John Kennedy

From: Hankins, Danny [dhankins@cessna.textron.com]
Sent: Wednesday, September 28, 2005 5:34 PM
To: 'mike.bowers@faa.gov'
Cc: John Kennedy
Subject: GPS Re-radiator Coordination Request IDP Assembly Bldg

Importance: High


IDP Faciities GPS Re-rad Coord...


IDP Assembly Bldg System Diagr...


IDP Assembly Building #1.pdf (...


IDP Assembly Building #2.pdf (...


IDP Assembly Bldg Re-rad Power...


GPS Networking L1GPSA-10.pdf (...


GPS Networking 2 Port Amplifie...


GPS Networking L1KRRPA-S.pdf (...

Reference FCC File Number 0258-EX-PL-2004

Mike,

I am requesting coordination for a GPS re-radiating system located in Cessna's Assembly Building at IDP. There will be a similar request for the Delivery Building, and another for the Flight Building, both at IDP following before Friday. For the present, the FCC has requested that they be Cc'd on the coordination requests. Would like to discuss. Will try to call early afternoon.

<<IDP Faciities GPS Re-rad Coordination Request.pdf>> <<IDP Assembly Bldg System Diagram.pdf>> <<IDP Assembly Building #1.pdf>> <<IDP Assembly Building #2.pdf>> <<IDP Assembly Bldg Re-rad Power Calculations.pdf>>
<<GPS Networking L1GPSA-10.pdf>> <<GPS Networking 2 Port Amplified Splitter.pdf>> <<GPS Networking L1KRRPA-S.pdf>>

Thanks,

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GPS Networking Inc.

ALDCBS1X2

Technical Product Data

Features

- **Amplifier Gain of 20dB**
  Gain ≥ 20dB

- **Extremely Flat Group Delay**
  Less that 1ns variation

- **Phase Matched Outputs**
  Phase (J1 – J2) < 1.0^{o}

Description

The ALDCBS1X2 GPS Amplified Splitter is a one input, two output device with a 20dB min. gain block. The frequency response covers the GPS L1 & L2 bands with excellent gain flatness. In the normal configuration, one of the splitter RF outputs (J1) passes DC from the connected GPS receiver through the splitter to the antenna, allowing the GPS receiver to power both the antenna and the splitter amp. The other RF output (J2) is DC loaded with a 200Ω resistor to simulate the antenna current draw.

Electrical Specifications, $T_A = 25^0C$

Parameter	Conditions	Min	Typ	Max	Units
Freq. Range	Ant – J1, J2 - 50Ω ; Ant – J2, J1 - 50Ω	1.1		1.7	GHz
In/Out Imped. (1)	Ant, J1, J2		50		Ω
Gain	Normal Configuration, Ant – J1, J2 - 50Ω ; Ant – J2, J1 - 50Ω	20	22	24	dB
	Hi Isolation Config, Ant – J1, J2 - 50Ω ; Ant – J2, J1 - 50Ω	4	6	8	dB
Input SWR	All ports - 50Ω			2.0:1	-
Output SWR	Normal Configuration , All prots - 50Ω			1.8:1	-
	Hi Isolation Config, All prots - 50Ω			1.5:1	-
Noise Figure	Normal Configuration, Ant – J1, J2 - 50Ω ; Ant – J2, J1 - 50Ω		3.3	3.5	dB
	Hi Isolation Config, Ant – J1, J2 - 50Ω ; Ant – J2, J1 - 50Ω		3.6	4.0	dB
Gain Flatness	| L1 – L2 | ; Ant – J1, J2 - 50Ω ; Ant – J2, J1 - 50Ω		0.5	1	dB
Amplitude Balance	| J1 – J2 | ; Ant – J1, J2 - 50Ω ; Ant – J2, J1 - 50Ω			0.5	dB
Phase Balance	Phase (J1 – J2) ; Ant – J1, J2 - 50Ω ; Ant – J2, J1 - 50Ω			1.0	deg
Isolation	Normal Configuration, J1 – J2, Ant - 50Ω	16		30	dB
	Hi Isolation Config, J1 – J2, Ant - 50Ω	42		63	dB
Group delay	$\tau_{d,max} - \tau_{d,min}$: Ant – J1, J2 - 50Ω ; Ant – J2, J1 - 50Ω			1	ns

Flatness					
Req. DC Input V.	Non-Network Configuration, DC Input on J1	3.6		15	Vdc
Current (2)	Amplifier Current Draw, All prots - 50Ω			15	mA

(1). Input/Output Impedance = 75Ω for 75Ω connector option.

(2). Current draw on input DC port in the non-networked configuration.

Available Options

Network Power Supply		
Source Voltage Options	VOLTAGE INPUT	STYLE
	110VAC	Transformer (Wall Mount)
	220 VAC	Transformer (Wall Mount)
	240 VAC (United Kingdom)	Transformer (Wall Mount)
	Customer Supplied DC 8-28 VDC	Military Style Connector
Output Voltage Options (1)	DC VOLTAGE OUT	MAX CURRENT OUT FOR CORRESPONDING Vout(2)
	5 V	110mA
	7.5V	130mA
	9V	140mA
	12V	170mA
	15V	210mA
	Custom	TDB
Output Port Isolation Options		
Isolation Options	Normal Isolation, 16dB min. Output Port – to – Output Port	
	High Isolation, 42dB min. Output Port – to – Output Port	
Pass/Block DC Options		
Pass DC(1)	All Ports Pass DC	
DC Blocked (1)	J2 is DC blocked, Pass DC from J1 to ANT.	
RF Connector Options		
Connector Options	CONNECTOR STYLE	CHARGE
	Type N	NC
	Type SMA	NC
	Type TNC	NC
	Type N - 75Ω	Contact Sales Agent

(1). With Network Option, any RF port (input or output) can be DC blocked or can pass the network DC voltage.

(2). T_A = +50°C. Assuming Source of 110V or 220V Wall Mount Transformer. In general, maximum output current can be determined by:

$$Iout \leq 2.9 / (V_{sourceDC} - V_{out}) \ A$$

Part Number

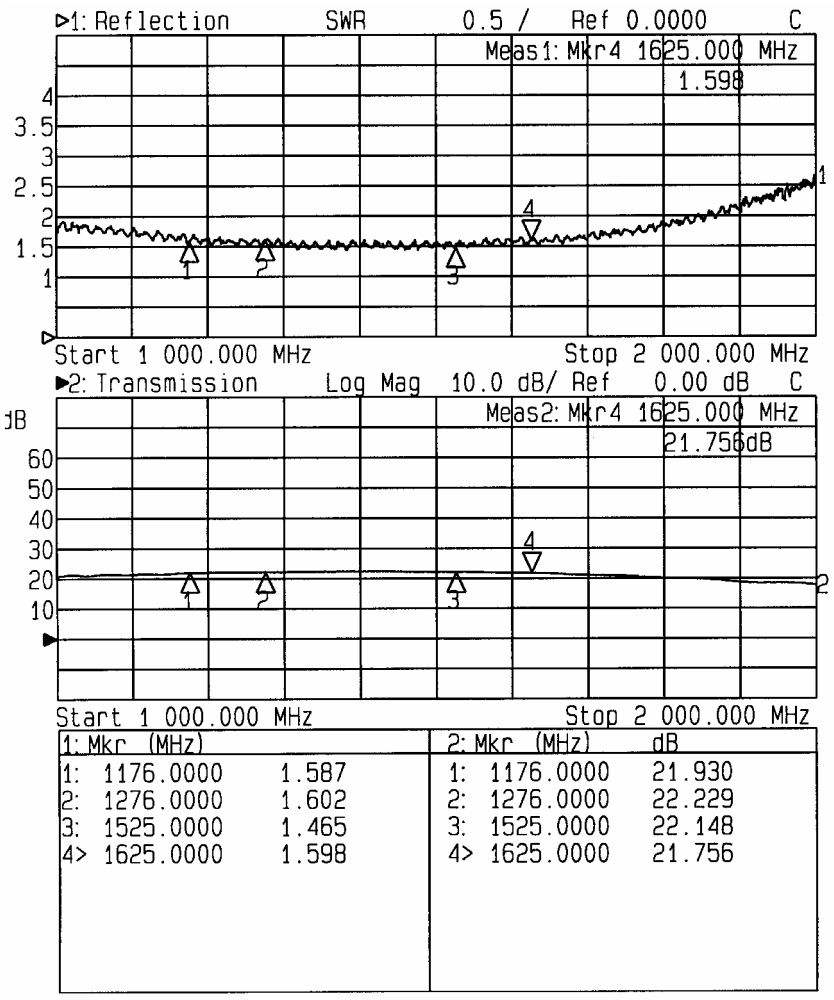
HI N AL DCB S1X2- S / 5 / 110

Isolation Option:
HI =Hi Isolation Opt. ; **Blank** = Normal
Network Option:
N =Network Opt. ; **Blank**: No Network
DC Options:
DCB: DC Blocked ; **PDC**: Pass DC.
Connector Options:
N: N type; **S**: SMA; **T**: TNC; **N75**: N type -75Ω
DC Output Voltage:
5, **7.5**, **9**, **12**, **15**, **CXX** (Custom:"**XX"** denotes the desired V)
Source Voltage:
110 -Transformer, **220** – Transformer, **240** – Transformer, **MC** – Military Conn. (User supplies DV Voltage)

Performance

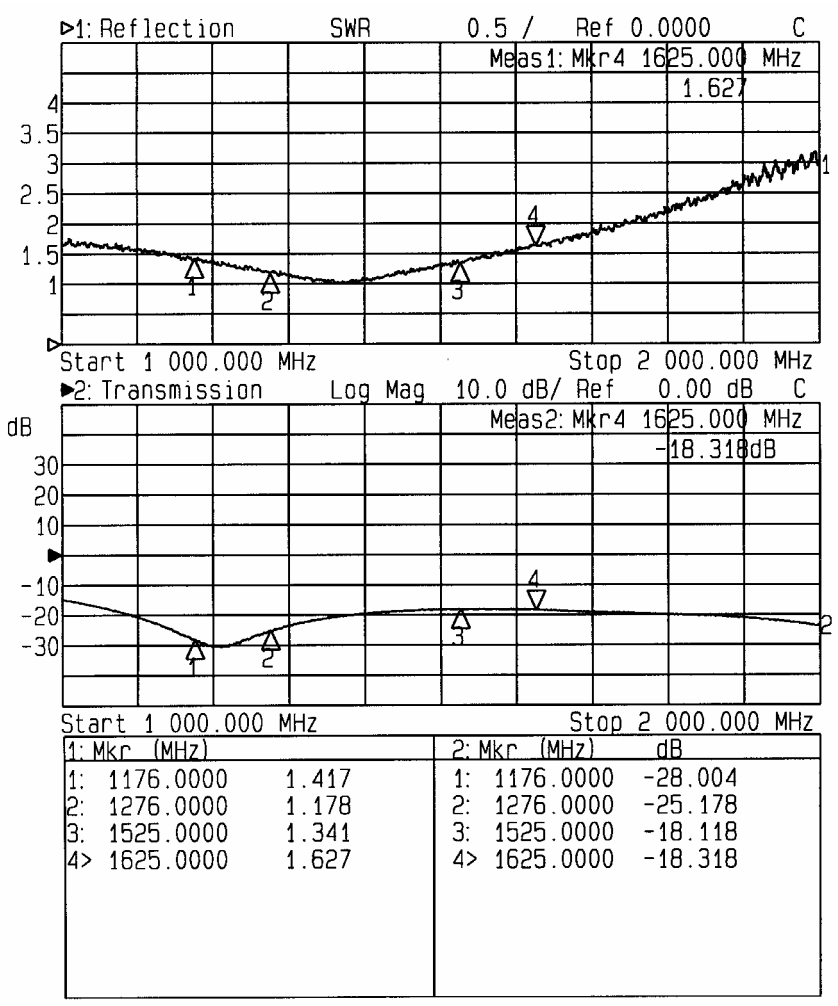
ALDCBS1X2 (Normal Output Isolation Option):

Input SWR (Ant. Port) and Frequency Response: Ant. To J1, J2 (Typical, type N conn.):



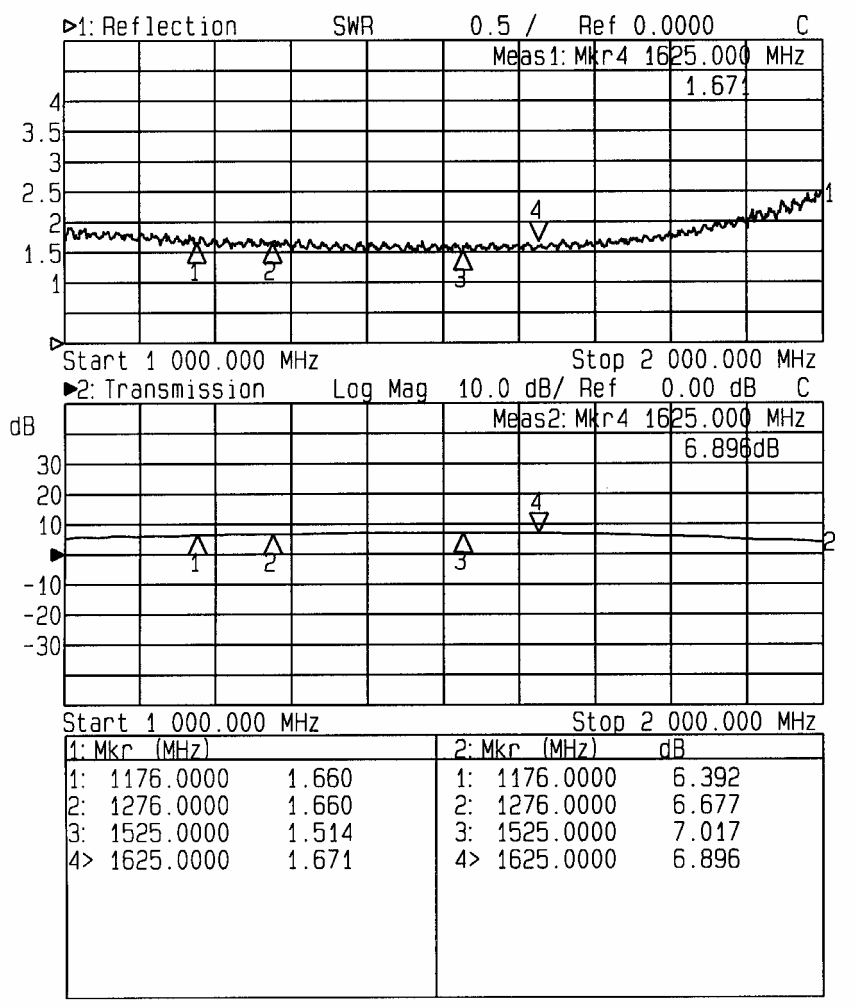
ALDCBS1X2 (Normal Output Isolation Option) (continued):

Output SWR (J1, J2) and Output – to – Output Isolation (S23, S32) (Typical, type N conn.):



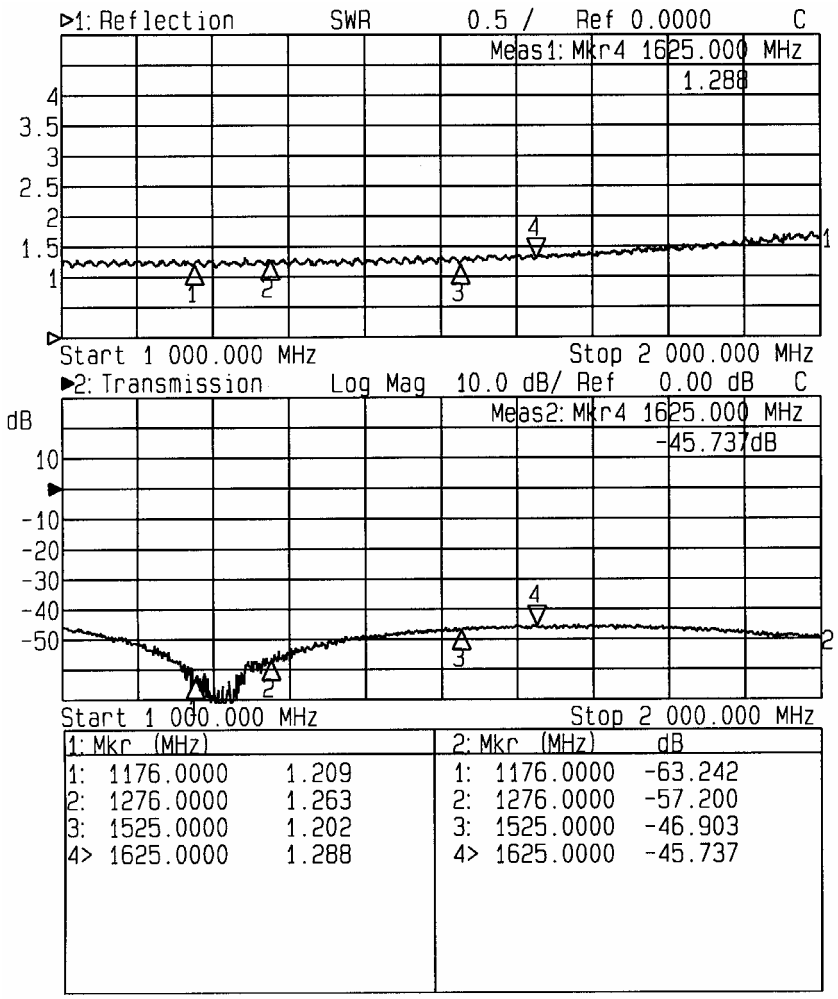
HIALDCBS1X2 (Hi Output Isolation Option):

Input SWR (Ant. Port) and Frequency Response: Ant. To J1, J2 (Typical, type N conn.):



HIALDCBS1X2 (Hi Output Isolation Option) (continued):

Output SWR (J1, J2) and Output – to – Output Isolation (S23, S32) (Typical, type N conn.):



Mechanical

Dimensions: Height: 1.3”

Length (not including connectors) Body: 2.5”
Base Plate: 3.25”

Width (not including connectors): 2.5”

Weight: 10 oz. (286 grams)

Operating Temp. Range: -40^{o} to + 75^{o}C

L1 GPS Active Antenna

The L1GPSA-N GPS antenna is a 38db Gain Antenna designed specifically for the GPS L1 carrier frequency. The L1GPSA-N is powered by 5VDC it receives on the center conductor.

Contact GPS Networking or your Local Dealer for Prices!

Specifications:

ELECTRICAL

Operating Frequency	L1 1575.42 MHZ +/- 1.023 MHz (typ.)
VSWR	1.5:(typ.)
Impedance	50 OHMS
Polarization	Right-hand Circular
Axial Ratio	3db (typ.)
Power Handling	1 Watt
Gain	3.0dBi (typ.) -10dBi min. @ 0 degrees elevation

LOW NOISE AMPLIFIER

Gain	38db
Noise Figure	1.8db
Supply Voltage	5VDC +/- 0.5VDC
Current	20mA (typ.)

MECHANICAL

Weight	300 grams
Dimensions	Dia. 90x 98..4 H mm
Mounting	Pole Mount (Optional)
Connector	N-Type

ENVIRONMENTAL

Temperature	-40C to +85C
Humidity	40 to 95 % RH (Below Dew Point)

IDP Assembly Bldg GPS Re-radiated Power Calculations

Note: The calculations are identical for both re-radiating antennas due to identical components, cable lengths and same distance to 100 ft outside the building.

(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 = -130 dBm
G_1 = Roof Antenna Gain = 41 dBi
G_2 = Re-radiating Antenna Gain = 0.3 dBi
A_1 = Amplifier Gain = 24 dB
C_1 = Coax Attenuation, Roof Antenna to Amplifier
= 5.1 dB/100 ft X 25 ft
= 1.28 dB
C_2 = Coax Attenuation, Amplifier to Re-radiating Antenna
= 5.1 dB/100 ft X 66 ft
= 3.37 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
= (125 ft + 100 ft)/5280

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

FL = 20Log(1575.42) + 20Log((125+100)/5280) +36.56
= 73.1 dB

Inserting these values into equation (1) then becomes:

P_{Rerad} = -130 + 41 + 0.3 + 24 – 1.28 – 3.37 – 73.1
= - 142.45 dBm

GPS Re-radiating Information & Calculations

Assembly Building Re-radiating Antenna #2

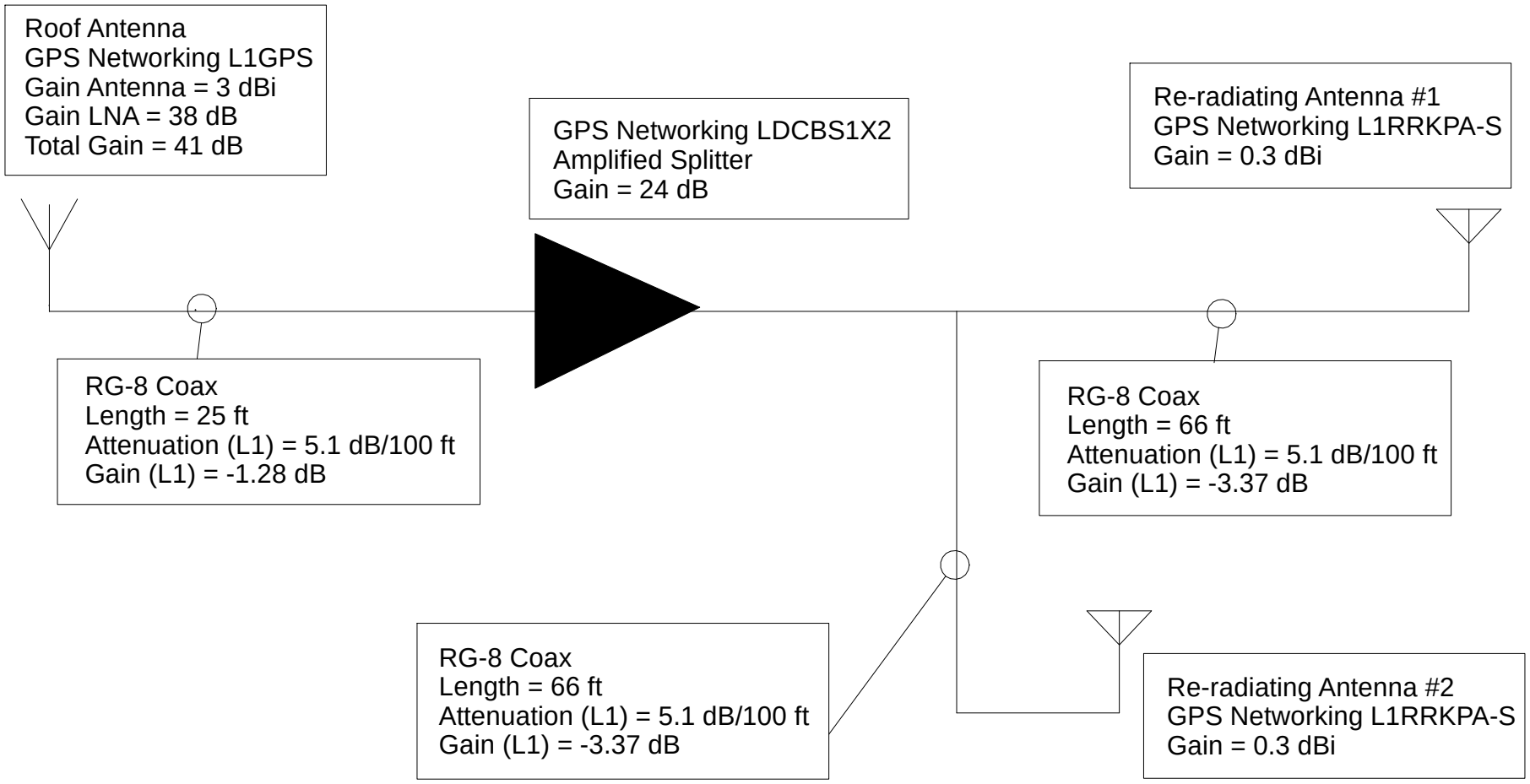
Site Information	
1) Facility Name and Address	Assembly Building, 1 Cessna Blvd. Independence, Ks 67301
2) Point Of Contact Name & Phone	Jerry Williams Facilities Manit. 620-332-0607
3) Location of switch & shutoff instructions	Electrical Panel A-1-LF12 on north wall of high bay, across for column AF12, ckt brk #51
4) Coordinates, NAD 83, ddd-mm-ss.s	37-09-45.2 N, 095-46-21.1 W
5) Coordinate Description	Center of assy building
6) Ground Elevation (ft)	840
Antenna - Receiving (RX)	
7) Make and Model	GPS Networking L1GPS
8) Gain (dBi)	41
Antenna - Re-radiating (TX)	
9) Make and Model	GPS Networking L1RRKPA-S passive antenna
10) Gain (dBi)	0.3
11) Distance to nearest outer wall (ft)	125
12) Location Description	South Final Line
13) Antenna Height AGL (ft)	25
Free Space Loss	73.10
Amplifier	
14) Make and Model	GPS Networking LDCBS1X2 Amplified Splitter
15) Gain (max rating in dB)	24
Coax - RX Antenna to Amp	
16) Type or Description	RG-8
17) Attenuation @1575 MHz (dB/100 ft)	5.1
18) Length (ft)	25
Coax Loss - RX Antenna to Amp	1.275
Coax - Amp to TX Antenna	
19) Type or Description	RG-8
20) Attenuation @1575 MHz (dB/100 ft)	5.1
21) Length (ft)	66
Coax Loss - Amp to TX Antenna	3.366
Attenuator	
22) Make & Model	
23) Attenuation @1575 MHz (dB)	
Calculated Signal Strength 100 ft Outside Building (dBm)*	**-142.44**

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

GPS Re-radiating Information & Calculations Assembly Building Re-radiating Antenna #1	
Site Information	
1) Facility Name and Address	Assembly Building, 1 Cessna Blvd, Independence, Ks 67301
2) Point Of Contact Name & Phone	Jerry Williams Facilities Maint. 620-332-0607
3) Location of switch & shutoff instructions	Electrical Panel A-1-LF12 on north wall of high bay, across from column AF12, ckt. Brk. #51
4) Coordinates, NAD 83, ddd-mm-ss.s	37-09-45.2 N, 095-46-21.1 W
5) Coordinate Description	Center of Assembly Building.
6) Ground Elevation (ft)	840
Antenna - Receiving (RX)	
7) Make and Model	GPS Networking L1GPSA
8) Gain (dBi)	41
Antenna - Re-radiating (TX)	
9) Make and Model	GPS Networking 1RRKPA-S passive antenna
10) Gain (dBi)	0.3
11) Distance to nearest outer wall (ft)	125
12) Location Description	North Final Line
13) Antenna Height AGL (ft)	25
Free Space Loss	73.10
Amplifier	
14) Make and Model	GPS Networking Amplified Splitter LDCBS1X2
15) Gain (max rating in dB)	24
Coax - RX Antenna to Amp	
16) Type or Description	RG-8
17) Attenuation @1575 MHz (dB/100 ft)	5.1
18) Length (ft)	25
Coax Loss - RX Antenna to Amp	1.275
Coax - Amp to TX Antenna	
19) Type or Description	RG-8
20) Attenuation @1575 MHz (dB/100 ft)	5.1
21) Length (ft)	66
Coax Loss - Amp to TX Antenna	3.366
Attenuator	
22) Make & Model	
23) Attenuation @1575 MHz (dB)	
Calculated Signal Strength 100 ft Outside Building (dBm)*	**-142.44**

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

Independence Assembly Bldg L1 System Diagram



Date: 28-Sep-05

To: FAA Central Region HQ
Non-Federal Assignments

Subject: Frequency Coordination Request for IDP Assembly Building

Background

Cessna Aircraft Company (Cessna) is requesting coordination for use of GPS re-radiators at our facilities in Independence, KS. There are three buildings located at IDP, Indepence Municipal Airport for which we will request coordination. This request is for the Assembly building. The other two requests will be for the Delivery and a Flight buildings, and are expected to be submitted before EOB on 30-Sep. GPS re-radiators enable testing of GPS navigation systems installed in aircraft while they are on the production lines and inside hangars.

General Information

Equipment nomenclature, facility information, equipment nomenclature and Point of Contact information for the assembly building are attached to this request. Also attached are documents from the manufacturers containing component specifications for antennas and amplifiers. The 0.3 dB gain value for the 1RRKPA-S passive re-radiating antenna was obtained from GPS Networking technical support via telephone as it is not in their documentation.

Frequencies, Power & Emisssions

Frequencies: M1575.42
Power: 72 pW at the antenna, -140 dBm at 100 ft outside building
Emission Designator: 24M0G1D

System Description & Power Calculations

A diagram of the system is in the attachment "IDP System Diagram Assembly Building.pdf." The complete calculations are in the attachment "IDP Assembly Building Re-rad Power Calculations.pdf."

V/R,

Danny Hankins
Engineer, Technologist Sr.
Cessna Aircraft Company