FCC TEST REPORT

FCC ID: 2AF2V-MOTICAM

On Behalf of

Motic China Group Co., Ltd.

Moticam

Model No.: Moticam 4000X, Moticam 4000X BMH

Prepared for	:	Motic China Group Co., Ltd.
Address	:	No 810 Fangshan Nan Road, XiangAn, Xiamen 361101, P.R. China

Prepared By	:	Shenzhen Alpha Product Testing Co., Ltd.
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Date of Receipt	:	December 18, 2024
Date of Test	:	December 18, 2024 - March 11, 2024
Date of Report	:	March 11, 2024
Version Number	:	V0
Result		**Pass**

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TABLE OF CONTENTS

TEST REPORT DECLARATION

Applicant	:	Motic China Group Co., Ltd.
Address	:	No 810 Fangshan Nan Road, XiangAn, Xiamen 361101, P.R. China
Manufacturer	:	Motic China Group Co., Ltd.
Address	:	No 810 Fangshan Nan Road, XiangAn, Xiamen 361101, P.R. China
EUT Description	:	Moticam
	(A) Model No.	: Moticam 4000X, Moticam 4000X BMH
	(B) Trademark	: N/A

Measurement Standard Used:

FCC Part 15 Subpart E, FCC KDB 905462 D02, FCC KDB 905462 D03

The device described above is tested by Shenzhen Alpha Product Testing Co., Ltd. to determine the maximum emission levels emanating from the device. The maximum emission levels are compared to the FCC limits. The test results are contained in this test report and Shenzhen Alpha Product Testing Co., Ltd. is assumed of full responsibility for the accuracy and completeness of these tests.

After the test, our opinion is that EUT compliance with the requirement of the above standards.

This report applies to above tested sample only. This report shall not be reproduced in parts without written approval of Shenzhen Alpha Product Testing Co., Ltd.

Tested by (name + signature).....:	Yannis Wen Project Engineer	
Approved by (name + signature).....:	Reak Yang Project Manager	
Date of issue.....:	March 11, 2024	

Revision History

Revision	Issue Date	Revisions	Revised By
V0	March 11, 2024	Initial released Issue	Yannis Wen

1. GENERAL INFORMATION

1.1. Description of Device (EUT)

EUT Name	:	Moticam
Model No.	:	Moticam 4000X, Moticam 4000X BMH
DIFF.	:	The Moticam 4000X BMH adds a display screen and a display connection bracket on top of the Moticam 4000X, making the camera part completely identical. So all the test were performed on the model Moticam 4000X BMH.
Power supply	:	DC 12V from adapter
Radio Technology	:	5G WIFI
Operation Frequency	:	802.11a/n(HT20)/ac(VHT20): 5180~5240MHz; 5260-5320MHz; 5500-5700MHz; 5745~5825MHz 802.11n(HT40)/ac(VHT40): 5190~5230MHz; 5260-5320MHz; 5510-5670MHz; 5755~5795MHz 802.11ac(VHT80): 5210MHz, 5290MHz, 5530MHz, 5775MHz
Channel separation	:	20MHz for 802.11a/ 802.11ac(VHT20)/ 802.11n(HT20) 40MHz for 802.11ac(VHT40)/ 802.11n(HT40) 80MHz for 802.11ac(VHT80)
Modulation technology:	:	IEEE 802.11n: OFDM (64QAM, 16QAM, QPSK, BPSK) IEEE 802.11a: OFDM (64QAM, 16QAM, QPSK, BPSK) IEEE 802.11ac: OFDM (64QAM, 16QAM, QPSK, BPSK)
Antenna Type	:	Rod antenna 1, max gain 5dBi Rod antenna 2, max gain 5dBi The antenna MIMO combining gain is 8.01dBi. (Antenna information is provided by applicant.)
Software version	:	V1.0
Hardware version	:	V1.0
Intend use environment	:	Residential, commercial and light industrial environment

Note: In this report, the main test model is Moticam 4000X BMHMH, and the main test model serial number is A0000001

1.2.Accessories of Device (EUT)

Accessories1	:	Power Supply
Manufacturer	:	Shen Zhen Shi Yingyuan Electronics Co.,Ltd ,
Model	:	ICP301-120-2500
Input	:	100-240V~50/60Hz 0.8A
Output	:	12.0 ⎓ 2.5A 30.0W

1.3.Tested Supporting System Details

No.	Description	Manufacturer	Model	Serial Number	Certification Or SDOC
1	N/A	N/A	N/A	N/A	N/A
Note: 1. master ping IP 192.168.100.5 for salve. 2. It takes 150 seconds for the master and slave devices to fully start up.					

1.4.Block Diagram of connection between EUT and simulators

3. EMC EQUIPMENT LIST

Equipment	Manufacture	Model No.	Firmware version	Serial No.	Last cal.	Cal Interval
9*6*6 anechoic chamber	CHENYU	9*6*6	/	N/A	2022.05.17	3Year
Spectrum analyzer	ROHDE&SCHWARZ	FSV40-N	2.3	102137	2023.08.16	1Year
Spectrum analyzer	Agilent	N9020A	A.14.16	MY499100060	2023.08.16	1Year
Receiver	ROHDE&SCHWARZ	ESR	2.28 SP1	1316.3003K03-102082-Wa	2023.08.16	1Year
Receiver	R&S	ESCI	4.42 SP1	101165	2023.08.16	1Year
Bilog Antenna	Schwarzbeck	VULB 9168	/	VULB 9168#627	2023.08.28	1Year
Horn Antenna	SCHWARZBECK	BBHA 9120 D	/	2106	2023.08.19	1Year
Loop Antenna	SCHWARZBECK	FMZB 1519B	/	00128	2023.08.19	1Year
RF Cable	Resenberger	Cable 1	/	RE1	2023.08.16	1Year
RF Cable	Resenberger	Cable 2	/	RE2	2023.08.16	1Year
RF Cable	Resenberger	Cable 3	/	CE1	2023.08.16	1Year
Pre-amplifier	HP	HP8347A	/	2834A00455	2023.08.16	1Year
Pre-amplifier	Agilent	8449B	/	3008A02664	2023.08.16	1Year
L.I.S.N.#1	Schwarzbeck	NSLK8126	/	8126-466	2023.08.16	1Year
L.I.S.N.#2	ROHDE&SCHWARZ	ENV216	/	101043	2023.08.16	1Year
Horn Antenna	SCHWARZBECK	BBHA 9170	/	00946	2023.08.19	1Year
Preamplifier	SKET	LNPA_1840-50	/	SK2018101801	2023.08.16	1 Year
Power Meter	Agilent	E9300A	/	MY41496628	2023.08.16	1 Year
Power Sensor	DARE	RPR3006W	/	15100041SNO91	2023.08.16	1 Year
Temp. & Humid. Chamber	Teelong	TL-HW408S	/	TL-20191205-01	2023.07.25	1 Year
Switching Mode Power Supply	JUNKE	JK12010S	/	20140927-6	2023.08.16	1 Year
Adjustable attenuator	MWRFtest	N/A	/	N/A	N/A	N/A
10dB Attenuator	Mini-Circuits	DC-6G	/	N/A	N/A	N/A

Software Information			
Test Item	Software Name	Manufacturer	Version
RF-CE	MTS 8310	MW	V2.0.0.0

4. SUMMARY OF MEASUREMENT

4.1. Summary of test result

UNII	Bandwidth and Channel	Description	Measured	Limit	Result
U-NII-2A 5250-5350MHz	20MHz (CH60) 5300MHz	Channel Move Time	1.4 sec	10 sec	Pass
		Channel Closing Transmission time	<200ms +3.6 ms (aggregate)	200 ms + aggregate of 60 ms over remaining 10 s period	Pass
		Non-Occupancy Period and Client Beacon Test	No transmission or Beacons occurred	30 minutes	Pass
U-NII-2C 5470-5725MHz	20MHz (CH100) 5500MHz	Channel Move Time	1.4 sec	10 sec	Pass
		Channel Closing Transmission time	<200ms +3.6 ms (aggregate)	200 ms + aggregate of 60 ms over remaining 10 s period	Pass
		Non-Occupancy Period and Client Beacon Test	No transmission or Beacons occurred	30 minutes	Pass

Note: Since the product is client without radar detection function, only Channel Move Time, Channel Closing Transmission Time and Non-Occupancy Period Test are required to be performed.

RSS-247			
Requirement	Operational Mode		RESULTS
	Master	Client	
Non-Occupancy Period	Yes	Yes	Pass
DFS Detection Threshold	Yes	Not required	Not required
Channel Availability Check Time	Yes	Not required	Not required
Channel Closing Transmission Time	Yes	Yes	Pass
Channel Move Time	Yes	Yes	Pass
U-NII Detection Bandwidth	Yes	Not required	Not required

4.2. Equipment Type

☐ Master Device

☒ Client Device(No Ad-Hoc mode, without radar detection function and TPC)

3.2.Channel list

U-NII-2A:

Mode	Data rate (Mbps) see Note	Channel	Frequency (MHz)
IEEE 802.11a	6	CH52	5260
	6	CH56	5280
	6	CH64	5320
IEEE 802.11n HT20	6.5	CH52	5260
	6.5	CH56	5280
	6.5	CH64	5320
IEEE 802.11n HT40	13.5	CH54	5270
	13.5	CH62	5310
IEEE 802.11ac VHT20	6.5	CH52	5260
	6.5	CH56	5280
	6.5	CH64	5320
IEEE 802.11ac VHT40	13.5	CH54	5270
	13.5	CH62	5310
IEEE 802.11ac VHT80	433	CH58	5290
Note: According exploratory test and product specification EUT will have maximum output power in those data rate, so those data rate were used for all test.			

U-NII-2C:

Mode	Data rate (Mbps) see Note	Channel	Frequency (MHz)
IEEE 802.11a	6	CH100	5500
	6	CH116	5580
	6	CH140	5700
IEEE 802.11n HT20	6.5	CH100	5500
	6.5	CH116	5580
	6.5	CH140	5700
IEEE 802.11n HT40	13.5	CH102	5510
	13.5	CH134	5670
IEEE 802.11ac VHT20	6.5	CH100	5500
	6.5	CH116	5580
	6.5	CH140	5700
IEEE 802.11ac VHT40	13.5	CH102	5510
	13.5	CH134	5670
IEEE 802.11ac VHT80	433	CH106	5530
Note: According exploratory test and product specification EUT will have maximum output power in those data rate, so those data rate were used for all test.			

3.3.Test Conditions and channel

Temperature range	21-25℃
Humidity range	40-75%
Pressure range	86-106kPa

Channel List for 802.11n20		
Band Frequency	EUT Channel	Test Frequency (MHz)
Band II	CH60	5300
Band III	CH100	5500

Note: (1) The measurements are performed at the lowest available channels.

3.4.Measurement Uncertainty (95% confidence levels, k=2)

Item	MU	Remark
Uncertainty for conducted RF Power	0.37dB	

5. DFS PARAMETERS

5.1. DFS Parameters

Table 1: Applicability of DFS Requirements Prior to Use of a Channel

Requirement	Operational Mode		
	Master	Client Without Radar Detection	Client With Radar Detection
Non-Occupancy Period	Yes	Not required	Yes
DFS Detection Threshold	Yes	Not required	Yes
Channel Availability Check Time	Yes	Not required	Not required
U-NII Detection Bandwidth	Yes	Not required	Yes

Table 2: Applicability of DFS requirements during normal operation

Requirement	Operational Mode		
	Master	Client Without Radar Detection	Client With Radar Detection
DFS Detection Threshold	Yes	Not required	Yes
Channel Closing Transmission Time	Yes	Yes	Yes
Channel Move Time	Yes	Yes	Yes
U-NII Detection Bandwidth	Yes	Not required	Yes
Client Beacon Test	N/A	Yes	Yes

Additional requirements for devices with multiple bandwidth modes	Operational Mode	
	Master or Client With Radar Detection	Client Without Radar Detection
U-NII Detection Bandwidth and Statistical Performance Check	All BW modes must be tested	Not required
Channel Move Time and Channel Closing Transmission Time	Test using widest BW mode available	Test using the widest BW mode available for the link
All other tests	Any single BW mode	Not required

Note

Frequencies selected for statistical performance check (Section 7.8.4) should include several frequencies within the radar detection bandwidth and frequencies near the edge of the radar detection bandwidth. For 802.11 devices it is suggested to select frequencies in each of the bonded 20 MHz channels and the channel center frequency.

Table 3: DFS Detection Thresholds for Master Devices and Client Devices With Radar Detection

Maximum Transmit Power	Value (see notes 1, 2, and 3)
EIRP ≥ 200 milliwatt	-64 dBm
EIRP < 200 milliwatt and power spectral density < 10 dBm/MHz	-62 dBm
EIRP < 200 milliwatt that do not meet the power spectral density requirement	-64 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.
Note 3: EIRP is based on the highest antenna gain. For MIMO devices refer to KDB Publication 662911 D01.

The radar Detection Threshold, lowest antenna gain is the parameter of Interference radar DFS detection threshold, The Interference Detection Threshold is the (-62dBm) + (0) [dBi]+ 1 dB= -61 dBm.

Table 4: DFS Response Requirement Values

Parameter	Value
Non-occupancy period	Minimum 30 minutes
Channel Availability Check Time	60 seconds
Channel Move Time	10 seconds See Note 1.
Channel Closing Transmission Time	200 milliseconds + an aggregate of 60 milliseconds over remaining 10 second period. See Notes 1 and 2.
U-NII Detection Bandwidth	Minimum 100% of the 99% power bandwidth See Note 3.

Note 1: The instant that the *Channel Move Time* and the *Channel Closing Transmission Time* begins is as follows:

- For the Short pulse radar Test Signals this instant is the end of the *Burst*.
- For the Frequency Hopping radar Test Signal, this instant is the end of the last radar *Burst* generated.
- For the Long Pulse radar Test Signal this instant is the end of the 12 second period defining the radar transmission.

Note 2: The *Channel Closing Transmission Time* is comprised of 200 milliseconds starting at the beginning of the *Channel Move Time* plus any additional intermittent control signals required to facilitate *Channel* changes (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 *U-NII Detection Bandwidth* detection test, radar type 0 is used and for each frequency step the minimum percentage of detection is 90%. Measurements are performed with no data traffic.

Table 5 – Short Pulse Radar Test Waveforms

Radar Type	Pulse Width (μsec)	PRI (μsec)	Number of Pulses	Minimum Percentage of Successful Detection	Minimum Number of Trials
0	1	1428	18	See Note 1	See Note 1
1	1	Test A: 15 unique PRI values randomly selected from the list of 23 PRI values in Table 5a	$\text{Roundup}\left\{\left(\frac{1}{360}\right)\cdot\left(\frac{19\cdot 10^6}{\text{PRI}_{\mu\text{sec}}}\right)\right\}$	60%	30
		Test B: 15 unique PRI values randomly selected within the range of 518-3066 μsec, with a minimum increment of 1 μsec, excluding PRI values selected in Test A			
2	1-5	150-230	23-29	60%	30
3	6-10	200-500	16-18	60%	30
4	11-20	200-500	12-16	60%	30
Aggregate (Radar Types 1-4)				80%	120
Note 1: Short Pulse Radar Type 0 should be used for the detection bandwidth test, channel move time, and channel closing time tests.					

Table 5a - Pulse Repetition Intervals Values for Test A

Pulse Repetition Frequency Number	Pulse Repetition Frequency (Pulses Per Second)	Pulse Repetition Interval (Microseconds)
1	1930.5	518
2	1858.7	538
3	1792.1	558
4	1730.1	578
5	1672.2	598
6	1618.1	618
7	1567.4	638
8	1519.8	658
9	1474.9	678
10	1432.7	698
11	1392.8	718
12	1355	738
13	1319.3	758
14	1285.3	778
15	1253.1	798
16	1222.5	818
17	1193.3	838
18	1165.6	858
19	1139	878
20	1113.6	898
21	1089.3	918
22	1066.1	938
23	326.2	3066

The aggregate is the average of the percentage of successful detections of Short Pulse Radar Types 1-4. For example, the following table indicates how to compute the aggregate of percentage of successful detections.

Radar Type	Number of Trials	Number of Successful Detections	Minimum Percentage of Successful Detection
1	35	29	82.9%
2	30	18	60%
3	30	27	90%
4	50	44	88%
Aggregate (82.9% + 60% + 90% + 88%)/4 = 80.2%			

Long Pulse Radar Test Waveform

Table 6 – Long Pulse Radar Test Waveform

Radar Type	Pulse Width (µsec)	Chirp Width (MHz)	PRI (µsec)	Number of Pulses per *Burst*	Number of *Bursts*	Minimum Percentage of Successful Detection	Minimum Number of Trials
5	50-100	5-20	1000-2000	1-3	8-20	80%	30

Figure 1 provides a graphical representation of the Long Pulse Radar Test Waveform.

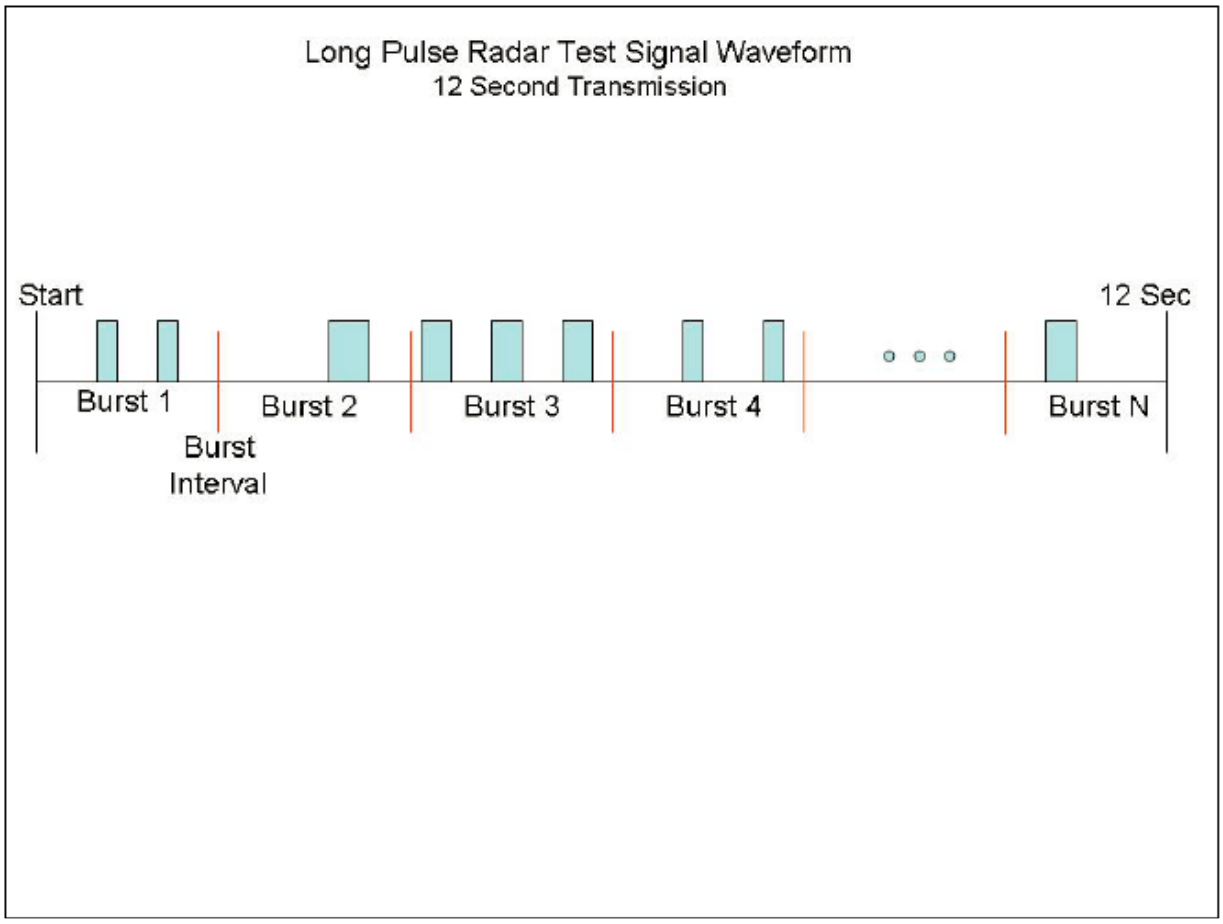


Table 7 – Frequency Hopping Radar Test Waveform

Radar Type	Pulse Width (µsec)	PRI (µsec)	Pulses per Hop	Hopping Rate (kHz)	Hopping Sequence Length (msec)	Minimum Percentage of Successful Detection	Minimum Number of Trials
6	1	333	9	0.333	300	70%	30

5.2. DFS –Test Results

4.2.1 DFS MEASUREMENT METHODS

a.DFS – CHANNEL CLOSING TRANSMISSION TIME AND CHANNEL MOVE TIME

Channel Move Time and the Channel Closing Transmission Time should be performed with Radar Type 0. The measurement timing begins at the end of the Radar Type 0 burst.
The Channel Closing Transmission Time is comprised of 200 milliseconds starting at the beginning of the Channel Move Time plus any additional intermittent control signals required to facilitate a Channel move (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.

b.DFS – CHANNEL NON-OCCUPANCY AND VERIFICATION OF PASSIVE SCANNING

Non-occupancy Period. A channel that has been flagged as containing a radar system, either by a channel availability check or in-service monitoring, is subject to a non-occupancy period of at least 30 minutes. The non-occupancy period starts at the time when the radar system is detected.

c.CHANNEL AVAILABILITY CHECK TIME

Channel Availability Check Time. A U-NII device shall check if there is a radar system already operating on the channel before it can initiate a transmission on a channel and when it has to move to a new channel. The U-NII device may start using the channel if no radar signal with a power level greater than the interference threshold values listed in paragraph (h)(2) of this section, is detected within 60 seconds.

d.CONTROL (TPC)

Compliance with the transmit power control requirements for devices is demonstrated through measurements showing multiple power levels and manufacturer statements explaining how the power control is implemented.

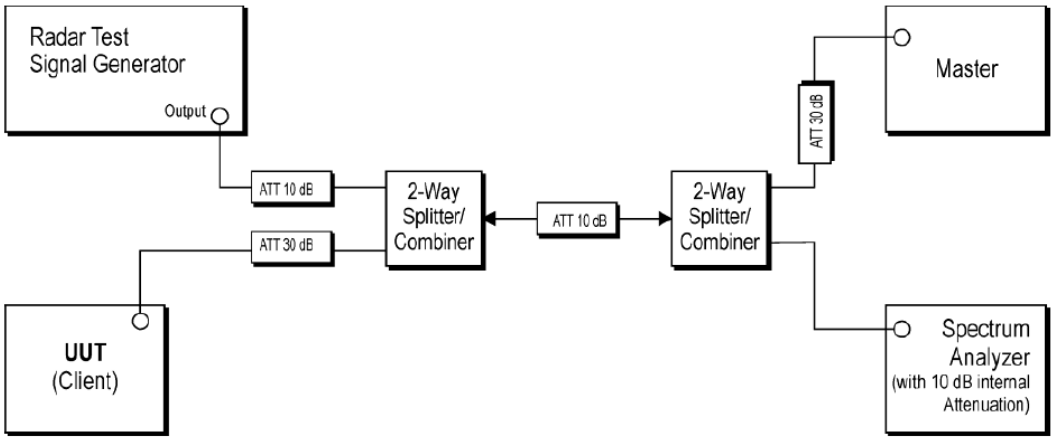
e.DETECTION PROBABILITY / SUCCESS RATE
During the U-NII Detection Bandwidth detection test, radar type 0 should be used. For each frequency step the minimum percentage of detection is 90 percent. Measurements are performed with no data traffic. Minimum 100% of the U-NII 99% transmission power bandwidth.

f.NON- OCCUPANCY PERIOD

During the 30 minutes observation time, UUT did not make any transmissions on a channel after a radar signal was detected on that channel by either the Channel Availability Check or the In-Service Monitoring

4.2.2 DFS CONDUCTIONTEST METHOD

a.The signal level of the simulated waveform is set to a reference level equal to the threshold level (plus 1dB if testing against FCC requirements).
Lower levels may also be applied on request of the manufacturer.
The signal level is verified by measuring the CW signal level at the coupling point to the RDD antenna port. The radar signal level is calculated from the measured level, R (dBm) and the lowest gain antenna assembly intended for use with the RDD
If both master and client devices have radar detection capability then the radar level at the non RDD is verified to be at least 20dB below the threshold level to ensure that any responses are due to the RDD detecting radar.
The antenna connected to the channel monitoring subsystem is positioned to allow both master and client transmissions to be observed, with the level of the EUT's transmissions between 6 and 10dB higher than those from the other device.

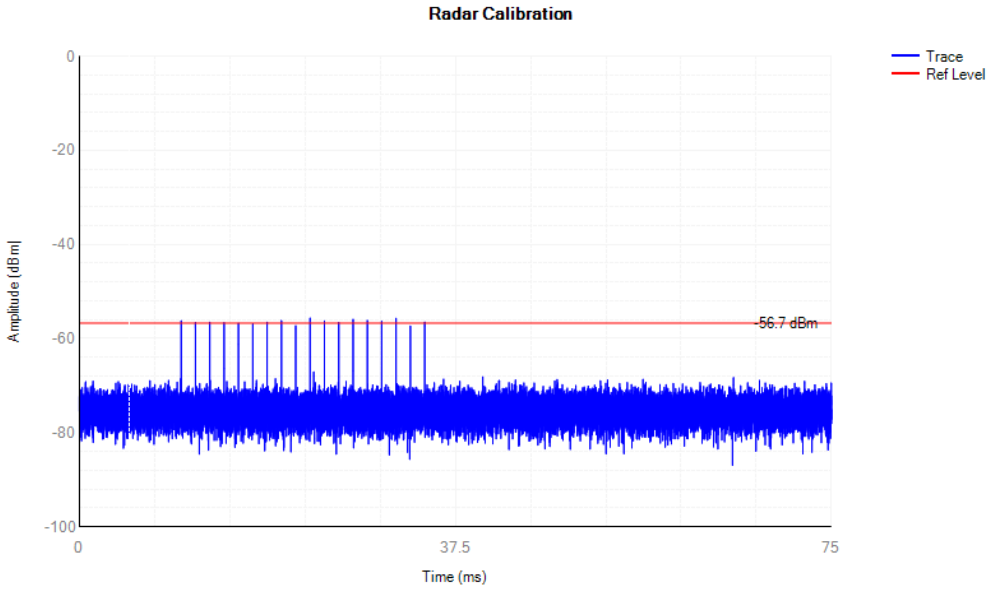


b. *Set-up B* is a set-up whereby the UUT is an RLAN device operating in slave mode, with or without Radar Interference Detection function.
This set-up also contains an RLAN device operating in master mode.
The radar test signals are injected into the master device.
The UUT (slave device) is associated with the master device.
Figure 5 shows an example for *Set-up B*. The set-up used shall be documented in the test report.

Radar Waveform Calibration Result

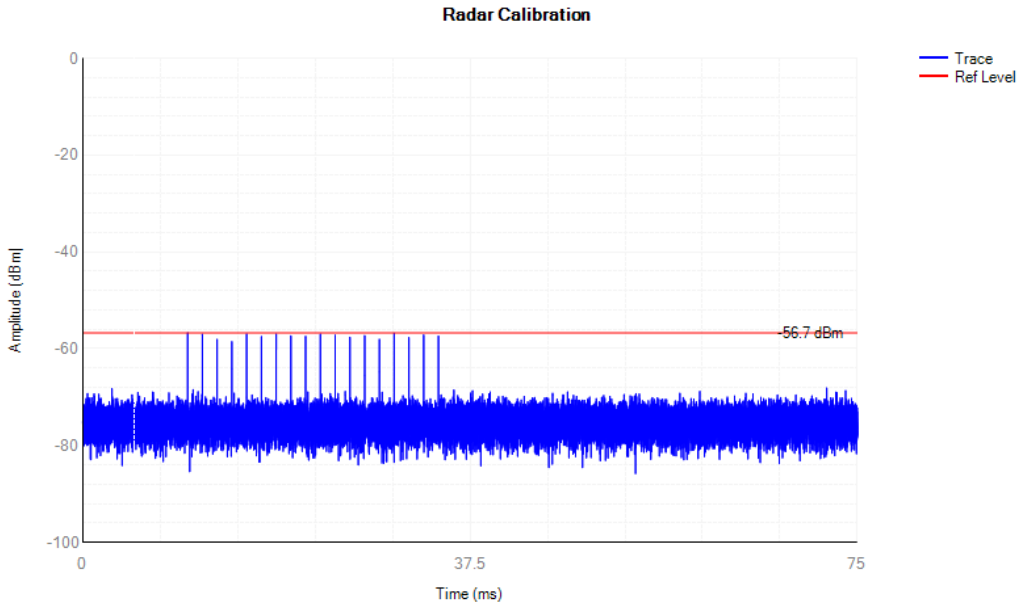
<20MHz / 5300 MHz> In-Service Monitoring

Radar / DFS detection threshold level and the burst of pulses on the Channel frequency



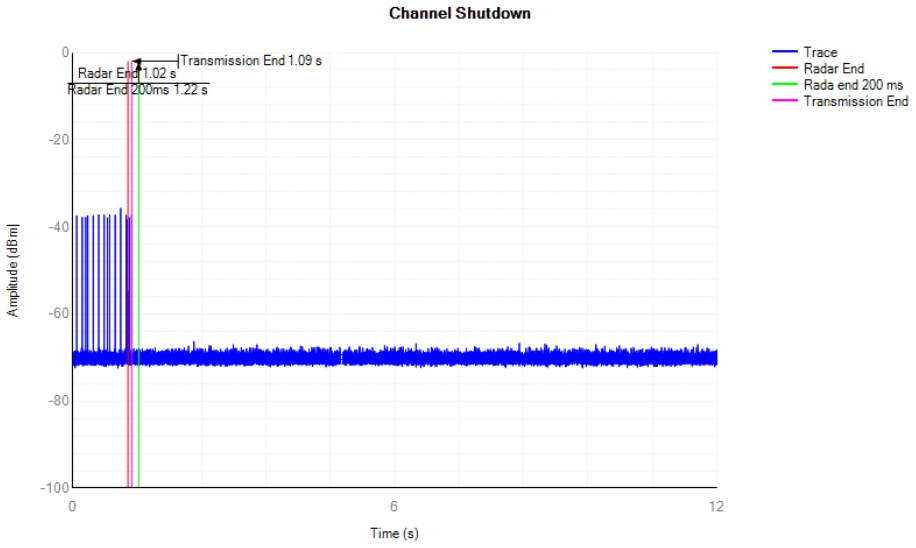
<20MHz / 5500 MHz> In-Service Monitoring

Radar / DFS detection threshold level and the burst of pulses on the Channel frequency

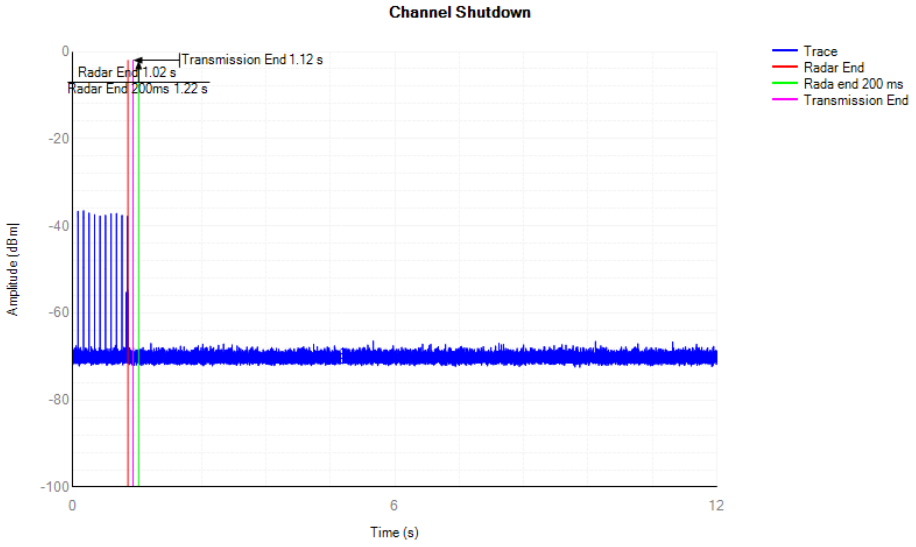


Channel Move Time, Channel Closing Transmission Time and Non-Occupancy Period for Client Beacon Test Plots

<20MHz / 5300 MHz> In-Service Monitoring



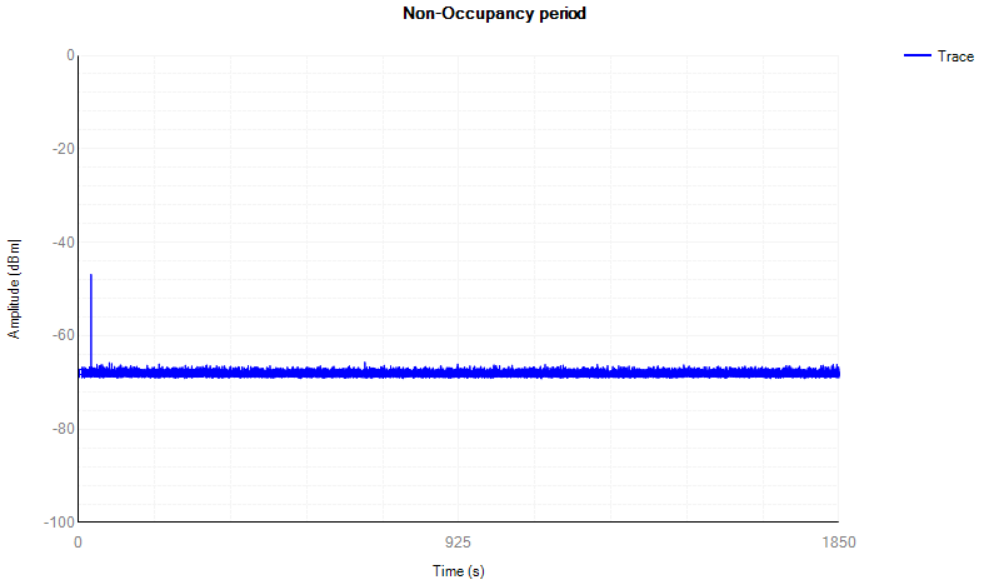
<20MHz / 5500 MHz> In-Service Monitoring



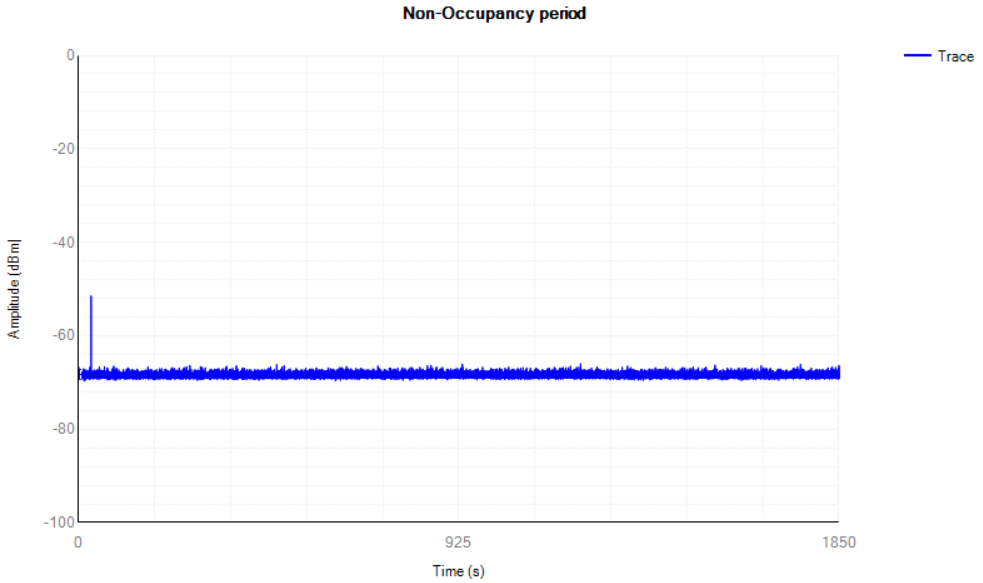
Data Traffic and Noise Floor Plots

Noise Floor (No transmission)

<20MHz / 5300 MHz Non-Occupancy >



<20MHz / 5500 MHz Non-Occupancy >



Note: 1. All the test modes and all antennas have been tested. only the worst data of each pattern is reflected.

6. SETUP PHOTO

--------END OF REPORT-------