John Kennedy

From: Hankins, Danny [dhankins@cessna.textron.com]
Sent: Wednesday, September 28, 2005 12:32 PM
To: John Kennedy
Subject: 0217-EX-PL-2004 Orlando Location Addition

Orlando CSC Facility Info.pdf ... | Orlando System Diagram.pdf (3 ... | Orlando alculations.pdf (13 K | KMCO Orlando Int'l Airport.pdf... | gpssource L1L2 Active Antennas... | gpssource.S14 Amplified Splitt... | gpssource L12GP Passive Antenn...

Orlando POCs for Stop Buzzer.d...

John,

Please add the following location, info and attachments to 0217-EX-PL-2004:

* Location: Orlando, FL, Orange County.
* Coordinates: 28-26-51.4 N Lat, 81-19-53.4 W Lon
* Ground Elevation: 147 ft. MSL
* Antenna Height AGL: 40 ft.
* Frequencies: 1227.6 MHz and 1575.42 MHz
* Output Power = 72 pW both freqs (less than this in reality)
* Emission Designator is 24M0G1D both freqs
* Frequency Tolerance is +/- 0.001 % (controlled by GPS satellite)

<<Orlando CSC Facility Info.pdf>> <<Orlando System Diagram.pdf>>
<<Orlando Calculations.pdf>> <<KMCO Orlando Int'l Airport.pdf>>
<<gpssource L1L2 Active Antennas.pdf>> <<gpssource.S14 Amplified Splitter Data.pdf>>
<<gpssource L12GP Passive Antennas.pdf>> <<Orlando POCs for Stop Buzzer.doc>>
Call if you have questions or need additional info.

Thanks,

Danny Hankins
Engineer, Technologist Sr.
Cessna Aircraft Company
Phone: (316) 517-7053
Fax: (316) 206-8396
Email: dhankins@cessna.textron.com

Antenna GPS L1& L1/L2

PRODUCT DATA SHEET

Part Number: L12GP – Passive GPS L1 Antenna
Part Number: L1L22GP – Passive GPS L1/L2 Antenna

Performance Specifications

Frequency response covers GPS L1 & L2
- **1575.42 +- 10MHz**
- **1227.00 +- 10MHz**
- **VSWR < 1.5:1**
- **Antenna Gain: +3.5dBic**
- **DC Grounding: Yes (lightening protection)**
- **Rejection: (2) 2-pole Filters for each band**
- **Polarization: Right Hand Circular**
- **Impedance: 50 Ohms**

Environmental

- **Temperature: -55°C to +85°C**
- **Altitude: 70,000ft**
- **Vibration: 10G's**
- **Leakage: Hermetically Sealed**

Federal & Military Specifications

- **FAA TSO C-144, DO-160D, DO-228**
- **MIL-C-5541, MIL-E-5400**
- **MIL-I-45208A, MIL-STD-810**

Mechanical Specifications

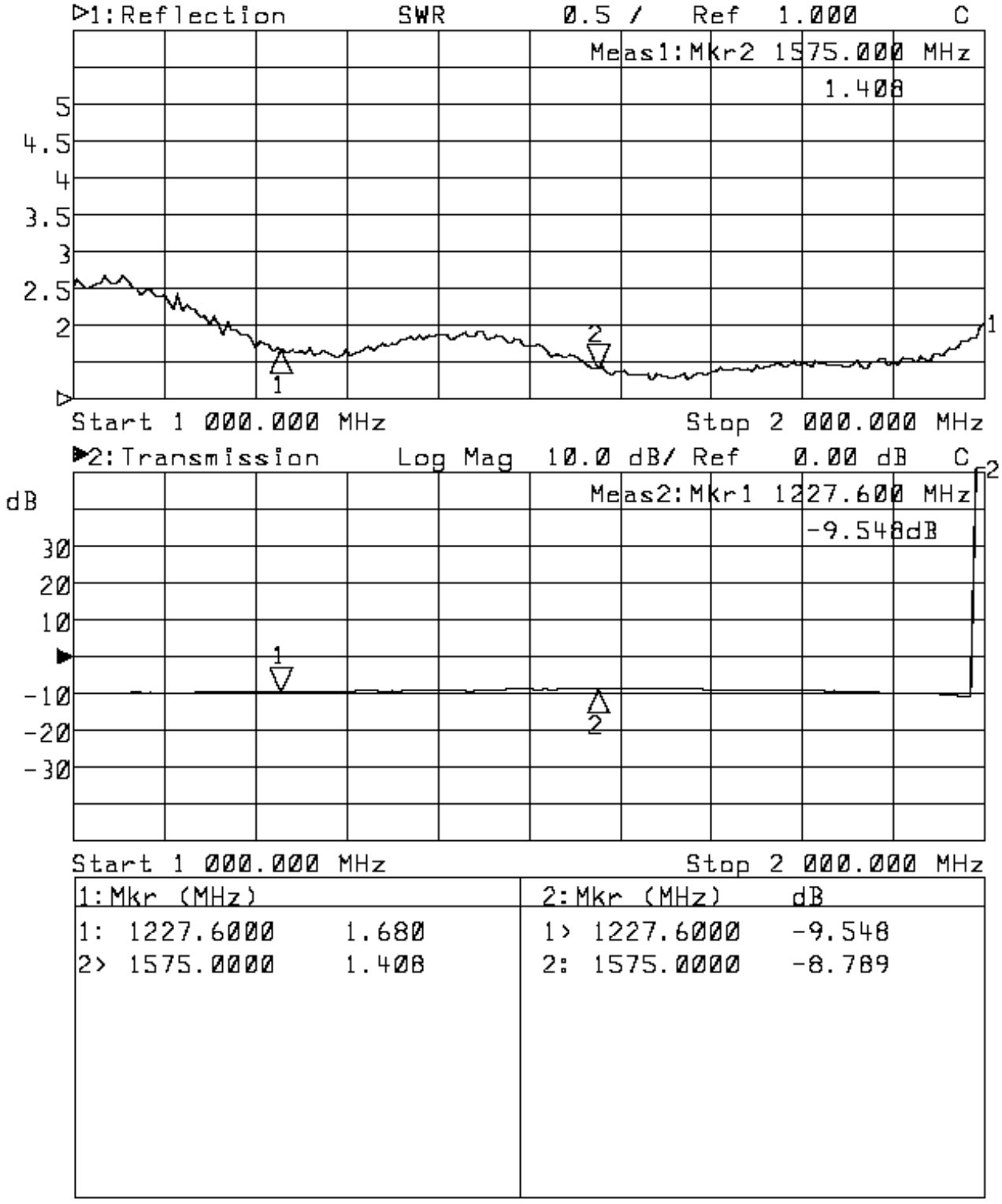
Dimensions
- **Size: 2.6"D x 0.64"H**
- **Weight: 3.9oz**

Connector
- **SMA(f)**

GPS SOURCE

2211 Jones Ave
Pueblo, CO 81004
Phone 719-561-9520
Fax 719-565-0890
www.gpssource.com
Sales@gpssource.com

S14 Product Data



PRODUCTS | S14

Electrical Specifications:

- **Frequency response for GPS L1/L2 & GLONASS**
  - **1GHz to 2GHz**
  - **Flatness less than 2dB**
  - **Noise figure less than 1.8dB**

- **All ports can either pass DC or block DC voltage**
  - **200-ohm load on all DC blocked ports**
  - **50 ohm impedance on all ports**
  - **Input & Output SWR less than 2.0:1**
  - **Isolation greater than 16dB**

- **Amplified Option**
  - **Required DC input 3.1 to 15VDC**
  - **20dB gain each output port**
  - **Current draw less than 7mA**

- **High Isolation Option**
  - **10 dB gain each output port**
  - **Isolation greater than 25dB**
  - **Current draw less than 7mA**

Mechanical Specifications:

- **Dimension**
  - **Length 2.5"**
  - **Width 2.5"**
  - **Height 1.25"**
  - **Base Plate 3.25"x2.5"**

- **Operating Temperature**
  - **-40 to 75 degrees C**

L1/L2 Antennas

Part Number: L1L23G

Part Number: L1L24G

Performance Specifications:

- **Frequency L1: (1575.42+-10) MHz**
- **Frequency L2: (1227.00+-10) Mhz**
- **VSWR: 1.5:1**
- **DC Grounding: Yes (lightening protection)**
- **LNA Noise Figure: less than 2.4dB**
- **LNA Gain: 33.0+-3.0dB**
- **LNA Current Draw: greater than 40mA**
- **LNA Votlage: +3.5 to +24VDC**
- **Rejection: 2 2-Pole Filters for each band**
- **Polarization: Right-Hand Circular**
- **Impedance: 50 Ohms**
- **Temperature: -55 to +85 C**
- **Connector: SMA, Female**

Design Specifications:

- **FAA TSO-C144**
- **DO-160D, D0-228**
- **MIL-C-5541, MIL-E-5400**
- **MIL-I-45208A, MIL-STD-810**

Toll Free: 866-289-4777
Telephone: 719-561-9520
Fax: 719-565-0890

sales@gpssource.com

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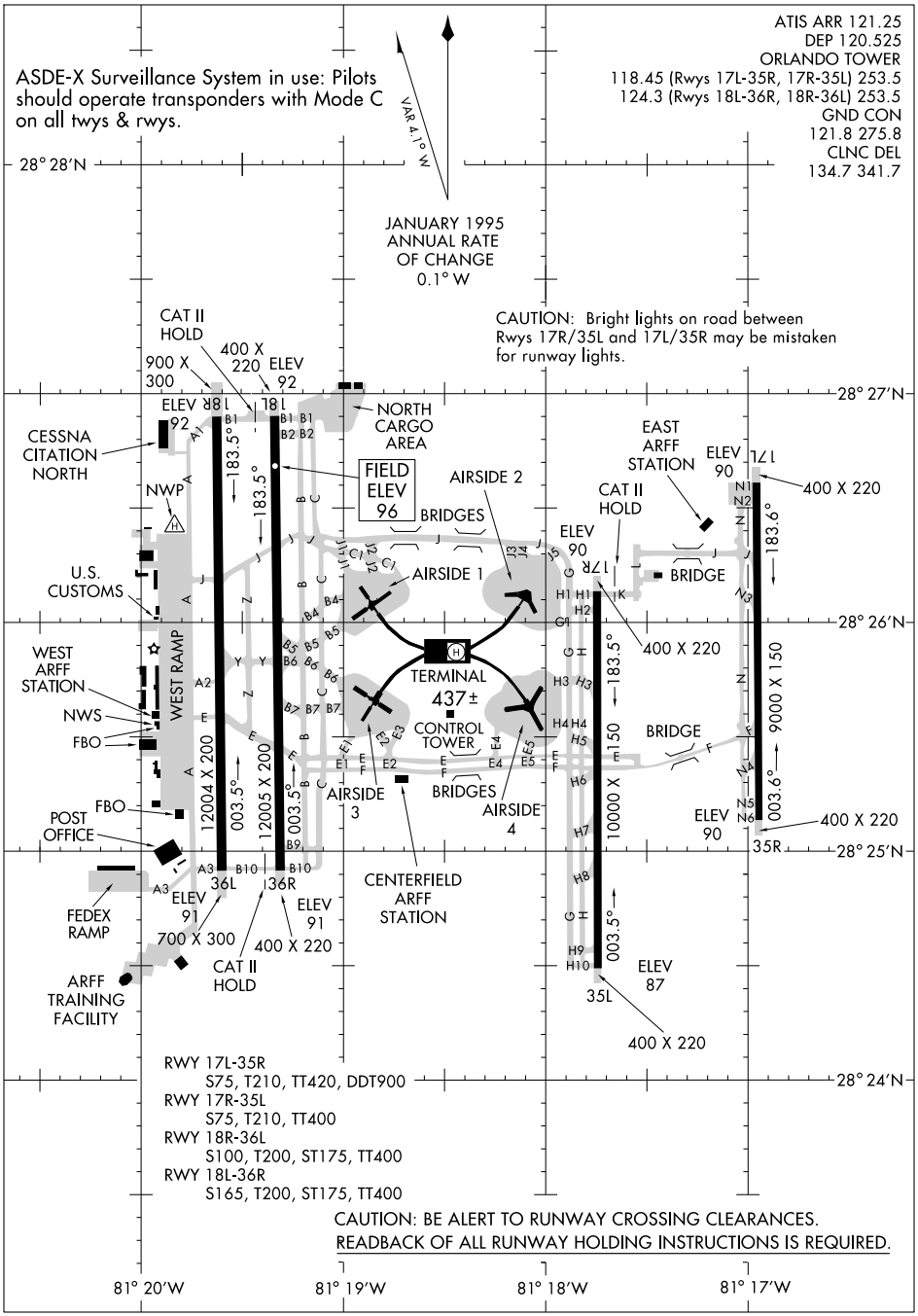

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Orlando Re-radiated Power Calculations

Note 1: This system re-radiates both L1 (1575.42 MHz) and L2 (1227.6 MHz). Calculations are done for each antenna for the L1 frequency, and for each antenna for the L2 frequency.

Note 2: The only difference between the two re-radiating antennas is the distance to 100 ft outside the building and coax lengths between the amp/splitter and re-radiating antennas. Total FL distance for re-rad antenna #1 is 102 ft versus 105 ft for re-rad antenna #2.

<u>Re-radiating Antenna #1 @ 1575.42 MHz</u>

(1) $P_{Rerad} = P_{Rec} + G_1 + G_2 + A_1 – C_1 – C_2 – FL$

Where:
P_{Rerad} = Re-radiated signal strength 100 ft outside the building
P_{Rec} = Received Power from Satellites (L1) = -130 dBm
G_1 = Roof Antenna Gain = 36 dBi
G_2 = Re-radiating Antenna Gain = 3.5 dBic
A_1 = Amplified Splitter Gain = 20 dB
C_1 = Coax Attenuation, Roof Antenna to Amplifier
= 6.5 dB/100 ft X 80 ft
= 5.2 dB
C_2 = Coax Attenuation, Amplifier to Re-radiating Antenna
= 6.5 dB/100 ft X 50 ft
= 3.25 dB
FL = Freespace Loss

(2) FL = 20LogF + 20LogD + 36.56

Where:
F = Frequency in MHz = 1575.42
D = Distance in Miles
= (Distance from antenna to outer wall in feet + 100)/5280
= (2 ft + 100 ft)/5280

Inserting the values for F and D into equation (2) yields

FL = 20Log(1575.42) + 20Log((2+100)/5280) +36.56
= 66.23 dB

Inserting these values into equation (1) then becomes:

P_{Rerad} = -130 + 36 + 3.5 + 20 – 5.2 – 3.25 – 66.23
= - 145.18 dBm

Re-radiating Antenna #2 @ 1575.42 MHz

(1) $P_{Rerad} = P_{Rec} + G_1 + G_2 + A_1 – C_1 – C_2 – FL$

Where: P_{Rerad} = Re-radiated signal strength 100 ft outside the building
P_{Rec} = Received Power from Satellites (L1) = -130 dBm
G_1 = Roof Antenna Gain = 36 dBi
G_2 = Re-radiating Antenna Gain = 3.5 dBic
A_1 = Amplified Splitter Gain = 20 dB
C_1 = Coax Attenuation, Roof Antenna to Amplifier
= 6.5 dB/100 ft X 80 ft
= 5.2 dB
C_2 = Coax Attenuation, Amplifier to Re-radiating Antenna
= 6.5 dB/100 ft X 7 ft
= 0.455 dB
FL = Freespace Loss

(3) FL = 20LogF + 20LogD + 36.56

Where: F = Frequency in MHz = 1575.42
D = Distance in Miles
= (Distance from antenna to outer wall in feet + 100)/5280
= (5 ft + 100 ft)/5280

Inserting the values for F and D into equation (2) yields

FL = 20Log(1575.42) + 20Log((5+100)/5280) +36.56
= 66.48 dB

Inserting these values into equation (1) then becomes:

P_{Rerad} = -130 + 36 + 3.5 + 20 – 5.2 – 0.455 – 66.48
= - 142.63 dBm

Re-radiating Antenna #1 @ 1227.6 MHz

(1) $P_{Rerad} = P_{Rec} + G_1 + G_2 + A_1 – C_1 – C_2 – FL$

Where: P_{Rerad} = Re-radiated signal strength 100 ft outside the building
P_{Rec} = Received Power from Satellites (L2) = -136 dBm
G_1 = Roof Antenna Gain = 36 dBi
G_2 = Re-radiating Antenna Gain = 3.5 dBic
A_1 = Amplified Splitter Gain = 20 dB
C_1 = Coax Attenuation, Roof Antenna to Amplifier

= 5.8 dB/100 ft X 80 ft
= 4.64 dB

C_2 = Coax Attenuation, Amplifier to Re-radiating Antenna
= 5.8 dB/100 ft X 50 ft
= 2.9 dB

FL = Freespace Loss

(4) FL = 20LogF + 20LogD + 36.56

Where: F = Frequency in MHz = 1227.6
D = Distance in Miles
= (Distance from antenna to outer wall in feet + 100)/5280
= (2 ft + 100 ft)/5280

Inserting the values for F and D into equation (2) yields

FL = 20Log(1227.6) + 20Log((2+100)/5280) +36.56
= 64.06 dB

Inserting these values into equation (1) then becomes:

P_{Rerad} = -136 + 36 + 3.5 + 20 – 4.64 – 2.9 – 64.06
= - 148.1 dBm

<u>Re-radiating Antenna #2 @ 1227.6 MHz</u>

(1) P_{Rerad} = P_{Rec} + G_1 + G_2 + A_1 – C_1 – C_2 – FL

Where: P_{Rerad} = Re-radiated signal strength 100 ft outside the building
P_{Rec} = Received Power from Satellites (L2) = -136 dBm
G_1 = Roof Antenna Gain = 36 dBi
G_2 = Re-radiating Antenna Gain = 3.5 dBic
A_1 = Amplified Splitter Gain = 20 dB
C_1 = Coax Attenuation, Roof Antenna to Amplifier
= 5.8 dB/100 ft X 80 ft
= 4.64 dB

C_2 = Coax Attenuation, Amplifier to Re-radiating Antenna
= 5.8 dB/100 ft X 7 ft
= 0.406 dB

FL = Freespace Loss

(5) FL = 20LogF + 20LogD + 36.56

Where: F = Frequency in MHz = 1226.7

D = Distance in Miles
= (Distance from antenna to outer wall in feet + 100)/5280
= (5 ft + 100 ft)/5280

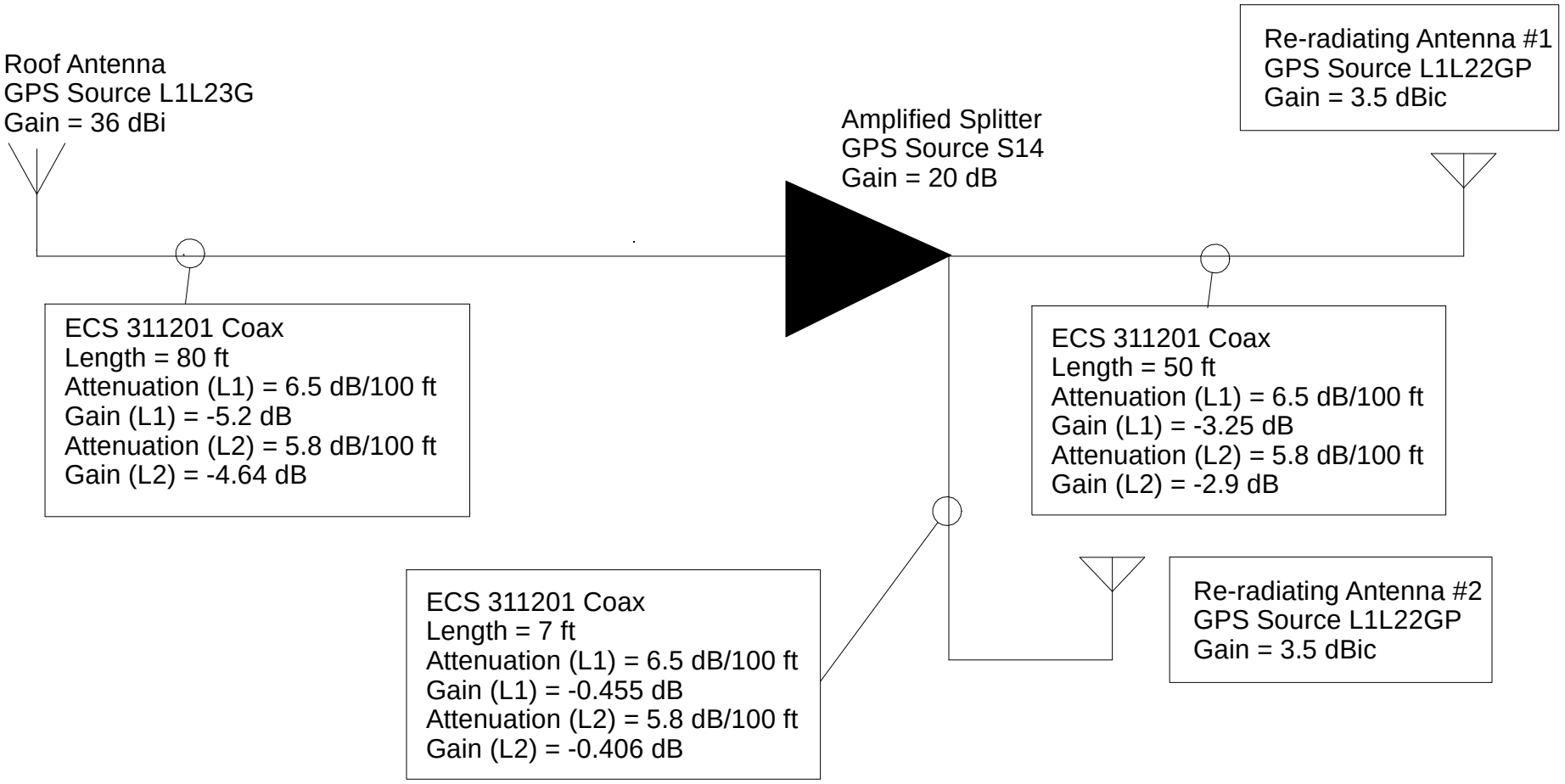
Inserting the values for F and D into equation (2) yields

FL = 20Log(1226.7) + 20Log((5+100)/5280) +36.56
= 64.31 dB

Inserting these values into equation (1) then becomes:

P_{Rerad} = -136 + 36 + 3.5 + 20 – 4.64 – 0.406 – 64.31
= - 145.86 dBm

Orlando L1/L2 System Diagram



GPS Re-radiating Information & Calculations Ant#1 L1

Site Information	
1) Facility Name and Address	Orlando Citation Service Center
2) Point Of Contact Name & Phone	Robert Decker, Avionics Lead Work Ph 407-859-1245
3) Location of switch & shutoff instructions	Breaker box in 3rd floor electrical room, panel 2AR2, breaker #2.
4) Coordinates, NAD 83, ddd-mm-ss.s	28-26-51.4 N 81-19-53.4 W
5) Coordinate Description	Center of Hangar facility, between North hangar and South Hangar
6) Ground Elevation (ft)	147'
Antenna - Receiving (RX)	
7) Make and Model	GPS Source L1L23G
8) Gain (dBi)	36
Antenna - Re-radiating (TX)	
9) Make and Model	GPS Source L1L22GP
10) Gain (dBi)	3.5
11) Distance to nearest outer wall (ft)	2
12) Location Description	South Hangar, North Wall
13) Antenna Height AGL (ft)	40
Free Space Loss	66.23
Amplifier	
14) Make and Model	GPS Source S14
15) Gain (max rating in dB)	20
Coax - RX Antenna to Amp	
16) Type or Description	ECS 311201
17) Attenuation @1575 MHz (dB/100 ft)	6.5
18) Length (ft)	80
Coax Loss - RX Antenna to Amp	5.2
Coax - Amp to TX Antenna	
19) Type or Description	ECS 311201
20) Attenuation @1575 MHz (dB/100 ft)	6.5
21) Length (ft)	50
Coax Loss - Amp to TX Antenna	3.25
Attenuator	
22) Make & Model	
23) Attenuation @1575 MHz (dB)	0
Calculated Signal Strength 100 ft Outside Building (dBm)*	**-145.18**

*** This value MUST be less than negative 140 dBm**

GPS Re-radiating Information & Calculations Ant#2 L1

Site Information	
1) Facility Name and Address	Orlando Citation Service Center
2) Point Of Contact Name & Phone	Robert Decker, Avionics Lead Work Ph 407-859-1245
3) Location of switch & shutoff instructions	Breaker box in 3rd floor electrical room, panel 2AR2, breaker #2.
4) Coordinates, NAD 83, ddd-mm-ss.s	28-26-51.4 N 81-19-53.4 W
5) Coordinate Description	Center of Hangar facility, between North hangar and South Hangar
6) Ground Elevation (ft)	147'
Antenna - Receiving (RX)	
7) Make and Model	GPS Source L1L23G
8) Gain (dBi)	36
Antenna - Re-radiating (TX)	
9) Make and Model	GPS Source L1L22GP
10) Gain (dBi)	3.5
11) Distance to nearest outer wall (ft)	5
12) Location Description	North Hangar,south wall;
13) Antenna Height AGL (ft)	40
Free Space Loss	66.48
Amplifier	
14) Make and Model	GPS Source S14
15) Gain (max rating in dB)	20
Coax - RX Antenna to Amp	
16) Type or Description	ECS 311201
17) Attenuation @1575 MHz (dB/100 ft)	6.5
18) Length (ft)	80
Coax Loss - RX Antenna to Amp	5.2
Coax - Amp to TX Antenna	
19) Type or Description	ECS 311201
20) Attenuation @1575 MHz (dB/100 ft)	6.5
21) Length (ft)	7
Coax Loss - Amp to TX Antenna	0.455
Attenuator	
22) Make & Model	
23) Attenuation @1575 MHz (dB)	0
Calculated Signal Strength 100 ft Outside Building (dBm)*	**-142.63**

*** This value MUST be less than negative 140 dBm**

GPS Re-radiating Information & Calculations Ant#1 L2

Site Information	
1) Facility Name and Address	Orlando Citation Service Center
2) Point Of Contact Name & Phone	Robert Decker, Avionics Lead Work Ph 407-859-1245
3) Location of switch & shutoff instructions	Breaker box in 3rd floor electrical room, panel 2AR2, breaker #2.
4) Coordinates, NAD 83, ddd-mm-ss.s	28-26-51.4 N 81-19-53.4 W
5) Coordinate Description	Center of Hangar facility, between North hangar and South Hangar
6) Ground Elevation (ft)	147'
Antenna - Receiving (RX)	
7) Make and Model	GPS Source L1L23G
8) Gain (dBi)	36
Antenna - Re-radiating (TX)	
9) Make and Model	GPS Source L1L22GP
10) Gain (dBi)	3.5
11) Distance to nearest outer wall (ft)	2
12) Location Description	South Hangar, North Wall
13) Antenna Height AGL (ft)	40
Free Space Loss	64.06
Amplifier	
14) Make and Model	GPS Source S14
15) Gain (max rating in dB)	20
Coax - RX Antenna to Amp	
16) Type or Description	ECS 311201
17) Attenuation @1227 MHz (dB/100 ft)	5.8
18) Length (ft)	80
Coax Loss - RX Antenna to Amp	4.64
Coax - Amp to TX Antenna	
19) Type or Description	ECS 311201
20) Attenuation @1227 MHz (dB/100 ft)	5.8
21) Length (ft)	50
Coax Loss - Amp to TX Antenna	2.9
Attenuator	
22) Make & Model	
23) Attenuation @1575 MHz (dB)	0
Calculated Signal Strength 100 ft Outside Building (dBm)*	**-148.10**

*** This value MUST be less than negative 140 dBm**

GPS Re-radiating Information & Calculations Ant#2 L2

Site Information	
1) Facility Name and Address	Orlando Citation Service Center
2) Point Of Contact Name & Phone	Robert Decker, Avionics Lead Work Ph 407-859-1245
3) Location of switch & shutoff instructions	Breaker box in 3rd floor electrical room, panel 2AR2, breaker #2.
4) Coordinates, NAD 83, ddd-mm-ss.s	28-26-51.4 N 81-19-53.4 W
5) Coordinate Description	Center of Hangar facility, between North hangar and South Hangar
6) Ground Elevation (ft)	147'
Antenna - Receiving (RX)	
7) Make and Model	GPS Source L1L23G
8) Gain (dBi)	36
Antenna - Re-radiating (TX)	
9) Make and Model	GPS Source L1L22GP
10) Gain (dBi)	3.5
11) Distance to nearest outer wall (ft)	5
12) Location Description	North Hangar,south wall;
13) Antenna Height AGL (ft)	40
Free Space Loss	64.31
Amplifier	
14) Make and Model	GPS Source S14
15) Gain (max rating in dB)	20
Coax - RX Antenna to Amp	
16) Type or Description	ECS 311201
17) Attenuation @1227 MHz (dB/100 ft)	5.8
18) Length (ft)	80
Coax Loss - RX Antenna to Amp	4.64
Coax - Amp to TX Antenna	
19) Type or Description	ECS 311201
20) Attenuation @1227 MHz (dB/100 ft)	5.8
21) Length (ft)	7
Coax Loss - Amp to TX Antenna	0.406
Attenuator	
22) Make & Model	
23) Attenuation @1575 MHz (dB)	0
Calculated Signal Strength 100 ft Outside Building (dBm)*	**-145.86**

*** This value MUST be less than negative 140 dBm**

Stop Buzzer POCs - Cessna Aircraft Company
Orlando Citation Service Center

Robert Decker
Tech, Avionics A/C Sr OSC – AP
Orlando Citation Service Center
407-816-6969

Mike Leahy
Avionics Supervisor
Orlando Citation Service Center
Work: 407-816-6833

Walter Berchtold
General Manager
Orlando Citation Service Center
Phone: 407-859-1245

Danny Hankins
Engineer Technologist, Sr.
Cessna Aircraft Company
Work: 316-517-7053
Mobile: 316-516-8982