FCC Part 15 Subpart E §15.407

Test Report

Equipment Under Test	**Car AVN**
Model Name	**DGU-8745-C300SA-1**
Variant Model Name	**DGU-8745-X150SA-1**
FCC ID	**2AE77DGU8745C300SA1**
Applicant	**DIGEN**
Manufacturer	**DIGEN**
Date of Test(s)	**2018. 11. 26 ~ 2019. 01. 10**
Date of Issue	**2019. 01. 31**

In the configuration tested, the EUT complied with the standards specified above.

Issue to	Issue by
DIGEN 89, Seongseo4chacheomdan-ro, Dalseo-gu, Daegu, 704-801, Korea Tel.: +82-70-4850-3311 Fax: +82-2-532-8811	**MOVON CORPORATION** 498-2, Geumeo-ro, Pogok-eup, Cheoin-gu, Yongin-si, Gyeonggi-do, Korea, 17030 Tel.: +82-31-338-8837 Fax: +82-31-338-8847

Revision history

Revision	Date of issue	Description	Revised by
--	Jan 31, 2019	Initial	-

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1. Applicant Information

1.1. Details of applicant

Applicant	:	DIGEN
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Contact Person	:	Jun Kim
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1.2. Manufacturer Information

Manufacturer	:	DIGEN
Address	:	89, Seongseo4chacheomdan-ro, Dalseo-gu, Daegu, 704-801, Korea

2. Laboratory Information

Company name	:	MOVON CORPORATION
Test site number	:	FCC (KR0151)
Address	:	498-2, Geumeo-ro, Pogok-eup, Cheoin-gu, Yongin-si, Gyeonggi-do, South Korea
Test site number	:	IC (6432B-3)
Address	:	194-1 Geumeo-ri, Pogok-eup, Cheoin-gu, Yongin-si, Gyeonggi-do 449-812 Korea
Test site number	:	IC (21313-1)
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Web site	:	http://www.movonlab.com
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3. Summary of test results

The EUT has been tested according to the following specifications:

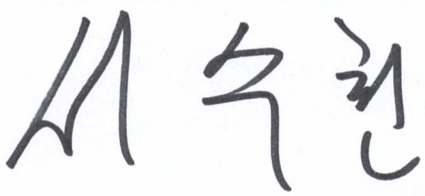
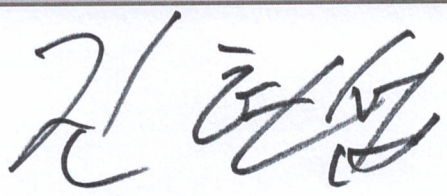
Section in FCC part 15	Description	Result
§15.407(h)	Dynamic frequency selection	C

※ Abbreviation

C Complied
N/A Not applicable
F Fail

The sample was tested according to the following specification:
FCC Public Notice KDB 905462 D02 v02

Approval Signatories

Test and Report Completed by :	Report Approval by :
	
Suhyun Seo Test Engineer MOVON CORPORATION	Issac Jin Technical Manager MOVON CORPORATION

4. EUT Description

Kind of product	Car AVN
Model Name	DGU-8745-C300SA-1
Variant Model Name	DGU-8745-X150SA-1
FCC ID	2AE77DGU8745C300SA1
IC Number	-
Power supply	DC 13.5 V
Frequency range	UNII-1 5 180 ㎒ ~ 5 240 ㎒ (802.11a/n_HT20) 5 190 ㎒ ~ 5 230 ㎒ (802.11n_HT40) 5 210 ㎒ (802.11ac_VHT80) UNII-2A 5 260 ㎒ ~ 5 320 ㎒ (802.11a/n _HT20) 5 270 ㎒ ~ 5 310 ㎒ (802.11n _HT40) 5 290 ㎒ (802.11ac_VHT80) UNII-2C 5 500 ㎒ ~ 5 700 ㎒ (802.11a/n _HT20) 5 510 ㎒ ~ 5 670 ㎒ (802.11n _HT40) 5 530 ㎒ (802.11ac_VHT80) UNII-3 5 745 ㎒ ~ 5 805 ㎒ (802.11a/n _HT20) 5 755 ㎒ ~ 5 795 ㎒ (802.11n _HT40) 5 775 ㎒ (802.11ac_VHT80)
Modulation technique	OFDM
Number of channels	UNII-1 5 180 ㎒ ~ 5 240 ㎒_4 ch (802.11a/n_HT20) 5 190 ㎒ ~ 5 230 ㎒_2 ch (802.11n_HT40) 5 210 ㎒_1 ch (802.11ac_VHT80) UNII-2A 5 260 ㎒ ~ 5 320 ㎒_4 ch (802.11a/n _HT20) 5 270 ㎒ ~ 5 310 ㎒_2 ch (802.11n _HT40) 5 290 ㎒_1ch (802.11ac_VHT80) UNII-2C 5 500 ㎒ ~ 5 700 ㎒_8 ch (802.11a/n _HT20) 5 510 ㎒ ~ 5 670 ㎒_3 ch (802.11n _HT40) 5 530 ㎒_1 ch (802.11ac_VHT80) UNII-3 5 745 ㎒ ~ 5 805 ㎒_4 ch (802.11a/n _HT20) 5 755 ㎒ ~ 5 795 ㎒_2 ch (802.11n _HT40) 5 775 ㎒_1 ch (802.11ac_VHT80)
Antenna gain	0.00 ㏈i (Max.)
Test Site Registration Number	FCC (KR0151), IC (6432B-3), IC (21313-1)

4.1. Table for Test Modes and Frequency

Preliminary tests were performed in different data rate to find the worst radiated emission.
The data rate shown in the table below is the worst-case rate with respect to the specific test item.
Investigation has been done on all the possible configurations for searching the worst cases.
The following table is a list of the test modes shown in this test report.

Mode	Data rate (Worst case)	Frequency (Freq. MHz)
802.11a	6 Mbps	**UNII-1** **Lowest** (5 180) / **Middle** (5 200) / **Highest** (5 240) **UNII-2A** **Lowest** (5 260) / **Middle** (5 280) / **Highest** (5 320) **UNII-2C** **Lowest** (5 500) / **Middle** (5 580) / **Highest** (5 700) **UNII-3** **Lowest** (5 745) / **Middle** (5 785) / **Highest** (5 805)
802.11n_HT20	MCS0	**UNII-1** **Lowest** (5 180) / **Middle** (5 200) / **Highest** (5 240) **UNII-2A** **Lowest** (5 260) / **Middle** (5 280) / **Highest** (5 320) **UNII-2C** **Lowest** (5 500) / **Middle** (5 580) / **Highest** (5 700) **UNII-3** **Lowest** (5 745) / **Middle** (5 785) / **Highest** (5 805)
802.11n_HT40	MCS0	**UNII-1** **Lowest** (5 190) / **Highest** (5 230) **UNII-2A** **Lowest** (5 270) / **Highest** (5 310) **UNII-2C** **Lowest** (5 510) / **Middle** (5 550) / **Highest** (5 670) **UNII-3** **Lowest** (5 755) / **Highest** (5 795)
802.11ac_VHT80	MCS0	**UNII-1** **Lowest** (5 210) **UNII-2A** **Lowest** (5 290) **UNII-2C** **Lowest** (5 530) **UNII-3** **Lowest** (5 775)

5. Measurement equipment

Equipment	Manufacturer	Model	Serial number	Calibration Interval	Calibration date	Calibration due.
Test Receiver	R&S	ESVS30	829673/015	1 year	2018-12-06	2019-12-06
Signal Generator	R&S	SMB100A	178128	1 year	2018-12-07	2019-12-07
Spectrum Analyzer	R&S	FSV-40	100832	1 year	2018-05-28	2019-05-28
Power Meter	Agilent	E4416A	GB41290645	1 year	2018-05-29	2019-05-29
Power Sensor	Agilent	9327A	US40441490	1 year	2018-05-29	2019-05-29
Horn Antenna	R&S	HF906	100236	2 year	2017-04-25	2019-04-25
Horn Antenna	AH Systems	SAS-572	269	2 year	2017-08-01	2020-08-01
Horn Antenna	AH Systems	SAS-573	164	2 year	2018-04-26	2020-04-26
Bi-Log Ant.	S/B	VULB 9161SE	4159	2 year	2018-06-11	2020-06-11
Loop Antenna	ETS LINDGREN	6502	00118166	2 year	2018-10-30	2020-10-30
Power Amplifier	TESTEK	TK-PA18H	170013-L	1 year	2018-05-28	2019-05-28
Power Amplifier	MITEQ	AFS43-01002600	2048519	1 year	2018-10-29	2019-10-29
Power Amplifier	MITEQ	AMF-6F-26004000-33-8P-HS	1511665	1 year	2018-12-10	2019-12-10
Power Amplifier	SONOMA INSTRUMENT	310N	185428	1 year	2018-12-07	2019-12-07
Step Attenuator	Agilent	8494B	US37181955	1 year	2018-05-31	2019-05-31
Step Attenuator	Agilent	8496B	US39212569	1 year	2018-05-29	2019-05-29
Controller	INNCO	CO2000	CO2000/064/6961003/L	N/A	N/A	N/A
Antenna Master	INNCO	MA4000	MA4000/038/6961003/L	N/A	N/A	N/A
Controller	INNCO	CO3000	CO3000/812/34240914/L	N/A	N/A	N/A
Antenna Master	INNCO	MA4640-XP-ET	None	N/A	N/A	N/A
Power Divider	HP	11636B	12481	1 year	2018-05-31	2019-05-31
Power Divider	HP	11636B	50387	1 year	2018-05-31	2019-05-31
RF Cable	SUHNER	SUCOFLEX100	84047746	N/A	N/A	N/A
RF Cable	SUHNER	SUCOFLEX102	801270/2	N/A	N/A	N/A
RF Cable	SUHNER	SUCOFLEX102	801270/2	N/A	N/A	N/A

※Remark
Support equipment

Description	Manufacturer	Model	Serial number
Access Point	NETGEAR	WAC720	-
Notebook computer	DELL	Lattitude D510	-

6. Dynamic frequency selection

6.1. Applicability

The following table from KDB 905462 D02 v02 lists the applicable requirements for the DFS testing. The device evaluated in this report is considered a client device without radar detection capability

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 1. DFS Applicability

Requirement	Operational Mode	
	Master Device or Client with Radar Detection	Client Without Radar Detection
DFS Detection Threshold	Yes	Not required
Channel Closing Transmission Time	Yes	Yes
Channel Move Time	Yes	Yes
U-NII Detection Bandwidth	Yes	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.		

Table1.1 DFS During normal operation

6.2. Requirements

KDB 905462 D02 v02 the following are the requirements for Client Devices:

a) A Client Device will not transmit before having received appropriate control signals from a Master Device.

b) A Client Device will stop all its transmissions whenever instructed by a Master Device to which it is associated and will meet the Channel Move Time and Channel Closing Transmission Time requirements.
The Client Device will not resume any transmissions until it has again received control signals from a Master Device.

c) If a Client Device is performing In-Service Monitoring and detects a Radar Waveform above the DFS Detection Threshold, it will inform the Master Device. This is equivalent to the Master Device detecting the Radar Waveform and d) through f) of section 5.1.1 apply.

d) Irrespective of Client Device or Master Device detection the Channel Move Time and Channel Closing Transmission Time requirements remain the same.

e) The client test frequency must be monitored to ensure no transmission of any type has occurred for 30 minutes.
Note: If the client moves with the master, the device is considered compliant if nothing appears in the client non-occupancy period test. For devices that shutdown (rather than moving channels), no beacons should appear

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 Note3.
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 (and 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 the used. For each frequency step the minimum percentage of detection is 90 percent. Measurements are performed with no data traffic.	

Table.1.2 DFS Response Requirement Values

6.3. Parameters of DFS test signals

As the EUT is a Client Device with no Radar Detection only Zero type radar pulse is required for the testing. Radar Pulse type 0 was used in the evaluation of the Client device for the purpose of measuring the channel Move Time and the Channel Closing Transmission Time.

Radar Type	Pulse Width (μsec)	PRI (μsec)	Number of Pulses	Minimum Percentage of Successful Detection	Mnimum 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: {(1/360)*(19*10^6 PRI μsec)}	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.					

Table1.3 Short Pulse Radar Test Waveforms

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

Table1.4 Long Pulse Radar Test Waveforms

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

Table1.5 Frequency Hopping Radar Test Waveforms

6.4. Test setup

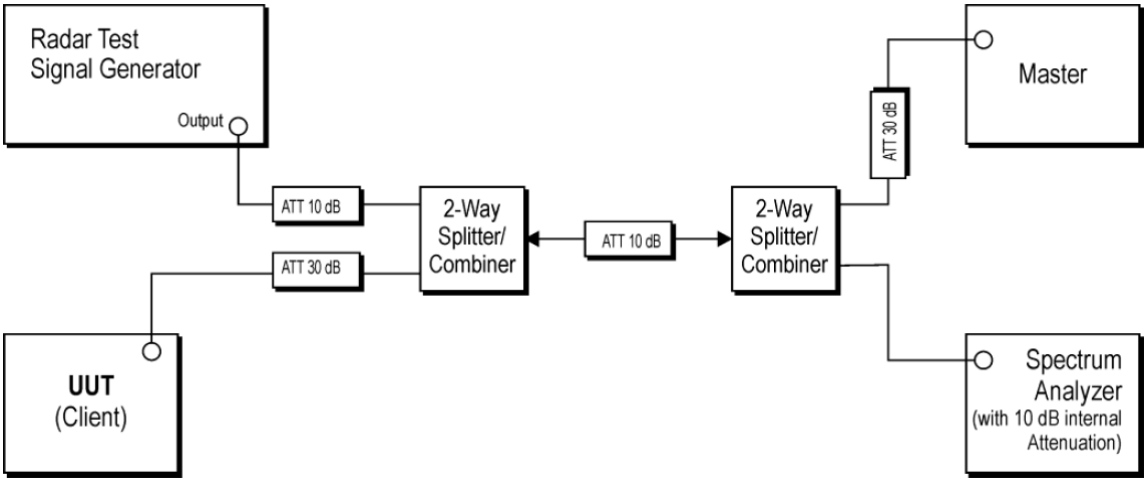


Figure 1: Conducted Test Setup for DFS

6.5. Test procedure

KDB 905462 D02 v02 describes a radiated test setup and a conducted test setup. The conducted test setup was used for this testing. Figure 1 shows the typical test setup.

1. One frequency will be chosen from the Operating Channels of the UUT within the 5250 ~5350 ㎒ or 5470 ~5725 ㎒ bands.
2. The Client Device (EUT) is setup per the diagram in Firure1 and communications between the Master device and the Client is established.
3. An MPEG or data file that is typical for the device is streamed from the Master to the Client to properly load he network.

6.6. Test results

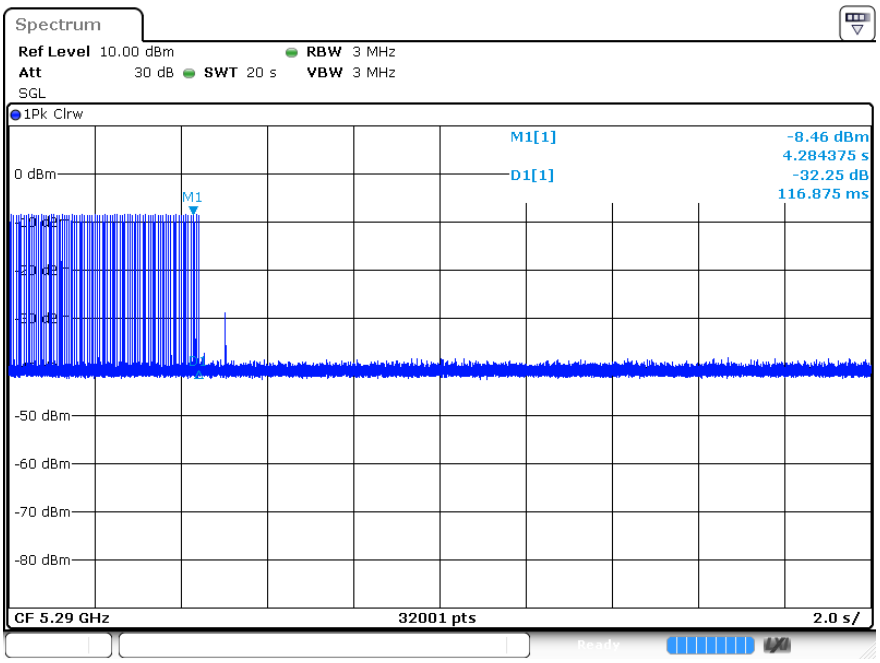
Freqency (MHz)	Parameter	Test Result
5 290	Channel move time	0.117 s
5 530	Channel move time	0.059 s

※Remark

Dwell = S / B
where **Dwell** is the dwell time per spectrum analyzer sampling bin, **S** is the sweep time and **B** is the number of spectrum analyzer sampling bins.
An upper bound of the aggregate duration of the *Channel Closing Transmission Time* is calculated by:
C = N * Dwell
where **C** is the Closing Time, **N** is the number of spectrum analyzer sampling bins showing a U-NII transmission and **Dwell** is the dwell time per bin.

6.6.1 Test plot

Test mode : 802.11a_UNII-2A (5 290 MHz)



Test mode : 802.11a_UNII-2A (5 530 MHz)