A.1.3.5 – Lubrication

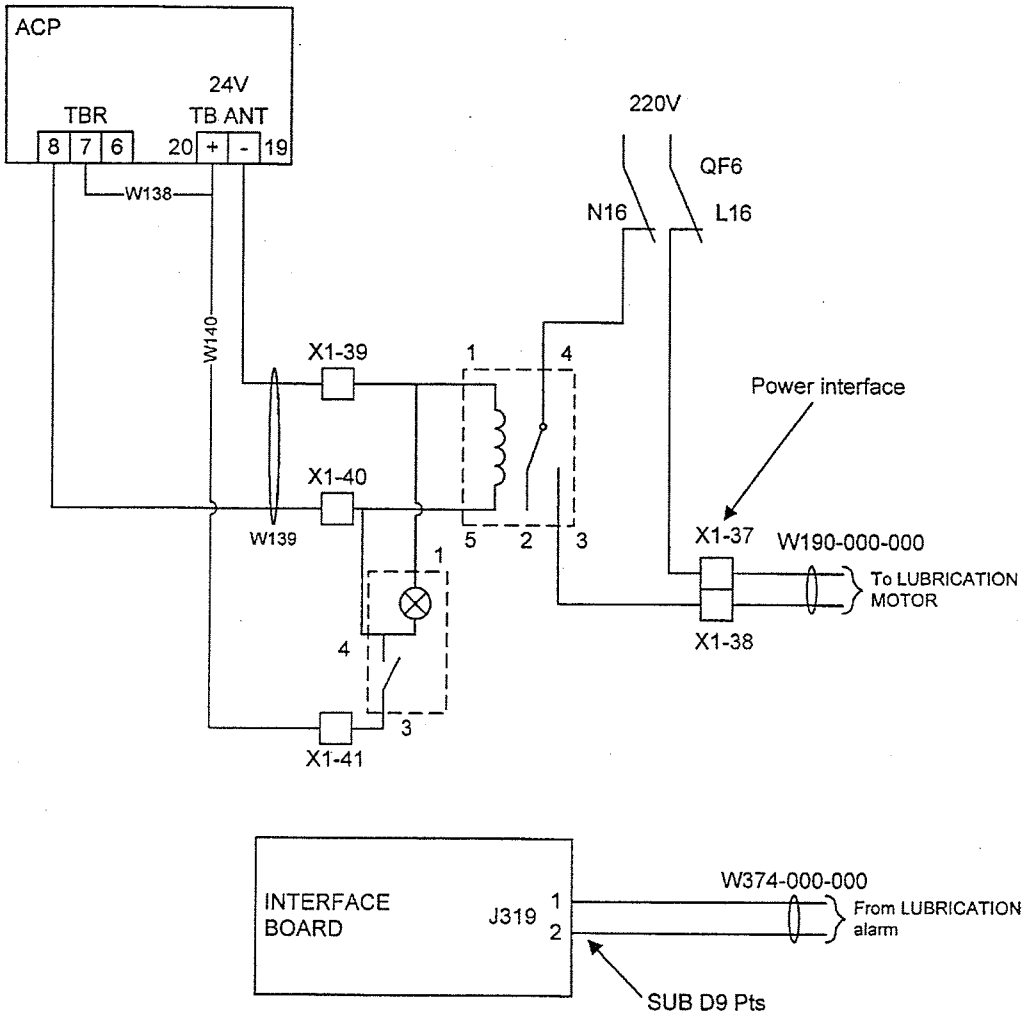


Figure 179 – Lubrication wiring diagram

A.1.3.6 – Pressurization

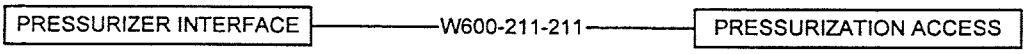


Figure 180 – Antenna to outdoor cabinet antenna tracking general wiring

		W600-211-211					
ORIGIN CONNECTOR		PIPE NOBEL PU-X PIPE Φ 10mm 77096010			END CONNECTOR		
MARKING CAB INTF		LENGTH m			MARKING FEED INTERFACE		
FUNCTION	**ORIGIN EQUIPMENT**	**TB**	**Pin**	**Wire**	**Pin**	**TB**	**END EQUIPMENT**
PRESSURIZATION	CABINET INTERFACE						FEED INTF

A.1.4 — Gateway building to outdoor cabinet wiring

A.1.4.1 – Signals

Figure 181 – Gateway to outdoor cabinet signals general wiring

			W240-000-000				
ORIGIN CONNECTOR			CABLE			END CONNECTOR	
L5NM		ANDREW	LDF5P-50A (0.8 à 2.3 GHz)		ANDREW	L5NM	ANDREW
MARKING			LENGTH			MARKING	
TxRHCP			m			TxRHCP	
FUNCTION	**ORIGIN EQUIPMENT**	**TB**	**Pin**	**Wire**	**Pin**	**TB**	**END EQUIPMENT**
Tx RHCP	Tx RHCP FLEX. COAX.						IN CABINET INTF

			W241-000-000				
ORIGIN CONNECTOR			CABLE			END CONNECTOR	
L5NM		ANDREW	LDF5P-50A		ANDREW	L5NM	ANDREW
MARKING			LENGTH			MARKING	
TxLHCP			m			TxLHCP	
FUNCTION	**ORIGIN EQUIPMENT**	**TB**	**Pin**	**Wire**	**Pin**	**TB**	**END EQUIPMENT**
Tx LHCP	Tx LHCP FLEX. COAX.						IN CABINET INTF

			W242-000-000				
ORIGIN CONNECTOR			CABLE			END CONNECTOR	
N MALE		1AB095530004	KX4PU		77095151	N FEMALE	1AB079710003
MARKING			LENGTH			MARKING	
			m				
FUNCTION	**ORIGIN EQUIPMENT**	**TB**	**Pin**	**Wire**	**Pin**	**TB**	**END EQUIPMENT**
Tx RHCP	OUT CABINET INTF						Tx RHCP 5/50 COAX

			W243-000-000				
ORIGIN CONNECTOR			CABLE			END CONNECTOR	
N MALE		1AB095530004	KX4PU		77095151	N FEMALE	1AB079710003
MARKING			LENGTH			MARKING	
			m				
FUNCTION	**ORIGIN EQUIPMENT**	**TB**	**Pin**	**Wire**	**Pin**	**TB**	**END EQUIPMENT**
Tx LHCP	OUT CABINET INTF						Tx LHCP 5/50 COAX

			W250-000-000				
ORIGIN CONNECTOR			CABLE			END CONNECTOR	
L5NM		ANDREW	LDF5P-50A		ANDREW	L5NM	ANDREW
MARKING			LENGTH			MARKING	
RxRHCP			m			RxRHCP	
FUNCTION	**ORIGIN EQUIPMENT**	**TB**	**Pin**	**Wire**	**Pin**	**TB**	**END EQUIPMENT**
Rx RHCP	Rx RHCP FLEX. COAX.						IN CABINET INTF

W251-000-000							
ORIGIN CONNECTOR L5NM ANDREW		CABLE LDF5P-50A ANDREW			END CONNECTOR L5NM ANDREW		
MARKING RxLHCP		LENGTH m			MARKING RxLHCP		
FUNCTION	**ORIGIN EQUIPMENT**	**TB**	**Pin**	**Wire**	**Pin**	**TB**	**END EQUIPMENT**
Rx LHCP	Rx LHCP FLEX. COAX.						IN CABINET INTF

W252-000-000							
ORIGIN CONNECTOR N MALE 1AB095530004		CABLE KX4PU 77095151			END CONNECTOR N FEMALE 1AB079710003		
MARKING		LENGTH m			MARKING		
FUNCTION	**ORIGIN EQUIPMENT**	**TB**	**Pin**	**Wire**	**Pin**	**TB**	**END EQUIPMENT**
Rx RHCP	OUT CABINET INTF						Rx RHCP 5/50 COAX

W253-000-000							
ORIGIN CONNECTOR N MALE 1AB095530004		CABLE KX4PU 77095151			END CONNECTOR N FEMALE 1AB079710003		
MARKING		LENGTH m			MARKING		
FUNCTION	**ORIGIN EQUIPMENT**	**TB**	**Pin**	**Wire**	**Pin**	**TB**	**END EQUIPMENT**

W260-000-000							
ORIGIN CONNECTOR R161004 RADIALL		CABLE KX22DT			END CONNECTOR R161004 RADIALL		
MARKING 10MHz		LENGTH m			MARKING 10MHz		
FUNCTION	**ORIGIN EQUIPMENT**	**TB**	**Pin**	**Wire**	**Pin**	**TB**	**END EQUIPMENT**
10 MHz	OUT CABINET INTF						IN CABINET INTF

A.1.4.2 – Monitoring and control

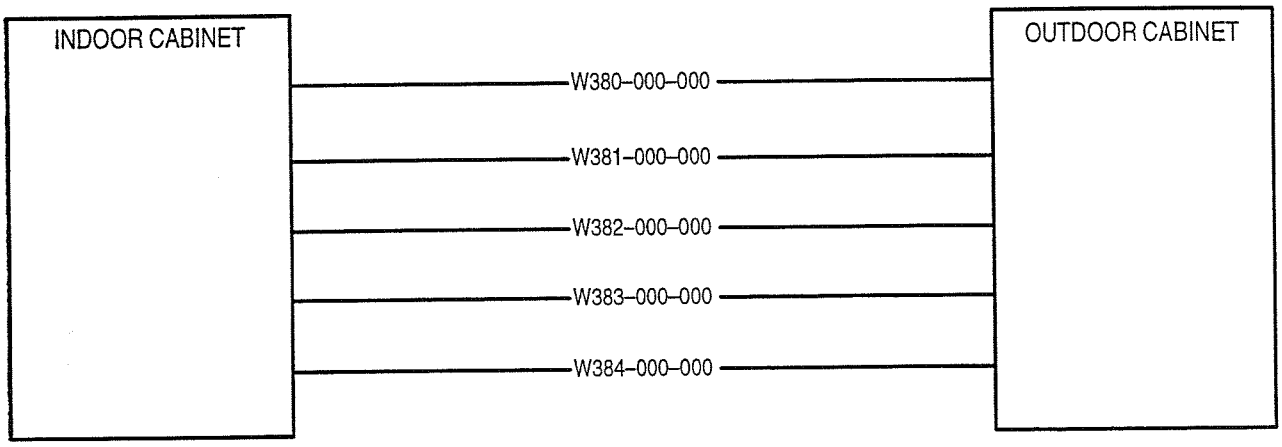


Figure 182 – Gateway to outdoor cabinet monitoring & control general wiring

W380-000-000							
ORIGIN CONNECTOR SUB D – DEM9P 1AB003110036		CABLE G650-2/2			END CONNECTOR 85107-R14-19P50-44 1AB035530005		
MARKING ESTP		LENGTH m			MARKING ESTP		
FUNCTION	**ORIGIN EQUIPMENT**	**TB**	**Pin**	**Wire**	**Pin**	**TB**	**END EQUIPMENT**
ESTP	OUT CABINET INTF		5		A		IN CABINET INTF
ESTP	OUT CABINET INTF		4		B		IN CABINET INTF
ESTP	OUT CABINET INTF		3		C		IN CABINET INTF
ESTP	OUT CABINET INTF		2		D		IN CABINET INTF
ESTP	OUT CABINET INTF		1		E		IN CABINET INTF

W381-000-000							
ORIGIN CONNECTOR SUB D – DEM9P 1AB003110036		CABLE G650-2/2			END CONNECTOR 85107-R14-19P50-44 1AB035530005		
MARKING MAC		LENGTH m			MARKING MAC		
FUNCTION	**ORIGIN EQUIPMENT**	**TB**	**Pin**	**Wire**	**Pin**	**TB**	**END EQUIPMENT**
MAC	OUT CABINET INTF		5		A		IN CABINET INTF
MAC	OUT CABINET INTF		4		B		IN CABINET INTF
MAC	OUT CABINET INTF		3		C		IN CABINET INTF
MAC	OUT CABINET INTF		2		D		IN CABINET INTF
MAC	OUT CABINET INTF		1		E		IN CABINET INTF

W382-000-000							
ORIGIN CONNECTOR SUB D – DEM9P 1AB003110036		CABLE G650-2/2			END CONNECTOR 85107-R14-19P50-44 1AB035530005		
MARKING RCDMA		LENGTH m			MARKING RCDMA		
FUNCTION	**ORIGIN EQUIPMENT**	**TB**	**Pin**	**Wire**	**Pin**	**TB**	**END EQUIPMENT**
RHCP CDMA	OUT CABINET INTF		5		A		IN CABINET INTF
RHCP CDMA	OUT CABINET INTF		4		B		IN CABINET INTF
RHCP CDMA	OUT CABINET INTF		3		C		IN CABINET INTF
RHCP CDMA	OUT CABINET INTF		2		D		IN CABINET INTF
RHCP CDMA	OUT CABINET INTF		1		E		IN CABINET INTF

W383-000-000							
ORIGIN CONNECTOR SUB D – DEM9P 1AB003110036		CABLE G650-2/2			END CONNECTOR 85107-R14-19P50-44 1AB035530005		
MARKING LCDMA		LENGTH m			MARKING LCDMA		
FUNCTION	**ORIGIN EQUIPMENT**	**TB**	**Pin**	**Wire**	**Pin**	**TB**	**END EQUIPMENT**
LHCP CDMA	OUT CABINET INTF		5		A		IN CABINET INTF
LHCP CDMA	OUT CABINET INTF		4		B		IN CABINET INTF
LHCP CDMA	OUT CABINET INTF		3		C		IN CABINET INTF
LHCP CDMA	OUT CABINET INTF		2		D		IN CABINET INTF
LHCP CDMA	OUT CABINET INTF		1		E		IN CABINET INTF

W384-000-000							
ORIGIN CONNECTOR SUB D – DEM9P 1AB003110036		CABLE G650-2/2			END CONNECTOR 85107-R14-19P50-44 1AB035530005		
MARKING LTCU		LENGTH m			MARKING LTCU		
FUNCTION	**ORIGIN EQUIPMENT**	**TB**	**Pin**	**Wire**	**Pin**	**TB**	**END EQUIPMENT**
LHCP TCU	OUT CABINET INTF		5		A		IN CABINET INTF
LHCP TCU	OUT CABINET INTF		4		B		IN CABINET INTF
LHCP TCU	OUT CABINET INTF		3		C		IN CABINET INTF
LHCP TCU	OUT CABINET INTF		2		D		IN CABINET INTF
LHCP TCU	OUT CABINET INTF		1		E		IN CABINET INTF

A.1.4.3 – Optical fiber

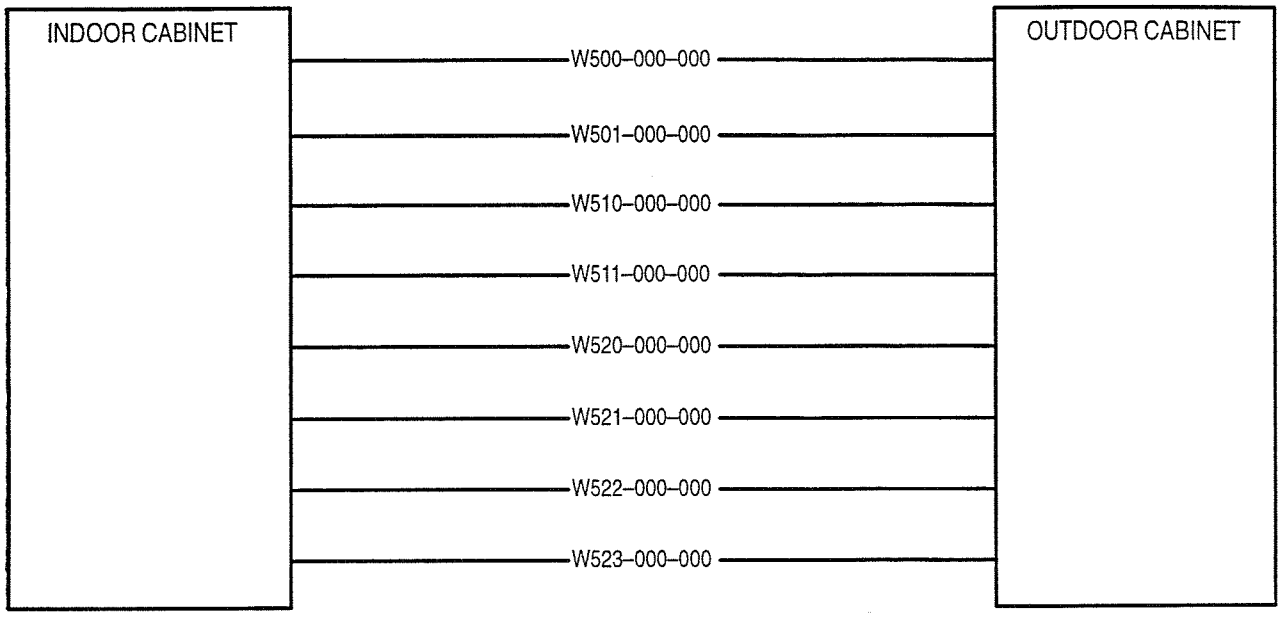


Figure 183 – Gateway to outdoor cabinet optical fiber general wiring

W500-000-000							
ORIGIN CONNECTOR		CABLE			END CONNECTOR		
MARKING TxRHCP+10MHz		LENGTH m			MARKING TxRHCP+10MHz		
FUNCTION	**ORIGIN EQUIPMENT**	**TB**	**Pin**	**Wire**	**Pin**	**TB**	**END EQUIPMENT**
TxRHCP+10MHz	IN CABINET INTF						OUT CABINET INTF

W501-000-000							
ORIGIN CONNECTOR		CABLE			END CONNECTOR		
MARKING TxLHCP+10MHz		LENGTH m			MARKING TxLHCP+10MHz		
FUNCTION	**ORIGIN EQUIPMENT**	**TB**	**Pin**	**Wire**	**Pin**	**TB**	**END EQUIPMENT**
TxLHCP+10MHz	IN CABINET INTF						OUT CABINET INTF

W510-000-000							
ORIGIN CONNECTOR		CABLE			END CONNECTOR		
MARKING RxRHCP		LENGTH m			MARKING RxRHCP		
FUNCTION	**ORIGIN EQUIPMENT**	**TB**	**Pin**	**Wire**	**Pin**	**TB**	**END EQUIPMENT**
RxRHCP	IN CABINET INTF						OUT CABINET INTF

W511-000-000							
ORIGIN CONNECTOR		CABLE			END CONNECTOR		
MARKING RxLHCP		LENGTH m			MARKING RxLHCP		
FUNCTION	**ORIGIN EQUIPMENT**	**TB**	**Pin**	**Wire**	**Pin**	**TB**	**END EQUIPMENT**
RxLHCP	IN CABINET INTF						OUT CABINET INTF

W520-000-000							
ORIGIN CONNECTOR		CABLE			END CONNECTOR		
MARKING CTRLTx		LENGTH m			MARKING CTRLTx		
FUNCTION	**ORIGIN EQUIPMENT**	**TB**	**Pin**	**Wire**	**Pin**	**TB**	**END EQUIPMENT**
CONTROL LINK Tx	IN CABINET INTF						OUT CABINET INTF

W521-000-000							
ORIGIN CONNECTOR		CABLE			END CONNECTOR		
MARKING CTRLRx		LENGTH m			MARKING CTRLRx		
FUNCTION	**ORIGIN EQUIPMENT**	**TB**	**Pin**	**Wire**	**Pin**	**TB**	**END EQUIPMENT**
CONTROL LINK Rx	IN CABINET INTF						OUT CABINET INTF

		W522-000-000					
ORIGIN CONNECTOR		CABLE			END CONNECTOR		
MARKING SPARE		LENGTH m			MARKING SPARE		
FUNCTION	**ORIGIN EQUIPMENT**	**TB**	**Pin**	**Wire**	**Pin**	**TB**	**END EQUIPMENT**
SPARE	IN CABINET INTF						OUT CABINET INTF

		W523-000-000					
ORIGIN CONNECTOR		CABLE			END CONNECTOR		
MARKING SPARE		LENGTH m			MARKING SPARE		
FUNCTION	**ORIGIN EQUIPMENT**	**TB**	**Pin**	**Wire**	**Pin**	**TB**	**END EQUIPMENT**
SPARE	IN CABINET INTF						OUT CABINET INTF

A.1.5 – Gateway building monitoring & control cabinet wiring

		W201					
ORIGIN CONNECTOR N Male		CABLE KX22DT			END CONNECTOR Sma Male		
MARKING 10MHz		LENGTH m			MARKING 10MHz		
FUNCTION	**ORIGIN EQUIPMENT**	**TB**	**Pin**	**Wire**	**Pin**	**TB**	**END EQUIPMENT**
10 MHz	ICC						Extended IFL RACK

		W202					
ORIGIN CONNECTOR SUB D – DEM9P		CABLE G650–2/2			END CONNECTOR SUB D – DEM9S		
MARKING ESTC		LENGTH m			MARKING ESTC		
FUNCTION	**ORIGIN EQUIPMENT**	**TB**	**Pin**	**Wire**	**Pin**	**TB**	**END EQUIPMENT**
ESTC	ICC		3		3		Extended IFL RACK
ESTC	ICC		4		2		Extended IFL RACK
ESTC	ICC		5		1		Extended IFL RACK
ESTC	ICC		1				Extended IFL RACK
ESTC	ICC		2				Extended IFL RACK

Appendix 2 – List of spares and consummables

A.2.1 – Antenna

A.2.1.1 – Spares

DESIGNATION	ALCATEL REFERENCE	QUANTITY ON ANTENNA SITE	QUANTITY ON CENTRAL SITE *
Ground azimuth pedestal automatic lubrication device Manufacturer : MARTIN Ref : GSR 740-1-13	–	0	2
Azimuth frame reducer Manufacturer : BONFIGLIOLI Ref : 303 L3 90 HZ	77096259	0	2
Azimuth frame buffer Manufacturer : VIBRACHOC Ref : V1B1134-50A	–	0	3
Elevation reducer Manufacturer : BONFIGLIOLI Ref : C302F50P90	77096260	0	3
Elevation or azimuth motor Manufacturer : A2V Ref : MS55BYY2Y0-033	77096258	0	3
Cross-elevation motor Manufacturer : A2V Ref : MS42CYY2Y0-030	77096257	0	1
Elevation screw-jack with accessories Manufacturer : BENZLERS Ref : BDK66	77096268	0	3
Elevation screw-jack gusset Manufacturer : BENZLERS	–	0	3
Cross elevation screw-jack with accessories Manufacturer : BENZLERS Ref : BDK58	77096269	0	3
Cross-elevation screw-jack gusset Manufacturer : BENZLERS	–	0	3
Coder + coupling devices Manufacturer : CODECHAMP Ref : COA23184	77096264	1	2
Limit switch (AZ, EL or XEL) Manufacturer : TELEMECANIQUE Ref : ZC2-JC16+ZC2-JE626	ACL 06937 0001 + ACL 06938 0001	2	3

DESIGNATION	ALCATEL REFERENCE	QUANTITY ON ANTENNA SITE	QUANTITY ON CENTRAL SITE *
Anti–lightning shunts :			
• Brush and brush holder Manufacturer : ROUGIER	3BT 12115 AAAA	0	TBD
• Tinned copper shunt (length : 500 mm) Manufacturer : HELITA Ref : STP5050	3BT 12107 AAAA	0	TBD
• Tinned copper shunt (length : 750 mm) Manufacturer : HELITA Ref : STP5075	3BT 12108 AAAA	0	TBD
• Tinned copper shunt (length : 1000 mm) Manufacturer : HELITA Ref : STP5100	3BT 12109 AAAA	0	TBD
• Tinned copper shunt (length : 200 mm) Manufacturer : HELITA	3BT 12110 AAAA	0	TBD
Radome Manufacturer : ALCATEL Ref : 3BT 08596 AAAA	3BT 08596 AAAA	4	12

* Quantity on central site is for 100 antennas.

A.2.1.2 – Consummables

DESIGNATION	CONSUMPTION PER ANTENNA	QUANTITY ON ANTENNA SITE	QUANTITY ON CENTRAL SITE *
Grease for crown-wheel Manufacturer : KLUBER Ref : ISOFLEX TOPASNCA5051 ALCATEL Ref. : ACL 07732 0001	8 kg/year	2 x 25kg drums	10 x 25kg drums
EL and XEL screw-jacks grease cartridges Manufacturer : BENZLERS Ref : 97-06-11	4/year	4	15
Oil for azimuth and elevation reducers Manufacturer : MOBIL Ref : SHC 626 ALCATEL Ref. : ACL 07733 0001 (20 liters drum)	8 l after first 150 h operation then 8 l/10 years	2 x 20 l drums for first oil changing	5 x 20 l drums
Grease tube for protection of ball-joints Manufacturer : SKF Ref : LGLT2 ALCATEL Ref. : ACL 07731 0001	1 for 6 months	8	40

* Quantity on central site is for 100 antennas.

A.2.2 – Equipment of antenna hub

A.2.2.1 – Spares

DESIGNATION	QUANTITY ON ANTENNA SITE	QUANTITY ON CENTRAL SITE *
Low Noise Amplifier Manufacturer : ALCATEL Ref : 77 095 284	0	3
Switch Manufacturer : ALCATEL Ref : 77 095 188	0	3
Power sensor Manufacturer : ALCATEL Ref : 77 070 715	0	3
80 W amplifier Manufacturer : ALCATEL Ref : 3BT 08413 AAAA	1	8
Up/Down converter Manufacturer : ALCATEL Ref : 3BT 08346 AAAA	1	3
Blower and box assembly Manufacturer : ALCATEL Ref : 3BT 09360 AAAA	1	3
Blower Manufacturer : AIRTECHNIC Ref : G2E 120–AR 77–89	0	3

A.2.2.2 – Consummables

Not applicable.

A.2.3 – Equipment of Outdoor cabinet

A.2.3.1 – Spares

DESIGNATION	QUANTITY ON ANTENNA SITE	QUANTITY ON CENTRAL SITE *
Milliwattmeter Manufacturer : ALCATEL Ref : 77 095 283	0	0
IEEE/RS488 interface Manufacturer : ALCATEL Ref : 77 092 362	1	2
10 MHz divider Manufacturer : ALCATEL Ref : 3BT 08678 AAAA	1	2
Antenna Control Unit Manufacturer : Ref : ?	1	2
48 V power supply Manufacturer : ALCATEL Ref : 3BT 09565 AAAA	0	0
AZ & EL axes motor speed controller Manufacturer : ? Ref : ?	1	3
XEL axis motor speed controller Manufacturer : ? Ref : ?	0	3
Relay set Manufacturer : ? Ref : ?	1	1
Power transformer Manufacturer : ? Ref : ?	0	2
Pressurization Manufacturer : SOFRER Ref : 52 61 31 SO	0	2
Door with air conditioning Manufacturer : ? Ref : ?	1	1
Air conditioning control maintenance kit Manufacturer : ? Ref : ?	0	1
Set of fuses and bulbs Manufacturer : ? Ref : ?	1	3

A.2.3.2 – Consummables

Not applicable.

A.2.3.3 – Maintenance tool

DESIGNATION	QUANTITY ON ANTENNA SITE	QUANTITY ON CENTRAL SITE *
Remote control box for ACU Manufacturer : ? Ref : ?	1	1

A.2.4 — Equipment of Gateway building cabinet

A.2.4.1 – Spares

DESIGNATION	QUANTITY ON ANTENNA SITE	QUANTITY ON CENTRAL SITE *
Interface control cabinet terminal Manufacturer : ? Ref : ?	1	1

A.2.4.2 – Consummables

Not applicable.

A.2.5 — Extended IFL option

A.2.5.1 – Spares

DESIGNATION	QUANTITY ON ANTENNA SITE	QUANTITY ON CENTRAL SITE *
1 GHz transceiver pair + 10 MHz Manufacturer : FOXCOM Ref : 6125	0	1
2 GHz transceiver pair + 10 MHz Manufacturer : FOXCOM Ref : 6225	0	1

DESIGNATION	QUANTITY ON ANTENNA SITE	QUANTITY ON CENTRAL SITE *
RS422 transceiver 2pps Manufacturer : FOXCOM Ref : 7050 D422	0	1
Power supply Manufacturer : FOXCOM Ref : ?	0	1

A.2.5.2 – Consummables

Not applicable.

Appendix 3 – Fiberoptic Interfacility Link

A.3.1 – Introduction

This manual describes the Foxcom Fiberoptic Interfacility Link serving Globalstar gateways. Foxcom strives to offer leading edge technology economically with superior quality and performance. The following manual is intended to provide all the information required to setup, operate and maintain the fiberoptic link. We have designed the installation to be plug–and–play, requiring little or no previous experience in fiberoptic technology and have included a technical note in the Appendix, "Fiberoptic Cable, Connectors & Installation" for your benefit.

The system is a bi–directional fiberoptic link for the transmission of both RF antenna signals as well as monitor/control data lines and clock references allowing fully remote operation of the antenna. It is used when the antenna to gateway distance exceeds approximately 100 meters and will maintain stringent RF characteristics and dynamic range requirements over distances of up to 5 Km.

Foxcom proprietary AGC (automatic gain control), indicators, alarms and test points make the link easy to set up and use with little or no maintenance required. The system is modular and based on piug in modules to the system chassis and power supply. This makes for fast MTTR (meant time to repair) and allows a low cost spares policy. We are now proud to announce that the unit meets international EMC (electromagnetic compatibility) requirements as well as safety standards.

A.3.2 – Unpacking/Handling

The units were inspected before shipment and found to be free of mechanical and electrical defects. Examine the units for any damage which may have been caused in transit. Keep all packing materials until your inspection is complete. If damage is discovered, file a claim with the freight carrier immediately. Notify Foxcom, Inc. as soon as possible.

Be aware during unpacking that fiber cable can be damaged by very tight bends, and be careful not to expose the optical connector end faces to dirt or dust.

A.3.3 – Caution/Warnings

A. Personnel safety

WARNING!

Optical radiation

Applying power to the transmitter unit will create a laser energy source operating in Class IIIb. The transmitter incorporates a laser emission indicator in compliance with 21 CFR 10410.10, Subchapter J, 1985. When power is applied to unit, for example during installation, service or maintenance, the user is warned to take required precautions including **not to look directly into the transmitter fiber connector with the naked eye! The light emitted from the fiberoptic connector is invisible and may be harmful to the human eye!** Use either an infrared viewer, optical power meter or fluorescent screen for optical output verification. All handling precautions as outlined by the DHHS and ANSI Z136.1 and other authorities of Class III lasers must be observed.

WARNING!

AC Power Hazard

The rackmount power supplies line are EMI filtered and fused. The chassis is connected to earth ground in compliance with safety requirements. Always use the 3 prong AC plug with earth ground to avoid possibility of electrical shock hazard to personnel.

CAUTION!

Fuses

To avoid possibility of fire hazard, always replace fuses with the same type and rating of fuse as recommended on the power supply rear label.

CAUTION!

Redundant Supply

The redundant power supply is not disconnected from the AC source unless both AC power cords are removed.

B. Equipment Safety

CAUTION!

General Equipment Safety

1) Do not allow any dirt or foreign material to get into the optical connector bulkheads! This may cause damage to the polished optical connector end faces.

2) The optical fiber jumper cable bend radius is 3 cm. Smaller radii can cause excessive optical loss and/or fiber breakage.

3) Allow sufficient room for adequate ventilation, otherwise the units may overheat causing possible safety hazard or equipment damage!

A.3.4 — System diagrams

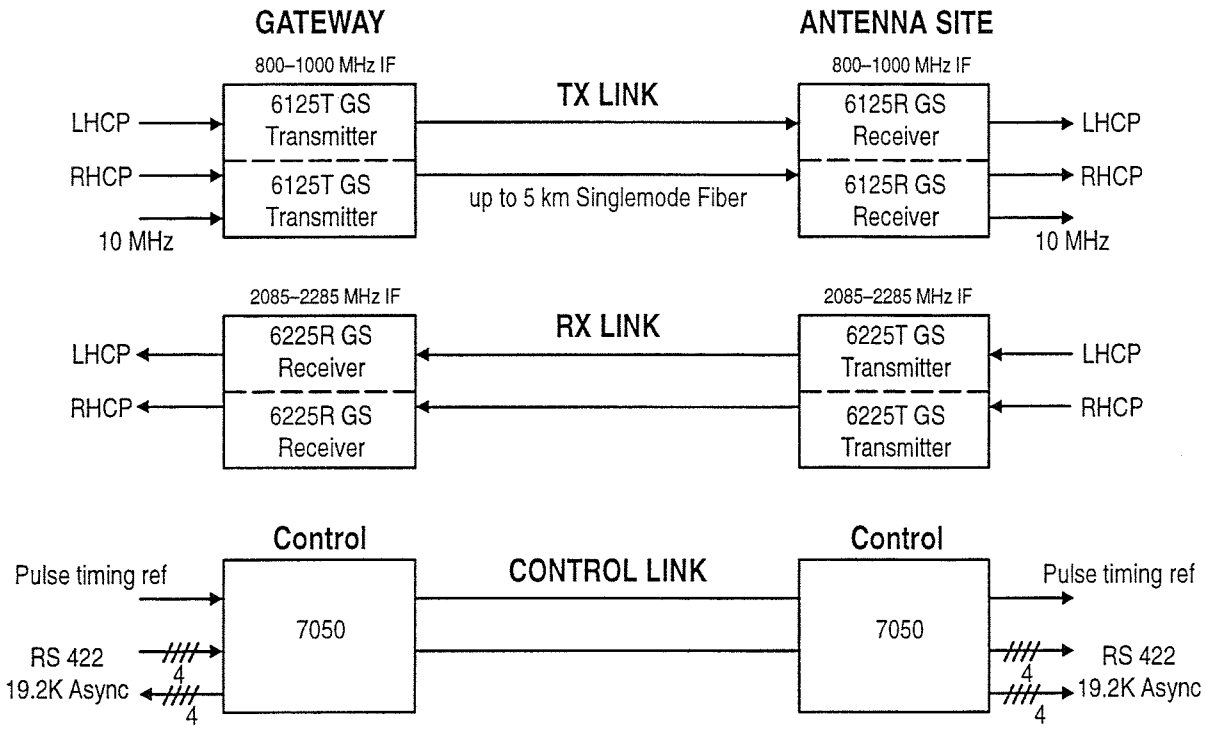


Figure 184 – System block diagram

The fiberoptic interfacility link connects a dual polarity uplink and downlink from the equipment room to the antenna site over a distance of up to 5 km using fiberoptic cable. The 800-1000 MHz IF is transmitted to the antenna and the 2085-2285 MHz IF is received from the antenna. In addition, the transmit site generates and forwards a 10 MHz reference signal and a pulse timing reference to the antenna site. A 4 channel bi-directional RS422 monitor and control data channel is passed between the two sites as well. Singlemode (9/125 micron) fiber cable is used between sites with a nominal loss of approximately 0.4/km. An 8 strand fiber cable is recommended with 6 active fibers and 2 spares for system expansion or repair. For simplicity, power supplies have been omitted from the diagram.

Front panel diagram

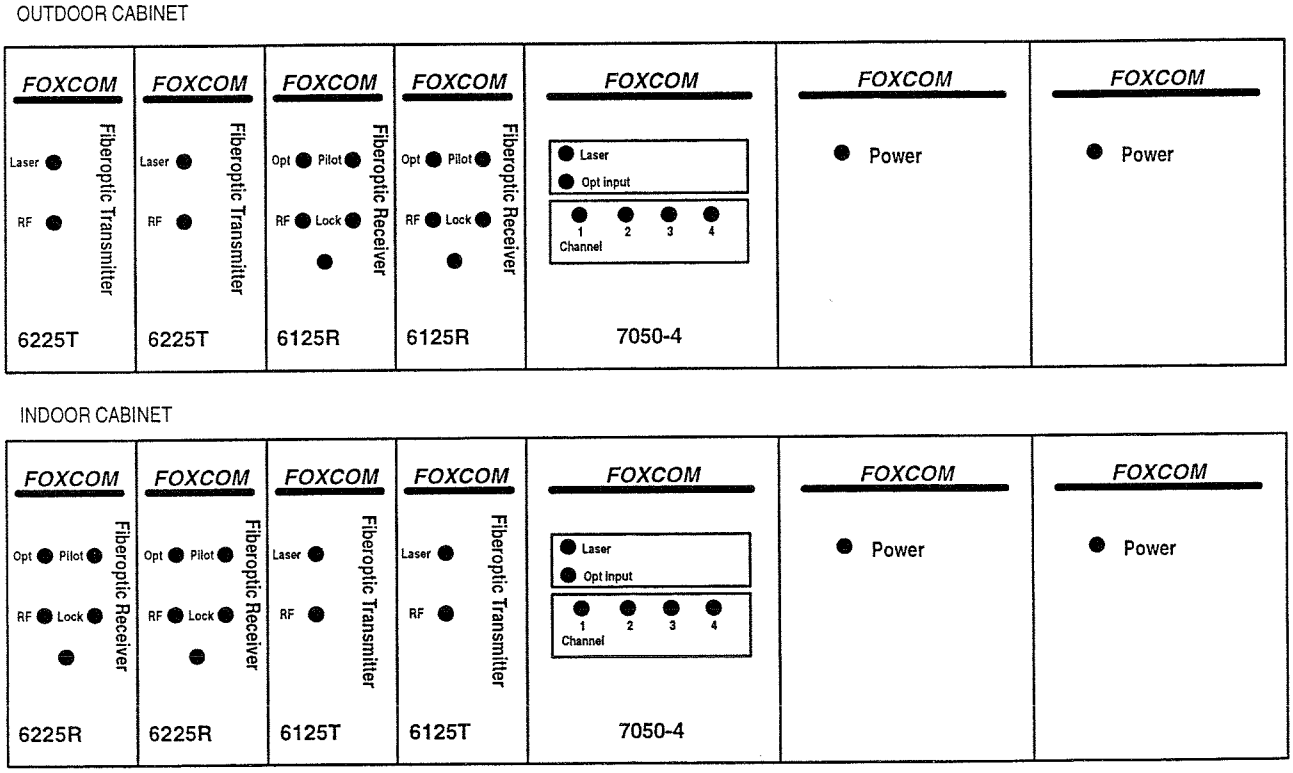


Figure 185 – E-IFL subracks front panels

Rear panel diagram

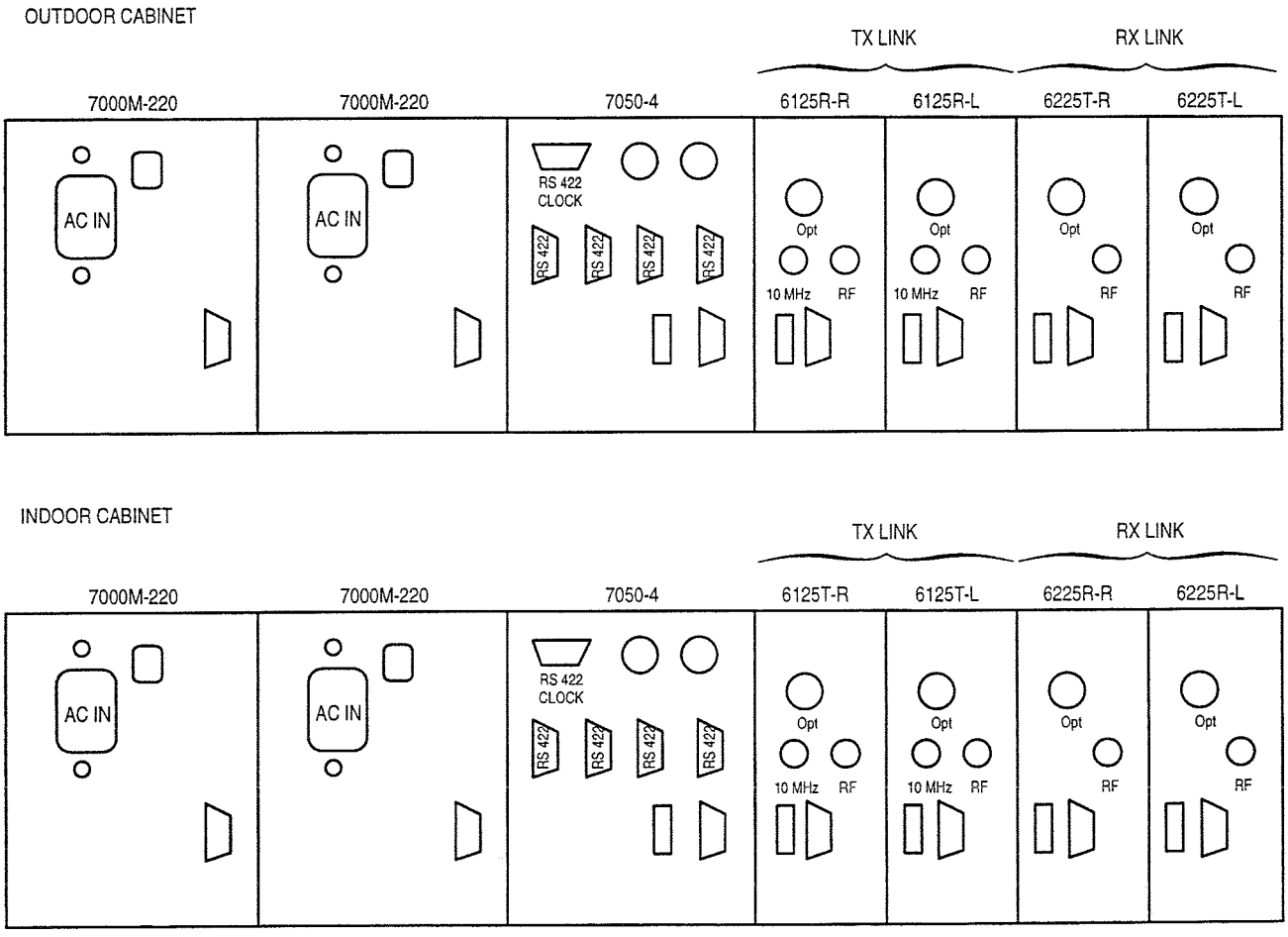


Figure 186 – E-IFL subracks rear panels

Interconnect diagram

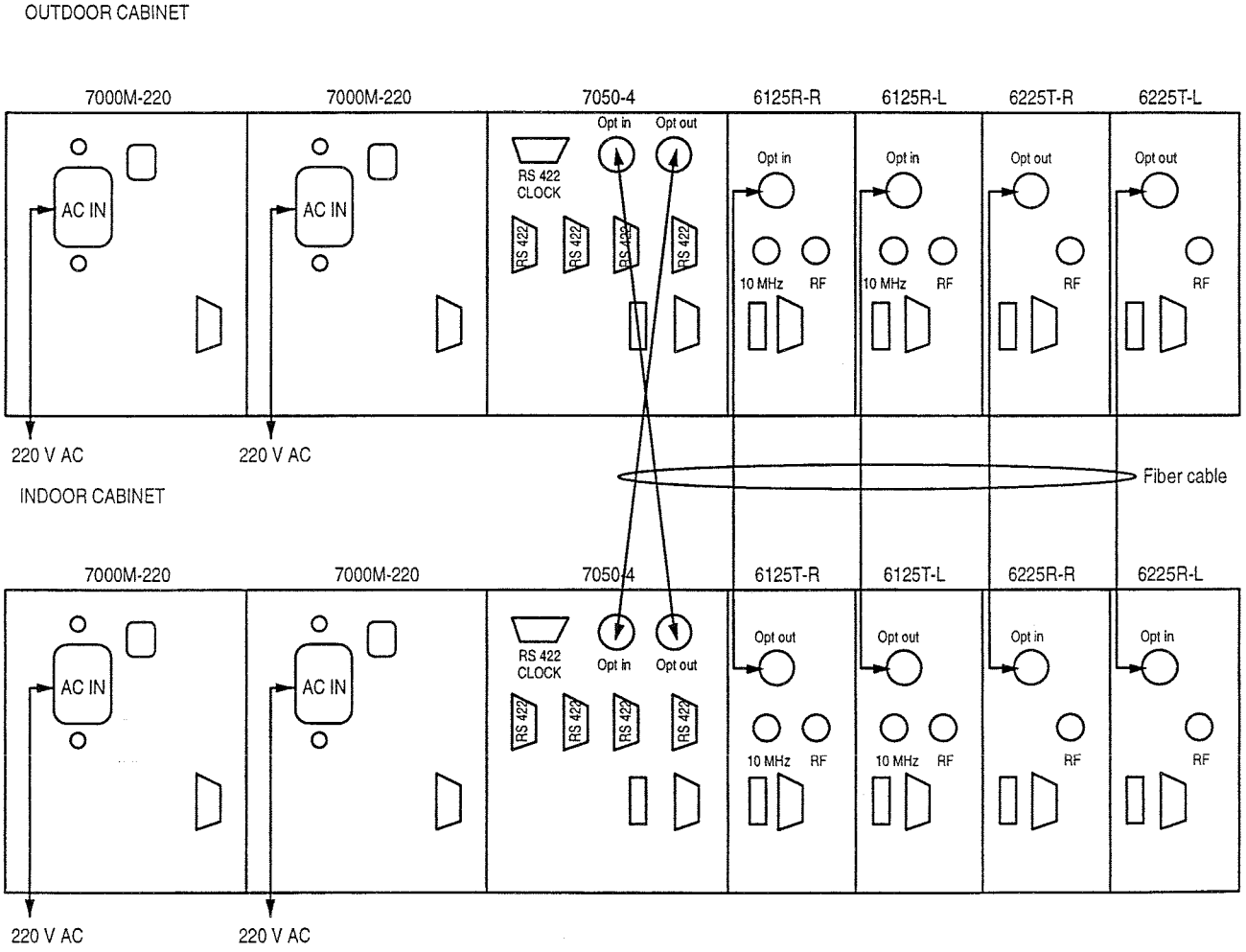


Figure 187 – Interconnect diagram

A.3.5 – Basic setup

The following are the set–up instructions for the system. Observe ali warnings and cautions mentioned at the beginning of this manual. Refer to the interconnect and block diagram to assist you in the initial set–up. Consult the LED indicator tables below to verify proper system performance. If after set–up you experience problems, consult both the "General Description" and the section entitled "Problems & Troubleshooting Guide".

AT ANTENNA SITE

1. Mounting – Mount units away from direct sunlight or other sources of heat. The system is not weatherized and must be mounted in a protected enclosure in an environment from +10 to +55C maximum. Rackmount units should be mounted with sufficient airflow.

2. Power – When AC power is applied the green "Laser" LED should light on all transmitter units indicating optical power output is stabilized.

3. Optical – The interconnecting fiber cable must be either fusion spliced or connected via FC/APC connectors. See appendix of this manual for further information. Rub clean the mating optical connectors with a lint free cloth. Mate the connectors to the corresponding transmitter or receiver plug ins. For best performance keep the transmitter and receivers as a matched pair. Note that the optical connector is keyed and polarized.

4. Check LED indicators on optical receiver units to verify optical power received and

AGC lock.

5. Check LED indicators on Multiplexer to verify optical power received and carrier detect present.

6. With all fiberoptic connections made at both the Antenna and Gateway sites, and all fiberoptic equipment turned on both sites, the following LEDs should be lit:

LED INDICATOR TABLE

6125R	6125R	6225T	6225T	7050–4	Power supply	Power supply
Optical Power	Optical Power	Laser	Laser	Optical Power	Power	Power
Pilot	Pilot			Laser		
AGC Lock	AGC Lock			Carrier detect 1–4		

7. Upon application of RF signals, the RF LEDs on the transmitters and receivers, should light as well.

AT GATEWAY SITE

1. Mounting – Follow the same guidelines as above.

2. Power – Apply DC power to unit and mate optical connector as described above.

3. With power to all units at both the Antenna and Gateway sites, and all fiberoptic connections in place, the following LED indicators shouid be lit:

LED INDICATOR TABLE

6125T	6125T	6225R	6225R	7050–4	Power supply	Power supply
Laser	Laser	Optical Power	Optical Power	Optical Power	Power	Power
		Pilot	Pilot	Laser		
		AGC Lock	AGC Lock	Carrier detect 1–4		

4. If RF signals are being transmitted the RF signal indicators on both transmitter and receiver will also light.

AGC Interference

Strong 10 kHz signals, which can leak back into the output of the 6125R or 6225R receiver from other equipment may cause the link signal level and RF characteristics to change in real time. Verify that there are no stray 10 kHz leakage signals present from any other interconnected equipment!

Optical Connectors

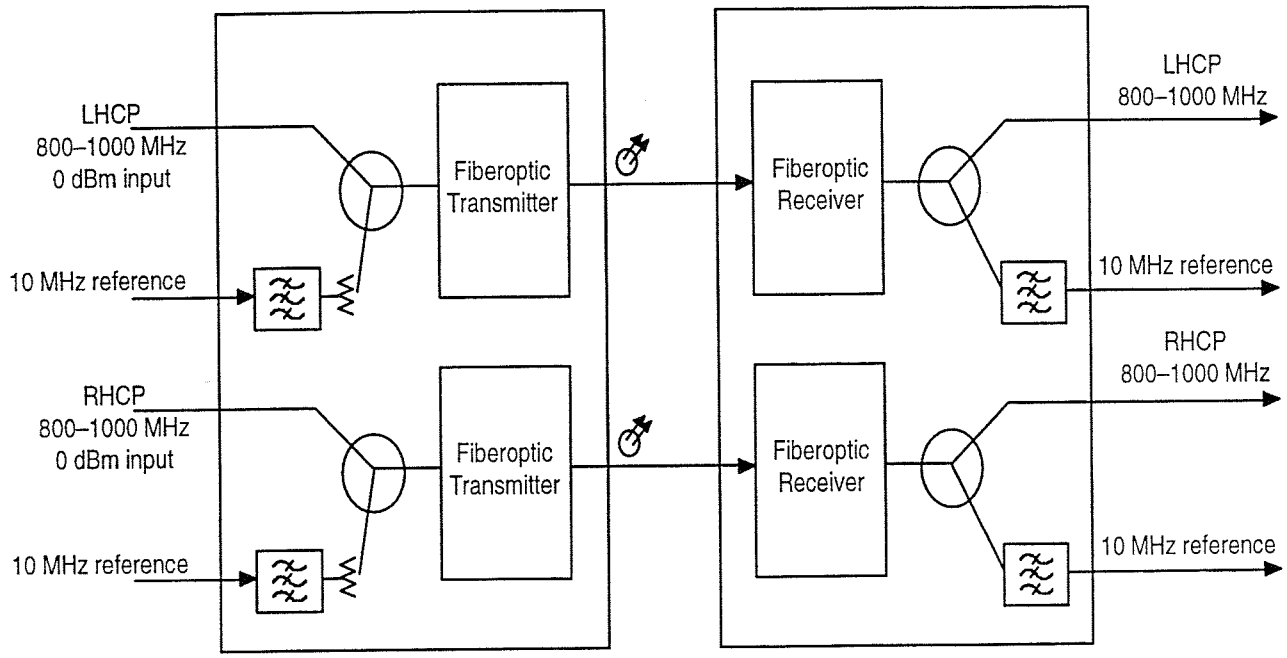
For proper link operation, the installed singlemode (9/125 micron) optical fiber cable including connectors must have low optical reflections (–55 dB return loss). Either fusion splicing or angle polished connectors (FC/APC) are acceptable. (for more details see Appendix on fiberoptic connectors and cable as well as the fiberoptic specification requirements).

Alarms & Monitors

The System has been equipped with various alarms and monitors. The monitors give a voltage indication of proper system "health" while the normally closed dry contact alarms open during an out of specification condition. A list of alarms and monitors with their appropriate pin numbers is provided in "PINOUTS".

A.3.6 — General description

6125 TX LINK

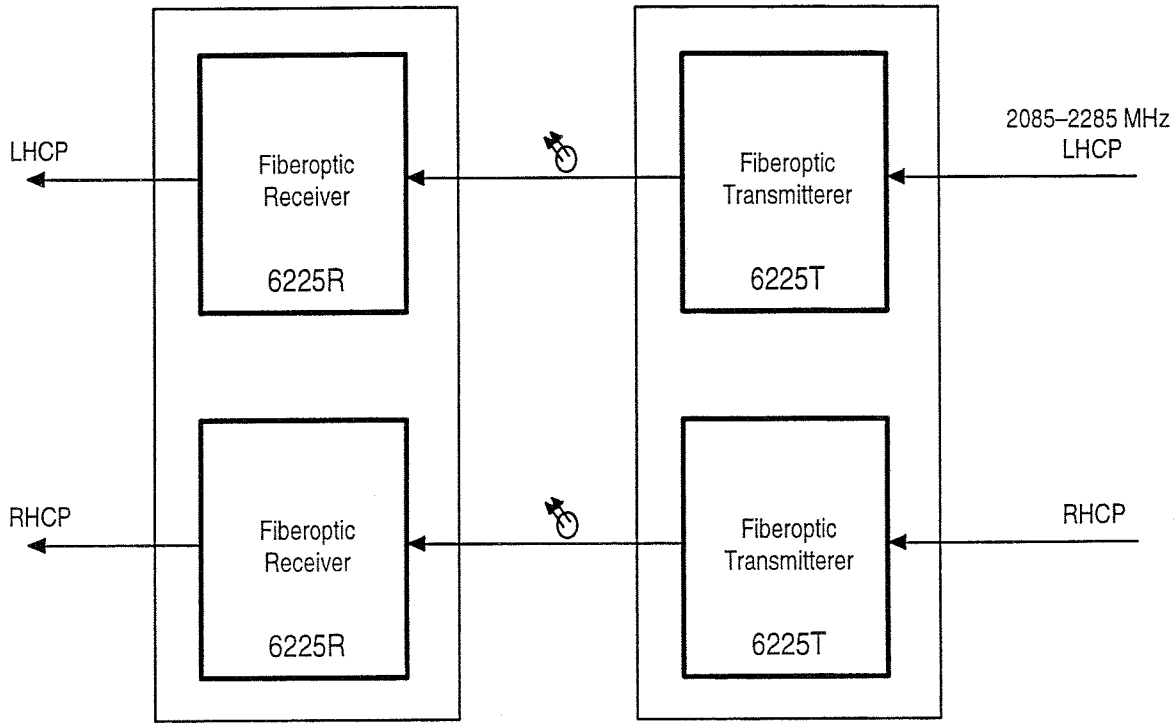


The 6125T transmitter accepts RF input signal levels nominally @ 0 dBm total power. The signal, is fed to a laser diode which linearly converts the broadband RF signal to light intensity. The advanced 6125T circuitry includes input RF matching from 800–1000 MHz, transient protection, AGC pilot tone generator, 10 MHz signal multiplexer input, optical power stabilization and internal laser temperature control. Illuminated green LEDs on the front panel indicate link's status, and monitors and alarms are available on the power connector.

The 6125R optical receiver receives the optical intensity signal, linearly converts it back to RF, amplifies and reproduces the broadband composite signal. Features include adjustable automatic gain control to set and maintain the correct output signal levels for varying link distances or signal output requirements and LED indicators for optical power and AGC status.

The link is capable of high dynamic range, low noise and flat frequency and phase response as can be seen from the specification table.

6225 RX Link

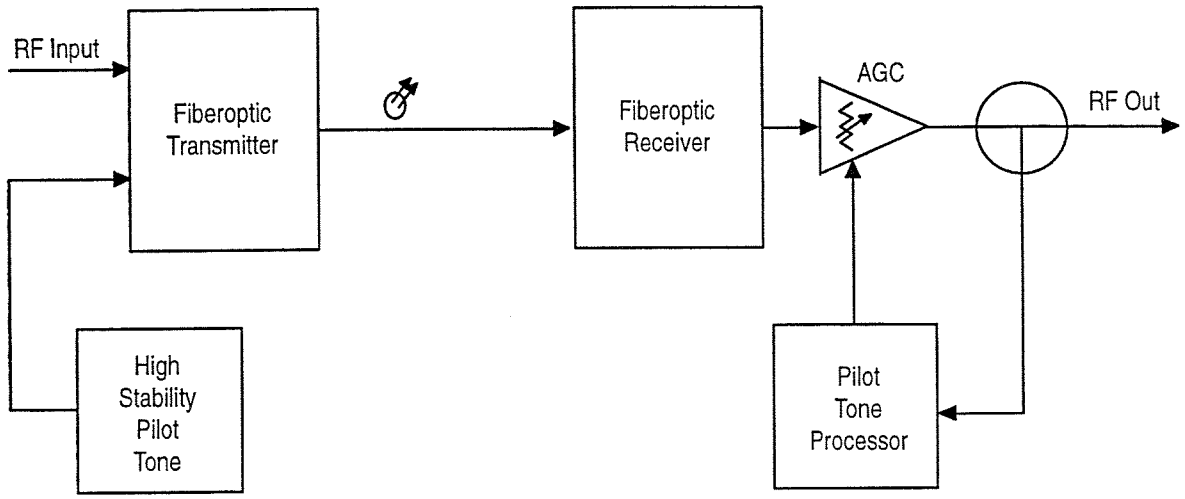


The 6225T transmitter accepts RF input signal levels nominally @ –10 dBm total power. The signal, is fed to a laser diode which linearly converts the broadband RF signal to light intensity. The advanced 6225T circuitry includes input RF matching from 2085–2285 MHz, transient protection, AGC pilot tone generator, optical power stabilization and Internal laser temperature control. Illuminated green LEDs on the front panel indicate link's status, and monitors and alarms are available on the power connector.

The 6225R optical receiver receives the optical intensity signal, linearly converts it back to RF, amplifies and reproduces the broadband composite signal. Features include adjustable automatic gain control to set and maintain the correct output s'gnal levels for varying link distances or signal output requirements and LED indicators for optical power and AGC status.

The link is capable of high dynamic range, low noise and flat frequency and phase response as can be seen from the specification table.

Gain Stabilizer



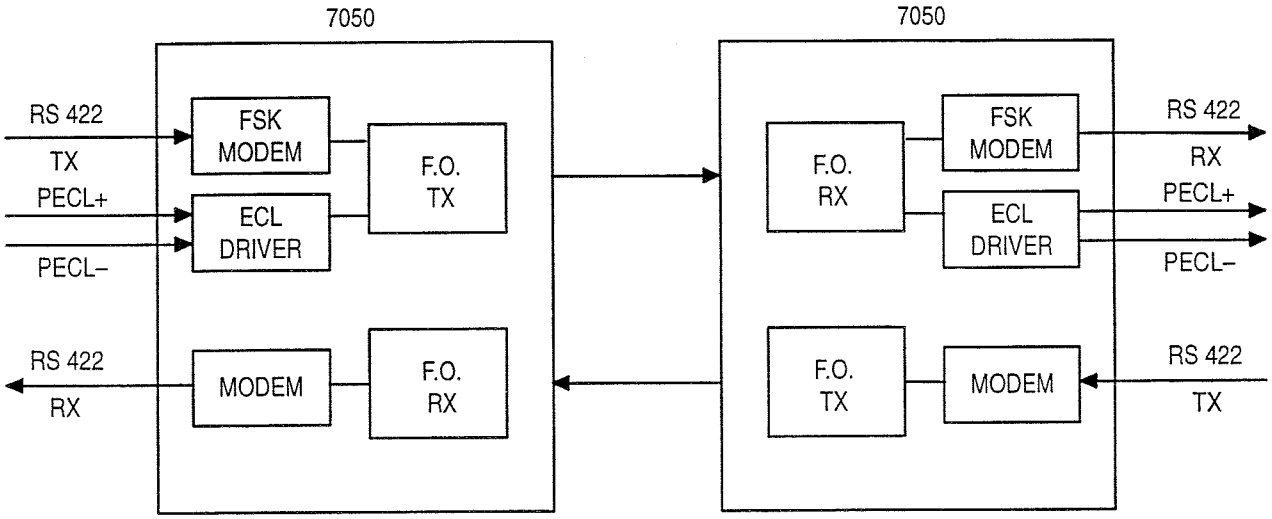
Fiberoptic ilnk gain may change due to many factors including:

- Aging and temperature effect on fiberoptic components (Laser diode, photodiode, coupling).
- Aging, temperature and micro stresses of fiber cable itself (over 5 km length).
- Remating of optical connectors.

An estimate for a real world system is that +/– 1 dB is not unrealistic to expect. To overcome all of these factors, Foxcom's proprietary gain stabilization scheme is capable of maintaining link gain constant to within +/– 0.1 dB over time and temperature. This consists of a high stability pilot tone oscillator circuit at the fiberoptic transmitter input, and a processor feeding a gain controlled amplifier at the receiver output. In this fashion the entire link (including the amplification chain) is compensated.

Pilot tone level monitors as well as an **AGC** LED indicator and alarm are available at the optical receiver to indicate proper system operation.

7050–4 RS 422 MULTIPLEXER



The 7050–4 multipiexes 4 each RS422 bi–directional data signals at any speed from DC to 19.2 KBs/s NRZ over a common pair of fiberoptic cables. This is done in FDM fashion using robust yet cost effective FSK modulation. in addition the 0.5 Hz clock reference pulse is amplitude modulated to preserve excellent rise time and jitter specifications. Alarms monitors and LEDs indicate proper system performance at all times.

7000M Chassis and power supply

The chassis accepts and powers 2 transmitters, 2 receivers and a bi–directional multiplexer plug in units while dissipating up to 45 watts of power.

The power supply is a linear unregulated type for maximum in reliability and lowest possible noise. Voltage regulation is provided on each plug in. Power supply capacity is rated at +15 VDC at up to 3 Amps. AC input is either 110 VAC or 220 VAC (user selectable). Units can be plugged in "hot" and swapped out for easy maintenance. A front panel LED indicates power supply operation. There is an internal PCB mounted 5 ampere fuse for secondary protection, meeting international safety guidelines. It may be user replaced should it open. An internal normally closed relay has been added to provide remote alarm monitoring capability.

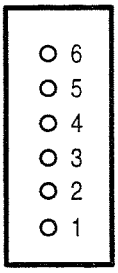
7000S (optional) Hot standby power supply

For applications demanding the utmost in reliability and uptime, the 7000M standby power supply can be optionaily plugged into the standard chassis. The 7000M features hot swapping – supplies may be installed and removed even during operation. Each power supply is fully redundant and can power a completely loaded chassis on Its own should its "partner" fail. During normal operation the two units share the ioad by means of current steering diodes located on the rear panel. Even the diodes are redundant! Alarms are also available on this unit as well.

A.3.7 — Unit pinouts

TX LINK 6125 Pin–out & Alarm Table

The 7000M backpiane incorporates 5 slots, each of which has its own 6 pin Molex header associated with it. The pins are numbered as follows:



Any monitor voltages to be measured may be done between the chassis ground and the required pin.

Transmitter Unit 6125T–GS

Plug in 9 pin–D	Rackmount Alarm	Pin (signal) Name	Function	Range	Alarm Conditions
1		+15V	DC Power	100–300mA	
2		Spare	N.U.		
3	chassis	GND	DC power return		
4	4	RF sig.	RF signal strength indicator	0.5 - 2V	
5	6	Laser PDI	Laser optical power	–4.0V to +/–0.5V	
6	1	LSRI	Laser current monitor	–4.7V+/–0.4V	
7	2	RF Alarm	Sinks current	Off normal	RF not present
8	3	Relay 1	Relay Contact	Normally closed	Relay 1&2 open in alarm condition
9	5	Relay 2	Relay Contact	Normally closed	Relay 1&2 open in alarm condition

Receiver Unit – 6125R–GS

Plug in 9 pin–D	Rackmount Alarm	Pin (signal) Name	Function	Range	Alarm Conditions
1		+15V	DC Power	500mA	
2		Spare	N.U.		
3	chassis	GND	DC power return		
4	4	RF signal	RF signal strength indicator	0.5 - 2V	
5	6	Opt	Optical power input level	1V/mW	
6	1	Pilot	Pilot level monitor	1.5 - 5V	
7	2	Spare	N.U.		
8	3	Relay 1	Relay Contact	Normally closed	Relay 1&2 open in alarm condition
9	5	Relay 2	Relay Contact	Normally closed	Relay 1&2 open in alarm condition

LED Condition Tables (6125–GS Transrnitter Unit)

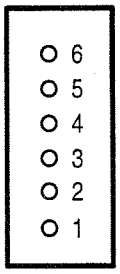
LED name	Color	State	Conditions
Laser	GREEN	ON OFF	Normal optical & DC power conditions Laser opt. power is out of range or DC not applied
RF	GREEN	ON OFF	RF Above –5 dBm input RF below

LED Conditions Tables (6125–GS Receiver Unit)

LED name	Color	State	Conditions
OPT.	GREEN	ON OFF	Normal optical & DC power conditions Low opt power or DC not applied
RF	GREEN	ON OFF	RF output above –15 dBm RF below
PILOT	GREEN	ON OFF	Pilot signal present (above 1V) Low pilot signal
LOCK	GREEN	ON OFF	AGC loop is locked AGC loop unlocked

RX Link 6225 Pin–out & Alarm Table

The 7000M backplane incorporates 5 slots, each of which has its own 6 pin Molex header associated with it. The pins are numbered as follows:



Any monitor voltages to be measured may be done between the chassis ground and the required pin.

Transmitter Unit 622ST–GS

Plug in 9 pin–D	Rackmount Alarm	Pin (signal) Name	Function	Range	Alarm Conditions
1		+15V	DC Power	100–300mA	
2		Spare	N.U.		
3	chassis	GND	DC power return		
4	4	RF signal	RF signal strength indicator	0.5 - 2V	
5	6	Laser PDI	Laser optical power	–4.0V to +/–0.5V	
6	1	LSRI	Laser current monitor	–4.7+/–0.3V	
7	2	RF Alarm	Sinks current	Off normal	RF not present
8	3	Relay 1	Relay Contact	Normally closed	Relay 1&2 open in alarm condition
9	5	Relay 2	Relay Contact	Normally closed	Relay 1&2 open in alarm condition

Receiver Unit – 622SR–GS

Plug in 9 pin–D	Rackmount Alarm	Pin (signal) Name	Function	Range	Alarm Conditions
1		+15V	DC Power	500mA	
2		Spare	N.U.		
3	chassis	GND	DC power return		
4	4	RF signal	RF signal strength indicator	0.5 - 2V	
5	6	Opt	Optical power input level	1V/mW	
6	1		Pilot level monitor	1.5–5V	
7	2	Spare	N.U.		
8	3	Relay 1	Relay Contact	Normally closed	Relay 1&2 open in alarm condition
9	5	Relay 2	Relay Contact	Normally closed	Relay 1&2 open in alarm condition

LED Conditions Tables (6225–GS Receiver Unit)

LED name	Color	State	Conditions
OPT	GREEN	ON OFF	Normal optical & DC power conditions Low opt power or DC not applied
RF	GREEN	ON OFF	RF output above –15 dBm RF below
PILOT	GREEN	ON OFF	Pilot (Above 1 V) Low pilot signal
LOCK	GREEN	ON OFF	AGC loop is locked AGC loop unlocked

3.4.24 LED and Alarm Conditions (6225–GS Transmitter Unit)

LED name	Color	State	Conditions
Laser	GREEN	ON OFF	Normal optical & DC power conditions Laser opt. power is out of range or DC not applied
RF	GREEN	ON OFF	RF above –15 dBm input RF below

7050D–422–P Data Multiplexer Pin–Out Table

Each multiplexer has four (4) identical bi-directional data channels consisting of a 9 pin type connector per channel. The fifth 9 pin–D connector is used for the RS-422 clock channel.

RS 422 DATA PORTS

Pin N°	Pin Name	Function	Polarity
1	RX1	Receiver input	+
2	RX2	Receiver input	–
3	GND	DC power return	
4	TX2	Transmitter output	–
5	TX1	Transmitter output	+

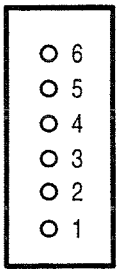
Clock Reference Port

Pin N°	Pin Name	Function	Polarity
1	RX1	Receiver input	+
2	RX2	Receiver input	–
3	GND	DC power return	
4	TX2	Transmitter output	–
5	TX1	Transmitter output	+

Chassis Pin-out for MUX connector

The modified 7000M backplane incorporates 5 slots, each of which has its own 6 pin Molex header associated with it. There are monitor voltages and alarms on each plug in unit. (The alarms are gathered so that there is one summary alarm per chassis in each extremity, serially connected.)

The pins are numbered as follows:



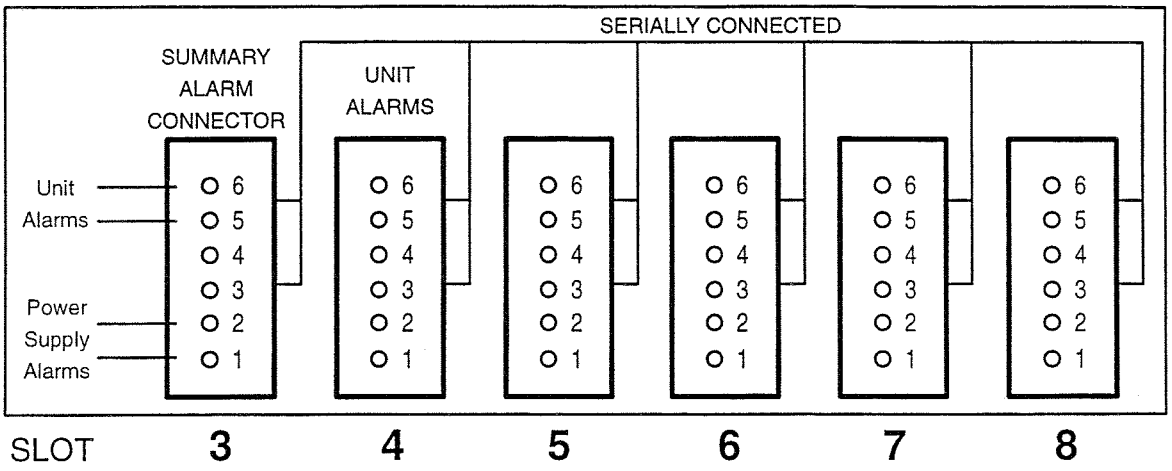
Any monitor voltages to be measured may be done between the chassis ground and the required pin.

	Pin #	Signal name	Function	Range	Alarm Conditions
1		+15V	DC Power	500mA	
2		Spare			
3	chassis	GND	DC power return		
4	4	RX PDI	PD optical power input level	1V/mW	
5	6	Laser PDI	Laser optical power	-3.6V to -4.8V	
6	1	LSRI	Laser current monitor	-4.7V+/-0.4V	
7	2	Spare			
8	3	Relay 1	Relay Contact	Contacts closed	Relay contacts opened if: 1. opt power not present 2. AC or DC power not applied
9	5	Relay 2	Relay Contact		Relay contacts opened if: 1. opt power not present 2. AC or DC power not applied

LED CONDITIONS TABLE

LED's name	Color	State	Conditions
Laser	GREEN	ON OFF	Laser opt power is normal Laser optical power is out of range
OPT INPUT	GREEN	ON OFF	Opt power exist, fiber connection normal OPT RX LED is OFF- opt. power insufficient
CHANNEL 1	GREEN	ON OFF	Channel 1 receives data There is no data on Channel 1
CHANNEL 2	GREEN	ON OFF	Channel 2 receives data There is no data on Channel 2
CHANNEL 3	GREEN	ON OFF	Channel 3 receives data There is no data on Channel 3
CHANNEL 4	GREEN	ON OFF	Channel 4 receives data There is no data on Channel 4

CHASSIS ALARM PINOUTS



The alarm pins consist of individual plug in units dry contacts wired in series and presented as one set of dry contacts at the summary alarm connector at slot 3, pins 5 & 6. This way not only can the presence of any plug in failure be detected, but later any individual plug in can be identified at any slot using a simple resistance test. The same is true for the power supply. Each power supply is normally closed when DC power of over +15 VDC is emerging. In case of failure, the relay opens up. The relays are wired in series and presented as a summary alarm at slot 3 pin 1 & 2.

RELAY LOGIC TABLE

CONDITION	RELAY
No AC or DC power	OPEN
Fault	OPEN
Normal	CLOSED

A.3.8 – Adjustments

Link gain control

Receiver gain control allows output signal levels to be set and maintained regardless of length of fiber, optical budgets or RF cable losses. The AGC potentiometer is adjusted while monitoring the signal level of the Receiver. Once set, there **is** no need for constant monitoring as the AGC will maintain a +/- 0.1 dB level control regardless of external factors.

	Nominal Input Level	RF. Signal Strength Monitor		Pilot Level	RF. Signal Strength Monitor	Nominal RF. Output Level
TX LINK	0 dB	0.5-2V		1.5-5V	0.5-2V	-7 dBm
RX LINK	-10 dBm	0.5-2V		1.5-5V	0.5-2V	-10 dB

A.3.9 — Problems & troubleshooting guide

The System was tested before it left the factory, however if you are experiencing difficulties consult the list below for possible solutions. If your system is still experiencing problems, please attempt to isolate and identify the malfunctioning unit.

PROBLEM **POSSIBLE CAUSE**

Transmitter

1. Laser LED not on	1. No DC power to the unit. Possible power supply problem or AC power input problem. Check the fuse. 2. Verify LSRI monitor is below –4.0V. If not, laser may have overheated! Disconnect power or remove plug in and allow to cool. Try again with better airflow or heat sinking to the unit. 3. If optical power meter is available, measure optical power out of the transmitter. It should be 2 mW to 4 mW. If no optical power meter is available, then use another receiver to determine 'If there is optical power emerging from the transmitter. If there is no optical power, then the transmitter unit is malfunctioning. If any or all the above are not within the guidelines, laser or laser circuit is defective.
2. RF LED is not illuminated	1. The input signal is too low, Verify signal level in or RF signal strength pin 4. Even if LED is off, the unit will still function, although you will register an alarm condition.

PROBLEM **POSSIBLE CAUSE**

Receiver

1. No optical power, LED not illuminated	1. Check DC / AC power as in above. 2. Transmitter is not functioning, see above. 3. There is a break or severe bend in the fiber optic cable. Use an optical power meter or another functioning receiver unit to verify optical power coming down the flber. Exchange with another transmitter to verify good source / bad receiver. 4. Opticai power too low, too many splits, too long a distance (thus exceeding optical budget). System *may still function* without LED illuminated although at reduced performance.
2. RF LED **is** not illuminated	The output signal is too low, check RF output level to verify signal output. Check RF signal strength monitor on pin
3. Pilot LED flickers	Check input optical power being sure to use a mating optical transmitter. Pilot levels may vary from transmitter unit to unit.

4. AGC LED Flickers or is not lit	1. Check for vai'id optical power and pilot level as above. 2. The gain control has been set too high or too low. 3. The optical budget has been exceeded, and the gain control cannot sufficiently amplify. 4. There is dust in the optical connectors causing the laser to become very noisy. Remove, clean and remate the optical connectors.

A.3.10 – Maintenance

All internal adjustments have been set up at the factory; the only user adjustment is output RF signal levels accessible from the front panel of the receiver and described in the previous sections. If there are any problems or questions please contact Foxcom and we will be happy to instruct you further.

To ensure long term system performance and detect faults before they may occur, the following maintenance checks are advised along with the schedule of time intervals. Should readings vary significantly from nominal, consult the trouble shooting guide, the factory or replace with a spare plug in unit.

	ITEM	MAINTENANCE INTERVAL
1	Alarms	Constantly in real time
2	Voltage monitors – Pilot, Optical power, LSRI, RF signal, PDI, etc from pinout table	Quarterly
3	LEDs	Quaterly
4	Gain and RF levels	Quaterly
5	Spare unit – loopback tests Using optical jumper cable to interconnect and verify operational condition of transmitter and receivers. Each link requires its own set of test equipment	Yearly

Gain adjust - periodic need for gain readjustment may need to take place. This is simply performed using a stable single tone input signal within the band of interest while monitoring the signal of interest using a power meter or spectrum analyzer. The front panel potentiometer is adjusted for the required gain.

Clean optical connectors - in case of equipment moving or severe environmental conditions (water encroachment) it may be necessary to clean the optical connector interfaces. Rub the end faces with a smooth lint-free dry cloth and replace. In case of foreign material or dust present in the interface, it will be necessary to remove the plug-in cover (5 black screws) and clean the internal connector as well. Be sure to observe the key and the polarity of the connector and the bulkhead.

Primary Fuse in power supply - replace the fuse only with the same type and rating of fuse in case of failure. This is easily accessible on the rear panel of each power supply module.

Secondary power supply fuse - In case of failure of the internal power supply fuse (5A) perform the following:

1) Unseat the power supply plug in from the chassis with the 4 captive screws.

2) Remove the 5 cover screws.

3) Locate the fuse on the PCB and remove the plastic cover.

4) Replace only with the same type and rating of fuse (5 amps 250V).

5) When reinstalling the cover, line up the LED with the front panel hole.

110/220 VAC Operation

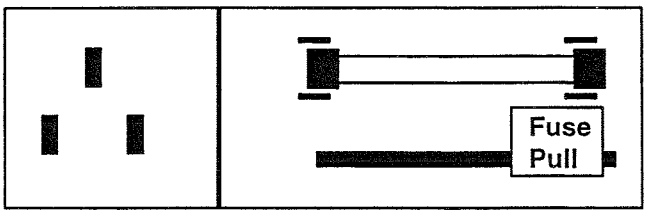
WARNING!

The chassis/power supply can be operated in either 110 or 220 VAC mode. All units received will come standard in 220 VAC mode.

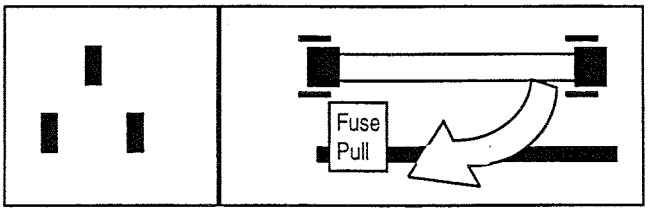
In order to change to 110 VAC operation the instructions below **must** be followed to avoid damage to both personnel and equipment.

avol I

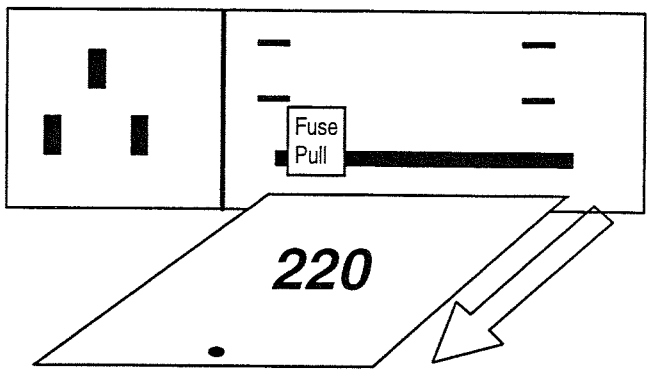
1. Disconnect AC power.
2. Unplug power supply module from chassis.
3. Turn power supply around with AC pins facing you.
4. Slide plastic cover to the left side covering the AC pins.



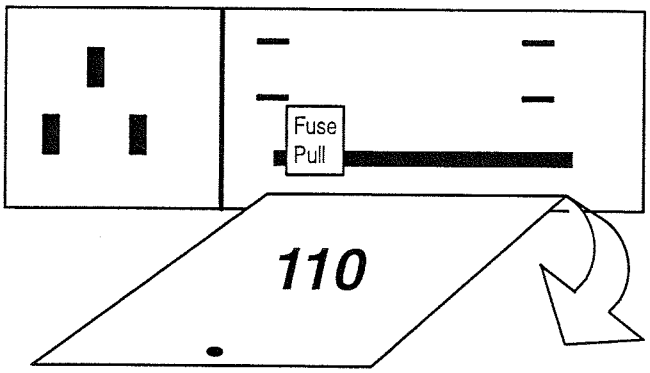
1. Rotate the lever found under the fuse to the left, the fuse will pull out.
2. Take out the fuse.



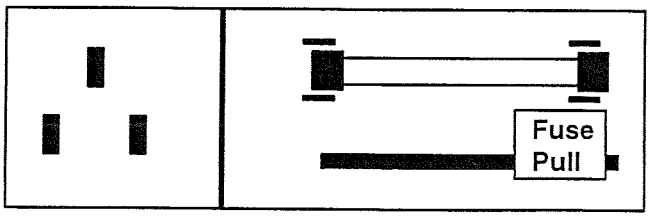
1. Take a small screwdriver insert it in the hole on the PCB found under the fuse.
2. Pull out the PCB.
3. You will see 220 printed on the middle of the PCB.



1. Turn over PCB with 110 shown in the middle of the PCB.
2. Insert the PCB into the slot.
3. You have now changed the power supply from 220 VAC to 110 VAC.



1. Return lever to the right and insert a 1 amp fuse for 110 VAC operation and 0.5 amp fuse for 220 VAC operation.
2. Close cover.



A.3.11 — Warranty and repair policy

Foxcom performs testing and inspection to verify the quality and reliability of our products. Foxcom uses every reasonable precaution to ensure that each unit meets specifications prior to shipment. Customers are asked to advise their incoming inspection, assembly, and test personnel as to the precautions required in handling and testing our products. Many of these precautions are to be found in this manuai.

The products are covered by the following warranties:

A. General Warranty

Foxcom warrants to the original purchaser all standard products sold by Foxcom to be free of defects in material and workmanship for one (1) year from date of shipment from Foxcom. During the warranty period, Foxcom will repair or replace any product that Foxcom proves to be defective. This warranty does not apply to any product which has been subject to alteration, abuse, improper installation or application, accident, electrical or environmental over-stress, negligence in use,storage, transportation or handling.

B. Specific Product Warranty Instructions

All Foxcom products are warranted against defects in workmanship, materials and construction, and to no further extent. Any claim for repair or replacement of units found to be defective on incoming inspection by a customer must be made within 30 days of receipt of shipment, or within 30 days of discovery of a defect within the warranty period.

This warranty is the only warranty made by Foxcom and is in lieu of all other warranties, expressed or implied. Foxcom sales agents or representatives are not authorized to make commitments on warranty returns.

C. Returns

In the event that it is necessary to return any product against above warranty, the following procedure shall be followed:

a. Return authorization is to be received from Foxcom prior to returning any unit. Advise Foxcom of the model, serial number, and discrepancy. The unit may then be forwarded to Foxcom, transportation prepaid. Devices returned collect or without authorization may not be accepted.

b. Prior to repair, Foxcom will advise the customer of our test results and any charges for repair for customer-caused problems or out-of-warranty conditions etc.

c. Repaired products are warranted for the balance of the original warranty period, or at least 90 days from date of shipment.

D. Limitations of Liabilities

Foxcom's liability on any claim, of any kind, including negligence for any loss or damage arising from, connected with, or resulting from the purchase order, contract, quotation, or from the performance or breach thereof, or from the design, manufacture, sale, delivery, installation, inspection, operation ouse of any equipment covered by or furnished under this contact, shall in no case exceed the purchase price of the device which gives rise to the claim.

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E. Communication

All communication by letter, phone or fax to Foxcom should be directed to:

Foxcom, Inc.

P.O.B. 35746

Los Angeles, CA 90035

Tel: 310–275–8420

Fax: 310–285–0797

Attn: Customer Service Dept.

A.3.12 — System specifications

TX LINK (6125–GS)

Specs are tested at nominal I/O power according to Foxcom internal test procedures

ITEM	PARAMETER	SPEC
3.1.0	Frequency band	800 – 1000 MHz
3.1.1	Gain:	
	Nominal at any temp in the full band	–7 +/–0.6 dB (note 1)
3.1.2	Stability in the temperature range for any frequency in the frequency band	
	Short term (per 2 hour)	< +/–0.1 dB (note 3)
	Medium term (1 month – calculated)	< +/–0.2 dB (note 3)
3.1.3	Gain Adjustability:	–5 to +5 dB
3.1.4	Gain fiatness:	
	Full band	< +/–0.4 dB (note 3)
	Channel Output Power Ripple	<.15 dB/ 1.2 MHz
3.1.5	Noise figure	< 42 dB
3.1.6	Intermodulation:	
	3rd order output intercept point (minimum)	+25 dBm
	Power Output at 1 dB compression	+15 dBm
3.1.7	Out of BAND Harmonics	NO SPEC
3.1.8	Dynamic range	> 45 dB
3.1.9	Output power swept frequency response $\underline{\Delta P}$	< 0.1 dB p to p (note 4)
3.1.10	In band integrated phase error over any 1.2 MHz band	< 0.001 rad^2 (+/- 1.8°/1.2 MHz)
3.1.11	Input level (nominal)	0 dBm
3.1.12	Maximum input level	+ 5 dBm
3.1.13	Resistance to overload	+ 20 dBm
3.1.14	Impedance	50 Ohms
3.1.15	VSWR	
	Input Max.	< 1.25 :1
	Output Max.	< 1.25 :1
3.1.16	SFDR	> 104 dB /Hz
3.1.17	Connector	SMA

TX Control Channel Specs

1 0 Mhz Reference (Multiplexed in with the TX Link)

ITEM	PARAMETER	SPEC
3.1	Frequency	10 MHz
3.2	Input level (nominal)	–20 dBm
3.3	Impedance	50 Ohms
3.4	Output level	– 25 dBm +/– 2 dB Tracks with gain control adjustment
3.5	Spurious	< –60 dBc 10 kHz to 1 MHz
3.6	SNR	> –110 dBc
3.7	Connector	SMA
3.8	VSWR	< 1.3:1

RX LINK (6225–GS)

Specs are tested at nominal I/O power according to Foxcom internal test procedures

ITEM	PARAMETER	SPEC
3.4.0	Frequency band	10 MHz
3.4.1	Gain:	
	nominal at any temp in the full band	0 +/- 0.6 dB (note 1)
3.4.2	Stability in the temp range for any frequency in the frequency band	
	Short term (2 hours)	< +/- 0.1 dB (note 3)
	Medium term (1 month calculated)	< +/- 0.2 dB (note 3)
3.4.3	Gain Adjustability	-5 to +5 dB
3.4.4	Gain flatness:	
	Full band	< +/- 0.4 dB (note 3)
	Channel Output Power Ripple	0.15 dB /1.2 MHz
3.4.5	Noise figure	< 44 dB
3.4.6	Intermodulation	
	3rd order output intercept point	> +25 dBm
	Power output at 1 dB compression	+15 dBm
3.4.7	Out of band harmonics	No Spec
3.4.8	Dynamic range	> 45 dB
3.4.9	Output Power Swept Frequency Response	< 0.1 dB (note 4)
3.4.10	In band integrated phase error (per 1.2 MHz)	< .001 rad (+/- 1.8°/ 1.2 MHz)
3.4.11	Input level nominal	-10 dBm
3.4.12	Max. Input Level	-5 dBm
3.4.13	Resistance to overload	> 20 dBm
3.4.14	Impedance	50 Ohms
3.4.15	VSWR	No Spec
	Input Max.	< 1.25 :1
	Output Max.	< 1.25 :1
3.4.17	Connector	SMA

7050–4 RS – 422 DATA MULTIPLEXER UNIT

ITEM	PARAMETER	SPEC
3.5.2	Data Rate	19.2KBS, NRZ
3.5.3	B.E.R.	<10-9
3.5.4	Operating mode	Asynchronous
3.5.5	Connector	9 pin D
3.5.6	Delay between each port	<40 MS (<100μ typ.)
3.5.7	Size	3U Plug In, 2 Slots
3.5.8	Fiber count	2 Fibers
3.5.9	Fiber connectors	FC/APC

Pulse Reference

ITEM	PARAMETER	SPEC
3.6.1	I/O Standard	RS422 / RS485
3.6.2	Period	500 MS
3.6.3	Rep rate	0.5 Hz
3.6.4	Connector	9 pin D
3.6.5	Rise / fall time	< 20 ns
3.6.6	Jitter	< 100 ns

Common specs

ITEM	PARAMETER	SPEC
4.1	**PHYSICAL:**	
4.2	Size	3U x 19" x X 12"
4.3	Weight	TBD
4.4	Reliability	150.000 hrs
4.5	Power requirements	110/220 VAC @ 45W

FIBEROPTIC CABLE SPECIFICATION

4.6.1	Cable type	Singlemode, 9/125, dispersion zero at 1310
4.6.2	Connectors	FC/APC
4.6.3	Insertion loss	< 0.5 dB / mated pair
4.6.4	Return loss	> 60 dB optical
4.6.5	Environment	-40 to +85C
4.6.7	Fiber loss	< 0.4 dB / km
4.6.8	Fiber length	100 to 5000 meters - (no splices)

ENVIRONMENTAL

5.1	Electronic equipment operating temp	+10/+55 °C
5.2	Optical fiber operating temp	- 40/+55 °C
5.3	Storage temp	- 40/+85 °C
5.4	Humidity operating mode	80 %
5.5	Altitude operating	3000 m
5.6	Altitude air ship	10000 m
5.7	Operating vibration	zone 4 seismic ( )
5.8	EMC	ETS 300339
5.9	Safety (laser)	CLASS IIIB

DESCRIPTION	PART NUMBER	FUNCTION DESCRIPTION	ORDERING INFORMATION	REMARKS
FIBEROPTIC INTERFACILITY LINK	FIL 6000 A	ONE FULL OPERABLE SYSTEM	SHOULD BE ORDERED AS: FIL 6000 A PER 9500101	
FIBEROPTIC INTERFACILITY LINK - GATEWAY	FIL 6000 A-G	ONE FULL OPERABLE SUBSYSTEM (INDOOR UN,IT)	SHOULD BE ORDERED AS: FIL 6000 AG PER 9500101	
6125T GS Transmitter	6125T GS	TX Linl Transmitter	6125T GS PER 9500101	2 Pcs per subassembly
6225R GS Receiver	6225R GS	RX Link Receiver	6225R GS PER 9500101	2 Pcs per subassembly
7050–4 Multiplexer	7050–D–422–T/R	Control Link	7050–D–422–T/R PER 9500101	1 Pcs per subassembly
7000 M 110/220	7000 M 110/220	Main Power Supply	7000 M 110/220 PER 9500502	1 Pcs per subassembly
7000 S 110/220	7000 S 110/220	Standby Power Supply	7000 S 110/220 PER 9500502	1 Pcs per subassembly
7000 Rack	7000 C AL	Chassis	7000 C AL PER 9500101	1 Pcs per subassembly
FIBEROPTIC INTERFACILITY LINK ANTENNA	FIL 6000 A-A	ONE FULL OPERABLE SUBSYSTEM (OUTDOOR UN,IT)	SHOULD BE ORDERED AS: FIL 6000 AA PER 9500101	
6125R GS Receiver	6125R GS	TX Link Receiver	6125R GS PER 9500101	2 Pcs per subassembly
6225T GS Transmitter	6225T GS	RX Link Transmitter	6225T GS PER 9500101	2 Pcs per subassembly
7050–4 Multiplexer	7050–D–422–T/R	Control Link	7050–4 PER 9500101	1 Pcs per subassembly
7000 M 110/220	7000 M 110/220	Main Power Supply	7000 M 110/220 PER 9500502	1 Pcs per subassembly
7000 S 110/220	7000 S 110/220	Standby Power Supply	7000 S 110/220 PER 9500502	1 Pcs per subassembly
7000 Rack	7000 C AL	Chassis	7000 C AL PER 9500101	1 Pcs per subassembly

Fiberoptic cable, connectors and installation

FOXCOM – TECHNICAL BULLETIN – T03. REV B

SCOPE

This technical bulletin is meant to introduce the user to fiberoptic cable, as well as to provide important information needed to specify fiberoptic cable when used with FOXCOM products. While short lengths of pre-terminated cable can be installed by non-fiberoptic installers, **Foxcom recommends that cable be installed by experienced personnel.**

FIBER OPTICS

A fiber optic cable is an extremely thin piece of continuous glass coated with protective layers. Fiber has useful communications characteristics in transmission of signals over light waves namely:

Signal attenuation – low attenuation over long distances.

Bandwidth – very high bandwidth / signal capacity.

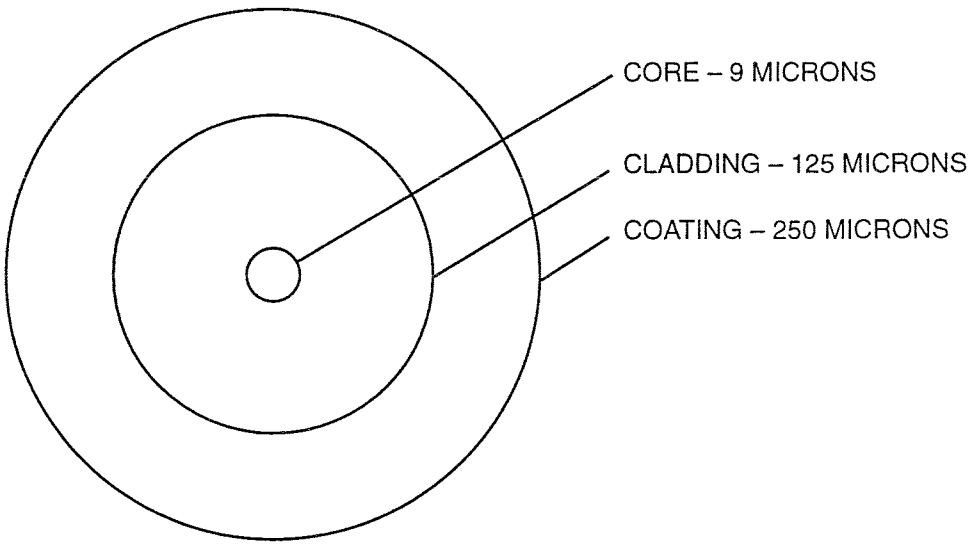
Dielectric – electrical isolation of transmit and receive sites from each other.

Electromagnetic compatibility – immunity from EMI, RFI, NEMP. Signal security.

Lightweight & flexible – can weigh 100X less than coax and is easy to bend.

The two commonly used types of fiber for signal communications are singlemode and multimode fiber.

SINGLEMODE fiber is used in long distance high bandwidth applications at wavelengths of 1310 nm and 1550 nm. Its crossection looks like this..



TYPICAL SPECS

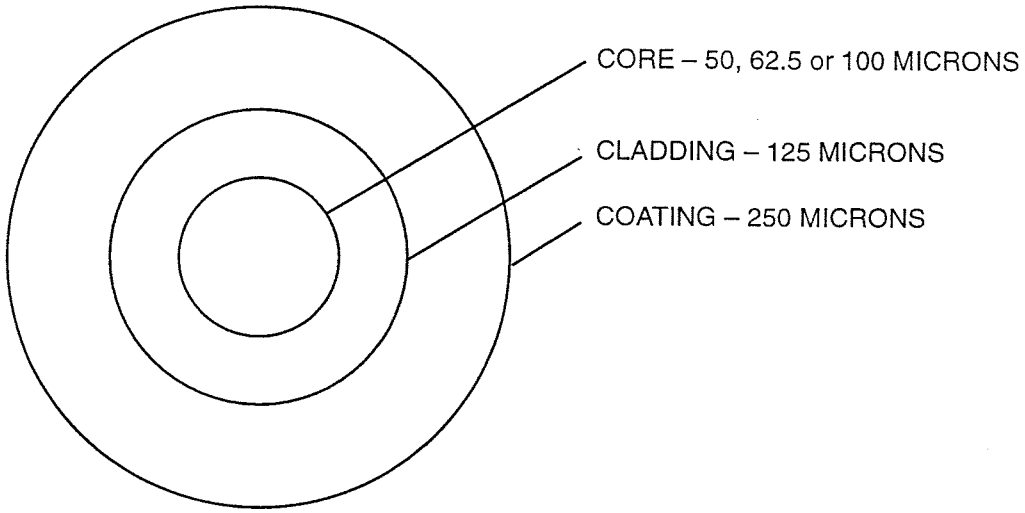
Attenuation – 0.38 dB / km optical loss at 1310 nm, and 0.25 dB / km at 1550 nm.

Dispersion – standard fiber has no dispersion at 1310 nm, and significant dispersion at 1550 nm. Dispersion can cause signal distortions especially in multichannel systems.

Optical reflection – High performance transmission requires that all the light travel to the receiver and none be reflected back towards the transmitter. Normal fiber has negligible reflection, however long pieces of fiber (10 km +), have cumulative backscatterring of light towards the source. This can reach –30 dB optical.

Bandwidth – fiber bandwidth exceeds 100 GHz / km and is limited by the fiberoptic source.

MULTIMODE FIBER – is used in short distance (<3 km) for low and medium digital data communications. It is used with 850 nm and 1310 nm optical wavelengths.



Core sizes – the most common size used is 62.5 micron. The core sizes of two mating fibers should be matched in splicing or connecting otherwise severe optical losses can result.

Attenuation – this varies with core size, wavelength and fiber manufacturer.

	Typicai optical loss per kilometer	
Core diameter	**850 nm**	**1310 nm**
50 micron	3 dB	1 dB
62.5 micron	3.75 dB	1.5 dB
100 micron	5 dB	2 dB

Bandwidth – varies with core size and wavelength. Generaily 1310 and small core size has the highest bandwidth. Typical values are 200 MHz/km for 850 nm and 500 MHz/km for 1310 nm.

CABLE is used to protect fiber from breakage during installation and from hostile environments (rodents, sharks bites or excessive moisture). Different types of cable are for different applications:

1. **JUMPERS** - are used as patchcords consisting of typically a 3 mm outer jacket with internal Kevlar strands. Used to terminate equipment, for temporary use and in protected areas.

2. IN-BUILDING - cable can consist of the 3 mm cable mentioned above for protected areas, or be complex - such as hybrid fiber / copper types with multiple armor. It can be pulled through existing ducting, overlashed on existing cables or tacked down to the walls directly. Generally indoor applications require plenum cable for fire / smoke safety ratings.

3. OUTDOOR AERIAL - is used to overlash onto existing rights of way. Slack is left at interim locations and on longer runs splice enclosures are outdoor mounted. These cables typically have strength members built in and have loose inner tube construction to avoid microstress due to temperature changes and gel fillings to avoid moisture ingress.

4. OUTDOOR BURIAL - can be accomplished by laying a duct and installing fiber cable (along with any other wire or cabling) or can be direct burial type. The environment should be known in advance (temperature changes, moisture, etc.) as well as the appropriate burial depth to avoid potential dig ups.

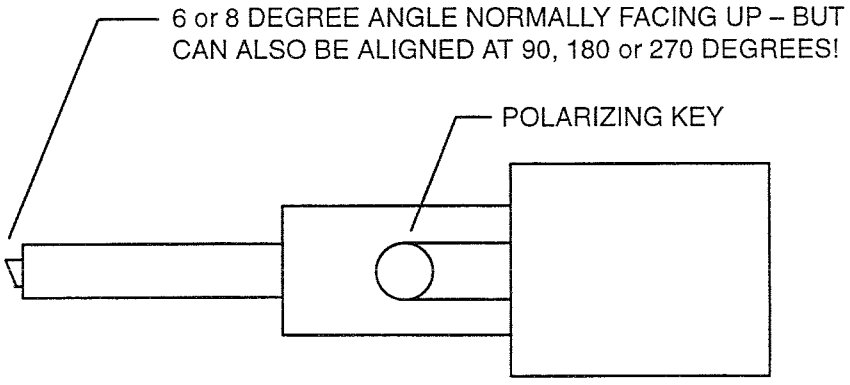
COSTS

Although bare fiber costs are iow ($.20 per meter) the cable type represents the major cost. Typicai prices are in the range of $1.50/meter for simple indoor cable, and $4/meter for multistrand outdoor cable. Costs of burying cable are directly related to digging and dependent upon labor costs in the geographic region. This can vary widely!

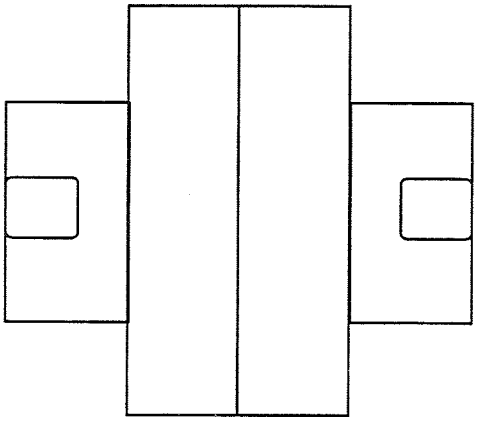
CONNECTORS - the connector must be able to precisely locate, center, join and maintain an optical connection sometimes to within less than 1 micron tolerance. Evolving connector technology has made this practical at reasonable costs. The major specifications are attenuation, optical reflection and number of mating cycles. Optical connectors usually mate to a bulkhead or receptacle.

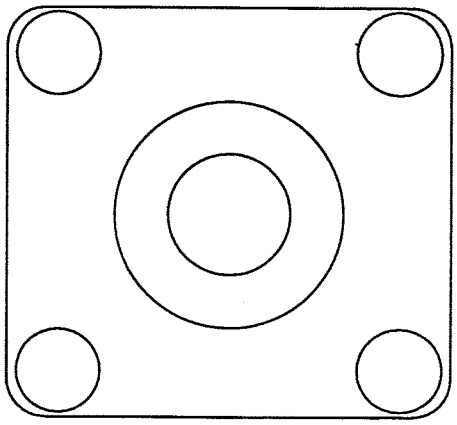
APC - stands for Angled Physical Contact. This connector was developed specifically for lowest optical reflection (optical return loss). Used mainly in very high data rate transmission, high precision and CATV applications, these connectors are both expensive and NOT STANDARD.

POLARITY Shown below is the preferred orientation of the APC for FOXCOM products



In case your connectors do not match this polarity all is not lost! FOXCOM products have a unique bulkhead which can carefully be unscrewed unmated and rotated in 90 degree increments to match any input connector polarity.





APC TYPICAL SPECS

Attenuation (insertion loss) – typically 0.5 dB

Reflection (return loss) – typically –55 to –70 dB

ST - the ST connector is one of the most widely used connectors in industry today and exists in a common standard. Originally with poor reflection specs (–14 dB to –30 dB), it is now available with polishing techniques which can bring the reflection levels down to –50 dB.

TYPICAL ST SPECS

Attenuation (insertion loss) – typically 0.2 to 0.4 dB

Reflection (return loss) – available in –30, –40 and –50 dB grades ("super" and "ultra" polish).

FIBER INSTALLATION - fiber cable is normally available in 2 km lengths and has to be spliced together. Short lengths of cable can either be pre terminated with connectors and pulled, tacked or overlashed into place. or termination can be done in the field. In the case of low return loss connectors, it is not possible for the user to terminate in the field, however a "pigtail" can be fusion spliced onto the installed cable.

PULLING - fiber cable can be pulled through exiting ducting or for long lengths can even be "blown" at high air pressures down a length of pre-lubricated ducting. Care must be taken not to stress the cable and not to allow any existing connectors to be broken or stressed along the way.

SPLICING there are two accepted methods of joining a bare fiber: mechanical & fusion:

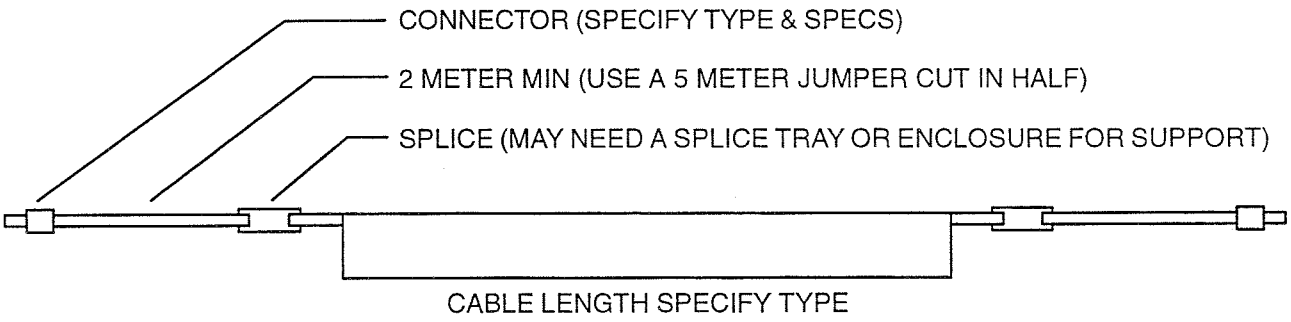
1. **MECHANICAL** splices are normally used for fast, emergency or temporary restoration. Due to questions of long term reliability and lower performance specs mechanical splices are not recommended by FOXCOM for high performance systems.

2. **FUSION** splicing basically aligns and welds two fibers together. It has the advantage of very low attenuation and reflection, however it is an expensive technique. A splicer with automatic alignment, microscope/TV monitor, and means for local injection or estimation of splice losses can cost $10,000 to $25,000. There are low cost units which are manual and rely solely upon operator experience but produce unrepeatable splices.

TESTING - The installer should test the finai fiber installation with a power meter and lightsource injection or with an OTDR (optical time domain reflectometer). Only an OTDR can evaluate both the insertion and reflection performance of a fiber as well as locate exactly where the problem is.

Occasional problems arise when trying to splice fiber made by different manufacturers. FOXCOM has had the best experiences using fiber made by CORNING, although there are other manufacturers including AT&T (and European and Asian manufacturers).

PATCH PANELS - often splice trays, fiber organizers and patch panels are useful accessories in installations where there will be future upgrading, fiber tests or need to move equipment racks around. In a fixed installation, there will be no need for this, and is an unnecessary introduction of insertion loss, return loss and maintenance. In the case where there will be no need to move the equipment, a cable assembly with adequate pigtail or jumper lengths should be specified as shown:

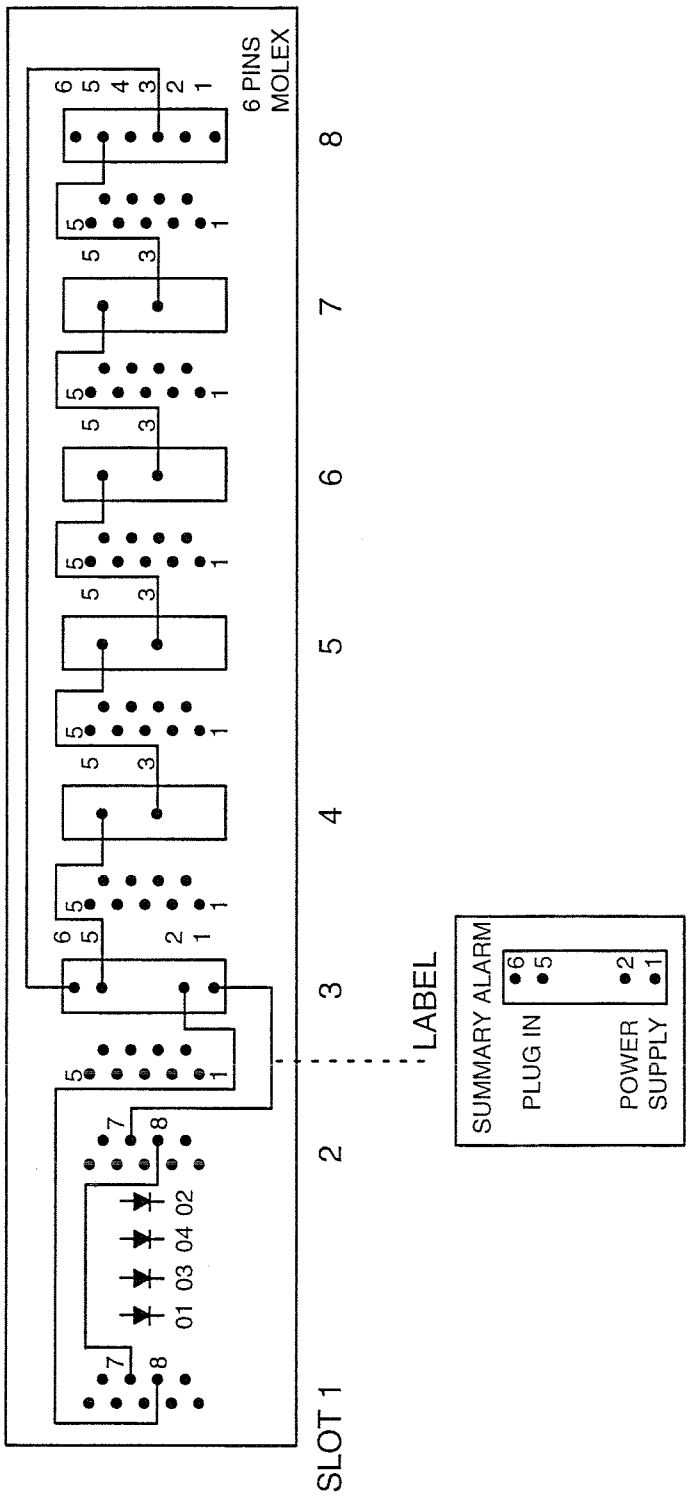


SOLUTIONS

Foxcom manufactures fiberoptic transmitters and receivers with bandwidths from 10 Hz to several GHz. Wideband response of Foxcom links is superior, and therefore transmit and reproduce RF, video or pulsed signals with minimal noise, distortion or group delay variation. Output signals can be amplified to required levels with manual gain control or with our proprietary AGC circuitry. For applications where limited fiber is available, and large numbers of channels must be transmitted, Foxcom can multiplex many channels per fiber by a variety of approaches including FDM and WDM.

Foxcom can assist in the design and implementation of your fiberoptic requirements. Our experienced staff has provided solutions for Wireless, Broadcast & Satellite users as well as Government, Research and CATV customers alike. Contact the factory directly for technical assistance or price quotations.

FAX TRANSMITTAL FORM



Alarms block diagram

FIN DE DOCUMENT

ALCATEL

GLOBALSTAR GATEWAY RF SUBSYSTEM

PROGRAM TRACK ANTENNA

SITE ACCEPTANCE TEST PROCEDURE

Beta	13 October 1998	Creation	Andre REUMAUX	Andre REUMAUX
ED	**DATE**	**CHANGE NOTE**	**APPRAISAL AUTHORITY**	**ORIGINATOR**

ALCATEL

EDITIONS SUMMARY

Edition	Date	Writer	Detailed Modifications
1	11 November 1998	André REUMAUX	Creation

TABLES OF CONTENTS

1 Introduction

The Globalstar antenna is installed and tested in three main steps :

◊ The antenna is mechanically assembled and wired by following the instructions of the installation manual 3BT13406 ABAA TQ BJB.

◊ The antenna is adjusted and preliminary tested by following the instructions of the procedure 3BT 11520 AAAA QT BJA.

◊ The site acceptance test are made by following the instructions of the test procedure 3BT 11520 AAAA UC BJA.

The following document is the Program track Antenna Site Test.

Applying this procedure will bring the Globalstar antenna from the end of adjustment and preliminary test to the readiness for operation. As this procedure continues, the operator fills out the "Antenna Site Test Results". It is an Excel 97 electronic document, named "STRxxxxn.xls" where xxxx are four letters for the site abbreviation name and n is the number of the antenna tested.

A Qualcomm representative's can witness the tests running. At the end of the test, the site test report is completed and signed by both the Qualcomm and Alcatel site representative's. This signed report guarantees that all the tests have been performed following the procedure, that all the results are included in the "STRxxxxn.xls" electronic document and that the antenna is ready for operation. For very rare case, if some tests results are not compliant with the specifications, they can be noted like remarks on the site test report.

ALCATEL

Antenna Site Test Report

Site :	Antenna Number :

All the antenna site acceptance tests have been successfully performed by following the procedure Version : _____

All the site test results have been entered in the "STRxxxxn.xls" excel file : _____

Remarks (Optional) :

ALCATEL representative		
Date	Name	Signature

Qualcomm representative		
Date	Name	Signature

2 Method of Application

2.1 Authorized personnel

Alcatel Test Engineer which has been specially trained on the Globalstar Antenna system.

2.2 Test Sequence

Before following this procedure the following steps should have been completed :

◊ The Globalstar Alcatel antenna has been installed following the instructions in the Installation Manual reference 3BT13406 ABAA TQ BJB 01.

◊ The Globalstar Alcatel Antenna has been adjusted following the procedure for antenna adjustments reference 3BT 11520 AAAA QT BJA

The sequence of the tests in this procedure is anything but random and must be followed for correct antenna testing. For special situation and unexpected events, the sequence of the test can be modified with Qualcomm and Alcatel Globalstar Installation Manager agreement.

When several antennas are to be tested on the same site, the testing should be run in parallel on all antennas.

2.3 Tools.

To perform the test, the Alcatel Test Engineer must be equipped with the following tools :

◊ Computer with the following software :

⇒ Email account and email Software

⇒ Alcatel GTS Software

⇒ Alcatel TCU power meter reading software

⇒ Alcatel CDMA power meter reading software

⇒ Alcatel ACU parameter recording software

⇒ HP Bench Link Software

⇒ Microsoft Word and Excel 97

◊ Following accessories :

⇒ RS 232/RS422 converter code 77096636

⇒ One PCMCIA GPIB controller board

⇒ One PCMCIA dual RS422 Board.

⇒ 25 to 9 pin adapter code 1AB035620016

⇒ GTS outdoor cable code 3BT13017AAAA

⇒ GTS indoor cable code 3BT13018AAAA

⇒ RS232 motor drive cable

⇒ RS 232 ACU parameter cable

⇒ 9pts extension cord L=2m

⇒ HP sensor cable L=10m code : HP11730D

⇒ Gigatronic sensor cable

◊ Following RF accessories

⇒ 6 N - male / SMA - female connector code : R191329

⇒ 2 N - female / N - female connector code : R161705

⇒ 4 N - female / SMA - female connector code : R191331

⇒ 6 SMA - female / SMA - female connector code : R125720001

⇒ 4 50 ohm load N - male code: 404130

⇒ 2 SMA 10dB attenuator code R411810119

⇒ 2 SMA 20dB attenuator code R411820119

⇒ 1 3dB SMA combiner

⇒ 6 RF test cables SMA - male / SMA - male code RG 142 M17/158

◊ Standard Engineer tool box.

The RF test must be done using the above specified RF accessories. Using others RF test cables than the above specified cables is not allowed without agreement of Qualcomm and Alcatel Globalstar Installation Manager.

2.4 Measurement equipment

The following measurement equipment are necessary to perform the test. Manufacturer name and model are given as example. Other equipment with similar characteristic can be utilized.

The measurement equipment should have been properly calibrated and their calibration due date must be higher than the date of the test.

Equipment	Reference (given as example)	Quantity
Power meter	HP437B	1
Power Sensor	HP8481A	1
Spectrum analyzer	HP 8562A	1
Synthesizer	HP 83752B	2

2.5 Test Results

The result of each measurement will be entered in a specific Excel workbook named STRxxxxn.xls where xxxx are four letters for the site abbreviation name and n is the number of the antenna tested. There is one excel workbook per antenna.

Each measurement result is entered in its specific cell and the STRxxxxn.xls workbook is performing all the necessary computation to determine if the result of the test is compliant or not. Some test result are documented with spectrum analyzer plots. Theses plots are annexed to the site test results.

The STRxxxn.xls file can be printed to obtain a hard copy of the results.

When all the data have been entered in the Workbook and all the results are compliant, the test engineer will lock the Workbook using a secret random password generated by an automatic macro. It is then impossible to modify any test result.

2.6 Site Test Result Approval.

All the test may be witnessed by a Qualcomm Representative's available on site.

All the results are automatically analyzed by the Excel Workbook to verify their compliance with the specifications.

As soon as the test are completed, the Site Test Report document is completed with :

◊ the sentence "All test have been successfully completed following the site test procedure Vn" (where n is the version number of the procedure followed) if all the test result are compliant with the specification.

◊ The exact name of the "STRxxxxn.xls" files that contains all the results.

◊ some remarks if some test results do not comply with specifications.

The Site Test Report is then dated and signed by Qualcomm and Alcatel Test Engineer to confirm end of the site acceptance test.

The original Site test report is sent to the Alcatel Program manager to be send officially to Qualcomm in San Diego.

3 General Technical Recommendations

3.1 Warm up time of antenna equipment

The Site Acceptance test are made after the antenna Adjustment and preliminary tests have been completed. That means that all the system has been powered on for several days. If for any reason the main power has been shut down, all the RF test can resume only after a minimum of two hours warm up time. Other test than RF are not affected by a minimum warm up time.

For all the transmit RF test, all SSPA should have been enabled at least two hours in advance.

3.2 Warm up time of Measurement Equipment.

Spectrum Analyzer and RF synthesizer should have been powered ON (in On or Stand-By position) for at least two hours before starting the test.

If the measurement equipment has to be transported from one antenna to another, they can be shut down for a short time. In this case 10 minutes warming up time will be sufficient.

3.3 RF Test Cables.

Some RF test cables have to be utilized to connect the measurement equipment to the antenna system and their characteristics must be taken in account to insure a proper measurement.

The test procedure has been written taking in account the official Alcatel Globalstar Site Test RF Cables and all the measurement must be done by using this cable. It is a RF brown cable, 2 meters length equipped with SMA male connector and its reference is : RG 142 M17/158.

The following losses characteristic of this cable are taken in account in all the RF measurement :

Frequency (In MHz)	Losses (in dB)
900 MHz	0.8
2185 MHz	1.6
5150 MHz	2.6
6975 MHz	3.3

3.4 EIRP Measurement

The Power output measurements reference is the 40 dB test coupler included in the hub. Its value has been measured in factory and is noted in the hub near the coupler port. This test coupler is used as a reference to adjust the nominal 68 dBW EIRP. The feed losses to take into account to measure the EIRP is 0.3 dB (0.25dB typ.) The antenna gain to take into account at 5.05GHz is 47.8 dB and the EIRP is given by the formula :

EIRP = Pc measured (at the coupler) + C(test) - 0.3 dB + 47.8 dB

Where C(test) is the Hub test coupled value.

During the antenna adjustment following the procedure 3BT11520 AAAA QT BJA, the CDMA and TCU power meter are calibrated, the RF levels are adjusted, RX and TX gain level diagram are completed. Power measurement are noted on CDMA power meter and on the test power meter connected to hub test coupler. The CDMA power meter coupler port is then calibrated in reference of the hub test coupler and its value is noted C(cdma).

For all the TX measurement in the site test procedure, the output power measurement will be made using the CDMA power meter and the Eirp will be calculated using the formula :

EIRP = Pcdma measured at CDMA P.M. + C(cdma) - 0.3 dB + 47.8 dB

Where C(cdma) is the Hub test coupled value.

To avoid any mistake, STRxxxxn.xls is making the necessary computation.

4 Adjustment and Preliminary test report

4.1 Purpose of the test

1 Verify that the antenna adjustment and preliminary test report has been completed.

4.2 Test sequence

1 Open the "STRxxxxn.xls" workbook.

2 Verify that the all the adjustment data have been entered in the "Adjust" sheet

3 Verify that the report has been completed in the "A_Rpt" sheet.

4.3 Result analysis

1 Test result is compliant if the Antenna adjustment and preliminary test report has been completed and signed and if all data have been entered in the "STRxxxxn.xls" workbook.

2 This test must be compliant to continue the procedure.

5 Transmit test

5.1 Purpose of the test

1 The purpose of the test is to verify the following RF characteristic of the system :

⇒ IFL input level equivalent to 68 dBW Eirp

⇒ Intermodulation products generated by two carriers at same level and 1.2 MHz apart

⇒ Noise output of the SSPA

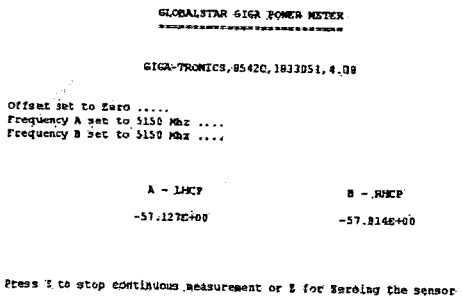
⇒ In Band radiated spurious

⇒ Pass Band output power deviation

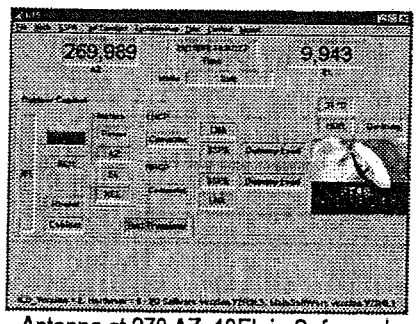
⇒ CDMA and TCU detection band

5.2 Test Sequence

1 In the CER, connect to the ICC indoor cabinet the customer laptop PC equipped with the Dual port RS485 PCMCIA board : port 1 to the CDMA port and the port2 to the M&C port. On the PC run the GTS.exe and the GIGA.exe software. Verify the connection with the ACU (connect Alcatel) and the connection with the Gigatronic power meter. Put the antenna in POSITION MODE 270 AZ and 10 EL and then put the antenna in safe mode.

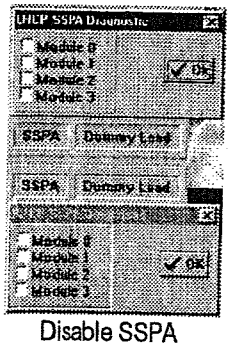


Power meter reading with Giga software

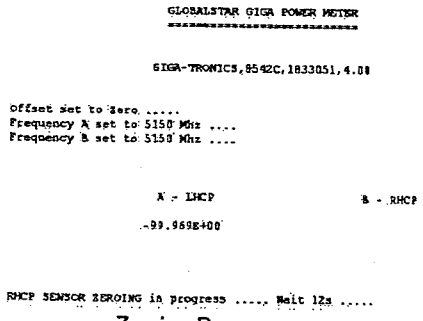


Antenna at 270 AZ, 10EL in Safe mode

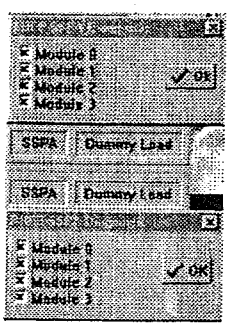
2 With the GTS, SSPA control window, disable all the SSPA. Then with the GIGA software, start a sensor zeroing by pressing the Z key. After the zeroing is completed, enable all the SSPA.



Disable SSPA

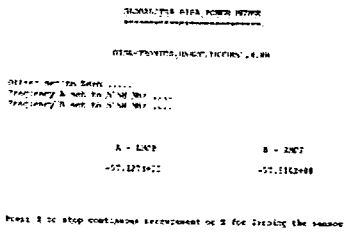


Zeroing Power sensor



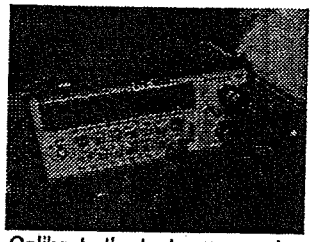
Enable SSPA

3 Once the SSPA are enabled, note the noise level measured by the LHCP and RHCP CDMA GIGA power meter. The level is typically around -56 dBm and should not exceed -50 dBm. The two values (LHCP and RHCP) should be entered in the "STRxxxxn.xls" workbook, sheet "TX test".



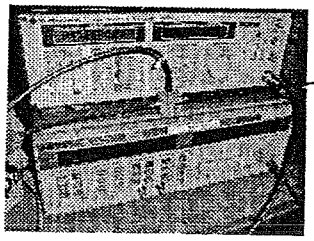
Noise floor reading with Giga software

4 Near the ICC indoor cabinet in the CER, install and calibrate the HP437B test power meter : Connect the sensor to the reference port in front of the power meter and calibrate the sensor as following : Preset - Enter, Zeroing, Shift-Cal-Enter. Wait until the calibration cycle complete. Verify calibration : press Shift - Power Ref and verify that the displayed power is 0.00 dBm - press Shift - Power Ref to switch off the Ref signal of the power meter. Set the measurement frequency to 900 MHz : FREQ - 0.9000 GHz.



Calibrate the test power meter

5 Near the ICC indoor cabinet, install the two RF synthesiser. Connect the two synthesisers to the test combiner. Connect one RF brown test cable at the output of the test combiner and terminate the cable with a N-Male connector. Set the Synthesizer#1 frequency to 899.4 MHz and the Synthesizer#2 frequency to 900.6 MHz. Set the output level of each Synthesiser to +5 dBm.

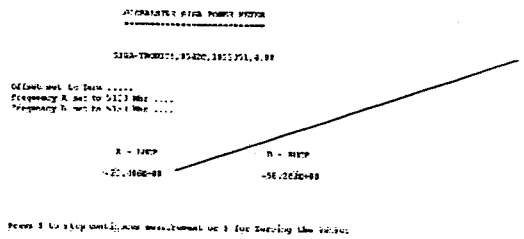


Two Synthesisers connected to test combiner

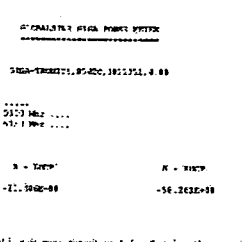
6 Connect the two synthesizers combined output to the TX LHCP port in the ICC cabinet. Read the output power on the Giga Software. Switch On and Off the RF and adjust the output level of each RF synthesizer to have an identical GIGA LHCP level with the two following configuration :

⇒ Synthesizer#1 RF ON and synthesizer#2 RF OFF

⇒ Synthesizer#1 RF OFF and synthesizer#2 RF ON

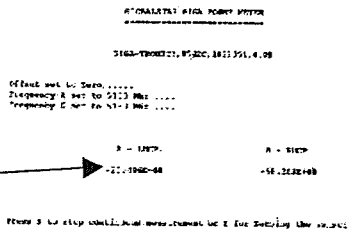


#1 ON & #2 OFF
and
#1 OFF & #2 ON
=
Identical level



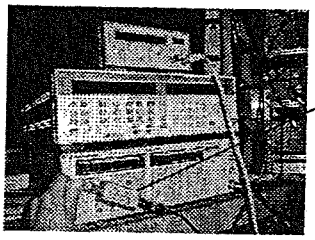
7 In the "STRxxxxn.xls", sheet "Adjust", read the LHCP CDMA output level equivalent to the 68 dBW EIRP measured during adjustment of the transmit level diagram. Read the LHCP level on the GIGA software and adjust the output level of the two synthesizers to have a GIGA LHCP level equivalent to 68 dBW EIRP. Adjust the output level of the two synthesizer simultaneously to keep the two carriers at the same level.

LHCP	Frequency	LHCP Level	RHCP Level
IFL input level at GRS cabinet	900 MHz	0 dBm	0 dBm
Outdoor cabinet IF test coupler power level	900 MHz	-28,2 dBm	-27,8 dBm
Hub Calibrated test coupler value - noted in the hub during factory test	5150 MHz	41,1 dB	40,9 dB
Hub Calibrated test coupler power reading in dBm for 68dBW EIRP	5150 Mhz	9,4 dBm	9,6 dBm
Up Converter test coupler - power level	5150 MHz	3,1 dBm	2,5 dBm
CDMA power meter - power reading	5150 MHz	-26,6 dBm	-26,2 dBm



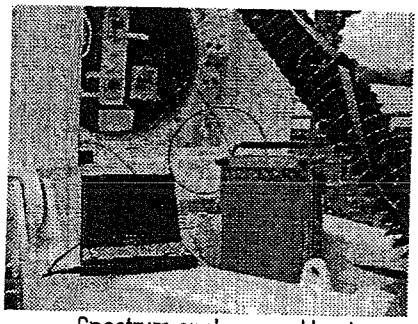
Adjust the output level to nominal 68 dBW EIRP

8 Disconnect the cable from the TX LHCP port and connect it to the power meter sensor by using a N-Female connector. Note the level to be entered in the "STRxxxxn.xls" workbook, sheet "TX test". If this level is not between -1 and +1 dBm then the TX level diagram should be readjusted by following the adjustment procedure document 3BT 11520 AAAA QT BJA. Connect back the cable to the TX LHCP port at the ICC cabinet.

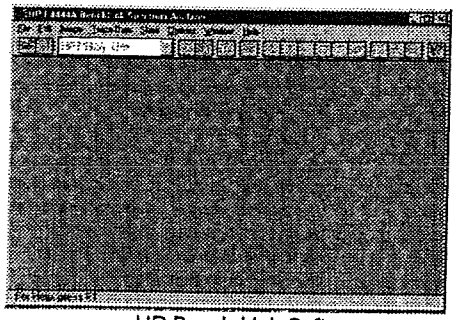


Note the level of the two combined synthesiser

9 Climb the antenna with the spectrum analyser , one RF test cable equipped with N-Male connector, one Laptop PC equipped with the GPIB PCMCIA interface and the HP Bench Link software . With the RF test cable, connect the spectrum analyser to the Hub LHCP TX test coupler. Connect the PC to the spectrum analyser with the HP IB cable and run the HP Bench Link software.



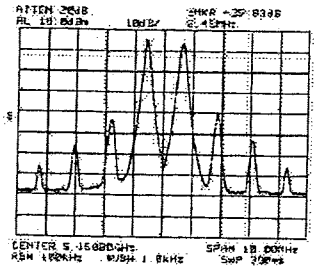
Spectrum analyser and Laptop



HP Bench Link Software

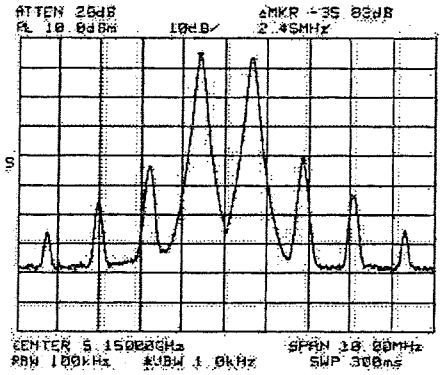
10 Enter the following setting in the spectrum analyzer connected to the TX LHCP coupler. The two carriers and their intermodulation products should be visible as on the following picture.

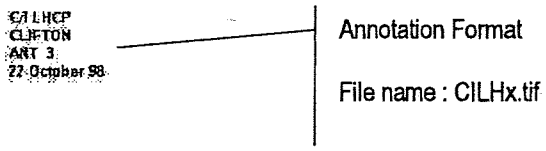
Center Frequency	5.150GHZ
RBW	100KHz
VBW	1.0KHz
Span	10.00MHz
Sweep	Auto
Attenuator	Auto
Ref Level	10 dBm
DB/div	10 dB



11 On the spectrum analyzer, run a single sweep trace (Sweep/ Single). Place two markers to measure the C/I : Marker Peak Search / Marker Delta / Marker Next peak / Marker next peak. Note the C/I value to be entered in the "STRxxxxn.xls" workbook sheet "TX Test". The C/I should be lower than -28 dBc and is typically between -30dBc and -38 dBc. If the C/I is not between -30 and -38 dBc, the TX level diagram should be verified following the procedure in document 3BT 11520 AAAA QT BJA. If after verifying the level diagram, the result is lower than -28 dBc, the result is acceptable.

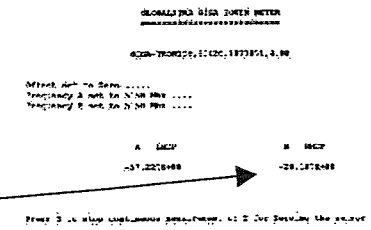
12 On the HP Bench Link software, with the command : "Image / New / OK", capture the screen of the spectrum analyzer. With the command : "Image / Annotation / text", place the following text annotation at the right side of the trace : "C/I LHCP - Site - ANTx (where x is antenna number) - Date". Save the trace with the command : "File / Save as" in TIF format in a file named "CILHx.tif" where x is the antenna number.



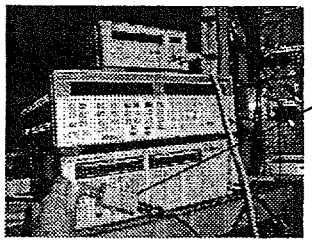


13 In the CER, connect the two combined synthesizers to the TX RHCP port in the ICC cabinet. In the "STRxxxxn.xls", sheet TX Level, read the RHCP CDMA output level equivalent to the 68 dBW EIRP measured during adjustment of the transmit level diagram. Read the RHCP level on the GIGA software and adjust the output level of the two synthesizers to have a GIGA RHCP level equivalent to 68 dBW EIRP. Adjust the output level of the two synthesizer simultaneously to keep the two carriers at the same level.

LHCP	Frequency	LHCP Level	RHCP Level
IFL input level at GRS cabinet	900 MHz	0 dBm	0 dBm
Outdoor cabinet IF test coupler power level	900 MHz	-28,2 dBm	-27,9 dBm
Hub Calibrated test coupler value - noted in the hub during factory test	5150 MHz	41,1 dB	40,9 dB
Hub Calibrated test coupler power reading in dBm for 68dBW EIRP	5150 Mhz	9,4 dBm	9,6 dBm
Up Converter test coupler - power level	5150 MHz	3,1 dBm	2,8 dBm
CDMA power meter - power reading	5150 MHz	-20,1 dBm	-28,2 dBm



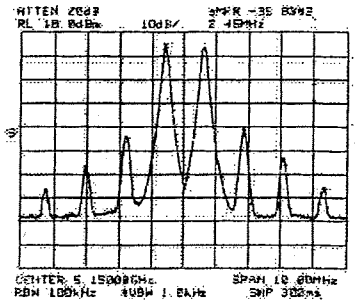
14 Disconnect the cable from the TX RHCP port and connect it to the power meter sensor by using a N-Female connector. Note the level to be entered in the "STRxxxxn.xls" workbook, sheet "TX test". If this level is not between -1 and +1 dBm then the TX level diagram should be readjusted by following the adjustment procedure document 3BT 11520 AAAA QT BJA. Connect back the cable to the TX RHCP port at the ICC cabinet.



Note the level of the two combined synthesiser

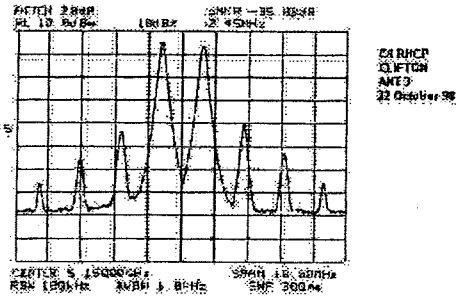
15 Enter the following setting in the spectrum analyzer connected to the TX RHCP coupler near the hub. The two carriers and their intermodulation products should be visible as on the following picture.

Center Frequency	5.150GHZ
RBW	100KHz
VBW	1.0KHz
Span	10.00MHz
Sweep	Auto
Attenuator	Auto
Ref Level	10 dBm
DB/div	10 dB



16 On the spectrum analyzer, run a single sweep trace (Sweep/ Single). Place two markers to measure the C/I : Marker Peak Search / Marker Delta / Marker Next peak / Marker next peak. Note the C/I value to be entered in the "STRxxxxn.xls" workbook sheet "TX Test". The C/I should be lower than -28 dBc and is typically between -30dBc and -38 dBc. If the C/I is not between -30 and -38 dBc, the TX level diagram should be verified following the procedure in document 3BT 11520 AAAA QT BJA. If after verifying the level diagram, the result is lower than -28 dBc, the result is acceptable.

17 On the HP Bench Link software, with the command : "Image / New / OK", capture the screen of the spectrum analyzer. With the command : "Image / Annotation / text", place the following text annotation at the right side of the trace : "C/I RHCP - Site - ANTx (where x is antenna number) - Date". Save the trace with the command : "File / Save as" in TIF format in a file named "CIRHx.tif" where x is the antenna number.



Annotation Format

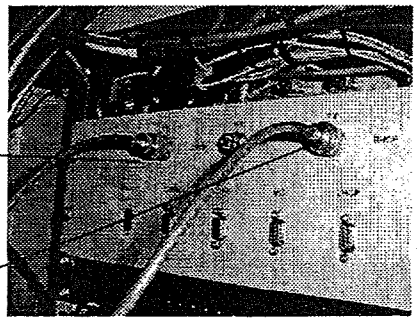
File name : CIRHx.tif

18 Disconnect the test combiner from the two synthesizers. By using a simple RF test cable equipped with a N-Male connector, connect the Synthesizer#1 to the TX LHCP port and Synthesizer#2 to the TX RHCP port in the ICC indoor cabinet. Set the two synthesizers in CW at 900 MHz. Read the level on the Giga software and adjust the output power of each synthesizer to have 68 dBW on LHCP and RHCP.

Two synthesizer set with CW 900 MHz

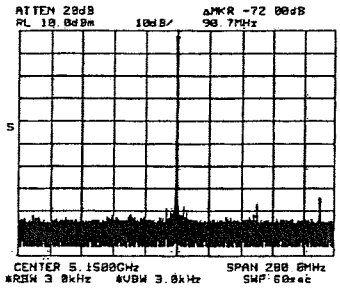
Connect cable#1 to TX LHCP

Connect cable#2 to TX RHCP

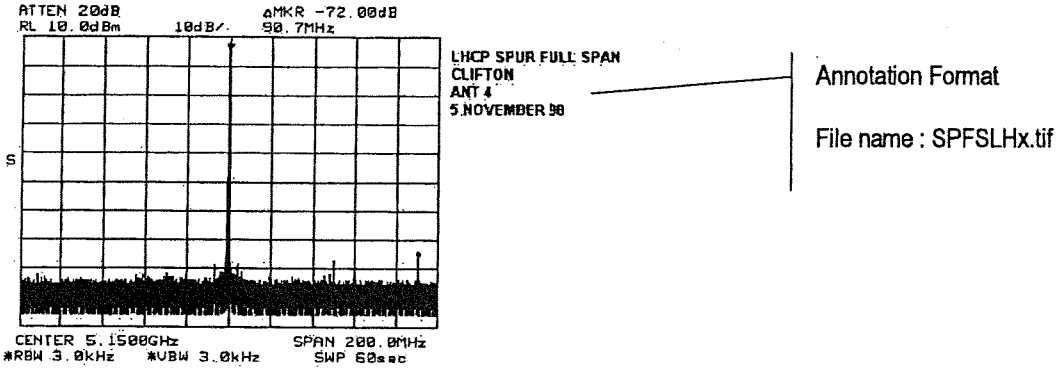


19 Go near the hub and enter the following setting in the spectrum analyzer connected to the TX LHCP coupler. The carrier should be visible as on the following picture with eventually some spurious. Run a single sweep trace (Sweep/ Single). Place two markers to measure the highest spurious : Marker Peak Search / Marker Delta / Marker Next peak. Note the value of the spurious to be entered in the "STRxxxxn.xls" workbook sheet "TX Test". The spurious should be lower than -60 dBc.

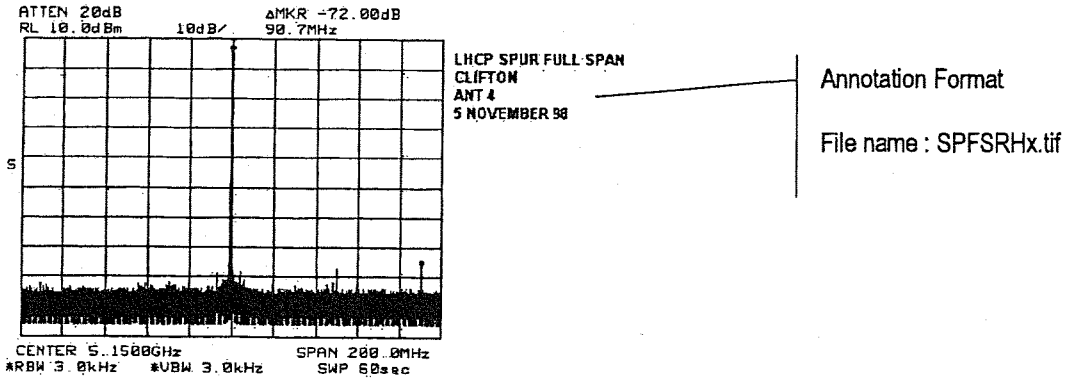
Center Frequency	5.150GHZ
RBW	3 kHz
VBW	3 kHz
Span	200 MHz
Sweep	Auto
Attenuator	Auto
Ref Level	10 dBm
DB/div	10 dB



20 On the HP Bench Link software, with the command : "Image / New / OK", capture the screen of the spectrum analyzer. With the command : "Image / Annotation / text", place the following text annotation at the right side of the trace : "LHCP SPUR FULL SPAN - Site - ANTx (where x is antenna number) - Date". Save the trace with the command : "File / Save as" in TIF format in a file named "SPFSLHx.tif" where x is the antenna number.

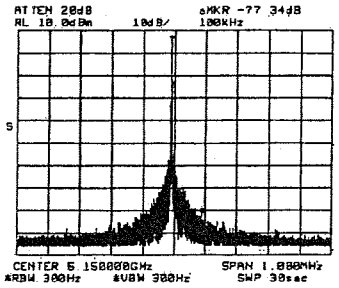


21 Connect the spectrum Analyzer to the TX RHCP coupler. Run a single sweep trace (Sweep/ Single). Place two markers to measure the highest spurious : Marker Peak Search / Marker Delta / Marker Next peak. Note the value of the spurious to be entered in the "STRxxxxn.xls" workbook sheet "TX Test". The spurious should be lower than -60 dBc. On the HP Bench Link software, with the command : "Image / New / OK", capture the screen of the spectrum analyzer. With the command : "Image / Annotation / text", place the following text annotation at the right side of the trace : "RHCP SPUR FULL SPAN - Site - ANTx (where x is antenna number) - Date". Save the trace with the command : "File / Save as" in TIF format in a file named "SPFSRHx.tif" where x is the antenna number.

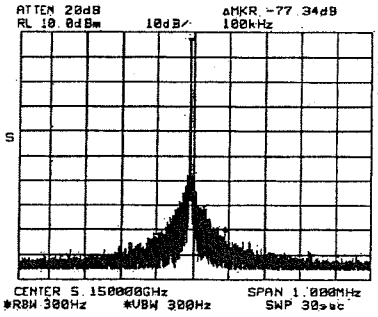


22 Enter the following setting in the spectrum analyzer connected to the TX RHCP coupler. The carrier should be visible as on the following picture with eventually some spurious. Run a single sweep trace (Sweep/ Single). Place two markers to measure the highest spurious : Marker Peak Search / Marker Delta / Move the marker manually minimum at 100 kHz from the carrier to the highest visible peak. Note the value of the spurious to be entered in the "STRxxxxn.xls" workbook sheet "TX Test". The spurious should be lower than -60 dBc.

Center Frequency	5.150GHZ
RBW	300 Hz
VBW	300 Hz
Span	1 MHz
Sweep	Auto
Attenuator	Auto
Ref Level	10 dBm
DB/div	10dB



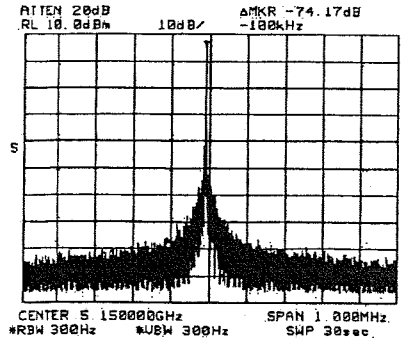
23 On the HP Bench Link software, with the command : "Image / New / OK", capture the screen of the spectrum analyzer. With the command : "Image / Annotation / text", place the following text annotation at the right side of the trace : "RHCP SPURIOUS NARROW SPAN - Site - ANTx (where x is antenna number) - Date". Save the trace with the command : "File / Save as" in TIF format in a file named "SPNSRHx.tif" where x is the antenna number.



Annotation Format

File name : SPNSRHx.tif

24 Connect the spectrum analyzer to TX RHCP port. Run a single sweep trace (Sweep/ Single). Place two markers to measure the highest spurious : Marker Peak Search / Marker Delta / Move the marker manually minimum at 100 kHz from the carrier to the highest visible peak. Note the value of the spurious to be entered in the "STRxxxxn.xls" workbook sheet "TX Test". The spurious should be lower than -60 dBc. On the HP Bench Link software, with the command : "Image / New / OK", capture the screen of the spectrum analyzer. With the command : "Image / Annotation / text", place the following text annotation at the right side of the trace : "LHCP SPURIOUS NARROW SPAN - Site - ANTx (where x is antenna number) - Date". Save the trace with the command : "File / Save as" in TIF format in a file named "SPNSLHx.tif" where x is the antenna number.



Annotation Format

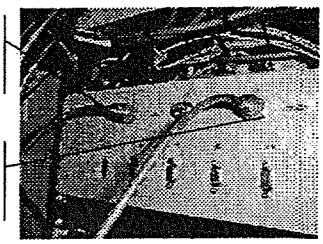
File name : SPNSLHx.tif

25 In the CER, set the two synthesizers in sweep mode : CF = 900 MHz, SPAN=205 MHz, Sweep time = 100 seconds.

Two synthesizers set in
CF 900 MHz
SPAN = 205 MHz
Sweep = 100 s.

Connect cable#1 to TX LHCP

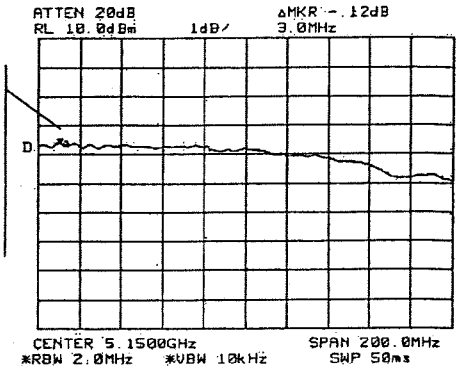
Connect cable#2 to TX RHCP



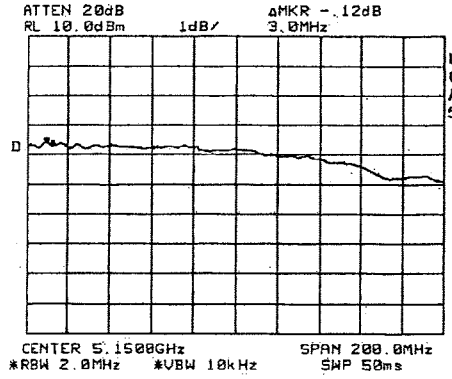
26 Enter the following setting in the spectrum analyzer connected to the TX LHCP coupler. Put the spectrum analyzer in Max Hold mode : TRACE / CLR-WRT A / MAX HOLD A. Wait few minutes for the trace to be drawn. The level variation is showing a smooth curve with some sharp drop of level. The sharp drop of levels due to the measurement technique does not have to be taken in account : they can be identified as being present on both polarization. Note the part of the smooth curve that is showing the sharpest slope. Place a first marker at the beginning and a second delta marker at the end of the sharpest portion of the slope. Note the delta level and delta frequency of the marker to be entered in the "STRxxxxn.xls" workbook, "TX Test" sheet. The slope should be lower than 0.25 dB in 1.2 MHz. The Excel workbook compute if the results are within specifications. Note also in the "TX Test" sheet the total amplitude variation of the curve : this is measured by looking in how many divisions the curve fit. The amplitude variation should be lower than 4 dB.

Center Frequency	5.150GHZ
RBW	2 MHz
VBW	10 kHz
Span	200 MHz
Sweep	Auto
Attenuator	Auto
Ref Level	10 dBm
DB/div	1dB

Delta Marker at the beginning and at the end of the sharpest slope of the whole curve.



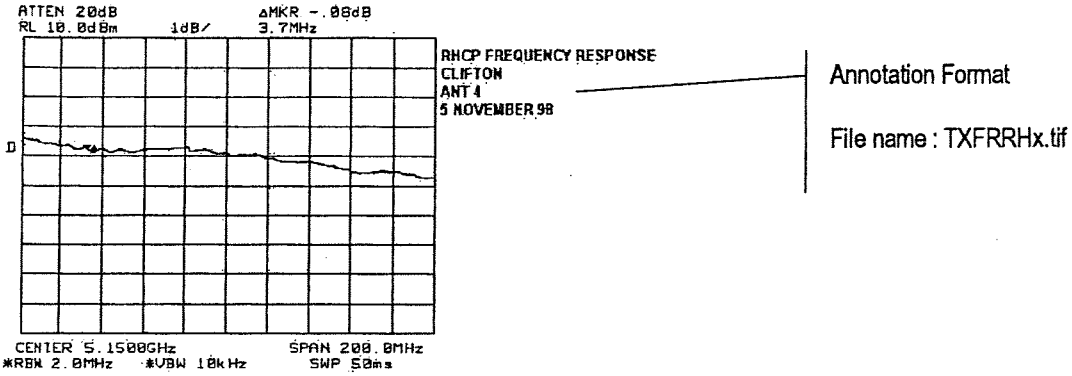
27 On the HP Bench Link software, with the command : "Image / New / OK", capture the screen of the spectrum analyzer. With the command : "Image / Annotation / text", place the following text annotation at the right side of the trace : "LHCP FREQUENCY RESPONSE - Site - ANTx (where x is antenna number) - Date". Save the trace with the command : "File / Save as" in TIF format in a file named "TXFRLHx.tif" where x is the antenna number.



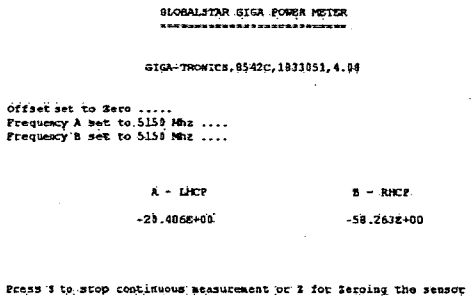
Annotation Format

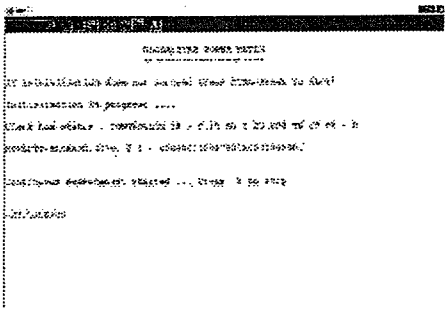
File name : TXFRLHx.tif

28 Connect the Spectrum analyzer to TX RHCP coupler and do the same operation to measure the TX frequency response on the RHCP. On the HP Bench Link software, with the command : "Image / New / OK", capture the screen of the spectrum analyser. With the command : "Image / Annotation / text", place the following text annotation at the right side of the trace : "RHCP FREQUENCY RESPONSE - Site - ANTx (where x is antenna number) - Date". Save the trace with the command : "File / Save as" in TIF format in a file named "TXFRRHx.tif" where x is the antenna number.

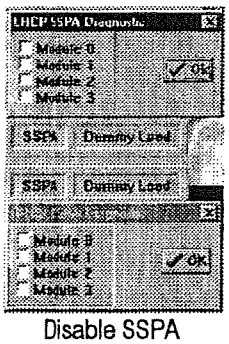


29 In the CER connect the Laptop PC to the ICC indoor cabinet : Port 1 to the CDMA port and Port 2 to the TCU port and port 3 to the M&C port. Run the GIGA and HP software to read the transmit power through the CDMA and TCU filter. Run the GTS software to command the SSPA.

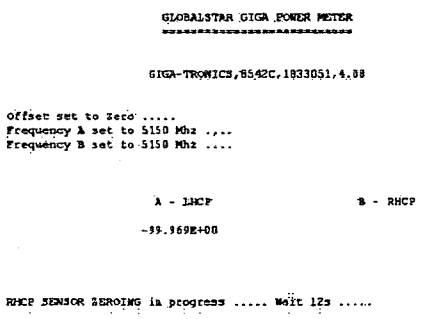




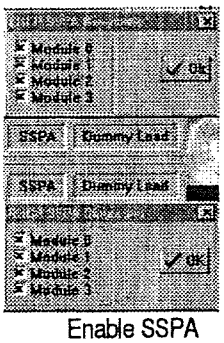
30 With the GTS, SSPA control window, disable all the SSPA. Then with the GIGA and HP software, start a sensor zeroing by pressing the Z key. After the zeroing is completed, enable all the SSPA.



Disable SSPA



Zeroing Power sensor



Enable SSPA

31 On the synthesizer #1 connected to TX LHCP port, set the frequency to 841,5 MHz. Note the output power displayed on the GIGA and HP software and enter the value in the "STRxxxxn.xls" workbook, sheet "TxTest". Do the same operation for the following frequency : 842,5 - 843,5 - 844,5 - 845,5 - 846,5 - 847,5 - 848,5. The Excel workbook compute the data and indicates if the results are compliant or not.

5.3 Result Analysis

1 All the results of the RF TX test are entered in the "STRxxxn.xls" Excel Workbook, "TxTest" sheet. All the necessary computation are made automatically and the Excel "TxTest" sheet indicates if the results are compliant with the specifications or not.

2 The plots recorded during the testing are included in the following sheet of the "STRxxxxn.xls" for reference only. To include the plots in the Excel Workbook, the "Insert Plot" macro should be used. For that, it is important that the files as been saved using the name included in this procedure.

⇒ Intermodulation products are included in "CI"

⇒ Spurious in full span are included in "SPFS"

⇒ Spurious in narrow span are included in "SPNS"

⇒ Frequency response are included in "TXFR"

6 Receive test

6.1 Purpose of the test

1 The purpose of the test is to verify the following characteristic of the system :

⇒ RF Received Spurious

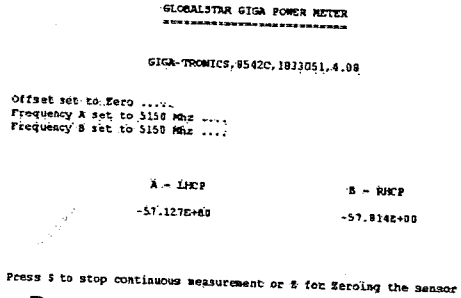
⇒ Antenna Encoder Adjustment

⇒ Antenna G/T

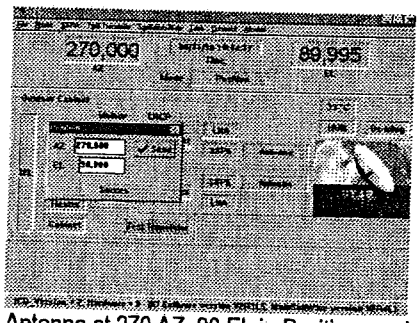
⇒ RF Receive Amplitude / Frequency response

6.2 Test Sequence

1 In the CER, connect to the ICC indoor cabinet the customer laptop PC equipped with the Dual port RS485 PCMCIA board : port 1 to the CDMA port and the port2 to the M&C port. On the PC run the GTS.exe and the GIGA.exe software. Verify the connection with the ACU (connect Alcatel) and the connection with the Gigatronic power meter. Put the antenna in POSITION MODE 270 AZ and 90 EL. Enable all the SSPA on Antenna.



Power meter reading with Giga software



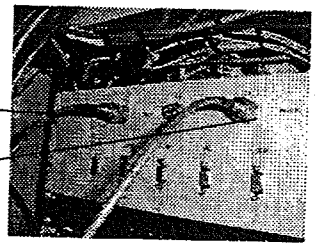
Antenna at 270 AZ, 90 EL in Position mode

2 By using a simple RF test cable equipped with a N-Male connector, connect the Synthesizer#1 to the TX LHCP port and Synthesizer#2 to the TX RHCP port in the ICC indoor cabinet. Set the two synthesizers in CW at 900 MHz. Read the level on the Giga software and adjust the output power of each synthesizer to have 68 dBW EIRP on LHCP and RHCP.

Two synthesiser set with CW 900 MHz

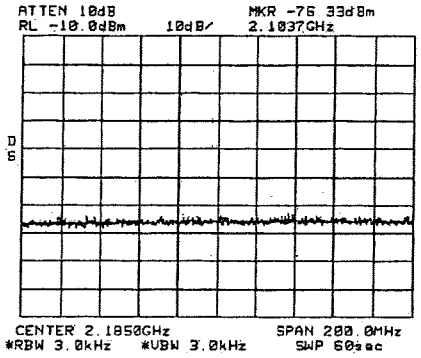
Connect cable#1 to TX LHCP

Connect cable#2 to TX RHCP

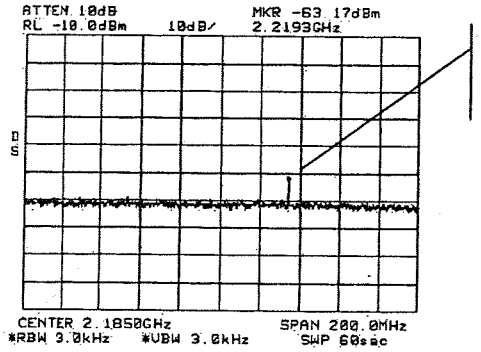


3 Enter the following setting in the spectrum analyzer and connect it the RX LHCP port at the ICC indoor cabinet. Put the spectrum analyzer in POS PEAK mode : TRACE / MORE / DETECTOR MODE / POS PEAK. The noise should appear on the spectrum analyzer without any spurious.

Center Frequency	2.185 GHZ
RBW	3 kHz
VBW	3 kHz
Span	200 MHz
Sweep	Auto
Attenuator	Auto
Ref Level	-10 dBm
DB/div	10 dB

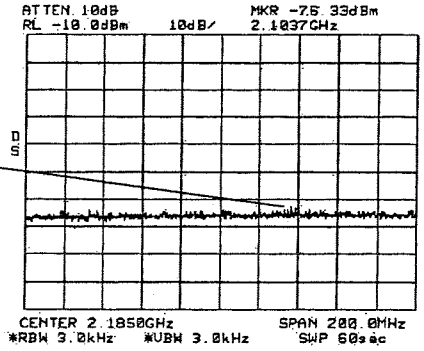


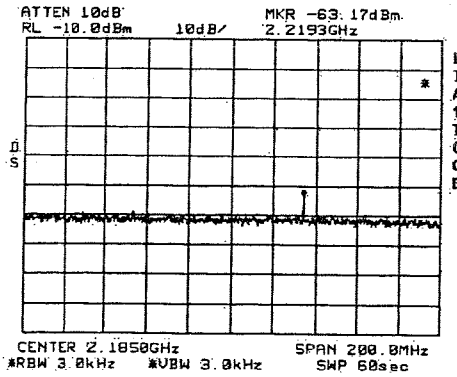
4 Attention : if a spurious appear, it will be really visible : do not make confusion between the measurement noise and a real spurious. See following picture for example. If a spurious appears, verify that is not coming from an external perturbator : when moving the antenna in elevation and azimuth, the spurious level will change if it is coming from an external perturbator. If possible, find an antenna position where the spurious does not appear. If it not possible, clearly indicates on the plot that the spurious is coming from an external perturbator



Real Spurious

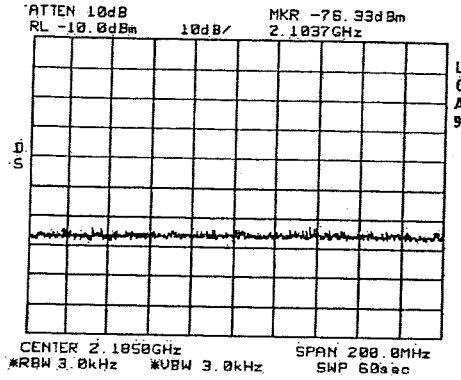
False Spurious
Measurement Noise





Clearly indicates that the spurious is coming from an external perturbator.

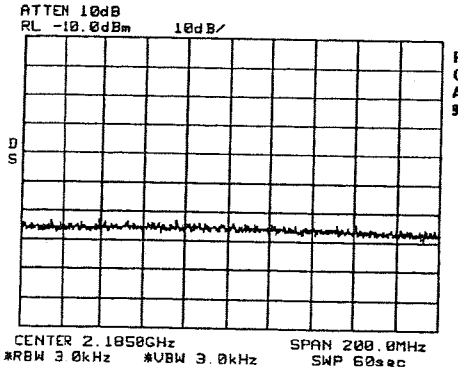
5 On the Spectrum Analyzer, run a single sweep : SWEEP / SINGLE. On the HP Bench Link software, with the command : "Image / New / OK", capture the screen of the spectrum analyzer. With the command : "Image / Annotation / text", place the following text annotation at the right side of the trace : "LHCP RX SPURIOUS - Site - ANTx (where x is antenna number) - Date". Save the trace with the command : "File / Save as" in TIF format in a file named "RXSPLHx.tif" where x is the antenna number.



Annotation Format

File name : RXSPLHx.tif

6 Connect the spectrum analyzer to RX RHCP Port in the ICC cabinet and do the same operation. On the HP Bench Link software, with the command : "Image / New / OK", capture the screen of the spectrum analyzer. With the command : "Image / Annotation / text", place the following text annotation at the right side of the trace : "RHCP RX SPURIOUS - Site - ANTx (where x is antenna number) - Date". Save the trace with the command : "File / Save as" in TIF format in a file named "RXSPRHx.tif" where x is the antenna number.

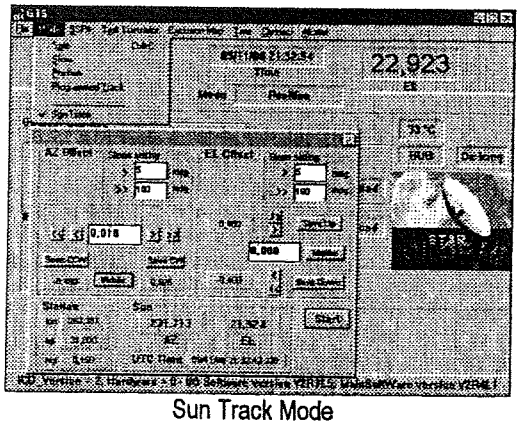


Annotation Format

File name : RXSPRHx.tif

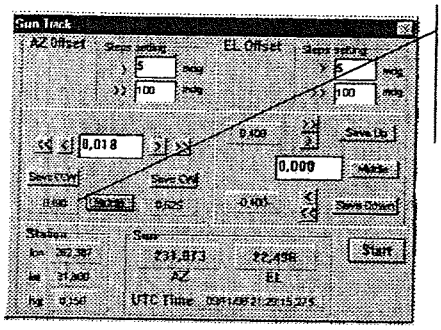
7 Sun Tracking. Enter the following setting in the Spectrum analyser. On the GTS software connected in Alcatel Mode, verify that the ACU is synchronized with the GPS time and enter the Sun Track Mode.

Center Frequency	2.185 GHZ
RBW	1 MHz
VBW	1 Hz
Span	0
Sweep	50 s
Attenuator	20 dB
Ref Level	-40 dBm
DB/div	1 dB



Sun Track Mode

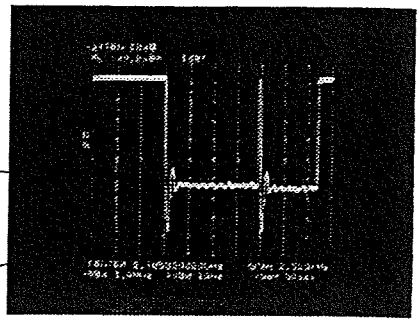
8 The noise level should be about -41 dBm on the spectrum analyzer. From the center position, Introduce an offset in Az minus to have a drop of about 5 dB in the noise level. Then introduce an offset in Az plus to have a drop of exactly the same level. Then press the case Middle to read the pointing error on the Az encoder. Do the same operation in Elevation.



Enter offset in + and - from beam center to have same level drop on spectrum analyzer

Level in offset +

Level in offset -

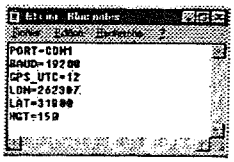


9 Press the key "Middle" : the encoder error will be displayed for both axis. Enter the errors in the "STRxxxn.xls" workbook, sheet "RxTest". Enter the AZ and EL of the antenna and the time of the measurement. The Excel sheet computes the BRE and indicates if the result is compliant. 5 points should be measured during the day : Early Morning point (sun between 10 and 20 ° EL), Noon point (Midday local time), Late Afternoon (sun between 20 and 10 EL), and two other points : middle of morning and middle of afternoon. The BRE specifications are 70 millidegrees, but if one point have a BRE higher than 50 millidegrees, the encoder's offsets should be tuned again following the adjustment procedure.

Sun Tracking	Time GPS	AZ degree	EL degree	Azoffset degree	Eloffset degree	BRE mili degree	Compliant
Early Morning point						0	No
Mid-morning Point						0	No
Noon Point						0	No
Mid-afternoon point	21:25	239.4	23.1	0.018	0.000	17	Yes
Late Afternoon point						0	No
Site Coordinates		LON	262387	LAT	31800	HGT	150

BRE computation and Result compliance test

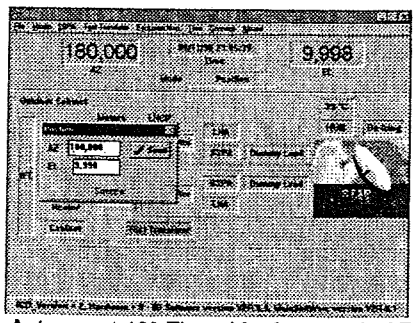
Enter the site coordinates utilised for the test



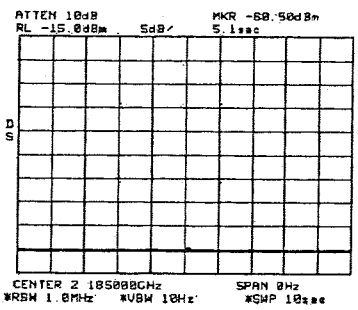
10 G/T. Enter the following setting in the spectrum analyzer connected to the RX LHCP Port in the ICC Cabinet. With the GTS software, put the antenna in Position mode at 10 degrees Elevation and at azimuth angle at least 30 degrees far from the sun position. The noise level should be visible as on the following picture. Run a single sweep : SWEEP / SINGLE and place a delta marker middle of the trace : MARKET ON / MARKER DELTA.

Center Frequency	2.185 GHZ
RBW	1 MHz
VBW	10 Hz
Span	0
Sweep	10 s
Attenuator	10 dB
Ref Level	-15 dBm
DB/div	5 dB

Spectrum Analyzer Settings

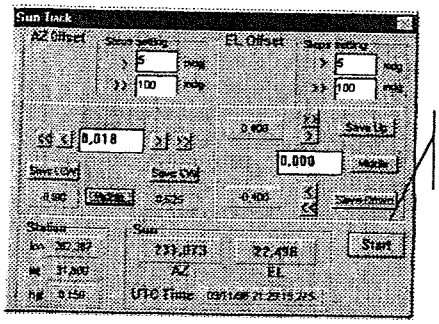


Antenna at 10° EL and far from sun in AZ

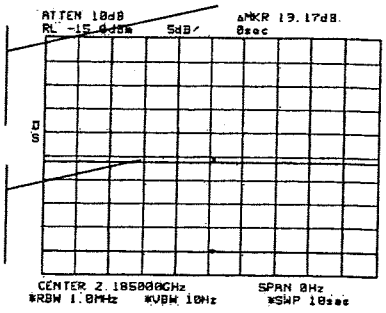


Clear Sky noise at 10° EL

11 With GTS software, enter the Sun Track mode. Once the antenna is pointing the sun, run a single sweep on the spectrum analyzer : SWEEP / SINGLE. A trace will appear with the sun noise and the delta marker will indicates the Y factor to be entered in the "STRxxxxn.xls" workbook, sheet " RxTest".



Sun Track Mode Start



Y Factor to be entered in "STRxxxn.xls"

Sun Noise

12 Connect the Spectrum analyzer to the RX RHCP port at the ICC Cabinet and following the same process, do the measurement of the Y factor for the RHCP. The next day, consult the solar flux data at internet address : gopher://proton.sec.noaa.gov:70/00/lists/radio/7day_rad . The solar flux is given at different time of the day by different stations. Chose the one that is close of your measurement time. Enter all the values in the "STRxxxn.xls" workbook that will make all the G/T computation and verify if the result is compliant.

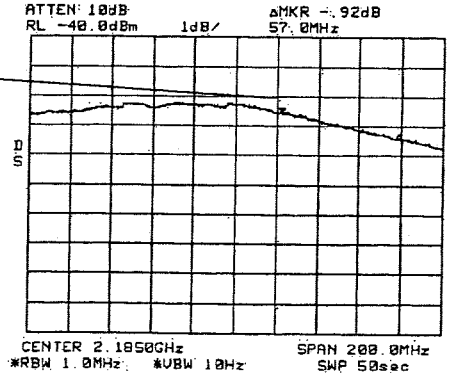
Antenna G/T	Date	Time	Measured Y factor	4995MHz solar flux from Web	8800MHz solar flux from Web	G/T	Compliant
	GPS	GPS	dB	W/m^2/Hz	W/m^2/Hz	dB	
LHCP G/T	09/11/98	22:30	19,25	1,15E-20	2,00E-20	30,70	Yes
RHCP G/T	09/11/98	22:25	19,75	1,15E-20	2,00E-20	31,20	Yes

G/T Computation and result compliance analysis

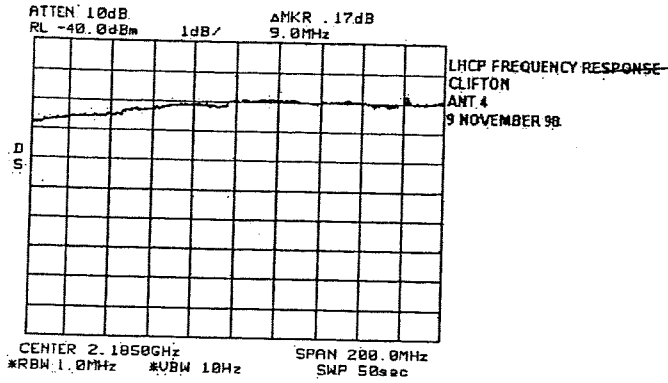
13 Rx Frequency Response. Enter the following setting in the spectrum analyzer connected to the RX LHCP coupler. Run the antenna in Sun Track Mode from the GTS software. Run a single sweep on the spectrum analyzer : SWEEP / SINGLE. Wait for the trace to be drawn. The level variation is showing a smooth curve with some sharp drop of level. The sharp drop of levels due to the measurement technique does not have to be taken in account : they can be identified as present on both polarization. Note the part of the smooth curve that is showing the sharpest slope. Place a first marker at the beginning and a second delta marker at the end of the sharpest portion of the slope. Note the delta level and delta frequency of the marker to be entered in the "STRxxxxn.xls" workbook, "RxTest" sheet. The slope should be lower than 0.25 dB in 1.2 MHz. The Excel workbook compute if the results are within specifications.

Center Frequency	2.185GHZ
RBW	1 MHz
VBW	10 Hz
Span	200 MHz
Sweep	Auto
Attenuator	Auto
Ref Level	-40 dBm
DB/div	1 dB

Delta Marker at the beginning and at the end of the sharpest slope of the whole curve.



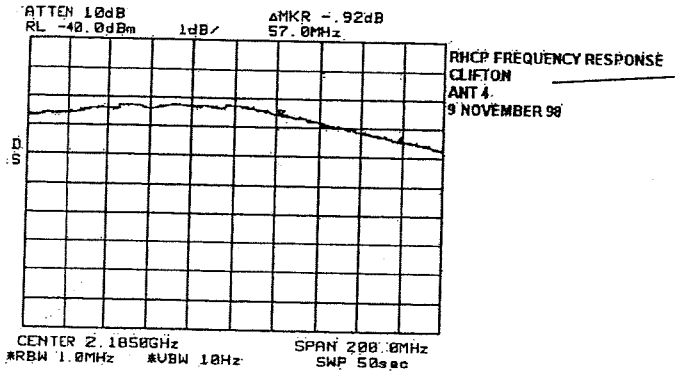
14 On the HP Bench Link software, with the command : "Image / New / OK", capture the screen of the spectrum analyzer. With the command : "Image / Annotation / text", place the following text annotation at the right side of the trace : "LHCP FREQUENCY RESPONSE - Site - ANTx (where x is antenna number) - Date". Save the trace with the command : "File / Save as" in TIF format in a file named "RXFRLHx.tif" where x is the antenna number.



Annotation Format

File name : RXFRLHx.tif

15 Connect the Spectrum analyzer to the RX RHCP port and do the same operation to measure the Frequency response of the RHCP. Place the following text annotation at the right side of the trace : "RHCP FREQUENCY RESPONSE - Site - ANTx (where x is antenna number) - Date". Save the trace with the command : "File / Save as" in TIF format in a file named "RXFRRHx.tif" where x is the antenna number.



Annotation Format

File name : RXFRRHx.tif

16 Enter the Frequency response data in the STRxxxxn.xls Workbook, sheet "RxTest".

Receive Test	Result		Specif	Compliant	
	LHCP	RHCP	L & RHCP	LHCP	RHCP
Visible Receive Spurious	No	No	No	Yes	Yes
Computed variation in 1.2 MHz band	0,02 dB/1.2 MHz	0,02 dB/1.2 MHz	0,25	Yes	Yes
Frequency Response - Level delta of the marker	0,17 dB	0,92 dB			
Frequency Response - Frequency delta of the marker	9 MHz	57 MHz			

6.3 Result Analysis

1 All the results of the RX test are entered in the "STRxxxn.xls" Excel Workbook, "RxTest" sheet. All the necessary computation are made automatically and the Excel "RxTest" sheet indicates if the results are compliant with the specifications or not.

2 The plots recorded during the testing are included in the following sheet of the "STRxxxxn.xls" for reference only. To include the plots in the Excel Workbook, the "Insert Plot" macro should be used. For that, it is important that the files as been saved using the name included in this procedure.

⇒ Receive Spurious are included in "RXSP"

⇒ Receive Frequency Response are included in "RXFR"

NOT USED

7 Tracking Test

7.1 Purpose of the test

1 Verify the program track capability of the antenna.

7.2 Test sequence

1 Connect the Laptop running GTS software at the M&C port of the ICC cabinet.

2 With the GTS, SSPA control command, enable all SSPA in Antenna mode.

3 With the GTS, send to the ACU the default exclusion map zone at 9.88 degrees

4 Open the trajectory file : TZ6Z2_P0.TRJ and adjust time 0 to begin 1 min later than current time. Check that the trajectory starts and that the RF Switches remain on Dummy Load until EL axis is beyond 9,88 degrees and then are on antenna . At the end of the pass, note the max BRE error recorded in the GTS detailed windows. Enter the BRE in the "STRxxxxn.xls" Workbook, "Tracking" sheet.

5 Do the same operation with the trajectories TZ5Z1_P0, TZ5Z1 and TZ4Z2.

6 Connect the laptop PC at the outdoor cabinet, on the GTS port of the ACU. Connect in Alcatel mode and open the detail window to read the antenna encoder angles

7 Connect the JJHB remote control box at the outdoor cabinet. Slowly drive the antenna to each electrical switch : AZCCW, AZCW, EL+, EL-, XEL+, XEL -. For each electrical stop, note in the "Tracking" sheet of the "STRxxxxn.xls" workbook the angle displayed in the detail windows where the antenna stops.

7.3 Result analysis

1 All the results of the Tracking test are entered in the "STRxxxn.xls" Excel Workbook, "Tracking" sheet. All the necessary computation are made automatically and the Excel "Tracking" sheet indicates if the results are compliant with the specifications or not.

8 Configuration record

8.1 Purpose of the test

1 Record the serial number of different equipment composing the system.

2 Record the serial number and calibration date of the measurement equipment utilized to perform the tests.

8.2 Test sequence

1 Open the "STRxxxxn.xls" workbook, "Serial" sheet.

2 Fulfill all the equipment serial number requested by the form.

3 Fulfill the requested information for each measurement equipment utilized for testing. Model, Calibration date, Calibration due date, serial number. If the measurement equipment is coming from the Alcatel field department, the serial number is the Alcatel inventory number noted on the equipment

8.3 Result analysis

1 All the serial number and calibration date are entered in the "STRxxxxn.xls" Excel Workbook, "Serial" sheet. All the necessary computation are made automatically and the Excel "Serial" sheet indicates if the results are compliant or not.

1.2.3 Obtaining frequency assignments

The operating frequencies are pre-assigned by GLP based upon the service area. Knowledge of both transmit and receive frequencies is important at the frequency coordination stage, because it will allow the SP to decide if the selected site can be coordinated or not if the bands are not completely clear from interference.

R.1 and R.2 To define the service area, the SP shall provide a set of latitude, longitude, and altitude points, referenced to the World Geodetic System (WGS 84) map reference, that define the service areas [R.1]. At the perimeter, the SP shall ensure that the cells which the system uses to define the service area do not overlap other SP's service area boundaries [R.2].

1.2.4 Measuring the radio frequency interference

R.3 To ensure that there is an adequate protection margin to the frequencies used by the Gateway, the SP shall measure the ambient interference level, I_o at the site and show that it does not exceed the following values [R.3].

Table 1–1 Radio frequency interference limits

Frequency band	I_o limit
6,875 to 7,075 MHz	I_o < -215 dBW Hz^{-1}
1,573 to 1,578 MHz	incident PFD < -133.5dBW m^{-2}
2,483.5- 2,500MHz	I_o < -210dBW Hz^{-1}

The interference power spectral density, I_o in dBWHz $^{-1}$ is calculated (after correcting for a RFI test system losses and spectrum analyser bandwidth corrections) by summing the power of all spurious products, bands of noise and modulated carriers, and averaging the total power over a 1.2 MHz bandwidth as indicated in Figure 1–1.

If the antennas are deployed in an environment that exceeds these limits, then QUALCOMM will not guarantee proper operation of the Gateway. Subsequent rectification of any RFI problem shall be the responsibility of the SP

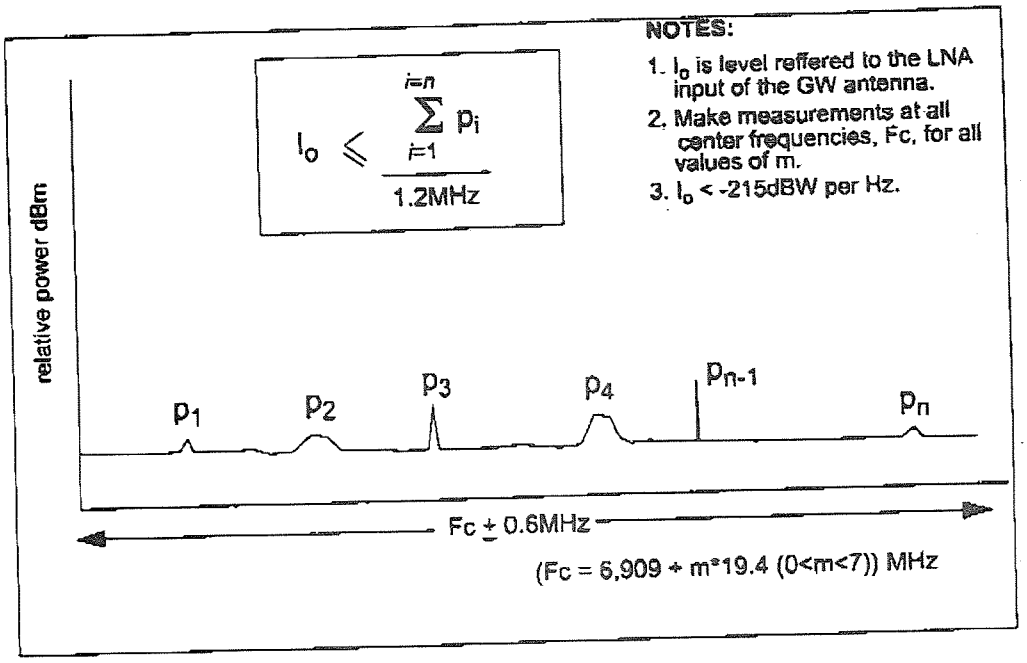


Figure 1–1 Interference calculation

R.4 Copies of the RFI surveys shall be delivered to QUALCOMM in accordance with AD[20] [R.4]. The SP is referred to the *Site Preparation Guidelines Technical Manual* (80-25822-3) which contains recommended measurement methods and discusses the impacts of interference on system link quality.

1.2.5 Electric fields

R.5 To ensure adequate protection from extraneous radiated signals, the antennas shall be qualified to operate within the electromagnetic immunity limits specified in AD[5] [R.5].

R.6 If the antennas are deployed in an unknown area or an environment that exceeds these limits, then they are not guaranteed to operate as designed. Subsequent diagnosis and rectification of any EMI problem shall be the responsibility of the SP [R.6].

We strongly recommend that the SP refer to the *Site Preparation Guidelines Technical Manual* (80-25822-3) for measurement procedures to ensure compliance with AD[5].

1.2.6 Obtaining operating licenses

R.7 The SP shall be responsible for resolving all frequency coordination disputes and obtaining all Gateway operating licenses, in accordance with the AD[3] and its latest revisions regarding earth stations operating in the feeder link 5/7 GHz bands of the Mobile Satellite Service [R.7].

1.3 The site geography

The site geography, i.e., the latitude and horizon profile, influences the service quality and availability. The dominant factor is the latitude of the Gateway because it greatly affects how many satellites are available, while the horizon profile just affects how long the satellites can be used. The choice of latitude is probably the most critical factor, affecting subscriber-service quality, coverage and availability.

1.3.1 Limits on the site location

R.8 The SP shall not select a site location which exceeds the following limits [R.8]:

- North latitude: 70.0 degrees
- South latitude: 70.0 degrees

  These are the absolute theoretical maximum system operating limits, where service can no longer be provided. However, practical factors reduce the latitude limits to ± 57 degrees.
- East longitude: no limit.
- Altitude: < 3,000 m

  This limit is created by loss of cooling efficiency for convection-cooled equipment operating outside, and by physiological and personnel safety issues for operations and maintenance personnel.

1.3.2 Evaluating the horizon

R.9 To provide the maximum coverage for subscribers, the SP should select a site where the local horizon profile, as viewed from each antenna location, shall not exceed 10 degrees in elevation for all azimuth values [R.9]. Depending upon the latitude of the site, there is a space in the sky and horizon, called the obscura region, where there are no satellite trajectories. This is a good place for the building because it does not block the paths between the satellites and antennas. GLP will compute the obscura region for your site upon request.

4.2 RF Interference

It is the Service Provider's responsibility to conduct an RF interference survey and provide the results to Globalstar for review. The following general guidelines and frequently asked questions should be used to evaluate potential sources of interference.

General Guidelines

1. Conduct a 360 degree sweep at your selected antenna site location(s) for frequencies between 5 GHz and 7.5 GHz at 10 KHz steps.

   - ✓ The data should be collected over a 24-hour period.
   - ✓ Measurements can be done with an omni-directional antenna first, followed by a polarized horn antenna
   - ✓ A 24-hour test period with an omni and a 24-hour test period with a directional antenna is recommended
   - ✓ A Low Noise Analyzer (LNA) and Spectrum Analyzer may also be used to support the RFI survey
   - ✓ Suggested Spectrum Analyzer settings:
     - Span: 6800-7100
     - Sweep Time: 1 sec
     - RBW: 10KHz
     - VBW: Auto

     NOTE: Once a peak is detected, then the amplitude should be measured after reducing the span below 1 MHz, and the resolution bandwidth below 500Hz

     NOTE: In setting the Spectrum Analyzer, the frequency span may be reduced if the UNCAL display occurs. This is acceptable.

   - ✓ Use your judgement in selecting the LNA gain so that it is enough to increase the noise floor of the Spectrum Analyzer by 10 dB.
   - ✓ In the measurement using the polarized horn antenna (directional):
     - The rotor should be set at 360 seconds per rotation
     - The rotor should start every 10 minutes, allowing 4 minutes before restart

     NOTE: Peak values will be plotted every 30 minutes for the omni antenna measurements. Specific times of peak signal will be checked for closer attention in later measurements with the horn antenna.

2. Local RF database search. Research your local in-country Radio Frequency Radiation database and provide the following information using Table 1 or a similar format:

   - frequency
   - customer name
   - usage
   - azimuth
   - antenna height
   - distance from your antenna site
   - interference level in dBW/Hz

   NOTE: An interference level not to exceed -215 dBW/Hz is recommended
   NOTE: Measured antenna bandwidth is 400 MHz (6700-7100 kHz)

Frequently Asked Questions (FAQ):

1. **Question:** We are uncertain whether the usually available rotator can be controlled as we want in terms of rotations per minute. Can you confirm the required rotator's capability?
   Response: GLP cannot comment on rotator capability.

2. **Question:** Do we have to measure in both horizontal and vertical positions? Will it require an additional 24 hours unless we use two sets of LNA and Spectrum Analyzers in each polarization?
   Response: Both polarizations should be measured, ideally, at the same time using either a switch at the feed or two separate sets of equipment

3. **Question:** A VLP or HLP interference will be received in a circular polarized receiving system 3 dB weaker than it was received in a linear polarized receiver. Accordingly, a -212 dBW/Hz interference which is 3 dB stronger than the -215 threshold should still be OK. Please confirm.
   Response: GLP is looking into a confirmation of this statement.

4. **Question:** Globalstar may accept stronger interference than in a fixed system because the receiving antenna will not continuously stay in line with the interference source. Does the -215 threshold value already take this into account? If not, now can the additional tolerance be translated into dB/Hz?
   Response: The -215 level does take the 10% tolerance into account.

5. **Question:** Please provide recommended and minimum specification for the omni-directional antenna.
   Response: GLP cannot recommend any specific antenna. You must use your own judgement based on equipment availability.

6. **Question:** Please also specify whether you have any minimum requirements for the omni-directional antenna, spectrum analyzer, LNA, etc.
   Response: As indicated above, GLP does not identify manufacturer or model of equipment to be used. The Service Provider must select the necessary equipment which is available and will meet the operational requirements needed to perform the measurements.

No.	Frequency (MHZ)	Customer Name	Usage	Azimuth (deg)	Antenna Height	Distance (KM)	Interference Level (dBW/Hz)
1							
2							
3							
4							
5							
6							
7							
8							
9							
10							
11							
12							
13							
14							
15							
16							
17							
18							
19							
20							
21							
22							
23							
24							
25							
26							

Table 1 - Local Interference Data Base Search Report