



AUX - 80 MHz Bandwidth

Measurement Configuration	Data Rate/MCS	Transmitter Channel	Band Edge Frequency (MHz)	Peak Level (dBuV/m)	Average Level (dBuV/m)
SISO	802.11ac	42	5150.0	60.14	48.46
SISO	802.11ac	58	5350.0	64.35	51.36
SISO	802.11ac	106	5460.0	65.16	52.40

Table 398

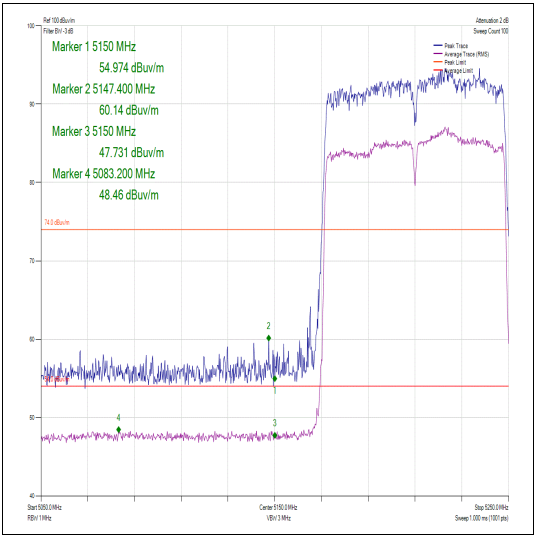


Figure 551 – Channel 42 – Restricted Band Edge

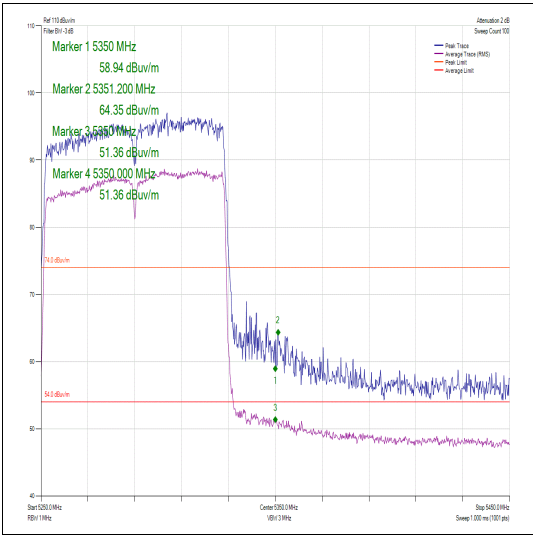


Figure 552 – Channel 58 - Restricted Band Edge

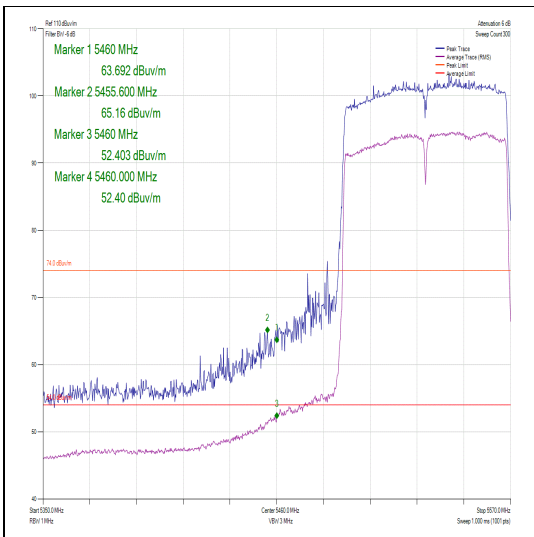


Figure 553 – Channel 106 - Restricted Band Edge



2.6.7 Test Location and Test Equipment Used

This test was carried out in EMC Chamber 5.

Instrument	Manufacturer	Type No	TE No	Calibration Period (months)	Calibration Due
10dB/1W SMA Attenuator dc - 18GHz	Sealectro	60-674-1010-89	3	12	31-Aug-2018*
Mains Voltage Monitor	TUV SUD Product Service	MVM1	1378	12	17-Apr-2019
Turntable Controller	Inn-Co GmbH	CO 1000	1606	-	TU
EMI Test Receiver	Rohde & Schwarz	ESU40	3506	12	22-Nov-2018
1 Metre SMA Cable	Rhophase	3PS-1801A-1000-3PS	4099	12	19-Sep-2018
Cable (Rx, Nm-Nm, 7m)	Scott Cables	SLU18-NMNM-07.00M	4498	-	O/P Mon
Cable (Rx, Km-Km 2m)	Scott Cables	KPS-1501-2000-KPS	4526	6	31-Aug-2018
EMI Receiver	Keysight Technologies	N9038A MXE	4628	12	4-Jul-2019
EMI Receiver	Keysight Technologies	N9038A MXE	4629	12	13-Sep-2018
Mast Controller	Maturo GmbH	NCD	4810	-	TU
Tilt Antenna Mast	Maturo GmbH	TAM 4.0-P	4811	-	TU
9m N type RF cable	Rosenberger	2303-0 9.0m PNm PNm	4827	6	4-Jan-2019
Double Ridge Broadband Horn Antenna	Schwarzbeck	BBHA 9120 B	4848	12	12-Feb-2019
Hygrometer	Rotronic	HP21	4989	12	26-Apr-2019

Table 399

TU – Traceability Unscheduled

O/P Mon – Output monitored using calibrated equipment.

*Item may appear to be out of calibration, however, testing was performed over multiple days and TUV SUD can confirm that when used the item was within its calibration period and that we hold records of this.



2.7 Channel Move Time, Channel Closing Transmission Time and Non-Occupancy Period

2.7.1 Specification Reference

FCC 47 CFR Part 15E, Clause 15.407 (h)(2)(iii)(iv)
Industry Canada RSS-247, Clause 6.3.2(c)(d)(e)

2.7.2 Equipment Under Test and Modification State

A1993, S/N: C07WR049K2T5 - Modification State 0

2.7.3 Date of Test

14-August-2018 to 16-August-2018

2.7.4 Test Method

This test was performed in accordance with FCC KDB 905462 D02, clause 7.8.3. The EUT and test equipment was configured as described in the calibration setup section below.

Radar Pulse Type 0 was transmitted and the spectrum monitored. The transmissions from the EUT were observed for a period of 12 seconds after the final injected Radar Pulse.

It was checked that all transmissions stopped within the 10 second period defined from the point of the end of the final Radar pulse + 10 seconds. In addition, the aggregate on time during the first 200ms and the following 9.8 seconds of the Channel Move Time was recorded.

The markers on the trace data correspond to the following time periods:

Red - End Of Radar Burst, (T0)
Purple - End Of 200ms Period, (T0 + 200 ms)
Orange - End Of Channel Move Time, (T0 + 10 seconds)

To verify the non-occupancy period, the PXI digitiser was replaced with a Spectrum Analyser. The external trigger from the Aeroflex DFS test system was used to trigger a 30 minute sweep from the moment the radar burst sequence was injected. It was verified that no transmissions occurred on the test channel during this time period.

2.7.5 Environmental Conditions

Ambient Temperature	21.5 - 22.5 °C
Relative Humidity	50.7 - 55.2 %

2.7.6 Calibration of Radar Waveforms and EUT Channel Loading

Main – 802.11a

The equipment was set up as shown in the diagram below. The EUT was configured to run iPerf, transmitting UDP to the client laptop. The channel loading was set to >17% by adjusting the bandwidth specified in the iPerf UDP transfer.

To calibrate the level of the radar at the input to the companion device, the companion device was replaced by the spectrum analyser and the output of the PXI RF generator adjusted to give -62 dBm.

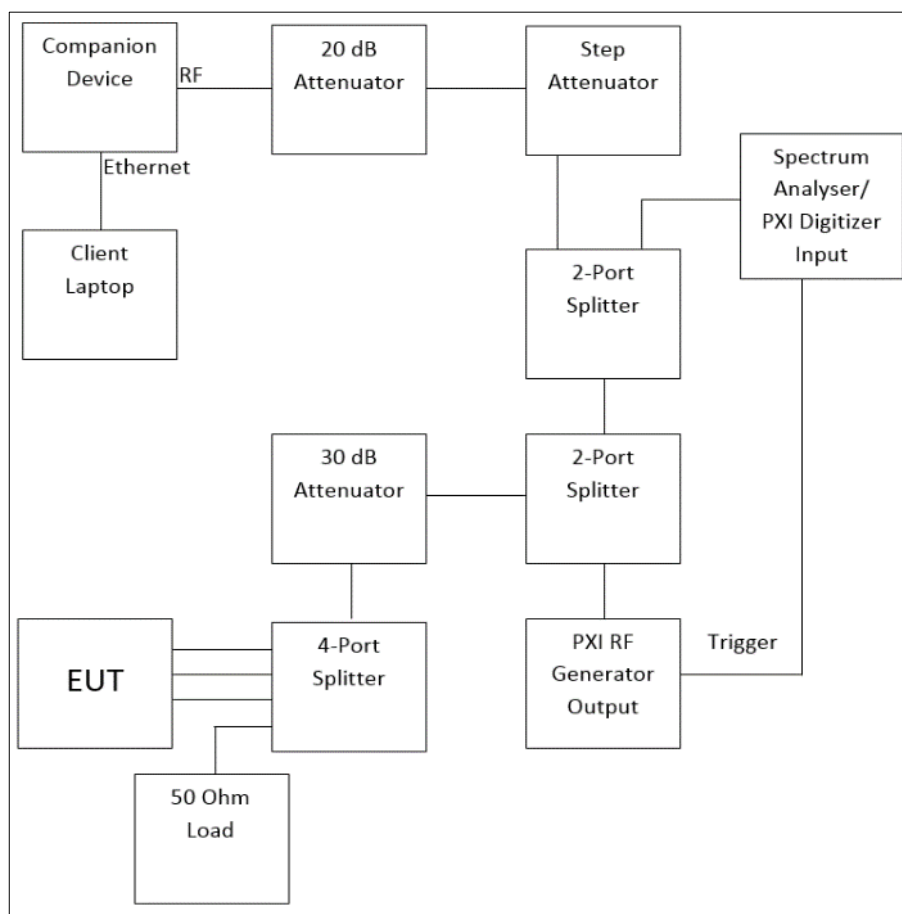


Figure 554 - Test Equipment Setup for Client Without Radar Detection with Injection at the Master



Radar Type	Pulse Width (μs)	PRI (μs)	Number of Pulses
0	1	1428	18

Table 400 - Radar Pulse Type 0 Characteristics

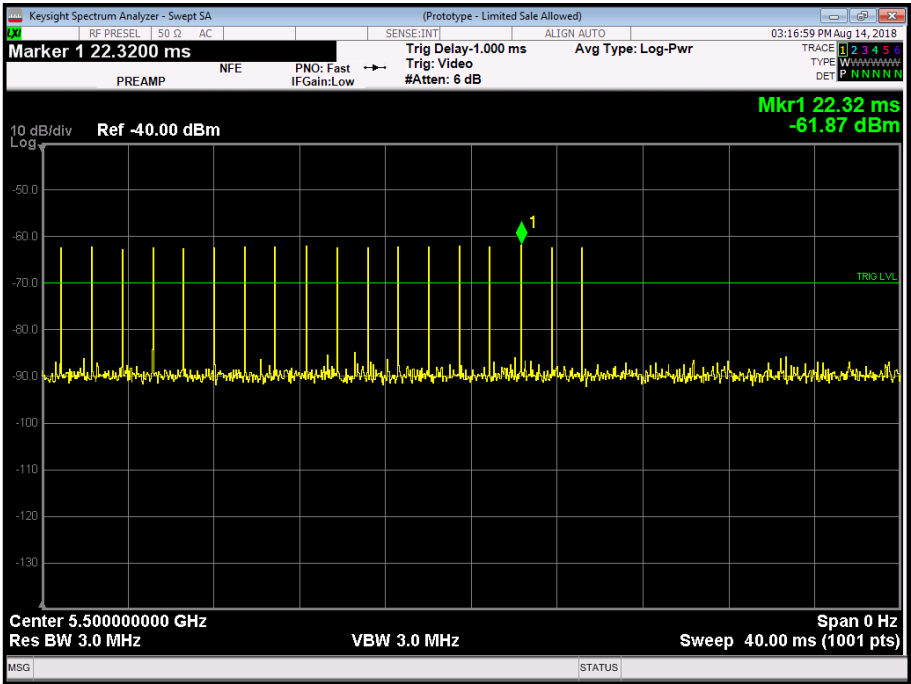


Figure 555 - Verification of Radar Type 0

Maximum Transmit Power	Value (Notes 1 and 2)
≥ 200 milliwatt	-64 dBm
< 200 milliwatt	-62 dBm
Note 1: This is the level at the input of the receiver assuming a 0 dBi receive antenna.	
Note 2: Throughout these test procedures an additional 1 dB has been added to the amplitude of the test transmission waveforms to account for variations in measurement equipment. This will ensure that the test signal is at or above the detection threshold level to trigger a DFS response.	

Table 401 - DFS Detection Thresholds for Master Devices and Client Devices With Radar Detection



Product Service

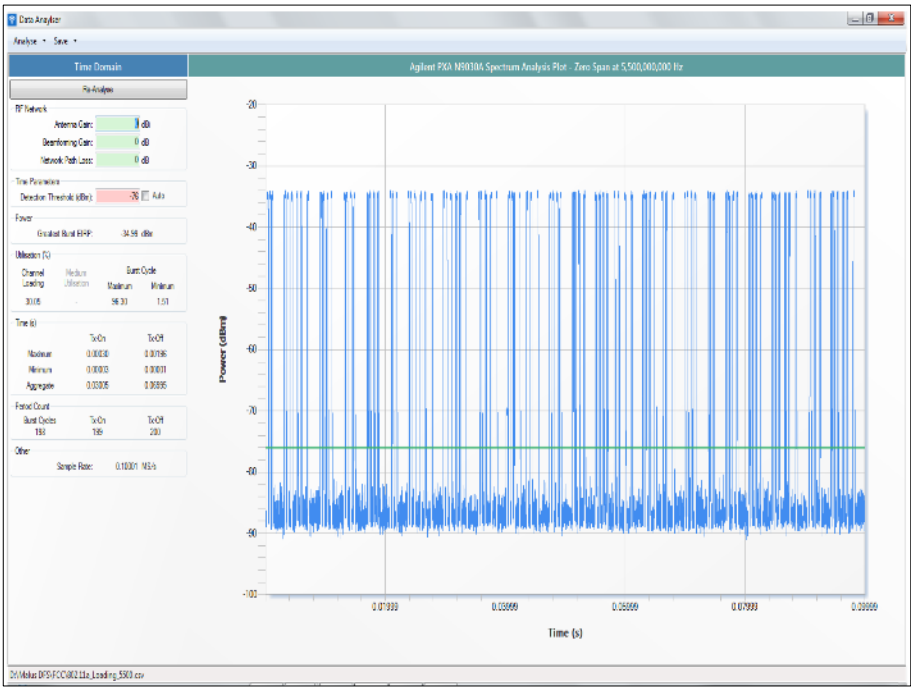


Figure 556 - Channel Loading

The channel loading was measured as 30.05%

Main - VHT80

The equipment was set up as shown in the diagram below. The EUT was configured to run iPerf, transmitting UDP to the client laptop. The channel loading was set to >17% by adjusting the bandwidth specified in the iPerf UDP transfer.

To calibrate the level of the radar at the input to the companion device, the companion device was replaced by the spectrum analyser and the output of the PXI RF generator adjusted to give -62 dBm.

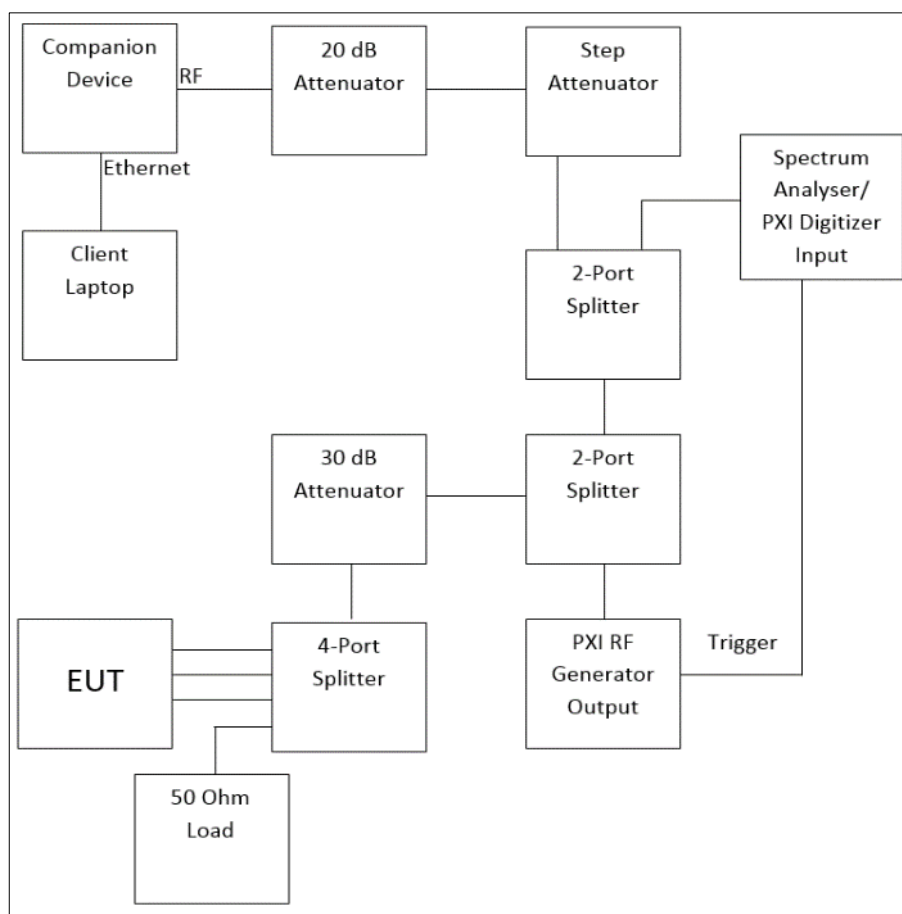


Figure 557 - Test Equipment Setup for Client Without Radar Detection with Injection at the Master



Radar Type	Pulse Width (μs)	PRI (μs)	Number of Pulses
0	1	1428	18

Table 402 - Radar Pulse Type 0 Characteristics

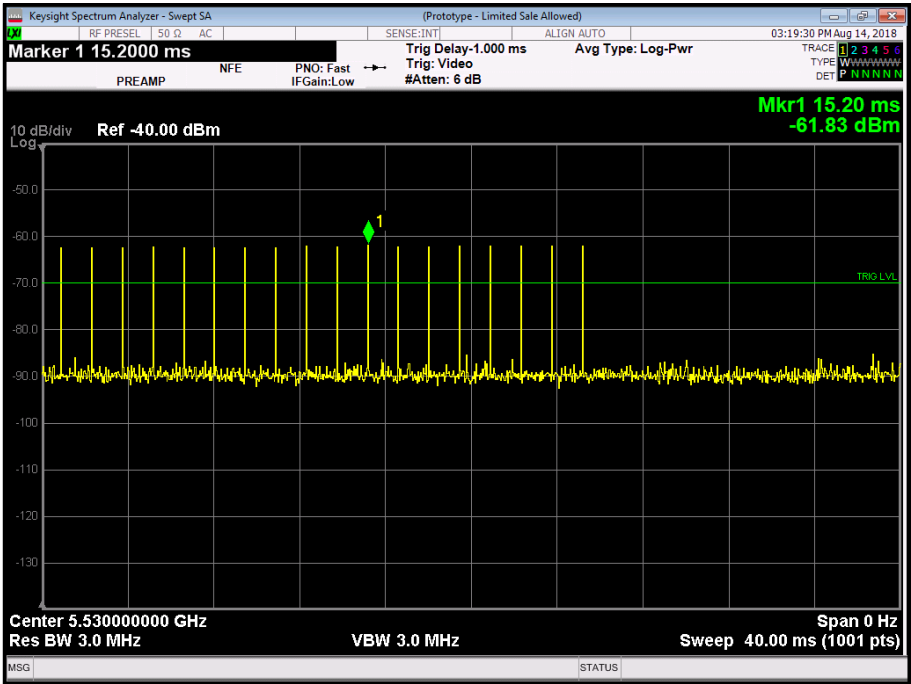


Figure 558 - Verification of Radar Type 0

Maximum Transmit Power	Value (Notes 1 and 2)
≥ 200 milliwatt	-64 dBm
< 200 milliwatt	-62 dBm

Note 1: This is the level at the input of the receiver assuming a 0 dBi receive antenna.

Note 2: Throughout these test procedures an additional 1 dB has been added to the amplitude of the test transmission waveforms to account for variations in measurement equipment. This will ensure that the test signal is at or above the detection threshold level to trigger a DFS response.

Table 403 - DFS Detection Thresholds for Master Devices and Client Devices With Radar Detection



Product Service

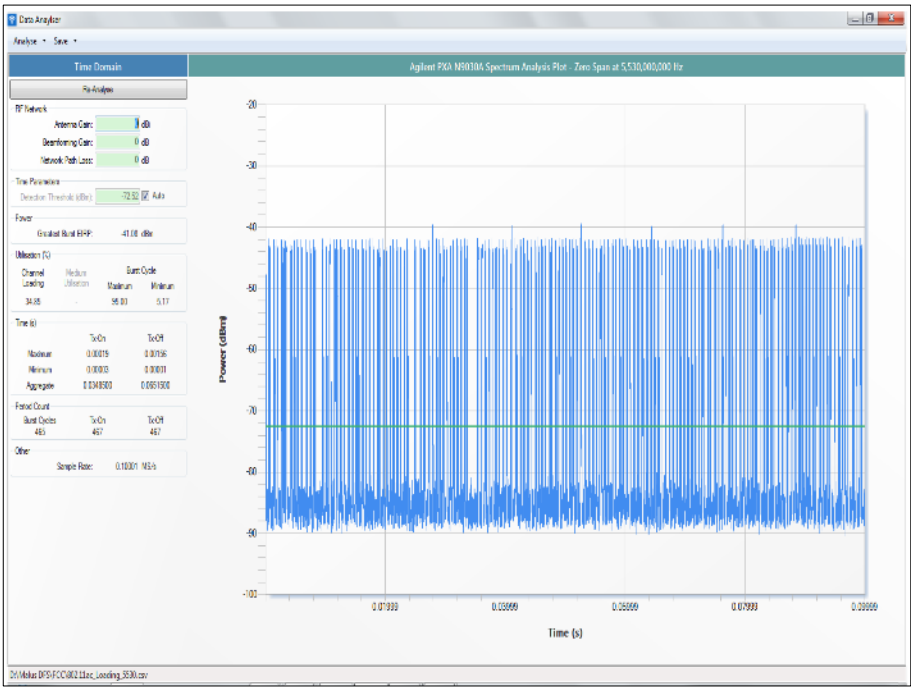


Figure 559 - Channel Loading

The channel loading was measured as 34.85%



2.7.7 Test Results

Main – 802.11a

Test Parameter	Result
Channel Move Time	0.134 s
Channel Closing Time (Aggregate Time During 200 ms)	27.459 ms
Channel Closing Time (Aggregate Time During 200 ms to 10 s)	0 ms
Channel Closing Time (Aggregate Time During 10 s)	27.459 ms
Transmission Observed During Non-Occupancy Period	None

Table 404 - In-Service Monitoring Test Results

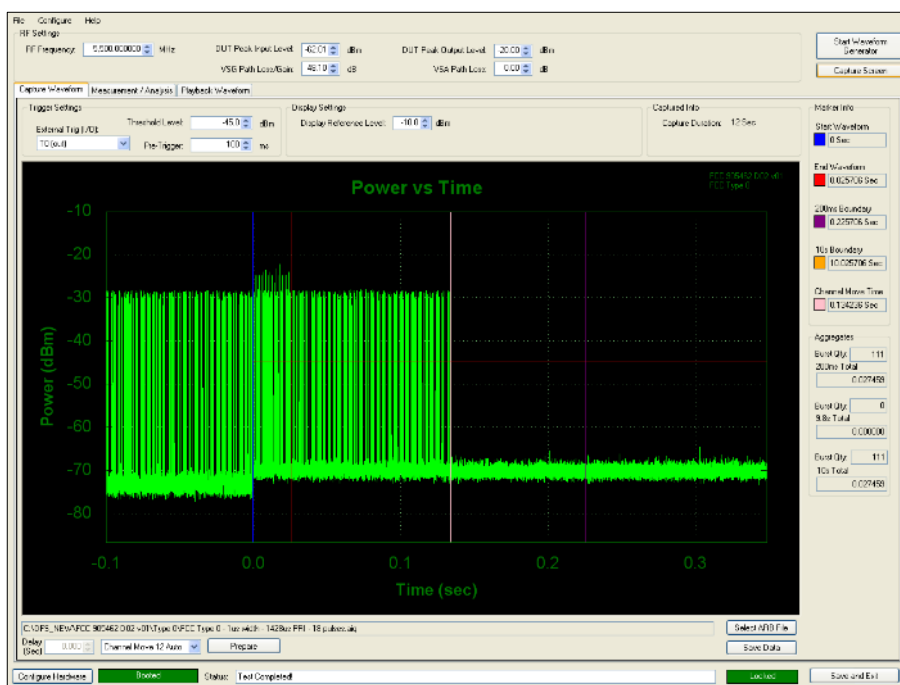


Figure 560 - First 200 ms of Channel Shutdown Period

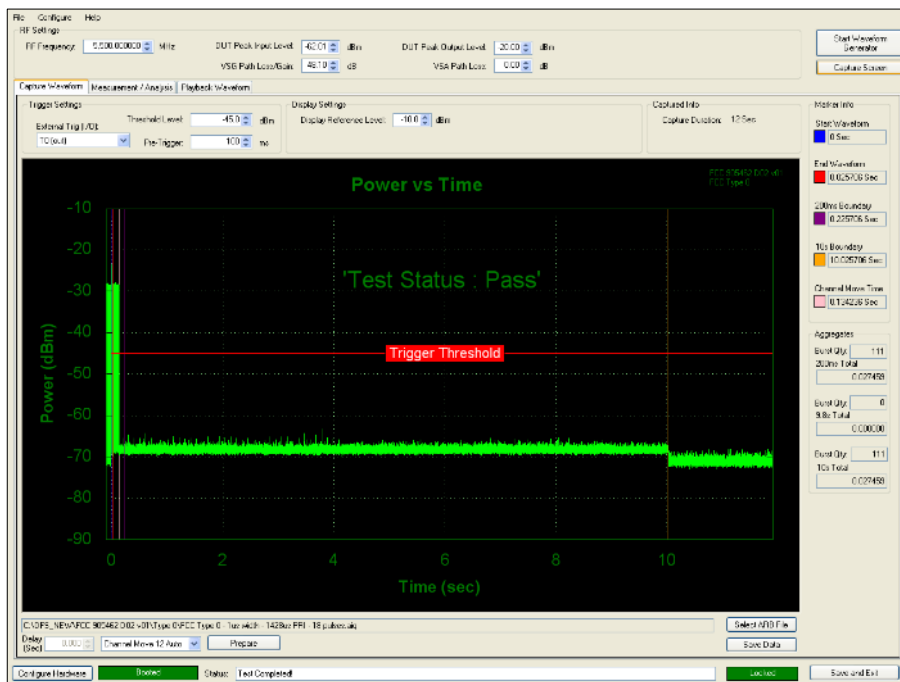


Figure 561 - 10 s Channel Shutdown

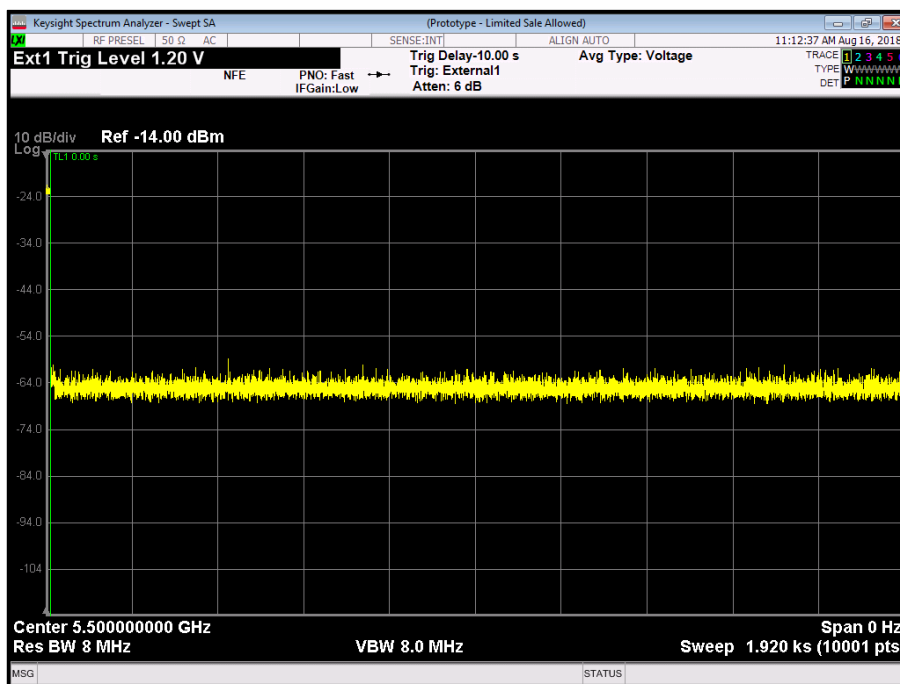


Figure 562 - Non - Occupancy Period



FCC 47 CFR Part 15, Limit Clause 15.407 (h)(2)(iii) and Industry Canada RSS-247, Limit Clause 6.3.2(c)(d)

Channel Move Time	<10 seconds
Channel Closing Time (Aggregate Time During 200ms)	<200 ms
Channel Closing Time (Aggregate Time During +200ms to 10s)	<60 ms

Table 405 - Channel Move Time and Channel Closing Transmission Time Limits

FCC 47 CFR Part 15, Limit Clause 15.407 (h)(2)(iv) and Industry Canada RSS-247, Limit Clause 6.3.2(e)

Non-occupancy Period	> 30 minutes
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Table 406 - Non-Occupancy Period Limit



Main - VHT80

Test Parameter	Result
Channel Move Time	0.116 s
Channel Closing Time (Aggregate Time During 200 ms)	14.303 ms
Channel Closing Time (Aggregate Time During 200 ms to 10 s)	0 ms
Channel Closing Time (Aggregate Time During 10 s)	14.303 ms
Transmission Observed During Non-Occupancy Period	None

Table 407 - In-Service Monitoring Test Results

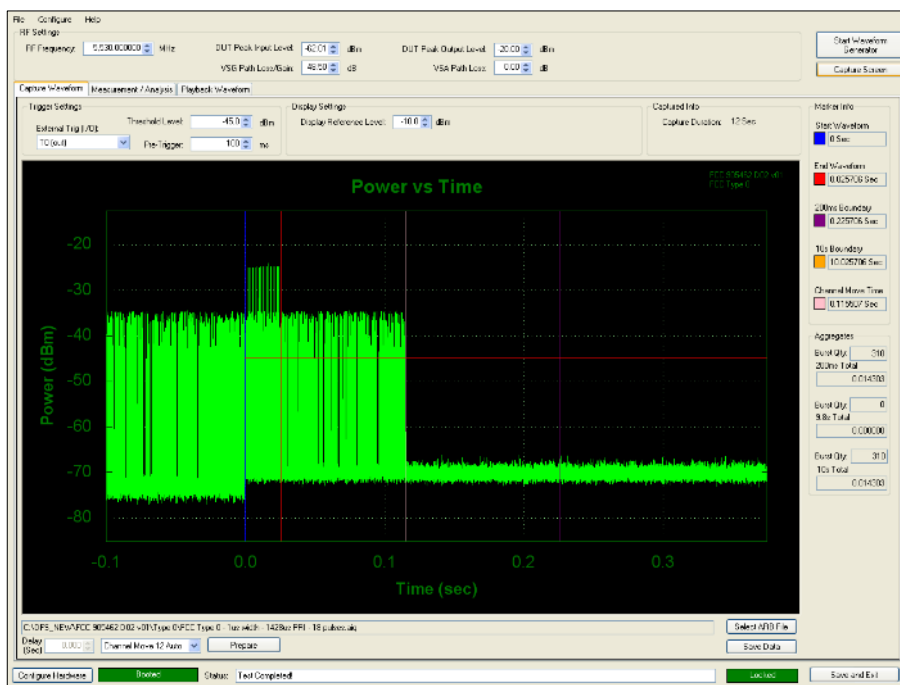


Figure 563 - First 200 ms of Channel Shutdown Period

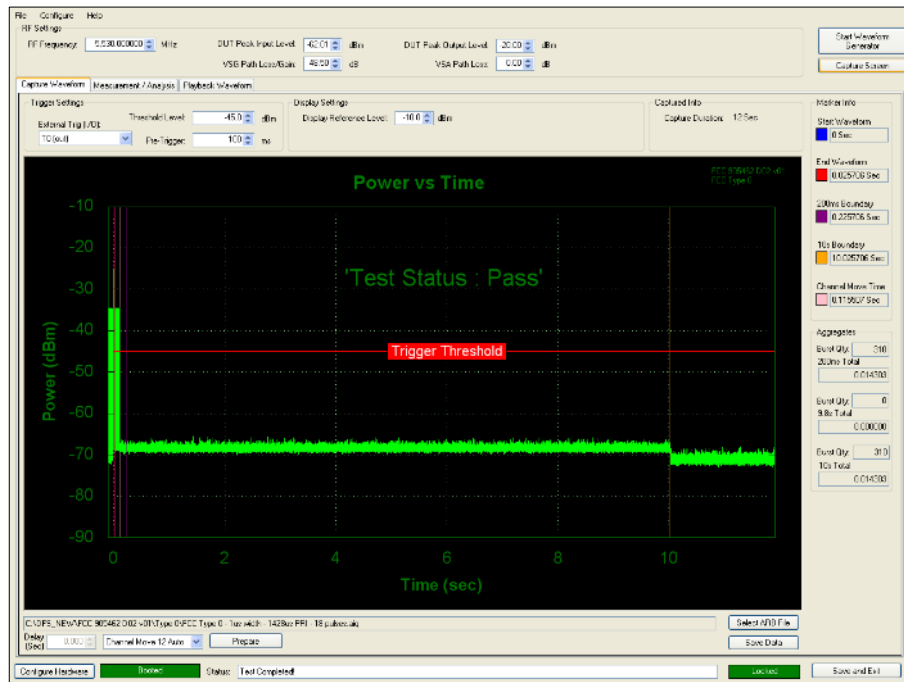


Figure 564 - 10 s Channel Shutdown

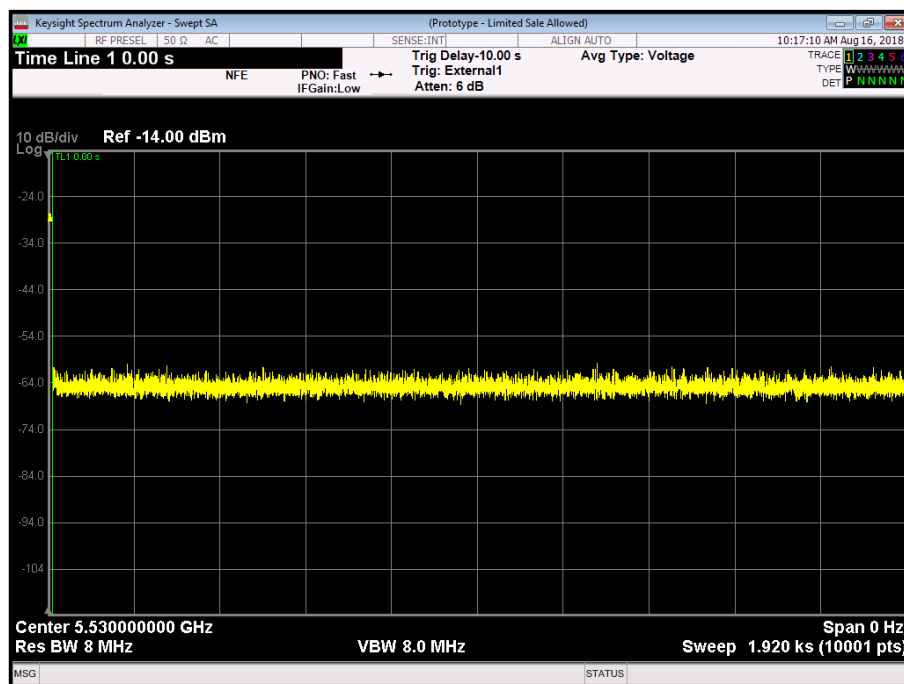


Figure 565 - Non - Occupancy Period



Product Service

FCC 47 CFR Part 15, Limit Clause 15.407 (h)(2)(iii) and Industry Canada RSS-247, Limit Clause 6.3.2(c)(d)

Channel Move Time	<10 seconds
Channel Closing Time (Aggregate Time During 200ms)	<200 ms
Channel Closing Time (Aggregate Time During +200ms to 10s)	<60 ms

Table 408 - Channel Move Time and Channel Closing Transmission Time Limits

FCC 47 CFR Part 15, Limit Clause 15.407 (h)(2)(iv) and Industry Canada RSS-247, Limit Clause 6.3.2(e)

Non-occupancy Period	> 30 minutes
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Table 409 - Non-Occupancy Period Limit



2.7.8 Test Location and Test Equipment Used

This test was carried out in RF Chamber 10.

Instrument	Manufacturer	Type No	TE No	Calibration Period (months)	Calibration Due
Attenuator (10dB, 10W)	Texscan	HFP-50N	468	12	31-Aug-2018
Step Attenuator	Rohde & Schwarz	DPSP	1672	-	O/P Mon
Attenuator (20dB, 10W)	Aeroflex / Weinschel	23-20-34	3158	12	31-Aug-2018
Hygrometer	Rotronic	I-1000	3068	12	21-Jun-2019
PXI RF Digitizer	Aeroflex	3035	4012	24	15-Mar-2020
PXI RF Synthesizer	Aeroflex	3010	4013	24	15-Mar-2020
PXI RF Synthesizer	Aeroflex	3011	4014	24	15-Mar-2020
PXI Digital RF Signal Generator	Aeroflex	3025	4015	24	15-Mar-2020
DC to TTL Converter	TUV SUD Product Service	N/A	4378	-	TU
EMI Receiver	Keysight Technologies	N9038A MXE	4629	12	13-Sep-2018
Power splitter - 2 port	Mini-Circuits	ZN2PD-63-S+	4742	12	14-Sep-2018
Power splitter - 2 port	Mini-Circuits	ZN2PD-63-S+	4743	12	14-Sep-2018
Power splitter - 4 port	Mini-Circuits	ZN4PD1-63-S+	4744	12	14-Sep-2018
Wireless Cable & Fibre Router - AC 1900, Dual-band	Asus	RT-AC68U	4881	-	TU
Cable (18GHz)	Rosenberger	LU7-036-1000	5031	-	O/P Mon
Cable (18GHz)	Rosenberger	LU7-036-1000	5033	-	O/P Mon
Cable (18GHz)	Rosenberger	LU7-036-1000	5034	-	O/P Mon

Table 410

TU - Traceability Unscheduled

O/P Mon – Output Monitored using calibrated equipment



3 Measurement Uncertainty

For a 95% confidence level, the measurement uncertainties for defined systems are:

Test Name	Measurement Uncertainty
Maximum Conducted Output Power	± 3.2 dB
Maximum Conducted Power Spectral Density	± 3.2 dB
Emission Bandwidth	± 2.028 MHz
Authorised Band Edges	± 6.3 dB
Spurious Radiated Emissions	30 MHz to 1 GHz: ± 5.2 dB 1 GHz to 40 GHz: ± 6.3 dB
Restricted Band Edges	± 6.3 dB

Table 411