

Prüfbericht-Nr.: Test report No.:	50318311 001	Auftrags-Nr.: Order No.:	168139923	Seite 1 von 26 Page 1 of 26
Kunden-Referenz-Nr.: Client reference No.:	N/A	Auftragsdatum: Order date.:	12.11.2019	
Auftraggeber: Client:	THUMBS UP(UK) LTD Unit L, Braintree Industrial Estate, Braintree Road, HA4 0EJ, Ruislip, London, United Kingdom			
Prüfgegenstand: Test item:	True Wireless Earphones			
Bezeichnung / Typ-Nr.: Identification / Type No.:	TWSEBBKV3PRM-FOB, TWSEBWHV3PRM-FOB (Trademark: Primark)			
Auftrags-Inhalt: Order content:	FCC approval			
Prüfgrundlage: Test specification:	CFR47 FCC Part 15: Subpart C Section 15.247 CFR47 FCC Part 15: Subpart C Section 15.207 CFR47 FCC Part 15: Subpart C Section 15.209 CFR47 FCC Part 15: Subpart B Section 15.107 CFR47 FCC Part 15: Subpart B Section 15.109 CFR47 FCC Part 2: Section 2.1093			
Wareneingangsdatum: Date of receipt:	13.11.2019	Please refer to photo documents		
Prüfmuster-Nr.: Test sample No.:	A001023348-012 A001023348-010			
Prüfzeitraum: Testing period:	13.11.2019 - 30.11.2019			
Ort der Prüfung: Place of testing:	TÜV Rheinland (Shenzhen) Co., Ltd.			
Prüflaboratorium: Testing laboratory:	TÜV Rheinland (Shenzhen) Co., Ltd.			
Prüfergebnis*: Test result*:	Pass			
geprüft von / tested by:		kontrolliert von / reviewed by:		
06.01.2020 Ryan Yang / Assistant Project Manager 		06.01.2020 Winnie Hou / Technical Certifier 		
Datum Date	Name/Stellung Name/Position	Unterschrift Signature	Datum Date	Name/Stellung Name/Position
Sonstiges / Other:				
FCC ID: 2AHHETWSEBV3PRM				
Zustand des Prüfgegenstandes bei Anlieferung: Condition of the test item at delivery:		Prüfmuster vollständig und unbeschädigt Test item complete and undamaged:		
* Legende: 1 = sehr gut 2 = gut 3 = befriedigend P(ass) = entspricht o.g. Prüfgrundlage(n) F(ail) = entspricht nicht o.g. Prüfgrundlage(n) Legend: 1 = very good 2 = good 3 = satisfactory P(ass) = passed a.m. test specifications(s) F(ail) = failed a.m. test specifications(s)		4 = ausreichend 5 = mangelhaft N/A = nicht anwendbar N/T = nicht getestet 4 = sufficient 5 = poor N/A = not applicable N/T = not tested		
Dieser Prüfbericht bezieht sich nur auf das o.g. Prüfmuster und darf ohne Genehmigung der Prüfstelle nicht auszugsweise vervielfältigt werden. Dieser Bericht berechtigt nicht zur Verwendung eines Prüfzeichens. <i>This test report only relates to the a. m. test sample. Without permission of the test center this test report is not permitted to be duplicated in extracts. This test report does not entitle to carry any test mark.</i>				

Test Summary

5.1.1 ANTENNA REQUIREMENT*RESULT: Pass***5.1.2 MAXIMUM PEAK CONDUCTED OUTPUT POWER***RESULT: Pass***5.1.3 99% BANDWIDTH***RESULT: Pass***5.1.4 20dB BANDWIDTH***RESULT: Pass***5.1.5 CARRIER FREQUENCY SEPARATION***RESULT: Pass***5.1.6 NUMBER OF HOPPING FREQUENCY***RESULT: Pass***5.1.7 TIME OF OCCUPANCY***RESULT: Pass***5.1.8 CONDUCTED SPURIOUS EMISSIONS MEASURED IN 100 KHz BANDWIDTH***RESULT: Pass***5.1.9 RADIATED SPURIOUS EMISSION***RESULT: Pass***5.1.10 CONDUCTED EMISSION ON AC MAINS***RESULT: Pass***5.1.11 RADIATED EMISSION***RESULT: Pass*

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1 General Remarks

1.1 Complementary Materials

All attachments are integral parts of this test report. This applies especially to the following appendix:

Appendix A: Photographs of the Test Set-up

Appendix B: Test Results of Bluetooth

Appendix C: Test Results of Part 15B

2 Test Sites

2.1 Test Facilities

TÜV Rheinland (Shenzhen) Co., Ltd.

1F East & 2-4F, Cybio Technology Building No. 1, No. 16 Kejibei 2nd Road, High-Tech Industrial Park
North Nanshan District, Shenzhen, 518057

FCC accredited testing laboratory: CN1260

ISED wireless device testing laboratory: 25069

2.2 List of Test and Measurement Instruments

Table 1: List of Test and Measurement Equipment

TÜV Rheinland (Shenzhen) Co., Ltd.

Radio Spectrum Testing (TS8997)					
Equip. No.	Equipment	Manufacturer	Model	Serial No.	Cal. until
1825795	Signal Analyzer	R&S	FSV 40	101441	20.08.2020
1825798	OSP	R&S	OSP 150	101017	20.12.2019
1825799	Control PC	DELL	OptiPlex 7050	FTJZ9P2	N/A
1825800	Test Software	R&S	WMS32 (V10.40.10)	N/A	N/A
1825801	Power Meter	R&S	NRP2	107105	20.12.2019
1825802	Wideband Power Sensor	R&S	NRP-Z81	105350	20.12.2019
1826431	Shielding Room 8#	Albatross	SR8	APC17151- SR8	23.07.2020
Unwanted Emission Testing (TS9975)					
Equip. No.	Equipment	Manufacturer	Model	Serial No.	Cal. until
1826021	EMI Test Receiver	R&S	ESR 7	102021	19.08.2020
1826023	Signal Analyzer	R&S	FSV 40	101439	21.08.2020
1826024	System Controller Interface	R&S	SCI-100	S10010038	N/A
1826025	Filterbank	R&S	Wlan	100759	21.08.2020
1826026	OSP	R&S	OSP 120	102040	N/A
1826028	Pre-amplifier	R&S	SCU08F1	08320031	20.08.2020
1826029	Amplifier	R&S	SCU-18F	180070	20.08.2020
1826030	Amplifier	R&S	SCU40A	100475	20.09.2020
1826031	Trilog Broadband Antenna (30 MHz - 7 GHz)	Schwarzbeck	VULB 9162	193	02.09.2020
1826032	Double-Ridged Antenna (1 -18 GHz)	ETS-LINDGREN	3117	00218717	02.09.2020
1826033	Wideband Ridged Horn Antenna (18-40 GHz)	Steatite	QMS-00880	19067	02.09.2020

1826034	Active Loop Antenna	Schwarzbeck	FMZB 1513	302	01.09.2020
1826035	Wideband Ridged Horn Antenna (12-18 GHz)	Steatite	QMS-00208	18313	02.09.2020
1826036	Test software	R&S	V10.40.10-EMC32	N/A	N/A
1826037	Control PC	Dell	OptiPlex 7050	36NV9P2	N/A
1826433	3m Semi-Anechoic Chamber	Albatross	SAC-3m	APC17151-SAC	06.07.2020

Conducted Emission on AC Mains

Equip. No.	Equipment	Manufacturer	Model	Serial No.	Cal. until
1822625	EMI Test Receiver	R&S	ESR3	102428	03.09.2020
1822627	Artificial Mains Network	R&S	ENV216	102333	19.08.2020
1822626	Artificial Mains Network	R&S	ENV432	101411	19.08.2020
1822629	Attenuator	R&S	ESH2Z31	100300	19.08.2020
1825090	EMC32 test software	R&S	EMC32(Ver.10.5 0.01)	N/A	N/A

Radiated Emission (3m chamber)

Equip. No.	Equipment	Manufacturer	Model No.	Serial No.	Cali. until
1822620	3m SAC	ETS	SAC3	CT001632-Q1362	23.08.2021
1825044	EMI Test Receiver	R&S	ESR7	102111	23.01.2020
1825004	Horn Antenna	R&S	HF907	102706	01.09.2020
1825005	Preamplifier	FIT	SCU-18F	180077	19.08.2020
1825042	Trilog-Broadband antenna	SCHWARZBEC K	VULB9168	0945	12.09.2020
1825072	Switching Controller Interface	R&S	OSP 120	102039	N/A
1825090	EMC32 test software	R&S	EMC32(Ver.10.5 0.01)	N/A	N/A

2.3 Traceability

All measurement equipment calibrations are traceable to NIM (National Institute of Metrology) or where calibration is performed in other countries, to equivalent nationally recognized standards organizations.

2.4 Calibration

Equipment requiring calibration is calibrated periodically by the manufacturer or according to manufacturer's specifications. Additionally all equipment is verified for proper performance on a regular basis using in house standards or comparisons.

2.5 Measurement Uncertainty

The estimated combined standard uncertainty for radiated emissions and conducted emissions measurements as below table.

Parameter	Uncertainty
Radio Frequency	$\pm 1 \times 10^{-7}$
RF Power (conducted)	± 2.5 dB
Radiated Emission of Transmitter, valid up to 26.5 GHz	± 6 dB
Radiated Emission of Receiver, valid up to 26.5 GHz	± 6 dB
Conducted Emission, (9kHz to 150kHz)/(150kHz to 30MHz)	± 3.70 dB / ± 3.30 dB
Radiated Emission (3m SAC), 30MHz to 1000MHz	± 4.52 dB
Radiated Emission (3m SAC), above 1000MHz	± 4.37 dB
Temperature	± 1 °C
Humidity	± 5 %
Voltage (DC)	± 1 %
Voltage (AC, <10kHz)	± 2 %

2.6 Location of Original Data

The original copies of all test data taken during actual testing were attached at Appendix A & B & C of this report and delivered to the applicant. A copy has been retained in the TÜV Rheinland (Shenzhen) Co., Ltd. file for certification follow-up purposes.

2.7 Status of Facility Used for Testing

The TÜV Rheinland (Shenzhen) Co., Ltd. Test facility located at 1F East & 2-4F, Cybio Technology Building No. 1, No. 16 Kejibei 2nd Road, High-Tech Industrial Park North Nanshan District, Shenzhen, 518057 is listed on the US Federal Communications Commission list of facilities approved to perform measurements.

3 General Product Information

3.1 Product Function and Intended Use

The EUT is a True Wireless Earphones which consists of a left earphone and a right earphone, they are totally identical and support Bluetooth 5.0 technology.

According to the declaration of the applicant, the electrical circuit design, PCB layout and construction Design are identical for all models, only the model No. and color are different.

Note: When the EUT is charged, other functions cannot be used.

For details refer to the User Manual, Technical Description and Circuit Diagram.

3.2 Ratings and System Details

Table 2: Technical Specification of EUT

General Information of EUT	Value
Kind of Equipment	True Wireless Earphones
Type Designation	TWSEBBKV3PRM-FOB, TWSEBWHV3PRM-FOB
Trademark	Primark
FCC ID	2AHHETWSEBV3PRM
Operating Voltage	DC 5.0V via USB port for charging DC 3.7V@40mAh via internal battery
Testing Voltage	AC 120V@60HZ Fully charged battery
Battery	DC 3.7V@40mAh lithium battery
Technical Specification of Bluetooth	
Operating Frequency	2402.0 to 2480.0 MHz
Type of Modulation	GFSK(BDR), $\pi/4$ DQPSK(EDR)
Channel Number	79 channels
Channel Separation	1MHz
Antenna Type	FPC Antenna
Antenna Gain	0 dBi

Table 3: Operating Frequencies/Channels of EUT

Operating Mode	Description
Bluetooth®	☒ BDR/EDR $f_c = 2402 + k$ MHz, where $k = 0 \sim 78$ ☐ Low Energy $f_c = 2402 + k*2$ MHz, where $k = 0 \sim 39$

Table 4: Frequency Hopping Information

Technical Specification	Description
Hopping Range	Hereby we declare that the frequency range of this device is: 2402-2480MHz. This is according the Bluetooth Core Specification V5.0 + EDR for devices which will be operated in the USA. This was checked during the Bluetooth Qualification tests (Test Case: TRM/CA/04-E).
Hopping Sequence	Example of a 79 hopping sequence in data mode: 33,04,21,44,23,42,53,46,55,48,40,59,72,29,76,31,08,73,07,75,09,45,60,39,58,13,47,11,77,52,35,50,65,54,67,56,69,62,71,64, 7,25,27,66,57,70,74,61,78,63,10,41,05,43,15,44,64,68,02,70,06,01,51,03,55,05,03,66,53,49,36,47,
Receiver input bandwidth	The input bandwidth of the receiver is 1MHz. In every connection one Bluetooth device is the master and the other one is the slave. The master determines the hopping sequence. The slave follows this sequence. Both devices shift between RX and TX time slot according to the clock of the master. Additionally the type of connection is set up at the beginning of the connection. The master adapts its hopping frequency and its TX/RX timing according to the packet type of the connection. Also the slave of the connection will use these settings. Repeating of a packer has no influence on the hopping sequence. The hopping sequence generated by the master of the connection will be followed in any case. That means a repeated packet will not be send on the same frequency, it is send on the next frequency of the hopping sequence.

3.3 Independent Operation Modes

The basic operation modes are:

- A. On, Bluetooth transmitting mode (BDR & EDR mode)
 - 1) Low Channel
 - 2) Middle Channel
 - 3) High Channel
- B. On, Transmitting on Hopping channel
- C. On, Bluetooth connecting mode
- D. On, Charging mode for charger box
- E. Off

3.4 Noise Generating and Noise Suppressing Parts

Refer to Circuit Diagram for further details.

3.5 Submitted Documents

- | | |
|----------------------------------|---------------|
| - Block Diagram | - Schematics |
| - FCC/IC Label and Location Info | - User Manual |

4 Test Set-up and Operation Modes

4.1 Principle of Configuration Selection

Radio Spectrum: The equipment under test (EUT) was configured at its highest power output in order to measure its highest possible radiation and conducted level. The test modes were adapted accordingly in reference to the instructions for use.

Emission: The equipment under test (EUT) was configured to measure its highest possible radiation level. The test modes were adapted accordingly in reference to the instructions for use.

4.2 Test Operation and Test Software

Test operation refers to test setup in chapter 5. All tests were performed according to the procedures in ANSI C63.10: 2013 and ANSI C63.4: 2014.

According to clause 3.1, all tests were performed on model TWSEBBKV3PRM-FOB(right earphone) in this report.

Table 5: List of Frequencies under Test

☒ Bluetooth				
Operation mode	Frequencies under Test (MHz)			Power Level setting (dBm)
	CH _{Low}	CH _{Mid}	CH _{High}	
☒ BDR/EDR	2402.0	2441.0	2480.0	Level 3

4.3 Special Accessories and Auxiliary Equipment

Table 6: Auxiliary Equipment Used during Test

Description	Manufacturer	Model	S/N	Rating
Laptop	Lenovo	T480	PF-16A6N8	N/A
Adapter	N/A	N/A	N/A	DC 5V

4.4 Countermeasures to Achieve EMC Compliance

The test sample which has been tested contained the noise suppression parts as described in the Technical Construction File (TCF).

No additional measures were employed to achieve compliance.

4.5 Test Setup Diagram

Diagram of Measurement Configuration for Radiation Test (Below 1GHz)

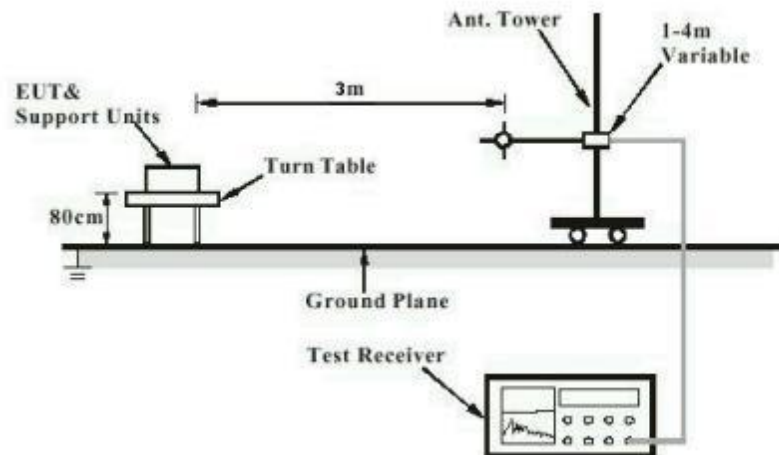


Diagram of Measurement Configuration for Radiation Test (Above 1GHz)

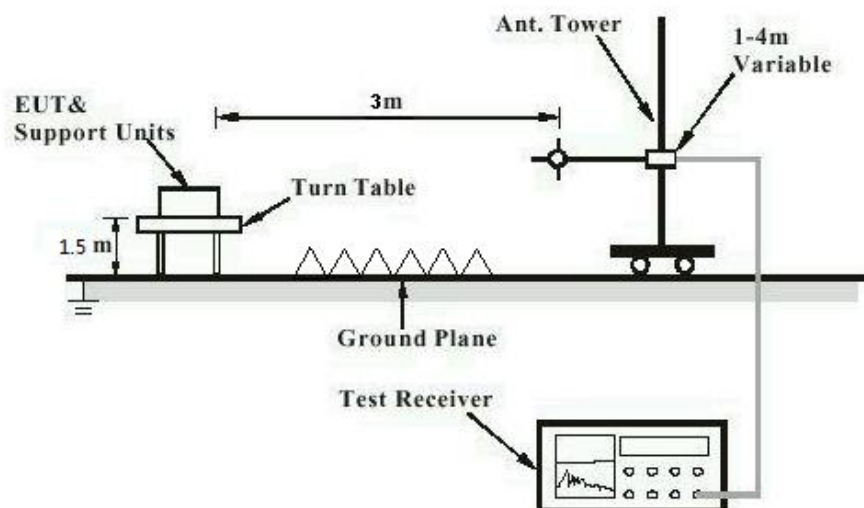


Diagram of Measurement Configuration for Mains Conduction Measurement

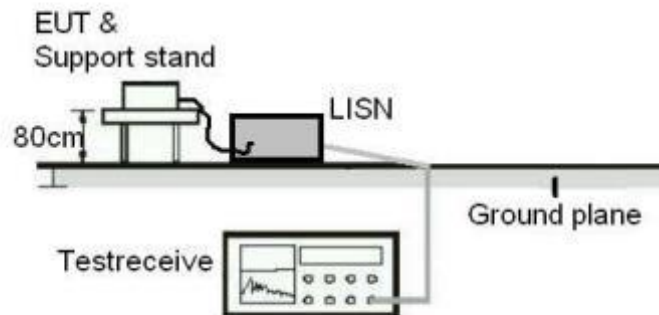
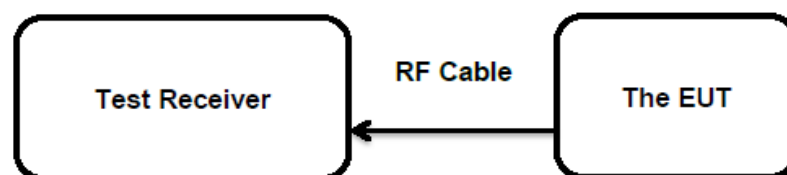


Diagram of Measurement Configuration for Conducted Transmitter Measurement



5 Test Results

5.1 Transmitter Requirement & Test Suites

5.1.1 Antenna Requirement

RESULT:

Pass

Test Specification

Test standard : FCC Part 15.247(b)(4) and Part 15.203

According to the manufacturer declared, the EUT has an internal antenna, the directional gain of antenna is 0 dBi, and the antenna connector is designed with permanent attachment and no consideration of replacement. Therefore the EUT is considered sufficient to comply with the provision.

Therefore the EUT is considered sufficient to comply with the provision.

Refer to EUT Photo for further details.

5.1.2 Maximum Peak Conducted Output Power

RESULT:
Pass
Test Specification

Test standard : FCC Part 15.247(b)(1)
 Basic standard : ANSI C63.10: 2013
 Limits : DSS < 0.125 Watts
 Kind of test site : Shielded Room

Test Setup

Date of testing : 22.11.2019
 Input voltage : Fully charged battery
 Operation mode : A
 Test channel : Low / Middle / High
 Ambient temperature : 25 °C
 Relative humidity : 56 %
 Atmospheric pressure : 101 kPa

Table 7: Test Result of Maximum Peak Conducted Output Power, Bluetooth

Test Mode	Test Channel (MHz)	Measured Peak Power		Limit (W)
		(dBm)	(W)	
GFSK (BDR)	2402.0	-2.41	0.0006	< 0.125
	2441.0	-1.94	0.0006	
	2480.0	-0.72	0.0008	
Maximum Measured Value		-0.72	0.0008	

Test Mode	Test Channel (MHz)	Measured Peak Power		Limit (W)
		(dBm)	(W)	
π/4DQPSK (EDR)	2402.0	-1.57	0.0007	< 0.125
	2441.0	-1.06	0.0008	
	2480.0	-0.79	0.0008	
Maximum Measured Value		-0.79	0.0008	

Note:

- 1) The cable loss is taken into account in results.
- 2) Antenna gain(G): 0 dBi,
 $e.i.r.p. = P_{(Peak\ power)} + G$, which is far below the 4 W

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5.1.3 99% Bandwidth

RESULT:**Pass****Test Specification**

Test standard	: FCC Part 15.247(a)
Basic standard	: ANSI C63.10: 2013
Kind of test site	: Shielded Room

Test Setup

Date of testing	: 21.11.2019
Input voltage	: Fully charged battery
Operation mode	: A
Test channel	: Low / Middle / High
Ambient temperature	: 25 °C
Relative humidity	: 56 %
Atmospheric pressure	: 101 kPa

For the measurement records, refer to the appendix B.

5.1.4 20dB Bandwidth**RESULT:****Pass****Test Specification**

Test standard	: FCC Part 15.247(a)(1)
Basic standard	: ANSI C63.10: 2013
Kind of test site	: Shielded Room

Test Setup

Date of testing	: 21.11.2019
Input voltage	: Fully charged battery
Operation mode	: A
Test channel	: Low / Middle / High
Ambient temperature	: 25 °C
Relative humidity	: 56 %
Atmospheric pressure	: 101 kPa

For the measurement records, refer to the appendix B.

5.1.5 Carrier Frequency Separation

RESULT:

Pass

Test Specification

Test standard	: FCC Part 15.247(a)(1)
Basic standard	: ANSI C63.10: 2013
Limits	: $\geq 25\text{kHz}$ or 2/3 of 20dB bandwidth, whichever is greater
Kind of test site	: Shielded Room

Test Setup

Date of testing	: 21.11.2019
Input voltage	: Fully charged battery
Operation mode	: B
Test channel	: Low / Middle / High
Ambient temperature	: 25 °C
Relative humidity	: 56 %
Atmospheric pressure	: 101 kPa

For the measurement records, refer to the appendix B.

5.1.6 Number of Hopping Frequency

RESULT:**Pass****Test Specification**

Test standard	: FCC part 15.247(a)(1)(iii)
Basic standard	: ANSI C63.10: 2013
Limits	: ≥ 15 non-overlapping channels
Kind of test site	: Shielded Room

Test Setup

Date of testing	: 21.11.2019
Input voltage	: Fully charged battery
Operation mode	: B
Ambient temperature	: 25 °C
Relative humidity	: 56 %
Atmospheric pressure	: 101 kPa

For the measurement records, refer to the appendix B.

5.1.7 Time of Occupancy

RESULT:

Pass

Test Specification

Test standard	: FCC part 15.247(a)(1)(iii)
Basic standard	: ANSI C63.10: 2013
Limits	: < 0.4s
Kind of test site	: Shielded Room

Test Setup

Date of testing	: 21.11.2019
Input voltage	: Fully charged battery
Operation mode	: B
Test channel	: Low / Middle / High
Ambient temperature	: 25 °C
Relative humidity	: 56 %
Atmospheric pressure	: 101 kPa

Note:

Dwell time = Pulse width x Number of channels in Period

Period = 0.4 (seconds/ channel) x 79 (channel) = 31.6 seconds

For the measurement records, refer to the appendix B.

5.1.8 Conducted Spurious Emissions Measured in 100 kHz Bandwidth

RESULT:**Pass****Test Specification**

Test standard	: FCC Part 15.247(d)
Basic standard	: ANSI C63.10: 2013
Limits	: 20dB (below that in the 100kHz bandwidth within the band that contains the highest level of the desired power); In addition, radiated emissions which fall in the restricted bands, must also comply with the radiated emission limits specified in 15.209(a)
Kind of test site	: Shielded Room

Test Setup

Date of testing	: 21.11.2019
Input voltage	: Fully charged battery
Operation mode	: A
Test channel	: Low / Middle / High
Ambient temperature	: 25 °C
Relative humidity	: 56 %
Atmospheric pressure	: 101 kPa

Test results of 100kHz Bandwidth of Frequency Band Edge by Conducted method refer to test plots, and compliance is achieved as well.

For the measurement records, refer to the appendix B.

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5.1.9 Radiated Spurious Emission

RESULT:**Pass****Test Specification**

Test standard	: FCC Part 15.247(d) & FCC Part 15.205
Basic standard	: ANSI C63.10: 2013
Limits	: Refer to 15.209(a) of FCC part 15.247(d)
Kind of test site	: 3m Semi-anechoic Chamber

Test Setup

Date of testing	: Refer to test result
Input voltage	: Fully charged battery
Operation mode	: A
Test channel	: Low / Middle / High
Ambient temperature	: 23 °C
Relative humidity	: 49 %
Atmospheric pressure	: 101 kPa

Remark:

Testing was carried out within frequency range 9kHz to the tenth harmonics. Only the worst case spurious emissions configuration of the each mode were reported.

For the measurement records, refer to the appendix B.

5.1.10 Conducted Emission on AC Mains**RESULT:****Pass****Test Specification**

Test standard	: FCC Part 15.107(a)
Basic standard	: ANSI C63.4: 2014
Frequency range	: 0.15 – 30MHz
Limits	: FCC Part 15.107(a)
Kind of test site	: Shielded Room

Test Setup

Date of testing	: 25.11.2019
Input voltage	: AC 120V@60HZ
Operation mode	: D
Earthing	: Not connected
Ambient temperature	: 24 °C
Relative humidity	: 50 %
Atmospheric pressure	: 101 kPa

For the measurement records, refer to the appendix C.

5.1.11 Radiated Emission**RESULT:****Pass****Test Specification**

Test standard	: FCC Part 15.109(a)
Basic standard	: ANSI C63.4: 2014
Frequency range	: 30 - 6000MHz
Classification	: Class B
Limits	: FCC Part 15.109(a)
Kind of test site	: 3m Semi-anechoic Chamber

Test Setup

Date of testing	: 29.11.2019
Input voltage	: AC 120V@60HZ DC 3.7V@40mAh
Operation mode	: D
Earthing	: Not connected
Ambient temperature	: 24 °C
Relative humidity	: 50 %
Atmospheric pressure	: 101 kPa

For the measurement records, refer to the appendix C.

6 Photographs of the Test Set-Up

For photographs of the test set-up, refer to the appendix A.

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Appendix B: Test Results of Bluetooth

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Appendix B.1: Test Results of 99% Bandwidth

BDR mode (GFSK)

FCC Part 47 §15.247 2400-2483.5 MHz 2017

Occupied Channel Bandwidth 99% (2402 MHz; 5.000 dBm; 1 MHz; Test Mode)

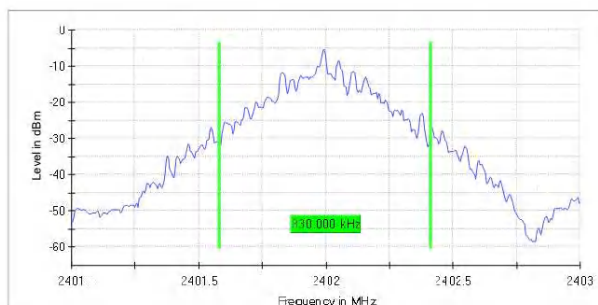
Test according to FCC title 47 part 15 §15.247(a), KDB 558074 D01 DTS Meas Guidance v04 and ANSI C63.10-2013

99 % Bandwidth

DUT Frequency (MHz)	Bandwidth (MHz)	Limit Min (MHz)	Limit Max (MHz)	Band Edge Left (MHz)	Band Edge Right (MHz)
2402.000000	0.830000	—	—	2401.582500	2402.412500

(continuation of the "99 % Bandwidth" table from column 6 ...)

DUT Frequency (MHz)	Result
2402.000000	PASS



Measurement

Setting	Instrument Value	Target Value
Start Frequency	2.40100 GHz	2.40100 GHz
Stop Frequency	2.40300 GHz	2.40300 GHz
Span	2.000 MHz	2.000 MHz
RBW	10.000 kHz	>= 10.000 kHz
VBW	30.000 kHz	>= 30.000 kHz
SweepPoints	400	~ 400
SweepTime	189.648 µs	AUTO
Reference Level	0.000 dBm	0.000 dBm
Attenuation	20.000 dB	AUTO
Detector	MaxPeak	MaxPeak
SweepCount	500	500
Filter	3 dB	3 dB
Trace Mode	Max Hold	Max Hold
SweepType	FFT	AUTO
Preamp	off	off
Stablemode	Trace	Trace
Stablevalue	0.30 dB	0.30 dB
Run	5 / max. 150	max. 150
Stable	3 / 3	3
Max Stable Difference	0.12 dB	0.30 dB

FCC Part 47 §15.247 2400-2483.5 MHz 2017

Occupied Channel Bandwidth 99% (2441 MHz; 5.000 dBm; 1 MHz; Test Mode)

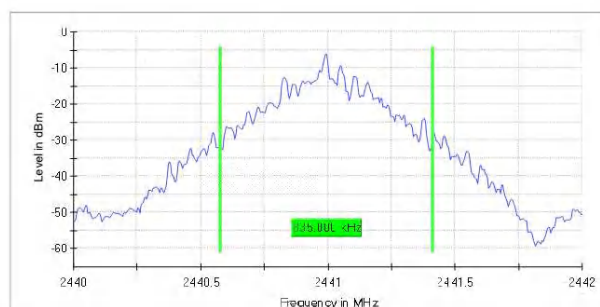
Test according to FCC title 47 part 15 §15.247(a), KDB 558074 D01 DTS Meas Guidance v04 and ANSI C63.10-2013

99 % Bandwidth

DUT Frequency (MHz)	Bandwidth (MHz)	Limit Min (MHz)	Limit Max (MHz)	Band Edge Left (MHz)	Band Edge Right (MHz)
2441.000000	0.835000	—	—	2440.577500	2441.412500

(continuation of the "99 % Bandwidth" table from column 6 ...)

DUT Frequency (MHz)	Result
2441.000000	PASS



Measurement

Setting	Instrument Value	Target Value
Start Frequency	2.44000 GHz	2.44000 GHz
Stop Frequency	2.44200 GHz	2.44200 GHz
Span	2.000 MHz	2.000 MHz
RBW	10.000 kHz	>= 10.000 kHz
VBW	30.000 kHz	>= 30.000 kHz
SweepPoints	400	~ 400
SweepTime	189.648 µs	AUTO
Reference Level	0.000 dBm	0.000 dBm
Attenuation	20.000 dB	AUTO
Detector	MaxPeak	MaxPeak
SweepCount	500	500
Filter	3 dB	3 dB
Trace Mode	Max Hold	Max Hold
SweepType	FFT	AUTO
Preamp	off	off
Stablemode	Trace	Trace
Stablevalue	0.30 dB	0.30 dB
Run	7 / max. 150	max. 150
Stable	3 / 3	3
Max Stable Difference	0.06 dB	0.30 dB

FCC Part 47 §15.247 2400-2483.5 MHz 2017

Occupied Channel Bandwidth 99% (2480 MHz; 5.000 dBm; 1 MHz; Test Mode)

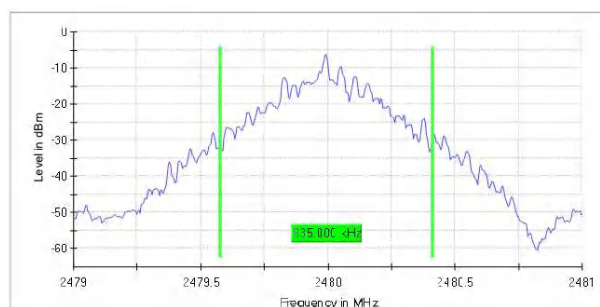
Test according to FCC title 47 part 15 §15.247(a), KDB 558074 D01 DTS Meas Guidance v04 and ANSI C63.10-2013

99 % Bandwidth

DUT Frequency (MHz)	Bandwidth (MHz)	Limit Min (MHz)	Limit Max (MHz)	Band Edge Left (MHz)	Band Edge Right (MHz)
2480.000000	0.835000	—	—	2479.577500	2480.412500

(continuation of the "99 % Bandwidth" table from column 6 ...)

DUT Frequency (MHz)	Result
2480.000000	PASS



Measurement

Setting	Instrument Value	Target Value
Start Frequency	2.47900 GHz	2.47900 GHz
Stop Frequency	2.48100 GHz	2.48100 GHz
Span	2.000 MHz	2.000 MHz
RBW	10.000 kHz	>= 10.000 kHz
VBW	30.000 kHz	>= 30.000 kHz
SweepPoints	400	~ 400
SweepTime	189.648 µs	AUTO
Reference Level	0.000 dBm	0.000 dBm
Attenuation	20.000 dB	AUTO
Detector	MaxPeak	MaxPeak
SweepCount	500	500
Filter	3 dB	3 dB
Trace Mode	Max Hold	Max Hold
SweepType	FFT	AUTO
Preamp	off	off
Stablemode	Trace	Trace
Stablevalue	0.30 dB	0.30 dB
Run	4 / max. 150	max. 150
Stable	3 / 3	3
Max Stable Difference	0.10 dB	0.30 dB

EDR mode ($\pi/4$ -DQPSK)

FCC Part 47 §15.247 2400-2483.5 MHz 2017

Occupied Channel Bandwidth 99% (2402 MHz; 5.000 dBm; 1 MHz; Test Mode)

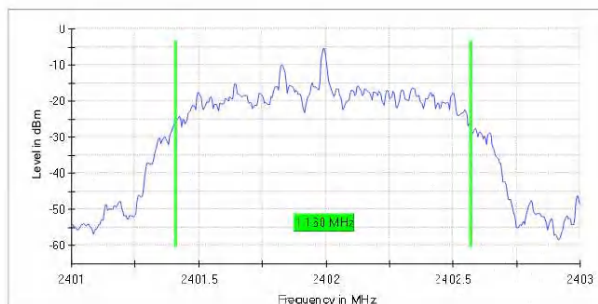
Test according to FCC title 47 part 15 §15.247(a), KDB 558074 D01 DTS Meas Guidance v04 and ANSI C63.10-2013

99 % Bandwidth

DUT Frequency (MHz)	Bandwidth (MHz)	Limit Min (MHz)	Limit Max (MHz)	Band Edge Left (MHz)	Band Edge Right (MHz)
2402.000000	1.160000	—	—	2401.412500	2402.572500

(continuation of the "99 % Bandwidth" table from column 6 ...)

DUT Frequency (MHz)	Result
2402.000000	PASS



Measurement

Setting	Instrument Value	Target Value
Start Frequency	2.40100 GHz	2.40100 GHz
Stop Frequency	2.40300 GHz	2.40300 GHz
Span	2.000 MHz	2.000 MHz
RBW	10.000 kHz	≥ 10.000 kHz
VBW	30.000 kHz	≥ 30.000 kHz
SweepPoints	400	~ 400
SweepTime	189.648 μ s	AUTO
Reference Level	0.000 dBm	0.000 dBm
Attenuation	20.000 dB	AUTO
Detector	MaxPeak	MaxPeak
SweepCount	500	500
Filter	3 dB	3 dB
Trace Mode	Max Hold	Max Hold
SweepType	FFT	AUTO
Preamplifier	off	off
Stablemode	Trace	Trace
Stablevalue	0.30 dB	0.30 dB
Run	4 / max. 150	max. 150
Stable	3 / 3	3
Max Stable Difference	0.05 dB	0.30 dB

FCC Part 47 §15.247 2400-2483.5 MHz 2017

Occupied Channel Bandwidth 99% (2441 MHz; 5.000 dBm; 1 MHz; Test Mode)

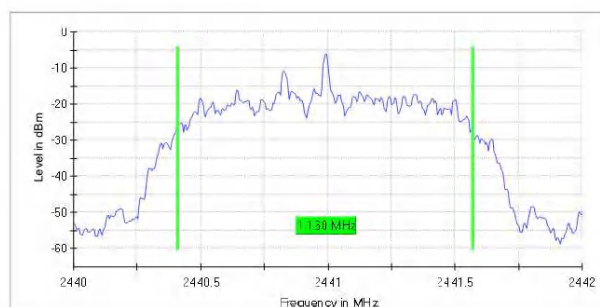
Test according to FCC title 47 part 15 §15.247(a), KDB 558074 D01 DTS Meas Guidance v04 and ANSI C63.10-2013

99 % Bandwidth

DUT Frequency (MHz)	Bandwidth (MHz)	Limit Min (MHz)	Limit Max (MHz)	Band Edge Left (MHz)	Band Edge Right (MHz)
2441.000000	1.160000	—	—	2440.412500	2441.572500

(continuation of the "99 % Bandwidth" table from column 6 ...)

DUT Frequency (MHz)	Result
2441.000000	PASS



Measurement

Setting	Instrument Value	Target Value
Start Frequency	2.44000 GHz	2.44000 GHz
Stop Frequency	2.44200 GHz	2.44200 GHz
Span	2.000 MHz	2.000 MHz
RBW	10.000 kHz	>= 10.000 kHz
VBW	30.000 kHz	>= 30.000 kHz
SweepPoints	400	~ 400
SweepTime	189.648 µs	AUTO
Reference Level	0.000 dBm	0.000 dBm
Attenuation	20.000 dB	AUTO
Detector	MaxPeak	MaxPeak
SweepCount	500	500
Filter	3 dB	3 dB
Trace Mode	Max Hold	Max Hold
SweepType	FFT	AUTO
Preamplifier	off	off
Stablemode	Trace	Trace
Stablevalue	0.30 dB	0.30 dB
Run	5 / max. 150	max. 150
Stable	3 / 3	3
Max Stable Difference	0.03 dB	0.30 dB

FCC Part 47 §15.247 2400-2483.5 MHz 2017

Occupied Channel Bandwidth 99% (2480 MHz; 5.000 dBm; 1 MHz; Test Mode)

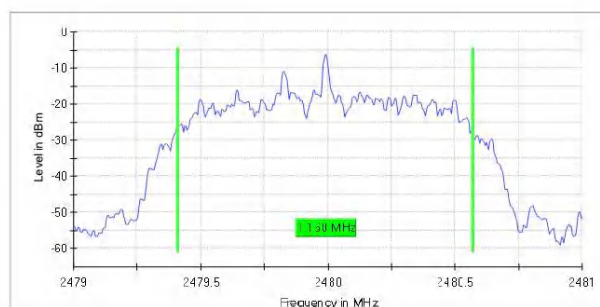
Test according to FCC title 47 part 15 §15.247(a), KDB 558074 D01 DTS Meas Guidance v04 and ANSI C63.10-2013

99 % Bandwidth

DUT Frequency (MHz)	Bandwidth (MHz)	Limit Min (MHz)	Limit Max (MHz)	Band Edge Left (MHz)	Band Edge Right (MHz)
2480.000000	1.160000	—	—	2479.412500	2480.572500

(continuation of the "99 % Bandwidth" table from column 6 ...)

DUT Frequency (MHz)	Result
2480.000000	PASS



Measurement

Setting	Instrument Value	Target Value
Start Frequency	2.47900 GHz	2.47900 GHz
Stop Frequency	2.48100 GHz	2.48100 GHz
Span	2.000 MHz	2.000 MHz
RBW	10.000 kHz	>= 10.000 kHz
VBW	30.000 kHz	>= 30.000 kHz
SweepPoints	400	~ 400
SweepTime	189.648 µs	AUTO
Reference Level	0.000 dBm	0.000 dBm
Attenuation	20.000 dB	AUTO
Detector	MaxPeak	MaxPeak
SweepCount	500	500
Filter	3 dB	3 dB
Trace Mode	Max Hold	Max Hold
SweepType	FFT	AUTO
Preamp	off	off
Stablemode	Trace	Trace
Stablevalue	0.30 dB	0.30 dB
Run	5 / max. 150	max. 150
Stable	3 / 3	3
Max Stable Difference	0.01 dB	0.30 dB

Appendix B.2: Test Results of 20dB Bandwidth

BDR mode (GFSK)

FCC Part 47 §15.247 2400-2483.5 MHz 2017

Emission Bandwidth 20 dB (2402 MHz; 5.000 dBm; 1 MHz; Test Mode)

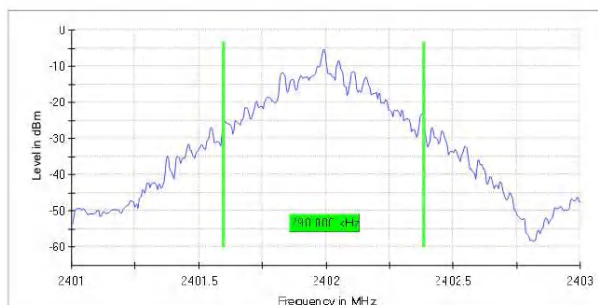
Test according to FCC title 47 part 15 §15.247(a), KDB 558074 D01 DTS Meas Guidance v04 and ANSI C63.10-2013

20 dB Bandwidth

DUT Frequency (MHz)	Bandwidth (MHz)	Limit Min (MHz)	Limit Max (MHz)	Band Edge Left (MHz)	Band Edge Right (MHz)
2402.000000	0.790000	—	—	2401.597500	2402.387500

(continuation of the "20 dB Bandwidth" table from column 6 ...)

DUT Frequency (MHz)	Max Level (dBm)	Result
2402.000000	-5.3	PASS



Measurement

Setting	Instrument Value	Target Value
Start Frequency	2.40100 GHz	2.40100 GHz
Stop Frequency	2.40300 GHz	2.40300 GHz
Span	2.000 MHz	2.000 MHz
RBW	10.000 kHz	>= 10.000 kHz
VBW	30.000 kHz	>= 30.000 kHz
SweepPoints	400	~ 400
SweepTime	189.648 µs	AUTO
Reference Level	0.000 dBm	0.000 dBm
Attenuation	20.000 dB	AUTO
Detector	MaxPeak	MaxPeak
SweepCount	200	200
Filter	3 dB	3 dB
Trace Mode	Max Hold	Max Hold
SweepType	FFT	AUTO
Preamplifier	off	off
Stablemode	Trace	Trace
Stablevalue	0.50 dB	0.50 dB
Run	11 / max. 150	max. 150
Stable	5 / 5	5
Max Stable Difference	0.08 dB	0.50 dB

FCC Part 47 §15.247 2400-2483.5 MHz 2017

Emission Bandwidth 20 dB (2441 MHz; 5.000 dBm; 1 MHz; Test Mode)

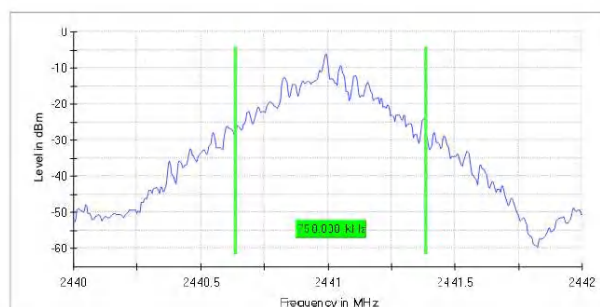
Test according to FCC title 47 part 15 §15.247(a), KDB 558074 D01 DTS Meas Guidance v04 and ANSI C63.10-2013

20 dB Bandwidth

DUT Frequency (MHz)	Bandwidth (MHz)	Limit Min (MHz)	Limit Max (MHz)	Band Edge Left (MHz)	Band Edge Right (MHz)
2441.000000	0.750000	—	—	2440.637500	2441.387500

(continuation of the "20 dB Bandwidth" table from column 6 ...)

DUT Frequency (MHz)	Max Level (dBm)	Result
2441.000000	-6.1	PASS



Measurement

Setting	Instrument Value	Target Value
Start Frequency	2.44000 GHz	2.44000 GHz
Stop Frequency	2.44200 GHz	2.44200 GHz
Span	2.000 MHz	2.000 MHz
RBW	10.000 kHz	>= 10.000 kHz
VBW	30.000 kHz	>= 30.000 kHz
SweepPoints	400	~ 400
SweepTime	189.648 µs	AUTO
Reference Level	0.000 dBm	0.000 dBm
Attenuation	20.000 dB	AUTO
Detector	MaxPeak	MaxPeak
SweepCount	200	200
Filter	3 dB	3 dB
Trace Mode	Max Hold	Max Hold
SweepType	FFT	AUTO
Preamp	off	off
Stablemode	Trace	Trace
Stablevalue	0.50 dB	0.50 dB
Run	9 / max. 150	max. 150
Stable	5 / 5	5
Max Stable Difference	0.05 dB	0.50 dB

FCC Part 47 §15.247 2400-2483.5 MHz 2017

Emission Bandwidth 20 dB (2480 MHz; 5.000 dBm; 1 MHz; Test Mode)

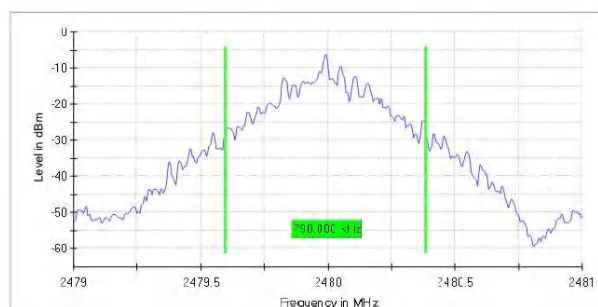
Test according to FCC title 47 part 15 §15.247(a), KDB 558074 D01 DTS Meas Guidance v04 and ANSI C63.10-2013

20 dB Bandwidth

DUT Frequency (MHz)	Bandwidth (MHz)	Limit Min (MHz)	Limit Max (MHz)	Band Edge Left (MHz)	Band Edge Right (MHz)
2480.000000	0.790000	—	—	2479.597500	2480.387500

(continuation of the "20 dB Bandwidth" table from column 6 ...)

DUT Frequency (MHz)	Max Level (dBm)	Result
2480.000000	-6.4	PASS



Measurement

Setting	Instrument Value	Target Value
Start Frequency	2.47900 GHz	2.47900 GHz
Stop Frequency	2.48100 GHz	2.48100 GHz
Span	2.000 MHz	2.000 MHz
RBW	10.000 kHz	>= 10.000 kHz
VBW	30.000 kHz	>= 30.000 kHz
SweepPoints	400	~ 400
SweepTime	189.648 µs	AUTO
Reference Level	0.000 dBm	0.000 dBm
Attenuation	20.000 dB	AUTO
Detector	MaxPeak	MaxPeak
SweepCount	200	200
Filter	3 dB	3 dB
Trace Mode	Max Hold	Max Hold
SweepType	FFT	AUTO
Preamp	off	off
Stablemode	Trace	Trace
Stablevalue	0.50 dB	0.50 dB
Run	6 / max. 150	max. 150
Stable	5 / 5	5
Max Stable Difference	0.04 dB	0.50 dB

EDR mode ($\pi/4$ -DQPSK)

FCC Part 47 §15.247 2400-2483.5 MHz 2017

Emission Bandwidth 20 dB (2402 MHz; 5.000 dBm; 1 MHz; Test Mode)

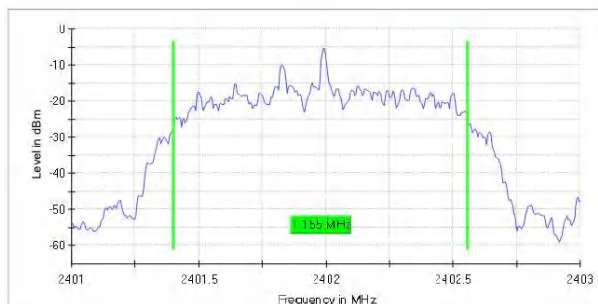
Test according to FCC title 47 part 15 §15.247(a), KDB 558074 D01 DTS Meas Guidance v04 and ANSI C63.10-2013

20 dB Bandwidth

DUT Frequency (MHz)	Bandwidth (MHz)	Limit Min (MHz)	Limit Max (MHz)	Band Edge Left (MHz)	Band Edge Right (MHz)
2402.000000	1.155000	—	—	2401.402500	2402.557500

(continuation of the "20 dB Bandwidth" table from column 6 ...)

DUT Frequency (MHz)	Max Level (dBm)	Result
2402.000000	-5.4	PASS



Measurement

Setting	Instrument Value	Target Value
Start Frequency	2.40100 GHz	2.40100 GHz
Stop Frequency	2.40300 GHz	2.40300 GHz
Span	2.000 MHz	2.000 MHz
RBW	10.000 kHz	≥ 10.000 kHz
VBW	30.000 kHz	≥ 30.000 kHz
SweepPoints	400	~ 400
SweepTime	189.648 μ s	AUTO
Reference Level	0.000 dBm	0.000 dBm
Attenuation	20.000 dB	AUTO
Detector	MaxPeak	MaxPeak
SweepCount	200	200
Filter	3 dB	3 dB
Trace Mode	Max Hold	Max Hold
SweepType	FFT	AUTO
Preamplifier	off	off
Stablemode	Trace	Trace
Stablevalue	0.50 dB	0.50 dB
Run	6 / max. 150	max. 150
Stable	5 / 5	5
Max Stable Difference	0.04 dB	0.50 dB

FCC Part 47 §15.247 2400-2483.5 MHz 2017

Emission Bandwidth 20 dB (2441 MHz; 5.000 dBm; 1 MHz; Test Mode)

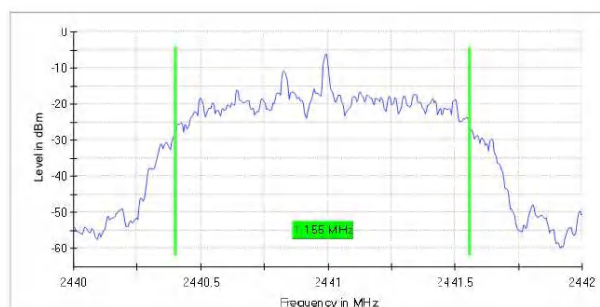
Test according to FCC title 47 part 15 §15.247(a), KDB 558074 D01 DTS Meas Guidance v04 and ANSI C63.10-2013

20 dB Bandwidth

DUT Frequency (MHz)	Bandwidth (MHz)	Limit Min (MHz)	Limit Max (MHz)	Band Edge Left (MHz)	Band Edge Right (MHz)
2441.000000	1.155000	—	—	2440.402500	2441.557500

(continuation of the "20 dB Bandwidth" table from column 6 ...)

DUT Frequency (MHz)	Max Level (dBm)	Result
2441.000000	-6.2	PASS



Measurement

Setting	Instrument Value	Target Value
Start Frequency	2.44000 GHz	2.44000 GHz
Stop Frequency	2.44200 GHz	2.44200 GHz
Span	2.000 MHz	2.000 MHz
RBW	10.000 kHz	>= 10.000 kHz
VBW	30.000 kHz	>= 30.000 kHz
SweepPoints	400	~ 400
SweepTime	189.648 µs	AUTO
Reference Level	0.000 dBm	0.000 dBm
Attenuation	20.000 dB	AUTO
Detector	MaxPeak	MaxPeak
SweepCount	200	200
Filter	3 dB	3 dB
Trace Mode	Max Hold	Max Hold
SweepType	FFT	AUTO
Preamp	off	off
Stablemode	Trace	Trace
Stablevalue	0.50 dB	0.50 dB
Run	8 / max. 150	max. 150
Stable	5 / 5	5
Max Stable Difference	0.04 dB	0.50 dB

FCC Part 47 §15.247 2400-2483.5 MHz 2017

Emission Bandwidth 20 dB (2480 MHz; 5.000 dBm; 1 MHz; Test Mode)

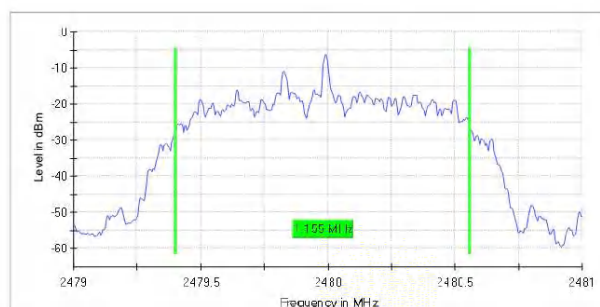
Test according to FCC title 47 part 15 §15.247(a), KDB 558074 D01 DTS Meas Guidance v04 and ANSI C63.10-2013

20 dB Bandwidth

DUT Frequency (MHz)	Bandwidth (MHz)	Limit Min (MHz)	Limit Max (MHz)	Band Edge Left (MHz)	Band Edge Right (MHz)
2480.000000	1.155000	—	—	2479.402500	2480.557500

(continuation of the "20 dB Bandwidth" table from column 6 ...)

DUT Frequency (MHz)	Max Level (dBm)	Result
2480.000000	-6.4	PASS



Measurement

Setting	Instrument Value	Target Value
Start Frequency	2.47900 GHz	2.47900 GHz
Stop Frequency	2.48100 GHz	2.48100 GHz
Span	2.000 MHz	2.000 MHz
RBW	10.000 kHz	>= 10.000 kHz
VBW	30.000 kHz	>= 30.000 kHz
SweepPoints	400	~ 400
SweepTime	189.648 µs	AUTO
Reference Level	0.000 dBm	0.000 dBm
Attenuation	20.000 dB	AUTO
Detector	MaxPeak	MaxPeak
SweepCount	200	200
Filter	3 dB	3 dB
Trace Mode	Max Hold	Max Hold
SweepType	FFT	AUTO
Preamp	off	off
Stablemode	Trace	Trace
Stablevalue	0.50 dB	0.50 dB
Run	7 / max. 150	max. 150
Stable	5 / 5	5
Max Stable Difference	0.00 dB	0.50 dB

Appendix B.3: Test Results of Carrier Frequency Separation

BDR mode (GFSK)

FCC Part 47 §15.247 2400-2483.5 MHz 2017

Carrier Frequency Separation (2402 MHz; 5.000 dBm; 1 MHz; Test Mode)

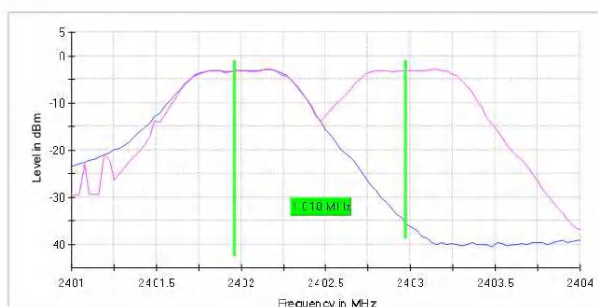
Test according to FCC title 47 part 15 §15.247(a), KDB 558074 D01 DTS Meas Guidance v04 and ANSI C63.10-2013

Result

DUT Frequency (MHz)	Frequency Separation (MHz)	Limit Min (MHz)	Limit Max (MHz)	Center Frequency low Channel (MHz)	Center Frequency high Channel (MHz)
2402.000000	1.009901	0.526667	---	2401.965347	2402.975248

(continuation of the "Result" table from column 6 ...)

DUT Frequency (MHz)	Result
2402.000000	PASS



Measurement 1

Setting	Instrument Value	Target Value
Start Frequency	2.40100 GHz	2.40100 GHz
Stop Frequency	2.40400 GHz	2.40400 GHz
Span	3.000 MHz	3.000 MHz
RBW	300.000 kHz	<= 300.000 kHz
VBW	300.000 kHz	>= 300.000 kHz
SweepPoints	101	~ 10
SweepTime	1.000 ms	AUTO
Reference Level	0.000 dBm	0.000 dBm
Attenuation	20.000 dB	AUTO
Detector	MaxPeak	MaxPeak
SweepCount	200	200
Filter	3 dB	3 dB
Trace Mode	Max Hold	Max Hold
SweepType	Sweep	Sweep
Preamp	off	off
Stablemode	Trace	Trace
Stablevalue	0.50 dB	0.50 dB
Run	15 / max. 150	max. 150
Stable	10 / 10	10
Max Stable Difference	0.04 dB	0.50 dB

FCC Part 47 §15.247 2400-2483.5 MHz 2017

Measurement 2

Setting	Instrument Value	Target Value
Start Frequency	2.40100 GHz	2.40100 GHz
Stop Frequency	2.40400 GHz	2.40400 GHz
Span	3.000 MHz	3.000 MHz
RBW	300.000 kHz	<= 300.000 kHz
VBW	300.000 kHz	>= 300.000 kHz
SweepPoints	101	~ 10
SweepTime	1.000 ms	AUTO
Reference Level	0.000 dBm	0.000 dBm
Attenuation	20.000 dB	AUTO
Detector	MaxPeak	MaxPeak
SweepCount	200	200
Filter	3 dB	3 dB
Trace Mode	Max Hold	Max Hold
SweepType	Sweep	Sweep
Preamplifier	off	off
Stablemode	Trace	Trace
Stablevalue	0.50 dB	0.50 dB
Run	11 / max. 150	max. 150
Stable	10 / 10	10
Max Stable Difference	0.05 dB	0.50 dB

FCC Part 47 §15.247 2400-2483.5 MHz 2017

Carrier Frequency Separation (2441 MHz; 5.000 dBm; 1 MHz; Test Mode)

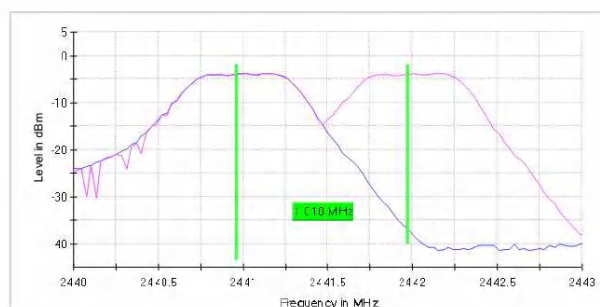
Test according to FCC title 47 part 15 §15.247(a), KDB 558074 D01 DTS Meas Guidance v04 and ANSI C63.10-2013

Result

DUT Frequency (MHz)	Frequency Separation (MHz)	Limit Min (MHz)	Limit Max (MHz)	Center Frequency low Channel (MHz)	Center Frequency high Channel (MHz)
2441.000000	1.009901	0.500000	---	2440.965347	2441.975248

(continuation of the "Result" table from column 6 ...)

DUT Frequency (MHz)	Result
2441.000000	PASS



Measurement 1

Setting	Instrument Value	Target Value
Start Frequency	2.44000 GHz	2.44000 GHz
Stop Frequency	2.44300 GHz	2.44300 GHz
Span	3.000 MHz	3.000 MHz
RBW	300.000 kHz	<= 300.000 kHz
VBW	300.000 kHz	>= 300.000 kHz
SweepPoints	101	~ 10
SweepTime	1.000 ms	AUTO
Reference Level	0.000 dBm	0.000 dBm
Attenuation	20.000 dB	AUTO
Detector	MaxPeak	MaxPeak
SweepCount	200	200
Filter	3 dB	3 dB
Trace Mode	Max Hold	Max Hold
SweepType	Sweep	Sweep
Preamp	off	off
Stablemode	Trace	Trace
Stablevalue	0.50 dB	0.50 dB
Run	12 / max. 150	max. 150
Stable	10 / 10	10
Max Stable Difference	0.00 dB	0.50 dB

FCC Part 47 §15.247 2400-2483.5 MHz 2017

Measurement 2

Setting	Instrument Value	Target Value
Start Frequency	2.44000 GHz	2.44000 GHz
Stop Frequency	2.44300 GHz	2.44300 GHz
Span	3.000 MHz	3.000 MHz
RBW	300.000 kHz	<= 300.000 kHz
VBW	300.000 kHz	>= 300.000 kHz
SweepPoints	101	~ 10
SweepTime	1.000 ms	AUTO
Reference Level	0.000 dBm	0.000 dBm
Attenuation	20.000 dB	AUTO
Detector	MaxPeak	MaxPeak
SweepCount	200	200
Filter	3 dB	3 dB
Trace Mode	Max Hold	Max Hold
SweepType	Sweep	Sweep
Preamp	off	off
Stablemode	Trace	Trace
Stablevalue	0.50 dB	0.50 dB
Run	13 / max. 150	max. 150
Stable	10 / 10	10
Max Stable Difference	0.01 dB	0.50 dB

FCC Part 47 §15.247 2400-2483.5 MHz 2017

Carrier Frequency Separation (2480 MHz; 5.000 dBm; 1 MHz; Test Mode)

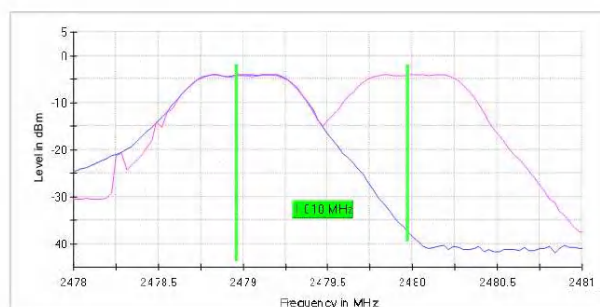
Test according to FCC title 47 part 15 §15.247(a), KDB 558074 D01 DTS Meas Guidance v04 and ANSI C63.10-2013

Result

DUT Frequency (MHz)	Frequency Separation (MHz)	Limit Min (MHz)	Limit Max (MHz)	Center Frequency low Channel (MHz)	Center Frequency high Channel (MHz)
2480.000000	1.009901	0.526667	---	2478.965347	2479.975248

(continuation of the "Result" table from column 6 ...)

DUT Frequency (MHz)	Result
2480.000000	PASS



Measurement 1

Setting	Instrument Value	Target Value
Start Frequency	2.47800 GHz	2.47800 GHz
Stop Frequency	2.48100 GHz	2.48100 GHz
Span	3.000 MHz	3.000 MHz
RBW	300.000 kHz	<= 300.000 kHz
VBW	300.000 kHz	>= 300.000 kHz
SweepPoints	101	~ 10
SweepTime	1.000 ms	AUTO
Reference Level	0.000 dBm	0.000 dBm
Attenuation	20.000 dB	AUTO
Detector	MaxPeak	MaxPeak
SweepCount	200	200
Filter	3 dB	3 dB
Trace Mode	Max Hold	Max Hold
SweepType	Sweep	Sweep
Preamplifier	off	off
Stablemode	Trace	Trace
Stablevalue	0.50 dB	0.50 dB
Run	12 / max. 150	max. 150
Stable	10 / 10	10
Max Stable Difference	0.00 dB	0.50 dB

FCC Part 47 §15.247 2400-2483.5 MHz 2017

Measurement 2

Setting	Instrument Value	Target Value
Start Frequency	2.47800 GHz	2.47800 GHz
Stop Frequency	2.48100 GHz	2.48100 GHz
Span	3.000 MHz	3.000 MHz
RBW	300.000 kHz	<= 300.000 kHz
VBW	300.000 kHz	>= 300.000 kHz
SweepPoints	101	~ 10
SweepTime	1.000 ms	AUTO
Reference Level	0.000 dBm	0.000 dBm
Attenuation	20.000 dB	AUTO
Detector	MaxPeak	MaxPeak
SweepCount	200	200
Filter	3 dB	3 dB
Trace Mode	Max Hold	Max Hold
SweepType	Sweep	Sweep
Preamplifier	off	off
Stablemode	Trace	Trace
Stablevalue	0.50 dB	0.50 dB
Run	11 / max. 150	max. 150
Stable	10 / 10	10
Max Stable Difference	0.04 dB	0.50 dB

EDR mode ($\pi/4$ -DQPSK)

FCC Part 47 §15.247 2400-2483.5 MHz 2017

Carrier Frequency Separation (2402 MHz; 5.000 dBm; 1 MHz; Test Mode)

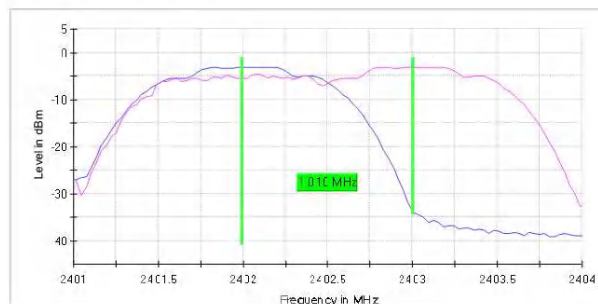
Test according to FCC title 47 part 15 §15.247(a), KDB 558074 D01 DTS Meas Guidance v04 and ANSI C63.10-2013

Result

DUT Frequency (MHz)	Frequency Separation (MHz)	Limit Min (MHz)	Limit Max (MHz)	Center Frequency low Channel (MHz)	Center Frequency high Channel (MHz)
2402.000000	1.009900	0.770000	---	2401.995050	2403.004950

(continuation of the "Result" table from column 6 ...)

DUT Frequency (MHz)	Result
2402.000000	PASS



Measurement 1

Setting	Instrument Value	Target Value
Start Frequency	2.40100 GHz	2.40100 GHz
Stop Frequency	2.40400 GHz	2.40400 GHz
Span	3.000 MHz	3.000 MHz
RBW	300.000 kHz	<= 300.000 kHz
VBW	300.000 kHz	>= 300.000 kHz
SweepPoints	101	~ 10
SweepTime	1.000 ms	AUTO
Reference Level	0.000 dBm	0.000 dBm
Attenuation	20.000 dB	AUTO
Detector	MaxPeak	MaxPeak
SweepCount	200	200
Filter	3 dB	3 dB
Trace Mode	Max Hold	Max Hold
SweepType	Sweep	Sweep
Preamp	off	off
Stablemode	Trace	Trace
Stablevalue	0.50 dB	0.50 dB
Run	12 / max. 150	max. 150
Stable	10 / 10	10
Max Stable Difference	0.06 dB	0.50 dB

FCC Part 47 §15.247 2400-2483.5 MHz 2017

Measurement 2

Setting	Instrument Value	Target Value
Start Frequency	2.40100 GHz	2.40100 GHz
Stop Frequency	2.40400 GHz	2.40400 GHz
Span	3.000 MHz	3.000 MHz
RBW	300.000 kHz	<= 300.000 kHz
VBW	300.000 kHz	>= 300.000 kHz
SweepPoints	101	~ 10
SweepTime	1.000 ms	AUTO
Reference Level	0.000 dBm	0.000 dBm
Attenuation	20.000 dB	AUTO
Detector	MaxPeak	MaxPeak
SweepCount	200	200
Filter	3 dB	3 dB
Trace Mode	Max Hold	Max Hold
SweepType	Sweep	Sweep
Preamplifier	off	off
Stablemode	Trace	Trace
Stablevalue	0.50 dB	0.50 dB
Run	11 / max. 150	max. 150
Stable	10 / 10	10
Max Stable Difference	0.04 dB	0.50 dB

FCC Part 47 §15.247 2400-2483.5 MHz 2017

Carrier Frequency Separation (2441 MHz; 5.000 dBm; 1 MHz; Test Mode)

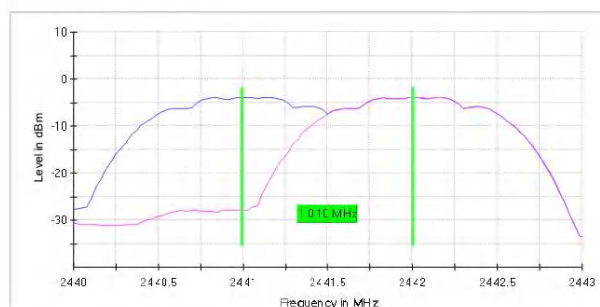
Test according to FCC title 47 part 15 §15.247(a), KDB 558074 D01 DTS Meas Guidance v04 and ANSI C63.10-2013

Result

DUT Frequency (MHz)	Frequency Separation (MHz)	Limit Min (MHz)	Limit Max (MHz)	Center Frequency low Channel (MHz)	Center Frequency high Channel (MHz)
2441.000000	1.009900	0.770000	---	2440.995050	2442.004950

(continuation of the "Result" table from column 6 ...)

DUT Frequency (MHz)	Result
2441.000000	PASS



Measurement 1

Setting	Instrument Value	Target Value
Start Frequency	2.44000 GHz	2.44000 GHz
Stop Frequency	2.44300 GHz	2.44300 GHz
Span	3.000 MHz	3.000 MHz
RBW	300.000 kHz	<= 300.000 kHz
VBW	300.000 kHz	>= 300.000 kHz
SweepPoints	101	~ 10
SweepTime	1.000 ms	AUTO
Reference Level	0.000 dBm	0.000 dBm
Attenuation	20.000 dB	AUTO
Detector	MaxPeak	MaxPeak
SweepCount	200	200
Filter	3 dB	3 dB
Trace Mode	Max Hold	Max Hold
SweepType	Sweep	Sweep
Preamp	off	off
Stablemode	Trace	Trace
Stablevalue	0.50 dB	0.50 dB
Run	15 / max. 150	max. 150
Stable	10 / 10	10
Max Stable Difference	0.01 dB	0.50 dB

FCC Part 47 §15.247 2400-2483.5 MHz 2017

Measurement 2

Setting	Instrument Value	Target Value
Start Frequency	2.44000 GHz	2.44000 GHz
Stop Frequency	2.44300 GHz	2.44300 GHz
Span	3.000 MHz	3.000 MHz
RBW	300.000 kHz	<= 300.000 kHz
VBW	300.000 kHz	>= 300.000 kHz
SweepPoints	101	~ 10
SweepTime	1.000 ms	AUTO
Reference Level	0.000 dBm	0.000 dBm
Attenuation	20.000 dB	AUTO
Detector	MaxPeak	MaxPeak
SweepCount	200	200
Filter	3 dB	3 dB
Trace Mode	Max Hold	Max Hold
SweepType	Sweep	Sweep
Preamp	off	off
Stablemode	Trace	Trace
Stablevalue	0.50 dB	0.50 dB
Run	12 / max. 150	max. 150
Stable	10 / 10	10
Max Stable Difference	0.18 dB	0.50 dB

FCC Part 47 §15.247 2400-2483.5 MHz 2017

Carrier Frequency Separation (2480 MHz; 5.000 dBm; 1 MHz; Test Mode)

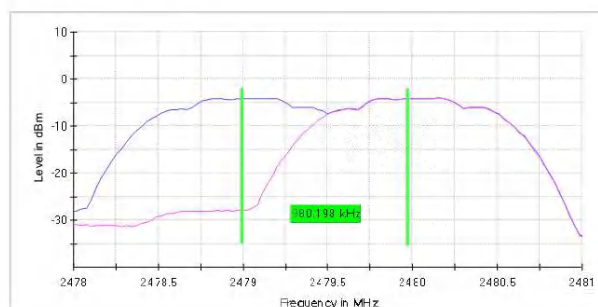
Test according to FCC title 47 part 15 §15.247(a), KDB 558074 D01 DTS Meas Guidance v04 and ANSI C63.10-2013

Result

DUT Frequency (MHz)	Frequency Separation (MHz)	Limit Min (MHz)	Limit Max (MHz)	Center Frequency low Channel (MHz)	Center Frequency high Channel (MHz)
2480.000000	0.980198	0.770000	---	2478.995050	2479.975248

(continuation of the "Result" table from column 6 ...)

DUT Frequency (MHz)	Result
2480.000000	PASS



Measurement 1

Setting	Instrument Value	Target Value
Start Frequency	2.47800 GHz	2.47800 GHz
Stop Frequency	2.48100 GHz	2.48100 GHz
Span	3.000 MHz	3.000 MHz
RBW	300.000 kHz	<= 300.000 kHz
VBW	300.000 kHz	>= 300.000 kHz
SweepPoints	101	~ 10
SweepTime	1.000 ms	AUTO
Reference Level	0.000 dBm	0.000 dBm
Attenuation	20.000 dB	AUTO
Detector	MaxPeak	MaxPeak
SweepCount	200	200
Filter	3 dB	3 dB
Trace Mode	Max Hold	Max Hold
SweepType	Sweep	Sweep
Preamp	off	off
Stablemode	Trace	Trace
Stablevalue	0.50 dB	0.50 dB
Run	19 / max. 150	max. 150
Stable	10 / 10	10
Max Stable Difference	0.00 dB	0.50 dB

FCC Part 47 §15.247 2400-2483.5 MHz 2017

Measurement 2

Setting	Instrument Value	Target Value
Start Frequency	2.47800 GHz	2.47800 GHz
Stop Frequency	2.48100 GHz	2.48100 GHz
Span	3.000 MHz	3.000 MHz
RBW	300.000 kHz	<= 300.000 kHz
VBW	300.000 kHz	>= 300.000 kHz
SweepPoints	101	~ 10
SweepTime	1.000 ms	AUTO
Reference Level	0.000 dBm	0.000 dBm
Attenuation	20.000 dB	AUTO
Detector	MaxPeak	MaxPeak
SweepCount	200	200
Filter	3 dB	3 dB
Trace Mode	Max Hold	Max Hold
SweepType	Sweep	Sweep
Preamp	off	off
Stablemode	Trace	Trace
Stablevalue	0.50 dB	0.50 dB
Run	12 / max. 150	max. 150
Stable	10 / 10	10
Max Stable Difference	0.01 dB	0.50 dB

Appendix B.4: Test Results of Number of Hopping Frequency

BDR mode (GFSK)

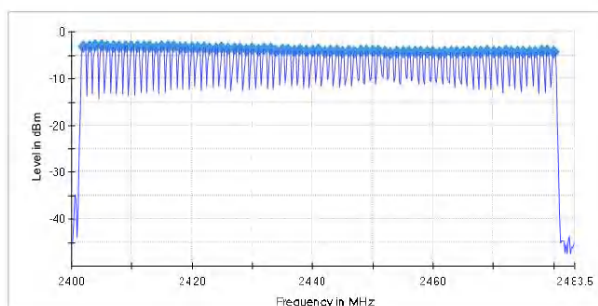
FCC Part 47 §15.247 2400-2483.5 MHz 2017

Hopping Frequencies (frequency independent; 5.000 dBm; 1 MHz)

Test according to FCC title 47 part 15 §15.247(a),(g), KDB 558074 D01 DTS Meas Guidance v04 and ANSI C63.10-2013

Channels

Channels	Limit Min	Limit Max	Result
79	15	---	PASS



Measurement

Setting	Instrument Value	Target Value
Start Frequency	2.40000 GHz	2.40000 GHz
Stop Frequency	2.48350 GHz	2.48350 GHz
Span	83.500 MHz	83.500 MHz
RBW	200.000 kHz	<= 299.000 kHz
VBW	200.000 kHz	>= 200.000 kHz
SweepPoints	418	~ 418
SweepTime	1.060 ms	AUTO
Reference Level	0.000 dBm	0.000 dBm
Attenuation	20.000 dB	AUTO
Detector	MaxPeak	MaxPeak
SweepCount	100	100
Filter	3 dB	3 dB
Trace Mode	Max Hold	Max Hold
SweepType	Sweep	AUTO
Preamp	off	off
Stablemode	Trace	Trace
Stablevalue	0.50 dB	0.50 dB
Run	46 / max. 150	max. 150
Stable	3 / 3	3
Max Stable Difference	0.18 dB	0.50 dB

EDR mode ($\pi/4$ -DQPSK)

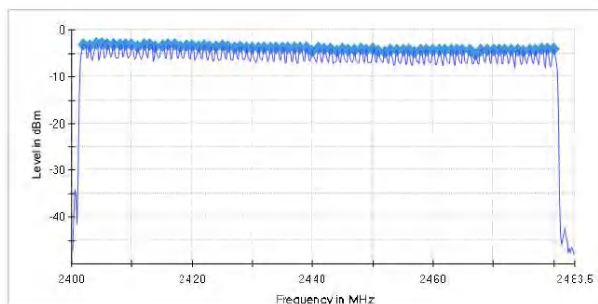
FCC Part 47 §15.247 2400-2483.5 MHz 2017

Hopping Frequencies (frequency independent; 5.000 dBm; 1 MHz)

Test according to FCC title 47 part 15 §15.247(a),(g), KDB 558074 D01 DTS Meas Guidance v04 and ANSI C63.10-2013

Channels

Channels	Limit Min	Limit Max	Result
79	15	—	PASS



Measurement

Setting	Instrument Value	Target Value
Start Frequency	2.40000 GHz	2.40000 GHz
Stop Frequency	2.48350 GHz	2.48350 GHz
Span	83.500 MHz	83.500 MHz
RBW	200.000 kHz	≤ 299.000 kHz
VBW	200.000 kHz	≥ 200.000 kHz
SweepPoints	418	~ 418
SweepTime	1.060 ms	AUTO
Reference Level	0.000 dBm	0.000 dBm
Attenuation	20.000 dB	AUTO
Detector	MaxPeak	MaxPeak
SweepCount	100	100
Filter	3 dB	3 dB
Trace Mode	Max Hold	Max Hold
SweepType	Sweep	AUTO
Preamplifier	off	off
Stablemode	Trace	Trace
Stablevalue	0.50 dB	0.50 dB
Run	120 / max. 150	max. 150
Stable	3 / 3	3
Max Stable Difference	0.00 dB	0.50 dB

Appendix B.5: Test Results of Time of Occupancy

BDR mode (GFSK)

FCC Part 47 §15.247 2400-2483.5 MHz 2017

Time of Channel Occupancy (2441 MHz; 5.000 dBm; 1 MHz)

Test according to FCC title 47 part 15 §15.247(a), KDB 558074 D01 DTS Meas Guidance v04 and ANSI C63.10-2013

Result

DUT Frequency (MHz)	Result	Number of Hops	Average time of occupancy (ms)	Threshold (dBm)
2441.000000	PASS	318	138.370	-15.0

Periode

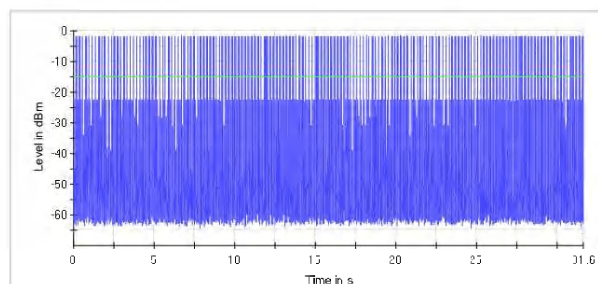
Min (ms)	Max (ms)	Mean (ms)
2.500	196.250	99.036

Transmit Time per Hop

Min (ms)	Max (ms)	Limit Max for Max (ms)	Limit Min for Max (ms)	Mean (ms)
0.43	0.86	400.000	0.000	0.434

DwellTime

Min (ms)	Max (ms)	Mean (ms)
0.43	1.680	0.436



Trace Threshold

FCC Part 47 §15.247 2400-2483.5 MHz 2017

Measurement

Setting	Instrument Value	Target Value
Center Frequency	2.44100 GHz	2.44100 GHz
Span	ZeroSpan	ZeroSpan
RBW	500.000 kHz	~ 500.000 kHz
VBW	1.000 MHz	~ 1.500 MHz
SweepPoints	30001	~ 30001
SweepTime	31.600 s	31.600 s
Reference Level	-10.000 dBm	-10.000 dBm
Attenuation	0.000 dB	0.000 dB
Detector	MaxPeak	MaxPeak
SweepCount	1	1
Filter	Channel	Channel
Trace Mode	Clear Write	Clear Write
SweepType	Sweep	AUTO
Preamp	off	off
Trigger	External	External
Trigger Offset	0.000 s	0.000 s

OSP

Setting	Instrument Value	Target Value
Measurement Time	31.600 s	31.600 s
Tracepoints	31600000	31600000
Time resolution	1.000 µs	1.000 µs
Detector	RMS	RMS

FCC Part 47 §15.247 2400-2483.5 MHz 2017

Time of Channel Occupancy(2) (2441 MHz; 5.000 dBm; 1 MHz)

Test according to FCC title 47 part 15 §15.247(a), KDB 558074 D01 DTS Meas Guidance v04 and ANSI C63.10-2013

Result

DUT Frequency (MHz)	Result	Number of Hops	Average time of occupancy (ms)	Threshold (dBm)
2441.000000	PASS	153	261.670	-15.0

Periode

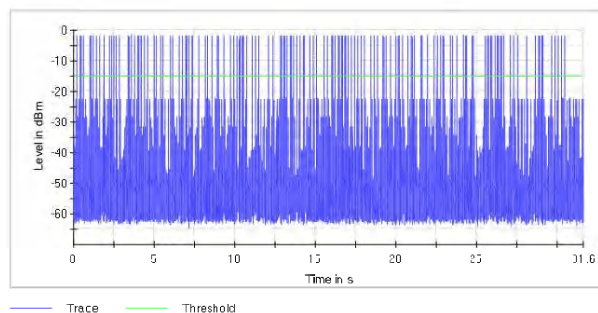
Min (ms)	Max (ms)	Mean (ms)
19.990	742.490	198.829

Transmit Time per Hop

Min (ms)	Max (ms)	Limit Max for Max (ms)	Limit Min for Max (ms)	Mean (ms)
1.680	3.380	400.000	0.000	1.699

DwellTime

Min (ms)	Max (ms)	Mean (ms)
1.680	4.190	1.705



FCC Part 47 §15.247 2400-2483.5 MHz 2017

Measurement

Setting	Instrument Value	Target Value
Center Frequency	2.44100 GHz	2.44100 GHz
Span	ZeroSpan	ZeroSpan
RBW	500.000 kHz	~ 500.000 kHz
VBW	1.000 MHz	~ 1.500 MHz
SweepPoints	30001	~ 30001
SweepTime	31.600 s	31.600 s
Reference Level	-10.000 dBm	-10.000 dBm
Attenuation	0.000 dB	0.000 dB
Detector	MaxPeak	MaxPeak
SweepCount	1	1
Filter	Channel	Channel
Trace Mode	Clear Write	Clear Write
SweepType	Sweep	AUTO
Preamp	off	off
Trigger	External	External
Trigger Offset	0.000 s	0.000 s

OSP

Setting	Instrument Value	Target Value
Measurement Time	31.600 s	31.600 s
Tracepoints	31600000	31600000
Time resolution	1.000 µs	1.000 µs
Detector	RMS	RMS

FCC Part 47 §15.247 2400-2483.5 MHz 2017

Time of Channel Occupancy(3) (2441 MHz; 5.000 dBm; 1 MHz)

Test according to FCC title 47 part 15 §15.247(a), KDB 558074 D01 DTS Meas Guidance v04 and ANSI C63.10-2013

Result

DUT Frequency (MHz)	Result	Number of Hops	Average time of occupancy (ms)	Threshold (dBm)
2441.000000	PASS	120	355.310	-15.0

Periode

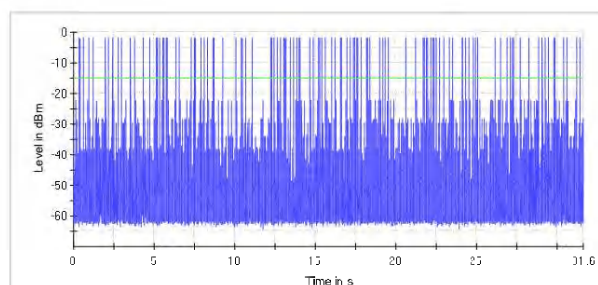
Min (ms)	Max (ms)	Mean (ms)
7.500	1121.230	258.903

Transmit Time per Hop

Min (ms)	Max (ms)	Limit Max for Max (ms)	Limit Min for Max (ms)	Mean (ms)
2.930	2.940	400.000	0.000	2.937

DwellTime

Min (ms)	Max (ms)	Mean (ms)
2.930	2.940	2.937



Trace Threshold

FCC Part 47 §15.247 2400-2483.5 MHz 2017

Measurement

Setting	Instrument Value	Target Value
Center Frequency	2.44100 GHz	2.44100 GHz
Span	ZeroSpan	ZeroSpan
RBW	500.000 kHz	~ 500.000 kHz
VBW	1.000 MHz	~ 1.500 MHz
SweepPoints	30001	~ 30001
SweepTime	31.600 s	31.600 s
Reference Level	-10.000 dBm	-10.000 dBm
Attenuation	0.000 dB	0.000 dB
Detector	MaxPeak	MaxPeak
SweepCount	1	1
Filter	Channel	Channel
Trace Mode	Clear Write	Clear Write
SweepType	Sweep	AUTO
Preamplifier	off	off
Trigger	External	External
Trigger Offset	0.000 s	0.000 s

OSP

Setting	Instrument Value	Target Value
Measurement Time	31.600 s	31.600 s
Tracepoints	31600000	31600000
Time resolution	1.000 µs	1.000 µs
Detector	RMS	RMS

EDR mode ($\pi/4$ -DQPSK)

FCC Part 47 §15.247 2400-2483.5 MHz 2017

Time of Channel Occupancy (2441 MHz; 5.000 dBm; 1 MHz)

Test according to FCC title 47 part 15 §15.247(a), KDB 558074 D01 DTS Meas Guidance v04 and ANSI C63.10-2013

Result

DUT Frequency (MHz)	Result	Number of Hops	Average time of occupancy (ms)	Threshold (dBm)
2441.000000	PASS	319	138.660	-15.0

Periode

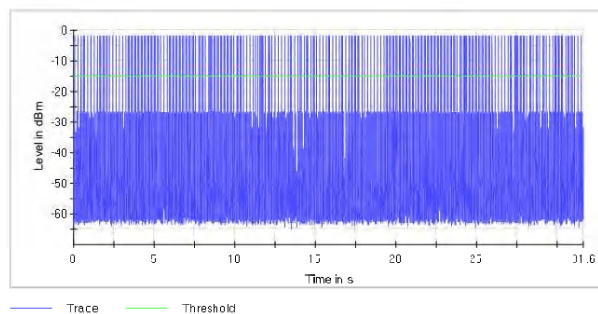
Min (ms)	Max (ms)	Mean (ms)
7.500	192.500	98.772

Transmit Time per Hop

Min (ms)	Max (ms)	Limit Max for Max (ms)	Limit Min for Max (ms)	Mean (ms)
0.41	0.45	400.000	0.000	0.433

DwellTime

Min (ms)	Max (ms)	Mean (ms)
0.44	0.45	0.442



FCC Part 47 §15.247 2400-2483.5 MHz 2017

Measurement

Setting	Instrument Value	Target Value
Center Frequency	2.44100 GHz	2.44100 GHz
Span	ZeroSpan	ZeroSpan
RBW	500.000 kHz	~ 500.000 kHz
VBW	1.000 MHz	~ 1.500 MHz
SweepPoints	30001	~ 30001
SweepTime	31.600 s	31.600 s
Reference Level	-10.000 dBm	-10.000 dBm
Attenuation	0.000 dB	0.000 dB
Detector	MaxPeak	MaxPeak
SweepCount	1	1
Filter	Channel	Channel
Trace Mode	Clear Write	Clear Write
SweepType	Sweep	AUTO
Preamplifier	off	off
Trigger	External	External
Trigger Offset	0.000 s	0.000 s

OSP

Setting	Instrument Value	Target Value
Measurement Time	31.600 s	31.600 s
Tracepoints	31600000	31600000
Time resolution	1.000 µs	1.000 µs
Detector	RMS	RMS

FCC Part 47 §15.247 2400-2483.5 MHz 2017

Time of Channel Occupancy(2) (2441 MHz; 5.000 dBm; 1 MHz)

Test according to FCC title 47 part 15 §15.247(a), KDB 558074 D01 DTS Meas Guidance v04 and ANSI C63.10-2013

Result

DUT Frequency (MHz)	Result	Number of Hops	Average time of occupancy (ms)	Threshold (dBm)
2441.000000	PASS	157	261.950	-15.0

Periode

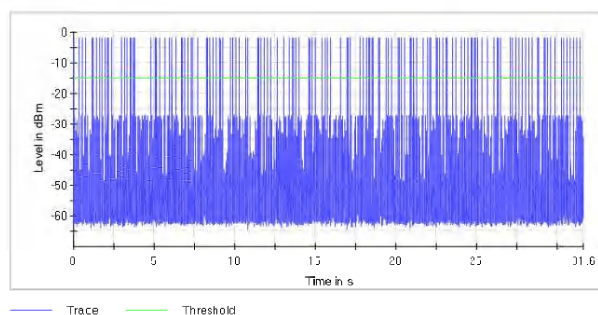
Min (ms)	Max (ms)	Mean (ms)
12.500	1034.990	200.029

Transmit Time per Hop

Min (ms)	Max (ms)	Limit Max for Max (ms)	Limit Min for Max (ms)	Mean (ms)
1.600	1.700	400.000	0.000	1.658

DwellTime

Min (ms)	Max (ms)	Mean (ms)
1.690	1.700	1.694



FCC Part 47 §15.247 2400-2483.5 MHz 2017

Measurement

Setting	Instrument Value	Target Value
Center Frequency	2.44100 GHz	2.44100 GHz
Span	ZeroSpan	ZeroSpan
RBW	500.000 kHz	~ 500.000 kHz
VBW	1.000 MHz	~ 1.500 MHz
SweepPoints	30001	~ 30001
SweepTime	31.600 s	31.600 s
Reference Level	-10.000 dBm	-10.000 dBm
Attenuation	0.000 dB	0.000 dB
Detector	MaxPeak	MaxPeak
SweepCount	1	1
Filter	Channel	Channel
Trace Mode	Clear Write	Clear Write
SweepType	Sweep	AUTO
Preamp	off	off
Trigger	External	External
Trigger Offset	0.000 s	0.000 s

OSP

Setting	Instrument Value	Target Value
Measurement Time	31.600 s	31.600 s
Tracepoints	31600000	31600000
Time resolution	1.000 µs	1.000 µs
Detector	RMS	RMS

FCC Part 47 §15.247 2400-2483.5 MHz 2017

Time of Channel Occupancy(3) (2441 MHz; 5.000 dBm; 1 MHz)

Test according to FCC title 47 part 15 §15.247(a), KDB 558074 D01 DTS Meas Guidance v04 and ANSI C63.10-2013

Result

DUT Frequency (MHz)	Result	Number of Hops	Average time of occupancy (ms)	Threshold (dBm)
2441.000000	PASS	101	293.260	-15.0

Periode

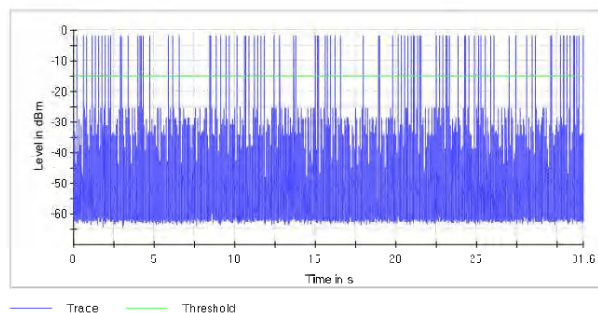
Min (ms)	Max (ms)	Mean (ms)
7.500	1904.960	311.507

Transmit Time per Hop

Min (ms)	Max (ms)	Limit Max for Max (ms)	Limit Min for Max (ms)	Mean (ms)
2.810	2.950	400.000	0.000	2.875

DwellTime

Min (ms)	Max (ms)	Mean (ms)
2.940	2.950	2.942



FCC Part 47 §15.247 2400-2483.5 MHz 2017

Measurement

Setting	Instrument Value	Target Value
Center Frequency	2.44100 GHz	2.44100 GHz
Span	ZeroSpan	ZeroSpan
RBW	500.000 kHz	~ 500.000 kHz
VBW	1.000 MHz	~ 1.500 MHz
SweepPoints	30001	~ 30001
SweepTime	31.600 s	31.600 s
Reference Level	-10.000 dBm	-10.000 dBm
Attenuation	0.000 dB	0.000 dB
Detector	MaxPeak	MaxPeak
SweepCount	1	1
Filter	Channel	Channel
Trace Mode	Clear Write	Clear Write
SweepType	Sweep	AUTO
Preamp	off	off
Trigger	External	External
Trigger Offset	0.000 s	0.000 s

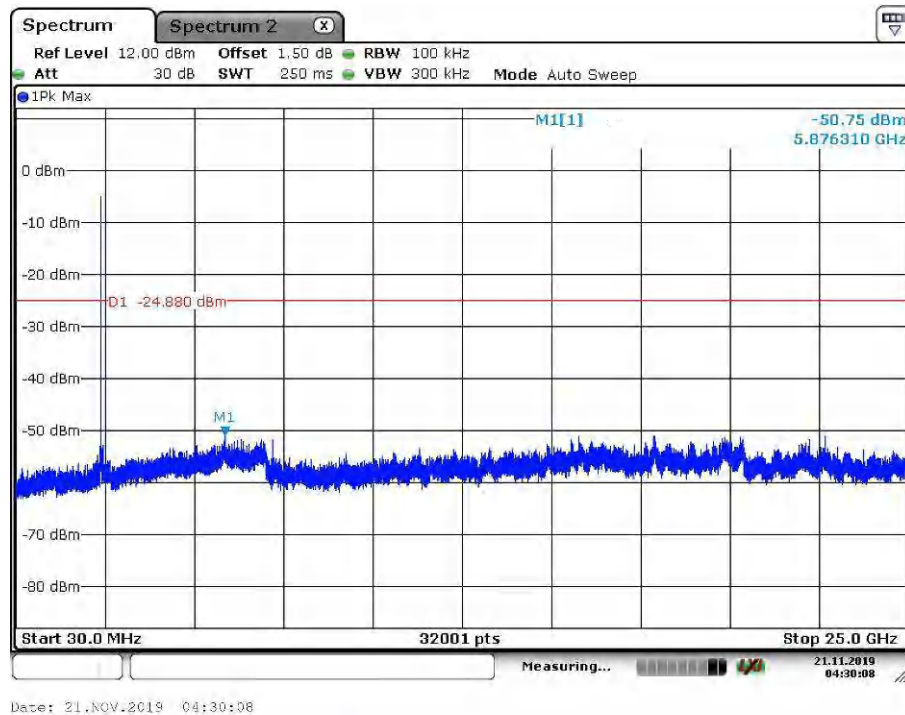
OSP

Setting	Instrument Value	Target Value
Measurement Time	31.600 s	31.600 s
Tracepoints	31600000	31600000
Time resolution	1.000 µs	1.000 µs
Detector	RMS	RMS

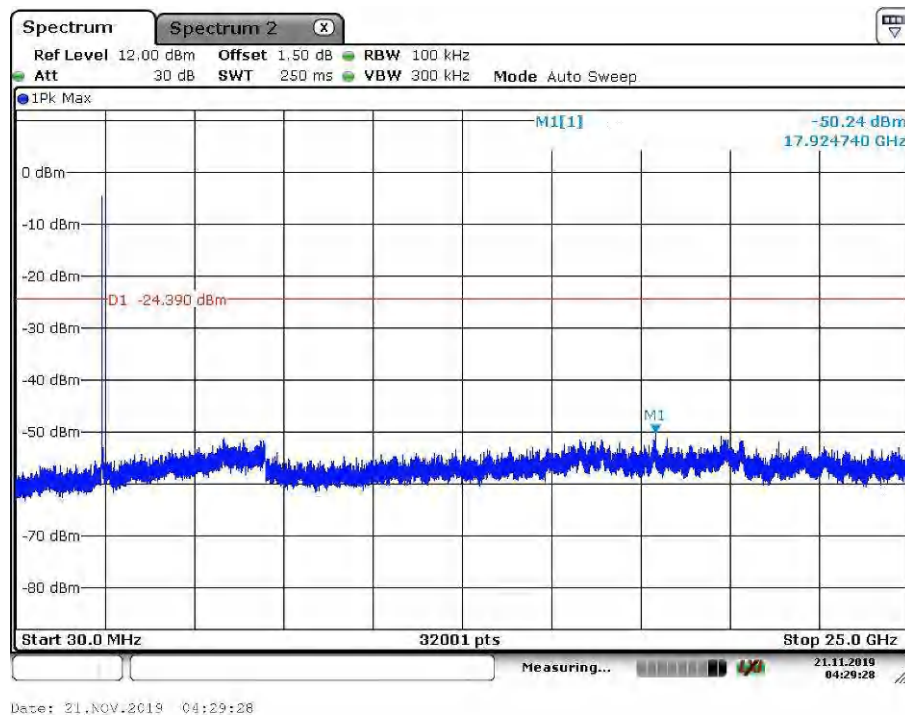
Appendix B.6: Test Results of Conducted Spurious Emissions Measured in 100 kHz Bandwidth

BDR mode (GFSK)

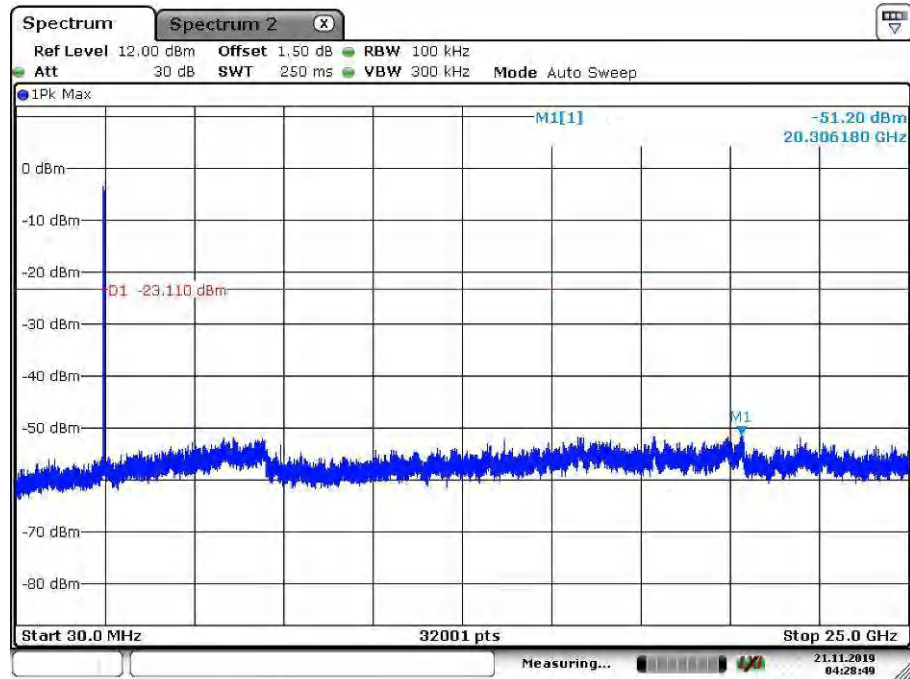
Low Channel



Middle Channel

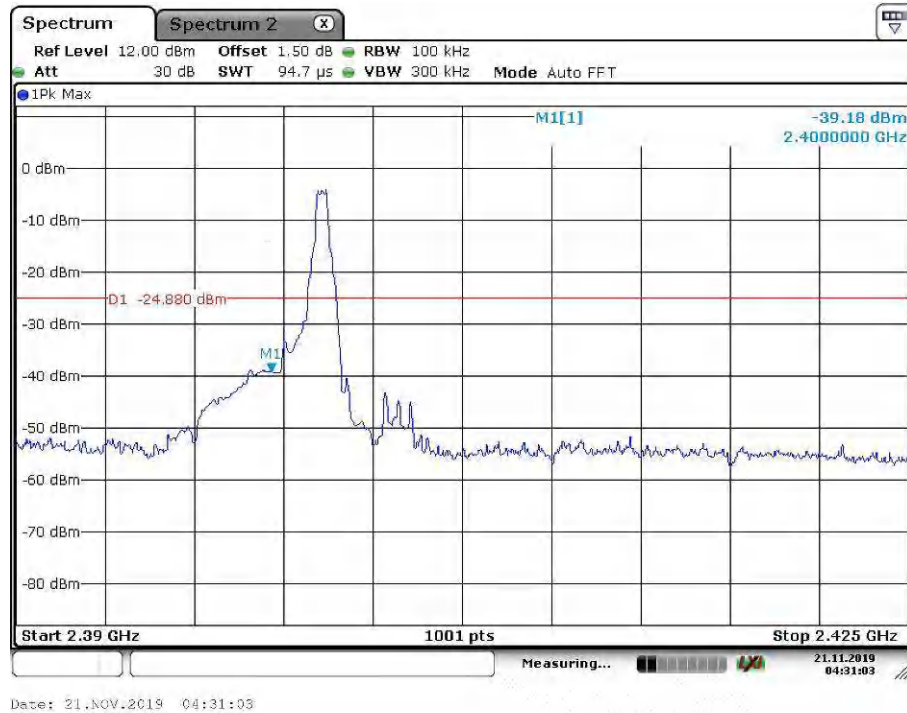


High Channel

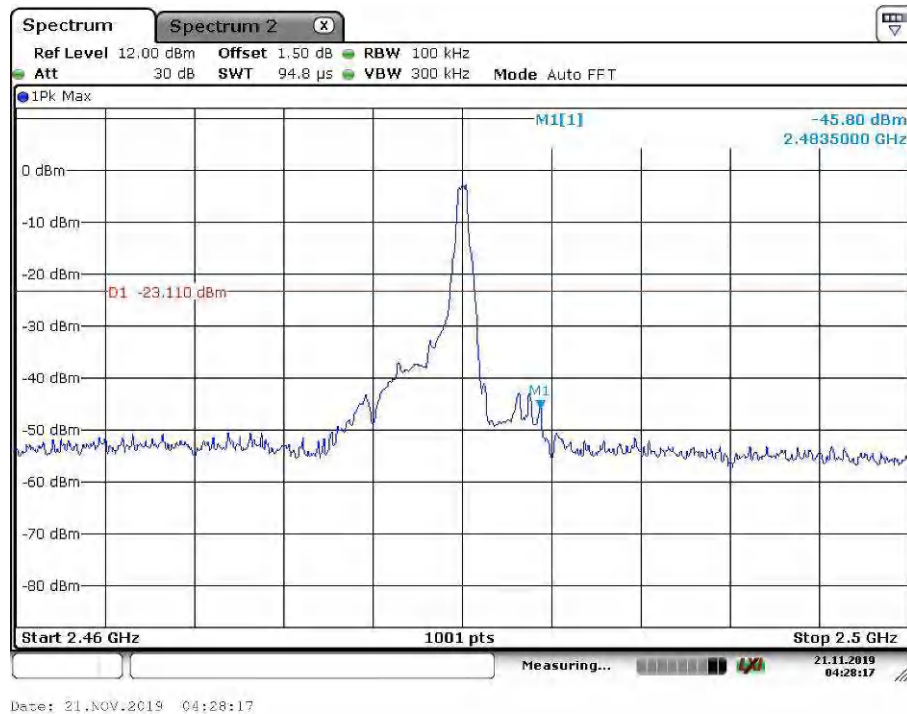


Date: 21.NOV.2019 04:28:49

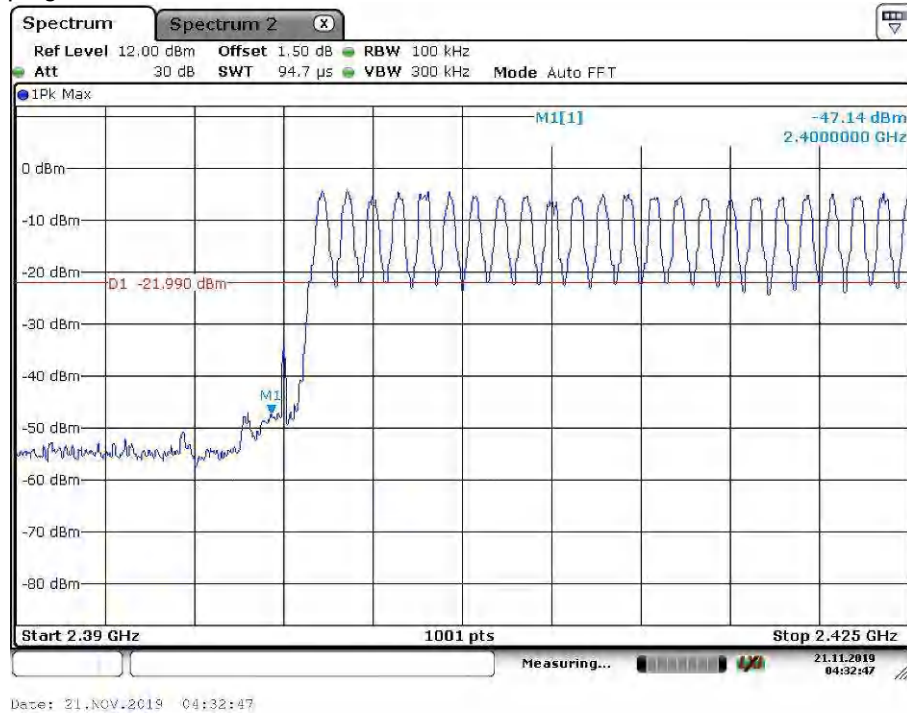
Band Edge, Low Channel



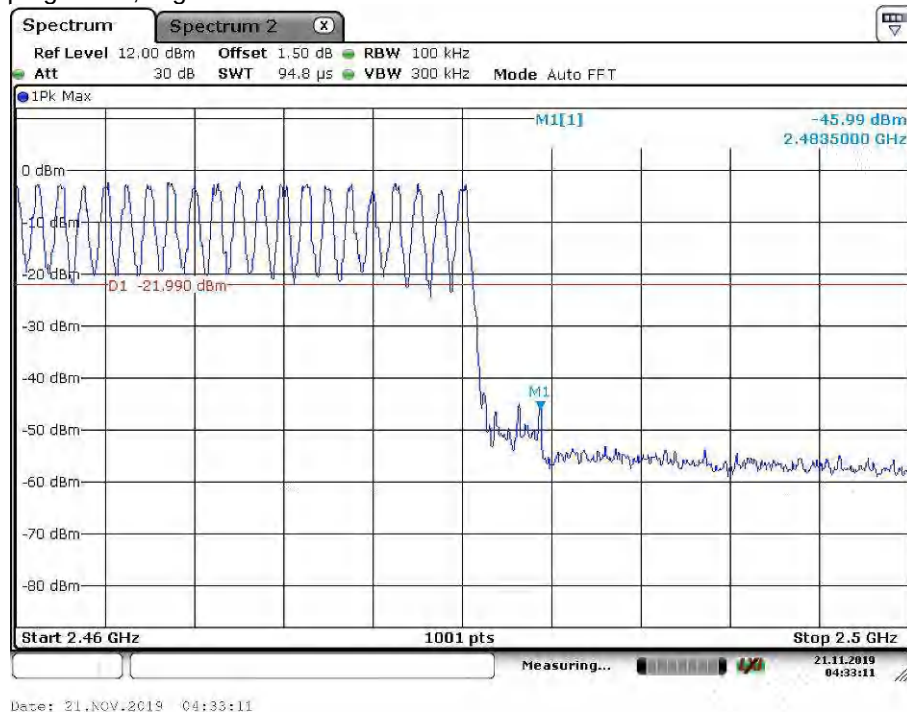
Band Edge, High Channel



Band Edge, Hopping Mode, Low Channel

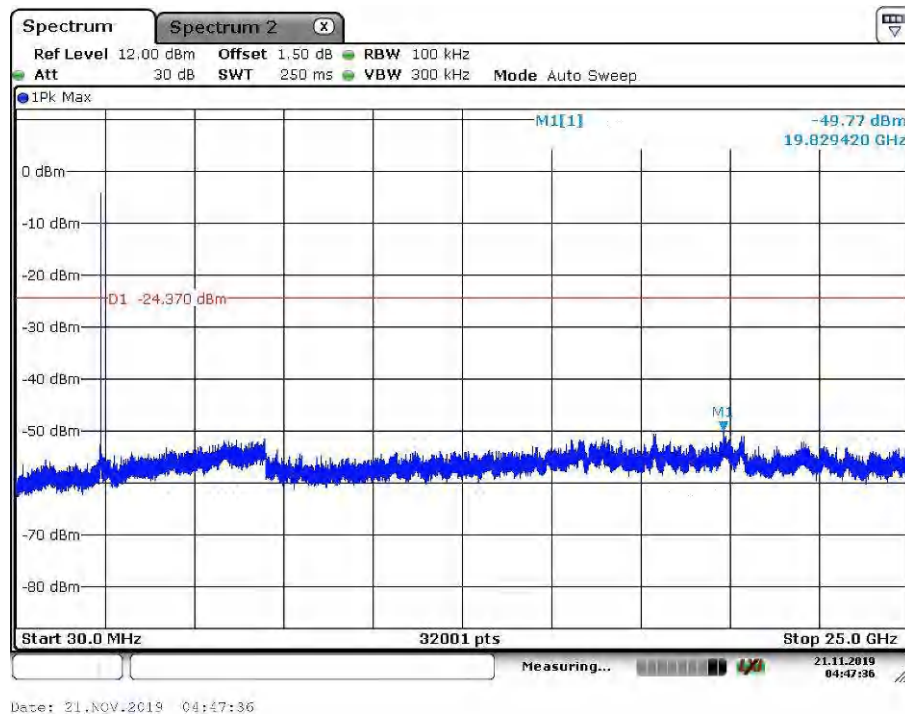


Band Edge, Hopping Mode, High Channel

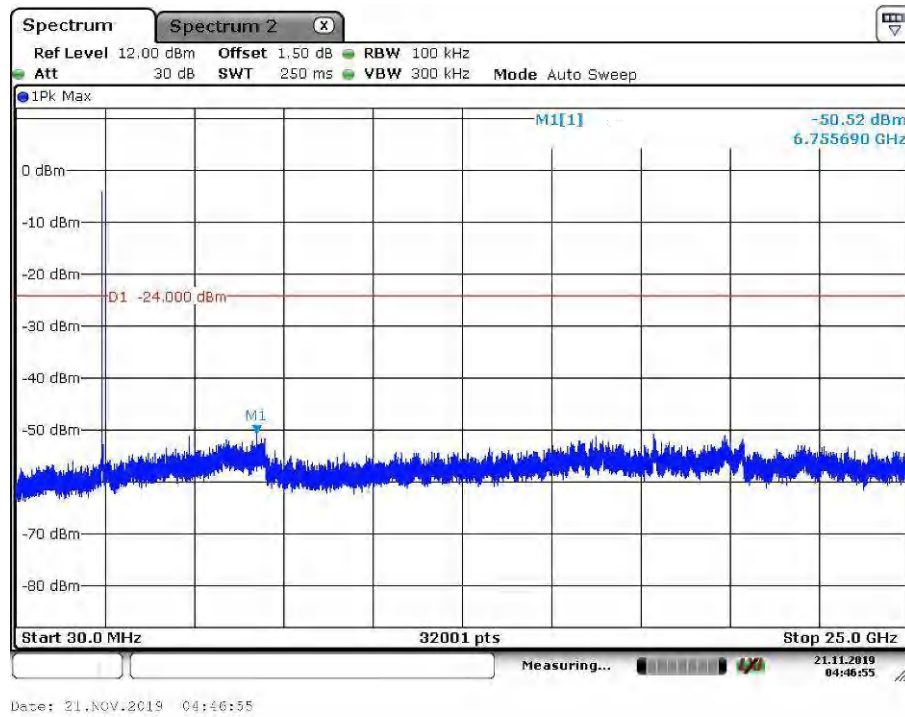


EDR mode ($\pi/4$ -DQPSK)

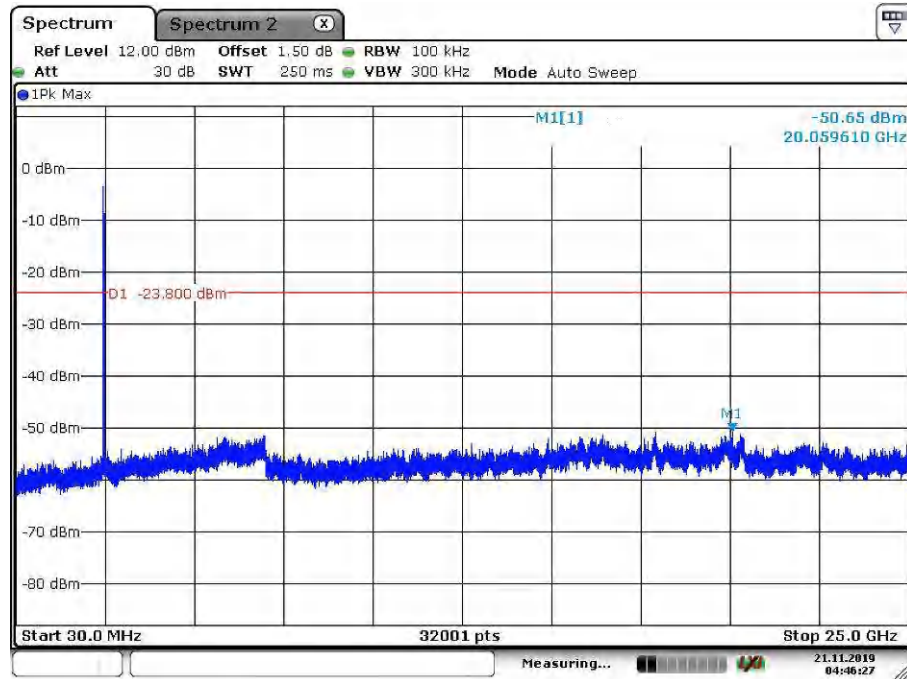
Low Channel



Middle Channel

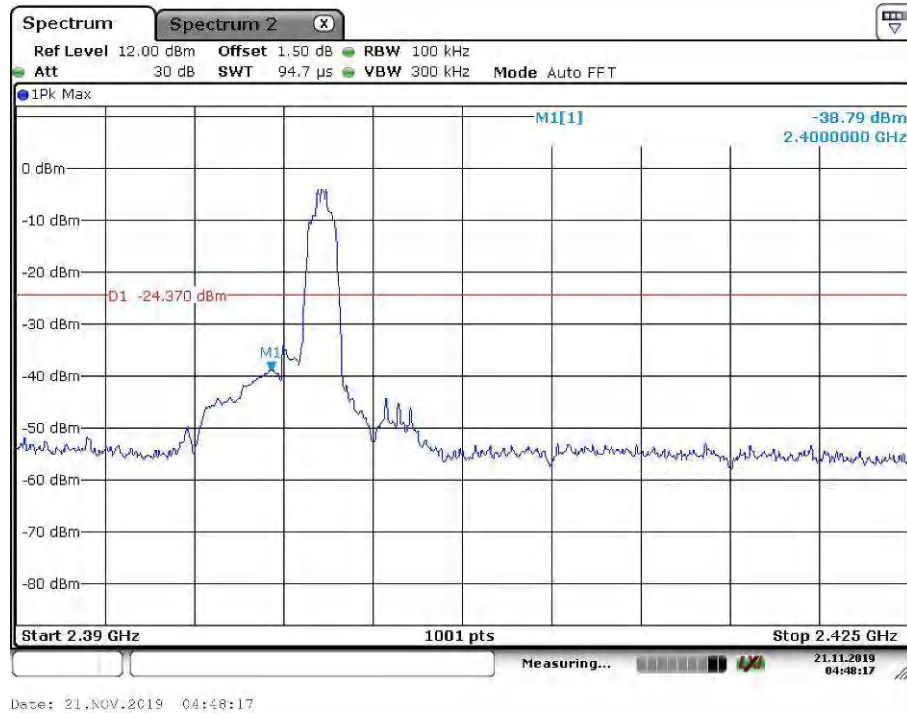


High Channel

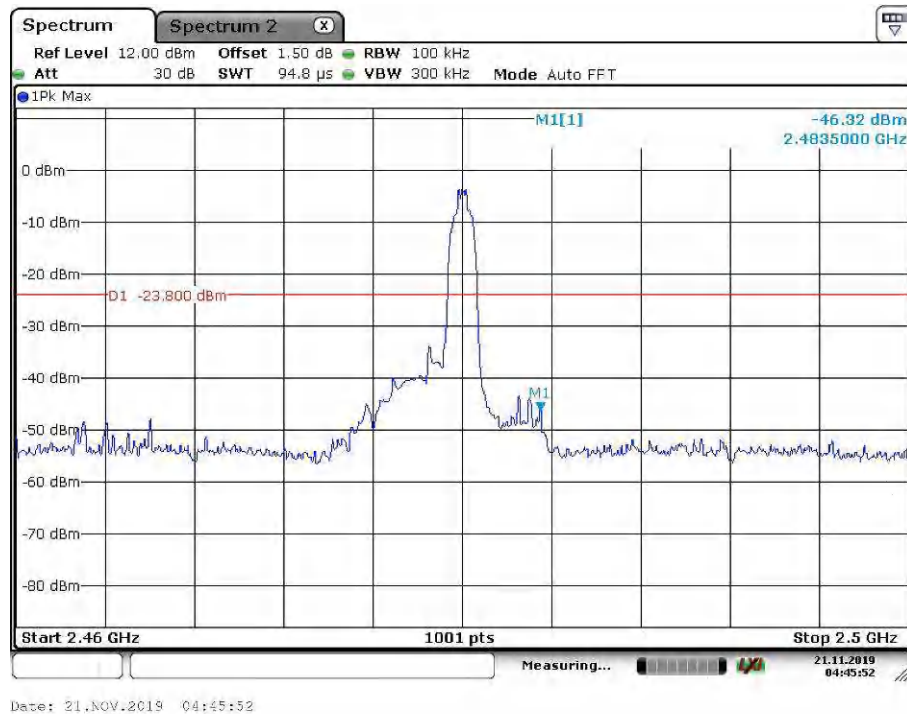


Date: 21.NOV.2019 04:46:27

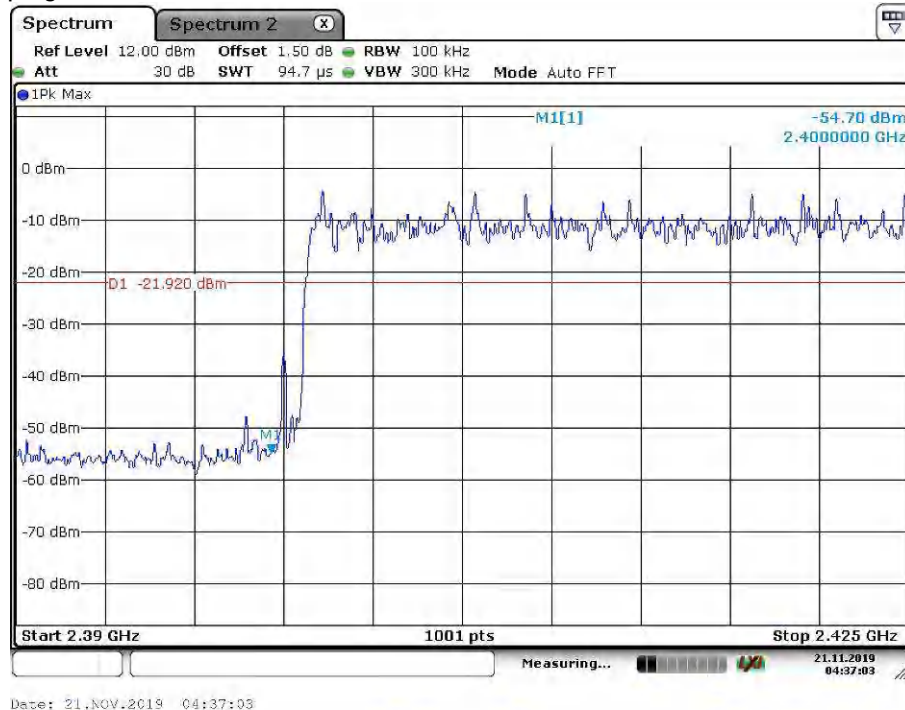
Band Edge, Low Channel



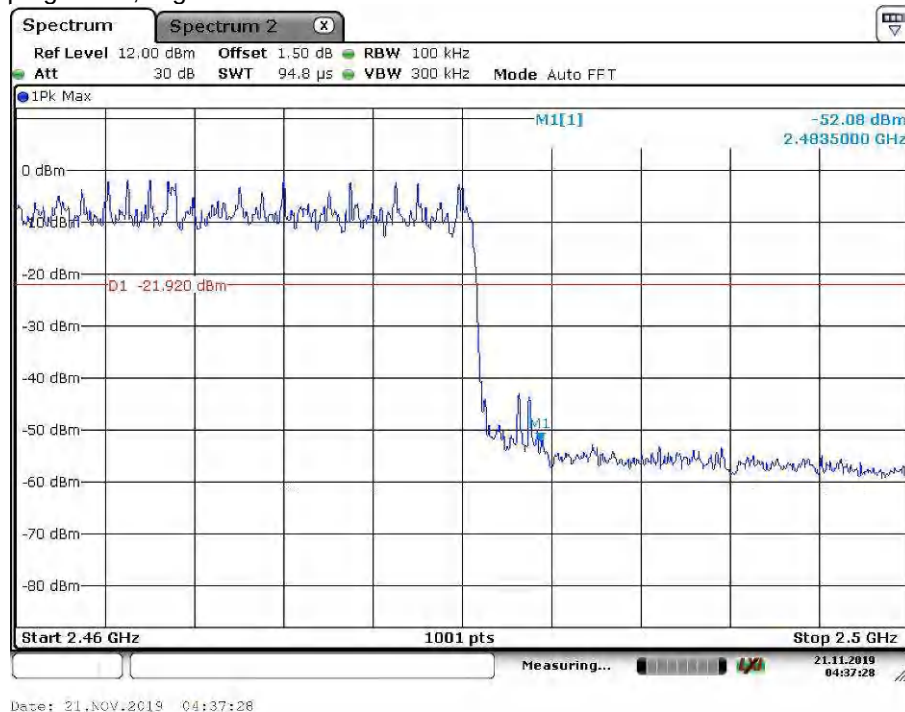
Band Edge, High Channel



Band Edge, Hopping Mode, Low Channel



Band Edge, Hopping Mode, High Channel



Note: Testing was carried out within frequency range 9kHz to the tenth harmonics. The measurement results below 30MHz and 18GHz - 26.5GHz were greater than 20dB below the limit, so only the radiated spurious emissions from 30MHz to 18GHz were reported.

Appendix B.7: Test Results of Radiated Spurious Emissions

Note: This testing was carried out on different modulations, but only the worst case (GFSK) was presented in this report.

30MHz - 1GHz

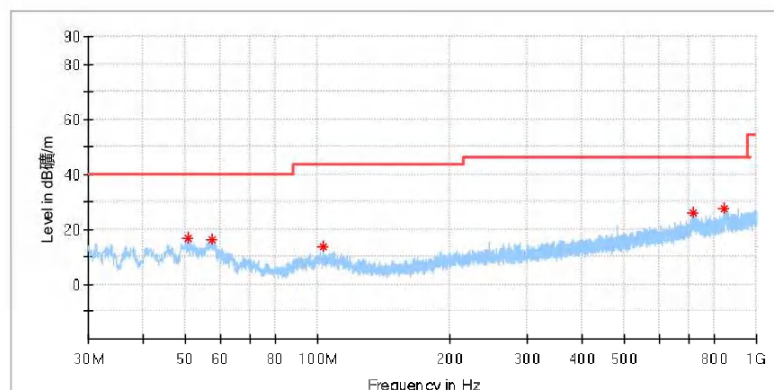
Test

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Test Report

EUT Information

EUT Name:	V2 TWS Earbuds
Model:	TWSEBBKV2PRM
TestMode:	TX_Low Channel
TestVoltage::	Fully charged battery
Remark:	Temp:23; Humi:48%
Test Standard:	FCC 15.247
Tested By:	Kei Zhang
Reviewed By:	Terry Yin



Critical Freqs

Frequency (MHz)	MaxPeak (dBμV/m)	Average (dBμV/m)	Limit (dBμV/m)	Margin (dB)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB/m)
50.709500	16.82	---	40.00	23.18	100.0	H	1.0	-18.6
57.596500	16.26	---	40.00	23.74	100.0	H	218.0	-19.0
103.041000	13.89	---	43.50	29.61	100.0	H	104.0	-19.2
718.894000	26.25	---	46.00	19.75	100.0	H	153.0	-8.1
845.527500	27.39	---	46.00	18.61	100.0	H	309.0	-6.0

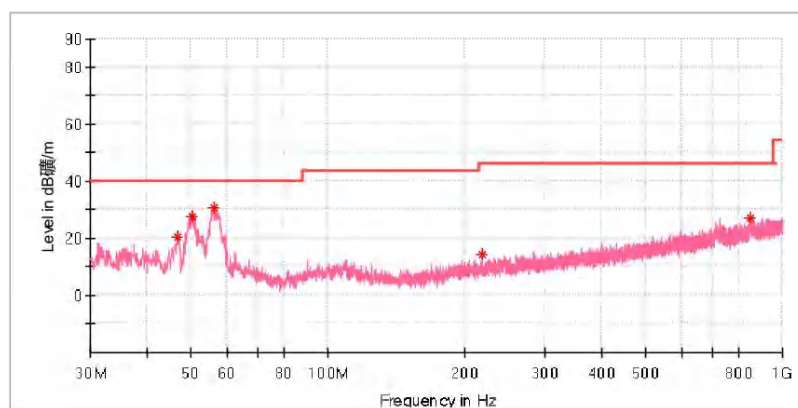
Test

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Test Report

EUT Information

EUT Name:	V2 TWS Earbuds
Model:	TWSEBBKV2PRM
Test Mode:	TX_Low Channel
Test Voltage:	Fully charged battery
Remark:	Temp:23; Humi:48%
Test Standard:	FCC 15.247
Tested By:	Kei Zhang
Reviewed By:	Terry Yin



Critical Freqs

Frequency (MHz)	MaxPeak (dBµV/m)	Average (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB/m)
46.829500	20.56	---	40.00	19.44	100.0	V	306.0	-18.9
50.321500	27.54	---	40.00	12.46	100.0	V	330.0	-18.6
56.044500	30.63	---	40.00	9.37	100.0	V	306.0	-18.8
218.228500	14.33	---	46.00	31.67	100.0	V	92.0	-19.0
846.982500	27.05	---	46.00	18.95	100.0	V	347.0	-6.0

20/11/2019

2:34:12 PM

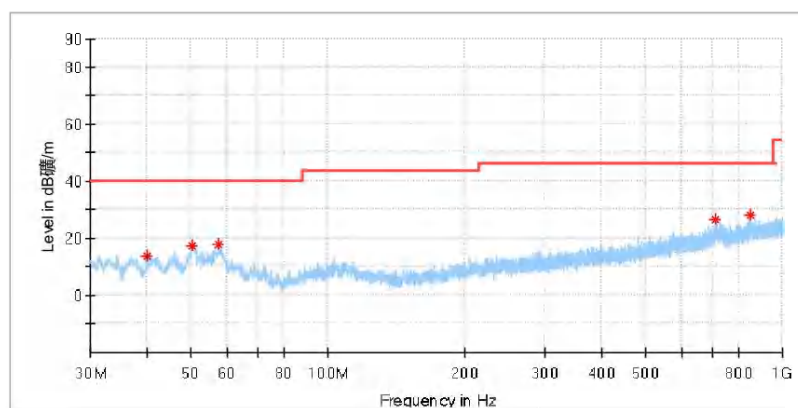
Test

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Test Report

EUT Information

EUT Name: V2 TWS Earbuds
Model: TWSEBBKV2PRM
Test Mode: TX_High Channel
Test Voltage: Fully charged battery
Remark: Temp:23; Humi:48%
Test Standard: FCC 15.247
Tested By: Kei Zhang
Reviewed By: Terry Yin



Critical Freqs

Frequency (MHz)	MaxPeak (dBμV/m)	Average (dBμV/m)	Limit (dBμV/m)	Margin (dB)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB/m)
39.894000	13.76	---	40.00	26.24	100.0	H	295.0	-20.4
50.127500	17.33	---	40.00	22.67	100.0	H	328.0	-18.6
57.596500	18.06	---	40.00	21.94	100.0	H	256.0	-19.0
709.630500	26.62	---	46.00	19.38	100.0	H	109.0	-8.3
846.982500	28.25	---	46.00	17.75	100.0	H	240.0	-6.0

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2:34:12 PM

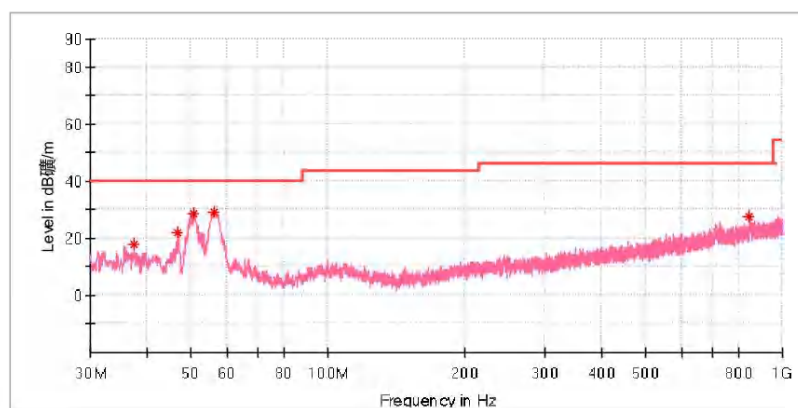
Test

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Test Report

EUT Information

EUT Name:	V2 TWS Earbuds
Model:	TWSEBBKV2PRM
Test Mode:	TX_High Channel
Test Voltage:	Fully charged battery
Remark:	Temp:23; Humi:48%
Test Standard:	FCC 15.247
Tested By:	Kei Zhang
Reviewed By:	Terry Yin



Critical Freqs

Frequency (MHz)	MaxPeak (dBμV/m)	Average (dBμV/m)	Limit (dBμV/m)	Margin (dB)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB/m)
37.469000	17.74	---	40.00	22.26	100.0	V	9.0	-21.3
46.878000	21.91	---	40.00	18.09	100.0	V	164.0	-18.9
50.855000	28.52	---	40.00	11.48	100.0	V	58.0	-18.6
56.141500	29.12	---	40.00	10.88	100.0	V	41.0	-18.9
845.382000	27.63	---	46.00	18.37	100.0	V	254.0	-6.0

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2:34:12 PM

Above 1GHz

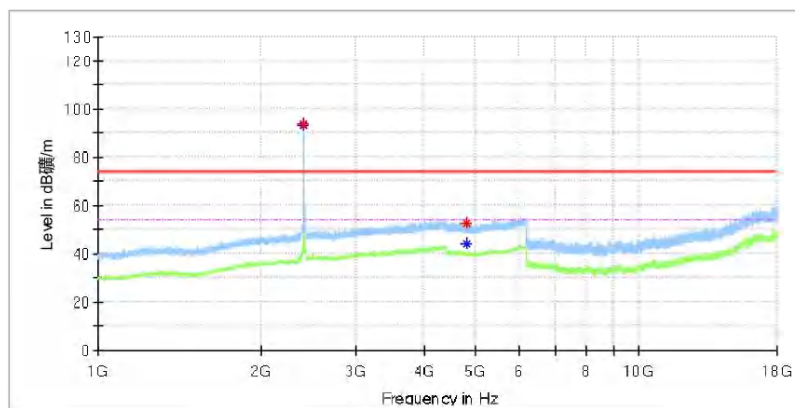
Test

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Test Report

EUT Information

EUT Name:	V2 TWS Earbuds
Model:	TWSEBBKV2PRM
Test Mode:	TX_Low Channel
Test Voltage:	Fully charged battery
Remark:	Temp:23; Humi:48%
Test Standard:	FCC 15.247
Tested By:	Kei Zhang
Reviewed By:	Terry Yin



Critical Freqs

Frequency (MHz)	MaxPeak (dBμV/m)	Average (dBμV/m)	Limit (dBμV/m)	Margin (dB)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB/m)
2402.000000	---	92.90	54.00	-38.90	100.0	H	291.0	7.0
2402.000000	93.51	---	74.00	-19.51	100.0	H	291.0	7.0
4801.000000	52.46	---	74.00	21.54	100.0	H	305.0	13.6
4801.000000	---	43.91	54.00	10.09	100.0	H	305.0	13.6

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10:55:16 AM

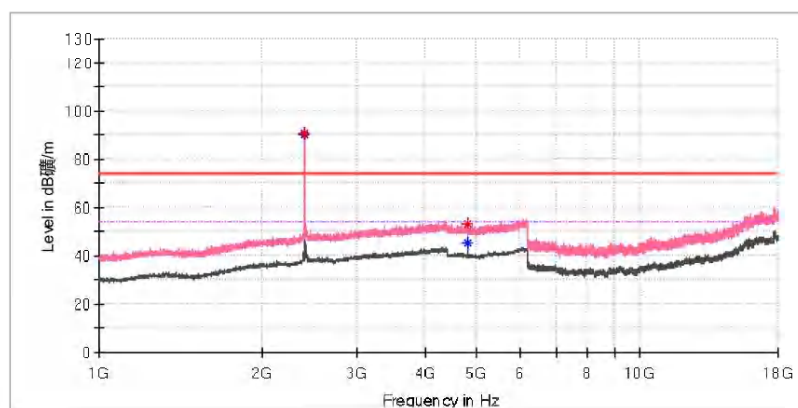
Test

2 / 6

Test Report

EUT Information

EUT Name:	V2 TWS Earbuds
Model:	TWSEBBKV2PRM
Test Mode:	TX_Low Channel
Test Voltage:	Fully charged battery
Remark:	Temp:23; Humi:48%
Test Standard:	FCC 15.247
Tested By:	Kei Zhang
Reviewed By:	Terry Yin



Critical Freqs

Frequency (MHz)	MaxPeak (dBμV/m)	Average (dBμV/m)	Limit (dBμV/m)	Margin (dB)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB/m)
2402.000000	---	90.17	54.00	-36.17	100.0	V	94.0	7.0
2402.000000	90.65	---	74.00	-16.65	100.0	V	94.0	7.0
4801.000000	---	45.21	54.00	8.79	100.0	V	142.0	13.6
4801.000000	53.08	---	74.00	20.92	100.0	V	142.0	13.6

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10:55:16 AM

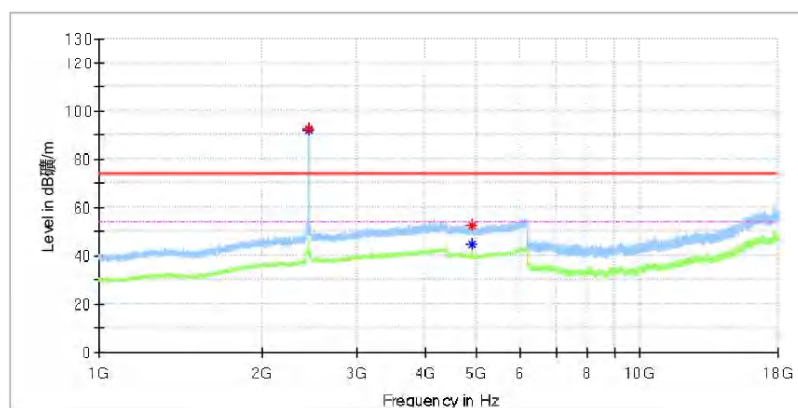
Test

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Test Report

EUT Information

EUT Name:	V2 TWS Earbuds
Model:	TWSEBBKV2PRM
Test Mode:	TX_Mid Channel
Test Voltage:	Fully charged battery
Remark:	Temp:23; Humi:48%
Test Standard:	FCC 15.247
Tested By:	Kei Zhang
Reviewed By:	Terry Yin



Critical Freqs

Frequency (MHz)	MaxPeak (dBμV/m)	Average (dBμV/m)	Limit (dBμV/m)	Margin (dB)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB/m)
2441.000000	---	91.71	54.00	-37.71	100.0	H	293.0	7.4
2441.000000	92.22	---	74.00	-18.22	100.0	H	293.0	7.4
4879.000000	---	45.04	54.00	8.96	100.0	H	259.0	13.4
4879.000000	52.62	---	74.00	21.38	100.0	H	259.0	13.4

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10:55:16 AM

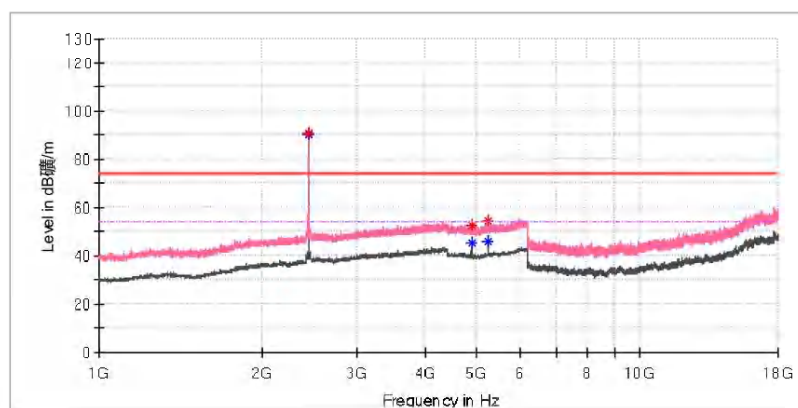
Test

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Test Report

EUT Information

EUT Name:	V2 TWS Earbuds
Model:	TWSEBBKV2PRM
Test Mode:	TX_Mid Channel
Test Voltage:	Fully charged battery
Remark:	Temp:23; Humi:48%
Test Standard:	FCC 15.247
Tested By:	Kei Zhang
Reviewed By:	Terry Yin



Critical Freqs

Frequency (MHz)	MaxPeak (dBμV/m)	Average (dBμV/m)	Limit (dBμV/m)	Margin (dB)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB/m)
2441.000000	---	90.04	54.00	-36.04	100.0	V	100.0	7.4
2441.000000	90.61	---	74.00	-16.61	100.0	V	100.0	7.4
4879.000000	52.50	---	74.00	21.50	100.0	V	37.0	13.4
4879.000000	---	45.20	54.00	8.80	100.0	V	37.0	13.4
5224.500000	---	46.02	54.00	7.98	100.0	V	0.0	13.9
5224.500000	54.44	---	74.00	19.56	100.0	V	0.0	13.9

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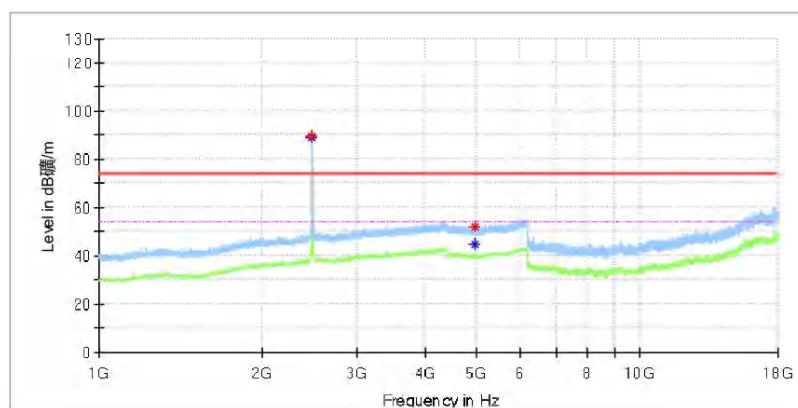
Test

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Test Report

EUT Information

EUT Name:	V2 TWS Earbuds
Model:	TWSEBBKV2PRM
Test Mode:	TX_High Channel
Test Voltage:	Fully charged battery
Remark:	Temp:23; Humi:48%
Test Standard:	FCC 15.247
Tested By:	Kei Zhang
Reviewed By:	Terry Yin



Critical Freqs

Frequency (MHz)	MaxPeak (dBμV/m)	Average (dBμV/m)	Limit (dBμV/m)	Margin (dB)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB/m)
2480.000000	---	88.69	54.00	-34.69	100.0	H	345.0	7.4
2480.000000	89.26	---	74.00	-15.26	100.0	H	345.0	7.4
4957.000000	---	45.04	54.00	8.96	100.0	H	260.0	13.2
4957.500000	52.17	---	74.00	21.83	100.0	H	251.0	13.2

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10:55:16 AM

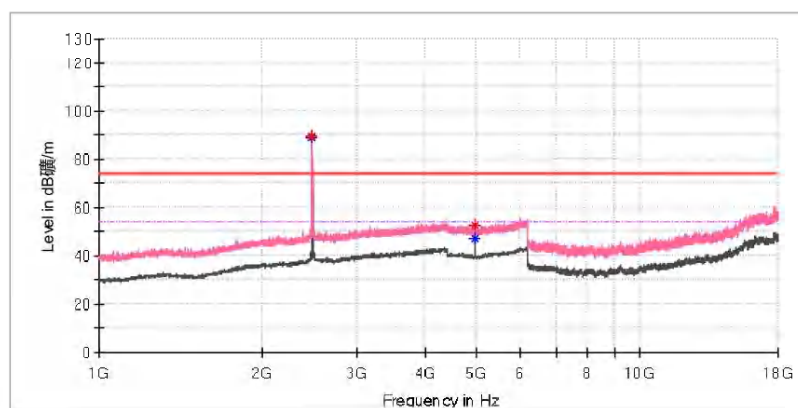
Test

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Test Report

EUT Information

EUT Name:	V2 TWS Earbuds
Model:	TWSEBBKV2PRM
Test Mode:	TX_High Channel
Test Voltage:	Fully charged battery
Remark:	Temp:23; Humi:48%
Test Standard:	FCC 15.247
Tested By:	Kei Zhang
Reviewed By:	Terry Yin



Critical Freqs

Frequency (MHz)	MaxPeak (dBμV/m)	Average (dBμV/m)	Limit (dBμV/m)	Margin (dB)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB/m)
2480.000000	---	88.62	54.00	-34.62	100.0	V	99.0	7.4
2480.000000	89.34	---	74.00	-15.34	100.0	V	99.0	7.4
4957.000000	---	47.39	54.00	6.61	100.0	V	342.0	13.2
4957.500000	52.39	---	74.00	21.61	100.0	V	38.0	13.2

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Remark: In this appendix, the model No. TWSEBBKV2PRM is replaced by TWSEBBKV3PRM-FOB, they are totally identical except model No.

Appendix B.8: Test Results of Radiated Emissions in Restricted Bands

Note: This testing was carried out on different modulations, but only the worst case (GFSK) was presented in this report.

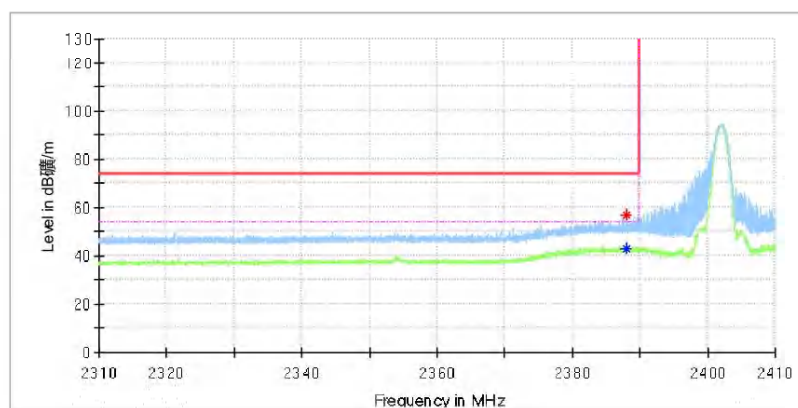
Test

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Test Report

EUT Information

EUT Name:	V2 TWS Earbuds
Model:	TWSEBBKV2PRM
Test Mode:	TX_Low Channel
Test Voltage:	Fully charged battery
Remark:	Temp:23; Humi:48%
Test Standard:	FCC 15.247
Tested By:	Kei Zhang
Reviewed By:	Terry Yin



Critical Freqs

Frequency (MHz)	MaxPeak (dBμV/m)	Average (dBμV/m)	Limit (dBμV/m)	Margin (dB)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB/m)
2387.985294	56.90	—	74.00	17.10	100.0	H	291.0	7.0
2388.073529	—	43.14	54.00	10.86	100.0	H	201.0	7.0

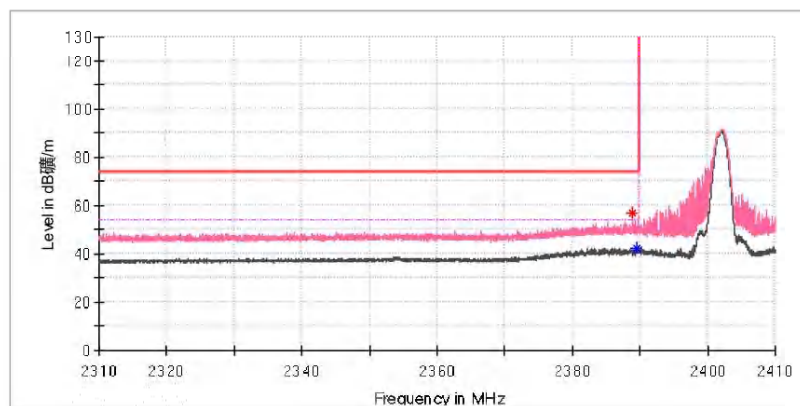
Test

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Test Report

EUT Information

EUT Name:	V2 TWS Earbuds
Model:	TWSEBBKV2PRM
Test Mode:	TX_Low Channel
Test Voltage:	Fully charged battery
Remark:	Temp:23; Humi:48%
Test Standard:	FCC 15.247
Tested By:	Kei Zhang
Reviewed By:	Terry Yin



Critical Freqs

Frequency (MHz)	MaxPeak (dBμV/m)	Average (dBμV/m)	Limit (dBμV/m)	Margin (dB)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB/m)
2388.882353	56.74	---	74.00	17.26	100.0	V	91.0	7.0
2389.602941	---	42.41	54.00	11.59	100.0	V	182.0	7.0

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10:44:36 AM

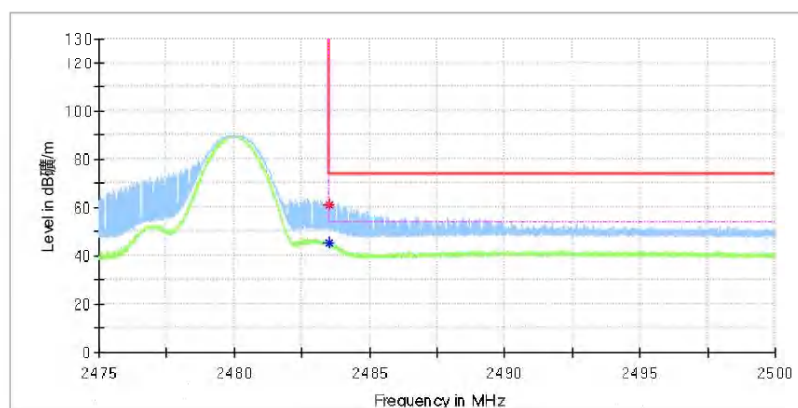
Test

3 / 4

Test Report

EUT Information

EUT Name:	V2 TWS Earbuds
Model:	TWSEBBKV2PRM
Test Mode:	TX_High Channel
Test Voltage:	Fully charged battery
Remark:	Temp:23; Humi:48%
Test Standard:	FCC 15.247
Tested By:	Kei Zhang
Reviewed By:	Terry Yin



Critical Freqs

Frequency (MHz)	MaxPeak (dBμV/m)	Average (dBμV/m)	Limit (dBμV/m)	Margin (dB)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB/m)
2483.525735	---	45.11	54.00	8.89	100.0	H	299.0	7.4
2483.529412	61.22	---	74.00	12.78	100.0	H	341.0	7.4

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10:44:36 AM

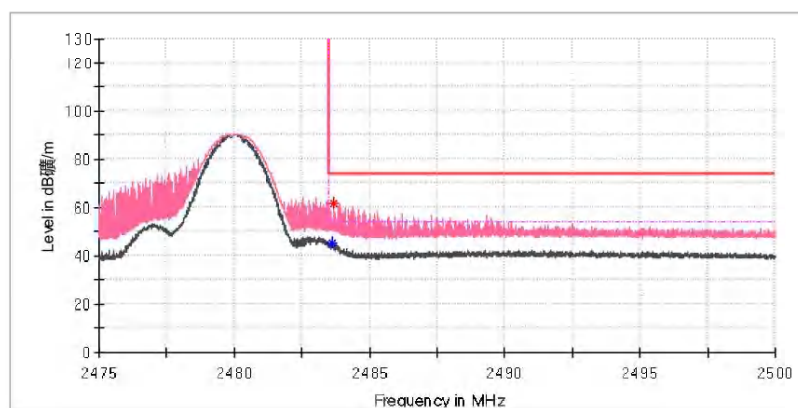
Test

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Test Report

EUT Information

EUT Name:	V2 TWS Earbuds
Model:	TWSEBBKV2PRM
Test Mode:	TX_High Channel
Test Voltage:	Fully charged battery
Remark:	Temp:23; Humi:48%
Test Standard:	FCC 15.247
Tested By:	Kei Zhang
Reviewed By:	Terry Yin



Critical Freqs

Frequency (MHz)	MaxPeak (dBμV/m)	Average (dBμV/m)	Limit (dBμV/m)	Margin (dB)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB/m)
2483.625000	---	45.57	54.00	8.43	100.0	V	94.0	7.4
2483.654412	61.92	---	74.00	12.08	100.0	V	94.0	7.4

20/11/2019

10:44:36 AM

Remark: In this appendix, the model No. TWSEBBKV2PRM is replaced by TWSEBBKV3PRM-FOB, they are totally identical except model No.

Appendix C: Test Results of FCC 15B

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Appendix C.1: Test Plots of Conducted Emission on AC Mains

Charging mode for charger box

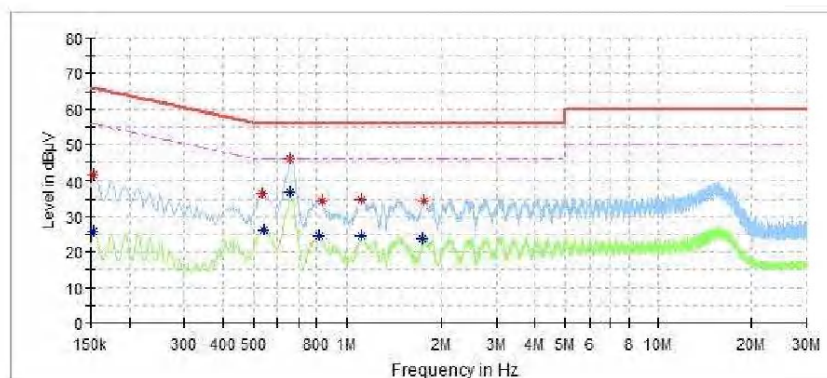
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Test Report

EUT Information

EUT Name:	V2 TWS Earbuds
Model:	TWSEEBBKV2PRM
Order No.:	168139923
Test Mode:	Charging mode
Test Voltage:	AC 120V/60Hz
Test By:	Charlie Wang
Review By:	Gary Chen



Critical Freqs

Frequency (MHz)	MaxPeak (dBµV)	Average (dBµV)	Limit (dBµV)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Line	Corr. (dB)
0.154000	---	25.85	55.78	29.93	---	---	L1	9.6
0.154000	41.28	---	65.78	24.50	---	---	L1	9.6
0.536000	36.49	---	56.00	19.51	---	---	L1	9.7
0.540000	---	26.13	46.00	19.87	---	---	L1	9.7
0.660000	45.85	---	56.00	10.15	---	---	L1	9.7
0.660000	---	37.00	46.00	9.00	---	---	L1	9.7
0.812000	---	24.69	46.00	21.31	---	---	L1	9.7
0.832000	34.61	---	56.00	21.39	---	---	L1	9.7
1.112000	34.76	---	56.00	21.24	---	---	L1	9.7
1.116000	---	24.52	46.00	21.48	---	---	L1	9.7
1.744000	---	23.94	46.00	22.06	---	---	L1	9.7
1.760000	34.60	---	56.00	21.40	---	---	L1	9.7

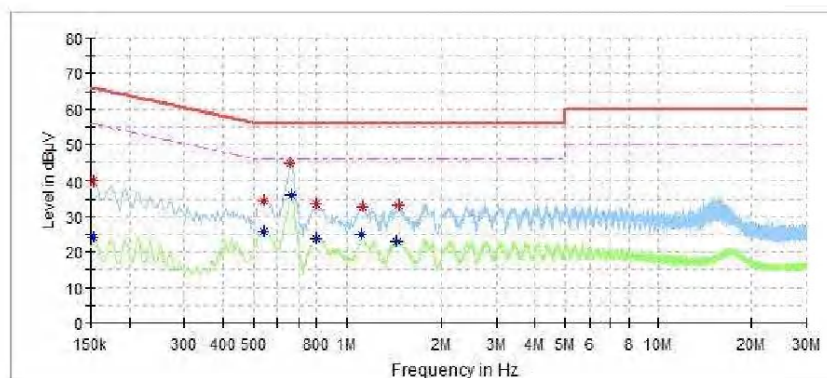
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Test Report

EUT Information

EUT Name:	V2 TWS Earbuds
Model:	TWSEBBKV2PRM
Order No.:	168139923
Test Mode:	Charging mode
Test Voltage:	AC 120V/60Hz
Test By:	Charlie Wang
Review By:	Gary Chen



Critical Freqs

Frequency (MHz)	MaxPeak (dBµV)	Average (dBµV)	Limit (dBµV)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Line	Corr. (dB)
0.154000	---	24.19	55.78	31.59	---	---	N	9.6
0.154000	39.96	---	65.78	25.83	---	---	N	9.6
0.544000	---	25.99	46.00	20.01	---	---	N	9.7
0.544000	34.37	---	56.00	21.63	---	---	N	9.7
0.660000	44.75	---	56.00	11.25	---	---	N	9.7
0.668000	---	36.07	46.00	9.93	---	---	N	9.7
0.796000	---	23.96	46.00	22.04	---	---	N	9.7
0.796000	33.75	---	56.00	22.25	---	---	N	9.7
1.116000	---	24.88	46.00	21.12	---	---	N	9.7
1.132000	32.63	---	56.00	23.37	---	---	N	9.7
1.444000	---	23.01	46.00	22.99	---	---	N	9.7
1.464000	33.20	---	56.00	22.80	---	---	N	9.7

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Remark: In this appendix, the model No. TWSEBBKV2PRM is replaced by TWSEBBKV3PRM-FOB, they are totally identical except model No.

Appendix C.2: Test Plots of Radiated Emission, Below 1GHz

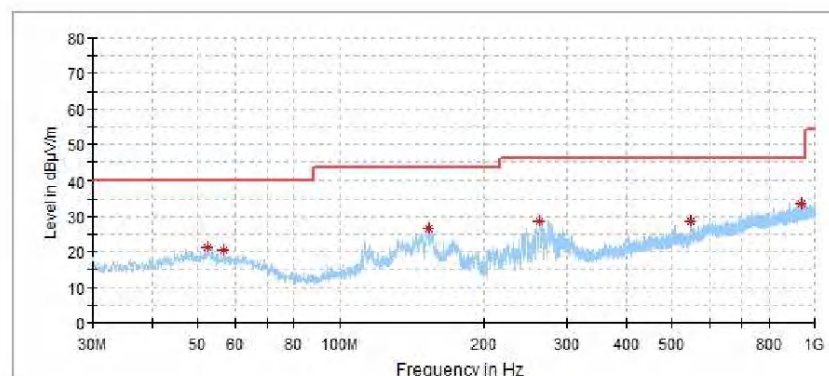
Charging mode for charger box

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EMC32 Report

EUT Information

EUT Name:	V2 TWS Earbuds
Model:	TWSEBBKV2PRM
Order No:	168139923
Test Mode:	Charging mode
Test Voltage:	AC 120V/60Hz
Test By:	Charlie Wang
Review By:	Gary Chen
Remark:	3M Chamber



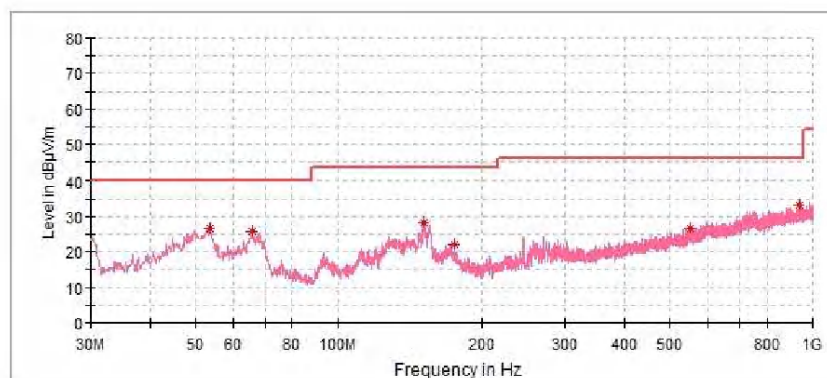
Critical Freqs

Frequency (MHz)	MaxPeak (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)
262.897000	28.91	46.00	17.09	---	---	100.0	H	188.0
941.121000	33.57	46.00	12.43	---	---	100.0	H	225.0
549.144000	28.54	46.00	17.46	---	---	100.0	H	254.0
56.675000	20.45	40.00	19.55	---	---	150.0	H	260.0
152.608000	26.70	43.50	16.80	---	---	200.0	H	36.0
52.407000	21.25	40.00	18.75	---	---	200.0	H	239.0

EMC32 Report

EUT Information

EUT Name:	V2 TWS Earbuds
Model:	TWSEBBKV2PRM
Order No:	168139923
Test Mode:	Charging mode
Test Voltage:	AC 120V/60Hz
Test By:	Charlie Wang
Review By:	Gary Chen
Remark:	3M Chamber



Critical_Freqs

Frequency (MHz)	MaxPeak (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)
65.793000	26.00	40.00	14.00	---	---	100.0	V	0.0
936.659000	33.18	46.00	12.82	---	---	100.0	V	106.0
150.959000	28.16	43.50	15.34	---	---	100.0	V	210.0
174.724000	22.04	43.50	21.46	---	---	100.0	V	236.0
53.668000	26.86	40.00	13.14	---	---	100.0	V	241.0
551.569000	26.81	46.00	19.19	---	---	150.0	V	311.0

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EMC32 V10.50.0

1:34:55 PM

Remark: In this appendix, the model No. TWSEBBKV2PRM is replaced by TWSEBBKV3PRM-FOB, they are totally identical except model No.

Appendix C.3: Test Plots of Radiated Emission, Above 1GHz

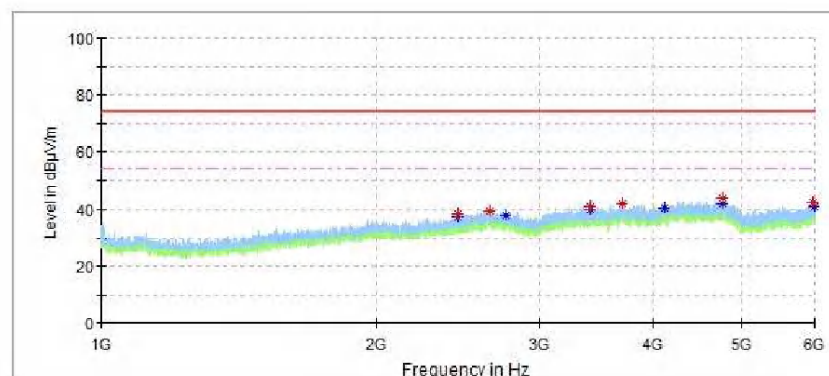
Charging mode for charger box

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EMC32 Report

EUT Information

EUT Name:	V2 TWS Earbuds
Model:	TWSEBBKV2PRM
Order No:	168139923
Test Mode:	Charging mode
Test Voltage:	AC 120V/60Hz
Test By:	Charlie Wang
Review By:	Gary Chen
Remark:	3M Chamber



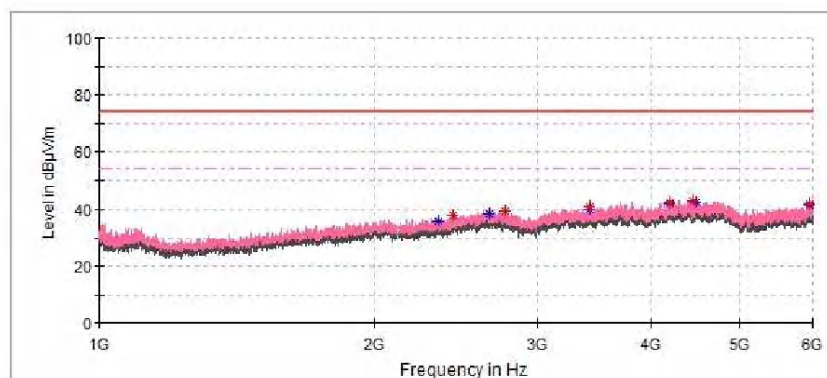
Critical Freqs

Frequency (MHz)	MaxPeak (dBµV/m)	Average (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Pol
3414.000000	41.11	---	74.00	32.89	---	---	100.0	H
3414.000000	---	39.92	54.00	14.08	---	---	100.0	H
4764.500000	---	42.30	54.00	11.70	---	---	100.0	H
4765.500000	44.07	---	74.00	29.93	---	---	100.0	H
2755.000000	---	38.04	54.00	15.96	---	---	100.0	H
3705.500000	42.22	---	74.00	31.78	---	---	100.0	H
2646.000000	39.43	---	74.00	34.57	---	---	100.0	H
2441.000000	38.34	---	74.00	35.66	---	---	100.0	H
2441.000000	---	37.20	54.00	16.80	---	---	100.0	H
4111.000000	---	40.63	54.00	13.37	---	---	100.0	H
5968.500000	42.47	---	74.00	31.53	---	---	100.0	H
5990.500000	---	40.93	54.00	13.07	---	---	100.0	H

EMC32 Report

EUT Information

EUT Name:	V2 TWS Earbuds
Model:	TWSEBBKV2PRM
Order No:	168139923
Test Mode:	Charging mode
Test Voltage:	AC 120V/60Hz
Test By:	Charlie Wang
Review By:	Gary Chen
Remark:	3M Chamber



Critical_Freqs

Frequency (MHz)	MaxPeak (dBµV/m)	Average (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Pol
2662.000000	---	38.39	54.00	15.61	---	---	100.0	V
4447.500000	43.30	---	74.00	30.70	---	---	100.0	V
3426.000000	41.25	---	74.00	32.75	---	---	100.0	V
3426.000000	---	39.91	54.00	14.09	---	---	100.0	V
4474.000000	---	42.34	54.00	11.66	---	---	100.0	V
5964.500000	42.28	---	74.00	31.72	---	---	100.0	V
5964.500000	---	41.42	54.00	12.58	---	---	100.0	V
2769.500000	39.49	---	74.00	34.51	---	---	100.0	V
2427.500000	38.12	---	74.00	35.88	---	---	100.0	V
2342.500000	---	36.04	54.00	17.96	---	---	100.0	V
4182.500000	---	41.90	54.00	12.10	---	---	100.0	V
4182.500000	42.67	---	74.00	31.33	---	---	100.0	V

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EMC32 V10.50.0

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Remark:

- 1 In this appendix, the model No. TWSEBBKV2PRM is replaced by TWSEBBKV3PRM-FOB, they are totally identical except model No.
- 2 This testing was carried out on all operation modes, but only the worst case was presented in this appendix.