Tecnoroll BMB s.r.l.

FM/AM MODULATOR

FLEXMod

Rev. E, October 13 2014

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9. This board is just an 'electronic component' that cannot work in a standalone mode, therefore all the tests and qualifications for electromagnetic compatibility, all the CE certifications and any other regulations concerning the final product implemented by the customer are to be carried out by the customer himself referring to the final product for which this electronic component has been used.

Revision history

- October 9, 2013, dbrini@tecnoroll.it : first release.
- February 12, 2014. dbrini@tecnoroll.it: adapted to the firmware version 0.25.
- March 5, 2014. dbrini@tecnoroll.it: adapted to the firmware version 0.36.
- March 11, 2014 dbrini@tecnoroll.it: adapted to the firmware version 0.40.
- July 16, 2014 dbrini@tecnoroll.it: adapted to the firmware version 0.64.
- October 13, 2014 dbrini@tecnoroll.it: adapted to the firmware version 0.72.

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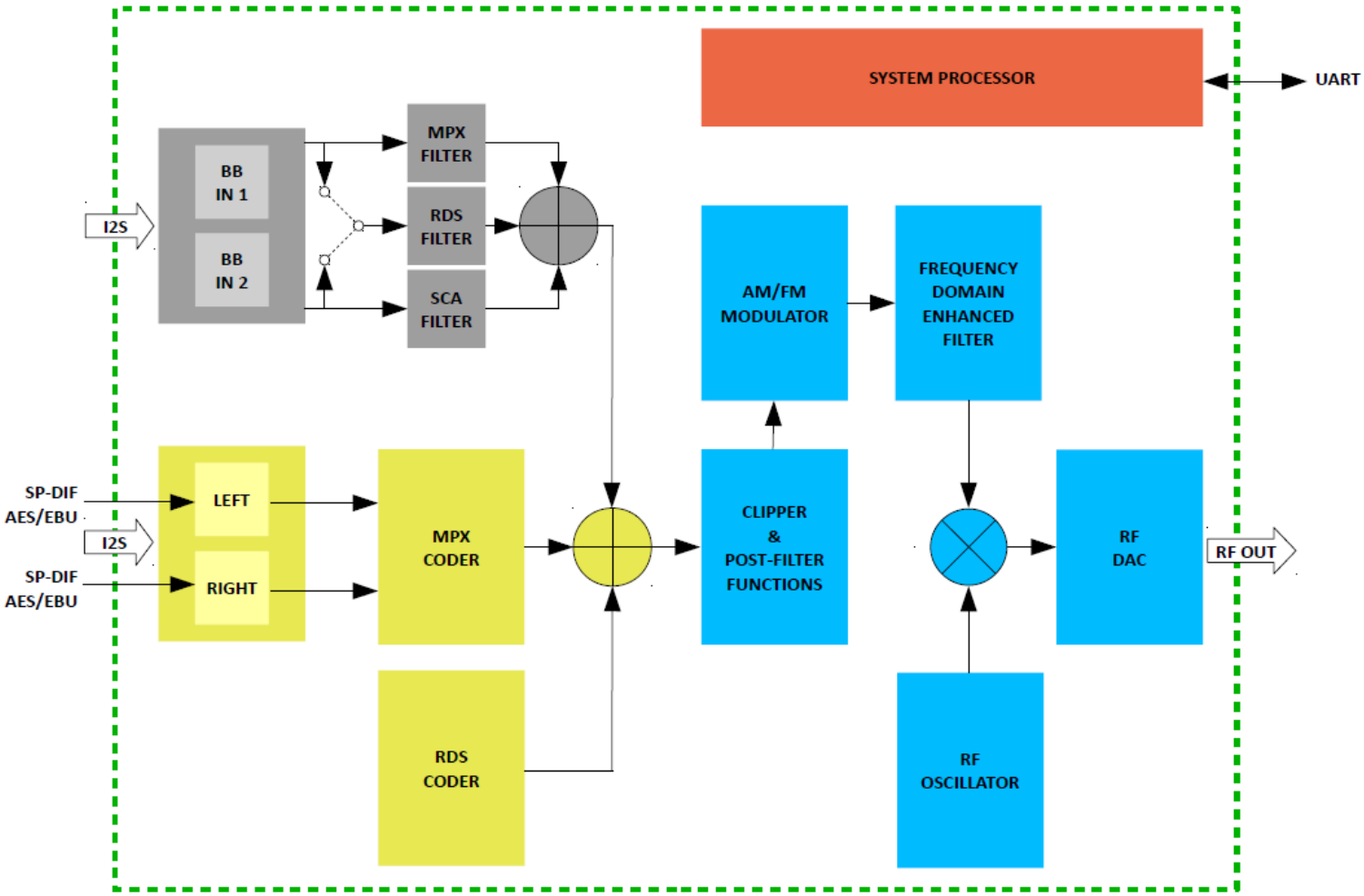
BLOCK DIAGRAM

Complete and versatile FM Modulator with integrated RDS and MPX coders, which can be bypassed when the MPX and RDS signals are coming from an external source. Thanks to the internal 1GHz DAC there is no need to add an upconverter, since the maximum power out can reach up to 0dBm.

The system is fully manageable through string commands sent via serial interface.



FLEXMOD 2 BOOTLOADER

Tecnoroll's modules have got an embedded bootloader which manages all the firmwares and applications that are stored into the modules themselves.

Before focusing on the FM modulator application, please take a moment to understand how to use the bootloader function.

To gain access to the bootloader, press <Enter> when the firmware is booting up and a series of dots appear on the terminal screen. A message will follow informing you that the booting process has been stopped: press <Enter> again to access the bootloader command line.

Bootloader functions:

- Manage several different firmwares on a single module (such as DVB-T, DVB-S and DVB-C modulators) and, if required, each time it is started, it allows the selection of the firmware to start by using the same procedure, rather than having to run different commands depending on the firmware running in that moment.
- Upgrade the firmware fail-safe. Since the firmware bootloader can be used to update all other firmwares, in case of problems, the bootloader firmware will still be running and will be able to be used to retry the update.
- Load new bitstreams into the memory in a fast and reliable way. It also supports high bitrates and XMODEM-CRC or XMODEM-1K protocols.

SERIAL COMUNICATION SETUP

The bootloader manages the user interface via serial communication. You can use any terminal to interact with it; for example, you can use Hyper-terminal, which is already present in Windows XP, and configure it according to the Figure 1. Please, also remember to set the ANSI emulation in the *"settings"* tab of the terminal connection properties (Figure 2).

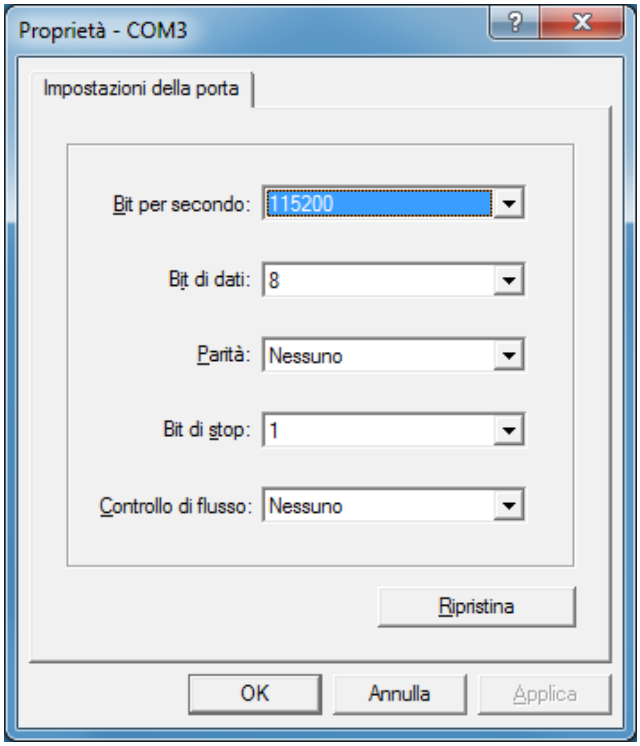


Figure 1

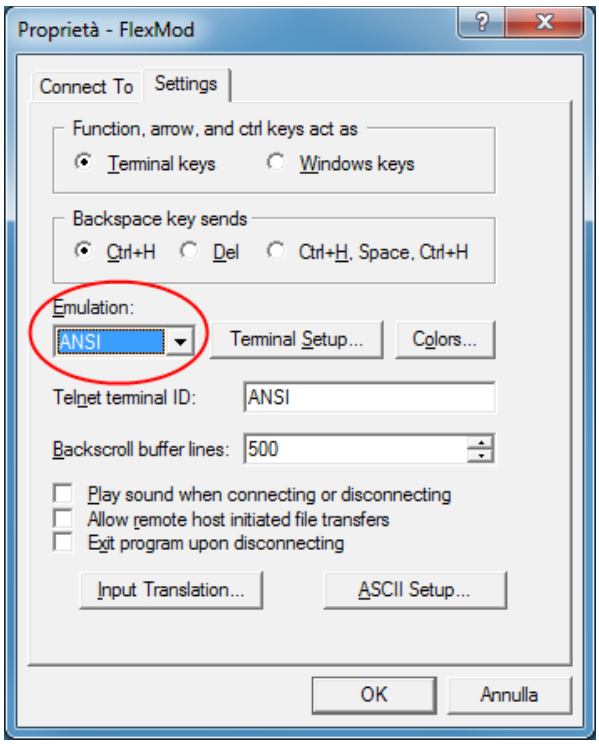


Figure 2

In order to optimize the upload speed of a desired bitstream into the flash memory, set the COM port latency to 1mS (shown below) and set the FLEXMod baudrate to 921600bit/s.

The setting of the COM port latency at 1ms is fundamental, if using the FM modulator.

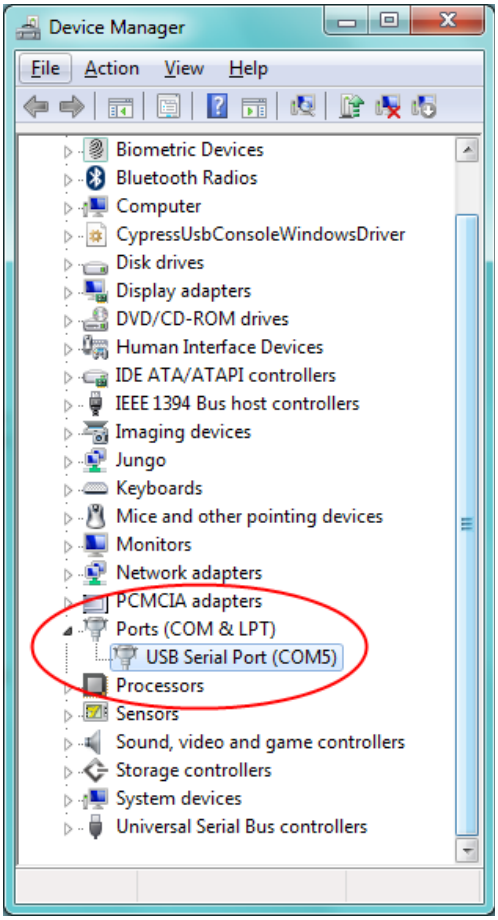


Figure 3 - Step 1

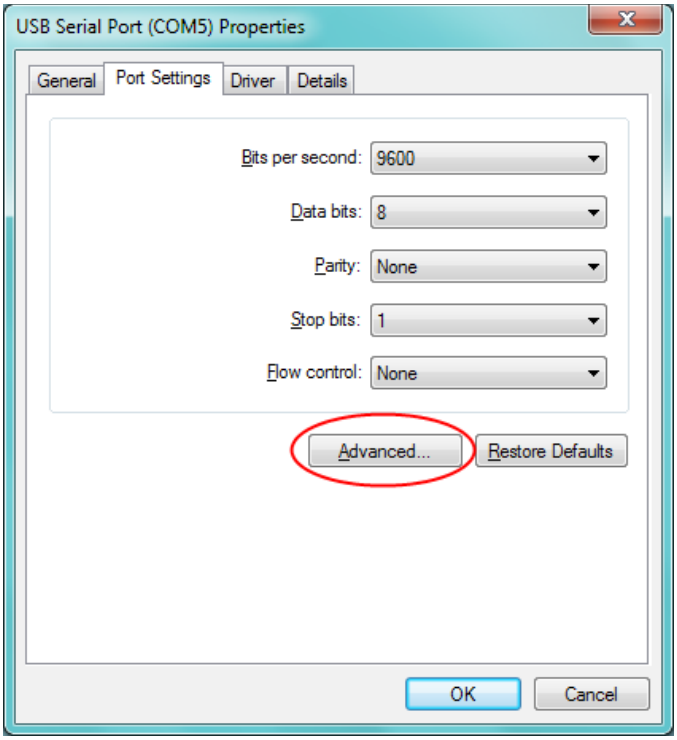


Figure 4 - Step 2

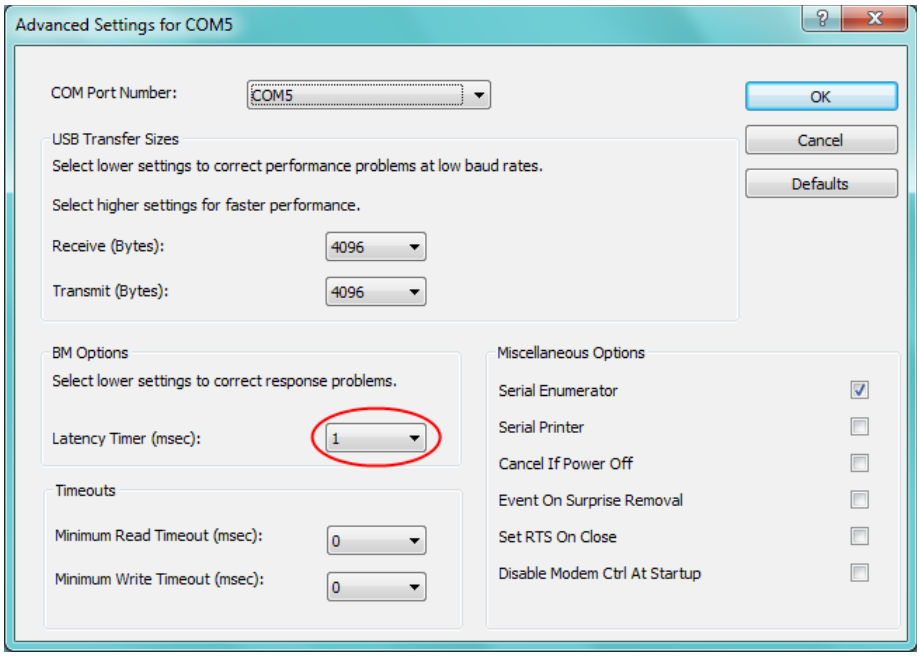


Figure 5 - Step 3

LOADING A BITSTREAM

It is possible to load a bitstream into the FLASH memory by using the ***LoadBitStream*** command.

In the above screenshot you can see the command help (accessible by typing the command followed by the <tab> key) with all the options and the typical syntax. Usually, only three parameters are enough to complete the process: the password, the location of the bitstream within the table and the bitstream name. The default transfer protocol is Xmodem-1K with CRC. If you want to change the upload mode, just add the optional corresponding parameters.

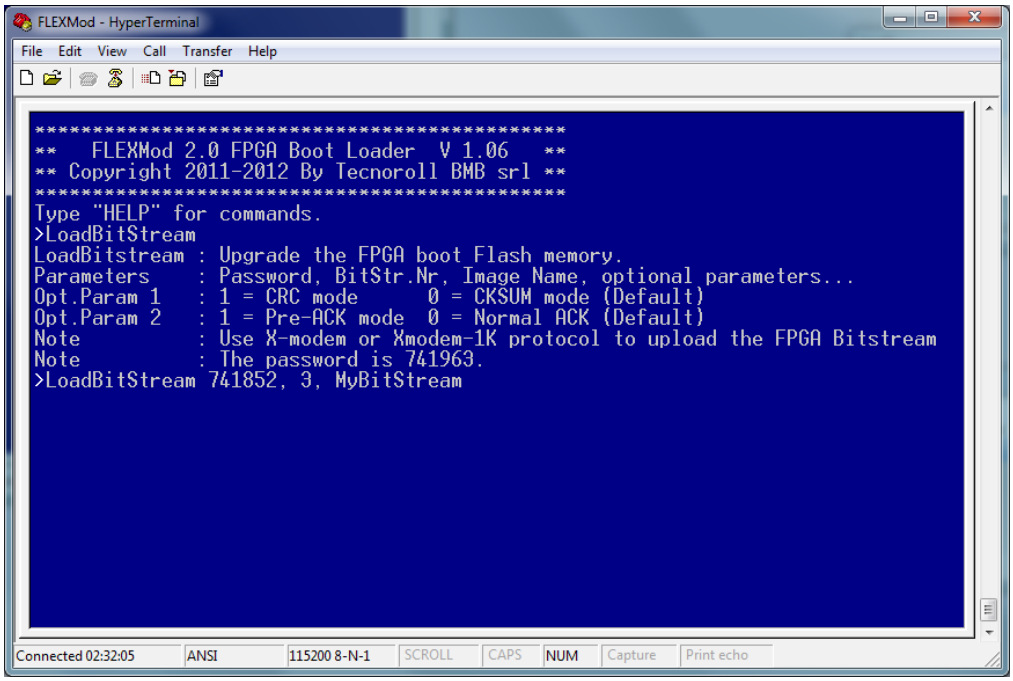


Figure 6

Once the <ENTER> key is pressed, you will see a sequence of characters. The module is now ready to receive the bitstream to be loaded. Select the "*Transfer*" and "*Send File*" option from the HyperTerminal menu.

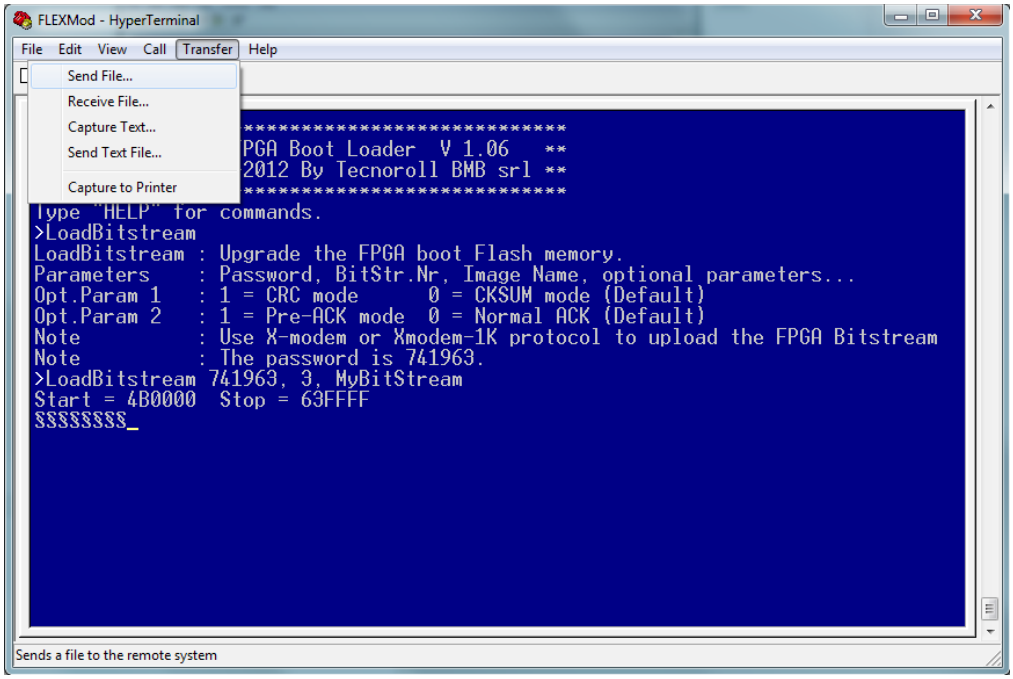


Figure 7

Select the file you want to upload and set the "*protocol*" to 1K Xmodem, then press the "*Send*" button.

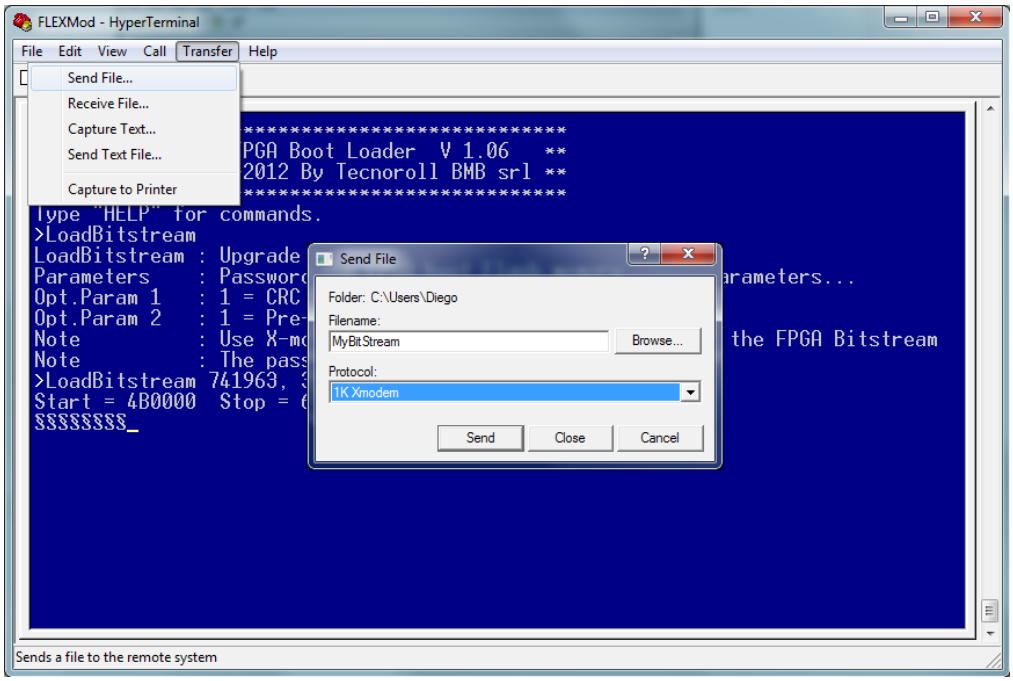


Figure 8

If everything is working fine, a window showing the upload progress should open.

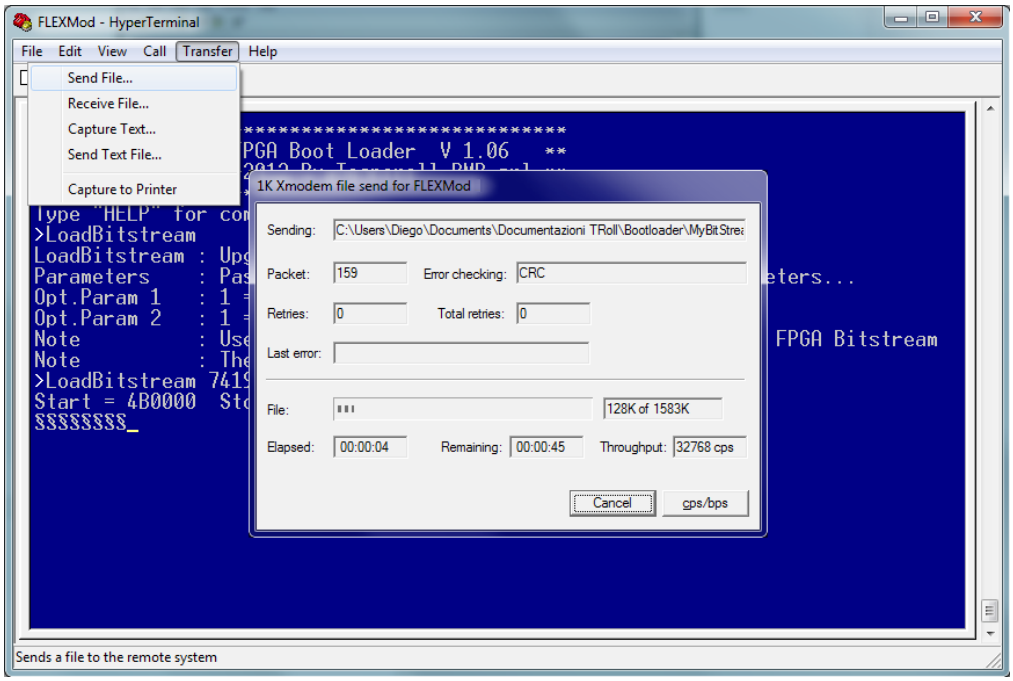


Figure 9

When the file has been uploaded, the module calculates the CRC. After a few seconds, a report on the use of the flash memory is also displayed. The bitstream upload is now complete, and the loaded bitstream is now available in the selection table.

BOOTLOADER COMMANDS

The complete list of the bootloader commands is also viewable on a computer terminal by typing Help followed by <Return>.

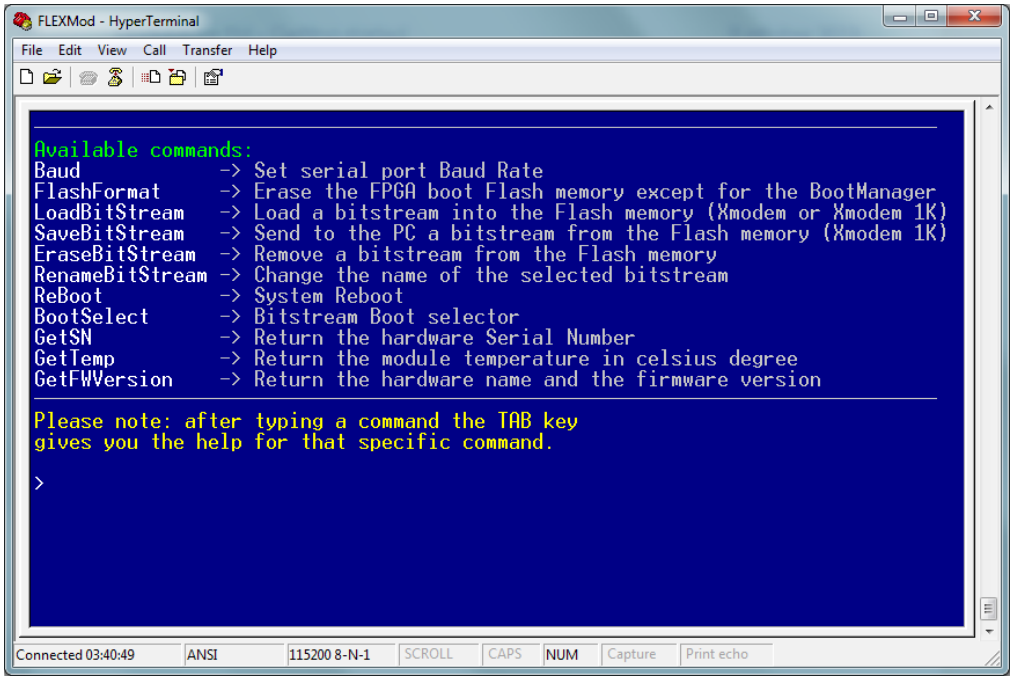


Figure 10

Baud

Sets the serial port baud rate.

COMMAND PARAMETERS		
Name	***Values***	***Note***
Baud rate	Any rate	
USAGE EXAMPLES		
Command syntax	***Possible answer***	***Note***
Baud 9600	9600, Bps 0 Ok	
GENERAL NOTES		
The default baud rate is 11520.		

FlashFormat

Delete and subdivide the FPGA flash memory, except for the area where the bootloader resides.

COMMAND PARAMETERS		
Name	***Values***	***Note***
Password	741963	
Size of partition	1 = 1.6Mbyte partition 2 = 2Mbyte partition	Use 1.6Mbyte partition with FLEXMod module or 2Mbyte partition for FLEMod AV module.
USAGE EXAMPLES		
Command syntax	***Possible answer***	***Note***
FlashFormat 741963, 1		
GENERAL NOTES		
None.		

LoadBitStream

Upload a new firmware into the flash memory (see page 8).

COMMAND PARAMETERS		
Name	***Values***	***Note***
Password	741963	
Bitstream number	1 - 4	
Image name	Any name	
Optional parameter 1	0 = CKSUM mode 1 = CRC mode	Default = 0
Optional parameter 2	0 = Normal ACK mode 1 = Pre- ACK mode	Default = 0
USAGE EXAMPLES		
Command syntax		***Note***
LoadBitStream 741963, 2, FM modulator		Xmodem-1K upload of a firmware on position 2 and give it the name "FM modulator"
LoadBitStream 741963, 3, FM modulator, 1		Xmodem-CRC upload of a firmware on position 1 and give it the name "FM modulator"
GENERAL NOTES		
The image name is only used to describe the firmware during the boot-up and for the BootSelect command, therefore any text can be used. The name can be changed afterwards by using the RenameBitstream command. When the upload is finished, you will receive a report indicating the number of errors that occurred while uploading the firmware, the file and the flash CRC. The loading can be done either by using Xmodem or Xmodem-1K. The bootloader is able to detect and use the correct protocol automatically. The loading is normally done using Xmodem (or Xmodem-1K) Checksum. Xmodem-CRC (or Xmodem-1K-CRC) may be optionally used with the optional CRC parameter on the command line. The PreACK option will accelerate the transfer, thus anticipating the ACK response, but this prevents the ability to retransmit a faulty block, causing an interruption in case of error.		

SaveBitStream

Backup a bitstream from the flash memory to a mass storage (PC).

COMMAND PARAMETERS		
Name	***Values***	***Note***
None		
USAGE EXAMPLES		
Command syntax		***Note***
SaveBitstream		
GENERAL NOTES		
The bitstream to be saved is chosen via selection screen. The protocol to be used can be either Xmodem-1K-Checksum or Xmodem-1K-CRC.		

EraseBitStream

Removes a firmware from the flash memory.

COMMAND PARAMETERS		
Name	***Values***	***Note***
Password	741963	
Bitstream number	1 - 4	
USAGE EXAMPLES		
Command syntax	***Possible answer***	***Note***
EraseBitStream 741963, 1		
GENERAL NOTES		
If you do not enter the bitstream number to be deleted, you will visualize a selection screen.		

RenameBitStream

Changes the name of the selected bitstream.

COMMAND PARAMETERS		
Name	***Values***	***Note***
Bitstream number	1 - 4	
USAGE EXAMPLES		
Command syntax	***Possible answer***	***Note***
RenameBitStream 1		
GENERAL NOTES		
The bootloader asks the new bitstream name.		

Reboot

Restarts the FLEXMod module.

COMMAND PARAMETERS		
Name	***Values***	***Note***
None		
USAGE EXAMPLES		
Command syntax	***Possible answer***	***Note***
Reboot		
GENERAL NOTES		
None.		

BootSelect

Restarts the module by loading a given bitstream.

COMMAND PARAMETERS		
Name	***Values***	***Note***
Bitstream number	0 - 4	
USAGE EXAMPLES		
Command syntax	***Possible answer***	***Note***
Bootselect 1		
GENERAL NOTES		
It's possible to select number 0 as boot image. In this case, the bootloader will not load any image and will stop after the initial copyright disclaimer. If the bitstream number is omitted the bootloader restarts the module and displays a selection screen for the bitstream to be loaded.		

GetSN

Displays the serial number of the FLEXMod module.

COMMAND PARAMETERS		
Name	***Values***	***Note***
None		
USAGE EXAMPLES		
Command syntax	***Possible answer***	***Note***
GetSN		
GENERAL NOTES		
None.		

GetTemp

Displays the current temperature of the FLEXMod module.

COMMAND PARAMETERS		
Name	***Values***	***Note***
None		
USAGE EXAMPLES		
Command syntax	***Possible answer***	***Note***
GetTemp		
GENERAL NOTES		
The temperature is displayed in Celsius degrees.		

GetFWVersion

Displays the firmware version of the FLEXMod module.

COMMAND PARAMETERS		
Name	***Values***	***Note***
None		
USAGE EXAMPLES		
Command syntax	***Possible answer***	***Note***
GetFWVersion		
GENERAL NOTES		
None.		

FM/AM MODULATOR

FM/AM MODULATOR SECTION COMMANDS

This section contains all the configuration and control commands for the modulation block of the module. For an overview of all the commands through a terminal, type <help> and press enter. In order to get help on a specific command, type the same command and press the tab key.

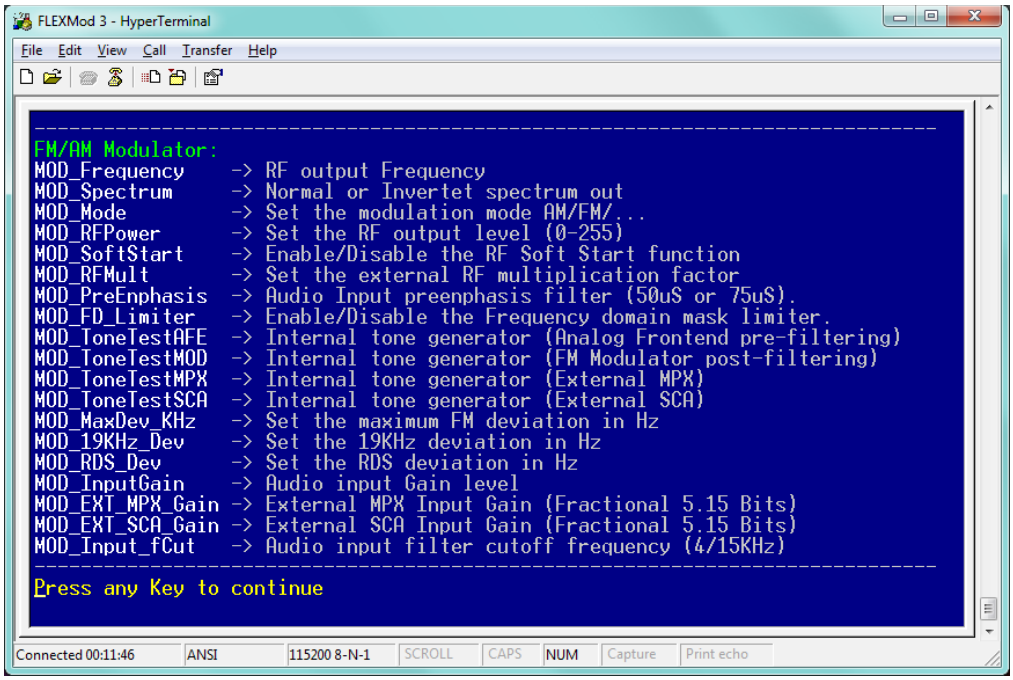


Figure 11

MOD_Frequency

Set the RF output frequency and/or IF output frequency.

COMMAND PARAMETERS		
Name	***Values***	***Note***
RF out	87.6 – 108.0	
IF out	0 – 1000.0	Optional parameter.
USAGE EXAMPLES		
Command syntax	***Possible answer***	***Note***
MOD_Frequency 87.6	87600000, 87.600, RDS 0, 0.000, IF 0 Ok	Direct RF frequency mode.
MOD_Frequency 87.6, 250.0	87600000, 87.600, RDS 250000000, 250.000, IF 0 Ok	250MHz IF output mode.
GENERAL NOTES		
None.		

MOD_Spectrum

Set the normal or inverted spectrum out.

COMMAND PARAMETERS		
Name	***Values***	***Note***
Spectrum	0 = normal 1 = inverted	
USAGE EXAMPLES		
Command syntax	***Possible answer***	***Note***
MOD_Spectrum 0	0, Normal 0 Ok	
MOD_Spectrum 1	1, Inverted 0 Ok	
GENERAL NOTES		
None.		

MOD_Mode

Set the modulator operating mode (see EasyMod page 35).

COMMAND PARAMETERS			
Name	***Values***		***Note***
Mode	0 = MPX & RDS 1 = MPX 2 = L & RDS 3 = R & RDS 4 = L + R & RDS 5 = L 6 = R 7 = L + R 8 = L + L 9 = R + R 10 = L + L & RDS 11 = R + R &RDS	12 = MPX + BBN 13 = MPX & RDS + BBN 14 = MPX + BBN & RDS 15 = FULL BASEBAND 16 = BASEBAND + IRDS 17 = BASEBAND + RDS 18 = BASEBAND + SCA 19 = RDS NOTCH 20 = RDS LOCAL 21 = AM L 22 = AM R 23 = AM L + R	
USAGE EXAMPLES			
Command syntax	***Possible answer***		***Note***
MOD_Mode 0	0, MPX & RDS 0 Ok		Takes the external analog audio signal and uses the internal MPX and RDS coders.
MOD_Mode 17	17, RDS LOCAL 0 Ok		Takes the external baseband signal, cuts the external RDS and adds the internal RDS.
GENERAL NOTES			
For a user-friendly configuration It is possible to use the "EasyMod" command to have a graphical display of the available configurations (see page 35).			

MOD_RFPower

Sets the RF output level.

COMMAND PARAMETERS		
Name	***Values***	***Note***
Output level	0 – 255	
USAGE EXAMPLES		
Command syntax	***Possible answer***	***Note***
MOD_RFPower 150	150 0 Ok	Sets the output power to 150.
GENERAL NOTES		
The actual output level is detectable via an external tool; 0-255 are the adjustment steps made available by the DAC module (0 minimum level , 255 maximum level).		

MOD_SoftStart

Enable or disable the RF soft start.

COMMAND PARAMETERS		
Name	***Values***	***Note***
Soft start	1 = enable 0 = disable	
USAGE EXAMPLES		
Command syntax	***Possible answer***	***Note***
MOD_SoftStart 1	1, ON 0 Ok	RF soft start enabled.
GENERAL NOTES		
None.		

MOD_RFMult

Sets the RF multiplication factor in case of external multiplier.

COMMAND PARAMETERS		
Name	***Values***	***Note***
Multiplication factor	1, 2, 4	
USAGE EXAMPLES		
Command syntax	***Possible answer***	***Note***
MOD_RFMult 2	2, RF Mult.Factor 0 Ok	It divides by 2 the RF output frequency (it takes account of external multiplier).
GENERAL NOTES		
None.		

MOD_PreEnphasis

Sets the audio input pre-emphasis filter.

COMMAND PARAMETERS		
Name	***Values***	***Note***
Audio preenphasis	0 = 0µS 50 = 50µS 75 = 75µS	
USAGE EXAMPLES		
Command syntax	***Possible answer***	***Note***
MOD_PreEnphasis 50	50, uS 0 Ok	Sets the audio preenphasis to 50µS.
GENERAL NOTES		
None.		

MOD_FD_Limiter

Enables or disables the frequency domain mask limiter.

COMMAND PARAMETERS		
Name	***Values***	***Note***
Enable/disable limiter	0 = limiter OFF 1 = limiter ON	
USAGE EXAMPLES		
Command syntax	***Possible answer***	***Note***
MOD_FD_Limiter 1	1, ON 0 Ok	FD limiter is ON
GENERAL NOTES		
None.		

MOD_ToneTestAFE

Turns on and sets the interal audio tone generator (analog front end pre-filtering).

COMMAND PARAMETERS		
Name	***Values***	***Note***
Left tone	0.0 – 15000.0	Sets the left tone frequency.
Left level	0 – 32768	Sets the left tone level.
Rigth tone	0.0 – 15000.0	Sets the right tone frequency.
Right level	0 – 32768	Sets the right tone level.
Phase	0.0 – 360.0	Sets the phase difference between L and R tone.
USAGE EXAMPLES		
Command syntax		***Note***
FM_ToneTestAFE 9000.0, 16000, 11000.0, 16000, 90		
GENERAL NOTES		
This command is intended only for lab testing purposes. Don't use it in your products.		

FM/AM Modulator – Getting started

MOD_ToneTestMOD

Turns on and sets the internal audio tone generator (FM modulator post-filtering).

COMMAND PARAMETERS		
Name	***Values***	***Note***
Left tone	0.0 – 15000.0	Sets the left tone frequency.
Left level	0 – 32768	Sets the left tone level.
Rigth tone	0.0 – 15000.0	Sets the right tone frequency.
Right level	0 – 32768	Sets the right tone level.
Phase	0.0 – 360.0	Sets the phase difference between L and R tone.
USAGE EXAMPLES		
Command syntax		***Note***
MOD_ToneTestMOD 9000.0, 16000, 11000.0, 16000, 90		
GENERAL NOTES		
This command is intended only for lab testing purposes. Don't use it in your products.		

MOD_ToneTestMPX

Turns on and sets the internal audio tone generator (external MPX input).

COMMAND PARAMETERS		
Name	***Values***	***Note***
Tone	0 - 99999	
USAGE EXAMPLES		
Command syntax		***Note***
MOD_ToneTestMPX 47000		
GENERAL NOTES		
This command is intended only for lab testing purposes. Don't use it in your products.		

MOD_ToneTestSCA

Turns on and sets the sound tone generator for internal test (SCA external input).

COMMAND PARAMETERS		
Name	***Values***	***Note***
Tone	0 - 99999	
USAGE EXAMPLES		
Command syntax		***Note***
MOD_ToneTestSCA 47000		
GENERAL NOTES		
This command is intended only for lab testing purposes. Don't use it in your products.		

MOD_MaxDev_KHz

Sets the maximum FM deviation frequency in Hz.

COMMAND PARAMETERS		
Name	***Values***	***Note***
Max deviation frequency	Typically 75000	Frequency in Hz
USAGE EXAMPLES		
Command syntax	***Possible answer***	***Note***
MOD_MaxDev_KHz 135000	135000, Hz 0 Ok	Max deviation 135KHz
GENERAL NOTES		
None.		

MOD_19KHz_Dev

Sets the 19KHz stereo sub-carrier in Hz.

COMMAND PARAMETERS		
Name	***Values***	***Note***
Frequency	0 - 65535	Frequency in Hz
USAGE EXAMPLES		
Command syntax	***Possible answer***	***Note***
MOD_19KHz_Dev 6800	6800, Hz 0 Ok	
GENERAL NOTES		
None.		

MOD_RDS_Dev

Sets the RDS modulation in Hz.

COMMAND PARAMETERS		
Name	***Values***	***Note***
Frequency	0 - 65535	Frequency in Hz
USAGE EXAMPLES		
Command syntax	***Possible answer***	***Note***
MOD_RDS_Dev 4500	4500, Hz 0 Ok	
GENERAL NOTES		
None.		

MOD_InputGain

Sets the audio input gain. The parameter can be setted in two different ways: indicating the 5.15 bits fractional multiplier or the decimal multiplier.

COMMAND PARAMETERS		
Name	***Values***	***Note***
Gain	0 - 1048575 (fractional 5.15 bits) or 0,0 - 31,99999 (decimal)	32768 for gain = 1
USAGE EXAMPLES		
Command syntax	***Possible answer***	***Note***
MOD_InputGain 5500	5500, 0.16 0 Ok	
MOD_InputGain 0,16	5500, 0.16 0 Ok	
GENERAL NOTES		
The gain value is a fractional 5.15 bits multiplier.		

MOD_EXT_MPX_Gain

Sets the external MPX input gain.

COMMAND PARAMETERS		
Name	***Values***	***Note***
Gain	0 - 1048575 (fractional 5.15 bits) or 0,0 - 31,99999 (decimal)	32768 for gain = 1
USAGE EXAMPLES		
Command syntax	***Possible answer***	***Note***
MOD_EXT_MPX_Gain 32768	32768, 1.00 0 Ok	
MOD_EXT_MPX_Gain 1,00	32768, 1.00 0 Ok	
GENERAL NOTES		
The gain value is a fractional 5.15 bits multiplier.		

MOD_EXT_SCA_Gain

Sets the external SCA input gain.

COMMAND PARAMETERS		
Name	***Values***	***Note***
Gain	0 - 1048575 (fractional 5.15 bits) or 0,0 - 31,99999 (decimal)	32768 for gain = 1
USAGE EXAMPLES		
Command syntax	***Possible answer***	***Note***
MOD_EXT_SCA_Gain 32768	32768, 1.00 0 Ok	
MOD_EXT_SCA_Gain 1,00	32768, 1.00 0 Ok	
GENERAL NOTES		
The gain value is a fractional 5.15 bits multiplier.		

MOD_Input_fCut

Audio input filter cutoff frequency.

COMMAND PARAMETERS		
Name	***Values***	***Note***
Frequency	0 = no filter 4 = 4KHz 15 = 15KHz	
USAGE EXAMPLES		
Command syntax	***Possible answer***	***Note***
MOD_Input_fCut 15	15, KHz 0 Ok	
GENERAL NOTES		
None.		

RDS_CODER SECTION COMMANDS

This section contains all the configuration and control commands of the RDS signal encoding of the module. For an overview of the commands via terminal, type <help> and press enter. In order to get help on a specific command, type the command itself and press the tab key.

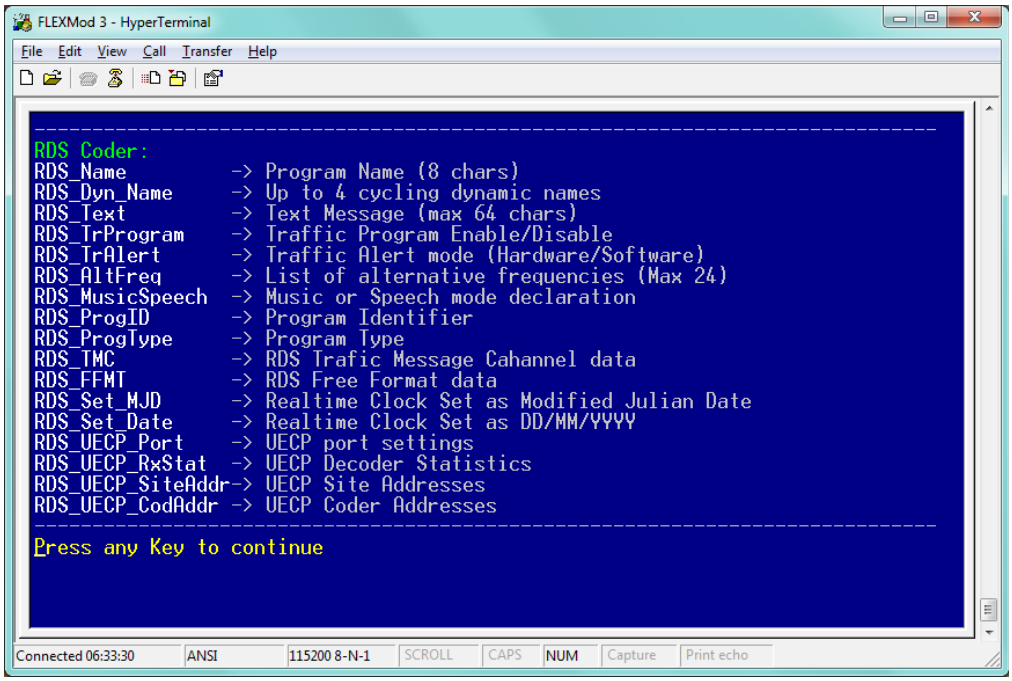


Figure 12

RDS_Name

Sets the program name (PI → Program Information).

COMMAND PARAMETERS		
Name	***Values***	***Note***
Name	8 chars	
USAGE EXAMPLES		
Command syntax	***Possible answer***	***Note***
RDS_Name MyRadio1	"MyRadio1" 0 Ok	
GENERAL NOTES		
The maximum length of the program name is 8 characters		

RDS_Dyn_Name

Sets up to 4 program names and cycles them continuously.

COMMAND PARAMETERS		
Name	***Values***	***Note***
Name 1	8 chars	
Repetitions 1	0 - 255	Sets the number of repetitions of name 1.
Name 2	8 chars	
Repetitions 2	0 - 255	Sets the number of repetitions of name 2.
Name 3	8 chars	
Repetitions 3	0 - 255	Sets the number of repetitions of name 3.
Name 4	8 chars	
Repetitions 4	0 - 255	Sets the number of repetitions of name 4.
USAGE EXAMPLES		
Command syntax	***Possible answer***	***Note***
RDS_Dyn_Name FLEXMOD!, 180, Tecno, 20, Roll, 105, Bubble, 77	"FLEXMOD!", 180, Name, Rep. "Tecno", 20, Name, Rep. "Roll", 105, Name, Rep. "Bubble", 77, Name, Rep. 0 Ok	
GENERAL NOTES		
None.		

RDS_Text

Sets the free text message (RT → Radio Text).

COMMAND PARAMETERS		
Name	***Values***	***Note***
Text	64 chars	
USAGE EXAMPLES		
Command syntax	***Possible answer***	***Note***
RDS_Text "Questo è un messaggio"	"Questo è un messaggio" 0 Ok	
GENERAL NOTES		
The maximum length of the text message is 64 characters.		

RDS_TrProgram

Sets the flag that indicates whether the broadcasting station transmits traffic information or not. (TP → Traffic Program).

COMMAND PARAMETERS		
Name	***Values***	***Note***
TP enable	0 = off 1 = on	
USAGE EXAMPLES		
Command syntax	***Possible answer***	***Note***
RDS_TrProgram 1	1, on 0 Ok	
GENERAL NOTES		
The maximum length of the text message is 64 characters.		

RDS_TrAlert

Sets the flag that indicates the transmission of traffic news (TA → Traffic Announcements).

COMMAND PARAMETERS		
Name	***Values***	***Note***
TR alert mode	0 = off 1 = on 2 = hardware (normal) 3 = hardware (reversed)	
USAGE EXAMPLES		
Command syntax	***Possible answer***	***Note***
RDS_TrAlert 1	1, software 1, ON 0 Ok	
GENERAL NOTES		
None.		

RDS_UECP_Port

UECP port settings.

COMMAND PARAMETERS		
Name	***Values***	***Note***
Port	0 = off 1 = G703 neg. pin 2 = serial LAN 3 = ASI	
Polarity	0 = normal 1= inverted	
Speed	Baud rate	
USAGE EXAMPLES		
Command syntax	***Possible answer***	***Note***
RDS_UECP_Port 1, 0, 0	1, 0, 0, G703N, Normal, Baud 0 Ok	
GENERAL NOTES		
None.		

RDS_UECP_RxStat

UECP decoder statistics.

COMMAND PARAMETERS		
Name	***Values***	***Note***
USAGE EXAMPLES		
Command syntax	***Possible answer***	***Note***
RDS_UECP_RxStat	321, 6, 5, Bytes, Rx, Prc 0 Ok	Bytes received, commands received, command processed.
GENERAL NOTES		
None.		

RDS_UECP_SiteAddr

UECP site addresses.

COMMAND PARAMETERS		
Name	***Values***	***Note***
Address	0...1023	
USAGE EXAMPLES		
Command syntax	***Possible answer***	***Note***
RDS_UECP_SiteAddr 25, 36, 568, 821, 1023	25, 36, 568, 821, 1023 0 Ok	
GENERAL NOTES		
Up to 5 addresses are supported		

RDS_UECP_CodAddr

UECP coder addresses.

COMMAND PARAMETERS		
Name	***Values***	***Note***
Address	0...63	
USAGE EXAMPLES		
Command syntax	***Possible answer***	***Note***
RDS_UECP_CodAddr 1, 7, 25, 57, 62	1, 7, 25, 57, 62 0 Ok	
GENERAL NOTES Up to 5 addresses are supported		
Up to 5 addresses are supported		

RDS_AltFreq

Sets up alternative frequencies for re-tuning of the broadcasting station (AF → Alternate Frequencies).

COMMAND PARAMETERS		
Name	***Values***	***Note***
List of alternative frequencies	87.5, 102.5, 106.9, ...	Max. 24 alternative frequancies allowed.
USAGE EXAMPLES		
Command syntax	***Possible answer***	***Note***
RDS_AltFreq 89.7, 101.0, 93.6	4, Fields 87.6, Main 89.7, Alt. 101.0, Alt. 93.6, Alt. 0 Ok	
GENERAL NOTES		
A maximum of 24 alternative frequencies can be indicated in addition to those already in use.		

RDS_MusicSpeech

Indicates if the broadcasted program is musical or spoken one.

COMMAND PARAMETERS		
Name	***Values***	***Note***
Music or speech mode	0 = music 1 = speech	
USAGE EXAMPLES		
Command syntax	***Possible answer***	***Note***
RDS_MusicSpeech 0	0, Music 0 Ok	
GENERAL NOTES		
None.		

RDS_ProgID

Sets the numeric code that uniquely identifies the radio station (PI → Program Identification)

COMMAND PARAMETERS		
Name	***Values***	***Note***
PI number	0 - 65535	
USAGE EXAMPLES		
Command syntax	***Possible answer***	***Note***
RDS_ProgID 12540	12540, 0x30FC 0 Ok	
GENERAL NOTES		
None.		

RDS_ProgType

Identifies the type of content of the program on air (PTY → Program Type)

COMMAND PARAMETERS		
Name	***Values***	***Note***
Program type number	0 - 31	See table below.
USAGE EXAMPLES		
Command syntax	***Possible answer***	***Note***
RDS_ProgType 15	15, 0x000F	
GENERAL NOTES		
None.		

PTY Code	RDS program type (EU)	RDBS Program type (USA)	PTY Code	RDS program type (EU)	RDBS Program type (USA)
0	Undefined	Undefined	**16**	Weather	R&B
1	News	News	**17**	Finance	Soft R&B
2	Current Affairs	Information	**18**	Children's programmes	Language
3	Information	Sport	**19**	Social affairs	Religious music
4	Sport	Talk show	**20**	Religion	Religious show
5	Education	Rock	**21**	Phone-in	Personality
6	Drama	Classic rock	**22**	Travel	Public
7	Culture	Adult hits	**23**	Leisure	College
8	Science	Soft rock	**24**	Jazz	*Spanish talk*
9	Varied	Top 40	**25**	Country	*Spanish music*
10	Pop	Country	**26**	National music	*Hip Hop*
11	Rock	Oldies	**27**	Oldies	*Non assegnato*
12	Easy listening	Soft	**28**	Folk	*Non assegnato*
13	Light classical	Nostalgia	**29**	Documentary	Weather
14	Serious classical	Jazz	**30**	Alarm (Test)	Emergency (test)
15	Other music	Classical	**31**	Alarm	Emergency

RDS_TMC

Sets the RDS traffic message channel data (TMC → Traffic Message Channel)

COMMAND PARAMETERS		
Name	***Values***	***Note***
Buffer	0 - 3	
Repetitions	0 - 16	
Message	AABBCCDDEE	Hex value message
USAGE EXAMPLES		
Command syntax	***Possible answer***	***Note***
RDS_TMC 1, 3, 02A58D7752	1, 3, 02A58D7752, Buff, Rep, Msg 0 Ok	
GENERAL NOTES		
None.		

RDS_Set_MJD

Sets the realtime clock as a modified julian date.

COMMAND PARAMETERS		
Name	***Values***	***Note***
Hour	0 - 23	
Minutes	0 - 59	
Seconds	0 - 59	
Day	Number of days	
Timezone in steps	-24 - +24	Sets the number of steps (½ hour)
USAGE EXAMPLES		
Command syntax	***Possible answer***	***Note***
RDS_Set_MJD 11, 56, 24, 56728, 2	11, 56, 24, 56728, 2, hour, min, sec, day, timezone (+1,0h) 0 Ok	
GENERAL NOTES		
A modified Julian day (MJD) represents the number of days passed since midnight on November 17, 1858. On the web may be easily find a converter from conventional date to modified Julian date.		

RDS_Set_Date

Sets the realtime clock as day/month/year.

COMMAND PARAMETERS		
Name	***Values***	***Note***
Hour	0 - 23	
Minutes	0 - 59	
Seconds	0 - 59	
Day	1 - 31	
Month	1 - 12	
Year	xxxx	
Timezone in ½ hour steps	-24 - +24	
USAGE EXAMPLES		
Command syntax	***Possible answer***	***Note***
RDS_Set_Date 11, 56, 24, 12, 3, 2014, 2	11, 56, 24, 12, 3, 2014, 2, h, m, s, Day, Month, Year, Timezone (+1,0h) 0 Ok	
GENERAL NOTES		
None.		

MISCELLANEOUS COMMANDS

This section contains some generic commands that allow to manage and monitor some operating conditions of the module. For an overview of the commands via computer, type <help> and press enter. In order to get help on a specific command, type the command itself and press the tab key.

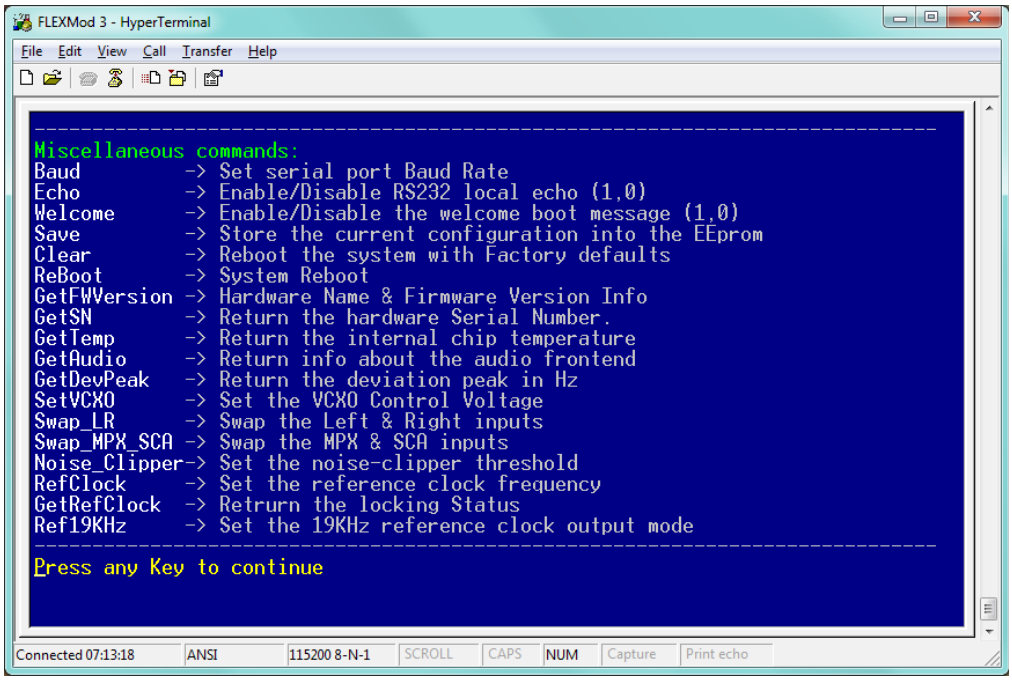


Figure 13

Baud

Sets the serial port baud rate.

COMMAND PARAMETERS		
Name	***Values***	***Note***
Baud rate	Any rate	
USAGE EXAMPLES		
Command syntax	***Possible answer***	***Note***
Baud 9600	9600, Bps 0 Ok	
GENERAL NOTES		
The default baud rate is 11520.		

Echo

Enables or disables the RS232 local echo.

COMMAND PARAMETERS		
Name	***Values***	***Note***
Enable	0 = echo off 1 = echo on	
USAGE EXAMPLES		
Command syntax	***Possible answer***	***Note***
Echo 1	1, Echo ON 0 Ok	
GENERAL NOTES		
It is suggested to disable the echo in case of communication between FLEXMod module and microprocessors.		

Welcome

Enables or disables the welcome boot message.

COMMAND PARAMETERS		
Name	***Values***	***Note***
Enable	0 = welcome off 1 = welcome on	
USAGE EXAMPLES		
Command syntax	***Possible answer***	***Note***
Welcome 1	1, ON 0 Ok	
GENERAL NOTES		
None.		

Save

Stores the current configuration into the Eeprom.

COMMAND PARAMETERS		
Name	***Values***	***Note***
None		
USAGE EXAMPLES		
Command syntax	***Possible answer***	***Note***
Save	0 Ok	
GENERAL NOTES		
None.		

Clear

Reboots the system with factory defaults.

COMMAND PARAMETERS		
Name	***Values***	***Note***
None		
USAGE EXAMPLES		
Command syntax	***Possible answer***	***Note***
Reboot		
GENERAL NOTES		
None.		

Reboot

Reboots the system.

COMMAND PARAMETERS		
Name	***Values***	***Note***
None		
USAGE EXAMPLES		
Command syntax	***Possible answer***	***Note***
Reboot		
GENERAL NOTES		
Pressing <ENTER> key during the reboot stop the process and upload the bootloader (see page 7).		

GetFWVersion

Returns the hardware name and firmware version info.

COMMAND PARAMETERS		
Name	***Values***	***Note***
None		
USAGE EXAMPLES		
Command syntax	***Possible answer***	***Note***
GetFWVersion	FlexMod-FM011 v0.40 0 Ok	
GENERAL NOTES		
None.		

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GetSN

Returns the hardware serial number.

COMMAND PARAMETERS		
Name	***Values***	***Note***
None		
USAGE EXAMPLES		
Command syntax	***Possible answer***	***Note***
GetSN	0B.56.FC.AB.0B.55.03 0 Ok	Answer depending on device
GENERAL NOTES		
None.		

GetTemp

Returns the internal chip temperature.

COMMAND PARAMETERS		
Name	***Values***	***Note***
None		
USAGE EXAMPLES		
Command syntax	***Possible answer***	***Note***
GetTemp	62, Celsius Degree. 0 Ok	
GENERAL NOTES		
None.		

GetAudio

Returns info about the audio frontend.

COMMAND PARAMETERS		
Name	***Values***	***Note***
Mode	0 = single shot 1 = single shot with deviation level 2= continous with deviation level	
USAGE EXAMPLES		
Command syntax	***Possible answer***	***Note***
GetAudio 0	1, 48000, 0, 0, 0, 0 0 Ok	The returned values are: audio lock status, sample rate, left in level, right in level, left post-filter leve, right post-filter level.
GENERAL NOTES		
None.		

GetDevPeak

Returns the instant deviation peak in Hz.

COMMAND PARAMETERS		
Name	***Values***	***Note***
None		
USAGE EXAMPLES		
Command syntax	***Possible answer***	***Note***
GetDevPeak	10688, Hz 0 Ok	The returned value depends on modulation status.
GENERAL NOTES		
None.		

SetVCXO

Sets the VCXO control voltage.

COMMAND PARAMETERS		
Name	***Values***	***Note***
Voltage	-2048,,,2047	
USAGE EXAMPLES		
Command syntax	***Possible answer***	***Note***
SetVCXO 0	0 0 Ok	
GENERAL NOTES		
None.		

Swap_LR

Swaps the Left and Right inputs.

COMMAND PARAMETERS		
Name	***Values***	***Note***
None		
USAGE EXAMPLES		
Command syntax	***Possible answer***	***Note***
Swap_LR	1, Swapped 0 Ok	
GENERAL NOTES		
None.		

Swap_MPX_SCA

Swaps the MPX and SCA inputs.

COMMAND PARAMETERS		
Name	***Values***	***Note***
None		
USAGE EXAMPLES		
Command syntax	***Possible answer***	***Note***
Swap_LR	0, Normal 0 Ok	
GENERAL NOTES		
None.		

Noise_Clipper

Sets the noise-clipper threshold (the input signal is clipped if under the threshold).

COMMAND PARAMETERS		
Name	***Values***	***Note***
Analog input threshold	threshold	
MPX/SCA/DARC input threshold	threshold	
USAGE EXAMPLES		
Command syntax	***Possible answer***	***Note***
Noise_Clipper 65536, 15000	3658, Noise Left 2731, Noise Right 0, Noise DARC 65536, Set for Analog 15000, Set for MPX/SCA/DARC 0 Ok	
GENERAL NOTES		
The command return also the instant value of noise on inputs.		

RefClock

Sets the reference clock frequency.

COMMAND PARAMETERS		
Name	***Values***	***Note***
Frequency	0 – 13000000	In Hz
USAGE EXAMPLES		
Command syntax	***Possible answer***	***Note***
RefClock 10000000	2, 10000000, Hz on Ref. Clock Input 0 Ok	
GENERAL NOTES		
It is possible to set the parameter 0 = disabled or 1 = 1Hz on PPS input.		

GetRefClock

Returns the reference clock locking status.

COMMAND PARAMETERS		
Name	***Values***	***Note***
None		
USAGE EXAMPLES		
Command syntax	***Possible answer***	***Note***
GetRefClock	2, Detected 4, Locked 0 Ok	
GENERAL NOTES		
None.		

Ref19KHz

Sets the 19KHz reference clock output mode.

COMMAND PARAMETERS		
Name	***Values***	***Note***
Mode	0 = off 1 = 19KHz on ASI_OUT 2 = 19KHz on LAN_RESET pin 3 = 19KHz on ASI_OUT and LAN_RESET pins	
USAGE EXAMPLES		
Command syntax	***Possible answer***	***Note***
Ref19KHz 1	1, On ASI_OUT 0 Ok	
GENERAL NOTES		
The level of 19KHz is a LVDS on ASI_OUT or a LVTTS on LAN_RESET pin.		

BASIC COMMANDS

In this section you can find some simplified configuration commands and / or monitors. For an overview of the commands via computer, type <help> and press enter. In order to get help on a specific command, type the command itself and press the tab key.

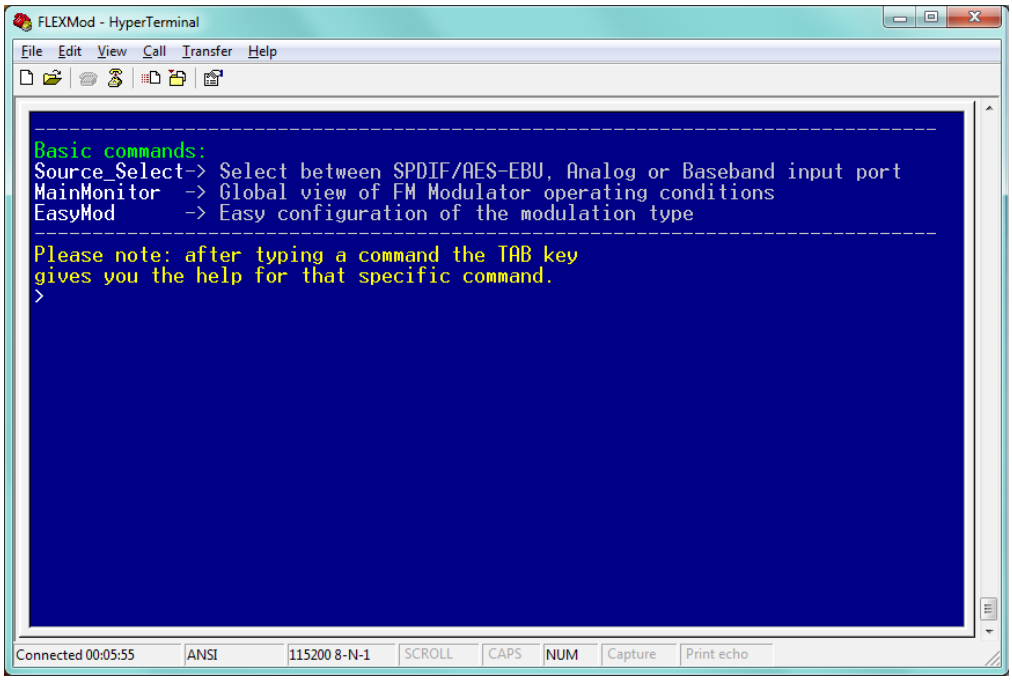


Figure 14

Source_Select

Selects between SPDIF/AES-EBU, analog or baseband input ports.

COMMAND PARAMETERS			
Name	***Values***		***Note***
Input port	0 = SPDIF/AES-EBU optical 1 = SPDIF/AES-EBU electrical 2 = SPDIF/AES-EBU on ASI	3 = SPDIF/AES-EBU on SDI 4 = Analog XLR 5 = Analog baseband	
USAGE EXAMPLES			
Command syntax	***Possible answer***		***Note***
SourceSelect 0	0, AES-EBU (Optical) 0 Ok		
GENERAL NOTES			
None.			

MainMonitor

Displays a global view of FM Modulator operating conditions.

COMMAND PARAMETERS		
Name	***Values***	***Note***
Refresh time		Value in mSec
USAGE EXAMPLES		
Command syntax	***Possible answer***	***Note***
MainMonitor 10	See figure 15	
GENERAL NOTES		
When the main monitor mask is displayed in order to increase or decrease the input gain press <+> or <-> for fine tuning and <*> or </> for a high step tuning. Press <C> to reset the maximum deviation peak value. In order to exit the display, press <Esc>. The disply may change for different modulation setup.		

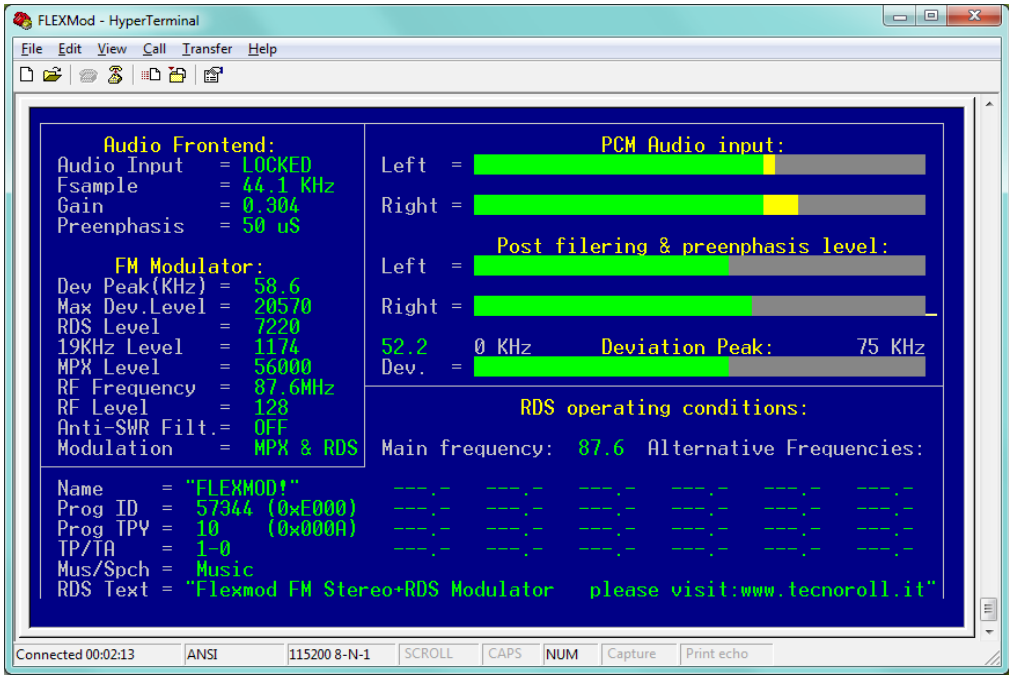


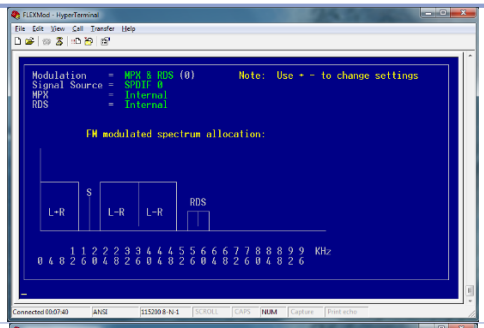
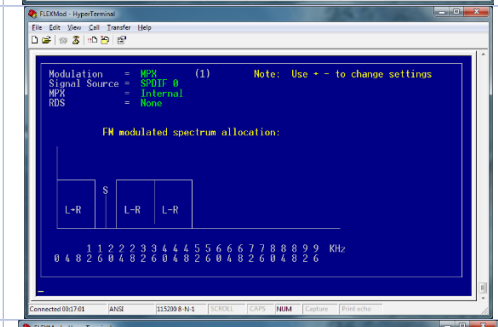
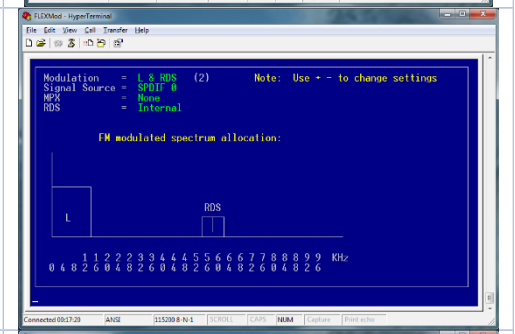
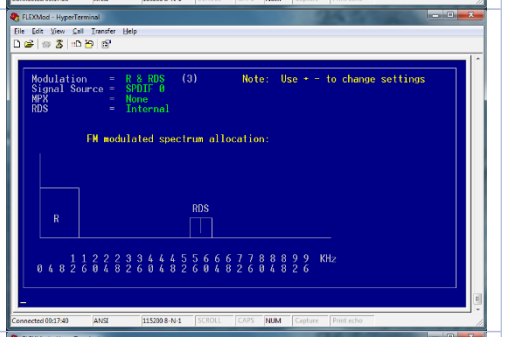
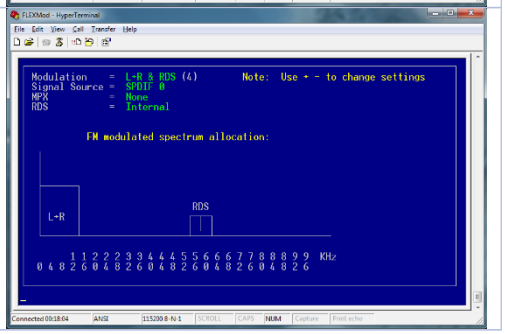
Figure 15

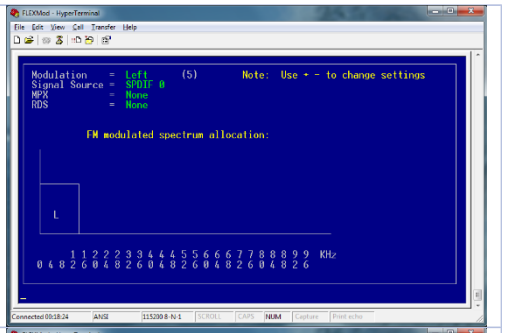
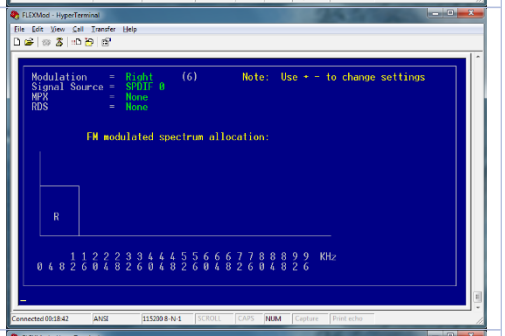
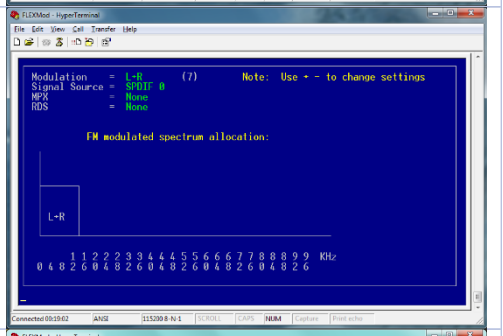
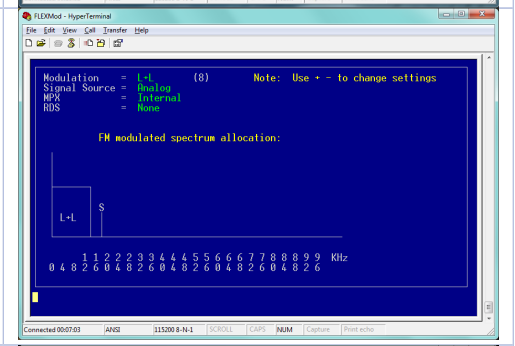
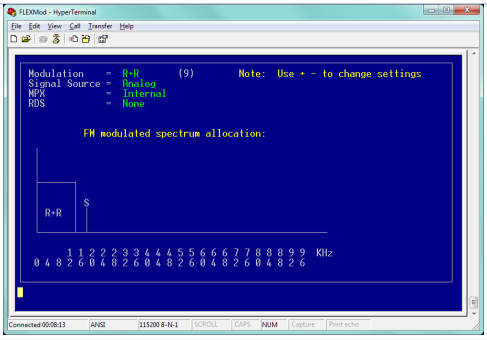
EasyMod

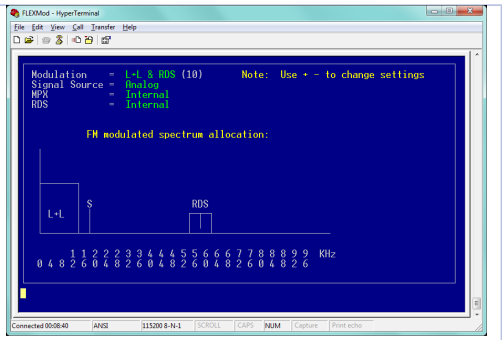
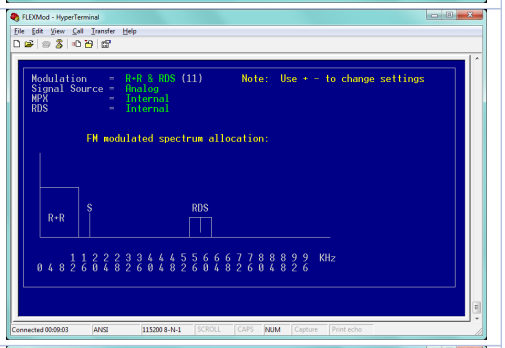
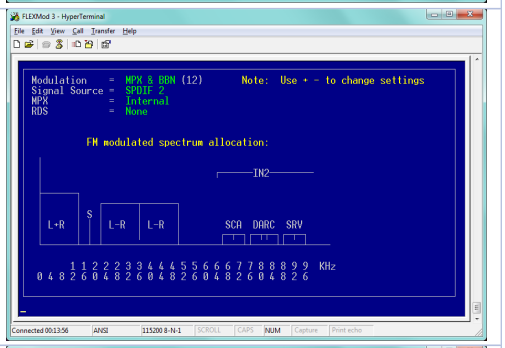
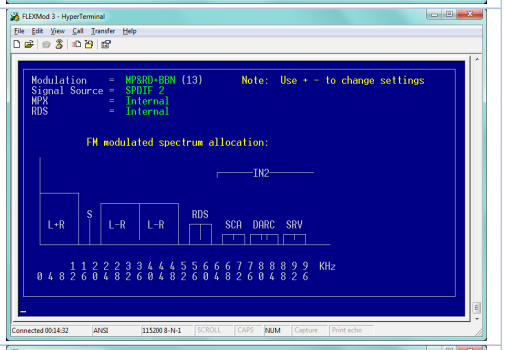
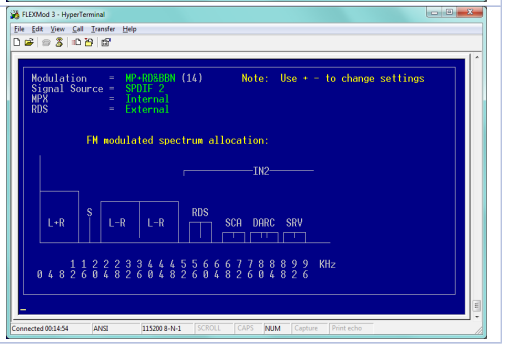
Easy setup of the modulation type.

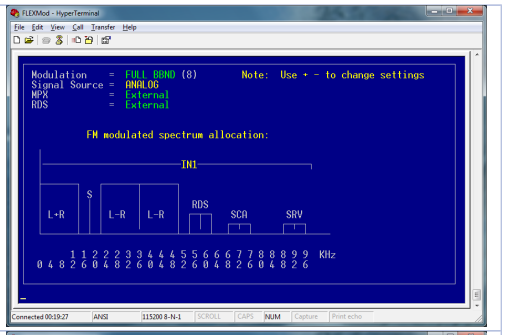
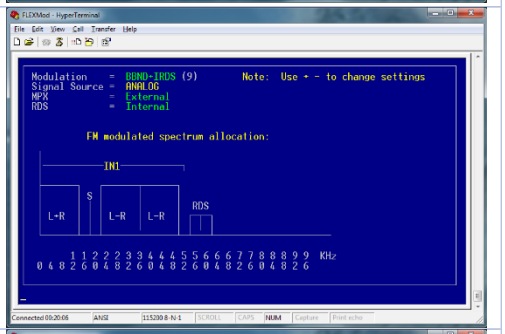
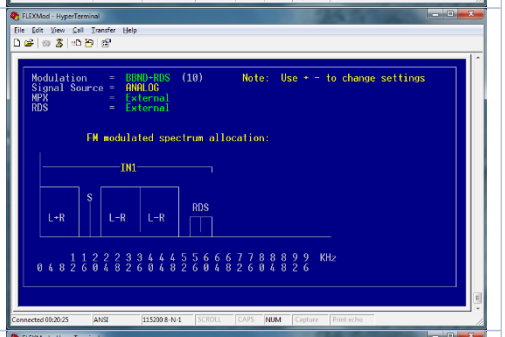
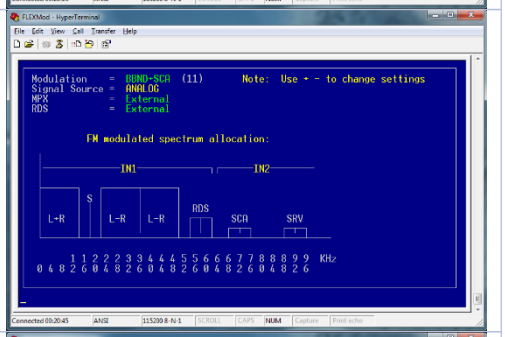
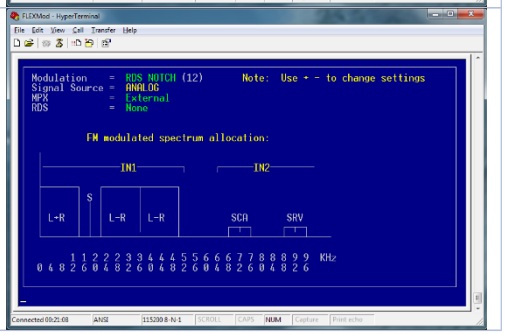
COMMAND PARAMETERS		
Name	***Values***	***Note***
None		
USAGE EXAMPLES		
Command syntax	***Possible answer***	***Note***
EasyMod	See the following table	
GENERAL NOTES		
Press the <+> and <-> keys to surf through the possible configurations, press <enter> to select the desired configuration.		

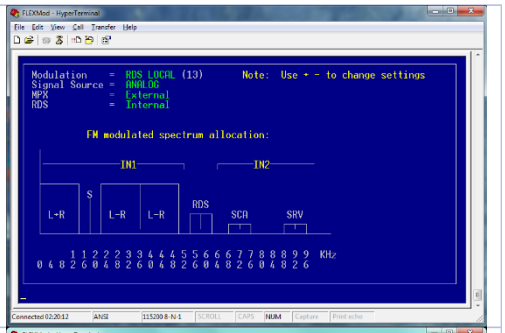
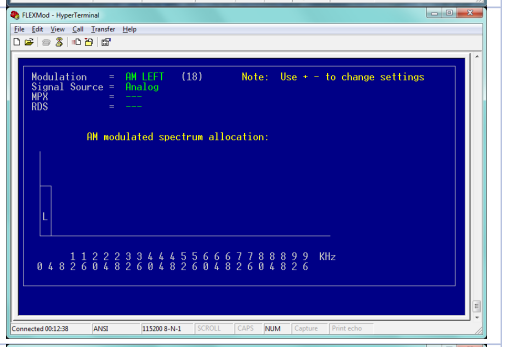
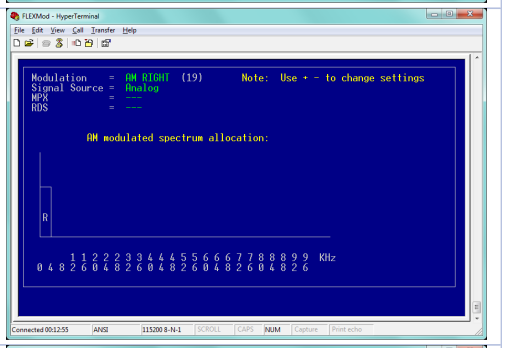
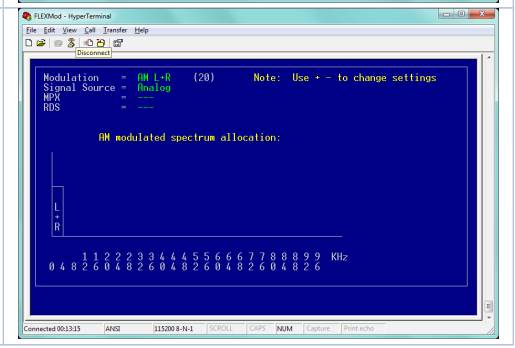
FM/AM Modulator – Getting started

Preset number	Modulation	MPX Coder	RDS Coder	Screenshot
0	MPX & RDS	Internal	Internal	
1	MPX	Internal	None	
2	Left & RDS	None	Internal	
3	Right & RDS	None	Internal	
4	Left+Right & RDS	None	Internal	

5	Left	None	None	
6	Right	None	None	
7	Left + Right	None	None	
8	Left + Left	Internal	None	
9	Right + Right	Internal	None	

10	Left + Left & RDS	Internal	Internal	
11	Right + Right & RDS	Internal	Internal	
12	MPX & baseband (DARC)	Internal	None	
13	MPX + RDS & baseband (DARC)	Internal	Internal	
14	MPX & baseband + RDS (DARC)	Internal	External	

15	Full baseband	External	External	
16	Baseband + IRDS	External	Internal	
17	Baseband + RDS	External	External	
18	Baseband + SCA	External	External	
19	RDS notch	External	None	

20	RDS local	External	Internal	
21	AM Left	None	None	
22	AM Right	None	None	
23	AM Left + Right	None	None	

ADDENDUM

List of command default answers.

```
-----------------------------------------------------------------
"MOD_Frequency":

87600000, 87.600, RDS
0, 0.000, IF
0 Ok

-----------------------------------------------------------------
MOD_Spectrum:

0, Normal
0 Ok

possible answers:
0, Normal
1, Inverted

-----------------------------------------------------------------
"MOD_Mode" default answer:

0, MPX & RDS
0 Ok

possible answers:
-1, "NOT AVAILABLE ON THIS HARDWARE !"
 0, "MPX & RDS"
 1, "MPX      "
 2, "L & RDS  "
 3, "R & RDS  "
 4, "L+R & RDS"
 5, "Left     "
 6, "Right    "
 7, "L+R      "
 8, "L+L      "
 9, "R+R      "
10, "L+L & RDS"
11, "R+R & RDS"
12, "MPX & BBN"
16, "MP&RD+BBN"
17, "MP+RD&BBN"
15, "FULL BBND"
16, "BBND+IRDS"
17, "BBND+RDS "
18, "BBND+SCA "
19, "RDS NOTCH"
20, "RDS LOCAL"
21, "AM LEFT  "
22, "AM RIGHT "
23, "AM L+R   "

-----------------------------------------------------------------
"MOD_RFPower" default answer:

128
0 Ok
```

```
-----------------------------------------------------------------
"MOD_SoftStart" default answer:

1, ON
0 Ok

possible answers:
0, Off
1, On

-----------------------------------------------------------------
"MOD_RFMult" default answer:

1, RF Mult.Factor
0 Ok

possible answers:
1, RF Mult.Factor
2, RF Mult.Factor
4, RF Mult.Factor

-----------------------------------------------------------------
"MOD_PreEnphasis"  default answer:

50, uS
0 Ok

possible answers:

0, uS
50, uS
75, uS

-----------------------------------------------------------------
"MOD_FD_Limiter" default answer:

0, OFF
0 Ok

possible answers:

-1, "NOT AVAILABLE ON THIS HARDWARE !"
0, OFF
1, ON

-----------------------------------------------------------------
"MOD_ToneTestAFE"
"MOD_ToneTestMOD"
"MOD_ToneTestMPX"
"MOD_ToneTestSCA"

Do not use these commands in your product.
These commands are only intended for Lab testing purposes.


-----------------------------------------------------------------
"MOD_MaxDev_KHz" default answer:

135000, Hz
0 Ok

-----------------------------------------------------------------
"MOD_19KHz_Dev" default answer:
```

```
6800, Hz
0 Ok

------------------------------------------------------------------
"MOD_RDS_Dev" default answer:

4500 Hz
0 Ok

------------------------------------------------------------------
"MOD_InputGain" default answer:

5500, 0.16
0 Ok

------------------------------------------------------------------
"MOD_EXT_MPX_Gain" default answer:

32768, 1.00
0 Ok

------------------------------------------------------------------
"MOD_EXT_SCA_Gain" default answer:

32768, 1.00
0 Ok

------------------------------------------------------------------
"MOD_Input_fCut" default answer:

15, KHz
0 Ok

possible answers:
0, OFF
4, KHz
15, KHz

------------------------------------------------------------------
"RSD_Name" default answer:

"FLEXMOD!"
0 Ok

------------------------------------------------------------------
"RSD_Dyn_Name" default answer:

"FLEXMOD!", 255, Name, Rep.
"FLEXMOD2", 100, Name, Rep.
"FLEXMOD3", 150, Name, Rep.
"FLEXMOD4", 70, Name, Rep.
0 Ok

------------------------------------------------------------------
"RSD_Text" default answer:

"Flexmod FM Stereo+RDS Modulator   please visit:www.tecnoroll.it"
0 Ok

------------------------------------------------------------------
"RDS_TrProgram" default answer:

1, ON
```

```
0 Ok

------------------------------------------------------------------
"RDS_TrAlert" default answer:

0, Software
0, OFF
0 Ok

possible answers:

0, Software
1, Hardware

0, OFF
1, ON

------------------------------------------------------------------
"RDS_AltFreq" default answer:

1, Fields
87.6, Main


possible answers:

1..25, Fields
xx.x, Main
xx.x, Alt.
xx.x, Alt.
......

------------------------------------------------------------------
"RDS_MusicSpeech" default answer:

0, Music
0 Ok

possible answers:
0, Music
1, Speech

------------------------------------------------------------------
"RDS_ProgID" default answer:

57344, 0xE000
0 Ok

------------------------------------------------------------------
"RDS_ProgType" default answer:

10, 0x000A
0 Ok

------------------------------------------------------------------
"RDS_TMC" default answer:

NO ASWER, this is a write only data stream command.

------------------------------------------------------------------
"RDS_Set_MJD" default answer:

0, 0, 0, 0, 0, hour, min, sec, timezone (+0.0h)
0 Ok
```

```
------------------------------------------------------------------
"RDS_SET_Date" default answer:

0, 0, 0, 23, 4, 2038, 0, h, m, s, Day, Month, Year, TimeZone (+0.0h)
0 Ok

------------------------------------------------------------------
"RDS_UECP_Port" default answer:

x, p, s, xd, pd, baud
0 Ok

x → 0=OFF, 1=G703 Neg. pin, 2=LAN Serial, 3=ASI
p → 0=Normal, 1=Inverted
s → Baud rate
xd → OFF, G703N, LAN232, ASI TS
pd → Normal, Inverted

------------------------------------------------------------------
"RDS_UECP_RxStat" default answer:

x, x, x, Bytes, Rx, Prc
0 Ok

------------------------------------------------------------------
"RDS_UECP_SiteAddr" default answer:

addr1, addr2, addr3, addr4, addr5
0 Ok
------------------------------------------------------------------
"RDS_UECP_CodAddr" default answer:

addr1, addr2, addr3, addr4, addr5
0 Ok

------------------------------------------------------------------

"Baud" default answer:

115384, Bps
0 Ok

------------------------------------------------------------------
"Echo" default answer:

1, Echo ON
0 Ok

------------------------------------------------------------------
"Welcome" default answer:

1, ON
0 Ok

possible answers:
0, OFF
1, ON

------------------------------------------------------------------
"Save" default answer:

0 Ok
```

```
-------------------------------------------------------------------
"Clear"  default answer:

NO ANSWER, this is a reboot with default values command.

-------------------------------------------------------------------
"ReBoot" default answer:

NO ANSWER, this is a reboot command.

-------------------------------------------------------------------
"GetFWVersion" default answer: (depending on version)

FlexMod-FM011
v0.38
0 Ok

-------------------------------------------------------------------
"GetSN" default answer: (depending on device)

0B.56.FC.AB.0B.55.03
0 Ok

-------------------------------------------------------------------
"GetTemp" default answer: (depending on temperature)

62, Celsius Degree.
0 Ok

-------------------------------------------------------------------
"GetAudio" default answer: (depending on audio input status)

1, 48000, 0, 0, 0, 0
0 Ok

-------------------------------------------------------------------
"GetDevPeak" default answer: (depending modulation status)

10688, Hz
0 Ok


-------------------------------------------------------------------
"SetVCXO" default answer:

0
0 Ok

-------------------------------------------------------------------
"Swap_LR" default answer:

0, Normal
0 Ok

possible answers:
0, Normal
1, Swapped

-------------------------------------------------------------------
"Swap_MPX_SCA" default answer:

0, Normal
0 Ok
```

```
possible answers:
0, Normal
1, Swapped

-----------------------------------------------------------------
Noise_clipper default answer:

Wait...
       0, Noise Left
       0, Noise Right
       0, Noise DARC

   65536, Set for Analog
   65536, Set for MPX/SCA/DARC
0 Ok

-----------------------------------------------------------------
"RefClock" default answer:


0, 0, Hz Disabled
0 Ok

possible answers:

-1, NOT AVAILABLE ON THIS HARDWARE !
0, 0, Hz Disabled
1, 1, Hz on PPS Input
2, xxxx, Hz on Ref.Clock Input

-----------------------------------------------------------------
"GetRefClock" default answer:

0, Disabled
0, Disabled
0 Ok

possible answers:

0, Disabled
1, NOT Detected
2, Detected


0, Disabled
1, HOLDOVER!
2, UNLOCKED!
3, Almost locked
4, Locked

-----------------------------------------------------------------
"Ref19KHz" default answer:

0, Disabled
0 Ok

possible answers:

0, Disabled
1, On ASI_OUT
2, On LAN_RESET Pin
3, Both On ASI_OUT & LAN_RESET Pin

-----------------------------------------------------------------
```

```
"Source_Select" default answer:

0, SPDIF/AES-EBU (Optical)
0 Ok

possible answers:

0, SPDIF/AES-EBU (Optical)
1, SPDIF/AES-EBU (Electrical)
2, SPDIF/AES-EBU (on ASI input)
3, SPDIF/AES-EBU (on SDI input)
4, Analog XLR (I2S)
5, BaseBand

-----------------------------------------------------------------
```