

# 5MHz Operating Procedures

## Introduction

This Guidance note is intended to help the holders of a 5MHz Notice of Variation (NoV) to operate in a way that has some experimental purpose, as required by the primary user, the Ministry of Defence (MoD), and as detailed in the 'terms and conditions' section of the NoV issued by Ofcom.

In applying for their 5MHz NoV holders are expected to undertake some form of experimentation that is particular to 5MHz. When access to the 5MHz was granted for UK Amateurs the RSGB launched what it termed “The Fivemegs Experiment” in September 2002. It offered everyone the opportunity to participate in a “mega” type of experiment. The concept of “The Fivemegs Experiment” was that amateurs would log QSOs and SINPO signal reports with other UK amateurs and Military Cadet Stations.

The 5MHz Working Group (5WG), formed in November 2002 took over the coordination of the Fivemegs experiment and other experimental activity on the 5MHz channels. In so doing the Fivemegs experiment was modified slightly and re-named the “5MHz Experiment”.

The RSGB’s 5MHz Experiment is a large-scale propagation and aerial experiment in which all can contribute through logging their normal contacts on one or more of the channels. It requires signal reports to be exchanged and recorded along with other detail in a special 5MHz log. Amateurs then submit these logs for inclusion in a computer database, which subsequently will be analysed.

This document aims to provide guidance on how to operate in a way that supports this collective experiment as well as allow individual experiments to take place. Gaining a uniform and consistent approach for the input to the 5MHz Experiment will help ensure that the right data is logged and that the subsequent analysis will be more straightforward.

## NoV Conditions

UK Radio Amateurs wishing to operate on 5MHz must hold a current Notice of Variation (NoV) of their Full UK Amateur Radio Licence issued by Ofcom. The first phase NoVs allowed operation until August 2006. The second phase issue of NoVs run until June 30<sup>th</sup> 2010. The 5MHz NoV specifies the legal limitations for UK Amateur operation on 5MHz, and also details precisely the spot frequency limits within which the experimental transmissions must be confined. NoVs are not available for Intermediate and Foundation Amateur Radio Licence holders.

The NoV is issued on the basis that it may be required to cease operation on the 5 MHz channels, at any time, upon an instruction issued by a person authorised under authority of the Secretary of State or any government or military official. Such a

request may be received via the RSGB, in which case the recipient will be given a source telephone number to refer to if they wish to verify the authenticity of the demand. Whatever the circumstances, the operator should comply with the instruction immediately. Failure to do so could result in the immediate suspension of the experimental access to the channels. The Ofcom monitoring station at Baldock and their MoD counterparts will be taking a close interest in the conduct of the usage of the channels and they will have information regarding the NoV holders.

Throughout these notes, reference is made to 3kHz wide channels designated by the MoD and centred on frequencies within the range 5250 kHz to 5450 kHz. Some military cadet stations from the ATC, CCF, ACF and SCC may take part in the experiments from time to time, and their authority to do so comes from the MoD. The channels designated by their centre frequency lie in a portion of the HF spectrum assigned internationally to the Fixed and Mobile Services.

Centre frequency kHz	USB carrier frequency kHz	Also known as
5260	5258.5	FA
5280	5278.5	FB
5290	5288.5	FC
5368	5366.5	FK
5373	5371.5	FL
5400	5398.5	FE
5405	5403.5	FM

Table 1: 5 MHz Channel frequencies

Since most amateur equipment in use is based upon an SSB transceiver, the suppressed carrier frequencies (or dial settings) have been included in the table detailed for operation in the USB mode. LSB is not recommended on 5MHz. Operators wishing to use modes other than SSB, for example digital modes or CW, must do so by using USB and audio signals below 3kHz, or use some method that ensures that their transmission conforms to the 3kHz wide channel. Users of narrow-band modes such as CW and PSK31 are encouraged to operate within the bottom 300Hz of a channel since this permits the channel to be used by voice-bandwidth modes at the same time. This can be done by using USB carrier frequencies below those in the above table, in conjunction with audio signals above 300Hz.

Channel FC, 5290kHz, is used for a 5MHz beacon chain – GB3RAL, GB3WES and GB3ORK – so other operation is discouraged on this channel. However, because of the narrow-band nature of the automatic-monitoring system for these beacons it is acceptable to operate CW on either 5289 or 5291kHz, i.e. within the channel, but 1kHz away from the beacon frequency of 5290kHz.

Some military operators on these channels will be using the Clansman PRC320 series transceivers on USB. Some of these transceivers use synthesisers with a 1kHz step size, and thus will not be able to net accurately with amateur transmissions using USB. Amateur stations will need to employ their RIT to receive their transmissions –

the amateur station will still need to remain within the 3kHz channel as far as transmission is concerned.

All modes are allowed, as set out in the UK Amateur Radio Licence for HF operation, but DSB voice AM is not practicable because of its 6kHz bandwidth. The use of USB for voice is recommended – particularly when military cadet stations are participating. Cross-band operation involving any one of the 5 MHz spot frequencies is only permitted between those stations holding current 5 MHz NoVs. Cross-band working with stations outside of the UK is not considered to be within the spirit of the experiment. When stations are working cross-band, as a part of the propagation investigations it is suggested that voice operations, in particular, be confined to a limited number of frequencies. Those suggested are 1990 kHz, 3645 kHz, and 7045 kHz, in order to minimise confusion to other amateur stations. The use of LSB on these three amateur bands, rather than USB, will have to be a matter of operating convenience, bearing in mind that USB is advised on 5 MHz.

It is important to note that the NoV requires all operating that involves more than two stations must be in the form of a controlled net. Note too that the maximum power output permitted on 5 MHz for Full licence holders is 200 Watts (23 dBW).

## **Equipment**

Commercially made transceivers for the Amateur service are often only designed to transmit on the amateur bands. Thus, unless you have one of the latest transceivers that now come with some of the 5MHz channels available, you will have to have your equipment modified. Mostly, modern solid-state equipment with digital read-out will have the required frequency setting accuracy and stability. Most amateur radio dealers and importers in the UK have the knowledge and capability to carry out this work, but they are likely to ask to see your Amateur Radio Licence documentation and your 5 MHz NoV before carrying out the modification. Also, they are entitled to ask for a copy of these for record purposes as they may subsequently receive enquiries from Ofcom.

There is a risk in “broad-banding” amateur radio transmitters and transceivers, which is the form of modification most likely to be necessary. NoV holders are required to ensure that any broad-banding modification does not cause their equipment to emit spurious signals outside the 5 MHz channels defined in the NoV, or outside any authorised amateur band. Operation on any unauthorised frequencies, or outside the authorised 3 kHz wide channels, could result in withdrawal of the Amateur Radio Licence involved.

## **Communicating with UK Military Stations**

The 5MHz NoV sets a licence condition that for the first time allows UK Amateurs to establish communication with military or military cadet stations. Such stations have an operating procedure that is based upon the four concepts of BREVITY, ACCURACY, SECURITY, and SPEED - or “BASS” for short, thus please respect their operating procedure.

Note that Air Cadet and Sea Cadet stations use M-prefix 3-letter call signs, usually followed by two digits, whilst Army Cadet stations use one or two figure call signs, sometimes followed by a letter. The military stations are not allowed to give their unit name, location, or the operator's name. It is hoped that they may be allowed some flexibility with respect to QTH locators. Cadet stations may be heard working each other on frequencies close to ours, but it is NOT permitted for amateurs to contact cadets on such frequencies.

## **5MHz Experiment**

The objective of the Experiment is to carry out propagation and antenna experiments with a view of gaining some better overall understanding of intra-UK propagation at this frequency. As a secondary basis trials of emergency radio communications will be being included as a more operational component of the experimental usage of the NoV. More detail of the 5MHz Experiment can be found in the September 2003 issue of RadCom, with current information available on the RSGB's 5MHz web site (<http://www.rsgb-spectrumforum.org.uk/5mhz.htm>). Ofcom believes that voice communication has an important role to play in this, and as such should not be considered subservient to narrower bandwidth data modes. This is partly why channel bandwidths of 3 kHz are being permitted.

Military Cadet Stations are allowed to take part in the 5 MHz Experiment using their military callsigns. Cadets and staff from various locations will operate these stations, and although many of the staff and some of the cadets may hold Amateur Radio Licences they will not make any reference to this on air. It is not permitted under the NoV to communicate with non-military Fixed and Mobile service stations.

## **Log data for the 5MHz Experiment**

In establishing the 5MHz Experiment the 5WG considered carefully what type of data should be collected, and in terms of signal, noise, etc, whether an objective form of reporting could replace the initial use of SINPO in the Fivemegs experiment. A suitable solution that would be both easy to set up and use was not found, so instead SINPO reporting was retained.

In order to add some form of objective reporting to the 5MHz Experiment, the 5WG decided, with MoD and Ofcom approval, to provide three beacons on channel FC, 5290kHz. Apart from the callsign, the beacons provide an accurate 6dB stepped output-power that listeners can use to assess and report S+N/N. A software download of an automatic monitoring program, gb3ral.exe, is available from <http://www.rsgb-spectrumforum.org.uk/5mhz%20beacon%20monitoring.htm>. This program automatically records S+N/N for the three beacons. An output file containing this and other data is produced that can be submitted for uploading to the 5MHz Experiment's database. The beacons also carry a pulse sequence for those equipped with the appropriate hardware and software to assess Doppler and multipath delay.

The accuracy of any subsequent analysis of the 5MHz Experiment's database will be dependent upon the amount of data gathered, thus the 5WG encourages all NoV holders to submit logs of their QSOs and also, if they can, set up automated beacon receiving systems and submit the beacon log files.

## Log format for the 5MHz Experiment

The format for the logs of QSOs that are submitted for upload to the 5MHz Experiment's database is the key to reducing the workload and improving the quality of the data that is entered into the computer for analysis. After using an EXCEL spreadsheet for some while a computerised logging program, called 5MHzLog, was developed specifically for the 5MHz Experiment. Released in March 2007, it is now the main way that logs are submitted electronically. The 5WG still accept hand-written logs from those who do not have access to a computer, although keying in the data does divert voluntary effort from participating in other aspects of the experiment. Thus, we do ask those who have a computer to try and use the 5MHzLog program. To assist those who may need some help we have a 5MHzLog Yahoo!Group (<http://groups.yahoo.com/group/5MHzLog/>) where problems and request for help can be posted.

For further information, and downloads, please go to: <http://www.rsgb-spectrumforum.org.uk/5mhz%20station%20log.htm>

The logged data is as follows:

a) **Data that may be common to many entries:** Information such as callsign, station location (using the 6 character QTH Locator system formerly known as the Maidenhead System), aerial type, aerial height above ground level in metres, aerial polarisation and alignment, is entered as static data into the 5MHzLog program. For people who change their location, e.g. SOTA operations, this static data can be changed within a log file overcoming the need to start another log file.

For those completing paper logs, where there are common data fields for several contacts, these are completed as "header" information. Different log sheets will be required where this common information changes, for example when using different aerials, location, etc.

b) **Station heard or worked:**

- Date and Time station heard/worked: the start details to be entered in as DD MM YYYY HH MM, i.e. 12th April 2003 at 5:35pm would be 12 4 2003 17 35. Note that the leading zeros are dropped and that a 24-hour clock is used.
- Callsign and Locator: as received (with no spaces and in capitals)
- SINPO (see section on SINPO below)
- Steps: this is a column to record the number of beacon steps received above the noise floor, whether that is atmospheric, man-made noise or interference from co- or in-channel operation.

c) **Received assessment:**

- SINPO: as received from the other station.

d) **Channel:** FA, FB, etc. channel designators.

e) **Mode:** The following designations are used: SSB, CW, DRM<sup>1</sup>, PSK, PSK31 SSTV and MT63.

f) **Power:** Enter the transmitter output power in watts (between 1 and 200)

g) **Aerial type:** It is requested that aerial types be classified as follows:

- RD for resonant dipole
- NRD for a non-resonant dipole
- V for vertical, whether resonant or not
- L for small loop
- O for other, e.g., inverted L, random lengths of wire tuned against ground, etc

h) **Aerial height above ground:** This is entered in metres, to the nearest whole number. Ground mounted vertical aerials should use zero.

i) **Aerial polarisation:** Enter V (vertical), H (horizontal) or M for mixed polarisation

j) **Aerial alignment:** Please use only N/S, NNE/SSW, NE/SW, ENE/WSW, E/W, ESE/WNW, SE/NW, SSE/NNW to show the plane of the aerial, otherwise use O for an omni-directional.

The 5MHzLog program checks the format of the entered data and creates a csv file with a checksum as an output. This should be sent as an e-mail attachment to [5MHz\\_Working\\_Group@rsgb.org.uk](mailto:5MHz_Working_Group@rsgb.org.uk). To make handling easier it is requested that the e-mail "Subject" field be marked "5MHz Activity Log, *callsign/SWL number*". The checksum that is automatically added to the log entries is there to validate that the file has not been edited outside the 5MHzLog program (to avoid errors in the data).

Opening the csv file in EXCEL and re-saving, even without editing will cause the file to subsequently fail validation. All edits must be done within the 5MHzLog program to avoid this problem; the processing within the program will make sure that any edits conform to the format for the various fields within the log.

Paper logs should be mailed to RSGB HQ, with the envelope marked "5WG Station Log".

The 5MHzLog program also allows entry of other data for personal use and can create an export ADIF for transferring the log data to your favourite station-logging program.

## Assessment of SINPO

Whilst the traditional RS(T) report can be given at the start of a contact to give the other station some idea of the likely quality of the subsequent contact for the purposes of the experiment, we require a more detailed and follow the ITU recommendation that SINPO reporting is used, as defined in their current document SM.1135.

The S (signal level) report, on a scale of 1 – 5, is effectively an assessment of how well the signal stands out above the background receiver noise. Details of the assessment are given in Table 2 below. Note that we ask that you record a "not heard" as S=1, when it is known that the station is actually transmitting on channel.

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<sup>1</sup> The use of the term DRM refers to digital voice transmissions that use Digital Radio Mondiale techniques, but where the transmission bandwidth is contained within 2.7kHz. For backward compatibility within the database other digital voice techniques should be logged as DRM.

Rating scale	S	I	N	P	O
	Signal strength	Degrading effect of			Overall rating
		Interference	Noise	Propagation disturbance	
5	Excellent	Nil	Nil	Nil	Excellent
4	Good	Slight	Slight	Slight	Good
3	Fair	Moderate	Moderate	Moderate	Fair
2	Poor	Severe	Severe	Severe	Poor
1	Barely audible	Extreme	Extreme	Extreme	Unusable

Table 2. ITU SM.1135 SINPO Reporting Code (note that we ask for not-heard S reports, when it is known that a transmission is taking place to be logged as S1).

I, N and P are defined in SM.1135 as measures of how badly degraded the signal is by interference, noise and propagation effects respectively. The definitions for the degrading effect are shown as Extreme (1), Severe (2), Moderate (3), Slight (4) and Nil (5). It might help to consider that in the RS(T) reporting system we use R5 to report a perfectly readable signal, and R1 for a signal that is unusable. With SINPO all we are doing is splitting the "R" report into its individual components, I, N and P:

- "I" stands for interference, or QRM. Think about this as a reading for the degrading effect of interference on the QSO, i.e. 5 for none, 1 for a lot. When giving the report you can think the same way as you do with the "R" report for RS(T) - for a signal with very heavy QRM you give it a report of 1, and a signal with little or no QRM gets a report of 5.
- "N" is for the degrading effects of noise, i.e. QRN. Again we can think about the report as 5 for none, 1 for a lot. Note that interference from a broad-band data transmission might sound like noise, so if you can do some checks to ensure that you gave correctly determined whether the apparent noise is indeed noise rather than QRM
- "P" is a measure of propagation-related distortion such as fading, flutter or perhaps an auroral rasp on the signal. Again, it is seen as a measure of the degrading effect on the desired signal, also scoring 5 for none, 1 for a lot. This is perhaps the more difficult one on which to report, as on a strong signal the effects of QSB may be less noticeable with the good AGC systems in our rigs these days. Conversely it could be that you hear more pronounced fading from QRP stations and therefore give a different report for P between QRO and QRP stations.

Further guidance on this is given in the August 2007 RadCom article "Signal Reporting in the 5MHz Experiment" [ref 1].

Finally, the O report is a measure of the extent to which all these factors contributed to the overall rating; 5 for excellent and 1 for unusable. O=1 is also used for "not heard"; when it is known that the station is transmitting on channel. SM.1135 has a useful set of tables to help the assessment of O. Table 3 below shows the assessment suggested for telephony transmissions:

Overall rating	Operating Condition	Quality
5. Excellent 4. Good	Signal quality unaffected Signal quality slightly affected	Commercial
3. Fair	Signal quality seriously affected; channel usable by operators or by experienced subscribers	Marginally commercial
2. Poor 1. Unusable	Channel just usable by operators Channel unusable by operators	Not commercial

Table 3: ITU SM.1135 SINPO Reporting Code for “overall” assessment of a telephony transmission.

## 5MHz Experiment – Activity Periods

For the analysis of the 5MHz Experiment data to be meaningful we need a good spread of operating times. The initial analysis of spread of the data showed that without any specific organisation of activity periods, the activity was roughly constant throughout the weekdays and weekends, with no specific days when activity peaked or dipped. This is ideal. However, we do need to spread the activity out more across the day, as most activity seems to occur between 2pm and 5pm. We would also be interested in stations attempting QSOs across the full 24 hours, and it would be of value to have QSOs attempted more often when propagation conditions are likely to be unfavourable, e.g. day-night transition and during the hours of darkness. Logs of unsuccessful QSOs, so long as there is reasonable certainty that the transmitting station was operating, are extremely valuable. Ideally, we would like logs of both sides of the attempted contact that may be carried out more effectively as a part of a net operation.

In order to bring additional activity and logs for the Experiment, the RSGB broadcasts its GB2RS News Service at 12:30 local time on Sundays using USB on 5403.5kHz. This is carried out by newsreaders that hold the 5MHz NoV. QSOs with the 5MHz GB2RS operator (drawn from the existing pool of NoV holders) following the news broadcast, SWL reports of the GB2RS broadcast and reporting by non-NoV holders on adjacent bands, have already become a standard feature of the activity. Please ensure that postal and e-mail reception reports are sent directly to the news reading station concerned and not to GB2RS. Reports of GB2RS and the post news-broadcast net have also become a part of the log input to the 5MHz Experiment; the 5WG encourages these reports to be a part of the log submission.

If you are an RSGB member with a 5MHz NoV and would like to become a GB2RS newsreader on 5405kHz as part of the ongoing experiment, you should contact GB2RS News Manager Gordon Adams G3LEQ on 01 565 652652 or by e-mail via [gb2rs@boltblue.com](mailto:gb2rs@boltblue.com)

## Miscellaneous

Real-time information about the F2-layer ionospheric critical frequencies, which govern Near Vertical Incidence Skywave (NVIS) communications performance in the UK, can be obtained from R.A.F. Fairford, Gloucestershire at

[http://sec.noaa.gov/ftplib/lists/iono\\_day/Fairford\\_iono.txt](http://sec.noaa.gov/ftplib/lists/iono_day/Fairford_iono.txt) and forecasts from the Radio Communications Research Unit, Rutherford Appleton Laboratories web site at [http://www.wdc.rl.ac.uk/ionosondes/view\\_latest.html](http://www.wdc.rl.ac.uk/ionosondes/view_latest.html). Archive material is also available from the same Radio Communications Research Unit web site.

The RAYNET HF Team <http://www.raynet-hf.net/> in its broader range of experiments on HF is making use of the 5MHz channels during their rolling 7-day cycle of nets around the UK.

Other groups are encouraged to set up regular nets with a view to submitting data into the 5MHz Experiment's database. Although not mandated by the NoV, those wishing to conduct experiments that are either outside the scope of 5MHz Experiment or those experiments arranged by the RAYNET HF Team, are invited to share their ideas with the 5WG. The 5WG should be in a position to give advice, support, and where appropriate give publicity to the particular experiment. The 5WG Chairman John Gould, G3WKL, can be contacted via e-mail to [5MHz\\_Working\\_Group@rsgb.org.uk](mailto:5MHz_Working_Group@rsgb.org.uk), or alternatively by letter to the 5MHz Working Group c/o RSGB HQ.

Version 4.3, updated 1st December 2007

## References

1. "Signal reporting in the 5MHz Experiment", Alan Messenger, G0TLK and John Gould, G3WKL, RadCom, August 2007, p 12 – 14