The History of Amateur Radio Callsigns

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The History of the Ham Radio Call Sign

- Ever wonder about why we use the letters and format we use for our call signs?
- If you are a legal Ham anywhere in the world you have a government issued call sign.
 - Many hams are better known by their call sign than they are by their given birth name. The uniqueness and prestige of a call sign is one of the things that provides the persona that is amateur radio.
 - Call signs are important. Think of the call sign W1AW, and 99% of hams would know that this once identified Hiram Percy Maxim, the founder of the ARRL.
 - The call sign was so important that it became the official call sign of ARRL.

✤K7JEP

But, if one thinks about it, we don't really own these call signs; they're leased to us by the FCC for our use as long as we remain licensed. We are the caretakers, and when we become a silent key, they are passed along to the next caretaker.

- ➤To truly understand call signs we have to cover some of the history of amateur radio itself.
- ➤The origins of Ham call signs go back to the earliest days of radio, informally at first, then more formalized as major world events transpired that changed the face of amateur radio itself.
- >This can be broken down into five distinct periods of history:

Era's of Amateur Radio Callsigns

- The Pioneer Years, Pre-1918
- The Constructive Years, 1918-1927
- The Pre-War Years, 1928-1941
- The Post-War Years, 1945 1975
- The Modern Era, 1975 present

The Pioneer Years, pre 1918, "The Days of Anarchy"

Prior to 1912 there were no real laws governing the new communication medium known as "wireless", it was for the most part completely unregulated. Much like the old "Wild West" itself.

- ➢The airwaves consisted of signals emitted from crude spark gap transmitters, by a combination of governmental, commercial interests, and fledgling ham operators (who mostly worked for these other interests).
- ➢The Marconi Company was among the first to use three letter call signs to identify their transatlantic coastal wireless telegraph stations, and to identify their company owned shipboard stations.

The coastal station call signs started either with a "V" (for "Voice of somewhere"), or "M" (for "Marconi"), while the shipboard stations just used the starting letter of "M".

- Hams for the most part started off by using just names as identifiers, such as "BILL" or "MAC", that evolved into a combination of two or three letters, a mixture of letters and numbers, or even just numbers!
- There ended up being a LOT of overlap in call signs, both commercially, and among hams themselves.
 - Was "MAC" a Marconi Company owned shipboard station, or Miles Cornwall (using the call sign "MAC")?
 - With such a limited range for the spark gap transmitter, often around a hundred miles or so, this wasn't much of an issue (at least at first.)
- ➢As the airwaves became more congested it was clear that more needed to be done to coordinate and publish established call signs to reduce conflicts.
 - While there were publications that listed known commercial stations, the May 1908 publication of <u>Modern Electrics</u> published one of the very first lists of known Hams, their associated call signs, and also the approximate wavelength they operated on.

- This was probably the first ten documented ham operators with most using two letter identifiers signifying their initials, but one, Otto Curtis, was simply known as "Q".
- By 1909 many more Ham stations and their call signs were listed and most were using three letters by now.
- Many used two letters followed by the third letter of "M" to denote that they were employees of Marconi Company. Some were listed with a combination of letters and numbers, such as "S4", and "3B". One special call sign listed was that of Earl C. Hawkings who utilized the call sign of "HAM". Does that make him the first real "ham"?
- In such an unregulated environment that had many stations competing, all utilizing transmitters with very broad emission spectrums, and coupled with crude receivers on the other end, conflicts caused by both unintentional and intentional interference were commonplace.
- This was getting worse by the day, and one day it all came to a head. That day was April 15, 1912.

April 15, 1912 - *RMS Titanic* (call sign: MGY) The date that changed amateur radio!

The *RMS Titanic* (call sign: MGY) hit an iceberg.
Hundreds of passengers were eventually rescued by

- the RMS Carpathia (callsign: MPA).
- Problems with radio communications played a key role in delaying the rescue effort, and undoubtedly added to the *Titanic's* fatality totals.



- 1. The shipboard station aboard the *Titanic* was owned and manned by employees of Marconi Company. Marconi's main competition for the ship telegraph market was his bitter rival Telefunken, based in Germany.
- 2. At the time Marconi Company owned stations were **not allowed** to have any contact with Telefunken owned stations (call signs beginning with "**D**"), and as result messages from the competition were largely ignored.

- 3. In addition, there was both unintentional and intentional interference from other commercial stations (and hams alike), making for even a more chaotic scene.
- 4. Many thought the distress signals from the doomed ship were fake. After all, how could the "unsinkable" *Titanic* really be sinking? It must be "fake news"!
- 5. A fifth issue also contributed to the casualty numbers. The Marconi Company early on had established the "CQD" ("CQ Distress"), message. The now familiar "SOS" ("Save Our Ship, or "Save Our Souls"), had actually been made the worldwide standard when the second <u>International Radiotelegraphic</u> <u>Convention</u>, was signed in 1906, and became effective on July 1, 1908.
 - This was a full four years earlier than the *Titanic* sinking and only the Marconi Company equipped ships still used "CQD" as the standard distress message when the *Titanic* ran aground.

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The Constructive Years, 1918 – 1927, "Starting Over"

>What does the Titanic sinking have to do with Ham radio?

➢The International Radiotelegraph Convention of 1912 was held in London on July 5, 1912 and on August 13, 1912 established the first internationally recognized call sign standards based on the country.

This standard replaced the random three letter call signs then prevalent.

Major world powers were given single prefixes such as "N", "W", and half of the "K" prefix allocations (KDA-KZZ) (United States), "A", "D", and "KAA-KCZ" (Germany), "F"(France), "B", "M", and "G" (Great Britain).

While these international standards were applied to commercial stations, amateurs for the large part were still left on their own. The US Congress, as well as the other major powers, began investigations into how to keep this disaster from repeating itself.

- Both the sole remaining *Titanic* wireless operator, Harold Bride, and Marconi himself was called before Congress to explain his company's practices
- These hearings became known as the <u>Radio Act of 1912</u>, written into law on August 13, 1912. This act had the following provisions, among others:
 - 1. Mandated that the familiar Morse "SOS" be the defacto standard for distress calls
 - 2. Provided the possibility of fines for intentional or malicious interference
 - 3. US stations (including amateurs) had to be inspected and licensed by the US government. (this act didn't really do much for formalizing call signs perse)

- It wasn't until May 9, 1913 that the U.S. Policy for Radio Call Letters was published:
 - Call letters for amateur stations in the U.S. were awarded according to the following system:
 - •The call will consist of three items; number of radio district; followed by two letters of the alphabet. The letters "X", "Y", "Z", must not be used as the first of the two letters.
 - If the entire 598 calls were exhausted, inspectors were to issue additional calls, consisting of the figure of the district followed by three letters. Combinations to be excluded were SOS, and PRB, all three-letter combinations beginning with QR or QS, all combinations involving the repetition of the same letter three times, three-letter combinations beginning with "K", "N", "W", "X", "Y", "Z", and other combinations, which, for various reasons, international, national, local, or individual, may be objectionable."

The constructive Years, 1918 - 1927, "Starting Over"

	Executive Order 2605-A (1917)			
←Executive Order 2605	by President of the United States	Executive Order 2606→		
Executive Order Assuming Control of Radio Communications				
See the Notes section for a list (of Executive Orders affected by or related to the issuance of this Executive Order	谢 sister projects: Wikidata item		
See the Motes section for a list of	🥥 more info.			
Signed by President Woodrow	External Information about this EO			

- WHEREAS the Senate and House of Representatives of the United States of America, in Congress assembled, have declared that a state of war exists between the United States and the Imperial German Government; and
- WHEREAS it is necessary to operate certain radio stations for radio communication by the Government and to close other radio stations not so operated, to insure the proper conduct of the war against the Imperial German Government and the successful termination thereof,
- Now, therefore, it is ordered by virtue of authority vested in me under the Constitution, under the Joint Resolution of Congress dated April 6, 1917, and under the Act to Regulate Radio Communication, approved August 13, 1912, that such radio stations within the jurisdiction of the United States as are required for Naval Communications shall be taken over by the Government of the United States and used and controlled by it, to the exclusion of any other control or use; and furthermore, that all radio stations not necessary to the Government of the United States for Naval Communications may be closed for radio communication and all radio apparatus therein may be removed therefrom.

The enforcement of this order is hereby delegated to the Secretary of the Navy, who is authorized and directed to take such action in the premises as to him may appear necessary.

This order shall take effect from and after this date

- April 7th, 1917 by executive order amateurs were told to "dismantle and render inoperable their radio equipment and antennas" as the United States formally entered WWI. This mandate applied to both receivers and transmitters, and all amateur licenses issued to date were immediately cancelled.
- ➢At the end of the war the US Navy tried to silence amateur radio so the military could continue to have the airwaves for themselves.
 - 1907, a small group of teenagers belonged to the Junior Areo Club of U.S. In 1909 they created the Junior Wireless Club Ltd. (Often noted as 1st radio club in U.S.)
 - Mostly due to their effort and of Hiram Maxim that effort was defeated. Amateurs could once again be licensed and back on the air starting in early 1919.
- Since all licenses had been cancelled at the start of US involvement in the war, all previous call signs were lost. When the nine district radio offices once again opened for business amateurs lined up in an attempt to ensure low letter suffix assignments.

In one year some of the districts had run out of two letter suffix assignments, so began the three letter suffix call sign.

- ➢ By 1923, both receiver and transmitter technology greatly improved and international contacts between amateurs were becoming commonplace.
 - Amateur stations still didn't follow the prefix standards set in 1912, so there were again problems related to duplication of call signs. (the policy established in 1913 did not cover prefixes for amateurs.)
 - There could be a 2AL in New York working a 2AL in Brazil, or another one in England. Amateurs took the matter in their own hands. Starting in the mid 1920's US amateurs began using an unofficial "u" as a prefix to denote they were from the US. By 1927 the prefix "nu" (North America, United States) became commonplace on QSL cards (example: nu6AA), hams in Canada were using"(North America, Canada) as a prefix.

➢ In 1925 the Department of Commerce allowed the "Y" letter suffixes to be used for educational institutions. The "X" letter suffix remained for "experimental" stations, and was not released as a 1X2 (ie: W7XQ), standard call sign until 1977. Two-by-three letter "X" suffix still remain reserved for experimental stations.

The Pre-War Years, 1927-1941, "Amateur Radio is Here to Stay!"

- The <u>Washington Conference / Radio Act of 1927</u> established formalized bands and finally put US amateurs loosely under the rules established in 1913.
- A new commission was formed, the **Federal Radio Commission**. Assigned the task of issuing licenses, including amateur radio. Also to follow the already established **International Telegraph Union (ITU)** call sign standards. (The ITU standards were upgraded to grant the entire "K" prefix to the US, in addition to the existing "W" and "N" prefixes.)
- ➢Oddity: How did "K" (for commercial stations West of the Mississippi), and "W" for Eastern stations come about? This goes back to early Federal Radio Commission regulations, and was originally applied to ships operating in the Atlantic, ("K" prefixes), or Pacific or Great Lakes area ("W" prefix). Eventually, this was applied to land based commercial stations as well, (but somehow in reverse order).
- In 1933 President Franklin Roosevelt created an interdepartmental committee for studying electronic communications.
 - This became known as the <u>Communications Act of 1934</u>. A key part of this act was the creation of a new federal organization known as the <u>Federal</u> <u>Communications Commission, (FCC)</u> to replace the FRC.

On December 7,1941, the "day that will live in infamy", the world of amateur radio was again suspended for the second time, as the US entered into the Second World War.

All amateur activity was officially suspended January9, 1942 for the remainder of the war.



- The big difference was that the FCC continued to issue and was allowed to renew amateur licenses. That gave the government a ready pool of trained and certified radio operators and technicians for the war effort.
- There were no station licenses issued, and existing ones were considered revoked. Once again hams were forced to silence their stations but at least this time, unlike the previous war, receivers were still allowed to be used.
- >This lasted until the war officially ended in **September 1945**
 - Amateurs were granted limited permission to get back on the air in November of 1945, with only the ten and two meter bands to start.

The Post-War Years, 1945-1975 "The Glory Years of Amateur Radio"

> The Atlantic_City ITU Conference of 1947 (The ITU had changed its name in 1932)

- Reallocated some call sign blocks, and granted a few developing island nations their own prefixes.
- In the US, the call sign districts were moved around to equalize ham populations. The Midwest and West coast had greatly increased their Ham populations. As a result, a new 10th call district was formed.
- Also at this time, possessions had their own unique prefixes assigned, i.e.: KP4 for Puerto Rico, KH6for Hawaii, and KL7 for Alaska.
- In 1951 an "entry level" amateur license was created, the Novice class, originally as a one year, non-renewable, low power, and CW only license.
 - These new "novices" were assigned either a WN or a KN prefix, but the "N" would be dropped from the call sign once the licensee upgraded. When the FCC ran out of "KN" and "WN" call signs, they began issuing "WV" prefixes for novices, which became "WA" or "WB prefix calls when upgraded.

Also created was the **Technician** class.

- It was a new VHF/UHF/microwave (220 MHz and higher) licensed designed to encourage experimental exploration of these frequencies, (but not intended as a communicators license!)
- Trivia: Since Novice and Technician privileges didn't overlap, it was possible to hold two different call signs at the same time. There was also another rule that if an amateur had homes, (such as a "snowbird"), in two different FCC districts, they could hold call signs that reflected the numbers of both districts. So, technically, an amateur could **potentially hold four amateur call signs** simultaneously! This system was in force until sometime in the 1960's.
- The "W" prefix call signs started to run out, so in 1947 the first "K" prefix calls began to appear. By 1953 most districts we reissuing them, and some still were until 1964.
- By the late50's/early 60's all of the possible combinations of 1X3 format "K" were all assigned in some districts, so "WA" and "WB" (2X3 format) call signs started appearing. "WB" call signs were issued from 1965 to 1975, but in the mid 1970's some districts were also running out of "WB" call signs.

The Modern Era, 1975 to Present "Things get complicated"

- ➤The issuance of the recycled call signs was a lot of work for the FCC, so it began issuing new "WD" prefix call signs around 1976. (In 1978 the "WD" prefix was replaced with the "KA" prefix, as systematic licensing was put into place).
- >But what happened to the "WC" prefix"?
 - Those prefixes were reserved for RACES stations. VHF and UHF club owned repeaters also had their own 2X3 format call signs issued, starting with the "WR" prefix.
 - One "WT" (WT6AAA) call sign is known to have been issued in the 1970's, as a "temporary" call after a FCC mix-up denied a prospective amateur's new license.
 - He had the same first and last names as somebody who previously had their license revoked. Once cleared up a temporary license was issued until the standard license could be processed).

Also in 1978, amateurs were no longer required to change their callsign when moving to a new district.

Secondary, Repeater, Control, and Auxiliary Station licenses were discontinued.

> Call signs were now assigned by Groups, and by license class. The Groups were defined as:

Group A -- Amateur Extra Class

Contains all "K", "N" and "W" 1x2, most 2x1, and most "AA-AK" prefixed 2x2 call signs

Group B -- Advanced Class

Contains most "K", "N", and "W" prefixed 2x2 call signs

Group C -- **Technician & General Class**

Contains all "N" 1x3 call signs. Unassigned "W" and "K" prefixed 1x3 call signs are not issued under the sequential call sign system, but are available under the later Vanity call sign system

Group D -- Novice Class

Contains most "K" and "W" prefixed 2x3 call signs. The letter "X" may not be the first digit of the suffix.

- Note that no provision was made for the issuance of AA-AL and NA-NZ prefixed 2x3 call signs, and these call signs are not currently issued to anyone.
- > In 1995 the Vanity "for a price" program was implemented, consisting of four "gates":
 - **Gate 1**: 5/31/96, for those amateurs that had held a call before, or eligible for "in memoriam "calls. 7/22/96, for Club station trustees that were eligible for "in memoriam" calls
 - Gate 2: 9/23/96, Amateur Extra requests
 - Gate 3: 8/6/97, Advanced Class requests
 - Gate 4: 12/2/97, Everybody else

So there is the full history of the ham radio call sign, from the infancy days of amateur radio, until the present day.

Bibliography: <u>http://earlyradiohistory.us/1913call.htm</u> - This is an HTML version of the original government document of 1912. <u>https://en.wikipedia.org/wiki/Amateur_radio_licensing_in_the_United_States</u>



And On We Go!

Update on RF Exposure Practices and Standards

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&

Doug Forster, W6AXR

So why bother?

1. Because the FCC says so



- 2. Because it could be a risk to you and your family
- 3. Because you are required to maintain *Positive Access Control*
- 4. Because if a neighbor ever complained , you are expected to be able to produce documentation dated *before* the complaint that demonstrates due diligence on your part

Known medical effects of RF emissions

- Primary mode of injury is heating
 - 2.45 GHz RF emission excites water molecules
 - As they move, they generate heat
 - Expose it long enough (duty cycle) to enough power and your food gets hot!
- Does RF energy including 60Hz AC cause cancer?
 - Very difficult question to answer
 - Power lines and brain tumors probably not
 - Does it cause other cancers probably not
 - Complex modeling is required.
- Human body "impedance match"
 - 30 MHz to 300 MHz (10m, 2m and 1.25m)



FCC requirements

- Hams have always had to *comply* with FCC RF exposure limits
- Starting a few years ago, hams have to *demonstrate* compliance
- It isn't that difficult to demonstrate compliance in most cases
- ARRL on-line calculator is reasonably easy to use, and defensible
 - Input power, frequency, and antenna gain and get required stand-off distance
- Easy approach is to input all worst-case values, and see if you can live with the calculated distance from antenna to a person
- If you can't provide that much separation between the antenna and a person, start taking credit for factors that reduce ERP and thus reduce required distance
 - Antenna pattern gain is not the same in all directions
 - Coax and SWR loss reduce power at antenna from power out of radio
 - Modulation and operational duty cycles reduce time-averaged exposure

All worst case HF example

V

(watts)

RF Exposure Calculator

Parameters

- Power at Antenna: 100
- Mode duty cycle: Conversational SSB, no speech processing (mode duty cycle=20%)
- Transmit duty cycle: (time transmitting)
 You transmit for 3 V minutes then receive for 10 V minutes (and repeat).
- Antenna Gain (dBi): 1.5
- Operating Frequency (MHz): 28.36
- Include Effects of Ground Reflections

This calculator should not be used for antennas that are less than 20 cm (8 in) from a person.

Results for a controlled environment:

Maximum Allowed Power Density (mW/cm²): 1.1190 Minimum Compliance Distance (feet): 1.6637 Minimum Compliance Distance (meters): 0.5071

For an uncontrolled environment:

Maximum Allowed Power Density (mW/cm²): 0.2238 Minimum Compliance Distance (feet): 2.8817 Minimum Compliance Distance (meters): 0.8783 Typical radio we have – ICOM 7300 at 100W full power on Ten-Ten net frequency.

1/4 wave vertical antenna.

You almost certainly can find 3 feet of separation.

You're good to go!

UHF – more gain, lower allowed exposure

RF Exposure Calculator

Parameters

- Power at Antenna: 100
- (watts)
- Mode duty cycle: FM (duty cycle=100%)

- \sim
- Transmit duty cycle: (time transmitting) You transmit for 3 V minutes then receive for 10 V minutes (and repeat).
- Antenna Gain (dBi): 9
- Operating Frequency (MHz): 440

☑ Include Effects of Ground Reflections

This calculator should not be used for antennas that are less than 20 cm (8 in) from a person.

Results for a controlled environment:

Maximum Allowed Power Density (mW/cm²): 1.4667 Minimum Compliance Distance (feet): 7.7058 Minimum Compliance Distance (meters): 2.3487

For an uncontrolled environment:

Maximum Allowed Power Density (mW/cm²): 0.2933 Minimum Compliance Distance (feet): 13.3469 Minimum Compliance Distance (meters): 4.0681 Diamond X300 antenna on 10 ft mast – looks like someone walking under it is non-compliant.

Antenna gain only comes from directivity. 9 dBi straight out, but about 10 dB less than that close under it.

Good to go without taking any credit for coax or SWR loss.



Reminder on Power

- It is ERP that matters, not output as measured at the transmitter
- Let's use a 2m EME station as an example
 - 1 kW output
 - 50 feet of LMR 400
 - 18.3 dBi (15.9 dB) antenna gain
 - Doing the math the calculated ERP is 32.5 kW!
- Not an unusual answer (actually describes my 2m EME station)
- Same math but with 100 watts out ERP is 3.25 kW (maybe your station)
- Moral to the story once into VHF/UHF where gain antennas are easier to build just be careful

You can reduce required distance by taking credit for modulation duty cycle

• Modulation duty cycle refers to the percentage of time the signal is transmitting in relation to the total length of the cycle



20% Modulation Duty Cycle AM SSB



100% Modulation Duty Cycle FM

Some common modulation duty cycles

•

• Per ARRL RF Exposure calculator Calculator

	Conversational SSB, no speech processing (mode duty cycle=20%)	
	Conversational SSB, heavy speech processing (duty cycle=50%)	
	Conversational CW (duty cycle=40%)	
2	FM (duty cycle=100%)	
	AM (duty cycle=100%)	
10	FSK/RTTY (duty cycle=100%)	t
4	AFSK SSB (duty cycle=100%)	
n	Carrier Always On, i.e., for Tuning Up (duty cycle=100%)	
0	For all others, or if unknown, assume worst case scenario (duty cycle=100%)	

• These are the only values you can put into the current ARRL exposure calculator

From	ARRL Handbook 101	
• S	SB (no compression)	20%
• S	SB (compressed)	40%
• C	Ŵ	40%
• A	M (with 100% modulation) 25%	
• A	M (unmodulated	100%
• F	M	100%
• F	SK/RTTY	100%
• A	FSK on SSB	100%
• S	STV on SSB	100%
• P	SK31	75%
• F	Τ4	34%
• F	Т8	42%
• J ⁻	Τ4	39%
• J ⁻	Т9	41%
• J ⁻	T65	39%
• C	RA64	40%
• V	VSPR	92%

Power at the antenna 145.600 MHz

Line Loss Calculator:

Note: Set Line Length 100 here to use the ERP Calc. Put actual line length in the ERP Calc.

Parameters:			Results:			
Line Type:	Times LMF	₹-400 🗸	Matched Loss:	1.492	dB	
Line Length:	100	● Feet ○ Meters	SWR Loss:	0.089	dB	
Frequency:	145.0	MHz	Total Loss:	1.58	dB	
Load SWR:	1.5	:1	Power Out:	69.494	Watts	
Power In:	100	Watts	Power Loss:	31	%	
	Calculate	before using ERP Calc.				

Effective Radiated Power Calculator:

	Paramete	:rs:		Results:	
Loss Per 100' at Op Freq:	1.58	dB	Calculated Loss:	0.8	dB
Actual Line Length:	50	Feet	Power Out:	83.4	Watts
Power In:	100	Watts	Power Loss:	17	%
Antenna Gain:	6.1	dBd ($\lambda/2$ dipole=0dB)	ERP:	<mark>33</mark> 9.6	Watts
	Calculate				

External Links

Parameters

•	Power at Antenna: (Need help with this?) 34.5 (watts)	
•	Mode duty cycle:	
	FM (duty cycle=100%)	~
•	Transmit duty cycle: (time transmitting)	
	You transmit for 2 🗙 minutes then receive for 3 👻 minutes (and repeat).	
•	Antenna Gain (dBi): (Need help with this?) 8.5	
•	Operating Frequency (MHz): 145.600	

Include Effects of Ground Reflections

If you would like to receive future announcements of any FCC news related to RF-exposure or the requirements for amateurs to evaluate their stations, you may **optionally** provide an email address.

Email Address: (optional)	
Comments: (optional)	

Calculate

This calculator should not be used for antennas that are less than 20 cm (8 in) from a person.

Results for a controlled environment:

Maximum Allowed Power Density (mW/cm ²): 1.0000			
Minimum Compliance Distance (feet): 5.17	48		
Minimum Compliance Distance (meters): 1.	5773		

For an uncontrolled environment:

Maximum Allowed Power Density (mW/cm ²): 0.2000				
/inimum Compliance Distance (feet): 10.3496				
Vinimum Compliance Distance (meters): 3.1546				

Your Job: "The Book"

- You will need to know:
 - Antenna gain
 - Antenna geometry (tower, etc., if applicable)
 - Feedline loss @ frequency (https://kv5r.com/ham-radio/coax-loss-calculator/)
 - Output power at radio
 - Mode (CW, FT8, SSB, etc.)
 - Approximate TX/RX cycle
- Need to know for all bands and antenna configurations

So, you need:

- One page per:
 - Band
 - Power output level (maybe "worst case" if you run differing power levels?)
 - Mode
 - Antenna + feedline type
- Be careful at VHF/UHF
 - Most sensitive RF spectrum for human absorption
 - Easy to get lots of gain out of small antennas
 - Antenna gain can be offset to some extent by feedline loss
- Pay particular attention to uncontrolled access distances

"RF in the shack"

- Not discussed here, but important, is RF energy getting into your shack via the shield on the coax line.
- Defies simple analysis.
- Ferrite chokes are your friend.

A topic for another day.