

Application Note

The Diagnostics Channel Protocol

Revision: **0.33**



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1 Overview

This application note describes how to use the Diagnostics channel for on-line diagnostics and set up. Related diagnostic function in transparent mode network is also provided in documentation.

2 Diagnostics Protocol and Structure of Diagnostics Commands.

All basic commands that the diagnostic channel protocol supports, have the following structure (Figure 1).

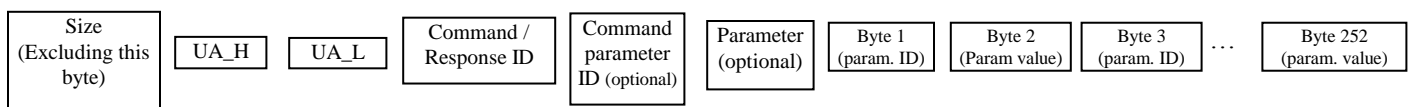


Figure 1. The frame structure for the diagnostic channel communication (direct addressing).

The first byte is always a packet size (this byte is not included in the number of sending or receiving bytes). The next two bytes represent the selected modem's unit address (UA_H, UA_L). The low byte always follows the high byte. Unit address 0 is reserved for the local modem request (the modem's address is unknown), and unit address 255 is reserved for the broadcast request (not implemented yet). Command or response ID determines the type of the data packet. Data bytes are optional and represent parameters' data: two bytes for every parameter (parameter ID and parameter value). All parameters are grouped in 5 Groups (Group 0, Group 1, Group 2, Group 3 and Diagnostic Group). For multi-byte parameters, the high byte is sent first.

The parameters, such as the Serial number, the Encryption key, the Version of firmware, are strings. The following settings for the Diagnostics Channel must be used: baud rate 115.2 Kbps, data format 8N1 with No-Hardware Handshaking. The Diagnostics channel has fixed character time-out 20 ms.

Example of the simplest command (command ID=0) for the modem with UA=5: 3, 0, 5, 0.

3 Using Primary COM port for Diagnostics Purpose (only for Master)

The primary modem's COM0 port could be used for the diagnostics purpose only for modem set up as a Master. To switch to this mode, user needs to enter into AT-command menu by using “+++” escape sequence or setting DTR high. The special command ATM is used to make COM0 port accessible for Diagnostics. Modem returns the response “OK” on this command. This mode is disabled on power up or reset: user can't save this mode by AT&W command. After receiving this response, user should go on-line by executing commands ATA or ATO. The settings for COM0 port are determined by the following S-registers and commands:

- S102 (baud rate)
- S110 (data format)
- S111 (minimum packet size)
- S112 (maximum packet size)
- S116 (character time-out)
- S142 (serial channel mode)
- AT&K (hardware handshaking)

All commands for local and remote Diagnostics described in these Application Notes are supported in this mode using COM0. The “+++” escape sequence to go off-line is supported in this mode as well. The data reception from Slave is blocked in this mode: only diagnostics responses from a Slave are accepted by the Master.

When user doesn't need to use Diagnostics using COM0 and wants to switch to the Data transfer mode, he can use the special Command 48 “Release of COM0 for the data transfer by Diagnostics (only for master)”. After receiving the response 148 on this command, user can start sending and receiving data (**Table 1**).

4 Warnings For Users of Diagnostics Protocol

Using diagnostics channel customer must follow special rules:

- 1) Diagnostics channel has a 20ms character time-out timer. If you have inter-command delay shorter than 20 ms, commands could be overlapped.
- 2) If modem returns a response on user's diagnostics command, user must wait for this response before sending next diagnostics command.
- 3) If response on a diagnostics command is not required, user must give the modem some time to process this command. For example, commands that update modem's parameters save them in the EEPROM and it is a time-consuming operation.
- 4) Multi-byte parameters must be updated at once.
- 5) Parameters with IDs 87 and 88 are not saved in the EEPROM.
- 6) Modem resets itself after updating some fundamental parameter (parameters' IDs are marked by stars in the Table 2).
- 7) The command 255 resets modem (all saving operations should be completed).

5 Diagnostics Protocol for Transparent Mode

The protocol is to provide customer local and remote diagnostic function in a transparent mode network. The same command structure applies as above. There is neither master nor slave in a transparent mode network, so any unit can initiate a request of diagnostics locally or remotely.

Diagnostic commands and parameters for transparent mode are listed respectively as Table 3 in Appendix C and Table 4 in Appendix D.

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Appendix A

Commands and Responses Set

Table 1

Group	Subgroup	Command ID	Function	Response ID	Response
Request	Group parameters	0	Request of modem's group parameters (Group 0) <u>Command format:</u> Size, UA_H, UA_L, Command ID. <u>Example for modem UA=5:</u> 3, 0, 5, 0	100	Modem's parameters (Group 0) <u>Command format:</u> Size, UA_H, UA_L, Command ID, (ParamID, ParamData)n. <u>Example for all parameters of Group 0 that are set to 0:</u> 43, 0, 5, 100, 1,0, 2,0, 3,0, 4,0, 5,0, 6,0, 7,0, 8,0, 9,0, 10,0, 11,0, 12,0, 13,0, 14,0, 15,0, 16,0, 17,0, 18,0, 19,0, 20,0
		1	Request of modem's diagnostic group parameters (Diagnostic Group) <u>Command format:</u> Size, UA_H, UA_L, Command ID. <u>Example for modem UA=5:</u> 3, 0, 5, 1	100	Modem's parameters (Diagnostic Group) <u>Command format:</u> Size, UA_H, UA_L, Command ID, (ParamID, ParamData)n. <u>Example for all parameters of Diagnostic Group that are set to 0:</u> 27, 0, 5, 100, 100,0, 103,0, 104,0, 105,0, 106,0, 107,0, 108,0, 109,0, 110,0, 111,0, 112, 0, 113,0
		2	Request of modem's group parameters (Group 1) <u>Command format:</u> Size, UA_H, UA_L, Command ID. <u>Example for modem UA=5:</u> 3, 0, 5, 2	100	Modem's parameters (Group 1) <u>Command format:</u> Size, UA_H, UA_L, Command ID, (ParamID, ParamData)n. <u>Example for all parameters of Group 1, that are set to 0 :</u> 35, 0, 5, 100, 21,0, 22,0, 23,0, 24,0, 25,0, 26,0, 27,0, 28,0, 29,0, 30, 0, 31, 0, 32, 0, 33, 0, 34, 0, 35, 0, 36, 0
		3	Request of modem's group parameters(Group 2) <u>Command format:</u> Size, UA_H, UA_L, Command ID. <u>Example:</u> 3, 0, 5, 3	100	Modem's parameters (Group 2) <u>Command format:</u> Size, UA_H, UA_L, Command ID, (ParamID, ParamData)n. <u>Example for all parameters of Group 2, that are set to 0 :</u> 35, 0, 5, 100, 50,0, 51,0, 52,0, 53,0, 54,0, 55,0, 56,0, 57,0, 58,0, 59, 0, 60, 0, 61, 0, 62, 0, 63, 0, 64, 0, 65, 0
		4	Request of modem's group parameters (Group 3) <u>Command format:</u>	100	Modem's parameters (Group 3) <u>Command format:</u>

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Group	Subgroup	Command ID	Function	Response ID	Response
			Size, UA_H, UA_L, Command ID. <u>Example:</u> 3, 0, 5, 4		Size, UA_H, UA_L, Command ID, (ParamID, ParamData)n. <u>Example for all parameters of Group 3 that are set to 0:</u> 35, 0, 5, 100, 66,0, 67,0, 68,0, 69,0, 70,0, 71,0, 72,0, 73,0, 74,0, 75, 0, 76, 0, 77, 0, 78, 0, 79, 0, 80, 0, 81, 0
		5	Request of modem's group parameters (Group 4) <u>Command format:</u> Size, UA_H, UA_L, Command ID. <u>Example:</u> 3, 0, 5, 5	100	Modem's parameters (Group 4) <u>Command format:</u> Size, UA_H, UA_L, Command ID, (ParamID, ParamData)n. <u>Example for all parameters of Group 4 that are set to 0:</u> 37, 0, 5, 100, 82,0, 83,0, 84,0, 85,0, 86,0, 87,0, 88,0, 89,0, 90,0, 91, 0, 92, 0, 93, 0, 94, 0, 95, 0, 96, 0, 97, 0, 98,0
		6	Request of modem's group parameters (Group 5) <u>Command format:</u> Size, UA_H, UA_L, Command ID. <u>Example:</u> 3, 0, 5, 6	100	Modem's parameters (Group 5) <u>Command format:</u> Size, UA_H, UA_L, Command ID, (ParamID, ParamData)n. <u>Example for all parameters of Group 5 that are set to 0:</u> 15, 0, 5, 100, 27,0, 38,0, 39,0, 40,0, 41,0, 42,0
		7	Request of modem's group parameters (Statistics 1) <u>Command format:</u> Size, UA_H, UA_L, Command ID. <u>Example:</u> 3, 0, 5, 7	100	Modem's parameters (Statistics 1) <u>Command format:</u> Size, UA_H, UA_L, Command ID, (ParamID, ParamData)n. <u>Example for all parameters of Group Statistics 1:</u> 7, 0, 5, 100, 65,0, 70,0
		8	Request of modem's group parameters (Group Adhoc) <u>Command format:</u> Size, UA_H, UA_L, Command ID. <u>Example:</u> 3, 0, 5, 8	100	Modem's parameters (Group Adhoc) <u>Command format:</u> Size, UA_H, UA_L, Command ID, (ParamID, ParamData)n. <u>Example for all parameters of Group Adhoc:</u> 23, 0, 5, 100, 148, 0, 149, 1, 150, 1, 151, 1, 152, 00, 153, 10, 154, 0, 155, 20, 156, 0, 157, 10

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Group	Subgroup	Command ID	Function	Response ID	Response
		9	Request of modem's group parameters (Group 6) <u>Command format:</u> Size, UA_H, UA_L, Command ID. <u>Example:</u> 3, 0, 5, 9	100	Modem's parameters (Group 6) <u>Command format:</u> Size, UA_H, UA_L, Command ID, (ParamID, ParamData)n. <u>Example for all parameters of Group Adhoc:</u> 7, 0, 5, 100, 158, 0, 159, 0
	Selected parameters	20/21	Request of selected parameters <u>Command format:</u> Size, UA_H, UA_L, Command ID, (ParamID)n. <u>Example for Power, Hop time, Protocol:</u> 6, 0, 5, 20, 3, 4, 11	100/121	Modem's selected parameters <u>Command format:</u> Size, UA_H, UA_L, Command ID, (ParamID, ParamData)n. <u>Example for Power=0, Hop time=2, Protocol=1:</u> 9, 0, 5, 100, 3, 0, 4, 2, 11, 1
		39	TDMA table single entry. The table of registered slaves is used for TDMA mode. It contains Unit Addresses of registered for TDMA mode slaves: high and low bytes (TDMA_UAH, TDMA_UAL). Zero Unit Address is used as a terminator. <u>Command format:</u> Size, MUA_H, MUA_L, COM_ID, ACTION, ENTRY, TDMA_UAH, TDMA_UAL, where ACTION - 0 (single read), 1 (single write). ENTRY – selected entry: 0...2047. TDMA_UAH, TDMA_UAL – Unit address, not present in "Read" command. <u>Example for the Unit Address 01,</u> Action Single Read Entry 2 06 00 01 39 00 00 02 Entry 65535 06 00 01 39 00 255 255	139	TDMA table single entry acknowledgement. Modem responds by an acknowledgement command: positive or negative (with error code). <u>Command format:</u> Size, MUA_H, MUA_L, COM_ID, ACTION, ENTRY, TDMA_UAH, TDMA_UAL, RETURN_CODE where RETURN_CODE - 0 – Success 1 – wrong size 2 – wrong ACTION 3 – wrong ENTRY 4 – wrong UA 5 – wrong TDMA table. <u>Example for the Unit Address 01,</u> Action Single Read Entry 2 06 00 01 39 00 00 02 00 Entry 65535 06 00 01 39 00 00 00 03 (error)

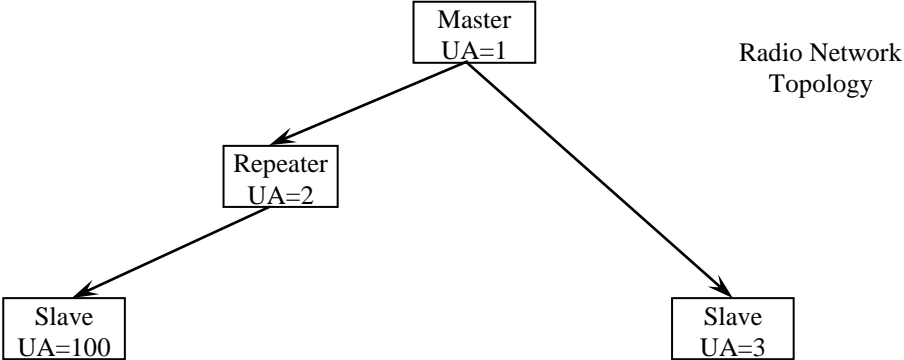
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Group	Subgroup	Command ID	Function	Response ID	Response
	String parameters		Action Single Write <i>Entry 2, UA 125</i> 08 00 01 39 00 00 02 00 125 <i>Entry 2, UA 65535</i> 08 00 01 39 00 00 02 255 255 Note: 1) Entries 0-127 are saved in non-volatile memory, entries 128-2047 must be entered every time on start-up.		<i>Entry 2</i> 09 00 01 39 00 00 02 00 125 00 <i>Entry 65535</i> 06 00 01 39 00 00 00 00 04 (error)
		40	Request of Firmware version <u>Command format:</u> Size, UA_H, UA_L, Command ID. <u>Example:</u> 3, 0, 5, 40	140	Version of firmware <u>Command format:</u> Size, UA_H, UA_L, Command ID, String <u>Example for the version of firmware Ver.1.01-15:</u> 14, 0, 5, 140, 'V', 'e', 'r', '.', '1', '.', '0', '1', '-', '1', '5'
		41	Request of Serial number <u>Command format:</u> Size, UA_H, UA_L, Command ID. <u>Example:</u> 3, 0, 5, 41	141	Serial number (maximum 11 characters) <u>Command format:</u> Size, UA_H, UA_L, Command ID, String <u>Example of response from the modem with UA=5 and Serial number : 12345-ABC</u> 12, 0, 5, 141, '1', '2', '3', '4', '5', '-', 'A', 'B', 'C'
		42	Request of Encryption key <u>Command format:</u> Size, UA_H, UA_L, Command ID. <u>Example:</u> 3, 0, 5, 42	142	Encryption key (32 characters) <u>Command format:</u> Size, UA_H, UA_L, Command ID, String <u>Example of response from modem with UA=5 for the key: Calgary</u> 10, 0, 5, 142, 'C', 'a', 'l', 'g', 'a', 'r', 'y'
		43	Reserved	143	Reserved
		44	Request of selected table of restricted frequencies <u>Command format:</u> Size, MUA_H, MUA_L, COM_ID, TABLE_INDEX,	144	Table of restricted frequencies <u>Command format:</u> Size, MUA_H, MUA_L, COM_ID,

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Group	Subgroup	Command ID	Function	Response ID	Response
			<p><i>Example:</i> 4 1 1 44 7</p>		<p>TABLE_INDEX, TABLE_UA, START_F0, STOP_F0, START_F7(H and L bytes), STOP_F7(H and L bytes)</p> <p><u>Example of response from modem with UA=257 and restricted table with the Index=7</u> 36 1 1 144 7 0 0 1 144 7 208 9 96 15 160 17 48 23 112 25 00 31 64 32 208 39 16 40 160 46 224 48 112 255 255 255 255</p>
		45	<p>Request of Network configuration</p> <p><u>Command format:</u> Size, MUA_H, MUA_L, Command ID.</p> <p><u>Example:</u> 3, 0, 5, 45</p>	145	<p>Network configuration (up to 32 unit addresses belong to the detected slaves). See the picture.</p> <p><u>Command format:</u> Size, MUA_H, MUA_L, Response ID, UA1_H,UA1_L,viaUA1_H, viaUA1_L....</p> <p><u>Example of response from modem with UA=3</u> 11, 0, 3, 145, 0, 1, 0, 1, 0, 3, 0, 3</p> <p><u>UA=2</u> 15, 0, 2, 145, 0, 1, 0, 1, 0, 2, 0, 2, 0, 100, 0, 100</p> <p><u>UA=100</u> 15, 0, 100, 145, 0, 1, 0, 2, 0, 2, 0, 2, 0, 100, 0, 100</p>
		 <pre> graph TD Master["Master UA=1"] --> Repeater["Repeater UA=2"] Master --> Slave3["Slave UA=3"] Repeater --> Slave100["Slave UA=100"] </pre> <p>Radio Network Topology</p>			

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Group	Subgroup	Command ID	Function	Response ID	Response
		46	Request of Network discovery, it is used in Search mode when slave is searching for the strongest master in from the group of masters that work in different zones. The empty hop interval is used for searching purpose. <u>Command format:</u> Size, MUA_H, MUA_L, Command ID. <u>Example:</u> 3, 0, 5, 46	146	Network discovery: information about masters, zones and their RSSI (up to 8 masters) <u>Command format:</u> Size, MUA_H, MUA_L, Response ID, DISCOVERY_SIZE, DISCOVERY STRUCTURE for up to 8 masters: - network ID (2 bytes); - Unit address (2 bytes); - RSSI (1 byte); - pattern size (1 byte); - restricted zone (1 byte); - control byte (1 byte, master's marker) <u>Example of response from modem with UA=5</u> 11, 0, 5, 146, 1, 0, 45, 0, 2, 75, 50, 1, 1
		47	User default settings AT&Fx (this command saves user parameters in EEPROM and resets modem) <u>Command format:</u> Size, MUA_H, MUA_L, Command ID, PARAM. <u>Example:</u> 4, 0, 5, 47, 1		No response, modem is reset
		48	Release of COM0 for the data transfer by Diagnostics (only for master) <u>Command format:</u> Size, MUA_H, MUA_L, Command ID <u>Example:</u> 3, 0, 1, 48	148	Release of COM0 for the data transfer by Diagnostics (only for master) <u>Command format:</u> Size, MUA_H, MUA_L, Response ID <u>Example of response from modem with UA=1</u> 3, 0, 1, 148
		49	Clear statistics (whole group Statistics 1 - Code 6). <u>Command format:</u> Size, MUA_H, MUA_L, Command ID <u>Example:</u> 3, 0, 1, 49	149	Acknowledgement on clear statistics (whole group Statistics 1 - Code 6). <u>Command format:</u> Size, MUA_H, MUA_L, Response ID <u>Example of response from modem with UA=1</u> 3, 0, 1, 149
		50	Load Frequency Table (whole 50-channel table #0 or #1). Updated table is taken in affect after modem's reset. <u>Command format:</u>	150	Acknowledgement on frequency table load. <u>Command format:</u>

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Group	Subgroup	Command ID	Function	Response ID	Response
			<p>Size, MUA_H, MUA_L, Command ID, Table #, F1, F2, F3, ..F50 (four bytes for every frequency Fi, the highest byte - first)</p> <p><u>Example:</u> 204, 0, 1, 50, 0, 90240000, 902800000, ... 927600000</p> <p>Read Frequency Table (whole 50-channel table #0 or #1).</p> <p><u>Command format:</u> Size, MUA_H, MUA_L, Command ID, Table #</p> <p><u>Example:</u> 4, 0, 1, 50, 00</p>		<p>Size, MUA_H, MUA_L, Response ID, Table #</p> <p><u>Example of response from modem with UA=1</u> 4, 0, 1, 150, 0</p> <p>Frequency table display.</p> <p><u>Command format:</u> Size, MUA_H, MUA_L, Response ID, Table #, F1, F2, F3, ..F50 (four bytes for every frequency Fi, the highest byte - first)</p> <p><u>Example of response from modem with UA=1</u> 204, 0, 1, 50, 0, 90240000, 902800000, ... 927600000</p>
		51	<p>Set up encryption mode (modem must support AES) If parameter is in the range and allowed, it will be saved and modem will be reset. If no parameter, S-register 159's current value will be returned.</p> <p><u>Command format:</u> Size, MUA_H, MUA_L, Command ID, ParamID. where ParamID (0 - disabled, 1 - AES-128, 2 - AES-192, 3 - AES-256)</p> <p><u>Example:</u> 4, 0, 5, 50, 1</p>	151	<p>Set up encryption (response)</p> <p><u>Command format:</u> Size, MUA_H, MUA_L, Response ID, ParamID, were ParamID (0, 1, 2, 3 – value is accepted; 255 - error)</p> <p><u>Example of response from modem with UA=5</u> 4, 0, 5, 151, 255</p>
		52	<p>Load the TDMA table of registered slaves. The table of registered slaves is used for TDMA mode. It contains Unit Addresses of registered for TDMA mode slaves: high and low bytes (TDMA_UAH, TDMA_UAL). Zero Unit</p>	152	<p>Acknowledgement of the downloaded TDMA table of registered slaves.</p>

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Group	Subgroup	Command ID	Function	Response ID	Response
			<p>Address is used as a terminator.</p> <p><u>Command format:</u> Size, MUA_H, MUA_L, COM_ID, TDMA_UAH, TDMA_UAL,...,0,0</p> <p><u>Example for the Unit Address 01 (download TDMA table):</u> 16 00 01 52 00 11 00 12 00 13 00 14 00 15 00 00</p> <p>Read the TDMA table of registered slaves. If command doesn't have parameters (TDMA_UAs), the existing TDMA table will be returned for verification purposes.</p> <p><u>Command format:</u> Size, MUA_H, MUA_L, COM_ID</p> <p><u>Example for the Unit Address 01 (reading TDMA table):</u> 03 00 01 52</p> <p>Note: 1) This command supports only 125 slaves. 2) The maximum number of slaves in the upgrading via Diagnostics TDMA table is 126 (Zero terminator is included)</p>		<p><u>Command format:</u> Size, RESP_ID, MUA_H, MUA_L, Response ID</p> <p><u>Example for the Unit Address 01 (download TDMA table):</u> 03 00 01 152</p> <p>Return the TDMA table of registered slaves.</p> <p><u>Command format:</u> Size, MUA_H, MUA_L, COM_ID, TDMA_UAH, TDMA_UAL,...,0,0</p> <p><u>Example for the Unit Address 01 (reading empty TDMA table):</u> 05 00 01 52 00 00</p> <p><u>Example for the Unit Address 01 (reading TDMA table):</u> 16 00 01 52 00 11 00 12 00 13 00 14 00 15 00 00</p>
		53	<p>Reset minimum and maximum RSSI to default settings.</p> <p><u>Command format:</u> Size, MUA_H, MUA_L, COM_ID</p> <p><u>Example for the Unit Address 01</u> 03 00 01 53</p>	153	<p>Reset minimum and maximum RSSI to default settings.</p> <p><u>Command format:</u> Size, MUA_H, MUA_L, COM_ID</p> <p><u>Example for the Unit Address 01</u> 03 00 01 153</p>
		54	<p>Put modem off-line into the AT-command mode.</p> <p><u>Command format:</u></p>	154	<p>Response on putting modem off-line (AT-command mode).</p> <p><u>Command format:</u></p>

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Group	Subgroup	Command ID	Function	Response ID	Response
			Size, MUA_H, MUA_L, COM_ID <u>Example for the Unit Address 01</u> 03 00 01 54		Size, MUA_H, MUA_L, COM_ID <u>Example for the Unit Address 01</u> 03 00 01 154
		55	Request of Manufacture Number <u>Command format:</u> Size, UA_H, UA_L, Command ID. <u>Example:</u> 3, 0, 5, 55	155	Manufacture number (maximum 12 characters) <u>Command format:</u> Size, UA_H, UA_L, Command ID, String <u>Example of response from the modem with UA=5 and Manufacture number :</u> <u>12345-ABCDE</u> 12, 0, 5, 155, '1', '2', '3', '4', '5', '-', 'A', 'B', 'C', 'D', 'E'
		56	Request of buffers allocation <u>Command format:</u> Size, UA_H, UA_L, Command ID. <u>Example:</u> 3, 0, 5, 56	156	Buffers allocation <u>Command format:</u> Size, UA_H, UA_L, Command ID, QueueSize1, QueueSize2, .. QueueSize10 <u>Example of response from the modem with UA=5</u> 13, 0, 5, 156, 200, 26, 35, 4, 5, 12, 10, 0, 0, 0
		57	Request of Product name <u>Command format:</u> Size, UA_H, UA_L, Command ID. <u>Example:</u> 3, 0, 5, 57	157	Product name <u>Command format:</u> Size, UA_H, UA_L, Command ID, String <u>Example for the product name:</u> 10, 0, 5, 157, 'M', 'H', 'X', '2', '4', '2', '0'
		58	Start/Stop sending supporting information <u>Command format:</u> Size, UA_H, UA_L, Command ID, Command. Where Command =1 (Start) or Command =0 (Stop) <u>Example:</u>	158	Acknowledgement of Start/Stop sending supporting information <u>Command format:</u> Size, UA_H, UA_L, Command ID, Command. <u>Example:</u>

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Group	Subgroup	Command ID	Function	Response ID	Response
				159	<p>Report supporting information</p> <p>Modem reports information about slaves' data packets by using the following command: <Size>, <UA_H , UA_L>, 159 , < SYNC_MARKER_H , SYNC_MARKER_L>, <Pkt_ID>, <SlaveUA_H , SlaveUA_L>, <DirectUA_H , DirectUA_L>, <Seq.Number>, <RSSI>, <Pkt_size_H, Pkt_size_L>.</p> <p><u>Example for Slave's packet ID=1, UA=2, Packet Sequence Number =79, RSSI=-95, Packet Size=256:</u> 14, 00, 00, 159, 0xFF, 0xFF, 01, 00, 02, 00, 02, 79, 95, 01, 00.</p> <p>Example: Master receives from the direct repeater (UA=3): 0E 00 01 9F FF FF 01 00 03 00 03 14 60 00 01 0E 00 01 9F FF FF 01 00 03 00 03 15 61 00 01 0E 00 01 9F FF FF 01 00 03 00 03 16 61 00 01</p> <p>Master receives from the slave (UA=2) that works via repeater (UA=3): 0E 00 01 9F FF FF 01 00 02 00 03 17 63 00 01</p> <p>Master receives from the direct slave (UA=5): 0E 00 01 9F FF FF 01 00 05 00 05 01 63 00 01</p>
		60	<p>Block write into the EEPROM</p> <p><u>Command format:</u> Size, MUA_H, MUA_L, Command ID, Block#, data bytes</p> <p><u>Example:</u> 36, 0, 5, 60, 125, 32 data bytes</p>		

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Group	Subgroup	Command ID	Function	Response ID	Response
		62	<p>Request of routing tables.</p> <p><u>Command format(single request Type=0):</u> <Size>, <MUA_H><MUA_L>, <Command ID>, <Type>, <UA_H><UA_L>;</p> <p><u>Command format(segment request Type=1):</u> <Size>, <MUA_H><MUA_L>, <Command ID>, <Type=1>, <Segment>;</p> <p><u>Command format Request of Maximum number of slaves (Type=2):</u> <Size>, <MUA_H><MUA_L>, <Command ID>, <Type=2>;</p>	162	<p>Routing table information</p> <p><u>Command format(single request):</u> <Size>, <MUA_H><MUA_L>, <Response ID>, <Type>, <UA_H><UA_L>, <ImmediateM_UA_H><ImmediateM_UA_L>, <via_UA_H><via_UA_L>, <Age_H><Age_L>, <Status>; Where Status has format: BIT0...BIT2 Direction (0- up, 1- down, 2- both, 3-unknown) BIT3...BIT5 Mode (0-master, 1- repeater, 2-slave, 3-slave_master);</p> <p><u>Command format(segment request, Successful)</u> <Size>, <MUA_H><MUA_L>, <Response ID>, <Type>, <Segment>, <ACK> <UA0_H><UA0_L>, <via_UA0_H><via_UA0_L>, <Age0_H><Age0_L>, <Status0>, <UA1_H><UA1_L>, <via_UA1_H><via_UA1_L>, <Age1_H><Age1_L>, <Status1>, <UA31_H><UA31_L>, <via_UA31_H><via_UA31_L>, <Age31_H><Age31_L>, <Status31>;</p> <p><u>Command format(segment request, Unsuccessful)</u> <Size>, <MUA_H><MUA_L>, <Command ID>, <Type>, <Segment>, <NAK></p> <p>Notes: a) ACK=0, NAK=1 (Unit address is invalid) b) if some modem has Age=0, it is not included in the 32-entry segment response.</p> <p><u>Command forma. Maximum number of slaves</u> <Size>, <MUA_H><MUA_L>, <Response ID>, <Type=2><MAX_N_SLAVES_H><MAX_N_SLAVES_H></p>

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Group	Subgroup	Command ID	Function	Response ID	Response
		63	<p>Noise RSSI request <Size>, <UA_H>, <UA_L>, <Command ID>, <SubCom></p> <p>where SubCom=0 – single last measured noise Rssi for down-stream link.</p> <p>SubCom=1 – single last measured noise Rssi for up-stream link.</p> <p>SubCom=2 – start and stop frequencies for scanning.</p> <p>SubCom=3 – table of down- stream noise Rssi (16 entries).</p>	163	<p>Response noise Rssi. <Size>, <UA_H>, <UA_L>, <Response ID>, <SubCom> SubCom = 255 if sub-command is out of range</p> <p><Size>, <UA_H>, <UA_L>, <<Response ID>, <SubCom>, <RSSI>, <Freq_H>, <Freq_M2>, <Freq_M1>, <Freq_L>, <SysTimeStamp_H>, <SysTimeStamp_M2>, <SysTimeStamp_M1>, <SysTimeStamp_L></p> <p>Freq is given in kHz SysTimeStamp is given in 10ms</p> <p><Size>, <UA_H>, <UA_L>, <<Response ID>, <SubCom>, <RSSI>, <Freq_H>, <Freq_M2>, <Freq_M1>, <Freq_L>, <SysTimeStamp_H>, <SysTimeStamp_M2>, <SysTimeStamp_M1>, <SysTimeStamp_L></p> <p><Size>, <UA_H>, <UA_L>, <<Response ID>, <SubCom>, <StartF_H>, <StartF_M2>, <StartF_M1>, <StartF_L>, <StopF_H>, <StopF_M2>, <StopF_M1>, <StopF_L>,</p> <p><Size>, <UA_H>, <UA_L>, <<Response ID>, <SubCom>, <RSSI>, <Freq_H>, <Freq_M2>, <Freq_M1>, <Freq_L>, <SysTimeStamp_H>, <SysTimeStamp_M2>, <SysTimeStamp_M1>, <SysTimeStamp_L>,</p>

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Group	Subgroup	Command ID	Function	Response ID	Response
			<p>SubCom=4 – table of up-stream noise Rssi (16 entries).</p> <p><i>Example:</i> 4 1 1 63 0</p>		<p><Size>, <UA_H>, <UA_L>, <<Response ID>, <SubCom>, <RSSI>, <Freq_H>, <Freq_M2>, <Freq_M1>, <Freq_L>, <SysTimeStamp_H>, <SysTimeStamp_M2>, <SysTimeStamp_M1>, <SysTimeStamp_L>,</p>
		65	<p>Flash memory upgrade commands</p> <p>Clear the RAM (Parameter ID=0)</p> <p><i>Command format:</i> Size, MUA_H, MUA_L, COM_ID, PARAM,</p> <p><i>Example:</i> 4 1 1 65 0</p> <p>Download of the firmware image into the RAM (Parameter ID=1)</p> <p><i>Command format:</i> Size, MUA_H, MUA_L, COM_ID, PARAM, SEG_SEQ_N_H, SEG_SEQ_N_L, DATA0,...DATA127</p> <p><i>Example:</i> 134 1 1 65 1 0 0 0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 ...127</p> <p>Arm the firmware upgrade procedure, start 10s time-out (PARAMETR ID=2)</p> <p><i>Command format:</i> Size, MUA_H, MUA_L, COM_ID, PARAM, MARKER1(23), MARKER2(113)</p> <p><i>Example:</i> 6 1 1 65 2 23 113</p>	165	<p>Acknowledgement for Clear the RAM (Parameter ID=0)</p> <p><i>Command format:</i> Size, MUA_H, MUA_L, RESP_ID, PARAM,</p> <p><i>Example:</i> 4 1 1 165 0</p> <p>Acknowledgement for the download of the firmware image into the RAM (Parameter ID=1)</p> <p><i>Command format:</i> Size, MUA_H, MUA_L, RESP_ID, PARAM, SEG_SEQ_N_H, SEG_SEQ_N_L</p> <p><i>Example:</i> 6 1 1 165 1 0 0</p> <p>Acknowledgement for the arm the firmware upgrade procedure (PARAMETR ID=2)</p> <p><i>Command format:</i> Size, MUA_H, MUA_L, RESP_ID, PARAM, MARKER1(23), MARKER2(113)</p> <p><i>Example:</i> 6 1 1 165 2 23 113</p>

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Group	Subgroup	Command ID	Function	Response ID	Response
			Download the firmware image into the FLASH memory (Parameter ID=3) <u>Command format:</u> Size, MUA_H, MUA_L, COM_ID, PARAM, <u>Example:</u> 4 1 1 65 3 Calculation of the firmware image's CRC-16 (Parameter ID=4) <u>Command format:</u> Size, MUA_H, MUA_L, COM_ID, PARAM, <u>Example:</u> 4 1 1 65 4		Acknowledgement for expiring 10s time-out. (Parameter ID=3) <u>Command format:</u> Size, MUA_H, MUA_L, RESP_ID, PARAM, <u>Example:</u> 4 1 1 65 3 Response – calculated the firmware image's CRC-16 (Parameter ID=4) <u>Command format:</u> Size, MUA_H, MUA_L, RESP_ID, PARAM, CRC_H, CRC_L <u>Example:</u> 6 1 1 165 4 47 89
Settings	Selected parameters	70	Sending modem's selected settings. <u>Command format:</u> Size, UA_H, UA_L, Command ID, (ParamIDs, ParamData)n. <u>Example for Retransmission=5, Unit address=149:</u> 9, 0, 5, 70, 9, 5, 26, 0, 27, 149		No response, Modem resets itself after updating some parameters.
		74	Lock awake mode <u>Command format:</u> Size, MUA_H, MUA_L, Command ID <u>Example for Unit address=5:</u> 3, 0, 5, 74	174	Acknowledgement for the lock awake mode <u>Command format:</u> Size, MUA_H, MUA_L, Command ID <u>Example for Unit address=5:</u> 3, 0, 5, 174
		75	Saving all user's parameters in the EEPROM. <u>Command format:</u> Size, MUA_H, MUA_L, Command ID <u>Example for Unit address=5:</u> 3, 0, 5, 75		
	String parameters	81	Sending Encryption key (maximum 32 character string) <u>Command format:</u>		

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Group	Subgroup	Command ID	Function	Response ID	Response
			Size, UA_H, UA_L, Command ID, String. <u>Example for the key: "Calgary Flames":</u> 17, 0, 5, 81, 'C', 'a', 'l', 'g', 'a', 'r', 'y', ' ', 'F', 'l', 'a', 'm', 'e', 's'		
		82	Set up the selected table of restricted frequencies <u>Command format:</u> Size, MUA_H, MUA_L, COM_ID, TABLE_INDEX, UA_H, UA_L, START0_H, START0_L, STOP0_H, STOP0_L, START7_H, START7_L, STOP7_H, STOP7_L, <u>Example for the Unit Address 257:</u> 36 1 1 82 0 0 0 1 144 7 208 9 96 15 160 17 48 23 112 25 00 31 64 32 208 39 16 40 160 46 224 48 112 255 255 255 255	182	Acknowledgement of the table of restricted frequencies set up <u>Command format:</u> Size, MUA_H, MUA_L, RESP_ID <u>Example for the Unit Address 257</u> 3 182 0 5
		83	Save all tables of restricted frequencies <u>Command format:</u> Size, MUA_H, MUA_L, COM_ID, <u>Example for the Unit Address 257:</u> 3 1 1 83	183	Acknowledgement of the table of restricted frequencies saving <u>Command format:</u> Size, MUA_H, MUA_L, RESP_ID <u>Example for the Unit Address 257:</u> 3 1 1 183
		84	Set up the Table of registered repeaters. If table is not present, modem returns existing table. Table is erased before execution of this command with valid number of repeaters. <u>Command format:</u> Size, MUA_H, MUA_L, COM_ID, REP0_H, REP0_L, REP1_H, REP1_L, REP15_H, REP15_L <u>Example for the Unit Address 257:</u> 36 1 1 84 00 02 00 03 00 04 00 05 00 06 00 07 00 08 00 09 00 0A 00 0B 00 0C 00 0D 00 0E 00 0F 00 10 00 11	184	Acknowledgement of setting the table of registered repeaters <u>Command format:</u> Size, RESP_ID, MUA_H, MUA_L, <u>Example for the Unit Address 257</u> 3 1 1 184

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Group	Subgroup	Command ID	Function	Response ID	Response
			03 1 1 84		36 1 1 184 00 02 00 03 00 04 00 05 00 06 00 07 00 08 00 09 00 0A 00 0B 00 0C 00 0D 00 0E 00 0F 00 10 00 11
		85	<p>Set up the call list of repeaters. Table is erased before execution of this command with valid number of repeaters. If table is not present, modem returns existing call list.</p> <p><u>Command format:</u> Size, MUA_H, MUA_L, COM_ID, REP0_H, REP0_L, REP1_H, REP1_L, ... REP31_H, REP31_L</p> <p><u>Example for the Unit Address 257:</u> 36 1 1 85 00 02 00 03 00 04 00 05 00 06 00 07 00 08 00 09 00 0A 00 0B 00 0C 00 0D 00 0E 00 0F 00 10 00 11</p> <p>03 1 1 85</p>	185	<p>Acknowledgement of setting the call list</p> <p><u>Command format:</u> Size, RESP_ID, MUA_H, MUA_L,</p> <p><u>Example for the Unit Address 257</u> 3 1 1 185</p> <p>36 1 1 185 00 02 00 03 00 04 00 05 00 06 00 07 00 08 00 09 00 0A 00 0B 00 0C 00 0D 00 0E 00 0F 00 10 00 11</p>
Data transfer	Formatted data/text message	90, 91	<p>Sending formatted data/text messages (up to 250 characters) to modem</p> <p><u>Command format:</u> Size, UA_H, UA_L, Command ID, String.</p> <p><u>Example for the message: "Hello world":</u> 14, 0, 5, 90, 'H', 'e', 'l', 'l', 'o', ' ', 'w', 'o', 'r', 'l', 'd'</p>		
				90, 91	<p>Received formatted data/text message (up to 250 characters) is sent back to user</p> <p><u>Command format:</u> Size, UA_H, UA_L, Command ID, String</p> <p><u>Example for the message: "Hello world":</u> 14, 0, 5, 90, 'H', 'e', 'l', 'l', 'o', ' ', 'w', 'o', 'r', 'l', 'd'</p>
Modem control		255	Sending RESET command		



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Group	Subgroup	Command ID	Function	Response ID	Response
instructions			<u>Command format:</u> Size, UA_H, UA_L, Command ID. <u>Example:</u> 3, 0, 5, 255		

Appendix B

Parameters IDs and Groups		Table 2	
Parameter ID	Parameter	Parameters Group	S-Register
Group 0 (Code 0)			
1	Serial channel mode	Group 0	S142
2*	Baud rate	Group 0	S102
3*	Power (saved in EEPROM)	Group 0	S108
4*	Hop time	Group 0	S109
5	Packet size minimum (H)	Group 0	S111
6	Packet size minimum (L)		
7	Packet size maximum (H)		
8	Packet size maximum (L)		
9	Retransmission	Group 0	S113
10*	Repeaters in system	Group 0	S141
11*	Protocol type	Group 0	S217
12	Handshake	Group 0	&K
13*	Operating mode	Group 0	S101
14*	Wireless link rate	Group 0	S103
15	Esc. Character	Group 0	S2
16*	Destination Address (H)	Group 0	S140
17*	Destination Address (L)		
18	Power up mode	Group 0	S0
19	Data format	Group 0	S110
20	Quick enter to command	Group 0	S119
Group 1 (Code 2)			
21	Bandwidth, %	Group 1	S250
22*	Network ID (H)	Group 1	S104
23*	Network ID (M2)		
24*	Network ID (M1)		
25*	Network ID (L)		
26*	Unit address (H)	Group 1	S105
27*	Unit address (L)		
28	Repeat interval	Group 1	S115
29	Character time-out	Group 1	S116
30*	Roaming (H)	Group 1	S118
31*	Roaming (L)		
32*	Sleep mode	Group 1	S143
33	Sleep time (H)	Group 1	S144
34	Sleep time (L)		
35	Wake time (H)	Group 1	S145
36	Wake time (L)		
Group 5 (Code 7)			
37	BadQOS(H)	Group 5	
38	BadQOS(L)		
39	GoodQOS(H)	Group 5	
40	GoodQOS(L)		

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Parameter ID	Parameter	Parameters Group	S-Register
41	IpSleep	Group 5	
42	Pin12enable	Group 5	
43	OnFlyPower (not saved in EEPROM)	Group 5	
44*	Channel Access Mode	Group 5	S244
45*	Multimaster Mode	Group 5	S154
46*	Secondary Network Key (H)	Group 5	S241
47*	Secondary Network Key (M2)		
48*	Secondary Network Key (M1)		
49*	Secondary Network Key (L)		
Group 2 (Code 3)			
50	Slave's tuning time	Group 2	S230
51	Slave ACK overhead	Group 2	S231
52	Max buffers IN storage (H)	Group 2	S232
53	Max buffers IN storage (L)		
54	Slow sync time-out (H)	Group 2	S248
55	Slow sync time-out (H)		
56	Packets per hop Tx limit	Group 2	S249
57	Master hop allocation time out	Group 2	S251
58	Slave channel allocation limit	Group 2	S252
59	FEC mode	Group 2	S158
60	No sync data intake	Group 2	S130
61	Primary channel (H)	Group 2	S131
62	Primary channel (L)		
63	Secondary channel (H)	Group 2	S132
64	Secondary channel (L)		
65	Network type	Group 2	S133
Group 3 (Code 4)			
66	Time to live for routing table	Group 3	S235
67	Master channel request time-out	Group 3	S234
68	Max buffers OUT storage (H)	Group 3	S236
69	Max buffers OUT storage (L)		
70	DSR	Group 3	&S
71	DTR	Group 3	&D
72	Tx done time-out (H)	Group 3	S146
73	Tx done time-out (L)		
74	Rx done time-out (H)	Group 3	S147
75	Rx done time-out (L)		
76	Restriction enable	Group 3	S148
77	LEDs brightness, %	Group 3	S149
78	Fast sync time-out (H)	Group 3	S151
79	Fast sync time-out (L)		
80	Sync mode	Group 3	S150
81	Fast sync hold on ACK	Group 3	S152
Group 4 (Code 5)			
82	Sniff time-out	Group 4	S237

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Parameter ID	Parameter	Parameters Group	S-Register
83	Address tag	Group 4	S153
84	Current save mode	Group 4	S239
85	Pattern size	Group 4	S165
86	RF emission control	Group 4	S167
87	Max number of attempts to get sync (H)	Group 4	
88	Max number of attempts to get sync (L)		
89	Country code	Group 4	
90	Sniff sleep time (H)	Group 4	S169
91	Sniff sleep time (L)		
92	Sniff wake time (H)	Group 4	S170
93	Sniff wake time (L)		
94	Filter	Group 4	S168
95	Rate Change TMO	Group 4	S162
96	QOS report request	Group 4	S163
97	Restriction zone	Group 4	S178
98	Header type	Group 4	S176
Diagnostic Group (Code 1)			
100	Temperature	Diagnostic Group	
101	Minimum Vcc in Rx mode (H)	Diagnostic Group	
102	Minimum Vcc in Rx mode (L)		
103	Mean Vcc in Rx mode (H)	Diagnostic Group	
104	Mean Vcc in Rx mode (L)		
105	Average RSSI	Diagnostic Group	S123
106	reserved	Diagnostic Group	
107	reserved		
108	reserved		
109	reserved	Diagnostic Group	
110	Mean VSWR (H)		
111	Mean VSWR (L)	Diagnostic Group	
112	Status of the packet bad/good	Diagnostic Group	
113	Sync parameter	Diagnostic Group	
114	Power DAC	Diagnostic Group	
115	Max RSSI	Diagnostic Group	
116	Min RSSI	Diagnostic Group	
117	Maximum VSWR (H)	Diagnostic Group	
118	Maximum VSWR (L)		
Statistics 1 (Code 6)			
120	Rx data, Kbytes (H)	Statistics 1	
121	Rx data, Kbytes (M2)		
122	Rx data, Kbytes (M1)		
123	Rx data, Kbytes (L)		
124	Tx data, Kbytes (H)	Statistics 1	
125	Tx data, Kbytes (M2)		
126	Tx data, Kbytes (M1)		
127	Tx data, Kbytes (L)		

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Parameter ID	Parameter	Parameters Group	S-Register
128	Rx data, packets (H)	Statistics 1	
129	Rx data, packets (M2)		
130	Rx data, packets (M1)		
131	Rx data, packets (L)		
132	Tx data, packets (H)	Statistics 1	
133	Tx data, packets (M2)		
134	Tx data, packets (M1)		
135	Tx data, packets (L)		
136	Corrected errors (H)	Statistics 1	
137	Corrected errors (M2)		
138	Corrected errors (M1)		
139	Corrected errors (L)		
140	CRC errors (H)	Statistics 1	
141	CRC errors (M2)		
142	CRC errors (M1)	Statistics 1	
143	CRC errors (L)		
144	Lost sync (H)	Statistics 1	
145	Lost sync (M2)		
146	Lost sync (M1)		
147	Lost sync (L)		
Group Adhoc (Code 8)			
148	Destination Address w/o reset (H)	Group Adhoc	S140
149	Destination Address w/o reset (L)	Group Adhoc	
150	Request Slots	Group Adhoc	S156
151	Fast Sync Ack En	Group Adhoc	S160
152	Adhoc Tx Backoff (H)	Group Adhoc	S161
153	Adhoc Tx Backoff (L)	Group Adhoc	
154	Adhoc Sync Hold (H)	Group Adhoc	S164
155	Adhoc Sync Hold (L)	Group Adhoc	
156	Adhoc Sync Acknowledgement Request	Group Adhoc	S166
157	M Ch allocation limit	Group Adhoc	S253
Group 6 (Code 9)			
158	Data time to live, 10ms(H)	Group 6	S184
159	Data time to live, 10ms (L)		
160	Encryption	Group 6	S159
161	CRC allow / ignore	Group 6	S221
162	Fast TDMA max. packet size (H)	Group 6	S212
163	Fast TDMA max. packet size (L)		
164	Average RSSI_2	Group 6	S124
165	Maximum RSSI_2	Group 6	
166	Minimum RSSI_2	Group 6	
167	Mean Vcc in Tx mode (H)	Group 6	
168	Mean Vcc in Tx mode (L)		
169	Minimum Vcc in Tx mode (H)	Group 6	
170	Minimum Vcc in Tx mode (L)		
179	V2xx Compatibility	Group 6	

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Parameter ID	Parameter	Parameters Group	S-Register
180	Packet retry limit	Group 6	S213
181	Reset synchronized state	Group 6	
Statistics 2 (Code 11)			
182	Received from user's COM port, bytes (H)	Statistics 2	
183	Received from user's COM port, bytes (M2)		
184	Received from user's COM port, bytes (M1)		
185#	Received from user's COM port, bytes (L)		
186	Transmitted to user's COM port, bytes (H)	Statistics 2	
187	Transmitted to user's COM port, bytes (M2)		
188	Transmitted to user's COM port, bytes (M1)		
189#	Transmitted to user's COM port, bytes (L)		
190	Sync loss counter, bytes (H)	Statistics 2	
191	Sync loss counter, bytes (M2)		
192	Sync loss counter, bytes (M1)		
193#	Sync loss counter, bytes (L)		
Group 7 (Code 12)			
194	DCD on, ms	Group 7	S120
195	DCD off, ms	Group 7	S121
196	Compatibility n320/425/1320 modems with MHX320/425/1320 modems.	Group 7	S218

Notes:

- 1) Parameter ID* - modem will self-reset itself if this parameter is updated.
- 2) Display Diagnostics Information:
 - Temperature = temperature reading – 55 (°C)
 - Voltage = (voltage reading * 36300/256/1000) (volts) for MHX modem
 - Voltage = (voltage reading * 30179/256/1000) (volts) for Nano modem
 - RSSI = -1* (rssi reading)
 - VSWR = (vswr reading /1000)
- 3) Parameter ID# - low byte must be read first.

Appendix C

Commands and Responses Set for Transparent Mode

Table 3

Command ID	Function	Response ID	Response
20	Request of selected parameters <u>Command format:</u> Size, UA_H, UA_L, Command ID, (ParamID)n. n>1 for multi parameters request. <u>Example for Power, Baud Rate, Repeaters:</u> 6, 0, 5, 20, 3, 2, 10	100	Modem's selected parameters <u>Command format:</u> Size, UA_H, UA_L, Command ID, (ParamID, ParamData)n. n>1 for multi parameters request. <u>Example for Power=0, Baud Rate=2, Repeaters=1:</u> 9, 0, 5, 100, 3, 0, 2, 2, 10, 1
40	Request of Firmware version <u>Command format:</u> Size, UA_H, UA_L, Command ID. <u>Example:</u> 3, 0, 5, 40	140	Version of firmware <u>Command format:</u> Size, UA_H, UA_L, Command ID, String <u>Example for the version of firmware Ver.1.01-15:</u> 14, 0, 5, 140, 'V', 'e', 'r', '.', '1', '.', '0', '1', '-', '1', '5'
41	Request of Serial number <u>Command format:</u> Size, UA_H, UA_L, Command ID. <u>Example:</u> 3, 0, 5, 41	141	Serial number (maximum 11 characters) <u>Command format:</u> Size, UA_H, UA_L, Command ID, String <u>Example of response from the modem with UA=5 and Serial number : 12345-ABC</u> 12, 0, 5, 141, '1', '2', '3', '4', '5', '-', 'A', 'B', 'C'
42	Request of Encryption key <u>Command format:</u> Size, UA_H, UA_L, Command ID. <u>Example:</u> 3, 0, 5, 42	142	Encryption key (32 characters) <u>Command format:</u> Size, UA_H, UA_L, Command ID, String <u>Example of response from modem with UA=5 for the key: Calgary</u> 10, 0, 5, 142, 'C', 'a', 'l', 'g', 'a', 'r', 'y'
65	Flash memory upgrade commands Clear the RAM (Parameter ID=0) <u>Command format:</u> Size, MUA_H, MUA_L, COM_ID, PARAM, <u>Example:</u> 4 1 1 65 0 Download of the firmware image into the RAM (Parameter ID=1)	165	Acknowledgement for Clear the RAM (Parameter ID=0) <u>Command format:</u> Size, MUA_H, MUA_L, RESP_ID, PARAM, <u>Example:</u> 4 1 1 165 0 Acknowledgement for the download of the firmware image into the RAM (Parameter ID=1) <u>Command format:</u> Size, MUA_H, MUA_L, RESP_ID, PARAM,

Diagnostics Channel Protocol

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Command ID	Function	Response ID	Response
	<p><u>Command format:</u> Size, MUA_H, MUA_L, COM_ID, PARAM, SEG_SEQ_N_H, SEG_SEQ_N_L, DATA0,...DATA127</p> <p><u>Example:</u> 134 1 1 65 1 0 0 0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 ...127</p> <p>Arm the firmware upgrade procedure, start 10s time-out (PARAMETR ID=2) <u>Command format:</u> Size, MUA_H, MUA_L, COM_ID, PARAM, MARKER1(23), MARKER2(113)</p> <p><u>Example:</u> 6 1 1 65 2 23 113</p> <p>Download the firmware image into the FLASH memory (Parameter ID=3) <u>Command format:</u> Size, MUA_H, MUA_L, COM_ID, PARAM,</p> <p><u>Example:</u> 4 1 1 65 3</p> <p>Calculation of the firmware image's CRC-16 (Parameter ID=4) <u>Command format:</u> Size, MUA_H, MUA_L, COM_ID, PARAM,</p> <p><u>Example:</u> 4 1 1 65 4</p>		<p>SEG_SEQ_N_H, SEG_SEQ_N_L</p> <p><u>Example:</u> 6 1 1 165 1 0 0</p> <p>Acknowledgement for the arm the firmware upgrade procedure (PARAMETR ID=2) <u>Command format:</u> Size, MUA_H, MUA_L, RESP_ID, PARAM, MARKER1(23), MARKER2(113)</p> <p><u>Example:</u> 6 1 1 165 2 23 113</p> <p>Acknowledgement for expiring 10s time-out. (Parameter ID=3) <u>Command format:</u> Size, MUA_H, MUA_L, RESP_ID, PARAM,</p> <p><u>Example:</u> 4 1 1 65 3</p> <p>Response – calculated the firmware image's CRC-16 (Parameter ID=4) <u>Command format:</u> Size, MUA_H, MUA_L, RESP_ID, PARAM, CRC_H, CRC_L</p> <p><u>Example:</u> 6 1 1 165 4 47 89</p>
70	<p>Sending modem's selected settings.</p> <p><u>Command format:</u> Size, UA_H, UA_L, Command ID, (ParamIDs, ParamData)n. n>1 for multi parameters set up.</p> <p><u>Example for Retransmission=5,</u></p>		<p>No response, Modem resets itself after updating some parameters.</p>

The Diagnostic Channel Protocol

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Command ID	Function	Response ID	Response
	<u>Unit address=149:</u> 9, 0, 5, 70, 9, 5, 26, 0, 27, 149		
75	Saving all user's parameters in the EEPROM. <u>Command format:</u> Size, MUA_H, MUA_L, Command ID <u>Example for Unit address=5</u> 3, 0, 5, 75		
76	Loading factory default settings without saving to EEROM <u>Command format:</u> Size, UA_H, UA_L, Command ID, ParamID. <u>Example at&f2 for Unit address=5:</u> 4, 0, 5, 76, 2,	176	Acknowledgement for factory default loading <u>Command format:</u> Size, UA_H, UA_L, Command ID, ParamID. <u>Example at&f2 and saving:</u> 4, 0, 5, 176, 2,
77	Loading factory default settings and saving to EEROM <u>Command format:</u> Size, UA_H, UA_L, Command ID, ParamID. <u>Example at&f2 and saving for Unit address=5:</u> 4, 0, 5, 77, 2,	177	Acknowledgement for factory default loading and saving <u>Command format:</u> Size, UA_H, UA_L, Command ID, ParamID. <u>Example for at&f2 and saving:</u> 4, 0, 5, 177, 2,
79	Reading local RSSI <u>Command format:</u> Size, UA_H, UA_L, Command ID, 0, 0, 1. <u>ExampleRSSI reading for Unit address=5:</u> 6, 0, 5, 79, 0, 0, 1	179	Acknowledgement RSSI reading <u>Command format:</u> Size, UA_H, UA_L, Command ID, 0, 0, 1. <u>ExampleRSSI reading for Unit address=5:</u> 6, 0, 5, 179, 0, 0, 80
92	Channel table operation <u>Command format:</u> Size, UA_H, UA_L, Command ID, OperationID, ChnID, (other parametes) <u>Example reading channel 20 for Unit address=5:</u> 5, 0, 5, 92, 0, 20	192	Acknowledgement for Channel table operation <u>Command format:</u> Size, UA_H, UA_L, Command ID, OperationID, ChnID, (other parametes) <u>Example of response for reading channel 20 from Unit address=5:</u> 10, 0, 5, 192, 1, 20, 460000000(w32), 10 (460000000 has been split to 4 bytes, highest first)



Diagnostics Channel Protocol

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Command ID	Function	Response ID	Response
	<p><u>Example loading channel 20 for Unit address=5:</u> 10, 0, 5, 92, 1, 20, 460000000(w32), 10 (460000000 should be split to 4 bytes, highest first) The last byte with channel parameter has the following format: BITS<7:4> - channel open = 0 BITS<3:2> - bandwidth 0 for 6.125kHz; 1 for 12.5kHz and 2 for 25kHz BITS<0:1> - direction: 0 for Rx, 1 for Tx, 2 for both Tx and Rx.</p> <p><u>Example clearing channel table for Unit address=5:</u> 5, 0, 5, 92, 1, 255</p>		<p><u>Example of response for loading channel 20 from Unit address=5:</u> 5, 0, 5, 192, 0, 20</p> <p><u>Example of response for clearing channel table from Unit address=5:</u> 5, 0, 5, 192, 1, 255</p>
255	<p>Sending RESET command</p> <p><u>Command format:</u> Size, UA_H, UA_L, Command ID.</p> <p><u>Example:</u> 3, 0, 5, 255</p>		

Notes:

- 1) Command ID 92 is for channel table operation. General format of the command is defined as below. The bytes in command are listed below.

Cmd ID 92	W/R 1/0	Channel # 0-63 Clean: 255	Freq 1	Freq 2	Freq 3	Freq 4	Bw/Dir
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Only write operation has the last 5 bytes in command buffer

W/R Byte : 1 for setting write; 0 for setting read in the second byte

Channel# Byte: 255 is a special sign for cleaning channel table; Normal channel number ranges between 0 and 63

Freq 1 Byte : the highest byte of channel frequency in 32 bit format

Freq 2 Byte : the second highest byte of channel frequency in 32 bit format

Freq 3 Byte : the third highest byte of channel frequency in 32 bit format

Freq 4 Byte : the lowest byte of channel frequency in 32 bit format

Bw/Dir Byte : the byte must be 0000**bbww**, in which the highest 4 bits are reserved.

Bit **bb** is the bandwidth, 0, 1 and 2

Bit **ww** is the direction, 00 (Rx-0), 01 (Tx-1) and 10 (Both-2)

Appendix D

Table 4
Parameters IDs and Groups for Transparent Mode

Parameter ID	Parameter	S-Register
1	Serial channel mode	S142
2*	Baud rate	S102
3*	Power (saved in EEPROM)	S108
10*	Repeaters in system	S141
13*	Operating mode	S101
14*	Wireless link rate	S103
15	Esc. Character	S2
16*	Destination Address (H)	S140
17*	Destination Address (L)	
18	Power up mode	S0
19	Data format	S110
20	Quick enter to command	S119
26*	Unit address (H)	S105
27*	Unit address (L)	
28	Repeat interval	S115
29	Character time-out	S116
32*	Sleep mode	S143
52	Max buffers IN storage (H)	S232
53	Max buffers IN storage (L)	
61	Primary channel Tx	S131
62	Secondary channel Tx	S191
63	Primary channel Rx	S132
64	Secondary channel Rx	S192
68	Max buffers OUT storage (H)	S236
69	Max buffers OUT storage (L)	
70	DSR	&S
71	DTR	&D
77	LEDs brightness, %	S149
99	Bandwidth	S125
100	Temperature	
103	Mean Vcc in Rx mode (H)	
104	Mean Vcc in Rx mode (L)	
105	Average RSSI	S123
112	Status of the packet bad/good	
114	Last Error Code	
115	Error Counter	
120	Rx data, Kbytes (H)	
121	Rx data, Kbytes (M2)	
122	Rx data, Kbytes (M1)	
123	Rx data, Kbytes (L)	
124	Tx data, Kbytes (H)	
125	Tx data, Kbytes (M2)	
126	Tx data, Kbytes (M1)	

Diagnostics Channel Protocol

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Parameter ID	Parameter	S-Register
127	Tx data, Kbytes (L)	
128	Rx data, packets (H)	
129	Rx data, packets (M2)	
130	Rx data, packets (M1)	
131	Rx data, packets (L)	
132	Tx data, packets (H)	
133	Tx data, packets (M2)	
134	Tx data, packets (M1)	
135	Tx data, packets (L)	
140	CRC errors (H)	
141	CRC errors (M2)	
142	CRC errors (M1)	
143	CRC errors (L)	
152	Power up state	
196	RSSI Threshold	S51
197	EEPROM Failed	
201	Tx Attack Delay Repeater (PPC) (H)	S185
202	Tx Attack Delay Repeater (PPC) (L)	
203	Protocol Selection (PCC, Trimtalk)	S186
204	Discard Duplicated Downstream Data Packets (Trimtalk)	S187
205	Strip Off Markers (Trimtalk)	S188
206	Up Link Enable for Master (Trimtalk)	S189

Notes:

- 1) Parameter ID* - modem will self-reset itself if this parameter is updated. In order to reduce setting up time, we recommend setting up parameters that force a modem to reset itself as one multi parameters command (when it is not too long).
- 2) Display Diagnostics Information:
Temperature = temperature reading – 55 (°C)
RSSI = -1* (rssi reading)