STARLITE

THE NEWSLETTER FOR THE STOURBRIDGE AND DISTRICT A.R.S.

G6OI
G6SRS

G4CVK

ISSUE: OCTOBER 2019

STOURBRIDGE & DISTRICT AMATEUR RADIO SOCIETY

INCORPORATING

OLD SWINFORD HOSPITAL SCHOOL RADIO CLUB

MEETINGS HELD AT

OLDSWINFORD HOSPITAL SCHOOL
HEATH LANE
STOURBRIDGE
[8:00 TO 10:00 PM]

VISITORS ALWAYS WELCOME

THE SOCIETY HOLDS ITS MEETINGS
EVERY MONDAY (EXCLUDING BANK HOLIDAYS)

THIS MONTH: JOTA @ NORTON SCOUTS

RSGB AFFILIATED SOCIETY

STARLITE

Telephone Enquiries to:-

Hon. Secretary
John Clarke M1EJG
[01562] 700513

Or by Email to:-
honsec@g6oi.org.uk

StARS Website URLs:-
www.g6oi.org.uk
http://g6oi.ross-lewis.co.uk/index.html

StARS Facebook Page:-
https://www.facebook.com/groups/stourbridge.ars/

All correspondence/enquiries should be addressed to the Hon Secretary at:-

StARS
c/o The Mill House
21 Mill Lane
Blakedown
Kidderminster
DY10 3ND

Forthcoming Meetings

October 7th	On Air. Informal. Digi Modes Group.
October 14th	On Air. Informal. Digi Modes Group.
October 18th - 20th	**Jamboree On The Air @ Norton Scouts**
October 21st	Main Meeting – Subject t.b.a.
October 28th	On Air. Informal. Digi Modes Group.
November 4th	On Air. Informal. Digi Modes Group.
November 11th	On Air. Informal. Digi Modes Group.
November 18th	**Annual Surplus Sale**
November 25th	On Air. Informal. Digi Modes Group.
December 2nd	On Air. Informal. Digi Modes Group.
December 9th	On Air. Informal. Digi Modes Group.
December 16th	On Air. Informal. Digi Modes Group.
December 23rd	Main Meeting – Subject t.b.a.
December 30th	**Final On Air & Informal Meeting Of 2019**
January 6th 2020	**First On Air & Informal Meeting Of 2020**

Editor's Comment

Good new from the RSGB: Recently, CEPT met in Turkey, where it finalised positions on a wide range of WRC-19 Agenda Items, including proposals for WRC-23.

At 144MHz, after a major effort, the 144 to 146MHz frequency range was successfully withdrawn from the French WRC-23 aeronautical proposal.

This hot topic had been the subject of detailed submissions by the IARU, France and Germany.

This excellent result for amateur radio occurred in parallel to a number of other proposals being adopted to support aeronautical interests.

There's more positive news at 50MHz.

CEPT confirmed its common position for an overall 50 to 52MHz secondary allocation for IARU Region 1.

Following requests from both the RSGB and the UK Six Metre Group to Ofcom, we are pleased to announce that the UK has signed an optional footnote in the CEPT proposal for national Primary status in the 50 to 50.5MHz segment, along with a number of other countries.

SSB Field Day: I asked for a report of the event and, lo and behold, I did not receive one! But John G8UAE did say that the contest entry will be for 10,476 points from 112 QSOs (*this equates to 4.66 QSOs per hour. Ed.*) Also, I believe the station had some problems and that propagation conditions were not too good.

I held this issue until the end of September, whilst awaiting a promised article. Unfortunately, this was not received prior to publication. It will, hopefully, be with me for the next issue (????)

Transmitter Power Measurement And Tolerance

What is the real difference between a transmitter with an output power of 25 Watt or 22 Watt or 28 Watt versus 25 Watt. This question or problem has been made as the authorities, love playing the numbers game. (The specification is 25 Watt therefore your transmitter must transmit 25 Watt and NO LESS or NO MORE).

ETSI 300-162-1: Technical characteristics and methods of measurement - that the European Community uses as a Standard for measurement. In that specification, Measurement uncertainties are stated, herewith the table:

6.7.1 Measurement uncertainty

Table 1: Absolute measurement uncertainties: maximum values

Parameter	Maximum uncertainty
RF frequency	±1 x 10^{-7}
RF power	±0,75 dB
Maximum frequency deviation: - within 300 Hz to 6 kHz of modulation frequency - within 6 kHz to 25 kHz of modulation frequency	 ±5 % ±3 dB
Deviation limitation	±5 %
Adjacent channel power	±5 dB
Conducted spurious emission of transmitter	±4 dB
Audio output power	±0,5 dB
Amplitude characteristics of receiver limiter	±1,5 dB
Sensitivity at 20 dB SINAD	±3 dB
Conducted emission of receiver	±3 dB
Two-signal measurement	±4 dB
Three-signal measurement	±3 dB
Radiated emission of transmitter	±6 dB
Radiated emission of receiver	±6 dB
Transmitter transient time	±20 %
Transmitter transient frequency	±250 Hz
Receiver desensitization (duplex operation)	±0,5 dB

Power measurements are for both **Power Meters** and **Signal Generators**.

Now down to basics. If we convert Power from Watts to dBm we see that 25 Watt = +43,979 dBm, rounded up to +44 dBm for simplicity. Next, we convert 22 Watt to dBm and end up with +43,424 dBm or a difference **0,57 dB**, hardly significant. dBm = Log (Power in mW) * 10, 1 Watt = (1000 Log)*10 = 3*10 = +30 dBm. 5 Watt = (5000 Log)*10 = (3,6989) * 10 = +36,989 dBm.

The power tolerance of a 25 Watt transmitter to meet specification is therefore between **21,134 Watt > 29,85 Watt**, worst case. Receiver measurement will have the same result, 0,25 uV = -119 dBm, so the limits will be **0,23 uV > 0,27 uV**. All things being equal there will always be some uncertainties in any measurement.

Test Cables are a strong point in question, especially if inter series adapters are used to connect the DUT to the measuring instrument. Test Equipment should normally be calibrated regularly to a traceable standard (CSIR/SANAS). Test Equipment suppliers (Rhode & Schwarz, Inala Technology & Protea Electronics) have their in-house calibration standards that are traceable. With that the calibration is also done in a controlled temperature environment.

Our Watt boxes and Test Instruments are not in a controlled environment, which leads to further discrepancies to accuracy. Who actually checks the state of the connectors on their instruments and cables? That only happens when measurements do not tally up. Using a Watt/SWR meter, what termination is used? 50 Ω Termination or an Antenna, the later can cause errors as the VSWR will affect the overall forward power measurements.

At the end of the day what have we really achieved? In the perfect world our **25 Watt** radio with all the path loss, cable loss, connector loss and a received signal of **0,25 uV**, or a **22 Watt** transmitter with all the stated losses a received signal of **0,23 uV** and finally a **29 Watt** transmitter with all the same losses a received signal of **0,27 uV**, is that really worth blaming the Transceiver that does not transmit 25 Watt?

To make any real difference on improving the received signal strength you will have to boost your transmitter power by 6 dB, so a 25 Watt transmitter will have to be replaced with a 100 Watt unit. At the extreme, the original 0,25 uV signal will now be 0,5 uV which is a 6 dB increase, a 4 fold increase in TX power to receive twice the signal strength, not even an "S" Point, **S9 = -73 dBm or 50 uV**, the typical sensitivity of the receivers are 0,25 uV -119 dBm for 12 dB SINAD, so from "S0" to "S9" receive level you would need a power increase of 46 dB. Some examples **1 watt** +46 dB = **40 Kilowatt**, **400 Watt** +46 dB = **16 Megawatt**. That is a substantial power increase, so the deviation of **< ± 0,75 dB** in transmitter power is not worth condemning the equipment. (*SINAD = Signal-to-noise and distortion ratio which is a measure of the quality of a signal from a communications device. Ed.)*

To minimize potential errors, I have made a set of Test cables with various terminations using RG-400 Teflon cable approximately 600 mm in length, with crimp connectors, that are used for controlled measurements. To remove uncertainties in measurements, one way would be to eliminate all cables and connectors and connect the DUT directly to the instrument, impractical as damaging the Test Instrument connector will set you back a good amount of money, so out with the test cables, use good quality cable and connectors for repeatable and reasonably accurate measurements. Also try to use one Test Instrument as a reference if measurement issues do arise, impractical if you are in the field.

Fifteen Years of CubeSats in Space

The barriers to access Space have changed very fast. With the end of Cold War, many missiles of both sides encountered a new peaceful use as spatial vehicles. The miniaturisation of electronics is spectacular. For first time the use of very affordable commercial off-the-shelf (COTS) components in space began. The movement of open source in software and hardware infuses technological innovation. And crowdfunding creates a new bunch of opportunities for the democratization of space access.

In this context, the CubeSat standard was created in 1999 as a collaborative effort between Jordi Puig-Suari, a professor at California Polytechnic State University (Cal Poly) and Bob Twiggs, a professor at Stan-ford University's Space Systems Development Laboratory (SSDL) to facilitate access to space for university students.

Often qualified as 'Bread-Loaf Size Satellites,' a CubeSat is a 10 cm cube with a mass of up to 1,33 kg. CubeSats can be scaled up from one to several units (1U, 2U, 3U, etc). Inside this container we can put any-thing we want as the payload of the satellite. The CubeSat uses an ad-hoc orbital deployer, i.e. a "Poly-Pico Satellite Orbital Deployer" or P-POD for short. CubeSats are carried into space inside one of these orbital deployers. This compact packaging ensures at same time the safety of the CubeSat and protects the prima-ry satellite on the launch vehicle. And it can easily fit as a 'secondary payload' in the current launch vehicles (until the recent appearance of launchers exclusively dedicated to put small satellites into orbit).

The CubeSat Design Specification, the current version of the standard is the cds_rev13 www.cubesat.org/s/cds_rev13_final2.pdf, is published on the CubeSat website at www.cubesat.org/.

As Bob Twiggs put it, "It all started as a university education program satellite." The question was, "How to do something that students could afford during their master's degree to launch for a reasonable price?" At the time, NASA, any military organisation or the aerospace industry had no interest and funded for the low cost alternative! In a recent interview, Bob says "I'm kind of glad that NASA did not help us, or we would probably never have got it done. It was developed for the education of students." For his part, Jordi Puig-Suari gave a lecture with the self-explanatory title 'CubeSat: An Unlikely Success Story'
https://web.archive.org/web/20150624071942/http:/www.kiss.caltech.edu/workshops/smallsat2012b/video/puig -suari/puig-suari_30Oct12.html

But finally, the first CubeSats were launched on 30 June 2003 www.eurockot.com/2003/06/rockot-successfully-launches-8-satellites-into-different-orbits/ from the Plesetsk Cosmodrome, by a Rokot https://en.wikipedia.org/wiki/Rokot, a space launch vehicle derivative of an intercontinental ballistic mis-sile from the USSR, supplied and operated by Eurockot Launch Services www.eurockot.com/about-us/. The manifest of the Rokot launch included six CubeSats:

XI-IV (Sai Four) developed by Intelligent Space Systems Laboratory (ISSL)-Nakasuka Laboratory at Uni-versity of Tokyo, Japan

CUTE-I of Tokyo Institute of Technology (TITech), Tokyo, Japan CanX-1 of the University of Toronto, Toronto, Canada AAUSat of Aalborg University, Aalborg, Denmark

DTUSat of the Technical University of Denmark, Lyngby, Denmark QuakeSat of Stanford

University, Stanford, CA, USA

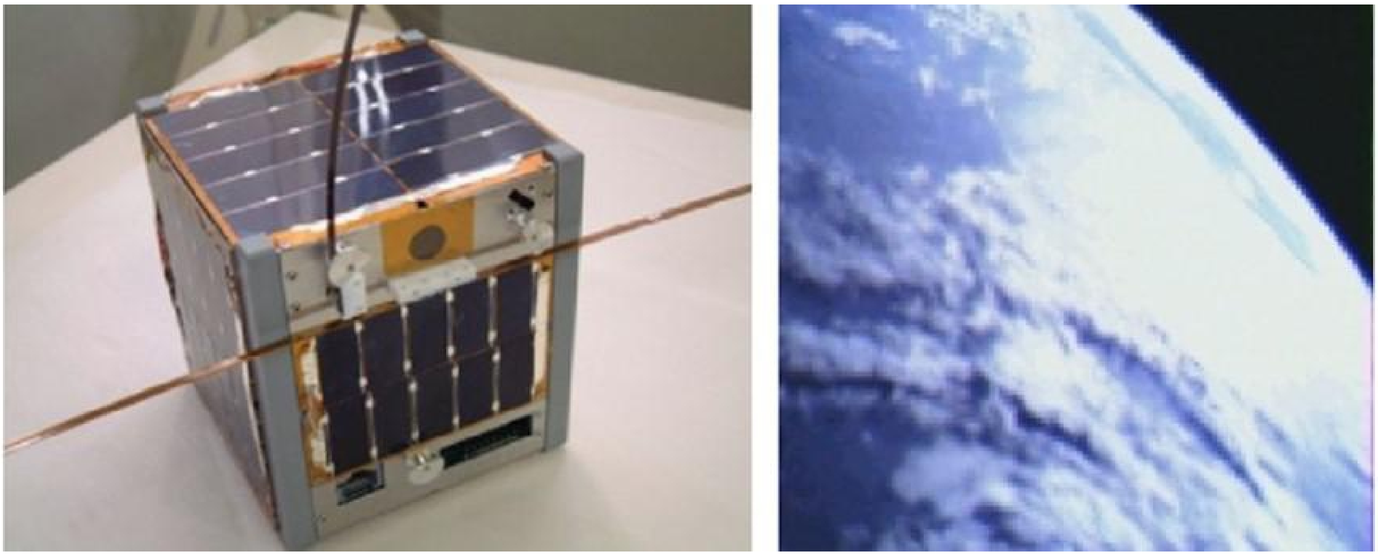
Very detailed information of these first CubeSats is compiled in 'CubeSat - Launch 1' https://directory.eoportal.org/web/eoportal/satellite-missions/c-missions/cubesat-launch-1. By the way, Cubesat XI-IV (Oscar 57) is still operation fifteen years later!

So far, more than 800 nanosatellites (CubeSat standard) have been launched into Earth orbit since 1999. The number of launches is exponential; the pace of miniaturisation and innovation is astounding! Among this launches we have seen the first truly personal do-it-yourself satellite by Korean artist Hojun Song (the OSSI-1 http://www.opensat.cc/) or the Greek UPSat mission https://upsat.gr/ by the Libre Space Foundation, the first completely open source satellite ever launched. The achievements of CubeSats are amazing, overcoming the initial misgivings towards these small spacecraft and conquering enthusiasm and imagination of all the people interested in space exploration. Fleets of CubeSats offer a daily image of all the Earth, they have made the most innovative experiments from quantum communication to the first node of a blockchain in space and are revolutionising astronomy.

And now the first twin interplanetary CubeSats (Mars Cube One or MarCO), designed to monitor InSight landing, launched on 8 May 2018 and is already on its way to Mars, going where no CubeSat has ever gone before! NASA hopes the MarCO CubeSats could transform the future of space exploration paving the way for low-cost exploration of deep space.

The age of small spacecraft is booming.

Pocket spacecrafts (PocketQube https://en.wikipedia.org/wiki/PocketQube), PhoneSats (using a smartphone as a spacecraft), Spacecraft-on-a-Chip pointing to interstellar travel (Breakthrough Starshot project https://breakthroughinitiatives.org/initiative/3) … *Ad astra!*



CubeSat XI-IV and an image taken of Earth - fifteen years later it is still in operation. Credit: Funase et al, ISSL

YOUR COMMITTEE

PRESIDENT	Tim Childe	G7TAC
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	Mark Cadman	M0TCG
	Keith Dixon	M0HPY
	Ross Lewis	2E0RLX

STARLITE EDITOR	Bob Egan	G4XOM
	Email:	g4xom@g6oi.org.uk