1.1 Terminology and Abbreviations

This section lists and defines commonly used terms and abbreviations.

ADC	Analog to Digital Converter
AGC	Automatic Gain Control
ASIC	Application Specific Integrated Circuit
BW	Bandwidth
CPE	Customer Premise Equipment
DAC	Digital to Analog Converter
dB	Decibels
DSP	Digital Signal Processor (or Processing)
EEPROM	Electrically Erasable Programmable Read Only Memory
FDD	Frequency Division Duplexing
FEC	Forward Error Correction
FLL	Frequency Locked Loop
FPGA	Field Programmable Gate Array
IDU	In Door Unit
IF	Intermediate Frequency
IMD	Intermodulation Distortion
LNA	Low Noise Amplifier
LO	Local Oscillator
LPF	Low Pass Filter
LSB	Least Significant Bit
MDS	Multipoint Distribution Service
MMDS	Multichannel Multipoint Distribution Service
ms	Milliseconds
MSB	Most Significant Bit
Msps	Mega samples per second
NPR	Noise Power Ratio
ns	Nanoseconds
NVM	Non-Volatile Memory (EEPROM)
ODU	Out Door Unit
P2MP	Point to Multi Point
P2P	Point to Point
PIC	Peripheral Interface Controller
PIN	P-type Intrinsic N-type (doped semiconductor junction)
PLD	Programmable Logic Device
PLL	Phase Locked Loop
Rx	Receive
SAW	Surface Acoustic Wave (filter)
SFDR	Spur Free Dynamic Range
SINAD	Signal to Noise and Distortion
SNR	Signal to Noise Ratio
SPI	Serial Peripheral Interface
T/H	Track and Hold
THD	Total Harmonic Distortion
Tx	Transmit
UART	Universal Asynchronous Receiver Transmitter
UBR	Universal Broadband Router
U-NII	Unlicensed National Information Infrastructure
VCA	Voltage Controlled Attenuator
VCXO	Voltage Controlled Crystal Oscillator
VOFDM	Vector Orthogonal Frequency Division Multiplexing

2 RF Head Description

Figure 1: RF Head Functional Block Diagram - TYPICAL, FOR REFERENCE ONLY

2.1 IF Coaxial Cable

One coaxial cable ports is provided on the bottom side of the RF Head. This cable carries the 6 signals from the IDU to the ODU.

- -48 V nominal DC voltage (High Power type only).
- 24 V nominal DC voltage (Standard Power type only).
- 24 MHz low noise frequency reference for the Tx and Rx PLLs
- Modulated Tx IF signal, centered at 330 MHz
- Modulated Rx IF signal (from ODU to IDU), centered at 426 MHz
- Modulated 750 kHz carrier for Serial Communication Channel
- Tx blanking signal (48 MHz carrier frequency)

2.1.1 IF Coaxial Cable Connector

The IF coaxial connector shall be a weatherized female Type-N on the RF Head

3.0 Operational Modes

3.1 Signal Bandwidths

The CPE must support 3 different signal bandwidths for both Tx and Rx operation. The three bandwidths are 1.5, 3.0 and 6 MHz nominally. *A bandwidth identification signal will be provided through the Serial Communication channel (this feature is currently under review).* For channelization plans with channel spacing different than these bandwidths, the signal bandwidth closest to, but not larger than, the channel spacing shall be utilized for that channel spacing.

3.2 Tx Gain Control

CPE Tx gain is controlled by the Hub Receiver. The Tx chain behaves as a linear programmable gain amplifier. The Tx power is a product of the Tx IF input signal and ODU Tx gain. Tx gain is set in response to the IDU host gain set command through the Serial Communication Channel. Calibration of the variable attenuator (if required) is performed during manufacturing and correction data is stored in the ODU NVM. The modulated Tx signal must meet all S/N specifications over the full Tx power range.

The entire gain control range of the Tx consists of a variable gain control and a fixed gain control step. Note that the high power CPEs and the millimeter-wave CPEs do not have a fixed gain control step. The state of the fixed gain control step is determined by proximity to the HUB receiver and is set appropriately at installation. It does not change during operation of the radio. The variable gain is controlled by the Hub Receiver and can be changed at any time. Implementation of the variable gain attenuator can be a continuously variable attenuator or a step attenuator with minimum step size of 1 dB.

The total gain control required for the standard power head is comprised of a fixed attenuation and a variable attenuation. For example, for the GHz band, the total gain control is 77 dB (3 MHz BW), which is comprised of 25 dB of fixed attenuation and 52 dB of variable attenuation. The maximum value of fixed attenuation is 25 dB and the minimum value is 0 dB. The fixed attenuation feature is required for the GHz band only. The amount of variable gain control varies with signal BW. The 6 MHz BW requires 3 dB less variable gain control, and the 1.5 MHz BW requires 3 dB more variable gain control.

3.3 Tx Power Blanking

The CPE Tx chain will be instructed to blank when it is not actually transmitting data. This is to prevent overloading the Hub Receiver with aggregate noise power from multiple CPEs having high Tx chain noise/gain products. The blanking command will be derived in the IDU. The Tx power amplifier chain must be sufficiently blanked to minimize excessive noise from being transmitted when in this mode.

3.4 Tx Power Maximum Threshold Detector

The output power of the Tx chain is monitored to insure that it does not exceed a pre-determined maximum output power. If the Tx power exceeds this level, than the Tx chain is blanked. The maximum threshold is set based on the signal bandwidth setting.

3.5 Rx Gain Control

Rx gain control consists of a fixed gain control step and a continuously variable control or Rx AGC. The state of the fixed gain control step is determined by proximity to the HUB receiver and is set appropriately at installation. Only the standard power CPE utilizes the fixed gain step. Note that the high power CPEs and the millimeter-wave CPEs do not have a fixed gain step. The Rx AGC level is set by commands from the IDU DSP. The requirement is to have ‘transient-free’ gain adjustments as to prevent glitches on the Rx signal from affecting the DSP. As such, Rx AGC is implemented using a continuously variable analog PIN diode attenuator driven by a heavily filtered 12 bit D/A. Factory calibration constants stored in NVM correct for AGC non-linearity.

3.6 Tx Cable Compensation (CC)

An attenuator with at least 12 dB of range is used to compensate for Tx IF cable loss from the IDU to the ODU. The attenuator is set automatically by use of a coupled power detector and attenuator feedback control in the IF section of the Transmitter. At site installation, the correct cable compensation setting is determined by adjusting the attenuator so that detected power falls within pre-determined settings. Use of the PIC microcontroller as well as NVM storage is allowed in the design of the feedback loop.

3.7 PLL Lock Detect

The ODU controller monitors Tx and Rx PLLs Lock detect signals. In the event one (or both) of the PLL’s become unlocked, the PIC control firmware will shut down the Tx signal as it may no longer be transmitting at the correct frequency. A status bit would also be made available to the IDU.

3.8 Temperature Monitoring

A temperature sensor in close proximity to the Tx Power Amp is used to measure heat sink temperature. In the event this becomes high enough to damage the Power Amp transistors or other circuitry, the ODU controller may shut down the Tx Power amp by instructing the power supply to disable the Vcc supply to the amp.

3.9 Supply Monitoring

Over voltage, over current, and over temperature condition of the DC-DC converter are monitored by the ODU controller. If such events should occur, a status bit would be made available to the IDU.

3.10 Calibration and Compensation

Performance anomalies are corrected by measuring and calibrating various circuits during manufacturing. Variables are stored in NVM and are accessed by the ODU controller during operation. Gain, frequency response, temperature, signal bandwidth and power detection effects are corrected. The following are examples of functions which can employ digital correction:

- Rx Static Gain

- Rx AGC Attenuator
- Tx Static Gain
- Tx Variable Gain
- Tx Power Maximum Threshold Detector
- Tx Cable Compensation
- Tx Amplifier Pre-Distortion Bias (optional if pre-distortion is used)

3.11 Identification Information

The ODU controller non-volatile memory contains certain product information necessary for field support and configuration communication with the IDU host. The following are examples of status information which could be read-back:

- Product Identifier
- Serial Number
- Date Code
- Revision Code
- Tx Frequency Range
- Tx Frequency Resolution
- Rx Frequency Range
- Rx Frequency Resolution
- Tx IF Frequency
- Rx IF Frequency
- Tx Spectral Inversion
- Rx Spectral Inversion
- Tx Power Range
- Duplexer Code
- High Power or Standard Power Unit

4 Specifications

4.1 Tx IF Input - All Bands, Except as Noted

Parameter	*Value*	*Condition*	*Notes*
Transmit Chain			
IF Input			
Center Freq.	330 .00 MHz		
Accuracy	+/- 5. 00 ppm	Coherent with 24 MHz Freq. Reference	
Average Power	-17 to -5 dBm	Maximum IF Input Power vs cable length	IF power is continuously variable over a 20 dB range, for any given IDU-ODU cable loss between 0 and 12
	-37 to –25 dBm	Minimum IF Input Power vs cable length	
Survival Power	+10 dBm	Unit shall not sustain permanent damage when subject to this average power level and set to maximum rated output power	
Modulation	OFDM		
PMPR	12.0 dB	99.999% Prob. Peak Pwr < (Mean + PMPR)	PMPR = Peak to Mean Power Ratio
BW	6.00 MHz	Max Modulated BW	
	3.00 MHz		
	1.50 MHz	Min Modulated BW	
Impedance	50 ohm	Nominal, 330 MHz +/- 3 MHz	
Match	1.5:1 VSWR	Max, 330 MHz +/- 3 MHz	
Tx Linearity			
Notch Depth	-46 dBc	Notch Depth of OFDM input signal with multiple tones nulled, at required transmitter input power range	
Spectral regrowth of input signal, at required transmitter input power range			
Spectral Mask	0.0 dBr	Reference: 100 KHz BW @ 330 MHz	
Regrowth	-48.0 dBr	@ Licensed Channel Band Edge in 100 KHz BW	Modulated with OFDM Waveform
	Decreasing Linearly from –48.0 dBc @ Channel Band Edge to –68.0 dBc @ Band Edge + 3 MHz		Modulated with OFDM Waveform
	-68.0 dBr	@ >= 3 MHz from Licensed Channel Band Edge in 100 KHz BW	Modulated with OFDM Waveform
Spurious	-68.0 dBc	Discrete Spur at Band Edge	Relative to total Tx Power
	Decreasing Linearly from –68.0 dBc @ Channel Band Edge to –88.0 dBc @ Band Edge + 3 MHz		Modulated with OFDM Waveform
	-85.0 dBc	Discrete Spur at >= 3 MHz from Band Edge	
	-58.0 dBc	Single Spur: within Channel BW	
	-52.0 dBc	Wide Band Spur: within Channel BW	

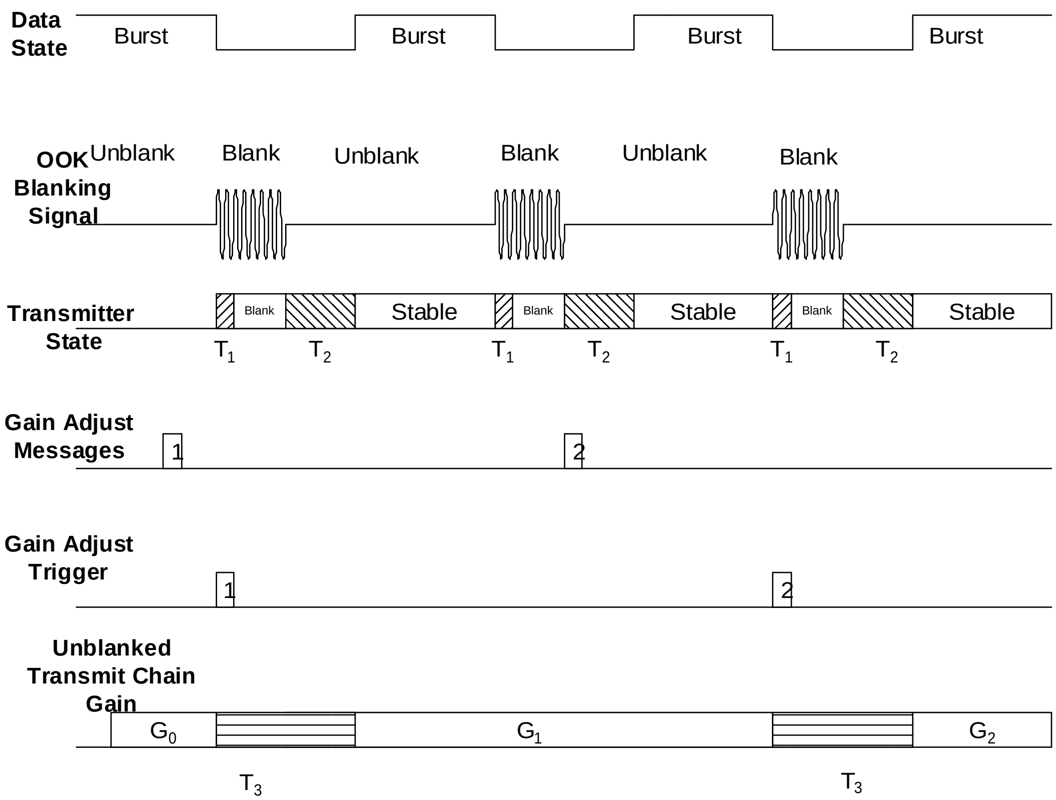
4.2 Tx RF Output

4.2.1 Tx RF Output - 5.7 GHz Band

Parameter	*Value*	*Conditions*	*Notes*
Transmit			
RF Output			
Center Freq	5730.0 MHz	Minimum	Based on 6 MHz channelization, first 2 MHz of band not used
	5772.0 MHz	Maximum	Based on 6 MHz channelization, last 2 MHz of band not used
	Fixed Tx/Rx Offset	$f_{Tx} = f_{Rx}$ - 48 MHz	
Resolution	6.0 MHz	Steps	
Accuracy	+/- 5 ppm	Coherent with IF 24 MHz Reference	
Flatness	1.0 dB Pk–Pk	Max., across any 6 MHz BW	
Tx Gain Control (standard power)			
Maximum Output Power @ Tx in = -17 dBm, TxCC = 0 dB	+15 to +19 dBm	1.5 MHz BW	@ 0 dB atten
	+12 to +16 dBm	3.0 MHz BW	@ 3 dB atten
	+9 to +13 dBm	6.0 MHz BW	@ 6 dB atten
Variable atten range	47 dB min	1.5 MHz BW	
	44 dB min	3.0 MHz BW	
	41 dB min	6.0 MHz BW	
Resolution	1 dB	Monotonic steps	
Accuracy, relative @ any possible Tx frequency	+/- (2.0 + 0.05 *A) dB	0 ≤ A ≤ 47 dB, A = Variable Attenuation	
Gain Adjust Settling Time	48 µs	3 dB step maximum, adjust gain and settle such that gain does not vary more than 0.05 dB over the following 200 µs	Measured from Unblank/Blank transition. See Figure 2.
Transmitter Settling Time	30 µs	Turn transmitter on and settle such that gain does not vary more than 0.05 dB over the following 200 µs	Measured from Blank/Unblank transition. See Figure 2.
Tx Linearity			
3rd Order IMs	-47 dBc	2 CW Signals within Modulation BW, each tone +14 dBm at Tx output connector Standard power, design guideline only	
Notch Depth	-40 dBc	Notch Depth Response to OFDM signal with multiple tones nulled, at all possible transmitter output powers	
Spectral regrowth wrt maximum output power setting, at any point in the output power accuracy window			
Spectral Mask	0.0 dBc	Reference: 1 MHz BW @ f_{LO} + 330 MHz	Modulated with OFDM Waveform, Tx IF input at -17 dBm input level. Average power output of 13 dBm. For 6 MHz modulation bandwidth, 22 dBi gain antenna, measured in lowest channel, fc = 5730 MHz, and highest channel, fc = 5820 MHz.
Regrowth	Constant @ -54.0 dBc up to 5715.0 MHz		Modulated with OFDM Waveform; measured in 1 MHz BW
	Increasing Linearly from -54.0 dBc @ 5715.0 MHz to –44.0 dBc @ 5725.0 MHz		Modulated with OFDM Waveform; measured in 1 MHz BW
	Unspecified between 5725.0 and 5825.0 MHz		

	Decreasing Linearly from -44.0 dBr @ 5825.0 MHz to –54.0 dBr @ 5835.0 MHz		Modulated with OFDM Waveform; measured in 1 MHz BW
	Constant @ -54.0 dBr above 5835.0 MHz		Modulated with OFDM Waveform; measured in 1 MHz BW
Spurious	-39 dBm	Max, discrete spur level at U-NII band edge; measured in 1 MHz RBW	Tx IF input at mid-band, -17 dBm input level; assumes antenna gain of 22 dBi
	Decreasing linearly from -39 dBm at U-NII band edge to -49 dBm at 10 MHz from the band edge; measured in 1 MHz RBW		
	-49 dBm	Max, discrete spur level at greater than 10 MHz from U-NII band edge; measured in 1 MHz RBW	
	-40 dBc	Narrowband spur within the channel BW, greater than 1 MHz offset, CW input at IF	
	-50 dBc	Narrowband spur within the channel BW, 1 kHz to 1 MHz offset, CW input at IF	
LO Spectral Purity			Measured with Manchester encoded control signal running with 60 ms ping rate.
Phase Noise	-69 dBc/Hz	1 KHz	
	-86 dBc/Hz	5 KHz	
	-94 dBc/Hz	10 KHz	
	-114 dBc/Hz	100 KHz	
	-129 dBc/Hz	1 MHz	
	-149 dBc/Hz	10 MHz	
Spurious	-50 dBc max.	Single spur	
Impedance	50 ohm	Nominal	
Match	1.5:1 VSWR	Max	
Tx Features			
Spectral Invert.	None	Tx Modulation sense is same as Tx IF Input	
Cable Compensation			
Range	12.0 dB		
Resolution	1.0 dB		
Accuracy	+/- 1.0 dB		
Tx Power Blanking	Mute Tx Power		
Off Power	24.00 dBkTB	Tx Noise Power when Blanking enabled	
Switch Time	10 usec	Max, from Trigger to < - 30dB	From Unblank to Blank State
Tx Max. Power Threshold (standard power)			
	+21 dBm		

Figure 2. Transmitter Blanking Timing Diagram



T_1- Time between arrival of 48 MHz Blanking Signal and when the transmitter output power goes to 24.00 dBkTB - 10 usec

T_2- Time between disappearance of 48 MHz Blanking Signal and when the transmitter output gain stabalizes to a point where it does not vary by more than 0.05 dB over a 200 usec period - 30 usec

T_3- Time between arrivel of 48 MHz Blanking Signal when a gain adjustment is scheduled and when the transmitter output gain stabalizes to a point where it does not vary by more than 0.05 dB over a 200 usec period - 48 usec

4.3 Rx RF Input

Rx RF Input - 5.7 GHz

Parameter	*Value*	*Conditions*	*Notes*
Receive			
RF Input			
Center Freq	5778.0 MHz	Minimum	Based on 6 MHz channelization, first 2 MHz of band not used
	5820.0 MHz	Maximum	Based on 6 MHz channelization, last 2 MHz of band not used
	Fixed Tx/Rx Offset	$f_{Rx} = f_{Tx} + 48$ MHz	
Resolution	6.0 MHz	Steps	
Accuracy	+/- 5 ppm	Coherent with IF 24 MHz Reference	
Impedance	50 ohm	Nominal	
Match	1.5:1 VSWR	Max	
Noise Figure with Transmitter on (standard power)			
	5.3 dB	Typical, 25 C	Maximum AGC Gain Setting
	6.0 dB	Max, 60 C	Maximum AGC Gain Setting
Noise Figure with AGC		Allowed to increase 1 dB for every 1 dB increase in gain control attenuation	
Max Input (standard power)			
	-20 dBm	operating	
	+10 dBm	survival	
Flatness	1.0 dB Pk – Pk	Max., across any 6 MHz BW	Typical, Rx RF in to Rx IF out
Image Rejection	80 dB	Min	
AGC			
Range	25.0 dB	Min	
Resolution	Continuous	Controlled by digital word to 12 bit D/A	
Accuracy	2.0 dB	Variance from straight line fit over Range	
Step Rsponse	10 mSec	Single pole time constant on D/A drive	No transients over any Range step
AGC Atten.	Digital Control	Control for IDU Message to ODU	
Linearity			
Input IP3	- 5.0 dBm	2 Tones in Channel BW @ AGC = 0 dB	
	4.0 dBm	2 Tones in Channel BW @ AGC = -10 dB	
	11.0 dBm	2 Tones in Channel BW @ AGC = -25 dB	
LO Spectral Purity			Measured with Manchester encoded control signal running with 60 ms ping rate.
Phase Noise	-69 dBc/Hz	1 kHz	
	-86 dBc/Hz	5 kHz	
	-94 dBc/Hz	10 kHz	
	-114 dBc/Hz	100 kHz	
	-129 dBc/Hz	1 MHz	
	-149 dBc/Hz	10 MHz	
Spurious	-50 dBc max.	Single spur	

4.4 Rx IF Output - All Bands

Parameter	*Value*	*Conditions*	*Notes*

Receive			
Rx IF Output			
Center Freq.	426.00 MHz		
Accuracy	+/- 5. 00 ppm	Coherent with 24 MHz Freq. Reference	
Gain	30.0 dB	Min: Rx AGC = 0 dB	All Operating Conditions
	34.0 dB	Max: Rx AGC = 0 dB	All Operating Conditions
Impedance	50 ohm	Nominal	
Match	1.5:1 VSWR	Max, 426 +/- 6 MHz	
Spurious		Relative to IF desired channel signal power	
Narrow Band	-50.0 dBc	Single spur	
	-47 dBc	All spurs combined	
Wide Band	-44.0 dBc		
Linearity			
Notch Depth	-40.0 dB	Response to OFDM with multiple tones nulled: All Input/AGC conditions	
	-40.0 dB	RF Input = -90 to –60 dBm: In Band Blocking signal =-40 dBm AGC = 0 dB	Blocking signal is within receive band of duplexer
	-40.0 dB	RF Input = -60 to –35 dBm: In Band Blocking signal = Input + 20 dB AGC = 0 dB @ -60 dBm increasing to AGC = 25 dB @ -35 dBm	Blocking signal is within receive band of duplexer
	-40.0 dB	RF Input = -35 to –20 dBm: In Band. Blocking signal = -15 dBm @ GHz band , -20 dBm @ 5.7 and GHz bands AGC = 25 dB	Blocking signal is within receive band of duplexer
	-40.0 dB	RF Input = -35 to –25 dBm: In Band. Blocking signal = -25 dBm @ 26 and 28 GHz bands AGC = 25 dB	Blocking signal is within receive band of duplexer
Spectral Invert.	None	Rx IF Modulation sense is same as Rx Input	

4.5 IDU to ODU Frequency Reference - All Bands

Parameter	*Value*	*Conditions*	*Notes*
IF Frequency Reference			
Frequency	24.00 MHz		
Accuracy	+/- 5 ppm		
Phase Noise	-50 dBc/Hz	1 Hz	
	-80 dBc/Hz	10 Hz	
	-110 dBc/Hz	100 Hz	
	-135 dBc/Hz	1 kHz	
	-145 dBc/Hz	10 kHz	Floor
Power	-8.0 dBm	Min	
	-5.0 dBm	Max	
IF Multiplexer Passband	200 kHz	Min	
Passband Insertion Loss	1.0 dB	Max	
IF Multiplexer Reject Band	48 MHz +/- 100 kHz	Min	
Rejection	30 dB	Min	

4.6 DC Power

4.6.1 DC Power - 5.7 GHz

Parameter	*Value*	*Conditions*	*Notes*
DC Input Power			
Voltage	18.00 V	Min	Reverse polarity protection required
	30.00 V	Max	Reverse polarity protection required
Current	2.2 A	Max	Steady state, excludes surge current
Surge	1.0 A	Max: Upon RF Head Connection or Power Turn-on	
DC Power	40 W	Max: Including DC-DC Converter efficiency	

4.7 RF Duplexer

4.7.2 RF Duplexer - 5.7 GHz

RF Duplexer			
Band Options			
Tx Band 1	5727 MHz	Lower Band Edge	
Tx Band 1	5751 MHz	Upper Band Edge	
Rx Band 1	5775 MHz	Lower Band Edge	
Rx Band 1	5799 MHz	Upper Band Edge	
Tx Band 2	5751 MHz	Lower Band Edge	
Tx Band 2	5775 MHz	Upper Band Edge	
Rx Band 2	5799 MHz	Lower Band Edge	
Rx Band 2	5823 MHz	Upper Band Edge	
Isolation	Duplexer must have sufficient isolation to meet all performance specifications when transmitting maximum allowable RF power		
Antenna	N Type: Female	Environmental Seal	
Lightning Protection	Ground Lug for 18 Gauge Wire	DC Grounded Antenna Port	

4.8 Serial Communications Channel

Control			
Center Frequency	750 kHz		
Bandwidth	300 kHz	1 dB BW of Serial Communications Channel path of IF Multiplexer	
Input Level	- 3 dBm	Min	
IF Multiplexer Rejection Band	20 - 500 MHz		
IF Multiplexer Rejection	40 dB	Min	
Data Format	Manchester encoded		

4.9 Transmitter Blanking Signal

Center Frequency	48 MHz		
Bandwidth	100 kHz	Min	
Input Level:ON	0 dBm	Max	On = Unblanked
Input Level:ON	-6 dBm	Min	
Input Level: OFF	-36 dBm	Max	Off = Blanked
IF Multiplexer Insertion Loss	1.0 dB	Max	
IF Multiplexer Rejection Band	24 MHz +/- 100 kHz	Min	
IF Multiplexer Rejection	40 dB	Min	

4.10 Miscellaneous Features

Features			
Temperature Measure		Temperature of Tx Amp base plate	Measured with PIC A/D
Range	-40^{0}C	Min	
	100^{0}C	Max	
Accuracy	+/- 5^{0}C		
Resolution	1^{0}C	Typical, Monotonic	
PLL Lock	Detect	Monitor Lock Status or Rx and Tx PLLs	
RF Duplexer Type		RF duplexer type entered in NVM	
Microcontroller Clock Speed		Operate using on-board 18 MHz crystal oscillator	

4.11 Environmental & Regulatory Requirements

Environmental & Regulatory Requirements			
Temperature			
Operating	$-40^{o}C$	Min	
	$+60^{o}C$	Max	Includes effect of sun loading
Storage	$-40^{o}C$	Min	
	$+85^{o}C$	Max	
Humidity	0 - 100% RH	Condensing	
Altitude	Refer to CPE Transverter Mechanical Requirements Specification		
Vibration & Shock			
Operational	Refer to CPE Transverter Mechanical Requirements Specification		
Storage	Refer to CPE Transverter Mechanical Requirements Specification		
ESD Protection	TBD		
Lightning Protection	Antenna Port DC grounded		
Susceptibility	TBD		
Safety Requirements			
US/Canada	UL 1950/CSA 950 UL NEMA 4 Enclosure		Listing shall be by a test facility that is recognized by US and Canada (i.e. UL or CSA, etc.)
International	CB report and certificate to IEC 60950		
Australia	TS001, AS3260		
EMI Compliance			
US	FCC Part 15 Class B		
Europe	EN50022 (CISPR 22, Class A), EN50082-1		
Canada	CSA standard C108.8, 1993 (Class A)		
Japan	VCCI		
Homologation (Radio Certification)			
US	Radio Certification compliance is documented and controlled in the US by Code of Federal Regulations (CFR) Part 47C, Telecommunications, Parts 2, 21, Docket 97-94, and Rule Making (RM) 9060		
Canada	TBD (No specification exists at this time, certification guidelines are in process).		
International	TBD		