Russound

Russound Dual Tuners

(ST2, ST2-XM, ST2-XM2, and ST2S)

RNET™ Protocol & Specifications
RS-232 Communication

Document version 1.00.03

NOTE: This document is intended for ST2 Chassis Firmware Version 2.00.06 or higher. The XM and Sirius Firmware must be V1.00.10 or higher.

Russound ST2 RS-232 Quick Start Guide

This document is meant to give you, the integrator, the knowledge of our protocols to be able to control our ST2 Dual Tuner.

Following are the basics you need to do or know to properly connect to and control Russound Products:

- Com Settings: • **19200** baud rate • 8 Data bits • 1 Start bit • 1 Stop bit • No flow control • No parity
- For most all equipment, you will need a DB9 to DB9 *STRAIGHT THRU* Serial Cable
  If you are using a USB to serial adapter, we suggest a Radio Shack model.
  (Belkin, Tripp Lite and Keyspan are known to be problematic)
  • Pin 1: NC • Pin 2: Transmit • Pin 3: Receive • Pin 4: NC • Pin 5: Ground
  • Pin 6: NC • Pin 7: NC • Pin 8: NC • Pin 9: NC
- The ST2 has a internal default source setting of 1 and 2 (tuner1=source1/tuner2=source2)
  These source settings specify which tuner you are controlling. If these source settings are needed to be changed, refer to the ST2 manual for info on this process.
  The codes listed in this manual are defined assuming that the ST2 is left at this default setting.

Its really easy…
The following base string is used for controlling every function of the ST2:

Byte #	1	2	3	**4**	5	6	7	8	9	10	11	12	13	14	**15**	16	17	18	**19**	20	21	**22**	23
Value	F0	00	7D	**kk**	00	00	70	05	02	01	00	02	01	00	**dd**	00	70	00	**kk**	00	01	**xx**	F7

For each desired function, change only the following 4 bytes as needed (4, 15, 19 and 22)
Byte #4(kk)= Source Number 00=source1, 01=source2, 02=source3, 03=source4, 04=source5, 05=source6
Byte #15(dd) = Event ID (This specifies what function you are wanting to perform)
Byte #19(kk)= Source Number (This specifies which tuner you are speaking to)
Byte #22(xx)= Checksum (This must be recalculated anytime that bytes 4, 15 or 19 are changed)
(Checksum is easy to calculate and instructions are given on page 11 of this document.)

See page 12 for a breakdown of each command along with those specific strings.

The following chart shows all ST2 functions designated by **Byte #15**:

Tuner Command Event IDs	**HEX Value (Byte 15)**	**Document Sections**
Common Commands		
DIGIT #0	**0A**	5.3
DIGIT #1	**01**	5.3
DIGIT #2	**02**	5.3
DIGIT #3	**03**	5.3
DIGIT #4	**04**	5.3
DIGIT #5	**05**	5.3
DIGIT #6	**06**	5.3
DIGIT #7	**07**	5.3
DIGIT #8	**08**	5.3
DIGIT #9	**09**	5.3

PRESET UP	**0E**	5.5
PRESET DOWN	**0F**	5.5
DIRECT BANK SELECTION MODE	**15**	5.8
DIRECT PRESET SELECTION MODE	**16**	5.6
DIRECT TUNING MODE (**FREQ** or **CHAN**)	**17**	5.3
BANK UP	**29**	5.7
BANK DOWN	**2A**	5.7
TUNE UP (**FREQUENCY** or **CHANNEL**)	**2F**	5.2
TUNE DOWN (**FREQUENCY** or **CHANNEL**)	**30**	5.2
POWER ON	**3A**	5.1
POWER OFF	**3B**	5.1
PRESET SAVE	**3C - 41**	5.4
AM/FM Commands		
SEEK	**1B**	6.1
SCAN	**46**	6.2
AM FM TOGGLE	**1A**	6.3
FM SELECT	**49**	6.4
AM SELECT	**4A**	6.4
STEREO / MONO TOGGLE	**13**	6.5
DIRECT STEREO SELECT	**33**	6.6
DIRECT MONO SELECT	**34**	6.6
LOCAL / DISTANT TOGGLE	**14**	6.7
DIRECT LOCAL SELECT	**42**	6.8
DIRECT DISTANT SELECT	**43**	6.8
Satellite Radio Commands (XM and Sirius)		
CATEGORY SELECT	**4D**	7.2
CATEGORY UP	**54**	7.1
CATEGORY DOWN	**55**	7.1
CAT CHANNEL UP	**58**	7.3
CAT CHANNEL DOWN	**59**	7.3

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1 Introduction

This document describes how to control and interpret data from the Russound Dual Tuners through their RS-232 serial port using the following **RNET**™ communications protocol. It is assumed that the reader is familiar with the features and operation of the ST2 and its variants. All commands use Hexadecimal or HEX values. In descriptive text these are indicated by preceding the value with a **0x**. Zero-based values are also used in certain areas and are noted as such. This means that a value of **0x00 = 1, 0x01 = 2, and 0x02 = 3** etc… Throughout this document all bytes within message packets not in bold must be referenced exactly as they appear.

2 Overview

The Russound Dual Tuner and its variants use a comprehensive Communications Protocol called **RNET™** which has been extended to the RS-232 port on its rear panel. Through this port, virtually all aspects of the device operation can be performed. This document provides detailed descriptions of messages required to perform basic device operation, as well as instructions on how to interpret Display Feedback messages.

3 COM Port

The following information is needed to allow connection and communication with the ST2 Chassis.

3.1 COM Settings

The following settings must be made to the RS-232 serial COM port used to interface with the ST2 and its variants:

- 19200 baud rate
- 1 Start bit
- 1 Stop bit
- No flow control
- No parity

3.2 Connector Type / Pin-out

Connector: Female DB-9

- Pin 1: NC
- Pin 2: Transmit
- Pin 3: Receive
- Pin 4: NC
- Pin 5: Ground
- Pin 6: NC
- Pin 7: NC
- Pin 8: NC
- Pin 9: NC

4 RNET™ Message Packet Format

Header				Body	Trailer	
0xF0	Target Device ID	Source Device ID	Type	Body	Checksum	0xF7

Every **RNET™** message has a consistent format. There are three major components: Message Header, Message Body and Message Trailer. Each of these is explained here in some detail.

MSB stands for **M**ost **S**ignificant **B**it which is the far left Bit of an 8-Bit Byte (MSB = Bit 7 = **0**0010001). There are several special characters used in this protocol. These special characters have the MSB set to high (1). All Bytes within the message of an **RNET™** packet have the MSB set to low (0) except for three special characters. The special characters with the MSB set to high (1) are the "**Start of Message Character**", the "**End of Message Character**", and the "**Invert Character**", which are explained within this document.

4.1 Message Header

Each message consists of a "Message Header" which is compiled of a **Start of Message Character**, **Target Device ID**, **Source Device ID**, and the **Message Type**.

4.1.1 Start of Message Character

As previously stated, there are several special characters. One of these is the Start of Message Character **0xF0** which is a special HEX value that indicates the beginning of a new message.

4.1.2 Target Device ID

The Target Device ID defines to which device the message is being sent. Every device on an **RNET™** system has a unique "Device ID" that allows messages to be sent to it. Each Device ID consists of a Controller ID, a Zone (Port) ID, and a Keypad ID. In the case of a Controller with zone Keypads, the purpose of each Device ID field is apparent. In the case of the Dual Tuner and all its variants, these fields will have different meanings because this is an **RNET™** Peripheral Device and not a Controller. These fields are explained in more detail below.

4.1.2.1 Target Controller ID

When communicating with a Dual Tuner and all its variants, the Controller ID is always set to a value of **0x00**. When the Dual Tuner is responding with a Display Feedback message, a value of **0x7D** will be seen in this field targeting the entire **RNET™** system.

4.1.2.2 Target Zone (Port) ID

When communicating with a Dual Tuner and all its variants, the Zone ID is always set to **0x7D**. The value **0x7D** in the Zone (Port) ID field indicates that the Target Device is an **RNET™** Peripheral. When the Dual Tuner is responding with a Source Broadcast Display Feedback message, a value of **0x00** will be seen in this field since the Target Controller ID already indicated All **RNET™** Devices, not a particular Zone of a Controller.

4.1.2.3 Target Keypad ID

The Keypad ID field is a zero-based value that is used to indicate the Source Number of each Tuner module within the Dual Tuner to be controlled. See the Dual Tuner operating instructions for how to set the Source Numbers for each Tuner module. The available Source Numbers are Source **#1** through Source **#6** and therefore use HEX values of **0x00** through **0x05**. The Source Numbers can also be set as "Unassigned" in which case you can not Target that Tuner with an **RNET™** protocol message. When receiving messages from the Dual Tuner, this field will use special values to indicate where the message is being sent. A value of **0x70** in this field would indicate that a Direct Display Feedback message is being sent from the Peripheral Device. A value of **0x79** in this field would indicate that a Broadcast Display Feedback message is being sent from the Peripheral Device.

4.1.2.4 Target Device ID Example

Example 1 shows a complete Target Device ID for a Dual Tuner that has one of its Tuner modules assigned as Source 1 in an **RNET™** system.
NOTE: The Dual Tuner has two tuner modules and therefore the two modules are viewed as two separate devices on the **RNET™** network. The Dual Tuner has two Device IDs that it will respond to.
Example 1:

Value (HEX)	Device ID Field	Description
00	Controller ID	ST2
7D	Zone (Port) ID	**RNET™** Peripheral
00	Keypad ID	Source 1 = 0x00 (Zero-based, see 4.1.2.3)

Example 2 shows a complete Target Device ID for a Source Broadcast Display message being sent from a Dual Tuner in an **RNET™** system.
Example 2:

Value (HEX)	Device ID Field	Description
7D	Controller ID	All **RNET™** Devices
00	Zone (Port) ID	Arbitrary value
79	Keypad ID	Broadcast Display Feedback message

4.1.3 Source Device ID

The "Source" Device ID is the identification of the Device that is sending the message. For external devices controlling the system, like an automation and control system, these can be any value that is a unique value among devices attached to the system. The recommend Device ID for external control systems is **Controller ID: 0x00, Zone ID: 0x00,** and **Keypad ID:** (**0x70** or **0x60**).

4.1.3.1 Source Controller ID

For 3rd party devices, this should be set to a value of **'0x00'.**

4.1.3.2 Source Zone (Port) ID

For 3rd party devices, this should be set to a value of **'0x00'.** When the Dual Tuner is responding with a Display Feedback message, a value of **0x7D** will be seen in this field indicating a Peripheral Device.

4.1.3.3 Source Keypad ID

The recommend Keypad ID for external control systems is **0x70**, which is a Keypad ID other than those used in the system. If using **0x60**, then the system will require a Handshake message. When the Dual Tuner is responding with a Display Feedback message, this field will indicate the zero-based value for the Source Number (**0x00** – **0x05**) of the Tuner sending the message.

4.1.4 Message Type

This value defines the type of message that is being sent. The most important Message Types are as follows:

Value (HEX)	Message Type	Description
00	Set Data	Sets a parameter's value
01	Request Data	Requests a parameter's value
02	Handshake	Acknowledges a Data send
05	Event	Triggers a system response that may set a parameter value, update displays, etc…

In some cases, setting parameter values can be done in two ways. A **Set Data** message can be sent directly to the parameter, or an **Event** message can be sent to trigger the Dual Tuner to set the value instead. **Event** messages are a little easier to use, and may trigger other desired results (such as updating Keypad displays, updating related parameters, etc…) where a **Set Data** message may not. Because of this, this document describes using **Event** messages to set parameter values where it is most desirable.

4.1.4.1 Event Messages

Event Messages trigger a system response that may set a parameter value, update displays, etc… Because of this, this document describes using **Event Messages** to set parameter values where it is most desirable. An **Event Message** Type consists of an Event ID, Event Timestamp, Event Data, and the Event Priority.

4.1.5 Paths

The Data within each RNET device is organized in a hierarchical tree similar to a computer's disk drive. When sending Data or Events from one system to another, a Path is specified to define exactly which object should be modified. Target and Source Paths are usually defined, but for the sake of remotely controlling the system, only the Target Path is of interest.

Paths in RNET messages are defined by first specifying how deep the path is, followed by the numeric values of each directory. For example, a Path that was three levels deep might be represented as "**3.1.2.8**". The "**3**" at the beginning defines how deep the Path is. The numbers that follow are the subdirectories. Think of the numbers as folder names (folder "**8**" is inside folder "**2**" which is inside folder "**1**"). Bear in mind that the folders are unique for each level, so folder "1" can be in folder "1" of the next level up (just like folders on a computer).

4.2 The Invert Character

The **Invert Character** is another one of the special characters. It is used in special cases as part of the Message Body. If the data in an **RNET™** message body includes any Byte values that have the MSB set to high (1) the Byte will be rejected as only the lower 7 Bits are used to hold data. When the MSB is set to high (1) the Byte has a HEX value greater than **0x7F**. In order to allow values greater than **0x7F** to be accepted, the Byte must first be Bitwise inverted (e.g., 10010101 = 01101010), and the special Invert Character (**0xF1**) is inserted just prior to the inverted Byte. When an **RNET™** packet is received, the system must detect the **0xF1** Invert Character. The **0xF1** Invert Character is then discarded and the following Byte is inverted back to its original value (e.g., 01101010 = 10010101).

Invert Character Usage Example:
Sent message with inverted character:

Value (HEX)	Notes
F0	Start of message character
00	
67	
7C	
F1	Special **Invert Character**
6A	Inverted Character (actual value 0x95)
34	Checksum
F7	End of message character

Received message after discarding the Invert Character and re-inverting the following Byte:

Value (HEX)	Notes
F0	Start of message character
00	
67	
7C	
95	After re-inverting
XX	Checksum (Discarded)
F7	End of message character

4.3 Message Body

The message body contains specific data which varies in value and byte count depending on the particular **Message Type** being sent. Refer to the particular messages.

4.4 Message Trailer

The Message Trailer consists of the **Checksum** and **End of Message Character**. The **Checksum** value changes and needs to be re-calculated whenever any one of the preceding characters in the message is changed. The **Checksum** is always followed by the **End of Message Character**.

4.4.1 Checksum

All messages include a Checksum that helps protect the integrity of the message. The Checksum is a single Byte that can be calculated using a formula (see example below). The **Checksum** itself and the **End of Message Character** are not included in the calculation. Only the low 7 Bits are used so overflow is discarded.

Calculate with calculator in scientific mode.

Checksum Calculation Example:

Byte #	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23
Value	F0	00	7D	00	00	00	70	05	02	01	00	02	01	00	3A	00	70	00	00	00	01	**28**	F7

Step #1 - Add the HEX value of every byte in the message that precedes the Checksum:
Example - **F0+00+7D+00+00+00+70+05+02+01+00+02+01+00+3A+00+70+00+00+00+01**
In this string, you are adding F0 to the 01 just previous to the checksum of 28
Answer is 293

Step #2 - "Create Byte Count" Count the number of bytes which precede the checksum and convert that value from DEC to HEX. Add the HEX byte count to the sum from step 1.
Dec count of bytes preceding checksum is 21
21 dec converted to hex is 15
293+15=2A8

Step #3 - **AND the value found from step 2 and HEX 7F (step2 value AND 7F = CHECKSUM!) (and not plus)**:
Example – **2A8 AND 7F = 28**
Checksum = 28

4.4.2 End of Message Character

The **End of Message Character** (**0xF7**) is the special HEX value that indicates the end of the message.

5 Common Control Messages (AM/FM, XM, and Sirius)

This section will provide information in regards to messages that apply to all three different ST2 Tuner Modules. The following strings are common command messages that would apply to the AM/FM Tuner as well as both Satellite Radio Tuners (XM and Sirius).

5.1 Power On / Power Off

This section describes how to initiate the Power On and Power Off functions. The Power On function wakes the Dual Tuner from "Standby Mode". The Power Off function puts the Dual Tuner into "Standby Mode".

NOTE*: The Power On and Power Off commands are common to both tuners. If a Power command is sent to one tuner it will affect both tuners (The entire ST2 Chassis). There is no need to address the second tuner for these functions.*

This is an example of a Power On / Power Off message

Byte #	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23
Value	F0	00	7D	**kk**	00	00	70	05	02	01	00	02	01	00	**##**	00	70	00	**kk**	00	01	**xx**	F7

kk = Source Number (Source 1 = **0x00** … Source 6 = **0x05**)
xx = Checksum
Byte #15 = Event ID (Power On = **0x3A** / Power Off = **0x3B**)

```
Tnr1 Power On     F0 00 7D 00 00 00 70 05 02 01 00 02 01 00 3A 00 70 00 00 00 01 28 F7
Tnr1 Power Off    F0 00 7D 00 00 00 70 05 02 01 00 02 01 00 3B 00 70 00 00 00 01 29 F7
```

5.2 Tune Up / Tune Down (Frequency or Channel)

The same HEX values for Tune Up and Tune Down are used for both Frequency Tuning and Channel Tuning. For AM/FM issuing this message will Tune Up or Tune Down one Frequency at a time. For XM and Sirius issuing this message will Tune Up or Tune Down one Channel at a time.

This is an example of Tune Up / Tune Down relative to the current Frequency or Channel

Byte #	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23
Value	F0	00	7D	**kk**	00	00	70	05	02	01	00	02	01	00	**##**	00	70	00	**kk**	00	01	**xx**	F7

kk = Source Number (Source 1 = **0x00** … Source 6 = **0x05**)
xx = Checksum
Byte #15 = Event ID (Frequency / Channel Up = **0x2F**) (Frequency / Channel Down = **0x30**)

```
Tnr1 Tune Up      F0 00 7D 00 00 00 70 05 02 01 00 02 01 00 2F 00 70 00 00 00 01 1D F7
Tnr1 Tune Dn      F0 00 7D 00 00 00 70 05 02 01 00 02 01 00 30 00 70 00 00 00 01 1E F7
Tnr2 Tune Up      F0 00 7D 01 00 00 70 05 02 01 00 02 01 00 2F 00 70 00 01 00 01 1F F7
Tnr2 Tune Dn      F0 00 7D 01 00 00 70 05 02 01 00 02 01 00 30 00 70 00 01 00 01 20 F7
```

5.3 Direct Tuning Mode (Frequency or Channel)

Direct Tuning mode will allow you to directly select a particular Frequency for AM/FM (i.e. 101.7 FM) or a particular Channel for XM and Sirius (i.e. XM Channel 20). The AM/FM Tuner will automatically detect if the entered frequency is intended for AM or FM based on the number sequence. For all three Tuners

(AM/FM, XM, and Sirius) the command sequence includes a series of messages. The first message is to tell the AM/FM or Satellite Radio Tuner to enter Direct Tuning mode. The proceeding messages are to indicate what Frequency or Channel Digits to select.

This is the message used to enter **Direct Tuning** mode (Frequency or Channel).

Byte #	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23
Value	F0	00	7D	**kk**	00	00	70	05	02	01	00	02	01	00	**17**	00	70	00	**kk**	00	01	**xx**	F7

kk = Source Number (Source 1 = **0x00** … Source 6 = **0x05**)
xx = Checksum
Byte #15 = Event ID (Direct Tuning mode **= 0x17)**

```
Enter Direct Tuning Mode
Tnr1                F0 00 7D 00 00 00 70 05 02 01 00 02 01 00 17 00 70 00 00 00 01 05 F7
Tnr2                F0 00 7D 01 00 00 70 05 02 01 00 02 01 00 17 00 70 00 01 00 01 07 F7
```

This is an example of the proceeding messages to select the **Digits** (Frequency or Channel). The maximum number of Digits for AM/FM would be four Digits. The maximum number of Digits for Satellite Radio would be three Digits.

Digit #1:

Byte #	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23
Value	F0	00	7D	**kk**	00	00	70	05	02	01	00	02	01	00	**##**	00	70	00	**kk**	00	01	**xx**	F7

Digit #2:

Byte #	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23
Value	F0	00	7D	**kk**	00	00	70	05	02	01	00	02	01	00	**##**	00	70	00	**kk**	00	01	**xx**	F7

Digit #3:

Byte #	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23
Value	F0	00	7D	**kk**	00	00	70	05	02	01	00	02	01	00	**##**	00	70	00	**kk**	00	01	**xx**	F7

Digit #4:

Byte #	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23
Value	F0	00	7D	**kk**	00	00	70	05	02	01	00	02	01	00	**##**	00	70	00	**kk**	00	01	**xx**	F7

kk = Source Number (Source 1 = **0x00** … Source 6 = **0x05**)
xx = Checksum
Byte #15 = Event ID (Digit #1 = **0x01**, #2 = **0x02** … #9 = **0x09**) (**NOTE**: Digit #0 = **0x0A**)

```
Tnr1 Digit-0        F0 00 7D 00 00 00 70 05 02 01 00 02 01 00 0A 00 70 00 00 00 01 78 F7
Tnr1 Digit-1        F0 00 7D 00 00 00 70 05 02 01 00 02 01 00 01 00 70 00 00 00 01 6F F7
Tnr1 Digit-2        F0 00 7D 00 00 00 70 05 02 01 00 02 01 00 02 00 70 00 00 00 01 70 F7
Tnr1 Digit-3        F0 00 7D 00 00 00 70 05 02 01 00 02 01 00 03 00 70 00 00 00 01 71 F7
Tnr1 Digit-4        F0 00 7D 00 00 00 70 05 02 01 00 02 01 00 04 00 70 00 00 00 01 72 F7
Tnr1 Digit-5        F0 00 7D 00 00 00 70 05 02 01 00 02 01 00 05 00 70 00 00 00 01 73 F7
Tnr1 Digit-6        F0 00 7D 00 00 00 70 05 02 01 00 02 01 00 06 00 70 00 00 00 01 74 F7
Tnr1 Digit-7        F0 00 7D 00 00 00 70 05 02 01 00 02 01 00 07 00 70 00 00 00 01 75 F7
Tnr1 Digit-8        F0 00 7D 00 00 00 70 05 02 01 00 02 01 00 08 00 70 00 00 00 01 76 F7
Tnr1 Digit-9        F0 00 7D 00 00 00 70 05 02 01 00 02 01 00 09 00 70 00 00 00 01 77 F7
```

Tnr2 Digit-0	F0 00 7D 01 00 00 70 05 02 01 00 02 01 00 0A 00 70 00 01 00 01 7A F7
Tnr2 Digit-1	F0 00 7D 01 00 00 70 05 02 01 00 02 01 00 01 00 70 00 01 00 01 71 F7
Tnr2 Digit-2	F0 00 7D 01 00 00 70 05 02 01 00 02 01 00 02 00 70 00 01 00 01 72 F7
Tnr2 Digit-3	F0 00 7D 01 00 00 70 05 02 01 00 02 01 00 03 00 70 00 01 00 01 73 F7
Tnr2 Digit-4	F0 00 7D 01 00 00 70 05 02 01 00 02 01 00 04 00 70 00 01 00 01 74 F7
Tnr2 Digit-5	F0 00 7D 01 00 00 70 05 02 01 00 02 01 00 05 00 70 00 01 00 01 75 F7
Tnr2 Digit-6	F0 00 7D 01 00 00 70 05 02 01 00 02 01 00 06 00 70 00 01 00 01 76 F7
Tnr2 Digit-7	F0 00 7D 01 00 00 70 05 02 01 00 02 01 00 07 00 70 00 01 00 01 77 F7
Tnr2 Digit-8	F0 00 7D 01 00 00 70 05 02 01 00 02 01 00 08 00 70 00 01 00 01 78 F7
Tnr2 Digit-9	F0 00 7D 01 00 00 70 05 02 01 00 02 01 00 09 00 70 00 01 00 01 79 F7

5.4 Saving Presets

There are six HEX values that are used as a "Save" command for each of the six available Presets. When you send one of the Save Preset # commands it will be applied to the currently selected Bank.

This example shows how to save Presets (1-6) within the currently selected Bank for the currently selected Frequency / Channel using a discrete message

Byte #	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23
Value	F0	00	7D	**kk**	00	00	70	05	02	01	00	02	01	00	##	00	70	00	**kk**	00	01	**xx**	F7

kk = Source Number (Source 1 = **0x00** … Source 6 = **0x05**)
xx = Checksum
Byte #15 = Event ID (Save Preset 1 = **0x3C**, 2 = **0x3D**, 3 = **0x3E**, 4 = **0x3F**, 5 = **0x40**, 6 = **0x41**)

Tnr1 SavePreset1	F0 00 7D 00 00 00 70 05 02 01 00 02 01 00 3C 00 70 00 00 00 01 2A F7
Tnr1 SavePreset2	F0 00 7D 00 00 00 70 05 02 01 00 02 01 00 3D 00 70 00 00 00 01 2B F7
Tnr1 SavePreset3	F0 00 7D 00 00 00 70 05 02 01 00 02 01 00 3E 00 70 00 00 00 01 2C F7
Tnr1 SavePreset4	F0 00 7D 00 00 00 70 05 02 01 00 02 01 00 3F 00 70 00 00 00 01 2D F7
Tnr1 SavePreset5	F0 00 7D 00 00 00 70 05 02 01 00 02 01 00 40 00 70 00 00 00 01 2E F7
Tnr1 SavePreset6	F0 00 7D 00 00 00 70 05 02 01 00 02 01 00 41 00 70 00 00 00 01 2F F7

Tnr2 SavePreset1	F0 00 7D 01 00 00 70 05 02 01 00 02 01 00 3C 00 70 00 01 00 01 2C F7
Tnr2 SavePreset2	F0 00 7D 01 00 00 70 05 02 01 00 02 01 00 3D 00 70 00 01 00 01 2D F7
Tnr2 SavePreset3	F0 00 7D 01 00 00 70 05 02 01 00 02 01 00 3E 00 70 00 01 00 01 2E F7
Tnr2 SavePreset4	F0 00 7D 01 00 00 70 05 02 01 00 02 01 00 3F 00 70 00 01 00 01 2F F7
Tnr2 SavePreset5	F0 00 7D 01 00 00 70 05 02 01 00 02 01 00 40 00 70 00 01 00 01 30 F7
Tnr2 SavePreset6	F0 00 7D 01 00 00 70 05 02 01 00 02 01 00 41 00 70 00 01 00 01 31 F7

5.5 Preset Up / Preset Down

This is an example of Preset Up / Preset Down within the current Bank

Byte #	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23
Value	F0	00	7D	**kk**	00	00	70	05	02	01	00	02	01	00	##	00	70	00	**kk**	00	01	**xx**	F7

kk = Source Number (Source 1 = **0x00** … Source 6 = **0x05**)
xx = Checksum
Byte #15 = Event ID (Preset Up = **0x0E** / Preset Down = **0x0F**)

Tnr1 Preset Up	F0 00 7D 00 00 00 70 05 02 01 00 02 01 00 3A 00 70 00 00 00 01 28 F7

Tnr1 Preset Dn	F0 00 7D 00 00 00 70 05 02 01 00 02 01 00 3B 00 70 00 00 00 01 29 F7
Tnr2 Preset Up	F0 00 7D 01 00 00 70 05 02 01 00 02 01 00 3A 00 70 01 00 00 01 30 F7
Tnr2 Preset Dn	F0 00 7D 01 00 00 70 05 02 01 00 02 01 00 3B 00 70 01 00 00 01 31 F7

5.6 Direct Preset Select

Direct Preset Select mode allows you to select a particular Preset (1 – 6) within the currently selected Bank. Just like Direct Tuning mode, the command sequence includes a series of messages. The first message is to put the Tuner into Direct Preset Select mode. The second message is to indicate what Preset Digit to select.

This is the message used to enter **Direct Preset Select** mode

Byte #	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23
Value	F0	00	7D	**kk**	00	00	70	05	02	01	00	02	01	00	**16**	00	70	00	**kk**	00	01	**xx**	F7

kk = Source Number (Source 1 = **0x00** … Source 6 = **0x05**)
xx = Checksum
Byte #15 = Event ID (Direct Preset Select mode = **0x16**)

Enter Direct Preset Select Mode

Tnr1	F0 00 7D 00 00 00 70 05 02 01 00 02 01 00 16 00 70 00 00 00 01 04 F7
Tnr2	F0 00 7D 01 00 00 70 05 02 01 00 02 01 00 16 00 70 00 01 00 01 06 F7

This is an example of the second message needed to select the Preset **Digit** (1 – 6)

Byte #	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23
Value	F0	00	7D	**kk**	00	00	70	05	02	01	00	02	01	00	**##**	00	70	00	**kk**	00	01	**xx**	F7

kk = Source Number (Source 1 = **0x00** … Source 6 = **0x05**)
xx = Checksum
Byte #15 = Event ID (Digit #1 = **0x01**, #2 = **0x02**, #3 = **0x03**, #4 = **0x04**, #5 = **0x05**, #6 = **0x06**)

Tnr1 Digit-1	F0 00 7D 00 00 00 70 05 02 01 00 02 01 00 01 00 70 00 00 00 01 6F F7
Tnr1 Digit-2	F0 00 7D 00 00 00 70 05 02 01 00 02 01 00 02 00 70 00 00 00 01 70 F7
Tnr1 Digit-3	F0 00 7D 00 00 00 70 05 02 01 00 02 01 00 03 00 70 00 00 00 01 71 F7
Tnr1 Digit-4	F0 00 7D 00 00 00 70 05 02 01 00 02 01 00 04 00 70 00 00 00 01 72 F7
Tnr1 Digit-5	F0 00 7D 00 00 00 70 05 02 01 00 02 01 00 05 00 70 00 00 00 01 73 F7
Tnr1 Digit-6	F0 00 7D 00 00 00 70 05 02 01 00 02 01 00 06 00 70 00 00 00 01 74 F7

Tnr2 Digit-0	F0 00 7D 01 00 00 70 05 02 01 00 02 01 00 0A 00 70 00 01 00 01 7A F7
Tnr2 Digit-1	F0 00 7D 01 00 00 70 05 02 01 00 02 01 00 01 00 70 00 01 00 01 71 F7
Tnr2 Digit-2	F0 00 7D 01 00 00 70 05 02 01 00 02 01 00 02 00 70 00 01 00 01 72 F7
Tnr2 Digit-3	F0 00 7D 01 00 00 70 05 02 01 00 02 01 00 03 00 70 00 01 00 01 73 F7
Tnr2 Digit-4	F0 00 7D 01 00 00 70 05 02 01 00 02 01 00 04 00 70 00 01 00 01 74 F7
Tnr2 Digit-5	F0 00 7D 01 00 00 70 05 02 01 00 02 01 00 05 00 70 00 01 00 01 75 F7
Tnr2 Digit-6	F0 00 7D 01 00 00 70 05 02 01 00 02 01 00 06 00 70 00 01 00 01 76 F7

5.7 Bank Up / Bank Down

This is an example of Bank Up / Bank Down relative to the current Bank

Byte #	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23

Value	F0	00	7D	**kk**	00	00	70	05	02	01	00	02	01	00	**##**	00	70	00	**kk**	00	01	**xx**	F7

kk = Source Number (Source 1 = **0x00** … Source 6 = **0x05**)
xx = Checksum
Byte #15 = Event ID (Bank Up = **0x29** / Bank Down = **0x2A**)

Tnr1 Bank Up	F0 00 7D 00 00 00 70 05 02 01 00 02 01 00 29 00 70 00 00 00 01 17 F7
Tnr1 Bank Dn	F0 00 7D 00 00 00 70 05 02 01 00 02 01 00 2A 00 70 00 00 00 01 18 F7
Tnr2 Bank Up	F0 00 7D 01 00 00 70 05 02 01 00 02 01 00 29 00 70 01 00 00 01 19 F7
Tnr2 Bank Dn	F0 00 7D 01 00 00 70 05 02 01 00 02 01 00 2A 00 70 01 00 00 01 1A F7

5.8 Direct Bank Select

Direct Bank Select mode allows you to select a particular Bank (1 – 6). Again, the command sequence includes a series of messages. The first message tells the Tuner to enter Direct Bank Select mode. The second message is to indicate what Bank Digit to select.

This is the message used to enter **Direct Bank** Select mode.

Byte #	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23
Value	F0	00	7D	**kk**	00	00	70	05	02	01	00	02	01	00	**15**	00	70	00	**kk**	00	01	**xx**	F7

kk = Source Number (Source 1 = **0x00** … Source 6 = **0x05**)
xx = Checksum
Byte #15 = Event ID (Direct Bank Select mode = **0x15**)

Tnr1	F0 00 7D 00 00 00 70 05 02 01 00 02 01 00 15 00 70 00 00 00 01 03 F7
Tnr2	F0 00 7D 01 00 00 70 05 02 01 00 02 01 00 15 00 70 00 01 00 01 05 F7

This is an example of the second message needed to select the Bank **Digit** (1 – 6)

Byte #	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23
Value	F0	00	7D	00	00	00	70	05	02	01	00	02	01	00	**bb**	00	70	00	00	00	01	**xx**	F7

kk = Source Number (Source 1 = **0x00** … Source 6 = **0x05**)
xx = Checksum
Byte #15 = Event ID (Digit #1 = **0x01**, #2 = **0x02**, #3 = **0x03**, #4 = **0x04**, #5 = **0x05**, #6 = **0x06**)

Tnr1 Digit-1	F0 00 7D 00 00 00 70 05 02 01 00 02 01 00 01 00 70 00 00 00 01 6F F7
Tnr1 Digit-2	F0 00 7D 00 00 00 70 05 02 01 00 02 01 00 02 00 70 00 00 00 01 70 F7
Tnr1 Digit-3	F0 00 7D 00 00 00 70 05 02 01 00 02 01 00 03 00 70 00 00 00 01 71 F7
Tnr1 Digit-4	F0 00 7D 00 00 00 70 05 02 01 00 02 01 00 04 00 70 00 00 00 01 72 F7
Tnr1 Digit-5	F0 00 7D 00 00 00 70 05 02 01 00 02 01 00 05 00 70 00 00 00 01 73 F7
Tnr1 Digit-6	F0 00 7D 00 00 00 70 05 02 01 00 02 01 00 06 00 70 00 00 00 01 74 F7

Tnr2 Digit-0	F0 00 7D 01 00 00 70 05 02 01 00 02 01 00 0A 00 70 00 01 00 01 7A F7
Tnr2 Digit-1	F0 00 7D 01 00 00 70 05 02 01 00 02 01 00 01 00 70 00 01 00 01 71 F7
Tnr2 Digit-2	F0 00 7D 01 00 00 70 05 02 01 00 02 01 00 02 00 70 00 01 00 01 72 F7
Tnr2 Digit-3	F0 00 7D 01 00 00 70 05 02 01 00 02 01 00 03 00 70 00 01 00 01 73 F7
Tnr2 Digit-4	F0 00 7D 01 00 00 70 05 02 01 00 02 01 00 04 00 70 00 01 00 01 74 F7
Tnr2 Digit-5	F0 00 7D 01 00 00 70 05 02 01 00 02 01 00 05 00 70 00 01 00 01 75 F7
Tnr2 Digit-6	F0 00 7D 01 00 00 70 05 02 01 00 02 01 00 06 00 70 00 01 00 01 76 F7

6 AM/FM Tuner Control Messages

This section provides information in regards to messages that **only** apply to the AM/FM Tuner module. These messages include Seek, Scan and AM/FM Band selection commands.
NOTE: Sending a "**Power On**" message will stop a Seek or Scan operation! Refer to Section 5.1 for the message used as "Power On".

6.1 Seek

The Seek function finds the next "Tuned Station" within the current Band.

Byte #	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23
Value	F0	00	7D	**kk**	00	00	70	05	02	01	00	02	01	00	**1B**	00	70	00	**kk**	00	01	**xx**	F7

kk = Source Number (Source 1 = **0x00** … Source 6 = **0x05**)
xx = Checksum
Byte #15 = Event ID (Seek = **0x1B**)

```
Tnr1   Seek          F0 00 7D 00 00 00 70 05 02 01 00 02 01 00 1B 00 70 00 00 00 01 09 F7
Tnr2   Seek          F0 00 7D 01 00 00 70 05 02 01 00 02 01 00 1B 00 70 00 01 00 01 0B F7
```

6.2 Scan

The Scan function finds the next Tuned Station within the current Band. It will rest on that Station for 5 seconds and then find the next Tuned Station, and so on. This sequence will continue until a "Power On" command is sent to stop the Scan function.

Byte #	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23
Value	F0	00	7D	**kk**	00	00	70	05	02	01	00	02	01	00	**46**	00	70	00	**kk**	00	01	**xx**	F7

kk = Source Number (Source 1 = **0x00** … Source 6 = **0x05**)
xx = Checksum
Byte #15 = Event ID (Scan = **0x46**)

```
Tnr1   Scan          F0 00 7D 00 00 00 70 05 02 01 00 02 01 00 46 00 70 00 00 00 01 34 F7
Tnr2   Scan          F0 00 7D 01 00 00 70 05 02 01 00 02 01 00 46 00 70 00 01 00 01 36 F7
```

6.3 AM/FM Toggle

The AM/FM Toggle function switches back and forth between AM and FM Bands.

Byte #	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23
Value	F0	00	7D	**kk**	00	00	70	05	02	01	00	02	01	00	**1A**	00	70	00	**kk**	00	01	**xx**	F7

kk = Source Number (Source 1 = **0x00** … Source 6 = **0x05**)
xx = Checksum
Byte #15 = Event ID (AM/FM Toggle = **0x1A**)

```
Tnr1 AM/FM Toggle F0 00 7D 00 00 00 70 05 02 01 00 02 01 00 1A 00 70 00 00 00 01 08 F7
Tnr2 AM/FM Toggle F0 00 7D 01 00 00 70 05 02 01 00 02 01 00 1A 00 70 00 01 00 01 0A F7
```

6.4 Direct AM Select / Direct FM Select

Direct AM/FM Selection will directly select the AM or FM band using a discrete message.

Byte #	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23
Value	F0	00	7D	**kk**	00	00	70	05	02	01	00	02	01	00	##	00	70	00	**kk**	00	01	**xx**	F7

kk = Source Number (Source 1 = **0x00** … Source 6 = **0x05**)
xx = Checksum
Byte #15 = Event ID (Direct AM Select = **0x4A**) (Direct FM Select = **0x49**)

Tnr1 AM Select	F0 00 7D 00 00 00 70 05 02 01 00 02 01 00 4A 00 70 00 00 00 01 38 F7
Tnr1 FM Select	F0 00 7D 00 00 00 70 05 02 01 00 02 01 00 49 00 70 00 00 00 01 37 F7
Tnr2 AM Select	F0 00 7D 01 00 00 70 05 02 01 00 02 01 00 4A 00 70 00 01 00 01 3A F7
Tnr2 FM Select	F0 00 7D 01 00 00 70 05 02 01 00 02 01 00 49 00 70 00 01 00 01 39 F7

6.5 Stereo / Mono Toggle

The Stereo / Mono Toggle message switches back and forth between Stereo and Mono modes when listening to an FM Station.

Byte #	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23
Value	F0	00	7D	**kk**	00	00	70	05	02	01	00	02	01	00	**13**	00	70	00	**kk**	00	01	**xx**	F7

kk = Source Number (Source 1 = **0x00** … Source 6 = **0x05**)
xx = Checksum
Byte #15 = Event ID (Stereo / Mono Toggle = **0x13**)

Tnr1Stero/MonoTggle	F0 00 7D 00 00 00 70 05 02 01 00 02 01 00 13 00 70 00 00 00 01 01 F7
Tnr2Stero/MonoTggle	F0 00 7D 01 00 00 70 05 02 01 00 02 01 00 13 00 70 00 01 00 01 03 F7

6.6 Direct Stereo Select / Direct Mono Select

The Direct Stereo Select and Direct Mono Select functions discreetly select the Stereo Listening mode or Mono Listening mode when listening to an FM Station.

Byte #	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23
Value	F0	00	7D	**kk**	00	00	70	05	02	01	00	02	01	00	##	00	70	00	**kk**	00	01	**xx**	F7

kk = Source Number (Source 1 = **0x00** … Source 6 = **0x05**)
xx = Checksum
Byte #15 = Event ID (Direct Stereo Select = **0x33**) (Direct Mono Select = **0x34**)

Tnr1 Stereo Select	F0 00 7D 00 00 00 70 05 02 01 00 02 01 00 33 00 70 00 00 00 01 21 F7
Tnr1 Mono Select	F0 00 7D 00 00 00 70 05 02 01 00 02 01 00 34 00 70 00 00 00 01 22 F7
Tnr2 Stereo Select	F0 00 7D 01 00 00 70 05 02 01 00 02 01 00 33 00 70 00 01 00 01 23 F7
Tnr2 Mono Select	F0 00 7D 01 00 00 70 05 02 01 00 02 01 00 34 00 70 00 01 00 01 24 F7

6.7 Local / Distant Toggle

The Local / Distant Toggle message switches back and forth between Local Tuning mode and Distant Tuning mode.

Byte #	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23
Value	F0	00	7D	**kk**	00	00	70	05	02	01	00	02	01	00	**14**	00	70	00	**kk**	00	01	**xx**	F7

kk = Source Number (Source 1 = **0x00** … Source 6 = **0x05**)
xx = Checksum
Byte #15 = Event ID (Local / Distant Toggle = **0x14**)

Tnr1Local/DistantTgl	F0 00 7D 00 00 00 70 05 02 01 00 02 01 00 14 00 70 00 00 00 01 02 F7
Tnr2Local/DistantTgl	F0 00 7D 01 00 00 70 05 02 01 00 02 01 00 14 00 70 00 01 00 01 04 F7

6.8 Direct Local Select / Direct Distant Select

The Direct Local Select and Direct Distant Select functions discreetly select the Local Tuning mode or Distant Tuning mode.

Byte #	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23
Value	F0	00	7D	**kk**	00	00	70	05	02	01	00	02	01	00	##	00	70	00	**kk**	00	01	**xx**	F7

kk = Source Number (Source 1 = **0x00** … Source 6 = **0x05**)
xx = Checksum
Byte #15 = Event ID (Direct Local Select = **0x42**) (Direct Distant Select = **0x43**)

Tnr1 Local Sel	F0 00 7D 00 00 00 70 05 02 01 00 02 01 00 42 00 70 00 00 00 01 30 F7
Tnr1 Distant Sel	F0 00 7D 00 00 00 70 05 02 01 00 02 01 00 43 00 70 00 00 00 01 31 F7
Tnr2 Local Sel	F0 00 7D 01 00 00 70 05 02 01 00 02 01 00 42 00 70 00 01 00 01 32 F7
Tnr2 Distant Sel	F0 00 7D 01 00 00 70 05 02 01 00 02 01 00 43 00 70 00 01 00 01 33 F7

7 Satellite Radio Tuner Control Messages (XM and Sirius)

This section provides information in regards to messages that apply specifically to the XM Tuner and Sirius Tuner modules. This will include Category selection commands.

7.1 Category Up / Category Down

Category Up and Category Down will select the next or previous Category relative to the currently selected Category.
NOTE: Once a Category is selected, the first Channel of that Category will be selected.

Byte #	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23
Value	F0	00	7D	**kk**	00	00	70	05	02	01	00	02	01	00	##	00	70	00	**kk**	00	01	**xx**	F7

kk = Source Number (Source 1 = **0x00** … Source 6 = **0x05**)
xx = Checksum
Byte #15 = Event ID (Category Up = **0x54**) (Category Down = **0x55**)

Tnr1 Category Up	F0 00 7D 00 00 00 70 05 02 01 00 02 01 00 54 00 70 00 00 00 01 42 F7
Tnr1 Category Dn	F0 00 7D 00 00 00 70 05 02 01 00 02 01 00 55 00 70 00 00 00 01 43 F7
Tnr2 Category Up	F0 00 7D 01 00 00 70 05 02 01 00 02 01 00 54 00 70 00 01 00 01 44 F7
Tnr2 Category Dn	F0 00 7D 01 00 00 70 05 02 01 00 02 01 00 55 00 70 00 01 00 01 45 F7

7.2 Direct Category Select

This section describes how to initiate Direct Category Selection of an XM or Sirius Category (e.g., Hits, Rock, Classical, etc...). Direct Category Selection will select a particular XM or Sirius Category using a discrete command.
NOTE: Once a Category is selected, the first Channel of that Category will be selected.

Byte #	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23
Value	F0	00	7D	**kk**	00	00	70	05	02	01	00	02	01	00	**4D**	00	##	00	**kk**	00	01	**xx**	F7

kk = Source Number (Source 1 = **0x00** … Source 6 = **0x05**)
xx = Checksum

Byte #15 = Event ID (Direct Category Select = **0x4D**)
Byte #17 = Category HEX Value (XM Category = **See list***) (Sirius Category = **See list***)

***Satellite Radio Category List:**
NOTE: While it is not expected that the Category List will change, it is not ruled out by XM or Sirius Satellite Radio.

Value (HEX)	XM Category	Sirius Category
00	None	Pop
01	Decades	Rock
02	Country	Electronica / Dance
03	Hits	Hip-Hop
04	Christian	Country
05	Rock	Jazz / Standards
06	Urban	Classical
07	Jazz & Blues	Latin / International
08	Lifestyle	Sports
09	Dance	Entertainment
0A	Latin	News / Talk
0B	World	Traffic / Weather
0C	Classical	N/A
0D	Kids	N/A
0E	News	N/A
0F	Sports	N/A
10	Comedy	N/A
11	Talk & Entertainment	N/A
12	Special Events	N/A
13	Traffic	N/A

7.3 Category Channel Up / Category Channel Down

Category Channel Up and Category Channel Down will toggle up and down through the channels within the currently selected Satellite Radio Category.
Example: If XM is selected to the Category "Decades" a Category Channel Up message will toggle up only through the Channels that are within the Category "Decades".

Byte #	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23
Value	F0	00	7D	**kk**	00	00	70	05	02	01	00	02	01	00	**##**	00	70	00	**kk**	00	01	**xx**	F7

kk = Source Number (Source 1 = **0x00** … Source 6 = **0x05**)
xx = Checksum
Byte #15 = Event ID (Category Channel Up = **0x58**) (Category Channel Down = **0x59**)
Tnr1 Category ChUp F0 00 7D 00 00 00 70 05 02 01 00 02 01 00 58 00 70 00 00 00 01 46 F7
Tnr1 Category ChDn F0 00 7D 00 00 00 70 05 02 01 00 02 01 00 59 00 70 00 00 00 01 47 F7
Tnr2 Category ChUp F0 00 7D 01 00 00 70 05 02 01 00 02 01 00 58 00 70 00 01 00 01 48 F7
Tnr2 Category ChDn F0 00 7D 01 00 00 70 05 02 01 00 02 01 00 59 00 70 00 01 00 01 49 F7

8 Display Messages

The following section describes how to read Display Messages. These include Direct Display Feedback messages, Source Broadcast Display Feedback messages, and Multi-Field Broadcast Display Feedback messages. Display messages have a payload which consists of several components: Alignment, Flash Time, the actual Text, the Null Terminating byte, and possibly several arbitrary values that should be ignored. The message can be displayed for a constant amount of time, or a "Flash" display with a specified length of time (Flash Time is in increments of 10ms). The Null Terminating Byte is the Byte consisting of a HEX value **0x00** immediately following the last character of the Text. Any additional Bytes between the Null Terminating Byte and the Checksum are arbitrary values that should be ignored. It is possible that some Display messages will include the special "Invert" character "0xF1" (refer to **section 4.2**)

NOTE: *In order to fully support the display capabilities, Direct Display feedback messages, Source Broadcast Feedback messages and Multi-Field Broadcast Messages, should be supported.*

8.1 Reading Direct Display Feedback

Direct Display Feedback messages are usually sent in direct response to a received command (Example: **AM/FM Tuner = Source 3** with the current frequency being "**102.7 MHz FM**", sending the "**Tune Up**" command as shown in **section 5.2** will trigger the Tuner to send a Display message back to the sender to update the frequency Display to "**102.9 MHz FM**"). The Direct Display Feedback message is sent directly to the Target Device ID of the message sender.

NOTE: *Some of the other bytes within this message may vary. Only the ones necessary to interpret the message are highlighted.*

This is what the Direct Display Feedback message would look like using the above example.

Byte #	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23
Value	F0	**00**	**00**	**70**	00	7D	**02**	00	02	01	01	02	01	01	00	00	01	00	**28**	00	**01**	**00**	**00**

Byte #	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46
Value	**31**	**30**	**32**	**2E**	**39**	**20**	**4D**	**48**	**7A**	**20**	**46**	**4D**	**00**	5A	5A	5A	5A	5A	5A	5A	5A	5A	5A

Byte #	47	48	49	50	51	52	53	54	55	56	57	58	59	60	61	62
Value	5A	5A	5A	5A	5A	5A	5A	5A	5A	5A	5A	5A	5A	5A	**19**	F7

Byte #2 – #4 = Target Device ID (The Device ID of the device that sent the Tune Up command)
Byte #7 = Source Number (Source 1 = **0x00** … Source 6 = **0x05**)
Byte #19 = Overall Payload Size
Byte #21 = Alignment (left = **0x01**) (center = **0x00**)
Byte #22 = Flash Time low byte (Flash time is in 10ms increments, **0x00** = Constant)
Byte #23 = Flash Time high byte
Byte #24 – #35 = Text (**102.9 MHz FM**) Refer to ASCII Conversion Chart
Byte #36 = Null Terminating Byte
Byte #61 = Calculated Checksum

8.2 Reading Source Broadcast Display Feedback

This section describes how to read Source Broadcast Display Feedback messages. These Feedback messages are sent to update all devices monitoring a given Source's status. These messages may be sent as a direct result of a sent command or as a general update. The Display Feedback message includes the Source Number indicating which Source the update is intended.

NOTE: *Some of the other bytes within this message may vary. Only the ones necessary to interpret the message are highlighted.*

This example shows a Source Broadcast Display Feedback message with text "**102.9 MHz FM**"

Byte #	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23
Value	F0	7D	00	**79**	00	7D	**02**	00	02	01	01	02	01	01	00	00	01	00	**28**	00	**12**	**00**	**00**

Byte #	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46
Value	**31**	**30**	**32**	**2E**	**39**	**20**	**4D**	**48**	**7A**	**20**	**46**	**4D**	**00**	5A	5A	5A	5A	5A	5A	5A	5A	5A	5A

Byte #	47	48	49	50	51	52	53	54	55	56	57	58	59	60	61	62
Value	5A	5A	5A	5A	5A	5A	5A	5A	5A	5A	5A	5A	5A	5A	**30**	F7

Byte #4 = Target Keypad ID (**NOTE**: A value of **0x79** in the Target Keypad ID field indicates that this message is a Broadcast Display Feedback message.)
Byte #7 = Source Number (Source 1 = **0x00** … Source 6 = **0x05**)
Byte #19 = Overall Payload Size
Byte #21 = Message Type **OR**-ed with the Source Number *****(See equation below)
Byte #22 = Flash Time low byte (Flash time is in 10ms increments, **0x00** = Constant)
Byte #23 = Flash Time high byte
Byte #24 – #35 = Text (**102.9 MHz FM**) Refer to ASCII Conversion Chart
Byte #36 = Null Terminating Byte
Byte #61 = Calculated Checksum

***Byte #21 Equation:**
In order to calculate the HEX value for **Byte #21** you must take the value for Source Broadcast Display Type (**0x10**) and "**OR**" it with the value of the Source Number that the message applies to (Source 1 = **0x00** … Source 6 = **0x05**).
Here is the equation for **Byte #21** using the above example as **Source 3**

Source Broadcast Display Type	**OR**	Source Number	**=**	**Byte #21**
0x10		**0x02**		**0x12**

8.3 Reading Multi-Field Broadcast Display Feedback Messages

Multi-Field Broadcast Display Feedback messages are only used with Satellite Radio. Multi-Field Broadcast Display Feedback messages are sent to update all devices monitoring a given Source's status and are sent as a direct result of a sent command or as a general update. The Display Feedback message includes the Source Number indicating which Source the update is intended. A "Field ID" is included with the message to indicate which text item is being updated (see table below). Example: Sirius Tuner = **Source 2**, Channel Name = **20:Octane**

Satellite Radio Display "Field ID" list

Field ID (first 6 bits)	**Display Field**
1	Song Title
2	Artist
3	Genre
6	Channel Number
7	Channel Name

NOTE: *Some of the other bytes within this message may vary. Only the ones necessary to interpret the message are highlighted.*

This example shows a Multi-Field Broadcast Display Feedback message with text "**20:Octane**"

Byte #	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23
Value	F0	7D	00	**79**	00	7D	**01**	00	02	01	01	02	01	01	00	00	01	00	**28**	00	**21**	**07**	1C

Byte #	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46
Value	**32**	**30**	**3A**	**4F**	**63**	**74**	**61**	**6E**	**65**	**00**	5A	5A	5A	5A	5A	5A	5A	5A	5A	5A	5A	5A	5A

Byte #	47	48	49	50	51	52	53	54	55	56	57	58	59	60	61	62
Value	5A	5A	5A	5A	5A	5A	5A	5A	5A	5A	5A	5A	5A	5A	**09**	F7

Byte #4 = Target Keypad ID (**NOTE**: A value of **0x79** in the Target Keypad ID field indicates that this message is a Broadcast Display Feedback message.)
Byte #7 = Source Number (Source 1 = **0x00** … Source 6 = **0x05**)
Byte #19 = Overall Payload Size
Byte #21 = Message Type **OR**-ed with the Source Number ***** (See equation below)
Byte #22 = Flash Bit and **Field ID** Bits ****** (See explanation below)
Bytes #24 – #32 = Text (**20:Octane**) Refer to ASCII Conversion Chart
Byte #33 = Null Terminating Byte
Byte #61 = Calculated Checksum

***Byte #21 Equation:**
In order to calculate the HEX value for **Byte #21** you must take the value for Multi-Field Broadcast Display Type (**0x20**) and "**OR**" it with the value of the Source Number that the message applies to (Source 1 = **0x00** … Source 6 = **0x05**).
Here is the equation for **Byte #21** using the above example as **Source 2**

Multi-Field Display Type	**OR**	Source Number	**=**	**Byte #21**
0x20		**0x01**		**0x21**

****Byte #22 Explanation:**
Here is a breakdown of the **8-Bits** in **Byte #22**
-**Bits 0 – 5** = Field Id (i.e., **0x07** = **0x47** = **0x87** = **7** = **Channel Name**) Refer to the Field ID list
-**Bits 6 and 7** are to be ignored
-**NOTE**: The special Invert Character (**0xF1**) will be inserted before this Byte if Bit 7 **is** set

9 Using the Acknowledge Message (Handshaking)

A Peripheral Source such as the Dual Tuner does not require Handshaking when the Keypad ID within the Source Device ID is set to **0x70**. If using a Source Device Keypad ID of **0x70**, and therefore **no** Handshaking, it is best to leave approximately 100ms between messages to ensure that all messages are processed correctly. If Handshaking is desired, it is recommended to use a Source Device Keypad ID of **0x60**. In this case, the Target Device will send an Acknowledge message in response to any High Priority Event messages. Acknowledge messages can be (and normally are) used to trigger the release of any additional messages that may be in the sender's queue.

Example: This is a "Tune Up" Event message sent to a Tuner. Notice that the Event Priority Byte is set to **0x00** (high) and the Source Device Keypad ID is set to **0x60**. This means that the Tuner will send an Acknowledge message in response.

Byte #	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23
Value	F0	00	7D	**kk**	00	00	**60**	05	02	01	00	02	01	00	**2F**	00	**70**	00	**kk**	00	**00**	**xx**	F7

kk = Source Number (Source 1 = **0x00** … Source 6 = **0x05**)
xx = Calculated Checksum
Byte #7 = Source Device Keypad ID **- 0x60** (indicates that this message requires a Handshake message if the Event Priority is High)
Byte #15 = Event ID (Tune Up = **0x2F**)
Byte #17 = Return Keypad ID **- 0x70** (This is the Keypad ID that will receive any resulting Direct Display Feedback message from the Tuner. If this byte is set to **0x70**, it will not require the Source Device to send an Acknowledge message in response to the Direct Display Feedback message. If the original Source Device Keypad ID of **0x60** is used here, you will need to send an Acknowledge message when the Direct Display Feedback message comes back. Failure to send the Acknowledge message will result in a system delay of approximately 2.5 seconds, while the Tuner tries to re-send the data.) **NOTE**: It is recommended to leave this Byte as **0x70**
Byte #21 = Event Priority (High = **0x00**) (Low = **0x01**)

Example: This is an Acknowledge message returned to the Source Device in response to the High Priority Event message of Tune Up as seen above.

Byte #	1	2	3	4	5	6	7	8	9	10	11
Value	F0	00	00	60	00	7D	**kk**	**02**	**06**	**xx**	F7

kk = Source Number of Event recipient (Source 1 = **0x00** … Source 6 = **0x05**)
xx = Calculated Checksum
Byte #8 = Message Type (Handshake = **0x02**)
Byte #9 = Handshake Type (Event Handshake = **0x06**) *See Handshake Types

***Handshake Types**

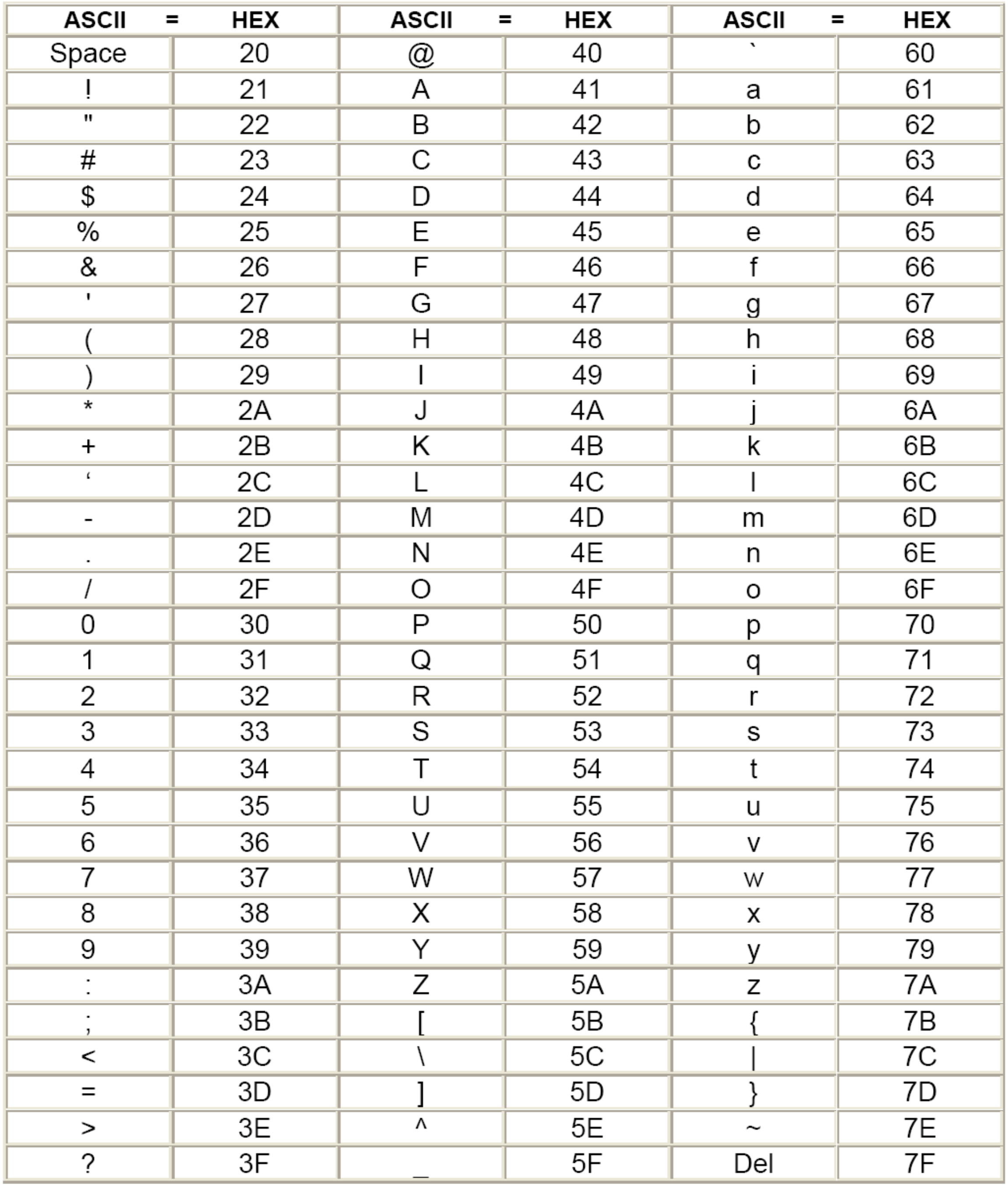
Value (HEX)	Handshake Type
0x02	Data Handshake
0x06	Event Handshake

10 Command Code Summary for Peripheral Tuner

Tuner Command Event IDs	HEX Value (Byte 15)	Document Sections
Common Commands		
DIGIT #0	**0A**	5.3
DIGIT #1	**01**	5.3
DIGIT #2	**02**	5.3
DIGIT #3	**03**	5.3
DIGIT #4	**04**	5.3
DIGIT #5	**05**	5.3
DIGIT #6	**06**	5.3
DIGIT #7	**07**	5.3
DIGIT #8	**08**	5.3
DIGIT #9	**09**	5.3
PRESET UP	**0E**	5.5
PRESET DOWN	**0F**	5.5
DIRECT BANK SELECTION MODE	**15**	5.8
DIRECT PRESET SELECTION MODE	**16**	5.6
DIRECT TUNING MODE (**FREQ** or **CHAN**)	**17**	5.3
BANK UP	**29**	5.7
BANK DOWN	**2A**	5.7
TUNE UP (**FREQUENCY** or **CHANNEL**)	**2F**	5.2
TUNE DOWN (**FREQUENCY** or **CHANNEL**)	**30**	5.2
POWER ON	**3A**	5.1
POWER OFF	**3B**	5.1
PRESET SAVE	**3C - 41**	5.4
AM/FM Commands		
SEEK	**1B**	6.1
SCAN	**46**	6.2
AM FM TOGGLE	**1A**	6.3
FM SELECT	**49**	6.4
AM SELECT	**4A**	6.4
STEREO / MONO TOGGLE	**13**	6.5
DIRECT STEREO SELECT	**33**	6.6
DIRECT MONO SELECT	**34**	6.6
LOCAL / DISTANT TOGGLE	**14**	6.7
DIRECT LOCAL SELECT	**42**	6.8
DIRECT DISTANT SELECT	**43**	6.8
Satellite Radio Commands (XM and Sirius)		

CATEGORY SELECT	**4D**	7.2
CATEGORY UP	**54**	7.1
CATEGORY DOWN	**55**	7.1
CAT CHANNEL UP	**58**	7.3
CAT CHANNEL DOWN	**59**	7.3

11 ASCII Character Set to HEX Conversion Chart



ASCII =	HEX	ASCII =	HEX	ASCII =	HEX
Space	20	@	40	`	60
!	21	A	41	a	61
"	22	B	42	b	62
#	23	C	43	c	63
$	24	D	44	d	64
%	25	E	45	e	65
&	26	F	46	f	66
'	27	G	47	g	67
(	28	H	48	h	68
)	29	I	49	i	69
*	2A	J	4A	j	6A
+	2B	K	4B	k	6B
‘	2C	L	4C	l	6C
-	2D	M	4D	m	6D
.	2E	N	4E	n	6E
/	2F	O	4F	o	6F
0	30	P	50	p	70
1	31	Q	51	q	71
2	32	R	52	r	72
3	33	S	53	s	73
4	34	T	54	t	74
5	35	U	55	u	75
6	36	V	56	v	76
7	37	W	57	w	77
8	38	X	58	x	78
9	39	Y	59	y	79
:	3A	Z	5A	z	7A
;	3B	[	5B	{	7B
<	3C	\	5C	|	7C
=	3D	]	5D	}	7D
>	3E	^	5E	~	7E
?	3F	_	5F	Del	7F

12 Russound ST2 RS-232 Hex Code Listing

The ST2 has a default source setting of 1 and 2 (tuner1=source1/tuner2=source2)
The following codes are defined assuming that the ST2 is left at this default setting.

Tnr1 Power On	F0 00 7D 00 00 00 70 05 02 01 00 02 01 00 3A 00 70 00 00 00 01 28 F7
Tnr1 Power Off	F0 00 7D 00 00 00 70 05 02 01 00 02 01 00 3B 00 70 00 00 00 01 29 F7
Tnr2 Power On	F0 00 7D 01 00 00 70 05 02 01 00 02 01 00 3A 00 70 00 01 00 01 30 F7
Tnr2 Power Off	F0 00 7D 01 00 00 70 05 02 01 00 02 01 00 3B 00 70 00 01 00 01 31 F7
Tnr1 Tune Up	F0 00 7D 00 00 00 70 05 02 01 00 02 01 00 2F 00 70 00 00 00 01 1D F7
Tnr1 Tune Dn	F0 00 7D 00 00 00 70 05 02 01 00 02 01 00 30 00 70 00 00 00 01 1E F7
Tnr2 Tune Up	F0 00 7D 01 00 00 70 05 02 01 00 02 01 00 2F 00 70 00 01 00 01 1F F7
Tnr2 Tune Dn	F0 00 7D 01 00 00 70 05 02 01 00 02 01 00 30 00 70 00 01 00 01 20 F7
Enter Direct Tuning Mode	
Tnr1	F0 00 7D 00 00 00 70 05 02 01 00 02 01 00 17 00 70 00 00 00 01 05 F7
Tnr2	F0 00 7D 01 00 00 70 05 02 01 00 02 01 00 17 00 70 00 01 00 01 07 F7
Tnr1 Digit-0	F0 00 7D 00 00 00 70 05 02 01 00 02 01 00 0A 00 70 00 00 00 01 78 F7
Tnr1 Digit-1	F0 00 7D 00 00 00 70 05 02 01 00 02 01 00 01 00 70 00 00 00 01 6F F7
Tnr1 Digit-2	F0 00 7D 00 00 00 70 05 02 01 00 02 01 00 02 00 70 00 00 00 01 70 F7
Tnr1 Digit-3	F0 00 7D 00 00 00 70 05 02 01 00 02 01 00 03 00 70 00 00 00 01 71 F7
Tnr1 Digit-4	F0 00 7D 00 00 00 70 05 02 01 00 02 01 00 04 00 70 00 00 00 01 72 F7
Tnr1 Digit-5	F0 00 7D 00 00 00 70 05 02 01 00 02 01 00 05 00 70 00 00 00 01 73 F7
Tnr1 Digit-6	F0 00 7D 00 00 00 70 05 02 01 00 02 01 00 06 00 70 00 00 00 01 74 F7
Tnr1 Digit-7	F0 00 7D 00 00 00 70 05 02 01 00 02 01 00 07 00 70 00 00 00 01 75 F7
Tnr1 Digit-8	F0 00 7D 00 00 00 70 05 02 01 00 02 01 00 08 00 70 00 00 00 01 76 F7
Tnr1 Digit-9	F0 00 7D 00 00 00 70 05 02 01 00 02 01 00 09 00 70 00 00 00 01 77 F7
Tnr2 Digit-0	F0 00 7D 01 00 00 70 05 02 01 00 02 01 00 0A 00 70 00 01 00 01 7A F7
Tnr2 Digit-1	F0 00 7D 01 00 00 70 05 02 01 00 02 01 00 01 00 70 00 01 00 01 71 F7
Tnr2 Digit-2	F0 00 7D 01 00 00 70 05 02 01 00 02 01 00 02 00 70 00 01 00 01 72 F7
Tnr2 Digit-3	F0 00 7D 01 00 00 70 05 02 01 00 02 01 00 03 00 70 00 01 00 01 73 F7
Tnr2 Digit-4	F0 00 7D 01 00 00 70 05 02 01 00 02 01 00 04 00 70 00 01 00 01 74 F7
Tnr2 Digit-5	F0 00 7D 01 00 00 70 05 02 01 00 02 01 00 05 00 70 00 01 00 01 75 F7
Tnr2 Digit-6	F0 00 7D 01 00 00 70 05 02 01 00 02 01 00 06 00 70 00 01 00 01 76 F7
Tnr2 Digit-7	F0 00 7D 01 00 00 70 05 02 01 00 02 01 00 07 00 70 00 01 00 01 77 F7
Tnr2 Digit-8	F0 00 7D 01 00 00 70 05 02 01 00 02 01 00 08 00 70 00 01 00 01 78 F7
Tnr2 Digit-9	F0 00 7D 01 00 00 70 05 02 01 00 02 01 00 09 00 70 00 01 00 01 79 F7
Tnr1 Preset1	F0 00 7D 00 00 00 70 05 02 01 00 02 01 00 3C 00 70 00 00 00 01 2A F7
Tnr1 Preset2	F0 00 7D 00 00 00 70 05 02 01 00 02 01 00 3D 00 70 00 00 00 01 2B F7
Tnr1 Preset3	F0 00 7D 00 00 00 70 05 02 01 00 02 01 00 3E 00 70 00 00 00 01 2C F7
Tnr1 Preset4	F0 00 7D 00 00 00 70 05 02 01 00 02 01 00 3F 00 70 00 00 00 01 2D F7
Tnr1 Preset5	F0 00 7D 00 00 00 70 05 02 01 00 02 01 00 40 00 70 00 00 00 01 2E F7
Tnr1 Preset6	F0 00 7D 00 00 00 70 05 02 01 00 02 01 00 41 00 70 00 00 00 01 2F F7
Tnr2 Preset1	F0 00 7D 01 00 00 70 05 02 01 00 02 01 00 3C 00 70 00 01 00 01 2C F7

Tnr2 Preset2	F0 00 7D 01 00 00 70 05 02 01 00 02 01 00 3D 00 70 00 01 00 01 2D F7
Tnr2 Preset3	F0 00 7D 01 00 00 70 05 02 01 00 02 01 00 3E 00 70 00 01 00 01 2E F7
Tnr2 Preset4	F0 00 7D 01 00 00 70 05 02 01 00 02 01 00 3F 00 70 00 01 00 01 2F F7
Tnr2 Preset5	F0 00 7D 01 00 00 70 05 02 01 00 02 01 00 40 00 70 00 01 00 01 30 F7
Tnr2 Preset6	F0 00 7D 01 00 00 70 05 02 01 00 02 01 00 41 00 70 00 01 00 01 31 F7

Tnr1 Preset Up	F0 00 7D 00 00 00 70 05 02 01 00 02 01 00 3A 00 70 00 00 00 01 28 F7
Tnr1 Preset Dn	F0 00 7D 00 00 00 70 05 02 01 00 02 01 00 3B 00 70 00 00 00 01 29 F7
Tnr2 Preset Up	F0 00 7D 01 00 00 70 05 02 01 00 02 01 00 3A 00 70 01 00 00 01 30 F7
Tnr2 Preset Dn	F0 00 7D 01 00 00 70 05 02 01 00 02 01 00 3B 00 70 01 00 00 01 31 F7

Enter Direct Preset Select Mode

Tnr1	F0 00 7D 00 00 00 70 05 02 01 00 02 01 00 16 00 70 00 00 00 01 04 F7
Tnr2	F0 00 7D 01 00 00 70 05 02 01 00 02 01 00 16 00 70 00 01 00 01 06 F7
Tnr1 Digit-1	F0 00 7D 00 00 00 70 05 02 01 00 02 01 00 01 00 70 00 00 00 01 6F F7
Tnr1 Digit-2	F0 00 7D 00 00 00 70 05 02 01 00 02 01 00 02 00 70 00 00 00 01 70 F7
Tnr1 Digit-3	F0 00 7D 00 00 00 70 05 02 01 00 02 01 00 03 00 70 00 00 00 01 71 F7
Tnr1 Digit-4	F0 00 7D 00 00 00 70 05 02 01 00 02 01 00 04 00 70 00 00 00 01 72 F7
Tnr1 Digit-5	F0 00 7D 00 00 00 70 05 02 01 00 02 01 00 05 00 70 00 00 00 01 73 F7
Tnr1 Digit-6	F0 00 7D 00 00 00 70 05 02 01 00 02 01 00 06 00 70 00 00 00 01 74 F7

Tnr2 Digit-0	F0 00 7D 01 00 00 70 05 02 01 00 02 01 00 0A 00 70 00 01 00 01 7A F7
Tnr2 Digit-1	F0 00 7D 01 00 00 70 05 02 01 00 02 01 00 01 00 70 00 01 00 01 71 F7
Tnr2 Digit-2	F0 00 7D 01 00 00 70 05 02 01 00 02 01 00 02 00 70 00 01 00 01 72 F7
Tnr2 Digit-3	F0 00 7D 01 00 00 70 05 02 01 00 02 01 00 03 00 70 00 01 00 01 73 F7
Tnr2 Digit-4	F0 00 7D 01 00 00 70 05 02 01 00 02 01 00 04 00 70 00 01 00 01 74 F7
Tnr2 Digit-5	F0 00 7D 01 00 00 70 05 02 01 00 02 01 00 05 00 70 00 01 00 01 75 F7
Tnr2 Digit-6	F0 00 7D 01 00 00 70 05 02 01 00 02 01 00 06 00 70 00 01 00 01 76 F7

Tnr1 Bank Up	F0 00 7D 00 00 00 70 05 02 01 00 02 01 00 29 00 70 00 00 00 01 17 F7
Tnr1 Bank Dn	F0 00 7D 00 00 00 70 05 02 01 00 02 01 00 2A 00 70 00 00 00 01 18 F7
Tnr2 Bank Up	F0 00 7D 01 00 00 70 05 02 01 00 02 01 00 29 00 70 01 00 00 01 19 F7
Tnr2 Bank Dn	F0 00 7D 01 00 00 70 05 02 01 00 02 01 00 2A 00 70 01 00 00 01 1A F7

Enter Direct Bank Mode

Tnr1	F0 00 7D 00 00 00 70 05 02 01 00 02 01 00 15 00 70 00 00 00 01 03 F7
Tnr2	F0 00 7D 01 00 00 70 05 02 01 00 02 01 00 15 00 70 00 01 00 01 05 F7

Tnr1 Digit-1	F0 00 7D 00 00 00 70 05 02 01 00 02 01 00 01 00 70 00 00 00 01 6F F7
Tnr1 Digit-2	F0 00 7D 00 00 00 70 05 02 01 00 02 01 00 02 00 70 00 00 00 01 70 F7
Tnr1 Digit-3	F0 00 7D 00 00 00 70 05 02 01 00 02 01 00 03 00 70 00 00 00 01 71 F7
Tnr1 Digit-4	F0 00 7D 00 00 00 70 05 02 01 00 02 01 00 04 00 70 00 00 00 01 72 F7
Tnr1 Digit-5	F0 00 7D 00 00 00 70 05 02 01 00 02 01 00 05 00 70 00 00 00 01 73 F7
Tnr1 Digit-6	F0 00 7D 00 00 00 70 05 02 01 00 02 01 00 06 00 70 00 00 00 01 74 F7

Tnr2 Digit-0	F0 00 7D 01 00 00 70 05 02 01 00 02 01 00 0A 00 70 00 01 00 01 7A F7
Tnr2 Digit-1	F0 00 7D 01 00 00 70 05 02 01 00 02 01 00 01 00 70 00 01 00 01 71 F7
Tnr2 Digit-2	F0 00 7D 01 00 00 70 05 02 01 00 02 01 00 02 00 70 00 01 00 01 72 F7

Tnr2 Digit-3	F0 00 7D 01 00 00 70 05 02 01 00 02 01 00 03 00 70 00 01 00 01 73 F7
Tnr2 Digit-4	F0 00 7D 01 00 00 70 05 02 01 00 02 01 00 04 00 70 00 01 00 01 74 F7
Tnr2 Digit-5	F0 00 7D 01 00 00 70 05 02 01 00 02 01 00 05 00 70 00 01 00 01 75 F7
Tnr2 Digit-6	F0 00 7D 01 00 00 70 05 02 01 00 02 01 00 06 00 70 00 01 00 01 76 F7
Tnr1 Seek	F0 00 7D 00 00 00 70 05 02 01 00 02 01 00 1B 00 70 00 00 00 01 09 F7
Tnr2 Seek	F0 00 7D 01 00 00 70 05 02 01 00 02 01 00 1B 00 70 00 01 00 01 0B F7
Tnr1 Scan	F0 00 7D 00 00 00 70 05 02 01 00 02 01 00 46 00 70 00 00 00 01 34 F7
Tnr2 Scan	F0 00 7D 01 00 00 70 05 02 01 00 02 01 00 46 00 70 00 01 00 01 36 F7
Tnr1 AM/FM Toggle	F0 00 7D 00 00 00 70 05 02 01 00 02 01 00 1A 00 70 00 00 00 01 08 F7
Tnr2 AM/FM Toggle	F0 00 7D 01 00 00 70 05 02 01 00 02 01 00 1A 00 70 00 01 00 01 0A F7
Tnr1 AM Select	F0 00 7D 00 00 00 70 05 02 01 00 02 01 00 4A 00 70 00 00 00 01 38 F7
Tnr1 FM Select	F0 00 7D 00 00 00 70 05 02 01 00 02 01 00 49 00 70 00 00 00 01 37 F7
Tnr2 AM Select	F0 00 7D 01 00 00 70 05 02 01 00 02 01 00 4A 00 70 00 01 00 01 3A F7
Tnr2 FM Select	F0 00 7D 01 00 00 70 05 02 01 00 02 01 00 49 00 70 00 01 00 01 39 F7
Tnr1Stero/MonoTggle	F0 00 7D 00 00 00 70 05 02 01 00 02 01 00 13 00 70 00 00 00 01 01 F7
Tnr2Stero/MonoTggle	F0 00 7D 01 00 00 70 05 02 01 00 02 01 00 13 00 70 00 01 00 01 03 F7
Tnr1 Stereo Select	F0 00 7D 00 00 00 70 05 02 01 00 02 01 00 33 00 70 00 00 00 01 21 F7
Tnr1 Mono Select	F0 00 7D 00 00 00 70 05 02 01 00 02 01 00 34 00 70 00 00 00 01 22 F7
Tnr2 Stereo Select	F0 00 7D 01 00 00 70 05 02 01 00 02 01 00 33 00 70 00 01 00 01 23 F7
Tnr2 Mono Select	F0 00 7D 01 00 00 70 05 02 01 00 02 01 00 34 00 70 00 01 00 01 24 F7
Tnr1Local/DistantTgl	F0 00 7D 00 00 00 70 05 02 01 00 02 01 00 14 00 70 00 00 00 01 02 F7
Tnr2Local/DistantTgl	F0 00 7D 01 00 00 70 05 02 01 00 02 01 00 14 00 70 00 01 00 01 04 F7
Tnr1 Local Sel	F0 00 7D 00 00 00 70 05 02 01 00 02 01 00 42 00 70 00 00 00 01 30 F7
Tnr1 Distant Sel	F0 00 7D 00 00 00 70 05 02 01 00 02 01 00 43 00 70 00 00 00 01 31 F7
Tnr2 Local Sel	F0 00 7D 01 00 00 70 05 02 01 00 02 01 00 42 00 70 00 01 00 01 32 F7
Tnr2 Distant Sel	F0 00 7D 01 00 00 70 05 02 01 00 02 01 00 43 00 70 00 01 00 01 33 F7
Tnr1 Category Up	F0 00 7D 00 00 00 70 05 02 01 00 02 01 00 54 00 70 00 00 00 01 42 F7
Tnr1 Category Dn	F0 00 7D 00 00 00 70 05 02 01 00 02 01 00 55 00 70 00 00 00 01 43 F7
Tnr2 Category Up	F0 00 7D 01 00 00 70 05 02 01 00 02 01 00 54 00 70 00 01 00 01 44 F7
Tnr2 Category Dn	F0 00 7D 01 00 00 70 05 02 01 00 02 01 00 55 00 70 00 01 00 01 45 F7
Tnr1 Category ChUp	F0 00 7D 00 00 00 70 05 02 01 00 02 01 00 58 00 70 00 00 00 01 46 F7
Tnr1 Category ChDn	F0 00 7D 00 00 00 70 05 02 01 00 02 01 00 59 00 70 00 00 00 01 47 F7
Tnr2 Category ChUp	F0 00 7D 01 00 00 70 05 02 01 00 02 01 00 58 00 70 00 01 00 01 48 F7
Tnr2 Category ChDn	F0 00 7D 01 00 00 70 05 02 01 00 02 01 00 59 00 70 00 01 00 01 49 F7