5G: EW CHALLENGE OR TECHNOLOGY DRIVER?

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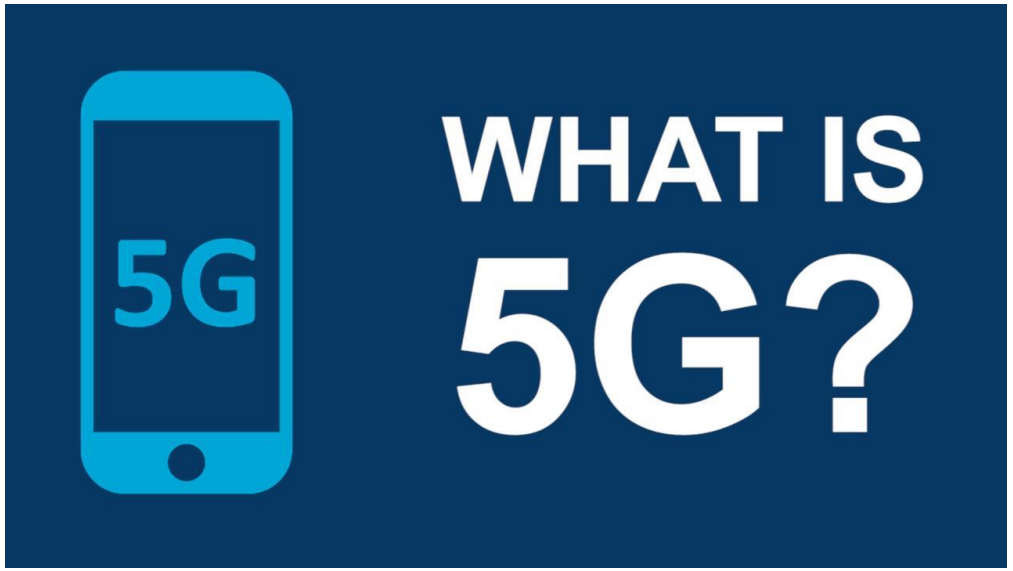
WHAT IS 5G?

- *5G* is the fifth generation of mobile network technology.
- Provides significant upgrades to the current 4G network.
  - Offering very high bandwidth and data transfer rates,
  - Minimal networking delay (low latency).
  - Allowing,
  - in the cloud networking and computing!
  - Internet Of Things (IoT) expansion
  - RF technology advances
    - (Antenna arrays, RF component technology)



WHY IS 5G SUCH A BUZZ WORD?

Provides Positive advances

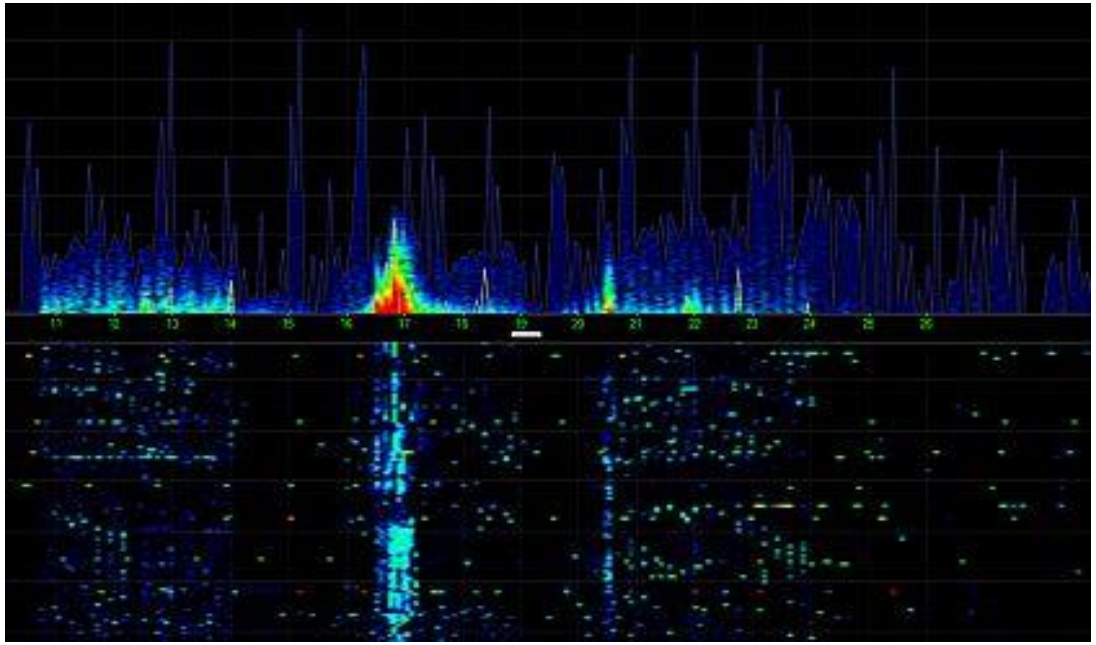
- Expands the Internet of Things (IoT) - billions of physical devices around the world, networking and sharing information, over the internet.
  - Devices such as Mobile / Vehicles / other Electronic
- 5G adds to the “Information revolution”

Image: Forbes.com

Some Negative concerns

- Concerns and challenges of the Electromagnetic (EM) spectrum usage…a fixed, limited and essential resource.
- Influence on existing military communication bands, in terms of signal interference and security.

INFLUENCE OF 5G ON EM SPECTRUM AND EW?



- Possible interference on EW, due to a shared EM spectrum
- Summary of known 5G frequency bands are:
  - 600 MHz (Communication influence?)
  - 3.4 GHz to 4.2 GHz (EW influence?)
  - 24 GHz to 29.5 GHz (mmW EW influence?)
  - Above 37 GHz (mmW EW influence?)
- 5G RF signal channel bandwidth of up to 400 MHz
- 5G Data rates up to 10 Gbps, modulated onto RF

5G FREQUENCY BANDS OVERVIEW

Image: EverythingRF.com

5G AND TRADITIONAL RADAR SURVEILANCE SYSTEMS

- Traditional high performance systems are typically based on envelope detection receiver technology.
  - Instantaneous Frequency Measurement (IFM)
  - Detector Log Video Amplifier (DLVA)
- Providing high performance in terms of dynamic range and Probability Of Intercept (POI)
- BUT…traditional systems do not perform well with complex mobile LTE (4G) signal environments.
- Expect potential loss of receiver sensitivity and signal masking in bands containing complex 5G signals
- Unable to identify or potentially utilize 5G signals to create a scenario picture.

OVERCOMING THE 5G PROBLEM – **CURRENT**

- First step to overcome the 5G vs EW spectrum problem, is to implement a digital system architecture.
- Current digital (direct) sampled EW systems typically achieve 500 MHz or 1 GHz IBW.
  - Example: Saab USME-250 Mk1 ESM/ELINT system (direct sampling techniques)
  - Example: Gripen EW suite (combination of sampling techniques), higher than typical IBW.
- Improving the situation faced by analogue systems, but are these systems ready for 5G?
- The answer is more than likely “yes”, but can we improve?
- Current techniques to improve processing and direct sampling can result in a SWaP trade-off.

MODERN DAY EW SYSTEMS – EXAMPLES

OVERCOMING THE 5G PROBLEM – **NEAR FUTURE**

- To deal with the highly advanced 5G spectrum, a highly capable and advanced system is required!
- We need highly improved processing, even wider instantaneous BW
- To deal with processing and high BW challenges, Saab introduced the USME-250 Mk2 Wideband Digital ESM/ELINT system.
  - Wideband Instantaneous BW in excess of 4 GHz,
  - while maintaining 100% POI activity detection, using stacked receivers.
  - Although, not originally intended for 5G identification and processing, but able to identify the presence of 5G signals.

5G TECHNOLOGY – **THE NEXT GENERATION**

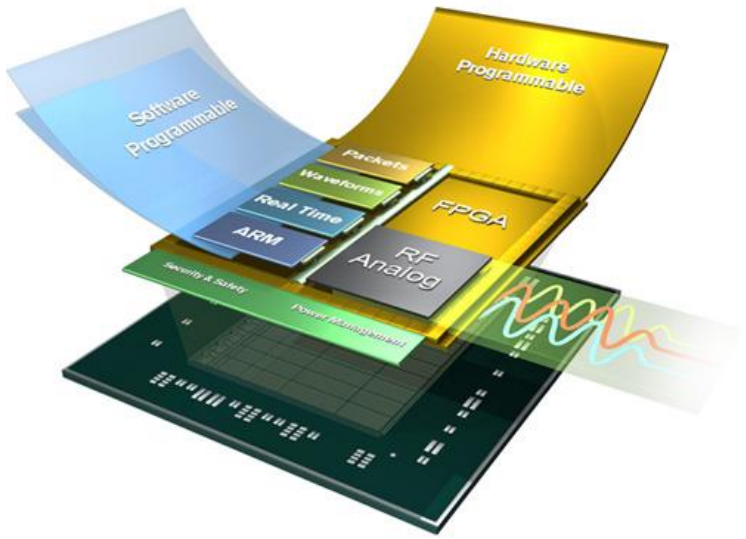
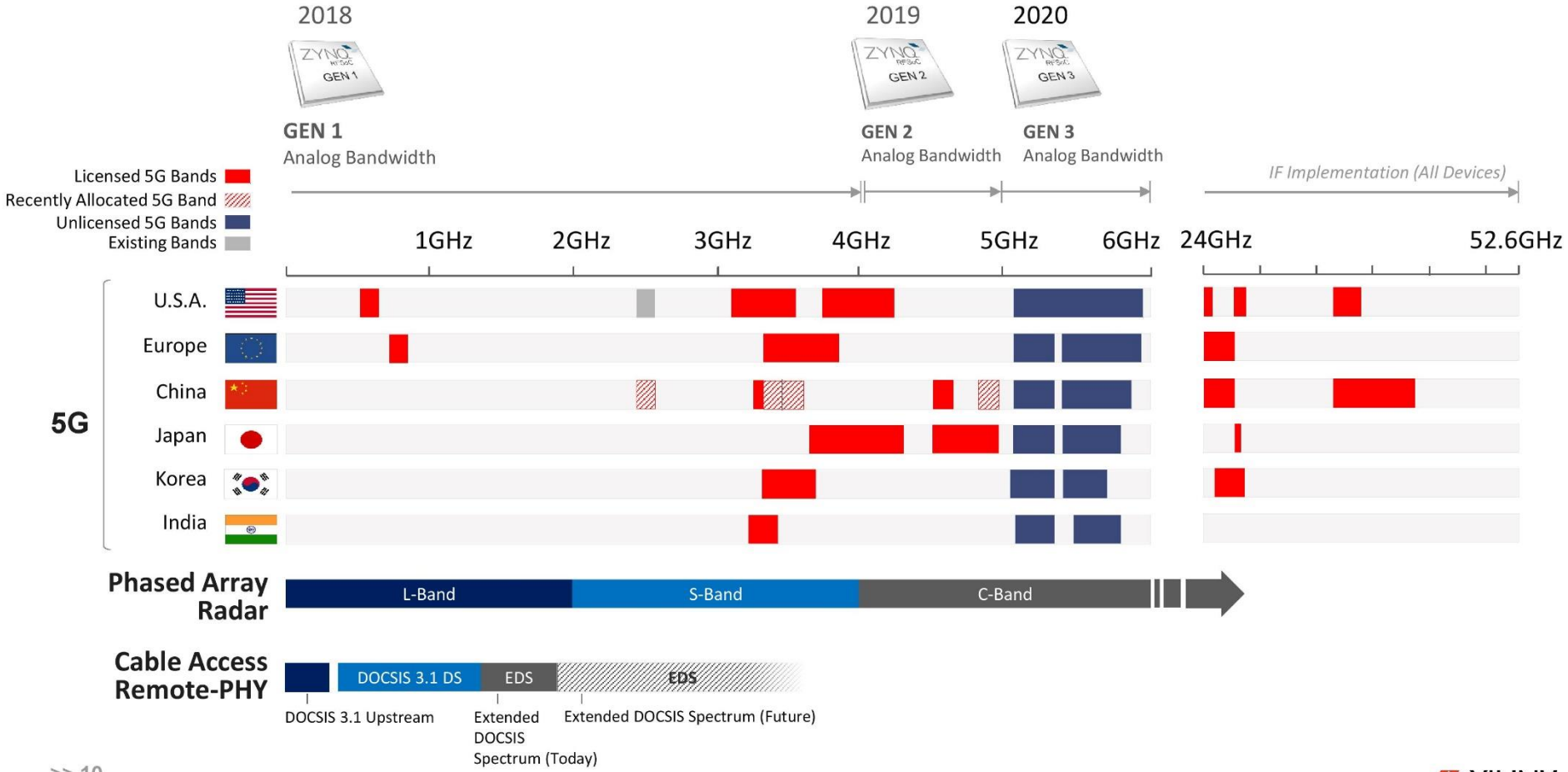


Image: Pentek.com

- As technology improves, even more processing power and wider BW is within our reach.
- One enabler is RF System-On-Chip (RFSoC) technology.
  - Integrating multi Giga-sample RF data converters into a single high end FPGA (processor) .
  - In 2019, RF Channel BW of up to 4 GHz, sampling at 4 Gbps, into 8 channels per RFSoC.
- Multiple channels of ADC sampling and FPGA processing can be replaced by a single device.
- Higher performance, at an improved low SWaP, *compared to traditional discrete ADC and FPGA based systems.*
- 5G advances in System In Chip (SIP) RF technology, allowing highly compact and efficient RF modules.

OVERCOMING THE 5G PROBLEM – NEXT GENERATION

Portfolio Aligned with Market Requirements



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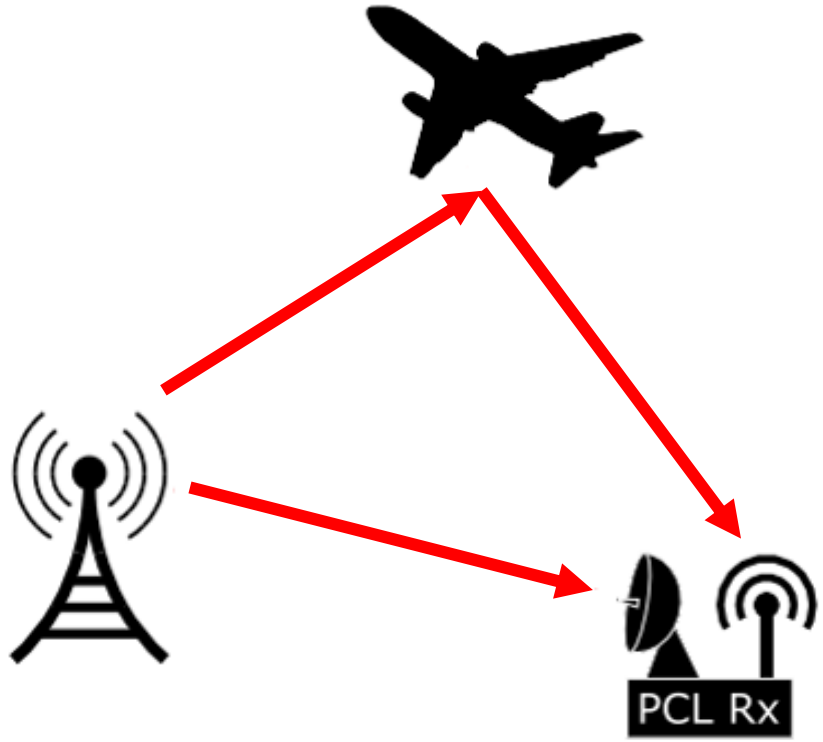
ADVANCES IN PASSIVE RADAR - FROM 5G

Passive Radar use Passive Coherent Location (PCL) to determine target location.

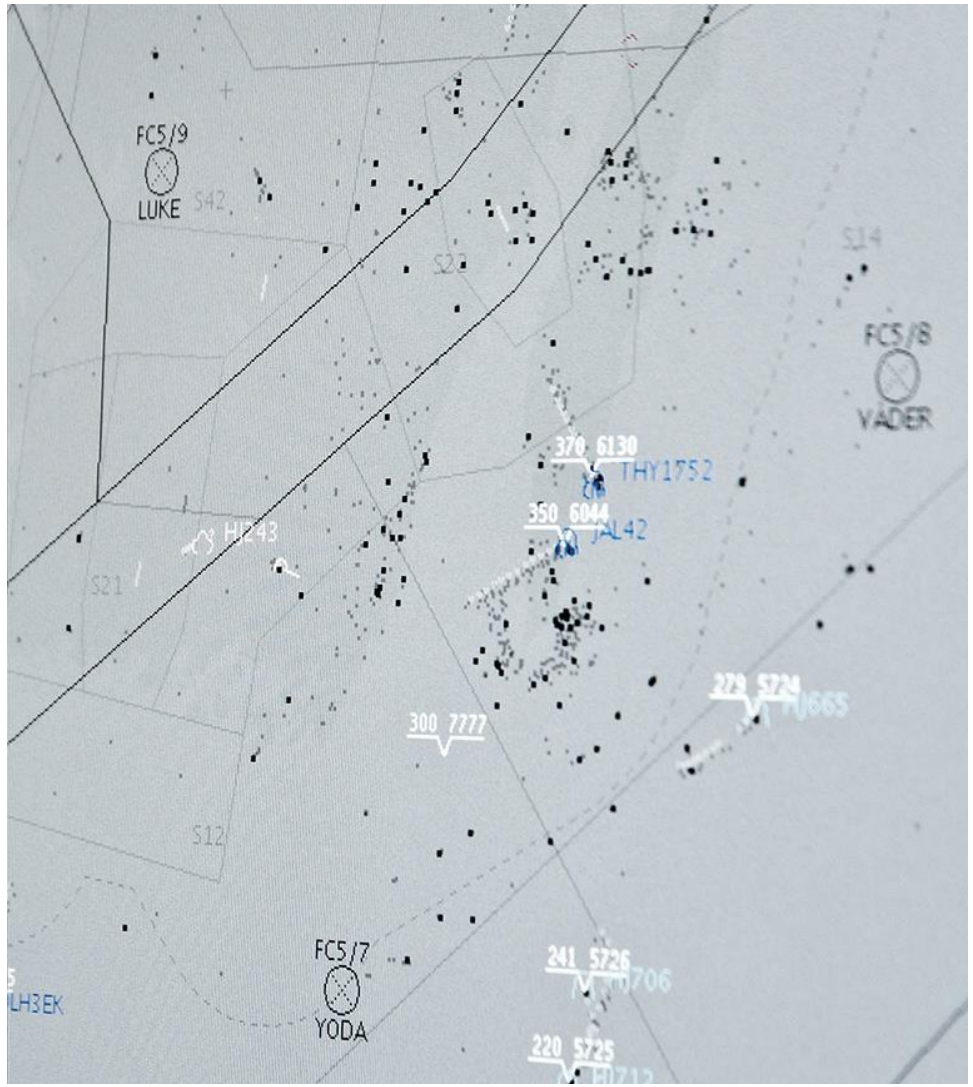
- Consisting of:
  - Transmitter of opportunity (illuminating the target)
  - Receiving sensor (receiving reflection from target) and
  - Reference signal antenna (receiving correlation reference).
- Performing correlation between reflection and reference.
- Advantage is a complete covert operation.
- Observer (sensor) and transmitter **does not cooperate**.



ADVANCES TOWARDS COOPERATIVE PASSIVE RADAR

A possible technology advance to Passive Radar is Cooperative Passive Coherent Location (CPCL).

- CPCL takes the idea behind Passive radar and adds cooperation between signal transmitters and sensors,
  - *on the same network.*
- Effectively turning isolated transmitter and sensor networks, into a Multiple Input Multiple Output (MIMO) sensor (radar) network.
- Technology is enabled by the scalability, flexibility and potential “in the cloud” networking and computing, provided by 5G.
- Concept was intended for automotive industry, but holds benefits for defence applications.



CONCLUSION

5G introduces challenges to the EW environment,

- In terms of EM spectrum usage
- Performance limitations of traditional systems.

BUT it does hold real technology enablers and drivers for the EW community,

- Advances in Low SWaP solutions
- Next generation system technology advances
- Passive Radar technology advances
- RF devices and Antenna advances

THANK YOU
FOR LISTENING!

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