FCC Test Report

Applicant	:	**Matco Tools**
Address	:	**4403 Allen Rd. Stow, OH 44224 USA, Stow, Ohio, United States**
Product Name	:	**Automotive Diagnostic Scan Tool**
Report Date	:	**Nov. 20, 2023**

Shenzhen Anbotek Compliance Laboratory Limited

Contents

TEST REPORT

Applicant	:	Matco Tools
Manufacturer	:	Matco Tools
Product Name	:	Automotive Diagnostic Scan Tool
Test Model No.	:	MAXIMUS5.0
Reference Model No.	:	N/A
Trade Mark	:	MATCO TOOLS
Rating(s)	:	Input: 12V 4A(with DC 7.6V, 9360mAh battery inside)

Test Standard(s) : FCC Part15 Subpart E, Paragraph 15.407

Test Method(s) : FCC KDB 905462 D02 UNII DFS Compliance Procedures New Rules v02

The device described above is tested by Shenzhen Anbotek Compliance Laboratory Limited to determine the maximum emission levels emanating from the device and the severe levels of the device can endure and its performance criterion. The measurement results are contained in this test report and Shenzhen Anbotek Compliance Laboratory Limited is assumed full of responsibility for the accuracy and completeness of these measurements. Also, this report shows that the EUT (Equipment Under Test) is technically compliant with the FCC Part 15 Subpart E requirements.

This report applies to above tested sample only and shall not be reproduced in part without written approval of Shenzhen Anbotek Compliance Laboratory Limited.

Date of Receipt Oct. 25, 2023

Date of Test Oct. 25, 2023 to Nov. 13, 2023

Prepared By

(TuTu Hong)

Approved & Authorized Signer

(Edward Pan)

Revision History

Report Version	Description	Issued Date
R00	Original Issue.	Nov. 20, 2023

1. General Information

1.1. Client Information

Applicant	:	Matco Tools
Address	:	4403 Allen Rd. Stow, OH 44224 USA, Stow, Ohio, United States
Manufacturer	:	Matco Tools
Address	:	4403 Allen Rd. Stow, OH 44224 USA, Stow, Ohio, United States

1.2. Description of Device (EUT)

Product Name	:	Automotive Diagnostic Scan Tool
Test Model No.	:	MAXIMUS5.0
Reference Model No.	:	N/A
Trade Mark	:	MATCO TOOLS®
Test Power Supply	:	AC 120V/60Hz for adapter; DC 7.6V battery inside
Test Sample No.	:	1-2-1(Normal Sample), 1-2-2(Engineering Sample)
Adapter	:	Model: XDJ481D-120400 Input: 100-240V~50/60Hz 1.8A Output: 12.0V 4.0A 48.0W
RF Specification		
Operation Mode	:	☒ a ☒ n(HT20) ☒ n(HT40) ☒ ac(VHT20) ☒ ac(VHT40) ☒ ac(VHT80) ☐ ac(VHT160) ☒ ax(HEW20) ☒ ax(HEW40) ☒ ax(HEW80) ☐ ax(HEW160)
Device Type	:	☐ Outdoor AP ☐ Indoor AP ☐ Point-to-point AP ☒ Client
TPC Function	:	☐ With TPC ☒ Without TPC
DFS Type	:	☒ Slave without radar detection ☐ Slave with radar detection ☐ Master
Operation Frequency	:	☒ Wi-Fi 5.3G: 5250~5350MHz ☐ Wi-Fi 5.6G: 5470~5725MHz
Number of Channel	:	Wi-Fi 5.3G: ☒ 4 Channels for 20MHz bandwidth (5260-5320MHz)

		☒2 Channels for 40MHz bandwidth (5270-5310MHz) ☒1 Channels for 80MHz bandwidth (5290MHz) Wi-Fi 5.6G: ☐11 Channels for 20MHz bandwidth (5500-5700MHz) ☐5 Channels for 40MHz bandwidth (5510-5670MHz) ☐2 Channels for 80MHz bandwidth (5530~5610MHz)
Modulation Type	:	☒802.11a: OFDM (64QAM, 16QAM, QPSK, BPSK) ☒802.11n: OFDM (BPSK, QPSK, 16QAM, 64QAM) ☒802.11ac: OFDM (BPSK, QPSK, 16QAM, 64QAM, 256QAM) ☒802.11ax: OFDMA(BPSK, QPSK, 16QAM, 64QAM, 256QAM, 1024QAM)
Antenna Type	:	FPC Aantenna
Antenna Gain(Peak)	:	ANT 1: Wi-Fi 5.2G: 3.38dBi Wi-Fi 5.3G: 3.62dBi Wi-Fi 5.8G: 1.64dBi ANT 2: Wi-Fi 5.2G: 3.37dBi Wi-Fi 5.3G: 3.08dBi Wi-Fi 5.8G: 2.42dBi
Remark: 1) All of the RF specification are provided by customer. 2) For a more detailed features description, please refer to the manufacturer's specifications or the User's Manual. 3) ANT 1 and ANT 2 can not support MIMO.		

1.3. Auxiliary Equipment Used During Test

Description	Rating(s)
Master device	Equipment: AX3000 Dual-Band Gigabit Wi-Fi 6 Router Model: RX9 Pro FCC-ID: V7TRX9P
Mi router 4A	Manufacturer: Mi Model: R4AC CMIIT ID: 2018AP5403

1.4. Description of Test Facility

The test facility is recognized, certified, or accredited by the following organizations:

FCC-Registration No.: 184111

Shenzhen Anbotek Compliance Laboratory Limited, EMC Laboratory has been registered and fully described in a report filed with the (FCC) Federal Communications Commission. The acceptance letter from the FCC is maintained in our files. Registration No. 184111.

ISED-Registration No.: 8058A

Shenzhen Anbotek Compliance Laboratory Limited, EMC Laboratory has been registered and fully described in a report filed with the (ISED) Innovation, Science and Economic Development Canada. The acceptance letter from the ISED is maintained in our files. Registration 8058A.

Test Location

Shenzhen Anbotek Compliance Laboratory Limited.
1/F, Building D, Sogood Science and Technology Park, Sanwei community, Hangcheng Street, Bao'an District, Shenzhen, Guangdong, China.

1.5. Disclaimer

1. The test report is invalid if not marked with the signatures of the persons responsible for preparing and approving the test report.
2. The test report is invalid if there is any evidence and/or falsification.
3. The results documented in this report apply only to the tested sample, under the conditions and modes of operation as described herein.
4. This document may not be altered or revised in any way unless done so by Anbotek and all revisions are duly noted in the revisions section.
5. Content of the test report, in part or in full, cannot be used for publicity and/or promotional purposes without prior written approval from the laboratory.
6. The authenticity of the information provided by the customer is the responsibility of the customer and the laboratory is not responsible for its authenticity.

The laboratory is only responsible for the data released by the laboratory, except for the part provided by the applicant.

1.6. Channel List

Frequency Band	Mode	Test channel	Frequency (MHz)
5.3GHz	OFDM 802.11a/n(HT20) /ac(HT20)/ax(HE20)	CH 52	5260
		CH 56	5280
		CH 60	5300
		CH 64	5320
	OFDM 802.11n(HT40)/ac(HT40)/ax(HE40)	CH 54	5270
		CH 62	5310
	OFDM 802.11ac(HT80)/ax(HE80)	CH 58	5290

1.7. Antenna Specification:

Ant.	Antenna Type	Connector	Gain (dBi)
1	FPC	N/A	3.62
2	FPC	N/A	3.08

1.8. Table for Antenna Configuration:

Operating Mode / TX Mode	1TX
802.11a	V
802.11n(HT20)	V
802.11ac(HT20)	V
802.11n(HT40)	V
802.11ac(HT40)	V
802.11ac(HT80)	V
802.11ax(HE20)	V
802.11ax(HE40)	V
802.11ax(HE80)	V

1.9. Maximum Output Power And E.I.R.P.

Mode: TX (802.11a)				
Frequency Band (MHz)	Max Average Output Power (dBm)	Gain (dBi)	Max. e.i.r.p. (dBm)	Max. e.i.r.p. (mW)
5250~5350	12.7	3.62	16.32	42.85

Mode: TX (802.11n(HT20))				
Frequency Band (MHz)	Max Average Output Power (dBm)	Gain (dBi)	Max. e.i.r.p. (dBm)	Max. e.i.r.p. (mW)
5250~5350	13.56	3.62	17.18	52.24

Mode: TX (802.11ac(HT20))				
Frequency Band (MHz)	Max Average Output Power (dBm)	Gain (dBi)	Max. e.i.r.p. (dBm)	Max. e.i.r.p. (mW)
5250~5350	12.72	3.62	16.34	43.05

Mode: TX (802.11ax(HT20))				
Frequency Band (MHz)	Max Average Output Power (dBm)	Gain (dBi)	Max. e.i.r.p. (dBm)	Max. e.i.r.p. (mW)
5250~5350	12.62	3.62	16.24	42.07

Mode: TX (802.11n(HT40))				
Frequency Band (MHz)	Max Average Output Power (dBm)	Gain (dBi)	Max. e.i.r.p. (dBm)	Max. e.i.r.p. (mW)
5250~5350	13.54	3.62	17.16	51.99

Mode: TX (802.11ac(HT40))				
Frequency Band (MHz)	Max Average Output Power (dBm)	Gain (dBi)	Max. e.i.r.p. (dBm)	Max. e.i.r.p. (mW)
5250~5350	14.8	3.62	18.42	69.50

Mode: TX (802.11ax(HT40))				
Frequency Band (MHz)	Max Average Output Power (dBm)	Gain (dBi)	Max. e.i.r.p. (dBm)	Max. e.i.r.p. (mW)
5250~5350	13.26	3.62	16.88	48.75

Mode: TX (802.11ac(HT80))				
Frequency Band (MHz)	Max Average Output Power (dBm)	Gain (dBi)	Max. e.i.r.p. (dBm)	Max. e.i.r.p. (mW)
5250~5350	13.29	3.62	16.91	49.09

Mode: TX (802.11ax(HT80))				
Frequency Band (MHz)	Max Average Output Power (dBm)	Gain (dBi)	Max. e.i.r.p. (dBm)	Max. e.i.r.p. (mW)
5250~5350	14.39	3.62	18.01	63.24

1.10. Transmit Power Control (TPC)

U-NII devices operating in the 5.25-5.35 GHz band and the 5.47-5.725 GHz band shall employ a TPC mechanism. The U-NII device is required to have the capability to operate at least 6 dB below the mean EIRP value of 30 dBm. A TPC mechanism is not required for systems with an e.i.r.p. of less than 500 mW.

Applicable	EIRP	FCC 15.407 (h)(1)
●	>500mW	The TPC mechanism is required for system with an EIRP of above 500mW
☼	<500mW	The TPC mechanism is not required for system with an EIRP of less 500mW

The UUT can adjust a transmitter's output power based on the signal level present at the receiver.TPC is auto controlled by software.

2. U-NII DFS Rule Requirements

2.1. Working Modes and Required Test Items

The manufacturer shall state whether the UUT is capable of operating as a Master and/or a Client. If the UUT is capable of operating in more than one operating mode then each operating mode shall be tested separately. See tables 6 and 7 for the applicability of DFS requirements for each of the operational modes.

Applicability of DFS Requirements Prior to Use a Channel

Requirement	Operational Mode		
	Master	Client without radar detection	Client with radar detection
Non-Occupancy Period	√	Not required	√
DFS Detection Threshold	√	Not required	√
Channel Availability Check Time	√	Not required	Not required
U-NII Detection Bandwidth	√	Not required	√

Applicability of DFS Requirements during Normal Operation

Requirement	Operational Mode		
	Master	Client without radar detection	Client with radar detection
DFS Detection Threshold	√	Not required	√
Channel Closing Transmission Time	√	√	√
Channel Move Time	√	√	√
U-NII Detection Bandwidth	√	Not required	√

Additional requirements for devices with multiple bandwidth modes	Master Device 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.		

2.2. Test Limits and Radar Signal Parameters

Detection Threshold Values:

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.	

Test Limit:

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 U-NII 99% transmission power bandwidth. See Note 3
Note 1: 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. 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 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. Note 3: 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.	

Parameters of DFS Test Signals And Minimum Percentage of Successful Detections:

Step intervals of 0.1 microsecond for Pulse Width, 1 microsecond for PRI, 1 MHz for chirp width and 1 for the number of pulses will be utilized for the random determination of specific test waveforms.

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	Roundup $\left\{\left(\frac{1}{360}\right)\cdot\left(\frac{19\cdot10^6}{PRI_{\mu sec}}\right)\right\}$	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.					

A minimum of 30 unique waveforms are required for each of the Short Pulse Radar Types 2 through 4. If more than 30 waveforms are used for Short Pulse Radar Types 2 through 4, then each additional waveform must also be unique and not repeated from the previous waveforms. If more than 30 waveforms are used for Short Pulse Radar Type 1, then each additional waveform is generated with Test B and must also be unique and not repeated from the previous waveforms in Tests A or B.

For example if in Short Pulse Radar Type 1 Test B a PRI of 3066 μsec is selected, the number of pulses would be Roundup $\left\{\left(\frac{1}{360}\right)\cdot\left(\frac{19\cdot10^6}{3066}\right)\right\}$ = Round up {17.2} = 18.

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.

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	5-100	5-20	1000-2000	1-3	8-20	80%	30

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

For the Frequency Hopping Radar Type, the same Burst parameters are μsed for each waveform. The hopping sequence is different for each waveform and a 100-length segment is selected from the hopping sequence defined by the following algorithm: If a segment does not contain at least 1 frequency within the U-NII Detection Bandwidth of the UUT, then that segment is not μsed.

The first frequency in a hopping sequence is selected randomly from the group of 475 integer frequencies from 5250 – 5724 MHz. Next, the frequency that was just chosen is removed from the group and a frequency is randomly selected from the remaining 474 frequencies in the group. This process continues until all 475 frequencies are chosen for the set. For selection of a random frequency, the frequencies remaining within the group are always treated as equally likely.

3. Test Equipment List

Item	Equipment	Manufacturer	Model No.	Serial No.	Last Cal.	Cal. Interval
1.	MAX Spectrum Analysis	Agilent	N9020A	MY51170037	Feb. 23, 2023	1 Year
2.	MXA Spectrum Analysis	KEYSIGHT	N9020A	MY53280032	Feb. 23, 2023	1 Year
3.	RF Control Unit	Tonscend	JS0806-2	21G8060455	Feb. 23, 2023	1 Year
4.	MXG RF Vector Signal Generator	Agilent	N5182A	MY48180656	Feb. 23, 2023	1 Year

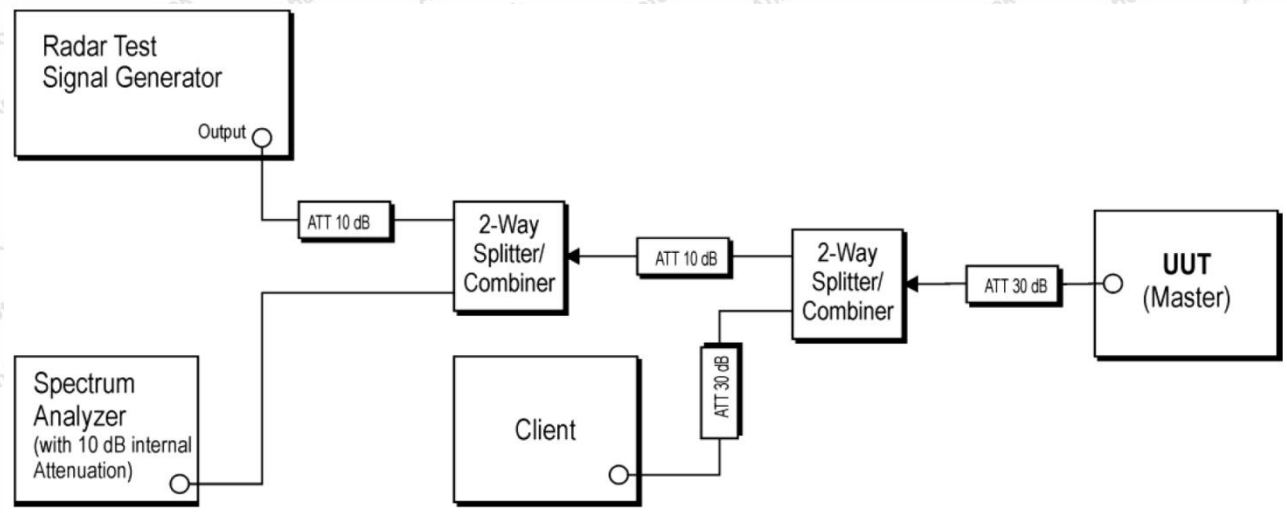
4. Dynamic Frequency Selection (DFS)

4.1. DFS Measurement System

Test Procedure:

1. Master device and client device are set up by conduction method as the following configuration.
2. The client device is connected to notebook and to access a IP address on wireless connection with the master device.
3. Then the master device is connected to another notebook to access a IP address.
4. Finally, let the two IP addresses run traffic with each other through the Run flow software “iPerf.exe” to reach 17% channel loading as below.
5. The time for the device to fully start up is 65s.

Setup for Master with injection at the Master



Radar Test Waveforms are injected into the Master.

4.2. Calibration of DFS Detection Threshold Level

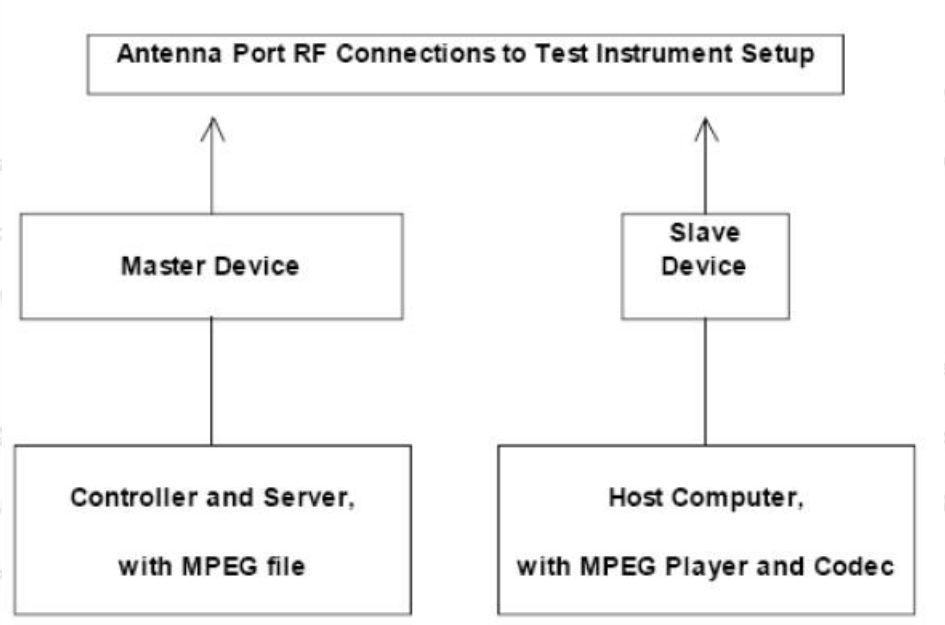
A 50 ohm load is connected in place of the spectrum analyzer, and the spectrum analyzer is connected in place of the master device and the signal generator is set to CW mode. The amplitude of the signal generator is adjusted to yield a level of -64dBm as measured on the spectrum analyzer.

Without changing any of the instrument settings, the spectrum analyzer is reconnected to the Common port of the Spectrum Analyzer Combiner/Divider. Measure the amplitude and calculate the difference from -64 dBm. Adjust the Reference Level Offset of the spectrum analyzer to this difference.

The spectrum analyzer displays the level of the signal generator as received at the antenna ports of the Master Device. The interference detection threshold may be varied from the calibrated value of -64 dBm and the spectrum analyzer will still indicate the level as received by the Master Device.

Set the signal generator to produce a radar waveform, trigger a burst manually and measure the level on the spectrum analyzer. Readjust the amplitude of the signal generator as required so that the peak

level of the waveform is at a displayed level equal to the required or desired interference detection threshold. Separate signal generator amplitude settings are determined as required for each radar type.



4.3. Deviation from Test Standard

No deviation.

5. Test Results

5.1. Summary of Test Results

Standard	Test Type	Remarks	Result
FCC 15.407	Channel Move Time	Applicable	PASS
FCC 15.407	Channel Closing Transmission Time	Applicable	PASS
FCC 15.407	Channel Loading	Applicable	PASS

5.2. DFS Detection Threshold

Calibration:

DFS Threshold Level	
DFS Threshold Level (3.62dBi antenna):-57.38dBm	☼At the antenna connector
	✉In front of the antenna

Note: For SISO mode, the maximum EIRP is less than 200 milliwatt, the antenna gain is 3.62dBi. According to clause 2.2 of this report. The detection threshold level is -57.38dBm.

Please refer to Appendix A of the Appendix Test Data.

5.3. Channel Move Time And Channel Closing Transmission Time

Please refer to Appendix C of the Appendix Test Data.

5.4. Channel Loading

Please refer to Appendix B of the Appendix Test Data.

APPENDIX I -- TEST SETUP PHOTOGRAPH

Please refer to separated files Appendix I -- Test Setup Photograph_DFS

APPENDIX II -- EXTERNAL PHOTOGRAPH

Please refer to separated files Appendix II -- External Photograph

APPENDIX III -- INTERNAL PHOTOGRAPH

Please refer to separated files Appendix III -- Internal Photograph

---------- End of Report ----------