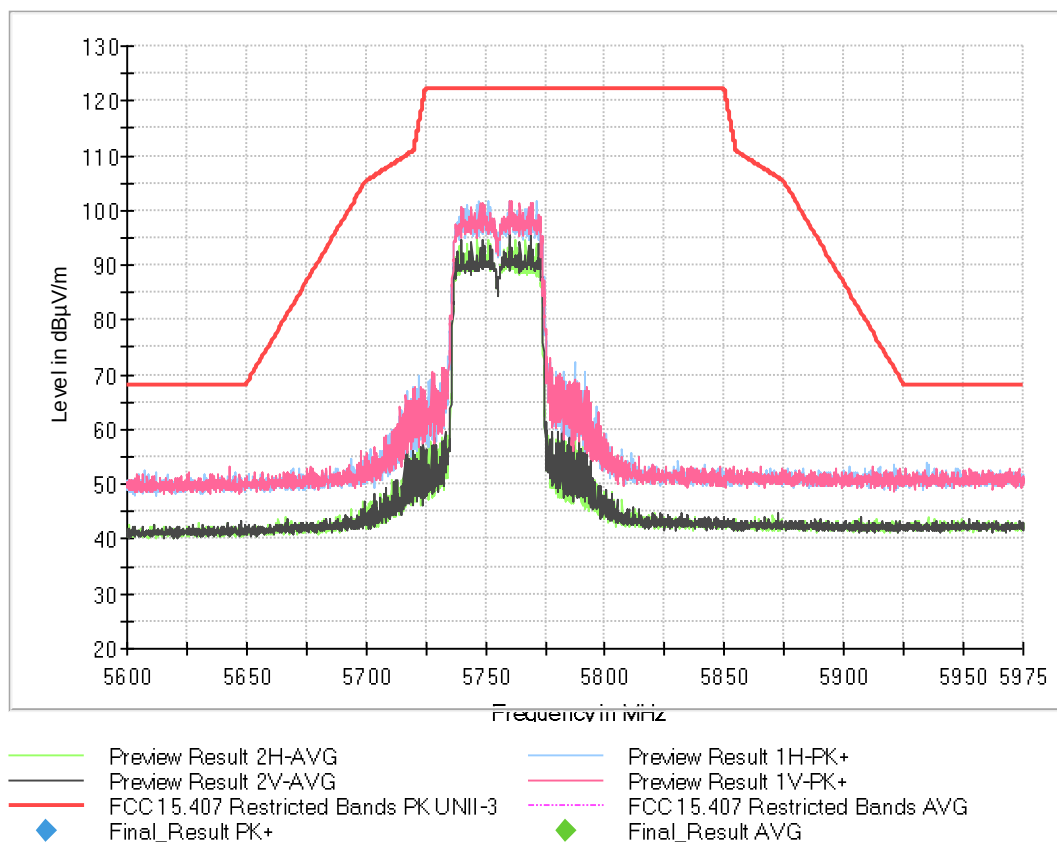
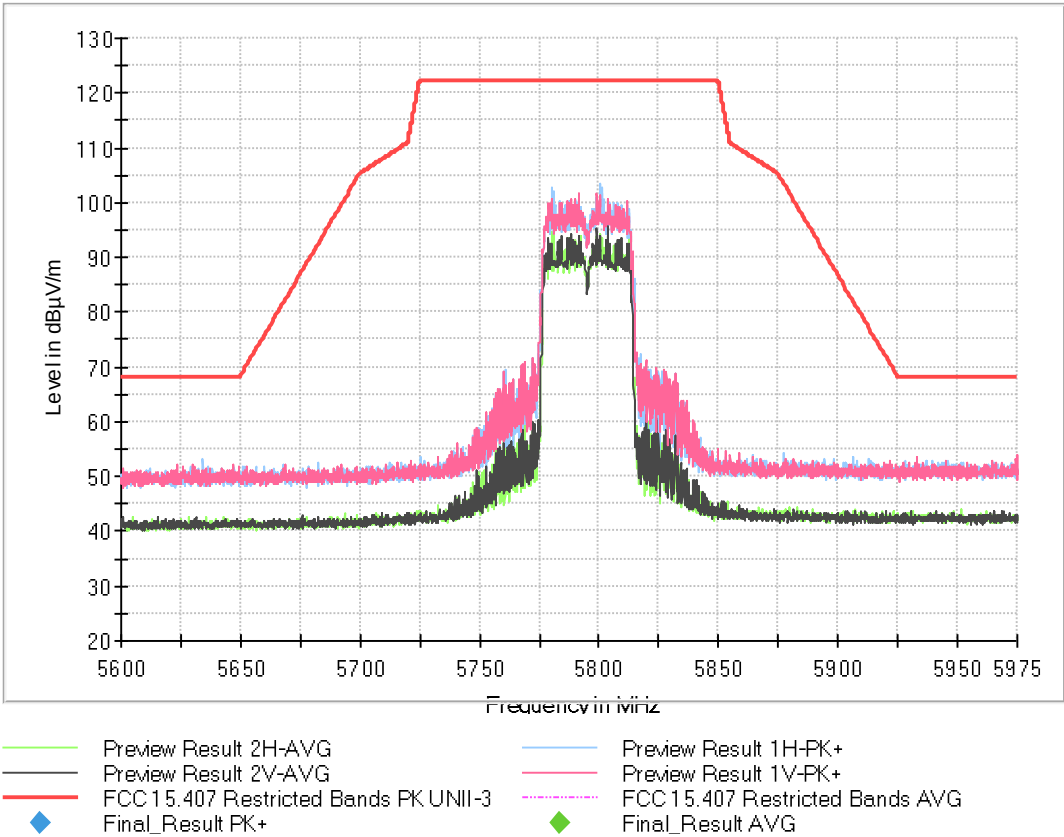


• **MIMO 802.11 n40:**

- Low Channel:

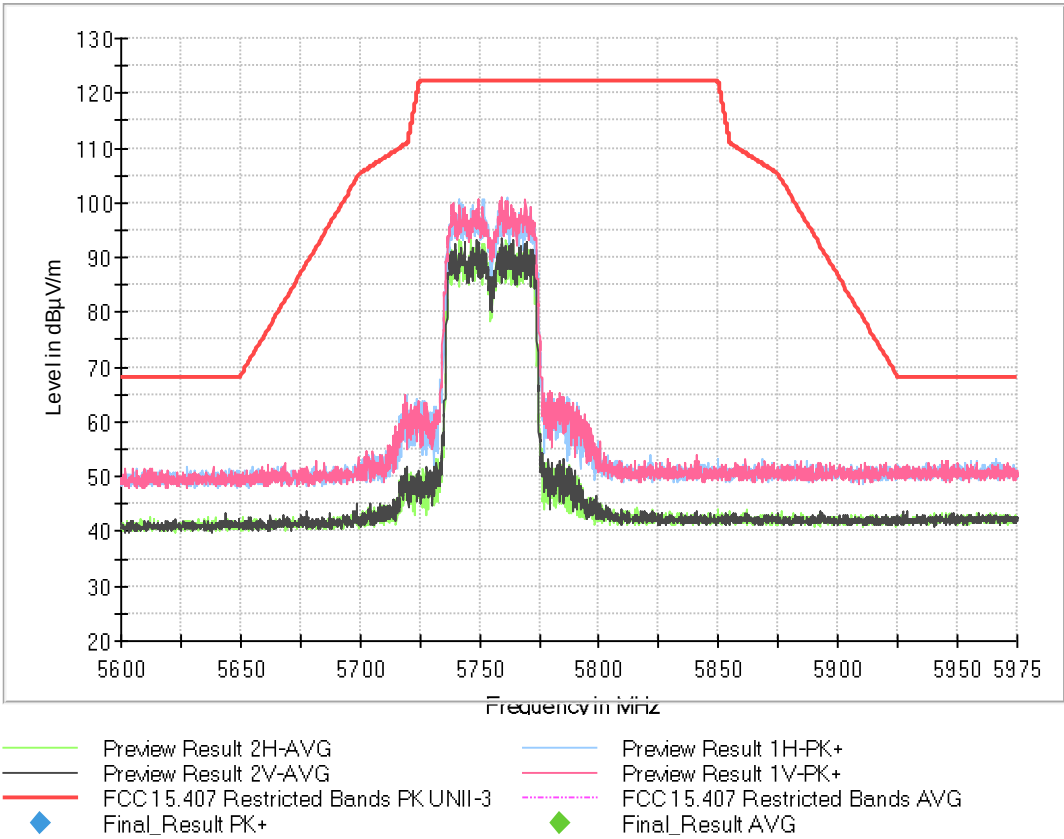


- High Channel:

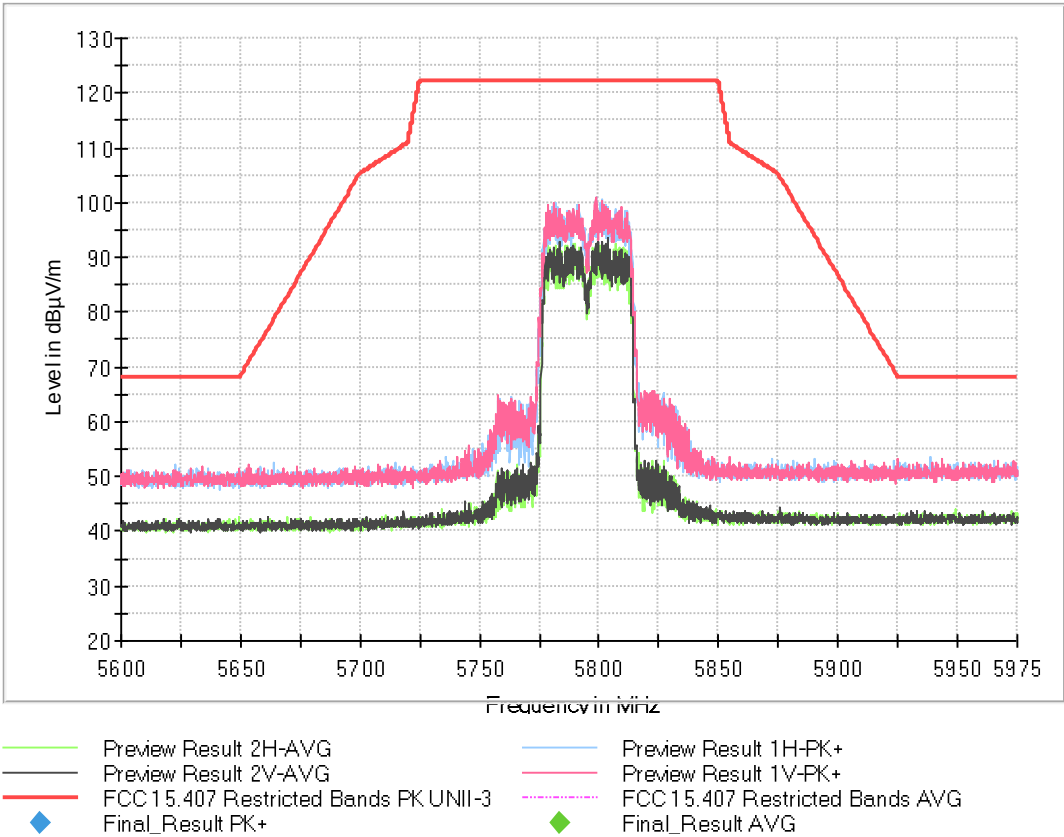


• MIMO 802.11 ac40:

- Low Channel:

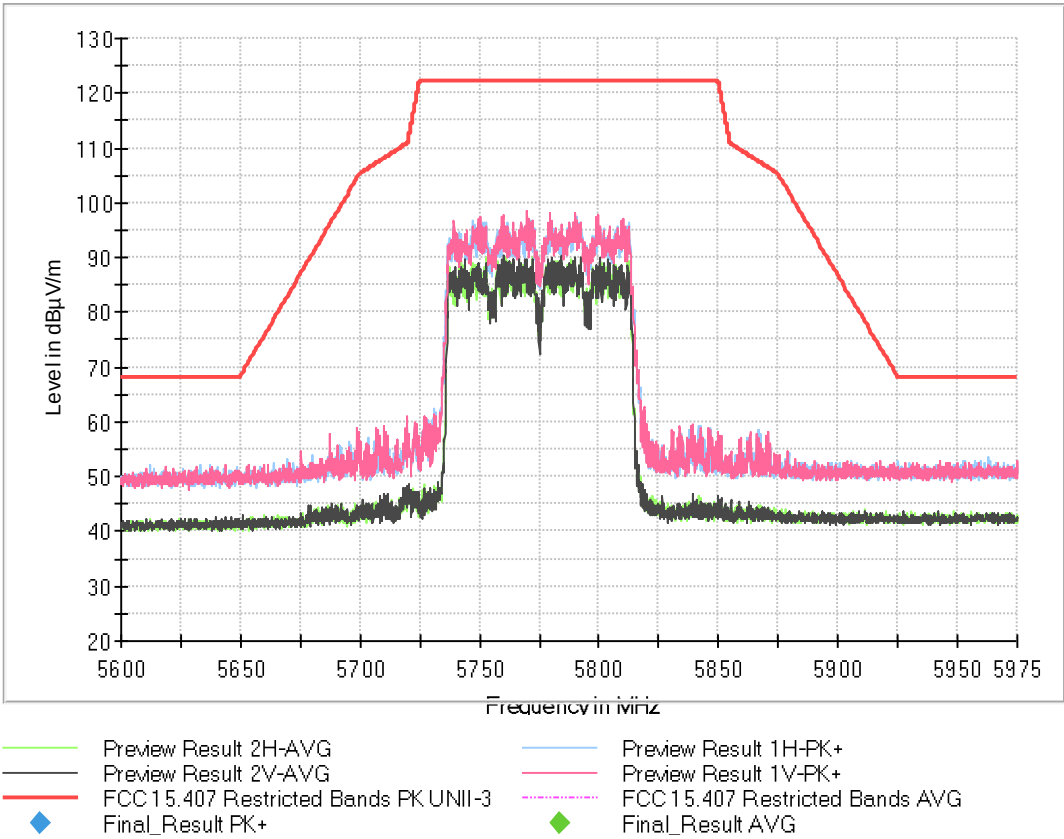


- High Channel:



• MIMO 802.11 ac80:

- Single Channel:



Appendix F: DFS for Slave Device Operational Mode

INDEX

TEST CONDITIONS.....690

FCC 15.407 (h)(2), KDB 905462 D02 7.8.3 / RSS-247 6.3.2 In-Service Monitoring 694

TEST CONDITIONS

(*) Declared by the Client.

POWER SUPPLY (*):

Vnominal: 115 Vac
Type of Power Supply: AC power

ANTENNA (*):

Type of Antennas: Monopoles (printed on PCB). 2 antennas.

Maximum Declared Antenna Gain Chain 0: +3.1 dBi

Maximum Declared Antenna Gain Chain 1: +5.0 dBi

Directional Antenna Gain Calculations for CDD MIMO In-Band Measurements:

U-NII-1, U-NII-2A, U-NII-2C & U-NII-3:

For 2Tx CDD MIMO modes, in accordance with KDB 662911 D01 v02r01 Section F)2)f)(ii) y F)2)e)ii), directional gain, directional gain was calculated as follows:

$$N_{SS} = 1, \quad N_{ANT} = 2, \quad G_{ANT0} = +3.1 \text{ dBi}, \quad G_{ANT1} = +5.0 \text{ dBi}$$

$$\begin{aligned} \text{Directional Gain} &= 10 \log \left[\frac{\sum_{j=1}^{N_{SS}} \left(\sum_{k=1}^{N_{ANT}} g_{j,k} \right)^2}{N_{ANT}} \right] = 10 \log \left[\frac{\sum_{j=1}^1 \left(\sum_{k=1}^2 g_{j,k} \right)^2}{2} \right] \\ &= 10 \log \left[\frac{(g_{1,1} + g_{1,2})^2}{2} \right] = 10 \log \left[\frac{\left(10^{\frac{3.1}{10}} + 10^{\frac{5.0}{10}} \right)^2}{2} \right] = 10 \log \left[\frac{\left(10^{\frac{3.1}{10}} + 10^{\frac{5.0}{10}} \right)^2}{2} \right] = 7.12 \text{ dBi} \end{aligned}$$

TEST FREQUENCIES (*):

Band U-NII-2A:

Technology Tested:	WLAN (IEEE 802.11 a20 / n2040 / ac204080 2x2) / U-NII-2A	
Modes:	802.11a: 6, 9, 12, 18, 24, 36, 48 & 54 Mbps (SISO)	
	802.11n HT20: MCS0 to MCS23 (1 or 2 spatial stream with either SISO or 2 chain MIMO CDD)	
	802.11n HT40: MCS0 to MCS23 (1 or 2 spatial stream with either SISO or 2 chain MIMO CDD)	
	802.11ac VHT20: MCS0 to MCS9 (1 or 2 spatial stream) (SISO, or MIMO with CDD without TxBF)	
	802.11ac VHT40: MCS0 to MCS9 (1 or 2 spatial stream) (SISO, or MIMO with CDD without TxBF)	
	802.11ac VHT80: MCS0 to MCS9 (1 or 2 spatial stream) (SISO, or MIMO with CDD without TxBF)	
Setting of cores / ports:	WLAN1, WLAN2, WLAN12	
Beamforming:	No.	
Frequency Range:	5250 - 5350 MHz	
Operating Channel Bandwidth:	20 MHz	
Transmission Channels:	Channels	Channel Frequency (MHz)
	Low: 52	5260
Operating Channel Bandwidth:	40 MHz	
Transmission Channels:	Channels	Channel Frequency (MHz)
	Low: 54	5270
	High: 62	5310
Operating Channel Bandwidth:	80 MHz	
Transmission Channels:	Channels	Channel Frequency (MHz)
	Single: 58	5290

Band U-NII-2C:

Technology Tested:	WLAN (IEEE 802.11 a20 / n2040 / ac204080 2x2) / U-NII-2C	
Modes:	802.11a: 6, 9, 12, 18, 24, 36, 48 & 54 Mbps (SISO)	
	802.11n HT20: MCS0 to MCS23 (1 or 2 spatial stream with either SISO or 2 chain MIMO CDD)	
	802.11n HT40: MCS0 to MCS23 (1 or 2 spatial stream with either SISO or 2 chain MIMO CDD)	
	802.11ac VHT20: MCS0 to MCS9 (1 or 2 spatial stream) (SISO, or MIMO with CDD without TxBF)	
	802.11ac VHT40: MCS0 to MCS9 (1 or 2 spatial stream) (SISO, or MIMO with CDD without TxBF)	
	802.11ac VHT80: MCS0 to MCS9 (1 or 2 spatial stream) (SISO, or MIMO with CDD without TxBF)	
Setting of cores / ports:	WLAN1, WLAN2, WLAN12	
Beamforming:	No.	
Frequency Range:	5470 - 5725 MHz	
Operating Channel Bandwidth:	80 MHz	
Transmission Channels:	Channels	Channel Frequency (MHz)
	Low: 106	5530

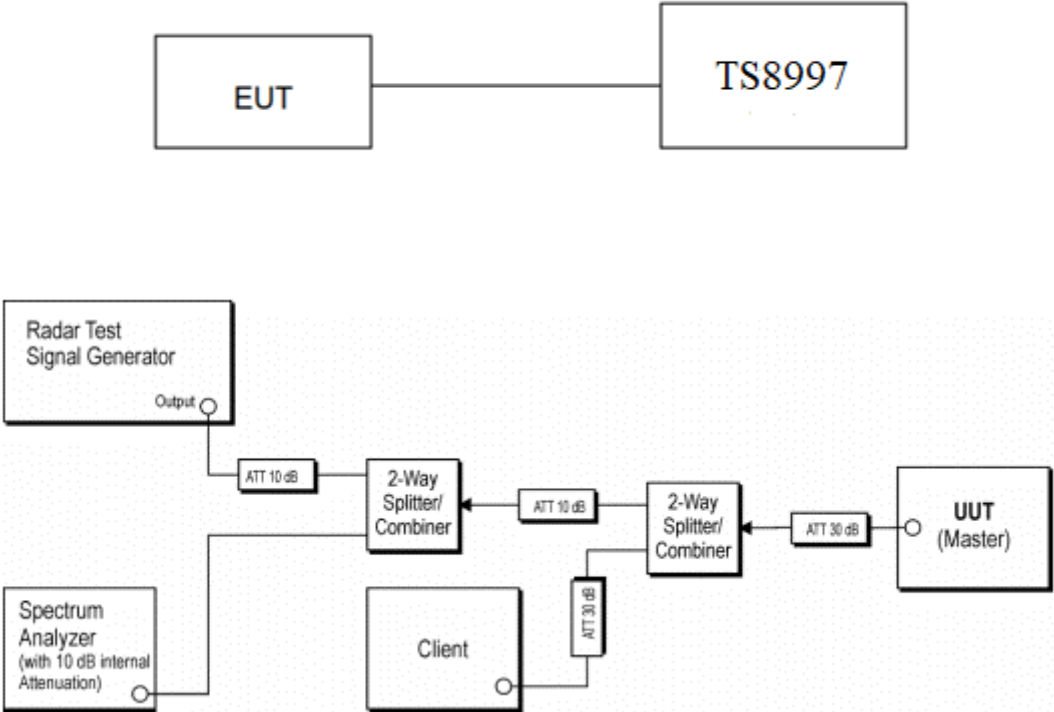
The test set-up was made in accordance to the general provisions of FCC Unlicensed National Information Infrastructure (U-NII) Devices 789033 D02 General U-NII Test Procedures New Rules v02r01 dated Dec 14, 2017 and KDB 905462 D02 UNII DFS Compliance Procedures New Rules v02

The EUT was tested in the following operating mode:

- Normal mode working as Client without radar detection.

CONDUCTED MEASUREMENTS:

The equipment under test was set up in a shielded room and it is connected to the TS8997 using a low loss RF cable. The reading of the spectrum analyser is corrected taking into account the cable loss.



FCC 15.407 (h)(2), KDB 905462 D02 7.8.3 / RSS-247 6.3.2 In-Service Monitoring

SPECIFICATION:

* KDB 905462 D02 7.8.3: The following DFS parameters are verified during In-Service Monitoring:

- Channel Closing Transmission Time.
- Channel Move Time.
- Non-Occupancy Period.

One frequency will be chosen from the Operating Channels of the UUT within the 5250-5350 MHz or 5470-5725 MHz bands.

Table 4: DFS Response Requirement Values

Parameter	Value
<i>Non-occupancy period</i>	Minimum 30 minutes
<i>Channel Availability Check Time</i>	60 seconds
<i>Channel Move Time</i>	10 seconds See Note 1.
<i>Channel Closing Transmission Time</i>	200 milliseconds + an aggregate of 60 milliseconds over remaining 10 second period. See Notes 1 and 2.
<i>U-NII Detection Bandwidth</i>	Minimum 100% of the U-NII 99% transmission power bandwidth. See Note 3.
Note 1: <i>Channel Move Time</i> and the <i>Channel Closing Transmission Time</i> should be performed with Radar Type 0. The measurement timing begins at the end of the Radar Type 0 burst. Note 2: The <i>Channel Closing Transmission Time</i> is comprised of 200 milliseconds starting at the beginning of the <i>Channel Move Time</i> plus any additional intermittent control signals required to facilitate a <i>Channel move</i> (an aggregate of 60 milliseconds) during the remainder of the 10 second period. The aggregate duration of control signals will not count quiet periods in between transmissions. Note 3: During the <i>U-NII Detection Bandwidth</i> detection test, radar type 0 should be used. For each frequency step the minimum percentage of detection is 90 percent. Measurements are performed with no data traffic.	

RESULTS:

Bandwidth: 80 MHz
Test Channel: Channel 58 (5290 MHz)
Radar Type: 0.
DFS Detection Threshold: -64 dBm
Radar Burst Level: -63 dBm (Radar Burst with a level equal to the DFS Detection Threshold + 1dB)
Operation Mode: Data transfer continuously with Iperf UDP protocol.

Special case for IEEE 802.11ac clients operating with 80 MHz BW modes: Client devices with 80 MHz BW mode can be tested with an approved master operating in 40 MHz BW mode. Test procedures for client devices with 80 + 80 MHz and 160 MHz BW modes must be approved using Pre-Approval Guidance (PAG) procedures (KDB Publication 388624). This is an interim solution until a few IEEE 802.11ac master devices with the various BW modes are approved.

Channel Closing Transmission Time:

DUT Frequency (MHz)	Radar Type No.	CCTT Type of Value	CCTT No. of Pulses found	CCTT Tx Time (ms)
5310.000000	0	first 200 ms	1	0.012
5310.000000	0	remaining 10.0 second(s) period	0	0.000

Channel Move Time:

DUT Frequency (MHz)	Radar Type No.	CMT Tx Time (s)	CMT Limit (s)
5310.000000	0	0.000	10.000

Non-Occupancy Period:

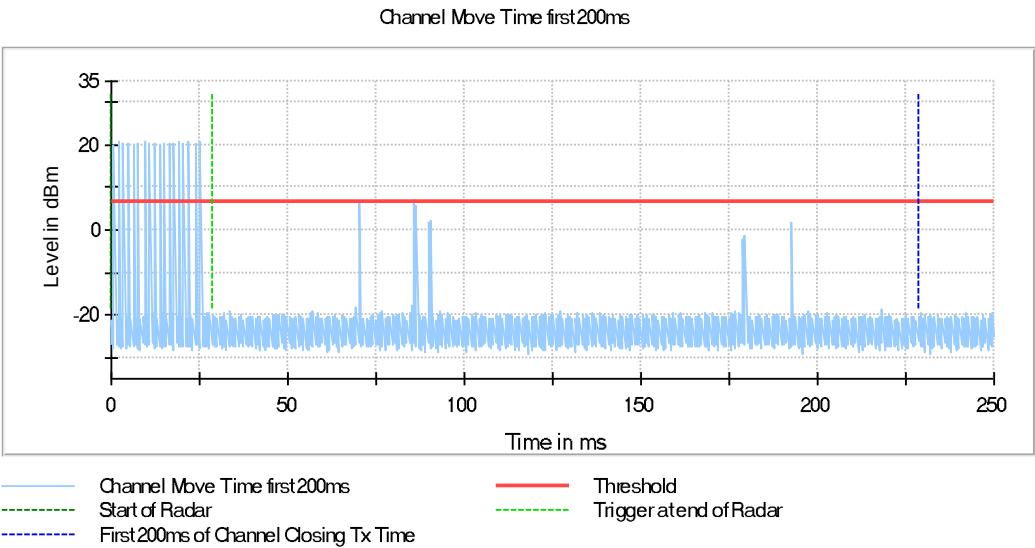
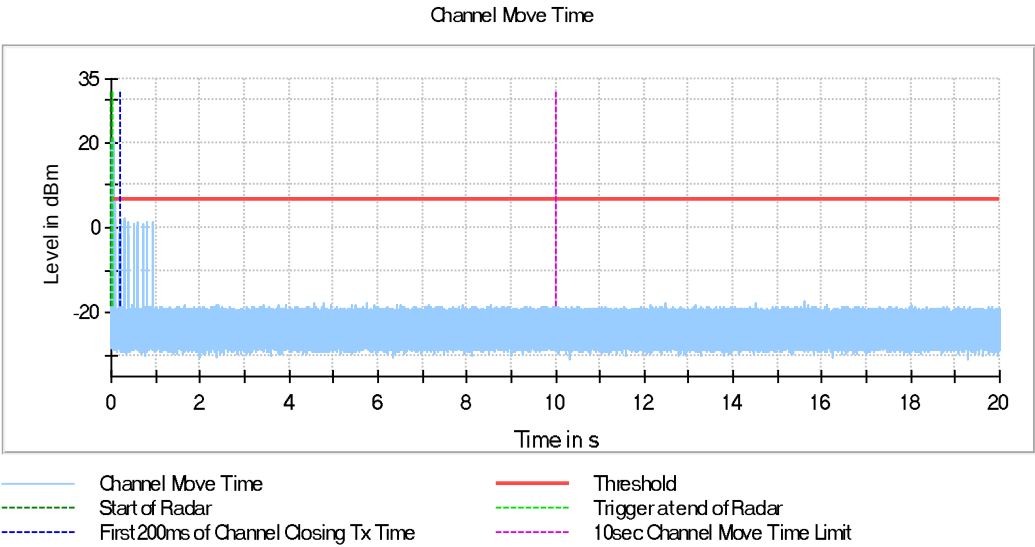
DUT Frequency (MHz)	Radar Type No.	NOP No. of Pulses found	NOP No. of Pulses Limit	NOP Tx Time (s)	NOP Tx Time Limit (s)	DUT Frequency (MHz)
5310.000000	0	0	0	0.000	0.000	5310.000000

Transmitting Test:

DUT Frequency (MHz)	Tx-Test Tx OnTime (µs)	Tx-Test Tx OnTime Limit	Tx-Test No. of Pulses found
5231.000000	0	0	-

Verdict: PASS

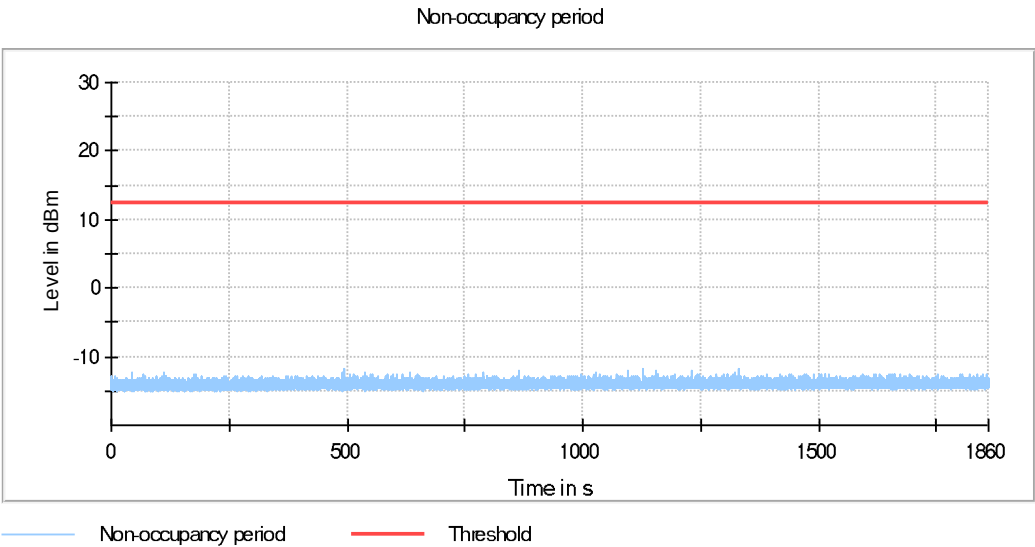
Channel MoveTime:



The measurement settings for Channel MoveTime is as follows:

Setting	Instrument Value	Target Value
Center Frequency	5.31000 GHz	5.31000 GHz
Span	ZeroSpan	ZeroSpan
RBW	3.000 MHz	>= 3.000 MHz
VBW	3.000 MHz	>= 3.000 MHz
SweepPoints	30001	~ 30001
SweepTime	20.000 s	20.000 s
Reference Level	-10.000 dBm	AUTO
Attenuation	0.000 dB	0.000 dB
Detector	MaxPeak	MaxPeak
SweepCount	1	1
Filter	3 dB	3 dB
Trace Mode	Clear Write	Clear Write
SweepType	Sweep	AUTO
Preamplifier	off	off
Trigger	External	External
Trigger Offset	0.000 s	0.000 s

Non-Occupancy Period:



The measurement settings for Non-occupancy period is as follows:

Setting	Instrument Value	Target Value
Center Frequency	5.31000 GHz	5.31000 GHz
Span	ZeroSpan	ZeroSpan
RBW	3.000 MHz	>= 3.000 MHz
VBW	3.000 MHz	>= 3.000 MHz
SweepPoints	30001	~ 30001
SweepTime	1.860 ks	1.860 ks
Reference Level	-10.000 dBm	AUTO
Attenuation	0.000 dB	0.000 dB
Detector	MaxPeak	MaxPeak
SweepCount	1	1
Filter	3 dB	3 dB
Trace Mode	Clear Write	Clear Write
SweepType	Sweep	AUTO
Preamp	off	off