FCC Radio Test Report

FCC ID: SY4-B01012

Report No.	:	TB-FCC160061
Applicant	:	Shanghai Huace Navigation Technology LTD.
Equipment Under Test (EUT)		
EUT Name	:	Handheld GNSS Data Collector
Model No.	:	LT700
Serial Model No.	:	N/A
Trade Mark	:	CHCNAV
Receipt Date	:	2018-01-15
Test Date	:	2018-01-15 to 2018-04-13
Issue Date	:	2018-04-13
Conclusions	:	**PASS**

In the configuration tested, the EUT complied with the standards specified above,
The EUT technically complies with the FCC requirements

This report details the results of the testing carried out on one sample. The results contained in this test report do not relate to other samples of the same product. The manufacturer should ensure that all products in series production are in conformity with the product sample detailed in the report.

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TEST REPORT DECLARATION

Applicant	:	Shanghai Huace Navigation Technology LTD.
Address	:	Building C,599 Gaojing Road,Qingpu District, Shanghai, China
Manufacturer	:	Shanghai Huace Navigation Technology LTD.
Address	:	Building C,599 Gaojing Road,Qingpu District, Shanghai, China
EUT Description	:	Handheld GNSS Data Collector
	(A) Model No.	: LT700
	(B) Trademark	: CHCNAV

Measurement Standard Used:

FCC KDB 905462 D02

The device described above is tested by Shenzhen Toby Technology Co., Ltd. to determine the maximum emission levels emanating from the device. The maximum emission levels are compared to the FCC KDB 905462 D02 limits both conducted and radiated emissions. The test results are contained in this test report and Shenzhen Toby Technology 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 Toby Technology Co., Ltd.

Tested by (name + signature).....…..:	Ivan Su Project Engineer	…….
Approved by (name + signature)…....:	Ray Lai Project Manager	…….
Date of issue…… ……..:	April 13, 2018	

Revision History

Revision	Issue Date	Revisions	Revised By
00	April 13, 2018	Initial released Issue	Ray Lai

1. GENERAL INFORMATION

1.1.Description of Device (EUT)

Trade Name	:	CHCNAV
EUT	:	Handheld GNSS Data Collector
Model No.	:	LT700
DIFF.	:	N/A
Antenna Type	:	PIFA Antenna : 1.3dBi
Operation Frequency	:	IEEE 802.11n HT20: 5260MHz-5320MHz,5500MHz-5700MHz IEEE 802.11n HT40: 5260MHz-5320MHz,5500MHz-5700MHz IEEE 802.11a: 5260MHz-5320MHz,5500MHz-5700MHz IEEE 802.11 ac-20/40/80MHz: 5260MHz-5320MHz, 5500MHz-5700MHz
Modulation type	:	IIEEE 802.11n :OFDM(64QAM, 16QAM, QPSK, BPSK) IEEE 802.11a :OFDM(64QAM, 16QAM, QPSK, BPSK) IEEE 802.11ac: OFDM(256 QAM)
Power Supply	:	DC 3.8V by battery or DC 5V from adapter input AC 120V, 60Hz

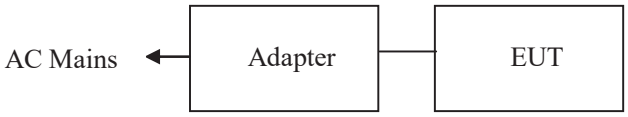
1.2.Accessories of Device (EUT)

Accessories1 : AC Adapter
Manufacturer : EDAC Power Electronics Co., Ltd.
Model : EA1012AVRU-050
Input : 100-240V~, 50/60Hz, 1.0A
Output : DC 5V, 2.4A

1.3.Tested Supporting System Details

No.	Description	Manufacturer	Model	Serial Number	Certification or DOC
1	Adapter	EDAC	EA1012AVRU-050	N/A	N/A
2	Router	Cisco Systems Inc	Air-CAP3702E-A-K9	N/A	FCC ID (FCC ID: LDK102087)
Note: master ping IP 192.168.1.3 for salve.					

1.4.Block Diagram of connection between EUT and simulators



2. EMC EQUIPMENT LIST

Equipment	Manufacturer	Model No.	Serial No.	Last Cal.	Cal. Due Date
Spectrum Analyzer	Agilent	E4407B	MY45106456	Jul. 20, 2017	Jul. 19, 2018
Spectrum Analyzer	Rohde & Schwarz	ESCI	100010/007	Jul. 20, 2017	Jul. 19, 2018
MXA Signal Analyzer	Agilent	N9020A	MY49100060	Oct. 26, 2017	Oct. 25, 2018
Vector Signal Generator	Agilent	N5182A	MY50141294	Oct. 26, 2017	Oct. 25, 2018
Analog Signal Generator	Agilent	N5181A	MY50141953	Oct. 26, 2017	Oct. 25, 2018
RF Power Sensor	DARE!! Instruments	RadiPowerRPR3006W	17I00015SNO26	Oct. 26, 2017	Oct. 25, 2018
	DARE!! Instruments	RadiPowerRPR3006W	17I00015SNO29	Oct. 26, 2017	Oct. 25, 2018
	DARE!! Instruments	RadiPowerRPR3006W	17I00015SNO31	Oct. 26, 2017	Oct. 25, 2018
	DARE!! Instruments	RadiPowerRPR3006W	17I00015SNO33	Oct. 26, 2017	Oct. 25, 2018
Signal analyzer	Agilent	N9020A	MY499100060	Sep. 23. 2017	Sep. 22. 2017
Vector signal generator	Agilent	N5182A	MY49060042	Sep. 22. 2017	Sep. 21. 2017

3. SUMMARY OF MEASUREMENT

3.1.Summary of test result

Test Item	Operation Mode		Result
	Master	Client	
Non-Occupancy Period	N/A	N/A	N/A
DFS Detection Threshold	N/A	N/A	N/A
Channel Availability Check Time	N/A	N/A	N/A
Channel Closing Transmission Time	N/A	Yes	Compliance
Channel Move Time	N/A	Yes	Compliance
U-NII Detection Bandwidth	N/A	N/A	N/A

3.2.Equipment Type

☐ Master Device

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

3.2.Channel list

For IEEE 802.11 a			
Channel	Frequency (MHz)	Channel	Frequency (MHz)
CH52	5260	CH56	5280
CH60	5300	CH64	5320
CH100	5500	CH104	5520
CH108	5540	CH112	5560
CH116	5580	CH120	5600
CH124	5620	CH128	5640
CH132	5660	CH136	5680
CH140	5700		

For IEEE 802.11 n/HT20			
Channel	Frequency (MHz)	Channel	Frequency (MHz)
CH52	5260	CH56	5280
CH60	5300	CH64	5320
CH100	5500	CH104	5520
CH108	5540	CH112	5560
CH116	5580	CH120	5600
CH124	5620	CH128	5640
CH132	5660	CH136	5680
CH140	5700		

For IEEE 802.11 n/HT40			
Channel	Frequency (MHz)	Channel	Frequency (MHz)
CH102	5510	CH134	5670
CH110	5550	CH151	5755
CH118	5590	CH159	5795
CH126	5630		

For IEEE 802.11ac20			
Channel	Frequency (MHz)	Channel	Frequency (MHz)
CH52	5260	CH56	5280
CH60	5300	CH64	5320
CH100	5500	CH104	5520
CH108	5540	CH112	5560
CH116	5580	CH120	5600
CH124	5620	CH128	5640
CH132	5660	CH136	5680
CH140	5700		

For IEEE 802.11ac40			
Channel	Frequency (MHz)	Channel	Frequency (MHz)
CH102	5510	CH134	5670
CH110	5550	CH151	5755
CH118	5590	CH159	5795
CH126	5630		

For IEEE 802.11ac80			
Channel	Frequency (MHz)	Channel	Frequency (MHz)
CH58	5290	CH106	5530

RF power

Band 2			
Max power		Min power	
5230MHz	9.43dBm	5290MHz	3.63dBm
Band 3			
Max power		Min power	
5580MHz	10.76dBm	5530MHz	4.82dBm

3.3.Test Conditions and channel

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

Channel List for 802.11ac(HT80)		
Band Frequency	EUT Channel	Test Frequency (MHz)
Band II	CH58	5290
Band III	CH106	5530

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	0.16dB	

4. DFS PARAMETERS

4.1.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 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.		

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. **Note3:** EIRP is based on the highest antenna gain. For MIMO devices refer to KDB Publication 662911 D01.	

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 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.	

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	Roundup $\left\{\left(\frac{1}{360}\right)\cdot\left(\frac{19\cdot 10^6}{PRI_{\mu sec}}\right)\right\}$	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.					

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.

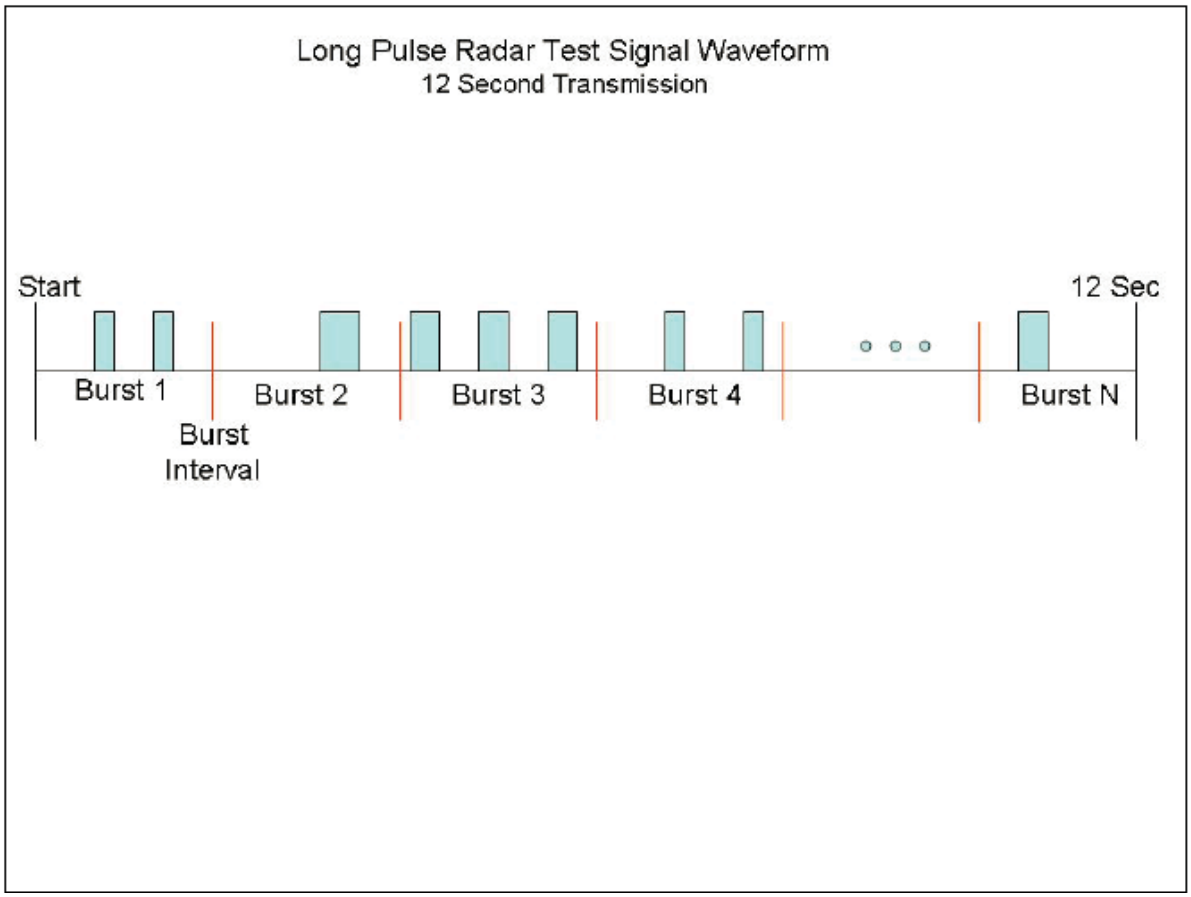


Table 7 – Frequency Hopping Radar Test Waveform

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

4.2.DFS Test Results

4.2.1 TEST RESULTS– FCC Part 15.407 CLIENT DEVICE

FCC Part 15.407 Client Device Test Result Summary						
Description	Radar Type	Radar Frequency	Measured Value	Requirement	Test Data	Result
Channel closing transmission time	0	5290	7ms	<60ms	4.2.4	Pass
Channel move time	0	5290	0.903s	<10s	4.2.4	Pass

FCC Part 15.407 Client Device Test Result Summary						
Description	Radar Type	Radar Frequency	Measured Value	Requirement	Test Data	Result
Channel closing transmission time	0	5530	7ms	<60ms	4.2.4	Pass
Channel move time	0	5530	0.903s	<10s	4.2.4	Pass

4.2.2 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 RadarType 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 \ dditional 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

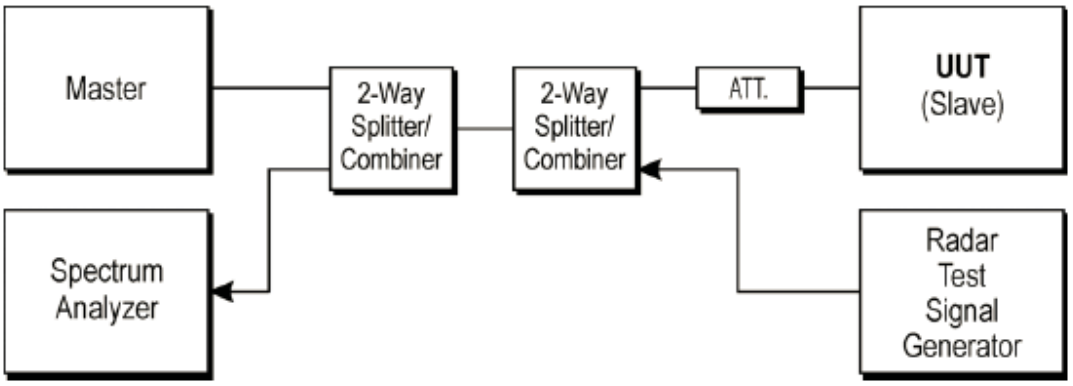
During the U-NII Detection Bandwidth detection test, radar type 0 should be used. For each frequency step the minimum percentage of detection is 90 percent. Measurements are performed with no data traffic. Minimum 100% of the U-NII 99% transmission power bandwidth.

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

4.2.3 DFS CONDUCTION TEST METHOD

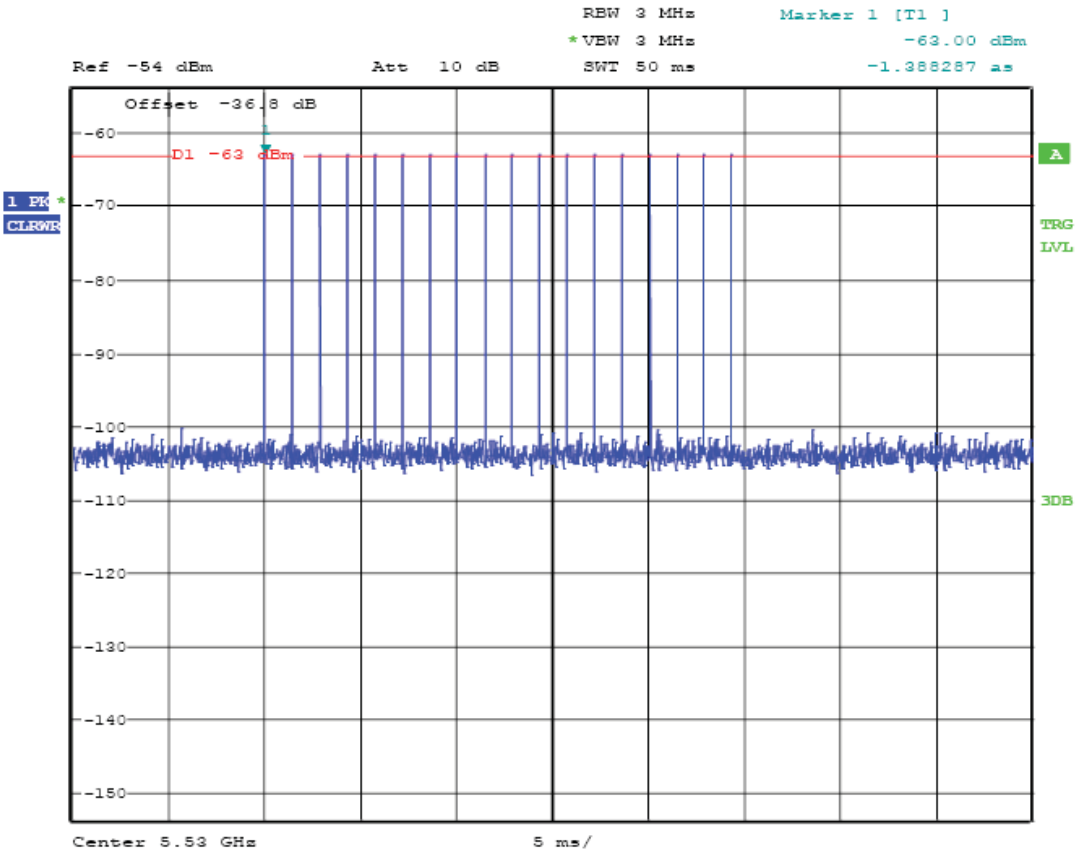
a. The signal level of the simulated waveform is set to a reference level equal to the threshold level (plus 1dB if testing against FCC requirements). Lower levels may also be applied on request of the manufacturer.
The signal level is verified by measuring the CW signal level at the coupling point to 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.



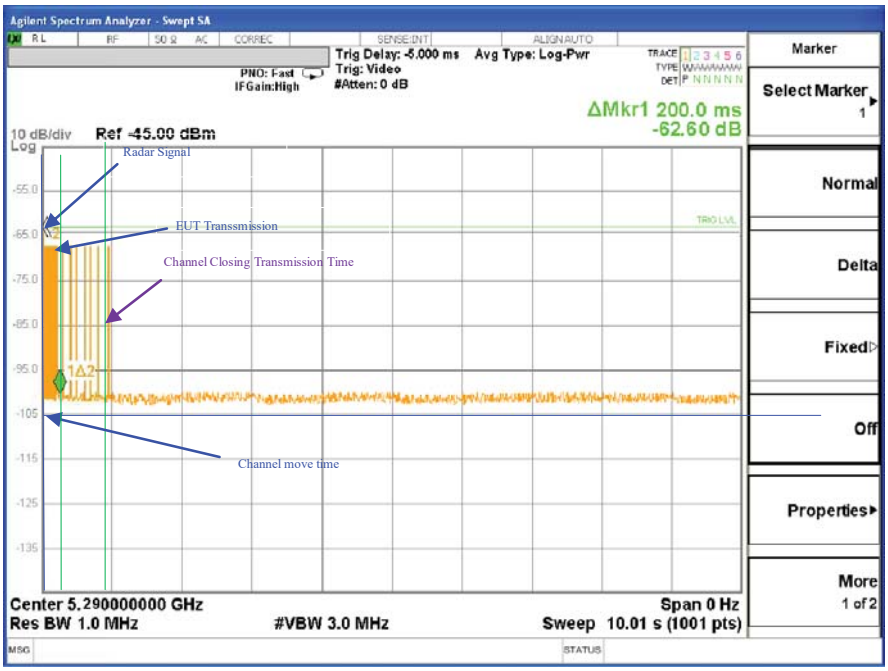
b.Set-upB is a set-up whereby the UUT is an RLAN device operating in slave mode, with or without Radar Interference Detection function. This set-up also contains an RLAN device operating in master mode. The radar test signals are injected into the master device. The UUT (slave device)is associated with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

4.2.4 DFS Test Data

Radar Type 0 Calibration



HT80 Channel move time & Channel Closing Transmission Time for Type 0 radar.



Note:

Dwell (1 ms)= Sweep Time (1001 ms) / Sweep Point Bins (1001)

Channel Closing Transmission Time (200 + 7 ms) = 200 + Number (7) X Dwell (1 ms) < 260ms

HT80 Channel move time & Channel Closing Transmission Time for Type 0 radar.

Note:

Dwell (10 ms)= Sweep Time (10010 ms) / Sweep Point Bins (1001)

Channel Closing Transmission Time (200 + 60 ms) = 200 + Number (6) X Dwell (10 ms) < 260ms

5. TEST SETUP PHOTOS

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