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

EMC Test Report

EB1902400TX
Issued: **April 22, 2020**

regarding

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

for

7015XGW RF Gateway

Category: Spread Spectrum Transceiver

Judgments:
FCC 15.247, ISED RSS-247 Compliant
Testing Completed: 12/12/19 - 04/19/20

TESTING
NVLAP LAB CODE 200129-0

Prepared for:

Elkhart Brass Mfg Co, Inc.

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Revision History

Rev. No.	Date	Details	Revised By
r0	April 22, 2020	Initial Release.	J. Brunett
r1	May 24, 2020	Address reviewer concerns.	J. Brunett

Contents

List of Tables

List of Figures

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 May 2030.

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 laboratories scope of accreditation.

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

This report shall not be reproduced, except in full, without the written approval of Amber Helm Development L.C.

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 (3m & 10m)	92723 Michigan Hwy-152, Sister Lakes, Michigan 49047 USA	OATSA

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
Spectrum Analyzer	R & S / FSV30	101660	RSFSV30001	RS / Apr-2021
EMI Receiver	HP / 85460A/85462A	3704A00422, 3807A00465	HP8546A	Std and Cal / May-2020
LISN	Solar / 8012-50-R-24-BNC	962138	LISN7	AHD / April-2021
BiconiLog Antenna	EMCO / 3142	1169	BILO3142	Lib.Labs / May-2020
(3m) LMR-400 Coax	AHD / LMR400	C090804	LMR400	AHD / Jan-2020
(LCI) DS Coax	AHD / RG58/U	920809	RG58U	AHD / Jul-2020
Double Ridged Horn	EMCO / 3115	2788	RH3115	Lib.Labs. / July-2020

2 Test Specifications and Procedures

2.1 Test Specification and General Procedures

The goal of Elkhart Brass Mfg Co, 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 Elkhart Brass Mfg Co, Inc. 7015XGW RF Gateway 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 "
TP0102RA	"AHD Internal Document TP0102 - Radiated Emissions Test Procedure"
TP0106RC	"AHD Internal Document TP0106 - Emissions Measurement Procedures (above 40 GHz)"
ISED Canada	"The Measurement of Occupied Bandwidth"

3 Configuration and Identification of the Equipment Under Test

3.1 Description and Declarations

The EUT is wireless controller used on a motor vehicle. The EUT is approximately 26 x 12 x 4 cm in dimension, and is depicted in Figure 1. It is powered by 12 Vdc vehicular power system. In use this product is mounted to a fire engine. Table 3 outlines provider declared EUT specifications.

Figure 1: Photos of EUT.

Table 3: EUT Declarations.

General Declarations	
Equipment Type:	Spread Spectrum Transceiver
Country of Origin:	USA
Nominal Supply:	12 Vdc
Oper. Temp Range:	not declared
Frequency Range:	902 – 928 MHz
Antenna Dimension:	Integral
Antenna Type:	dipole
Antenna Gain:	1.2 dBi
Number of Channels:	26
Channel Spacing:	750 kHz
Alignment Range:	Not Declared
Type of Modulation:	2FSK
United States	
FCC ID Number:	QT8EXM2GW
Classification:	DSS
Canada	
IC Number:	4637A-EXM2GW
Classification:	Spread Spectrum (902-928 MHz)

3.1.1 EUT Configuration

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

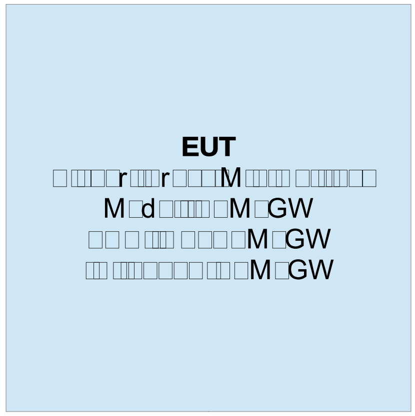


Figure 2: EUT Test Configuration Diagram.

3.1.2 Modes of Operation

The EUT is capable of operating in 2FSK mode. Test samples were placed into worst-case operating mode (highest data rate, highest operating power that may be employed). Additionally, CW mode was employed with the EUT in order to determine integral antenna gain.

3.1.3 Variants

There is only a single electrical version and PCB design of the EUT.

3.1.4 Test Samples

Two samples of the EUT were provided for emissions testing, one radiated sample and one sample for RF conducted measurements.

3.1.5 Functional Exerciser

EUT 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

None.

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.

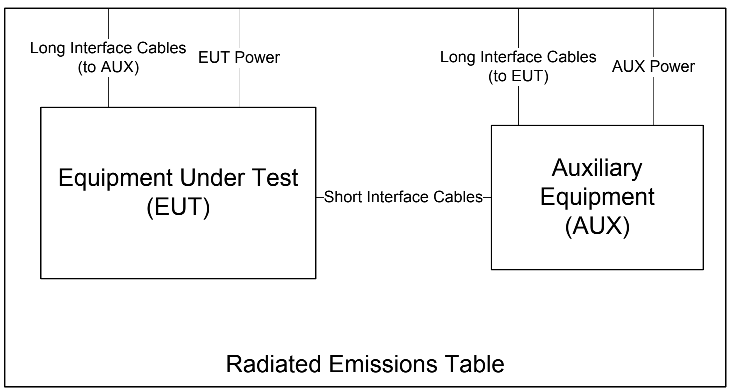


Figure 3: Radiated Emissions Diagram of the EUT.

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 regulations. Shielded loops are placed at a 1 meter receive height at the desired measurement distance. For exposure in this band, the broadband probes employed are 10cm diameter single-axis shielded transducers and measurements are repeated and summed over three axes.

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.

Where regulations call for substitution method measurements, the EUT is replaced by a substitution antenna if field strength measurements indicate the emission is close to the regulatory limit. This antenna is co-polarized with the test antenna and tuned (when necessary) to the emission frequency, after which the test antenna height is again optimized. The substitution antenna's signal level is adjusted such that its emission is equal to the level measured from the EUT. The signal level applied to the substitution antenna is then recorded. Effective isotropic radiated power (EIRP) and effective radiated power (ERP) in dBm are formulated from

$$EIRP = P_T - G_A = ERP + 2.16, \tag{1}$$

where P_T is the power applied to substitution antenna in dBm, including correction for cable loss, and G_A is the substitution antenna gain, in dBi.

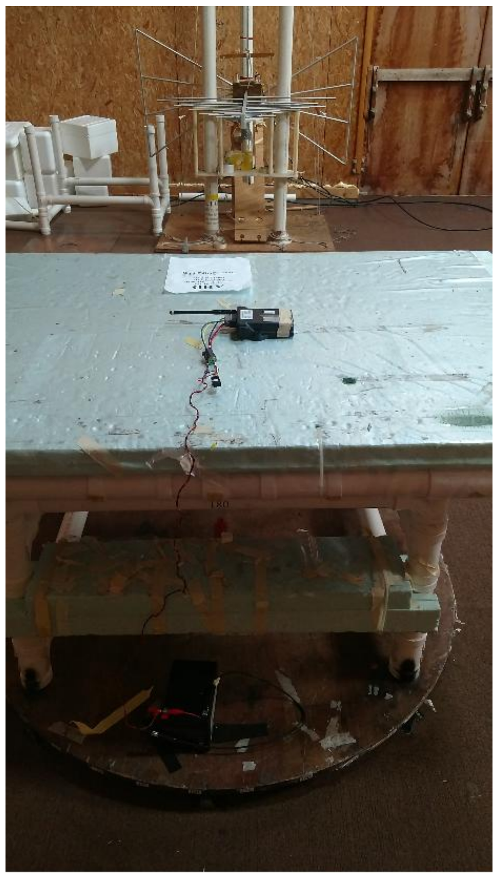


Figure 4: Radiated Emissions Test Setup Photograph(s).

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).

The EUT is not subject to measurement of power line conducted emissions as it is powered solely by its internal battery.

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.

Table 4: Pulsed Emission Characteristics (Duty Cycle).

Frequency Range	**Det**	**IFBW**	**VBW**		
f > 1 000 MHz	Pk	3 MHz	5 MHz	**Test Date:**	21-Jan-20
				Test Engineer:	Gordon Helm
				EUT	Elkhart Brass GW
				Meas. Distance:	Conducted

Pulsed Operation / Duty Cycle								
Transmit Mode	Symbol Rate (Msym/s)	Mod. / Data Rate (Mbps)	Voltage (V)	Observation Freq (MHz)	Tx Cycle Time* (ms)	On-Time** (ms)	Duty Cycle (%)	Single Channel Duty (>1GHz only) (dB)
Hopping	-	2FSK	3.6	914.0	>100	5.2	5.2	20.0
Transmit Mode	Symbol Rate (Msym/s)	Mod. / Data Rate (Mbps)	Voltage (V)	Observation Freq (MHz)	Exposure Window (ms)	On-Time*** (ms)	Duty Cycle (%)	Exposure Duty Correction (dB)
Hopping	-	2FSK	3.6	Full Band	400.000	10.4	2.6	-15.9

* For a single button press the EUT hopping transmission does not traverse all 50 channels. Only a single transmitted frame at any given channel occurs in a single manual activation.

** Worst case observed on-time at a single channel (same on average for all channels in pseudo-random FHSS protocol). 2.6 x 2 ms / 100 ms ; 20 max

*** Worst case observed on-time over all channels upon single button press. 4 x 2.6 ms / 400 ms

Equipment Used: RSFSV30001

4.2.2 Hopping Channel Dwell Time

The average time of occupancy on any hopping channel must not be greater than 0.4 seconds within a 20 second period for FHSS device with 50 operating channels. 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 6.

Table 5: Hopping Channel Dwell Time.

Frequency Range	**Det**	**IF Bandwidth**	**Video Bandwidth**	**Test Date:**	21-Jan-20
25 MHz ≤ f ≤ 1 000 MHz	Pk/QPk	120 kHz	300 kHz	**Test Engineer:**	Gordon Helm
f > 1 000 MHz	Pk	1 MHz	3 MHz	**EUT:**	Elkhart Brass GW
				Meas. Distance:	Conducted

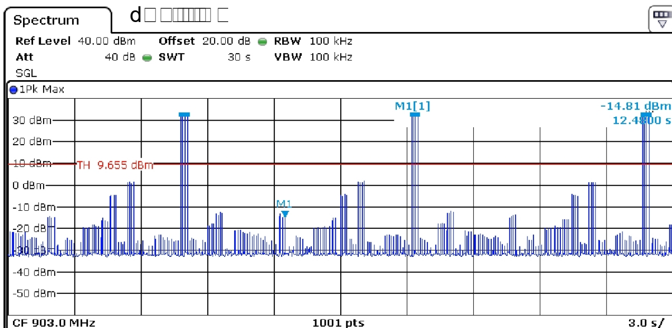
Dwell Time								
Mode	Frequency (MHz)	# Burst #	Observation Time (sec)	Limit Window (sec)	Burst On Time*** (sec)	Total On Time** (s)	Limit (s)	Pass/Fail
Hopping	903.0	3	30.0	10.0	0.0104	0.0104	<0.4	Pass
	914.0	3	30.0	10.0	0.0104	0.0104	<0.4	Pass
	923.6	3	30.0	10.0	0.0104	0.0104	<0.4	Pass

* Dwell Time Observed with EUT manually activated hopping.

** Only a single frame occurs per channel in the hopping sequence for a single button press.

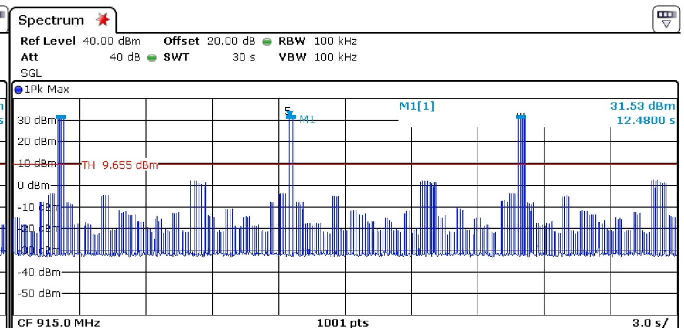
*** Worst case observed to be a single burst of 4 x 2.6 ms frames in any given 10 second window in each channel.

Equipment Used: RSFSV30001



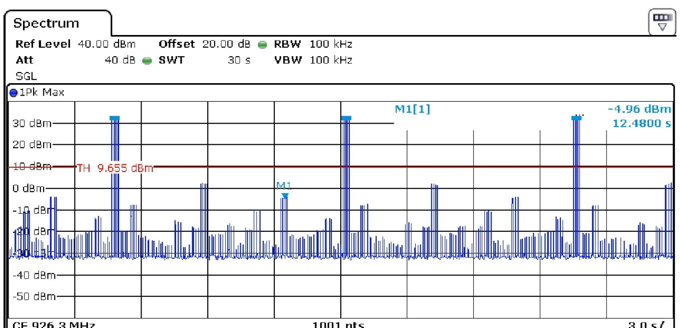
Marker Peak List

No	X-value	Y-value	No	X-value	Y-value
1	7.800000 s	32.563 dBm	7	18.390000 s	32.556 dBm
2	7.860000 s	32.554 dBm	8	18.480000 s	32.556 dBm
3	7.980000 s	32.558 dBm	9	28.620000 s	32.552 dBm
4	8.070000 s	32.551 dBm	10	28.710000 s	32.549 dBm
5	18.210000 s	32.544 dBm	11	28.800000 s	32.550 dBm
6	18.300000 s	32.549 dBm	12	28.920000 s	32.547 dBm



Marker Peak List

No	X-value	Y-value	No	X-value	Y-value
1	2.010000 s	31.474 dBm	7	12.600000 s	31.498 dBm
2	2.070000 s	31.493 dBm	8	12.690000 s	31.495 dBm
3	2.160000 s	31.494 dBm	9	22.830000 s	31.508 dBm
4	2.280000 s	31.519 dBm	10	22.920000 s	31.483 dBm
5	12.420000 s	31.489 dBm	11	23.010000 s	31.498 dBm
6	12.480000 s	31.527 dBm	12	23.100000 s	31.505 dBm



Marker Peak List

No	X-value	Y-value	No	X-value	Y-value
1	4.680000 s	32.239 dBm	7	15.270000 s	32.240 dBm
2	4.770000 s	32.222 dBm	8	15.390000 s	32.232 dBm
3	4.860000 s	32.236 dBm	9	25.530000 s	32.235 dBm
4	4.950000 s	32.225 dBm	10	25.590000 s	32.232 dBm
5	15.120000 s	32.230 dBm	11	25.710000 s	32.218 dBm
6	15.180000 s	32.223 dBm	12	25.800000 s	32.218 dBm

Figure 6(a): Example Plots of Duty Cycle and Channel Dwell Time.

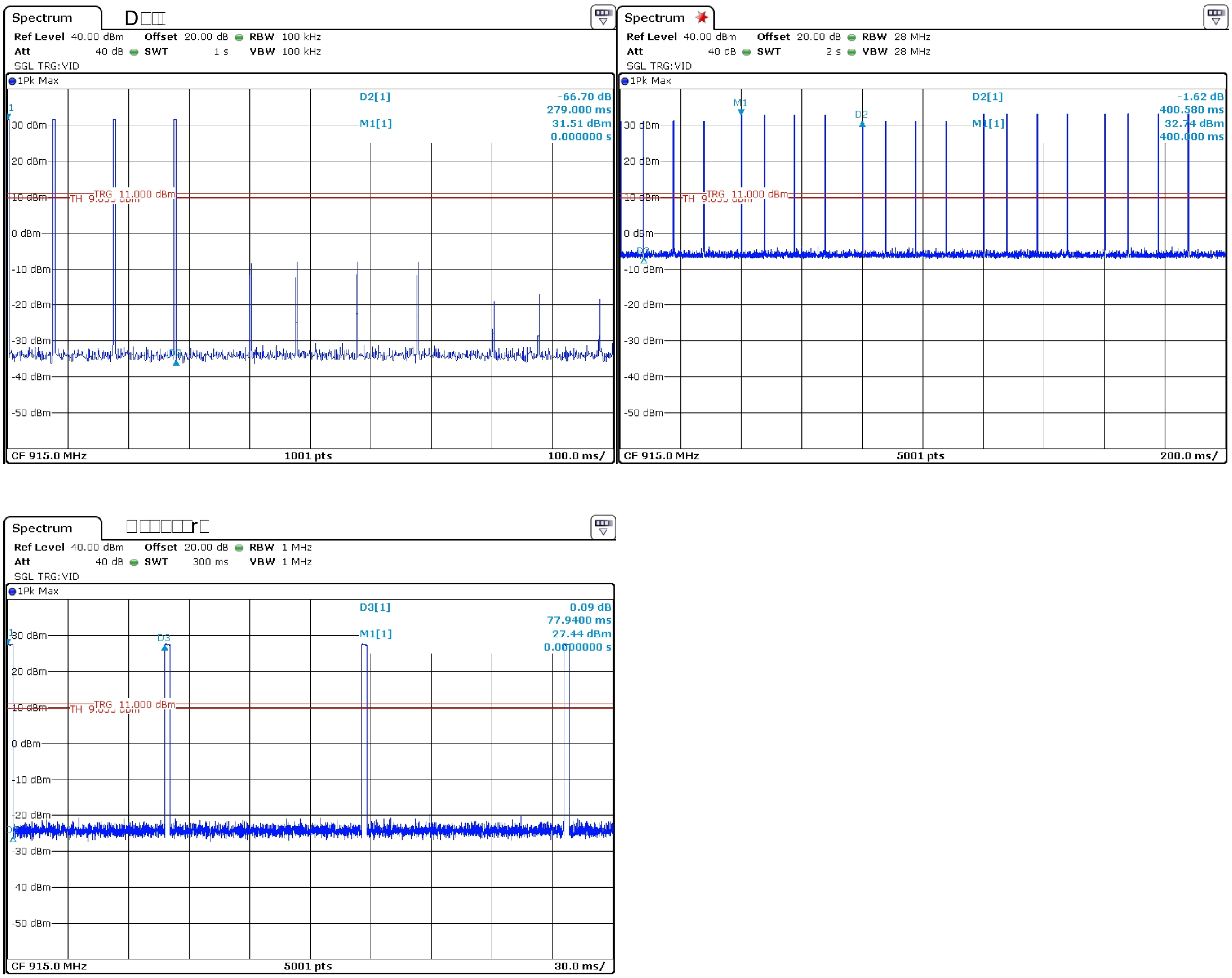


Figure 6(b): Example Plots of Duty Cycle and Channel Dwell Time.

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

The manufacturer has provided a separate exhibit addressing these items.

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 9.

Table 6: Intentional Emission Bandwidth.

Frequency Range	Det	IFBW	VBW
f > 1 000 MHz	Pk	20 kHz	100 kHz

Test Date:	01/21/20
Test Engineer:	Gordon Helm
EUT	Elkhart Brass GW
Meas. Distance:	Conducted

Occupied Bandwidth										
Transmit Mode	Symbol Rate (Msym/s)	Data Rate* (Mbps)	Voltage (V)	Oper. Freq (MHz)	6 dB BW (kHz)	6 dB BW Limit (MHz)	99% OBW (kHz)	20 dB BW (kHz)	20 dB BW Limit (kHz)	Comments
2FSK	-	-	3.7	903.0		-	320.7	336.8	500.0	
				915.0		-	325.4	335.8	500.0	
				926.3		-	316.7	333.5	500.0	

Equipment Used: RSFSV30001

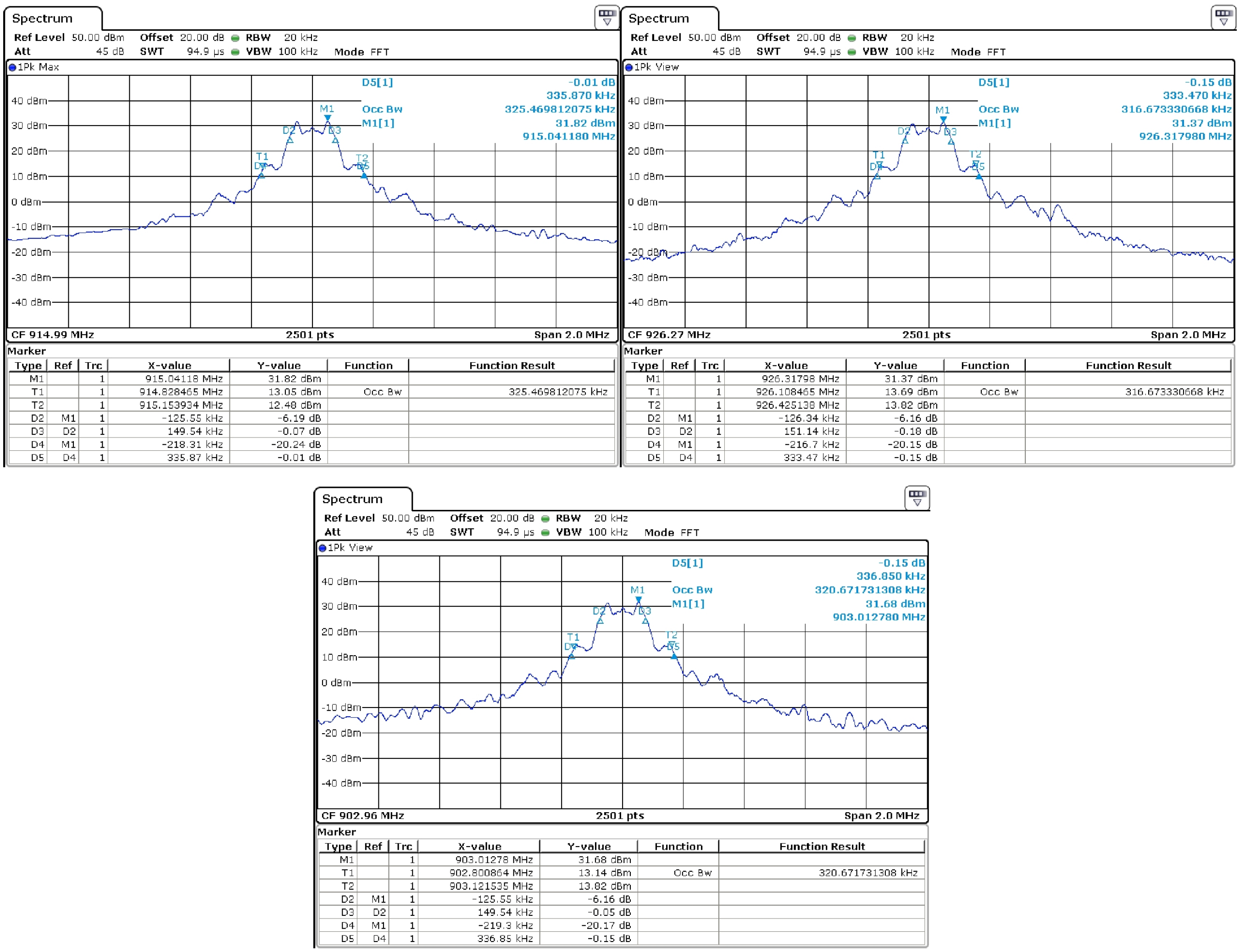


Figure 7: Intentional Emission Bandwidth.

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 8.

Table 7: Measured Number of Hopping Channels.

Frequency Range	Det	IF Bandwidth	Video Bandwidth		
25 MHz ≤ f ≤ 1 000 MHz	Pk/QPk	100/120 kHz	300 kHz	**Test Date:**	21-Jan-20
f > 1 000 MHz	Pk	100 kHz	3 MHz	**Test Engineer:**	Gordon Helm
				EUT:	Elkhart Brass GW
				Meas. Distance:	Conducted

Number of Hopping Channels						
Mode	Start Frequency (MHz)	Stop Frequency (MHz)	Number of Channels Observed (#)	Total Number (#)	Limit (#)	Pass/Fail
Hopping	903.0	926.3	26	26	25.0	Pass

Equipment Used: RSFSV30001

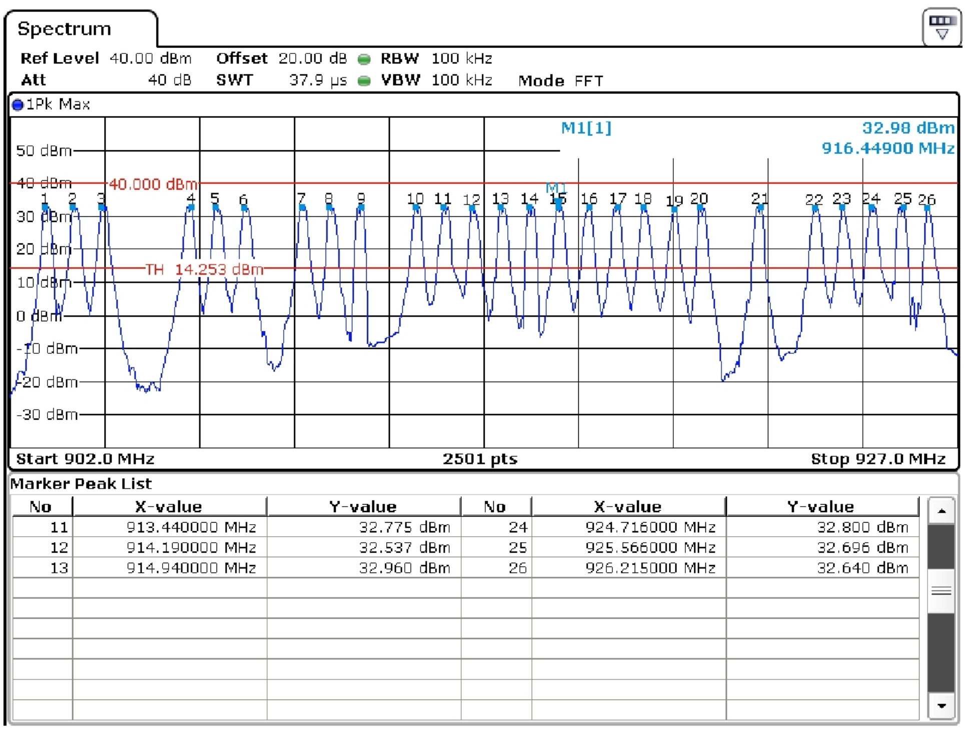


Figure 8: Measured Number of Hopping Channels.

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.

Frequency Range	Det	IF Bandwidth	Video Bandwidth
25 MHz ≤ f ≤ 1 000 MHz	Pk/QPk	100/120 kHz	300 kHz
f > 1 000 MHz	Pk	100 kHz	3 MHz

Test Date:	21-Jan-20
Test Engineer:	Gordon Helm
EUT	Elkhart Brass GW
Meas. Distance:	Conducted

Hopping Frequency Separation					
Mod	Low Channel (MHz)	High Channel (MHz)	Separation (kHz)	Min. Separation Limit (kHz)	Pass/Fail
2FSK	903.0	903.3	750.900	336.80	Pass
	915.1	915.4	750.900	336.80	Pass
	926.3	926.3	750.900	336.80	Pass

* Channel Separation Observed with the Device hopping over all available channels.

Equipment Used: RSFSV30001

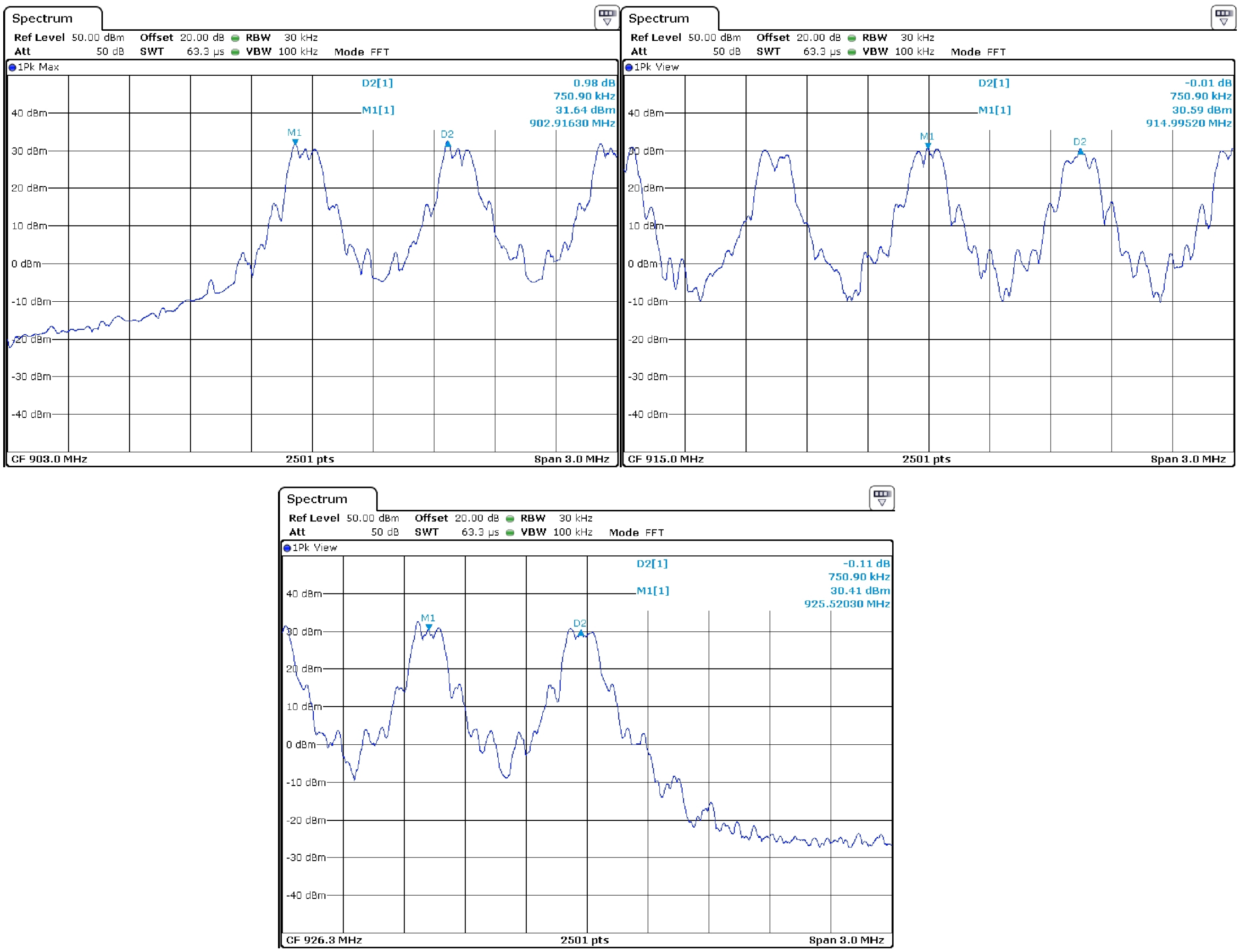


Figure 9: Measured Channel Separation.

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. Peak conducted output power was measured 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 antenna manufacturer or measured by comparison between calculated EIRP and conducted output power. Table 9 details the results of these measurements. Plots showing conducted measurements made are depicted in Figure 10.

Table 9: Radiated Power Results.

Frequency Range	**Det**	**IF Bandwidth**	**Video Bandwidth**
25 MHz ≤ f ≤ 1 000 MHz	Qpk	.12 MHz	0.3MHz

Test Date: 13-Apr-20
Test Engineer: Gordon Helm
EUT: Elkhart Brass GW
Meas. Distance: 3m

FCC/IC

#	Mod.	Channel	Freq. MHz	Ant. Used	Ant. Pol.	Pr (Pk)** dBuV/m	Ka dB	Kg dB	EIRP (Pk) dBm	Ant Gain dBi	Pout* (Pk) dBm	Po (Pk) Limit dBm	Pass dB	Comments
1	2GFSK	L	903.0	BILO3142	H	113.9	39.7	-0.2	18.7	0.7	18.0	24.0	6.0	
2		M	915.0	BILO3142	H	114.6	39.7	-0.2	19.4	0.3	19.1	24.0	5.0	
3		H	926.3	BILO3142	H	112.9	39.7	-0.2	17.7	0.8	16.9	24.0	7.1	
7														

#	Mod.	Channel	Freq. MHz	Supply Voltage	Ant. Pol.	Pout* (Pk) (dBm)
8	CW	M	903.0	3.6	H/V	19.1
9			903.0	3.3	H/V	19.1
10			903.0	3.0	H/V	19.1

* Measured conducted from the radio using conducted test sample.
** Measured radiated at 3 meter distance. Peak power measured with IFBW > OBW.

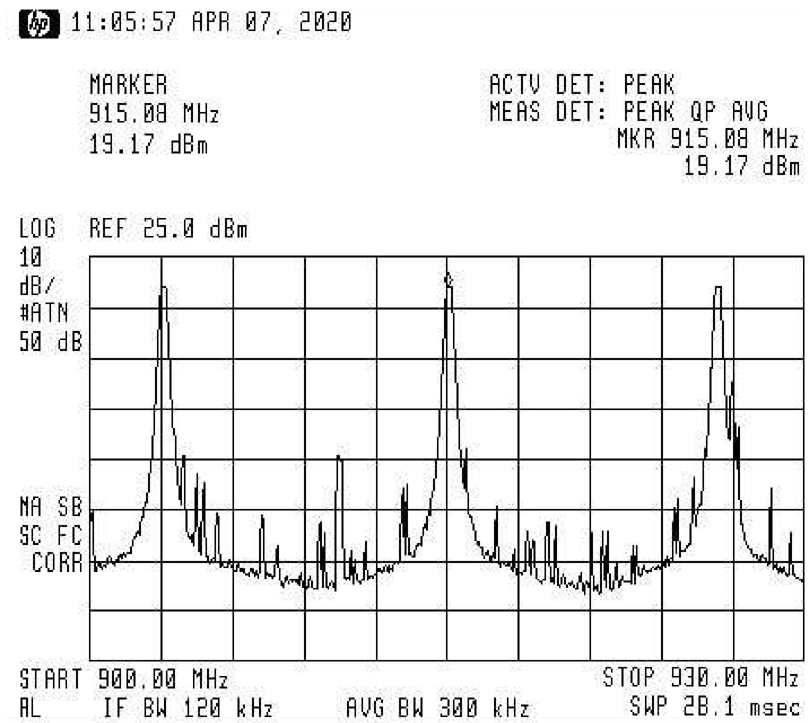


Figure 10: Conducted RF Power Plots

4.3 Unintentional Emissions

4.3.1 Transmit Chain Radiated 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: Transmit Chain Spurious Emissions.

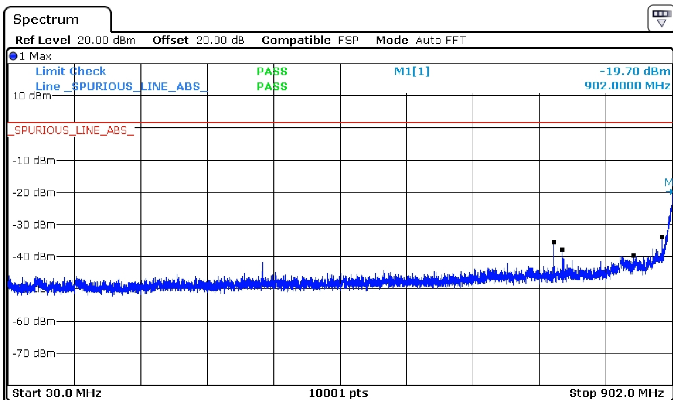
Frequency Range	**Det**	**IF Bandwidth**	**Video Bandwidth**		
25 MHz ≤ f ≤ 1 000 MHz	Pk/QPk	120 kHz	300 kHz	**Test Date:**	13-Apr-20
f > 1 000 MHz	Pk/Avg	1 MHz	3 MHz	**Test Engineer:**	Gordon Helm
				EUT:	Elkhart Brass GW
				Mode:	Hopping + Non-Hopping
Equipment Used: RH3115 RSFSV30001				**Meas. Distance:**	3m

													FCC/IC
#	Freq. Start MHz	Freq. Stop MHz	Ant. Used	Ant. Pol.	Ka dB	Kg dB			E3(Pk) dBµV/m	E3(Qpk/Avg) dBµV/m	E3 Avg Lim dBµV/m	Pass dB	Comments
1	Fundamental Band Edge (Low Side)												
2	900.0	900.0	BILO3142	H/V	39.7	-0.2				61.5		-	>20 dB down at band edges (non-hop)
3	900.0	900.0	BILO3142	H/V	39.7	-0.2				61.5		-	>20 dB down at band edges (hop)
4	Fundamental Band Edge (High Side)												
5	928.0	928.0	BILO3142	H/V	39.7	-0.2				60.8		-	>20 dB down at band edges (non-hop)
6	928.0	928.0	BILO3142	H/V	39.7	-0.2				60.8		-	>20 dB down at band edges (hop)
7	Harmonic / Spurious Emissions												
8	1806.0	1806.0	RH3115	H/V	30.9	0.4			74.6	54.6		-	>20 dB down
9	2779.0	2779.0	RH3115	H/V	32.6	0.6			68.5	48.5	54.0	5.5	Test Code (Non-Hopping)
10	2709.0	2709.0	RH3115	H/V	32.6	0.6			67.4	47.4	54.0	6.6	Test Code (Non-Hopping)
11	2779.0	2779.0	RH3115	H/V	32.6	0.6			57.1	37.1	54.0	16.9	Production code (Hopping)
12	2745.0	2745.0	RH3115	H/V	32.6	0.6			64.3	44.3	54.0	9.7	Production code (Hopping)
13	2745.0	2745.0	RH3115	H/V	32.6	0.6			69.7	49.7	54.0	4.3	Test Code
14	4575.0	4575.0	RH3115	H/V	36.6	0.6			58.9	38.9	54.0	15.1	Test Code
15													
16	NO OTHER EMISSIONS OBZERVED WITHIN 20 DB OF CLASS B LIMIT – EVALUATED TO 10 GHZ.												
17	898.5	900.0	BILO3142	H/V	39.7	-0.2				58.1		-	>20 dB down
18													
19													
20													
21													

*Qpk < 1 GHz, Avg > 1 GHz. Avg computed from Peak via duty cycle.

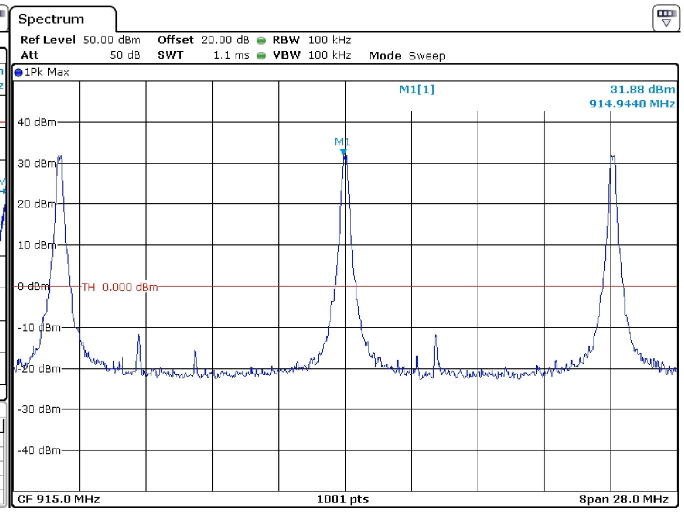
4.3.2 Relative Transmit Chain Spurious Emissions

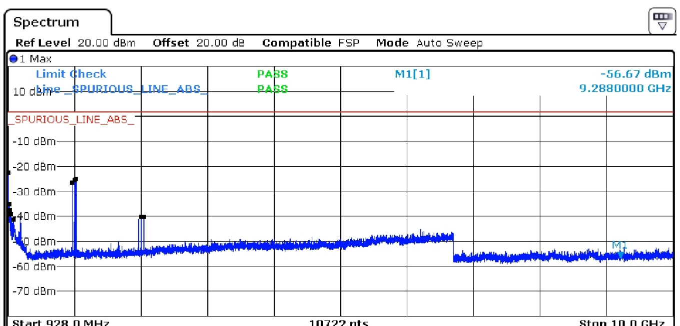
The results for the measurement of transmit chain spurious emissions relative to the fundamental in a 100 kHz receiver bandwidth (at the nominal voltage and temperature) are provided in Figure 11 below.



Spurious Emissions

Range Low	Range Up	RBW	Frequency	Power Abs	ΔLimit
30.000 MHz	902.000 MHz	100.000 kHz	901.95640 MHz	-19.70 dBm	-21.50 dB
30.000 MHz	902.000 MHz	100.000 kHz	888.96490 MHz	-33.97 dBm	-35.77 dB
30.000 MHz	902.000 MHz	100.000 kHz	746.05839 MHz	-35.46 dBm	-37.26 dB
30.000 MHz	902.000 MHz	100.000 kHz	757.30607 MHz	-37.97 dBm	-39.77 dB
30.000 MHz	902.000 MHz	100.000 kHz	851.03670 MHz	-39.78 dBm	-41.58 dB





Spurious Emissions

Range Low	Range Up	RBW	Frequency	Power Abs	ΔLimit
928.000 MHz	1.000 GHz	100.000 kHz	928.04993 MHz	-22.29 dBm	-24.09 dB
928.000 MHz	1.000 GHz	100.000 kHz	941.03190 MHz	-35.31 dBm	-37.11 dB
928.000 MHz	1.000 GHz	100.000 kHz	952.31623 MHz	-37.41 dBm	-39.21 dB
928.000 MHz	1.000 GHz	100.000 kHz	959.80583 MHz	-39.25 dBm	-41.05 dB
928.000 MHz	1.000 GHz	100.000 kHz	993.05964 MHz	-41.33 dBm	-43.13 dB
1.000 GHz	10.000 GHz	100.000 kHz	1.85266 GHz	-25.12 dBm	-26.92 dB
1.000 GHz	10.000 GHz	100.000 kHz	1.83017 GHz	-25.49 dBm	-27.29 dB
1.000 GHz	10.000 GHz	100.000 kHz	1.80587 GHz	-26.58 dBm	-28.38 dB
1.000 GHz	10.000 GHz	100.000 kHz	2.74448 GHz	-40.21 dBm	-42.01 dB
1.000 GHz	10.000 GHz	100.000 kHz	2.77867 GHz	-40.35 dBm	-42.15 dB

Figure 11: Conducted Transmitter 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	$\pm(f_{Mkr}/10^7 + RBW/10 + (SPN/(PTS-1))/2 + 1\,\mathrm{Hz})$
Conducted Emm. Amplitude	$\pm 1.9\,\mathrm{dB}$
Radiated Emm. Amplitude $(30 - 200\,\mathrm{MHz})$	$\pm 4.0\,\mathrm{dB}$
Radiated Emm. Amplitude $(200 - 1000\,\mathrm{MHz})$	$\pm 5.2\,\mathrm{dB}$
Radiated Emm. Amplitude $(f > 1000\,\mathrm{MHz})$	$\pm 3.7\,\mathrm{dB}$

†Ref: CISPR 16-4-2:2011+A1:2014

United States Department of Commerce
National Institute of Standards and Technology

NVLAP®

Certificate of Accreditation to ISO/IEC 17025:2005

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 17025:2005. 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).

2019-06-28 through 2020-06-30
Effective Dates

For the National Voluntary Laboratory Accreditation Program

Figure 12: Accreditation Documents