CQ Chatter

APRIL 2021 VOLUME B21 •ISSUE 2

WOOD COUNTY AMATEUR RADIO CLUB

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No $35 FCC Fee Yet

The $35 license application fee, when it becomes effective, would apply to new, modification (upgrade and sequential call sign change), renewal, and vanity call sign applications, as well as applications for a special temporary authority (STA) or a rule waiver. All fees will be per application. Administrative updates, such as a change of mailing or email address, are exempt. It is expected that such fees will not become effective before summer 2021. ■

13 Colonies Adds Station

From ARNewsline

Fans of the popular 13 Colonies Special Event will be happy to learn there's a new bonus station and a new design for the QSL cards. France, which played a key role in the American Revolution as the Continental Army's primary ally, will also provide some major assistance in this year's 13 Colonies Special Event.

Ken Villone, KU2US, manager of the popular on-air celebration, has announced that **TM13COL** will be operating from France and joining the other stations as one of the bonus contacts. Ken said Didier, F5OGL, asked whether he could represent France in the July event, and said five other hams will also be willing to become on-air participants. They are joining the other overseas bonus station **GB13COL**, which is always popular with operators in the U.S. and Europe.

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Net Check Ins

Mar 2 *Traffic: 0*

N1RB (NCS)
KD8RNO
N8MSU
KA8VNG
WE8TOM
WD8JWJ
WD8LEI
WB8NQW
KG8FH
KE8CVA
KC8EKT
KD8NJW
KB8YRS
K8BBK
WD8PIC
KD8VWU
WD8ICP (17)

Mar 9 *Traffic: 0*

KG8FH (NCS)
KE8CVA
KD8NJW
WB8NQW
KD8RNO
N1RB
KA8VNG
KE8CUZ
N1LB
W8MSW (10)

Mar 16 *Traffic: 0*

N1RB (NCS)
KE8CVA
KG8FH
WD8JWJ
KD8NJW
WB8NQW

Brain Teasers

1. What term describes station output (including the transmitter, antenna and everything in between), when considering transmitter power and system gains and losses?

a.) power factor
b.) half-power bandwidth
c.) effective radiated power
d.) apparent power

2. In an FM phone signal having a maximum frequency deviation of 3000 Hz either side of the carrier frequency, what is the modulation index when the modulating frequency is 1000 Hz?

a.) 3
b.) 0.3
c.) 3000
d.) 1000

3. What is the easiest voltage amplitude dimension to measure by viewing a pure sine wave signal on an oscilloscope?

a.) peak-to-peak voltage
b.) RMS voltage
c.) average voltage
d.) peak positive voltage

April Contests

The contest lineup for the month of April is given below. Please note that the WARC bands (60, 30, 17 and 12 m) are never open to contesting.

Apr 3-4	*1400 to 0200 Z*	160 m to 10 m
Louisiana QSO Party		**all modes**
Apr 3-4	*1400 to 0200 Z*	160 m to 10 m
Mississippi QSO Party		**all modes**
Apr 3-4	*1400 to 2200 Z*	80 m to 10 m
Florida State Parks OTA		**Call modes**
Apr 3-4	*1500 to 1500 Z*	160 m to10 m
SP (Poland) DX 'test		**CW/SSB**
Apr 7	*1700 to 2000 Z*	2 m
VHF FT-8 Activity 'test		**Digital**
Apr 10-11	*0700 to 1300 Z*	160 m to 10 m
JIDX (Japan) 'test		**CW**
Apr 10-11	*1200 to 1200 Z*	160 m to 10 m
OK/OM (Czech-Slovakia) DX 'test		**SSB**
Apr 10-11	*1300 to 2200 Z*	160 m to 10 m
Nebraska QSO Party		**all modes**
Apr 10-11	*1400 to 0200 Z*	160 m to 10 m
New Mexico QSO Party		**all modes**
Apr 10-11	*1800 to 1800 Z*	160 m to 10 m
North Dakota QSO Party		**all modes**

Net Check Ins

	WE8TOM	
	KA8VNG	
	KD8RNO	
	KE8CUZ	
	WD8ICP	
	KE8RJZ-Chance	
	N8RAC-Guy	(14)
Mar 23		Traffic: 0
	KD8NJW	(NCS)
	KE8CUZ	
	K8BBK	
	KE8CVA	
	KG8FH	
	WD8LEI	
	WB8NQW	
	KE8OGV	
	KD8RNO	
	KA8VNG	
	N1RB	(11)
Mar 30		Traffic: 0
	WB8NQW	(NCS)
	WD8LEI	
	WD8JWJ	
	KD8RNO	
	W8PSK	
	N1RB	
	KA8VNG	
	WE8TOM	
	N8VNT	
	KD8VWU	
	KE8CVA	
	KC8EKT	
	KG8FH	
	K8BBK	
	WD8ICP	
	NM8W	(16)

Brain Teaser answers: (E) 1-c, 2-a, 3-a

13 colonies—from p. 1

QSL cards are also getting a different look this year. They will feature ships, a popular image used about eight years ago. The U.S. bonus station **WM3PEN**, operating for its 11th year, will feature the USS United States, one of the first frigates built in Philadelphia for the US Navy. Each state will select a Colonial-era ship relevant to their history.

The event will be held from July 1st to July 7th. A certificate will also be available for successful contacts. That success comes in big numbers too: last year more than 202,000 QSOs were made. ■

History of the Capacitor- the Modern Era

***Steven Dufresne* in Hackaday**

The **pioneering years in the history of capacitors** was a time when capacitors were used primarily for gaining an early understanding of electricity, predating the discovery even of the electron. It was also a time for doing parlor demonstrations, such as having a line of people holding hands and discharging a capacitor through them. The modern era of capacitors begins in the late 1800s with the dawning of the age of the practical application of electricity, requiring reliable capacitors with specific properties.

Marconi with transmitting apparatus, Published in LIFE [Public domain], via Wikimedia Commons

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WCARC Weekly Net

Tuesdays at *2100* all year

147.18 MHz 67 Hz PL

Net Control Roster

Apr 6	*N1RB*
Apr 13	*KG8FH*
Apr 20	*KD8VWU*
Apr 27	*KD8NJW*
May 4	*WB8NQW*
May 11	*N1RB*

NEXT MEETING

Business Meeting

Monday

April 12

TIME: 7:30 PM/7:00 EB

PLACE:

Woodland Mall Food Ct.
1234 N. Main St.
Bowling Green, OH

10 meter Net

informal group meets

Sunday

@ 20:30

on 28.335 MHz

Fusion Net

Thursday

@ 19:30

on 442.125 MHz

67 Hz PL on analog

Informal net

capacitors—from p. 4

Leyden jars

One such practical use was in Marconi's wireless spark-gap transmitters, starting just before 1900 and into the first and second decade. The transmitters built up a high voltage for discharging across a spark gap, and so used porcelain capacitors to withstand that voltage. High frequency was also required. These were basically Leyden jars and to get the required capacitances took a lot of space.

Mica

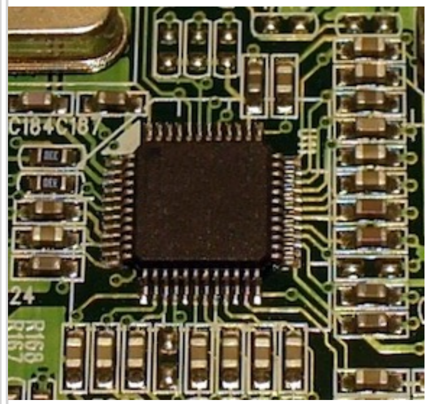
In 1909, William Dubilier invented smaller mica capacitors which were then used on the receiving side for the resonant circuits in wireless hardware.

Early mica capacitors were basically layers of mica and copper foils clamped together as what were called "clamped mica capacitors". These capacitors weren't very reliable though. Being just mica sheets pressed against metal foils, there were air gaps between the mica and foils. Those gaps allowed for oxidation and corrosion, and meant that the distance between plates was subject to change, altering the capacitance.

In the 1920s silver mica capacitors were developed, ones where the mica is coated on both sides with the metal, eliminating the air gaps. With a thin metal coating instead of thicker foils, the capacitors could also be made smaller. These were very reliable. Of course we didn't stop there. The modern era of capacitors has been marked by one breakthrough after another for a fascinating story. Let's take a look.

ceramic

In the 1920s mica wasn't as abundant in Germany and so they experimented with new families of ceramic capacitors, finding that titanium dioxide (rutile) had a linear temperature dependence of capacitance for temperature compensation and could replace mica capacitors. They were produced in small quantities at first and larger quantities in the 1940s. They consisted of a disc metallized on both sides.



MLCCs around a microprocessor. By Elcap [CC BY-SA 3.0], via [Wikimedia Commons](#)

To get higher capacitance, another ceramic, barium titanate was used, as it had 10 times the permittivity of mica or titanium dioxide. However, it had less stable electrical parameters and could replace mica only where stability was less important. This property was improved after World War II.

Electrolytic capacitor

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capacitors—from p. 6

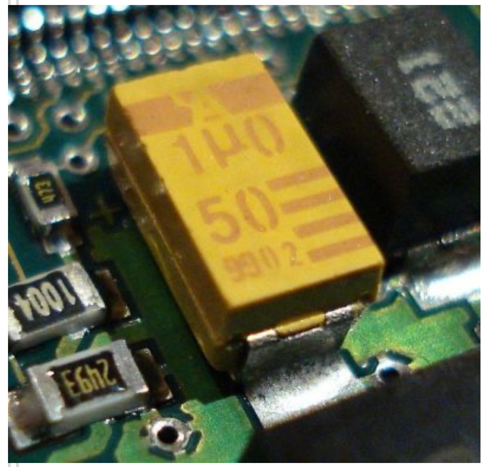
An American company launched in 1961 pioneered the multi-layer ceramic capacitor (MLCC), which was more compact and had higher capacitance. More than 10^{12} barium-titanate MLCCs are produced each year.

aluminum electrolytic

In the 1890s, Charles Pollak found that an oxide layer on an aluminum anode was stable in a neutral or alkaline solution and was granted a patent in 1897 for a borax electrolyte aluminum capacitor. The first "wet" electrolytic capacitors appeared in radios briefly in the 1920s but had a limited lifespan. They were called "wet" due to their high water content. They basically consisted of a container with a metal anode immersed in a solution of borax or other electrolyte dissolved in water. The outside of the container acted as the other plate. These were used in large telephone exchanges to reduce relay noise.

The patent for the electrolytic capacitor's modern ancestor was filed in 1925 by Samual Ruben. He sandwiched a gel-like electrolyte between the oxide coated anode and the second plate, a metal foil, eliminating the need for a water filled container. The result was the "dry" electrolytic capacitor. Another addition was a paper space between the turns of the foils. All of this reduced the size and price significantly.

In 1936 the Cornell-Dubilier company introduced their aluminum electrolytic capacitors, including improvements such as roughening the anode surface to increase capacitance. The Hydra-Werke, an AEG company, began mass production in Berlin, Germany at the same time. After World War II, the rapid development of radio and television technology lead to larger production quantities as well as a variety of styles and sizes. Improvements included reducing leakage currents and equivalent series resistance (ESR), wider temperature ranges and longer lifespans by using new electrolytes based on organics. Further developments from the 1970s to the 1990s also included lowering leakage currents, further reduction in ESR and higher temperatures.



A surface-mount tantalum capacitor. By Epop [Public domain], via [Wikimedia Commons]()

What became known as the "**[capacitor plague]()**" occurred during the years 2000 to 2005, possibly due to the use of a stolen recipe but without certain

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capacitors—from p. 7

stabilizing substances leading to premature failure.

tantalum electrolytic

Tantalum electrolytic capacitors were first manufactured for military purposes in the 1930s. These used wound tantalum foils and a non-solid electrolyte. In the 1950s Bell Laboratories made the first solid electrolyte tantalum capacitors. They ground the tantalum to a powder and sintered it as a cylinder. At first a liquid electrolyte was used, but they then discovered that manganese dioxide could be used as a solid electrolyte.

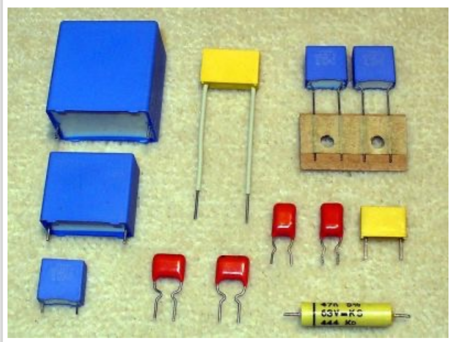
Although Bell Labs made the fundamental inventions, in 1954 the Sprague Electric Company made improvements in the process, producing the first commercially viable tantalum solid electrolyte capacitors.

1975 saw the emergence of polymer tantalum electrolytic capacitors with much higher conductivity, with conductive polymers replacing the manganese dioxide leading to lower ESR. NEC released their polymer tantalum capacitors in 1995 for SMDs (surface-mount devices) with Sanyo following suit in 1997.

Tantalum ore is subject to price shocks, and two such occurrences happened in 1980 and 2000/2001. The latter shock led to the development of niobium electrolytic capacitors with manganese dioxide electrolyte delivering properties roughly the same as tantalum capacitors.

polymer film

The metallized paper capacitor was patented in 1900 by G.F. Mansbridge. The metallizing was done by coating the paper with a binder filled with metal particles. These were commonly used in the early 1900s as decoupling capacitors in telephony (telecommunications.). During World War II, Bosch improved the process and manufactured them by coating the paper with lacquer and using vacuum deposition of metal to coat it. Around 1954, Bell Labs made a 2.5µm-thick metallized lacquer film separate from the paper, resulting in much smaller capacitors. This can be considered the first polymer film capacitor. Research in plastic by organic chemists during World War II resulted in further progress. In 1954 the first mylar capacitor was one of those. Mylar was trademarked by Dupont in 1952 and is a very strong PET (polyethylene terephthalate). In 1954 a 12µm-metallized mylar film capacitor was produced. By 1959, the list included capacitors made with polyethylene, polystyrene, polytetrafluoroethylene, PET



Film capacitors. Elcap [CC-BY-SA 3.0], via Wikimedia

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April Contests–cont.

Apr 17-18	*0700 to 0659 Z*	80 m to 10 m
YU (Serbia) DX ‘test		**CW/SSB**
Apr 17-18	*1600 to 0400 Z*	80 m to 10 m
Michigan QSO Party		**all modes**
Apr 17-18	*1400 to 2000 Z*	160 m to 10 m
Texas State Parks OTA		**all modes**
Apr 17-18	*0600 to 0559 Z*	80 m to 10 m
Worked All Provinces (China)		**CW/SSB**
Apr 17-18	*0900 to 2359 Z*	80 m to 10 m
CQ MM (Russia) DX ‘test		**CW**
Apr 17-18	*1800 to 1800 Z*	160 m to 10 m
Ontario QSO Party		**all modes**
Apr 18	*1800 to 2359 Z*	80 m to 10 m
ARRL Rookie Roundup		**SSB**
Apr 24-25	*1300 to 1259 Z*	160 m to10 m
Helvetia DX ‘test		**all modes**
Apr 24-25	*1600 to 2159 Z*	40 m to 10 m
Florida QSO Party		**all modes**

capacitors—from p. 8

and polycarbonate. By 1970, electric utilities were using film-foil capacitors without the paper.

double-layer (supercapacitors)

This takes us to the last of our capacitor types, and fairly exciting ones at

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capacitors—from p. 9

that, with capacitances in the thousands of farads. In the early 1950s researchers at General Electric used their background with fuel cells and rechargeable batteries to experiment with capacitors with porous carbon electrodes. This led to H. Becker patenting the capacitor as a “Low voltage electrolytic capacitor with porous carbon electrodes”, not understanding the

Supercapacitors, Maxwell Technologies, Inc. [CC BY-SA 3.0], via [Wikimedia Commons]

principle behind it that lead to the extremely high capacity. GE didn’t pursue it.

Standard Oil of Ohio (SOHIO) developed another version, and eventually licensed it in the 1970s to NEC who finally commercialized it under the trademarked name, supercapacitor. It was rated at 5.5 V and had capacitances up to 1F. The units were up to 5 cm^3 in size and were used as backup power for computer memory.

Brian Evans Conway, professor emeritus at the University of Ottawa, worked on ruthenium oxide electrochemical capacitors from 1975 to 1980. In 1991, he described the difference between supercapacitors and batteries in electrochemical storage, giving a full explanation in 1999, while coining the term supercapacitor again.

Products and markets grew slowly with product names such as Goldcaps, Dynacap and PRI Ultra-capacitor, the latter being the first supercapacitor with low internal resistance, developed in 1982 by Pinnacle Research Institute (PRI) for military purposes.

Relatively recent developments on the market include lithium-ion capacitors, which dope the activated carbon anode with lithium ions. These have capacitances in the thousands of farads (4-digits) at around 2.7V.

conclusion

In closing, I should point out that there’s no shortage of the usage of the term *condenser* rather than *capacitor*. So where does the term capacitor come from? That seems to be unknown, but the *Oxford English Dictionary* quotes from the 1922 BSI (British Standards Institution) *Glossary of Terms in Electrical Engineering* that says ‘capacitor’ is a ‘new term’ and suggests it be used to avoid confusion with the steam ‘condenser’.

While that concludes our history of the capacitor, there’s plenty more we’re sure could be added based on the **large number of types of capacitors** alone. ■

WCARC 2021 Roster- 1st Qtr.

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