

Attachment 6 Cygnus NTIA Filing

Purpose: This memorandum is an attachment to the Orbital Sciences Corporation (Orbital) FCC experimental radio license application for the Cygnus spacecraft.

Scope: This memorandum provides the filing used to provide NTIA approval in principle for the Cygnus spacecraft in support of the FCC Office of Engineering and Technology (OET) FCC Form 442. The data is submitted in support of the following application:

Description	Number
FRN:	0016225740
Form 442 Confirmation Number:	EL763271
Form 442 File Number:	0548-EX-PL-2011

UNCLASSIFIED		
SECURITY SUMMARY & SPECIAL HANDLING REQUIREMENTS		
The title of this application is : ORBITAL SCIENCES CYGNUS SPACECRAFT The overall classification of this application is : UNCLASSIFIED		
Refer to your Security Manual for further guidance.		
The Application Level Special Handling is : A Approved for public release; distribution is unlimited (DoD Directive 5230.24)		
DOWNGRADING INSTRUCTIONS		
Special Handling Instruction : A		
CLASSIFICATION		
UNCLASSIFIED		

FULL RECORD PRINT FOR Orbital Sciences Cygnus Spacecraft

Selected Frequencies

(U) 2040.566667 MHz

(U) 2216.000000 MHz

(U) 2205.000000 MHz

System Name : (U) Orbital Sciences Cygnus Spacecraft(Nomenclature)Stage : (U) 2 - ExperimentalAgency : (U) NASA - National Aeronautics and Space AdministrationNTIA Certified : (U) NoOverall Security : UnclassifiedDate/Time Last Mod. : 6/25/2010 2:00:26 PM (GMT)System Description : (U) The Orbital Sciences Cygnus spacecraft is part of the NASA International Space Station (ISS) Program's Commercial Orbital Transportation System (COTS) Project. The Cygnus spacecraft will demonstrate commercial capability to supply cargo to the ISS, and eventually provide cargo commercially under the Commercial Resupply Services (CRS) Project.Target Date(s)System Approval : (U) 9/30/2010System Activation : (U) 2/28/2011System Termination : (U) 2/28/2016NSEP Use : (U) NoITU Waiver : (U) NoReferencesType : OtherRef. To Cert.: NoRef. ID : API/A/4019, IFIC 2565Ref. Title : HTV-R ITU APIRef. Org. : (U) JAXARef. Date : 3/21/2006Ref. Is Class: NoType : OtherRef. To Cert.: NoRef. ID : API/A/3350, IFIC 3524Ref. Title : ATV ITU APIRef. Org. : (U) ESARef. Date : 12/14/2004Ref. Is Class: NoType : Previous CertificationRef. To Cert.: NoRef. ID : SPS-12395/5Ref. Stage : 4 - OperationalRef. Title : NASA TDRS SystemRef. Is Class: NoSource Documents

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- (U) SPS - SPS-12395/5 NASA TDRS System Stage 4
- (U) SPS - API/A/3350, IFIC 3524 ATV ITU API 12/14/2004
- (U) SPS - API/A/4019, IFIC 2565 HTV-R ITU API 3/21/2006

Number Of Units : (U) 6

Estimated Initial Cost of the System : (U) \$60000

Information Transfer Requirement

(U) The Orbital Sciences Cygnus spacecraft will transfer commands, data, and telemetry between the NASA Tracking and Data Relay Satellite System (TDRSS) on a primary basis and Universal Space Network (USN) ground stations and Wallops Flight Facility as required. The TT&C transceiver will use either spread spectrum QPSK or non-spread OQPSK at various data rates while operating at S-band. The Orbital Sciences Cygnus spacecraft will also transfer relative position and other telemetry data to the International Space Station (ISS) during rendezvous operations using S-band via the Proximity Communication System (PROX) operated by the Japanese Aerospace Exploration Agency (JAXA).

System Essentiality

(U) The Cygnus spacecraft is essential to demonstrate the commercial capability to provide cargo to the International Space Station (ISS) under the NASA Commercial Orbital Transportation System (COTS) and Commercial Resupply Services (CRS) Projects. The communication systems described herein are the only means to command and control this spacecraft and as such are vital to a successful mission.

Replacement Information

(U) The NASA COTS Project is part of the effort to bridge the gap between the retiring Space Shuttle and the next generation manned space vehicles. The Orbital Sciences Cygnus spacecraft is not a direct replacement for any existing systems.

Stations

Station Name : (U) Cygnus
City, State/Country : (U) Non-Geostationary, (U) Space
Location Type : (U) Non-geostationary Satellite
Apogee : (U) 350 km
Perigee : (U) 350 km
Equatorial Inclination : (U) 51.6 degrees
Period Of Orbit : (U) 5400 s

Transmitters

(U) Orbital Sciences TT&C Transmitter
(U) Orbital Sciences PLS Transmitter

Receivers

(U) Orbital Sciences TT&C Receiver
(U) Orbital Sciences PLS Receiver

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Antennas

(U) S-band Quadrifilar (48 deg pitch)
(U) S-band Quadrifilar (37 deg pitch)
(U) S-band Monofilar

Station Name : (U) ISS - Generic
City, State/Country : (U) Non-Geostationary, (U) Space
Location Type : (U) Non-geostationary Satellite
Apogee : (U) 350 km
Perigee : (U) 350 km
Equatorial Inclination : (U) 51.6 degrees
Period Of Orbit : (U) 5400 s

Station Name : (U) USN - Laurel, Maryland (Secondary)
Antenna Height : (U) 15.0 m
Min. Point Angle : (U) 5.00 degrees
City, State/Country : (U) Applied Physics Lab, (U) Maryland
Location Type : (U) Single Point
Lat/Lon : (U) 39 11'0"N 76 54'0"W

Transmitters

(U) USN Uplink Transmitter

Receivers

(U) USN Telemetry Receiver

Antennas

(U) John Hopkins Parabolic Antenna

Station Name : (U) USN - South Point, Hawaii (Secondary)
Antenna Height : (U) 15.0 m
Min. Point Angle : (U) 5.00 degrees
City, State/Country : (U) South Point, (U) Hawaii
Location Type : (U) Single Point
Lat/Lon : (U) 19 0'0"N 155 36'0"W

Transmitters

(U) USN Uplink Transmitter

Receivers

(U) USN Telemetry Receiver

Antennas

(U) South Point Parabolic Antenna

Station Name : (U) TDRSS (Primary)
City, State/Country : (U) TDRS E, (U) Space
Location Type : (U) Geosynchronous Satellite
Lat/Lon : (U) 41 0'0"W lat/lon
City, State/Country : (U) TDRS W, (U) Space
Location Type : (U) Geosynchronous Satellite

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Lat/Lon : (U) 174 0'0"W lat/lon
City, State/Country : (U) TDRS Z, (U) Space
Location Type : (U) Geosynchronous Satellite
Lat/Lon : (U) 88 0'0"E lat/lon

Transmitters

(U) Standard TDRS SA Transmitter

Receivers

(U) Standard TDRS SA Receiver

Antennas

(U) TDRS SA Antenna

Station Name : (U) Wallops Flight Facility (Secondary)
Antenna Height : (U) 15.0 m
Min. Point Angle : (U) 5.00 degrees
City, State/Country : (U) Wallops Island, (U) Virginia
Location Type : (U) Single Point
Lat/Lon : (U) 37 55'30"N 75 28'35"W

Transmitters

(U) Wallops S-Band Transmitter

Receivers

(U) Wallops S-Band Receiver

Antennas

(U) 11.3-m S-Band Antenna

Links - Selected Modes**Link****Transmitting Station**

(U) Cygnus

Receiving Station

(U) ISS

Radio Service : Space Operation

Station Class : ET

Radio Service : Space Research

Station Class : EH

Equipment Combination

Transmitter : (U) Orbital Sciences PLS Transmitter

Tx Antenna : (U) S-band Monofilar

Receiver : Generic

Rx Antenna : Generic

Coupling Loss : (U) 14.2 dB

Sp. Power Density : (U) -61.6 dBW/Hz

Selected Modes**Frequency**

(U) 2205.000000 MHz

Em. Des

(U) 6M00G1D

Power

Mean (U) 0.00617 W

Notes

PRI

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(U) 2205.000000 MHz

(U) 6M00G1D

Mean (U) 2.09 W

PRI

Equipment Combination**Transmitter** : (U) Orbital Sciences PLS Transmitter**Tx Antenna** : (U) S-band Quadrifilar (48 deg pitch)**Receiver** : Generic**Rx Antenna** : Generic**Coupling Loss** : (U) 2.88 dB**Sp. Power Density** : (U) -61.6 dBw/HzSelected ModesFrequency

(U) 2205.000000 MHz

(U) 2205.000000 MHz

Em. Des

(U) 6M00G1D

(U) 6M00G1D

Power

Mean (U) 0.00617 W

Mean (U) 2.09 W

Notes

PRI

PRI

Transmitting Station

(U) Cygnus

Receiving Station

(U) TDRSS (Primary)

Radio Service : Space Operation**Station Class** : ETRadio Service : Space Research**Station Class** : EHEquipment Combination**Transmitter** : (U) Orbital Sciences TT&C Transmitter**Tx Antenna** : (U) S-band Quadrifilar (37 deg pitch)**Receiver** : (U) Standard TDRS SA Receiver**Rx Antenna** : (U) TDRS SA Antenna**Coupling Loss** : (U) 3.04 dB**Sp. Power Density** : (U) -30.9 dBw/HzSelected ModesFrequency

(U) 2216.000000 MHz

(U) 2216.000000 MHz

(U) 2216.000000 MHz

(U) 2216.000000 MHz

Em. Des

(U) 42K0G1D

(U) 32K0G1D

(U) 16K0G1D

(U) 6M00G1D

Power

Mean (U) 7.08 W

Mean (U) 7.08 W

Mean (U) 7.08 W

Mean (U) 7.08 W

Notes

PRI

PRI

PRI

PRI

Transmitting Station

(U) Cygnus

Receiving Station

(U) Wallops Flight Facility (Secondary)

Radio Service : Space Operation**Station Class** : ETRadio Service : Space Research**Station Class** : EHEquipment Combination**Transmitter** : (U) Orbital Sciences TT&C Transmitter**Tx Antenna** : (U) S-band Quadrifilar (37 deg pitch)**Receiver** : (U) Wallops S-Band Receiver**Rx Antenna** : (U) 11.3-m S-Band Antenna**Coupling Loss** : (U) 5.44 dB**Sp. Power Density** : (U) -53.3 dBw/HzSelected ModesFrequency

(U) 2216.000000 MHz

Em. Des

(U) 3M00G1D

Power

Mean (U) 7.08 W

Notes

PRI

Transmitting Station

(U) Cygnus

Receiving Station

(U) USN - Laurel, Maryland (Secondary)

FULL RECORD PRINT FOR Orbital Sciences Cygnus Spacecraft

Radio Service : Space OperationStation Class : ETRadio Service : Space ResearchStation Class : EHEquipment CombinationTransmitter : (U) Orbital Sciences TT&C TransmitterTx Antenna : (U) S-band Quadrifilar (37 deg pitch)Receiver : (U) USN Telemetry ReceiverRx Antenna : (U) John Hopkins Parabolic AntennaCoupling Loss : (U) 5.44 dBSp. Power Density : (U) -53.3 dBw/HzSelected ModesFrequency

(U) 2216.000000 MHz

Em. Des

(U) 3M00G1D

Power

Mean (U) 7.08 W

Notes

PRI

Transmitting Station

(U) Cygnus

Receiving Station

(U) USN - South Point, Hawaii (Secondary)

Radio Service : Space OperationStation Class : ETRadio Service : Space ResearchStation Class : EHEquipment CombinationTransmitter : (U) Orbital Sciences TT&C TransmitterTx Antenna : (U) S-band Quadrifilar (37 deg pitch)Receiver : (U) USN Telemetry ReceiverRx Antenna : (U) South Point Parabolic AntennaCoupling Loss : (U) 5.44 dBSp. Power Density : (U) -53.3 dBw/HzSelected ModesFrequency

(U) 2216.000000 MHz

Em. Des

(U) 3M00G1D

Power

Mean (U) 7.08 W

Notes

PRI

LinkTransmitting Station

(U) TDRSS (Primary)

Receiving Station

(U) Cygnus

Radio Service : Space OperationStation Class : ETRadio Service : Space ResearchStation Class : EHEquipment CombinationTransmitter : (U) Standard TDRS SA TransmitterTx Antenna : (U) TDRS SA AntennaReceiver : (U) Orbital Sciences TT&C ReceiverRx Antenna : (U) S-band Quadrifilar (37 deg pitch)Sp. Power Density : (U) -36.0 dBw/HzSelected ModesFrequency

(U) 2040.566667 MHz

Em. Des

(U) 20K0G2D

Power

Mean (U) 5.00 W

Notes

SEC

(U) 2040.566667 MHz

(U) 6M00G1D

Mean (U) 5.00 W

SEC

LinkTransmitting StationReceiving Station

FULL RECORD PRINT FOR Orbital Sciences Cygnus Spacecraft

(U) USN - Laurel, Maryland (Secondary) (U) Cygnus

Radio Service : Space OperationStation Class : TTRadio Service : Space ResearchStation Class : THEquipment CombinationTransmitter : (U) USN Uplink TransmitterTx Antenna : (U) John Hopkins Parabolic AntennaReceiver : (U) Orbital Sciences TT&C ReceiverRx Antenna : (U) S-band Quadrifilar (37 deg pitch)Selected ModesFrequency

(U) 2040.566667 MHz

Em. Des

(U) 20K0G2D

Power

Mean (U) 200 W

Notes

SEC

LinkTransmitting Station

(U) USN - South Point, Hawaii (Secondary)

Receiving Station

(U) Cygnus

Radio Service : Space OperationStation Class : TTRadio Service : Space ResearchStation Class : THEquipment CombinationTransmitter : (U) USN Uplink TransmitterTx Antenna : (U) South Point Parabolic AntennaReceiver : (U) Orbital Sciences TT&C ReceiverRx Antenna : (U) S-band Quadrifilar (37 deg pitch)Selected ModesFrequency

(U) 2040.566667 MHz

Em. Des

(U) 20K0G2D

Power

Mean (U) 200 W

Notes

SEC

LinkTransmitting Station

(U) Wallops Flight Facility (Secondary)

Receiving Station

(U) Cygnus

Radio Service : Space OperationStation Class : TTRadio Service : Space ResearchStation Class : THEquipment CombinationTransmitter : (U) Wallops S-Band TransmitterTx Antenna : (U) 11.3-m S-Band AntennaReceiver : (U) Orbital Sciences TT&C ReceiverRx Antenna : (U) S-band Quadrifilar (37 deg pitch)Selected ModesFrequency

(U) 2040.566667 MHz

Em. Des

(U) 20K0G2D

Power

Mean (U) 200 W

Notes

SEC

FULL RECORD PRINT FOR Orbital Sciences Cygnus Spacecraft

TRANSMITTER USN Uplink Transmitter

Nomenclature : (U) USN Uplink Transmitter
Proxy : True
NTIA Approval Status : (U) Unapproved
Date/Time Last Mod. : 6/24/2010 8:25:29 PM (GMT)
Coordination ID : (U) J/F 12
Freq. Stability : (U) 0.0000000005 Hz
Output Device : (U) Field Effect Transistor
Tuning Method : (U) Digital Synthesizer
Radar/Comm : (U) Communications
Supp. of Harmonics : (U) No

Figure 1 - 2nd Harmonic Curve (U)

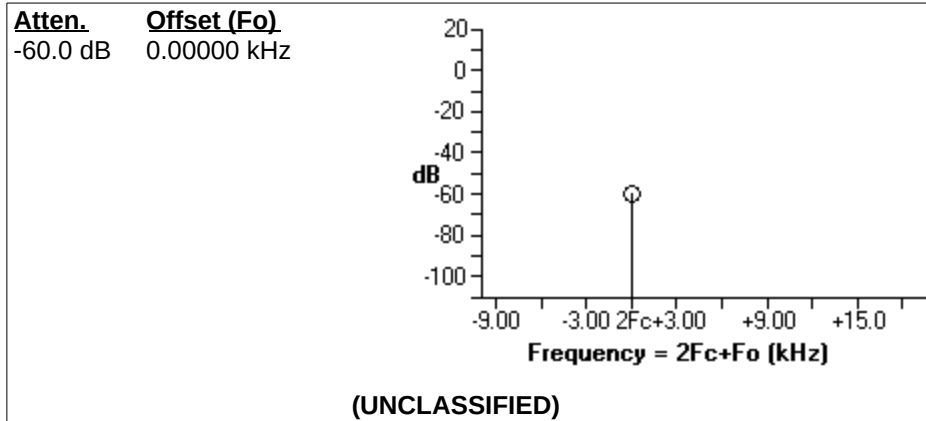
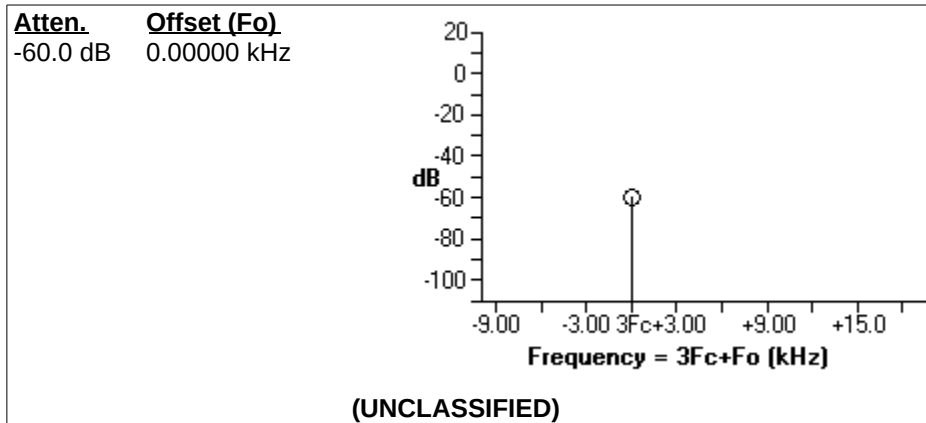
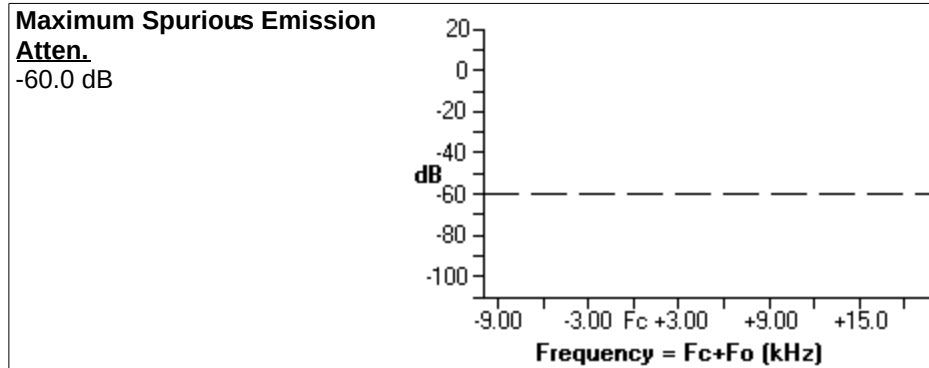


Figure 2 - 3rd Harmonic Curve (U)



FULL RECORD PRINT FOR Orbital Sciences Cygnus Spacecraft

Figure 3 - Spurious Emission Curve (U)



(UNCLASSIFIED)

Frequencies

Fixed Frequency : (U) 2040.566667 MHz

Em. Designator : (U) 20K0G2D

Necessary BW : (U) 20.000 kHz

Modulation - 20K0G2D

Occupied Bandwidth : (U) 20.000 kHz

Measured/Calculated : (U) Calculated

Radar/Communications : (U) Communications

Modulation Type : (U) Digital Modulation

Max. Modulation Frequency : (U) 10.000 kHz

Spread Spectrum : No

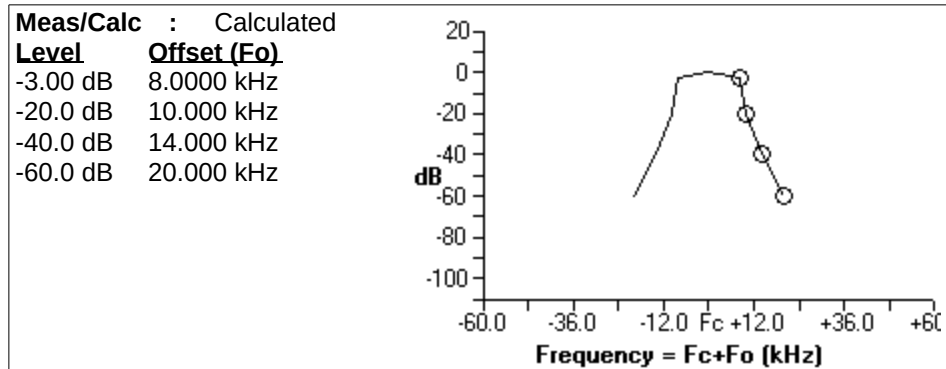
Dig. Modulation Type : (U) BPSK - Binary Phase Shift Keying

Number of Digital States : (U) 2

Digital Bit Rate : (U) 2000 bps

Digital Pulse Format : (U) NRZ-M (non return to zero mark)

Figure 4 - Fundamental Curve (U)



(UNCLASSIFIED)

Powers

Power Type : Mean

Upper Limit : (U) 200 W

FULL RECORD PRINT FOR Orbital Sciences Cygnus Spacecraft

FULL RECORD PRINT FOR Orbital Sciences Cygnus Spacecraft

TRANSMITTER Standard TDRS SA Transmitter

Nomenclature : (U) Standard TDRS SA Transmitter
Proxy : True
Manufacturer : (U) NATIONAL AERONAUTICS AND SPACE ADMINISTRATION
Model Name : (U) TDRS Transmitter
NTIA Approval Status : (U) Unapproved
Date/Time Last Mod. : 6/24/2010 8:59:07 PM (GMT)
Coordination ID : (U) J/F 12
Freq. Stability : (U) 20 ppm
Output Device : (U) Gallium Arsinide Field Effect Transistor
Tuning Method : (U) Digital Synthesizer
Radar/Comm : (U) Communications
Supp. of Harmonics : (U) No

Figure 5 - 2nd Harmonic Curve (U)

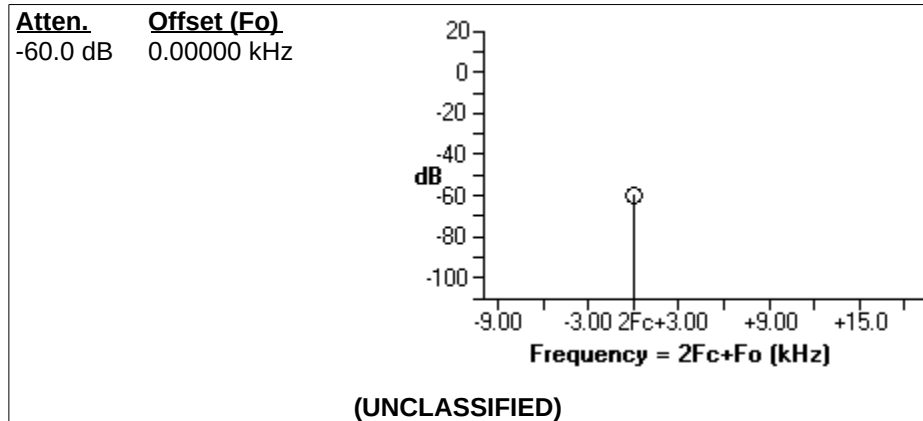
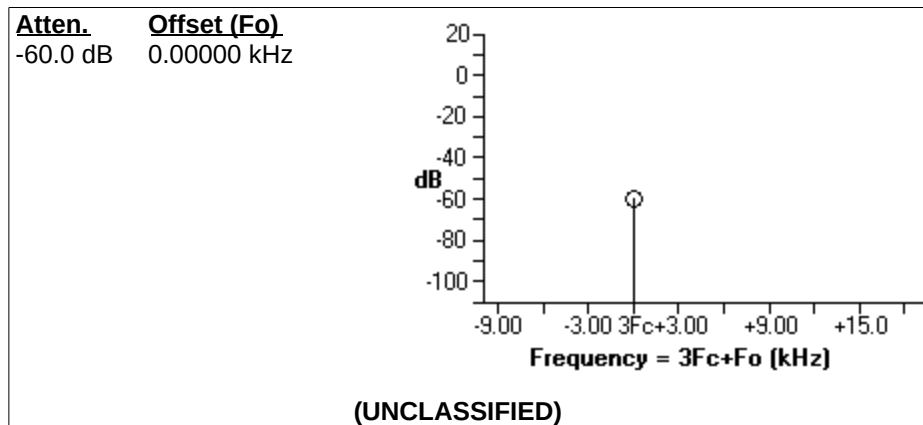
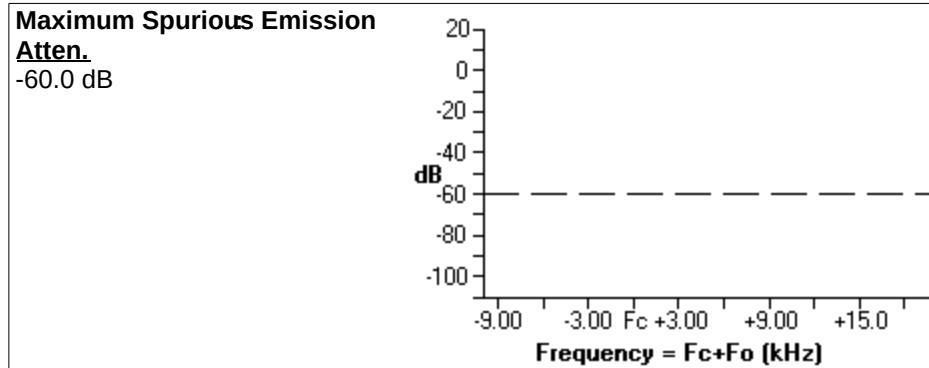


Figure 6 - 3rd Harmonic Curve (U)



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Figure 7 - Spurious Emission Curve (U)



(UNCLASSIFIED)

Frequencies

Fixed Frequency : (U) 2040.566667 MHz

Em. Designator : (U) 6M00G1D

Necessary BW : (U) 6000.0 kHz

Modulation - 6M00G1D

Occupied Bandwidth : (U) 6000.0 kHz

Measured/Calculated : (U) Calculated

Radars/Communications : (U) Communications

Modulation Type : (U) Digital Modulation

Spread Spectrum : Yes

Spread Spectrum Type : (U) Direct Sequence

Spread Spectrum Chip Rate : (U) 2980000 /sec

Information Data Rate : (U) 5960000 bps

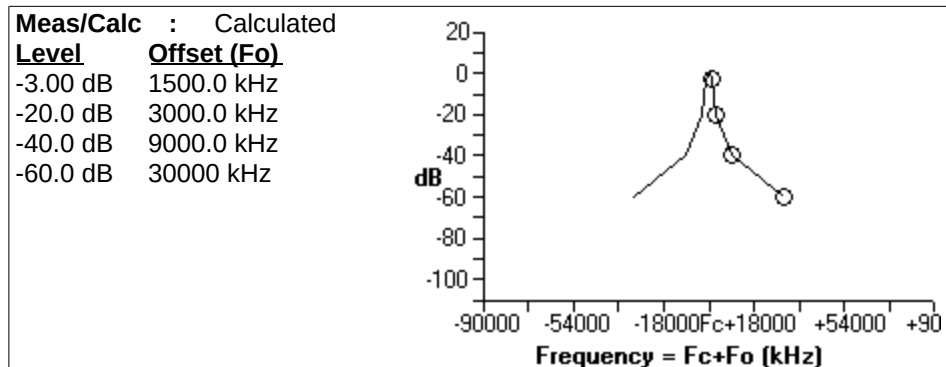
Dig. Modulation Type : (U) OQPSK - Offset Quadrature Phase Shift Keying

Number of Digital States : (U) 2

Digital Bit Rate : (U) 2000 bps

Digital Pulse Format : (U) NRZ-M (non return to zero mark)

Figure 8 - Fundamental Curve (U)



(UNCLASSIFIED)

Em. Designator : (U) 20K0G2D

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Necessary BW : (U) 20.000 kHz

Modulation - 20K0G2D

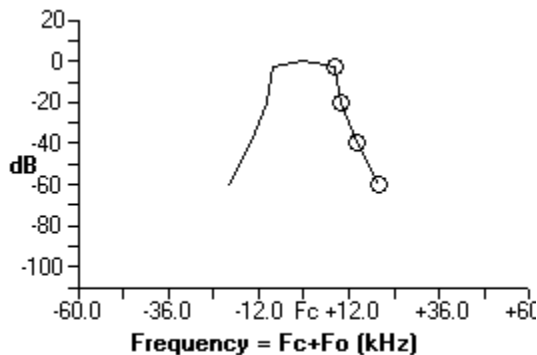
Occupied Bandwidth : (U) 20.000 kHz
 Measured/Calculated : (U) Calculated
 Radar/Communications : (U) Communications
 Modulation Type : (U) Digital Modulation
 Max. Modulation Frequency : (U) 10.000 kHz
 Spread Spectrum : No
 Dig. Modulation Type : (U) BPSK - Binary Phase Shift Keying
 Number of Digital States : (U) 2
 Digital Bit Rate : (U) 2000 bps
 Digital Pulse Format : (U) NRZ-M (non return to zero mark)

Figure 9 - Fundamental Curve (U)

Meas/Calc : Calculated

Level Offset (Fo)

-3.00 dB 8.0000 kHz
 -20.0 dB 10.000 kHz
 -40.0 dB 14.000 kHz
 -60.0 dB 20.000 kHz



(UNCLASSIFIED)

Powers

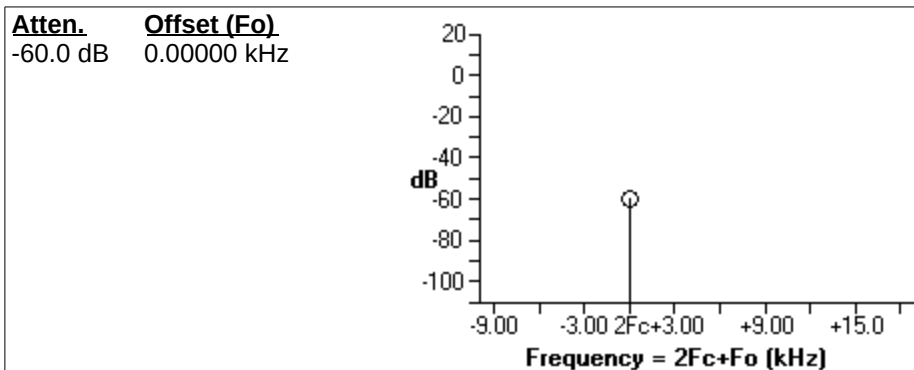
Power Type : Mean
 Upper Limit : (U) 5.00 W

FULL RECORD PRINT FOR Orbital Sciences Cygnus Spacecraft

TRANSMITTER Wallops S-Band Transmitter

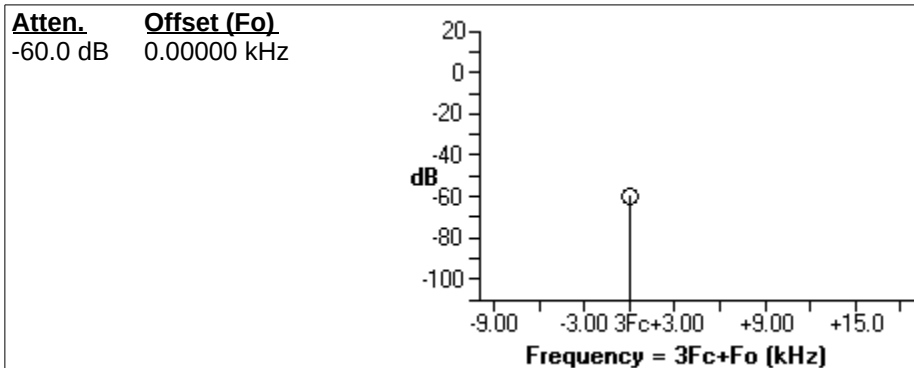
Nomenclature : (U) Wallops S-Band Transmitter
Manufacturer : (U) POWER SYSTEMS TECHNOLOGY INC
Model Name : (U) Wallops WGS
NTIA Approval Status : (U) Unapproved
Date/Time Last Mod. : 6/24/2010 9:01:53 PM (GMT)
Coordination ID : (U) J/F 12
Freq. Stability : (U) 0.001 ppm
Output Device : (U) Field Effect Transistor
Tuning Method : (U) Crystal Controlled Synthesizer
Radar/Comm : (U) Communications
Supp. of Harmonics : (U) Yes

Figure 10 - 2nd Harmonic Curve (U)



(UNCLASSIFIED)

Figure 11 - 3rd Harmonic Curve (U)



(UNCLASSIFIED)

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Figure 12 - Other Harmonic Curve (U)

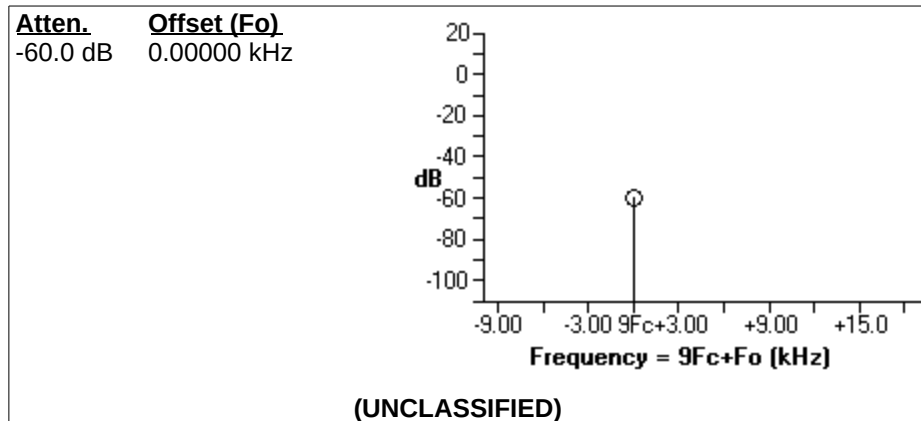
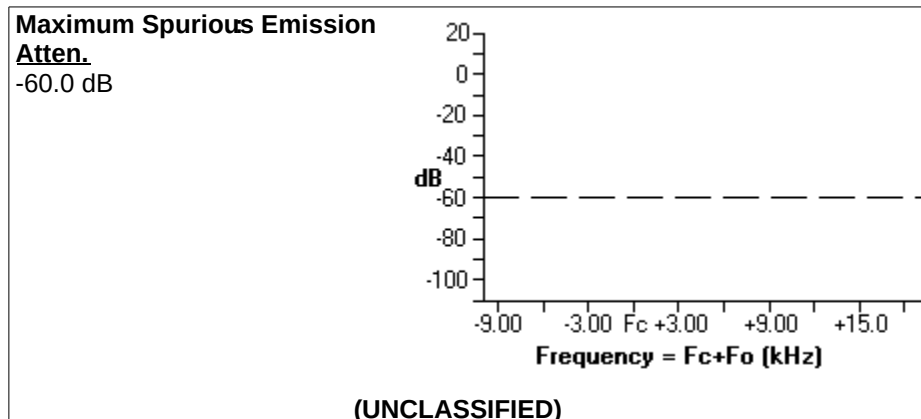


Figure 13 - Spurious Emission Curve (U)



Frequencies

Fixed Frequency : (U) 2040.566667 MHz

Em. Designator : (U) 20K0G2D

Necessary BW : (U) 20.000 kHz

Modulation - 20K0G2D

Occupied Bandwidth : (U) 20.000 kHz

Measured/Calculated : (U) Calculated

Radar/Communications : (U) Communications

Modulation Type : (U) Digital Modulation

Max. Modulation Frequency : (U) 10.000 kHz

Spread Spectrum : No

Dig. Modulation Type : (U) BPSK - Binary Phase Shift Keying

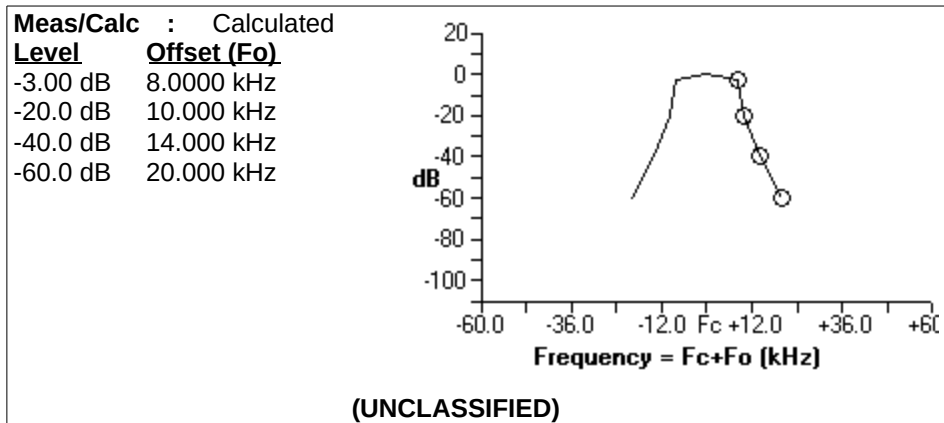
Number of Digital States : (U) 2

Digital Bit Rate : (U) 2000 bps

Digital Pulse Format : (U) NRZ-M (non return to zero mark)

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Figure 14 - Fundamental Curve (U)



Powers

Power Type : Mean
Upper Limit : (U) 200 W

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TRANSMITTER Orbital Sciences PLS Transmitter

Nomenclature : (U) Orbital Sciences PLS Transmitter
Manufacturer : (U) MITSUBISHI DENKI CO. OR MITSUBISHI ELECTRIC
Model Name : (U) PLS Transponder
NTIA Approval Status : (U) Unapproved
Date/Time Last Mod. : 6/25/2010 1:56:43 PM (GMT)
Coordination ID : (U) J/F 12
Freq. Stability : (U) 1 ppm
Output Device : (U) Gallium Arsinide Field Effect Transistor
Tuning Method : (U) PLL Synthesizer
Radar/Comm : (U) Communications
Supp. of Harmonics : (U) Yes

Figure 15 - 2nd Harmonic Curve (U)

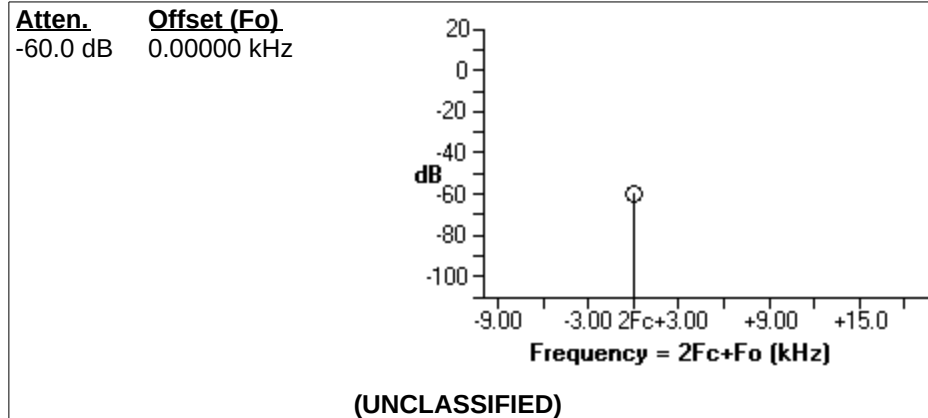
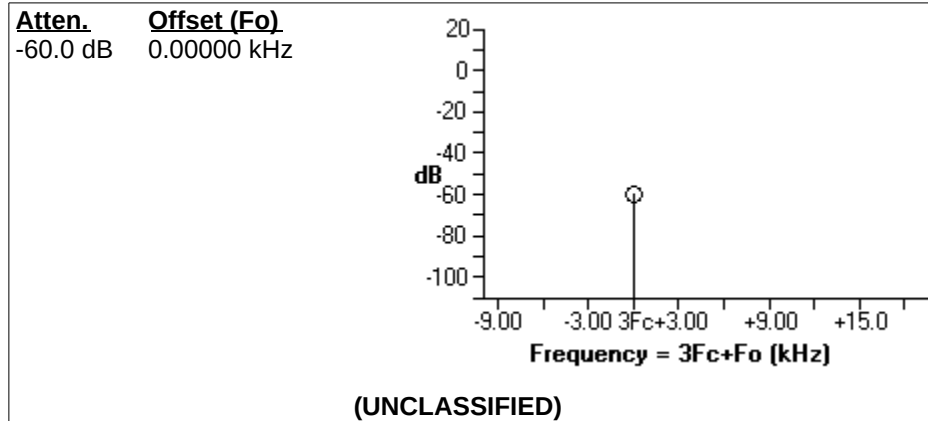


Figure 16 - 3rd Harmonic Curve (U)



FULL RECORD PRINT FOR Orbital Sciences Cygnus Spacecraft

Figure 17 - Other Harmonic Curve (U)

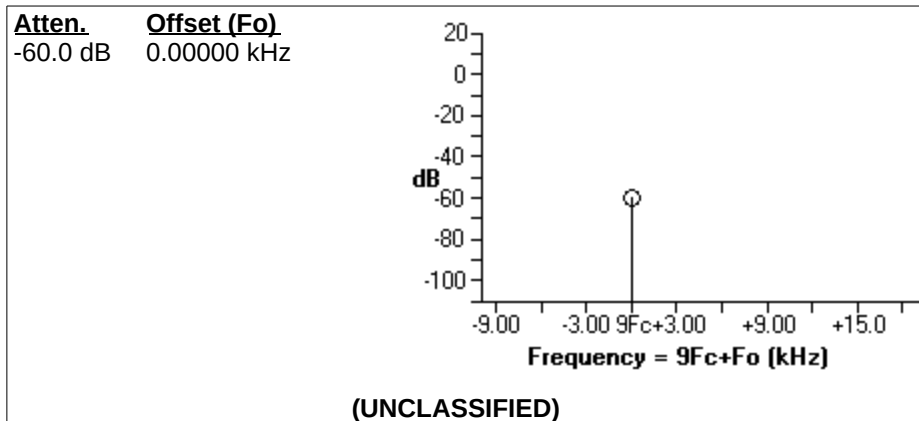
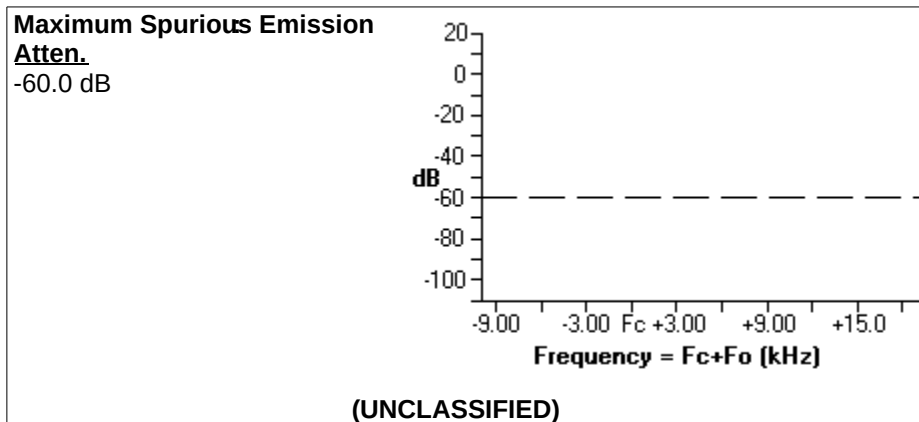


Figure 18 - Spurious Emission Curve (U)

Frequencies

Fixed Frequency : (U) 2205.000000 MHz

Em. Designator : (U) 6M00G1D

Necessary BW : (U) 6000.0 kHz

Modulation - 6M00G1D

Occupied Bandwidth : (U) 6000.0 kHz

Measured/Calculated : (U) Calculated

Radar/Communications : (U) Communications

Modulation Type : (U) Digital Modulation

Spread Spectrum : Yes

Spread Spectrum Type : (U) Direct Sequence

Spread Spectrum Chip Rate : (U) 2970000 /sec

Information Data Rate : (U) 5940000 bps

Dig. Modulation Type : (U) OQPSK - Offset Quadrature Phase Shift Keying

Number of Digital States : (U) 4

Digital Bit Rate : (U) 16000 bps

FULL RECORD PRINT FOR Transmitter

Digital Pulse Format : (U) Non-return to Zero
Figure 19 - Fundamental Curve (U)

Meas/Calc : Calculated

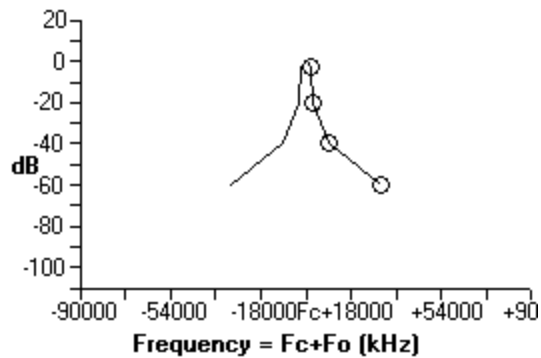
Level Offset (Fo)

-3.00 dB 2200.0 kHz

-20.0 dB 3000.0 kHz

-40.0 dB 9000.0 kHz

-60.0 dB 30000 kHz



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Powers

Power Type : Mean

Upper Limit : (U) 2.09 W

Power Type : Mean

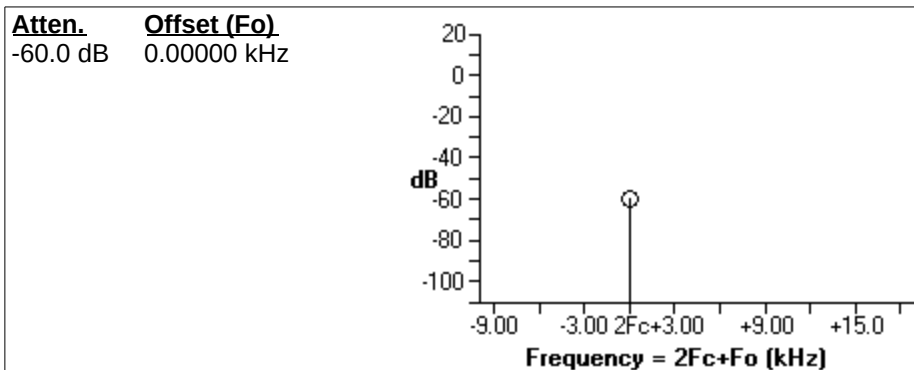
Upper Limit : (U) 0.00617 W

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TRANSMITTER Orbital Sciences TT&C Transmitter

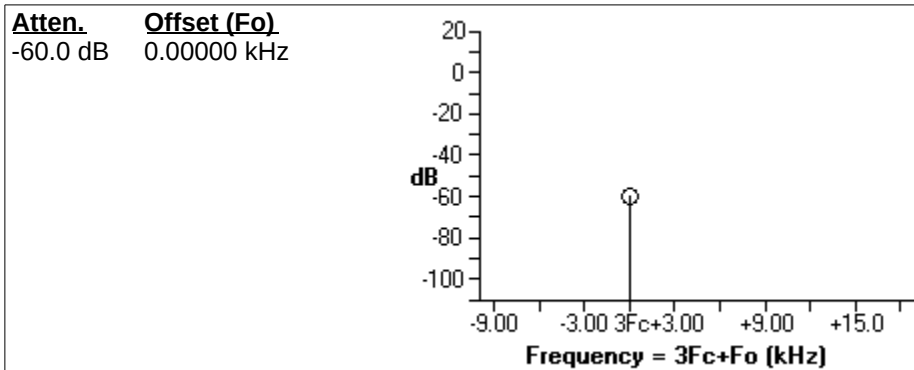
Nomenclature : (U) Orbital Sciences TT&C Transmitter
Manufacturer : (U) THALES ALENIA SPACE
Model Name : (U) ISBT Transceiver
NTIA Approval Status : (U) Unapproved
Date/Time Last Mod. : 6/25/2010 2:00:26 PM (GMT)
Coordination ID : (U) J/F 12
Freq. Stability : (U) 1 ppm
Output Device : (U) Gallium Arsinide Field Effect Transistor
Tuning Method : (U) PLL Synthesizer
Radar/Comm : (U) Communications
Supp. of Harmonics : (U) Yes

Figure 20 - 2nd Harmonic Curve (U)



(UNCLASSIFIED)

Figure 21 - 3rd Harmonic Curve (U)



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Figure 22 - Other Harmonic Curve (U)

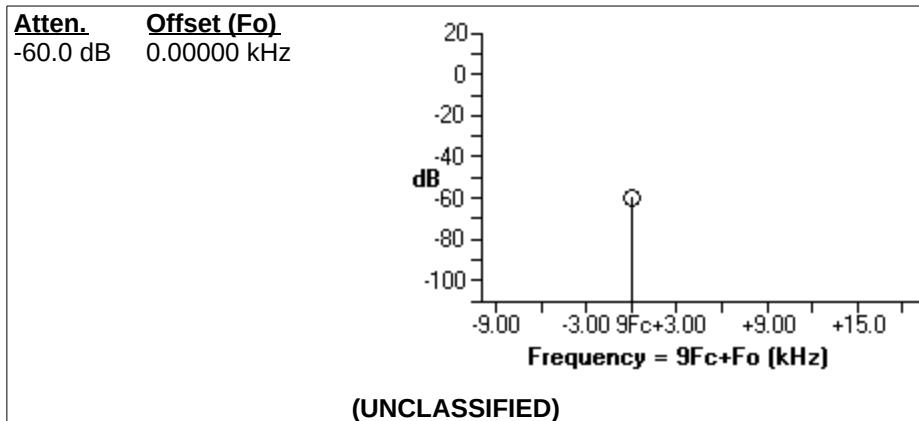
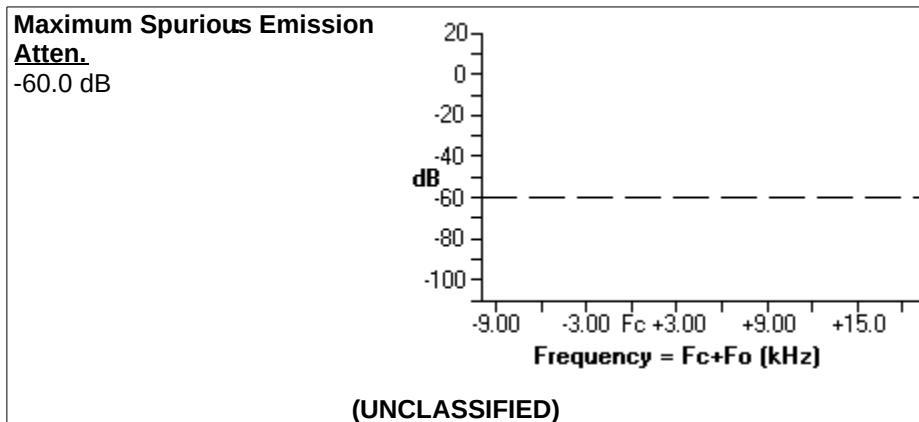


Figure 23 - Spurious Emission Curve (U)

Frequencies

Fixed Frequency : (U) 2216.000000 MHz

Em. Designator : (U) 6M00G1D

Necessary BW : (U) 6000.0 kHz

Modulation - 6M00G1D

Occupied Bandwidth : (U) 6000.0 kHz

Measured/Calculated : (U) Calculated

Radar/Communications : (U) Communications

Modulation Type : (U) Digital Modulation

Spread Spectrum : Yes

Spread Spectrum Type : (U) Direct Sequence

Spread Spectrum Chip Rate : (U) 2980000 /sec

Information Data Rate : (U) 5960000 bps

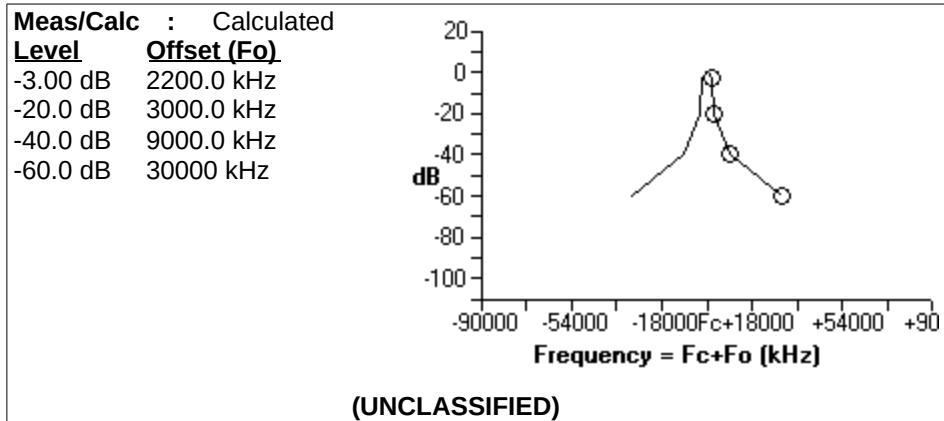
Dig. Modulation Type : (U) OQPSK - Offset Quadrature Phase Shift Keying

Number of Digital States : (U) 4

Digital Bit Rate : (U) 41958 bps

FULL RECORD PRINT FOR Transmitter

Digital Pulse Format : (U) NRZ-M (non return to zero mark)
 Figure 24 - Fundamental Curve (U)



Em. Designator : (U) 16K0G1D

Necessary BW : (U) 16.000 kHz

Modulation - 16K0G1D

Occupied Bandwidth : (U) 16.000 kHz

Measured/Calculated : (U) Calculated

Radar/Communications : (U) Communications

Modulation Type : (U) Digital Modulation

Spread Spectrum : No

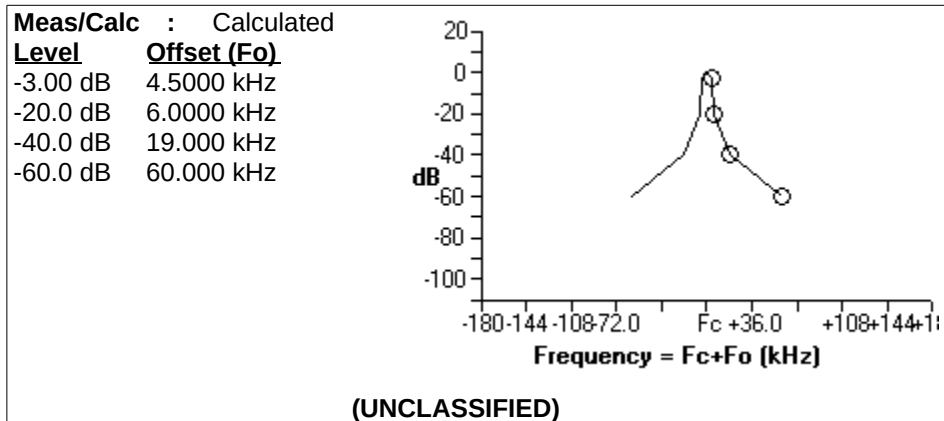
Dig. Modulation Type : (U) OQPSK - Offset Quadrature Phase Shift Keying

Number of Digital States : (U) 4

Digital Bit Rate : (U) 16000 bps

Digital Pulse Format : (U) NRZ-M (non return to zero mark)

Figure 25 - Fundamental Curve (U)



Em. Designator : (U) 3M00G1D

Necessary BW : (U) 3000.0 kHz

Modulation - 3M00G1D

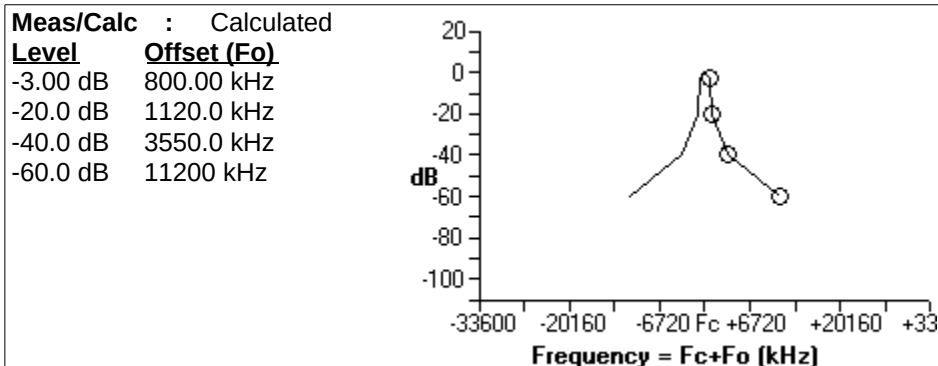
Occupied Bandwidth : (U) 3000.0 kHz

Measured/Calculated : (U) Calculated

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Radar/Communications : (U) Communications
Modulation Type : (U) Digital Modulation
Spread Spectrum : No
Dig. Modulation Type : (U) QPSK - Quadrature Phase Shift Keying
Number of Digital States : (U) 4
Digital Bit Rate : (U) 3000000 bps
Digital Pulse Format : (U) NRZ-M (non return to zero mark)

Figure 26 - Fundamental Curve (U)

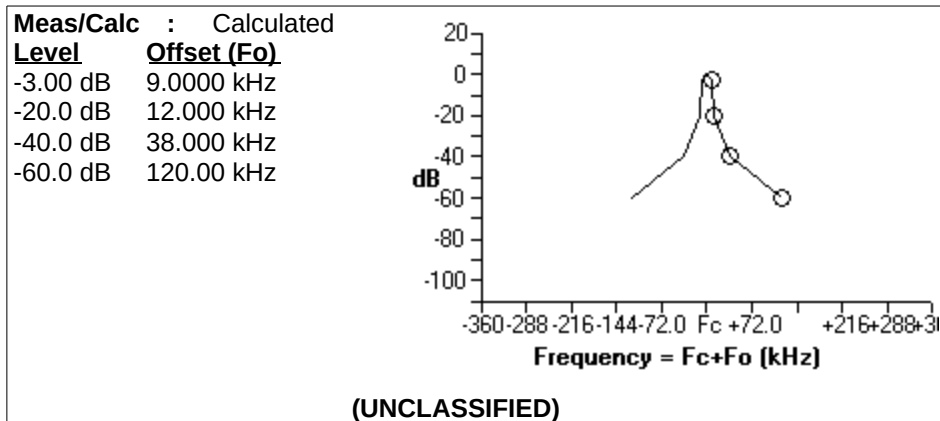


(UNCLASSIFIED)

Em. Designator : (U) 32K0G1D
Necessary BW : (U) 32.000 kHz
Modulation - 32K0G1D
Occupied Bandwidth : (U) 32.000 kHz
Measured/Calculated : (U) Calculated
Radar/Communications : (U) Communications
Modulation Type : (U) Digital Modulation
Spread Spectrum : No
Dig. Modulation Type : (U) OQPSK - Offset Quadrature Phase Shift Keying
Number of Digital States : (U) 4
Digital Bit Rate : (U) 32000 bps
Digital Pulse Format : (U) NRZ-M (non return to zero mark)

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Figure 27 - Fundamental Curve (U)

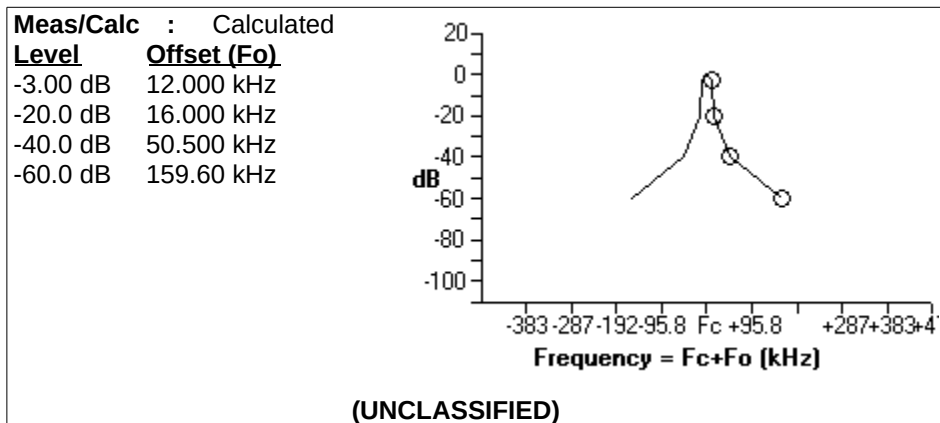


Em. Designator : (U) 42K0G1D
Necessary BW : (U) 42.000 kHz

Modulation - 42K0G1D

Occupied Bandwidth : (U) 42.000 kHz
Measured/Calculated : (U) Calculated
Radar/Communications : (U) Communications
Modulation Type : (U) Digital Modulation
Spread Spectrum : No
Dig. Modulation Type : (U) OQPSK - Offset Quadrature Phase Shift Keying
Number of Digital States : (U) 4
Digital Bit Rate : (U) 41958 bps
Digital Pulse Format : (U) NRZ-M (non return to zero mark)

Figure 28 - Fundamental Curve (U)



Powers

Power Type : Mean
Upper Limit : (U) 7.08 W

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RECEIVER USN Telemetry Receiver

Nomenclature : (U) USN Telemetry Receiver
Proxy : True
Manufacturer : (U) MICRODYNE CORP
Model Name : (U) 700-MR
NTIA Approval Status : (U) Unapproved
Date/Time Last Mod. : 6/24/2010 8:40:12 PM (GMT)
Coordination ID : (U) J/F 12
Freq. Stability : (U) 0.0000015 Hz
Image Reject : (U) 80.0dB
Oscillator Tuned : (U) Above
Tuning Method : (U) Digital Synthesizer

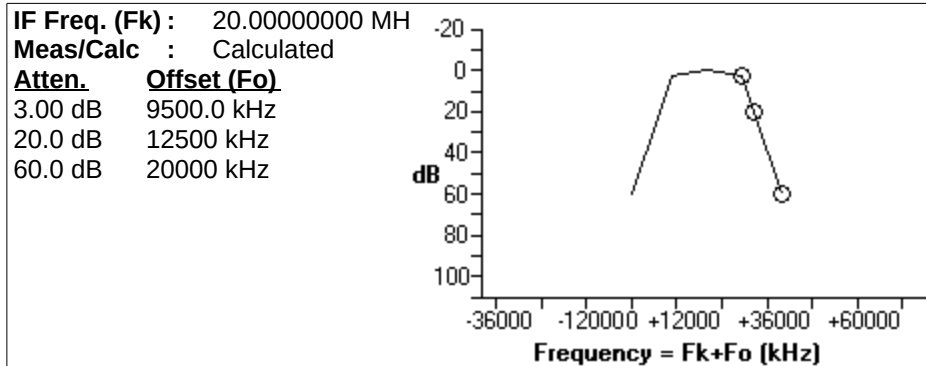
Frequencies

Fixed Frequency : (U) 2216.000000 MHz

Sensitivities

Em. Designator : (U) 3M00G1D
Necessary BW : (U) 3000.0 kHz
Perf. Crit. : (U) BER - Bit Error Rate
Perf. Value : (U) 0.00001
Sensitivity : (U) -110 dBm
Noise Fig. : (U) 2.19 dB
Noise Temp. : (U) 190 K
Spur. Reject : (U) 60.0 dB

Figure 29 - IF Selectivity Curve (U)



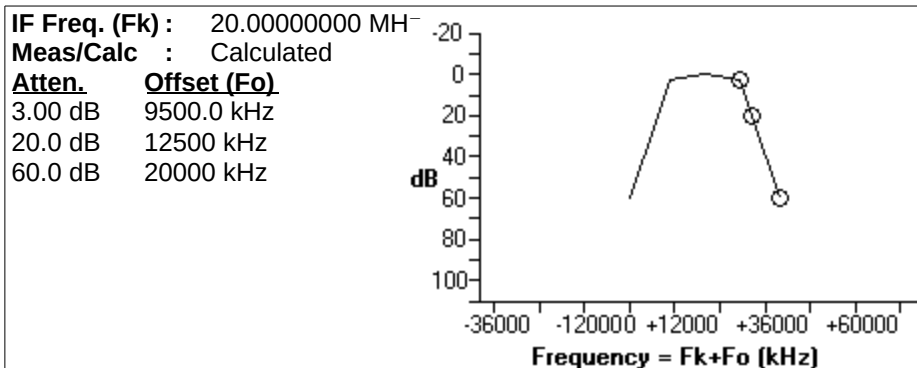
(UNCLASSIFIED)

Sensitivities

Em. Designator : (U) 16K0G1D
Necessary BW : (U) 16.000 kHz
Perf. Crit. : (U) BER - Bit Error Rate
Perf. Value : (U) 0.00001
Sensitivity : (U) -132 dBm
Noise Fig. : (U) 2.19 dB
Noise Temp. : (U) 190 K
Spur. Reject : (U) 60.0 dB

FULL RECORD PRINT FOR Orbital Sciences Cygnus Spacecraft

Figure 30 - IF Selectivity Curve (U)

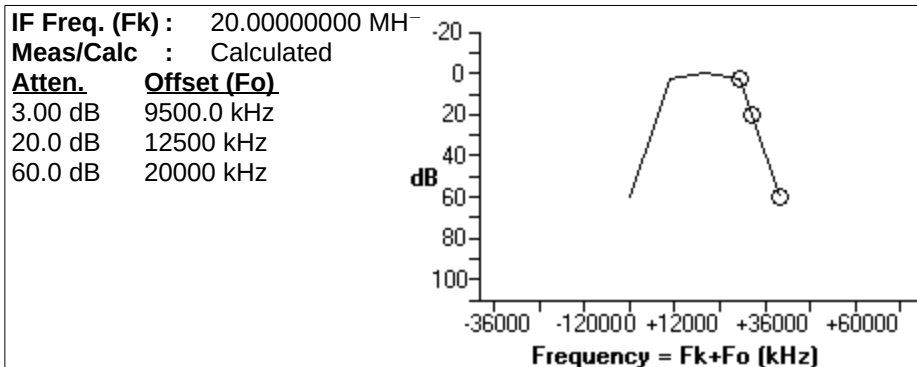


(UNCLASSIFIED)

Sensitivities

Em. Designator : (U) 32K0G1D
 Necessary BW : (U) 32.000 kHz
 Perf. Crit. : (U) BER - Bit Error Rate
 Perf. Value : (U) 0.00001
 Sensitivity : (U) -130 dBm
 Noise Fig. : (U) 2.19 dB
 Noise Temp. : (U) 190 K
 Spur. Reject : (U) 60.0 dB

Figure 31 - IF Selectivity Curve (U)



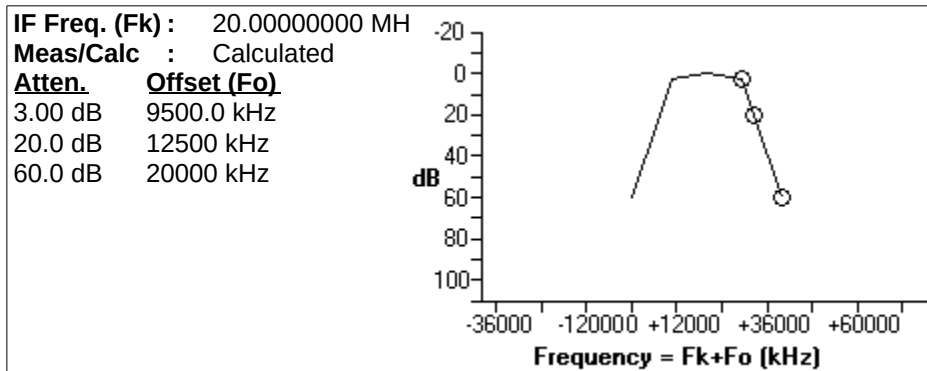
(UNCLASSIFIED)

Sensitivities

Em. Designator : (U) 42K0G1D
 Necessary BW : (U) 42.000 kHz
 Perf. Crit. : (U) BER - Bit Error Rate
 Perf. Value : (U) 0.00001
 Sensitivity : (U) -128 dBm
 Noise Fig. : (U) 2.19 dB

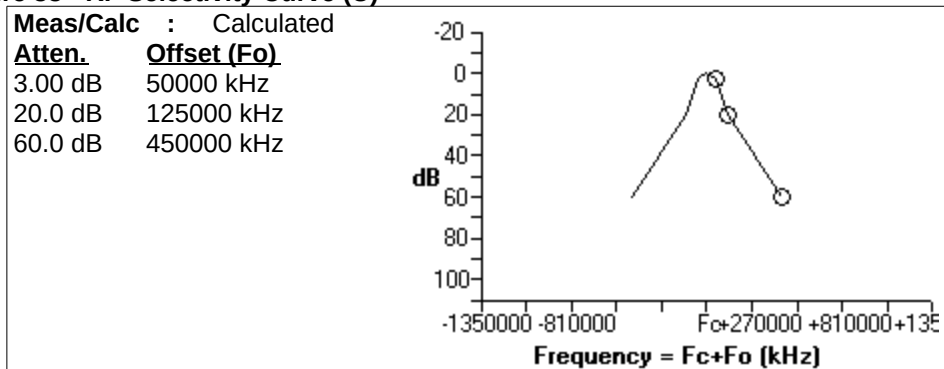
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Noise Temp. : (U) 190 K
Spur. Reject : (U) 60.0 dB
Figure 32 - IF Selectivity Curve (U)



(UNCLASSIFIED)

Figure 33 - RF Selectivity Curve (U)



(UNCLASSIFIED)

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RECEIVER Standard TDRS SA Receiver

Nomenclature : (U) Standard TDRS SA Receiver
Proxy : True
Manufacturer : (U) NATIONAL AERONAUTICS AND SPACE ADMINISTRATION
Model Name : (U) TDRS Receiver
NTIA Approval Status : (U) Unapproved
Date/Time Last Mod. : 2/25/2010 8:45:43 PM (GMT)
Coordination ID : (U) J/F 12
Freq. Stability : (U) 20 ppm
Image Reject : (U) 80.0dB
Oscillator Tuned : (U) Above
Tuning Method : (U) Digital Synthesizer

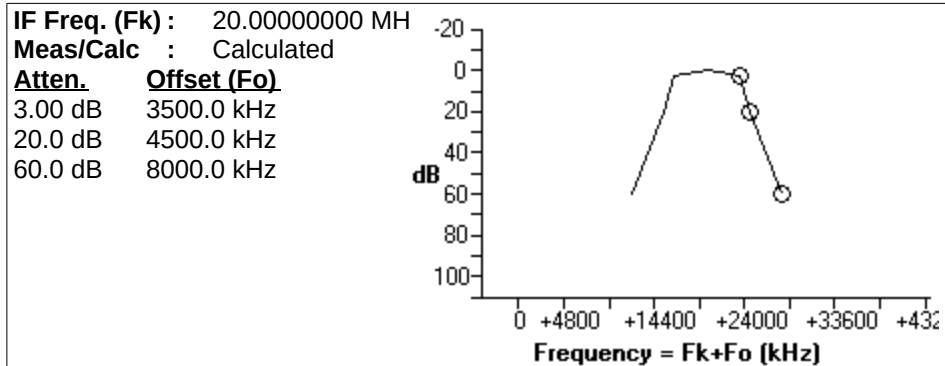
Frequencies

Fixed Frequency : (U) 2216.000000 MHz

Sensitivities

Em. Designator : (U) 6M00G1D
Necessary BW : (U) 6000.0 kHz
Perf. Crit. : (U) BER - Bit Error Rate
Perf. Value : (U) 0.00001
Sensitivity : (U) -138 dBm
Noise Fig. : (U) 3.44 dB
Noise Temp. : (U) 350 K
Spur. Reject : (U) 60.0 dB

Figure 34 - IF Selectivity Curve (U)



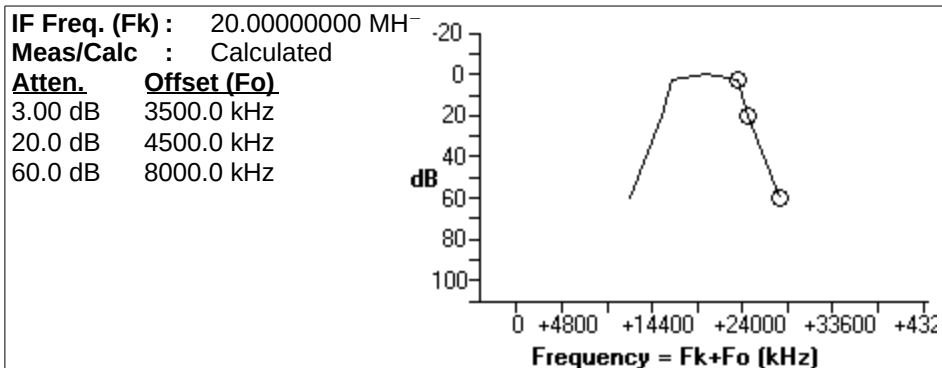
(UNCLASSIFIED)

Sensitivities

Em. Designator : (U) 42K0G1D
Necessary BW : (U) 42.000 kHz
Perf. Crit. : (U) BER - Bit Error Rate
Perf. Value : (U) 0.00001
Sensitivity : (U) -155 dBm
Noise Fig. : (U) 3.44 dB
Noise Temp. : (U) 350 K
Spur. Reject : (U) 60.0 dB

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Figure 35 - IF Selectivity Curve (U)

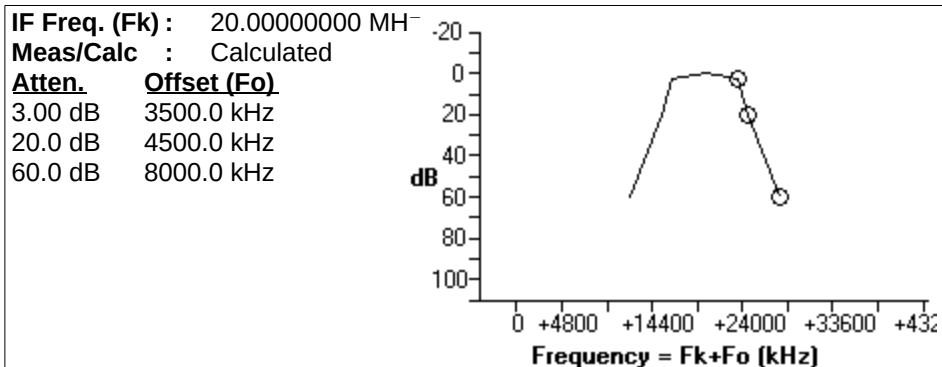


(UNCLASSIFIED)

Sensitivities

Em. Designator : (U) 32K0G1D
 Necessary BW : (U) 32.000 kHz
 Perf. Crit. : (U) BER - Bit Error Rate
 Perf. Value : (U) 0.00001
 Sensitivity : (U) -157 dBm
 Noise Fig. : (U) 3.44 dB
 Noise Temp. : (U) 350 K
 Spur. Reject : (U) 60.0 dB

Figure 36 - IF Selectivity Curve (U)



(UNCLASSIFIED)

Sensitivities

Em. Designator : (U) 16K0G1D
 Necessary BW : (U) 16.000 kHz
 Perf. Crit. : (U) BER - Bit Error Rate
 Perf. Value : (U) 0.00001
 Sensitivity : (U) -160 dBm
 Noise Fig. : (U) 3.44 dB

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Noise Temp. : (U) 350 K
 Spur. Reject : (U) 60.0 dB
 Figure 37 - IF Selectivity Curve (U)

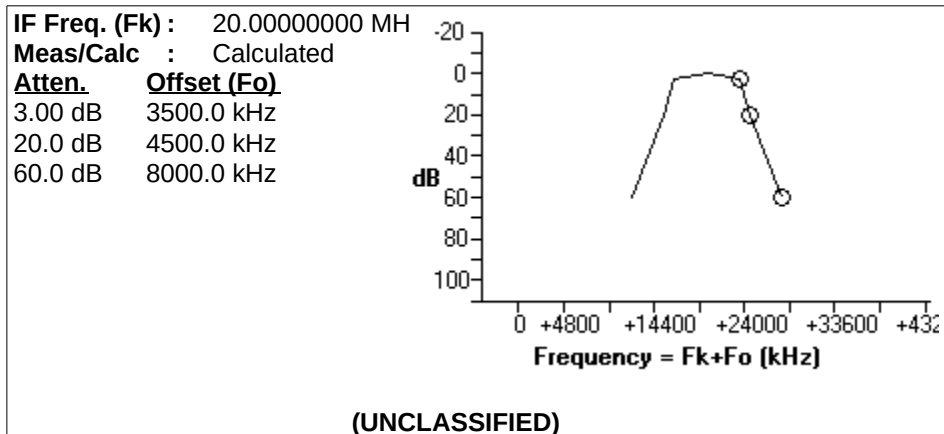
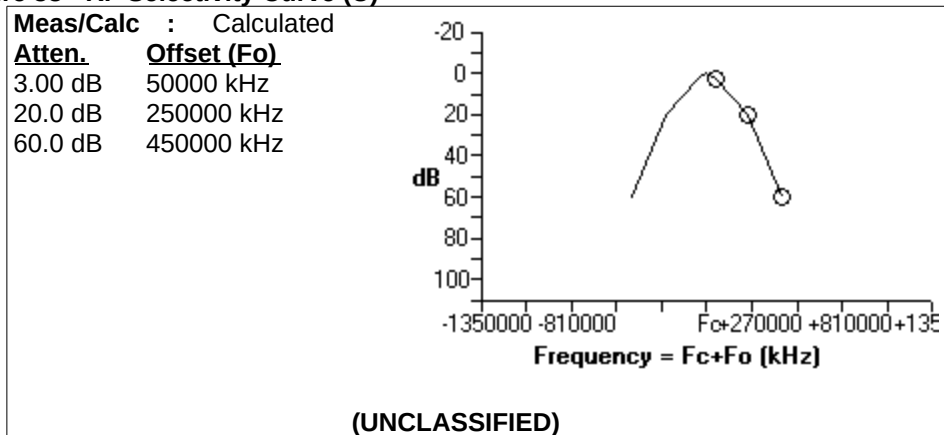


Figure 38 - RF Selectivity Curve (U)



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RECEIVER Wallops S-Band Receiver

Nomenclature : (U) Wallops S-Band Receiver
Manufacturer : (U) SCIENTIFIC ATLANTA CO.
Model Name : (U) SA-930
NTIA Approval Status : (U) Unapproved
Date/Time Last Mod. : 6/24/2010 8:57:57 PM (GMT)
Coordination ID : (U) J/F 12
Freq. Stability : (U) 0.01 ppm
Image Reject : (U) 80.0dB
Oscillator Tuned : (U) Above
Tuning Method : (U) Crystal Controlled Synthesizer

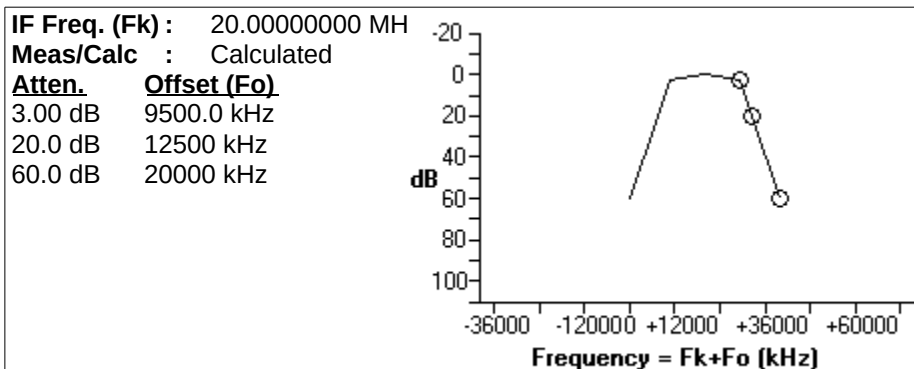
Frequencies

Fixed Frequency : (U) 2216.000000 MHz

Sensitivities

Em. Designator : (U) 3M00G1D
Necessary BW : (U) 3000.0 kHz
Perf. Crit. : (U) BER - Bit Error Rate
Perf. Value : (U) 0.00001
Sensitivity : (U) -104 dBm
Noise Fig. : (U) 1.30 dB
Noise Temp. : (U) 101 K
Spur. Reject : (U) 60.0 dB
Intermod. Reject : (U) 60.0 dB
Adj. Channel Sel. : (U) 60.0 dB

Figure 39 - IF Selectivity Curve (U)



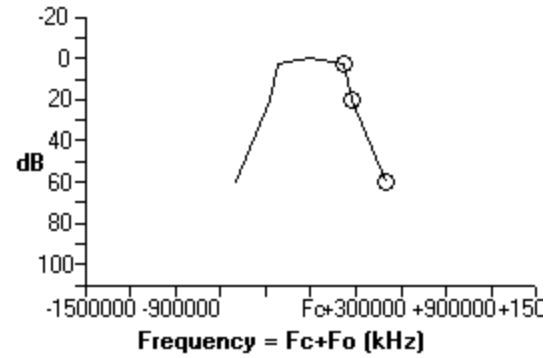
(UNCLASSIFIED)

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Figure 40 - RF Selectivity Curve (U)

Meas/Calc : Calculated

Atten.	Offset (Fo)
3.00 dB	225000 kHz
20.0 dB	272000 kHz
60.0 dB	500000 kHz



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RECEIVER Orbital Sciences PLS Receiver

Nomenclature : (U) Orbital Sciences PLS Receiver
Manufacturer : (U) MITSUBISHI DENKI CO. OR MITSUBISHI ELECTRIC
Model Name : (U) PLS Receiver
NTIA Approval Status : (U) Unapproved
Date/Time Last Mod. : 6/24/2010 8:11:04 PM (GMT)
Coordination ID : (U) J/F 12
Freq. Stability : (U) 1 ppm
Image Reject : (U) 60.0dB
Oscillator Tuned : (U) Either
Tuning Method : (U) PLL Synthesizer
Cond. Undesired Em. : (U) -40.0dBm

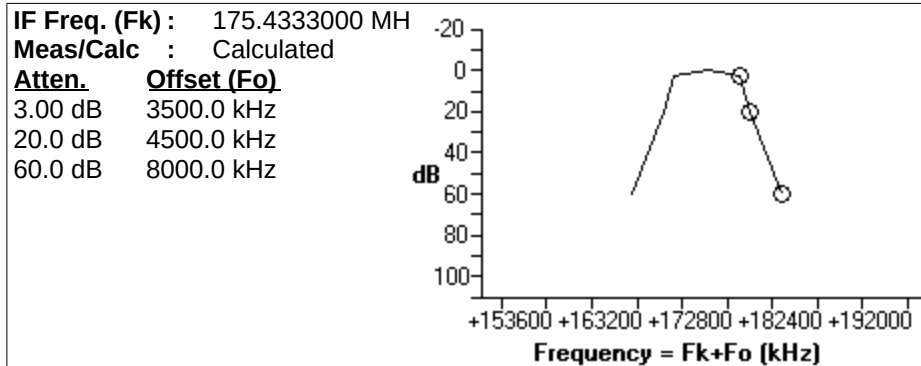
Frequencies

Fixed Frequency : (U) 2030.437500 MHz

Sensitivities

Em. Designator : (U) 6M00G1D
Necessary BW : (U) 6000.0 kHz
Perf. Crit. : (U) BER - Bit Error Rate
Perf. Value : (U) 0.000001
Sensitivity : (U) -124 dBm
Noise Fig. : (U) 2.50 dB
Noise Temp. : (U) 226 K
Spur. Reject : (U) 60.0 dB

Figure 41 - IF Selectivity Curve (U)



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RECEIVER Orbital Sciences TT&C Receiver

Nomenclature : (U) Orbital Sciences TT&C Receiver
Manufacturer : (U) THALES ALENIA SPACE
Model Name : (U) ISBT Receiver
NTIA Approval Status : (U) Unapproved
Date/Time Last Mod. : 6/24/2010 7:49:19 PM (GMT)
Coordination ID : (U) J/F 12
Freq. Stability : (U) 1 ppm
Image Reject : (U) 60.0dB
Oscillator Tuned : (U) Either
Tuning Method : (U) PLL Synthesizer

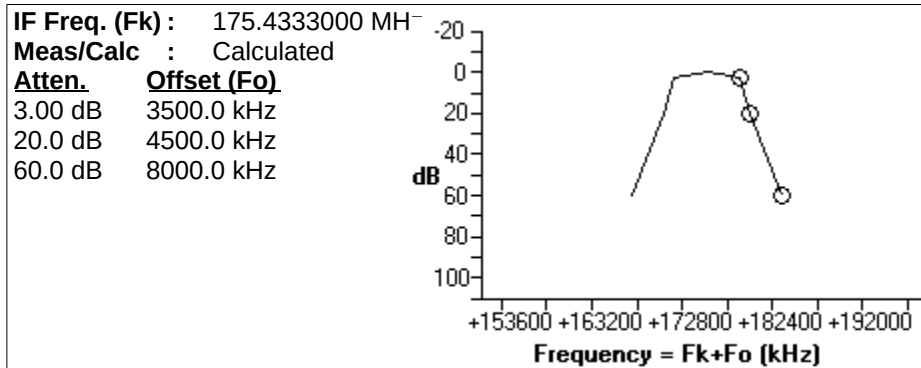
Frequencies

Fixed Frequency : (U) 2040.566667 MHz

Sensitivities

Em. Designator : (U) 20K0G2D
Necessary BW : (U) 20.000 kHz
Perf. Crit. : (U) BER - Bit Error Rate
Perf. Value : (U) 0.00001
Sensitivity : (U) -123 dBm
Noise Fig. : (U) 4.11 dB
Noise Temp. : (U) 457 K
Spur. Reject : (U) 60.0 dB

Figure 42 - IF Selectivity Curve (U)



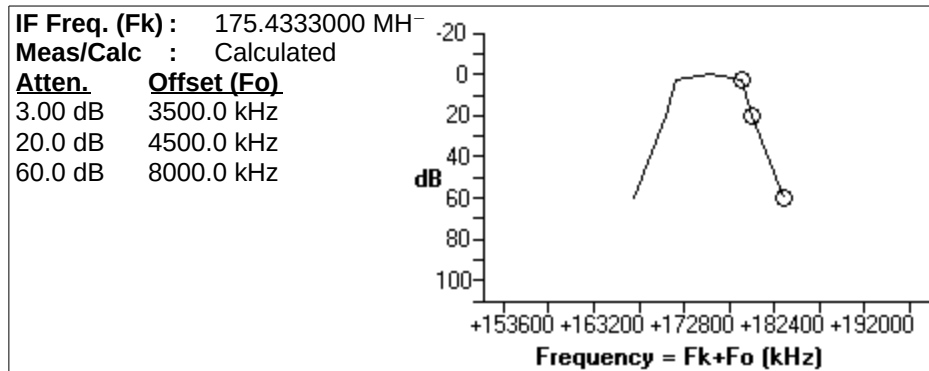
(UNCLASSIFIED)

Sensitivities

Em. Designator : (U) 6M00G1D
Necessary BW : (U) 6000.0 kHz
Perf. Crit. : (U) BER - Bit Error Rate
Perf. Value : (U) 0.00001
Sensitivity : (U) -124 dBm
Noise Fig. : (U) 4.11 dB
Noise Temp. : (U) 457 K
Spur. Reject : (U) 60.0 dB

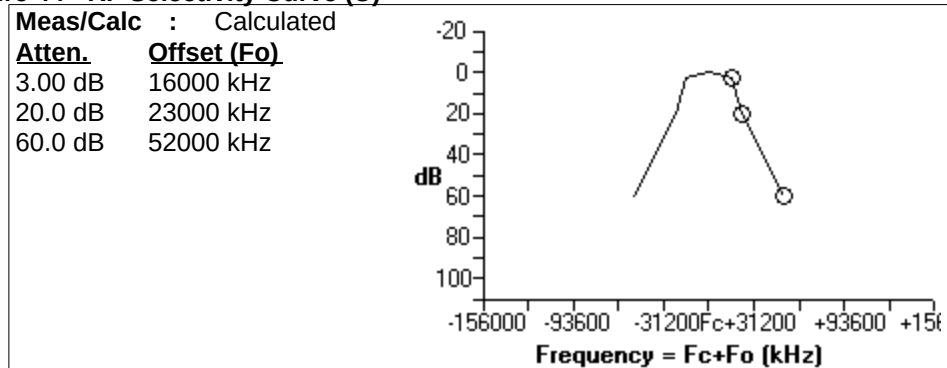
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Figure 43 - IF Selectivity Curve (U)



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Figure 44 - RF Selectivity Curve (U)



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FULL RECORD PRINT FOR Orbital Sciences Cygnus Spacecraft

ANTENNA South Point Parabolic Antenna

Nomenclature : (U) South Point Parabolic Antenna
Proxy : True
Antenna Code : Aperture
Manufacturer : (U) L-3 SPACE COMMUNICATIONS
Model Name : (U) 1453
NTIA Approval Status : (U) Unapproved
Date/Time Last Mod. : 6/24/2010 8:11:58 PM (GMT)
Coordination ID : (U) J/F 12
Lower Freq. Limit : (U) 2025.000000 MHz
Upper Freq. Limit : (U) 2300.000000 MHz
Polarization : (U) Right Hand Circular
Main Beam Gain : (U) 46.3 dBi
1st Horz. Sidelobe Atten. : (U) 20.0 dB
1st Vert. Sidelobe Atten. : (U) 20.0 dB
Atten. Rel/Act : (U) Relative dB
1st Horz. Pos. : (U) 3.00 degrees
1st Vert. Pos. : (U) 3.00 degrees
Gain Fr. to Bk. : (U) 56.0 dB
Horz. Beamwidth : (U) 0.700 degrees
Vert. Beamwidth : (U) 0.700 degrees
Horz. Scan Type : (U) Raster
Horz. Scan Speed : (U) 4.00 degrees/sec
Horz. Scan Rate : (U) 8.00 scans/min
Horz. Scan Type : (U) Raster
Vert. Scan Type : (U) Raster
Vert. Scan Speed : (U) 8.50 degrees/sec
Vert. Scan Rate : (U) 6.00 scans/min
Vert. Max. Elev. : (U) 90.0 degrees
Vert. Min. Elev. : (U) 5.00 degrees
Dish Diameter : (U) 13.0 meters

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ANTENNA S-band Monofilar

Nomenclature : (U) S-band Monofilar
Antenna Code : Linear
Manufacturer : (U) ORBITAL SCIENCES CORP.
Model Name : (U) 634145310000
NTIA Approval Status : (U) Unapproved
Date/Time Last Mod. : 6/24/2010 8:11:51 PM (GMT)
Coordination ID : (U) J/F 12
Lower Freq. Limit : (U) 2000.000000 MHz
Upper Freq. Limit : (U) 2300.000000 MHz
Polarization : (U) Right Hand Circular
Main Beam Gain : (U) 10.5 dBi
1st Horz. Sidelobe Atten. : (U) 14.0 dB
1st Vert. Sidelobe Atten. : (U) 14.0 dB
Atten. Rel/Act : (U) Relative dB
Horz. Beamwidth : (U) 20.0 degrees
Vert. Beamwidth : (U) 20.0 degrees

FULL RECORD PRINT FOR Orbital Sciences Cygnus Spacecraft

ANTENNA S-band Quadrifilar (37 deg pitch)

Nomenclature	:	(U) S-band Quadrifilar (37 deg pitch)
Antenna Code	:	Linear
Manufacturer	:	(U) ORBITAL SCIENCES CORP.
Model Name	:	(U) 634145330000
NTIA Approval Status	:	(U) Unapproved
Date/Time Last Mod.	:	2/24/2010 11:16:34 PM (GMT)
Coordination ID	:	(U) J/F 12
Lower Freq. Limit	:	(U) 2000.000000 MHz
Upper Freq. Limit	:	(U) 2300.000000 MHz
Polarization	:	(U) Right Hand Circular
Main Beam Gain	:	(U) 2.83 dBi
1st Horz. Sidelobe Atten.	:	(U) 14.0 dB
1st Vert. Sidelobe Atten.	:	(U) 14.0 dB
Atten. Rel/Act	:	(U) Relative dB
Horz. Beamwidth	:	(U) 60.0 degrees
Vert. Beamwidth	:	(U) 60.0 degrees

FULL RECORD PRINT FOR Orbital Sciences Cygnus Spacecraft

ANTENNA S-band Quadrifilar (48 deg pitch)

Nomenclature	:	(U) S-band Quadrifilar (48 deg pitch)
Antenna Code	:	Linear
Manufacturer	:	(U) ORBITAL SCIENCES CORP.
Model Name	:	(U) 634145320000
NTIA Approval Status	:	(U) Unapproved
Date/Time Last Mod.	:	2/24/2010 11:15:19 PM (GMT)
Coordination ID	:	(U) J/F 12
Lower Freq. Limit	:	(U) 2000.000000 MHz
Upper Freq. Limit	:	(U) 2300.000000 MHz
Polarization	:	(U) Right Hand Circular
Main Beam Gain	:	(U) 2.28 dBi
1st Horz. Sidelobe Atten.	:	(U) 14.0 dB
1st Vert. Sidelobe Atten.	:	(U) 14.0 dB
Atten. Rel/Act	:	(U) Relative dB
Horz. Beamwidth	:	(U) 60.0 degrees
Vert. Beamwidth	:	(U) 60.0 degrees

FULL RECORD PRINT FOR Orbital Sciences Cygnus Spacecraft

ANTENNA John Hopkins Parabolic Antenna

Nomenclature : (U) John Hopkins Parabolic Antenna
Proxy : True
Antenna Code : Aperture
NTIA Approval Status : (U) Unapproved
Date/Time Last Mod. : 5/21/2008 8:02:31 PM (GMT)
Coordination ID : (U) J/F 12
Lower Freq. Limit : (U) 2025.000000 MHz
Upper Freq. Limit : (U) 2300.000000 MHz
Polarization : (U) Left Hand Circular
Main Beam Gain : (U) 50.9 dBi
1st Horz. Sidelobe Atten. : (U) 20.0 dB
1st Vert. Sidelobe Atten. : (U) 20.0 dB
Atten. Rel/Act : (U) Relative dB
1st Horz. Pos. : (U) 0.700 degrees
1st Vert. Pos. : (U) 0.700 degrees
Gain Fr. to Bk. : (U) 61.0 dB
Horz. Beamwidth : (U) 0.300 degrees
Vert. Beamwidth : (U) 0.300 degrees
Dish Diameter : (U) 18.0 meters

FULL RECORD PRINT FOR Orbital Sciences Cygnus Spacecraft

ANTENNA TDRS SA Antenna

Nomenclature : (U) TDRS SA Antenna
Antenna Code : Aperture
Manufacturer : (U) NATIONAL AERONAUTICS AND SPACE ADMINISTRATION
Model Name : (U) TDRS SA Antenna
NTIA Approval Status : (U) Unapproved
Date/Time Last Mod. : 6/24/2010 8:56:56 PM (GMT)
Coordination ID : (U) J/F 12
Lower Freq. Limit : (U) 2025.000000 MHz
Upper Freq. Limit : (U) 2300.000000 MHz
Polarization : (U) Right Hand Circular
Main Beam Gain : (U) 36.0 dBi
1st Horz. Sidelobe Atten. : (U) 12.0 dB
1st Vert. Sidelobe Atten. : (U) 12.0 dB
Atten. Rel/Act : (U) Relative dB
1st Horz. Pos. : (U) 2.00 degrees
1st Vert. Pos. : (U) 2.00 degrees
Gain Fr. to Bk. : (U) 46.0 dB
Horz. Beamwidth : (U) 1.00 degrees
Vert. Beamwidth : (U) 1.00 degrees
Horz. Scan Type : (U) Tracker
Horz. Scan Type : (U) Tracker
Vert. Scan Type : (U) Tracker
Dish Diameter : (U) 4.90 meters

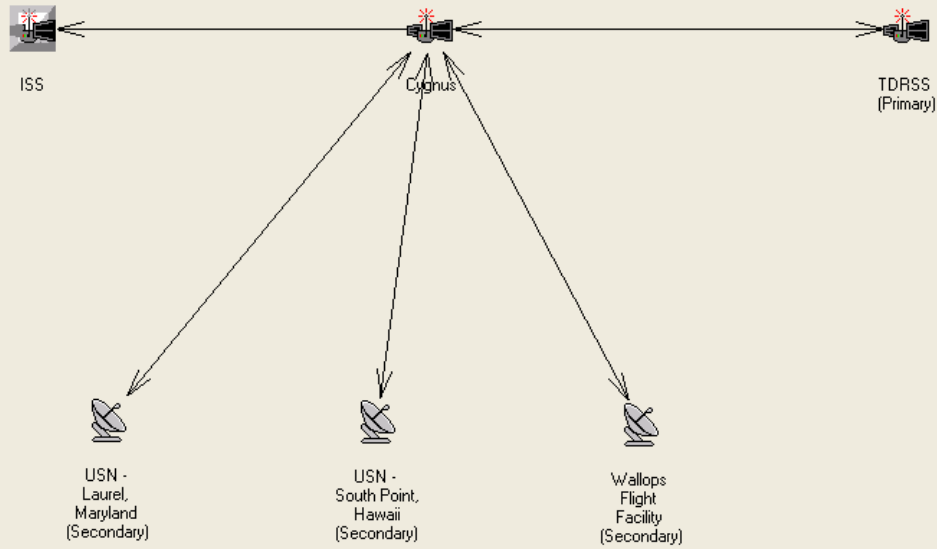
FULL RECORD PRINT FOR Orbital Sciences Cygnus Spacecraft

ANTENNA 11.3-m S-Band Antenna

Nomenclature	:	(U) 11.3-m S-Band Antenna
Antenna Code	:	Aperture
Manufacturer	:	(U) SCIENTIFIC ATLANTA CO.
Model Name	:	(U) 11.3m Ground Station
NTIA Approval Status	:	(U) Unapproved
Date/Time Last Mod.	:	8/25/2009 5:07:39 PM (GMT)
Coordination ID	:	(U) J/F 12
Lower Freq. Limit	:	(U) 2000.000000 MHz
Upper Freq. Limit	:	(U) 2400.000000 MHz
Polarization	:	(U) Right Hand Circular
Main Beam Gain	:	(U) 44.8 dBi
1st Horz. Sidelobe Atten.	:	(U) 19.0 dB
1st Vert. Sidelobe Atten.	:	(U) 19.0 dB
Atten. Rel/Act	:	(U) Relative dB
1st Horz. Pos.	:	(U) 2.00 degrees
1st Vert. Pos.	:	(U) 2.00 degrees
Gain Fr. to Bk.	:	(U) 54.0 dB
Horz. Beamwidth	:	(U) 0.950 degrees
Vert. Beamwidth	:	(U) 0.950 degrees
Horz. Scan Type	:	(U) Tracker
Horz. Scan Type	:	(U) Tracker
Vert. Scan Type	:	(U) Tracker
Vert. Max. Elev.	:	(U) 90.0 degrees
Vert. Min. Elev.	:	(U) 5.00 degrees
Dish Diameter	:	(U) 11.3 meters

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Line Diagram: Orbital Sciences Cygnus Spacecraft



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