Amber Helm Development L.C.
92723 Michigan Hwy-152
Sister Lakes, Michigan 49047 USA
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MESHBTA-WR2505NAR
Issued: **March 16, 2025**

Radio Test Report

regarding

USA: CFR Title 47, Part 15.247/15.109 (Emissions)
Canada: IC RSS-247v3/GENe (Emissions)

for

Badge Locator

Category: DTS Transceiver

Judgments:
Aligns with FCC 15.247, ISED RSS-247v3
Testing Completed: January 31, 2025

TESTING
NVLAP LAB CODE 200129-0

Prepared for:

Gojo Industries, Inc.

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Date of Issue: March 16, 2025

Revision History

Rev. No.	Date	Details	Revised By
r0	March 16, 2025	Initial Release.	J. Brunett
r1	March 20, 2025	Cond. Photo + Clarify.	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 April 2035.

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 1.8.0 lists all sites employed herein. Specific test sites utilized are also listed in the test results sections of this report where needed.

Table 1.8.0 Test Site List.

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

1.9 Traceability and Equipment Used

Pertinent test equipment used for measurements at this facility is listed in Table 1.9.0 . 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. All equipment is evaluated on a cycle no greater than 12 months following laboratory validation procedures and is calibrated following manufacturer recommended intervals.

Table 1.9.0 Equipment List.

Description	Manufacturer/Model	SN	Quality Num.	Cal/Ver By / Date Due
Spectrum Analyzer	R & S / FSW67	103233	RSFSW67	RS / Sept-2025
Spectrum Analyzer	R & S / FSV30	101660	RSFSV3001	RS / Apr-2025
Biconical	EMCO / 93110B	9802-3039	BICEMCO01	Keysight / Aug-2025
Log Periodic Antenna	EMCO / 3146	9305-3614	LOGEMCO01	Keysight / Aug-2025
Quad Ridge Horn	Singer / A6100	C35200	HQR1TO18S01	Keysight / Aug-2025
K-Band Horn	JEF / NRL Std.	001	HRNK01	AHD / On Use

2 Test Specifications and Procedures

2.1 Test Specification and General Procedures

The goal of Gojo Industries, Inc. 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 Gojo Industries, Inc. Badge Locator for compliance to:

Country/Region/Manu.	**Rules or Directive**	**Referenced Section(s)**
United States	Code of Federal Regulations	CFR Title 47, Part 15.247/15.109
Canada	ISED Canada	IC RSS-247v3/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 C63.10:2020	"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"
WR-ITP0102RA	"AHD Internal Document - Radiated Emissions Test Method"
WR-ITP0101LC	"AHD Internal Document - Conducted Emissions Test Method"
ICES-003; Issue 7 (2020)	"Information Technology Equipment (ITE) - Limits and methods of measurement"

3 Configuration and Identification of the Equipment Under Test

3.1 Description and Declarations

The equipment under test is a BLE badge tracking device. The EUT is approximately 19 x 19 x 6 cm in dimension, and is depicted in Figure 3.1.0 . It is powered by 6 VDC via four (4) D-Cell Alkaline batteries. The EUT is used in office spaces to track BLE badges. Table 3.1.0 outlines provider declared EUT specifications.

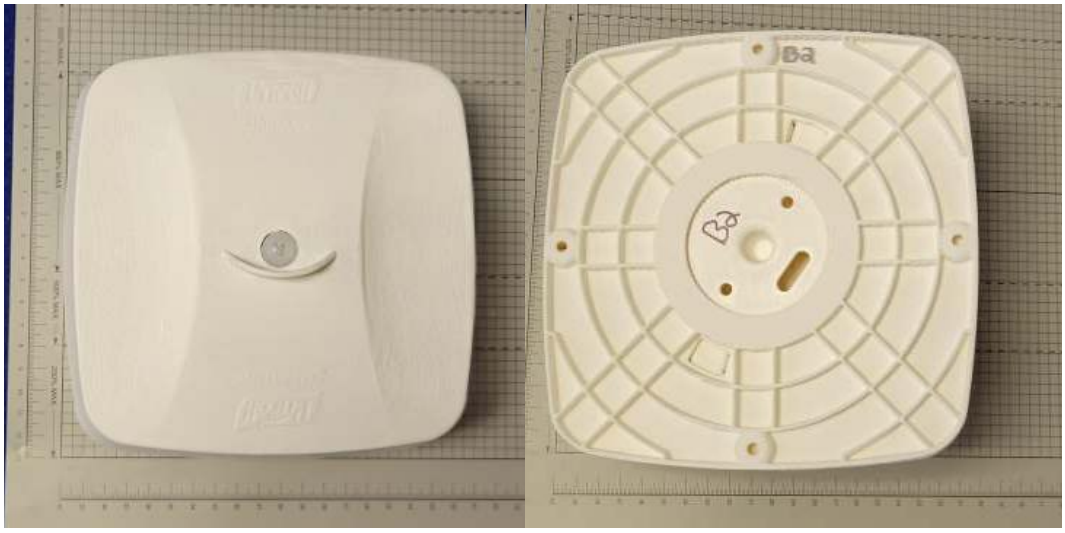


Figure 3.1.0 Photos of EUT.

Table 3.1.0 EUT Declarations.

General Declarations	
Equipment Type:	DTS Transceiver
Country of Origin:	Not Declared
Nominal Supply:	6 VDC via
Oper. Temp Range:	Not Declared
Frequency Range:	2400 – 2483.5 MHz
Antenna Dimension:	Integral
Antenna Type:	PCB Trace
Antenna Gain:	0.7 dBi meas.
Number of Channels:	40
Channel Spacing:	2 MHz
Alignment Range:	Not Declared
Type of Modulation:	GFSK
United States	
FCC ID Number:	O76-RIHP2400A
Classification:	DTS
Canada	
IC Number:	10391B-RIHP2400A
Classification:	Other

3.1.1 EUT Configuration

The EUT is configured for testing as depicted in Figure 3.1.1 .

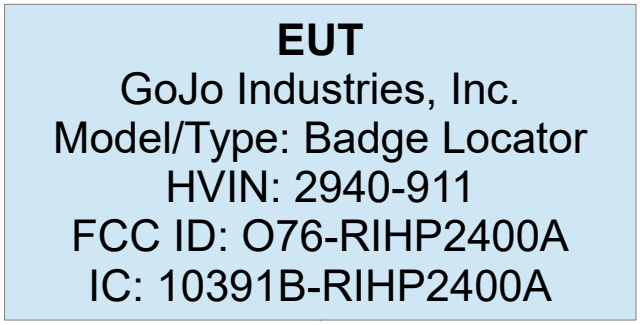


Figure 3.1.1 EUT Test Configuration Diagram.

3.1.2 Modes of Operation

The EUT is a BLE DTS transceiver which can operate in the a standard BLE core specification modes of 125kbps, 500kbps, 1Mbps, and 2 Mbps. The EUT is tested over all of these modes, as reported herein.

3.1.3 Variants

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

3.1.4 Test Samples

Two samples of the EUT were provided in total, one normal sample (SN: NORMA) with integral antenna, one modified RF test sample with a coaxial cable attached where the integral antenna is normally connected (SN:CONDA). Both test samples employed DTM test firmware for product testing control from a paired BLE application.

3.1.5 Functional Exerciser

Normal functionality was confirmed by measurement of transmitted signals.

3.1.6 Modifications Made

No modifications were made to the EUT by this lab. However, preliminary testing required the manufacturer to add output filtering components to the RF schematic to bring harmonic emissions into line with the regulations.

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 also contains a 2.4 GHz BLE Receive-only PCB used to determine Angle-of-Arrival information. As a superheterodyne receiver operating above 960 MHz, this receiver component is subject only to SDoC/Verification under the regulations. It is fully operational, powered, and tested for spurious emissions along with the EUT in this report. Manufacturer will address digital emissions and receiver compliance through SDoC separately.

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 4.1.1 . 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.

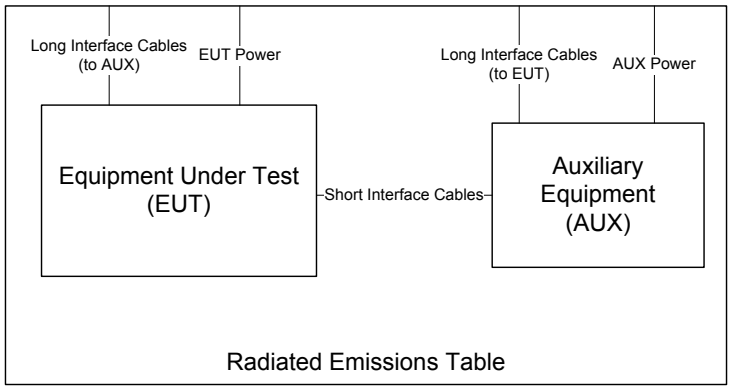


Figure 4.1.1 Radiated Emissions Diagram of the EUT.

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 RSS-102.NS.MEAS 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 4.1.1 .

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 4.1.1 Radiated Emissions Test Setup Photograph(s).

4.1.2 Conducted Emissions Test Setup and Procedures

Transmit Antenna Port Conducted Emissions At least one sample of the EUT 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 either directly or through a fixed attenuator. Photographs of the test setup employed are depicted in Figure 4.1.2 .

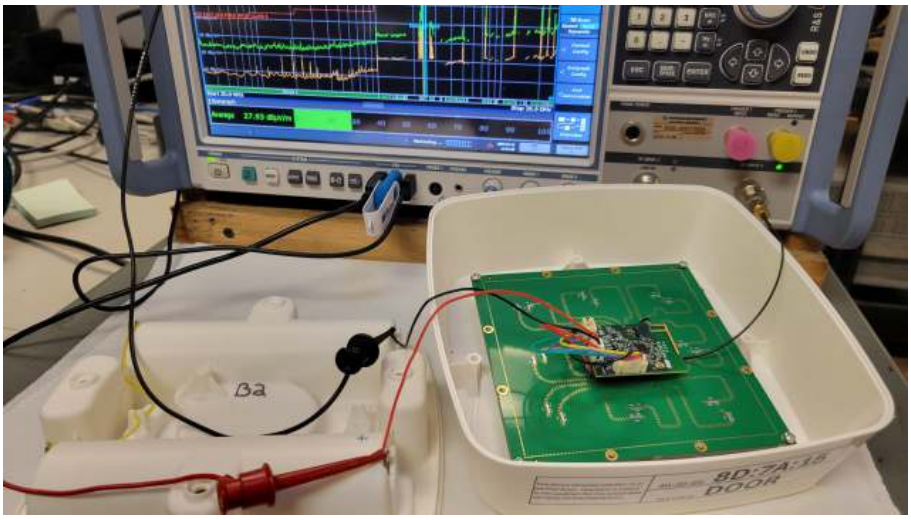


Figure 4.1.2 Conducted RF Test Setup Photograph(s).

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.

In the case the EUT is designed for operation from a battery power source, the extreme test voltages are evaluated over the range specified in the test standard; no less than ±10% of the nominal battery voltage declared by the manufacturer. For all battery operated equipment, worst case intentional and spurious emissions are re-checked employing a new (fully charged) battery.

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 4.2.1 . Plots showing the measurements made to obtain these values are provided in Figure 4.2.1 .

Table 4.2.1 Pulsed Emission Characteristics (Duty Cycle).

Test Date:	31-Jan-25
Test Engineer:	J. Brunett
EUT	GoJo Badge Locator
Meas. Distance:	Conducted

	Test Mode Pulsed Operation / Average Measurement Duty Cycle							
R0	Mode	Data Rate Mbps	Voltage V	Oper. Freq MHz	Pulse Length ms	Pulse Period ms	Fixed Duty Cycle %	Field Strength Avg/Pk Duty dB
R2	BLE RF Test Mode (fig. 4.2.1 (i))	0.125	6	2440.0	16.8	17.2	97.5	0.1
R3		0.500	6.0	2440.0	4.6	5.0	91.3	0.4
R4		1.000	6.0	2440.0	2.1	2.5	85.6	0.7
R5		2.000	6.0	2440.0	1.1	1.9	57.9	2.4
#	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.
R1	all	Fixed-Duty Cycle mode - Field duty correction applied to Restricted Band Spuriuos in this mode only. 558074 D01 v5r02 section 11, Q3.

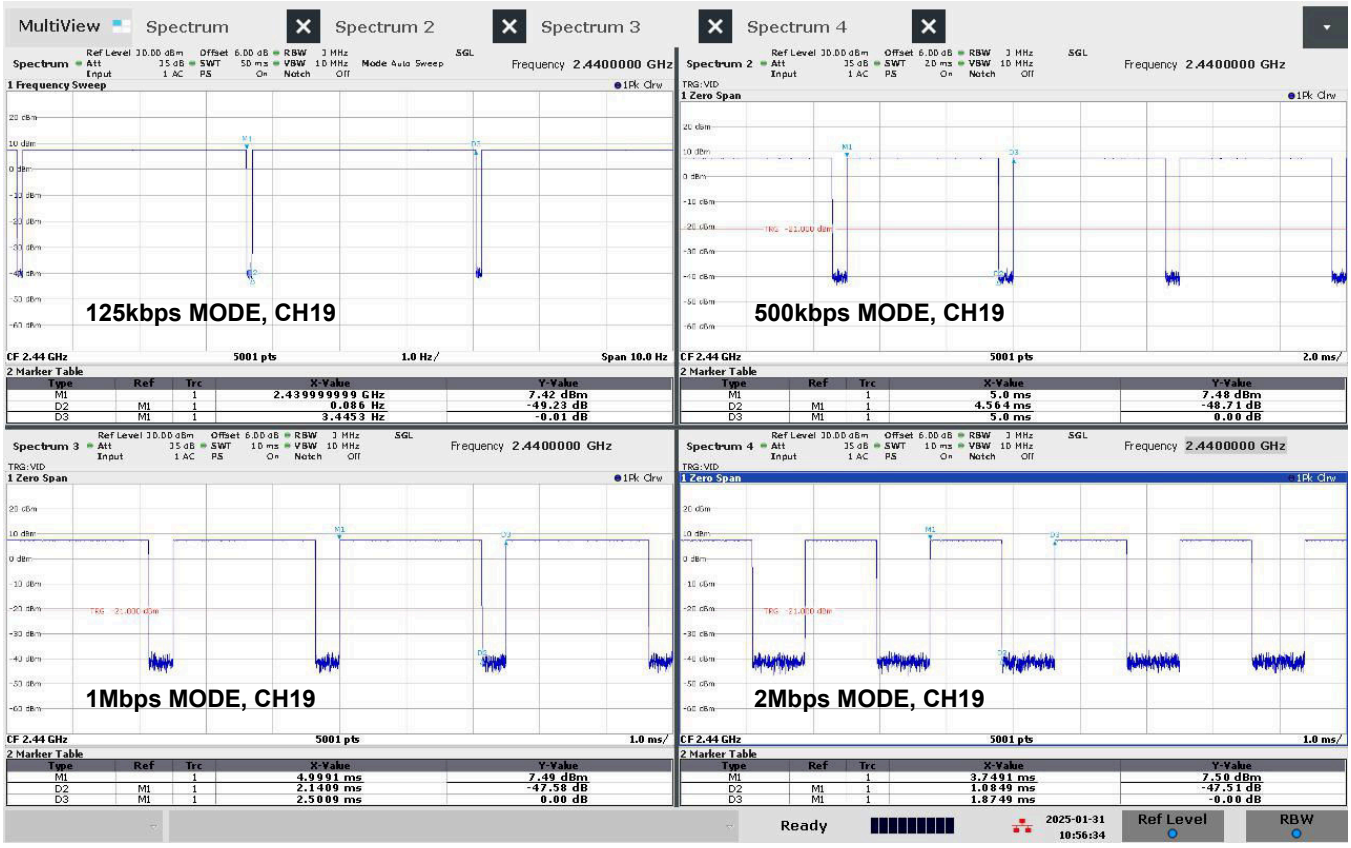


Figure 4.2.1 Example Pulsed Emission Characteristics (Duty Cycle).

4.2.2 Fundamental Emission Bandwidth

Emission bandwidth (EBW) of the EUT is measured with the device placed in the test mode(s) with the shortest available packet length and minimum packet spacing. Radiated emissions are recorded following the test procedures listed in Section 2.1. The 6 dB bandwidth is measured for the lowest, middle, and highest channels available. The 99% emission bandwidth per IC test procedures is also reported. The results of this testing are summarized in Table 4.2.2 . Plots showing measurements employed obtain the emission bandwidths reported are provided in Figure 4.2.2 .

Table 4.2.2 Intentional Emission Bandwidth.

Test Date: 31-Jan-25
Test Engineer: J. Brunett
EUT: GoJo Badge Locator
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)	Pass/Fail
R1	BLE	0.125	6.0	2402.0	0.626	0.500	1.040	Pass
R2				2440.0	0.629	0.500	1.042	Pass
R3				2480.0	0.623	0.500	1.038	Pass
R1	BLE	0.500	6.0	2402.0	0.662	0.500	1.018	Pass
R2				2440.0	0.668	0.500	1.018	Pass
R3				2480.0	0.665	0.500	1.019	Pass
R4	BLE	1.000	6.0	2402.0	0.653	0.500	1.007	Pass
R5				2440.0	0.653	0.500	1.006	Pass
R6				2480.0	0.647	0.500	1.008	Pass
R7	BLE	2.000	6.0	2402.0	1.160	0.500	2.001	Pass
R8				2440.0	1.150	0.500	2.003	Pass
R9				2480.0	1.160	0.500	2.000	Pass
#	C1	C2	C3	C4	C5	C6	C7	C9

ROW	COLUMN	NOTE
R1-R9	C5	DTS Bandwidth measured with RBW = 100 kHz per ANSI C63.10, section 11.8.1

125kbps MODE **500kbps MODE, CH19**

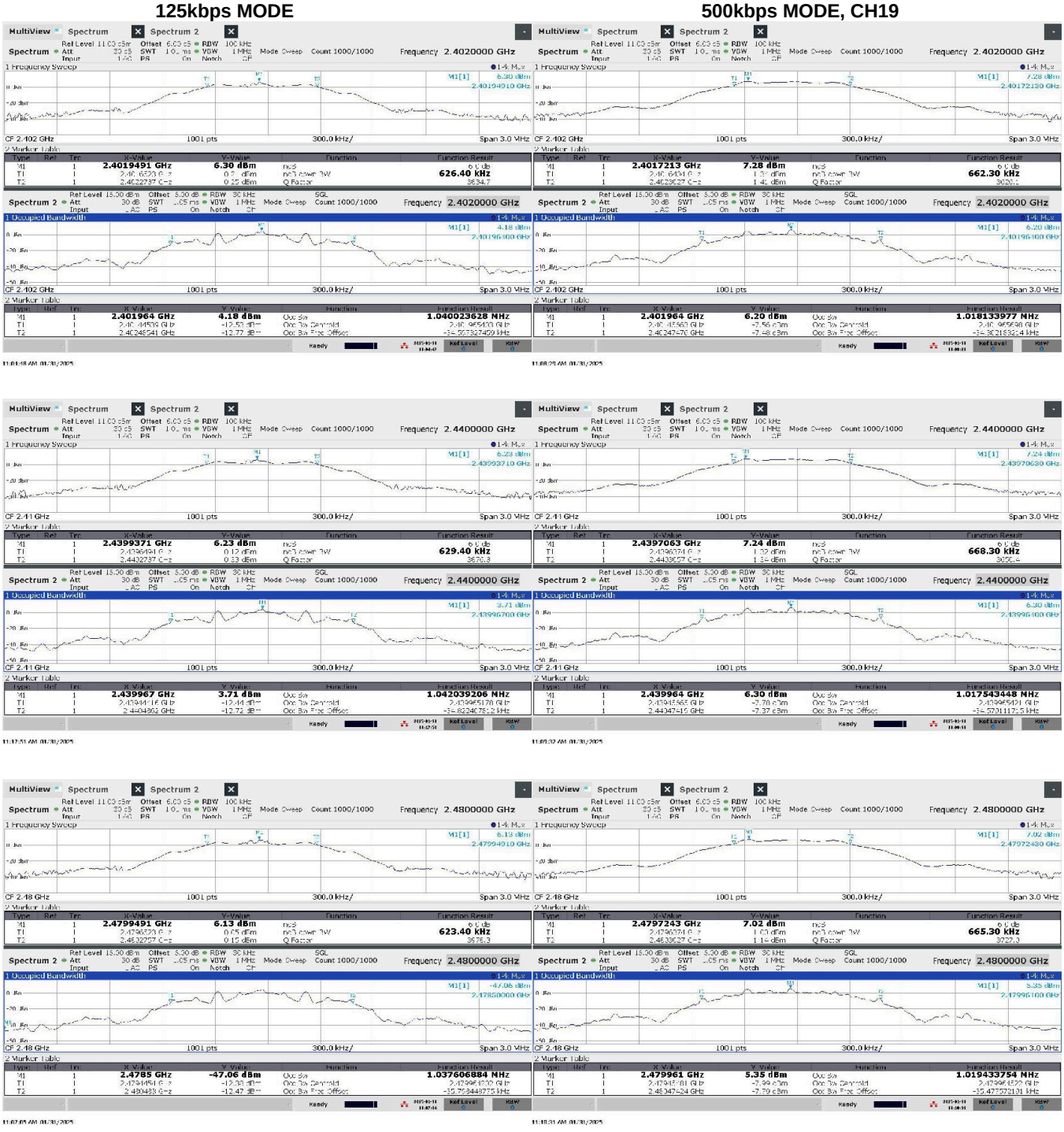


Figure 4.2.2 (i) Example Intentional Emission Bandwidth Plots.

1Mbps MODE, CH19 **2Mbps MODE, CH19**

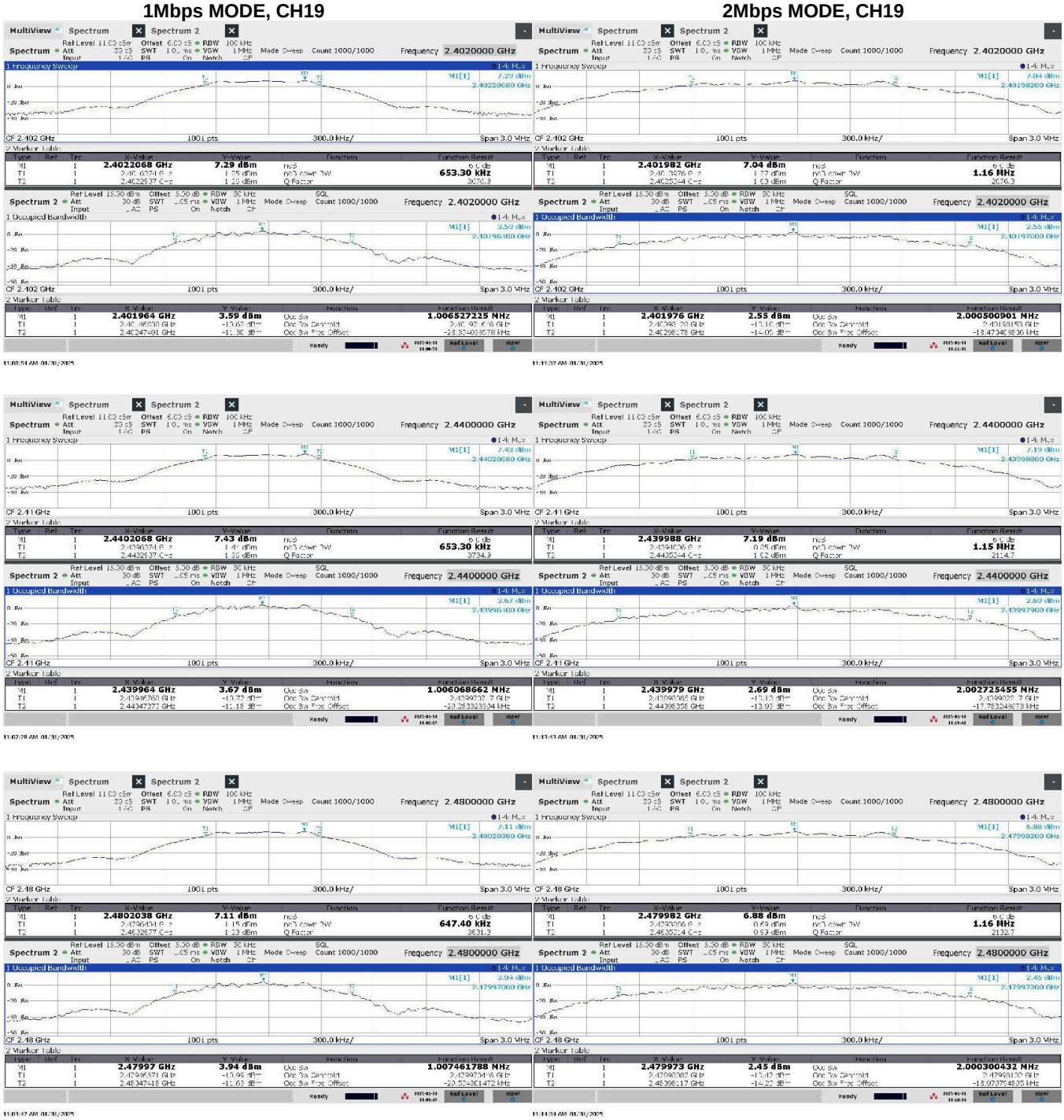


Figure 4.2.2 (ii) Example Intentional Emission Bandwidth Plots.

4.2.3 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 4.2.3 .

Table 4.2.3 Tx. Power Results.

Test Date: 31-Jan-25
Test Engineer: J. Brunett
EUT: GoJo Badge Locator
Meas. Distance: Conducted

	Fundamental Power										
R0	Mode	Channel	Freq. MHz	Pout (Pk) dBm	Duty dB	Efield (3m) dBuV/m	Ant Gain (meas.) dBi	EIRP (Pk) dBm	EIRP (Avg) Limit dBm	Pass dB	Comments
R1	BLE (CW)	0	2402.0	8.5	0.0	104.4	0.7	9.2	36.0	26.8	
R2		19	2440.0	8.7	0.0	104.6	0.7	9.4	36.0	26.6	
R3		39	2480.0	8.4	0.0	104.3	0.7	9.1	36.0	26.9	
#	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	C7	Worst case antenna gain from antenna specification / measurement.
R0	C8	Peak power is used to demonstrate compliance.

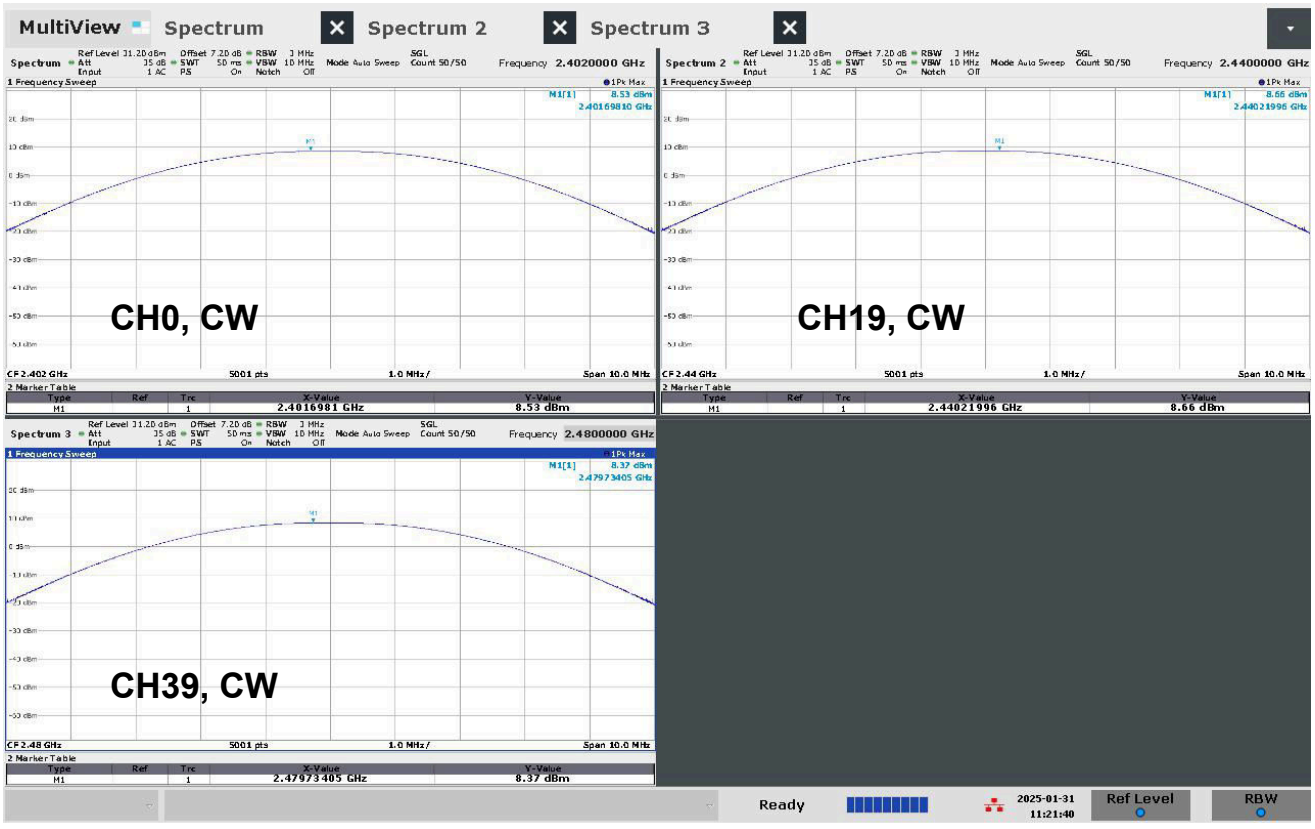


Figure 4.2.3 Conducted Power Measurement Plots.

4.2.4 Power Spectral Density

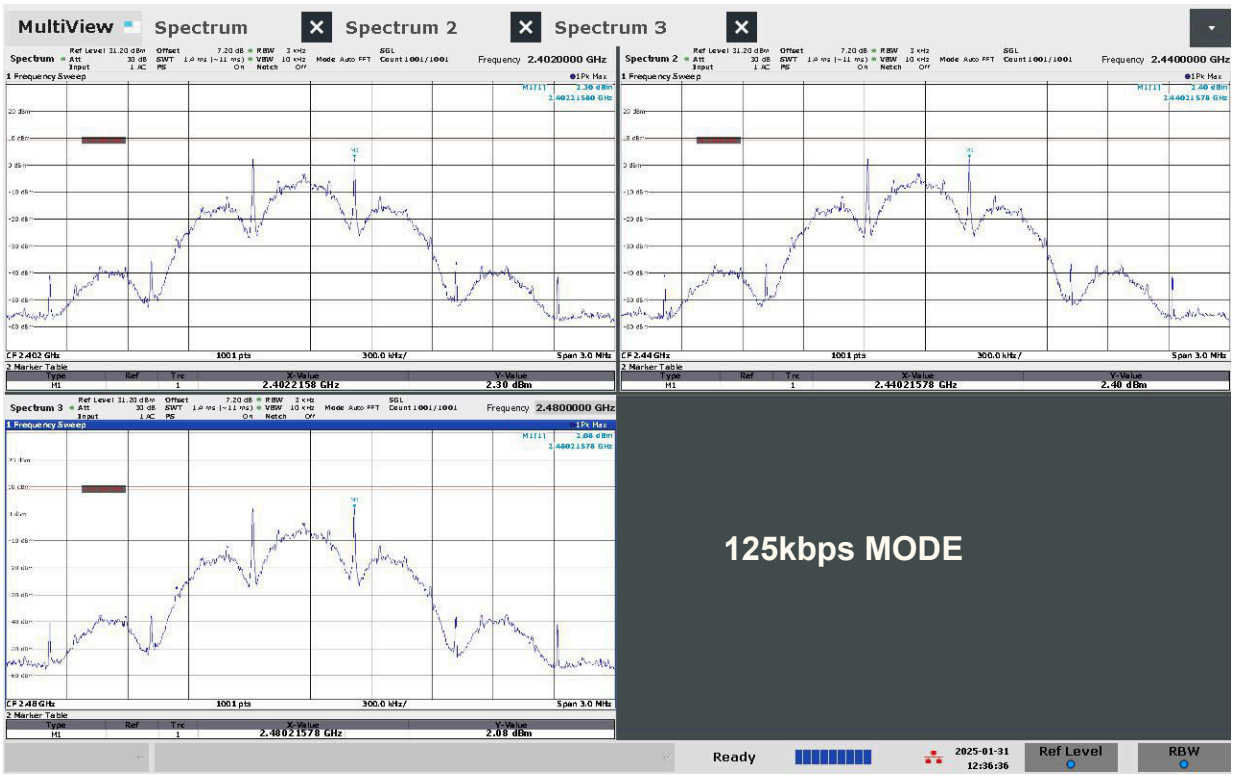
For this test, the EUT was attached directly to the test receiver. Following FCC DTS measurement procedures, the emission spectrum is first scanned for maximum spectral peaks, the span and receiver bandwidth are then reduced until the power spectral density is measured in the prescribed receiver bandwidth. The results of this testing are summarized in Table 4.2.4 . Plots showing how these measurements were made are depicted in Figure 4.2.4 .

Table 4.2.4 Power Spectral Density Results.

Frequency Range	**Detector**	**IF Bandwidth**	**Video Bandwidth**	**Test Date:**	31-Jan-25
2400-2483.5	Pk	3 kHz	10 kHz	**Test Engineer:**	J. Brunett
				EUT:	GoJo Badge Locator
				Meas. Distance:	Conducted

3kHz Power Spectral Density							
R0	Mode	Channel	Frequency (MHz)	Ant. Used	PSDcond (meas) (dBm/3kHz)	PSD Limit (dBm/3kHz)	Pass By (dB)
R1	BLE (125kBps)	0	2402.0	Cond.	2.3	8.00	5.7
R2		19	2440.0	Cond.	2.4	8.00	**5.6**
R3		39	2480.0	Cond.	2.1	8.00	5.9
R1	BLE (500kBps)	0	2402.0	Cond.	-0.8	8.00	8.8
R2		19	2440.0	Cond.	-0.7	8.00	8.7
R3		39	2480.0	Cond.	-1.5	8.00	9.5
R4	BLE (1MBps)	0	2402.0	Cond.	-7.4	8.00	15.4
R5		19	2440.0	Cond.	-7.3	8.00	15.3
R6		39	2480.0	Cond.	-7.6	8.00	15.6
R7	BLE (2 MBps)	0	2402.0	Cond.	-10.4	8.00	18.4
R8		19	2440.0	Cond.	-10.2	8.00	18.2
R9		39	2480.0	Cond.	-10.6	8.00	18.6
#	C1	C2	C3	C4	C5	C6	C7

(ROW)	(COLUMN)	NOTES
R0	C5	PSD measured conducted out the EUT antenna port following ANSI C63.10, 11.10.2



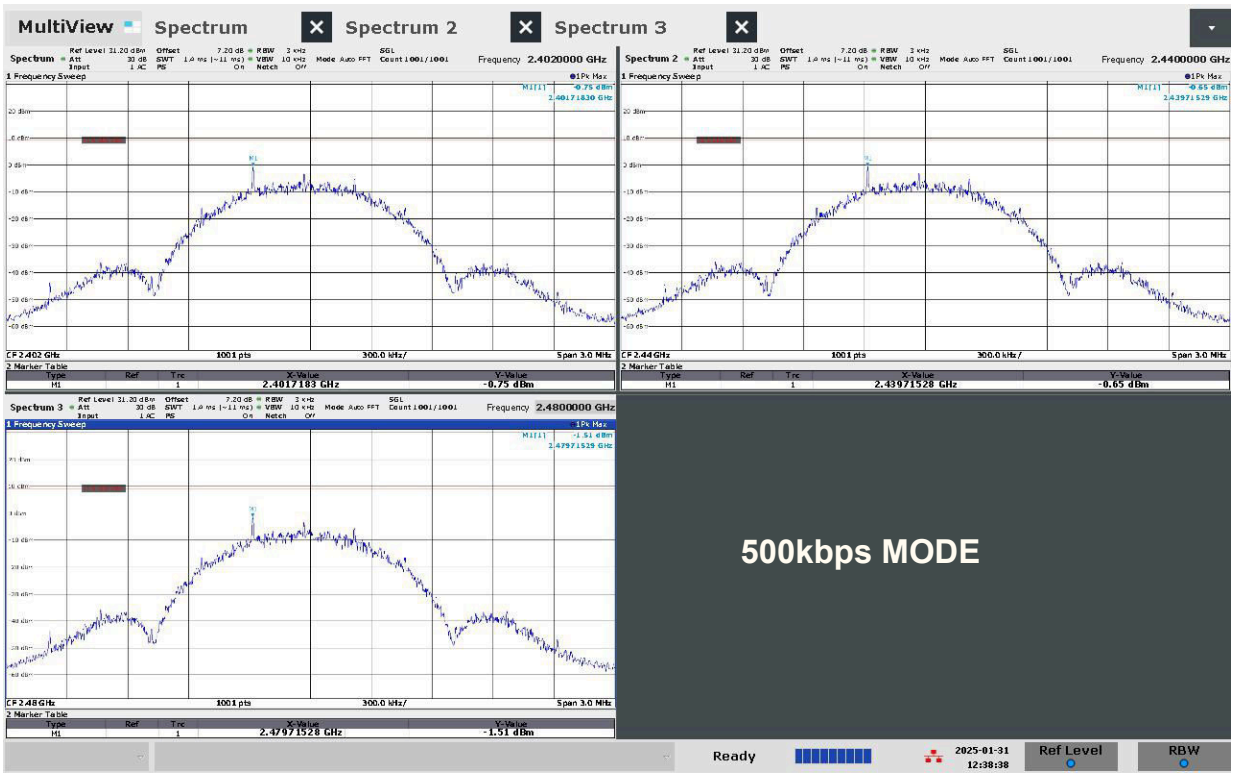
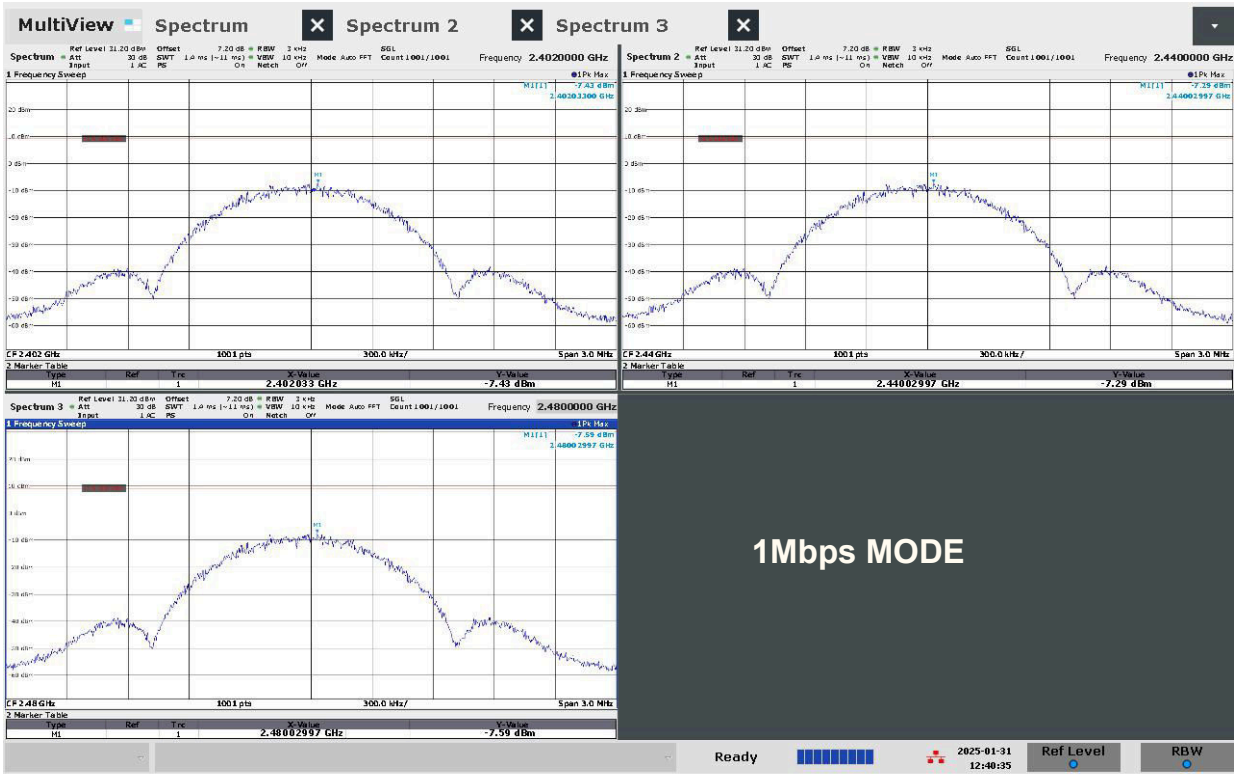


Figure 4.2.4 (i) Power Spectral Density Plots.



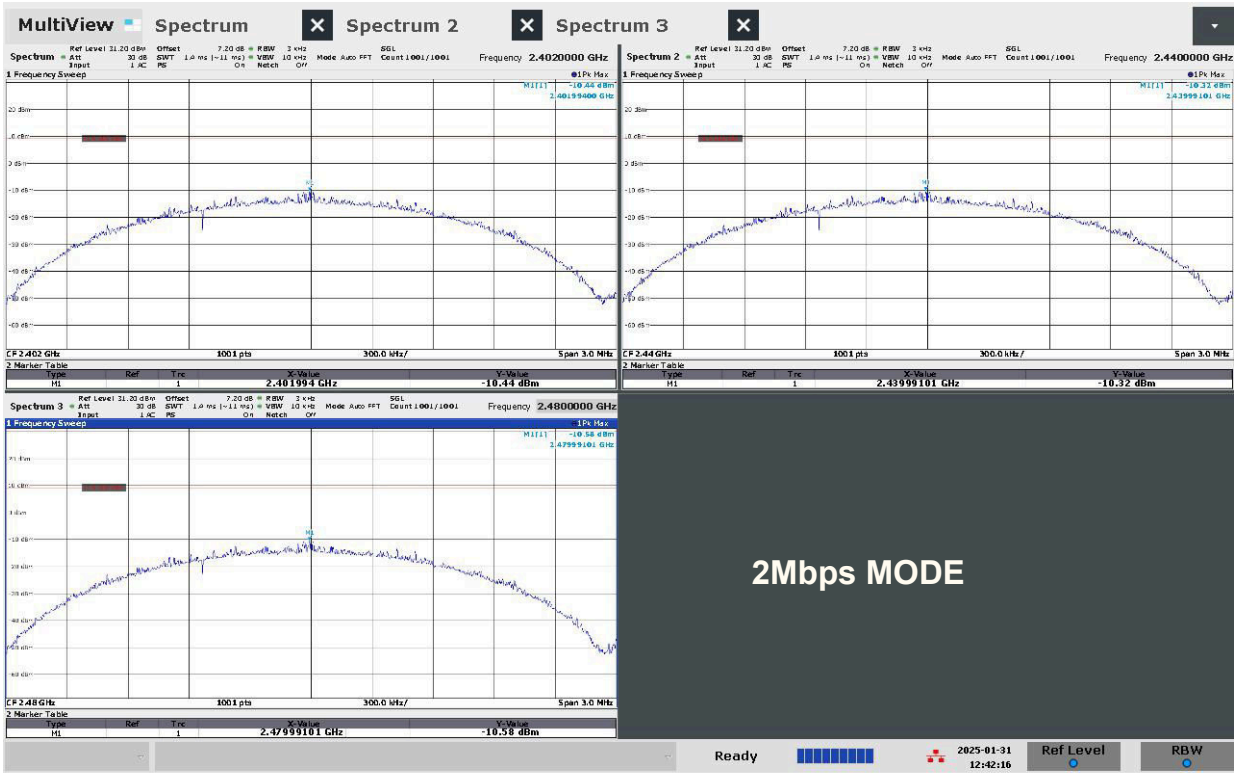


Figure 4.2.4 (ii) Power Spectral Density Plots.

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 4.3.1 . Measurements are performed to 10 times the highest fundamental operating frequency.

Table 4.3.1 (i) Transmit Chain Spurious Emissions.

	Frequency Range	Det	IF Bandwidth	Video Bandwidth		
Restricted Band Emissions	30 MHz< f < 1 000 MHz	Pk/Qpk	100 KHz	300 KHz	**Test Date:**	31-Jan-25
Restricted Band Emissions	f > 1 000 MHz	Pk/Avg	1 MHz	3 MHz	**Test Engineer:**	J. Brunett
Restricted Band Edge	f > 1 000 MHz	Pk/Avg	100 Khz	300 KHz	**EUT:**	GoJo Badge Locator
					Meas. Distance:	Conducted

Transmitter Spurious FCC/IC

	Mode	Frequency		Output Power Meas.		Ant	GR Factor	Avg Duty	Electric Field @ 3m				Pass	
		Start	Stop	Pk	Qpk/Avg	Gain		Factor	Calc. Pk	Limit Pk	Calc. Avg	Limit Avg		
R0		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	BLE (125Kbps)	2390.0	2390.0	-39.9	-67.0	2.0	0.0	0.1	57.3	74.0	30.3	54.0	16.7	CH0, CH19, CH39
R3	Fundamental Restricted Band Edge (High Side)													
R4	BLE (125Kbps)	2483.5	2483.5	-29.2	-52.3	2.0	0.0	0.1	68.0	74.0	45.0	54.0	6.0	CH0, CH19, CH39
R5	Restricted Bands Emissions													
R6	BLE (125Kbps)	30.0	88.0	-80.8		2.0	4.7	0.1	21.1			40.0	18.9	CH0, CH19, CH39
R7	BLE (125Kbps)	88.0	216.0	-77.9		2.0	4.7	0.1	24.0			43.5	19.5	CH0, CH19, CH39
R8	BLE (125Kbps)	216.0	960.0	-76.6		2.0	4.7	0.1	25.3			46.0	20.7	CH0, CH19, CH39
R9	BLE (125Kbps)	960.0	4000.0	-29.2	-52.3	2.0	0.0	0.1	68.0	74.0	45.0	54.0	9.0	CH0, CH19, CH39
R10	BLE (125Kbps)	4804.0	4804.0	-54.6	-62.1	2.0	0.0	0.1	42.6	74.0	35.2	54.0	18.8	CH0
R11	BLE (125Kbps)	4880.0	4880.0	-55.8	-63.7	2.0	0.0	0.1	41.5	74.0	33.6	54.0	20.4	CH19
R12	BLE (125Kbps)	4960.0	4960.0	-57.6	-67.2	2.0	0.0	0.1	39.6	74.0	30.1	54.0	23.9	CH39
R13	BLE (125Kbps)	4000.0	6000.0	-44.3	-49.1	2.0	0.0	0.1	52.9	74.0	48.2	54.0	5.8	CH0, CH19, CH39
R14	BLE (125Kbps)	6000.0	8400.0	-45.0	-52.0	2.0	0.0	0.1	52.2	74.0	45.3	54.0	8.7	CH0, CH19, CH39
R15	BLE (125Kbps)	7320.0	7320.0	-47.6	-54.9	2.0	0.0	0.1	49.6	74.0	42.4	54.0	11.6	CH19
R16	BLE (125Kbps)	7440.0	7440.0	-45.0	-52.0	2.0	0.0	0.1	52.2	74.0	45.3	54.0	8.7	CH39
R17	BLE (125Kbps)	8400.0	12500.0	-36.1	-45.3	2.0	0.0	0.1	61.1	74.0	52.0	54.0	**2.0**	CH0, CH19, CH39
R18	BLE (125Kbps)	12010.0	12010.0	-36.1	-45.3	2.0	0.0	0.1	61.1	74.0	52.0	54.0	**2.0**	CH0
R19	BLE (125Kbps)	12200.0	12200.0	-37.1	-45.5	2.0	0.0	0.1	60.1	74.0	51.8	54.0	2.2	CH19
R20	BLE (125Kbps)	12400.0	12400.0	-40.5	-47.9	2.0	0.0	0.1	56.7	74.0	49.4	54.0	4.6	CH39
R21	BLE (125Kbps)	12500.0	26000.0	-41.7	-50.2	2.0	0.0	0.1	55.5	74.0	47.1	54.0	6.9	CH0, CH19, CH39
R22	BLE (125Kbps)	22320.0	22320.0	-41.7	-50.2	2.0	0.0	0.1	55.5	74.0	47.1	54.0	6.9	CH39
R23														
R24														
#	C1	C2	C3	C4	C5	C6	C7	C8	C9	C10	C11	C12	C13	C14

(ROW)	(COLUMN)	NOTES
R0	C5	Conducted measurements were made in line with DTS guidance 558074 D01 v5 r02 sections 8.5, 8.6 and 8.7 respectively.
R2/R4	C5	Measured according to ANSI C63-10-2013 section 11.13.3.4
R6-R8	C4	Measured according to ANSI C63-10-2013 section 11.12.2.4
R9-R20	C5	Measured according to ANSI C63-10-2013 section 11.12.2.5.2
R0	C6	Minimum applicable antenna gain according to ANSI C63-10-2013 Section 11.12.2.6 is 2.0 dBi
R0	C7	Ground Reflection Factor as described in ANSI C63.10-2013 section 11.12.2.2c
R0	C9/C11	Computed according to ANSI C63.10-2013 section 11.12.2.2e

Table 4.3.1 (ii) Transmit Chain Spurious Emissions.

	Frequency Range	Det	IF Bandwidth	Video Bandwidth		
Restricted Band Emissions	30 MHz< f < 1 000 MHz	Pk/Qpk	100 KHz	300 KHz	**Test Date:**	31-Jan-25
Restricted Band Emissions	f > 1 000 MHz	Pk/Avg	1 MHz	3 MHz	**Test Engineer:**	J. Brunett
Restricted Band Edge	f > 1 000 MHz	Pk/Avg	100 KHz	300 KHz	**EUT:**	GoJo Badge Locator
					Meas. Distance:	Conducted

Transmitter Spurious														FCC/IC
		Frequency		Output Power Meas.		Ant	GR Factor	Avg Duty	Electric Field @ 3m				Pass	
	Mode	Start	Stop	Pk	Qpk/Avg	Gain		Factor	Calc. Pk	Limit Pk	Calc. Avg	Limit Avg		
R0		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	BLE (500kbps)	2390.0	2390.0	-41.2	-69.1	2.0	0.0	0.4	56.0	74.0	28.5	54.0	18.0	CH0, CH19, CH39
R3	Fundamental Restricted Band Edge (High Side)													
R4	BLE (500kbps)	2483.5	2483.5	-30.1	-54.6	2.0	0.0	0.4	67.1	74.0	43.0	54.0	6.9	CH0, CH19, CH39
R5	Restricted Bands Emissions													
R6	BLE (500kbps)	30.0	88.0	-80.8		2.0	4.7	0.4	21.1			40.0	18.9	CH0, CH19, CH39
R7	BLE (500kbps)	88.0	216.0	-79.0		2.0	4.7	0.4	22.9			43.5	20.6	CH0, CH19, CH39
R8	BLE (500kbps)	216.0	960.0	-78.5		2.0	4.7	0.4	23.4			46.0	22.6	CH0, CH19, CH39
R9	BLE (500kbps)	960.0	4000.0	-30.1	-54.6	2.0	0.0	0.4	67.1	74.0	43.0	54.0	11.0	CH0, CH19, CH39
R10	BLE (500kbps)	4804.0	4804.0	-56.8	-64.0	2.0	0.0	0.4	40.4	74.0	33.6	54.0	20.4	CH0
R11	BLE (500kbps)	4880.0	4880.0	-57.7	-65.8	2.0	0.0	0.4	39.5	74.0	31.8	54.0	22.2	CH19
R12	BLE (500kbps)	4960.0	4960.0	-58.8	-68.3	2.0	0.0	0.4	38.4	74.0	29.3	54.0	24.7	CH39
R13	BLE (500kbps)	4000.0	6000.0	-40.8	-45.9	2.0	0.0	0.4	56.4	74.0	51.7	54.0	2.3	CH0, CH19, CH39
R14	BLE (500kbps)	6000.0	8400.0	-46.5	-54.6	2.0	0.0	0.4	50.7	74.0	43.0	54.0	11.0	CH0, CH19, CH39
R15	BLE (500kbps)	7320.0	7320.0	-49.2	-57.3	2.0	0.0	0.4	48.0	74.0	40.3	54.0	13.7	CH19
R16	BLE (500kbps)	7440.0	7440.0	-46.5	-54.6	2.0	0.0	0.4	50.7	74.0	43.0	54.0	11.0	CH39
R17	BLE (500kbps)	8400.0	12500.0	-35.7	-45.6	2.0	0.0	0.4	61.5	74.0	52.0	54.0	**2.0**	CH0, CH19, CH39
R18	BLE (500kbps)	12010.0	12010.0	-36.3	-45.7	2.0	0.0	0.4	60.9	74.0	51.9	54.0	2.1	CH0
R19	BLE (500kbps)	12200.0	12200.0	-35.7	-45.6	2.0	0.0	0.4	61.5	74.0	52.0	54.0	**2.0**	CH19
R20	BLE (500kbps)	12400.0	12400.0	-42.0	-50.5	2.0	0.0	0.4	55.2	74.0	47.1	54.0	6.9	CH39
R21	BLE (500kbps)	12500.0	26000.0	-43.2	-53.1	2.0	0.0	0.4	54.0	74.0	44.5	54.0	9.5	CH0, CH19, CH39
R22	BLE (500kbps)	22320.0	22320.0	-43.2	-53.1	2.0	0.0	0.4	54.0	74.0	44.5	54.0	9.5	CH39
R23														
R24														
#	C1	C2	C3	C4	C5	C6	C7	C8	C9	C10	C11	C12	C13	C14

(ROW)	(COLUMN)	NOTES
R0	C5	Conducted measurements were made in line with DTS guidance 558074 D01 v5 r02 sections 8.5, 8.6 and 8.7 respectively.
R2/R4	C5	Measured according to ANSI C63-10-2013 section 11.13.3.4
R6-R8	C4	Measured according to ANSI C63-10-2013 section 11.12.2.4
R9-R20	C5	Measured according to ANSI C63-10-2013 section 11.12.2.5.2
R0	C6	Minimum applicable antenna gain according to ANSI C63-10-2013 Section 11.12.2.6 is 2.0 dBi
R0	C7	Ground Reflection Factor as described in ANSI C63.10-2013 section 11.12.2.2c
R0	C9/C11	Computed according to ANSI C63.10-2013 section 11.12.2.2e

Table 4.3.1 (iii) Transmit Chain Spurious Emissions.

	Frequency Range	Det	IF Bandwidth	Video Bandwidth		
Restricted Band Emissions	30 MHz< f < 1 000 MHz	Pk/Qpk	100 KHz	300 KHz	**Test Date:**	31-Jan-25
Restricted Band Emissions	f > 1 000 MHz	Pk/Avg	1 MHz	3 MHz	**Test Engineer:**	J. Brunett
Restricted Band Edge	f > 1 000 MHz	Pk/Avg	100 KHz	300 KHz	**EUT:**	GoJo Badge Locator
					Meas. Distance:	Conducted

Transmitter Spurious														FCC/IC
		Frequency		Output Power Meas.		Ant	GR Factor	Avg Duty	Electric Field @ 3m				Pass	
	Mode	Start	Stop	Pk	Qpk/Avg	Gain		Factor	Calc. Pk	Limit Pk	Calc. Avg	Limit Avg		
R0		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	BLE (1Mbps)	2390.0	2390.0	-41.2	-69.7	2.0	0.0	0.7	56.0	74.0	28.2	54.0	18.0	CH0, CH19, CH39
R3	Fundamental Restricted Band Edge (High Side)													
R4	BLE (1Mbps)	2483.5	2483.5	-29.9	-55.4	2.0	0.0	0.7	67.3	74.0	42.5	54.0	6.7	CH0, CH19, CH39
R5	Restricted Bands Emissions													
R6	BLE (1Mbps)	30.0	88.0	-81.0		2.0	4.7	0.7	20.9			40	19.1	CH0, CH19, CH39
R7	BLE (1Mbps)	88.0	216.0	-79.6		2.0	4.7	0.7	22.3			43.5	21.2	CH0, CH19, CH39
R8	BLE (1Mbps)	216.0	960.0	-78.2		2.0	4.7	0.7	23.7			46	22.3	CH0, CH19, CH39
R9	BLE (1Mbps)	960.0	4000.0	-29.9	-55.4	2.0	0.0	0.7	67.3	74.0	42.5	54.0	11.5	CH0, CH19, CH39
R10	BLE (1Mbps)	4804.0	4804.0	-56.8	-64.5	2.0	0.0	0.7	40.4	74.0	33.4	54.0	20.7	CH0
R11	BLE (1Mbps)	4880.0	4880.0	-57.8	-66.2	2.0	0.0	0.7	39.4	74.0	31.7	54.0	22.3	CH19
R12	BLE (1Mbps)	4960.0	4960.0	-59.1	-68.4	2.0	0.0	0.7	38.1	74.0	29.5	54.0	24.5	CH39
R13	BLE (1Mbps)	4000.0	6000.0	-40.8	-46.4	2.0	0.0	0.7	56.4	74.0	51.5	54.0	2.5	CH0, CH19, CH39
R14	BLE (1Mbps)	6000.0	8400.0	-46.5	-55.4	2.0	0.0	0.7	50.7	74.0	42.5	54.0	11.5	CH0, CH19, CH39
R15	BLE (1Mbps)	7320.0	7320.0	-49.1	-58.1	2.0	0.0	0.7	48.1	74.0	39.8	54.0	14.2	CH19
R16	BLE (1Mbps)	7440.0	7440.0	-46.5	-55.4	2.0	0.0	0.7	50.7	74.0	42.5	54.0	11.5	CH39
R17	BLE (1Mbps)	8400.0	12500.0	-35.2	-44.9	2.0	0.0	0.7	62.0	74.0	53.0	54.0	**1.0**	CH0, CH19, CH39
R18	BLE (1Mbps)	12010.0	12010.0	-35.2	-45.5	2.0	0.0	0.7	62.0	74.0	52.4	54.0	1.6	CH0
R19	BLE (1Mbps)	12200.0	12200.0	-35.7	-44.9	2.0	0.0	0.7	61.5	74.0	53.0	54.0	**1.0**	CH19
R20	BLE (1Mbps)	12400.0	12400.0	-42.1	-51.4	2.0	0.0	0.7	55.1	74.0	46.5	54.0	7.5	CH39
R21	BLE (1Mbps)	12500.0	26000.0	-43.1	-54.0	2.0	0.0	0.7	54.1	74.0	43.9	54.0	10.1	CH0, CH19, CH39
R22	BLE (1Mbps)	22320.0	22320.0	-43.1	-54.0	2.0	0.0	0.7	54.1	74.0	43.9	54.0	10.1	CH39
R23														
R24														
#	C1	C2	C3	C4	C5	C6	C7	C8	C9	C10	C11	C12	C13	C14

(ROW)	(COLUMN)	NOTES
R0	C5	Conducted measurements were made in line with DTS guidance 558074 D01 v5 r02 sections 8.5, 8.6 and 8.7 respectively.
R2/R4	C5	Measured according to ANSI C63-10-2013 section 11.13.3.4
R6-R8	C4	Measured according to ANSI C63-10-2013 section 11.12.2.4
R9-R20	C5	Measured according to ANSI C63-10-2013 section 11.12.2.5.2
R0	C6	Minimum applicable antenna gain according to ANSI C63-10-2013 Section 11.12.2.6 is 2.0 dBi
R0	C7	Ground Reflection Factor as described in ANSI C63.10-2013 section 11.12.2.2c
R0	C9/C11	Computed according to ANSI C63.10-2013 section 11.12.2.2e

Table 4.3.1 (iv) Transmit Chain Spurious Emissions.

	Frequency Range	Det	IF Bandwidth	Video Bandwidth		
Restricted Band Emissions	30 MHz< f < 1 000 MHz	Pk/Qpk	100 KHz	300 KHz	**Test Date:**	31-Jan-25
Restricted Band Emissions	f > 1 000 MHz	Pk/Avg	1 MHz	3 MHz	**Test Engineer:**	J. Brunett
Restricted Band Edge	f > 1 000 MHz	Pk/Avg	100 KHz	300 KHz	**EUT:**	GoJo Badge Locator
					Meas. Distance:	Conducted

Transmitter Spurious FCC/IC

	Mode	Frequency		Output Power Meas.		Ant	GR Factor	Avg Duty	Electric Field @ 3m				Pass	
		Start	Stop	Pk	Qpk/Avg	Gain		Factor	Calc. Pk	Limit Pk	Calc. Avg	Limit Avg		
R0		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	BLE (2Mbps)	2390.0	2390.0	-40.4	-68.9	2.0	0.0	2.4	56.8	74.0	30.7	54.0	17.2	CH0, CH19, CH39
R3	Fundamental Restricted Band Edge (High Side)													
R4	BLE (2Mbps)	2483.5	2483.5	-29.4	-49.9	2.0	0.0	2.4	67.8	74.0	49.7	54.0	**4.3**	CH0, CH19, CH39
R5	Restricted Bands Emissions													
R6	BLE (2Mbps)	30.0	88.0	-81.0		2.0	4.7	2.4	20.9			40	19.1	CH0, CH19, CH39
R7	BLE (2Mbps)	88.0	216.0	-79.5		2.0	4.7	2.4	22.4			43.5	21.1	CH0, CH19, CH39
R8	BLE (2Mbps)	216.0	960.0	-76.8		2.0	4.7	2.4	25.1			46	20.9	CH0, CH19, CH39
R9	BLE (2Mbps)	960.0	4000.0	-29.4	-49.9	2.0	0.0	2.4	67.8	74.0	49.7	54.0	4.3	CH0, CH19, CH39
R10	BLE (2Mbps)	4804.0	4804.0	-56.3	-71.8	2.0	0.0	2.4	40.9	74.0	27.8	54.0	26.2	CH0
R11	BLE (2Mbps)	4880.0	4880.0	-57.7	-78.9	2.0	0.0	2.4	39.5	74.0	20.7	54.0	33.3	CH19
R12	BLE (2Mbps)	4960.0	4960.0	-58.5	-74.7	2.0	0.0	2.4	38.7	74.0	24.9	54.0	29.1	CH39
R13	BLE (2Mbps)	4000.0	6000.0	-40.8	-55.2	2.0	0.0	2.4	56.4	74.0	44.4	54.0	9.6	CH0, CH19, CH39
R14	BLE (2Mbps)	6000.0	8400.0	-46.7	-61.1	2.0	0.0	2.4	50.5	74.0	38.5	54.0	15.5	CH0, CH19, CH39
R15	BLE (2Mbps)	7320.0	7320.0	-49.3	-63.8	2.0	0.0	2.4	47.9	74.0	35.8	54.0	18.2	CH19
R16	BLE (2Mbps)	7440.0	7440.0	-46.7	-61.1	2.0	0.0	2.4	50.5	74.0	38.5	54.0	15.5	CH39
R17	BLE (2Mbps)	8400.0	12500.0	-35.2	-50.6	2.0	0.0	2.4	62.0	74.0	49.0	54.0	5.0	CH0, CH19, CH39
R18	BLE (2Mbps)	12010.0	12010.0	-35.2	-50.6	2.0	0.0	2.4	62.0	74.0	49.0	54.0	5.0	CH0
R19	BLE (2Mbps)	12200.0	12200.0	-35.6	-50.9	2.0	0.0	2.4	61.6	74.0	48.7	54.0	5.3	CH19
R20	BLE (2Mbps)	12400.0	12400.0	-41.9	-57.4	2.0	0.0	2.4	55.3	74.0	42.2	54.0	11.8	CH39
R21	BLE (2Mbps)	12500.0	26000.0	-43.2	-59.8	2.0	0.0	2.4	54.0	74.0	39.8	54.0	14.2	CH0, CH19, CH39
R22	BLE (2Mbps)	22320.0	22320.0	-43.2	-59.8	2.0	0.0	2.4	54.0	74.0	39.8	54.0	14.2	CH39
R23														
R24														
#	C1	C2	C3	C4	C5	C6	C7	C8	C9	C10	C11	C12	C13	C14

(ROW)	(COLUMN)	NOTES
R0	C5	Conducted measurements were made in line with DTS guidance 558074 D01 v5 r02 sections 8.5, 8.6 and 8.7 respectively.
R2/R4	C5	Measured according to ANSI C63-10-2013 section 11.13.3.4
R6-R8	C4	Measured according to ANSI C63-10-2013 section 11.12.2.4
R9-R20	C5	Measured according to ANSI C63-10-2013 section 11.12.2.5.2
R0	C6	Minimum applicable antenna gain according to ANSI C63-10-2013 Section 11.12.2.6 is 2.0 dBi
R0	C7	Ground Reflection Factor as described in ANSI C63.10-2013 section 11.12.2.2c
R0	C9/C11	Computed according to ANSI C63.10-2013 section 11.12.2.2e

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 4.3.2 below.

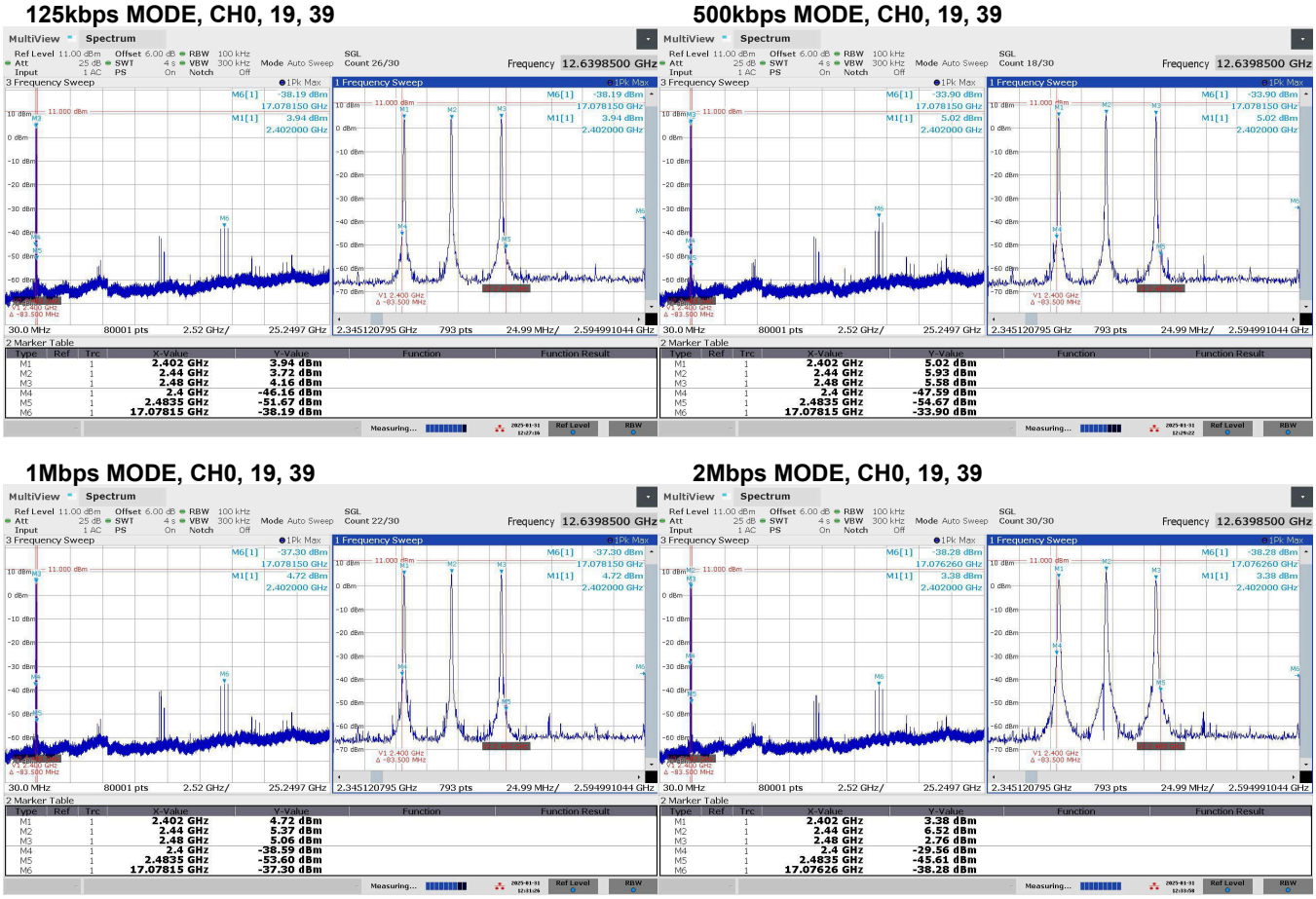


Figure 4.3.2 Worst Case Transmitter OOB Emissions Measured.

4.3.3 Radiated Digital and Cabinet Spurious

The results for the measurement of digital and cabinet spurious emissions are not reported herein as all emissions were greater than 20 dB below the regulatory limit. Emissions from digital components are measured to 1 GHz, or to five times the maximum crystal or oscillator operating frequency, whichever is greater. Cabinet emissions are measured up to the highest frequency tested during conducted measurements.

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 5.0.0 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
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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 on ISO/IEC 17025).

2024-06-13 through 2025-06-30
Effective Dates

For the National Voluntary Laboratory Accreditation Program

Figure 5.0.0 Accreditation Documents