TEST REPORT

Test Report No. : UL-RPT-RP90385JD16B

Manufacturer	:	Panasonic Mobile Communications Development of Europe Ltd
Model No.	:	NTT docomo EB-4063
FCC ID	:	UCE312057A
Technology	:	WLAN
Test Standard(s)	:	FCC Part 15.407(h)(2)

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2. The results in this report apply only to the sample(s) tested.
3. This sample tested is in compliance with the above standard(s).
4. The test results in this report are traceable to the national or international standards.
5. Version 1.0

Date of Issue: 30 November 2012

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ilac-MRA UKAS TESTING 0644

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1. Customer Information

Company Name:	Panasonic Mobile Communications Development of Europe Ltd
Address:	Panasonic House Willoughby Road Bracknell Berkshire RG12 8FP United Kingdom

2. Summary of Testing

2.1. General Information

Specification Reference:	47CFR15.407
Specification Title:	Code of Federal Regulations Volume 47 (Telecommunications) 2012: Part 15 Subpart E (Unlicensed National Information Infrastructure Devices) - Section 15.407
Site Registration:	209735
Test Date:	27 November 2012

2.2. Summary of Test Results

FCC Reference (47CFR)	Measurement	Result
Part 15.407(h)(2)(iii)	Channel Closing Transmission Time and Channel Move Time	✓
Part 15.407(h)(2)(iv)	Non-occupancy Period	✓
Key to Results ✓ = Complied ✗ = Did not comply		

Note(s):

1. The Manufacturer confirms that information regarding the parameters of the radar waveforms is not available to the end user.
2. Clause 8.3)18) of FCC 06-96 states tests are to be performed on the narrowest channel bandwidth (worst case). All tests were therefore performed at the 20 MHz bandwidth.

2.3. Methods and Procedures

Reference:	FCC 06-96
Title:	Compliance Measurement Procedures for Unlicensed-National Information Infrastructure Devices Operating in the 5250-5350 MHz and 5470-5725 MHz Bands Incorporating Dynamic Frequency Selection

2.4. Deviations from the Test Specification

For the measurements contained within this test report, there were no deviations from, additions to, or exclusions from the test specification identified above.

3. Equipment Under Test (EUT)

3.1. Identification of Equipment Under Test (EUT)

Brand Name:	NTT docomo
Model Name or Number:	EB-4063
IMEI:	353740050010663 *(Conducted sample)*
Hardware Version Number:	Rev B-2
Software Version Number:	ACPU: rupy-jb-10-0336 CCPU: 101033_DCM_00.12
FCC ID:	UCE312057A

3.2. Description of EUT

The equipment under test was a Multi-Mode LTE/UMTS/GSM Mobile Phone with WLAN, Bluetooth and RFID.

The EUT supports DFS as a Client without Radar Detection.

3.3. Modifications Incorporated in the EUT

No modifications were applied to the EUT during testing.

3.4. Additional Information Related to Testing

Technology Tested:	Unlicensed National Information Infrastructure Devices (U-NII)	
Type of Unit:	Transceiver	
Modulation:	BPSK, QPSK, 16QAM, 64QAM	
Data Rates:	IEEE 802.11a	6, 9, 12, 18, 24, 36, 48 & 54 Mbps
	IEEE 802.11n HT20	6.5, 13, 19.5, 26, 39, 52, 58.5, 65, 7.2, 14.4, 21.7, 28.9, 43.3, 57.8, 65 & 72.2 Mbps
	IEEE 802.11n HT40	13.5, 27, 40.5, 54, 81, 108, 121.5, 135, 15, 30, 45, 60, 90, 120, 135 & 150 Mbps
Power Supply Requirement(s):	3.8 VDC via 120 VAC 60 Hz adaptor	
Transmit / Receive Frequency Range:	5250 to 5350 MHz 5470 to 5725 MHz	
Transmit / Receive Channels Tested:	**Channel ID**	**Channel Frequency (MHz)**
	56	5320

3.5. Support Equipment

The following support equipment was used to exercise the EUT during testing:

Description:	Cisco Aironet IOS Access Point
Brand Name:	Cisco
Model Name or Number:	AIR-AP1252AG-A-K9
Serial Number:	FTX122391JU

Description:	Laptop (Streaming Server and Router Configuration)
Brand Name:	Dell
Model Name or Number:	Latitude D610
Serial Number:	CN-0C4708-48643-61P-1843

Description:	2GB Micro SD Card
Brand Name:	N/A
Model Name or Number:	Not marked or stated
Serial Number:	Not marked or stated

4. Operation and Monitoring of the EUT during Testing

4.1. Operating Modes

The EUT was tested in the following operating modes, unless otherwise stated:

- Operating on the channel selected by the Master device in either UNII Band 2 or UNII Band 2e.
- The Master device was set to 17 dBm / 50 mW.
- The Master device was set to 802.11a / 6 Mbps.
- The Master device set the channel bandwidth to either 20 MHz or 40 MHz. Only 20 MHz bandwidth testing was performed as this was worst-case as determined in FCC 06-96 clause 8.3)18).
- The DFS detection threshold of -61 dBm was used at the Master device antenna port.

FCC 06-96 Table 3: DFS Detection Thresholds for Master Devices and Client Devices With Radar Detection

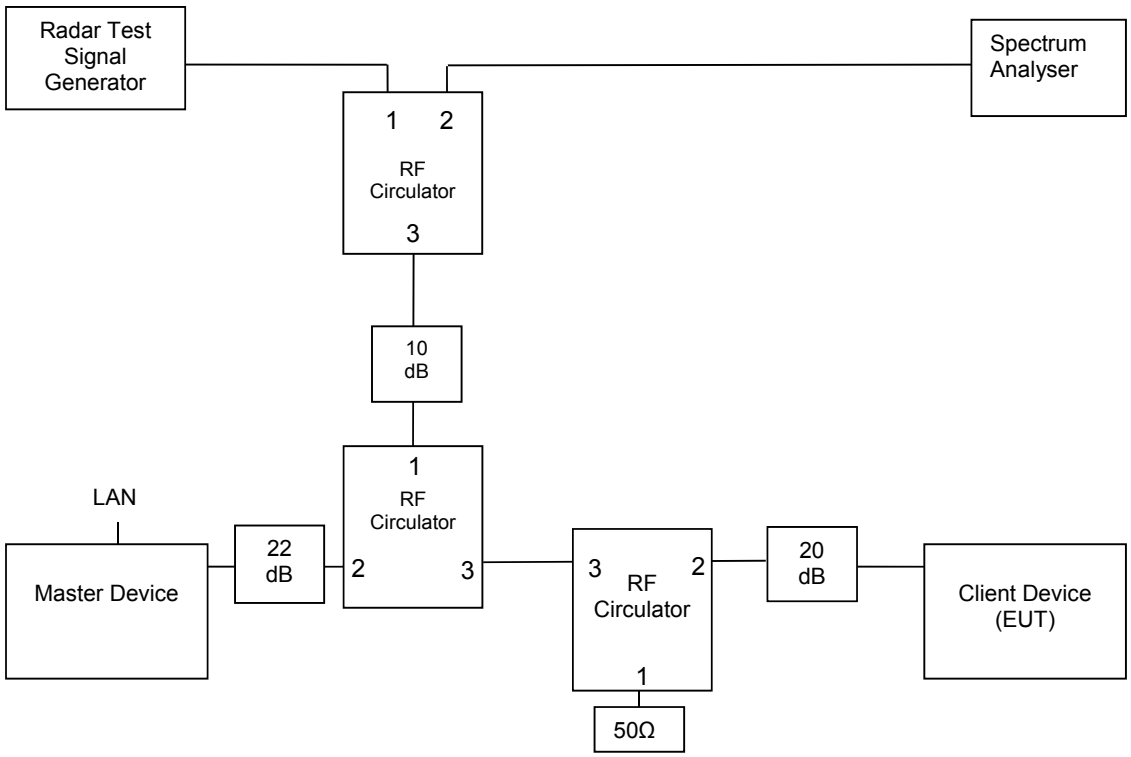
Maximum Transmit Power	**Value (See Notes 1 and 2)**
≥ 200 milliwatt	-64 dBm
< 200 milliwatt	-62 dBm
Note 1: This is the level at the input of the receiver assuming a 0 dBi receive antenna. Note 2: Throughout these test procedures an additional 1 dB has been added to the amplitude of the test transmission 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.	

4.2. Configuration and Peripherals

The EUT was tested in the following configuration(s):

- The EUT is a DFS Client without Radar Detection capability. It was tested in combination with a FCC approved Cisco DFS enabled router (FCC ID: LDK102061) being used as the Master. Due to the full compliance of the Master, radar pulse types 1 and 5 were injected to test the Client channel move behaviour.
- All measurements were made using a conducted link. The EUT has one external antenna port fitted for test purposes. System losses for the interconnecting hardware were measured and taken into consideration.
- For the required channel loading, the full motion, 30 frames per second test MPEG video file from http://ntiacsd.ntia.doc.gov/dfs/ was streamed from an HTTP server on a test laptop, via the DFS Master device, to the EUT (Client). The remote file was located from within the web browser then decoded using VLC video playback software which was installed on the EUT.
- The Radar test platform used was the Aeroflex DFS Radar 110105 Simulator which has been verified and accepted by Andrew Leimer of the FCC/NTIA on the 23rd of September 2011. Refer to Appendix 4 of this Test Report for the original confirmation email.
- Plots and data were captured using a Rohde and Schwarz ESU 40 Test Receiver in spectrum analyser mode. The number of data points was increased to maximum and the trace data exported so it could be analysed in more detail than available on the built-in display.
- The Channel Move Time was the time taken from the end of the radar waveform to the time the Client ceased transmissions. The Channel Closing Transmission Time was calculated to the nearest sample from any additional pulses occurring >200 ms after the end of the radar.

Setup diagram for test of DFS Client without Radar Detection.



Rationale

The setup shown above ensures the waveforms indicated on the spectrum analyser are in order of magnitude. The circulators have approximately 18 dB attenuation in the reverse direction. The lower left-hand circulator directs the radar towards the master, ensuring there is not an overly large radar pulse into the client (EUT) even though there is less fixed attenuation between the client and the radar generator. The radar signal should be approximately 34 dB smaller at the client than the master. The lower right-hand circulator is to give the same path loss between master and client in both directions.

The Radar signal is most predominant on the spectrum analyser, coming straight through a circulator. The client is 2nd largest, being attenuated by the 20 dB, 10 dB and 18 dB from the top circulator. The smallest signal is the master, being attenuated by 32 dB from the two attenuators and approximately 36 dB from the two circulators.

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
Uniform Spreading	Yes	Not required	Not required

Applicability of DFS requirements during normal operation

Requirement	Operational Mode		
	Master	Client (without DFS)	Client (with DFS)
DFS Detection Threshold	Yes	Not required	Yes
Channel Closing Transmission Time	Yes	**Yes**	Yes
Channel Move Time	Yes	**Yes**	Yes

Interference Threshold values, Master or Client incorporating In-Service Monitoring

Maximum Transmit Power	Value (see note)
≥ 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 1dB 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.	

DFS Response requirement values

Parameter	Value
Non-occupancy period	30 minutes
Channel Availability Check Time	60 seconds
Channel Move Time	10 seconds
Channel Closing Transmission Time	200 milliseconds + 60 milliseconds over remaining 10 second period

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. 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 approximately 60 milliseconds) during the remainder of the 10 second period. The aggregate duration of control signals will not count quiet periods in between transmissions.

Short Pulse Radar Test Waveforms

Radar Type	Pulse Width (Microseconds)	PRI (Microseconds)	Pulses	Minimum Percentage of Successful Detection	Minimum Trials
1	**1**	**1428**	**18**	60%	30
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	

Long Pulse Radar Test Signal

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

Frequency Hopping Radar Test Signal

Radar Waveform	Pulse Width (µsec)	PRI (µsec)	Burst Length (ms)	Pulses per Hop	Hopping Rate (kHz)	Minimum Percentage of Successful Detection	Minimum Trials
6	1	333	300	9	.333	70%	30

5. Measurements, Examinations and Derived Results

5.1. General Comments

Measurement uncertainties are evaluated in accordance with current best practice. Our reported expanded uncertainties are based on standard uncertainties, which are multiplied by an appropriate coverage factor to provide a statistical confidence level of approximately 95%. Please refer to *Section 6 Measurement Uncertainty* for details.

In accordance with UKAS requirements all the measurement equipment is on a calibration schedule. All equipment was within the calibration period on the date of testing.

5.2. Test Results

5.2.1. Channel Closing Transmission Time and Channel Move Time

Test Summary:

Test Engineer:	Philip Harrison	**Test Date:**	27 November 2012
Test Sample IMEI:	353740050010663		

FCC Reference:	Part 15.407(h)(2)(iii)
Test Method Used:	FCC 06-96 Section 7.8.3

Environmental Conditions:

Temperature (°C):	22.1
Relative Humidity (%):	42

Note(s):

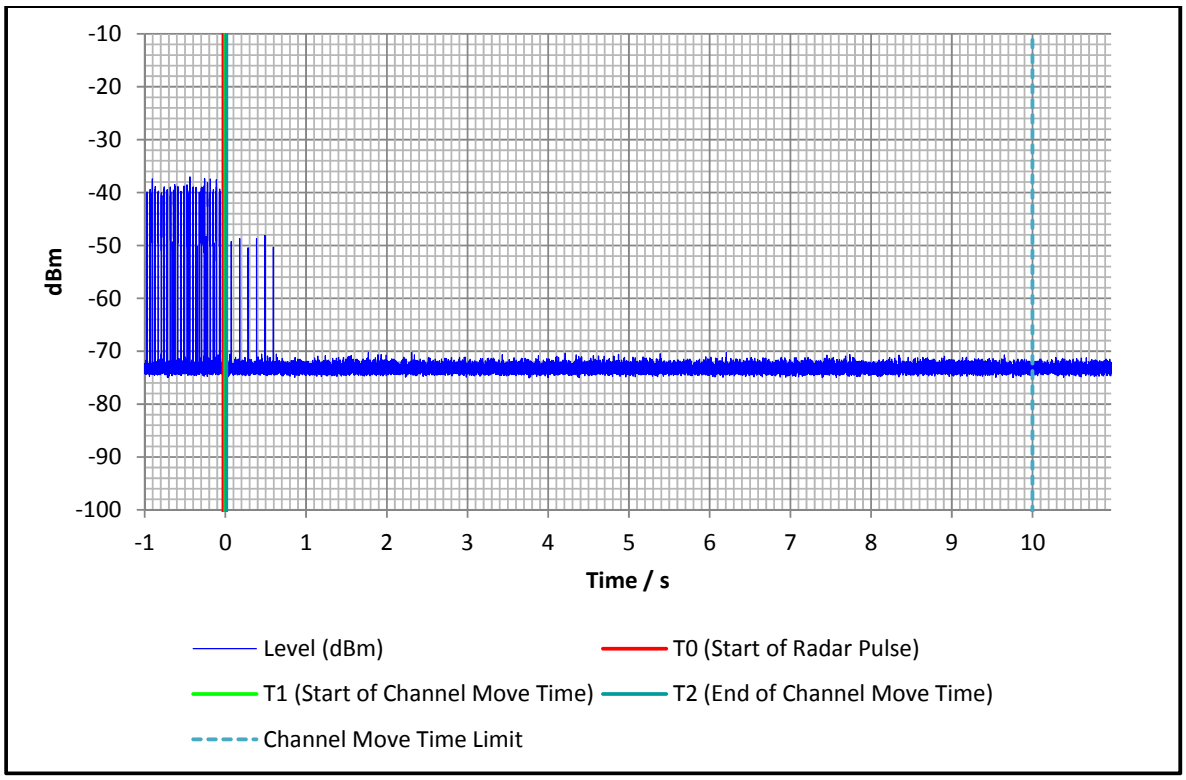
1. The channel move time is the time taken from the end of the radar burst to the ceasing of transmissions of the EUT.
2. The Total Aggregate Channel Closing Transmission Time shown in the table below was measured from 200 ms after the end of the radar burst and compared to the 60 ms limit.

Results: 20 MHz / 5250 – 5350 MHz band

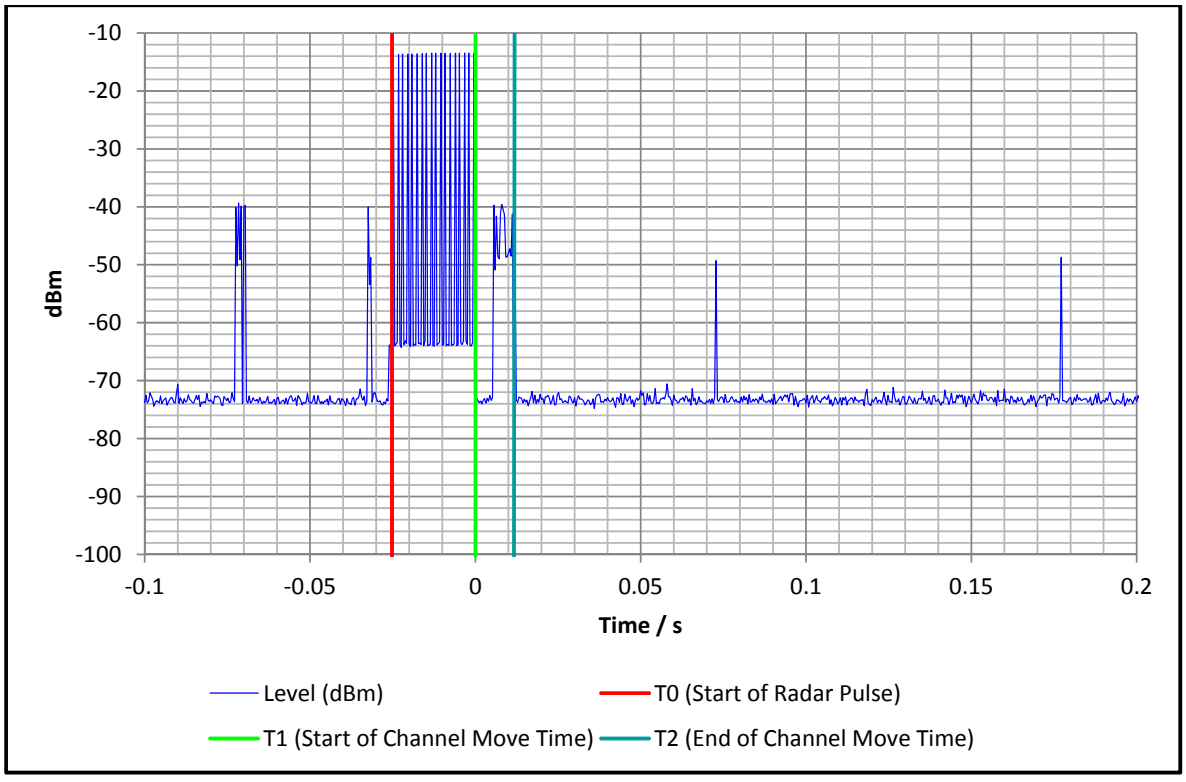
Radar #	Channel Frequency (MHz)	Channel Move Time (ms)	Channel Closing Transmission Time after 200 ms (ms)	Limit (ms)	Margin (ms)	Status
1	5320	11.6	-	10000.0	9988.4	Complied
1	5320	-	0	60.0	60.0	Complied

Radar burst type 1 was detected and channel move occurred.

Channel Closing Transmission Time and Channel Move Time (continued)



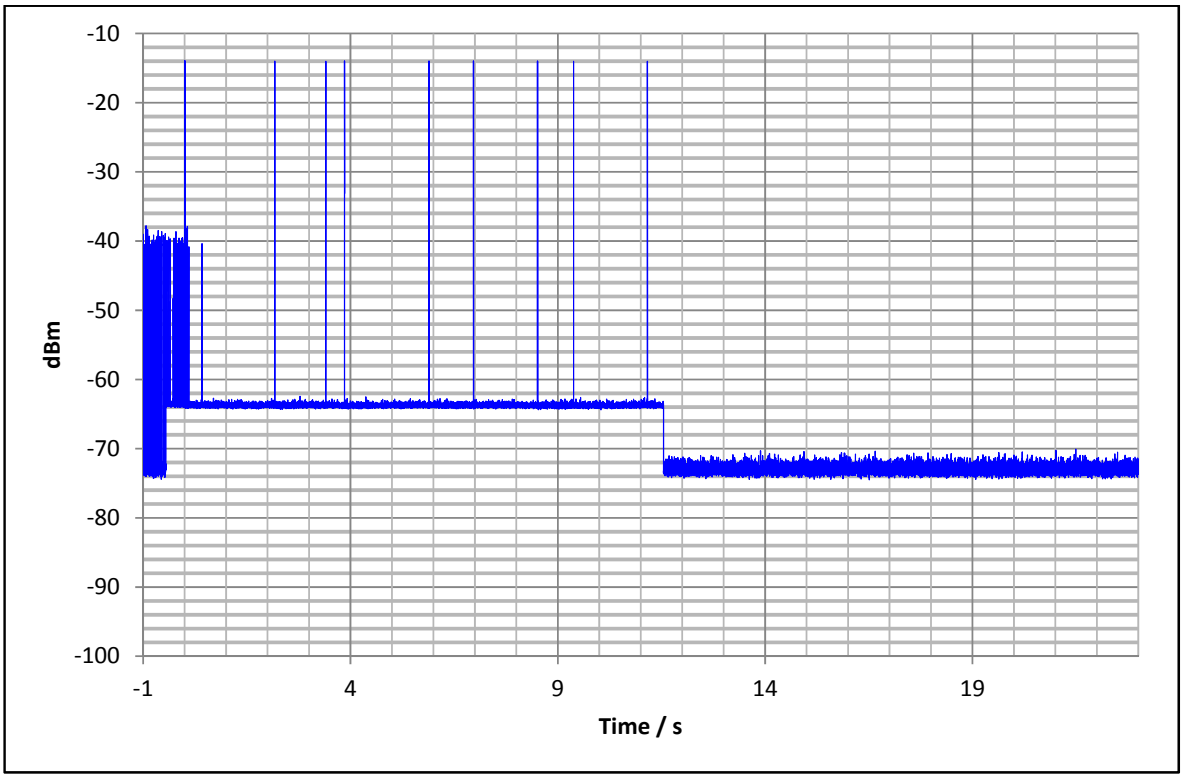
Channel Move Time 5320 MHz – Short Radar (Type 1) - Full 10 seconds



Channel Move Time 5320 MHz – Short Radar (Type 1) - First 200 ms

Channel Closing Transmission Time and Channel Move Time (continued)

Channel Move Time and Channel Closing Transmission Time are not calculated from the long radar type. The type 5 shutdown plot is included for reporting purposes only. Radar burst type 5 was detected and channel move occurred.



Channel Move Time 5320 MHz – Long Radar (Type 5)

Type 5 Radar Parameters

Burst Segment	Number of Pulses	Pulse Width (usec)	Chirp Width (MHz)	Pulse 1-to-2 Spacing (usec)	Pulse 2-to-3 Spacing (usec)	Starting Location Within Interval (usec)
1	3	53	13	1716	1517	452064
2	2	58	9	1003	0	1291010
3	2	79	8	1152	0	1190993
4	2	84	14	1127	0	307090
5	2	80	9	1982	0	1009501
6	2	54	5	1933	0	751015
7	3	64	10	1888	1976	960394
8	1	92	6	0	0	497165
9	1	84	6	0	0	947974

5.2.2. Non-Occupancy Period

Test Summary:

Test Engineer:	Philip Harrison	**Test Date:**	27 November 2012
Test Sample IMEI:	353740050010663		

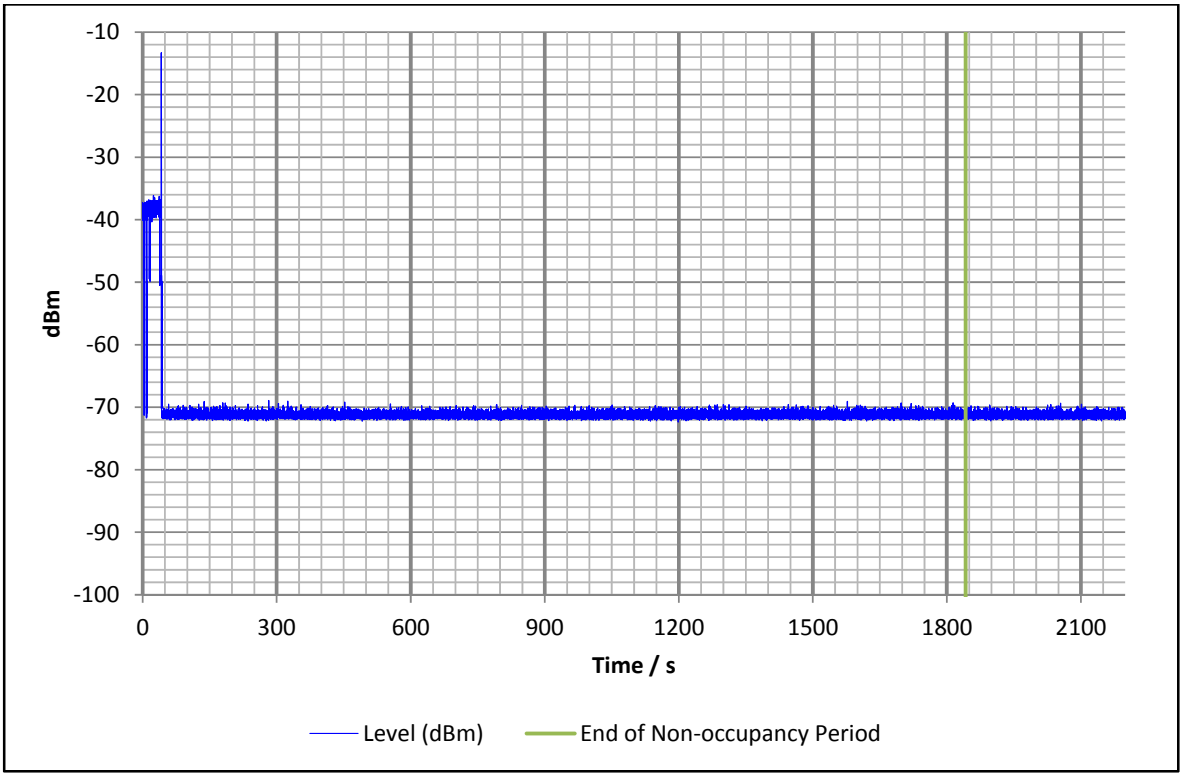
FCC Reference:	Part 15.407(h)(iv)
Test Method Used:	FCC 06-96 Section 7.8.3

Environmental Conditions:

Temperature (°C):	22.1
Relative Humidity (%):	42

Results: 20 MHz

Radar burst type 1 detected and channel was vacated for >30 minutes.



Non-occupancy Period

6. Measurement Uncertainty

No measurement or test can ever be perfect and the imperfections give rise to error of measurement in the results. Consequently the result of a measurement is only an approximation to the value of the measurand (the specific quantity subject to measurement) and is only complete when accompanied by a statement of the uncertainty of the approximation.

The expression of uncertainty of a measurement result allows realistic comparison of results with reference values and limits given in specifications and standards.

The uncertainty of the result may need to be taken into account when interpreting the measurement results.

The reported expanded uncertainties below are based on a standard uncertainty multiplied by an appropriate coverage factor such that a confidence level of approximately 95% is maintained. For the purposes of this document “approximately” is interpreted as meaning “effectively” or “for most practical purposes”.

Measurement Type	Range	Confidence Level (%)	Calculated Uncertainty
Channel Move Time	5.15 GHz to 5.825 GHz	95%	0.8 ms (2 samples)
Channel Close Time	5.15 GHz to 5.825 GHz	95%	0.8 ms (2 samples)
Non-Occupancy Period	5.15 GHz to 5.825 GHz	95%	132 ms (2 samples)
DFS Threshold (Conducted)	5.15 GHz to 5.825 GHz	95%	0.28 dB

The methods used to calculate the above uncertainties are in line with those recommended within the various measurement specifications. Where measurement specifications do not include guidelines for the evaluation of measurement uncertainty the published guidance of the appropriate accreditation body is followed.

7. Report Revision History

Version Number	Revision Details		
	Page No(s)	Clause	Details
1.0	-	-	Initial Version

Appendix 1. Test Equipment Used

RFI No.	Instrument	Manufacturer	Type No.	Serial No.	Date Calibration Due	Cal. Interval (Months)
M1631	DFS Test System	Aeroflex	PXI 3000	300110/291	Calibrated Before Use	-
M1630	Test Receiver	Rohde & Schwarz	ESU40	100233	13 Jan 2013	12
A248	Step Attenuator	Narda	743-60	01411	Calibrated Before Use	-
A030	Step Attenuator	Narda	445-69	01544	Calibrated Before Use	-
A163	Step Attenuator	Narda	743-80	01344	Calibrated Before Use	-
A2179	Coaxial Circulator 4-18GHz	Atlantec	ACC-20130-SF-SF-SF	120409230	Calibrated Before Use	-
A2182	Coaxial Circulator 4-18GHz	Atlantec	ACC-20130-SF-SF-SF	120409231	Calibrated Before Use	-
A2183	Coaxial Circulator 4-18GHz	Atlantec	ACC-20130-SF-SF-SF	120409232	Calibrated Before Use	-