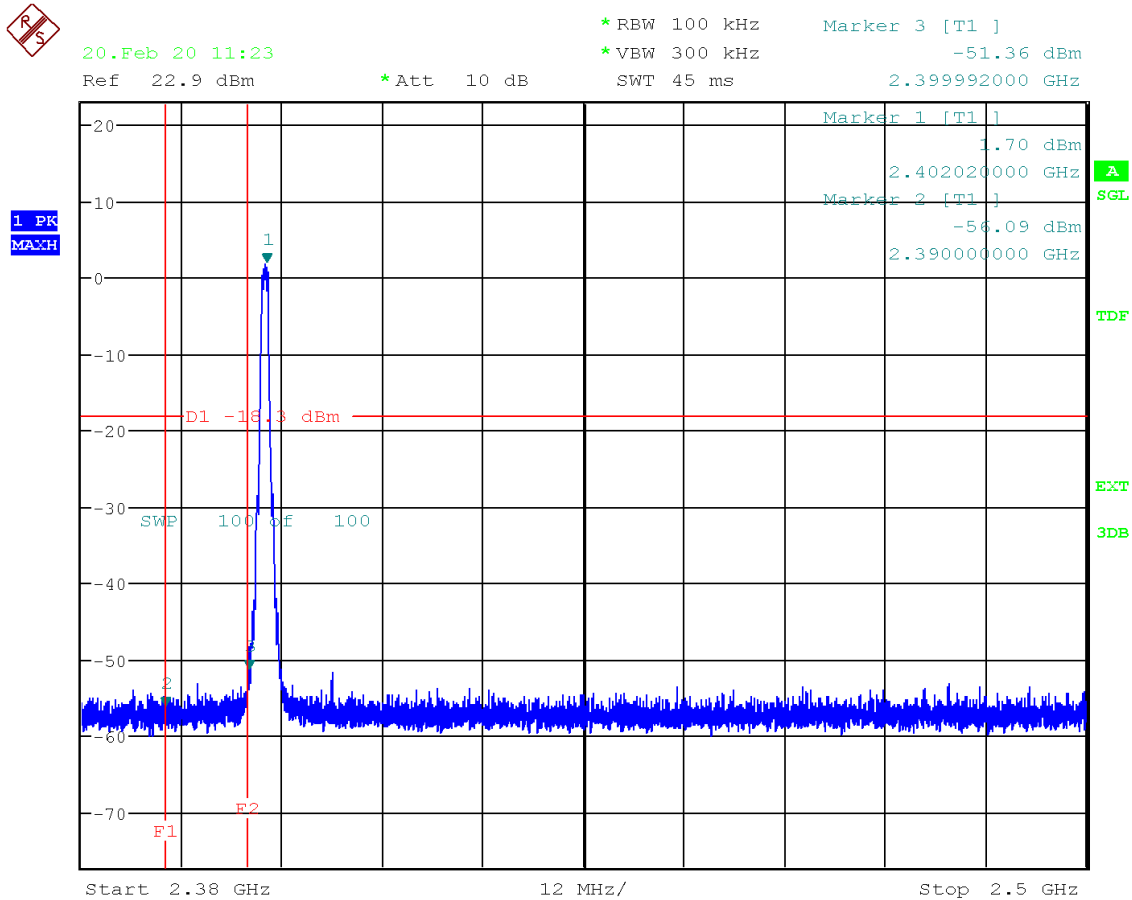
Date: 17.FEB.2020 11:11:22

4.6 Test Results – Band Edge Compliance (Authorized Band)

4.6.1 Band Edge Compliance (Authorized Band) – Test Summary

Test Specification	47 CFR 15.247 (d)				
Test Engineer & Date	Niall Forrester		2020.02.20		
EUT and Ancillary Equipment IDs	A000252971-003		A000252971-013 A000252971-015		
EUT Operation Mode(s)	#2				
EUT Wireless Configuration(s)	See below				
EUT Hardware Configuration(s)	-				
Overall Result	PASS				
Test Parameter	Wireless Configuration		Measured Lvl (dBm)	Limit (dBm)	Result
Emissions at Band Edge (Auth. Band – Low Edge)	BLE Low Channel (2402 MHz) GFSK		-51.36	-18.30	PASS
Emissions at Band Edge (Auth. Band – High Edge)	BLE High Channel (2480 MHz) GFSK		-52.74	-18.65	PASS

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



Date: 20.FEB.2020 11:23:37

4.7 Test Results – Band Edge Compliance (Restricted Band)

4.7.1 Band Edge Compliance (Restricted Band) – Test Summary

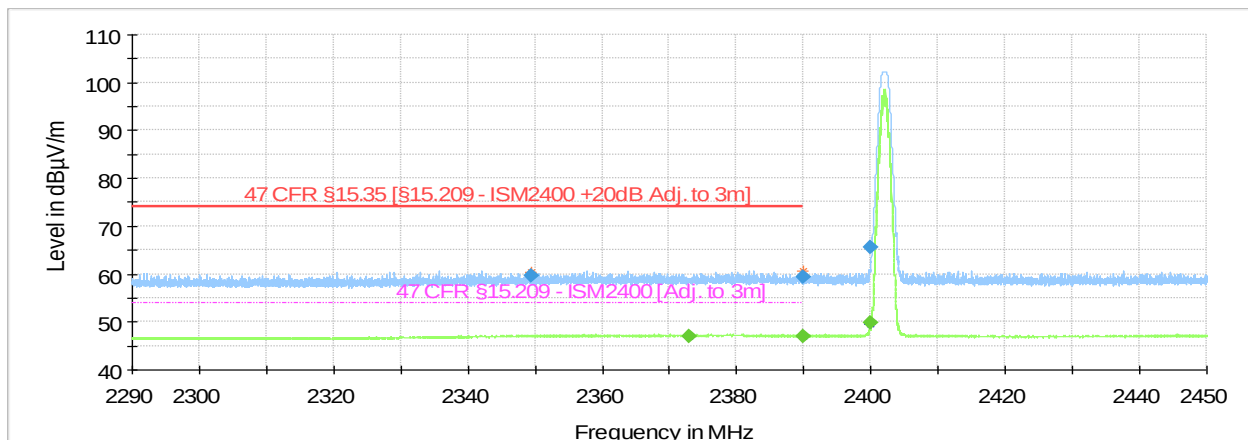
Test Specification	47 CFR 15.209 & 15.247 (d)	
Test Engineer & Date	Sam Ebadeh	2020.1.30
EUT and Ancillary Equipment IDs	A000252971-001	A000252971-013 A000252971-015
EUT Operation Mode(s)	#1	
EUT Wireless Configuration(s)	See below	
EUT Hardware Configuration(s)	-	
Overall Result	PASS	
Test Parameter	Wireless Configuration	Result*
Emissions at Band Edge (Rest. Band – Low Edge)	BLE Low Channel (2402 MHz) GFSK	PASS
Emissions at Band Edge (Rest. Band – High Edge)	BLE High Channel (2480 MHz) GFSK	PASS

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

4.7.2 Band Edge Compliance (Restricted Band) – Test Details

Restricted Band – Low Edge –GFSK

Test	BLE Band EDGE	
Test mode condition	Low channel - TX Mode	
Test frequency	2290 MHz - 2450 MHz	
antenna position	Vertical and Horizontal	
Standard	FCC Part 15 Subpart C	
EUT	A000252971-001	
Ancillary Equipment	Ancillary devices inside the chamber: - A000252971-015 USB cable Ancillary devices outside the chamber: - A000252971-013 Control computer	
EUT Configuration	Back on table	
Test Engineer	Sam Ebadeh	Date: 2020-01-30
Environmental conditions	Temperature: 21,1 °C	Humidity: 35,0%
Chamber details	Chamber: SAC 5	Measurement distance: 3 meter

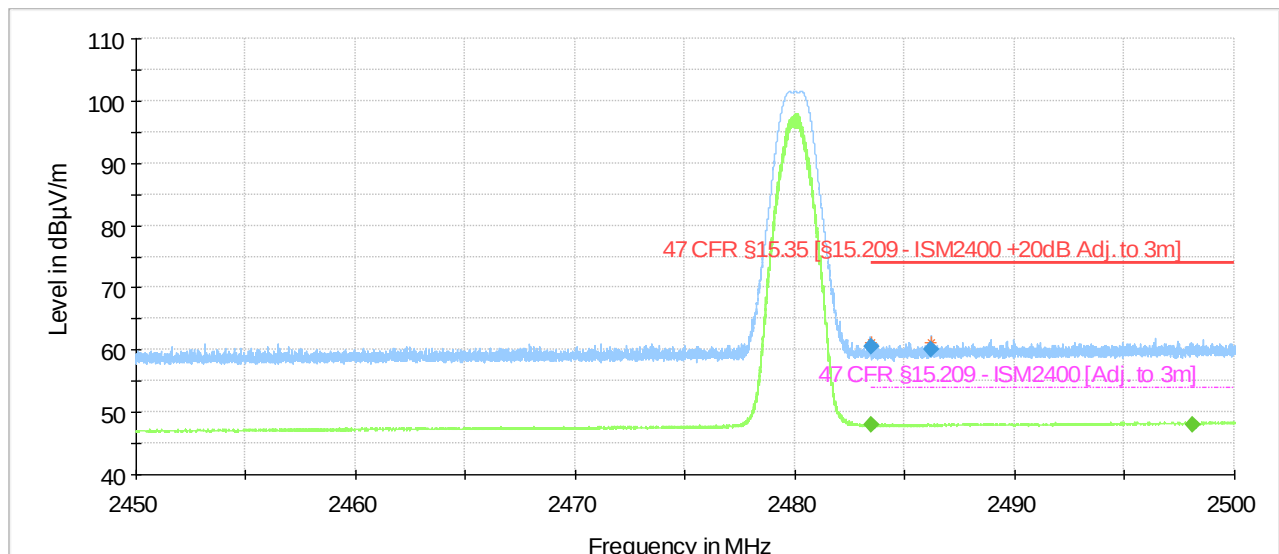


- PreviewResult 2-AVG
- PreviewResult 1-PK+
- Critical_Freqs AVG
- Critical_Freqs PK+
- 47 CFR §15.35 [§15.209 - ISM2400 +20dB Adj. to 3m]
- 47 CFR §15.209 - ISM2400 [Adj. to 3m]
- Final_Result PK+
- Final_Result AVG
- MaxPeak-PK+ (Single)
- Average-AVG (Single)

Frequency (MHz)	MaxPeak (dBµV/m)	Average (dBµV/m)	Limit (dBµV/m)	Margin dB	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)
2349.504000	59.59	---	73.98	14.39	1000.0	1000.000	122.0	V	0.0
2372.848000	---	47.01	53.98	6.97	1000.0	1000.000	133.0	V	213.0
2390.000000	---	46.91	53.98	7.07	1000.0	1000.000	100.0	H	270.0
2390.000000	59.38	---	73.98	14.60	1000.0	1000.000	210.0	V	131.0
2400.000000	---	49.85	---	---	1000.0	1000.000	146.0	H	167.0
2400.000000	65.57	---	---	---	1000.0	1000.000	100.0	H	258.0

Restricted Band – High Edge –GFSK

Test	BLE Band EDGE	
Test mode condition	High channel - TX Mode	
Test frequency	2450 MHz-2500 MHz	
antenna position	Vertical and Horizontal	
Standard	FCC Part 15 Subpart C	
EUT	A000252971-001	
Ancillary Equipment	Ancillary devices inside the chamber: - A000252971-015 USB cable Ancillary devices outside the chamber: - A000252971-013 Control computer	
EUT Configuration	Back on table	
Test Engineer	Sam Ebadeh	Date: 2020-01-30
Environmental conditions	Temperature: 21,1 °C	Humidity: 35,0%
Chamber details	Chamber: SAC 5	Measurement distance: 3 meter



- 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)
2483.500000	---	47.90	53.98	6.08	1000.0	1000.000	181.0	H	143.0
2483.500000	60.61	---	73.98	13.37	1000.0	1000.000	169.0	V	0.0
2486.190000	60.03	---	73.98	13.95	1000.0	1000.000	100.0	V	63.0
2498.085000	---	48.04	53.98	5.94	1000.0	1000.000	169.0	H	143.0

4.8 Test Results – 20dB Bandwidth

4.8.1 20dB Bandwidth – Test Summary

Requirement is not applicable as the device is non-hopping

4.9 Test Results – Carrier (Hopping Channel) Separation

4.9.1 Carrier (Hopping Channel) Separation – Test Summary

Requirement is not applicable as the device is non-hopping

4.10 Test Results – Number of Hopping Channels

4.10.1 Number of Hopping Channels – Test Summary

Requirement is not applicable as the device is non-hopping

4.11 Test Results – Time of Occupancy (Dwell Time)

4.11.1 Time of Occupancy (Dwell Time) – Test Summary

Requirement is not applicable as the device is non-hopping

4.12 Test Results – 6dB Bandwidth

4.12.1 6dB Bandwidth – Test Summary

Test Specification	47 CFR 15.247 (a)(2)			
Test Engineer & Date	Niall Forrester		2020-02-17	
EUT and Ancillary Equipment IDs	A000252971-003		A000252971-013 A000252971-015	
EUT Operation Mode(s)	#2			
EUT Wireless Configuration(s)	See below			
EUT Hardware Configuration(s)	-			
Overall Result	PASS			
Test Parameter	Wireless Configuration	Bandwidth (kHz)	Limit Min (kHz)	Result
6dB Bandwidth	BLE Low Channel (2402 MHz) GFSK	716.40	500	PASS
6dB Bandwidth	BLE Mid Channel (2444 MHz) GFSK	709.80	500	PASS
6dB Bandwidth	BLE High Channel (2480 MHz) GFSK	715.20	500	PASS

4.12.2 6dB Bandwidth – Test Details



17.Feb 20 11:02

Ref 23 dBm

Att 30 dB

*RBW 100 kHz

Marker 3 [T1]

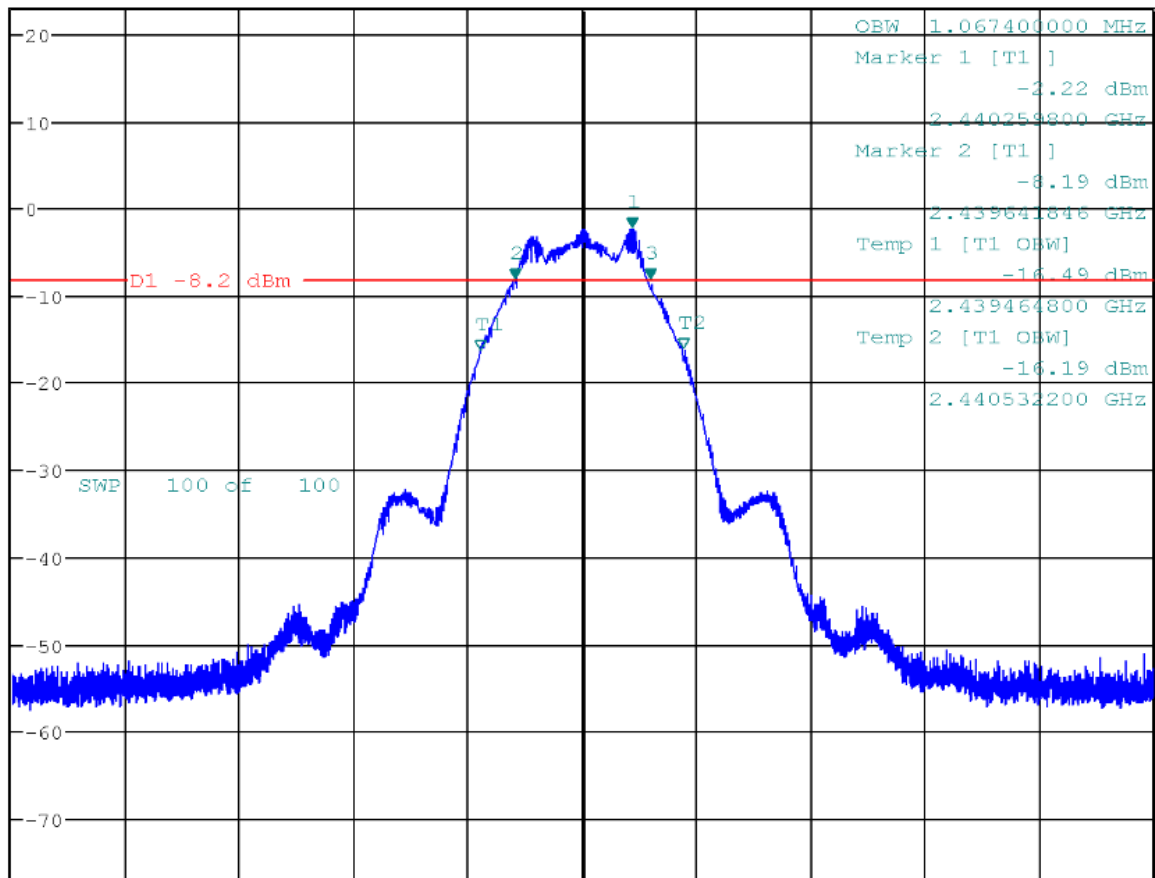
*VBW 300 kHz

-8.27 dBm

SWT 45 ms

2.440351562 GHz

1 PK
MAXH



Center 2.44 GHz

600 kHz/

Span 6 MHz

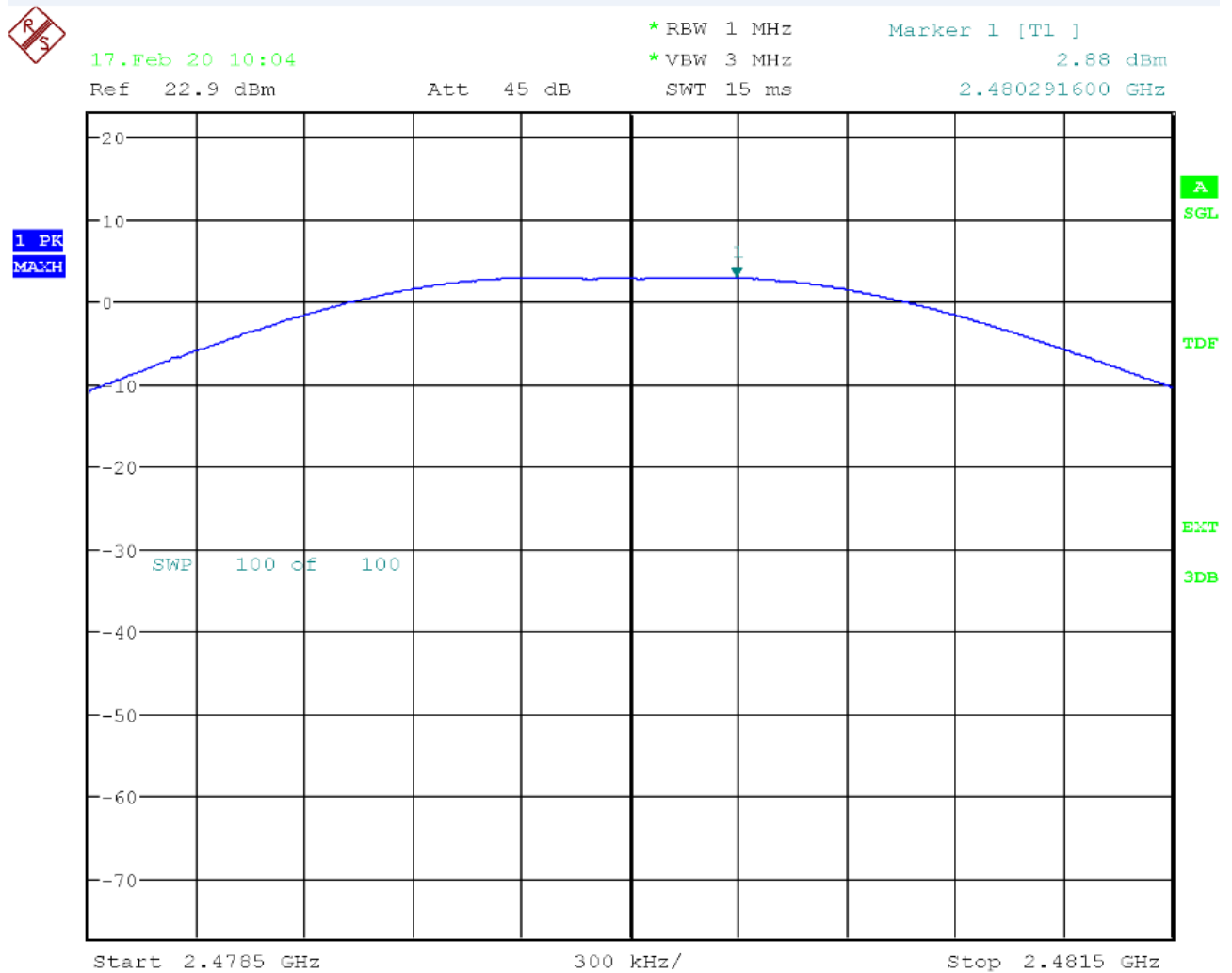
Date: 17.FEB.2020 11:02:34

4.13 Test Results – Peak Conducted Output Power

4.13.1 Peak Conducted Output Power – Test Summary

Test Specification		47 CFR 15.247(b)				
Test Engineer & Date		Niall Forrester			2020.02.17	
EUT and Ancillary Equipment IDs		A000252971-003			A000252971-013 A000252971-015	
EUT Operation Mode(s)		#2				
EUT Wireless Configuration(s)		See below				
EUT Hardware Configuration(s)		-				
Overall Result		PASS				
Test Parameter	Wireless Configuration	Peak Power (dBm)			Max Limit (dBm)	Result
		Low 4.75V	Nom 5.00V	High 5.25V		
Peak Conducted Output Power	BLE Low Channel (2402 MHz) GFSK	2.69	2.67	2.66	30	PASS
Peak Conducted Output Power	BLE Mid Channel (2444 MHz) GFSK	2.80	2.76	2.74	30	PASS
Peak Conducted Output Power	BLE High Channel (2480 MHz) GFSK	2.88	2.87	2.88	30	PASS

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



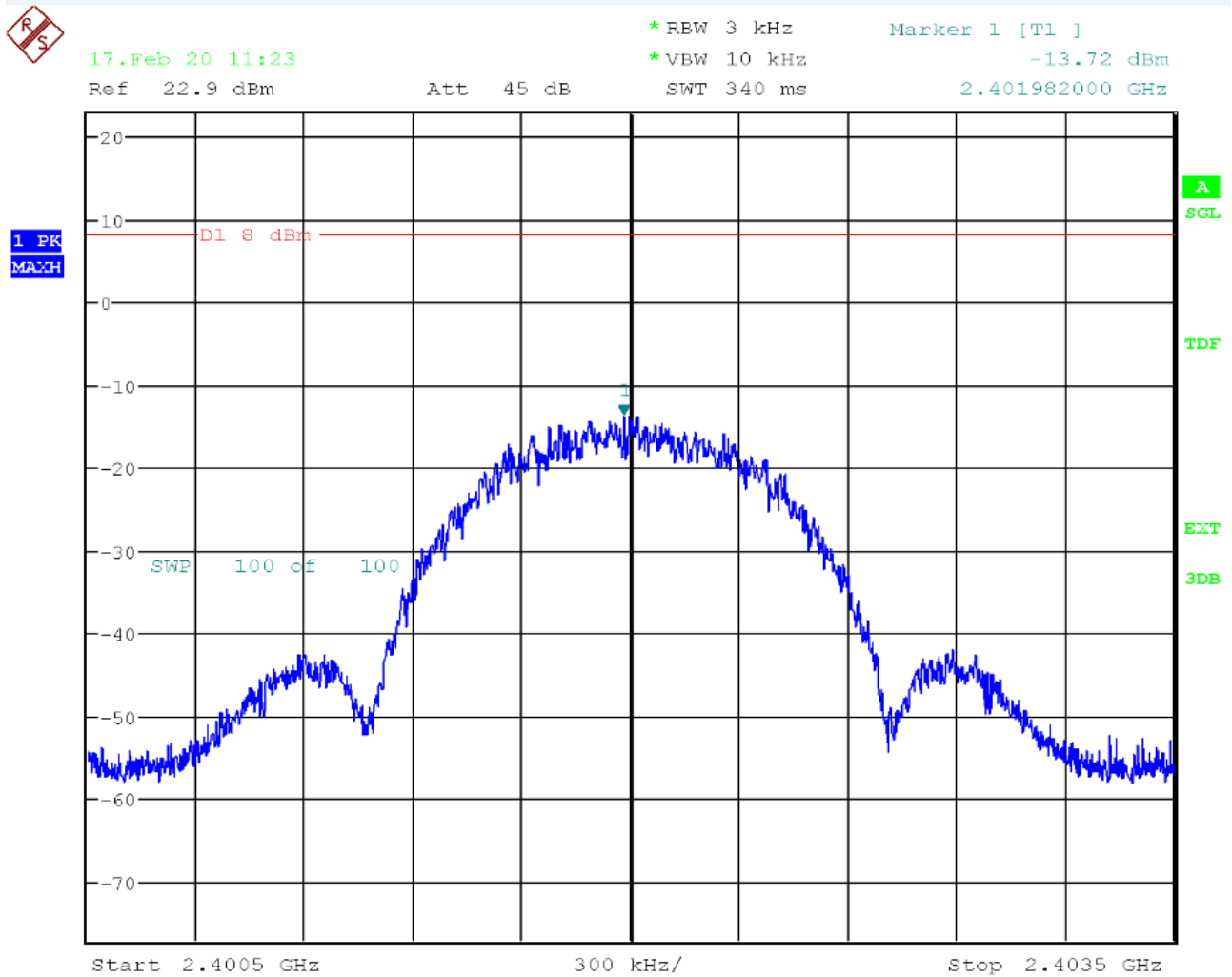
Date: 17.FEB.2020 10:04:42

4.14 Test Results – Power Spectral Density

4.14.1 Power Spectral Density – Test Summary

Test Specification		47 CFR 15.247 (e)			
Test Engineer & Date		Niall Forrester		2020.02.17	
EUT and Ancillary Equipment IDs		A000252971-003		A000252971-013 A000252971-015	
EUT Operation Mode(s)		#2			
EUT Wireless Configuration(s)		See below			
EUT Hardware Configuration(s)		-			
Overall Result		PASS			
Test Parameter	Wireless Configuration	Measured (dBm/3kHz)	Low Limit (dBm/3kHz)	High Limit (dBm/3kHz)	Result
Power Density	BLE Low Channel (2402 MHz) GFSK	-13.72	-30	8	PASS
Power Density	BLE Mid Channel (2444 MHz) GFSK	-13.59	-30	8	PASS
Power Density	BLE High Channel (2480 MHz) GFSK	-13.44	-30	8	PASS

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



Date: 17.FEB.2020 11:23:33

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
Wideband Radio comm.tester	Rohde & Schwarz	CMW500	163750 2711468	15.07.2019	15.07.2020
Spectrum Analyzer	Rohde & Schwarz	FSU26	100308 2704108	10.07.2019	10.07.2020
Vector Signal Generator	Rohde & Schwarz	SMU 200A	101584 2704111	12.07.2019	12.07.2020
High Speed Power Supply	Keithley	2303	1198722 2717714	19.08.2019	19.08.2020
Multimeter / Data Acquisition System	Keithley	2700	995343 2704115	10.07.2019	10.07.2020
Power Probe	Rohde & Schwarz	NRP-Z31	102145 2704104	11.07.2019	11.07.2020
RadiPower Wireless 6 GHz Power meter	Dare	RPR3006W	RPR6W-1901-006 2969972	16.07.2019	16.07.2020
Signal Generator	Rohde & Schwarz	SMF 100A	102374 2704110	30.07.2019	30.07.2022
Baseband & Fading Simulator	Rohde & Schwarz	AMU200A	100304 2704114	09.10.2017	09.10.2020
Digital Multimeter	Fluke	87	61320241 2744110	03.07.2019	03.07.2020
Single Input Thermometer	Fluke	Fluke-51-2	41410362WS 2807523	08.07.2019	08.07.2020
Temperature & humidity Logger	Lufft	OPUS 20	113.0118.0802.033 2771025	22.02.2018	22.02.2020
Temperature Chamber	Vötsch	VT4002	58566032870010 2709706	N/A	N/A

5.1.2 Hardware List – Conducted Emissions System

Test Equipment List					
Type:	Manufacturer	Model	Serial Number	ID	Calibration Due:
Two-Line V-network	Rohde & Schwarz	ENV216	845268/010	2704076	09.07.2020
Test Receiver 9KHz to 3.5 GHz	Rohde & Schwarz	ESR3	101674	2704016	03.07.2020
RF PROBE	Fischer Custom Communication INC	F-52	22	2902256	09.04.2020

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	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	01.04.2019	01.04.2020
Open Switch & Control Unit	Rohde & Schwarz	OSP120	100084 2761253	01.04.2019	01.04.2020
Shielded Filter Unit	Rohde & Schwarz	OSP-F Extension	101333 2761265	01.04.2019	01.04.2020
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
Comprehensive Testing Environment (CTE)	CTE – TMF CTE – BT	V47.1 V43.1
Conducted Emissions System	EMC 32	V10.50.10
SAC 5	EMC 32	V10.50.40

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

7.1 Photographs of the Test Setup

See report 60343169-002 Appendix 1