TECHNICAL EXHIIBT FOR IOT ANTENNA

Parameters of IOT Antenna

Globalstar, LLC is proposing to test the performance of the Globalstar 1.6/2.4 GHz MSS satellites using the Globalstar Payload Test System (GPTS), also known as the In-Orbit Test (IOT) equipment. The location for the IOT equipment is the Clifton Gateway Site, as shown in Figure 1.

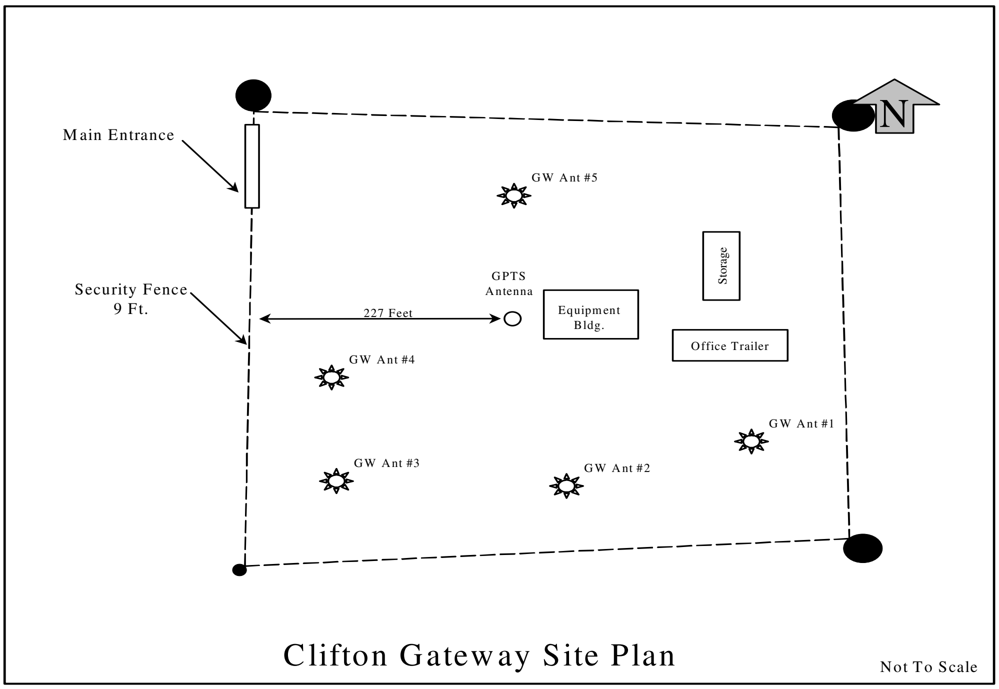


Figure 1: Clifton Gateway Site Plan

The IOT equipment will perform the Return Link Antenna Pattern measurement by transmitting a single L-band carrier within the Globalstar frequency plan (1610 MHz to 1618.725 MHz).

The parameters of the IOT equipment are as follows:

a) Frequency of operation: Transmit band of 1610 to 1618.725 MHz. Receive band of 2483.5 to 2500 MHz.

b) Antenna Polarization: Left hand circular.

c) Emission Designator: N0N.

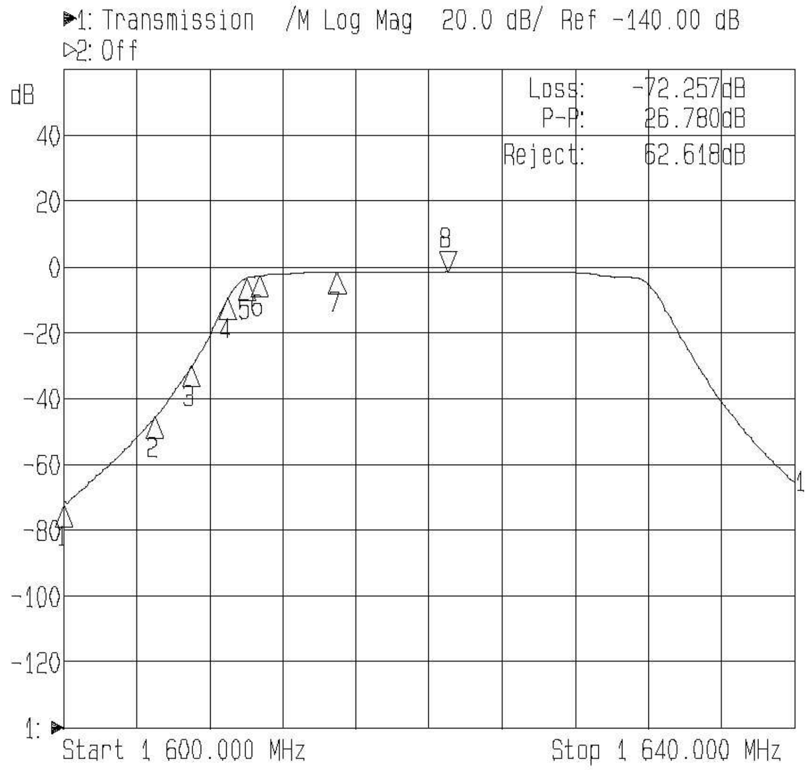
d) Maximum EIRP: The maximum EIRP is dictated by the maximum available transmitter power for a particular radio and its peak antenna gain.

e) Maximum EIRP density: The EIRP density is the EIRP divided by the carrier bandwidth and further corrected for the required 4 kHz bandwidth. This is same as the EIRP for CW carrier as all the RF power is present in the narrow bandwidth around the carrier.

Transmit Mode

Antenna Type and Mode	***Max EIRP (dBW)***	***Max EIRP Density (dBW/4 kHz)***
IOT	24	24

f) Description of Modulation: The Globalstar IOT transmitter will use single carrier CW only signal. This transmitter will not be used for CDMA signals. Bandpass filtering will be implemented as shown in Figure 2 below.



1: Mkr (MHz)	dB	2: Mkr (MHz)	dB
1: 1600.0000	-72.257		
2: 1605.0000	-45.477		
3: 1607.0000	-30.201		
4: 1609.0000	-9.639		
5: 1610.0000	-3.398		
6: 1610.7300	-2.667		
7: 1615.0000	-1.658		
8> 1621.0000	-1.473		

Figure 2: Bandpass Filter Frequency Response

Summary of measurements for compliance with FCC Rules

The Globalstar IOT equipment was originally designed to be used for initial in orbit checkout of the payload performance following launch. It performed this function admirably and is maintained operational for performing the same function when the ground spares will be launched in Q4 '06. However, it has also proven extremely useful in monitoring and maintaining the RF performance of the payload, particularly the gain. CDMA systems require a gain balance when calls are handed off from beam to beam, and satellite to satellite. As the Globalstar satellites have aged, there has been gain drift in the transponders, which the IOT equipment has been able to measure, and corrections on the satellites have been made. This has enabled Globalstar to optimize performance and maintain high call reliability percentages. This equipment will allow us to maintain the health of the satellites and operation within the licenses over a long-term period as the satellite ages.

Measurements were taken for the IOT equipment for compliance with the FCC's requirements for protection of GPS (47 C.F.R. § 25.213(b)) and GLONASS (47 C.F.R. § 25.216). The measurements were obtained by transmitting four (4) representative CW signals in the Globalstar L-band frequencies at 24.0 dBW. The four frequencies were chosen to cover the entire licensed Globalstar band from Channel 1 to Channel 9. This equipment will be used for only single carrier frequency measurement and hence third order intermodulation products will be not generated in the frequency of interest. Third intermodulation products can only be generated when two different carriers are transmitted through the same power amplifier.

Primary satellite measurements made using the IOT equipment are antenna patterns, gain and EIRP. Additional used capabilities are gain transfer, swept responses, telemetry "EIRP in a bandwidth" and command receiver levels. 24 dBW for the return link patterns is required in order to close the link to the satellite at low elevations, where the satellite antennas have lower gain, and where there is increased space loss. This power level needs to be a least 30 dB above the noise floor so the entire dynamic range of the patterns and side lobes can be measured. Globalstar MSS earth stations transmit a CDMA signal rather than a CW carrier. CDMA signals are known to operate significantly below the noise floor as they have the advantage of spreading over a wide bandwidth. This type of signal is not useful for the pattern measurement, as the required signal needs to be 30 dB above noise floor while CDMA signal for MSS earth station operates with -15 dB signal to noise ratio.

During these transmissions, the GPS and GLONASS frequency bands were monitored for both discrete and noise related interference signals. The detailed measurement method used for these tests is described in the next section. The results of these tests are listed in Table 1.

Table 1*: *GPS and GLONASS Out-of-Band Emissions Measurements

GPTS L-band Frequencies	GPTS EIRP	GPS band		GLONASS band	
	dBW	Measured	Specification	Measured	Specification
Channel # 1 (1610.73 MHz) GPS band discrete test	24 dBW	-119.5	**-80 dBW/600 Hz**		
Channel # 1 (1610.73 MHz) GPS band Noise test	24 dBW	-88.5	**-70 dBW/MHz**		
Channel # 1 (1610.73 MHz) GLONASS band discrete test	24 dBW			-108.9	**-80 dBW/600 Hz**
Channel # 1 (1610.73 MHz) GLONASS band Noise test	24 dBW			-76.7	**-70 dBW/MHz**
Channel # 3 (1613.2 MHz) GPS band discrete test	24 dBW	-118.7	**-80 dBW/600 Hz**		
Channel # 3 (1613.2 MHz) GPS band Noise test	24 dBW	-88.5	**-70 dBW/MHz**		
Channel # 3 (1613.2 MHz) GLONASS band discrete test	24 dBW			-111.9	**-80 dBW/600 Hz**
Channel # 3 (1613.2 MHz) GLONASS band Noise test	24 dBW			-81.2	**-70 dBW/MHz**
Channel # 7 (1618.11 MHz) GPS band discrete test	24 dBW	-116.4	**-80 dBW/600 Hz**		
Channel # 7 (1618.11 MHz) GPS band Noise test	24 dBW	-88.5	**-70 dBW/MHz**		
Channel # 7 (1618.11 MHz) GLONASS band discrete test	24 dBW			-116.4	**-80 dBW/600 Hz**
Channel # 7 (1618.11 MHz) GLONASS band Noise test	24 dBW			-88	**-70 dBW/MHz**

These results indicate that the IOT equipment meets the FCC regulations for EIRP and EIRP density for protection of GPS and GLONASS. The IOT antenna's discrete emissions in both the GPS and GLONASS bands meet the requirement by ~ 28 or more dB. The IOT antenna's noise emissions with 1 MHz bandwidth meet the requirement by ~ 18 dB in the GPS bands and by ~7 dB in the GLONASS band. No discrete emissions were detected in the GPS or GLONASS frequency bands. The noise floor of the spectrum analyzer mainly limited the noise measurements in the 1 MHz bandwidth.

These data indicate that the IOT equipment meets the EIRP and EIRP density requirements in the GPS and GLONASS frequency bands by 28 dB and 7 dB margin, respectively.

Additional testing was performed for FCC part 25.216 (f) rules and FCC part 25.216 (g) rules. Figures 3 and 4 show the requirements and the results of the testing with the carriers in the same 4 different frequencies chosen for the earlier testing. As seen in Figure 3, the EIRP density requirement in the 1605 to 1610 MHz band is met by ~7 to ~20 dB margin. Also, as seen in Figure 4, the EIRP requirements in the 1605 to 1610 MHz band are met by ~28 dB margin.

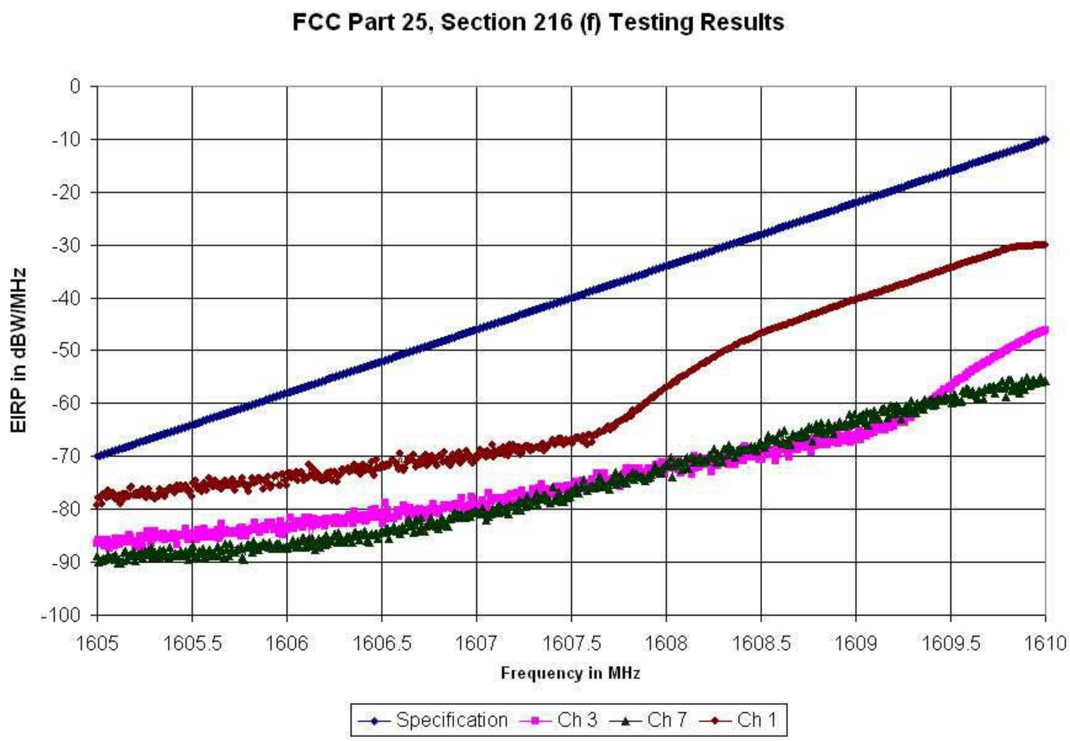


Figure 3: FCC Part 25.216 (f) Testing Results

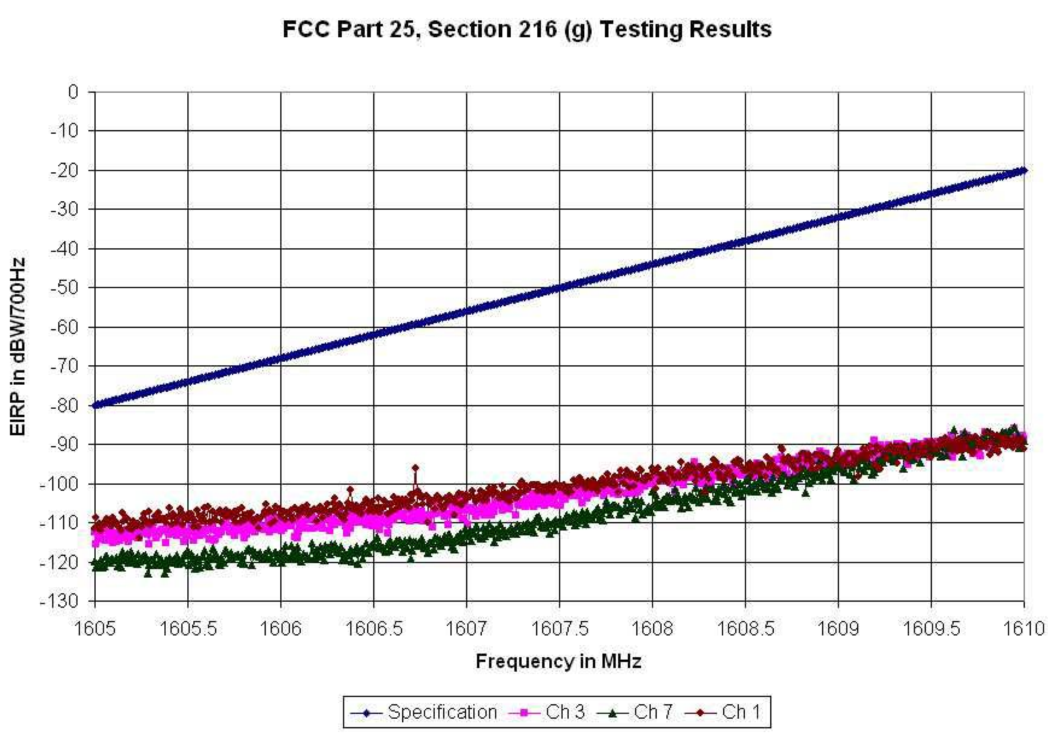


Figure 4: FCC Part 25.216 (g) results for discrete EIRP measurements

<u>Method of measurements for compliance with FCC Rules</u>

Figure 5 shows the test setup used for the measurements for compliance with FCC rules. The measurements were made at the input of the antenna and the output of the bandpass filter. Figure 6 shows the frequency response of the bandstop filter used to attenuate the main signal level into the spectrum analyzer while passing the out of band emissions. The bandstop filter had more than 10-15 dB attenuation in the band 1610-1618.725 MHz while -1.8 dB attenuation in the band 1559-1605 MHz where the out of band emission measurements were required. This filter helped in reducing the internal spurs generated by the spectrum analyzer. The results shown in Table 1 and Figure 1 are corrected for the cable loss, Antenna gain and the insertion loss for the bandstop filter.

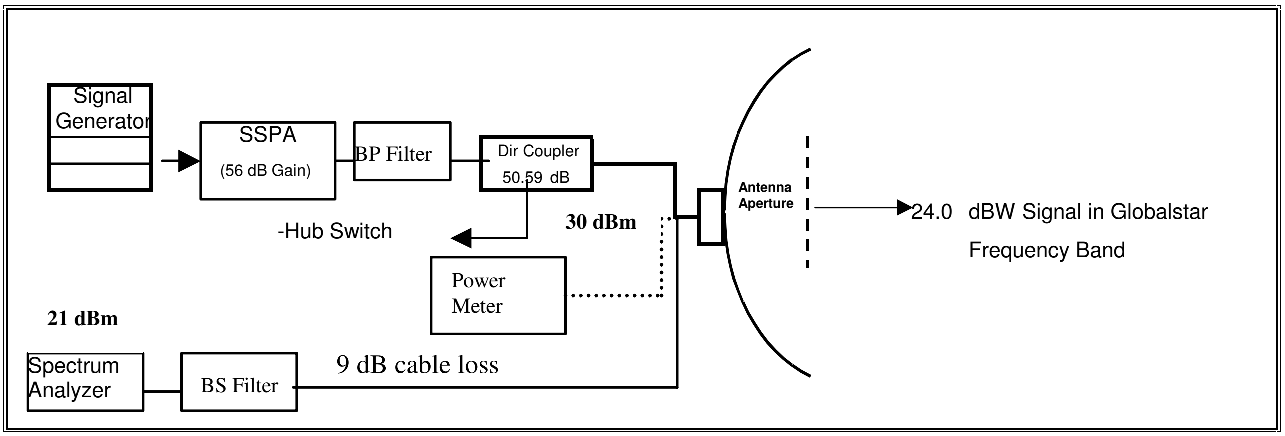


Figure 3: Measurement Setup

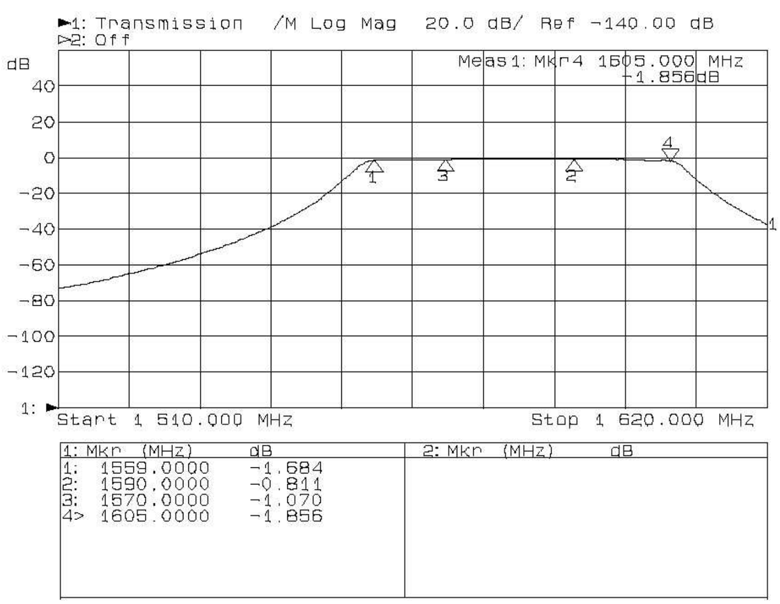


Figure 4: Measured Bandstop filter frequency response