



FCC

General Discussion

Panel 1

TCB Workshop
October 26-29, 2015

Revised slides 35 and 39: October 30, 2015



White Space Devices

TCB Workshop
October 26-29, 2015



White Space Device KDB Pub 416721 D01 (1)

- KDB 416721 D01 will be modified to incorporate the rules adopted on August 6, 2015 (ET Docket 14-165).
 - The term TVBD (TV Band Device) will be replaced with WSD, which include devices for unlicensed white space operation in the TV bands, as well as in the 600 MHz Band.
 - Update reference to rule sections that no longer exist, were moved, or were modified.
 - Remove the measurement procedure for 602-620 MHz band (TV Channels 36-38), since operation on Channel 37 is allowed.
 - Add procedure to test new 'Push' notification. Certified devices must file a permissive change.
 - Add procedure to test if the device is capable of power level reduction.



White Space Device KDB Pub 416721 D01 (2)

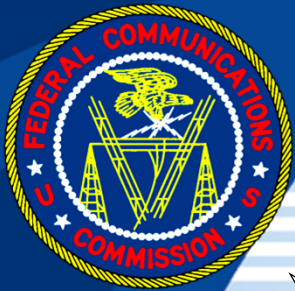
- Add measurement procedures for channel aggregation or bonding (contiguous and non-contiguous).
- Provide documentation requirements for Fixed and Mode II devices that use different means to determine location, other than GPS technology.
- Will consider upgrades of Fixed devices (such as adding external GPS) through permissive changes.



Effective dates and transition periods (1)

- What is the effective date for the WSD rules adopted on August 6, 2015 by the Commission in ET Docket No. 14-165 (FCC 15-99)?
 - Most of the rules will be effective 30 days after the publication in the Federal Register.

- If a device is already certified, do I need to file a permissive change to comply with the new rules?
 - With the exception of the 'push' notification, manufacturers of approved devices are not required to incorporate the new rules into their equipment.



Effective dates and transition periods (2)

- What is the transition period for the 'push' notification?
 - **Certification** - All new application for certification filed 6 months after the effective date, must comply with the 'push' notification.
 - **Marketing** – All WSD imported and marketed after nine months of the effective date, must comply with the 'push' notification.
 - **Operation** – A device that does not comply with the 'push' notification, must cease operation after one year of the effective date

- For already certified devices, what is the deadline to comply with the 'push' notification?
 - Certified devices must file Class II Permissive Changes when the rules become effective, 30 days after publication in the Federal Register, up to 1 year after the effective date. (See above dates for marketing and operation deadlines)



Questions?



Wireless Microphones

October 28, 2015



Wireless Microphones

- **ET Docket No. 15-99 and 15-100 updated rules for part 15 unlicensed and part 74 licensed wireless microphones**
 - Operation of licensed and unlicensed in TV Bands
 - Operation in 600 MHz service band
 - ETSI Emission Mask
 - Disclosure and labeling requirements
 - New equipment classes and grant notes
 - Grant Note 26 - This device has shown compliance, in all grant listed sub-bands, with the new rules for wireless microphones and low power auxiliary stations adopted under Docket Numbers 15-99 and 15-100 and may be marketed, manufactured, operated or imported after the transition deadline.



Wireless Microphones - Unlicensed

- **§15.236 Operation of wireless microphones in TV Bands and 600 MHz service band**
 - Applications for certification filed beginning nine month following Channel Reassignment Public Notice must comply with requirements of §15.236.
 - A wireless microphone that is certified to operate in any portion of the 600 MHz service band may no longer be marketed or operated after the specified cutoff dates.
 - Post incentive auction 600 MHz operation limited to:
 - Upper 6 MHz of the 600 MHz duplex gap
 - 600 MHz guard band between TV band and 600 MHz downlink, excluding upper 1 MHz
 - 600 MHz guard band adjacent to channel 37, excluding upper 1 MHz



Wireless Microphones - Unlicensed

- **§15.236 Operation of wireless microphones in TV Bands and 600 MHz service band**
 - Emission mask in Section 8.3 of ETSI EN 300 422-1 V1.4.2
 - Disclosure Requirement of Rule Part 15.37(k)
 - New equipment class:
 - **DWM** – Part 15 Wireless Microphone



Wireless Microphones - Licensed

- **§74H Low power auxiliary stations (LPAS)**
 - Effective nine months after release of Channel Reassignment PN, applications for certification shall no longer be accepted for LPAS devices capable of operating in the 600 MHz service band
 - 600 MHz duplex gap operations limited to the 4 MHz segment from 1-5 MHz above the lower edge and 20 mW EIRP
 - Output Power in TV Bands now specified in EIRP
 - New equipment class
 - **TLD** – Licensed LPAS Device



Wireless Microphones - Licensed

- **§74H Low power auxiliary stations (LPAS)**
 - Emission mask in Section 8.3 of ETSI EN 300 422-1 V1.4.2
 - Disclosure Requirement of Rule Part 74.851(k)
 - 944-952 MHz band transition period for the out-of-band emissions
 - 169-172 MHz available for wireless microphone operations under part 90.265

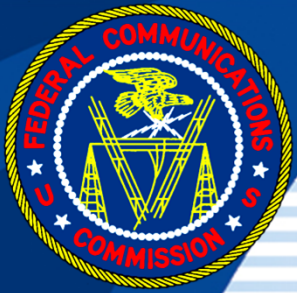


Wireless Microphones

Summary of affected bands

<i>Frequency Band</i>	<i>Unlicensed</i>		<i>Licensed</i>	
	<i>Rule Part</i>	<i>Output Power</i>	<i>Rule Part</i>	<i>Output Power</i>
26.1 - 26.48 MHz (VHF)			74H	1 Watt
54-72 MHz (VHF)(TV Band Ch 2-4), 76-88 MHz (VHF)(TV Band Ch 5-8)	15.236	50 mW EIRP	74H	50 mW EIRP
161.625 - 161.775 MHz (VHF)			74H	1 Watt
169-172 MHz (VHF)			90.265	50 mW
174-216 MHz (VHF)(TV Band Ch 7-13)	15.236	50 mW EIRP	74H	50 mW EIRP
450-451 MHz (UHF), 455-456 MHz			74H	1 Watt
470-608 MHz (UHF)(TV Band Ch 14-36)	15.236	50 mW EIRP	74H	250 mW
614-698 MHz (service band)*	15.236	50 mW EIRP	74H	250 mW
614-698 MHz (guard bands, duplex gap)*	15.236	20 mw EIRP	74H	20 mw EIRP
941.5 - 952.0 MHz, 952.850 - 956.250 MHz, 956.450 - 959.85 MHz, 6875 - 6900 MHz, 7100 - 7125 MHz			74H	1 Watt
1435 - 1525 MHz			74H	250 mW

*Specific frequencies will be determined after completion of incentive auction (GN Docket No. 12-268)



Questions?



Citizen Broadband Radio Service- Part 96

Office of Engineering and Technology
Laboratory Division



Citizen Broadband Radio Service- Part 96

- Technical Rules
 - Radio Requirements
 - Equipment Authorization
 - Interface Requirements
 - Additional Requirements



Technical Rules

Radio Requirements (§96.41)

Device	Geographic area	Maximum conducted output power (dBm/10 MHz)	Maximum EIRP (dBm/10 MHz)	Maximum conducted PSD (dBm/MHz)
End User Device	All	n/a	23	n/a
Category A CBSD	All	24	30	14
Category B CBSD [†]	Non-Rural	24	40	14
Category B CBSD [†]	Rural	30	47	20

–[†]Category B CBSDs will only be authorized for use after an ESC is approved and commercially deployed consistent with §96.15 and §96.67.

–*Power management.* CBSDs and End User Devices shall limit their operating power to the minimum necessary for successful operations.

–(1) CBSDs must support transmit power control capability and the capability to limit their maximum EIRP and the maximum EIRP of associated End User Devices in response to instructions from an SAS.



Technical Rules Radio Requirements (§96.41)

● 3.5 GHz Emissions and Interference Limits – Power of any Emission outside the Fundamental

- Within 0-10 MHz above the Assigned Channel
 - Within 0-10 MHz below the assigned Channel
- } < -13
dBm/MHz
- Greater than 10 MHz above the Assigned Channel
 - Greater than 10 MHz below the Assigned Channel
- } < -25
dBm/MHz
- Power of any Emission below 3530 MHz
 - Power of any Emission above 3720 MHz
- } < -40
dBm/MHz



Technical Rules

Radio Requirements (§96.41)

- OOB Measurement Procedure

- RBW* (beyond 1MHz outside of authorized channel) : 1MHz
- RBW* (within 1 MHz immediately outside of authorized channel): 1% of fundamental BW
- EBW: 26 dB BW
- Detector: Peak
- Trace: Max Hold

- * Narrower RBW is permitted in all cases provided the measured power is integrated over the full reference BW (i.e., 1 MHz or 1% of EBW as specified)



Technical Rules

- Equipment Authorization
 - CBSDs will define new equipment class in EAS
 - FCC will propose new class once test procedures finalized.
 - Manufacturers shall submit their operation with SAS to be considered for authorization
 - The operation of all CBSDs shall be coordinated by one or more SAS (§96.1)
 - Currently No SAS has been approved for operation
 - Until then the Lab will not process any authorization request



Technical Rules Interface Requirements

- Geo-Location and Reporting Capability to SAS (§ 96.39)
 - Applicable to all CBSDs
 - Must be able to report coordinates referenced to NAD83:
 - +- 50 meters (horizontal)
 - +- 3 meters (elevation)
 - Coordinates must be reported to SAS at the time of first activation from a power-off condition
 - Professionally Installed CBSDs report coordinates:
 - At the time of installation and registration
 - Non-Professionally Installed CBSDs report Coordinates:
 - Anytime location changes by more then 50 m horizontal and 3 m elevation
 - Must report location change to SAS within 60 seconds



Technical Rules Interface Requirements

- Registration With SAS (§ 96.39)
 - CBSDs must register and be authorized by SAS
 - CBSDs must provide the SAS:
 - Geographic Location
 - Antenna Height Above Ground (in meters)
 - CBSD Class (Cat. A/ Cat. B)
 - FCC ID, Serial Number
 - Requested Authorization Status (PA or GA)
 - Call Sign
 - User Contact Information
 - Air Interface Technology
 - CBSDs must be capable of two-way communications with SAS (§ 96.39)
 - Signal Level Reporting
 - Security



Technical Rules Interface Requirements

- Registration With SAS (§ 96.39)
 - CBSDs must be capable of two-way communications with SAS (§ 96.39)
 - CBSDs must comply with any incoming command from SAS within 60s
 - Power level change
 - Changes to frequency assignments
 - Signal Level Reporting
 - Security
- End User Device (§ 96.47)
 - Operate only if they can positively receive and decode authorization signal by a CBSD
 - Must discontinue operation, change frequencies, or change power level within 10s of receiving instructions from its CBSD

Airborne Operations Prohibited!



Additional Requirements for Category A and B CBSDs (§96.43/45)

- Category A CBSDs shall not be deployed outdoors with antennas exceeding 6m height above average terrain
 - Otherwise they will be classified Class B
- Category B CBSDs must be professionally installed
- Category B CBSDs are limited to outdoor operations
- When registering with SAS, Category B CBSDs must transmit information required under §96.39 plus the following:
 - Antenna gain, beamwidth, azimuth, downtilt angle, and antenna height above ground level



Questions?



Medical Body Area Network (MBAN) Devices

Office of Engineering and Technology
Laboratory Division



Review of MBAN Program

- **First R&O- May 2012**
 - Modified Part 95 MedRadio Rules
 - Enabled Deployment of MBAN Devices in 2360- 2400 MHz
 - 2360- 2390 MHz (indoors)
 - 2390- 2400 MHz (anywhere)
 - Adopted Requirements for MBAN Operations (Frequency Coordinator)
- **Second R&O- August 2014**
 - Revised 1st R&O. A few Modifications are as follows:
 - Modified Definition of “Health Care Facility”
 - Removed Antenna Height Restriction (2360- 2390 MHz)
 - Required Health Care Facilities to Register MBAN Devices in both 2360- 2390 MHz Band as well as 2390- 2400 MHz Band
- **Order- February 2015**
 - Designated ASHE/AHA to Serve as MBAN Frequency Coordinator



Review of MBAN EMC Requirements

● Part 95 of Title 47 Code of Federal Regulations

- §95.1223: Registration and Frequency Coordination
- §95.1225: Frequency Coordinator
- **Technical Requirements**
 - **§95.628(c): Spectrum Operations**
 - Transmission in 2360- 2390 MHz Contingent upon Receipt of a Control Message
 - Transmission Cessation in the Absence of a Control Message
 - **§95.628(d): Frequency Stability**
 - ± 100 ppm over a temperature range of 0-55 degrees Celsius (MedRadio P/C, Body-worn Devices)
 - **§95.633(e): Emission Bandwidth**
 - (20 dB) Bandwidth less than or equal to 5 MHz
 - **§95.635(d): Unwanted Radiation**
 - **1st 2.5 MHz Beyond Authorized Band:** the EIRP level associated with any unwanted emission must be attenuated within a 1 megahertz bandwidth by at least 20 dB relative to the maximum EIRP level within any 1 megahertz of the fundamental emission.
 - **More than 2.5 MHz outside of the authorized Band:** Emissions from a MedRadio transmitter shall be attenuated to a level no greater than the field strength limits shown in the following table:

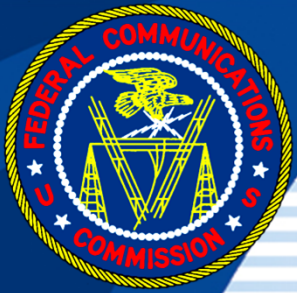
Frequency (MHz)	Field Strength Limit ($\mu\text{V}/\text{m}$)	Field Strength Limit ($\text{dB}\mu\text{V}/\text{m}$)
30-88	100	40.0
88-216	150	43.5
216-960	200	46.0
960 and above	500	54.0

- **§95.639(f): Maximum Transmitter Power**
 - Lesser of 1 mW or $(10 \cdot \text{Log}(BW_{20\text{dB}}))$ dBm (2360- 2390 MHz)
 - Lesser of 20 mW or $(16 + 10 \cdot \text{Log}(BW_{20\text{dB}}))$ dBm (2390- 2400 MHz)



MBAN KDB Publication

- KDB Publication 670572 D01 (MBAN v01)
 - Published (as a DRAFT) on Oct. 15, 2015
 - Provides further guidance on test procedures and EMC requirements (Slide 3)
 - Will be updated as industry comments are received



Questions?



DFS Update

Andy Leimer

Equipment Authorization and Compliance Branch

**Federal Communications Commission
Office of Engineering and Technology
Laboratory Division**



Bin 5 Radar Chirp

- Chirp may partially fall outside the channel radar detection BW
 - Issue in radar detection near the edge of the radar detection BW
 - Raised the issue of the percentage of the chirp spectrum must fall within the radar detection BW for a successful detection



Bin 5 Radar Chirp – Interim Procedure

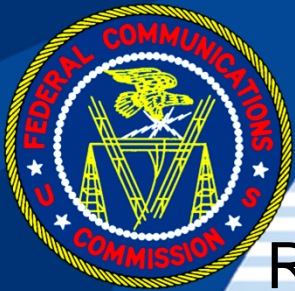
- Interim solution – KDB Publication [905462 D02](#) (Footnote 4)
 - The center frequency for each of the 30 trials of the Bin 5 radar shall be randomly selected within 80% of the Occupied Bandwidth
- Interim Solution Requirements
 - Basically for Bin 5 use the old method of radar detection BW of 80% of the OBW
 - The frequencies must be randomized for all 30 trials
 - All 30 randomized test frequencies for Bin 5 must be included in the DFS test report
 - Requirement became effective for all applications submitted after July 1, 2015



Bin 5 Radar Chirp - Proposed Solution

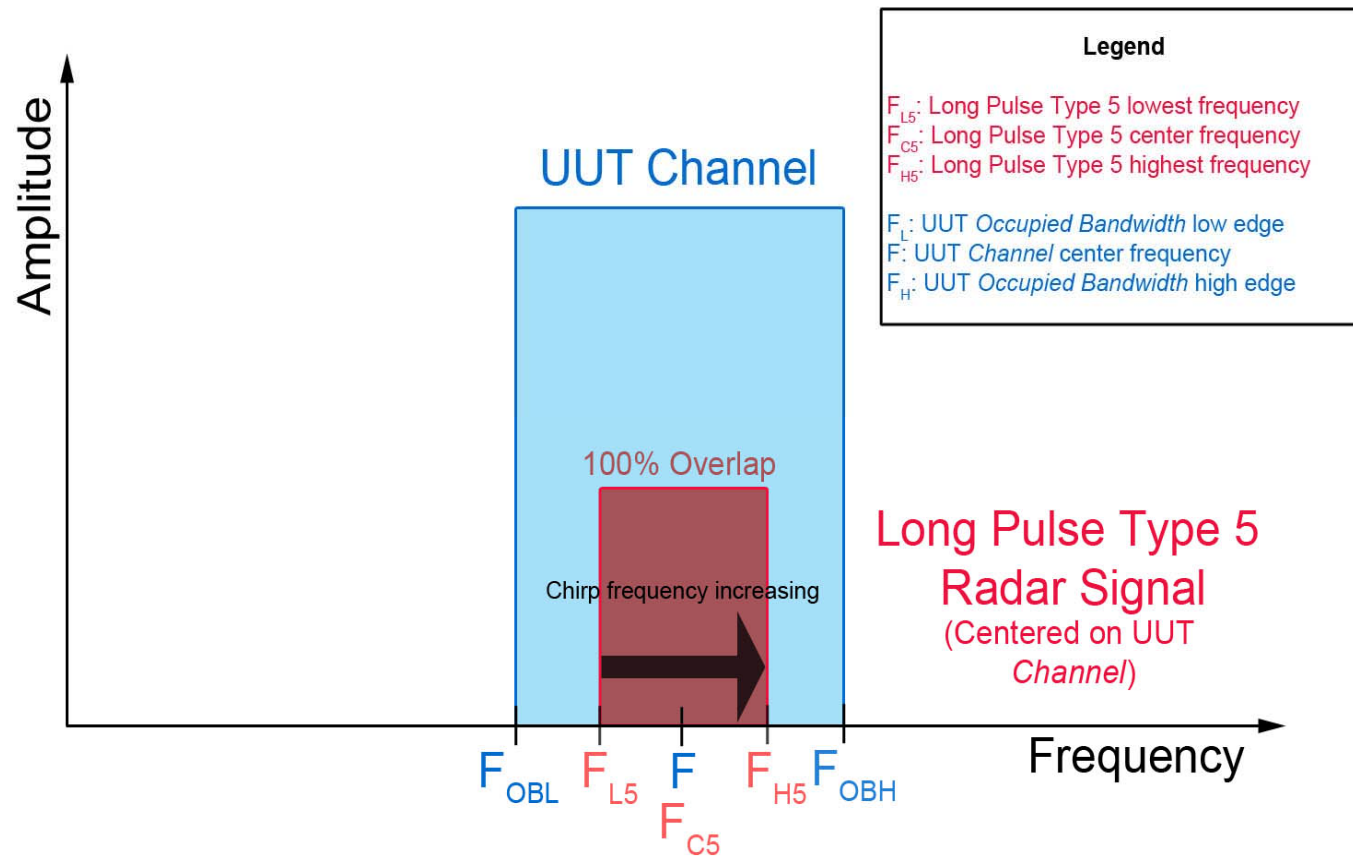
- Proposed solution
 - Test procedure published for comment
 - Transition period will be announced after final adoption of the procedure

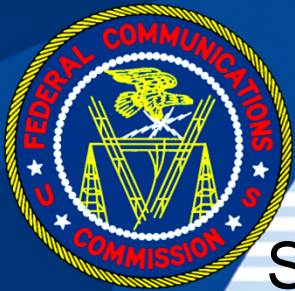
- Three subsets of trials will be performed
 - Chirp is varied for each trial and is not randomized within the trial bursts
 - Minimum of ten trials per subset
 - Subset 1 (10 trials randomized Bin 5)
 - Center frequency of device channel
 - Subset 2 (10 trials randomized Bin 5)
 - Tuned frequencies such that 90% of the Long Pulse Type 5 frequency modulation is within the low edge of the UUT Occupied BW
 - Subset 3 (10 trials randomized Bin 5)
 - Tuned frequencies such that 90% of the Long Pulse Type 5 frequency modulation is within the high edge of the UUT Occupied BW



Subset 1

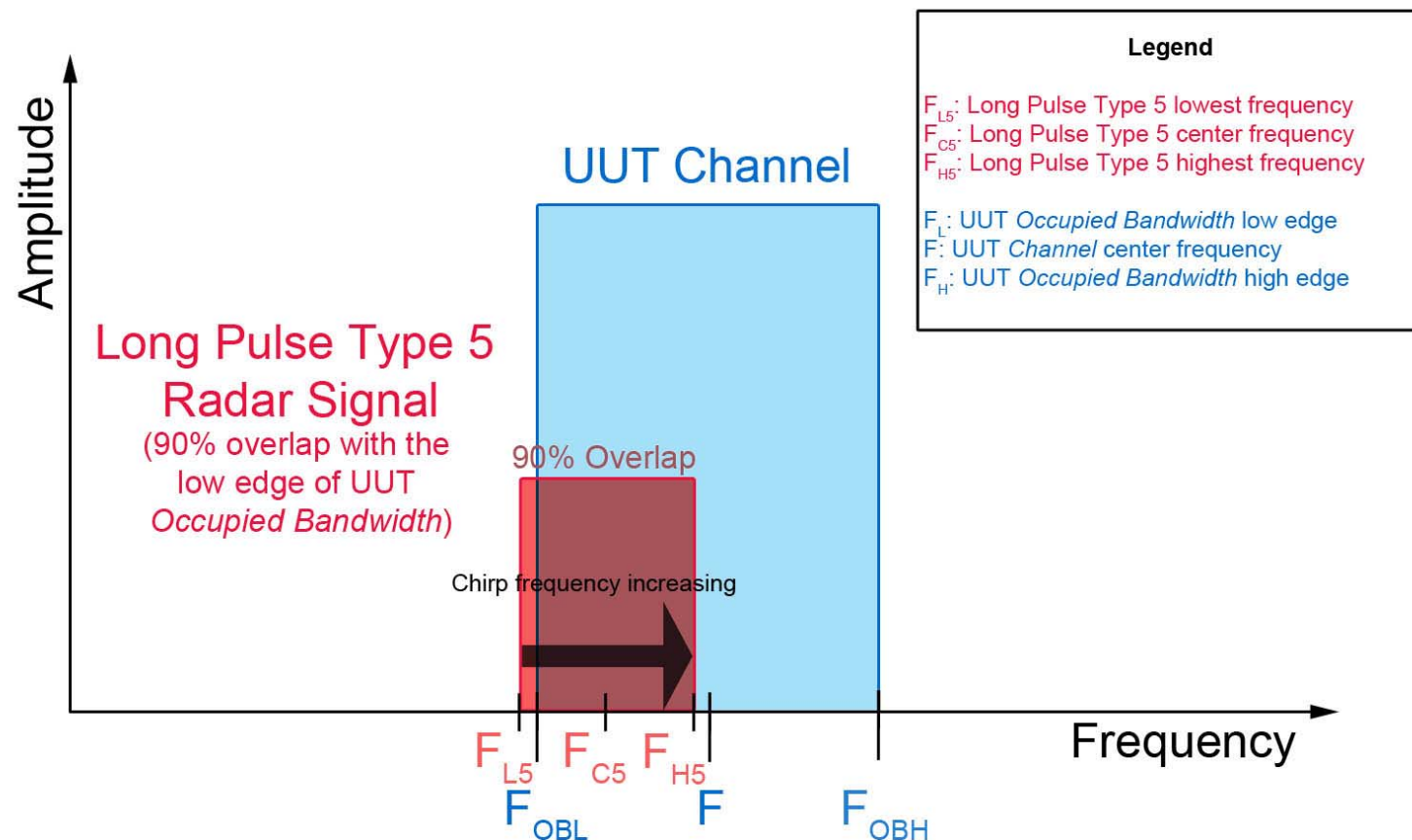
Radar is Tuned to the UUT Channel Center Frequency

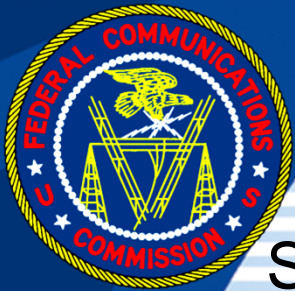




Subset 2

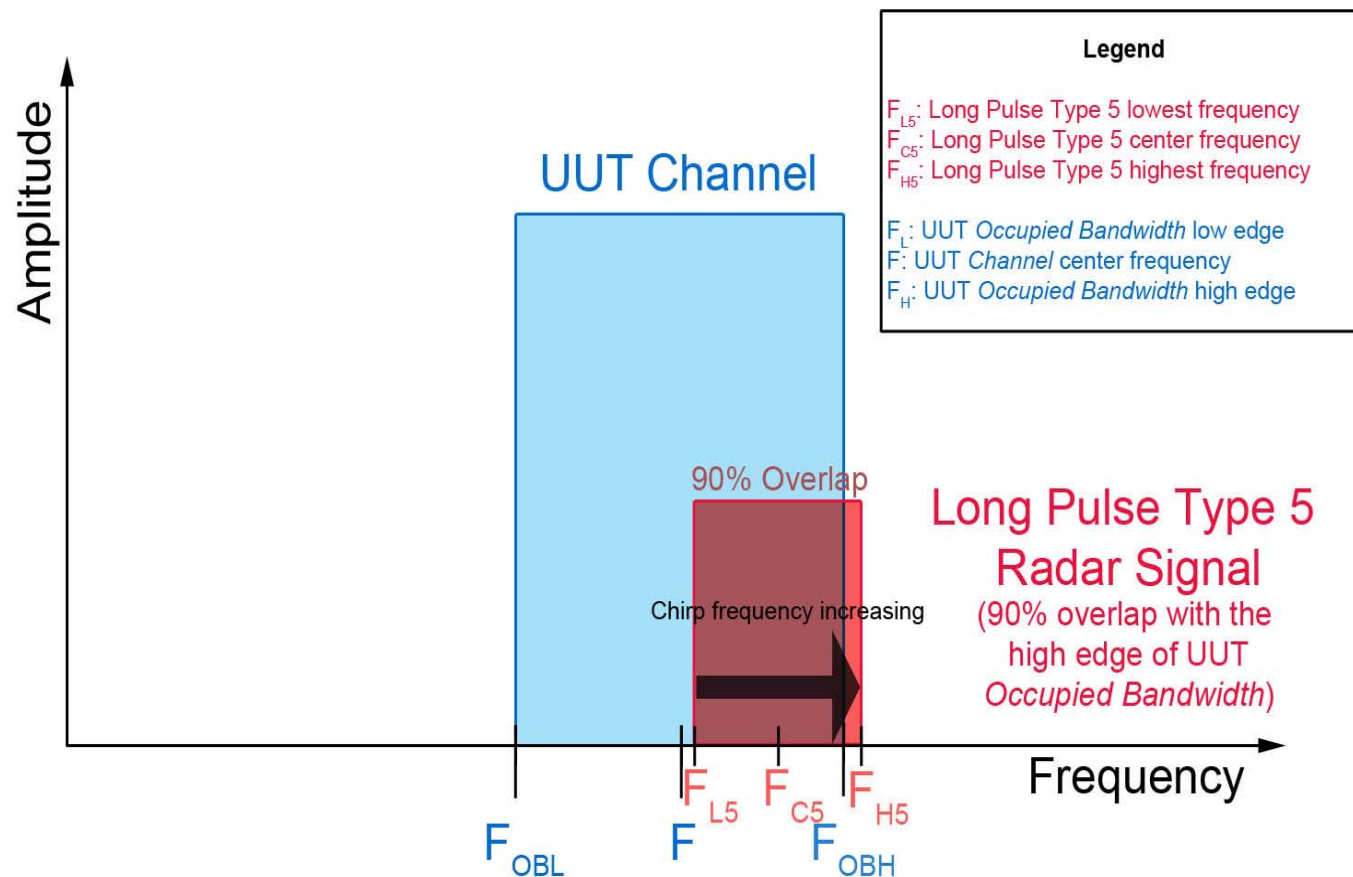
Signal is Tuned so that 90% of the Radar Signal Overlaps with the Low Edge of the UUT Occupied BW





Subset 3

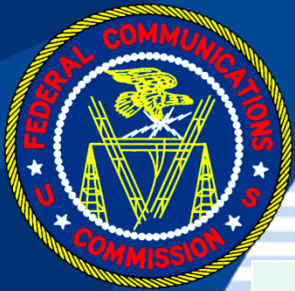
Signal is Tuned so that 90% of the Radar Signal Overlaps with the High Edge of the UUT Occupied BW





Example

- Device – 80 MHz BW
 - Radar detection BW (100% OBW) = 76 MHz
 - Channel 106 (CF = 5530 MHz)
 - Bin 5 test frequencies without chirp offset
 - Edge 1 (F_H): 5530 MHz + 38 MHz = 5568 MHz
 - Edge 2 (F_L): 5530 MHz - 38 MHz = 5492 MHz
 - CF: 5530 MHz
- Test Frequencies
 - Subset 1: Channel center frequency
 - Subset 2: $F_H - 0.4 \cdot \text{Chirp Width (MHz)}$
 - Subset 3: $F_L + 0.4 \cdot \text{Chirp Width (MHz)}$



Chirp Offset Example (Subset 1 – Low Edge)

Center Freq (MHz)	Low Edge (MHz)	High Edge (MHz)	
5530	5492	5568	
Trial	Chirp	Offset	VSG Freq (MHz)
1,	6,	2.4	5494
2,	14,	5.6	5498
3,	6,	2.4	5494
4,	8,	3.2	5495
5,	18,	7.2	5499
6,	5,	2	5494
7,	7,	2.8	5495
8,	17,	6.8	5499
9,	13,	5.2	5497
10,	20,	8	5500



Chirp Offset Example (Subset 2 – Center Frequency)

Center Freq (MHz)	Low Edge (MHz)	High Edge (MHz)	
5530	5492	5568	
Trial	Chirp	Offset	VSG Freq (MHz)
11,	5,	2	5530
12,	5,	2	5530
13,	17,	6.8	5530
14,	15,	6	5530
15,	19,	7.6	5530
16,	13,	5.2	5530
17,	17,	6.8	5530
18,	18,	7.2	5530
19,	9,	3.6	5530
20,	16,	6.4	5530



Chirp Offset Example (Subset 3 – High Edge)

Center Freq (MHz)	Low Edge (MHz)	High Edge (MHz)	
5530	5492	5568	
Trial	Chirp	Offset	VSG Freq (MHz)
21,	19,	7.6	5560
22,	18,	7.2	5561
23,	17,	6.8	5561
24,	14,	5.6	5562
25,	17,	6.8	5561
26,	15,	6	5562
27,	12,	4.8	5563
28,	14,	5.6	5562
29,	16,	6.4	5562
30,	5,	2	5566



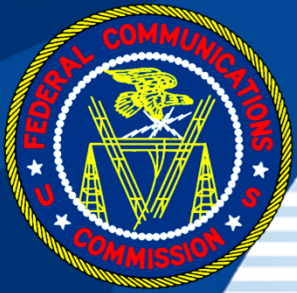
Additional Issues

- Non-DFS channels that may overlap into the DFS Bands
 - U-NII-1 band channels - DFS detection is required if the OBW based on the 99% BW overlaps 5.25 GHz
 - U-NII-3 band channels - DFS detection is required if the OBW based on the 99% BW overlaps 5.725 GHz
 - Unintended overlap is typically caused by an overdriven amplifier
 - Lower power
 - Check band edge compliance



Additional Issues

- 802.11ac – 80 + 80 Mode
 - Refer to [KDB Publication 644545 D03](#)
 - No 80 + 80 Master Devices Available
 - Clients can be tested with an approved 80 MHz Master device



Questions?