

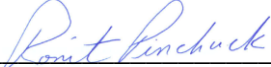


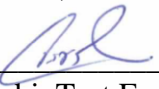
**DATE: 14 October 2013**

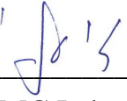
**I.T.L. (PRODUCT TESTING) LTD.  
FCC Radio Test Report  
for  
Roseman Engineering Ltd.**

**Equipment under test:  
Car Data Logger**

**Modular Fleet Gate (FG3)**

Written by:   
R. Pinchuck, Documentation

Approved by:   
A. Sharabi, Test Engineer

Approved by:   
I. Raz, EMC Laboratory Manager

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This report relates only to items tested.





# TABLE OF CONTENTS

<b>1.</b>	<b>GENERAL INFORMATION</b>	<b>5</b>
1.1	Administrative Information	5
1.2	List of Accreditations	6
1.3	Product Description	7
1.4	Test Methodology	7
1.5	Test Facility	7
1.6	Measurement Uncertainty	7
<b>2.</b>	<b>SYSTEM TEST CONFIGURATION</b>	<b>8</b>
2.1	Justification	8
2.2	EUT Exercise Software	8
2.3	Special Accessories	8
2.4	Equipment Modifications	8
2.5	Configuration of Tested System	8
<b>3.</b>	<b>RADIATED MEASUREMENT TEST SET-UP PHOTO</b>	<b>9</b>
<b>4.</b>	<b>26DB BANDWIDTH</b>	<b>11</b>
4.1	Test Specification	11
4.2	Test procedure	11
4.3	Test Results	13
4.4	Test Equipment Used	14
<b>5.</b>	<b>20DB BANDWIDTH</b>	<b>15</b>
5.1	Test Specification	15
5.2	Test procedure	15
5.3	Test Results	17
5.4	Test Equipment Used	18
<b>6.</b>	<b>NUMBER OF HOPPING FREQUENCIES SECTION 15.247(A)(1)(III)</b>	<b>19</b>
<b>7.</b>	<b>CHANNEL FREQUENCY SEPARATION</b>	<b>26</b>
7.1	Test Specification	26
<b>8.</b>	<b>RADIATED POWER OUTPUT</b>	<b>29</b>
8.1	Test Specification	29
8.2	Test procedure	29
8.3	Results Calculation	32
8.4	Test Equipment Used, Radiated Maximum Power Output	33
<b>9.</b>	<b>DWELL TIME ON EACH CHANNEL</b>	<b>34</b>
9.1	Test Specification	34
9.2	Test Procedure	34
9.3	Test Results	34
9.4	Test Equipment Used, Dwell Time	36
<b>10.</b>	<b>BAND EDGE</b>	<b>37</b>
10.1	Test procedure	37
10.2	Results table	38
10.3	Test Equipment Used, Band edge Spectrum	39
<b>11.</b>	<b>RADIATED EMISSION, 9 KHZ – 30 MHZ</b>	<b>40</b>
11.1	Test Specification	40
11.2	Test Procedure	40
11.3	Measured Data	40
11.4	Test Instrumentation Used, Radiated Measurements	41
11.5	Field Strength Calculation	42
<b>12.</b>	<b>SPURIOUS RADIATED EMISSION 30 – 25000 MHZ</b>	<b>43</b>
12.1	Test Specification	43
12.2	Test Procedure	43
12.3	Test Data	44
	Test Instrumentation Used, Radiated Measurements	48



12.4	Field Strength Calculation 30 – 1000 MHz .....	49
<b>13.</b>	<b>ANTENNA GAIN/INFORMATION-----</b>	<b>50</b>
<b>14.</b>	<b>R.F EXPOSURE/SAFETY-----</b>	<b>51</b>
<b>15.</b>	<b>APPENDIX B - CORRECTION FACTORS -----</b>	<b>52</b>
15.1	Correction factors for CABLE.....	52
15.2	Correction factors for CABLE.....	53
15.3	Correction factors for CABLE.....	54
15.4	12.6 Correction factors for LOG PERIODIC ANTENNA .....	55
15.5	Correction factors for LOG PERIODIC ANTENNA .....	56
15.6	Correction factors for BICONICAL ANTENNA.....	57
15.7	Correction factors for Double-Ridged Waveguide Horn .....	58
15.8	Correction factors for Horn Antenna .....	59
15.9	Correction factors for Horn Antenna .....	60
15.10	Correction factors for ACTIVE LOOP ANTENNA .....	61



# 1. General Information

## 1.1 Administrative Information

Manufacturer:	Roseman Engineering Ltd.
Manufacturer's Address:	Kiryat Atidim, P.O. Box 58181 Tel Aviv, 61580 Israel Tel: +972-3-573-1801 Fax: +972-3-573-1807
Manufacturer's Representative:	Haim Kashi
Equipment Under Test (E.U.T):	Car Data Logger
Equipment Model No.:	Modular Fleet Gate (FG3)
Equipment Serial No.:	701
Date of Receipt of E.U.T:	29.9.13
Start of Test:	29.9.13
End of Test:	30.9.13
Test Laboratory Location:	I.T.L (Product Testing) Ltd. Kfar Bin Nun, ISRAEL 99780
Test Specifications:	FCC Part 15 Sub-part C



## **1.2 List of Accreditations**

The EMC laboratory of I.T.L. is accredited by the following bodies:

1. The American Association for Laboratory Accreditation (A2LA) (U.S.A.), Certificate No. 1152.01.
2. The Federal Communications Commission (FCC) (U.S.A.), Registration No. 90715.
3. The Israel Ministry of the Environment (Israel), Registration No. 1104/01.
4. The Voluntary Control Council for Interference by Information Technology Equipment (VCCI) (Japan), Registration Numbers: C-1350, R-1285.
5. Industry Canada (Canada), IC File No.: 46405-4025; Site No. IC 4025B-1.
6. TUV Product Services, England, ASLLAS No. 97201.

I.T.L. Product Testing Ltd. is accredited by the American Association for Laboratory Accreditation (A2LA) and the results shown in this test report have been determined in accordance with I.T.L.'s terms of accreditation unless stated otherwise in the report.



### **1.3 Product Description**

The FG3 is a main component of the Fleet Journal system (FJ2) installed in the vehicle. It stores the vehicle usage data, including each ride start and end times, initial and final odometer reading, maximum speed, and ride participants etc, provides the fleet manager full supervision and control over the use of all fleet vehicles. The FG3 stores the vehicle usage data, this data is automatically transferred via the WAF unit to Fleet Journal application. The FJ2 process the data and generates required reports for the use of the fleet manager.

The FG3 can be configured to record either odometer or engine hour readings; and gets its power from the vehicle's battery.

The Vehicle data is uploaded in one of the following methods:

- 2.4GHz Wireless connection with fuel station controller.
- 2.4GHz Wireless connection at parking lot garage etc.

All the data is collected into a central data base server.

The FG3's power is supplied from the vehicle's battery. It requires either a 12 VDC or a 24 VDC system, and draws a maximum 150mA of current.

### **1.4 Test Methodology**

Both conducted and radiated testing was performed according to the procedures in ANSI C63.4: 2003. Radiated testing was performed at an antenna to EUT distance of 3 meters.

### **1.5 Test Facility**

The radiated emissions tests were performed at I.T.L.'s testing facility at Kfar Bin-Nun, Israel. This site is a FCC listed test laboratory (FCC Registration No. 90715, date of listing November 21, 2012).

I.T.L.'s EMC Laboratory is also accredited by A2LA, certificate No. 1152.01.

### **1.6 Measurement Uncertainty**

#### **Radiated Emission**

Radiated Emission (CISPR 11, EN 55011, CISPR 22, EN 55022, ANSI C63.4) for open site 30-1000MHz:

Expanded Uncertainty (95% Confidence, K=2):

± 5.2 dB

Note: See ITL Procedure No. PM 198.

## 2. System Test Configuration

### 2.1 *Justification*

Radiated emission screening was performed in 3 orthogonal orientations. The worst case orientation was the vertical position for both the enclosure and the antenna.

### 2.2 *EUT Exercise Software*

No special exercise software was used.

### 2.3 *Special Accessories*

No special accessories were needed to achieve compliance.

### 2.4 *Equipment Modifications*

No equipment modifications were needed to achieve compliance.

### 2.5 *Configuration of Tested System*

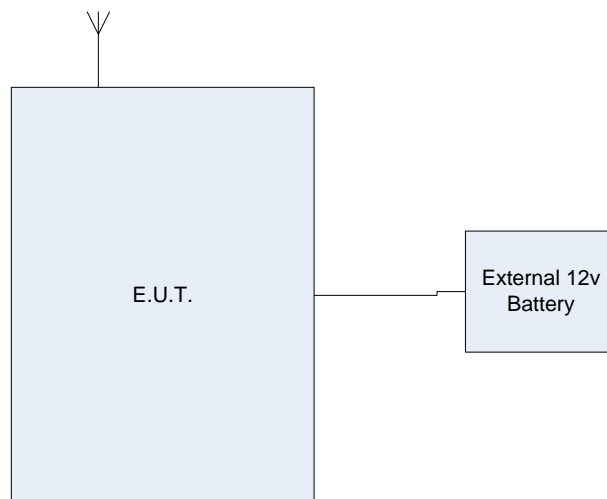


Figure 1. Configuration of Tested System



### 3. Radiated Measurement Test Set-up Photo



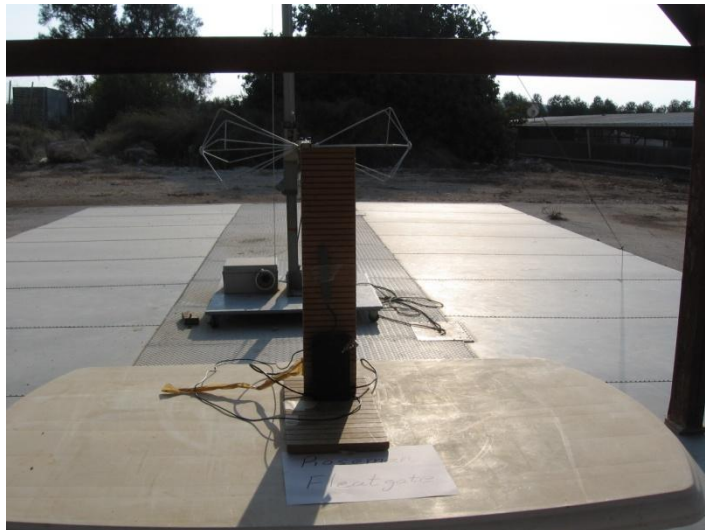
Figure 2. Radiated Emission Test



Figure 3. Radiated Emission Test



**Figure 4. Radiated Emission Test**



**Figure 5. Radiated Emission Test**

## 4. 26dB Bandwidth

### 4.1 Test Specification

F.C.C. Part 15, Subpart C: 15.247(a)(2)

### 4.2 Test procedure

The E.U.T was placed on a non-metallic table, 0.8 meters above the ground plane, on a remote-controlled turntable in the OATS. The test distance was 3 meters. The transmitter unit operated with normal modulation. The EMI receiver was set to 100 kHz resolution BW. The spectrum bandwidth of the transmitter unit was measured and recorded. The test was performed to measure the transmitter occupied bandwidth. The EUT was set up as shown in Figure 3, and its proper operation was checked. The transmitter occupied bandwidth was measured with the EMI receiver as frequency delta between reference points on modulation envelope. The E.U.T. was tested in three frequencies: Low, Mid and High

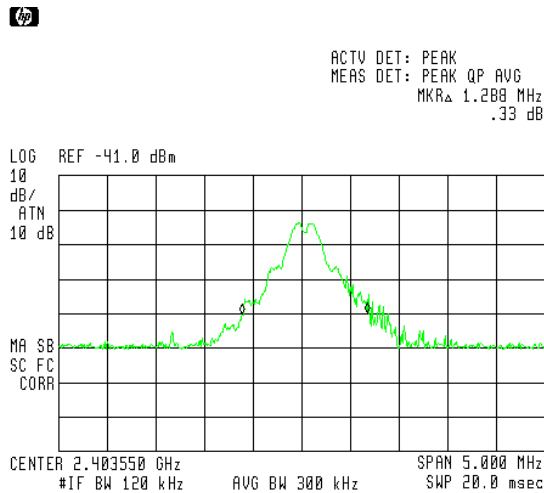


Figure 6. Low Channel



ACTV DET: PEAK  
MEAS DET: PEAK QP AVG  
MKR $\Delta$  1.675 MHz  
-.72 dB

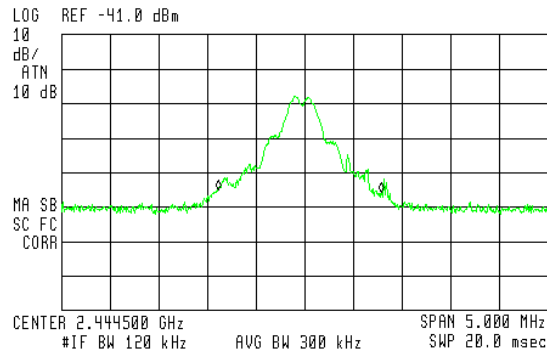


Figure 7. Mid Channel



ACTV DET: PEAK  
MEAS DET: PEAK QP AVG  
MKR $\Delta$  1.275 MHz  
.39 dB

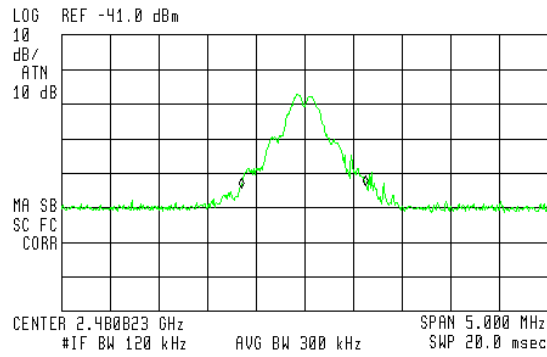


Figure 8. High Channel



### 4.3 Test Results

E.U.T Description: Car Data Logger

Model: Modular Fleet Gate (FG3)

Serial Number: 701

Operation Frequency (MHz)	Bandwidth Reading (MHz)
Low	1.288
Mid	1.675
High	1.275

JUDGEMENT: Passed

TEST PERSONNEL:

Tester Signature: 

Date: 22.10.13

Typed/Printed Name: A. Sharabi



#### 4.4 Test Equipment Used.

Instrument	Manufacturer	Model	Serial Number	Calibration	Period
EMI Receiver	HP	85422E	3906A00276	February 26, 2013	1 year
RF Section	HP	85420E	3705A00248	February 26, 2013	1 year
Horn Antenna	ETS	3115	29845	March 14, 2012	2 Years
Antenna Mast	ARA	AAM-4A	1001	N/A	N/A
Turntable	ARA	ART-1001/4	1001	N/A	N/A
Mast & Table Controller	ARA	ACU-2/5	1001	N/A	N/A
Printer	HP	LaserJet 2200	JPKG19982	N/A	N/A

Figure 9 Test Equipment Used

## 5. 20dB Bandwidth

### 5.1 Test Specification

Specification: FCC Part 15, Subpart C (15.247-a2)

### 5.2 Test procedure

The E.U.T was placed on a non-metallic table, 0.8 meters above the ground plane, on a remote-controlled turntable in the OATS. The test distance was 3 meters. The transmitter unit operated with normal modulation. The EMI receiver was set to 100 kHz resolution BW. The spectrum bandwidth of the transmitter unit was measured and recorded. The test was performed to measure the transmitter occupied bandwidth. The EUT was set up as shown in Figure 3, and its proper operation was checked. The transmitter occupied bandwidth was measured with the EMI receiver as frequency delta between reference points on modulation envelope. The E.U.T. was tested in three frequencies : Low, Middle and High.

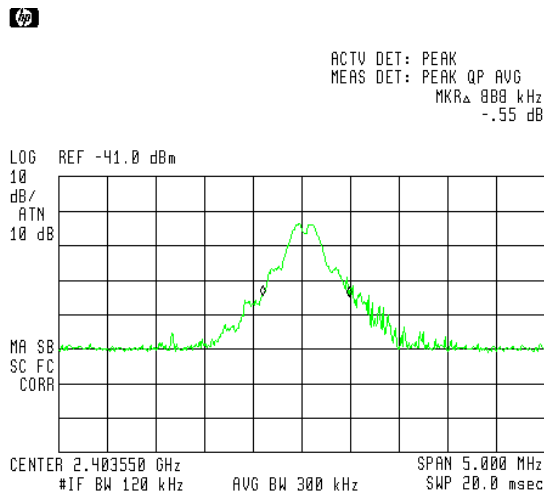


Figure 10. Low Channel

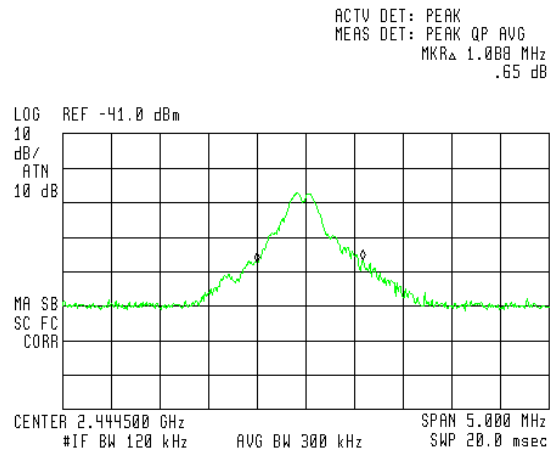


Figure 11. Mid Channel

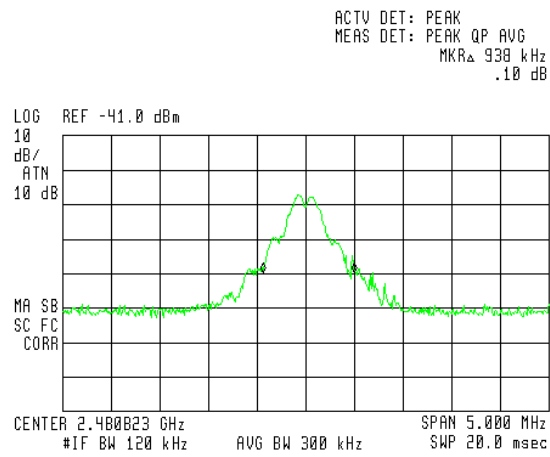


Figure 12. High Channel





### 5.3 Test Results

E.U.T Description: Car Data Logger


Model: Modular Fleet Gate (FG3)

Serial Number: 701

Operation Frequency (MHz)	Bandwidth Reading (MHz)
Low	0.888
Mid	1.088
High	0.938

JUDGEMENT: Passed

TEST PERSONNEL:

Tester Signature: 

Date: 22.10.13

Typed/Printed Name: A. Sharabi



#### 5.4 Test Equipment Used.

20dB Bandwidth

Instrument	Manufacturer	Model	Serial Number	Calibration	Period
EMI Receiver	HP	85422E	3906A00276	February 26, 2013	1 year
RF Section	HP	85420E	3705A00248	February 26, 2013	1 year
Horn Antenna	ETS	3115	29845	March 14, 2012	2 Years
Antenna Mast	ARA	AAM-4A	1001	N/A	N/A
Turntable	ARA	ART-1001/4	1001	N/A	N/A
Mast & Table Controller	ARA	ACU-2/5	1001	N/A	N/A
Printer	HP	LaserJet 2200	JPKG19982	N/A	N/A

Figure 13 Test Equipment Used



## 6. Number of Hopping Frequencies Section 15.247(a)(1)(iii)

### 6.1 *Test Specification*

F.C.C., Part 15, Subpart C

### 6.2 *Test Procedure*

The E.U.T. was set to hopping mode.

The spectrum analyzer was set to the following parameters:

Span: Every 40 MHz Frequency

Band of Operation: 2402-2481 MHz

RBW: 30kHz

VBW: 300kHz

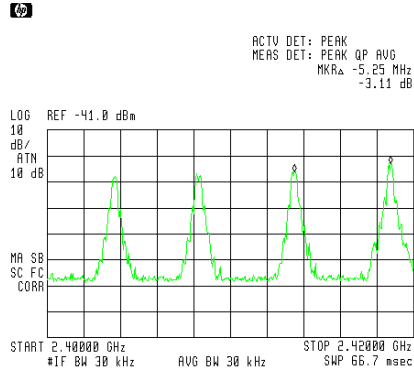
Detector Function: Peak

Trace: Maximum Hold

The number of hopping frequencies is 16 (See plots).

# Number of Hopping Frequencies

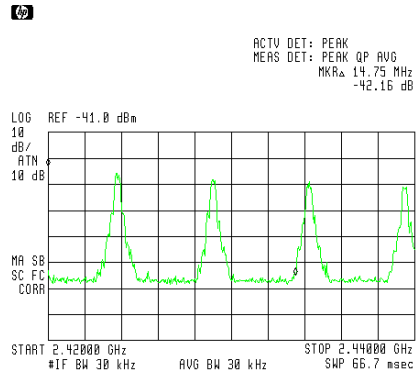
E.U.T Description    Car Data Logger  
 Type                    Modular Fleet Gate (FG3)  
 Serial Number:        701



**Figure 14. Frequency Hopping**

# Number of Hopping Frequencies

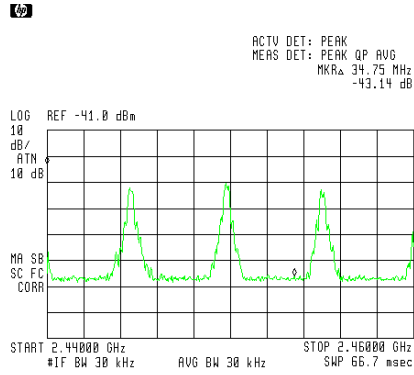
E.U.T Description    Car Data Logger  
 Type                    Modular Fleet Gate (FG3)  
 Serial Number:        701



**Figure 15. Frequency Hopping**

# Number of Hopping Frequencies

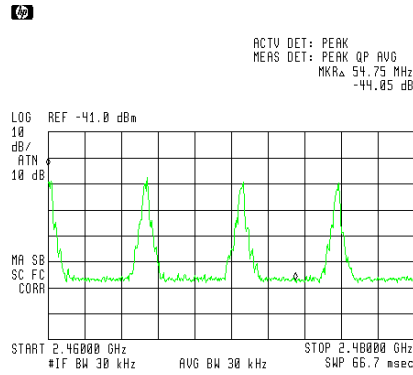
E.U.T Description    Car Data Logger  
 Type                    Modular Fleet Gate (FG3)  
 Serial Number:        701



**Figure 16. Frequency Hopping**

# Number of Hopping Frequencies

E.U.T Description    Car Data Logger  
 Type                    Modular Fleet Gate (FG3)  
 Serial Number:        701



**Figure 17. Frequency Hopping**



### 6.3 Results table

E.U.T. Description: Car Data Logger

Model No.: Modular Fleet Gate (FG3)


Serial Number: 701

Specification: FCC Part 15, Subpart C, 15.247(a)(1)(iii)

Modulation	Number of Hopping Frequencies	Specification
Standard	15	$\geq 15$

**Figure 18 Number of Hopping Frequencies**

TEST PERSONNEL:

Tester Signature: 

Date: 22.10.13

Typed/Printed Name: A. Sharabi





#### 6.4 Test Instrumentation Used

Instrument	Manufacturer	Model	Serial Number	Calibration	
				Last Calibration Date	Period
Spectrum Analyzer	HP	8564E	3442A00275	February 28, 2013	1 year
Cable	Rhophase	KPS-5000-KPS	A1674	September 29, 2013	1 year

## 7. Channel Frequency Separation

### 7.1 Test Specification

Specification: FCC Part 15, Subpart C, 15.247(a) (1)

### 7.2 Test procedure

The E.U.T. was set to hopping mode.

The spectrum analyzer was set to the following parameters:

Span: 20 MHz

RBW: 30kHz

VBW: 30kHz

Detector Function: Peak

Trace: Maximum Hold

The marker delta function to determine the separation between the peaks of the adjacent channels was used.

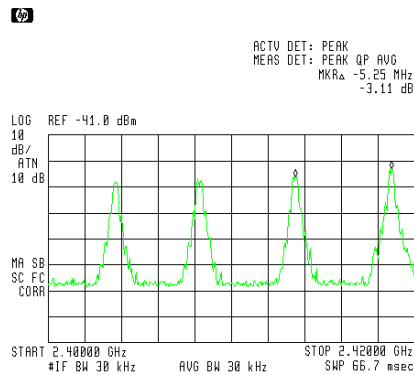


Figure 19. Separation



### 7.3 Results table

E.U.T. Description: Car Data Logger

Model No.: Modular Fleet Gate (FG3)

Serial Number: 701


Specification: FCC Part 15, Subpart C, 15.247(a) (1)

Specification (kHz)	Result (kHz)	Margin (kHz)
>725.00	5250 kHz	4525.00

**Figure 20 Channel Frequency Separation**

JUDGEMENT: Passed by 4525 kHz

TEST PERSONNEL:

Tester Signature: 

Date: 22.10.13

Typed/Printed Name: A. Sharabi



#### 7.4 Test Instrumentation Used

Instrument	Manufacturer	Model	Serial Number	Calibration	
				Last Calibration Date	Period
Spectrum Analyzer	HP	8564E	3442A00275	February 28, 2013	1 year
Cable	Rhophase	KPS-5000-KPS	A1674	September 29, 2013	1 year

## 8. Radiated Power Output

### 8.1 Test Specification

F.C.C. Part 15, Subpart C: 15.247(b)

### 8.2 Test procedure

The E.U.T was placed on a non-metallic table, 0.8 meters above the ground plane, on a remote-controlled turntable in the OATS. The test distance was 3 meters.

The transmitter unit operated with normal modulation. The EMI receiver was set to 1 MHz resolution BW. The EUT was set up as shown in Figure 3, and its proper operation was checked.

The readings were maximized by adjusting the antenna height between 1-4 meters, the turntable azimuth between 0-360°, and the antenna polarization.

The E.U.T. was tested in three operating channels and frequencies (1 (2.404 GHz); 8 (2.444 GHz); 14 (2.480 GHz)).

Radiated output power levels were measured at selected operation frequencies and the results were converted to power level according to the formula as shown below:

$$P = \frac{(E_{V/m} \times d)^2}{(30 \times G)} \text{ [W]}$$

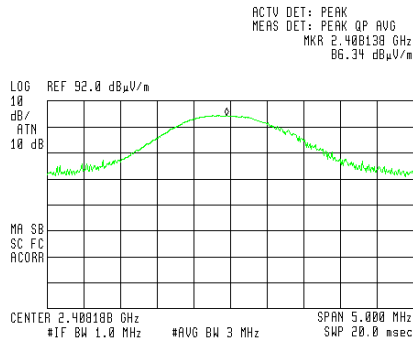


Figure 21 Low – Vertical

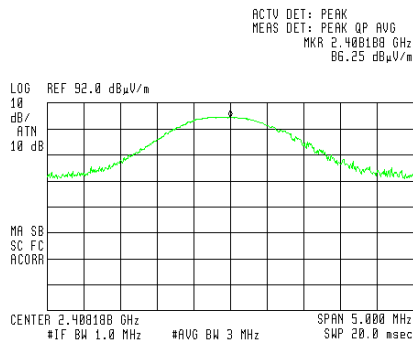


Figure 22 Low – Horizontal

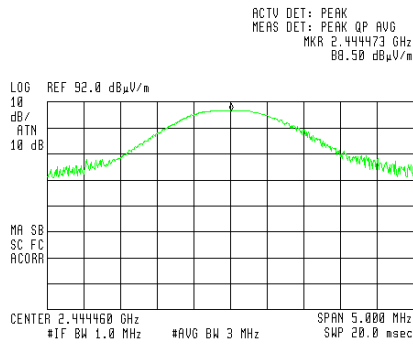


Figure 23 Mid – Vertical

49

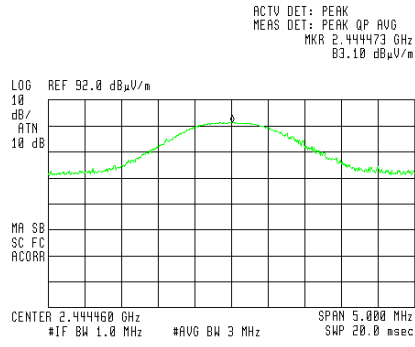


Figure 24 Mid – Horizontal

49

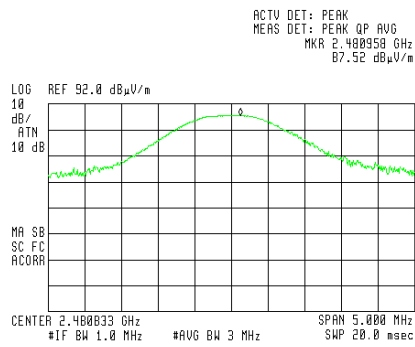


Figure 25 High – Vertical

49

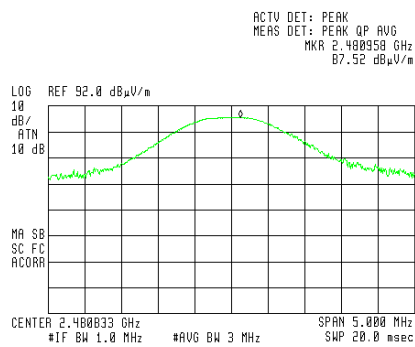


Figure 26 High – Horizontal



### 8.3 Results Calculation

E.U.T. Description: Car Data Logger  
Model No.: Modular Fleet Gate (FG3)  
Serial Number: 701  
Specification: F.C.C. Part 15, Subpart C

The following calculations were used to determine maximum radiated power output.

$$P = \frac{(E_{V/m} \times d)^2}{(30 \times G)} \text{ [W]}$$

Operation Frequency (MHz)	Modulation	Polarization	Power (dBuV/m)	Power (W)	Power (mW)	Specification (mW)	Margin (mW)
2404.00	Standard	Vertical	86.34	0.00006	0.06	1000	-999.94
2444.00	Standard	Vertical	88.50	0.000135	0.14	1000	-999.86
2480.00	Standard	Vertical	87.52	0.00006	0.06	1000	-999.94

Figure 27 Radiated Power Output

JUDGEMENT: Passed

TEST PERSONNEL:

Tester Signature: 

Date: 22.10.13

Typed/Printed Name: A. Sharabi





#### 8.4 Test Equipment Used, Radiated Maximum Power Output

Instrument	Manufacturer	Model	Serial Number	Calibration	Period
Receiver	HP	85422E	3906A00276	February 26, 2013	1 year
RF Section	HP	85420E	3705A00248	February 26, 2013	1 year
Horn Antenna	ETS	3115	29845	March 14, 2012	2 Years
Antenna Mast	ARA	AAM-4A	1001	N/A	N/A
Turntable	ARA	ART-1001/4	1001	N/A	N/A
Mast & Table Controller	ARA	ACU-2/5	1001	N/A	N/A
Printer	HP	LaserJet 2200	JPKG19982	N/A	N/A

Figure 28 Test Equipment Used

## 9. Dwell Time on Each Channel

### 9.1 Test Specification

FCC Part 15, Section 15.247(a)(1)(iii)

### 9.2 Test Procedure

The E.U.T. was tested in radiated mode using the substitutional antenna. The spectrum analyzer was set to 100 kHz RBW and 100 kHz VBW.

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

### 9.3 Test Results

The E.U.T met the requirements of the FCC Part 15, Section 15.247(a)(1)(iii).

Additional information of the results is given in *Figure 29 to Figure 30*.

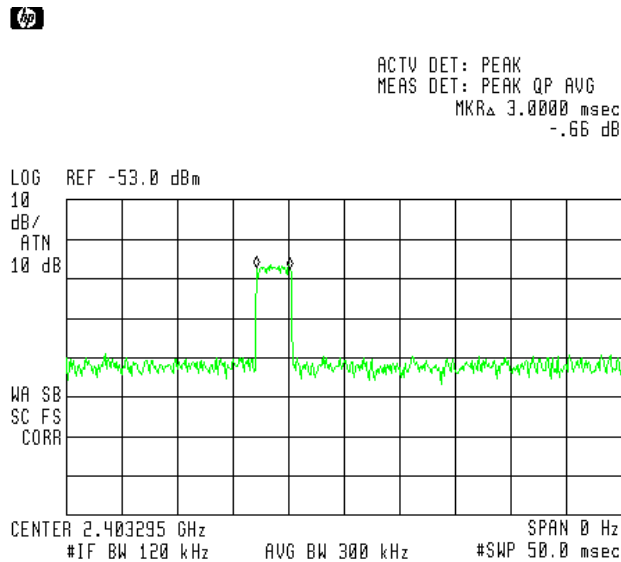
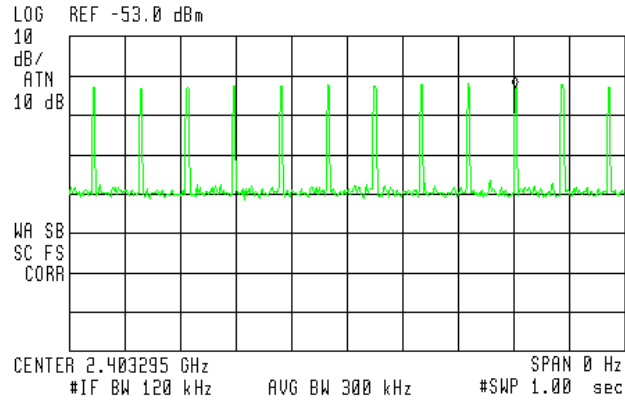


Figure 29 — Ton=3msec



ACTV DET: PEAK  
MEAS DET: PEAK QP AVG  
MKR 002.50 msec  
-65.86 dBm



**Figure 30 — Dwell time at 2.403GHz**  
**[12 X 3msecX6=216msec , limit 400msec]**



**9.4 Test Equipment Used, Dwell Time.**

Instrument	Manufacturer	Model	Serial Number	Calibration	
				Last Calibration Date	Period
Spectrum Analyzer	HP	8564E	3442A00275	February 28, 2013	1 year

**Figure 31 Test Equipment Used**

# 10. Band Edge

[In Accordance with section 15.247(d)]

## 10.1 Test procedure

The E.U.T was placed on a non-metallic table, 0.8 meters above the ground plane, on a remote-controlled turntable in the OATS. The test distance was 3 meters. The transmitter unit operated with normal modulation. The EMI receiver was set to 1 MHz resolution BW. The EUT was set up as shown in Figure 3, and its proper operation was checked.

The EMI receiver was adjusted to the transmission channel at the maximum radiated level. The display line was set to 20 dBc and the EMI receiver was set to the band edge frequencies.

Maximum power level below 2400 MHz and above 2483.5 MHz was measured relative to power level at the Low and the High channels correspondingly.

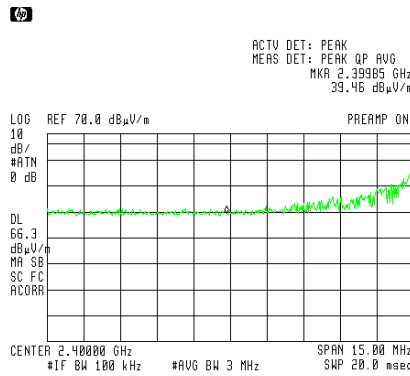


Figure 32 — Lower Band Edge

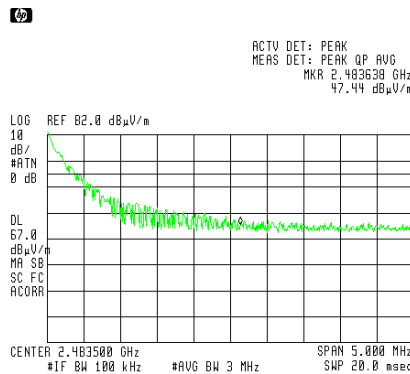


Figure 33 — Upper Band Edge



## 10.2 Results table


E.U.T. Description: Car Data Logger  
Model No.: Modular Fleet Gate (FG3)  
Serial Number: 701  
Specification: F.C.C. Part 15, Subpart C (15.247 (d))

Operation Frequency (MHz)	Band Edge Frequency (MHz)	Spectrum Level (dBuV/m)	Specification (dBuV/m)	Margin (dB)
2404.0	2400.0	39.46	66.3	-26.8
2480.0	2483.5	47.44	67.0	-19.5

**Figure 34 Band Edge**

JUDGEMENT: Passed by 19.5 dB

TEST PERSONNEL:

Tester Signature: 

Date: 22.10.13

Typed/Printed Name: A. Sharabi



### 10.3 Test Equipment Used, Band edge Spectrum

Instrument	Manufacturer	Model	Serial Number	Calibration	Period
Receiver	HP	85422E	3906A00276	February 26, 2013	1 year
RF Section	HP	85420E	3705A00248	February 26, 2013	1 year
Horn Antenna	ETS	3115	29845	March 14, 2012	2 Years
Antenna-Log Periodic	A.H.System	SAS-200/511	253	April 2, 2013	2 years
Antenna Mast	ARA	AAM-4A	1001	N/A	N/A
Turntable	ARA	ART-1001/4	1001	N/A	N/A
Mast & Table Controller	ARA	ACU-2/5	1001	N/A	N/A
Printer	HP	LaserJet 2200	JPKG19982	N/A	N/A

Figure 35 Test Equipment Used



## 11. Radiated Emission, 9 kHz – 30 MHz

### 11.1 Test Specification

9 kHz-30 MHz, FCC, Part 15, Subpart C, Section 209

### 11.2 Test Procedure

The E.U.T. operation mode and test set-up are as described in Section 3.

A preliminary measurement to characterize the E.U.T was performed inside the shielded room at a distance of 3 meters, using peak detection mode and broadband antennas. The preliminary measurements produced a list of the highest emissions. The E.U.T was then transferred to the open site, and placed on a remote-controlled turntable. The E.U.T was placed on a non-metallic table, 0.8 meters above the ground. The configuration tested is shown in Figure 3.1.

The frequency range 9 kHz-30 MHz was scanned.

The emissions were measured using a computerized EMI receiver complying with CISPR 16 requirements. The specification limits and applicable correction factors are loaded to the receiver via a 3.5" floppy disk.

In the frequency range 9 kHz-30MHz, the loop antenna was rotated on its vertical axis. The antenna height (center of loop) was 1 meter at a distance of 3 meters.

The E.U.T. was tested in three operating channels and frequencies (2.404 GHz); (2.444 GHz); (2.480 GHz).

### 11.3 Measured Data

JUDGEMENT: Passed

The EUT met the requirements of the F.C.C. Part 15, Subpart C, Section 209 specification.

The results for all three channels were the same.

No signals were detected in the frequency range of 9 kHz – 30 MHz.

TEST PERSONNEL:

Tester Signature: 

Date: 22.10.13

Typed/Printed Name: A. Sharabi





#### 11.4 Test Instrumentation Used, Radiated Measurements

Instrument	Manufacturer	Model	Serial Number	Calibration	Period
EMI Receiver	HP	85422E	3906A00276	February 26, 2013	1 year
RF Section	HP	85420E	3705A00248	February 26, 2013	1 year
Active Loop Antenna	EMCO	6502	9506-2950	October 21, 2012	1 year
Antenna Mast	ARA	AAM-4A	1001	N/A	N/A
Turntable	ARA	ART-1001/4	1001	N/A	N/A
Mast & Table Controller	ARA	ACU-2/5	1001	N/A	N/A
Printer	HP	LaserJet 2200	JPKG19982	N/A	N/A

Figure 36 Test Equipment Used



### 11.5 **Field Strength Calculation**

The field strength is calculated directly by the EMI Receiver software, and a "Correction Factors" data disk, using the following equation:

$$FS = RA + AF + CF$$

- FS: Field Strength [dB $\mu$ v/m]
- RA: Receiver Amplitude [dB $\mu$ v]
- AF: Receiving Antenna Correction Factor [dB/m]
- CF: Cable Attenuation Factor [dB]

Example: FS = 30.7 dB $\mu$ V (RA) + 14.0 dB (AF) + 0.9 dB (CF) = 45.6 dB $\mu$ V

No external pre-amplifiers are used.

## 12. Spurious Radiated Emission 30 – 25000 MHz

### 12.1 Test Specification

30 MHz- 25000 MHz, F.C.C., Part 15, Subpart C

### 12.2 Test Procedure

The E.U.T. operation mode and test set-up are as described in Section 3.

See Section 3.1 Justification of the System Test Configuration concerning the E.U.T. orientation for this test.

A preliminary measurement to characterize the E.U.T was performed inside the shielded room at a distance of 3 meters, using peak detection mode and broadband antennas. The preliminary measurements produced a list of the highest emissions. The E.U.T was then transferred to the open site, and placed on a remote-controlled turntable. The E.U.T was placed on a non-metallic table, 0.8 meters above the ground.

The frequency range 30 MHz-1000 MHz was scanned and the list of the highest emissions was verified and updated accordingly.

The levels of the emissions within the frequency ranges of the restricted bands (Section 15.205 of FCC Part 15) were compared to the limits of the table in Section 15.209 (a), General Requirements.

The emissions were measured using a computerized EMI receiver complying with CISPR 16 requirements. The specification limits and applicable correction factors are loaded to the receiver via a 3.5" floppy disk.

In the frequency range 30-1000 MHz, the readings were maximized by adjusting the antenna height between 1-4 meters, the turntable azimuth between 0-360°, and the antenna polarization.

In the frequency range 1-2.9 GHz, a computerized EMI receiver complying with CISPR 16 requirements was used.

In the frequency range 2.9-25.0 GHz, a spectrum analyzer including a low noise amplifier was used. During average measurements the IF bandwidth was 1 MHz and the video bandwidth was 100Hz. During peak measurements the IF bandwidth was 1 MHz and the video bandwidth was 3 MHz.

The test distance was 3 meters.

The readings were maximized by adjusting the antenna height between 1-4 meters, the turntable azimuth between 0-360°, and the antenna polarization.

Verification of the E.U.T emissions was based on the following methods: turning the E.U.T on and off; using a frequency span less than 10 MHz; observation of the signal level during turntable rotation. (Background noise is not affected by the rotation of the E.U.T.)

The E.U.T. was tested in three operating channels and frequencies (2.404 GHz); (2.444 GHz); (2480 GHz).



### 12.3 Test Data

JUDGEMENT: Passed


The EUT met the requirements of the F.C.C. Part 15, Subpart C, specification.

For the operation channel 1 (2.404 GHz), the margin between the emission level and the specification limit is 15.3 db in the worst case at the frequency of 4804.00 MHz, vertical polarization.

For the operation channel 8 (2.444 GHz), the margin between the emission level and the specification limit is 14.5 db in the worst case at the frequency of 4882.00 MHz, vertical polarization.

For the operation channel 14 (2.480 GHz), the margin between the emission level and the specification limit is 8.6 db in the worst case at the frequency of 2483.5 MHz, vertical polarization.

TEST PERSONNEL:

Tester Signature:  \_\_\_\_\_

Date: 22.10.13

Typed/Printed Name: A. Sharabi



## Radiated Emission

E.U.T Description    Car Data Logger  
Type                    Modular Fleet Gate (FG3)  
Serial Number:        701

Specification: FCC, Part 15, Subpart C

Antenna Polarization: Horizontal/Vertical    Frequency range: 1.0 GHz to 25.0 GHz  
Test Distance: 3 meters                            Detector: Peak

Operation Frequency (MHz)	Freq. (MHz)	Polarity (H/V)	Peak Reading (dB $\mu$ V/m)	Peak. Specification (dB $\mu$ V/m)	Peak. Margin (dB)
2404.0	2390.0	H	49.5	74.0	-24.5
2404.0	2390.0	V	50.6	74.0	-23.4
2404.0	4808.0	H	55.5	74.0	-18.5
2404.0	4808.0	V	58.7	74.0	-15.3
2444.0	4882.0	H	55.5	74.0	-18.5
2444.0	4882.0	V	59.5	74.0	-14.5
2480.0	4960.0	H	49.5	74.0	-24.5
2480.0	4960.0	V	54.0	74.0	-20.0
2480.0	2483.5	H	64.7	74.0	-9.3
2480.0	2483.5	V	65.4	74.0	-8.6

**Figure 37. Radiated Emission. Antenna Polarization: HORIZONTAL / VERTICAL.  
Detector: Peak**

Margin refers to the test results obtained minus specified requirement; thus a positive number indicates failure, and a negative result indicates that the product passes the test.

“Peak Amp” includes correction factor.

\* “Correction Factor” = Antenna Factor + Cable Loss- Low Noise Amplifier Gain

\* Avg. Factor calculation:



## Radiated Emission

E.U.T Description Car Data Logger  
Type Modular Fleet Gate (FG3)  
Serial Number: 701

Specification: FCC, Part 15, Subpart C

Antenna Polarization: Horizontal/Vertical      Frequency range: 1.0 GHz to 25.0 GHz  
Test Distance: 3 meters      Detector: Average

Operation Frequency (MHz)	Freq. (MHz)	Polarity (H/V)	Average Reading (dB $\mu$ V/m)	Average Specification (dB $\mu$ V/m)	Average Margin (dB)
2404.0	2390.0	H	25.1	54.0	-28.9
2404.0	2390.0	V	26.2	54.0	-27.8
2404.0	4808.0	H	31.1	54.0	-22.9
2404.0	4808.0	V	34.3	54.0	-19.7
2444.0	4882.0	H	31.1	54.0	-22.9
2444.0	4882.0	V	35.1	54.0	-18.9
2480.0	4960.0	H	25.1	54.0	-28.9
2480.0	4960.0	V	29.6	54.0	-24.4
2480.0	2483.5	H	40.3	54.0	-13.7
2480.0	2483.5	V	41.0	54.0	-13.0

**Figure 38. Radiated Emission. Antenna Polarization: HORIZONTAL / VERTICAL.  
Detector: Average**

Notes:

Margin refers to the test results obtained minus specified requirement; thus a positive number indicates failure, and a negative result indicates that the product passes the test.

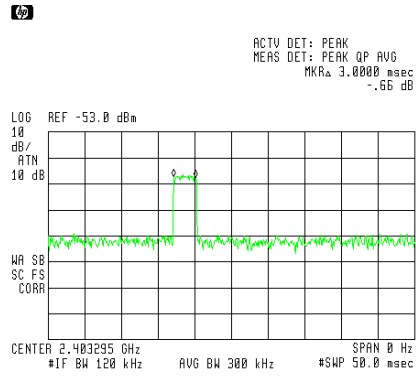


Figure 39. Avg. Factor – burst duration 3msec

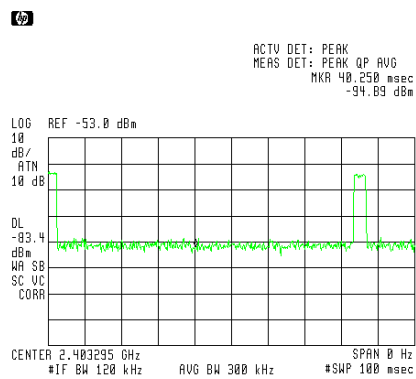


Figure 40. Avg. Factor – transmission within 100msec =  $20\log((2 \times 3) \setminus 100) = -24.4\text{dB}$



### Test Instrumentation Used, Radiated Measurements

Instrument	Manufacturer	Model	Serial No.	Last Calibration Date	Period
EMI Receiver	HP	85422E	3906A00276	February 26, 2013	1 Year
RF Filter Section	HP	85420E	3705A00248	February 26, 2013	1 Year
Antenna Biconical	EMCO	3104	2606	August 30, 2013	1 Year
Antenna Log Periodic	ARA	LPD-2010/A	1038	April 2, 2013	1 Year
Double Ridged Waveguide Horn Antenna	EMCO	3115	29845	March 14, 2012	2 Years
Horn Antenna	ARA	SWH-28	1007	January 26, 2011	3 Years
Horn Antenna	ETS	3115	29845	March 14, 2012	2 Years
Low Noise Amplifier	DBS MICROWAVE	LNA-DBS-0411N313	013	August 21, 2013	1 Year
Low Noise Amplifier	Sophia Wireless	LNA 28-B	232	August 28, 2013	1 Year
Spectrum Analyzer	HP	8592L	3826A01204	February 28, 2013	1 Year
Spectrum Analyzer	HP	8564E	3442A00275	February 28, 2013	1 Year
Antenna Mast	ARA	AAM-4A	1001	N/A	N/A
Turntable	ARA	ART-1001/4	1001	N/A	N/A
Mast & Table Controller	ARA	ACU-2/5	1001	N/A	N/A
Printer	HP	LaserJet 2200	JPKG19982	N/A	N/A





#### 12.4 **Field Strength Calculation 30 – 1000 MHz**

The field strength is calculated directly by the EMI Receiver software, and a "Correction Factors" data disk, using the following equation:

$$[\text{dB}\mu\text{v/m}] \text{ FS} = \text{RA} + \text{AF} + \text{CF}$$

- FS: Field Strength [dB $\mu$ v/m]
- RA: Receiver Amplitude [dB $\mu$ v]
- AF: Receiving Antenna Correction Factor [dB/m]
- CF: Cable Attenuation Factor [dB]

Example: FS = 30.7 dB $\mu$ V (RA) + 14.0 dB (AF) + 0.9 dB (CF) = 45.6 dB $\mu$ V

No external pre-amplifiers are used.

# 13. Antenna Gain/Information

## Roseman Fleet Gate

### PATCH ANTENNA

#### for 2.4Ghz

#### GNR0668-AVIV

##### Electrical Specification

Frequency range	2400~2500MHZ
Gain	3 dBi
VSWR	≤2.0
Polarization	Linear ( V or H)
Power handling	10W
Impedance	50 Ohms
Connector	STRIP OPEN

##### Environmental & Mechanical Characteris

Temperature	-40°C to +80°C
Radome color	Gray 431U
Radome material	TPR
Weight	38g
Length	123 *19.5 * 5.8MM



##### Antenna Cable

Type: RG174

Cable Length: 1.5meter

## 14. R.F Exposure/Safety

Typical use of the E.U.T. is as a Car Data Logger installed in a vehicle. The typical distance between the E.U.T. and the user in the worst case application, is 20 cm.

Calculation of Maximum Permissible Exposure (MPE)  
Based on Section 1.1310 Requirements

(a) FCC limit at 2444 MHz is:  $1 \frac{mW}{cm^2}$

Using table 1 of Section 1.1310 limit for general population/uncontrolled exposures, the above level is an average over 30 minutes.

(b) The power density produced by the E.U.T. is

$P_t$ - Transmitted Power 88.50 dBm (Peak) = 0.14 mW

$$S = \frac{P_t G_t}{4\pi R^2}$$

$G_T$ - Antenna Gain, 3 dBi = 2 numeric

R- Distance from Transmitter using 20 cm worst case

(c) The peak power density is :

$$S_p = \frac{0.14 \times 2}{4\pi(20)^2} = 5.57 \times 10^{-5} \frac{mW}{cm^2}$$

(d) This is below the FCC limit.



## 15. APPENDIX B - CORRECTION FACTORS

### 15.1 Correction factors for CABLE

from EMI receiver  
to test antenna  
at 3 meter range.

FREQUENCY (MHz)	CORRECTION FACTOR (dB)	FREQUENCY (MHz)	CORRECTION FACTOR (dB)
10.0	0.3	1200.0	7.3
20.0	0.6	1400.0	7.8
30.0	0.8	1600.0	8.4
40.0	0.9	1800.0	9.1
50.0	1.1	2000.0	9.9
60.0	1.2	2300.0	11.2
70.0	1.3	2600.0	12.2
80.0	1.4	2900.0	13.0
90.0	1.6		
100.0	1.7		
150.0	2.0		
200.0	2.3		
250.0	2.7		
300.0	3.1		
350.0	3.4		
400.0	3.7		
450.0	4.0		
500.0	4.3		
600.0	4.7		
700.0	5.3		
800.0	5.9		
900.0	6.3		
1000.0	6.7		

**NOTES:**

1. The cable type is RG-214.
2. The overall length of the cable is 27 meters.
3. The above data is located in file 27MO3MO.CBL on the disk marked "Radiated Emission Tests EMI Receiver".



**15.2 Correction factors for CABLE**

**from EMI receiver  
to test antenna  
at 3 meter range.**

FREQUENCY (GHz)	CORRECTION FACTOR (dB)
1.0	1.2
2.0	1.6
3.0	2.0
4.0	2.4
5.0	3.0
6.0	3.4
7.0	3.8
8.0	4.2
9.0	4.6
10.0	5.0
12.0	5.8

*NOTES:*

- 1. The cable type is RG-8.*
- 2. The overall length of the cable is 10 meters.*

**15.3 Correction factors for CABLE**

**from spectrum analyzer  
to test antenna above 2.9 GHz**

FREQUENCY (GHz)	CORRECTION FACTOR (dB)	FREQUENCY (GHz)	CORRECTION FACTOR (dB)
1.0	1.9	14.0	9.1
2.0	2.7	15.0	9.5
3.0	3.5	16.0	9.9
4.0	4.2	17.0	10.2
5.0	4.9	18.0	10.4
6.0	5.5	19.0	10.7
7.0	6.0	20.0	10.9
8.0	6.5	21.0	11.2
9.0	7.0	22.0	11.6
10.0	7.5	23.0	11.9
11.0	7.9	24.0	12.3
12.0	8.3	25.0	12.6
13.0	8.7	26.0	13.0

*NOTES:*

- 1. The cable type is SUCOFLEX 104 E manufactured by SUHNER.*
- 2. The cable is used for measurements above 2.9 GHz.*
- 3. The overall length of the cable is 10 meters.*



**15.4 12.6 Correction factors for LOG PERIODIC ANTENNA  
Type LPD 2010/A  
at 3 and 10 meter ranges.**

**Distance of 3 meters**

<b>FREQUENCY (MHz)</b>	<b>AFE (dB/m)</b>
200.0	9.1
250.0	10.2
300.0	12.5
400.0	15.4
500.0	16.1
600.0	19.2
700.0	19.4
800.0	19.9
900.0	21.2
1000.0	23.5

**Distance of 10 meters**

<b>FREQUENCY (MHz)</b>	<b>AFE (dB/m)</b>
200.0	9.0
250.0	10.1
300.0	11.8
400.0	15.3
500.0	15.6
600.0	18.7
700.0	19.1
800.0	20.2
900.0	21.1
1000.0	23.2

*NOTES:*

- 1. Antenna serial number is 1038.*
- 2. The above lists are located in file number 38M30.ANT for a 3 meter range,  
and file number 38M100.ANT for a 10 meter range.*
- 3. The files mentioned above are located on the disk marked "Radiated Emission  
Test EMI Receiver".*



**15.5 Correction factors for LOG PERIODIC ANTENNA**  
**Type SAS-200/511**  
**at 3 meter range.**

FREQUENCY (GHz)	ANTENNA FACTOR (dB)
1.0	24.9
1.5	27.8
2.0	29.9
2.5	31.2
3.0	32.8
3.5	33.6
4.0	34.3
4.5	35.2
5.0	36.2
5.5	36.7
6.0	37.2
6.5	38.1

FREQUENCY (GHz)	ANTENNA FACTOR (dB)
7.0	38.6
7.5	39.2
8.0	39.9
8.5	40.4
9.0	40.8
9.5	41.1
10.0	41.7
10.5	42.4
11.0	42.5
11.5	43.1
12.0	43.4
12.5	44.4
13.0	44.6

**NOTES:**

1. Antenna serial number is 253.
2. The above lists are located in file number SAS3M0.ANT for a 3 meter range.
3. The files mentioned above are located on the disk marked "Antenna Factors".





**15.6 Correction factors for BICONICAL ANTENNA**

**Type BCD-235/B,  
at 3 meter range**

<b>FREQUENCY</b> (MHz)	<b>AFE</b> (dB/m)
20.0	19.4
30.0	14.8
40.0	11.9
50.0	10.2
60.0	9.1
70.0	8.5
80.0	8.9
90.0	9.6
100.0	10.3
110.0	11.0
120.0	11.5
130.0	11.7
140.0	12.1
150.0	12.6
160.0	12.8
170.0	13.0
180.0	13.5
190.0	14.0
200.0	14.8
210.0	15.3
220.0	15.8
230.0	16.2
240.0	16.6
250.0	17.6
260.0	18.2
270.0	18.4
280.0	18.7
290.0	19.2
300.0	19.9
310	20.7
320	21.9
330	23.4
340	25.1
350	27.0

*NOTES:*

- 1. Antenna serial number is 1041.*
- 2. The above list is located in file 19BC10M1.ANT on the disk marked "Radiated Emissions Tests EMI Receiver".*



**15.7 Correction factors for Double-Ridged Waveguide Horn**

**Model: 3115, S/N 29845  
at 3 meter range.**

FREQUENCY (GHz)	ANTENNA FACTOR (dB 1/m)	ANTENNA Gain (dBi)	FREQUENCY (GHz)	ANTENNA FACTOR (dB 1/m)	ANTENNA Gain (dBi)
1.0	24.8	5.4	10.0	38.8	11.4
1.5	26.1	7.6	10.5	38.9	11.8
2.0	28.6	7.7	11.0	39.0	12.1
2.5	29.8	8.4	11.5	39.6	11.8
3.0	31.4	8.4	12.0	39.8	12.0
3.5	32.4	8.7	12.5	39.6	12.5
4.0	33.7	8.6	13.0	40.0	12.5
4.5	33.4	9.9	13.5	39.8	13.0
5.0	34.5	9.7	14.0	40.2	13.0
5.5	35.1	9.9	14.5	40.6	12.9
6.0	35.4	10.4	15.0	41.3	12.4
6.5	35.6	10.8	15.5	39.5	14.6
7.0	36.2	10.9	16.0	38.8	15.5
7.5	37.3	10.4	16.5	40.0	14.6
8.0	37.7	10.6	17.0	41.4	13.4
8.5	38.3	10.5	17.5	44.8	10.3
9.0	38.5	10.8	18.0	47.2	8.1
9.5	38.7	11.1			



**15.8 Correction factors for**

**Horn Antenna  
Model: SWH-28  
at 1 meter range.**

<b>FREQUENCY (GHz)</b>	<b>AFE (dB /m)</b>	<b>Gain (dB1)</b>
18.0	40.3	16.1
19.0	40.3	16.3
20.0	40.3	16.1
21.0	40.3	16.3
22.0	40.4	16.8
23.0	40.5	16.4
24.0	40.5	16.6
25.0	40.5	16.7
26.0	40.6	16.4



**15.9 Correction factors for**

**Horn Antenna  
Model: V637**

<b>FREQUENCY (GHz)</b>	<b>AFE (dB /m)</b>	<b>Gain (dB1)</b>
26.0	43.6	14.9
27.0	43.7	15.1
28.0	43.8	15.3
29.0	43.9	15.5
30.0	43.9	15.8
31.0	44.0	16.0
32.0	44.1	16.2
33.0	44.1	16.4
34.0	44.1	16.7
35.0	44.2	16.9
36.0	44.2	17.1
37.0	44.2	17.4
38.0	44.2	17.6
39.0	44.2	17.8
40.0	44.2	18.0



**15.10 Correction factors for ACTIVE LOOP ANTENNA**

**Model 6502**

**S/N 9506-2950**

<b>FREQUENCY</b> (MHz)	<b>Magnetic Antenna Factor</b> (dB)	<b>Electric Antenna Factor</b> (dB)
.009	-35.1	16.4
.010	-35.7	15.8
.020	-38.5	13.0
.050	-39.6	11.9
.075	-39.8	11.8
.100	-40.0	11.6
.150	-40.0	11.5
.250	-40.0	11.6
.500	-40.0	11.5
.750	-40.1	11.5
1.000	-39.9	11.7
2.000	-39.5	12.0
3.000	-39.4	12.1
4.000	-39.7	11.9
5.000	-39.7	11.8
10.000	40.2	11.3
15.000	-40.7	10.8
20.000	-40.5	11.0
25.000	-41.3	10.2
30.000	42.3	9.2