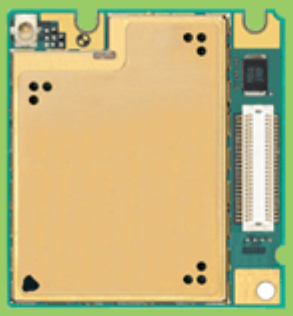
CINTERION
WIRELESS MODULES

Migration from MC55/MC56 to MC55i



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Migration Guide

Document Name:	**Migration from MC55/MC56 to MC55i**
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0 Document History

Preceding document: "Migration from MC55/MC56 to MC55i" Version 01
New document: "Migration from MC55/MC56 to MC55i" Version 02

Chapter	What is new
--	Removed section on electrostatic discharge. ESD at antenna port has been measured to be the same as for MC55/MC56.
2.3.2	Revised complete section.
2.4	Added new section: Charging Application.
--	Removed section on antenna interface.
2.5.2.3	Updated audio mode characteristics.
3.6	Removed separate section “Deferred Shutdown”. Summary of new AT^SCTM parameters provided in Section 3.6 only.

1 Introduction

This migration document[1] compares the Cinterion wireless modules MC55/MC56 and MC55i and lists hardware as well as software related differences between the modules.

The aim of the document is to provide information and to offer support in order to facilitate the migration from MC55/MC56 to MC55i.

1.1 Related Documents

[1] MC55/MC56 Hardware Interface Description
[2] MC55i Hardware Interface Description
[3] MC55/MC56 AT Command Set
[4] MC55i AT Command Set
[5] DSB45 Development Support Box
[6] Remote-SAT User's Guide for MC55i
[7] Application Note 02: Audiio Interface Design for GSM Applications
[8] Application Note 23: DSB45 Installation for MC55i

1.2 Type Approval

MC55/MC56 and MC55i comply with the same standards and directives.

[1] The document is effective only if listed in the appropriate Release Notes as part of the technical documentation delivered with your Cinterion wireless product.

2 Hardware Related Differences

This chapter comprises hardware related differences between MC55/MC56 and MC55i.

It also refers to sections of the MC55/MC56 Hardware Interface Description [1] describing features and properties that were modified for MC55i.

2.1 General Properties

This section lists general properties that were modified for MC55i compared to MC55/MC56.

2.1.1 Frequency Bands

Table 1: Frequency bands

MC55i	***MC55/MC56***
• Full quad-band support according to 3GPP: GSM 850 GSM 900 GSM 1800 GSM 1900	• *MC55 (tri-band):* *GSM 900,* *GSM 1800,* *GSM 1900* • *MC56 (tri-band):* *GSM 850,* *GSM 1800,* *GSM 1900*

MC55/MC56-HID reference (see [1]):
- Section 2.1: “MC55/MC56 Key Features at a Glance”

2.1.2 Dimensions and Weight

The mechanical dimensions of the two modules are identical: 35 x 32.5 x 3.1mm.
The height excluding application connector is 2.9mm. MC55i's weight is approx. 6g.

MC55i has an additional oblong hole for mounting the module as well as a new single shield protecting baseband and radio frequency components (see Figure 1).

For a more detailed drawing of MC55i's dimensions please see [2].

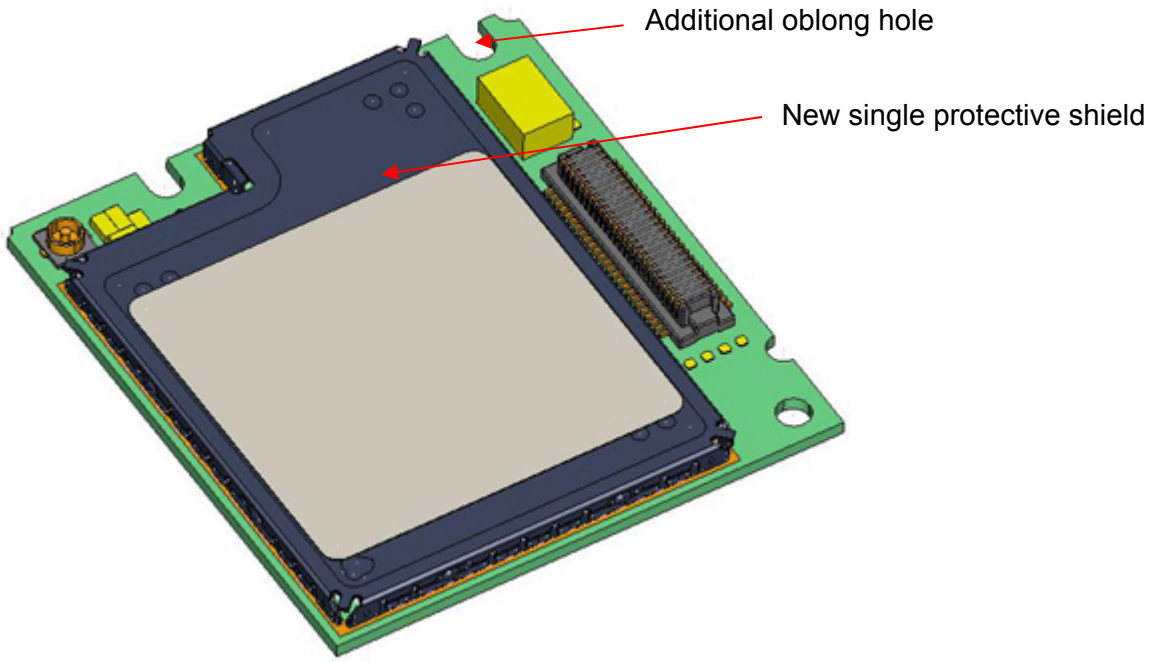


Figure 1: MC55i – top view

MC55/MC56-HID reference (see [1]):

- Section 2.1: "MC55/MC56 Key Features at a Glance"
- Section 6.1: "Mechanical Dimensions of MC55/MC56"

2.1.3 Operating Temperature

The operating temperatures for both modules are listed in the below table.

Table 2: Operating temperatures

Parameter	Unit	MC55i			*MC55/MC56*		
		Min	Typ	Max	*Min*	*Typ*	*Max*
Ambient temperature (according to GSM 11.10)	°C	-20	+25	+55	*-20*	*+25*	*+55*
Restricted operation	°C	-40 to -20		+55 to +70	*-25 to -20*		*+55 to +70*
Automatic shutdown	°C						
Module temperature		-40		+70	*-25*		*+70*
Battery temperature		-20		+60	*-18*		*+60*
Charging temperature (software controlled fast charging)	°C	0		+45	*0*		*+45*

It is possible to mount a heat sink at the bottom side of MC55i.

MC55/MC56-HID reference (see [1]):
- Section 2.1: “MC55/MC56 Key Features at a Glance”
- Section 5.2: “Operating Temperatures”

2.1.4 TTY/CTM Support

Table 3: TTY support

MC55i	*MC55/MC56*
• CTM equipment can be connected to one of the three audio interfaces. • In addition, MC55i supports an internal TTY/CTM-Modem. TTY equipment can therefore be connected directly to one of the three audio interfaces (see also Section 3.3.2).	• *CTM equipment can be connected to one of the three audio interfaces.*

2.1.5 Operating Modes

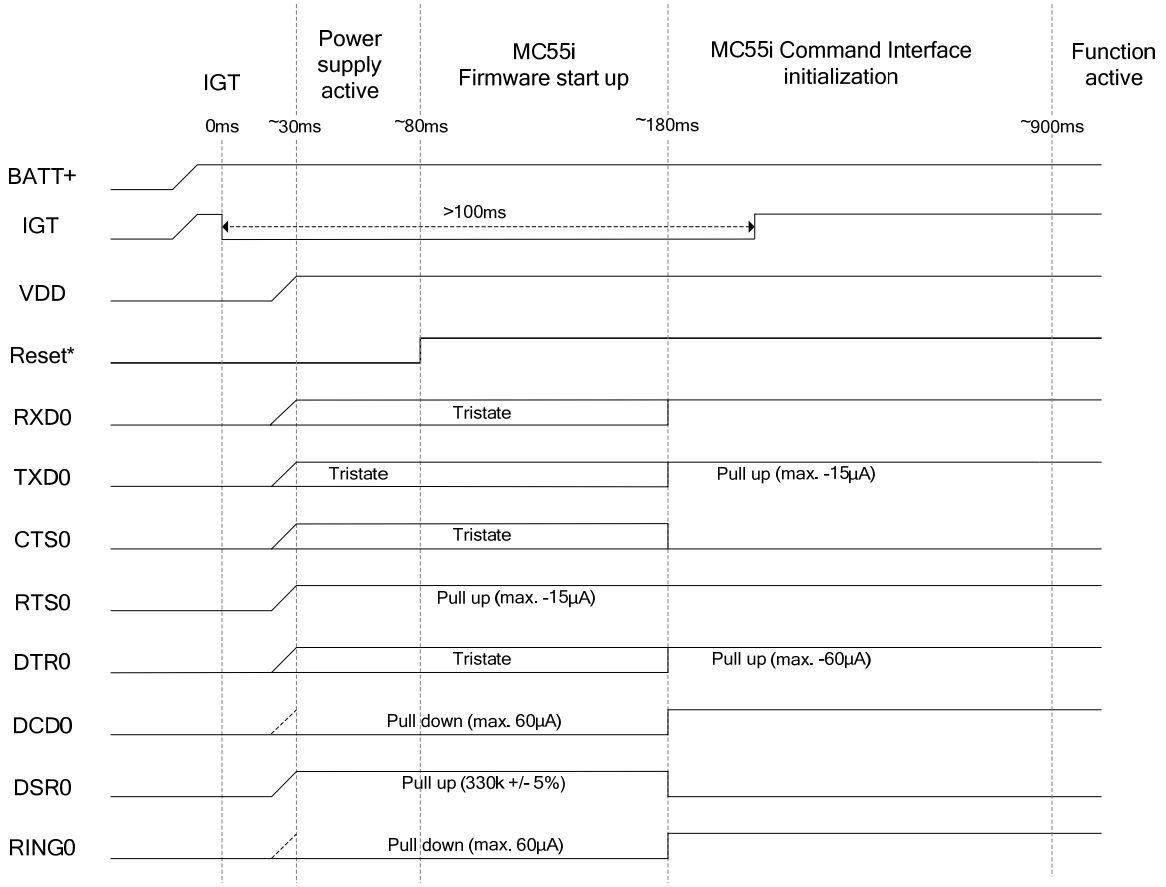
With MC55i a direct transition between Charge-only mode and ALARM mode is no longer possible. An indirect state transition via other modes is available – for details see [2].

MC55/MC56-HID reference (see [1]):
- Section 3.7: “Summary of State Transitions (except SLEEP mode)”

2.2 Power-Up Behavior

The startup timing of MC55/MC56 and MC55i is different. MC55/MC56 starts up approximately 180ms after IGT is released. MC55i is faster and starts approximately 80ms after IGT.

The following figure shows the startup timing of MC55i:



* Reset is an internal signal that is set to high once the module's processor is powered up.

Figure 2: MC55i startup

MC55/MC56-HID reference (see [1]):

- Section 3.3.1: "Turn on MC55/MC56"

2.3 Power-Down Behavior

The switch off timing varies between MC55/MC56 and MC55i. The switch off time for MC55/MC56 ranges from immediately to about 3.2s. MC55i is always powered off immediately, even for a hardware driven emergency shutdown using the EMERGOFF (Power Down) line.

MC55/MC56-HID reference (see [1]):
- Section 3.3.2: “Turn off MC55/MC56”
- Section 3.7: “Summary of State Transitions (Except SLEEP Mode)”

2.3.1 Discharge at VDD Pin

On switching off MC55i, the discharge at the external voltage supply pin VDD requires more time than with MC55/MC56. The varying VDD behavior is shown in the below figure.

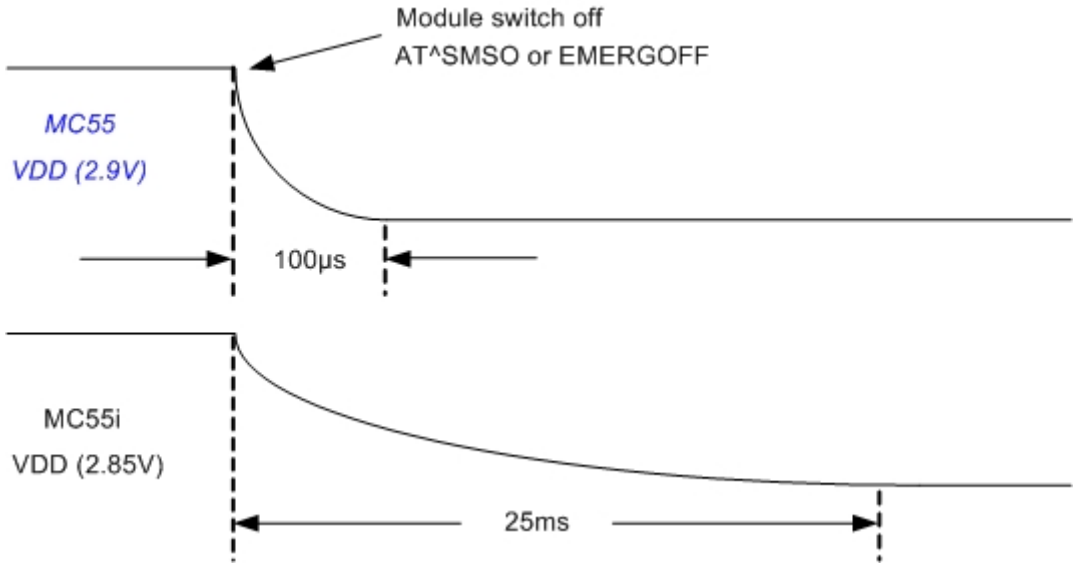


Figure 3: Discharge at VDD pin

Please note that because of this behavior the serial interface drivers on the development Support Board DSB45 react in a way that the modem status lines will stay in an active state, even if the MC55i itself is switched off.

2.3.2 Switch off during Charge-only Mode

To switch off MC55i during Charge-only mode an external circuit will have to be implemented at the module's charging interface as shown in the figure below:

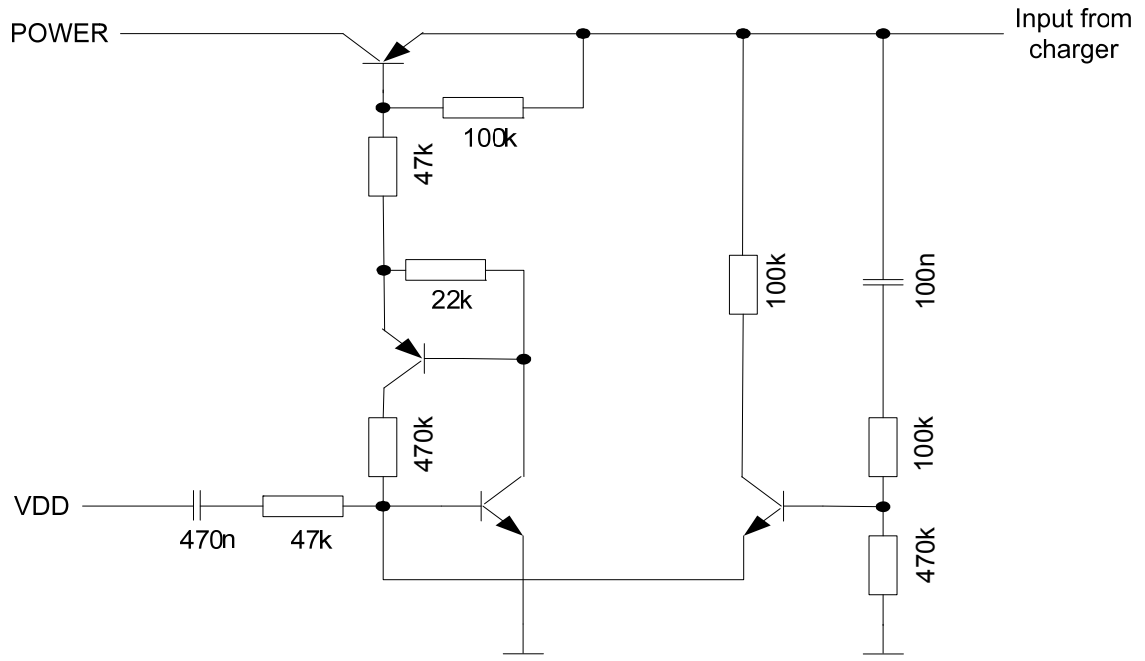


Figure 4: External circuit to switch off MC55i during charging.

Alternatively, the charger has to be disconnected, i.e., the charging interface's POWER signal has to be set to low, in order to switch the module off during Charge-only mode.

2.4 Charging Application

In order to employ a sine half-wave charger for MC55i that generates a pulsating DC voltage it is necessary to insert a 47µF 25V capacitor between the charger and the module's POWER line.

The DSB45 Support Board Revision B1.2 has an appropriate capacitor and can be used with MC55i as described in [5] and [8]. The following figure shows how to mount such a 47µF capacitor on a DSB45 Support Board B1.1.

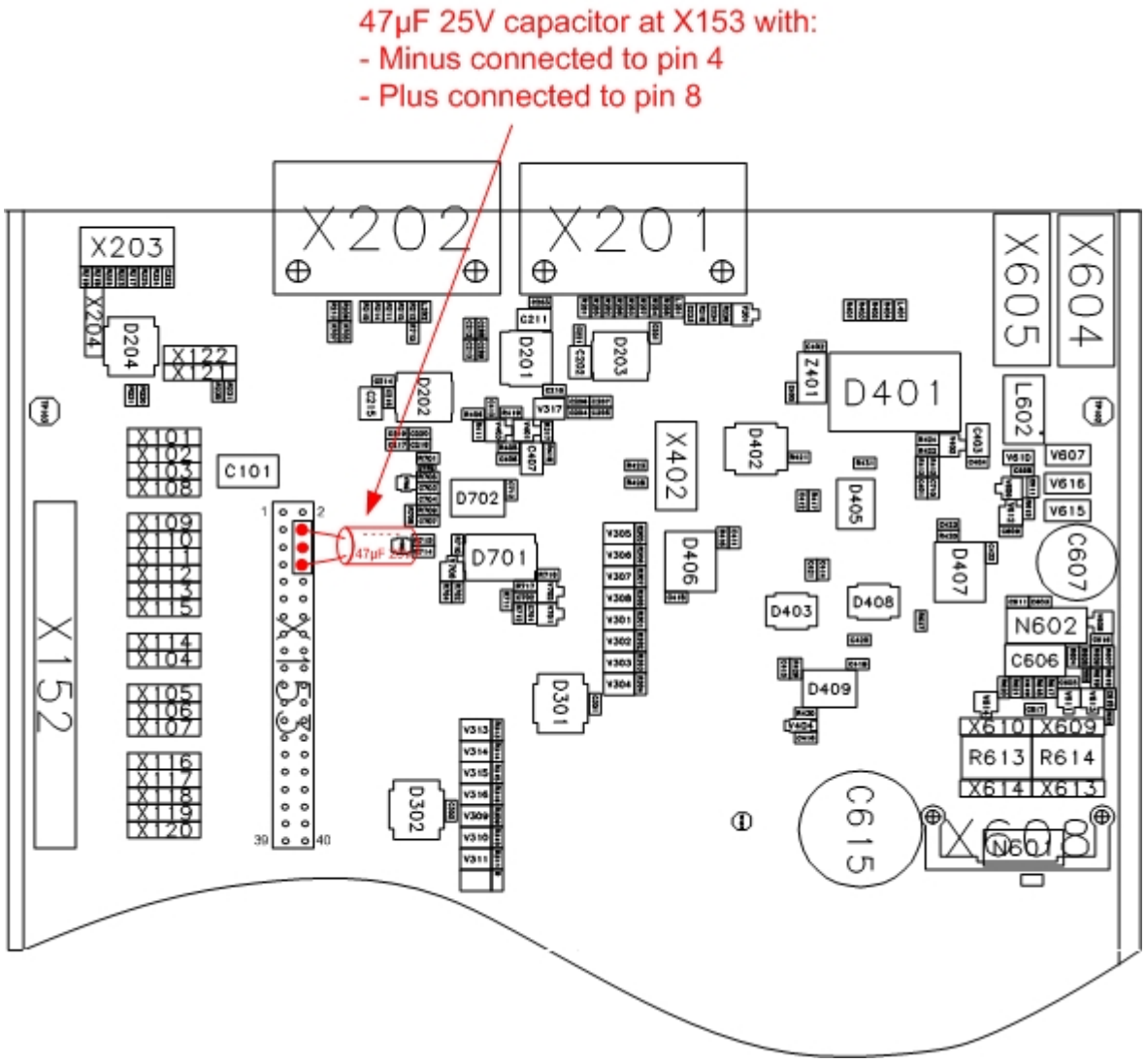


Figure 5: Additional capacitor on DSB45 B1.1

Because of this modification the sample application given in the MC55i-HID has been adapted. It now shows the 47µF 25V capacitor instead of the 100nF capacitor recommended for MC55/MC56 on the connection between the charger and the POWER pin. Replacing the capacitor has no effect on MC55/MC56 applications.

MC55/MC56-HID reference (see [1]):

- Chapter 8: "Design Example"

2.5 Application Interfaces

This section lists differences between the application interfaces of MC55/MC56 and MC55i.

2.5.1 SIM Interface

Table 4: SIM interface

MC55i	*MC55/MC56*
• Supported SIM cards: 3V 1.8V	• *Supported SIM card:* *3V*

MC55/MC56-HID reference (see [1]):
- Section 2.1: “MC55/MC56 Key Features at a Glance”
- Section 3.11: “SIM interface”

2.5.2 Audio Interface

Due to a different implementation of the digital audio interface, SCLK is now used as bit clock output, and RFSDAI has currently no function and is reserved for future use. These differences are marked in red in Figure 6.

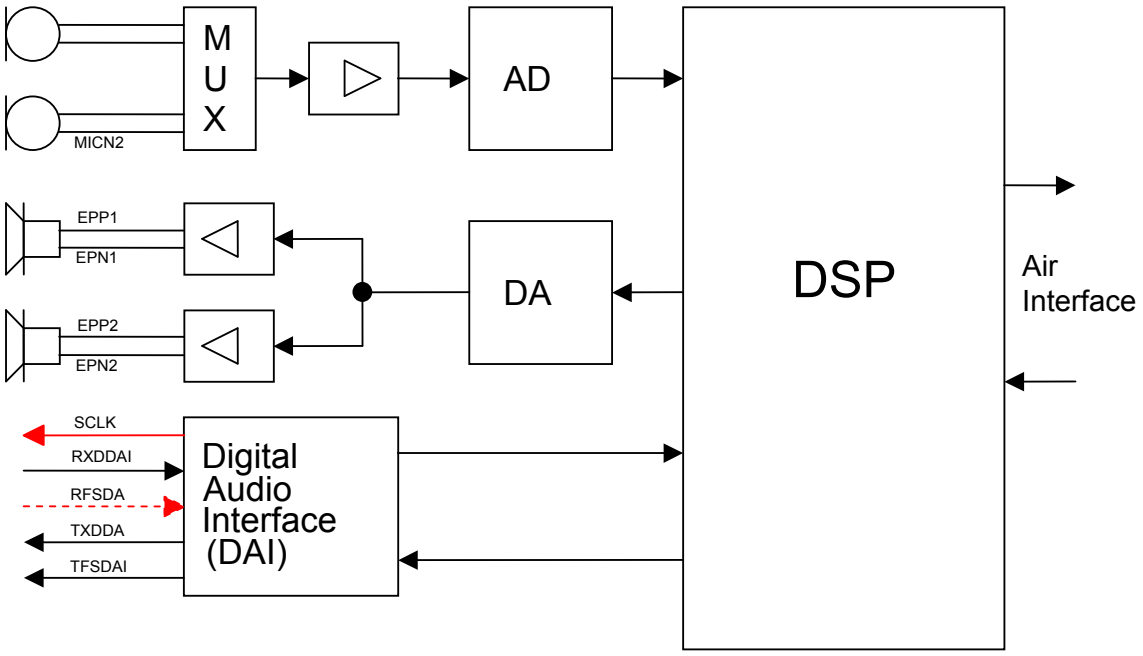


Figure 6: Audio block diagram

MC55/MC56-HID reference (see [1]):
- Section 3.10: “Audio Interfaces”

2.5.2.1 DAI timing

To support the DAI function, MC55i integrates a four-line serial interface with one input data line (RXDDAI) and three lines for output data, clock and frames (TXDDAI, SCLK and TFSDAI). The input RFSDAI line is reserved for future use.

This DAI implementation differs from MC55/MC56 with regard to the direction of the SCLK signal. The MC55i SCLK signal is an output, generating a 256-kHz-bit-clock as master. Furthermore the frame synchronization can no longer be done independently for both directions. For MC55i there is a so called “long frame synchronization” signal available for both directions at the TFSDAI pin.

The 4-wire PCM interface uses the SCLK line for bit shifting, the TFSDAI line to synchronize transmission and receipt of data simultaneously as well as the TXDDAI and RXDDAI lines to transfer data.

Data transfer between MC55i and an application is initiated via a pulse at TFSDAI. The duration of the TFSDAI pulse is 16 SCLK periods, starting at the rising edge of SLCK. During these 16 SLCK cycles, the 16-bit sample will be transferred over the TXDDAI line and received via RXDDAI. The next samples will be transferred after the next TFSDAI pulse. The TFSDAI pulses occur every 125 µs – synchronized with the GSM data flow.

The MC55i timing characteristics of both data transfer directions are shown in Figure 7.

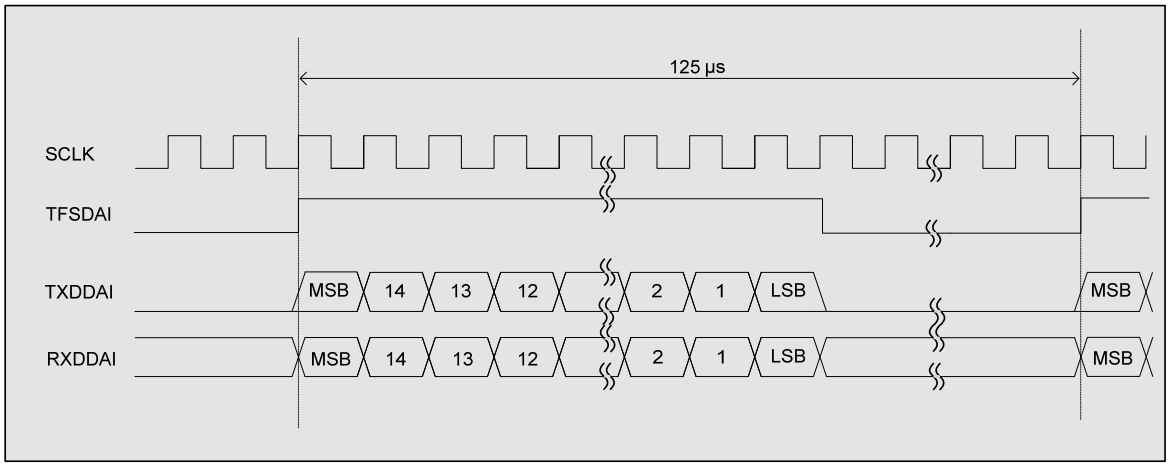


Figure 7: MC55i DAI timing

A comparison of the MC55/MC56 and MC55i DAI characteristics can be found in the following table.

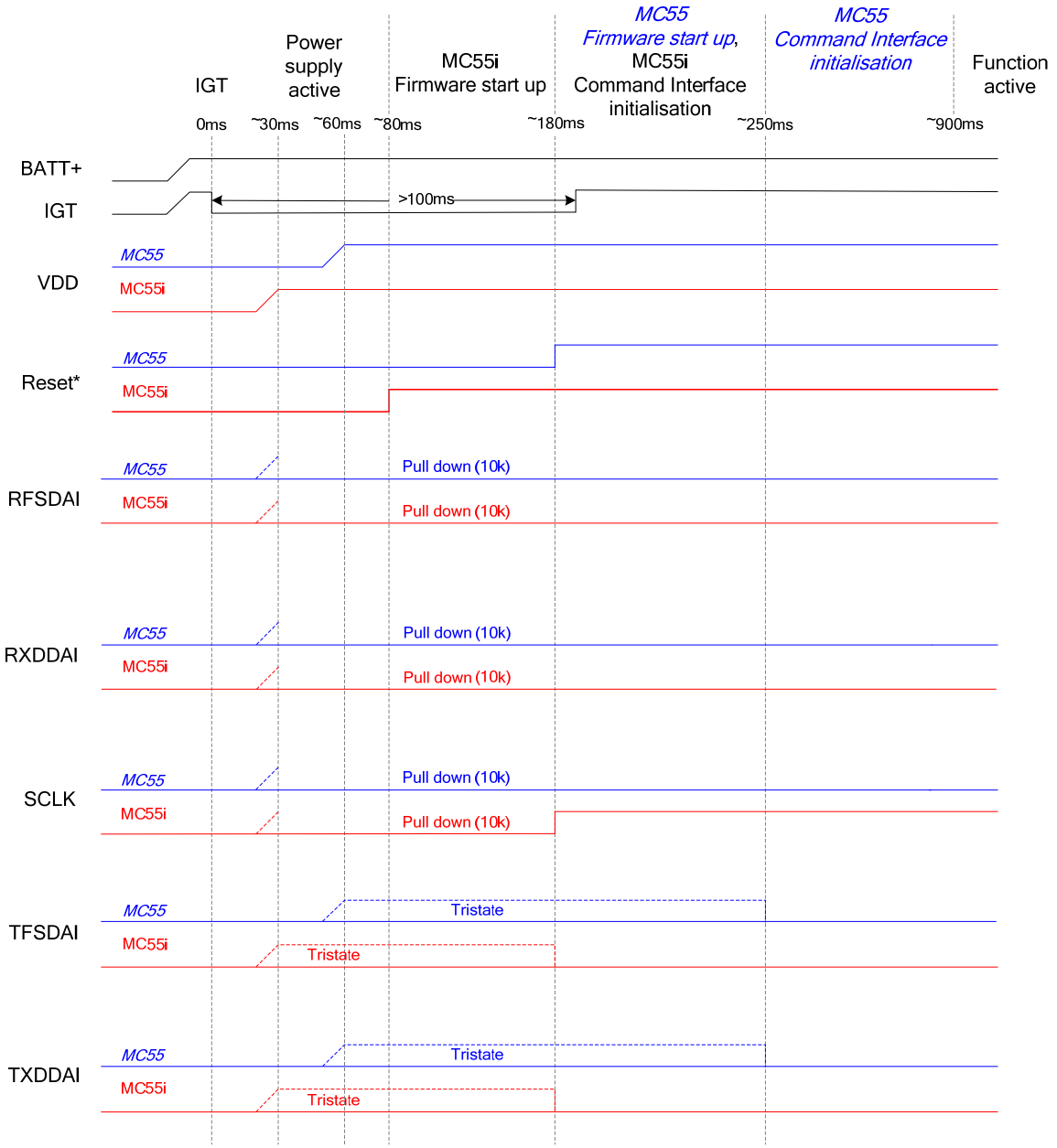
Table 5: DAI characteristics comparison

Characteristic	MC55i	*MC55/MC56*
SCLK direction	Output (Master)	*Input*
SCLK frequency	256 kHz	*200 kHz – 10 MHz*
TFSDAI direction	Output (Master)	*Output (Master)*
TFSDAI sync format	Long Frame	*Short Frame*
TFSDAI Jitter	None	*± 1 SLCK period*
RFSDAI direction	Input, reserved for future use	*Input*

Characteristic	MC55i	*MC55/MC56*
RFSDAI sync format	n/a	*Short Frame*
RFSDAI to TFSDAI delay	not possible, both directions are transferred simultaneously	*up to 100 µs*
Data format	16 bit, linear, MSB first	*16 bit, linear, MSB first*
Data shifted out with	rising edge	*rising edge*
Data sampled in with	falling edge	*falling edge*

MC55/MC56-HID reference (see [1]):
- Section 3.10.3: “DAI Timing”

Figure 8 compares the startup behavior of the modules DAI pins:



* Reset is an internal signal that is set to high once the module’s processor is powered up.

Figure 8: DAI startup

2.5.2.2 Audio programming model

The MC55i audio programming model shows how the signal path can be influenced by varying the AT command parameters. The model is the same for all three interfaces, except for the parameters <outBbcGain> and <inBbcGain> which cannot be modified if the digital audio interface is being used, since in this case the DAC is switched off.

The parameters <inBbcGain> and <inCalibrate> can be set with AT^SNFI. All the other parameters are adjusted with AT^SNFO and AT^SAIC.

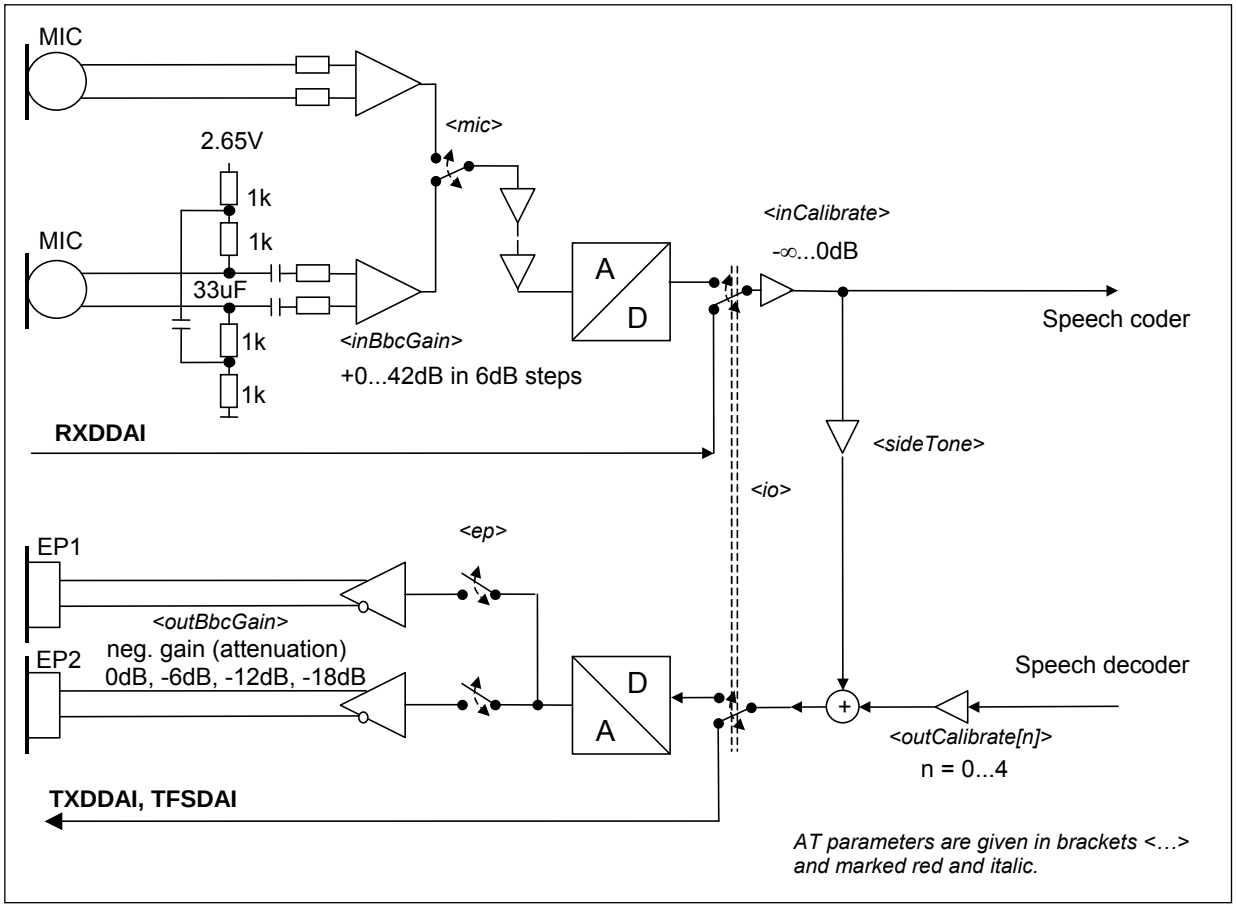


Figure 9: AT audio programming model

In transmit direction; all MC55i audio modes contain internal scaling factors that are not accessible by the user (digital amplification). In case of digital signal input via DAI, these scaling factors are set to 0dB, so that further correction using <inCalibrate> as with MC55/MC56 is no longer required. <inCalibrate> can be left at its default value of 32767.

MC55/MC56-HID reference (see [1]):

- Section 5.7.2: “Audio Programming Model”

2.5.2.3 Characteristics of audio modes

MC55i provides a new audio architecture and audio hardware. Due to the higher quality of the new audio hardware it is not longer necessary to improve for example some noise and linearity characteristics using limiters, compressors or AGC. MC55i therefore does not need these audio functions and they are not implemented.

For MC55i, the echo suppression function of MC55/MC56 in some audio modes is replaced by a more suitable echo cancellation algorithm, providing for a better echo loss figure.

Please note that the settings for the MC55/MC56 audio parameter blocks are incompatible with MC55i. Wherever necessary new parameter sets *will have to be generated and imported*.

Nevertheless the audible characteristics of each audio mode of MC55i are more or less the same compared to MC55/MC56.

The following table shows the characteristics of the MC55i audio modes. MC55/MC56 values that differ from MC55i values are shown in *italics* (and blue).

Table 6: Audio mode characteristics

Audio mode no. AT^SNFS=	**1** (Default settings, not adjustable)	**2**	**3**	**4**	**5**	**6**
Name	Default Handset	Basic Handsfree	Headset	User Handset	Plain Codec 1	Plain Codec 2
Purpose	DSB with Votronic handset	Car Kit Portable	Headset	DSB with individual handset	Direct access to speech coder	Direct access to speech coder
Gain setting via AT command. Defaults:	Fix	Adjustable	Adjustable	Adjustable	Adjustable	Adjustable
inBbcGain	4 (24dB)	2 (12dB)	6 (36dB) *5 (30dB)*	4 (24dB)	0 (0dB)	0 (0dB)
outBbcGain	0 (6dB) *1 (-6dB)*	2 (-12dB) *1 (-6dB)*	2 (-12dB) *2 (-12dB)*	0 (0dB) *1 (-6dB)*	0 (0dB)	0 (0dB)
Default audio interface	1	2	2	1	1	2
Power supply	ON (2.65V)	ON (2.65V)	ON (2.65V)	ON (2.65V)	ON (2.65V) *OFF (GND)*	ON (2.65V) *OFF (GND)*
Sidetone	ON	---	Adjustable	Adjustable	Adjustable	Adjustable
Volume control	OFF	Adjustable	Adjustable	Adjustable	Adjustable	Adjustable
Limiter (receive)	--- *ON*	--- *ON*	--- *ON*	--- *ON*	---	---
Compressor (receive)	---	--- *OFF*	---	---	---	---
AGC (send)	---	---	--- *ON*	---	---	---

Audio mode no. AT^SNFS=	**1** (Default settings, not adjustable)	**2**	**3**	**4**	**5**	**6**
Echo control (send)	Cancellation *Suppression*	Cancellation *Cancellation Suppression*	Cancellation *---*	Cancellation *Suppression*	---	---
Noise suppression	---	15dB *up to 10dB*	15dB *10dB*	---	---	---
MIC input signal for 0dBm0 @ 1024 Hz (default gain)	18mV *23mV*	65mV *58mV*	7.5mV *7.5mV @ -3dBm0 due to AGC*	18mV *23mV*	315mV	315mV
EP output signal in mV rms. @ 0dBm0, 1024 Hz, no load (default gain); @ 3.14 dBm0	620mV *284mV*	210mV *120mV* default @ max volume	320mV *300mV* default @ max volume	620mV *284mV* default @ max volume	880mV *895mV* 3.7Vpp	880mV *895mV* 3.7Vpp
Sidetone gain at default settings	21.5dB *22.8dB*	-∞ dB	20.5dB *Affected by AGC, 13dB @ 7.5mV (MIC)*	21.5dB *22.8dB*	-3dB @ sidetone = 8192 *-∞ dB*	-3dB @ sidetone = 8192 *-∞ dB*

The AT^SNFO parameter settings also differ between MC55i and MC55/MC56. The following table shows the default parameters for both modules - MC55/MC56 values are shown in *italics* (and blue).

Table 7: Default SNFO parameter

Audio mode	**Default SNFO parameters**
1	0,16384,16384,16384,16384,16384,4,10752 *1,16384,16384,16384,16384,16384,4,8192*
2	2,4685,6301,8500,11205,15115,4,0 *1,4685,6301,8500,11205,15115,4,0*
3	2,1253,2452,4891,9759,16383,4,2048 *2,1253,2452,4891,9759,16383,4,682*
4	0,4096,5792,8192,11584,16384,4,10752 *1,10337,11598,13014,14602,16384,4,8192*
5	0,4096,5792,8192,11584,16384,4,0 *0,16384,16384,16384,16384,16384,4,0*
6	0,4096,5792,8192,11584,16384,4,0 *0,16384,16384,16384,16384,16384,4,0*

MC55/MC56-HID reference (see [1]):

- Section 5.7.3: “Characteristics of Audio Modes”

2.5.2.4 Voiceband Receive Path

Table 8: Voiceband receive path

Parameter	Min	Typ	Max	Unit	Test condition / remark
MC55i: Differential load capacitance			100	pF	from EPP1 to EPN1
MC55i: Differential load capacitance			2000	pF	from EPP2 to EPN2
MC55/MC56: Differential load capacitance			*1000*	*pF*	*from EPPx to EPNx*

MC55/MC56-HID reference (see [1]):

- Section 5.7.4: “Voiceband Receive Path”

2.5.2.5 Reference Equipment for Type Approval

No DAI-Box is necessary for MC55i. The GSM type approval DAI according to GSM 11.10 is not supported by MC55i. Acoustic type approval will be done via the air interface.

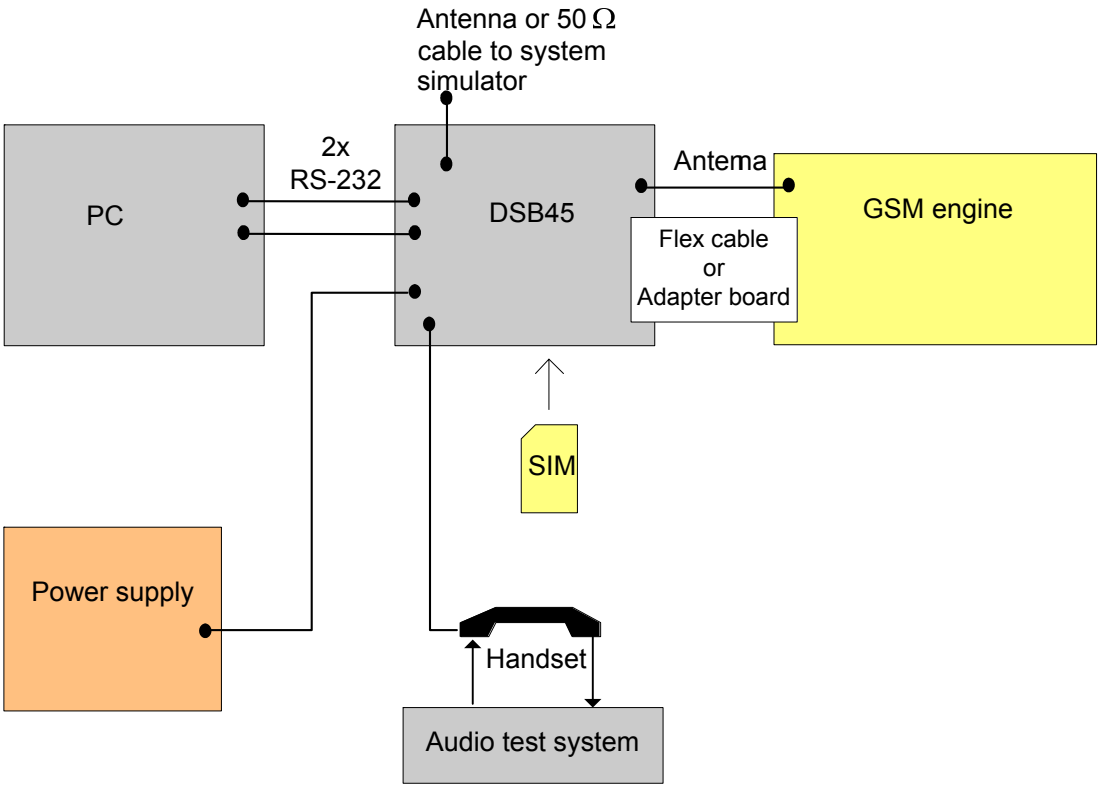


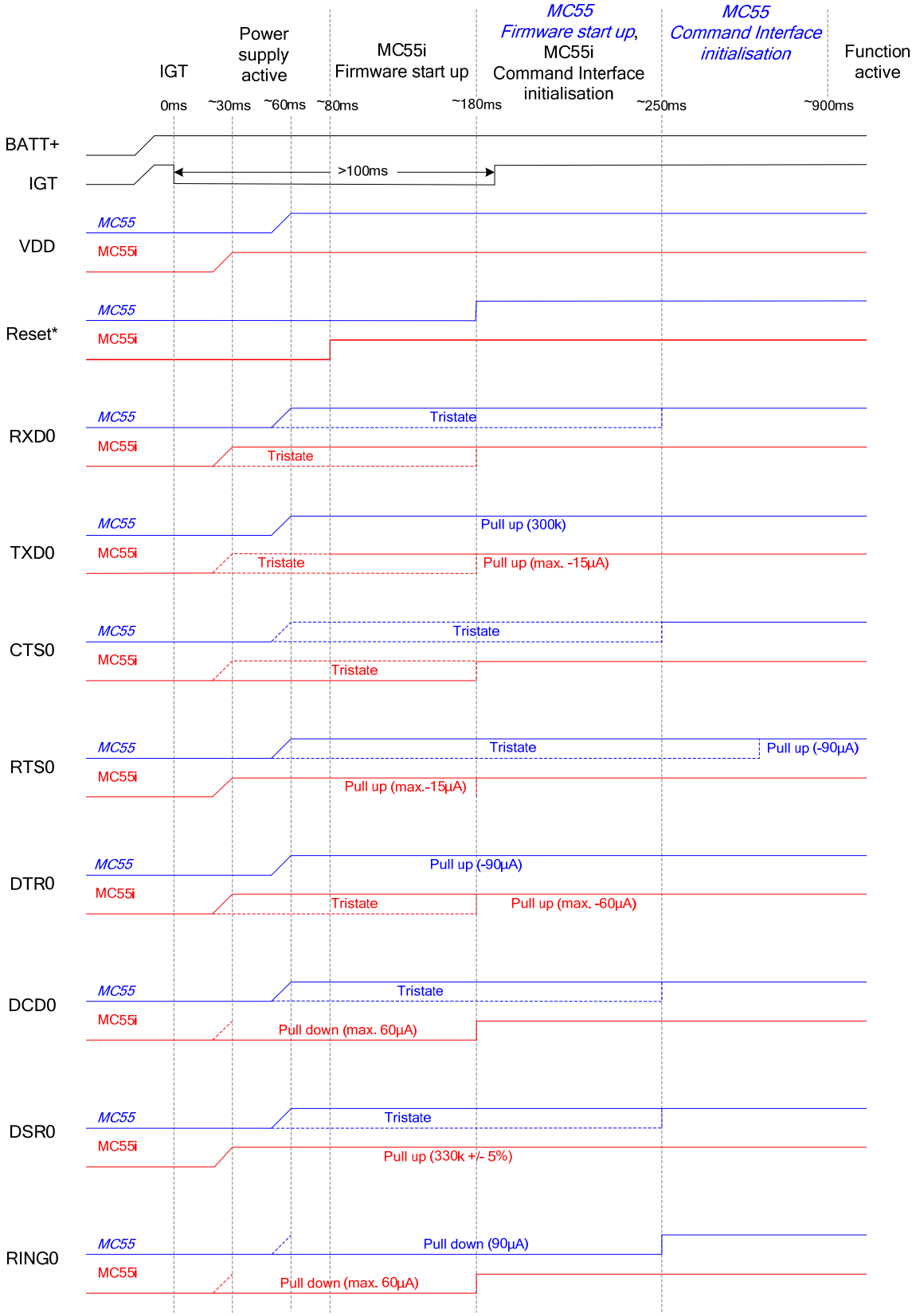
Figure 10: Reference equipment for MC55i type approval

MC55/MC56-HID reference (see [1]):

- Section 7.1: “Reference Equipment for Type Approval”

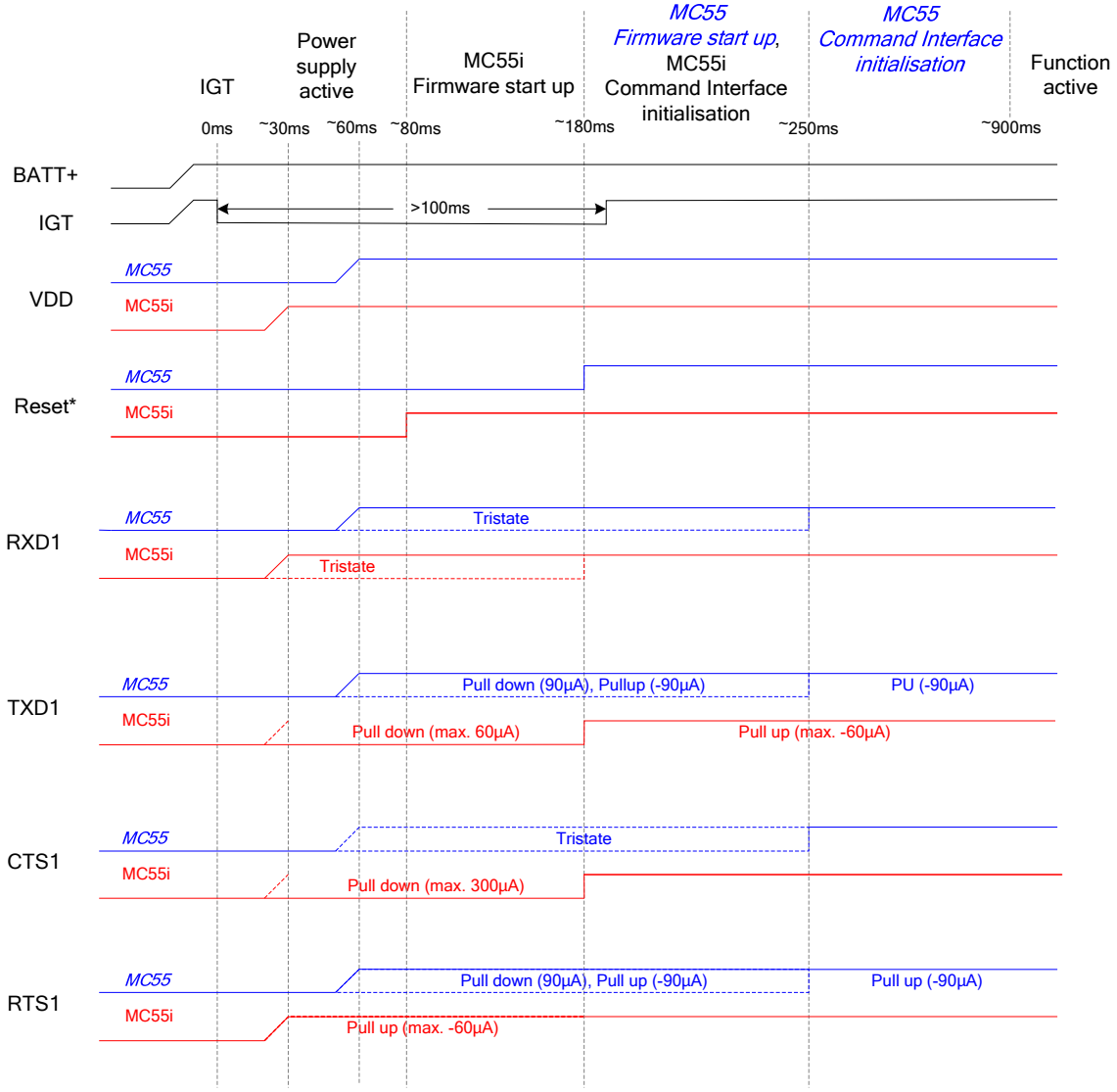
2.5.3 Serial Interface

The startup timing and the signal levels are different as shown in the following figures:



* Reset is an internal signal that is set to high once the module's processor is powered up.

Figure 11: ASC0 signal state differences between MC55/MC56 and MC55i



* Reset is an internal signal that is set to high once the module's processor is powered up.

Figure 12: ASC1 signal state differences between MC55/MC56 and MC55i

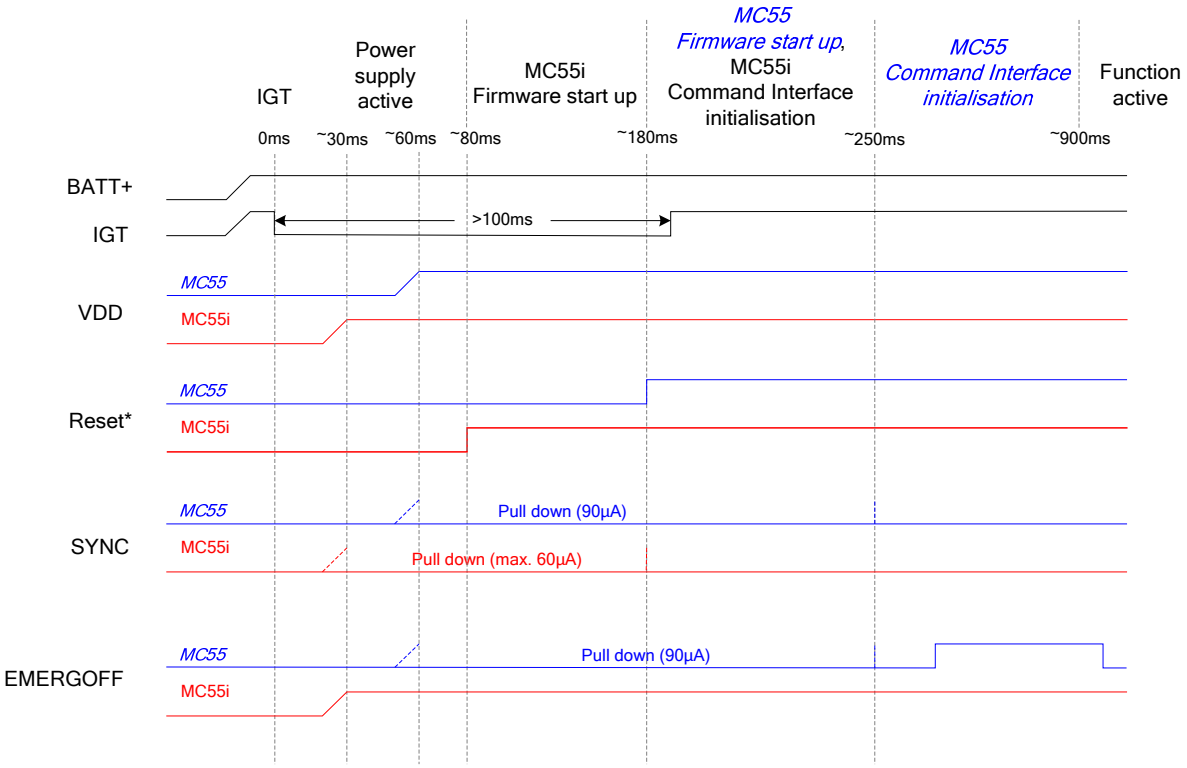
MC55/MC56-HID reference (see [1]):

- Section 3.3.1.1: "Turn on MC55/MC56 using the ignition line /IGT (Power on)"
- Section 3.9: "Serial Interfaces"

2.5.4 Control Signals

Figure 13 shows the differences between both modules SYNC and EMERGOFF signals during the start-up phase.

After start-up, the MC55i EMERGOFF signal will remain high (no toggling). The function to switch off the module due to serious problems remains unchanged.



* Reset is an internal signal that is set to high once the module's processor is powered up.

Figure 13: SYNC and EMERGOFF upon startup

MC55/MC56-HID reference (see [1]):

- Section 3.12: "Control Signals"

2.6 Electrical Characteristics

This section lists differences in the modules' electrical characteristics.

2.6.1 Signal Description

The differences in the characteristics of the electrical signals between both modules are described in the following table.

Table 9: Electrical description of application interface

Function	Signal name	IO	Signal form and level	Comments
Charge interface	POWER	I	MC55i $V_I$min = 3.5V $V_I$max = 12V *MC55/MC56* *VImin = 3.0V* *$V_I$max = 15V*	Maximum input voltage reduced.
	CHARGE	O	MC55i: I_{CHARGE}max = 2mA V_{IH}max = 12V V_{LO}max = 0.25V at I = 2mA *MC55/MC56:* *I_{CHARGE} = 300µA ...-600µA* *@ 3V < V_{CHARGE} < V_{LOAD}*	Changed from current sink to open collector.
External supply voltage	VDD	O	MC55i: VDDmin = 2.75V, VDDtyp= 2.85V, VDDmax = 2.95V *MC55/MC56:* VDDmin = 2.84V, VDDtyp= 2.9V, VDDmax = 2.96V Imax = -10mA $C_L$max = 1µF	The minimum output voltage is reduced by about 100mV.
VDD Low Power	VDDLP			In Power Down mode, VDDLP does not drive IGT to HiZ any more.
Ignition	IGT	I	MC55i: V_{IL}max = (BATT+) -0.5V at I = -5µA V_{IL}min = 0V at Imax = -50µA V_{Open}max = 4.8V *MC55/MC56:* *V_{IL}max = 0.5V at Imax = -20µA* *V_{Open}max = 2.3V* R_I ≈ 100kΩ, C_I ≈ 1nF ON ~~~|____|~~~ Active Low ≥ 100ms	The maximum output voltage is higher and therefore the current has also changed. The line must be driven low by an Open Drain or Open Collector driver.

Function	Signal name	IO	Signal form and level	Comments
Emergency shutdown (Watchdog)	EMERGOFF	I/O	MC55i: R_I ≈100kΩ V_{IL}max = 0.3V at Imax = -500µA V_{Open}max = 2.82V *MC55/MC56* *R_I ≈22kΩ* *V_{IL}max = 0.5V at Imax = -100µA* *V_{Open}max = 2.73V* *Signal ~~~|_____|~~~ Active Low ≥ 3.2s* *Watchdog:* *V_{OL}max = 0.35V at I = 10µA* *V_{OH}min= 2.25V at I = -10µA* *$f_O$min = 0.16Hz* *$f_O$max = 1.55Hz*	MC55i has no watchdog signal on EMERGOFF. This signal is always high. The driver current is 5 times higher.
3V SIM Interface	CCIN			No changes at CCIN. Interface differences for CCRST, CCIO, CCCLK and CCVCC.
	CCRST	O	MC55i: R_O ≈47Ω V_{OL}max = 0.25V at I = 1mA V_{OH}min = 2.50V at I = -1mA V_{OH}max = 2.95V *MC55/MC56:* *R_O ≈ 47Ω* *V_{OL}max = 0.25V at I = 1mA* *V_{OH}min = 2.3V at I = -1mA* *V_{OH}max = 2.73V*	
	CCIO	I/O	MC55i: R_I ≈4.7kΩ V_{IL}max = 0.5V V_{IH}min = 2.00V, V_{IH}max=3.3V R_O ≈100Ω V_{OL}max = 0.3V at I = 1mA V_{OH}min = 2.65V at I = -20µA V_{OH}max = 2.95V *MC55/MC56:* *R_I ≈10kΩ* *V_{IL}max = 0.5V* *V_{IH}min = 1.95V, V_{IH}max=3.3V* *R_O ≈ 47Ω* *V_{OL}max = 0.4V at I = 1mA* *V_{OH}min = 2.15V at I = -1mA* *V_{OH}min = 2.55V at I = -20µA* *V_{OH}max = 2.96V*	
	CCCLK	O	MC55i: R_O ≈100Ω V_{OL}max = 0.3V at I = 1mA V_{OH}min = 2.45V at I = -1mA V_{OH}max = 2.95V *MC55/MC56:* *R_O ≈ 220Ω* *V_{OL}max = 0.4V at I = 1mA* *V_{OH}min = 2.15V at I = -1mA* *V_{OH}max = 2.73V*	

Function	Signal name	IO	Signal form and level	Comments
	CCVCC	O	MC55i: $R_O$max ≈ 5Ω CCVCCmin = 2.75V, CCVCCmax = 2.95V Imax = 20mA *MC55/MC56:* *$R_O$max = 5Ω* *CCVCCmin = 2.84V,* *CCVCCmax = 2.96V* *Imax = -20mA*	
	CCGND		Ground	
1.8V SIM Interface	CCIN	I	R_I ≈ 100kΩ V_{IL}max = 0.5V V_{IH}min = 2.15V at I = 20µA, V_{IH}max=3.3V at I = 30µA	1.8V SIM Interface is new for MC55i.
	CCRST	O	R_O ≈47Ω V_{OL}max = 0.25V at I = 1mA V_{OH}min = 1.40V at I = -1mA V_{OH}max = 1.95V	
	CCIO	IO	R_I ≈4.7kΩ V_{IL}max = 0.3V V_{IH}min = 1.20V, V_{IH}max=3.3V R_O ≈100Ω V_{OL}max = 0.3V at I = 1mA V_{OH}min = 1.60V at I = -20µA V_{OH}max = 1.95V	
	CCCLK	O	R_O ≈100Ω V_{OL}max = 0.3V at I = 1mA V_{OH}min = 1.40V at I = -1mA V_{OH}max = 1.95V	
	CCVCC	O	$R_O$max ≈ 5Ω CCVCCmin = 1.71V, CCVCCmax = 1.95V Imax = 20mA	
	CCGND		Ground	
ASC0 interface	RXD0	O	MC55i: V_{OL}max = 0.2V at I = 1mA V_{OH}min = 2.40V at I = -1mA V_{OH}max = 2.82V V_{IL}max = 0.5V V_{IH}min = 2.00V, V_{IH}max=3.3V *MC55/MC56:* *VOLmax = 0.2V at I = 1mA* *VOHmin = 2.35V at I = -1mA* *VOHmax = 2.73V* *V_{IL}max = 0.5V* *V_{IH}min = 1.95V, V_{IH}max=3.3V* *DTR0, RTS0: Imax = -90µA at V_{IN} = 0V* *TXD0: Imax = -30µA at V_{IN} = 0V*	TXD0, RTS0: pull up -15µA at 0V DTR0: pull up -60µA at 0V
	TXD0	I		
	CTS0	O		
	RTS0	I		
	DTR0	I		
	DCD0	O		
	DSR0	O		
	RING0	O		

Function	Signal name	IO	Signal form and level	Comments
ASC1 interface	RXD1	O	MC55i: V_{OL}max = 0.2V at I = 1mA V_{OH}min = 2.40V at I = -1mA V_{OH}max = 2.82V V_{IL}max = 0.5V V_{IH}min = 2.00V, V_{IH}max=3.3V *MC55/MC56:* *V_{OL}max = 0.2V at I = 1mA* *V_{OH}min = 2.35V at I = -1mA* *V_{OH}max = 2.73V* *V_{IL}max = 0.5V* *V_{IH}min = 1.95V, V_{IH}max=3.3V* *$I_I$max = -90µA at V_{IN} = 0V*	TXD1, RTS1: pull up -60µA at 0V
	TXD1	I		
	CTS1	O		
	RTS1	I		
Digital audio interface	RFSDAI	I	MC55i: V_{OL}max = 0.2V at I = 1mA V_{OH}min = 2.40V at I = -1mA V_{OH}max = 2.82V V_{IL}max = 0.5V V_{IH}min = 2.00V, V_{IH}max=3.3V *MC55/MC56:* *V_{OL}max = 0.2V at I = 1mA* *V_{OH}min = 2.35V at I = -1mA* *V_{OH}max = 2.73V* *V_{IL}max = 0.5V* *V_{IH}min = 1.95V, V_{IH}max=3.3V* *$I_I$max = 330µA at V_{IN} = 3.3V*	This interface has a changed functionality. RFSDAI, RXDDAI, SCLK: pull down +330µA at V_{IN} = 3.3V
	RXDDAI	I		
	SCLK	O *I*		
	TFSDAI	O		
	TXDDAI	O		

MC55/MC56-HID reference (see [1]):
- Section 5.5: “Electrical Specifications of the Application Interface”

2.6.2 Air Interface

MC55i has improved receiver input sensitivity values:

Parameter		Min	Typ	Max	Unit
Receiver input sensitivity @ ARP BER Class II < 2.4% (static input level)	GSM 850	-102	-107*)		dBm
	EGSM 900	-102	-107*)		dBm
	GSM 1800	-102	-107*) *MC55: -106*		dBm
	GSM 1900	-102	-107*) *MC55: -105.5*		dBm

*) Typical value is at least -107dBm.

MC55/MC56-HID reference (see [1]):
- Section 5.8: “Air Interface”

3 Software Related Differences

This chapter comprises software related differences between MC55/MC56 and MC55i.

3.1 Firmware Update

The SIM Swup feature available for MC55/MC56 is no longer supported for MC55i.

3.2 Encryption Algorithms

MC55i employs the A5/1 encryption algorithm. The A5/2 encryption algorithm is no longer supported.

3.3 Audio Interface

3.3.1 Audio Loop Setting

The new AT^SCFG parameter “Audio/Loop” has been introduced to configure an audio loop which can be used to simplify the verification of audio connections. The intention of this audio loop is for testing only at an implementer’s production facility. Full audio processing will be performed. Audio parameterization capabilities remain nearly unrestricted. Microphone and loudspeaker ports can be selected with random access. The audio loop cannot be used in combination with the digital audio interface. Neither a SIM card nor a GSM network is necessary to turn the audio loop on.

For details on the AT command AT^SCFG and “Audio/Loop” see [4].

3.3.2 Internal CTM Modem

MC55i incorporates an internal CTM modem. The AT^SNFTTY parameter <audioState> has been enhanced to activate the TTY/CTM mode for this internal CTM modem.

For details on the AT command AT^SNFTTY see [4].

3.4 Remote SAT (SIM Application Toolkit)

The Remote SAT interface has been changed as described in the following sections. For details please refer to [6].

3.4.1 Interface Activation

The Remote SAT interface activation via AT^SSTA is now able to switch between a default automatic response mode (AR Mode) and an explicit response mode (ER Mode).

- In AR mode (<mode>=0) all commands and responses are exchanged automatically between the ME and the SIM application (default). This eliminates the need to enter any Remote SAT AT commands incl. the AT^SSTA command.
  If AR mode is enabled the ME enters the OFF state (<state>=1) after reboot.
- ER mode (<mode>=1) is intended for use with an MMI. If ER mode is enabled the MMI is required to handle, via the module's Remote-SAT interface, all commands and responses transmitted to or from the SIM.
  If ER mode is enabled the ME enters the IDLE state (<state>= 2) after reboot.

3.4.2 Remote SAT Get Information

The command “AT^SSTGI Remote_Sat Get Information – Refresh (1) has been enhanced to support the new parameters <pathLen>,<fileNum>, <fileList>:

```
AT^SSTGI=1
^SSTGI: <cmdType>,<commandDetails>,<pathLen>,<fileNum>, <fileList>
OK
```

<pathLen>: Number of bytes coded in <fileList>
<fileNum>: Number of updated Elementary Files (EF) with path given in <fileList>
<fileList>: String containing Elementary File paths.

This extra information enables the customer application to check which data files on the SIM/USIM have been changed and need to be read again. Doing so will prevent the application from working with outdated values.

3.4.3 Icon Handling

Several Remote SAT Proactive commands may provide an icon identifier. Icons are intended to enhance an MMI by providing graphical information to the user. The display of icons is optional for the ME. The SIM indicates to the ME whether the icon replaces an alpha identifier or text string, or whether it accompanies it (icon qualifier).

3.5 Support for Windows XP, Windows Vista, Windows Mobile 6

The MC55i modules supports Microsoft® Windows XP, Microsoft® Windows Vista™ and Windows Mobile® 6:

- Multiplexer and Modem drivers are provided for Windows XP and Windows Vista.
- New RIL and Multiplexer drivers are provided for Windows Mobile 6. If MC55/MC56 is replaced by MC55i these drivers will also have to be replaced.

3.6 Temperature Control

The AT^SCTM command has been enhanced as follows:

- The additional parameters <p> of the AT^SCTM write command and <temp> of the AT^SCTM? read command enable the MC55i module to display the exact board temperature in degrees Celsius.
- Compared to MC55/MC56, the guard period for deferred shutdown has been extended from 15 seconds to 2 minutes after power-up.

For details on the AT command AT^SCTM see [2] and [4].

3.7 Setting Escape Sequence Character (ATS2)

With MC55i the AT command ATS2 has been implemented for V.250ter compatibility reasons.

For details on the AT command ATS2 see [4].

3.8 AT+CCLK Real Time Clock

MC55i	***MC55/MC56***
Default time: "03/01/01,00:00:00"	Default time: *"02/01/01,00:00:00"*

For details on the AT+CCLK command see [4].