



Test report No.: 23C0510R-RFUSV01S-A

# TEST REPORT

Product Name	Car Infotainment Unit
Trademark	APTIV
Model and /or type reference	IHP
FCC ID	LTQIHP
Applicant's name / address	Aptiv Services Deutschland GmbH Am Technologiepark 1 D-42119 Wuppertal Germany
Manufacturer's name	Aptiv Services Deutschland GmbH
Test method requested, standard	FCC CFR Title 47 Part 15 Subpart C ANSI C63.4: 2014, ANSI C63.10: 2013
Verdict Summary	IN COMPLIANCE
Documented By (Senior Project Specialist / April Chen)	<i>April Chen</i>
Tested By (Senior Engineer / Ivan Chuang)	<i>Ivan Chuang</i>
Approved By (Senior Engineer / Steven Tsai)	<i>Steven Tsai</i>
Date of Receipt	2023/12/14
Date of Issue	2024/01/26
Report Version	V1.0

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Appendix 1: EUT Test Photographs

Appendix 2: Product Photos-Please refer to the file: 23C0510R-Product Photos

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## Competences and Guarantees

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DEKRA is a testing laboratory competent to carry out the tests described in this report.

In order to assure the traceability to other national and international laboratories, DEKRA has a calibration and maintenance program for its measurement equipment.

DEKRA guarantees the reliability of the data presented in this report, which is the result of the measurements and the tests performed to the item under test on the date and under the conditions stated in the report and it is based on the knowledge and technical facilities available at DEKRA at the time of performance of the test.

DEKRA is liable to the client for the maintenance of the confidentiality of all information related to the item under test and the results of the test.

The results presented in this Test Report apply only to the particular item under test established in this document.

**IMPORTANT:** No parts of this report may be reproduced or quoted out of context, in any form or by any means, except in full, without the previous written permission of DEKRA.

## General conditions

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1. The test results relate only to the samples tested.
2. The test results shown in the test report are traceable to the national/international standard through the calibration report of the equipment and evaluated measurement uncertainty herein.
3. This report must not be used to claim product endorsement by TAF or any agency of the government.
4. The test report shall not be reproduced without the written approval of DEKRA Testing and Certification Co., Ltd.
5. Measurement uncertainties evaluated for each testing system and associated connections are given here to provide the system information for reference. Compliance determinations do not take into account measurement uncertainties for each testing system, but are based on the results of the compliance measurement.

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## Revision History

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Report No.	Version	Description	Issued Date
23C0510R-RFUSV01S-A	V1.0	Initial issue of report.	2024/01/26

## 1. General Information

### 1.1. EUT Description

Product Name	Car Infotainment Unit
Trademark	APTIV
Model and /or type reference	IHP
EUT Rated Voltage	DC 12V by Battery
EUT Test Voltage	DC 12V by Battery
Frequency Range	2402-2480 MHz
Channel Number	79 CH
Type of Modulation	GFSK(1 Mbps) / $\pi$ /4DQPSK(2 Mbps) / 8DPSK(3 Mbps)
Channel Control	Auto
Blockchain verified QR code	

#### Antenna List

No.	Manufacturer	Part No.	Antenna Type	Peak Gain
1	AMOTECH	AMO-PHA-AP001	PIFA	1.94 dBi for 2400 MHz

#### Note:

- 1.The antenna of EUT conforms to FCC 15.203.
2. The antenna gain as by the manufacturer provided.

## Center Frequency of Each Channel:

Channel	Frequency (MHz)	Channel	Frequency (MHz)	Channel	Frequency (MHz)	Channel	Frequency (MHz)
00	2402	01	2403	02	2404	03	2405
04	2406	05	2407	06	2408	07	2409
08	2410	09	2411	10	2412	11	2413
12	2414	13	2415	14	2416	15	2417
16	2418	17	2419	18	2420	19	2421
20	2422	21	2423	22	2424	23	2425
24	2426	25	2427	26	2428	27	2429
28	2430	29	2431	30	2432	31	2433
32	2434	33	2435	34	2436	35	2437
36	2438	37	2439	38	2440	39	2441
40	2442	41	2443	42	2444	43	2445
44	2446	45	2447	46	2448	47	2449
48	2450	49	2451	50	2452	51	2453
52	2454	53	2455	54	2456	55	2457
56	2458	57	2459	58	2460	59	2461
60	2462	61	2463	62	2464	63	2465
64	2466	65	2467	66	2468	67	2469
68	2470	69	2471	70	2472	71	2473
72	2474	73	2475	74	2476	75	2477
76	2478	77	2479	78	2480	--	--

## Note:

1. The EUT is a Car Infotainment Unit with built-in WLAN and Bluetooth transceiver, this report for Bluetooth V2.1+EDR.
2. Regarding to the operation frequency, the lowest, middle and highest frequency are selected to perform the test.
3. The radiation measurements are performed in X, Y, Z axis positioning. Only the worst case is shown in the report.
4. The spectrum plot against conducted item only shows the worst case.
5. DEKRA has evaluated each test mode. Only the worst case is shown in the report.
6. These tests were conducted on a sample for the purpose of demonstrating compliance of transmitter with Part 15 Subpart C Paragraph 15.247 for spread spectrum devices.
7. The test mode is based on the Bluetooth technology, while testing 1Mbps, 2Mbps and 3Mbps, the worst case is 1Mbps and 3Mbps, and only worse case data is recorded in this report.

Test Mode	Mode 1	Transmit-1 Mbps
		Transmit-3 Mbps

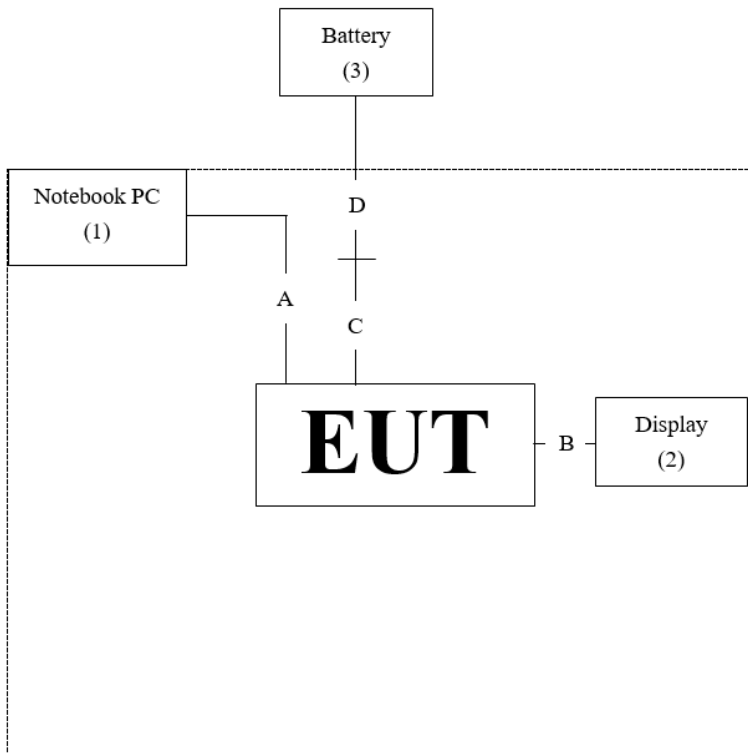
1.2. Tested System Details

The types for all equipment, plus descriptions of all cables used in the tested system (including inserted cards) are:

Product	Manufacturer	Model No.	Serial No.	Power Cord
1 Notebook PC	Lenovo	TP00067C	PF-0EW0C3	N/A
2 Display	N/A	IHP DISPLAY	N/A	N/A
3 Battery	BOSCH	60044	N/A	N/A

Cable Type	Cable Description
A USB Cable	Shielded, 1m
B 4 Pin cable	Non-shielded, 1m
C Power Cable	Non-shielded, 2m
D Power Cable	Non-shielded, 2m

1.3. Configuration of Tested System



1.4. EUT Exercise Software

1	Setup the EUT as shown in Section 1.3.
2	Execute software “cmd Ver. 10.0.19045.3803” on the Notebook PC.
3	Configure the test mode, the test channel, and the data rate.
4	Press “OK” to start the continuous transmit.
5	Verify that the EUT works properly.



## 1.5. Test Facility

Ambient conditions in the laboratory:

Performed Item	Items	Required	Actual
Radiated Emission	Temperature (°C)	10~40 °C	23.7 °C
	Humidity (%RH)	10~90 %	34.0 %
Conductive	Temperature (°C)	10~40 °C	27.5 °C
	Humidity (%RH)	10~90 %	58.0 %

USA	FCC Registration Number: TW0033
Canada	CAB Identifier Number: TW3023 / Company Number: 26930

Site Description	Accredited by TAF
	Accredited Number: 3023

Test Laboratory	DEKRA Testing and Certification Co., Ltd.
	Linkou Laboratory
Address	No.5-22, Ruishukeng Linkou District, New Taipei City, 24451, Taiwan, R.O.C.
Performed Location	No. 26, Huaya 1st Rd., Guishan Dist., Taoyuan City 333411, Taiwan, R.O.C.
Phone Number	+886-3-275-7255
Fax Number	+886-3-327-8031

## 1.6. List of Test Equipment

**For Conducted Measurements / HY-SR02**

	Equipment	Manufacturer	Model No.	Serial No.	Cal. Date	Due Date
V	Spectrum Analyzer	R&S	FSV30	103465	2023/06/14	2024/06/13
V	Peak Power Analyzer	KEYSIGHT	8990B	MY51000539	2023/05/15	2024/05/14
V	Wideband Power Sensor	KEYSIGHT	N1923A	MY59240002	2023/05/18	2024/05/17
V	Wideband Power Sensor	KEYSIGHT	N1923A	MY59240003	2023/05/18	2024/05/17

Note:

1. All equipments are calibrated every one year.
2. The test instruments marked with “V” are used to measure the final test results.
3. Test Software Version: RF Conducted Test Tools R3 V3.0.0.14.

**For Radiated Measurements /HY-CB03**

	Equipment	Manufacturer	Model No.	Serial No.	Cal. Date	Due Date
V	Loop Antenna	AMETEK	HLA6121	49611	2023/02/21	2024/02/20
V	Bi-Log Antenna	SCHWARZBECK	VULB9168	9168-0675	2023/08/09	2025/08/08
V	Horn Antenna	Com-Power	AH-840	101100	2023/10/02	2025/10/01
V	Horn Antenna	RF SPIN	DRH18-E	210507A18ES	2023/05/11	2024/05/10
V	Pre-Amplifier	SGH	SGH0301-9	20211007-11	2023/01/10	2024/01/09
V	Pre-Amplifier	SGH	PRAMP118	20200701	2023/01/10	2024/01/09
V	Pre-Amplifier	EMCI	EMC05820SE	980310	2023/01/10	2024/01/09
V	Pre-Amplifier	EMCI	EMC184045SE	980369	2023/01/10	2024/01/09
	Coaxial Cable	EMCI	EMC102-KM-KM-600	1160314		
	Coaxial Cable	EMCI	EMC102-KM-KM-7000	170242		
V	Filter	MICRO TRONICS	BRM50702	G269	2023/01/05	2024/01/04
	Filter	MICRO TRONICS	BRM50716	G196	2023/01/05	2024/01/04
V	EMI Test Receiver	R&S	ESR3	102793	2023/12/11	2024/12/10
V	Spectrum Analyzer	R&S	FSV3044	101113	2023/02/04	2024/02/03
V	Coaxial Cable	SGH	SGH18	2021005-1	2023/01/10	2024/01/09
	Coaxial Cable	SGH	SGH18	202108-4		
V	Coaxial Cable	SGH	HA800	GD20110223-1	2023/01/10	2024/01/09
V	Coaxial Cable	SGH	HA800	GD20110222-3		

Note:

1. Bi-Log Antenna and Horn Antenna (AH-840) is calibrated every two years, the other equipments are calibrated every one year.
2. The test instruments marked with “V” are used to measure the final test results.
3. Test Software Version: e3 230303 dekra V9.

### 1.7. Uncertainty

Uncertainties have been calculated according to the DEKRA internal document.

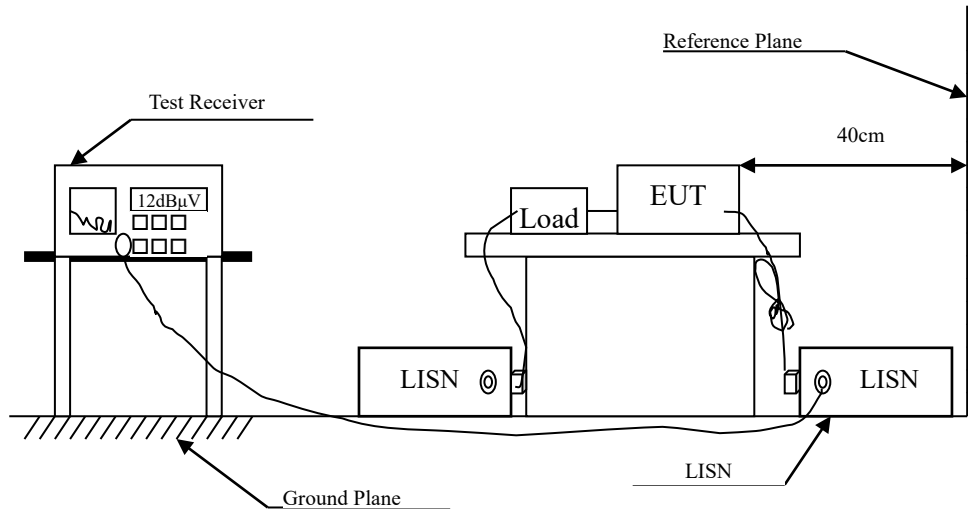
The reported expanded uncertainties are based on a standard uncertainty multiplied by a coverage factor of  $k=2$ , providing a level of confidence of approximately 95%.

Measurement uncertainties evaluated for each testing system and associated connections are given here to provide the system information for reference. Compliance determinations do not take into account measurement uncertainties for each testing system, but are based on the results of the compliance measurement.

Test Item	Uncertainty
Conducted Emission	$\pm 3.50$ dB
Peak Power Output	Spectrum Analyzer: $\pm 2.14$ dB Power Meter: $\pm 1.05$ dB
Radiated Emission	9 kHz~30 MHz: $\pm 3.88$ dB 30 MHz~1 GHz: $\pm 4.42$ dB 1 GHz~18 GHz: $\pm 4.28$ dB 18 GHz~40 GHz: $\pm 3.90$ dB
RF Antenna Conducted Test	$\pm 2.14$ dB
Band Edge	For Radiated: 9 kHz~30 MHz: $\pm 3.88$ dB 30 MHz~1 GHz: $\pm 4.42$ dB 1 GHz~18 GHz: $\pm 4.28$ dB 18 GHz~40 GHz: $\pm 3.90$ dB For Conducted: $\pm 2.14$ dB
Channel Number	N/A
Channel Separation	$\pm 1580.61$ Hz
Dwell Time	$\pm 0.53$ %
Occupied Bandwidth	$\pm 1580.61$ Hz
Duty Cycle	$\pm 0.53$ %

## 2. Conducted Emission

### 2.1. Test Setup



### 2.2. Limits

FCC Part 15 Subpart C Paragraph 15.207 (dB $\mu$ V) Limit		
Frequency MHz	Limits	
	QP	AV
0.15 - 0.50	66-56	56-46
0.50 - 5.0	56	46
5.0 - 30	60	50

### 2.3. Test Procedure

The EUT and Peripherals are connected to the main power through a line impedance stabilization network (L.I.S.N.). This provides a 50 ohm /50uH coupling impedance for the measuring equipment. The peripheral devices are also connected to the main power through a LISN that provides a 50ohm /50uH coupling impedance with 50ohm termination. (Please refer to the block diagram of the test setup and photographs.)

Both sides of A.C. line are checked for maximum conducted interference. In order to find the maximum emission, the relative positions of equipment and all the interface cables must be changed according to ANSI C63.4: 2014 on conducted measurement.

Conducted emissions were investigated over the frequency range from 0.15MHz to 30MHz using a receiver bandwidth of 9kHz.

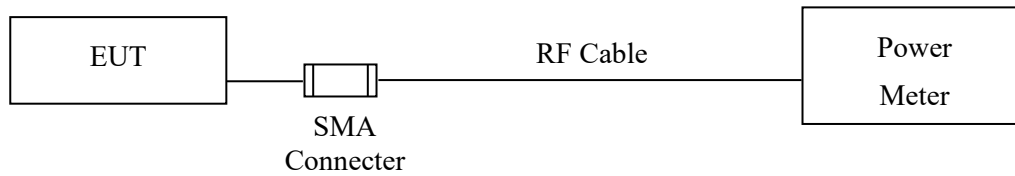
The EUT setup and the test procedure are according to ANSI C63.4, 2014 to comply with the requirements of FCC 47CFR Subpart C.

#### 2.4. Test Result of Conducted Emission

Owing to the DC operation of EUT, this test item is not performed.

### 3. Peak Power Output

#### 3.1. Test Setup



#### 3.2. Limit

The maximum peak power shall be less 1Watt,for all other frequency hopping systems in the 2400-2483.5MHz band: 0.125 watts.

#### 3.3. Test Procedure

Tested according to FHSS test procedure of KDB 558074 section 9 (b for compliance to FCC 47CFR 15.247 requirements.

## 3.4. Test Result of Peak Power Output

Product : Car Infotainment Unit  
Test Item : Peak Power Output  
Test Mode : Transmit-1 Mbps  
Test Date : 2023/12/20

Channel No.	Frequency (MHz)	Measurement (dBm)	Required Limit	Result
00	2402	4.25	0.125Watt = 21 dBm	Pass
39	2441	4.62	0.125Watt = 21 dBm	Pass
78	2480	4.56	0.125Watt = 21 dBm	Pass



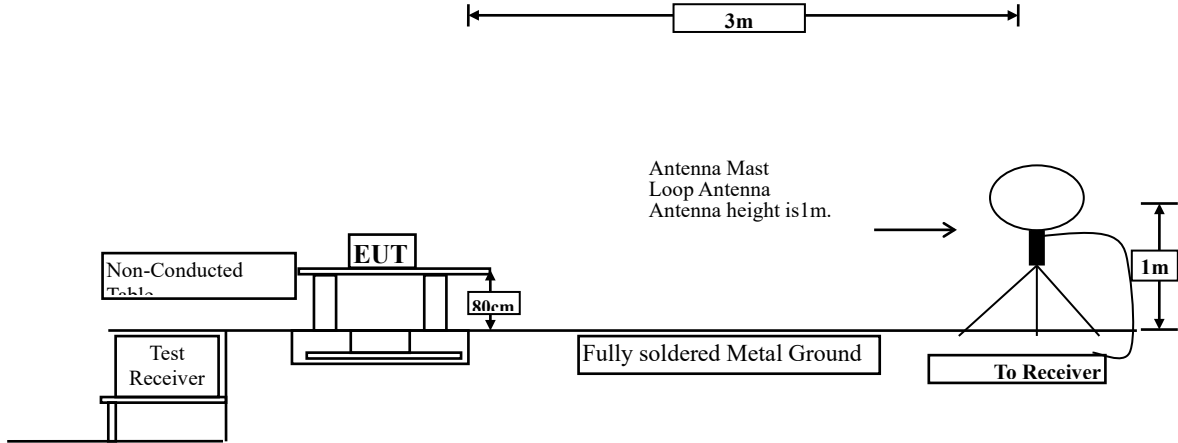
Product : Car Infotainment Unit  
Test Item : Peak Power Output  
Test Mode : Transmit-3 Mbps  
Test Date : 2023/12/20

Channel No.	Frequency (MHz)	Measurement (dBm)	Required Limit	Result
00	2402	6.77	0.125Watt = 21 dBm	Pass
39	2441	7.09	0.125Watt = 21 dBm	Pass
78	2480	7.02	0.125Watt = 21 dBm	Pass

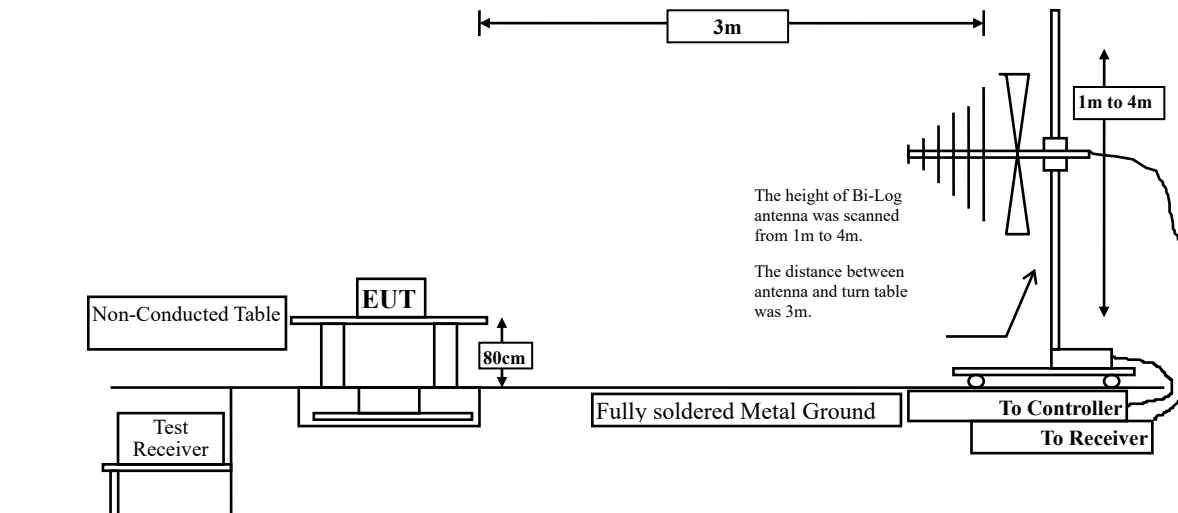
## 4. Radiated Emission

### 4.1. Test Setup

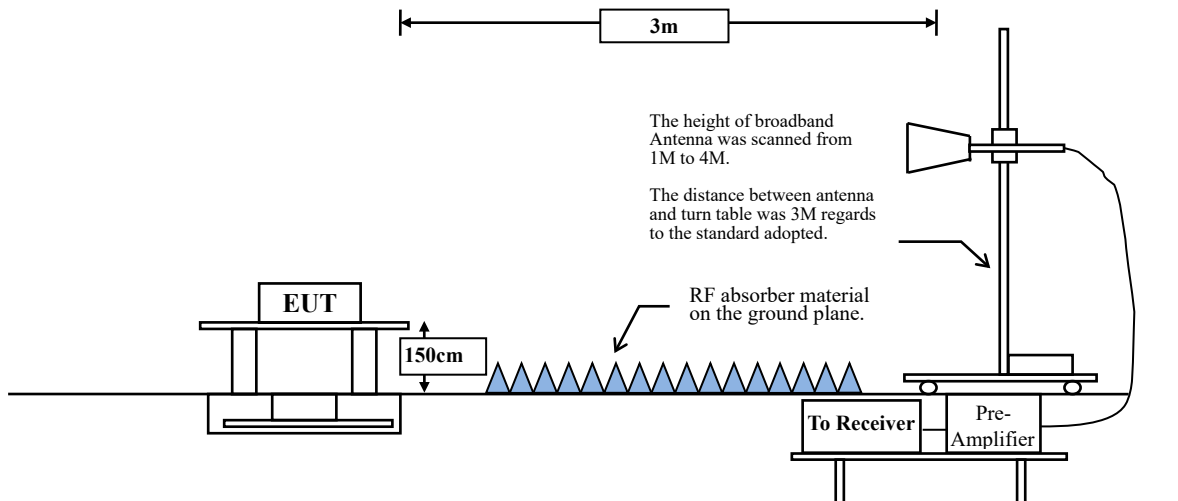
#### Radiated Emission Under 30 MHz



#### Radiated Emission Below 1 GHz



#### Radiated Emission Above 1 GHz



## 4.2. Limits

### ➤ General Radiated Emission Limits

Emissions radiated outside of the specified frequency bands, except for harmonics, shall be attenuated by at least 20dB below the level of the fundamental or to the general radiated emission limits in paragraph 15.209, whichever is the lesser attenuation.

FCC Part 15 Subpart C Paragraph 15.209 Limits		
Frequency MHz	Field strength (microvolts/meter)	Measurement distance (meter)
0.009-0.490	2400/F(kHz)	300
0.490-1.705	24000/F(kHz)	30
1.705-30	30	30
30-88	100	3
88-216	150	3
216-960	200	3
Above 960	500	3

#### Remarks:

1. RF Voltage (dB $\mu$ V) = 20 log RF Voltage ( $\mu$ V)
2. In the Above Table, the tighter limit applies at the band edges.
3. Distance refers to the distance in meters between the measuring instrument antenna and the closed point of any part of the device or system.

#### 4.3. Test Procedure

The EUT was setup according to ANSI C63.10, 2013 and tested compliance to FCC 47CFR 15.247 requirements.

Measuring the frequency range below 1 GHz, the EUT is placed on a turn table which is 0.8 meter above ground, when measuring the frequency range above 1GHz, the EUT is placed on a turn table which is 1.5 meter above ground.

The turn table is rotated 360 degrees to determine the position of the maximum emission level.

The EUT was positioned such that the distance from antenna to the EUT was 3 meters.

The antenna is scanned between 1 meter and 4 meters to find out the maximum emission level. This is repeated for both horizontal and vertical polarization of the antenna. In order to find the maximum emission, all of the interface cables were manipulated according to ANSI C63.10: 2013 on radiated measurement.

The resolution bandwidth below 30 MHz setting on the field strength meter is 9kHz and 30 MHz~1 GHz is 120 kHz and above 1 GHz is 1 MHz.

Radiated emission measurements below 30 MHz are made using Loop Antenna and 30 MHz~1 GHz are made using broadband Bilog antenna and above 1 GHz are made using Horn Antennas.

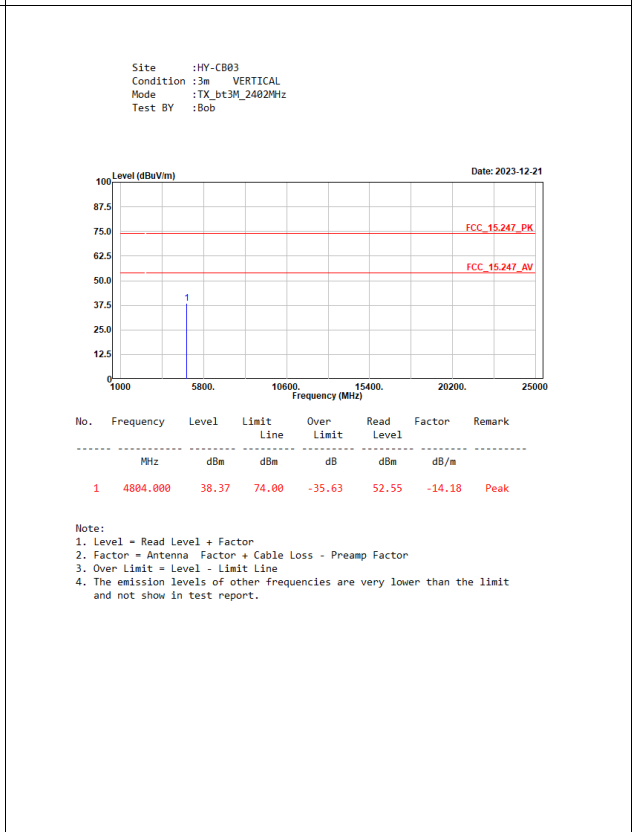
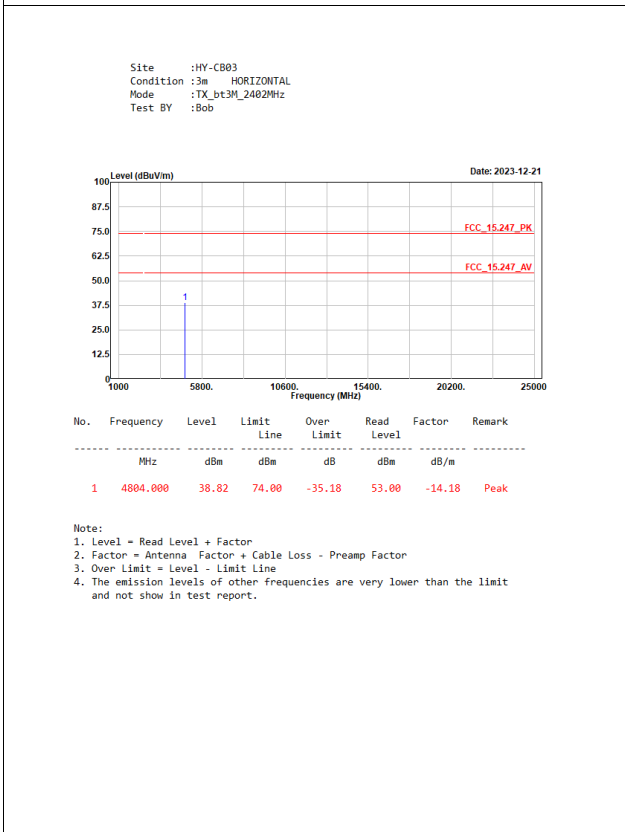
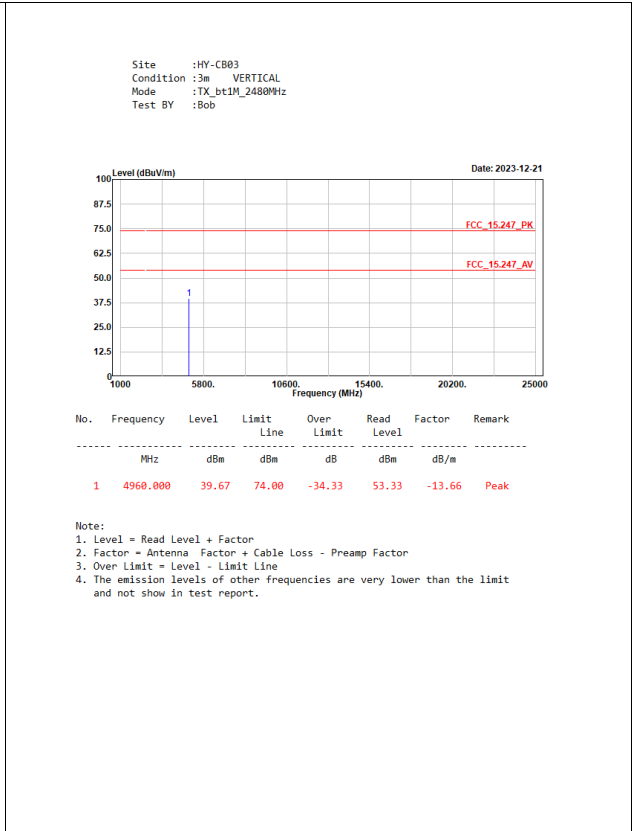
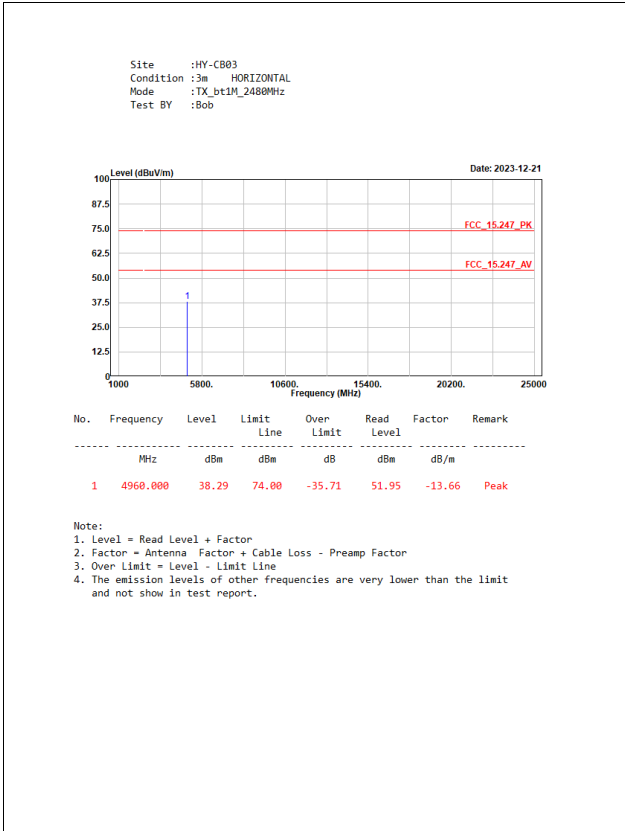
The measurement is divided into the Preliminary Measurement and the Final Measurement.

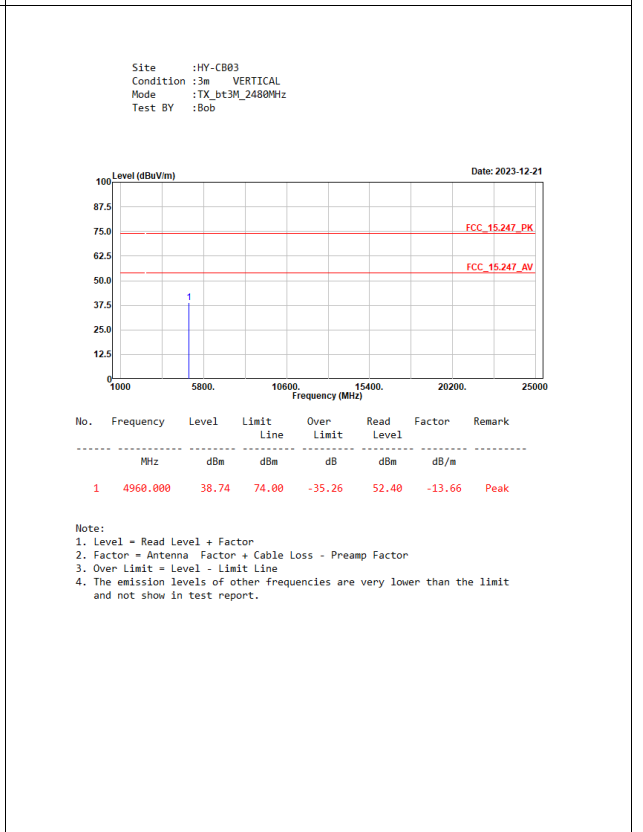
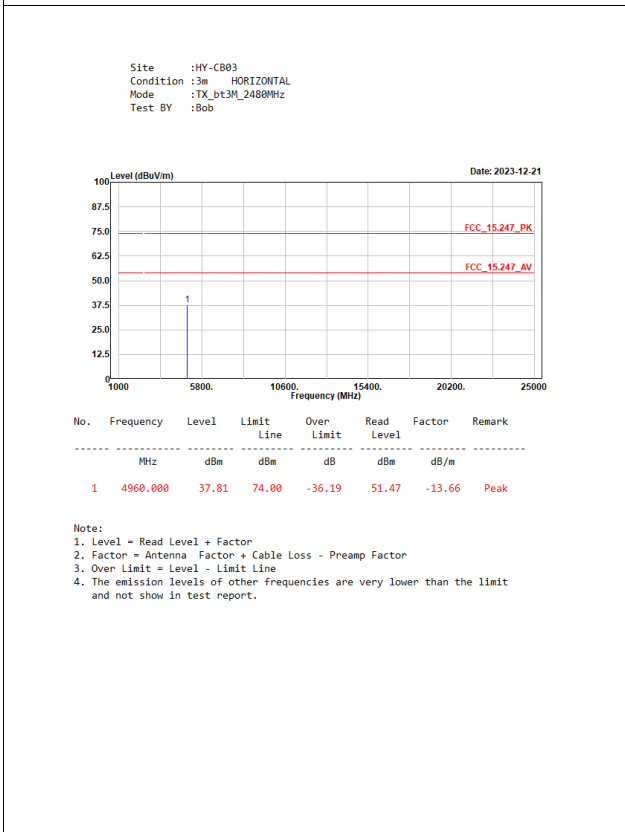
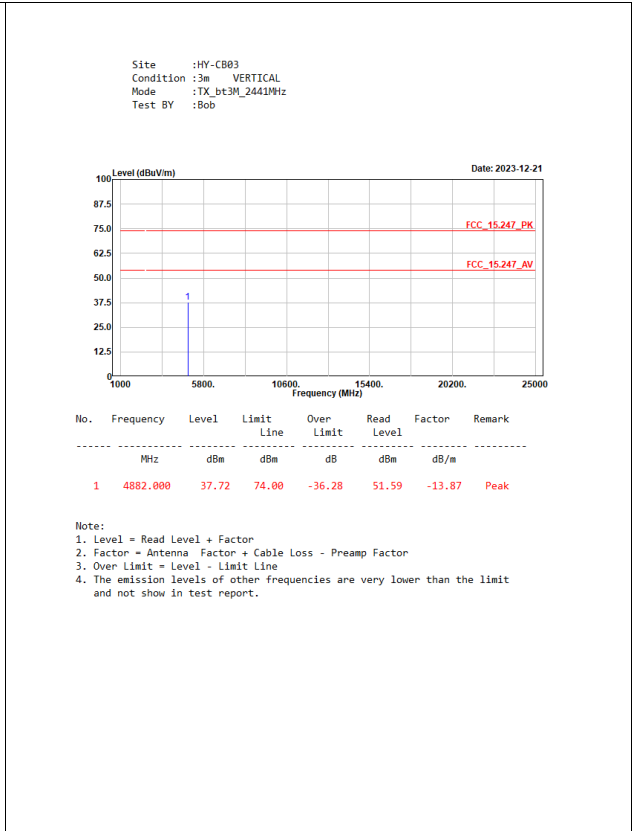
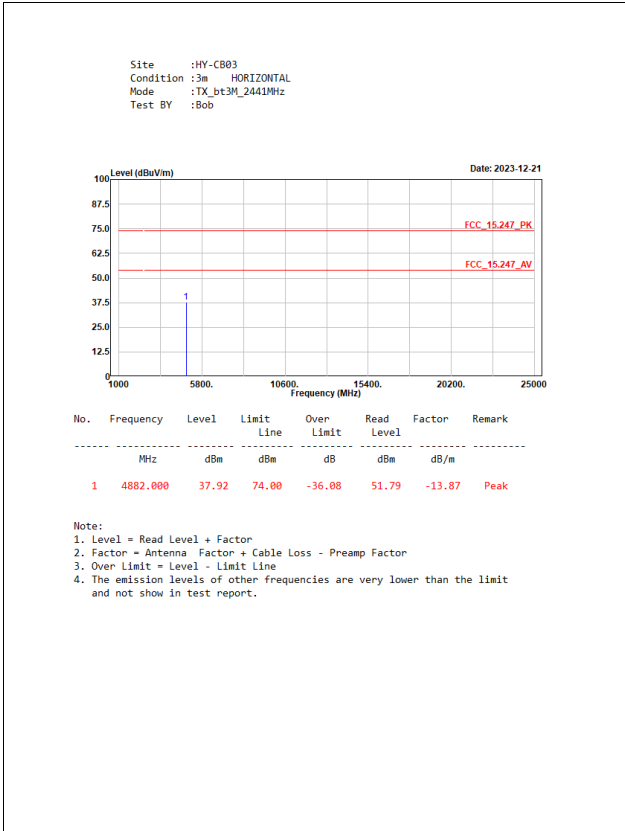
The suspected frequencies are searched for in Preliminary Measurement with the measurement antenna kept pointed at the source of the emission both in azimuth and elevation, with the polarization of the antenna oriented for maximum response. The antenna is pointed at an angle towards the source of the emission, and the EUT is rotated in both height and polarization to maximize the measured emission. The emission is kept within the illumination area of the 3 dB bandwidth of the antenna.

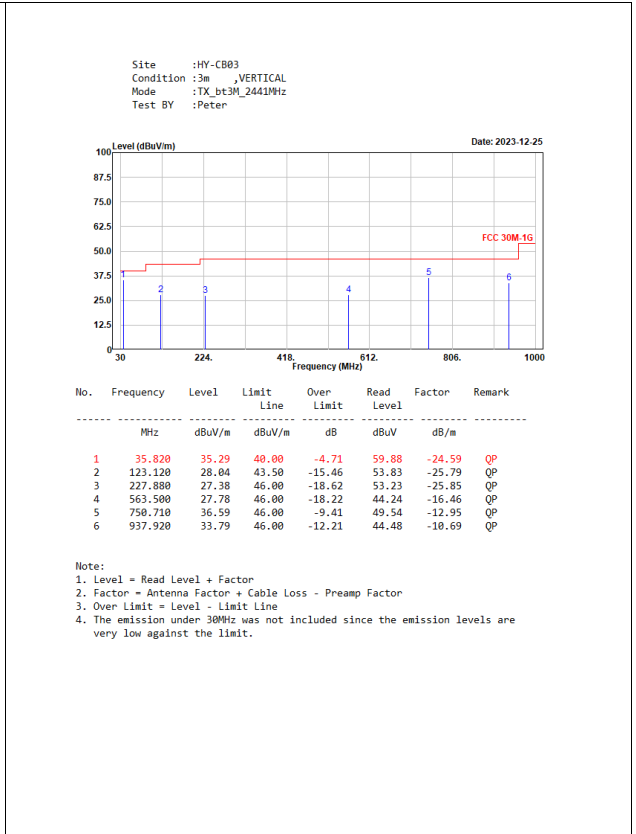
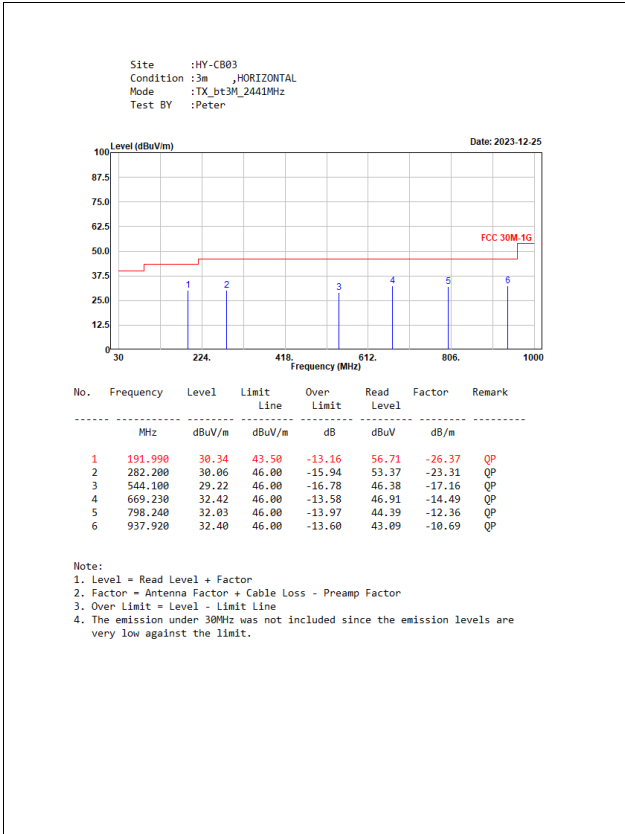
The measurement frequency range from 9 kHz - 10th Harmonic of fundamental was investigated.

### 4.4. Test Result of Radiated Emission

<p>Site :HY-CB03 Condition :3m HORIZONTAL Mode :TX_bt1M_2402MHz Test BY :Bob</p> <p style="text-align: right;">Date: 2023-12-21</p> <table border="1"> <thead> <tr> <th>No.</th> <th>Frequency MHz</th> <th>Level dBm</th> <th>Limit Line dBm</th> <th>Over Limit dB</th> <th>Read Level dBm</th> <th>Factor dB/m</th> <th>Remark</th> </tr> </thead> <tbody> <tr> <td>1</td> <td>4884.000</td> <td>39.31</td> <td>74.00</td> <td>-34.69</td> <td>53.49</td> <td>-14.18</td> <td>Peak</td> </tr> </tbody> </table> <p>Note: 1. Level = Read Level + Factor 2. Factor = Antenna Factor + Cable Loss - Preamp Factor 3. Over Limit = Level - Limit Line 4. The emission levels of other frequencies are very lower than the limit and not show in test report.</p>	No.	Frequency MHz	Level dBm	Limit Line dBm	Over Limit dB	Read Level dBm	Factor dB/m	Remark	1	4884.000	39.31	74.00	-34.69	53.49	-14.18	Peak	<p>Site :HY-CB03 Condition :3m VERTICAL Mode :TX_bt1M_2402MHz Test BY :Bob</p> <p style="text-align: right;">Date: 2023-12-21</p> <table border="1"> <thead> <tr> <th>No.</th> <th>Frequency MHz</th> <th>Level dBm</th> <th>Limit Line dBm</th> <th>Over Limit dB</th> <th>Read Level dBm</th> <th>Factor dB/m</th> <th>Remark</th> </tr> </thead> <tbody> <tr> <td>1</td> <td>4884.000</td> <td>39.49</td> <td>74.00</td> <td>-34.51</td> <td>53.67</td> <td>-14.18</td> <td>Peak</td> </tr> </tbody> </table> <p>Note: 1. Level = Read Level + Factor 2. Factor = Antenna Factor + Cable Loss - Preamp Factor 3. Over Limit = Level - Limit Line 4. The emission levels of other frequencies are very lower than the limit and not show in test report.</p>	No.	Frequency MHz	Level dBm	Limit Line dBm	Over Limit dB	Read Level dBm	Factor dB/m	Remark	1	4884.000	39.49	74.00	-34.51	53.67	-14.18	Peak
No.	Frequency MHz	Level dBm	Limit Line dBm	Over Limit dB	Read Level dBm	Factor dB/m	Remark																										
1	4884.000	39.31	74.00	-34.69	53.49	-14.18	Peak																										
No.	Frequency MHz	Level dBm	Limit Line dBm	Over Limit dB	Read Level dBm	Factor dB/m	Remark																										
1	4884.000	39.49	74.00	-34.51	53.67	-14.18	Peak																										
<p>Site :HY-CB03 Condition :3m HORIZONTAL Mode :TX_bt1M_2441MHz Test BY :Bob</p> <p style="text-align: right;">Date: 2023-12-21</p> <table border="1"> <thead> <tr> <th>No.</th> <th>Frequency MHz</th> <th>Level dBm</th> <th>Limit Line dBm</th> <th>Over Limit dB</th> <th>Read Level dBm</th> <th>Factor dB/m</th> <th>Remark</th> </tr> </thead> <tbody> <tr> <td>1</td> <td>4882.000</td> <td>38.05</td> <td>74.00</td> <td>-35.95</td> <td>51.92</td> <td>-13.87</td> <td>Peak</td> </tr> </tbody> </table> <p>Note: 1. Level = Read Level + Factor 2. Factor = Antenna Factor + Cable Loss - Preamp Factor 3. Over Limit = Level - Limit Line 4. The emission levels of other frequencies are very lower than the limit and not show in test report.</p>	No.	Frequency MHz	Level dBm	Limit Line dBm	Over Limit dB	Read Level dBm	Factor dB/m	Remark	1	4882.000	38.05	74.00	-35.95	51.92	-13.87	Peak	<p>Site :HY-CB03 Condition :3m VERTICAL Mode :TX_bt1M_2441MHz Test BY :Bob</p> <p style="text-align: right;">Date: 2023-12-21</p> <table border="1"> <thead> <tr> <th>No.</th> <th>Frequency MHz</th> <th>Level dBm</th> <th>Limit Line dBm</th> <th>Over Limit dB</th> <th>Read Level dBm</th> <th>Factor dB/m</th> <th>Remark</th> </tr> </thead> <tbody> <tr> <td>1</td> <td>4882.000</td> <td>38.57</td> <td>74.00</td> <td>-35.43</td> <td>52.44</td> <td>-13.87</td> <td>Peak</td> </tr> </tbody> </table> <p>Note: 1. Level = Read Level + Factor 2. Factor = Antenna Factor + Cable Loss - Preamp Factor 3. Over Limit = Level - Limit Line 4. The emission levels of other frequencies are very lower than the limit and not show in test report.</p>	No.	Frequency MHz	Level dBm	Limit Line dBm	Over Limit dB	Read Level dBm	Factor dB/m	Remark	1	4882.000	38.57	74.00	-35.43	52.44	-13.87	Peak
No.	Frequency MHz	Level dBm	Limit Line dBm	Over Limit dB	Read Level dBm	Factor dB/m	Remark																										
1	4882.000	38.05	74.00	-35.95	51.92	-13.87	Peak																										
No.	Frequency MHz	Level dBm	Limit Line dBm	Over Limit dB	Read Level dBm	Factor dB/m	Remark																										
1	4882.000	38.57	74.00	-35.43	52.44	-13.87	Peak																										



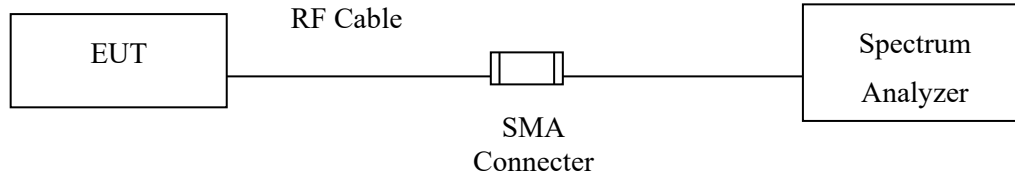






## 5. RF Antenna Conducted Test

### 5.1. Test Setup



### 5.2. Limits

According to FCC Section 15.247(d). In any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20 dB below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power, based on either an RF conducted or measurement, provided the transmitter demonstrates compliance with the peak conducted power limits. If the transmitter complies with the conducted power limits based on the use of RMS averaging over a time interval, the attenuation required under this paragraph shall be 30 dB instead of 20 dB.

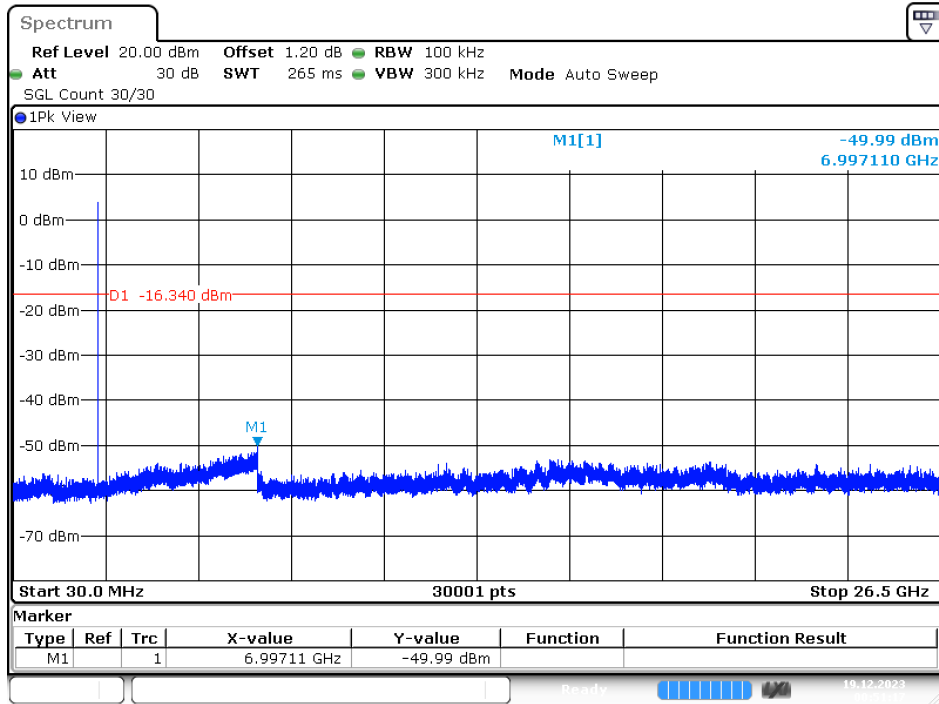
### 5.3. Test Procedure

Tested according to FHSS test procedure of KDB558074 section 9 b) for compliance to FCC 47CFR 15.247 requirements.

5.4. Test Result of RF Antenna Conducted Test

Product : Car Infotainment Unit  
 Test Item : RF Antenna Conducted Test  
 Test Mode : Transmit-1 Mbps  
 Test Date : 2023/12/19

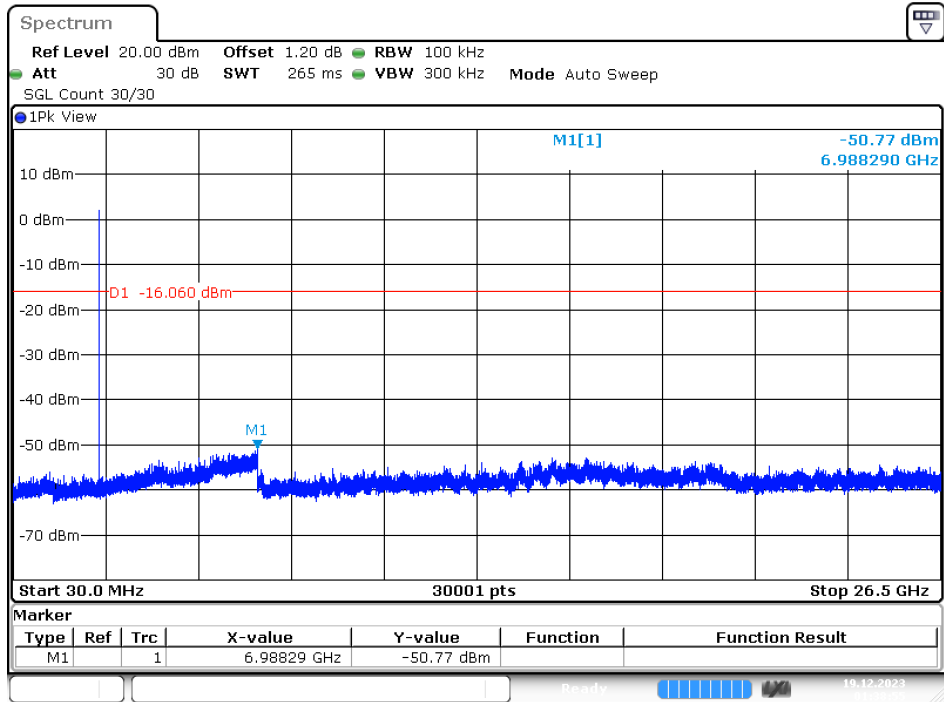
Figure Channel 39



Date: 19.DEC.2023 00:51:18

Product : Car Infotainment Unit  
 Test Item : RF Antenna Conducted Test  
 Test Mode : Transmit-3 Mbps  
 Test Date : 2023/12/19

Figure Channel 78

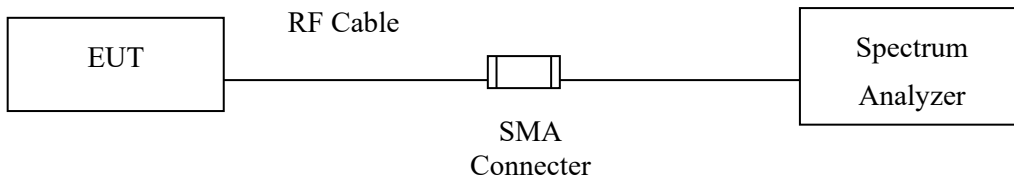


Date: 19.DEC.2023 01:38:56

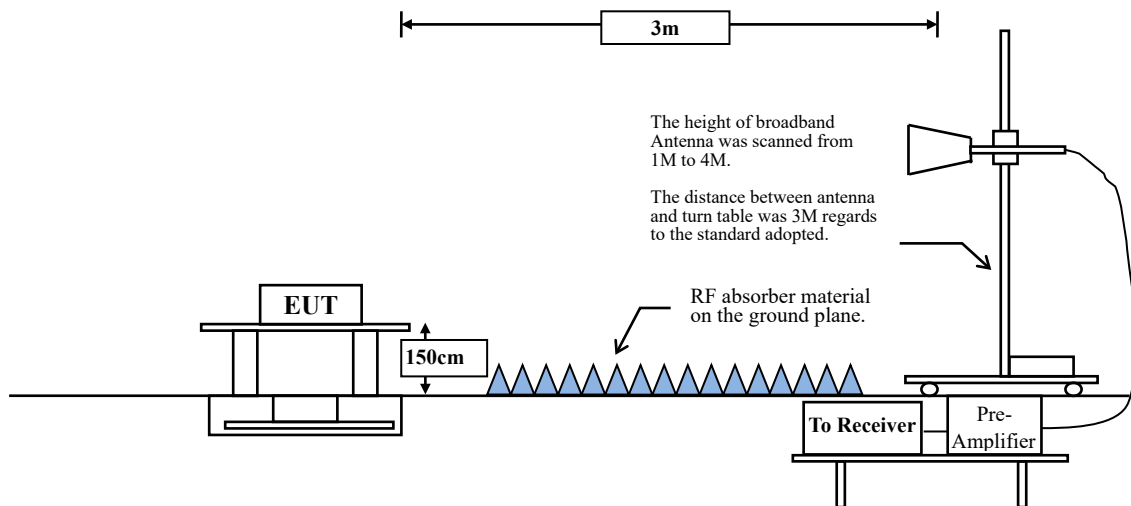
## 6. Band Edge

### 6.1. Test Setup

#### RF Conducted Measurement



#### RF Radiated Measurement:



## 6.2. Limit

According to FCC Section 15.247(d). In any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20 dB below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power, based on either an RF conducted or measurement, provided the transmitter demonstrates compliance with the peak conducted power limits. If the transmitter complies with the conducted power limits based on the use of RMS averaging over a time interval, the attenuation required under this paragraph shall be 30 dB instead of 20 dB. Attenuation below the general limits specified in Section 15.209(a) is not required. In addition, radiated emissions which fall in the restricted bands, as defined in Section 15.205(a), must also comply with the radiated emission limits specified in Section 15.209(a) (see Section 15.205(c)).

## 6.3. Test Procedure

The EUT is placed on a turn table which is 1.5 meter above ground. The turn table is rotated 360 degrees to determine the position of the maximum emission level. The EUT was positioned such that the distance from antenna to the EUT was 3 meters.

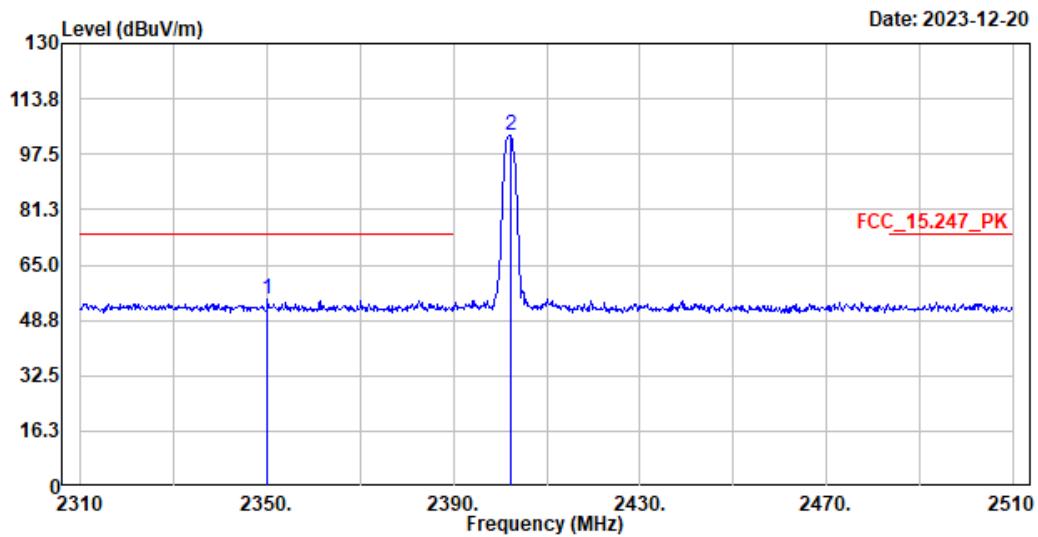
The antenna can move up and down between 1 meter and 4 meters to find out the maximum emission level.

Both horizontal and vertical polarization of the antenna are set on measurement. In order to find the maximum emission, all of the interface cables must be manipulated according to ANSI C63.10: 2013 on radiated measurement.

The bandwidth setting below 1 GHz and above 1 GHz on the field strength meter is 120 kHz and 1MHz, respectively.

6.4. Test Result of Band Edge

Site :HY-CB03  
 Condition :3m Horizontal  
 Mode :TX\_bt1M\_2402MHz  
 Test BY :Peter



No.	Frequency	Level	Limit	Over	Read	Factor	Remark
	MHz	dBm	dBm	dB	dBm	dB/m	
1	2350.200	54.81	74.00	-19.19	47.83	6.98	Peak
2	2402.200	102.94	-----	-----	96.02	6.92	Peak

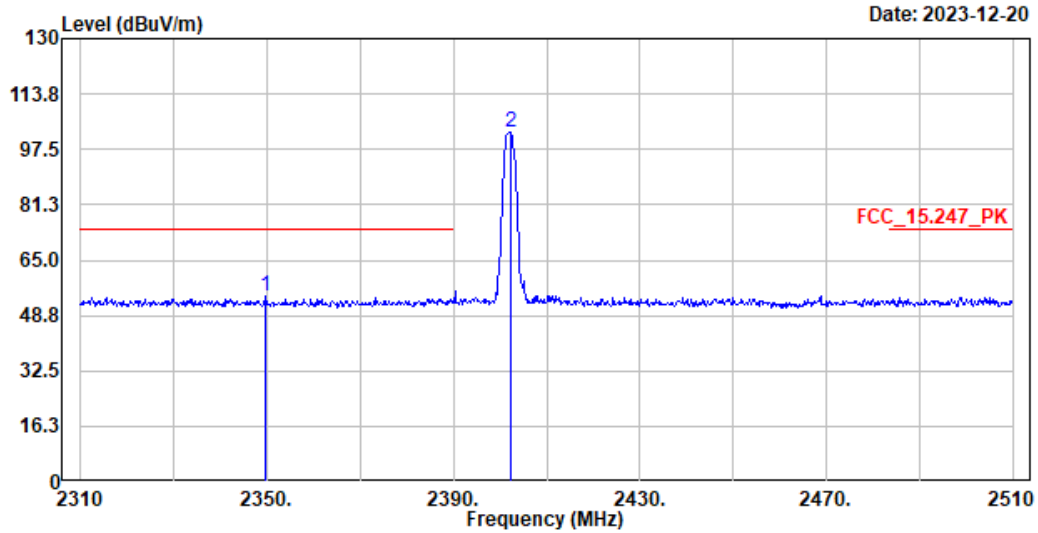
Note:

1. Level = Read Level + Factor
2. Factor = Antenna Factor + Cable Loss - Preamp Factor
3. Over Limit = Level - Limit Line
4. The emission levels of other frequencies are very lower than the limit and not show in test report.

Horizontal-Average Detector:

Frequency (MHz)	Peak Measurement (dBμV/m)	Duty Cycle Factor (dB)	Measurement Level (dBμV/m)	Margin (dB)	Limit (dBμV/m)
2350.2	54.81	-30.755	24.055	-29.945	54.000
2402.2	102.94	-30.755	72.185	--	--

Site :HY-CB03  
 Condition :3m Vertical  
 Mode :TX\_bt1M\_2402MHz  
 Test BY :Peter



No.	Frequency	Level	Limit	Over	Read	Factor	Remark
	MHz	dBm	dBm	dB	dBm	dB/m	
1	2349.800	54.23	74.00	-19.77	47.25	6.98	Peak
2	2402.200	102.46	-----	-----	95.54	6.92	Peak

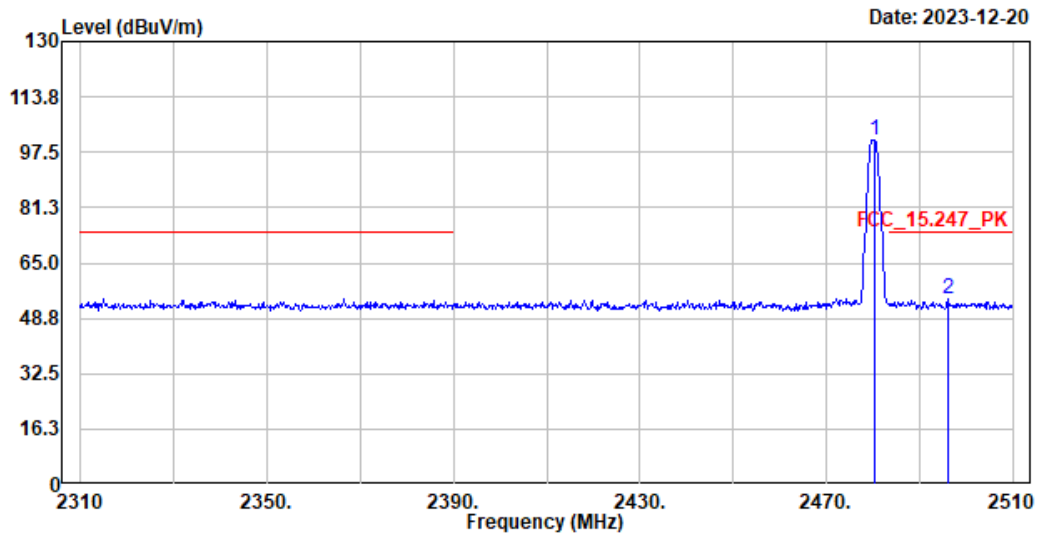
Note:

1. Level = Read Level + Factor
2. Factor = Antenna Factor + Cable Loss - Preamp Factor
3. Over Limit = Level - Limit Line
4. The emission levels of other frequencies are very lower than the limit and not show in test report.

Vertical-Average Detector:

Frequency (MHz)	Peak Measurement (dBμV/m)	Duty Cycle Factor (dB)	Measurement Level (dBμV/m)	Margin (dB)	Limit (dBμV/m)
2349.8	54.23	-30.755	23.475	-30.525	54.000
2402.2	102.46	-30.755	71.705	--	--

Site :HY-CB03  
 Condition :3m Horizontal  
 Mode :TX\_bt1M\_2480MHz  
 Test BY :Peter



No.	Frequency	Level	Limit	Over	Read	Factor	Remark
			Line	Limit	Level		
	MHz	dBm	dBm	dB	dBm	dB/m	
1	2480.200	101.03	-----	-----	94.13	6.90	Peak
2	2496.000	54.39	74.00	-19.61	47.47	6.92	Peak

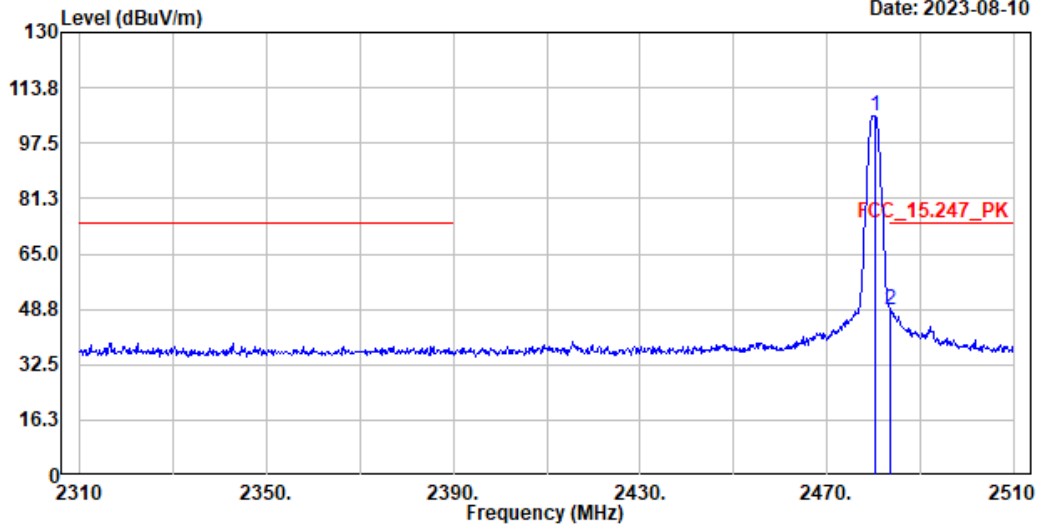
Note:

1. Level = Read Level + Factor
2. Factor = Antenna Factor + Cable Loss - Preamp Factor
3. Over Limit = Level - Limit Line
4. The emission levels of other frequencies are very lower than the limit and not show in test report.

Horizontal-Average Detector:

Frequency (MHz)	Peak Measurement (dBμV/m)	Duty Cycle Factor (dB)	Measurement Level (dBμV/m)	Margin (dB)	Limit (dBμV/m)
2480.2	101.03	-30.755	70.275	--	--
2496	54.39	-30.755	23.635	-30.365	54.000





No.	Frequency	Level	Limit	Over	Read	Factor	Remark
	MHz	dBuV/m	Line	Limit	Level		
			dBuV/m	dB	dBuV	dB	
1	2480.200	105.58	-----	-----	98.68	6.90	Peak
2	2483.600	48.68	74.00	-25.32	41.78	6.90	Peak

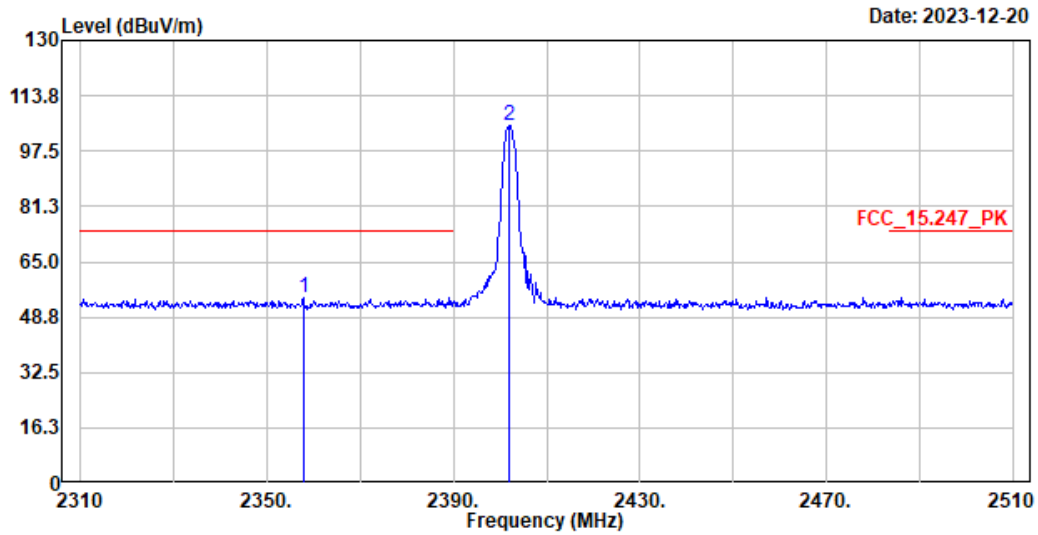
Note:

1. Level = Read Level + Factor
2. Factor = Antenna Factor + Cable Loss - Preamp Factor
3. Over Limit = Level - Limit Line
4. The emission levels of other frequencies are very lower than the limit and not show in test report.

Vertical-Average Detector:

Frequency (MHz)	Peak Measurement (dBμV/m)	Duty Cycle Factor (dB)	Measurement Level (dBμV/m)	Margin (dB)	Limit (dBμV/m)
2480	104.24	-30.755	73.485	--	--
2487	54.56	-30.755	23.805	-30.195	54.000

Site :HY-CB03  
 Condition :3m Horizontal  
 Mode :TX\_bt3M\_2402MHz  
 Test BY :Peter



No.	Frequency	Level	Limit	Over	Read	Factor	Remark
	MHz	dBm	dBm	dB	dBm	dB/m	
1	2357.800	54.68	74.00	-19.32	47.77	6.91	Peak
2	2402.000	104.92	-----	-----	98.00	6.92	Peak

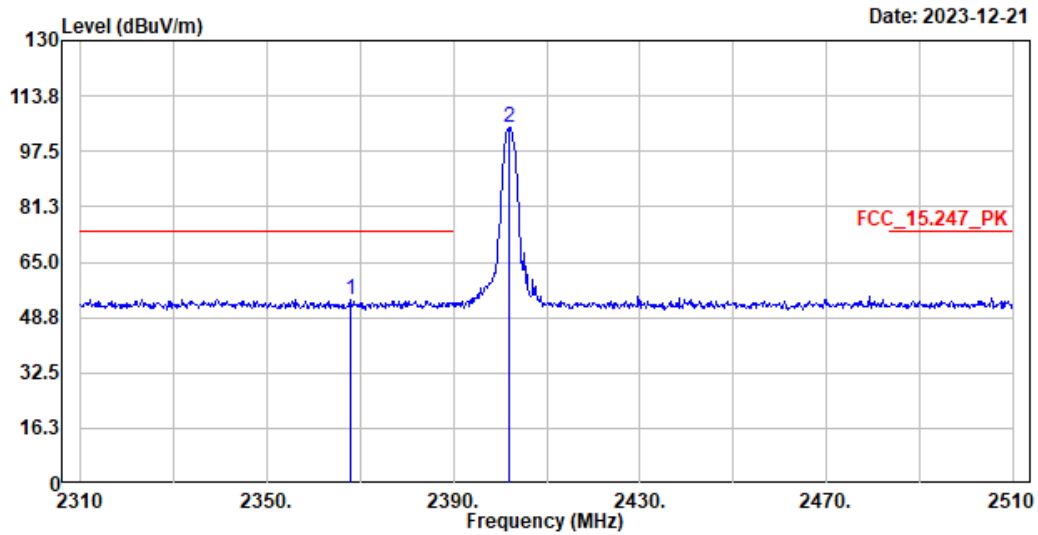
Note:

1. Level = Read Level + Factor
2. Factor = Antenna Factor + Cable Loss - Preamp Factor
3. Over Limit = Level - Limit Line
4. The emission levels of other frequencies are very lower than the limit and not show in test report.

Horizontal-Average Detector:

Frequency (MHz)	Peak Measurement (dBμV/m)	Duty Cycle Factor (dB)	Measurement Level (dBμV/m)	Margin (dB)	Limit (dBμV/m)
2357.8	54.68	-30.755	23.925	-30.075	54.000
2402	104.92	-30.755	74.165	--	--

Site :HY-CB03  
 Condition :3m Vertical  
 Mode :TX\_bt3M\_2402MHz  
 Test BY :Peter



No.	Frequency	Level	Limit	Over	Read	Factor	Remark
	MHz	dBm	Line	Limit	Level	dB/m	
			dBm	dB	dBm		
1	2367.800	54.02	74.00	-19.98	47.13	6.89	Peak
2	2402.000	104.36	-----	-----	97.44	6.92	Peak

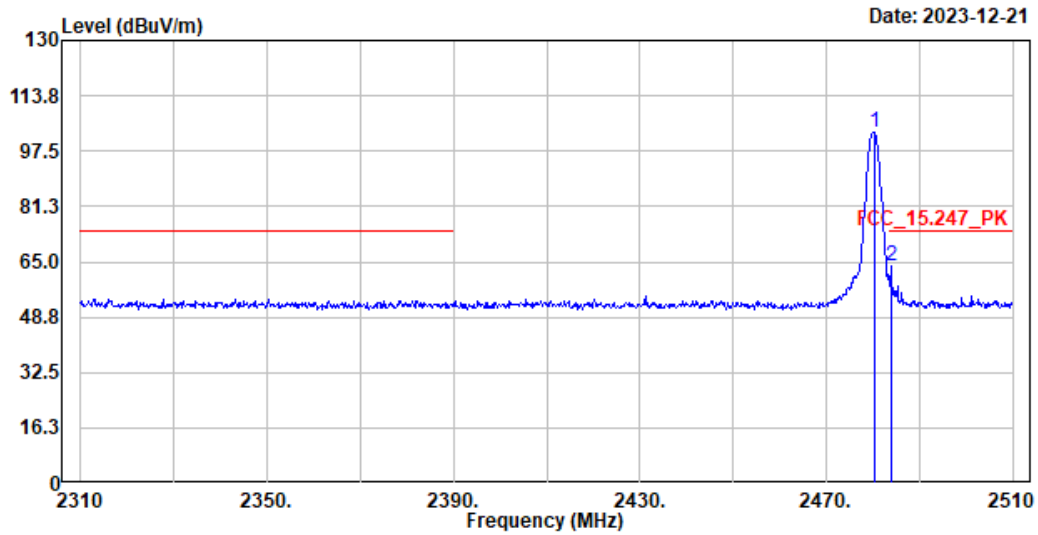
Note:

1. Level = Read Level + Factor
2. Factor = Antenna Factor + Cable Loss - Preamp Factor
3. Over Limit = Level - Limit Line
4. The emission levels of other frequencies are very lower than the limit and not show in test report.

Vertical-Average Detector:

Frequency (MHz)	Peak Measurement (dBμV/m)	Duty Cycle Factor (dB)	Measurement Level (dBμV/m)	Margin (dB)	Limit (dBμV/m)
2367.8	54.02	-30.755	23.265	-30.735	54.000
2402	104.36	-30.755	73.605	--	--

Site :HY-CB03  
 Condition :3m Horizontal  
 Mode :TX\_bt3M\_2480MHz  
 Test BY :Peter



No.	Frequency	Level	Limit	Over	Read	Factor	Remark
	MHz	dBm	dBm	dB	dBm	dB/m	
1	2480.200	102.91	-----	-----	96.01	6.90	Peak
2	2483.800	63.71	74.00	-10.29	56.81	6.90	Peak

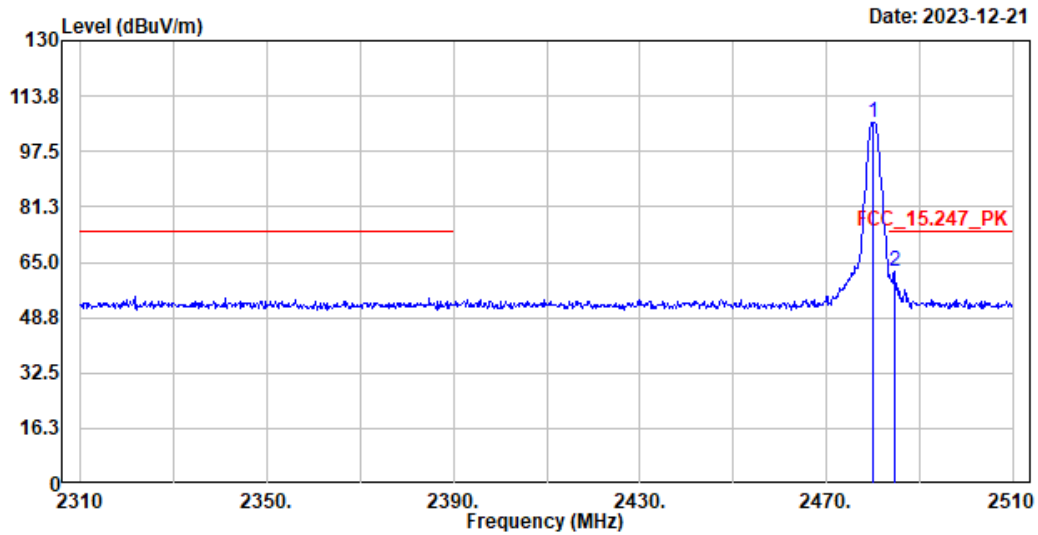
Note:

1. Level = Read Level + Factor
2. Factor = Antenna Factor + Cable Loss - Preamp Factor
3. Over Limit = Level - Limit Line
4. The emission levels of other frequencies are very lower than the limit and not show in test report.

Horizontal-Average Detector:

Frequency (MHz)	Peak Measurement (dBµV/m)	Duty Cycle Factor (dB)	Measurement Level (dBµV/m)	Margin (dB)	Limit (dBµV/m)
2480.2	102.91	-30.755	72.155	--	--
2483.8	63.71	-30.755	32.955	-21.045	54.000

Site :HY-CB03  
 Condition :3m Vertical  
 Mode :TX\_bt3M\_2480MHz  
 Test BY :Peter



No.	Frequency	Level	Limit	Over	Read	Factor	Remark
	MHz	dBm	dBm	dB	dBm	dB/m	
1	2480.000	106.17	-----	-----	99.27	6.90	Peak
2	2484.600	62.19	74.00	-11.81	55.29	6.90	Peak

Note:

1. Level = Read Level + Factor
2. Factor = Antenna Factor + Cable Loss - Preamp Factor
3. Over Limit = Level - Limit Line
4. The emission levels of other frequencies are very lower than the limit and not show in test report.

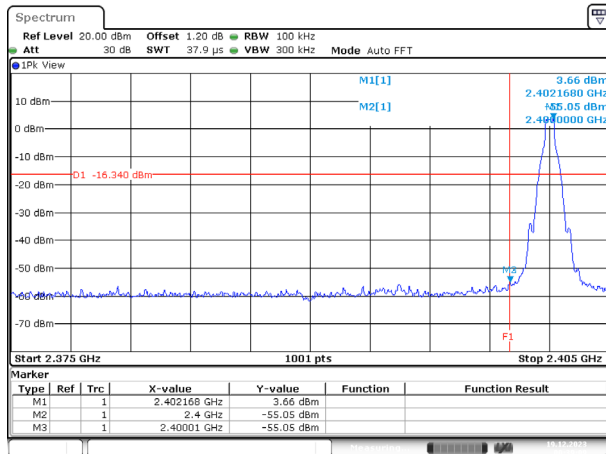
Vertical-Average Detector:

Frequency (MHz)	Peak Measurement (dBμV/m)	Duty Cycle Factor (dB)	Measurement Level (dBμV/m)	Margin (dB)	Limit (dBμV/m)
2480	106.17	-30.755	75.415	--	--
2484.6	62.19	-30.755	31.435	-22.565	54.000

Product : Car Infotainment Unit  
 Test Item : Band Edge  
 Test Mode : Transmit-1 Mbps (Hopping off)  
 Test Date : 2023/12/19

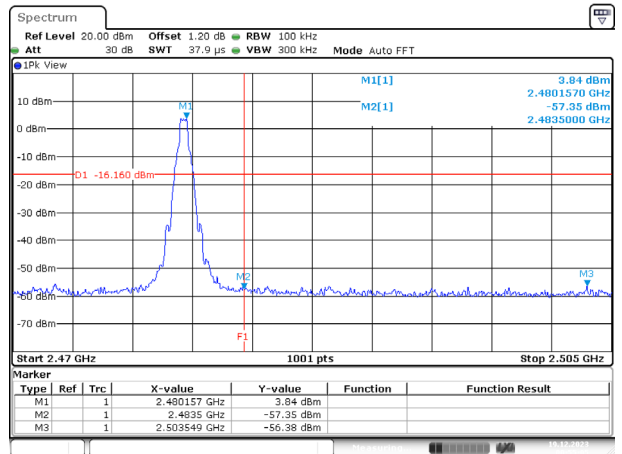
Measurement Level	Result
$\Delta$ (dB)	
> 20	PASS

Channel 00



Date: 19 DEC 2023 00:39:10

Channel 78

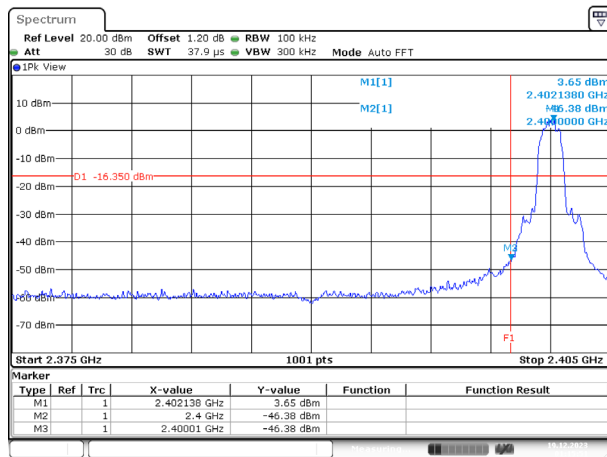


Date: 19 DEC 2023 00:55:05

Product : Car Infotainment Unit  
 Test Item : Band Edge  
 Test Mode : Transmit-3 Mbps (Hopping off)  
 Test Date : 2023/12/19

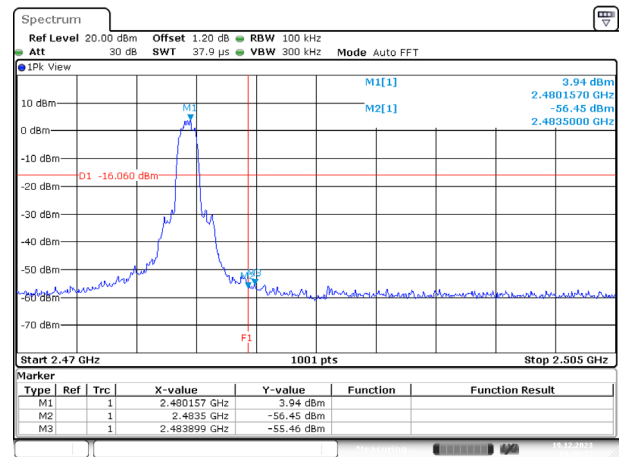
Measurement Level $\Delta$ (dB)	Result
> 20	PASS

Channel 00



Date: 19 DEC 2023 01:15:52

Channel 78

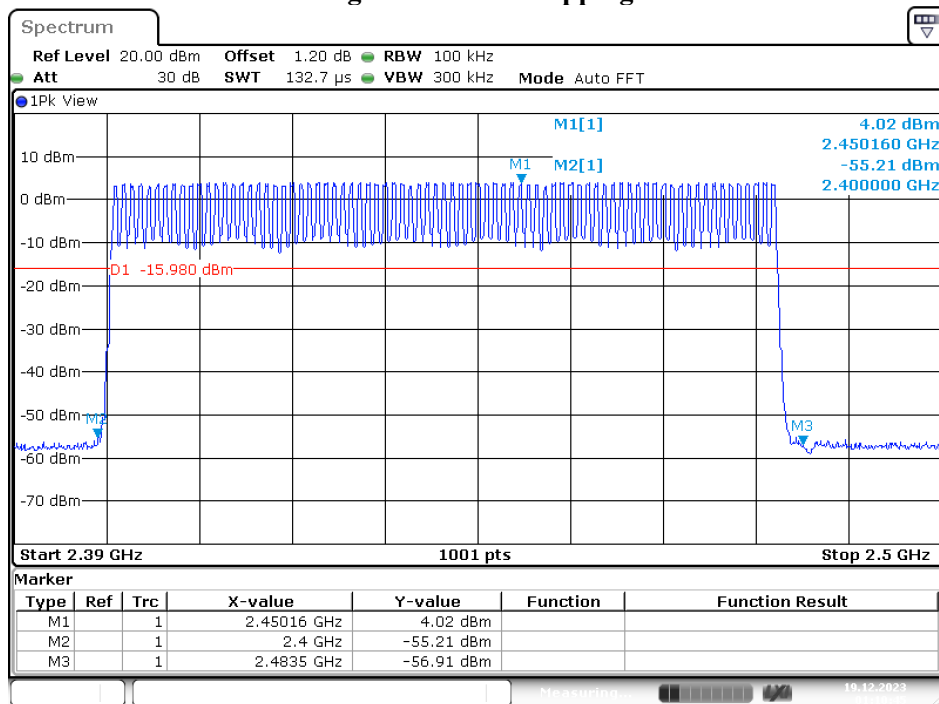


Date: 19 DEC 2023 01:38:18

Product : Car Infotainment Unit  
 Test Item : Band Edge  
 Test Mode : Transmit-1 Mbps (Hopping on)  
 Test Date : 2023/12/19

Measurement Level $\Delta$ (dB)	Result
> 20	PASS

Figure Channel Hopping



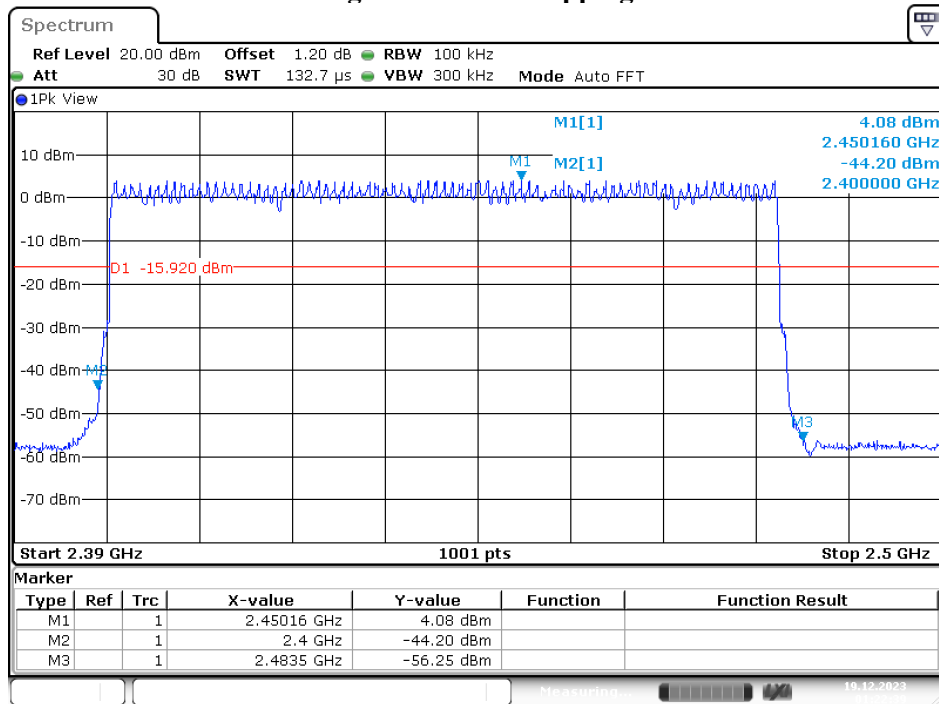
Date: 19.DEC.2023 01:10:45



Product : Car Infotainment Unit  
 Test Item : Band Edge  
 Test Mode : Transmit-3 Mbps (Hopping on)  
 Test Date : 2023/12/19

Measurement Level	Result
$\Delta$ (dB)	
> 20	PASS

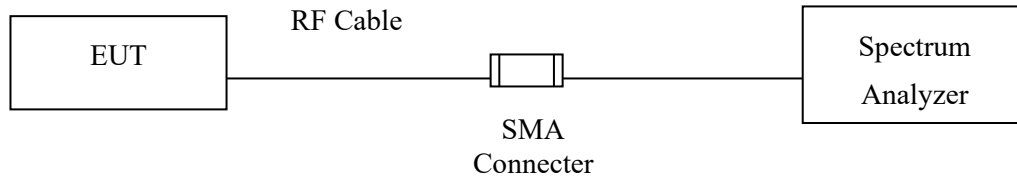
Figure Channel Hopping



Date: 19.DEC.2023 01:22:39

## 7. Channel Number

### 7.1. Test Setup



### 7.2. Limit

Frequency hopping systems operating in the 2400-2483.5 MHz bands shall use at least 15 hopping frequencies.

### 7.3. Test Procedure

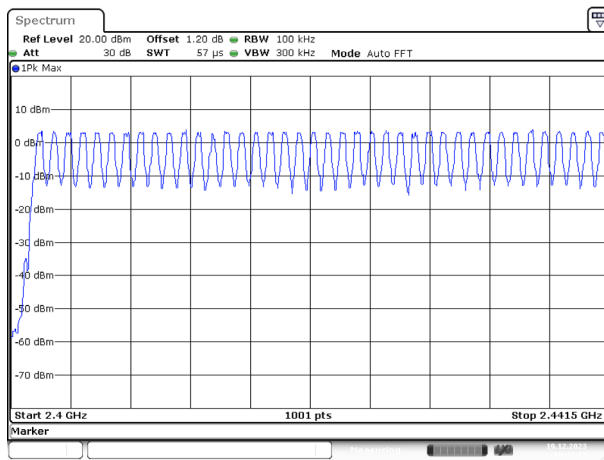
Tested according to FHSS test procedure of KDB558074 section 9 (b for compliance to FCC 47CFR 15.247 requirements.

7.4. Test Result of Channel Number

Product : Car Infotainment Unit  
 Test Item : Channel Number  
 Test Mode : Transmit-1 Mbps  
 Test Date : 2023/12/19

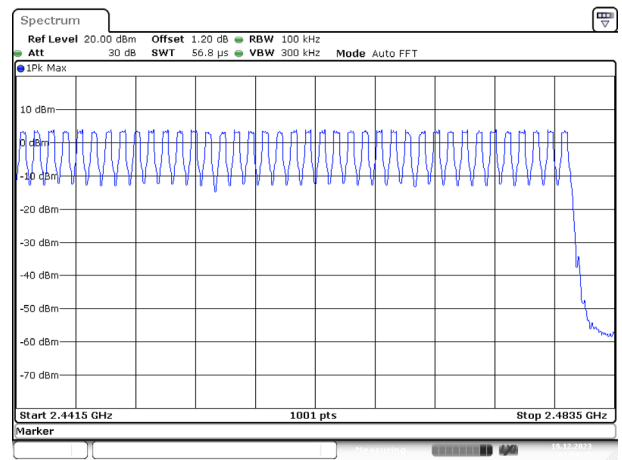
Frequency Range (MHz)	Measurement (Hopping Channel)	Required Limit (Hopping Channel)	Result
2402 ~ 2480	79	>15	Pass

2402 MHz



Date: 19.DEC.2023 00:43:23

2480 MHz

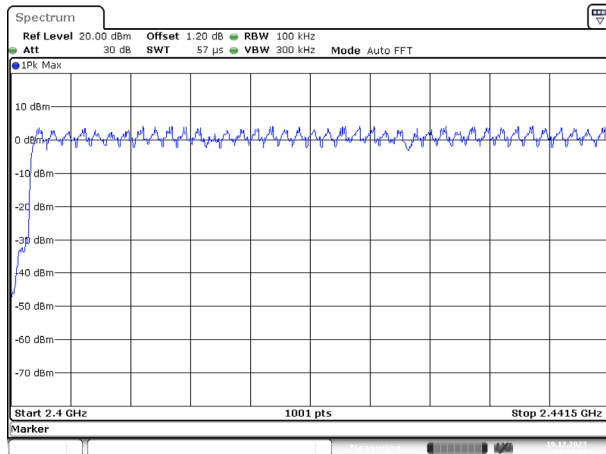


Date: 19.DEC.2023 01:00:26

Product : Car Infotainment Unit  
 Test Item : Channel Number  
 Test Mode : Transmit-3 Mbps  
 Test Date : 2023/12/19

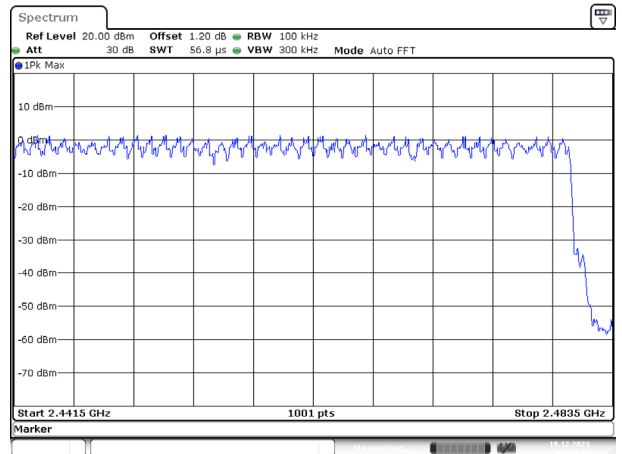
Frequency Range (MHz)	Measurement (Hopping Channel)	Required Limit (Hopping Channel)	Result
2402 ~ 2480	79	>15	Pass

2402 MHz



Date: 19 DEC 2023 01:19:02

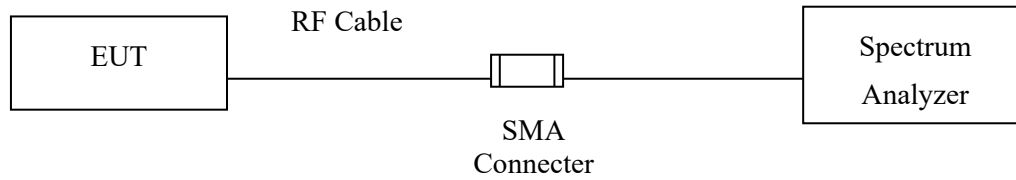
2480 MHz



Date: 19 DEC 2023 03:02:18

## 8. Channel Separation

### 8.1. Test Setup



### 8.2. Limit

Frequency hopping systems shall have hopping channel carrier frequencies separated by a minimum of 25 kHz or the 20 dB bandwidth of the hopping channel, whichever is greater.

### 8.3. Test Procedure

Tested according to FHSS test procedure of KDB558074 section 9 (b for compliance to FCC 47CFR 15.247 requirements.

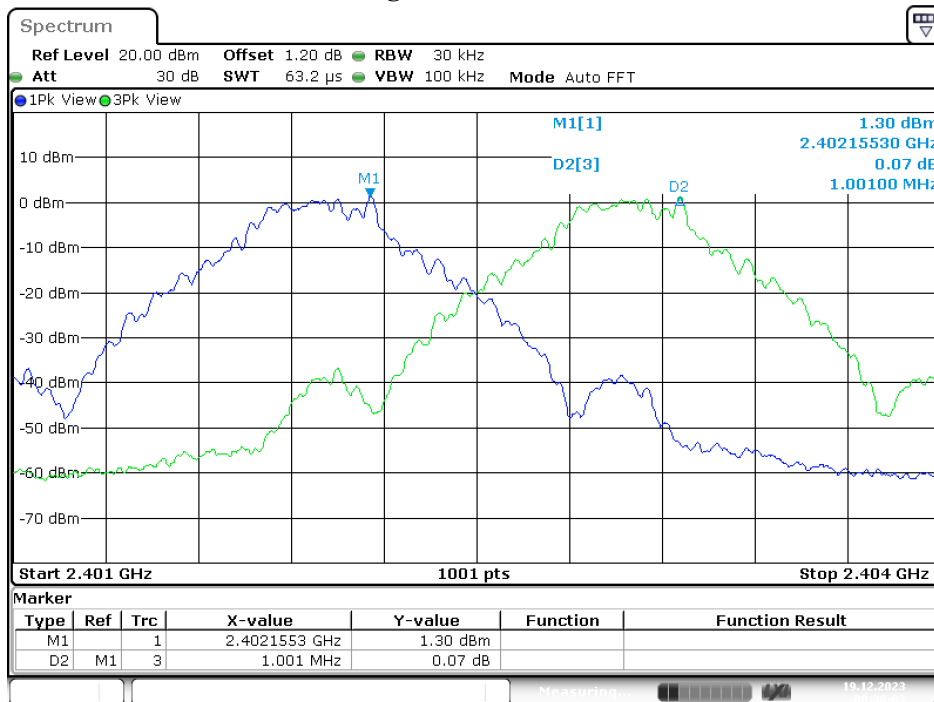
8.4. Test Result of Channel Separation

Product : Car Infotainment Unit  
 Test Item : Channel Separation  
 Test Mode : Transmit-1 Mbps  
 Test Date : 2023/12/19

Channel No.	Frequency (MHz)	Measurement Level (kHz)	Limit (kHz)	Limit of (2/3)*20dB Bandwidth (kHz)	Result
00	2402	1001	>25	631.4	Pass
39	2441	998	>25	631.4	Pass
78	2480	998	>25	631.4	Pass

Note: The 20dB Bandwidth is refer to section 10.

Figure Channel 00



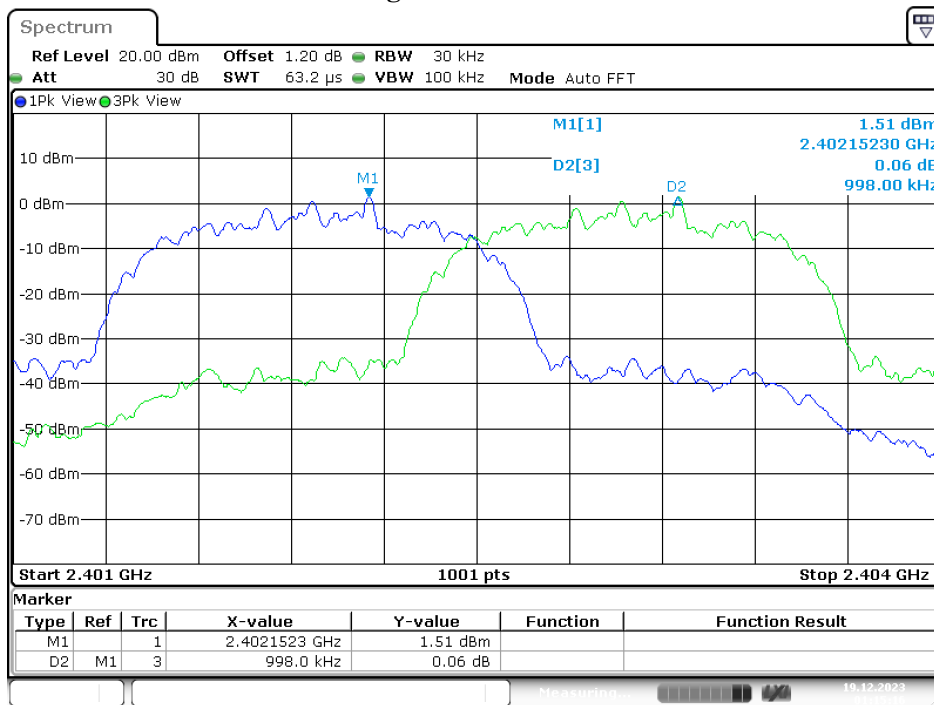
Date: 19.DEC.2023 00:38:04

Product : Car Infotainment Unit  
 Test Item : Channel Separation  
 Test Mode : Transmit-3 Mbps  
 Test Date : 2023/12/19

Channel No.	Frequency (MHz)	Measurement Level (kHz)	Limit (kHz)	Limit of (2/3)*20dB Bandwidth (kHz)	Result
00	2402	998	>25	857.1	Pass
39	2441	998	>25	857.1	Pass
78	2480	998	>25	857.1	Pass

Note: The 20dB Bandwidth is refer to section 10.

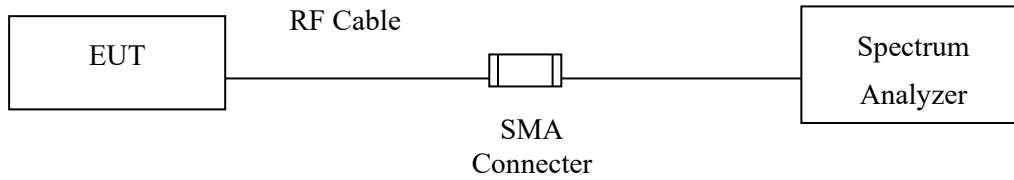
Figure Channel 00



Date: 19.DEC.2023 01:15:17

## 9. Dwell Time

### 9.1. Test Setup



### 9.2. Limit

The average time of occupancy on any channel shall not be greater than 0.4 seconds within a period of 0.4 seconds multiplied by the number of hopping channels employed.

### 9.3. Test Procedure

Tested according to FHSS test procedure of KDB558074 section 9 (b for compliance to FCC 47CFR 15.247 requirements.



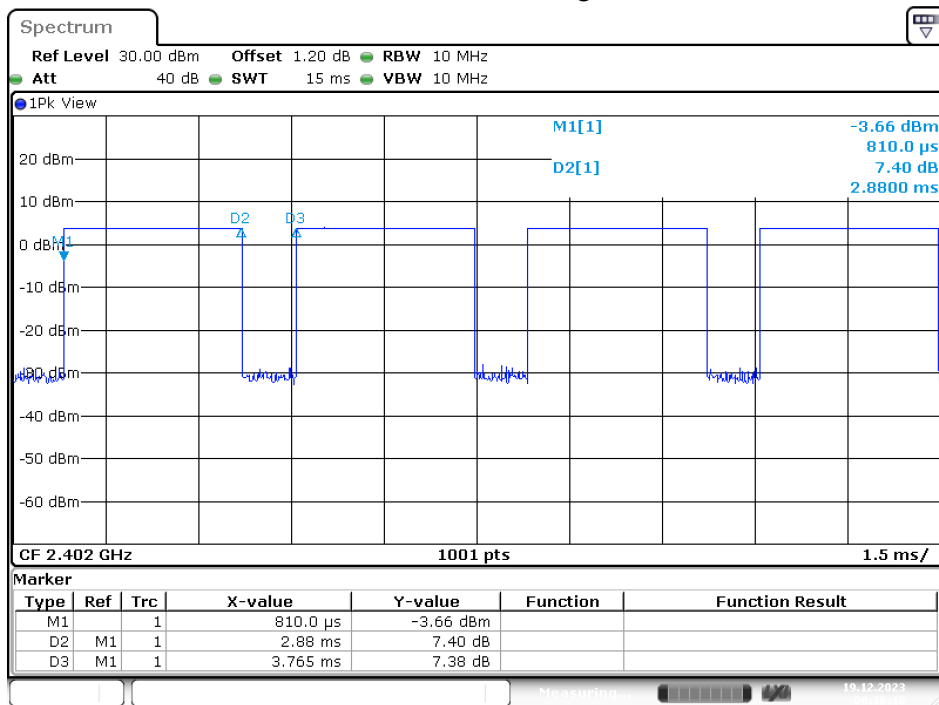
9.4. Test Result of Dwell Time

Product : Car Infotainment Unit  
 Test Item : Dwell Time  
 Test Mode : Transmit-1 Mbps (Channel 00, 39, 78)  
 Test Date : 2023/12/19

Frequency (MHz)	Time slot length (ms)	Period (sec)	(calculation)	Dwell Time (ms)	Limit (ms)	Result
2402	2.880	31.6	Time(sec)*(266.67/79)*31.6	307.204	400	Pass
2441	2.865	31.6	Time(sec)*(266.67/79)*31.6	305.604	400	Pass
2480	2.880	31.6	Time(sec)*(266.67/79)*31.6	307.204	400	Pass

Note: Dwell time =Time slot length\* calculation

CH 00 Time slot length

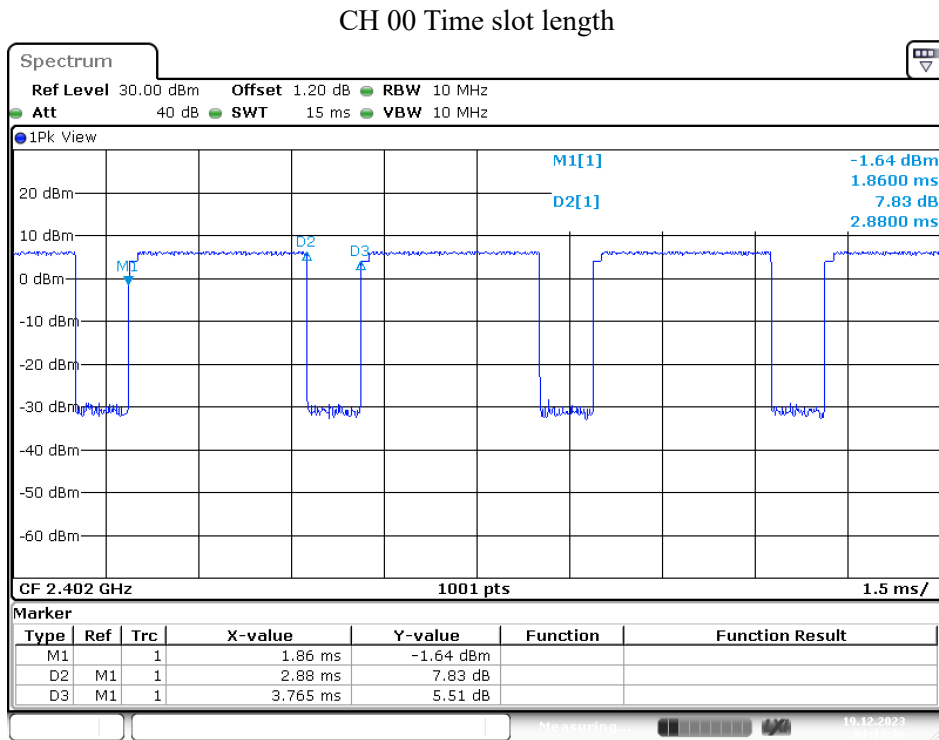


Date: 19\_DEC.2023 00:36:18

Product : Car Infotainment Unit  
 Test Item : Dwell Time  
 Test Mode : Transmit-3 Mbps (Channel 00, 39, 78)  
 Test Date : 2023/12/19

Frequency (MHz)	Time slot length (ms)	Period (sec)	(calculation)	Dwell Time (ms)	Limit (ms)	Result
2402	2.880	31.6	Time(sec)*(266.67/79)*31.6	307.204	400	Pass
2441	2.880	31.6	Time(sec)*(266.67/79)*31.6	307.204	400	Pass
2480	2.880	31.6	Time(sec)*(266.67/79)*31.6	307.204	400	Pass

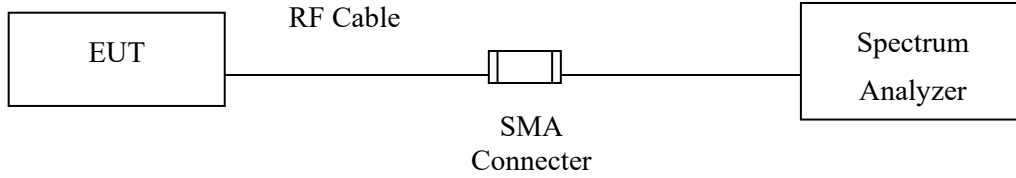
Note: Dwell time =Time slot length\* calculation



Date: 19.DEC.2023 01:12:27

## 10. Occupied Bandwidth

### 10.1. Test Setup



### 10.2. Limits

N/A

### 10.3. Test Procedure

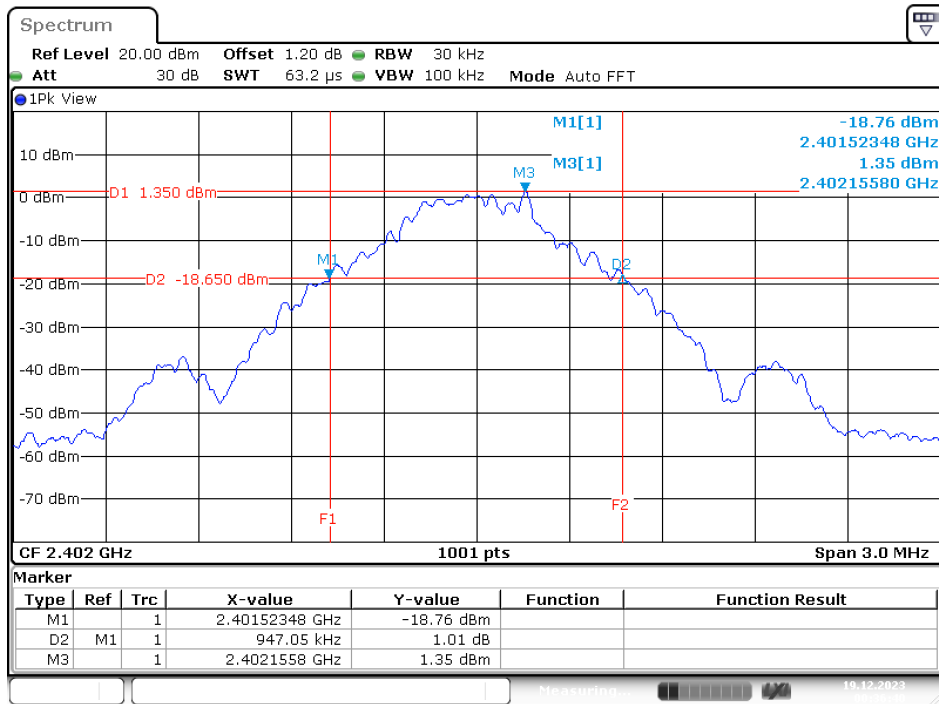
Tested according to FHSS test procedure of KDB558074 section 9 (b for compliance to FCC 47CFR 15.247 requirements.

10.4. Test Result of Occupied Bandwidth

Product : Car Infotainment Unit  
 Test Item : Occupied Bandwidth Data  
 Test Mode : Transmit-1 Mbps  
 Test Date : 2023/12/19

Channel No.	Frequency (MHz)	Measurement Level (kHz)	Required Limit (kHz)	Result
00	2402	947	--	NA
39	2441	947	--	NA
78	2480	947	--	NA

Figure Channel 00:

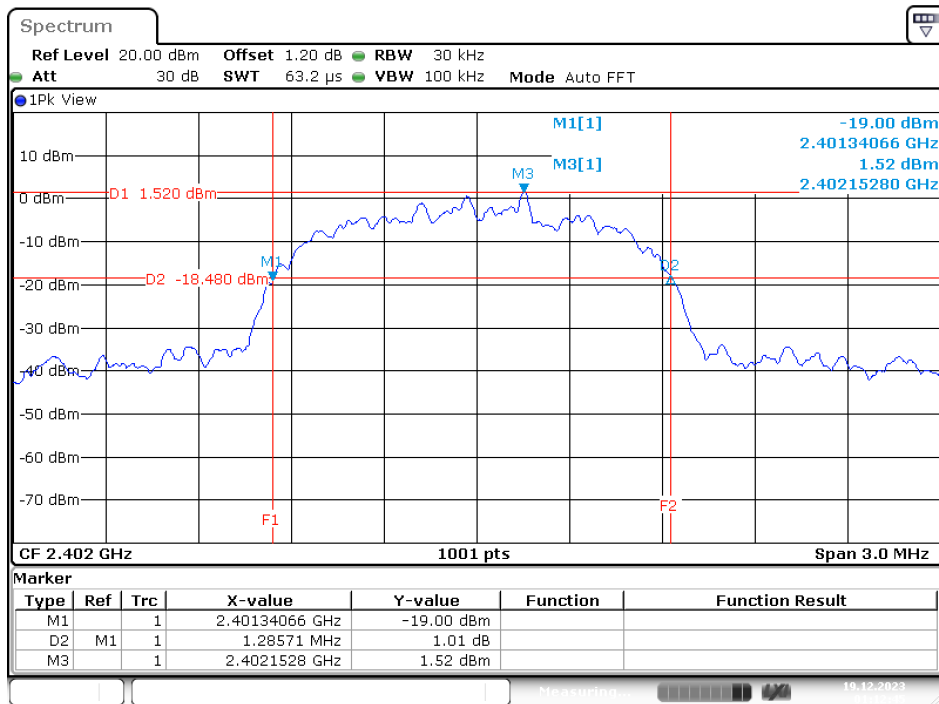


Date: 19.DEC.2023 00:36:41

Product : Car Infotainment Unit  
 Test Item : Occupied Bandwidth Data  
 Test Mode : Transmit-3 Mbps  
 Test Date : 2023/12/19

Channel No.	Frequency (MHz)	Measurement Level (kHz)	Required Limit (kHz)	Result
00	2402	1286	--	NA
39	2441	1286	--	NA
78	2480	1286	--	NA

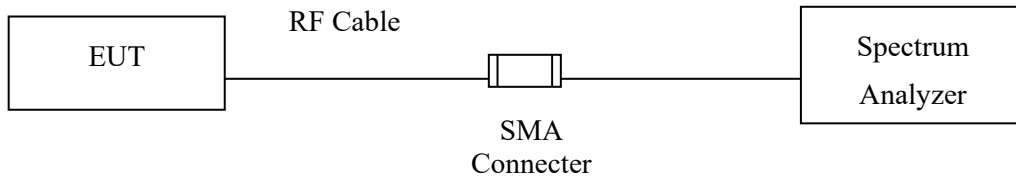
Figure Channel 00:



Date: 19.DEC.2023 01:12:45

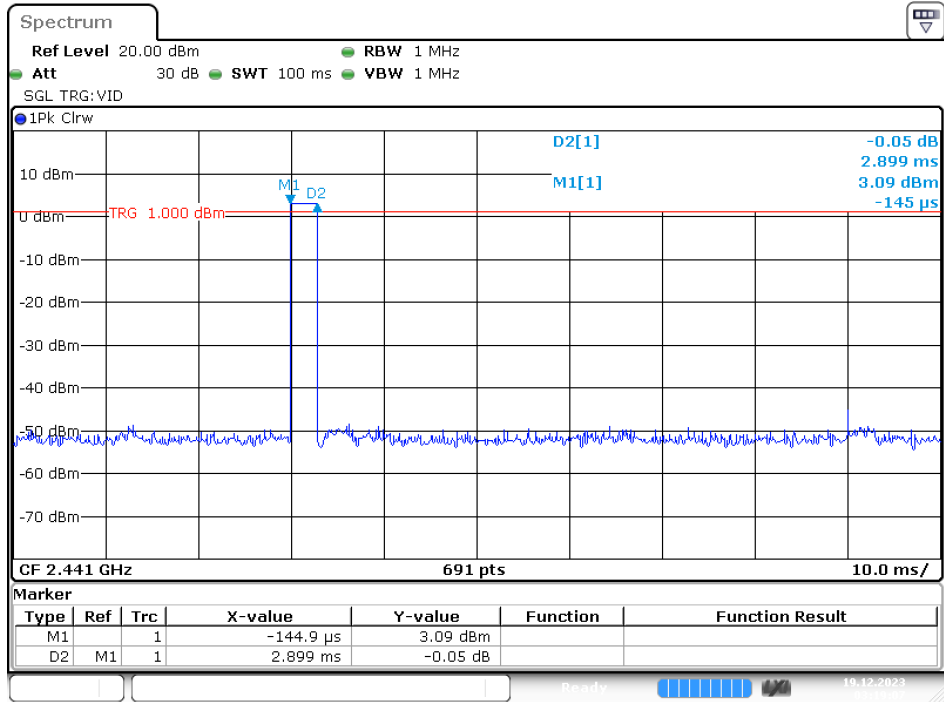
## 11. Duty Cycle

### 11.1. Test Setup



11.2. Test Result of Duty Cycle

Product : Car Infotainment Unit  
 Test Item : Duty Cycle Data  
 Test Mode : Transmit-1 Mbps



Date: 19.DEC.2023 03:19:08

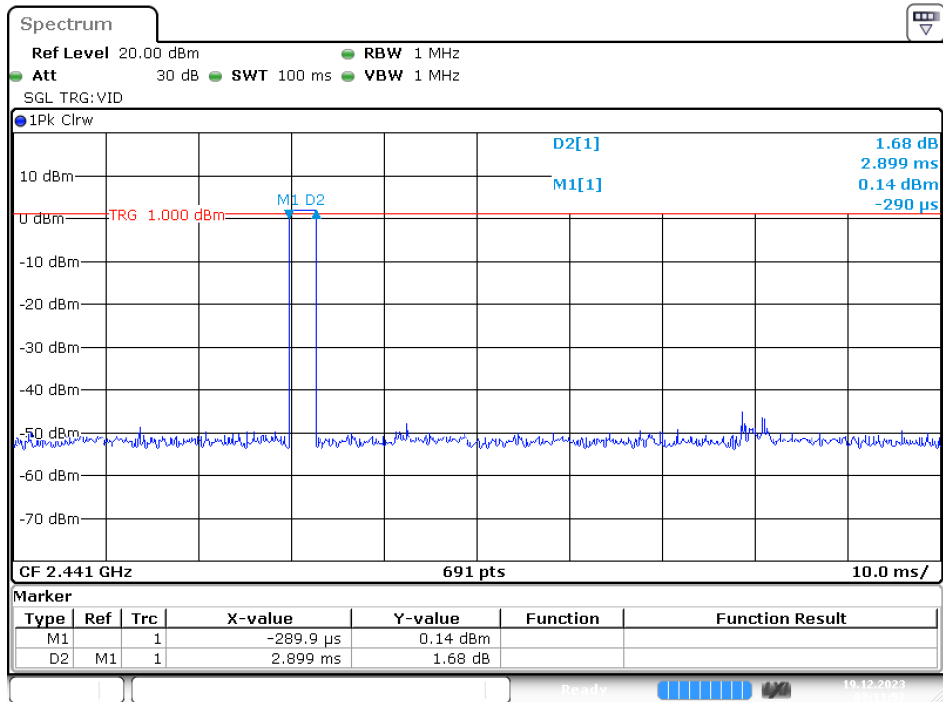
Time on of 100ms = 2.899 msec

Duty Cycle = 2.899 msec / 100 msec = 0.02899

Duty Cycle correction factor = 20 LOG 0.02899 = -30.755 dB

<b>Duty Cycle correction factor</b>	<b>-30.755 dB</b>
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Product : Car Infotainment Unit  
 Test Item : Duty Cycle Data  
 Test Mode : Transmit-3 Mbps



Date: 19.DEC.2023 03:11:57

Time on of 100ms = 2.899 msec

Duty Cycle = 2.899 msec / 100 msec = 0.02899

Duty Cycle correction factor = 20 LOG 0.02899 = -30.755 dB

<b>Duty Cycle correction factor</b>	<b>-30.755 dB</b>
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