

Prüfbericht-Nr.: Test report no.:	60342650-003	Auftrags-Nr.: Order no.:	23870303 030	Seite 1 von 59 Page 1 of 59	
Kunden-Referenz-Nr.: Client reference no.:		Auftragsdatum: Order date:	2020.02.10		
Auftraggeber: Client:	GN Audio A/S				
Prüfgegenstand: Test item:	Jabra Link 380c				
Bezeichnung / Typ-Nr.: Identification / Type no.:	END050W FCC ID: BCE-END050W / IC ID: 2386C-END050W				
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:	2020.01.17 – 2020.03.10				
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: 2020.03.17 Date:	Signed by: Niall Forrester		Datum: 2020.03.17 Date:	Signed by: Per Isacson	
Stellung / Position:	Senior Technical Expert		Stellung / Position:	Lab Manager	
Sonstiges / Other:	Only Bluetooth BDR/DER (Classic Bluetooth) 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 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 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	2020-03-10	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	PASS	
15.109	Radiated Emissions (Unintentional Radiators)	YES	4.2	PASS	
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	YES	4.8	PASS	
15.247 (a)(1)	Carrier (Hopping Channel) Separation	YES	4.9	PASS	
15.247 (a)(1)	Number of Hopping Channels	YES	4.10	PASS	
15.247 (a)(1)	Time of Occupancy (Dwell Time)	YES	4.11	PASS	
15.247 (a)(2)	6dB Bandwidth	NO	4.12	N/A	Frequency Hopping Device
15.247 (b)	Peak Conducted Output Power	YES	4.13	PASS	
15.247 (e)	Power Spectral Density	NO	4.14	N/A	Frequency Hopping Device

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. |

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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 380c
Manufacturer:	GN Audio A/S
Model number / Marketing name:	END050W
FCC ID:	BCE-END050W
Description:	Bluetooth USB Type C 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	A000252971-004 (s/n 00301801986)	Standard Sample HW: Alpha 2, SW: 0.5.4	Radiated Tests (SAC 5)
2	A000252971-005 (s/n 00301801729)	Standard Sample HW: Alpha 2, SW: 0.5.4	Radiated Tests (SAC 5) Conducted Emissions
3	A000252971-006 (s/n 00301801662)	Modified with semi-rigid antenna connector HW: Alpha 2, 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	YES
Bluetooth Low Energy (BLE)	2.4GHz	2400.0 MHz – 2483.5 MHz	NO

*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	stamped plate monopole	1.5 dBi

2.6 Wireless Technology Details

Technology	Band	Modulation Type(s)	No. of Channels	Channel Spacing	Adaptivity
Bluetooth BDR/EDR	2.4 GHz	BDR: GFSK EDR: $\pi/4$ -DQPSK EDR: 8-DPSK	79	1 MHz	Adaptive

2.7 Ancillary Equipment

A000252971-007	Control Computer
A000252971-009	Power Supply to Control Computer
A000252971-012	USB C adaptor
A000252971-013	Control Computer
A000252971-015	USB Cable
A000252971-016	USB C adaptor

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)(1)
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)	Conducted Emissions
15.109	Radiated Emissions (Unintentional Radiators)	SAC5
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	N/A
15.247 (b)	Peak Conducted Output Power	CTE
15.247 (e)	Power Spectral Density	N/A

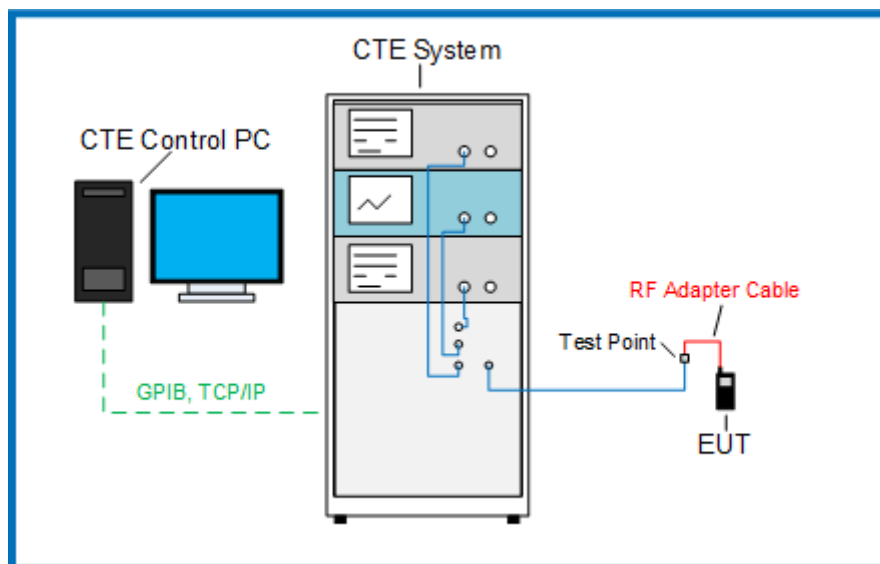
3.4.3 Test Equipment Setup – CTE System

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.

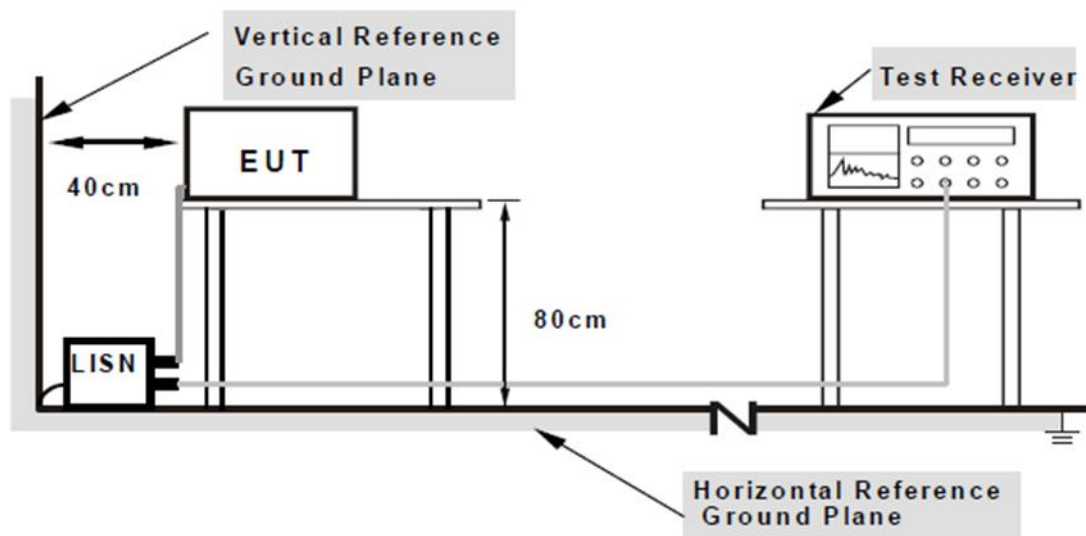
Losses in the cables and interconnects have been measured using the system's own automated routines and are compensated for automatically. Any additional loss in RF adapter cables supplied together with the EUT can be compensated for using the known characteristics of that adapter.

CTE Block Diagram



3.4.4 Test Equipment Setup – Conducted Emissions

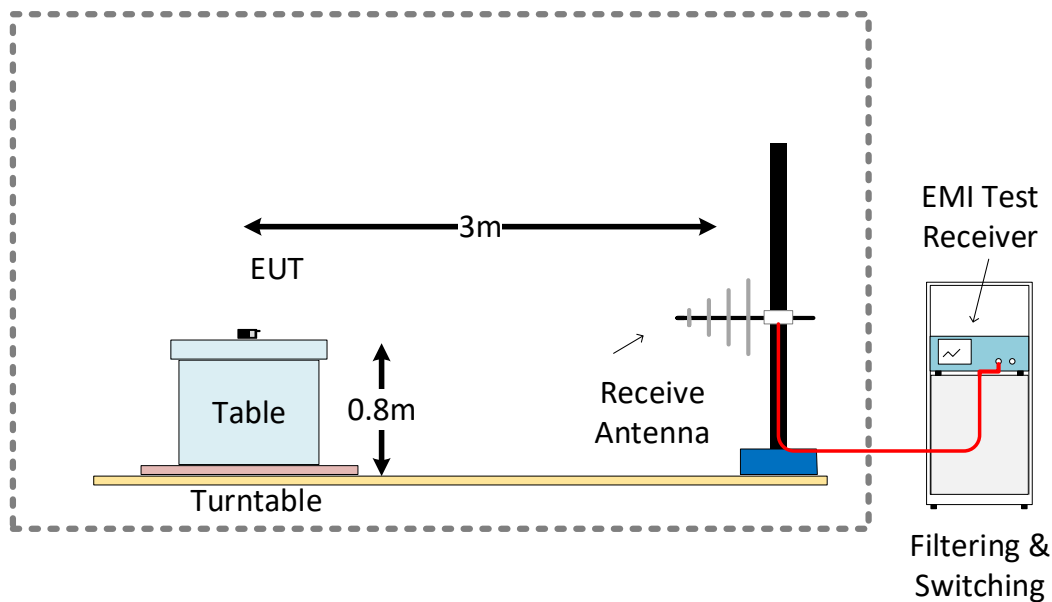
- The EUT was placed 0.4 meters from the conducting wall of the shielded room with EUT being connected to the power mains through a line impedance stabilization network (LISN). Other support units were connected to the power mains through another LISN. The LISNs provide $50\Omega/50\mu\text{H}$ of coupling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



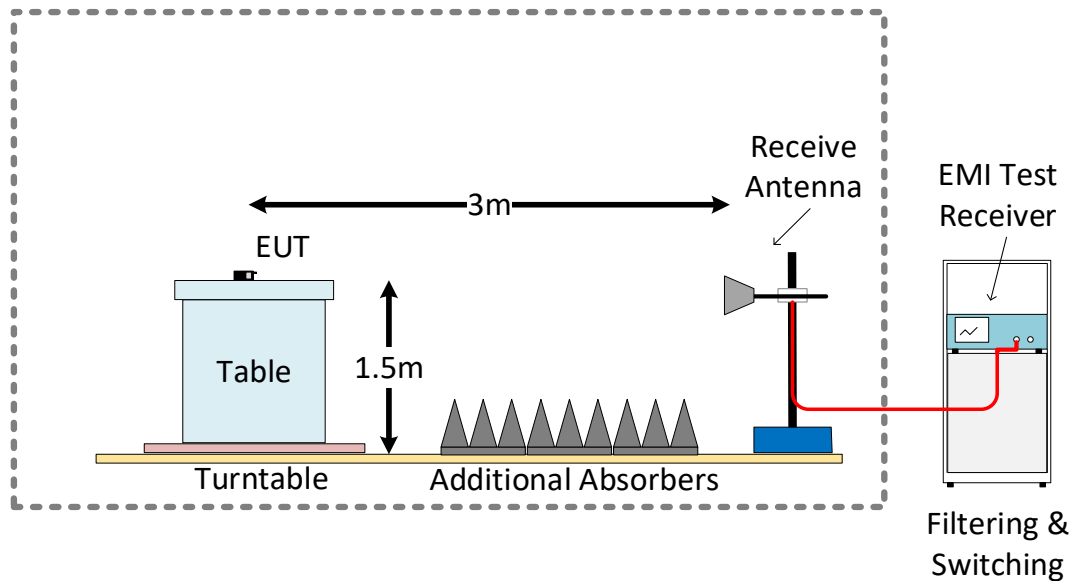
3.4.5 Test Equipment Setup – SAC 5 (Radiated Emissions and Restricted Band Edge)

- 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.

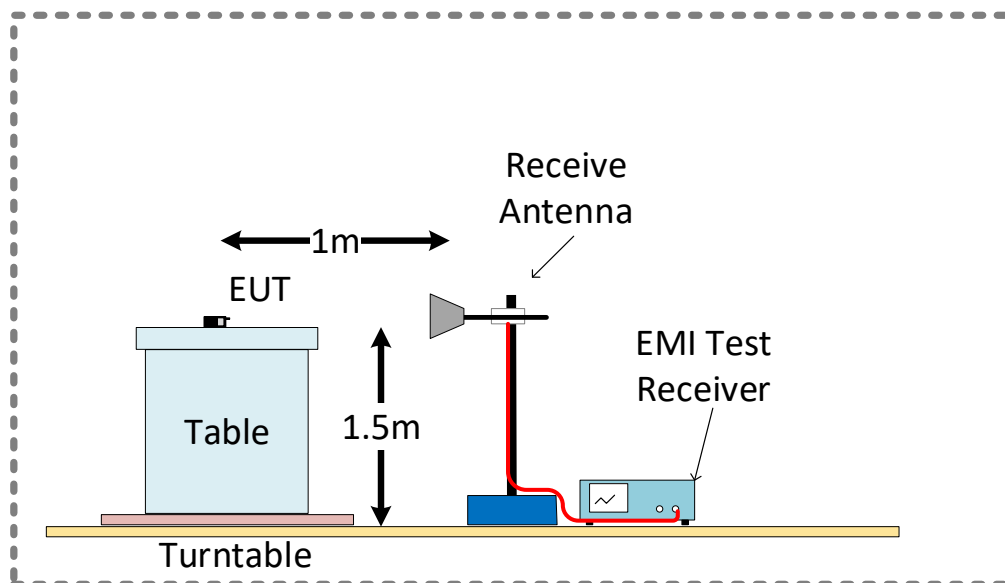
SAC 5 Test Setup Configuration 30MHz – 1GHz



SAC 5 Test Setup Configuration 1GHz – 18GHz



SAC 5 Test Setup Configuration 18GHz – 40GHz



3.5 EUT 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 Bluetooth test mode as defined by Bluetooth specifications. Device is controlled over the air from Bluetooth test instrument
#3	Device set in receive mode

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 (%)
2020.02.11	08:45	22.7	26.8
2020.02.18	07:15	21.0	32.3

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.)

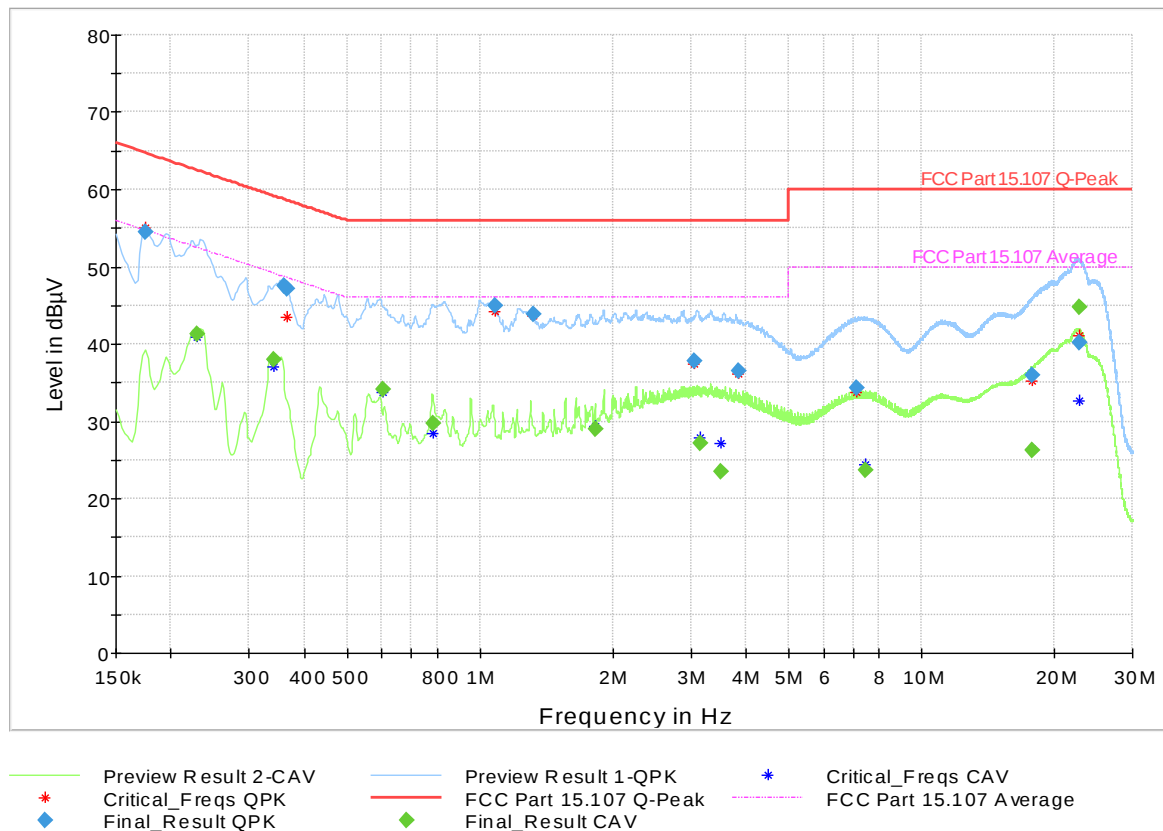
4.1.1 AC Power Line Conducted Emissions (Unintentional) – Test Summary

Test Specification	FCC 47 CFR 15.107 (Part 15 Subpart B)	
Test Engineer & Date	Fariborz Abasi	2020.02.17
EUT and Ancillary Equipment IDs	A000252971-005	A000252971-016 A000252971-007 A000252971-009
EUT Operation Mode(s)	#3	
EUT Wireless Configuration(s)	Idle Mode (no Tx)	
EUT Hardware Configuration(s)	-	
Overall Result	PASS	
Test Parameter	Frequency Range	Result*
AC Power Line Emissions - Idle Mode – “N” Line	150 kHz – 30 MHz	PASS
AC Power Line Emissions - Idle Mode – “L1” Line	150 kHz – 30 MHz	PASS

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

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

Test	Conducted Emission	
Test mode condition	Idle mode	
Standard	FCC part 15.107	
EUT	A000252971-005	
Ancillary Equipment	Ancillary devices inside the chamber:	- A000252971-016 USB C adaptor - A000252971-007 Control computer - A000252971-009 Power supply to Control computer
Test Engineer	Fariborz Abasi	Date: 2020-02-17
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
0.174750	54.53	---	64.73	10.20	1000.0	9.000	N	ON
0.228750	---	41.26	52.50	11.23	1000.0	9.000	L1	ON
0.341250	---	37.89	49.17	11.28	1000.0	9.000	L1	ON
0.359250	47.47	---	58.75	11.27	1000.0	9.000	L1	ON
0.366000	47.08	---	58.59	11.51	1000.0	9.000	L1	ON
0.604500	---	34.06	46.00	11.94	1000.0	9.000	L1	ON
0.782250	---	29.74	46.00	16.26	1000.0	9.000	L1	ON
1.083750	44.90	---	56.00	11.10	1000.0	9.000	L1	ON
1.326750	43.77	---	56.00	12.23	1000.0	9.000	L1	ON
1.819500	---	28.96	46.00	17.04	1000.0	9.000	L1	ON
3.066000	37.81	---	56.00	18.19	1000.0	9.000	L1	ON
3.151500	---	27.17	46.00	18.83	1000.0	9.000	L1	ON
3.498000	---	23.50	46.00	22.51	1000.0	9.000	N	ON
3.844500	36.47	---	56.00	19.53	1000.0	9.000	N	ON
7.129500	34.29	---	60.00	25.71	1000.0	9.000	N	ON
7.458000	---	23.62	50.00	26.38	1000.0	9.000	N	ON
17.747250	36.01	---	60.00	23.99	1000.0	9.000	L1	ON
17.756250	---	26.30	50.00	23.70	1000.0	9.000	L1	ON
22.659000	40.12	---	60.00	19.88	1000.0	9.000	N	ON
22.737750	---	44.74	50.00	5.26	1000.0	9.000	N	ON

4.2 Test Results – Radiated Emissions (Unintentional Transmitter)

4.2.1 Radiated Emissions (Unintentional) – Test Summary

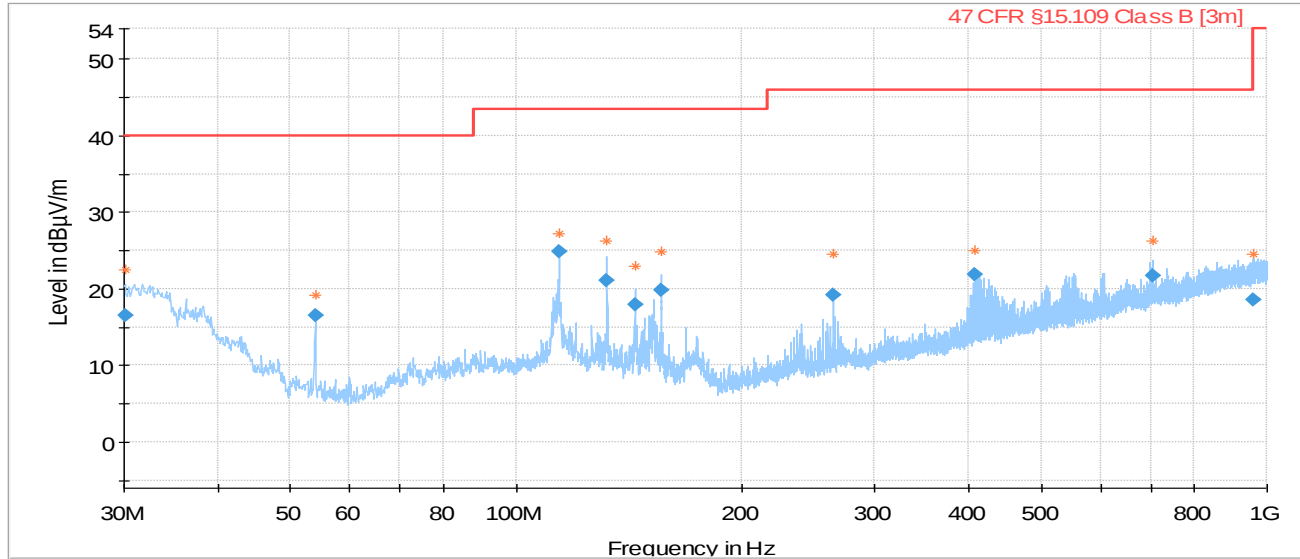
Test Specification	FCC 47 CFR 15.109 (Part 15 Subpart B)	
Test Engineer & Date	Fariborz Abasi	2020.01.18
EUT and Ancillary Equipment IDs	A000252971-004	A000252971-012 A000252971-015 A000252971-013
EUT Operation Mode(s)	#3	
EUT Wireless Configuration(s)	Idle Mode (no Tx)	
EUT Hardware Configuration(s)	-	
Overall Result	PASS	
Test Parameter	Frequency Range	Result*
Radiated Emissions - Idle Mode	30 MHz – 1 GHz	PASS
Radiated Emissions - Idle Mode	1 GHz – 18 GHz	PASS

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

4.2.2 Radiated Emissions (Unintentional) – Test Details

30MHz – 1GHz

Test	Bluetooth classic	
Test mode condition	Idle mode	
Test frequency	30 MHz- 1 GHz	
antenna position	Vertical and Horizontal	
Standard	FCC Part 15 Subpart B	
EUT	A000252971-004	
Ancillary Equipment	Ancillary devices inside the chamber: - A000252971-012 USB C adaptor - A000252971-015 USB cable Ancillary devices outside the chamber: - A000252971-013 Control computer	
EUT Configuration	Back on table	
Test Engineer	Fariborz Abasi	Date: 2020-01-18
Environmental conditions	Temperature: 20,0 °C	Humidity: 33,7%
Chamber details	Chamber: SAC 5	Measurement distance: 3 meter

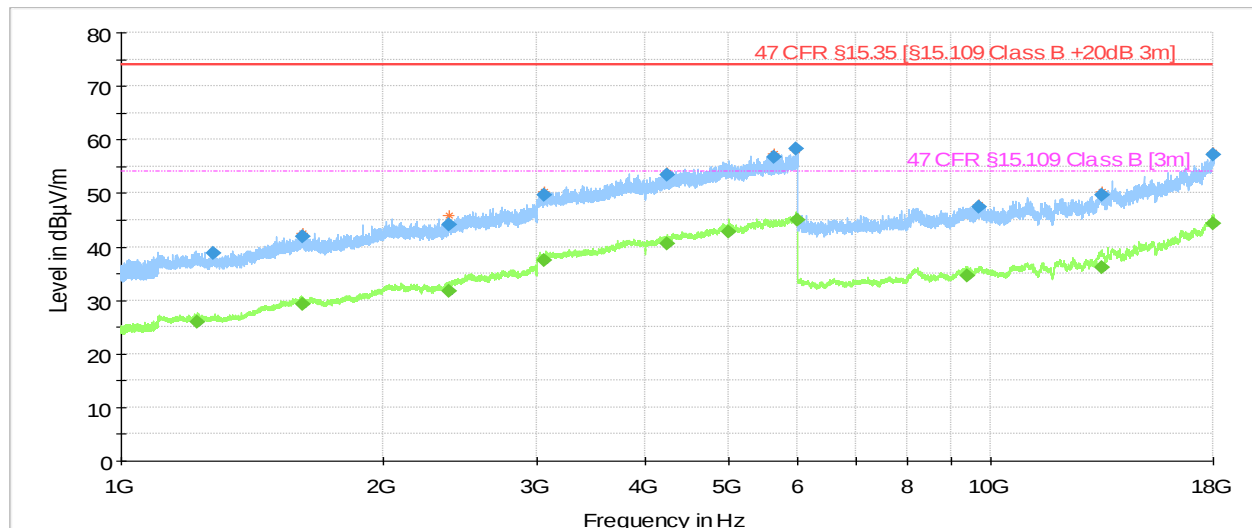


	PreviewResult 2-AVG		PreviewResult 1-PK+
	Critical_Freqs AVG		Critical_Freqs PK+
	47 CFR §15.109 Class B [3m]		Final_Result QPK
	Final_Result AVG		

Frequency	QuasiPeak	Limit	Margin	Meas. Time	Bandwidth	Height	Pol	Azimuth
30.145673	16.54	40	23.46	1000	120	100	V	196
54.011156	16.47	40	23.53	1000	120	125	V	275
113.99056	24.91	43.52	18.62	1000	120	375	H	-23
132.02428	21.13	43.52	22.39	1000	120	100	V	295
156.02928	19.78	43.52	23.74	1000	120	103	V	250
408.01284	21.88	46.02	24.15	1000	120	100	H	38

1GHz – 18GHz

Test	Bluetooth classic	
Test mode condition	Idle mode	
Test frequency	1 GHz- 18 GHz	
antenna position	Vertical and Horizontal	
Standard	FCC Part 15 Subpart B	
EUT	A000252971-004	
Ancillary Equipment	Ancillary devices inside the chamber: - A000252971-012 USB C adaptor - A000252971-015 USB cable Ancillary devices outside the chamber: - A000252971-013 Control computer	
EUT Configuration	Back on table	
Test Engineer	Fariborz Abasi	Date: 2020-01-17
Environmental conditions	Temperature: 21,8 °C	Humidity: 33,7%
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 [§15.109 Class B +20dB 3m]	47 CFR §15.109 Class B [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)
3069.707	---	37.38	53.98	16.6	1000	1000	265	H	172
4237.971	---	40.6	53.98	13.38	1000	1000	285	H	98
4999.657	---	42.71	53.98	11.27	1000	1000	209	V	8
5976.339	58.31	---	73.98	15.67	1000	1000	100	H	142
5980.153	---	45.01	53.98	8.97	1000	1000	135	V	-5
17994.093	---	44.36	53.98	9.62	1000	1000	239	H	172

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

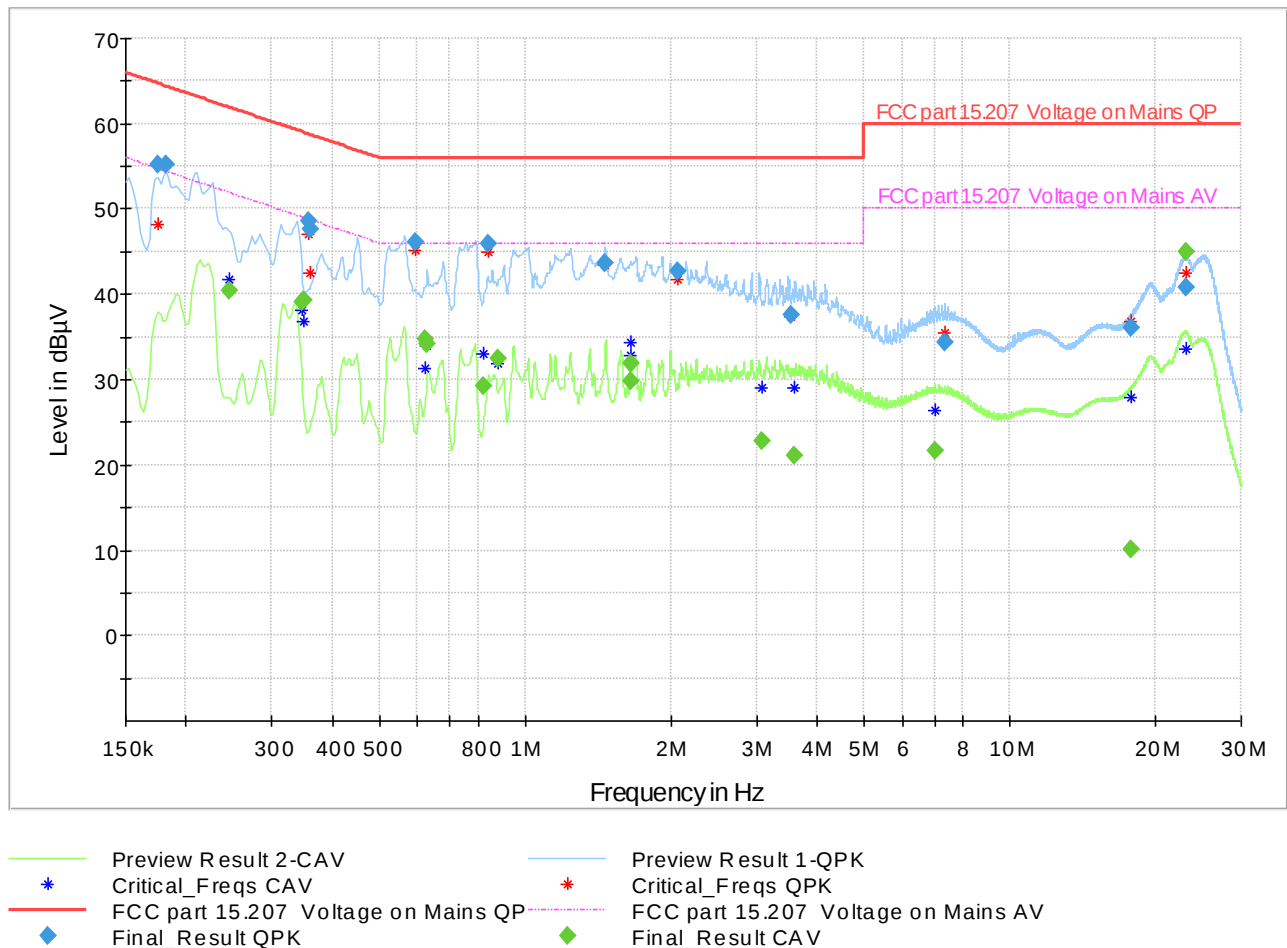
4.3.1 AC Power Line Conducted Emissions (Intentional) – Test Summary

Test Specification	FCC 47 CFR 15.207 (Part 15 Subpart C)		
Test Engineer & Date	Fariborz Abasi	2020.02.17	
EUT and Ancillary Equipment IDs	A000252971-005	A000252971-016 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	BT Mid Channel (2441 MHz) 3-DH5 (8-DPSK)	150 kHz – 30 MHz	PASS
AC Conducted Power Line Emissions – “L1” Line	BT Mid Channel (2441 MHz) 3-DH5 (8-DPSK)	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 Classic Mid channel (2441 MHz)	
Standard	FCC part 15.207	
EUT	A000252971-005	
Ancillary Equipment	Ancillary devices inside the chamber:	A000252971-016 USB C adaptor A000252971-007 Control computer A000252971-009 Power supply to Control computer
Test Engineer	Fariborz Abasi	Date: 2020-02-17
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
0.174750	55.31	---	64.73	9.42	1000.0	9.000	L1	ON
0.181500	55.16	---	64.42	9.25	1000.0	9.000	N	ON
0.244500	---	40.41	51.94	11.53	1000.0	9.000	N	ON
0.348000	---	39.15	49.01	9.86	1000.0	9.000	L1	ON
0.350250	---	39.31	48.96	9.65	1000.0	9.000	L1	ON
0.357000	48.66	---	58.80	10.13	1000.0	9.000	L1	ON
0.361500	47.60	---	58.69	11.09	1000.0	9.000	L1	ON
0.595500	46.18	---	56.00	9.82	1000.0	9.000	L1	ON
0.622500	---	34.77	46.00	11.23	1000.0	9.000	L1	ON
0.624750	---	34.15	46.00	11.85	1000.0	9.000	L1	ON
0.820500	---	29.27	46.00	16.73	1000.0	9.000	L1	ON
0.840750	45.96	---	56.00	10.04	1000.0	9.000	L1	ON
0.881250	---	32.42	46.00	13.58	1000.0	9.000	L1	ON
1.457250	43.62	---	56.00	12.38	1000.0	9.000	L1	ON
1.648500	---	31.90	46.00	14.10	1000.0	9.000	L1	ON
1.650750	---	29.77	46.00	16.23	1000.0	9.000	L1	ON
2.058000	42.75	---	56.00	13.25	1000.0	9.000	L1	ON
3.090750	---	22.71	46.00	23.29	1000.0	9.000	L1	ON
3.527250	37.56	---	56.00	18.44	1000.0	9.000	N	ON
3.590250	---	21.06	46.00	24.94	1000.0	9.000	N	ON
7.023750	---	21.60	50.00	28.40	1000.0	9.000	N	ON
7.329750	34.28	---	60.00	25.72	1000.0	9.000	N	ON
17.731500	36.01	---	60.00	23.99	1000.0	9.000	L1	ON
17.783250	---	10.06	50.00	39.94	1000.0	9.000	L1	ON
23.064000	40.88	---	60.00	19.12	1000.0	9.000	N	ON
23.169750	---	45.02	50.00	4.98	1000.0	9.000	N	ON

4.4 Test Results – Radiated Emissions (Intentional Transmitter)

4.4.1 Radiated Emissions (Intentional) – Test Summary

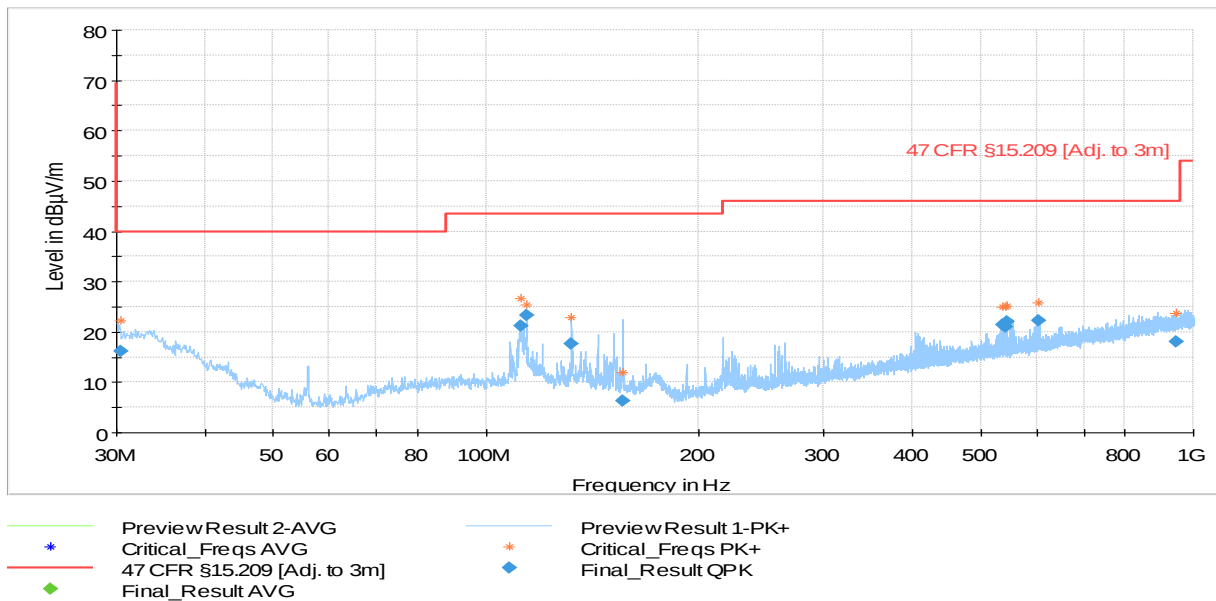
Note: The Radiated Emissions (Intentional Transmitter) testing has been performed using the 3-DH5 packet type (8-DPSK modulation) as this is expected to represent the worst case, based on peak conducted output power measurements. Other wireless configurations operating within the same frequency range and using the same antenna but with lower peak output power have been excluded from radiated emissions testing.

Test Specification		FCC 47 CFR 15.209 (Part 15 Subpart C)	
Test Engineer & Date		Fariborz Abasi Sam Ebadeh Simon Palmhager	2020.01.13 – 2020.01.26
EUT and Ancillary Equipment IDs		A000252971-004 A000252971-005	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	BT Low Channel (2402 MHz) 3-DH5 (8-DPSK)	30 MHz – 1 GHz	PASS
Radiated Emissions	BT Low Channel (2402 MHz) 3-DH5 (8-DPSK)	1 GHz – 18 GHz	PASS
Radiated Emissions	BT Low Channel (2402 MHz) 3-DH5 (8-DPSK)	18 GHz – 40 GHz	PASS
Radiated Emissions	BT Mid Channel (2441 MHz) 3-DH5 (8-DPSK)	30 MHz – 1 GHz	PASS
Radiated Emissions	BT Mid Channel (2441 MHz) 3-DH5 (8-DPSK)	1 GHz – 18 GHz	PASS
Radiated Emissions	BT Mid Channel (2441 MHz) 3-DH5 (8-DPSK)	18 GHz – 40 GHz	PASS
Radiated Emissions	BT High Channel (2480 MHz) 3-DH5 (8-DPSK)	30 MHz – 1 GHz	PASS
Radiated Emissions	BT High Channel (2480 MHz) 3-DH5 (8-DPSK)	1 GHz – 18 GHz	PASS
Radiated Emissions	BT High Channel (2480 MHz) 3-DH5 (8-DPSK)	18 GHz – 40 GHz	PASS

4.4.2 Radiated Emissions (Intentional) – Test Details

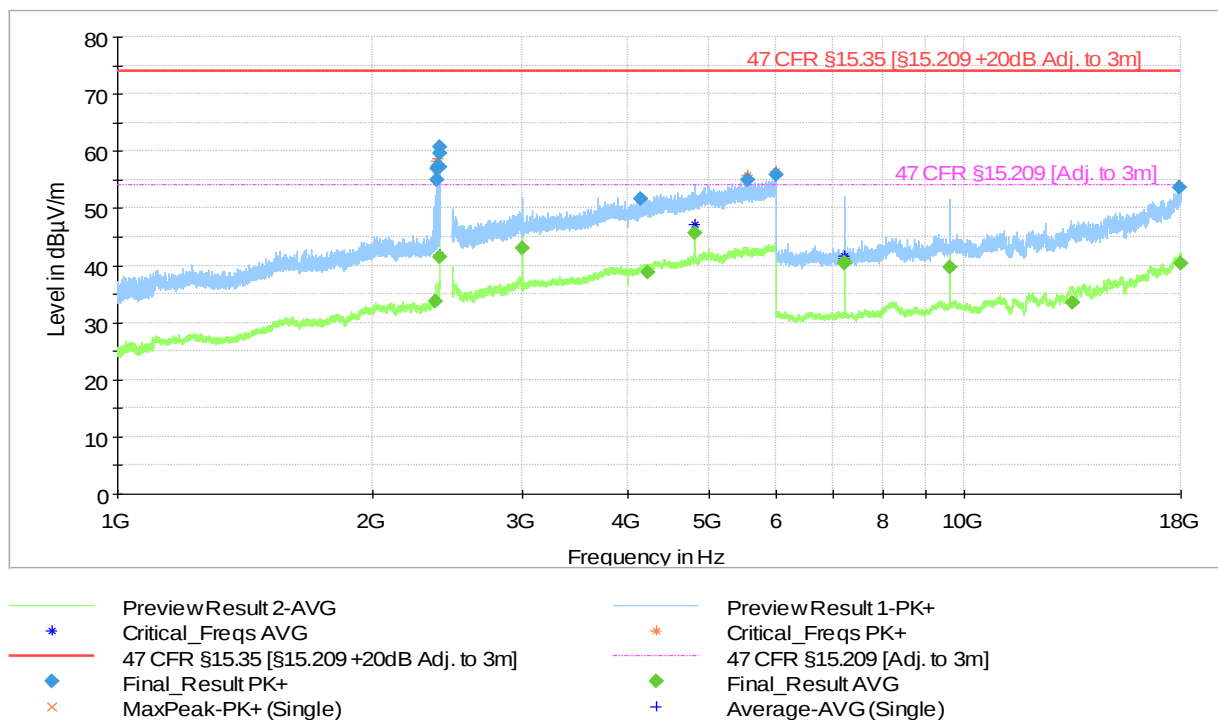
Low Channel

Test	Bluetooth classic	
Test mode condition	Low channel: 2402 MHz – TX mode	
Test frequency	30 MHz- 1 GHz	
antenna position	Vertical and Horizontal	
Standard	FCC Part 15 Subpart C	
EUT	A000252971-005	
Ancillary Equipment	Ancillary devices inside the chamber: - A000252971-016 USB C adaptor - A000252971-015 USB cable Ancillary devices outside the chamber: - A000252971-013 Control computer	
EUT Configuration	Back on table	
Test Engineer	Sam Ebadeh	Date: 2020-01-17
Environmental conditions	Temperature: 22,9 °C	Humidity: 33,4%
Chamber details	Chamber: SAC 5	Measurement distance: 3 meter



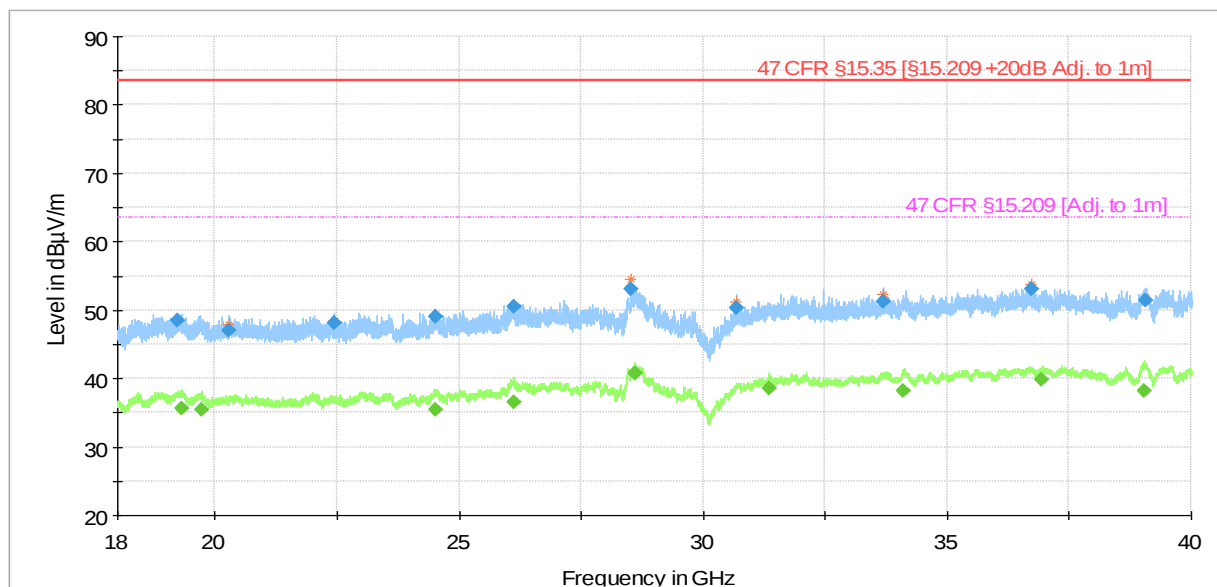
Frequency (MHz)	QuasiPeak (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Meas. Time	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)
30.441968	16.10	40.00	23.90	1000.0	120.000	375.0	H	67.0
111.884320	21.19	43.52	22.34	1000.0	120.000	380.0	H	-23.0
114.005240	23.23	43.52	20.30	1000.0	120.000	318.0	H	184.0
538.008920	21.51	46.02	24.51	1000.0	120.000	216.0	H	173.0
544.018360	22.03	46.02	23.99	1000.0	120.000	214.0	H	183.0
604.016920	22.17	46.02	23.85	1000.0	120.000	225.0	H	128.0

Test	Bluetooth classic	
Test mode condition	Low channel: 2402 MHz – TX mode	
Test frequency	1 GHz- 18 GHz	
antenna position	Vertical and Horizontal	
Standard	FCC Part 15 Subpart C	
EUT	A000252971-005	
Ancillary Equipment	Ancillary devices inside the chamber: - A000252971-016 USB C adaptor - A000252971-015 USB cable Ancillary devices outside the chamber: - A000252971-013 Control computer	
EUT Configuration	Back on table	
Test Engineer	Sam Ebadeh	Date: 2020-01-13
Environmental conditions	Temperature: 21,8 °C	Humidity: 34,8%
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)
2399.948172	60.83	---	73.98	13.15	1000.0	1000.000	102.0	H	274.0
2399.973500	---	41.36	53.98	12.61	1000.0	1000.000	103.0	H	265.0
3002.547080	---	42.95	53.98	11.03	1000.0	1000.000	103.0	H	309.0
4803.908000	---	45.73	53.98	8.25	1000.0	1000.000	125.0	H	296.0
7205.977000	---	40.53	53.98	13.45	1000.0	1000.000	100.0	H	-8.0
7206.104000	---	40.30	53.98	13.68	1000.0	1000.000	100.0	H	-6.0

Test	Bluetooth classic	
Test mode condition	Low channel: 2402 MHz – TX mode	
Test frequency	18 GHz- 40 GHz	
antenna position	Vertical and Horizontal	
Standard	FCC Part 15 Subpart C	
EUT	A000252971-005	
Ancillary Equipment	Ancillary devices inside the chamber: - A000252971-016 USB C adaptor - A000252971-015 USB cable Ancillary devices outside the chamber: - A000252971-013 Control computer	
EUT Configuration	Back on table	
Test Engineer	Sam Ebadeh	Date: 2020-01-26
Environmental conditions	Temperature: 21,1 °C	Humidity: 36,0%
Chamber details	Chamber: SAC 5	Measurement distance: 3 meter

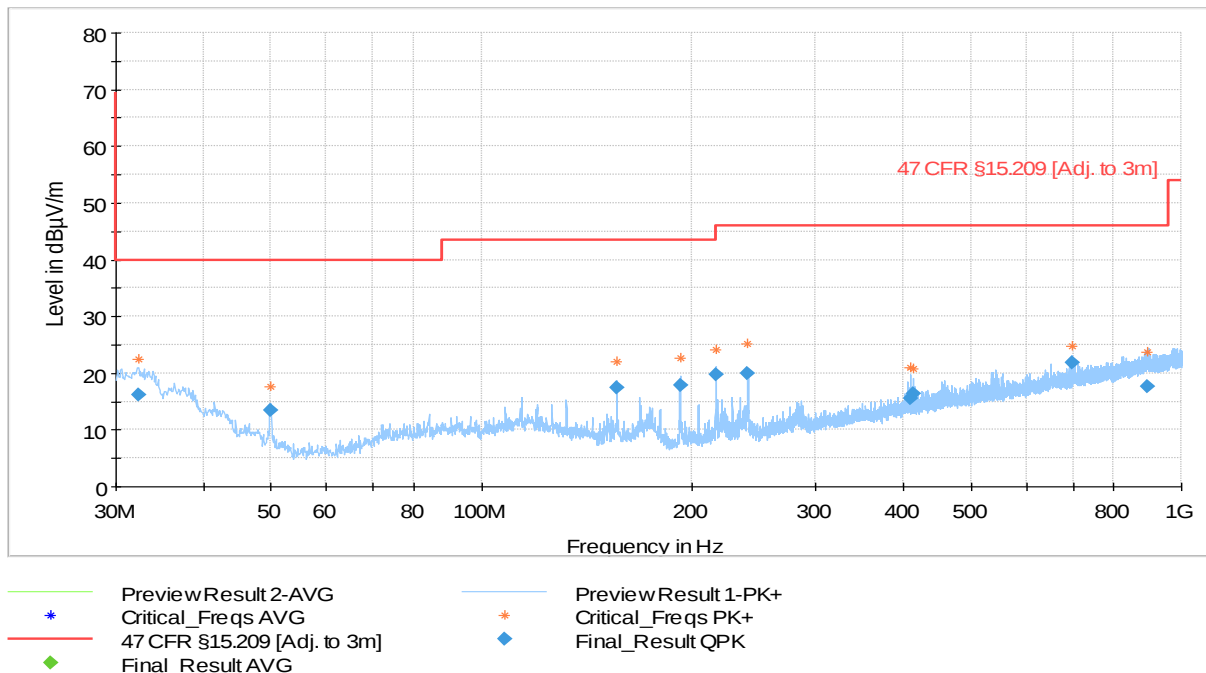


— PreviewResult 2-AVG
— PreviewResult 1-PK+
— 47 CFR §15.35 [§15.209 +20dB Adj. to 1m]
— 47 CFR §15.209 [Adj. to 1m]
◆ Final_Result PK+
◆ Final_Result AVG

Frequency (MHz)	MaxPeak (dBμV/m)	Average (dBμV/m)	Limit (dBμV/m)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)
28607.853	---	40.84	63.52	22.68	1000	1000	155	V	10
28608.914	---	40.8	63.52	22.72	1000	1000	155	V	22
31349.61	---	38.58	63.52	24.94	1000	1000	155	H	277
34093.395	---	38.21	63.52	25.32	1000	1000	155	V	10
36921.596	---	39.79	63.52	23.74	1000	1000	155	V	35
39034.787	---	38.19	63.52	25.33	1000	1000	155	H	113

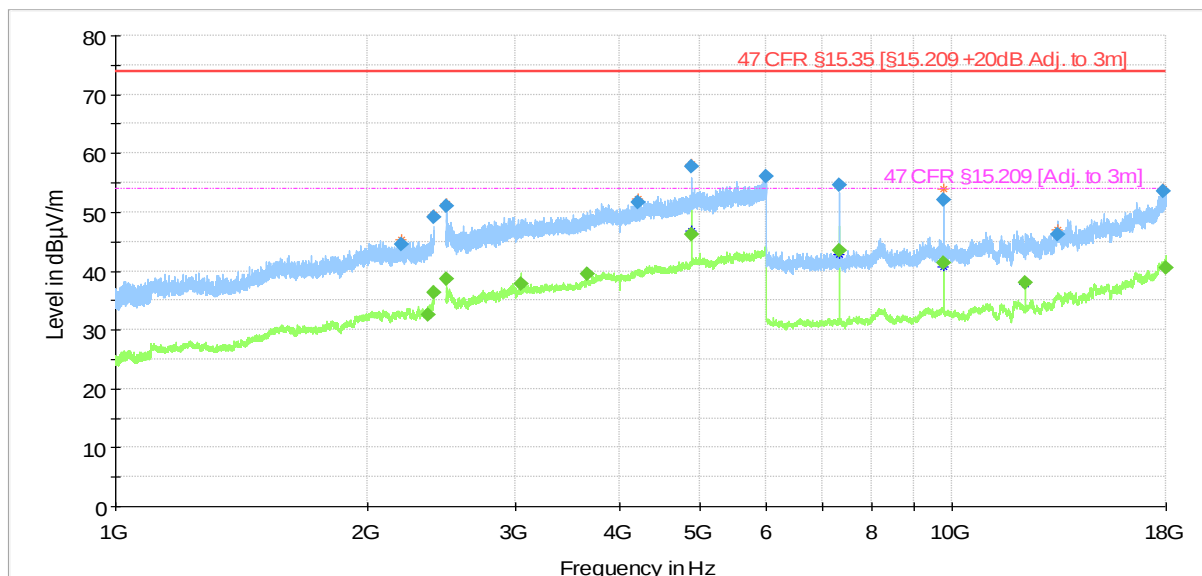
Mid Channel

Test	Bluetooth classic	
Test mode condition	Mid channel: 2441 MHz – TX mode	
Test frequency	30 MHz- 1 GHz	
antenna position	Vertical and Horizontal	
Standard	FCC Part 15 Subpart C	
EUT	A000252971-005	
Ancillary Equipment	Ancillary devices inside the chamber: - A000252971-016 USB C adaptor - A000252971-015 USB cable Ancillary devices outside the chamber: - A000252971-013 Control computer	
EUT Configuration	Back on table	
Test Engineer	Sam Ebadeh	Date: 2020-01-24
Environmental conditions	Temperature: 22,0 °C	Humidity: 34,4%
Chamber details	Chamber: SAC 5	Measurement distance: 3 meter



Frequency (MHz)	QuasiPeak (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Meas. Time	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)
32.362760	16.18	40.00	23.82	1000.0	120.000	410.0	H	40.0
155.994720	17.38	43.52	26.14	1000.0	120.000	375.0	H	190.0
192.008360	17.95	43.52	25.57	1000.0	120.000	170.0	H	338.0
216.002520	19.81	46.02	26.21	1000.0	120.000	225.0	H	310.0
239.992760	19.97	46.02	26.05	1000.0	120.000	175.0	H	157.0
698.003480	21.84	46.02	24.18	1000.0	120.000	280.0	V	220.0

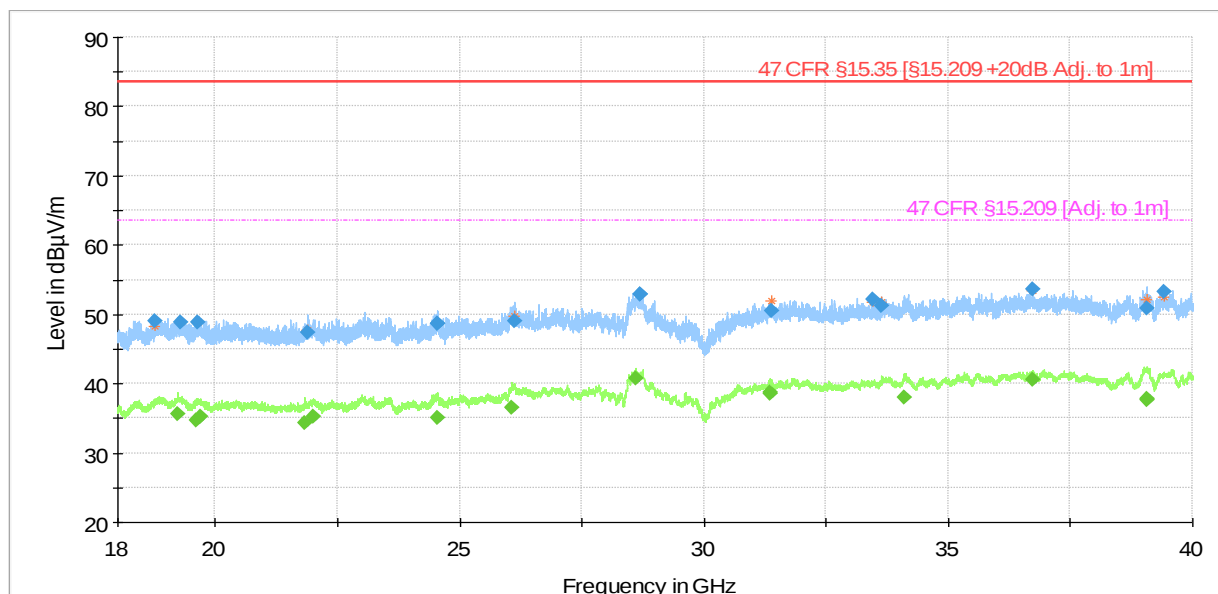
Test	Bluetooth classic	
Test mode condition	Mid channel: 2441 MHz – TX mode	
Test frequency	1 GHz- 18 GHz	
antenna position	Vertical and Horizontal	
Standard	FCC Part 15 Subpart C	
EUT	A000252971-005	
Ancillary Equipment	Ancillary devices inside the chamber: - A000252971-016 USB C adaptor - A000252971-015 USB cable Ancillary devices outside the chamber: - A000252971-013 Control computer	
EUT Configuration	Back on table	
Test Engineer	Sam Ebadeh	Date: 2020-01-13
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	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)
2483.5652	---	38.62	53.98	15.36	1000	1000	137	V	-23
3661.263	---	39.51	53.98	14.47	1000	1000	175	H	182
4881.875	---	46.24	53.98	7.74	1000	1000	128	H	84
7322.852	---	43.47	53.98	10.51	1000	1000	101	V	130
9764.453	---	41.35	53.98	12.63	1000	1000	125	H	128
17992.889	---	40.58	53.98	13.4	1000	1000	159	H	183

Test	Bluetooth classic	
Test mode condition	Mid channel: 2441 MHz – TX mode	
Test frequency	18 GHz- 40 GHz	
antenna position	Vertical and Horizontal	
Standard	FCC Part 15 Subpart C	
EUT	A000252971-005	
Ancillary Equipment	Ancillary devices inside the chamber: - A000252971-016 USB C adaptor - A000252971-015 USB cable Ancillary devices outside the chamber: - A000252971-013 Control computer	
EUT Configuration	Back on table	
Test Engineer	Sam Ebadeh	Date: 2020-01-26
Environmental conditions	Temperature: 21,1 °C	Humidity: 36,0%
Chamber details	Chamber: SAC 5	Measurement distance: 3 meter

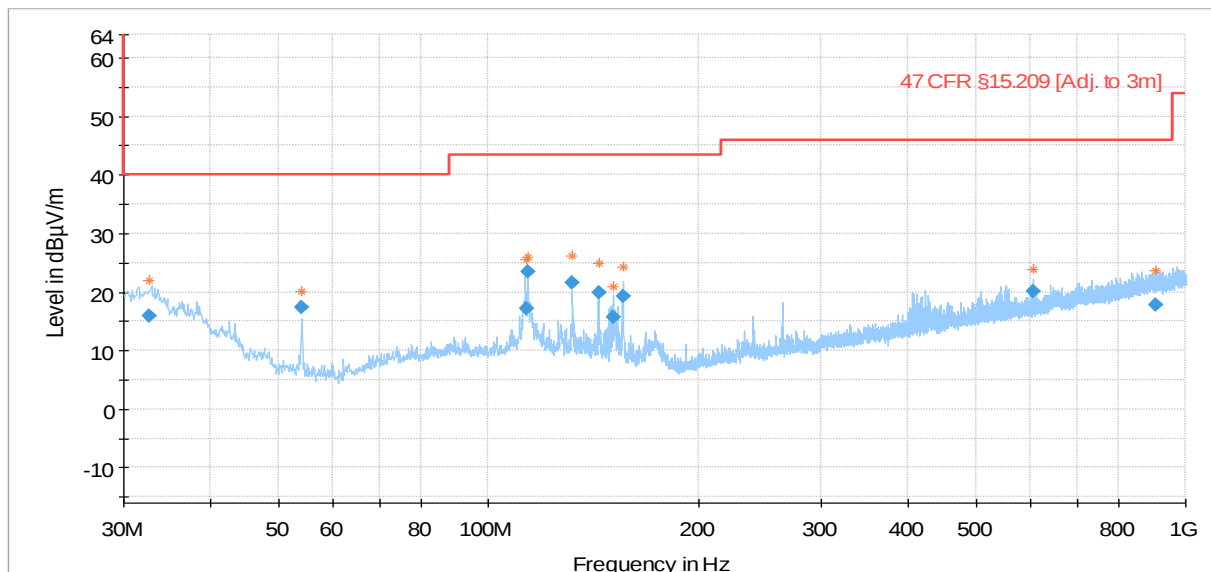


PreviewResult 2-AVG	PreviewResult 1-PK+
* Critical_Freqs AVG	* Critical_Freqs PK+
47 CFR §15.35 [§15.209 +20dB Adj. to 1m]	47 CFR §15.209 [Adj. to 1m]
◆ Final_Result PK+	◆ Final_Result AVG

Frequency (MHz)	MaxPeak (dBμV/m)	Average (dBμV/m)	Limit (dBμV/m)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)
28605.386	---	40.79	63.52	22.73	1000	1000	155	V	-5
31346.543	---	38.59	63.52	24.94	1000	1000	155	H	247
31357.886	---	38.73	63.52	24.79	1000	1000	155	H	190
34096.083	---	38.08	63.52	25.44	1000	1000	155	H	-8
36718.781	---	40.49	63.52	23.03	1000	1000	155	V	7
39056.965	---	37.87	63.52	25.65	1000	1000	155	H	217

High Channel

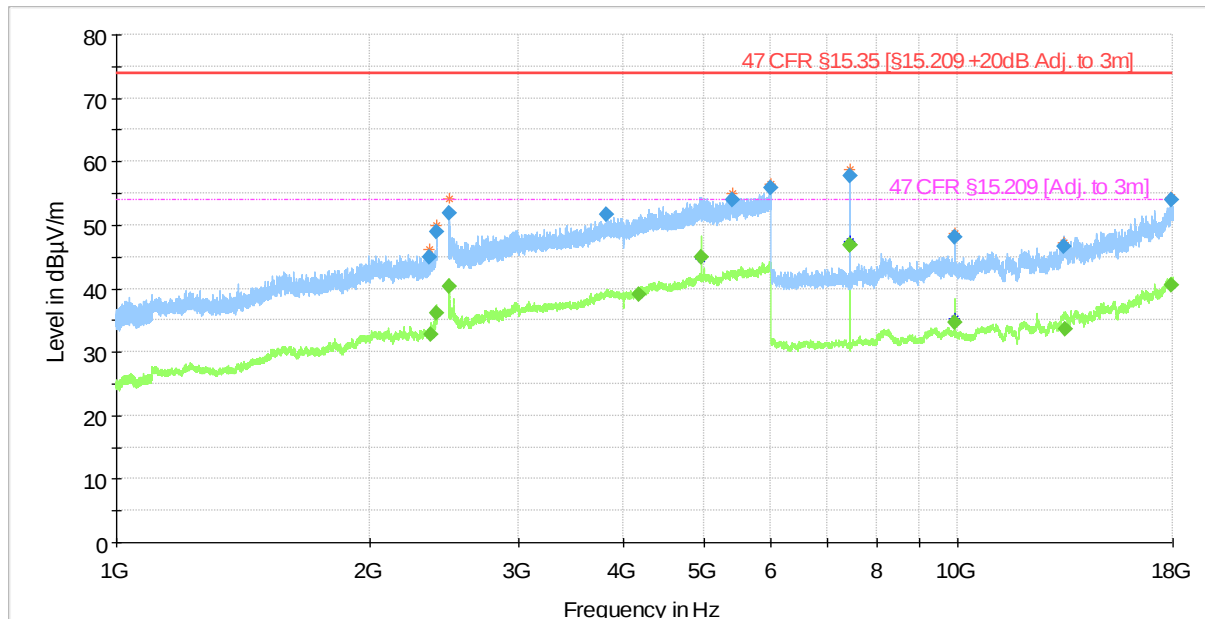
Test	Bluetooth classic	
Test mode condition	High channel: 2480 MHz – TX mode	
Test frequency	30 MHz- 1 GHz	
antenna position	Vertical and Horizontal	
Standard	FCC Part 15 Subpart C	
EUT	A000252971-005	
Ancillary Equipment	Ancillary devices inside the chamber: - A000252971-016 USB C adaptor - A000252971-015 USB cable Ancillary devices outside the chamber: - A000252971-013 Control computer	
EUT Configuration	Back on table	
Test Engineer	Fariborz Abasi	Date: 2020-01-18
Environmental conditions	Temperature: 20,0 °C	Humidity: 33,7%
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		

Frequency (MHz)	QuasiPeak (dBμV/m)	Limit (dBμV/m)	Margin (dB)	Meas. Time	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)
32.701080	15.92	40.00	24.08	1000.0	120.000	248.0	H	84.0
54.002080	17.46	40.00	22.54	1000.0	120.000	100.0	V	265.0
114.015800	23.40	43.52	20.12	1000.0	120.000	298.0	H	160.0
132.005600	21.52	43.52	22.00	1000.0	120.000	125.0	V	296.0
144.010480	19.97	43.52	23.56	1000.0	120.000	104.0	V	-23.0
156.031200	19.38	43.52	24.14	1000.0	120.000	125.0	V	206.0

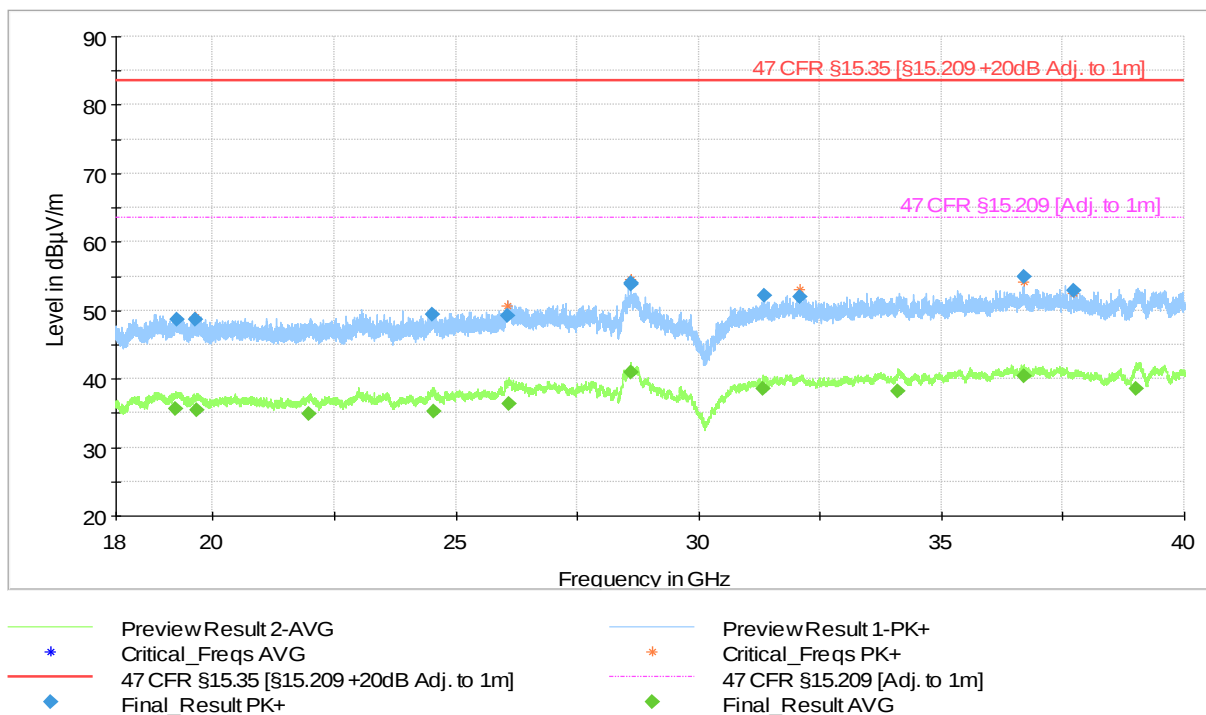
Test	Bluetooth classic	
Test mode condition	High channel: 2480 MHz – TX mode	
Test frequency	1 GHz- 18 GHz	
antenna position	Vertical and Horizontal	
Standard	FCC Part 15 Subpart C	
EUT	A000252971-004	
Ancillary Equipment	Ancillary devices inside the chamber: - A000252971-012 USB C adaptor - A000252971-015 USB cable Ancillary devices outside the chamber: - A000252971-013 Control computer	
EUT Configuration	Back on table	
Test Engineer	Fariborz Abasi	Date: 2020-01-13
Environmental conditions	Temperature: 22,6 °C	Humidity: 33,5%
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	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)
2483.691374	---	40.29	53.98	13.69	1000.0	1000.000	175.0	H	220.0
4185.455000	---	38.96	53.98	15.02	1000.0	1000.000	210.0	V	333.0
4960.014000	---	44.83	53.98	9.15	1000.0	1000.000	125.0	H	292.0
7439.876000	---	46.90	53.98	7.08	1000.0	1000.000	120.0	H	-8.0
7440.220000	---	46.72	53.98	7.26	1000.0	1000.000	120.0	H	-8.0
17958.498000	---	40.50	53.98	13.48	1000.0	1000.000	125.0	H	157.0

Test	Bluetooth classic	
Test mode condition	High channel: 2480 MHz – TX mode	
Test frequency	18 GHz- 40 GHz	
antenna position	Vertical and Horizontal	
Standard	FCC Part 15 Subpart C	
EUT	A000252971-005	
Ancillary Equipment	Ancillary devices inside the chamber: - A000252971-012 USB C adaptor - A000252971-015 USB cable Ancillary devices outside the chamber: - A000252971-013 Control computer	
EUT Configuration	Back on table	
Test Engineer	Sam Ebadeh	Date: 2020-01-26
Environmental conditions	Temperature: 21,1 °C	Humidity: 36,0%
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)
19236.266	---	35.53	63.52	27.99	1000	1000	155	H	37
26082.05	---	36.39	63.52	27.14	1000	1000	155	V	262
28601.555	---	40.9	63.52	22.62	1000	1000	155	H	40
31316.384	---	38.57	63.52	24.95	1000	1000	155	V	4
34093.516	---	38.11	63.52	25.42	1000	1000	155	V	52
36704.648	---	40.47	63.52	23.06	1000	1000	155	V	113

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		2020.02.11		
EUT and Ancillary Equipment IDs	A000252971-006		A000252971-012 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)	BT Low Channel (2402 MHz) DH5 (GFSK)	7.15	-45.15	-12.84	PASS
Spurious Emissions (30 MHz – 25 GHz)	BT - Hopping DH5 (GFSK)	7.10	-43.22	-12.90	PASS
Spurious Emissions (30 MHz – 25 GHz)	BT Low Channel (2402 MHz) 2-DH5 ($\pi/4$ -DQPSK)	6.69	-45.52	-13.31	PASS
Spurious Emissions (30 MHz – 25 GHz)	BT - Hopping 2-DH5 ($\pi/4$ -DQPSK)	6.05	-45.88	-13.95	PASS
Spurious Emissions (30 MHz – 25 GHz)	BT Low Channel (2402 MHz) 3-DH5 (8-DPSK)	6.68	-46.92	-13.32	PASS
Spurious Emissions (30 MHz – 25 GHz)	BT - Hopping 3-DH5 (8-DPSK)	6.55	-46.67	-13.45	PASS
Spurious Emissions (30 MHz – 25 GHz)	BT High Channel (2480 MHz) DH5 (GFSK)	7.30	-45.60	-12.70	PASS
Spurious Emissions (30 MHz – 25 GHz)	BT - Hopping DH5 (GFSK)	6.98	-44.37	-13.02	PASS
Spurious Emissions (30 MHz – 25 GHz)	BT High Channel (2480 MHz) 2-DH5 ($\pi/4$ -DQPSK)	6.72	-45.07	-13.28	PASS
Spurious Emissions (30 MHz – 25 GHz)	BT - Hopping 2-DH5 ($\pi/4$ -DQPSK)	5.97	-45.42	-14.03	PASS
Spurious Emissions (30 MHz – 25 GHz)	BT High Channel (2480 MHz) 3-DH5 (8-DPSK)	6.96	-46.20	-13.04	PASS
Spurious Emissions (30 MHz – 25 GHz)	BT - Hopping 3-DH5 (8-DPSK)	6.16	-45.00	-13.84	PASS

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



11.Feb 20 18:45

Ref 22.9 dBm

*Att 10 dB

*RBW 100 kHz

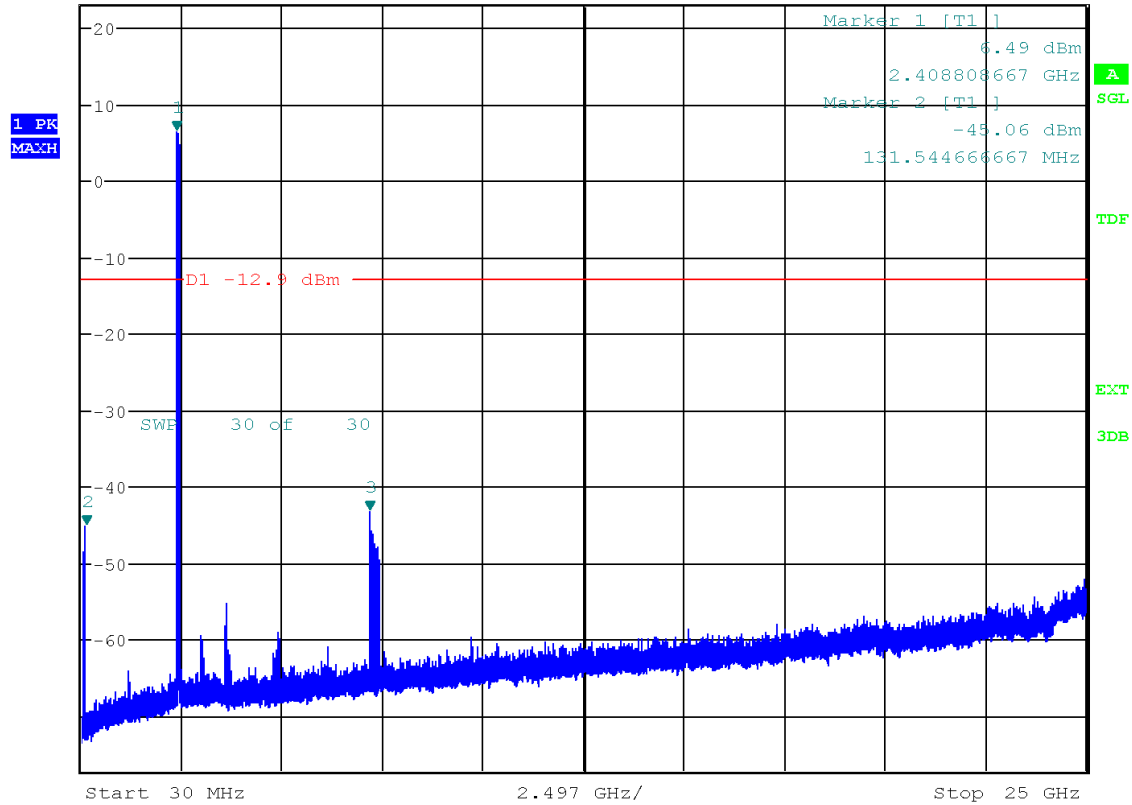
*VBW 300 kHz

SWT 2.5 s

Marker 3 [T1]

-43.22 dBm

7.212204333 GHz



Date: 11.FEB.2020 18:45:13

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		2020.02.11	
EUT and Ancillary Equipment IDs	A000252971-006		A000252971-012 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)	BT - Hopping DH5 (GFSK)	-54.29	-13.57	PASS
Emissions at Band Edge (Auth. Band – Low Edge)	BT Low Channel (2402 MHz) DH5 (GFSK)	-49.77	-13.25	PASS
Emissions at Band Edge (Auth. Band – Low Edge)	BT - Hopping 2-DH5 ($\pi/4$ -DQPSK)	-49.23	-13.72	PASS
Emissions at Band Edge (Auth. Band – Low Edge)	BT Low Channel (2402 MHz) 2-DH5 ($\pi/4$ -DQPSK)	-49.11	-13.31	PASS
Emissions at Band Edge (Auth. Band – Low Edge)	BT - Hopping 3-DH5 (8-DPSK)	-49.77	-13.67	PASS
Emissions at Band Edge (Auth. Band – Low Edge)	BT Low Channel (2402 MHz) 3-DH5 (8-DPSK)	-44.29	-13.42	PASS
Emissions at Band Edge (Auth. Band – High Edge)	BT - Hopping DH5 (GFSK)	-58.76	-12.72	PASS
Emissions at Band Edge (Auth. Band – High Edge)	BT High Channel (2480 MHz) DH5 (GFSK)	-48.64	-13.09	PASS
Emissions at Band Edge (Auth. Band – High Edge)	BT - Hopping 2-DH5 ($\pi/4$ -DQPSK)	-57.17	-13.80	PASS
Emissions at Band Edge (Auth. Band – High Edge)	BT High Channel (2480 MHz) 2-DH5 ($\pi/4$ -DQPSK)	-49.67	-13.24	PASS
Emissions at Band Edge (Auth. Band – High Edge)	BT - Hopping 3-DH5 (8-DPSK)	-58.18	-13.19	PASS
Emissions at Band Edge (Auth. Band – High Edge)	BT High Channel (2480 MHz) 3-DH5 (8-DPSK)	-52.58	-14.55	PASS

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



11.Feb 20 18:27

Ref 14.9 dBm

*Att 10 dB

*RBW 100 kHz

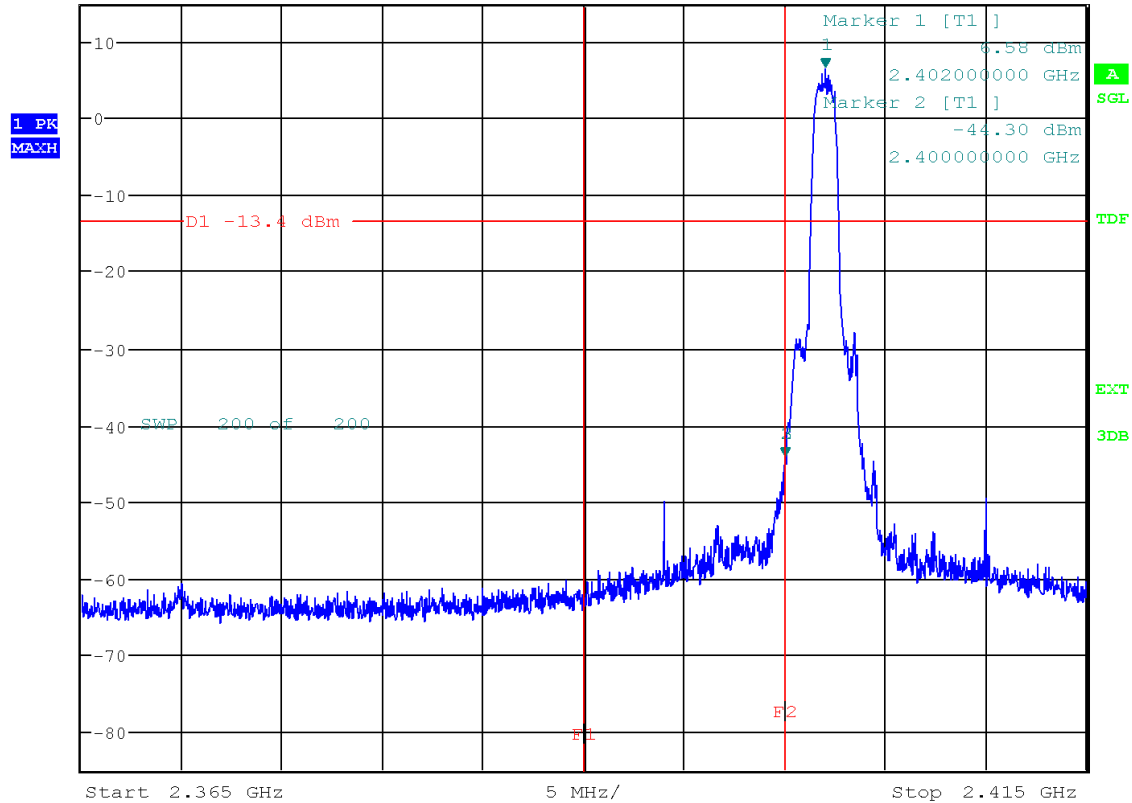
*VBW 300 kHz

SWT 20 ms

Marker 3 [T1]

-44.29 dBm

2.399980000 GHz



Date: 11.FEB.2020 18:27:17

4.7 Test Results – Band Edge Compliance (Restricted Band)

4.7.1 Band Edge Compliance (Restricted Band) – Test Summary

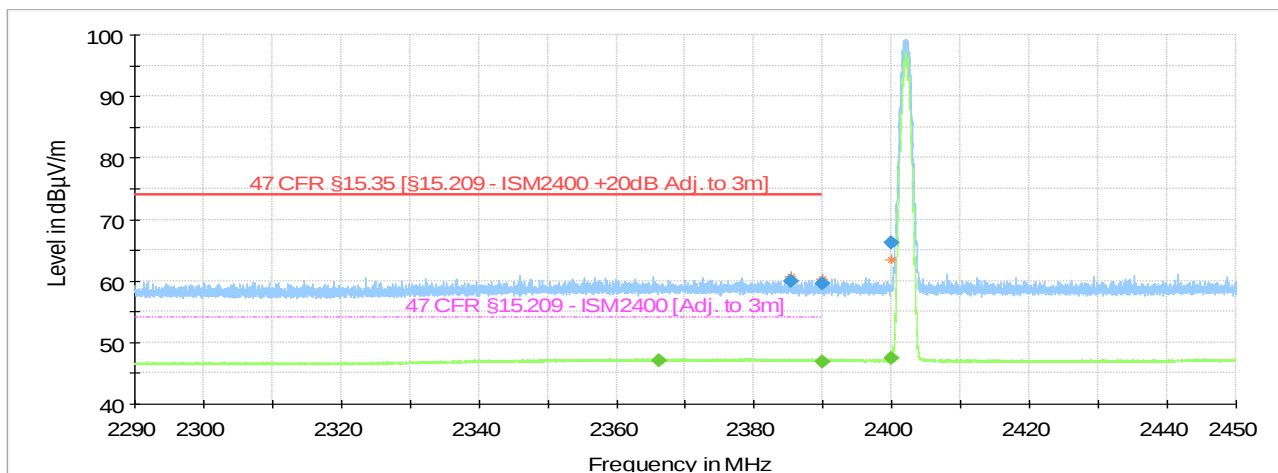
Test Specification	47 CFR 15.209 & 15.247 (d)	
Test Engineer & Date	Simon Palmhager Joel Efraimsson Niall Forrester	2020.1.17 – 2020.03.10
EUT and Ancillary Equipment IDs	A000252971-005	A000252971-016 A000252971-015 A000252971-013
EUT Operation Mode(s)	#1	
EUT Wireless Configuration(s)	See below	
EUT Hardware Configuration(s)	-	
Overall Result	PASS	
Test Parameter	Wireless Configuration	Result*
Emissions at Band Edge (Rest. Band – Low Edge)	BT Low Channel (2402 MHz) DH5 (GFSK)	PASS
Emissions at Band Edge (Rest. Band – Low Edge)	BT Low Channel (2402 MHz) 2-DH5 ($\pi/4$ -DQPSK)	PASS
Emissions at Band Edge (Rest. Band – Low Edge)	BT Low Channel (2402 MHz) 3-DH5 (8-DPSK)	PASS
Emissions at Band Edge (Rest. Band – High Edge)	BT High Channel (2480 MHz) DH5 (GFSK)	PASS
Emissions at Band Edge (Rest. Band – High Edge)	BT High Channel (2480 MHz) 2-DH5 ($\pi/4$ -DQPSK)	PASS
Emissions at Band Edge (Rest. Band – High Edge)	BT High Channel (2480 MHz) 3-DH5 (8-DPSK)	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 – DH5 (GFSK)

Test	Bluetooth classic	
Test mode condition	Band EDGE Low channel: 2402 MHz – 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: - A000252971-016 USB C adaptor - A000252971-015 USB cable Ancillary devices outside the chamber: - A000252971-013 Control computer	
EUT Configuration	Back on table	
Test Engineer	Simon Palmhager	Date: 2020-01-17
Environmental conditions	Temperature: 22,9 °C	Humidity: 33,4%
Chamber details	Chamber: SAC 5	Measurement distance: 3 meter

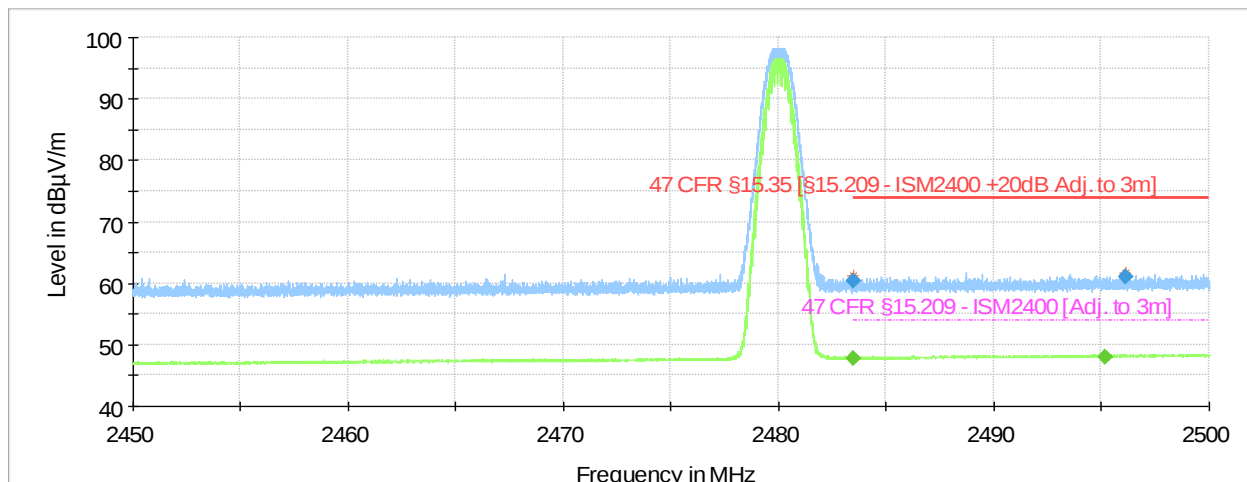


- Preview Result 2-AVG
- Preview Result 1-PK+
- Critical_Freqs AVG
- Critical_Freqs PK+
- 47 CFR §15.35 [§15.209 - ISM2400 +20dB Adj. to 3m]
- 47 CFR §15.209 - ISM2400 [Adj. to 3m]
- Final_Result PK+
- Final_Result AVG

Frequency (MHz)	MaxPeak (dBµV/m)	Average (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Meas. Time	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)
2366.096000	---	46.97	53.98	7.01	1000.0	1000.000	204.0	H	189.0
2385.328000	59.97	---	73.98	14.01	1000.0	1000.000	100.0	V	0.0
2390.000000	59.59	---	73.98	14.39	1000.0	1000.000	210.0	H	0.0
2390.000000	---	46.87	53.98	7.11	1000.0	1000.000	194.0	V	178.0
2400.000000	66.16	---	---	---	1000.0	1000.000	146.0	H	221.0
2400.000000	---	47.36	---	---	1000.0	1000.000	169.0	H	201.0

Restricted Band – High Edge – DH5 (GFSK)

Test	Bluetooth classic	
Test mode condition	Band EDGE High channel: 2480 MHz – TX mode	
Test frequency	2377,6 MHz- 2557,4 MHz	
antenna position	Vertical and Horizontal	
Standard	FCC Part 15 Subpart C	
EUT	A000252971-005	
Ancillary Equipment	Ancillary devices inside the chamber: - A000252971-016 USB C adaptor - A000252971-015 USB cable Ancillary devices outside the chamber: - A000252971-013 Control computer	
EUT Configuration	Back on table	
Test Engineer	Sam Ebadeh	Date: 2020-01-17
Environmental conditions	Temperature: 22,9 °C	Humidity: 33,4 %
Chamber details	Chamber: SAC 5	Measurement distance: 3 meter

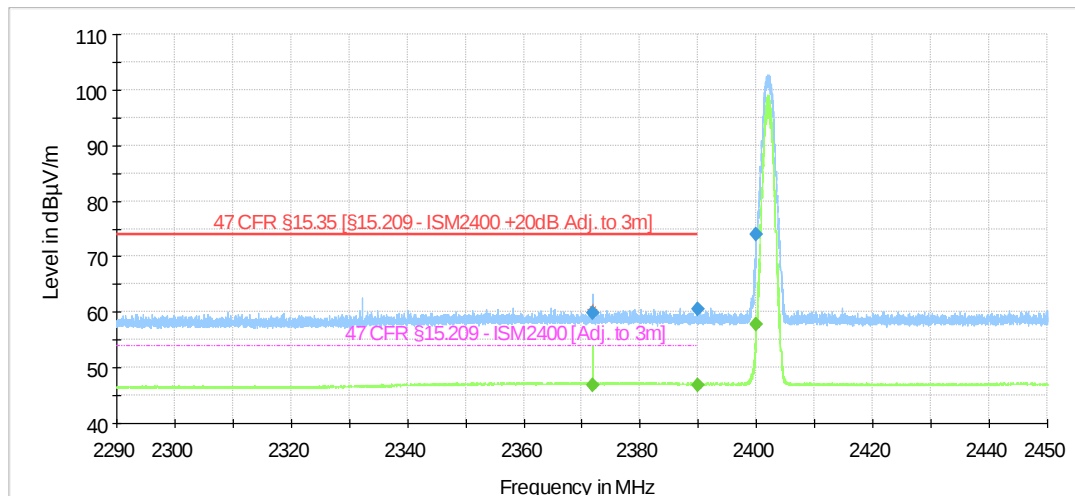


- PreviewResult 2-AVG
- PreviewResult 1-PK+
- Critical_Freqs AVG
- Critical_Freqs PK+
- 47 CFR §15.35 [§15.209 - ISM2400 +20dB Adj. to 3m]
- 47 CFR §15.209 - ISM2400 [Adj. to 3m]
- Final_Result PK+
- Final_Result AVG
- MaxPeak-PK+ (Single)
- Average-AVG (Single)

Frequency (MHz)	MaxPeak (dBµV/m)	Average (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)
2483.500000	---	47.74	53.98	6.24	1000.0	1000.000	205.0	H	200.0
2483.500000	60.38	---	73.98	13.60	1000.0	1000.000	158.0	V	0.0
2495.150000	---	47.97	53.98	6.01	1000.0	1000.000	134.0	H	189.0
2496.140000	61.10	---	73.98	12.88	1000.0	1000.000	146.0	H	0.0

Restricted Band – Low Edge – 2-DH5 ($\pi/4$ -DQPSK)

Test	Bluetooth classic	
Test mode condition	Band EDGE Low channel: 2402 MHz – TX mode	
Test frequency	2290 MHz- 2450 MHz	
antenna position	Vertical and Horizontal	
Standard	FCC Part 15 Subpart C	
EUT	A000252971-005	
Ancillary Equipment	Ancillary devices inside the chamber: - A000252971-016 USB C adaptor - A000252971-015 USB cable Ancillary devices outside the chamber: - A000252971-013 Control computer	
EUT Configuration	Back on table	
Test Engineer	Joel Efraimsson	Date: 2020-03-10
Environmental conditions	Temperature: 20,4 °C	Humidity: 35,6%
Chamber details	Chamber: SAC 5	Measurement distance: 3 meter

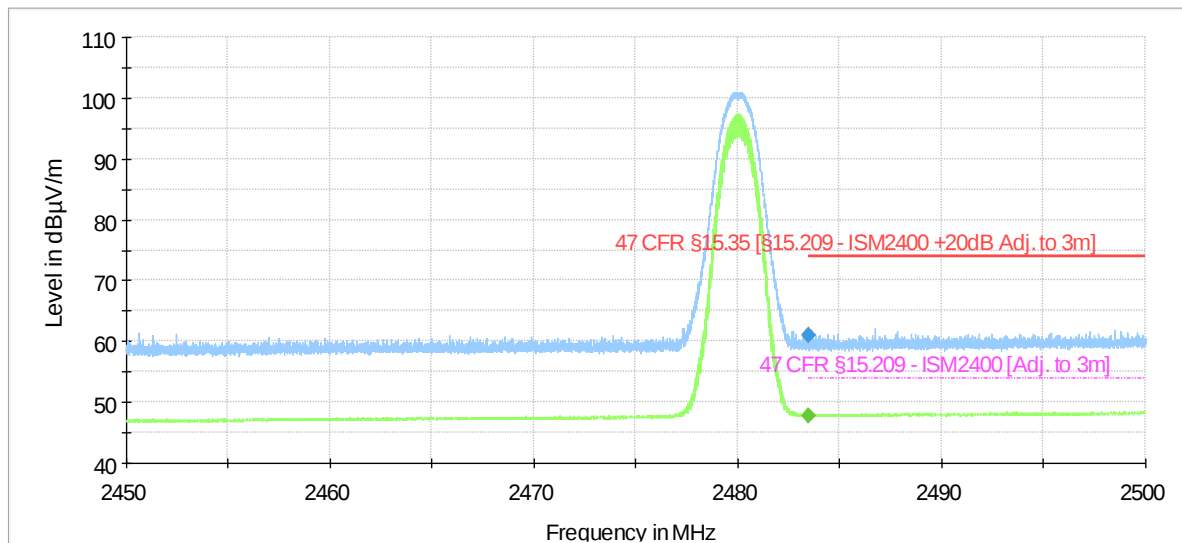


- PreviewResult 2-AVG
- PreviewResult 1-PK+
- Critical_Freqs AVG
- Critical_Freqs PK+
- 47 CFR §15.35 [§15.209 - ISM2400 +20dB Adj. to 3m]
- 47 CFR §15.209 - ISM2400 [Adj. to 3m]
- Final_Result PK+
- Final_Result AVG

Frequency (MHz)	MaxPeak (dBμV/m)	Average (dBμV/m)	Limit (dBμV/m)	Margin (dB)	Meas. Time	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)
2379.680000	---	46.96	53.98	7.02	1000.0	1000.000	100.0	H	179.0
2388.672000	60.17	---	73.98	13.81	1000.0	1000.000	100.0	V	0.0
2390.000000	---	46.85	53.98	7.13	1000.0	1000.000	100.0	H	177.0
2390.000000	60.64	---	73.98	13.34	1000.0	1000.000	134.0	H	108.0
2400.000000	---	53.59	---	---	1000.0	1000.000	100.0	H	187.0
2400.000000	70.92	---	---	---	1000.0	1000.000	100.0	H	180.0

Restricted Band – High Edge – 2-DH5 ($\pi/4$ -DQPSK)

Test	Bluetooth classic	
Test mode condition	Band EDGE High channel: 2480 MHz – TX mode	
Test frequency	2450 MHz- 2500 MHz	
antenna position	Vertical and Horizontal	
Standard	FCC Part 15 Subpart C	
EUT	A000252971-005	
Ancillary Equipment	Ancillary devices inside the chamber: - A000252971-016 USB C adaptor - A000252971-015 USB cable Ancillary devices outside the chamber: - A000252971-013 Control computer	
EUT Configuration	Back on table	
Test Engineer	Sam Ebadeh	Date: 2020-03-10
Environmental conditions	Temperature: 20,4 °C	Humidity: 35,6%
Chamber details	Chamber: SAC 5	Measurement distance: 3 meter

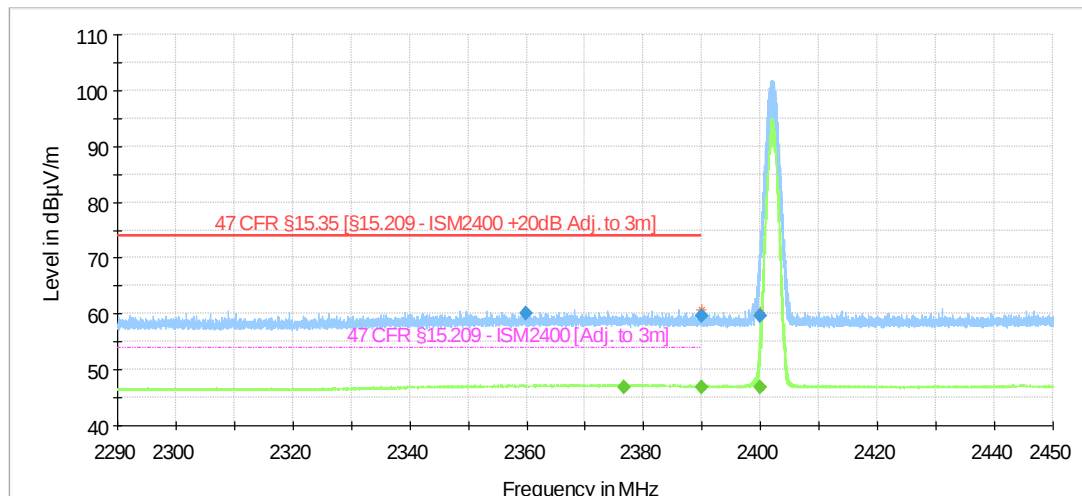


- PreviewResult 2-AVG
- PreviewResult 1-PK+
- Critical_Freqs AVG
- Critical_Freqs PK+
- 47 CFR §15.35 [§15.209 - ISM2400 +20dB Adj. to 3m]
- 47 CFR §15.209 - ISM2400 [Adj. to 3m]
- Final_Result PK+
- Final_Result AVG

Frequency (MHz)	MaxPeak (dBμV/m)	Average (dBμV/m)	Limit (dBμV/m)	Margin (dB)	Meas. Time	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)
2483.500000	---	47.73	53.98	6.25	1000.0	1000.000	102.0	H	213.0
2483.500000	61.03	---	73.98	12.95	1000.0	1000.000	181.0	V	0.0

Restricted Band – Low Edge – 3-DH5 (8-DPSK)

Test	Bluetooth classic	
Test mode condition	Band EDGE Low channel: 2402 MHz – TX mode	
Test frequency	2290 MHz- 2450 MHz	
antenna position	Vertical and Horizontal	
Standard	FCC Part 15 Subpart C	
EUT	A000252971-005	
Ancillary Equipment	Ancillary devices inside the chamber: - A000252971-016 USB C adaptor - A000252971-015 USB cable Ancillary devices outside the chamber: - A000252971-013 Control computer	
EUT Configuration	Back on table	
Test Engineer	Niall Forrester	Date: 2020-03-09
Environmental conditions	Temperature: 20,5 °C	Humidity: 31,6%
Chamber details	Chamber: SAC 5	Measurement distance: 3 meter

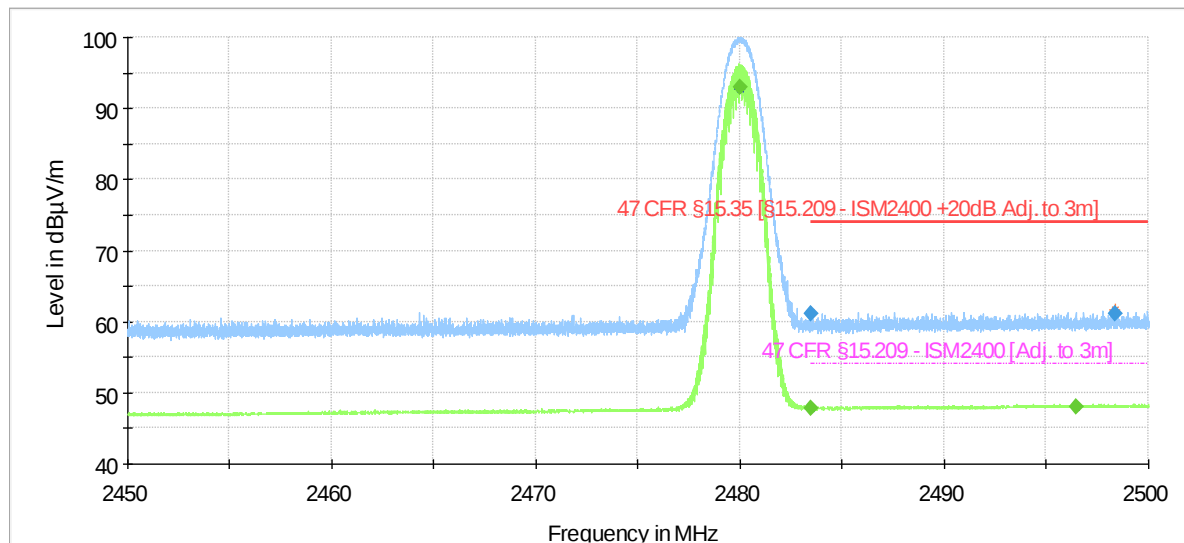


- PreviewResult 2-AVG
- PreviewResult 1-PK+
- Critical_Freqs AVG
- Critical_Freqs PK+
- 47 CFR §15.35 [§15.209 - ISM2400 +20dB Adj. to 3m]
- 47 CFR §15.209 - ISM2400 [Adj. to 3m]
- Final_Result PK+
- Final_Result AVG

Frequency (MHz)	MaxPeak (dBuV/m)	Average (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Meas. Time	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)
2359.920000	60.03	---	73.98	13.95	1000.0	1000.000	146.0	V	0.0
2376.688000	---	46.92	53.98	7.06	1000.0	1000.000	204.0	V	15.0
2390.000000	---	46.80	53.98	7.18	1000.0	1000.000	146.0	H	3.0
2390.000000	59.70	---	73.98	14.28	1000.0	1000.000	170.0	V	120.0
2400.000000	---	46.81	---	---	1000.0	1000.000	210.0	H	338.0
2400.000000	59.59	---	---	---	1000.0	1000.000	111.0	H	0.0
2359.920000	60.03	---	73.98	13.95	1000.0	1000.000	146.0	V	0.0

Restricted Band – High Edge – 3-DH5 (8-DPSK)

Test	Bluetooth classic	
Test mode condition	Band EDGE High channel: 2480 MHz – TX mode	
Test frequency	2450 MHz- 2500 MHz	
antenna position	Vertical and Horizontal	
Standard	FCC Part 15 Subpart C	
EUT	A000252971-005	
Ancillary Equipment	Ancillary devices inside the chamber: - A000252971-016 USB C adaptor - A000252971-015 USB cable Ancillary devices outside the chamber: - A000252971-013 Control computer	
EUT Configuration	Back on table	
Test Engineer	Sam Ebadeh	Date: 2020-03-09
Environmental conditions	Temperature: 18,4 °C	Humidity: 36,8 %
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	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)
2479.990000	102.64	---	---	---	1000.0	1000.000	182.0	H	167.0
2480.005000	---	92.88	---	---	1000.0	1000.000	100.0	V	220.0
2483.500000	---	47.76	53.98	6.22	1000.0	1000.000	100.0	V	216.0
2483.500000	61.01	---	73.98	12.97	1000.0	1000.000	180.0	V	0.0
2496.430000	---	47.94	53.98	6.04	1000.0	1000.000	100.0	H	296.0

4.8 Test Results – 20dB Bandwidth

4.8.1 20dB Bandwidth – Test Summary

Test Specification		47 CFR 15.247 (a)(1)		
Test Engineer & Date		Niall Forrester	2020.02.11	
EUT and Ancillary Equipment IDs		A000252971-005	A000252971-012 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 (kHz)	Result
20dB Bandwidth	BT Low Channel (2402 MHz) DH5 (GFSK)	943.20	2000.00	PASS
20dB Bandwidth	BT Low Channel (2402 MHz) 2-DH5 ($\pi/4$ -DQPSK)	1346.40	2000.00	PASS
20dB Bandwidth	BT Low Channel (2402 MHz) 3-DH5 (8-DPSK)	1293.60	2000.00	PASS
20dB Bandwidth	BT Mid Channel (2441 MHz) DH5 (GFSK)	945.60	2000.00	PASS
20dB Bandwidth	BT Mid Channel (2441 MHz) 2-DH5 ($\pi/4$ -DQPSK)	1329.60	2000.00	PASS
20dB Bandwidth	BT Mid Channel (2441 MHz) 3-DH5 (8-DPSK)	1300.80	2000.00	PASS
20dB Bandwidth	BT High Channel (2480 MHz) DH5 (GFSK)	945.60	2000.00	PASS
20dB Bandwidth	BT High Channel (2480 MHz) 2-DH5 ($\pi/4$ -DQPSK)	1329.60	2000.00	PASS
20dB Bandwidth	BT High Channel (2480 MHz) 3-DH5 (8-DPSK)	1327.20	2000.00	PASS

4.8.2 20dB Bandwidth – Test Details (Worst Case Plot)



11.Feb 20 18:05

Ref 23 dBm

Att 30 dB

*RBW 30 kHz

*VBW 100 kHz

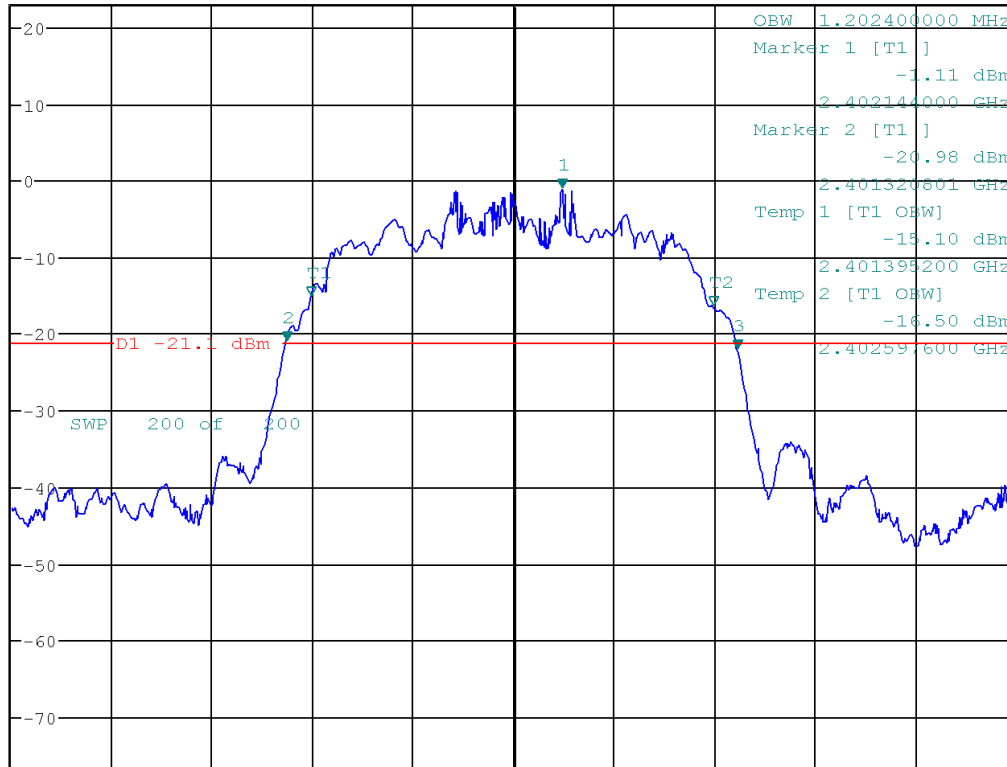
SWT 15 ms

Marker 3 [T1]

-22.00 dBm

2.402667236 GHz

1 PK
MAXH



Center 2.402 GHz

300 kHz/

Span 3 MHz

Date: 11.FEB.2020 18:05:59

4.9 Test Results – Carrier (Hopping Channel) Separation

4.9.1 Carrier (Hopping Channel) Separation – Test Summary

Test Specification		47 CFR 15.247 (a)(1)		
Test Engineer & Date		Niall Forrester	2020.02.18	
EUT and Ancillary Equipment IDs		A000252971-005	A000252971-012 A000252971-015	
EUT Operation Mode(s)		#2		
EUT Wireless Configuration(s)		See below		
EUT Hardware Configuration(s)		-		
Overall Result		PASS		

Test Parameter	Wireless Configuration	Separation (kHz)	Limit Min (kHz)	Result
Carrier Frequency Separation	BT Low Channel (2402 MHz) DH1 (GFSK)	1004.40	593.60	PASS
Carrier Frequency Separation	BT Low Channel (2402 MHz) 2-DH1 ($\pi/4$ -DQPSK)	1001.40	842.40	PASS
Carrier Frequency Separation	BT Low Channel (2402 MHz) 3-DH1 (8-DPSK)	1000.80	856.00	PASS
Carrier Frequency Separation	BT Mid Channel (2441 MHz) DH1 (GFSK)	1023.60	592.80	PASS
Carrier Frequency Separation	BT Mid Channel (2441 MHz) 2-DH1 ($\pi/4$ -DQPSK)	1004.40	857.60	PASS
Carrier Frequency Separation	BT Mid Channel (2441 MHz) 3-DH1 (8-DPSK)	992.40	860.80	PASS
Carrier Frequency Separation	BT High Channel (2480 MHz) DH1 (GFSK)	1009.80	592.00	PASS
Carrier Frequency Separation	BT High Channel (2480 MHz) 2-DH1 ($\pi/4$ -DQPSK)	1009.80	843.20	PASS
Carrier Frequency Separation	BT High Channel (2480 MHz) 3-DH1 (8-DPSK)	997.20	863.20	PASS

4.9.2 Carrier (Hopping Channel) Separation – Test Details (Worst Case Plot)



18.Feb 20 10:48

Ref 22.9 dBm

Att 45 dB

*RBW 300 kHz

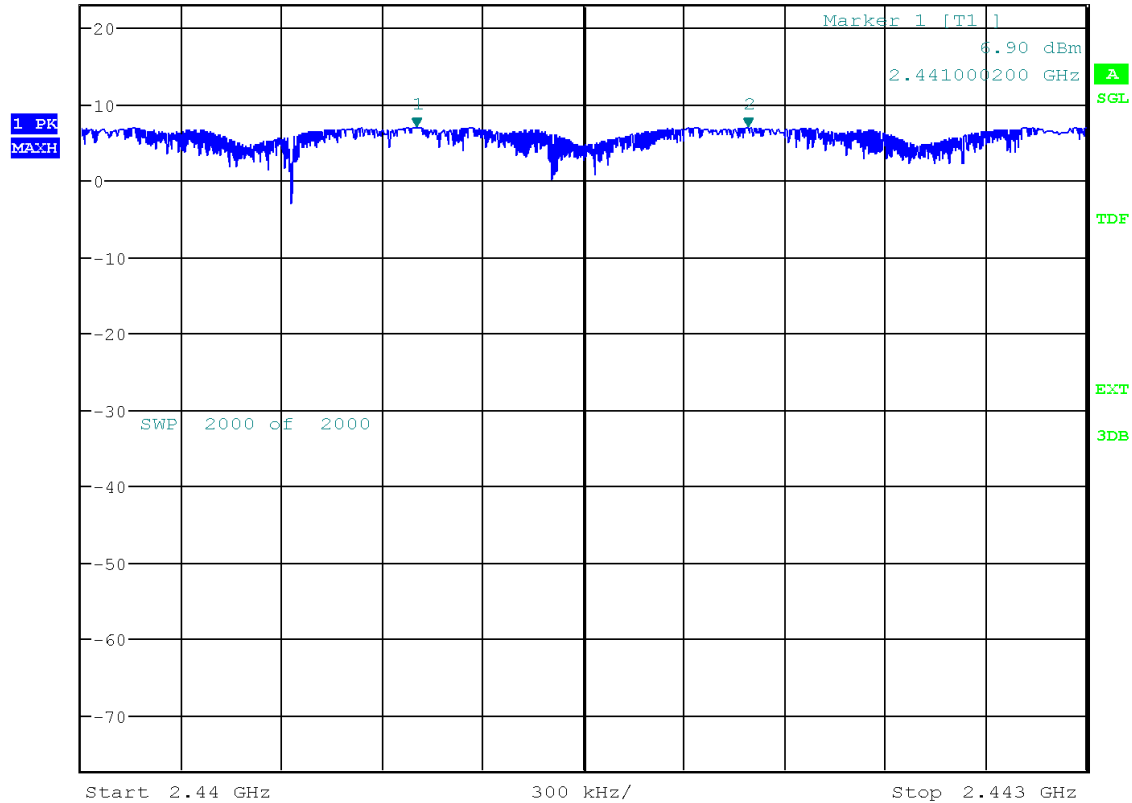
*VBW 1 MHz

SWT 25 ms

Marker 2 [T1]

6.92 dBm

2.441992600 GHz



Date: 18.FEB.2020 10:48:36

4.10 Test Results – Number of Hopping Channels

4.10.1 Number of Hopping Channels – Test Summary

Test Specification		47 CFR 15.247 (a)(1)		
Test Engineer & Date		Niall Forrester	2020.02.14	
EUT and Ancillary Equipment IDs		A000252971-005	A000252971-012 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 #Channels	Limit Min #Channels	Result
Number of Hopping Channels	BT - Hopping DH1 (GFSK)	79	15	PASS

4.10.2 Number of Hopping Channels – Test Details



14.Feb 20 18:01

Ref 23 dBm

Att 50 dB

*RBW 100 kHz

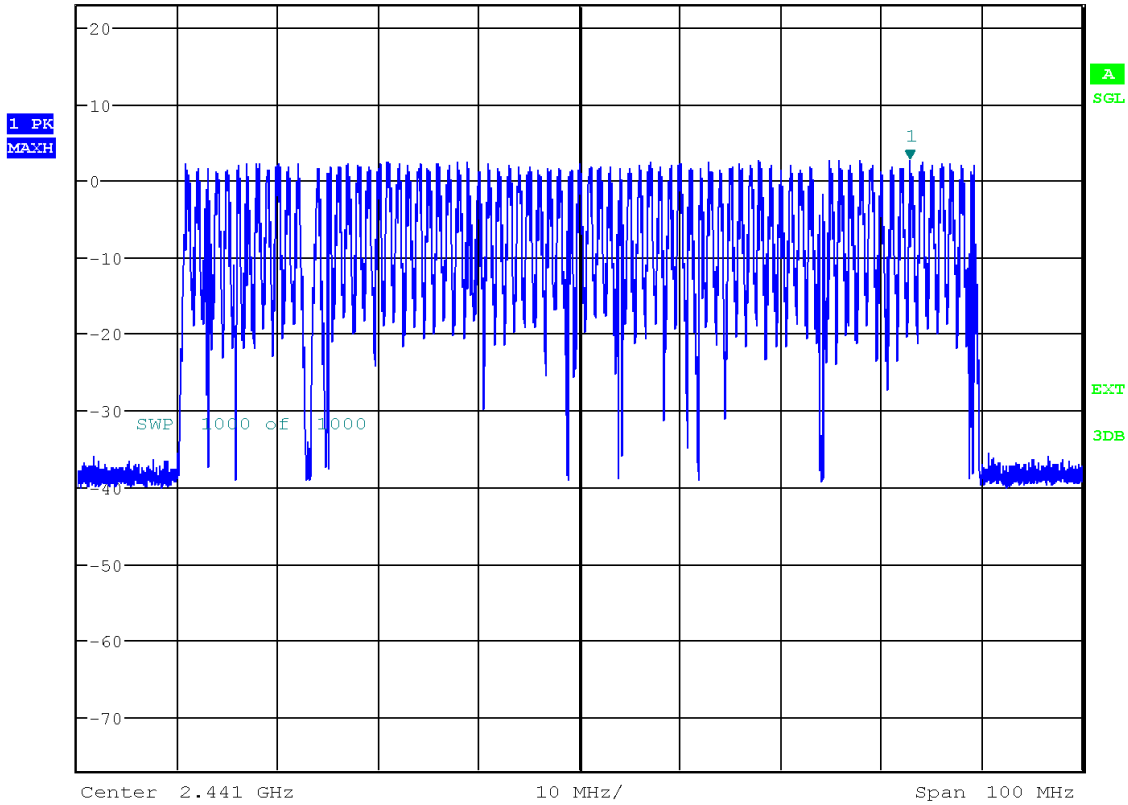
*VBW 300 kHz

SWT 45 ms

Marker 1 [T1]

2.69 dBm

2.473830000 GHz



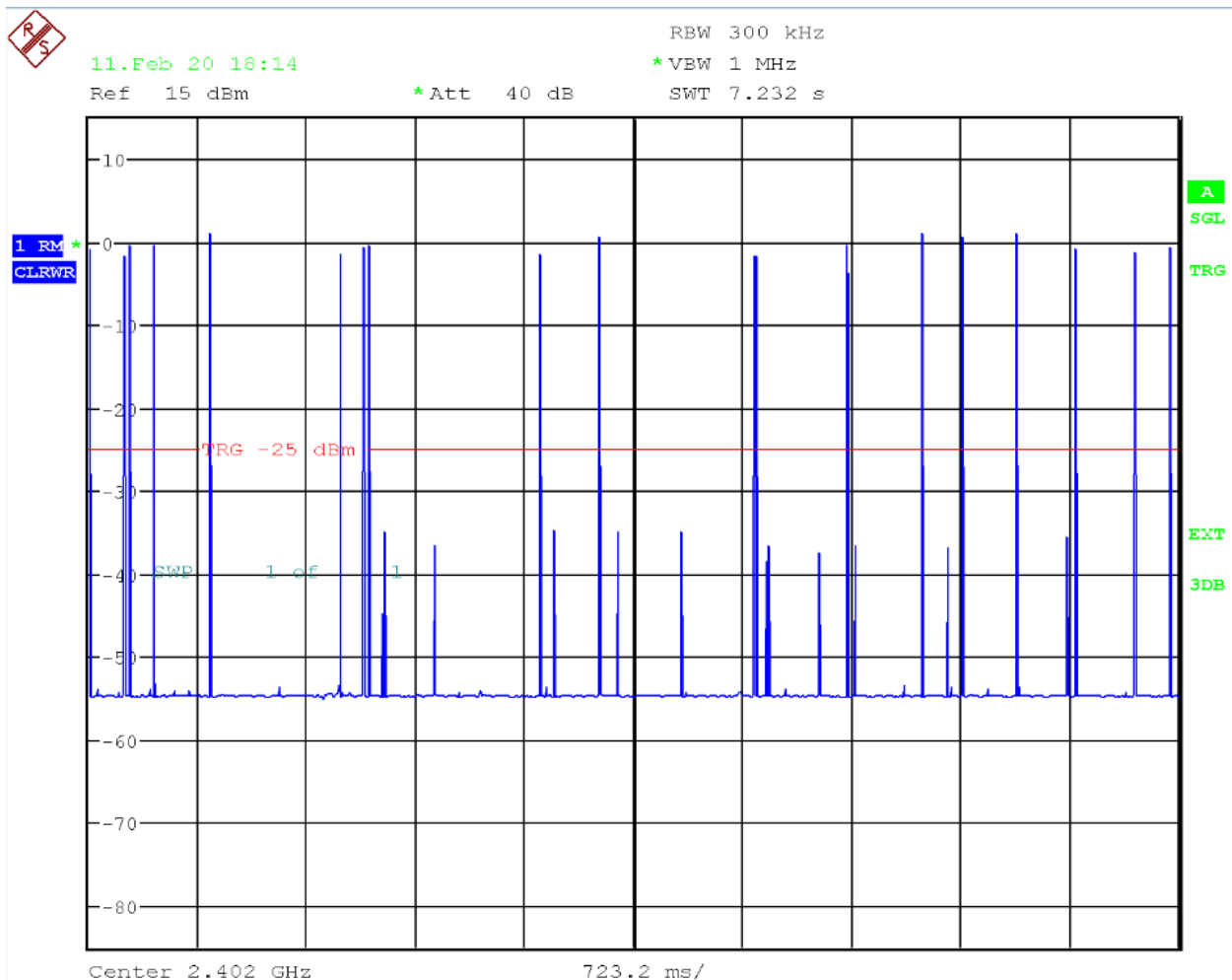
Date: 14.FEB.2020 18:01:25

4.11 Test Results – Time of Occupancy (Dwell Time)

4.11.1 Time of Occupancy (Dwell Time) – Test Summary

Test Specification		47 CFR 15.247 (a)(1)		
Test Engineer & Date		Niall Forrester		2020.02.14
EUT and Ancillary Equipment IDs		A000252971-005		A000252971-012 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 Time (ms)	Limit Max (ms)	Result
Dwell Time	BT Low Channel (2402 MHz) DH1 (GFSK)	126.349	400	PASS
Dwell Time	BT Low Channel (2402 MHz) DH5 (GFSK)	252.699	400	PASS
Dwell Time	BT Low Channel (2402 MHz) 2-DH1 ($\pi/4$ -DQPSK)	138.984	400	PASS
Dwell Time	BT Low Channel (2402 MHz) 2-DH5 ($\pi/4$ -DQPSK)	214.794	400	PASS
Dwell Time	BT Low Channel (2402 MHz) 3-DH1 (8-DPSK)	138.984	400	PASS
Dwell Time	BT Low Channel (2402 MHz) 3-DH5 (8-DPSK)	176.889	400	PASS
Dwell Time	BT High Channel (2480 MHz) DH1 (GFSK)	151.619	400	PASS
Dwell Time	BT High Channel (2480 MHz) DH5 (GFSK)	202.159	400	PASS
Dwell Time	BT High Channel (2480 MHz) 2-DH1 ($\pi/4$ -DQPSK)	138.984	400	PASS
Dwell Time	BT High Channel (2480 MHz) 2-DH5 ($\pi/4$ -DQPSK)	189.524	400	PASS
Dwell Time	BT High Channel (2480 MHz) 3-DH1 (8-DPSK)	138.984	400	PASS
Dwell Time	BT High Channel (2480 MHz) 3-DH5 (8-DPSK)	151.619	400	PASS

4.11.2 Time of Occupancy (Dwell Time) – Test Details (Worst Case Plots)



Date: 11.FEB.2020 18:14:39



11.Feb 20 18:14

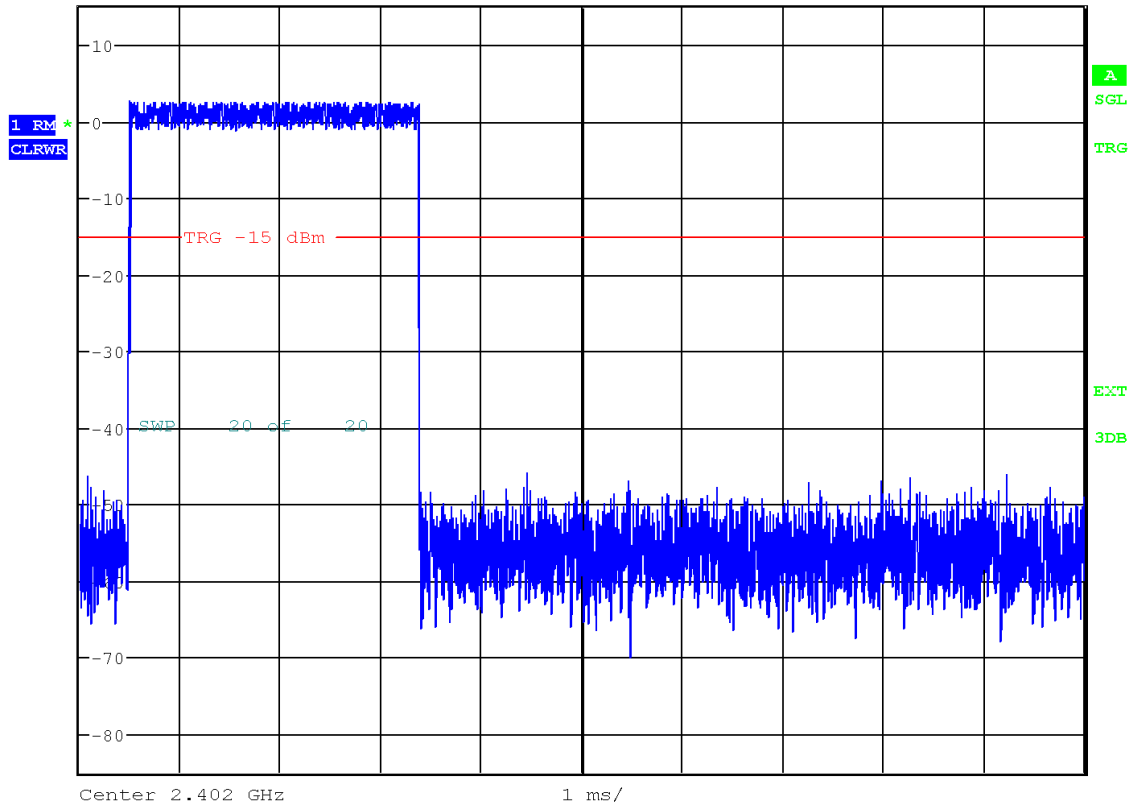
Ref 15 dBm

*Att 40 dB

RBW 300 kHz

*VBW 1 MHz

SWT 10 ms



Date: 11.FEB.2020 18:14:21

4.12 Test Results – 6dB Bandwidth

4.12.1 6dB Bandwidth – Test Summary

Requirement is not applicable as the device supports frequency hopping

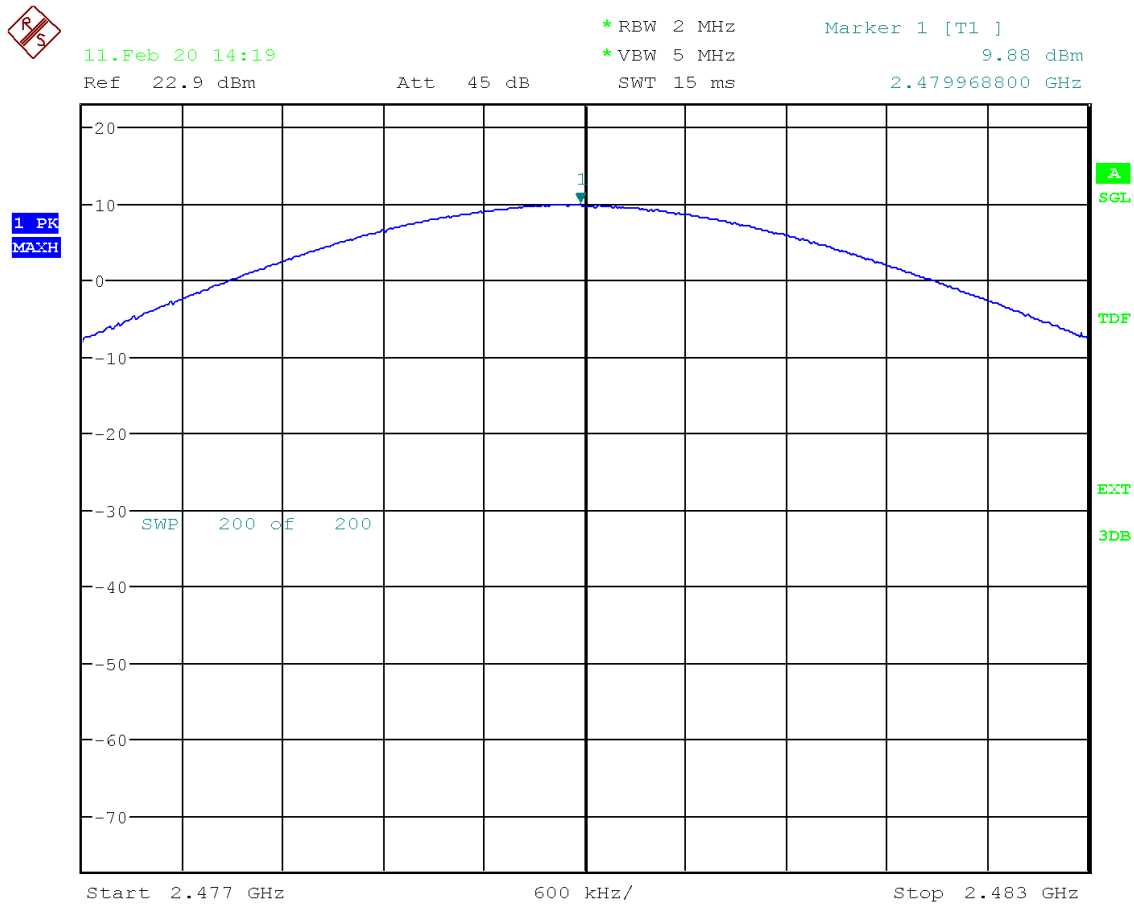
4.13 Test Results – Peak Conducted Output Power

4.13.1 Peak Conducted Output Power – Test Summary

Test Specification		47 CFR 15.247(b)				
Test Engineer & Date		Niall Forrester			2020.02.14	
EUT and Ancillary Equipment IDs		A000252971-003			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	BT Low Channel (2402 MHz) DH5 (GFSK)	7.31	7.39	7.33	30	PASS
Peak Conducted Output Power	BT Low Channel (2402 MHz) 2-DH5 ($\pi/4$ -DQPSK)	8.99	9.08	8.97	30	PASS
Peak Conducted Output Power	BT Low Channel (2402 MHz) 3-DH5 (8-DPSK)	9.55	9.67	9.55	30	PASS
Peak Conducted Output Power	BT Mid Channel (2441 MHz) DH5 (GFSK)	7.47	7.54	7.45	30	PASS
Peak Conducted Output Power	BT Mid Channel (2441 MHz) 2-DH5 ($\pi/4$ -DQPSK)	9.14	9.19	9.13	30	PASS
Peak Conducted Output Power	BT Mid Channel (2441 MHz) 3-DH5 (8-DPSK)	9.70	9.79	9.70	30	PASS
Peak Conducted Output Power	BT High Channel (2480 MHz) DH5 (GFSK)	7.57	7.62	7.53	30	PASS
Peak Conducted Output Power	BT High Channel (2480 MHz) 2-DH5 ($\pi/4$ -DQPSK)	9.22	9.30	9.24	30	PASS
Peak Conducted Output Power	BT High Channel (2480 MHz) 3-DH5 (8-DPSK)	9.78	9.88	9.84	30	PASS

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



Date: 11.FEB.2020 14:19:28

4.14 Test Results – Power Spectral Density

4.14.1 Power Spectral Density – Test Summary

Requirement is not applicable as the device supports frequency hopping

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 60342650-002 Appendix 1