TITLE: Notes on the use of the FM1200 ESI Diagnostics Facility

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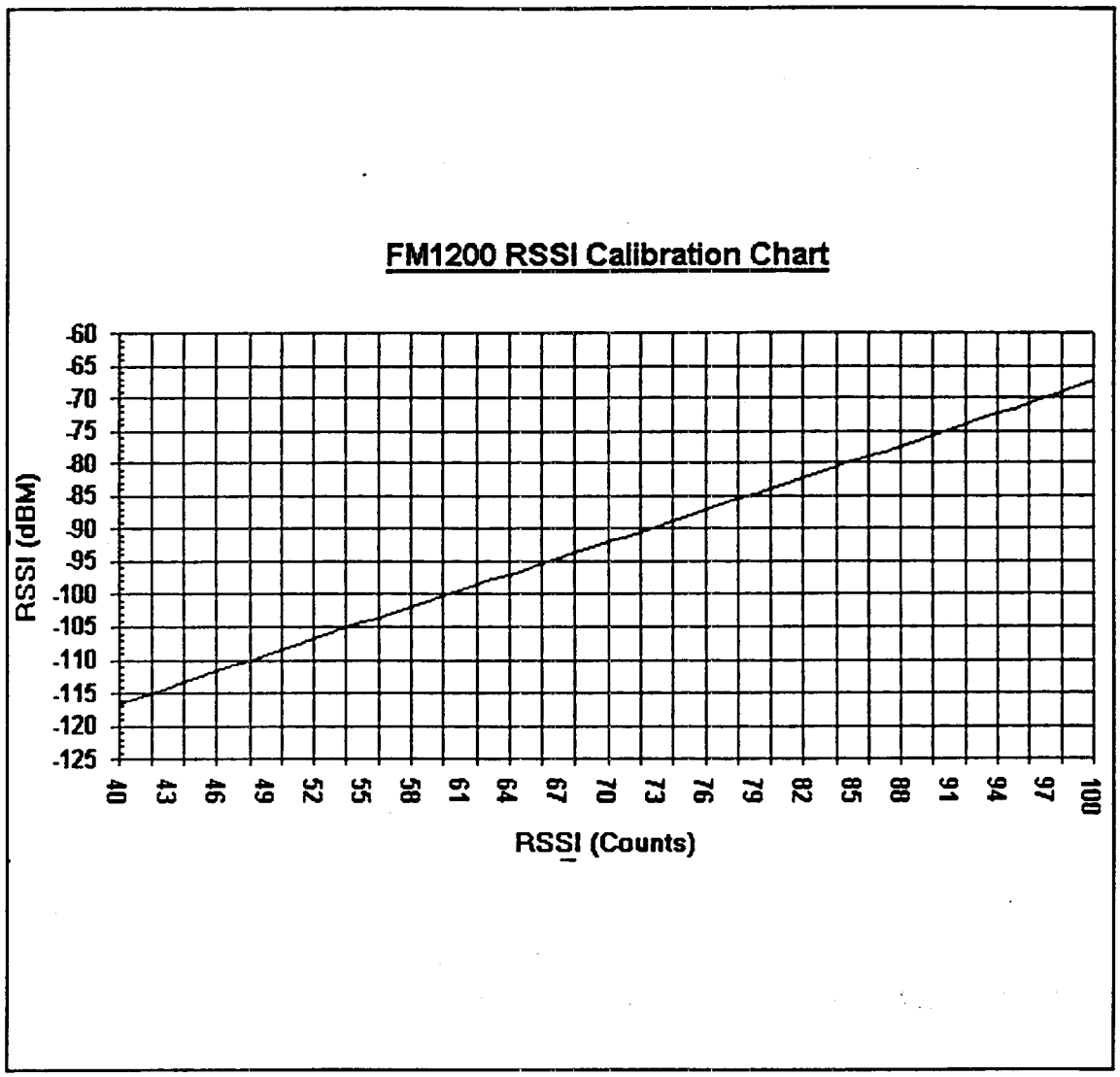
APPENDIX D Graph showing the corresponding dBm values for RSSI readings from a typical FM1200



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INCOMPLETENESS RECORD

62: Background Searching has identified one or more prospective control channels which may offer better service so the mobile tries to confirm one of these.

63: No valid CCSC has been received for a period TS (parameter 739).

64: A codeword sample error has been detected either when confirmed or prior to confirmation of the channel.

68: The modem has failed to detect FFSK data on the channel.

69: The mobile has failed to detect an Aloha codeword (ALH) on the channel during hunting.

6C: The mobile synthesiser has failed to tune to the channel. This may occur due to :

hardware failure;
invalid customisation (e.g. bad base codes, bad frequency band, channel in hunt list or simplex list outside the range permitted by the sub-band ranges (parameters 803, 804);
channel number received over air (GTC, MOVE, CLEAR, BCAST); which is out of the customised range.

71: During the first cycle of the normal (or comprehensive) hunt, the channel is rejected because the measured signal strength is < L2.

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42: A SYS code has been received on the channel for which bits 1-12 did not have the required value. This may occur (eg) if the mobile has to hunt during a call setup so only the same value of SYS bits 1-12 will be acceptable, or if the value of bits 1-12 in SYS codes on the confirmed control channel differ continuously from the confirmed value for a period exceeding TS.

44: A valid MOVE message has been received on the channel.

45: General failure to verify SYS code.

46: During hunting or background searching the mobile has encountered a SYS code on which it has previously been denied registration. The mobile will make no further attempt to access such SYS codes until the list of denied registrations is cleared at switch-off.

47: SYS code cannot be verified because it is radiating an invalid network for the mobile; i.e this is not an ESI SYS code

48: An ALHF was received on a non-fallback channel

4A: SYS code cannot be verified because it bears an invalid NDD for Fallback. This applies only if the mobile is customised for a fixed fallback channel (parameter 690). ESI mobile normally uses variable fallback channel.

4B: During hunting or sampling, a SYS code was received for which the NDD field did not correspond to any entry in the Access Authorisation Table (See parameters 676.0 to 676.9 and 677.0 to 677.9).

4C: The user has disabled roaming whilst the mobile was in service on a SYS code outside the normally permitted range for the mobile. The mobile is therefore no longer authorised to access the confirmed SYS code and must hunt.

50: Registration denied by network (ACKX(QUAL=0)).

58: The mobile has timed out waiting for a response to a demanded registration.

59: Registration has failed due to system overload (ACKX(QUAL=1)).

5A: Registration attempt has failed due to signalling timeout or access error.

60: When sampling or hunting, the measured signal strength was < L0, or when confirmed on a channel the received signal strength was < L0 for longer than 60 seconds.

61: The measured signal strength on a voted channel exceeds the confirmed channel by the required threshold so the mobile tries to confirm the voted channel. This facility is disabled if background searching is enabled.

1 PREFACE

1.1 Overview

This document is intended to provide some guidelines on the use of the FM1200 ESI engineering facility which supplies Channel Diagnostics information to the Alphanumeric display while the radio is hunting or sampling potential control channels.

1.2 Purpose

This document supplies the information necessary to make use of the Diagnostics messages which are displayed in the engineering mode, including the definition of the two digit codes explaining why the mobile joined and left a particular channel during hunting or sampling (Appendices B and C).

1.3 Scope

This document addresses the diagnostics feature of the FM1200 only. For details of other FM1200 features, please refer to the FM1200 ESI Alphanumeric Display User Manual {1} or to the User Guide.

1.4 Audience

This document is intended for those people who will make use of the channel diagnostics facility of the FM1200 ESI mobile radio. It is not intended for everyday users of the mobile radio.

1.5 Terminology

Throughout the document, references within {} denote reference documents identified in sub-section 1.6.

The following abbreviations are used in this document:

ESI - Electricity Supply Industry

1.6 References

{1} Alphanumeric Display Console User Manual. FM1200 - Electricity Supply Industry Variant. Issue 1, 9th February 1993.

{2} Air Interface Specification for the ESI Trunked Mobile Radio System. Issue 1, 13th December 1990.

APPENDIX C Two Digit codes for channel leaving reasons (Lv)

Leaving Code Value (Lv) (hexadecimal)	Note: the reason codes describe the radio's reason for leaving the channel displayed under 'Chan'.
00:	In service, the mobile has acquired service on the channel.
10:	The mobile is leaving the confirmed control channel to perform a timed sampling activity. The frequency of timed sampling is governed by timer TL (parameter 816).
14:	The mobile is leaving the confirmed control channel to perform an elected sampling activity following receipt of a non-applicable address codeword with data codewords appended.
18:	The mobile is leaving the confirmed control channel to perform a voted sampling activity following a BCAST (vote now) message.
19:	The mobile has successfully measured the RSSI on the channel.
1A:	The period allowed for a timed sampling activity expired before sampling of the channel could be completed.
1B:	The mobile has successfully measured the RSSI and sampled a CCSC with a valid SYS code on the channel.
1C:	The mobile is leaving the confirmed channel to perform voting on the alternative channel specified in a BCAST (vote now) message. This facility is disabled when background searching is enabled.
1D:	The mobile has completed voting and found that the voted channel does not exceed the confirmed channel by the required threshold.
1F:	Paging complete.
20:	The mobile's internal process has requested a channel hunt. This may be due to the following: Single channel hunt at switch-on; Resume channel hunt following (eg) a traffic channel call; Normal hunt following timeout of an outgoing user request.
40:	CHAN4 error received. Indicates co-channel interference or incorrect programming of mobile Rx base code (parameters 805.0 to 805.9).
41:	The confirmed channel has been allocated for traffic by the system so the mobile must hunt.

2 FM1200 Channel Diagnostics Facility

This channel diagnostics facility of FM1200 ESI allows the user to see channel hunting or background sampling information on the Alphanumeric Display. This is an engineering facility.

The user may select the type of information that is displayed from the following:

Channel Hunting Information;
Channel Sampling Information;
Both Sampling and Hunting Information.

The information messages are displayed each time that the radio tunes to a control channel. When rapid background sampling is taking place the information may be updated very rapidly, making it difficult for the user to view the received information. For this reason, the received channel diagnostics messages are buffered in the console so that the buffered messages can be checked through at leisure.

2.1 Enabling and Disabling Channel Diagnostics

Channel diagnostics are enabled at the console by dialling one of the following strings:

*591# - Enable channel hunting diagnostics;

*592# - Enable channel sampling diagnostics;

*59# - Enable both hunting and sampling diagnostics.

Note that the hunting procedures for FM1200 ESI include some pre-sampling of the candidate control channels which will not be shown if only channel hunting diagnostics are enabled.

Channel diagnostics are disabled at the console by dialling one of the following strings:

#591# - Disable channel hunting diagnostics;

#592# - Disable channel sampling diagnostics;

#59# - Disable both hunting and sampling diagnostics.

APPENDIX B Two Digit codes for channel joining reasons (Jn)

Joining Code Value (Jn) (Hexadecimal)	Note that the reason codes describe the radio's reason for tuning to the channel displayed under 'Chan'.
01:	In service. Resume Channel Hunt (e.g. at the end of a traffic channel call)
04:	In service on previous channel. Voting on the channel displayed
08:	In service on previous channel. Background sampling on the channel displayed
20:	Single channel hunt (e.g. at switch-on, or after a MOVE message)
37:	Preferential sampled hunt stage
41:	First Cycle of the Normal Hunt
42:	Second Cycle of the Normal Hunt
49:	Pre-sampling phase for the first cycle of the Normal Hunt
4A:	Pre-sampling phase for the second cycle of the Normal Hunt
51:	First Cycle of the Comprehensive Hunt (this is normally disabled for ESI)
52:	Second Cycle of the Comprehensive Hunt (this is normally disabled for ESI)
60:	Fallback Hunt

2.2 Channel Diagnostics Display

When the channel diagnostics facility is in use, the information is displayed on the console in the following format:

```
Chan Sys  Sig Jn Lv Next
dddd hhhh ddd hh hh dddd
```

The elements of the display give information about features of the mobile's hunting/sampling activities as follows:

Chan: The JRC channel number which the radio was last tuned to. This is displayed as a decimal channel number with leading zeroes where necessary.

Sys: If a SYS code was detected on the channel displayed under 'Chan', then the value of that SYS code is displayed here as a four digit hexadecimal string. The format of the SYS codes expected on the ESI system is given in the ESI Air Interface specification {2}. Appendix A shows the format of the ESI SYS codes and gives details of how to translate these into REGION, CELL and SITE information. If no SYS code was detected this display shows FFFF. Note that during the channel sampling phases the mobile does not always remain on a candidate control channel for long enough to guarantee detection of CCSCs.

Sig: This value corresponds to the RSSI level received on the channel displayed under 'Chan'. The number displayed is a decimal number output from the Radio unit's A/D convertor. Hence the values given do NOT correspond directly to dBm or dBW values. The relationship between the units used and dBm can be assumed to be linear in the range -70dBm to -110dBm. A graph showing the corresponding dBm values for a typical FM1200 can be found in Appendix D. Note that the value displayed is an instantaneous reading at the time that the diagnostics message is output.

Jn: This two digit hexadecimal code displays the radio unit's reason for tuning to the channel displayed under 'Chan'. The actual meanings of these two digit codes is given in Appendix B.

Lv: This two digit hexadecimal code displays the radio unit's reason for leaving the channel displayed under 'Chan'. The actual meanings of these two digit codes is given in Appendix C.

Next: This display shows the JRC channel number of the next channel to which the mobile radio unit tuned when it left the channel displayed under 'Chan'. This is displayed as a decimal channel number with leading zeroes where necessary.

APPENDIX A . ESI SYS code format

The structure of the SYS codes used on the ESI system are as defined by the JRC. These differ from those used on MPT1343 systems as described in reference {2}.

The binary format of the 15 bit JRC SYS code is as shown below:

1 . 2	3 . 4 . 5 . 6	7 . 8 . 9 . 10 . 11 . 12	13 . 14 . 15
OPID	REGION	CELL	SITE
2 bits	4 bits	6 bits	3 bits

For ESI systems, the two bits defined as OPID (bits 1-2) will always be set to '00'. SYS codes received with any other value for OPID should be rejected by an ESI mobile (Invalid network, leave code Lv = 47).

The four bit REGION code (bits 3-6) defines the Electricity company which the SYS code applies to. Values are listed below:

Number	Code (binary)	Electricity Company	
0	0000	Not used	
1	0001	East Midlands Electricity	(EME)
2	0010	National Grid	(NGC)
3	0011	South Western Electricity	(SWE)
4	0100	South Wales Electricity	(SWaE)
5	0101	Northern Electric	(NE)
6	0110	North West Electricity	(NORWEB)
7	0111	Eastern Electricity	(EE)
8	1000	Yorkshire Electricity Group	(YEB)
9	1001	South Eastern Electricity	(SEEBOARD)
10	1010		(SSEB)
11	1011	Merseyside and North Wales	(MANWEB)
12	1100		(NoSHEB)
13	1101	Midlands Electricity	(MEB)
14	1110	Southern Electric	(SEB)
15	1111	Test Mode	

The six bit CELL code (bits 7-12) numbers the cell which is being received. Normally a particular control channel is time-shared between the sites in the cell.

The three bit SITE code (bits 13-15) identifies the particular site within the cell.

The value zero is not generally used to number cells and/or sites within the ESI system. However, a site which is operating in standalone mode will radiate all zeroes in both the CELL and SITE codes.

2.3 Channel Diagnostics Buffer

When channel diagnostics is enabled on the FM1200 ESI mobile radio, then the diagnostics information messages are buffered so that the user can step through them at leisure to analyze a particular hunt/sampling sequence.

The display can be switched between display of the current diagnostics messages and the buffered diagnostics messages by keying in the following codes at the console:

58 - View buffered diagnostics messages;
#58# - View incoming diagnostics messages.

When the mobile is displaying buffered diagnostics messages, the display will show the same information as described in section 2.2, except that the leftmost display field will be labelled 'Buff' as opposed to 'Chan'.

If increment and decrement (+ and -) keys are enabled on the console then the user may use these to step through the diagnostics messages contained in the buffer. When either end of the buffer is reached, an attempt to scroll past this will cause an operator-alert tone ("beep") and the current message displayed will not change.

An attempt to view the diagnostics buffer when the radio unit is not in diagnostics mode will be unsuccessful. It is important to note that the diagnostics buffer is frozen while the user is examining it, so the current diagnostics information will be lost. If the user switches back to viewing the incoming diagnostics messages, then the buffer begins to be updated again from that point.