## XPON ONU Stick

FEATURES

> Single fiber bi-directional data links GPON ONU and EPON ONU application with XPON MAC

> SC/UPC receptacle SFP with PON ONU MAC inside, "Plug-and-play" via auto-discovery and configuration

> 1310nm DFB burst mode transmitter, 1490nm TIA continuous mode receiver

> Single 3.3V power supply

> Digital diagnostic monitor interface compatible with SFF-8472

> SFP MSA compliance

> Low EMI and excellent ESD protection

> Class I laser safety standard IEC-60825 compliant

> RoHS compliance

> XPON stick compatible with GPON and EPON system

> Complies with SFP Multi-Source Agreement (MSA) SFF-8074i

> Complies with ITUT-T G.984.2, G.984.2 Amendment 1

> Complies with ITUT G.988 ONU management and control interface (OMCI) specification

> Complies with IEEE802.3AH

> Complies with SGMII and 1000BASE-X

APPLICATIONS

> Passive Optical Networks (PON)

> The product is an MSA-compliant SFP that incorporates not just the optics for an ONU, but all of the electronics need

as well. It is a "PON on a Stick" that an entire FTTH ONU in a slightly oversized SFP. It can be plugged into

networking equipment. Allowing the data interfaces on a switch, router, etc. to be customized for different fiber environments and distance requirements.
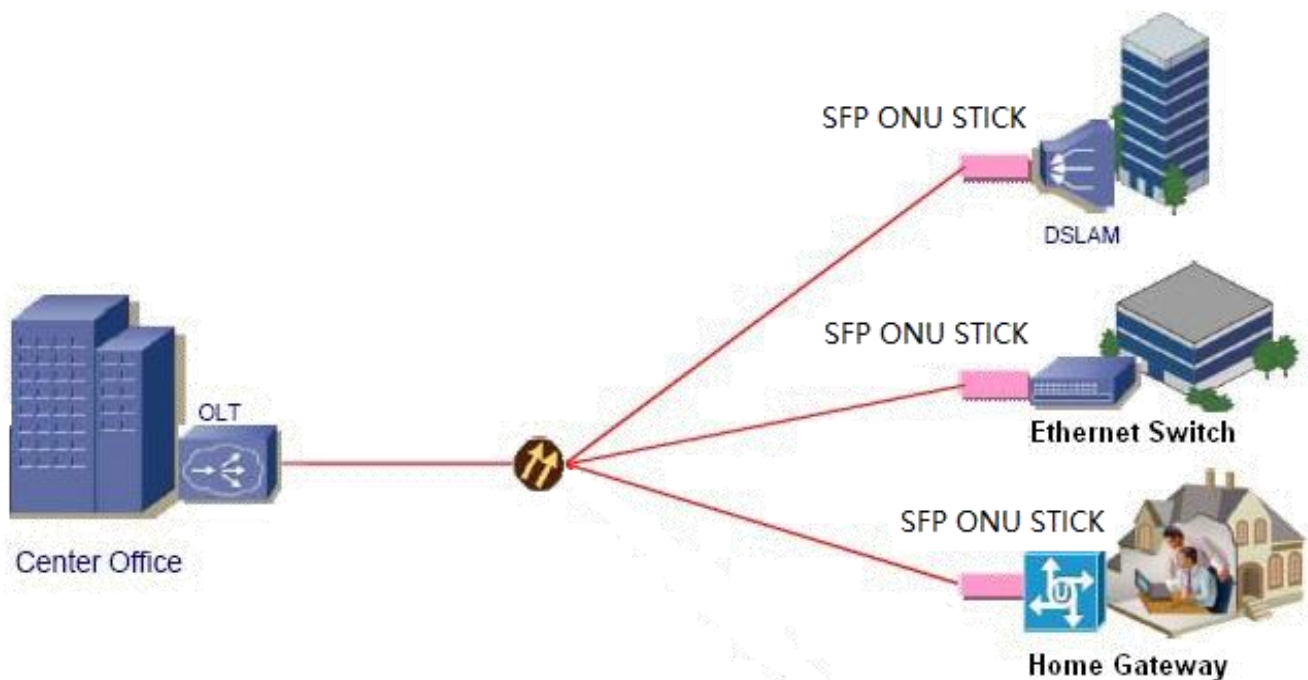
ABSOLUTE MAXIMUM RATING					
Parameter	Symbol	Min.	Max.	Unit	Notes
Storage Ambient Temperature	TSTG	-40	85	°C	
Operating Case Temperature	Tc	0	70	°C	
	Tc	-40	85	°C	
Operating Humidity	OH	5	95	%	
Power Supply Voltage	VCC	-0.5	3.6	V	

RECOMMENDED OPERATING CONDITION						
Parameter	Symbol	Min.	Typ.	Max.	Unit	Notes
Power Supply Voltage	VCC	3.13	3.3	3.47	V	
Power Dissipation	PD	-	2.10	2.5	W	Max value under High temp environment
Operating Case Temperature	Tc	0		+70	°C	
	Tc	-40		+85	°C	
Operating Humidity Range	OH	5		95	%	
Data Rate			TX:1.244 / RX:2.488		Gbit/s	GPON MODE
			TX:1.25 / RX:1.25			EPON MODE
Data Rate Drift		-100		+100	PPM	

TRANSMITTER OPTICAL CHARACTERISTICS						
Parameter	Symbol	Min.	Typ.	Max.	Unit	Note
Optical Center Wavelength	λC	1290	1310	1330	nm	
Spectral Width (-20dB)	Δλ			1	nm	
Side Mode Suppression Ratio	SMSR	30			dB	
Average Launch Optical Power	AOP	0.5		4	dBm	Launched into SMF Fiber
Burst off Average Output Power				-45	dBm	
Extinction Ratio	ER	10			dB	
Rise/Fall Time (20%-80%)	TR/TF			0.26	ns	Unfiltered PRBS 2^{23} - 1@1244.16 Mbps
RIN$_{15}$OMA				-115	dB/Hz	
Optical Return Loss Tolerance		-15			dB	
Transmitter Reflectance				-10	dB	
Transmitter and Dispersion Penalty	TDP			1	dB	Transmit on 20km SMF.

Optical Waveform Diagram	Compliant With ITU-T G984.2	PRBS $2^{23} -1$ @1244.16Mbps

TRANSMITTER ELECTRICAL CHARACTERISTICS

Parameter	Symbol	Min.	Typ.	Max.	Unit	Notes
Data Input Differential Swing		300		1800	mV	CML input, AC coupled
Input Differential Impedance		90	100	110	Ω	
Transmitter TxDisable Control Voltage -		0		0.8	V	
Transmitter TxDisable Voltage - High		2.0		VCC	V	
Transmitter Fault Alarm Voltage - Low		0		0.4	V	
Transmitter Fault Alarm Voltage – High		2.4		Vcc	V	

RECEIVER OPTICAL CHARACTERISTICS

Parameter	Symbol	Min.	Typ.	Max.	Unit	Notes
Operating Wavelength	λ_c	1480	1490	1500	nm	
Sensitivity	SEN			-28	dBm	PRBS 2^{23} - 1 @1G~2.5Gbps
Saturation Optical Power	SAT	-8			dBm	
Loss of Signal De-Assert	LOSD			-29	dBm	
Loss of Signal Assert	LOSA	-40			dBm	
Signal-Detected Hysteresis		0.5		6	dBm	
Receiver Reflectance				-12	dB	λ=1490nm
WDM Filter Isolation		38			dB	λ=1550nm
		35			dB	λ=1650nm

RECEIVER ELECTRIAL CHARACTERISTICS

Parameter	Symbol	Min.	Typ.	Max.	Unit	Notes
Data Output Differential Swing		300		1200	mV	CML output, AC coupled
Loss of Signal - Low		0		0.4	V	
Loss of Signal - High		2.4		VCC	V	

PIN DESCRIPTION

PIN	Name	Description	Notes
1	VeeT	Transmitter Ground	Note 5
2	TX Fault	Transmitter Fault Indication	Note 1
3	TX Disable	NC	
4	MOD-DEF2	Module Definition 2	Note 3,2 wire serial ID Interface
5	MOD-DEF1	Module Definition 1	Note 3,2 wire serial ID Interface
6	MOD-DEF0	Module Definition 0	Note 3 Grounded in Module
7	Rate	NC	-
8	LOS	Loss of Signal	Note 4
9	VeeR	Receiver Ground	Note 5
10	VeeR	Receiver Ground	Note 5
11	VeeR	Receiver Ground	Note 5
12	RD-	Inv. Received DataOut	Note 6
13	RD+	Received Data Out	Note 6
14	VeeR	Receiver Ground	Note 5
15	VccR	Receiver Power	3.3 ±5%, Note 7
16	VccT	Transmitter Power	3.3 ±5%, Note
17	VeeT	Transmitter Ground	Note 5
18	TD+	Transmit Data In	Note 8
19	TD-	Inv.Transmit Data In	Note 8
20	VeeT	Transmitter Ground	Note 5

20	VeeT	
19	TD-	
18	TD+	
17	VeeT	
16	VccT	
15	VccR	
14	VeeR	
13	RD+	
12	RD-	
11	VeeR	

Top of Board

1	VeeT	
2	TxFault	
3	Tx Disable	
4	MOD-DEF(2)	
5	MOD-DEF(1)	
6	MOD-DEF(0)	
7	Rate Select	
8	LOS	
9	VeeR	
10	VeeR	
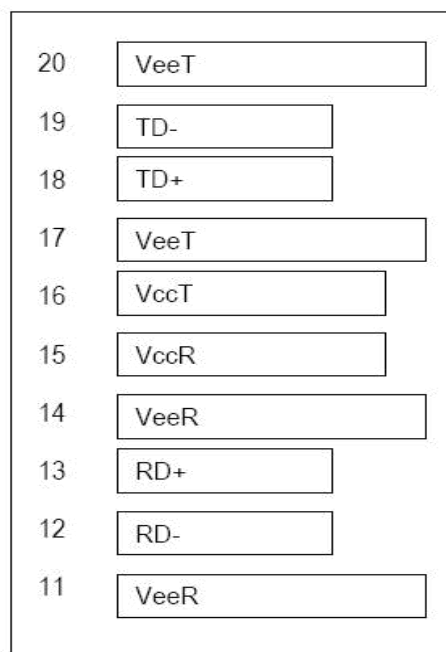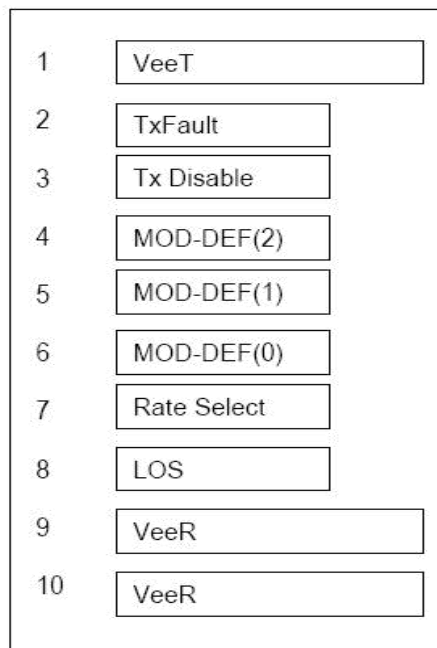
Bottom of Board (as viewed thru top of board)

1) TX Fault is an open collector/drain output, which should be pulled up with a 4.7K – 10KΩ resistor on the host board. Pull up

voltage between 2.0V and VccT, R+0.3V. When high, output indicates a laser fault of some kind. Low indicates normal operation.

In the low state, the output will be pulled to < 0.8V.

2) TX disable : This pin is no function for SFP STICK

3) Mod-Def 0,1,2. These are the module definition pins. They should be pulled up with a 4.7K – 10KΩ resistor on the host board.

The pull-up voltage shall be VccT or VccR.

Mod-Def 0 is grounded by the module to indicate that the module is present

Mod-Def 1 is the clock line of two wire serial interface for serial ID

Mod-Def 2 is the data line of two wire serial interface for serial ID

4) LOS (Loss of Signal) is an open collector/drain output, which should be pulled up with a 4.7K – 10KΩ resistor. Pull up

voltage between 2.0V and VccT, R+0.3V. When high, this output indicates the received optical power is below the

worst-case receiver sensitivity (as defined by the standard in use). Low indicates normal operation. In the low state, the

output will be pulled to <

0.8V.

5) VeeR and VeeT may be internally connected within the SFP module.

6) RD-/+: These are the differential receiver outputs. They are AC coupled 100 Ω differential lines which should be terminated with

100 Ω (differential) at the user SERDES. The AC coupling is done inside the module and is thus not required on the host

board. The voltage swing on these lines will be between 370 and 2000 mV differential (185 – 1000 mV single ended) when

properly terminated.

7) VccR and VccT are the receiver and transmitter power supplies. They are defined as 3.3V ±5% at the SFP connector pin.

Maximum supply current is 300 mA. Recommended host board power supply filtering is shown below. Inductors with DC

resistance of less than 1Ω=should be used in order to maintain the required voltage at the SFP input pin with 3.3V supply

voltage. When the recommended supply filtering network is used, hot plugging of the SFP transceiver module will result in

an inrush current of no more than 30 mA greater than the steady state value. VccR and VccT may be internally connected

within the SFP transceiver module.

8) TD-/+: These are the differential transmitter inputs. They are AC-coupled, differential lines with 100Ω differential termination

inside the module. The AC coupling is done inside the module and is thus not required on the host board. The inputs will

accept differential swings of 500 – 2400 mV (250 – 1200 mV single-ended), though it is recommended that values between

500 and

1200 mV differential (250 – 600 mV single-ended) be used for best EMI performance.
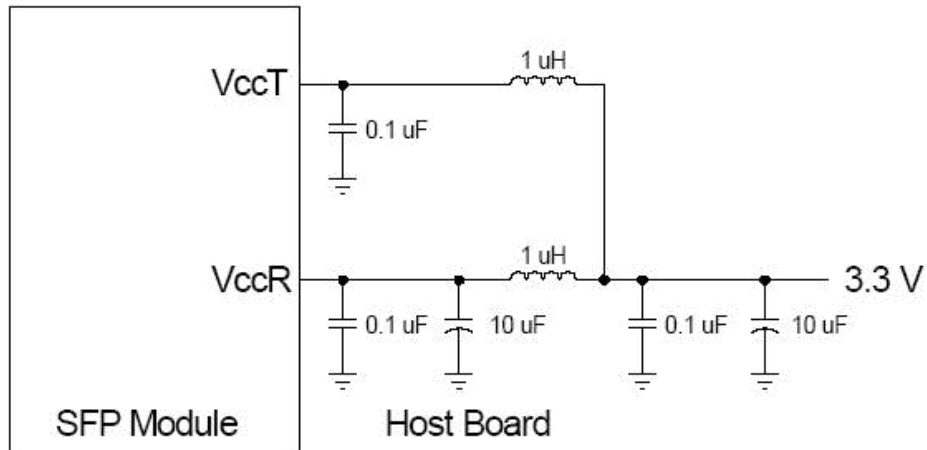
Recommended Host Board Supply Filtering Network

Figure 2   Recommended Host Board Supply Filtering Network

DESCRIPTION OF EEPROM ADDRESS A0H AND A2H

SFP ONU uses the two wire serial bus to access two blocks of 256-byte EEPROM address 1010000X (A0h) and 1010001X

(A2h) , A0h stores static information including product and vendor IDs and A2h provides diagnostic information about the

module's present operating conditions. The transceiver generates this diagnostic data by digitization of internal analog signals.

Calibration and alarm/warning threshold data is written during device manufacture.

The below figure shows the detail descriptions of A0h and A2h. All this information is not only accessible by a local host

equipment into which the EPON Stick is plugged, but also can be retrieved by OLT remotely through EPON OAM messages.
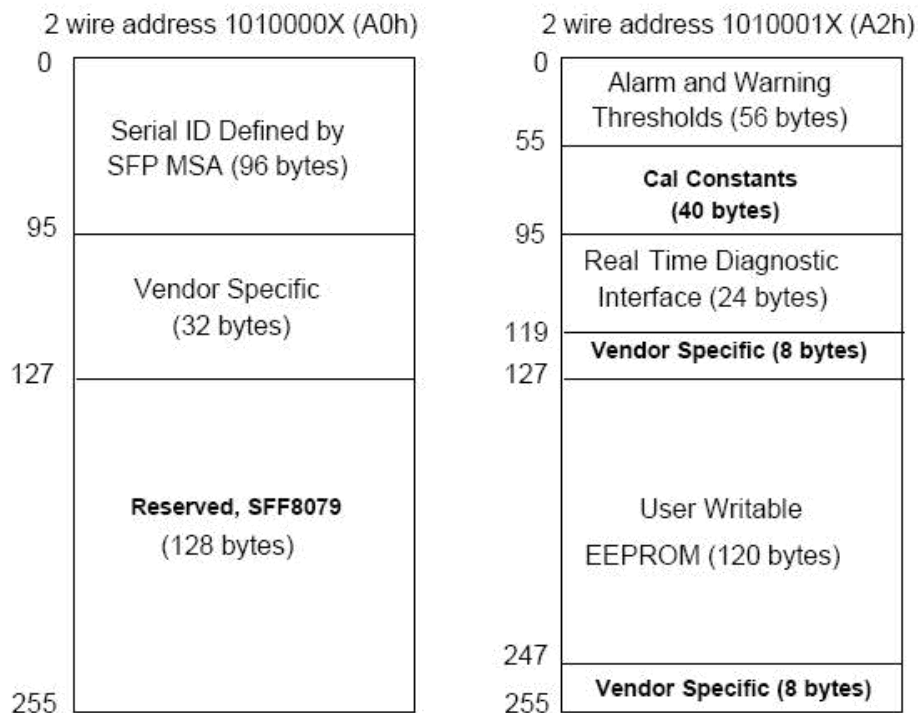

Figure 4   Detail descriptions of A0h and A2h defined by SFF-8472

A0H map

Data Addr	Field Size (Byte)	Name Of filed	Hex	Coded value
0(00)	1	Identifier	03	SFP
1(01)	1	Ext .Identifier	04	GBIC/SFP function is defined by serial ID
2(02)	1	Connector	01	SC
3(03)	8	Transceiver (Note 3)	00	
4(04)			00	
5(05)			00	
6(06)			02	
7(0X07)			00	
8(0X08)			00	
9(0X09)			00	
10(0X0A)			00	
11(0X0B)	1	Encoding	03	NRZ
12(0C)	1	BR, Nominal	0C	1.244GH
13(0D)	1	Reserved	00	
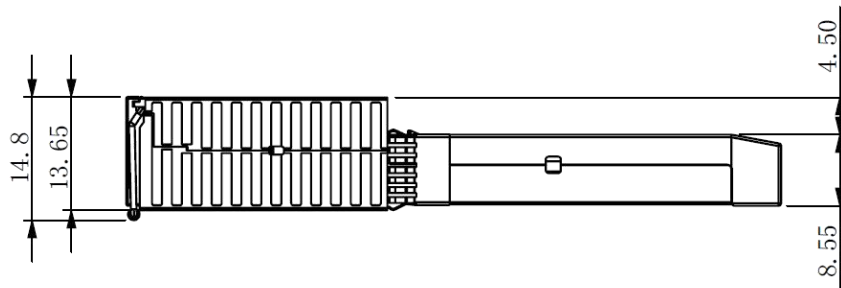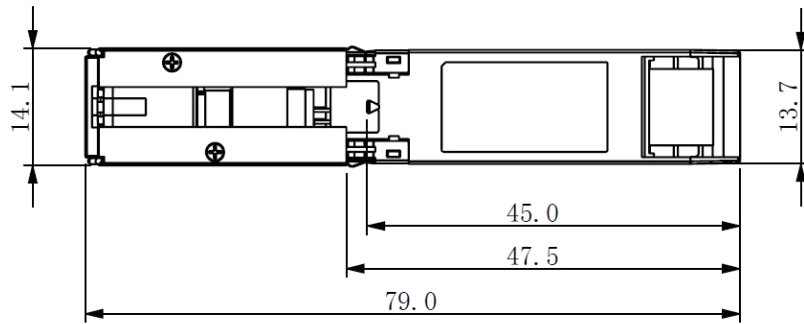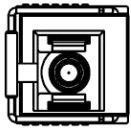
Mechanical Specification

14(0E)	1	Length (9m)	14	20(km)
15(0F)	1	Length (9m)	C8	200(100m
16(10)	1	Length (50um)	00	

Address	Length	Name	Hex	Value
17(11)	1	Length (62.5um)	00	
18(12)	1	Length (Copper)	00	
19(13)	1	Reserved	00	
20(14)	16	Vendor name	--	--
21(15)			--	--
22(16)			--	--
23(17)			--	--
24(18)			--	--
25(19)			--	--
26(1A)			--	--
27(1B)			--	--
28(1C)				
29(1D)				
30(1E)				
31(1F)				
32(20)				
33(21)				
34(22)				
35(23)				
36(24)	1	Reserved	00	
37(25)	3	Vendor OUI	00	
38(26)			00	
39(27)			00	
40(28)	16	Vendor PN(Note)	--	X
41(29)			--	X
42(2A)			--	X
43(2B)			--	X
44(2C)			--	X
45(2D)			--	X
46(2E)			--	X
47(2F)			--	X
48(30)			--	-
49(31)			--	X
50(32)			--	X
51(33)			--	X

Address	Length	Name	Hex	Value
52(34)			--	X
53(35)			--	<space>
54(36)			--	<space>
55(37)			--	<space>
56(38)			31	1
57(39)		Vendor	30	0

Address	Size	Name	Hex	Description
58(3A)			20	<space>
59(3B)			20	<space>
60(3C)	2	Wavelength	05	1310nm
61(3D)			1E	
62(3E)	1	Reserved	00	
63(3F)	1	CC_BASE	00	Note1
64(40)	2	Options	00	TX_FAULT, LOS
65(41)			0A	
66(42)	1	BR, max	00	
67(43)	1	BR, min	00	
68(44)	16	Vendor SN (Note3)	FF	
69(45)			FF	
70(46)			FF	
71(47)			FF	
72(48)			FF	
73(49)			FF	
74(4A)			FF	
75(4B)			FF	
76(4C)			FF	
77(4D)			FF	
78(4E)			FF	
79(4F)			FF	
80(50)			FF	
81(51)			FF	
82(52)			FF	
83(53)			FF	
84(54)	8	Date code (Note3)	xx	Year
85(55)			xx	Year
86(56)			xx	Month
87(57)			xx	Month
88(58)			xx	Day
89(59)			xx	Day

Address	Size	Name	Hex	Description
90(5A)			20	<Space>
91(5B)			20	<Space>
92(5C)	1	Diagnostic	68	DD Implemented; Internally
93(5D)	1	Enhanced Options	B0	Optional Alarm/warning Flags
94(5E)	1	SFF-8472 Compliance	02	Rev 9.4of SFF-8472.

95(5F)	1	CC_EXT	FF	Note 2

1) The check code shall be the low order 8 bits of the sum of the contents of all the bytes from byte.

2) The check code shall be the low order 8 bits of the sum of the contents of all the bytes from byte 64 to byte 94, inclusive.

3) The value is reference date, it will be assigned accord to the module's actual situation

A2H

110(6E)	TX_DISABLE_STATE	TX_DISABLE_STATE	XX	-
	SOFT_TX_DISABLE	Enables direct control of the transmitter via I2C		Disable
	ROGUE_ONU	Set this bit to"1" on the occurrence of a rogue ONU condition. Set to "0" to reset.		-
	N/A			-
	ROGUE_TXP_LO_FLAG	Set to 1 when TXP_LO_FLAG has been set in Rogue_TXP_LO_EN bit enable.		-
	TX_FAULT_STATE	TX_FAULT_STATE		-
	RX_LOS_STATE	RX_LOS_STATE		-
	DATA_READY_BAR_STATE	Indicates LDD has achieved power and data is ready. Bit stays high until data is ready at which time the LDD sets this bit low		-
111(6F)	N/A		40	-
	TX_FAST_SLEEP	Default "0" means on de-assert of TX_SLEEP, Tx implements a reset start. Set to "1" enable the Tx to use the last known bias & mod values.		Set to "1" enable the Tx to use the last known bias & mod values.
	RX_SLEEP_ASSERT	Set to 1　enable RX_SLEEP mode		disable
	RX_SLEEP_STATE	RX_SLEEP_STATE		-
	TX_SLEEP_STATE	TX_SLEEP_STATE		-

	POW_LEV	Sets the GPON power leveling control		00=0dB
112(70)	Alarm_flags1	alarm & warning flags	00	00
113(71)	Alarm_flags2	alarm & warning flags	00	00

114(72)	Rogue ONU Timer Setup	Sets the interval time for counters located at 78h and 79h.4 vaules are avialable.80h=40ms,40h=80ms,20h=160	80	set as 80h=40ms
	Reserved			
115(73)	Reserved		FF	
116(74)	Warning_flag1	alarm & warning flags	xx	xx
117(75)	Warning_flag2	alarm & warning flags	xx	xx
118(76)	Reserved		FF	
119(77)	unallocated		FF	
120-255	Reserved	Reserved for debug information		

DIGITAL DIAGNOSTIC MONITORING INTERFACE			
Parameter	Range	Accuracy	Calibration
Temperature	-40 to 85°C (I Temp)	±3°C	Internal
	0 to 70°C(C Temp)	±3°C	Internal
Voltage	0 to 3.7V	±3%	Internal
Bias Current	0 to 130mA	±10%	Internal
TX Power	-10 to 8 dBm	±2dB	Internal
RX Power monitor	-30 to -8 dBm	±2dB	Internal