Global Traffic Technologies

OPTICOMGPS2 Radio Transceiver Module

User Manual

79-1000-0772-0

Revision A

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1. Introduction

1.1 Scope

This specification defines and controls the serial communications interface between the Global Traffic Technologies (GTT) Radio Module controller and the RF module controller through which the configuration and control of the RF module is performed.

1.2 Definitions, Acronyms, and Abbreviations

This section contains descriptions of terms, acronyms, and abbreviations that are used throughout this document.

3D – Three dimensional

RF – Radio Frequency

PPS – Pulse Per Second

2. Protocol Specification

The following subsections detail the structure of the protocol. Individual message types are defined in the next major section.

2.1 Roles

This protocol is intended to be used in a point-to-point mode only meaning one GTT controller to one RF module. The devices act as near peers in that the GTT device assumes the role of a master device in order to perform configuration of the RF module. However, once operations have begun, the RF module autonomously reports inbound data as it occurs while the GTT controller periodically sends content to be transmitted and the time index to be used in frequency hopping.

2.2 Error Detection & Recovery

All devices are expected to detect framing, checksum and overflow errors. If a device detects a communication error such as these, the device will not send a response to the received message. It is the sender's responsibility to detect the lack of response from the receiving device and resend the command if it so chooses. During configuration, the GTT controller will perform retries to ensure that the RF module is fully configured prior to enabling over-the-air operation.

If a device receives a message without error, but the message contains invalid data, or the requested operation cannot be performed due to the current context of the receiving device, then the device is expected to provide information in the response to the sender that it could not carry out the command.

Under operational conditions (i.e. over-the-air), the messages are transfers of data, not diagnostics or configuration. Failure of a transfer (See annotations in the message section) shall not require a retry since loss of a single data is non-critical (i.e. either repeated or new data will be arriving momentarily).

2.3 Flow Control

No flow control shall be supported by this protocol.

2.4 Character Format

The supported binary character format is the following:

Start bits:	1
Data bits:	8
Stop bits:	1
Parity:	None

2.5 Supported Data Types

In order to specify the message formats, the following data type definitions are necessary:

Type	Size	Range
UCHAR	8 bits	0..255
CHAR	8 bits	-128..127
USHORT	16 bits	0..65535
SHORT	16 bits	-32768..32767
ULONG	32 bits	0..4,294,967,295
LONG	32 bits	-2,147,483,648..2,147,483,647

Each byte (where a byte is 8 bits in size) of these data types is serial transmitted least-significant bit first, most-significant bit last. Multi-byte data types are transmitted least-significant byte first, most significant byte last. For example, an unsigned short with value 1234H would be transmitted as a byte with value 34H followed by a byte with value 12H (i.e. little endian).

2.6 Message Format

Messages are sent from the host to the radio in multiple of 8 bytes. For messages that are not even multiples of 8 bytes, the remaining package is padded with trailing zeros (0).

Messages have the following structure:

<Header><Length><Command><Data><Checksum>

with the fields further defined below:

<Header>

The <Header> shall be a single UCHAR with a value 0x02 representing an STX.

A message receiver begins assembling a new incoming message when it receives a <Header> meeting this specification.

<Length>

16 bit value specifying the number of bytes to follow including the checksum.

<Command>

The <Command> is composed of a single ASCII CHAR. Commands are defined in section 5. Commands that are initiated by the host are always an uppercase character. Commands that initiated by the RF module or responses to host commands are always a lowercase character.

<Data>

The <Data> field is an optional, variable length field which has a format that is context dependent for each <Message ID>. The maximum length for this field is not limited by the protocol.

<Checksum>

The <Checksum> field is a single USHORT field which is the 16-bit sum (sum modulo 2^{16}) of all the bytes in the message prior to this field. This sum includes the <Header>,<Length>,<Command>, and <Data> fields.

3. Setup and Configuration Messages

3.1 Set Mode (M)

Used by the host to change the operational mode of RF module. Offline mode is an idle mode where operational setup occurs. Online mode is an active operations mode where normal transmit and receive functions are performed. Tests modes are receive test mode and transmit test mode. RF Module responds with the new active mode or a Broken Mode status.

Offline Mode is characterized by no RF activity (transmitter off, receiver off) and no frequency hopping.

Online Mode is possible when the RF module has been completely configured.

Note: When enabled, programming mode may use a different protocol

Sent by Host:

Data Element	Base Type	Instances	Description
Length	USHORT	1	Number of bytes to follow including checksum. Always 4 for this message.
Command	UCHAR	1	Single ASCII character ‘M’ for mode.
Mode	UCHAR	1	Values are : 0 – Offline Mode 1 – Online Mode 2 – Transmit Test Mode 3 – Programming

Sent by RF Module:

Data Element	Base Type	Instances	Description
Length	USHORT	1	Number of bytes to follow including checksum. Always 5 for this message.
Command	UCHAR	1	Single ASCII character ‘m’ mode acknowledge.
Status	UCHAR	1	Values are: 0 – Accepted 1 – Invalid mode 2 – Cannot change mode, insufficient information or setup
Current Mode	UCHAR	1	Values are : 0 – Offline Mode 1 – Online Mode 2 – Transmit Test Mode 3 – Programming 4 – Broken Mode

3.2 Set Framing Configuration (F)

Used by the host to configure the number of slots to occur in each frequency hop, number of data slots, and the individual slot configurations. All slots are assumed to be receive slots until configured otherwise.

Note: the first one or more slots of a frame may not be useable if the transmission time is less than 3.167 msec. This time is needed by the radio to tune to the new frequency.

Sent by Host:

Data Element		Base Type	Instances	Description
Length		USHORT	1	Number of bytes to follow including checksum. Value is 4 + (number of slots * 2).
Command		UCHAR	1	Single ASCII character 'F' for framing configuration.
Number of slots/hop		UCHAR	1	Number of slots to follow. Maximum of 255 slots. Default is 186.
For each slot	Slot Size	USHORT	1	Number of bytes in this slot. Maximum size is dictated by the number of slots. Total number of bytes sent per frame cannot exceed 16,000. Note: Slot sizes must be even number of bytes.

Sent by RF Module:

Data Element	Base Type	Instances	Description
Length	USHORT	1	Number of bytes to follow including checksum. Always 4 for this message.
Command	UCHAR	1	Single ASCII character 'f' for framing configuration acknowledge.
Status	UCHAR	1	Values are: 0 – Accepted 1 – Invalid number of slots 2 – Invalid size 3 - Exceeds maximum byte total

3.3 Hop Table Configuration (H)

Used by the host to specify the set of frequencies to be used in the hopping sequence. Frequencies are specified in rows and columns. Each row is indexed by the seconds since midnight calculated from the UTC time reported by the GPS receiver modulo the number of rows. The host will calculate the seconds since midnight and row index each second.

Sent by Host:

Data Element		Base Type	Instances	Description
Length		USHORT	1	Number of bytes to follow including checksum. Value is 5 + (number of row * number of columns)
Command		UCHAR	1	Single ASCII character 'H' for hop table configuration.
Number of rows		UCHAR	1	Number of seconds before repeating. Maximum of 25 rows. Default is 25.
Number of columns		UCHAR	1	Number of frequency changes per second. Maximum of 5 columns. Default is 3. Note: rows * columns MUST be less than or equal to 75.
For each row	Channel 1	UCHAR	1	Receive channel for 1st hop in this second. Integer channel value. Valid range is 1 to 81.
	Channel 2	UCHAR	1	Receive channel for 2nd hop second.
	Channel 3	UCHAR	1	Receive channel for 3rd hop in this second.
	Channel n	UCHAR	1	Receive channel for nth hop in this second.

Sent by RF Module:

Data Element	Base Type	Instances	Description
Length	USHORT	1	Number of bytes to follow including checksum. Always 4for this message.
Command	UCHAR	1	Single ASCII character 'h' for hop table configuration acknowledge.
Status	UCHAR	1	Values are: 0 – Accepted 1 – Invalid channel 2 – Invalid size 3 – Invalid channel sequence

Possible Hop Table Channels and Associated Frequencies:

Channel	Receive Frequency

Number	
1	2401024
2	2402048
3	2403072
4	2403096
5	2494120
6	2495144
7	2407168
8	2408192
9	2409216
10	2410240
11	2411264
12	2412288
13	2413312
14	2414336
15	2415360
16	2416384
17	2417408
18	2418432
19	2419456
20	2420480
21	2421504
22	2422528
23	2423552
24	2424576
25	2425600
26	2426624
27	2427648
28	2428672
29	2429696
30	2430720
31	2431744
32	2432768
33	2433792
34	2434816
35	2435840
36	2436864
37	2437888
38	2438912
39	2439936
40	2440960
41	2441984
42	2443008
43	2444032
44	2445056
45	2446080
46	2447104
47	2448128
48	2449152
49	2450176
50	2451200
51	2452224
52	2453248
53	2454272
54	2455296

55	2456320
56	2457344
57	2458368
58	2459392
59	2460824
60	2461848
61	2462872
62	2463896
63	2464920
64	2465536
65	2466560
66	2467584
67	2468608
68	2469632
69	2470656
70	2471680
71	2472704
72	2473728
73	2474752
74	2475776
75	2476800
76	2477824
77	2478848
78	2479872
79	2480896
80	2481920
81	2482944

Default Hop Table Channels:

Row	Column	Channel Number
1	1	2
	2	57
	3	54
2	1	4
	2	50
	3	58
3	1	8
	2	52
	3	6
4	1	48
	2	60
	3	10
5	1	46
	2	42
	3	12
6	1	62
	2	44
	3	40
7	1	14
	2	38
	3	64
8	1	18
	2	16

	3	66
9	1	68
	2	32
	3	20
10	1	72
	2	70
	3	30
11	1	34
	2	78
	3	74
12	1	28
	2	76
	3	24
13	1	81
	2	26
	3	3
14	1	55
	2	53
	3	5
15	1	49
	2	59
	3	9
16	1	51
	2	7
	3	47
17	1	61
	2	11
	3	45
18	1	41
	2	13
	3	63
19	1	43
	2	39
	3	15
20	1	37
	2	65
	3	19
21	1	17
	2	67
	3	69
22	1	31
	2	21
	3	73
23	1	71
	2	29
	3	33
24	1	79
	2	75
	3	27
25	1	77
	2	25
	3	23

3.4 Hop Table Row Index (I)

Defines the transmit and receive frequencies for the next 1 second interval by specifying the row index into the Hop Table.

Sent by Host:

Data Element	Base Type	Instances	Description
Length	USHORT	1	Number of bytes to follow including checksum. Always 4 for this message.
Command	UCHAR	1	Single ASCII character 'I' for hop table row index.
Hop Table Index	UCHAR	1	Index into the Hop table configured at startup. Indexed by seconds since midnight modulo number of rows in Hop Table.

Sent by RF Module:

Data Element	Base Type	Instances	Description
Length	USHORT	1	Number of bytes to follow including checksum. Always 4 for this message.
Command	UCHAR	1	Single ASCII character 'i' for hop table row index.
Status	UCHAR	1	Values are: 0 – Accepted 4 – Invalid Index

3.5 Transmit Slot Data (T)

The Transmit Slot Data message is used by the host to instruct the RF module on which slot of the slots defined in the Framing Configuration to broadcast the supplied data. The slot, number of bytes and the data are specified. Data is only broadcast for the next time period as defined by the framing configuration.

Data must be received by the radio no later than 50 msec prior to the 1PPS.

Only 1 TX slot per unit is allowed (i.e. no multiple broadcasts within a single frame).

Sent by Host:

Data Element	Base Type	Instances	Description
Length	USHORT	1	Number of bytes to follow including checksum. Value is 6 + value of Size)
Command	UCHAR	1	Single ASCII character 'T' for Transmit Slot Data.
Slot	UCHAR	1	Must be one of the slots defined in the framing configuration. Range of values is 1 to Number of slots. A value of 0 is not used.
Size	USHORT	1	Number of bytes to be broadcast. Length is limited by the size of the slot defined in the framing configuration and the maximum size for a single transmission. The size will be the width of the slot. If the data
Data	UCHAR[Size]	1	Data to be broadcast. First byte [index 0] is first to be broadcast over the air.

Sent by RF Module:

Data Element	Base Type	Instances	Description
Length	USHORT	1	Number of bytes to follow including checksum. Always 4 for this message.
Command	UCHAR	1	Single ASCII character 't' for Transmit Slot Data acknowledgement.
Status	UCHAR	1	Values are: 0 – Accepted 1 – Invalid slot 2 – Invalid size

3.6 Receive Slot Data (r)

A Receive Slot Data message is sent at the conclusion of each slot regardless of whether data was received or not.

If no data was received, then the Size field specifies 0, the data field is omitted, the received CRC is 0, the calculated CRC is 0, and the RSSI is the valued that was sampled during the slot.

Sent by RF Module:

Data Element	Base Type	Instances	Description
Length	USHORT	1	Number of bytes to follow including checksum. Value is 12 + value of Size).
Command	UCHAR	1	Single ASCII character 'r' for Receive Slot Data.
Slot	UCHAR	1	Must be one of the slots defined in the framing configuration.
Size	USHORT	1	Number of bytes received. Length is limited by the size of the slot defined in the framing configuration.
Data	UCHAR[Size]	1	Data received. . First byte [index 0] is first to be received over the air. Field is omitted if length is 0.
TX CRC	USHORT	1	Transmitted CRC. Calculated by transmitter.
RX CRC	USHORT	1	Calculated CRC on the receive side.
RSSI	UCHAR	1	Received Signal strength indicator.
SNR	UCHAR	1	Approximation of Signal to noise ration 0-255 representing 0-25.5 dB. At 10 dB, running at .01 BER.

Sent by Host:

No acknowledgement. Assumed that new data will with the next frequency hop.

3.7 Broken Mode Report (b)

A Broken Mode Report message is sent to the GTT controller whenever a failure is detected.

Sent by RF Module:

Data Element	Base Type	Instances	Description
Length	USHORT	1	Number of bytes to follow including checksum. Value is 4 + number of failures).
Command	UCHAR	1	Single ASCII character 'b' for Broken Mode Report.
Number of Failures	UCHAR	1	Count of failure codes to follow.
Failure	UCHAR	Number of failures	Active failure indications. 1 – No 1 PPS detected 2 – VSWR fault

Sent by Host:

No acknowledgement.

3.8 Signal Strength Report (s)

The Signal Strength Report message is sent to the GTT controller at the end of every frame. There is an RSSI value for each slot in the frame. The report is sent even if none of the slots had data in them.

Sent by RF Module:

Data Element		Base Type	Instances	Description
Length		USHORT	1	Number of bytes to follow including checksum. Value is 3 + number of slots).
Command		UCHAR	1	Single ASCII character 's' for Signal Strength Report.
For each slot	RSSI	UCHAR	Number of slots in the frame	The RSSI for each slot defined in the framing configuration.

Sent by Host:

No acknowledgement.

3.9 Set Serial Number (N)

Used by the host controller to set the radio module's serial number.

Sent by Host:

Data Element	Base Type	Instances	Description
Length	USHORT	1	Number of bytes to follow including checksum. Always 13 for this message.
Command	UCHAR	1	Single ASCII character 'N' for Set Serial Number.
Serial Number	UCHAR[10]	1	Format is: RAyywwssss where RA denotes RF module with OMAP processor (dual core) yy demotes the last two digits of the year and ww is the week since the beginning of the year and ssss is the sequence number as labeled on the radio board. RByywwssss denotes RF module with TMS processor (single core).The yy, ww and ssss fields are the same.

Sent by RF Module:

Data Element	Base Type	Instances	Description
Length	USHORT	1	Number of bytes to follow including checksum. Always 3 for this message.
Command	UCHAR	1	Single ASCII character 'n' for Set Serial Number acknowledge.

3.10 Set Attenuation Level (G)

Used by the host controller to set the radio module's transmit attenuation level.

Sent by Host:

Data Element	Base Type	Instances	Description
Length	USHORT	1	Number of bytes to follow including checksum. Always 4 for this message.
Command	UCHAR	1	Single ASCII character 'G' for Set Attenuation Level.
Attenuation Level	UCHAR	1	Valid range of values is 0-15.A value of 0 is no attenuation and a value of 15 is maximum attenuation.

Sent by RF Module:

Data Element	Base Type	Instances	Description
Length	USHORT	1	Number of bytes to follow including checksum. Always 4 for this message.
Command	UCHAR	1	Single ASCII character 'g' for Set Attenuation Level Acknowledge.
Status	UCHAR	1	Values are: 0 – Accepted 5 – Invalid attentuation

3.11 Erase Faults (J)

Used by the host controller to clear any existing fault indicators.

Sent by Host:

Data Element	Base Type	Instances	Description
Length	USHORT	1	Number of bytes to follow including checksum. Always 43for this message.
Command	UCHAR	1	Single ASCII character ‘J’ for Erase Faults.

Sent by RF Module:

Data Element	Base Type	Instances	Description
Length	USHORT	1	Number of bytes to follow including checksum. Always 3 for this message.
Command	UCHAR	1	Single ASCII character ‘j’ for Erase Faults acknowledge.

4. Query Messages

4.1 Module Identity Query (D)

Used by the host controller to query the make/model and firmware revision of the unit.

Sent by Host:

Data Element	Base Type	Instances	Description
Length	USHORT	1	Number of bytes to follow including checksum. Always 3 for this message.
Command	UCHAR	1	Single ASCII character ‘D’ for Query Identity.

Sent by RF Module:

Data Element	Base Type	Instances	Description
Length	USHORT	1	Number of bytes to follow including checksum. Always 22 for this message.
Command	UCHAR	1	Single ASCII character ‘d’ for Identity acknowledge.
Serial Number	UCHAR[10]	1	Format is: RMssssssss where RM denotes RF module and ssssssss is the sequence number as labeled on the radio board. Refer to GTT Serial Number Format specification 79-1000-0205-0
Firmware Revision	UCHAR[9]	1	ASCII string representing the revision string. Format is: XX.XX .XXX Leading zeros to be supplied if single digit version number.

4.2 Mode Query (Q)

Used by the host controller to query the current operating mode of the unit.

Sent by Host:

Data Element	Base Type	Instances	Description
Length	USHORT	1	Number of bytes to follow including checksum. Always 3 for this message.
Command	UCHAR	1	Single ASCII character ‘Q’ for query mode.

Sent by RF Module:

Data Element	Base Type	Instances	Description
Length	USHORT	1	Number of bytes to follow including checksum. Always 4 for this message.
Command	UCHAR	1	Single ASCII character ‘q’ for Mode Acknowledge
Current Mode	UCHAR	1	Values are : 0 – Offline Mode 1 – Online Mode 2 – Transmit Test Mode 3 – Programming 4 – Broken Mode

4.3 Framing Configuration Query (C)

Used by the host controller to query the current framing configuration of the unit.

Sent by Host:

Data Element	Base Type	Instances	Description
Length	USHORT	1	Number of bytes to follow including checksum. Always 3for this message.
Command	UCHAR	1	Single ASCII character ‘C’ for Query Framing Configuration.

Sent by RF Module:

Data Element		Base Type	Instances	Description
Length		USHORT	1	Number of bytes to follow including checksum. Value is 4 + (Number of slots * 2).
Command		UCHAR	1	Single ASCII character ‘c’ for Framing Configuration acknowledge.
Number of slots/hop		UCHAR	1	Number of slots to follow. Maximum of 255 slots. Default is 186.
For each slot	Slot Size	USHORT	1	Number of bytes in this slot. Maximum size is dictated by the number of slots. Total number of bytes sent per frame cannot exceed 16,000.

4.4 Hop Table Configuration Query (A)

Used by the host controller to query the Hop Table Configuration of the unit.

Sent by Host:

Data Element	Base Type	Instances	Description
Length	USHORT	1	Number of bytes to follow including checksum. Always 3 for this message.
Command	UCHAR	1	Single ASCII character 'A' for query Hop Table Configuration.

Sent by RF Module:

Data Element		Base Type	Instances	Description
Length		USHORT	1	Number of bytes to follow including checksum. Value is 5 + (number of rows * number of columns)
Command		UCHAR	1	Single ASCII character 'a' for Hop Table Configuration acknowledge.
Number of rows		UCHAR	1	Number of seconds before repeating. Maximum of 25 rows. Default is 25.
Number of columns		UCHAR	1	Number of frequency changes per second. Maximum of 5 columns. Default is 3. Note: rows * columns MUST be less than or equal to 75.
For each row	Channel 1	UCHAR	1	Receive channel for 1st hop in this second.
	Channel 2	UCHAR	1	Receive channel for 2nd hop second.
	Channel 3	UCHAR	1	Receive channel for 3rd hop in this second.
	Channel n	UCHAR	1	Receive channel for nth hop in this second.

4.5 Broken Mode (B)

Used by the Host to query the reasons behind a Broken Mode report.

Sent by Host:

Data Element	Base Type	Instances	Description
Length	USHORT	1	Number of bytes to follow including checksum. Always 3 for this message.
Command	UCHAR	1	Single ASCII character ‘‘B’ for Query Broken Mode Report.

Sent by RF Module:

Data Element	Base Type	Instances	Description
Length	USHORT	1	Number of bytes to follow including checksum. Value is 4 + Number of failures)
Command	UCHAR	1	Single ASCII character ‘b’ for Broken Mode Report.
Number of Failures	UCHAR	1	Count of failure codes to follow.
Failure	UCHAR	Number of failures	Active failure indications. 1 – No 1 PPS detected 2 – VSWR fault

5. Hardware Interface

The following table provides the signal interface to the 20 pin interface connector

Pin Number	Signal Name	Description
1	GND	Signal/Power Ground
2	5V	5VDC Input
3	NC	
4	NC	
5	RXD	UART Receive Data Input
6	TXD	UART Transmit Data Output
7	J4.7	General Purpose Input/Output
8	GPIO2	General Purpose Input/Output 2
9	RESET	Reset Input – Active High
10	STATUS	Status Output
11	BOOT	Boot Mode Select – Active High
12	1PPS	1 Pulse Per Second Input
13	GND	Signal/Power Ground
14	3.3V	3.3VDC Input
15	NC	
16	NC	
17	GPIO4	General Purpose Input/Output 4
18	GPIO2	General Purpose Input/Output 2
19	GPIO3	General Purpose Input/Output 3
20	GPIO1	General Purpose Input/Output 1

6. Agency Statements

FCC Statements

Compliance Statement (Part 15.19)

This device complies with Part 15 of the FCC Rules.

Operation is subject to the following two conditions:

1. This device may not cause harmful interference, and
2. This device must accept any interference received, including interference that may cause undesired operation.

Warning (Part 15.21)

Changes or modifications not expressly approved by the party responsible for compliance could void the user's authority to operate the equipment.

FCC Interference Statement (Part 15.105 (b)

This equipment has been tested and found to comply with the limits for a Class B digital device, pursuant to Part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference in a residential installation. This equipment generates uses and can radiate radio frequency energy and, if not installed and used in accordance with the instructions, may cause harmful interference to radio communications. However, there is no guarantee that interference will not occur in a particular installation. If this equipment does cause harmful interference to radio or television reception, which can be determined by turning the equipment off and on, the user is encouraged to try to correct the interference by one of the following measures:

- Reorient or relocate the receiving antenna.
- Increase the separation between the equipment and receiver.
- Connect the equipment into an outlet on a circuit different from that to which the receiver is connected.
- Consult the dealer or an experienced radio/TV technician for help.

RF Exposure (OET Bulletin 65)

To comply with FCC/IC RF exposure requirements for mobile transmitting devices, this transmitter should only be used or installed at locations where there is at least 20cm separation distance between the antenna and all persons.

To comply with FCC/IC RF exposure limits for general population / uncontrolled exposure, the antenna(s) used for this transmitter must be installed to provide a separation distance of at least 20 cm from all persons and must not be co-located or operating in conjunction with any other antenna or transmitter.

Industry Canada Statements

Section 7.1.2 of RSS-GEN

Under Industry Canada regulations, this radio transmitter may only operate using an antenna of a type and maximum (or lesser) gain approved for the transmitter by Industry Canada. To reduce potential radio interference to other users, the antenna type and its gain should be so chosen that the equivalent isotropically radiated power (e.i.r.p.) is not more than that necessary for successful communication.

User manuals for transmitters equipped with detachable antennas shall also contain the following notice in a conspicuous location:

This radio transmitter IC7275A-OPTICOM2 has been approved by Industry Canada to operate with the antenna types listed

below with the maximum permissible gain and required antenna impedance for each antenna

type indicated. Antenna types not included in this list, having a gain greater than the maximum

gain indicated for that type, are strictly prohibited for use with this device.

This device has been designed to operate with the antenna(s) listed below, and having a maximum gain of 3.5 dB. Antennas not included in this list or having a gain greater than 3.5 dB are strictly prohibited for use with this device. The required antenna impedance is 50 ohms.

List of all Antennas Acceptable for use with the Transmitter

Laird # MAF94192

HOW TSEN # S-001-1

Mobile Mark # DM2-2400/1575

Section 7.1.3 of RSS-GEN

This Device complies with Industry Canada License-exempt RSS standard(s). Operation is subject to the following two conditions: 1) this device may not cause interference, and 2) this device must accept any interference, including interference that may cause undesired operation of the device.

Industrie Canada déclarations

Section 7.1.2 du RSS-GEN

Aux termes des règlements de l'industrie du Canada, cet émetteur radio peut fonctionner uniquement à l'aide d'une antenne d'un type et un maximum (ou moins) de gain approuvé pour l'émetteur par Industrie Canada. Pour réduire le risque d'interférence aux autres utilisateurs, le type d'antenne et son gain doivent être choisis afin que la puissance isotrope rayonnée équivalente (e.i.r.p.) ne dépasse pas ce qui est nécessaire pour une communication réussie.

Les manuels d'utilisation pour des émetteurs équipés des antennes détachables contiendront également la notification suivante dans un endroit remarquable

Cet émetteur radio IC7275A-OPTICOM2 a été approuvé par Industrie Canada pour fonctionner avec les types d'antennes énumérées ci-dessous avec le gain maximal admissible et l'impédance d'antenne requise pour chaque antenne type indiqué. Types d'antenne non inclus dans cette liste, ayant un gain supérieur au maximum gagner indiqué pour ce type, sont strictement interdites pour une utilisation avec cet appareil.

Ce dispositif a été conçu pour fonctionner avec l'antenne (s) ci-dessous, et ayant un gain maximum de 3,5 dB. Antennes pas inclus dans cette liste ou ayant un gain supérieur à 3,5 dB sont strictement interdites pour une utilisation avec cet appareil. L'impédance d'antenne requise est de 50 ohms.

Liste de toutes les antennes acceptables pour une utilisation avec l'émetteur

Laird # MAF94192
HOW TSEN # S-001-1
Mobile Mark # DM2-2400/1575

Section 7.1.3 du RSS-GEN

Cet appareil est conforme avec Industrie Canada norme exempte de licence RSS (s). Son fonctionnement est soumis aux deux conditions suivantes: 1) cette appareil peut ne pas causer l'interférence et 2) cet appareil doit accepter toute interférence, y compris les interférences qui peuvent causer un mauvais fonctionnement de l'appareil.

OEM Responsibilities to comply with FCC and Industry Canada Regulations

The OPTICOMGPS2 Module has been certified for integration into products only by OEM integrators under the following conditions:

1. The antenna(s) must be installed such that a minimum separation distance of 20cm is maintained between the radiator (antenna) and all persons at all times.
2. The transmitter module must not be co-located or operating in conjunction with any other antenna or transmitter.

As long as the two conditions above are met, further transmitter testing will not be required. However, the OEM integrator is still responsible for testing their end-product for any additional compliance requirements required with this module installed (for example, digital device emissions, PC peripheral requirements, etc.).

IMPORTANT NOTE: In the event that these conditions cannot be met (for certain configurations or co-location with another transmitter), then the FCC and Industry Canada authorizations are no longer considered valid and the FCC ID and IC Certification Number cannot be used on the final product. In these circumstances, the OEM integrator will be

responsible for re-evaluating the end product (including the transmitter) and obtaining a separate FCC and Industry Canada authorization.

End Product Labeling

The OPTICOMGPS2 Module is labeled with its own FCC ID and IC Certification Number. If the FCC ID and IC Certification Number are not visible when the module is installed inside another device, then the outside of the device into which the module is installed must also display a label referring to the enclosed module. In that case, the final end product must be labeled in a visible area with the following:

"**Contains Transmitter Module FCC ID: VJB-OPTICOMGPS2"**

"**Contains Transmitter Module IC: 7275A-OPTICOM2"**

or

"**Contains FCC ID: VJB-OPTICOMGPS2"**

"**Contains IC: 7275A-OPTICOM2"**

The OEM of the OPTICOMGPS2 Module must only use the approved antenna(s) listed above, which have been certified with this module.

The OEM integrator has to be aware not to provide information to the end user regarding how to install or remove this RF module or change RF related parameters in the user manual of the end product.

To comply with FCC and Industry Canada RF radiation exposure limits for general population, the antenna(s) used for this transmitter must be installed such that a minimum separation distance of 20cm is maintained between the radiator (antenna) and all persons at all times and must not be co-located or operating in conjunction with any other antenna or transmitter.

7. Revision History

Date	Revision	Status	Description of Changes
March 15, 2012	A	Active	Initial release