Amber Helm Development L.C.
92723 Michigan Hwy-152
Sister Lakes, Michigan 49047 USA
Tel: 888-847-8027

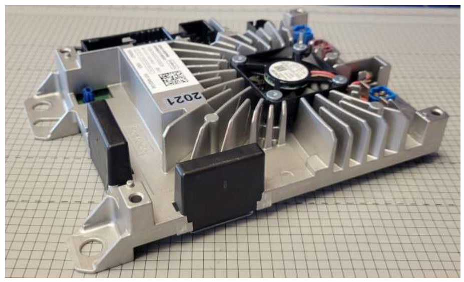
SG5PHX-WR2301NABT
Issued: **February 27, 2023**

BT FHSS Test Report

regarding

USA:	**CFR Title 47, Part 15.247**	(Emissions)
Canada:	**IC RSS-247/GENe**	(Emissions)

for



SG5PHX

Category: Vehicular Domain Controller

Judgments:
FCC 15.247, ISED RSS-247v2 Compliant
Testing Completed: February 27, 2023

TESTING
NVLAP LAB CODE 200129-0

Prepared for:

Ford Motor Company

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Revision History

Rev. No.	Date	Details	Revised By
r0	February 27, 2023	Initial Release.	J. Brunett
r1	May 3, 2023	Updates per TCB comments.	J. Brunett

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1 Test Report Scope and Limitations

1.1 Laboratory Authorization

Test Facility description and attenuation characteristics are on file with the FCC Laboratory, Columbia, Maryland (FCC Reg. No: US5348 and US5356) and with ISED Canada, Ottawa, ON (File Ref. No: 3161A and 24249). Amber Helm Development L.C. holds accreditation under NVLAP Lab Code 200129-0.

1.2 Report Retention

For equipment verified to comply with the regulations herein, the manufacturer is obliged to retain this report with the product records for the life of the product, and no less than ten years. A copy of this Report will remain on file with this laboratory until March 2033.

1.3 Subcontracted Testing

This report does not contain data produced under subcontract.

1.4 Test Data

This test report contains data included within the laboratory's scope of accreditation. Any data in this report that is not covered under the laboratory's scope is clearly identified.

1.5 Limitation of Results

The test results contained in this report relate only to the item(s) tested. Any electrical or mechanical modification made to the test item subsequent to the test date shall invalidate the data presented in this report. Any electrical or mechanical modification made to the test item subsequent to this test date shall require reevaluation.

1.6 Copyright

1.7 Endorsements

This report shall not be used to claim product endorsement by any accrediting, regulatory, or governmental agency.

1.8 Test Location

The EUT was fully tested by **Amber Helm Development L.C.**, headquartered at 92723 Michigan Hwy-152, Sister Lakes, Michigan 49047 USA. Table 1 lists all sites employed herein. Specific test sites utilized are also listed in the test results sections of this report where needed.

Table 1: Test Site List.

Description	Location	Quality Num.
OATS (3 meter)	3615 E Grand River Rd., Williamston, Michigan 48895	OATSC

1.9 Traceability and Equipment Used

Pertinent test equipment used for measurements at this facility is listed in Table 2. The quality system employed at Amber Helm Development L.C. has been established to ensure all equipment has a clearly identifiable classification, calibration expiry date, and that all calibrations are traceable to the SI through NIST, other recognized national laboratories, accepted fundamental or natural physical constants, ratio type of calibration, or by comparison to consensus standards.

Table 2: Equipment List.

Description	Manufacturer/Model	SN	Quality Num.	Cal/Ver By / Date Due
EMI Receiver	R & S / ESW26	101313	RSESW2601	RS / October-2023
Spec. Analyzer 70GHz	Anritsu / MS2760A	1705006	ANMS2760A1	ANR / Sept-2023
Pk/Avg Pwr Mtr	BK Prec. / RFP3008	620C22101	BKPM300801	BK / Mar-2024
Power Meter	R & S / NRP50S	101087	RSNRP50	RS / Nov-2024

2 Test Specifications and Procedures

2.1 Test Specification and General Procedures

The goal of Ford Motor Company is to demonstrate that the Equipment Under Test (EUT) complies with the Rules and/or Directives below. Detailed in this report are the results of testing the Ford Motor Company SG5PHX for compliance to:

Country/Region	Rules or Directive	Referenced Section(s)
United States	Code of Federal Regulations	CFR Title 47, Part 15.247
Canada	ISED Canada	IC RSS-247/GENe

It has been determined that the equipment under test is subject to the rules and directives above at the date of this testing. In conjunction with these rules and directives, the following specifications and procedures are followed herein to demonstrate compliance (in whole or in part) with these regulations.

ANSI C63.4:2014	"Methods of Measurement of Radio-Noise Emissions from Low-Voltage Electrical and Electronic Equipment in the Range of 9 kHz to 40 GHz"
ANSI C63.10:2013	"American National Standard of Procedures for Compliance Testing of Unlicensed Wireless Devices"
KDB 558074 D01 v05r02	"GUIDANCE FOR COMPLIANCE MEASUREMENTS ON DIGITAL TRANSMISSION SYSTEM, FREQUENCY HOPPING SPREAD SPECTRUM SYSTEM, AND HYBRID SYSTEM DEVICES OPERATING UNDER SECTION 15.247 OF THE FCC RULES "
KDB 662911 D01v02r01	"Emissions Testing of Transmitters with Multiple Outputs in the Same Band"
KDB 662911 D02 v01	"MIMO with Cross-Polarized Antenna"
TP0102RA	"AHD Internal Document TP0102 - Radiated Emissions Test Procedure"

3 Configuration and Identification of the Equipment Under Test

3.1 Description and Declarations

The equipment under test is a vehicle entertainment and information system containing Bluetooth, BLE, and 2x2 WiFi. The EUT is approximately 15 x 22 x 4 cm in dimension, and is depicted in Figure 1. It is powered by 13.5 VDC nominal vehicular power system. In use, this device is a vehicle entertainment module permanently installed into Ford motor vehicles. Table 3 outlines provider declared EUT specifications.

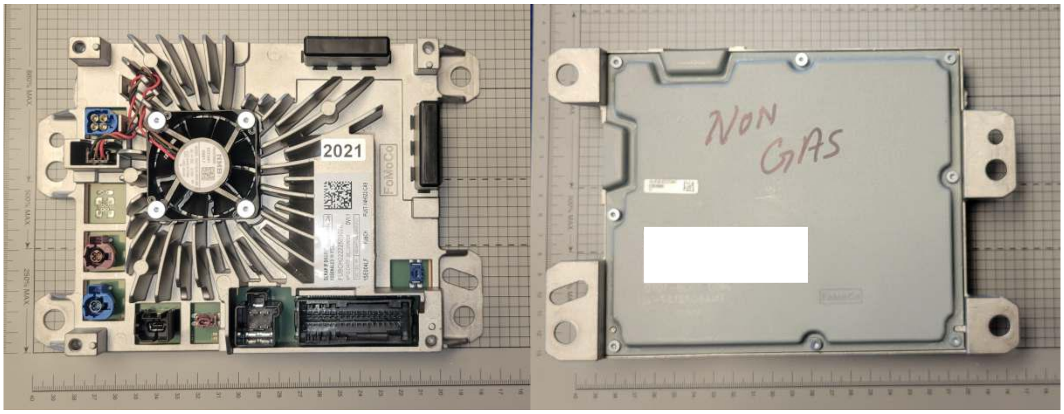


Figure 1: Photos of EUT.

Table 3: EUT Declarations.

General Declarations	
Equipment Type:	Vehicular Domain Controller
Country of Origin:	Not Declared
Nominal Supply:	13.5 VDC nominal
Oper. Temp Range:	-40^oC to $+75^o$C
Frequency Range:	BT/BLE/2G WLAN (2400 – 2483.5 MHz)
Antenna Dimension:	Integral
Antenna Type:	PCB Trace
Antenna Gain:	4.3 dBi max. (2400 – 2483.5 MHz)
Number of Channels:	BT, BASIC/EDR2M/EDR3M (0-79)
Channel Spacing:	BT 1 MHz
Alignment Range:	Not Declared
Type of Modulation:	BT: GFSK, π/4-DQPSK, 8DPSK

United States	
FCC ID Number:	KMH-SG5PHX
Classification:	FHSS

Canada	
IC Number:	1422A-SG5PHX
Classification:	Vehicle Entertainment/Network Device

3.1.1 EUT Configuration

The EUT is configured for testing as depicted in Figure 2.

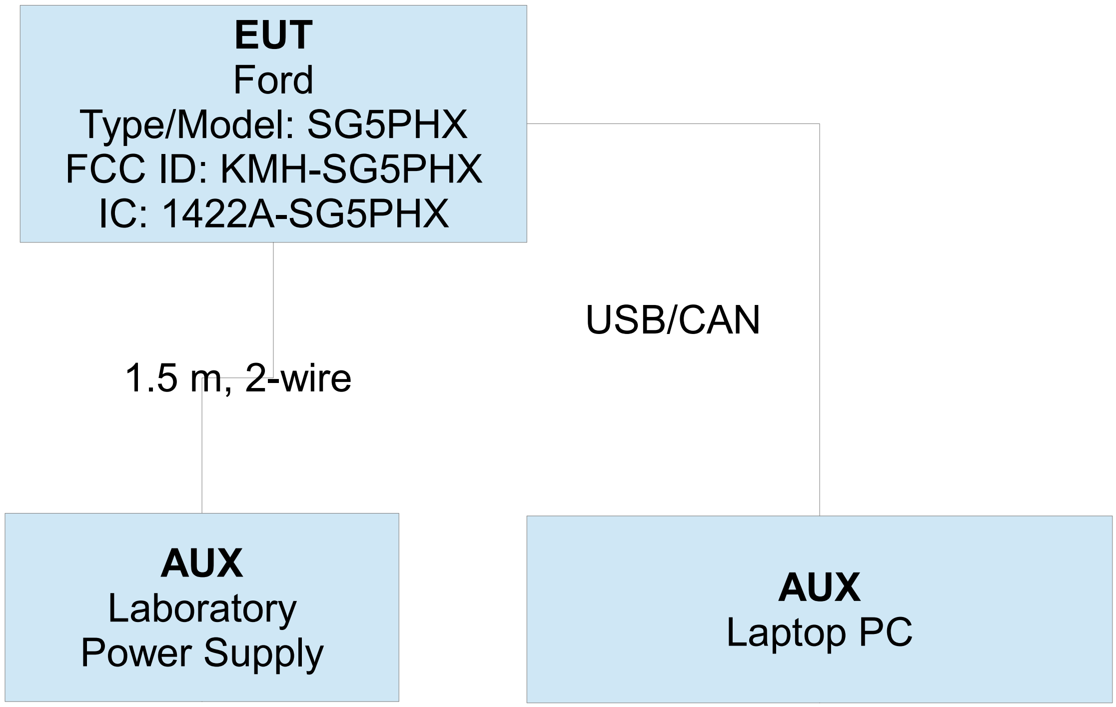


Figure 2: EUT Test Configuration Diagram.

3.1.2 Modes of Operation

The EUT employs two radio paths (PATH A and PATH B), over six modes (BT, BLE, 2G-BG-STA, 2G-N-STA, 5G-STA, 5G-AP). This report addresses only the following mode: **MODE BT**: In this mode the EUT operates as a Bluetooth 5.2 FHSS device including BASIC, EDR 2Mb, and EDR 3Mb data rates in the 2.4-2.4835 GHz band. This mode only employs radio PATH A.

3.1.3 Variants

There is only a single variant of the EUT, as tested.

3.1.4 Test Samples

Four samples of the EUT were provided in total, two normal (production ready) samples (SN: 2020, 2021) with integral antennas and two with the antennas replaced by coaxial cable connections (SN:2016, 1376). Each sample provided was capable of receiving radio instructions via CAN + USB interface to a personal computer. The manufacturer provided software tools and firmware need to place the EUT radio into test and normal operating modes.

3.1.5 Functional Exerciser

Normal functionality was confirmed by measurement of transmitted signals.

3.1.6 Modifications Made

There were no modifications made to the EUT by this laboratory.

3.1.7 Production Intent

The EUT appears to be a production ready sample.

3.1.8 Declared Exemptions and Additional Product Notes

The EUT is permanently installed in a transportation vehicle. As such, digital emissions are exempt from US and Canadian digital emissions regulations (per FCC 15.103(a) and IC correspondence on ICES-003). General spurious emissions (cabinet emissions with the EUT antenna ports terminated) are reported in the associated spurious emission test report for this product.

4 Emissions

4.1 General Test Procedures

4.1.1 Radiated Test Setup and Procedures

Radiated electromagnetic emissions from the EUT are first pre-scanned in our screen room. Spectrum and modulation characteristics of all emissions are recorded. Instrumentation, including spectrum analyzers and other test equipment as detailed in Section 1.8 are employed. After pre-scan, emission measurements are made on the test site of record. If the EUT connects to auxiliary equipment and is table or floor standing, the configurations prescribed in relevant test standards are followed. Alternatively, a layout closest to normal use (as declared by the provider) is employed if the resulting emissions appear to be worst-case in such a configuration. See Figure 3. All intentionally radiating elements that are not fixed-mounted in use are placed on the test table lying flat, on their side, and on their end (3-axes) and the resulting worst case emissions are recorded. If the EUT is fixed-mounted in use, measurements are made with the device oriented in the manner consistent with installation and then emissions are recorded. If the EUT exhibits spurious emissions due to internal receiver circuitry, such emissions are measured with an appropriate carrier signal applied.

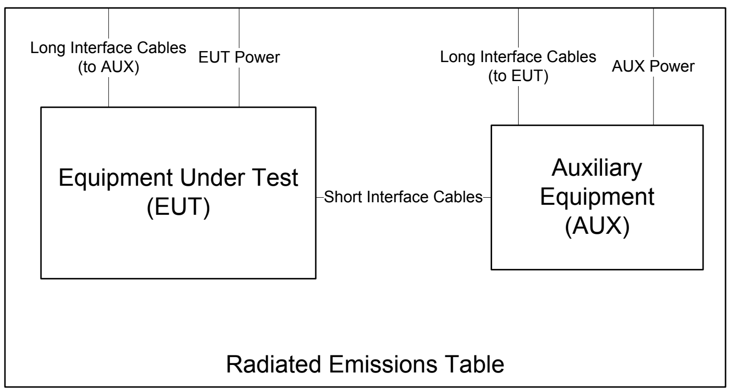


Figure 3: Radiated Emissions Diagram of the EUT.

For devices with intentional emissions below 30 MHz, a shielded loop antenna and/or E-field and H-Field broadband probes are used depending on the regulation. Shielded loops are placed at a 1 meter receive height at the desired measurement distance. For exposure in this band, 10cm diameter single-axis broadband probes meeting the requirements of ISED SPR-002 section 5.2 are employed. Measurements are repeated and summed over three axes, and the entire frequency range is measured with and without the EUT transmitting.

Emissions between 30 MHz and 1 GHz are measured using calibrated broadband antennas. For both horizontal and vertical polarizations, the test antenna is raised and lowered from 1 to 4 m in height until a maximum emission level is detected. The EUT is then rotated through 360^o in azimuth until the highest emission is detected. The test antenna is then raised and lowered one last time from 1 to 4 m and the worst case value is recorded. Emissions above 1 GHz are characterized using standard gain or broadband ridge-horn antennas on our OATS with a 4×5 m rectangle of ECCOSORB absorber covering the OATS ground screen and a 1.5m table height. Care is taken to ensure that test receiver resolution and video bandwidths meet the regulatory requirements, and that the emission bandwidth of the EUT is not reduced. Photographs of the test setup employed are depicted in Figure 4.

Where regulations allow for direct measurement of field strength, power values (dBm) measured on the test receiver / analyzer are converted to dBμV/m at the regulatory distance, using

$$E_{dist} = 107 + P_R + K_A - K_G + K_E - C_F$$

where P_R is the power recorded on spectrum analyzer, in dBm, K_A is the test antenna factor in dB/m, K_G is the combined pre-amplifier gain and cable loss in dB, K_E is duty correction factor (when applicable) in dB, and C_F is a distance conversion (employed only if limits are specified at alternate distance) in dB. This field strength value is then compared with the regulatory limit. If effective isotropic radiated power (EIRP) is computed, it is computed as

$$EIRP(dBm) = E_{3m}(dB\mu V/m) - 95.2.$$

When presenting data at each frequency, the highest measured emission under all possible EUT orientations (3-axes) is reported.

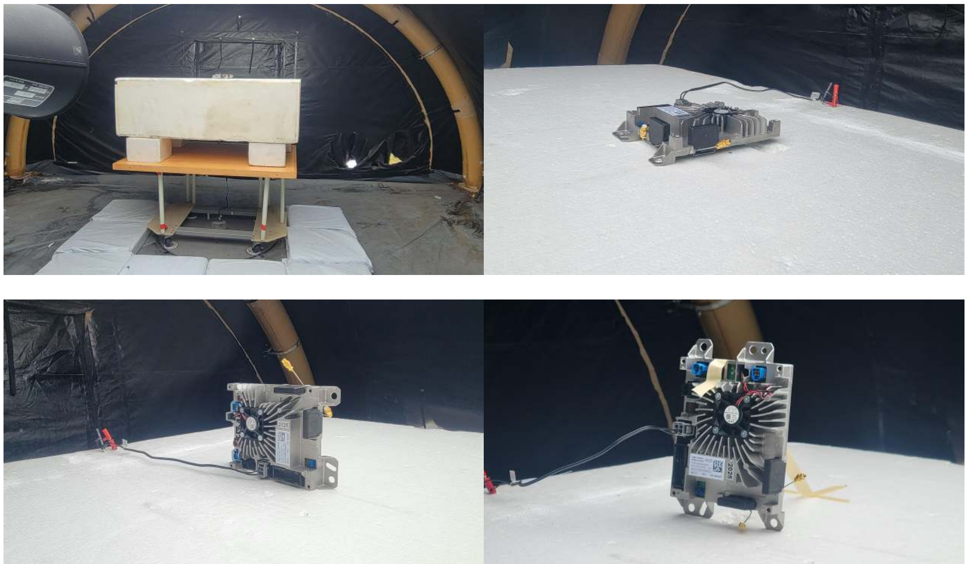


Figure 4: Radiated Emissions Test Setup Photograph(s).

4.1.2 Conducted Emissions Test Setup and Procedures

Transmit Antenna Port Conducted Emissions At least one sample EUT supplied for testing was provided with a 50Ω antenna port. Conducted transmit chain emissions measurements (where applicable) are made by connecting the EUT antenna port directly to the test receiver port. Photographs of the test setup employed are depicted in Figure 5.

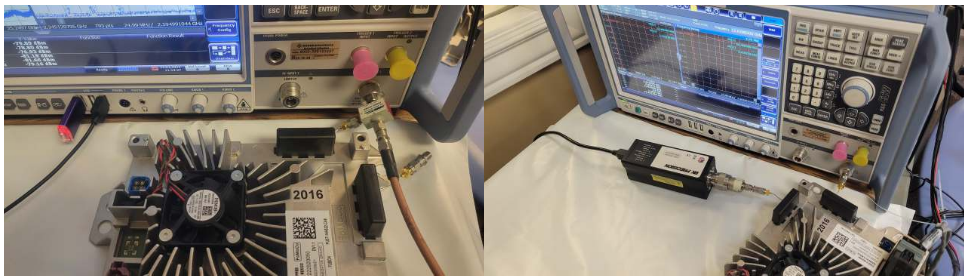


Figure 5: Conducted RF Test Setup Photograph(s).

4.1.3 Power Supply Variation

Tests at extreme supply voltages are made if required by the procedures specified in the test standard, and results of this testing are detailed in this report.

4.2 Intentional Emissions

4.2.1 Duty and Transmission Cycle, Pulsed Operation

The details and results of testing the EUT for pulsed operation are summarized in Table 4.

Table 4: Pulsed Emission Characteristics (Duty Cycle).

Test Date:	24-Feb-23
Test Engineer:	J. Brunett
EUT	Ford SG5PHX
Meas. Distance:	Conducted

	Test Mode Pulsed Operation / Average Measurement Duty Cycle							
R0	Mode	Data Rate Mbps	Voltage V	Oper. Freq MHz	Pulse Length	Pulse Period	Duty Cycle %	Power Duty Correction dB
R1	GFSK (1 Mbps)	0.500	13.4	2440.0	15.41	18.76	82.1	0.9
R2	Pi/4 DPSK (2 Mbps)	1.000	13.4	2440.0	15.46	18.76	82.4	0.8
R3	8DPSK (3 Mbps)	2.000	13.4	2440.0	15.46	18.91	81.8	0.9
#	C1	C3	C4	C5	C6	C7	C8	C9

(ROW)	(COLUMN)	NOTE
R0	C8	Duty Cycle is measured in line with DTS guidance 558074 D01 v5 r02 section 6(b) for averaging only over full-power transmission pulses.
NOTE:	For a FHSS Bluetooth, the peak to average ratio in any given 100 ms window is always <10%. Thus, maximum 15.35 duty of 20 dB can be applied to peak measurements for demonstrating average field strength compliance, were applicable. However, no duty cycle is applied herein for demonstrating compliance.	

Figure 6: Example Plots of Test Mode Duty Cycle.

4.2.2 Hopping Channel Dwell Time

The average time of occupancy on any hopping channel must not be greater than 0.4 seconds. For this test, the EUT was set for data transmission with hopping enabled. Results of this testing are depicted in Table 5. Plots showing example measurements made to obtain these values are provided in Figure 7.

Table 5: Hopping Channel Dwell Time.

Frequency Range	**Det**	**IF Bandwidth**	**Video Bandwidth**		
25 MHz ≤ f ≤ 1 000 MHz	Pk/QPk	100/120 kHz	300 kHz	**Test Date:**	24-Feb-23
f > 1 000 MHz	Pk	3 MHz	3 MHz	**Test Engineer:**	Joseph Brunett
				EUT:	Ford SG5PHX
				Meas. Distance:	Conducted

	Dwell Time								
R0	MODE	Frequency (MHz)	# Bursts #	Observation Time (sec)	Window (sec)	Active Time (sec)	Total On Time** (s)	Limit (s)	Pass/Fail
R1	GFSK (1 Mbps)	2440.0	75	31.6	31.6	0.00289	0.2168	<0.4	Pass
R2	Pi/4 DPSK (2 Mbps)	2440.0	55	31.6	31.6	0.00289	0.1590	<0.4	Pass
R3	8DPSK (3 Mbps)	2440.0	64	31.6	31.6	0.00289	0.1850	<0.4	Pass
#	C1	C2	C3	C4		C5	C6	C7	C8

(ROW)	(COLUMN)	NOTE
ALL	C5	Dwell Time Observed with EUT placed into self-test hopping mode via Bluetooth tester.
ALL	C6	The measured dwell time may not indicate the actual single channel dwell time of the DUT. A dwell time of 0.3797 seconds in data mode is independent from the packet type (packet length) for all Bluetooth devices. Therefore, Bluetooth devices comply with the dwell time requirement.

BT CLASSIC DWELL

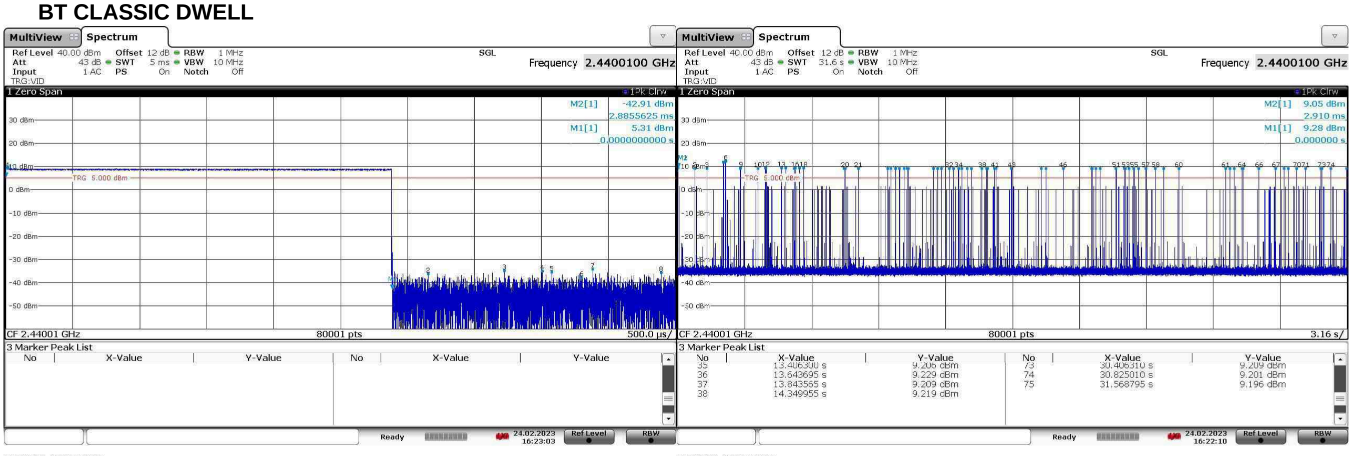


Figure 7: Example Plots of Channel Dwell Time (Hopping).

4.2.3 Hopping Sequence and Spectrum Use

It is required that the EUT hop to channel frequencies that are selected at the system hopping rate from a pseudo randomly ordered list of hopping frequencies. Each frequency must be used equally on the average. In addition, system receivers are required to have input bandwidths that match the hopping channel bandwidths of their corresponding transmitters and that shift frequencies in synchronization with the transmitted signals. Furthermore, the system must be designed to comply should the transmitter be presented with a continuous data (or information) stream. In addition, a system employing short transmission bursts must comply with the definition of a frequency hopping system and must distribute its transmissions over the minimum number of hopping channels specified in this section. Finally, the incorporation of intelligence within a frequency hopping spread spectrum system that permits the system to recognize other users within the spectrum band so that it individually and independently chooses and adapts its hopsets to avoid hopping on occupied channels is permitted. The coordination of frequency hopping systems in any other manner for the express purpose of avoiding the simultaneous occupancy of individual hopping frequencies by multiple transmitters is not permitted.

This product complies with the Bluetooth Core Specification which ensures compliance with these requirements.

4.2.4 Channel Bandwidth

For this test, the EUT was set continuous data transmission (hopping disabled) in each modulation. The 20-dB bandwidth as well as 99% emission bandwidth were measured for the low, middle, and high channels. Results of these measurements are shown in Table 6. Plots showing example measurements employed to obtain this data are provided in Figure 10.

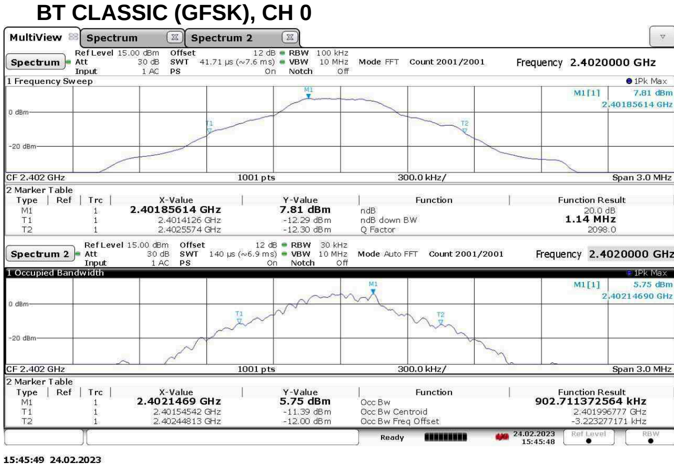
Table 6: Intentional Emission Bandwidth.

Test Date:	24-Feb-23
Test Engineer:	J. Brunett
EUT:	Ford SG5PHX
Meas. Distance:	Conducted

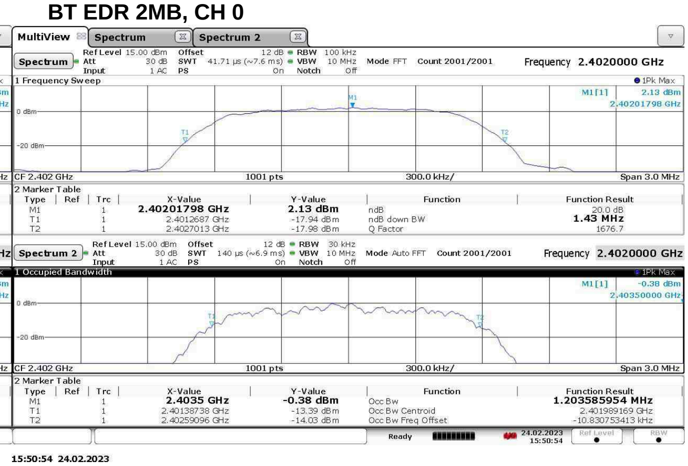
	Occupied Bandwidth								
R0	Transmit Mode	Data Rate (Mbps)	Voltage (V)	Oper. Freq (MHz)	6 dB BW (MHz)	6 dB BW Limit (MHz)	99% OBW (MHz)	20 dB BW (MHz)	Pass/Fail
R1	GFSK (1 Mbps)	1.000	13.4	2402.0			0.903	1.140	Pass
R2				2440.0			0.899	1.140	Pass
R3				2480.0			0.898	1.130	Pass
R4	Pi/4 DPSK (2 Mbps)	2.000	13.4	2402.0			1.204	1.430	Pass
R5				2440.0			1.203	1.430	Pass
R6				2480.0			1.208	1.450	Pass
R7	8DPSK (3 Mbps)	3.000	13.4	2402.0			1.205	1.430	Pass
R8				2440.0			1.207	1.440	Pass
R9				2480.0			1.214	1.440	Pass
#	C1	C2	C3	C4	C5	C6	C7	C8	C9

ROW	COLUMN	NOTE
R1-R12	C5	

BT CLASSIC (GFSK), CH 0



BT EDR 2MB, CH 0



BT EDR 3MB, CH 0

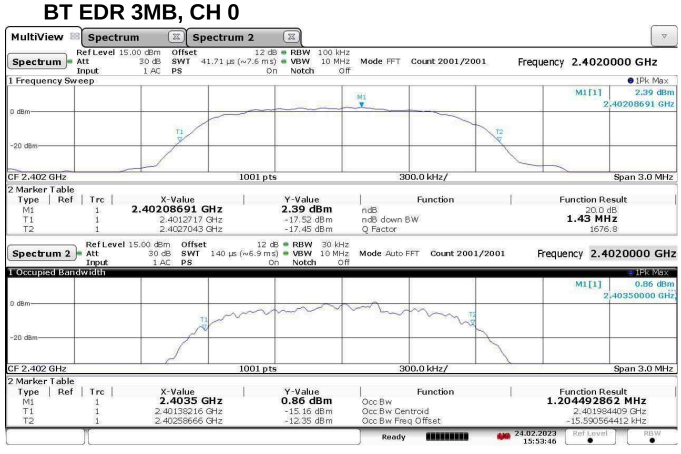


Figure 8: Example Intentional Emission Bandwidth Plots.

4.2.5 Number of Hopping Channels

For this test, the EUT was enabled for data transmission with hopping. The number of channels measured is reported here in Table 7. Plots showing example measurements employed to obtain this data are provided in Figure 9.

Table 7: Measured Number of Hopping Channels.

Test Date:	24-Feb-23
Test Engineer:	Joseph Brunett
EUT:	Ford SG5PHX
Meas. Distance:	Conducted

	Number of Hopping Channels						
R0	Mode	Start Frequency (MHz)	Stop Frequency (MHz)	Number of Channels Observed (#)	Total Number (#)	Limit (#)	Pass/Fail
R1	ALL	2400.0	2483.5	79	79	15.0	Pass
R2							
#	C1	C2	C3	C4	C5	C6	C7

(ROW)	(COLUMN)	NOTE
ALL	C4	Number of Hopping Channels the same for all modes.

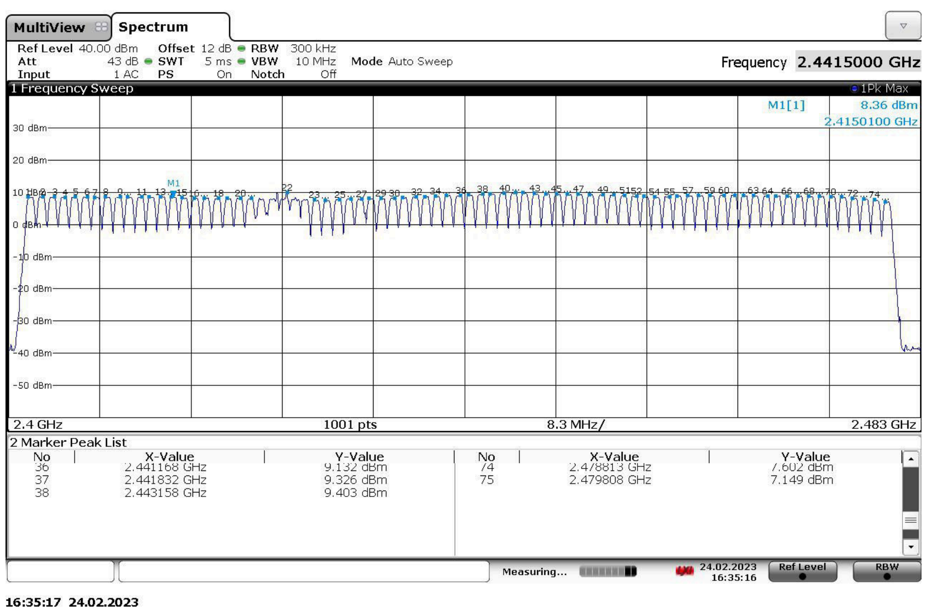


Figure 9: Example Measured Number of Hopping Channels.

4.2.6 Channel Separation

For this test, the EUT was enabled for data transmission with hopping. The Carrier Separation was measured for low, mid, and high channels. Results of these measurements are shown in Table 8.

Table 8: Measured Channel Separation.

Test Date:	24-Feb-23
Test Engineer:	Joseph Brunett
EUT	Ford SG5PHX
Meas. Distance:	Conducted

	Hopping Frequency Separation						
R0	Mode	Low Channel Frequency (MHz)	High Channel Frequency (MHz)	Separation (MHz)		Separation Limit (MHz)	Pass/Fail
R1	GFSK (1 Mbps)	2402.0	2403.0	1.001		0.760	Pass
R4	Pi/4 DPSK (2 Mbps)	2402.0	2403.0	1.001		0.953	Pass
R7	8DPSK (3 Mbps)	2402.0	2403.0	1.001		0.953	Pass
#	C1	C2	C3	C4	C5	C6	C7

(ROW)	(COLUMN)	NOTE
ALL	C2, C3	Channel Separation Observed with the Device hopping over all available channels.

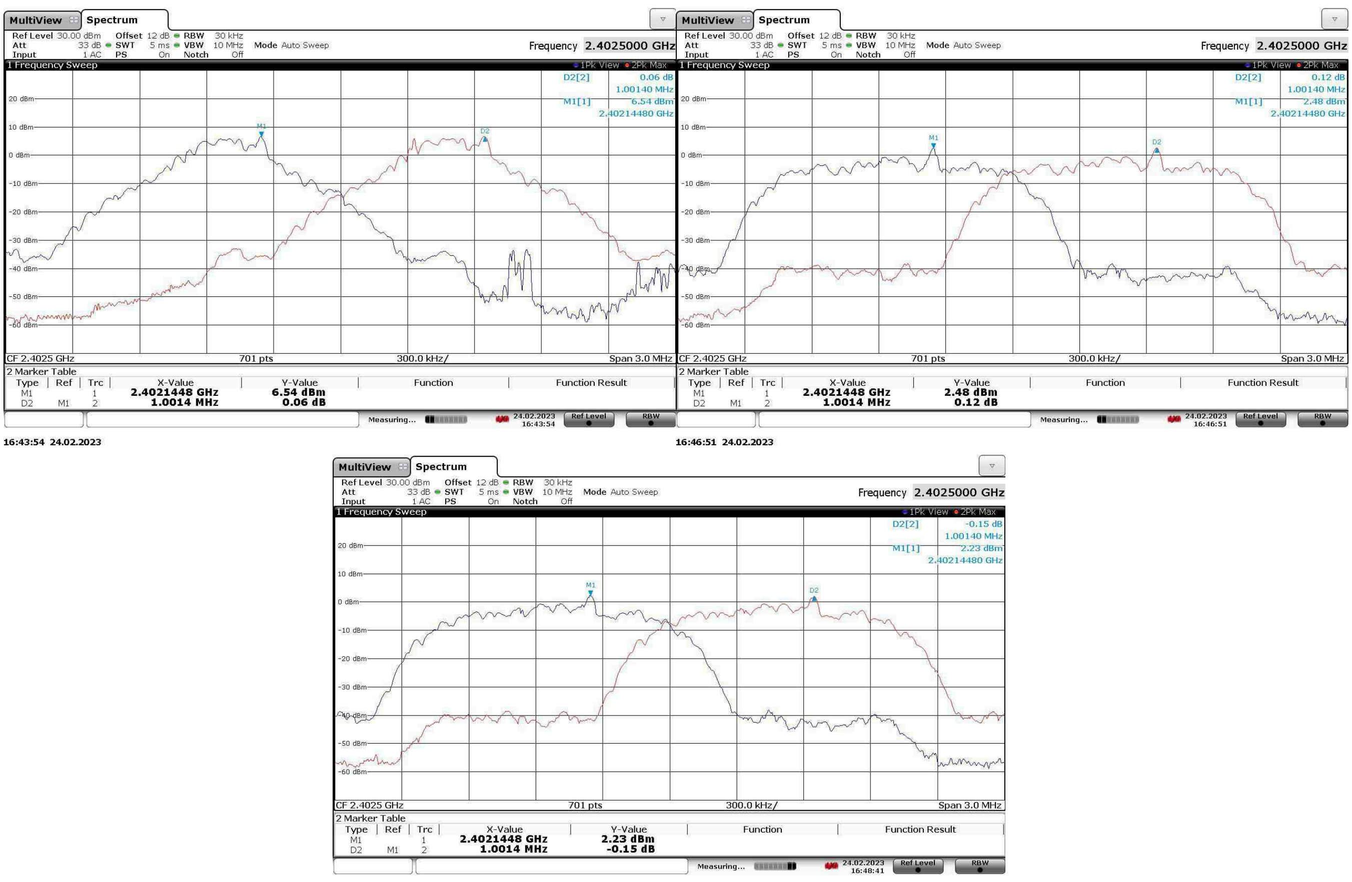


Figure 10: Example Measured Channel Separation.

4.2.7 Effective Isotropic Radiated Power

The EUT's radiated power is computed from antenna port conducted power measurements and the gain of the EUT antenna(s). Where the EUT is not sold with an antenna connector, a modified product has been provided including such. The results of this testing are summarized in Table 9. Peak conducted output power was measured

Table 9: Radiated Power Results.

Test Date: 24-Feb-23
Test Engineer: J. Brunett
EUT: Ford SG5PHX
Meas. Distance: Conducted

	Fundamental Power										
R0	Mode	Channel	Freq. MHz	Pout (Pk) dBm	Po Duty dB	Pout + Duty (Pk) dBm	Ant Gain (meas) dBi	EIRP (Pk) dBm	EIRP (Avg) Limit dBm	Pass dB	Comments
R1	GFSK (1 Mbps)		2402.0	8.9		8.9	4.3	13.2	36.0	22.8	
R2		38	2440.0	9.3		9.3	4.3	13.6	36.0	22.4	
R3		79	2480.0	7.3		7.3	4.3	11.6	36.0	24.4	
R4	Pi/4 DPSK (2 Mbps)		2402.0	7.0		7.0	4.3	11.3	36.0	24.7	
R5		38	2440.0	7.4		7.4	4.3	11.7	36.0	24.3	
R6		79	2480.0	5.2		5.2	4.3	9.5	36.0	26.5	
R7	8DPSK (3 Mbps)		2402.0	7.2		7.2	4.3	11.5	36.0	24.5	
R8		38	2440.0	7.4		7.4	4.3	11.7	36.0	24.3	
R9		79	2480.0	5.3		5.3	4.3	9.6	36.0	26.4	
#	C1	C2	C3	C4	C5	C6	C7	C8	C9	C10	C11

(ROW)	(COLUMN)	NOTE
R0	C4	Maximum peak conducted output power measured following DTS Guidance 558074 D01 v5 r02 Section 8.3.1.1
R0	C4	Peak measured field strength at 3 meters on OATS
R13	C5	No duty applied. Pk data measured and reported
R13	C6	EIRP (Pk) computed from measured output power.

directly from the EUT at the port where the antenna attaches. The test receiver bandwidth was set to be greater than the measured emission bandwidth of the EUT to capture the true peak. Antenna gain is either provided directly by the manufacturer or measured by comparison between calculated EIRP and conducted output power. Plots showing conducted measurements made are depicted in Figure 11.

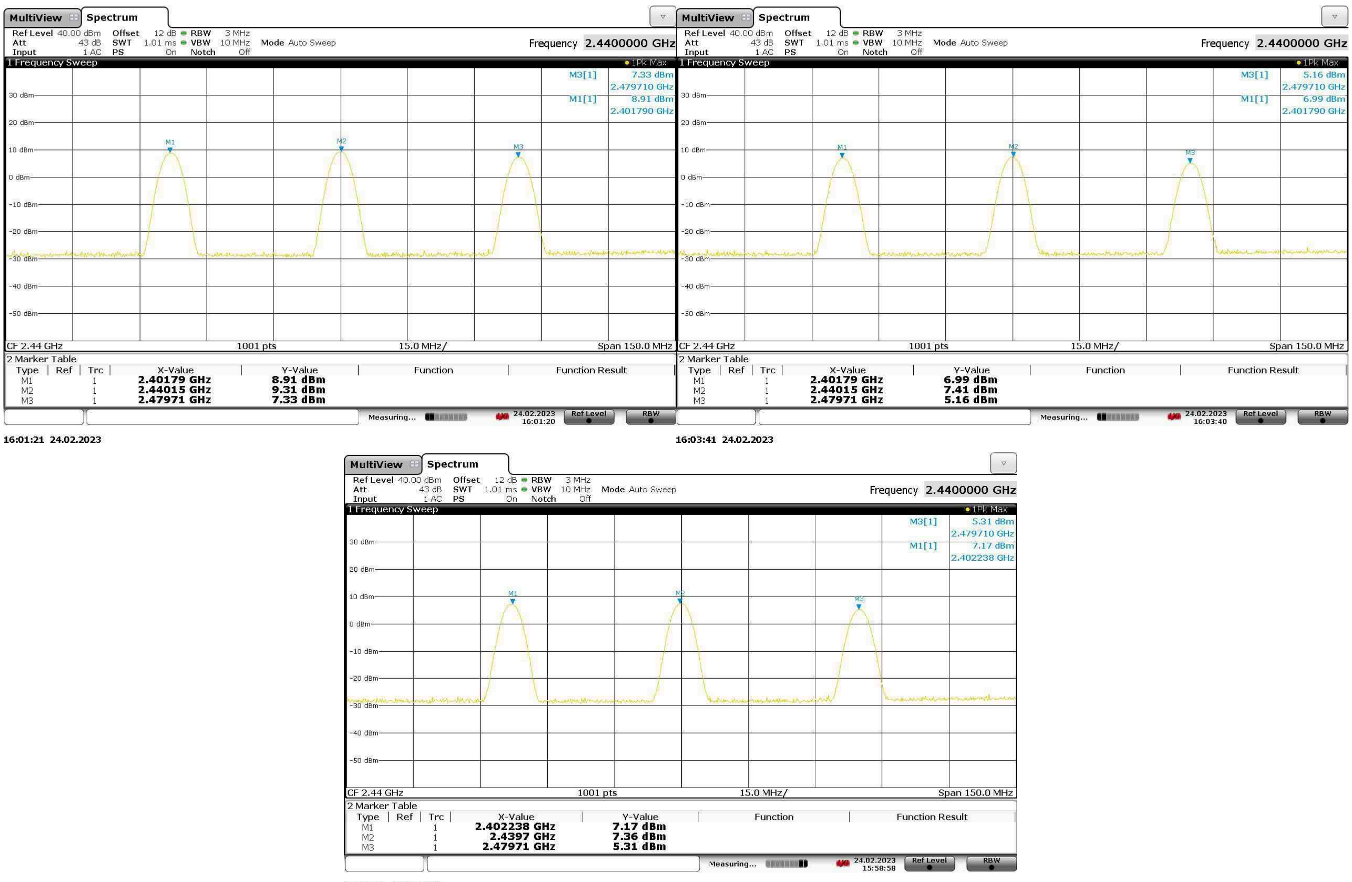


Figure 11: Conducted RF Power Plots

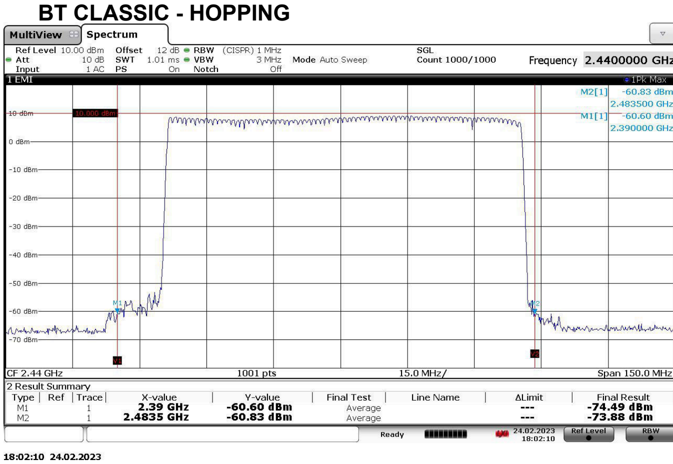
4.3 Unintentional Emissions

4.3.1 Restricted Band Transmit Chain Spurious Emissions

The results for the measurement of transmit chain spurious emissions at the nominal voltage and temperature are provided in Table 10. Measurements are performed to 10 times the highest fundamental operating frequency.

Table 10(a): Transmit Chain Spurious Emissions.

BT CLASSIC - HOPPING



BT CLASSIC - NON-HOPPING

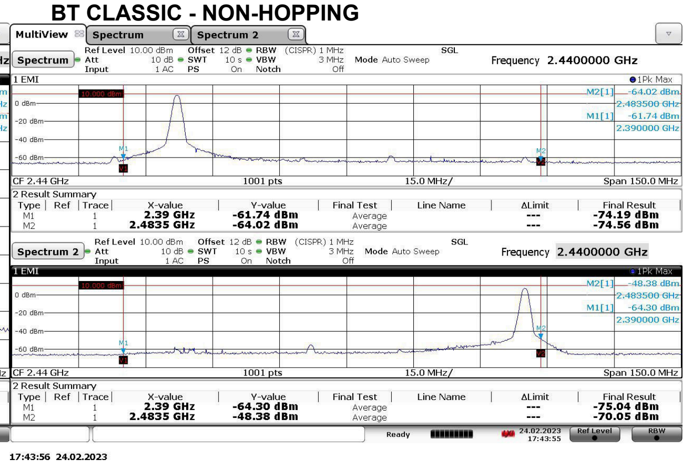


Table 10(b): Transmit Chain Spurious Emissions.

Frequency Range	Det	IF Bandwidth	Video Bandwidth
30 >= f > 1000 MHz	Pk/QPk	100 kHz	300 kHz
f < 1000 MHz	Pk/Avg	1 MHz	3 MHz

Test Date:	1-Mar-23
Test Engineer:	J. Brunett
EUT:	Ford SG5PHX
Meas. Distance:	Conducted

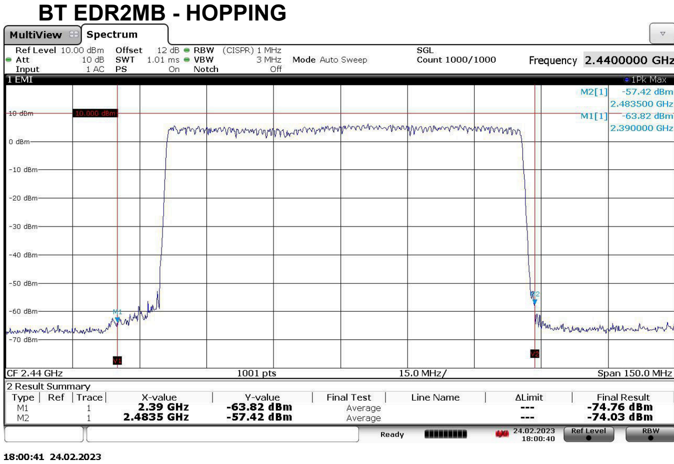
Transmitter Spurious in Restricted Bands — FCC/IC

#	Mode	Path A / B	Frequency Start MHz	Frequency Stop MHz	Output Power Pk dBm	Output Power Avg dBm	Ant Gain dBi	GR Factor dB	Avg Duty Factor dB	Electric Field @ 3m Calc. Pk dBuV/m	Limit Pk dBuV/m	Calc. Avg dBuV/m	Limit Qpk/Avg dBuV/m	Pass dB	Comments
R1	Fundamental Restricted Band Edge (Low Side)														
R2	GFSK (1 Mbps)	A	2390.0	2390.0	-61.7	-74.2	4.3	0.0	0.9	37.8	74.0	26.2	54.0	27.8	max all - L,M,H channels
R3	GFSK (1 Mbps)	A	2390.0	2390.0	-60.6	-74.5	4.3	0.0	0.9	38.9	74.0	25.9	54.0	28.1	Hopping
R4	Fundamental Restricted Band Edge (High Side)														
R5	GFSK (1 Mbps)	A	2483.5	2483.5	-48.4	-70.1	4.3	0.0	0.9	51.1	74.0	30.3	54.0	22.9	max all - L,M,H channels
R6	GFSK (1 Mbps)	A	2483.5	2483.5	-60.8	-73.9	4.3	0.0	0.9	38.7	74.0	26.5	54.0	27.5	Hopping
R7															
R8	GFSK (1 Mbps)	A	30	88	-84.3		4.3	4.7	0.9	19.9			40.0	20.1	max all - L,M,H channels
R9	GFSK (1 Mbps)	A	88	216	-81.8		4.3	4.7	0.9	22.4			43.0	20.6	max all - L,M,H channels
R10	GFSK (1 Mbps)	A	216	1000	-80.6		4.3	4.7	0.9	23.6			46.0	22.4	max all - L,M,H channels
R14	GFSK (1 Mbps)	A	1000.0	4000.0	-59.3	-69.3	4.3	0.0	0.9	40.2	74.0	31.1	54.0	22.9	max all - L,M,H channels
R15	GFSK (1 Mbps)	A	4804.0	4804.0	-71.9	-75.9	4.3	0.0	0.9	27.6	74.0	24.5	54.0	29.5	
R16	GFSK (1 Mbps)	A	4874.0	4874.0	-64.8	-76.1	4.3	0.0	0.9	25.4	74.0	24.3	54.0	29.7	
R17	GFSK (1 Mbps)	A	4960.0	4960.0	-64.3	-76.7	4.3	0.0	0.9	35.2	74.0	23.7	54.0	30.3	
R18	GFSK (1 Mbps)	A	4000.0	6000.0	-64.3	-75.9	4.3	0.0	0.9	35.2	74.0	24.5	54.0	29.5	max all - L,M,H channels
R19	GFSK (1 Mbps)	A	6000.0	8400.0	-60.0	-70.3	4.3	0.0	0.9	39.5	74.0	30.1	54.0	23.9	max all - L,M,H channels
R20	GFSK (1 Mbps)	A	8400.0	12500.0	-58.0	-68.1	4.3	0.0	0.9	41.5	74.0	32.3	54.0	21.7	max all - L,M,H channels
R21	GFSK (1 Mbps)	A	12500.0	26000.0	-56.6	-66.5	4.3	0.0	0.9	42.9	74.0	33.9	54.0	20.1	max all - L,M,H channels
#	C1	C2	C3	C4	C5	C6	C7	C8	C9	C10	C11	C12	C13	C14	C15

ROW	COLUMN	
All	C5/C6	Conducted measurements were made in line with DTS guidance 558074 D01 v5 r02 sections 8.5, 8.6, 8.7 / ANSI C63.10 11.10, 11.11, 11.12
All	C8	Ground Reflection Factor as described in ANSI C63.10-2013 section 11.12.2.2 (c)
All	C10/C12	Computed according to ANSI C63.10-2013 section 11.12.2.2 (e)

Table 10(c): Transmit Chain Spurious Emissions.

BT EDR2MB - HOPPING



BT EDR2MB - NON-HOPPING

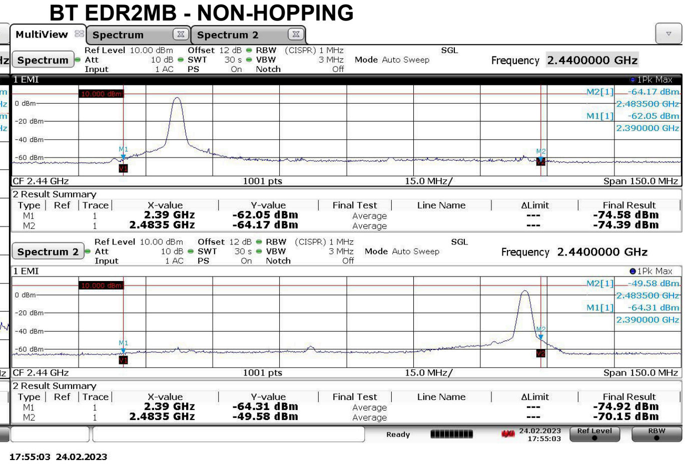


Table 10(d): Transmit Chain Spurious Emissions.

Frequency Range	Det	IF Bandwidth	Video Bandwidth
30 >= f > 1000 MHz	Pk/QPk	100 kHz	300 kHz
f < 1000 MHz	Pk/Avg	1 MHz	3 MHz

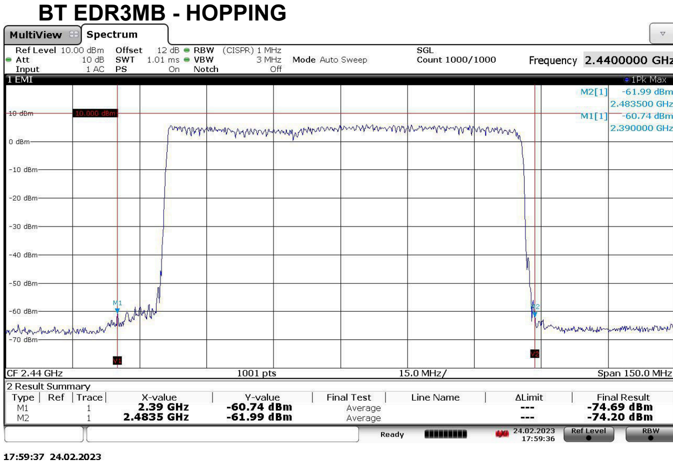
Test Date:	1-Mar-23
Test Engineer:	J. Brunett
EUT:	Ford SG5PHX
Meas. Distance:	Conducted

Transmitter Spurious in Restricted Bands															FCC/IC
			Frequency		Output Power		Ant	GR Factor	Avg Duty	Electric Field @ 3m				Pass	
	Mode	Path	Start	Stop	Pk	Avg	Gain		Factor	Calc. Pk	Limit Pk	Calc. Avg	Limit Qpk/Avg		
#		A / B	MHz	MHz	dBm	dBm	dBi	dB	dB	dBuV/m	dBuV/m	dBuV/m	dBuV/m	dB	Comments
R1	Fundamental Restricted Band Edge (Low Side)														
R2	Pi/4 DPSK (2 Mbps)	A	2390.0	2390.0	-62.1	-74.6	4.3	0.0	0.8	37.4	74.0	25.7	54.0	28.3	max all - L,M,H channels
R3	Pi/4 DPSK (2 Mbps)	A	2390.0	2390.0	-63.8	-74.8	4.3	0.0	0.8	35.7	74.0	25.5	54.0	28.5	Hopping
R4	Fundamental Restricted Band Edge (High Side)														
R5	Pi/4 DPSK (2 Mbps)	A	2483.5	2483.5	-49.6	-70.2	4.3	0.0	0.8	49.9	74.0	30.1	54.0	23.9	max all - L,M,H channels
R6	Pi/4 DPSK (2 Mbps)	A	2483.5	2483.5	-57.4	-74.0	4.3	0.0	0.8	42.1	74.0	26.3	54.0	27.7	Hopping
R7															
R8	Pi/4 DPSK (2 Mbps)	A	30	88	-84.8		4.3	4.7	0.8	19.4	40.0		40	20.6	max all - L,M,H channels
R9	Pi/4 DPSK (2 Mbps)	A	88	216	-79.3		4.3	4.7	0.8	24.9	43.0		43	18.1	max all - L,M,H channels
R10	Pi/4 DPSK (2 Mbps)	A	216	1000	-81.0		4.3	4.7	0.8	23.2	46.0		46	22.8	max all - L,M,H channels
R14	Pi/4 DPSK (2 Mbps)	A	1000.0	4000.0	-59.3	-69.2	4.3	0.0	0.8	40.2	54.0	31.1	54.0	22.9	max all - L,M,H channels
R15	Pi/4 DPSK (2 Mbps)	A	4804.0	4804.0	-72.8	-75.9	4.3	0.0	0.8	26.7	54.0	24.5	54.0	29.5	
R16	Pi/4 DPSK (2 Mbps)	A	4874.0	4874.0	-64.8	-76.0	4.3	0.0	0.8	25.4	54.0	24.3	54.0	29.7	
R17	Pi/4 DPSK (2 Mbps)	A	4960.0	4960.0	-74.7	-77.2	4.3	0.0	0.8	24.8	54.0	23.1	54.0	30.9	
R18	Pi/4 DPSK (2 Mbps)	A	4000.0	6000.0	-72.8	-75.9	4.3	0.0	0.8	26.7	54.0	24.5	54.0	29.5	max all - L,M,H channels
R19	Pi/4 DPSK (2 Mbps)	A	6000.0	8400.0	-59.7	-70.2	4.3	0.0	0.8	39.8	54.0	30.1	54.0	23.9	max all - L,M,H channels
R20	Pi/4 DPSK (2 Mbps)	A	8400.0	12500.0	-57.9	-68.0	4.3	0.0	0.8	41.6	54.0	32.3	54.0	21.7	max all - L,M,H channels
R21	Pi/4 DPSK (2 Mbps)	A	12500.0	26000.0	-56.2	-66.4	4.3	0.0	0.8	43.3	54.0	33.9	55.0	21.1	max all - L,M,H channels
#	C1	C2	C3	C4	C5	C6	C7	C8	C9	C10	C11	C12	C13	C14	C15

ROW	COLUMN	
All	C5/C6	Conducted measurements were made in line with DTS guidance 558074 D01 v5 r02 sections 8.5, 8.6, 8.7 / ANSI C63.10 11.10, 11.11, 11.12
All	C8	Ground Reflection Factor as described in ANSI C63.10-2013 section 11.12.2.2 (c)
All	C10/C12	Computed according to ANSI C63.10-2013 section 11.12.2.2 (e)

Table 10(e): Transmit Chain Spurious Emissions.

BT EDR3MB - HOPPING



BT EDR3MB - NON-HOPPING

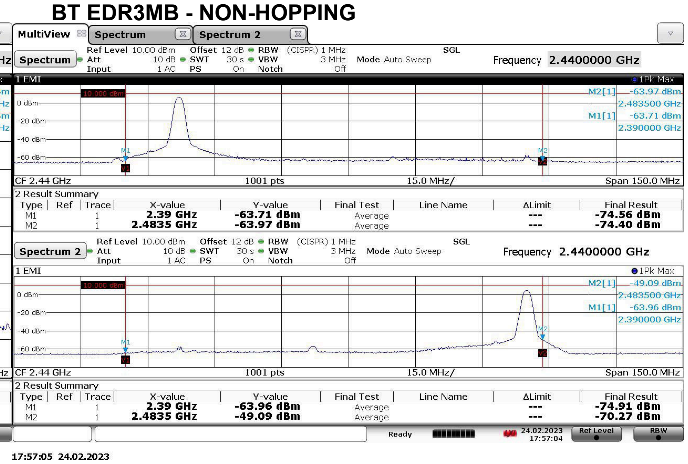


Table 10(f): Transmit Chain Spurious Emissions.

Frequency Range	Det	IF Bandwidth	Video Bandwidth
30 >= f > 1000 MHz	Pk/QPk	100 kHz	300 kHz
f < 1000 MHz	Pk/Avg	1 MHz	3 MHz

Test Date:	1-Mar-23
Test Engineer:	J. Brunett
EUT:	Ford SG5PHX
Meas. Distance:	Conducted

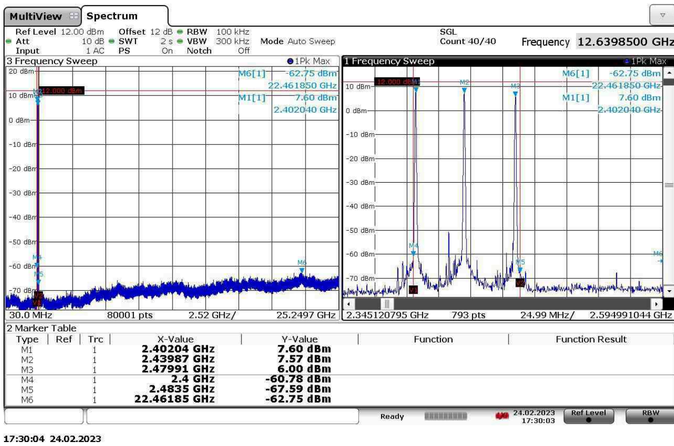
Transmitter Spurious in Restricted Bands															FCC/IC
			Frequency		Output Power		Ant	GR Factor	Avg Duty	Electric Field @ 3m				Pass	
	Mode	Path	Start	Stop	Pk	Avg	Gain		Factor	Calc. Pk	Limit Pk	Calc. Avg	Limit Qpk/Avg		
#		A / B	MHz	MHz	dBm	dBm	dBi	dB	dB	dBuV/m	dBuV/m	dBuV/m	dBuV/m	dB	Comments
R1	Fundamental Restricted Band Edge (Low Side)														
R2	8DPSK (3 Mbps)	A	2390.0	2390.0	-63.7	-74.6	4.3	0.0	0.9	35.8	74.0	25.8	54.0	28.2	max all - L,M,H channels
R3	8DPSK (3 Mbps)	A	2390.0	2390.0	-63.8	-74.8	4.3	0.0	0.9	35.7	74.0	25.6	54.0	28.4	Hopping
R4	Fundamental Restricted Band Edge (High Side)														
R5	8DPSK (3 Mbps)	A	2483.5	2483.5	-49.1	-70.3	4.3	0.0	0.9	50.4	74.0	30.1	54.0	23.6	max all - L,M,H channels
R6	8DPSK (3 Mbps)	A	2483.5	2483.5	-62.0	-74.2	4.3	0.0	0.9	37.5	74.0	26.2	54.0	27.8	Hopping
R7															
R8	8DPSK (3 Mbps)	A	30	88	-85.2		4.3	4.7	0.9	19.0			40.0	21.0	max all - L,M,H channels
R9	8DPSK (3 Mbps)	A	88	216	-79.5		4.3	4.7	0.9	24.7			43.0	18.3	max all - L,M,H channels
R10	8DPSK (3 Mbps)	A	216	1000	-78.4		4.3	4.7	0.9	25.8			46.0	20.2	max all - L,M,H channels
R14	8DPSK (3 Mbps)	A	1000.0	4000.0	-59.3	-69.3	4.3	0.0	0.9	40.2	74.0	31.1	54.0	22.9	max all - L,M,H channels
R15	8DPSK (3 Mbps)	A	4804.0	4804.0	-72.8	-75.9	4.3	0.0	0.9	26.7	74.0	24.5	54.0	29.5	
R16	8DPSK (3 Mbps)	A	4874.0	4874.0	-64.8	-76.1	4.3	0.0	0.9	25.4	74.0	24.3	54.0	29.7	
R17	8DPSK (3 Mbps)	A	4960.0	4960.0	-61.4	-80.4	4.3	0.0	0.9	38.1	74.0	20.0	54.0	34.0	
R18	8DPSK (3 Mbps)	A	4000.0	6000.0	-61.4	-75.9	4.3	0.0	0.9	38.1	74.0	24.5	54.0	29.5	max all - L,M,H channels
R19	8DPSK (3 Mbps)	A	6000.0	8400.0	-59.5	-70.3	4.3	0.0	0.9	40.0	74.0	30.1	54.0	23.9	max all - L,M,H channels
R20	8DPSK (3 Mbps)	A	8400.0	12500.0	-58.1	-68.1	4.3	0.0	0.9	41.4	74.0	32.3	54.0	21.7	max all - L,M,H channels
R21	8DPSK (3 Mbps)	A	12500.0	26000.0	-56.0	-66.5	4.3	0.0	0.9	43.5	74.0	33.9	54.0	20.1	max all - L,M,H channels
#	C1	C2	C3	C4	C5	C6	C7	C8	C9	C10	C11	C12	C13	C14	C15

ROW	COLUMN	
All	C5/C6	Conducted measurements were made in line with DTS guidance 558074 D01 v5 r02 sections 8.5, 8.6, 8.7 / ANSI C63.10 11.10, 11.11, 11.12
All	C8	Ground Reflection Factor as described in ANSI C63.10-2013 section 11.12.2.2 (c)
All	C10/C12	Computed according to ANSI C63.10-2013 section 11.12.2.2 (e)

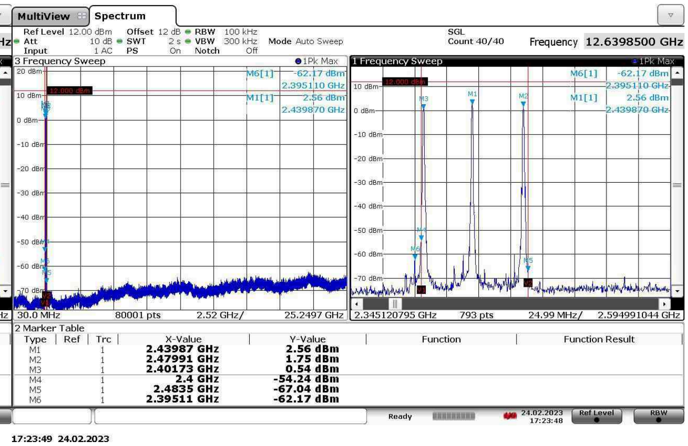
4.3.2 OOB Transmit Chain Spurious Emissions

The results for the measurement of transmit chain spurious emissions relative to the fundamental in a 100 kHz receiver bandwidth (at the nominal voltage and temperature) in the worst cases are provided in Figure 12 below.

BT CLASSIC - OOB 100K SPUR



BT EDR2MB - OOB 100K SPUR



BT EDR3MB - OOB 100K SPUR

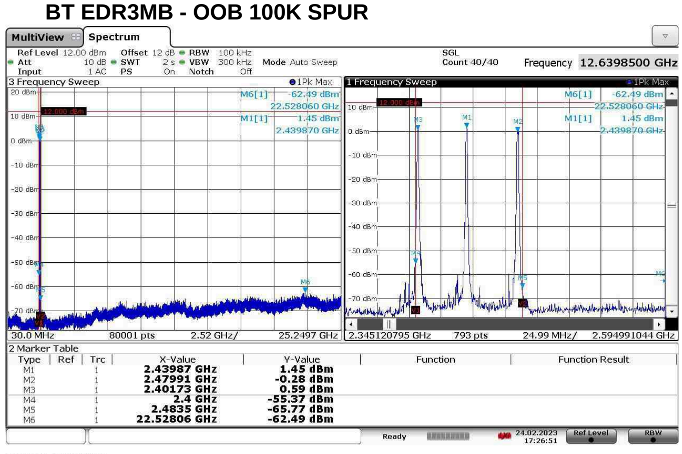


Figure 12: Worst Case Transmitter OOB Emissions Measured.

5 Measurement Uncertainty and Accreditation Documents

The maximum values of measurement uncertainty for the laboratory test equipment and facilities associated with each test are given in the table below. This uncertainty is computed for a 95.45% confidence level based on a coverage factor of $k = 2$.

Table 11: Measurement Uncertainty.

Measured Parameter	Measurement Uncertainty[†]
Radio Frequency	$\pm(f_{Mkr}/10^7 + RBW/10 + (SPN/(PTS-1))/2 + 1\,\text{Hz})$
Conducted Emm. Amplitude	$\pm 1.9\,\text{dB}$
Radiated Emm. Amplitude ($f < 30\,\text{MHz}$)	$\pm 3.1\,\text{dB}$
Radiated Emm. Amplitude ($30 - 200\,\text{MHz}$)	$\pm 4.0\,\text{dB}$
Radiated Emm. Amplitude ($200 - 1000\,\text{MHz}$)	$\pm 5.2\,\text{dB}$
Radiated Emm. Amplitude ($f > 1000\,\text{MHz}$)	$\pm 3.7\,\text{dB}$

[†]Ref: CISPR 16-4-2:2011+A1:2014

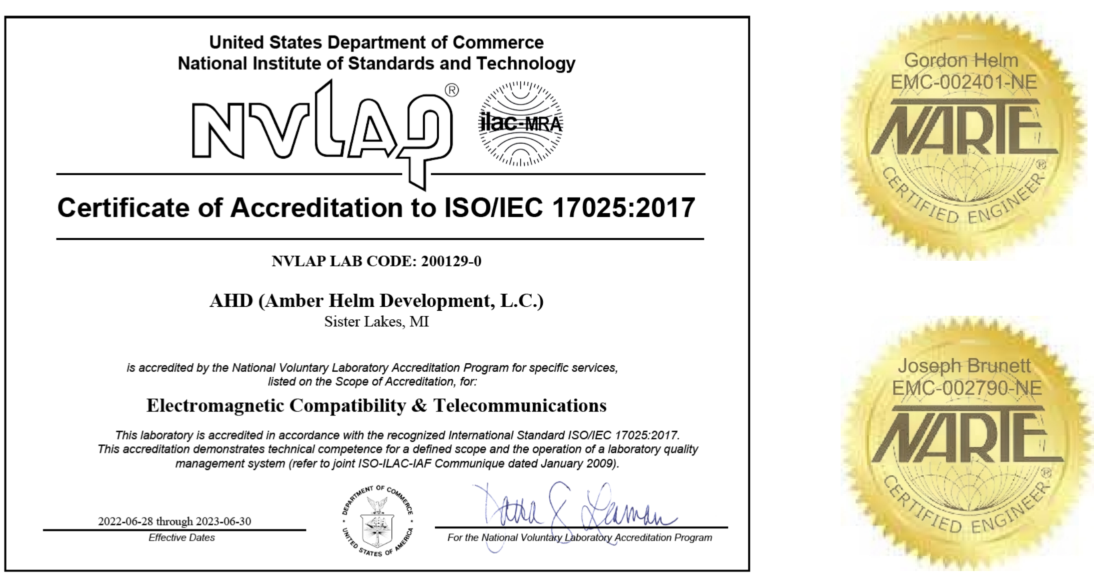

United States Department of Commerce
National Institute of Standards and Technology
NVLAP® ilac-MRA
Certificate of Accreditation to ISO/IEC 17025:2017
NVLAP LAB CODE: 200129-0
AHD (Amber Helm Development, L.C.)
Sister Lakes, MI
is accredited by the National Voluntary Laboratory Accreditation Program for specific services, listed on the Scope of Accreditation, for:
Electromagnetic Compatibility & Telecommunications
This laboratory is accredited in accordance with the recognized International Standard ISO/IEC 17025:2017. This accreditation demonstrates technical competence for a defined scope and the operation of a laboratory quality management system (refer to joint ISO-ILAC-IAF Communique dated January 2009).
2022-06-28 through 2023-06-30
Effective Dates
For the National Voluntary Laboratory Accreditation Program

Figure 13: Accreditation Documents